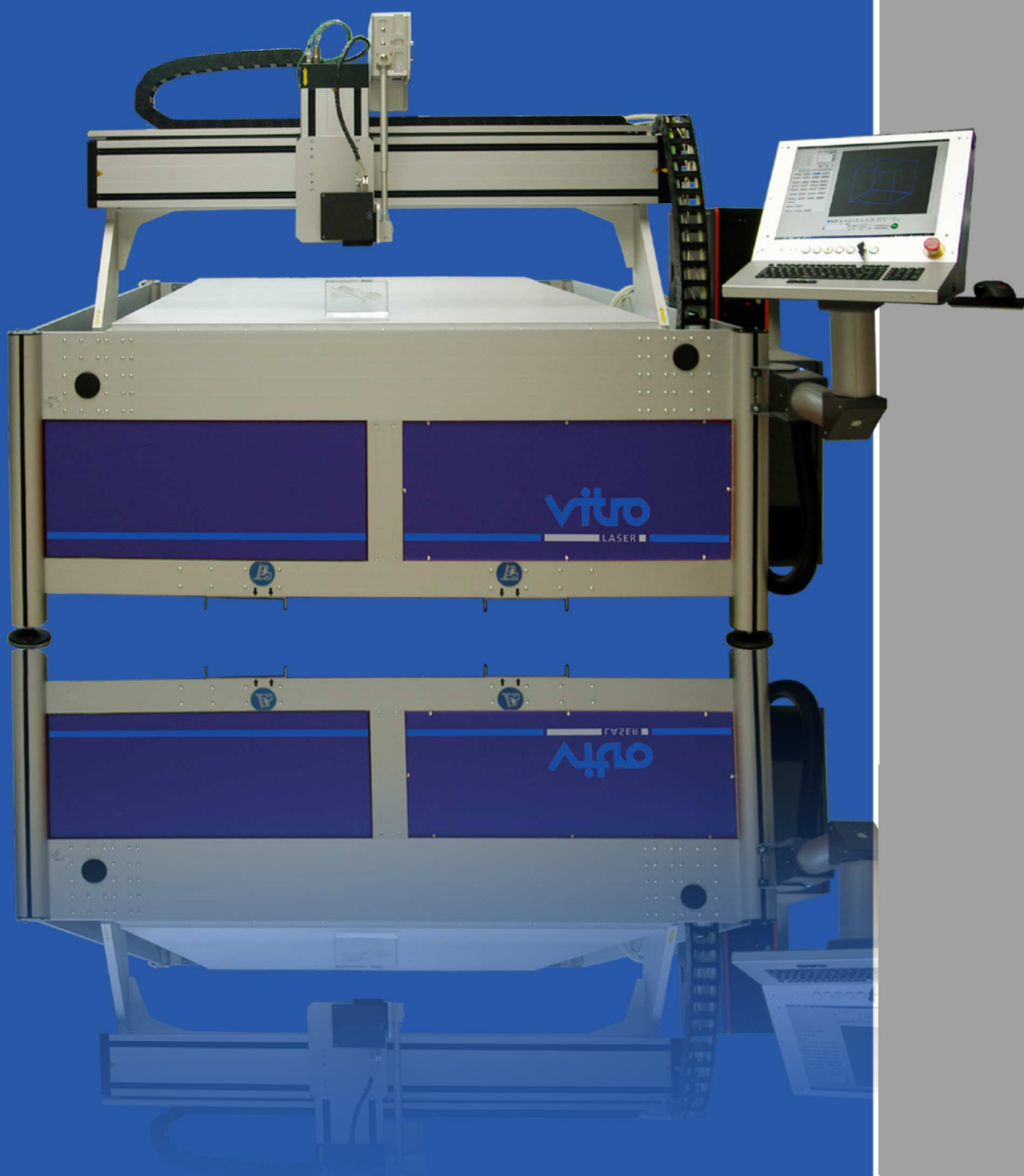


vitro

LASER

# User Manual Vitrolux E / F



**Note**

Always keep the serial number shown on this page close to hand when contacting Vitro Laser Solutions UG.

Vitro Laser Solutions UG reserved the right to make technical changes to improve the product.

All measures have been taken to ensure this documentation is correct. Please inform Vitro Laser Solutions UG if you find any mistakes in the documentation.

**Copyright**

The documentation is the Copyright of Vitro Laser Solutions UG.

It is only intended for the proprietor and operating personnel. The instructions and information contained may not be copied in full or part, distributed or transferred by any electrical data transfer methods or used for competitive purposes without authorized approval. Offenders will be liable to prosecution.

**Declaration of Conformity**

We

**Vitro Laser Solutions UG  
Ellerbusch 28  
D-32429 Minden**

assume the sole responsibility that the product

**Typ : Vitrolux E/F**

Serial Number:

□ □ □ □ □ □ □ □ □ □

fulfills the requirements stipulated in:

the relevant safety and health protection laws set out in the EEC machinery safety guidelines 89/392/EEC, 89/336/EEC and 73/23/EEC and amendments 91/368/EEC (20.06.91), 93/44/EEC (14.06.93), 93/68/EEG (22.07.93) as well as the 9<sup>th</sup> ordinance regulating safety (Ordinance Regulating Machines, 9<sup>th</sup> GSGV), the other appropriate EU guidelines, DIN EN 292 Part 1 and 2 (safety of machines), EN 60204 (equipping of machines), EN 60825 (radiation safety concerning laser equipment), EN 55011 (radio interference of electrical resources) EN 50082-2 (electromagnetic compatibility), the accident prevention regulations concerning laser radiation (BGV B2), E DIN 5335 on screening workplaces, safety related requirements and tests and national standards VDE 100 (directive for erecting high voltage systems) and VDE 0105 (operating high voltage systems).

Minden, .....

A. Sperling  
Board of Managers

## Preface

This operating instruction manual provides detailed information on using the Vitrolux laser system for subsurface engraving. It contains safety information which ensures safe use of the laser.

It also contains instructions on installation, maintenance, fault location and troubleshooting. The spare parts list enables spare parts for the laser system to be ordered simply.

The aim of this manual is to help you exploit the full potential of the laser system.

The laser system will provide years of satisfaction when it is used and cared for properly. The documents provided should help to ensure this.

Always keep the documentation available in the direct vicinity of the laser system. Observe all the information, notes, instructions and guidance contained in it. This will prevent accidents through incorrect operations, secure rights to claim under the full terms of manufacturers guarantee and ensure that your laser system is always full functional.

Vitro Laser Solutions UG constantly aims to improve its products. For this reason it reserves the right to make modifications and improvements which it deems necessary. However this does not involve any obligations to make reconstructions to laser systems already supplied.

The following symbols appear at important sections of this manual. Observe the information precisely and take particular care in such cases.

Used symbols:



### Warning

This symbol indicates the risk of fatal or severe personal injury if certain behavioural regulations are ignored. Where this symbol appears, ensure all the relevant safety precautions are met.



### Caution

This notice warns you against material damage as well as financial and criminal disadvantages (such as loss of the warranty rights, liability cases, etc.).



### Information

Here you will find important information and details on the effective, economic and environmentally safe management of the system



### Warning

You have to read the operating manual and understood the safety information contained in it before starting up the laser system.

## Table of contents

<b>1. Safety</b> .....	<b>7</b>
<b>1.1 For your safety</b> .....	<b>8</b>
1.1.1 General information.....	8
1.1.2 Obligations of the proprietor.....	8
1.1.3 Obligations of operating personnel.....	9
<b>1.2 Liability</b> .....	<b>10</b>
<b>1.3 Accident prevention regulations</b> .....	<b>11</b>
1.3.1 General information.....	11
1.3.2 Laser system.....	11
1.3.3 Protective measures from the operator .....	13
1.3.4 Assembly and disassembly .....	14
1.3.5 Transport and assembly.....	14
1.3.6 Storage .....	14
1.3.7 Maintenance and repair.....	15
1.3.8 Safety when out of service.....	15
1.3.9 Electrics.....	15
1.3.11 Other points of danger .....	16
<b>1.4 Intended use</b> .....	<b>17</b>
<b>1.5 Operation</b> .....	<b>18</b>
<b>1.6 Information labels and rating plates</b> .....	<b>18</b>
<b>2. Transport and installation</b> .....	<b>21</b>
<b>2.1 General information</b> .....	<b>22</b>
<b>2.2 Transport</b> .....	<b>22</b>
2.2.1 Transport vehicles .....	22
2.2.2 Notes on the packaging.....	22
2.2.3 Tilt and shock monitoring .....	23
<b>2.3 Installation</b> .....	<b>24</b>
<b>3. Product description</b> .....	<b>25</b>
<b>3.1 Components comprising the laser system</b> .....	<b>26</b>
3.1.1 Overview.....	26
3.1.2 View of the components.....	27

- 3.2 Laser head ..... 28
- 3.3 Scanner ..... 29
- 3.4 Laser optics..... 30
- 3.5 Motor axis ..... 31
- 3.6 Laser system switches..... 33
- 3.7 Components in the control module box ..... 35
- 3.7 Components in the control module box ..... 35
  - 3.7.1 Control unit .....35
  - 3.7.2 Axis controller.....36
- 3.8 PC Console ..... 37
- 3.9 Function setting safety contacts (Laser class 1 with doors only) ..... 37
- 4. Operation ..... 38
  - 4.1 Power-on routine ..... 39
  - 4.2a Load/engrave laser class 1 ..... 39
  - 4.2b Load/engrave laser class 4 ..... 40
  - 4.3 Shutdown procedure ..... 40
- 5. Maintenance ..... 41
  - 5.1 General information..... 42
  - 5.2 Maintenance work and intervals ..... 42
    - 5.2.1 Fixed intervals.....42
    - 5.2.2 Maintenance work as necessary.....42
  - 5.3 Lubricate motor axles ..... 43
    - 5.3.1 Guide rails .....43
    - 5.3.2 X-axis .....43
    - 5.3.3 Y-axis .....44
    - 5.3.4 Z-axis .....45

