User Manual
Vitrolux Hv2

Note

Please always have the serial number listed on this page ready when contacting Vitro Laser Solutions UG.
Vitro Laser Solutions UG reserves the right to make technical changes to improve the product.
Errors or omissions in the documentation excepted. If you notice any errors in this documentation, please notify Vitro Laser Solutions UG.

Copyright

Declaration of Conformity

We, the Vitro Laser Solutions UG
Ellerbusch 28
D-32429 Minden

declare in sole responsibility that the product Vitrolux Hv2

Serial number

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fulfills the requirements of European machinery directive 2006/42/EG IIB

The following harmonizing standards have been applied:

EN ISO 12400:2010	Safety of machinery - General principles for risk assessment and risk reduction
EN ISO 13857:2008	Safety of machinery – Safety distances to avoid reaching of dangerous regions with upper and lower extremities
EN 349:1993+A1:2008	Safety of machinery – Minimum distances to avoid bruising of the body
EN ISO 14120:2015	Safety of machinery – General requirements for fixed and movable guards
EN ISO 13850:2015	Safety of machinery – Emergency Halt – Design guidelines
EN 60204-1:2006	Safety of machinery – Electrical equipment of machines, Part 1, General requirements
IEC 60825-1:2014	Safety of laser products – Part1, Equipment classification and requirements

Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed.3., as described in Laser Notice No. 56, dated May 8, 2019.

Also the following EU Directives have been applied

2014/30/EU	EMC Directive
2014/35/EU	Low Voltage Directive

Minden, ...

A. Sperling, Management

Preface

This operating manual provides detailed information on the operation of your Vitrolux laser system for internal engraving.
It contains safety instructions that ensure safe use of the laser system. In addition, you will find information on installation, maintenance, troubleshooting and error correction in this operating manual. A spare parts list allows you to easily order parts for your laser system.

With this operating manual, we want to help you get the most out of your laser system. The laser system will serve you for a long time to your satisfaction if you always use it properly and take care of it carefully.

The documentation you have been given will help you to do this. Always keep the documentation at hand in the immediate vicinity of the laser system.
Always observe all the information, notes, instructions and guidance contained in it. In this way, you will avoid accidents due to incorrect operation, retain the full manufacturer's warranty and always have a fully functional laser system.

Vitro Laser Solutions UG always strives to improve its products. It reserves the right to make any changes and improvements it deems necessary.
However, this does not imply an obligation to retrofit already delivered laser systems.

The following symbols can be found at all important points in this manual. Pay close attention to these notices and exercise particular caution in these cases.

Marking of the notes:

Warning

This symbol indicates that there is a risk of injury and/or death if certain rules of of conduct are disregarded. If you see this sign in the manual, please take all necessary safety precautions.

Caution

This notice warns you of material damage as well as of financial and penal disadvantages (e.g. loss of warranty rights, liability claims, etc.).

Information

Here you will find important notes and information on effective, economical and environmentally compatible handling.

Warning

Before commissioning the laser system, you must have read and understood the operating instructions and the safety regulations contained therein.

Table of contents

1. Safety

Content

The operating manual for your laser system contains important information on installation, operation, maintenance, as well as on malfunctions and ordering spare parts.
With this information we help you to operate your laser system safely and without danger.
All safety instructions and liability regulations necessary for handling the laser system are contained in this chapter.
You will also find instructions for proper use here.

Structure

Objective

This chapter warns you of possible dangers when handling your new laser system. The information contained here on hazard recognition is intended to enable you to operate the system safely and properly.

It is essential that you read and observe these operating instructions and especially this chapter before operating the laser system!

1.1 For your safety

1.1.1 General information

In addition to safety information, this operating manual includes:

- a general product description
- information for installing the laser system
- instructions for operating the laser system
- maintenance and care instruction
- troubleshooting and error correction instructions
- technical data
- overview of special equipment
- Spare parts list

Always keep this operating manual and other documents on the laser system within easy reach in the immediate vicinity of the operating unit.
The operation was explained to you during the handover. Before using the system for the first time, also read this manual and be sure to observe the safety instructions. Particularly important points are marked with a symbol.

Your laser system has been tested at the factory. Nevertheless, there is a risk of danger in the event of incorrect operation or misuse:

- to life and limb of operators, third persons and animals who are in the vicinity of the laser system
- for the laser system and other material assets of the operator and third persons
- for the efficient operation of the laser system

1.1.2 Obligation of the proprietor

The proprietor is obligated to only allow persons to work on the laser system who are

- are familiar with the basic regulations on safety and accident prevention and have been instructed in the operation of the laser system.
- have read and understood the operating instructions, the safety chapter and the warnings and have confirmed this by their signature.

The proprietor is responsible for the selection of the operating personnel. He must pay special attention to the suitability of the personnel for operating the laser system.
The operator of the laser system must comply with and observe the following regulations and rules:

- the relevant accident prevention regulations
- the legal operating regulations for laser systems
- the functional limits and safety regulations specified in the technical instructions.

The proprietor regularly (at least once a year) instructs the operators about the dangers of laser radiation.

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

1.1.3 Obligation of operating personnel

All persons entrusted with the laser system are obliged:

- to ensure the safety of third parties and of the laser system at all times,
- to read the operating instructions, the safety chapter and the warning symbols, and to confirm by their signature that they have understood them,
- operate the laser system only if they are familiar with the functions of the laser system, its safety and emergency devices and are able to control it safely.

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

Warning
The safety of you, colleagues ad bystanders in the vicinity of the laser system is at stake!

1.2 Liability

In principle, our »General Terms and Conditions of Sale and Delivery« shall apply. Warranty and liability claims for personal injury and property damage are excluded if they are due to one or more of the following causes:

- Improper use of the laser system
- Improper setup, commissioning, operation and maintenance the laser system
- Operation of the laser system with defective safety devices or improperly installed or non-functioning safety or protective devices.
- Failure to observe the instructions in the documentation regarding the operation, maintenance, care and troubleshooting of the laser system.
- Unauthorized structural modifications to the laser system
- Inadequate monitoring of parts that are subject to wear.
- Improperly performed repairs
- Catastrophic events caused by foreign bodies and force majeure.

Note
The manufacturer assumes the complete warranty service only and exclusively for the spare parts ordered from him.

Caution
You may not make any changes, additions or conversions to the laser system without the manufacturer's approval. All modification measures require a written confirmation of the company Vitro Laser Solutions UG.

Caution
Use only original spare and wear parts. If parts are purchased from other manufacturers, it cannot be guaranteed that they are designed and manufactured in a manner that is suitable for the stresses and safety requirements.

1.3 Accident prevention regulations

1.3.1 General information

A safety check must be carried out before the initial start-up after an installation (new installation or installation after transport). During this check, all load-bearing parts and the machine parts must be checked to ensure that they are in perfect condition.
Check the laser system daily for operational safety before each start-up! In addition to the instructions in the operating manual, observe the generally applicable local safety and accident prevention regulations.
Attached warning and information signs provide important information for safe operation. Observe these instructions in the interest of third parties and also in your own interest!
Any malfunctions that impair safety must be eliminated immediately. Defective parts must be replaced immediately.
The laser system must not be operated until the fault has been rectified.
All direction designations ("right", "left", "front", "rear") assume a location in front of the laser system.

The direction of rotation is defined as follows:

- Sense of rotation right = clockwise
- Sense of rotation left = anticlockwise

Rotations of screws, nuts or similar always seen from the actuation side.

1.3.2 Laser system

In normal operation (safety door are completely closed and the laser beam is inaccessible), the Vitrolux Hv2 laser system corresponds to laser class 1.

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

1. The housing as well as the safety door are completely closed.
2. The operating personnel have been instructed and have read and understood the operating instructions.
3. The optical fiber must not be damaged.

Warning
Only put the laser into production operation with the laser head closed, the scanner closed and the laser beam path covered. The optical fiber must be undamaged. Danger 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 will void the warranty

In maintenance, adjustment and repair mode (the laser beam is then accessible), the Vitrolux laser system complies with laser class 4.

The laser system may only be operated in maintenance, adjustment and repair mode under the following conditions:

1. An expert person must be appointed in writing by the proprietor as a laser protection officer.
2. The proprietor has notified the responsible authorities of the operation of class 4 laser equipment in accordance with local regulations prior to the initial start-up.
3. The laser area is clearly marked and access to the laser area is provided with a warning light.
4. The operator and all persons present in the laser area shall wear appropriate safety glasses to protect against direct, reflected or diffusely scattered laser radiation. Protective gloves are recommended.

Warning
Prevent unauthorized persons from unintentionally being in the laser area. Danger of accident!

Note
In chapter 8 Special equipment you will find the order numbers of suitable protective goggles.

Danger from laser beams

The laser radiation emitted by the Vitrolux laser system can be partially invisible (depending on the laser head). It can cause serious eye damage and burns on the skin.
Diffuse scattered 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 that could endanger you or third parties due to uncontrolled reflection. Risk of injury.

Warning
The viewing window of the sliding door and side windows must not be damaged.
Risk of accident through escaping laser radiation.

Laser beams can lead to an increased risk of fire and explosion. Remove all flammable and easily combustible gases, liquids or solids from the laser area.

Warning
Never operate the laser system in an environment where there is a risk of fire or explosion. Danger of accident!

Toxic gases or dusts may be generated when processing metals or plastics.

Note
On the type plate and in chapter 7 Technical Data you will find information about the maximum laser power, the pulse energy, the pulse duration and wavelength.

1.3.3 Protective measures by the operator

The safety doors of the laser system are switched off with circuit breakers, which are part of a protective circuit. The laser beam switches off as soon as a circuit breaker has opened.

Warning
Never bridge or manipulate protective circuits.
Danger of accident.

