VisUV/IR Laser Platform

PicoQuant

Versatile Picosecond Laser Module

Externally triggerable high power picosecond laser

User Manual

Document version 2.0.3

Table of Contents

1. General safety information

CAUTION! Before using this device, make sure that you have read and understood the content of this user manual. Store this documentation in a safe and easily accessible place for future reference.

Incorrect handling of this product may result in personal injury or physical damage. The manufacturer assumes no responsibility and cannot be held liable for any injury / damages resulting from operating the device outside of the normal usage defined in this manual.

1.1. Warning Symbols and Conventions

The following symbols and conventions will be used throughout this manual. Please take time to familiarize yourself with their meaning before proceeding.

	The **general safety alert symbol** is used to alert you to hazards that may lead to personal injury or physical damage. Follow all associated safety instructions to avoid possible injury or death.
	A **high voltage warning symbol** is used to indicate the presence of un-insulated, dangerous voltage inside the enclosure. Note that this voltage may be sufficient to constitute a risk of shock.
	The **laser radiation warning symbol** alerts you that the device can generate laser radiation. Follow all applicable laser safety instructions to avoid injury or damages.
	The **warning for hot surfaces symbol** is used to indicate areas of the housing (e.g., heat sinks) that can become dangerously hot under specific conditions. Do not touch or place any inflammable objects on these surfaces during operation.
	The device's susceptibility to electrostatic discharge (ESD) is indicated by the **ESD warning symbol**. Ensure that you follow proper ESD protection rules to avoid damaging the device.
CAUTION!	Make sure to follow any instructions prefaced with "**CAUTION!**" to avoid personal injury or damaging the device.
WARNING!	The "**WARNING!**" label prefaces any instructions that shall be followed to avoid severe injury or death.
NOTICE	Important tips and information for device operation that do not include a risk of injury or damage are prefaced with the "***NOTICE***" label.
	This symbol indicates that an earth terminal shall be connected to the ground (to avoid risks of electrical shock).

1.2. Electrical Safety Instructions

WARNING! To avoid electric shock, the power cord's protective grounding conductor must be connected to the ground.

This device contains no user serviceable components. Do not remove covers! Servicing of internal components is restricted to qualified personnel.

CAUTION! Never connect or disconnect any cable while the system is powered ON. Before plugging or unplugging any interconnection between laser driver and laser head, **switch off** all components using the ON/OFF switch at the rear panel. Charged cables can damage electronic devices!

Disconnect the power cord from the electrical outlet before performing any maintenance.

1.3. Laser Safety Instructions

WARNING! Visible and invisible laser radiation

The VisUV/IR laser module platform is available in different configurations and can emit visible, infrared, or UV light. Infrared or UV light is not visible to the eye! **These lasers modules can emit laser light of class 3b / IIIb or class 4 / IV, depending on module type.** Please refer to the labels affixed to the laser head, the table in Appendix 11.2 as well as to the laser delivery report for information on your device's classification.

Lasers can be hazardous and have unique safety requirements. Permanent eye injury and blindness is possible if lasers are used incorrectly. Pay close attention to each safety related CAUTION and WARNING statement in the user manual. Read all instructions carefully BEFORE operating this device.

The VisUV/IR laser modules are manufactured according to the International Laser Safety Standard IEC 60825-1:2014 and comply with the US law 21 CFR §1040.10 and §1040.11.

Required Laser Safety Measures

Please observe the laser safety measures for class 3b / IIIb or class 4 / IV lasers (depending on your device's classification) in accordance with applicable national and federal regulations. The owner / operator is responsible for observing the laser safety regulations.

What does the owner / operator have to observe?

- The owner / operator of this product is responsible for proper and safe operation and for following all applicable safety regulations.
- The owner / operator is fully liable for all consequences resulting from the use of the laser for any purposes other than those listed in the operating manual. The laser may be operated only by persons who have been instructed in the use of this laser and the potential hazards of laser radiation.
- The owner / operator is responsible for performing and monitoring suitable safety measures (according to IEC/EN 60825-1 and the corresponding national regulations).
- The owner / operator is also responsible for naming a laser safety officer or a laser protection adviser (according to the standard IEC/EN 60825-1: "Safety of laser products, Part 1: Classification of systems, requirements and user guidelines" and the respective national regulations).
- When using lasers of class 3B or class 4 / IV, it is required to wear special eye protection (laser safety goggles).
- The room in which the VisUV/IR laser module is installed must be labeled as laser area.

The following security instructions must be followed at all times.

General Safety Instructions for Operation

- Never look directly into a laser beam or a reflection of the laser beam. Avoid all contact with the laser beam.
- Beams of class 4 / IV laser light can ignite flammable materials or cause explosions.
- Do not introduce any reflective objects into the laser beam path.
- Every person involved with the installation and operation of this device has to:
  - Be qualified
  - Follow the instructions of this manual
- As it is impossible to anticipate every potential hazard, please be careful and apply common sense when operating the VisUV/IR laser module. Observe all safety precautions relevant to Class 4 / IV lasers.
- Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
- This device contains not user servicable optical or electrical components. Do not open the device's housing under any cirumstances.

1.4. Laser Safety Labels

The safety labels are visible on the optical output side of the VisUV/IR laser module, while the laser aperture labels are located below and above the respective laser outputs, as shown in Fig. 1 and Fig. 2, respectively.

NOTICE The labels shown in the following figures represent only examples. Please check the labels on your device as well as the laser delivery report in the appendix for the applicable wavelengths and optical power. A table summarizing the warning labels for all currently available VisUV/IR laser modules is provided in section 11.2.

Each laser output port features a manually operated mechanical shutter (highlighted by green boxes in Fig. 1 and Fig. 2). The shutters are labeled with the wavelength that is emitted from their respective laser output port. The shutters are operated by pulling / pushing the labeled sliders:

- The shutter is **closed** (laser emission is mechanically blocked) when the slider is **pushed in**
- The shutter is **open** (laser emission is not mechanically blocked) when the slider is fully **pulled out**

WARNING! Laser light can be emitted from the aperture when the shutter is open. Ensure that all applicable laser safety measures are observed before opening any of the mechanical shutters.

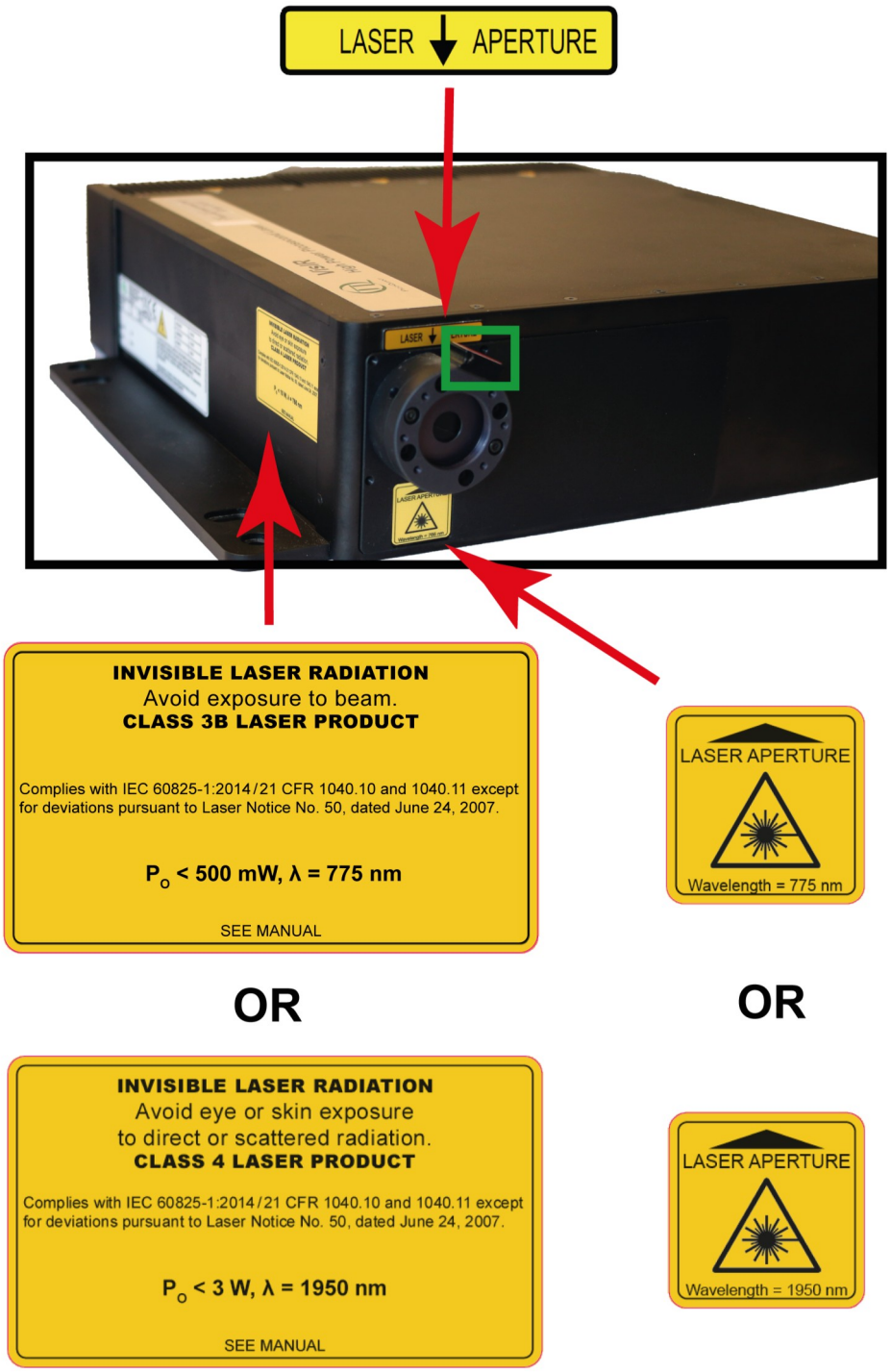


Fig. 1: VisIR-775 (class 3b / IIIb) or VisIR-1950 (class 4 / IV) – laser aperture label and laser warning sign

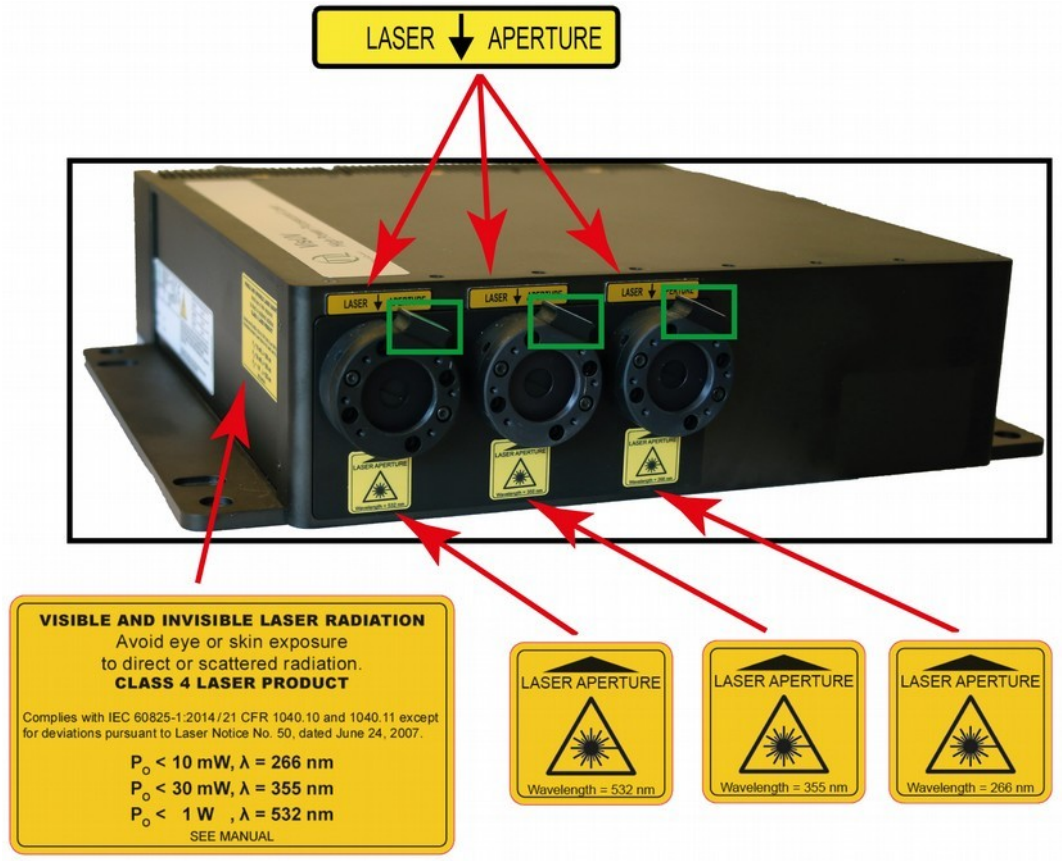


Fig. 2: VisUV-266-355-532 (calss 4 /IV) – laser aperture label and laser warning sign

The identification / product label (including PicoQuant's logo, model name, serial number, WEEE symbol and CE symbol) is located on the backside of the VisUV/IR laser module (see chapter 3.4,).

