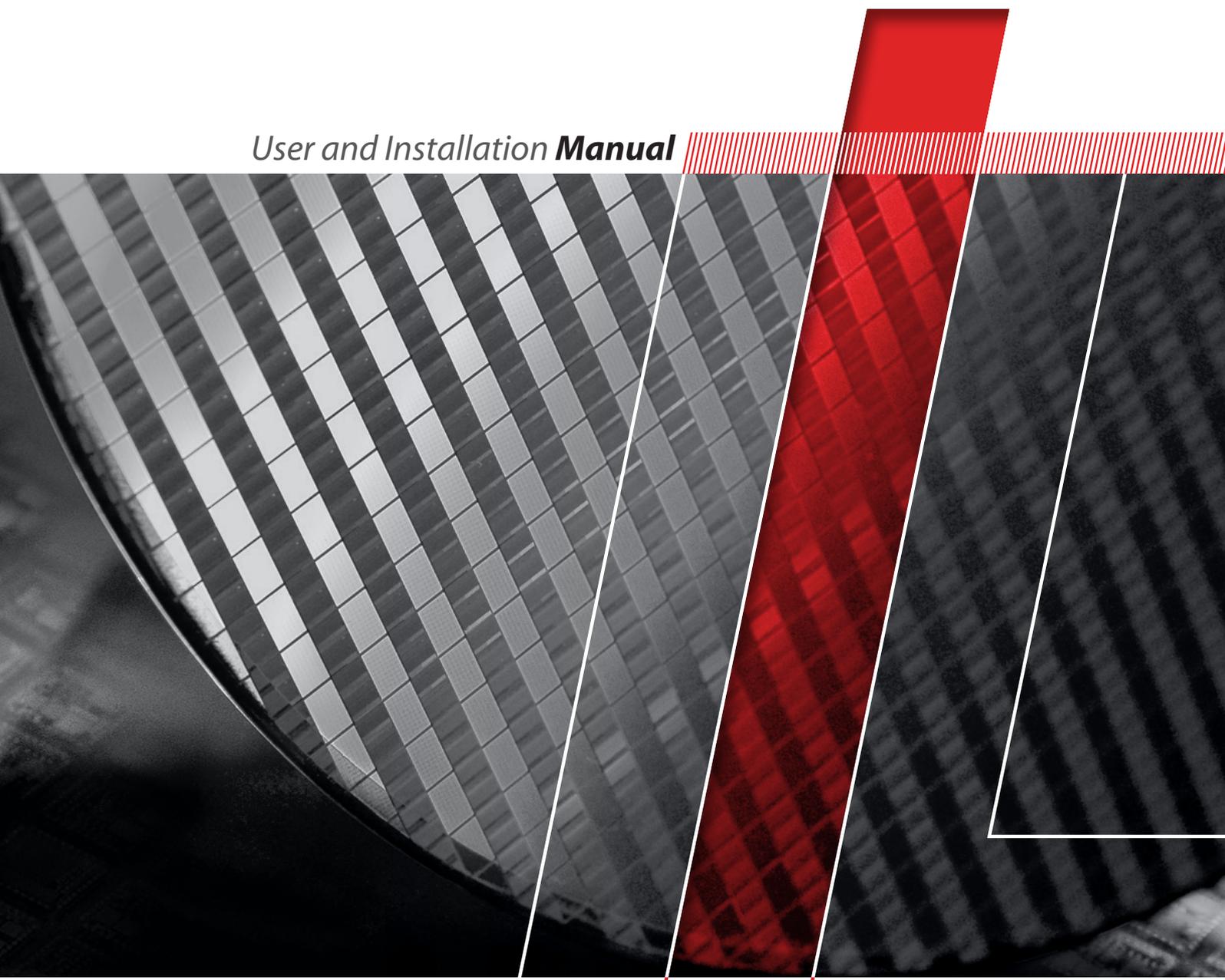


# mosquito\*

Mini DPSS Lasers

User and Installation **Manual**



Think of **LASER** as a tool

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**Revision History**

1.0 First release

1.1 Add US export compliance

Release date: 28/07/2014

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## Preface

### Audience

This manual should be read by all personnel who install or operate the mosquito laser.

**Important!**

Read this manual carefully before operating the laser for the first time. Pay special attention to the Safety chapter.

The mosquito laser is designed and sold for use in Original Equipment Manufacturer (OEM) systems and is not to be used as a stand-alone laser. The OEM is responsible for compliance with all applicable safety regulations.

### Other publications

- *EN60825–1 Radiation Safety of Laser Products, Equipment Classification, Requirements and User's Guide*  
<http://www.cenelec.org>
- *IEC 60204–1 Safety of Machinery, Electrical Equipment of Machines*
- *IEC 61010–1 Safety Requirements for Electrical Equipment for Measurements, Control and Laboratory Use*
- *Laser Safety Guide*  
Laser Institute of America, 13501 Ingenuity Drive, Suite 128, Orlando, Florida 32826, USA  
<http://www.laserinstitute.org>
- *ANSI Z136.1–2000 – Safe Use of Lasers*, American National Standards Institute  
<http://www.ansi.org/>  
<http://www.z136.org/>
- *H.I.B. Systemtechnik GmbH Industrial Cooling Systems, Operating Instructions Withdrawable Units (19 inch)*

### How to use this manual

The manual contains information required for safe operation, installation and routine maintenance of the equipment.

### U.S. Export Control Laws Compliance

Lasers from InnoLas Laser GmbH are made in Germany. Nevertheless many of our lasers contain sub-components that are originating from the U.S. and need to comply with U.S. export control laws.

Export and re-export of lasers manufactured by InnoLas Laser are subject to U.S. Export Administration Regulations, which are administered by the Commerce Department. In addition, shipments of certain components might be regulated by the State Department under the International Traffic in Arms Regulations (ITAR).

The applicable restrictions vary depending on the specific product involved and its destination. In some cases, U.S. law requires that U.S. Government approval be obtained prior to resale, export or reexport of certain articles. When there is uncertainty about the obligations imposed by U.S. law, clarification should be obtained from an appropriate U.S. Government agency.

---

## 1. Safety

Only authorised personnel, familiar with the potential dangers presented by laser equipment during operation or installation, are allowed to work with the laser system. It is of utmost importance that personnel working with the system read, understand and observe the information and instructions in this manual.



### **WARNING**

#### **Risk of exposure to laser radiation**

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

The mosquito is a Class IV laser intended to be used as part of an integrated laser-based processing system.

Safe use of this equipment is reinforced by safety labels fixed to the equipment in a visible manner. The type of safety labels used and their location is detailed in section 1.4.

The use of controls, replacement parts, adjustments, or procedures other than those specified within this manual may result in exposure to any of these hazards.

- Laser hazards
- Electrical hazards
- Environmental hazards
- Mechanical hazards.

The degree of seriousness of the hazard is indicated by the use of the following signal words:

### **DANGER**

Indicates an imminent hazard which, if not avoided, is extremely likely to result in death or serious injury.

### **WARNING**

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

### **CAUTION**

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It is also used to alert the user against unsafe working practices and potential damage to the equipment.

### 1.1. Qualification and training of personnel

Personnel who install and/or operate the laser must be adequately qualified for the work concerned and should have read this manual. The user must clearly specify the sphere of responsibility, competence and certification for personnel concerned.

## 1.2. Electrical



### **DANGER** **Risk of electrocution**

Switch off and disconnect the equipment from the mains electrical supply before removing covers. Only trained and authorised personnel should remove covers from the power supply.

Before working on the system:

- Remove the key from the key switch on the power supply.
- Turn off the mains electrical supply and, if possible, disconnect the equipment from the supply.
- Restrict access to the area to trained people who are aware of the hazards.
- Refer to the system manual and circuit diagrams for wiring connections and polarities. Never guess or use trial and error techniques.
- Fit only InnoLas Laser approved parts.
- Do not operate the equipment with safety panels removed or with interlock switches overridden (unless a key operated override facility has been included).
- Never attempt to work on electrical circuits when alone; always have a colleague nearby.
- Observe the requirement of the electrical safety codes for the establishment where the laser is installed.
- External equipment connected to the system must comply with EN61010-1 and appropriate local standards.