In addition to these constructive protective measures of the laser system, Vitro Laser Solutions UG recommends to equip also the access doors to the laser area with such switches.
Keep unauthorized persons away from the laser area.
This can be ensured by self-closing doors that can only be opened with a key or similar protective measures.

1.3.4 Assembly and disassembly

Handle the Vitrolux Hv2 in an upright position. Observe the transport and position information on the outer packaging of the laser system.

Caution
Transport the laser system carefully without packaging. Shock or force must be avoided. Risk of damage!

Before transporting the laser system, carefully pack the components (e.g. seaworthy boxes, desiccants). The following transport systems are permitted:

- Rail
- Ship
- Truck with air suspension
- Forklift truck (for transporting the laser system and components on pallets)

The substrate must have a load-bearing capacity of at least 300kg/m². The laser system may only be set up in locations that:

- are not exposed to extreme vapors from oil, solvents or cleaning agents and are dust-free
- are not potentially explosive
- are clean
- are free from shocks and vibration.

During assembly and disassembly, only and exclusively the personnel involved in assembly and disassembly may be present at the laser system. Third parties (such as spectators) must remain outside the laser area. Ensure that the floor is sufficiently firm.
Also ensure the stability of the laser system and its components during setup or dismantling. After setup, check that all parts are properly connected and that all cables and connecting lines are securely attached.
When laying cables on the floor, make sure to minimize tripping hazards.
Before commissioning the laser system, the commissioning personnel must satisfy themselves of the perfect condition of the laser system by means of prescribed checks and by trial production!

1.3.5 Storage

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

1.3.6 Maintenance and repair

Carry out all prescribed maintenance work in due time.
Before maintenance and repair work, disconnect the system from the power supply (main switch in OFF position and disconnect the power plug)! If maintenance work should be necessary while the plant is running, the control panel must be manned by an additional supervisor at all times. Defective parts must be replaced immediately by original parts in perfect condition. After completion of the maintenance and repair work, check all safety devices for proper function.
Handle and dispose of used substances and materials properly, especially greases and solvents.

1.3.7 Safety when not in use

Secure the laser system against operation by unauthorized persons during periods of non-use (e.g. by means of a padlock on the main switch). Make sure that children do not have access to the laser system. Never allow children to play on, in or under the laser system.

1.3.8 Electrical system

A voltage of up to 5,000 V is required to generate the laser pulses. High voltage carrying parts are electrically isolated.

Warning
Do not remove or damage the insulation. Do not touch live parts. Do not get close to High-voltage parts. Danger to life!

The following parts can carry such high voltage:

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

Other system components (e.g. control unit, scanner power supply, cooling unit) are supplied with local mains voltage (230 V/110V).

Warning
Never touch any live parts. Danger to life!

Have work on the electrical supply and the control unit performed only by a qualified electrician. Observe the locally applicable safety regulations for working on mains or high-voltage equipment.
Always disconnect the power supply before working on the electrical system!
Do not trust that the power supply has been disconnected, but make sure of this by measuring! Never pull or plug the plug under load! Fire hazard!
Always keep plugs dry when inserted.
Always keep switch cabinets closed (protection against moisture and contamination).
Check the electrical equipment of the laser system regularly. Remove loose connections and damaged or scorched cables immediately.

1.3.9 Other points of danger

There are further danger points on or in the laser system which are not necessarily obvious. In the following you will find safety instructions for these danger points.

High power laser diodes (HP laser diodes)

The control unit is equipped with HP laser diodes. They are used to excite the laser crystal located in the laser head. The radiation emitted by the HL laser diodes has a wavelength of 800 to 850 nm and is normally not accessible to the operator.

Warning
If the fiber optic cable between the laser head and the pump module is damaged or loose, laser radiation can escape from the HL laser diodes. Danger of accident!

If the connection between the laser head and the pump module is damaged (e.g. the metallic sheathing is broken or has come loose from the screw connection and the inner fiber is visible), the laser system must be shut down immediately (emergency stop) and qualified personnel must be notified.

UV radiation

When processing material using a laser, UV radiation may be generated which can cause damage to the eyes and skin.

Warning
Never operate the laser with the protective devices (device door) open. Danger of accident!

Warning
Laser safety goggles do not protect against UV radiation. Danger of accident!

If operation with open protective devices is required for maintenance, adjustment or repair work, the operator and the persons in the laser area must wear special UV protective goggles.

Pilot-laser

The pilot laser corresponds to laser class 2 and causes the natural eyelid protection reflex (visible light) to protect the eyes.

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

The pilot laser does not pose any danger 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 devices (device door) open.
Danger of accident!

If operation with the door open is necessary for maintenance, adjustment or repair work, the operator must be particularly careful.

Warning
When driving the axes with the door open, hands or other body parts must not be held in the driving range of the motor axes. Danger of accident!

Workpieces

The optics can be damaged if the workpieces placed are too high. Do not lower the scanner too low in this case. Follow the special instructions when processing mirror glass.

Caution
When processing mirror glass, the optics in the scanner (lens, mirror) can be damaged by back reflection.

1.4 Intended use

The laser system is intended exclusively for material processing (internal and surface engraving). Only suitable materials may be processed.
Any use beyond this is considered improper. Vitro Laser Solutions UG is not liable for any resulting damage.

Intended use also includes:

- observance of all instructions in the operating manual and in the manufacturer's manuals supplied with the unit
- compliance with the service and maintenance conditions and intervals specified by the manufacturer.

Comply with the relevant accident prevention regulations and other generally accepted safety and medical rules.

1.5 Operation

Warning

In case of malfunctions, operation must be stopped immediately!

Malfunctions must be investigated immediately. If necessary, the operating personnel must call in specialists. Only when the safety of the laser system is beyond doubt, operation may be resumed.
Operation may only be resumed when the operating personnel are satisfied that all maintenance work (as described in this operating manual) has been carried out.
If it is discovered during operation that pending maintenance measures have not been carried out, operation must be stopped immediately.

1.6 Information and type plates

Caution

Real safety means that you are familiar with all safety instructions. This concerns the type and location of the hazard and, in particular, the safety measures to be taken. Always remain alert and be aware of the hazard(s).

This laser system is equipped with information and type plates.
Keep all information and type plates on the laser system in legible condition.

Caution

Always observe the notes, instructions and operating values on the information and type plates.

Type plates
The following components have type plates:
Control unit / Axis controller / Scanner controller (CUA) / Laser system with serial number

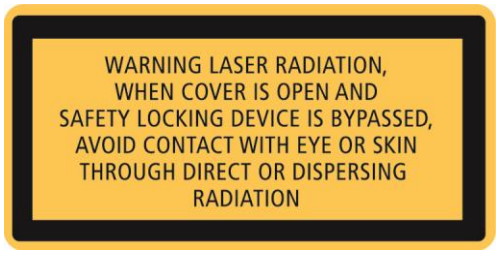
Note

Always refer to the serial number of your laser system when making inquiries, orders or purchase orders. This will facilitate communication with the manufacturer and avoid errors in processing your inquiry.

Warning labels

Various warning stickers can be found in the following places, for example:

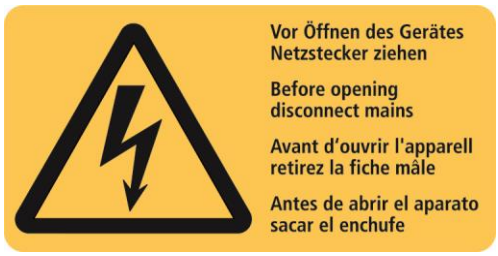
Examples of warning labels



(1) Warning laser radiation when cover is open / safety interlock bypassed

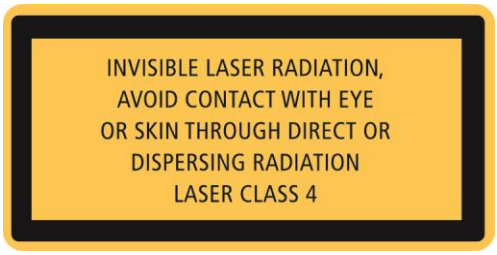
(2) laser class specification of entire system

(3) Warning locations with crushing hazards



(4) Warning unplug mains before opening electrical device

(5) Warning Dangerous laser radiation



(6) Warning Laser radiation Laser Class 4 (laser diode, laser head)

(7) Warning General risk of electric shock

2. Transport and installation

Content

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

Structure

Objective

You will receive information on the transport and installation of the laser system.

2.1 General information

During transport and installation work, ensure that you remain calm and level-headed.
Avoid stress and hectic, as this can lead to work errors or even accidents.
Never work alone, but ensure good, coordinated cooperation.
Keep all transport routes and the installation site free of disturbing objects during the entire work.

2.2 Transport

2.2.1 Transport vehicles

On delivery, the laser system is placed on a suitable pallet or in a wooden crate which can be transported by the following means:

- Rail
- Ship
- Truck with air suspension
- Forklift truck (if the laser systems and components are transported on pallets)
- On lifting lugs

2.2.2 Notes on the packaging

It is essential to observe the notes and instructions attached to the wooden crate:

Top
The arrows indicate the „top" position.

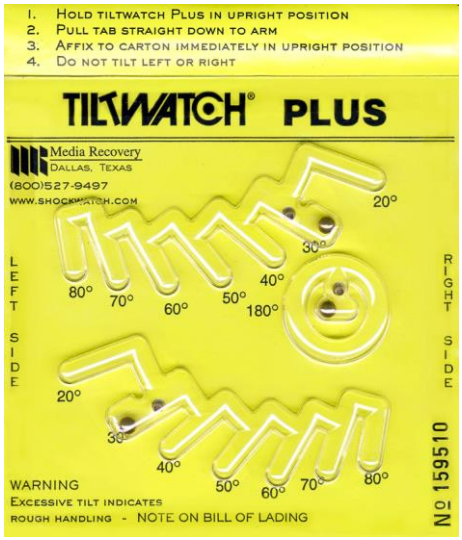
Keep dry
Protect the wooden box and the laser system packed inside from moisture and wetness.