5.4 Clean air filter .....	46
5.5 Clean interior of the system .....	46
5.6 Clean the optics .....	47
<b>6. Troubleshooting .....</b>	<b>48</b>
6.1 General information.....	49
6.2 Errors.....	49
6.2.1 System can't be switched on .....	49
6.2.2 „Power" button does not work .....	49
6.2.3 Laser does not engrave.....	49
6.2.4 Software works incorrectly .....	49
6.2.5 Software message „Door open“ in closed .....	50
6.2.6 Engraving moved in glass.....	50
6.2.7 Motives with defects always in the same place .....	50
6.2.8 Motives with streaks or strips.....	50
6.2.9 Motive rare to see .....	51
6.3 Changing the lens .....	51
6.4 Replacing the laser diode module .....	51
<b>7 Technical Data .....</b>	<b>52</b>
7.1 General Data .....	53
7.2 Environmental conditions .....	53
7.3 Electrical installations.....	53
7.4 Laser.....	53
<b>8 Spare parts, special equipment.....</b>	<b>54</b>
This chapter defines the spare parts and the related order numbers. This ensures the correct definition of the necessary parts for orders. ....	54
8.1 Grease for the axes bearings .....	55
8.2 Warning labels .....	55
8.3 Diode module.....	56
8.4 Lens .....	56
8.5 Laser safety glass .....	56
8.6 Protection goggles .....	56
8.7 Glass tension tester .....	57
<b>9 Warranty.....</b>	<b>58</b>

# 1. Safety

## Contents

This operating manual for your laser system contains important information on installation, operation, maintenance, fault conditions and ordering spare parts. We provide this information to ensure safe, reliable operation of your laser system.

All the safety information are necessary for safe use of the laser system and terms of liability are contained in this chapter. It also provides information on the intended use.

## Organization

- 
- 1.1 For your safety
    - 1.1.1 General information
    - 1.1.2 Obligations of the proprietor
    - 1.1.3 Obligations of the operating personnel
  - 1.2 Liability
  - 1.3 Accident prevention regulations
    - 1.3.1 General information
    - 1.3.2 Laser System
    - 1.3.3 Protective measures from the operator
    - 1.3.4 Assembly and disassembly
    - 1.3.5 Transport and assembly
    - 1.3.6 Storage
    - 1.3.7 Maintenance and repair
    - 1.3.8 Safety when out of service
    - 1.3.9 Electrics
    - 1.3.10 Other points of danger
  - 1.4 Intended use
  - 1.5 Operation
  - 1.6 Information labels and rating plates
- 

## Objective

This chapter points out the potential dangers involved when using the laser system. It provides information on recognizing dangerous situations and should help to ensure you operate the system in a safe, proper way.

**Read this operating manual, paying particular attention to this chapter, before starting to use the laser system!.**

## 1.1 For your safety

### 1.1.1 General information

In addition to safety information, this operating manual provides:

- a general description of the product
- information on installing the laser system
- instructions on operating the laser system
- instructions on maintenance and upkeep
- instructions on fault location and elimination
- technical data
- an overview of special optional equipment
- a spare parts list

Always keep this operating manual and other documents related to the laser system close to hand in the vicinity of the operating unit. Operation of the system was explained when the system was handed over. Read this manual before operating the system for the first time, paying particular attention to the safety information. Sections marked by a symbol are of special importance.

Your laser system was tested at the factory. However, risks are present in the case of incorrect operation or misuse:

- risk of fatal injury to operators, third-parties and animals in the vicinity of the laser system
- risk of damage to the laser system and other property damage of the proprietor and third-parties
- for the efficient operation of the laser system

### 1.1.2 Obligations of the proprietor

The proprietor is obliged to ensure personnel working on the laser system:

- are familiar with the basic regulations on safety and accident prevention and who have received instruction on operating the laser system
- has read the operating manual, the chapter on safety and the warning symbols, has understood them and confirmed this with their signature.

The proprietor is accountable for selecting operating personnel. During selection, he or she must pay attention to the suitability of personnel for using the laser system.

The laser system operator must observe and maintain the following regulations:

- the appropriate accident prevention laws
- company laws on laser systems
- the functional limits and safety regulations stipulated in the technical manuals.



The proprietor must instruct users regularly (at least once a year) on the dangers of laser radiation.

**Warning**

The proprietor is finally accountable for safety.  
This responsibility cannot be delegated to others.

### 1.1.3 Obligations of operating personnel

All persons involved in operating the laser system are obliged:

- to constantly ensure the safety of the laser system and third-parties
- to read the operating instructions, the chapter on safety and the warning symbols, and to confirm they have understood it by applying their signature
- operate the laser system only when they are familiar with the laser system functionality, its safety and emergency equipment and are in full control of it

Operating personnel must devote their full attention to working with the laser system.

**Warning**

This not only concerns your safety but also that of colleagues and others in the vicinity of the laser system!

## 1.2 Liability

Principally, our »General Terms of Business« apply. Claims under the terms of warranty and liability in the case of personal injury or property damage are excluded when they are the result of one or more of the following causes.

- Non-intended use of the laser system
- Unauthorized assembly, starting up, operation and maintenance of the laser system
- Operation of the laser system with defect safety equipment or when safety or protection equipment is incorrectly mounted or not functional
- Failure to observe the information in the documentation in respect of laser system operation, maintenance, upkeep and fault location
- Unauthorized constructional modifications on the laser system
- Insufficient monitoring of parts subject to wear
- Improperly completed repairs
- Catastrophes caused by foreign bodies and Acts of God



### Note

The manufacturer only assumes the full terms of warranty for spare parts ordered from him.



### Caution

No modifications, refitting or reconstruction may be made on the laser system without authorization from the manufacturer. All reconstruction work requires written approval from Vitro Laser Solutions UG.



### Caution

Only use original spare parts and parts subject to wear. It cannot be guaranteed that parts obtained from other sources have been constructed and produced according to the applicable load and safety requirements.

## 1.3 Accident prevention regulations

### 1.3.1 General information

Before starting the equipment up for the first time following assembly (new installation or assembly after transport), a safety check must be made. All the load-bearing and machine parts must be checked that they are in perfect condition.

Check that the laser system is operationally safe before starting up each day! Apart from the information in the operating manual, the generally applicable and any local safety and accident prevention regulations must also be observed.

The warning and information labels attached provide important information on safe operation. Observe this information in the interest of third-parties as well as your own.

Any faults which occur that affect safety must be cleared immediately.

Damaged parts must be replaced immediately. The laser system may not be operated again until the fault has been cleared

All mentioned directions are viewed from the operating side.

Direction of rotation is defined as follows:

- Turn right = clockwise
- Turn left = anticlockwise

The turning of screws, nuts, etc., is always viewed from the operating side

### 1.3.2 Laser system

The laser system can be delivered as Laser Class 1 (with cover and doors) or as Laser Class 4 (as shown on front page of this manual).

The system complies to Laser Class 1 under normal working conditions with cover and doors fully closed.

The laser system may only be operated under the following conditions in Normal mode:

- The housing and doors are fully closed (Laser Class 1)
- All persons located in the same room as the system wear safety-glasses (Laser Class 4)
- The laser head, scan head and laser beam path to its intended outlet at the lens are fully closed
- The operating personnel has been instructed and has read and understood the operating manual
- The fiber optics are not damaged.



#### Warning

The laser may only set to production mode when the protective guards and cover flaps are closed, the laser head and scan head are closed and the laser beam path is covered. The optical waveguide must not be damaged. Risk of accident.



#### Warning

If the beam guide is not mounted, the laser beam escapes at the side of the laser head. Risk of accident.

**Caution**

Do not open the laser head, scan head and diode module. Particles can enter and damage the high performance optics. Opening these components annuls rights to claims under the terms of warranty

In Maintenance, Set-up and Repair modes (the laser beam can be accessed) the Vitrolux C laser system complies to Laser Class 4.

The laser system may only be operated in Maintenance, Set-up and Repair modes under the following conditions:

1. The proprietor must contract a specialist for laser protection in writing.
2. The operator has submitted the requirements for operating laser equipment complying to Laser Class 4 to the relevant local authority department prior to commissioning the
3. The laser zone is clearly identified and the entrance to the laser zone is equipped with a warning lamp.
4. The operator and all those in the laser zone must wear protective goggles which provide protection from direct, specular reflected or diffuse radiated laser beams. It is recommended to wear protective gloves.

**Warning**

Prevent the possibility of unauthorized persons accessing the laser zone. Risk of accident!

**Warning**

If the beam guide is not mounted, the laser beam escapes at the side of the laser head. Risk of accident.

**Note**

The order numbers for appropriate protective goggles is provided in Chapter 8 Special Equipment.

**Danger from laser beams**

The laser beams radiated by the Vitrolux laser system are (in)visible. They can cause severe damage to the eyes and cause skin burns.

Diffuse leakage radiation or reflected radiation can also be dangerous.

**Warning**

Never expose yourself to direct or reflected laser beams. Never look directly into the laser beams. Risk of injury.

**Warning**

While the material is being processed, aggressive UV radiation is generated. Risk of injury.

**Warning**

Remove all objects from the laser zone which could put you or others at risk through uncontrolled reflection. Risk of injury.

**Warning**

The viewing window of the sliding door must not be in a damaged condition. Risk of accident through escaping laser beams.

