

ENESKAlaser 1500 mobile

— USER MANUAL —



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joke Technology GmbH and its affiliates may not be held liable to the purchaser or third parties for any damages, losses, costs or expenses incurred due to: accidents, improper use or misuse of this product, modifications, unauthorised repairs or alterations carried out on this product, or non-compliance with the operating and maintenance instructions provided by joke Technology GmbH.

joke Technology GmbH may not be held responsible for any damages or problems caused by the use of consumables other than those indicated as original products and/or approved by joke Technology GmbH.

The manufacturer guarantees that newly-purchased machines will remain free from defects, taking into account current technological advances, for two years from the delivery date indicated on the transport documents. Without prejudice to the period of validity indicated in the preceding point, the warranty shall also cover parts of the machine not directly manufactured by joke Technology GmbH, excluding optical fibre, lamps, fuses and all consumables. The manufacturer shall also guarantee any repair or replacement parts according to his/her own discretion on the basis of the specific technical requisites.

If the manufacturer accepts that any given repair or replacement falls within the terms and conditions of the warranty, he/she shall be liable for all costs associated with the respective repair/replacement procedures. All parts with manufacturing or machining defects must be replaced, as well as any other parts that may be damaged as a consequence of such defects. The replaced parts will become the property of joke Technology GmbH. Any replacement of defective parts will not result in an extension of the warranty period, either in the case of the replaced parts or the machine as a whole.

ALL REPAIR AND REPLACEMENT OPERATIONS SHALL BE CARRIED OUT AT Joke Technology GmbH. FOR THIS REASON, WE RECOMMEND THAT CUSTOMERS PRESERVE THE ORIGINAL PACKAGING IN CASE IT IS NECESSARY TO TRANSPORT THE MACHINE.

The warranty shall no longer be considered valid in cases where the error is due to the following:

- The purchaser fails to notify the manufacturer of the defects within eight days of the date of delivery, in writing or by commissioning the corresponding intervention;
- The machine or its parts have been used improperly and/or for a purpose other than that for which they are intended;
- The equipment has been repaired by third parties who are unrelated to joke Technology GmbH or not expressly authorised by joke Technology GmbH.
- Components that were not authorised by joke Technology GmbH have been used on the machine, or the machine and the spare parts themselves have undergone modifications that had not been authorised by joke Technology GmbH.
- The end user has failed to adhere to the instructions contained in this user manual regarding the use and maintenance of the machine.
- There are signs that the closing panels have been opened and the warranty label has been violated.
- Defects, breakdowns and damage caused by normal wear and tear or natural events are also excluded from the warranty.
- Periodic servicing operations, calibration, scheduled and extraordinary maintenance are not covered by the warranty.

In case that the machine is sent to joke Technology GmbH for scheduled/extraordinary maintenance, joke Technology GmbH will reimburse the customer for all costs related strictly to transport costs only if the machine is under warranty.

CONTRACTUAL WARRANTY

However, joke Technology GmbH may not be held liable for any ancillary costs such as insurance coverage, etc., to the extent that joke Technology GmbH may not be held responsible for damage and/or loss of the machine during transportation.

We recommend using only the original packaging. Any 'All Risk' insurance costs shall be charged to the customer. Without prejudice to the validity of the purchaser's warranty rights described above, the purchaser's right to request the termination of the contract and/or the replacement of the machine is expressly excluded.

In the event that one of our technicians is required to intervene as a result of omissions and/or negligence on the part of the user, the respective expenses will be charged to the customer by joke Technology GmbH. If a fault is detected during the warranty period, joke Technology GmbH will eliminate it, free of charge, in full compliance with the "Warranty conditions". Recognition of the guarantee does not confer the right to claim damages of any kind.



joke Technology GmbH

Stamp and signature for acceptance of the
"warranty conditions"

Jo/ke

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SAFETY



This chapter covers topics relating to personal safety. The tests carried out on the equipment demonstrate the safety and reliability of the laser when used properly. However, the operator must be aware of the precautionary instructions designed to avoid the risk of injuring personnel or damaging the equipment itself.



ATTENTION: incorrect implementation of the safety instructions when using the welding machine described in this manual may expose the user to harmful laser radiation. Follow the procedures carefully. joke Technology GmbH disclaims all liability for any damage resulting from a failure to implement the safety instructions provided.

LASER RADIATION

Laser radiations are micrometric wavelength emissions in the far infrared (CO₂ laser), near infrared (Nd-YAG laser, Nd-YVO₄), visible (He: Ne or Argon laser), or ultraviolet (excimer laser) regions of the electromagnetic spectrum.

They are considered non-ionising radiations. In ENESKA laser 1500 mobile systems, the emission is produced by a crystal rod when stimulated by the "optical pumping" generated by a laser power lamp. The photons rebound continuously between a front mirror and a rear mirror, establishing a positive reaction that results in their number increasing instant by instant; this continues until they reach the concentration necessary to form a beam, which is projected through the semi-reflective front mirror. The reaction (which we can imagine as an "invisible light beam") is then collimated and focused using lens to form a point where the intensity is so high that it can react with different materials, causing an alteration due to the thermal effect.

This means that, while ENESKA laser 1500 mobile radiation is invisible to the human eye, it is close to the threshold of visibility, so that the eye receives it almost in its entirety, but without resulting in a pupillary light reflex. This, coupled with the fact that the beam is generally very intense, means that it can cause very serious eye damage or even permanent blindness.

To avoid permanent injuries, it is necessary to follow a series of precautions.

Anyone who may be exposed to harmful levels of laser radiation must be aware of when the laser is active and ensure they are wearing protective glasses.

Due to its high power, the laser installed on the machine causes laser light to be reflected from flat surfaces. Reflected light is potentially dangerous to the eyes and skin. The micrometric wavelength emission is located in the far infrared region of the electromagnetic spectrum and is, therefore, invisible to the human eye, this means that it is not evident where the laser beam is directed.

ABSORPTION OF LASER RADIATION

Human tissue absorbs the electromagnetic radiation differently depending on the wavelength of the radiation itself. Both the eye and the skin have their own "predisposition" to absorbing certain wavelengths, while being more refractory to others. In the case of the eye, the cornea and the crystalline lens allow all wavelengths between 400 to 1400 nm (corresponding to the region between visible light and IRA Infrared radiation) to reach the retina, albeit with differing degrees of attenuation. Therefore, it is immediately apparent that, since Nd: YAG laser radiation (wavelength 1064 nm) falls within this range, **the retina will be exposed directly to it**. With regard to the skin, the "biological window" differs in terms of absorption percentages but not in terms of wavelengths. Naturally, the maximum permissible exposure values for the skin differ considerably compared to the eye.

The damage mechanism caused by absorbed radiation also depends on the wavelength. Short wavelengths (ultraviolet UV-C 180-280nm, UV-B 180-280nm, UV-A 315-400nm) generally cause photochemical effects:

cataract or opacification of the lens in the case of the eye, and melanic colouring or reddening in the case of the skin. Longer wavelengths (infrared: IR-a 780-1400nm IR-c 3000-10 E6nm) generally cause thermal effects: detachment and photo-coagulation of the retina in the case of the eye, and burns in the case of the skin. Naturally, the degree of damage caused depends on the **amount of radiation absorbed** and on the **instantaneous power** of the radiation source.

WARNING: direct exposure to a laser beam can cause irreversible damage to the eyesight.

WARNING: it is essential to protect yourself against beams of reflected light, because they can be intense enough to cause permanent damage to the eyes or skin.

ATTENTION: This device is equipped with a Class IV laser. Class IV includes all lasers that can produce risks, not only in the case of the direct or reflected radiation, but also the diffused radiation. Such laser sources may constitute significant risks for the skin, as well as the risk of igniting inflammable materials.

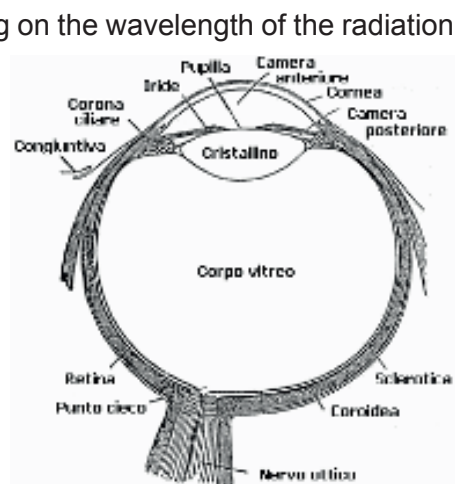


Figure 1 - Eyeball

CLASSIFICATION AND HAZARDS

The applicable regulations have established various classes of laser hazard based on their ability to cause injury in human beings, ranging from class I lasers (intrinsically safe in all conditions) to class IV lasers (dangerous under a variety of conditions).

Class III includes lasers bearing the "WARNING" label. Such lasers generally do not result in damage to the eye in the event of momentary exposure (thanks to the eyelid self-defence reflex when exposed to intense visible light), but which may be extremely hazardous if observed through microscopes or magnifying glasses. Other lasers included in the same class, but bearing the "HAZARD" label may exceed the maximum permitted exposure level within 0.25 seconds of exposure.

Class IV includes all lasers that can produce risks, not only in the case of the direct or reflected radiation, but also the diffused radiation. Such laser sources may constitute significant risks for the skin, as well as the risk of igniting inflammable materials. For the reasons listed above, the user must implement all the measures necessary to confine the radiation so as to ensure that it is terminated at the end of its useful process. Furthermore, the operator must be aware of the risks deriving from exposure to laser radiation and be equipped with the appropriate PPE (personal protective equipment) consisting of certified glasses for protection from laser radiation.

RADIATION VISION CONDITIONS

The laser at the output of the resonator should be regarded as a highly collimated and intense monochromatic light source. Thus, it may be thought of as a very bright "point source". This means that the resulting "image" is then focused on the retina in a highly concentrated spot having a dangerously high power density! If, on the other hand, the beam becomes divergent and spreads out over a non-reflecting screen, the image will be viewed as an "extended" area, having a significantly less dangerous power density. It is, therefore, possible to distinguish between different types of radiation vision conditions in relation to the way the radiation itself is accessed and hence the differing degree of danger.

- **Direct vision of the laser beam**
This type of exposure is the most dangerous and may occur at the laser aperture, after removing the optics. This should be avoided at all costs! No protective eyewear can guarantee protection against direct exposure to the laser beam.
- **Direct vision of a specularly reflected laser beam**
This may occur when the beam is directed at a reflecting surface. Viewing a laser beam that has been reflected specularly by a flat surface is as dangerous as direct exposure to the beam.
- **Direct vision of the beam at the output of an optical fibre**
This may occur when connecting the optical fibre to the resonator. Viewing the beam is dangerous up to a significant distance. Filters and safety glasses cannot guarantee safety.
- **Direct vision of the beam downstream of the focusing optics**
This may occur if the laser beam is not "killed" by a dedicated absorber device at the limit of its working range. Viewing the beam is dangerous up to a considerable distance. Filters and goggles can guarantee safety in the event of short exposures, provided they are suitably sized and certified.
- **Vision of the diffused laser beam, downstream of the focusing optics**
This is the most common vision condition in the case of a device in the working configuration. The beam is not dangerous unless exposure occurs at a short distance from the optics, but suitable filters and goggles can guarantee safety, even in the event of lengthy exposure.

The Nominal Ocular Hazard Distance for the ENESKA laser 1500 mobile is less than 15m in the case of direct or specularly reflected radiation, and less than 0.5m in the case of diffuse radiation! Only suitable eyewear having an Optical Density (OD) in excess of 4 is capable of protecting the eyesight against accidental exposure to harmful laser radiation!

RISKS

FOR EYES AND SKIN

If subjected to intense laser radiation, even for brief periods, or to less intense radiation but for extended periods, both the cornea and the retina may be burnt and damaged irreparably. This is a very real possibility in the case of exposure to a class IV laser beam.

Direct exposure to focused laser radiation may also cause the skin to burn. Furthermore, it should be noted that the main radiation may also be accompanied by collateral radiation in the ultraviolet region, which can cause carcinomas in the event of prolonged exposure.

ATTENTION: Always use certified eye protectors (an example of a certified device is shown in Fig. 2). Remember that no type of eyewear is capable of protecting against prolonged direct exposure!



Figure 2 – Safety glasses in compliance with the regulations | Bestell-Nr. 4 910 020

GENERAL SAFETY REQUIREMENTS

In order to avoid compromising the safety level of the equipment, the user must behave appropriately and ensure that the most rigorous possible safety conditions are maintained at all times. Thus, it is necessary to develop a Standard Operating Procedure (SOP) relating to the manoeuvres that must be carried out when activating and deactivating the device. This procedure, displayed near the device, shall serve as a reference for the Operator and will be written in his own language.

It is also essential to ensure that personnel receive appropriate training designed to:

- Familiarise them with the system operating procedures
- Ensure they are aware of the biological effects of radiation on eyes and skin
- Ensure they understand the need for Personal Protective Equipment (PPE)

An additional risk is represented by the possibility of fires if the device is used to process materials other than those it is intended for. The most serious collateral risk associated with a laser device is, without doubt, the potentially lethal hazard posed by electricity.

This risk may arise when personnel fail to observe the warnings and procedures imposed by the equipment manufacturer. Unauthorised and inexperienced personnel must never attempt any kind of intervention on the electrical part.

COLLATERAL RISKS AND SAFETY SYSTEMS

Safety devices must never be removed and must be checked at regular intervals to ensure that they function correctly. If, for example, when using the laser source for its intended purpose, the material undergoes alterations and produces irritating and/or toxic fumes or vapours, it may be necessary to extract and filter the fumes produced by the process before reintroducing them into the environment.

ATTENTION: If the intended use of the source is altered, for example for material processing applications, collateral risks may arise due to the production of fumes and vapours that may be irritating or toxic if they are not extracted and filtered before being reintroduced into the environment.

NOTE: We strongly recommend that the user does not alter the intended use without having previously contacted the manufacturer.

CAUTION: When processing flammable materials, since there is a risk of fire, it is essential to follow the instructions provided by the manufacturer when commissioning the machine.

CAUTION: Do not subject materials other than those the device was designed to process to laser radiation.

An additional risk is represented by the possibility of fires if the device is used to process materials other than those it is intended for.

ATTENTION: Only qualified electrical technicians should work on the electrical parts and components. Do not remove the protective devices.

WARNING: When processing flammable materials it is essential to follow the instructions provided by the manufacturer when commissioning the machine.

This LASER welder is equipped with a large number of safety systems to prevent the LASER radiation from escaping the control of the machine in any way.

NOTE: Do not subject materials other than those the device was designed to process to laser radiation.

NOTE: When processing flammable materials, such as plastics, since there is a risk of fire, it is essential to follow the instructions provided by the manufacturer when starting the machine.

SAFETY SYSTEMS

These systems are listed below, together with a description of how they work:

1. Resonator shutter
2. Microscope shutter
3. Microscope infrared filter
4. Infrared welding filter

1. RESONATOR SHUTTER
2. MICROSCOPE SHUTTER
3. MICROSCOPE INFRARED FILTER

Description	This device consists of a panel operated by an electro-magnet and located inside the LASER resonator. The shutter interrupts the path of the LASER inside the resonator when the welding machine is in STAND-BY.
Purpose	The purpose of the resonator shutter is to prevent the generation of unwanted LASER radiation.
Operation	When the electrical power supply is switched on, but before rotating the key switch to the START position, the shutter is activated. When the operator rotates the key switch to the START position, the shutter opens the LASER path, so that the welding machine is ready for normal operation. When the key is set to the LOCK position, the machine executes the switch off procedure, the shutter is closed and a check is performed to ensure that it is closed within the specified time interval.

4. INFRARED WELDING FILTER

Description	This device consists of an LCD (liquid crystal display) filter that, when a specific voltage is applied to it, becomes completely opaque. It is positioned between the 45° mirror and the microscope focusing lens. The shutter intervenes by interrupting the operator's view through the microscope at the moment the LASER causes the workpiece to melt.
Purpose	<p>The purpose of this device is to:</p> <ul style="list-style-type: none"> • Prevent the operator from being dazzled by the flash of visible radiation light emitted by the weld pool. <p>As explained later in this manual, the microscope shutter constitutes the second of three safety devices designed to prevent LASER radiation from reaching the operator's eyes indirectly.</p>
Operation	<p>The SHUTTER OPEN position corresponds to the normal operating state of this device both when the machine is in STAND-BY (resonator shutter ON), and when it is in START (resonator shutter OFF). This means that the microscope may be used at any time. After the operator has rotated the key switch to the START position, the shutter operating logic is as follows:</p> <ul style="list-style-type: none"> • The operator presses the firing pedal; • The microprocessor detects that the pedal contact has closed and commands the shutter to close; • The microprocessor activates the LASER lamp; • The shutter remains in the ON position for a period corresponding to the LASER ignition time, plus an additional interval sufficient to allow the weld pool to cool down and, hence, lose its luminosity. • The shutter returns to its home position and the system checks that it is fully open.

Description	This filter is an optical glass that is opaque to 1.064 nm wavelength LASER radiation. To the human eye, it appears light grey in colour and perfectly transparent. It is located inside the microscope (Ref. A, Figure 3)
Purpose	The purpose of this filter is to protect the operator’s eyes in the unlikely event of LASER radiation penetrating this section of the microscope optical path.
Operation	Since the glass is opaque to LASER radiation at a wavelength of 1.064 nm, it prevents the LASER radiation generated by the welding machine from passing, in either direction.

