

LASER MARKING SYSTEMS



Operating Instructions

**DPL *Nobilis* Marker
Business *Diode GN***

**DPL *Lexis* Marker
Business *Diode UV***

OEM Version

Laser Device Class 4

Mark your territory...

This product conforms to the requirements of the Machinery Directive 2006/42/EC.
The CE symbol is located on the type plate.

Manufacturer: ACI Laser GmbH
Steinbrüchenstraße 14
D-99428 Grammetal OT Nohra
Germany

Phone: +49 3643 4152-0
Fax: +49 3643 4152-77
info@ACI-Laser.de
www.ACI-Laser.de

We are constantly working on further developments.

Therefore, please understand that we must reserve the right to change the scope of the delivery in respect of the form, equipment and technology at any time.

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The manufacturer shall only be responsible for the safety characteristics of this device within the scope of the legally applicable regulations if it is operated by the user in accordance with the operating instructions and repaired by ACI Laser GmbH itself or someone appointed by and acting under the instructions of ACI Laser GmbH.

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1 Introduction

Dear customer,

thank you for the confidence which you have shown in us by purchasing our quality product. We would like to wish you every success with the use of the device.

Make yourself familiar with these operating instructions before starting use. The operating instructions tell you how to use your new device correctly and safely, and take you step by step through the actions which have to be performed before using it for the first time.

2 Important Information

Our Products are developed and manufactured under strict quality monitoring to give a long and fault-free service life.

This guarantees:

- highest quality and a long life,
- easy and safe operation,
- functional design,
- optimisation for the intended purpose.

The **DPL Nobilis Marker** and the **DPL Lexis Marker** are state-of-the-art devices. The EC Declaration of Incorporation and the EC Declaration of Conformity confirm that the manufacturer has complied with the relevant directives. The CE-symbol is located on the type plate.

The laser marking device contains a class 4 laser according to DIN EN 60825-1 "Safety of Laser Devices".

Should the operating company integrate the device as an OEM component into an existing installation, it shall bear the sole responsibility for fulfilling the standards and directives. This includes, for example, fitting it into a laser protection hood or integrating it into a production line.

The company operating the laser marking device is **obliged** to implement the safety measures arising from DGUV no. 11 "Laser Radiation" and from DIN EN 60825-4 "Safety of Laser Devices".

Please read these operating instructions carefully from the beginning in order to avoid errors and risks.

Reference is made to residual hazards at the relevant places in the operating instructions. Please also take note of the warning notice stickers on the device.

2.1 Intended Use

- The operating company is obliged to appoint a laser safety officer in accordance with para. 6 of DGUV no. 11 "Laser Radiation" to ensure that the relevant safety guidelines and standards are observed.
- The **DPL Nobilis Marker** and the **DPL Lexis Marker** laser marking systems are intended to be used exclusively for marking applications in conjunction with the associated **Magic Mark** software.
The performance parameters must be adapted to suit the properties of the materials to be marked.
- The laser marking device is intended for integration into installations or lines. Please contact the customer for information about other possible applications.
- Usage for the intended purpose includes observance of these operating instructions, the instructions in the software manual and the warning stickers on the device.
- The supplier/manufacturer shall not be liable for personal injury or material damage resulting from improper use of the laser itself or the safety devices.

2.2 Improper Use

All other uses other than use for the intended purpose, including that with other control software, shall be deemed to be improper use.

The laser marking device must not be used by:

- persons who have not read or understood these operating instructions,
- persons who have not been instructed in the proper operation,
- persons who are under the influence of alcohol and or drugs, or
- persons whose alertness is impaired by medicines or other influences.

The laser marking device must not be used:

- if the required protective devices have not been provided according to para. 4 of DGUV no. 11 "Laser Radiation",
- if protective/safety devices are bridged, defective or if they cannot reliably fulfil their function,
- if there is a suspicion that direct or leakage radiation can emanate.

2.3 Notices in the Document

Take note of the warning notices, take the specified actions and observe the prohibitions. A warning notice warns of a possible hazard and contains recommendations for preventing the hazard occurring. Key words indicate the type of hazard, symbols emphasize this visually.

Follow the stated measures for preventing hazards to the operator or tangible assets.

The following classification of dangers are used in these safety instructions:

DANGER

RISK OF DEATH OR SERIOUS INJURIES!

Indication of an imminent danger, which will result in death or serious injuries if the appropriate precautionary measures are not taken.

WARNING

DANGER OF INJURIES AND/OR RISK OF PROPERTY DAMAGE.

Indication of an immediately impending hazard which can cause serious injuries or property damage if the appropriate precautionary measures are not taken.

CAUTION

RISK OF PROPERTY DAMAGE.

Indication of a possible hazard which may cause damages of the equipment if the appropriate precautionary measures are not taken.

Additional information on working with the laser marking device and protection of the environmental are emphasised as follows:

NOTICE

Useful additional information and tips!

ENVIRONMENT

**Protect the environment!
Instructions for observing environmental protection regulations!**

2.4 Warranty

The manufacturer guarantees that the product does not have any manufacturing or material defects.

The warranty period shall be 12 months from the dispatch date in as far as no other contractual ruling has been made.

The scope of warranty is limited to the repair or replacement of the product supplied by the manufacturer.

The manufacturer is responsible for returning repairs under warranty to the customer, the customer is responsible for returning the device to the manufacturer.

The manufacturer does not accept any liability under warranty

- if the product has been damaged by incorrect handling or operation, or as a result of improper use,
- if seals on the device have been broken,
- for damage caused by use under unauthorised environmental conditions,
- for damage to the device if it is not returned in its original packaging,
- for consequential damage.

2.5 Technical Customer Service

ACI Laser GmbH
Steinbrüchenstraße 14
D-99428 Grammetal OT Nohra
Germany

Phone: +49 3643 4152-0
Fax: +49 3643 4152-77
service@ACI-Laser.de
www.ACI-Laser.de

NOTICE

The laser device may only be maintained and repaired by the manufacturer. Any manipulations on the device or breaking the warranty seal will void any claims under warranty.

3 Safety

3.1 Basic Safety Instructions



The following safety instructions have fundamental importance for the use of the laser marking device, and for its care and maintenance. They must always be followed and are only stated centrally here.

Functional safety

In order to realise functional safety, the laser marking devices of ACI product groups, **Business Diode GN** und **Business Diode UV**, contain the safety module, "laser safety device" (hereinafter also referred to as SD). It is classed in category 3 and achieves performance level (PL) e according to the DIN EN ISO 13849-1 standard.

Characteristics according to DIN EN ISO 13849-1:

Performance Level:	e
Category:	3
MTTF _d :	> 67 years
DC _{avg} :	mean (90% - 99%)

Based on the useful life of the shutter module (swivelling diaphragm), this module must be replaced after 14 years, at the latest, in order to maintain performance level e.

Laser class

As an OEM component, the **DPL Nobilis Marker** and the **DPL Lexis Marker** are class 4 laser marking devices according to DIN EN 60825-1 "Safety of Laser Devices".

- The accessible laser radiation is very dangerous to the eyes and skin.
- Even diffuse, scattered laser radiation can be dangerous if the accessible radiation exceeds the class 1 threshold.
- Improperly used laser radiation may lead to a risk of fire or explosion.

