

# PowerLine Prime 12/15

*Assembly and Operating Instructions*





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# 1. General information

## 1.1 Introduction

These Assembly and Operating Instructions provide important information on the assembly, commissioning, operation, and maintenance of the PowerLine Prime 12/15 laser system (referred to hereafter as "the laser system").

The laser system is intended for installation into laser processing machines. The high-quality manufacturing of the laser system assures the precise marking of materials made of metal or plastic. Its compact design also permits safe integration into smaller laser processing machines.

Safe operation of the laser system can only be guaranteed if all persons in charge of the integration, assembly, commissioning, operation and maintenance of the laser system have carefully read the Assembly and Operating Instructions and understood them. The safety notes in the individual chapters must be observed.

The Assembly and Operating Instructions are part of the laser system and must therefore always be accessible at a suitable place. A copy of the Assembly and Operating Instructions must always be kept at the location where the laser system is used.

Due to technical developments, the pictures shown in these Assembly and Operating Instructions may deviate from the laser system delivered. The manufacturer will inform you of the respective current version.

## 1.2 Intended use

The scope of delivery of the laser system is partly completed machinery as defined in Article 2 (g) of Directive 2006/42/EC.

The scope of delivery of the laser system is intended for incorporation into other machinery or partly completed machinery or equipment, or for assembly onto such equipment.

The scope of delivery of the laser system must only be commissioned if it has been ascertained that the machinery into which the scope of delivery of the laser system has been installed complies with the guidelines under Directive 2006/42/EC and with all other applicable guidelines (e.g. EMC Directive 2014/30/EU).

The scope of delivery of the laser system is intended for marking and treating the surface of metals and plastics by means of laser radiation. The limits of the intended use are defined in "Technical data" chapter and in the other applicable documents. The operating and storage conditions are also part of these limits.

Intended use also requires the observance of the accompanying documents included with the delivery. In particular, the maintenance instructions must be complied with.

The intended use of the laser system presupposes specially trained personnel who have been trained regarding laser safety and maintenance.

Any modifications to the scope of delivery of the laser system (hardware or software changes) must only be carried out after prior approval by Coherent Munich GmbH & Co. KG.



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The standard scope of delivery of the laser system includes an emergency stop mechanism and a key switch. These are located on the supplied control panel. If the control panel is not included or has been removed, the manufacturer of the machine into which the scope of delivery of the laser system is incorporated is responsible for the installation of the emergency stop mechanism and the key switch.

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Use of the scope of delivery of the laser system beyond the limits of intended use is not permissible. Installation into medical devices and use in explosion-hazard areas (ATEX), as well as use for light shows, is prohibited.

Machine components that are no longer in optimum condition must be replaced immediately.

Only use original spare parts and parts subject to wear. Installation must be performed by trained personnel.

There is no guarantee that parts purchased from third parties are constructed and manufactured to meet stress and safety requirements. The manufacturer accepts no liability for any non-Coherent parts.

The operation of the scope of delivery of the laser system outside the range of an isolating protective device acc. to IEC 60825-4:2006 or outside an area with controlled access is prohibited. The proprietor is responsible for integrating the laser system into a suitable safety concept.

### 1.3 Applicable documents

Additional technical documents must be observed for the safe operation of the laser system:

- Operating instructions of the VisualLaserMarker (VLM) marking software
- User manual for the LaserConsole program
- Technical drawings
- Supplier documentation (optional)
- Safety data sheets (optional)

No liability is assumed for any errors in the supplier documents.

### 1.4 Assembly and operating instructions

The original publication was created in German. Publications in other languages are translations of the original publication.

A copy of the assembly and operating instructions must always be kept at the place of use of the machine. Every person commissioned with work on or with the machine must have read and understood the assembly and operating instructions. The safety notes in the individual chapters must be observed.

Due to further technical development, the figures in these assembly and operating instructions may deviate from the delivered material processing laser. The manufacturer will inform you of the respective current version.

## 1.5

### Warranty and liability

Our "General Sales and Delivery Terms" apply in all circumstances.

These terms will be made available to the proprietor when the contract is concluded at the latest. Warranty and liability claims in the event of physical injury or damage to property are invalid if they are caused by one or more of the following:

- Improper use of the laser system
- Improper assembly, commissioning, operation and maintenance of the laser system
- Failure to observe the information in these Assembly and Operating Instructions concerning the transport, storage, assembly, commissioning, operation and maintenance of the laser system
- Unauthorized structural modifications to the laser system
- Removing the laser head cover.




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The screws of the laser head cover are sealed with warranty labels. Opening the laser head cover leads to loss of warranty.

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- Insufficient monitoring of components subject to wear
- Assembly/disassembly work which has been carried out improperly
- Catastrophes caused by external influences or force majeure

## 1.6

### Display conventions

#### 1.6.1

#### General symbols & fonts

The meanings of the symbols and fonts used in these Assembly and Operating Instructions are as follows:

**Boldface indicates an instruction for performing a particular operation.**

1. Indicates a work step which must be performed in a particular order (1., 2., etc.).
  - Indicates the result of a work step
- Indicates lists and work steps which do not have to be performed in a particular order.
- » *A detailed description of the topic can be found in the specified section.*

Cross-references appear in color (blue).

#### 1.6.2






#### Safety notes

These Assembly and Operating Instructions contain notes on the prevention of personal injuries and property damage.

### 1.6.2.1 Classification of the safety notes

The general safety notes have been classified according to standard IEC 82079-1.

The safety notes must be strictly observed and are labeled as follows according to the hazard level:

Hazard symbol	Hazard level	Explanation
	<b>DANGER</b>	Warns against an immediate hazard that will result in death or serious injury if the relevant safety instructions are ignored or not sufficiently observed.
	<b>WARNING</b>	Warns against the possible occurrence of a hazardous situation which could result in death or serious injury.
	<b>CAUTION</b>	Indicates the possible occurrence of a hazardous situation which could result in minor personal injury.
	<b>NOTICE</b>	Indicates the possible occurrence of a hazardous situation which could result in damage to property and the environment.
		Identifies additional information and tips without hazards to people and equipment.

### 1.6.2.2 Structure of the safety notes

Safety notes are marked out by an upper and lower dividing line. They are structured according to the following basic principle:




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**Hazard level**
**Hazard type and source**

Potential consequences.

⇒ Measures for preventing the hazard

---



## 1.7

### Operating and storage conditions

The laser system is transported and delivered in special cardboard packaging.



#### NOTICE

The laser system can be damaged by non-permitted transport methods or unsuitable storage.

- ⇒ Only transport and store the laser system in the cardboard packaging supplied.
- ⇒ Keep the original transport container (cardboard packaging, molded foam sections) in a safe place in case the device needs to be shipped back for repair.

The operating conditions can be found in the technical data and the other applicable documents. Generally, the following must be complied with:

- Avoid direct sunlight.
- Do not place the laser system near external heat sources (e.g. radiators).
- Do not expose the laser system to extreme temperature fluctuations. Extreme temperature fluctuations can lead to condensation and/or to a misalignment of the components.

## 1.8

### Conformity

The laser system has been designed and built according to the following standards and regulations and its design conforms to the latest technological standards:

- Directive 2006/42/EC (Machinery Directive)
- Directive 2014/30/EU (EMC Directive)
- Directive 2014/35/EU (Low Voltage Directive)
- as well as the harmonized standards stated by us

The Declaration of Incorporation can be found in the other applicable documents.  
EN 60825-1:2014 was applied for the purpose of classifying the laser.



## 2. Safety

A basic prerequisite for handling the laser system safely and smoothly is being familiar with the safety notes in these Assembly and Operating Instructions and complying with them.

### 2.1 Basic safety notes



#### **DANGER**

##### **Danger from failure to observe safety notes**

Possible bodily injury.

⇒ Observe the information contained in these Assembly and Operating Instructions and in the other applicable documents.



#### **NOTICE**

To avoid damage to the laser system, observe the safety notes in these Assembly and Operating Instructions as well as in the applicable documents.

The Assembly and Operating Instructions must be read and observed by all persons commissioned to carry out work on the laser system. This includes, for example, all operational activities, including setup, troubleshooting during the work flow, the removal of production waste, upkeep, the disposal of operating supplies and materials, maintenance (service, inspection) and/or transport.

In addition to the Assembly and Operating Instructions and the laws and binding accident prevention regulations applicable in the country and location where the system is used, all recognized technical regulations regarding safe and professional operation must also be observed. Within the European Union, these regulations include in particular Directives 2006/25/EC (Artificial Optical Radiation) and 2009/104/EC (Use of Work Equipment).

#### 2.1.1 Obligations of the proprietor

The laser system has been designed and built according to the requirements of the EU Machinery Directive 2006/42/EC. Some of the safety objectives lie within the scope of responsibility of the proprietor.

The laser system is intended for installation into a laser processing machine. With regard to laser safety, the proprietor has two options for safe operation of the laser system:

- The laser system is located in a housing resistant to laser radiation; this housing satisfies laser class 1 requirements according to EN 60825-1:2014 for production.
- The laser system is operated in an area with controlled access.

The proprietor of the laser system must ensure that it is incorporated into a suitable safety concept. The proprietor is responsible for compliance with the applicable national laws and regulations regarding occupational safety and environmental protection.

The proprietor must ensure that:

- The intended use is ensured;
- The laser system is only operated in a safe and technically impeccable condition;
- The operating, maintenance and service personnel are provided with the correct and undamaged personal protective equipment (PPE);
- The operating, maintenance and service personnel have been informed of the risks if the PPE is not used;
- All safety and warning notices affixed to the laser system are legible;
- No safety and warning notices affixed to the laser system are removed;
- Operating, maintenance and service personnel are sufficiently qualified and regularly trained;
- Operating, maintenance and service personnel are regularly instructed in laser safety and risk prevention;
- Operating, maintenance and service personnel are regularly instructed in the proper handling of hazardous material;
- Maintenance and service work is performed only by sufficiently qualified personnel;
- The Assembly and Operating Instructions and all other applicable documents are available in their entirety at the place of use of the laser system;
- All work on or with the laser system must be performed with sufficient local lighting.

## **2.1.2 Obligations of the operating, maintenance and service personnel**

Within their own work area, personnel are responsible for ensuring their own safety and that of any third parties. The Assembly and Operating Instructions must be read and understood before work can be performed on the laser system.

If the safety notes are not observed, people could be killed or severely injured. Machine and other property damage and environmental damage can only be prevented by observing the safety notes.

Persons under the influence of drugs, alcohol or medication that may affect their ability to react quickly may not operate, service or repair the laser system.

The operating, maintenance and service personnel must ensure that:

- Semi-skilled personnel never work with the laser system without being supervised by a sufficiently qualified person;
- The required PPE is worn when working with the laser system;
- The personal protective equipment is checked for damage and the proprietor is informed about any damaged PPE;
- The proprietor is informed about any laser system damage or malfunction;
- The function of the safety equipment (e.g. emergency stop) is checked before the start of work;
- No unauthorized personnel are present in the danger zone;
- In the case of damage or errors, the laser system is immediately shut down and secured against reactivation.

## 2.1.3

## Personnel qualifications

**DANGER**

**Danger of laser malfunction through failure to observe personnel qualifications**

Possible bodily injury

⇒ Observe safety notes and personnel qualifications for all work carried out on and with the laser system.

**NOTICE**

Non-observance of the personnel qualifications can result in malfunctions in the laser system.

Activity	Qualified electrician <sup>a)</sup>	Specialist <sup>b)</sup>	Personnel trained in laser safety <sup>c)</sup>
Setup		X	
Electrical installation/integration	X		
Mechanical installation		X	
Electrical commissioning/programming	X		
Normal operation		X	X
Maintenance/cleaning		X	X
Troubleshooting	X	X	
Disassembly		X	

Tab. 2-1. Personnel qualifications

- a) A qualified electrician is someone who, based on his or her specialized training, has knowledge and experience – and is also familiar with the applicable standards and regulations – regarding the work assigned to him or her and is capable of evaluating it and recognizing the possible dangers it entails.
- b) A specialist is someone who, based on his or her specialized training, has knowledge and experience in the stated area of activity and is capable of evaluating, in accordance with the applicable standards and regulations, the work assigned to him or her and recognizing the possible dangers it entails.
- c) Trained and instructed personnel are workers who have been given the necessary training and instruction by specialists regarding the work assigned to them and the possible dangers it entails in case of improper behavior, also with respect to protective equipment and measures.

## 2.2

**Safety equipment**

The laser system contains safety equipment to prevent personal injury and damage to property. Intended use of the laser system is not possible without the safety equipment.

Before starting up the laser system, ensure that all safety equipment has been correctly installed and is fully functional.

**DANGER****Danger from dismantled or non-functional protective and safety equipment**

Possible bodily injury.

- ⇒ Check the function of safety and protective equipment regularly.
- ⇒ Do not remove or modify safety and protective equipment.
- ⇒ Do not disable safety and protective equipment.
- ⇒ Only operate the laser system if all protective and safety equipment is fully functional.
- ⇒ Shut down the laser system immediately if safety equipment develops defects during operation.
- ⇒ Have trained specialists rectify defects on safety equipment immediately.

**NOTICE**

Dismantled or non-functional protective and safety devices can cause damage to the laser system.

Safety equipment	Safety notes
<b>Shutter</b>	The laser system contains a fail-safe shutter. When the shutter is closed, no hazardous laser radiation escapes.
<b>Emergency stop</b>	<p>An emergency stop mechanism is located on the control panel.</p> <p>Actuating the red-yellow emergency stop button stops all movements of the operation as quickly as possible and switches off the laser so that no more laser radiation can be emitted.</p> <p>If you want to restart the laser system after an emergency stop, you must first unlock the red emergency stop push-button by pulling it out.</p>
<b>Key switch</b>	A key switch is located on the control panel. The key switch prevents uncontrolled starting of the laser.
<b>Laser radiation warning lamps</b>	<p>The warning lamps for laser radiation are located on the top of the laser head.</p> <p>The red warning lamps light up as soon as laser radiation is generated.</p>

Tab. 2-2. Safety equipment

Safety equipment	Safety notes
<b>Protective covers for fans</b>	The externally accessible fans of the laser system are fitted with protective covers to prevent accidental contact.

Tab. 2-2. Safety equipment (Cont.)



The standard scope of delivery of the laser system includes an emergency stop mechanism and a key switch. These are located on the supplied control panel. If the control panel is not included or has been removed, the manufacturer of the machine into which the scope of delivery of the laser system is incorporated is responsible for the installation of the emergency stop mechanism and the key switch.



All safety equipment in the laser system achieves Performance Level d in accordance with EN ISO 13849-1.

## 2.3

### Personal protective equipment (PPE)

Safe operation of the laser system requires the use of personal protective equipment. The personal protective equipment may vary depending on the work performed on the laser system.

Safety boots and protective gloves are mandatory for transport. It is not permitted to operate the laser as a Class 4 system without wearing suitable laser protection goggles. The necessary information for choosing the correct laser protection goggles can be found on the labels on the laser system (see chapter [2.5 Labeling and warning signs on page 2-12](#)).

Respiratory masks and protective gloves may be necessary for maintenance, cleaning and service work.



#### **DANGER**

#### **Danger from missing, unsuitable, or damaged personal protective equipment (PPE)**

Possible bodily injury.

The proprietor of the laser system is responsible for the selection and use of the PPE.

- ⇒ Observe the information on PPE contained in these Assembly and Operating Instructions and in the other applicable documents (e.g. safety data sheets).
- ⇒ Use suitable PPE when carrying out all work with and on the laser system.
- ⇒ Do not wear damaged or unsuitable PPE; this applies to laser protection goggles in particular.

## 2.4 Residual risk

The laser system has been built according to the latest state of the art and the acknowledged safety regulations. However, operating the system can result in residual risk to the operator or other persons and/or in damage to the laser system or other property.

### 2.4.1 General residual risks



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**WARNING****Risk of injury from objects scattered around**

Possible bodily injury.

- ⇒ Only workpieces to be processed may be present in the processing area of the laser.
  - ⇒ All other objects (e.g. tools, cleaning agents, etc.) must be removed after completion of repair, maintenance or cleaning work.
- 



---

**WARNING****Risk of slipping and tripping**

Possible bodily injury.

- ⇒ The work area around the laser system must be free from obstacles.
  - ⇒ Clean up pools of liquid immediately.
  - ⇒ Cover and label cables and hoses.
- 



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**WARNING****Danger from insufficient lighting of the work area**

Increased risk of bodily injury.

- ⇒ During all work on the laser system, there must be adequate lighting that must be switched on.
- 



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**NOTICE**

Inadequate lighting of the working area can result in damage to the laser system. Only perform work on the laser system with adequate lighting.

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## 2.4.2 Dangerous electric voltage



### **DANGER**

#### **Danger from electric voltage**

Possible bodily injury or death due to electric shock.

- ⇒ All work on the electric installation of the laser system must only be carried out by a qualified electrician. This individual must also be briefed about the hazards associated with laser radiation.
- ⇒ When performing any kind of maintenance, inspection, and repair work, disconnect the laser system from the mains supply and secure it against restart.

## 2.4.3 Fire hazards



### **DANGER**

#### **Fire hazard arising from the ignition of gases, liquids and solids**

Possible bodily injury or death.

- ⇒ Do not store any combustible or easily flammable gases, liquids or solids in the processing area of the laser.
- ⇒ Remove these hazard sources from the processing area immediately after completion of maintenance, cleaning or repair work.



### **DANGER**

#### **Fire hazard arising from short-circuits in the electric installation**

Possible bodily injury or death.

- ⇒ All work on the electric installation of the laser system must only be carried out by a qualified electrician. This individual must also be briefed about the hazards associated with laser radiation.



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**DANGER****Fire hazard arising from direct and scattered laser radiation with an open beam path**

Possible bodily injury or death.

The high output power from a Class 4 laser can ignite a wide range of materials. Thus, with an open beam path, ensure that the appropriate fire prevention measures are in place.

- ⇒ Prevent the direct or reflected laser beam from hitting paper (circuit diagrams, leaflets, or even posters on the wall), curtains which are not impregnated with fire retardants, thin wood panels or similar materials.
  - ⇒ Do not place any containers holding easily flammable or explosive solvents or cleaning agents (used for maintenance, for example) in the processing area of the laser beam. Accidental exposure of containers to invisible, intense laser beams can destroy them and very quickly result in major fires or explosions.
  - ⇒ Do not lay any electric cables in the processing area of the laser beam.
  - ⇒ Any electric cables which are present in the processing area of the laser beam must be safely covered to protect them against laser radiation.
  - ⇒ The escape of direct and scattered laser radiation from the processing area must be prevented by means of opaque, fire-retarding protective screens, such as laser safety curtains.
- 



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**DANGER****Danger from using the wrong solvent**

Possible bodily injury.

The wrong choice of extinguishing agent can have fatal consequences. For instance, some chemical substances react on contact with water. This can result in an explosion hazard or the formation of acid.

- ⇒ Do not use water hoses at full force to combat fires.
- 



Should it become necessary to extinguish a fire, the following extinguishing agents may be used:

- Foam
  - Extinguishing powder
  - Carbon dioxide
-

## 2.4.4

## Dangerous laser radiation

**DANGER****Danger from direct and indirect laser radiation: Eyes**

Possible damage to the eyes.

The laser system is an item of Class 4 laser equipment (according to EN 60825-1:2014).

Laser radiation can even cause eye damage at great distances.

Depending on its wavelength, laser radiation may be invisible to the naked eye.

» *The wavelength can be found on the labels on the laser system (see chapter 2.5 Labeling and warning signs on page 2-12).*

In the wavelength range from 400 nm to 1400 nm, the high radiation intensity on the retina causes extreme local heating and burning of the retina tissue. As a result, sight may be impaired or even lost completely.

In the wavelength range below 400 nm and above 1400 nm, the laser radiation is absorbed by the lens of the eye and the cornea in particular. If the eye is exposed to direct radiation, there is a risk of losing the sight in it.

- ⇒ Only use the laser system for its intended purpose.
- ⇒ Do not direct the laser beam toward people or animals.
- ⇒ Demarcate and enclose the laser area, i.e. the area exposed to "open laser beams" in which the work is being performed, and affix suitable warning signs.
- ⇒ Do not use any operating or alignment equipment, or carry out any processes, other than those specified here.
- ⇒ Never look into the laser beam directly or with optical devices.
- ⇒ All persons in the laser area must wear appropriate laser protection goggles. These laser protection goggles must match the appropriate protection class for the laser output power.
- » *The necessary information for choosing the correct laser protection goggles can be found on the labels on the laser system (see chapter 2.5 Labeling and warning signs on page 2-12).*



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**DANGER****Danger from direct and indirect laser radiation: Skin**

Possible burning and sensitization of the skin.

The laser system is an item of Class 4 laser equipment (according to EN 60825-1:2014).

Although skin can withstand a considerably higher radiation intensity than eyes, depending on the length of exposure and radiation intensity, skin tissue can be damaged through burning.

In addition, dangerous UV radiation can arise when processing materials, even if the laser system itself does not emit any UV radiation. Superheated particles can hit the skin.

- ⇒ Only use the laser system for its intended purpose.
  - ⇒ Do not direct the laser beam toward people or animals.
  - ⇒ Demarcate and enclose the laser area, i.e. the area exposed to "open laser beams" in which the work is being performed, and affix suitable warning signs.
  - ⇒ Do not use any operating or alignment equipment, or carry out any processes, other than those specified here.
  - ⇒ Protect persons in the laser area against excessive radiation intensity by means of appropriate measures (e.g. protective screens and protective clothing, if necessary).
  - ⇒ Protect the skin on the face, head, arms, and hands of the operating personnel, e.g. by ensuring they wear a face shield made of polycarbonate in addition to the laser protection goggles, along with light cotton gloves and long-sleeved clothing.
  - ⇒ Provide exposed areas of skin with additional protection by applying a commercially available UV protective cream with a high protection factor.
-



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**DANGER****Danger by laser radiation: Released hazardous substances**

Possible severe damage to health caused by escaping by-products (hazardous materials).

Toxic by-products (e.g. dusts and gases) may develop when certain materials (e.g. metals or plastics) are processed with lasers. These by-products have different medical effects on the human body and can be toxic, allergenic, irritating to the respiratory system, or carcinogenic.

- ⇒ The proprietor of the laser system must establish which by-products are released during processing.
  - ⇒ Remove and dispose of by-products (hazardous materials) in accordance with the local, national, or regional threshold limit values.
  - ⇒ Take suitable measures (e.g. exhaust ventilation system) depending on the health risks. An exhaust ventilation system must be appropriately designed and sized with a high air flow rate, and must be equipped with special filters with paper or activated carbon cartridges.
  - ⇒ Do not blow off dust particles with compressed air; instead, use suitable suction apparatus to extract it.
  - ⇒ Wear a respiratory mask, protective gloves, and long-sleeved clothing when carrying out all cleaning and maintenance work (e.g. replacing contaminated filters or opening components)..
- 



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**CAUTION****Danger from direct laser radiation from the alignment laser**

Possible damage to the eyes.

The laser beam of the alignment laser may also be emitted when the shutter is closed. The alignment laser corresponds to a Class 2 laser.

- ⇒ Do not stare directly into the beam.
-

## 2.5 Labeling and warning signs

Identification labels and warning signs are affixed to the laser system.



### **WARNING**

#### **Danger from missing or illegible labels and warning signs**

Possible bodily injury.

⇒ Do not remove labels and warning signs.

⇒ Keep labels and warning signs in a legible condition.



### **NOTICE**

Missing or illegible signs warning notes can result in misoperation and consequently in damage to the laser system.



The following labels do not represent any technical specifications; they show maximum values of the respective product range.

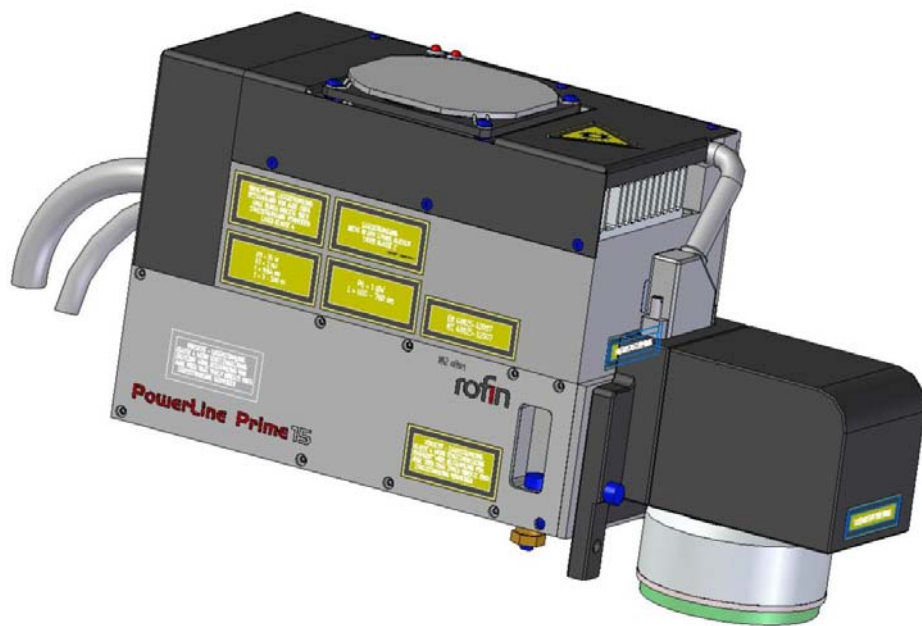


Fig. 2-1. Warning signs and labeling on the laser head

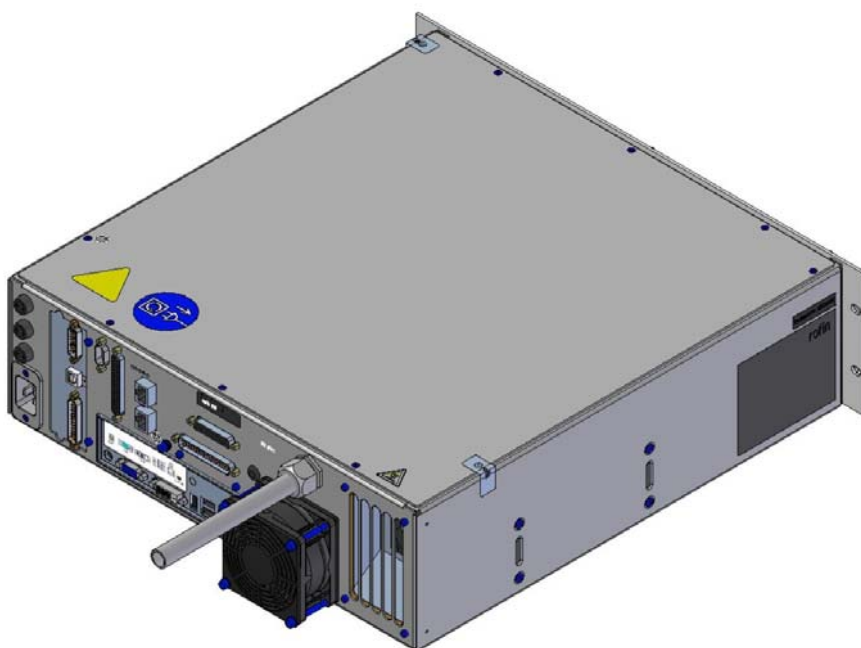



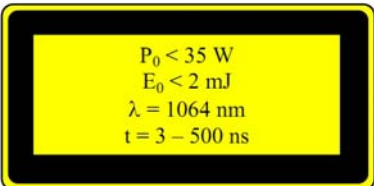


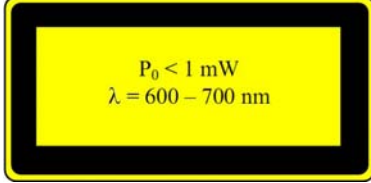


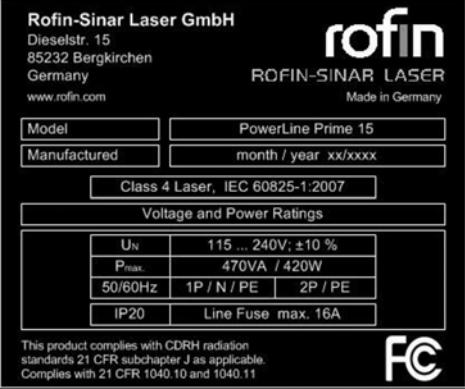
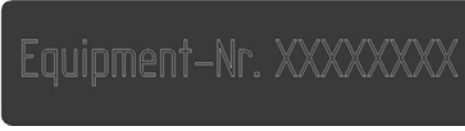



Fig. 2-2. Warning signs and labeling on the plug-in supply unit

This hazard symbol warns you of laser radiation.	
INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT	
EN 60825-1:2014 IEC 60825-1:2014	
$P_0 < 35 \text{ W}$ $E_0 < 2 \text{ mJ}$ $\lambda = 1064 \text{ nm}$ $T = 3 - 500 \text{ ns}$ (Characteristics of the emitted Class 4 laser radiation)	
LASER APERTURE	

<p>LASER RADIATION</p> <p>DO NOT STARE INTO BEAM</p> <p>CLASS 2 LASER PRODUCT</p> <p><i>(Characteristics of the emitted Class 2 laser radiation; only present with alignment laser installed)</i></p>	
<p><math>P_0 \leq 1 \text{ W}</math></p> <p><math>\lambda = 600\text{--}700 \text{ nm}</math></p> <p><i>(Characteristics of the emitted Class 2 laser radiation; only present with alignment laser installed)</i></p>	
<p>This danger symbol warns against dangerous electric voltage.</p>	
<p>The "disconnect before opening" label reminds you that the plug-in supply unit or the mains plug must be disconnected before the housing cover is removed, since the inside of the plug-in unit contains energized parts.</p>	
<p>The identification label (figure shows an example) contains important data relating to the laser system and serves to identify it.</p> <p>The label is located on the side of the supply unit.</p> <p>» <i>More information see chapter 3. Technical data on page 3-1.</i></p>	
<p>The identification label (figure shows an example) contains the equipment number of the laser system.</p> <p>The label is located on the side of the supply unit.</p>	
<p>The identification label (figure shows an example) contains the RSM number of the laser system.</p> <p>This number is required to establish the LAN connection between an external PC/notebook and plug-in supply unit.</p> <p>The label is located on the front of the plug-in supply unit.</p>	



## 3. Technical data

### 3.1 General technical data



The following laser parameters/beam data are typical values. All safety-relevant data is contained in "Safety" chapter and in the labels on the laser system (see chapter 3. Technical data on page 3-1).


We reserve the right to make technical changes.

PowerLine Prime		
Laser type	Prime 12	Prime 15
General information		
Classification	Class 4 laser product acc. to EN 60825-1:2014 The laser product fulfills the CDRH (radiation) standards: 21 CFR subchapter J, as far as possible 21 CFR 1040, 10 and 1040, 11	
Laser parameters/beam data		
Laser wavelength $\lambda$ [nm]	1064	1064
Continuous wave output P [W]	8	14
Average power $P_{av}$ [W]	8 @ 40 kHz	13 @ 50 kHz
Pulse repetition rate range $f_p$ [kHz]	cw, 10 - 200	cw, 20 - 200
Beam quality $M^2$	$\leq 1.3$ @ 40 kHz	$\leq 2.0$ @ 50 kHz $\leq 2.5$ @ cw
Pulse-to-pulse stability [% rms]	$\leq 1.5$	$\leq 5$
Pulse energy Q [mJ]	0.2 @ 40 kHz	0.25 @ 50 kHz
Peak power $P_{Pk}$ [kW]	20 @ 40 kHz	20 @ 50 kHz
Beam diameter at the beam output [mm] • from ... to • typical (depending on BE <sup>a)</sup> )	1.2 ... 1.6 1.4 (1x BE) ... 5.6 (4x BE)	1.6 ... 1.8 1.7 (2x BE) ... 6.8 (4x BE)
Polarization (condition/degree)	unpolarized	unpolarized
Beam ellipticity in focus	$\geq 85\%$	$\geq 85\%$
Pulse width $\tau$ [ns]	7-12 @ 40 kHz	9-14 @ 50 kHz
Long-term drift (8h) at 80% $P_{max}$ . [% rms]	$\leq 2$	$\leq 2$


Tab. 3-1. Technical data

<b>PowerLine Prime (Cont.)</b>		
<b>Laser type</b>	<b>Prime 12</b>	<b>Prime 15</b>
<b>Alignment laser</b>		
Alignment laser wavelength <sup>b)</sup> [nm]	600 - 700	600 - 700
cw-power P [mW]	< 1	< 1
<b>Outer cabling</b>		
Glass fiber (shielded; can be disconnected) [m]	3 or 5	3 or 5
Electrical cables (can be disconnected) [m]	3 or 5	3 or 5
Bending radius Glass fiber [mm]		
• Packaging/transport	65	65
• Laser operation	75	75
Bending radius of electrical cables [mm]		
• Occasionally moved	160	160
• Permanently installed	75	75
<b>Electrical power supply</b>		
Voltage [V]	115 - 240 V ± 10% 50/60 Hz	115 - 240 V ± 10% 50/60 Hz
Electrical connection	1P / N / PE @50/60 Hz 2L / PE @50/60Hz	1P / N / PE @50/60 Hz 2L / PE @50/60Hz
Power consumption		
• Max. [VA] / [W]	470 / 420	470 / 420
• Typ. <sup>c)</sup> [VA] / [W]	350 / 320	350 / 320
Fuse [A]	Max. 16 (IEC) Max. 20 (UL/CSA)	Max. 16 (IEC) Max. 20 (UL/CSA)
<b>Dimensions</b>		
Plug-in supply unit (H <sup>d)</sup> x W x D) [mm]	3U x 440 x 460	3U x 440 x 460
Installation depth of plug-in supply unit [mm]	590	590
Laser head (H x W x L) [mm] (without marking head)	181 x 250 x 128	181 x 250 x 128
<b>Weight</b>		
Laser head [kg]	approx. 10	approx. 10
Plug-in supply unit [kg]	approx. 20	approx. 20

Tab. 3-1. Technical data (Cont.)

PowerLine Prime (Cont.)		
Laser type	Prime 12	Prime 15
Cooling system and air flow		
Cooling	Air cooling, active with fans	
Plug-in supply unit [m³/h]	approx. 250	approx. 250
Laser head [m³/h]	approx. 80	approx. 80
Waste heat		
Plug-in supply unit [W]	280	280
Laser head [W] (without marking head <sup>e</sup> )	50	50
Operating and storage conditions for overall system		
Ambient temperature [°C]	+15 to +35	
Storage temperature [°C]	+5 to +40	
Transport temperature [°C]	+5 to +60	
Humidity	5 - 95% relative humidity, non-condensing	
Mechanical vibrations/acceleration [g]	max. 0.5	
Sound pressure level [dB(A)]	< 70	
Enclosure rating		
Laser head	IP 54	
Marking head	IP 54	
Plug-in supply unit	IP 20	
Safety evaluation of the safety notes		
Regulations	EN ISO 13849-1:2015	
Performance Level (PL)	d	
Conformity		
	Applicable standards according to EU directive on electromagnetic compatibility (EMC): EN 55011:2009 + A1:2010 EN 61000-6-4:2007 EN 61000-6-2:2005 EN 61000-3-2:2006 + A1:2009 + A2:2009 EN 61000-3-3:2008	

Tab. 3-1. Technical data (Cont.)

PowerLine Prime (Cont.)		
Laser type	Prime 12	Prime 15
	Applicable standards according to Federal Communications Commission (FCC) Class A 47 CFR Part 18 ICES-003 Issue 4:2004	
Installation conditions		
Laser head	<ul style="list-style-type: none"><li>• All installation positions are permitted for the laser head.</li><li>• The laser head may only be affixed at the intended points.</li><li>• Air must be able to be supplied from above.</li><li>• The air exhaust on the front and rear side must be ensured.</li><li>• The permissible bending radii of the glass fiber must be observed!</li></ul>	
Plug-in supply unit	<ul style="list-style-type: none"><li>• Installation is only permitted in a "lying down" position (horizontally, cover on top).</li><li>• The plug-in supply unit must be lying flat on the bottom (entirely, or on side rails) and may not be installed suspended on the front panel.</li><li>• The air intake/air exhaust from the front and rear must be ensured.</li><li>• The space requirements for cables and glass fiber lines are as per the integration drawings.</li></ul>	

Tab. 3-1. Technical data (Cont.)

