

# Device Manual

# Nitrogen Laser MNL300



September 2016, Rev. 3

## Dear customers

With the purchase of a laser from the MNL 300 series, you have selected a state-of-the-art Nitrogen Laser.

The laser satisfies sophisticated needs and demanding goals in various applications within the industrial area. The following properties reveal the advantages of the MNL 300.

- High pulse power
- Minimal beam divergence
- Minimal time jitter
- Pulse halfwidths in the sub- and nanosecond range
- Long lifetime
- Low operating costs

These properties make the laser attractive for applications where high quality, stable output and cost-effectiveness are required.

The MNL is mainly used in

- MALDI-TOF-Mass spectroscopy
- Laser-induced fluorescence spectroscopy
- Time-resolved spectroscopy
- laser-induced plasma spectroscopy
- Laser ablation
- Micro-structuring
- Cell dissection under the microscope
- Laser acoustics
- Calibration of fast sensors
- Pump source of dye lasers
- Amplification of ultra-short laser pulses
- Technological processes like laser-induced bonding, hardening and cleaning
- Special applications in the environment and biotechnology

The laser operates on the principle of transversal excitation. A fast high-current discharge will be triggered by means of a solid-state high-voltage switch thus generating laser radiation.

Your laser has been carefully tested for all operating states with LTB's end test program and left the firm in a good condition.

LTB wishes you much success in working with the laser on your projects. If this operation manual does not answer all your questions, please do not hesitate to contact us.

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# 1 Safety precautions

**MNL Lasers are 3B class lasers (IEC 60825-1).**

Improper treatment and operation of the laser can cause damage to your health.

Please follow carefully all the instructions in this manual.

## 1.1 Invisible laser radiation

The laser emits intensive invisible laser radiation in the UV range.

**Do not look into the laser beam! Direct eye contact will cause serious damage and possible blindness.**

Please always wear laser safety goggles appropriate to the wavelength of 337.1 nm and ensure that all persons in the vicinity of the laser also wear laser goggles during laser operation.

For MNL lasers, you need class L6 laser goggles.

Please observe that there are no reflecting materials in the beam path by which the laser beam could unintentionally be directed towards persons or sensitive materials.

**Always use beam shutters made of non-inflammable materials in your set-up.**

Always follow the safety regulations.

## 1.2 High voltage up to 12 kV

A high voltage of up to 12kV is generated in the laser. Therefore, observe the protected earth connection of the mains. The earth conductor connection from the laser housing to the input of the LTB power supply of the laser is ensured.

**Do not open the laser due to occurring dangerous high voltages in the interior of the laser!**

Because of high voltage circuits, the laser should never be opened nor should any objects be put into the laser casing openings.

## 1.3 Dangerous gases

The high-energetic UV radiation causes ozone. No noxious gases are used in the laser. The cartridge has a pressure-safe sealing.

**Please observe that the laser operating room is sufficiently ventilated.**

## 1.4 Symbols



Danger of hazardous invisible laser radiation.



Danger of hazardous high voltage.



Important operating instructions. Please read the manual first.

## **1.5 Servicing and Disclaimer**

The laser must be used properly. LTB is not liable for improper use.

Opening of the laser is prohibited. If warranty or general repair or service to a LTB product is requested by the customer involving the product's return to LTB.

### ***1.5.1 Resonsibilities of the buyer***

The buyer is responsible for providing the appropriate utilities and a operating enviroment as outlined in the product literatur.

Damage to the laser system caused by failure of buyer's utilities or failure to maintain an appropriate operating environment, is solely the responibiliety of the buyer and is specifically excluded from any warranty, warranty extension, or services ageement.

### ***1.5.2 Liability, Replacement parts***

Any modification of the laser, replacement of components or adjustment of the laser must be done by authorized service staff.

Only components tested by LTB must be used.

Any liability and warranty lapses with the opening of the laser or any modification without LTB's explicit written consent.

Damages caused by the disregard of this user manual are not subject to warranty. LTB will not accept liability for any resulting defects or problems.