## 1.3. Laser radiation



### **WARNING** **Risk of exposure to laser radiation**

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

During installation or in a maintenance situation, the operating area of the laser system must be clearly marked to warn unauthorised personnel not to enter the area. All entrances and exits must be marked with appropriate warning signs.

OEM system integrators are obliged to provide training to their customers and to make them familiar with the potential dangers of Class IV laser in general and the mosquito laser in particular.

When working on the system during installation or in a maintenance situation, observe the following rules:

- Avoid eye or skin contact to direct or scattered radiation.

- 
- Always wear protective eye wear matched to the emission wavelength and output power of the laser. Instruct all personnel in the vicinity to wear identical protective eye wear.
  - Never look into the laser beam!
  - Make sure there are no reflective materials in the beam path that could deflect the beam toward the operator or another person in the vicinity.
  - Use only non-flammable, absorbing or non-reflective materials as beam dumps.
  - Never operate the laser in the vicinity of explosive liquids or gases.
  - Be aware that laser processing certain materials (e.g. plastics) may create poisonous fumes and by-products.

#### 1.4. Location of safety labels

The labels shown on the following drawing are fitted to the equipment in the locations specified and must not be removed or defaced. Immediately replace any missing labels. Replacement labels can be obtained from InnoLas Laser.

Labels on the side of the laser head are repeated on both side faces.

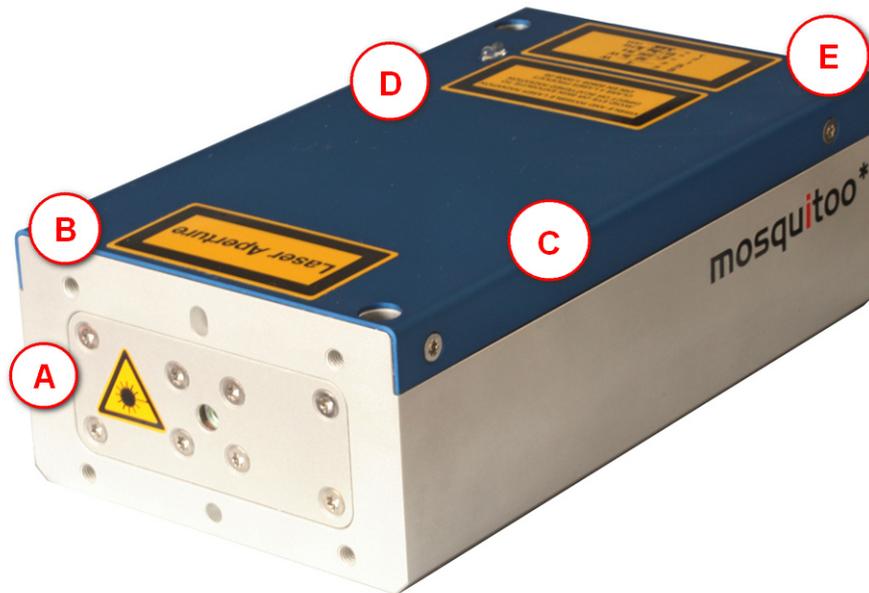


Figure 1 - Safety label locations

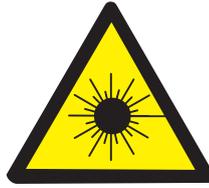


Figure 2 - Label A



Figure 3 - Label B



Figure 4 - Label C

*Note: Label C is on the resonator cover, within the head cover.*



Figure 5 - Label D

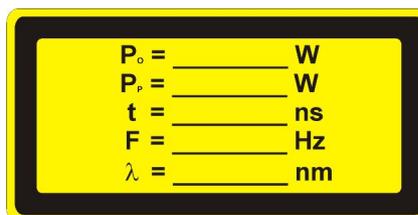


Figure 6 - Label E

The following information appears on Label E, depending on the laser type:

$P_o$	5 W
$P_p$	20 kW
$t$	3–200 ns
$F$	Single shot to 200 kHz
$\lambda$	1064/532/355 nm

---

**mosquitoo Laserhead**  
Modell : **mosquitoo 532-2-V**  
Serial-Nr. : **P879**  
Manufactured : **02 / 2011**

---

**InnoLas Laser GmbH**  
Justus-von-Liebig-Ring 8, D 82152 Krailling  
Tel. : +49 (0)89 899360-0 Fax : -16  
Made in Germany

Figure 7 - Type label



Figure 8 - Mains cord connection point

### 1.5. Hazardous materials

The laser head contains indium used as a heat conductor in the diode module and all crystal mounts. Indium is toxic. Do not open the laser head or crystal assemblies.

### 1.6. Decommissioning and disposal

If the laser will be definitively taken out of service and decommissioned, disconnect and remove all signal and power cables.

Dispose of the system according to appropriate local regulations, paying particular attention to disposal of indium components in the laser head.





---

## 2. General description

### 2.1. Intended use

The mosquito is a diode-pumped solid-state laser system designed for OEM applications as part of an integrated laser-based materials processing system. It offers a choice of output wavelengths and powers with repetition rates up to 200 kHz and excellent beam quality and stability.

### 2.2. Laser head



**Figure 9 - Laser head**

The laser head consists of a sealed resonator module and an electronics compartment. All electrical connections are on the end face of the laser head. Laser output is emitted from the front face of the resonator module. The laser head is mounted using the bottom surface. A four-point fixing is provided with precise and repeatable location assured by means of precision reference holes and slots for dowel pins. The complete assembly is sealed to prevent the ingress of dust and humidity.

**Important!**

Never open the laser head. No user serviceable parts inside.

The laser head contains the following key components:

- A laser diode module
- Control electronics
- Laser crystal and resonator mirrors
- Intra-cavity acousto-optic Q-switch

In addition, it can be fitted with harmonic generation and separation modules and an external acousto-optic modulator.

All connectors can be supplied in either inline or 90° configurations.

### 2.3. Power supply



Figure 10 - Power supply

The power supply is common to all mosquito lasers. This provides maximum flexibility and minimises spare part holdings. The power supply is designed to fit into a 19-inch rack and is 1RU high. The standard mains supply is 115–230 VAC  $\pm$  10%, 50–60 Hz, single phase.

### 2.4. Thermal management

The mosquito laser head is conduction cooled and must be mounted on a heatsink capable of removing all the waste heat generated in normal operation. At a nominal operating temperature of 25°C approximately 40 W of waste heat must be removed. This rises to approximately 80 W at the maximum specified operating temperature of 35°C.

The heatsink must be capable of maintaining the laser baseplate temperature below 35°C but must not allow it to fall below 15°C. Cooler ambient temperatures reduce the cooling demand on the heatsink since some waste heat will be extracted due to convection. It is important to determine the heat removal capacity of your heatsink mounting before installing the laser head and to ensure that there is good thermal contact between the baseplate and the heatsink. The heatsink surface must be flat to 0.050 mm or better if no heat-conducting material is used (such as the included graphene thermal pad).

InnoLas Laser offers an optional heatsink with an auxiliary fan that can be attached to the laser head and controlled through the mosquito power supply. Refer to the fan connector description under “Rear Panel Connections” on page 7.3 for details.



**Figure 11 - Optional heatsink**

As soon as the head temperature exceeds approximately 35°C, a Warning Code xy “Laser Head Base Temp Warning” is issued, but the laser will continue to operate normally. However, once the maximum operating limit of 40°C is exceeded, the laser will perform an emergency shut-off, whereby the laser is immediately placed into Sleep mode. At the same time, a temperature error signal is emitted. Sleep mode can be exited by restarting the laser after the laser head temperature has dropped below 40°C (typical) again.