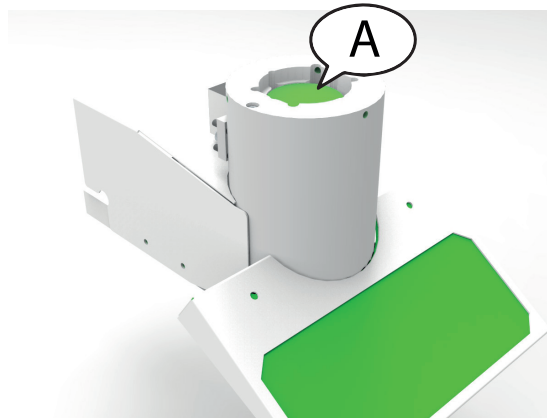


Figure 3 – Microscope infrared filter

Descrizione	This filter is an optical glass that is opaque to 1.064 nm wavelength LASER radiation (Ref. B, Figure 4). To the human eye, it appears light grey in colour and perfectly transparent. It constitutes the welding chamber inspection window and is designed to be easily replaceable.
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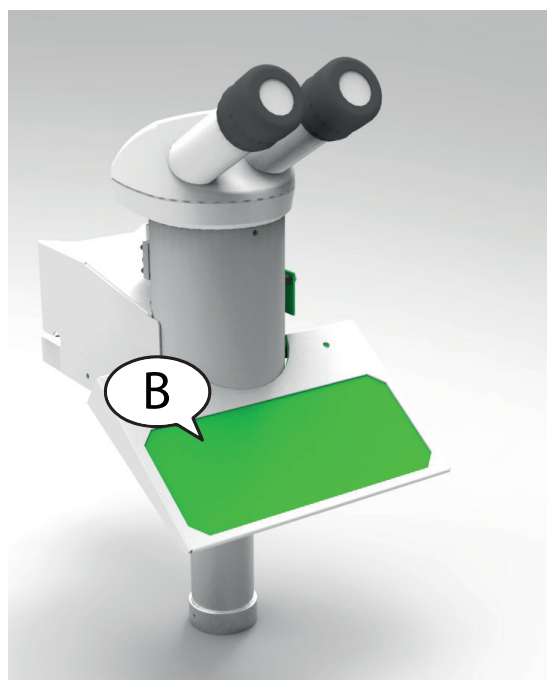


Figure 4 – Infrared welding filter

SAFETY LABELS

The welding system is fitted with seals at various points. The seals must not be broken or removed for any reason. In fact, the sealed parts may only be opened by joke Technology GmbH personnel.

Labels and plates are applied to the equipment in accordance with European safety regulations. These must not be removed or damaged. If replacements are required, contact joke Technology GmbH.

WARNING LABELS

NOTE: If the seals affixed to the laser system by the manufacturer are removed or damaged in any way, the warranty covering the entire welding system shall be considered null and void.

ATTENTION: The manufacturer declines all responsibility for improper use of its products. The device must not be started up unless the machine it is to be installed on has been declared to comply with the current directives.

ATTENTION: Access to the internal parts of the electrical equipment is restricted to authorised, qualified personnel who are aware of the electrical risks!

joke Technology GmbH disclaims all liability in the event that any work is carried out on live electrical parts by unqualified and/or untrained personnel!

ATTENTION: Access to the internal parts of the laser resonator is restricted to authorised, qualified personnel who are aware of the optical risks! joke Technology GmbH disclaims all liability for any work carried out by unqualified and/or untrained personnel!



Figure 5 – Laser Warning

This label indicates that the machine is equipped with a laser device, without specifying the respective class. It is 22 x 55 mm in size and positioned near the resonator slide where the laser beam originates. When this label is present it is mandatory to use the appropriate protective eyewear for the type of laser present on the machine. In the case of ENESKA, use glasses that meet the requirements set out on page 12 when operating the machine.



Figure 6 – Radiation information

This label indicates that the machine is equipped with a laser device, without specifying the respective class. It is 104 x 52 mm / 52 x 26 mm in size and positioned on the rear of the machine. When this label is present, it is mandatory to use the appropriate protective glasses, as recommended on page 12, when operating the machine.



Figure 7 – Laser class information

This label indicates that the machine is equipped with a laser device, as well as specifying the respective class. It is 104 x 52 mm / 52 x 26 mm in size and positioned on the front of the machine below the handle. When this label is present, it is mandatory to use the appropriate protective glasses, as recommended on page 12, when operating the machine.



Figure 8 – Laser aperture information

This label indicates the area where the laser exits the machine. It is 104 x 26 mm in size and positioned on the focal extension. When this label is present, it is mandatory to use the appropriate protective glasses, as recommended on page 12, when operating the machine.

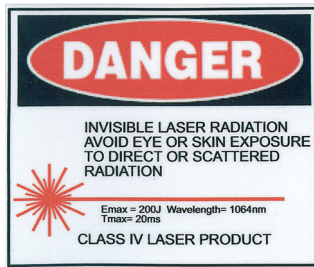


Figure 9 – Laser exposure information

This label indicates that the machine is equipped with a laser device, specifying the respective class and the power rating of the machine in use. It is 56 x 40 mm in size and positioned on the rear of the machine above the sticker shown in figure 6. When this label is present, it is mandatory to use the appropriate protective glasses, as recommended on page 12, when operating the machine.



Figure 10 – Laser technical data

This label indicates the class of the laser device and the power rating of the machine. It is 104 x 25 mm in size and positioned on the front of the machine under the sticker in figure 7.

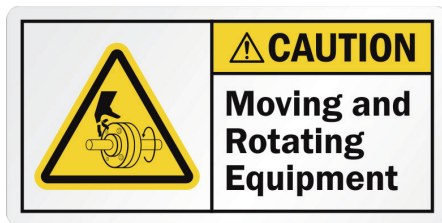


Figure 11 – Components in motion

This label indicates the presence of moving mechanical components, warning personnel not to place their hands between the parts when in motion. It is 60 x 30 mm in size and positioned on the upright of the Y axis, at the extreme right hand end.



Figure 12 – Radio frequency hazard

This label indicates the presence of radio frequency emissions that could interfere with pacemakers or other medical devices. It is mandatory to maintain a safe distance to avoid interference. It is 41 x 30 mm in size and positioned on the upright of the Y axis, at the extreme right hand end, close to the sticker in figure 11.




Hersteller: JOKE Technology GmbH Asselborner Weg 14-16 D-51429 Bergisch Gladbach GERMANY				
Modell: ENESKA 1500				
Spannung:	230V -10+5%	Frequenz:	50/60 Hz	To prevent electrical shocks, do not remove covers. For any service refer only to qualified staff. Zur vermeiden von Stromschlagen, entfernen Sie bitte nicht die Abdeckungen. Reparaturen bitte nur durch qualifiziertes Personal durchführen lassen.
N°. Phasen:	1	Gewicht:	250kg	
Stromverbrauch:	2.3 KW	LASER CLASS IV		
Max Energie:	200J			
Wellenlänge:	1064 nm			

Figure 13 – Machine identification label

This label includes the data relating to the manufacturer (Fig. 13 - Ref A), the electrical specifications (Fig. 13 - Ref B) the generator power (Fig. 13 - Ref C) and the risk class of the laser machine (Fig 13 - Ref D).

FOR YOUR SAFETY

Before using the laser welding machine, carefully read the warnings in this section. Ensure that all warnings and instructions displayed on the machine are observed. The following warnings are provided to ensure the safe use of our products and to prevent damage or injury to operators or other persons. Make sure that you have taken all the precautions indicated in the manual, all precautions are important for personal and work safety.

THE LASER WELDING MACHINE IS POTENTIALLY HAZARDOUS

Take all the necessary steps to protect yourself and others from the risk of serious injury or death. Always wear protective eyewear. Keep children away from the machine. Personnel with pacemakers should remain at a safe distance from the machine, unless they have specific medical permission. When using lasers, operators may be exposed to certain risks. Welding is safe if the necessary precautions are taken. Risks related to welding are limited to handling manufactured products. The process itself is extremely safe. In any case, it is important to ensure that the machine is operated by authorised personnel only. All installation, maintenance and repair work on the machine must be assigned to joke Technology GmbH personnel or its authorised technicians.

ELECTRICAL SHOCKS CAN KILL

Contact with live electrical parts can have fatal consequences or cause severe burns. Incorrect installation or earthing of the machine can be dangerous.

- Do not touch live electrical parts. Remove the power cable from the power outlet before installing the machine or carrying out maintenance work on it.
- Install and earth the machine in accordance with the user manual and in full compliance with local regulations and standards.
- Switch the machine off after use.
- Do not use cables that are weak or damaged, have insufficient cross section or are poorly connected.
- Make sure that the cables are routed away from heat sources.
- Use the device only if it is in perfect condition. Make sure that any damaged parts are repaired or replaced immediately.
- Make sure that all the cover panels remain fixed and in place.

IN THE EVENT OF A MALFUNCTION, SWITCH THE MACHINE OFF IMMEDIATELY

If the device generates smoke or unusual odours, unplug the power cable immediately, taking care to avoid burns or other injuries. Continued use of the laser welder in such conditions may result in serious injury and/or damage. The device should only be examined by joke Technology GmbH personnel or its authorised technicians.

DO NOT ATTEMPT TO DISMANTLE THE EQUIPMENT

The internal components of the device can cause injury. In the event of malfunction, the product must be repaired by qualified joke Technology GmbH personnel only.

DO NOT USE IN THE PRESENCE OF FLAMMABLE GASES

To avoid the risk of explosions or fires, do not use the equipment in environments saturated with flammable gases with minimal ventilation. Always keep a fire extinguisher nearby.

FUMES AND GAS MAY POSE HEALTH HAZARDS

The welding processes produce fumes and gases. Inhaling these may be dangerous to human health.

- Keep your head away from fumes. Do not inhale the fumes.
- Do not cover any part of the machine.
- Carefully read the instructions regarding the various types of materials that can be laser welded.
- We recommend using the laser welding system in a spacious environment specifically designed for this purpose. If the working environment is small, make sure it is well ventilated.
- Do not weld near areas where degreasing, cleaning or vapourisation operations are carried out. The heat may react with the vapours, producing highly toxic and irritating gases.
- Avoid using materials containing impurities that could produce smoke or gas during laser welding.

WELDING CAN CAUSE FIRES OR EXPLOSIONS

During the welding process the materials may emit sparks and/or overheat, causing fires and/or burns. Accidental contact between overheated parts and the gas cylinder could result in an explosion.

- Do not carry out laser welding in places where the sparks could come into contact with flammable material.
- Remove all flammable objects located near the LASER welding machine. If this is not possible, cover them correctly with a flame retardant material.
- Be aware of fire risks: always keep a fire extinguisher nearby.
- Monitor the machine attentively during operation.

LASER RADIATION CAN DAMAGE THE RETINA AND BURN THE SKIN

Always wear protective eyewear when using the machine. Uncontrolled reflections of the LASER beam can cause burns or, in the worst case, irreversible damage to the retina. Never weld on reflective objects. Keep children away when using the equipment.

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SEPARATION OF WASTE MATERIALS

This symbol indicates that this product must be disposed of in special waste containers.

The following instructions are intended exclusively for cases where the equipment is used in European countries:

- This product must be disposed of in special waste containers. Do not dispose of with household waste.
- For further information, please contact the local authorities responsible for waste disposal.

INTRODUCTION



B

This manual has been designed to offer you the best possible introduction to your experience with the ENESKAlaser 1500 mobile laser welding machine. It is essential that you read this manual in order to ensure that you develop your skills with the ENESKAlaser 1500 mobile laser.

In the initial chapters we will explain the basics of the ENESKAlaser 1500 mobile laser, how to install the product and how to set it up correctly by starting, thus ensuring a perfect introduction to your welding experience.

joke Technology GmbH is pleased to welcome you to the world of ENESKAlaser 1500 laser mobile.

Enjoy.

ATTENTION: incorrect implementation of the practical usage and/or procedures described in this manual may expose the user to harmful laser radiation. Follow the procedures carefully.

NOTE: the system may not be used for any purpose other than that which it has been designed and built for. joke Technology GmbH disclaims all liability for improper use of its products.

PRECAUTIONS FOR USE

LASER SAFETY OFFICER (LSO)

- The employer shall be responsible for appointing a laser safety officer, who must be qualified to carry out operations using LASER equipment and in LASER safety, in order to assess the potential risks associated with using the machine.
- The LASER safety officer (LSO) must:
 - Possess the necessary knowledge to carry out the task assigned to him/her. No regulations exist specifying how such knowledge should be acquired.
 - Assume responsibility for the equipment activation key.
 - Provide operators with adequate training concerning safety aspects and work process management.
 - Establish a controlled LASER zone (CLZ) where the equipment may be operated safely (see corresponding chapter).
 - Isolate the area where the equipment is operated, using panels and posters that prohibit access by unauthorised personnel.

BEFORE EVERY USE

In order to ensure the equipment is used correctly, it is necessary to observe the following instructions:

- Do not insert foreign objects into the grooves/holes in the device.
- Take great care not to spill liquids on the equipment.
- Always switch the device off using the main switch.
- Perform maintenance work as described in the relevant chapter at regular intervals.
- If the focus lens is dirty, wipe it with a dry or slightly damp cloth. If it is very dirty, use a neutral detergent, such as alcohol. Never use thinners, benzene, etc., as they may discolour or alter plastic components. If the lens is damaged, contact technical assistance.
- Use the buttons and the touch screen display with care, using only your fingers. Press the buttons one at a time; if several buttons are pressed simultaneously, the device may not respond and may even result in it being damaged.

TRANSPORT PRECAUTIONS

When transporting the laser welding machine, observe the following precautions to avoid potential risks.

- Place the laser welder in its packaging before transporting it.
- Ensure operators wear personal protective equipment including helmet, safety shoes and gloves. (Leather gloves are recommended).
- When transporting the equipment, use a forklift, a crane, a belt, etc. having a load bearing capacity of at least 500 kg.
- Remove all accessories when transporting the equipment.
- Avoid impacts and ensure the equipment is not dropped when transporting it as this may damage the electrical parts and internal optical components.

INTENDED USE OF THE WELDING MACHINE

The range of laser welding machines is intended for use by qualified personnel for welding metal, plastic products, etc. The main areas of use are: jewellery (welding precious metals), dentistry (welding and repairing medical devices), industrial (modifying moulds), automotive, arts and crafts.

- Do not attempt to weld objects that may contain materials not listed as recommended
- Use only joke Technology GmbH parts and consumables.
- If you require assistance, contact thejoke Technology GmbH customer service department.
- Once consumable parts are used up they must be replaced.
- Observe all the instructions and safety regulations set out in this manual.

WHAT NOT TO DO

- Do not modify the equipment.
- Do not attempt to weld objects that contain any of the following materials: beryllium, uranium, plutonium, cadmium, magnesium, sodium, potassium mercury, lead, arsenic...
- Do not position combustible materials along the path of the laser beam.
- Do not use materials that emit toxic or explosive gases.
- Do not stare at the laser beam without safety glasses.
- Do not allow any clothing to remain in the trajectory of the LASER.
- Do not introduce living or dead organisms (such as animals) into the path of the laser beam.
- Do not use the welding laser to heat food.
- Do not use the laser welding machine to dry clothes and materials in general.