The following measures must be taken in order to be able to categorise the **DPL Nobilis Marker** and the **DPL Lexis Marker** as a class 1 laser device (accessible laser radiation is harmless):

- Ensure that the entire beam path to the work piece is shielded beam-tight.
- Those parts of the screening which can be removed without tools must be fitted with safety switches which interrupt the beam path before the laser beam leaves the device.
- Viewing windows (e.g. in the enclosure or the screening) must be fitted with laser protection glass appropriate for the wavelength and the laser power class.

The guidelines stated in DIN EN 60825-4 "Safety of Laser Devices" and DGUV no. 11 "Laser Radiation" must be implemented if the accessible laser radiation cannot be reduced to below the class 1 threshold values when the device is integrated into the installation.

Emissions

- If the design of the installation prevents the requirements for class 1 laser devices being fulfilled, the area around the laser system must be protected by
 - adjustable walls,
 - light signals and
 - warning noticesso that adequate notice is given of the danger before the area is entered.
- Install a second emission warning light in the view of the operator. During operation, this signals that the beam catcher (shutter) arranged in the laser beam path is open. The shutter consists of a screen which can be swivelled into the beam path, so interrupting the laser process.
- Chemical and physical reactions during the laser marking can cause
 - gases,
 - vapours,
 - aerosols,
 - dusts,

- mists or
- other reaction products

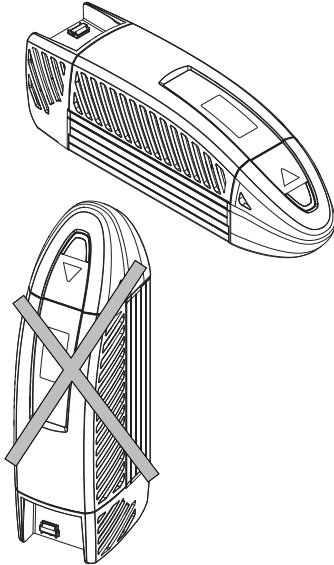
to be given off from the material surface.

These may be toxic, depending upon the material being processed. The operating company must therefore provide effective extraction. Information about this can be found, for example, in the VDI guideline 2262 1...3 "Air Quality in the Work Place".

- Please contact the manufacturer with regard to relevant accessories and protective equipment.

Safety

General



- Read the operating instructions and always keep them in an accessible place.
- Do not mark any easily flammable or combustible materials.
- Do not transport, store or operate the device in a vertical position. There is a risk of damaging optical components.

Initial start-up

- The ambient temperature must lie within the range of $> 20\text{ }^{\circ}\text{C}$ and $< 30\text{ }^{\circ}\text{C}$. The condensation temperature as a function of the momentary relative air humidity must be $< 20\text{ }^{\circ}\text{C}$. You will find an instruction for estimating the momentary value in the appendix.
- Ensure that the relative air humidity does not exceed 85%.
- Never start the device immediately after large temperature changes. Condensation water may damage the device.
- Ensure that an adequate air supply can be provided at the location of the supply unit

and that none of the vents are covered.

The vents must be clear and free of any residual packing material.

- Mount the device at the installation site in accordance with the regulations.
- Ensure that the shutter is active (closed) during the set up.

The main beam is simulated by a pilot laser.

The laser is not harmful to the skin. The eyes are protected by the natural blink reflex.

Operation

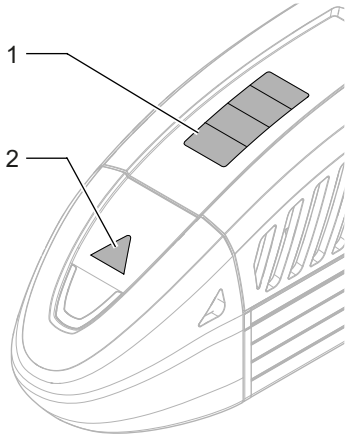
- The laser marking device may only be operated by trained personnel. It is advisable to log both the initial training as well as the regular refresher courses.
- The device may only be operated when connected to an alternating voltage supply corresponding to the specifications on the type plate.
- The effectiveness of the protective conductor must be regularly checked and confirmed by an authorised skilled worker.
- If a defect occurs in the laser marking device, it must be disconnected from the power supply system and secured against being switched on again.

Maintenance/Care

- Maintenance and repair work on the laser device may only be performed by the manufacturer.
- The device must be disconnected from the power supply system before the covers are removed.
- Do not touch the electrical/electronic components. Capacitors could still be charged and so be under voltage.

3.2 Labels at the Device

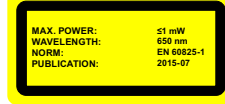
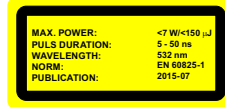
Warning notices



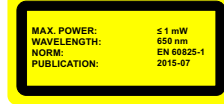
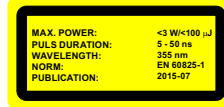
The warning notices on the device point out possible hazards from the laser and provide information about the basic performance data of the laser units.

- On the top of the enclosure (1):

DPL *Nobilis* Marker



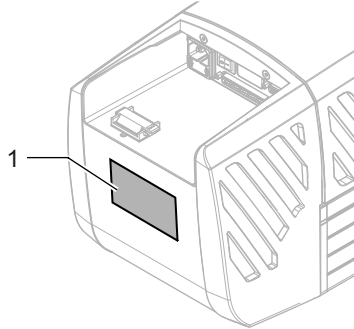
DPL *Lexis* Marker



- On the beam outlet cover (2):



Type plate



The type plate (1) on the back of the laser marking device contains information about:

- series number,
- manufacturer,
- date of manufacturing,
- operating voltage/frequency range,
- power consumption and
- device fuse.

ACI Laser GmbH
Steinbrüchenstraße 14
99428 Grammetal OT Nohra
Germany
phone: + 49(0)3643 4152-0
fax: + 49(0)3643 4152-77
www.ACI-Laser.de
info@ACI-Laser.de



Model:	DPL Nobilis Marker
Serial Number:	2001NL0580
Manufacturer:	ACI Laser GmbH
Date of Manufacturing:	01/2020
Line Voltage:	100-240VAC, 50-60Hz
Max. rated power:	200W
Fuse:	230V/2 x 2,5AT 110V/2 x 5,0AT



Vor Öffnen des Gehäuses Netzstecker ziehen!
Disconnect power before opening cover!
Avant d'enlever le capot débrancher l'appareil!

