Glider – External cavity laser system

Operation manual

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I. Foreword

Thank you for having purchased the GLIDER system! The GLIDER is a monolithic all-in-one light source with measurement capabilities that requires no assembly or external drivers.

Your first task upon receiving the GLIDER system will be to unpack and install the system safely. Please familiarize yourself with the instructions in §V and §VII of this manual so you can perform this step upon arrival of your system. Once installed, operation instructions are contained in §VIII.

Do not hesitate to contact Alpes Lasers' sales office or your local representative if you have any questions!

A. Notes on this documentation

This manual is only intended for the use of trained specialists and users in optics, optoelectronics and electrical engineering who are familiar with the applicable national standards.

It is essential that the following notes and explanations are followed when installing and commissioning these components.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, laws, regulations, guidelines and standards in the country of operation.

Disclaimer

The documentation has been prepared with the best care. The products described are, however, constantly in development.
For that reason the documentation is not in every case checked for consistency with performance data, standards and other characteristics.
If it contains technical or editorial errors, we retain the right to make alteration at any time and without warning.
No claims for the modification of the products that have already been supplied may be made based on the data, diagrams and descriptions in this documentation.

B. Documentation Issue status

Version	Comment
1.0	First Published
1.3	General revision, Laser safety compliance, Glider S
1.4	Add detail to VIII.A. to better describe difference between M and S model.
1.5	
1.6	

C. Glossary of terms & General information

ADC – Analog to Digital converter

DAC – Digital to Analog Converter

EC – External cavity

GUI – Graphical User Interface

Laser – Light Amplification by Stimulated Emission of Radiation

POI – Point of interest

S-2m – Alpes Lasers' embedded Laser driver

As a documentation rule Information specific to the Glider M (for Multi lasers Glider) will be surrounded in **BLUE** and the one specific to the Glider S (for Single laser Glider) in **PURPLE**.

II. Safety & User information

A. Personnel qualification

This description is only intended for the use of trained specialists and users in optics, optoelectronics and electrical engineering who are familiar with the applicable national standards.

B. Description of safety symbols

 DANGER	**Serious risk of injury!** Failure to follow the safety instructions associated with this symbol directly endangers the life and health of persons.
 WARNING	**Caution – Risk of injury!** Failure to follow the safety instructions associated with this symbol endangers the life and health of persons.
 CAUTION	**Personal injuries!** Failure to follow the safety instructions associated with this symbol can lead to injuries to persons.
 Attention	**Damage to the enviroment or devices!** Failure to follow the safety instructions associated with this symbol can lead to damage to the environment or equipment.
 Note	**Tip or pointer** This symbol indicates information that contributes to better understanding.

C. Special safety instruction

Serious risk of injury through high electrical voltage

- All statements regarding safety of operation and technical data in this manual will only apply when the unit is operated correctly as it was designed for.
- Never open the product when it is live. Opening the device invalidates all warranty and liability claims.
- Negligent, improper handling of the product and bypassing of the safety devices can lead to personal injury or death through electric shock.
- Ensure that the cable and connector are connected properly and free of breach.
- Disconnect the product from the mains supply and secure it against reconnection before connecting or disconnecting the pluggable terminals. Hot plug is forbidden.
- Prior to applying power to the product, make sure that the protective conductor of the 3 conductor mains power cord is correctly connected to the protective earth ground contact of the main power socket outlet.

Danger of explosion

The product must not be operated in explosion endangered environments.

Hazard to persons

- Carefully read this manual before using the product thoroughly, paying particular attention to the safety instruction. In the event of any uncertainties please notify your sales office immediately and refrain from working on the product.
- During the electrical installation, it is essential to ensure that the correct fuses/protective circuit breakers are used between the mains supply and the product. Further information can be found in the manual.
- If a product is installed in a machine, it must not be commissioned until proof of compliance of the machine with the latest version of the EC Machinery directive has been provided. This includes all relevant harmonised standards and regulations required for implementation of this directive in national legislation.
- The product emits invisible and/or visible optical radiation that can be hazardous to eyes, skin and other living tissue. The product complies with harmonized regulation IEC 60825-1:2014 and is marked with all relevant laser safety warning label and laser class rating label. Always wear the appropriate laser safety eyewear and observe the necessary safety procedures when operating the laser system.

Attention

Hazard to equipment and environment

- During installation, it is essential to ensure that the specified ventilation clearances and climatic conditions are adhered to. Further information can be found in the “Technical data” and “Mechanical installation”.
- The product contains components at risk from electrostatic discharge caused by improper handling:
  - Please ensure you are electrostatically discharged before touching the product directly.
  - Avoid contact with highly insulating material (synthetic fibres, plastic film etc.).
  - Place the product on a conductive surface.

CAUTION

EMC

- This equipment has been tested and found to comply with the limits of class A device as per EN 61326-1. These limits are designed to provide reasonable protection against harmful interference when the product is operated in a commercial environment. The product generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with this manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
- The manufacturer is not responsible for any radio television interference caused by modification of the product or the substitution or attachment of connecting cables and equipment other than those supplied with the products. The correction of interference caused by such unauthorized modification, substitution or attachment will be the responsibility of the user.
- The use of shielded I/O cables is required.

WARNING

LASER SAFETY

This equipment is a laser class 3B emitting invisible light in the Mid Infrared range, avoid exposure to the beam.

CAUTION

LASER SAFETY

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

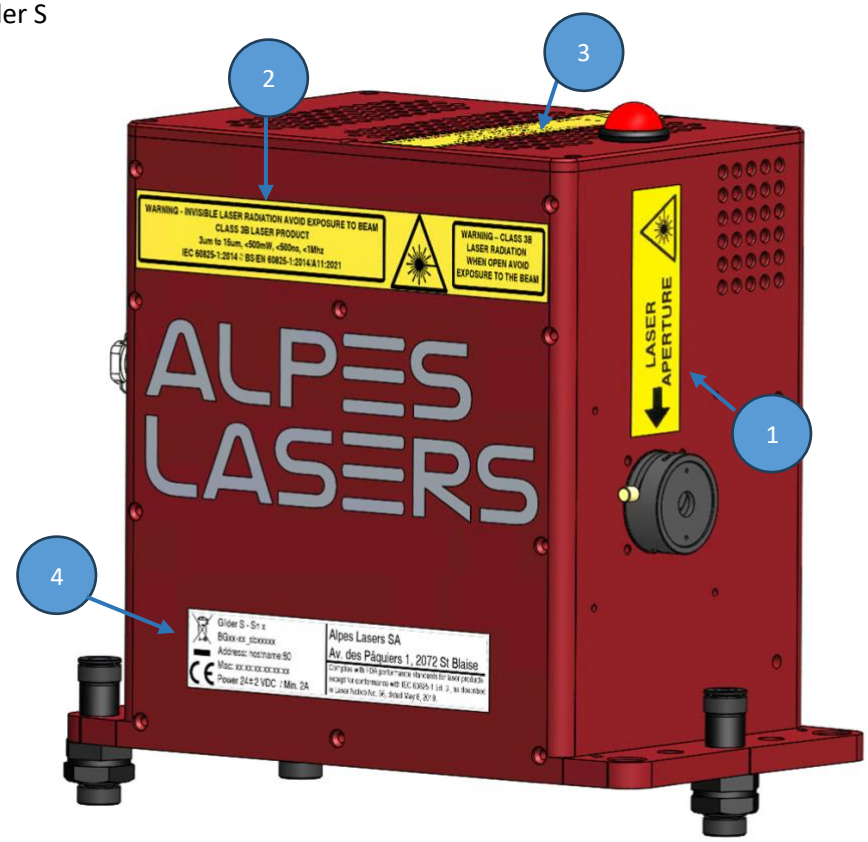
D. Label location diagram

a. Glider M

Front view

Rear view

b. Glider S

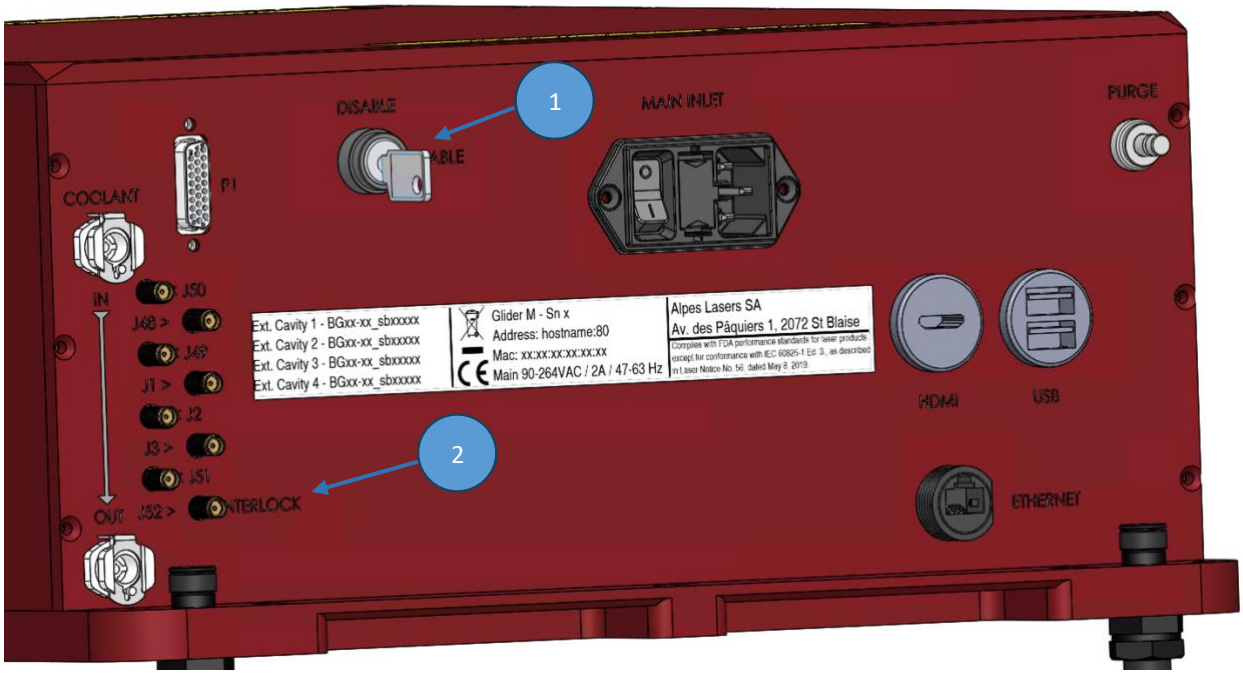


Class 3b Laser labels:

Location	Type	Label
1	Laser Aperture & warning label	LASER APERTURE
2	Explanatory, warning & housing label	WARNING - INVISIBLE LASER RADIATION AVOID EXPOSURE TO BEAM CLASS 3B LASER PRODUCT 3um to 15um, <500mW, <500ns, <1Mhz IEC 60825-1:2014 // BS/EN 60825-1:2014/A11:2021 WARNING – CLASS 3B LASER RADIATION WHEN OPEN AVOID EXPOSURE TO THE BEAM
3	Explanatory & warning label	WARNING - INVISIBLE LASER RADIATION AVOID EXPOSURE TO BEAM CLASS 3B LASER PRODUCT 3um to 15um, <500mW, <500ns, <1Mhz IEC 60825-1:2014 // BS/EN 60825-1:2014/A11:2021
4	Manufacturer ID	Ext. Cavity 1 - BGxx-xx_sbxxxxx Ext. Cavity 2 - BGxx-xx_sbxxxxx Ext. Cavity 3 - BGxx-xx_sbxxxxx Ext. Cavity 4 - BGxx-xx_sbxxxxx Glider M - Sn x Address: hostname:80 Mac: xx:xx:xx:xx:xx:xx Main 90-264VAC / 2A / 47-63 Hz Alpes Lasers SA Av. des Pâquiers 1, 2072 St Blaise Complies with FDA performance standards for laser products except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019. Or: Glider S - Sn x BGxx-xx_sbxxxxx Address: hostname:80 Mac: xx:xx:xx:xx:xx:xx Power 24±2 VDC / Min. 2A Alpes Lasers SA Av. des Pâquiers 1, 2072 St Blaise Complies with FDA performance standards for laser products except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019. Complies with FDA performance standards for laser products except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019 (x) characters in the label relate to laser type & serial numbers, mac address of the product, those are unique IDs that change from label to label.

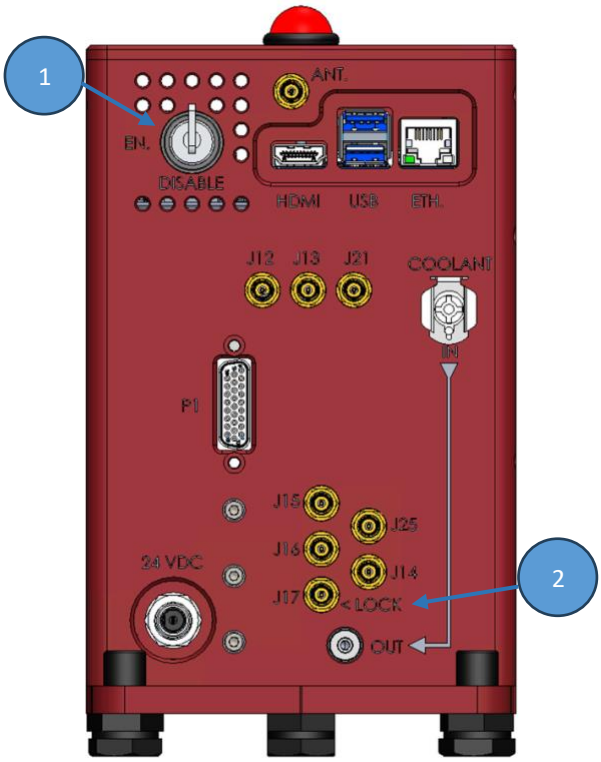
E. Interlock diagram and function

a. Glider M



Detailed rear view

b. Glider S



Detailed rear view

1. Safety key

The interlock safety key is only removable in the disabled state to secure the laser and forbid operation.

The safety key must be on the enable position for the laser to initialize and operate.

If the safety key is turned to disable while the laser is in operation, a system error will occur. A clear error action is required from the user, the safety key must be returned to enable position and a re-initialization of the system is required.