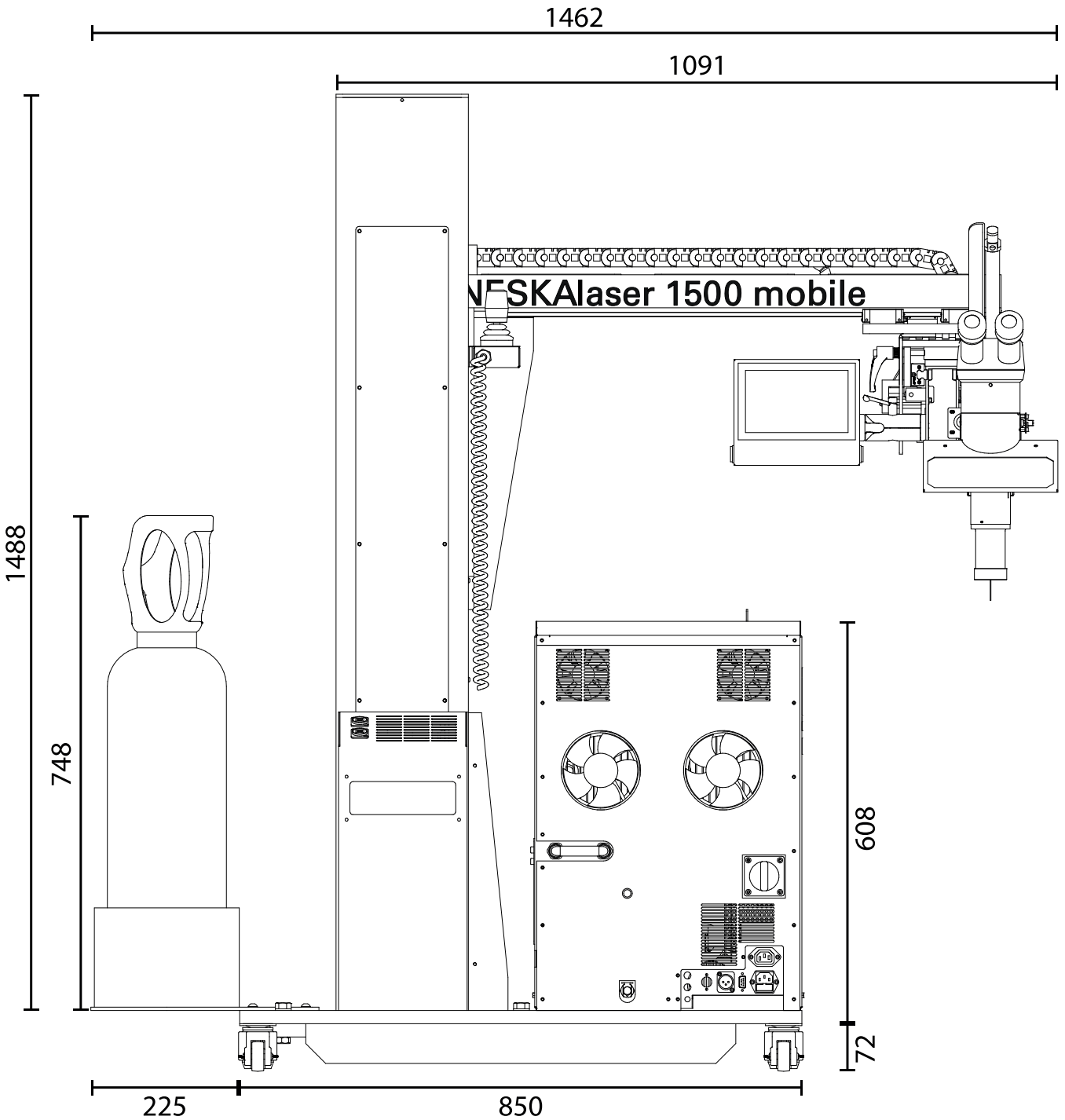
TECHNICAL SPECIFICATIONS

SPECIFICATIONS	DESCRIPTION
Power supply VAC	230
Power supply system <i>N. of phases</i>	1
Frequency Hz	50-60
Mean power consumption KW	2,3
LASER crystal <i>tipo</i>	Nd: YAG
Wavelength nm	1.064
Pulse energy joule	0,5-200
Pulse duration msec	0,5-20
Repetition frequency Hz	0,5-30
Mean power W	140
Max. peak power KW	10
Duty Cycle	80%
LASER spot dimensions mm	0,2-2,0
Max. pressure of Argon shielding gas under operating conditions bar	1,5
Cooling system	Liquido
Power plug fuse rating	16AT
Weight kg	250
Dimensions cm	1460 X 1500 X 800
Max. air cylinder pressure	5-6

SPECIFICATIONS	DESCRIPTION
Ambient operating temperature °C	17-35
Max. operating humidity %	65
Noise level dB (A)	<70
GUARANTEED AND CERTIFIED PURITY OF Argon shielding gas %	99.8
Shielding gas consumption l/min	2-4 con 1,5 bar

HOW IT WORKS

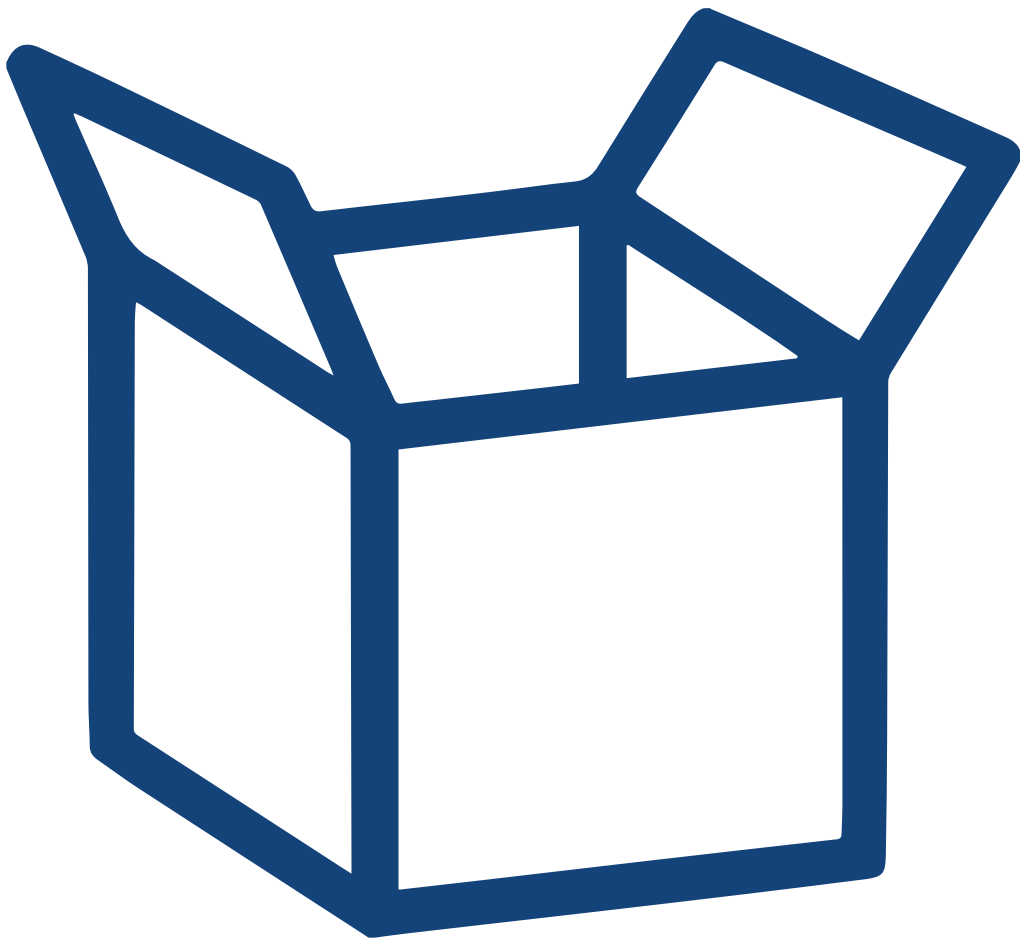
The ENESKAlaser 1500 mobile is a triple-axis laser welding machine that can be positioned as required around significantly sized objects in order to achieve maximum welding precision. The camera installed on the laser binocular allows the operator to monitor the entire welding process precisely and clearly and in real time.



INSTALLATION



Installing ENESKAlaser 1500 mobile is easy, however it is necessary to observe a series of basic rules. Unpack the machine taking the same care as we did when packing it and get ready for it to be installed.



WARNING: when you open the crate and start to unpack the machine, be careful not to damage it, joke Technology GmbH disclaims all liability for damage caused by carelessness and lack of attention when unpacking the machine.

WHAT'S IN THE BOX?

The box also contains the following accessories, which have been packed separately and must be mounted on the machine:



ENESKAlaser 1500 mobile
WELDING MACHINE



RUBBER TUBE WITH FITTING AND FUNNEL



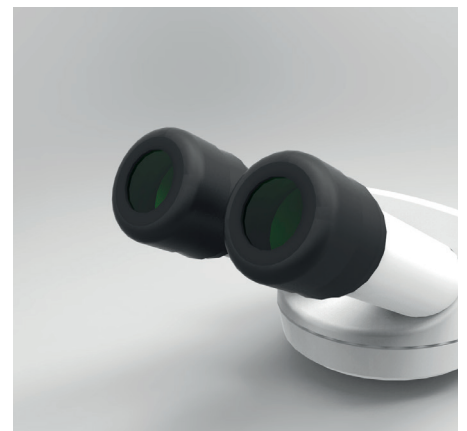
JERRYCAN WITH COOLANT LIQUID



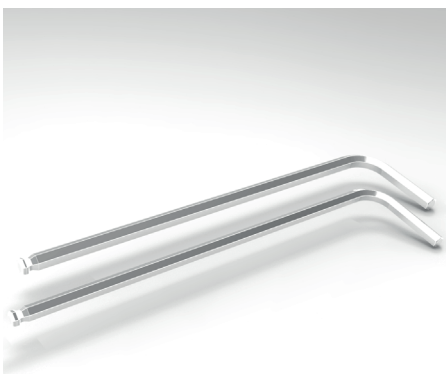
JOYSTICK WITH CABLE



PEDAL WITH CABLE



EYE PIECES (only the black parts shown in
the image)



2.5mm and 3mm ALLEN KEYS

UNPACKING THE MACHINE

Once you have opened the box, start assembling the accessories and begin the initial installation procedure; the machine must be positioned on a flat surface so that it can be moved on its wheels.

After removing the wooden packaging panels, remove the wooden retaining blocks using a crosstip screwdriver (figure 14). Remove the straps (plastic ropes with metal clamps) that secure the machine to the platform.

In order to remove the machine from the crate and place it on the floor, use lifting straps having suitable load bearing capacity (the machine weighs about 250kg) and a forklift with the forks capable of supporting it.

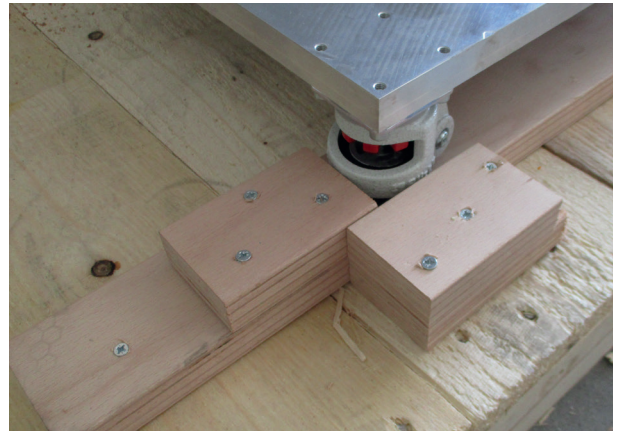


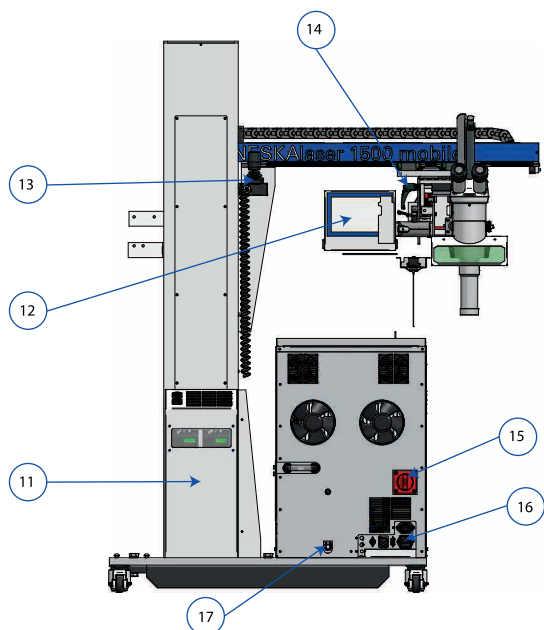
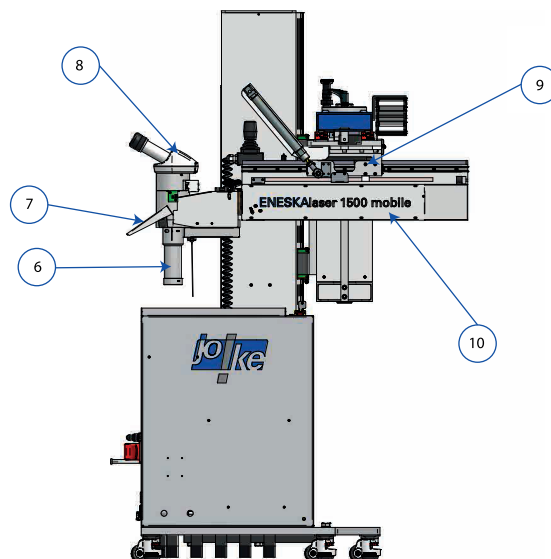
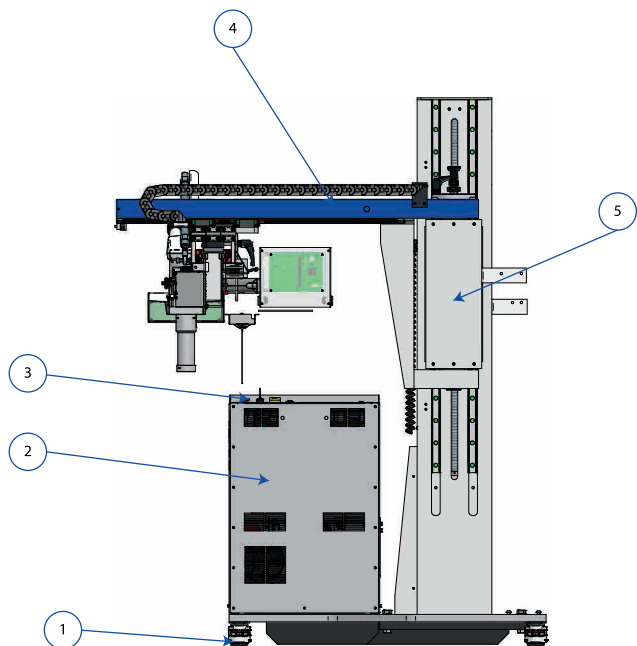
Figure 14 – Wheel locking blocks

Pass the straps under the machine and tie them to the lifting forks that do not interfere with the machine (figure 15). Lift slowly, making sure the machine does not rotate in any direction. Once it has been raised by a few centimetres, slide the platform from under the machine. Lower the forks, always taking care to prevent the machine from rotating in any direction, until the machine is resting on the ground. Free the machine from the rest of its packaging.



Figure 15 – Slings system for lifting the machine

ENESKAlaser 1500 mobile – Main Components



1. Lockable rotating castors
2. Case
3. Emergency stop push-button and ignition key
4. Y Axis
5. Z Axis
6. Focal extension (laser exit point)
7. Infrared welding filter
8. Binocular
9. X Axis
10. Resonator
11. Driver safety guard
12. Touch screen display
13. Joystick
14. X axis alignment knob
15. Main switch
16. Machine power connection
17. Cooling liquid filler

INSTALLING ACCESSORIES

Before starting to install the accessories, make sure that the machine is located in a closed environment with a suitable ventilation system and is isolated from other environments.

First of all, it is necessary to install a magnetic sensor on the entrance door to the environment where the welding machine is installed and connect it to the circular interlock socket located on the rear of the machine (figure 16). This device is used to switch the machine off if the door is opened, thus preventing the laser from injuring anyone who might enter the environment while it is being operated.

After connecting the interlock sensor, mount the eyepieces shown in their protective containers in figure 17. Open the containers, taking care to protect the eyepieces from contact with dust as far as possible and place them on the binocular, after removing the protections (Figure 18), inserting them until they reach the stop (Figure 19). Tighten the fixing screw after centring each eyepiece as shown in figure 19.

The right eyepiece is distinguished from the left by a cross that you can only see by looking inside the eyepiece itself. To complete the installation of the eyepieces, turn the eyecup counter-clockwise, as shown in figure 19, and pull it towards you until it reaches the stop. Once in the stop position, turn the eyecup clockwise until it locks into place. Repeat the operation for both eyepieces.

Connect the pedal to the DB9 socket next to the interlock socket (figure 16) and place the pedal in a position where it may be accessed easily by the operator, making sure that the pedal cable is not pinched or trapped in any way.



Figure 18 – Binocular

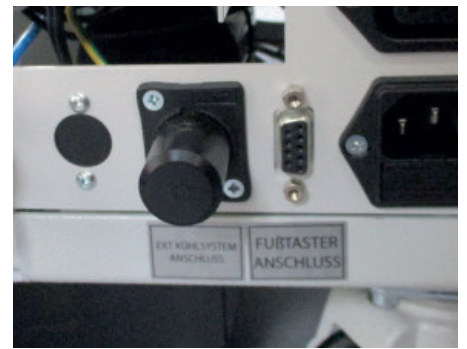


Figure 16 – Interlock socket and pedal



Figure 17 – Eyepieces in protective containers

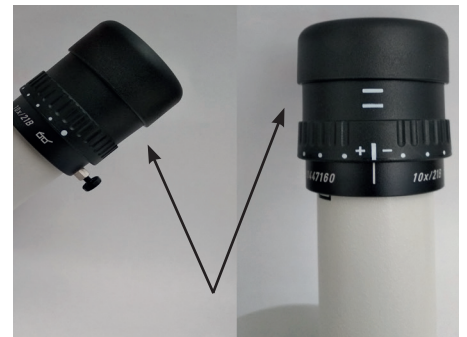


Figure 19 – Eyepiece inserted and centred

Take the joystick and hang it from the dedicated bracket on the machine supporting column, as shown in figure 20. Connect the DB15 connector to the connector panel located on the side of the case in front of the driver safety guard. The joystick connector is marked with a label bearing the word "JOYSTICK" (figure 21). Take the cylinder support and install it as shown in figure 22, using the screws that you will find screwed to the base of the machine.



Figure 20 – Joystick support

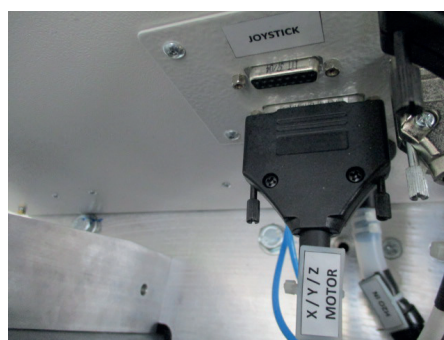


Figure 21 – Joystick support

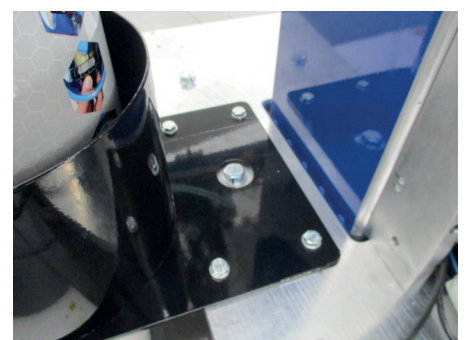


Figure 22 – Cylinder support

FILLING THE COOLING LIQUID

- Insert the plastic connection supplied with the machine (figure 23) into the female connector at the bottom left of the rear machine panel.
- Remove the red cap at the top.
- Fill the tank using the funnel provided.
- The limit is reached when the water begins to escape from the upper connector of the tank. The coolant supplied separately with the machine in the jerrycan corresponds, more or less, to the correct quantity.
- Close the top connector using the red cap and remove the plastic connector.



