



GREEN EVO USER'S MANUAL

USER'S MANUAL

Version 3.1

TABLE OF CONTENTS

INTRODUCTION	4
Tips and Tricks	5
Manual Syntax	5
CONTACT INFORMATION	6
WARRANTY CONDITIONS	7
LASER SAFETY	8
Optical Safety	10
Operational Safety	11
Safety Features and Compliance to Government Requirements	12
Electrostatic Discharge Safety	13
CONNECTING THE LASER	14
Connecting the Laser to the Controller	14
Handling the Transport Fiber	16
LOADING THE PROGRAM	18
GUI LAYOUT	19
OPERATING THE GUI	20
Introduction	20
Laser Menu	22
Temperature Menu	25
Tools Menu	26
Matrix Intelligent Controller	

Connection Menu	30
Help Menu	30
COOLING AND MOUNTING	31
Cooling Options	31
CONTROLLER MECHANICAL DIMENSIONS	32
SAFE PACKING AND TRANSPORTATION	33
UnPacking procedure	33
Packing procedure	33
APPENDIX A – COMMAND LIST	34
Introduction	34
Commands	35
APPENDIX B – FAULT SIGNS	38
APPENDIX C – PIN-OUT GUIDE	39
Controller Pin Out Descriptions	39

Matrix Intelligent Controller

INTRODUCTION

The Green developer's kit is a complete laser driver assemble intend to be used with the Necsel Green Laser. Each kit includes a green laser driver, connection screws, Windows GUI, and a power supply. The functionality of the green driver includes external and internal pulsing, analog control, and PPLN temperature monitoring. The complete kit can be controlled with a windows GUI connected via USB or RS-232. The easy to use interface and built in safety features means you do not have to be a laser expert use the Green Developer's Kit.



Components of the Green Developer's Kit include:

- ▶ Green Evo Laser
- ▶ Green Driver
- ▶ Microsoft GUI
- ▶ USB Cable
- ▶ Connection Cables
- ▶ AC/DC Power Cord

Green Evo Laser Driver

TIPS AND TRICKS

- ▶ The GUI program does not control the lasers; the program sends a message to the firmware inside of the controller which then commands the lasers.
- ▶ The computer running the program must be connected to the controller to make any adjustments to the lasers.
- ▶ Even when the program is closed, the lasers will continue to run unless the controller is turned off or lasers are disabled via the GUI.
- ▶ Upon receipt of the unit, inspect the shipping container for signs of damage. Save all original packing materials until the unit is verified to be in operating condition.
- ▶ Direct laser light can be extremely dangerous, always wear safety glasses, keep lasers away from eyes and skin, be cautious of flammable objects that can ignite with heat, and use in a controlled environment
- ▶ When the fiber-coupled laser is not connected to the transport fiber be sure to replace the dust caps on the laser and fiber **IMMEDIATELY** to avoid damage to the optics
- ▶ The PPLN temperature should be enabled first and settle to the desired temperature before the laser is enabled.
- ▶ Always remember to actively cool the laser while running, otherwise this could result in over heating the laser and damage the diodes

MANUAL SYNTAX

Below are examples of the standard syntax that are used within this manual:

- ▶ GUI menu items are **bold** and *italicized*:
 - ▶ Example: **Tools** > *Preferences*
- ▶ GUI clickable boxes are *italicized* in "quotations":
 - ▶ Example: *"Save"*
- ▶ Notable items are in **bold** and all CAPITAL letters:
 - ▶ Example: **NOTE:** This is an important sentence.

Green Evo Laser Driver

CONTACT INFORMATION

Do not hesitate to contact us with any questions or difficulties concerning installation and operation of the Matrix Intelligent Controller and the family of Matrix lasers.

Green Evo Laser Driver

WARRANTY CONDITIONS

All Necsel laser products are inspected, tested and certified before they are shipped to the customer. Necsel warrants that the laser and controller at the time when the risk passes over to the purchaser are not affected by defects that will insignificantly cancel or deteriorate the value or the suitability for ordinary use or the use authorized by the contract. If not contractually guaranteed, the time of warranty is 6 months.

Depending on the character of the laser and its properties a decrease of optical power up to 50% within the warranty period on constant current is not a reason for any warranty claims.

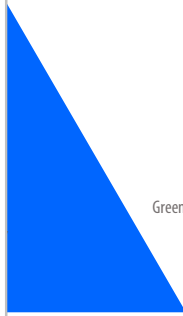
The purchaser is responsible for correct cooling of the Necsel laser product. Appropriate cooling, typically in the 20°C to 25°C range, is a prerequisite for obtaining a stable power. Varying power due to improper cooling is not a reason for any warranty claim.

Necsel will not honor any warranty claim for damages caused by unsuitable or improper use, non-observance of indications for application or by defective or negligent handling as well as by natural wear.

Lasers that have any visual evidence of mishandling will not be replaced, even if this was not the initial reason for returning the unit. This evidence is as follows:

- ▶ Contaminated or scratched thermal contact surfaces, even if no other mishandling is assessable because these defects influence the laser characteristics by increased thermal resistance.
- ▶ Contaminated or damaged front window of the laser package.
- ▶ Burned spots on the laser die emitters caused by excess current, current transients or deposited particles burning the facets by absorbing the laser energy.
- ▶ Electro-static discharge [ESD] damage.
- ▶ Mechanical damage (e.g. deformed heat sink, kinked or torn cables, broken or re-attached parts)

Necsel deliveries have to be inspected after receipt. Non-merchants must report an obvious defect within two weeks in writing stating the laser serial number and P.O. number, otherwise the warranty is excluded.



Green Evo Laser Driver

LASER SAFETY



Read this manual carefully before operating the laser for the first time. Special attention should be given to the material in Section One, Laser Safety, that describes the safety features built into the laser.



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



Use of the system in a manner other than that described herein may impair the protection provided by the system.



Laser safety glasses can present a hazard as well as a benefit; while they protect the eye from potentially damaging exposure, they block light at the laser wavelengths, which prevents the operator from seeing the beam. Therefore, use extreme caution even when using safety glasses.

Green Evo Laser Driver

WARNING: Direct eye contact with the output beam from the laser will cause serious damage and possible blindness

Please observe proper laser safety at all times when operating Necsel lasers. Necsel lasers are Class IV devices in the visible spectrum.