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

Lifting points for hoists
Pay attention to the load capacity of the ropes used. Secure the ropes against accidental slipping. Ensure even load distribution when lifting the wooden crate.

2.2.3 Tilt and shock monitoring

A tilt angle template and an acceleration template are attached to the wooden crate. On the tilt angle template, you can always read off the maximum tilt angle that the wooden crate had assumed during transport.



Note
Be sure to note the displayed tilt angle on the receiving papers if angle values greater than 20° are displayed. This is necessary for any warranty claims.

The acceleration template contains a tube that turns red if the acceleration levels is too high.

Note
Be sure to note on the receiving papers if the tube is colored red.
This is necessary for any warranty claims.

2.3 Installation

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

Caution
The foundation must have a minimum load-bearing capacity of 300 kg/m^2

2. the transport box consists of a base and a complete hood. The hood is attached to the base with 2 screws on each side to the base. To unpack, remove the 8 screws and lift off the complete hood.
   The machine is secured on the base plate with straps or metal hooks to prevent it from slipping. Please remove these securing devices as well.

3. Set up the laser system at the intended location.

4. Have the connections between the laser system and the mains power supply made in a de-energized state by trained personnel.

3. Product description

Content

The laser system consists of various components which differ in task, construction and behavior.
All essential information for understanding the laser system components is contained in this chapter.
You will also find information on where in the laser system the individual components are installed.

Structure

Objective

This chapter contains an overview of the modules of the laser system. After reading this chapter, you will have an overview of all assemblies of the laser system, you will know their function and task and you will be informed about the exact designation of the assemblies and their parts..

3.1 Components of the laser system

3.1.1 Overview

A complete processing system consists of the following components:

(1) Laser head
The laser beam is generated in the laser head.

(2) Periscope
The periscope directs the laser beam - even when the scanner is moved in x- and z-direction - centered in the scanner.

(3) Scanner
The scanner is used to deflect the beam in the engraving plane.

(4) Industrial PC
The industrial PC installed in the rear part is used to control all components involved in the engraving process. Keyboard and mouse can be connected via a USB socket at the front.

(5) Door
The safety door closes off the processing area. It is opened and closed manually and is locked during the laser process.

(6) Viewing windows
Laser safety glass viewing windows are integrated in the safety door and the sides, through which you can monitor the production process.

(7) Operating elements
The control panel houses the emergency stop switch, the power switch that enables the system for operation, and the button for opening the safety door.

(8) Status displays
Status indicators are integrated in the upper part of the system to the left and right of the door, so that the operating status of the system can be seen even from a greater distance.

(9) Camera
A camera is mounted inside the laser area next to the laser head. This can be used for remote monitoring, online control during service visits, or in store operation to display the engravings on an additionally connected monitor.

(10) Interior lighting
The interior lighting can be switched manually "On" and "Off" via the software. or operated in automatic mode "On" - for loading/unloading the machine and "Off" - during the laser process.

(11) Supply modules
All supply modules required for operation are located in the rear part of the laser system. The software for preparing and controlling the laser process is stored on the hard disk of the control computer.

12) Motor axes
The motor axes to which the scanner is attached can be moved in the X and Z planes, and the motor axis of the workpiece table can be moved in the Y plane. The units are connected by power cables and control lines.

3.1.2 Representation of the components

Figure 1: Overview

(1) Door
(2) Touch screen
(3) Control panel
(4) Status lights
(5) Windows

(1) The door opens upwards.
There are 2 windows with laser protection glass and a touchscreen monitor integrated.
It has a safety interlock and can only be opened when the power is on and no lasering is in progress.
To open the door, press the white illuminated "Cover" key and simultaneously move the door upwards by the handle.

If the "Cover" key is not illuminated, the door is locked and cannot be opened!

(2) The monitor is connected to the integrated industrial PC and is used, among other things, for machine control using VitroMark. In addition to operation by keyboard and mouse, operation directly via the monitor is also possible.

(3) The control panel contains 2 USB ports, indicator lights, buttons and the emergency stop switch. More information can be found in section 3.6 Switches and indicator lights.

(4) These LED lights indicate the operating status of the system. This is especially useful when using multiple units, as you can see the status from a greater distance.
More information can be found in section 3.6 Switches and indicator lights.

(5) The 4 built-in windows are made of special laser protection glass, so that the laser process can be observed without danger.

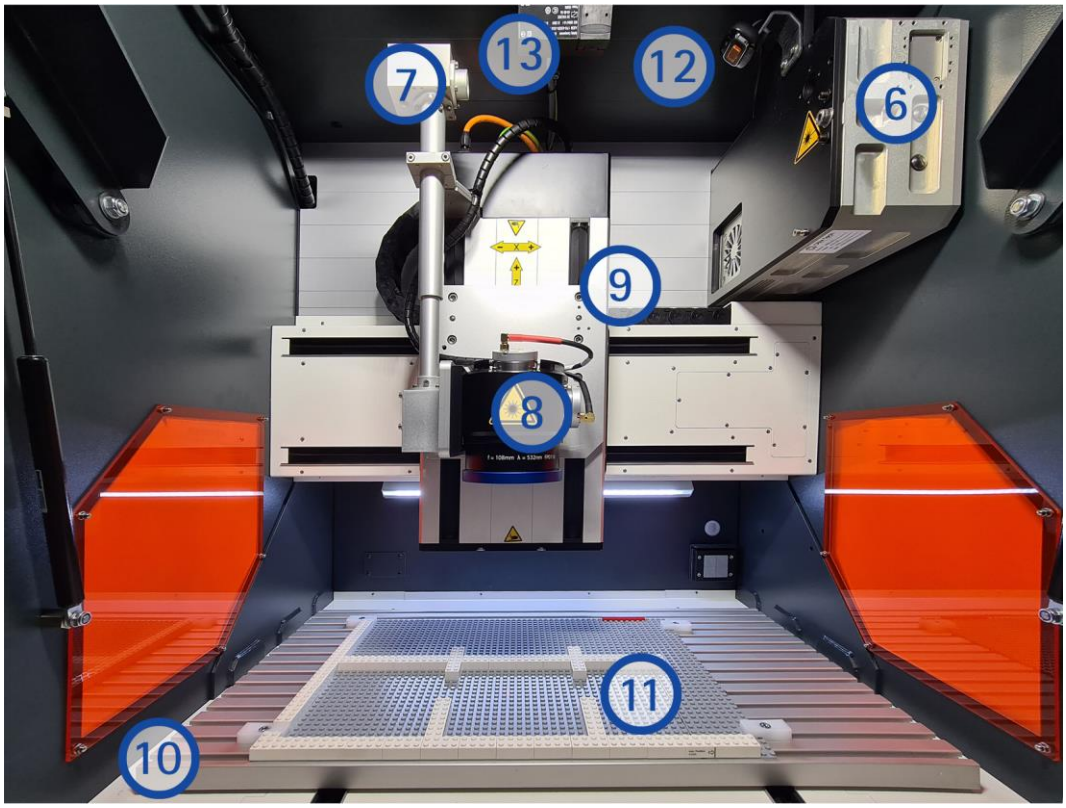


Figure 2: Interior

(6) Laser head
(7) Periscope
(8) Scanner
(9) x- and z-axis
(10) y-axis, laser table
(11) laser area with LEGO plate
(12) camera
(13) safety interlock

(6) The laser head is attached to the vertical retaining plate with 3 screws. Two of these are located in the rear part of the unit, one in the front. Next to the screws for fixing, there are adjustment screws for precise alignment of the housing.

(7) The periscope consists of 2 housings with finely adjustable holders on which special mirrors are mounted. The two housings are connected with a telescopic tube and the entrance of the upper housing is closed with a protective glass to avoid dust deposits especially on the lower mirror.

(8) The scanner with the mounted lens moves and focuses the laser beam in one plane. The field in which the beam can be moved through the scanner depends on the objective. With the 108mm objective, the size of the scan field is 75mm, with the 170mm objective it is 160mm.

(9) The x-axis moves the scanner periscope unit from left to right, the z-axis from top to bottom.

(10) The y-axis is realized by the laser stage, which can be moved from front to back.
This design of separate x- and y-axis allows high weights to be moved and either very large, heavy blocks or many smaller ones to be lasered in one pass.

(11) To simplify mass or serial production, we always ship the systems with the LEGO plate mounted, as this allows you to very quickly create grids using LEGO bricks, which you can then use to align the different glass blocks.
Useful side effect - the studs and the soft surface of the LEGO plate prevent scratches on the underside of the glass.
There is a mark engraved on one of the Lego blocks that indicates the end of the x-axis movement. The actual engraving area is still 37mm or 80mm larger depending on the lens [see (8)] but is realized exclusively by the scanner.

(12) The installed camera is equipped with a special protective glass that allows part of the laser radiation to pass through. This makes it possible to see whether a green beam is present during remote maintenance.
The images from the camera can also be output via the external monitor output on the back of the machine - for example, to show customers the engraving process.

(13) The Schmersal safety interlock includes several functions:
a) locking of the door when the machine is switched off
b) Locking of the door during the engraving process
c) Switching off the laser beam when the door is open
(if the interlock is switched off, special key necessary)

3.2 Laser head

As shown in the overview, the laser head is firmly mounted in the upper part of the housing.
The laser crystal located in the laser head is excited to emit radiation via the laser diode radiation from the control unit.
This laser diode radiation is guided to the laser head by means of a quartz fiber cable. The laser radiation exits the laser head and is used for internal engraving after passing through the scanner's deflection mirrors. The laser radiation is emitted in the form of short pulses.