Figure 23 – Filling the cooling system

POSITIONS OF CONTROLS

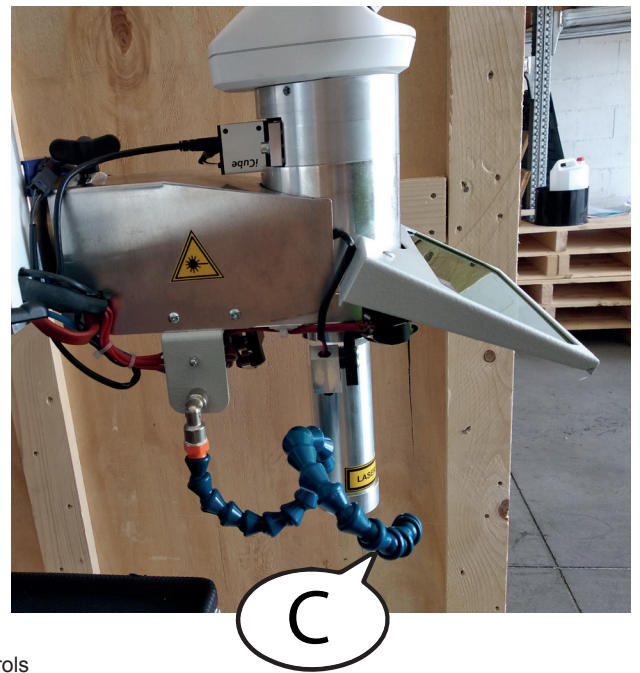
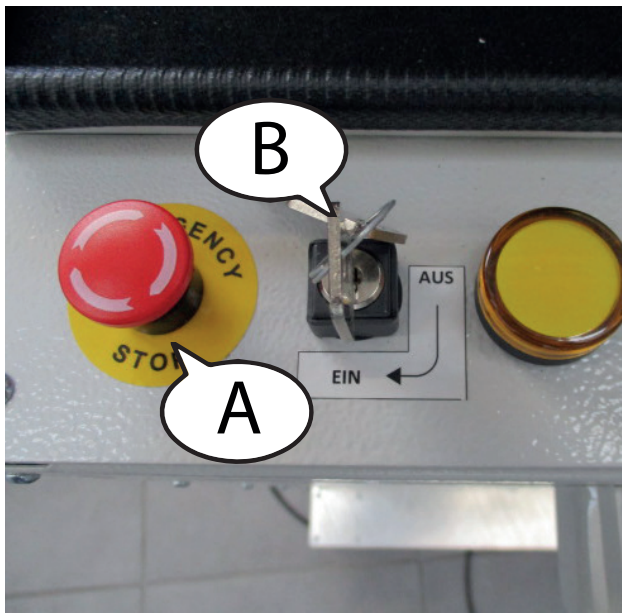


Figure 24 – Controls

Reference	Description
A	Emergency stop mushroom push-button
B	Ignition key
C	Mobile shielding gas diffuser

JOYSTICK

- Moving the joystick to the LEFT or RIGHT will cause the arm to move along the X AXIS;
- Moving the joystick FORWARD or BACK will cause the arm to move along the Y AXIS;
- Rotating the joystick CLOCKWISE or COUNTER-CLOCKWISE will cause the arm to move along the Z AXIS;



Figure 25 – Joystick controls

- By pressing the buttons on the joystick it is possible to use 3 different configurations, which may be selected via the touch screen display by pressing the icon, at the bottom left of the display highlighted in figure 26:
 1. Maintain button P1 and P2 pressed to change the spindle rotation direction from CLOCKWISE to COUNTER-CLOCKWISE, or vice versa, when it is present and connected.
 2. Maintain button P1 and P2 pressed while the axes are moving to change the travel speed from MINIMUM to MAXIMUM or vice versa;
 3. Press BUTTONS P1 and P2 simultaneously to activate laser beam emission;

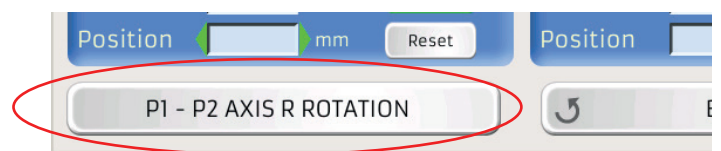


Figure 26 – Joystick button options

TOUCH SCREEN DISPLAY CONTROLS

The touch screen display mounted on the machine may be used to access the various machine functions and set-up the corresponding parameters depending on the type of welding operation.

The home screen includes the MENU BAR (highlighted in RED in figure 27), the INFO MENU, identified by a button bearing the letter "i" (highlighted in GREEN in figure 27), the MEMORY MENU, identified by a button bearing the letter "N" (highlighted in BLUE in figure 27) and the MOTOR CONTROL MENU button, identified by an icon representing two interconnected gears (highlighted in ORANGE in figure 27).

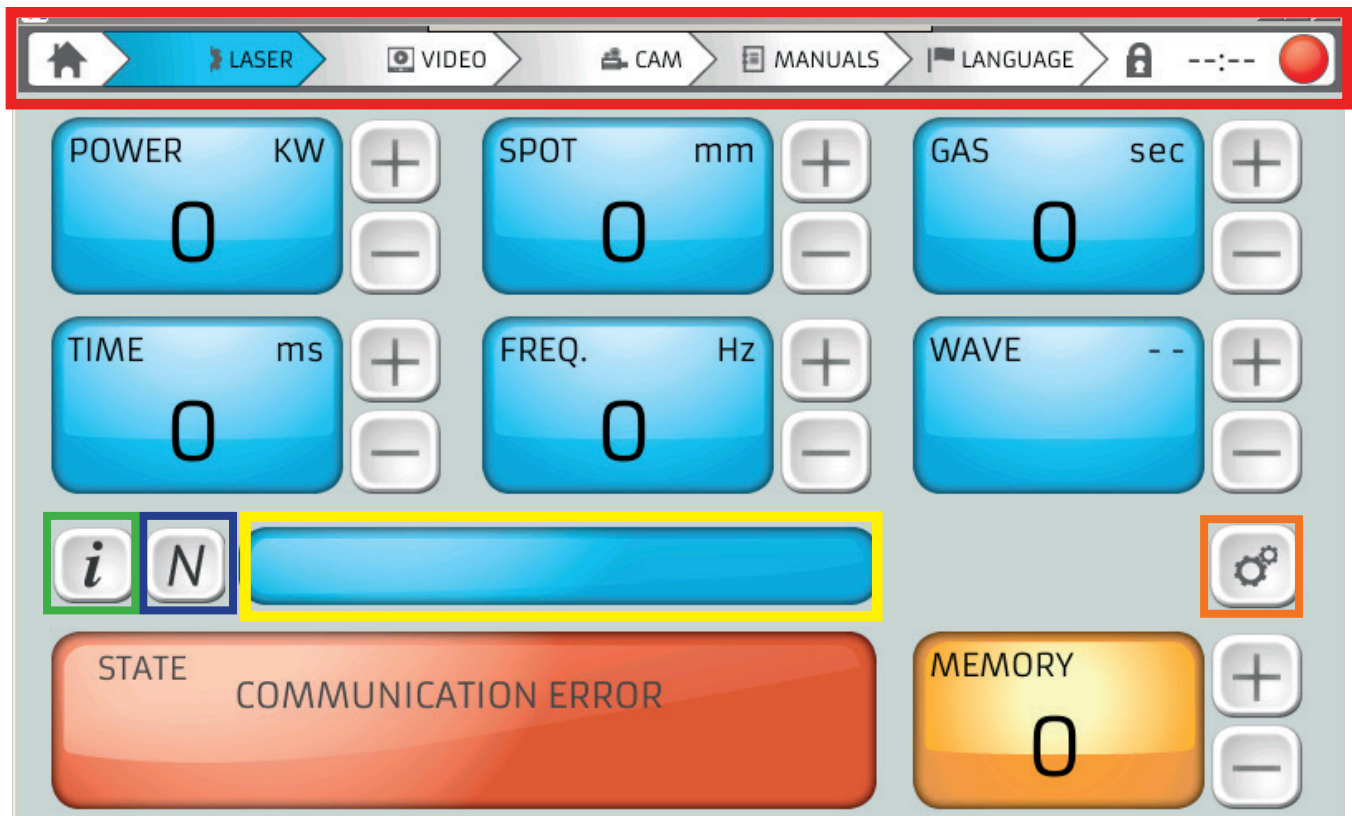


Figure 27 – Home screen controls

The home screen also contains a series of boxes with a light blue background, the orange memory box and the main box where the machine status, all operations that must be performed and any machine errors are displayed. Each box displays the assigned parameter, which is indicated in the top left corner, while the corresponding unit of measurement is displayed in the top right corner. To the right of each box are two additional buttons: "+" and "-", which may be used to modify the value of the associated parameter.

HOME SCREEN

The following is a description of each box that appears in the HOME screen:

- **POWER** – displays the pulse power in kW (kilowatt); this value may be adjusted between 0.1 kW and 15 kW by using the "+" and "-" buttons to the right of the box.
- **TIME** – displays the welding pulse duration in ms (milliseconds). This value can be set between 0.1 ms up to a value that depends on the machine Joules and scaled as a frequency.
- **SPOT** – indicates the diameter of the focused laser beam spot projected onto the part to be welded in mm (mm). This value may be set from 0.2 mm to 2 mm.
- **FREQ.** – indicates the laser pulse frequency when firing. This frequency can be set from 0.5 Hz (hertz) to a maximum of 40 Hz. It is also possible to deactivate the continuous firing function by scrolling to the position preceding the value 0.5 Hz using the "-" key. The frequency value setting is linked to the power parameter setting (Kw), which means that the value will be regulated automatically in order to guarantee correct welding.
- **GAS** – indicates if the supply of inert gas used to shield the welds is selected, as well as a countdown of the remaining delivery time since the last laser firing. It is possible to increase or decrease the delivery time since the last laser firing. If this value is set to 0 it means that the operator has selected the welding mode without shielding gas.

- **WAVE** – graphically displays the LASER pulse waveform in use. You can choose from 5 different waveforms using the buttons positioned next to this box. The default setting is the "normal" or square-shaped waveform.
- **STATE** – this is the large red box where all the interface messages between the machine and the operator are displayed, together with any error messages.
- **MEMORY** – the number corresponding to the currently selected memory and the name that has been assigned to it are displayed in this box, which is highlighted in YELLOW in figure 27.

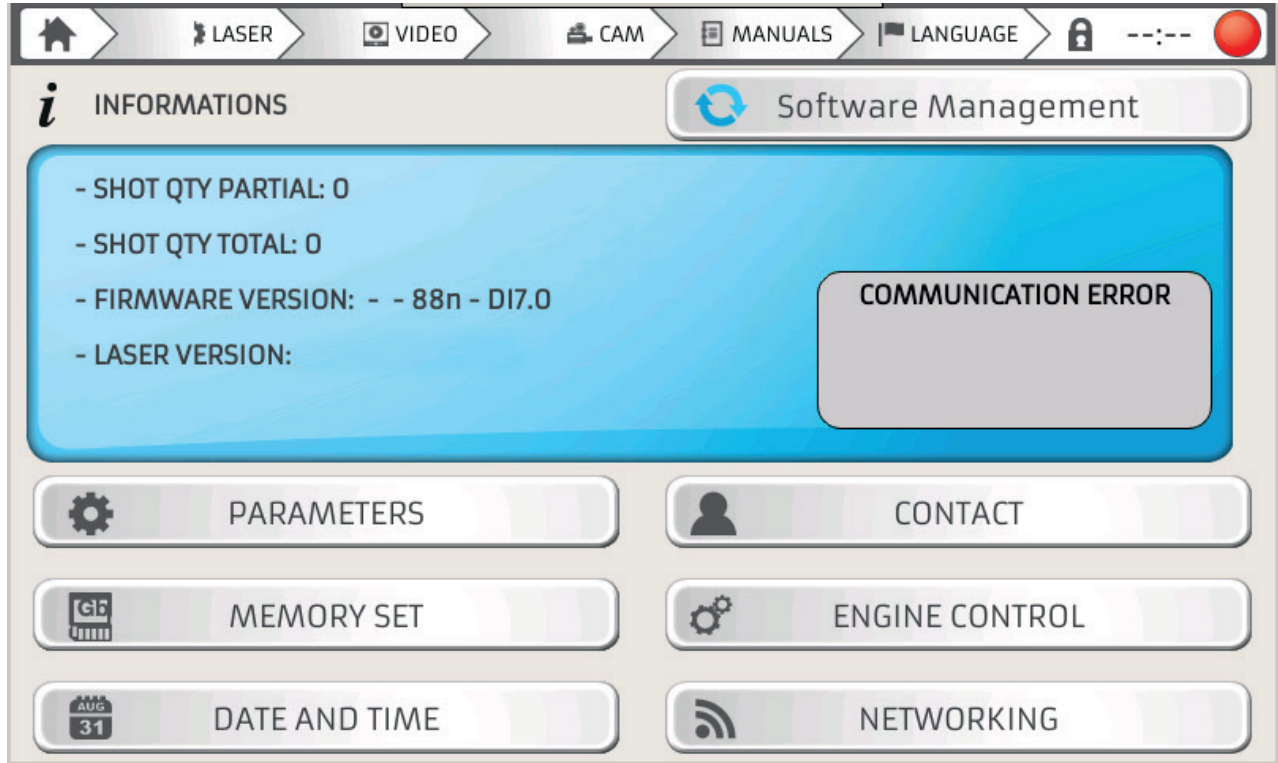


Figure 28 – Information menu screen

INFO SCREEN

Press the INFO button to access the information menu, which contains 6 setting options (Figure 28).

- **PARAMETER** – which may be used to set-up different parameters and view data relating to the machine status, as shown in figure 29. It is possible to select machine stand-by mode, switch the pointers on or off and access the alarm history and the data logger using the two buttons at the bottom left of the screen.

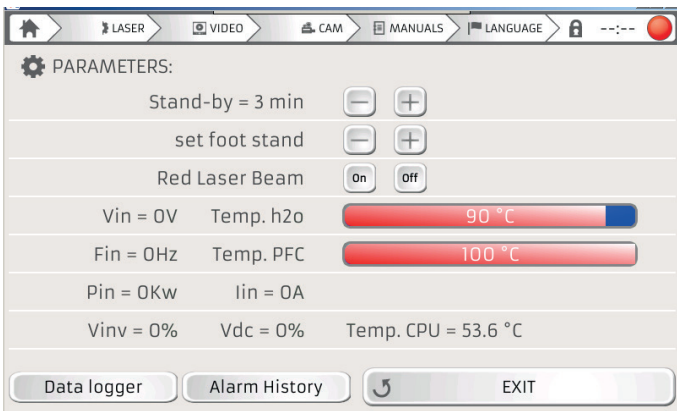


Figure 29 – Parameters screen



Figure 30 – Contact screen

- **CONTACT** – press this button to access the contact screen, as shown in figure 30, where it is possible to view the manufacturer's data.
- **MEMORY SETTING** – you can save up to 99 combinations of parameters and use this screen to select one of the saved ones (figure 31).
- **MOTOR CONTROL** – press this button to access the machine axes control screen. In this window it is possible to decide whether to lock or unlock each axis, set the respective displacement speed, expressed in mm/s (millimetres per second), or return it to the 0 position by pressing the RESET key. Each axis is set separately from the others. The R axis is active only when the spindle is connected (Figure 32).
- **DATE AND TIME** – access this window to set the date and time (figure 33).
- **NETWORKING** – access this window to select either INTERNET or WIRELESS connection mode. To select the internet connection (optional function) simply check the "Enable DHCP" option and the connection parameters will be set automatically. In the case of wireless connection it is necessary to fill in some data fields in order to establish a successful connection. First of all, enter the name of the router you wish to connect to in the "essID" field. When entering data, please respect upper and lower case letters, spaces and special characters. If the entered name does not match the name of the router perfectly, the connection will not be established. Next, enter the password necessary to access the router in the "Password" field. Again, it is essential to respect uppercase, lowercase, spaces and special characters. Once all data has been entered, click on the "SAVE" button to establish the connection.
- **SOFTWARE MANAGEMENT** – this screen contains 3 buttons. The first, VNC SERVER, allows you to control the machine remotely via a PC or a SMARTPHONE. UPDATE DER SOFTWARE and EXT. KONFIGURATION buttons may be used to update the display firmware. The technical assistance service will indicate which of the two commands to select, based on the update to be carried out.