Laser beams can increase the risk of fire and explosion. Remove all flammable and easily combustible gases, liquids and substances from the laser zone.

**Warning**

The laser system must not be operated in environments in which there is a risk of fire or explosion. Risk of accident.

When processing metals or plastics, poisonous gases or dusts can be produced.

**Note**

The rating plate and information in Chapter 7 Technical Data provides specifications on the maximum laser power, pulse energy, pulse duration and wavelengths.

### 1.3.3 Protective measures from the operator

The laser system door is equipped with protective switches which are part of a protection circuit. The laser beam is switched off when a protective switch is opened.

**Warning**

Never bridge or manipulate protective switches that has the consequence that the warranty expires. Risk of accident.

In addition to these constructional protective measures for the laser system, Vitro Laser Solutions UG also recommends equipping the entrance doors to the laser zone with such switches.

Keep all unauthorized persons away from the laser zone.

This can be achieved by installing self-closing doors which can only be opened using a key or similar protective equipment.

### 1.3.4 Assembly and disassembly

Only personnel involved with the assembly and disassembly work may be in the vicinity of the laser system during assembly and disassembly. Others (e.g. spectators) must be kept outside the laser zone.

Ensure the load-bearing capacity of the ground is sufficient.

During assembly and disassembly work, also ensure the stability of the laser system and its components.

Following assembly, check all the parts are properly connected and that all connection cables and lines are correctly attached. When the cable and line layout is on the floor, ensure it is done in a way to minimize the risks of tripping.

Before starting the laser system, the personnel responsible for switching it on must be sure that the system is in perfect condition by carrying out the prescribed checks and controlling sample production!

### 1.3.5 Transport and assembly

Only transport the Vitrolux E / F in a standing position. Observe the transport and storage information provided on the laser system packing material



#### Caution

Transport the laser system carefully without the packing. Avoid vibrations and the use of force. The cooling water must be drained off. Risk of damage.

Before transporting the laser system, pack the components carefully (e.g. applicable sea freight cases, drying agents). The following transport systems are permitted:

- Rail
- Ship
- Truck with pneumatic suspension
- Fork-lift truck (for transporting the laser system and components on pallets)

The base must have a load-bearing capacity of at least 300 kg/m<sup>2</sup>.

The laser system may only be installed in locations which:

- are not exposed to extreme vapors from oils, solvents or cleaning agents
- are free of dust
- are not potentially explosive
- are clean
- are not subject to vibration.

### 1.3.6 Storage

The laser system must be kept dry and in an upright position when stored.

### 1.3.7 Maintenance and repair

Carry out all the prescribed maintenance work according to the maintenance schedules. Disconnect the power supply before beginning any maintenance or repair work (switch the main switch in the to OFF and unplug the mains connector).

If maintenance work must be carried out with the system in operation, the operating panel must be supervised by an additional person. Damaged parts must be replaced immediately by perfect, original parts.

Check the functionality of all the safety equipment after completing maintenance and repair work. Handle and dispose of materials and substances used properly, particularly lubricants and solvents.

### 1.3.8 Safety when out of service

Secure the laser system against unauthorized activation during periods out of service (e.g. by inserting a padlock in the main switch).

Ensure that children have no access to the laser system. Never allow children to play on or in the laser system.

### 1.3.9 Electrics

A voltage up to 5 kV is required to generate laser pulses. Parts conducting high voltage are electrically insulated.



#### Warning

Never remove or damage the insulation. Never touch electrically conductive parts. Never access parts conducting high voltage. Risk of fatal injury.

The following parts conduct such high voltage:

- Q-switch laser connections in the laser head,
- High voltage power lines in the laser power supply,
- Connection lines between laser head and laser power supply

Other system components (e.g. control, scanner, power supply) have a 230 V power supply.



#### Warning

Never touch parts conducting voltage. Risk of fatal injury.

Work on the power supply system and control may only be carried out by a suitably trained electrician. Observe locally applicable safety regulations when working on equipment conducting mains power or high voltage.

Always disconnect the power supply before starting work on the electrical System!

Do not simply rely on the fact that the power supply is disconnected, check for yourself by taking the necessary measurements.

When plugs are disconnected, keep them dry.  
Always keep the doors closed (protect from damp and dirt).  
Check the laser system's electrical equipment regularly. Tighten loose connections and replace damaged or scorched cable.

### 1.3.11 Other points of danger

There are other points of danger on or around the laser system which are not immediately obvious. Safety information on these areas is provided below..

#### ■ High performance laser diodes (HP laser diodes)

The control unit is equipped with HP laser diodes. They serve to excite the laser in the laser head. The beam emitted from the HP laser diodes has a wavelength of 800 to 850 nm and is not normally accessible to the user.



#### Warning

Damaged or loose cable between the laser head and laser power supply unit can cause laser beams to escape from the HP laser diodes. Risk of accident.

If the connection between the laser head and laser power supply unit is damaged (e.g. the optical waveguides in the spiral protection hose are broken), the laser system must be shut down immediately and a specialist contacted.

#### ■ UV radiation

When processing material using a laser, UV radiation may occur which could damage the eyes and skin.



#### Warning

Never operate the laser with the protective equipment open door. Risk of accident.



#### Warning

Protective laser goggles do not protect against UV radiation.  
Risk of accident.

If operation with open protective equipment is necessary for maintenance, set-up or repair work, the user and others in the laser area must wear special protection goggles.

#### ■ Pilot-laser

The pilot laser complies to Laser Class 2 requirements and protects the eyes through the natural eyelid reflex (visible light).



#### Warning

Never look directly into the pilot laser beam using optical instruments.  
Risk of accident.

The pilot laser represents no risk to the skin.



### ■ Risk of crushing

The laser system is equipped with strong motor drives to position the working table. There is a risk of crushing limbs within the movement range of the laser head.



#### Warning

Never operate the laser with the protective equipment open (access flaps). Risk of accident.

If operation with open protective equipment is necessary for maintenance, set-up or repair work, the user must be particularly careful.



#### Warning

During operation with the protective equipment open, hands or other limbs must not be held within the area of movement of the motor axes. Risk of accident.

### ■ Workpieces

Too high workpieces can damage the optics, control the height of scanner head. When processing mirror glass watch the special instructions.



#### Caution

When processing mirror glass, the optics in the scan head (lens, mirror) can be damaged by reflection. Put the mirror glass into a little diagonal position before you begin to laser.

## 1.4 Intended use

The laser system is intended exclusively for processing material (inner engraving). The laser operates as a source of a beam for the processing system. Only appropriate materials may be processed.

Any other use is considered unintended use. The company Vitro Laser Solutions UG is not considered liable for any damage resulting from unintended use.

The following are also considered part of the intended use:

- observation of all information provided in the operating manual and manufacturer's documents supplied, and
- maintaining all the maintenance and servicing conditions and intervals stipulated by the manufacturer.

Observe all the applicable accident prevention regulations and other generally accepted safety and health protection regulations.

## 1.5 Operation



### Warning

In the case of functional faults, operation must be stopped immediately!

The cause of functional faults must be located immediately. If necessary, operating personnel must call experts. Operation may only be restarted when there is absolutely no doubt about the safety of the laser system.

Operation may be resumed when the operating personnel is convinced that the maintenance work has been properly completed (as described in this manual).

If it becomes apparent during operation that the necessary maintenance measures have not been performed, operation must be shut down immediately.

## 1.6 Information labels and rating plates



### Caution

Real safety infer that you are familiar with all the safety information and regulations. This relates to the type and location of the specific dangers and, particularly, to the safety measures necessary. Always be alert and remain conscious of the danger(s) involved.

This laser system is equipped with information labels and rating plates. Keep the information on the labels and plates on the laser system in a legible condition.



### Caution

Always observe the information, instructions and operating values provided on the labels and rating plates.

### Rating plates

The following components have rating plates:

Control unit / Axles control unit / laser system with serial number



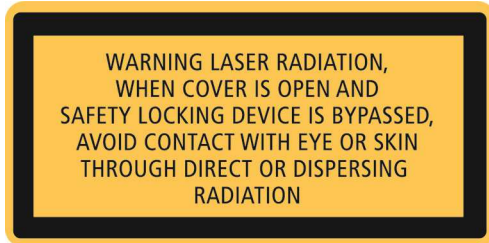
### Note

Always refer to the laser system's serial number in the case of queries, orders and contracts. This simplifies communication with the manufacturer and helps prevent errors when processing your inquiries.

**Warning labels**

Different warning labels are provided for example at the following points:

Examples of warning labels



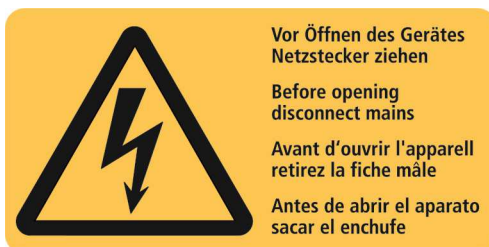
(1) laser irradiation with open cover / bridged safety loc



(2) laser class specification of entire system



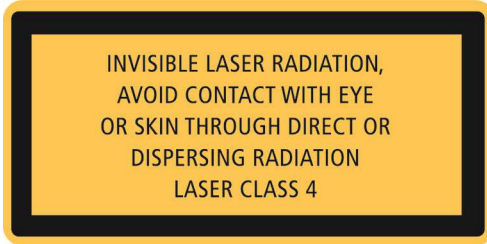
(3) Warning at points with risk of crushing



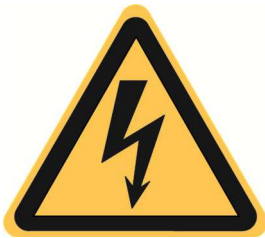
(4) Warning at points with a general risk of electric shock



(5) Warning - dangerous laser irradiation



(6) Warning laser irradiation with Laser Class 4 (laser diode, laser head)



(7) Warning at points with a general risk of electric shock

## 2. Transport and installation

### Contents

The laser system must be transported carefully and assembled in a suitable location. The subsequent system installation requires a great deal of care and coordination and should only be performed by trained personnel from Vitro Laser Solutions UG.