- a) BE = Beam expansion
- b) Class 2 laser product acc. to EN 60825-1: 2014
- c) At a room temperature of 23°C and 80% laser power
- d) 1 HU (height unit) = 44.5 mm
- e) Waste heat from marking head approx. 50 W, depending on model

## 3.2

## Optics module (marking head [galvo] and lens)

Optics module	RS.RM10
<b>Aperture</b>	
Maximum diameter of the beam ray inside the marking head [mm]	10
<b>Marking values</b>	
Repeating accuracy ( $3\sigma$ , P2P) [ $\mu$ rad]	< 22
Long-term drift over 8 hours after warm-up phase [ $\mu$ rad]	< 0.3 <sup>a)</sup>
Offset drift [ $\mu$ rad/K]	30
Gain drift [ppm/K]	50
<b>Lens (F-Theta)</b>	
Focal distance • Lens f=160 [mm] • Lens f=347 [mm]	193 $\pm$ 7 432 $\pm$ 25
Size of marking area • Lens f=160 [mm] • Lens f=347 [mm]	120 x 120 240 x 240
<b>Electrical connections</b>	
Signal inputs and outputs	XY2-100 Standard 16 bit
Supply voltage [V DC]	$\pm (15+3)$ , max. 2 A per supply voltage
<b>Weight</b>	
without lens [kg]	1.2
<b>Operating and storage conditions</b>	
Ambient temperature [ $^{\circ}$ C]	25 $\pm$ 10
Storage and transport temperature [ $^{\circ}$ C]	-10 to +60
Ambient conditions	Non-condensing, non-corrosive

Tab. 3-2. Marking head RS.RM10

a) @  $\Delta T_U < 1K$

### 3.3 Integration drawings



All measurements in the figures are in mm.  
Subject to technical changes without notice

#### 3.3.1 19" plug-in supply unit

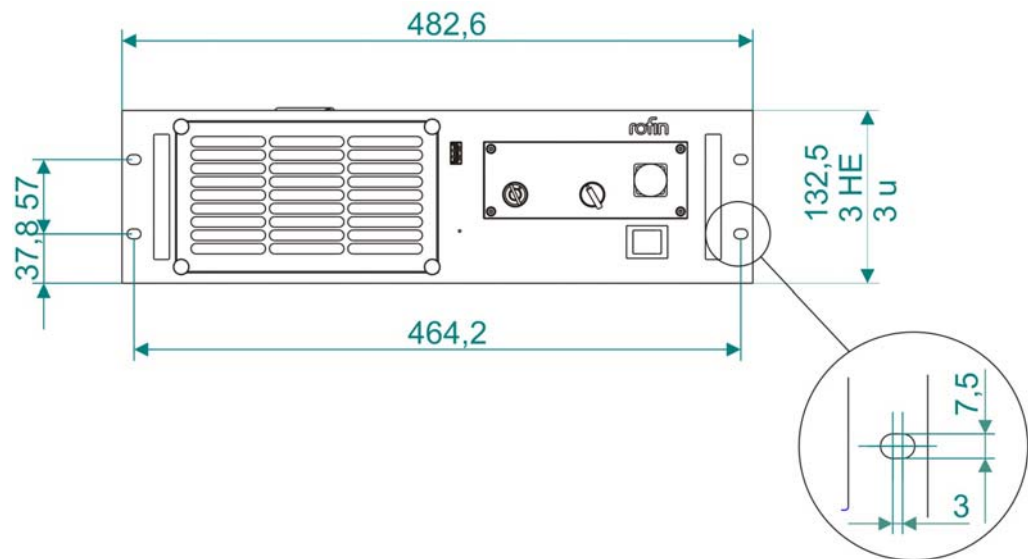


Fig. 3-1. Plug-in supply unit, front view

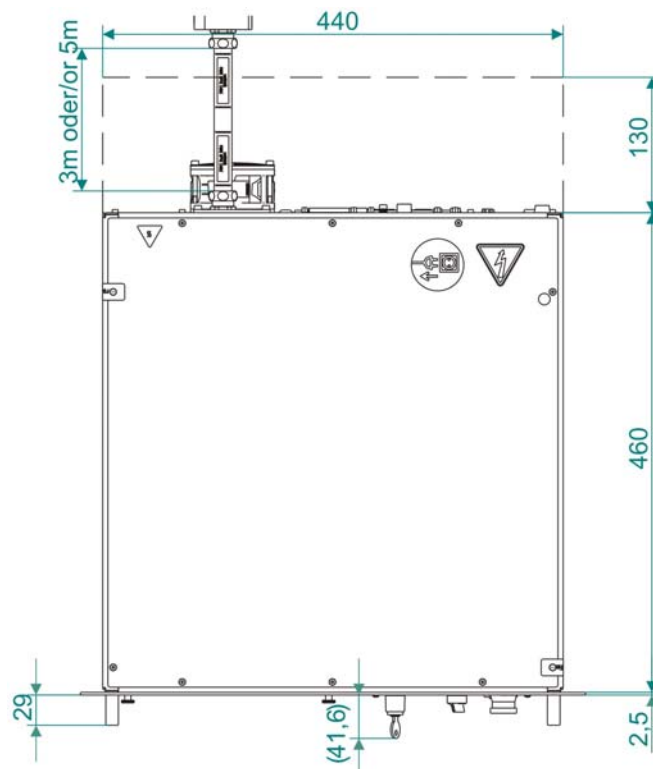
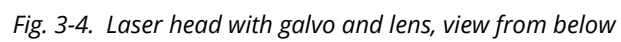
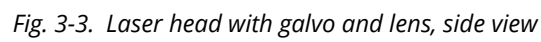
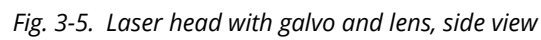


Fig. 3-2. Plug-in supply unit, top view

## Laser head with galvo and f160 lens



## Laser head with galvo and f347 lens





## 4. System overview

The laser system consists of a laser head (1) and a 19 inch plug-in supply unit (2).

The resonator, the cooling unit, the marking head (galvo) and the lens are components of the laser head (1). The plug-in supply unit (2) comprises the electrical power supply components, the control unit and the pump diode for the resonator.

The electrical and data interfaces on the plug-in supply unit and laser head are connected with two plug-in cables. The laser radiation emitted by the pump diode in the plug-in supply unit is routed to the resonator in the laser head by means of a shielded glass fiber. The glass fiber is permanently connected to the plug-in supply unit and can, if necessary, only be disconnected at the laser head.

A desktop or notebook PC, or a monitor with keyboard and mouse, must be provided by the proprietor of the laser system for the marking process.

The marking process is carried out either via the external PC/notebook or via the monitor with keyboard and mouse. The communication between the desktop/notebook PC and the laser control unit in the plug-in supply unit is handled through the network interface on the back of the plug-in supply unit. Alternatively, a monitor, keyboard and mouse can be connected to the rear of the plug-in supply unit to work in local mode.

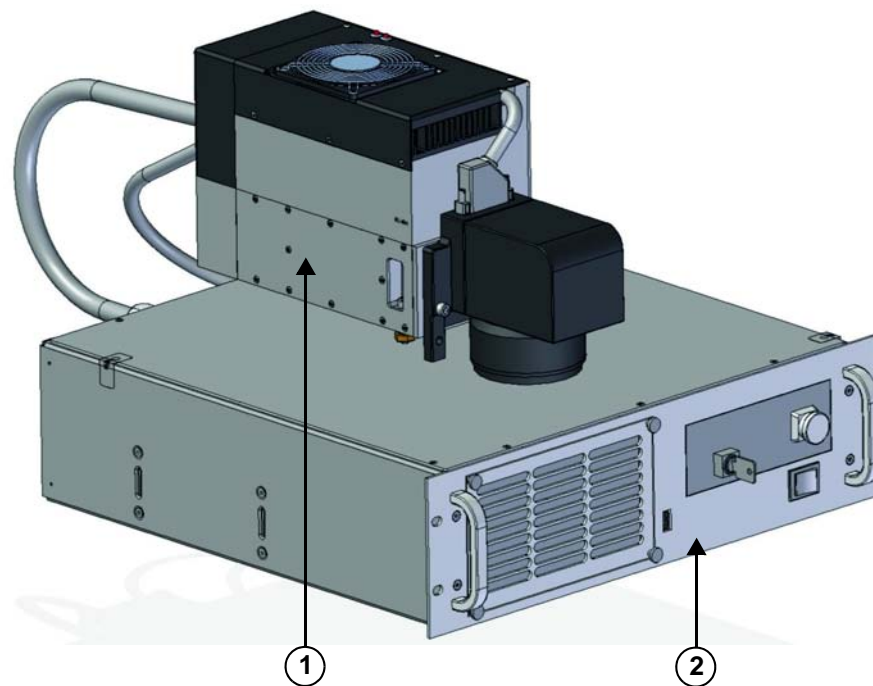


Fig. 4-1. System view with laser head and plug-in supply unit, front view

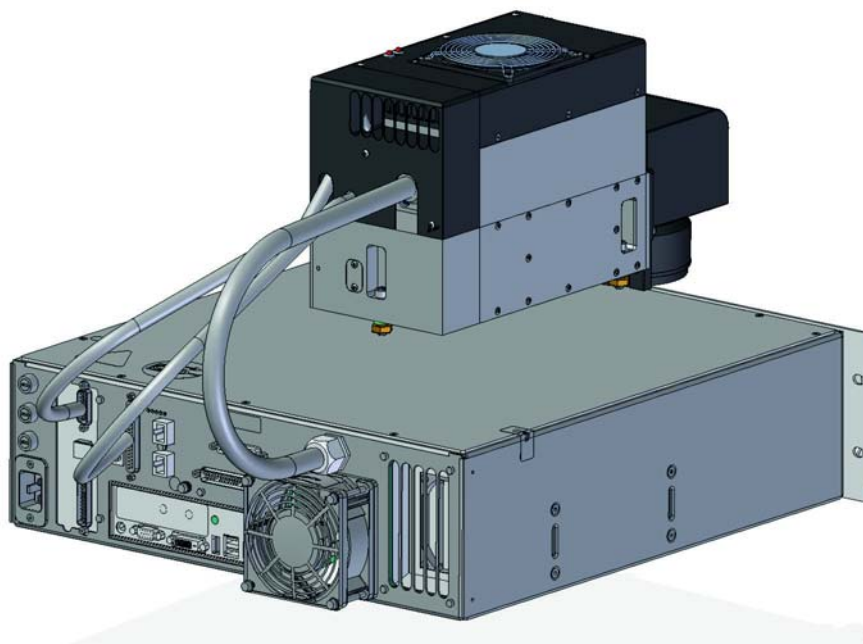


Fig. 4-2. System view with laser head and plug-in supply unit, rear view

- 1 Laser head
- 2 Plug-in supply unit



The connections between the laser head and plug-in supply unit are presented in shortened form and do not correspond to the actual dimensions.

## 4.1

### Laser head with optics module

The laser head consists of two monolithic blocks that are screwed together.

The top part (1) contains the resonator and the bottom part (2) contains the shutter, pilot laser and a variable beam expander.

On the front of the laser head is the optics module (10), consisting of the marking head (galvo) (6) and lens (5).

The fan (8) positioned centrally at the top of the laser head takes in air to cool the resonator. The heated air exits through the front and rear ventilation grates (7).

The laser radiation warning lamps (9) indicate the operating status of the laser.

Secure mounting of the laser head in a laser system is attained with the help of the mounting feet (3-point support plate) (3).

The working distance is measured from the reference edge (4).

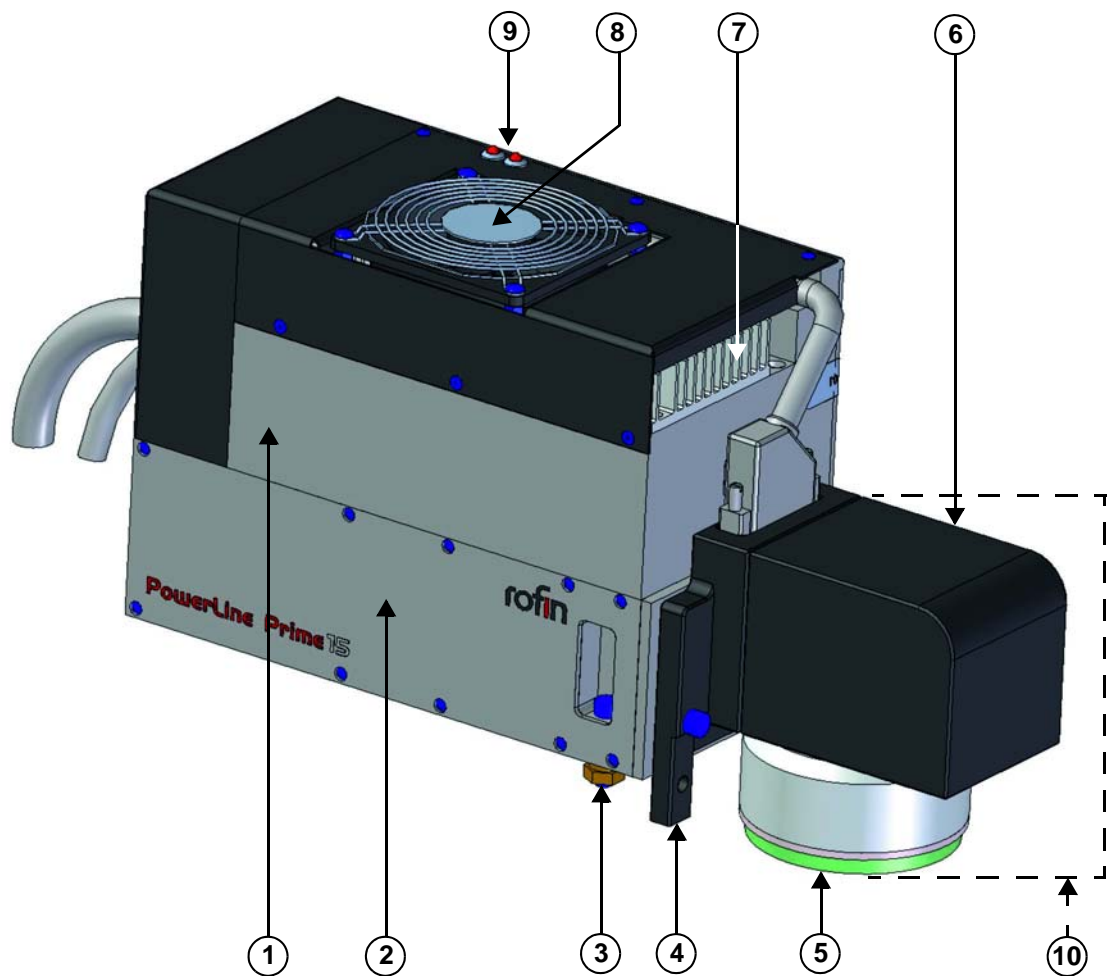


Fig. 4-3. Laser head with optics module

- |   |                                 |
|---|---------------------------------|
| 1 Resonator casing                      | 6 Marking head (galvo)          |
| 2 Expander casing                       | 7 Ventilation grate             |
| 3 Mounting feet (3-point support plate) | 8 Fan                           |
| 4 Galvo flange reference edge           | 9 Laser radiation warning lamps |
| 5 Lens                                  | 10 Optics module                |

## 4.2

### Marking head

The beam emitted by the laser head is deviated by two mirrors located in the marking head in x and y direction and then focused into the marking field. These mirrors are positioned via PC signals.

In this way it is possible to transmit the programmed character sets and fonts onto the marking field via the lens.

The optic is located in a dust-tight housing. The replaceable protective glass keeps any dirt particles resulting from the marking process away from the special lens system.

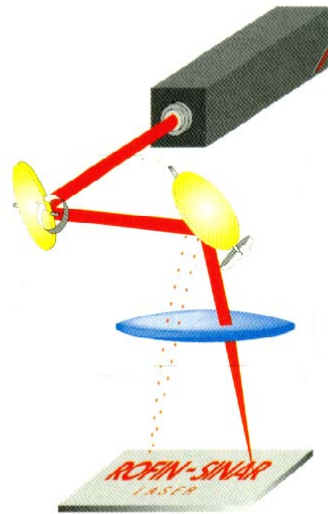


Fig. 4-4. Functional principle of the marking head (galvo)

### 4.3

#### 19" plug-in supply unit

The plug-in supply unit is designed in 19-inch format, with 3 height units (HU). The plug-in supply unit supplies the laser head with energy and controls the laser and the galvo.

A ventilation grate (1) on the front and the fan on the rear side of the plug-in supply unit provide for sufficient cooling. Cool air flows through the plug-in supply unit from the front to the back.

The plug-in supply unit is available with a control panel (2) or, alternatively, with a dummy panel. The control panel features various display and operating elements.

The laser system's main switch (3) is located on the front of the plug-in supply unit.

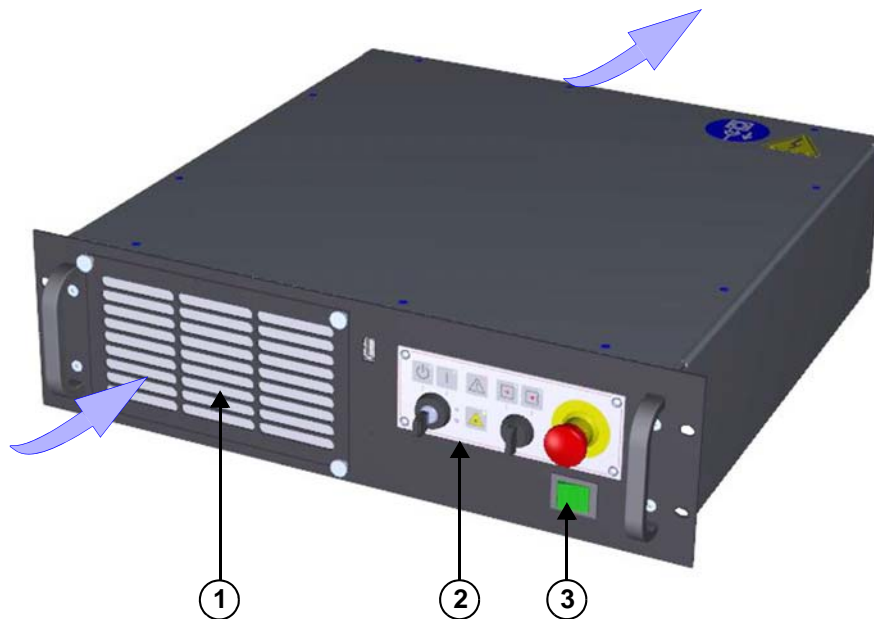


Fig. 4-5. Plug-in supply unit

- 1 Ventilation grate
- 2 Control panel with operating and display elements
- 3 Laser system's main switch

## 4.4 Operating and display elements

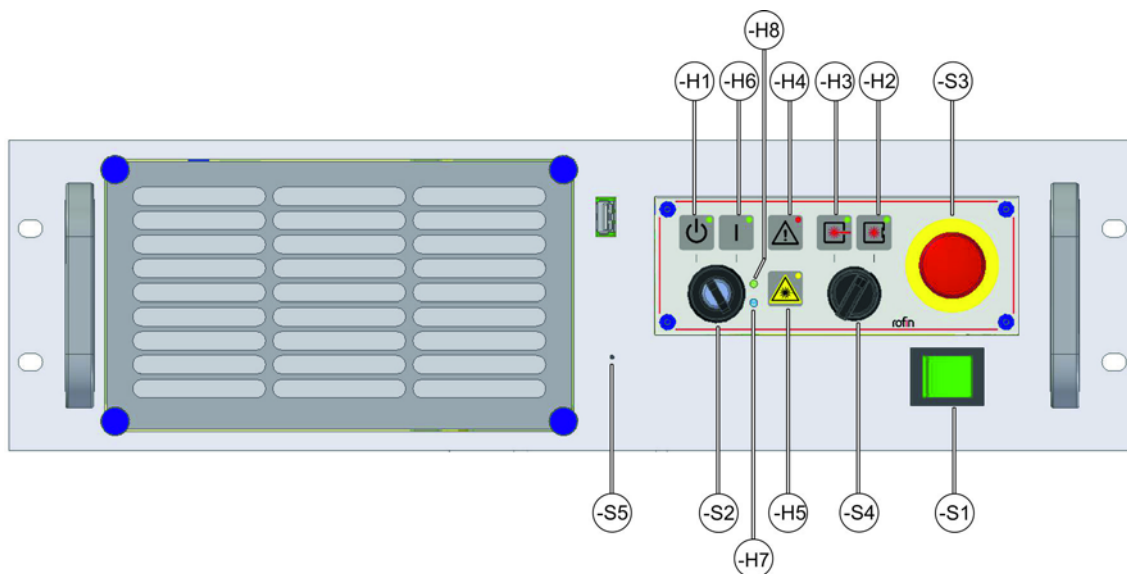





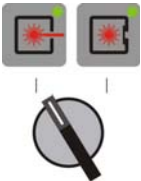












Fig. 4-6. Operating and display elements on the plug-in supply unit, view from front

Designation	Type	Function
<b>-S1</b> 	Main switch	Turning the laser system on and off. In on mode, the green lamp lights up in the main switch.
<b>-S2</b> 	Key switch	 Key position left: The laser system is in standby mode. Laser radiation is not being generated.
		 Key position right: The laser switches to the operating mode and laser radiation is generated.
<b>-S3</b> 	Emergency stop button	In case of an emergency, the laser system can be stopped with this pushbutton.
<b>-S4</b> 	Knob switch	Switch position right: The shutter is closed. Laser radiation <b>cannot</b> escape.
		Switch position left: The shutter can be opened.
<b>-S5</b> 	Button	Is used only for service purposes.

Tab. 4-1. Operating and display elements

Designation	Type	Function
<b>-H1</b> 	"Mains on" status display	The green LED lights up when the laser system is ready to start (standby mode).
<b>-H2</b> 	"Shutter closed" status display	The green LED lights up when the shutter is closed.
<b>-H3</b> 	"Shutter open" status display	The green LED lights up when the shutter is open.
<b>-H4</b> 	"Error" status display	The red "Error" LED lights up to show that an error has occurred.
<b>-H5</b> 	"Laser radiation possible" status display	The yellow "Laser radiation possible" LED lights up for as long as laser radiation is being generated and for approx. 1 second before laser radiation is generated.
<b>-H6</b> 	"Operating mode" status display	The green LED lights up when the laser is ready for operation at the end of the warm-up phase.
<b>-H7</b> 	"Hard disk being accessed" status display	The blue LED lights up when the processor is reading from/writing to the hard disk drive (HDD).
<b>-H8</b> 	"Processor operating mode" status display	The green LED lights up when the processor (ITX board) is being supplied with operating voltage.

Tab. 4-1. Operating and display elements (Cont.)

Designation	Type	Function
	<ul style="list-style-type: none"><li>The LEDs (green, blue) <b>only light up</b> on the control/dummy panel of the plug-in supply unit.</li><li>The LEDs (green, blue) on an external control panel <b>do not light up</b>.</li><li>The -H7 and -H8 symbols are only visible when the LEDs light up.</li></ul>	

Tab. 4-1. Operating and display elements (Cont.)

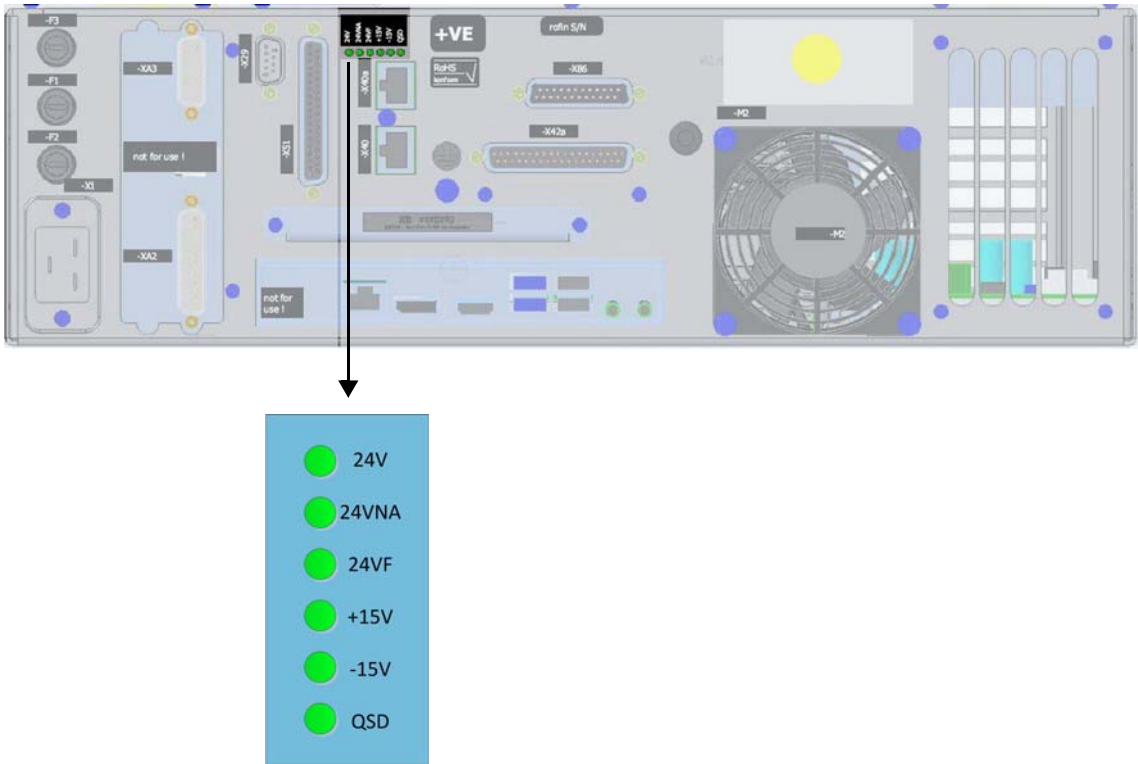


Fig. 4-7. Status displays on the plug-in supply unit, rear

Designation	Type	Function
24V	Status display	Green LED lights up if 24 V control voltage is OK.
24VNA	Status display	Green LED lights up if 24 V emergency stop is OK.
24VF	Status display	Green LED lights up if 24 V fuse (F3) is OK.
+15V	Status display	Green LED lights up if galvo voltage is OK.
-15V	Status display	Green LED lights up if galvo voltage is OK.
QSD	Status display	Green LED lights up if laser is switched on and supply voltage to Q-switch is OK.

Tab. 4-2. Status displays



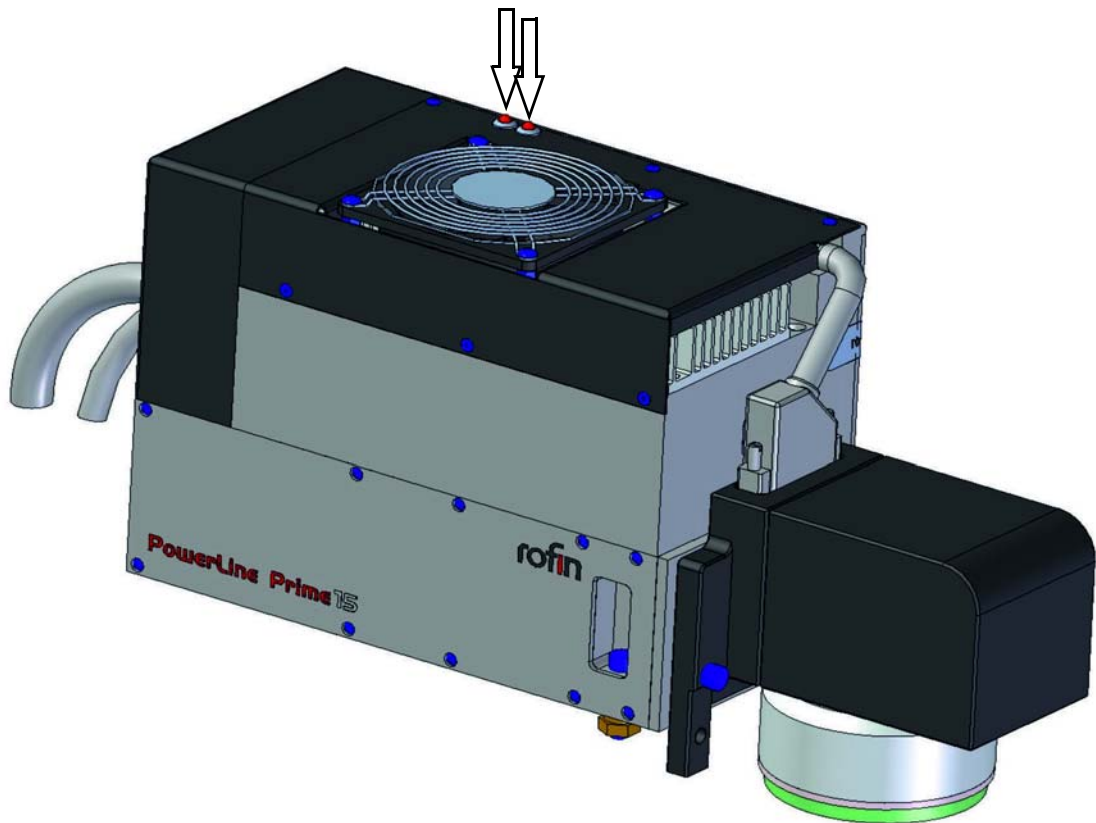


Fig. 4-8. Warning lamps Laser radiation; laser head top

Designation	Type	Function
<b>Laser radiation warning lamps</b>	Status display	The red warning lamps light up as soon as laser radiation is generated.
	Error display	The red warning lamps flash when an error occurs.

Tab. 4-3. Warning lamps laser radiation



#### **WARNING**

##### **Danger from a damaged laser radiation warning lamp**

Possible damage to the eyes and skin from invisible laser radiation.

⇒ If a laser warning lamp fails, this must be replaced by a Coherent- service technician to ensure the safety function.



The laser radiation warning lamps have a redundant configuration.

4.4.1 Operating condition displays on the control panel

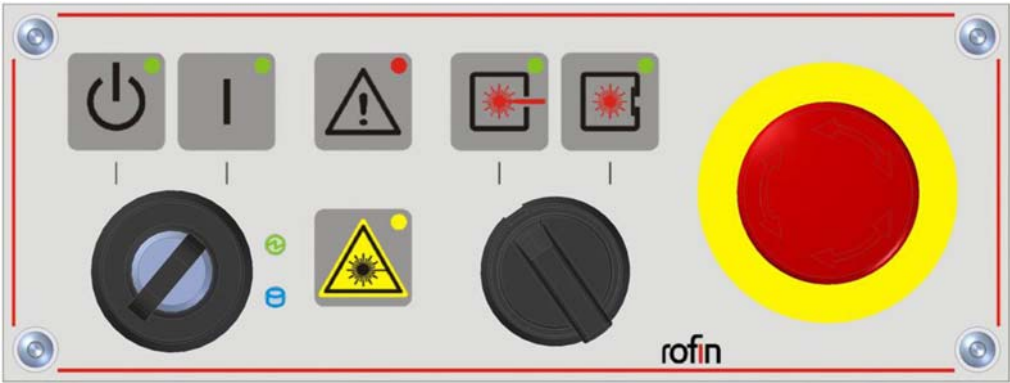


Fig. 4-9. Control panel

The following table gives an overview of the laser system operating statuses displayed on the control panel.

- » For information on the control panel elements (-S1 to -S5 and H1 to -H8), see chapter 4.4 Operating and display elements on page 4-6.
- » For information on operating status and error displays, see chapter 12. Troubleshooting on page 12-1.

































Illuminated or flashing indicator lights (LEDs) are shown as follows (example illustration):

Indicator light is lit up	Indicator light is flashing	Inactive indicator light
		Not illustrated





Tab. 4-4. Indicator lights (LEDs)

Function	Indicator lights (LEDs)	Position of key switch	Position of knob switch
<p><b>Switching on</b></p> <p><b>ⓘ</b> When the laser system is switched on, the green lamp lights up in the main switch (-S1).</p>			
<b>Pre-run</b>			

Tab. 4-5. Indicator lights (LEDs)

Function	Indicator lights (LEDs)	Position of key switch	Position of knob switch
Operating mode (Shutter open)	 +  +  + 		
Operating mode (Shutter closed)	 +  +  + 		
	Interlock circuit open:  +  +  + 		
Emer- gency stop	 + 		 or 
Shutter error	 +  +  +  +  + 		 or 

Tab. 4-5. Indicator lights (LEDs) (Cont.)

Function	Indicator lights (LEDs)	Position of key switch	Position of knob switch
<b>Error state</b>			 or 

Tab. 4-5. Indicator lights (LEDs) (Cont.)

## 4.5 Control concept

The proprietor of the laser system can choose between two control concepts; remote and local modes.

### 4.5.1 Remote mode

The laser system is controlled by means of a PC or notebook, which must be provided by the customer. A Windows operating system must be installed on this external PC/notebook. The operating system is not included in the scope of delivery. Communication between the external PC/notebook and the laser system is handled via the LAN interfaces on the plug-in supply unit and the external PC/notebook. The LAN connection can be established directly or indirectly via the customer network. The software from the company Coherent Munich is also installed via this connection (see chapter 9. [PowerLine Prime Web Interface on page 9-1](#)).

The operation takes place via the control elements on the control panel and on the screen via the VisualLaserMarker (VLM) marking software. An additional control panel (optional, not included in the scope of delivery) can be retrofitted.



The laser system's current operating states, including e.g. error and warning messages, are shown on the control panel of the plug-in supply unit via the status indicators (LEDs), as well as in the Coherent software on the external connected PC/notebook.

- » *Coherent software: For detailed information on the LaserConsole program and the related applications, please see the separate User Manual for the LaserConsole program.*
- » *Coherent software: For detailed information on the VisualLaserMarker marking program, please see the separate User Manual for the marking software.*

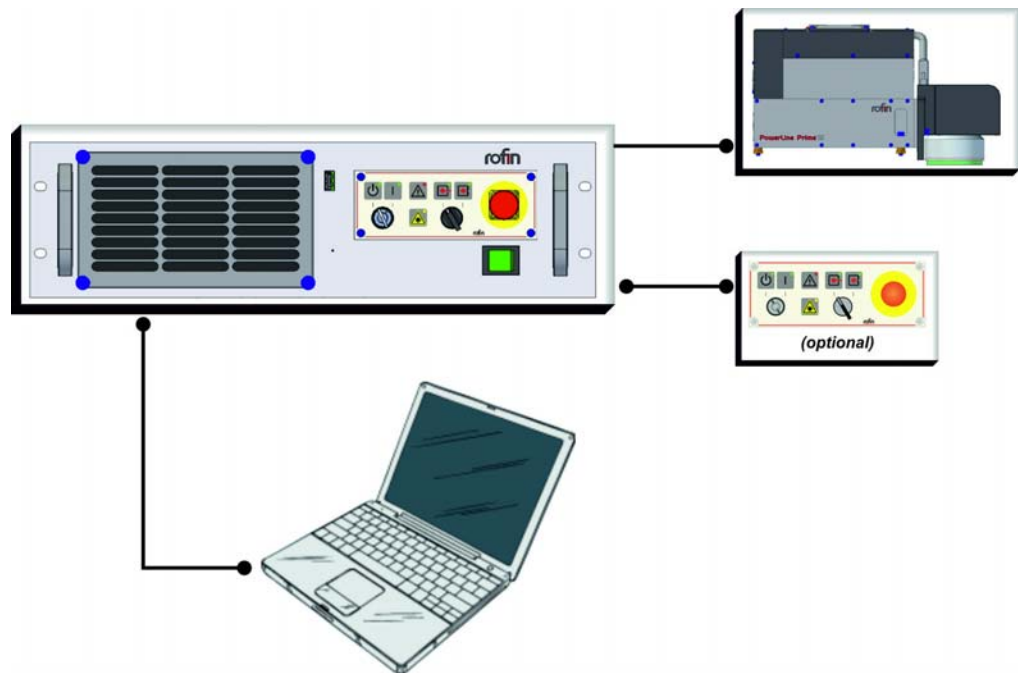


Fig. 4-10. Control concept (remote mode)

## 4.5.2

### Local mode

The plug-in supply unit is equipped with a Windows operating system and Coherent software. The Coherent software comprises the RCU (Rofin Control Unit) control unit software and the VLM (VisualLaserMarker) marking software.

A monitor, keyboard, and mouse are connected to the rear of the plug-in supply unit. The system is operated via the control elements on the front of the plug-in supply unit and on the monitor using the VLM (VisualLaserMarker) marking software. An additional control panel (optional) can be connected to the rear of the plug-in supply unit.



The laser system's current operating statuses, including error and warning messages, for example, are shown on the control panel of the plug-in supply unit via the status displays (LEDs), as well as on the monitor via the Coherent software.

- » *Coherent software: For detailed information on the LaserConsole program and the related applications, please see the separate User Manual for the LaserConsole program.*
- » *Coherent software: For detailed information on the VisualLaserMarker marking program, please see the separate User Manual for the marking software.*

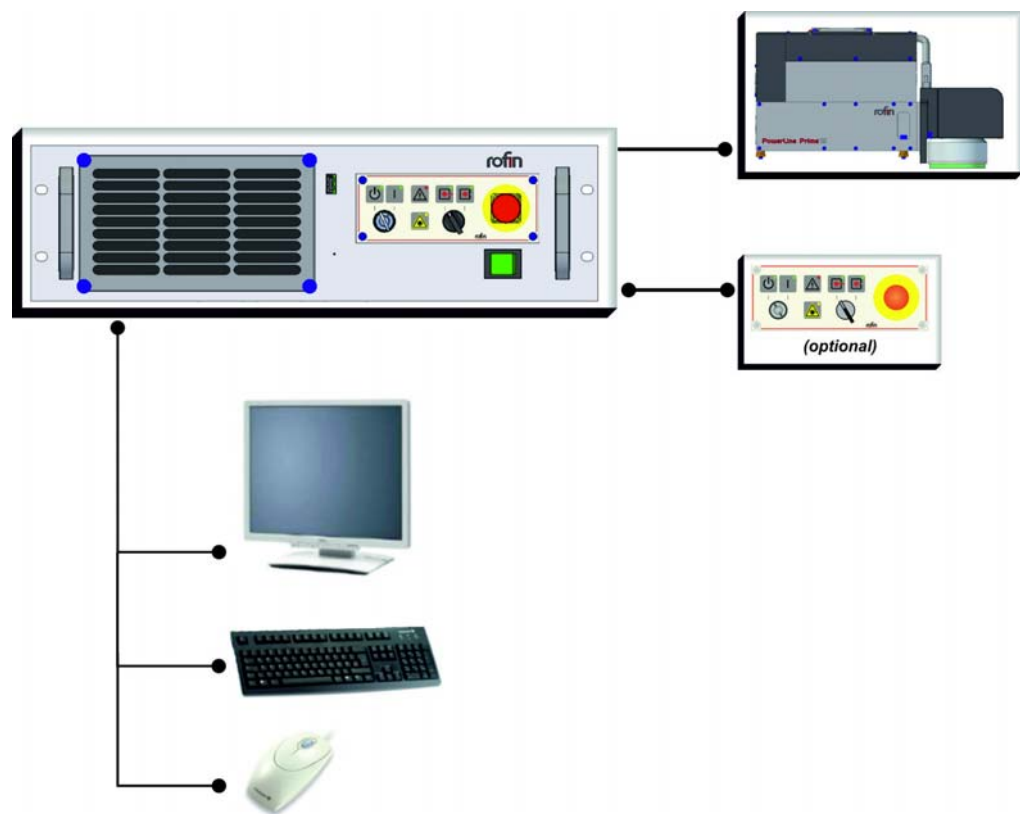


Fig. 4-11. Control concept (local mode)

## 4.6 Components, optional

The laser system can be equipped with the following components:

- Exhaust ventilation system
- External control panel
- Cabling between external control panel and plug-in supply unit
- External power measurement
- CAN I/O extension module
- Axis extension or stepping motor extension



More detailed information on the optional components is available from Coherent Munich.