ACI Laser GmbH
Steinbrüchenstraße 14
99428 Grammetal OT Nohra
Germany
phone: + 49(0)3643 4152-0
fax: + 49(0)3643 4152-77
www.ACI-Laser.de
info@ACI-Laser.de



Model:	DPL Lexis Marker
Serial Number:	2001LX0580
Manufacturer:	ACI Laser GmbH
Date of Manufacturing:	01/2020
Line Voltage:	100-240VAC, 50-60Hz
Max. rated power:	200W
Fuse:	230V/2 x 2,5AT 110V/2 x 5,0AT

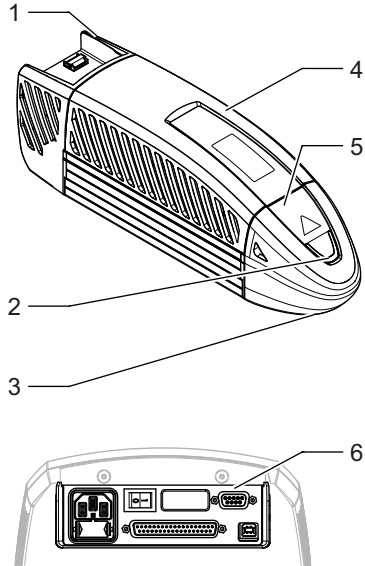


Vor Öffnen des Gehäuses Netzstecker ziehen!
Disconnect power before opening cover!
Avant d'enlever le capot débrancher l'appareil!

Description

4 Description

4.1 Overview



The functional units of the laser marking device contain the following components:

- (1) air cooling for beam source
- (2) multi function display
- (3) focal lens
- (4) laser electronics, beam source, beam expander and shutter
- (5) galvanometer scan unit
- (6) power input module and interfaces

4.2 Intended Purpose

The object of marking a work piece is to produce a marking with the following properties:

- durability,
- high contrast,
- high resolution,
- minimal stress on the material and
- minimal change in its properties.

These requirements are optimally fulfilled by the **DPL Nobilis Marker** and the **DPL Lexis Marker**.

The laser marking device is a highly-integrated marking system.

The components

- optics and
- control electronics

are located in a compact functional unit.

In contrast to other comparable systems, the **DPL Nobilis Marker** and the **DPL Lexis Marker** guarantee:

- The easiest integration into existing production lines because of its small dimensions and low weight.
- Increased operational safety by the elimination of external electrical components.
- Increased operational safety by the elimination of complex water-air-cooling units.
- Minimising the down times and maintenance costs by replacing the complete functional unit during maintenance and service work.

4.3 Principle of Operation

Laser beam source

The laser source consists of a Q-switched Nd:YVO₄ laser (neodymium-doped yttrium vanadate) whose emission wavelength 1064 nm is converted by frequency multiplication with optically nonlinear crystals in the visible or ultraviolet spectral range.

The pulsed laser radiation of the basic wavelength 1064 nm is generated in a resonator by the optically pumping of a Nd:YVO₄ crystal and modulated with an acousto-optic Q-switch. Depending on the configuration frequency conversion takes place inside a resonator with a SHG (second harmonic generation) crystal in the visible spectral range at 532 nm (**DPL Nobilis Marker**) or by another THG (Third Harmonic Generation) crystal at 355 nm (**DPL Lexis Marker**).

First-pulse suppression

Q-switched solid-state lasers possess the characteristic that at high pulse frequencies in the kHz range, the pulse energy of the first pulses is often significantly greater than the pulse energy of the following pulses. For extremely sensitive materials, in particular, this pulse increase results in a strong reaction on the material, which is revealed in the form of broadened laser structures at the beginning of the vector contours. In order to minimise (or prevent) this effect, first-pulse suppression (FPS) can be activated. FPS reduces the pulse energy of the first pulses so that all the pulses in a pulse train possess virtually the same energy.

The FPS setting is made in the **Magic Mark** software by specifying a time in μs , which should be indirectly proportional to the pulse repetition frequency. This value should always be set (or optimised) depending on the material involved. The reciprocal value of the pulse repetition frequency - plus 20% of this value - is recommended as the start value for optimising this time. For example, for a pulse repetition frequency of 40 kHz, this would result in a start value of 30 μs to optimise the FPS. The FPS is not activated if a time of 0 μs is specified.

Shutter	<p>A swivelling screen is arranged in the laser. The laser process is interrupted by closing the shutter.</p>
Pilot laser	<p>The wavelength of the working laser is not in the visible range. The light of a low power red laser diode is reflected into the beam path between the shutter and scanhead to check the marking window.</p> <p>This enables the positions of the marking window to be made visible when the shutter is closed.</p>
Beam deflection	<p>The focusing point of the laser beam has to be deflected in the x and y directions in order to mark greatly differing materials. This is achieved by the deflection units of a galvanometer scanner.</p> <p>Focusing is assisted by one of three alternative plane field objectives, whose focal length determines the size of the marking field and the spot diameter.</p>
Laser electronics	<p>The internal laser control monitors and regulates the entire process of beam generation and deflection. It communicates with the controlling PC via an USB interface. Its information and commands are evaluated and executed.</p> <p>The laser marking device has a laser control interface with active 24 V I/O signals as an interface to external systems.</p>
Laser Safety Device (SD)	<p>The laser safety device (SD) is the central safety module of the laser marking devices of the ACI product groups, Business Diode GN und Business Diode UV. It meets the requirements for the safety feature according to the DIN EN ISO 13849-1 standard, performance level e.</p> <p>The safety feature consists of the redundant control and continuous monitoring of the two output paths (diaphragm/shutter, protective relay) as well as continuous monitoring of the input paths (interlock circuits, ILK1 and ILK2). This ensures at all times that, in the event of error, emission of laser radiation due to opening of the interlock circuits is prevented.</p>

Description

Opening the interlock circuits will immediately cause the diaphragm to swivel into the beam path, thus interrupting the laser process.

In the event of the following errors:

- Exceeding the defined time period of 200 ms upon opening or closing the diaphragm,
- Short circuit or interruption of the interlock circuits,
- Exceeding the defined time period of 150 ms upon switching the two interlock circuits,
- Overvoltage or undervoltage in the SD power supply,
- Internal SD error

in addition to closing the diaphragm, the protective relay is switched off, thus disconnecting the entire laser marking device from the power supply. Only the laser electronics continues to be supplied with power, thus allowing communication with the user application; hence, display or analysis of the error cause.

A system that was switched off due to an error can be put into operation again only by switching it off and on again, provided that the error cause has been removed.

The SD checks all safety-relevant features upon switching on the laser marking device. Only in the absence of errors will the protective relay be activated, thus starting up the laser marking device. If the SD detects errors in the instant of switching on, then these will also be forwarded to the user application via the laser electronics.