### Organization

---

#### 2.1 General information

#### 2.2 Transport

##### 2.2.1 Transport vehicles

##### 2.2.2 Notes on the packaging

##### 2.2.3 Tilt monitoring

#### 2.3 Installation

---

### Objectives

This chapter provides operators with information on transporting and installing the laser system.

## 2.1 General information

Always remain calm during transportation and installation work. Avoid any stress and hectic activity because this can lead to mistakes or even accidents. Never work alone, but ensure good, well coordinated teamwork.

Keep transport routes and installation location free of interfering obstacles during the entire working process.

## 2.2 Transport

### 2.2.1 Transport vehicles

When the laser system is supplied, it is delivered on an appropriate pallets or in a wooden box which can be transported by the following means:

- Rail
- Ship
- Truck with pneumatic suspension
- Fork-lift truck (for transporting the laser system and component on pallets)
- On hoisting rings

### 2.2.2 Notes on the packaging

It is essential to observe the information and symbols on the wooden box:



#### Top

The arrows point to the „top“ position.



#### Keep dry

Protect the wooden box, and the laser system packed inside, from moisture and damp.



#### Fragile

Caution, the contents are fragile. Transport the wooden box carefully.

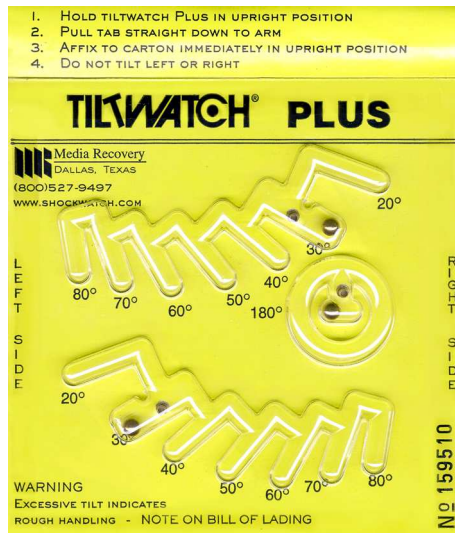


#### Attachment points for hoisting gear

Pay attention to the load-bearing capacity of the ropes used. Secure the ropes against accidental slipping. Ensure the load is evenly distributed when hoisting the wooden box.

## 2.2.3 Tilt and shock monitoring

The wooden box is equipped with a tipping bracket template and an acceleration template. The tipping bracket template can be used to read the maximum tilt angle that the wooden box was subjected to during transport.



### Note

It is essential to note the angle indicated on the delivery documents in the case of angles in excess of 20°. This may be necessary for any claims under the terms of warranty.



The acceleration template contains a tube which turns red if the acceleration value is too high.



### Note

It is essential to note if the tube has turned red in the delivery papers. This may be necessary in any claims under the terms of warranty.

## 2.3 Installation

Prepare the installation site for the laser system. The system must be installed on a clean, level site.

**Caution**

The foundation must have a minimum load-bearing capacity of 300-500 kg/m<sup>2</sup> depending on the type of system - see technical data.

Remove the cover and side panel marked „Front“ from the transport crate.

Lift the laser system from the euro pallet

Position the laser system at the intended installation site.

Trained electricians should make the cable connections between the laser system and mains power supply with the power supply itself switched off.

**Caution**

The laser may only be switched on when all the cables have been connected properly.



## 3. Product description

### Contents

The laser system is comprised of several components which differ according to their task, construction and behavior.

All the most important information required to understand the laser system components is contained in this chapter. It also contains information as to where the individual components are installed within the laser system.

### Organization

---

#### 3.1 Components comprising the laser system

##### 3.1.1 Overview

##### 3.1.2 View of the components

#### 3.2 Laser head

#### 3.3 Scan head

#### 3.4 Laser optics

#### 3.5 Motor axis

#### 3.6 Laser system switches

#### 3.7 Control units housing

##### 3.7.1 Control unit

##### 3.7.2 Axle controller

#### 3.8 PC console

---

### Objectives

This chapter contains an overview of the laser system components.

After reading the section, you will know all the components comprising the laser system, their method of operation and purpose and the precise names of the components and their parts.

## 3.1 Components comprising the laser system

### 3.1.1 Overview

The complete processing system consists of the following components:

(1) **Laser head**

The laser beam is generated in the laser head.

(2) **Scan head**

The scan head serves to deflect the beam.

(3) **PC Console**

The PC console is connected to the control computer. It is used to control the system and to control the manufacturing process. The required software is installed.

(4) **Door(s) (if any)**

These doors are manually opened and closed, and are separating the processing area. The doors are equipped with security contacts who either prevent from opening the doors during the editing process, or turn off the laser beam with opening. Which of these options will be executed can be set at the contacts.

(5) **Additional buttons and switch on the PC Console**

The toolbar contains the emergency off switch, the power switch that releases the facility to operate, as well as the push button to open and close the doors.

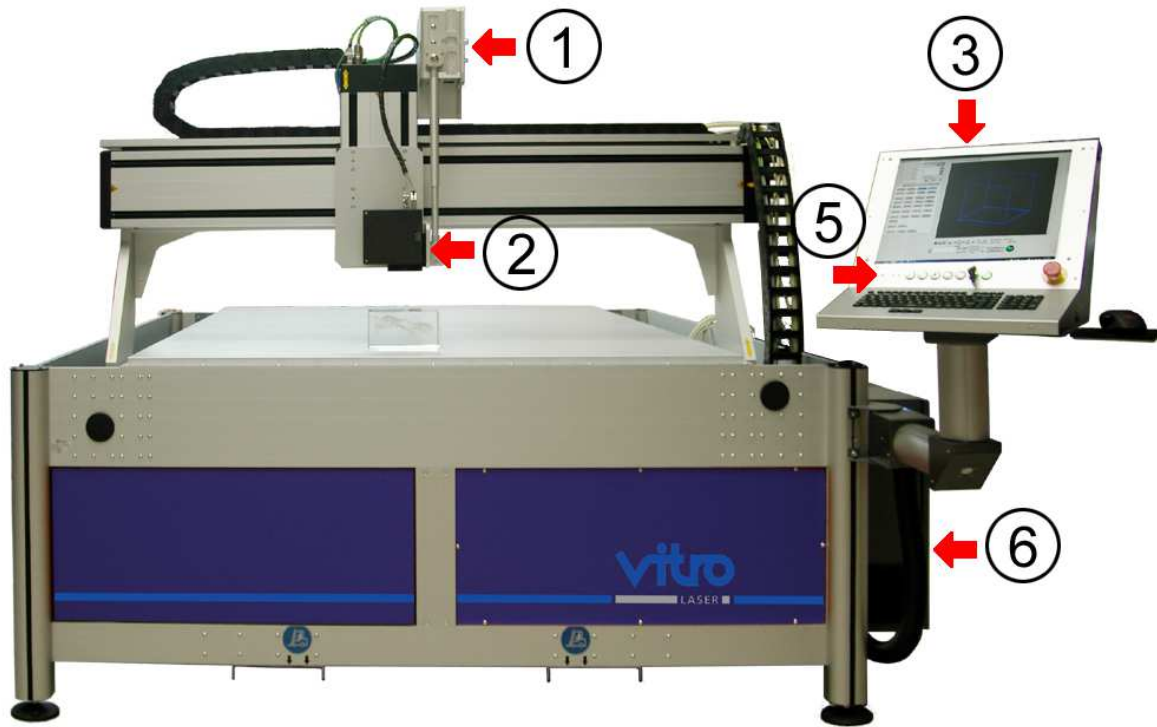
(6) **Supply modules**

Side of the laser system all necessary to operate supply modules as well as the main switch are located.

(7) **Motor axles**

The motor axles of the laser and the scan head are movable in the X, Y, and Z-axis. The units are connected to each other by means of power cables, control lines and an optical waveguide.

### 3.1.2 View of the components



**Figure 1: Overview**

- (1) Laser head
- (2) Scan head
- (3) PC Console
- (5) Additional buttons and emergency stop
- (6) Supply module housing with main switch

### 3.2 Laser head

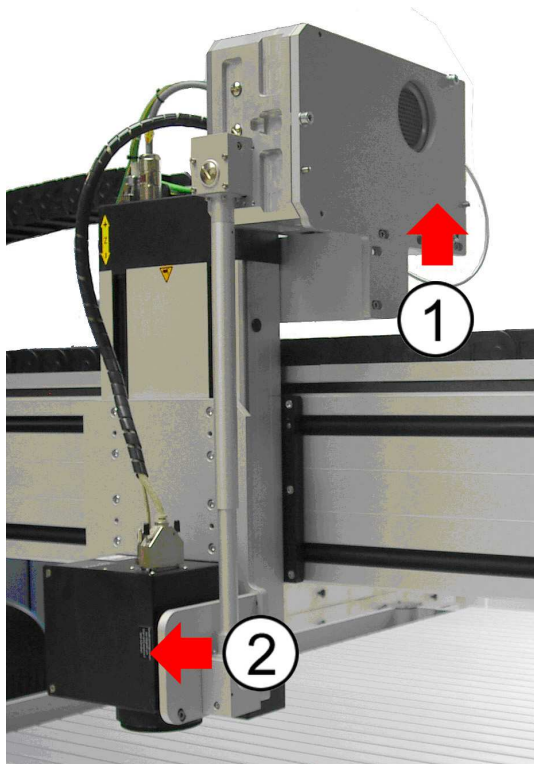
The scanner and laser head are both fixed to an axis. The laser crystal in the laser head is excited to emit the beam via the laser diode beam by the control unit. The laser diode beam is fed by means of a quartz glass fiber cable.

