

# RSM PowerLine E Air

*Repair Manual*



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# 1 General Information

## 1.1 Identification data

Identification data	
<b>Machine type:</b>	
<b>Model designation:</b>	
<b>Serial number:</b>	
<b>Order number:</b>	
<b>Parts list number:</b>	
<b>Manufactured on:</b>	

## 1.2 Customer data

Customer data	
<b>Inventory number:</b>	
<b>Location:</b>	

## 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!



**Caution:** 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 Air series lasers.

This repair manual is valid for lasers of the ROFIN-SINAR PowerLine E Air 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.



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

All products and brand names mentioned in the repair manual are brands or registered trademarks of the corresponding owner.

### 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. 0121857-01



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 Radiation" 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 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, such as protective goggles with the corresponding protective class adapted to the wavelength of the laser.
- 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, etc.) 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.
- 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: Warning against laser radiation!**

*A laser without any special protective unit corresponds to protection class 4. A laser beam is invisible at a wave length of 1064 nm. If the positioning laser is activated (wavelength 675 nm, red laser beam, protection class 2), the laser beam is visible.*

The RSM PowerLine E Air laser head corresponds to protection class 4.

The plug-in supply unit corresponds to safety class 1 due to its safety equipment.

The safety equipment consists of a metal tube and an adapter block or a fiber terminal box. The safety equipment comprises the following:

- In the case of RSM PowerLine E Air-10, the metal tube is permanently connected with the diode module via an adapter block.
- In the case of RSM PowerLine E Air-25/-30, the metal tube is permanently connected with the fiber terminal box under which the fiber couplings of the diode modules are located. The diode modules protrude into the fiber terminal box.

This equipment is intrinsically safe and requires no special safety precautions, since no hazardous laser emissions are generated.



**Attention:** The plug-in supply unit corresponds to protection class 4 as soon as the safety devices (metal hose with adapter block or fiber terminal box) are dismantled, e.g. when changing a diode module. In this state, all corresponding laser protection measures can be taken for test/measurement tasks.



### 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 2

Lasers that emit a visible radiation in a wavelength range of 400 nm to 700 nm; here, eye protection is usually effected by defensive reactions, including the eyelid closure reflex (up to 0.25 s).  
It is to be expected that this reaction offers appropriate protection under reasonably predictable operating conditions.



### 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 optics are attached, the laser beam is emitted out of the front of the laser head.

- The owner of a laser system is obliged to name a laser protection officer for the operation of the plant.
- When the protective housing is completely mounted, 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 corresponding laser protection measures can be observed.



**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.



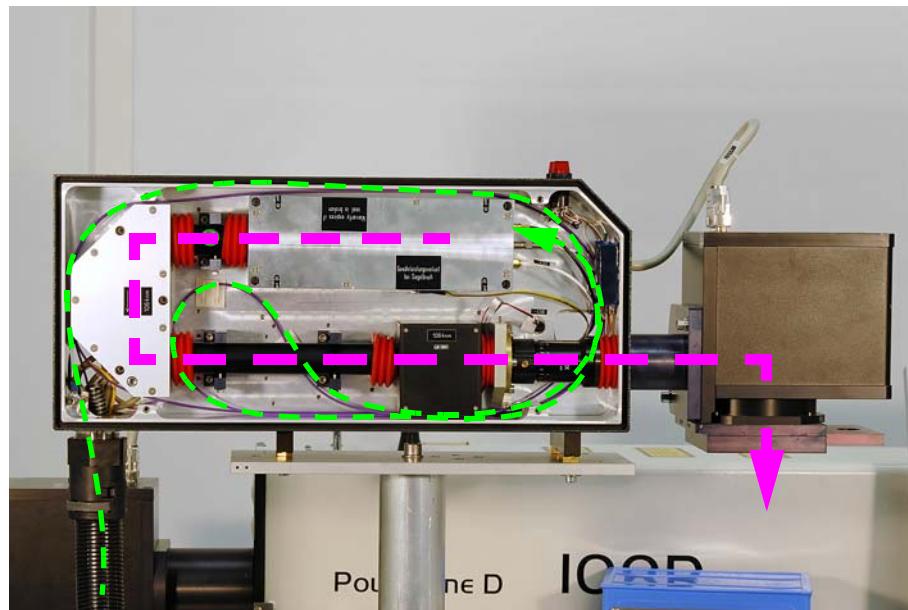
**Attention:** If the laser system has to be switched on for testing/measuring purposes, measures for protection against laser radiation must be taken (use of protective goggles, setup and positioning of partition walls, attachment of warning signs and barriers, etc.). These measures must be coordinated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

### 2.4.1.1 RSM PowerLine E Air-10



**Figure 2.1** Beam path in laser head RSM PowerLine E Air-10

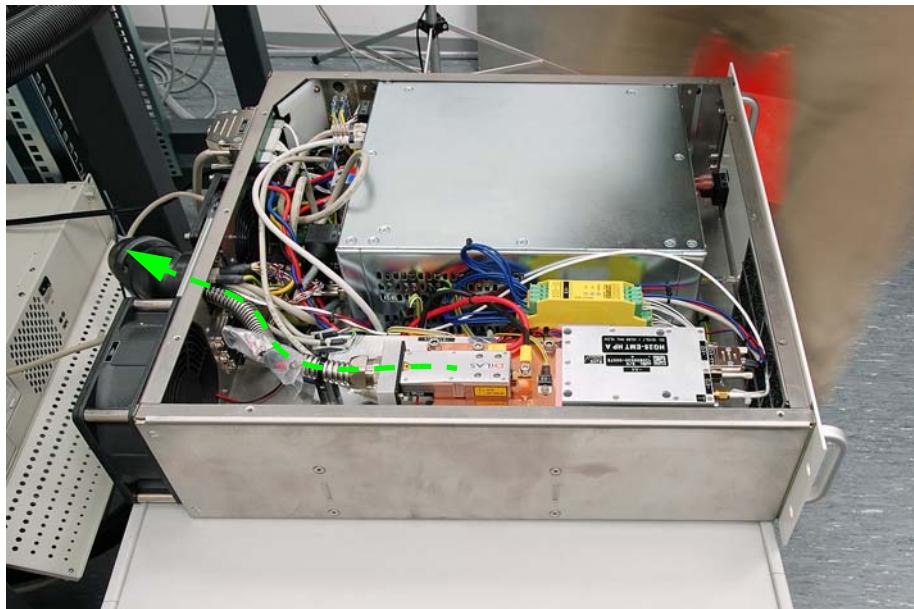
The dashed line designates the beam path of the main laser. The beam path of the diode laser is marked in green.



**Note:** The position of the glass fibers can deviate from the figure depending on the model and connection.

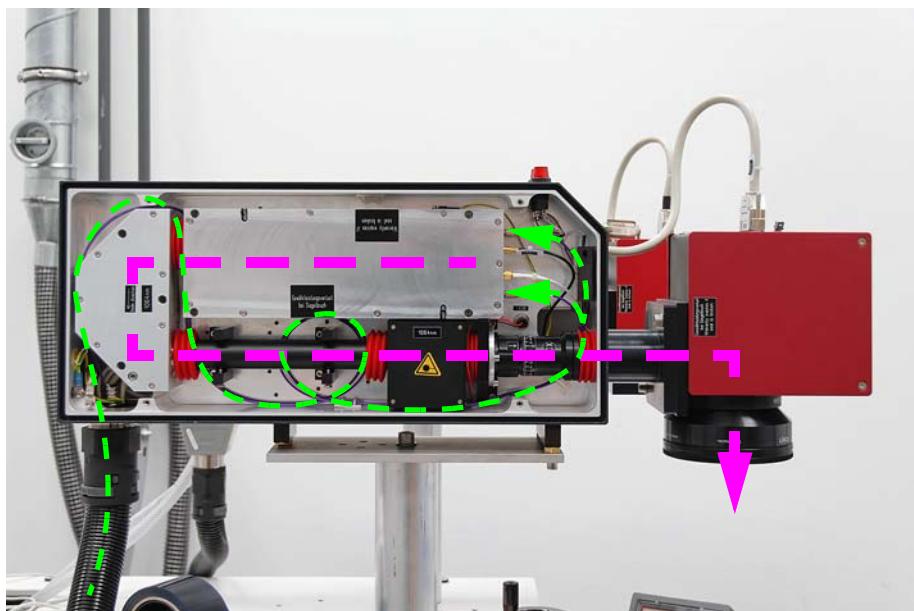


**Attention:** The minimum bending radius of the glass fiber may not be undershot at risk of damage.



**Figure 2.2** Beam path in plug-in supply unit RSM PowerLine E Air-10

#### 2.4.1.2 RSM PowerLine E Air-25/-30



**Figure 2.3** Beam path in laser head RSM PowerLine E Air-25/-30

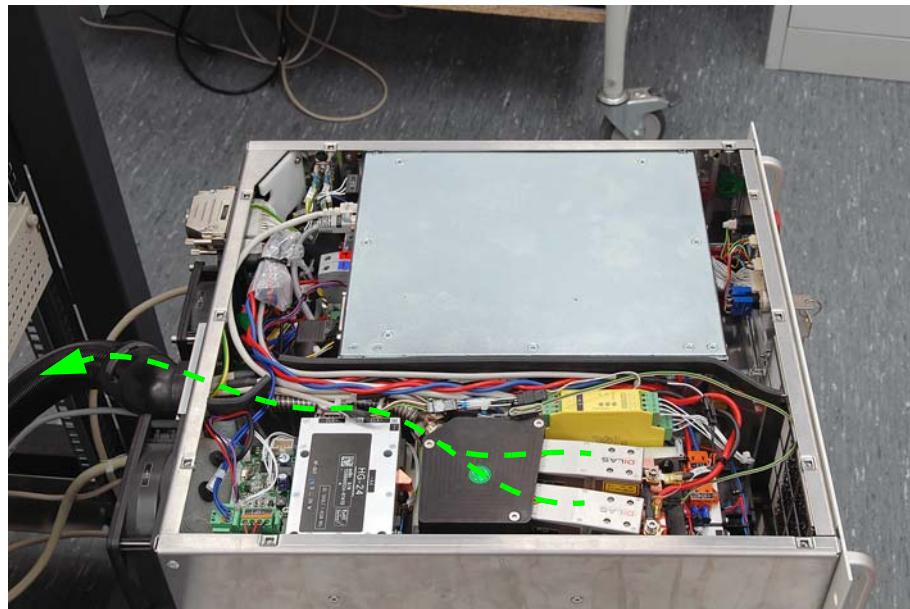
The dashed line designates the beam path of the main laser. The beam path of the diode laser is marked in green.



**Note:** The position of the glass fiber(s) can deviate from the figure depending on the model and connection.



**Attention:** The minimum bending radius of the glass fiber may not be undershot at risk of damage.



**Figure 2.4** Beam path in plug-in supply unit RSM PowerLine E Air-25/-30

#### 2.4.2 Alignment laser<sup>1</sup>

The alignment laser is a laser diode of hazard class 2. According DIN EN 60825, the eyes are usually protected by defensive reactions, including the eyelid closure reflex. The alignment laser radiation is not dangerous to the skin.



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

### 2.5 Safety instructions for maintenance and setup 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, plug-in control modules, and 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.

1. Installation depends on the respective laser type

- 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:** *Danger by laser radiation: 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 9).*



**Attention:** *The mechanical processing (grinding, drilling, separating, etc.) of parts of the laser system must strictly take place outside of the working area! The processing of supporting assemblies and components is strictly 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!*

*Before opening the plug-in supply unit and working on the electrical system, pull the mains plug. The plug-in supply unit 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 plug-in supply unit 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 Electrostatically sensitive devices (ESD)



**Attention:** The diode modules are electrostatically sensitive devices (ESD)! In case of work on and with the diodes, you must take protective measures!

**Protective measures to be performed:**

- Make sure the equipotential bonding is constant!
- Make sure personnel are grounded using wrist and shoe grounding!
- Make sure clothing is conductive and closed!
- Avoid electrostatically chargeable materials such as normal PE, PVC, styrofoam, etc.!
- Avoid electrostatic fields > 100 V/cm!
- Only use marked and defined packaging and transport materials!



**Attention:** When the mains connection is disconnected as required before the plug-in supply unit is opened, the protective conductor connection is also disconnected! Before working on diodes, ground the plug-in unit using suitable means! The external grounding line must be implemented on a marked PE terminal of the plug-in unit and on a marked PE terminal in the vicinity of the plant! The correct equipotential bonding must be checked using measuring technology! The ESD wrist band must then be connected to a PE terminal of the plug-in unit!

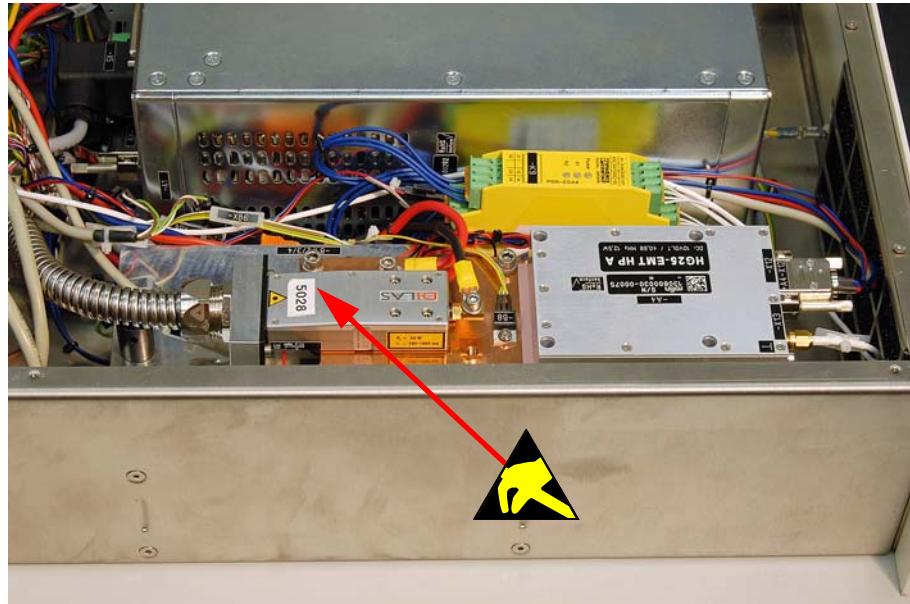
Before that, the diode modules may not be disconnected!



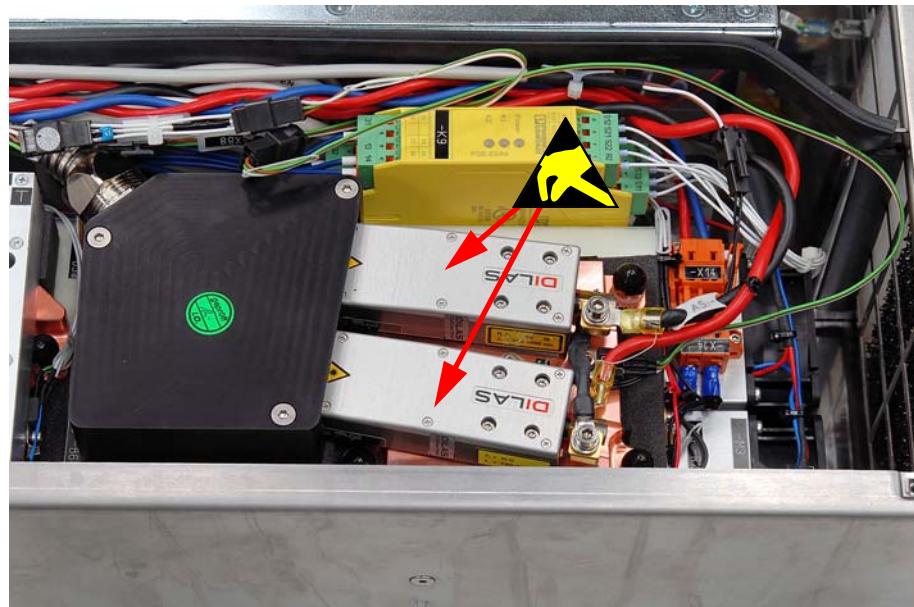
**Attention:** Everyone who works on the diode modules must observe the measures for the protection of electrostatically sensitive devices (ESD)! The work area must be secured!



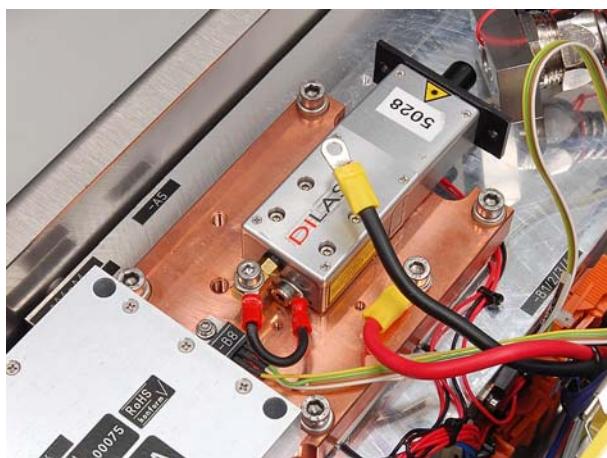
**Attention:** In the case of remote connecting lines, touching connecting terminals can lead to the destruction of the diode! This also applies to disconnecting the connecting lines on the power supply unit! Diodes must be short-circuited by grounded personnel directly after disconnection!



**Figure 2.5** Diode module RSM PowerLine E Air-10



**Figure 2.6** Diode modules RSM PowerLine E Air-25/-30

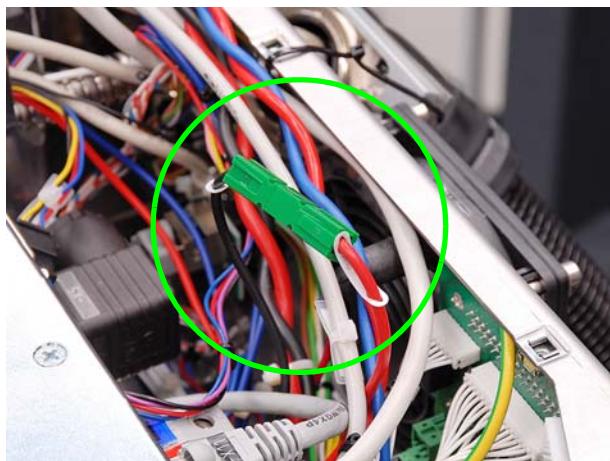


**Figure 2.7** Short-circuited diode module RSM PowerLine E Air-10

Figures 2.7 and 2.8 show short-circuited diode modules.



**Figure 2.8** Short-circuited diode modules RSM PowerLine E Air-25/-30



**Figure 2.9** Short-circuit bridge diode modules



**Attention:** The short-circuit bridge (Figure 2.9) can be used only for work for which the diode connecting lines have to be disconnected on the power supply unit (e.g. exchange of the power supply unit). When you are working directly on the diodes, they should be short-circuited as shown in Section 2.8, page 16.

## 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 is used to prevent injury to persons, or damage to the machine or workpiece.

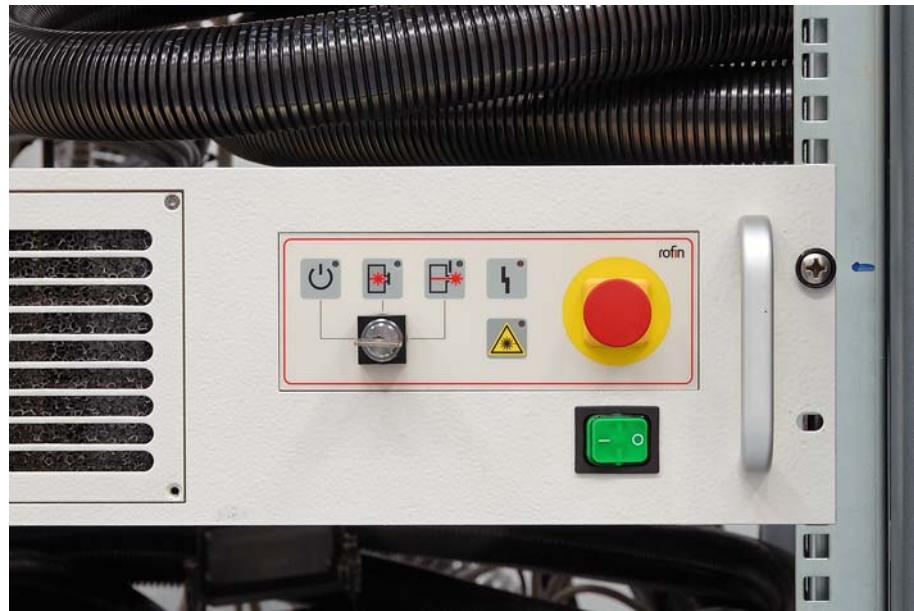
The emergency stop push button is located on the external control panel or on the plug-in supply unit, depending on the setup of the plant.



**Figure 2.10** Emergency stop push button on the external control panel



**Note:** The external control panel can be integrated anywhere into the handling unit (see the maintenance and integration manual).

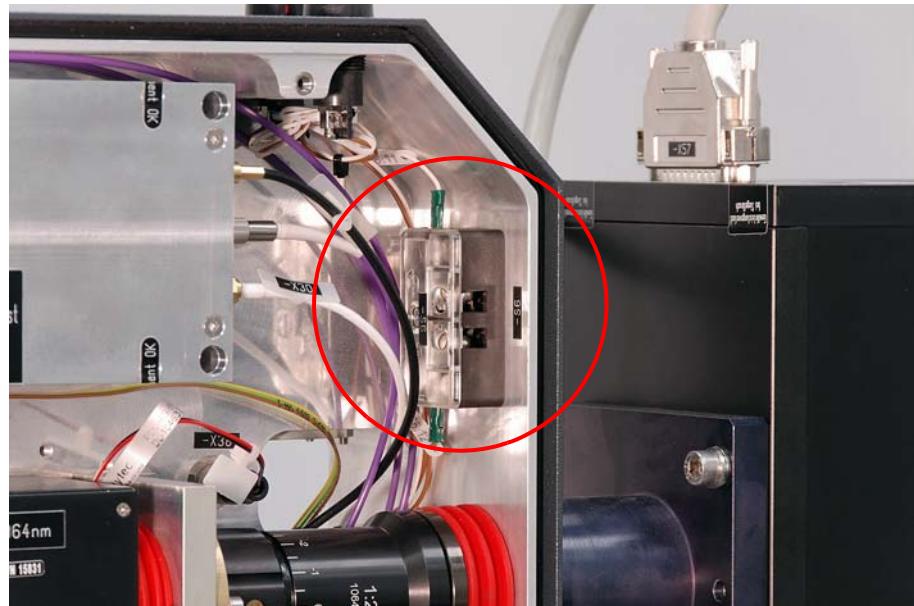


**Figure 2.11** Emergency stop push button, plug-in supply unit



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

## 2.8.2 Safety equipment



**Figure 2.12** Interlock switch for laser head

An interlock switch has been mounted for both lateral covers of the laser head.

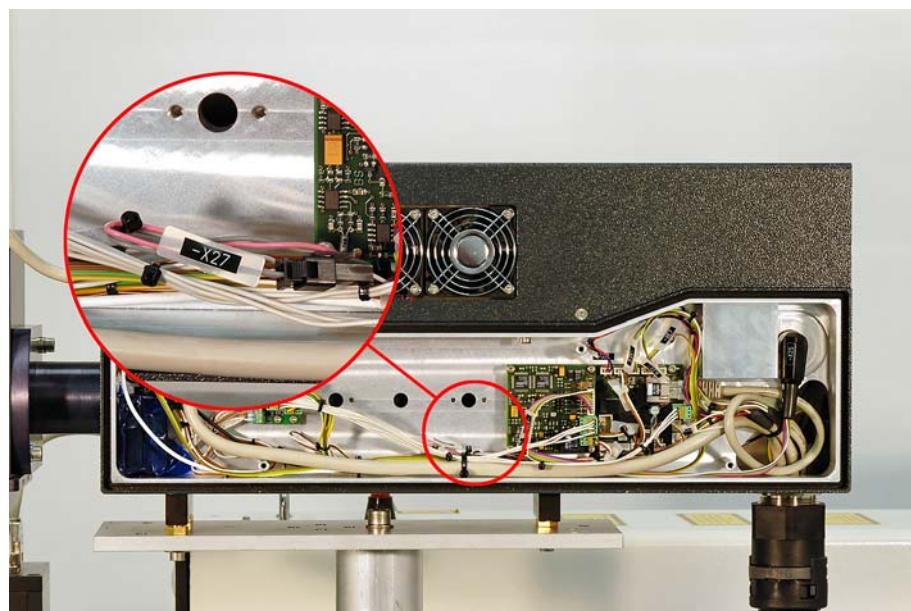


**Note:** As required, the laser system can be equipped with a connection for an external interlock -X28 (see the "Shutter, shutter interlock" page of the circuit diagram"). This installation set can be obtained from ROFIN-SINAR.

For mounting, the cover of the installation opening (Figure 2.13) should be removed. The electrical connection takes place on Plug -X27 on the CAN bus side of the laser head (Figure 2.14).



**Figure 2.13** Installation opening of the external interlock



**Figure 2.14** Connecting plug -X27 in the laser head

## 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 806 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.

- 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 wavelengths of 1064 and 806 nm.
- The interlock circuits which act as safety devices must not be removed or bypassed during the operation of the laser system; if they are bypassed they will not operate in accordance with regulations. No liability whatsoever is assumed by the manufacturer if the safety devices are removed or bypassed.

## 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 (such as 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.*

## Safety

## Notes

## Safety

## 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 E Air series:



**Figure 3.1** Protective goggles

- Protective goggles\*

**!** **Attention:** The protective goggles must be adapted to the wavelength of the laser.



**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** Diode and fiber line measurement parts set

- Diode and fiber line measurement parts set PL-E\*



**Figure 3.4** Adjustment tube of galvo head with base plate

- Adjustment tube of galvo head with base plate\*



**Figure 3.5** Cross wires with seat

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



**Figure 3.6** Adjusting aperture for beam expander

- Adjusting aperture for beam expander\*



- Adapter for cross wires, flange for galvo head, E-Line\*



**Figure 3.8** Transducer disk  
VW-IR 800-1700 nm

- Transducer disk VW-IR 800-1700 nm  
"IR beam catcher"

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



**Figure 3.9** IR transducer screen LDT-007

- IR transducer screen LDT-007\*

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



- Multimeter

**Figure 3.10** Multimeter



- Fine measuring tips

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

**Figure 3.11** Fine measuring tips



- Measuring adapter for galvo voltage\*

**Figure 3.12** Measuring adapter for galvo voltage



- Measuring adapter HG-24/HG-25 signals, SubD9\*



- Amperemeter pliers



- Precision thermometer

**Figure 3.13** Measuring adapter HG-24/HG-25 signals, SubD9



- Amperemeter pliers

**Figure 3.14** Amperemeter pliers



- Precision thermometer

**Figure 3.15** Precision thermometer



**Figure 3.16** HF power and standing wave measuring device

- HF power and standing wave measuring device including HF measuring cable for PWL-E 1xBNC and 1xSMA\*



**Figure 3.17** Scotch tape no. 6877 50x66

- Scotch tape no. 6877 50x66\*

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



**Figure 3.18** Torque wrench

- Torque wrench with hexagon socket inserts M2, M2.5, M3, M4 (for work on the diode module and screws on the copper block)



**Figure 3.19** Precision level gauge

- Precision level gauge



**Figure 3.20** Lens cleaning paper pack

- Lens cleaning paper pack\*



**Figure 3.21** Isopropyl alcohol

- Isopropyl alcohol for the cleaning of optical components\*



**Figure 3.22** Compressed air can

- Compressed air can\*



**Figure 3.23** Rubber gloves and dust protection mask

- Rubber gloves and dust protection mask for cleaning tasks\*



**Figure 3.24** ESD wrist band with spiral cable

- ESD wrist band with spiral cable\*

- CAN bus diagnosis kit\*



**Figure 3.25** CAN bus diagnosis kit

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

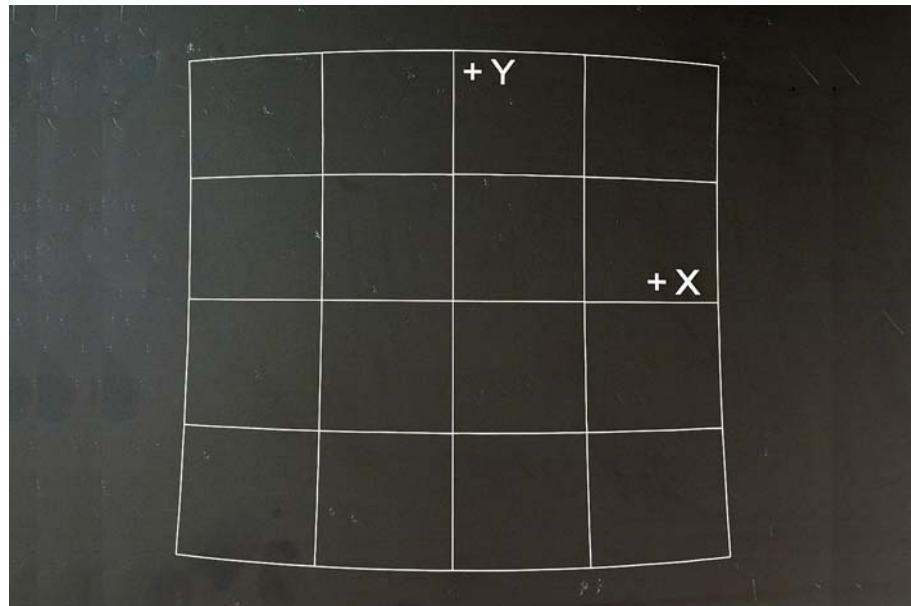


## 4 Trouble-shooting

### 4.1 Image errors

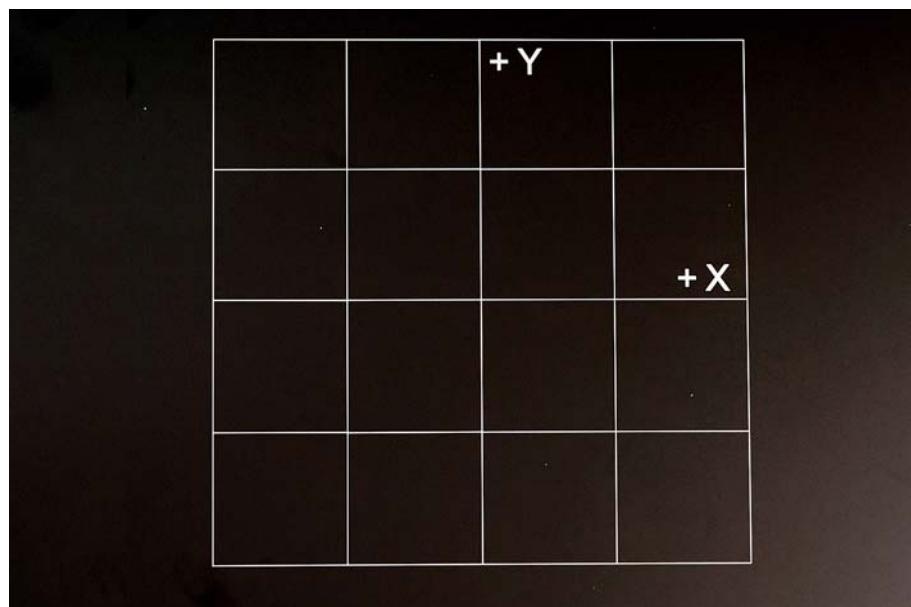


**Note:** For the precise assessment of the image errors, a measuring magnifier or microscope is required.

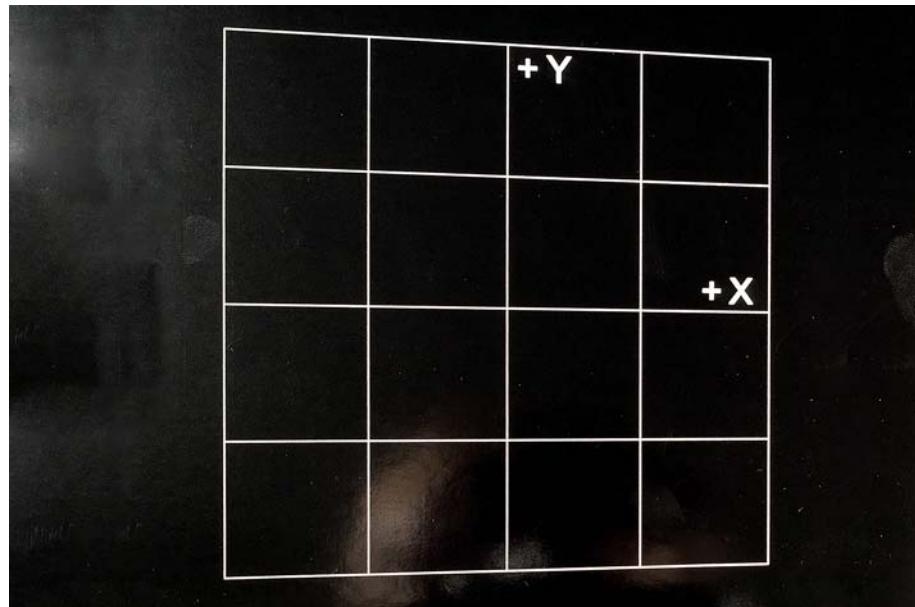


**Figure 4.1** Barrel or pillow shaped distortion

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

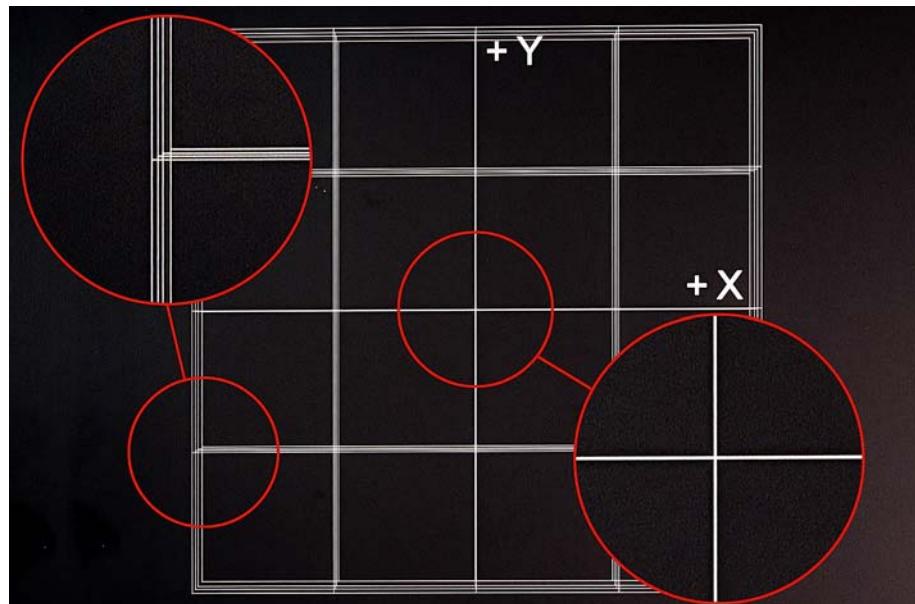


**Figure 4.2** Compensation file loaded



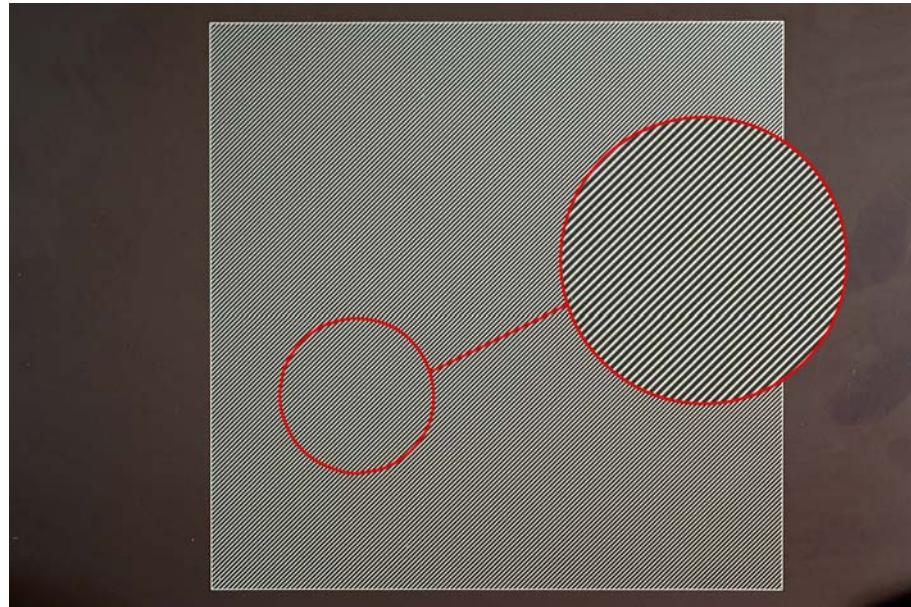
**Figure 4.3** Trapezoidal distortion

Error	Remedy
Trapezoidal distortions in the X and Y directions	Check the adjustment of the workpiece support plate and the galvo head ( <a href="#">see Section 6.1, page 81</a> ).



**Figure 4.4** Focusing errors

Error	Remedy
Focusing error (center point okay, deviation at edge)	Check the focal distance of the galvo head ( <a href="#">see Section 6.1, page 81</a> ).



**Figure 4.5** 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 to the maximum marking field of the laser)
- Hatching 45°
- Hatching distance approx. 0.5 mm to 2.0 mm
- Speed, current, and frequency should be adapted to the material to be marked (e.g. for steel/anodized aluminum: 400 m/s, 30 A, 20 kHz).

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



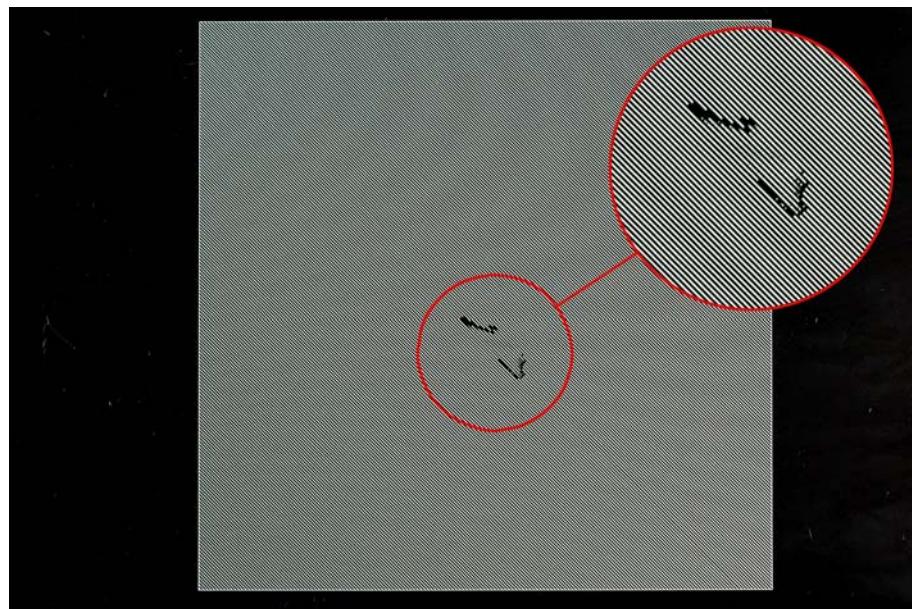
**Attention:** The laser system and the workpiece support plate must be absolutely vibration-free! The suction system must be switched on since vapors obstruct/weaken the laser radiation!



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

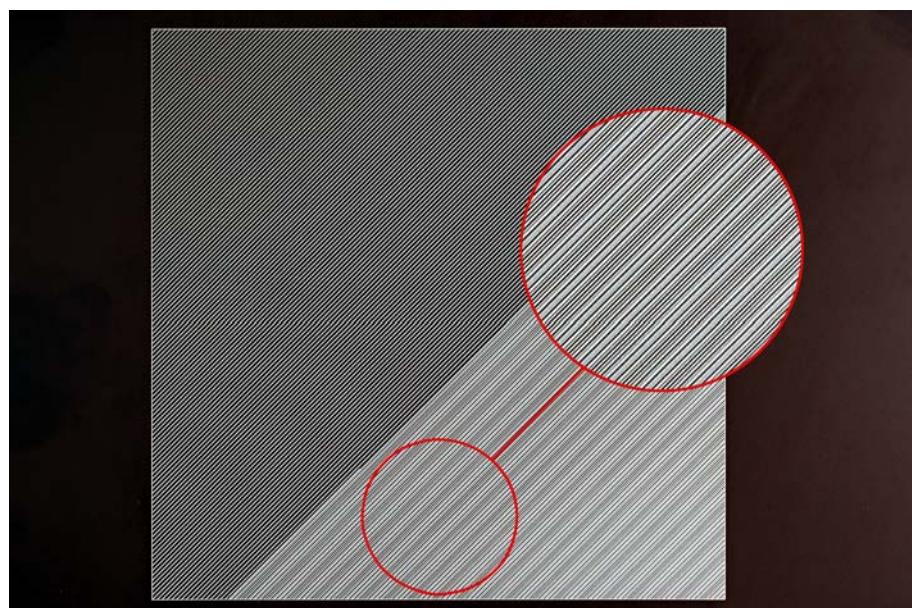


**Note:** For the precise assessment of the image errors, a measuring magnifier or microscope is required.



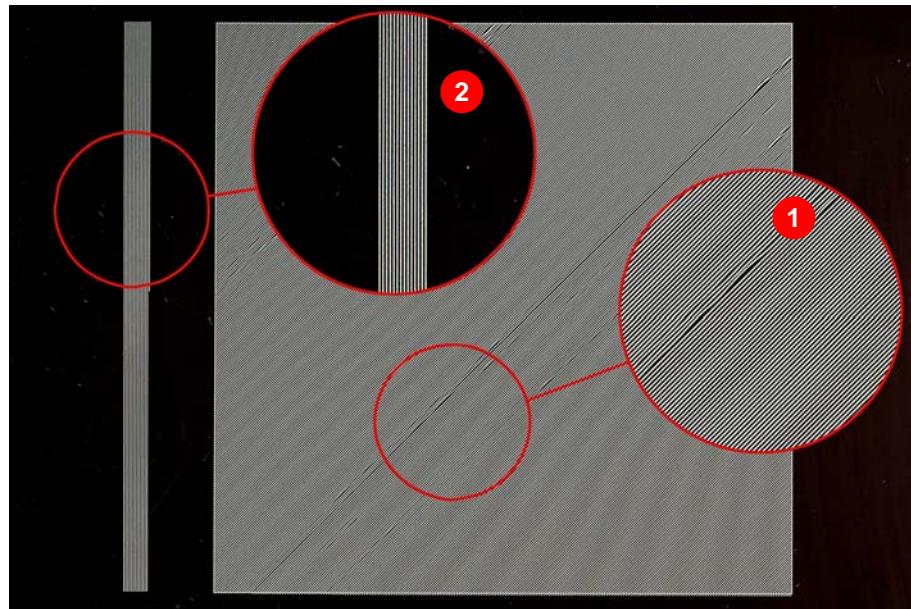
**Figure 4.6** Irregular power fluctuations

Error	Remedy
Irregular power fluctuations	Check the optics for soiling and burning (see Chapter 5).



**Figure 4.7** Regular power fluctuations

Error	Remedy
Regular power fluctuations due to internal or external influences	Check and/or exchange the power supply unit, resonator, and Q-switch. Check the system for vibrations.



**Figure 4.8** 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).

## 4.2 Marking errors

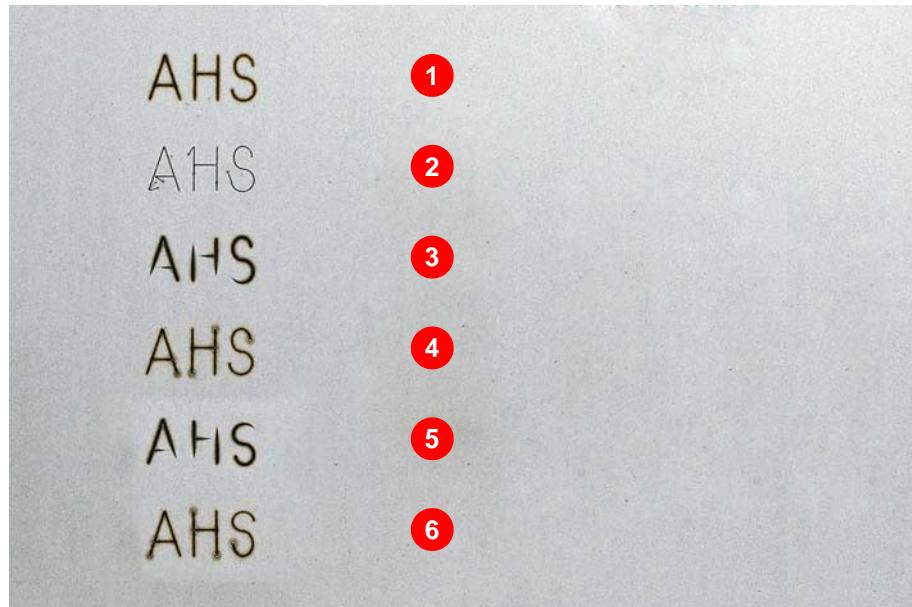


Figure 4.9 Marking errors, vector marking

No.	Error	Remedy
1	No error	—
2	Distortions	<ul style="list-style-type: none"><li>Check the parameters and hardware.</li></ul>
3	The first pulse is too strongly attenuated.	<ul style="list-style-type: none"><li>Check the parameters and hardware.</li></ul>
4	LASER-OFF-DELAY too long	<ul style="list-style-type: none"><li>Check the parameters and hardware.</li></ul>
5	LASER-OFF-DELAY too short	<ul style="list-style-type: none"><li>Check the parameters and hardware.</li></ul>
6	The first pulse is not attenuated enough.	<ul style="list-style-type: none"><li>Check the parameters and hardware.</li></ul>

### 4.3 Emergency stop circuit



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



**Figure 4.10** Emergency stop relay – OK

- Emergency stop circuit OK



**Figure 4.11** Emergency stop relay – Fault in one channel

- Emergency stop circuit triggered (one channel)

**i Note:** The emergency stop circuit can be triggered only after a channel is switched off (e.g. one-sided opening of the laser head). In this case, the power LED and the LED of the emergency stop circuit that is still working light up.



**Figure 4.12** Emergency stop relay – Fault in both channels

- Emergency stop circuit triggered (both channels)

## 4.4 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.

#### 4.4.1 Measuring points



Figure 4.13 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 focal length of 160 mm, for example, measure a maximum of 60 to 70 mm below the protective glass!

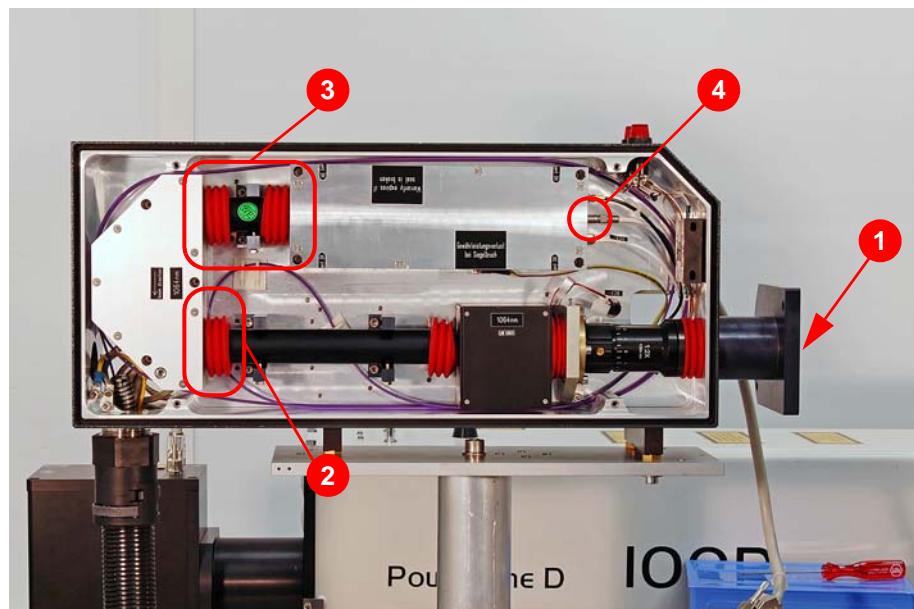


Figure 4.14 Laser power measuring points (example: RSM PowerLine E Air-10)

No.	Measuring point
1	Galvo flange*
2	Output of the deflecting unit
3	Output of the resonator module

No.	Measuring point
4	Diode power of the fiber end

\*. Perform the measurement with and without the installed beam expander.

