

PowerLine E Air

Operator's Manual

Version 1.3

WE THINK LASER

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This document was originally published in German. A version published in any other language is a translation of the original publication.

We reserve the right to make technical changes in order to improve the laser system.

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1 Safety

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

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

1.1 Operation according to regulations

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

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

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

- EN ISO 12100
- EN 60204
- EN 60825
- VDE 0837 (IEC 825)
- UVV BGV B2
- VDE 0100
- VDE 0105
- 21 CFR National Center for Devices and Radiological Health

ROFIN-SINAR lasers correspond to the valid EU guidelines.

- 2014/35/EU (Low Voltage Directive)
- 2014/30/EU (EMC Directive)
- 2006/42/EC, Appendix IIA (Machinery Directive [if there is machine status])

1.2 Operation of the laser

The rules for the prevention of accidents by laser irradiation (UVV) BGV B2 (formerly VBG 93) must be observed when operating the laser in the area within which these rules and relating instructions are valid. Under UVV BGV B2, a person must be appointed to take charge of laser safety, and the professional association and the appropriate work safety authorities for lasers from class 3B or 4 must also be informed.

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

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

- ROFIN-SINAR Laser GmbH (maintenance, application, operation)
- OEM suppliers (operation)





- Professional Association of Precision Mechanics and Electronic Technique (UVV)
- PTB Physical and Technical Federal Institute Braunschweig (UVV)
- Technical Supervisory Associations (UVV)

1.3 General safety instructions

Danger



The "Danger" notice is used in this manual in the case in which lethal danger or serious damage to health may occur if the relevant safety instructions are ignored or not sufficiently observed.

Warning



The "Warning" notice is used in this manual in the case in which damage to health or considerable damage to property may occur if the relevant safety instructions are ignored or not sufficiently observed.

Attention



The "Attention" notice is used in this manual in the case in which damage to health will not occur but damage to property may occur if the relevant safety instructions are ignored or not sufficiently observed.

Note



Indicates important or additional information as well as tips.

1.3.1 Explanation of symbols

Indicates an instruction for performing a particular operation.

- Indicates a work step that must be performed.
- Indicates lists.
- » A detailed description of the topic can be found in the specified section.

1.4 Danger by laser radiation

Danger



Laser radiation is very hazardous for the eyes. Irradiation of the skin can cause severe burns. Diffuse, secondary (reflected) radiation is also dangerous. Laser radiation can cause fire risk or risk of explosion. At all times during installation, operation, maintenance or service of your laser, avoid any exposure to direct or secondary laser radiation, and never look into the laser beam directly or with optical devices. Pay attention to administrative and personal precautions!

Depending on the layout of the laser marker, the beam is emitted from the optics of the marking head. The optics in these beam guide systems can point in any direction (360°). If the laser system is equipped with two marking heads, the laser beam is emitted either simultaneously (for beam splitters) or alternately (for beam switches) from the optics of the respective marking head. If no optics are attached, the laser beam is emitted out of the front of the laser head.



To counteract potential malfunctions arising from inadvertent laser radiation we remind you to comply with the proper use of the safety-relevant shutter. A safely closed beam lock (shutter) in accordance with Laser Class 1 can only be ensured if the 2-channel shutter interlock circuit of the laser system is disconnected.

1.4.1 Beam path

The diode light is conducted from the 19" plug-in for electrical components, in which, according to the laser, one or two diode modules are located, to the resonator module in the laser head via a passive glass fiber (transport fiber).

The passive glass fiber or transport fiber is surrounded by a metal tube that safely covers the glass fiber from the diode module in the 19" plug-in for electrical components through an adapter block or a fiber terminal box to the laser head.

The metal tube is conducted into a corrugated tube together with the electrical lines. This tube is permanently connected with the 19" plug-in for electrical components and the laser head through screw connections.

The dashed lines designate the beam path of the laser beam.

1 Corrugated pipe (transport fiber in metal tube)



FIG. 1 Beam path from the 19" plug-in for electrical components to the laser head



1.4.1.1 **PowerLine E Air 10**

The dashed lines designate the beam path of the laser beam.

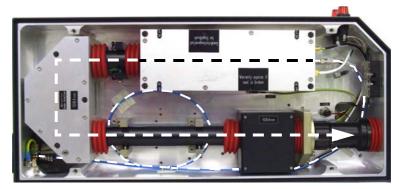


FIG. 2 Beam path in laser head

- 1 Diode module
- 2 Adapter block
- 3 Transport fiber in metal tube

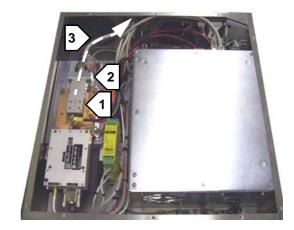


FIG. 3 Beam path in 19" plug-in for electrical components



1.4.1.2 PowerLine E Air 25/30

The dashed lines designate the beam path of the laser beam.

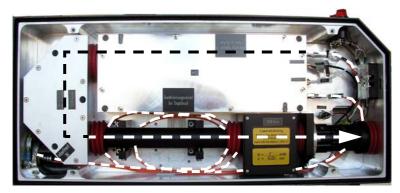


FIG. 4 Beam path in laser head

- 1 Diode module
- 2 Fiber terminal box
- 3 Transport fiber in metal tube

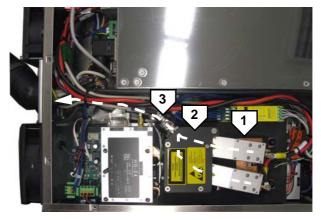


FIG. 5 Beam path in 19" plug-in for electrical components

1.4.2 Danger of laser radiation

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



The PowerLine E Air laser head corresponds to safety class 4.

The 19" plug-in for electrical components corresponds to safety class 1 due to its safety equipment.

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

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

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



Danger



The 19" plug-in for electrical components corresponds to safety class 4 as soon as the safety equipment (metal tube with adapter block or fiber terminal box) is disassembled, e.g. when a diode module is changed. In this state, all corresponding laser protection measures can be taken.

1.4.3 Alignment laser (optional)

This is a laser diode of hazard class 2. According DIN EN 60825 the eyes are protected by the natural eyelid reflex. The alignment laser radiation is not dangerous to the skin.

Warning



Never stare, either directly or with an optical device, into the beam of the alignment laser!

1.5 Other dangers

1.5.1 Ultraviolet radiation

Warning



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

The laser protective goggles for 1064nm according to DIN EN 207 or EN 208 are not suitable to protect the eyes from this ultraviolet radiation. Special goggles which in addition to the wavelength also protect the eyes against ultraviolet radiation are commercially available.

1.5.2 Hazardous materials

Warning



Ensure that an appropriate working exhaust ventilation system is connected to the material processing laser.

Hazardous fumes and dust may be given off during the marking process or when carrying out service tasks (e.g. replacing contaminated filters). Please observe the supplier's directives concerning safety and wear a suitable respiratory mask and safety gloves when handling hazardous materials.

Do not open components in the 19" plug-in for electrical components as doing so could release hazardous materials.

1.6 Personal protective measures

Warning



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



- Always avoid any exposure to direct or secondary laser radiation, and never look into the laser beam directly or with optical devices!
- Servicing or maintenance work may only be carried out when the system is off!
- Wear suitable protective goggles in the laser area in accordance with DIN EN 207 and EN 208 – Eye Protection Against Laser Radiation at a Wavelength of 1064 nm.
- The Interlock circuits which act as safety devices must not be removed or bypassed; if they are bypassed they will not operate in accordance with regulations. No liability whatsoever is assumed by the manufacturer if the safety devices are removed or bypassed.
- Wear an appropriate respiratory mask as well as protective gloves when working with high-risk materials.
- Avoid pulling, bending, or jamming the corrugated pipe.

1.7 Administrative precautions

Adhere to the following rules and observe the detailed administrative precautions and regulations according to DIN EN 60825, classification VDE 0837 (IEC 825).

- Instruct the operators on safety instructions periodically.
- Provide warning labels.
- Deny access to the laser system to anybody not working on it.
- Designate the laser area adequately.
- Remember that combustible or flammable gases, liquids or solids can ignite. Remove these danger sources from the laser area.
- Toxic decomposition products may develop when certain materials (metals or plastics) are processed. Find out what hazards are associated with the processing of these materials.
 Professional organizations can provide the necessary information.
- Remove any objects from the laser area which might accidentally reflect laser radiation and injure you or other persons.
- Have authorised and purposely appointed persons check the effectiveness of integrated safety equipment (e.g. EMERGENCY STOP) according to defined test cycles. All relevant national safety regulations and guidelines must be observed (see Section "1.1, Operation according to regulations" on page 1).
 - Utilize all available safety equipment while the system is running. Any endangering functions must immediately be stopped or interrupted. Acknowledge the corresponding signals and/or error messages prior to restarting the laser system. Ensure that the laser system can be restarted. If this is confirmed the safety equipment is in proper working order.
- When using the jumper plug -X42a follow the safety instructions on the package insert (M-101117017). The jumper plug is included in the delivery.
- Make sure that the warning lamps for laser radiation function properly. A defective lamp must be replaced immediately. The laser radiation warning lamps are located on top of the laser head.
- Always wear protective gloves when handling optical components. Only use the protective gloves listed in chapter "Spare Parts" in the Maintenance and Integration Manual.



1.8 Disposal

Comply with all national and regional regulations regarding waste disposal.

1.9 Emergency stop

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

Warning



The emergency stop should not be used to End a normal working cycle.

Depending on the system layout, the emergency stop pushbutton is located

on the control panel of the 19" plug-in for electrical components,



on the external control panel (optional),



or can be integrated into a handling system as an external Emergency stop pushbutton if the customer so wishes.

1.10 Safety equipment

Both lateral covers of the laser head are monitored by the interlock switch (see 1). An open interlock switch leads to the emergency shutdown of the laser system.



FIG. 6 Interlock switch of the laser head (electrical side)



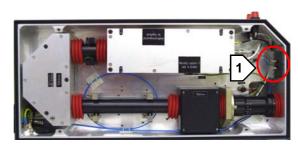


FIG. 7 Interlock switch of the laser head (optical side)

1.11 Labelling

All locations which, under certain circumstances (such as when protective covers are opened), represent a potential risk, are labeled with the required warning labels. The location of the individual labels are shown in the following pictures. These labels must not be removed.



1.11.1 Warning labels for 1064nm

The following warning labels are on top of the laser head.

Labels 3 and 4 only exist in the case of systems that use an alignment laser.

Labels 6 and 7 are also placed on the front of the marking head.

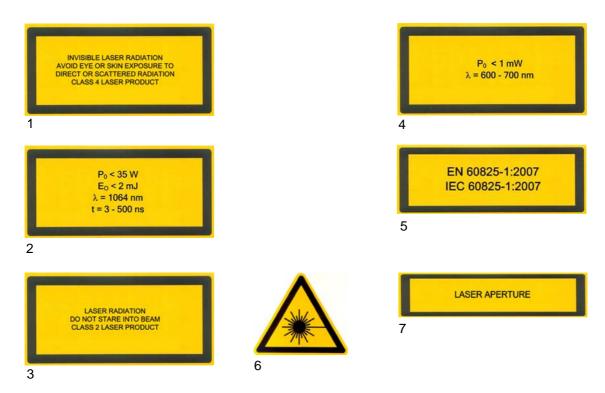




FIG. 8 PowerLine E Air laser head (example)

Note



Warning label **#6** warns against laser radiation (see Section "1.4.2, Danger of laser radiation" on page 5).



1.11.1.1 19"plug-in for electrical components

According to the laser used, the 19" plug-in for electrical components has one or two diode modules.

The following warning label is inside the 19" plug-in for electrical components.



PowerLine E Air 10:

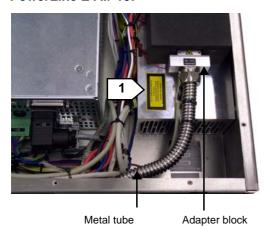


FIG. 9 19" plug-in for electrical components (inside)

PowerLine E Air 25/30:

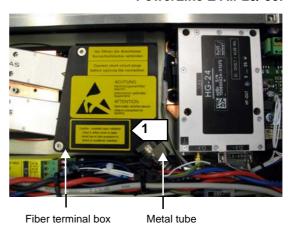


FIG. 10 19" plug-in for electrical components (inside)

Warning

The 19" plug-in for electrical components corresponds to safety class 4 as soon as the safety equipment (metal tube with adapter block or fiber terminal box) is disassembled, e.g. when a diode module is changed. In this state, all corresponding laser protection measures shall be taken.





1.11.2 Instruction labels

1.11.2.1 19"plug-in for electrical components

The labels below are on the top of the 19" plug-in for electrical components in addition to the warning label.



The "Disconnect before opening" label reminds you that the 19" plug-in for electrical components must be disconnected before the housing cover is removed or the mains plug is disconnected, since the inside of the 19" plug-in contains energized parts.