The pulse energy is varied via the pulse height and can be influenced via the VitroMark software. 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 dots in the glass or plastic also increases with the pulse energy.

Since laser radiation is dangerous to the eyes and can also cause skin burns, the system is equipped with a safety circuit that forcibly and automatically switches off the laser in the event of a fault or when the lift door is opened.

Figure 3: Laser head

(1) Exit opening laser beam
(2) Fan

3.3 Scanner

The scanner is mounted on axes that can be moved in the X and Z directions.
The scanner itself is used for laser beam deflection in two planes by means of two galvanometer mirrors.
A lens is mounted at the bottom of the scanner to focus the laser beam.

The scanner deflects a parallel beam in the X-Y direction (see figure). The beam enters the scanner via the entrance aperture. In the instrument, the beam first hits mirror 1 on galvanometer scanner 1 and is then deflected onto mirror 2 on galvanometer scanner 2.
The deflection angle is determined by the controllable position of the galvanometer scanners. The beam exits the scanner through the exit port, which may be equipped with an F-theta lens.
The F-Theta objective focuses the parallel beam onto the image field plane.
With an F-Theta objective, there is exact proportionality between the angle of incidence of the beam and the position of the focused image point in the imaging field.
The square imaging field experiences a barrel-cushion shaped field distortion due to the beam path at the mirrors and through the lens. This field distortion must be compensated by the control.
The scanner is designed for a parallel beam with a defined maximum diameter, which is called the aperture. An incoming beam must not exceed this diameter in the device.

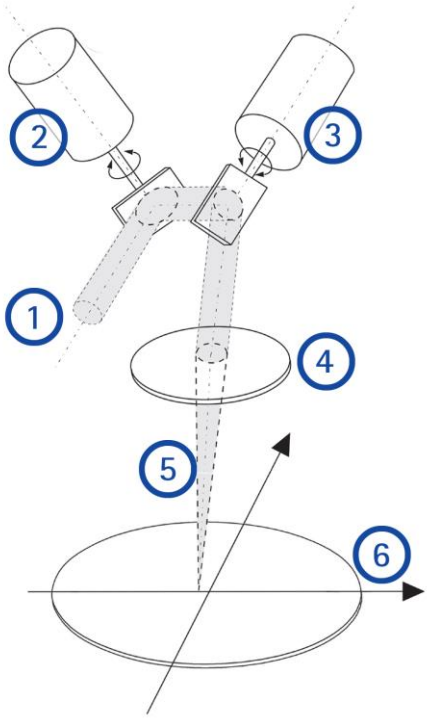


Figure 4: Scanner structure schematic

(1) Beam inlet
(2) Motor with mirror y-direction
(3) Motor with mirror x-direction
(4) F-Theta lens
(5) Focused beam
(6) Image field plane/scan field

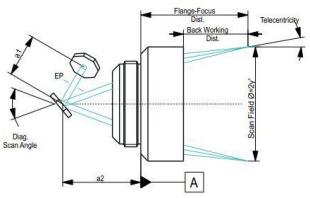
3.4 Laser optics

Specially calculated lenses are used to focus the laser beam.
They ensure that the focus of the laser beam lies in a flat surface.
Depending on the application, lenses with different focal lengths and for different laser wavelengths are available.

Figure 5: Lenses

108mm and 170mm objective
The blue ring with the protective glass can be unscrewed.

Focal length:	108.5 mm
Wavelength:	532 nm
Scan field Ø:	75 mm
Diagonal scan angle:	40°
Back working distance:	132.2 mm
Flange focus distance:	170.9 mm
Entrance pupil Ø:	22 mm
Input beam Ø 1/e²:	15 mm
Focus size Ø 1/e²:	7 µm
a1	16 mm
a2	39.2 mm
Telecentricity:	3.7°
Weight:	0.9 kg



Focal length:	170 mm
Wavelength:	532 nm
Scan field Ø:	160 mm
Diagonal scan sngle:	54°
Back working distance:	195 mm
Flange focus distance:	244 mm
Entrance pupil Ø:	21 mm
Input beam Ø 1/e²:	14 mm
Focus size Ø 1/e²:	12 µm
a1	17 mm
a2	40.5 mm
Telecentricity:	11°
Weight:	1.213 kg

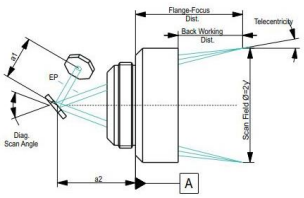


Figure 6: Lens data

108mm and 170mm F-Theta Lens

3.5 Motor axes

In order to enable laser measurements that are larger than the actual scan field, the scanner and the laser table can be moved via an axis system. The scanner can be moved in X and Z direction and the table in Y direction.

The directions of movement are:

- Z-axis (vertical: up +, down -) - moves lower periscope mirror and scanner with lens.
- X-axis (horizontal, right +, left -) - moves the complete z-axis
- Y-axis (horizontal, back +, forward -) - moves the laser table

The movements are performed by motor axes, which enable high processing speed and accuracy.
The loading table has a footprint of 700 x 375 mm.
The loading area, which can be controlled via the axes, is approx. 375 x 295 x 120 mm.
Depending on the lens, a maximum of up to 35 or 80 mm more can be lasered in the x and y directions.

Note
The directions of movement are marked on the axes with signs, where the direction of movement refers to the engraving in the glass.
For the y-axis, the forward movement of the axis means that the engraving moves backwards in the glass.