1.5. Remote Interlock Connector and Manual Reset

In order to meet laser safety regulations for laser class 4 / IV devices, a hardware lock as well as a remote interlock connector are part of the VisUV/IR laser module. Removing the green LEMO connector plug will immediately deactivate the power supply of the laser. The remote interlock connector is located on the front plate of the VisUV/IR laser module as shown in Fig. 11.

Fig. 3: Location of the interlock connector (highlighted by a red box)

In order to meet laser safety regulations, you may need to install a remote interlock, e. g., a door switch, to deactivate the power to the laser when the door to the laser area is opened.

Pin assignment for the interlock

The interlock is a 4 pin LEMO EGG.00.304.CLL female connector as shown in Fig. 4. In order to activate laser emission, **pins 2 and 3** need to be bridged using a suitable adapter. Do **not** apply any voltage.

Fig. 4: Interlock LEMO connector

Important Note:

In order to comply with Laser Class 4 / IV regulations, laser output will be internally blocked if one of the following events occur:

- Power interruption during the operation of the VisUV/IR laser module. Laser emission will **not** resume once power is restored.
- Interruption of the remote interlock circuit.
- Laser key switch is **not** in the *STBY* position when the power button is pushed in order to start the VisUV/IR laser module
- When using the SEM interface, the connected Sepia PDL 828 can generate a lock

Once the hardware lock of the system has been triggered, the *ON* LED will **permanently blink red**, even when the laser key switch is in the *ON* position.

To unlock the system, a **manual reset** is needed. The **manual reset** is done by turning the laser key switch back into the *STBY* position. Laser emission can then be reactivated by turning the laser key switch into the ON position.

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

2. Introduction

Devices based on the VisUV/IR laser platform are compact, stand alone picosecond laser modules. They implement a Master Oscillator Fiber Amplifier (MOFA) concept with optional frequency conversion. The master oscillator generates infrared picosecond laser pulses with variable repetition rates up to 80 MHz using the proven gain-switching techniques from PicoQuant. The output of this seed laser is directly fed into a multi-stage fiber amplifier, which boosts the output from the seed laser by several dB while conserving all other characteristics of the seed light such as emission wavelength, polarization, and pulse width.

Modules derived from the VisUV/IR laser platform can be used as stand-alone devices including an internal driver unit with all common driving functions as found in the Sepia PDL 828 from PicoQuant. The modules can be operated at 12 different internally selectable repetition rates ranging from 80 MHz to 31.25 kHz and can also be triggered externally by TTL or NIM signals at any repetition rate from <1 Hz and up to 80 MHz. This feature is useful for perfect synchronization of the laser in a master/slave configuration.

The VisUV/IR laser module can also be controlled by an external Sepia PDL 828 through the SEM interface. It is also possible to control the VisUV/IR laser module through an RS232 interface using human-readable commands. The command set features are the same as in the two Sepia modes.

The VisUV/IR laser module are built from a versatile, picosecond pulsed, high power laser platform and are available in several configurations.

VisIR modules

The *VisIR* master oscillator generates infrared picosecond pulses at 1064, 1531, 1550 or 1950 nm that are fed into a multi-stage fiber amplifier and, optionally, a single pass Second Harmonic Generation (SHG) stage yielding the final laser output. In that way, it is possible to generate picosecond pulses at 766 or 775 nm with an average output power of more than 1.5 W. An example of the working principle for the VisIR-765-HP “STED” is schematically depicted in Fig. 5.

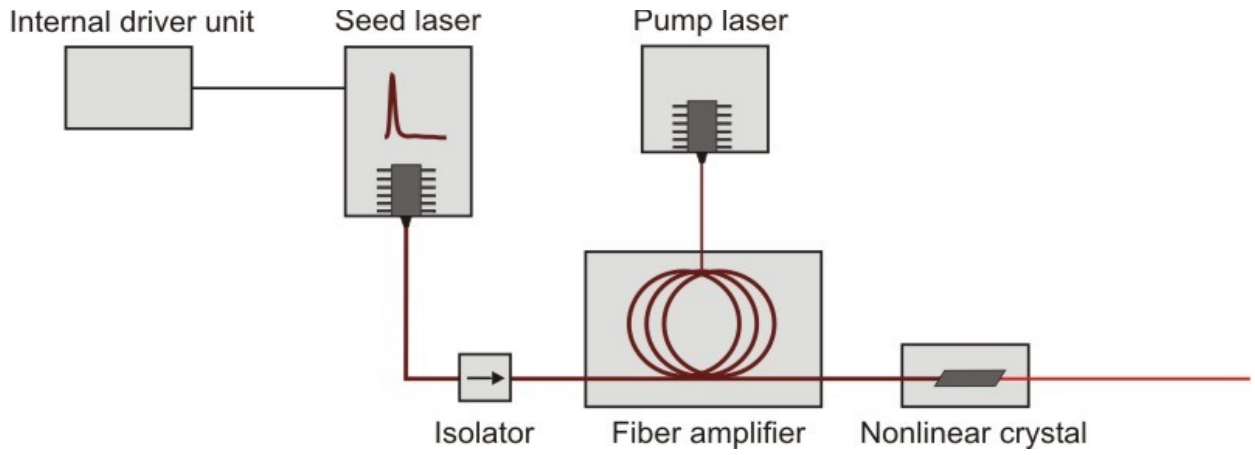


Fig. 5: VisIR – Schematic representation of the working principle

VisUV modules

The master oscillator of the *VisUV* generates infrared picosecond pulses at 1064 nm. The seed beam is then passed through a multi-stage fiber amplifier, which boosts the seed beams intensity by several dB while maintaining the other characteristics of the laser light such as emission wavelength, polarization, and pulse width.

The high pulse energies of the amplified infrared laser allow for efficient wavelength conversion enabling optical output at 266, 280, 295, 532, 560, and 590 nm with power levels up to 750 mW (wavelength dependent). Each wavelength is emitted from its own discreet output port, equipped with an individual shutter. VisUV modules are available in 1, 2, or 3 beam configurations. Fig. 6 illustrate the working principle of a 3-color VisUV-266-355-532 module.

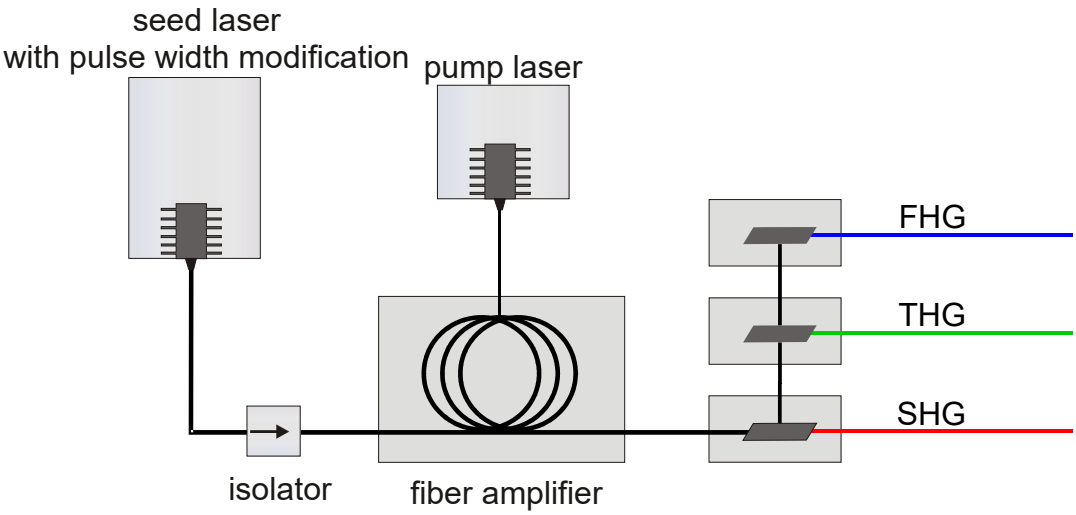


Fig. 6: VisUV - schematic representation of the working principle

3. Hardware Description

3.1. Front Panel

NOTICE

The front panel does not feature any manual controls for setting the operating parameters (e.g., instensity, repetition rate, selecting the trigger source) of the VisUV/IR laser module. These settings must be performed via a Graphical User Interface (GUI), see section 5.2 for more details.
However, the laser device may be used without connection to a PC. The VisUV/IR laser module will then be running with the last set of operational parameters that were saved to its memory.

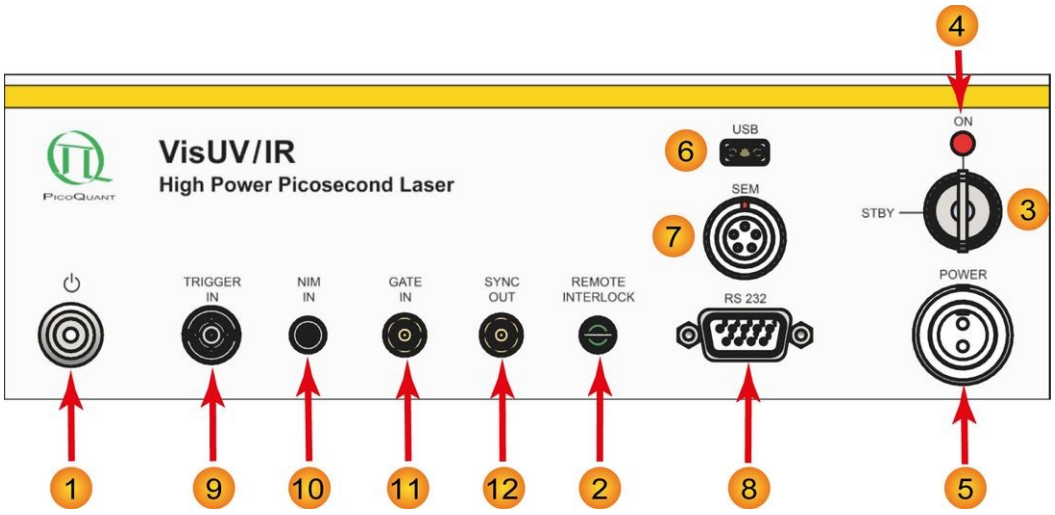


Fig. 7: Front panel

1 **Power button and indicator**. Pressing this button switches the VisUV/IR laser module's power state from off to on (and vice versa). The white LED indicates that the VisUV/IR laser module is on and that laser radiation can be emitted

2 **REMOTE INTERLOCK** socket for remote interlock connector (see section 1.5).

3 **Key switch** (laser switch): Turning the key to the *ON* position activates the laser. Power to the laser can be locked off by turning the key to the *STBY* position and removing the key.

4 **Key switch indicator**. The lit orange LED indicates that the VisUV/IR laser module is *ON* and that laser radiation is being emitted. A **red blinking *ON* LED** indicates that the laser module is in internally **locked condition**.