Laser type	Power
HP/HQ - 1064 nm for RSM PowerLine E Air-10	<ul style="list-style-type: none"> <li>CW HP: 10.5 - 11 W</li> <li>CW HQ: 8.5 - 9 W</li> </ul>
1064 nm for RSM PowerLine E Air-25	<ul style="list-style-type: none"> <li>CW HQ: min. 24 W, max. 25 W</li> </ul>
1064 nm for RSM PowerLine E Air-30	<ul style="list-style-type: none"> <li>CW HP: min. 25 W, max. 27 W</li> </ul>



**Note:** These values refer to the maximum diode current at a diode module output power of 30 W (RSM PowerLine E Air-10) or 30 W (RSM PowerLine E Air-25/30). These values are the minimum values, measured at the galvo flange with beam expander 1.5 - 2.0.

## 4.4.2 General information

### 4.4.2.1 Performing the measurement



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



**Attention:** Do not move the measurement head through the activated laser beam! There is a risk of an uncontrolled deflection of the laser beam!

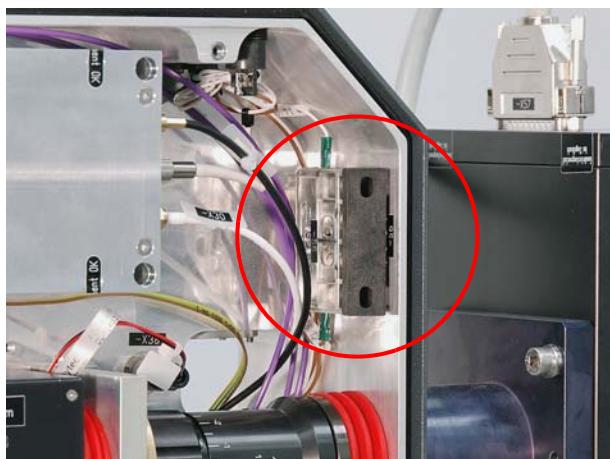


Figure 4.15 Interlock switch bridged

1. Open the cover of the resonator side of the laser head (slanted corner located on the right).
2. Bridge the interlock switch (Figure 4.15).

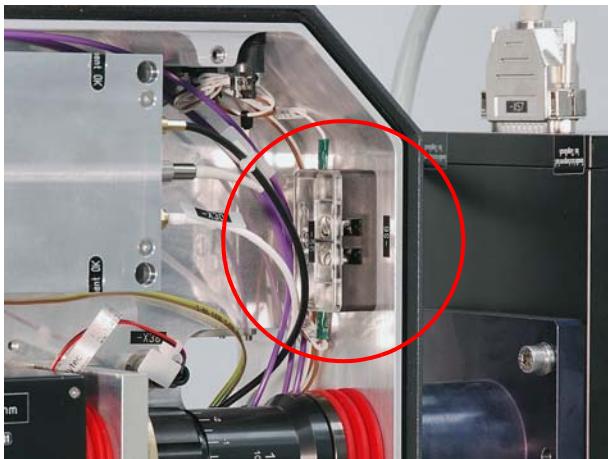
**Attention:** When the interlock switch is bridged, the laser system may be switched on for testing/measuring purposes only under supervision! Production while the interlock switch is bridged is fundamentally prohibited (see Chapter 2, page 7)!

3. Secure the shutter against activation.

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

4. Position the measurement head.

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



**Figure 4.16** Interlock switch

5. 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.*

6. Open the shutter.
7. Perform the measurement.
8. Close the shutter.
9. Remove the measurement head.
10. Turn off the main switch to reset the emergency stop relay for a restart.
11. Remove the bridge from the interlock switch.
12. Completely mount the components.
13. Mount the cover on the resonator side of the laser head.
14. Commission the laser system.

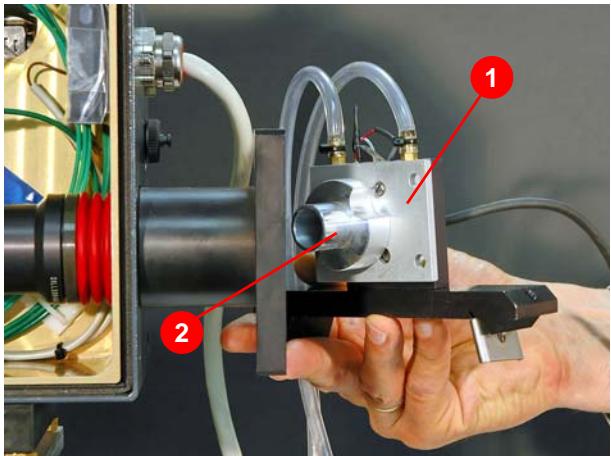
#### 4.4.2.2 Assessment of the measurement

Error	Possible Reasons	Remedy
Power okay, marking result faulty	Focal distance incorrectly adjusted	<ul style="list-style-type: none"> <li>• Adjusting</li> </ul>
	Focal point incorrectly adjusted	<ul style="list-style-type: none"> <li>• Adjusting</li> </ul>
	Optical components have changed their properties	<ul style="list-style-type: none"> <li>• Perform further power measurements</li> </ul>
	Handling system faulty	<ul style="list-style-type: none"> <li>• Check it.</li> <li>• Adjusting</li> </ul>

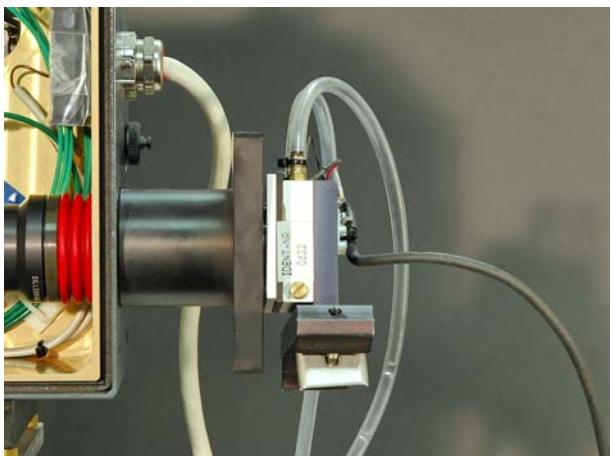
Error	Possible Reasons	Remedy
Power too low	Voltage and current supply	<ul style="list-style-type: none"> <li>Check HN80x/HN90x.</li> </ul>
	Diode module, glass fiber	<ul style="list-style-type: none"> <li>Check the diode power.</li> </ul>
	HF generator	<ul style="list-style-type: none"> <li>Check the HF power.</li> <li>Adjustment of the residual level of the hardware or software</li> <li>Check the wiring for the residual level.</li> </ul>
	Laser beam	<ul style="list-style-type: none"> <li>Power measurement</li> <li>Check the beam adjustment.</li> <li>Check the optical components.</li> </ul>
	Cooling system	<ul style="list-style-type: none"> <li>Check the temperatures.</li> <li>Check the filter.</li> <li>Check the cooling function (Peltier elements).</li> </ul>
Power fluctuations	Voltage and current supply	<ul style="list-style-type: none"> <li>Check HN80x/HN90x.</li> </ul>
	Vibrations	<ul style="list-style-type: none"> <li>Check it.</li> </ul>
	Diode module, glass fiber	<ul style="list-style-type: none"> <li>Check the diode power.</li> <li>Check the attachment of the glass fiber.</li> </ul>
	HF generator	<ul style="list-style-type: none"> <li>Check the HF power.</li> <li>Check the wiring for the residual level.</li> </ul>
	ALI board	<ul style="list-style-type: none"> <li>Check the ALI board</li> </ul>
	Strong or sudden fluctuations in the ambient temperature	<ul style="list-style-type: none"> <li>Make sure the ambient temperature is even and correct.</li> </ul>

## 4.4.3 Power measurement on the galvo flange

### 4.4.3.1 Performing the measurement



**Figure 4.17** Complete the measurement head.



**Figure 4.18** Measurement on the galvo flange

1. Dismantle the galvo head.

**Attention:** Remove or insert the connecting cable of the galvo head only without tension!  
In case of non-observance, the galvo head can be damaged!

2. Attach the fitting (1) (Figure 4.17) on the power measurement head.
3. Insert the cross wire adapter (2) to the fitting.

**Note:** Fittings and adapters to be used: see Chapter 3.

4. Insert the measurement head into the galvo flange.
5. Perform the measurement (see Section 4.4, page 42).

**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 expander to detect any power losses due to the beam expander.

**Attention:** Perform the measurement only for a short time so that the measuring head is not damaged! Follow the instructions in the operating instructions of the measuring device!

#### 4.4.3.2 Assessment of the measurement

Error	Possible Reasons	Remedy
Power loss	Soiling, protective glass damage, focusing lens, beam expander, galvo mirror	<ul style="list-style-type: none"> <li>Clean, exchange</li> </ul> <p><b>i Note:</b> In case of damage to the galvo head, the complete head must be exchanged.</p>
	Galvo head voltage supply fault	<ul style="list-style-type: none"> <li>Measure the voltage and adjust it if necessary.</li> <li>Check HN80x/HN90x.</li> </ul>
	Defective galvo head	<ul style="list-style-type: none"> <li>Check its function.</li> <li>Exchange the galvo head or the ALI board for the optics if necessary.</li> </ul>
	Faulty cooling	<ul style="list-style-type: none"> <li>Check the cooling function (Peltier elements).</li> </ul>

#### 4.4.4 Power measurement at the output of the deflecting unit

##### 4.4.4.1 Performing the measurement

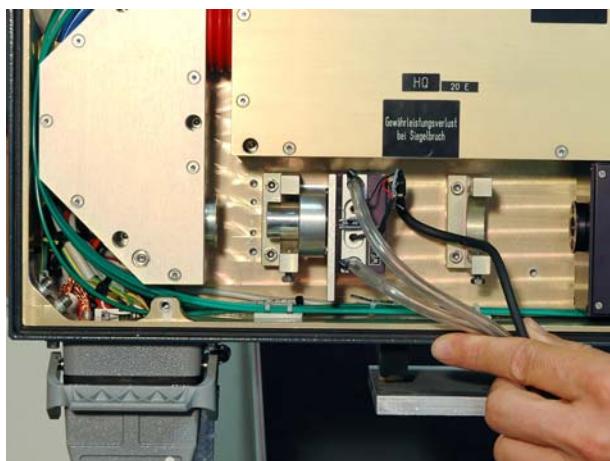


Figure 4.19 Positioning the measurement head

1. Dismantle the beam guide between the deflecting unit and the beam expander or alignment laser housing (optional).
2. Position the measurement head at the output of the deflecting unit.
3. Perform the measurement (see Section 4.4, page 42).

**i Note:** Compare the measured power with the power at the galvo head to detect any power losses due to the beam expander or coupling mirror of the alignment laser.

#### 4.4.4.2 Assessment of the measurement

Error	Possible Reasons	Remedy
Power loss	Soiling of the beam expander	<ul style="list-style-type: none"> <li>• Clean it.</li> </ul>
	Soiling of the coupling mirror of the alignment laser	<ul style="list-style-type: none"> <li>• Clean it.</li> </ul>

#### 4.4.5 Power measurement at the output of the resonator module

##### 4.4.5.1 Performing the measurement

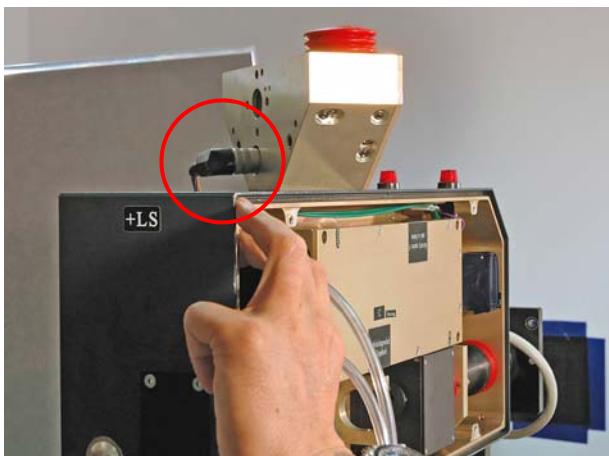


Figure 4.20 Connecting plug (-X25)

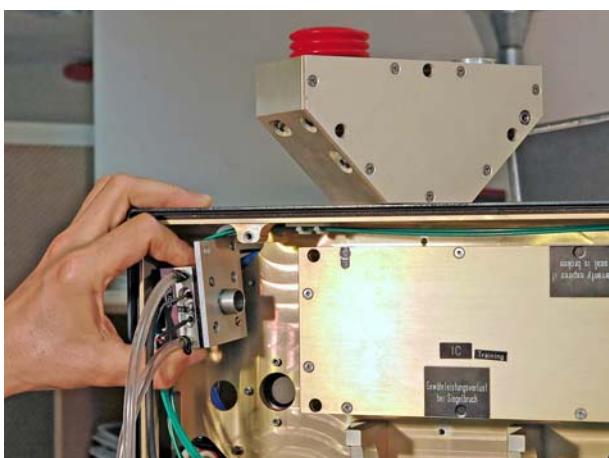


Figure 4.21 Positioning the measurement head

1. Dismantle the deflecting unit (see [Section 7.2, page 106](#)).
2. Turn off the deflecting unit on the laser head and reinsert the connecting plug (-X25).

**!** **Attention:** The openings of the deflecting unit should be taped up (tape to be used: see [Chapter 3](#)) so that no dust gets on the deflecting mirror during the measurement.

3. Position the measurement head at the output of the resonator module.
4. Perform the measurement (see [Section 4.4, page 42](#)).

**!** **Attention:** The laser beam cannot be deflected by the shutter. Shut down the laser system via the emergency stop in case of emergency!

**i** **Note:** Compare the measured power with the power at the output of the deflecting unit to detect any power losses due to the deflecting unit.

#### 4.4.5.2 Assessment of the measurement

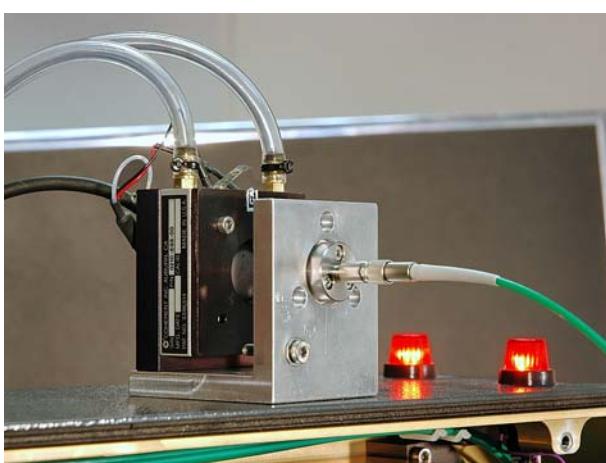
Error	Possible Reasons	Remedy
Power loss	Soiling of the deflecting mirror	<ul style="list-style-type: none"> <li>• Clean it.</li> </ul>
	Defective coating of the deflecting mirror	<ul style="list-style-type: none"> <li>• Exchange the deflecting mirror.</li> </ul>
	Defective shutter module	<ul style="list-style-type: none"> <li>• Exchange the shutter module</li> </ul>
	Defective resonator module (if the diode power, HF/QS, and fiber are OK)	<ul style="list-style-type: none"> <li>• Exchange the resonator module</li> </ul>
	Fault in the residual level of the hardware/software	<ul style="list-style-type: none"> <li>• Check the resonator module</li> <li>• Check the setting of the HF generator (residual level, setting, cable)</li> <li>• Check the software setting.</li> </ul>
	Faulty cooling	<ul style="list-style-type: none"> <li>• Check the cooling function (Peltier elements).</li> </ul>

#### 4.4.6 Measurement of the diode power

##### 4.4.6.1 Performing the measurement

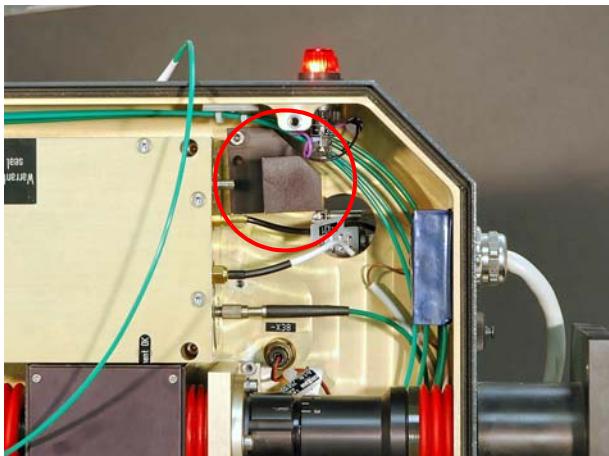


**Attention:** The peripheral components of the laser system should be shut down and secured against reactivation.



1. Mount the measurement head of the power measuring device at the measuring adapter for the diode power ([see Chapter 3](#)).
2. Disconnect the glass fiber line from the resonator module.
3. Connect the glass fiber line to the measuring adapter.

**Figure 4.22** Measuring adapter for diode power



**Figure 4.23** Install the absorber

4. **RSM PowerLine E Air-25/-30:** Mount the absorber in front of the respective connection of the removed glass fiber on the resonator module to shield any fed-back residual laser radiation.

! **Attention:** Never close the connection of the resonator module using dust protection caps! A risk of damaging the resonator module exists!

! **Attention:** Use the laser protection goggles to guarantee protection from wavelengths between 750 and 900 nm (wavelength of the radiation after the fiber) and 1064 nm.

! **Attention:** In this case, the shutter has no function and provides no protection!

5. Perform the measurement (see Section 4.4, page 42).
6. **RSM PowerLine E Air-25/-30:** Perform the measurement at the second fiber.

#### 4.4.6.2 Assessment of the measurement

##### RSM PowerLine E Air-10:

Error	Possible Reasons	Remedy
Power loss (in comparison with the logbook entry)	Declining diode power	<ul style="list-style-type: none"> <li>Reset the laser power using the current limitation (Configurator in LaserConsole).</li> </ul>
	Diode module or glass fiber defective	<p>Check the temperature of the coupling points on the diode and resonator modules.</p> <p><b>a)</b> Temperature okay &gt; diode module defective</p> <p><b>b)</b> Temperature too high &gt; check the state of the fiber ends</p> <ul style="list-style-type: none"> <li>In case of soiling/damage &gt; exchange the fiber</li> <li>Fiber okay &gt; exchange the diode module</li> </ul>
	Power supply fault	<ul style="list-style-type: none"> <li>Check the diode voltage</li> <li>Check HN80x/HN90x.</li> </ul>
	Diode current fault	<ul style="list-style-type: none"> <li>Measure the diode current</li> <li>Check HN80x/HN90x.</li> </ul>
	Faulty cooling	<ul style="list-style-type: none"> <li>Check the cooling function (Peltier elements).</li> </ul>
No power	Power supply fault	<ul style="list-style-type: none"> <li>Check the diode voltage</li> <li>Check HN80x/HN90x.</li> </ul>
	Diode current fault	<ul style="list-style-type: none"> <li>Measure the diode current</li> <li>Check HN80x/HN90x.</li> </ul>
	Diode module defective	<ul style="list-style-type: none"> <li>Exchange the diode module</li> </ul>

**RSM PowerLine E Air-25/-30:**

Error	Possible Reasons	Remedy
Power loss at the end of a fiber	Declining diode power	<ul style="list-style-type: none"> <li>Reset the laser power using the current limitation (Configurator in LaserConsole).</li> </ul>
	Diode module or glass fiber defective	<ul style="list-style-type: none"> <li>Exchange the fiber and repeat the measurement.</li> <li>a) Fault occurs in another diode module &gt; glass fiber defective</li> <li>b) Fault occurs in the same diode module &gt; diode module defective</li> </ul>
Power loss at both fiber ends	Declining diode power	<ul style="list-style-type: none"> <li>Reset the laser power using the current limitation (Configurator in LaserConsole).</li> </ul>
	Power supply fault	<ul style="list-style-type: none"> <li>Check the diode voltage</li> <li>Check HN80x/HN90x.</li> </ul>
	Diode current fault	<ul style="list-style-type: none"> <li>Measure the diode current</li> <li>Check HN80x/HN90x.</li> </ul>
	Faulty cooling	<ul style="list-style-type: none"> <li>Check the cooling function (Peltier elements).</li> </ul>
No power	Power supply fault	<ul style="list-style-type: none"> <li>Check the diode voltage</li> <li>Check HN80x/HN90x.</li> </ul>
	Diode current fault	<ul style="list-style-type: none"> <li>Measure the diode current</li> <li>Check HN80x/HN90x.</li> </ul>
	Diode module defective	<ul style="list-style-type: none"> <li>Exchange the diode module</li> </ul>

## 4.5 Measurement of the HF power

### 4.5.1 Performing the measurement



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



**Figure 4.24** Connect the HF power and standing wave measuring device in the laser head.

1. Disconnect the HF line -X13 from the resonator module or HF generator and connect it to the "ANT" connection of the HF power and standing wave measuring device (see Chapter 3).
2. Connect the "TX" connection of the HF power and standing wave measuring device and the HF connection -X13 of the resonator module or HF generator with a measuring line.
3. Perform the measurement.



**Figure 4.25** Connect the HF power and standing wave measuring device in the plug-in supply unit.

#### 4.5.2 Assessment of the measurement

Error	Possible Reasons	Remedy
	<p>Measurement OK</p> <ul style="list-style-type: none"> <li>The measured value lies between 12 and 15 W.</li> </ul>	–
	<p>HF power too low</p> <ul style="list-style-type: none"> <li>Measured value &lt; 10 W</li> </ul>	<ul style="list-style-type: none"> <li>Check the voltage at -X8 of the HN80x/HN90x.</li> <li>Check the setting of the HF generator.</li> </ul>
	HF fault, no power	<ul style="list-style-type: none"> <li>Check the voltage at -X8 of the HN80x/HN90x.</li> <li>Check the setting of the HF generator.</li> <li>Check the ALI board</li> </ul>
	HF power okay, reflection of Q-switch	<ul style="list-style-type: none"> <li>Check the voltage at -X8 of the HN80x/HN90x.</li> <li>Check the connecting cable between the HF generator and resonator module.</li> <li>Exchange the resonator module (Q-switch defective)</li> </ul>

## 4.6 Measuring the diode voltage

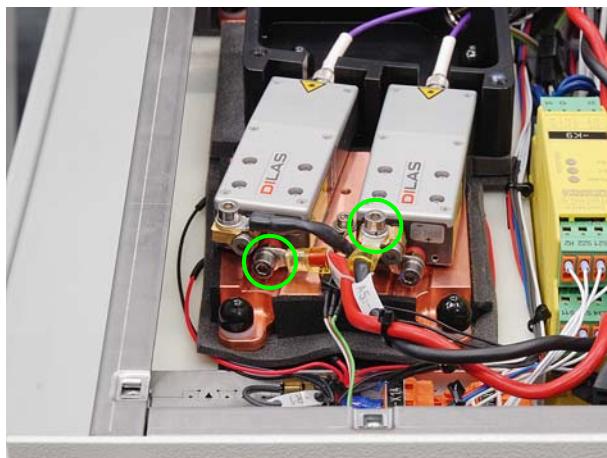
### 4.6.1 Performing the measurement



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



**Figure 4.26** Diode voltage measurement RSM PowerLine E Air-10



**Figure 4.27** Diode voltage measurement RSM PowerLine E Air-25/30

1. Check the voltage at -X6 of the HN80x/HN90x.
2. **RSM PowerLine E Air-10:** Measure the voltage of the diode.  
**RSM PowerLine E Air-25/30:** Measure the voltage via both diodes.

#### Measured values (at maximum current):

- For a diode ~1.7 V to ~2.0 V
- For two diodes ~3.4 V to ~4.0 V

#### 4.6.2 Assessment of the measurement

Error	Possible Reasons	Remedy
Voltage loss	Cable defective	<ul style="list-style-type: none"> <li>Check the cable</li> </ul>
	Contact point faulty	<ul style="list-style-type: none"> <li>Check the contact point</li> </ul>
	Power supply fault	<ul style="list-style-type: none"> <li>Check HN80x/HN90x.</li> </ul>
	One/both diodes defective (short circuit)	<ul style="list-style-type: none"> <li>Exchange the diode module(s)</li> </ul>
No voltage	Power supply fault	<ul style="list-style-type: none"> <li>Check HN80x/HN90x.</li> <li>Short-circuit bridge (-X6a) connected for the diode module(s)</li> </ul>

### 4.7 Measuring the diode current

#### 4.7.1 Performing the measurement



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



Figure 4.28 Measuring the diode current

1. Measure the diode current using the amperemeter pliers.
2. Compare the current value with the programmed current value. The deviation may amount to a maximum of  $\pm 0.5 \text{ A}$ .

**i Note:** The amperemeter pliers used must be accordingly precise; i.e. the fluctuation of the measuring device may not be greater than the tolerance.

## 4.7.2 Assessment of the measurement

Error	Possible Reasons	Remedy
Reduced current flow	Power supply fault	<ul style="list-style-type: none"> <li>• Check HN80x/HN90x.</li> </ul>
	Contact point faulty	<ul style="list-style-type: none"> <li>• Check the contact point</li> </ul>
No current flow	Power supply fault	<ul style="list-style-type: none"> <li>• Check HN80x/HN90x.</li> <li>• Short-circuit bridge (-X6a) connected for the diode module(s)</li> </ul>
	Cable defective	<ul style="list-style-type: none"> <li>• Check the cable</li> </ul>
	Contact point faulty	<ul style="list-style-type: none"> <li>• Check the contact point</li> </ul>

## 4.8 Temperature measurement of the diodes

### 4.8.1 Performing the measurement



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



**Figure 4.29** Temperature measurement of the diode

1. Commission the laser system for about ten minutes at maximum current.
2. Check the temperature at the coupling between the diode module/resonator module and glass fiber (**max. 60°C**).

#### 4.8.2 Assessment of the measurement

Error	Possible Reasons	Remedy
Temperature too high	Diode module or glass fiber defective	<p>Check the state of the fiber ends:</p> <ul style="list-style-type: none"> <li>• In case of soiling/damage &gt; exchange the fiber.</li> <li>• Fiber optically okay &gt; check/exchange the diode module.</li> </ul> <p>Exchange the fiber and repeat the measurement:</p> <ul style="list-style-type: none"> <li><b>a)</b> Fault occurs in another diode module &gt; glass fiber defective.</li> <li><b>b)</b> Fault occurs in the same diode module &gt; diode module defective.</li> </ul>

## 4.9 Temperature measurement of the cooling block

### 4.9.1 Performing the measurement



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



**Figure 4.30** Temperature measurement of the cooling block RSM PowerLine E Air-10



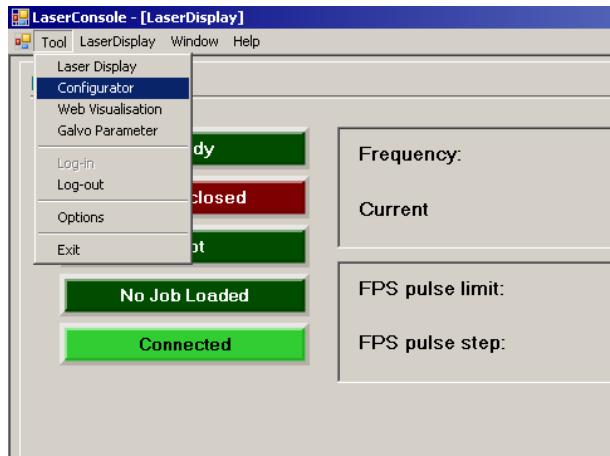
**Figure 4.31** Temperature measurement of the cooling block RSM PowerLine E Air-25/30

1. Commission the laser system for about ten minutes at maximum current.
2. **RSM PowerLine E Air-10:** Check the temperature of the copper block (**max. 25°C**).  
**RSM PowerLine E Air-25/30:** Measure the temperature on the copper block between both diodes (**max. 30°C**).

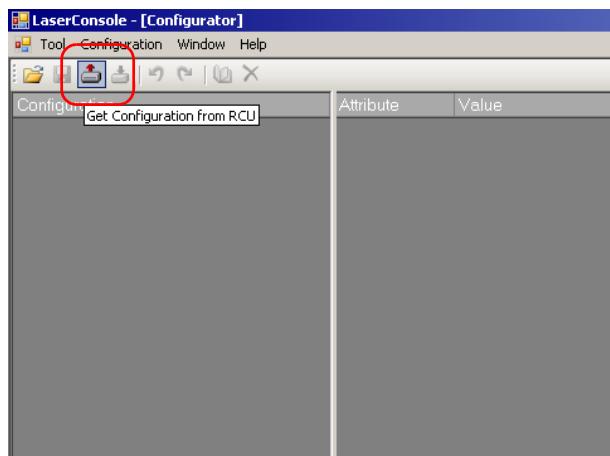
#### 4.9.2 Assessment of the measurement

Error	Possible Reasons	Remedy
Temperature too high	Cooling block dirty	<ul style="list-style-type: none"> <li>• Clean the cooling block</li> </ul>
	Malfunction/soiling of the fans	<ul style="list-style-type: none"> <li>• Function check/cleaning of the fans</li> </ul>
	Filter mats dirty	<ul style="list-style-type: none"> <li>• Clean/exchange the filter mats</li> </ul>
	Diode insulation damaged	<ul style="list-style-type: none"> <li>• Replacement of the insulation</li> </ul>
	Peltier elements defective	<ul style="list-style-type: none"> <li>• Exchange of the complete cooling element</li> </ul>
	Closed-loop control of HN 80x/HN90x faulty	<ul style="list-style-type: none"> <li>• Exchange the power supply unit</li> </ul>
	Fault in sensor R5	<ul style="list-style-type: none"> <li>• Exchange the sensor</li> </ul>
	Ambient temperature too high	<ul style="list-style-type: none"> <li>• Provide for corresponding ambient temperatures</li> </ul>
	The plug-in unit is unfavorably installed <ul style="list-style-type: none"> <li>• Supply air cannot be correctly suctioned</li> <li>• The exhaust air is blocked</li> <li>• The exhaust air circulate and is re-suctioned</li> </ul>	<ul style="list-style-type: none"> <li>• Provide for corresponding air circulation</li> </ul>
Temperature deviation between the measured value and the display in LaserConsole	Correct offset in LaserConsole	<ul style="list-style-type: none"> <li>• Set the offset (see <a href="#">Section 4.11, page 65</a>).</li> </ul>

## 4.10 Testing the control current of the Peltier elements



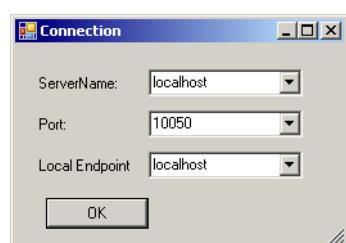
**Figure 4.32** Calling Configurator



**Figure 4.33** Loading the configuration of the RCU

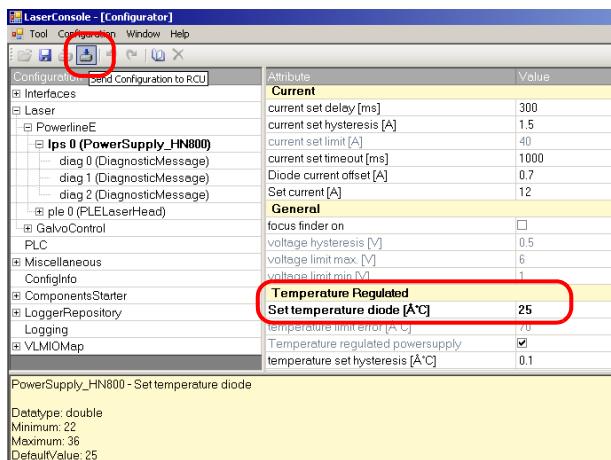
1. Call Configurator in LaserConsole (Tool > Configurator).

2. Click the "Get Configuration from RCU" button.

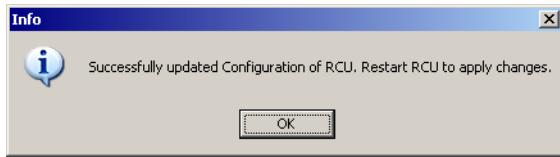


**Figure 4.34** Selecting/confirming the connection

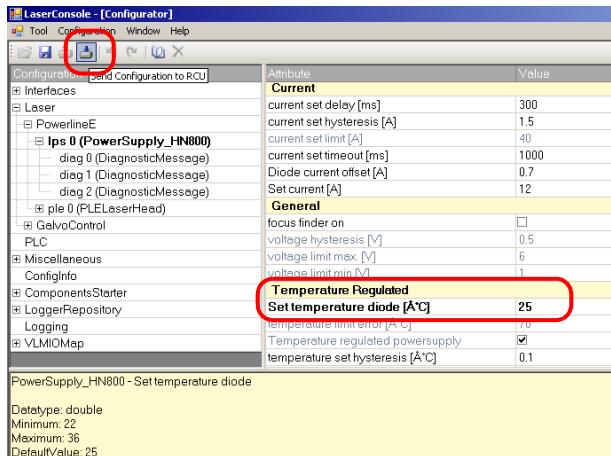
3. Select and confirm the connection in the popup window.



**Figure 4.35** Checking/setting the temperature value



**Figure 4.36** Confirming sending



**Figure 4.37** Setting the temperature values for measurement

**i Note:** Note the currently set temperature value and re-enter it after testing.

4. Check the current temperature value (**25°C**) and set it if necessary.
5. Send the configuration to the RCU using the "Send Configuration to RCU" button.

6. Confirm the sending of the confirmation.
7. End the RCU software and restart it to assume the changes.
8. Set the key-operated switch on the control panel to "0" and then to "1" (system on, shutter off) again.
9. Measure the current flow at the Peltier elements using ammeter pliers:
  - Heating: set the highest value for the temperature(**28°C**) and send it to the RCU (see 5. through 8.). The current flow runs toward zero.
  - Cooling: set the value for the temperature(**22°C**) and send it to the RCU (see 5. through 8.). Current flow briefly up to **about 20 A**.
  - Control operation after cooling: current flow up to **about 4 A to 7 A** (among other things, dependent on the ambient temperature).

**i Note:** A strongly reduced current flow indicates that the Peltier elements are defective. In this case, the cooling element in the plug-in supply unit should be exchanged (see Section 7.10, page 175).

10. Call Configurator again.
11. Reset the previously noted highest temperature value.
12. Send the configuration to the RCU.
13. Restart the RCU software.

## 4.11 Setting the temperature offset in LaserConsole



**Note:** These settings should be checked and adapted if necessary after a power supply unit change, a software update, and a change of the cooling block.

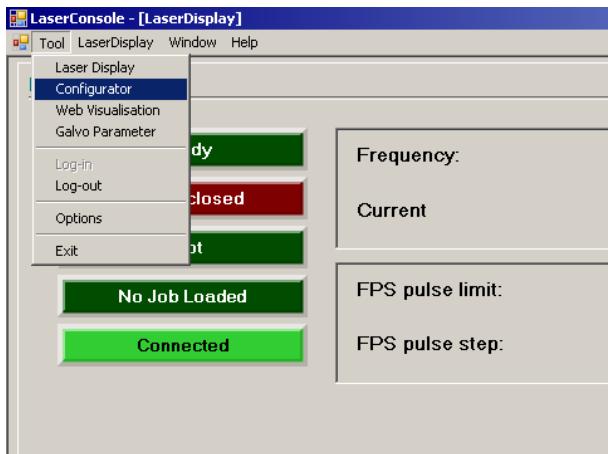


Figure 4.38 Calling Configurator

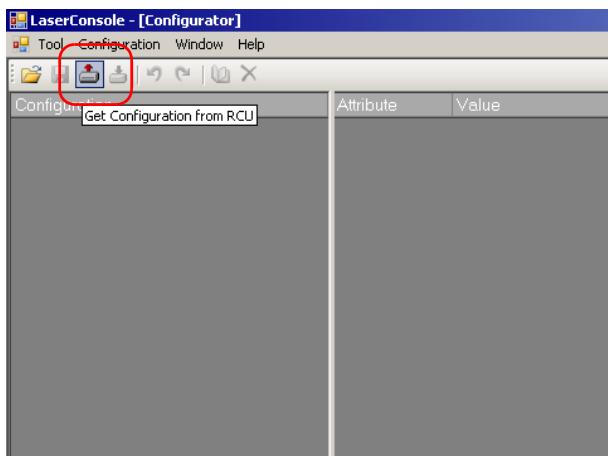


Figure 4.39 Loading the configuration of the RCU

1. Call Configurator in LaserConsole (Tool > Configurator).

2. Click the "Get Configuration from RCU" button.

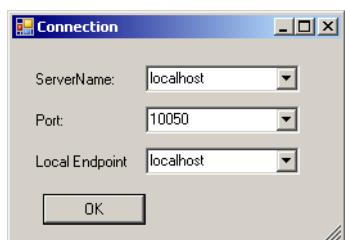
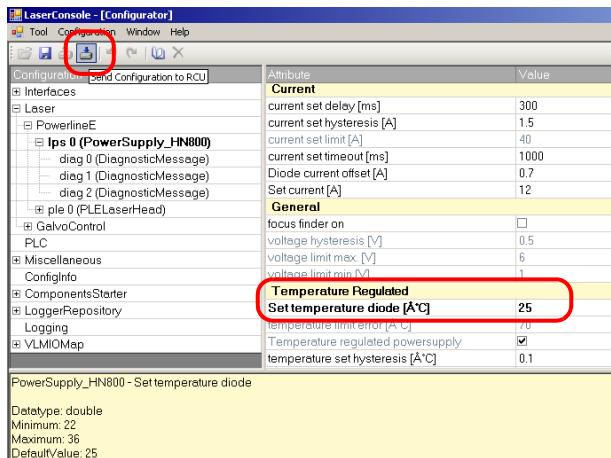
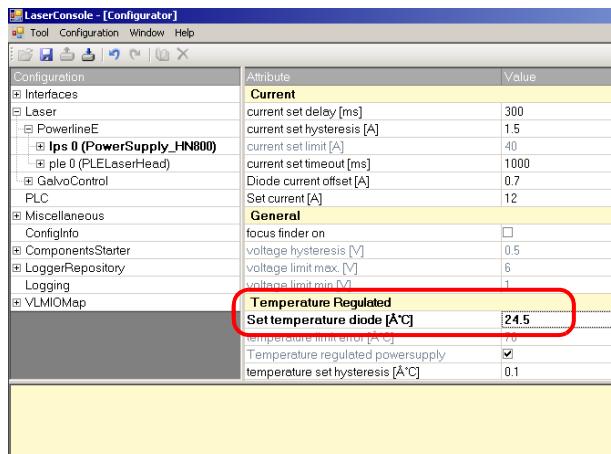


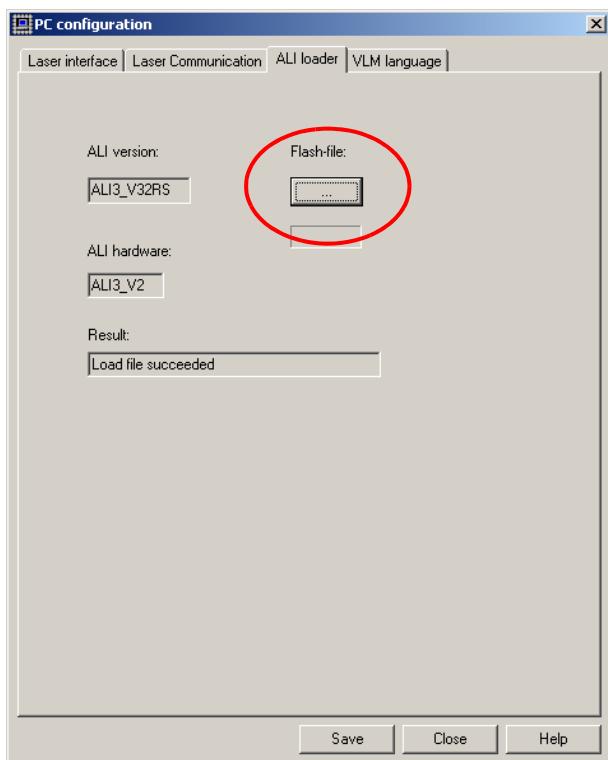
Figure 4.40 Selecting/confirming the connection

3. Select and confirm the connection in the popup window.

**Figure 4.41** Setting the standard temperature**Figure 4.42** Confirming sending**Figure 4.43** Setting the temperature offset

4. Set the standard value for the temperature.  
**RSM PowerLine E Air-10:** 25°C.  
**RSM PowerLine E Air-25/-30:** 30°C.
5. Send the configuration to the RCU using the "Send Configuration to RCU" button.
6. Confirm the sending of the confirmation.
7. End the RCU software and restart it to assume the changes.
8. Set the key-operated switch on the control panel to "0" and then to "1" (system on, shutter off) again.
9. Perform the temperature measurement on the cooling block (see [Section 4.9, page 61](#)).
10. Call Configurator again.
11. Set the temperature offset.  
**For example:**  
Software display: 25°C  
Measured value: 25.5°C  
Entry in Configurator: 24.5°C
12. Send the configuration to the RCU.
13. Restart the RCU software.
14. Check the assumption of the calibration by performing the measurement again.

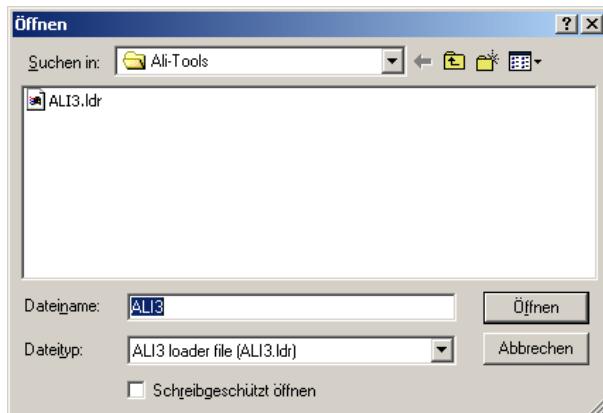
## 4.12 Loading a new ALI configuration



**Figure 4.44** VLM PC configuration

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

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



**Figure 4.45** Selecting the ALI loader file

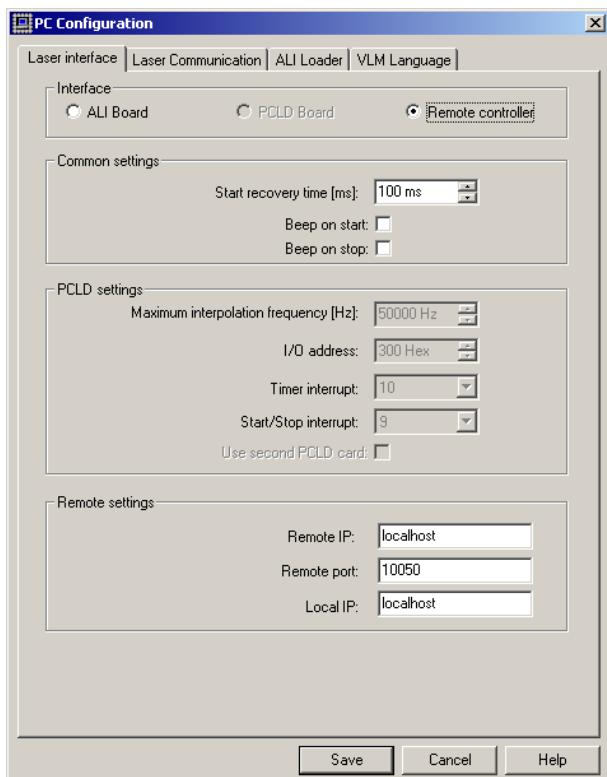
4. Select and open the corresponding ALI loader file.



**Figure 4.46** Installation ended

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

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



**Figure 4.47** Laser interface

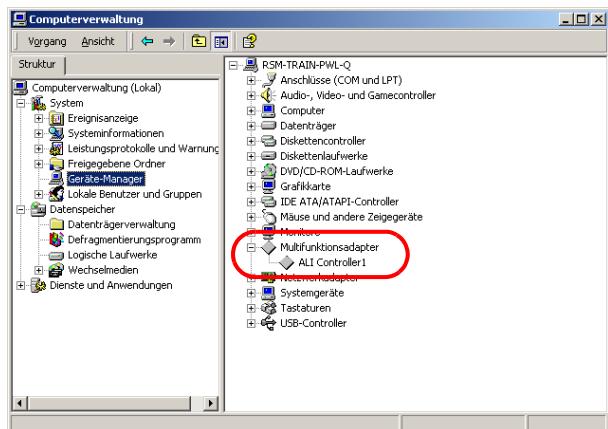
6. Adapt the settings in the laser interface.

## 4.13 Checking the ALI system settings



**Figure 4.48** Call the computer administration

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



**Figure 4.49** Device Manager

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



**Figure 4.50** Device properties

4. Check the device properties.

## 4.14 Settings in the RCU and VLM software

Information regarding the installation of the software and the necessary settings can be found in the respective software manuals.

## Trouble-shooting

## Notes



## 5 Cleaning optical components



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



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



**Attention:** Isopropyl alcohol basically has special dangers. It may basically only be used by accordingly trained personnel with the necessary care.

The substance is highly flammable and irritates the eyes. Fumes can cause sleepiness and a dazed state. The safety data sheet absolutely must be observed!

### 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.

### 5.1 Galvo head

#### 5.1.1 Protective glass

1. Remove the protective glass mount from the protective glass slide.
2. Loosen the respective fastening of the protective glass and remove it.
3. Clean it.
4. Put and fix the protective glass back in place.
5. Push the protective glass mount into the protective glass slide.

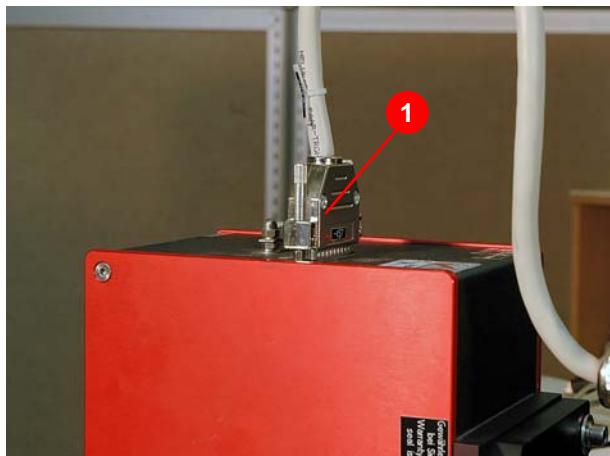


**Note:** Make sure that the protective glass and protective glass mount are installed on the right side.

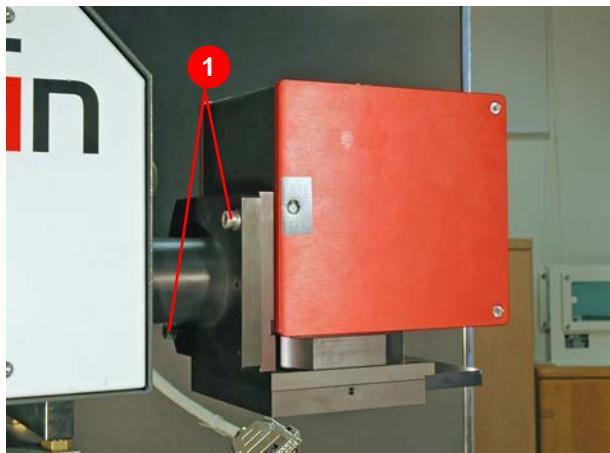
### 5.1.2 Focusing lens



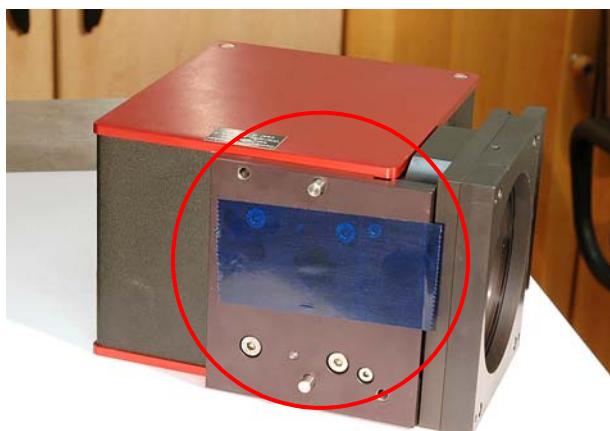
**Attention:** Switch off the laser system and secure it against reactivation. Pull the mains plug. The peripheral components of the laser system should also be shut down and secured against reactivation.