## 2.5. Beam delivery options

- Beam expander
- Scan head mounting option

## 2.6. Specifications

### 2.6.1. Electrical supply — laser

Maximum power consumption	150 W
Maximum current demand	2 A
Supply voltage	Single phase, 115–230 VAC ± 10%
Supply frequency	50/60 Hz

### 2.6.2. Dimensions — laser head

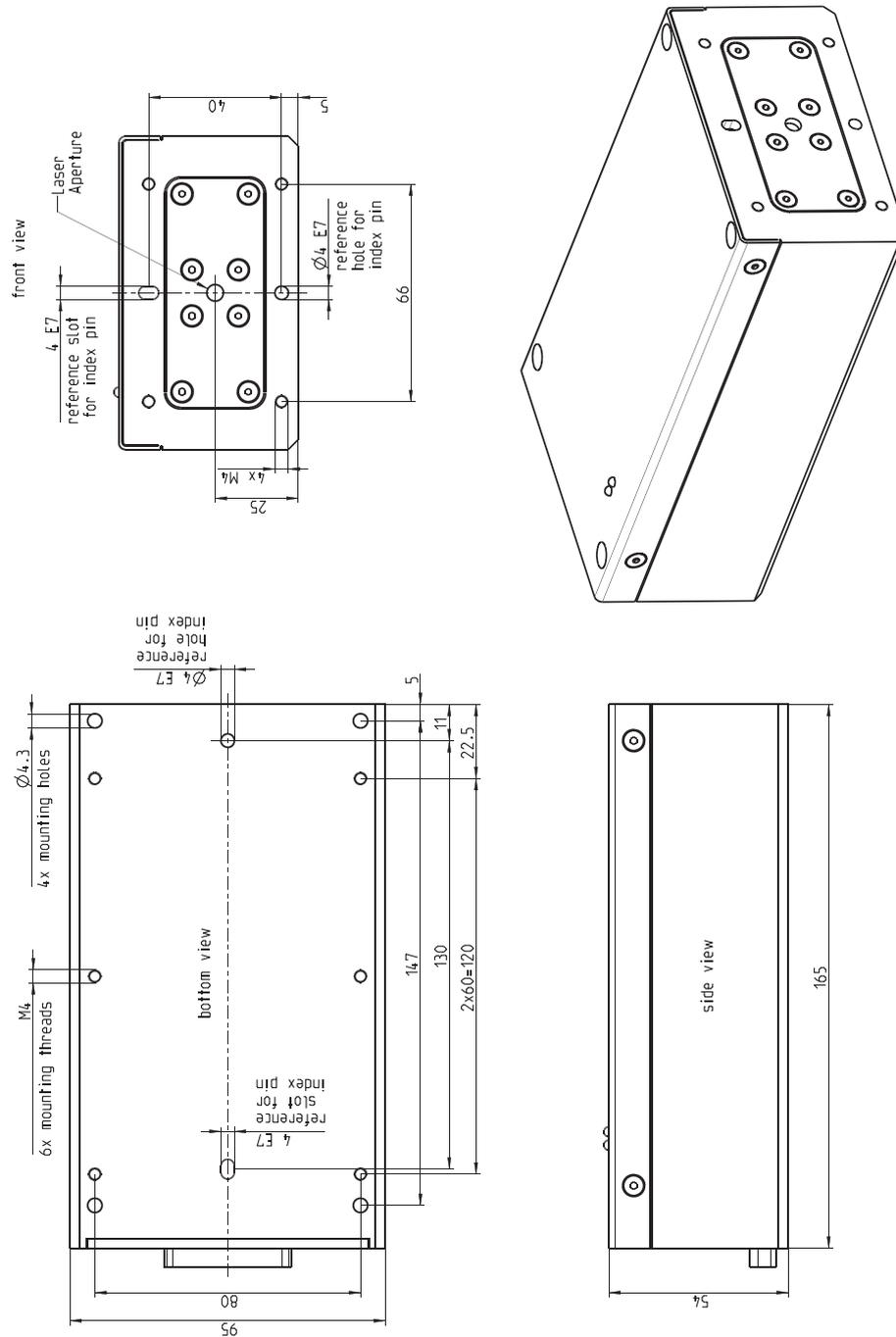


Figure 12 - mosquito head

*Note: 3D step files are available on request.*

### 2.6.3. Dimensions — power supply

19-inch rack mount — 1RU

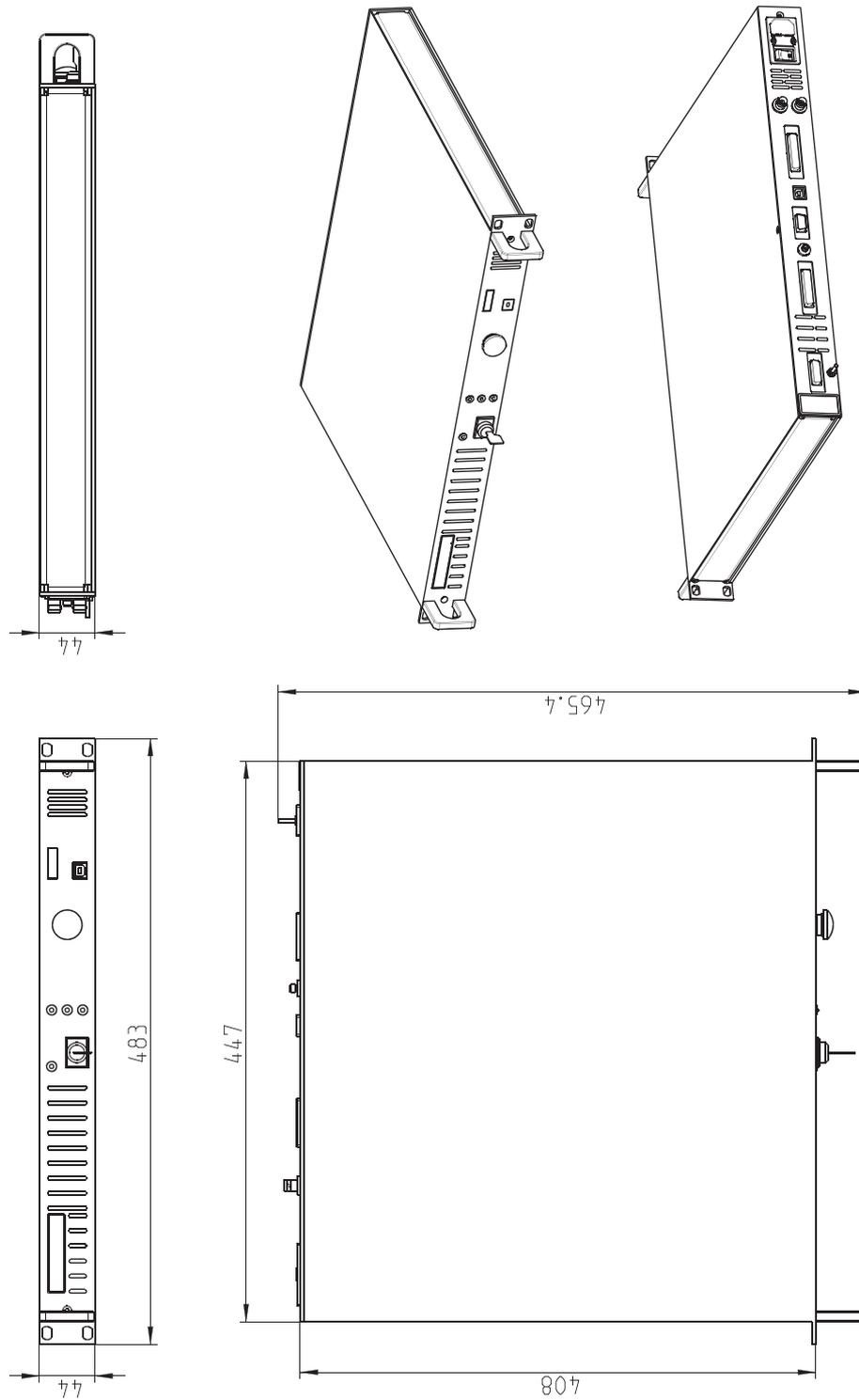


Figure 13 - Power supply

#### 2.6.4. Interconnection cables

The umbilical cable linking laser head and power supply has a standard length of 3 m but can be supplied in lengths from 1 m to 10 m on request.

### 2.6.5. Nominal weights

Laser head	≤1.4 kg depending on model
Power supply unit	≤5.8 kg

### 2.6.6. Customer connections

Customer connections for control and safety circuits are available on the rear of the power supply. Interfacing details are given in the Interfacing chapter (Chapter 9).

### 2.6.7. Performance

Refer to the product data sheet and final test protocol.

### 2.6.8. Environmental

#### Ambient temperature range

Working	15–35°C, non-condensing
Transport and storage	Above 2°C

#### Relative humidity and conductive dust

The mosquito must not be installed in an environment with conductive dust or condensation.

#### Altitude range

0–3300 m

#### Shock, vibration and acceleration

The mosquito is robust in normal operation but may be damaged by dropping or when subject to severe vibration and shocks, such as those encountered during transport over rough or uneven floors.