### ***1.5.3 Disclaimer of Implied Warranty***

The foregoing is in lieu of all other warranties Expressed or Implied, and there are no warranties of merchantability or fitness or any other remedies available other than as expressed herein.

## **1.6 Cleaning instruction**

For cleaning, turn off the laser and disconnect from mains!  
Do not use cleaning supplies. Use a slightly moist or dry cloth to clean the enclosure, be careful with the link.  
The laser can be put back into operation after drying.

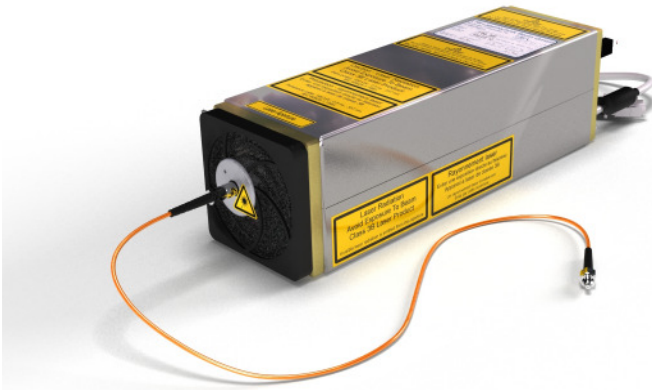
## **1.7 Conditions Of acceptability**

The user is responsible to verify the requirement of the standard IEC60825-1:2007 and has to provide information about NOHD (Nominal Ocular Hazard Distance) and MPE in his own devise documentation.



## 2 System requirements

### 2.1 Place and way of installation



The laser has to be operated and stored in a dry, dust-poor and well-ventilated area.

Operation temperature	°C	+15 ... +38
Storage temperature	°C	-10 ... +60
Max. rel. humidity	%	85
Air pressure	mbar	750 ... 1300

Please make sure that the laser is not placed close to any heat sources.

Moreover observe that the air inlet is on the side of the beam output of the laser and must not be blocked. We advice to replace the air inlet filters of the laser every 6 to 18 months depending on the dust concentration of the cooling air.

The air outlet openings on both sides of the laser cover must stay free. Minimum spacing to cabinet walls perpendicular to airflow is 80 mm.

No spacing requirements for other surfaces.

Mounting the laser may only be realized via the base plate with the red-marked threaded holes. (See Dimensions and interfaces, appendix 7.4)

The laser may be used in a standing position or hanging with the beam output downwards. Other positions can be checked on request.

## 2.2 Electric requirements

The laser is supplied with a low voltage of 24 V DC 3.0 A. A power supply unit providing the low voltage from the mains is optional part of the delivery.

The mains connection values are:

100 to 240 V, 47/63 Hz, 1.1-0.45 A (see type label).

**Connect the laser power supply unit only to a mains that corresponds to the values stated on the type**

The laser power supply unit has an earthed conductor connection that is connected to the laser housing via the connection cable. The low voltage is off-earth, the minus line is connected to the frame ground.

Using another power supply requires the written consent of LTB Lasertechnik Berlin.

**Please observe: only a mains that provides an earthed conductor is to be used.**

## 2.3 Laser control

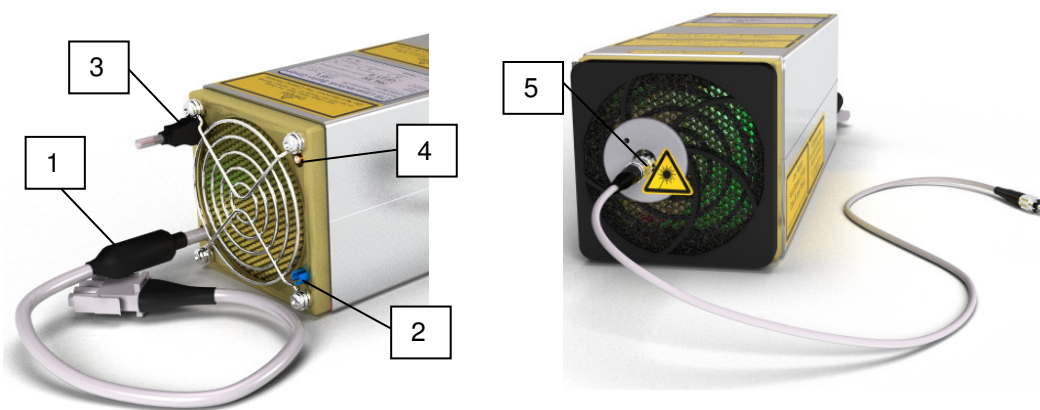
The lasers of the MNL 300 series operate without computer. The laser has to be triggered. The trigger input is only optical (HP OWG). Electrical triggering is possible with optional converter (6.2)