**Figure 5.1** Galvo head connecting plug



**Figure 5.2** Dismantling the galvo head



**Figure 5.3** Covering the entry openings

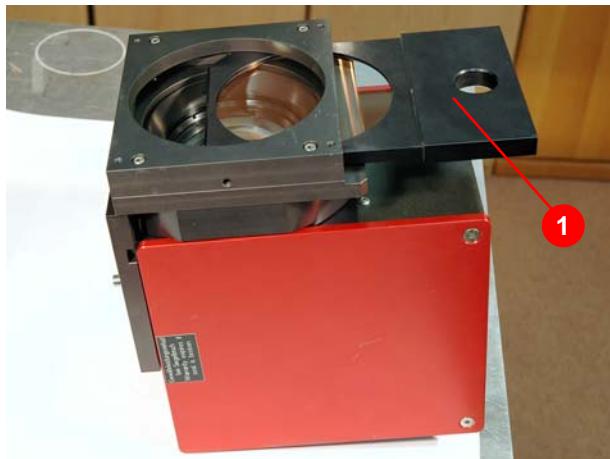
**Attention:** Remove or insert the connecting cable of the galvo head only without tension!

In case of non-observance, the galvo head can be damaged!

1. Loosen and remove the connecting plug of the galvo head (1) (Figure 5.1).

2. Loosen the fastening screws (1) (Figure 5.2).
3. Remove the galvo head.

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 5.4** Removing the protective glass

5. Remove the protective glass (1) ([Figure 5.4](#)).

**i Note:** If the protective glass is damaged, it must be exchanged ([see Section 7.1.2, page 101](#)).

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

6. Clean the protective glass ([see page 73](#)).



**Figure 5.5** Dismantling the guide plate

7. Loosen the screws ([Figure 5.5](#)) of the guide plate for the protective glass.

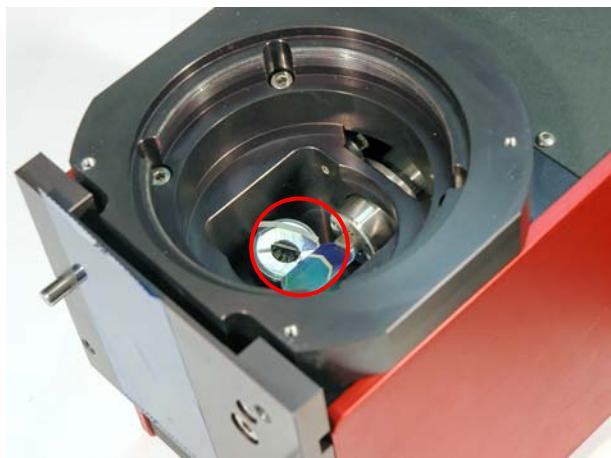


**Figure 5.6** Removing the focusing optics

8. Unscrew the focusing optics (1) ([Figure 5.6](#)).
9. Clean it ([see page 73](#)).



**Figure 5.7** Removing the distance ring



**Figure 5.8** Checking the cleanliness condition

10. Removing the distance ring (1) ([Figure 5.7](#)).

11. Clean the deflecting mirror ([Figure 5.8](#)) (see page 73).
12. Clean ([see Section 5.1, page 73](#)) if necessary.
13. Mount the galvo head in the reverse order.

**i** *Note:* When mounting the galvo head, pay attention to the correct position of the distance ring ([see Figure 5.7](#)).

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

## 5.2 Deflecting mirror

### 5.2.1 Deflecting 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.

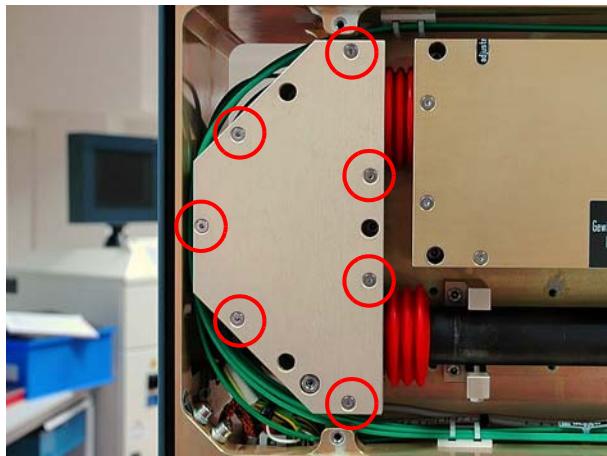


Figure 5.9 Cover of deflecting unit

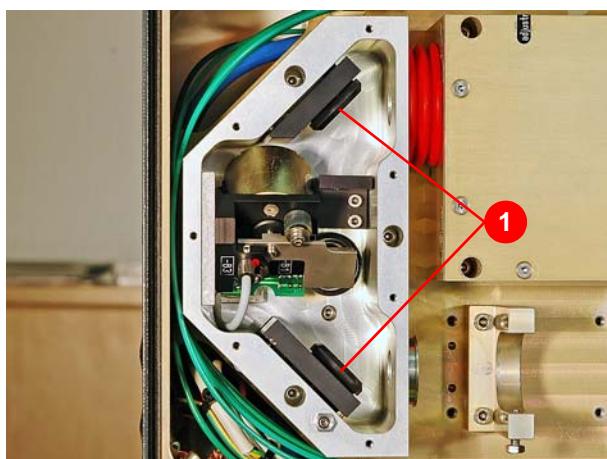
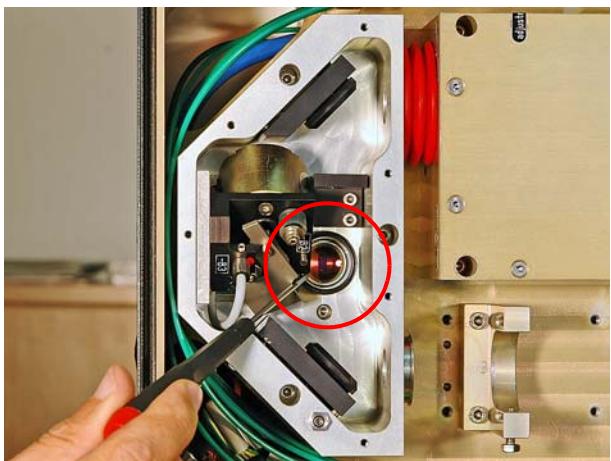


Figure 5.10 Removing the deflecting mirror

1. Open the lateral cover of the resonator side of the laser head.
2. Loosen the seven fastening screws on the cover of the deflecting unit.
3. Remove the cover.

4. Unscrew the deflecting mirror (1) ([Figure 5.10](#)) and lay it on a clean foundation.

**Attention:** Do not use a tool to unscrew the deflecting mirror! A risk of damaging the deflecting mirror exists!



**Figure 5.11** Lens in front of the internal power measurement unit or in front of the absorber

5. Swivel back the shutter mirror carefully to check the degree of soiling of the lens in front of the internal power measurement unit or in front of the absorber.

6. If cleaning is necessary, the complete deflecting unit and shutter module must be disassembled (see [Section 7.2, page 106](#)).

**Attention:** *If the shutter module is installed during the lens cleaning procedure, there is a risk of damage to the electronic or optical components of the shutter module!*

7. Unscrew the lens in front of the internal power measurement unit or in front of the absorber and lay it on a clean foundation.

8. Clean the deflecting mirror, the lens, and the shutter mirror ([see page 73](#)).

9. Reinstall the lens, shutter module, and deflecting mirror into the deflecting unit.

10. Mount the cover of the deflecting unit and install the deflecting unit into the laser head.

11. Check the adjustment of the laser beam and adjust it if necessary ([see Section 6.2.1, page 83](#)).

12. Mount the cover on the resonator side of the laser head.

13. Commission the laser system.

14. 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.

## 5.2.2 Alignment laser<sup>1</sup>



**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.

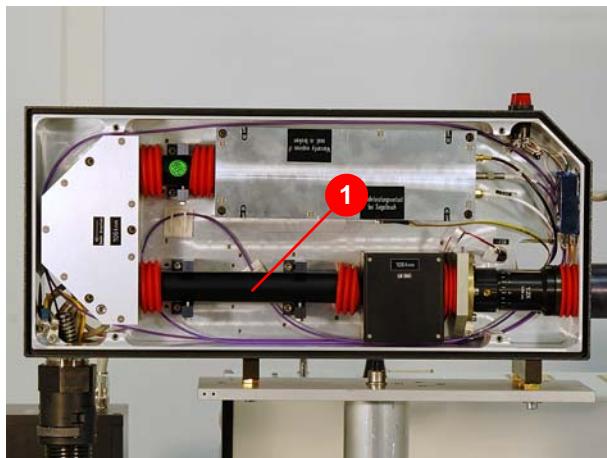


Figure 5.12 Dismantling the beam guide

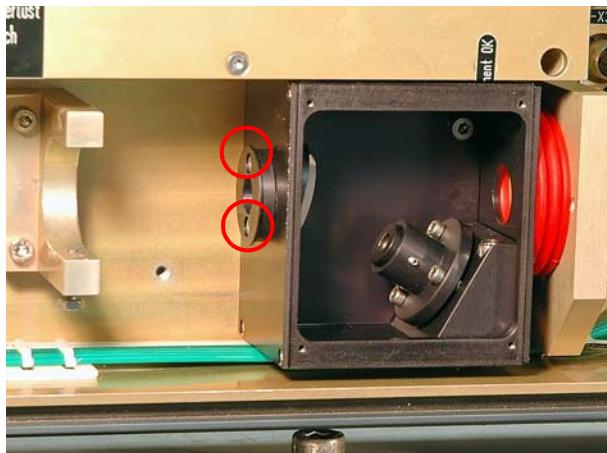


Figure 5.13 Alignment laser housing

1. Open the lateral cover of the resonator side of the laser head.
2. Remove the beam guide (1) ([Figure 5.12](#)) of the laser head.
3. Loosen the four fastening screws on the cover of the alignment laser.
4. Remove the cover.
5. Clean the inside of the positioning laser housing.
6. Remove the coupling mirror.
7. Clean the coupling mirror ([see page 73](#)).
8. Reinstall the coupling mirror.
9. Install the beam guide and pay attention to the correct position of the bellows.
10. Check the adjustment of the laser beam and adjust it if necessary ([see Section 6.2.3, page 92](#)).
11. Mount the cover of the alignment laser housing.
12. Mount the cover on the resonator side of the laser head.
13. Commission the laser system.

1. Installation depends on the respective laser type

## 5.3 Beam expander



**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 5.14** Dismantle the beam expander.

1. Remove the beam expander (1) ([Figure 5.14](#)) and the mount (2).

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

2. Unscrew the beam expander from the mount.
3. Clean it ([see page 73](#)).
4. 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!

5. Check the adjustment of the laser beam and adjust it if necessary ([see Section 6.2.1, page 83](#)).
6. Check the adjustment of the beam expander; set the value read before cleaning if necessary.
7. Mount the cover on the resonator side of the laser head.
8. Commission the laser system.
9. 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.

## 5.4 Glass fiber lines



**Attention:** The connections of glass fiber lines should be cleaned only with purified compressed air!

When isopropyl alcohol is used, liquid can get into the connections and lead to damage!

## 5.5 Resonator module



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

## Notes

## 6 Adjustment tasks

### 6.1 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 6.1** Checking the position of the workpiece support plate

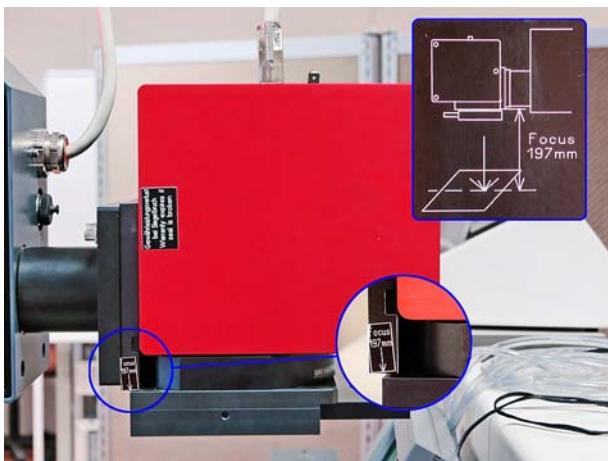
1. Check the X and Y directions of the position of the workpiece support plate using a precision level gauge.
2. Perform an adjustment if necessary.



**Figure 6.2** Checking the position of the galvo head



**Figure 6.3** Adjusting the laser head



**Figure 6.4** Adjusting the focal distance

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

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

**i** **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.

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

## 6.2 Adjusting the laser beam

### 6.2.1 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.



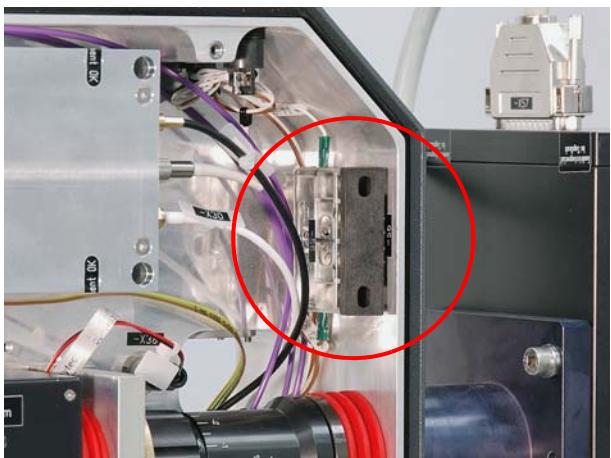
**Attention:** Remove or insert the connecting cable of the galvo head only without tension!  
In case of non-observance, the galvo head can be damaged!

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 resonator side of the laser head (slanted corner located on the right).

**Figure 6.5** Dismantling the galvo head



3. Remove the beam expander (1) ([Figure 6.6](#)) and the mount (2).
- Note:** The current adjustment 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. Reinstall the mount.
- Attention:** Do not crush or jam the cables and lines inside the laser head during installation!
- Figure 6.6** Dismantle the beam expander.
- RSM PowerLine E Air – Repair Manual
- 85



**Figure 6.7** Interlock switch bridged

6. Bridge the interlock switch ([Figure 6.7](#)).

**!** **Attention:** When the interlock switch is bridged, the laser system may be switched on for testing/measuring purposes only under supervision! Production while the interlock switch is bridged is fundamentally prohibited!

7. Secure the shutter against activation.

**!** **Attention:** Take measures for protection against laser radiation ([see page 85](#))!

8. 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.

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

10. Activate the laser system and set low power (approx. 5 to 7 W).

11. Open the shutter and check the emission of the main and alignment lasers on the transducer disk.

12. Close the shutter.

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

14. Insert the cross wires and their seat into the base plate.

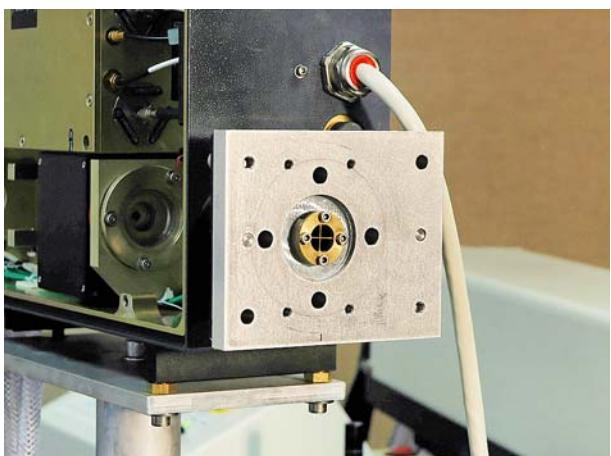
**i** **Note:** In the following steps, make sure that the cross wires are always in the same installation position.

**!** **Attention:** Careful handling of the adjusting aids must be guaranteed! Damaged adjusting aids lead to imprecise adjusting results!

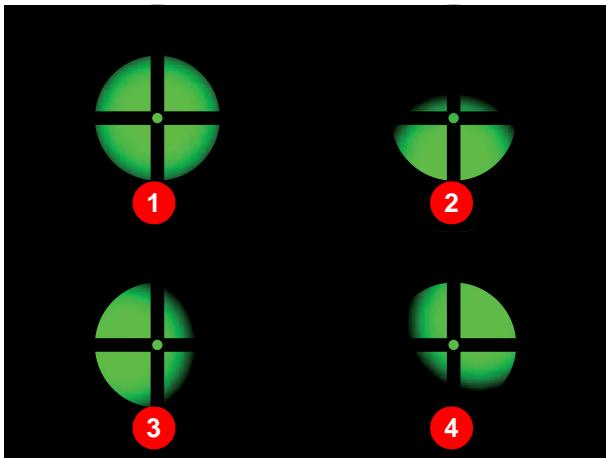
**i** **Note:** Adjusting aids to be used: [see Chapter 3](#).



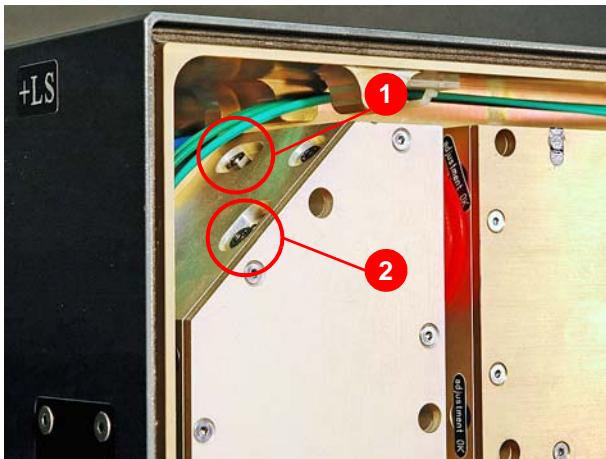
**Figure 6.8** Mounting the transducer disk



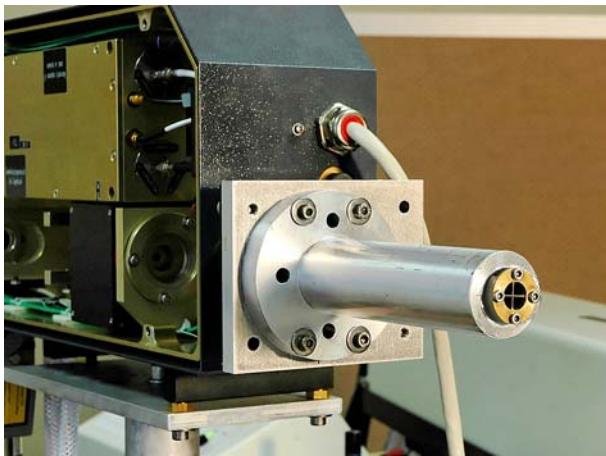
**Figure 6.9** Mounting the cross wires



**Figure 6.10** Checking the beam adjustment



**Figure 6.11** Beam adjustment of the upper deflecting mirror



**Figure 6.12** Mounting the adjustment tube

15. Open the shutter and check the image of the laser on the transducer disk. [Figure 6.10](#) shows examples of possible images:
  - Adjustment OK (1)
  - Emission too low (2)
  - Emission too far to the left (3)
  - Emission too far to the right (4)

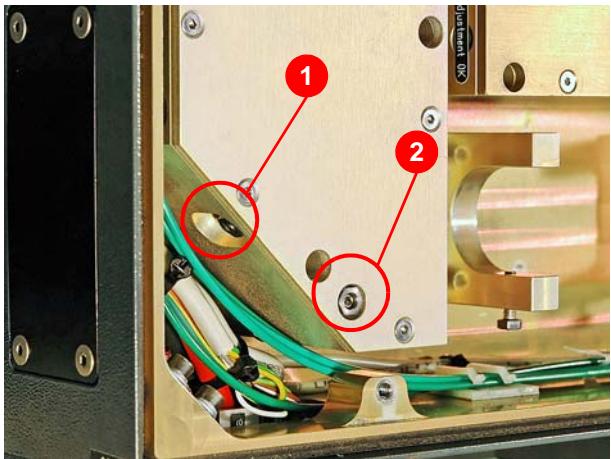
16. Adjust the beam by adjusting the upper deflecting mirror of the deflecting unit.
  - Horizontal adjustment (1) ([Figure 6.11](#))
  - Vertical adjustment (2) ()
17. Close the shutter after adjustment.

18. Remove the cross wires and their seat from the base plate.
19. Screw the adjustment tube to the base plate of the galvo flange.
20. Insert the cross wires and their seat into the adjustment tube.

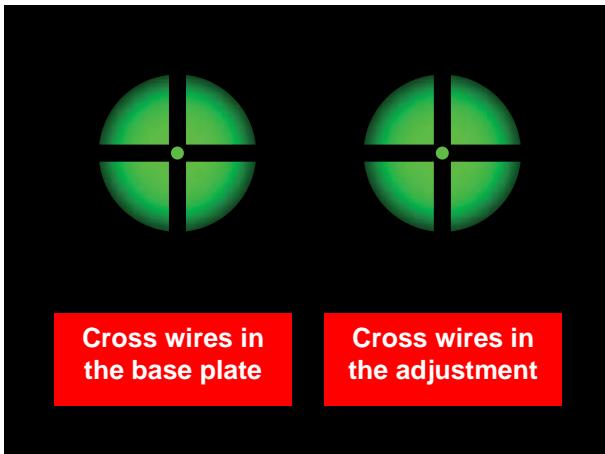
**i** *Note:* Make sure the cross wires are always installed in the same position.

**!** *Attention:* Careful handling of the adjusting aids must be guaranteed! Damaged adjusting aids lead to imprecise adjusting results!

21. Open the shutter and check the image of the laser on the transducer disk (see [Figure 6.10](#)).



**Figure 6.13** Beam adjustment of the lower deflecting mirror



**Figure 6.14** Beam adjustment OK

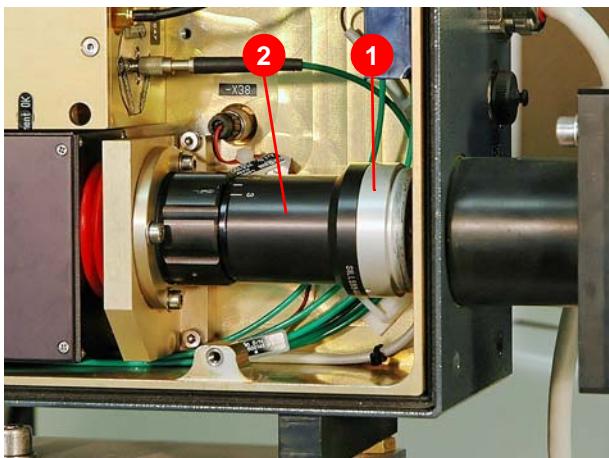
22. Adjust the beam by adjusting the lower deflecting mirror of the deflecting unit.
  - Horizontal adjustment (1) ([Figure 6.13](#))
  - Vertical adjustment (2) ()
23. Close the shutter after adjustment.
24. Remove the adjustment tube from the base plate and insert the cross wires and their seat into the base plate again.

**i** **Note:** Make sure the cross wires are always installed in the same position.

25. Open the shutter and check the image of the laser on the transducer disk and adjust it if necessary.
26. Close the shutter after adjustment.
27. Remove the cross wires and their seat from the base plate.
28. Screw the adjustment tube to the base plate of the galvo flange.
29. Insert the cross wires and their seat into the adjustment tube.
30. Open the shutter and check the image of the laser on the transducer disk and adjust it if necessary.

**i** **Note:** Repeat Steps 14 through 30 until no more deviations can be determined in the image after the installation position changes.

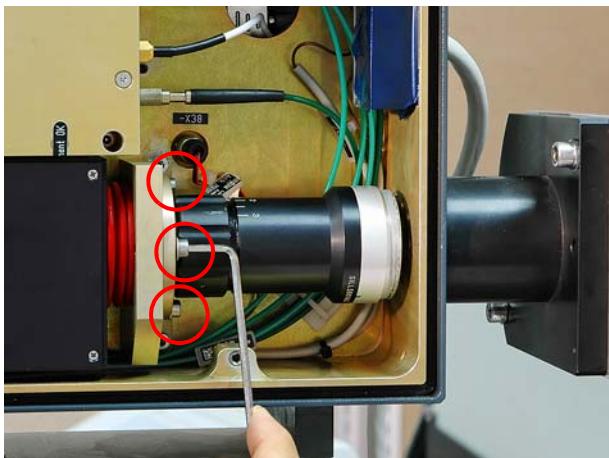
31. If no more deviations in the image can be determined, the adjustment is okay ([see Figure 6.14](#)).



**Figure 6.15** Beam expander with adjusting aperture



**Figure 6.16** Beam adjustment of the beam expander



**Figure 6.17** Adjustment of the beam expander

32. Remove the adjustment tube from the base plate.

33. Measure the power in front of the beam expander or alignment laser housing (optional) and on the galvo flange (see [Section 4.4, page 42](#)).

**i Note:** If a power difference can be determined, the adjustment should be performed again.

In case of the soiling/damage of the optical elements, exchange the beam expander if necessary and set the focus to the value set on the galvo head.

34. Screw the adjusting aperture for beam expander (1) ([Figure 6.15](#)) onto the beam expander (2).

35. Remove the beam expander mount, screw the beam expanders into the mount, and reinstall the mount.

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

36. Open the shutter and check the image of the laser on the transducer disk. [Figure 6.16](#) shows examples of possible images:

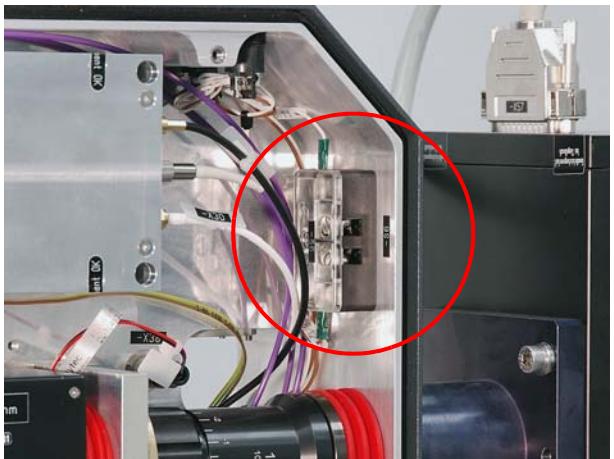
37. Adjust the beam expander using the three adjustment screws.

38. Close the shutter; Switch off the system and secure it against reactivation.

39. Remove the beam expander mount and screw on the adjusting aperture of the beam expander.

40. Install the beam expander and the mount again; pay attention to the correct position of the bellows.

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



**Figure 6.18** Interlock switch

41. Check the adjustment of the beam expander; set the value read before the adjustment procedure if necessary.

42. Measure the power in front of the beam expander or alignment laser housing (optional) and on the galvo flange (see [Section 4.4, page 42](#)).

**i** *Note:* If a power difference can be determined, the adjustment should be performed again.

43. Mount the galvo head.

44. Perform an adjustment if necessary (see [Section 6.2.3, page 94](#)).

45. Remove the bridge from the interlock switch.

46. Mount the cover on the resonator side of the laser head.

47. Commission the laser system.

48. 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.

## 6.2.2 Focal point



**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!

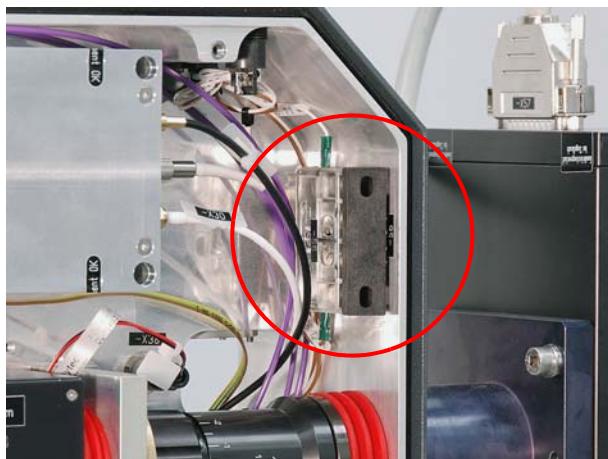


Figure 6.19 Interlock switch bridged

1. Open the cover of the resonator side of the laser head (slanted corner located on the right).
2. Bridge the interlock switch (Figure 6.19).

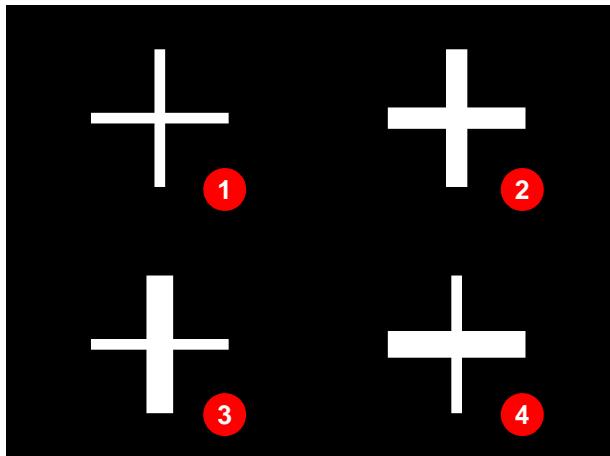
**Attention:** When the interlock switch is bridged, the laser system may be switched on for testing/measuring purposes only under supervision! Production while the interlock switch is bridged is fundamentally prohibited!

3. Secure the shutter against activation.

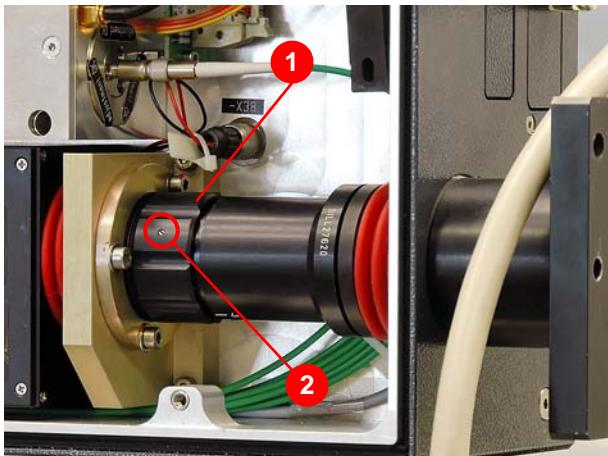
**Attention:** Take measures for protection against laser radiation (see page 91)!

4. 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 6.20** Checking the focus setting



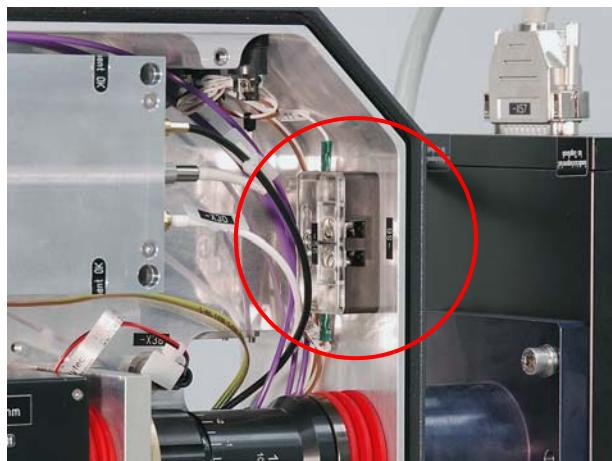
**Figure 6.21** Setting the focal point

5. Lay material (an anodized metal sheet, coated paper) under the galvo head.
6. Switch on the laser system using the key switch.
7. Open shutter; the emission of the laser beam is blocked by the Q-switch.
8. Let the program for the cross in the middle of the field with the material run according to the laser parameters.
9. Close the shutter.
10. 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)
11. If necessary, change the focal point by adjusting the adjusting ring (1) ([Figure 6.21](#)).
12. Move material under the galvo head, open the shutter, and let the program run.
13. Check the image of the cross.



**Note:** Repeat Steps 7 through 13 until the focal point is correctly set.

14. Fix the position of the beam expander using the locking screw (2).



**Figure 6.22** Interlock switch

15. Remove the bridge from the interlock switch.
16. Mount the cover on the resonator side of the laser head.
17. Commission the laser system.

### 6.2.3 Alignment laser<sup>1</sup>



**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.

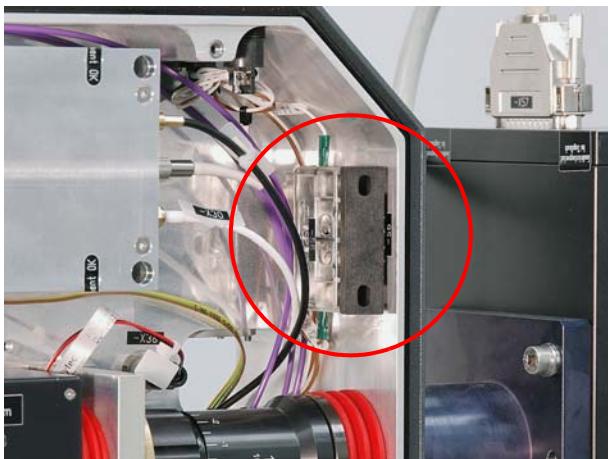


Figure 6.23 Interlock switch bridged

1. Open the cover of the resonator side of the laser head (slanted corner located on the right).
2. Bridge the interlock switch (Figure 6.23).

**Attention:** When the interlock switch is bridged, the laser system may be switched on for testing/measuring purposes only under supervision! Production while the interlock switch is bridged is fundamentally prohibited!

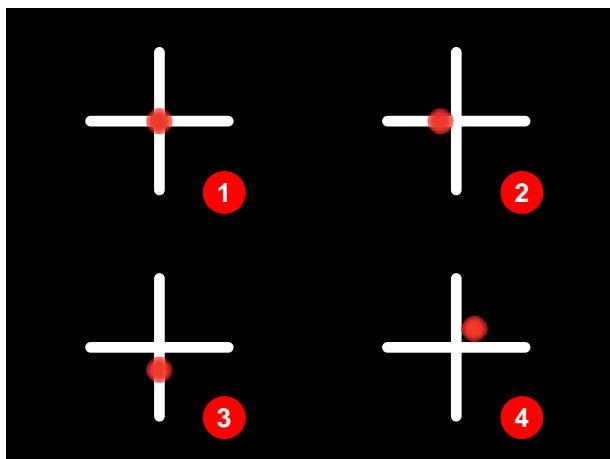
3. Secure the shutter against activation.

**Attention:** Take measures for protection against laser radiation (see page 94)!

4. 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.

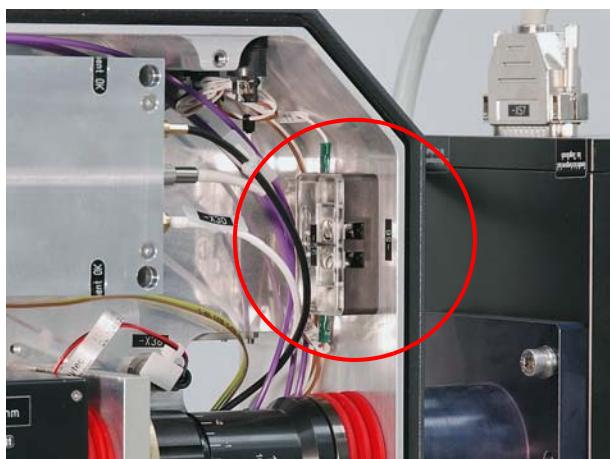
1. Installation depends on the respective laser type



**Figure 6.24** Checking the adjustment of the alignment laser



**Figure 6.25** Adjustment of the alignment laser



**Figure 6.26** Interlock switch

5. Fix material (an anodized metal sheet, coated paper) into place in the focus under the galvo head using tape.
6. Switch on the laser system using the key switch.
7. Open shutter; the emission of the laser beam is blocked by the Q-switch.
8. Let the program for the cross in the middle of the field with the material run according to the laser parameters.
9. Close the shutter.
10. Switch off the laser system; leave the main switch at the "On" position.
11. Check the position of the alignment laser in relation to the image of the cross hairs. [Figure 6.24](#) shows examples of possible images:
  - Adjustment OK (1)
  - Emission too far to the left (2)
  - Emission too low (3)
  - Emission too far to the right (4)
12. Open the housing of the alignment laser.
13. Adjust the alignment laser to the center of the marked cross hairs using the three adjusting screws ([Figure 6.25](#)).
14. Close the housing of the alignment laser.
15. Remove the bridge from the interlock switch.
16. Mount the cover on the resonator side of the laser head.
17. Commission the laser system.

## 6.3 Adjustment of the internal power measurement device (optional)

1. Measure the laser power after the deflecting unit (see Section 4.4.4, page 48).
2. Close the shutter, use the same parameters as under Section 1, switch on the laser beam, and read the power display of the internal measurement head.
3. In case of deviations in the display, adapt it in the LaserConsole software.

## Adjustment tasks

## Notes

## Adjustment tasks

## Notes

# 7 Repair work



**Note:** The "Maintenance Schedule" chapter in the PowerLine E 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 PowerLine E Air user manual.

## 7.1 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.

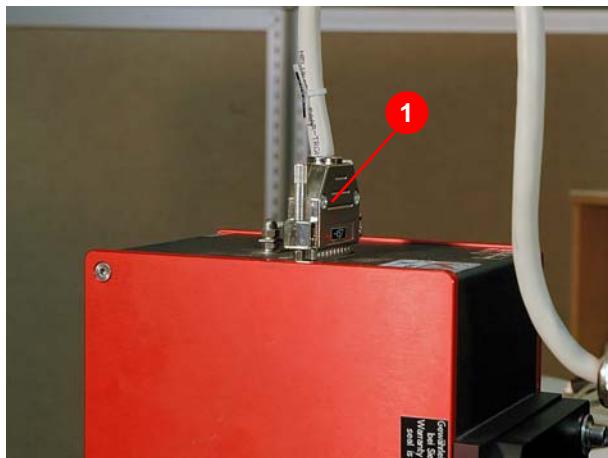
### 7.1.1 Galvo head



**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.

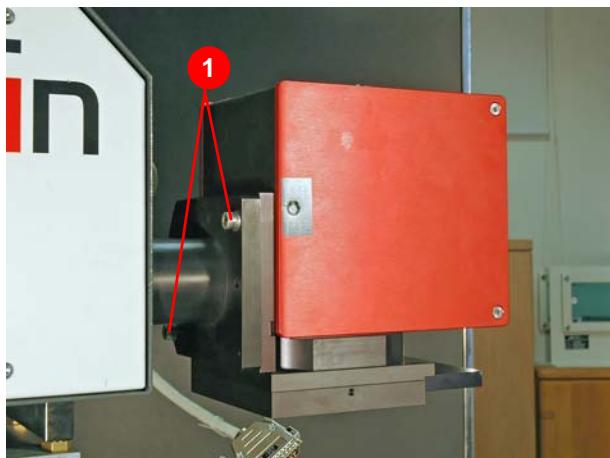


**Figure 7.1** Galvo head connecting plug

1. Switch off the main switch and wait 30 s until the voltage has completely reduced.

**Attention:** Remove or insert the connecting cable of the galvo head only without tension!  
In case of non-observance, the galvo head can be damaged!

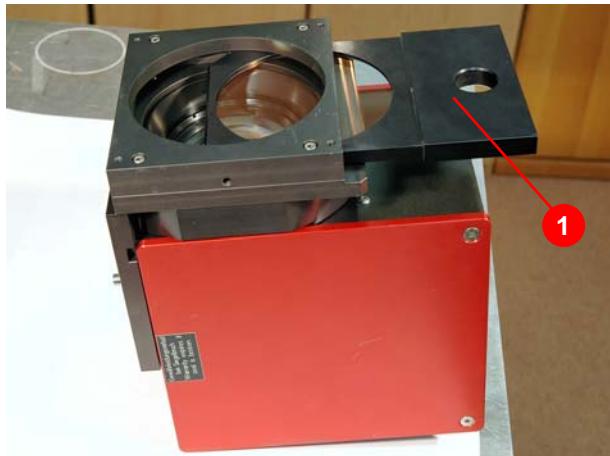
2. Loosen and remove the connecting plug of the galvo head (1) ([Figure 7.1](#)).



**Figure 7.2** Dismantling the galvo head



**Figure 7.3** Covering the entry openings



**Figure 7.4** Removing the protective glass

3. Loosen the fastening screws (1) ([Figure 7.2](#)).
4. Remove the galvo head.

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.

6. Remove the protective glass (1) ([Figure 7.4](#)).

**i** **Note:** If the protective glass is damaged, it must be exchanged ([see Section 7.1.2, page 103](#)).

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



**Figure 7.5** Dismantling the guide plate

7. Loosen the screws ([Figure 7.5](#)) of the guide plate for the protective glass.



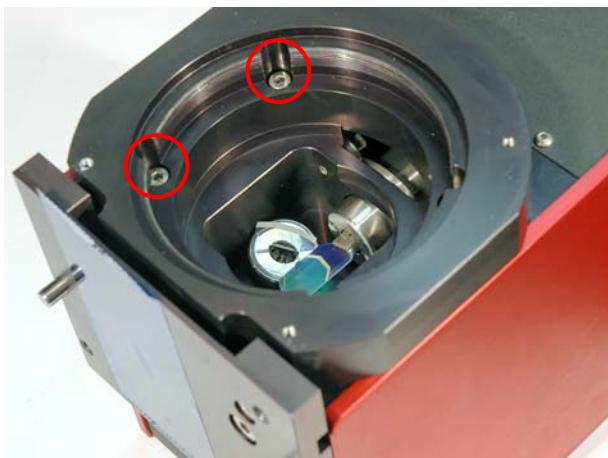
**Figure 7.6** Removing the focusing optics

8. Unscrew the focusing optics (1) ([Figure 7.6](#)).

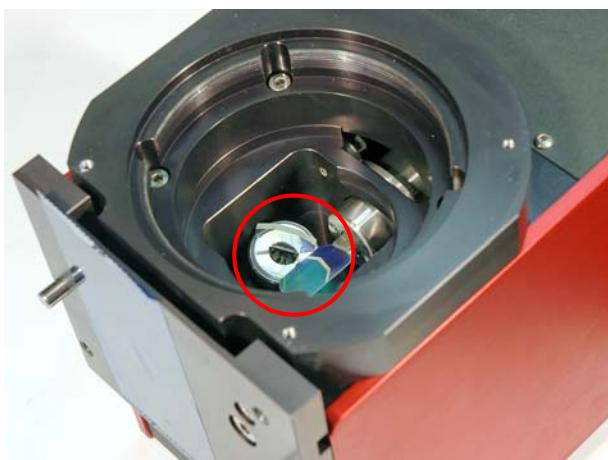


**Figure 7.7** Removing the distance ring

9. Removing the distance ring (1) ([Figure 7.7](#)).



**Figure 7.8** Removing the optics mount



**Figure 7.9** Checking the cleanliness condition



**Figure 7.10** Setting the operating voltage -1

10. Loosen the four fastening screws ([Figure 7.8](#)) of the optics mount and remove it.

11. Check to see if the deflecting mirror ([Figure 7.9](#)) is clean.
12. Clean ([see Section 5.1, page 71](#)) if necessary.
13. Mount the galvo head in the reverse order.

**i** *Note:* When mounting the galvo head, pay attention to the correct position of the distance ring ([see Figure 7.7](#)).

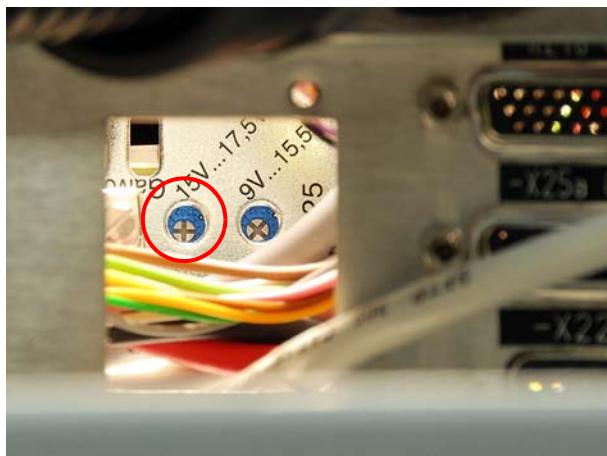
14. Remount the galvo head to the laser.

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

**!** *Attention:* Remove or insert the connecting cable of the galvo head only without tension!

*In case of non-observance, the galvo head can be damaged!*

16. Turn on the main switch.
17. Perform a voltage measurement (+15.5 V).



**Figure 7.11** Setting the operating voltage - 2



**Figure 7.12** Setting the operating voltage - 3

18. Set the operating voltage (**+15.5 V**) on the HN80x/HN90x using a small screwdriver. Setting precision: **±0.2 V**.

19. Perform a voltage measurement (**-15.5 V**).

**i** **Note:** The display of the minus value can have an offset to the set plus value.

20. Switch off the laser system.

21. Remove the measuring adapter.

**!** **Attention:** Remove or insert the connecting cable of the galvo head only without tension!

In case of non-observance, the galvo head can be damaged!

22. Commission the laser system.

23. Check the focal point of the laser and adjust it if necessary (see [Section 6.2.2, page 89](#)).

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

## 7.1.2 Protective glass

1. Remove the protective glass mount from the protective glass slide.
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.



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

### 7.1.3 Beam expander



**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 7.13** Dismantle the beam expander.

1. Open the lateral cover of the resonator side of the laser head.
2. Remove the beam expander (1) ([Figure 7.13](#)) and the mount (2).
3. Unscrew the beam expander from the mount.
4. Screw a new beam expander into the mount.
5. Check the adjustment of the laser beam and adjust it if necessary ([see Section 6.2.1, page 83](#)).
6. Install the beam expander and the mount again; pay attention to the correct position of the bellows.



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

7. Check the focal point of the laser and adjust it if necessary ([see Section 6.2.2, page 89](#)).
8. Mount the cover on the resonator side of the laser head.
9. Commission the laser system.