4.4 Technical Data

Laser device

DPL *Nobilis* Marker

Laser material:	Nd:YVO4, frequency-doubled
Wave length:	532 nm
Laser power:	5 W
Pulse repetition rate:	60 - 300 kHz
Pilot laser:	650 nm, < 390 μ W
Laser class:	4
Performance level:	e

DPL *Lexis* Marker

Laser material:	Nd:YVO4, frequency-tripled
Wave length:	355 nm
Laser power:	2 W
Pulse repetition rate:	40 - 200 kHz
Pilot laser:	650 nm, < 390 μ W
Laser class:	4
Performance level:	e

Connection values

Power supply:	85 - 264 VAC/6 A/50 - 60 Hz
Power consumption (max.):	200 W

Fuse protection

110 VAC:	2 x 5 AT
220 VAC:	2 x 2.5 AT

Description

Interfaces

Power supply:	3-pin socket with fine-wire fuse
PC interface:	USB 2.0
Interlock connection:	- dual-circuit interlock - SD-Ready
Laser control interface for:	- external emission light - signal ready - 8 freely programmable in-/outputs - optional connections for encoder

Scan unit

Aperture:	9 mm
Scanning speed:	< 10 m/sec

Focusing objectives (optional)

DPL *Nobilis* Marker 100

Spot diameter ⁽¹⁾ :	13 µm
Marking field size:	50 mm x 50 mm
Focusing length ⁽²⁾ :	136 mm ± 3 mm

DPL *Nobilis* Marker 160

Spot diameter ⁽¹⁾ :	21 µm
Marking field size:	100 mm x 100 mm
Focusing length ⁽²⁾ :	210 mm ± 3 mm

DPL *Nobilis* Marker 240

Spot diameter ⁽¹⁾ :	32 µm
Marking field size:	160 mm x 160 mm

Focusing length⁽²⁾: 305 mm ± 5 mm

DPL Lexis Marker 100

Spot diameter⁽¹⁾: 9 µm

Marking field size: 60 mm x 60 mm

Focusing length⁽²⁾: 155 mm ± 3 mm

DPL Lexis Marker 162

Spot diameter⁽¹⁾: 15 µm

Marking field size: 95 mm x 95 mm

Focusing length⁽²⁾: 248 mm ± 3 mm

DPL Lexis Marker 255

Spot diameter⁽¹⁾: 22 µm

Marking field size: 140 mm x 140 mm

Focusing length⁽²⁾: 398 mm ± 5 mm

(1) Deviations may occur with different materials.

(2) The exact value for distance is stated in the parameter file supplied with each device.

Beam source dimensions incl. scanner

Length x width x height: 740 mm x 201 mm x 233 mm

Weight: 20 kg

Operation and storage conditions

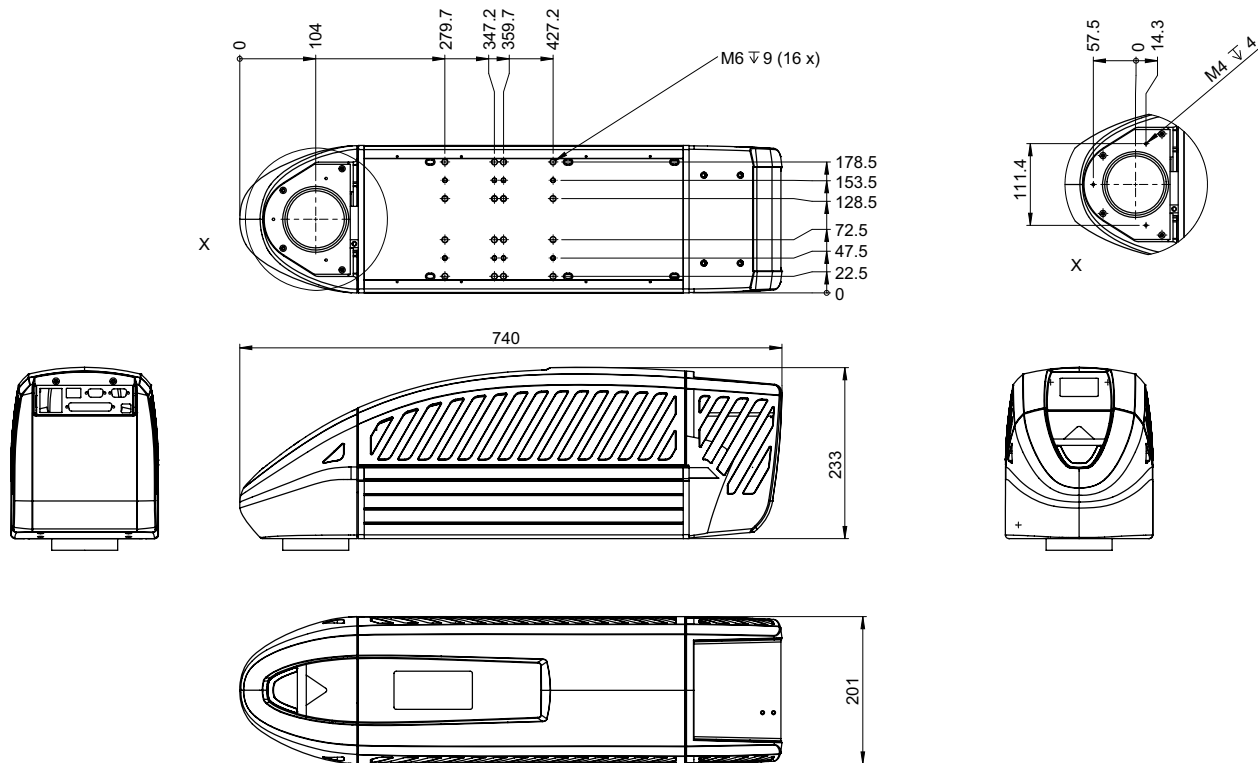
Operating temperature: 25 °C ± 5 °C

Storage temperature: 10 °C - 50 °C

Air humidity: 30% - 85%, non-condensing

Description

Technical drawing



4.5 Scope of Delivery

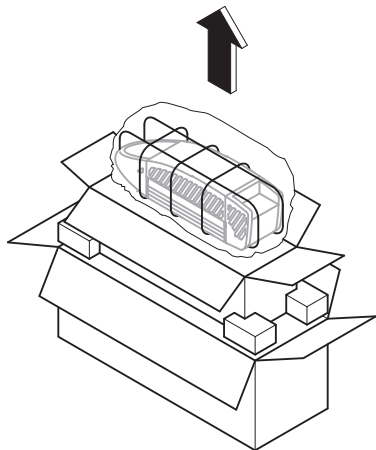
- **DPL *Nobilis* Marker** or **DPL *Lexis* Marker** laser device completely mounted,
- power cable,
- connection cable for USB 2.0,
- 37-pin sub-D housing to wire the laser control interface,
- 9-pin sub-D housing to wire the interlock connection,
- CD ROM with Marking software,
- operating instructions,
- software manual.

NOTICE

Check that the delivery is complete and undamaged. Please contact our service department if you have any queries.

5 Installation

5.1 Unpacking



The laser marking device is delivered in a packaging which meets UPS "falling regulations".

From the inside outwards:

- **DPL Nobilis Marker** or **DPL Lexis Marker** laser device completely mounted,
- foam grid,
- vacuum-tight, welded aluminium foil with desiccant,
- inner carton,
- foam corners,
- outer carton with accessories included in the scope of delivery.

1. Open the carton on the top. Take note of the marking **OBEN (TOP)**!
2. Remove the laser marking device in its packing material and put it down in a safe place.
3. Open the foil packing and pull it off.
4. Remove the foam grid from the device.
5. Place the device on a flat surface.
6. Remove the accessories and place them down.
7. Check the scope of delivery for completeness.

NOTICE

Store the packaging material in a safe place in case the device has to be returned to the manufacturer under warranty for maintenance and repair work.

In such a case repack the laser marking device into its original packaging in the reverse order and seal it securely.