Since there is no beam shutter that fulfills the safety requirements of system redundancy, the customer has to sign an OEM agreement. The user has a higher responsibility for the compliance with laser safety. The regulations of the IEC 60825-1 (laser safety) are to be observed.

## 3 Installation

### 3.1 Connections

- 1 Power cable (Mate-N-Lok)
- 2 External trigger input, optical (HP OWG)
- 3 Remote key (Mini-USB, Interlock and visual laser warning)
- 4 Sync.-Out (SMB, optional)
- 5 Fiber output (SMA)



### 3.2 Acclimatizing the laser

We recommend that the laser is acclimatized before it is switched on in the operating room for 1 hour, if it was exposed to ambient temperatures outside the allowable operational temperature range before.

## 4 Operating the laser

### 4.1 Establish the readiness for operation

Connect the power supply unit via the device cord with the mains. Connect the Mate-N-Lok connector to the laser.



### 4.2 Remote key and remote socket

The remote socket (see page 10, [3]) is provided for:

- Closing the external remote circuit with the remote key
- Integrating external applications in the remote circuit of the laser

The remote key assures the laser against unauthorized use and serves the additional safety during laser operation.

Always remove the remote key after switching off the laser and keep it safe.

**With an open remote circuit, the laser cannot be operated!**

### 4.3 The external remote circuit

The external remote circuit is closed, if the remote key is plugged into the remote socket (Mini-USB) of the laser.

### 4.4 Connecting external applications

For additional protection against laser radiation, the position switch of the laser beam guidance and the sample chambers of a laser application can be incorporated into the external remote circuit.

With the opening of the beam guidance or of the sample chamber the laser will be automatically switched off.  
The necessary cables can be obtained from LTB.

#### 4.5 Starting the laser operation

You must provide the laser an external optical trigger signal.

The input socket (S.10; [2]) is positioned next to the device cord.

The trigger converter cable (optional) converts electrical pulses into the corresponding trigger pulses.

If you use the trigger converter cable, please observe the following requirements:

Amplitude:           5 Volt (TTL, without OFFSET)  
Driver current:        $\geq 10$  mA  
Pulse width:         2 - 60  $\mu$ s

If you use your own optical trigger source, please observe:  
The laser is equipped with a HP OWG receiver system for  $\varnothing 1$  mm POF fibers and requires the following specifications:

- Pulse width of the light impulse 2-60  $\mu$ s
- light power  $\geq 100\mu$ W @ 660 nm

#### 4.6 Switching off the laser

Stop triggering the laser and interrupt the operation voltage.

#### 4.7 Protecting the laser

If you remove the remote key from the remote connection after switching off the laser, the laser cannot be switched on by unauthorized persons.

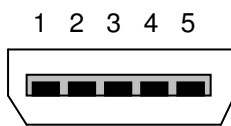
## 5 Safety functions

To ensure a safe laser operation, a number of monitoring functions has been set up.

They comprise:

- Supervision of the casing, protection against contact
- Temperature monitoring inside the laser
- External interlock circuit at remote key connector

### 5.1 Configuration of remote key connector



Pin	configuration	description
1	Remote sink	Interlock circuit
2	Remote source	
3	LED2 anode	Visual laser warning
4	LED1 anode	
5	Common LED cathode	

## 6 Optional Features

### 6.1 Fiber coupling

The generated laser light is coupled into a quartz fiber. The fiber diameter is 400, 600 or 1000  $\mu\text{m}$ . The numerical aperture NA is 0.22.