Green Evo Laser Driver

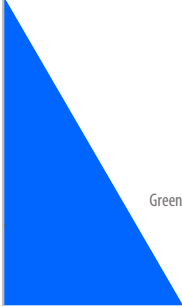
OPTICAL SAFETY

Because of its unique properties, laser light poses safety hazards. For safe use it is required that the operator or users of the laser system be aware of the hazards of the laser and its light beam. The Matrix Intelligent Controller is designed to shut off the lasers should any malfunction occur, but as a precaution, always follow laser safety policies.

In addition to the main beam, there are often many smaller beams present that are formed by the main beam reflecting off polished surfaces. These beams can also be intense enough to cause eye damage.

Beams are powerful enough to burn skin, clothing, or paint. They can ignite volatile substances such as alcohol, gasoline, other solvents, and can damage light sensitive products such as a camera. The heat from the laser beams can ignite substances that it shines on or indirectly by reflecting off of a polished surface. Below are safety precautions that are advised to follow when working with or in the vicinity of lasers.

- ▶ Observe all safety precautions in the user's guide.
- ▶ Extreme caution should be exercised when using solvents in the area of the laser.
- ▶ Limit access to the laser to qualified users who are familiar with laser safety practices and who are aware of the dangers involved.
- ▶ Never look directly onto the laser light source or at scattered laser light from any reflective surface. Never stare down the beam into the source.
- ▶ Maintain experimental setups at low heights to prevent inadvertent beam-eye encounters at eye level.
- ▶ As a precaution against accidental exposure to the output beam or its reflection, those using the system should wear laser safety glasses.
- ▶ Avoid direct exposure to the laser light. The intensity of the beam may burn skin or ignite clothing.
- ▶ Use the laser in an enclosed room. Laser light may remain collimated over long distances and therefore presents a potential hazard if not confined.
- ▶ Post warning signs in the area of the laser beam to alert those present.
- ▶ Advise all those using the laser of these precautions. It is good practice to operate the laser in a room with controlled and restricted access.



Green Evo Laser Driver

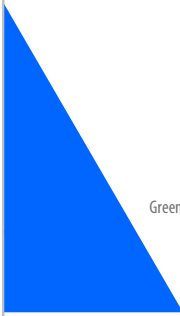
OPERATIONAL SAFETY

The laser controls are positioned so that the operator is not exposed to the laser emission while using the Green driver. The laser conforms to all governmental regulations but use of the laser in a way other than specified in the manual may result in hazardous radiation exposure. For safety:

1. Do NOT open the Green Controller while the power is on or while the lasers are engaged.
2. Do NOT break or cut the transport fiber.
3. Do NOT remove the transport fiber from the SMA-905 outlet of the laser box while the controller is powered on or the lasers are engaged.

If it is suspected that the laser system is missing safety related parts, has been damaged, or may otherwise be unsafe, turn the laser off and disconnect the input power immediately. Do not operate the laser until all potential safety hazards have been eliminated. Do not attempt to use any tool to remove covers to investigate or repair the equipment unless specifically trained to service this equipment.

Some examples of failure or damage are: physical damage to the external covers; evidence of loose, missing, or broken parts (either internal or external); water leaks; blown fuses; disconnected, partially connected, or broken electrical connectors; cut, missing, or damaged wire or cable insulation; electric shock, sparks, or other indications of dangerous accessible voltages; missing or improperly functioning safety related subsystems; evidence of smoke, fire, or excessive heat. There may be other indications of failure, damage, or a safety hazard which are not listed above.



Green Evo Laser Driver

SAFETY FEATURES AND COMPLIANCE TO GOVERNMENT REQUIREMENTS

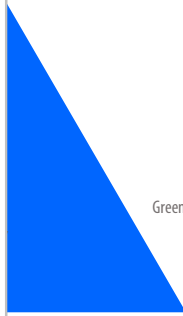
Laser owners have the fundamental responsibility to provide information for the safe use of lasers within their facility and to implement safety programs to adequately control the hazards associated with laser use. In the United States, the accepted governing standard is ANSI Z136.1, *The Safe Use of Lasers*. Outside of the United States, international standards such as IEC 60825-14, *Safety of Laser Products*, prevail. We recommend for laser owners to follow the governing standard in their country to assure regulatory compliance and to provide the necessary safety programs to protect their employees and property.

FOR USA

The manufacture and subsequent sale of laser equipment is under guidelines governed by the Center for Devices and Radiological Health (CDRH). In accordance with those guidelines, specifically subchapter J of the Radiation Standards, 21CFR, the Necsel laser is a **Class 4 Laser Product**.

FOR EUROPE

In accordance with EN60825 – Safety of Laser Products – the laser is a **Class 4 Laser Product**.



Green Evo Laser Driver

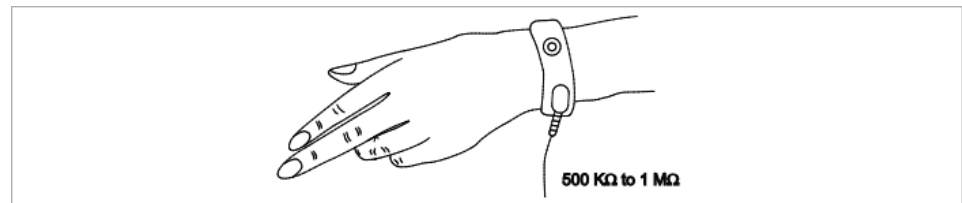
ELECTROSTATIC DISCHARGE SAFETY

Electrostatic discharge and electric spike input which may damage the diodes should be prevented. The main causes of undesirable surge energy are static electricity on the human body, shipping containers made of unsuitable materials, abnormal pulses generated from test equipment, and voltage leakage from soldering irons. Precautions below should be taken when using diodes.

1. The human body should be grounded through a high resistance of 500 k Ω to 1 M Ω while handling diodes in order to prevent diode destruction due to static electricity contained in the body and clothes.
2. Soldering irons should be grounded to prevent voltage leakage from transferring to the diodes.
3. Suitable materials should be chosen for shipping containers and jigs so that they will not become charged with static electricity by rubbing during transportation. Use of electro-conductive materials or aluminum foil is effective

ADVICE FOR BEGINNERS

1. Set the electric potential of the work bench to the same as that of the power supply ground line.
2. Ground the operator's body by wearing a wrist band as shown in figure 1, and connect it to the same potential as the power supply ground line.
3. Do not operate equipment which may generate high frequency surge energy near diodes. The lead wires of drive circuits pick up surge electricity which may destroy diodes in the induced electric field.