5.2 Mechanical Installation

⚠ WARNING**RISK OF PERSONAL INJURIES AND MATERIAL DAMAGE FROM LASER RADIATION!**

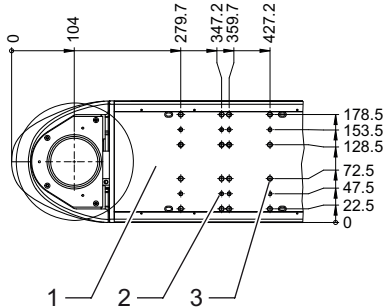
All safety-related devices must be installed and their effectiveness proven before the system is started up. The acceptance must be performed by the laser safety officer and recorded in writing. For safety reasons, the laser must not be activated until all the above-mentioned conditions have been fulfilled.

⚠ CAUTION**RISK OF DAMAGING THE OBJECTIVE!**

Leave the protective cover on the objective throughout the entire installation.

Installation

Assembly



A mounting surface (1) is provided on the underside of the device to enable it to be mechanically integrated into a system.

The position of the bore holes (measured in mm) for

- M6 fixing screws (3) with washers/tooth lock washers
- alignment pins (2) $\varnothing 6$ H7

can be seen in the drawing on the left.

For the attachment four screws and two pins are used at a time.

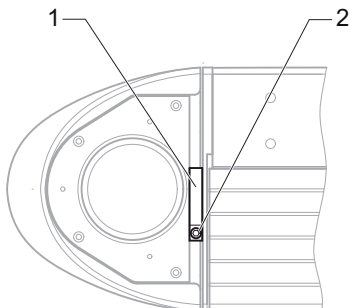
NOTICE

The above-mentioned standard parts are not included in the scope of delivery. Take note of the maximum screw depth of 8 mm.

The length of the bearing surface on the system side should be at least 100 mm.

NOTICE

The manufacturer recommends fitting in a horizontal position as the scan unit can be swivelled if necessary.

Swivelling the scan unit

1. Loosen the fixing screw (2) of the clamp ring (1).
2. Rotate the scan unit through the permissible swivelling range.

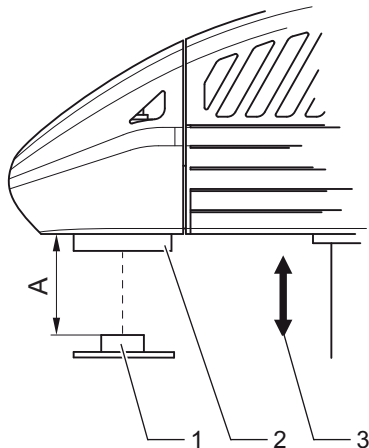
⚠ CAUTION

RISK OF DAMAGING THE CABLE HARNESS!
Avoid the damage of the cable harness when rotating the scan unit.

3. Lock the scan unit by hand-tightening the fixing screw (2).

Installation

Focusing



NOTICE

A defined distance between the objective of the scan head and the work piece must be set in order to focus the laser beam optimally on the surface of the work piece.

The distance (A) between the lower edge of the scan unit (2) and the surface of the work piece (1) depends upon the type of objective used:

Type	A	Marking field size
DPL Nobilis Marker 100	136 mm \pm 3 mm	50 mm x 50 mm
160	210 mm \pm 3 mm	100 mm x 100 mm
240	305 mm \pm 5 mm	160 mm x 160 mm
DPL Lexis Marker 100	155 mm \pm 3 mm	60 mm x 60 mm
162	248 mm \pm 3 mm	95 mm x 95 mm
255	398 mm \pm 5 mm	140 mm x 140 mm

NOTICE

The exact value for distance (A) is stated in the parameter file supplied with each device!

The availability of a suitable height adjustment (3) is a useful aid when focusing.

5.3 Installing the Marking Software

Minimum hardware requirements

- PC with 64 bit operating system Windows 7 or 10,
- CD ROM drive,
- 1 free USB 2.0 interface,
- monitor (recommendation: 17 inch),
- keyboard, mouse.

If necessary, you will receive this additional information from the manufacturer.

Installation

1. Start your PC.
2. Ensure that the above-mentioned operating system is installed on your PC.
3. Place the CD labelled **Magic Mark** into the CD drive.
4. Open the directory **Magic Mark** in Explorer with a double click.
5. Start the setup.exe by double-clicking.
6. Follow the instructions of the installation program.
The following message appears when the installation has been completed:
Setup Complete.
7. Confirm this by pressing the **ENTER** key.
8. Start your PC again.

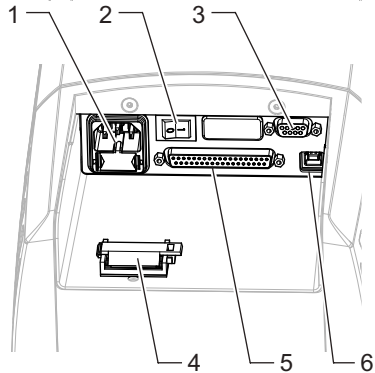
NOTICE

You will find detailed instructions for configuring the marking system in the Software Manual.

Installation

5.4 Electrical Installation

5.4.1 Interfaces



WARNING



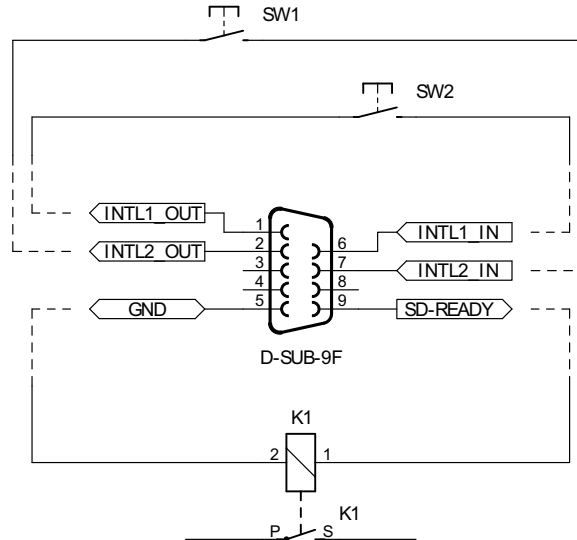
DANGER OF INJURIES AND/OR RISK OF PROPERTY DAMAGE!

The device interfaces may only be connected to the plant by an electrician in cooperation with a laser safety officer!

The interfaces are located on the back above the laser diode module:

- (1) the power input module with integrated power switch and drawer for fine fuses
- (2) power switch
- (3) interlock connection, 9-pin, sub-D
- (4) cable relief to lock connected cables
- (5) laser control interface, 37-pin, sub-D, panel socket, as an interface to the plant/line
- (6) USB 2.0 interface, for communication between control PC and laser marking device

Interlock connection



Interlock circuit 1 and 2

Pin 1, pin 6 INTL1_OUT, INTL1_IN
external interlock circuit 1

Pin 2, pin 7 INTL2_OUT, INTL2_IN
external interlock circuit 2

In order to integrate the laser marking device into an external, dual-channel, safety circuit, 2 potential-free independent safety switches must be wired between pin 1/6 and pin 2/7 (see image).

To this end, it must be ensured (mechanically) that both switches reliably within a period of 150 ms.