### 2.6.9. Design lifetime of the equipment

The mosquito system is designed for a maximum use of ten years from initial date of shipment. After this period it should be decommissioned or returned to InnoLas Laser for refurbishment.

---

## 3. Operation

### 3.1. Direct start up

1. Turn on the main switch on the power supply back panel. The white **Power** status lamp illuminates.
2. Ensure that the **Emergency Stop (System Off)** button on the power supply front panel is in the active position (turn it clockwise to release).
3. Insert the key in the key switch and turn the key switch clockwise to position 1. The white **Warmup/Ready** status lamp flashes to indicate that the system is warming up. The white laser emission warning indicator lamps on the front of the power supply and on the top of the laser head diode module illuminate.

*Note: The key can only be inserted or removed when the switch is in position 0.*

When the white **Warmup/Ready** lamp illuminates continuously, the system is ready for use but the diode power supply is not enabled.

*Note: The warm up may take up to 15 minutes.*

#### **Important!**

When wearing personal eye protection, remember that the emission warning and status lamp colour depends on the filter glass used in the eye protection.

4. Turn the key switch to position 2. The diode power supply starts if the interlock circuits are enabled.

### 3.2. Direct shut down

1. Turn the key switch counter-clockwise to position 1. The diode power supply shuts down.
2. Turn the key switch to position 0. The **Warmup/Ready** lamp and the emission warning indicator lamps on the laser head and power supply go out.
3. Switch off the main switch. The **Power** lamp goes out.

### 3.3. Remote start up

This assumes that:

- The laser power supply main switch is on
  - The key switch is in position 2
  - No **Emergency Stop** has been activated
1. Turn on the AC mains power to power supply. The **Power** status lamp illuminates.
  2. Wait for five seconds to allow the system to initialise.
  3. Send a system reset signal (from the interlock connector or the RS232 interface).
  4. Apply a system enable signal (from the customer interface or the RS232 interface). The **Warmup/Ready** status lamp flashes to indicate that the system is warming up. The laser emission warning indicator lamps on the front of the power supply and on the top of the laser head diode module illuminate.

When the system is warmed up, the Warmup/Ready lamp illuminates and the diode power supply starts if the interlock circuits are enabled.

**Important!**

When wearing personal eye protection, remember that the emission warning and status lamp colour depends on the filter glass used in the eye protection.

### 3.4. Remote shut down

1. Deactivate the system enable signal (from the customer interface or the RS232 interface). The diode power supply shuts down. The Warmup/Ready lamp and the emission warning indicator lamps on the laser head and power supply go out.
2. Turn off the AC mains power to the power supply. The Power status lamp goes out.

### 3.5. Emergency shut down

In an emergency either:

Press the Emergency Stop (System Off) button on the power supply front panel fully in until it locks.

or

Activate any external Emergency Stop device fitted to the complete system.

### 3.6. Restart after an emergency shut down

1. Release all Emergency Stop (System Off) devices that have been activated and locked in the off position.
2. Apply a system reset signal (from the interlock connector or the RS232 interface) or turn the key switch to position 0.
3. Perform a normal direct or remote start up procedure.

## 4. Software

Access to the RS232 commands is limited by access code. After startup, the access level is always set to level 0, operator access. This access level has been preset and can only be exceeded by using a password.

Access levels are:

- Level 0 – Operator
- Level 1 – Customer service or maintenance
- Level 2 – InnoLas Laser certified service personnel
- Levels 3 and higher are for factory use only.

### 4.1. Default software installation

1. Insert the mosquito control software CD-ROM in the CD drive or your PC. Check that the Microsoft™ .NET 2.0 or higher and the Windows™ Installer are already installed on the PC. If not, install them from the CD-ROM before installing the mosquito control software.
2. Install the mosquito control software from the CD-ROM.
3. Remove the CD-ROM and then launch the mosquito control software.

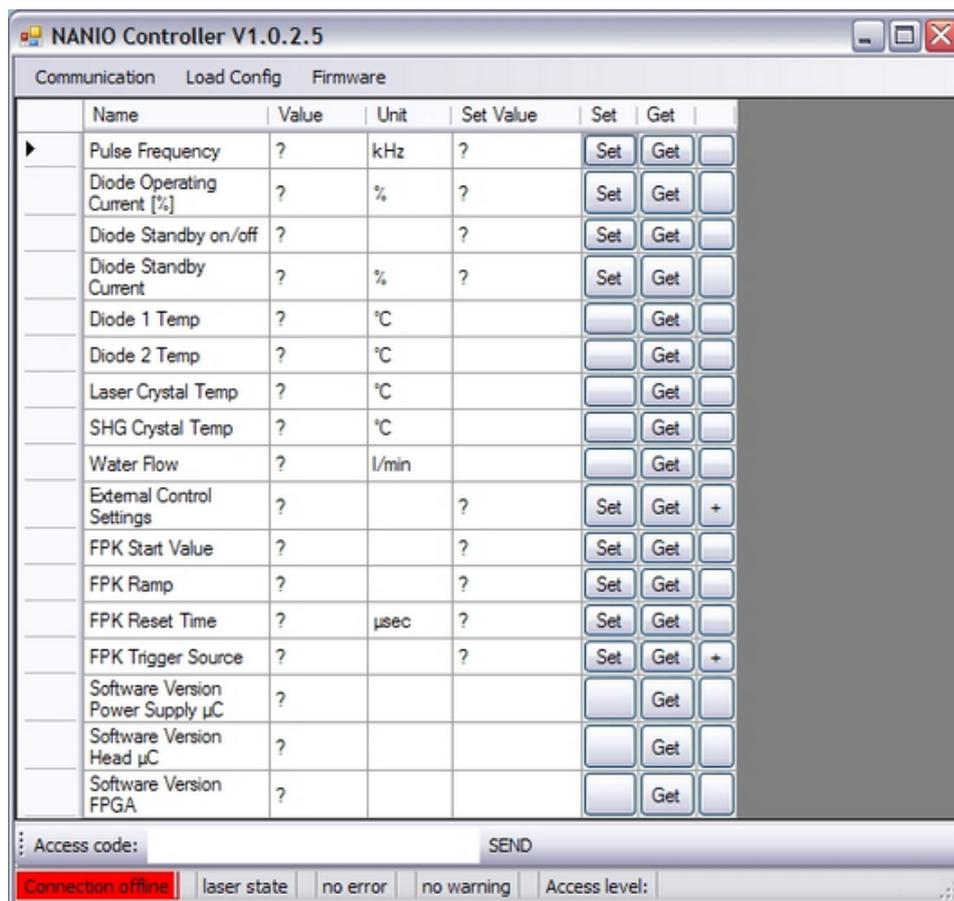
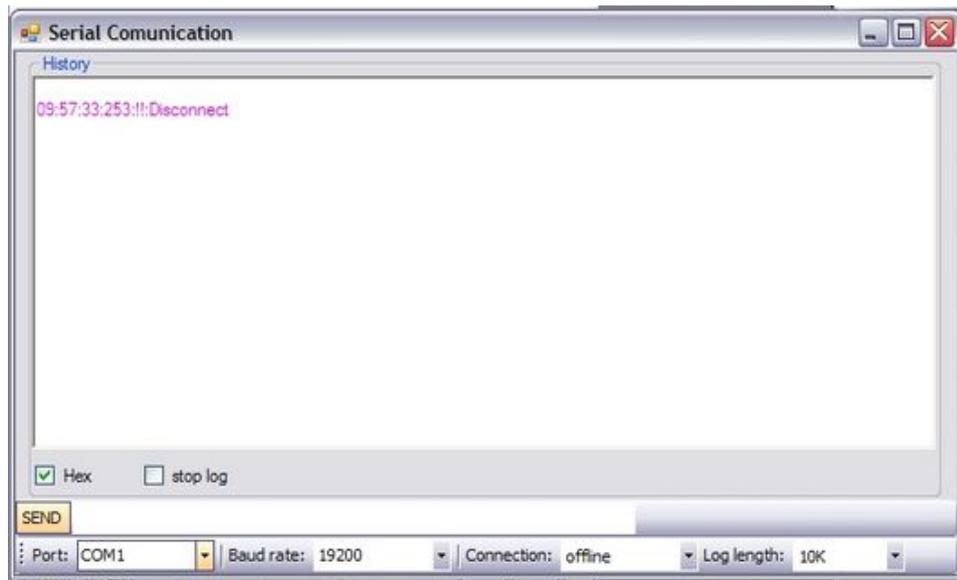


Figure 14 - mosquito controller offline

4. Select **Communications > Serial Communication** and then select the appropriate COM port setting at the bottom-left of the Serial Communication dialog box.