2. User Interlock

J52- SMA Female			
Pin number	Name	Level	Function & Description
1	User_Interlock	0-3.3 VDC	User interlock, active low, bridge to GND to enable operation (Supplied with a bridging cap)

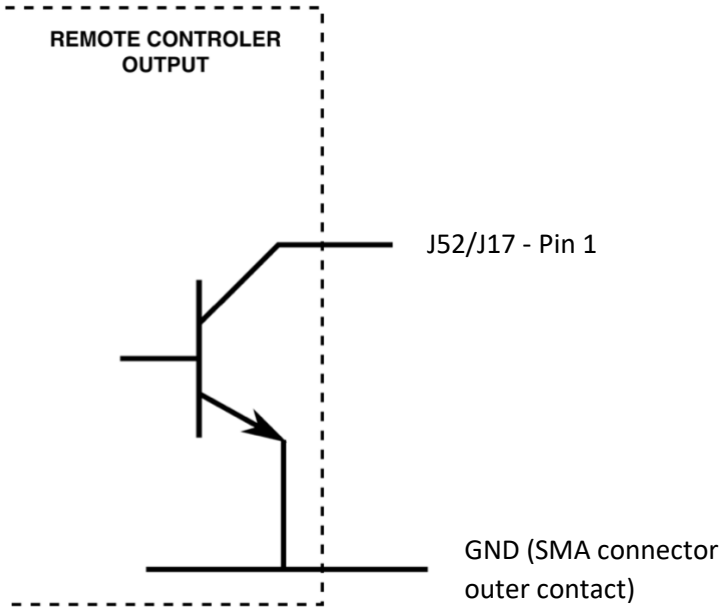
J17- SMA Female			
Pin number	Name	Level	Function & Description
1	User_Interlock	0-3.3 VDC	User interlock, active low, bridge to GND to enable operation (Supplied with a bridging cap)

The user Interlock connection is provided to the user through an SMA connector; this signal must be bridged to the GND to enable the system an allow initialization and lasing. The outer casing of the SMA is connected to GND.

This SMA is fitted of an SMA bridging cap by default that makes the connection to GND.

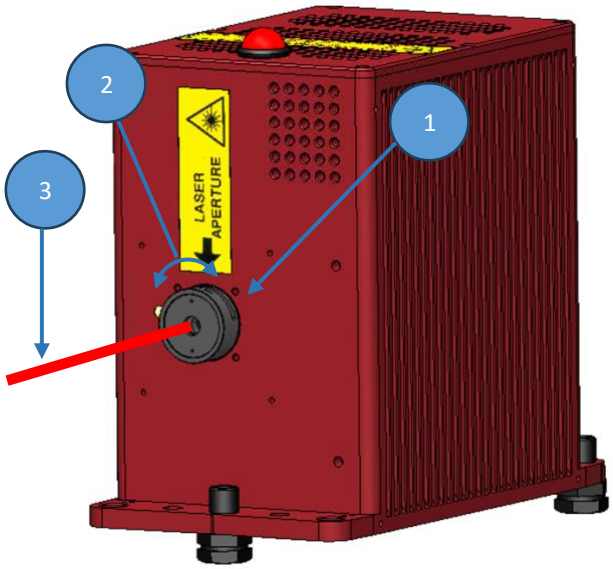
If the signal is turned to disable (open) while the laser is in operation, a system error will occur. A clear error action is required from the user, the signal key must be returned to enable (close) and a re-initialization of the system is required.

For remote operation of the user interlock, it is recommended to use any open collector or isolated open collector output supporting at least 5VDC (VCE) to drive this remote-control function, refer to below examples:



F. Laser beam output position

Glider M



Glider S

The laser beam is emitted in free space by the free space laser aperture (1) when the manual shutter (2) is in the open position as illustrated by the red line (3). Optionally the Glider M can be supplied with a fiber coupling port (4).

The free space laser aperture incorporates an SM1 female thread for a direct interface to any SM1 threaded systems or optics such as 1 inch lens tube and accessories.

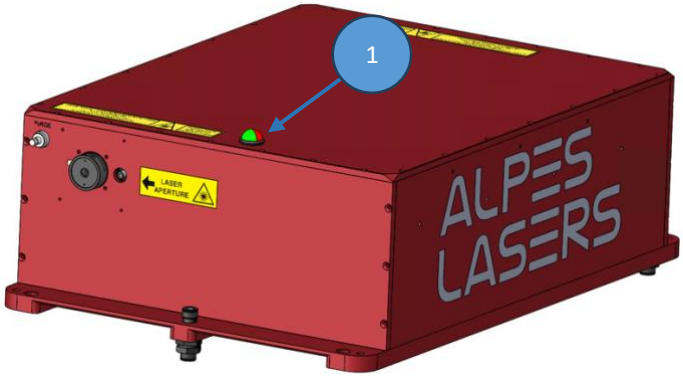
4 x UNC 4-40 threads disposed as a square 60 mm apart offer a direct connection to 60 mm cage system allowing to the user to use the full cage system accessories ecosystem.

G. Laser emission light beacon

Even if the light beacon illumination scheme allows to identify various systems status, as soon as the laser emission light beacon is either blinking or solid colored, the Laser must be considered potentially ON.

Note: when the main switch is turned on, the Red light can potentially turn on for one second due to the power supplies going live, the laser emission is impossible at this very moment.

The Laser system is equipped with a Laser Emission beacon (1) which is bi-colored Green/Red.



Glider M

Glider S

The below list summarizes the various illumination possibilities:

Flashing Green – System initializing.

Solid Green – System initialized.

Yellow/Orange (Red+Green) – The system is actively lasing.

Note

Note: A Laser warning sign is also visible on the GUI next to Alpes Lasers' logo.

Attention

If Lasing is observed with only red or only green color, one of the Laser emission light beacon channels has failed. The system needs to be returned to the manufacturer for repair.

H. Service & Adjustment

The device is service and maintenance free without schedule maintenance, customers or third parties are not allowed to open the device.

Only qualified personnel at the factory can open the device. Warranty void stickers are installed and will show tempered mark if the product is opened.

The unit shall be returned to the factory shall any service or repair be necessary.

I. Manufacturer information

Postal address:

Alpes Lasers SA
Avenue du Pâquiers 1
CH-2072 St-Blaise
SWITZERLAND

Phone:

+41 32 729 95 10

Email:

sales@alpeslasers.ch

Website:

https://www.alpeslasers.ch/

J. Safety equipment

1. Primary hazard

Class 3B lasers operating in the Mid-IR spectral range present serious safety risks primarily due to their **invisible radiation** and moderate-to-high output power. The most critical hazard is **ocular injury**, as the human eye cannot detect or react to IR radiation in this wavelength range. Unlike visible light, exposure to 3-14 µm radiation can cause **corneal or lens damage** without triggering the natural blink reflex, leading to **irreversible vision impairment or blindness**.

Additionally, prolonged exposure to the laser beam can result in **thermal damage to the skin**, particularly at short distances or high-power densities. The beam can also pose a **fire hazard** when focused or incident on flammable materials or surfaces. Moreover, because mid-IR radiation is invisible, **accidental exposure is harder to detect**, increasing the risk of unintentional injuries in unprotected or poorly controlled environments. These factors make rigorous safety protocols and protective measures essential when working with this type of laser system.

2. Laser safety googles and requirement

For this product, it is mandatory to wear safety goggles designed to protect the eyes of the operator and any other person present in the same room and/or within a distance shorter than the NOHD.
In accordance with the European directive EN 207/208, goggles suitable for use with this product must have an optical density greater than or equal to 6 (OD6).

Laser safety googles available here: https://www.alpeslasers.ch/laser-safety-goggles/

Additionally operating this device requires strict adherence to safety protocols to minimize risks to users and bystanders. The laser must be used within a **designated controlled area**, clearly marked with **appropriate warning signs** at all access points. Access to this area should be **restricted to trained and authorized personnel** only.

The laser setup should incorporate **beam enclosures** or **protective barriers** wherever possible to prevent accidental exposure or beam propagation outside the intended path. A **beam stop or beam dump** should be installed to safely absorb the laser energy at the end of the beam path. Reflective surfaces must be avoided near the beam path, as they can redirect the invisible IR radiation

unpredictably. Proper alignment procedures must be established to ensure beam direction is always controlled.

3. Nominal Ocular Hazard Distance (NOHD)

To evaluate the ocular hazard zone of a class 3B laser at 3-14 µm, we calculated the NOHD (Nominal Ocular Hazard Distance) using key laser parameters: output power (0.5 W), beam waist (2 mm), and divergence (6 mrad).

The irradiance at the beam waist was computed and compared to the MPE (Maximum Permissible Exposure) for corneal exposure in the mid-infrared range, set at 100 W/m². Based on this, the NOHD was determined to be approximately 6.3 meters. Within this range, proper laser safety goggles rated for 3-14 µm (mid-IR) protection and sufficient optical density (OD) must be worn. Additionally, warning signs, access control, and beam enclosures or beam dumps are strongly recommended to mitigate accidental exposure risks below the NOHD.

$$\text{NOHD} = \frac{\theta}{d}\left(\sqrt{\frac{D}{MPE}} - 1\right)$$

$$\text{NOHD} = \frac{0.002}{0.006}\left(\sqrt{\frac{159000}{100}} - 1\right) \approx 6.3\ \text{m}$$

Within this range, proper laser safety goggles rated for 3-14 µm (mid-IR) protection and sufficient optical density (OD) must be worn. Additionally, warning signs, access control, and beam enclosures or beam dumps are strongly recommended to mitigate accidental exposure risks below the NOHD.

Important: If the beam is used in an optical setup with focusing elements (lenses, curved mirrors, telescopes, etc.), we recommend calculating the NOHD at each stage of the system and using the **maximum value** as the reference for the entire setup.

Summary Table

Parameter	Divergence	Beam waist	NOHD (3-14µm)
Value	0.002 Rad	6mm	**6.3m**

III. Handling

A. Transport and storage

Transport

- Only by qualified personnel
- Only in recyclable original manufacturer's packaging, inform the transport company that this packaging is non-stackable and do not stack labels/cones should be applied to the packaging.
- Avoid sharp impacts, ideally, place shock watch inside and outside of the packaging.
- Temperature: -10…. +40°C, varying no faster than 10K/hour
- Air Humidity: Relative humidity max. 95%, non-condensing. Protect the product with an ESD bag and desiccant.
- The product contains components at risk from electrostatic discharge caused by improper handling:
    - Please ensure you are electrostatically discharged before touching the product directly.
    - Avoid contact with highly insulating material (synthetic fibres, Plastic film etc.).
    - Place the product on a conductive surface
- If the packaging is damaged check the product and any accessories for visible damage. Inform the transport company and, if necessary, the manufacturer.

Storage

- The devices and its accessories must not be stored outdoors. The storage space must be adequately ventilated and dry.
- The devices must be stored in the recyclable original manufacturer's packaging.
- The product contains components at risk from electrostatic discharge caused by improper handling:
    - Please ensure you are electrostatically discharged before touching the product directly.
    - Avoid contact with highly insulating material (synthetic fibres, plastic film etc.).
    - Place the product on a conductive surface
- Do not Stack
- Storage temperature: 0…. +40°C, varying no faster than 10K/hour
- Air Humidity: Relative humidity max. 95%, non-condensing. Protect the product with an ESD bag and desiccant.
- Duration of storage:
    - < 5 years: No limitation.
    - >5 years: The dielectric (an oxidation layer with a thickness of approx. 1um) in the DC link capacitors degrades over time, and the capacitors lose their forming.
      Prior to commissioning of the product the capacitor must be reformed.
      Release all electrical connections and feed the product for about 30 minutes with its nominal supply before operation.

Attention

B. Disposal

- Screw connections enable the products to be dismantled into main components (aluminium heat sink, steel case, PCBs)
- The device should be disposed of by a certified disposal company.
- Metal part can be sent for metal recycling.
- Electronic parts such as circuit boards and terminals must be disposed of in accordance with the national electronics scrap regulations.

C. Cleaning

- Soiled housing: Clean with isopropanol or similar **(Do not immerse or spray!)**
- Contamination inside the device: Cleaning by manufacturer

IV. Product Overview

The product is comprised of a compact laser system embedding QCL or ICL laser(s) encapsulated into a laser housing, laser driver(s) and temperature controller(s), making it an all-in-one complete laser source.

Key features are:

- Turn-key, all in one solution for operating an EC - QCL or EC – ICL with high speed and resolution dual channel analog acquisition capability, spectrometric measurements are just a few clicks away.
- Easy external synchronization with various I/O including real time analog wavelength output.
- Direct interface to renowned optical standard SM1 and 60 mm cage system
- Simple operation
- Calibrated optical power and wavelength.
- Collimated output beam
- Integrated internal temperature safety monitoring
- Water cooled
- User-adjustable levelling legs for height and pointing adjustment
- Internal controlled steering mirrors allow for full beam pointing match between lasers.
- Levelling legs spacing compatible with optical bread board with standard metric and imperial spacing
- Additional precision interfaces available for integration

V. Reception and Unpacking

- Inspect the outer shock watches, if tripped, damaged, or removed, do not refuse shipment but notify the transportation company of the deviation. Take pictures evidence and send them to Alpes Lasers SA.

Attention

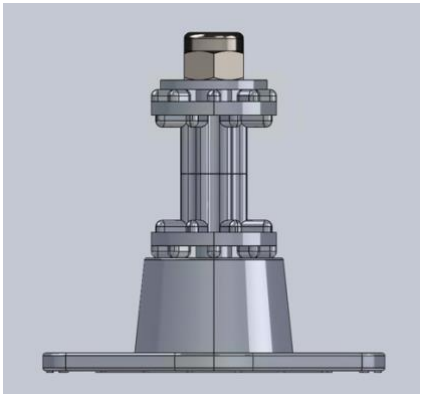
Prior starting the unpacking procedure, ensure that the complete package is left to rest for at least 12H in a room with outside air temperature above the dew point to avoid sudden condensation on the product. Do not forget to store the original packaging for future transportation.

- Break the tensioned wrap ribbons and open the top lid.

- Remove the tape on the plastic wrap and unfold it to the sides.

- Inspect the inner shock watches, if tripped, do not refuse shipment but notify the transportation company of the deviation. Take pictures evidence and send them to Alpes Lasers SA.
- Open the accessories cardboard box and remove the items.
- Unscrew the three nylon stop nuts with a 10 mm key and lift the product out of the package, carefully placing it on top of a flat surface.
- Remove the 6 x Ribbed Vibration-Damping Bushings and place them on the M6 struts.