## 5. Transport



### **DANGER**

#### **Danger from falling objects**

Possible bodily injury

- ⇒ The laser system, including packaging, may only be transported with sufficiently dimensioned lifting equipment (e.g. forklift).
- ⇒ Secure laser system components against slipping and falling.
- ⇒ Make sure that the weight-bearing capacity of a storage area is sufficient for the entire weight, including packaging.
- ⇒ Personal protective equipment (PPE) in the form of safety boots is mandatory.
- ⇒ When transporting the laser system components, please take into account the weight of the respective components including the weight of the packaging material.
- » *For information on its size, weight and the space required by the laser system, see chapter 3. [Technical data on page 3-1.](#)*



### **DANGER**

#### **Danger from tripping**

Possible bodily injury

There is a risk of tripping over the connection cables during transportation.

- ⇒ The laser system should be unpacked close to the subsequent setup and installation location.



### **NOTICE**

Falling loads can result in damage to the laser system.



### **NOTICE**

Loose connecting wires represent a trip hazard and can result in damage to the laser system.



---

**NOTICE**

To avoid transport damage, it is not permitted to expose the laser system to significant knocks, vibrations and acceleration (see chapter 3. [Technical data on page 3-1](#)). Otherwise, the optics could become misaligned or damaged.

- ⇒ The appropriate load-lifting devices and transport equipment should be selected accordingly.
  - ⇒ Long-distance transport must be carried out in accordance with the standard for Carrier Safety Management Systems.
  - ⇒ Never lift the plug-in supply unit by the plugs, cables or fan.
  - ⇒ The laser components are heavy and must be unpacked and packed by **two** persons.
- 



---

**NOTICE**

To avoid glass fiber breaks (protective tube), it is not permitted to expose the glass fiber to any pressure or tensile forces. The glass fiber line must neither be jammed, pinched, nor pulled on (see chapter 3. [Technical data on page 3-1](#)).

---



If the laser head is integrated into a system, it must be transported in a horizontal position. If the mounting position of the integrated laser head deviates from the horizontal position, the laser head and the plug-in supply unit must be dismantled and transported separately.

---

## 5.1

### Scope of delivery



When the system is delivered, the plug-in supply unit and the laser head are connected via the glass fibers. These components may only be removed together from the outer packaging.

The scope of delivery represents the standard configuration of a laser system.

---

- Laser head (with mounted optics module)
- Optics module (marking head "galvo" with lens) mounted on the laser head
- Plug-in supply unit with fitted glass fiber
- Electrical connecting cables
  - 1x cable between laser head and plug-in supply unit
  - 1x cable between galvo and plug-in supply unit
- Power supply cable for the plug-in supply unit; length 2 m
  - Cable with three-pin plug (CEE7/7)
  - Standard USA cable
- Patch cable (network connection); length 3 m
- Cross-cable (connection to an external PC), 2 m length
- Jumper plug -X42a and -X86
- VLM dongle
- Documentation
- Terminating connector (CAN)



- Various protective covers, e.g. when the glass fiber connection has been disconnected (see chapter [11.4 Protective covers on page 11-6](#)).

## 5.2 Packaging and transport

The entire laser system is protected against damage during transport by cardboard outer packaging. The laser system components are packed inside special cardboard packaging. The components can be manually removed from the cardboard outer packaging and transported. The components can be manually replaced back into the cardboard outer packaging for further transport.

We recommend keeping the original transport containers (cardboard packaging, molded foam sections, and – where applicable – pallet) in a safe place so they can be used to transport the laser system.

### Transport damage

If there is any transport damage or any discrepancy between the consignment and the delivery note, inform the shipper, Coherent Munich GmbH & Co. KG, or an authorized dealer immediately.

Make a record of any transport damage, ideally with photographic evidence. Keep any damaged transport containers.

### 5.2.1 Unpacking



#### NOTICE

Incorrect unpacking of the laser system as well as an incorrect fixing surface can result in damage to the laser system.

- ⇒ Under no circumstances should a pointed and/or sharp-edged object (e.g. knife, screwdriver or similar) be used to open the packaging.
- ⇒ The designated surface must be vibration-free, clean and level.
- ⇒ Do not place the laser head on the optics or on the fan.

#### Unpack the laser system components as follows:

1. Remove the molded foam sections.
2. Visually inspect the packaging contents for transport damage.
3. Carefully remove the component packaging.
4. Take the accessories (documentation, cables) out of the packaging.
5. With **two** persons, remove the laser system from the packaging.
6. Carefully place the laser system components on a suitable surface.

## 5.2.2 Packing for transport

The laser system can be packed and transported either completely or as individual components. In the following section, the different ways of packing are described.



### NOTICE

Incorrect disconnection of the electrical plug connections, as well as incorrect unpacking, can result in damage to the laser system.

- ⇒ The laser system should be transported fully packed as standard.
- ⇒ Only in exceptional cases (e.g. for repair) can the components be packed and transported individually (see chapter 11. [Maintenance on page 11-1](#)).
- ⇒ Note the weights of the laser system components.
- ⇒ Never lift the plug-in supply unit on the plugs or on the fan.
- ⇒ Never disconnect any plug-in connections as long as the laser system is connected to the mains power supply.



### NOTICE

A dirty working environment can result in damage to the laser system.

- ⇒ All work must be carried out in a clean, dust-free environment. Otherwise, the components of the laser system, in particular the glass fiber connection, can be damaged.



In case of repair, the cables and plugs (e.g. interlock, network cable) and the VLM dongle are not sent off; they remain with the customer.



Fig. 5-1. VLM dongle

## 5.2.2.1

**Complete laser system****NOTICE**

The shielded glass fiber line between the plug-in supply unit and laser head is not disassembled.

To avoid glass fiber breaks (protective tube), it is not permitted to expose the glass fibers to any pressure or tensile forces. The glass fiber must not be jammed, pinched or pulled on.

⇒ It is essential that the bending radius of the glass fibers is observed (see chapter [11. Maintenance on page 11-1](#)).

⇒ The maximum bending radius is not permitted to be exceeded (see chapter [3. Technical data on page 3-1](#)).

**Pack the laser system as follows:**

1. Remove all installed cables (e.g. interlock, network cables).
2. Remove the plug-in cable connections on the plug-in supply unit and laser head.
3. Unfasten all the threaded connections that have been used to attach the laser system to its installation environment.
4. Remove the laser system components from the installation environment.
5. Fit all protective covers.
6. Pack the laser system components in the respective original transport container.

## 5.2.2.2

**Individual components**

If the components of the laser system are to be individually packed, then the glass fiber connection between the laser head and the plug-in supply unit must also be disconnected.

» For more information, see chapter [11.7 Replacing the laser head on page 11-17](#).

**NOTICE**

To avoid glass fiber breaks (protective tube), it is not permitted to expose the glass fibers to any pressure or tensile forces. The glass fiber must not be jammed, pinched or pulled on (see chapter [3. Technical data on page 3-1](#)).

**NOTICE**

The non-use of the protective covers can result in damage to the laser system.

⇒ Close the ends of the glass fiber with the enclosed protective caps immediately after opening the connection!

⇒ Put protective covers on the laser head (see chapter [11.4 Protective covers on page 11-6](#)).

### 5.2.2.3 Laser head

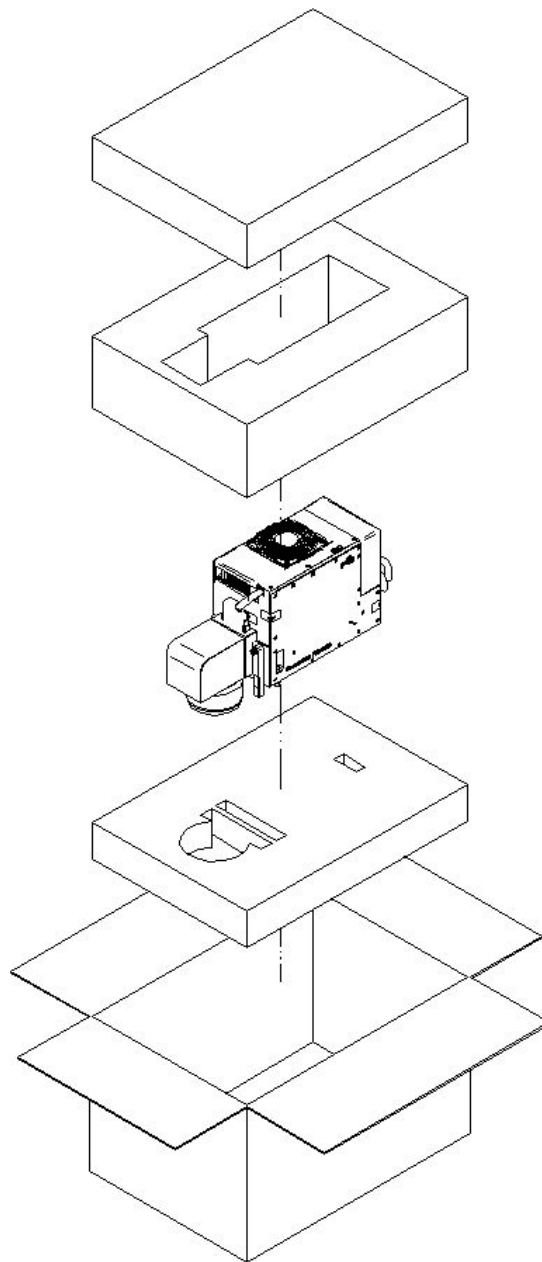


Fig. 5-2. Packing the laser head

**Pack the laser head as follows:**

1. Remove all installed cables (e.g. interlock, network cables, etc.).
2. Remove the plug-in cable connections on the plug-in supply unit and laser head.
3. Disconnect the glass fiber connection to the laser head and put all protective caps in place (see chapter [11.7 Replacing the laser head on page 11-17](#)).
4. Unfasten all threaded connections with which the laser head is attached to its installation surroundings.
5. Remove the laser head.

6. Pack the laser head in a suitable transport container.



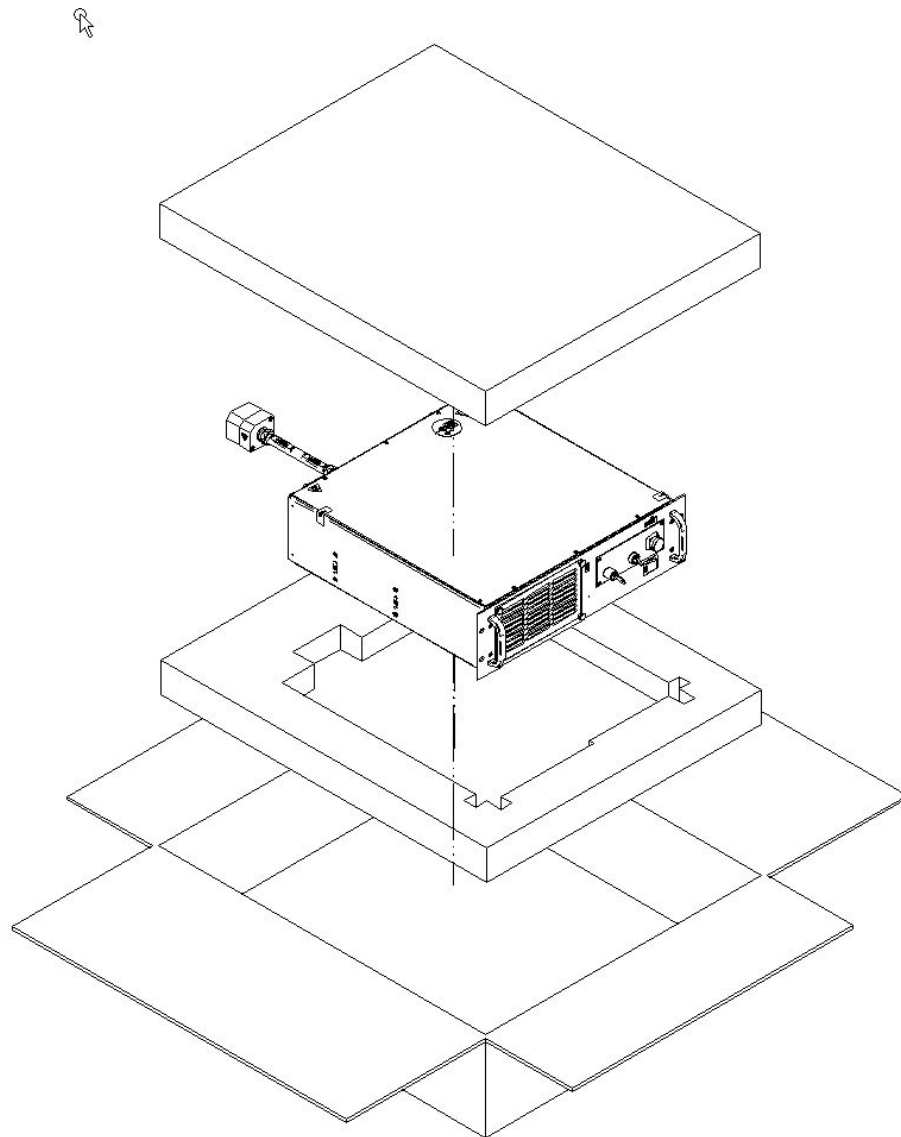
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In case of repair, the cables are not supplied and remain with the customer.

---

#### 5.2.2.4

#### Plug-in supply unit



*Fig. 5-3. Packing the plug-in supply unit*

**Pack the plug-in supply unit as follows:**

1. Remove all installed cables (e.g. interlock, network cables, etc.).
2. Remove the cable connections on the plug-in supply unit and laser head.
3. Disconnect the glass fiber connection to the laser head and put all protective caps in place (see chapter [11.7 Replacing the laser head on page 11-17](#)).
4. Unfasten all threaded connections with which the plug-in supply unit is attached to its installation surroundings.

- 5.** Remove the plug-in supply unit.
- 6.** Pack the plug-in supply unit in a suitable transport container.

## 6. Assembly

The laser system is intended for installation into machines. This chapter describes the correct installation and electrical integration procedures.

» *For more information on dimensions and installation conditions (see chapter 3. Technical data on page 3-1).*



### **DANGER**

#### **Danger from insufficiently qualified personnel**

Possible bodily injury

Special qualifications are mandatory for the personnel who are to perform the prescribed work.

⇒ It is essential that the instructions in chapter 2.1.3 [Personnel qualifications on page 2-3](#) are observed. Failure to comply with these instructions can lead to malfunctioning of the laser system, which can result in danger to human life and property.



### **NOTICE**

Inadequate personnel qualifications can result in damage to the laser system.



### **NOTICE**

To avoid glass fiber breaks (protective tube), it is not permitted to expose the glass fibers to any pressure or tensile forces. The glass fiber may neither be jammed, pinched or be pulled on.

## 6.1 Mechanical integration

### 6.1.1 Fastening the laser head to the mounting surface

The laser head is equipped with a 3-point support plate (1) and is fastened to the mounting surface using three M6 screws (see figure 6-2 [Mounting feet \(3-point support plate\)](#)).

In the height-adjustable mounting foot there is a Ø 6.5 drill hole (see figure 6-1 [Mounting surface requirements](#)). A M6 x 30 screw can be threaded into the housing from the side.



### **NOTICE**

Incorrect fastening of the laser head can result in functional errors.

⇒ Only set up the laser head via the 3-point support plate (1).

⇒ Select the right screw size and tightening torque for the mounting surface.



The laser head is aligned via the height-adjustable mounting feet of the 3-point support plate (1). Adjust the laser head so it is parallel to the marking level.



The screws used to fasten the laser head in place are not included in the scope of delivery. The proprietor of the laser system must provide the correct screws for the mounting surface conditions.

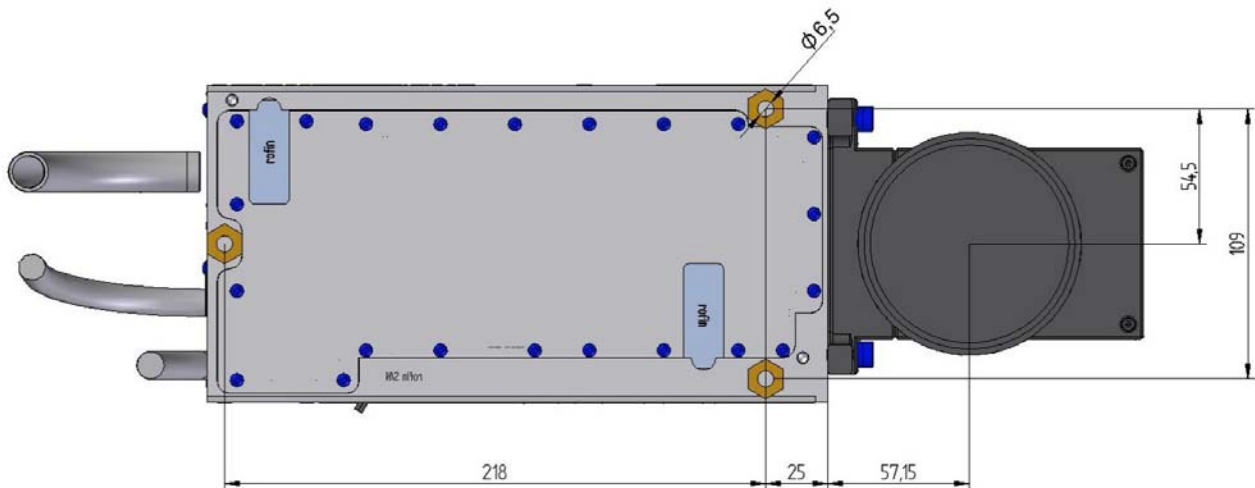


Fig. 6-1. Mounting surface requirements

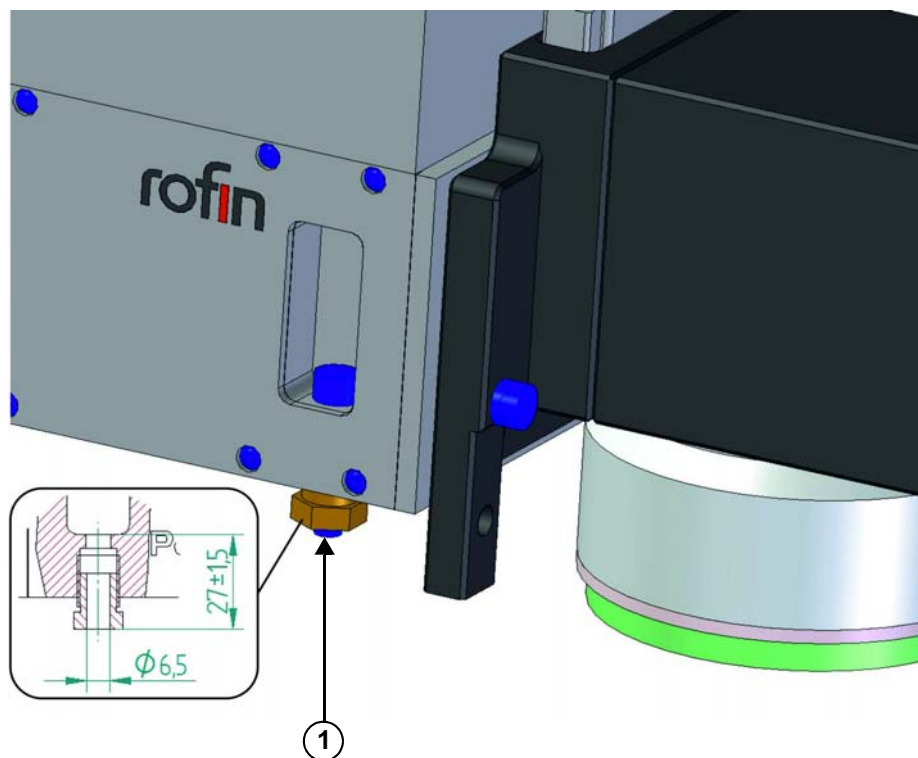


Fig. 6-2. Mounting feet (3-point support plate)

1 3-point support plate (mounting feet)



### 6.1.2 Working distance ("focus")

The working distance for laser marking is defined as the distance between the reference edge (1) and the workpiece surface.

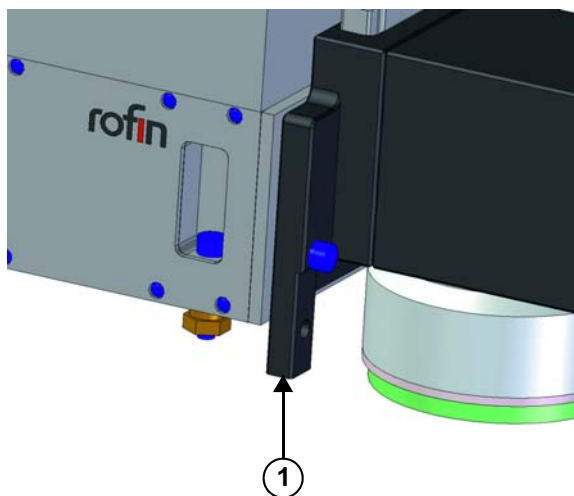


Fig. 6-3. Reference edge (1)

There is a sticker on the reference edge that provides detailed information about the working distance/focus.

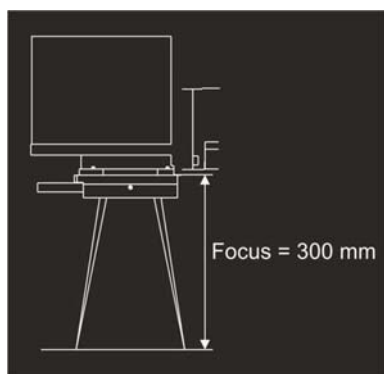


Fig. 6-4. "Working distance" label

The marking field size "E" and the working distance "B" (focus) are determined by the lens that is used.

- » For information on the marking field size and the working distance, see [chapter 3.2 Optics module \(marking head \[galvo\] and lens\)](#) on page 3-5.

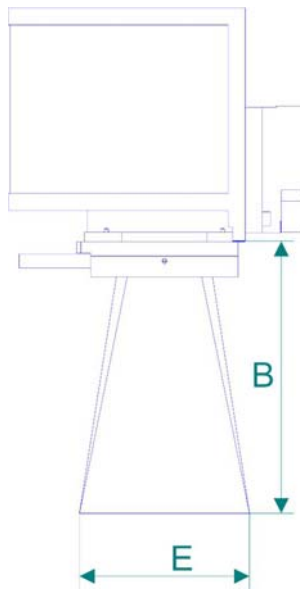


Fig. 6-5. Marking field (**E**) and focus (**B**)

### 6.1.3

#### Installing the plug-in supply unit

The plug-in supply unit has been designed for a 19" rack system and, as such, can be installed in 19" cabinets ("racks"). The installation is carried out using the mounting holes on the sides of the front panel (figure, see arrows).

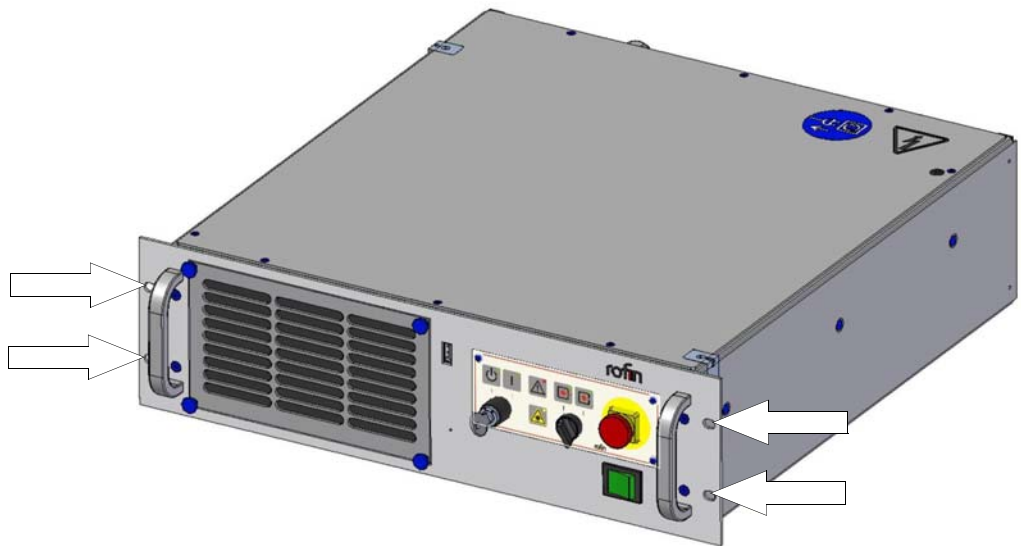


Fig. 6-6. Plug-in supply unit

## 6.2 Electrical integration

Electrical interfaces are located on the rear of the plug-in supply unit. Some of these interfaces are provided as integration interfaces. The laser system can be integrated into a production system with the help of the integration interfaces.

The remaining interfaces are used within the laser system.

All interfaces and connections are labeled. Customer-specific modifications are possible.

» For a graphical representation of the integration interfaces, see figure 6-7 Graphical overview of the integration interfaces (highlighted in yellow).



### DANGER

#### Danger from electric voltage

Potential for bodily injury or death due to electric shock (see chapter 2.4 Residual risk on page 2-6).

⇒ Disconnect the laser system from the power supply before electrical installation and secure against reactivation.

### 6.2.1 Connection diagram

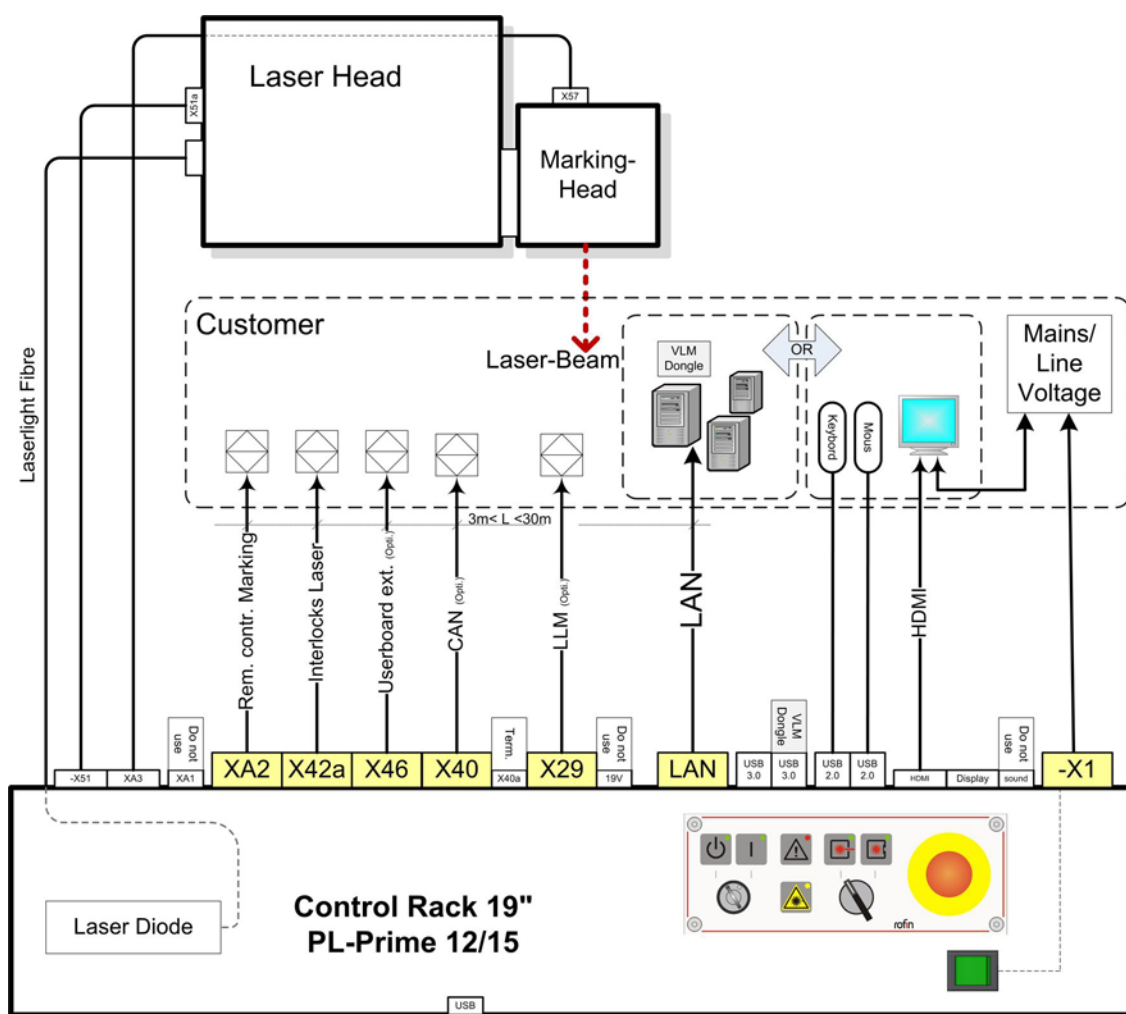


Fig. 6-7. Graphical overview of the integration interfaces (highlighted in yellow)

6.3 Interfaces and connections on the plug-in supply unit

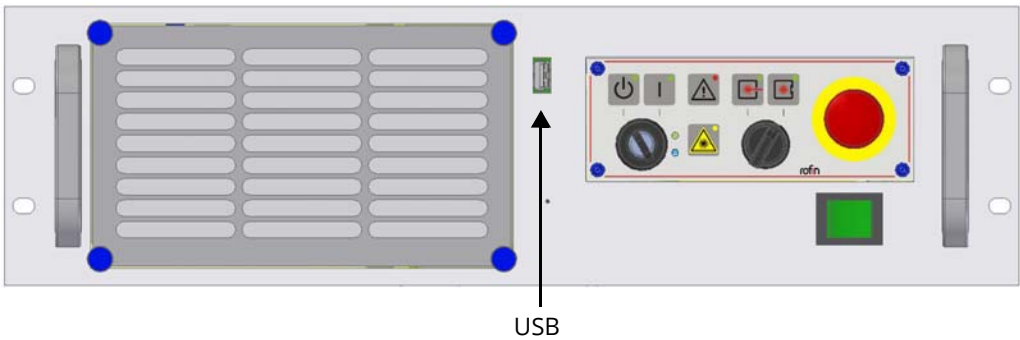


Fig. 6-8. Plug-in supply unit interfaces, front

Name	Type	Function
USB	USB 2.0 interface	Connection of USB sticks, e.g. for software updates <b>NOTICE</b> Connecting non-approved devices can result in damage to the laser system and in functional errors. Connecting USB data carriers is allowed. Connecting other devices with an USB connection, e.g. fans, hot plates, etc. is forbidden.

Tab. 6-1. Plug-in supply unit interfaces, front

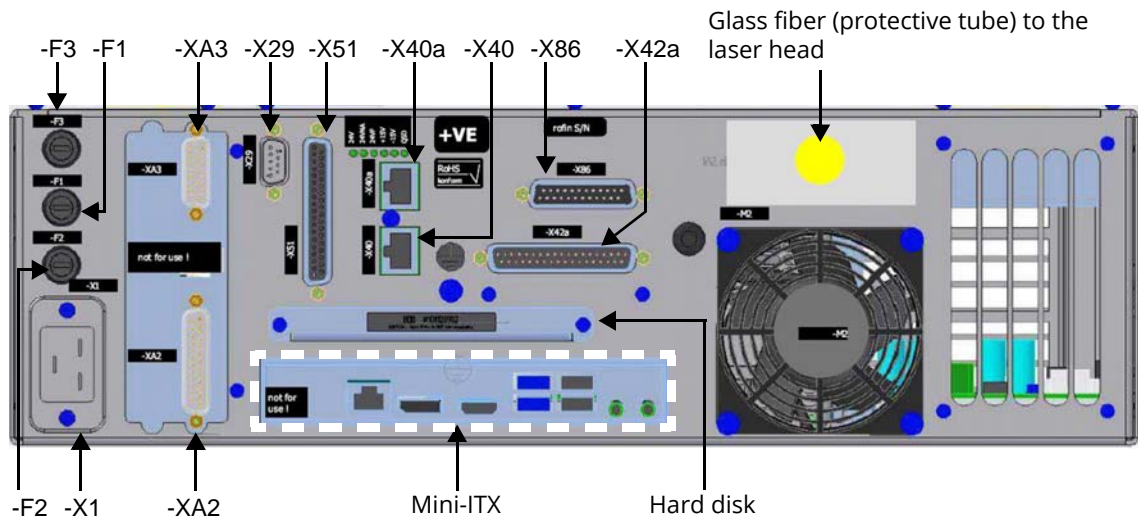



Fig. 6-9. Plug-in supply unit interfaces, rear

Designation	Type	Function
-X1	Plug	Mains power connection
-XA2	Plug	Integration interface: Marker control
-XA3	Plug	Marking head interface (known as a galvo)

Tab. 6-2. Plug-in supply unit interfaces, rear

Designation	Type	Function
-X29	Plug	Interface performance measurement
-X40	Plug	CAN bus
-X40a	Plug	CAN bus
-X42a	Plug	Integration interface: Laser control
-X51	Plug	Laser head interface
-X86	Plug	External control panel interface
Mini ITX	.I.	» For information on the interfaces please refer to the separate manufacturer's documentation
	 DC plug Mini-ITX	<b>NOTICE</b> Connecting voltage to this connection can result in damage to internal power components of the laser system. Under no circumstances may voltage be applied to this connection.
-F1	Fuse	Mains fuse (10 AT)
-F2	Fuse	Mains fuse (10 AT)
-F3	Fuse	Control voltage fuse (3.15 AT)

Tab. 6-2. Plug-in supply unit interfaces, rear (Cont.)

## 6.4 Integration interfaces

These integration interfaces are necessary if you wish to integrate the laser system into a production system.

### 6.4.1 Plug types

Name	Type	Description
-X1	Plug	Device coupler 16 A/250 V (UL/CSA 21 A/250 V) C19; e.g. Schurter, type: 4790.0000
-XA2	Plug	For example, Harting; article name D-sub 25 multipoint socket connector IEC 60807; article number 09670254704; Coherent article number 120 105 950
	Housing	For example, Harting; article name D-sub 25 housing metallic; article number 09670250443; Coherent article number 120 104 808

Tab. 6-3. Plug types

Name	Type	Description
<b>-X40</b>	Plug	RJ45 8-pin
<b>-X42a</b>	Plug	For example, Harting; article name D-sub 37 multipoint socket connector IEC 60807; article number 09670374704; Coherent article number 120 104 416
	Housing	For example, Harting; article name D-sub 37 housing metallic; article number 09670370443; Coherent article number 120 104 809
<b>-X86</b>	Plug	For example, Harting; article name D-sub 25 blade connector IEC 60807; article number 09670255604; Coherent article number 120 104 378
	Housing	For example, Harting; article name D-sub 25 housing metallic; article number 09670250443; Coherent article number 120 104 808
<b>LAN</b>	Plug	Standard RJ45 8-pin design min. category 5e
<b>USB</b>	Plug	Standard A type (DIN IEC 61076-3107)

Tab. 6-3. Plug types (Cont.)

## 6.4.2

### Assignment of the plug-in connections

Name	Type	Description
<b>-X1</b>	Power plug	Power supply for the laser system
<b>-XA2</b>	D-Sub	Control of the marking functions (ALI I/Os)
<b>-X40</b>	RJ45 8-pin	CAN nodes, e.g. CAN I/O or CAN stepper motors
<b>-X42a</b>	D-Sub	Interlock and laser control unit
<b>-X86</b>	D-Sub	Connection, external control panel (prio 1) or laser control unit

Tab. 6-4. Assignment of the plug-in connections

The interfaces are divided into the following function areas:

1. Laser control
2. Marker control

The voltage supply for the interfaces is partially permanently connected to the control voltage of the laser system or it must be connected externally.

» Detailed information on this can be found in the signal descriptions below.

All safety circuits are floating.

The VisualLaserMarker (VLM) program is available as marking software.

The following examples are given based on a standard system  
 » see also the electrical plan.

### 6.4.3 Technical description of the inputs and outputs

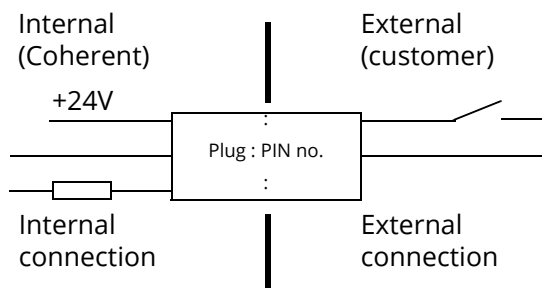


Fig. 6-10. Explanation of symbols

## 6.5 Grounding

Grounding can be connected to the rear of the plug-in supply unit, e.g. for a 19" supply cabinet.



#### NOTICE

M4 thread. Max. screw-in depth 10mm. Max. grounding screw-in depth 6 mm. If longer screws are used, there is a risk of damage to the components of the laser system.

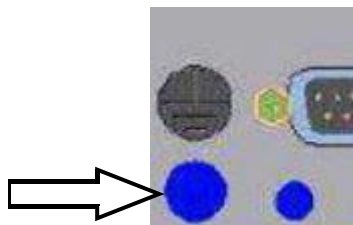


Fig. 6-11. Grounding connection on the plug-in supply unit

The laser head must be electrically grounded with the help of a 2.5mm<sup>2</sup> wire (e.g. on the mounting surface).