Green Evo Laser Driver

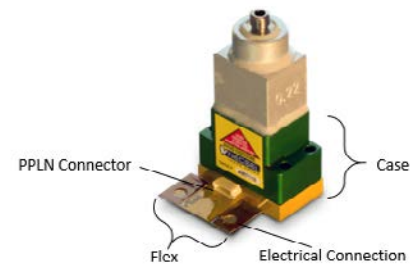
CONNECTING THE LASER

CONNECTING THE LASER TO THE CONTROLLER

The Green laser has two connection points that need to be wired to the controller, the flex assembly and the PPLN control. Once the laser has been connected via the wires the user can use a USB cable to connect to their computer and power on the controller. **First set up the controller and laser before connecting the controller to the power supply.**

CONTROLLER SET-UP

4. All laser currents must be turned off before connecting the device or there is a high risk of damage.
5. Take proper precaution when handling the laser device. It is recommended to wear a static wrist strap to ground yourself and **never** touch the electrical connection with your hands. DO NOT hold the laser by the flex when handling.
6. The laser and the controller should have adequate heat sinking. For laser heat removal, refer to the laser's specifications. For the controller, only a minimum amount of heat removal is required, such as being placed on a heat conductive surface or by having some air flow nearby.
7. Plug the electrical wires and PPLN cable into the controller (see **Appendix C for pin-out diagrams**).
8. Plug in a remote interlock clip into driver (this must be in to run the driver). Note that this could be hooked into a doorway or any other desired inter-lock system.



Green Evo Laser Driver

CONNECTING THE ELECTRICAL WIRE TO THE LASER

1. The wire connector will come with two screws and two washers
2. Align the metal connectors holes on the wire connector to the holes on the laser's flex-
 - ▶ Be sure to not cross the wires when connecting
3. Place the screw in and hand tighten each side before using a tool.
 - ▶ Check that the screws are not loose after tightening



CONNECTING PPLN CABLE TO THE LASER

1. Plug the PPLN wire into the PPLN connector by pushing the white connector into the area on top of the flex



POWERING ON THE CONTROLLER

1. Plug the USB cable from the controller to a Windows computer
2. Plug the 15V DC connection into the controller (this must be done first to prevent arcing at this connector, and should be removed last).
3. Plug the AC connector into the power brick.
4. Plug the power brick into the wall.

NOTE: Unplug the AC connector from the power brick before unplugging the DC power cable from the controller (to prevent arcing).

IMPORTANT: The laser device is sensitive to electro-static discharge; therefore, proper care should be used when handling the device.



Green Evo Laser Driver

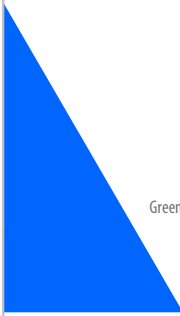
HANDLING THE TRANSPORT FIBER

A dirty or damaged transport fiber can cause reduction in output power or permanent damage to the laser device. Each fiber end is highly polished (sometimes with anti-reflection coatings) to allow for maximum transmission of the laser light. Optics and optical coatings can be chipped, scratched, or smudged easily. Follow these simple guidelines when handling or cleaning the fiber ends:

- ▶ Always keep fiber connector covered with the protective cap when not in use
- ▶ Do not allow the end of the fiber optic cable to contact any surface, including your hands.
- ▶ When handling the fiber bundle, make sure that the end of fiber bundle does not get exposed to high temperatures; this may cause burn spots or potentially catastrophic damage to the fiber. This may also result from back-reflections when the lasers are turned on.
- ▶ When using an SMA connector, make sure that the connector does not rotate while it is being inserted into the bulkhead mount, this may cause damage to the fiber.
- ▶ Do not clean the fiber if there is no visible contamination.
- ▶ The end of the fiber optic cable constitutes an optical surface.
- ▶ Wear finger cots, or powder free surgical gloves, while handling fiber optic cables.
- ▶ Only fresh (dry) spectroscopic grade Methanol should be used as a cleaning solvent.
- ▶ Do not use Acetone as a cleaning solvent on the fiber optical surfaces. It will dissolve the epoxy resin which supports the fiber, and permanently destroy the optical transport fiber.

CONNECTING THE TRANSPORT FIBER TO THE LASER

1. Remove the red dust cap from the SMA-905 connector on the nose of the laser.
2. Keep the connector end clean by avoiding direct contact with hand or other materials.



Green Evo Laser Driver

3. Remove protective cap from transport fiber cable and *gently* insert into SMA-905 connection port at an angle.



4. DO NOT touch the end of the transport fiber cable.
5. Twist the bolt on the fiber to tighten *finger tight* (the metal covering of the transport fiber should not be able to move).
 - › **NOTE:** DO NOT use tools such as pliers to tighten the bolts this will harm the fiber
6. DO NOT leave transport fiber anywhere it could be harmed or easily broken.
7. Keep the red dust cap and fiber protective caps in a safe location, if the fiber is removed from the laser these caps must be placed back on the laser and fiber *immediately*. This will prevent scratching, dust, and burn damage to the optics.

Green Evo Laser Driver

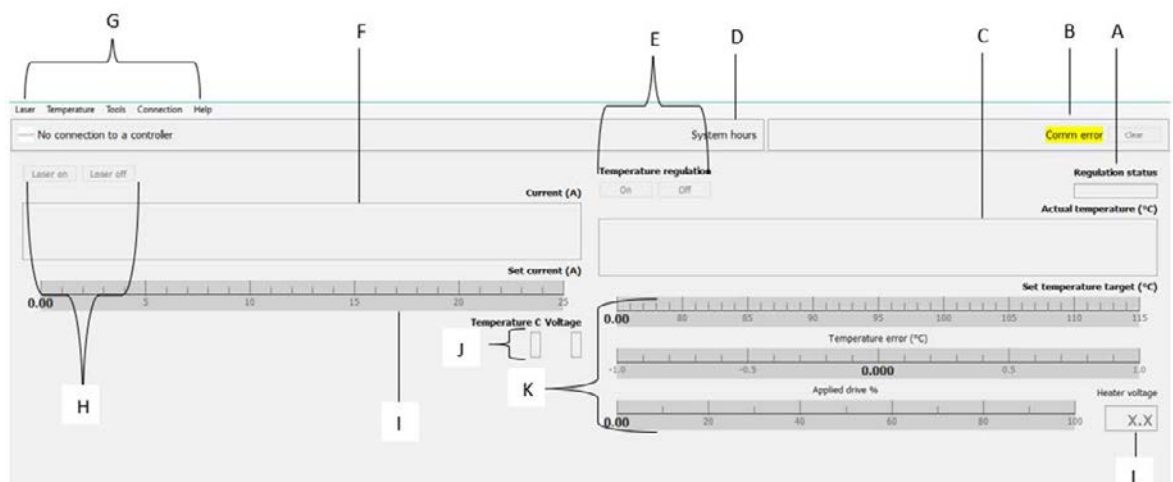
LOADING THE PROGRAM

The Driver software and User's Manual will be emailed, mailed or available for download