5 Main **POWER** input socket for the power supply.

6 **USB-C** connector to interface the VisUV/IR laser module with the PC

7 **SEM laser connector**: the VisUV/IR laser module can be optionally connected to and controlled by a Sepia PDL 828 laser driver via this port using a dedicated connector cable. Please refer to section 4.4 and the Sepia PDL 828 manual for more information

8 **RS 232 connector**: This port can be used to connect the VisUV/IR laser module to a control device via an RS 232 interface.

NOTICE

Changing the operational parameters of the VisUV/IR laser module requires that at least one type of interface (6 to 8) is connected to a control device, such as a PC or Sepia PDL 828, that runs a compatible software application (e.g., PicoQuant's `PQLaserDrv.exe`). If more than one of these connections are active at the same time, the VisUV/IR laser mod-

ule will accept control inputs from only one of them in the following order of priority: USB-C, SEM, and RS 232 (from highest to lowest). If no connection is active, the VisUV/IR laser module will operate with the last configuration. Changing interfaces is not possible while VisUV/IR laser module is on. In order to change the interface, a power cycle is needed.

9 **TRIGGER IN***:* external trigger input with variable trigger threshold, typically using a TTL pulse.

10 **NIM IN**: external NIM trigger input. Ideal to trigger from, e. g., the oscillator module (SOM 828) of the Sepia PDL 828 from PicoQuant.

11 **GATE IN**: gating input (female SMA connector)

The gating function affects the triggering mechanism. The gating input accepts TTL pulses and is effective if the VisUV/IR laser module is being triggered either from the internal oscillator or from an external source. The gating function can perform transition between on and off states within nanoseconds. Presuming a precise timing, it can switch in between two laser pulses, even at high repetition rates. The number of laser pulses that can be gated off depends on the repetition rate and is in the range of 3 to 8 pulses. If too many pulses are gated, the fiber amplifier switches off to prevent damage to it. The amplifier will switch on again once the gating signal is disabled. Note that switching the amplifiers on is not instantaneous but needs a few hundred milliseconds.

12 **SYNC OUT***:* Synchronization output connector (SMA connector)

3.2. Laser Locking Behavior

- The key switch 3 interrupts the laser power supply when it is in the horizontal position. The key can be removed only in this position. It's a good practice to keep the key switch locked unless the VisUV/IR laser module can be operated according to safety regulations.
- The remote interlock 2 shuts the laser power supply off when the loop current is interrupted.
- To comply to the laser safety regulations, laser emission is locked off for at least the first 10 seconds after the main power has been switched on.
- Laser emission is locked off as long as the VisUV/IR laser module checks its hardware while powering up.
- The VisUV/IR laser module keeps laser emission locked off, if it detects any abnormal operating conditions.
- Losing the trigger signal when the VisUV/IR laser module is triggered externally will NOT activate the hardware lock. In this case, the intensity of the pump diodes will be minimized while the seed laser is in a “stand-by” mode, waiting for the trigger signal for 10 s. This might lead to low powered residual seed laser emission from the corresponding aperture (1064 nm for VisUV or 1530 nm for VisIR).
  - Additionally, the ON LED on the front panel will still be lit in orange for 10 s before switching off. After that time, the pump diodes will be fully turned off.
  - Restoring the trigger signal will lead the VisUV / VisiR laser module to resume laser emission without needing a manual reset. Please note that if the trigger signal is restored during the 10 s “grace time” window (when the ON LED is still lit in orange), laser emission will be restored on the first trigger pulse. Resuming laser emission after this time window has elapsed will occur only after several trigger pulses.
- The controller can be instructed from the GUI or from any software using the programming library (API DLL) to hold the lasers locked off regardless of the position of the key switch. Refer to section 5.2.3 (GUI) and the separate API manual for more information on soft locking.

WARNING! Soft locking the lasers does not ensure eye safety!

3.3. Optical Output

The *VisUV/IR* platform features up to three dedicated laser output ports. Depending on the hardware configuration of the laser platform, one to three of these ports can be active. Unused laser output ports are closed with screw-on lids.

Fig. 8: Single UV wavelength VisUV unit equipped with cylindrical filter holder

The *VisIR* has one optical free beam output equipped with a manually controlled laser output shutter. The label on the shutter shows the output wavelength as shown in Fig. 1. The mechanical shutters feature threaded holes allowing to attach optional fiber couplers.

The VisUV can have up to three active, dedicated laser output ports, as shown in Fig. 2. Each active port is equipped with a manually controlled laser output shutter, while unused ports are closed.

However, note that if the *VisUV* is equipped with only a single UV wavelength (*VisUV-266* or *VisUV-355*), the shutter will be replaced with a cylindrical shaped filter holder (see Fig. 8). For laser safety reasons, these single wavelength *VisUV* models are also delivered with a red safety cap at the end of the cylindrical filer holder (see Fig. 9). This protective cap is secured via a single M3 hex crew and needs to be removed by the end user before first use of the laser module.

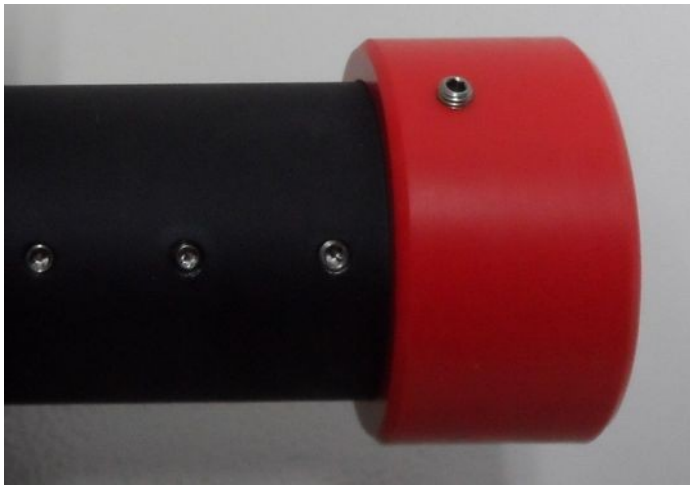


Fig. 9: Protective end cap (red) closing off the optical output on the single wavelength VisUV models VisUV-266 and VisUV-355.

A fiber coupler can be attached to the filter holder in the case of the *VisUV-355*.

The laser output can be coupled into either multi mode (MM) or polarization maintaining (PM) single mode fibers.

If a fiber coupler is attached to the output:

- The fiber type used is indicated in the individual test report (see appendix).
- Do not remove the fiber from the coupling optics since this will lead to a loss of the coupling adjustment! Re-adjustment is a demanding task and needs experience.

Note that some VisUV/IR laser module (such as the VisIR-1950-F), see Fig. 10 are equipped with a fixed optical fiber output. This fiber cannot be removed or exchanged by the user.

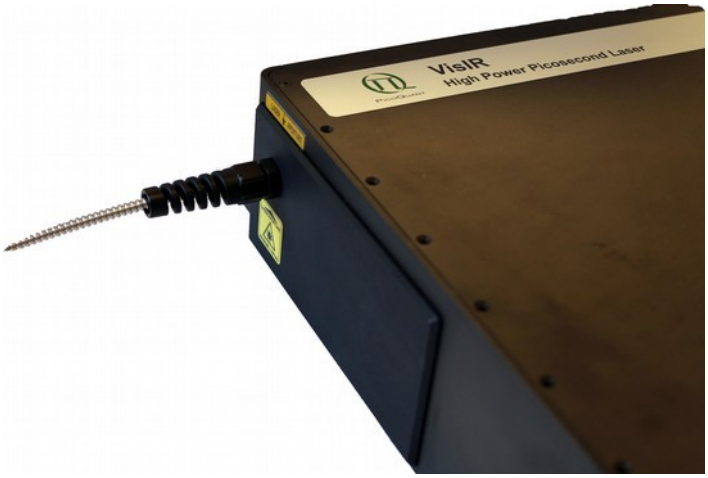


Fig. 10: VisIR-1950-F with fixed optical fiber.

3.4. Backside – Product Label

The product label can be found on the backside of the laser module (see Fig. 11). It shows all relevant information needed to identify the device, including product name, part number, serial number, manufacturing date as well as the PicoQuant logo with address, CE label, and waste regulation identifier.

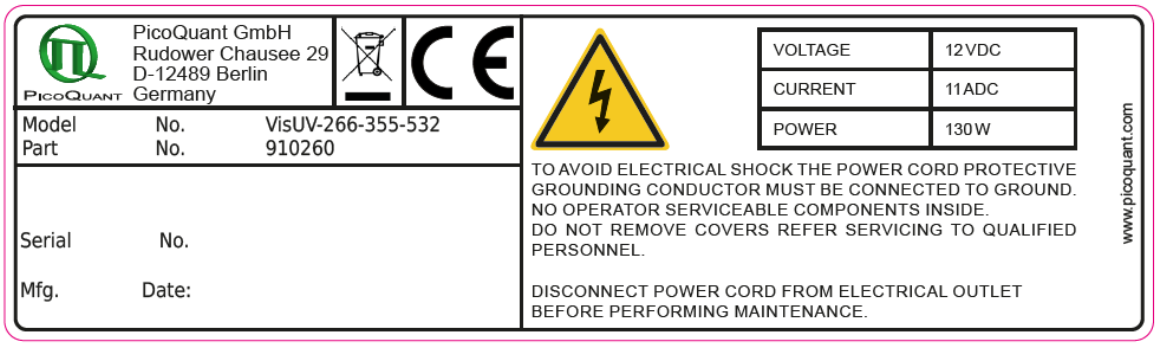


Fig. 11: Product label

This product information must be communicated to PicoQuant in all communication and trouble shooting processes regarding this device.

3.5. Cooling Fan Aperture Side – Heat Dissipation

A special design for heat dissipation is required due to the laser's high pulse energies. The laser module is therefore equipped with cooling fans on the heat sink as shown in Fig. 12. In order to ensure best laser performance and stability, please ensure free air circulation around the whole laser module.

CAUTION! Do not block the fan apertures. This might lead to laser instabilities or damage to the laser module!

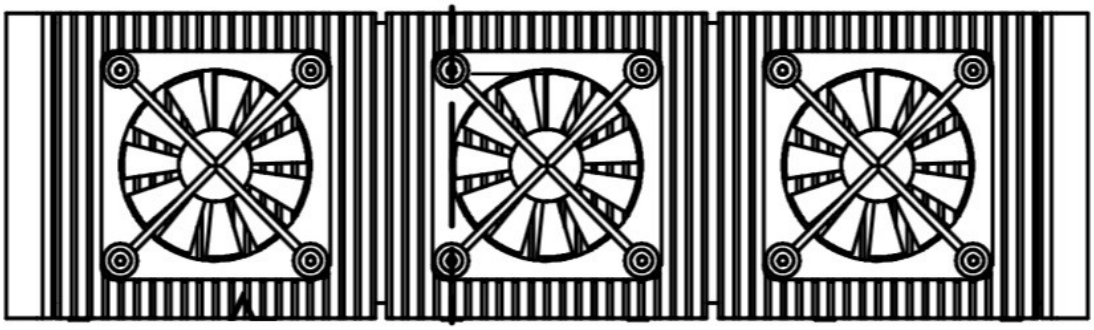


Fig. 12: Heat sink with integrated fan aperture

By default, the cooling fans will be running when the VisUV/IR laser module is powered on. PicoQuant recommends to leave the fan permanently running when using the laser module.

However, if your set-up is very sensitive to vibrations, the fans can be temporarily turned off via the *Fan* check box in the softwrae GUI (see section 5.2.4). This mode of operation should be restricted to short periods of time to prevent laser instabilities or even damage to the module.

All tests made at PicoQuant have, however, never showed any noticeable effect of fan vibration on vibration sensitive measurements.

CAUTION! **Disabling the fans via software for a longer time span will result in the VisUV/IR laser module's heat sinks becoming very hot (> 65 °C). Do not touch the heat sinks under these conditions!**
The high temperature may also prevent the stable and safe operation of the laser. Note that the laser module will enter a lock state when the temperature reaches ~ 68 °C. Higher temperatures may result in damage to the laser module.