FIG. 11 "Disconnect before opening" label

Warning



The laser system may only be operated, repaired and serviced by trained and authorized personnel (see Section "1, Safety" on page 1).

This label warns against dangerous electric voltage.

<u>(!</u>\

Warning

This high-performance laser functions with dangerous electrical voltage (mains voltage). The housing cover may only be opened by instructed and trained personnel. During all work on electrical components:

- Verify absence of voltage!
- Take precautions!
- Observe safety regulations!

This label warns against laser radiation.



FIG. 12 "Dangerous electrical voltage" label



FIG. 13 "Laser radiation" label



PowerLine E Air 10

In the 19" plug-in for electrical components, the "Do not remove" label is located on the adapter block between the diode module and metal tube.



FIG. 14 "Dangerous electrical voltage" label

The "Do not remove" label indicates that the screw connection of the metal tube on the adapter block and the adapter block itself may not be loosened.



FIG. 15 "Do not remove" label

PowerLine E Air 25/30

The following two labels are located in the 19" plug-in for electrical components on the fiber terminal box.



The "Connect short circuit plug" label indicates that a diode module must be shortcircuited before it can be changed.



/!\ Warning

Failing to short-circuit the diode module can cause the diode(s) to be damaged!



/! Warning

The laser system may only be operated, repaired and serviced by trained and authorized personnel.

Vor Öffnen der Anschlüsse Kurzschlußstecker verbinden

Connect short circuit plugs before opening the connection

FIG. 16 "Connect short circuit plug" label



The "Electrostatically endangered components" label indicates that the precautionary measures for the handling of components at risk of electrostatic discharge must be observed.



FIG. 17 "Electrostatically endangered components" label

1.11.2.2 Laser head

The laser head has a shock indicator.

The shock indicator serves to show any excessive jarring of the laser head during transport. A sensor (1) is used for this.

A discoloration of the sensor display indicates excessive shaking of the laser system.



Attention

If the indicator has discolored, please get in contact with your shipper or Rofin-Sinar laser immediately.



FIG. 18 Shock indicator

1.11.2.3 Marking head

The "Plug-in connections" label is located on the top of the marking head.



- 1. Hauptschalter OFF
- 2. Steckverbindung öffnen
- 1. Mainswitch OFF
- 2. Open plug-in connection

The "plug-in connection" label acts a reminder that the laser system must be switched off before the plug-in connection is opened.



Attention

Failure to comply with this could result in damage to the marking head

FIG. 19 "Plug-in connection" label



1.11.2.4 19" plug-in PC

There are no labels on the 19-inch plug-in PC.



FIG. 20 PC

1.11.3 Identification label

The identification label contains the laser's important data. It is located on the left housing side of the 19" plug-in for electrical components and on the back of the laser head.

i Note

The pictures here show an example of the identification label.

» For more information, see the technical data.

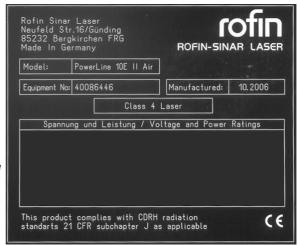


FIG. 21 Identification label - PowerLine E Air 10



FIG. 22 Identification label - PL-E Air 25/30

Safety





2 Transport

Some preparatory measures must be taken before transporting the laser system, as described below.

Observe the following requirements when transporting the laser system:

Truck: Only trucks with air suspension are admitted.

Railway/ship/plane: According to the customer's request, the laser is packed and

prepared for transport by ROFIN-SINAR depending on the

means of transport.

Note

Before preparing the laser system for transport, please familiarize yourself with the main components of the system (see Section "5, Main components" on page 39).



Preparatory measures for transporting include:

- Disconnecting the connection between the laser and the mains.
- Unplugging the electrical connections
- Unplugging the jumper plugs -X42a (if plugged) and -X46 on the 19" plug-in unit for electrical components
- Unplugging of terminating connectors on non-assigned CAN bus interfaces and packing them for transport
- Disconnecting the cables between the laser head and the marking head
- Disconnecting the connection between the laser head and the mounting surface
- Preparing the jumper plugs, the mains cable and all loose cables for transport

2.1 Disconnecting the mechanical and electrical connections

The electrical connections between the 19" plug-ins and the laser head and between the 19" plug-ins and the laser head, as well as the monitor, the keyboard and mouse can be disconnected as described below.

The connections between the laser head and the marking head can be disconnected, as described below.

Warning

Before disconnecting an electrical connection, you must first switch off the laser system properly (see Section "6.3, Switching off the laser system" on page 56) and disconnect it from the mains supply.



How to disconnect the electrical cables:

- Pull the power plug
- Wait for five seconds
- Disconnect the electrical connections



Note

i

These interfaces are all located on the back of the 19" plug-ins and on the top of the marking head. All connections are labelled.

2.1.1 19" plug-in PC

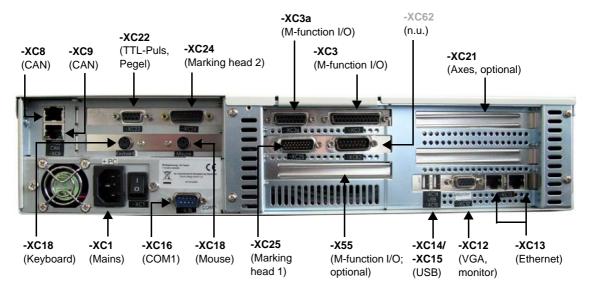


FIG. 23 Connector strip with interfaces



2.1.2 19"plug-in for electrical components

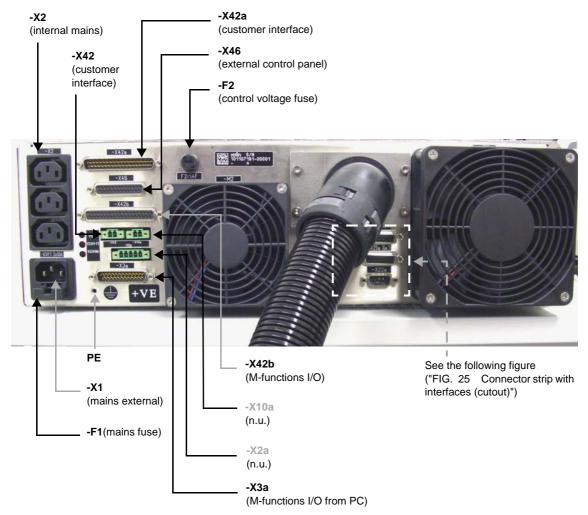


FIG. 24 Connector strip with interfaces

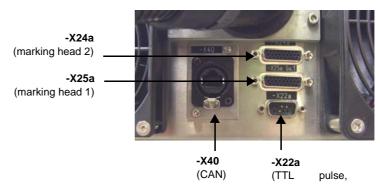


FIG. 25 Connector strip with interfaces (cutout)

Attention

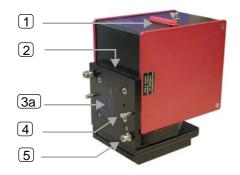
Carefully loosen the plug-in connections, as the contact pins could otherwise be damaged.

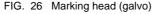


- **-X46**: In systems without an external control panel, a jumper plug is located on -X46. Unplug the -X46 jumper plug before packing the 19" plug-in unit for transport.
- -X42a: If plugged, unplug the -X42a jumper plug before packing the 19" plug-in unit for transport.



2.1.3 Disconnecting the connection between the laser head and the marking head





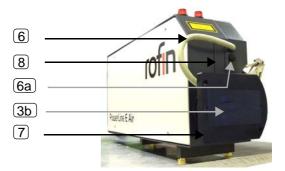
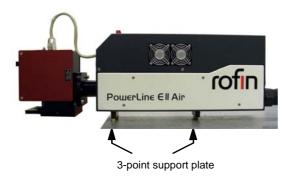


FIG. 27 Laser head



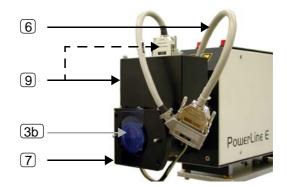


FIG. 28 Laser head with focusing axis FFM (option)

1	-X57 interface (marking head)	6	Galvo cable (marking head)
2	Flange plate for marking head	6a	Blind plug (marking head 2, double head laser systems)
3a, 3b	Protective film on beam path	7	Flange
4	Dowel pins (2x)	8	Blind plate for -X28 interface (integration interface) (optional)
5	Screws (2x)	9	Focusing axis FFM with interface -X58

• Disconnect the galvo cable (6) from the the -X57 (1) interface on the marking head.

i Note

If the laser is equipped with a focusing axis FFM (Fast Focusing Module), the interface connection -X58 (9) on the focusing axis can remain connected.

• Apply the sealing cap to the plug connection -X57 (1) on the marking head.

i Note

When the laser unit is delivered, the protective cap is located on the plug connection -X57.

• Disconnect the cable at the -X28 integration interface (8), if applicable.

i Note

The integration interface -X28 is located behind the dummy panel (plug D-Sub 15) and can be optionally made available.

- Carefully loosen the screws (5) and dowel pins (4) between the flange (7) and flange plate (2) on the laser head and marking head. Place the screws and dowel pins to the side.
- Carefully lift the marking head.
- Loosen the screws on the 3-point support plate and carefully lift the laser head.



Apply wide, commercially available tape to the beam path on the laser and marking head.



Attention

Only tape that can be completely removed without residue may be used.

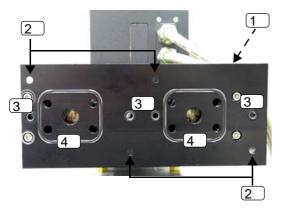
» See chapter "Spare Parts" in the Maintenance and Integration Manual.

Attention

The focusing axis FFM (optional) is firmly connected to the laser head and must not be removed.



2.1.3.1 Disconnecting the connection between the laser head and the marking head (double head laser systems)



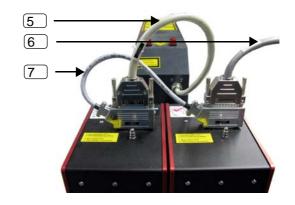


FIG. 29 Laser head (double head laser systems)

FIG. 30 Marking heads (double head laser systems)

1	Flange unit (double head system)	5	-X57 interface; galvo cable (marking head 1)
2	Openings for screws (4x)	6	-X157 interface; galvo cable (marking head 2)
3	Openings for dowel pins (4x) with O-rings	7	Connection cable for marking heads
4	Laser beam outlet with O-rings		

Attention

To disconnect the marking heads in the case of double head laser systems, observe the procedure outlined in chapter "2.1.3 Disconnecting the connection between the laser head and the marking head".



Particularly in the case of double head laser systems, note:

- Disconnect the galvo cable (5) from the -X57 interface on the marking head.
- Connect the galvo cable of the second marking head (6) via the interface -X157 to the second marking head.
- Loosen the screws of the connection cable (7) on the two marking heads and pull the connection cable. Put the connection cable to one side.
- On the flange unit (1), remove the four o-rings in the slot for the dowel pins (3) as well as the two o-rings in the slot for the laser beam outlet (4). Put the o-rings to one side.

Note

The focusing axis FFM (Fast Focusing Module) is not available in double head laser systems.





2.2 Transport of the laser head and the 19" plug-in for electrical components

The laser is an optical device. The laser has to be transported very carefully in order to avoid damage by force during loading or unloading.

The laser head and the 19" plug-in for electrical components are permanently connected via a corrugated pipe and can be transported only together.

Warning



Avoid pulling, bending, or jamming the corrugated pipe. Non-compliance can result in damage to the laser system. When transporting the laser head and the 19" plug-in for electrical components, pay attention to the following safety instructions.

During the transport of the laser head and the 19" plug-in for electrical components, observe the following safety instructions.



Attention

Do not lift the laser head at the corrugated pipe.



FIG. 31 Laser head - corrugated pipe (transport fiber in metal

 Do not lift the 19" plug-in for electrical components at the corrugated pipe.



FIG. 32 19" plug-in for electrical components - corrugated pipe (transport fiber in metal tube)

- Do avoid strong vibrations of the laser head and the 19" plug-in for electrical components.
- Make sure to remove the jumper plugs -X42a (if plugged) and -X46 on the back of the 19" plug-in for electrical components before packing the plug-in unit for transport.
- If the laser head is integrated in a system, transport it in a horizontal position. In case the
 mounting position of the integrated laser head deviates from the horizontal position, the
 laser head must be dismantled and transported separately together with the 19" plug-in
 for electrical components.



 Do not transport the laser head in a position deviating from the horizontal position if it is integrated.

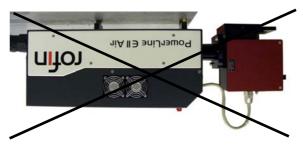


FIG. 33 Example of incorrect transport position

2.3 Packaging

ROFIN-SINAR lasers are usually wrapped in plastic film and are transported upright on pallets or in special cartons with shock-absorbing foam parts.