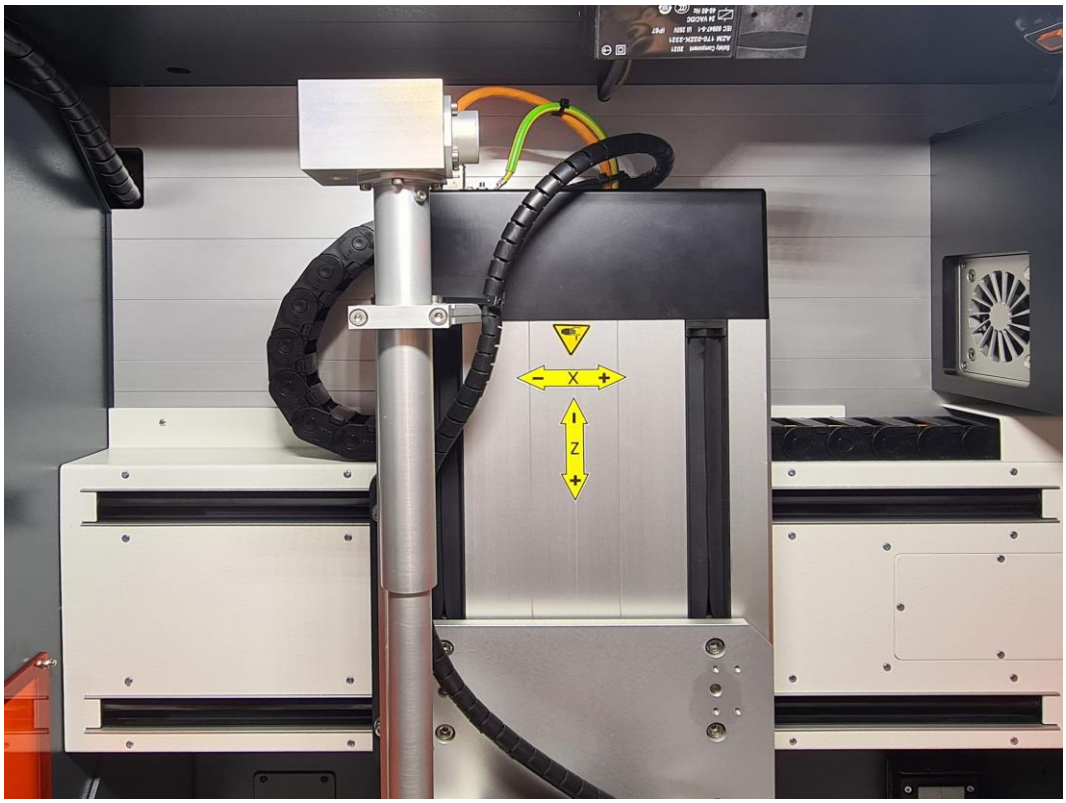


Figure 7: Motor axes X / Z

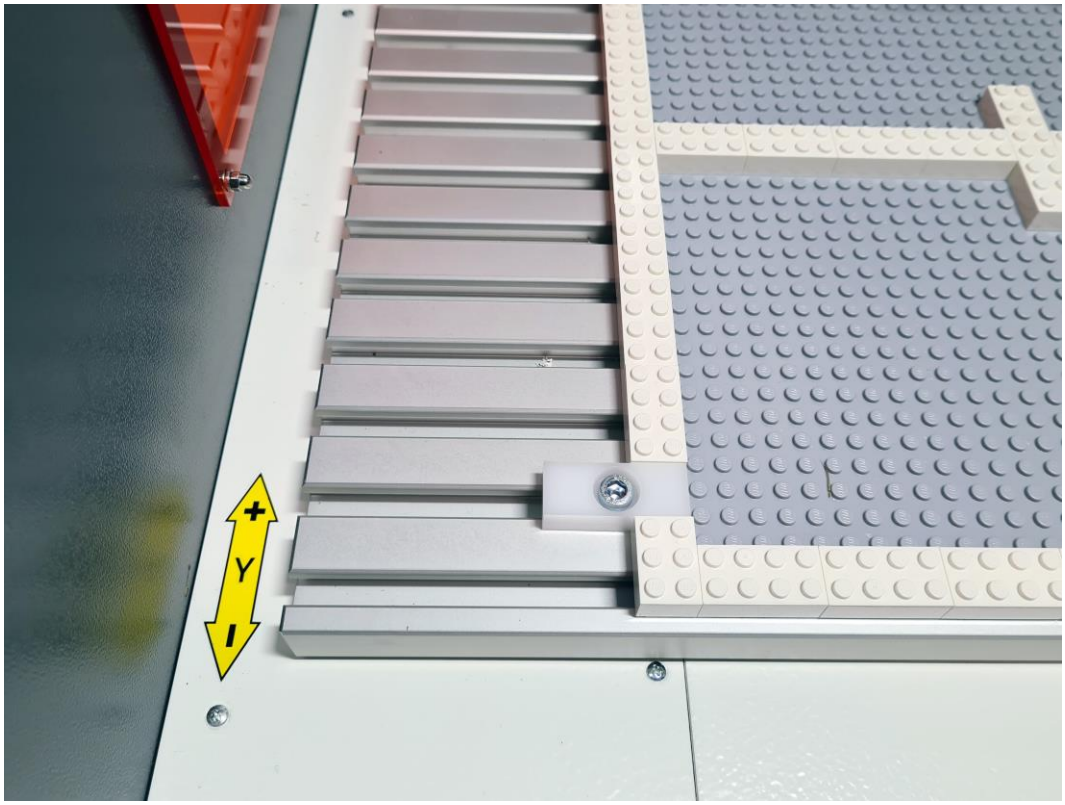


Figure 8: Motor axis Y

3.6 Switches, connections and control lamps of the laser system

The mains connection and the main switch for the power supply are located on the rear side of the machine. In the block with the mains connection there is also the compartment with the main fuses. Furthermore, an additional monitor and a network connection can be connected on the rear side.

Figure 9: Main switch and connections on the rear panel

(1) Socket for power cable
(2) Main switch
(3) Removable compartment with fine-wire fuses
(4) Additional ground connection
(5) Ethernet connector
(6) Monitor connector

The following connections, switches and indicators are located on the front of the laser system below the safety door:

Figure 10: Control bar

From left to right:

1. USB port 1 - for keyboard and mouse connection.

2. green LED, power indicator from computer
3. yellow LED, hard disk access indicator

4. USB port 2 - for external data media

5. PC Power button
   The computer is automatically started when the machine is switched on, but can also be switched Off and On again with this button.

6. Cover - with white illumination.
   Unlocks the safety door for loading and unloading the machine.
   During the laser process, the illumination is switched off and pressing the key has no function to prevent accidental aborted laser loading.
   When the key is lit, no laser process is active and the door can be opened without danger.
   To open the door, press the "Cover" key and lift the door at the same time.
   A soft click when pressing the "Cover" key indicates the release of the lock.

7. Fault - display illuminated orange/red
   Signals faults in the safety circuit, e.g. the emergency stop button being pressed, and lights up as a function check when the machine is switched on.
   The display goes out - if everything is OK - a few seconds after the "Power" button has been has been pressed.

8. Mode - key switch
   Used to lock the door in open sales environments. Turned to the left, the switch deactivates the the "Cover" key, so the door cannot be opened anymore. For example then the keyboard and mouse can be locked inside.

9. Power - with green illumination
   After switching on the machine, for safety reasons all axes are still without power to prevent unattended sudden movement of the axes. By pressing the "Power" key the power supply for the axis system and the laser is switched on.
   When the axes are ready for operation shortly after pressing the "Power" key, the "Fault" indicator goes out.

10. Emergency stop - red/yellow
    For immediate switching off of the axes and the laser head in emergencies.
    When pressed, the button is automatically locked in the "Off" position!
    To be able to use the machine again after an "emergency stop", the switch must be unlocked again (turn in the direction of the arrow) and restart the machine.

Note
A pressed emergency stop switch often leads to service requests. If the laser no longer responds to inputs of any kind and/or the "Fault" display lights up, please check the emergency stop switch first! (Turn and check if the switch pops out!).

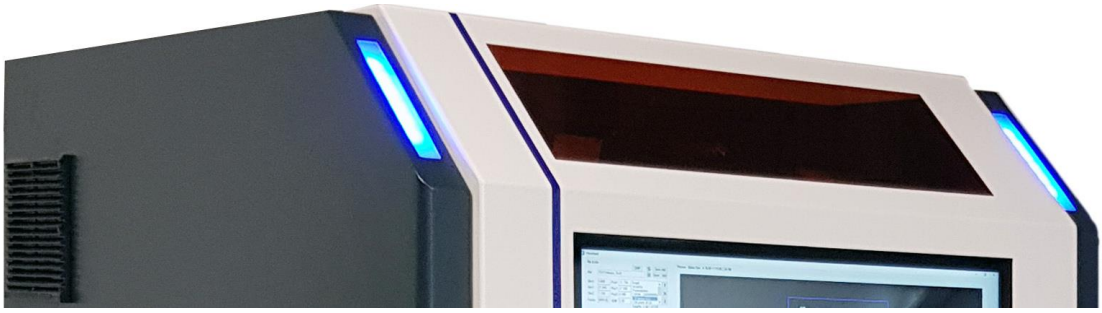


Figure 11: LED status display

The two LED indicators next to the door can indicate different operating states.
So far, the following has been implemented:

a) White - when the system is switched on
b) Blue - VitroMark is started and the system is ready for operation
c) Green - the laser is active and engraved
d) Yellow - in a VT series production, the inserted cups are finished and the next ones can be inserted, but the series is not yet complete.
After the series is completed, the display lights up again Blue

3.7 Components in the rear part of the system

The rear part of the system contains the axis controller for controlling the X, Y and Z axes, the control unit for the laser, the control module for the scanner, the industrial computer and power supply units.

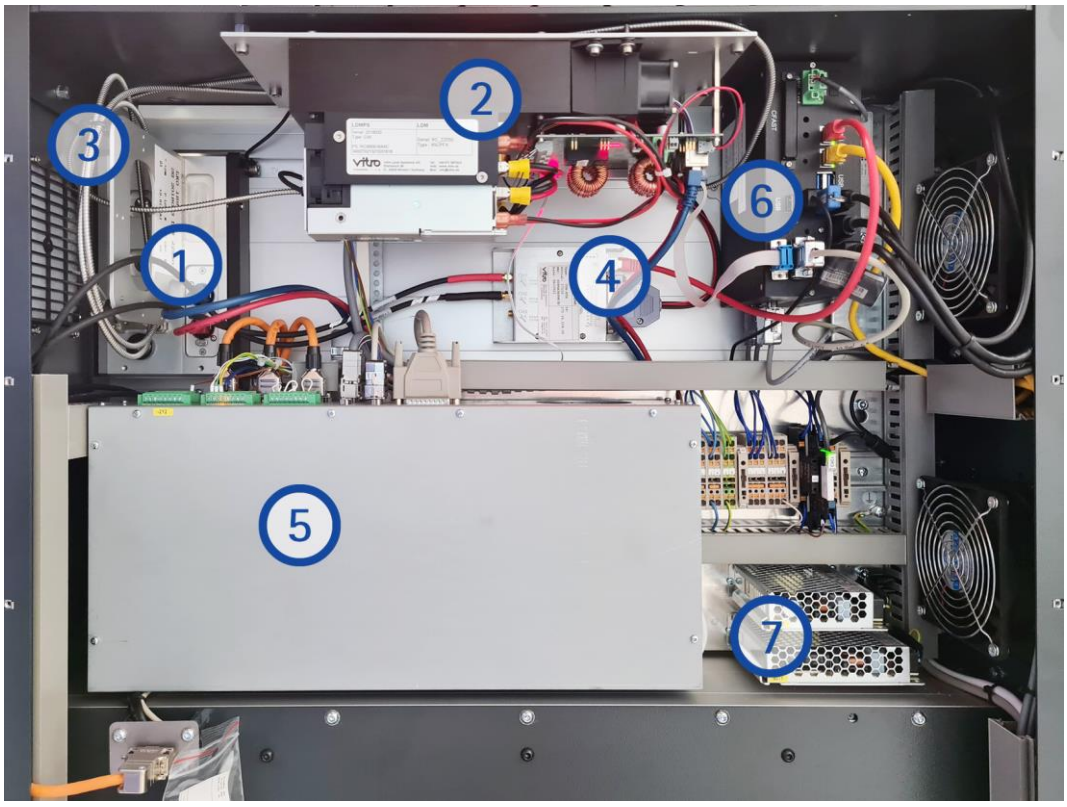


Figure 12: Electronic modules and assemblies

(1) Laser head
(2) Laser controller
(3) Fiber optic, connection from pump module to laser head
(4) Scanner controller, CUA
(5) Axis controller
(6) Industrial computer
(7) Low voltage power supplies

3.8 Control computer

An industrial PC is installed as control computer, Windows 10 is installed as operating system.
2 USB ports are accessible for free use on the front side, one Ethernet and one HDMI port are located on the back of the system.
The LEDs for power (green) and hard drive access (yellow) are mounted between the two USB ports on the front.
The complete control of the laser processes is done via the pre-installed special software VitroMark.

4. Operation

Content

The laser system may only be started up and operated by trained and instructed personnel who are familiar with all the operating elements as well as their function and correct use.

Structure

Objective

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 options permitted to you.

4.1 Switch-on routine

Preparations

1. Check that the power supply is correctly connected.
2. Check that the emergency stop switch is unlocked.
3. Make sure that the door of the unit is closed..

Switch-on routine

1. Switch the main switch (at the mains connection cable) on the back of the system to the ON position
2. Switch on the PC if not started automatically.
   (The switch is located left side at the front)
3. Log in.

Note
A password may have been assigned for logging in.
Enter the correct password and confirm with OK

4. Press the "Power" key on the front of the system. The key then lights up green and the red "Fault" display goes out after a few seconds.
5. Start the "VitroMark" program and confirm the reference run of the axis system with "OK".