4. Installation

4.1. Unpacking and Preparations

Your VisUV/IR laser module is delivered with a series of cables, accessories, and software that need to be connected / installed before the device can be used. Start by unpacking the delivery box and check that all components listed in the table below are present.

CAUTION! **The VisUV/IR laser module is quite heavy (7.5 kg). Be careful when unpacking the device and observe all appropriate guidance for lifting heavy objects. Not observing such guidelines may result in back injuries. Please refer to your safety officers or institutional safety guidelines if you are unsure on how to safely lift heavy objects.**

VisUV/IR laser module

This printed manual

Remote interlock stub plug (4 pin LEMO plug with green end cap)

2 keys for the laser keyswitch

Cable USB 3.0 C MALE TO USB 3.0 A MALE (2 m, 6.5x ft)

Power supply with power cable featuring appropriate mains plug (cabel not shown)

Installation medium for the operational software (CD)

Before installing and using the VisUV/IR laser module, please make sure to have

1. a solid base onto which the VisUV/IR laser module can be placed (e. g., an optical table)
2. a computer to install and run the operation software. The computer needs to have a free USB slot as well as a Windows 10 operating system.

Make sure that all of the following conditions are met before proceeding with the installation (numbering refers to the front panel as shown in Fig. 7):

- Laser key switch 3 is set to the position ***STBY*** (horizontal)
- Green remote Interlock stub connector is plugged into the remote interlock socket 2

4.2. Electrical Power and Signal Connections

- If desired, connect an external trigger signal to the connector labeled **TRIGGER IN** 9
- If desired, connect the **SYNC OUT** output connector 12 to an external device, e.g., TCSPC electronics from PicoQuant such as the TimeHarp 260, PicoHarp 300, MultiHarp 150, HydraHarp 400, or an oscilloscope
- Plug the power cable into the **main power socket** 5 But do not plug the power cable into a power outlet before installing the PicoQuant laser driver software (see section 4.3)

4.3. Software Installation

Once the VisUV/IR laser module is in its dedicated place and the relevant cables have been inserted, connect the VisUV/IR laser module to the host computer using the delivered USB C cable.

NOTICE	The VisUV/IR laser module should not be powered on before the control software is installed on the host computer!

The control software "**`PQLaserDrv.exe`**" for your VisUV/IR laser module and other laser drivers manufactured by PicoQuant needs to be set-up by an installer and is supplied on the CD along with your device. Installing the software is straightforward and performed by a step-by-step installation wizard.

NOTICE	In order to future-proof the software, a switch to a new USB driver architecture is required **starting with software version 1.2.xx.636** (changing from PQUSB to WinUSB). The two driver architectures are **NOT** compatible with each other. This means that once the new drivers have been installed and they have registered the PicoQuant laser driver(s), software packages relying on the older drivers will no longer be able to "see" or connect to these USB devices. The reverse is also true: i.e. a software package relying on the newer drivers will not be able to discover or communicate with laser drivers registered to the older USB driver architecture. An important consequence of this is that both the PQLaserDrv package as well as any software package requiring a connection to a PicoQuant laser driver (i.e. SymPhoTime 64 or EasyTau) should be fully updated together.

To install the software:

1. Insert the installation medium into the host computer
2. Launch the program: `PQLaserDrv_Setup.exe`
3. Follow the instructions on the screen
4. Accept the License agreement and click *Next* when requested
5. Define the destination folder for the installation of the software
6. Select the components to be installed (availability of which can change depending on product releases or discontinuations)
7. Select which launcher icons will be generated
8. Validate your choices by clikcing on *Next* and then click on the *Install* button to start the installation

Important Remarks:

The PicoQuant Laser Driver Software can control not only the VisUV/IR laser module but also the Sepia devices from PicoQuant. In case you need to control multiple lasers, then it is necessary to install all relevant components (see point 6 in the above list).

It is recommended to choose at least one of the suggested icon options. For each icon option chosen, the installer automatically creates two software launchers corresponding to the “Bright” and “Dark” PicoQuant color themes. For more details about the software color themes please refer to section 5.2.

9. Click *Next* to start the installation of the drivers. It is possible that a *Windows Safety Warning* windows pops up. In that case confirm the installation when requested in order to continue with the installation.
10. Click *Next* when requested to complete the installation
11. Click *Finish* to close the Installation wizard

Once the software is installed, the VisUV/IR laser module can be turned on (see chapter 5). When the laser is powerd on for the first time, Windows will detect a new device and install the necessary device drivers.

4.4. Connecting the VisUV/IR laser module to a Sepia PDL 828 (optional)

The VisUV/IR laser module can be optionally connected to a Sepia PDL 828 laser driver from PicoQuant via a Sepia Extension Module (SEM 828). This allows fully controlling a connected VisUV/IR laser module (e.g., setting the intensity, repetition rate, trigger source) from the Sepia PDL 828’s GUI. The connected laser module can then be operated along with laser heads from the LDH or LDH-FA Series as well as with plused LEDs from the PLS Series, exploiting the full functionality of the Sepia PDL 828’s oscillator module.

Perform the following steps to connect the VisUV/IR laser module to a Sepia PDL 828:

1. Make sure that both devices are powered down before proceeding
2. Install an SEM 828 (see Fig. 13) into the Sepia PDL 828 (if not already present). Refer to the manual of the Sepia PDL 828 for detailed instructions

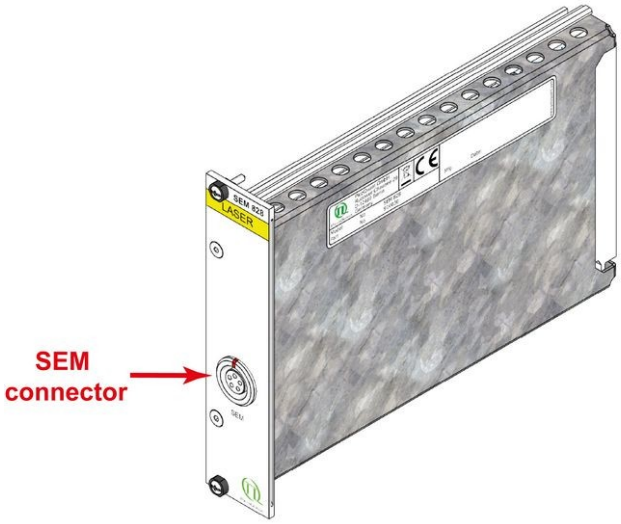


Fig. 13: Sepia Extension Module (SEM 828) with connector

3. Plug the dedicated SEM cable into the corresponding SEM sockets on both VisUV/IR laser module and Sepia PDL 828
4. Power up the VisUV/IR laser module and let it fully initialize (the Sepia PDL 828 has to be powered down)
5. Power up the Sepia PDL 828 and let it fully initialize
6. Start the PQLaserDrv.exe and select the Sepia PDL 828 as active laser driver (if necessary)
7. The control elements (see section 5.2.4) of the connected VisUV/IR laser module should now appear in appropriate slot of the Sepia GUI. Refer to the Sepia PDL 828 Manual for instructions on how to use its specific software controls

NOTICE	The order in which the devices are turned on is very important (steps 4 and 5)! Always turn on the connected stand alone laser device first. Only turn on the Sepia PDL 828 afterwards or the control elements will not show up in the GUI.

WARNING! **To prevent data corruption: do not unplug the dedicated SEM cable while both devices are powered on**

Perform the following steps to power down the combination of VisUV/IR laser module and Sepia PDL 828:

1. Power off the Sepia PDL 828
2. Power off the VisUV/IR laser module
3. If needed remove SEM cable

WARNING! Laser Safety

To ensure laser safety, the Sepia PDL 828 will control the interlock state of a connected VisUV/IR laser module. This has the following consequences:

- if the interlock is triggered by the Sepia PDL 828, then laser emission is shut down for all laser heads as well as for the connected VisUV/IR laser module.
- If the Sepia PDL 828 is powered off, the connected laser device will not be able to emit laser light while SEM cable is applied.
- While starting up, the Sepia PDL 828 will also block laser emission from any connected device.
- Using the Soft Lock button in the Sepia PDL 828 GUI will also turn off laser emission from any connected device.
- To activate laser emission from a connected **VisUV/IR laser module,** first make sure that the Sepia PDL 828 is unlocked and that the key switch of the **VisUV/IR laser module** is in STBY position. Only then turn key switch of the VisUV/IR laser module to the ON position

4.5. Connecting to a PC via the RS 232 Interface (Optional)

If no USB or SEM cable is attached the **VisUV/IR laser module** starts in RS 232 mode. In this mode all settings can be changed like in the other modes. In order to control the **VisUV/IR laser module** connect a standard RS 232 connector. Use a terminal program like TeraTerm or Putty to write commands to the **VisUV/IR laser module**.

Perform the following steps to connect the VisUV/IR laser module with a PC over RS 232 interface:

1. Connect the PC and the VisUV/IR laser module with a standard RS 232 cable. One can also use some kind of USB-to-RS 232 adapter
2. open a terminal program and connect to the correct com port[1] while using baudrate of 115200 and data format of 8 data bits and one stop bit.

1 If you don't know the correct port either check the window device manager or try every port by typing *IDN?

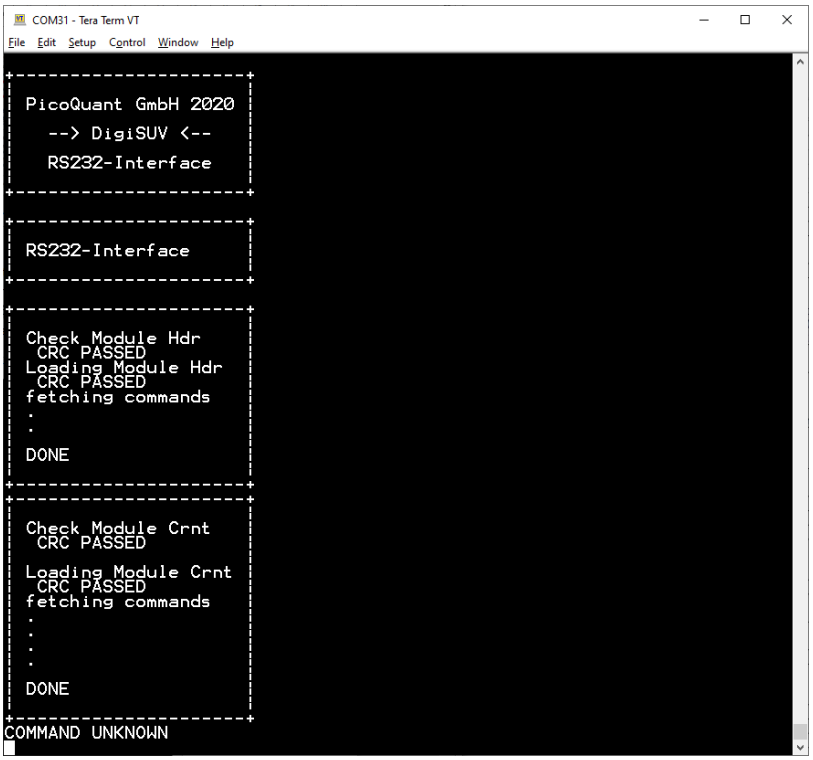


Fig. 14 :Startup output when using RS 232 interface

3. Power on the VisUV/IR laser module, some startup messages should appear (Fig. 14)
4. to verify the sending commands is also possible type '*IDN? In a newline and the VisUV/IR laser module should response with the device name

For successful usage keep following points in mind:

- Use only uppercase letters, numbers and special character '!', '*' and '?'
- single white space is also possible depending on command but not in numerical values
- only use short form (uppercase part) of command
- all settings are nonvolatile if otherwise noted
- command processing starts with *newline*
- system response:
  - *BUSY* system is busy and can therefore not handle command
  - *ACK* response for every correct set command (ends with '!')
  - NACK response for commands with wrong parameter
  - *COMMAND UNKNOWN* wrong or misspelled command