Together with the 19" plug-in for electrical components, the laser head is transported in a special shipping container.

Attention

 Always use the original transport containers for transporting the laser head, the 19" plug-in for electrical components, and the marking head.



- Include the dowel pins and screws with the marking head (see Section "2.1.3, Disconnecting the connection between the laser head and the marking head" on page 20).
- In the case of double head laser systems, place the o-rings, the dowel pins and the screws for each marking head in a plastic bag and include this with the respective marking head.
- In the case of double head laser systems, place the connection cable in the shipping container.
- Roll up the mains cable and all loose cables and place them in the transport container.
- Put the jumper plugs -X42a and -X46 into plastic bags and place them in the transport container.
- Remove the terminating connectors on all unassigned CAN bus interfaces. Put the terminating connectors into a plastic bag and place it in the transport container.

Note

Keep the original transport packaging in a safe place (cartons, molded foam sections, transport containers, pallets) in case the device needs to be transported again. If you no longer have the original transport containers, please contact ROFIN-SINAR Laser.





Procedure for shock and tilt indicators: B

Attention



If the original transport containers of the system initially supplied are provided with shock and tilt indicators, proceed as is described as follows.

- When transporting the laser system, remove the old shock and tilt indicators on the original shipping containers.
- Fix new shock and tilt indicators to the outside of the packaging where they are easy to see.



Please contact your shipper or ROFIN-SINAR Laser in this regard.





(example)

The laser head is also equipped with a shock indicator.

Check the shock indicator on the laser head. The shock indicator must not be discolored prior to transportation (see Section "1.11.2.2, Laser head" on page 14).



Please contact ROFIN-SINAR Laser if the shock indicator on the laser head is discolored prior to transportation.



TILY WATCH "

FIG. 36 Shock indicator (laser head)

2.4 **Storage**

Store the ROFIN-SINAR lasers in a dry place. Take appropriate measures to avoid corrosion.

For information on environmental and storage conditions, see Section "9, Technical data" on page 81.



3 Setting up the laser system

Please read the "Safety" section carefully before setting up and commissioning the laser system. The laser system may only be installed, connected and taken into operation by specially trained staff.

Preparatory measures for commissioning the system include:

- 1. Unpacking and setting up the laser system:
- Unpacking and checking the delivery
- Setting up the laser system
- 2. Connecting the laser system:
- Establishing an electrical connection between 19" plug-ins, monitor, keyboard, and mouse
- Fastening the jumper plugs (see Section "4, Connecting the laser system" on page 33)
- Fastening the terminating connectors on non-assigned CAN bus interfaces.
- 3. Connecting the mains
- 4. Switching the laser system on

Attention

Rofin-Sinar lasers are high-accuracy systems.



- Never use the laser system within the vicinity of extreme oil, solvent or detergent vapors.
- Make sure that the ground can withstand a weight of at least 200 kg/m² (see Section "9, Technical data" on page 81):
- Make sure that the laser head has reached the permissible ambient temperature before
 putting the laser system into operation (see Section "9, Technical data" on page 81). To
 this purpose, the laser head should stand in the room for approx. 1 hour to acclimate to
 ambient temperature.
- When setting up the laser system, take the required distances for ventilation, maintenance, and service purposes into account.
- » More information about this can be found in the integration diagrams in the Maintenance and Integration Manual of the laser system.

Note

If your laser system is also equipped with a filtering device, comply with the separate instructions from the manufacturer. It is not possible to control a filtering device with the laser itself.





3.1 Unpacking and setting up

ROFIN-SINAR lasers are usually wrapped in plastic film and are transported upright on pallets or in special cartons with shock-absorbing foam parts.

Together with the 19" plug-in for electrical components, the laser head is transported in a special shipping container.

Check the shock and tilt indicators (if present):

Attention



The original shipping containers may be provided with shock and tilt indicators. In the center of these indicators are sensors which discolor as soon as the system is improperly handled during transportation, i.e. tilted or excessively shaken. There is also a shock indicator on the laser head.

- Prior to unpacking the system, check for any discoloration on the sensors of the shock and tilt indicators.
- If the indicators have discolored, please get in contact with your shipper or Rofin-Sinar laser immediately. Observe the instructions on the indicators.





FIG. 37 Shock indicator FIG. 38 Tilt indicator (example) (example)

3.1.1 Unpacking the laser system

- Remove films and possible wooden packaging completely.
- Remove the packaging carefully.
- Carefully remove the 19" plug-in for electrical components together with the laser head, 19" plug-in for the PC, and, if necessary, the 19" plug-in for the UPS from the packaging and put everything in the position required.

. Attention

Do not lift the laser head and the 19" plug-in for electrical components at the corrugated pipe.

- Check the shock indicator on the laser head. It must not be discolored.
- Unpack the monitor, keyboard, and mouse and place everything with the 19" plug-ins.
- Check the content for visible transport damage.

Attention



- If you should ascertain any transport damage or any discrepancy between the consignment and the delivery note, please inform the shipper, ROFIN-SINAR Laser GmbH or your authorized dealer without delay. If you have ascertained transport damage, please record the damage, ideally by taking photographs, and do not throw any damaged shipping containers away.
- In case of discoloration of the laser head shock indicator, please immediately contact the shipping agent or ROFIN-SINAR Laser.



Note

Keep the original transport packaging in a safe place (cartons, molded foam sections, transport containers, pallets) in case the device needs to be transported again.



3.1.2 Setting up the laser system

- Set up the laser head as described in the following.
- Remove the marking head carefully from the packaging and connect it to the laser as described in the following.
- Adjust the operating distance.

Attention

 Install all 19" plug-in units in a horizontal position only. Use wide bearing rails when mounting the 19" plug-in units.



- Install the 19" plug-in units in such a way that they can be completely pulled out of the installation location for service purposes without unplugging the cabling.
- When integrating the 19" plug-in units, prevent the exhaust air from reentering the air supply area. This is achieved by properly routing the air flow.
- During the mounting or integration of the 19" plug-ins, make sure they are well ventilated (see Section "9.1, Supply units" on page 81).
- During the mounting and integration of the laser head and the 19" plug-in for electrical components, take the length of the corrugated pipe between the 19" plug-in for electrical components and the laser head (see Section "9, Technical data" on page 81) and the cable bending radius into consideration.
- » More information about this can be found in the integration diagrams in the Maintenance and Integration Manual of the laser system.

3.1.2.1 Setting up the laser head

Necessary working aids:

- Allen wrench, size 5
- Install the laser head on a stable mounting surface, e.g. a metal plate.
- Secure the laser head in place using three M6 screws.
- Tighten the three screws with a max.
 tightening torque of 5 Nm. This will fix
 the threaded bushings in place as well.

The laser head is now set up.



3-point support plate with screws (size M6) and vertically adjustable threaded bushings

FIG. 39 Laser head – setup on the 3-point support plate

» For information on adjusting the laser head see Section "3.2.1, Setting the operating distance" on page 31.



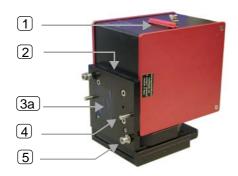
» Observe the "2.2 Transport of the laser head and the 19" plug-in for electrical components" section regarding the transport position of the laser head.

Attention



Should you require mounting positions that deviate from the horizontal position, please be sure to contact ROFIN-SINAR Laser.

3.1.2.2 Establishing the connection between the laser head and the marking head





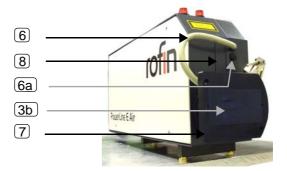


FIG. 41 Laser head

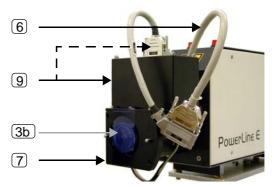


FIG. 42 Laser head with focusing axis FFM (option)

1	-X57 interface (marking head)	6	Galvo cable (marking head)							
2	Flange plate for marking head	6a	Blind plug (marking head 2, double head laser systems)							
3a, 3b	Protective film on beam path	7	Flange							
4	Dowel pins (2x)	8	Blind plate for -X28 interface (integration interface) (optional)							
5	Screws (2x)	9	Focusing axis FFM with interface -X58							

- Remove the protective film (3a, 3b) from the beam path of the marking and laser head.
- Remove the red cover cap (1) from the -X57 interface on the marking head.
- Insert the two dowel pins (4) provided into the specially designated openings in the flange plate (2) on the back of the marking head.
- Connect the marking head and laser head by inserting the dowel pins (4) on the flange plate (2) into the corresponding openings on the flange (7) on the front of the laser head or, if applicable, on the flange on the front of the focusing axis FFM (9).
- Screw the marking head and laser head into place using the two provided screws (5).

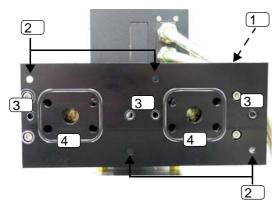


Connect the galvo cable (6) to the marking head via the -X57 interface.

The laser head and marking head are now connected to each other. Now you have to set the operating distance as described below.

Information about the -X28 integration interface on the front of the laser head can be found in the section "Integrating the laser system" in the Maintenance and Integration Manual of the laser system.

3.1.2.3 Establishing the connection between the laser head and the marking head (double head laser systems)



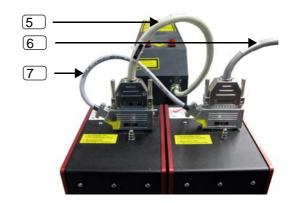


FIG. 43 Laser head (double head laser systems)

FIG. 44 Marking heads (double head laser systems)

1	Flange unit (double head system)	5	-X57 interface; galvo cable (marking head 1)
2	Openings for screws (4x)	6	-X157 interface; galvo cable (marking head 2)
3	Openings for dowel pins (4x) with O-rings	7	Connection cable for marking heads
4	Laser beam outlet with O-rings		

Attention

To connect the marking heads in the case of double head laser systems, observe the procedure outlined in chapter "3.1.2.2 Establishing the connection between the laser head and the marking head".



Particularly in the case of double head laser systems, note:

- On the flange unit (1), position the four O-rings in the slot for the dowel pins (3) as well as the two O-rings in the slot for the laser beam outlet (4). The O-rings are included in the initial delivery of the laser system.
- Connect the connection cable (7) via the interfaces -X57 and -X157 to the marking heads.
- Connect the galvo cable (5) to the marking head via the -X57 interface.
- Connect the galvo cable of the second marking head (6) via the interface -X157 to the second marking head.

Note

The focusing axis FFM (Fast Focusing Module) is not available in double head laser systems.

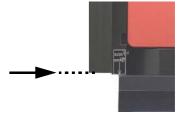




3.2 Operating distance

The operating distance depends on the optical focal distance as well as the beam expansion.

The operating distance is the distance from the lower edge of the flange plate on the back of the marking head, which is provided with the label "Focus", to the surface of the workpiece to be marked.



Another label is on the front of the marking head.

Detailed information about the operating distance can be found on these labels or in the following tables (subject to technical changes without notice).



Attention

Observe the focus or operating distance precisely.



1064nm - E Air 10/30

Working distances PowerLine E Air-10/ -30 mechanical integration																		
Optic	80 100		160 (a)* 160 (b)*		163		240		254		300		420					
Beam expand.	value	±	value	±	value	±	value	±	value	±	value	±	value	±	value	±	value	±
0,8x	97	2	129	3	244	7	237	7	260	7	460	17	486	18	590	25	1095	35
1,2x	90	2	116	3	217	7	207	7	233	7	378	17	405	18	487	25	753	35
1,5x	89	2	112	3	206	7	197	7	223	7	358	17	374	18	442	25	650	35
2x	88	2	110	3	201	7	192	7	218	7	344	17	360	18	426	25	600	35
3x	87	2	108	3	198	7	189	7	214	7	333	17	352	18	413	25	566	35
5x	86	2	108	3	195	7	184	7	210	7	322	17	343	18	401	25	546	35
10x	86	2	108	3	193	7	183	7	210	7	320	17	337	18	395	25	540	35
Values o	fworki	ng c	distanc	es a	and foca	al le	ngths r	mea	sured	in m	ım							- 12

*Note: (a) and (b) = different manufacturers

Note



- Information on the operating distance of a PowerLine E Air 25 laser is available on request.
- Information on the operating distance of a laser with a focusing axis FFM (option) is available on request.
- For more information see Section "9.4, Focusing axis FFM (Fast Focusing Module)" on page 87.