On the rear side of the laser head there is a threaded hole available for a M4x10 screw.



#### NOTICE

M4 thread. Max. screw-in depth 10mm. Max. grounding screw-in depth 6 mm. If longer screws are used, there is a risk of damage to the components of the laser system.

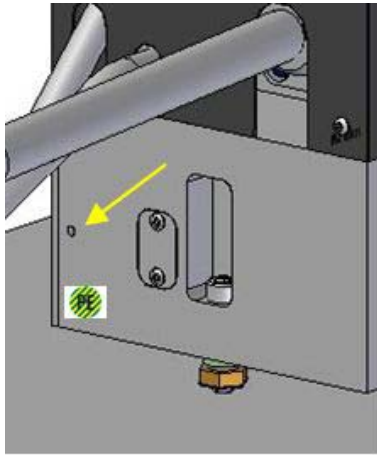


Fig. 6-12. Grounding connection on the laser head

## 6.6

### -X1 integration interface

The laser system is supplied with single-phase or two-phase mains power.

The C19 type plug must be used if you wish to power the laser without the standard power cable supplied.

» For details on the mains voltage, see [chapter 3. Technical data on page 3-1](#).



Fig. 6-13. Plugs



## 6.7

### Laser interface -X42a

The -X42a integration interface includes all the required safety circuits and control signals for integrating the laser system into a customer-specific system (handling unit).

All signal inputs are operated by voltages from the laser system. Safety circuits must be generally connected "floating".

Digital inputs laser control	
Nominal value	24 [V] DC
Connection	Relay contact/optocoupler
Current consumption at +24 V	< 100 [mA]
Digital outputs laser control	
Connection	Semiconductor relay
Power per signal output	2.4 [W] max./24 [W] EMO-OFF NC
Total power	24 [W] max.

Tab. 6-5. Laser interface -X42a

### 6.7.1

#### Emergency stop

The laser control unit of the laser system has a 2-channel emergency stop mechanism of safety class 3. The following external connections are shown as an example:

1. External emergency stop pushbutton; internal reset (see chapter [6.7.1.1 External emergency stop pushbutton; internal reset on page 6-12](#)).
2. External emergency stop pushbutton; emergency stop mechanism can also be reset from the outside (see chapter [6.7.1.2 External emergency stop pushbutton; emergency stop mechanism can also be reset from the outside on page 6-13](#)).
3. External emergency stop mechanism as master; internal emergency stop mechanism as slave (see chapter [6.7.1.3 External emergency stop mechanism as master; internal emergency stop mechanism as slave on page 6-14](#)).

### 6.7.1.1

### External emergency stop pushbutton; internal reset

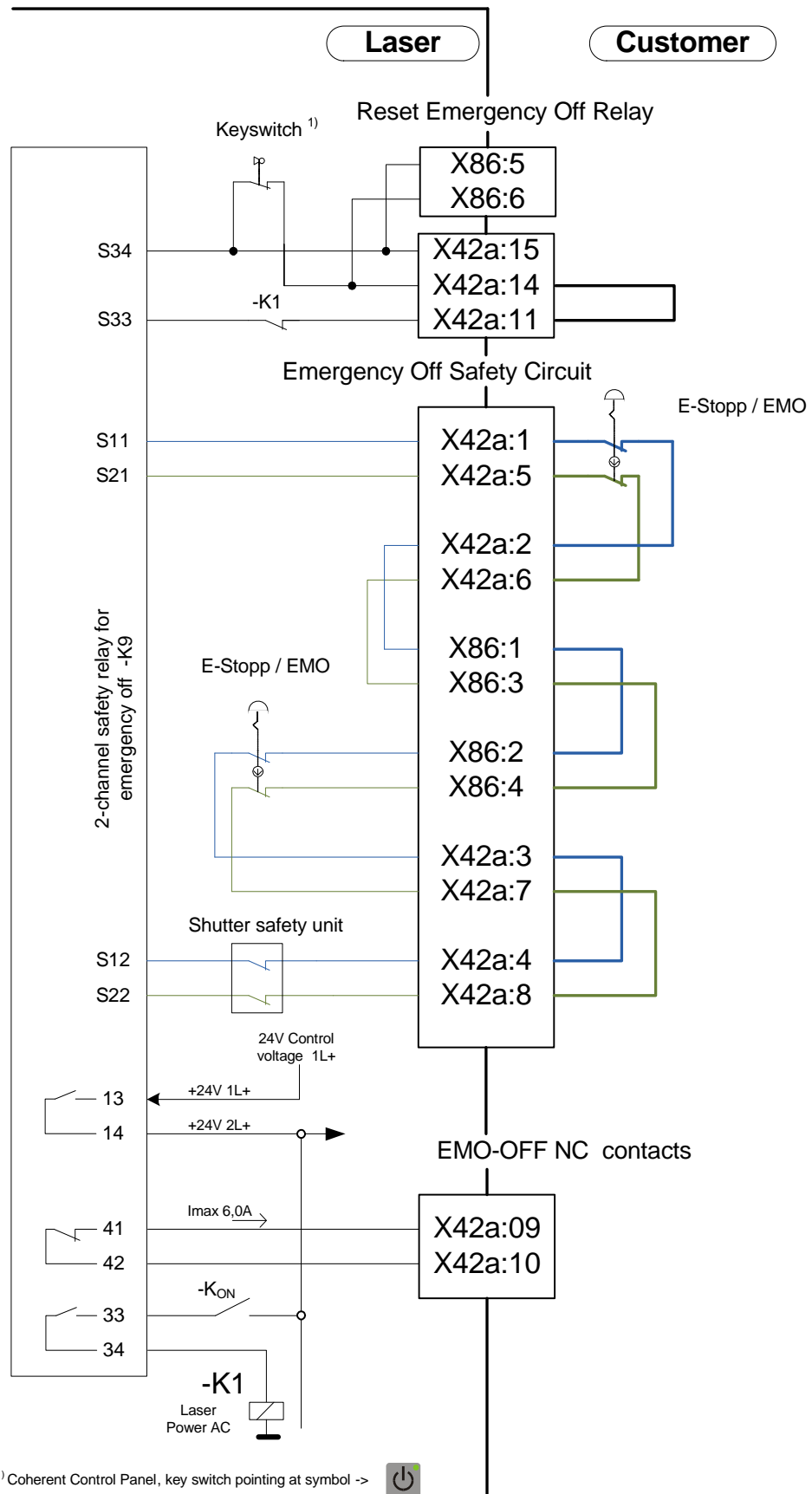


Fig. 6-14. External emergency stop #1

## 6.7.1.2

### External emergency stop pushbutton; emergency stop mechanism can also be reset from the outside

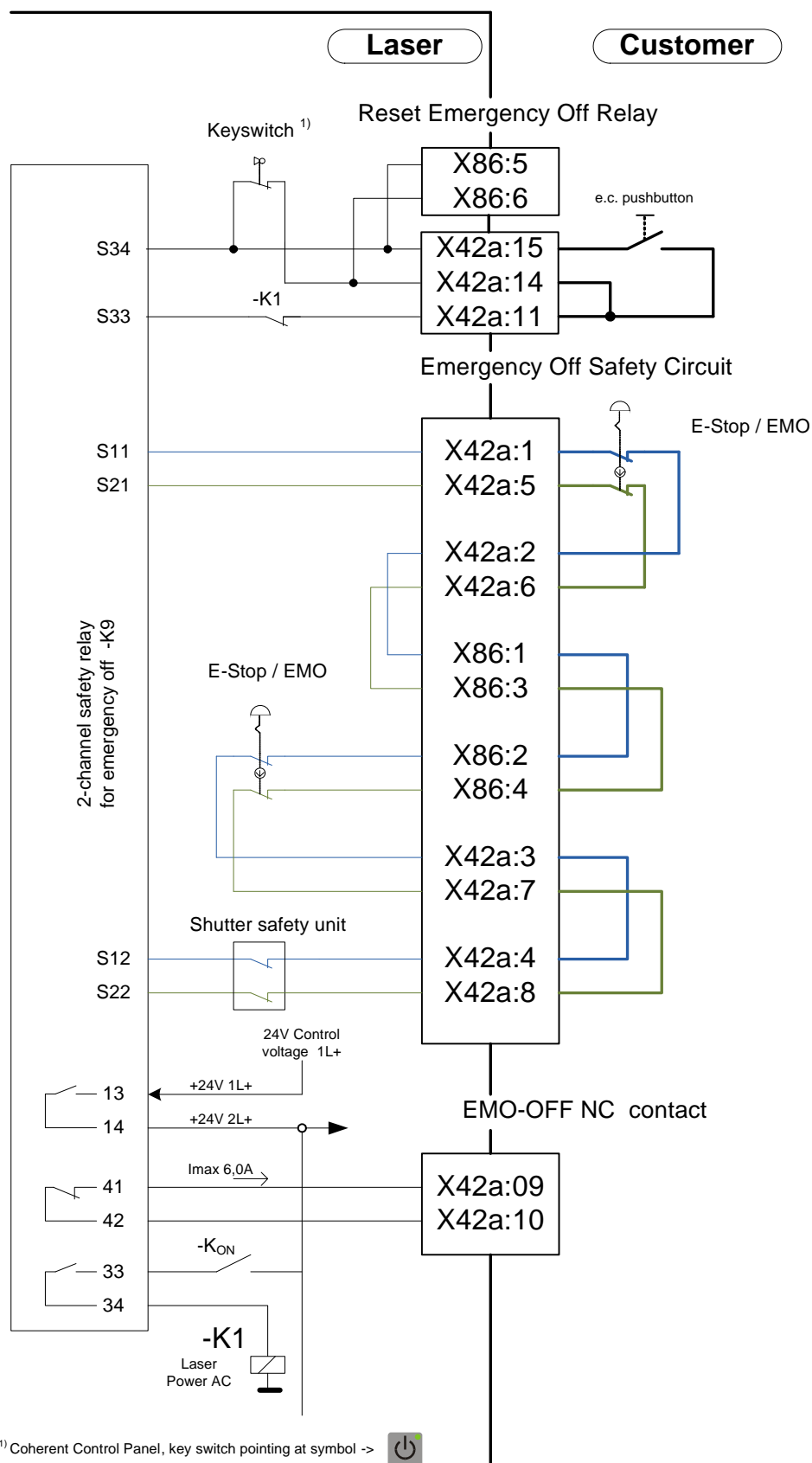


Fig. 6-15. External emergency stop #2

### 6.7.1.3 External emergency stop mechanism as master; internal emergency stop mechanism as slave

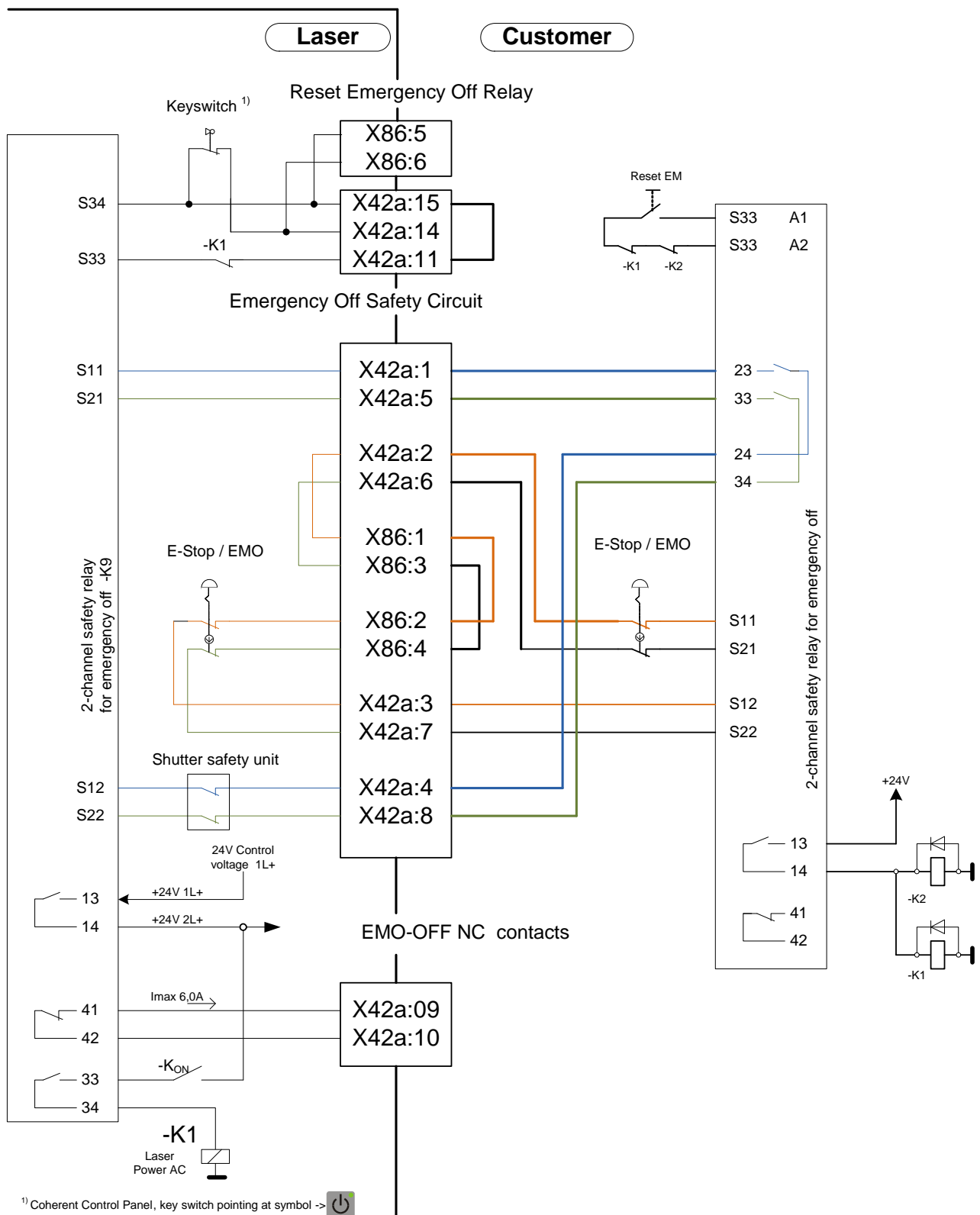
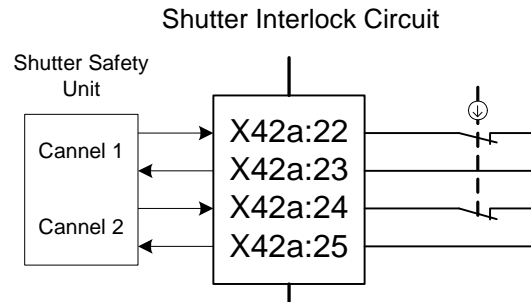


Fig. 6-16. External emergency stop #3

## 6.7.2 Digital inputs laser control

### 6.7.2.1 Shutter safety circuit

The shutter safety circuit has a 2-channel design and is connected with a safety monitoring unit in the laser.



#### WARNING

##### Danger from unintentional laser beam emissions

Possible bodily injury.

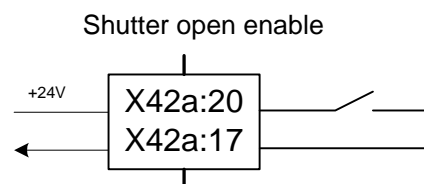
⇒ Only connect the shutter safety circuit or interlock with floating contacts that comply with safety requirements.



The signals from channels 1 and 2 must reach the same level within 0.5 seconds. If the value of 0.5 seconds is exceeded, there is a shutter interlock error message.

The external output resistance of the shutter safety circuit must not exceed 6.0 ohms per channel (see chapter [6.9.4 Shutter control on page 6-22](#)).

The shutter can only be opened if the shutter enable has been activated.



Do not use the shutter enable as a safety circuit.

This signal is also available at -X86 if an external control panel is not connected.

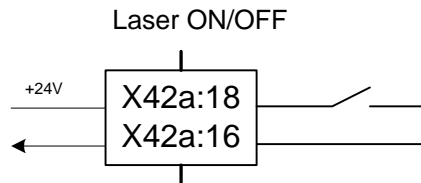
### 6.7.2.2 Laser ON/OFF

The laser system can be switched on externally via a floating contact.

The main switch (-S1) must be in position I "ON" and the key switch (-S2) must be in the right position "Operating mode".

Pay attention to electrical isolation.

This signal is also available at -X86.

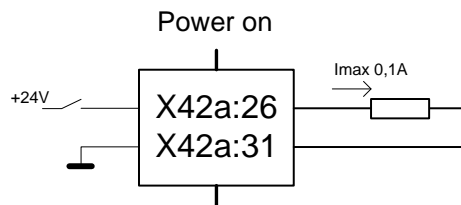


### 6.7.3 Digital outputs laser control

#### 6.7.3.1 Control voltage/Mains ON

This output is set as soon as the main switch (-S1) on the plug-in supply unit of the laser system is turned on, control voltage is applied, and the laser control unit is running.

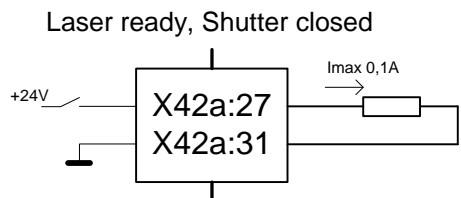
This signal is also available at -X86.



#### 6.7.3.2 Laser ready, shutter closed

This output is set when the shutter is safely closed and the laser is ready for operation (see chapter [6.9.4 Shutter control on page 6-22](#)).

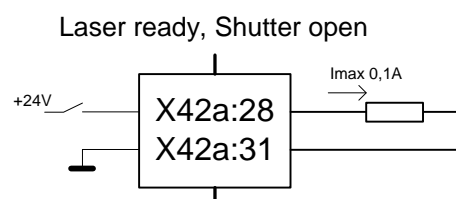
This signal is also available at -X86.



### 6.7.3.3 Laser ready, shutter open

This output is set when the shutter is safely open and the laser is ready for operation (see chapter 6.9.4 Shutter control on page 6-22).

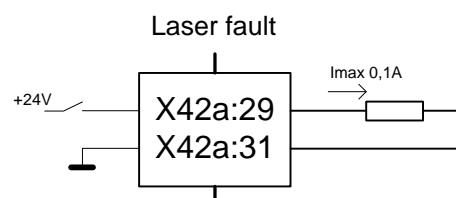
This signal is also available at -X86.



### 6.7.3.4 Laser error

This output is set when the laser control unit has detected an error.

This signal is also available at -X86.



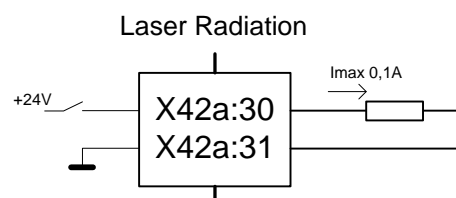
### 6.7.3.5 Laser radiation possible

This output is set before laser radiation can be generated and remains in the set condition while the laser beam is being generated.

This signal can be used to show persons present that laser radiation is being generated or can be emitted when the laser system is being operated in an area with controlled access.

» See the relevant regulations (EN 60825-1 in the currently valid version or CDRH 1040.10 (f)(5)).

This signal is also available at -X86.



#### NOTICE

The output signals and voltages (+24 V) sent by the laser control unit must not be electrically connected to one another. In extreme cases, such electrical connections could cause malfunctions.

The 0 V potential (control voltage 24 V), which is connected to the -X42a plug at pin 19, 21, and 31, is an exception.

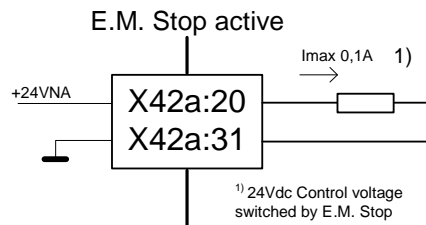
The control voltage is grounded at the plug-in supply unit (19" plug-in).

### 6.7.3.6 Emergency stop protection relay active

If the emergency stop relay of the plug-in supply unit is active, the 24V control voltage is provided as signal output.

The signal "Emergency stop relay not active" is also provided.

» see chapter [6.7.1 Emergency stop on page 6-11](#); emergency stop -X42a:9 and 10





## 6.8

### Laser interface -X86

The -X86 laser interface is intended for the external Coherent control panel. This application is not mandatory. In terms of function and technical design, the signals can be considered to be the same as those of the -X42a interface.

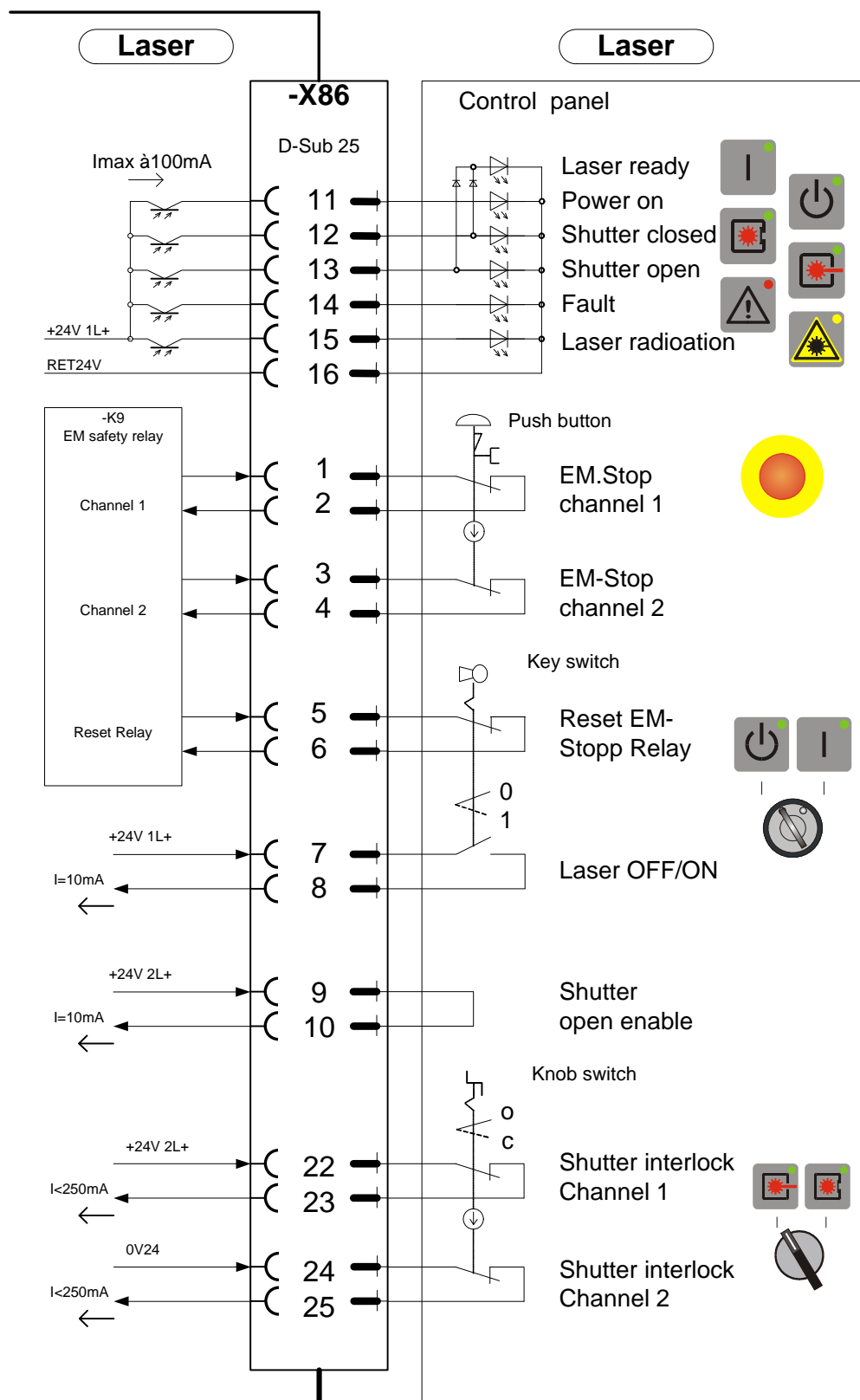


Fig. 6-17. Laser interface -X86

## 6.9 Laser control flow diagrams

### 6.9.1 Description of the flow diagrams

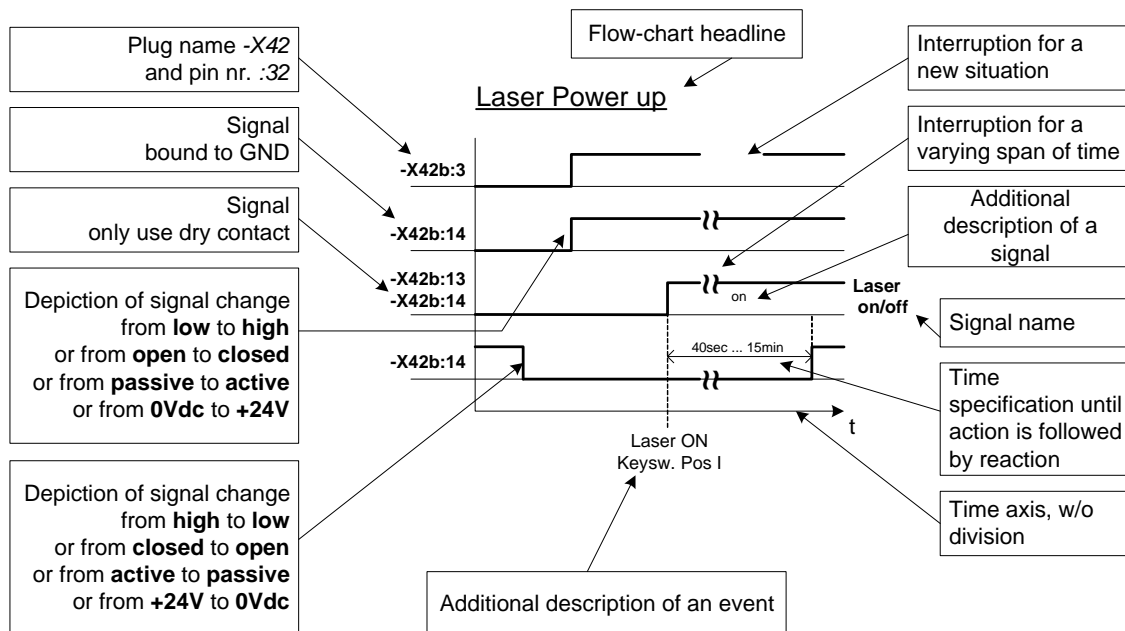


Fig. 6-18. Flow diagram, description of laser control

### 6.9.2 Switching on the laser, general

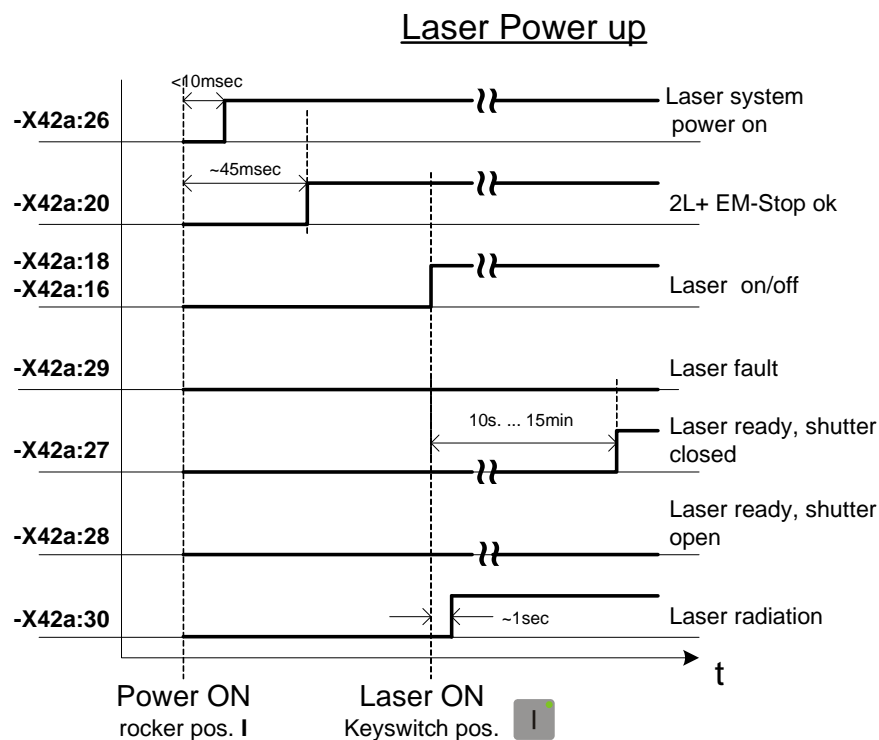





Fig. 6-19. Flow diagram "Laser ON"

### 6.9.3

### Switching on the laser externally

If the laser system is switched on and off externally and the shutter is opened and closed externally, the following conditions must be fulfilled:

- The main switch (-S1) is in position I "ON" .
- The key switch (-S2) is in the right position "Operating mode" .
- The knob switch (-S4) is in the left position "Shutter open" .

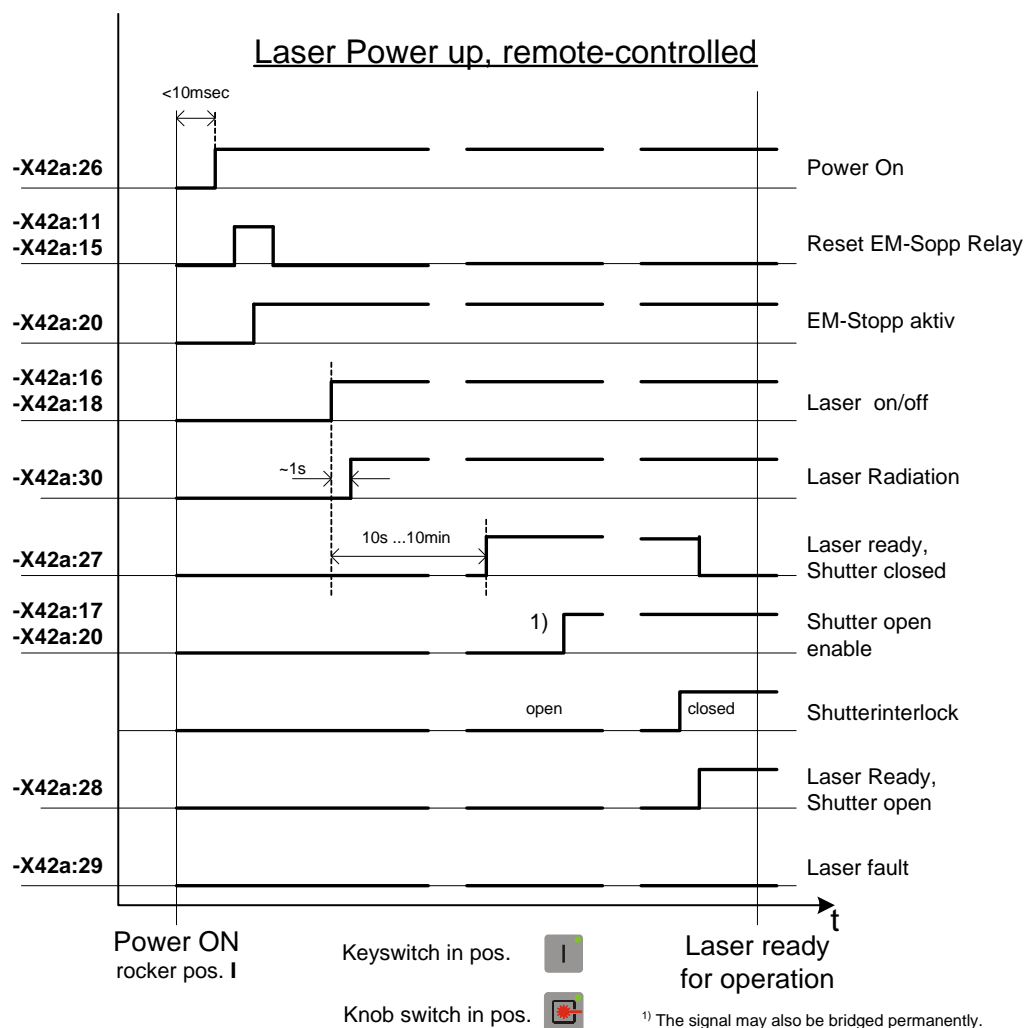


Fig. 6-20. Flow diagram "Laser ON - external"

## 6.9.4 Shutter control

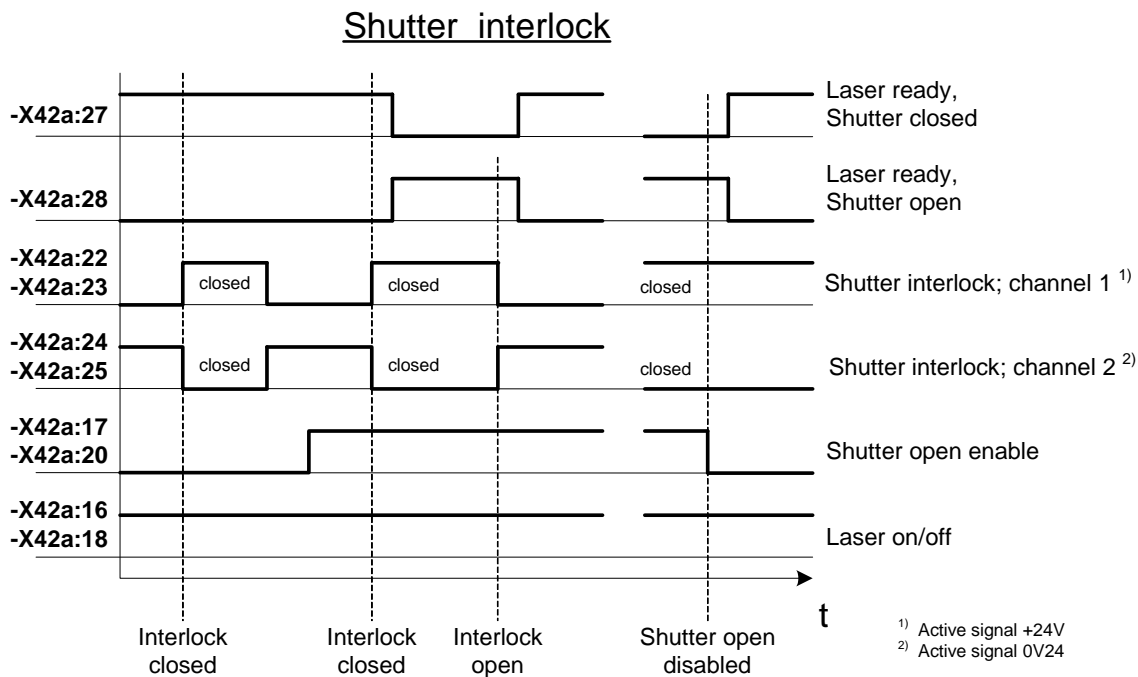


Fig. 6-21. Flow diagram "Shutter interlock"



The signals from channels 1 and 2 must reach the same level within 0.5 seconds. If the value of 0.5 seconds is exceeded, there is a shutter interlock error message.

## 6.9.5 Shutter control, causes of error

### Shutter interlock - fault examples

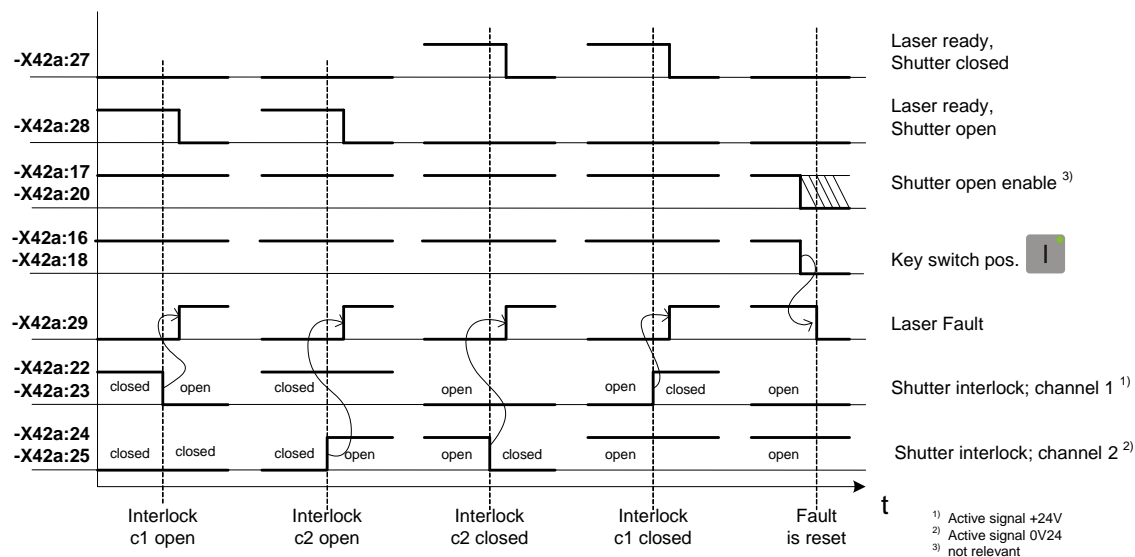


Fig. 6-22. Flow diagram "Shutter interlock, causes of error"

## 6.10 Marker control

### 6.10.1 M functions (ALI I/Os)

All marker control signals are supplied with external control voltage. The 24V control voltage of the laser system may be used for this purpose.

- » see chapter [6.12 Marker control flow diagrams on page 6-26](#)
- » Also observe Chapter 9 of the separate VMC2 software documentation for general information on M functions.