4.5.1. RS 232 Command Reference

- ***IDN?**
  - Print model name as device idendification
- **SYS**tem
  - **:FW?**
    - Print firmware version
  - **:RES!**
    - Reset front panel controller
  - **:PFW?**

        - Print pump controller firmware version
    - **:HOUR?**
        - Print total uptime
- **SOUR**ce
    - **:INTE**nsity**[**? | NUM**]**
        - intensity in ‰
- **TRIG**ger
    - **:STAT**us**?**
        - Returns *OK* or *NOK* depending on trigger detection on seed PCB
    - **:SOUR**ce[? | INT1 | INT2 | VAR | NIM | OFF**]**
        - ? Print current trigger source
        - INT1 80 MHz (internal)
        - INT2 1 MHz (internal)
        - VAR external input
        - NIM external input
    - **:DIV**ider[? | 1 | 2 | 4 | 8 | 16 | 32]
        - change trigger divider
        - divider only applies to internal trigger sources
    - **:TH**reshold[? | 0..4095]
        - trigger threshold for external input (VAR only)
            - -1V → 0
            - 0V → 2048
            - +1V → 4095

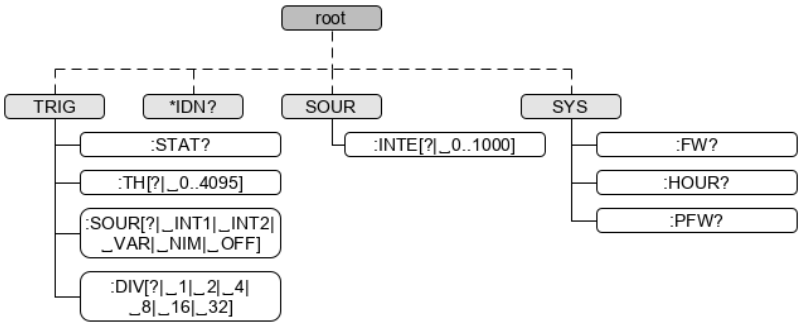


Fig. 15: RS 232 command overview

5. Operation

This section describes detailed step by step operation procedures for powering the VisUV/IR laser module on as well as on how to use the GUI for setting the different laser module settings (i.e. power intensity, trigger source, repetition rate, fan control). This section covers only the USB ans SEM mode.

5.1. Powering the System On

1. Make sure the key switch 3 in on *STBY* position
2. Make sure that the remote interlock connector 2 in place
3. Press the power button 1 to start up the VisUV/IR laser module. The power button indicator LED will light up white. The key switch indicator 4 start flashing red during initialization. After about 10 seconds, this LED will turn off and the system is ready for operation.

NOTICE	In order to comply with **Laser Class 4 / IV regulations**, laser output will be internally blocked if the key switch is not in the *STBY* position when the power button is pressed. This hardware locking will be indicated by **a permanently red blinking ON LED** 4 and the system is switched into an internal locked condition. To unlock the system a manual reset is needed. The manual reset is done by turning the key switch back into the *STBY* position.

4. Turn the key switch to the *ON* position. The LED labeled **ON** 4 will turn yellow.

   In order to reach stable output power, please let the *VisUV/IR* laser module warm-up for at least 20 min before you activate laser emission through the key switch.

WARNING!	**Before proceeding to the next steps, please make sure that all safety measures have been taken according to chapter 1.3 Laser Safety Instructions.**

5. Open the laser output shutter.
6. Adjust the operating parameters through the appropriate software (e.g. with PQLaserDrv.exe in stand alone mode or connected to a Sepia PDL 828).

If you cannot detect a laser beam, please check the trouble shooting diagram in section 6.4.

5.2. Setting Operating Parameters with PQLaserDrv Graphical User Interface

NOTICE	The VisUV/IR laser module must be turned on and the initialization process completed, before the software can be started!

The GUI is available in three different **color schemes:** PicoQuant bright scheme, PicoQuant dark scheme and a standard Windows scheme. The latter can be customized using the standard Window control panel.

The dark scheme is intended for light sensitive set-ups and experiments such as, e.g., photon counting and single molecule sensitive spectroscopy set-ups, where ambient light perturbation should be minimized as far as possible. However, for better readability, all screen shots in this manual correspond to the PicoQuant bright color scheme.

The color scheme is applied by the command line parameter "/style=<scheme>" where the placeholder <scheme> could be one of the legal values "dark", "bright" or "windows".

During the installation setup of the software, the installer can optionally generate separate desktop as well as quick launch icons for the respective bright and dark schemes (see section 4.3).

In the interest of ergonomics, all relevant active controls (button, edit box, etc.) change color when the mouse pointer hovers above them.

An overview of the GUI with all control elements is shown in Fig. 16 below.

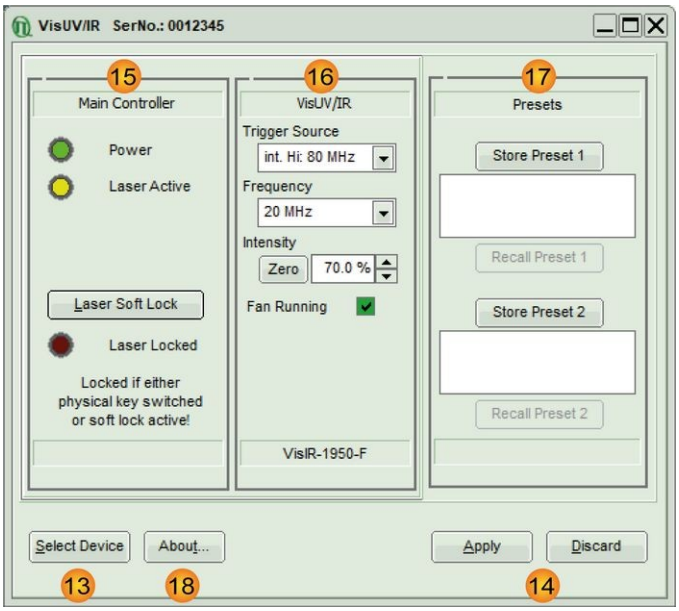


Fig. 16: PQLaserDrv GUI with a connected VisIR-1950-F - Overview of all control groups with indication of the individual sections

5.2.1. Select Device

The *Select Device* 13 function is useful if more than one VisUV/IR laser module (or any other USB laser device from PicoQuant) are connected to the same host computer. It can also be used to restore the USB connection to the device should it be lost during operation for any reason.

A mouse click on the *Select Device* button will start a scan for supported devices connected to the PC.

A modal dialogue with an *OK* and *Cancel* button presents a list box with the currently connected devices (Fig. 17). When opening the list box, all detected devices are listed by their serial number. The currently selected device is marked with an asterisk "*".

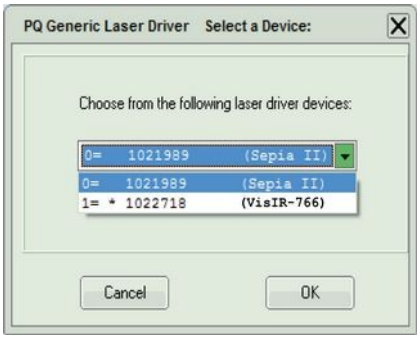


Fig. 17: Select device

Cancel	Back to the main window without any changes.
OK	Change to the newly selected device. Note that this might lead to changes in the GUI, if a device of different type or configuration is selected. The serial number of the currently selected device is always displayed in the title bar of the software.

5.2.2. Apply / Discard

Apply and *Discard* buttons 14 must be used to confirm or discard the configuration changes made in the GUI. The label of any control panel where changes have been made but not yet commited, will highlighted in orange as well as the *Apply* button. These highlights remain until the changes are either applied or discarded.

5.2.3. Soft Lock and Unlock of the VisUV/IR laser module

The VisUV/IR laser module can be locked (no laser light emission) not only with the hardware key switch on the front panel, but also via the GUI by clicking on the button labeled *Laser Soft Lock* / *Laser Soft Unlock* 15 , which is located in the controller frame on the left side of the software window.

The mechanism behind the soft lock is similar to that of an interrupt via the interlock loop. The soft lock can be used in USB and SEM mode.

WARNING! Soft locking the lasers does not ensure eye safety!

The *Laser Unlocked* state is recognizable in the software by the *Laser Locked* indicator turning dark red (see Fig. 18). In addition, the Key switch indicator LED 4 on the VisUV/IR laser module has turned OFF.

The *Laser Locked* state is recognizable in the software by the *Laser Locked* indicator turning bright red. The button text could be either *Laser Soft Lock* in case the system was hard locked by key or remote interlock circuit (see Fig. 19), or *Laser Soft Unlock* (see Fig. 20) in case the system was soft locked (This even masks a hard lock state). In addition, the **key switch indicator** LED 4 on the VisUV/IR laser module has light up red.

Please note that the lock state indicated in the GUI may refresh with a slight delay (< 1 s) with respect to the hardware LED on the front panel of the VisUV/IR laser module. **Consider:** The soft lock state is not persistently stored in the system; It is lost after power down / power up.

To unlock the system from any lock condition, a **manual reset** is needed. The **manual reset** is done by turning the laser key switch back into the *STBY* position. Laser emission can then be reactivated by turning the laser key switch into the ON position.

WARNING! Before unlocking the laser, please refer to chapter 1.3 for laser safety instructions. Allow about 3 – 5 minutes warm-up time after unlocking the laser to reach a stable output power.

Fig. 18: Laser unlocked

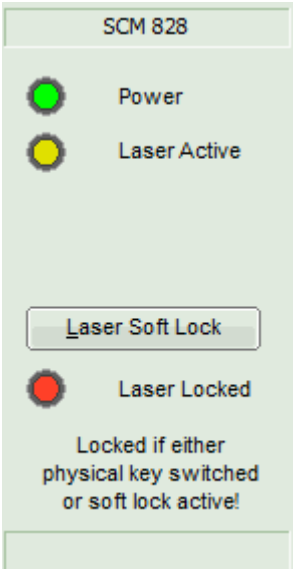


Fig. 19: Laser hard locked

Fig. 20: Laser soft locked

5.2.4. Laser Module Control Panel

Fig. 21) shows the laser control elements availble for the VisUV/IR laser module Note that the type of connected module will be automatically detected and displayed at the bottom of the control panel.

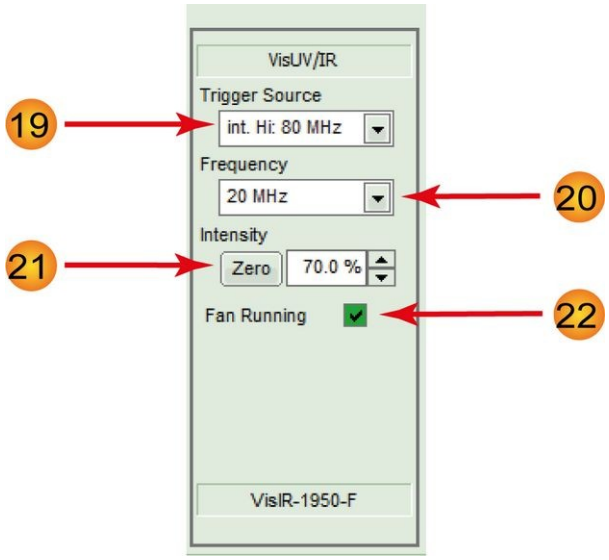


Fig. 21: VisUV/IR laser control elements in the GUI

19 **Trigger source:**

- Use this selection box to choose the trigger source for the connected VisIR / VisUV module. You can select one of the module's internal clocks by choosing i*nt. Hi. 80 MHz* or i*nt. Lo. 1 MHz.* If an external trigger signal should be used, then select either *ext. (var.)* or *ext. (NIM),* depending on the signal type (e.g., *ext. (NIM)* when using a NIM signal and *ext. (var.)* for other types of periodic signals) .
- Selecting *Off* as trigger source will turn the VisUV/IR laser module off.