**Figure 15 - COM port setting**

5. Establish a connection to the mosquito and verify that the connection is set to **Online**.

#### **4.2. Default software**

Click **Communication** to establish a link between your PC and the mosquito, the following screen displays.

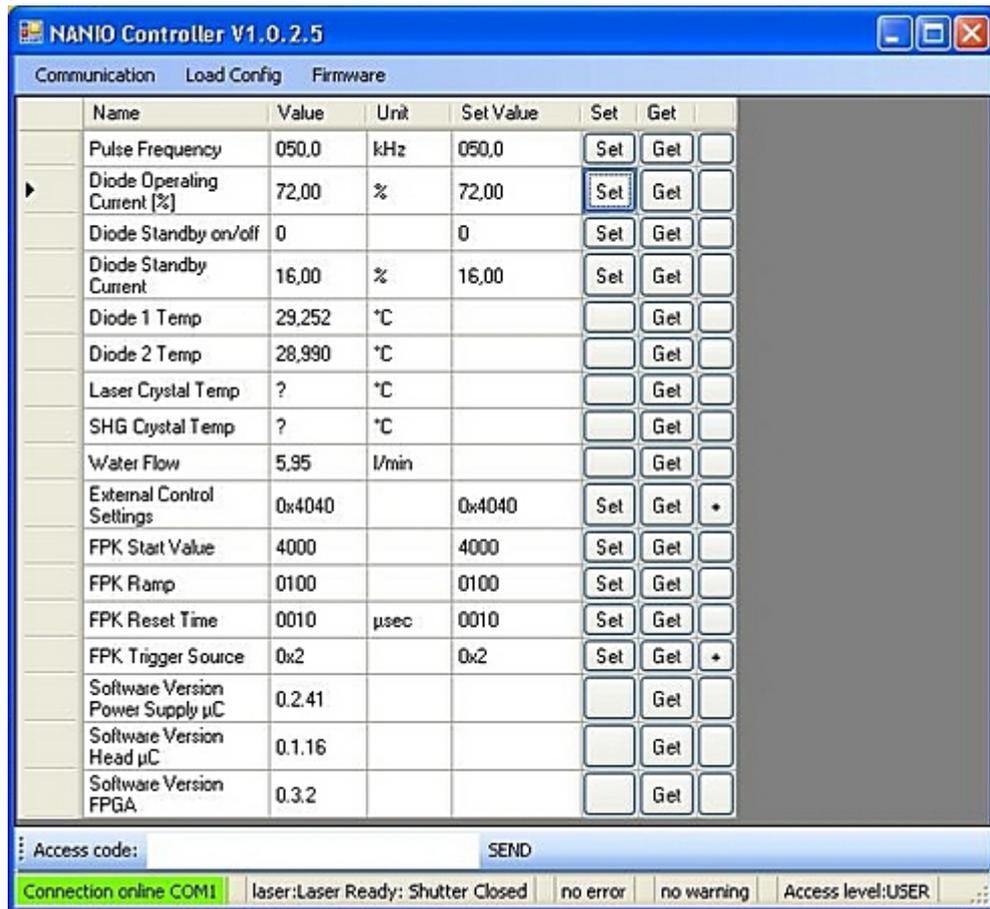


Figure 16 - mosquito controller online

- **Connection online**

Confirms that the communication link between your PC and the mosquito is active.

- **Laser state**

Displays the current laser state. See Appendix D for a list of state codes.

- **No error and No warning**

Both show that there is no current error or warning active. Otherwise, the error or warning code displays.

See Appendix B for a list of error codes and Appendix C for a list of warning codes.

To enter or view laser parameters:

- Click **Get** to view the active parameter.
- To change a parameter, enter the new value in the **Set Value** box and click **Set**. The new value is sent to the laser.

### 4.3. RS232 port configuration

- Data bits — 8
- Stop bits — 1
- Parity bits — None
- Baud rate — 19200

#### 4.4. RS232 protocol

- Any query is answered using the same message ID
- Any executable command will be answered by an acknowledge using the same message ID
- A faulty, non-executable or non-authorized command will be answered by a warning command **not executable** using the same message ID. The warning will be followed by a laser generated command using a new message ID indicating the cause of the warning.
- The laser will automatically send any warning, error or change in state (e.g. shutter open/close, warmup , ready...) on the RS232 Interface.

This makes available the necessary information for the laser without polling.

The sending of laser generated commands can be deactivated.

Name	Size	Description
Startbyte	2 byte	Value is 0xFF00; for synchronising to the start of a message in case of interrupted or faulty connection.
Length of command	1 byte	In bytes counting as follows: <ul style="list-style-type: none"> <li>• without startbyte</li> <li>• without length of command</li> <li>• including command type</li> <li>• including message ID</li> <li>• including opcode</li> <li>• including parameters</li> <li>• including checksum</li> <li>• including endbyte (carriage return)</li> </ul>
Message ID	2 byte	For enumeration of commands and queries to avoid mixing up responses. PC originated commands or queries may use the numbers 0... 0x7FFF. Laser originated commands will use the numbers 0x8000... 0xFFFF. The laser will respond to a PC command or query using the same message ID that was sent by the PC.
Command type	1 byte	0x47 query (get) 0x57 command (set) 0x74 response query 0x75 Acknowledge of command 0x76 Warning, command not executable 0x77 Laser generated message
Opcode	2 byte	See opcode list for details
Parameter	0...245 byte	See opcode list for details
Checksum	1 byte	Addition mod 256 (including startbyte, excluding checksum, excluding endbyte [carriage return])
Endbyte (carriage return)	1 byte	Send 0x0D

#### 4.5. RS232 basic control commands

**Important!**  
Contact InnoLas Laser for custom features and advanced controls.

Op code	Name	Description	Type	Param. length (Byte)	Format	Scaling	Access level	
							Get	Set
0x0026	Laser Crystal Temp	Measured temperature of laser crystal	get	2	unsigned integer	0.002°C	1	na
0x0036	SHG Crystal Temp	Measured temperature of SHG crystal	get	2	unsigned integer	0.01°C	0	na
0x0056	Diode 1 Temp	Measured temperature of diode 1	get	2	unsigned integer	0.01°C	0	na
0x0070	Diode Operating Current [%]	Set diode current in %	set + get	2	unsigned integer	0.01%	0	0
0x0071	Diode Standby Current	Standby current in %	set + get	2	unsigned integer	0.01%	0	0
0x0072	Diode Standby on/off	Send 0 for normal operation Send 1 to set diodes to standby	set + get	1	unsigned integer	na	0	0
0x0081	Pulse Frequency	Pulse repetition frequency	set + get	2	unsigned integer	0.1 kHz	0	0
0x0088	Software Version FPGA	Version of FPGA firmware	get	2	unsigned integer	na	0	na
0x0092	External Control Settings	FPGA pulse mode <ul style="list-style-type: none"> <li>• Bit 15 = not used</li> <li>• Bit 14 = trigger external</li> <li>• Bit 13 = not used</li> <li>• Bit 12 = not used</li> <li>• Bit 11 = not used</li> <li>• Bit 10 = not used</li> <li>• Bit 9 = FPK on</li> <li>• Bit 8 = Sample sync on</li> <li>• Bit 7 = AOM gate high active</li> <li>• Bit 6 = Trigger high active</li> <li>• Bit 5 = Gate high active</li> <li>• Bit 4 = Edge triggered</li> <li>• Bit 3 = CW</li> <li>• Bit 2 = not used</li> <li>• Bit 1 = not used</li> <li>• Bit 0 = not used</li> </ul>	set + get	1	bit	na	0	3: all 0: &0xc3ed