The laser beam emerges from the laser head and, after passing the scanner's deflecting mirror, is used for the inner engraving.

The laser beam is issued in the form of short pulses.

As the pulse current of the laser diodes increases so does the height of the laser pulse and, thus, the pulse energy. The size of the pulse energy directly affects the size of the point in the glass or plastic.

Since laser beams are dangerous to the eyes and can cause skin burns, the laser class 1 systems are equipped with doors and a safety circuit which automatically shuts the laser down in the case of a fault or opening the doors.



**Figure 2: Laser- und scan head**

(1) Laser head

(2) Scan head

### 3.3 Scanner

The scan head serves for the laser beam deflection in two levels. The deflection is performed by means of two galvanometer mirrors. At scan head is a focussing optic which focuses the laser beam.

The scanner deflects a parallel bundle of beams in the X-Y direction (see Figure). The beam enters the scan head via the inlet aperture. Inside the unit, the beam first hits mirror 1 on galvanometer scanner 1 and is deflected to mirror 2 on galvanometer scanner 2.

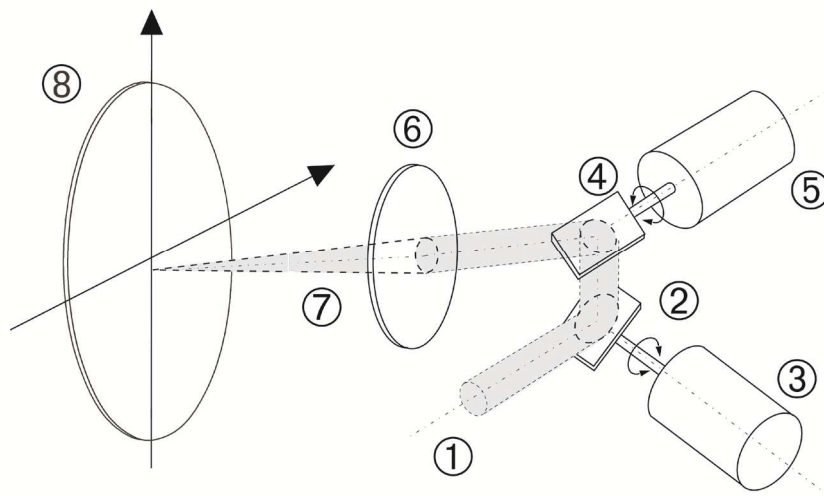
The deflection angle is determined by the controllable position of the galvanometer scanner. The beam emerges from the scan head through the outlet aperture, which is equipped with an F-theta lens.

The F-theta lens focuses the parallel bundle of beams to the image field level. The lens creates an exact proportionality between the angle of incidence of the beam and the position of the focused image point in the image field.

The square image field experiences a positive-negative field distortion due to the course of the beam on the mirrors and the lens. The field distortion must be compensated for by the control drive.

The scan head designed for a parallel bundle of beams with a maximum diameter, referred to as the aperture. An incoming beam may not exceed this diameter in the unit.

The scanfield takes 70 by 70 mm in float glas.

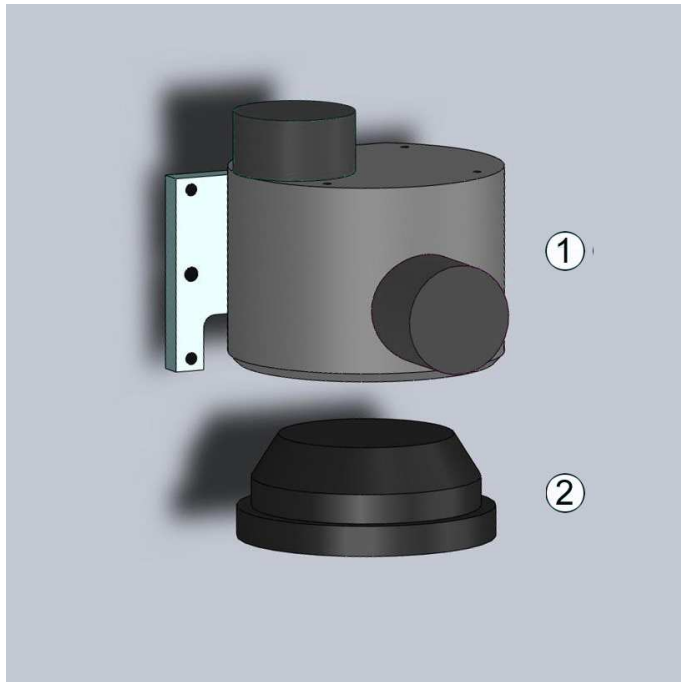


**Figure 3: Scan head principle of function**

- (1) incoming beam
- (2) Mirror 1
- (3) Galvanometer scanner 1
- (4) Mirror 2
- (5) Galvanometer scanner 2
- (6) F-Theta-lens
- (7) Beam emission
- (8) Image field level

### 3.4 Laser optics

The laser beam emerges through the specially changeable lens.  
Lenses of various focal depths are available according to the application.



**Figure 4: Laser optics**

- (1) Scanner
- (2) Lens with protective glass

### 3.5 Motor axis

The laser head can be moved in X, Y and Z direction.

The directions of motion are:

- Z-axis (vertical: up +, down -) on the laser head
- X-axis (horizontal, right +, left -) on the X-Y plate
- Y-axis (horizontal, back +, forward -) on the X-Y plate

The movements are performed by the motor axes which enable high processing speeds and high processing accuracy.

The size of the loading of table and the controllable area to engrave are depending on the type of the machine and are:

Machine	Loading table	Engraving area
Vitrolux E-S	750 x 750 mm	700 x 600 x 95 mm
Vitrolux E-M	750 x 1000 mm	700 x 900 x 95 mm
Vitrolux E-L	1250 x 1000 mm	1200 x 900 x 95 mm
Vitrolux E-X	1250 x 1500 mm	1200 x 1400 x 95 mm
Vitrolux F-S	1750 x 2250 mm	1500 x 1700 x 95 mm
Vitrolux F-M	2750 x 2250 mm	2500 x 1700 x 95 mm
Vitrolux F-L	2250 x 3250 mm	1700 x 3000 x 95 mm



**Caution**

The above values for the engraving area refer to the laser class 4 machines. Machines laser class 1 - with adjoining doors - the engraving area in x and y direction is less 20 cm each..



**Note**

The directions are on the axes with signs referred to

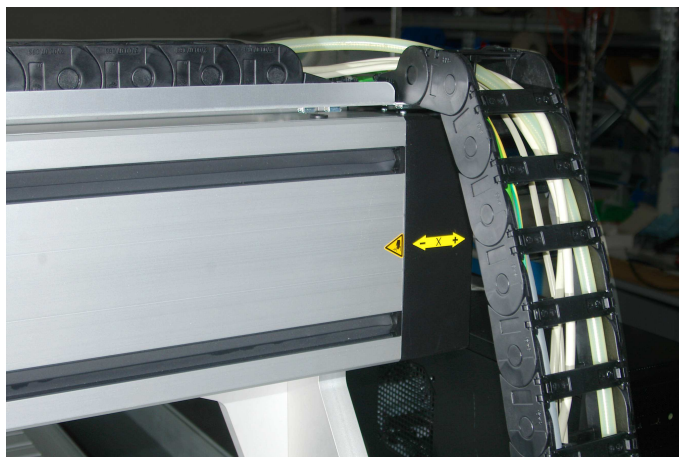
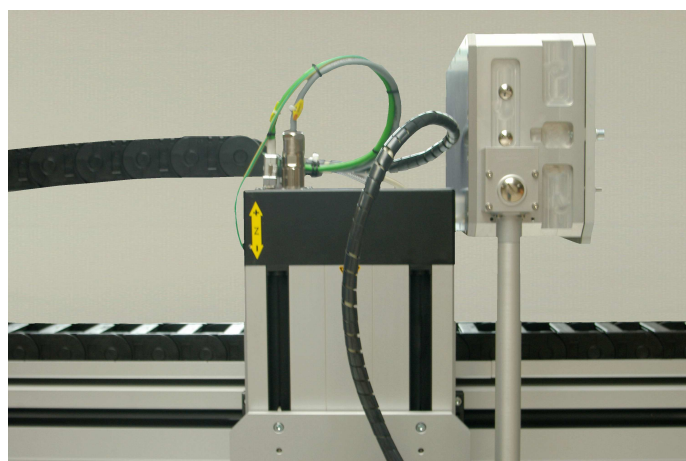


Figure 5: Motor axis X



**Figure 6: Motor axis Y**

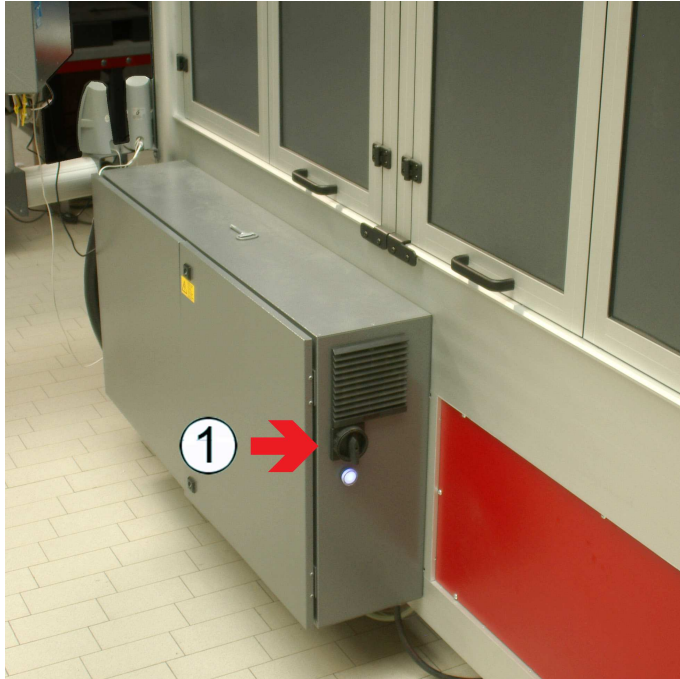


**Figure 7: Motoraxis Z**



### 3.6 Laser system switches

The main switch for the power supply is located at the control box of the machine.