Digital inputs Marker control	
Nominal value	24 [V] DC
Connection	Relay contact/optocoupler/PLC
Logical 1 signal corresponds to	+24 [V] DC (+13 ... +30 [V])
Logical 0 signal corresponds to	0 [V] DC (-30 ... +5 [V])
Current consumption at +24 V	< 6.5 [mA]
Max. input voltage	+30 [V] DC
Digital outputs Marker control	
Nominal value	24 [V] DC
Logical 1 signal corresponds to	+24 [V] DC (+20 ... +30 [V])
Logical 0 signal corresponds to	0 [V] @ $R_{load} \leq 100 \text{ [k}\Omega\text{]}$
Max. load (transistor output):	50 [mA]
• Total current	300 [mA]
Short-circuit-proof	Yes

Tab. 6-6. M functions (ALI I/O)

## 6.10.2 Standard connection diagram for M functions (ALI I/Os)

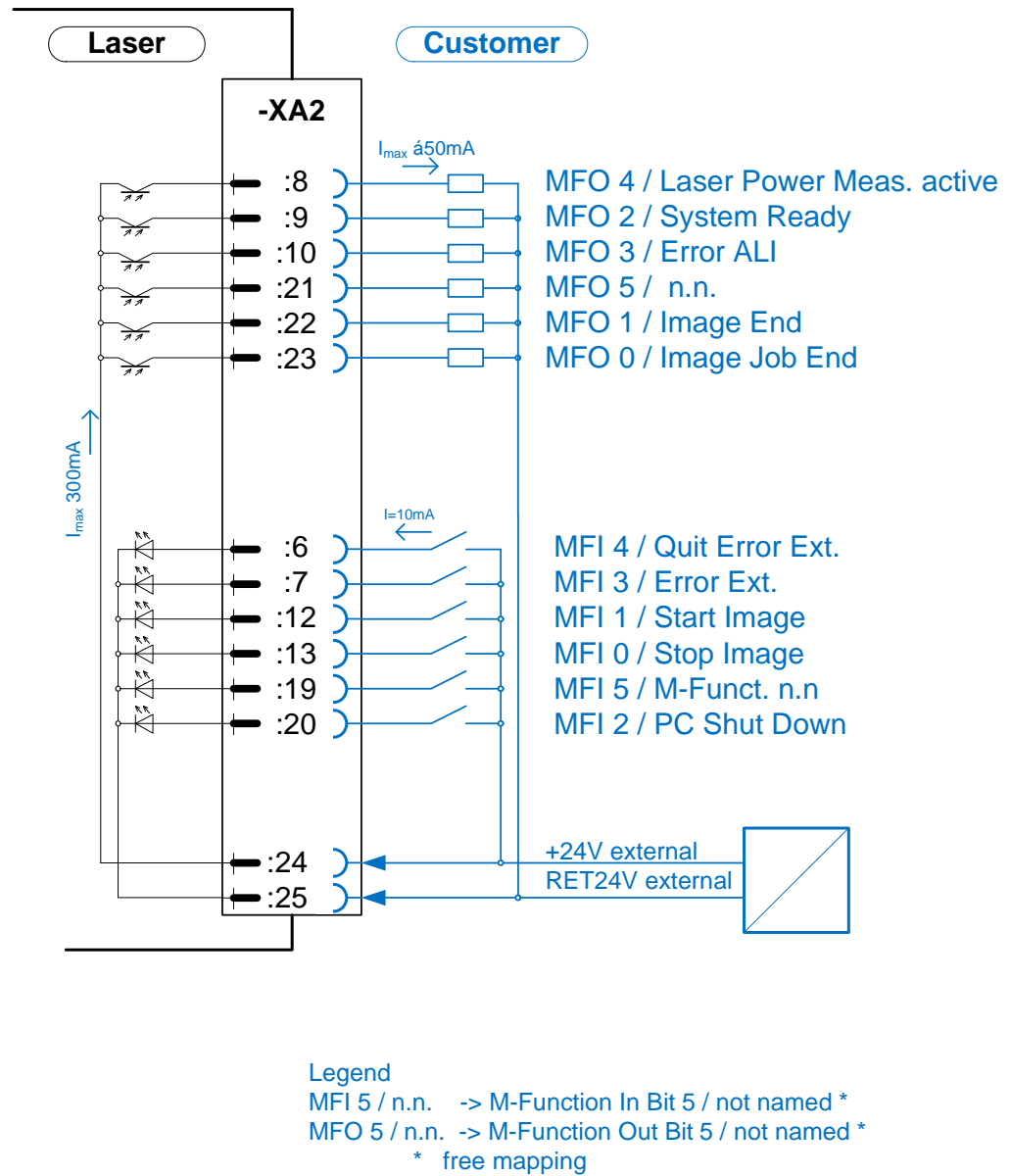


Fig. 6-23. Connection diagram for M functions (ALI I/Os), standard

### 6.10.3 Digital inputs Marker control

Digital inputs marker control	
Reset external error [Quit Error Ext.]	The "Error Ext." message indicated by the marking software is reset by a logical 1 signal (+24 V).
External error [Error Ext.]	If a signal with logical 1 (+24 V) is applied to this input, the marking software indicates "Error Ext."
Marking start [Start Image]	This signal serves to remotely start a marking process. The external start must be set in the software.
Marking stop [Stop Image]	This signal stops a running marking program or marking job.
Shut down PC; close computer software [PC Shut Down]	This signal shuts down the control computer of the marking software. The signal (+24 V) must be present for approx. 100 ms.
Signal n.n.	This signal has no fixed function assignment in the delivered state. Bit no. 5.

Tab. 6-7. Digital inputs marker control

### 6.10.4 Digital outputs Marker control

The following signal outputs have a 0 V or +24 V level.

Digital outputs marker control	
Laser power measurement active [Laser Power Meas. Active]	This signal remains in the set condition as long as a laser power measurement is carried out.
Software loaded [System Ready]	As soon as the marking software is loaded, this output has a logical signal 1 (+24 V).
Error in the marking system [Error ALI]	When the marker control detects an error, this output has a logical signal 1 (+24 V).
Marking end [Image End]	If no marking takes place, this output has a logical signal 1 (+24V).
Job ended [Image Job End]	As long as a marking job is loaded, this output has a logical signal 0 (0 V).
Signal n.n.	This signal has no fixed function assignment in the delivered state. Bit no. 5.

Tab. 6-8. Digital outputs marker control

## 6.11 Optional M functions

Additional M-functions can be implemented via the -X40 (RJ45/8-pin) CAN bus interface. If you have any questions about this, please contact the Service department of Coherent Munich.

## 6.12 Marker control flow diagrams

### 6.12.1 Marker control without marking stop

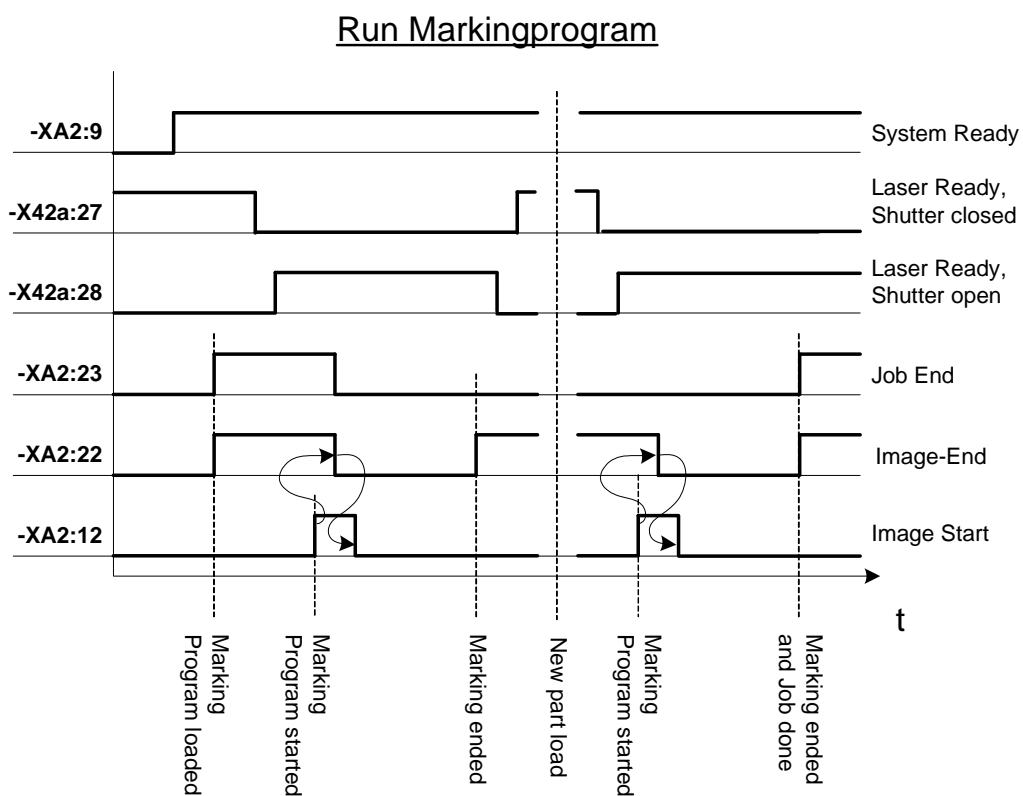


Fig. 6-24. Marker control flow diagram; no marking stop



## 6.12.2

### Marker control with marking stop

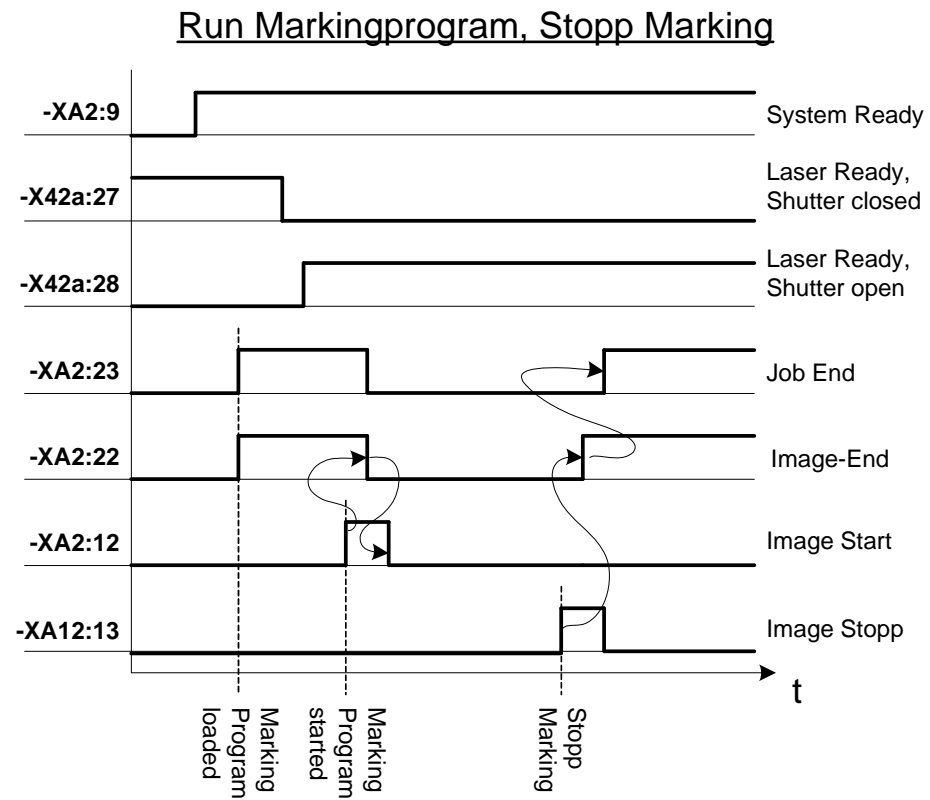


Fig. 6-25. Marker control flow diagram with marking stop

**6.13 "Fast" marker control ("fast I/Os")**

The following inputs and outputs have differential signals of 3.3 V to 5.0V (RS422 standard), which are preferably used for marking moving surfaces, i.e. for the "Marking on the Fly (MOF)" application.

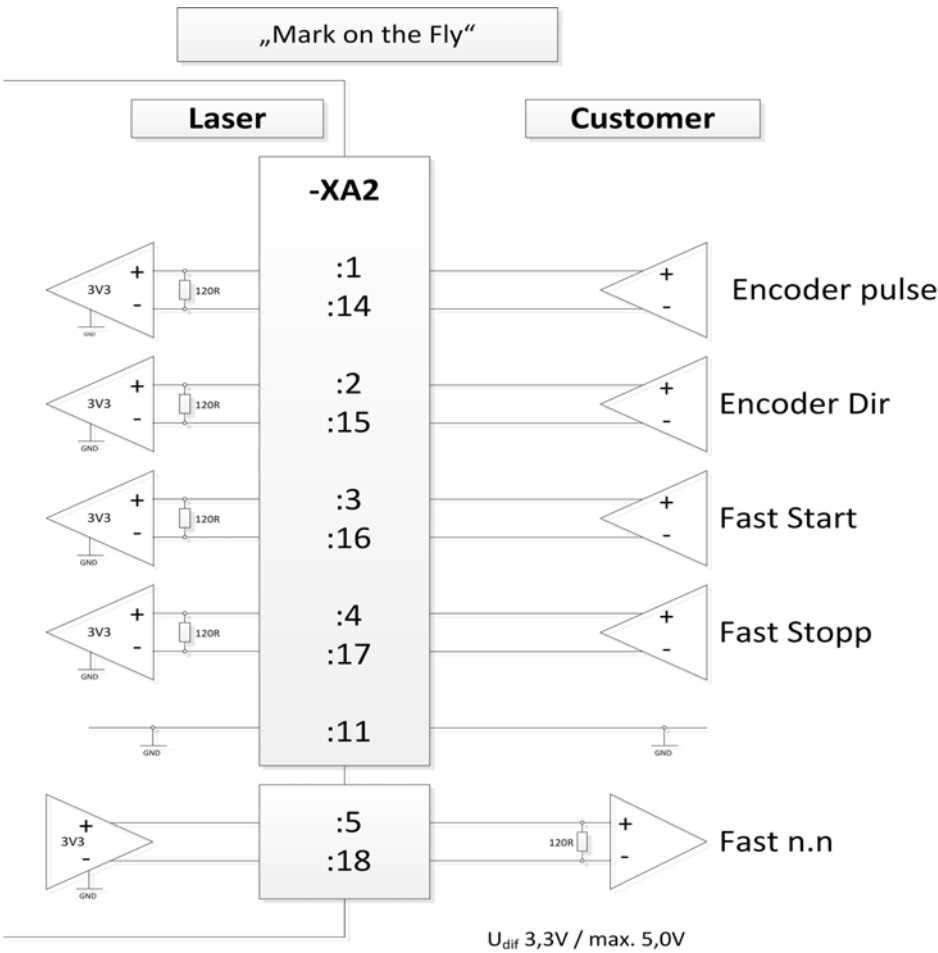


Fig. 6-26. Flow diagram, fast marker control

Digital inputs "fast" marker control	
Encoder pulse [Encoder pulse]	The output of an encoder, or similar unit, is connected to this input to ascertain the motion speed of the surface to be marked.
Encoder direction [Encoder Dir]	The output of an encoder, or similar unit, is connected to this input to ascertain the marking direction of the surface to be marked.

Tab. 6-9. "Fast" marker control

Digital inputs "fast" marker control	
Fast start [Fast Start]	<p>The output of a sensor, or similar unit, that triggers the fast marking start is connected to this input.</p> <p><b>i</b> The marking program must be open before connecting the sensor.</p> <p>» For detailed information on the "Marking on the Fly" application, please see the separate software documentation in the Windows Start menu under VisualLaserMarker/Documentation/VisualLaserMarker/Marking on the Fly Documentation, as well as the User Manual for the VisualLaserMarker marking software.</p>
Marking stop [Stop Image]	<p>The customer control output or similar is connected to this input.</p> <p>» For detailed information on the "Marking on the Fly" application, please see the separate software documentation in the Windows Start menu under VisualLaserMarker/Documentation/VisualLaserMarker/Marking on the Fly Documentation, as well as the User Manual for the VisualLaserMarker marking software.</p>
Digital output "fast" marker control	
Fast n.n.	This signal currently has no function.

Tab. 6-9. "Fast" marker control (Cont.)

## 6.14

### LAN interface

The LAN interface on the plug-in supply unit can be used as a connection to a customer network (LAN) or as a P2P connection to a specific customer computer.

The connection of the plug-in supply unit with the customer network (LAN) is created with the help of a standard patch cable Cat 5e 2x RJ45.

The direct connection of the plug-in supply unit to a PC/notebook is established using a crossover patch cable Cat 5e 2x RJ45. Both cables are included in the scope of delivery.

The requirements regarding the electromagnetic compatibility (EMC) for the laser system can only be fulfilled if LAN cables with the quality "double shielded and twisted pair" are used. Cable structure "**SF/UTP**" according to ISO/IEC11801 (2002) E.

### **6.14.1**

## **Technical data**

### **LAN subsystem**

The LAN subsystem consists of the following:

- Intel 82801GBM ICH7-M
- Realtek 8111D Gigabit Ethernet controller for 10/100/1000 Mbps/sec Ethernet LAN connectivity
- RJ-45 LAN connection with integrated status LEDs

Further attributes of the LAN subsystem:

- CSMA/CD protocol engine
- LAN connect interface that supports the Ethernet controller
- Conventional PCI bus power management
  - Supports ACPI technology
  - Supports LAN wake capabilities

## 7. Putting into service



### DANGER

#### Danger due to missing personal protective equipment (PPE)

Potential burning hazard to the eyes and skin.

⇒ If applicable, the prescribed personal protective equipment (PPE) must be worn prior to beginning operating tasks on the laser system.



### DANGER

#### Danger from failure to observe safety notes

Possible bodily injury.

⇒ The intended use and safety notes in chapter must be observed during putting into service, especially the notes on laser radiation.



### DANGER

#### Danger due to lack of control over control functions

Possible bodily injury.

⇒ The laser system may only be put into service if the user has control over all control functions which either isolate the laser beam or deactivate the generation of laser radiation (e.g. plug-in supply unit or control panel). A software control alone does not constitute a safety-related control.



### NOTICE

Non-observance of the safety notes can result in damage to the laser system.



### NOTICE

To avoid damage to the laser system, never disconnect any plug-in connections as long as the laser system is connected to the mains power supply.



To prevent condensation on the surface of the optical components, the system must be acclimatized in the operating environment before switching on.

#### The following prerequisites must be fulfilled before the laser system can be put into service:

- The laser system is correctly installed and electrically connected.
- All tools and foreign parts have been removed from the processing area.
- All protective measures regarding laser safety have been taken.

- No other sources of danger are present.
- During operation in local mode, ensure that the VLM dongle is correctly connected (see chapter 9. [PowerLine Prime Web Interface on page 9-1](#)).
- The jumper plugs -X42a and -X86 are connected at the rear of the plug-in supply unit or the integration interfaces are configured accordingly (see page 6.7 [Laser interface -X42a on page 6-11](#)).
- The CAN terminating connector is plugged in at -X40 or -X40a.

## 7.1

### Sequence for putting into service

The laser system is put into service using the operating elements on the front of the plug-in supply unit.



#### **DANGER**

##### **Danger from laser radiation**

Damage to the eyes and to the skin is possible.

When opening the shutter, Class 4 laser radiation will be emitted.

⇒ Adapt the protective measures to the installation conditions (see chapter 2.1.1 [Obligations of the proprietor on page 2-1](#)).



#### **CAUTION**

##### **Danger from direct laser radiation from the alignment laser**

Possible damage to the eyes.

The laser beam of the alignment laser may also be emitted when the shutter is closed. The alignment laser corresponds to a Class 2 laser.

⇒ Do not stare directly into the beam.



The Coherent software shows the operating statuses of the laser system.

- » *More information see chapter 10. [LaserConsole program on page 10-1](#).*
- » *For an overview of the operating and display elements found on the control panel, see chapter 4. [System overview on page 4-1](#).*

Putting into service can be carried out in two different ways, depending on the operating mode selected.

With the operating modes, it is possible to select between the remote mode with external PC/notebook and the local mode with connected monitor, keyboard and mouse.

On delivery, the laser system is always in remote mode. The proprietor of the laser system must switch the laser system to local mode via the web interface for operation in local mode.

- » *For information on the web interface, see chapter 9. [PowerLine Prime Web Interface on page 9-1](#).*

7.1.1 Sequence for putting into service in remote mode

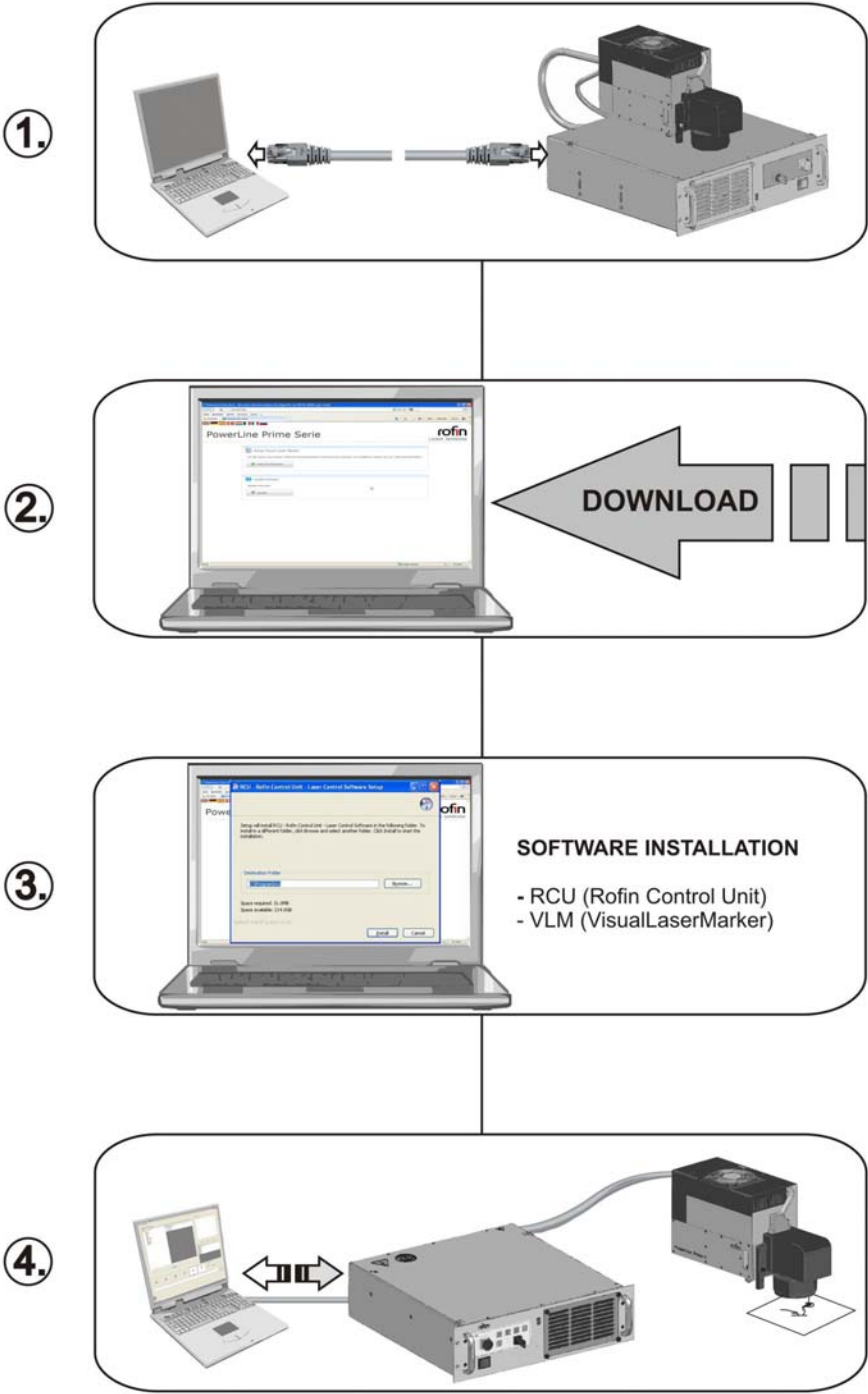


Fig. 7-1. Schematics for putting into service (remote mode)

### 7.1.2 Sequence for putting into service in local mode

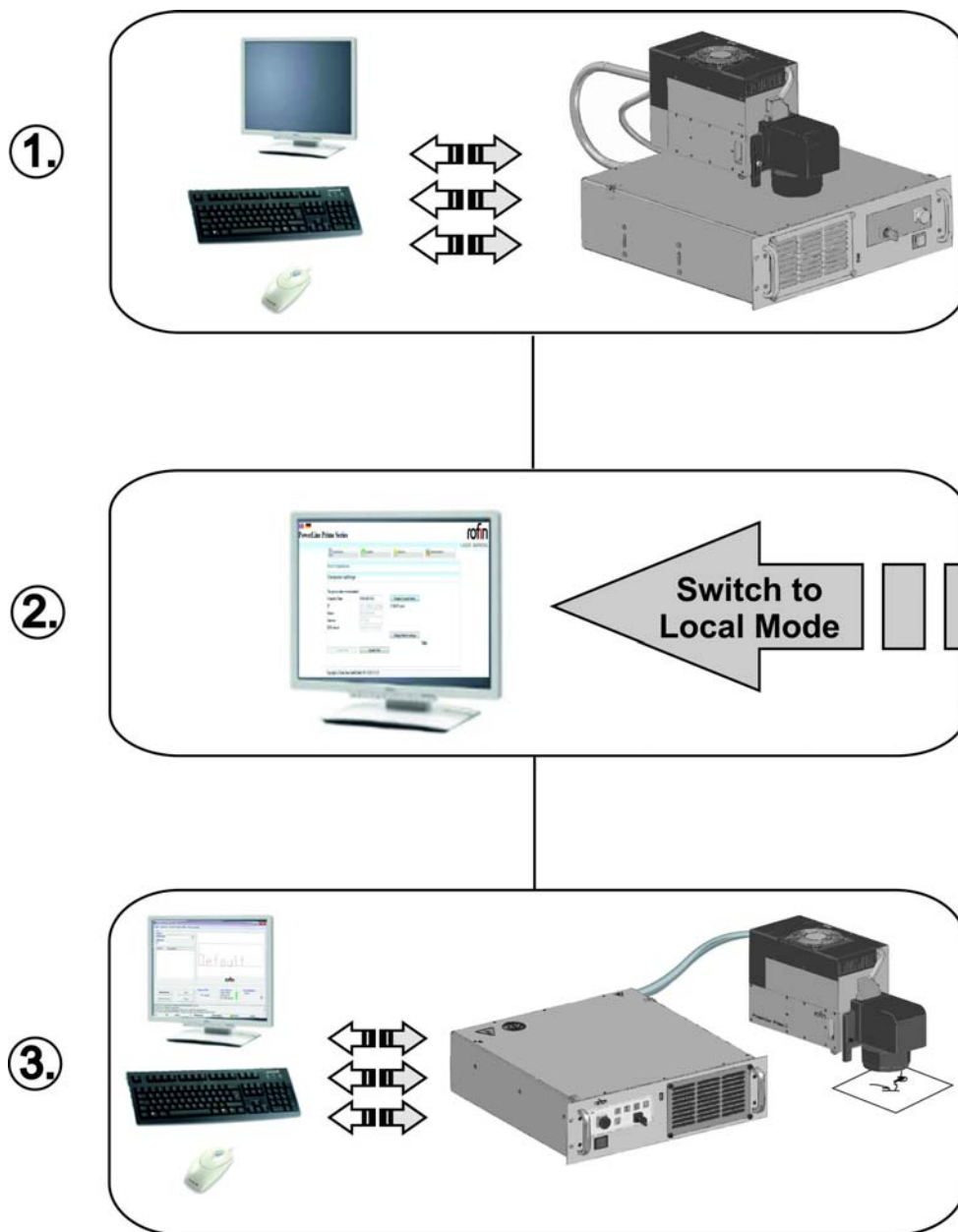


Fig. 7-2. Schematics for putting into service (local mode)

### 7.1.3 Establishing the connection to the laser system




When using an external PC/notebook, the connection to the laser system is established via the network (LAN interface).

#### Put the laser system into service as follows:

1. Either connect the external PC/notebook to the control computer of the plug-in supply unit via the LAN interface or connect the monitor, keyboard and mouse directly to the plug-in supply unit.



2. Turn main switch (-S1) of the plug-in supply unit to position I "ON" .
  - The control computer and the laser control unit (Coherent software) are booted; this may take several minutes.
3. Turn the key switch (-S2) on the control panel of the plug-in supply unit to the right position (operating mode).
4. Position the knob switch (-S4) to the right-hand position (shutter closed).

A marking process can be carried out as soon as the knob switch (-S4) is turned to the left position (Shutter open).

**[1] For operation with an external PC/notebook:**

5. Start the PC/notebook and wait until it boots.
6. Access the laser system using a web browser (see chapter [9.3 Establishing the connection to the laser system on page 9-1](#)).
7. Install Coherent software (see chapter [9.4.1 \[Download\] tab on page 9-3](#)).



The network connection of the PC must be configured in such a way that the IP address and the DNS address are obtained automatically.

» *For detailed information on the settings procedure, please refer to the operating system documentation or ask the network administrator of the laser system proprietor.*



Depending on the operating system and the security settings, requests for agreeing to certain installation steps are displayed. Acknowledge these messages with "OK".

**[2] For operation with connected monitor, keyboard and mouse:**

8. Access the laser system using a web browser (see chapter [9.3 Establishing the connection to the laser system on page 9-1](#)).
9. Switch to local mode (see chapter [9.4.5.3 Switch to local mode - Switch off write protection on page 9-9](#)).

## 7.2

### Performing a marking test



#### **DANGER**

##### **Danger from laser radiation**

Damage to the eyes and to the skin is possible.

When opening the shutter, Class 4 laser radiation will be emitted.

⇒ Adapt the protective measures to the installation conditions (see chapter [2.1.1 Obligations of the proprietor on page 2-1](#)).

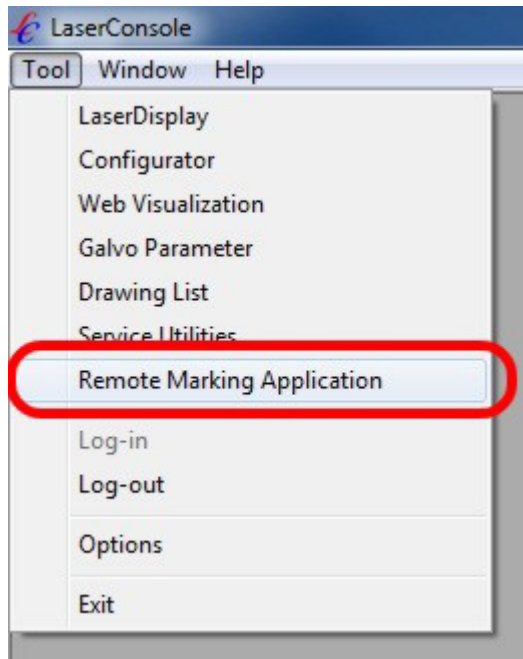
##### **Perform the marking test as follows:**

1. Click on the [LaserConsole] desktop symbol.
  - The LaserConsole program is opened.



Fig. 7-3. LaserConsole symbol

2. Click the "Tool" menu.
3. Select [Remote Marking Application].

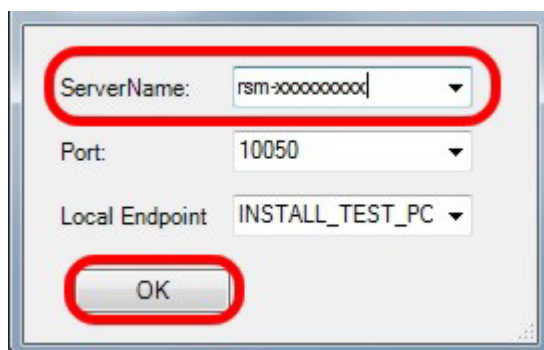


4. Enter the remote IP (ServerName)



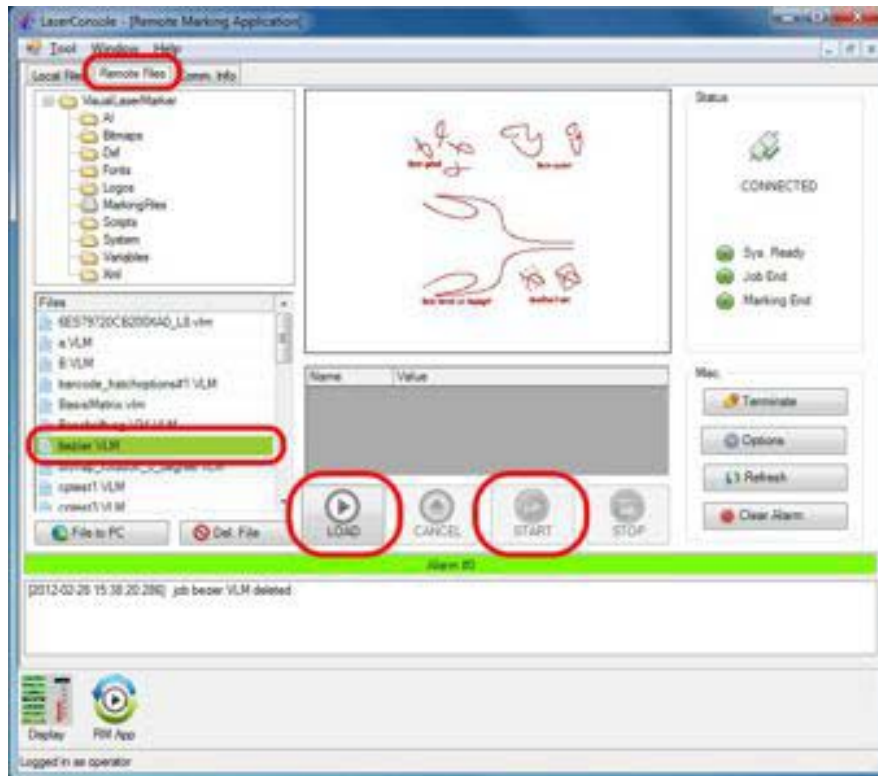
The server name corresponds to the RSM number. The RSM number is located on the front of the plug-in supply unit (see chapter 2. Safety on page 2-1)

5. Click [OK].



6. Position the workpiece in the marking field (marking field size, see chapter 3.1 General technical data on page 3-1).

Start the marking in the Coherent software as follows:



7. Select the [Remote Files] tab.
  8. Select a marking file, e.g. "Example1.vlm".
  9. Click the [LOAD] button.
  10. Click the [START] button.
- » The description of the "Remote Marking Application" and the VisualLaserMarker (VLM) marking software can be found in the separate documentation.
11. If, having finished the marking process, another marking file is to be loaded, click the [CANCEL] button.

The first marking process is finished.



The result can be analyzed and optimized by repeating the marking process in chapter 12. [Troubleshooting](#).



## 8. Operation



### **DANGER**

#### **Danger from failure to observe the safety notes**

Possible bodily injury

⇒ Observe the intended use and all safety notes contained in the "Safety" chapter when commissioning the system, especially the notes on laser radiation and personnel qualifications.



### **NOTICE**

Non-observance of the safety notes can result in damage to the laser system.



The description of the operation of the laser system assumes that operation is carried out by means of the Coherent control panel and the Coherent software.

### 8.1

## **Switching on in normal operation**



### **CAUTION**

#### **Danger from direct laser radiation from the alignment laser**

Possible damage to the eyes.

The laser beam of the alignment laser may also be emitted when the shutter is closed. The alignment laser corresponds to a Class 2 laser.

⇒ Do not stare directly into the beam.



The installed Coherent software shows the operating statuses of the laser system.

- » *More information on the LaserConsole program, see chapter 10. [LaserConsole program on page 10-1.](#)*
- » *For an overview of the operating and display elements found on the control panel, see chapter 4.4 [Operating and display elements on page 4-6.](#)*
- » *For information on the software installation, see chapter 9. [PowerLine Prime Web Interface on page 9-1.](#)*



Control panel on plug-in supply unit:




- The key switch (-S2) must be in the left position (Mains on).
- The knob switch must be in the right position (Shutter closed).



### 8.1.1

#### Remote mode




The external PC/notebook must be connected to the plug-in supply unit via the LAN interface.

1. Close the shutter interlock circuit of the laser system (integrated into the entire system).
2. Turn main switch (-S1) of the plug-in supply unit to position I "ON" 
  - The lamp in the main switch (-S1) and the green LED of the "Mains on" (-H1) status display light up. 
  - The control computer and the laser control (Coherent software) are booted.
3. Start the external PC/notebook and wait until it boots.
4. Start the LaserConsole program on the external PC/notebook (see chapter [10. LaserConsole program on page 10-1](#)).
5. Turn the key switch (-S2) to the right position (operating mode).
  - The yellow LED of the "Laser radiation possible" status display  (-H5) lights up.
  - The warm-up phase of the laser system begins. The time for the warm-up phase is dependent on the environmental conditions and is  $\leq 15$  minutes.

The laser is ready as soon as the green LEDs of the "Operating mode"  (-H6) and "Shutter closed"  (-H2) status displays light up.

6. A marking process can be carried out as soon as the knob switch (-S4) is turned to the left position (Shutter open).

If the shutter interlock circuit of the laser system has been closed properly, the green LED of the "Shutter open" status display  (-H3) lights up.



#### **DANGER**

##### **Danger from laser radiation**


Damage to the eyes and to the skin is possible.



When opening the shutter, Class 4 laser radiation will be emitted.



⇒ Adapt the protective measures to the installation conditions (see chapter [2.1.1 Obligations of the proprietor on page 2-1](#)).

### 8.1.2


#### Local mode

1. Close the shutter interlock circuit of the laser system (integrated into the entire system).
2. Turn main switch (-S1) of the plug-in supply unit to position I "ON" .