Op code	Name	Description	Type	Param. length (Byte)	Format	Scaling	Access level	
							Get	Set
0x0093	FPK Start Value	FPK start value	set + get	2	unsigned integer	1	0	0
0x0094	FPK Ramp	FPK ramp	set + get	2	unsigned integer	1	0	0
0x0095	FPK Reset Time	FPK reset time	set + get	2	unsigned integer	1	0	0
0x0096	FPK Trigger Source	FPK trigger source <ul style="list-style-type: none"> <li>• Bit 7 = not used</li> <li>• Bit 6 = not used</li> <li>• Bit 5 = not used</li> <li>• Bit 4 = not used</li> <li>• Bit 3 = not used</li> <li>• Bit 2= Trigger pause</li> <li>• Bit 1 = FPK Start (User interface)</li> <li>• Bit 0 = Gate (User interface)</li> </ul>	set + get	1	bit	na	0	0
0x00A2	Software Version Power Supply $\mu$ C	Hardware, software, bugfix	get	3	unsigned integer	na	0	na
0x00A3	Software Version Head $\mu$ C	Hardware, software, bugfix	get	2	unsigned integer	na	0	na

#### 4.6. RS232 Events

Event Code (decimal)	Event Code (hex)	Message ID	Name
Byte 1 + 2	Byte 1 + 2	Byte 3 + 4	
16	0010	xxxx	Command not available
18	0012	xxxx	OpCode unknown
20	0014	xxxx	Value out of range
22	0016	xxxx	Access level violation

---

## 5. Routine maintenance



**DANGER**  
**Risk of electrocution**

Switch off the system and disconnect it from the AC mains supply before carrying out any maintenance.

**Important!**

After performing maintenance, always run a complete check on the system before putting it into production.

### 5.1. Safety compliance checks

**Frequency:** Weekly

1. Check all emission warning lamps function and ensure that they are clearly visible.
2. Check that all safety labels are present.
3. Check the correct functioning of Emergency Stop and external interlocks.

### 5.2. Power supply



**DANGER**  
**Risk of electrocution**

Switch off and disconnect the equipment from the mains electrical supply before removing covers. Only trained and authorised personnel should remove covers from the power supply.



**DANGER**  
**Risk of electrocution**

Electrical connections must only be made by trained and authorised personnel.



**DANGER**  
**Risk of electrocution and damage to equipment**

If the insulation around the AC mains supply terminals is damaged do not connect the power supply. Replace it with an undamaged power supply.



**DANGER**  
**Risk of electrocution**

Before switching on the AC power, verify the quality of the ground connection according to the appropriate standards.

There are no user serviceable parts inside the power supply.

In case of a fault, replace the complete power supply or call InnoLas Laser customer support for instructions.

The power supply may be returned to InnoLas Laser customer service for factory repair.

### 5.3. Laser head

There are no user serviceable parts inside the laser head. Maintenance and service must only be performed by trained and certified personnel.

The laser head may be returned to InnoLas Laser customer service for factory repair.



**CAUTION**  
**Risk of optical damage**

Do not open the laser head. Only to be opened by trained and qualified service personnel.



**CAUTION**  
**Risk of optical damage**

Do not touch the beam output window or place it under mechanical stress.

Contact InnoLas Laser for maintenance/troubleshooting training and certification.

## 6. Troubleshooting

### 6.1. Error messages

Code	Error Message	Description	Action
2000	Emergency Stop Loop 1 Open	The interlock circuits for the external emergency stop device are not closed.	Check the emergency stop circuit 1 at interlock connector HAN14, pin 1-8
2001	Emergency Stop Loop 2 Open	The interlock circuits for the external emergency stop device are not closed.	Check the emergency stop circuit 2 at interlock connector HAN14, pin 2-9
4005	Diode 1 Temp Error	Diode 1 outside the limit settings.	Check water temperature and water flow.
4007	Laser Crystal Temp Error	Laser crystal temperature outside the limit settings.	Check water temperature and water flow.
4008	SHG Temp Error	SHG crystal temperature outside the limit settings.	Check water temperature and water flow.
4009	THG Temp Error	THG crystal temperature outside the limit settings.	Check water temperature and water flow.
4011	Laser Head Base Temp Error	Laser head base temperature outside the limit setting.	Check heat sinking of the laser head, heat sink fans, or cable connection to the heat sink.
5005	Diode Overvoltage Error	The diode voltage outside the limit setting.	Check cable connections at the diode module after pump diode replacement. <b>Note:</b> When changing from very short (e.g. 3m) to long (>10m) umbilical lengths, the error limit settings need to be adapted.
5006	Diode Undervoltage Error	The diode voltage outside the limit setting.	Check cable connections at the diode module after pump diode replacement. <b>Note:</b> When changing from very long (>10m) to short (e.g. 3m) umbilical lengths, the error limit settings need to be adapted.

### 6.2. Warning messages

Code	Warning message	Description	Action
4000	Diode 1 Low Temperature	Diode 1 outside the low limit setting.	Check cooling water temperature.
4001	Diode 1 High Temperature	Diode 1 outside the high limit setting.	Check cooling water temperature.
4004	Laser Crystal Low Temperature	Laser crystal temperature outside the low limit setting.	Check cooling water temperature.
4005	Laser Crystal High Temperature	Laser crystal temperature outside the high limit setting.	Check cooling water temperature.

<b>Code</b>	<b>Warning message</b>	<b>Description</b>	<b>Action</b>
4006	SHG Low Temperature	SHG crystal temperature outside the low limit setting.	Check cooling water temperature.
4007	SHG High Temperature	SHG crystal temperature outside the high limit setting.	Check cooling water temperature.
4008	THG Low Temperature	THG crystal temperature outside the low limit setting.	Check cooling water temperature.
4009	THG High Temperature	THG crystal temperature outside the high limit setting.	Check cooling water temperature.

Due to our policy of continuous product and software improvement, please contact InnoLas Laser for updated troubleshooting details.

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## 7. Installation

**Important!**

If you have any questions or problems during the integration contact InnoLas Laser support.

### 7.1. Unpacking

1. Transport the equipment carefully. Do not subject it to excessive shock or vibration. (See 8.1.)
2. Carefully unpack all the packages and check the components against the packing list supplied. Check that the Shockwatch and Tiltwatch sensors have not been activated. *Notify any shortages or damage to the shipping company and to InnoLas Laser immediately.*  
(See Appendix E.)
3. Remove the packaging from the laser head and power supply. Keep the packing materials for use when transporting the system to the final destination.

### 7.2. Positioning and mechanical mounting

**Important!**

The mosquito system must not be installed in an environment with conductive dust or condensation.

**Important!**

Ensure that all parts of the system are securely fixed to withstand vibrations.

**Important!**

Position all components so that the safety and type labels are clearly visible.



**WARNING**

**Risk of injury or damage to equipment**

The laser head is heavy. Transport it using the handles provided and fasten it in position firmly using appropriate bolts and dowels.

The support framework must be sufficient to provide a solid and safe fixing.

### 7.2.1. Laser head

The laser head is mounted from the bottom face. A four-point fixing is provided in each case together with a precision hole and slot to locate on dowel pins on the system support framework. This assures accurate and stable beam pointing.

1. Locate the laser head onto two dowel pins that are securely fixed to the system support framework, then firmly fix the head in position using three bolts.

**Important!**

Ensure that the laser head is fastened to a heatsink adequate for the operating environment.

2. Remove the protection tape from the beam output window.



**CAUTION**  
**Risk of optical damage**

Do not touch the beam output window or place it under mechanical stress.

### 7.2.2. Power supply

The power supply is designed to fit into a 19-inch rack. Ensure that the rack is fitted with rails sufficient to support the weight of the power supply.

*Never rely on the front plate fixing holes to support the full weight of the unit.*

Position the power supply so that the emission warning lamp and other status lamps are visible during operation.

## 7.3. Electrical connections

**Important!**

Work on the electrical system must only be carried out by trained and authorised personnel. The valid VDE guidelines must be observed.

The site mains supply voltage *must* match the voltage stated on the device label.

**Important!**

External equipment connected to the system must comply with EN61010-1 and appropriate local standards.

**Important!**

Use only cables complying with EN61010-1 and EN60204-1.



**DANGER**  
**Risk of electrocution**

Switch off and disconnect the equipment from the mains electrical supply before exposing electrical terminals. Only trained and authorised personnel should remove covers from the power supply.



**DANGER**  
**Risk of electrocution**

Electrical connections must only be made by trained and authorised personnel.

1. Connect the power supply to the laser head using the special D-connectors.
2. Connect the mains supply and a good ground. Fit a circuit breaker with 16 A capacity.