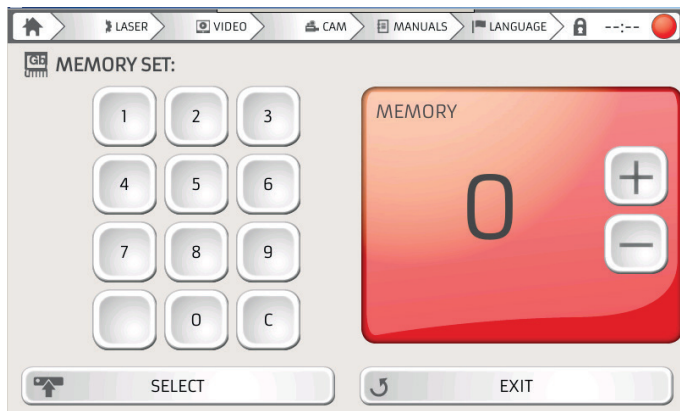


Figure 31 – Memory screen



Figure 33 – Date and time screen

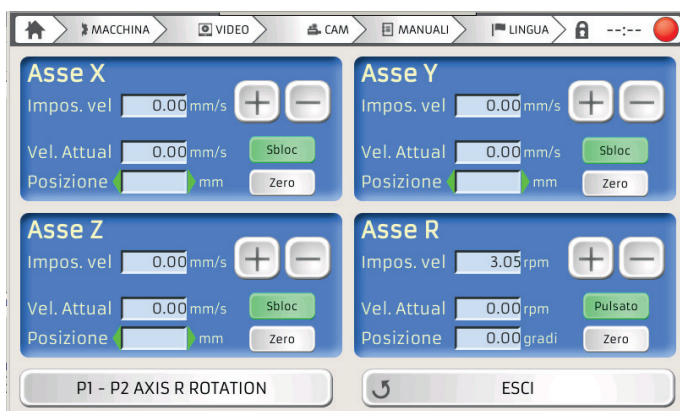


Figure 32 – Axes control screen

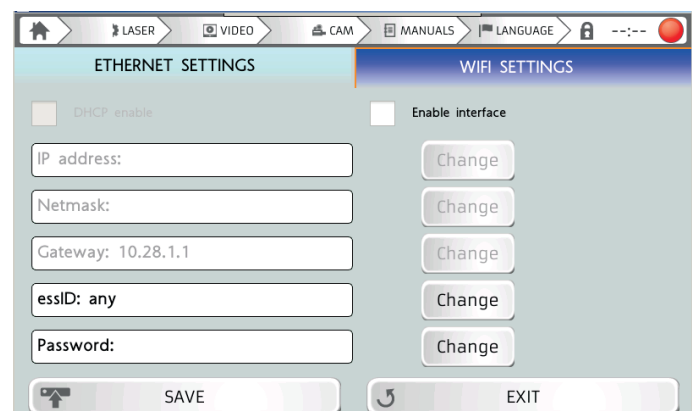


Figure 34 – Connection screen

KEYBOARD/MEMORY SCREEN

Press the "N" button in the HOME screen to access the screen illustrated in figure 35. This function may be used to save the current machine parameter settings. Use the text box at the top left to assign the configuration a name and the red box for the configuration number. This number will appear on the HOME screen in the "MEMORY" box.

If you want to include symbols, numbers or special characters in the name of the configuration so be saved, press the key highlighted in red in figure 35 and the symbols and numbers will appear on the keyboard as shown in figure 36. After you have entered the configuration name and chosen the position assigned to it in the memory, press the green button with the word "SAVE" in the bottom left of the screen.



Figure 35 – Keyboard screen

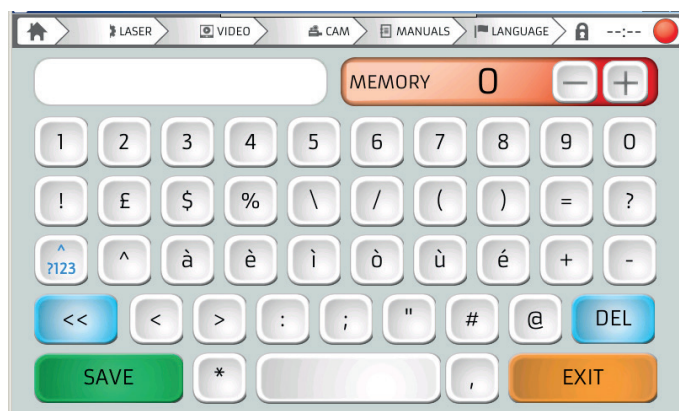


Figure 36 – Symbols keyboard screen

MOTOR CONTROL SCREEN

Press the key representing the two gears (highlighted in ORANGE in figure 27) to enter the motor control screen. You may also access this screen via the information menu, as explained on page 28 (figure 32).

MENU BAR

The menu bar contains the following buttons, reading from left to right: the HOME button indicated by a house icon, the LASER, VIDEO, CAM, MANUALS, LANGUAGE and TIME buttons and a dot that indicates the status of the machine. (Figure 37).

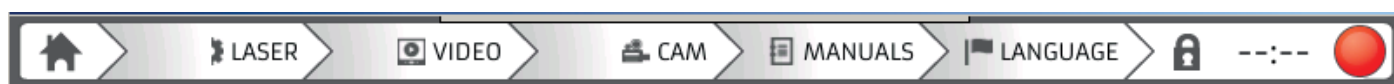


Figure 37 – Menu bar

VIDEO SCREEN

Press "VIDEO" on the menu bar to access the video player screen where it is possible to play videos preloaded on the machine or externally loaded via USB. This screen is equipped with all the standard video player commands, i.e. Play, Stop, Next Track, Previous Track, Playback Speed, Full Screen (Figure 38).



Figure 38 – Video screen

CAM SCREEN

In the CAM screen it is possible to monitor the point where the machine is centred for welding in real time via the webcam installed on the machine. A red cross is displayed at the centre of the screen (figure 39) representing the laser contact point, behind which appear the images transmitted by the webcam installed on the machine. It is important to focus the laser at the welding point, otherwise it may impact on the quality of the weld.

The screen also includes two side panels containing the welding and video controls. IT IS POSSIBLE TO MODIFY THE VALUES OF THE FOLLOWING WELDING PARAMETERS: SPOT, GAS, TIME, FREQUENCY, WAVE and SAVED CONFIGURATION (MEMORY). To change the welding parameter values, simply press the button corresponding to the desired value and, when the text inside the icon changes colour, modify the value using the + and - buttons at the bottom right of the screen.

The left hand panel contains other controls, such as the ZOOM, which may be used to enlarge the view of the welding point by up to 4 times. The HDMI button allows you to transmit images via an HDMI cable to an externally connected display. The controls are completed by the MENU button, highlighted in red in figure 39, which may be used to access additional welding point focusing commands (figure 40) and, lastly, FULL SCREEN, which enlarges the image so that it fills the entire screen.

The images transmitted by the webcam also appear in the centre of the CAM MENU screen, whereas a series of new commands are displayed in the side panels. The direction arrows that are used to move the cross to the precise point where the laser will make contact with the material to be welded appear at the top of the two panels. The EXT RING option is located in the right hand panel, below the two arrow buttons; if selected, this option may be used to freeze the image at the moment the laser is fired, whereas, if it is deselected, the images will scroll automatically. The FULLSCREEN AUTO button is located in the left hand panel, below the two arrow buttons; which, if selected, may be used to activate full screen mode automatically for a few seconds after pressing the pedal to initiate the welding process. This function is enabled if the word ON appears on the button and disabled if the word OFF appears on the button.

The AUTO EXPOSURE control, if active, automatically controls the exposure of images transmitted by the webcam that may be disturbed by glare during welding or reflections. If this function is disabled the images will be transmitted using the last settings that were selected. If enabled the text on the button is displayed in green, whereas if it is disabled it is displayed in red. The last icon in the bottom left corner is the SAVE button, which can be used to save all the parameters and settings.

MANUALS SCREEN

Press "MANUALS" in the menu bar to access the manuals screen where it is possible to consult the manuals preloaded on the machine to assist the operator in the event of problems and/or provide information about the procedures to be carried out before a given operation.

A list of the available manuals will appear on the left hand side of the screen, as shown in figure 41; click on the corresponding icon to access the desired manual.

It is also possible to upload other manuals from an external USB flash drive. As long as you remain on this screen the icon on the menu bar will be highlighted in light blue (figure 41).

LANGUAGE SCREEN

Press "LANGUAGE" in the menu bar to access the language menu screen where it is possible to select the display language from the "TEXTS" list on the left hand side of the screen, and the language of the keyboard illustrated on page 29 from the "KEYBOARD" list on the right hand side.

As long as you remain on this screen the icon on the menu bar will be highlighted in light blue (figure 42).

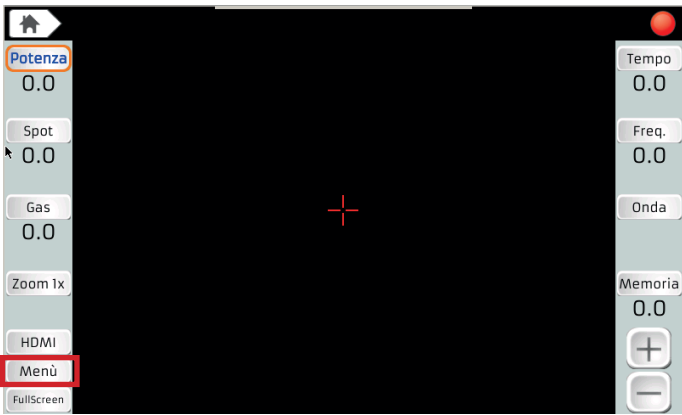


Figure 39 – Cam screen

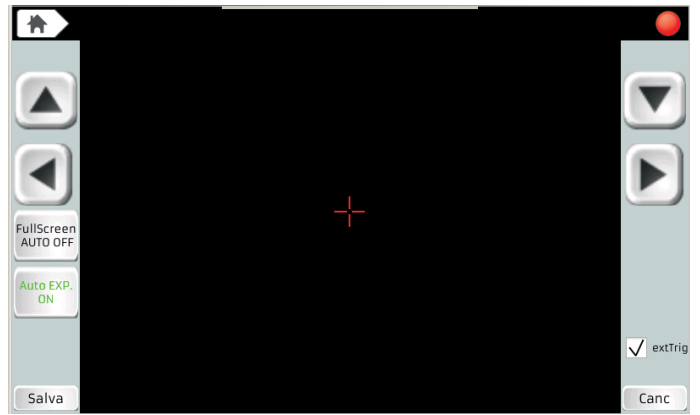


Figure 40 – Cam menu screen

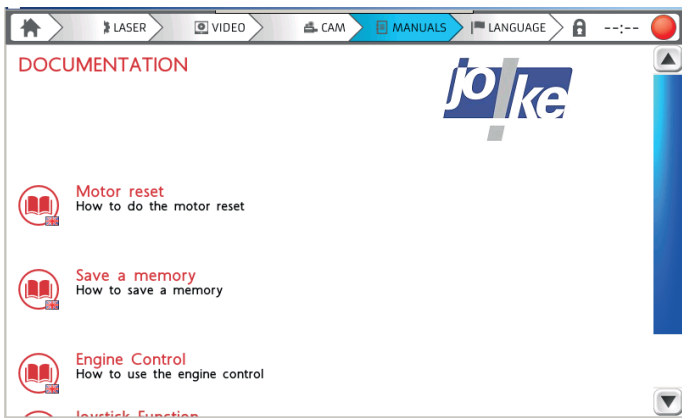


Figure 41 – Manuals screen



Figure 42 – Language menu screen

SWITCHING ON FOR THE FIRST TIME

After ensuring that you have carried out the instructions on pages 23 and 24 to the letter it is possible to switch the machine on for the first time.

- Connect the power cable to the female socket on the rear of the machine, as indicated in Figure 43;
- Connect the compressed air and gas hoses to their respective ports on the rear panel (figure 43);
- Make sure that the EMERGENCY STOP PUSH-BUTTON has not been pressed (figure 44);
- Turn the red ON/OFF selector switch on the rear panel to ON (figure 45);
- Set the ignition key to the UNLOCK position (this will activate the machine hydraulic system);

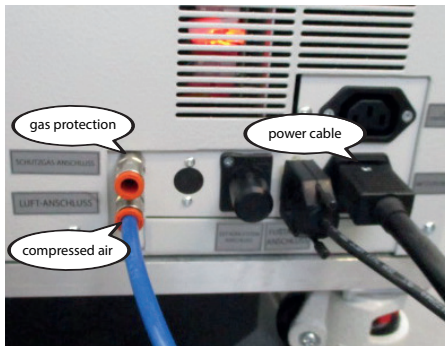


Figure 43 – Rear user panel

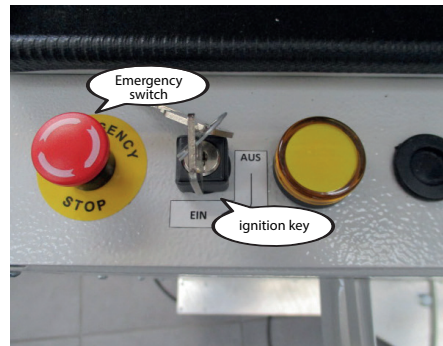


Figure 44 – Front user panel



Figure 45 – Rear panel

At this point the START button will appear on the display to the right of the red box, as shown in Figure 46 and the status dot on the menu bar will turn green. If the start button does not appear in the machine status box then an error status message will appear in the red box.

When the operator presses the START button, the default setting values and the wording "LASER ACTIVE – CHECK VALUES" will appear on the display.

At this point, the operator can choose whether to select the welding parameters and execute the process using the foot control, or load the working parameters stored permanently in a memory cell by selecting the corresponding number using the joystick or the display, as described earlier.



Figure 46 – Machine home screen

SWITCHING THE MACHINE OFF

To switch the machine off, first turn the ignition key to the LOCK position and wait for the message "LASER LOCKED" to appear in the red box on the display. When this message appears, turn the ON/OFF selector switch on the rear of the machine to OFF.

Remove the key if it is considered necessary to prevent other personnel from using the machine.

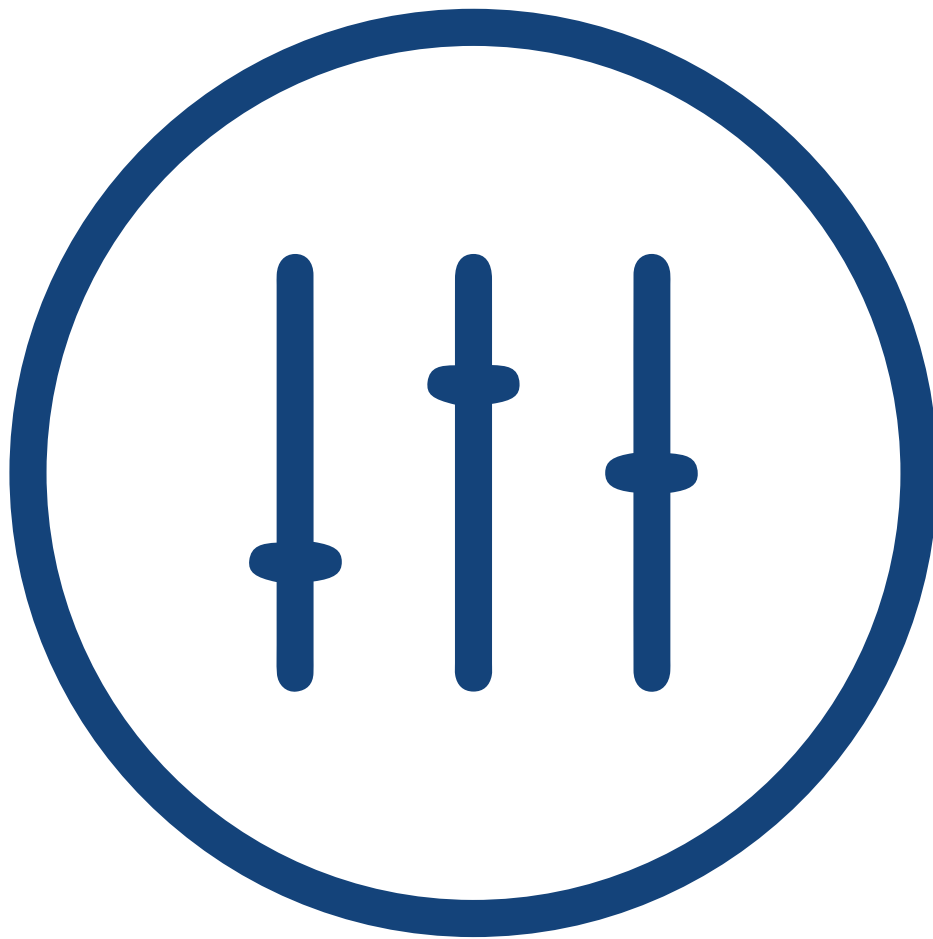
NOTE: If the seals affixed to the laser system by the manufacturer are removed or damaged in any way, the warranty covering the entire welding system shall be considered null and void.

WARNING: Always turn the key to the LOCK position first when switching the welding machine off to allow the microprocessor to discharge the capacitor bank.

SETTING THE MACHINE PARAMETERS



The preceding chapters provide all the necessary information about safety, the machine and its accessories, the assembly procedures and initial start-up; the following chapter concentrates on setting the parameters and the actual welding process.



ATTENTION: the welding settings provided in this chapter consist of groups of parameters that are specific for the type of material but are not UNIVERSAL. ALWAYS ADAPT the parameters to the material to be welded. Differences between the alloys used for each individual material may mean that the default settings are not capable of guaranteeing optimum results.

SETTING THE WELDING PARAMETERS

Before starting work, set the POWER, SPOT, TIME, FREQUENCY and WAVE TYPE values, depending on the type of material to be welded.

The table in figure 47 lists the default settings for various types of material. These data, which were obtained from laboratory tests on samples of commercially available material, are provided FOR REFERENCE ONLY. Welding parameters vary depending on the alloy used for the material to be processed, the chemical-physical characteristics of the material and the surface finish of the piece to be welded.

All these variables mean that the table should only be used as a STARTING POINT for welding and that the recommended parameters must not be considered as universal. If you are unable to determine the correct welding configuration for your application, please contact the manufacturer's technical assistance service.