- Place back the nylon stop nuts on the struts, **the complete packaging can be dismounted and folded, store it for future use.**

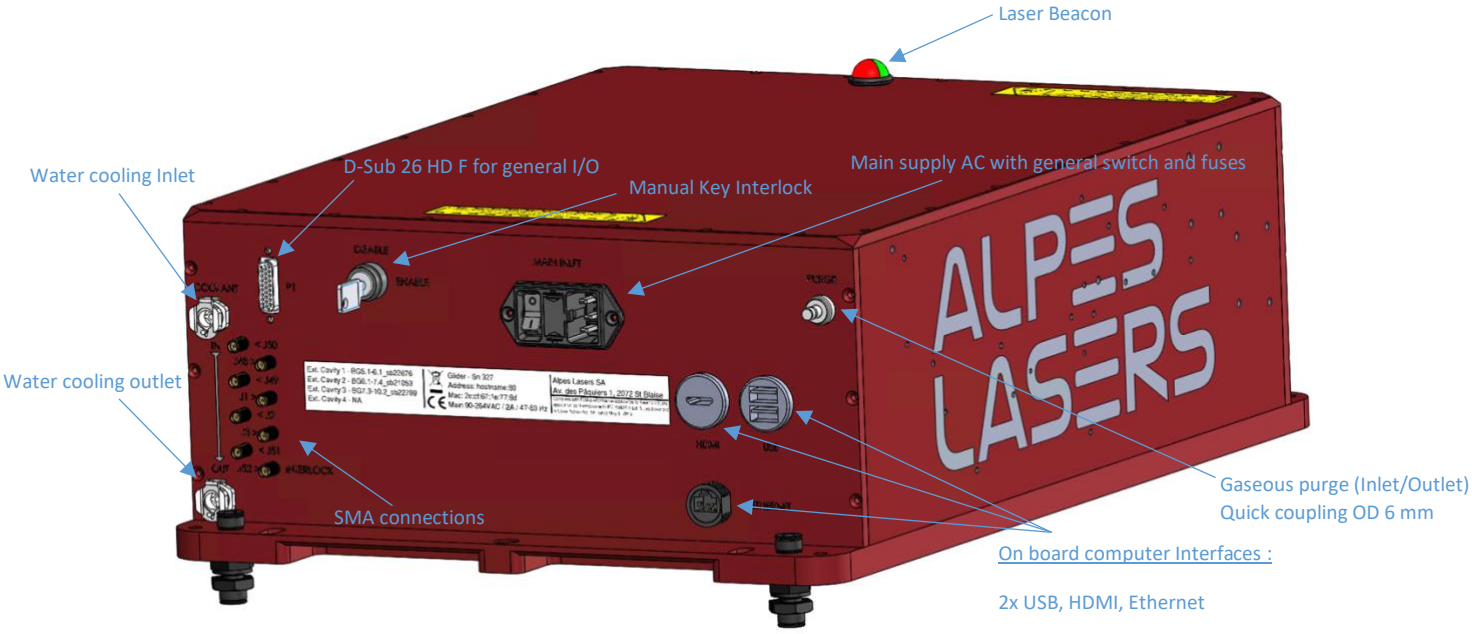


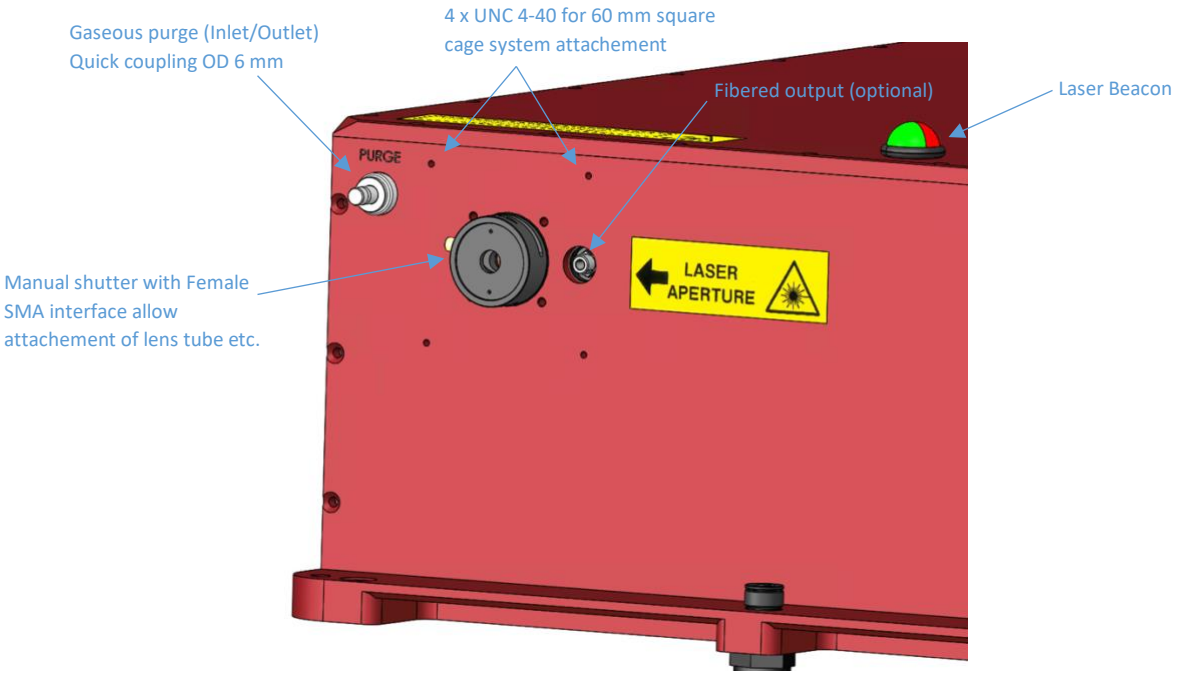
In case of product return, this procedure can be followed in reverse. Refer also to the water-cooling section for the purge.

VI. Description

A. General

a. Glider M

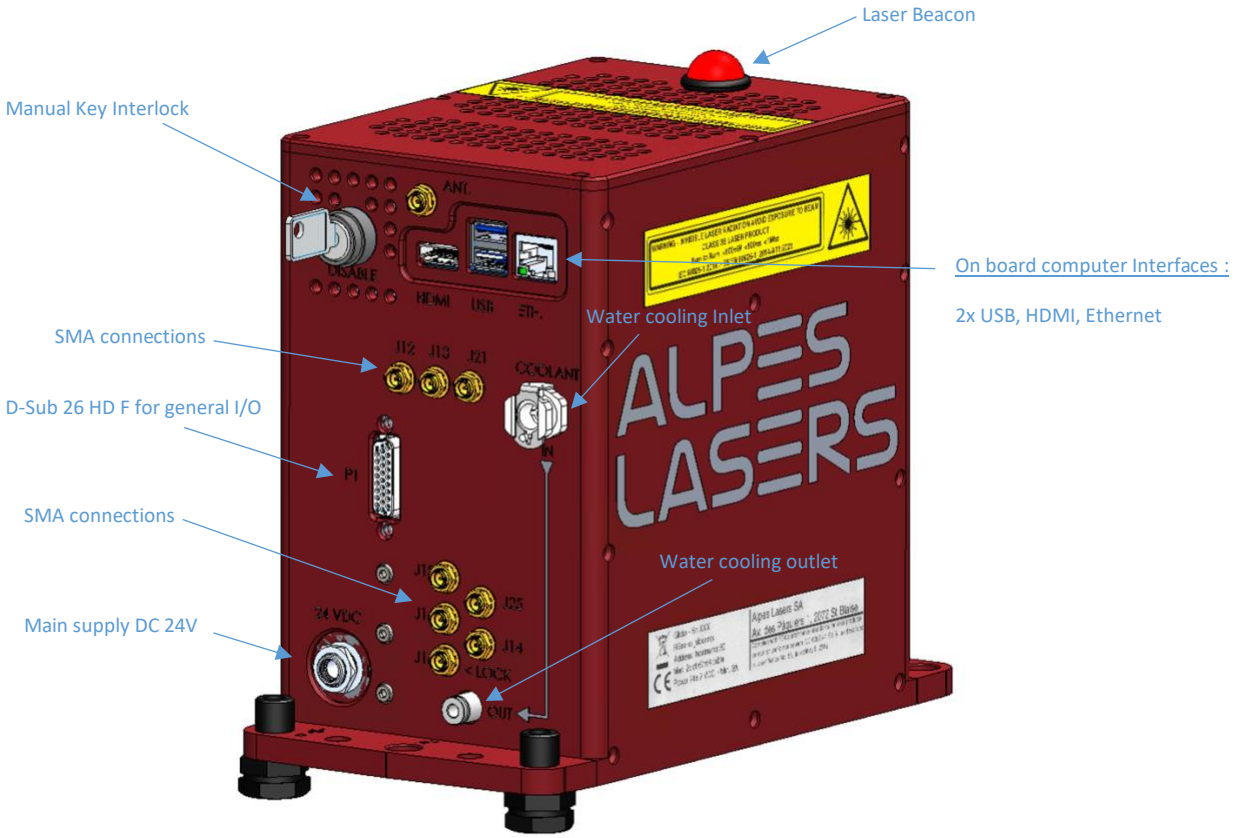




Attention

Read the instruction relative to water cooling & gaseous purge before operating.

b. Glider S



Attention

Read the instruction relative to water cooling & gaseous purge before operating.

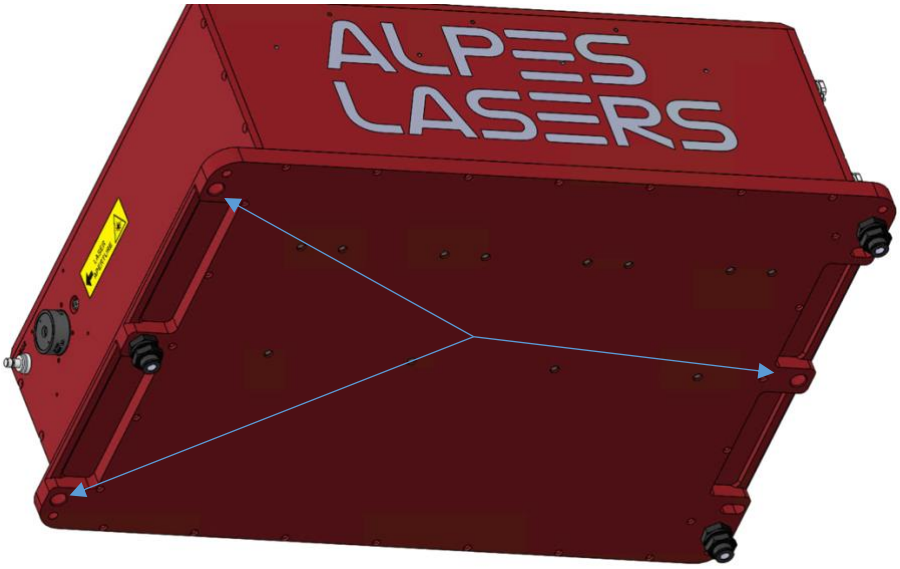
VII. Installation

Refer to the product interface drawing for detailed dimensions and interfaces details as well as beam height and possible adjustment. 3D step file is available on request.

A. Mounting using levelling feet

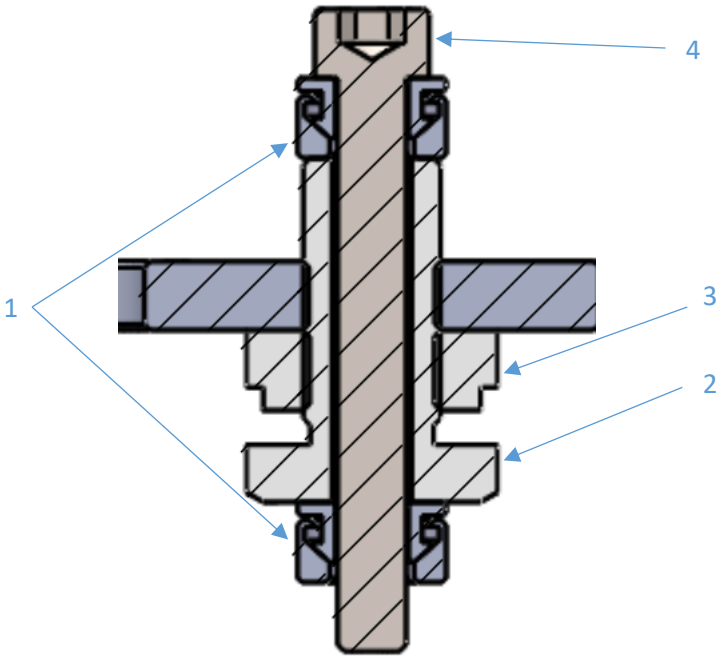
The product interfaces are compatible with Metric and Imperial spacing optical bread board. By default, Metric levelling feet's will be installed.

To use an imperial spacing board, move the feet to the below locations pointed with a blue arrow. The imperial feet mounting positions are marked with // on the top side.



The levelling feet provide a vertical stroke of maximum 4 mm and an angular correction of maximum +/- 1°

To perform an adjustment, release the main screws (4) and adjust the levelling feet (2) to get the required beam pointing. Lock the nuts (3) and then lock the main screws (4).



SECTION D-D
SCALE 1 : 1

Provided material 3x:

1 - Spherical washers

2- Levelling feet

3 - Lock nut

4 – M6 screw

Attention

The above cross section describes each of the three levelling feet assembly, it is mandatory to mount them as describe using two spherical washers on both ends. These washers are compensating for plane mismatch due to the angular adjustment and avoid product deformation.

The levelling feet provide a vertical stroke of maximum 4 mm and an angular correction of maximum +/- 1°

To perform an adjustment, release the main screws (4) and adjust the levelling feet (2). Lock the nuts (3) and then lock the main screws (4).

B. Water cooling

Connect the water-cooling lines with the provided connectors using a 6 mm OD water resistant tubes (Festo PUN-H for example). The flow shall be minimum 1L/min and the pressure shall be less than 5 Bar.

Attention

Respect the flow direction, it's optimized to provide the best cooling performance.

Attention

Use DI water optionally with fungicide or water treatment compound. The user is responsible to control that the used media/chemical is compatible with:

- Polyurethane tubing, Hydrolysis-resistant
- Acetal plastic
- NBR and FPM O-ring
- 316 stainless steel and High alloy stainless steel
- Brass, chemically nickel-plated
- Aluminium, chromate passivated

Attention

In case of product return, the cooling circuit must be entirely purged with compressed air. To do so simply use the same tubing as the water-cooling circuit and circulate a low flow of air through the circuit for a few minutes until no water can be seen exiting the system.

C. Gaseous purge

The product can be purged with a gas for example to avoid/reduce naturally present light absorbs ions in the atmosphere.

Attention

The product is not hermetically sealed and is not a pressure vessel. Do not apply more than 100 mbar of pressure inside the product and do not use potentially harmful gas. Corrosive gasses are forbidden.

The purge port positions are optimized for:

- Stand-alone use with one port use as inlet and the other with a bleeder to control pressure and flow.
- Daisy chaining with one port use as an inlet and the other connected to following optical arrangement for example a lens tube system. In this case the bleeder is located at the end of the chain.