The laser system is now ready for operation.

4.2 Loading / Engraving

1. Press the white illuminated "Cover" key and keep it pressed, a soft click indicates that the door lock has been released.
2. Now slide the door up and position the objects to be lasered on the table. Note that the maximum space for lasering is approximately 400 x 300 x 120 mm, although the laser table is larger.
3. Close the door and start the laser process via the "VitroMark" software. Top indicator lights will switch to green.
4. Wait for the end of the laser process - the "Cover" key lights up again, the LED status lights are blue again.
   Then open the door as described in 1., remove the finished products and then continue as described in 2. until all objects are finished.
5.

Caution!
During the laser process, the door cannot be opened – the "Cover" key is locked during this time to avoid accidentally aborted lasering. For intentional interruptions of the entire process in case of emergency, use the "Emergency Stop" key.

4.3 Switch-off process

1. Close the door of the system.
2. Exit the VitroMark software.
3. Shut down the operating system of the computer via the Windows menu or the "PC Start" key. Wait until this shutdown process is complete.
4. Turn the main switch on the rear of the machine to "Off".

Attention!

If this sequence is not followed and the laser is simply switched off via the main switch, it can happen in rare cases that the assignment of the monitor connections in Windows is lost. If you don't get a monitor display when switching on the system although the green PC power LED is on and the yellow hard disk LED is flickering, please wait until the flickering of the yellow LED stops (boot process completed) and switch the system off again.
Then switch the system on again. This may have to be repeated several times until Windows has restored the correct monitor assignment.

5. Maintenance

Content

The laser system is largely maintenance-free, but minor work must be carried out regularly by trained personnel.
In this chapter, you will find information on which parts must be maintained and at what intervals. Extensive maintenance measures are explained step by step (partly with the help of graphics).

Structure

Objective

This chapter contains an overview of all care and maintenance measures of the laser system. After reading this chapter, you will be able to maintain the laser system within the limits of your possibilities.

5.1 General information

Carry out all maintenance work in due time and document that the work has been done.

To perform the maintenance, switch on the machine and move all axes to their start position.
Open the door by pressing the "Cover" key and slide it upwards.
Now switch off the machine and also disconnect the power plug to prevent it from being switched on accidentally.

Warning
Disconnect the system from the power supply before carrying out maintenance work (main switch on the system "Off" and disconnect the power plug)!

After completing the maintenance work, check all safety devices for proper function.
Handle and dispose of used substances and materials properly, especially greases and solvents.

5.2 Maintenance work and intervals

5.2.1 Fixed intervals

Every 3 month	Clean cooling fan air filter
	Clean fan on laser head
	Check dry cartridge on laser head and replace if necessary
Once a year	Grease guide rails and drive shafts of the axis system

Note
Since especially the inspection of the desiccant cartridge with the dismantling of the back panel is a considerable amount of work, after the first year - if the location of the machine is not changed - the interval of the inspection can be extended to the period after which the desiccant cartridge had to be replaced.

You will find a maintenance plan for printing at the end of this operating manual.

5.2.2 Maintenance work as required

as required	Clean interior of the system
	Clean optics

5.3 Cleaning the air filters

To clean the air filters, first remove the protective grids. There can be 2 different types installed.

1. version with one locking device visible from the front and central recessed grip
2. version with 2 locks visible from below

Figure 13: Air filter version 1

To remove the protective grille, open the locking mechanism with a screwdriver and pull the grille forward at the bottom of the recessed grip with the other hand.

There are additional latches on the side of the protective grille, which then open with a click. Then remove the protective grille by pulling it upwards.

Depending on the degree of contamination, clean or replace the filter fleece.

Suitable filter fleece can be ordered in our webshop.

Figure 14: Air filter version 2

To remove the protective grille, use a screwdriver to open the two latches from below, pressing slightly on the grille from above with the other hand.
When it is released at both positions at the bottom, pull it forward and then remove it upward.

Depending on the degree of contamination, clean or replace the filter fleece.

Suitable filter fleece can be ordered in our webshop.

5.4 Cleaning the laser head fan

To clean the laser head fan, simply use a vacuum cleaner to remove loose debris through the openings in the cover. If at some point the fan needs to be replaced, a brush can also be used to remove dust from the then exposed heat sink.

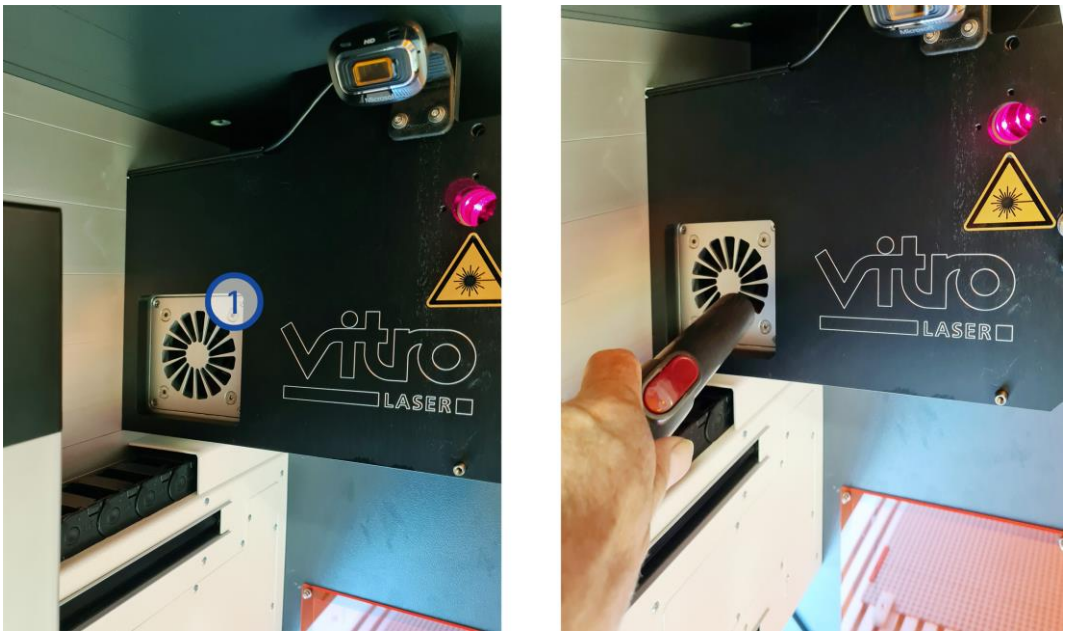


Figure 15: Cleaning the laser head fan

(1) Fan

5.5 Check/Replace dry cartridge

The crystals built into the laser head are partly hygroscopic, therefore a desiccant cartridge is built into the laser head to protect the crystals from moisture.
This desiccant cartridge is accessible from the outside of the laser head so that it can be replaced if necessary.
However, the rear wall of the laser system must also be removed for inspection.
Since the durability of the desiccant cartridges depends very much on the installation location (humidity) of the machine, we recommend initially checking every 3 months.
If the location of the machine is not changed and, for example, replacement is not required until after 12 months, future checks can be based on this time period and only take place after 12 months.

If the desiccant cartridges are not replaced after consumption, this can lead to extremely expensive repairs, replacement of crystals in the laser head can only be carried out by us under clean room conditions!

Attention!
Before dismantling the rear panel, disconnect the machine from the power supply!
To dismantle, remove all but one of the screws from the rear panel.
When the last screw is removed, please press the back panel lightly against the machine to prevent it from falling down. Then carefully lift off the back panel and pull off the grounding cable on the inside. After that, the back panel can be put aside.

The packaging of the new desiccant cartridge is also the tool to unscrew the used cartridge. Place the packaging on the used cartridge and turn counterclockwise. If the cartridge does not move immediately, just keep the pressure on, the rubber ring to seal the opening will slowly loosen.
When the spent desiccant cartridge has been removed, immediately insert and tighten the new one to prevent dust from entering the laser head through the opening.

Figure 16: Drying cartridge with packaging

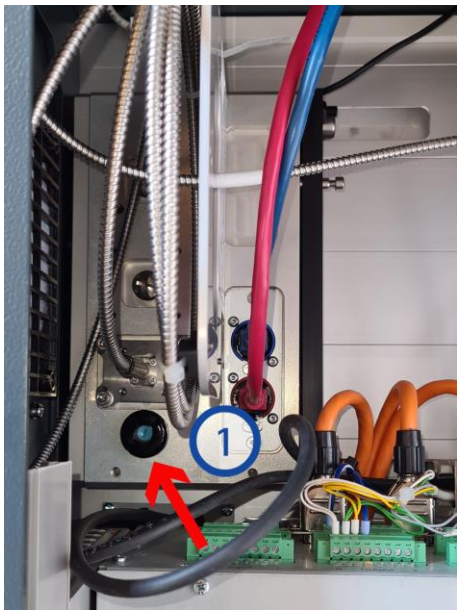


Figure 17: Drying cartridge

(1) Drying cartridge position

Figure 18: Drying cartridges Spent / New

Spent (white), New (light blue). The 40% imprint has no meaning for the condition.

5.6 Greasing the motor axles

The motor axes are greased with the machine switched off. To do this, a reference run is performed, then the z-axis is moved down 125 mm and then the door is opened.
Now the system is switched off and disconnected from the mains.

5.6.1 Guide rails

Most of the guide rails of the axes can be greased through the gap between the black sealing lips. The sealing lips themselves contain a Teflon component and do not require any special maintenance. Ex works, all guides and shafts are lubricated with the sodium soap grease GP00/000F-20 according to DIN 51 502. This grease is also available from us as a spare part.

Each shaft has 2 guides, so there are a total of 6 guides to be greased.

To lubricate the guides, please press the sealing lips slightly apart with your finger approx. in the middle of the guide and apply some grease to the guide rail.