## 7.1.4 Deflecting mirror

### 7.1.4.1 Deflecting 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.

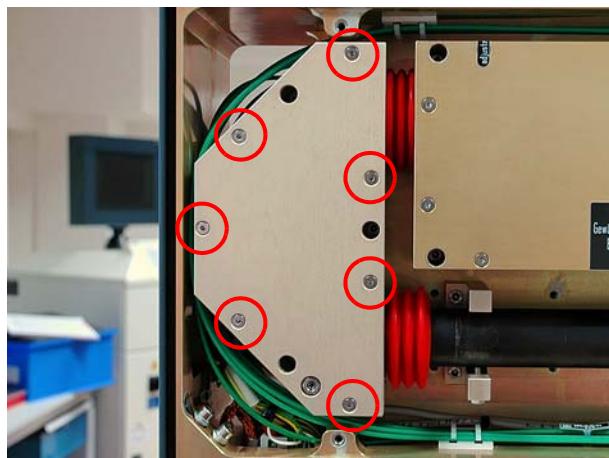


Figure 7.14 Cover of deflecting unit

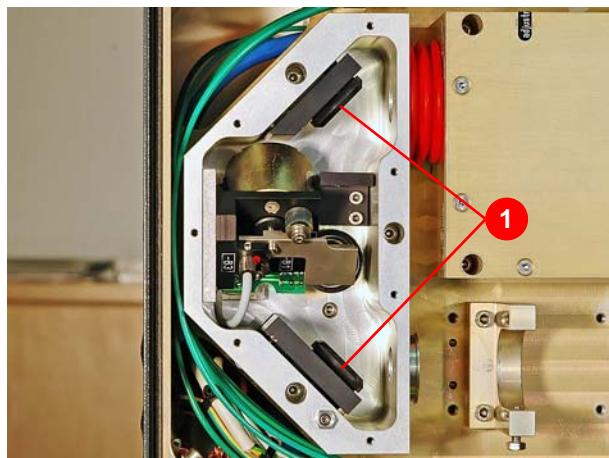
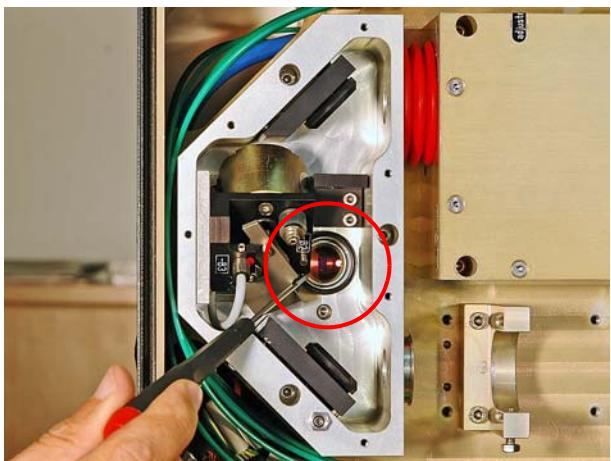


Figure 7.15 Removing the deflecting mirror

1. Open the lateral cover of the resonator side of the laser head.
2. Loosen the seven fastening screws on the cover of the deflecting unit.
3. Remove the cover.

4. Unscrew the deflecting mirror (1) ([Figure 7.15](#)) and lay it on a clean foundation.

**Attention:** Do not use a tool to unscrew the deflecting mirror! A risk of damaging the deflecting mirror exists!



**Figure 7.16** Lens of the measuring head or absorber

5. Swivel back the shutter mirror carefully so that you can reach the lens of the measuring head or absorber.

6. Unscrew the lens and lay it on a clean foundation.

**i** **Note:** If necessary to remove the lens, the complete deflecting unit and shutter module must be disassembled (see [Section 7.2, page 108](#)).

7. Clean the deflecting mirror, the lens, and the shutter mirror if necessary.

8. Reinstall the deflecting mirror and lens. Mount the cover of the deflecting unit.

9. Check the adjustment of the laser beam and adjust it if necessary (see [Section 6.2.1, page 83](#)).

10. Mount the cover on the resonator side of the laser head.

11. Commission the laser system.

12. 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.

### 7.1.4.2 Alignment laser<sup>1</sup>



**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.

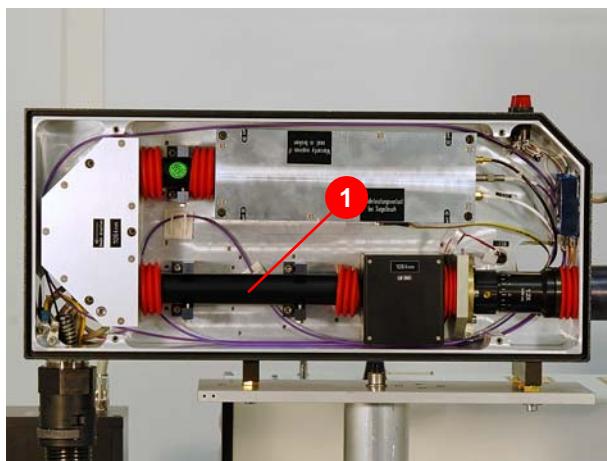


Figure 7.17 Dismantling the beam guide

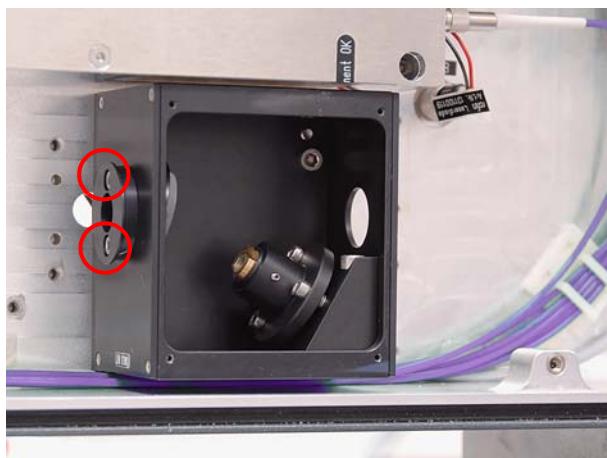


Figure 7.18 Alignment laser housing

1. Open the lateral cover of the resonator side of the laser head.
2. Remove the beam guide (1) ([Figure 7.17](#)) of the laser head.
3. Loosen the four fastening screws on the cover of the alignment laser.
4. Remove the cover.
5. Clean the inside of the positioning laser housing.
6. Remove the coupling mirror.
7. Clean the coupling mirror if necessary.
8. Reinstall the coupling mirror.
9. Install the beam guide and pay attention to the correct position of the bellows.
10. Check the adjustment of the laser beam and adjust it if necessary ([see Section 6.2.3, page 92](#)).
11. Mount the cover of the alignment laser housing.
12. Mount the cover on the resonator side of the laser head.
13. Commission the laser system.

1. Installation depends on the respective laser type

## 7.2 Changing the shutter module



**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 shutter module, check the adjustment of the laser beam.



Figure 7.19 Shutter module connecting plug

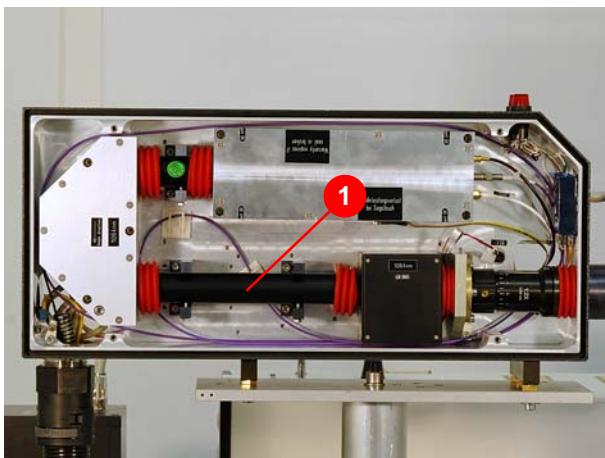
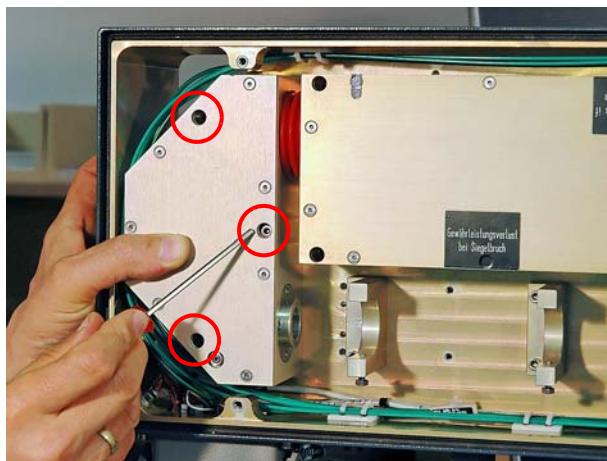


Figure 7.20 Dismantling the beam guide

1. Open both lateral covers of the laser head.
2. Remove the connecting plug (-X25) of the shutter module (1) ([Figure 7.19](#)) on the CAN node side of the laser head.

**Attention:** If the use of tools is necessary, do not apply force! Do not damage the connecting plug!

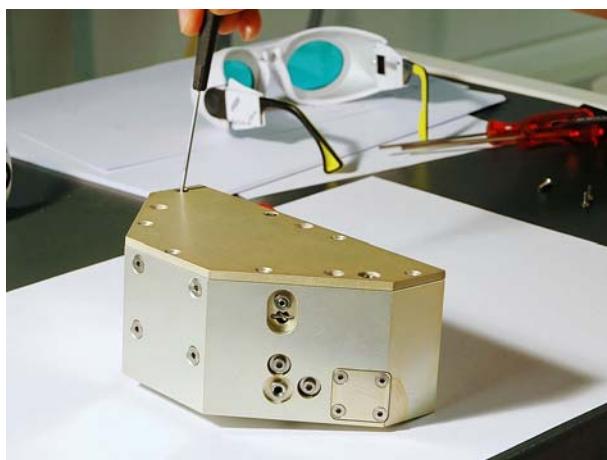
3. Remove the beam guide (1) ([Figure 7.20](#)) on the resonator side of the laser head.



**Figure 7.21** Deflecting unit fastening screws



**Figure 7.22** Beam aperture of the resonator module

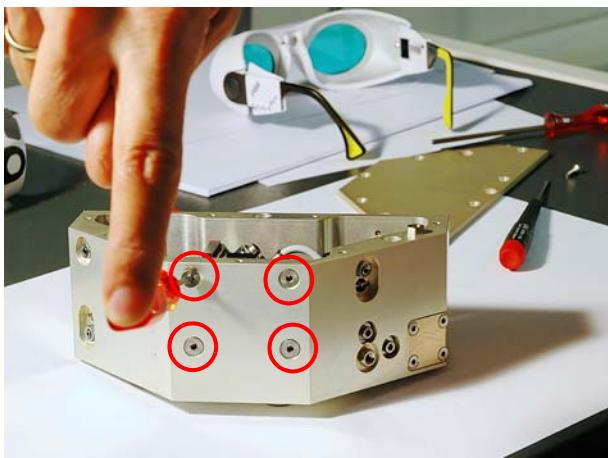


**Figure 7.23** Cover of deflecting unit

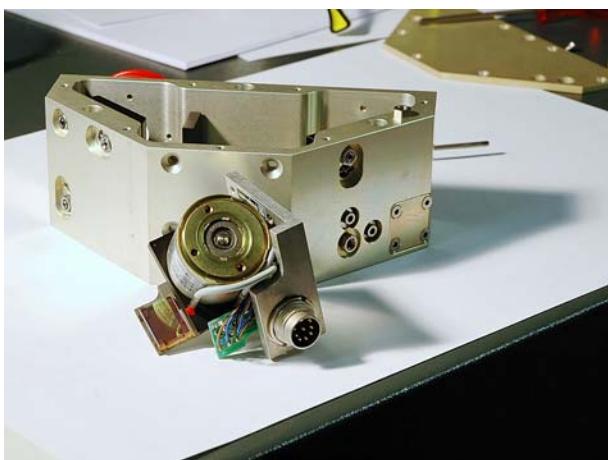
4. Loosen the three fastening screws of the deflecting unit.
5. Pull the deflecting unit forward off the alignment pins and remove it.

6. Remove the bellows from the resonator module.
7. Cover the beam aperture of the resonator module with tape (tape to be used: [see Chapter 3](#)) to prevent the antireflection-coated outlet window of the resonator module from getting dirty.

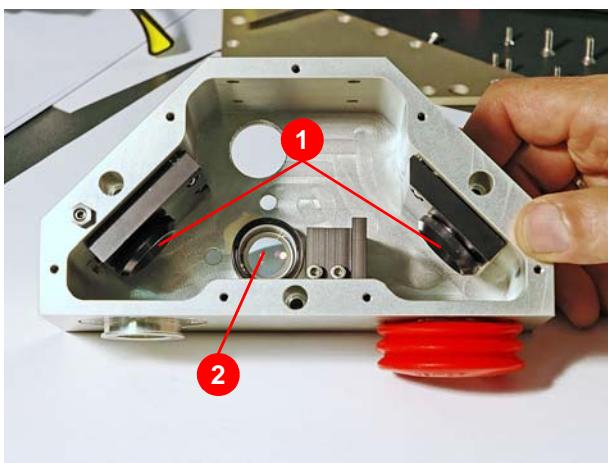
8. Lay the deflecting unit on a clean foundation.
9. Loosen the seven fastening screws on the cover of the deflecting unit.
10. Remove the cover.



**Figure 7.24** Loosening the shutter module



**Figure 7.25** Removing the shutter module

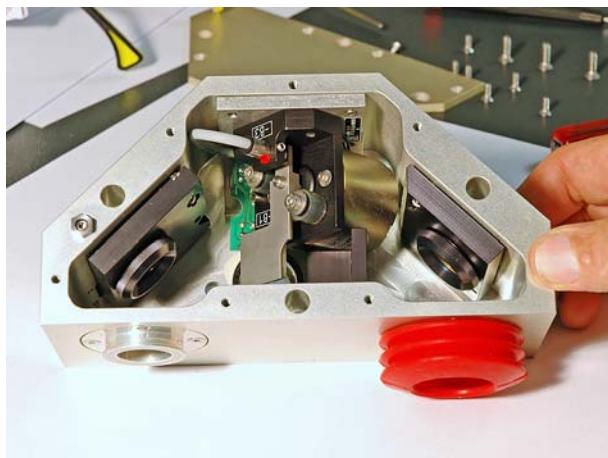


**Figure 7.26** Deflecting mirror/lens in front of the internal power measurement or absorber

11. Loosen the four fastening screws of the shutter module.

12. Remove the shutter module.

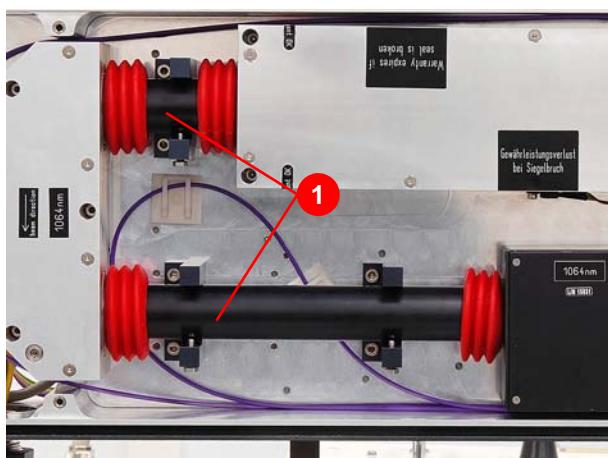
13. Check the cleanliness of the deflecting mirror (1) ([Figure 7.26](#)) and lens in front of the internal power measurement or absorber (2) in the deflecting unit. Clean them if necessary.



**Figure 7.27** Inserting the shutter module



**Figure 7.28** Installation of the deflecting unit



**Figure 7.29** Installing the beam guide

**i** **Note:** Before installation, check how clean the shutter mirror is. Clean it if necessary.

14. Insert a new shutter module into the deflecting unit and screw it into place.
15. Mount the cover of the deflecting unit.

16. Remove the tape from the beam aperture of the resonator module.
17. Insert the bellows between the deflecting unit and the resonator module, place the deflecting unit onto the alignment pins, and make sure the bellows are in the correct position.
18. Screw the deflecting unit into place; then insert the connecting plug (-X25) of the shutter module on the CAN node side of the laser head and screw it into place.

**!** **Attention:** Tighten the connecting plug only by hand to prevent any damage to the thread due to the use of tools!

19. Check the adjustment of the laser beam (see [Section 6.2, page 83](#))
20. Install the beam guide (1) ([Figure 7.29](#)) on the resonator side of the laser head and pay attention to the correct position of the bellows.
21. Mount both lateral covers of the laser head.
22. Commission the laser system.

## 7.3 Changing the resonator module



**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.

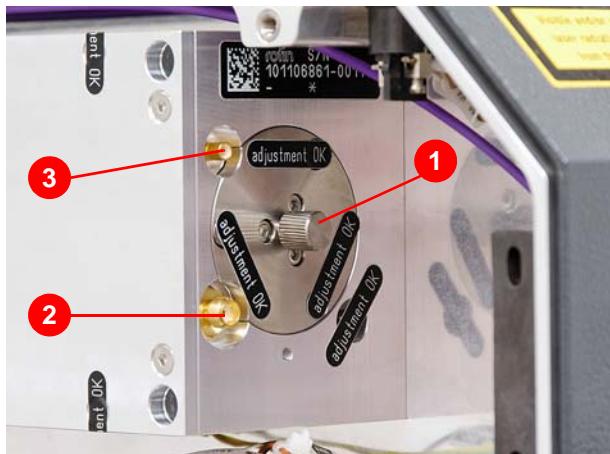
The DIN EN 207 Filter und Augenschutzgeräte gegen Laserstrahlung (BS EN 207 Filters and Eye-Protectors Against Laser Radiation (Laser Eye-Protectors)), DIN EN 60825-1 Sicherheit von Lasereinrichtungen (BS EN 60825-1 Safety of Laser Products), and DIN EN 60825-4 Sicherheit von Laserschutzwänden (BS EN 60825- 4 Safety of Laser Products: Laser Guards) standards must be observed.



**Note:** The resonator module should be exchanged as a complete unit together with the cooling element. Repair inside the resonator module may be performed only by ROFIN-SINAR. In case of non-observance, the warranty is no longer valid.



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



**Figure 7.30** Disconnecting the resonator module

1. Mount the cover on the resonator side of the laser head.
2. Loosen the swivel nut and remove the glass fiber line(s).

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

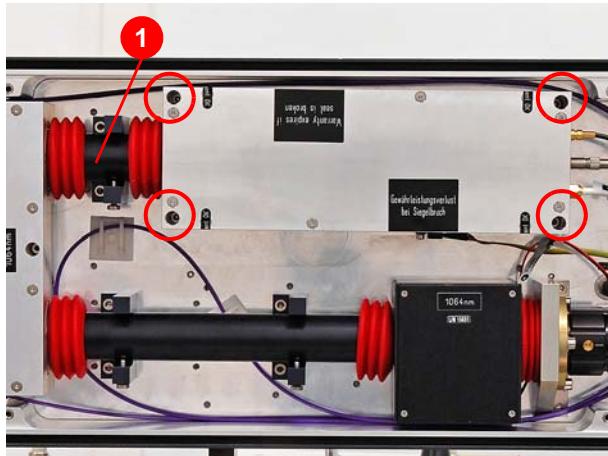
- Note:** In the case of RSM PowerLine E Air-25/-30, which has two glass fiber lines, mark the connection at which the respective glass fiber was connected. In this way, the lines are not mixed up, which can lead to malfunctions.
3. Attach dust protection caps to the glass fiber(s) and the connections on the resonator module (1) (Figure 7.30).



**Figure 7.31** Dust protection caps and short-circuit bridges

**i** **Note:** A bag with dust protection caps and short-circuit bridges is located in the plug-in supply module (Figure 7.31). Reattach the bag with dust protection caps and short-circuit bridges there when work is completed.

4. Disconnect the SMA plug of the HF line (2) (Figure 7.30) and the SMB plug of the Q-Switch interlock line (3).



**Figure 7.32** Loosening the resonator module

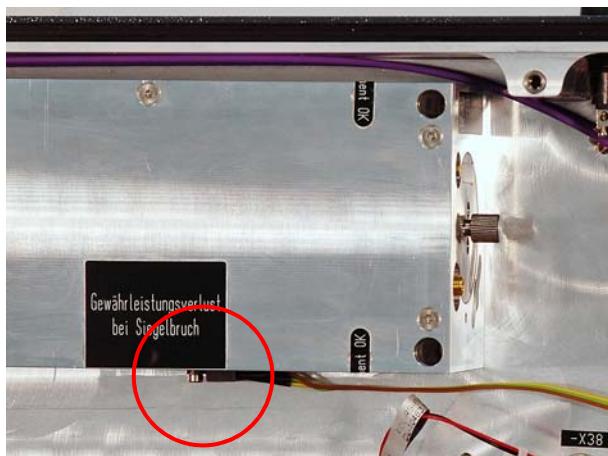
5. Applies only for RSM PowerLine E Air-10: remove the beam guide (1) (Figure 7.32).

6. Loosen the fastening screws of the resonator module.

**i** **Note:** Hold the resonator module securely to prevent it from tipping out. Do not lose the fastening screws.

7. Remove the resonator module from the alignment pins. In the process, secure the fastening screws against falling out.

**i** **Note:** Carefully remove the resonator module since sensor -B7 is still attached to the resonator module.



**Figure 7.33** Sensor -B7

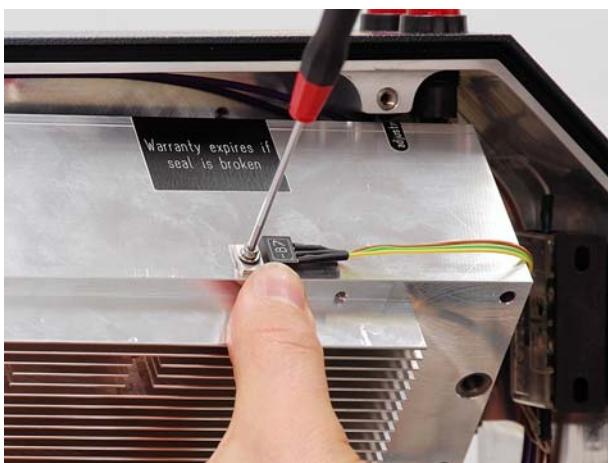


Figure 7.34 Dismantling sensor -B7

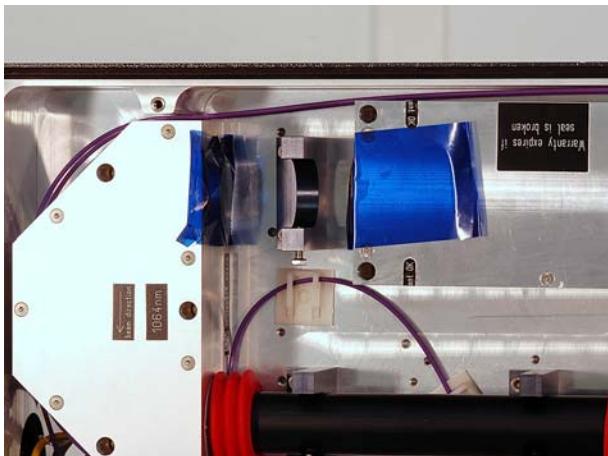


Figure 7.35 Covering the beam path

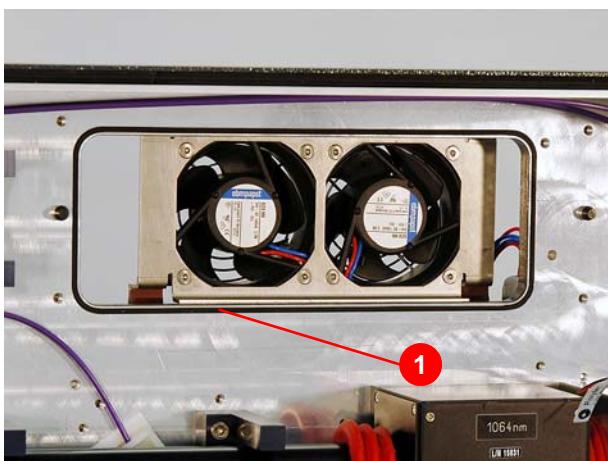


Figure 7.36 O-ring

8. Hold the resonator module firmly and dismantle sensor -B7.

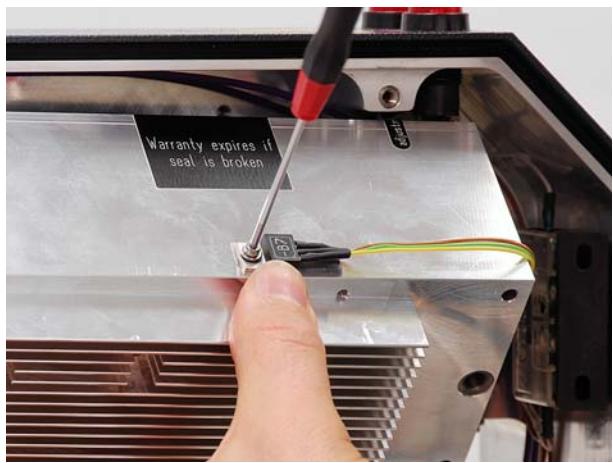
**i** **Note:** Do not lose the fastening screw, washer, plastic sleeve, and piece of mica.

9. Unscrew the resonator module and lay it on a clean foundation.

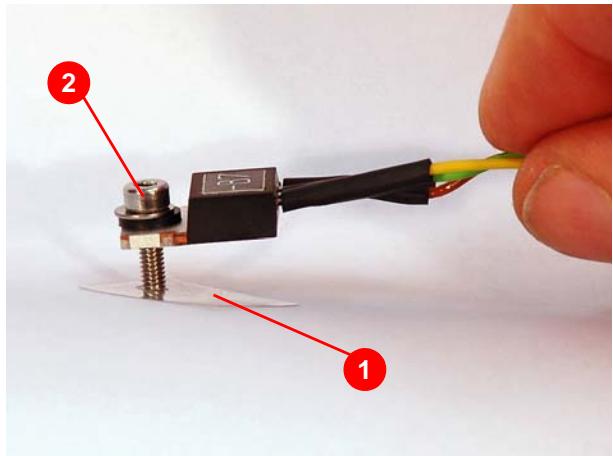
10. Cover the beam output aperture of the resonator module and the beam input aperture of the shutter module with (tape to be used: see Chapter 3) to prevent them from getting dirty.

11. Check the state of the O-ring (1) (Figure 7.36).

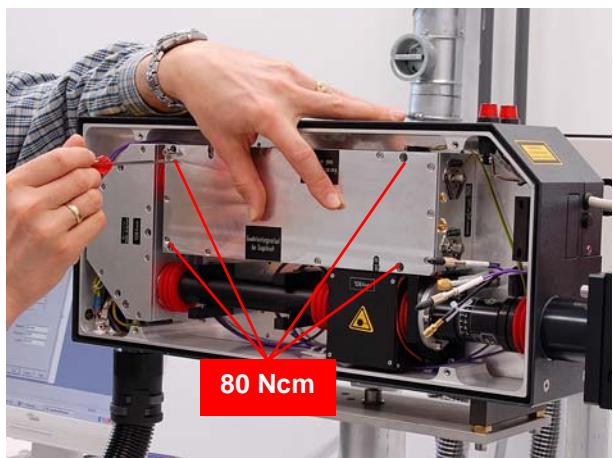
**i** **Note:** The O-ring must be exchanged in case of danger, but after the exchange of the resonator module, at the latest.



**Figure 7.37** Mounting sensor -B7



**Figure 7.38** Attachment of sensor -B7



**Figure 7.39** Inserting the resonator module

12. Check the state and correct seat of the O-ring on the cooling fans.
13. Screw sensor -B7 onto the new resonator module.

The following exchange sets can be obtained from ROFIN-SINAR:

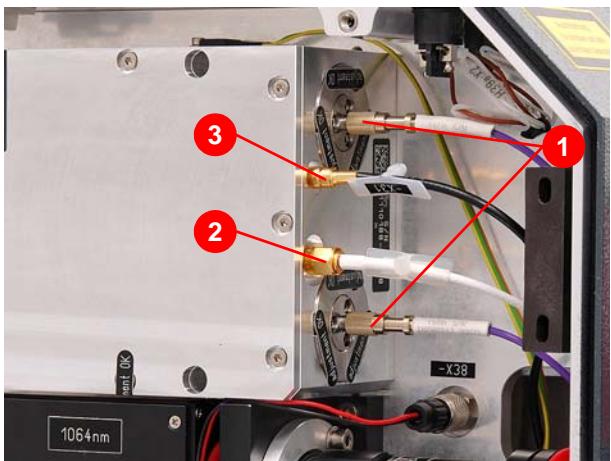
- 101110928  
Resonator module; PL-E Air-10; HP;  
V; exchange
- 101110929  
Resonator module; PL-E Air-10; HQ;  
V; exchange
- 101110930  
Resonator module; PL-E Air-25; HQ;  
V; exchange
- 101110931  
Resonator module; PL-E Air-30; HP;  
V; exchange

**Attention:** Pay attention to the correct attachment of the sensor. (1) The piece of mica should be between the sensor and resonator module, and (2) the fastening screw should have a washer and plastic sleeve.

14. Measure the contact resistance between the sensor surface and the resonator module. The resistance must be infinite.

**Attention:** Before the installation of the resonator module, make sure that all tape (beam aperture) is removed again. In case of non-observance, severe damage to the laser (risk of fire) may result.

15. Push the resonator module onto the alignment pins.
16. Insert the fastening screws included with the new resonator modules and tighten them crosswise at a torque of **80 Ncm**.



**Figure 7.40** Connecting the resonator module

17. Remove the dust cap(s) from the resonator module and the glass fiber line(s) and connect the glass fiber(s) (1) (Figure 7.40).

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

**Note:** In the case of RSM PowerLine E Air-25/-30, pay attention to the correct connection of the respective glass fibers. Reattach the bag with dust protection caps and short-circuit bridges in the plug-in supply unit when work is completed (see Figure 7.31, page 113).

18. Connect the SMA plug of the HF line (2) and the SMB plug of the Q-switch interlock line (3).

19. Bridge the interlock switch (Figure 7.41).

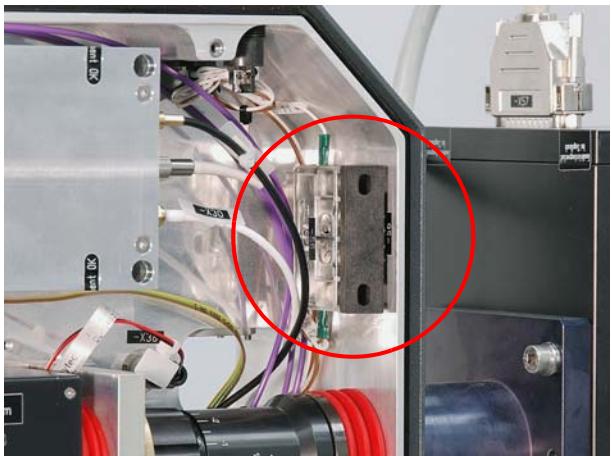
**Attention:** When the interlock switch is bridged, the laser system may be switched on for testing/measuring purposes only under supervision! Production while the interlock switch is bridged is fundamentally prohibited!

20. Secure the shutter against activation.

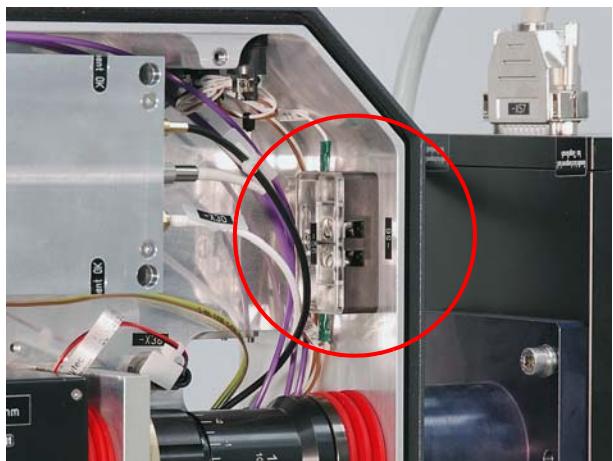
**Attention:** Take measures for protection against laser radiation (see page 112)!

21. 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 7.41** Interlock switch bridged



**Figure 7.42** Interlock switch

22. Check the adjustment of the laser beam (see [Section 6.2, page 83](#))
23. Remove the bridge from the interlock switch.
24. Mount the cover on the resonator side of the laser head.
25. Commission the laser system.
26. Check the laser power behind the galvo head (on the workpiece) using the power measurement device.
27. Check the laser leakage power of the HF generator (see [Section 7.8.5, page 166](#) or [Section 7.8.4, page 162](#)).
28. Perform the measurement test marking. Enter the measurement values in the logbook.

## 7.4 Changing the alignment laser<sup>1</sup>



**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.

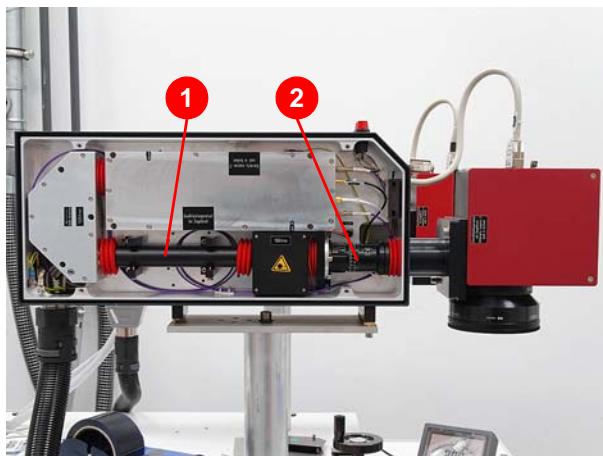


Figure 7.43 Dismantling the beam guide



Figure 7.44 Connecting plug of the alignment laser

1. Open the lateral cover of the resonator side of the laser head.
2. Remove the beam guide (1) ([Figure 7.43](#)) of the laser head, the beam expander (2), and the beam expander mount.

3. Remove the connecting plug of the alignment laser (-X38).
4. Loosen the four fastening screws on the cover of the alignment laser.
5. Remove the cover.
6. Loosen the fastening screws of the alignment laser housing; remove the housing.

1. Installation depends on the respective laser type

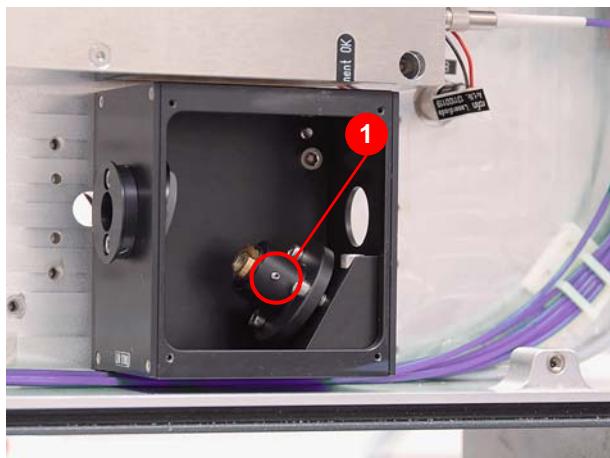


Figure 7.45 Alignment laser housing

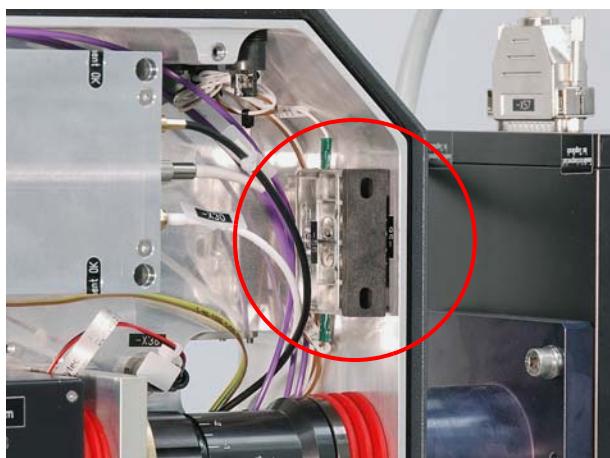


Figure 7.46 Interlock switch bridged

7. Remove the alignment laser after loosening the headless screw (1) (Figure 7.45).

8. Bridge the interlock switch (Figure 7.46).

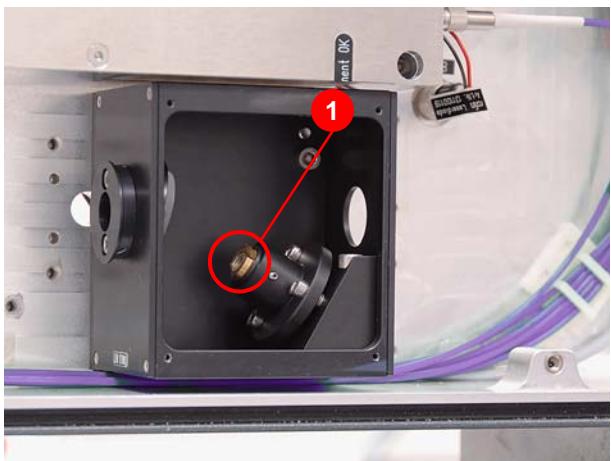
**! Attention:** When the interlock switch is bridged, the laser system may be switched on for testing/measuring purposes only under supervision! Production while the interlock switch is bridged is fundamentally prohibited!

9. Secure the shutter against activation.

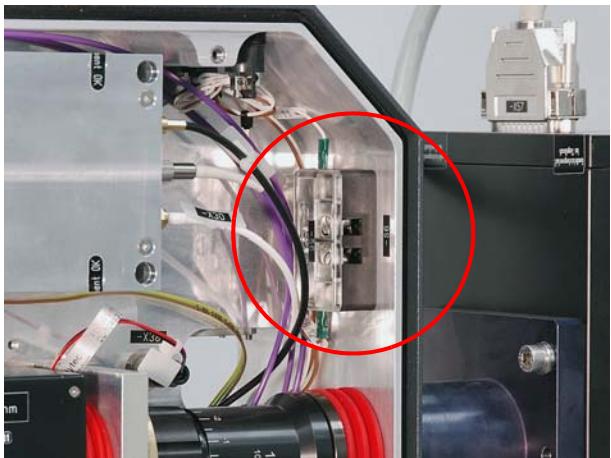
**! Attention:** Take measures for protection against laser radiation (see page 118)!

10. Insert the mains plug 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.



**Figure 7.47** Adjustment of the alignment laser



**Figure 7.48** Interlock switch

11. Connect the new alignment laser to the -X38 plug, switch on the system, start up the software (LaserConsole), and switch on the positioning laser.

12. Using the brass screw (1) ([Figure 7.47](#)), align the red laser beam to a white surface that is about 1.5 m to 2 m and turn the brass screw until the minimum diameter of the laser beam is reached.

13. Insert the new alignment laser and screw it tight.

14. Mount the housing.

**!** ***Attention:** Do not crush, jam, or abrade the connecting lines of the alignment laser during installation!*

15. Check the adjustment of the pilot beam and adjust it if necessary ([see Section 6.2.3, page 92](#)).

16. Mount the cover of the alignment laser housing.

17. Install the beam guide and pay attention to the correct position of the bellows.

18. Install the beam expander and the mount again; pay attention to the correct position of the bellows.

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

19. Check the setting of the beam expander.

20. Remove the bridge from the interlock switch.

21. Mount the cover on the resonator side of the laser head.

22. Commission the laser system.

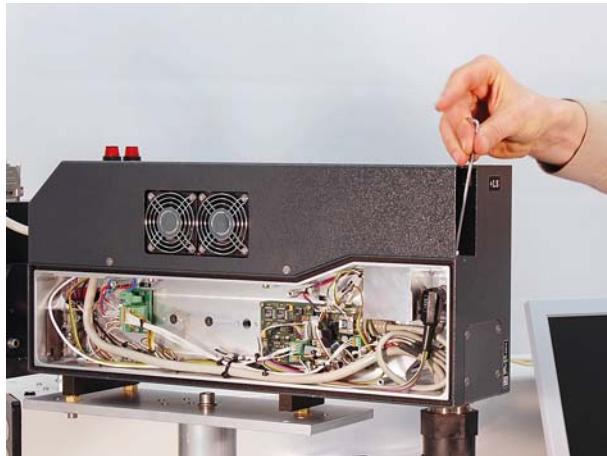
## 7.5 Changing of the fan unit on the laser head



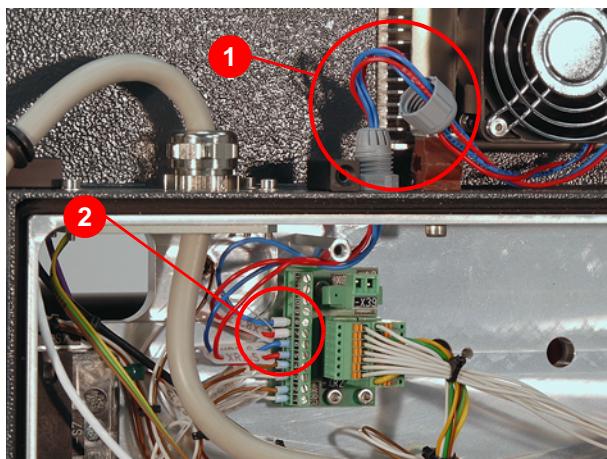
**Attention:** Switch off the laser system and secure it against reactivation. Pull the mains plug. The peripheral components of the laser system should also be shut down and secured against reactivation.



**Note:** For the complete exchange of the fan unit, an exchange set (101108336, fan unit exchange set for PL-E Air) can be obtained from ROFIN-SINAR.



**Figure 7.49** Dismantling the fan cover



**Figure 7.50** Disconnecting the fan

1. Dismantle the fan cover of the laser head.

2. Open the cable screw connection (1) ([Figure 7.50](#)) of the fan lines.
3. Disconnect the fan lines (2) and pull them through the cable screw connection one by one.

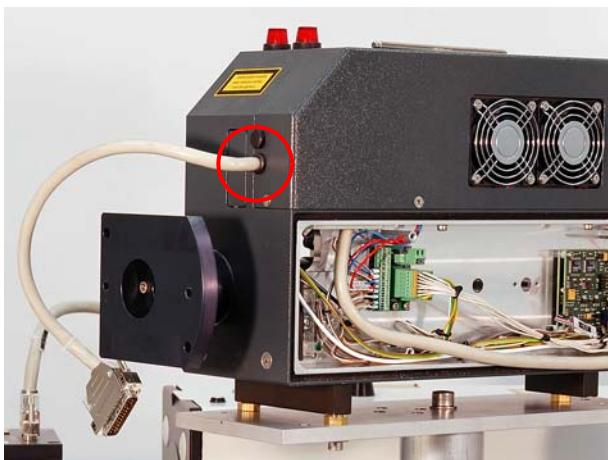
**i** **Note:** The lines must be pulled through individually so that the cable markings are not rubbed off the lines.



**Figure 7.51** Dismantling/mounting the fan



**Figure 7.52** Connecting the fan



**Figure 7.53** Mounting the fan cover

4. Loosen the screw connections of the fan plate.

**i Note:** Counter with suitable pliers so as not to deform the rubber buffer.

5. Clean or exchange the fan unit as required.

**i Note:** Make sure it is in the correct installation position (direction of flow). Also check the degree of soiling of the cooling ribs of the cooling element and clean it with a soft brush as required.

6. Mount the fan plate and screw it into place.

**i Note:** Counter with suitable pliers so as not to deform the rubber buffer.

**!** **Attention:** Never replace the rubber buffer with rigid materials! Any vibrations can negatively influence the marking result.

7. Pull the fan lines through the cable screw connection (1) ([Figure 7.52](#)) one by one and connect them (2).

8. Tighten the cable screw connection.

9. Make sure the rotors are free of the risk of collision.

10. For a function check, insert the mains plug and turn on the main switch of the plug-in supply unit.

11. Switch off the main switch again.

12. Mount the fan cover and tighten all fastening screws.

**i Note:** Pay attention to the correct position of the rubber sleeve of the connecting line of the galvo head.

## 7.6 Changing the diode module



**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 mains connection is disconnected as required before the plug-in supply unit is opened, the protective conductor connection is also disconnected! Before working on diodes, ground the plug-in unit using suitable means! The external grounding line must be implemented on a marked PE terminal of the plug-in unit and on a marked PE terminal in the vicinity of the plant! The correct equipotential bonding must be checked using measuring technology! The ESD wrist band must then be connected to a PE terminal of the plug-in unit!

Before that, the diode modules may not be disconnected!



**Attention:** Everyone who works on the diode modules must observe the measures for the protection of electrostatically sensitive devices (ESD)! The work area must be secured!



**Attention:** In the case of remote connecting lines, touching connecting terminals can lead to the destruction of the diode! This also applies to disconnecting the connecting lines on the power supply unit! Diodes must be short-circuited by grounded personnel directly after disconnection!



**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.



**Note:** The new diode module is sent when ordered. The transport container is to be used for the return of the old diode module.



**Note:** Before changing the diode module, measure/check the laser power behind the protective glass of the galvo head using the power measurement device (see Section 4.4, page 42). Enter the measured value in the logbook.

### 7.6.1 Preparatory tasks



Figure 7.54 Plug-in supply unit



**Attention:** Electrostatically sensitive devices (ESD)! The diode module may be changed only after equipotential bonding has been performed!

1. Take out the plug-in supply unit and remove the top cover.
2. Remove the heat insulation on the diode module(s) (1) ([Figure 7.54](#)).

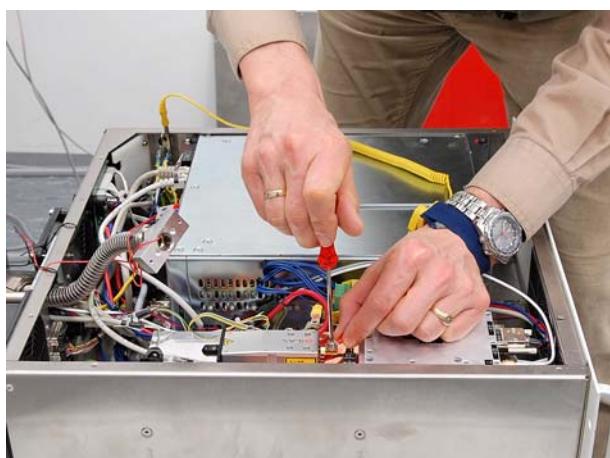


Figure 7.55 Performing equipotential bonding

3. Put on the grounding strap and securely fasten the terminal of the ground cable to a port in the plug-in supply unit marked with  $\oplus$ .

## 7.6.2 RSM PowerLine E Air-10

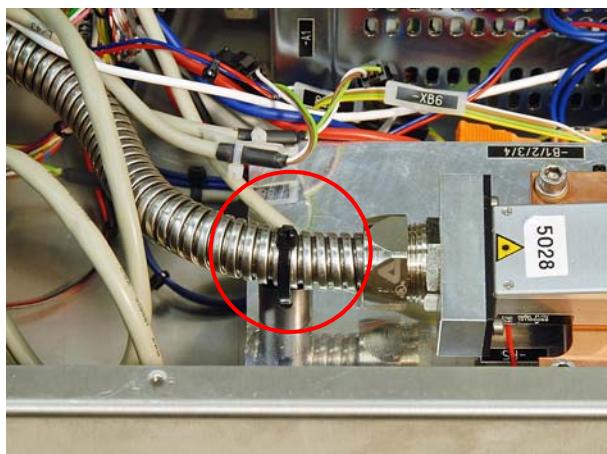


Figure 7.56 Tension relief of the metal tube



Figure 7.57 Dust protection caps and short-circuit bridges

1. Perform the preparatory tasks ([Section 7.6.1, page 124](#)).
2. Remove the tension relief of the metal tube using a side cover.

**i** **Note:** A bag with dust protection caps and short-circuit bridges is located in the plug-in supply module ([Figure 7.57](#)). Reattach the bag with dust protection caps and short-circuit bridges there when work is completed.