**Figure 8: Main switch at control box**  
(1) Power switch and indicator



**Figure 9: Power switch PC**  
(1) Power switch

On the PC console the following switch and indicator are located next above the keyboard:

- (1) **ACK white**  
For service personnel only. Without function during normal operation
- (2) **Cover white**  
Unlock the security door to load and unload the machine. During the laser process, the button has no function to avoid accidentally stopped processes.  
If the button lights up no laser process is active and the door can be opened safely.  
To open the door, press and hold the key and open the door after the safety lock has been resolved.
- (3) **Fault red**  
Signals error in the security, such as the pressed emergency-stop button, and lights up when you turn on the machine as functional testing.  
If everything is OK the light is switched off a few seconds after pressing the "power" button.
- (4) **Stop red**  
For service personnel only. Without function during normal operation.
- (5) **Start green**  
For service personnel only. Without function during normal operation..
- (6) **Key switch Mode**  
For service personnel only. Without function during normal operation.
- (7) **Power green**  
Safety switches, switches on laser and engines.
- (8) **Emergency stop yellow/red**  
To immediately turn off the axles and the laser head in case of an emergency



**Figure 10: Switch and indicators**



**Note**

A pressed emergency stop button often is the reason for service requests.  
If the laser provides no reactions to all kinds of input and/or the "fault" indicator in on, please check the emergency stop switch first! (Turn and check whether the button pops out!)

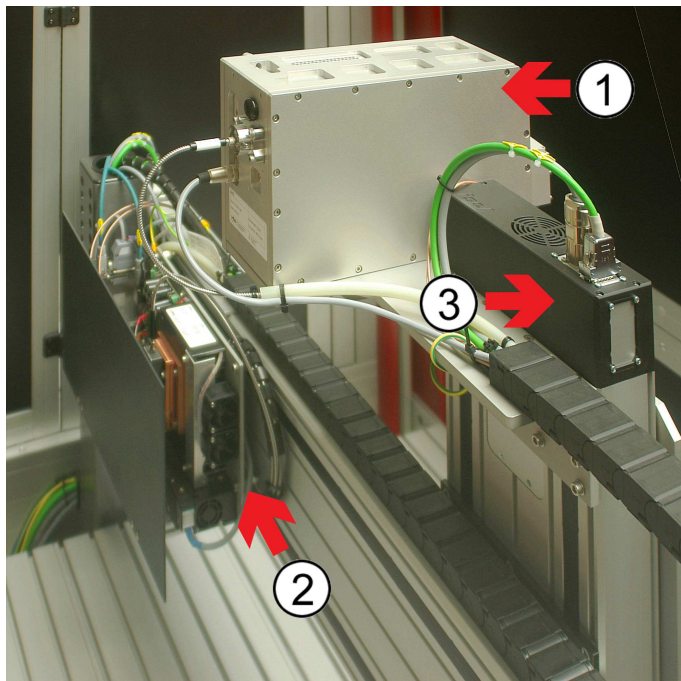
### 3.7 Components in the control module box

The control module carrier contains the axis controller for the control of X, Y, and Z axes, as well as possibly the control unit for the laser.

#### 3.7.1 Control unit

The control unit responsible for the care and control of the laser and is responsible for the monitoring of the safety functions.

Depending on the system the control unit is either integrated into the control module box, or is mounted at the backside of the x axis (see fig.).



**Figure 11: Control unit**

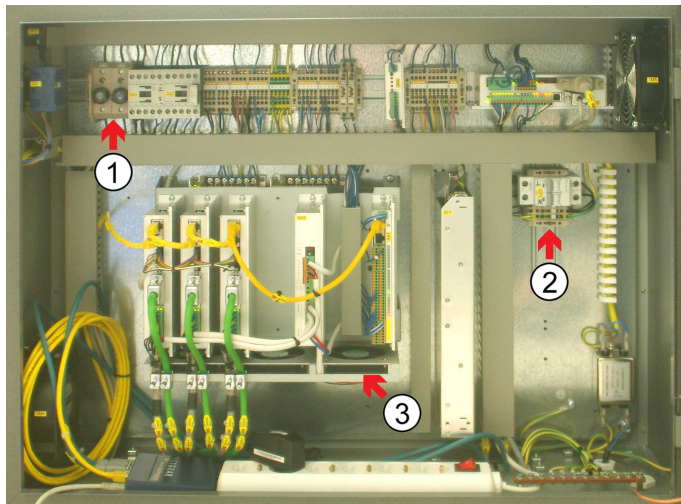
- (1) Laser head
- (2) Control unit
- (3) Z axis

### 3.7.2 Axis controller

The controller contains the electronics necessary for controlling the axis.

**Caution**

Axes may run on. The axes can be moved by hand when the power supply is off.



**Figure 12: Axis control unit**

- (1) Fuses whole system
- (2) Fuse laser head
- (3) Axis control

### 3.8 PC Console

In the PC Console a complete PC is installed in addition to the already mentioned special keys and indicators.

Through the Windows interface the pre-installed software "VitroMark" can be called, which takes over the complete control of the laser processing.

### 3.9 Function setting safety contacts (Laser class 1 with doors only)

All doors on the laser class 1 systems are fitted with safety devices. These safety devices can be operated in 2 ways:

Door is locked during the laser process and cannot be opened (the default). The "cover" button must be pressed to open the doors always. This effectively prevents errors by accidental opening of the doors during the process.

The door can be opened at any time without having to press the "cover" button, but the opening of the door is supervised and the laser immediately switched off if a door is opened. This can be useful on large machines with only one operator because he does not have to press the "Cover" button with one hand and open the door with the other hand at the same time

However broken laser operations can not be continued by accidental opening of the doors. The process must be restarted.

The operation of the door contacts can be switched with the special key supplied.



**Figure 13: Function conversion door contact**

## 4. Operation

### Contents

The laser system may only be started up and operated by personnel who have received the necessary training and instruction, are familiar with all the operating elements and their respective functions and know when they should be used.

This chapter contains all the information necessary to operate the laser system.

### Organization

---

4.1 Power-on routine

4.2a Load/engrave Laser class 1

4.2b Load/engrave Laser class 4

4.3 Shut down procedure

---

### Objectives

This chapter describes the operation of the laser system. After reading this chapter, you will be able to operate the laser system within the scope of the control possibilities for which you are authorized.

## 4.1 Power-on routine

### Preparations

1. Check that the power supply is connected correctly.
2. Check that the Emergency Stop button is not locked.
3. Check that the doors are closed (if any).

### Power-on routine

1. Switch the main switch on the control module box on the side of the system in the "ON" position.
2. Switch on the PC.  
(The switch is located right on top of the console housing.)
3. Log in via the PC keyboard.



#### Note

It is possible that a password has been assigned for the login procedure. Enter the correct password and confirm with OK.

4. Switch on the green power switch on the front of the PC console.  
The red indicator "Fault" goes off then after a few seconds.
5. Start the program "VitroMark"

**The laser system is now switched on and ready to start production.**

## 4.2a Load/engrave laser class 1

1. Press the "cover" button (a quiet "click" indicates that the locking of the door has solved) and open the door when holding down the "cover"-button.
2. Position objects to engrave on the table.  
Please note the maximum possible engraving area.
3. Close the door and start the laser process on the software "VitroMark".
4. Wait for the end of the laser process (the "cover" button lights up again), then open the door as described in 1., remove the finished products and continue until all the objects are completed then as described in 2..



#### Caution!

During the laser process, the door can not be opened - the key of "Cover" is locked during this time, to avoid accidentally stopped engraving. For deliberate interruptions of the whole process in case of an emergency, please use the "Emergency stop" button.

## 4.2b Load/engrave laser class 4

1. Position objects to engrave on the table.  
Please note the maximum possible engraving area.
2. Make sure that no unauthorized people are around, put on your safety glasses and start the laser process on the software "VitroMark".
3. Wait for the end of the laser process (the window with the "progress" indicator has disappeared) and remove the finished products.
4. Repeat the procedure 1-3 until all pending orders are processed.

## 4.3 Shutdown procedure

1. Stop the laser system software.
2. Shut down the computer operating system by clicking „Start -> Shutdown“. Wait until the shutdown routine is completely finished.
3. Shut the doors (if any),
4. Turn the main switch to "Off" position.



## 5. Maintenance

### Contents

The laser system is largely maintenance-free, however small work must be performed by trained personnel regularly.

This chapter contains information as to which parts must be maintained at and what intervals. Comprehensive maintenance measures are described step by step.