Alternatively for the use of potential-free safety switches, it is possible to use a safety relay based on Performance Level e with appropriate wiring in accordance with the manufacturer's specifications.

Please use a shielded, four-wire cable with a wire cross-section of at least $4 \times 0.5 \text{ mm}^2$ to connect the interlock circuits and connect the diaphragm located on the plug connector of the laser marking device to connector housing and earth (pin 5).

Pin 9 **SD-READY**
24 V, max. 100 mA, short-circuit proof

Pin 5 **GND**
Reference for SD-READY

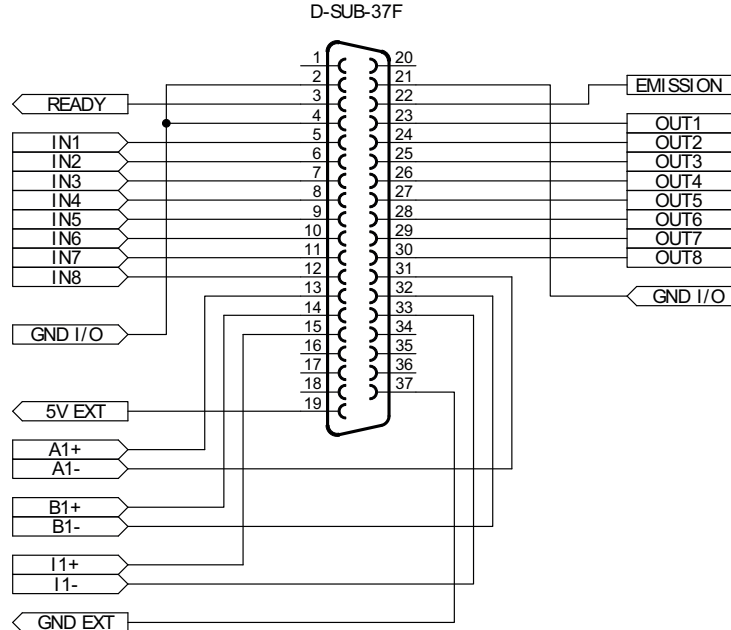
When the laser safety device (SD) is ready for operation, pin 9 carries 24 V against pin 5. Connecting a suitable indicator light or a switching element allows readiness for operation and absence of errors in all safety-relevant components to be signalled to the user, respectively the overriding control.

For connection, please use a shielded, two-wire cable with a wire cross-section of at least $2 \times 0.5 \text{ mm}^2$ and connect the diaphragm located on the plug connector of the laser marking device to connector housing and earth (pin 5).

If possible, the end points of connected cables should also be connected to earth, respectively earth potential (protective conductor).

Laser control interface



The Laser control interface is realised by a 37-pin, sub-D, panel socket, two-rowed. Depending upon the application case, the laser control interface may be wired by the user.



External emission light

Pin 22 **EMISSION**
24 V, max. 200 mA, protected by polyfuse.

Pin 22 carries 24 V when the shutter is open.
The connected emission warning light signals danger from laser radiation.

 WARNING	
	<p>DANGER OF INJURIES AND/OR RISK OF PROPERTY DAMAGE FROM LASER RADIATION!</p> <p>Wiring this output is specified for operation in accordance with a class 4 laser.</p>

Emission ready

Pin 3 **READY**
24 V, max. 200 mA, protected by polyfuse.

This output produces a composite signal of all possible error states.
The output is set when all components function within normal parameters and the laser is ready for operation.
This signal can be processed both optically and electronically.
This output is an essential aid, particularly for use in production lines.

Inputs and outputs

Pin 5 to 12 **IN1 to IN8**
24 V, 3.5 mA
Control inputs for the PLC connector

Pin 23 to 30 **OUT1 to OUT8**
24 V, max. 0.5 A

electronically secured, short-circuit-proof,
Inductive loads may be connected.
There is an internal freewheel diode.

Pin 2, 4, 21

GND I/O

Reference points for all 24 V inputs and outputs
as well as READY and EMISSION

The inputs can be queried during a marking cycle and so start e.g. a marking job. The freely programmable outputs can, for example, be used to indicate the end of an inscription. Please refer to the software manual for information concerning the processing of signals by the marking software.

NOTICE

Current limitation: There is a common limit to the current for all outputs. If the maximum permissible current (0.55 A) is exceeded, all the outputs are switched off (see page 49 Overload I/O).

Connections for optional encoders (Marking on the fly)

Pin 13, Pin 31
Pin 14, Pin 32
Pin 15, Pin 33

A1+, A1-
B1+, B1-
I1+, I1-

Differential encoder inputs for 1.5 V level

Pin 19, Pin 37

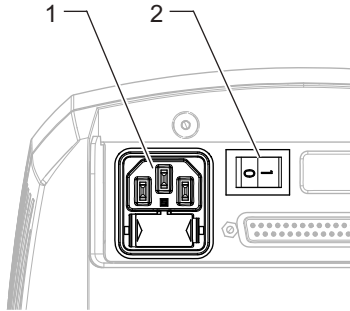
5V EXT, GND EXT

Encoder power supply, 5 V,
max. 100 mA, protected by polyfuse,
The supply voltage is switched on by software.

Installation

5.4.2 Connection

Power connection



1. Ensure that the device power switch (2) is switched off.
2. Connect the supplied power cable to the power input module (1) of the laser device.
3. Connect the power cable to a safety contact socket.

Connection with the PC

1. The marking software must be installed.
2. Connect the USB interface of the laser marking device with the PC.

NOTICE

The laser control interface must be correspondingly wired.

5.5 Checking the Installation



RISK OF PROPERTY DAMAGE.
Perform the following tests to avoid material damage.

Please check the following points again before you start your laser system:

- Have the mechanical and electrical installations been performed correctly and completely?
- Does the fuse for the device correspond to the available operating voltage (110 V: 5 A, 2 x or 220 V: 2.5 A, 2 x)?
- **Have you removed the protective cover from the focusing objective?**
- Is the focusing objective clean and dust-free?
- Do the environmental conditions meet the requirements (temperature, air humidity)?
- Are all the vents open?
- Is there an adequate fresh air supply to the laser device?
- Are you familiar with the essential laser protection regulations? Have all the laser safety measures been taken?
- Has the laser safety officer accepted the installation?

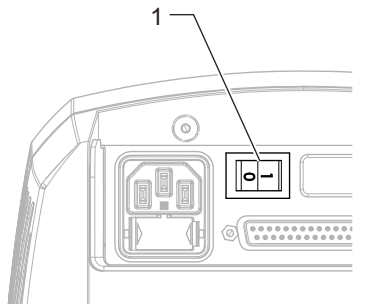
Operation

6 Operation

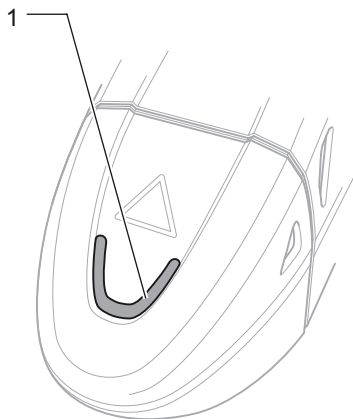
6.1 Operating and Display Elements

Control elements

The laser marking system just has a power switch (1) beside the power input module.