- The lamp in the main switch (-S1) and the green LED of the "Mains on"  (-H1) status display light up.
  - The control computer and the laser control unit (Coherent software) are booted; this may take several minutes. The LaserConsole program automatically opens on the monitor.
3. Turn the key switch (-S2) to the right position (operating mode).
- The yellow LED of the "Laser radiation possible" status display  (-H5) lights up.
  - The warm-up phase of the laser system begins. The time for the warm-up phase is dependent on the environmental conditions and is  $\leq 15$  minutes.

The laser is ready as soon as the green LEDs of the "Operating mode"  (-H6) and "Shutter closed"  (-H2) status displays light up.

4. A marking process can be carried out as soon as the knob switch (-S4) is turned to the left position (Shutter open).

If the shutter interlock circuit of the laser system has been closed properly, the green LED of the "Shutter open" status display  (-H3) lights up.



### **DANGER**

#### **Danger from laser radiation**




Damage to the eyes and to the skin is possible.

When opening the shutter, Class 4 laser radiation will be emitted.

⇒ Adapt the protective measures to the installation conditions (see chapter 2.1.1 [Obligations of the proprietor on page 2-1](#)).

## **8.2**

### **Restarting the system after power failure or emergency stop**




1. Turn the key switch (-S2) on the control panel of the plug-in supply unit to the left position (Mains on).
  - The green LEDs of the "Mains on" status display  (-H1) light up.
  - The yellow LED of the "Laser radiation possible" status display  (-H5) flashes.
2. Unlock the emergency stop pushbutton by pulling it out/turning it if an emergency stop has been triggered.
  - The yellow LED of the "Laser radiation possible" status display  (-H5) goes out.
3. Acknowledge error messages (see chapter 12. [Troubleshooting on page 12-1](#)).
4. Put the system back into service as described in chapter 8.1 [Switching on in normal operation on page 8-1](#).



In the event of an emergency stop, the error message ЕМСУСТОП (Emergency Stop) will be shown in the Coherent software (LaserConsole program, Laser Display application).


### 8.3

#### Switching off in normal operation

1. Stop laser processing.
2. Exit the Coherent software on the external PC/notebook or on the connected monitor by clicking [Shutdown] in the LaserConsole program ("LaserDisplay" application).
  - All programs are closed and the operating system shuts down.
- » *The procedure for exiting the Coherent software via the LaserConsole program is described in the relevant user manual.*
3. On the control panel, turn the key switch to the left position (Mains on).
  - The green LED of the "Operating mode" status display  (-H6) goes out.
4. Wait until the green LED of the "Processor operating mode" status display  (-H8) has gone out.
5. Switch off the laser system at the main switch  (-S1) of the plug-in supply unit.
  - The lamp in the main switch goes out.



#### NOTICE

Improper shutdown of the laser system can result in damage to the hard disk. Only switch off the laser system at the main switch after the green LED of the "Processor operating mode" status display  (-H8) has gone out.

### 8.4

#### Switching off in case of emergency

In case of emergency, switch off the laser system with the emergency stop pushbutton on the plug-in supply unit or with an emergency stop mechanism for the entire system.



#### NOTICE

improper actuation of the emergency stop button can result in damage to the laser system. The emergency stop shutdown does not replace the function of a regulated shutdown and should not be treated as a shutdown method. Only press the emergency stop button in the event of hazards to persons or to avoid machine damage.



## 9. PowerLine Prime Web Interface

On delivery, the laser system will be in remote mode for operation with an external PC/notebook. The network connection to the external PC/notebook can be established via the web interface.

When operating the laser system with connected monitor, keyboard and mouse, it is possible to switch to local mode via the web interface.

### 9.1 System requirements

» Detailed information on the system requirements are given in the user manual on the VisualLaserMarker (VLM) marking software. Subject to technical changes without notice.

### 9.2 Coherent software

The Coherent software contains two programs:

- RCU (Rofin Control Unit) control software
- VLM (VisualLaserMarker) marking software

When using an external PC/notebook, the LaserConsole program for controlling the laser is available following installation of the Coherent software on the external PC/notebook. Different applications for controlling and configuring the laser can be started in the LaserConsole program (see chapter [10. LaserConsole program on page 10-1](#)).

### 9.3 Establishing the connection to the laser system

#### Preparatory measures:

- For operation with an external PC/notebook, ensure that the VLM dongle is plugged into the external PC/notebook.
- For operation with an external PC/notebook, this is connected to the plug-in supply unit via a network (e.g. LAN interface).

#### Access the laser system using a web browser:

1. Open the browser.

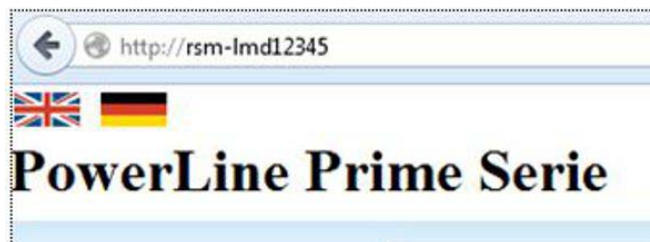


Fig. 9-1. Enter RSM number

2. Enter in the address field {http://rsm-xxxxxxxxx}.

- The connection to the control computer in the plug-in supply unit of the laser system is established and the web interface is opened, as described below.



The RSM number is located on the front of the plug-in supply unit (see chapter 2.5 Labeling and warning signs on page 2-11).

## 9.4 Main screen

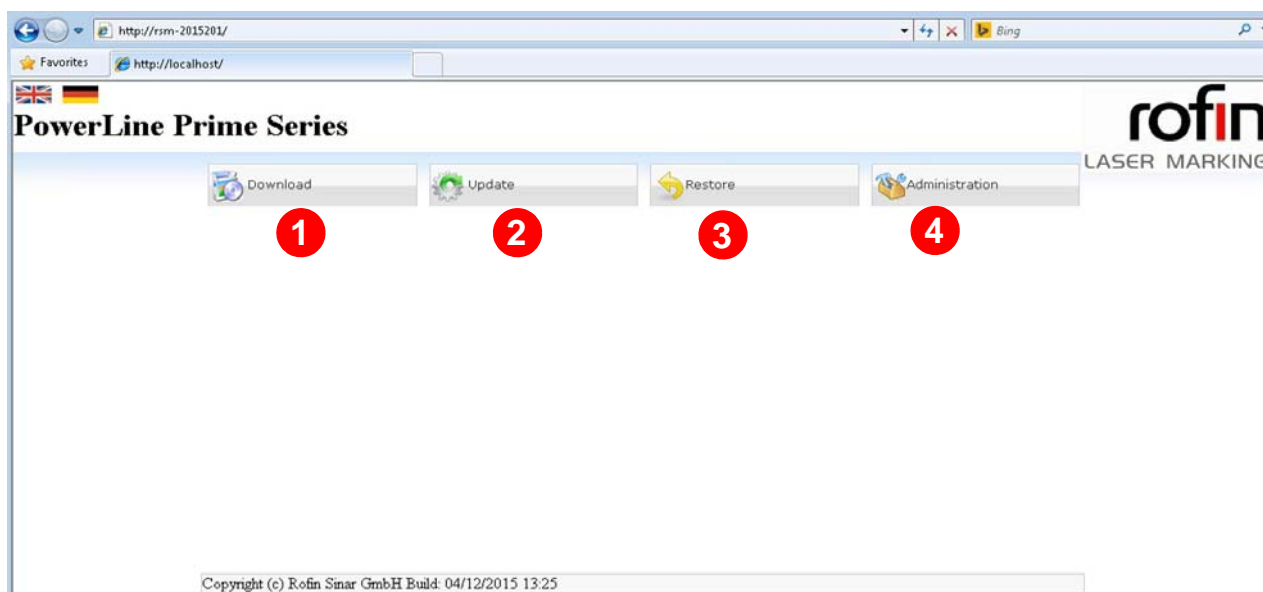


Fig. 9-2. PowerLine Prime Web Interface, main screen

No.	Tab	Description
1	[Download]	Download the Coherent software to the external PC/notebook
2	[Update]	Update the Coherent software
3	[Restore]	Reset the laser system to the factory settings
4	[Administration]	Install fonts from the external PC/notebook onto the control computer in the plug-in supply unit.
	Drop-down menu [Computer settings]	<ul style="list-style-type: none"> <li>• Change settings for the control computer in the plug-in supply unit</li> <li>• Change the network settings</li> <li>• <u>Switch off write protection:</u> Switch to local mode for operation with connected monitor, keyboard and mouse</li> <li>• <u>Switch on write protection:</u> Switch to remote mode for operation with an external PC/notebook</li> </ul>

Tab. 9-1. PowerLine Prime Web Interface, main screen

### 9.4.1 [Download] tab

The Coherent software can be downloaded on the [Download] tab and saved onto the external PC/notebook.

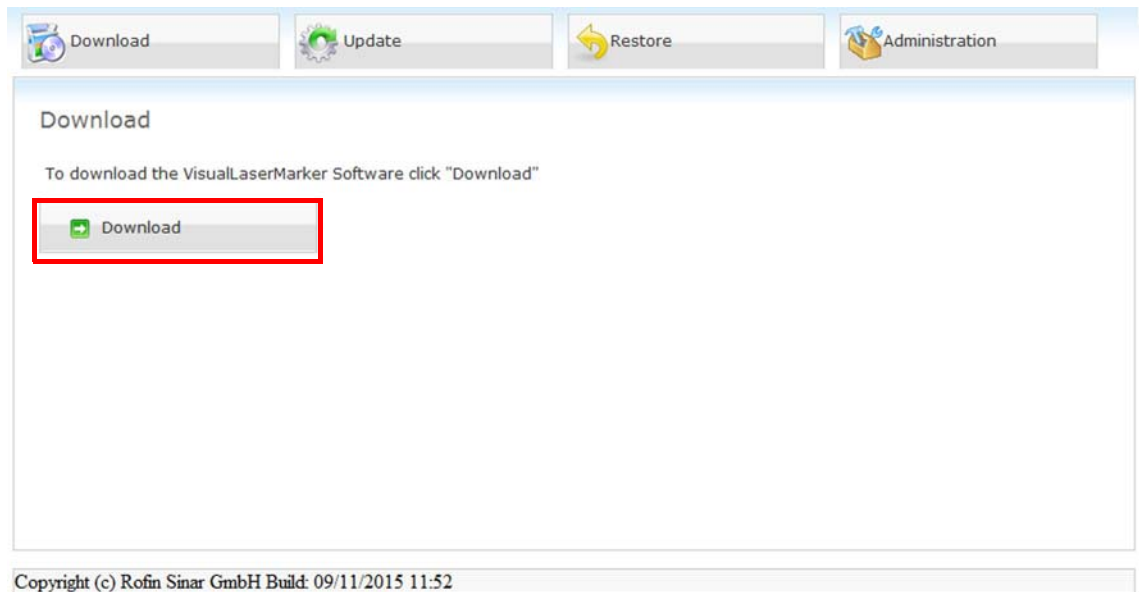
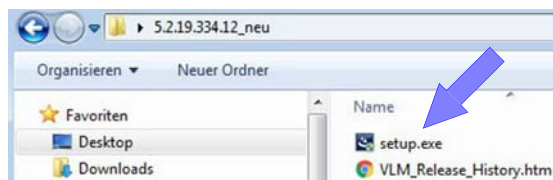


Fig. 9-3. [Download] tab

#### Download the Coherent software as follows:

1. On the [Download] tab, click [Download Now].
  - The "Setup.exe" file is saved on the external PC/notebook, e.g. on the desktop. The save location may vary depending on the internet browser and browser settings.



2. Double-click the "Setup.exe" file.
  - The Coherent software is installed on the external PC/notebook.

### 9.4.2 [Update] tab

The [Update] tab can be used to update the Coherent software on the control computer of the plug-in supply unit.

The software update ("setup.exe" file) can be downloaded directly from the Coherent Munich GmbH & Co. KG server or via a Coherent Munich branch office.

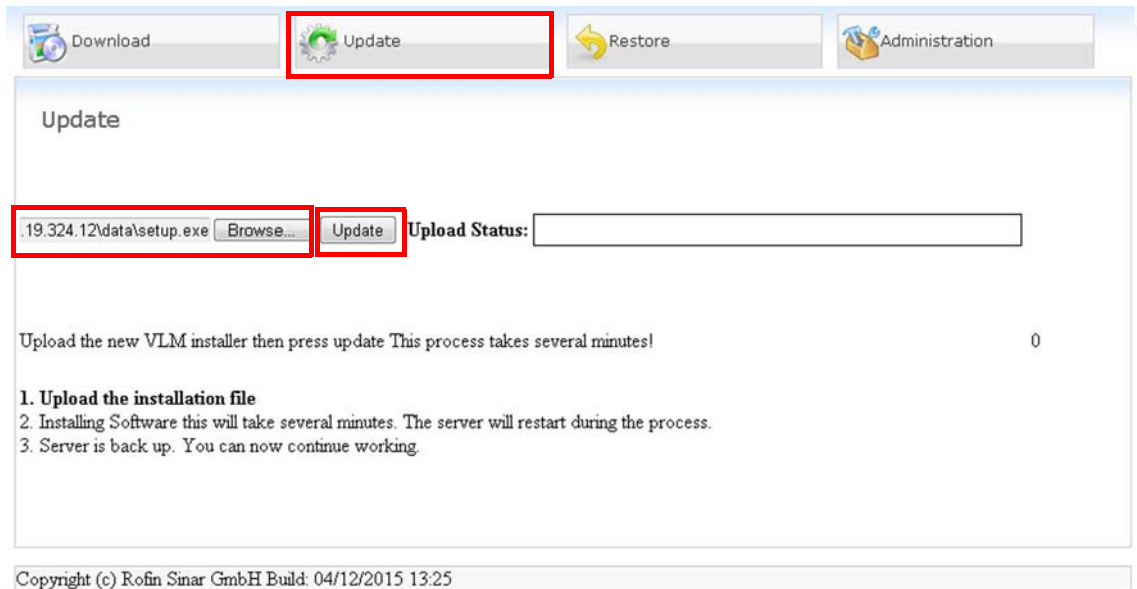


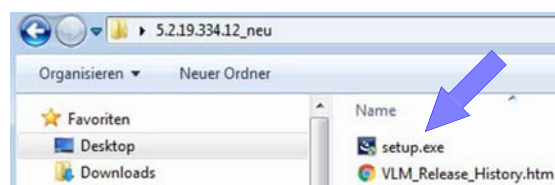
Fig. 9-4. [Update] tab

#### Preparatory measures:

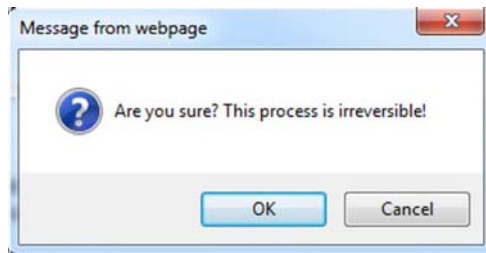
- For operation with an external PC/notebook, save the software update ("setup.exe" file) on the external PC/notebook, e.g. on the desktop.
- For operation with monitor, keyboard and mouse, save the software update ("steup.exe" file) onto the control computer in the plug-in supply unit, e.g. onto the desktop.

#### Run the software update as follows:

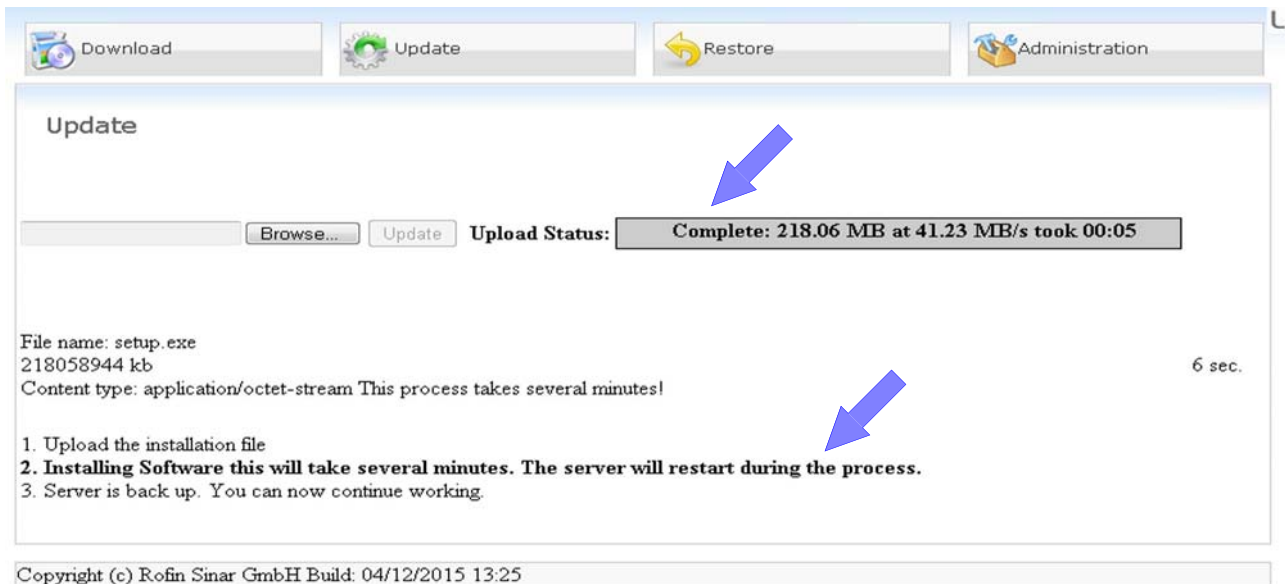
1. On the [Update] tab, click [Search...].
2. Select the "setup.exe" file (software update).



3. Click [Update].
  - An alert message is displayed.



4. Confirm the message by clicking [OK].
  - A progress bar runs in the "Upload Status:" field.
  - Sentences 1. to 3. are shown in bold in sequence whilst the process is progressing. The installation can take several minutes.
  - The control computer in the plug-in supply unit of the laser system powers down and restarts.



After restarting the laser system, the software update is completed and the new versions of the Coherent software (RCU and VLM) are available.

### 9.4.3 [Restore] tab

All settings of the laser system can be reset to the factory settings on the [Restore] tab.

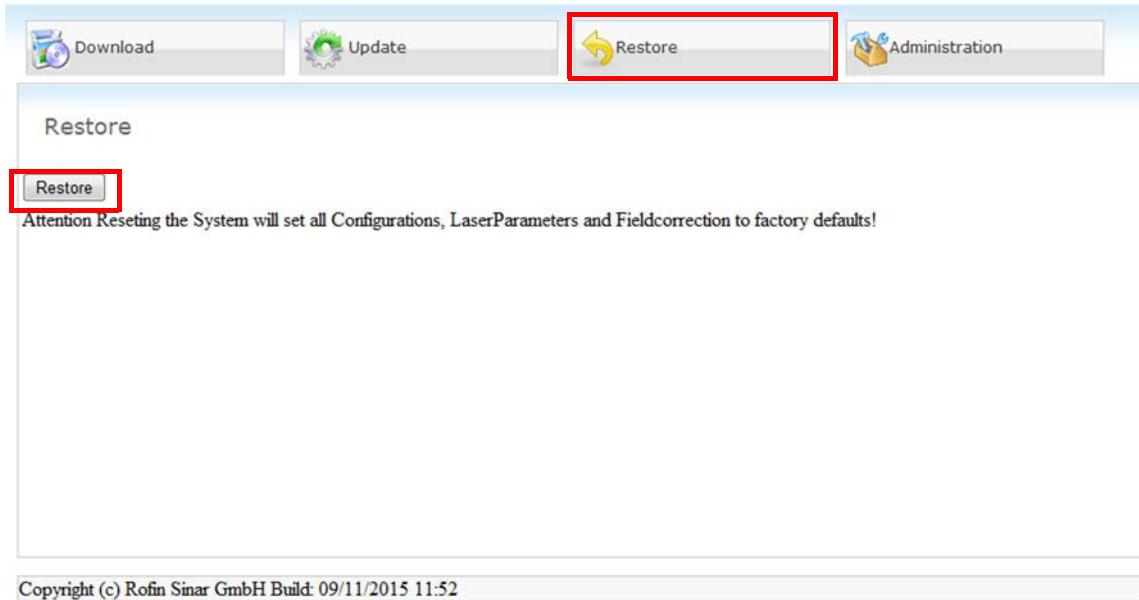
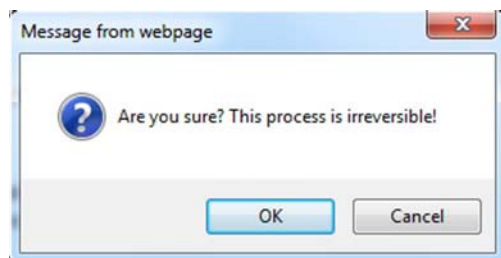


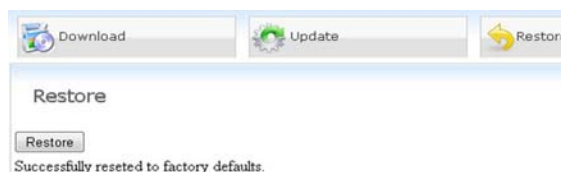
Fig. 9-5. [Restore] tab

#### Restore the factory settings as follows:

1. On the [Restore] tab, click [Restore].
  - An alert message is displayed.



2. Confirm the message by clicking [OK].
  - The successful restore process to the factory settings is displayed.



Resetting the laser system to the factory settings means that all settings made by the proprietor of the laser system are lost!

We recommend contacting Coherent Munich before resetting the laser system to the factory settings.

### 9.4.4 [Administration] tab

The [Administration] tab can be used to install fonts that are located on the external PC/notebook onto the control computer in the plug-in supply unit.

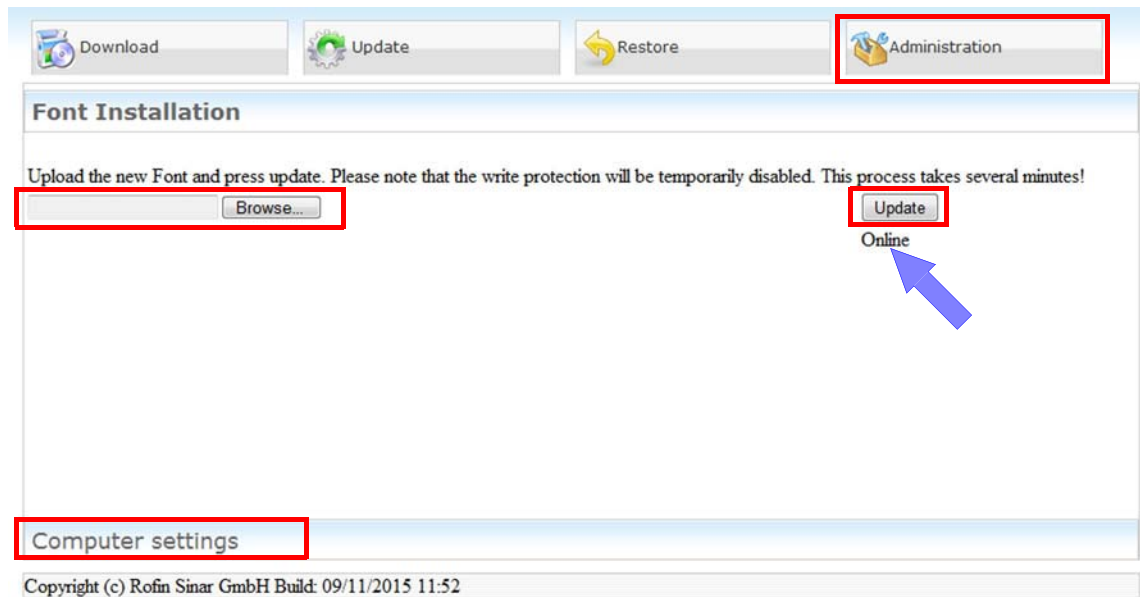
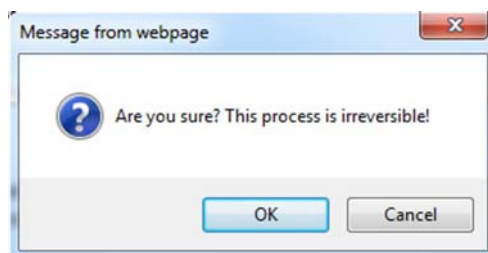


Fig. 9-6. [Administration] tab

#### 9.4.4.1 Install fonts

##### Install the font as follows:

1. On the [Administration] tab, click [Search...].
2. Select the required font on the external PC/notebook.
3. Click [Update].
  - An alert message is displayed.



4. Confirm the message by clicking [OK].
5. "Online" is displayed underneath the [Update] button. Wait until the display has changed from "Online" to "Shutdown" and then to "Restarted". This can take several minutes.

When "Restarted" is displayed, the installation of the font on the control computer in the plug-in supply unit is complete.



The font installation can be used by the laser system proprietor to use his own fonts to create VLM layouts in the VisualLaserMarker (VLM) marking program.

### 9.4.5

#### [Administration] tab, [Computer setting] menu

The [Administration] tab in the [Computer settings] menu can be used to carry out various system settings and the write protection can be switched on and off, i.e. switched to remote mode or local mode.

##### Open the [Computer settings] menu:

1. On the [Administration] tab, click [Computer settings].
  - The [Computer settings] drop-down menu is displayed.

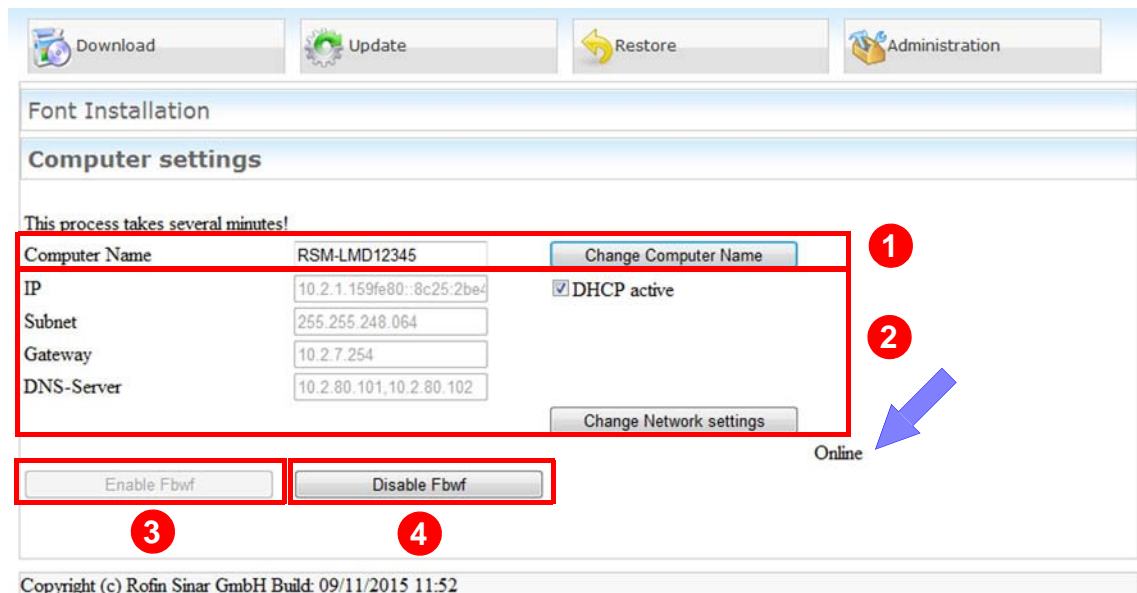


Fig. 9-7. [Computer settings] menu

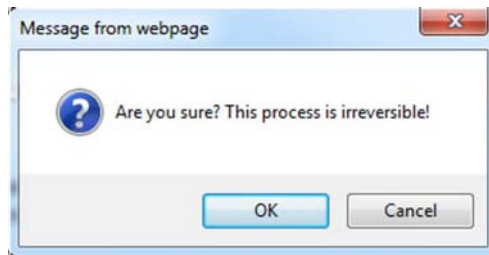
- |                        |                         |
|------------------------|-------------------------|
| 1 Change computer name | 3 Switch to remote mode |
| 2 Network settings     | 4 Switch to local mode  |

#### 9.4.5.1

#### Change the name of the external PC/notebook

1. Enter the required computer name into the "Computer name" field.
2. Click [Change computer name].
  - An alert message is displayed.





3. Confirm the message by clicking [OK].
4. Wait until the display has changed from "Online" to "Shutdown" and then to "Restarted". This can take several minutes.

Once "Restarted" is displayed, the name has been changed.

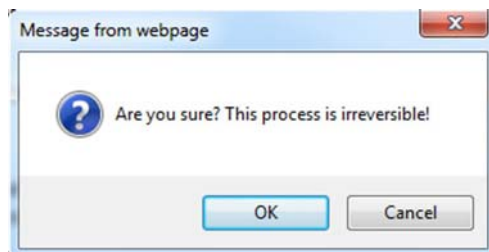


Please note that the address displayed in the web browser (<http://rsm-xxxxxxx>) is also changed when assigning the required computer name.

### 9.4.5.2

#### Change network settings

1. Network settings can be made in the fields "IP", "Subnet", "Gateway" and "DNS-Server" or "DHCP Active".
2. Click [Change network settings].
  - An alert message is displayed.



3. Confirm the message by clicking [OK].
  - The control computer in the plug-in supply unit of the laser system powers down and restarts. "Online" is displayed in the [Computer settings] menu.



We recommend contacting the network administration for network settings.

### 9.4.5.3

#### Switch to local mode - Switch off write protection

##### Preparatory measures:

- Remove the VLM dongle from the external PC/notebook.
- Connect the VLM dongle to the USB port of the plug-in supply unit of the laser system.
- Connect a monitor, keyboard and mouse to the plug-in supply unit.

**Disable write protection:**

1. Click [Disable Fbwf].
  - The control computer in the plug-in supply unit of the laser system powers down and restarts.



*Fig. 9-8. Write protection disabled*

After re-starting the laser system, it is possible to work in local mode via the monitor, keyboard and mouse.



---

The laser system is supplied in remote mode, in other words for operation with an external PC/notebook.

---

#### 9.4.5.4

#### **Switch to remote mode - Enable write protection**

**Preparatory measures:**

- Connection between the monitor, keyboard, mouse and plug-in supply unit.
- Connect the external PC/notebook and plug-in supply unit to the network via the LAN interface.

**Enable write protection:**

1. Click [Enable Fbwf].



*Fig. 9-9. Write protection enabled*

2. Wait until the control computer in the laser system plug-in supply unit powers down and restarts.
3. After restarting the laser system, remove the VLM dongle from the plug-in supply unit and connect to the LAN interface on the external PC/notebook.

## 10. LaserConsole program

Several applications can be started to control and configure the laser in the LaserConsole program.



Fig. 10-1. LaserConsole icon

The LaserConsole program is used for all lasers with the RCU (Rofin Control Unit) software.

The windows and status displays may vary depending on the system configuration, i.e. status displays or windows may or may not be displayed or assigned.

» *For detailed information on the LaserConsole program and the related applications, please see the separate User Manual for the LaserConsole program.*

### For operation in remote mode:

When starting applications, the following error message "Connection failed" is displayed if there is no LAN connection between the external PC and the plug-in supply unit.

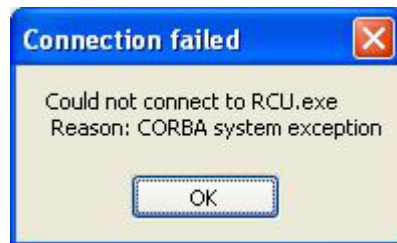


Fig. 10-2. "Connection failed" error message



# 11. Maintenance



## **DANGER**

### **Danger from electric voltage**

There is a risk of bodily injury or death due to electric shock.

- ⇒ When performing maintenance, inspection, and repair work, disconnect the laser system from the mains supply and secure it against restart.



## **DANGER**

### **Danger from laser radiation**

Damage to the eyes and to the skin is possible.

- ⇒ Work on laser beam emitting units may only be performed by service personnel from Coherent Munich GmbH & Co. KG.
- ⇒ Under no circumstances may any structural modifications be made to laser beam emitting units.
- ⇒ When performing all repair, maintenance and cleaning work, demarcate and enclose the laser area, i.e. the area exposed to "open laser beams" in which the work is being performed, using appropriate means (e.g. protective screens) and affix suitable warning signs.



## **DANGER**

### **Danger from failure to observe safety notes**

Possible bodily injury.

- ⇒ Observe the intended use and all safety notes contained in the "Safety" chapter when commissioning the system, especially the notes on laser radiation and personnel qualifications.



## **WARNING**

### **Danger from hazardous materials**

Respiratory diseases possible due to hazardous materials, particularly vapors and gases.

- ⇒ Do not blow off any existing processing residue (dust particles) in the laser system and processing area using compressed air; instead, use suitable suction apparatus to extract it.
- ⇒ Wear a respiratory mask and protective gloves when performing all cleaning and maintenance work (e.g. replacing contaminated filters or opening components).
- ⇒ Provide adequate ventilation or air extraction.
- ⇒ Observe the other applicable documents and safety data sheets when handling hazardous materials.



#### NOTICE

Non-observance of the safety notes can result in damage to the laser system.

## 11.1

### Maintenance measures to be taken

The following table gives an overview of the maintenance work to be performed on the laser system.



#### WARNING

##### Danger from missing or faulty safety devices

Risk of bodily injury

⇒ After maintenance and servicing is finished, check that all safety equipment is working properly.



#### NOTICE

Maintenance work being carried out incorrectly and missed maintenance interval deadlines can result in damage to the laser system.

⇒ Carry out the required adjustment, maintenance and inspection jobs at the prescribed intervals.

⇒ Check that any screw connections that were loosened are fastened tight again following reassembly.

### 11.1.1

#### Maintenance schedule

Component	Maintenance work	When
Safety equipment	Perform function test; check safety equipment	Each time the laser system is switched on  In shift operation, at least once a day
Filter mat	Clean (dry clean, e.g., by beating. Do <b>not</b> use water or any other cleaning agent!)	Dependent on operating and ambient conditions; at least once every six months
	Replace	As necessary; at least once a year
Fan on the plug-in supply unit	Inspection	Dependent on operating and ambient conditions; at least once a month
	Clean/vacuum	As necessary

Tab. 11-1. Maintenance schedule

Component	Maintenance work	When
<b>Fan on the laser head</b>	Inspection	Dependent on operating and ambient conditions; at least once a month
	Clean/vacuum	As necessary
<b>Protective glass/lens</b>	Clean surface Check surface for damage and deposits Contact Coherent Munich or an authorized dealer	Dependent on operating and ambient conditions
	Replace Contact Coherent Munich or an authorized dealer	If damage and deposits are present
<b>Laser head</b>	Replace Contact Coherent Munich or an authorized dealer	As necessary
<b>Optics module</b>	Replace Contact Coherent Munich or an authorized dealer	As necessary
<b>Software update</b>	Software installation Contact Coherent Munich or an authorized dealer	As necessary

Tab. 11-1. Maintenance schedule (Cont.)

## 11.2 Replacing the filter mat



### WARNING

#### Danger from improper reaching into the plug-in supply unit

Damaged components inside the plug-in supply unit can lead to malfunctions and associated hazards.

⇒ Under no circumstances should hands or tools be inserted into the plug-in unit.



### WARNING

#### Danger from incorrect or missing filter mat

Damaged components inside the plug-in supply unit can lead to malfunctions and associated hazards.

⇒ The dimensions of a new filter mat must identically fit the opening of the plug-in supply unit in order to prevent any dirt from entering.

⇒ Only use original filter mats from Coherent Munich.

⇒ Operation without a filter mat in place is prohibited.



### NOTICE

Improper operations carried out on the plug-in supply unit can result in damage to components inside the plug-in supply unit and result in malfunctions in the laser system.



### NOTICE

An incorrect or missing filter mat can result in dust deposits on the inside of the supply unit and in damage to the laser system. The working area must be kept free of dust and dirt while the filter mat is being replaced.



### NOTICE

Under no circumstances should water or other cleaning agents be used for cleaning the filter mat. The filter mat can become unusable, e.g. due to shrinking.

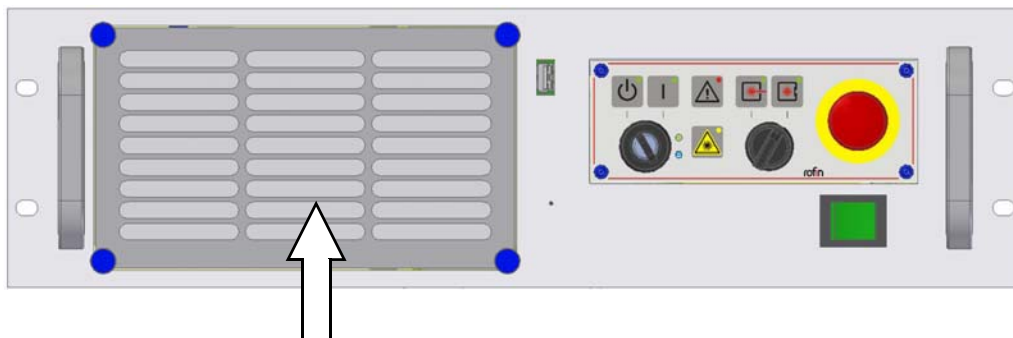


Fig. 11-1. Ventilation grate with filter mat on the plug-in supply unit



**Replace the filter mat as follows:**

1. Switch off the laser system.
2. Ensure there is no current to the plug-in supply unit, e.g. disconnect the mains plug (-X1).
3. Unscrew the knurled screws of the ventilation grate.
4. Remove and clean the filter mat, or replace it.
5. Put the cleaned or new filter mat back in place.
6. Fasten the ventilation grate over the filter mat.
7. Reconnect the mains plug.
8. Restart the laser system.

**11.3****Cleaning the fans****NOTICE**

Incorrect cleaning of the fans can result in damage to the laser system.