20 **Frequency / Trigger Level:**

- The label and type of this control element will change depending on the selected trigger source:
  - If one of the internal clocks is selected, this element will be a drop down selection box labeled *Frequency*. The repetition rates available in the selection box depend on the selected internal clock.
    - For *int. Hi 80 MHz*, the choices are: 2.5, 5, 10, 20, 40, and 80 MHz
    - For int. Lo. 1 MHz, the choices are: 31.25, 62.5, 125, 250, 500 kHz, and 1 MHz
  - If the external trigger signal *ext. (var.)* is selected, the selection box turns into a spin edit box labeled *Trigger Level*. This box allows setting the threshold of the trigger signal in V.

21 **Intensity:**

- The intensity of the laser head can be set on a freely adjustable scale from 0 to 100 %, with a step width of 0.1%. Please note that the optical output power of a laser head does not correlate linearly with the intensity scale. Each laser head has a particular threshold value for laser emission, a particular slope and a particular maximal power value.
- The *Zero* button provides an easy toggle between any intensity value and zero intensity. This is useful in case a laser needs to be switched off quickly. The button memorizes the intensity previously set. Pressing it again restores this intensity setting (and vice versa).

22 **Fan Running:**

The high powered, versatile platform on which the *VisIR/VisUV* is based has been specially designed for maximum heat dissipation. Internal thermoelectric (TE) cooler elements maintain the temperatures of diode elements, fiber amplifier stages, and collimating optics at a constant level.

Under normal conditions, allow about 2 to 5 minutes after start-up for the TE cooler system to reach the set-point temperature. For optimal output power stability, it is recommended to allow the *VisIR/VisUV* laser module to warm-up for at least 20 min while ensuring free air circulation around the whole module.

Toggling the check box 22 allows switching the cooling fans of the connected VisIR/VisUV on or off. PicoQuant recommends keeping the cooling fans running during operation of the VisIR / VisUV module. Yet in some cases, one might be interested in momentarily shutting off the fans in order to exclude any possible contribution of the device to mechanical vibrations on the setup. Due to thermal safety considerations, the fans may have a different minimal speed depending on the VisIR / VisUV laser module type. This minimal speed is set by PicoQuant during manufacturing and cannot be changed by the end user.

NOTICE A permanently red blinking ON LED 4, even after a manual reset (see section 5.1), means that the cooling system is, for some reason, not able to maintain the internal set-point temperature. Should this occur, please check that the fan apertures are not obstructed and the fans are working properly. Please also check the ambient room temperature. High ambient room temperatures make it difficult for the TE cooler elements to maintain the set-point temperature.

5.2.5. Presets

Two working configurations can be saved and recalled under in the frame labeled *Presets* 17. Each preset stores all working parameters of the device. The currently applied configuration can be saved by clicking on the *Store Preset 1* or *Store Preset 2* button (see Fig. 22). A pop up window gives the possibility to include a short comment with a maximal length of 64 characters for each stored configuration (see Fig. 23). A stored configuration can simply be recalled by clicking on the button labeled *Recall Preset 1* or *Recall Preset 2*.

Fig. 22: Save a configuration

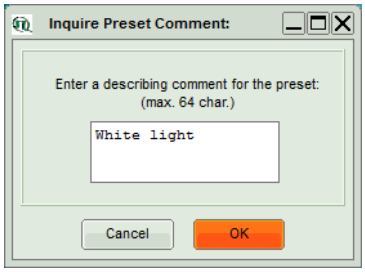


Fig. 23: Edit comment for a preset

Note: The presets are stored in the internal memory of the device and not on the host computer. They can therefore also be recalled if the device is connected to a different host computer.

NOTICE Clicking on a *Recall Preset* leads to an immediate configuration change without the need to manually apply the changes! The process itself can, however, take some time depending on the difference between current and recalled settings!

5.2.6. "About..." button

Extended information about the device, including hardware version, serial number, operating hours, software and firmware version etc. can be brought up by clicking on the button labeled *About...* 18

For every support request its is recommend to save the entire information by clicking on the button labeled *Copy Support Infos* (see Fig. 24), save the information as a plain text file, and send it per mail to

support@picoquant.com

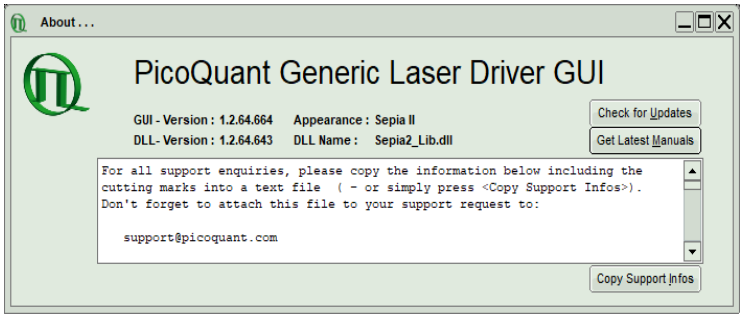


Fig. 24: The “About” window includes extended information about the status of the device

It is also possible to search for possible software updates by clicking on the button labeled *Check for Updates* (Fig. 24). If an update is available, a download link to the latest version will be provided. The button labeled “Get Latest Manuals” will also check online if newer versions of applicable manuals are available. An example of such a search result is shown in Fig. 25.

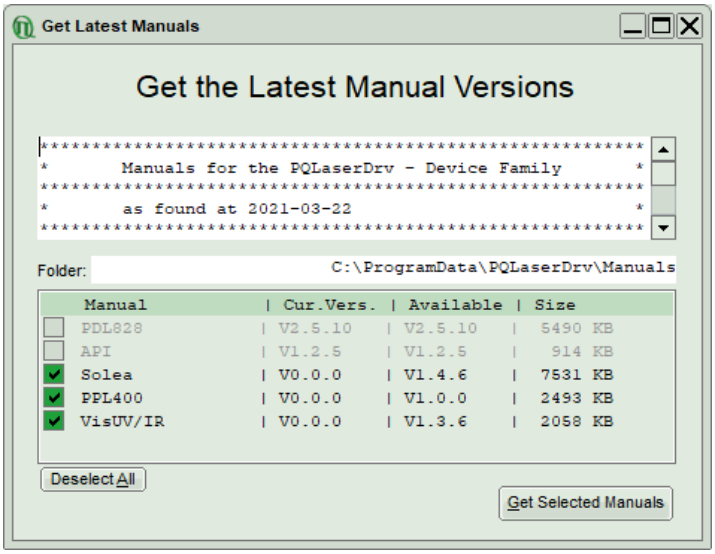


Fig. 25: A potential result screen after searching for latest manual versions

Lines corresponding to manuals that are up-to-date will be greyed out. Manuals that are currently not installed are listed as v0.0.0 in the column *Cur. Vers*.

To download the latest version of one or more manuals, tick the corresponding check-boxes and click on “*Get Selected Manuals*”.

6. Trouble Shooting, Tips and Tricks

6.1. Power stability

Please allow a warm-up time of about 20 minutes between powering up the laser module and activating it through the laser key switch. This thermal equilibration time will ensure the ideal stability of the optical output power.

6.2. Pulse Repetition Rate and Intensity Settings

Changes to the pulse repetition rate have an impact on the total average output power of the laser.

As opposed to directly pulsed laser diodes, e .g., *LDH series* from PicoQuant, the pulse energy of the fiber amplified *VisIR* and *VisUV* modules is not constant for all repetition rates. Consequently, the average output power does not depend linearly on the repetition rate.

The highest average power for the *VisIR-765-HP "STED"* (> 1.5 W) is achieved at a repetition rate of 10 MHz. A slight drop in pulse energy can occur at other frequencies.

6.3. Applications example:

The *VisIR-765-HP "STED"* is primarily designed to be used as a depletion laser for STED microscopy. The optimal pulse duration for a STED depletion laser lies between the commonly accepted minimal value of 100 ps to 200 ps (ensuring a complete depletion process) and less than 1 ns (avoiding unnecessary over-illumination and photobleaching of the probes). Consequently, the *VisIR-765 "STED"* is delivered with a pulse duration of a few 100 ps, typically around 0.5 ns.

The *VisUV* modules are is ideally suited for applications such as fluorescence lifetime imaging (FLIM), Förster resonance energy transfer analysis (FLIM-FRET) or fluorescence correlation spectroscopy (FCS).

6.4. Trouble Shooting Diagram

You can use the following trouble shooting diagram to diagnose common issues that result in the VisIR/VisUV laser module not generating laser light.

<table>
<tr><td colspan="6">Does the key switch LED indicator ON 4 lit orange?</td></tr>
<tr><td>YES</td><td colspan="5">NO</td></tr>
<tr><td rowspan="8">Is the laser power adjusted to a suitable level by the intensity control 21?</td><td colspan="5">Is the key switch 3 on the ON position?</td></tr>
<tr><td colspan="5">Is the Remote Interlock 2 loop closed?</td></tr>
<tr><td colspan="3">LED indicator ON 4 is off</td><td colspan="2">4 LED indicator ON is blinking permanently red</td></tr>
<tr><td colspan="3">check if trigger status is not triggered (see section 5.2.6)</td><td colspan="2">Interlock condition: manually reset is necessary by turning the key switch 3 back on position STBY.</td></tr>
<tr><td colspan="3">Trigger source selector 19?</td><td>ON indicator LED 4 turns off</td><td>ON indicator LED 4 remains permanently blinking red</td></tr>
<tr><td>INT</td><td colspan="2">EXT</td><td rowspan="3">Interlock condition is turned off. Turning key switch 3 back on ON position will lead to laser light emission.</td><td rowspan="3">Heat dissipation is not sufficient. Please ensure that the FAN switch is turned ON 22 and free air circulation is ensured.</td></tr>
<tr><td rowspan="2">Is the selected frequency above an internally set limit? Check rear panel for a note.</td><td colspan="2">Is the trigger level set correctly?</td></tr>
<tr><td colspan="2">Does the triggering signal meet the specifications of pulse width and amplitude?</td></tr>
<tr><td colspan="3">Is the Gate in off state?
(A short circuit on the GATE connector 11 switches off the laser)</td></tr>
</table>

7. Technical Data / Specifications

Mainframe

Power supply (external)..... 100 to 250 VAC, 50/60 Hz, max 130 Watt
Dimensions..... 352 x 336 x 82.5 mm (W x D x H)
Weight..... 7.5 kg

Temperature at heatsink

When fans are disabled..... 70 °C

Internal Triggering

Range of repetition rates..... 80, 40, 20, 10, 5, 2.5 MHz (80 MHz base frequency)
.....1000, 500, 125, 62.5 or 31.25 kHz (1 MHz base frequency)

External NIM trigger input

Connector type..... NIM-CAMAC
Trigger level..... fixed trigger level at -400 mV
Range of repetition rates..... < 1 Hz to 80 MHz

External TTL trigger input

Connector type ..... BNC
Amplitude..... -5 V to +5 V (maximum limits)
Trigger level..... adjustable between -1 V and +1 V
Range of repetition rates..... < 1 Hz to 80 MHz

Gate

Connector type..... SMA (female)
Trigger level ..... +5 V TTL, high active

Synchronization output

Connector..... SMA (female)
Amplitude..... < -800 mV into 50 Ω (NIM)

Optical output

VisIR (1 beam output)
Available center wavelengths..... 766 ± 1 nm, 775 ± 1 nm,1064 ± 2 nm, 1531 ± 3 nm,1550 ± 3 nm
.....1950± 3 nm
Max. average output power..... > 1.5 W
Pulse width (FWHM)..... 70 ps to 0.5 ns
Stability..... < 3 % rms
Beam Quality..... M^2 ~ 1,02
Polarisation..... Vertical >1:60 to >1:1000 (depending on model)

VisUV (1, 2 or 3 beam outputs)

Available center wavelengths[1]..... 266 ± 1 nm, 280 ± 1 nm, 295 ± 1 nm, 355 ± 1 nm,
..... 532 ± 2 nm, 561 ± 1 nm, 589 ± 1 nm
Max. average output power..... > 750 mW
Pulse width (FWHM)..... < 85 ps to 1 ns
Stability..... < 3 % rms
Beam Quality..... M² ~ 1,02
Polarisation..... Vertical, >300:1