### Organization

---

#### 5.1 General information

#### 5.2 Maintenance work and intervals

##### 5.2.1 Fixed intervals

##### 5.2.2 Maintenance work as necessary

#### 5.3 Lubricate motor axles

##### 5.3.1 Guide rails

##### 5.3.2 X-axis

##### 5.3.3 Y-axis

##### 5.3.4 Z-axis

#### 5.4 Clean filters

#### 5.5 Clean interior of the system

#### 5.6 Clean the optics

---

### Objectives

This chapter contains an overview of all the necessary servicing and maintenance measures for the laser system. After reading the chapter, you will be capable of completing maintenance work within the scope of the authorization assigned to you.

## 5.1 General information

Complete all maintenance work according to schedule (once a year) and document the work completed in an operation logbook.

To perform the maintenance, switch on the machine and drive all axes to their starting position.

Open - if available - the door by pressing the button "Cover".

Now turn off the machine and unplug in addition, to prevent an accidental switching.



### Warning

Switch off the power supply before starting any maintenance work (turn the main switch on the system cabinet to OFF and unplug the power plug)!

When the maintenance work is completed, check all the safety equipment is fully functional. Handle and dispose of substances and materials used properly, particularly in respect of lubricants and solvents.

## 5.2 Maintenance work and intervals

### 5.2.1 Fixed intervals

**Once a year** Grease motor axles and guide rails

### 5.2.2 Maintenance work as necessary

**as necessary** Clean cooling system fans  
Clean cooling fan of PC (if any)  
Clean interior of the system  
Clean optics

## 5.3 Lubricate motor axes

### 5.3.1 Guide rails

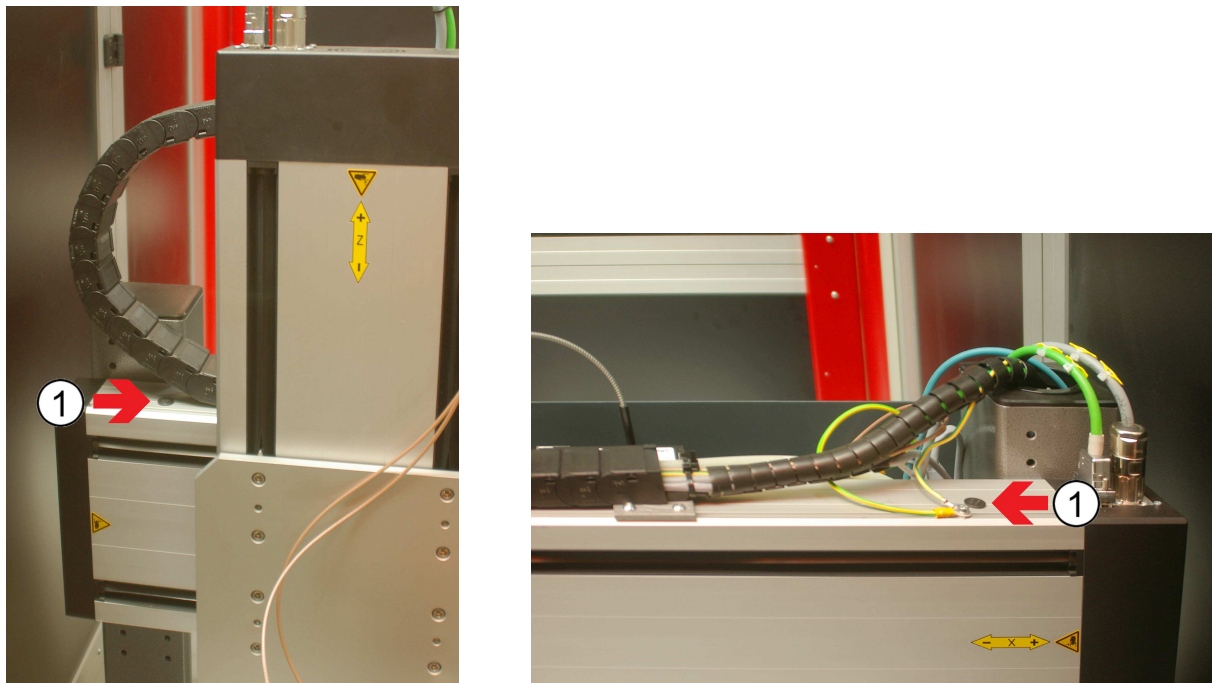
The rails of all axes can be lubricated by the gap between the black lips. The sealing lips even include a Teflon component and require no special maintenance. From the factory all guided rails and waves are lubricated with the sodium SOAP grease GP00/000F-20 DIN 51 502. This fat also s available from us as a spare part.

To smear the guide rails open the sealing lips tightly and apply some fat - approximately in the middle of the rail - on the guide rail with your fingertip. Each axle has 2 channels, so a total of 6 guide rails has to be lubricated.

The fat is distributed later manually by controlled movement (2-3 times) across the entire range of motion after switching on the machine.

### 5.3.2 X-axis

Both lubrication nipples are located on top of the axis. Pull off the black plastic caps and lubricate the axes using the lubrication nipples which have been exposed. Replace the plastic caps after finishing the procedure.



**Figure 1:**  
(1) Plastic cap. Underneath the cap the nipples for lubrication are located.

### 5.3.3 Y-axis

The lubrication nipples for the Y-axis are easy to access directly. It is located at the right side of the engraving area.

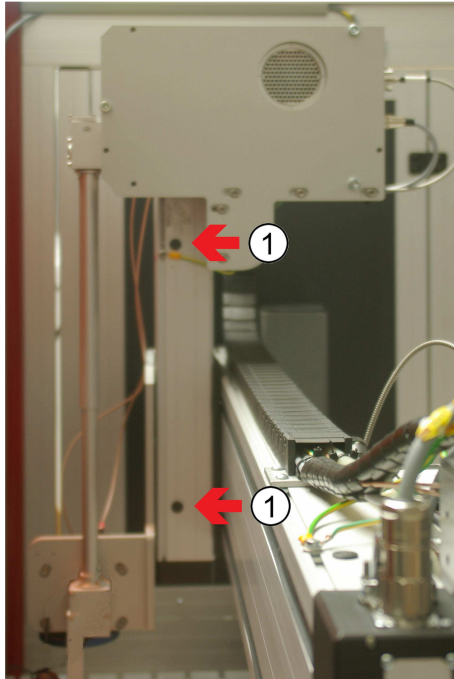


**Figure 2: Access lubrication Y-axis**

(1) Lubrication nipples.

### 5.3.4 Z-axis

The z-axis is lubricated through 4 nipples located on both sides of the axis. Pull off the black plastic caps and lubricate the axes using the lubrication nipples which have been exposed. Replace the plastic caps after finishing the procedure.



**Figure 3: Access lubrication Z-axis**

(1) Plastic cap. Underneath the cap the nipples for lubrication are located. There are two more nipples located at the opposite side of the axis.

At the end of the lubrication process please plug in the power and switch on again the system at the main switch. Please start the control computer and unlock the laser with the green power button again. Then move all 3 axis by using the "VitroMark" software 2 times over the entire range of motion to distribute the lubricant.

## 5.4 Clean air filter

Fan, fitted with a dirt filter is located in the control module box. Depending on the pollution of the environment, the dirt filter should be reviewed at regular intervals to ensure a trouble-free exchange of air.

The black covers can be easily lifted with a flat blade screwdriver on the bottom side and then removed completely.

The used filter can be extracted and cleaned with compressed air or a vacuum cleaner. If you want to clean the filter wet, please reinstall it after complete drying.

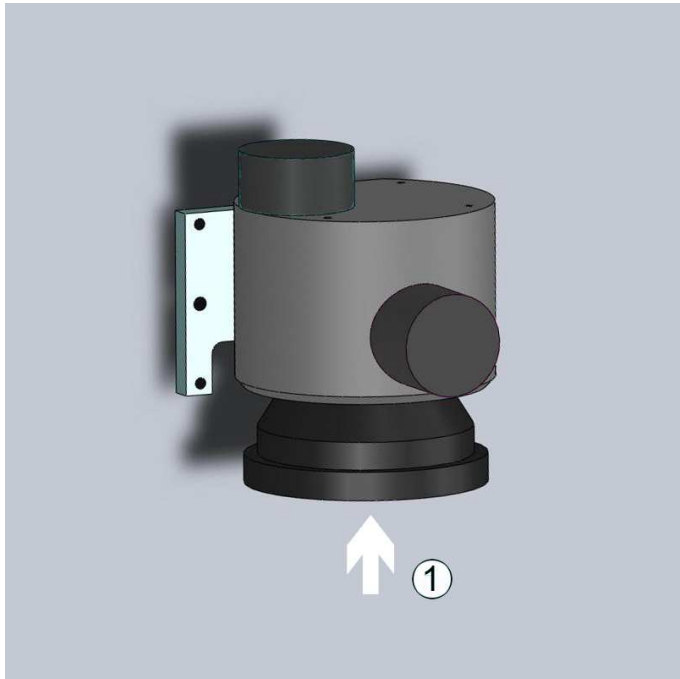
To reinstall the cleaned dirt filter, mount cover at the top side and lock it again by pressing on the lower edge.

## 5.5 Clean interior of the system

Clean the interior of the system if necessary with a hand brush or vacuum cleaner. Please don't use compressed air, because otherwise particles flying around could damage the optics or could be blown between the sealing lips into the axes.

## 5.6 Clean the optics

If necessary, clean the protective glass of the laser lens.  
Clean the protective glass of the laser lens with special cleaning tissue and pure alcohol (pharmacy quality).



**Figure 4: Position protective glass**



### Caution

Never use scouring agents or cleaning utensils. The optical surfaces are extremely sensitive and could be damaged.



### Note

Clean the lens from the center towards the edge in a circular motion.

## 6. Troubleshooting

### Contents

The laser system is comprised of various components which may show signs of wear or cause faults during the course of time.

This chapter contains information to help locate faults and eliminate them, as well as some notes on the possible.