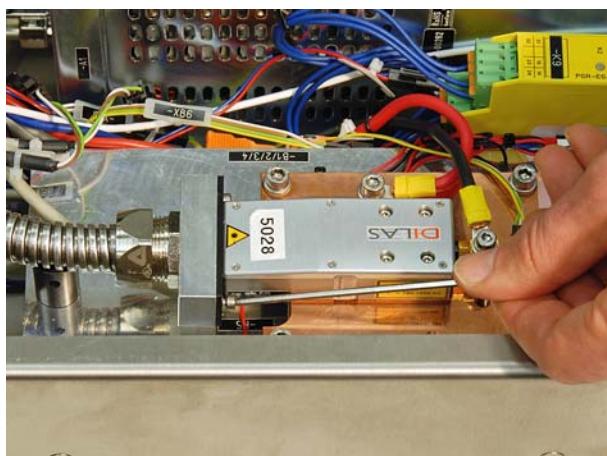
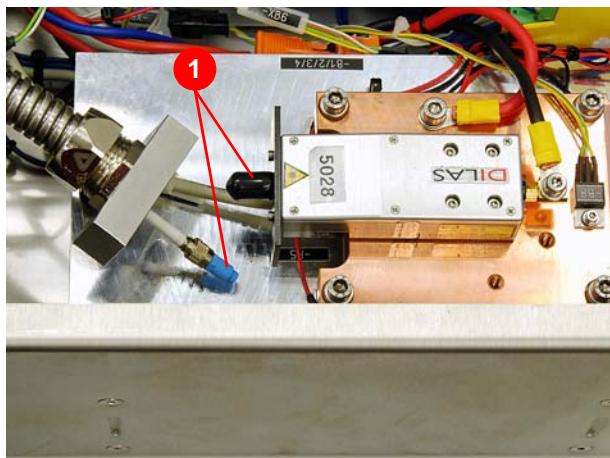
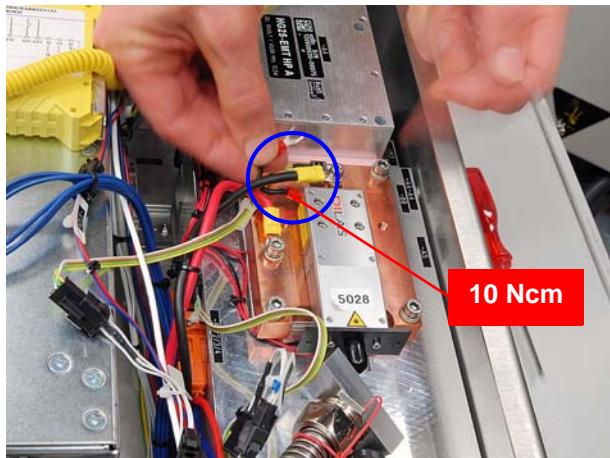


Figure 7.58 Unscrewing the metal tube

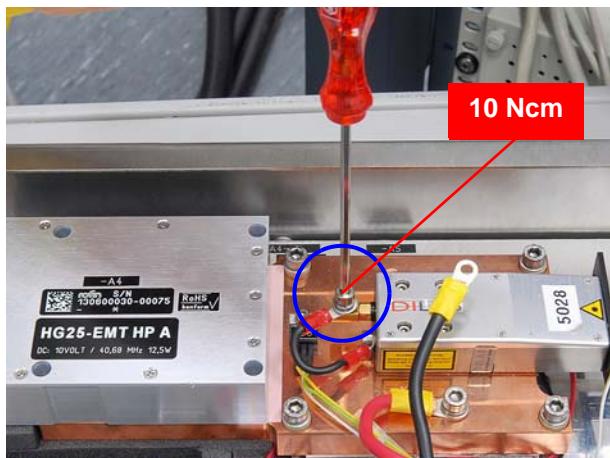
3. Unscrew the metal tube from the diode module.
4. Carefully push back the metal tube.



**Figure 7.59** Disconnecting the glass fiber line from the diode module



**Figure 7.60** Short-circuit bridge on the housing



**Figure 7.61** Short-circuit bridge on the connecting terminal

5. Loosen the washer and then remove the glass fiber line.

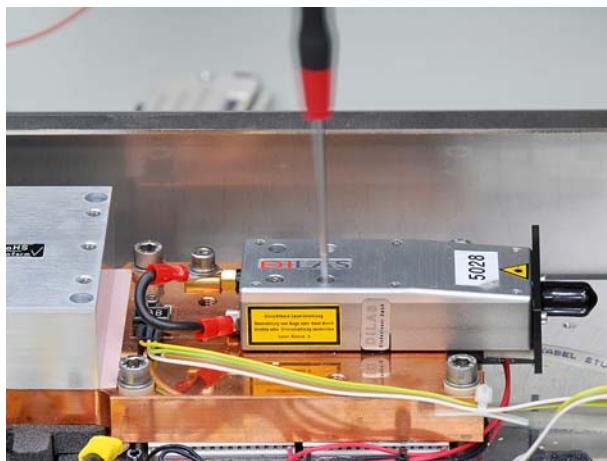
**Attention:** In the process, do not use tools! Risk of damage!

**Note:** Secure the glass fiber line against slipping into the metal tube.

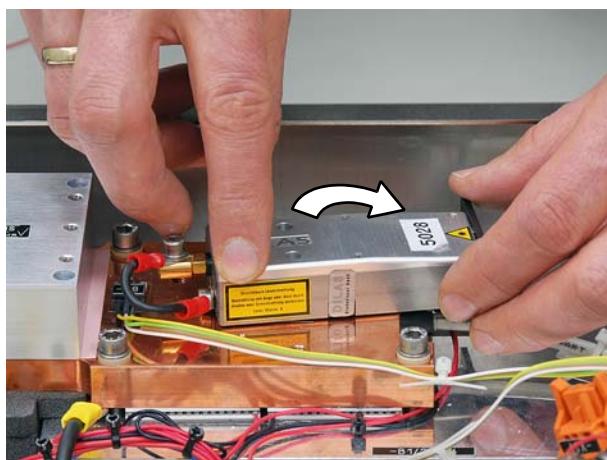
6. Attach dust protection caps to the glass fibers and the connections on the diode module (1) (Figure 7.59).
7. Remove the short-circuit bridge from the bag and keep it at hand.

8. Screw the short-circuit bridge to the housing of the diode module (maximum tightening torque: **10 Ncm**).

9. Disconnect the diode module and screw the short-circuit bridge to the connecting terminal (maximum tightening torque: **10 Ncm**).



**Figure 7.62** Loosen the fastening screws



**Figure 7.63** Loosening the diode module



**Figure 7.64** "Diode module" exchange set

10. Loosen the fastening screws of the diode module.

11. Loosen the diode module by turning it.

12. Keep the "Diode module" exchange set (Art. No. 101110922) at hand.  
Contents:
  - Plastic scraper (plastic card)
  - Graphite film
  - Diode module
  - Brief instructions M-101110922
  - Cable binding strip

**Note:** The exchange set will be provided by ROFIN-SINAR depending on your system. Compare the article number of the dismantled module with the new one. Contact ROFIN-SINAR in case of any questions.

13. Remove the plastic scraper.

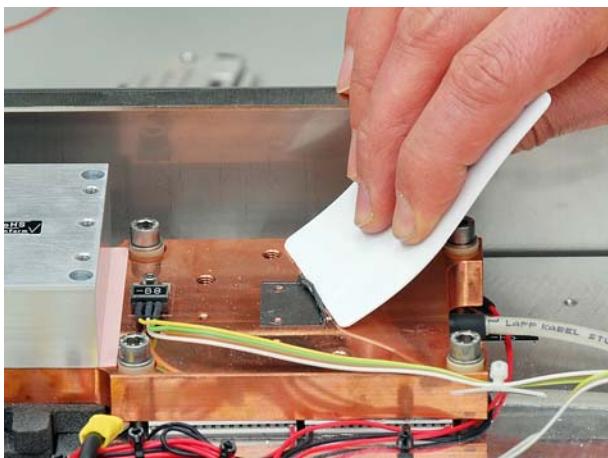


Figure 7.65 Removing the residual graphite

14. Clean residual graphite off the cooling surface with a plastic scraper and collect the rubbings.

**!** **Attention:** Only use a plastic scraper to remove the residual graphite! Do not scratch the cooling surface!

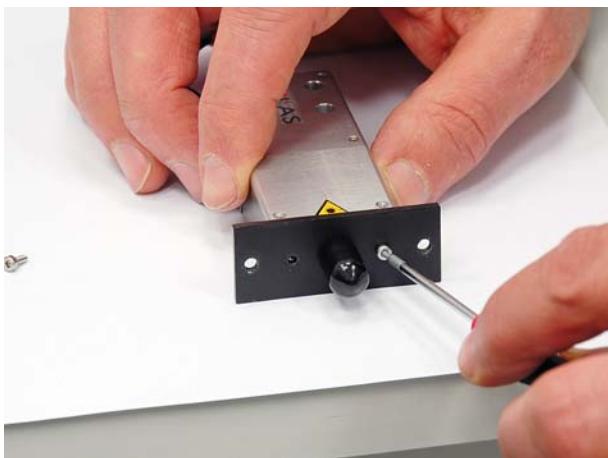


Figure 7.66 Mounting strap of the metal tube

15. Unscrew the mounting strap of the metal tube from the diode module.

**i** **Note:** To remove the mounting strap, the dust protection cap must be removed. After that, put the dust protection cap back in place.

16. Screw the mounting strap onto the new diode module and put the dust protection cap into place.

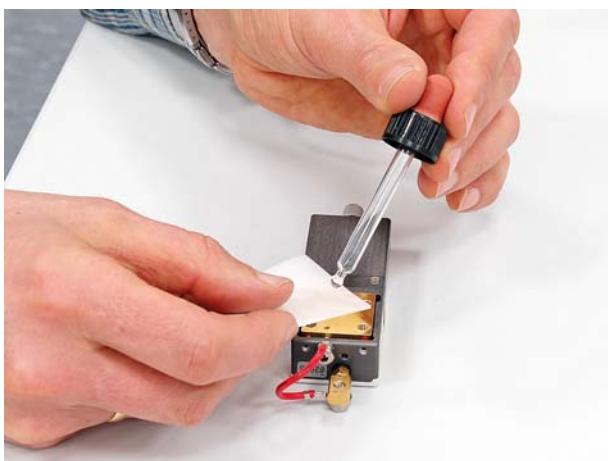
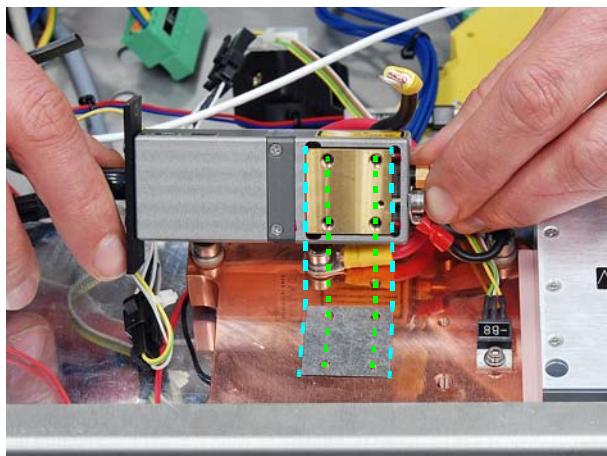
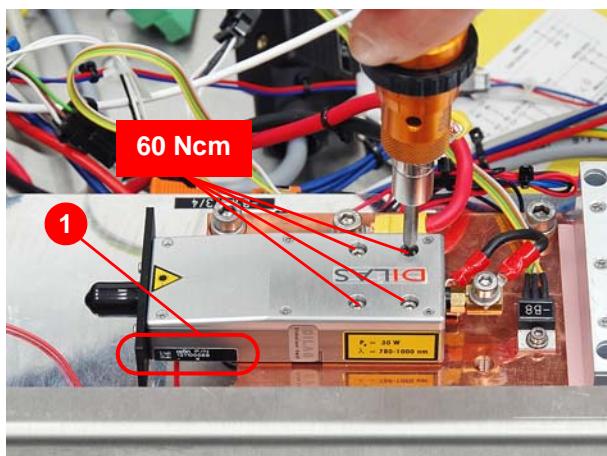


Figure 7.67 Cleaning the cooling surface of the diode module with isopropyl alcohol and lens cleaning paper

17. Clean the cooling surface in the plug-in supply unit using lens cleaning paper and isopropyl alcohol. This makes a later adhesion of the graphite film more difficult.
18. Clean the cooling surface of the new diode module in the same way.



**Figure 7.68** Applying graphite film



**Figure 7.69** Inserting the diode module and screwing it tight

19. Apply the graphite film on the correct side using tweezers (see Figure 7.68).

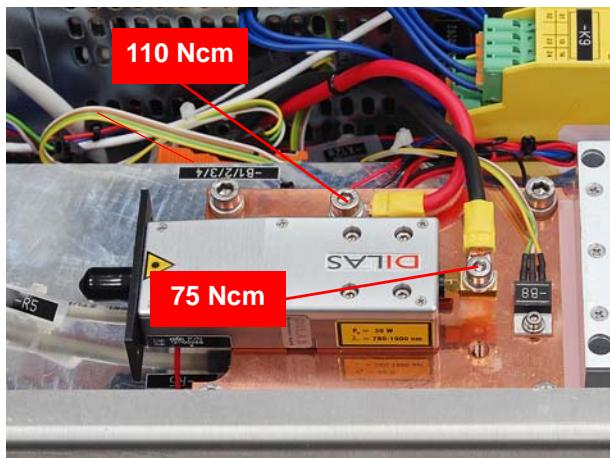
⚠ **Attention:** Do not bend the graphite film! In case the film is bent, electrical and thermal contact may be insufficiently established!

⚠ **Attention:** Always use the fastening screws included in the exchange set! Longer screws can damage the cooling surface!

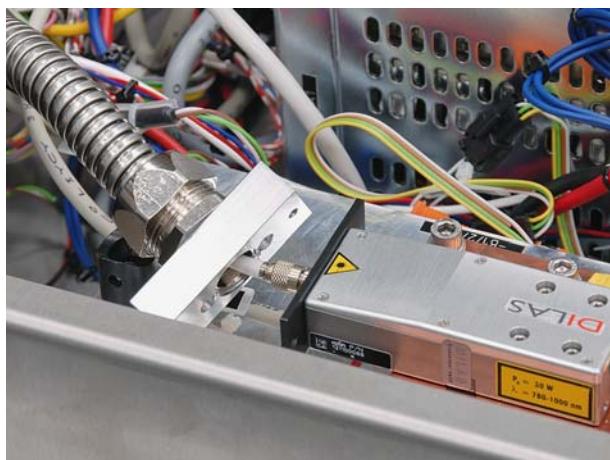
20. Insert the diode module and slightly tighten the fastening screws.

21. Make sure that the graphite film does not slip during the insertion of the diode module.

22. Tighten the fastening screws crosswise with a maximum tightening torque of **60 Ncm**.



**Figure 7.70** Connecting the diode module



**Figure 7.71** Connecting the glass fiber

23. Remove the short-circuit bridge from the connection and connect the diode module (maximum tightening torques: minus contact on diode module **75 Ncm**, plus contact on the cooling plate **110 Ncm**). Use a lock washer to secure against loosening.

**!** **Attention:** Loose connections result in high contact resistance and can cause damage.  
Due to contact resistance, do not use washers or other materials between the cable lug and the cooling plate/connection.

**i** **Note:** Pay attention to the position of the connecting lines (see [Figure 7.70](#)) to guarantee the correct placement of the heat insulation.

24. Unscrew the short-circuit bridge from the housing of the diode module.
25. Remove the dust protection caps from the diode module and the glass fiber line and connect the glass fiber ([Figure 7.71](#)).

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

26. Secure the shutter against activation.

**!** **Attention:** Take measures for protection against laser radiation (see page 123)!

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



Figure 7.72 Temperature check

**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.

28. Commission the laser system for about ten minutes at maximum current.
29. Check the temperature at the coupling between the diode module and the glass fiber (**max. 60°C**).

**Note:** When the maximum temperature is exceeded, check the connection of the glass fiber. It is possible that the diode module must be replaced or the glass fiber exchanged.

30. Check for the correct diode current. Compare it with the programmed current (max. deviation of  $\pm 0.5$  A).



Figure 7.73 Measuring the diode current



**Figure 7.74** Screwing on the metal tube

31. Connect the metal tube to the diode module.

32. Create tension relief using a cable binder.

**i** **Note:** Reattach the bag with dust protection caps and short-circuit bridges to the metal tube when work is completed (see [Figure 7.57, page 125](#)).

33. Place heat insulation over the diode module.

**!** **Attention:** The heat insulation must lie smoothly since insufficient insulation leads to heat problems and thus to malfunctions! Place the heat insulation over the diode module without forcing it. In the process, the heat insulation may not be crushed. Make sure that the cables are laid in such a way that they lie in the openings provided for this purpose.

34. Mount the cover of the plug-in supply unit.

35. Push back the plug-in supply unit and attach it.

36. Enter the operating hours of the laser system and the time of the diode change in the logbook.

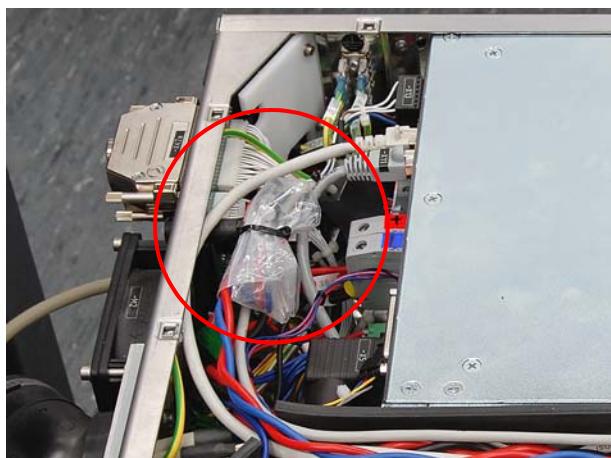
37. Set the laser power using the current limiter (LaserConsole) (see the "Laser type - power" table on [Page 43](#)).

38. Commission the laser system.



**Note:** With a new diode module, functioning glass fibers, a functioning resonator module, and perfect optical components, the following power values should be reached according to the "Laser type - power" table on [Page 43](#). Enter the measured values in the logbook.

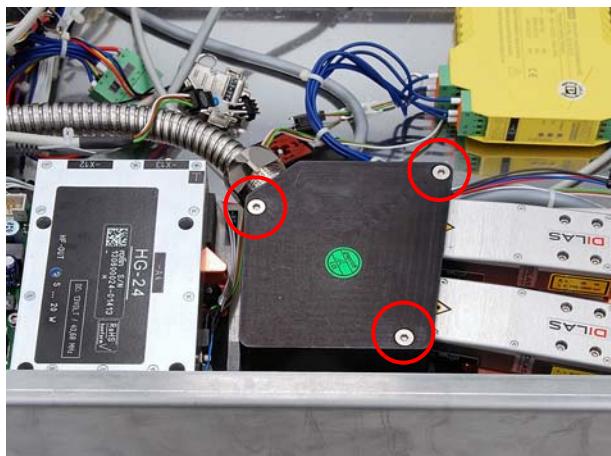
### 7.6.3 RSM PowerLine E Air-25/-30



**Figure 7.75** Dust protection caps and short-circuit bridges

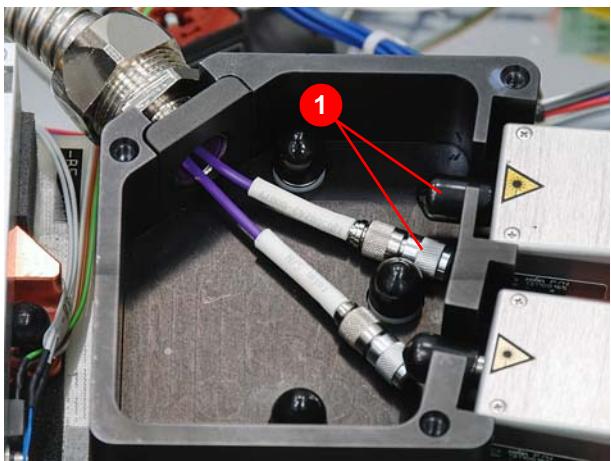
1. Perform the preparatory tasks (Section 7.6.1, page 124).

**i** **Note:** A bag with dust protection caps and short-circuit bridges is located in the plug-in supply module (Figure 7.75). Reattach the bag with dust protection caps and short-circuit bridges there when work is completed.



**Figure 7.76** Fiber terminal box

2. Open the fiber terminal box.



**Figure 7.77** Disconnecting the glass fiber line from the diode modules

3. Loosen the swivel nut and remove the glass fiber line(s).

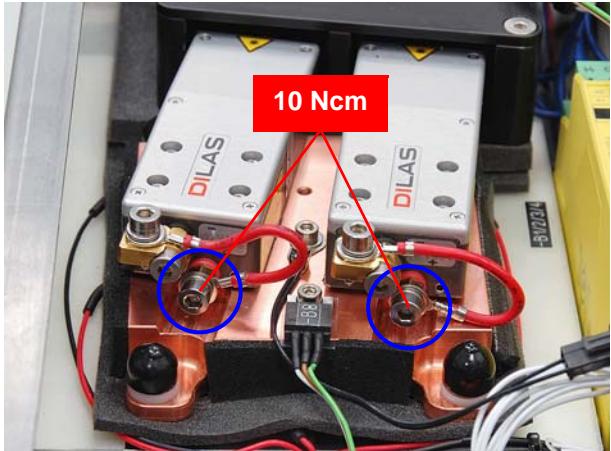
**!** **Attention:** In the process, do not use tools! Risk of damage!

**i** **Note:** Secure the glass fiber lines against slipping into the metal tube.

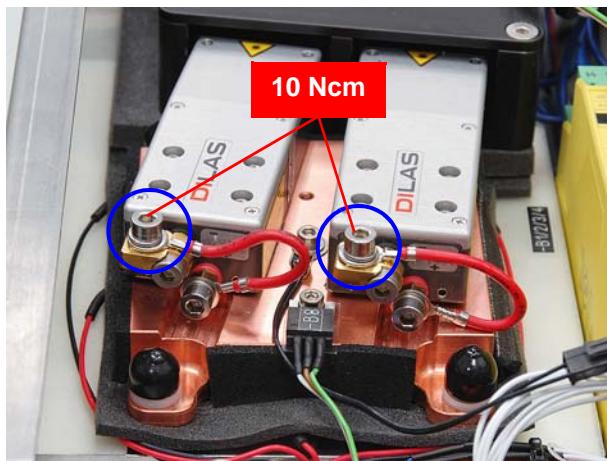
**i** **Note:** In the case of RSM PowerLine E Air-25/-30, which has two glass fiber lines, mark the connection at which the respective glass fiber was connected. In this way, the lines are not mixed up, which can lead to malfunctions. **In the case of RSM PowerLine E Air-25/-30, the diode modules should always be changed in pairs.**

**i** **Note:** The glass fibers are marked with a serial number on the white insulating tube.

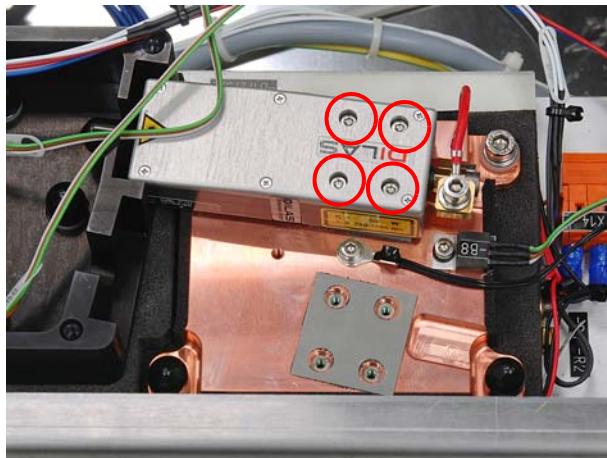
4. Attach dust protection caps to the glass fibers and the connections on the diode modules (1) ([Figure 7.77](#)).
5. Remove the short-circuit bridges from the bag and keep them at hand.
6. Screw the short-circuit bridges to the housings of the diode modules (maximum tightening torque: **10 Ncm**).



**Figure 7.78** Short-circuit bridges on the housings



**Figure 7.79** Short-circuit bridges on the connecting terminals



**Figure 7.80** Loosening fastening screws/ removing the diode module



**Figure 7.81** "Diode module" exchange set

7. Disconnect the diode module and screw the short-circuit bridge to the connecting terminal (maximum tightening torque: **10 Ncm**).

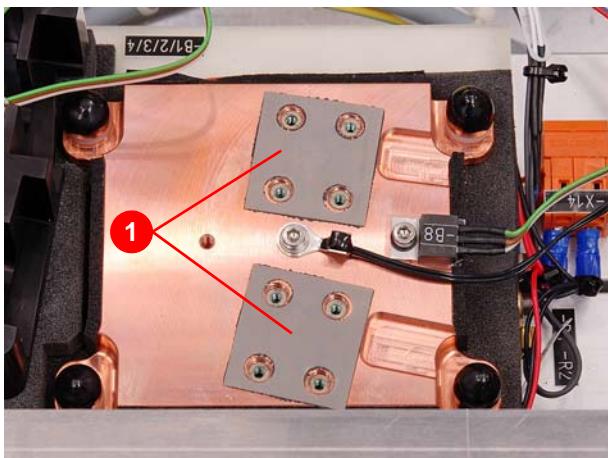
**!** **Attention:** In the case of RSM PowerLine E Air-25/-30, touching the connecting terminals of the second diode without applied equipotential bonding can lead to the destruction of the diode!

8. Loosen the fastening screws of the diode module.
9. Remove the diode module.

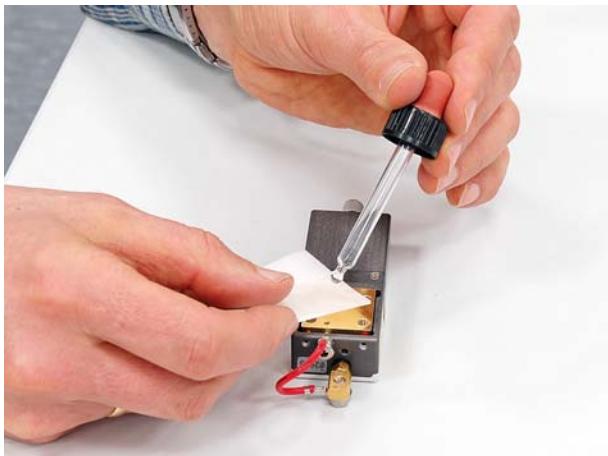
10. Keep the "Diode module" exchange set (Art. No. 101110923) at hand.  
Contents:
  - Diode module
  - Threaded inserts (replacement parts)
  - Cable binding strip
  - Brief instructions M-101110923

**i** **Note:** The exchange set will be provided by ROFIN-SINAR depending on your system. Compare the article number of the dismantled module with the new one. Contact ROFIN-SINAR in case of any questions.

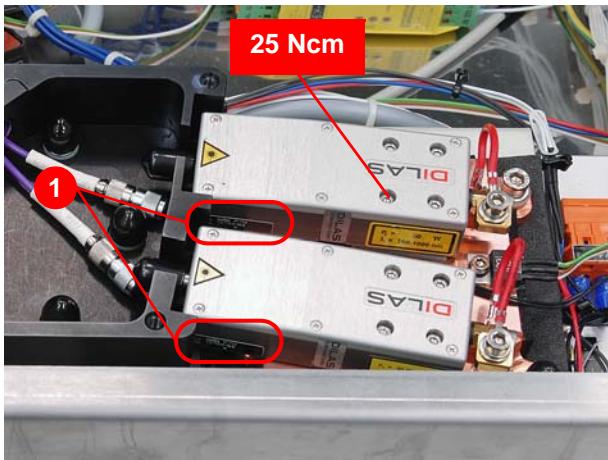
**i** **Note:** The graphite film is not required in case of RSM PowerLine E Air-25/-30.



**Figure 7.82** Cleaning the cooling surface



**Figure 7.83** Cleaning the cooling surface of the diode module with isopropyl alcohol and lens cleaning paper



**Figure 7.84** Inserting the diode modules

11. Clean the cooling surface using lens cleaning paper and isopropyl alcohol.

⚠ **Attention:** The electrically insulated heat convectors are permanently connected to the copper block! Do not damage or remove them! Check the state of the threaded inserts in the copper block!

⚠ **Attention:** The copper block and electrical contact points/surfaces of the diode modules may not be connected.

12. Clean the cooling surface in the new diode module using lens cleaning paper and isopropyl alcohol.

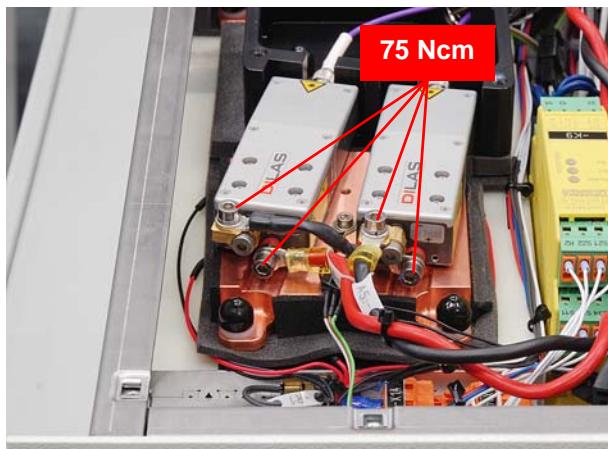
⚠ **Attention:** Before installing the diode module, make sure that the correct article number is on the diode module, (1) (Figure 7.84)!

13. Insert the diode module and slightly tighten the fastening screws.

⚠ **Attention:** Always use the fastening screws included in the exchange set! Longer screws can damage the cooling surface!

14. Tighten the fastening screws crosswise with a maximum tightening torque of **25 Ncm**.

⚠ **Attention:** A higher tightening torque leads to the destruction of the threaded inserts in the copper block!



**Figure 7.85** Connecting the diode modules

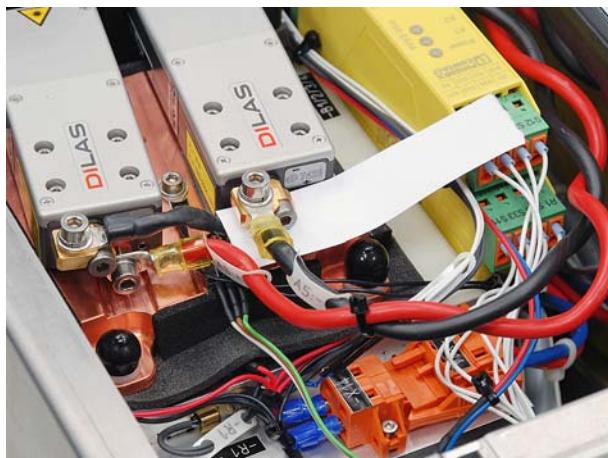
15. Remove the short-circuit bridge from the connection and connect the diode module (insert the minus bridge, maximum tightening torques: **75 Ncm**). Use a lock washer to secure against loosening.

**Attention:** Loose connections result in high contact resistance and can cause damage.  
Due to contact resistance, do not use washers or other materials between the cable lug and the cooling plate/connection.

16. Unscrew the short-circuit bridges from the housings of the diode modules.

**Note:** Pay attention to the position of the connecting lines (see [Figure 7.85](#)) to guarantee the correct placement of the heat insulation.

17. Using a paper strip, check both diode modules to make sure the connections are short-circuit-free and not connected to the copper block.

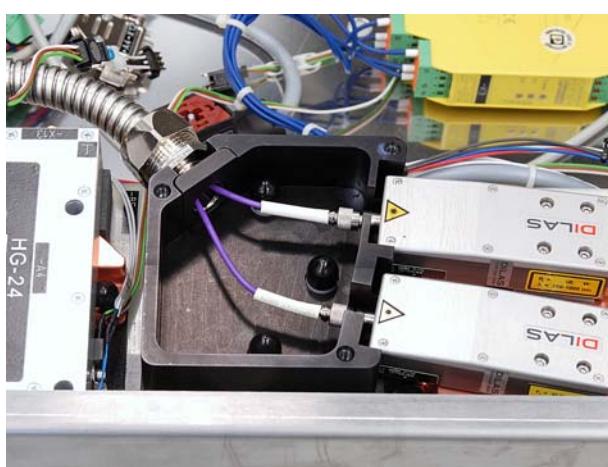


**Figure 7.86** Checking the connections

18. Remove the dust protection caps from the diode modules and glass fiber lines and connect the glass fibers ([Figure 7.87](#)).

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

**Note:** In the case of RSM PowerLine E Air-25/-30, pay attention to the correct connection of the respective glass fibers. Reattach the bag with dust protection caps and short-circuit bridges in the plug-in supply unit when work is completed (see [Figure 7.75](#), page 133).



**Figure 7.87** Connecting the glass fibers



Figure 7.88 Temperature check

19. Secure the shutter against activation.
- !** **Attention:** Take measures for protection against laser radiation (see page 123)!
20. 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.
21. Commission the laser system for about ten minutes at maximum current.
22. Check the temperature at the coupling between the diode modules and the glass fibers (**max. 60°C**).

**i** **Note:** When the maximum temperature is exceeded, check the connection of the glass fiber. It is possible that the diode module must be replaced or the glass fiber exchanged.



**Figure 7.89** Measuring the diode current

23. Check for the correct diode current. Compare it with the programmed current (max. deviation of  $\pm 0.5 \text{ A}$ ).
24. Close the fiber terminal box.
25. Place heat insulation over the diode modules.

**!** **Attention:** The heat insulation must lie smoothly since insufficient insulation leads to heat problems and thus to malfunctions! Place the heat insulation over the diode modules without forcing it. In the process, the heat insulation may not be crushed. Make sure that the cables are laid in such a way that they lie in the openings provided for this purpose.

26. Mount the cover of the plug-in supply unit.
27. Push back the plug-in supply unit and attach it.
28. Check/measure the laser power (measuring point according to [Section 4.4.1, page 42](#)). Perform trouble-shooting if necessary.
29. Enter the operating hours of the laser system and the time of the diode change in the logbook.
30. Set the laser power using the current limiter (LaserConsole) (see the "Laser type - power" table on [Page 43](#)).
31. Commission the laser system.



**Note:** With a new diode module, functioning glass fibers, a functioning resonator module, and perfect optical components, the following power values should be reached according to the "Laser type - power" table on [Page 43](#). Enter the measured values in the logbook.

## 7.7 Changing glass fiber lines



**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.



**Note:** Before changing glass fiber lines, measure/check the laser power behind the protective glass of the galvo head using the power measurement device (see [Section 4.4, page 42](#)). Enter the measured value in the logbook.

### 7.7.1 Preparatory tasks



1. Take out the plug-in supply unit and remove the top cover.
2. Remove the heat insulation on the diode module(s) (1) ([Figure 7.90](#)).

**Figure 7.90** Plug-in supply unit



**Figure 7.91** Disconnecting the resonator module

3. Mount the cover on the resonator side of the laser head.
4. Loosen the swivel nut and remove the glass fiber line(s).

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

**Note:** In the case of RSM PowerLine E Air-25/-30, which has two glass fiber lines, mark the connection at which the respective glass fiber was connected. In this way, the lines are not mixed up, which can lead to malfunctions. Both glass fiber lines should be removed if necessary since the lines are laid in common holding clamps.

**Note:** The glass fibers are marked with a serial number on the white insulating tube.

5. Attach dust protection caps to the glass fiber(s) and the connections on the resonator module (1) (Figure 7.91).

**Note:** Pay particular attention to the correct seat of the dust protection cap of the glass fibers on the resonator side so that it is not removed when the threading wire is pulled.



**Figure 7.92** Dust protection cap, glass fiber (resonator-side)

## 7.7.2 RSM PowerLine E Air-10

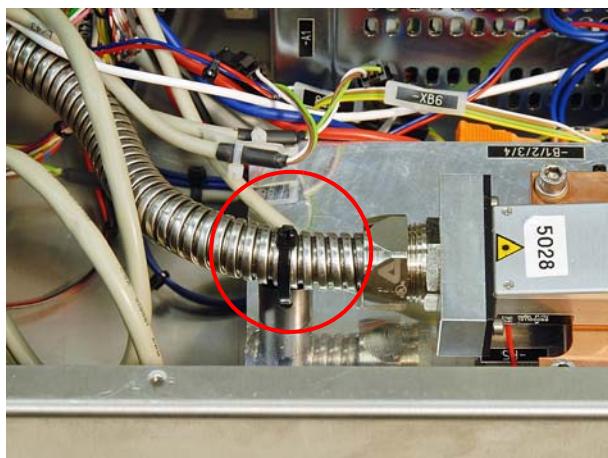


Figure 7.93 Tension relief of the metal tube



Figure 7.94 Dust protection caps and short-circuit bridges

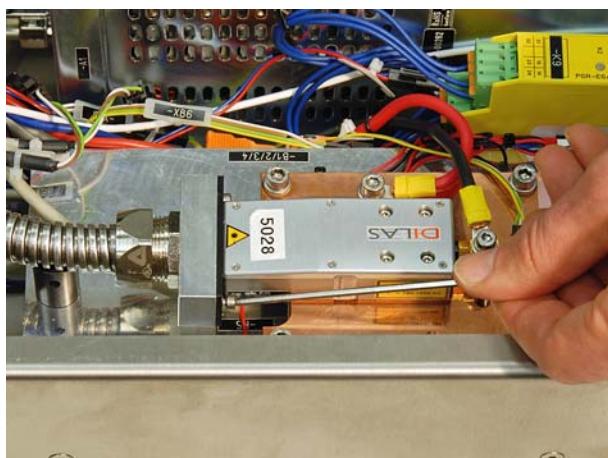
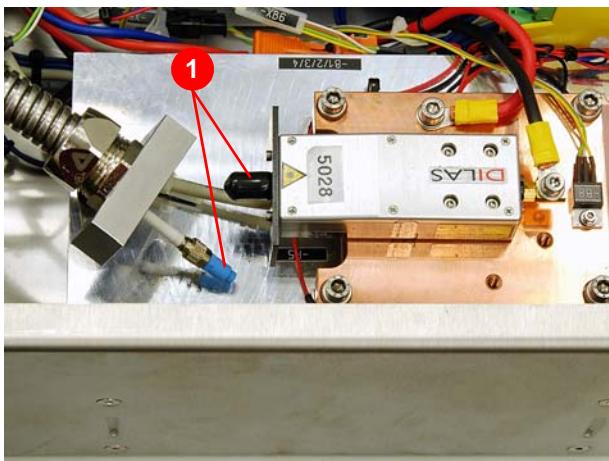


Figure 7.95 Unscrewing the metal tube

1. Perform the preparatory tasks ([Section 7.7.1, page 140](#)).
2. Remove the tension relief of the metal tube using a side cover.

**i** **Note:** A bag with dust protection caps and short-circuit bridges is located in the plug-in supply module ([Figure 7.94](#)). Reattach the bag with dust protection caps and short-circuit bridges there when work is completed.

3. Unscrew the metal tube from the diode module.
4. Carefully push back the metal tube.



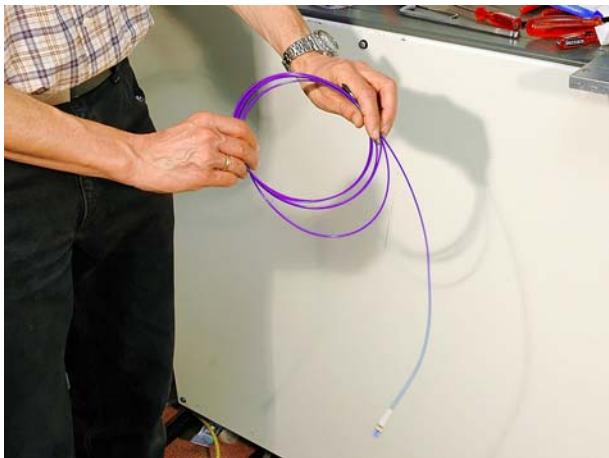
**Figure 7.96** Disconnecting the glass fiber line from the diode module

5. Loosen the washer and then remove the glass fiber line.

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

**i** **Note:** Secure the glass fiber line against slipping into the metal tube.

6. Attach dust protection caps to the glass fibers and the connections on the diode module (1) ([Figure 7.96](#)).
7. Remove the glass fiber lines from the holding clamps (see [Figure 7.103, page 145](#)) in the laser head.



**Figure 7.97** Handling of the glass fiber lines

**!** **Attention:** Be careful when handling glass fiber 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)!



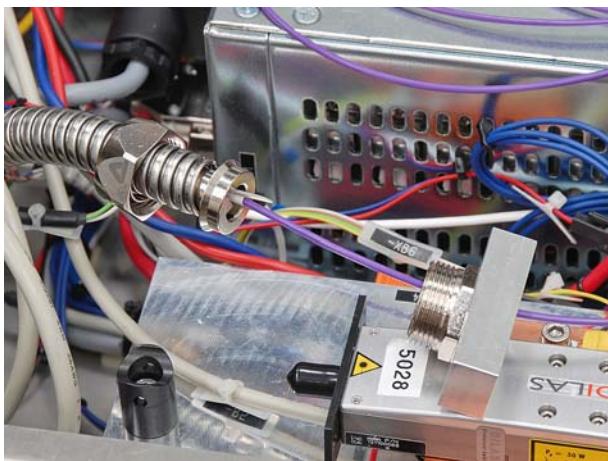
**Figure 7.98** Threading wire

8. Bind the threading wire to the dust protection cap on the resonator side.

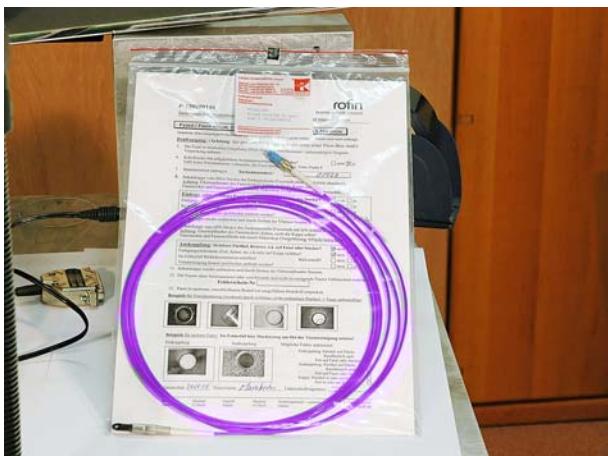
**i** **Note:** For glass fiber lines with separate type plates, the type plates should be fixed using tape (tape to be used: see [Chapter 3](#)) to prevent slippage.

9. Lay a corrugated tube between the laser head and the plug-in supply unit in large radii (min. 30 cm).
10. Carefully pull the glass fiber toward the plug-in unit and roll up the glass fiber.

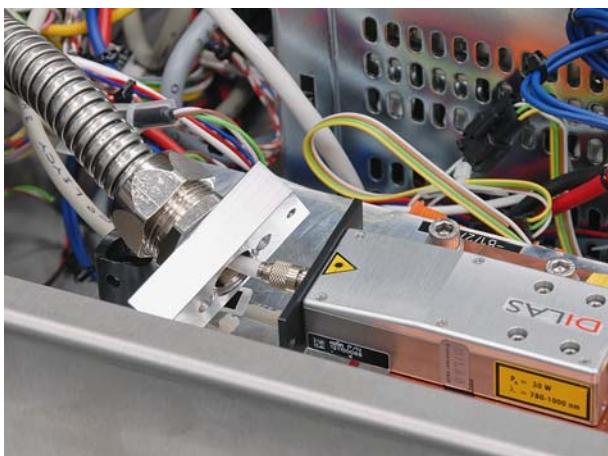
**!** **Attention:** Do not use force! Pull the threading wire along after!



**Figure 7.99** Mount of the metal tube



**Figure 7.100** Glass fiber line in transport bag



**Figure 7.101** Connecting the glass fiber

**i** **Note:** For glass fiber lines with separate type plates, the screw connection of the mount of the metal tube should be opened to guarantee passage.

11. Remove the threading wire from the glass fiber line.

**!** **Attention:** The threading wire absolutely must be left in the metal tube!

12. Remove the new glass fiber from the sealed transport bag.

**i** **Note:** Pay attention to the correct fiber length: fiber length 5 m for 3 m outer wiring; fiber length 7 m for 5 m outer wiring.

13. Bind the threading wire to the new glass fiber line.

14. Carefully pull the glass fiber toward the laser head using the threading wire and roll up the glass fiber.

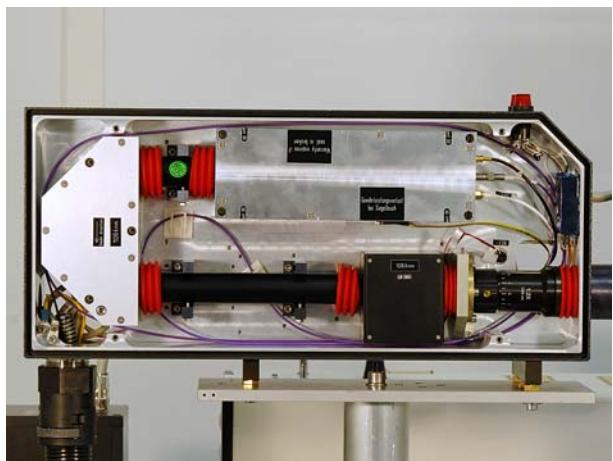
**!** **Attention:** Do not use force! Pull the glass fiber line along after!

15. Remove the dust protection caps from the diode module and the glass fiber line and connect the glass fiber (Figure 7.101).

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

**i** **Note:** Prevent soiling of the dust protection caps and the connections.

**i** **Note:** For glass fiber lines with separate type plates, the screw connection should be remounted to the mount of the metal tube.



**Figure 7.102** Laying the glass fiber in the laser head

16. Lay the glass fiber in the laser head.

**Attention:** Do not bend the glass fiber when inserting it and do not lay radii that are too small.

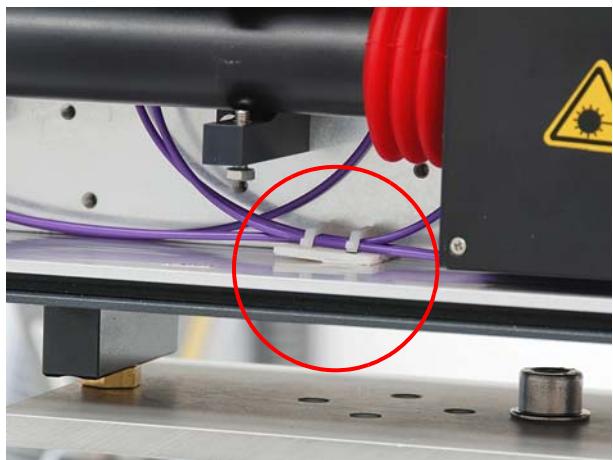
**Note:** The position of the glass fiber can deviate from the figure depending on the model and connection. The glass fiber should basically be installed in the same manner in which it was before removal.

17. Insert the glass fiber into the holding clamp.
18. Remove the dust protection caps from the glass fiber and resonator module. Push the glass fiber onto the resonator module without force and screw it into place.

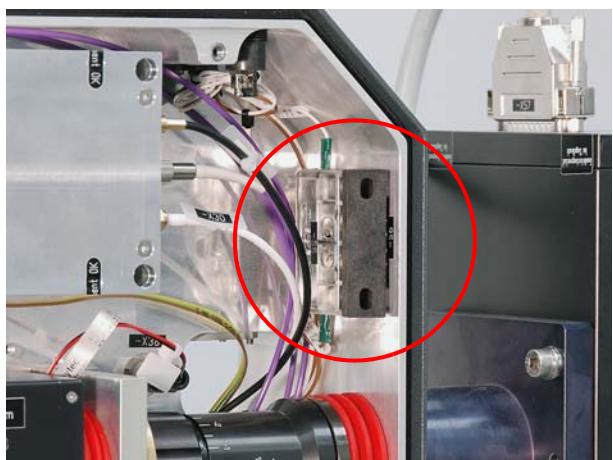
**Note:** Lay the glass fiber line flatly in the holding clamps. At tight places, open the holding clamps using a suitable screw driver.

**Attention:** Do not damage the glass fiber line with the screwdriver!

**Attention:** Before switching on the laser system, make sure the glass fiber is completely connected on both sides. Otherwise, the glass fiber will be destroyed!



**Figure 7.103** Holding clamps of the glass fiber



**Figure 7.104** Interlock switch bridged

19. Bridge the interlock switch (Figure 7.104).

**Attention:** When the interlock switch is bridged, the laser system may be switched on for testing/measuring purposes only under supervision! Production while the interlock switch is bridged is fundamentally prohibited!

20. Secure the shutter against activation.

**Attention:** Take measures for protection against laser radiation (see page 140)!

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



**Figure 7.105** Temperature check



**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.

22. Commission the laser system for about ten minutes at maximum current.
23. Check the temperature at the coupling between the diode module and the glass fiber (**max. 60°C**).



**Note:** When the maximum temperature is exceeded, check the connection of the glass fiber. It is possible that the diode module or glass fiber must be exchanged for new parts.