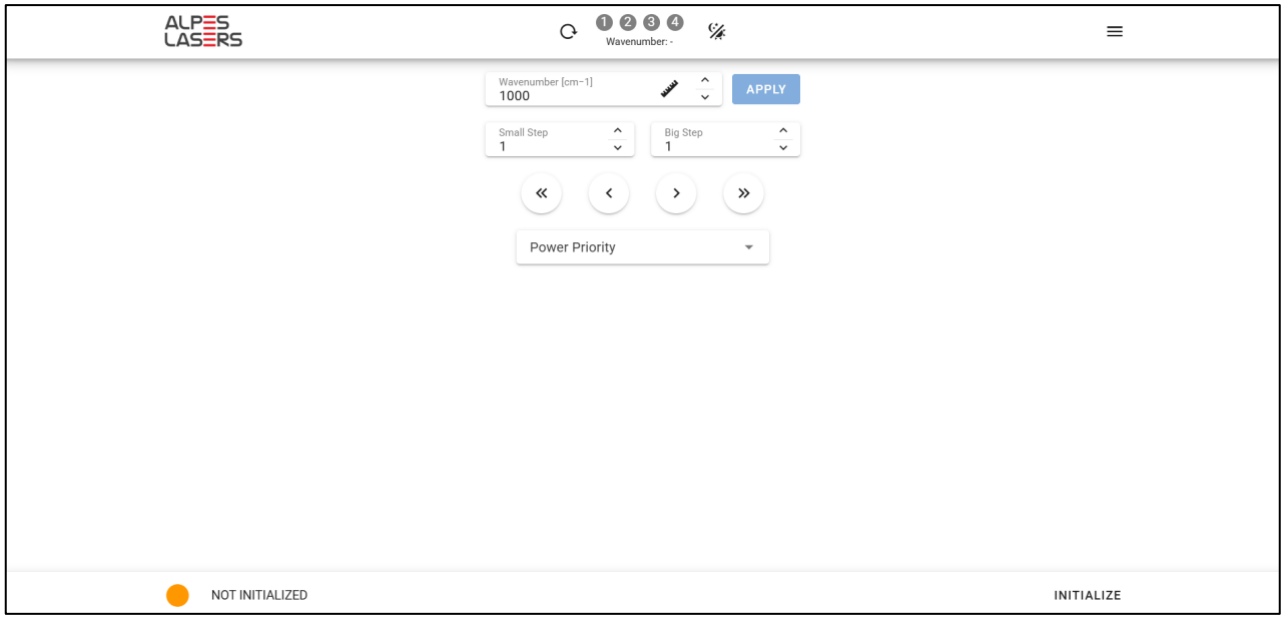
VIII. Operation

A. Installation and general wiring

- Install the Glider – External cavity Laser source as per VII.A.
- **Check the main switch is on "0" position**
- Connect the water-cooling lines, 1L / Min at 20°C is necessary.
- Plug a keyboard and a mouse to the USB port
- Plug an HDMI screen to the HDMI port
- Check that the interlock on **J52**/**J17** is correctly connected or an SMA bridging cap is present.
- Complete cabling on all application related I/Os if needed (Optional, can be done at later stage by switching off the device)
- Turn the interlock key to ENABLE
- Plug the main inlet **and turn the main switch to "1" position**

B. Startup

- Turn the main switch to "1" and wait for the internal computer to boot. The below screen will appear automatically after the boot. It's also possible to access the screen remotely using the RJ45 connection and the address http://hostname:80 in a web browser.

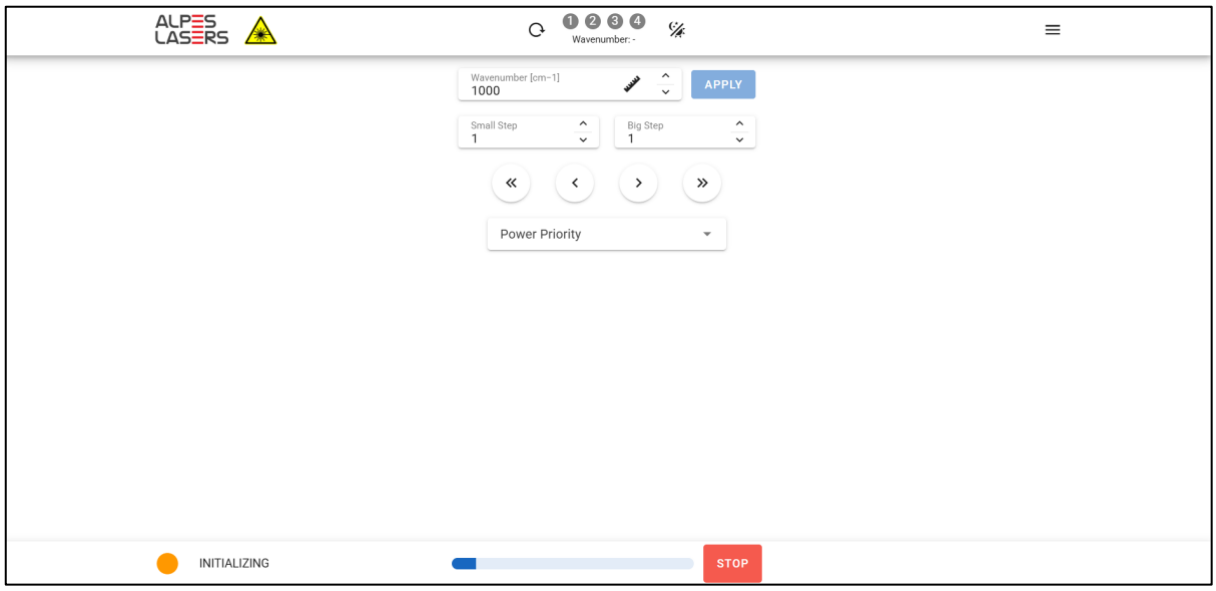


Attention

Before proceeding to the initialization, all interlocks must be enabled, and the water cooling must be running.

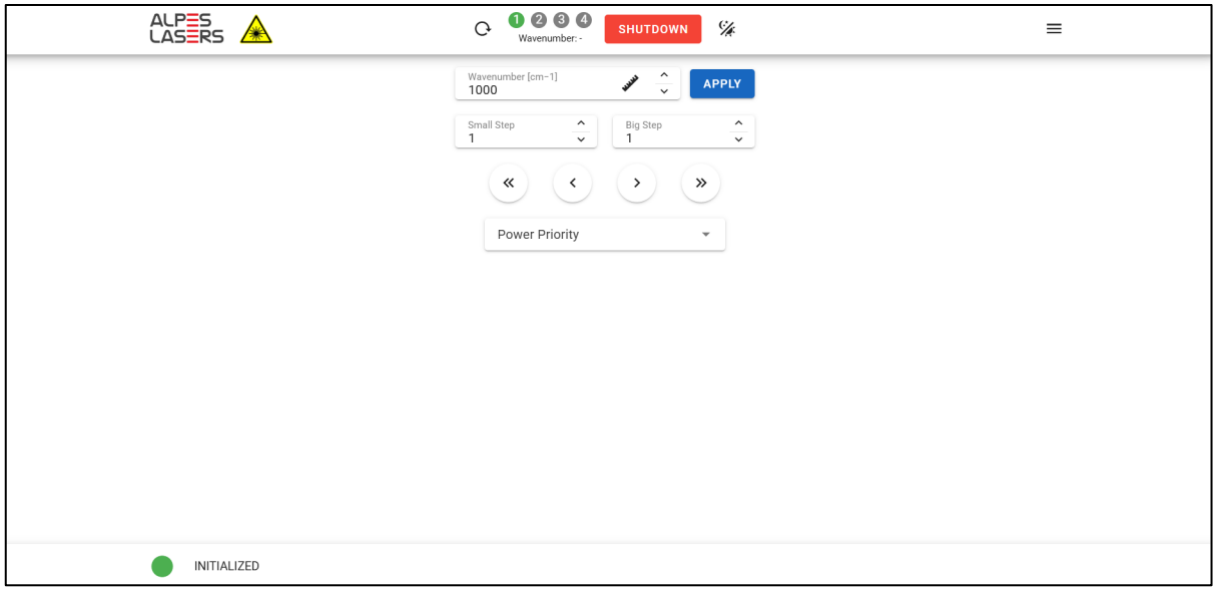
- Click on initialize.

Initialization in progress:



During initialization the laser emission light beacon will blink green, the initialization process starts all internal systems like motor, temperature controller, etc. From this point on the Laser must be considered potentially live. The laser warning sign is also visible on the GUI next to the Alpes Lasers' logo.

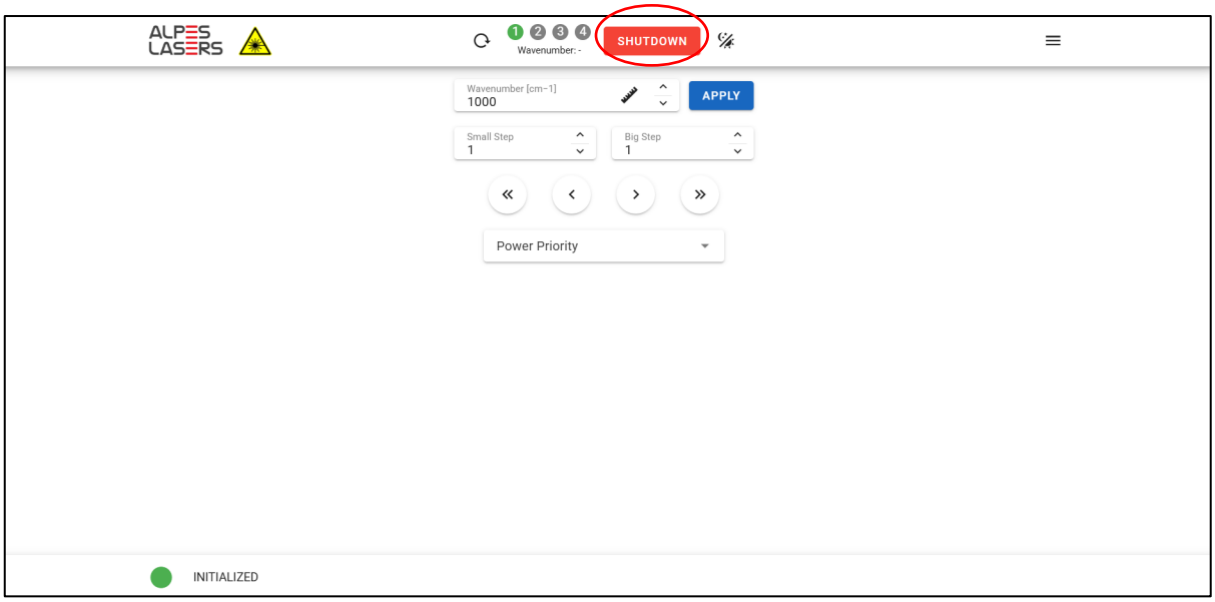
Initialization completed:



Once the initialization is completed the laser emission light beacon will turn to solid green, Laser must be considered potentially live. The laser warning sign is also visible on the GUI next to the Alpes Lasers' logo.

C. Shutdown

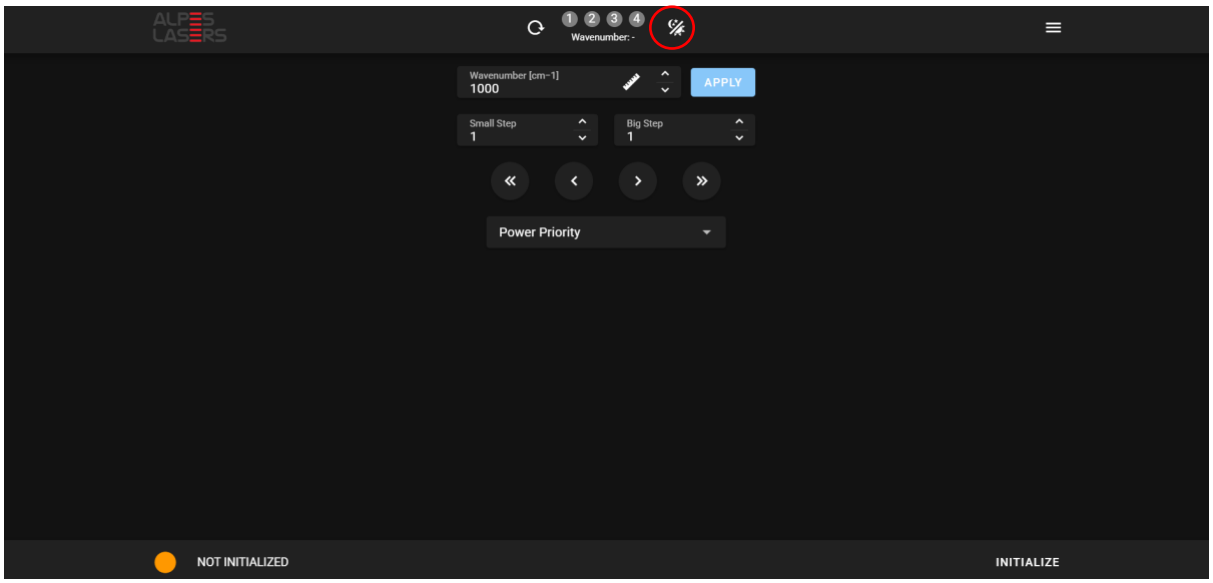
Accessible anytime, the shutdown button (circled below) will turn the system off to a not initialized state (See startup), in this condition the main switch can be turned off at any time.



D. Generalities of operation

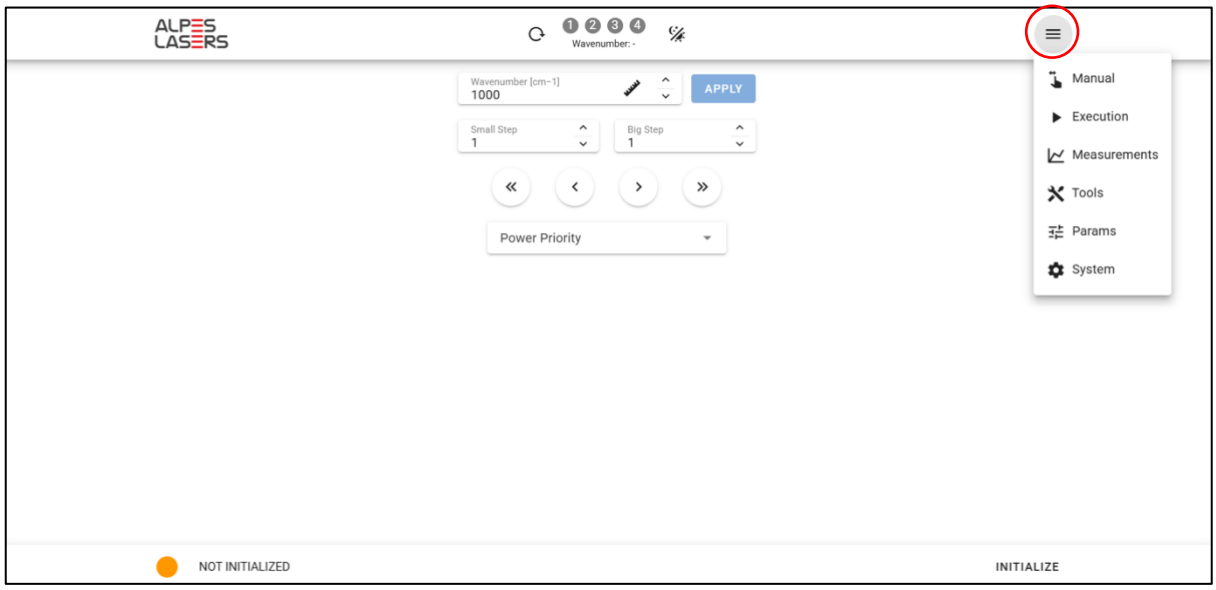
1. Bright mode / Dark mode:

The GUI can be switch between bright mode and dark mode at any time by pressing on the below red circled icon.