The transmission of the fiber coupling is approx. 90 % (1000  $\mu\text{m}$ ).

### 6.2 Electrical triggering

The following components and devices are optionally available with the MNL 300:

1. TWE 40

Trigger converter for the exact optical external triggering, if only an electrical trigger source is available

Input: TTL level 50 Ohm

Output: Optical waveguide fitting the trigger input of the laser

Time jitter: < 1 ns

2. Trigger converter cable

[electrical (BNC female)/ optical (HP)]

Usage and connections like TWE4 40, but for standard requirements:

Time jitter: 5 ns,

Amplitude: 5 Volt (TTL, without OFFSET)

Driver current:  $\geq 10$  mA

Pulse width: 2 - 60  $\mu\text{s}$

### 6.3 Pulse energy measurement

Optionally the Energy meter  $\mu$ -Joule Meter PEM 250 or PEM 500 can be used to measure the pulse energy of the laser.

## 7 Appendix

### 7.1 Specifications, Technical Data

#### General

		MNL302	MNL305	MNL308
Wavelength	nm	337.1		
Spectral bandwidth	nm	0.1		
Pulse halfwidth FWHM, typ. <sup>1</sup>	ns	3		
Guaranteed pulse energy (90 % after 60 mill.) <sup>2</sup>	µJ	85@20Hz	80@50Hz	75@80Hz
Typ. pulse energy (typ. 70 % after 100 mill.) <sup>2</sup>	µJ	28@20Hz	26@50Hz	25@80Hz
Repetition rate (Max)	Hz	20Hz	50Hz	80Hz
Peak Power (Max)	kW	100		
Energy stability SD/<E> (for all rep. rates)	%	≤ 2		
Beam dimensions, vertical x horizontal, typ.	mm	3 x 4		
Beam divergence, vertical x horizontal <sup>3</sup>	mrad	≤ 3.5 x ≤ 3		
Focus stability <sup>4</sup>	µm	< 15		
Beam exit angle, vertical / horizontal, typ.	grad	+0.5 (±0.2) / 0±0.1		
Trigger In		Optical or electrical (TTL)		
Jitter: ext. trigger ↔ laser pulse	ns	± 5		
Pulse delay: ext. Trigger ↔ laser pulse	ns	1600 ± 10%		
Sync Out (optional):		Typ. 3.5 ns before the laser pulse (U>4V)		
Jitter: electr. Trigger exit ↔ laser pulse	ns	< 0.2		
Warm-up time	s	< 20		
Control		External Trigger		
Warranty		Mind. 90% from specified start energy (after 40 [60] mill. pulses or 2 [3] years)		
Certifications		CE, ETL (UL, CSA, VDE, Semco), FDA		
Laser class		3B / IIIb		

#### Electrical interface

Power supply <sup>5</sup>	V DC	24		
Power consumption (peak)	A	3,0		
Power consumption (average)	A	0,8@20Hz	1,15@50Hz	1,45@80Hz
Maximum power consumption	VA	72		

#### Environment and conditions of use

Operating temperature	°C	+15 ... +38		
Storage temperature	°C	-10 ... +60		
Max. relative humidity (non-condensing)	%	85		
Air pressure	mbar	750 ... 1300		
Dimensions of the laser (L x B x H)	mm	300 x 87 x 87		
Weight of the laser	kg	2,8		
Dimensions of the power supply (L x B x H)	mm	180 x 80 x 50		
Weight of the power supply	kg	0.6		

<sup>1</sup> reduction of request

<sup>2</sup> higher energies on request

<sup>3</sup> at max. rep.rate; measuring at 5m distance

<sup>4</sup> based on focusing of 60mm

<sup>5</sup> via external wide-range power supply (100...240 V AC) (part of the delivery)

Subject to technical changes.