1. Copy folders to PC
 - › Copy the contents of the CD-ROM to a new folder on your computer's hard drive
 - › Do not change the original folder and subfolder structure
 - › Open up the Zip file
2. Launch the Program
 - › Locate the file and double click to launch the program.
 - › One of the files is names library.zip. Do not unzip this file; the program expects it to be in compressed format
 - › The program will automatically scan the USB and serial ports to locate any attached green laser drivers. If no connection is detected the words "No Connection" will appear near the upper left corner of the window
 - › When a controller is attached after the program is already running, use the "communication → communication settings" dialog box and click on "Reset USB" or "Reset RS-232" as appropriate.

Green Evo Laser Driver

GUI LAYOUT



- A. Displays "seeking" while regulating and "locked" once the temperature is set
- B. Displays fault codes
- C. Displays the PPLN temperature of the laser
- D. How many hours of lifetime the driver has run
- E. Turn the temperature regulation on/off
- F. Displays the current level to the laser
- G. GUI menu
- H. Turn the current on/off
- I. Set the amount of current to transfer to the laser
- J. Displays thermistor temperature and voltage transferring to the laser in conjunction with the current
- K. Allows the user to set the temperature and provides diagnostics on PPLN temperature control
- L. Displays voltage travelling across heater

Green Evo Laser Driver

OPERATING THE GUI

INTRODUCTION

The GUI can be utilized by full computer control or a mix of computer and analog inputs. The GUI is customizable to fit your needs by using the various menu items. This GUI can interact with the laser driver by using either a USB or RS-232.

If the connection between the GUI and driver is lost the laser will continue to operate at the set parameters.

The user must always indicate that the entry they are typing is complete by hitting “enter” on the keyboard or “ok” on the dialog box.

CUSTOMIZING THE LAYOUT

To open a new window on the GUI simply click on the desired menu item, the item will have a check mark next to it and the window will appear. The windows can be maximized to be full screen, can be minimized to the bottom of the GUI or can be adjusted to show multiple windows at once.

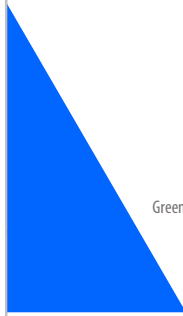
TURNING ON THE LASER

First click temperature regulation to “on” and allow the actual temperature to stabilize to the desired temperature (the regulation status will say “locked”). To turn the laser on click “laser on” button at the left side of the GUI. When the laser has been enabled the button will turn blue and the current displays will change from gray to white.

CONTROLLING THE CURRENT SLIDER

There are many ways to control the slider and apply current

1. Drag the slider thumb
2. Click on the background of the slider to make large incremental changes
3. Click on the arrow buttons to make small changes in current
4. Right click on the slider bar and enter in desired current by text



Green Evo Laser Driver

MAIN TEMPERATURE CONTROL

Controls the operating temperature of the PPLN. The temperature setting should be turned on and stabilized to the desired temperature before the laser is turned on. There are only two areas of the temperature menu that can be manipulated: Temperature On/Off and the slide bar to set the temperature, everything else is fixed and can be used for diagnostic purposes. When the temperature has reached the desired setting the regulation status will change from "seeking" to "locked".

Set Temperature Target

This slider bar is used to set the temperature. There is minimum and maximum limit set on the controller, however the GUI has the ability to set visually what limits are available, this can be found in **Laser > Laser**

Temperature Check

Temperature Error

This graph is fixed and shows the difference between the actual and desired temperature, if the bar is to the left of 0°C the temperature is cooler than desired, if the bar is right of 0°C the temperature is hotter than desired. The temperature is expected to fluctuate slightly and is noticeable when the laser is first turned on and the PPLN has to re-stabilize with the heat from the laser.

Applied drive %

Displays the amount of voltage the system is driving across the heater. The harder the driver is working to meet the set temperature the further right the bar will be. This bar tends to regulate at about 20%.

MAIN LASER CONTROL

Controls the current and operating state of the laser as well as sets an upper limit on the current. Control of the current is done by moving the slider or clicking at either end of the slider bar. The more current applied the more light the laser will produce. The GUI software will open with the "Main laser control" window visible. All other windows can be opened from the "Laser" menu as well. **NOTE: Any changes to the main laser control panel will only be implemented by the controller if the laser is connected and the "Laser on" button is enabled.**

Green Evo Laser Driver

LASER MENU

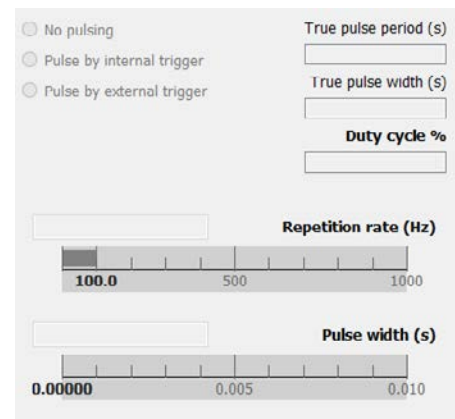
PULSING

Click **Laser > Set laser current with analog input signals** to enable this feature.

This window is used to select either CW or pulsed operation and to set the pulsed parameters. In every case turning the laser on and setting the current are separate operations, and are performed by the main laser control Panel. The laser must be turned on and the current must be set to a non-zero value before pulsing will occur. Pulsing will occur as soon as it is selected.

Pulsing Options

- ▶ No Pulsing
 - ▶ CW mode, pulsing is off and main slider bar is active
- ▶ Pulse by internal trigger
 - ▶ Pulsing is active and manipulated using the pulsing menu
- ▶ Pulse by external trigger
 - ▶ Pulsing is active and is manipulated using an external source; slider bars are not active; repetition rate and pulse width are not active



Internal Pulse Mode

- ▶ Repetition rate
 - ▶ How often the laser will pulse
 - ▶ As the repetition rate is changed the pulse width will change automatically to correspond
 - ▶ Under internal pulse control the user can set the repetition rate using either the slider bar or by typing in the requested value and hitting enter. A change in repetition rate effects the pulse width slider. The controller remembers this setting even if it is on power cycle.
- ▶ Pulse Width
 - ▶ How many fractions of a second there is between pulses
 - ▶ Under internal pulse control the user can set the repetition rate using either the slider bar or by typing in the requested value and hitting enter.
 - ▶ **NOTE:** The user must be careful to enter a pulse width that does not exceed 100% duty cycle or is shorter than the rise time of the current
- ▶ Additional Information

Green Evo Laser Driver

- ▶ The additional fields are read only
- ▶ The controller uses an internal digital clock to generate the timings, and in some cases the requested values cannot be achieved precisely. In these cases the driver will select a value as close as possible to the requested settings and will display these values in the fields labeled "true pulse period" and "true pulse width".
- ▶ The duty cycle is the percentage in one period (from laser on to laser off) in which a signal is active.