Note
Exception is the right guide rail of the z-axis, here the guides are located behind the drive shaft and must be greased via a grease nipple, for more details see drive shaft z-axis.

The grease is later distributed evenly over the entire range of motion after the machine is switched on by 2-3 manually controlled travels.

5.6.2 X-axis drive shaft

The X-axis lubrication nipples are accessible from the outside left of the machine.

Figure 19: Access to X-axis lubrication

(1) Position of grease nipple
(2) Cover caps
(3) Grease nipple

5.6.3 Y-axis drive shaft

The grease nipples for the Y-axis are located just before the loading table.
Remove the plastic plugs and grease the drive shaft over the grease nipples.
Then press the cover caps back in.

Figure 20: Access to lubrication Y-axis

5.6.4 Drive shaft Z-axis

In the Z-axis, the drive shaft and the guide rails underneath are lubricated through the opening on the side of the axis. In the lower approached position, the grease nipple of the drive shaft is accessible.
In order to reach the grease nipple for the guide rails, either the carriage must be moved upwards by hand, or after switching on the machine with the axis control, by approx. 100mm.
Then the 2nd grease nipple is accessible through the opening.
As orientation in which position the lubrication nipples are, the dowel pins in the mounting plate can be used, which are located centrally between 2 screws.

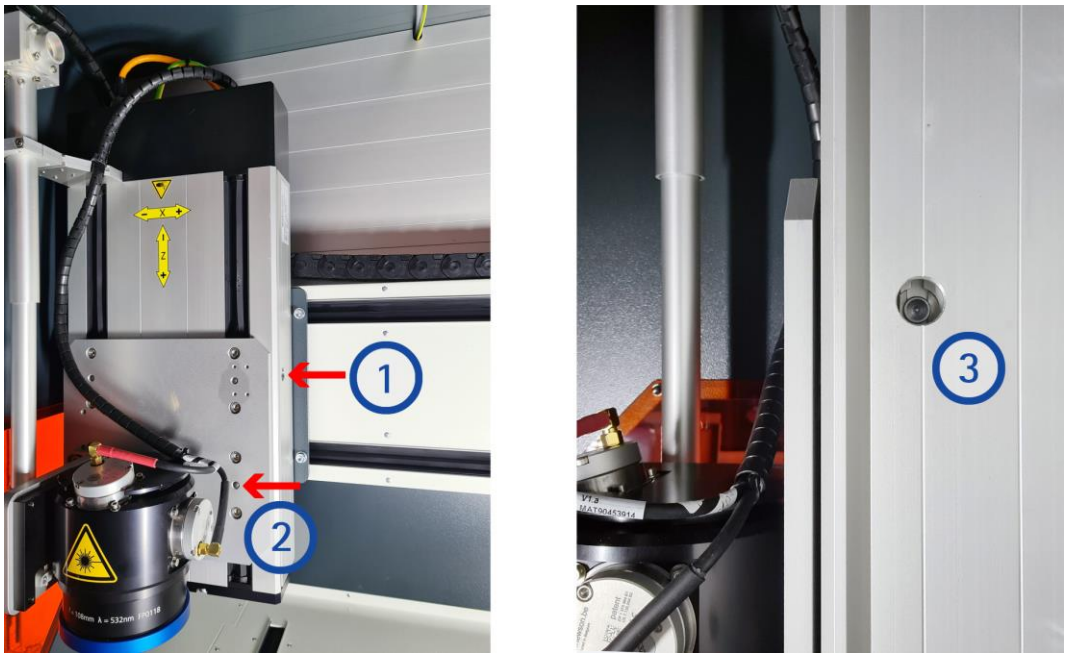


Figure 21: Access lubrication Z-axis

(1) Opening for grease nipple
(2) Fitting pin
(3) Grease nipple

To finish the lubrication, please close the front door of the machine, plug in the power plug again and switch on the machine again with the main switch.
Press the green power key and start "VitroMark".
Go to the Tools section, enter 400 in the Diff (mm) window in the Axis Tools section, and move all 3 axes back and forth 2 times to evenly distribute the lubricants.
Since the movement of the axes is limited internally by the software, the value 400 can be used for all axes.

5.7 Cleaning the interior of the unit

If necessary, clean the interior of the system with a hand brush or vacuum cleaner.
Please do not use compressed air, otherwise particles flying around could damage the optics or could be blown into the axes through the sealing lips.

5.6 Cleaning the optics

The protective glass of the laser objective can be cleaned if necessary.

Clean the protective glass only with special lint-free cleaning paper and pure alcohol (pharmaceutical grade).
The protective glass can be unscrewed for cleaning (use gloves to avoid fingerprints). If it has been unscrewed, please ensure that there are no dirt particles between the protective glass and the objective before subsequent assembly.

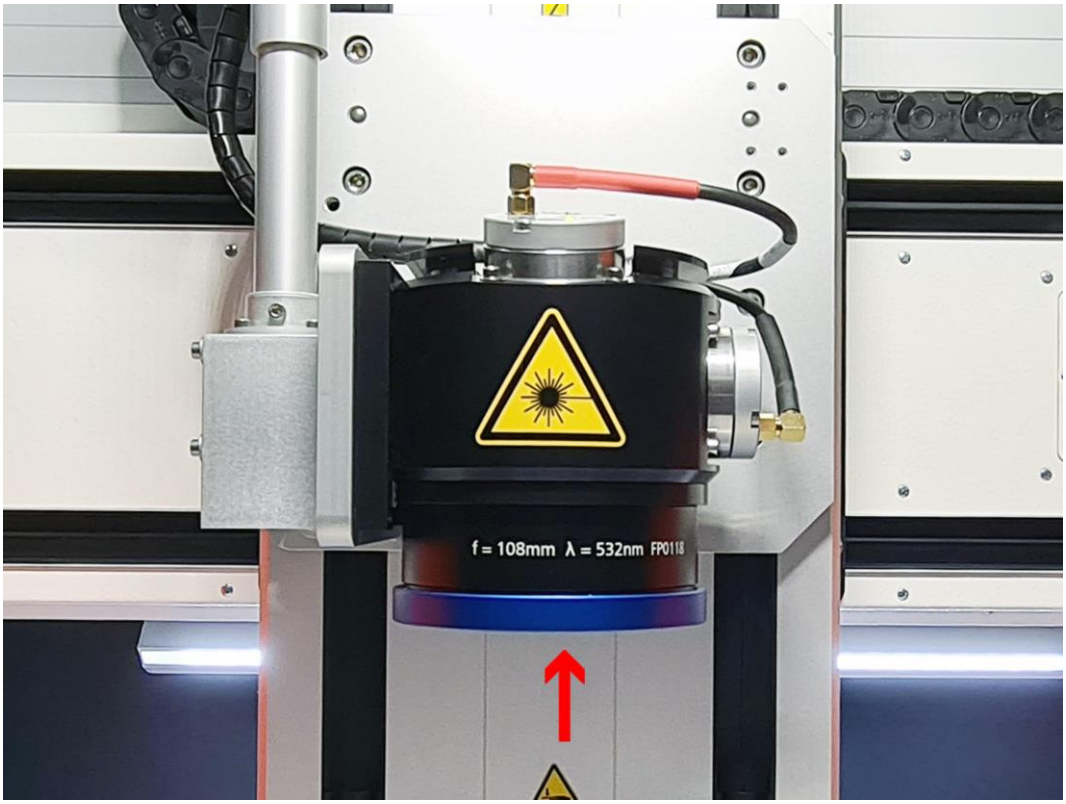


Figure 22: Position of protective glass

Warning
Do not use any abrasive agents or cleaning utensils.
The optical surfaces are sensitive and could be damaged.
be damaged.

Note
Clean the glass from the center outward in rotating movements.

6. Troubleshooting / fault rectification

Content

The laser system consists of different components which may wear out or show a malfunction in the course of time.
In this chapter you will find help for troubleshooting, as well as hints if the malfunctions cannot be eliminated by you.

Structure

Objective

This chapter contains assistance for troubleshooting and describes repair measures as far as they are within your possibilities.

Note

For replacement, always use original spare parts that you can obtain from Vitro Laser Solutions UG.

6.1 General information

During normal operation of the system, fault messages / error messages with exact descriptions are displayed on the control computer.
For example, you will receive a message if you want to start the laser process but the door of the system is not closed.

However, some easily correctable errors can occur before the correct cooperation between control computer and laser has started, or they cannot be detected by the software..

6.2 Faults/errors

6.2.1 System cannot be switched on

Possible cause:	Check/rectify:
Mains connection not present	Mains plug inserted?
	Main switch turned on?
	Power strip has power?
	Fuse in unit defective? Fuses are located directly next to the mains connection. Disconnect mains plug, check fuses and replace if necessary. Fuses 2 x 10A/250V slow blow

6.2.2 „Power" key does not work

Possible cause:	Check/rectify:
Emergency stop not unlocked	Unlock emergency stop (turn red knob)
	Fuse defective - See 6.2.1

6.2.3 Machine does not laser

Possible cause:	Check/rectifyix:
After transport - protective cap on lens is not removed	Remove cap
Too little power	Check with internal camera if green beam is present, if yes - Increase power, if no - Contact service technician
Pump module, fiber, power supply or laser head defective	Contact service technician
Periscope misaligned	Check if pilot laser hits upper mirror correctly.
Lower periscope mirror dirty	Remove lower periscope mirror and clean carefully with compressed air (spray can, not compressor!)

6.2.4 Software massage „Door open" when door is closed

Possible cause:	Check/rectify:
Door contact defective	Replace or contact service technician.