USB

Connector type..... USB Type-C
USB Version..... 2.0
Connector type..... Windows™ 10

RS232

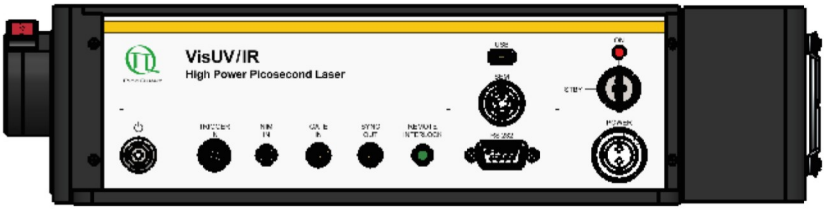
Connector type..... Sub-D9 female
Baud rate..... 115200
Data ..... 8 bit
Parity..... none
Stop..... 1 bit

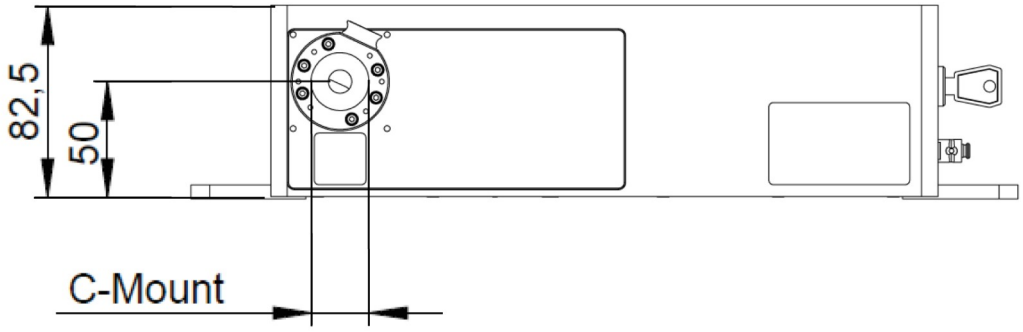
Retraction of Old Devices

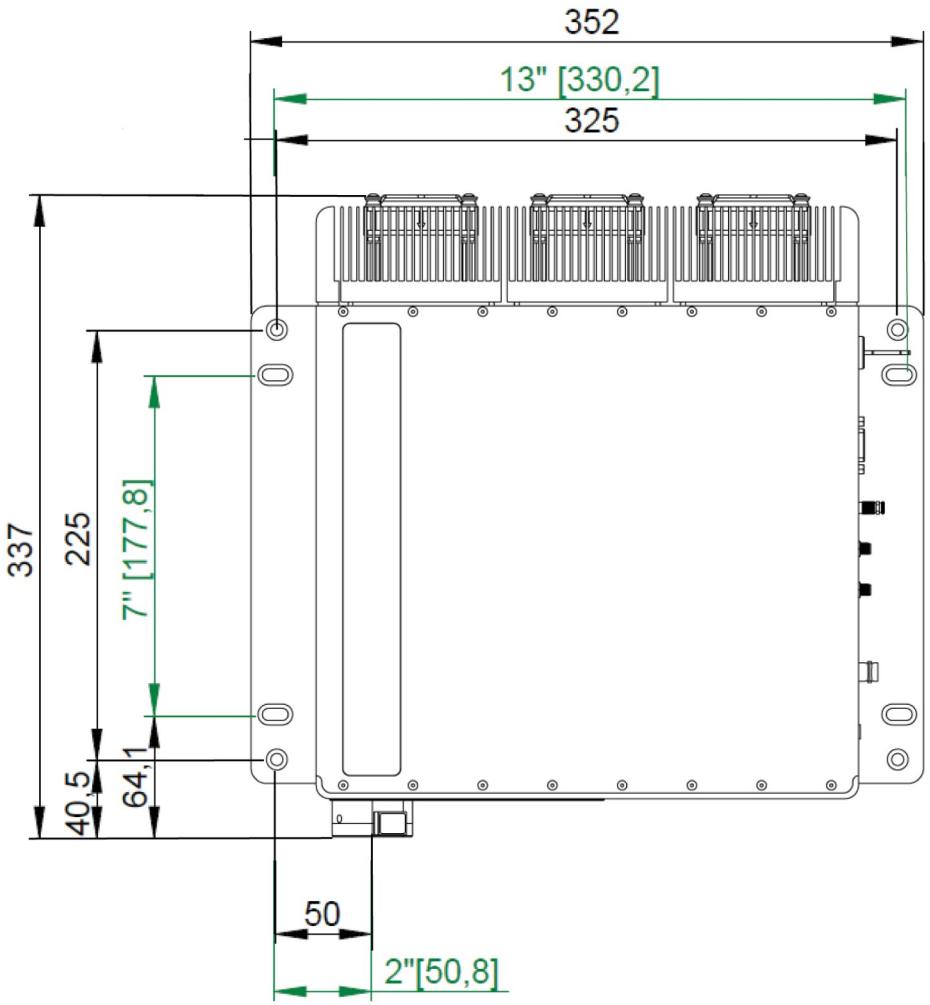
Waste electrical products must not be disposed of with household waste. This equipment should be taken to your local recycling center for safe treatment.
WEEE–Reg.–No. DE 96457402

1 Any of these wavelengths can be offered individually or in combination with one or both of the other wavelengths.

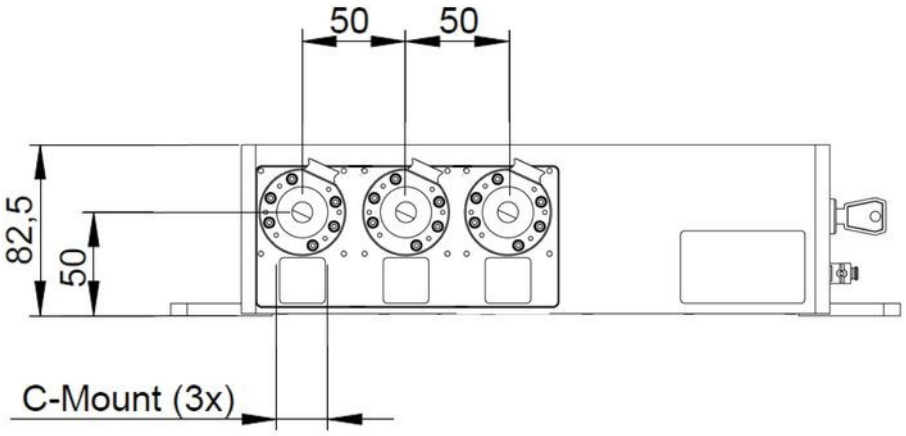
Dimensions of the VisIR laser module with shutter:

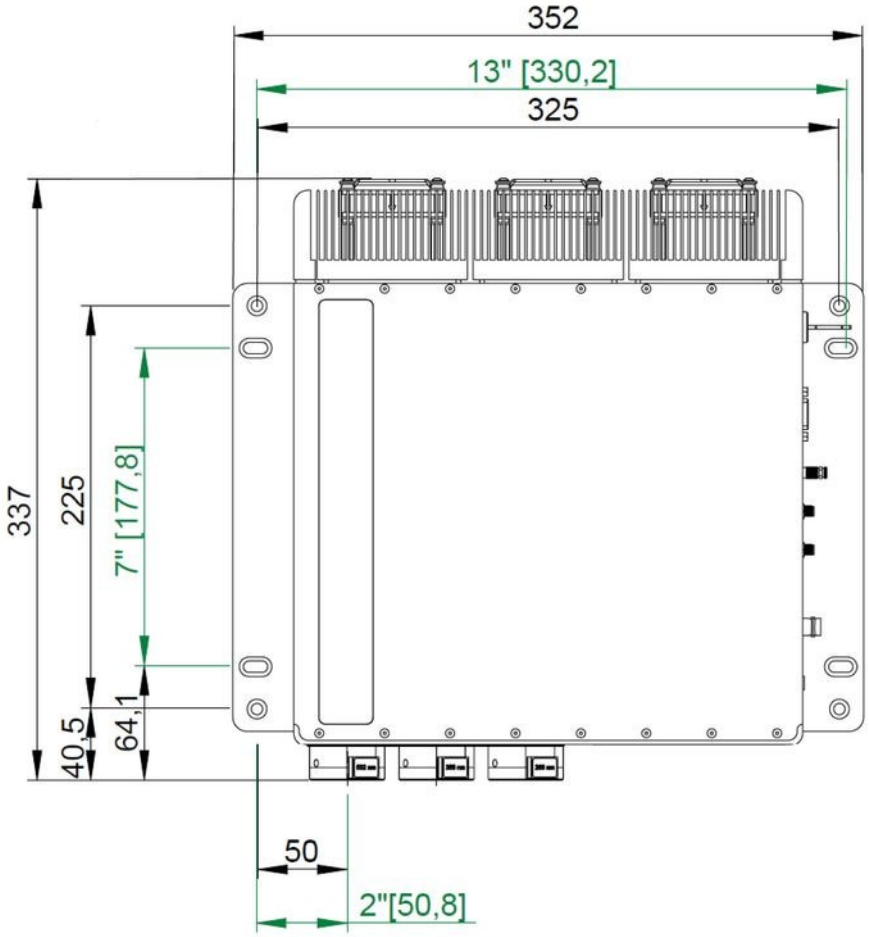




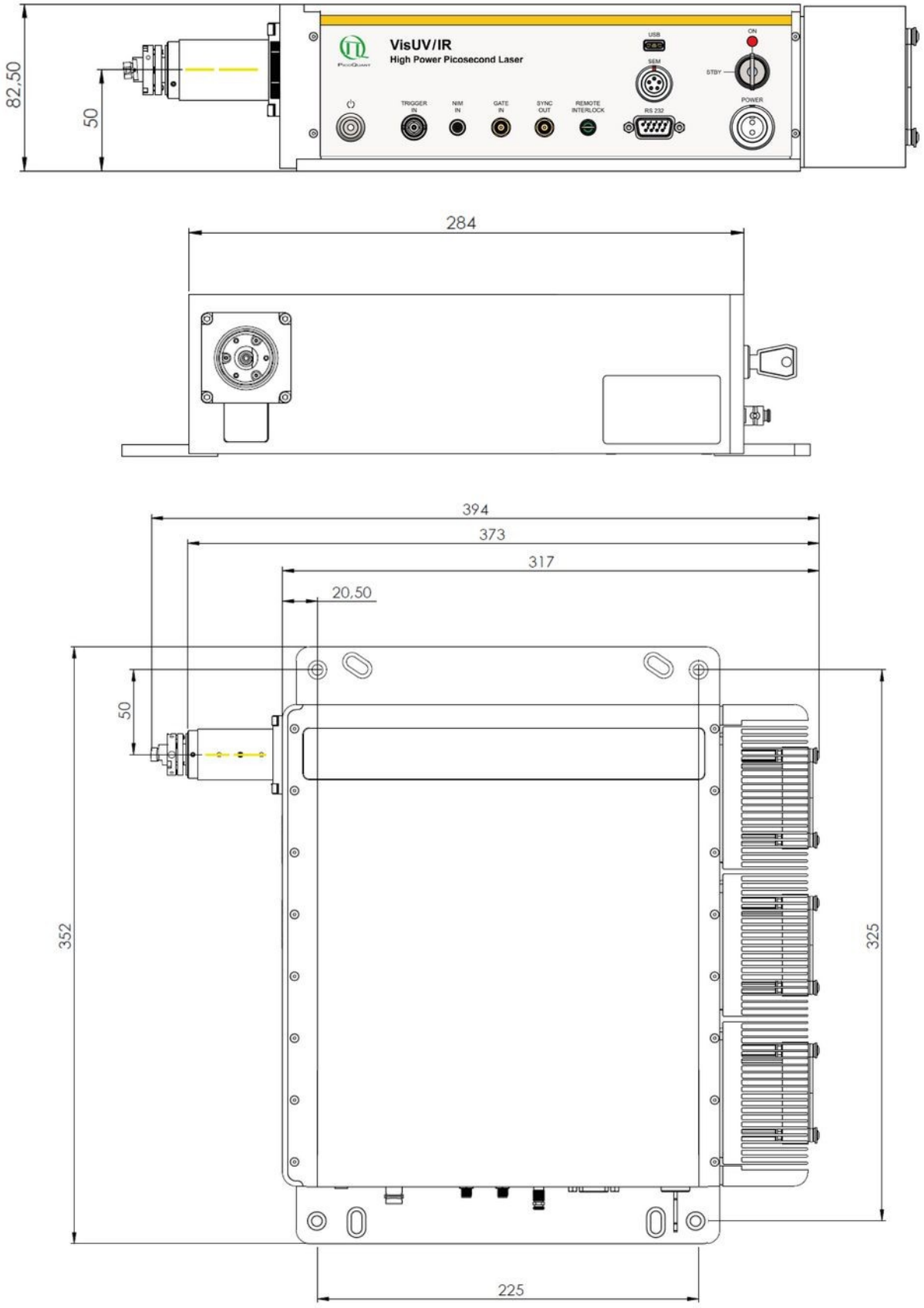


Dimensions of the VisIR-AC laser module with shutter:





Dimensions of the VisIR/VisUV laser module with filter holder:



8. Support

8.1. Returning Products for Repair

Should you encounter problems that require sending the device in for inspection / repair, please contact us first at: https://support.picoquant.com or support@picoquant.com and request an RMA number before shipping the device. Please include the serial number of your device. Observe precautions against static discharge under all circumstances during handling, packaging and shipping. Use original or equally protective packaging material. Inappropriate packaging voids any warranty.