MATERIAL	POWER	SPOT	TIME m/s	FREQUENCY	WAVE
THIN YELLOW GOLD	2	0.2	2	5	SLO+
YELLOW GOLD WIRE	2.4	0.4	2.4	6.5	SLO+
COATED YELLOW GOLD	3.6	0.7	3.6	6.5	SLO+
THIN WHITE GOLD	1.5	0.2	1.6	6.5	SLO-
WHITE GOLD WIRE	1.7	0.4	1.7	6.5	SLO-
COATED WHITE GOLD	2.3	0.8	2.1	6.5	SLO-
THIN RED GOLD	1.6	0.2	1.9	5	SLO+
RED GOLD WIRE	1.8	0.3	2.2	5	SLO+
COATED RED GOLD	3.2	0.6	3.1	6.5	SLO+
THIN SILVER	3.7	0.3	3.7	5	NORM
SILVER WIRE	4.2	0.3	4.2	5	NORM
COATED SILVER	4.5	0.4	4.5	4	NORM
THIN PLATINUM	1.8	0.4	0.8	5	NORM
PLATINUM WIRE	1.8	0.5	1	1.6	NORM
COATED PLATINUM	2.2	0.8	1.8	1.9	NORM
THIN STEEL	1	0.3	1	6	NORM
STEEL WIRE	1.	0.5	1.2	7	NORM
COATED STEEL	1.8	0.7	1.8	7	NORM
THIN TITANIUM	1.8	0.7	1.8	7	NORM
TITANIUM WIRE	1	0.2	0.2	2.5	NORM
COATED TITANIUM	1	0.2	0.2	2.5	NORM
THIN PALLADIUM	1.6	0.2	1.3	5	NORM
PALLADIUM WIRE	1.8	0.5	1.6	6.5	NORM
COATED PALLADIUM	2.4	0.7	1.8	8	NORM
THIN NICKEL SILVER	1.6	0.7	1.4	5	NORM
NICKEL SILVER WIRE	1.4	0.7	1.4	7	NORM
COATED NICKEL SILVER	1	0.9	1.9	8	NORM

Figure 47 – DEFAULT welding parameters table

SETTING THE AXIS PARAMETERS

To set the X, Y, Z and R axes parameters, press the corresponding button on the home screen or the info menu to access the motor controls screen (figure 48). Each axis must be set independently of the others. The movement of the axes may only be controlled by the JOYSTICK.

AXES SPEED

The maximum speed of the axis movement can be set using the + and - buttons in the blue box corresponding to each axis. If you need to use a higher maximum speed on an occasional basis, then just press the P2 button on the joystick while executing the desired movement to activate TURBO mode. Conversely, if you require a very slow speed, press the P1 key while executing the desired movement to activate SLOW MOTION mode. Remember that, since the joystick is sensitive to movements, it is only possible to set the maximum speed value, which may only be reached when performing the maximum travel in the desired direction.

LOCK / UNLOCK AXES

Once the desired point has been reached, it is possible to lock the axis in position by pressing the green button in the respective axis box in order to deactivate the joystick. If the lock is active, the button will turn red and the word LOCKED will appear otherwise it will remain green with the word UNLOCKED displayed.

ZERO AXIS POSITION

Press the white button under the axis lock button to return the axis to the zero position, cancelling the entire run. Make sure that there are no obstructions when returning the axis to the zero position as this may damage the axis motor and generate machine errors.

SPINDLE ROTATION

When the message "P1-P2 AXIS R ROTATION" appears on the button in the bottom left of the screen (highlighted in figure 48), the buttons P1 and P2 may be used to control the spindle rotation.

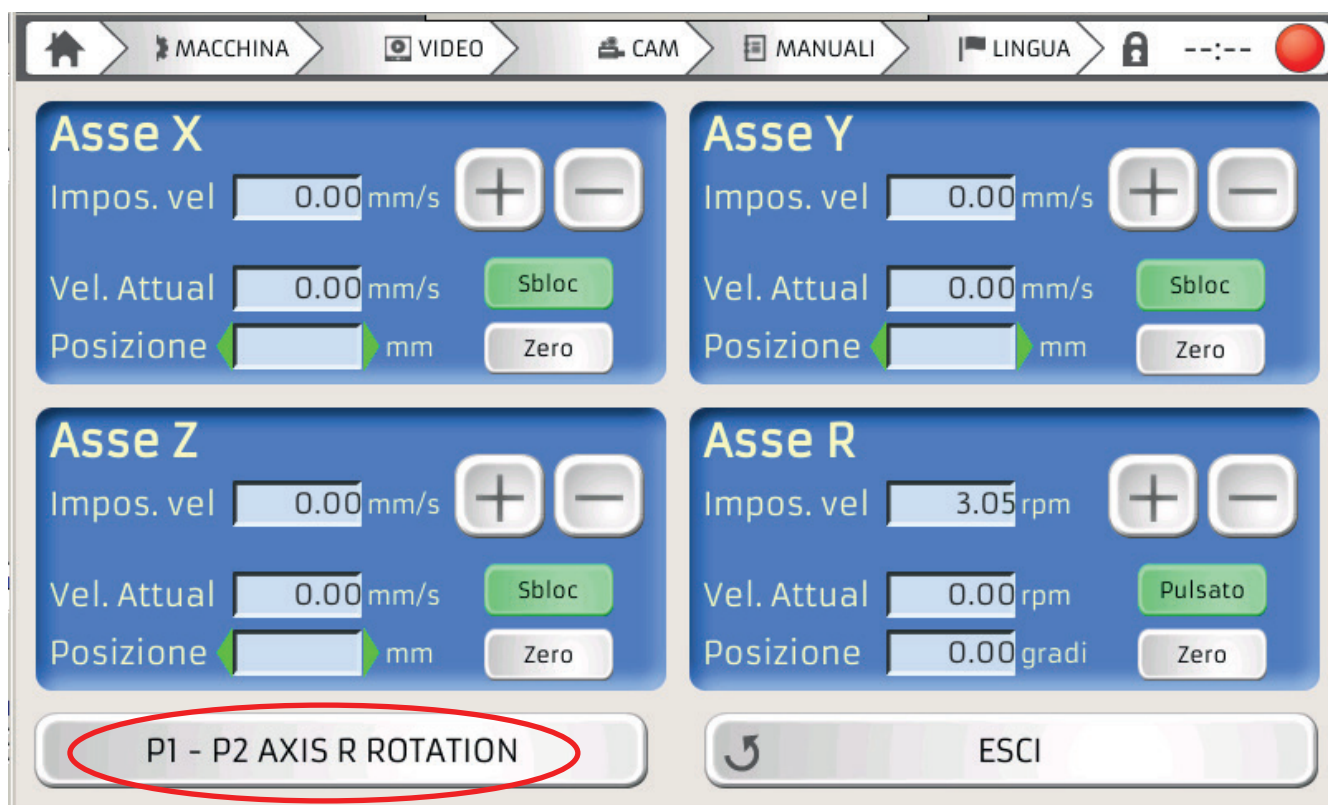


Figure 48 – Axis controls

WELDING WITH THE ENESKAlaser 1500 mobile



By following a few simple instructions you will be ready to use the ENESKAlaser 1500 mobile and embark on a new welding experience



ATTENTION: if you have never welded using laser technology before, we recommend contacting the machine manufacturer, who can organise training courses explaining how to weld using the ENESKAlaser 1500 mobile.

THE PHYSICAL PRINCIPLE OF LASER WELDING

The physical principle behind the generation of laser light is the phenomenon of stimulated light emission. In fact, LASER stands for Light Amplification by Stimulated Emission of Radiation. Thus, a laser may be defined as light amplified by the emission of a chain of photons, originating from an initial photon (light particle) that interacts with an excited atomic system and stimulates the emission of two additional photons, which, in turn, interact with other atoms, giving rise to an avalanche effect.

To excite the atomic system an external energy supply capable of triggering the laser effect is required. "Optical pumping", is obtained when the light emitted by a light source strikes the active material (material capable of emitting laser light) causing the atoms to become excited through the absorption of light energy. The laser effect is amplified by causing the emitted light to pass through the active material repeatedly.

This is accomplished by interposing the active medium between two opposing mirrors, i.e. constructing and "aligning" what is known as a "resonator". When the resonator is perfectly "aligned", the crystal and the mirrors are centered on the optical axis. The faces of the crystal, the front mirror and the face of the rear mirror closest to the crystal lie parallel to each other. In this optical configuration the resonator extracts the maximum laser energy, the beam is circular and approximately uniform in intensity. After being amplified, the laser beam will be concentrated by a focusing lens that may have varying focal lengths and can be deflected into the welding chamber by a 45° mirror. In this way the energy will be concentrated in an area of just a few tenths of a millimetre, making it possible to melt metals.

The energy intensity of the concentrated laser beam is in the order of 800 – 1000 KW/cm. To get this into perspective it is worth considering that, if the same lens were used to focus the sun's rays, the resulting energy intensity would be 0.5 KW/cm.

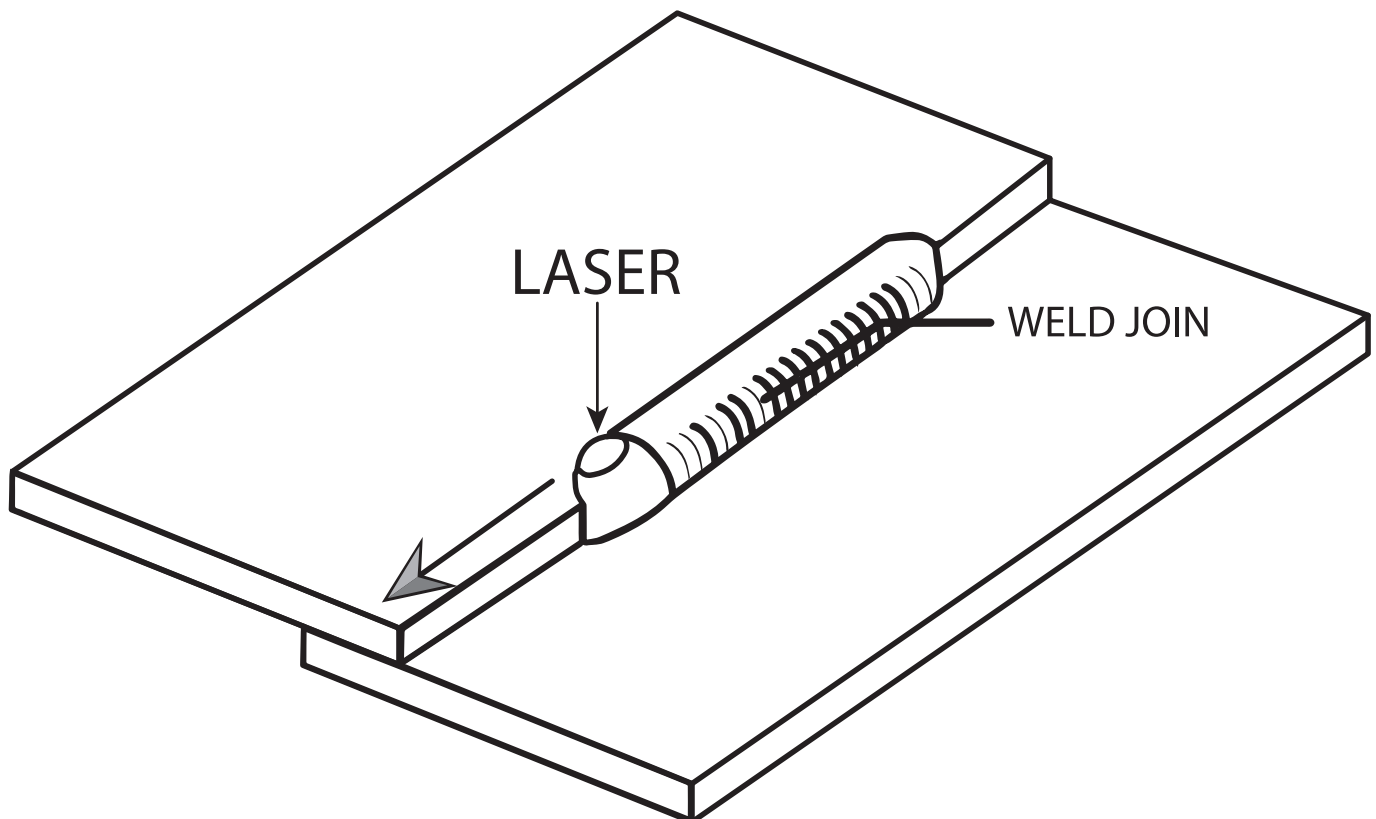


Figure 49 – Laser welding diagram

Follow these step by step instructions to start welding:

1. Switch on the machine as described in the initial installation procedure, and then rotate the ON/OFF selector switch on the rear of the machine to the "ON" position.
2. Rotate the ignition key to UNLOCK; the key is located on the front control panel near the emergency stop push-button, which must not be pressed.
3. Adjust the binocular. Take care when adjusting the binocular since if it is not regulated correctly it may affect the focusing process and hence the welding quality. A cross is visible in the right hand eyepiece, this must be aligned with the laser in order to ensure that the welding starts at the correct point.
 - 3.1 First of all, set the eyepiece regulator to the neutral dioptre position, repeating the operation for both eyepieces. If the eyepieces are set to different dioptries, it will be very difficult to achieve a precise and regular focus (Figure 50).
 - 3.2 If the operator wears glasses, move the eyecups to the CLOSED position, then rotate them counter-clockwise, lower them as far as they will go and lock them in position by rotating them clockwise. If the operator does not wear glasses, remove the eyecups to the OPEN position, then rotate them counter-clockwise to unlock them, raise them as far as they will go and lock them in position by rotating them clockwise (figure 51).
 - 3.3 Place an object at the focal length at a height where it is in focus and then adjust the width of the binocular (figure 52) so that you see a single circle without shadows and a clear image when you look through it.
4. Position the part to be welded, or on which the welding is to be carried out, and use the joystick to move the laser pointer to the welding start point. While doing this, make sure that the machine arms do not interfere with the object to be welded or other objects in the vicinity when in motion.
5. Adjust the parameters as described in chapter D, depending on the material to be welded. We recommend carrying out a series of preliminary test welds on a sample of the material to be welded in order to determine the correct welding parameter settings, starting from the values listed on page 36.
6. Press the pedal and start welding. If you choose to use the display rather than the binocular to monitor the welding process, make sure that you are USING THE PROTECTIVE EYEWEAR PROVIDED.

HAPPY WELDING!



Figure 50 – Dioptre



Figure 51 – Eyecups



Figure 52 – Binocular

TROUBLESHOOTING FAULT MAINTENANCE



This chapter describes the maintenance procedures and basic issues affecting your ENESKAlaser 1500 mobile. For details and important issues contact customer support.



ERROR MESSAGES

The error messages that may appear on the display are listed in the table in figure 50:

ER.No	MESSAGE	CAUSE	REMEDY
01	SIMMER ERROR	The Laser lamp does not switch on	<p>A. Check the fuse</p> <p>B. Call CUSTOMER SERVICE</p>
02	COOLANT AT STILLSTAND	<p>The coolant is at stillstand inside the cooling pipes</p> <p>A. Pump stopped</p> <p>B. Water dirty or cloudy</p>	<p>A. Check the fuse and call CUSTOMER SERVICE</p> <p>B. Check the colour of the coolant through the openings and if there is any sediment on the bottom of the tank. If so, replace the coolant and clean the cooling svstem.</p>
03	COOLANT TEMPERATURE HIGH	<p>The coolant has reached the warning temperature (55 °C):</p> <p>A. Intensive machine working cycle</p> <p>B. Insufficient coolant in the storage tank</p> <p>C. Lateral cooling fan not running</p> <p>D. Excess dust or dirt deposited on the heat pump</p>	<p>A. Wait 15 minutes, without switching the machine off, for the error to disappear; if it does not, call CUSTOMER SERVICE</p> <p>B. Check the coolant level in the tank, viewing it from the side, and top-up with distilled water if necessary</p> <p>C. Check the operation of the fan, which, in the case of Error 01, should run very fast, generating considerable noise. If not, call CUSTOMER SERVICE</p> <p>D. Direct a jet of compressed air through the openings in order to free the heat pump of any dust. Do not open the machine before first having consulted the CUSTOMER SERVICE</p>
04	ELECTRONIC POWER UNIT TEMPERATURE HIGH	<p>The thermostat located inside the electronic power unit has detected a high temperature:</p> <p>A. Intensive machine working cycle</p> <p>B. Dirt or dust deposited on the rear cooling fans</p> <p>C. Rear cooling fans not running</p>	<p>A. Wait a few minutes for the error to disappear and leave the machine to cool down for around 20 minutes</p> <p>B. Direct a jet of compressed air through the openings on the rear panel to determine whether there is any dirt or dust deposited on the fans. Before opening the machine, call CUSTOMER SERVICE</p> <p>C. Call CUSTOMER SERVICE</p>
05	INPUT RELAY	<p>The machine is switched on but cannot be used for welding</p> <p>A. Problems with the power supply</p>	<p>A. Check the power supply connections</p> <p>B. Replace the power supply</p>
06	CAPACITOR VOLTAGE LOW	<p>The electronic power unit has failed to charge the capacitor bank</p> <p>A. The generator is faulty</p>	<p>A. Call CUSTOMER SERVICE</p>

Figure 50 – Error table

AXIS ERROR MESSAGES

The axis error messages, which are listed below, only appear on the motor control page:

- MOTOR TEMPERATURE ERROR** – this error occurs when the motor reaches the working temperature limit. Wait for the motor to cool down before using the respective axis (figure 51). When this error is active, the axis position reset button is replaced by the high temperature warning icon. If this problem occurs frequently contact the technical assistance service.
- AXIS LIMIT SWITCH** – this error appears when the axis reaches the maximum effective run. Depending on whether the end or start limit switch is affected, the corresponding movement indicator arrow turns red (see Y Axis in Figure 52) and the ENDSTOP MAX message appears. This is not an error but a warning that the axis has reached its limit switch; this means that no action is required other than to move the axis in the opposite direction to that indicated in the current error message.
- AXIS DRIVER ERROR** – this error is due to a fault on the drivers associated with the respective axis, when active the box corresponding to the affected axis turns orange (see Y Axis in figure 53). Reset the driver by pressing the button that appears in this box. If the problem persists after resetting the driver, contact the technical assistance service.
- SAFETY PISTON PRESSURE ERROR** – when the air pressure is not sufficient to operate the safety piston this error will be generated, indicated by the message SAFE AXIS and the red dot in the top right corner of the box corresponding to the affected axis (see Y Axis in figure 54). The same error may be generated in the event of an axis malfunction in order to prevent unwanted movements. Check that the air pressure is correct and that there are no leaks. If the problem persists after all the checks have been carried out and completed, contact the technical assistance service.