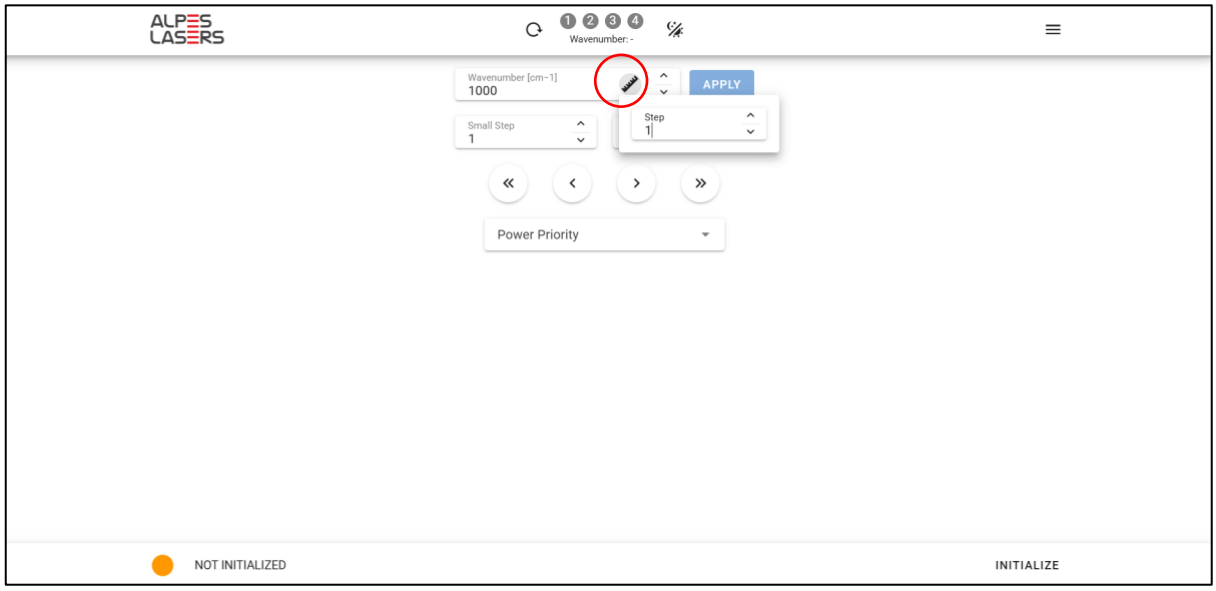
2. Menu:

Depending on the screen resolution and size the menu will either be directly accessible on the top bar or by clicking on the red circled icon below.



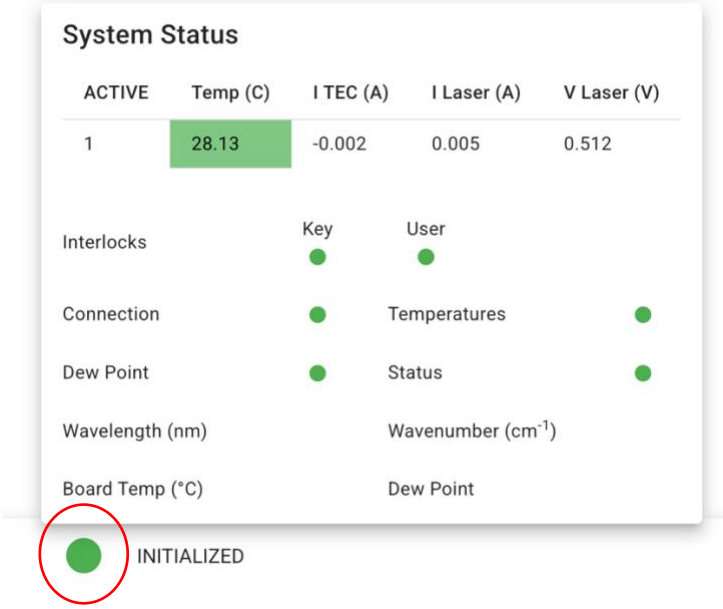
3. Incremental adjustment steps:

Anywhere the ruler icon (red circled below) is visible, clicking on it will allow the user to set the incremental step response when pressing on the up/down adjustment arrow next to it.



4. Status pop up & system states:

As illustrated below the status pop up is available anytime by pressing on the status-colored icon (circled in red below), it provides an overview of all internal systems status like the interlock, temperatures, laser operations, etc.



The status-colored icon can be:

Green – The system is nominal.

Orange – The system has a warning, monitoring or actions are required.

Red – The system is in error state, error state needs to be corrected and errors need to be cleared.

Next to it on the right, the state of the system is displayed, the different states are listed below:

Connection error – internal components are not reachable.

Connecting – The system is establishing internal connections with the internal components.

Firmware upgrade - firmware upgrade is required for some subcomponent(s)

Not Initialized – All components are connected; but are not initialized.

Initializing – The system initialization sequence is running.

Initialized – The system is initialized and ready to start lasing.

Lasing – The system is currently Lasing.

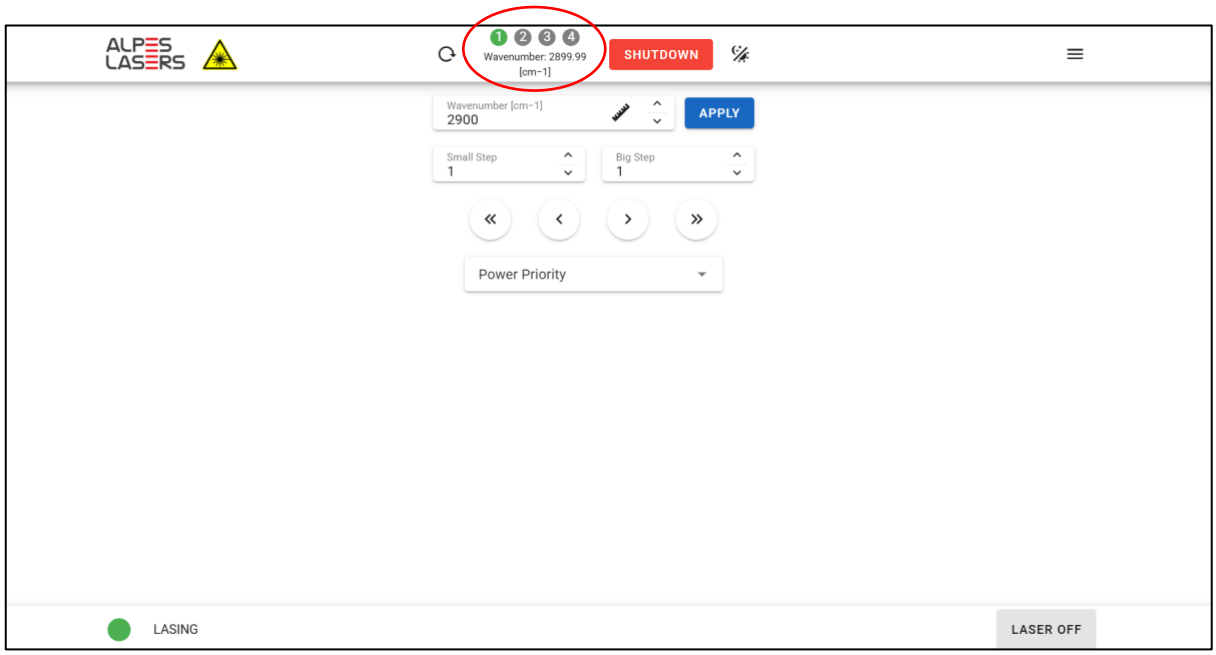
Executing lasing – The system is executing a programmed lasing sequence.

System excursion – One of the important parameters of the system went outside its boundary after initialization, the system did proceed to an auto shutdown, check the status pop-up and correct the fault, the user needs to clear the error.

System error - One parameter of the system went outside its boundary, check the status pop-up and correct the fault, the user needs to clear the error.

5. Active laser and emitted wavelength:

On the top menu bar (circled in red), the system constantly displays the active laser and the currently selected wavelength.

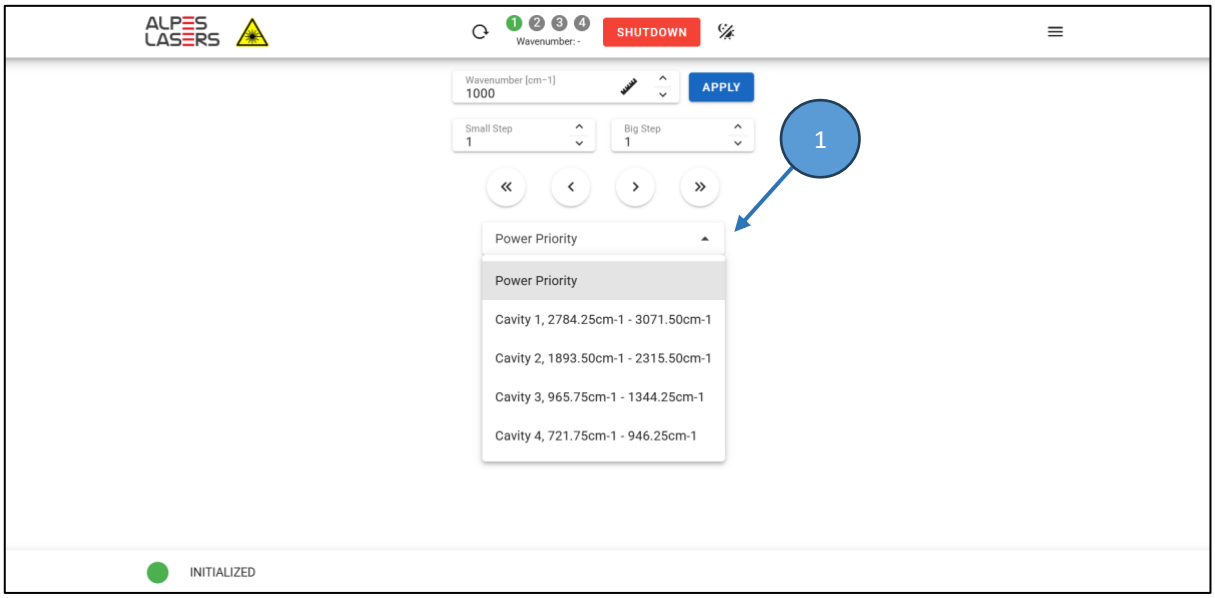


E. Lasing operations

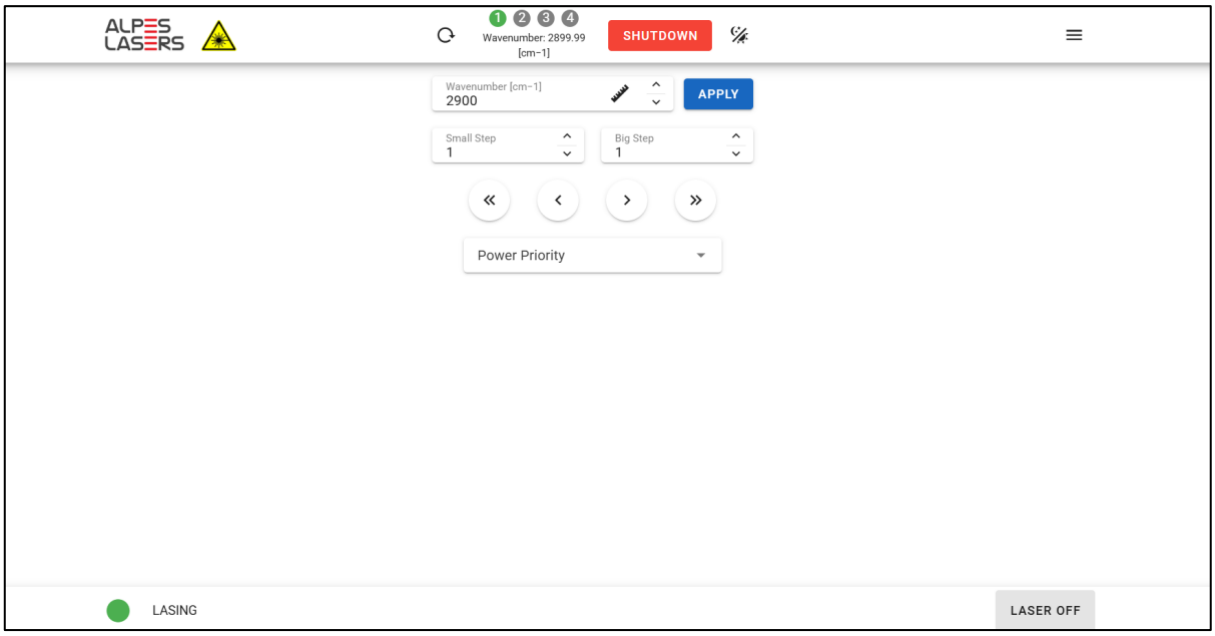
1. Manual operation

The manual operation is the default boot page of the GUI, the user can navigate to it any time using the main menu button.

- Enter a wavenumber/wavelength within the tuning range of your unit(s), refer to datasheet(s) or the drop-down menu (1) and press the apply to start the lasing.
- The drop-down menu (1) offers the possibility to the user to force an EC laser specifically or to switch between them by power priority, in this mode (default), if the tuning range of two EC laser overlaps, the most powerful laser will be selected.



The system will automatically select the active Laser which is represented by a Green colored dot on the top menu, steer the output mirrors and switch the laser On.



From this point the user can either enter or scroll to a new wavenumber/wavelength and click on apply.

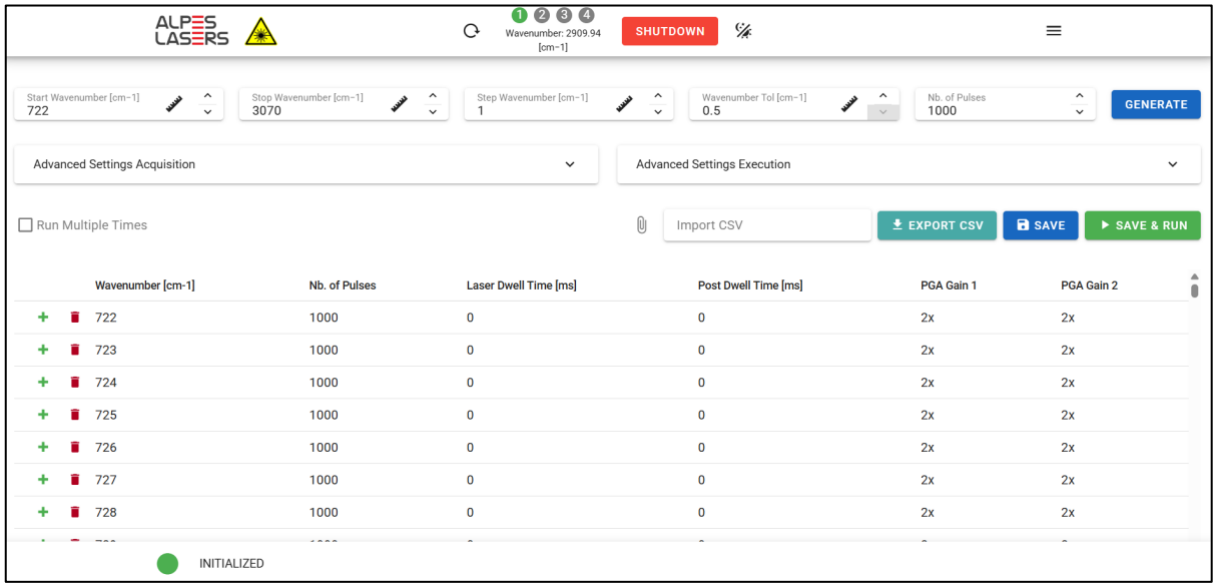
Or use the horizontal arrows to directly step the wavenumber/wavelength, a small and large step size can be defined by the user.