**DANGER**  
**Risk of electrocution and damage to equipment**

If the insulation around the AC mains supply terminals is damaged do not connect the power supply. Replace it with an undamaged power supply.



**DANGER**  
**Risk of electrocution**

Before switching on the AC power, verify the quality of the ground connection according to the appropriate standards.

## 7.4. Safety and interlock connections

Interlock and system reset connections are made using a 15-pin sub-D connector.

### 7.4.1. Emergency stop interlock

The mosquito Emergency Stop circuits must be connected to the system Emergency Stop.

### 7.4.2. External laser emission warning lamp

At least one external laser emission warning lamp must be provided in a clearly visible location on the laser safety enclosure. This must comply with EN60825.

## 7.5. Control connections

1. Connect either the USB or RS232 connector on the power supply to an external controller or to a PC.
2. Connect the 25-pin user interface connector to an external controller.

## 7.6. External beam delivery components

External OEM beam delivery components must not degrade the beam from the mosquito laser head and must fully comply with the requirements of EN60825.

## 7.7. Initial operation



### **WARNING** **Hazardous laser radiation**

Always wear protective eye wear matched to the emission wavelength and output power of the laser. Instruct all personnel in the vicinity to wear identical protective eye wear.

1. Place a suitable beam block or power monitoring device in the beam path. Do not place it close to optical surfaces to avoid risk of contamination by evaporated material.
2. Turn on the main switch on the power supply back panel. The **Power** status lamp illuminates.
3. Ensure that the **Emergency Stop (System Off)** button on the power supply front panel is in the active position. (Turn it clockwise to release.)
4. Ensure that all external interlock circuits are enabled.
5. Insert the key in the key switch and turn the key switch clockwise to position 1. The **Warmup/Ready** status lamp flashes to indicate that the system is warming up. The laser emission warning indicator lamps on the front of the power supply and on the top of the laser head diode module illuminate.  
*Note: The key can only be inserted or removed when the switch is in position 0.*  
When the **Warmup/Ready** lamp illuminates continuously, the system is ready for use but the diode power supply is switched off.  
*Note: The warm up may take up to 15 minutes.*
6. Turn the key switch to position 2. The shutter opens if the external safety and interlock circuits are enabled.
7. Transmit a set of process parameters to the mosquito
  - Check that the mosquito emits a beam.
  - Open an external emergency stop interlock. Check that the mosquito powers off.
8. Power up the system again and carry out beam delivery alignment, as required.

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## 8. Transport and recommissioning

### 8.1. Transport

- Fit the protection tape over the beam output window.
- Store and transport in a clean, dry environment away from dust, moisture, etc.
- Do not subject the system to excessive shock or vibration. (See 2.6.8)
- Transport in a horizontal position. Maximum tilt angle 15°.

### 8.2. Recommissioning

Follow the procedures and checks used for the initial installation.

**Important!**

The complete system must be checked by a qualified specialist before restarting.

**Important!**

Remember to remove the cover plate from the output window before starting the system.



**DANGER**  
**Risk of electrocution**

Switch off and disconnect the equipment from the mains electrical supply before removing covers. Only trained and authorised personnel should remove covers from the power supply.



**DANGER**  
**Risk of electrocution**

Electrical connections must only be made by trained and authorised personnel.



**DANGER**  
**Risk of electrocution and damage to equipment**

If the insulation around the AC mains supply terminals is damaged do not connect the power supply. Replace it with an undamaged power supply.



**DANGER**  
**Risk of electrocution**

Before switching on the AC power, verify the quality of the ground connection according to the appropriate standards.



**WARNING**  
**Hazardous laser radiation**

Always wear protective eye wear matched to the emission wavelength and output power of the laser. Instruct all personnel in the vicinity to wear identical protective eye wear.

## 9. Interfacing

All external customer connections are located on the rear panel of the power supply.

*Note: D-connector locking screws have #4–40UNC threads.*



- 1 Optional heatsink fan power
- 2 Interlocks
- 3 Laserhead
- 4 RF output
- 5 RS232 sub-D control signals
- 6 USB control signals
- 7 User interface
- 8 External trigger
- 9 AC mains in
- 10 RF level

**Figure 17 - Power supply connections**

### 9.1. Interlocks

Interlock and system reset connections are made using a 15-pin sub-D connector.

#### 9.1.1. Emergency stop

Signal name	Pin number	Function
User_NA1.1	9	Emergency stop loop 1, send. Keep voltage free!
User_NA1.2	10	Emergency stop loop 1, return. Keep voltage free!
User_NA2.1	11	Emergency stop loop 2, send. Keep voltage free!
User_NA2.2	12	Emergency stop loop 2, return. Keep voltage free!

#### 9.1.2. System reset

Signal name	Pin number	Function
User_SystemReset 1.1	13	Reset emergency stop send (can be also done by turning the keyswitch to position 0 or by RS232 command)
User_SystemReset 1.2	14	Reset emergency stop return (can be also done by turning the keyswitch to position 0 or by RS232 command)
24 Vdc Out (Fan or chiller start)	4 & 5	Switched DC output for heatsink fans or chiller remote start
GND (Fan or chiller start)	6 & 7	GND for 24 Vdc for heatsink fans or chiller remote start

### 9.2. Q-switch and AOM control inputs

Q-switch control inputs are made using BNC connectors.

### Trigger

Used to trigger the intra-cavity Q-switch.

Voltage: TTL

State or edge triggered

Switchable between high or low active

Pullup or pulldown to stop emission in case the cable is disconnected

### RF level

An analog voltage used to control the RF level in the intra-cavity Q-switch.

Voltage: 0–10 V

0 V = 0% RF

10 V = 100% RF

(not linear)

## 9.3. User interface

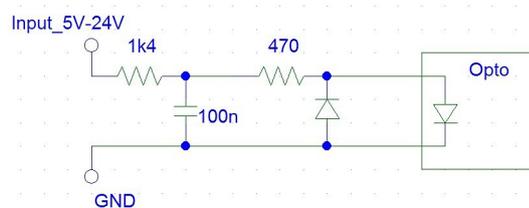
User interface connections are made using a 25-pin D-connector.

### Important!

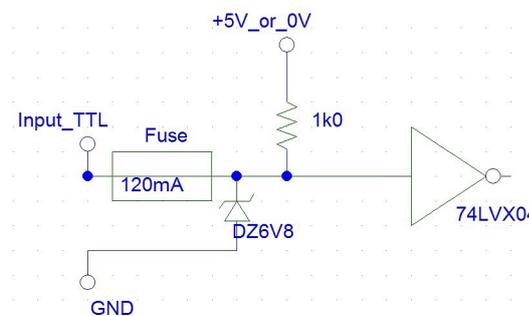
24 V output signal levels are standard but may be globally reconfigured to 5 V TTL levels, if required.

### 9.3.1. Input and output configurations

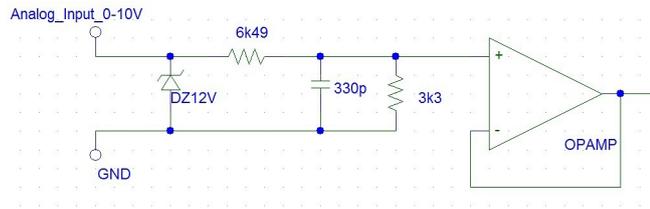
#### Input 5–24 V



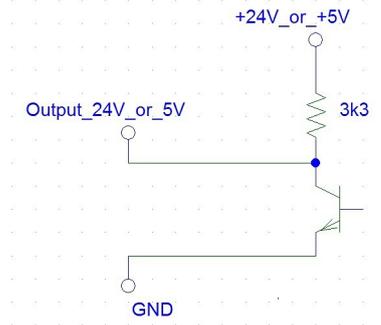
#### Input 5 V TTL



## Input analog



## Output 5–24 V



### 9.3.2. Signal list

Signal name	Pin N°	Function	Type	Range	Comment	Max. current ( $I_{max}$ )
Ground	1	Signal ground				
FPK Start	2	Initiates an FPK sequence	TTL in	TTL	Rising or falling edge trigger; software configurable	5 mA
Emergency Stop status	3	Indicates if the Emergency Stop circuits are open or closed	TTL / 24 V out	TTL or 24 V	High = closed	8 mA @ 24 V or 1.5 mA @ 5 V
Changes Complete	5	Confirms that changes are active after a change of parameter set	TTL / 24 V out	TTL or 24 V	High = changes complete	8 mA @ 24 V or 1.5 mA @ 5 V
RF Modulation	6	Represents the RF power that is applied to the intra-cavity Q-switch during the RF-off time	Analog in	0–10 V	0 V = 0% RF 10 V = 100% RF (not linear)	1 mA
Trigger	7	External trigger for the intra-cavity Q-switch	TTL in	TTL	State or edge triggered Switchable between high or low active Pullup or pulldown to stop emission in case cable is disconnected	5 mA
Laser Ready	8	Indicates the laser is ready to lase	TTL / 24 V out	TTL or 24 V	High = ready	8 mA @ 24 V or 1.5 mA @ 5 V