3.2.1 Setting the operating distance

Necessary work aids:

Precision level gauge

How to set the operating distance:

- Check and adjust, if necessary, the position of the workpiece support plate in the X and Y directions using the precision spirit level.
- Check the position of the marking head in the X and Y directions uing the precision spirit level.
- If necessary, adjust the location of the marking head using the height-adjustable threaded bushings on the laser head three-point support. Align the laser head parallel to the marking level.

i Note

Take the height of the mounting surface into account with regard to the operating distance.

• Check the focus or operating distance using the label on the marking head; adjust the focus or operating distance if necessary.

The operating distance is adjusted now.





4 Connecting the laser system

After you have assembled the laser system, you have to connect the individual components. All connection cables and interfaces are marked.

Measures for connecting the laser system include:

- Establishing an electrical connection between 19" components, monitor, keyboard, and mouse.
- Fastening the jumper plugs on the 19" plug-in for electrical components (see Section "4.1.2,
 19" plug-in for electrical components" on page 35)
- Fastening the terminating connectors to unassigned CAN bus interfaces.

Warning

Before connecting the laser system to the mains, please make sure that the main switch on the 19"-plug-in for electrical components and the key switch on the operating panel are in position **0**.



- » An overview of the components can be found in section "5 Main components".
- » For information on connection data see Section "9, Technical data" on page 81.

4.1 Connecting the electrical cables

Before operating the laser system, establish electrical connections between the 19" plug-in for electrical components and PC, as well as the monitor, keyboard and mouse as described below.

Attention

- Make sure that there is no connection to the mains.
- Connect the plug carefully, as the contact pins could otherwise be damaged.





4.1.1 19" plug-in PC

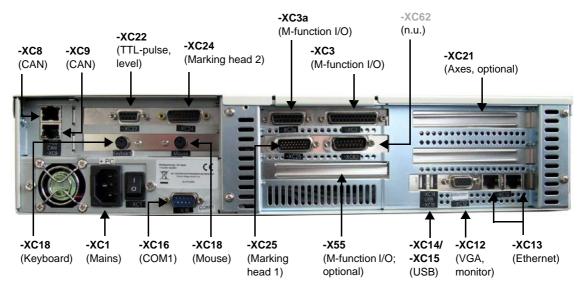


FIG. 45 Connector strip with interfaces

Connection to the 19" plug-in PC

Interface (from)	Connecting cables	Interface (to)	Destination (on)
-XC62	./.	./.	./.
-XC14	USB interface	J.	./.
-XC15	USB interface	J.	./.
-XC9	CAN bus interface	J.	Terminating connector
-XC8	CAN bus interface	-X40	Plug-in for electrical components
-XC16	Data interface	J.	./.
-XC22	Signal cable	-X22a	Plug-in for electrical components
-XC3	Control cable	-X3a	Plug-in for electrical components
-XC24	Signal cable (only for double head laser systems)	-X24a	Plug-in for electrical components
-XC25	Signal cable	-X25a	Plug-in for electrical components
-XC1 (mains)	Network cable, IEC plug/socket	X2	Plug-in for electrical components
Connections of	Connections optional:		
-XC3a	to the handling unit, control signals	.J.	./.



Interface (from)	Connecting cables	Interface (to)	Destination (on)
-XC21	to the handling unit, control signals	J.	./.
-X55	to the handling unit, control signals	J.	./.

Attention

- Unnecessary intefraces (marked with "n.u.") must not be used.
- Non-assigned CAN bus interfaces shall be provided with terminating connectors.



4.1.2 19" plug-in for electrical components

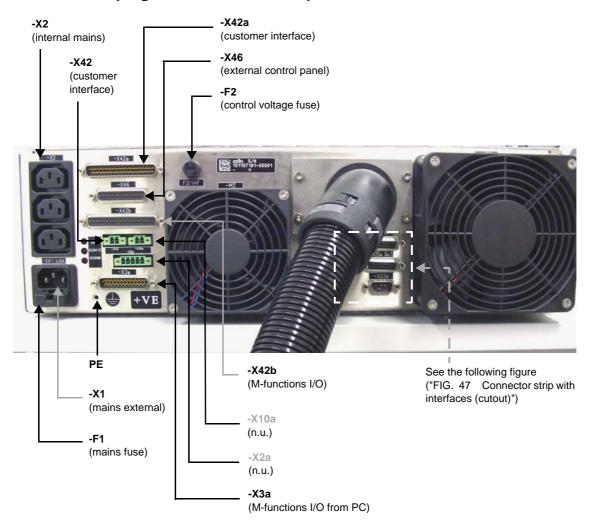


FIG. 46 Connector strip with interfaces

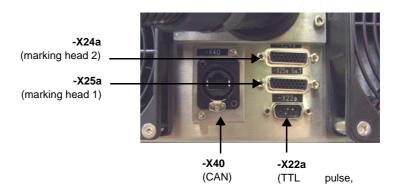


FIG. 47 Connector strip with interfaces (cutout)

Connections on the 19 inch plug-in for electrical components

Interface (from)	Connecting cables	Interface (to)	Destination (on)
-X1	Network cable, external supply, IEC-socket	J.	./.
-X2:	Network cable, IEC plug/socket	Mains	Monitor:
-X2:	Network cable, IEC plug/socket	Mains	Plug-in PC
-X2:	Network cable, IEC plug/socket	J.	J.
-PE	Protective earth, screw M4	J.	Control cabinet
-X2a:	./.	./.	J.
-X10a	./.	./.	./.
-X3a	Control cable	-XC3	Plug-in PC
-X22a	Control cable	-XC22	Plug-in PC
-X40	Data line	-XC8	Plug-in PC
-X46	Control cable	J.	External control panel
-X25a	Signal cable	-X25	Plug-in PC
Connections of	ptional:		
-X42	to the handling unit, 24V DC	J.	./.
-X42a	to the handling unit, interlock, jumper plug D-Sub 37	J.	./.
-X42b	to the handling unit, control signals	J.	./.
-X24a	Signal cable (only for double head laser systems)	-XC24	Plug-in PC

Attention



- **-X46**: When the system is delivered, NO jumper plug is on -X46.
- Attach the jumper plug to -X46 in systems without external control panel. Non-observance may lead to error messages.



-X42a: When the system is delivered, NO jumper plug is on -X42a.

Connect your control unit or safety circuits to -X42a

or

for temporary function tests attach the jumper plug to -X42a.

Follow the safety instructions in the package insert (M-101117017) of the jumper plug.

Attention

Safe and monitored closing of the shutter is only ensured by activation of the 2-channel shutter interlock circuit. For the purpose of temporary function tests, the shutter interlock circuit may be short-circuited by using the jumper plug. If the shutter interlock circuit is bridged and if an error occurs (key switch is defective), class 4 laser radiation may be emitted in key switch position I.



Attention

- Unnecessary interfaces (marked with "n.u.") must not be used.
- Non-assigned CAN bus interfaces shall be provided with terminating connectors.



Note

The jumper plugs can be found among the accessories in the transport container.



4.2 Commissioning the laser system

Attention

19" plug-in for electrical components:



Make sure that the 19" plug-in for electrical components was properly wired before putting the laser system into service. Non-observance may lead to error messages.

How to start operation of the laser system:

- Connect the mains voltage.
- Make sure that the key switch on the control panel is in the 0 position.
- Turn the main switch to position I.

The green indicator light on the control panel lights up.

- Switch the UPS on (if available).
- Switch on the external filtering unit (comply with the manufacturer's description).
- Set the mains switch on the back side of the 19" plug-in PC to position I.

The PC will be booted. The RCU control software (with Windows) boots up. The Laser Console program automatically opens on the screen.

• Turn the key switch on the control panel to position I or, if you wish to enable the opening of the shutter immediately, to position II . In this case, laser radiation can be emitted after the system has started up.



Protective goggles must be worn!



The warm-up phase of the laser system begins.

 The warm-up phase is shown in the laser console program on the [Laser] screen through the status display PRERUNNING.

The switch-on procedure is completed after 1-2 minutes (depending on ambient conditions) and is indicated on the control panel and Laser Console program:

- On the control panel of the 19" plug-in for electrical components, the "System in operating mode" or LEDs light up.
- The system's operational readiness is shown at the end of the warm-up phase through the status display OPERATIONAL.

The laser system is now ready for operation.

Note



If the key switch is **not** at Position **0** before the main switch is pressed, the KEY ERROR error message appears in the Laser Console program.

- For an overview of the key switch positions, see Section "5.6, Control elements of the laser system" on page 48.
- For an overview of the Laser Console program, see Section "8, Laser Console program" on page 61.



5 Main components

The main components of the laser system are:

- the laser head
- the marking head
- the 19" plug-in for electrical components
- the PC
- the monitor, the mouse and the keyboard.

The following components are optionally available:

- an uninterruptible power supply (UPS)
- footswitch
- filtering device
- an external control panel

Also, the following component is optionally available:

an FFM (Fast Focusing Module) focusing axis

Note

It is not possible to control a filtering device with the laser itself.



5.1 Functioning principle - 19" plug-in unit for electrical components and laser head

The diode light is generated in the diode module conducted from the 19" plug-in for electrical components, in which the diode module and Q-switch driver, are located to the resonator module in the laser head via a passive glass fiber (transport fiber).

The passive glass fiber or transport fiber is surrounded by a metal tube that safely covers the glass fiber from the diode module in the 19" plug-in for electrical components through an adapter block or a fiber terminal box to the laser head (see Section "1.4.1, Beam path" on page 3).

The metal tube is conducted into a corrugated tube together with the electrical lines. This tube is permanently connected with the 19" plug-in for electrical components and the laser head through screw connections.

Note

According to the laser (PowerLine E Air 10/25/30), one or two diode modules and, accordingly, one or two transport fibers are located in the 19" plug-in for electrical components.



5.1.1 Laser head

The laser crystal in the resonator module is pumped with the diode light. The optical energy generated in this way is converted into the specific laser radiation for the laser and provided for coupling out.



The laser only works if part of the laser radiation coupled out by the laser crystal can be coupled back and then amplified when passing through the laser crystal again. This is done with the two resonator mirrors which send the diode light time and again through the laser crystal. One of the two mirrors is semi-reflecting so that the laser beam can leave the laser head after several cycles and then be used for laser processing.

The laser beam is switched on and off with the quality switch (Q-switch). The Q-switch (quality switch) is an acousto-optical unit with which the feedback of the laser beam can be influenced. The Q-switch can be used to switch the laser on or off in continuous-wave mode. The laser can also operate in pulse mode. In this mode, the Q-switch can be switch on and off at a frequency between several hertz and typically 200 kHz. The laser then emits pulses with the specified frequency and a pulse duration of typically anywhere between <10 nsec and several hundred nsec at peak power.

Since laser radiation is dangerous for the eyes and can also lead to skin burns, the laser is equipped with a safety shutter (Shutter), which prevents the laser beam from being emitted out of the laser head if necessary.

The CAN interface PL-E and SSC (Safety Shutter Control) monitor the shutter, laser warning lamps, and emergency stop circuit and communicate with the power supply unit and the RCU control software via CAN bus signals.

The resonator module is cooled using a fan unit located on the side of the laser head. The exhaust air is emitted to the surroundings through the exhaust air shaft. The fan unit (air inlet opening) and the exhaust air shaft may not be blocked.

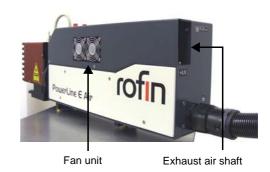


FIG. 48 Air cooling of laser head

5.1.2 Laser head layout

Warning



Do not open the resonator module! The components could otherwise be contaminated and the laser power impaired. Opening the resonator module also leads to loss of warranty.

5.1.2.1 PowerLine E Air 10/ 25/ 30



FIG. 49 Laser head - electrical side



5.1.2.2 PowerLine E Air 10

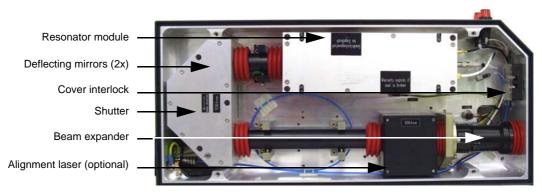


FIG. 50 Laser head - optical side

5.1.2.3 PowerLine E Air 25/30

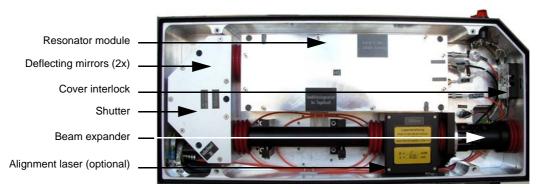


FIG. 51 Laser head - optical side

5.1.2.4 Double head systems

Beam splitter

The beam splitter implements two simultaneously working marking heads. In this arrangement, each marking head is supplied with laser light by a beam splitter.

Beam switch

The beam switch implements two sequentially working marking heads. The laser beam is switched by the beam switch from one marking head to the other for large dimensioned workpieces.