Multi function display



On the multi function display (1) the current working state of the laser marking device is to be seen.

Display	State	Meaning
Dark blue	Offline	Device switched on, Software not started or no communication
Dark-straw	Off	Communication exists, laser not activated
Dark green with pale yellow flash	On (not ready)	Laser activated, not ready for operation
Dark-green	On (ready)	Laser activated, ready for operation
Dark green with pale yellow light running down on both sides	Emission	Device operates
Light-yellow flashing	Warning	Warning, but the device continues to operate
Bright red flashing	Error	Fault, device deactivated, all power levels switched off electronically, see Fault Finding

6.2 Starting the Laser Marking Device

NOTICE

Keep to the switching sequence on each start.

1. Start the control PC.
2. Wait until the operating system has completely loaded.
3. Switch on the device power switch.

NOTICE

The interlock circuits must be open when switching on the device.

Follow the Windows installation instructions during the initial commissioning.
The main power pack supplies the supply voltages required.
The laser is not yet ready for operation.

4. Start the marking software.
The laser and scanner control, and the galvanometer are then initialized.

NOTICE

**The marking software starts in demo mode if it is not possible to communicate with the laser marking device.
The same happens if the software is started before the marking device.
You will find more detailed information on the software manual.**

6.3 Handling

The laser marking device is operated via the marking software.

All operating sequences are controlled from the control PC via the laser control interface.

All the parameters are exclusively entered on the keyboard of the control computer.

NOTICE

Detailed information for using the marking software is contained in the software manual provided.

6.4 Fault Finding

6.4.1 General Faults

Problem/Fault	Possible cause	Elimination
Error message when loading the marking software	Marking software incorrectly installed	Reinstall the software.
No communication	USB cable not connected properly	Check whether the cable is plugged in correctly.
	No supply voltage	Check whether your laser is supplied with power.

Problem/Fault	Possible cause	Elimination
Laser will not start	USB cable not connected properly	Check whether the cable is plugged in correctly.
	Interlock circuits closed	Open the interlock circuits (must always be open upon system start-up).
	SD error	Start the marking software and check status / error reports in the status bar, respectively in the message window, to receive detailed information.
No laser beam	Shutter closed	Check whether all safety switches are locked. Check whether the shutter is opened in your marking job.
	Defocusing	Check the focus position by changing the distance between focusing objective and work piece.
	Incorrect laser parameters	Check your laser parameters, they may not be suitable for the work piece to be marked.
Laser power too low	Defocusing	Check the focus position by changing the distance between focusing objective and work piece.
	Incorrect laser parameters	Check your laser parameters, they may not be suitable for the work piece to be marked.
Laser switches off automatically	Environmental conditions do not meet the specifications	Check the environmental conditions. Keep to the environmental conditions required.

NOTICE

Please contact our Technical Customer Service in the first instance if the fault cannot be eliminated as described above.

6.4.2 Specific Faults

The **Magic Mark** marking software monitors the laser device for possible faults and provides the user with status messages about the state of individual system components.

The messages are displayed in the system windows **Messages** on the monitor.

Status/Error	Trigger	Message	Evaluation per Software
+/-15V Error,<13V >-13V	Head Control	ERROR 15V	Display + Cut Off
+/-15 Error,<13.5V >-13.5V	Head Control	WARNING 15V	Display Warning
Interlock circuits closed during the starting process	Laser Safety Device	SD WARNING interlock closed during startup	Display Warning
Interlock circuits open during current labelling	Laser Safety Device	SD WARNING interlock opened during operation	Display Warning
Shutter fault	Laser Safety Device	SD shutter ERROR	Display + Cut Off
Interlock fault	Laser Safety Device	SD interlock ERROR	Display + Cut Off
SD undervoltage	Laser Safety Device	SD ERROR internal undervoltage	Display + Cut Off
SD error	Laser Safety Device	SD internal ERROR	Display + Cut Off
24V Error, <22.0V	LaserIFace	ERROR 24V	Display + Cut Off
24V Error, <22.5V	LaserIFace	WARNING 24V	Display Warning
Overload I/O	LaserIFace I/O	ERROR Overload I/O	Display + Cut Off
Laser fault	Laser beam source/ LaserIFace	ERROR Laser beam source	Display + Cut Off
Temperature fault, Laser beam source	Laser beam source/ LaserIFace	WARNING Temp > 40 deg.C	Display Warning

Operation

Status/Error	Trigger	Message	Evaluation per Software
Temperature fault, Laser beam source	Laser beam source/ LaserIFace	ERROR Temp > 40 deg.C	Display + Cut Off

An overview of the possible messages and their meaning can be found in the software manual.

7 Maintenance and Repair

7.1 Care

Perform the following care activities on the device at regular intervals.

- Clean the objective.
- Clean the ventilation slits of the covers.

 WARNING	
	DANGER OF INJURIES AND/OR RISK OF PROPERTY DAMAGE. Ensure that the power plug has been pulled out before starting the cleaning tasks!

Maintenance and Repair

Cleaning the objective

A dirty objective reduces the transmission of the laser radiation. This leads to a reduction of the laser power on the work piece. The dirt can burn into the surface and damage the focusing objective.

NOTICE

The warranty does not cover any damage caused by inadequate or improper cleaning.

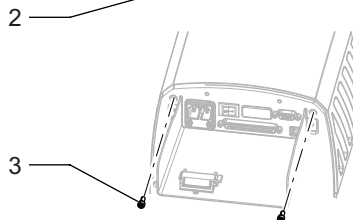
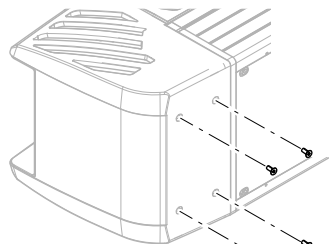
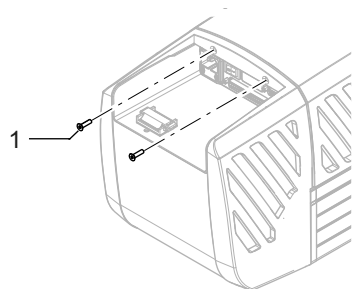
Make a regular visual inspection of the focusing objective. Clean the objective if any dirt is found. Only cleansers which are authorised for high-quality optics may be used for this purpose:

- Never attempt to remove particles of dirt from the surface with compressed air.
- Use a suitable lens cleaning paper and ethanol of optical purity standard.
- Moisten one side of the cleaning paper. Do not touch the moist side under any circumstances.
- Draw the cleaning paper slowly over the focusing objective. In so doing, draw the cloth in one direction only.
- Remove any ethanol residue with a dry lens cleaning paper if necessary.
- Repeat the procedure until the surface is completely clean. Use a new cleaning paper each time.

NOTICE

Suitable cleansers can be obtained from the manufacturer.