6.2.5 Motifs displaced in glass

Possible cause:	Check/rectify:
Legoboard moved/loosened	Move table to start position with software and check if pilot laser hits at correct position. Check whether the plate is still firmly connected to the table
Values for start position(s) changed	Redefine values for start position(s) - see software manual.
Wrong start position selected	Check start position selected in the "Tools" area of the software.

6.2.6 Motives with defects always at the same position

Possible cause:	Check/rectify:
Dirt particles on the lens	Clean the optics with a soft cloth and alcohol if necessary. Laser the glass plate with a white surface over the entire scan area without tiling (approx. 70mm/130mm Ø – depending on used lens) to check whether the error has been eliminated. If error is still present then possibly
Optics defective	Replace objectivelens, must be done by service technician

6.2.8 Motives with streaks or strips

Possible cause:	Check/rectify:
Tension in the glass or surface badly polished	Stresses in the glass can be checked with the glass stress tester - see 8.6. Continuous stripes can be caused by slight waves in the surface of the glass which deflect the laser beam. This can be checked by mirroring straight edges - e.g. neon tubes - in the surface and looking for deformations. If deformations or stresses occur, the glass is not suitable for laser engraving.

6.2.9 Motifs faintly visible

Possible cause:	Check/rectify:
Dot density too low	With newly created motifs, the dot spacing may have been selected too high and thus the dot density too low. As a comparison for good visibility, lasered text can also be used. If text is clearly legible but the motif is only faintly visible, create a new point cloud.
Diode power decreases	Increase current for pump diodes. Please ask your service technician for permissible values. If current can no longer be increased, replace diode module.
3D motifs ok but 2D motifs too weak	Remove lower periscope mirror and check for dirt. If necessary, clean carefully with compressed air spray (no compressor!).

6.3 Changing the lens

If the lens has been determined as the source of the error, e.g. due to mechanical damage, it must always be replaced by a service technician!
The exchange requires a new calibration of the system, which cannot be done by you.

6.4 Replacing the laser diode module

The exchange of a laser diode module - see also 6.2.9 - can be carried out by yourself under certain circumstances. For this purpose, please contact a service technician who can clarify in consultation with you whether the exchange can be carried out by yourself.

7. Technical Data

Content

The laser system is a complex technical system. Its components have certain characteristics which are necessary for safe and smooth operation.
All essential data on the individual components and on the entire laser system are contained in this chapter. The data are arranged as tables and structured according to individual components.

Structure

Objective

This chapter contains the most important technical data of the laser system and its components.

7.1 General Data

Dimensions:	800 x 910 x 900 mm (WxHxD)
- with door open:	800 x 1350 x 900 mm (WxHxD)
Weight approx.:	215 kg
Table	700 x 375 mm
Lase processing area:	400 x 300 x 98(125)mm

7.2 Ambient conditions

Production nvironment	Vibration-free, dust-free room, air without aerosols
Air temperaure	15 to 30°C (with uniform heat)
Min. floor lod-bearing capacity	300 kg / m²
Space requirements	Machine dimensions plus 10cm at rear, the side fan inlet and outlet openings must remain free, as well as free access at the front.

7.3 Electrical values

Power supply (single phase):	110 - 230 V AC, 50 – 60 Hz
Power consumption:	average 300W, max. 600W
Fuse	2 x 10 A / 250V slow blow, IEC 127 HBC

7.4 Laser

Laser type:	Diode pumped solid state laser, DPSS
Laser head wavelength:	532 nm
Max. laser power:	1,6W (2,3W)
Pulse repetition frequency:	max. 10 kHz
Usable average laser frequency:	4 kHz (8kHz)
Pulse length:	< 10 ns
max. pulse energy:	0,5 mJ
Laser diode modul max.:	40W
Wavelength:	~ 810 nm
Wavelength pilot laser approx.:	650 nm
Laser class	
- normal operation with doors:	Laser class 1
- Maintenance/setup operation:	Laser class 4
Scan field in flat glass with	
108mm focus lens:	70mmØ
170mm focus lens:	125mmØ

8. Spare parts / Accessories

Content

This spare parts list contains important information about possibly required exchange parts and available accessories.
With this information we help you to determine the required spare parts.
Graphical representations help to locate the spare parts. A table indicates the order number and the exact article name.

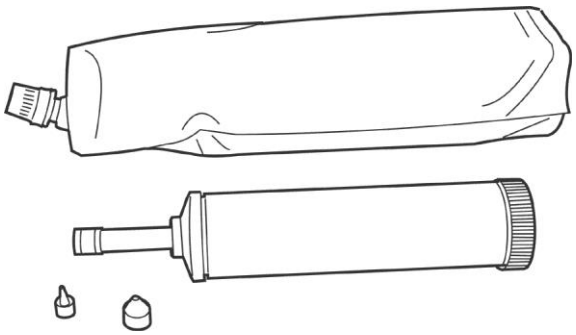
Structure

Objective

This chapter shows you the spare parts, accessories and the corresponding order numbers. This will enable you to name the required parts correctly when ordering.
Additional accessories such as filter fleeces, desiccant cartridges and others can also be ordered directly on our website vitro.de in the store.

8.1 Grease for the axle bearing

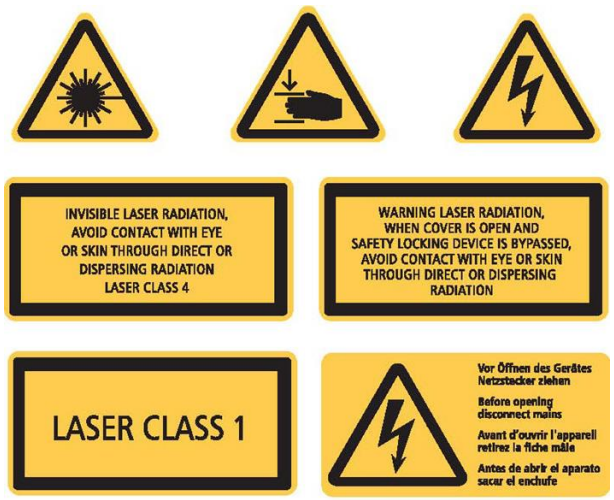
The grease listed below is suitable for lubricating the axles. The grease gun ensures that the grease is pressed securely into the grease nipples.



Item		No.
Grease tube with 250ml		45000357
Push press for grease incl. suitable fittings		45000358

8.2 Warning labels

A complete set of warning signs is available to replace warning signs that have become illegible or are no longer available.



Item		No.
Complete set of warning labels		15000060

8.3 Diode module

The following spare parts are available for the replacement of a defective diode module:

Item		No.
Diode module	LDM 40W CW air	43000015
Fiber	Fiber SMA isolated 3m	13000019

8.4 Lenses

The following lenses are available as a replacement for the standard lens or as an alternative:

Item		No.
Lens 108-532		43000003
Lens 170-532		43000025

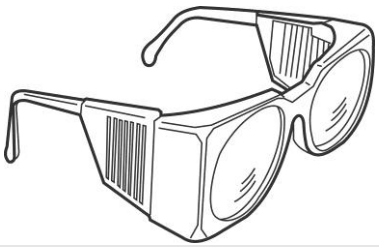
8.5 Laser safety glass

The following spare parts are available for the replacement of defective protective glasses:

Item	Wavelength Laser	No.
Safety glass door top	532/355nm	15011001
Safety glass door bottom	532/355nm	15011002
Safety glass side	532/355nm	15001103

8.6 Protective goggles

The following safety goggles are available for working on laser class 4 machines or laser class 1 machines in maintenance mode with the doors open:



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

8.7 Glass tension tester

With the following equipment, you will be able to test your glass for stress before you start laser cutting. If your glass has tension, the production will be faulty.

Contents: Light box, power adapter, goggle

Item		No.
Glass tension tester		15000045

9. Warranty

Vitro Laser Solutions UG grants a 12 months warranty. The warranty claim expires if the following warranty seals have been destroyed without prior written approval by Vitro Laser:

- Control unit
- Control computer (PC)
- Axis controller
- Laser head

In addition, the warranty is voided in the event of improper handling and failure to comply with our guidelines described in the manual.

Wartungsplan / Maintenance Schedule

Lüftgekühlte Lasersysteme / Air cooled laser systems

Jahr/Year

Alle 3 Monate / Every 3 month	Datum/Date
Reinigung Maschinen Luftfilter / Clean machines air filter	Name
Reinigung Lüfter Laserkopf / Clean fan grid laserhead	
Prüfen und ggf. Ersetzen Trockenpatrone / Check and, if necessary, replace the drying cartridge	OK ☐ ersetzt / replaced ☐

Alle 3 Monate / Every 3 month	Datum/Date
Reinigung Maschinen Luftfilter / Clean machines air filter	Name
Reinigung Lüfter Laserkopf / Clean fan grid laserhead	
Prüfen und ggf. Ersetzen Trockenpatrone / Check and, if necessary, replace the drying cartridge	OK ☐ ersetzt / replaced ☐

Alle 3 Monate / Every 3 month	Datum/Date
Reinigung Maschinen Luftfilter / Clean machines air filter	Name
Reinigung Lüfter Laserkopf / Clean fan grid laserhead	
Prüfen und ggf. Ersetzen Trockenpatrone / Check and, if necessary, replace the drying cartridge	OK ☐ ersetzt / replaced ☐

Einmal im Jahr / Once a year	Datum/Date
Reinigung Maschinen Luftfilter / Clean machines air filter	Name
Reinigung Lüfter Laserkopf / Clean fan grid laserhead	
Prüfen und ggf. Ersetzen Trockenpatrone / Check and, if necessary, replace the drying cartridge	OK ☐ ersetzt / replaced ☐
Prüfen und ggf. Ersetzen Luftfiltervlies / Check and, if necessary, replace filter fabric	OK ☐ ersetzt / replaced ☐
X-,Y- und Z-Achse schmieren / Lubricate X, Y and Z axis	