- ⇒ Do NOT remove the fans for cleaning work.
- ⇒ Do not use compressed air for cleaning under any circumstances.
- ⇒ Do not use corrosive cleaning agents or cleaning alcohol.
- ⇒ Do not tap dirt off; vacuum it off instead.

**NOTICE**

A dirty working environment can result in damage to the laser system.

- ⇒ The work area must be kept free of dust and dirt while the fans are being cleaned.



Fig. 11-2. Fan on the plug-in supply unit

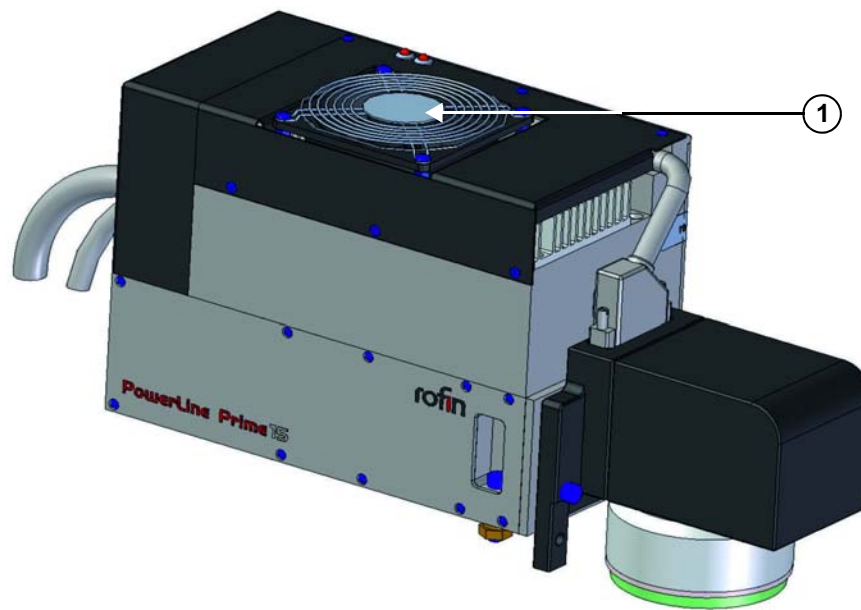


Fig. 11-3. Fan on the laser head

1 Fan

#### How to clean the fans:

1. Switch off the laser system.
2. Ensure there is no current to the plug-in supply unit, e.g. disconnect the mains plug (-X1).
3. Remove (vacuum off) any dirt on the fans.
4. Restore the connection with the mains power supply.
5. Restart the laser system.

## 11.4

### Protective covers

The protective covers are used to protect the laser system components during repair, maintenance and transport.



#### NOTICE

Dirty protective covers can result in damage to the optical components.

⇒ Do not attach any dirty protective covers. Optical components may be damaged if dirty protective covers are mounted.

⇒ Keep the protective covers dry and free from dust.

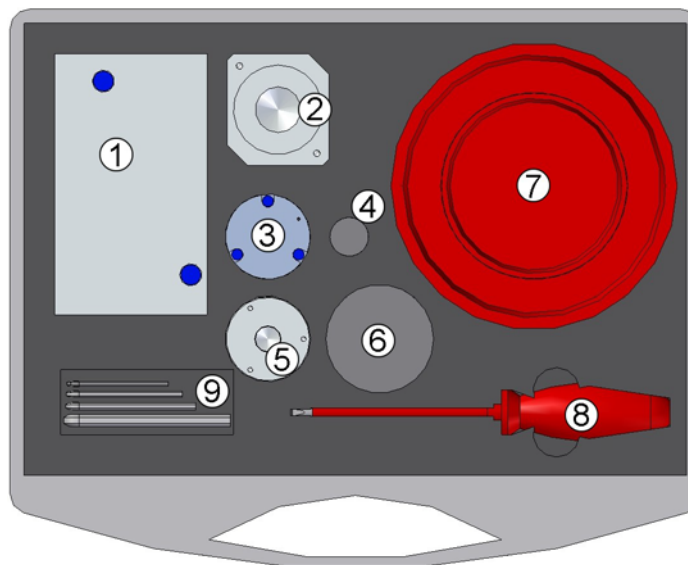


Fig. 11-4. Protective covers

Pos.	Article number	Designation
1	102 134 230	Protective cover; laser head; beam output
2	102 134 404	Protective cover; fiber plug; outside
3	102 134 320	Protective cover; laser head; fiber plug
4	./.	Protective cover; galvo; beam input
5	102 134 337	Protective cover; fiber plug; inside
6	./.	Protective cover; galvo; beam output
7	./.	Protective cover; lens f160; beam output Protective cover; lens f347; beam output
7b	./.	Protective cover; lens f160; beam input Protective cover; lens f347; beam input
8	./.	Screwdriver for electricians; size 3.5mm
9	150 500 266 150 500 267 150 500 268 150 500 230	Tools: Allen wrench Sizes: 2, 2.5, 3, 5

Tab. 11-2. Protective covers

## 11.5

### Cleaning and replacing the optical components

The optical components consist of the protective glass and the lens. The protective glass is screwed onto the lens.



#### NOTICE

Incorrect cleaning agents can result in damage to the optical components.

- ⇒ Use lens cleaning paper and anhydrous isopropyl alcohol (purity [GC]  $\geq 99.8\%$ ) or purified compressed air to clean the optical components. Water in isopropyl alcohol can cause streaks to form on the surface of optical components.



#### NOTICE

Improper cleaning, a dirty working environment and contaminated components in the laser system can result in damage to the optical components.

- ⇒ Do not damage optical components during cleaning.
- ⇒ Do not apply pressure.
- ⇒ Only wipe the lens cleaning paper in one direction.
- ⇒ Use a new piece of lens cleaning paper for each cleaning process.
- ⇒ Wear protective gloves (nitrile, Dermatrill) in order to avoid contaminating the optics.
- ⇒ The working area and laser system components must be free of dust and dirt before the protective glass or the lens is removed.
- ⇒ Do not attach any dirty protective covers. Optical components may be damaged if dirty protective covers are mounted.
- ⇒ Keep the protective covers dry and free from dust.



Replace the protective glass immediately if it is damaged.



Clean the surfaces of the optical components according to the maintenance schedule (see chapter [11.1.1 Maintenance schedule on page 11-2](#)).

## 11.5.1

## Changing the optical components

**CAUTION**

Danger from sharp-edged protective glass or fragments of the protective glass  
Possible lacerations.

⇒ Handle sharp-edged protective glass with care.

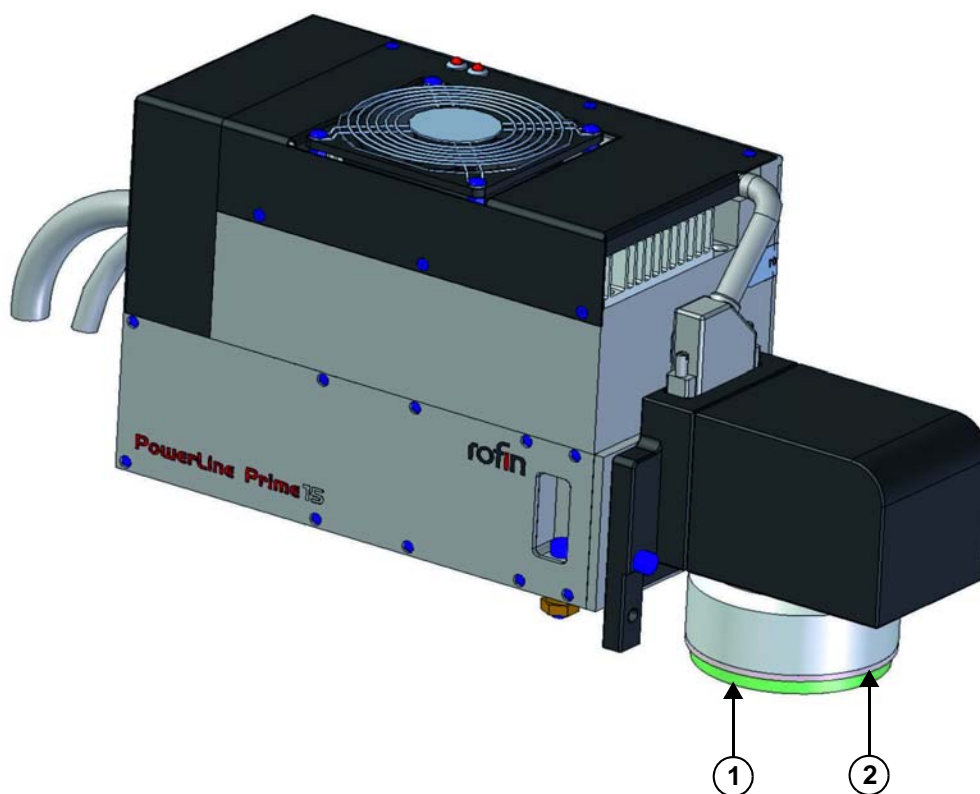


Fig. 11-5. Removing optical components

1 Lens

2 Spacer ring

**Remove optical components (protective glass, lens) as follows:**

1. Switch off the laser system.
2. Ensure there is no current to the plug-in supply unit, e.g. disconnect the mains plug (-X1).
3. Place the protective cap on the lens.
4. Unscrew the lens (1) (see figure [11-5 Removing optical components](#)) from the galvo.



- 
- To ensure easier turning, relieve the pressure (lift slightly) on the lens when unscrewing it.
  - Use caution with regard to the aluminum spacer ring (2) when removing the lens.
  - A case with diverse protective covers for the laser head, the galvo and the lens is attached to the laser system.
- » For an overview of the protective covers, see chapter [11.4 Protective covers on page 11-6](#).
- 

5. Attach the small protective cover (7) onto the rear of the lens (see chapter [11.4 Protective covers on page 11-6](#)).
6. Close the galvo entry opening with the associated protective cover (4) to prevent contamination inside the marking head (see chapter [11.4 Protective covers on page 11-6](#)).

**Fit optical components (protective glass, lens) as follows:**

1. Remove protective covers on the lens and galvo.
2. Put the protective covers back in the case again for reuse.
3. Screw a new lens into the galvo.



---

Use caution with regard to the aluminum spacer ring (2) when screwing in the lens.

---

4. Perform a field correction once the lens has been replaced. Please contact Coherent Munich or an authorized dealer for information about this.

### 11.5.1.1

#### Lenses f160 and f347

**Remove the protective glass as follows:**

1. Unscrew the protective glass from the lens. To do this, unscrew the upper, knurled ring.



---

All parts must be marked for reinstallation with suitable tools.

---

2. Remove the protective glass and perform cleaning (see chapter [11.5.2 Cleaning the optical components \(lens, protective glass\) on page 11-12](#)).

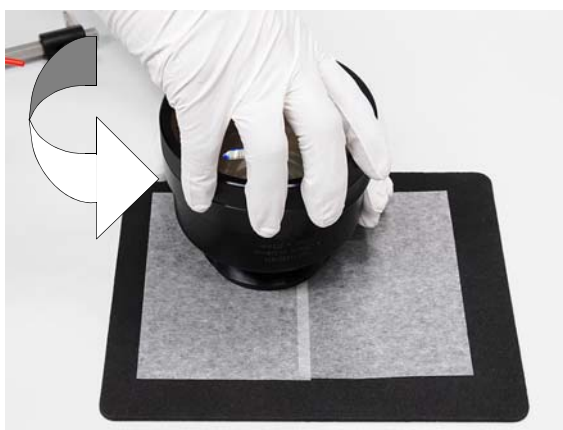


Fig. 11-6. Remove protective glass on f300 lens

### Procedure for removing a blocked protective glass:



To remove a stuck protective glass, the lens must be screwed out of the galvo (see chapter [11.5.1 Changing the optical components on page 11-9](#)).

The lens has been removed (see chapter [11.5.1 Changing the optical components on page 11-9](#)).

1. Place the lens, with the protective glass facing downwards, on a soft foam-rubber mat (e.g. a mouse pad that has been turned over).



### NOTICE

The surface on which the protective glass is placed must be completely free of any foreign objects so that the protective glass is not damaged.



Fig. 11-7. Setting the lens down

2. Exert axial pressure on the lens and unscrew the protective glass.



Fig. 11-8. Unscrewing a stuck protective glass

## 11.5.2

### Cleaning the optical components (lens, protective glass)

- Ensure that the optical components have been removed for cleaning (see chapter 11.5 [Cleaning and replacing the optical components on page 11-8](#)).
- Blow fine dust particles off the surfaces of the optical components using purified compressed air or nitrogen.
- Clean optical components using lens cleaning paper and isopropyl alcohol (purity [GC]  $\geq 99.8\%$ ).



For laser systems with a wavelength of 355 nm, cleaning residue left on the surfaces (lenses) of the optical components can lead to heat etching and their destruction.

#### Clean optical components as follows:

1. Blow the dust off of the surface to be cleaned using clean, dry and oil-free air or nitrogen.



#### **WARNING**

##### **Danger from nitrogen**

Possible bodily injury

⇒ If nitrogen is used, take the appropriate protective measures.

2. Using scissors, cut the lens cleaning paper so that you have a strip that is a little narrower than the surface to be cleaned. This ensures that the lens cleaning paper will lie entirely on the surface to be cleaned.





Fig. 11-9. Cleaning optical components (1)

3. Grasp the component to be cleaned from the sides.



Fig. 11-10. Cleaning optical components (2)

4. Place the lens cleaning paper on the surface to be cleaned and, with a pipette, apply one or two drops of isopropyl alcohol to the lens cleaning paper.



Fig. 11-11. Cleaning optical components (3)

5. Carefully pull off the paper which has been moistened with isopropyl alcohol.
6. Turn the component to be cleaned 90° and wipe the lens cleaning paper which has been moistened with isopropyl alcohol over the surface again. This minimizes streaking.

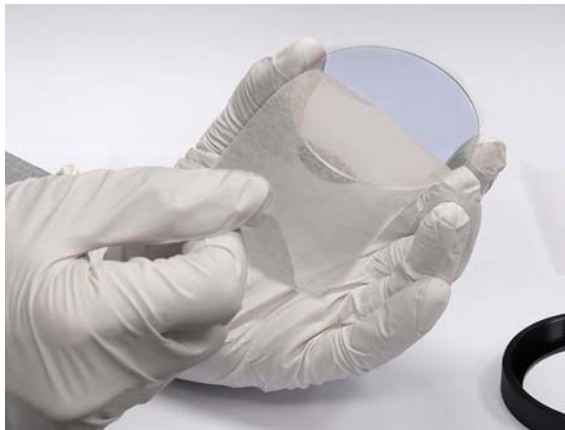


Fig. 11-12. Cleaning optical components (4)



---

**NOTICE**

Contamination of the optical components can result in damage to these components.

⇒ To prevent the component becoming dirty again, use a new piece of lens cleaning paper for each cleaning procedure

---

7. Repeat the cleaning procedure until the surface of the optics is clean.
8. Always clean both sides. During the cleaning process, make sure that the previously cleaned surface does not become dirty again and that it does not come into contact with isopropyl alcohol.

## 11.6

### Replacing the optics module

The optics module consists of the marking head (galvo) and the lenses with attached protective glass). The optics module is replaced as a unit with the lens, i.e. the lens remains assembled to the galvo and is not removed.



---

**NOTICE**

Before removing/installing the optics module, disconnect the laser system from the mains supply and secure it against restart to avoid damage from electric voltage.

---



---

**NOTICE**

A contaminated work environment, contaminated protective covers and improper handling can result in damage to the optical components.

- ⇒ The working area must be kept free of dust and dirt while the optics module is being installed/disassembled. Otherwise, components inside the laser head could be damaged.
- ⇒ Wear protective gloves (nitrile, Dermatrill) in order to avoid contaminating the optics.
- ⇒ Do not attach any dirty protective covers. Optical components may be damaged if dirty protective covers are mounted.
-



- All articles required to install the optics module (fastening screws, o-ring, etc.) are included for transport.
- A case with diverse protective covers for the laser head, the galvo and the lens is attached to the laser system (see chapter [11.4 Protective covers on page 11-6](#)).



When using protective films to cover the beam path of the marking head and laser head, we recommend using only films that leave no residue when removed.

### 11.6.1

### Removing/installing the optics module

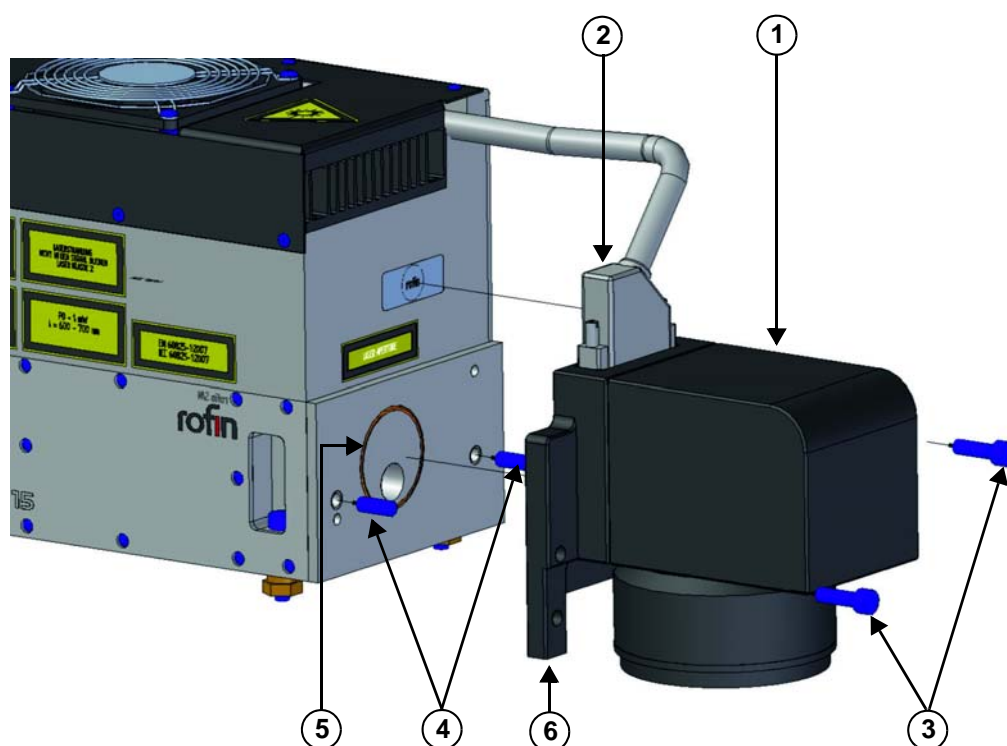


Fig. 11-13. Replacing the optics module

- |  |                         |
|--|-------------------------|
| 1 Optics module (marking head [galvo] with lens) | 4 Dowel pins (2x)       |
| 2 Galvo connector (interface -X57)               | 5 O-ring (sealing ring) |
| 3 Fastening screws (2x)                          | 6 Flange                |

#### Remove the optics module as follows:



#### NOTICE

Only remove or insert the connecting cable of the optics module when it is not energized (turn off the main switch).

1. Switch off the laser system (see chapter [8. Operation on page 8-1](#)).
2. Ensure there is no current to the plug-in supply unit, e.g. disconnect the mains plug (-X1).

3. Thoroughly clean the working area.
4. Loosen and unplug the connector (2) on the optics module (1).
5. Unfasten the fastening screws (3) on the flange (6).
6. Remove the optics module (1).
7. Check the o-ring (5) for damage and, if necessary, replace it.



Both the alignment pins (4) and the o-ring (5) remain in the dowel hole or in the groove on the laser head.

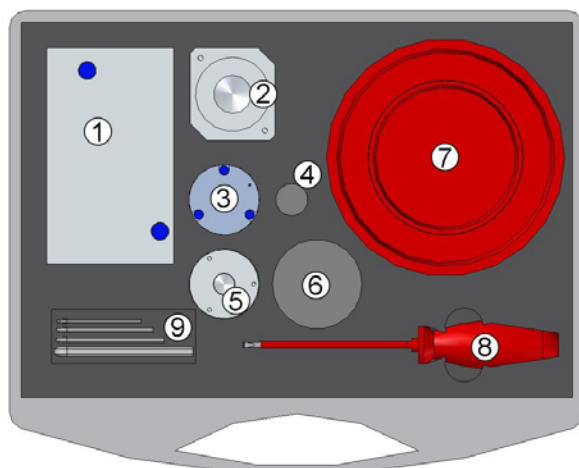


Fig. 11-14. Protective covers

8. Close the laser beam aperture with the protective cover (1) to prevent contamination inside the laser head.
9. Close the galvo entry opening with the protective cover (4) to prevent contamination inside the optics module.
10. Place the protective cap (7) on the lens.

#### Fit the optics module as follows:



#### NOTICE

Only put the laser system back into operation once the optics module has been fitted. Otherwise, components inside the laser head could be damaged.



The laser system is switched off (see chapter [11.6.1 Removing/installing the optics module on page 11-15](#)).

1. Remove all protective covers from the galvo, laser head and lens (see chapter [11.6.1 Removing/installing the optics module on page 11-15](#)).
2. Put the protective covers back in the case again for reuse.
3. Check the alignment pins (4) and o-ring (5) for damage and replace if necessary.
4. Position the optics module (1) on the laser head via the alignment pins (3) and use the two fixing screws (3) to screw onto the laser head via the flange.

5. Plug the connector (2) (interface -X57) onto the optics module and screw on.
6. Establish an electrical network connection for the plug-in supply unit.
7. Commission the laser system (see chapter [8. Operation on page 8-1](#)).

## 11.7

### Replacing the laser head



---

**NOTICE**

Disconnect the laser system from the mains before disassembly/assembly of the laser head and secure against reactivation to prevent it being damaged by electric voltage.

---



---

**NOTICE**

A dirty working environment and improper handling can result in damage of the optical components.

- ⇒ The working area must be kept free of dust and dirt while the laser head is being installed/disassembled. Otherwise, components inside the laser head could be damaged.
  - ⇒ Wear protective gloves (nitrile, Dermatril) in order to avoid contaminating the optics.
- 



---

A case with diverse protective covers for the laser head, the galvo and the lens is attached to the laser system (see chapter [11.4 Protective covers on page 11-6](#)).

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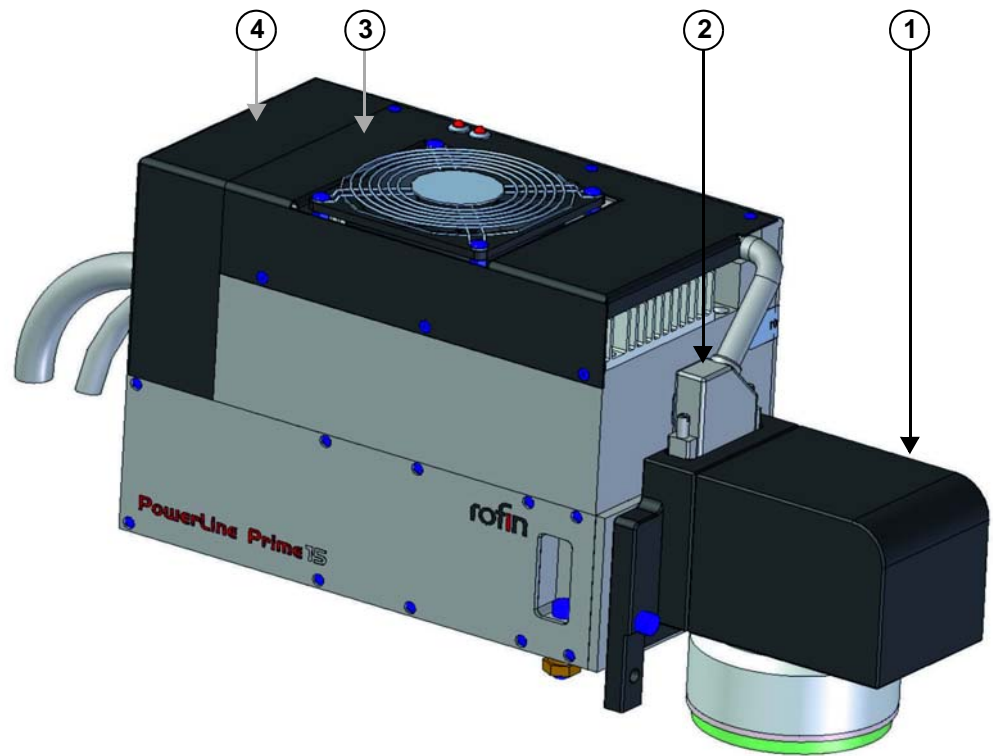


Fig. 11-15. Replacing the laser head

- |                                    |                    |
|------------------------------------|--------------------|
| 1 Optics module                    | 3 Laser head cover |
| 2 Galvo connector (interface -X57) | 4 Laser head cover |

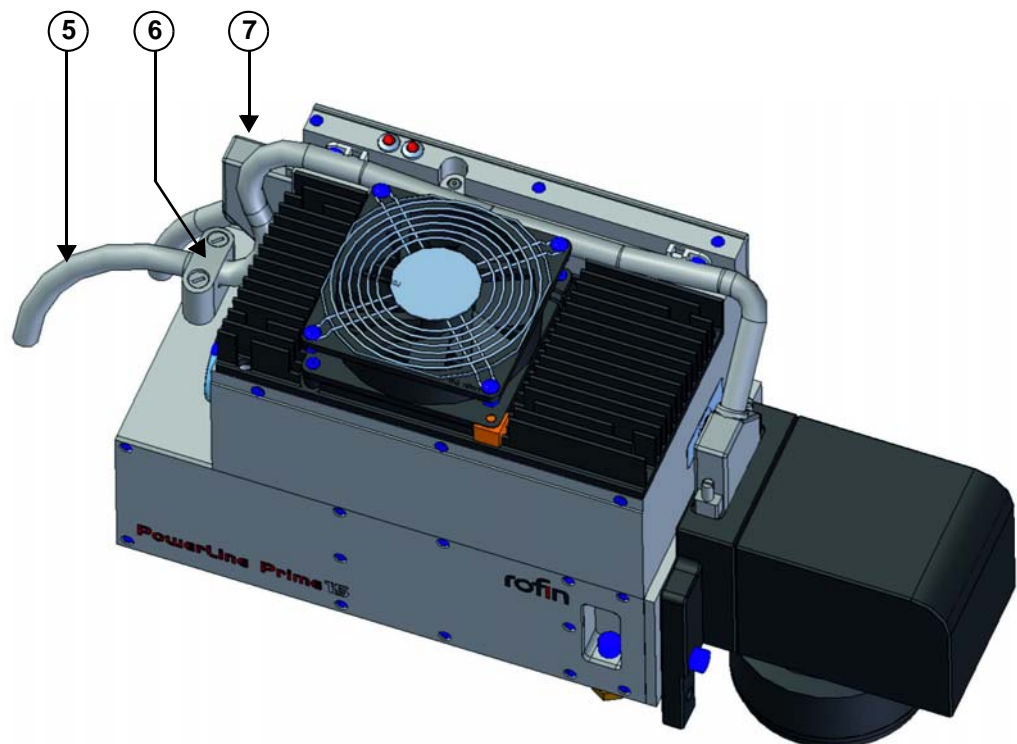


Fig. 11-16. Replacing the laser head - electric plug connections

5 Optics module connection cable  
6 Tension relief

7 Laser head connector (interface -X51a)

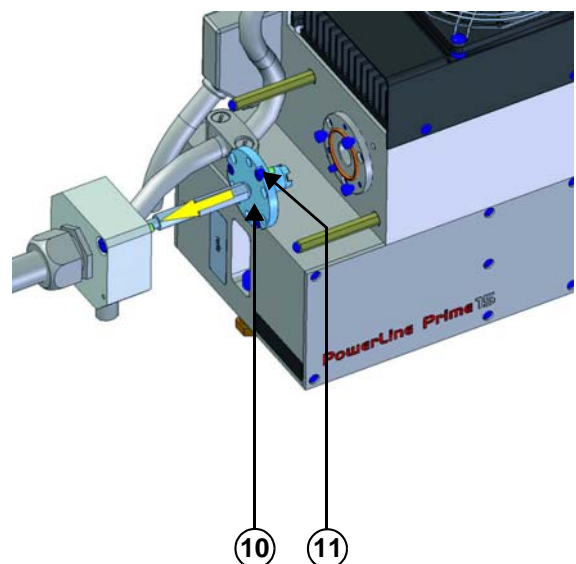
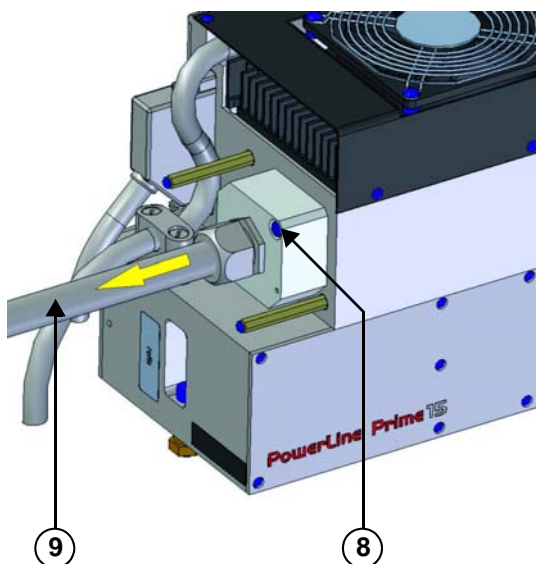


Fig. 11-17. Replacing the laser head - Disconnecting the glass fibers on the laser head

8 Fastening screws (2x)  
9 Protective tube (glass fiber)

10 Collimation unit fastening  
11 Fastening screws (3x) collimation unit



## 11.7.1 Removing/fitting the laser head

### Remove the laser head as follows:

1. Switch off the laser system (see chapter 8. Operation on page 8-1).
2. Ensure there is no current to the plug-in supply unit, e.g., disconnect the mains plug (-X1).
3. Thoroughly clean the working area.
4. Remove the optics module (1) (see chapter 11.6.1 Removing/installing the optics module on page 11-15).
5. Remove covers (3) and (4) from the laser head.
6. Open the tension relief (6) of the optics module connecting cable (5) by unfastening and removing the screws.
7. Remove the optics module connection cable (5) and re-fit the tension relief (6).
8. Unfasten the connecting plug (7) (interface -X51a) on the laser head and remove.



The two cables with the electrical plug connections remain with the proprietor of the laser system or on the plug-in supply unit.

9. Unscrew the two fastening screws (8) and push the protective tube (9) of the glass fiber approx. 100 mm towards the back in the direction of the arrow until the fastening (10) of the collimation unit is freely accessible.
10. Unfasten the three fastening screws (11) of the collimation unit and carefully pull the collimation unit in the direction of the arrow

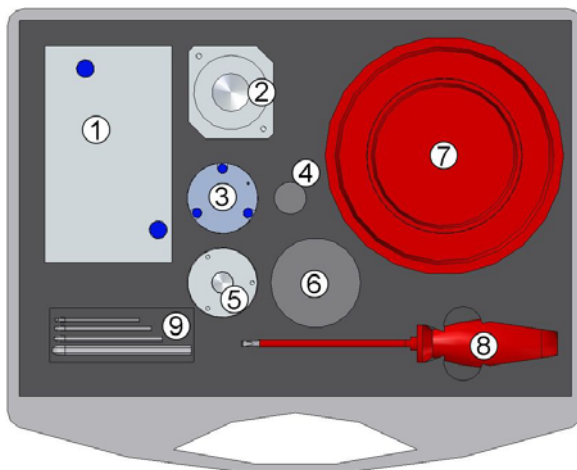


Fig. 11-18. Protective covers

11. Fasten the protective covers (2) and (5) on the collimation unit to prevent contamination of the glass fibers.
12. Close the opening of the collimation unit by installing the protective cover (3) in order to prevent contamination inside the laser head.



**NOTICE**

Incorrect handling of optical components can result in damage to the laser system.

- ⇒ Under no circumstance should you touch and/or contaminate the optical components!
- ⇒ These optical components are only permitted to be cleaned by Coherent Munich.

**13.** Dismantle the laser head.

**DANGER****Danger of laser radiation emission from the glass fibers**

Potential burning hazard to the eyes and skin.

- ⇒ After the laser head has been removed, the re-activation of the laser system must be effectively prevented.

**Fit the laser head as follows:**

1. Remove all protective covers from the laser head and from the glass fibers (see chapter [11.7.1 Removing/fitting the laser head on page 11-20](#)).
2. Put the protective covers back in the case again for reuse.
3. Fit the collimation unit fixing (10) to the laser head using the fastening screws (11).

**NOTICE**

Incorrect handling of optical components can result in damage to the laser system.

- ⇒ Under no circumstance should you touch and/or contaminate the optical components!
- ⇒ These optical components are only permitted to be cleaned by Coherent Munich.

4. Slide the protective hose of the glass fibers (9) in the direction of the laser head and fix using the fixing screws (8).
5. Open the tension relief (6) of the optics module connecting cable (5) by unfastening and removing the screws.
6. Plug the connector (2) (interface -X57) onto the optics module and screw on.
7. Close the tension relief (6) of the optics module connection cable (5) and tighten the screws hand-tight.
8. Plug the connector (7) (interface -X51a) onto the laser head and screw-fasten.
9. Fasten covers (3) and (4) back onto the laser head.
10. Fitting the optics module (see chapter [11.6.1 Removing/installing the optics module on page 11-15](#)).
11. Establish an electrical network connection for the plug-in supply unit.
12. Commission the laser system (see chapter [8. Operation on page 8-1](#)).

## 11.8 Software update

The Coherent software on the control computer of the laser system's plug-in supply unit can be updated by means of a software update. The software update ("setup.exe" file) can be directly downloaded from the Coherent Munich GmbH & Co. KG server or obtained from a Coherent Munich branch.

» For more information on the system requirements as well as the installation of the software, see chapter 9. [PowerLine Prime Web Interface on page 9-1](#).



During a software connection, the LAN connection to the PC/notebook of the laser system proprietor is not permitted to be interrupted nor the plug-in supply unit or the PC/notebook switched off.



The network connection of the PC must be configured in such a way that the IP address and the DNS address are obtained automatically.

» For detailed information on the settings procedure, please refer to the operating system documentation or ask the network administrator of the laser system proprietor.



Depending on the operating system and the security settings, requests for agreeing to certain installation steps are displayed. Acknowledge these messages with [OK].

### **The following prerequisites must be fulfilled before the software update can be carried out:**

- The laser system is switched on, the plug-in supply unit is in standby mode, and the shutter is closed (see chapter 8.1 [Switching on in normal operation on page 8-1](#)).
- All tools and foreign parts have been removed from the processing area.
- All protective measures regarding laser safety have been taken.
- No other sources of danger are present.
- Ensure that the Coherent software is closed.
- The "setup.exe" file is saved onto the external PC/notebook or onto the control computer of the plug-in supply unit, e.g. on the desktop.
- The laser system can be accessed via a web browser.

If the requirements above have been met, the software update can be started (see chapter 9.4.2 [\[Update\] tab on page 9-4](#)).

## 11.9 Removing the hard disk

Data of the proprietor of the laser system, such as parameter settings, VLM layouts, etc. is saved on a removable hard disk (1).

In case of repair, the plug-in supply unit must be returned to Coherent Munich or an authorized dealer. The hard disk must be removed before returning the plug-in supply unit. Once removed, the hard disk can be installed in a new plug-in supply unit, thereby reestablishing access to the hard disk.

Once the hard disk has been installed in a new plug-in supply unit, the data must be transferred from this hard disk to the computer of the new plug-in supply unit.

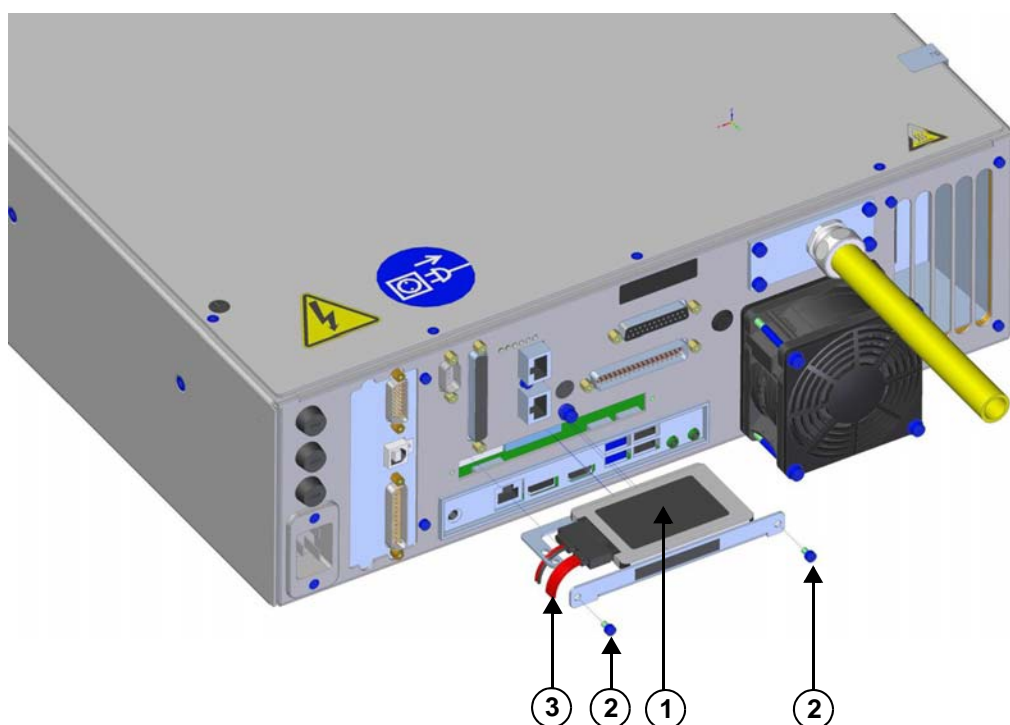


Fig. 11-19. Removable hard disk (plug-in supply unit)

- 1 Hard disk with the data of the proprietor of the laser system
- 2 Fastening screws
- 3 Hard disk connection cable

**Remove the hard disk from the plug-in supply unit as follows:**

1. Switch off the laser system.
2. Ensure there is no current to the plug-in supply unit, e.g. disconnect the mains plug (-X1).
3. Loosen the fastening screws (2) with an Allen key (size 2.5) and remove them.
4. Carefully pull out the hard disk (1) from the plug-in supply unit until the hard disk connection cable (3) is freely accessible.
5. Remove the cable binding strip on the hard disk connection cable (3).
6. Disconnect the hard disk connection cable (3) from the hard disk (1).
7. Remove the hard disk (1) containing the data from the old plug-in supply unit.
8. Also remove the hard disk from the new plug-in supply unit, as described here.
9. Insert the hard disk (1) with the data into the new plug-in supply unit.
10. Connect the hard disk connection cable (3) to the hard disk (1).
11. Fix the hard disk connection cable (3) with a cable binding strip.
12. Insert the hard disk (1) into the plug-in supply unit and fasten it by means of the fastening screws (2).