### Organization

---

#### 6.1 General information

#### 6.2 Errors

6.2.1 System can't be switched on

6.2.1 „Power“ button does not work

6.2.3 laser does not engrave

6.2.4 Software works incorrectly

6.2.5 Software message „Door open“ in closed door

6.2.6 Engraving moved in the glass

6.2.7 Motives with defects always in the same place

6.2.8 Motives with streaks or strips

6.2.9 Motive rare to see

#### 6.3 Changing the lens

#### 6.4 Replacing the laser diode module

---

### Objectives

This chapter contains information to help locate faults and explains corrective measures that are within the scope of your possibilities.



#### Note

Only use original spare parts obtained from Vitro Laser Solutions UG.



## 6.1 General information

The normal operation of the system displays error messages / errors with accurate description on the control computer.

For example - you get a message if you want to start the process of engraving, but the door of the system is not closed.

But some easy to address errors can occur before the proper cooperation between control computer and laser has started, or they can not be detected by the software.

## 6.2 Errors

### 6.2.1 System can't be switched on

Possible cause:	Check/fix:
No main current	Mains plug plugged?
	Main switch turned on?
	Power strip has power?
	Fuse defective? The fuses are located in the control module box (see Chapter 3.7) Unplug, check fuses and replace if necessary. 2 X 6, 3A/250V slow backups

### 6.2.2 „Power" button does not work

Possible cause:	Check/fix:
Emergency stop not unlocked	Unlock emergency stop (turn red button)
	Fuse defective See 6.2.1

### 6.2.3 Laser does not engrave

Possible cause:	Check/fix:
After transportation - protective cap on optics is not removed	Remove cap
Defect laser module	Contact technicians

### 6.2.4 Software works incorrectly

Possible cause:	Check/fix:
Laser system not switched on	Switch laser system on - green button on PC console
Connection disturbed	Check USB connection between PC and laser, Exchange wire if necessary

### 6.2.5 Software message „Door open“ in closed

Possible cause:	Check/fix:
Broken door contact	Replace or contact technician

### 6.2.6 Engraving moved in glass

Possible cause:	Check/fix:
Legoboard moved/loosened	Drive table on start position and check whether pilot laser appears in the right place. Check if the Legoboard is still firmly connected with the table.
Start position values changed	Redefine values for starting position - see software manual

### 6.2.7 Motives with defects always in the same place

Possible cause:	Check/fix:
Dirt particles on the lens	The clean the optics with soft cloth and alcohol. Engrave flat glass with white pattern over the entire scan area without tiling (approx. 70 mm Ø), to determine whether the error is resolved. If error still exists then
Optics defekt	Replace lens, must by made service technicians

### 6.2.8 Motives with streaks or strips

Possible cause:	Check/fix:
Tension in the glass or surface badly polished	Stresses inside the glass can be checked with the glass tension tester (see special equipment). Continuous strip can be caused by light waves in the surface of the glass, which deflect the laser beam. You can check this by mirroring straight edges - e.g. fluorescent tubes - in the surface can and watch for deformations. If deformation or tension is noticed, the glass is not useable for subsurface engraving.

### 6.2.9 Motive rare to see

Possible cause:	Check/fix:
Density of dots too low	For newly created motive dot pitch has been chosen may be too high and thus the density of dots is too low. In addition engraved text can be used as a reference for good visibility. If text is OK, but only the motive is weakly to see, just create a new point cloud of the motive
Diode performance declines	Increase power for pumping diodes. Please check the allowed values with service technicians. If power can not be increased, exchange diode module.

### 6.3 Changing the lens

If as source of error the lens is identified e.g. by mechanical damage, the exchange has to be done by a service technician in any case!

The exchange requires a new calibration of the system, which can not be made by you.

### 6.4 Replacing the laser diode module

The exchange of a laser diode module - See also 6.2.9 - can possibly be done by yourself under certain circumstances. To do this please contact a service technician who can clarify in consultation with you, whether the exchange can be done by yourself.

## 7 Technical Data

### Contents

The laser system is a complex technical system. Its components have specific properties which are necessary for safe, reliable operation.

This chapter contains all the most important data concerning the individual components and entire laser system as a whole. The data is provided in tables and organized according to the individual components.

### Organization

- 
- 7.1 General data
  - 7.2 Environmental conditions
  - 7.3 Electric
  - 7.4 Laser
- 

### Objectives

This chapter contains the most important technical data on the laser system and its component parts.

## 7.1 General Data

System	Dimensions (WxDxH) mm	Table (WxD)mm	Engraveable area (WxDxH) mm	Engraveable area with doors	Weight kg
Vitrolux E-S	1420x1150x1870	700x600	700x600x95	500x400x95	Ca. 400
Vitrolux E-M	1420x1450x1870	700x900	700x900x95	500x700x95	Ca. 440
Vitrolux E-L	1920x1450x1870	1250x1000	1200x900x95	1000x700x95	Ca. 550
Vitrolux E-X	1920x1950x1870	1250x1500	1200x1400x95	1000x1195x95	Ca. 620
Vitrolux F-S	2216x2430x1600	1750x2250	1500x1700x95		Ca. 540
Vitrolux F-M	3216x2430x1600	2750x2250	2500x1700x95		Ca. 610
Vitrolux F-L	2716x3750x1600	2250x3250	1700x3000x95		Ca. 680

## 7.2 Environmental conditions

Production environment	Vibration-free, dust-free room, air without aerosols
Air temperature	15 to 32°C (with even warming)
Min. floor load-bearing capacity	400-500 kg/m <sup>2</sup> depending on type of machine (see 7.1)
Spatial requirements	1 m (clearance) System cabinet

## 7.3 Electrical installations

Power supply (single phase):	110 - 230 V AC, 50 – 60 Hz
Power consumption:	max. 700W
Fuse:	2 x 6,3 A / 250V träge

## 7.4 Laser

Laser type:	Diode pumped solid state Laser
Wave length, laser head:	532 nm
Average laser power:	Max. 2 W
Laser repeat pulse:	max. 10 kHz
Average usable frequency:	4 kHz
Puls length:	< 10 ns
max. pulse energy:	0,5 mJ
Wavelength scanner:	532 nm
Wavelength:	790 to 820 nm
Laser diode modul max.:	40W
Wavelength pilot laser ca.:	650 nm
Laser class	
- normal operation with doors:	Laser class 1
- Maintenance + inching:	Laser class 4
Scan field in flat glass:	70mmØ
Working distance:	132,2 mm

## 8 Spare parts, special equipment

### Contents

This spare parts list contains important information on parts which may need to be replaced. This information should help to ensure you define the correct part. Diagrams help localizing the spare parts. A table provides the order number and precise article name.

### Organization

---

8.1 Grease for the axes bearings

8.2 Warning labels

8.3 Diode module

8.4 Lens

8.5 Laser protecting glass

8.6 Protection goggles

8.7 Glass tension tester

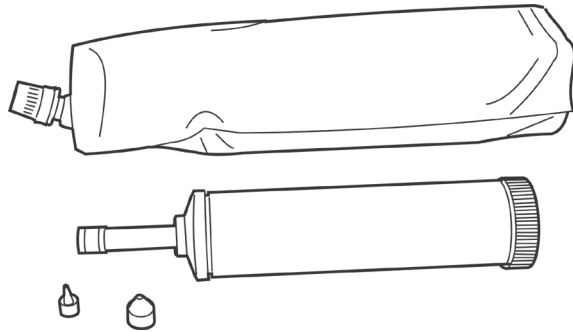
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### Objectives

This chapter defines the spare parts and the related order numbers. This ensures the correct definition of the necessary parts for orders.

## 8.1 Grease for the axes bearings

The grease specified below is suitable for greasing the axes. The grease gun ensures the grease is forced properly into the lubrication nipples.



Item	No.
Tube of grease 250ml	45000357
Grease gun for grease including applicable connection pieces	45000358

## 8.2 Warning labels

A complete set of warning labels is available to replace warning labels which have become illegible or as substitutes for labels no longer available.



Item	No.
Complete set of warning labels	15000060

### 8.3 Diode module

Replacement for the diode module.

Item		No.
Diode module	LDM 50W CW Luft	43000015

### 8.4 Lens

Replacement for the standard lens.

Item		No.
Lens 03-75FT-108-532		43000003

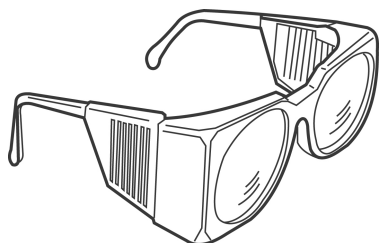
### 8.5 Laser safety glass

The following spare part is available in order to replace a defect protecting glass (orange) of the sliding door.

Item	Wavelength Laser	No.
Safety glass side	532 nm	15000041
Safety glass door	532 nm	15000040
Safety glass side	1064 nm	15000043
Safety glass door	1064 nm	15000042

### 8.6 Protection goggles

Protection goggles for working at laser class 4 machines.



Item	Wavelength Laser	No.
Safety goggles	532 nm	15000046
Safety goggles	1064 nm	15000047



### 8.7 Glass tension tester

With the following equipment you are able to test your glass workpieces (glass tensions) before starting the laser process. In this kind you prevent a production with defectively glass.

Contents: lighting box, power pack, eyeglass



Item		No.
Glass tension tester		15000045

## 9 Warranty

Vitro laser solutions UG provides 12 months warranty. The warranty shall lapse if following warranty seal without previous written approval by vitro laser were destroyed:

**Control unit**  
**Control computer (PC)**  
**Axles controller**  
**Laser head**

Also the improper handling and failure to comply with our policies described in the manual will void the warranty.