External Pulse Mode

In external mode the laser current is switch on in response to a TTL high signal and switched off in response to a TTL low. The repetition rate and pulse width are not relevant in this mode. It may be desired to pulse from a threshold current level greater than zero.

EXTERNAL ANALOG CURRENT CONTROL

It is possible to directly control the green laser via the analog input pins. Note that this signal still goes through the digital interface, so timing considerations are provided below. Click **Laser > Set laser current with analog input signals** to enable this feature.

When this feature is enabled there's a check box next to the menu text and the three slide bars on the main window become greyed out. When the slide bars are greyed you cannot use them to set the current, however they will still display what the current is.

When the lasers are off with the "Lasers off" button, no current will flow no matter what voltage is applied to the input pins. When you turn the lasers on, the analog voltages applied to the three pins determine the laser currents.

The laser current will not respond instantly to a change in one of the voltage pins. There are two components to the driver's response:

- ▶ A digital delay of between 10 and 30 microseconds
- ▶ An analog delay of about 50 microseconds

Adding these two times together results in an overall response time of slightly less than 100 microseconds, so a 10 kHz rate is the maximum achievable.

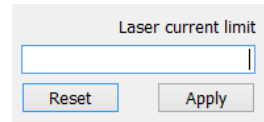
NOTE: You cannot use the analog input and the internal pulsing mode at the same time

CURRENT LIMITS

Click **Laser > Current Limits** to enable this feature

Green Evo Laser Driver

The current limit dictates the maximum current that can go through each laser. The controller has a maximum level; however, the lasers may have a different maximum current than the controller. Check specifications of the product before setting current limits. After editing the current limit, the bar graph will change to reflect the new maximum limit.



LASER TEMPERATURE CHECK

The Green driver has the ability to measure a temperature sensor next to the laser. As a safety precaution if the temperature goes out of this range the controller will automatically shut off the laser.

How to Edit Temperature Checking

1. Click **Laser > Laser Temperature Check** to enable this feature
2. Input desired minimum and maximum temperature. These values would typically be in the range of 15°C to 35°C or 40°C
3. Select the "enable checking" box
4. Click "save"



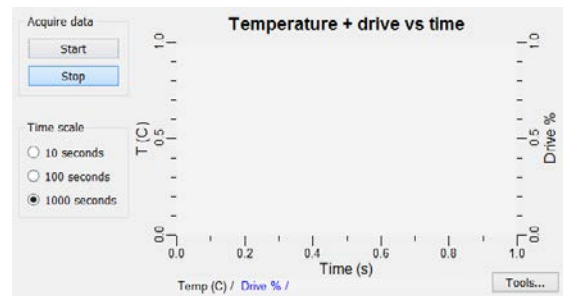
Green Evo Laser Driver

TEMPERATURE MENU

This window displays the PPLN temperature (in Celsius) over the time the laser is enabled. It is helpful in discovering how the controller is maintaining the target temperature of the laser and captures the performance of the unit. To view this window click *Temperature -> Track PPLN temperature/drive vs. time* and a check mark will appear in the menu and the window will appear in the interface.

How to start collecting Data

1. Choose your time scale based on how often the data will be collected
2. Click "tools" button to scale the left, right, and bottom axis, to save the chart as an image or to copy the chart to your clipboard
3. Click "start" to begin recording data and "stop" to end the recording session
4. Data will continue to record until on the same session each time the laser is enabled unless the user presses stop



Green Evo Laser Driver

TOOLS MENU

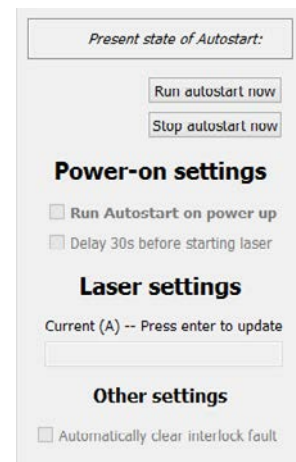
AUTOSTART

Click **Tools > Autostart** to enable this feature.

The driver can be configured to operate stand-alone, without a PC interface. The autostart window allows the user to configure the operating conditions that will be applied each time the driver is powered up.

The parameters set through the Limits button on the Main Laser Control window are still in effect. If using internal pulsed operation the pulse settings last entered in the Pulsing Window will be the values used when autostart is enabled and the current slide bar on the Main Laser Control pane is disabled.

- ▶ Present state of Autostart (this applies to the immediate time)
 - ▶ Auto start will run with present temperature on current selected from the mail GUI window
 - ▶ **Run autostart**- instantly applies autostart
 - ▶ **Stop autostart**- instantly stops autostart
- ▶ Power –On Settings
 - ▶ **Run Autostart on power-on**- Enables Autostart next time power is turned on
 - ▶ **Delay 30s**- Recommended as a safety precaution autostart will engage after 30 seconds
- ▶ Laser settings
 - ▶ The user has the ability to select what current the laser will be set to the next time the power is turned on with autostart enables
- ▶ Other Settings
 - ▶ As a safety precaution there is an interlock fault on autostart startup, to disable this feature uncheck the “*automatically clear interlock fault*” box



The screenshot shows the 'Autostart' configuration window. At the top, it displays the 'Present state of Autostart:' with two buttons: 'Run autostart now' and 'Stop autostart now'. Below this is the 'Power-on settings' section, which includes two checkboxes: 'Run Autostart on power up' (checked) and 'Delay 30s before starting laser' (checked). The 'Laser settings' section features a 'Current (A) -- Press enter to update' label and a text input field. The 'Other settings' section at the bottom has a checkbox for 'Automatically clear interlock fault' which is currently unchecked.