5.1.3 Laser radiation warning lamps

These warning lamps come on when the laser system has been switched on with the main switch and the key switch has been turned to position I or position II e.g. if the laser beam is generated (see Section "6.2, Switching on the laser system" on page 54).



FIG. 52 Laser beam warning lamps

Attention



Make sure that the warning lamps function properly. A defective lamp must be replaced immediately.

5.2 19" plug-in for electrical components

The main switch of the laser system is located on the 19" plug-in for electrical components. The 19" plug-in for electrical components is available both with and without control panel. The control panel is also available as an external component.

The 19" plug-in for electrical components essentially contains a power supply unit, a cooling unit for one or two diode modules, the Q-switch driver, and the emergency stop relay.

The diode module or modules and the Q-switch driver must be kept at a constant operating temperature. For this purpose, these components are attached to a cooling unit. The cooling process takes place using Peltier elements. The heat loss is conducted outside via the fan on the back of the 19" plug-in for electrical components.

The power supply generates all required supply voltages, controls the diode current for the diode module, as well as controls and regulates its temperature.

Warning



Do not open the diode module or modules! The components could otherwise be contaminated and the laser power impaired. Opening a diode module also leads to loss of warranty.

» For information on the functions of the signal lamps and displays see Section "5.6, Control elements of the laser system" on page 48.



5.2.1 Views of the housing

5.2.1.1 Frontal view



FIG. 53 19" plug-in for electrical components with control panel



FIG. 54 19" plug-in for electrical components without control panel

External control panel

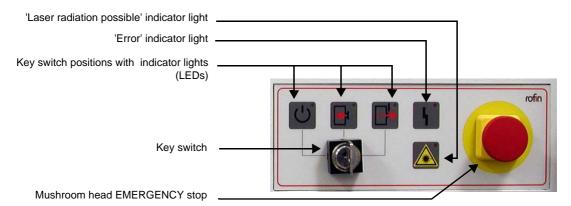


FIG. 55 Controls - external control panel



5.2.1.2 Rear view

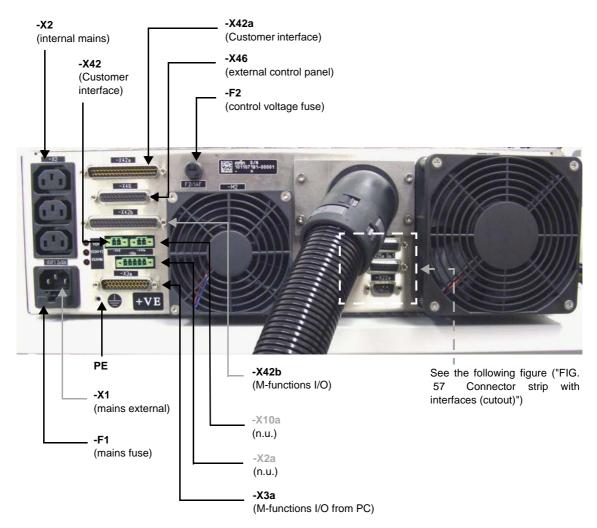


FIG. 56 Connector strip with interfaces

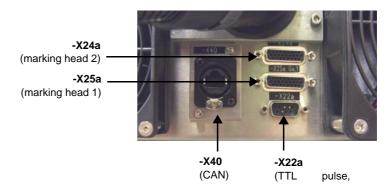


FIG. 57 Connector strip with interfaces (cutout)

» For information on connections see Section "4.1.2, 19" plug-in for electrical components" on page 35.



5.3 Marking head

The beam which is emitted by the laser is deviated by two mirrors 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 via focusing optics to the marking field.

The optical unit 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.



Attention

Particles of any kind are burnt into the lens system by the laser beam, whereby the lens system is destroyed.



FIG. 58 Mirror in the Galvo head (marking head)

5.4 19" plug-in PC

An IBM-compatible personal computer is used to manage and execute marking jobs and to operate the laser system; see the "Technical data" section.

The computer is equipped with a Windows operating system and the RCU (Rofin Control Unit) control unit software.

The 19" plug-in for the PC includes an ALI board (Active Laser Interface) as well as USB interfaces for program installation and data storage (optionally with DVD-RW drive; reading/writing DVDs and CDs). The ALI board (Active Laser Interface) is a control board in the PC developed by ROFIN-SINAR. It connects the marking head and other components (handling unit, axes, etc.) via the control software.

Attention

If programs are installed which were not created by ROFIN-SINAR Laser, make sure that these programs do not impair the marking quality as a result of the additional system load they impose. Screensavers, games, etc. should not be started.



The installation of virus-scanning programs must be released by ROFIN-SINAR Laser. In general, make sure that the automatic start of the virus-scanning program is deactivated, since otherwise the marking quality is impaired.



5.4.1 Views of the housing

5.4.1.1 Frontal view

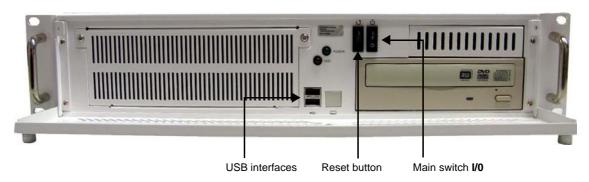


FIG. 59 19" plug-in PC

5.4.1.2 Rear view

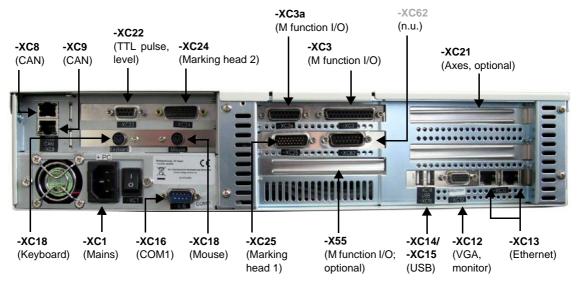


FIG. 60 Connector strip with interfaces

» For information on connections see Section "4.1, Connecting the electrical cables" on page 33.



5.5 Filter mat(s)

According to the laser used, the 19" plug-in for electrical components has one or two filter mats to protect it from soiling.

The filter mat(s) is/are located at the front behind the grille of the 19" plug-in for electrical components.



FIG. 61 Filter mat inside the 19" plug-in for electrical components

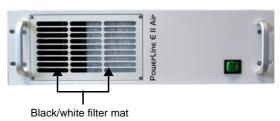


FIG. 62 Filter mats inside the 19" plug-in for electrical components

- » For information about the maintenance intervals, see Section "7, Maintenance schedule" on page 59.
- » For information on changing the filter mat(s) consult the Maintenance and Integration Manual of the laser system.



5.6 Control elements of the laser system

The operating controls of the laser system include:

- The main switch
- The key switch, the indicator lights (LEDs), the emergency stop pushbutton (on the external control panel or on the 19" plug-in for electrical components with a control panel)
- An external control panel

The operation takes place via the control elements and on the screen via the marking software VisualLaserMarker (VLM).

» For information on the marking software VisualLaserMarker, see the separate user handbook VLM.

Note

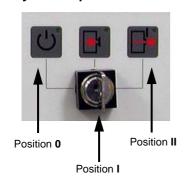


The laser system's current operating statuses, including e.g. error and warning messages, are shown on the screen via the Laser Console program (see Section "8, Laser Console program" on page 61).

EMERGENCY STOP pushbutton	With this push button you can stop the entire system in case of emergency.
	Attention Never use the emergency stop procedure to shut down the system unless there is truly an emergency. It shall only be used in the case of emergency.
Main switch	With the main switch, you can switch the entire laser system on and off. Attention Never switch off a running laser with the main switch.
Operating panel	The control panel includes key switch, indicator lights (LEDs) and the emergency stop pushbutton. The current operating state of the laser system and error states are displayed using the indicator lights on the control panel and using the screen of the Laser Console program (see Section "8, Laser Console program" on page 61). If an error occurs, an error message is also displayed on the screen in the VisualLaserMarker program.



Key switch positions





With the key switch you can choose between the operating modes **0** (Laser OFF), **I** (Laser ON / shutter enable OFF) and **II** (Laser ON / shutter enable ON):

Indicator light	Key switch	Main switch
	Position 0	O (OFF)
(h)	System is switched off	(LED is not lit up)
	Position 0	I (ON)
(A)	System is ready to star (green LED is lit up)	t / 'Startup Mode'
	Position I	I (ON)
1	System is in operating enable OFF' (green LI	
	Position II	I (ON)
- *	System in operating mo ON'* (green LED**)	ode / 'Shutter enable

*Danger

Class 4 laser radiation can cause injury to the eyes and skin!

The key switch may not be used as a substitute for activation of the shutter interlock circuit. The key switch is not a safety-related component. Personal safety equipment (e.g. laser protective goggles) must be worn until it is certain that no laser radiation is being emitted.

/!\

*Attention

A safely closed beam lock (shutter) according to laser class 1 can only be ensured if the 2-channel shutter interlock circuit of the laser system is disconnected.

i

Note

The green 'Startup Mode' indicator light remains continuously lit if the main switch is in the position.

i **No

The LEDs of the key switch positions or change according to the actual status of the shutter (see Section ", Indicator lights (LED)" on page 50).



Indicator lights (LED) 'Shutter closed' Key switch Status indication Indicator light Position I 'Shutter closed' The system is in operating mode / 'Shutter open' 'shutter enable OFF' Position II 'Shutter open' The system is in operating mode / 'shutter enable ON' Shutter interlock open: The green LED 'Shutter open' I is The green LED 'Shutter closed' 🖪 is Shutter interlock closed: The green LED 'Shutter open' is The green LED 'Shutter closed' 🛅 is not lit. i Note The LEDs or I light up as soon as the laser system is ready for operation. The LEDs light up depending on the existing operating state ('Shutter open' or 'Shutter closed'). The red 'Error' indicator light flashes to show that an 'Error' error has occurred. An error report is shown on the screen in the VisualLaserMarker program. The corresponding error state appears on the [Diagnostic] screen of the Laser Console program. First remove the cause of the error and then solve the actual error (see Section "6.2.3, How to switch back on after an error message" on page 55).





'Laser radiation possible'

The red 'Laser radiation possible' indicator light lights up for as long as laser radiation is generated and approx. 5 seconds before the laser radiation is generated (see Section "1, Safety" on page 1).

!\

Attention

Since laser radiation is dangerous for the eyes and can also lead to skin burns, the laser is equipped with a safety-related shutter which prevents the laser beam from being emitted if necessary. The shutter is a mechanical safety switch which interrupts the laser beam.

5.7 Additional components

5.7.1 Focusing axis FFM (Fast Focusing Module) (optional)

The focusing axis is located between the laser head and the marking head (Galvo).

With single head systems, the operating distance (Z-direction) can be increased or reduced with the focusing axis. It is not necessary to manually move the laser head and the marking head to adjust the operating distance.

The focusing axis is controlled by the marking software VisualLaserMarker on the monitor in the properties page 'Layer' or in the properties page of the laser parameters.

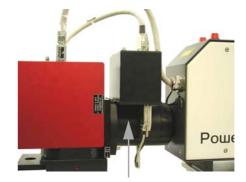


FIG. 63 FFM focusing axis

- » Information on controlling the focusing axis can be found in the separate user handbook on the marking software VisualLaserMarker.
- » Information on the operating distance of a laser with a focusing axis FFM is available on request.
- » For information on how to switch off the laser system, see Section "3.1.2.2, Establishing the connection between the laser head and the marking head" on page 28.
- » Information on the dimensions of the laser with focusing axis FFM is available on request.
- » Technical data see Section "9.4, Focusing axis FFM (Fast Focusing Module)" on page 87.

5.7.2 Uninterruptible power supply (UPS)

The UPS is an external emergency power supply. UPS protects the files stored in the temporary memory of the PC from loss when there is a power failure. This enables the controlled shut down of the software and saving of data.



Frontal view



Rear view



Note



Comply with the separate instructions from the manufacturer.

5.7.3 Extraction system

Your system can be provided with a filtering device which filters off particles created by the operating laser.

The optional accessories included in the delivery (hose, fittings, sleeves) are designed for the suction of hot air up to a temperature of +85°C. During the processing of workpieces, extremely hot particles may occur that usually cool off by the time they enter the nozzle. If, however, they do not cool off, adequate appliances must be affixed. In case of doubt, contact the closest Rofin-Sinar Service department.

Note



It is not possible to control a filtering device with the laser itself.

» Also observe the separate instructions of the manufacturer.

5.7.4 Foot switch

Marking can be started using a foot switch.

5.7.5 Performance test (option)

To always ensure consistent laser performance, test the system's performance regularly as required as well as after exchanging the diode module.

During an internal performance test (option), laser performance is measured in the laser head. The external power measurement (optional) measures the laser power in the marking area.



6 Operation

The laser system can be switched on off using the main switch and be operated using the controls on the control panel (see Section "5.6, Control elements of the laser system" on page 48). The indicator lights (LEDs) on the control panel and the status displays in the Laser Console program show the current operating status (start-up phase or ready for operation) as well as any errors which may have occurred.