Signal name	Pin N°	Function	Type	Range	Comment	Max. current (I <sub>max</sub> )
Not used	9					
Ground	10	Signal ground				
System Enable	12	Softstart and softstop System starts if Pin12 is high and RS232 system enable=1 (RS232 default is system enable=1)	5–24 V digital in	5–24 V	High = system on Low = system off	12 mA @ 24 V or 2 mA @ 5 V
Ground	13	Signal ground				
Diodes Powered	14	Warning signal that the diodes are powered and laser emission is possible.	TTL / 24 V out	TTL or 24 V	High = diodes are powered	8 mA @ 24 V or 1.5 mA @ 5 V
Warning	15	Indicates there is a system warning	TTL / 24 V out	TTL or 24 V	High = warning	8 mA @ 24 V or 1.5 mA @ 5 V
Error	16	Indicates there is an error (Error always leads to emergency stop)	TTL / 24 V out	TTL or 24 V	High = error	8 mA @ 24 V or 1.5 mA @ 5 V
Not used	17					
Not used	18					
Gate	19	Enable for pulsed or CW output Rising edge can start FPK Sequence. Internal pulse generator is synchronised to rising or falling edge of gate	TTL in	TTL	State triggered Switchable between high or low active Pullup or pulldown to stop emission in case cable is disconnected	5 mA
Set Parameter Strobe	20	Strobe clocks pins 21 to 24 with micro-controller and activates the transmitted parameter set	5–24 V digital in	5–24 V	Positive edge	12 mA @ 24 V or 2 mA @ 5 V
Parameter Set – bit 0	21	Bit 0 of the parameter set	5–24 V digital in	5–24 V	High = 1 NC or low = 0	12 mA @ 24 V or 2 mA @ 5 V
Parameter Set – bit 1	22	Bit 1 of the parameter set	5–24 V digital in	5–24 V	High = 1 NC or low = 0	12 mA @ 24 V or 2 mA @ 5 V
Parameter Set – bit 2	23	Bit 2 of the parameter set	5–24 V digital in	5–24 V	High = 1 NC or low = 0	12 mA @ 24 V or 2 mA @ 5 V

Signal name	Pin N°	Function	Type	Range	Comment	Max. current (I <sub>max</sub> )
Parameter Set – bit 3	24	Bit 3 of the parameter set	5–24 V digital in	5–24 V	High = 1 NC or low = 0	12 mA @ 24 V or 2 mA @ 5 V
24 V Supply	25	24 V supply for external components and/or system enable and shutter control	24 V	24 V ±10%	Fused @ 200 mA	100 mA



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## 10. Parts list

- Heatsink with fans — Part number 22153
- Adapter plate for heatsink — Part number 22078



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## Appendix A. RS232 event codes

Event Code (decimal)	Event Code (hex)	Message ID	Name
Byte 1 + 2	Byte 1 + 2	Byte 3 + 4	
16	0010	xxxx	Command not available
18	0012	xxxx	OpCode unknown
20	0014	xxxx	Value out of range
22	0016	xxxx	Access level violation



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## Appendix B. RS232 error codes

Error code (decimal)	Error code (hex)	Name	Description
2000	07D0	Emergency stop loop 1	Emergency stop loop 1 is open
2001	07D1	Emergency stop loop 2	Emergency stop loop 2 is open
2002	07D2	Emergency stop relay 1	Emergency stop relay 1 released
2003	07D3	Emergency stop relay 2	Emergency stop relay 2 released
4005	0FA5	Temperature error laser crystal	Laser crystal temperature out of range
4006	0FA6	Temperature error laser crystal	Laser crystal temperature out of range
4007	0FA7	Temperature error laser crystal	Laser crystal temperature out of range
4008	0FA8	Temperature error laser crystal	Laser crystal temperature out of range
4009	0FA9	Temperature error laser crystal	Laser crystal temperature out of range
5004	138C	QSD failure	Hardware failure
5005	138D	Overvoltage at diodes	Hardware failure
5006	138E	Undervoltage at diodes	Hardware failure

Due to our policy of continuous product and software improvement, please contact InnoLas Laser customer support for updated error code details.



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## Appendix C. RS232 warning codes

Warning code (decimal)	Warning code (hex)	Name	Description
4000	0FA0	Diode 1 low temperature	Device not at set temperature, e.g. during warm up.
4001	0FA0	Diode 1 high temperature	Device not at set temperature, e.g. during warm up.
4004	0FA4	Laser crystal low temperature	Device not at set temperature, e.g. during warm up.
4005	0FA5	Laser crystal high temperature	Device not at set temperature, e.g. during warm up.
4006	0FA6	SHG low temperature	Device not at set temperature, e.g. during warm up.
4007	0FA7	SHG high temperature	Device not at set temperature, e.g. during warm up.
4008	0FA8	THG low temperature	Device not at set temperature, e.g. during warm up.
4009	0FA9	THG high temperature	Device not at set temperature, e.g. during warm up.

Due to our policy of continuous product and software improvement, please contact InnoLas Laser customer support for updated warning code details.



## Appendix D. Laser state codes

Main state (hex)	Sub state (hex)	Description
0	0	Start initialising
0	1	Initialisation running
0	2	Initialisation complete
4	0	Emergency stop
6	0	System off
10	0	Warmup initialising
10	1	Warmup starting chiller
10	2	Warmup flow check OK
10	3	Warmup temperature check OK
10	4	Warmup chiller check OK
10	10	Warmup starting head power supply
10	11	Warmup DPS relay OK: Wait for CAN bus
10	12	Warmup head TECs temp reached
10	13	Warmup head TECs temp stabilisation
10	14	Warmup DPS feedback test
10	16	Warmup write head
10	17	Warmup CAN bus OK; Wait for DPS
10	18	Warmup start TECs
10	19	Warmup TECs ramp up
20	0	Standby 2
30	0	Standby 1
30	1	Standby 1; Shutter disabled
30	2	Standby 1; Shutter enabled
40	0	Laser ready
40	1	Laser ready; Shutter disabled
40	2	Laser ready; Shutter enabled
50	0	Shutdown initialising
50	1	Shutdown DPS off
50	2	Shutdown TECs off
50	3	Shutdown chiller off
50	4	Shutdown flow off
51	0	Shut down system
51	1	Shutdown start relay off
51	2	Shutdown DPS off
51	3	Shutdown chiller off

Main state (hex)	Sub state (hex)	Description
51	4	Shutdown system off

## Appendix E. Packing list

### Packing List mosquito



Customer: \_\_\_\_\_  
 Serial Nr.: \_\_\_\_\_

<u>Quantities</u>	<u>Description</u>	<u>Type</u>
_____	Laser Head	_____
_____	Power Supply Unit	_____

**Accessories**

_____	Keys	
_____	Cable Signals Laser head	_____
_____	Power Cable Supply	
_____	Control Cable PC Power Supply (RS232)	
_____	Dummy Connector User Interface	
_____	Dummy Connector Interlok	
_____	Short-circuit Connector Laserhead	
_____	Thermal Conductive Foil	

**Optional**

_____	Chiller	_____
_____	Water Hose	_____
_____	Power Cable Chiller	
_____	Water Bottle	
_____	Water Connectors	
_____	Air Cooling Unit incl. Cable	

**Documentation**

_____	User Manual	
_____	Software & Manual CD	
_____	Final Test Protocol	

**Additional**

_____		
_____		
_____		
_____		

Shockwatch Nr.: \_\_\_\_\_

\_\_\_\_\_ Date Name



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## Appendix F. Your notes