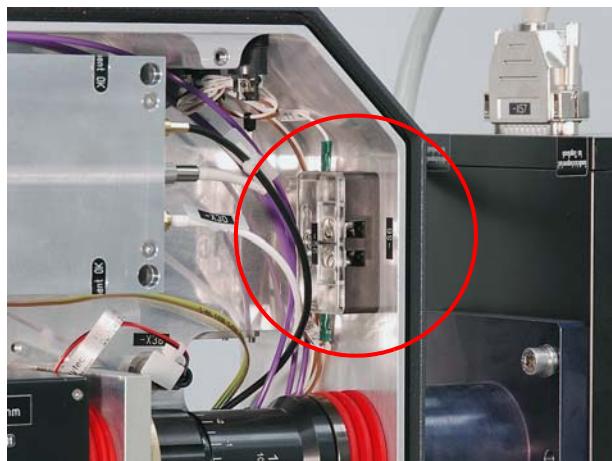
24. Measure the power of the laser diodes at the end of the fiber (see [Section 4.4.6, page 51](#)).
25. Connect the metal tube to the diode module.
26. Create tension relief using a cable binder (see [Figure 7.93, page 142](#)).



**Note:** Reattach the bag with dust protection caps and short-circuit bridges to the metal tube when work is completed (see [Figure 7.94, page 142](#)).



**Figure 7.106** Screwing on the metal tube



**Figure 7.107** Interlock switch

27. Remove the bridge from the interlock switch.
28. Connect the glass fiber lines to the resonator module. Tighten it by hand.

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

29. Place heat insulation over the diode module.

**Attention:** *The heat insulation must lie smoothly since insufficient insulation leads to heat problems and thus to malfunctions! Place the heat insulation over the diode module without forcing it. In the process, the heat insulation may not be crushed. Make sure that the cables are laid in such a way that they lie in the openings provided for this purpose.*

30. Mount the cover of the plug-in supply unit.
31. Push back the plug-in supply unit and attach it.
32. Enter the operating hours of the laser system and the time of the diode change in the logbook.
33. Commission the laser system.
34. Send the removed glass fiber to ROFIN-SINAR for repair.



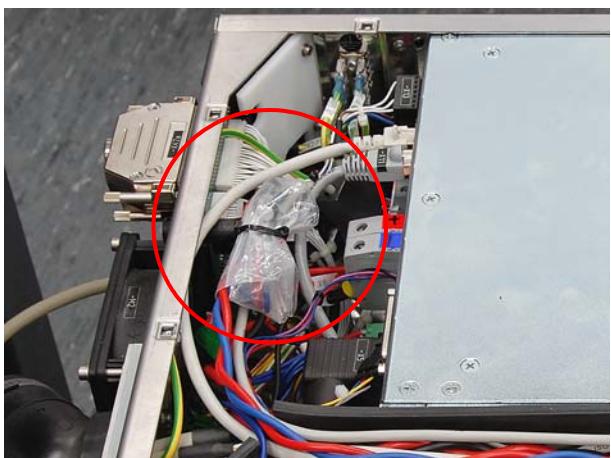
**Note:** After having changed the glass fiber lines, perform a comparative measurement of the laser power with the same laser parameters as before the change at the same measuring point. A power increase should be able to be determined.

With a new diode module, functioning glass fibers, a functioning resonator module, and perfect optical components, the following power values should be reached according to the "Laser type - power" table on [Page 43](#). Enter the measured values in the logbook.

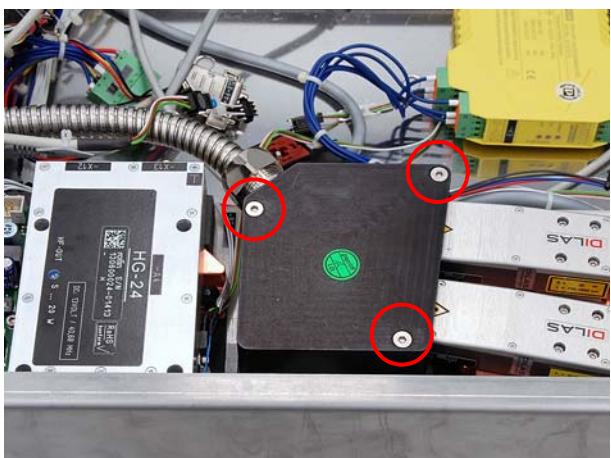


**Note:** If no power increase is determined, the power of the laser diodes should be measured at the end of the fiber ([see Section 4.4.6, page 51](#)).

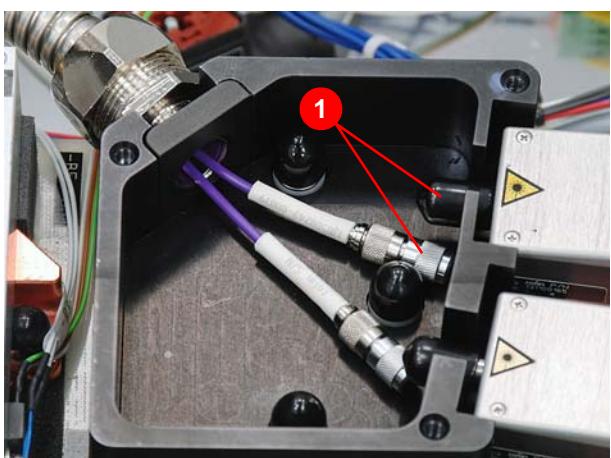
### 7.7.3 RSM PowerLine E Air-25/-30



**Figure 7.108** Dust protection caps and short-circuit bridges



**Figure 7.109** Fiber terminal box



**Figure 7.110** Disconnecting the glass fiber line from the diode modules

1. Perform the preparatory tasks (Section 7.7.1, page 140).

**i** **Note:** A bag with dust protection caps and short-circuit bridges is located in the plug-in supply module (Figure 7.108). Reattach the bag with dust protection caps and short-circuit bridges there when work is completed.

2. Open the fiber terminal box.
3. Loosen the swivel nut and remove the glass fiber line(s).

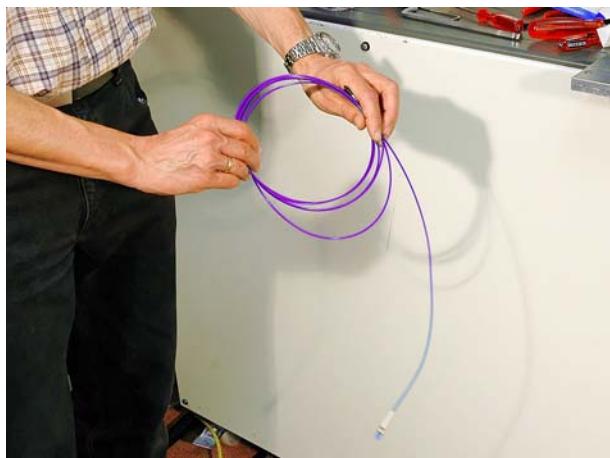
**!** **Attention:** In the process, do not use tools! Risk of damage!

**i** **Note:** Secure the glass fiber lines against slipping into the metal tube.

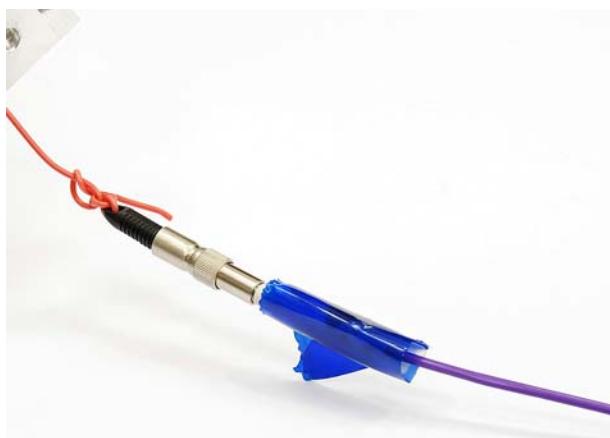
**i** **Note:** In the case of RSM PowerLine E Air-25/-30, which has two glass fiber lines, mark the connection at which the respective glass fiber was connected. In this way, the lines are not mixed up, which can lead to malfunctions.

**i** **Note:** The glass fibers are marked with a serial number on the white insulating tube.

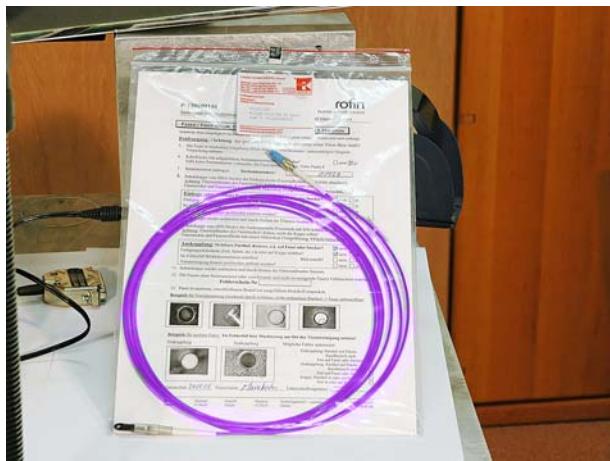
4. Attach dust protection caps to the glass fibers and the connections on the diode modules (1) (Figure 7.110).



**Figure 7.111** Handling of the glass fiber lines



**Figure 7.112** Threading wire



**Figure 7.113** Glass fiber line in transport bag

5. Remove the glass fiber lines from the holding clamps (see [Figure 7.116, page 150](#)) in the laser head.

**!** **Attention:** Be careful when handling glass fiber 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)!

6. Bind the threading wire to the dust protection cap on the resonator side.

**i** **Note:** For glass fiber lines with separate type plates, the type plates should be fixed using tape (tape to be used: see [Chapter 3](#)) to prevent slippage.

7. Lay a corrugated tube between the laser head and the plug-in supply unit in large radii (min. 30 cm).
8. Carefully pull the glass fiber toward the plug-in unit and roll up the glass fiber.

**!** **Attention:** The fibers absolutely must be pulled individually! Do not use force! Pull the threading wire along after!

9. Remove the threading wire from the glass fiber line.

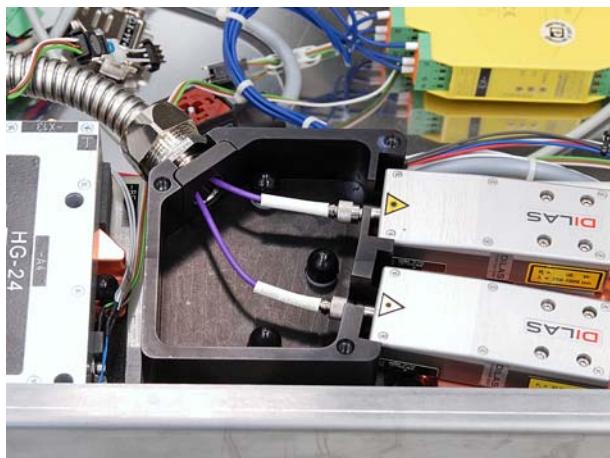
**!** **Attention:** The threading wire absolutely must be left in the metal tube!

10. Remove the new glass fiber from the sealed transport bag.

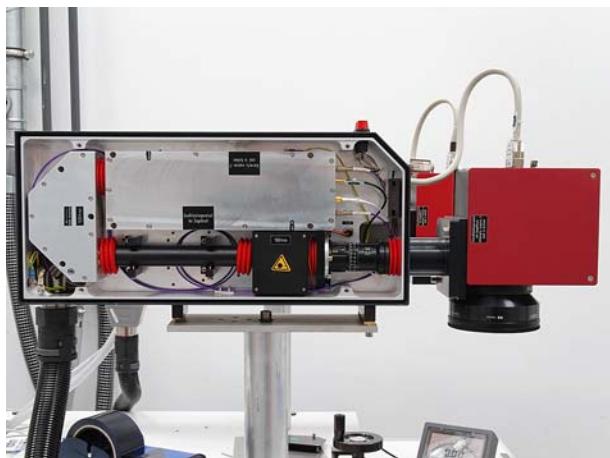
**i** **Note:** Pay attention to the correct fiber length: fiber length 5 m for 3 m outer wiring; fiber length 7 m for 5 m outer wiring.

11. Bind the threading wire to the new glass fiber line.
12. Carefully pull the glass fiber toward the laser head using the threading wire and roll up the glass fiber.

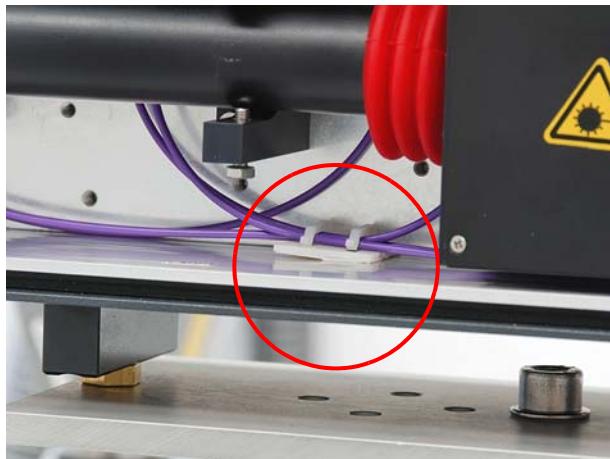
**!** **Attention:** The fibers absolutely must be pulled individually! Do not use force! Pull the glass fiber line along after!



**Figure 7.114** Connecting the glass fiber



**Figure 7.115** Laying the glass fiber in the laser head



**Figure 7.116** Holding clamps of the glass fiber

13. Remove the dust protection caps from the diode module and the glass fiber line and connect the glass fiber (Figure 7.114).

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

**Note:** Prevent soiling of the dust protection caps and the connections.

14. Lay the glass fiber in the laser head.

**Attention:** Do not bend the glass fiber when inserting it and do not lay radii that are too small.

**Note:** The position of the glass fiber can deviate from the figure depending on the model and connection. The glass fiber should basically be installed in the same manner in which it was before removal.

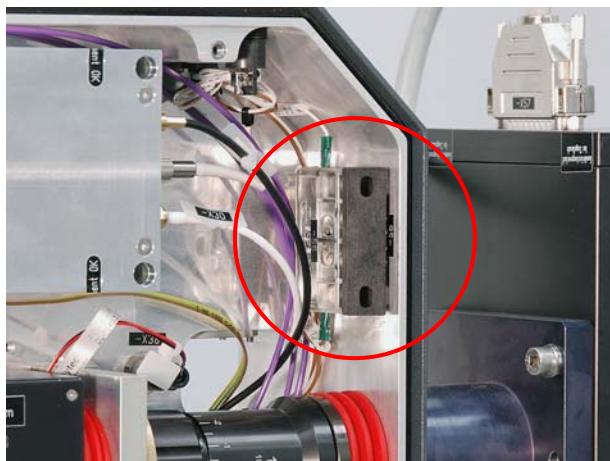
15. Insert the glass fiber into the holding clamp.

16. Remove the dust protection caps from the glass fiber and resonator module. Push the glass fiber onto the resonator module without force and screw it into place.

**Note:** Lay the glass fiber line flatly in the holding clamps. At tight places, open the holding clamps using a suitable screw driver.

**Attention:** Do not damage the glass fiber line with the screwdriver!

**Attention:** Before switching on the laser system, make sure the glass fiber is completely connected on both sides. Otherwise, the glass fiber will be destroyed!



**Figure 7.117** Interlock switch bridged

17. Bridge the interlock switch (Figure 7.117).

**!** **Attention:** When the interlock switch is bridged, the laser system may be switched on for testing/measuring purposes only under supervision! Production while the interlock switch is bridged is fundamentally prohibited!

18. Secure the shutter against activation.

**!** **Attention:** Take measures for protection against laser radiation (see page 140)!

19. 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.

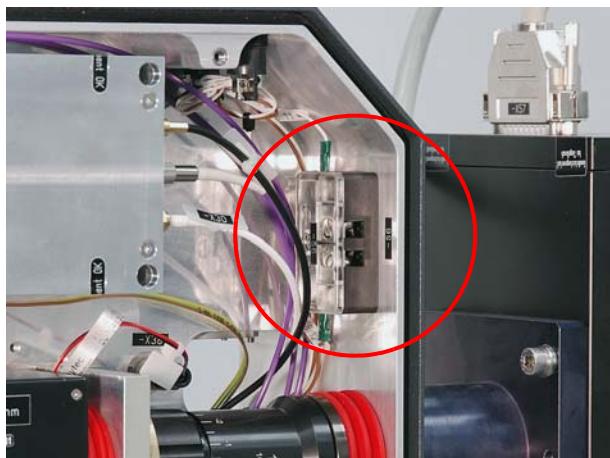
20. Commission the laser system for about ten minutes at maximum current.

21. Check the temperature at the coupling between the diode module and the glass fiber (**max. 60°C**).

**i** **Note:** When the maximum temperature is exceeded, check the connection of the glass fiber. It is possible that the diode module must be replaced or the glass fiber exchanged.



**Figure 7.118** Temperature check



**Figure 7.119** Interlock switch

22. Measure the power of the laser diodes at the end of the fiber (see [Section 4.4.6, page 51](#)).

23. Remove the bridge from the interlock switch.

24. Close the fiber terminal box.

25. Connect the glass fiber lines to the resonator module. Tighten it by hand.

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

26. Place heat insulation over the diode module.

**!** **Attention:** The heat insulation must lie smoothly since insufficient insulation leads to heat problems and thus to malfunctions! Place the heat insulation over the diode modules without forcing it. In the process, the heat insulation may not be crushed. Make sure that the cables are laid in such a way that they lie in the openings provided for this purpose.

27. Mount the cover of the plug-in supply unit.

28. Push back the plug-in supply unit and attach it.

29. Enter the operating hours of the laser system and the time of the diode change in the logbook.

30. Commission the laser system.

31. Send the removed glass fiber to ROFIN-SINAR for repair.



**Note:** After having changed the glass fiber lines, perform a comparative measurement of the laser power with the same laser parameters as before the change at the same measuring point. A power increase should be able to be determined.

With a new diode module, functioning glass fibers, a functioning resonator module, and perfect optical components, the following power values should be reached according to the "Laser type - power" table on [Page 43](#). Enter the measured values in the logbook.



**Note:** If no power increase is determined, the power of the laser diodes should be measured at the end of the fiber (see [Section 4.4.6, page 51](#)).

## 7.8 Changing the HF generator



**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.

### 7.8.1 RSM PowerLine E Air-10 (HG -25)



Figure 7.120 Plug-in supply unit

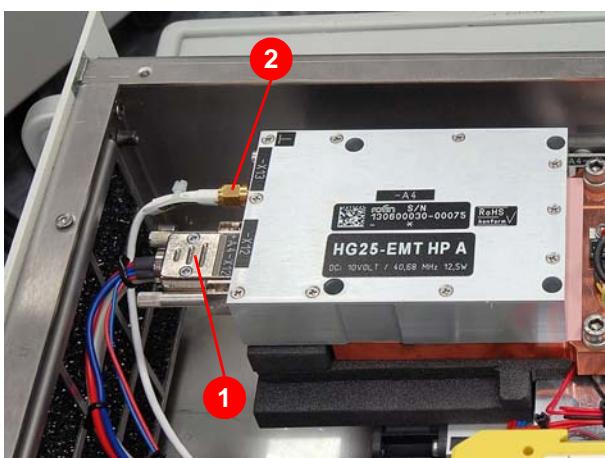


Figure 7.121 Removal of the HG-25

1. Take out the plug-in supply unit and remove the top cover.
2. Remove the heat insulation on the HF generator (1) ([Figure 7.120](#)).

3. Disconnect the connecting plug - X12 (1) ([Figure 7.121](#)), and HF line -X13 (2).

**Note:** Leave the ground line connected to the laser head for further use.

4. Loosen four fastening screws and remove HG-25.

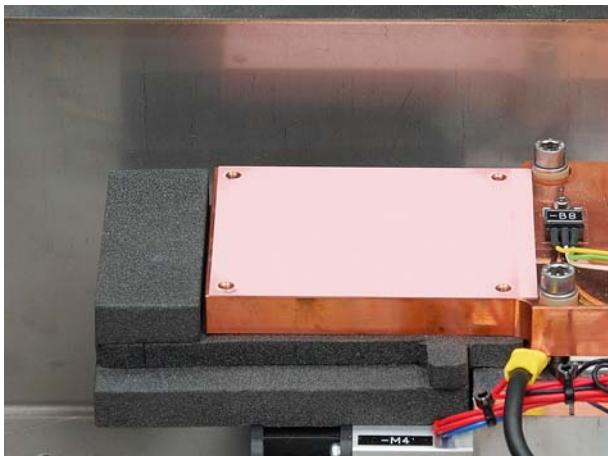


Figure 7.122 Heat conducting film



Figure 7.123 HG-25 fastening screw



Figure 7.124 Measuring the contact resistance

5. Check the state of the heat conducting film under the HG-25.

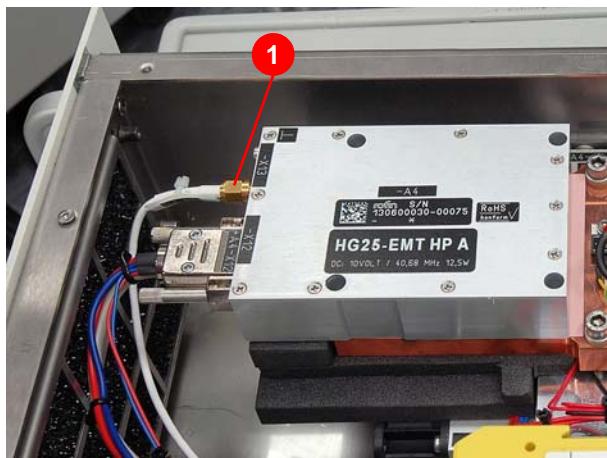
**!** **Attention:** The heat conducting film (electrically insulating and heat-conducting) absolutely may not be damaged! Short-circuit danger due to the plus pole of the diode module connected to the copper plate! A damaged film must be exchanged!

6. Clean the cooling surface and bottom of the new HG -25 with isopropyl alcohol.
7. Lay the heat conducting film on the right side.
8. Screw the HG-25 tight using four fastening screws.

**!** **Attention:** The fastening screws absolutely must be installed with plastic sleeves!

Short-circuit danger due to the plus pole of the diode module connected to the copper plate! Maximum tightening torque: **100 Ncm!**

9. Measure the contact resistance between the housing of the HF generator and the copper plate. The resistance must be infinite.



**Figure 7.125** Installation of the HG-25



**Figure 7.126** Measuring adapter of the operating voltage

10. Connect the HF line -X13 (1) ([Figure 7.125](#)).

11. Plug the measuring adapter ([see Chapter 3](#)) into -X12 of HG-25.
12. Plug the connecting plug -X12 into the measuring adapter.
13. Connect the voltmeter to Pin 1 (-) and Pin 5 (+) of the measuring adapter.
14. Set the operating voltage ([see Section 7.8.4, page 162](#)).
15. Stop the system:
  - Shut down the RCU/PC.
  - Set the key-operated switch to "Off".
  - Turn off the main switch.
16. Remove the measuring device.
17. Remove the measuring adapter.



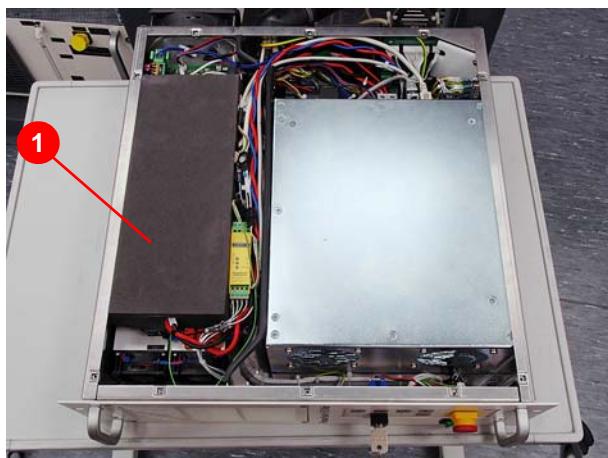
**Figure 7.127** Connecting HG-25

18. Plug in the connecting plug -X12 (1) ([Figure 7.127](#)).
19. Start the system:
  - Turn on the main switch.
  - Start up the RCU/PC.
  - Set the key-operated switch to "On".
20. Set the HF power ([see Section 7.8.4, page 162](#)).
21. Stop the system:
  - Shut down the RCU/PC.
  - Set the key-operated switch to "Off".
  - Turn off the main switch.
22. Place heat insulation over the HF generator and the diode(s).

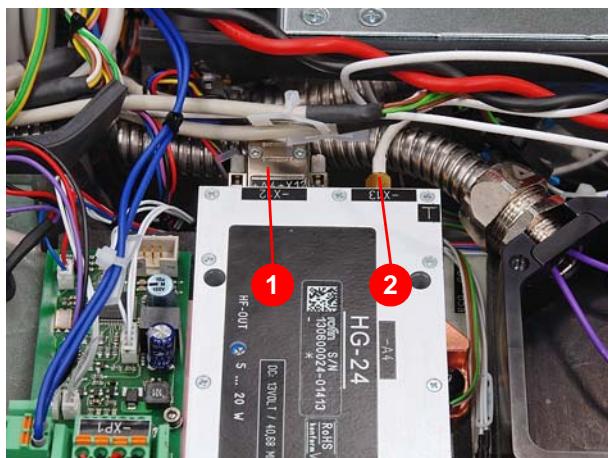
**!** *Attention: The heat insulation must lie smoothly since insufficient insulation leads to heat problems and thus to malfunctions! Place heat insulation over the HF generator and the diode(s) without force. In the process, the heat insulation may not be crushed. Make sure that the cables are laid in such a way that they lie in the openings provided for this purpose.*

23. Mount the cover of the plug-in supply unit.
24. Push back the plug-in supply unit and attach it.
25. Enter the operating hours of the laser system and the time of the change in the logbook.
26. Commission the laser system.
27. Perform a function check of the laser system (test marking, test processing).

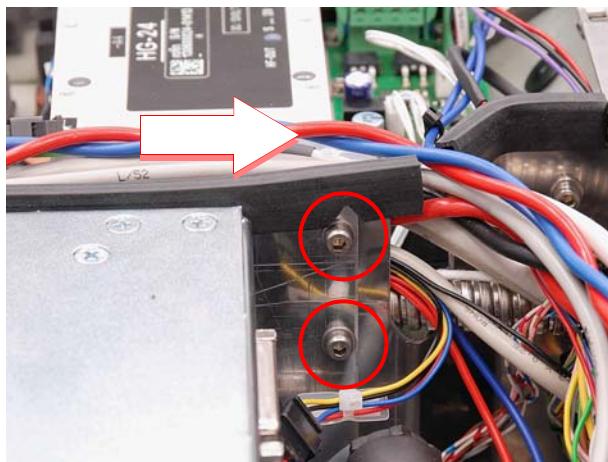
## 7.8.2 RSM PowerLine E Air-25/-30 (HG -24)



**Figure 7.128** Plug-in supply unit



**Figure 7.129** Removal of the HG-24



**Figure 7.130** Removal of the air guidance plate

1. Take out the plug-in supply unit and remove the top cover.
2. Remove the heat insulation on the HF generator (1) ([Figure 7.128](#)).

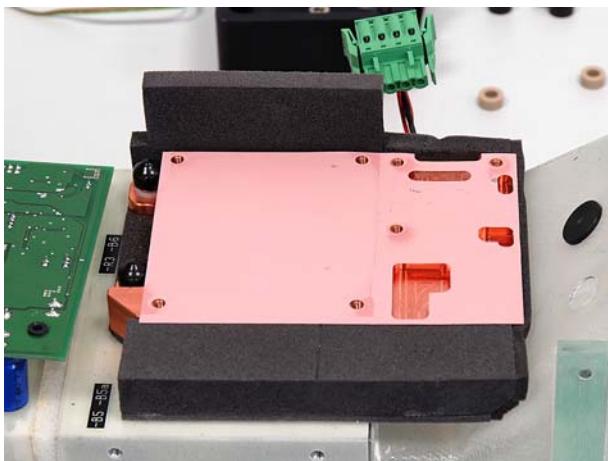
3. Disconnect the connecting plug - X12 (1) ([Figure 7.129](#)), and HF line -X13 (2).

**i** **Note:** To loosen the screws on the connecting plug -X12, use a very short screwdriver or offset screwdriver so as not to damage the screws. If a corresponding tool does not exist, the air guidance plate in the plug-in supply unit must be removed.

### Removal of the air guidance plate:

- a) Loosen the fastening screws.
- b) Carefully push back air guidance plant and pull it out.

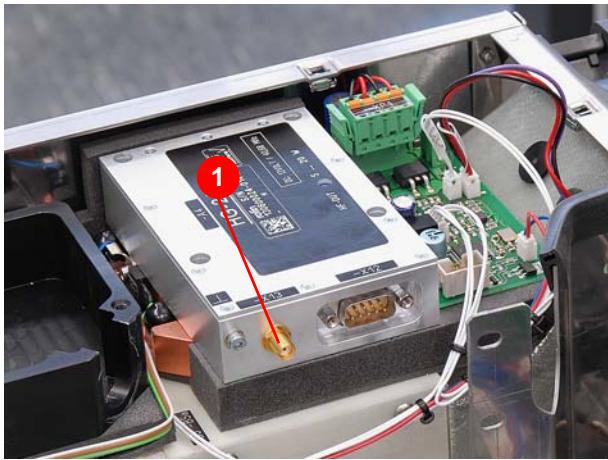
**!** **Attention:** Do not damage the cable and lines with the air guidance plate!



**Figure 7.131** Heat conducting film



**Figure 7.132** HG-24 fastening screw



**Figure 7.133** Installation of the HG-24

4. Loosen four fastening screws and remove HG-24.
5. Check the state of the heat conducting film under the HG-24.

**Attention:** The heat conducting film (electrically insulating and heat-conducting) absolutely may not be damaged! Short-circuit danger due to the plus pole of the diode module connected to the copper plate! A damaged film must be exchanged!

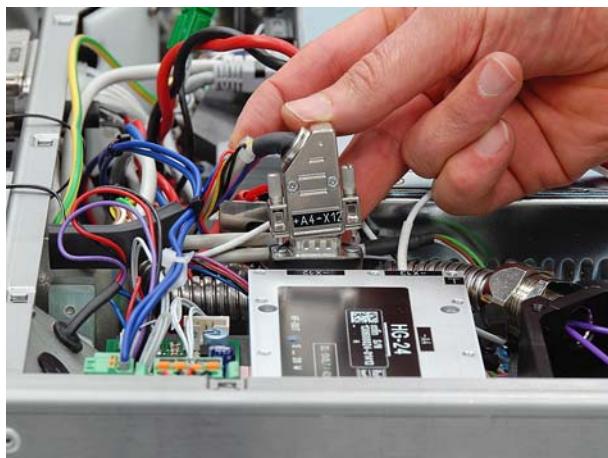
**Note:** One heat conducting film for both the HF generator and control electronics A3 is located under both units. This film cannot be exchanged until the control electronics are removed.

6. Clean the cooling surface and bottom of the new HG -24 with isopropyl alcohol.
7. Lay the heat conducting film on the right side.
8. Screw the HG-24 tight using four fastening screws.

**Attention:** The fastening screws absolutely must be installed with plastic sleeves!

Short-circuit danger due to the plus pole of the diode module connected to the copper plate! Maximum tightening torque: 100 Ncm!

9. Measure the contact resistance between the housing of the HF generator and the copper plate. The resistance must be infinite.
10. Connect the HF line -X13 (1) (Figure 7.133) to HG-24.



**Figure 7.134** Measuring adapter of the operating voltage



**Figure 7.135** Connecting HG-24

11. Plug the measuring adapter (see Chapter 3) into -X12 of HG-24.
12. Plug the connecting plug -X12 into the measuring adapter.
13. Connect the voltmeter to Pin 1 (-) and Pin 5 (+) of the measuring adapter.
14. Set the operating voltage (see Section 7.8.3, page 160).

15. Remove the measuring adapter and connect the connecting plug -X12 to HG-24.
16. Set the HF power (see Section 7.8.5, page 166).
17. Place the heat insulation onto the HF generator.

**Attention:** The heat insulation must lie smoothly since insufficient insulation leads to heat problems and thus to malfunctions! Place the heat insulation over the HF generator without forcing it. In the process, the heat insulation may not be crushed. Make sure that the cables are laid in such a way that they lie in the openings provided for this purpose.

18. If necessary, remount the air guidance plate.
19. Mount the cover of the plug-in supply unit.
20. Push back the plug-in supply unit and attach it.
21. Enter the operating hours of the laser system and the time of the change in the logbook.
22. Commission the laser system.
23. Perform a function check of the laser system (test marking, test processing).

### 7.8.3 Setting the operating voltage of HG-24

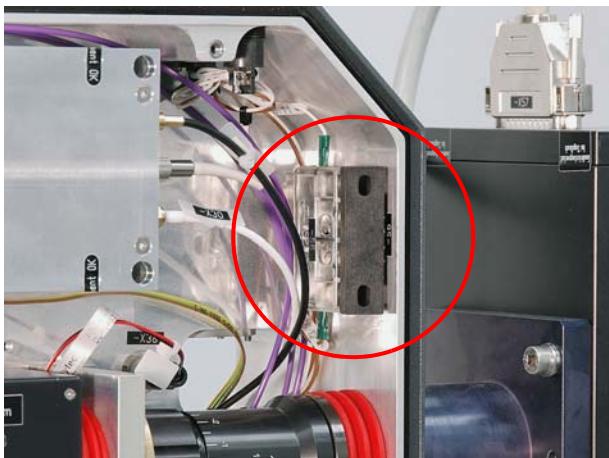


Figure 7.136 Interlock switch bridged

1. Bridge the interlock switch (Figure 7.136).

**!** **Attention:** When the interlock switch is bridged, the laser system may be switched on for testing/measuring purposes only under supervision! Production while the interlock switch is bridged is fundamentally prohibited!

2. Secure the shutter against activation.

**!** **Attention:** Take measures for protection against laser radiation (see page 153)!

3. Insert the mains plug 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.

4. Make access possible on the rear of the plug-in supply unit.
5. Remove the CAN bus connection (including the base plate).
6. Reinsert the line into the CAN bus connection.
7. Turn on the main switch.
8. Start the PC and then "RCU.exe."
9. Start the laser system using the key-operated switch.

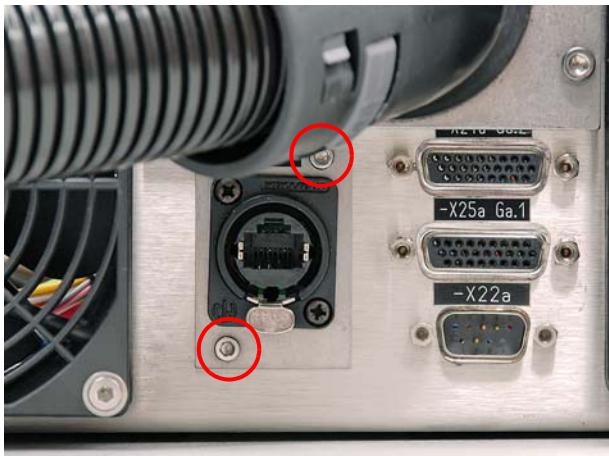
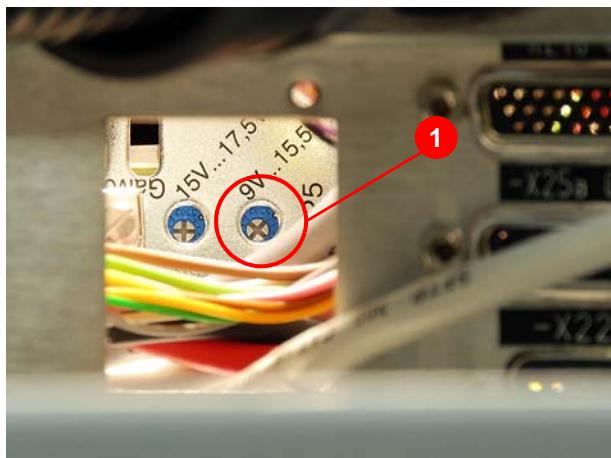
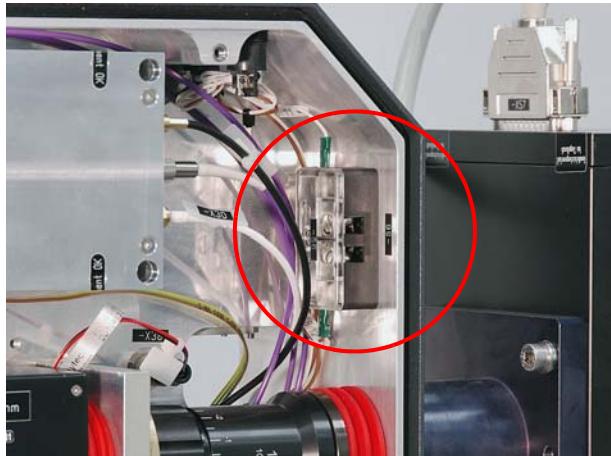


Figure 7.137 CAN bus connection of the plug-in supply unit



**Figure 7.138** Potentiometer for operating voltage



**Figure 7.139** Interlock switch

10. Using a small screwdriver, turn the HG-25 potentiometer (1) ([Figure 7.138](#)) until **13.0 V ±0.1 V** is measured at HG-24 (-X12).
11. To shut down the laser system:
  - Set the key-operated switch to zero.
  - Stop "RCU.exe."
  - Shut down WINDOWS®.
12. Turn off the main switch.
13. Mounting the CAN bus connection

14. Remove the bridge from the interlock switch.
15. Place the heat insulation onto the HF generator.

**Attention:** The heat insulation must lie smoothly since insufficient insulation leads to heat problems and thus to malfunctions! Place the heat insulation over the HF generator without forcing it. In the process, the heat insulation may not be crushed. Make sure that the cables are laid in such a way that they lie in the openings provided for this purpose.

16. Mount the cover of the plug-in supply unit.
17. Push back the plug-in supply unit and attach it.
18. Commission the laser system.
19. Perform a function check of the laser system (test marking, test processing).

## 7.8.4 RSM PowerLine E Air-10 – Setting the HF power of HG-25



**Attention:** Due to the structure of the laser system, the following activities should be performed by two people. These people must make sure that they can communicate with each other at all times!

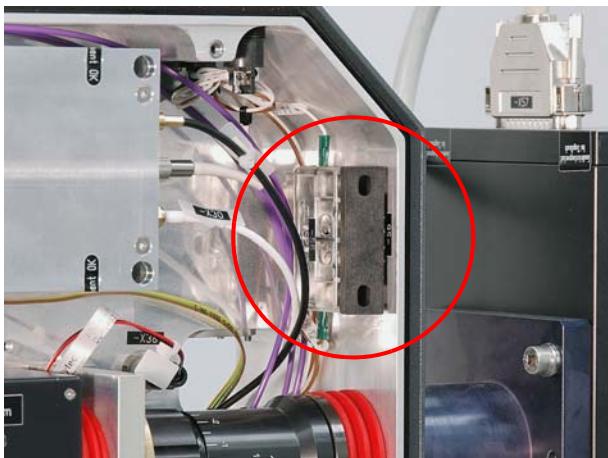


Figure 7.140 Interlock switch bridged

1. Bridge the interlock switch (Figure 7.140).

**Attention:** When the interlock switch is bridged, the laser system may be switched on for testing/measuring purposes only under supervision! Production while the interlock switch is bridged is fundamentally prohibited!

2. Secure the shutter against activation.

**Attention:** Take measures for protection against laser radiation (see page 153)!

3. Insert the mains plug of the laser system.

**Attention:** If the emergency stop button/main switch of the laser system is out of safe reach of one of the two people during the task to be performed, a third person must always be present who can press the emergency stop button/main switch in case of an emergency.

4. Make access possible on the rear of the plug-in supply unit.
5. Remove the CAN bus connection (including the base plate).
6. Reinsert the line into the CAN bus connection.

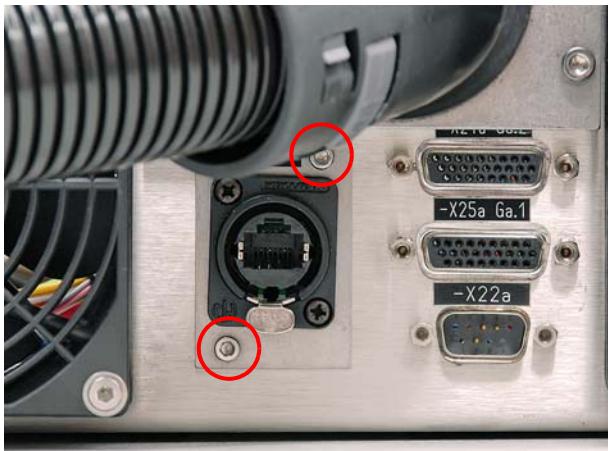
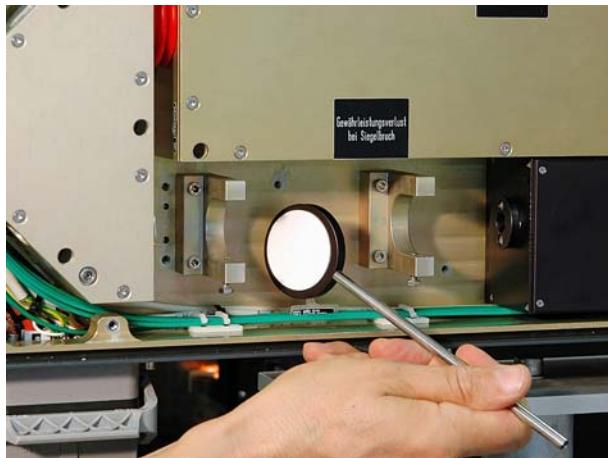


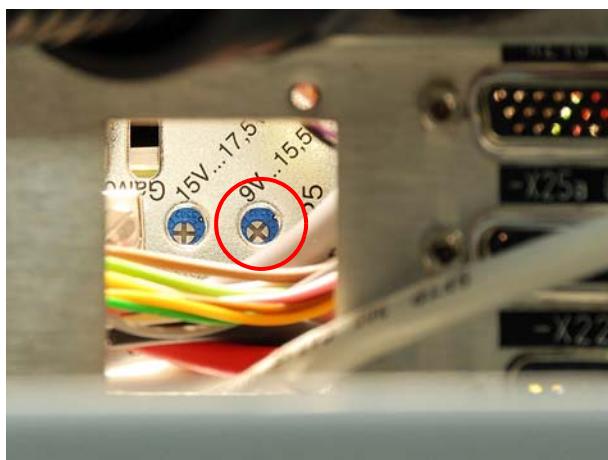
Figure 7.141 CAN bus connection of the plug-in supply unit



**Figure 7.142** Measuring adapter of the operating voltage



**Figure 7.143** Transducer disk



**Figure 7.144** HG-25 potentiometer

7. Plug the measuring adapter (see Chapter 3) into -X12 of HG-25.
8. Plug the connecting plug -X12 into the measuring adapter.
9. Connect the voltmeter to Pin 1 and Pin 5 of the measuring adapter.
10. Turn on the main switch.
11. Start the PC and then "RCU.exe."
12. Start the laser system using the key-operated switch.

13. Set the current value to the maximum current typical for this system (for example, 40 A).
  14. Open the shutter.
- i Note:** The necessary waiting time after the start of the laser (diode current flowing) amounts to at least 10 minutes. The HG-24/25 needs this warm-up time so that it obtains the right point in the process for blocking.
15. Using the transducer disk (see Chapter 3), search for laser radiation outside of the focal point.

16. Turn the potentiometer completely to the left using a suitable screwdriver. Increase the HF power by slowly turning the potentiometer to the right (clockwise) with a small screwdriver until the laser radiation disappears.



Figure 7.145 IR transducer screen

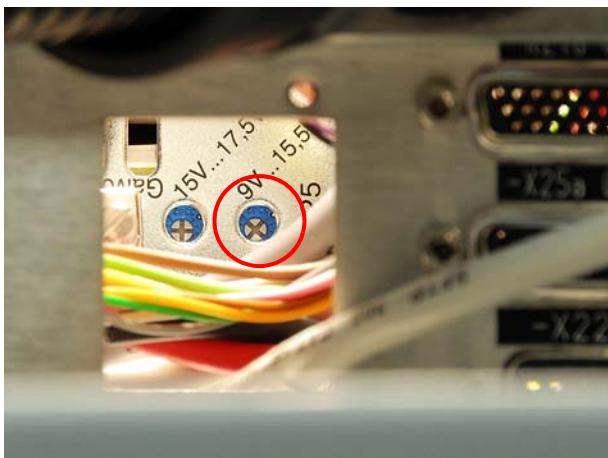


Figure 7.146 HG-25 potentiometer



Figure 7.147 Voltage measurement

17. Using the IR transducer screen (see Chapter 3), search for laser leakage radiation outside of the focal point.

**i** *Note:* When using the IR transducer screen, keep it moving to guarantee a constant display. After about 10 to 15 seconds, "load" the IR transducer screen at a light source (approx. 1 to 2 seconds).

18. Turn the HG-25 potentiometer to the right (clockwise) until the laser leakage radiation disappears.

19. Measure the voltage at Pin 1 and Pin 5 of the measuring adapter.
20. Increase the measured voltage at the potentiometer by **0.2 V**.

**i** *Note:* If the adjustment is carried out with a power measurement device, the residual laser power should not exceed **0.15 W**.

21. To shut down the laser system:
  - Set the key-operated switch to zero.
  - Stop "RCU.exe."
  - Shut down WINDOWS®.
22. Turn off the main switch.
23. Mounting the CAN bus connection

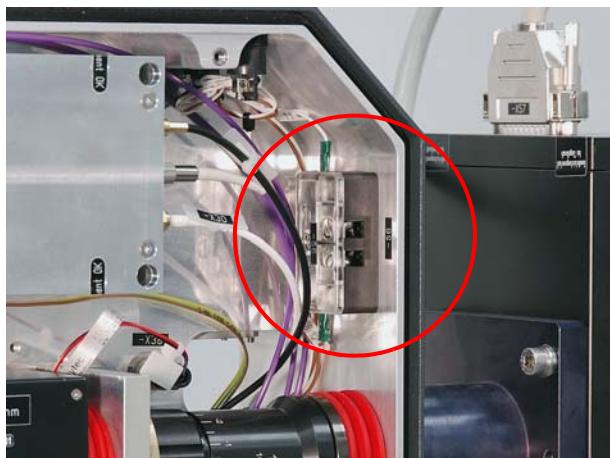


Figure 7.148 Interlock switch

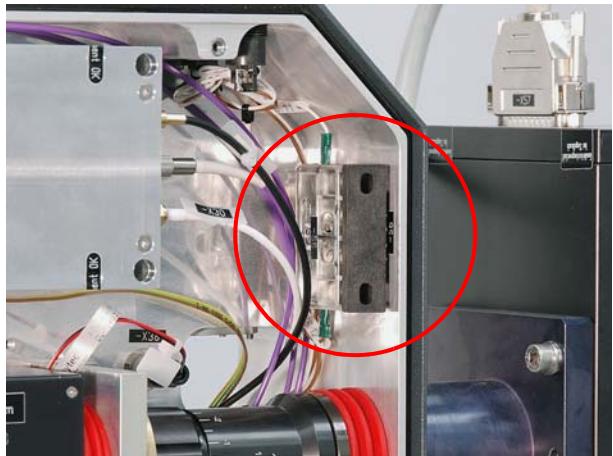
24. Remove the bridge from the interlock switch.
25. Place the heat insulation onto the HF generator.

**!** *Attention:* The heat insulation must lie smoothly since insufficient insulation leads to heat problems and thus to malfunctions! Place the heat insulation over the HF generator without forcing it. In the process, the heat insulation may not be crushed. Make sure that the cables are laid in such a way that they lie in the openings provided for this purpose.