Attention

The laser may only be operated by persons who are instructed in the operation of the laser and who are familiar with potential hazards during operation. This implies reading this operating manual and observing the remarks and instructions it contains.



Follow the operating and handling instructions in this manual and on the warning labels on the system exactly. Non-observance leads to loss of warranty.

Note

For operating systems with handling, please see the respective special description.



6.1 System settings via the VisualLaserMarker (VLM) marking software

The system settings are made on the screen via the marking software VisualLaserMarker (VLM).

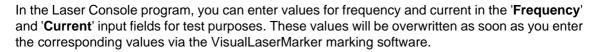
» For more information, please refer to the separate VisualLaserMarker user manual.

6.1.1 Laser parameters

The laser parameters are set on the screen via the VisualLaserMarker marking software.

The (diode) current, frequency, and first pulse suppression denote laser parameters. The laser parameters are determined according to the application and, under some circumstances, must be modified with time due to the natural aging of the diodes. There are limit values for these settings which cannot be exceeded or fallen below. Due to tolerances, the limit value for the max. current may vary depending on the system.

Note





6.1.1.1 Current and frequency

The laser can be operated in pulse mode or continuous-wave (CW) mode, depending on the application.

In pulse mode, short laser pulses with high peak powers are generated. In continuous-wave (CW) mode, however, the laser beam is continuously emitted. In pulse mode, both current and



frequency values must be entered. In continuous-wave mode, only the desired current value must be entered.

6.1.1.2 First pulse suppression

When the laser is in operating mode, the first laser pulse is stronger than the following laser pulses, with a pause in between pulses. An excessively strong laser pulse can damage the workpiece (shots, burning, melting). Therefore the first laser pulse must be diminished. The start value for the laser pulse suppression is the attenuation value for the first laser pulse. The first pulse parameters must be selected in such a way that the laser pulses are output with the same energy.

6.2 Switching on the laser system

The laser system is switched on with the main switch on the 19" plug-in for electrical components and the key switch on the control panel.

6.2.1 Switching on in normal operation

How to switch on the laser system:



Make sure that the key switch on the control panel is in position **0**

• Turn the main switch to position I.

The green indicator light on the control panel lights up.

- Switch the UPS on (if available).
- Make sure that the mains switch on the back side of the 19" plug-in PC is set to position I.

The PC will be booted. The RCU control software (with Windows) boots up. The Laser Console program automatically opens on the screen.



must be worn!

Turn the key switch on the control panel to position **I** or, if you wish to enable the opening of the shutter immediately, to position **II** . In this case, laser radiation can be emitted after the system has started up.

i Note

Wait until the Laser Control Program has opened on the screen before actuating the key switch. Failure to observe this point will result in an error message.

The warm-up phase of the laser system begins.

- The warm-up phase is shown in the laser console program on the [Laser] screen through the status display PRERUNNING.

The switch-on procedure is completed after 1-2 minutes (depending on ambient conditions) and is indicated on the control panel and Laser Console program:

On the control panel of the 19" plug-in for electrical components, the "Shutter closed" or "Shutter open" LEDs light up.



- The system's operational readiness is shown at the end of the warm-up phase through the status display OPERATIONAL.
- Switch on the external filtering unit (comply with the manufacturer's description).

Note

If the key switch is **not** at position **0** before the main switch is pressed, the KEY ERROR error message appears in the Laser Console program.



- The mains switch on the back side of the 19" plug-in PC can remain at position I.
- For an overview of the key switch positions see Section "5.6, Control elements of the laser system" on page 48.
- » For an overview of the Laser Console program, see Section "8, Laser Console program" on page 61.

6.2.2 Reactivation after an emergency stop

If you must switch off the laser system with the emergency stop push button, or if you have deactivated an interlock by removing the laser head cover during operation (for example), proceed as follows:

Switch the laser system on again following an emergency stop or a cover interlock deactivation using the following procedure:

- If the system was switched off via emergency stop,: release the emergency stop pushbutton by pulling it out.
- In case of a cover interlock deactivation:
- 1. Put the laser head cover on again.
- 2. Press the emergency stop pushbutton.
- 3. Unlock the emergency stop push button by pulling it out.
- Turn the key switch back to position 0 and then to position I .

Note

In case of an emergency stop or a cover interlock deactivation, the EMCY STOP error message is shown in the Laser Console program. In case of a cover interlock deactivation, the ERR:INTERLOCK 1 error message appears as well.



In the event of a shutter interlock or error with the shutter, the error message SHUTTER
 ERROR will appear in the Laser Console program.

6.2.3 How to switch back on after an error message

If the laser system has switched off automatically after an error message, you must proceed as follows:

Note

Clarify the cause of the error first and then acknowledge the error.

i



How to switch the laser system back on after an error message:

- Acknowledge the error:
- Turn the key switch back to position 0

Or:

- In the Laser Console program, click the [Reset Errors] button in the [Diagnostic] screen.

Note



If the error message cannot be ackowledged when the [Reset Errors] button is clicked, turn the key switch back to position **0**.



Danger!
Protective
goggles
must be worn!

Turn the key switch to position I or, if you would like to enable the opening of the shutter immediately, to position II . In this case, laser radiation can be emitted after the system has started up.

6.3 Switching off the laser system

Attention



Never switch off a running laser with the main switch!

6.3.1 Switching off in normal operation

How to switch off the laser system:

- Turn the key switch back to position 0 ...
- Shut down the PC properly.
- Shut down the computer or click the [**Shutdown**] button on the [**Laser**] screen in the Laser Console program.

The RCU control software is automatically shut down and the Laser Console program is automatically closed.

- Switch the UPS off (if available).
- Turn the main switch to position 0.

The switching off process has now been completed.

6.3.2 Switching off in case of emergency

In an emergency, the laser system can be switched off with the emergency stop pushbutton. The PC remains switched on.

Warning



Never use the emergency stop to shut down the system unless there is truly an emergency! The laser could be damaged.



How to turn the laser system off in case of emergency:

• Press the emergency stop pushbutton. This is located either on the control panel or can be individually integrated depending on the system layout.

Laser radiation will be switched off and the shutter closed.

Operation





7 Maintenance schedule

ROFIN-SINAR lasers are designed to be operated with a minimum of maintenance.

» A detailed description of the maintenance procedures can be found in the Maintenance and Integration Manual of the laser system.

7.1 19" plug-in for electrical components

Designation	Time	Explanation
Filter mat(s)	Depending on ambient conditions	Check the filter mat(s) for dirt regularly and replace if necessary.
	but at least once each year	The mat(s) is/are located at the front behind the grille of the 19" plug-in for electrical components.
		i Note
		PowerLine E Air 10 = 1x filter mat
		PowerLine E Air 25/ 30 = 2x filter mats

7.2 Laser head

Designation	Time	Explanation
Fan unit, cooling block, exhaust air shaft	Depending on operating conditions but at least once each month	Remove dust or particles from the surface of the fan unit, exhaust air shaft, and cooling block.

7.3 Marking head - optical components

Designation	Time	Explanation
Protective glass (if available)	Depending on operating conditions Recommendation: daily / 1 x week.	Clean the surface and check the protective glass for shots and layer peel-off. Clean or replace it if necessary. Please contact ROFIN-SINAR Laser or your authorized dealer.
Focusing optics	2000 h	Clean the surface and check the focusing optics for shots and layer peel-off. Replace if necessary. Please contact ROFIN-SINAR Laser or your authorized dealer.



7.4 Filtering device

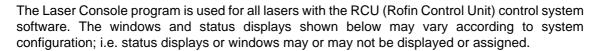
See separate instructions from the manufacturer.



8 Laser Console program

Several routines can be started to control and figure the laser in the Laser Console program.

Note





8.1 Laser Display program

The laser system's current operating statuses, including e.g. error and warning messages, are shown on the screen via the Laser Display program. In addition, various entry fields and command button are available on the [Laser] screen for test purposes.

Laser parameters and system settings are entered on the screen via the VLM marking software. For more information, please refer to the separate VLM user manual.

The following illustrations provide an overview of the laser system's operating states as well as error and warning messages in the Laser Display program.

Operating state	Color scheme
Current operating states are highlighted in bright colors (light red,	Bright red
light green).	Bright green
Non-occurring operating states appear in darker colors (dark red,	Dark red
dark green).	Dark green
Current warning messages are highlighted in bright colors (light yellow).	Bright yellow
Current warning messages are highlighted in bright colors (light red).	Bright red

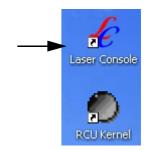


How to open the Laser Console program and the Laser Display program:

• Double-click the "Laser Console" symbol on the user interface screen.

The Laser Console program opens.

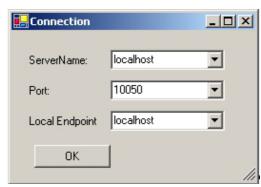
 Select the "Tool" menu from the menu bar and then the "Laser Display" menu item.





The "Connection" window will appear.

- Enter the following in the input fields:
- Server name: localhost
- Port: 10050
- Local Endpoint: localhost
- Click on the [OK] button.



The "Laser Console" window appears with the [Laser] screen.



8.1.1 [Laser] screen

The operating status of the laser is shown on the [Laser] screen. In addition, input fields and command buttons are available for test purposes.

i Note

You can select the individual pages using the screen switchover keys.

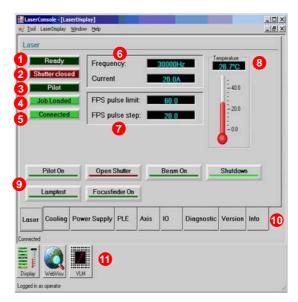


FIG. 64 Laser screen

- 1 'Laser' status display
- 2 'Shutter' status display
- 3 'Positioning aid' status display
- 4 Marking program status display
- 5 RCU control unit software connecting state
- 6 Entry fields
- 7 Display of the first pulse suppression
- 8 'Diode Temperature' display
- 9 Command buttons
- 10 Screen switchover keys
- 11 Program selection key

8.1.1.1 'Laser' status display

Display	State
Init	Laser initialization
Ready	Laser ready for activation
Prerunning	Laser preheating phase
Postcooling	Laser cooldown phase
Operational	Laser ready for operation
Key Error	Key switch in wrong position
Error	Laser error state
Emcy Stop	Display of an emergency stop or interlock deactivation



8.1.1.2 'Shutter' status display

Display	State
Shutter closed	Shutter closed
Shutter open	Shutter open

8.1.1.3 'Positioning aid' status display

Display	State
Pilot	Positioning aid on/off

8.1.1.4 'Marking program' status display

Display	State
No job loaded	VLM marking program not loaded
Job Loaded	VLM marking program loaded
Marking	The marking job is executed.

8.1.1.5 RCU control unit software connecting state

Display	State
Connected	The user interface of the Laser Console program (Laser Display) is connected to the RCU control unit software.
Disconnected	The connection to the RCU control unit software is interrupted. The displayed values are invalid.

8.1.1.6 Display of the first pulse suppression in pulse mode

Display	State
FPS pulse limit	Upper limit of the first pulse suppression(FPS = first pulse suppression) • Proportion of the power which is suppressed with the first pulse.
FPS pulse step	 Quantity of first pulse suppression. Quantity for the gradual removal of pulse suppression with each further pulse.



8.1.1.7 'Diode Temperature' display

Display	State
Diode Temp	Display of diode temperature (in Celsius)

8.1.1.8 Entry fields

In the "Frequency" and "Current" input fields, you can enter values for frequency and current for test purposes. These values will be overwritten as soon as you enter the corresponding values via the VLM marking software.

8.1.1.9 Command buttons

Pilot On/Off	Switches the positioning aid (optional) on or off
Shutter On/Off	Opens or closes the shutter
Beam On/Off	Switches the laser beam on or off
	/! Warning
	If the key on the control panel is at position II , laser radiation emerges immediately when the "BEAM ON" button is pressed.
Shutdown	Shuts down the operating system and RCU control software.
	i Note
	The Laser Console program is closed.
Lamptest	LED test. By right-clicking, you can check the functionality of the LEDs on the control panel and the "Laser radiation" warning lamps on the laser head.
Focusfinder On/Off	Switches the focus finder (optional) on or off



8.1.2 [Power Supply] screen

The operating status of the HN800 power supply unit is shown on the [**Power Supply**] screen.

i Note

Temperature-specific displays apply **ONLY** to air-cooled systems.