9. Legal Terms

9.1. Copyright

9.2. Trademarks

10. Further Reading

10.1. PicoQuant Bibliography

PicoQuant maintains a database of publications mentioning PicoQuant devices. It can be found at our website https://www.picoquant.com/scientific/references. It is a valuable source if you would like to know which laboratories are using PicoQuant products or how broad the field of various applications is.

10.2. Download of Technical Notes / Application Notes

PicoQuant, along with our customers, continuously writes and publishes short documents about techniques, methods and applications that are possible with our hardware or software. The download section can be found at https://www.picoquant.com/scientific/technical-and-application-notes

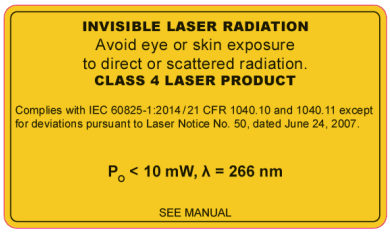
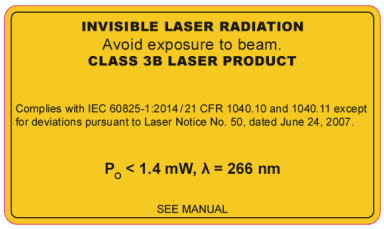
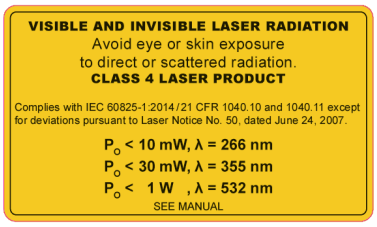
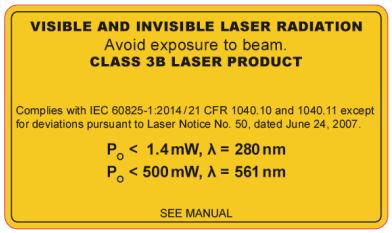
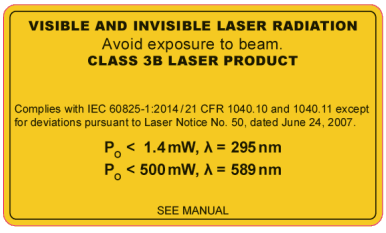
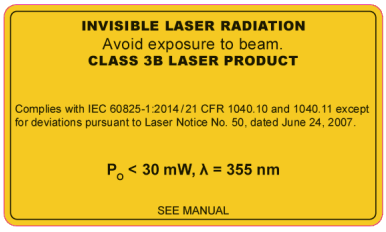
11. Appendix

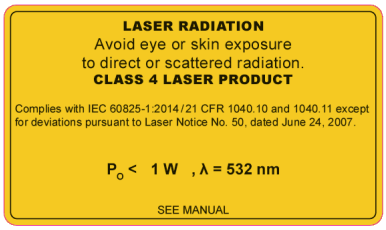
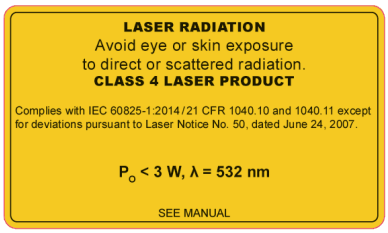
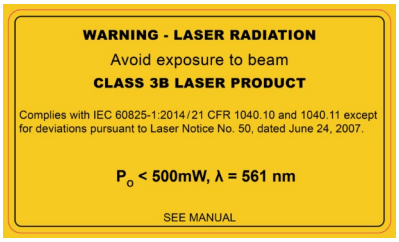
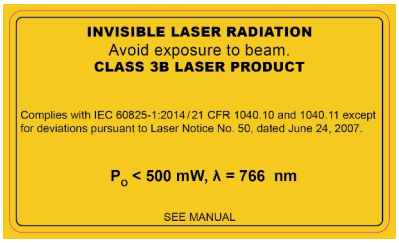
11.1. Abbreviations

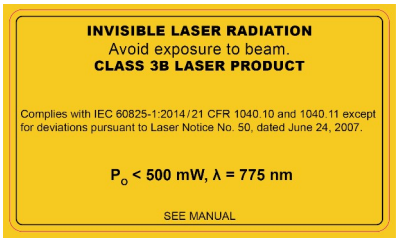
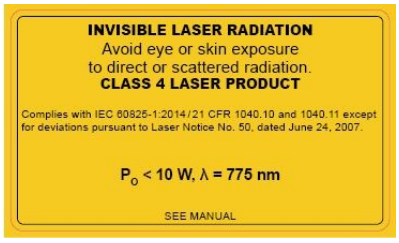
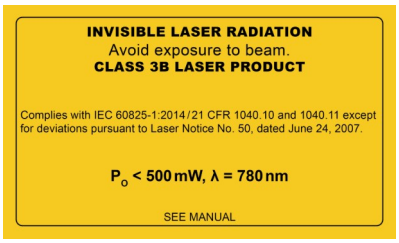
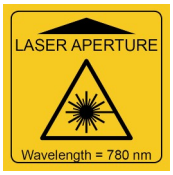
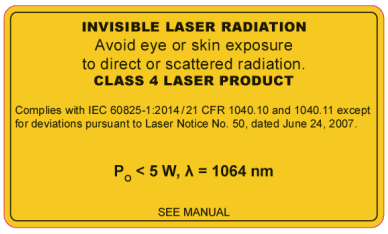
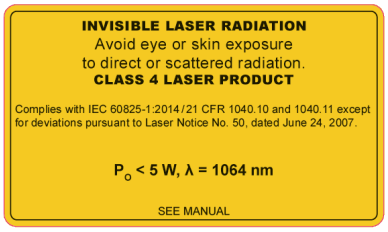
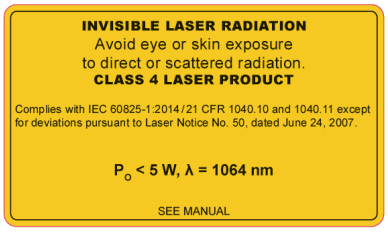
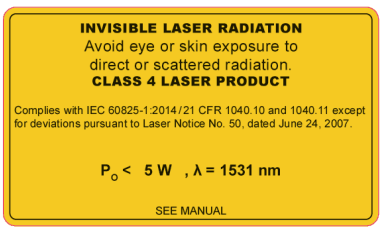
BNC	**British Naval Connector or Bayonet Nut Connector or Bayonet Neill Concelman**
CAMAC	**Corporations and Markets Advisory Committee**
FWHM	**Full Width at Half Maximum**
IEC	**International Electrotechnical Commission**
IR	**Infra-red**
IRF	**Instrument Response Function**
LED	**Light Emitting Diode**
MOFA	**Master Oscillator Fiber Amplifier**
NIM	**Nuclear Instrumentation Methods**
RMA	**Return Merchandise Authorization**
SMA	**Sub-Miniature version A (connector type)**
STED	**STimulated Emission Depletion**
TCSPC	**Time-Correlated Single Photon Counting**
TTL	**Transistor-Transistor Logic**
UV	**Ultra-violet**
VIS	**Visible**
WEEE	**Waste Electrical and Electronic Equipment**

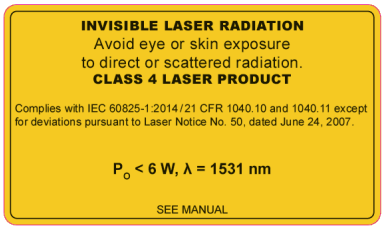
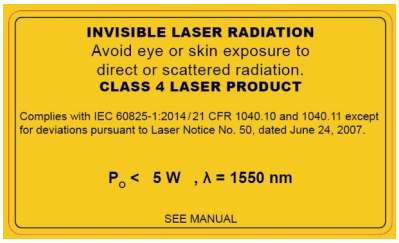
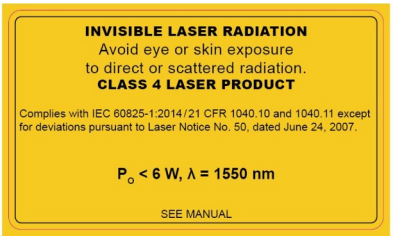
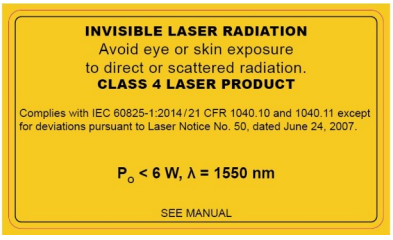
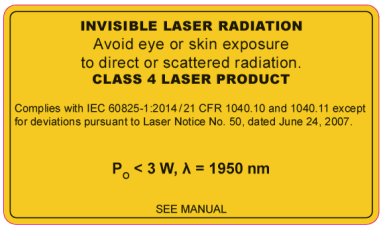
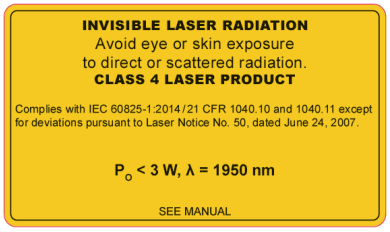
11.2. Overview of Laser Warning Labels by Module Type

The tanle in this section provides an overview of laser warning labels by model type. Note that this list encompasses all VisUV/IR laser module available at this manual was released.

Model type	Warning label on the backside	Warning labels below aperture(s)		
VisUV laser modules				
VisUV-266				
VisUV-266-MIC				
VisUV-266-355-532				
VisUV-280-560				
VisUV-295-590				
VisUV-355				

Model type	Warning label on the backside	Warning labels below aperture(s)		
VisUV-488				
VisUV-532				
VisUV-532-HP				
VisuV-560				
Model type	**Warning label on the backside**	**Warning labels below aperture(s)**		
VisIR laser modules				
VisIR-765				
VisIR-765-HP “STED”				

Model type	Warning label on the backside	Warning labels below aperture(s)		
VisIR-775				
VisIR-775-HP				
VisIR-780				
VisIR-1064				
VisIR-1064-HP				
VisIR-1064-HC				
VisIR-1530				

Model type	Warning label on the backside	Warning labels below aperture(s)		
VisIR-1530-HP				
VisIR-1550				
VisIR-1550-HP				
VisIR-1550-HC				
VisIR-1950				
VisIR-1950-F				

11.3. Laser Delivery Report

The delivery report of your laser, including all final production test results for pulse shape, optical power, and linewidth is attached to this user manual. A PDF copy can be provided on request.

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