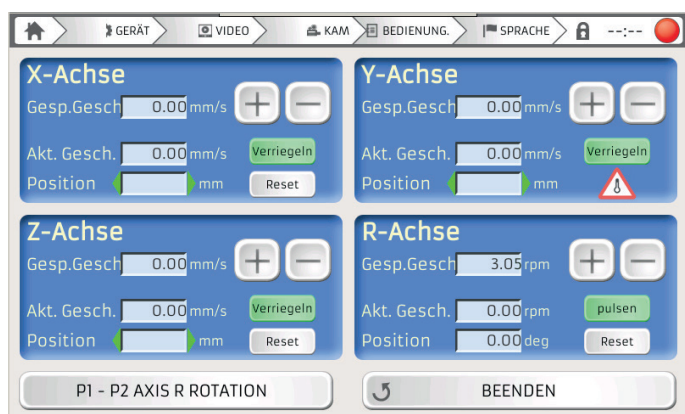


Figure 51 – Motor temperature error

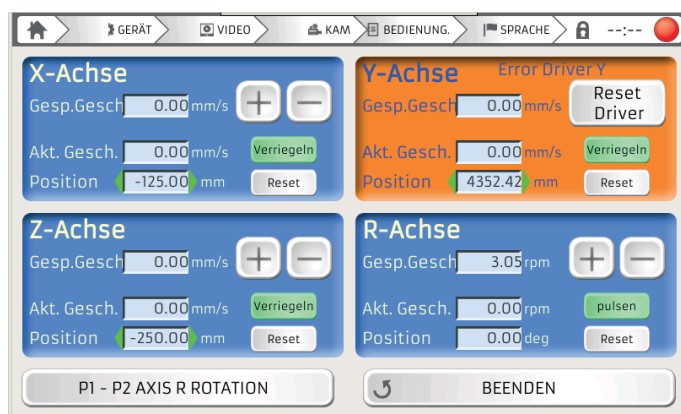


Figure 53 – Driver error

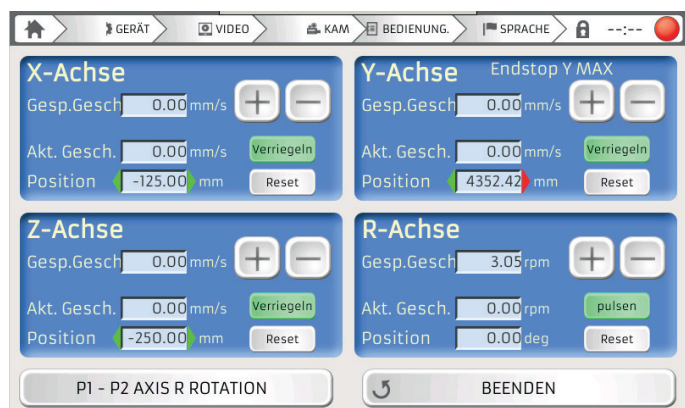


Figure 52 – Axis run limit error

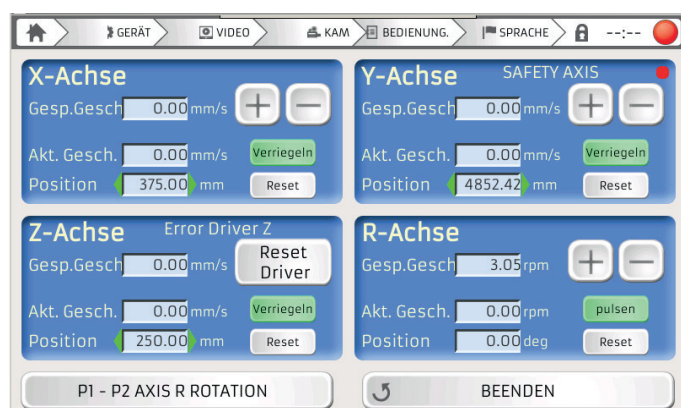


Figure 54 – Safety piston error

FAULTS

The table in figure 55 presents a list of faults and possible corrective actions.

PROBLEM	CORRECTIVE ACTIONS
The machine switches on but does not assume the START position.	<ul style="list-style-type: none"> ➤ Check the position of the key
The display indicates the parameters but the Laser does not fire.	<ul style="list-style-type: none"> ➤ Check that the firing pedal is connected to the machine
Nel microscopio vedThe microscope shutter interrupts the view and goes dark, but there are no visible effects on the workpieceo che lo shutter chiude la vista e.	<ul style="list-style-type: none"> ➤ The power and time settings are too low ➤ The MS5 zoom drum is not positioned correctly ➤ Positioning window dirty (see Chap. 7 MAINTENANCE)
The welding lights do not switch on.	<ul style="list-style-type: none"> ➤ Check the fuses
When the Laser fires, the fumes generated by the welding process rise towards the microscope, obscuring the view.	<ul style="list-style-type: none"> ➤ The filter on the welding chamber is excessively dirty ➤ The fan is not running: check the fuse
The shielding gas is not released when the firing pedal is pressed.	<ul style="list-style-type: none"> ➤ Check whether the gas release countdown has been activated on the display ➤ Check that the inlet pressure does not exceed 2 bars ➤ Check that the rear coupling is not obstructed in any way
The Laser does not switch on.	<ul style="list-style-type: none"> ➤ Check that the switch on the rear panel is set to ON ➤ Check that the emergency stop push-button has been released ➤ Check the fuses ➤ Check the connection to the electrical mains supply

Figure 55 – List of faults

Always replace fuses with the same type and rating. We recommend using the fuses supplied with the machine. Contact the technical assistance service if you require any further clarification.

REPLACING THE AR/AR SAFETY WINDOW

Whenever the protective window is "dirty" the laser power output is reduced. Therefore, when there is a significant concentration of metal spatter on its surface, the glass should be replaced.

Check the microscope lens protective window located inside the welding chamber at regular intervals. This special anti-reflective @ 1,064 nm glass is secured to the output of the optical path by means of an aluminium ring nut, which is, in turn, held in place by a screw.

To replace the special protective window, proceed as follows:

- Unscrew the ring nut retaining screw (Ref. A – figure 56);
- Remove the ring nut (Ref. B - Figure 56) from the optical body and then remove the window.
- Wipe the surface with a soft, non-abrasive cloth.
- Do not attempt to remove any metal spatter that may have been deposited.
- Insert the new window (figure 57) in its housing and carefully position the ring nut, tightening it using the two screws (figure 58).

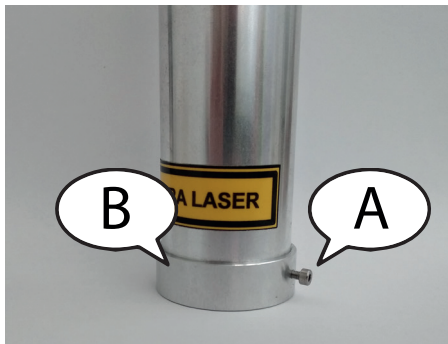


Figure 56



Figure 57



Figure 58

ATTENTION: It is advisable to replace the protective window in the presence of metallic spatter since the impulses generated by the LASER could cause it to overheat further and may even cause the glass itself to break.

ALIGNING THE CROSSHAIRS

It may be that the welding crosshairs is not aligned with the actual firing point. This may occur whenever the welding machine is moved or raised.

Even a microscopic bump could result in a misalignment between the crosshairs and the actual firing point. Such minor optical defects may be corrected quite easily by the operator.

To adjust the alignment of the crosshairs it is necessary to loosen the two screws on the upper part of focal extension (Ref. A and B - Figure 59). Once the screws are loosened, pull out the extension by about 40mm so it is possible to access the three crosshairs regulator screws (figure 60). Once the sight has been adjusted, return everything to its original position.

However, before adjusting these screws, it is advisable to secure both the stereo-microscope and the binocular firmly in their respective positions. To adjust the latter, simply slide the eyepieces on their support tubes as far as they will go and rotate them until their dioptric positions coincide with the 0 marker; then tighten the eyecups around the ends of the eyepieces.

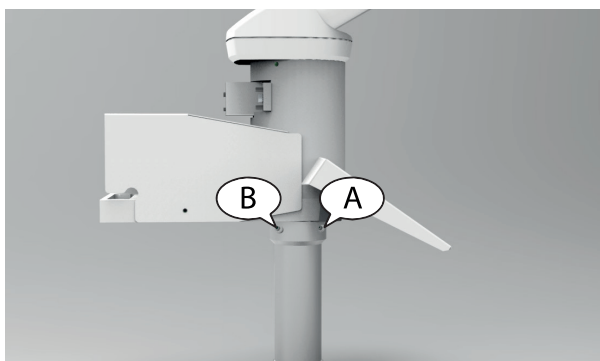


Figure 59

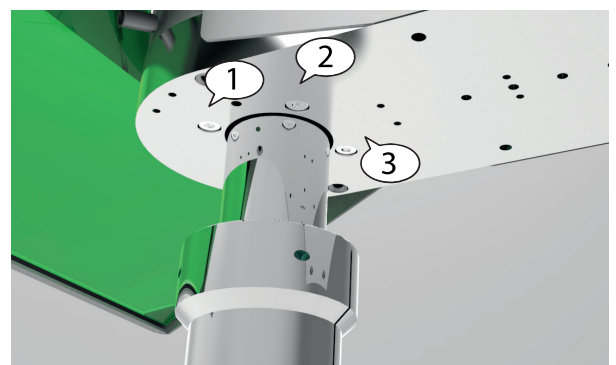


Figure 60

ALIGNING THE AIMING SIGHT

To adjust the stereo-microscope, unscrew it from its base (Ref. D - Fig. 61), using the 2.5 mm Allen screwdriver provided, and once it has been pushed firmly against the front edge of its base, or in other words away from the operator's position, screw it down firmly so it is immobilised permanently in that position.

Then, in order to check the alignment, place a sheet metal plate inside the welding chamber so that it is stable and in focus. Next, strike the metal plate with a single, low-power shot.

Now, looking inside the microscope, rotate the screws 1 and/or 3 by very small amounts (figure 61) until the aiming sight coincides with the point where the laser shot struck the metal plate. It is important to move only one screw at a time since they both have a distinct displacement effect. In fact, screw 1, is used for vertical (or north-south) adjustments, while screw 3 corrects horizontal (or east-west) displacements. Screw 2 remains fixed and must never be touched, otherwise the entire alignment system may be compromised.

Act progressively on these screws, alternating between one and the other and as many times as necessary to ensure both (the aiming sight used to focus on the object and the firing focus point) coincide perfectly, or are virtually and precisely superimposed.

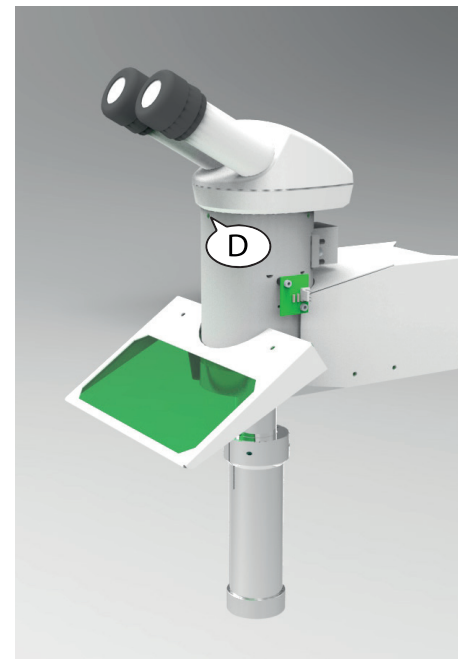


Figure 61

ATTENTION: During the alignment phases, make sure that hands are positioned where they do not interfere with the passage of the LASER.

ATTENTION: When adjusting the alignment, always use very small movements and ensure that the test plate remains perfectly stable. NEVER UNDO THE REGULATOR SCREWS COMPLETELY.

REPLACING THE COOLING LIQUID

- Insert the plastic connection without the funnel (figure 62) supplied with the machine into the female connector at the bottom of the laser rear panel, figure 63.
- Remove the red cap at the top (figure 62) and allow the water to drain completely from the plastic connection, tilting it downwards so that it collects in a suitable recipient.
- Insert the plastic connection supplied with the machine into the female connector at the bottom left on the rear panel of the machine and insert the funnel as shown in figure 64.



Figure 62



Figure 63

- Remove the red cap at the top.
- Fill the tank using the funnel provided.
- The limit is reached when the water begins to escape from the upper connector of the tank.
- Close the top connector using the red cap and remove the plastic connector.



Figure 64

ORDINARY MAINTENANCE

The instructions for carrying out ordinary maintenance on the machine mechanical parts are set out below. This type of maintenance is important to preserve the integrity of the parts that determine the precision and movement of the laser. These operations must be carried out at regular intervals since it is important to check the state of wear and tear of the mechanical parts and the integrity of the machine in general periodically.

GREASING THE WORM SCREW

In order to prevent malfunctions and potential mechanical faults, make sure that the worm screw, which is located inside the column (figure 65), is always well greased so as to guarantee the precision and fluidity of the movements. We recommend using a mineral oil-based, water repellent infusible grease, thickened with NLGI 2 grade bentonite. Next, position the Z axis at its lower limit, remove the safety guard in order to access the inside of the column, eliminate the old grease from the worm screw using a cloth and clean it thoroughly. Once the old grease has been removed, use a brush to apply the new grease along the entire length of the screw; avoid using excessive quantities of grease as this could compromise the correct operation of the machine. After applying the grease on the screw, position the Z axis at its upper limit and then return it to the lower limit; repeat this operation twice to distribute the grease evenly over the entire length of the screw.



Figure 65 - Worm screw

MAINTENANCE ON LINEAR GUIDES

To ensure the axes function correctly and run smoothly on the guides, we recommend cleaning the latter with a dry cloth, removing the dirt while taking care not to scratch the guides. Once cleaned, use a clean cloth to oil the guides, taking care not to apply excessive lubricant. Excess lubricant on the guides could cause further damage if it is transferred to electric cables or other electrical parts. We recommend inspecting the guides frequently and cleaning them whenever necessary.

The guides to be oiled are those highlighted in red in the figures below (figures 66-67-68-69). We recommend using synthetic CLP, CGLP (according to DIN 51517) or HLP (according to DIN 51524) type oil having a viscosity between ISO VG32-100 for working temperatures between 0° C and +70° C. We recommend ISO VG10 for use in environments with lower temperatures. Be very careful NOT TO OIL the magnetic strip on the Y axis highlighted in green (figure 66).

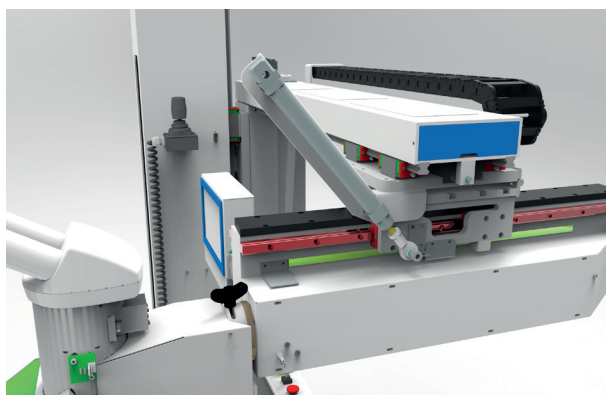


Figure 66 – Y axis guides

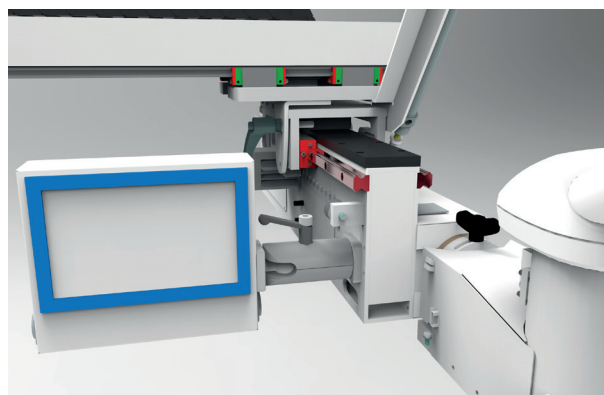


Figure 67 – Y axis guides

MAINTENANCE ON LINEAR MOTOR STATORS

The stators in the linear motors create a magnetic field that attracts metal parts and welding residues, so it is very important that they are always clean and free from any attached particles that could compromise their correct operation. The stators are highlighted in green in figures 70 and 71.