2. Execution

a. Initial setup & execution

The execution page is accessible any time via the menu.

The page allows the user to setup a complete execution sequence of Laser emission and eventually associated measurements.



The user can generate, export, modify, import a lasing sequence from this page. It's advised to always start by generating a generic sequence with the embedded generator before eventually exporting it for an eventual sequence adjustment.

<u>To do so:</u>

- Enter a start and a stop wavenumber/wavelength.
- Enter a step value.
- Enter a wavenumber/wavelength tolerance – This parameter defines the +/- tolerance for each point to be consider valid.
- Enter the number of Laser pulses per point.

Note

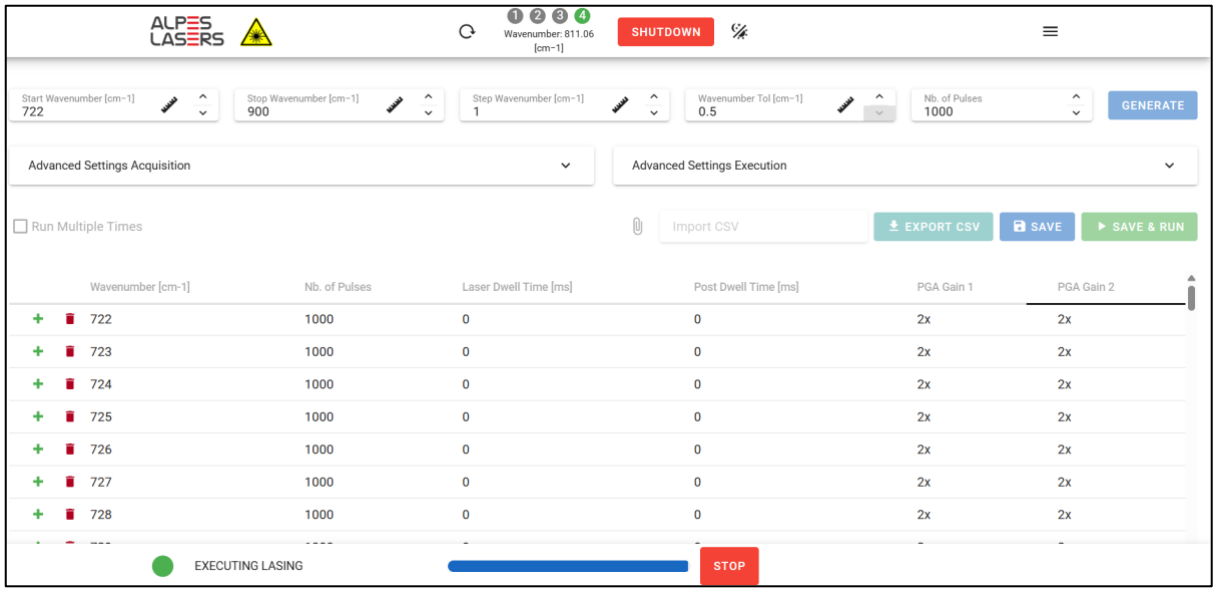
Note: The number of laser pulses per point is limited to 65500 in case of single ADC acquisition and to 32500 in case of dual ADC acquisition – Refer to Advance setting acquisition section below.

- Click on generate – The use will be prompt for confirmation to avoid unwanted erasing of a sequence, click yes to proceed.

The save button is saving the current sequence, it'll be recalled next time.

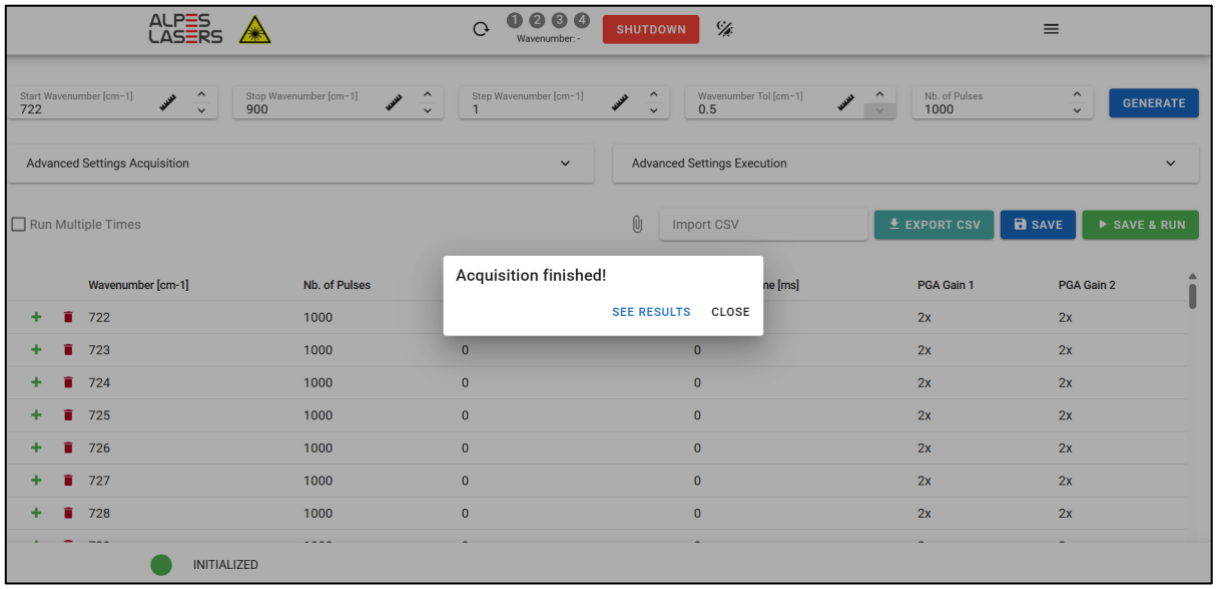
To execute the sequence, click on save and execute.

Example of sequence execution:



The user can follow the progress with a progress bar, the sequence can be aborted at any time with the stop button.

Once the acquisition is done the below pop-up will appear:



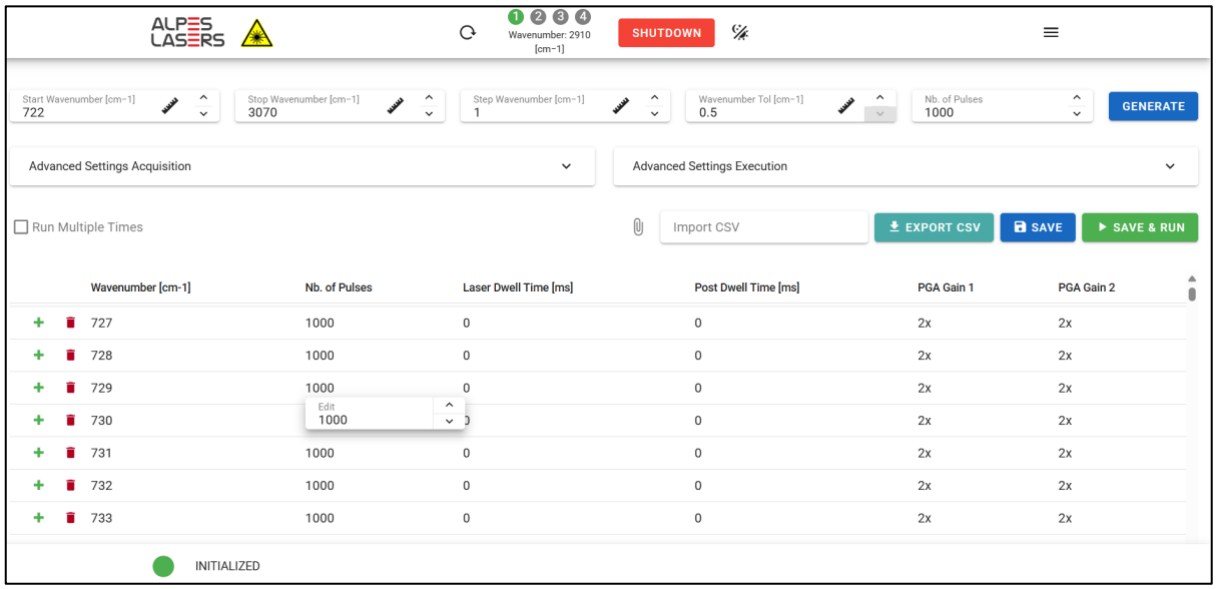
Click on see result to jump to the measurement page, click close will return to the execution page.

See measurement page chapter for further details on data display and processing.

b. Editing the sequence

The sequence can be scrolled and edited directly on the execution page.

Rows can be added or deleted; values can be edited individually per sequence line like on the below example:



Alternatively, the user can export the sequence table as a .CSV file to edit it with a third-party software using the export csv button.

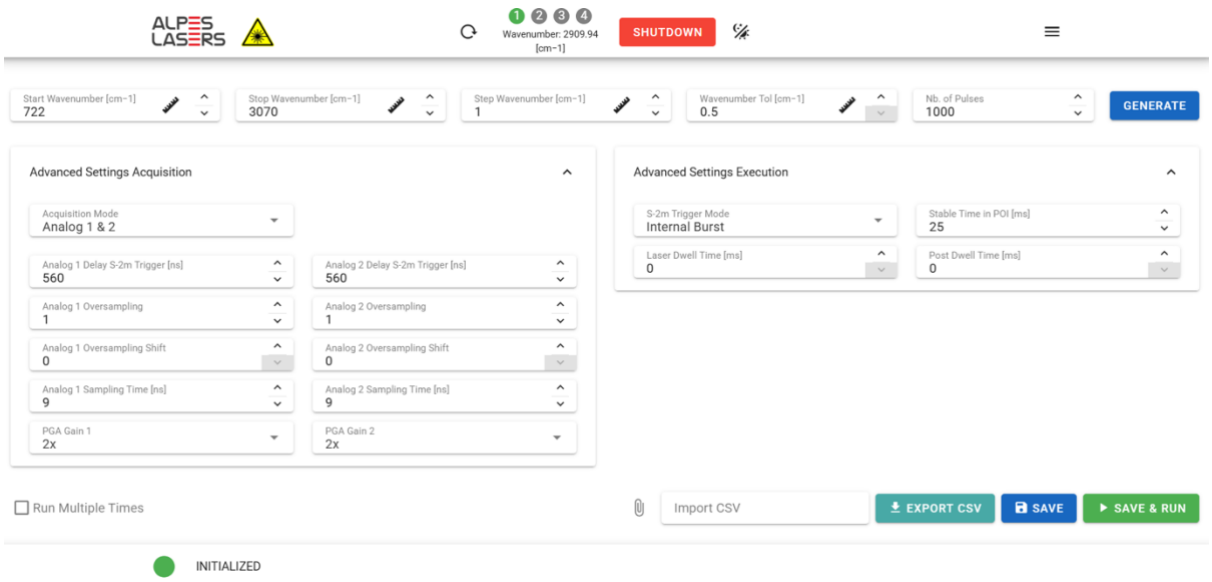
The modified sequence can be re-imported using the Import CSV button.

Note

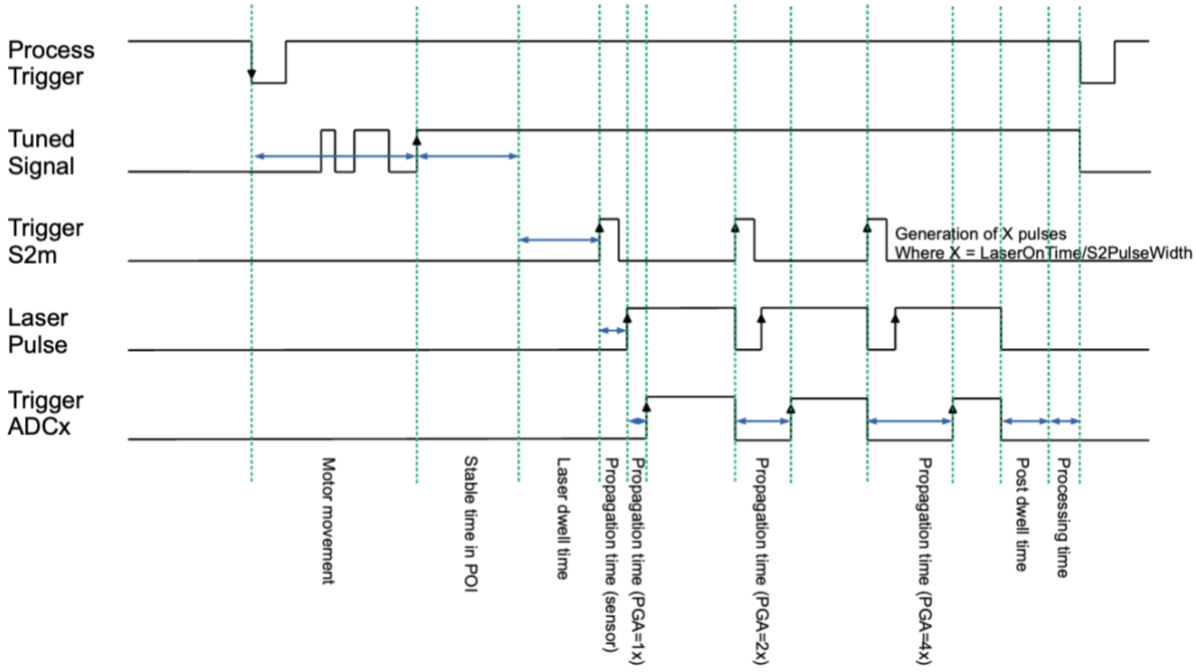
Note: Do not forget to save the modification to the sequence.

c. Advance settings

The advance settings menu allows the user to set acquisition parameters for the two analog channels and advance executions parameters related to the embedded laser driver S-2m.



<u>Description of timing per execution point:</u>



1. Advance settings acquisition:

The system embedded two fast acquisition ADC channels of 16 bits over 3.3VDC, those channels are synchronized at very low level and can thus acquire measurement at every single Laser pulse if those can be resolved by the user sensor. This allows to take full advantage of the peak power of the Laser system.

Acquisition mode:

In this drop down the user can select to make acquisitions or not and to select between single or dual channel acquisition.