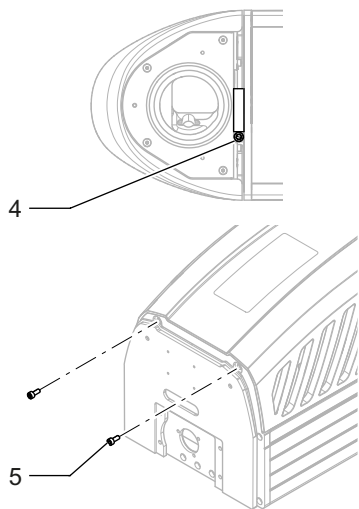
Cleaning the ventilation slits



Cleaning the ventilation slits regularly is a prerequisite for faultless operation of the device. Clean the ventilation slits as follows:

1. Remove the two fixing screws (1) from the back of the laser device and the four screws (2) from the bottom.
2. Pull the rear cover off the device.
3. Remove the two rear screws (3) of the center cover.

Maintenance and Repair



4. Loosen the screw (4) holding the clamping ring of the scan unit and turn the scan unit to the side or remove it.
Ensure that the connecting cable is not damaged or jammed.
5. Remove the two front screws (5) of the center cover.
6. Remove the center cover.
7. Clean the ventilation slits in the covers with a dry or slightly damp cloth.
Do not use any solvent for cleaning them.
8. Ensure that the covers are completely dry before reclosing the device.
9. Reassemble the covers in the reverse order.

NOTICE

**Slide the cover onto the device so its fits exactly.
Screw the fixing screws in hand tight.**

10. Check the electrical connections before bringing the device back into operation.

7.2 Maintenance, Repair

The laser device does not contain any parts which can be maintained or repaired by the user.

All maintenance and repair work must be performed exclusively by the manufacturer. The right to claim under warranty is lost as soon as third parties work on or modify the device.

The manufacturer has suitable test benches and routines to maintain your laser system optimally.



RISK OF PROPERTY DAMAGE.

During the warranty period, use the original packaging exclusively when dispatching the defective device.

Maintenance intervals

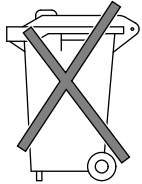
- Seek advice from the Customer Service of the manufacturer as to when your laser marking device should undergo maintenance. This depends on the specific use and duration.
- In order to maintain Performance Level e, the shutter assembly (swivel shutter) must be replaced no later than 14 years.

8 Scrap Disposal

ENVIRONMENT

Protect the environment!

For a fee, the customer will accept return of the laser device and dispose of it properly in a manner that is environmentally compatible.



Environmentally sensible disposal of electrical and electronic equipment!

Electrical and electronic equipment contains valuable materials that should be supplied to recycling or recovery.

Please dispose of electrical and electronic equipment at qualified collecting points separate from municipal waste.

9 Appendix**9.1 Saturation Vapour Pressure as a Function of the Temperature**

t [°C]	p _d ' [mbar]
15	17.04
16	18.17
17	19.36
18	20.63
19	21.96
20	23.37
21	24.86
22	26.42
23	28.08
24	29.82
25	31.66

t [°C]	p _d ' [mbar]
26	33.60
27	35.64
28	37.79
29	40.04
30	42.42
31	44.91
32	47.54
33	50.29
34	53.18
35	56.22

To estimate the condensation temperature T_k , you need:

- T_u ambient temperature,
- T_c internal temperature of the laser marking device = 20 °C = const,
- ϕ air humidity.

Example calculation ($T_u = 25\text{ °C}$, $\varphi = 0.65\%$)

Proceed as follows:

1. Determine the saturation vapour pressure p'_d for $t = T_u$ in the table ($p'_d = 31.66\text{ mbar}$).
2. Calculate the vapour pressure $p_d = \varphi \cdot p'_d$ ($p_d = 0.65\% \times 31.66\text{ mbar} = 20.58\text{ mbar}$).
3. Determine the value $t = T_K$ associated with p_d in the table = 20.63 (nearest value) ($T_K = 18\text{ °C}$).

The following applies as a rule:

For $T_k < T_c$ or $T_k < 20\text{ °C}$

there is no risk of condensation on the laser components.

9.2 EC Declaration of Incorporation

This is to declare that the partly completed machine, based on its design and type of construction and in the version put on the market by us, conforms to the following fundamental requirements as defined in Directive 2006/42/EC on machinery.

Anhang I, Artikel 1.1.2, 1.1.3, 1.1.5, 1.1.6, 1.1.1, 1.2.4.1, 1.3.2, 1.5.1, 1.5.2, 1.5.8, 1.6.3, 1.7

In addition, this partly completed machine conforms to the provisions set forth in Directive 2014/30/EC on electromagnetic compatibility and Directive 2011/65/EU on hazardous substances (RoHS) and the harmonized standard EN 50581:2012.

In the event of any alteration to the partly completed machine or the intended purpose which has not been approved by us, this statement shall thereby be made invalid.

Device:

Marking laser

Type:



Applied EC directives and standards:

- Directive 2006/42/EC on machinery
- EN ISO 12100:2010
- EN ISO 13857:2008
- EN 349:1993+A1:2008

- EN 60204-1:2006+A1:2009
- EN ISO 13849-1:2015
- EN 60825-1:2015-07

Representative for compiling technical documents:

Mirko Wunderlich, Steinbrüchenstraße 14, 99248 Grammetal OT Nohra

Signed on behalf of the manufacturer by:

Nohra, 2019-02-01

ACI Laser GmbH
Steinbrüchenstraße 14, 99428 Grammetal OT Nohra

Mirko Wunderlich
Geschäftsführer

Commissioning is prohibited until it has been determined that the machine which the device is to be installed complies with the provisions of the directive on machinery.

The manufacturer is obligated to send the specific documentation for the partially completed machine to the appropriate national authority in electronic form on request.

Declaration of Conformity according to the Electromagnetic Compatibility Directive 2014/30/EC on the following page.

9.3 EC Declaration of Conformity

We herewith declare that the machine described below, by virtue of its design and construction and moreover in the type brought onto the market by us, conforms to the relevant safety and health requirements of the applicable EU Directives. In the event of any alteration to the device or the intended purpose which has not been approved by us, this statement shall thereby be made invalid.

Device:

Marking laser

Type:



Applied EC directives and standards:

Electromagnetic Compatibility Directive 2014/30/EC
Directive 2011/65/EU on Hazardous Substances (RoHS)

EN 55016-2-1:2014-12
EN 55016-2-3:2014-11
EN 61000-3-2:2015-03
EN 61000-3-3:2014-03
EN 50581:2012

Representative for compiling technical documents:

Mirko Wunderlich, Steinbrüchenstraße 14, 99248 Grammetal OT Nohra

Signed on behalf of the manufacturer by:

Nohra, 2019-02-01



ACI Laser GmbH
Steinbrüchenstraße 14, 99248 Grammetal OT Nohra

Mirko Wunderlich
Geschäftsführer

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Operating Instructions for **DPL Nobilis Marker / DPL Lexis Marker**
Business Diode GN / Business Diode UV

Article number: 10000750
Version: EN 02/2019-03

ACI Laser GmbH
Steinbrüchenstraße 14
D-99428 Grammetal OT Nohra
Phone: +49 3643 4152-0
Fax: +49 3643 4152-77
info@ACI-Laser.de
www.ACI-Laser.de