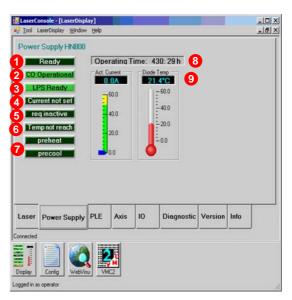


FIG. 65 Power Supply screeen

- 1 'Power supply unit' status display
- 2 'CAN Bus Node' status display
- 3 'Power supply unit' status display
- 4 'Set Current' status display
- 5 'Temperature Control' status display
- 6 'Diode Temperature' status display
- 7 'Diode Temperature Lead time' status display
- 8 Display of the operating hours
- 9 'Current' and 'Diode Temperature' displays

8.1.2.1 'Power supply unit' status display

Display	State
Init	Power supply unit initialization
Ready	Power supply unit ready for activation
Preheating	Power supply unit preheating phase
Precooling	Power supply unit precooling phase
Operating	Power supply unit ready for operation
Error	Power supply unit error state

8.1.2.2 'CAN Bus Node' status display

Display	State
CO Init	CAN bus node initialization



Display	State
HB Lost	Interruption of the connection between the CAN bus node and the RCU control unit software (HB Lost = heartbeat lost)
CO Operational	CAN bus node ready for operation (CO = CAN open)
CO Pre Op	CAN bus node waiting for initialization

8.1.2.3 'Power Supply unit' status display

Display	State
LPS Ready	Power supply unit ready for operation (LPS = laser power supply)
LPS Not Ready	Power supply unit not ready for operation

8.1.2.4 'Set Current' status display

Display	State
Current is set	The desired current is set.
Current is not set	The desired current is not set.

8.1.2.5 'Temperature Control' status display

Display	State
Reg Active	Temperature control active
Reg Inactive	Temperature control not active

8.1.2.6 'Diode Temperature' status display

Display	State
Temp Reached	Diode temperature reached
Temp Not Reached	Diode temperature not reached

8.1.2.7 'Diode Temperature Lead time' status display

Display	State
Preheat	Diode module preheating phase
Precool	Diode module precooling phase



8.1.2.8 'Current' and 'Diode Temperature' displays

Display	State
Act. Current	Display of actual current intensity (in ampere)
Diode Temp	Display of diode temperature (in Celsius)

8.1.2.9 Display of the operating hours

The number of operating hours is shown in the 'Operating Time' field.

8.1.3 [PLE] screen

The operating status of the laser head is shown on the [PLE] screen.

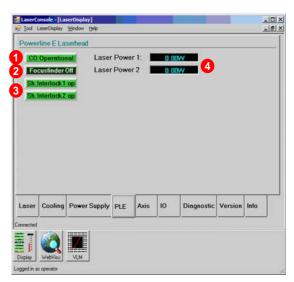


FIG. 66 PLE screen

- 1 'CAN bus node' status display
- 2 'Focus finder' status display
- 3 'Shutter interlock' status display
- 4 'Laser power 1' and 'Laser power 2' displays

8.1.3.1 'CAN bus node' status display

Display	State
CO Init	CAN bus node initialization
HB Lost	Interruption of the connection between the CAN bus node and the RCU control unit software (HB Lost = heartbeat lost)
CO Operational	CAN bus node ready for operation (CO = CAN open)
CO Pre Op	CAN bus node waiting for initialization



8.1.3.2 'Focus finder' status display

Display	State
Focus finder on	The focus finder is activated.
Focus finder off	The focus finder is not activated.

8.1.3.3 'Shutter interlock' status display

Display	State
Sh. Interlock 1	Channel 1 of the dual-channel shutter interlock circuit
Sh. Interlock 2	Channel 2 of the dual-channel shutter interlock circuit

8.1.3.4 'Laser power 1' and 'Laser power 2' displays

Display	State
Laser Power 1	Display of the laser power at power measuring head 1 (in Watt)
Laser Power 2	Display of the laser power at power measuring head 2 (in Watt)



8.1.4 [Axis] screen

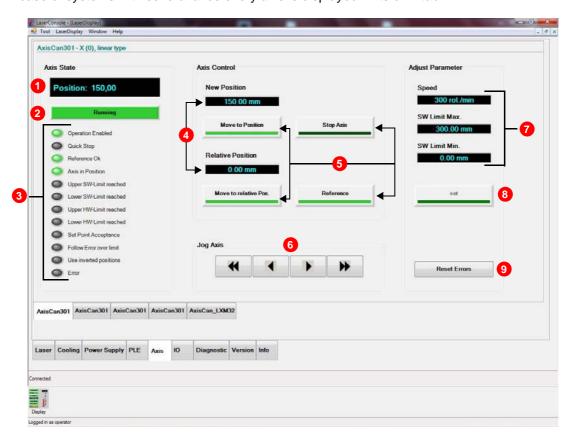
CAN axes or directly pulsed LIF axes can be installed into a handling unit. The assignment of the tab accordingly indicates [AxisCan301] or [LIFAxis] or [AxisCan_LXM32].

In the [AxisCan301] or [LIFAxis] or [AxisCan_LXM32] tab of the [Axis] screen, the operating state of one or more axes is displayed. In the respective tabs of the [Axis] screen, the corresponding axis can be referenced and moved. Errors, such as for example axis errors, can be acknowledged in the [Axis] or [Diagnostic] screen. The details of an error are displayed in the [Diagnostic] screen.

Note



The [Axis] screen refers only to systems with a handling unit into which axes have been installed. In case of systems with several axes every axis is displayed in its own tab.



- 1 Display of the current axis position
- 2 Display of the current axis status
- 3 'Axis' status displays
- 4 'Axis movement' entry fields
- 5 'Axis movement' buttons

- 6 'Axis movement' jog buttons
- 7 Entry fields for configuration values
- 8 [Set] button (for configuration values)
- 9 [Reset Errors] button

FIG. 67 [Axis] screen



8.1.4.1 Display of the axis position and the current status of the axis

Display	State
Position	In the 'Position' field, the position of the axis is displayed: - With linear axes, the position is displayed in mm. - With rotational axes, the position is displayed in degrees.
Resuming	The axis is initialized.
Running	The axis is ready for operation.
Error	The axis is in an error state.

Note

The value in the 'New Position' field will be displayed in red during the initialization phase of the axis because the current position of the axis is not known during the initialization phase.



8.1.4.2 'Axis' status display

Display	State
Operation Enabled	The axis is ready for operation.
Quick Stop	A stop signal is present at the motor (e.g. due to an open service door at the Handling unit).
Reference OK	The axis has been successfully initialized and thus has a clearly defined position.
Axis in Position	The axis stands still. The axis does not move.
Upper SW-Limit reached	An axis movement above the upper software limit was prevented.
Lower SW-Limit reached	An axis movement above the lower software limit was prevented.
Upper HW-Limit reached	The axis ran into the hardware limit switch. Move the axis back into position via the jog buttons or via reference movement.
Lower HW-Limit reached	The axis ran into the hardware limit switch. Move the axis back into position via the jog buttons or via reference movement.
Set Point Acceptance	This display appears with some axes where an axis position was adopted.
Follow error over limit	This display appears when a tracking error is defined and has been exceeded.
Use inverted positions	The axis is moved invertedly.
Error	An error has occured on the axis.



Note



The current status of the axis is marked as follows:

The green signal indicates an active status, gray indicates inactive statuses, red indicates an error or an active limit switch.

8.1.4.3 Axis movement' entry fields and buttons

Entry field	State
New Position	In the 'New Position' field, the desired position of the axis is entered.
Relative Position	In the 'Relative Position' field, the relative position of the axis is entered. The value of the relative position supplements the value in the field 'New Position' (relative axis movement e.g. +10mm or -10mm).

Button	State
[Move to Position]	Using the [Move to Position] button, the axis moves to the position entered in the 'Position' field.
[Move to relative Pos.]	Using the [Move to relative Position] button, the axis moves to the relative position entered in the 'Relative Position' field.
[Stop Axis]	Using the [Stop Axis] button, the axis movement is interrupted.
[Reference]	Using the [Reference] button, the axis carries out a reference movement.

Button	State
*	Using this jog button, the axis moves quickly in negative direction.
•	Using this jog button, the axis moves slowly in negative direction.
>>	Using this jog button, the axis moves quickly in positive direction.
•	Using this jog button, the axis moves slowly in positive direction.

8.1.4.4 Entry fields and button for configuration parameters

In these fileds, certain configuration parameters regarding the runtime of the RCU control software can be changed.

Entry field	State
Speed	In the 'Speed' field, the velocity of the axis motor (rotations/minute) can be set.



Entry field	State
SW Limit Max. SW Limit Min.	In the 'SW Limit Max.' and 'SW Limit Min.' fields, the maximum and minimum software limits can be changed.
	Access to the 'SW Limit Max.' and 'SW Limit Min.' fields is restricted to persons with a 'Service' access level.
	i Note
	For questions, please contact the Service department of ROFIN-SI-NAR Laser GmbH.
[set]	Using the [set] button, the entry in the field 'Speed' can be saved and set in the axis control.

Attention

Activating the [set] button permanently saves modifications to the configuration parameters in the system configuration.



8.1.4.5 [Reset Errors] button

Button	State
[Reset Errors]	Current errors can be acknowledged via the [Reset Errors] button.
	i Note
	Also see Section "8.1.6, [Diagnostic] screen" on page 75.



8.1.5 [IO] screen

8.1.5.1 IO modules (input/output)

In systems with the RCU control unit software, the following IO modules may exist:

- [LIFIO]
- [ALIIO]
- [CANIO]
- [PLTIO]

In the respective input tabs on the [IO] screen, the states of the input signals are displayed.



FIG. 68 IO screen

In the respective output tabs on the [IO] screen, the states of the output signals are displayed.



FIG. 69 IO screen

i Note

The respectively current status is marked with a bright green, illuminated dot.



8.1.6 [Diagnostic] screen

The [**Diagnostics**] screen shows all the current errors.

Current errors can be acknowledged via the [Reset Errors] button.

All relevant data is collected and automatically saved on the desktop as a zip file in case of an error via the [Collect Logfiles] button. The zip file can be forwarded to the Rofin Sinar service for error diagnostics.

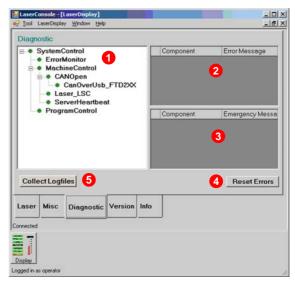


FIG. 70 Diagnostic screen

- 1 System components status displays
- 2 Display of the current error messages
- 3 Display of the current 'CAN Emergency Messages'
- 4 [Reset Error] button
- 5 [Collect Logfiles] button

8.1.6.1 'System components' status display

The display changes according to the status of the respective component.

Display	State
Green marking	Components marked in green are currently in operation.
Yellow marking	Components marked in yellow cannot be started.
Red marking	Components marked in red are faulty. ! Attention If there is an error on a component, there is automatically an error on all the controlling components (see "FIG. 70 Diagnostic screen", path display 1).

8.1.6.2 Display of the current error messages

Display	State
'Component' column	The 'Component' column shows the name of the respective system component which is faulty.



Display	State
'Error Message' column	The 'Error Message' column shows the specific error message.

8.1.6.3 Display of the current 'CAN Emergency Messages'

Display	State
'Component' column	The 'Component' column shows the name of the respective system component for which there is currently a "CAN Emergency Message".
'Error Message' column	The 'Error Message' column shows the specific so-called "Emergency Message".

8.1.7 [Version] screen

The [Version] screen shows all the version numbers of all the available system components.

Via the [Create Summary File] button, a text file of all the subsequently described displays is generated and shown on the screen.

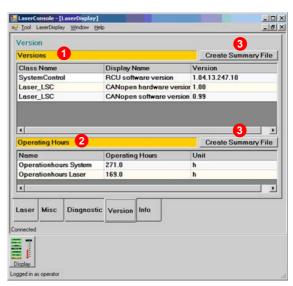


FIG. 71 Version screen

- 1 Version number display
- 2 Operating hours display
- 3 [Create Summary File] button

8.1.7.1 'Version number' display

Display	State
'Class Name' column	The 'Class Name' column shows the system components to which the respective version number is assigned.
'Display Name' column	The 'Display Name' column shows the name of the version number.



Display	State
'Version' column	The 'Version' column shows the version number itself.

8.1.7.2 Operating hours display

Display	State
'Name' column	The 'Name' column shows the system components.
'Operating Hours' column	The 'Operating Hours' column shows the number of operating hours for the respective system components.
'Unit' column	The 'Unit' column shows the unit in hours (h).

8.1.8 [Info] screen

The warning and error message report and information regarding the present operating states are shown on the [Info] screen.

The error report can be saved via the [Save] button.