26. Mount the cover of the plug-in supply unit.
27. Push back the plug-in supply unit and attach it.
28. Commission the laser system.
29. Adjust the parameters in VLM.
  - First pulse suppression: upper limit = stage 5 (see Chapter 9 of the "VLM User Manual")
  - Grayscale bitmap:  
Standard minimum DAC value = 200; standard maximum DAC value = 1400 (see Chapter 5.11 of the "VLM User Manual").

## 7.8.5

## RSM PowerLine E Air-25/-30 – Setting the HF power of HG-24

**Figure 7.149** Interlock switch bridged

1. Bridge the interlock switch (Figure 7.149).

**!** **Attention:** When the interlock switch is bridged, the laser system may be switched on for testing/measuring purposes only under supervision! Production while the interlock switch is bridged is fundamentally prohibited!

2. Secure the shutter against activation.

**!** **Attention:** Take measures for protection against laser radiation (see page 153)!

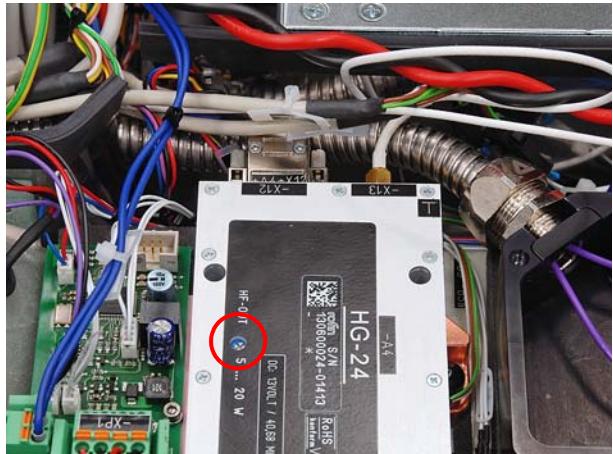
3. Insert the mains plug of the laser system.

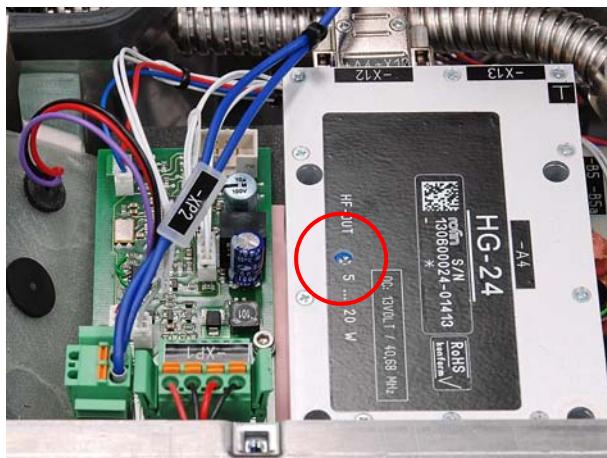
**!** **Attention:** If the emergency stop button/main switch of the laser system is out of reach, a second person must always be present who can press the emergency stop button/main switch in case of an emergency.

4. Set the current value to the maximum current typical for this system (for example, 40 A).

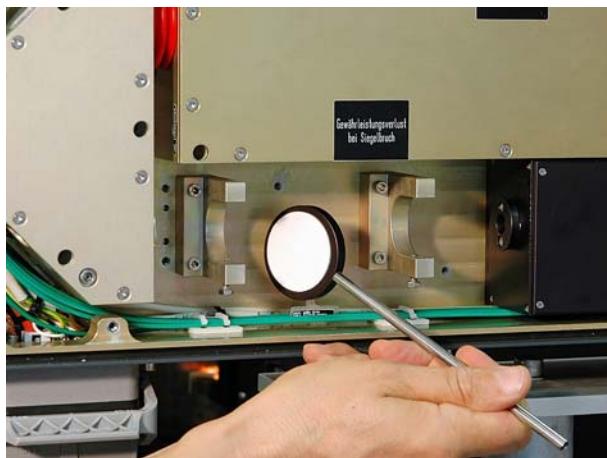
5. Open the shutter.

**i** **Note:** The necessary waiting time after the start of the laser (diode current flowing) amounts to at least 10 minutes. The HG-24/25 needs this warm-up time so that it obtains the right point in the process for blocking.

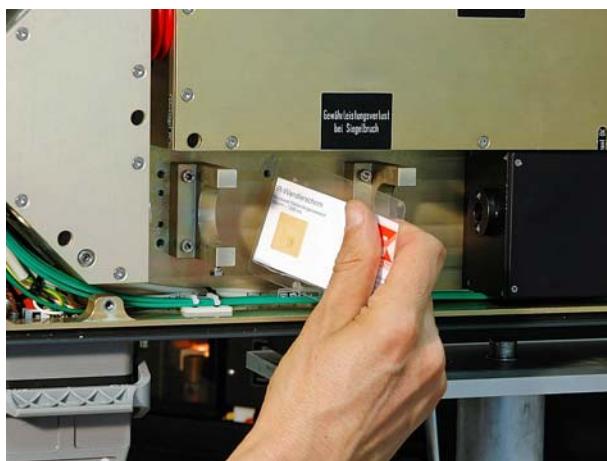
**Figure 7.150** HF power potentiometer



**Figure 7.151 HG-24 potentiometer**



**Figure 7.152 Transducer disk**



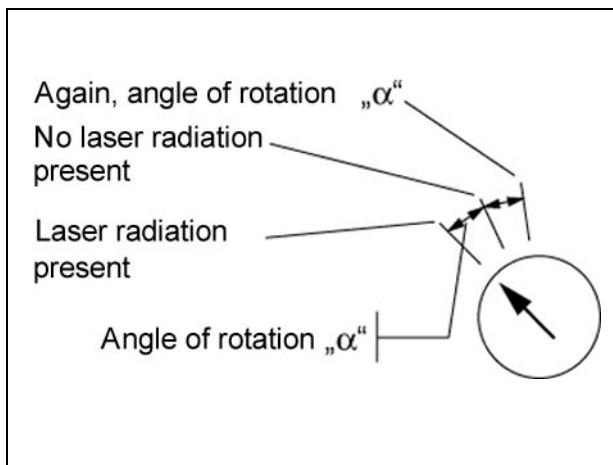
**Figure 7.153 IR transducer screen**

6. Turn the potentiometer completely to the left using a suitable screwdriver.

7. Using the transducer disk (see Chapter 3), search for laser radiation outside of the focal point.
8. Increase the HF power by slowly turning the potentiometer to the right (clockwise) with a small screwdriver until the laser radiation disappears.

9. Using the IR transducer screen (see Chapter 3), search for laser radiation outside of the focal point as follows:

**i Note:** When using the IR transducer screen, keep it moving to guarantee a constant display. After about 10 to 15 seconds, "load" the IR transducer screen at a light source (approx. 1 to 2 seconds).



**Figure 7.154** Setting the HF power of HG-24

#### Laser radiation present

- a) Increase the RF power by slowly turning the potentiometer to the right (clockwise) until the laser radiation disappears. Proceed with b).

#### No laser radiation present

- b) Decrease the HF power by slowly turning the potentiometer to the left (counterclockwise) until the laser radiation emerges.
- c) Turn the potentiometer to the right (clockwise) until the laser radiation disappears. The two positions of the potentiometer (laser radiation present/not present) describe the "α" angle of rotation (Figure 7.154).
- d) Turn the potentiometer by this angle of rotation to the right (clockwise) again. This guarantees that the value of the HF power is sufficiently high.



**Note:** If the adjustment is carried out with a power measurement device, the residual laser power should not exceed 0.15 W.

10. To shut down the laser system:
  - Set the key-operated switch to zero.
  - Stop "RCU.exe."
  - Shut down WINDOWS®.
11. Turn off the main switch.
12. Mount the CAN bus connection

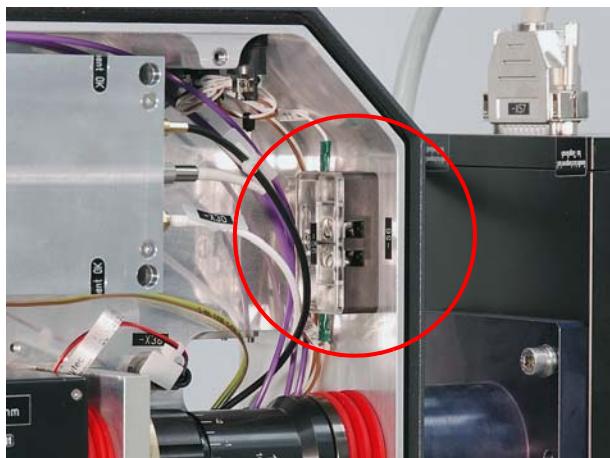


Figure 7.155 Interlock switch

13. Remove the bridge from the interlock switch.
14. Place the heat insulation onto the HF generator.

**Attention:** *The heat insulation must lie smoothly since insufficient insulation leads to heat problems and thus to malfunctions! Place the heat insulation over the HF generator without forcing it. In the process, the heat insulation may not be crushed. Make sure that the cables are laid in such a way that they lie in the openings provided for this purpose.*

15. Mount the cover of the plug-in supply unit.
16. Push back the plug-in supply unit and attach it.
17. Commission the laser system.
18. Adjust the parameters in VLM.
  - First pulse suppression: upper limit = stage 5 (see Chapter 9 of the "VLM User Manual")
  - Grayscale bitmap:  
Standard minimum DAC value = 200; standard maximum DAC value = 1000 (see Chapter 5.11 of the "VLM User Manual").

## 7.9 Changing the HN80x/HN90x 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.

### 7.9.1 RSM PowerLine E Air-10

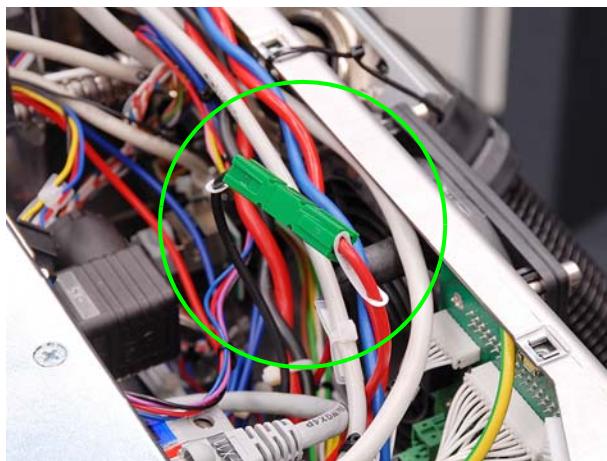


**Note:** In RSM PowerLine E Air-10, the HN80x and HN90x power supply unit types can be used.



**Figure 7.156** Plug-in supply unit

1. Take out the plug-in supply unit and remove the top cover.



**Figure 7.157** Short-circuit bridge of the diode module

2. Short-circuit the diode module using the short-circuit bridge (Figure 7.157).

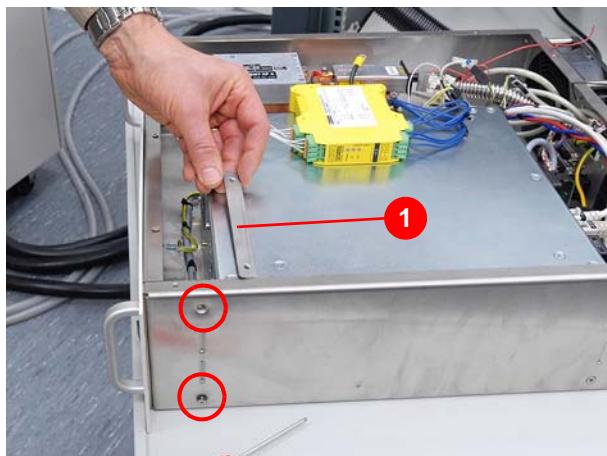
**Attention:** The short-circuit bridge can be used only for work for which the diode connecting lines have to be disconnected on the power supply unit (e.g. exchange of the power supply unit). When you are working directly on the diodes, they should be short-circuited as shown in Section 7.6, page 123.



**Figure 7.158** Dismantling -K9

3. Loosen all connecting lines from the back side of the plug-in supply unit.
4. Loosen the emergency stop relay - K9 from the top-hat rail using a screwdriver and set it aside.

**Note:** The relay must not be disconnected.



**Figure 7.159** Attachment of the power supply unit

5. Loosen the four fastening screws of the power supply unit and remove the mounting straps (1) (Figure 7.159).

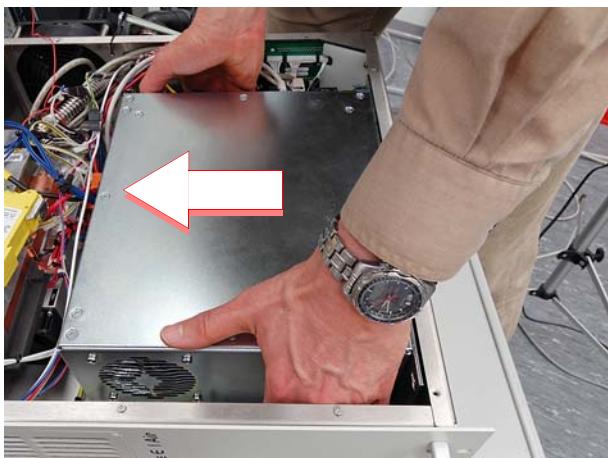


Figure 7.160 Removing the power supply unit



Figure 7.161 Placing the power supply unit

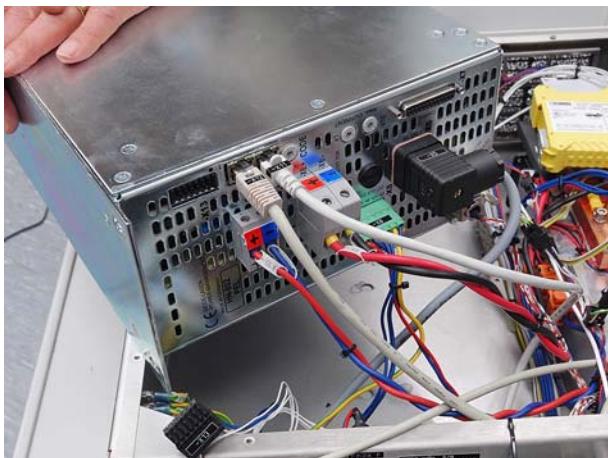


Figure 7.162 Power supply unit connections

6. Carefully remove the cable binders of the connecting lines of the power supply unit in the plug-in supply unit.

**!** *Attention: In the process, do not damage the cable!*

7. Push the power supply unit to the left (see Figure 7.160) and then carefully lift it out.

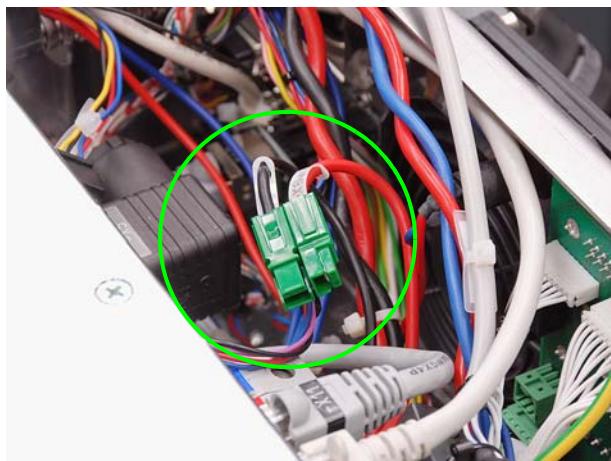
8. Place the power supply unit onto the plug-in supply unit in a slanted manner.

9. Loosen the shorter connecting lines from the power supply unit.

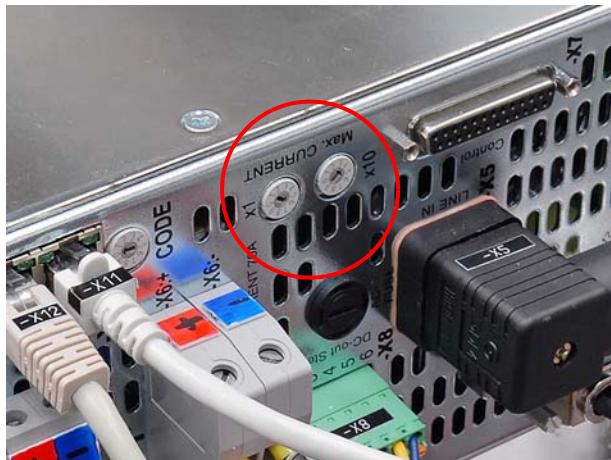
10. Lift out the power supply unit again, place it onto the plug-in supply unit, and remove the rest of the connecting lines.

11. Mount the new power supply unit in the reversed order.

**!** *Attention: Pay attention to the polarity! Use a tool of the correct size! Do not damage the cables during reinstallation!*



**Figure 7.163** Short-circuit bridge, diode modules



**Figure 7.164** Setting the limiting current

12. Open the short-circuit bridge of the diode module and fix it into place.
13. Perform a function check of the power supply unit:
  - Insert the mains plug.
  - Turn on the main switch. The fans must switch on.
  - Turn off the main switch.
  - Pull the mains plug.

#### Perform the following checks/settings:

14. Check/set the HF power of HG-25 (see [Section 7.8.4, page 162](#)).
15. Check/set the operating voltage of the galvo head ([see page 102](#)).
16. Check the setting of the limiting current on the dismantled power supply unit and assume this setting on the new power supply unit (for example: X10 = 4; X1 = 6). The limiting current is thus set to 46 A in this case.
17. Check the diode current (see [Section 4.7, page 57](#)).
18. Mount the cover of the plug-in supply unit.
19. Push back the plug-in supply unit and attach it.
20. Commission the laser system.
21. Perform a function check of the laser system (test marking, test processing).

## 7.9.2 RSM PowerLine E Air-25/-30



**Attention:** In RSM PowerLine E Air-25/-30, only the HN90x power supply unit type may be used.

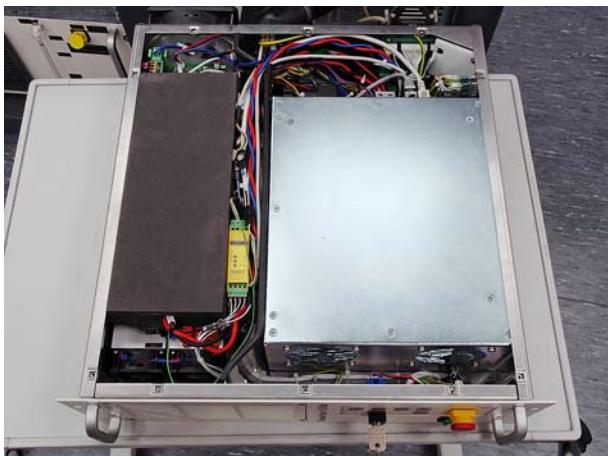


Figure 7.165 Plug-in supply unit

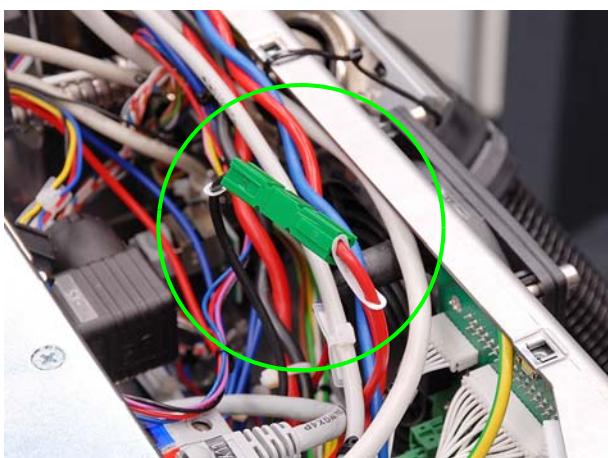


Figure 7.166 Short-circuit bridge, diode modules

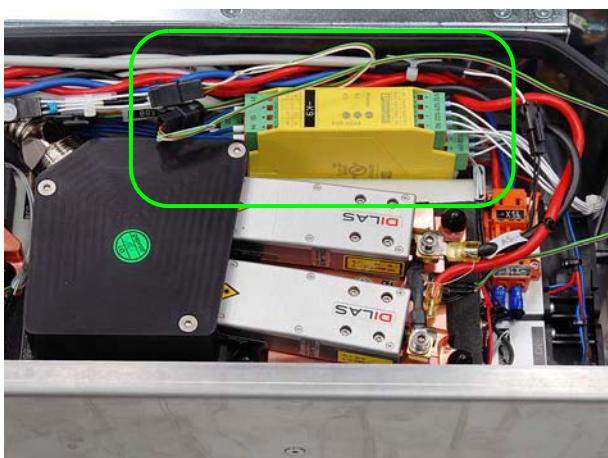


Figure 7.167 Dismantling -K9

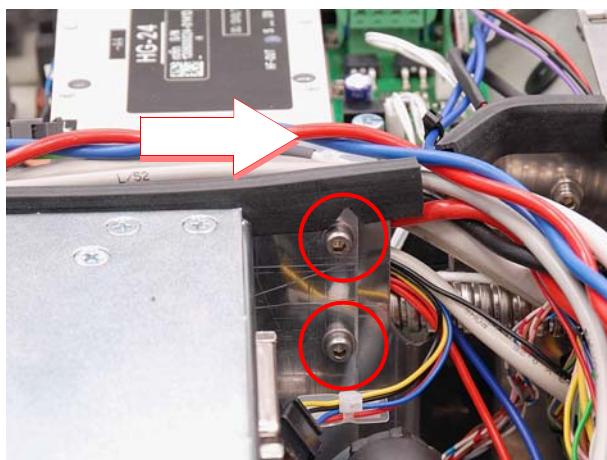
1. Take out the plug-in supply unit and remove the top cover.

2. Short-circuit the diode module using the short-circuit bridge (Figure 7.157).

**Attention:** The short-circuit bridge can be used only for work for which the diode connecting lines have to be disconnected on the power supply unit (e.g. exchange of the power supply unit). When you are working directly on the diodes, they should be short-circuited as shown in Section 7.6, page 123.

3. Loosen all connecting lines from the back side of the plug-in supply unit.
4. Loosen the emergency stop relay - K9 from the top-hat rail using a screwdriver and set it aside.

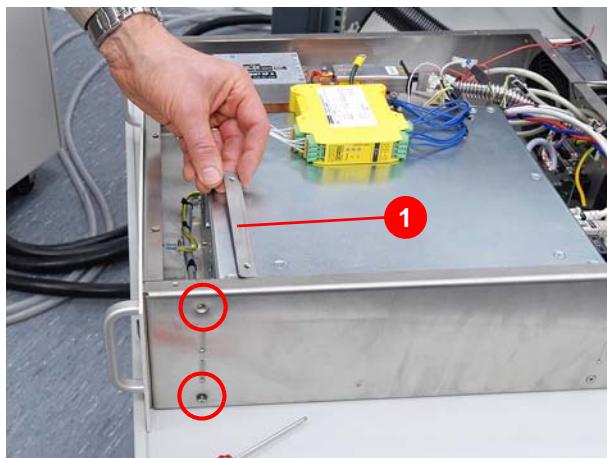
**Note:** The relay must not be disconnected.



**Figure 7.168** Removal of the air guidance plate

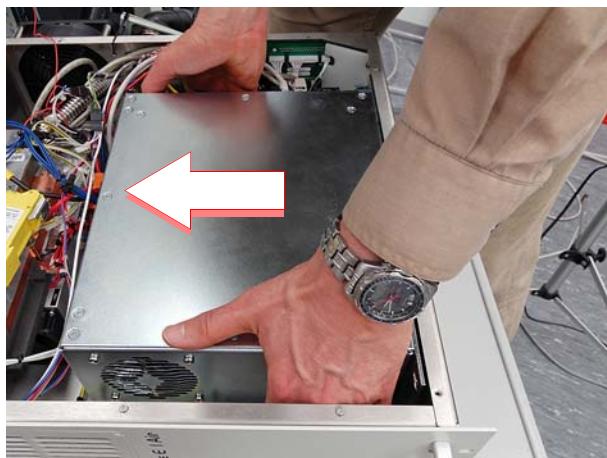
5. Loosen the fastening screws of the air guidance plate.
6. Carefully push back air guidance plant and pull it out.

**Attention:** Do not damage the cable and lines with the air guidance plate!



**Figure 7.169** Attachment of the power supply unit

7. Loosen the four fastening screws of the power supply unit and remove the mounting straps (1) (Figure 7.159).



**Figure 7.170** Removing the power supply unit

8. Carefully remove the cable binders of the connecting lines of the power supply unit in the plug-in supply unit.

**Attention:** In the process, do not damage the cable!

9. Push the power supply unit to the left (see Figure 7.160) and then carefully lift it out.



Figure 7.171 Placing the power supply unit

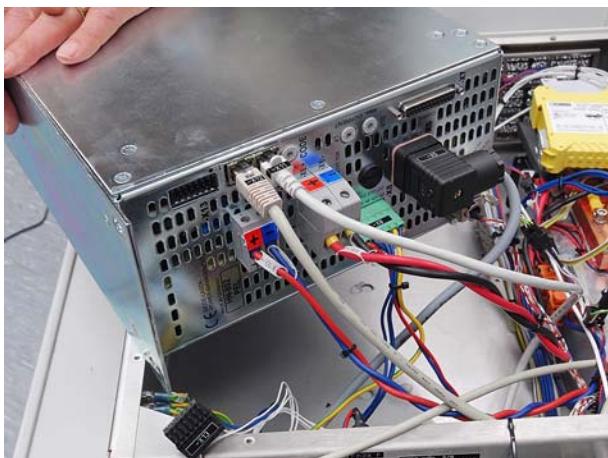


Figure 7.172 Power supply unit connections

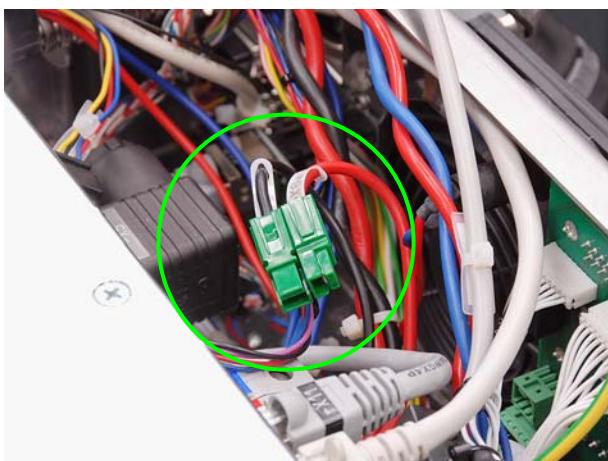


Figure 7.173 Short-circuit bridge, diode modules

10. Place the power supply unit onto the plug-in supply unit in a slanted manner.
11. Loosen the shorter connecting lines from the power supply unit.

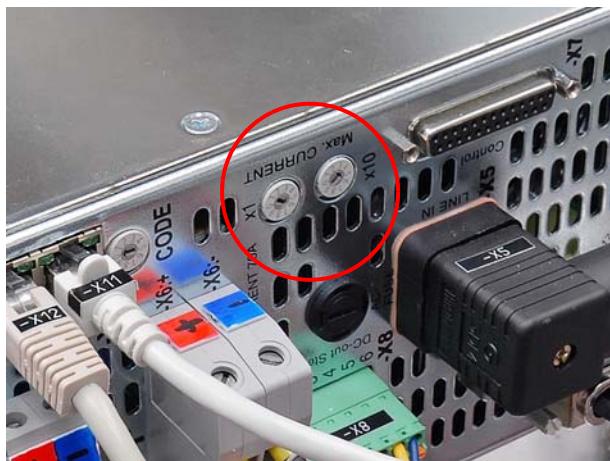
12. Lift out the power supply unit again, place it onto the plug-in supply unit, and remove the rest of the connecting lines.
13. Mount the new power supply unit in the reversed order.

**!** *Attention: Pay attention to the polarity! Use a tool of the correct size! Do not damage the cables during reinstallation!*

14. Remount the air guidance plate.

**!** *Attention: Do not damage the cable and lines with the air guidance plate!*

15. Open the short-circuit bridge of the diode module and fix it into place.
16. Perform a function check of the power supply unit:
  - Insert the mains plug.
  - Turn on the main switch. The fans must switch on.
  - Turn off the main switch.
  - Pull the mains plug.



**Figure 7.174** Setting the limiting current

**Perform the following checks/settings:**

17. Check/set the operating voltage of HG-24 (see [Section 7.8.3, page 160](#)).
18. Check/set the HF power of HG-24 (see [Section 7.8.5, page 166](#)) or HG-25 (see [Section 7.8.4, page 162](#)).
19. Check/set the operating voltage of the galvo head ([see page 102](#)).
20. Check the setting of the limiting current on the dismantled power supply unit and assume this setting on the new power supply unit (for example: X10 = 4; X1 = 6). The limiting current is thus set to 46 A in this case.
21. Check the diode current (see [Section 4.7, page 57](#)).
22. Mount the cover of the plug-in supply unit.
23. Push back the plug-in supply unit and attach it.
24. Commission the laser system.
25. Perform a function check of the laser system (test marking, test processing).

## 7.10 Exchange of the cooling element in the plug-in 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.

### 7.10.1 Preparatory tasks



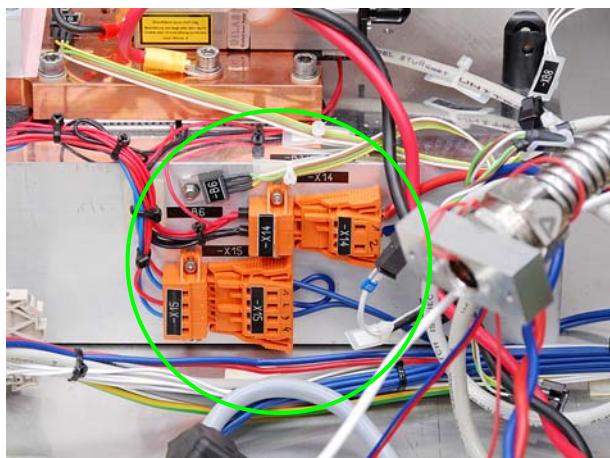
Figure 7.175 Plug-in supply unit

1. Take out the plug-in supply unit and remove the top cover.
2. Loosen all connecting lines from the back side of the plug-in supply unit.
3. Short-circuit, disconnect, and dismantle the diode module(s) (see [Section 7.6, page 123](#)).
4. Disconnect and dismantle the HF generator (see [Section 7.8, page 153](#)).
5. Remove the power supply unit (see [Section 7.9, page 170](#)).
6. Loosen the emergency stop relay - K9 from the top-hat rail using a screwdriver and set it aside.



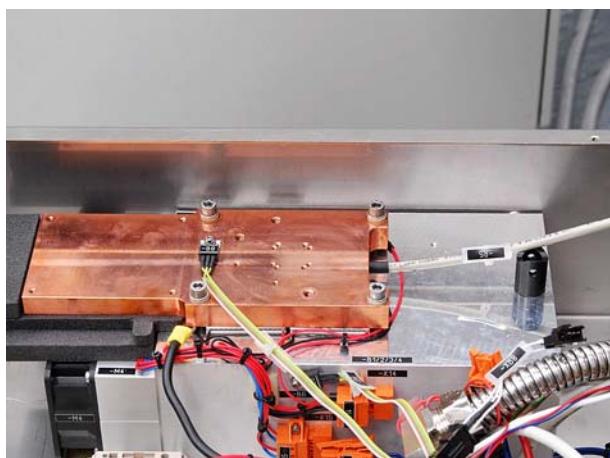
**Note:** The relay must not be disconnected.

### 7.10.2 RSM PowerLine E Air-10



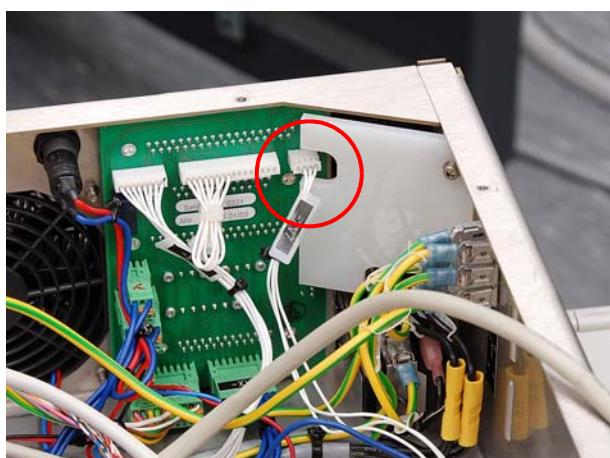
**Figure 7.176** Disconnecting the plug-in connections

1. Perform the preparatory tasks ([Section 7.10.1, page 178](#)).
2. Disconnect the plugs -XB6 and -XB8 in the plug-in supply unit.
3. Disconnect the plugs -X14 and -X15 ([Figure 7.176](#)) on the cooling element.



**Figure 7.177** Dismantling -R5

4. If present, unscrew the PT100 (-R5) or NTC (-R5) ([see Figure 7.192, page 185](#)).



**Figure 7.178** Removing -XV7

5. Remove the -XV7 plug.

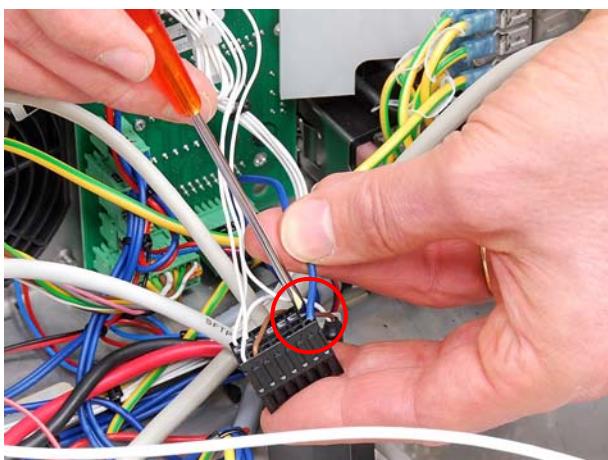


Figure 7.179 Plug -X13

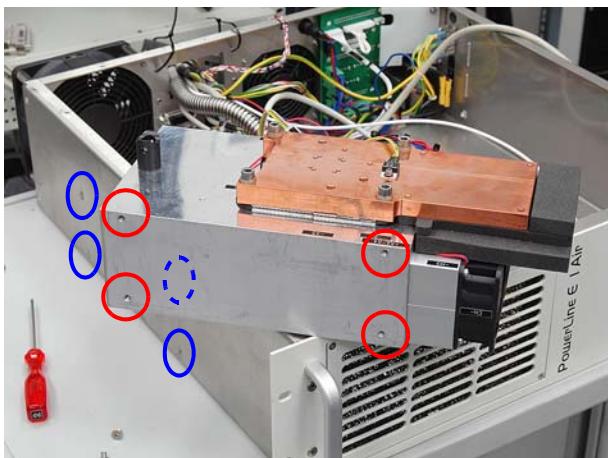


Figure 7.180 Attachment of the cooling element

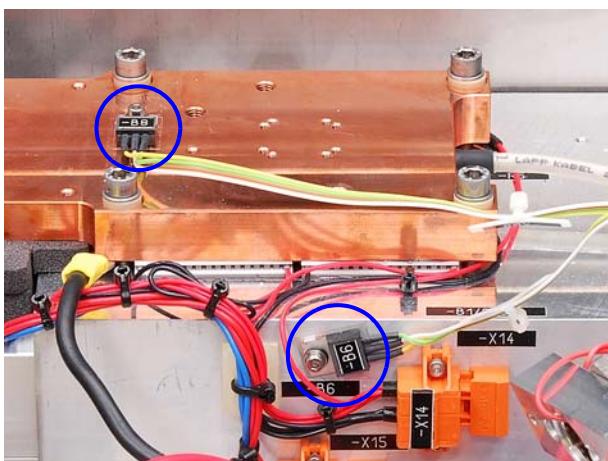


Figure 7.181 Sensors -B6 and -B8

6. Remove the blue line (Pin 2) from the plug -X13.

**i** *Note:* The plug assignment is shown in the connecting diagram.

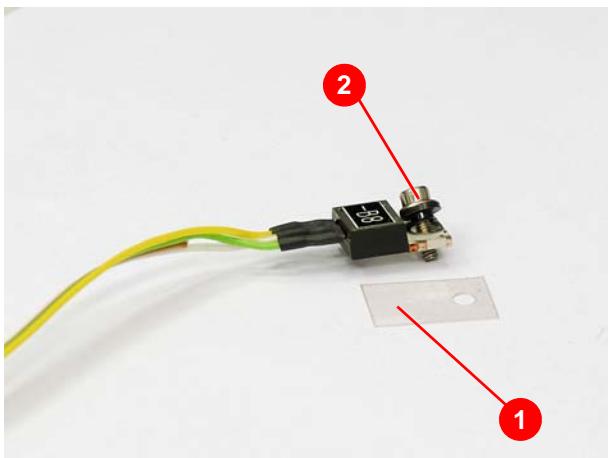
7. Unscrew plus pole of the diode module from the copper block.

8. Loosen the four fastening screws of the cooling element.
9. Push the cooling element out of the plug-in supply unit.

10. Unscrew sensors -B6 and -B8 from the cooling element.

**i** *Note:* Do not lose the fastening screw, washer, plastic sleeve, and piece of mica.

11. Check the cleanliness condition of the new cooling element and clean it with isopropyl alcohol and a non-linting cloth if necessary.



**Figure 7.182** Attachment of sensors -B6 and -B8

12. Mount sensors -B6 and -B8 to the cooling element (torque **80 Ncm**).

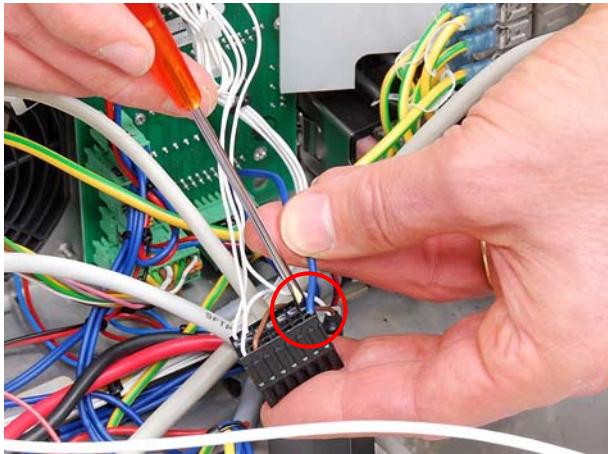
**Attention:** Observe the position of the sensors according to the wiring diagram!

**Attention:** Pay attention to the correct attachment of the sensor. (1) The piece of mica should be between the sensor and cooling element, and (2) the fastening screw should have a washer and plastic sleeve.

13. Measure the contact resistance between the sensor surface and the cooling element. The resistance must be infinite.
14. Place the cooling element into the plug-in supply unit and fasten it.
15. Connect the blue line (Pin 2) to the plug -X13.

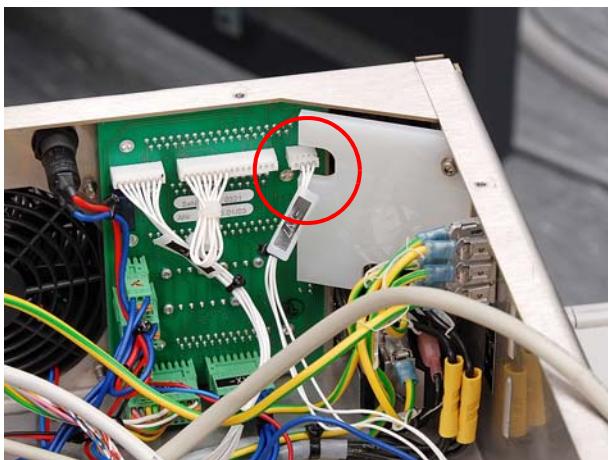
**Note:** The plug assignment is shown in the connecting diagram.

16. Mount the plus pole of the diode module to the copper block (maximum tightening torque: **110 Ncm**).

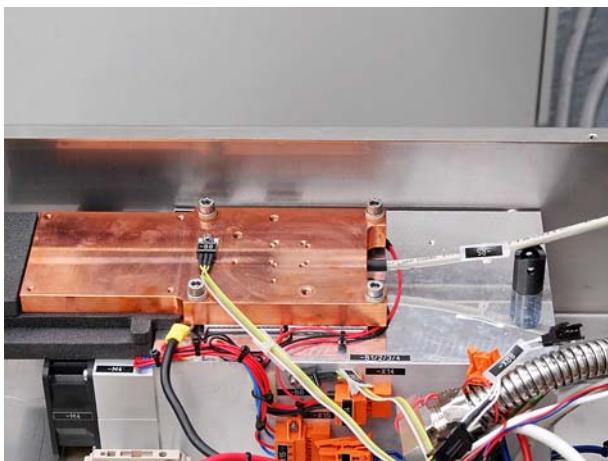


**Figure 7.183** Plug -X13

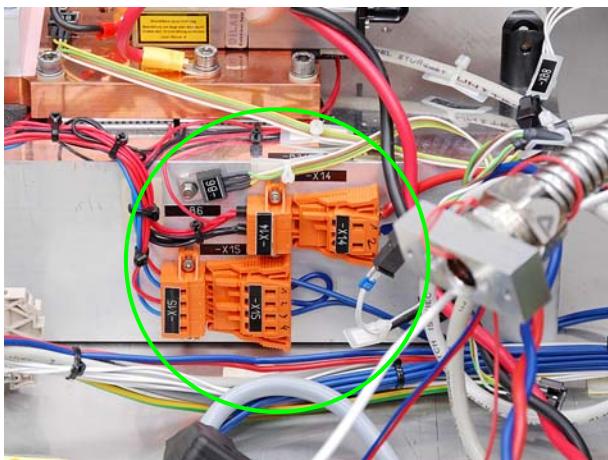
17. Insert the -XV7 plug.



**Figure 7.184** Inserting -XV7



**Figure 7.185** Mounting -R5



**Figure 7.186** Re-establishing the plug-in connections



**Figure 7.187** Plug-in supply unit

18. If present, screw in the PT100 (-R5) or screw on the NTC (-R5) ([see Figure 7.192, page 185](#)). Maximum tightening torques:  
**PT100: hand-tight;**  
**-R5: 80 Ncm.**

19. Connect the plugs -X14 and -X15 ([Figure 7.186](#)) to the cooling element.
20. Connect the plugs -XB6 and -XB8 in the plug-in supply unit.

**Attention:** *Do not mix up plugs -XB6 and -XB8! In case of non-observance, incorrect measurements result and the laser system switches off with an error message!*

21. Remount, connect and set the power supply unit ([see Section 7.9, page 170](#)).
22. Remount, connect, and set the HF generator ([see Section 7.8, page 153](#)).
23. Install and connect the diode module ([see Section 7.6, page 123](#)).
24. Engage the emergency stop relay -K9 into the top-hat rail.



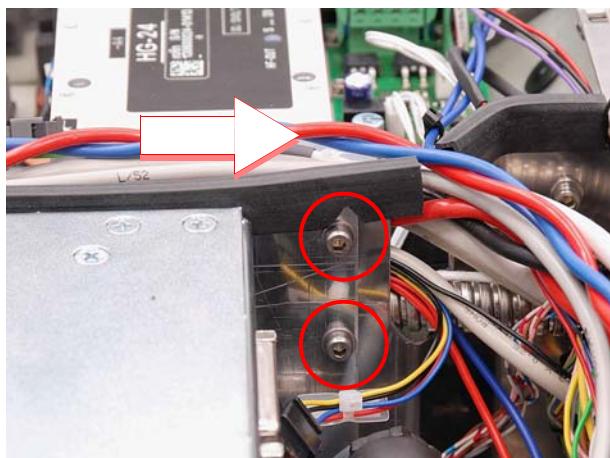
**Figure 7.188 Heat insulation**

25. Place the heat insulation onto the HF generator and diode module.

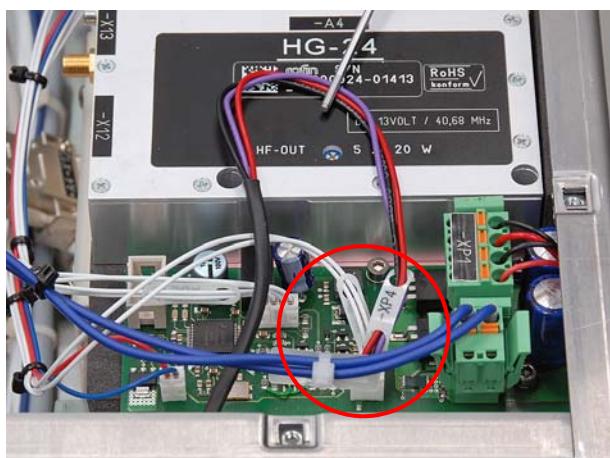
**!** *Attention: The heat insulation must lie smoothly since insufficient insulation leads to heat problems and thus to malfunctions! Place the heat insulation over the HF generator without forcing it. In the process, the heat insulation may not be crushed. Make sure that the cables are laid in such a way that they lie in the openings provided for this purpose.*

26. Connect all connecting lines on the back side of the plug-in supply unit.
27. Mount the cover of the plug-in supply unit.
28. Push back the plug-in supply unit and attach it.
29. Commission the laser system.
30. Perform a function check of the laser system (test marking, test processing).

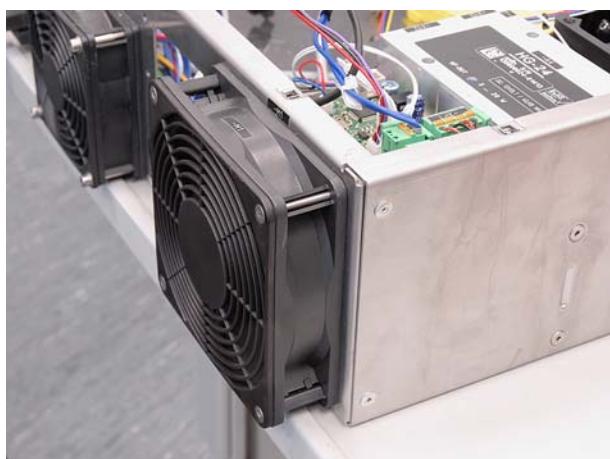
### 7.10.3 RSM PowerLine E Air-25/-30



**Figure 7.189** Removal of the air guidance plate



**Figure 7.190** Connection of the -M1 fan



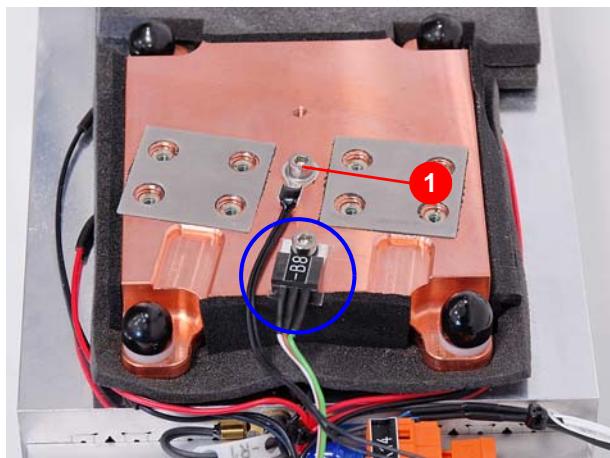
**Figure 7.191** -M1 fan

1. Perform the preparatory tasks ([Section 7.10.1, page 178](#)).
2. Loosen the fastening screws of the air guidance plate.
3. Carefully push back air guidance plant and pull it out.

**Attention:** *Do not damage the cable and lines with the air guidance plate!*

4. Unplug the -M1 (-XP4) fan.

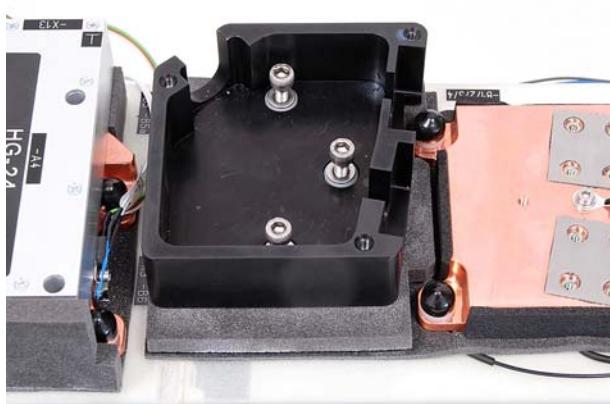
5. Dismantle the -M1 fan and pull the connecting line through the cable sleeve.
6. Remove the plug -XP2 on the fan circuit board.
7. Disconnect the plugs -XB6 and -XB8 in the plug-in supply unit.
8. Disconnect the plug -X14 on the cooling element.