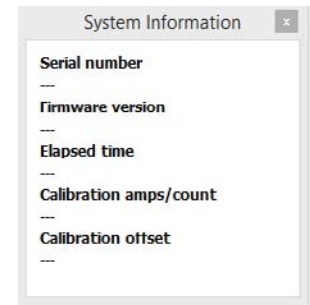
Green Evo Laser Driver

SYSTEM INFORMATION

Click **Tools > System Information** to enable this feature.

System information is a window to display data of the Firmware Serial number – the unique identification number of the controller.

- ▶ **Firmware version** – the version of the firmware that is running
- ▶ **Elapsed time** – how many hours the controller has been run
- ▶ **Calibration** – details of what the calibration is for the individual lasers



DIAGNOSTICS

Click **Tools > Diagnostics** to enable this feature.

Diagnostics displays the internal workings of the controller when the lasers are running. This information is typically not required by the user.

PREFERENCES

The preferences dialog allows customization of controller and GUI program communication, notices, and laser control labels.

Communication

To edit the communication between controller and program:

1. Click **Tools > Preferences... > Communication**
2. The controller can communicate to the program via USB or RS-232 ports, although the RS-232 port is physically located inside the controller enclosure
3. Selects which port is preferable, or select both

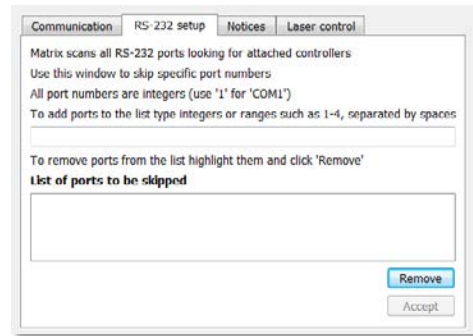
"Scan RS-232 ports automatically" will allow the computer to search all ports until it finds the controller

NOTE: In this mode the program could disrupt other RS-232 ports that are being used unless specific ports are listed to be skipped under **RS-232 setup**

RS-232 Setup

Green Evo Laser Driver

NOTE: The RS-232 port is located inside the controller on the processor chip and can only be accessed by removing the controller shell hardware. Any damage to the controller due to removing the hardware is liable by the user and is not under warranty. Necsel will also sell the "OEM version" of the controller without the outer shell. When scanning RS-232 ports automatically, it is necessary to list any ports that should be skipped otherwise the program may interrupt them.



Click "Tools > Preferences > RS-232 setup"

To add ports to the list type integers such as 1-4, separated by spaces

Click "Accept" and the port to be ignored will appear on the list

To delete a port from the list, highlight the port name and click "Remove"

Notices

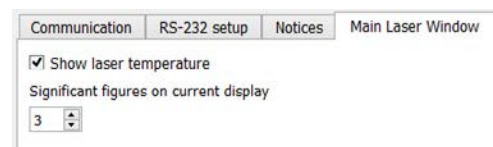
These are pop-up windows that appear when the controller detects a fault or the connection is lost for 10 seconds.

1. To stop pop-up windows from appearing simply unselect the pop-up notifications boxes
2. Once selected or deselected the program will remember the setting



Main Laser Window

The Main Laser Window gives the user the ability to set their visual preferences. Enabling "show laser temperature" show the thermistor temperature on the main GUI. The significant figures allows the user to choose how many decimals the current shows.



Green Evo Laser Driver

PPLN Temperature Window

The PPLN Temperature Window allows the user to edit the look of the GUI, however this window does not affect the working of the controller.

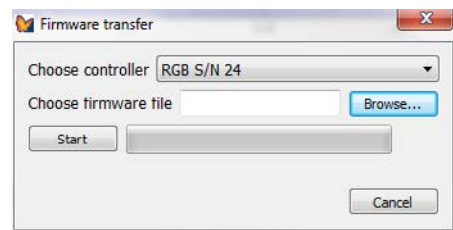
- ▶ Range of error display
 - ▶ The user can choose to scale the range displayed, write in number desired and click “apply”
- ▶ Minimum/ Maximum set point
 - ▶ Allows the user to change the temperature limits on the GUI
 - ▶ **NOTE: This does not change the temperature limits of the controller it is only a visualization of the GUI**
- ▶ The user can elect to hide or display the thermistor temperature or voltage across the controller

CHANGE FIRMWARE

Changing the firmware updates the software for the controller’s microprocessor.

How to Change Firmware

1. Download the newest edition of the firmware file
2. Click on **Tools > Change Firmware**
3. A box called Firmware transfer will appear
4. If the computer is connected to more than one controller, select which controller is to be updated from the pull down menu
5. Click “Browse” to select the updated firmware file
6. Click “Start” to begin. The firmware will be automatically uploaded and the controller will be ready to use immediately after completion
7. **NOTE:** If there is an interruption during the Firmware update the controller will remember and begin the update where it was interrupted; however, the controller will not function until the update is complete



Green Evo Laser Driver

CONNECTION MENU

SELECT CONNECTION

The computer can be connected to more than one controller; however, the program cannot talk to more than one controller at a time.

1. Click Connection
2. Float the cursor over Select Connection and a list of controllers that the program recognizes will appear
3. Select the controller that you want to manipulate

OPEN COMMUNICATION ACTIVITY LOG

The communication activity log shows all the data correspondence between the controller and the computer.

SCAN RS-232 PORTS NOW

In some cases the computer may not automatically recognize that the controller is connected to an RS-232 port and it must be instructed to connect.

1. Go to **Connection > Scan RS-232 ports now**
2. Also, set up the computer to automatically scan for ports:
3. Click **Tools > Preferences dialog** and then choose the Communication tab and select the box to scan the ports automatically

HELP MENU

ABOUT

This window provides that software name, version number, copyright information, driver information, and factory contact information

Green Evo Laser Driver

COOLING AND MOUNTING

COOLING OPTIONS

Necsel does not specify to the customer how they should cool the laser, however **it is essential that the cooling is able to dissipate 50W of heat from the laser while running**. Necsel does provide thermistor interfaces and the temperature at which the laser should be run on the data sheet and recommends mounting the laser onto a cooling plate.