## General

		<b>MNL330</b>
Wavelength	nm	337.1
Spectral bandwidth	nm	0.1
Pulse halfwidth FWHM, typ. <sup>1</sup>	ns	3
Guaranteed pulse energy (90 % after 60 mill.) <sup>2</sup>	µJ	28@300Hz
Repetition rate (Max)	Hz	300Hz
Peak Power (Max)	kW	100
Energy stability SD/<E> (for all rep. rates)	%	≤ 2
Beam dimensions, vertical x horizontal, typ.	mm	1,5 x 4
Beam divergence, vertical x horizontal <sup>3</sup>	mrad	≤ 2 x ≤ 3
Focus stability <sup>4</sup>	µm	< 15
Beam exit angle, vertical / horizontal, typ.	grad	0 ± 0.2
Trigger In		Optical or electrical (TTL)
Jitter: ext. trigger ↔ laser pulse	ns	± 5
Pulse delay: ext. Trigger ↔ laser pulse	ns	1600 ± 10%
Sync Out (optional):		
Jitter: electr. Trigger exit ↔ laser pulse	ns	< 0.2
Warm-up time	s	< 20
Control		External Trigger
Warranty		200 mill. pulses / 2 years)
Certifications		CE, ETL (UL, CSA, VDE, Semco), FDA
Laser class		3B / IIIb

## Electrical interface

Power supply <sup>5</sup>	V DC	24
Power consumption (peak)	A	3,0
Power consumption (average)	A	2,75@300Hz
Maximum power consumption	VA	72

## Environment and conditions of use

Operating temperature	°C	+15 ... +38
Storage temperature	°C	-10 ... +60
Max. relative humidity (non-condensing)	%	85
Air pressure	mbar	750 ... 1300
Dimensions of the laser (L x B x H)	mm	300 x 87 x 87
Weight of the laser	kg	2,8
Dimensions of the power supply (L x B x H)	mm	180 x 80 x 50
Weight of the power supply	kg	0.6

<sup>1</sup> reduction of request

<sup>2</sup> higher energies on request



<sup>3</sup> at max. rep.rate; measuring at 5m distance

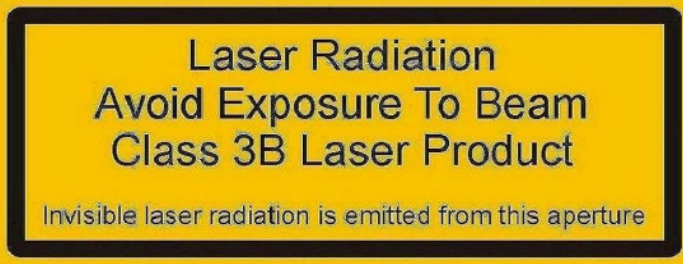



<sup>4</sup> based on focusing of 60mm







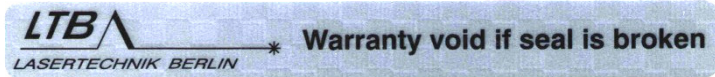

<sup>5</sup> via external wide-range power supply (100...240 V AC) (part of the delivery)

Subject to technical changes.

## 7.2 Table of labels

label type	label and symbol
Certification	Complies with 21 CFR 1040.10 and 21 CFR 1040.11
	Conforme à 21 CFR 1040.10 et 21 CFR 1040.11
	
Identification	
Laser power	<p><b>Caution - Laser Radiation</b>  <b>Avoid Exposure To Beam</b>  <b>Class 3B Laser Product</b></p> <p>Peak power: 100 kW ; 3 ns ; 337.1 nm            IEC 60825-1 : 2007</p>
	<p><b>Précaution - rayonnement laser</b>  <b>Eviter une exposition directe au faisceau</b>  <b>Appareil à laser de classe 3B</b></p> <p>Puissance crête: 100 kW ; 3 ns ; 337,1 nm            IEC 60825-1: 2007</p>

label type	label and symbol
Aperture	
	
	
	

label type	label and symbol
Warning	
	
	
	
	
	
Guaranty label	
Information label	

### 7.3 Inspection and maintenance

After the laser has run 2 years the laser should be sent for inspection and cleaning to LTB.