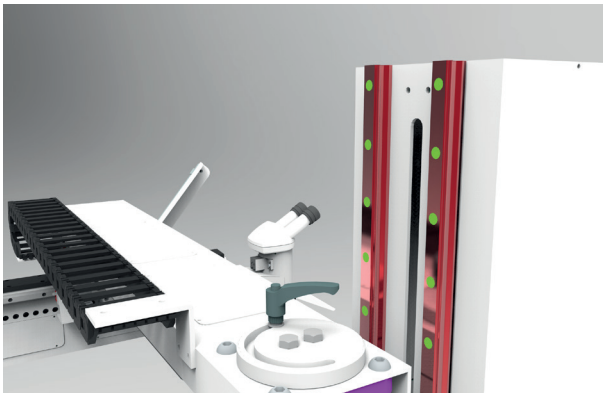


Figure 68 – Z axis linear guides

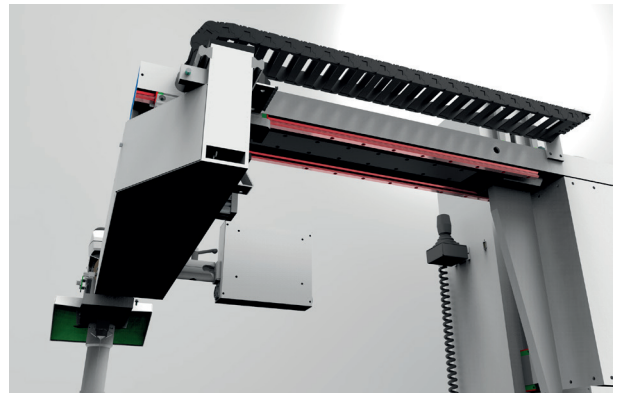


Figure 69 – X axis linear guides

Personnel fitted with pacemakers should remain at a safe distance from the stators since they may cause such devices to malfunction, which could be fatal to the wearer.

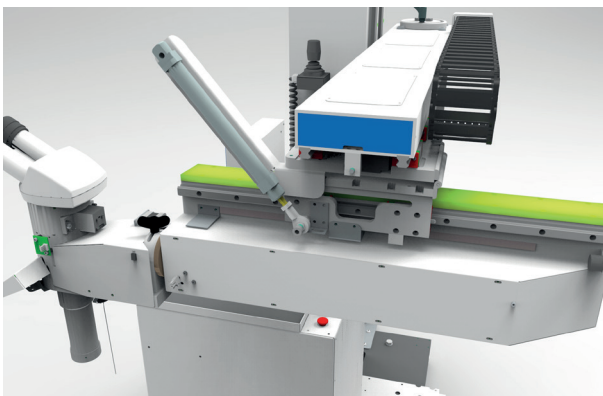


Figure 70 – Y axis stator

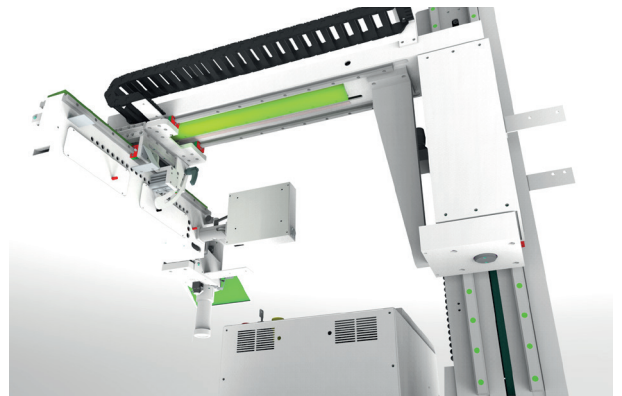


Figure 71 – X axis stator

MAINTENANCE ON HEAD ROTATION SYSTEM

To guarantee the system moves smoothly and precisely, introduce a few drops of the same oil used for the linear guides in the slot of the head rotation system, highlighted in red in figure 72. Do not use excessive lubricant because it could create clots of dirt, preventing the head rotation system from operating correctly.

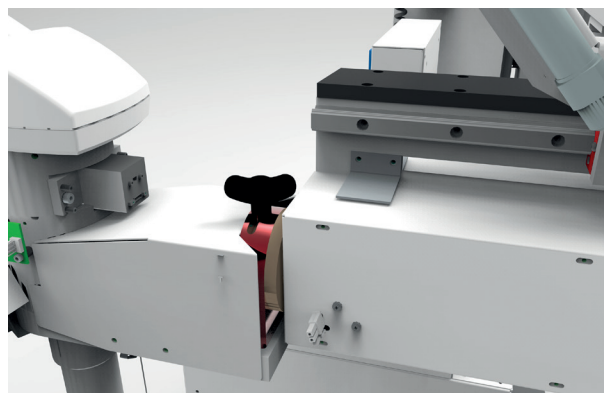


Figure 72 – Head rotation system

In the event of technical problems or any other issues, please contact:

joke Technology GmbH
Asselborner Weg 14 - 16
D-51429 Bergisch-Gladbach
TEL. +49 (0) 22 04 / 8 39-0 / FAX +49 (0) 22 04 / 8 39-60
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www.joke.de

TERMINOLOGY

International regulations have standardised the terminology related to lasers, their components, accessories, performances, etc. See below for a list of the principal definitions and the applicable regulations.

Definitions as set out in the European standard EN 12626 (ISO 11553) Safety of machinery; Laser processing machines.

- 1. MACHINE** – a set of connected parts or components, at least one of which in motion, with all the necessary actuators, controls and power circuits connected together for a specific application, in particular for the processing, treatment, handling or packing of material.
- 2. LASER SYSTEM** – Machinery that includes a laser source having sufficient energy to interact with the workpiece, and which is equipped with all the functional and safety aspects of a fully operational machine.
- 3. MANUFACTURER** – Individual or organisation that assembles the laser system.
- 4. COMPLEX COMPONENT** – An element used in the manufacture of a device, but which cannot be considered in itself a device, not having a function intrinsic to the end purpose.
- 5. INSTALLED SYSTEM** – A set consisting of several devices and/or systems combined in such a way as to achieve a specific objective but not intended to be placed on the market as a single commercial unit.
- 6. ELECTROMAGNETIC COMPATIBILITY** – the ability of a device, equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to other equipment in that environment, in compliance with both the emission (disturbance produced by the device) and immunity (insensitivity to disturbances produced by the surrounding environment) requirements.
- 7. SECOND ENVIRONMENT** – Environment that includes all industrial utilities other than those connected directly to a low voltage power supply network that supplies buildings used for domestic purposes.
- 8. IN SITU** – Environment in which the device is installed for normal use by the end user and in which the device must be tested.
- 9. RESTRICTED DISTRIBUTION** – Marketing mode in which the manufacturer limits the supply of equipment to suppliers, customers, or users who, separately or jointly, satisfy the applicable technical EMC requirements for the installation of electrical and electronic equipment and who, through the exchange of technical specifications, carry out "in situ" measurements of the actual boundary conditions.

EEC CONFORMITY AND CE MARKING

REFERENCE DOCUMENTS AND APPLICABLE STANDARDS

2004/108: Electromagnetic compatibility directive

2006/42/ EC: Machinery Directive: essential safety requirements

2006/95/EC: Low-voltage directive

EN 60825-1: Safety of laser systems

EN 61000-6-1: Electromagnetic compatibility. Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments.

EN 61000-6-3: Electromagnetic compatibility. Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments

EN 60204-1 - Part 1: Safety of machinery, electrical requirements for industrial equipment

COMPLIANCE WITH EEC DIRECTIVES AND CE MARKING

CONDITIONS FOR COMPLIANCE OF ENESKA LASER SOURCES WITH THE EMC DIRECTIVES

The compliance of the Laser sources defined in the heading of this paragraph to the Directives on Electromagnetic Compatibility is valid only if the conditions listed below are satisfied.

1. THE SOURCES DEFINED IN THE HEADING OF THIS PARAGRAPH ARE COMPLEX COMPONENTS SOLD TO BE INCLUDED AS A PART OF AN EQUIPMENT OR INSTALLED SYSTEM: THEREFORE, THE OPERATING CONDITIONS OF THE SOURCE WITHIN THE SYSTEM MUST CONFORM TO THOSE SET OUT IN THE RESPECTIVE PARAGRAPH OF THIS DOCUMENT.
2. THE SOURCES DEFINED IN THE HEADING OF THIS PARAGRAPH ARE SUBJECT TO A RESTRICTED DISTRIBUTION POLICY; THEREFORE IT IS ASSUMED THAT THE INSTALLER AND/OR USER ARE AWARE OF THE REQUIREMENTS RELATING TO ELECTROMAGNETIC COMPATIBILITY.
3. THE SOURCES DEFINED IN THE HEADING OF THIS PARAGRAPH SHALL BE INSTALLED ACCORDING TO THE INSTRUCTIONS SET OUT IN THIS DOCUMENT; IN ADDITION, ALL REQUIREMENTS SET OUT IN THIS DOCUMENT SHALL BE RESPECTED, INCLUDING THE FINAL ON SITE INSPECTION TO ENSURE THE SYSTEM CONFORMS TO THE APPLICABLE DIRECTIVES.
4. THE SOURCES DEFINED IN THE HEADING OF THIS PARAGRAPH ARE INTENDED FOR USE EXCLUSIVELY IN THE SECOND ENVIRONMENT.

DECLARATION OF COMPLIANCE

joke Technology GmbH declares that, provided the conditions specified in this document are satisfied, the ENESKAlaser 1500 mobile source complies with the requirements of the LOW VOLTAGE Community Directives.

NOTE FOR THE APPLICATION OF OTHER EEC DIRECTIVES

LASER sources are not subject to other EEC Directives, apart from those listed in paragraph 2. However, for practical purposes, reference is made to other Directives; in particular, in order to guarantee compliance with the requirements of the Machinery Directive 2006/42 EC, the declaration of incorporation is included below.

MANUFACTURER'S DECLARATION

PURSUANT TO THE REQUIREMENTS OF THE MACHINE DIRECTIVE, joke Technology GmbH hereby declares that the ENESKAlaser 1500 mobile source must be installed according to the instructions supplied with it and must not be put into service until the machinery on which it is installed has been declared compliant with the above mentioned Directive.

GENERAL SAFETY REQUIREMENTS DURING WELDING



When it is necessary to evaluate the safety of any given system, the first step is to identify the hazards relating to the operations performed by such a system.



INTRODUCTION

In the event that a LASER Device is installed on the system, in addition to the usual hazards deriving from the system functions and operating modes, it is necessary to bear in mind the additional hazards represented by LASER radiation (electromagnetic radiation, mainly infrared).

The safety of this type of equipment is subject to specific standards, both from the electrical point of view and from the point of view of radiation (non-ionised).

It follows that careful observation of the technical advice set out in the applicable Standards will lead to a reduction in the Risk of Exposure to Hazard to levels that are, presumably, compliant with the intention of the Legislator.

Thus, the manufacturer of the LASER Source, the Party assigned to Install it on the System and the end user are all responsible for ensuring that the applicable Standards and Regulations are observed.

Thus, rather than a single solution for increasing safety, a variety of different Protection Systems may be identified.

PROTECTION SYSTEMS

The general rule for protection systems is "... where there is a hazard personnel should not be present, and where there are personnel, hazards should not be present...".

Hence, it is obvious from the outset that the principal solution for guaranteeing safety is to place a barrier between personnel and any given hazard, in order to minimise the risk of access. Another solution is to implement a series of measures designed to notify personnel about the existence of a hazard in order to prevent them from coming into contact with it inadvertently. Finally, there remains the need for individual protection measures for those contingencies where the risk may vary according to the operating conditions. In the case of LASER equipment, three types of protection measures have been identified:

- A. Engineering Devices
- B. Procedural and Administrative measures
- C. Individual Protection solutions

ENGINEERING DEVICES

In the case of industrial environments, the most effective solutions consist of a series of measures implemented during the design, construction and integration phases with the aim of introducing devices designed to reduce the risk of exposure to the existing hazards to a minimum. When applicable, this is achieved by fitting the system with guards that enclose both the LASER and the working area and prevent hazardous radiation from escaping the enclosure. In this way the acceptable emission limit (AEL) is reduced to a level such that a LASER classified as hazardous (Class IV) does not emit any more radiation than a device classified as harmless (Class I).

STANDARD REQUIREMENTS FOR GUARDS

The guards or barriers or enclosures must be designed to intercept the infrared radiation emitted by the LASER and to resist perforation.

This requirement is easily achievable (in the case of low power LASERS) through the use of sheet metal panels that shield radiation completely and resist perforation by radiation that is not focused directly on them indefinitely. In the case of high power LASERS, it is necessary to establish a perforation interval between one inspection and the next, or implement active casings that are able to detect perforations (by means of cavities and appropriate sensors).

In the case Nd-Yag Laser equipment, metal panels in NdYVO₄ having a thickness in excess of 1.5 mm are sufficient to resist non-focused radiation generated by the integrated laser source indefinitely.

Access panels and safety locks must be designed to prevent access to hazardous radiation.

Depending on the type of process and/or operation to be carried out on the process, it may be necessary to remove guards or panels. In such cases, and if the panels are not secured to the structure by means of screws that require the use of special tools for their removal, such removable panels must be fitted with safety locks which, when engaged, reduce the radiation to permitted levels.

This is normally achieved by means of an electrical interlock connected to the LASER excitation system power supply. Since the purpose of the interlock device is to guarantee the safety of personnel, it must conform to the applicable standards and be approved for use in such applications.

SAFETY

The monitoring optics must be equipped with special attenuator devices capable of preventing personnel from accessing radiation levels in excess of class I AEL. This is particularly important in the case of systems fitted with inspection windows for viewing the interaction between the LASER beam and the process material. In this case the windows must incorporate optical density (OD) filters that are sufficient to reduce the radiation to non-hazardous levels. When calculating the required OD it is necessary to take into account the type of laser, how it is operated, the distance from the focal point, the direction of observation, the exposure time, etc. Since the purpose of the filter is to guarantee the safety of personnel, it must conform to the applicable standards and be approved for use in such applications.

SPECIAL REQUIREMENTS FOR CLASS IV LASERS

Class IV LASERS must be remotely controlled and activated by a key switch, in addition they must be equipped with an attenuator and an emission warning system. For such LASERS, the manufacturer must include a feature that enables the user to install a simple additional external LASER safety function. This consists of a remote blocking device, i.e. a contact that, if opened, interrupts or reduces the laser emission. The device used to switch the LASER on must be designed to prevent unauthorised personnel from activating it. This is achieved by means of a key switch where the key may only be removed when in the OFF position.

When LASER radiation is active, it is necessary to warn personnel that emissions are present. This is achieved by means of an emission warning device (usually a red flashing light).

Finally, the system must always be equipped with a solution capable of interrupting the LASER beam momentarily. This is achieved by the manufacturer of the laser source through the use of a beam attenuator or a shutter.

POSITIONS OF CONTROLS AND LABELS

Depending on requirements, the controls must be positioned in an area where it is not possible to come into contact with radiation, and that appropriate, standardised warning labels must be positioned so that they are clearly visible to all personnel.

USER INSTRUCTIONS, MANAGEMENT PROCEDURES AND STANDARD OPERATING PROCEDURE (SOP)

The operating instructions, which must be observed to guarantee correct use of the Laser equipment, are important in order to ensure that the safety measures implemented by the manufacturer are not compromised in any way, and to oblige the end user to assume responsibility for ensuring that the protective solutions provided by the manufacturer, and those implemented on site are used correctly, and to develop internal procedures and regulations aimed at guaranteeing the safest possible working condition through correct conduct in the workplace. They are also designed to prevent unauthorised persons from accessing the area where the LASER equipment processes are carried out. In particular, it is necessary to develop a Standard Operating Procedure (SOP) relating to the manoeuvres that must be carried out when commissioning and decommissioning the device. This procedure must be displayed near the installation, as a reference for the operator, and must be written in the operator's native language. It is essential to train personnel as follows:

- Familiarise them with the system operating procedures;
- Provide information regarding the appropriate use of hazard control procedures, warning signs, etc.;
- Underline the need for individual protection;
- Ensure they are aware of the biological effects of the LASER on Eyes and Skin;

INDIVIDUAL PROTECTION, PERSONAL PROTECTIVE EQUIPMENT (P.P.E.)

These devices must be seen as an additional safety measure to complement the protection systems indicated in A and B, and not as the main or only safety measure! They are identified in eye protection and it is clear that they must be very safe and with certified compliance, since they are the last barrier between the eye and the radiation! The calculation of the eyeglass O.D. must be conducted according to the regulatory recommendations, providing for the worst observation conditions. In any event, it is good practice to remember that no type of eyewear can protect the eye sufficiently in the case of direct exposure to the LASER beam!

RESIDUAL RISKS THAT THE USER MUST IDENTIFY AND ELIMINATE

These are risks deriving not from the LASER itself but from its use. In fact, associated with the main radiation, are collateral infrared and ultraviolet radiation, which, due to their intensity, may represent a potential hazard.

Due to its high power density (irradiation), the LASER beam is capable of triggering the combustion of flammable substances such as volatile substances (solvents, petroleum, ethers, alcohols, etc.) as well as methacrylate or plastic resins.

The interaction of the LASER beam with organic and inorganic materials causes the formation of fumes and vapours that, in some cases, may be harmful to health and/or toxic! The solvent used when cleaning the lenses is highly flammable and irritating to the eyes and when inhaled.

WARNINGS

In order to minimise residual risks, it is important to heed the following warnings:

- Do not remove the lamp rotation and the safety barriers.
- When using the lamps, use goggles and gloves.
- Do not point the LASER beam at materials considered to be flammable.
- Eliminate the fumes by means of a suitable extractor.
- Do not reintroduce fumes into the environment until they have been filtered.
- Do not work on live electrical equipment with the safety barriers removed.
- Do not make adjustments while the Laser is activated.
- Ensure all work is carried out by qualified and authorised personnel only.

In conclusion, if all the requirements set out above are met, there is no reason to assume that working with a system containing a LASER source involves a greater level of risk than any other activity!

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