There are many options to cooling the laser such as

- TECs
- Liquid chillers
- Heat pipes
- Fans

MOUNTING & COOLING THE LASER

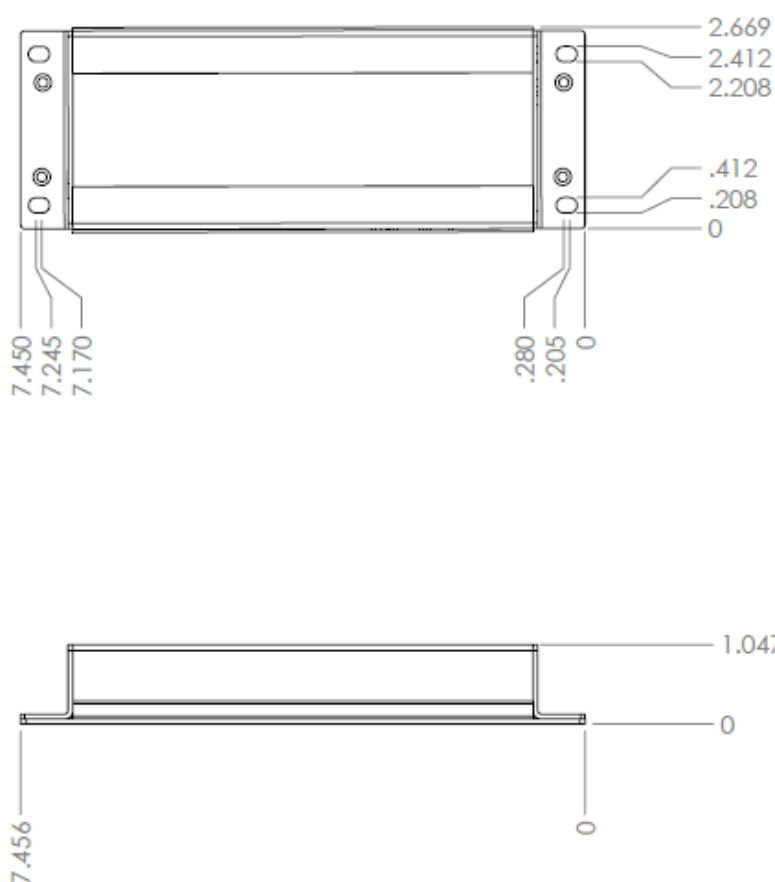
1. The green laser comes with a thermal conductive material, grafoil, on the base of the laser
2. Screw each of the corners of the laser hand tight, before fully tightening opposite corners. This ensures that your laser is equally mounted to the chill plate on all four sides
3. It is recommended to keep the cooling plate at a constant temperature to reduce experimental variables
4. Refer to the laser specifications sheet for specific temperature cooling requirements

NOTE: Take proper precaution when handling the laser device. It is recommended to wear a static wrist strap to ground yourself and never touch the electrical pins. When handling the laser hold it by the case.



Green Evo Laser Driver

CONTROLLER MECHANICAL DIMENSIONS



Green Evo Laser Driver

SAFE PACKING AND TRANSPORTATION

UNPACKING PROCEDURE

1. Two boxes will be shipped as part of the Developer's Kit
2. One box contains
 - › A Green laser driver
 - › USB cord
 - › Wire leg connecting cables
 - › PPLN connecting cable
3. The second box contains the laser
4. Carefully unpack the boxes and inspect the parts for possible damage during shipment. If damage is visible please document the damages and contact Necsel for support.

NOTE: The software is either included on a CD or it has been emailed to you with this documentation.

PACKING PROCEDURE

1. When packing the laser it must be wrapped in an anti-static bag and placed in a box with anti-static protection.
2. Wrap the laser driver in bubble wrap to prevent damage
3. If the laser is fiber-coupled **TAPE THE RED PROTECTIVE CAP** to prevent the cap from falling off and the SMA connector getting dirty.
4. Be sure to properly isolate package box with bubble wrap or packing peanuts to prevent damage to the products
5. There should be no loose products moving around in the box unprotected.

NOTE: If returning to Necsel be sure to include all parts such as cables, SMA protective caps etc.

Green Evo Laser Driver

APPENDIX A – COMMAND LIST

INTRODUCTION

This is the list of all the commands for the Necsel Green controller. The key to understanding the listing is:

- Each line is a command
- Characters before the first comma are the command text.
- Commands that end with a question mark cause the controller to reply with a value.
- Some commands take an argument. The type of argument is indicated by the small number that follows the first comma: 0 means no argument, 1 means an integer argument, 2 means a floating-point argument.
- Every command causes a reply from the controller: either the requested information, the word "OK" or an error message.
- This scheme is standard on all products. For further information about the interface rules, see http://www.vuemetrix.com/support/tech/comm_protocols.html.

After the second comma there is a brief description of the command. These are intended to be a sort of quick reference; in some cases the meaning may not be completely clear. Follow the links on the Programmer's Support page of our web site, see <http://www.vuemetrix.com/support/programmer.html>. Most of the commands are identical to ones on either the LV30 or TEC product, for which full documentation is available.

Some abbreviations and buzzwords used in the list.

- ADC or A/D – Analog to Digital Converter
- PPLN – Periodically Polled Lithium Niobate
- pwm – pulse width modulator, the device used to control the laser current
- xtl – crystal (a synonym for PPLN in this case)
- dac – digital to analog converter
- autostart – a VueMetrix-invented term for a feature that automatically starts the PPLN and the laser on power-up.

Green Evo Laser Driver

COMMANDS

```
hrs?,0,    // get operating hours
sn?,0,    // get serial number

f?,0,     // get operating fault
fdesc?,0, // get fault description (text)
cf,0,     // clear fault
prod?,0,  // returns "cwg"
uf,0,     // upload firmware (for approved customers only)
ver?,0,   // software version code

adixc?,0, // read external current set ADC
adv?,0,   // read laser voltage ADC
adlt?,0,  // read the laser temperature ADC
adi?,0,   // read current ADCs and divide by 2
adi1?,0,  // read current ADC #1
adi2?,0,  // read current ADC #2
adimis?,0, // get ADC current mismatch (current #1 - current #2)
adxi?,0,  // get PPLN current ADC
adxt?,0,  // get PPLN ADC
adv?,0,   // read voltage on PPLN heater
adref?,0, // read A/D reference voltage
adtcpu?,0, // read CPU temp ADC
advin?,0, // read input voltage sense ADC
apc?,0,   // laser amps per ADC count
dacx?,0,  // get PPLN control DAC
do?,0,    // get offset for current readings (in ADC counts)
i,2,     // set laser amps
is?,0,   // get current set point
itarg?,0, // get current servo target ADC value
i?,0,    // read laser amps
ioff,1,  // enable external current offset
ioff?,0, // is external current offset enabled?
l0,0,    // disable laser
l1,0,    // enable laser
l?,0,    // get laser enable state
limax,2, // set maximum laser amps
limax?,0, // get maximum laser amps
isysmax?,0, // returns system max current limit

lt?,0,    // get laser temperature
```