Analog ½ delay S-2m trigger:

This value is the propagation delay of the whole measurement chain stating from the Laser pulse generation to embedded acquisition system. It's composed by the user's sensor propagation time + PGA propagation time illustrated here above.

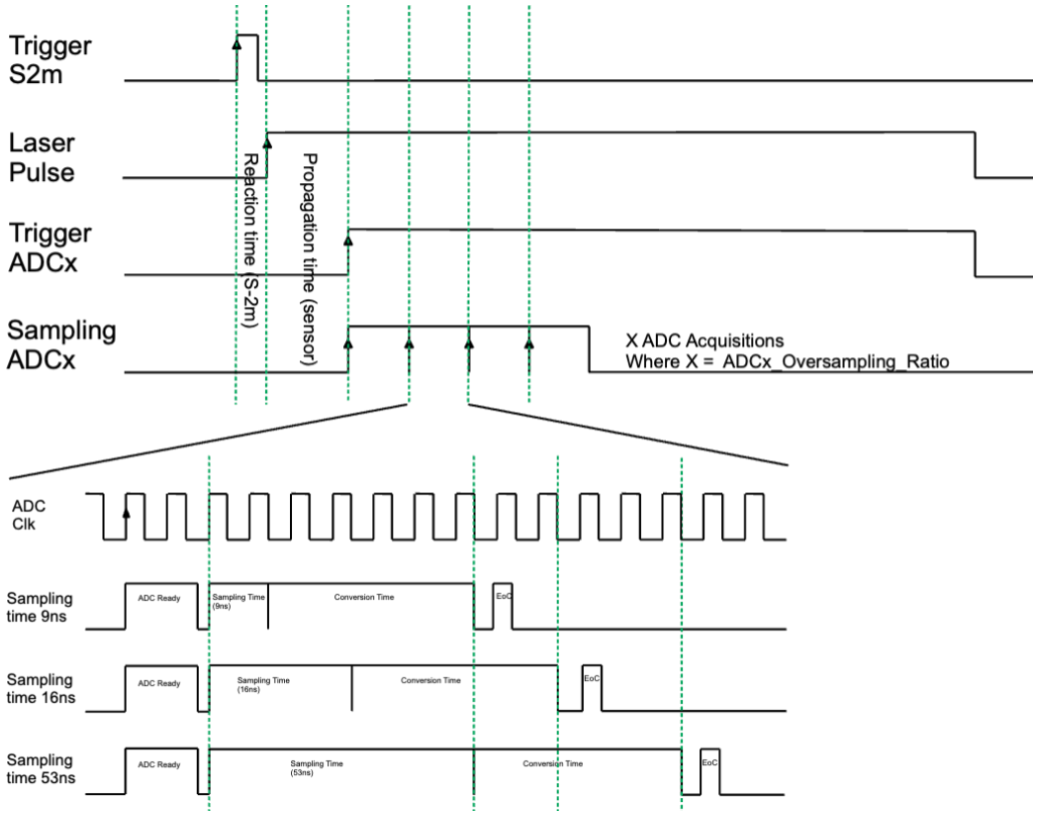
A tool is available to help the user set this value, please refer to tool section.

Note

Note: The illustration shows differences in timings for the various PGA gains, those differences are factory set, the user should only set the above delay based on PGA x1.

ADC acquisition parameters:

Each ADC acquisition obeys to a few parameters that can be user defined.



Analog ½ sampling time:

This is the basic parameter of an ADC acquisition; the sampling time is the time required for the Analog-to-Digital Converter (ADC) to capture the input voltage during sampling. The acquisition time of a Successive Approximation Register (SAR) ADC is the amount of time required to charge the holding capacitor (CHOLD) on the front end of an ADC.

The ADC channels being of high speed and high bandwidth this value is by default 9 ns but can be changes by the user to higher number if the user signal chain would require this.

This parameter can be 9, 16, 53, 103, 222, 403, 2422, 5066 ns.

Analog ½ oversampling:

By default, there is a single ADC acquisition and conversion per acquisition trigger, the oversampling parameters allows to add more acquisitions for a given trigger.

Oversampling value of one means that two acquisitions will be done in total.

Total sample acquisition = 1+Oversampling

Analog ½ oversampling shift:

The oversampling parameter here above adds acquisition number for a given acquisition trigger, the effect of that is that the value returned by the ADC per trigger will be the sum of all sampling points.

To get an average value of the sampling points, the oversampling shift can be use.

The shift is a binary shift right of the return value, basically every shift provides a division by 2 of the returned value.

Oversampling shift = 1 is equivalent to a division by 2; Oversampling shift = 2 is equivalent to a division by 4, etc.

For example:

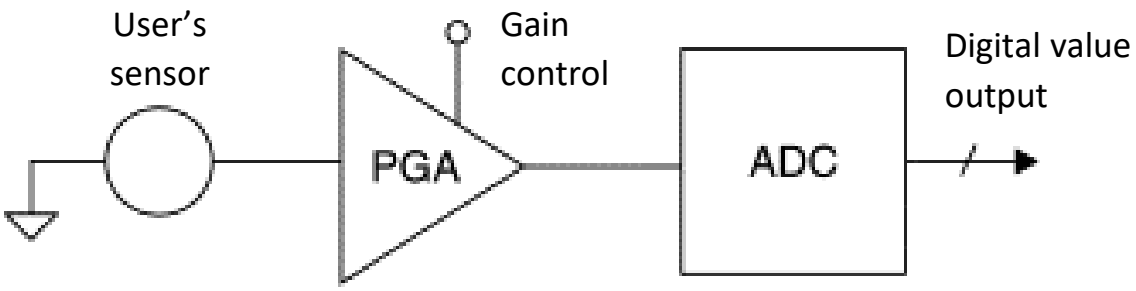
- For ADC oversampling value of 1 which gives a total sample acquisition of 2, using a sampling shift of 1 will return the average as it'll divide the total sample acquisition value by 2.
- For ADC oversampling value of 3 which gives a total sample acquisition of 4, using a sampling shift of 2 will return the average as it'll divide the total sample acquisition value by 4.

Note

Note: It not possible to get the average value with an odd total sample acquisition number as the division can only be by factor two, for example, with oversampling = 2 an oversampling shift of 1 would just reduce the value but not return the average as it's equal to 3 samples / 2.

PGA Gain:

Each ADC channel feature a PGA (Programable Gain Amplifier) in series in front of the ADC as the below illustration.



The feature allows the user to set an amplification factor to the user's sensor input and help to take advantage of the full dynamic range of the ADC.

The PGA gain can be set to x1, x2, x4, x8 and x16 amplification factors.

Note

Note: This global PGA gain is applied want using the generate function but it's possible to change the gain for each individual execution line individually. This allows the user to compensate for lower signal wherever needed.

2. Advance settings execution:

The advance execution system tab group all execution related parameters.

General parameters:

- Stable time in POI – The parameter defines the settling time after entering the wavenumber/wavelength stability window within which the wavenumber/wavelength should stay within the stability criteria before considering the emitted wavenumber/wavelength fully settled. It refers to the stabilization time in the above timing chart.

Note: A good starting number is about 30 ms, this number can be optimized depending on the user steps size between execution point (POI), a small step will put less energy into the system and will thus require less time to settle so this value can be reduced. Likewise for the opposite.
If the system is showing out of band error for some execution point, increase this value.

- Laser dwell time – Is a pre-measurement dwell time, the system will wait for this time before making any ADC acquisition. This parameter is helpful for example when using a slow time constant sensor. It refers to the delay before time in the above timing chart.

- Post dwell time - Is a post-measurement dwell time, the system will wait for this time after making any ADC acquisition. This parameter is helpful for example when the user is willing to do a pause between execution points.

Note: During all the above timings the laser could be lasing or not depending on the mode of control of the Laser driver selected in the Parameter menu.

Laser driver parameters (S-2m):

The embedded laser driver can be controlled with various operation mode, to change the operation mode, refer to the Parameter menu.

a. Internal mode

In this mode (default) the Laser driver is controlled internally by the system, the user can change the internal trigger mode, s-2m Trigger Mode, from:

- Internal burst – In this mode the laser will emit burst of Lasing at each execution point, when stable, after the Laser dwell time.

- Internal continuous -In this mode the Laser will emit continuously (as per its lasing datasheet parameters) from the beginning of the execution to the end.

b. Triggered mode

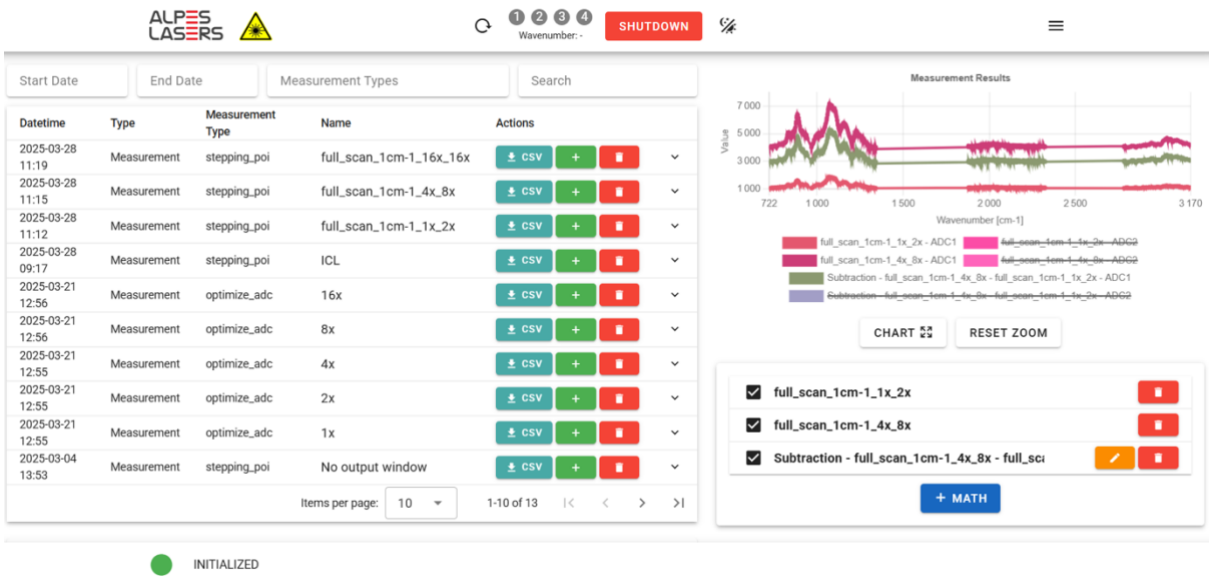
In this mode the laser driver is controlled externally by user's signals, the user can set a time out time, the system will generate an error if no external trigger was received after the set time during execution.

To trig the lasing pulse, the user shall supply a 3.3V pulse sequence on J2 with a period value being under or equal to the maximum duty cycle of the active external cavity laser. Refer to the laser datasheets to find this value.

If the user supplies a too high repetition rate, the laser driver will ignore non-compliant pulses.

F. Measurement

The measurement page is accessible any time by navigation through the menu.



Within this screen the user can:

- On the top right, access a dynamic result chart plotting the latest measured data set, the chart can be zoomed in indefinitely, a red dot on a measurement point shows the user that the measurement had an error, hovering other a chart will display the values of the point as well as the error code if it exists.

- Below it on the right, the active measurements are displayed. The latest measurement will be displayed by default. Measurements can be added from the saved list on the left at any time using the “+” button. Basic math functions are available using the “+ MATH” button do perform mathematical operation on compatible set of data’s and display them on the chart.

- On the top left, the saved measurement pane is displayed, the user can download the result from here in a CSV format, rename, filter and search for measurement as well as recall them to display on the chart for a comparison with a new dataset for example.

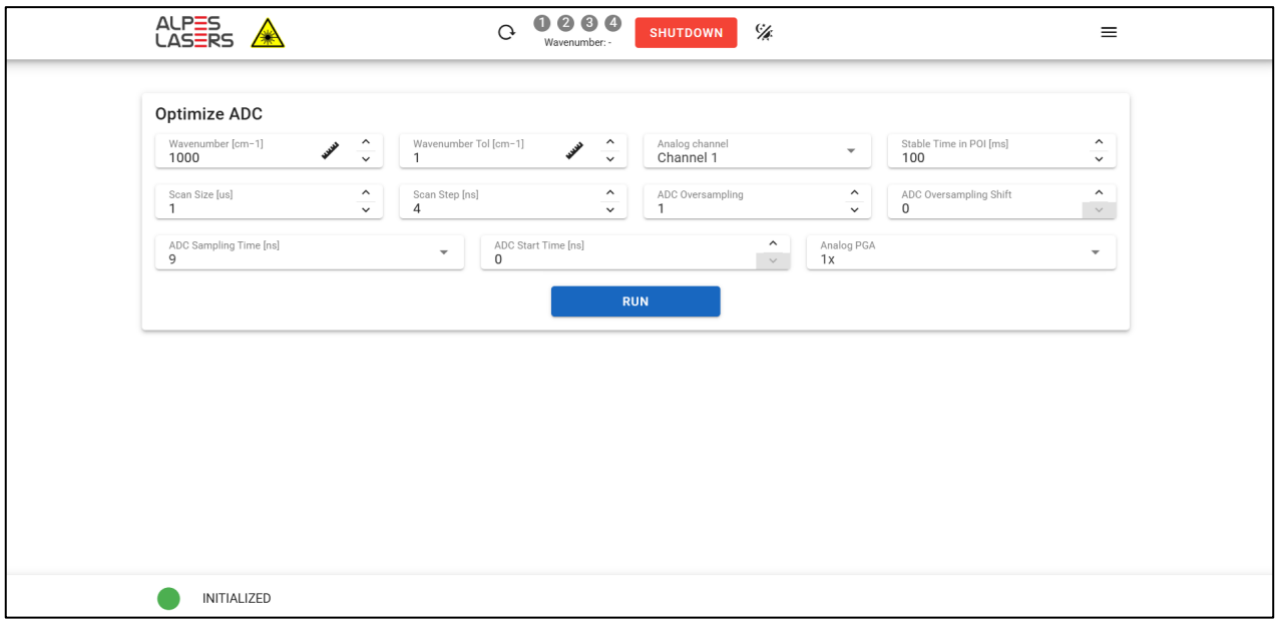
- Below it on the left the save pane is available for the last measurement, depending on the number of saved measurement and the screen resolution, the user may have to scroll down to it (Like in the example here above). Do not forget to save you latest measurement or it’ll be erased by the next one.

G. Tools

1. Optimize ADC

The optimize ADC delay allows to measure and set the delay between the internal pulsing request and the actual time the pulse is resolved by the embedded ADC acquisition system. The allow the user to properly characterize the complete delay chain of its measurement setup.

To use this tool, the user needs to first align its sensor using the manual operation lasing until a laser pulse can be resolved by the sensor on an oscilloscope for example, then, connect the signal to the chosen ADC acquisition channel.