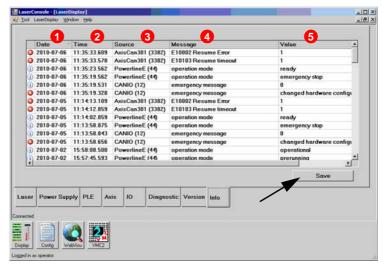
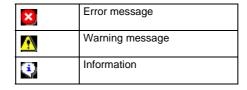


FIG. 72 Info screen

- 1 Date display
- 2 Time display
- 3 Module display
- 4 Display of the current operating state
- 5 Display of the actual status of the current operating state





Column	State
Date	In the "Date" column, the date of the respective information or warning or error message is displayed.
Time	The time at which the error and/or warning occurred is displayed in the "Time" column.
Source	The module in which the error and/or warning occurred is displayed in the "Source" column.
Message	The current operating, warning, or error state is displayed in the "Message" column.
Value	The actual status of the current operating, warning, or error state is displayed in the "Value" column.

8.2 Warnings and error messages

In general, there are two types of error displays:

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

Attention



In case of an error, the laser system will be switched off automatically for safety reasons. First remove the cause of the error and then solve the actual error (see Section "6, Operation" on page 53).

Acknowledge the error message as follows:

• Turn the key switch back to position **0** .

Or:

Click on the [Reset Errors] button in the [Diagnostic] screen or in the [Axis] screen.

Note



If the error message cannot be acknowledged when the [Reset Errors] button is clicked, turn the key switch back to position **0**.

8.2.1 Table of warnings and error messages

The warning and error messages are shown in the Laser Display program on the relevant tabs of the [**Diagnostic**] and [**Info**] screens.

The warnings and the error messages listed in the following table are indicated with their possible causes. In the event of warning or error messages, please contact customer services of ROFIN-SINAR Laser.

Error No.	Error/warning
./.	Warn:Temperature LPS-CW (Internal)



Error No.	Error/warning
./.	Warn: Set Current Timeout
./.	Warn: Peltier current max.
./.	Warn: Temperature min. diode
./.	Warn: Temperature max. diode
E10001	Configuration Error
E10002	Resume Error
E10102	Base emergency message
E10101	CAN node heartbeat lost
E50112	Timeout Preheating/Precooling
E50113	HW Max Current Limit
E50101	System microcontroller
E50102	EEProm (parameterization)
E50103	Control voltage 10 to 15V QSD
E50104	Min. diode voltage
E50105	Max. diode voltage
E50106	Timeout set current not reached
E50107	Temp. LPS-CW (internal)
E50108	Temp. limit max. diode (HW)
E50109	Peltier current max.
E50110	Temp. limit min. diode
E50111	Temp. limit max. diode
E50201	Temperature diode
E50202	Temperature heat sink
E50203	Temperature resonator
E50204	QS driver
E50205	QS overtemperature
E50206	Shutter





9 Technical data

9.1 Supply units

Lagor type	PowerLine E Air	
Laser type	Fower Line E All	
Electrical connections		
Voltage (incl. PC and monitor)		
PowerLine E Air 10	120-240 VAC; 1N/PE; 50/60 Hz	
PowerLine E Air 25/ 30	208-240 VAC; 1N/PE; 50/60 Hz	
Power consumption (total), max. [VA]		
PowerLine E Air 10	500	
19" plug-in for electrical components, max. [VA]	400	
PC incl. monitor, max. [VA]	approx. 100 (70 + 30)	
PowerLine E Air 25/ 30	610	
19" plug-in for electrical components, max. [VA]	510	
PC incl. monitor, max. [VA]	approx. 100 (70 + 30)	
Fuses	1 x 16 A slow acting	
Sound level [dB(A)]	< 65	
Safety classes		
Laser head	IP54	
Marking head	IP54	
19" plug-ins	IP20	
Dimensions		
19" plug-ins [H ^a x W x D]		
19" plug-in for electrical components [mm]	3U x 19" x 460	
19" plug-in PC [mm]	2U x 19" x 479	
Corrugated pipe (passive fiber) (between the 19" plug-in for electrical components and the laser head)		
PL-E Air 10/ 25/ 30 [m]	3 or 5	



Laser type	PowerLine E Air
Weight	
19" plug-in units	
19" plug-in PC	approx. 10
19" plug-in for electrical components [kg]	
PowerLine E Air 10	approx. 28
PowerLine E Air 25/ 30	approx. 30
Cooling system	Air-cooling
Air flow	
Laser head [m ³ /h]	approx. 120
19" plug-in for electrical components[m ³ /h]	approx. 250
19" plug-in PC [m ³ /h]	approx. 80
Waste heat	
PowerLine E Air 10	
19" plug-in for electrical components, max. [W]	254
Laser head with marking head, max. [W]	120
PC incl. monitor, max. [W]	90
PowerLine E Air 25/ 30	
19" plug-in for electrical components, max. [W]	330
Laser head with marking head, max. [W]	150
PC incl. monitor, max. [W]	90

a. 1U (height unit) = 44.5mm



9.2 Laser head

Laser type	PowerLine E Air			
	E 10 HQ	E 10 HP	E 25	E 30
Pump light source	Diodes	Diodes	Diodes	Diodes
Diode current	Maximum up to 43 A (after aging, max. 45 A), where the value "max. current" is preset by ROFIN and, depending on component tolerance (while complying with the specification) can also be less than the values of 43 or 45 A; adjustable in 0.1 A increments, stand-by: 8A			
Pulse unit	Acousto- optical Q- switch	Acousto- optical Q- switch	Acousto- optical Q- switch	Acousto- optical Q- switch
Beam data				
Wavelength [nm]	1064	1064	1064	1064
Output power [W] max	8	10	24	25
Beam quality	TEM ₀₀	TEM ₀₀	TEM ₀₀	Multimode
M²	< 1,3	< 1,5	< 1,3	> 3
Polarization	linear, >100:1	linear, >100:1	linear, >100:1	linear, >100:1
CW stability [rms] 8h	± 1%	± 1%	± 1%	± 1%
Q-switch pulse data		•	•	•
Pulse frequency [kHz]	0 - 200	0 - 200	0 - 200	0-200
Pulse to pulse stability [rms], 30 kHz	< 2%	< 2%	< 2%	< 2%
Dimensions (LxWxH) mm	500 x 118 x 220	500 x 118 x 220	500 x 118 x 220	500 x 118 x 220
Weight without marking head				
PowerLine E Air 10 [kg]	18			
PowerLine E Air 25/30	19.5			
Operating and storage conditions				
Ambient temperature [°C]	25 ± 10	25 ± 10		
Storage and transport temperature [°C]	+5 to +40	+5 to +40	+5 to +40	+5 to +40
Ambient conditions	20-80% relative humidity up to 30°C ambient temperature, max 65% relative humidity at higher ambient temperature, non-condensing			



9.3 Marking head - 1064 nm

Marking head	RS.S10	RS.S14	RS.S20
Aperture			
Maximum diameter of the beam ray inside the marking head [mm]	10	14	20
Step response (settling to 1/1000 full scale)			
At 1% full scale [ms]	0.25	0.40	0.80
At 10% full scale [ms]	./.	1.60	2.5
Optical performance			
Nominal deflection angle [rad]	0.82	0.82	0.82
Gain error [mrad]	< 5	< 5	< 5
Zero offset [mrad]	< 5	< 5	< 5
Skew [mrad]	< 1.5	< 1.5	< 1.5
Non-linearity [mrad]	< 3.5	< 3.5	< 3.5
Dynamic values		•	•
Tracking delay [ms]	0.14	0.24	0.40
Repeatability [µrad]	< 22	< 22	< 22
Long-term drift over 8 hours at operating temperature [mrad]	< 0.6	< 0.6	< 0.6
Electrical connections			
Maximum, theoretic range for input values	0 to 65535 increments	0 to 65535 increments	0 to 65535 increments
Input and output signals	XY2-100 standard	XY2-100 standard	XY2-100 standard
Power supply	± (15+1.5) V DC, max. 3 A per supply voltage	± (15+1.5) V DC, max. 3 A per supply voltage	± (15+3) V DC, max. 2.5 A per supply voltage
Calibration	± 0.41 rad optical at (32768 ± 31457) bits	± 0.41 rad optical at (32768 ± 31457) bits	± 0.41 rad optical at (32768 ± 31457) bits



Marking head	RS.S10	RS.S14	RS.S20
Mirrors			
Coating	Dielectric high performance coating (YAG)	Dielectric high performance coating (YAG)	Dielectric high performance coating (YAG)
Wavelength [nm]	1064	1064	1064
Reflectivity	More than 99.5% ^a per mirror over the whole range of angles	More than 99.5% ^c per mirror over the whole range of angles	More than 99.5% ^f per mirror over the whole range of angles
Maximum power density - Continuous-wave mode [W/cm²]: - Pulse mode (at 50 ns pulse length) [MW/cm²]:	500 ^b 100	500 ^d 100 ^e	500 ^g 100 ^h
Weight			
Without lens [kg]	approx. 3	approx. 3	approx. 5.8
Operating and storage conditions		•	
Ambient temperature [°C]	25 ± 10	25 ± 10	25 ± 10
Storage and transport temperature [°C]	-10 to +60	-10 to +60	-10 to +60
Ambient conditions	Humidity above dew point, non corrosive		

- a. Galvo head for 1064 nm and 880 nm: > 80.0% @ 880 nm
- b. Galvo head for 1064 nm and 880 nm: 300 $\mbox{W/cm}^2$ @ 1064 nm
- c. Galvo head for 1064 nm and 880 nm: > 98.0% @ 1064 nm; > 80.0% @ 880 nm
- d. Galvo head for 1064 nm and 880 nm: 300 $\mbox{W/cm}^2$ @ 1064 nm
- e. Galvo head for 1064 nm and 880 nm: 50 MW/cm² @ 1064 nm
- f. Galvo head for 1064 nm and 880 nm: > 98.0% @ 1064 nm; > 80.0% @ 880 nm
- g. Galvo head for 1064 nm and 880 nm: 300 $\rm W/cm^2$ @ 1064 nm
- h. Galvo head for 1064 nm and 880 nm: 50 MW/cm² @ 1064 nm



9.3.1 Marking head - 1064 nm (continued)

Marking head	RS.R10	RS.RM10-2; G4
Aperture		
Maximum diameter of the beam ray inside the marking head [mm]	10	10
Step response (settling to 1/1000 full scale)		
At 1% full scale [ms]	./.	./.
At 10% full scale [ms]	./.	./.
Optical performance		
Nominal deflection angle [rad]	0.79	0.79
Gain error [mrad]	./.	J.
Zero offset [mrad]	./.	./.
Skew [mrad]	./.	./.
Non-linearity [mrad]	./.	./.
Dynamic values		
Tracking delay [ms]	./.	./.
Repeatability [µrad]	< 20	< 20
Long-term drift over 8 hours at operating temperature [mrad]	< 0.3	< 0.3
Offset drift [%/K]	0.005	0.005
Gain drift [μrad/K]	30	30
Electrical connections		
Maximum, theoretic range for input values	0 to 65535 increments	0 to 65535 increments
Input and output signals	XY2-100 standard	XY2-100 standard
Power supply	± (15+1.5) V DC, max. 2 A per supply voltage	± (15+1.5) V DC, max. 2 A per supply voltage
Calibration	± 0.41 rad optical at (32768 ± 31457) bits	± 0.41 rad optical at (32768 ± 31457) bits
Mirrors		
Coating	Dielectric high performance coating (YAG)	Dielectric high performance coating (YAG)



Marking head	RS.R10	RS.RM10-2; G4	
Wavelength [nm]	1064	1064	
Reflectivity	More than 99.5% per mirror over the whole range of angles	More than 99.5% per mirror over the whole range of angles	
Maximum power density - Continuous-wave mode [W/cm²]: - Pulse mode (at 100 ns pulse length) [MW/cm²]:	500 100	500 100	
Weight			
Without lens [kg]	2.8	1.2	
Operating and storage conditions			
Ambient temperature [°C]	25 ± 10	25 ± 10	
Storage and transport temperature [°C]	-10 to +60	-10 to +60	
Ambient conditions	Humidity above dew point, non corrosive		

9.4 Focusing axis FFM (Fast Focusing Module)

Laser type	PowerLine E Air (single head)
Beam expander	2.8x
Focus shift [mm]	
Objective f = 160 [mm]	± 4.5
Objective f = 255 [mm]	± 12.5
Focusing time (Z-direction) [ms] between top and bottom axis position	15
Dimensions (LxWxH) [mm] (beam expansion and board)	130 x 130 x 185
Weight [kg]	approx. 1



9.5 PC

Laser type	PowerLine E Air
Monitor, keyboard, mouse	
19" plug-in	
Sockets and interfaces	CAN, USB, serial
Processor	Dual Core
Hard disk	HDD SATA
Operating system	Windows 7 / 32 bit / 64 bit

Note



Technical modifications reserved.

9.6 Operating and storage conditions for overall system

Laser type	PowerLine E Air
Ambient temperature [°C]	25 ± 10
Storage and transport temperature [°C]	+5 to +40
Ambient conditions	20-80% relative humidity up to 30°C ambient temperature, max 65% relative humidity at higher ambient temperature, non-condensing



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