Green Evo Laser Driver

```

v?,0,    // read laser voltage

pwm?,0,    // get value of PWM (proportional to laser voltage)

tx?,0,    // get temperature of xtl
tx,2,    // set xtl temperature
txc,2,    // set thermal time constant
txc?,0,    // get thermal time constant
txdd,2,    // set degrees per % drive
txdd?,0,    // get degrees per % drive
txdel,2,    // set thermal response delay (s)
txdel?,0,    // get thermal response delay
txdr?,0,    // get xtl heater drive (0=minimum 30000=full scale)
txen,1,    // enable/disable servo
txen?,0,    // is xtl temperature servo enabled?
txfdesc?,0,    // servo fault description
txi?,0,    // get xtl drive current
txs?,0,    // get xtl temperature servo state
txsp?,0,    // get xtl temperature servo set point
txsy?,0,    // has synchronized data?
txsd?,0,    // get synchronized drive (0-30000)
txst?,0,    // get synchronized temperature
txv?,0,    // get xtl drive voltage

pl,1, // pulse enable (1) or disable (0)
pl?,0, // get pulse enable
plm,1, // set pulse mode (1 external 0 internal)
plm?,0, // get pulse mode
plpt?,0, // get true pulse period (in ticks of 200kHz)
plrr,2, // set rep rate
plrr?,0, // get rep rate
plrm?,0, // get max rep rate
plw,2, // set pulse width
plw?,0, // get pulse width
plwt?,0, // get true pulse width (in ticks)

as,1, // enable/disable autostart
as0,0, // abort autostart
as1,0, // do autostart
as?,0, // is autostart enabled?
ascdrh,1, // autostart set CDRH compliance
ascdrh?,0, // autostart get CDRH compliance
asi,2, // set operating amps for autostart

```

Green Evo Laser Driver

```
asi?,0, // get operating amps for autostart
asiclr,1, // set state of auto interlock clear
asiclr?,0, // get state of auto interlock clear
ast?,0, // get autostart state
```

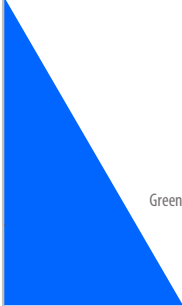
Green Evo Laser Driver

APPENDIX B – FAULT SIGNS

If the program sends the command “f?” the controller will respond with a small integer. If it's a 0, the controller doesn't have a fault and can be assumed to be working normally. If it's not a zero, then the controller has a fault. The laser will always be off in this case, and sometimes the PPLN heater as well (depending on the nature of the fault).

Further details are available by sending the command “fdesc?”. The controller will respond with a string (ASCII characters) containing a human-readable description of the fault.

- 0 No fault
- 1 not used at this time
- 2 not used at this time
- 3 Flash memory
- 4 Interlock
- 5 Input under voltage
- 6 Input over voltage
- 7 CPU over temperature
- 9 Temperature servo
- 10 Laser over voltage
- 11 Output power limit
- 12 Laser under temperature
- 13 Laser over temperature
- 15 Current at rail

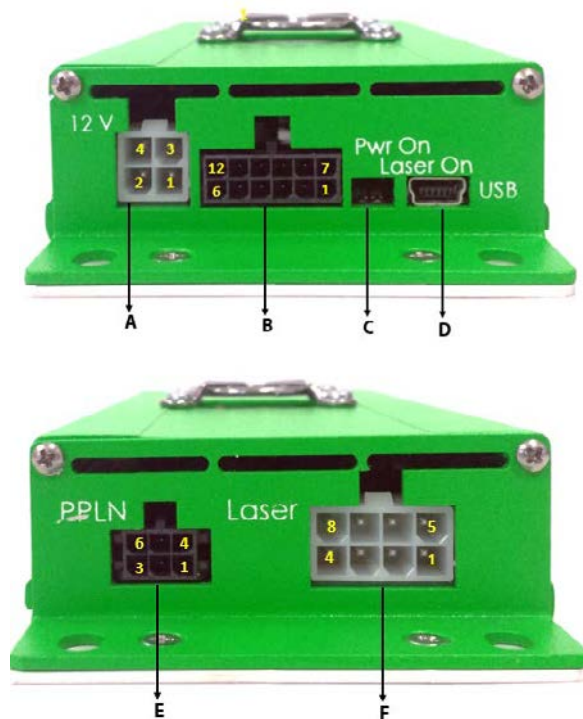


Green Evo Laser Driver

APPENDIX C – PIN-OUT GUIDE

CONTROLLER PIN OUT DESCRIPTIONS

- ▶ A – The AC/DC power supply connection
- ▶ B – External control, includes sync signals and system interlock pins
- ▶ C – These two LED lights show when the controller power is on and when the lasers are enabled
- ▶ D – A micro USB port to connects the controller to the GUI
- ▶ E – PPLN control (including heater and thermistor)
- ▶ F – Laser drive output (connects to the laser module)



Green Evo Laser Driver

A – FOR 15 VOLTS POWER: (CN9)

4 PINS MOLEX MINI FIT JR. SHELL: 39-01-2040
MOLEX MINI-FIT JR. PINS: 39-00-0039
Pin 2 and 4 +15
Pin 1 and 3 +15 return (Ground)

B – FOR EXTERNAL CONTROL: (J9)

12 PINS MOLEX MICRO-FIT : SHELL 43025-1200
MOLEX MICRO-FIT PINS: 0430300008
Pin 1 Interlock
Pin 2 Ground
Pin 3 Trigger/sync
Pin 4 Ground
Pin 5 External Bias
Pin 6 +5 volts (100 ma max)
Pin 7 RS232 txd
Pin 8 RS232 rxd
Pin 9 Ground
Pin 10 Expansion
Pin 11 Expansion
Pin 12 Expansion

C – LED POWER SIGNAL

Green LED Power On
Red LED Laser On

D- USB COMMUNICATION

Micro USB connection

E- For Thermistors:(J10)

6 PINS MOLEX MICRO-FIT : SHELL 0430250600
MOLEX MICRO-FIT PINS: 0430300008
Pin 6 Laser thermistor
Pin 5 PPLN thermistor
Pin 4 PPLN heater
Pin 3 Signal ground
Pin 2 Signal ground
Pin 1 PPLN heater return

F- For Power Output:(J12)

8 PINS MOLEX MINI FIT JR. SHELL:39-01-2080
MOLEX MINI-FIT JR. PINS: 39-00-0039
Pin 1,2,5,6 Cathode
Pin 3,4,7,8 Anode

END

Green Evo Laser Driver