New plug-in supply units are delivered with hard disk. This hard disk must be replaced by the hard disk containing the data of the proprietor of the laser system. The hard disk of the new plug-in supply unit remains with the proprietor of the laser system.



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In case of repair, the fastening screws from the removed hard disk are not sent and remain with the proprietor of the laser system.

---

**Transfer data from the hard disk to the computer of the plug-in supply unit:**

- 13.** Once the hard disk (1) has been installed in the new plug-in supply unit, the data must be transferred from this hard disk (1) to the computer of the new plug-in supply unit. This is done by installing the VisualLaserMarker (VLM) marking software.
  - » *Detailed information on the procedure for installing the VisualLaserMarker (VLM) marking software can be found on the VLM installation data carrier and in the special "Rofin-Backup" documentation on the documentation CD.*
- 14.** Restart the laser system.

## 11.10

### Articles for maintenance and repair

Articles for maintenance and repair as well as accessories can be purchased via the Service department of Coherent Munich GmbH & Co. KG.

The aids required for performing maintenance work can also be purchased from the Service department of Coherent Munich GmbH & Co. KG. This includes protective gloves, lens wipes, assembly tools for protective glasses, etc.

## 12. Troubleshooting

### 12.1 Warnings and error messages

In general, there are two types of error display:

- Warnings (the laser system continues to run)
- Errors (the laser system is switched off)



#### NOTICE

In the event of an error, the laser system will be switched off for safety reasons. First, the cause of the error must be removed. Subsequently, the error message is acknowledged (see chapter 8. [Operation on page 8-1](#)).

#### 12.1.1 Acknowledging an error message

##### How to acknowledge an error message:

- Turn the key switch (-S2) back to the left position (Mains on).

Or:

- Click the [Reset Errors] button on the **[Diagnostic]** screen in the LaserConsole program ("LaserDisplay" application).



If the error message cannot be acknowledged by clicking the **[Reset Errors]** button, turn the key switch (-S2) back to the left position (Mains on).

#### 12.1.2 Operating status and error displays

The operating statuses of the laser system are shown, along with any warnings and error messages, in the LaserConsole program ("Laser Display" application) on the relevant tabs of the **[Diagnostic]** and **[Info]** screens.

- » *For detailed information on the LaserConsole program and the related applications, please see the separate User Manual for the LaserConsole program.*
- » *See also chapter 10. [LaserConsole program on page 10-1](#).*

## 12.1.2.1

**Table of warnings and error messages**

The warnings and error messages are listed in the following table along with their possible causes.

Error no.	Error/warning	Measure
E60401	Shutter error	<ul style="list-style-type: none"> <li>Check the plug-in unit cable for laser head</li> <li>Exchange the laser head</li> </ul>
E60501	Timeout precooling	<ul style="list-style-type: none"> <li>Check the ambient temperature and the filter mat</li> <li>Exchange the plug-in unit</li> </ul>
E60502	Timeout preheating	<ul style="list-style-type: none"> <li>Check the ambient temperature and the filter mat</li> <li>Exchange the plug-in unit</li> </ul>
E60503	No communication with Peltier module	<ul style="list-style-type: none"> <li>Exchange the plug-in unit</li> </ul>
E60504	Timeout stabilize	<ul style="list-style-type: none"> <li>Check the ambient temperature and the filter mat</li> <li>Exchange the plug-in unit</li> </ul>
E60505	Diode 1: Temperature beyond maximum limit	<ul style="list-style-type: none"> <li>Check the ambient temperature and the filter mat</li> <li>Exchange the plug-in unit</li> </ul>
E60506	Crystal 1: Temperature beyond maximum limit	<ul style="list-style-type: none"> <li>Check the installation (no real error)</li> </ul>
E60507	Q-switch driver 1 temperature beyond maximum limit	<ul style="list-style-type: none"> <li>Check the ambient temperature and the filter mat</li> <li>Exchange the plug-in unit</li> </ul>
E60508	Bottom plate 1 temperature beyond maximum limit	<ul style="list-style-type: none"> <li>Check the ambient temperature and the filter mat.</li> <li>Exchange the plug-in unit</li> </ul>
E60509	Diode 1 temperature sensor malfunction	<ul style="list-style-type: none"> <li>Exchange the plug-in unit</li> </ul>
E60510	Crystal 1 temperature sensor malfunction	<ul style="list-style-type: none"> <li>Exchange the plug-in unit</li> </ul>
E60511	Q-switch-driver 1 temperature sensor malfunction	<ul style="list-style-type: none"> <li>Exchange the plug-in unit</li> </ul>
E60512	Bottom plate 1 sensor malfunction	<ul style="list-style-type: none"> <li>Exchange the plug-in unit</li> </ul>
E60701	Q-switch temperature beyond maximum limit	<ul style="list-style-type: none"> <li>Exchange the laser head</li> </ul>
E60702	Q-switch driver no response	<ul style="list-style-type: none"> <li>Exchange the laser head</li> </ul>
E60703	Q-switch driver wrong response	<ul style="list-style-type: none"> <li>Exchange the laser head or the plug-in unit</li> </ul>

Tab. 12-1. Warnings and error messages

Error no.	Error/warning	Measure
E60704	Q-switch driver supply voltage below limit	<ul style="list-style-type: none"> <li>Exchange the plug-in unit</li> </ul>
E60801	Diode power supply temperature beyond maximum limit	<ul style="list-style-type: none"> <li>Exchange the plug-in unit</li> </ul>
E60802	Diode power supply no response	<ul style="list-style-type: none"> <li>Exchange the plug-in unit</li> </ul>
E60803	Diode power supply wrong response	<ul style="list-style-type: none"> <li>Exchange the plug-in unit</li> </ul>
E60804	Diode voltage below minimum limit	<ul style="list-style-type: none"> <li>Exchange the plug-in unit</li> </ul>
E60805	Diode voltage beyond minimum limit	<ul style="list-style-type: none"> <li>Exchange the plug-in unit</li> </ul>
E60806	Diode current below minimum limit	<ul style="list-style-type: none"> <li>Exchange the plug-in unit</li> </ul>
E60807	Diode current measurement value too high	<ul style="list-style-type: none"> <li>Exchange the plug-in unit</li> </ul>
E60901	Error beam protection time	<ul style="list-style-type: none"> <li>Exchange the plug-in unit</li> </ul>
E60902	Error shutter protection time	<ul style="list-style-type: none"> <li>Exchange the plug-in unit</li> </ul>
E60903	Error gate monitoring	<ul style="list-style-type: none"> <li>Exchange the plug-in unit</li> </ul>
E60904	Error temperature drawer	<ul style="list-style-type: none"> <li>Check the ambient temperature and the filter mat</li> <li>Exchange the plug-in unit</li> </ul>
E60905	Error temperature laser head	<ul style="list-style-type: none"> <li>Check the ambient temperature and the fan</li> <li>Exchange the laser head</li> </ul>
E60909	Error key switch	<ul style="list-style-type: none"> <li>Turn the key switch to the zero position</li> </ul>

Tab. 12-1. Warnings and error messages (Cont.)

## 12.2 Errors in laser system





Error	Possible cause	Remedy
<b>Laser head</b>		
Fan does not rotate	Fan is stuck	<ul style="list-style-type: none"> <li>Check for foreign parts</li> </ul>
	Cable for laser head, plug -X51 or -X51a not connected or badly connected	<ul style="list-style-type: none"> <li>Check plug -X51 or -X51a</li> </ul>
	No mains voltage	<ul style="list-style-type: none"> <li>Check mains connection</li> </ul>
	No control voltage (status display <b>LED 24V</b> on the rear of the plug-in supply unit does not light up (see chapter <a href="#">4.4 Operating and display elements on page 4-6</a> ).	<ul style="list-style-type: none"> <li>Check micro fuse F3 in the plug-in supply unit and replace it if necessary</li> <li>Contact Coherent Munich Service department</li> </ul>
	Fan is not connected	<ul style="list-style-type: none"> <li>Check plug connection -XM3 (located behind cover (4) (see chapter <a href="#">11.7 Replacing the laser head on page 11-17</a>)</li> </ul>
	Fan defective	<ul style="list-style-type: none"> <li>Contact Coherent Munich Service department</li> </ul>
Galvo has no function	Cable for laser head, plug XA2 or X57 not connected or badly connected	<ul style="list-style-type: none"> <li>Check plug -XA2 or -X57 and cable. Check cable for damage</li> </ul>
	No operating voltage +15/-15	<ul style="list-style-type: none"> <li>Check status displays <b>LED +15 V</b> and <b>LED -15 V</b> on plug-in supply unit (see chapter <a href="#">4.4 Operating and display elements on page 4-6</a>).</li> </ul> <p>If one or both LEDs do not light up, contact Coherent Munich Service department</p>
<b>Plug-in supply unit</b>		
<p>Plug-in supply unit remains inactive.</p> <p>Mains switch (-S1) on plug-in supply unit is at position I "ON"</p> <p>Switch lamp <b>does not light up</b></p>	No mains voltage	<ul style="list-style-type: none"> <li>Check mains connection</li> <li>Check micro fuses F1 and F2 in the plug-in supply unit and replace them if necessary</li> <li>Contact Coherent Munich Service department</li> </ul>

Tab. 12-2. Errors in laser system



Error	Possible cause	Remedy
Plug-in supply unit remains inactive.  Mains switch (-S1) on plug-in supply unit is at position I "ON"	No control voltage (status display <b>LED 24V</b> on the rear of the plug-in supply unit lights up (see chapter 4.4 <a href="#">Operating and display elements on page 4-6</a> )	<ul style="list-style-type: none"> <li>Check micro fuse F3 in the plug-in supply unit and replace it if necessary</li> <li>Contact Coherent Munich Service department</li> </ul>
Switch lamp <b>lights up</b> (green)	Control error (status displays <b>LED 24V</b> and <b>LED 24VF</b> on the rear of the plug-in supply unit lights up (see chapter 4.4 <a href="#">Operating and display elements on page 4-6</a> )	<ul style="list-style-type: none"> <li>Contact Coherent Munich Service department</li> </ul>
Fan at the rear side (M2) does not rotate	Fan is stuck	<ul style="list-style-type: none"> <li>Check for foreign parts</li> </ul>
	Fan defective	<ul style="list-style-type: none"> <li>Contact Coherent Munich Service department</li> </ul>
	Ambient temperature is low	<ul style="list-style-type: none"> <li>No error, because fan (M2) is temperature-controlled</li> <li>If the fan does not run when the plug-in supply unit is switched on, please contact Coherent Munich service department</li> </ul>
	Laser is in operation; diode current supply is in standby mode	<ul style="list-style-type: none"> <li>No error, because fan (M2) is temperature-controlled</li> </ul>
Fan at the rear (M2) rotates slowly	No error as the fan (M2) is temperature-controlled	./.
Laser cannot be started	Emergency stop is pressed	<ul style="list-style-type: none"> <li>Unlock emergency stop and reset emergency stop mechanism (key switch [S2] is in left position [Mains on])</li> </ul>
	Main voltage was switched on again when the key switch (-S2) was in the left position	<ul style="list-style-type: none"> <li>Turn key switch (-S2) in the right position</li> </ul>
	The jumper plugs -X42a and -X86 are <b>not</b> connected at the rear of the plug-in supply unit or the integration interfaces are connected <b>incorrectly</b> (see chapter 6.7 <a href="#">Laser interface -X42a on page 6-11</a> ).	<ul style="list-style-type: none"> <li>Check connections or jumper plugs</li> </ul>

Tab. 12-2. Errors in laser system (Cont.)

Error	Possible cause	Remedy
Shutter does not open	The jumper plugs -X42a and -X86 are <b>not</b> connected at the rear of the plug-in supply unit or the integration interfaces are connected <b>incorrectly</b> (see chapter <a href="#">6.7 Laser interface -X42a on page 6-11</a> ).	<ul style="list-style-type: none"> <li>Check connections or jumper plugs</li> </ul>
	Plug -X51 or -X51a not connected or badly connected	<ul style="list-style-type: none"> <li>Check plug -X51 or -X51a and cable</li> </ul>
	Shutter defective	<ul style="list-style-type: none"> <li>Contact Coherent Munich Service department</li> </ul>
No start screen	Green LED for the "Processor operating mode" status display  (-H8) <b>does not light up</b> . Green LED for the "Mains on" status display  (-H1) <b>lights up</b> .	<ul style="list-style-type: none"> <li>Power supply for the ITX board is faulty.</li> <li>Contact Coherent Munich Service department.</li> </ul>
	Green LED for the "Processor operating mode" status display  (-H8) <b>lights up</b> . Blue LED for the "Hard disk being accessed" status display  (-H7) <b>does not light up</b> .	<ul style="list-style-type: none"> <li>Possible boot error.</li> <li>Contact Coherent Munich Service department.</li> </ul>
No start screen following power on	Monitor without line voltage; error on HDMI signal cable	<ul style="list-style-type: none"> <li>Check monitor's power supply</li> <li>Check HDMI cable</li> </ul>
	Computer does not boot up » <i>For further information, see "No start screen" error</i>	<ul style="list-style-type: none"> <li>Restart the computer (turn main switch [S1] to position <b>0</b> "OFF" and, after around 5 seconds, back to position <b>I</b> "ON")</li> </ul>
Cursor not responding	Connection error to mouse	<ul style="list-style-type: none"> <li>Check mouse connection cable and USB port</li> <li>Check mouse</li> <li>Restart the system</li> </ul>
Keyboard not functioning	Connection error to keyboard	<ul style="list-style-type: none"> <li>Check keyboard connection cable and USB port</li> <li>Check keyboard</li> <li>Restart the system</li> </ul>

Tab. 12-2. Errors in laser system (Cont.)

Error	Possible cause	Remedy
No marking, although a marking job is being executed	Shutter does not open	<ul style="list-style-type: none"> <li>Perform troubleshooting as described for the "Shutter does not open" error</li> </ul>
	Supply cable to marking head badly connected or not connected	<ul style="list-style-type: none"> <li>Check plugs -XA3 (plug-in supply unit) and -X57 (galvo)</li> </ul>
	No galvo operating voltage +15/-15	<ul style="list-style-type: none"> <li>Check status displays LED +15V and LED -15V on the plug-in supply unit (see chapter <a href="#">4.4 Operating and display elements on page 4-6</a>).</li> </ul> <p>If one or both LEDs do not light up, contact Coherent Munich Service department</p>

Tab. 12-2. Errors in laser system (Cont.)



If the error cannot be rectified, please contact the Coherent Munich Service department. For all inquiries, have the equipment number and the data contained on the type plate ready (see chapter [2.5 Labeling and warning signs on page 2-12](#)).

12.3

Image errors



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

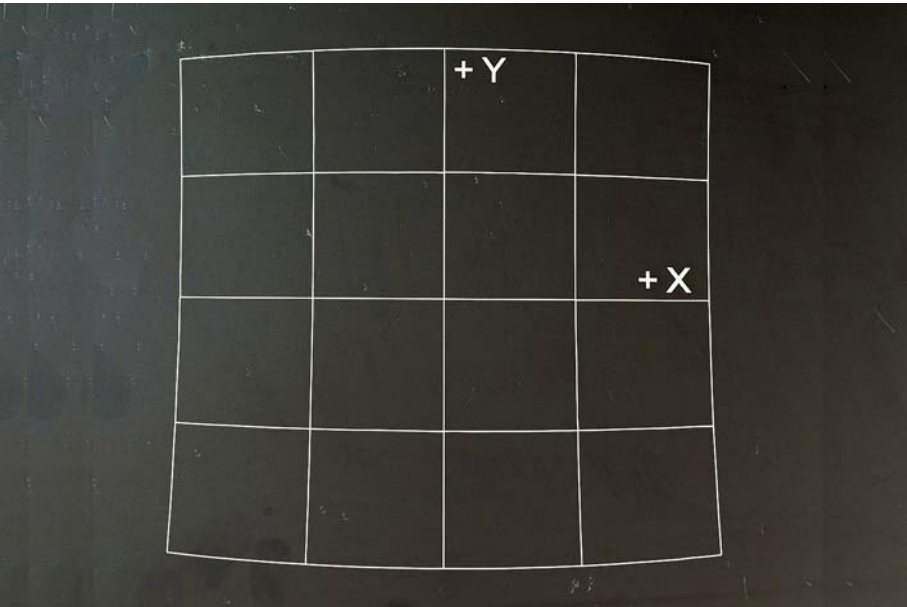


Fig. 12-1. Barrel- or pillow-shaped distortion

Error	Remedy
Barrel- and/or pillow-shaped distortions in the X and Y directions	Contact Coherent Munich Service department

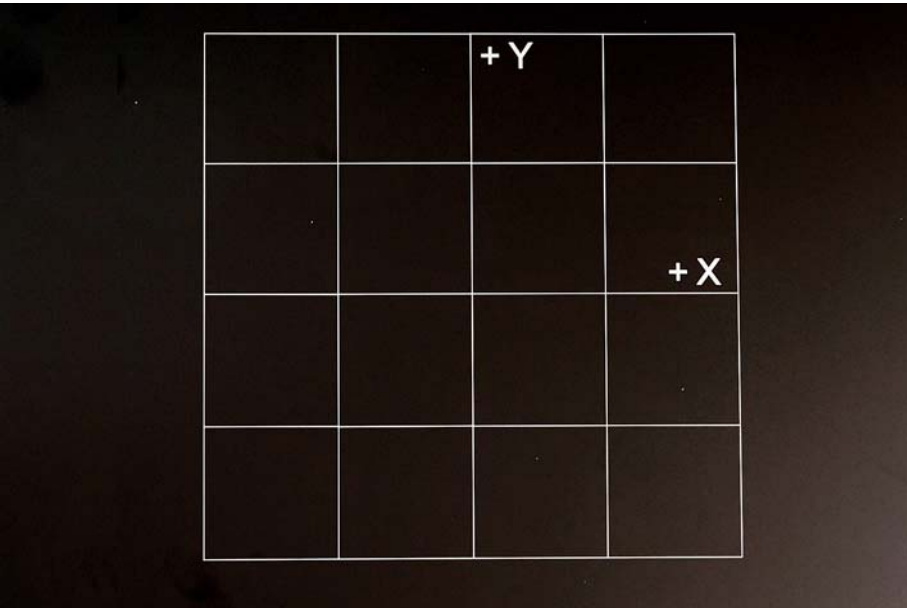


Fig. 12-2. Compensation file loaded

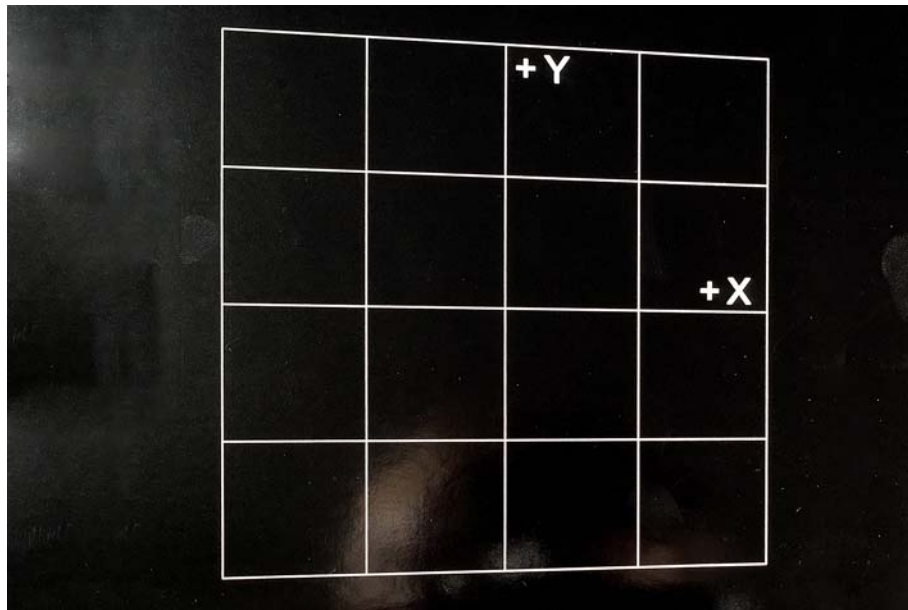


Fig. 12-3. Trapezoidal distortion

Error	Remedy
Trapezoidal distortions in the X and Y directions	Check the adjustment of the workpiece support plate and the galvo

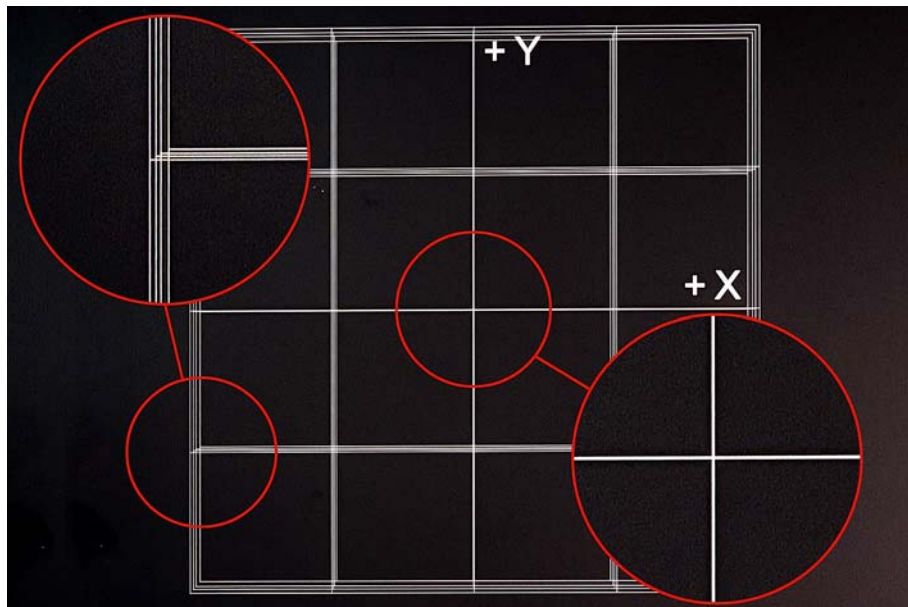


Fig. 12-4. Focusing errors

Error	Remedy
Focusing error (center point okay, deviations at edge)	Check the focal distance of the galvo

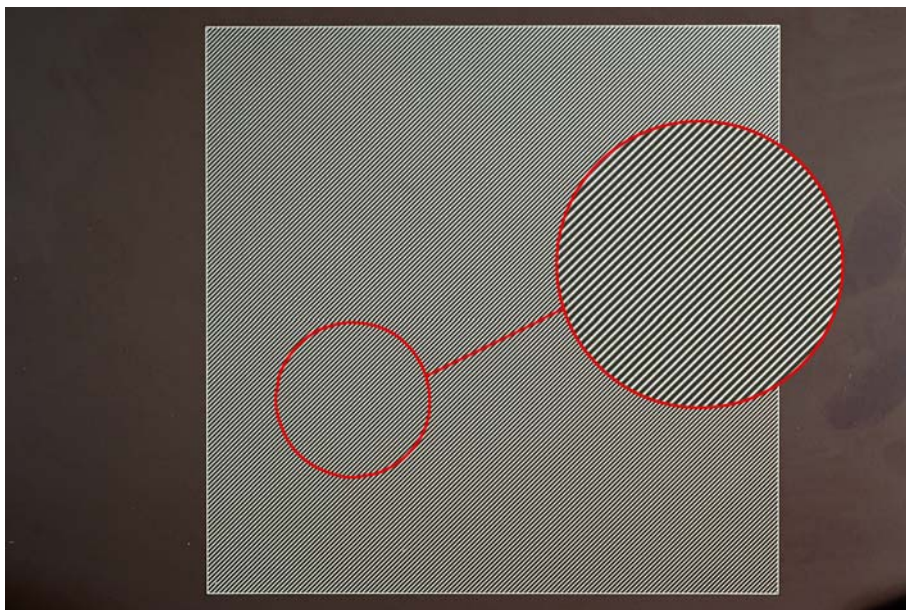


Fig. 12-5. Correct image



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A test program should be created to test the image

» see VLM user manual

---

#### **Sample settings for the test program:**

- Generate a square that has a size that corresponds to the maximum possible labeling field of the laser. The maximum size is taken from the VLM machine configuration.
- 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 edge definition.



- 
- To prevent errors due to the material being marked, run the test program through several test sequences.
  - For the precise assessment of image errors, a measuring magnifier or microscope is required.
  - The measurement results may be distorted if the laser system and the work-piece support plate are not absolutely free of vibrations.
  - The exhaust ventilation system must be switched on, as vapors obstruct/weaken the laser radiation.
-



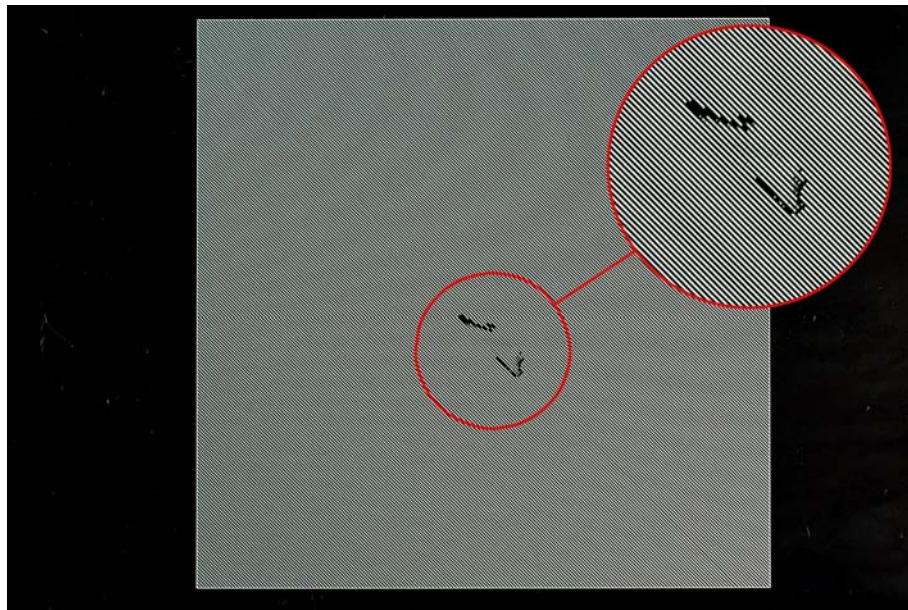


Fig. 12-6. Irregular power fluctuations

Error	Remedy
Irregular power fluctuations	Check the optic for dirt and heat etching

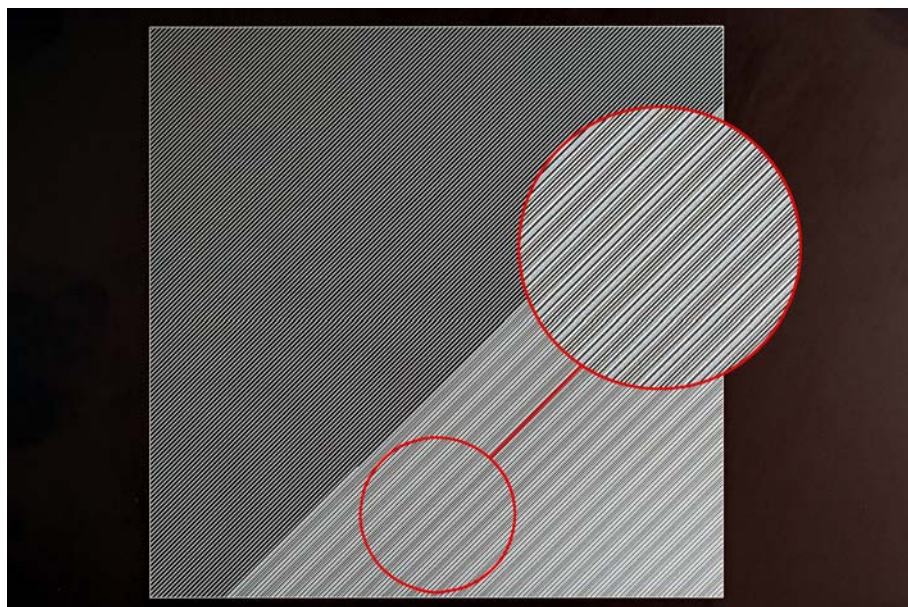


Fig. 12-7. Regular power fluctuations

Error	Remedy
Regular power fluctuations due to internal or external influences	Check the laser head for vibrations. Contact Coherent Munich Service department

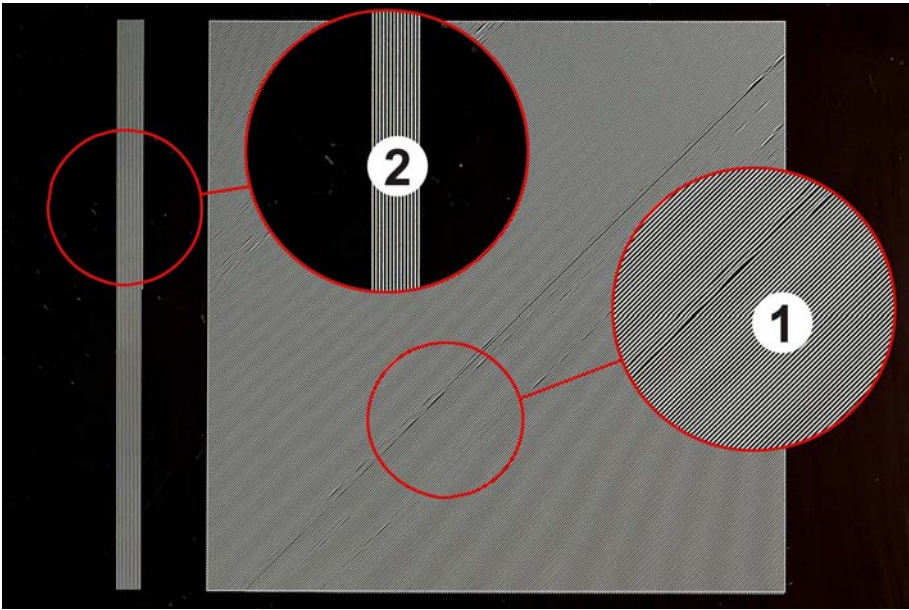


Fig. 12-8. Galvo positioning error

Error	Remedy
Positioning error of galvo (1) (X or Y direction)	Check the laser head for vibrations. Contact Coherent Munich Service department



If the test matrix is not hatched in a 45° angle, errors may not be recognized (2).



## 12.4

### Marking errors



- Generally, it is recommended to compare the marking with a reference sample. The reference sample can be created using the VisualLaserMarker (VLM) marking software.
- The parameters are set using the VisualLaserMarker (VLM) marking software.
- » *For detailed information on the VisualLaserMarker marking program, please see the separate User Manual for the marking software.*

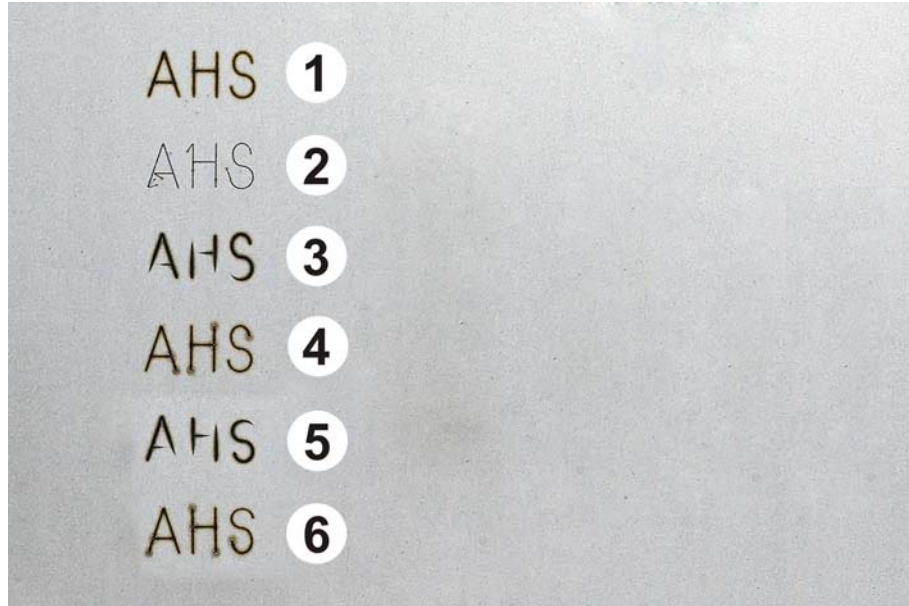



Fig. 12-9. Marking errors

No.	Error	Remedy
1	No error.	./.
2	'Delay Galvo' too short.	Check the parameters and hardware.
3	'Beam on delay' too strongly negative.	Check the parameters and hardware.
4	'Beam off delay' too long.	Check the parameters and hardware.
5	'Beam off delay' too short.	Check the parameters and hardware.
6	'Delay Galvo' too long or 'Beam on delay' too strongly positive.	Check the parameters and hardware.

Tab. 12-3. Marking errors

## 12.5 Focusing errors

Error	Possible cause	Remedy
The mark that is shown is too wide (>50 µm vs. the setting)	Laser parameters faulty	<ul style="list-style-type: none"> <li>• Recheck and adjust</li> </ul>
	Material to be marked is flawed	<ul style="list-style-type: none"> <li>• Check the material batch.</li> <li>• Use proper material</li> </ul>
	Focusing errors	<ul style="list-style-type: none"> <li>• Adjust focus</li> <li>• Inspect protective glasses (dust, spots, heat etching, discoloration).</li> <li>• Check the optics (optical inspection, cleaning, replacement with appropriate field correction)</li> </ul>
	Laser beam out-of-round (elliptical)	<ul style="list-style-type: none"> <li>•  Check test marking with process parameters at focal point for roundness. To do this, generate a cross with lines at 0° and 90°, as well as a cross with 45° offset.</li> <li>• If faulty, contact the Coherent Munich service department</li> </ul>

Tab. 12-4. Focusing errors

### 13. Record of instruction

Personnel deployed by the proprietor to work on the laser system hereby confirm that they have read and understood the Assembly and Operating Instructions.

With his or her signature, each person commits to conscientiously comply with the instructions and notes contained therein, particularly the safety regulations.

All personnel shall inform a responsible person if safety-related errors occur or if safety regulations cannot be complied with. In such cases, the laser system must not be operated.

[illegible]



## 14. Disassembly and disposal



### CAUTION

**Danger from failure to observe manufacturer's documentation, as well as regional laws and regulations**

Possible bodily injury

- ⇒ Notes on the disassembly and disposal of individual modules of the laser system can be found in the operating instructions of the respective component manufacturers and are to be observed. These documents remain valid without limitations.
- ⇒ When disassembling and disposing of the laser system, observe all locally applicable accident prevention and environmental protection regulations, as well as the waste disposal information of the individual manufacturers.



### NOTICE

Non-observance of the manufacturer's documentation as well as regional regulations and laws can result in environmental damage.

### 14.1 Disassembling the laser system

1. Switch off the laser system and disconnect it from the mains supply.
2. Disassemble the laser system components. Disassembly of the laser system must be undertaken by appropriately qualified and trained personnel.

### 14.2 Disposal information

When disposing of the individual system materials, sort them correctly and channel for reprocessing or dispose of them according to the conditions appropriate to the specific country.

#### Electrical and electronic components:

- Collect electrical and electronic components separately and channel them for appropriate disposal or reprocessing.

#### Batteries:

- Waste batteries must be collected and disposed of separately. Do not dispose of them with household waste. Comply with the respective manufacturer's instructions and all national and local stipulations regarding waste disposal.

#### Metallic parts:

- Collect steel, cast, and nonferrous metals separately and channel them for appropriate reprocessing.

**Plastics:**

- Collect plastics separately and channel them for appropriate disposal or reprocessing.

**Production waste:**

- Recycle or dispose of production waste according to the regulations of the proprietor.

**Filter mats:**

- Dispose of filters according to their level of contamination with pollutants.
- It is essential that local disposal regulations are complied with.

## 15. EC Declaration

Each machine is accompanied by an EC Declaration according to Directive 2006/42/EC (Machinery Directive) upon delivery.

An excerpt of this EC declaration reads as follows:

Coherent Munich GmbH & Co. KG

Zeppelinstr. 10

82205 Gilching

Germany

### **Declaration for the incorporation of partly completed machinery as defined by the EC Machinery Directive 2006/42/EC, Annex II B**

#### **Interdiction of commissioning**

We hereby declare that the machinery described in the following, "PowerLine Prime 12/15", is to be incorporated into other machinery or, as defined by Directive 2006/42/EC, assembled with other machinery to form a machine.

Commissioning is forbidden until it has been determined that the machinery into which the aforementioned product is to be incorporated complies with the provisions of the EC Machinery Directive and that a corresponding Declaration of Conformity according to EC Machinery Directive 2006/42/EC, Annex II A, has been issued.





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