Depending on the dust concentration in the cooling air, the dust filter has to be replaced every 6 to 18 months. If the filter is dirty, the laser can overheat.

#### 1. Remove the cover

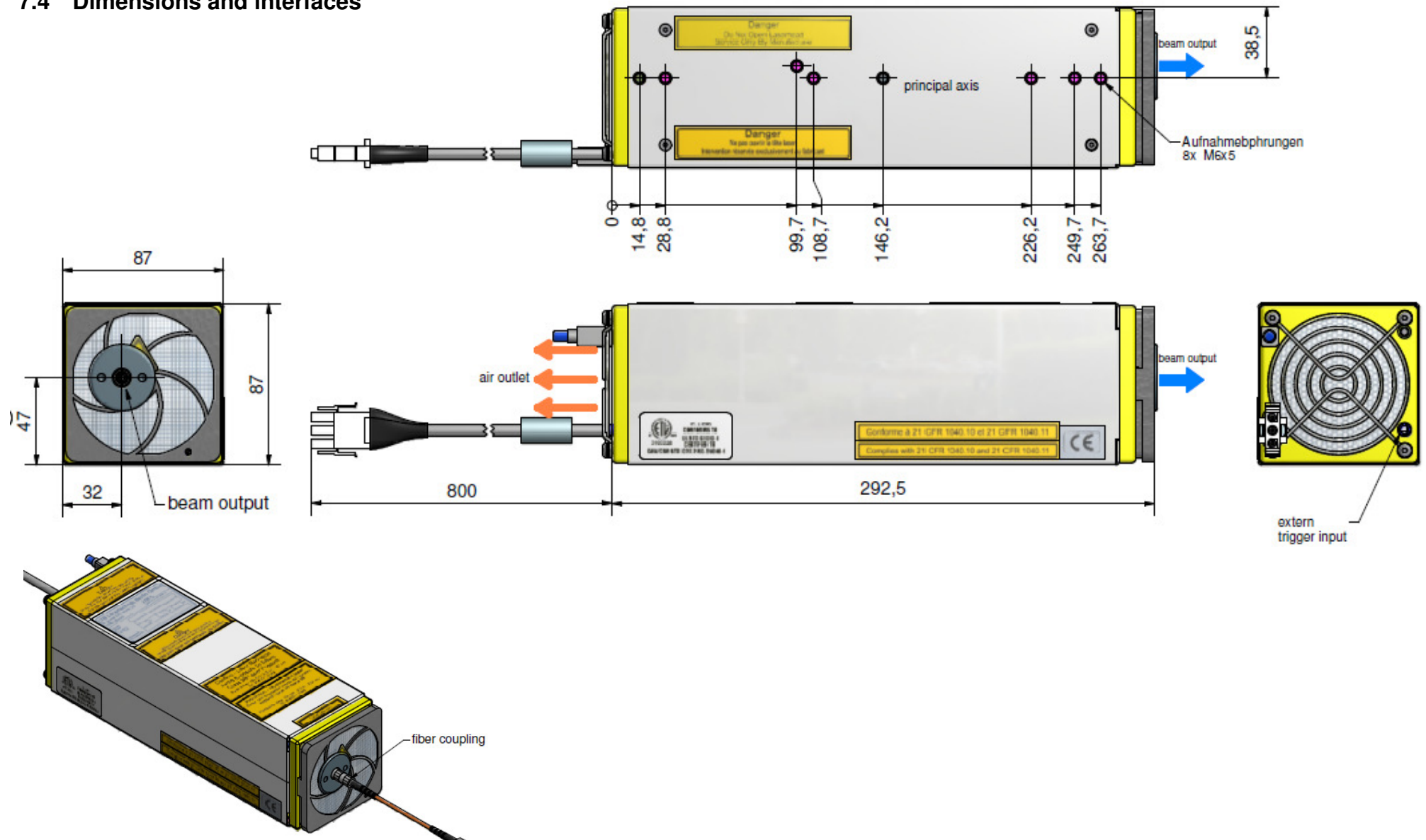


#### 2. Replace the filter mat.

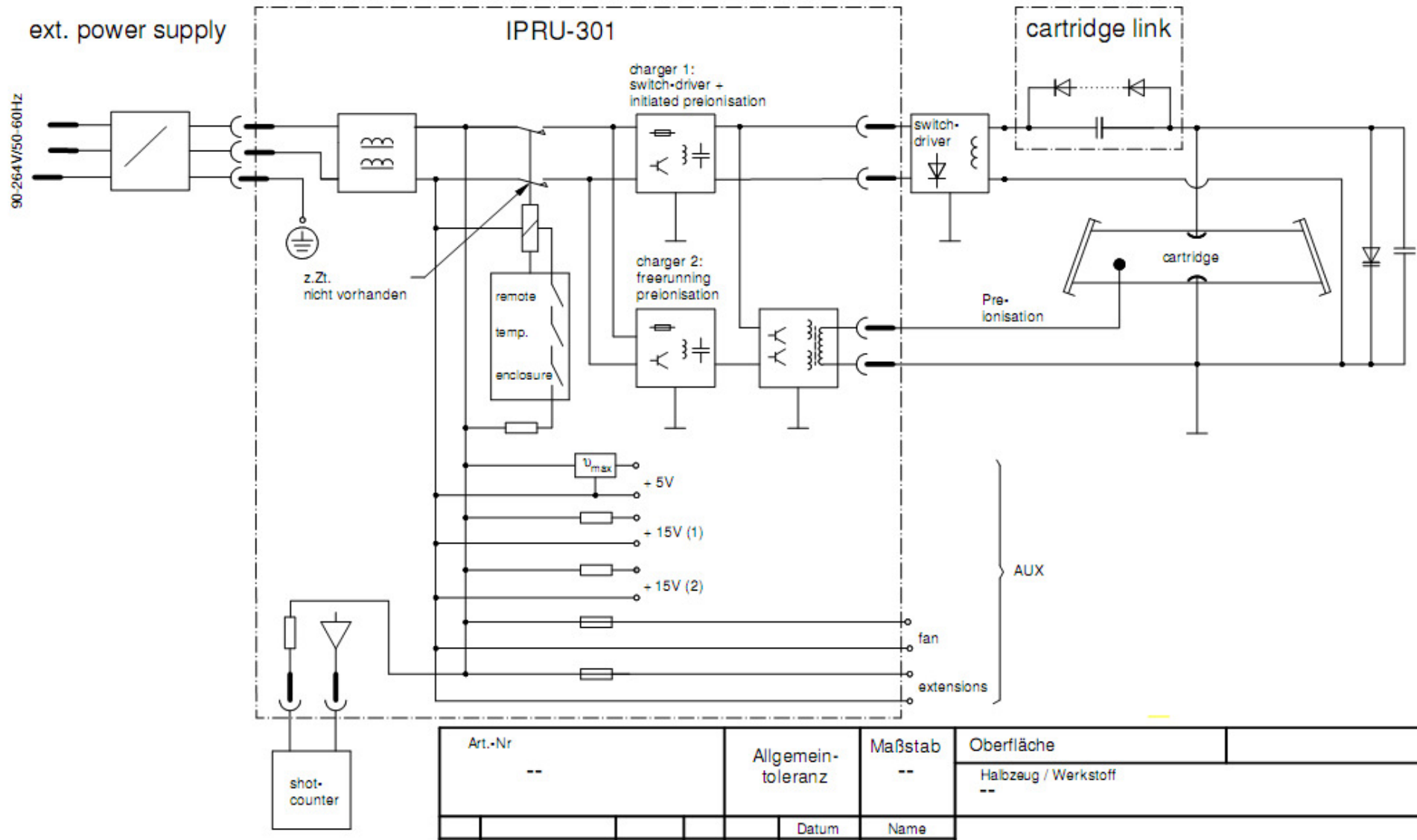