**Figure 7.192** Sensor -B8 and temperature sensor -R5



**Figure 7.193** Fan circuit board



**Figure 7.194** Fiber terminal box

9. Unscrew sensor -B8 from the cooling element (diode-side).

**i Note:** *Do not lose the fastening screw, washer, plastic sleeve, and piece of mica.*

10. Unscrew the temperature sensor -R5 (1) ([Figure 7.192](#)).

11. Unplug the connecting plugs -XP1, -XP3, -XP5, and -XP6 from the fan circuit board.

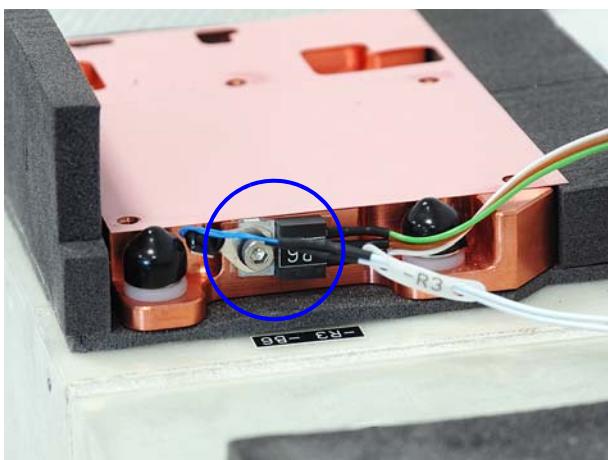
12. Unscrew the fan circuit board.

**i Note:** *Do not lose the disk spacers!*

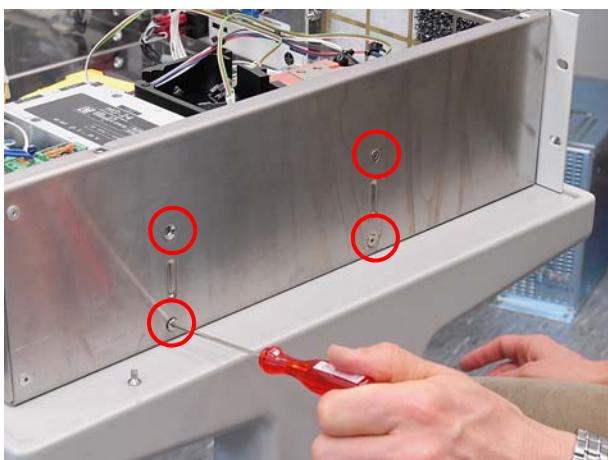
13. Dismantle the fiber terminal box.

**i Note:** *Do not lose the disk spacers and plastic caps!*

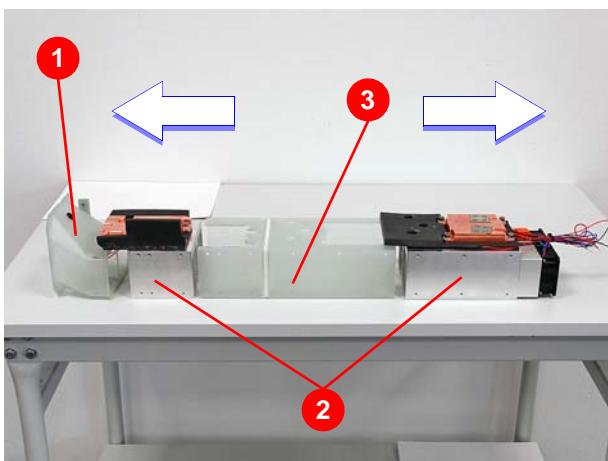
14. Dismantle the HF generator ([see Section 7.8, page 153](#)).



**Figure 7.195 Sensors -B6 and -R3**



**Figure 7.196 Attachment of the cooling element**



**Figure 7.197 Dismantling of the cooling element**

15. Unscrew sensors -B6 and -R3 from the cooling element (HF-side).

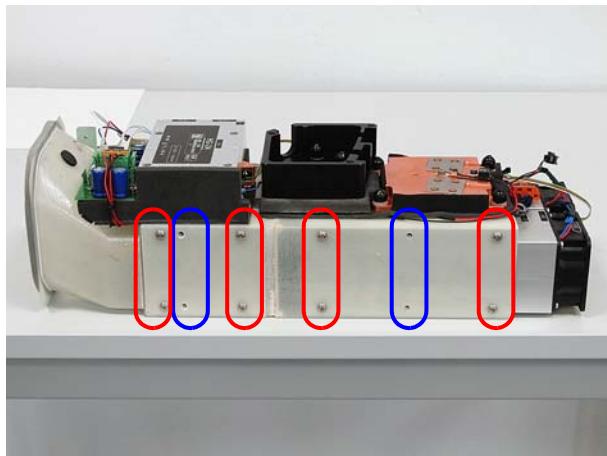
**i Note:** Do not lose the fastening screw, washer, plastic sleeve, and piece of mica.

16. Loosen the four fastening screws of the cooling element.
17. Push the cooling element out of the plug-in supply unit.

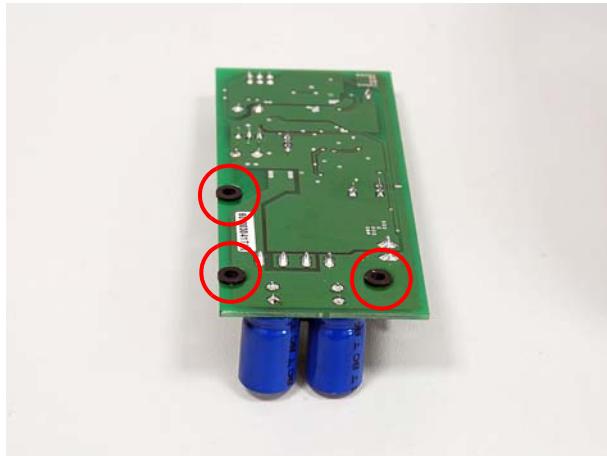
18. Unscrew the ventilation duct (1) ([Figure 7.197](#)) from the cooling element.
19. Remove the screw connections of the plastic sleeve with the cooling elements.

**i Note:** Mark the position of the screws! If the wrong boreholes are used, the cooling element cannot be attached in the plug-in supply unit!

20. Remove both cooling elements (2) from the plastic sleeve (2).



**Figure 7.198** Screw connections of the cooling element



**Figure 7.199** Mounting the fan circuit board

21. Check the cleanliness condition of the new cooling element and clean it if necessary.
22. Mount the subcomponents of the cooling block.  
Red: cooling element mounting screws.  
Blue: fastening screws in the plug-in supply unit.
23. Apply the correct side of the heat conducting film on the HF side.

**!** **Attention:** Make sure no metal particles, etc., are lying under the film. If necessary, clean with isopropyl alcohol.

24. Check the state of the heat conducting film under the HG-24.

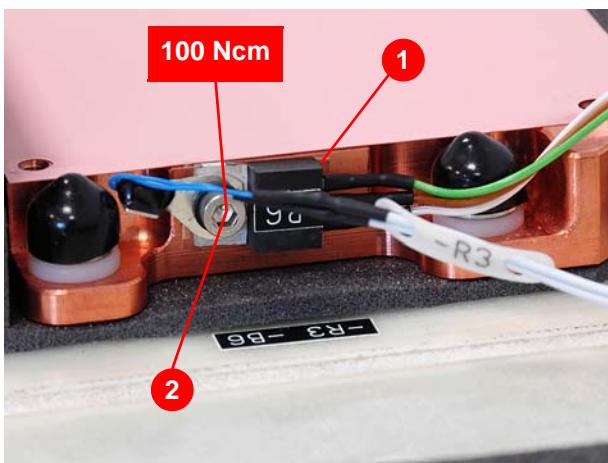
**!** **Attention:** The heat conducting film (electrically insulating and heat-conducting) absolutely may not be damaged! Short-circuit danger due to the plus pole of the diode module connected to the copper plate! A damaged film must be exchanged!

25. Mount the fan circuit board

**!** **Attention:** Check the fan circuit board for protruding soldering points and similar problems.  
Insert the disk spacers! Otherwise there is a danger of short circuits!

26. Connect the fan circuit board.

**!** **Attention:** Observe the position of the connecting plugs according to the wiring diagram!

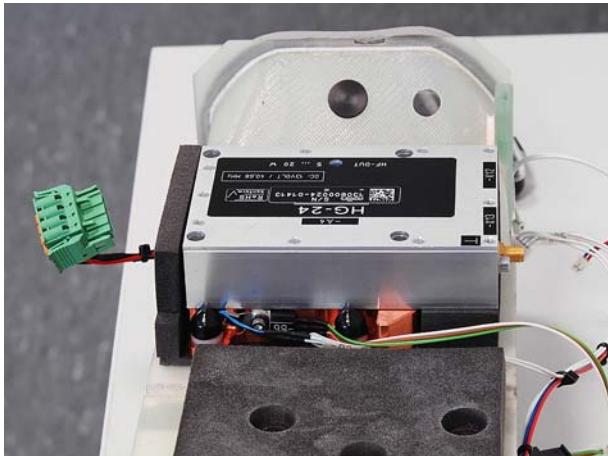


**Figure 7.200** Attachment of sensors -B6 and -B8

27. Screw sensors -B6 and -R3 onto the cooling element (HF-side) (torque: **100 Ncm**).

**Attention:** Observe the position of the sensors according to the wiring diagram!

**Attention:** Pay attention to the correct attachment of the sensor. (1) The piece of mica should be between the sensor and cooling element, and (2) the fastening screw should have a washer and plastic sleeve.



**Figure 7.201** Mounting the HF generator

28. Mount the HF generator (see Section 7.8, page 153).

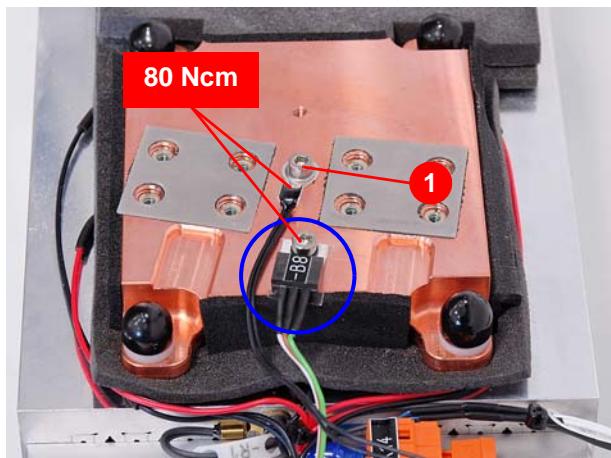
**Note:** We recommend that the HF generator be mounted on this side to protect the heat conducting film during the rest of the mounting procedure and to simplify measurements during mounting.

29. Plug the connecting plugs -XP1, -XP3, -XP5, and -XP6 into the fan circuit board.



**Figure 7.202** Sensors -B6 and -R3 are mounted

30. Measure the contact resistance between the sensor surface and the cooling element/HF generator. The resistance must be infinite.



**Figure 7.203** Sensor -B8 and temperature sensor -R5

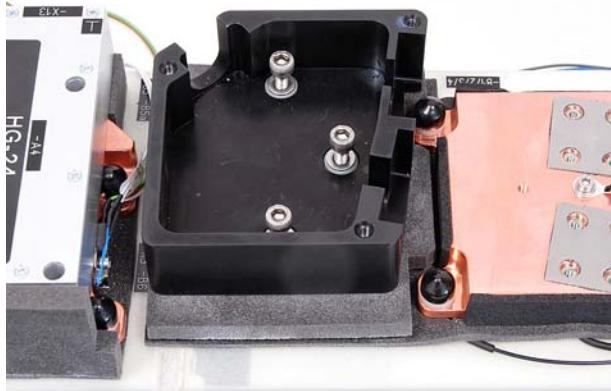
31. Screw sensor -B8 onto the cooling element (diode-side) parallel to the milled openings with a torque of **80 Ncm**.

**!** *Attention:* Pay attention to the correct attachment of the sensor (see Figure 7.200, page 188).

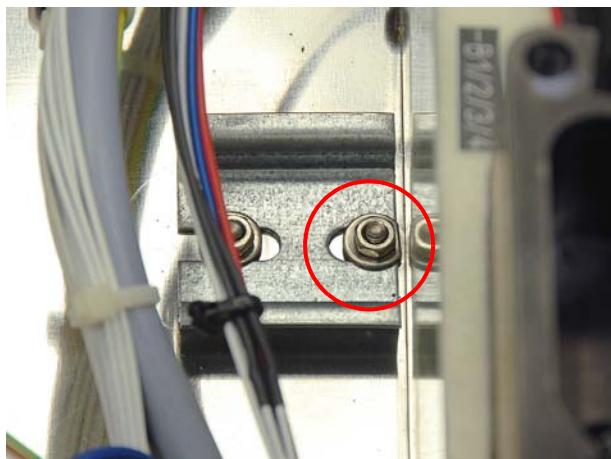
32. Measure the contact resistance between the sensor surface and the cooling element. The resistance must be infinite.
33. Screw temperature sensor -R5 (1) (Figure 7.203) onto the cooling element (diode-side) parallel to the milled openings with a torque of **80 Ncm**.

34. Mount the fiber terminal box.

**!** *Attention:* The disk spacers absolutely must be used! In case of non-observance, there is a danger of short circuits!  
Put the plastic caps (heat insulation) onto the screw heads.



**Figure 7.204** Fiber terminal box



**Figure 7.205** Attachment of the top-hat rail -K9

35. Place the cooling element in the plug-in supply unit.

**i** *Note:* Pay attention to the correct position of the washers used on the top-hat rail for relay -K9 (see Figure 7.205)! If a washer has been placed incorrectly, the cooling element can not be placed in the plug-in supply unit!

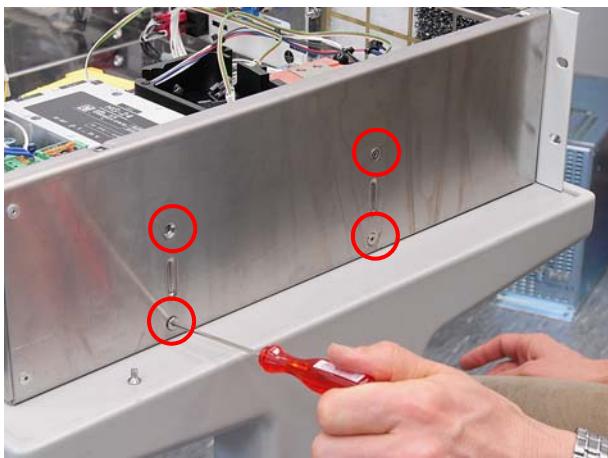


Figure 7.206 Attachment of the cooling element



Figure 7.207 -M1 fan



Figure 7.208 Installation position of the -M1 fan

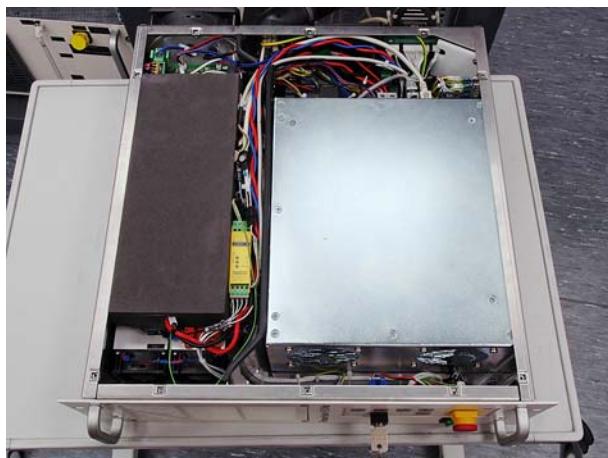
36. Tighten the four fastening screws of the cooling element.

37. Connect the plug -X14 on the cooling element.
38. Connect the plugs -XB6 and -XB8 in the plug-in supply unit.

**!** **Attention:** Do not mix up plugs -XB6 and -XB8! In case of non-observance, incorrect measurements result and the laser system switches off with an error message!

39. Connect the plug -XP2 on the fan circuit board.
40. Mount the -M1 fan and pull the connecting line through the cable sleeve.
41. Disconnect the -M1 (-XP4) fan.

**!** **Attention:** Pay attention to the correct installation position of the fan (the air flow should come from the plug-in supply unit)! Use spacers on the fastening screws to guarantee the free running of the fan! The impeller must be able to turn freely (no collision, for example, with the connecting line)!



**Figure 7.209** Plug-in supply unit



**Figure 7.210** Heat insulation

42. Remount, connect and set the power supply unit (see Section 7.9, page 170).
43. Connect and set the HF generator (see Section 7.8, page 153).
44. Install and connect the diode module (see Section 7.6, page 123).
45. Engage the emergency stop relay - K9 into the top-hat rail.
46. Remount the air guidance plate.

**!** **Attention:** Do not damage the cable and lines with the air guidance plate!

47. Place the heat insulation onto the HF generator and diode module.

**!** **Attention:** The heat insulation must lie smoothly since insufficient insulation leads to heat problems and thus to malfunctions! Place the heat insulation over the HF generator without forcing it. In the process, the heat insulation may not be crushed. Make sure that the cables are laid in such a way that they lie in the openings provided for this purpose.

48. Connect all connecting lines on the back side of the plug-in supply unit.
49. Mount the cover of the plug-in supply unit.
50. Push back the plug-in supply unit and attach it.
51. Commission the laser system.
52. Perform a function check of the laser system (test marking, test processing).

## 7.11 Exchange of the cable connection between the laser head and the plug-in 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.

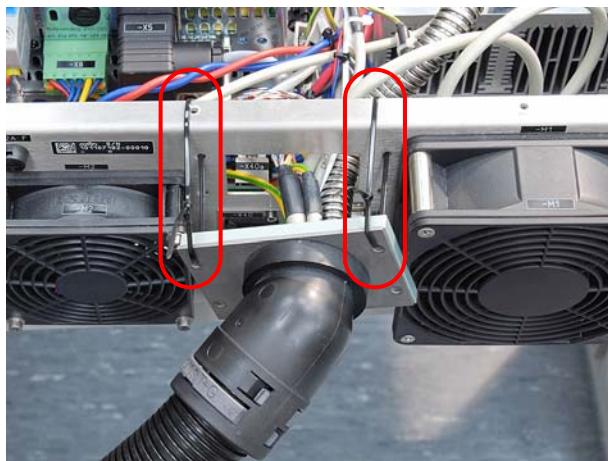
### 7.11.1 Disconnection of the cable connection



Figure 7.211 Plug-in supply unit

1. Take out the plug-in supply unit and remove the top cover.
2. Loosen all connecting lines from the back side of the plug-in supply unit.
3. Short-circuit, disconnect, and dismantle the diode module(s) (see [Section 7.6, page 123](#)).
4. Disconnect and dismantle the HF generator (see [Section 7.8, page 153](#)).
5. Remove the power supply unit (see [Section 7.9, page 170](#)).
6. Loosen the emergency stop relay - K9 from the top-hat rail using a screwdriver and set it aside.

**i** **Note:** The relay must not be disconnected.

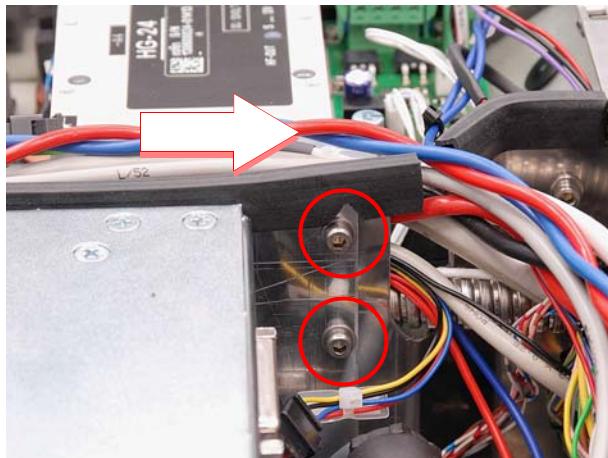


**Figure 7.212** Cable lead of the plug-in supply unit

7. Unscrew both top fastening screws of the cable lead on the plug-in supply unit.
8. Insert two suitable cable binders into the screw holes for tension relief and loosely close the cable binders (see Figure 7.212).

**!** *Attention:* Without tension relief, excessively strong forces will effect the cables and lines!

9. Remove both bottom fastening screws.

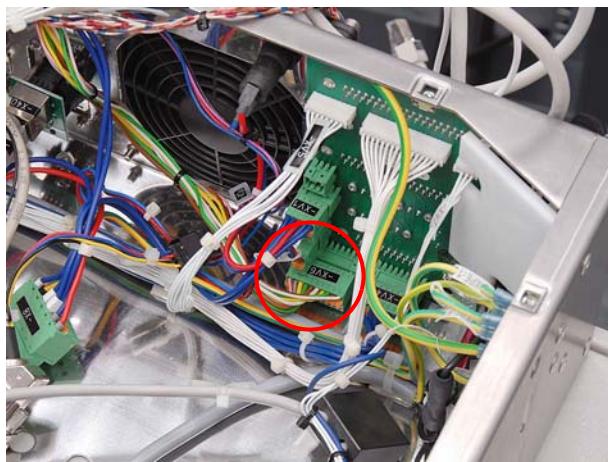


**Figure 7.213** Removal of the air guidance plate  
RSM PowerLine E Air-25-30

**Only applies for RSM PowerLine E Air-25-30:**

- a) Loosen the fastening screws of the air guidance plate.
- b) Carefully push back air guidance plant and pull it out.

**!** *Attention:* Do not damage the cable and lines with the air guidance plate!



**Figure 7.214** Plug-in connection -XV6

10. Disconnect the plugs -XB6 and -XB8 in the plug-in supply unit.
11. Disconnect the plug-in connection -XV6 in the plug-in supply unit.

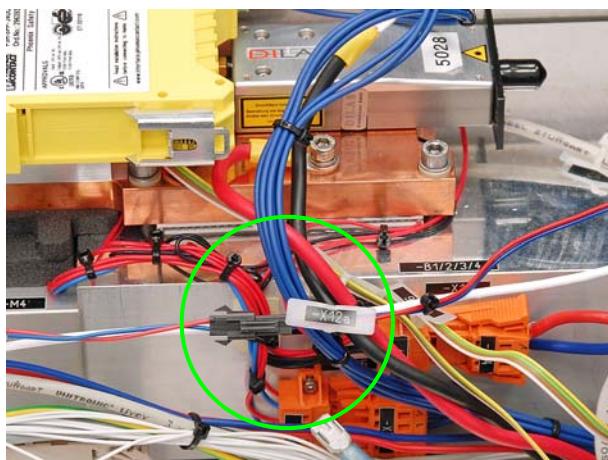


Figure 7.215 Plug-in connection -X12a

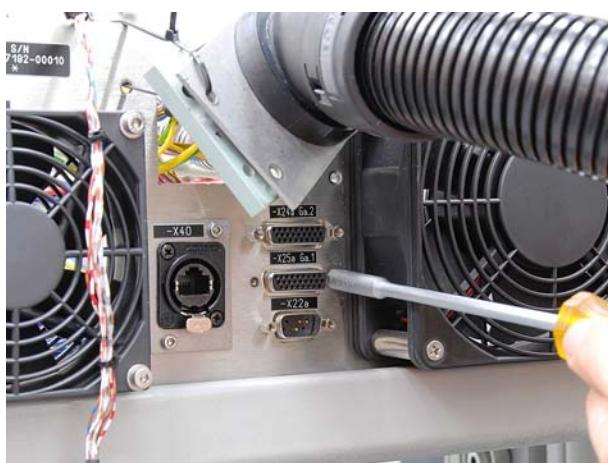


Figure 7.216 Socket -X25a



Figure 7.217 HF line -X13.

12. Disconnect the plug-in connection -X12a.

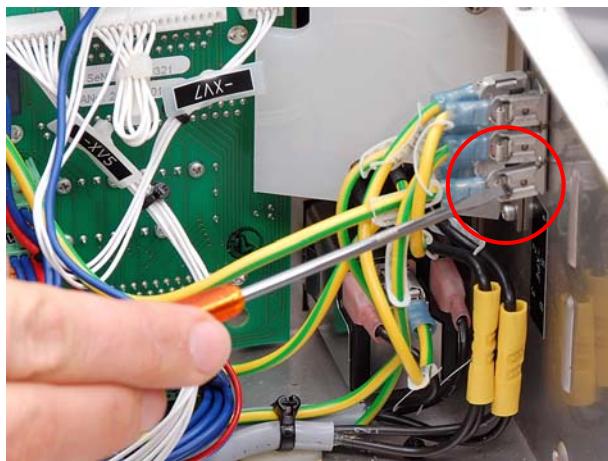
**i Note:** The plug-in connection can be found on relay -K9.

13. Unscrew the socket -X25 from the plug-in supply unit.

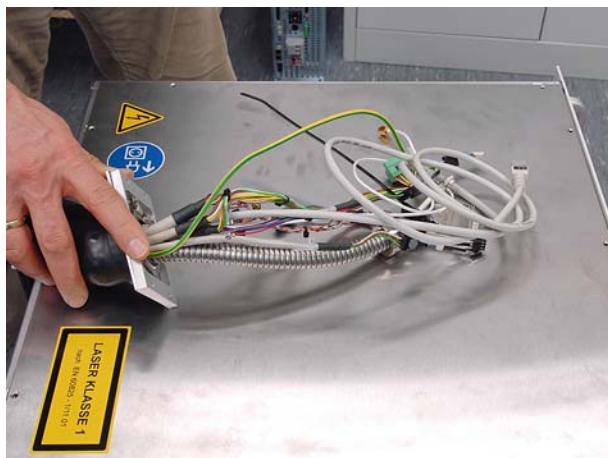
**i Note:** For double head systems, the socket -X24a should also be unscrewed.

14. Disconnect the HF line -X13 from the HF generator.

**i Note:** To obtain more freedom of movement when changing cable connections, we recommend that the plug -X12 be removed for RSM PowerLine E Air-25/-30.



**Figure 7.218 PE connection XPE:6**



**Figure 7.219 Winding the cable**

15. Removal of the PE connection XPE:6.

**i** **Note:** To remove the plug-in connection, the tab on the plug must be pressed in using a suitable screwdriver.

16. Make sure that all connecting lines have been removed.
17. Remove the tension relief on the cable lead (see Figure 7.212, page 193) and carefully remove the cable from the plug-in supply unit.

18. Wind the cable and secure it against slipping into the corrugated tube with a cable binder.

**i** **Note:** Secure the glass fiber line against slipping into the metal tube.

19. Wrap a layer of air cushion film around the cable for better protection.
20. Put the wrapped cable into a plastic bag for better protection and fix the plastic bag to the corrugated tube with a cable binder.

**!** **Attention:** Do not damage the cables in the further procedure!

21. If necessary (for example, for shipping), completely mount the plug-in supply unit.

## 7.11.2 Connection of the cable connection



Figure 7.220 Type plate of the laser head



Figure 7.221 Type shield of the plug-in supply unit

**i** **Note:** Before connecting the cable connection, make sure that the laser head and the plug-in supply unit have the same serial number. Otherwise, the HF reverse voltage and the current limit for the power limitation of the resonator module should be checked after connection.

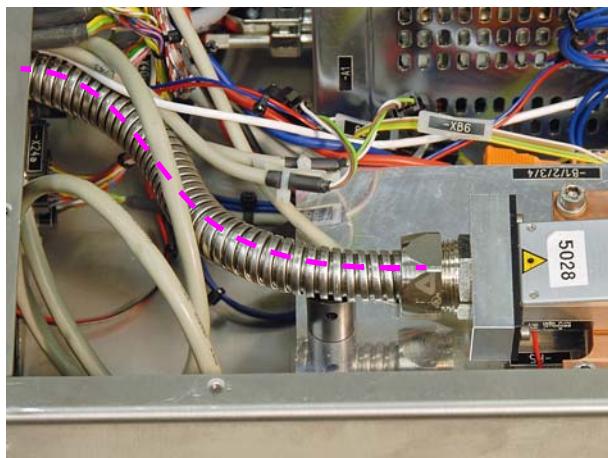
- On the laser head, the type plate is located below the cable lead.

- Type shields are located on the left and right of the plug-in supply unit.

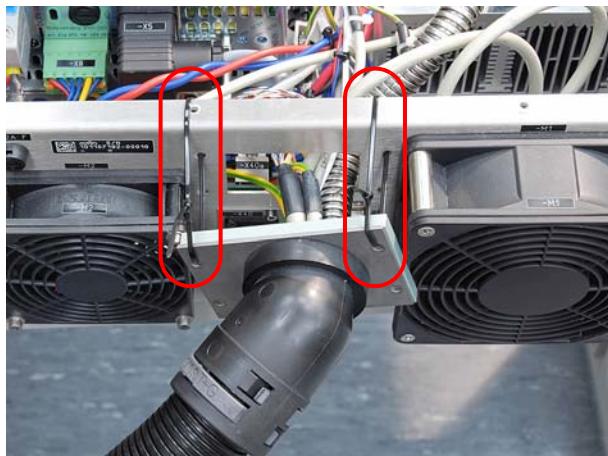
**To mount a plug-in supply unit supplied without wiring or to mount an existing plug-in unit to another laser system:**

- Remove the top cover of the plug-in supply unit.
- Disconnect, short-circuit, and dismantle the diode module(s) (see [Section 7.6, page 123](#)).
- Disconnect and dismantle the HF generator (see [Section 7.8, page 153](#)).
- Remove the power supply unit (see [Section 7.9, page 170](#)).
- Loosen the emergency stop relay - K9 from the top-hat rail using a screwdriver and set it aside.

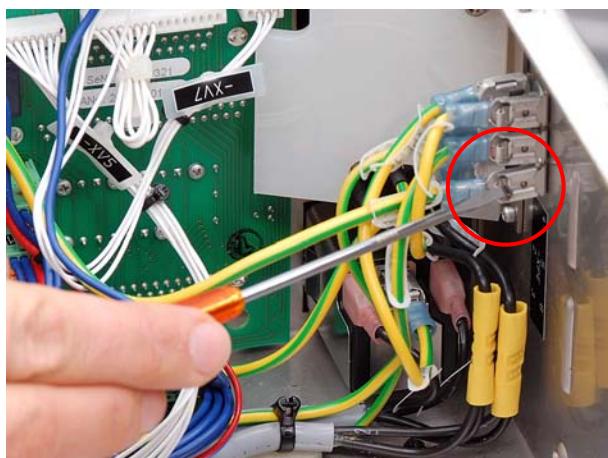
**i** **Note:** The relay must not be disconnected.



**Figure 7.222** Length of the metal tube after the insertion of the cable



**Figure 7.223** Cable lead of the plug-in supply unit



**Figure 7.224** PE connection XPE:6

If a new connecting cable is being mounted between the laser head and the plug-in supply unit:

- Check the length of the metal tube after inserting the cable of the plug-in supply unit and adapt it if necessary.
  - **RSM PowerLine E Air-10:** approx. 17.5 cm
  - **RSM PowerLine E Air-25/-30:** approx. 19 cm

**Attention:** If the metal tube is to be shortened, it should be trimmed cleanly and cleaned with alcohol!

The shortening procedure should be performed outside of the plug-in supply unit!

1. Remove the protective packaging from the cable.
2. Thread the cable carefully into the plug-in supply unit.
3. Insert two suitable cable binders into the top two screw holes of the cable lead for tension relief and loosely close the cable binders (see [Figure 7.223](#)).

**Attention:** Without tension relief, excessively strong forces will effect the cables and lines!

4. Plugging in the PE connection XPE:6.



Figure 7.225 HF line -X13.

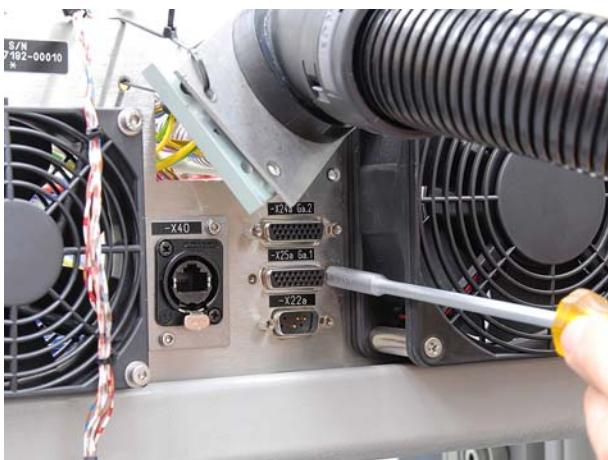


Figure 7.226 Socket -X25a

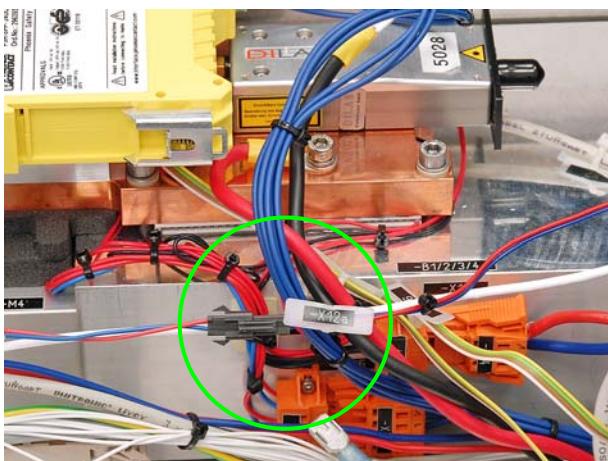


Figure 7.227 Plug-in connection -X12a

5. Screw the HF line -X13 onto the HF generator.

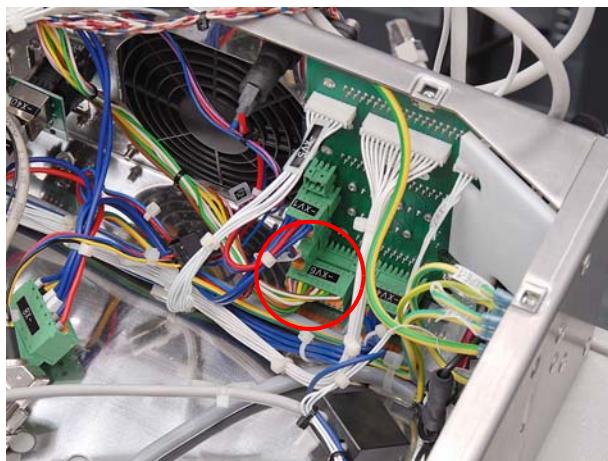
**i Note:** To obtain more freedom of movement when changing cable connections, we recommend that the plug -X12 be connected later for RSM PowerLine E Air-25/-30.

6. Screw the socket -X25 into the plug-in supply unit.

**i Note:** For double head systems, the socket -X24a should also be screwed in.

7. Establish the plug-in connection -X12a.

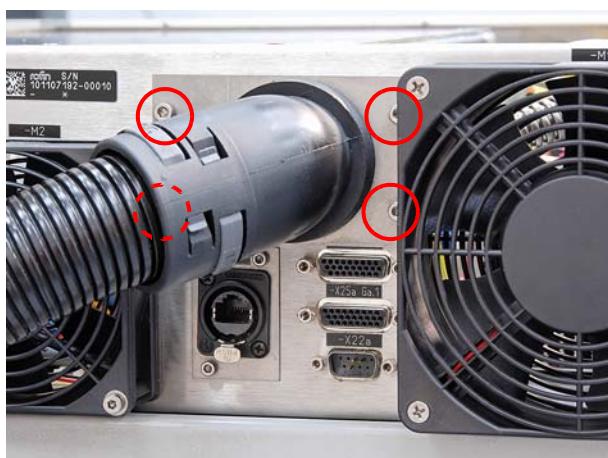
**i Note:** The plug-in connection can be found on relay -K9.



**Figure 7.228** Plug-in connection -XV6



**Figure 7.229** Plug-in supply unit



**Figure 7.230** Cable lead into the plug-in supply unit

8. Connect the plugs -XB6 and -XB8 in the plug-in supply unit.

**i Note:** *Do not mix up plugs -XB6 and -XB8! In case of non-observance, incorrect measurements result and the laser system switches off with an error message!*

9. Establish the plug-in connection -XV6 in the plug-in supply unit.

10. Remount, connect and set the power supply unit (see Section 7.9, page 170).
11. Connect and set the HF generator (see Section 7.8, page 153).
12. Install and connect the diode module (see Section 7.6, page 123).
13. Engage the emergency stop relay - K9 into the top-hat rail.

**Only applies for RSM PowerLine E Air-25/-30:**

- Remount the air guidance plate.

**!** **Attention:** *Do not damage the cable and lines with the air guidance plate!*

14. Unscrew both bottom fastening screws of the cable lead on the plug-in supply unit.
15. Remove the cable binder (tension relief).
16. Screw in both top fastening screws.



**Figure 7.231 Heat insulation**

17. Place the heat insulation onto the HF generator and diode module(s).

 **Attention:** *The heat insulation must lie smoothly since insufficient insulation leads to heat problems and thus to malfunctions! Place the heat insulation over the HF generator without forcing it. In the process, the heat insulation may not be crushed. Make sure that the cables are laid in such a way that they lie in the openings provided for this purpose.*

18. Connect all connecting lines on the back side of the plug-in supply unit.
19. Mount the cover of the plug-in supply unit.
20. Push back the plug-in supply unit and attach it.
21. Commission the laser system.
22. Perform a function check of the laser system (test marking, test processing).

## 7.12 Changing the PLE circuit board and the SSC board 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.

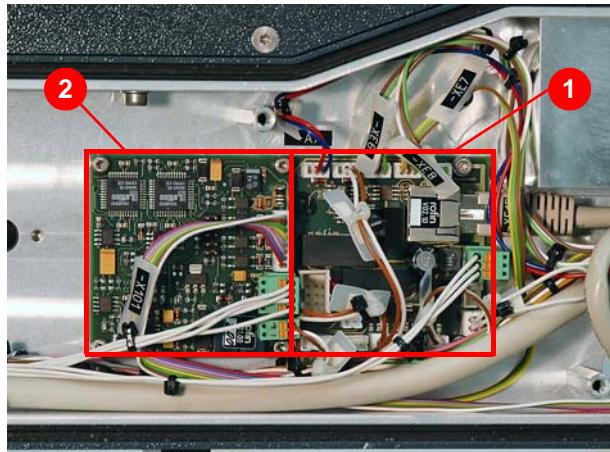


Figure 7.232 PLE circuit board and SSC board

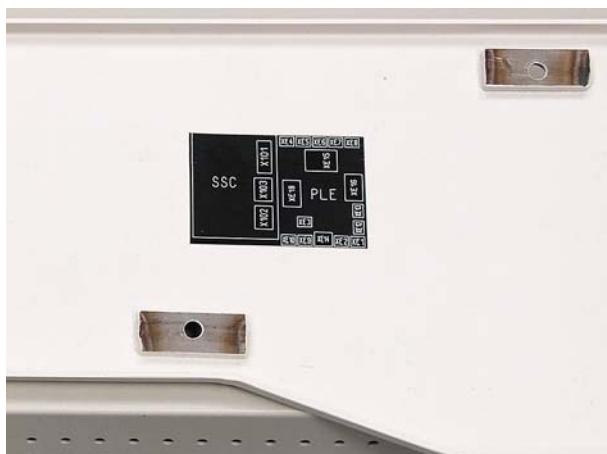


Figure 7.233 Connection assignment

1. Open the lateral cover of the CAN node side of the laser head.
2. Make sure the cable markings of the connecting lines of the PLE circuit board (1) ([Figure 7.232](#)) and SSC board (2) are present.
3. Carefully remove the connecting cable.



**Attention:** Do not pull out the plug by the cables!

4. Exchange the corresponding board.
5. Connect the new board.
6. Close the lateral cover of the CAN node side of the laser head.
7. Commission the laser system.



**Note:** The connection assignment is marked in the cover of the laser head.

## 7.13 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 mains connection is disconnected as required before the plug-in unit is opened, the protective conductor connection is also disconnected!

**Before working on electronic components, ground the plug-in unit using suitable means! The external grounding line must be implemented on a marked PE terminal of the plug-in unit and on a marked PE terminal in the vicinity of the plant! The correct equipotential bonding must be checked using measuring technology! The ESD wrist band must then be connected to a PE terminal of the plug-in unit!**

**Before that, no work may take place on electronic components!**



**Attention:** Everyone who works on the electronic components must observe the measures for the protection of electrostatically sensitive devices (ESD)! 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 7.234 Plug-in PC unit

1. Take out the plug-in PC unit and remove the top cover.
2. Loosen all connecting lines from the back side of the plug-in PC unit.

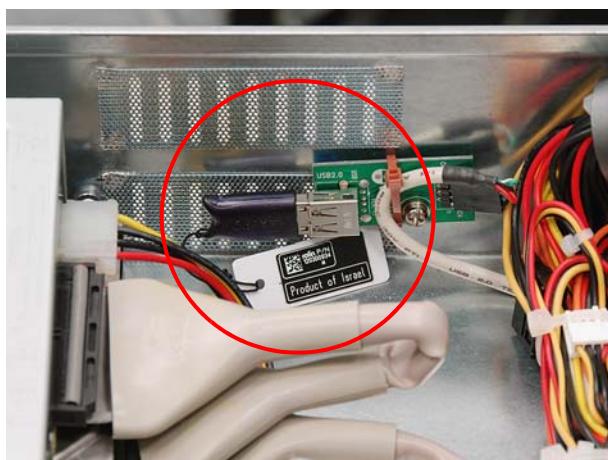


Figure 7.235 USB dongle for VLM software

**Attention:** A USB dongle for the VLM software is located on the left side of the plug-in PC unit (see Figure 7.235). This does not have to be removed for the exchange of the ALI board! The USB dongle may not be exchanged with a USB memory stick!

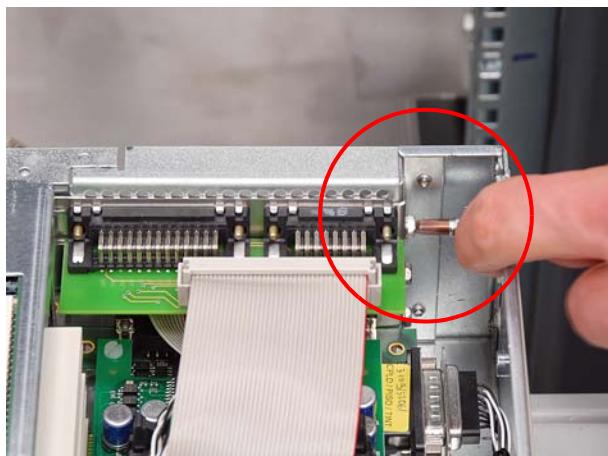


Figure 7.236 Loosening boards

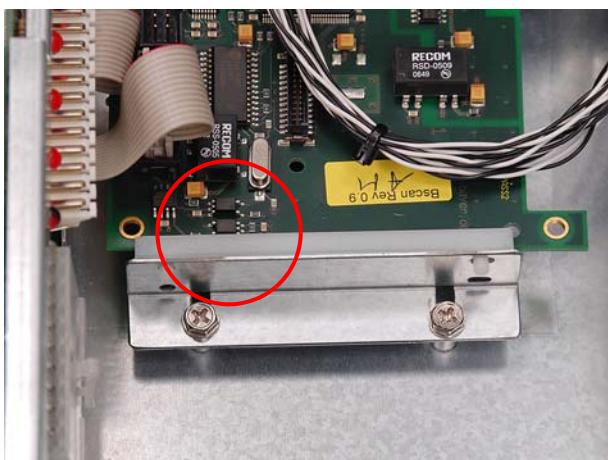
3. Loosen the attachment of the top board.



Figure 7.237 Removing boards

4. Remove the board from the side.
5. Pull the plug of the board.

**Attention:** Do not pull out the plug by the cables!



**Figure 7.238** Attaching the board

6. Insert new boards and fix them into place.

**!** ***Attention:** Do not damage the boards and structural elements with fastening elements (see Figure 7.238)!*

7. Connect the new boards.
8. Connect all connecting lines on the back side of the plug-in PC unit.
9. Mount the cover of the plug-in PC unit.
10. Push back the plug-in PC unit and attach it.
11. Load the new ALI configuration (see [Section 4.12, page 66](#) and [Section 4.13, page 68](#)).

## 7.14 Changing the PC



**Attention:** In the case of a laser system, the operator or its administrator should perform data backups at regular intervals (the software ACRONIS has been provided by ROFIN-SINAR) and save them on DVD (NERO OEM burning software and a DVD burner are included with the PC). The operator of the laser system is responsible for performing the data backup! ROFIN-SINAR cannot be held responsible for data losses due to missing 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 mains connection is disconnected as required before the plug-in unit is opened, the protective conductor connection is also disconnected! Before working on electronic components, ground the plug-in unit using suitable means! The external grounding line must be implemented on a marked PE terminal of the plug-in unit and on a marked PE terminal in the vicinity of the plant! The correct equipotential bonding must be checked using measuring technology! The ESD wrist band must then be connected to a PE terminal of the plug-in unit! Before that, no work may take place on electronic components!

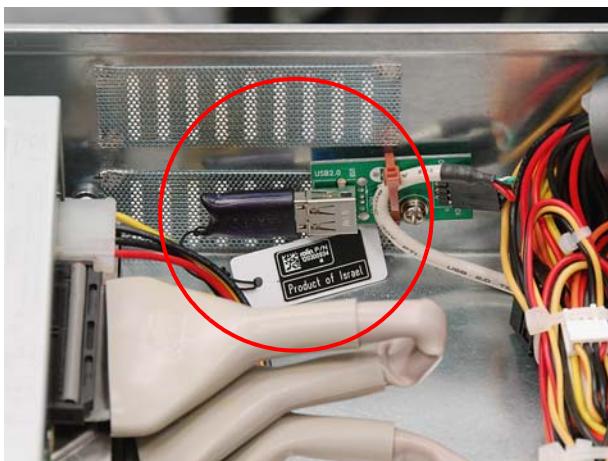


**Attention:** Everyone who works on the electronic components must observe the measures for the protection of electrostatically sensitive devices (ESD)! The work area must be secured!



Figure 7.239 Plug-in PC unit

1. If possible, another data backup should be performed.
2. Switch off the laser system and secure it against reactivation.
3. Take out the plug-in PC unit and remove the top cover.
4. Loosen all connecting lines from the back side of the plug-in PC unit.



**Figure 7.240** USB dongle for VLM software

5. Remove the USB dongle for the VLM software on the left side of the plug-in PC unit.
6. Dismantle the ALI board with all connected plug-in boards and connecting cables (see [Section 7.13, page 202](#)).
7. Reconnect and pack the plug-in PC unit and send it to ROFIN-SINAR.
8. Check the license sticker for WINDOWS® XP on the new PC.
9. Open the new plug-in PC unit.
10. Mount the ALI board with all connected plug-in boards and connecting cables in the plug-in PC unit (see [Section 7.13, page 202](#)).
11. Connect the new boards.
12. Insert the USB dongle for the VLM software on the left side of the plug-in PC unit.
13. Connect all connecting lines on the back side of the plug-in PC unit.
14. Mount the cover of the plug-in PC unit.
15. Push back the plug-in PC unit and attach it.
16. Install the existing customer backup with the ACRONIS software in the new PC (the ACRONIS True Image license is included in the scope of supply of every system/PC and preinstalled) or used the recovery DVD included in delivery to establish the delivery state on the new PC.
17. Load the new ALI configuration (see [Section 4.12, page 66](#) and [Section 4.13, page 68](#)).

## 7.15     **Changing the filter mats**



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

## 7.16     **Changing the particle filter and the deionizer bag**



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

## Repair work

## Notes

## Repair work

## Notes



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