#### 3. Affix and snap in the cover.

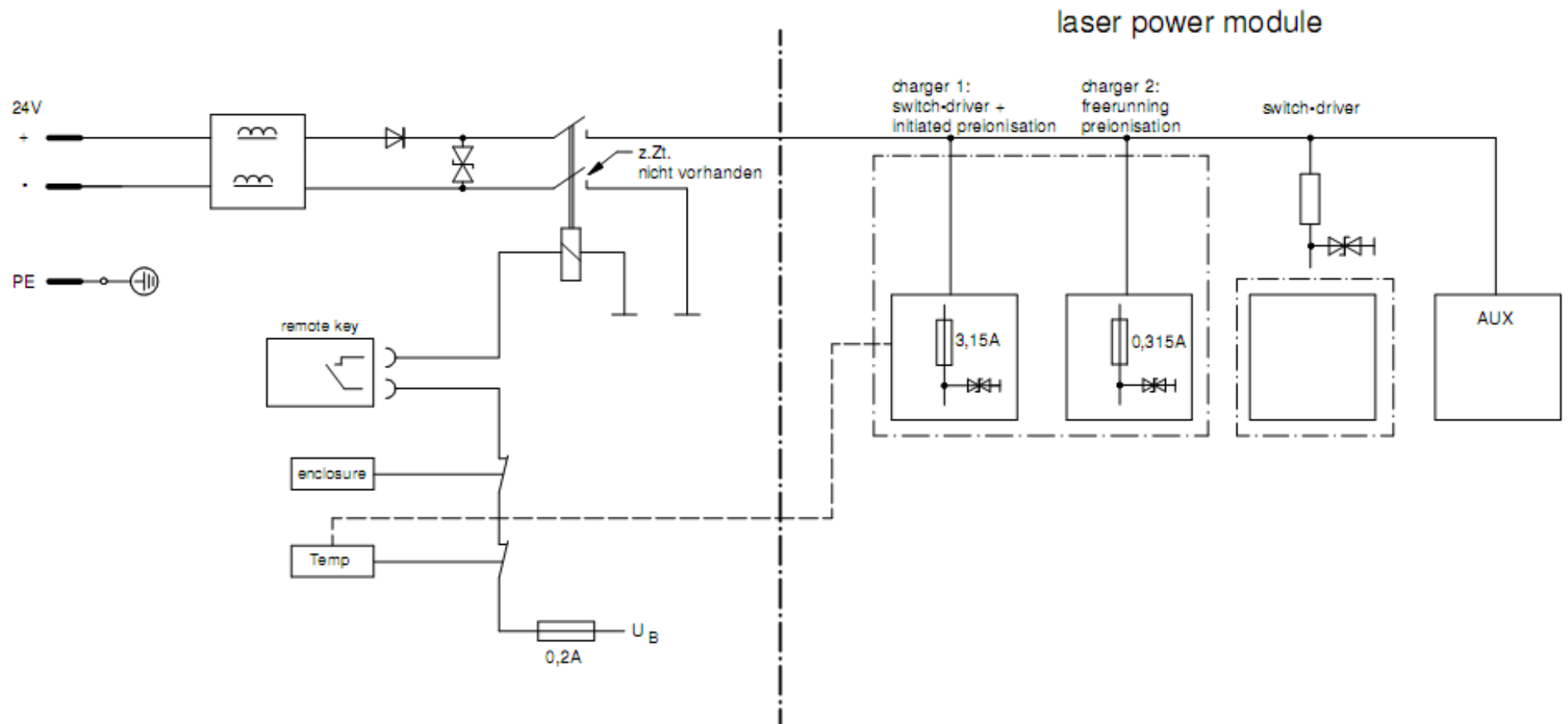
## 7.4 Dimensions and interfaces



### 7.5 Functional block diagram



## 7.6 Safety functions





## 7.7 Syncout (optional feature)

the “Syncout” signal is intended to trigger cameras and similar devices. It is designed to provide both minimum delay ( typical 4 ns) and very low jitter ( < 0,2 ns) with respect to laser output. The signal is provided via an SMB interface, corresponding cable has to be 50 Ohm terminated . It is recommended to choose the rising edge at 2 - 3V trigger level for triggering subsequent events.