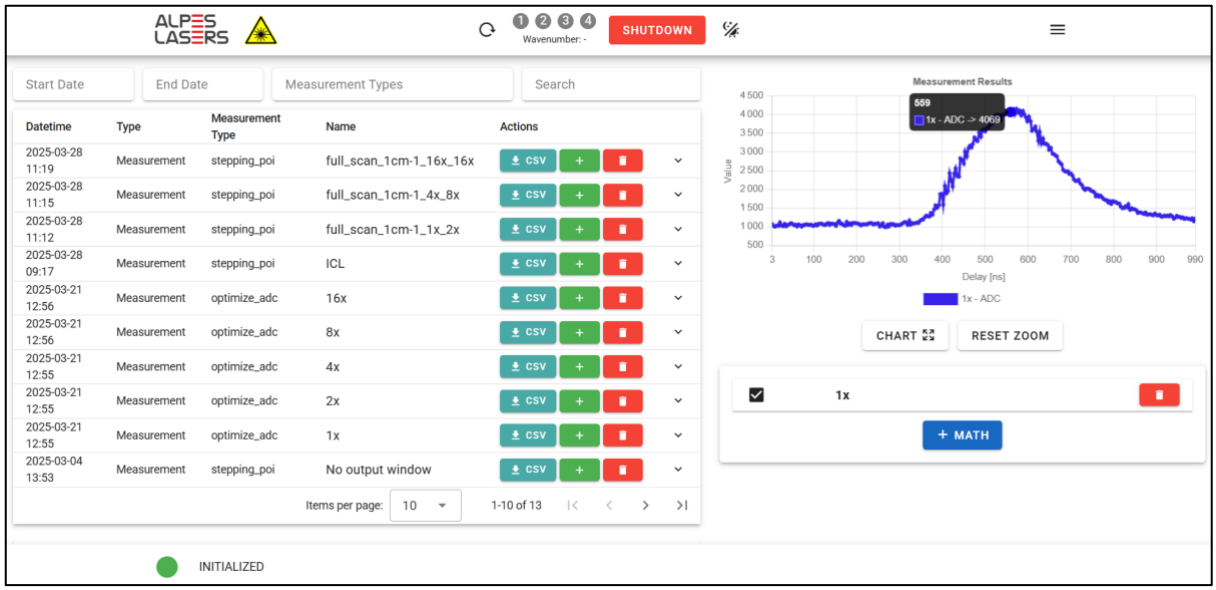
The test will perform repeated ADC acquisition while varying the offset from the start point (Laser pulse) to find the optimal delay to set.

The user needs to select a wavenumber/wavelength at which the test will be performed. The scan size is the maximum offset explored by the test and the step size is the size of the test steps.

If the user' sensors is particularly slow for example, the user can offset the beginning of the measurement by using ADC start time.

Other ADC acquisitions parameters are described in this chapter, please refer to it for further details.

Click on RUN to start the measurement. The measurement will be displayed in the Measurement page as any acquisition and can be save, renamed, and recalled anytime. Refer to previous chapter.

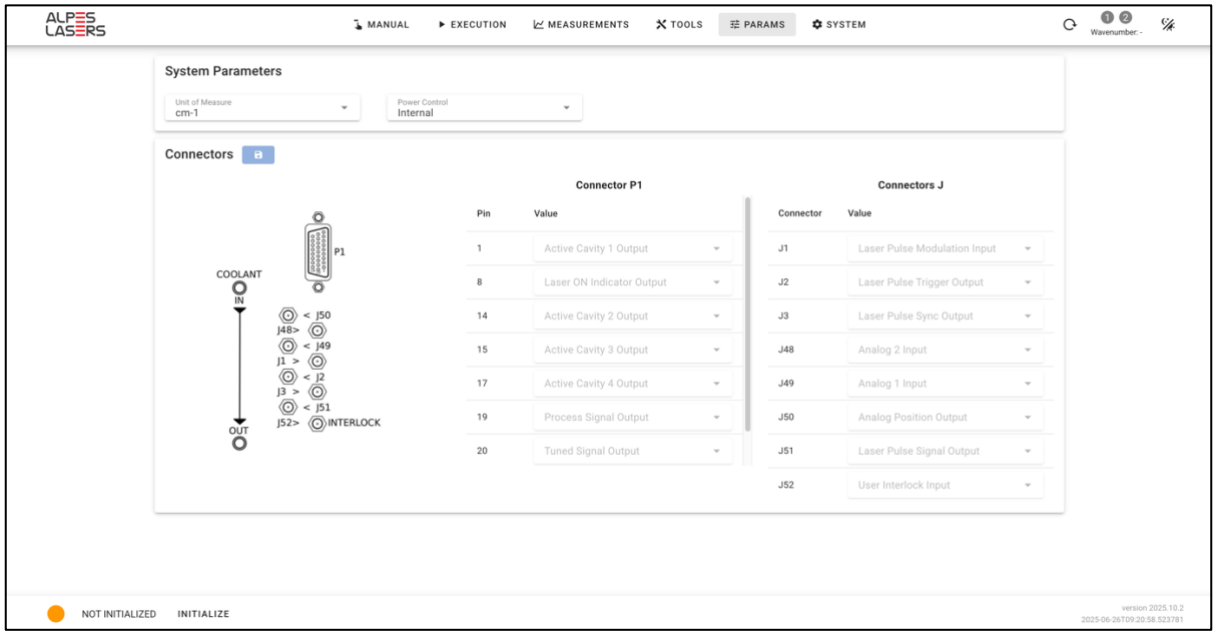


Here above is an example of optimized ADC delay, the optimal delay with a given ADC set of parameters is here 559 ns. This value can be used in the execution page under advanced setting “Analog ½ delay S-2m trigger”.

H. Parameters

The Parameter page is available anytime via the menu.

In this page the user can change parameters at the system level.



1. System parameters

- Unit of measure – In the drop down the user can select the unit between wavenumber (cm-1) and wavelength (nm) and (um).

- Power control – in this drop down the user can select the driving mode of the internal laser pulser S-2m.
    - Internal, the embedded system is taking care of all timings and laser trigger, lasing triggers are accessible as an output on J2 for external synchronization for example.
    - External, the user must take care of timings and triggering of the laser driver, triggers are to be addressed on J2 as an Input in this mode.

Note

Note: based upon the above selection the drop-down menu "advance settings execution" in the execution page will change automatically.
Do not forget to hit the save button to apply changes.

2. Connectors

This part of the page is showing all possible connections and functions of the connectors; it's linked automatically to the selection in the previous section and change dynamically. For information only.

Electrical connections vary with control modes, below pinout and function description is valid for all current execution with internal controls.

a. Glider M

P1 - D-Sub 26 Pins Female			
Pin number	Name	Level	Function & Description
1	Active laser cavity 1	0-3.3 VDC	High when laser cavity 1 is active
2	GND	0 VDC	Ground
3	OUT_0	0-3.3 VDC	No function
4	POS_Analog_IN	0-3.3 VDC	No function
5	IN/OUT_0	0-3.3 VDC	Process trigger OUT, Pulse low at start of move to next POI
6	IN_2	0-3.3 VDC	No function
7	NC		Not connected
8	Laser ON indicator	0-3.3 VDC	High when a laser is lasing (Envelop) - Same as light signal
9	5 VDC	5 VDC	5 VDC supply out, limit of 50 mA shared with Pin 18
10	OUT_5	0-3.3 VDC	No function
11	Key switch monitor OUT	0-5VDC	High when key switch is enabled
12	GND	0 VDC	Ground
13	NC		Not connected
14	Active laser cavity 2	0-3.3 VDC	High when laser cavity 2 is active
15	Active laser cavity 3	0-3.3 VDC	High when laser cavity 3 is active
16	IN/OUT_1	0-3.3 VDC	No function
17	Active laser cavity 4	0-3.3 VDC	High when laser cavity 4 is active
18	5 VDC	5 VDC	5 VDC supply out, limit of 50 mA shared with Pin 9
19	IN/OUT_9	0-3.3 VDC	Process Output signal, high when POI sequence is active
20	IN/OUT_8	0-3.3 VDC	Tuned Output signal, High when within wavelenght stability limit at a POI
21	IN/OUT_7	0-3.3 VDC	No function
22	GPIO 3	0-3.3 VDC	No function
23	GPIO 6	0-3.3 VDC	No function
24	GPIO 7	0-3.3 VDC	No function
25	GND	0 VDC	Ground
26	GND	0 VDC	Ground

J50 - SMA Female			
Pin number	Name	Level	Function & Description
1	Analog position OUT	0-3.3 VDC	Analog position OUT, analog value 12 bits image of the actual wavelenght per active cavity

J48 - SMA Female			
Pin number	Name	Level	Function & Description
1	Analog_IN_2	0-3.3 VDC	Analog input 16bits, for sensor acquisition

J49 - SMA Female			
Pin number	Name	Level	Function & Description
1	Analog_IN_1	0-3.3 VDC	Analog input 16bits, for sensor acquisition

J1 - SMA Female			
Pin number	Name	Level	Function & Description
1	Pulse_IN_Direct	0-3.3 VDC	No function

J2 - SMA Female			
Pin number	Name	Level	Function & Description
1	Pulse_Trigger OUT	0-3.3 VDC	Laser pulse trigger, High when laser pulse is trigged

J3 - SMA Female			
Pin number	Name	Level	Function & Description
1	Sync_OUT	0-3.3 VDC	No function

J51- SMA Female			
Pin number	Name	Level	Function & Description
1	Laser_Pulse_OUT	0-3.3 VDC	Laser pulse image, High when lasing

J52- SMA Female			
Pin number	Name	Level	Function & Description
1	User_Interlock	0-3.3 VDC	User interlock, active low, bridge to GND to enable operation (Supplied with a bridging cap)

b. Glider S

P1 - D-Sub 26 Pins Female			
Pin number	Name	Level	Function & Description
1	Active laser cavity 1	0-3.3 VDC	High when laser cavity is active
2	GND	0 VDC	Ground
3	OUT_0	0-3.3 VDC	No function
4	POS_Analog_IN	0-3.3 VDC	No function
5	IN/OUT_0	0-3.3 VDC	Process trigger OUT, Pulse low at start of move to next POI
6	IN_2	0-3.3 VDC	No function
7	NC		Not connected
8	Laser ON indicator	0-3.3 VDC	High when a laser is lasing (Envelop) - Same as light signal
9	5 VDC	5 VDC	5 VDC supply out, limit of 50 mA shared with Pin 18
10	OUT_5	0-3.3 VDC	No function
11	Key switch monitor OUT	0-5VDC	High when key switch is enabled
12	GND	0 VDC	Ground
13	NC		Not connected
14	NC		Not connected
15	NC		Not connected
16	IN/OUT_1	0-3.3 VDC	No function
17	NC		Not connected
18	5 VDC	5 VDC	5 VDC supply out, limit of 50 mA shared with Pin 9
19	IN/OUT_9	0-3.3 VDC	Process Output signal, high when POI sequence is active
20	IN/OUT_8	0-3.3 VDC	Tuned Output signal, High when within wavelenght stability limit at a POI
21	IN/OUT_7	0-3.3 VDC	No function
22	GPIO 3	0-3.3 VDC	No function
23	GPIO 6	0-3.3 VDC	No function
24	GPIO 7	0-3.3 VDC	No function
25	GND	0 VDC	Ground
26	GND	0 VDC	Ground

J13 - SMA Female			
Pin number	Name	Level	Function & Description
1	Analog position OUT	0-3.3 VDC	Analog position OUT, analog value 12 bits image of the actual wavelenght per active cavity

J21 - SMA Female			
Pin number	Name	Level	Function & Description
1	Analog_ IN_2	0-3.3 VDC	Analog input 16bits, for sensor acquisition

J12 - SMA Female			
Pin number	Name	Level	Function & Description
1	Analog_ IN_1	0-3.3 VDC	Analog input 16bits, for sensor acquisition

J25 - SMA Female			
Pin number	Name	Level	Function & Description
1	Pulse_IN_Direct	0-3.3 VDC	No function

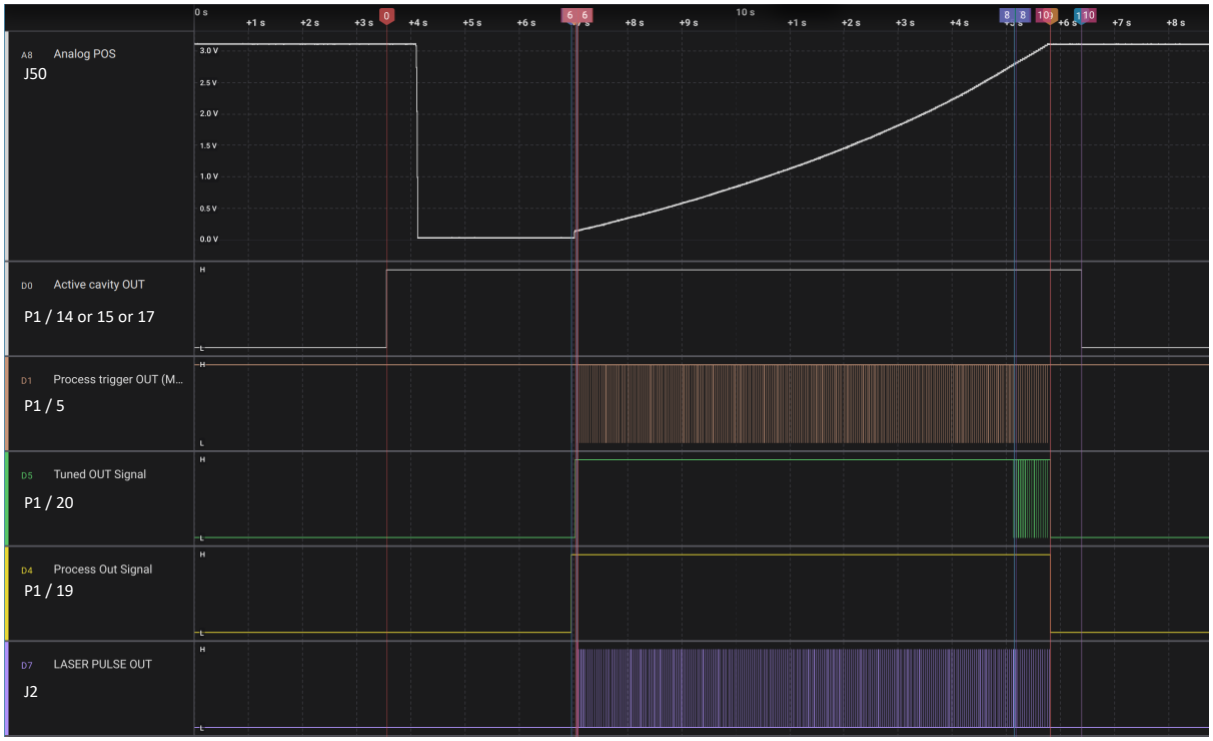
J14 - SMA Female			
Pin number	Name	Level	Function & Description
1	Pulse_Trigger OUT	0-3.3 VDC	Laser pulse trigger, High when laser pulse is trigged

J15 - SMA Female			
Pin number	Name	Level	Function & Description
1	Sync_OUT	0-3.3 VDC	No function

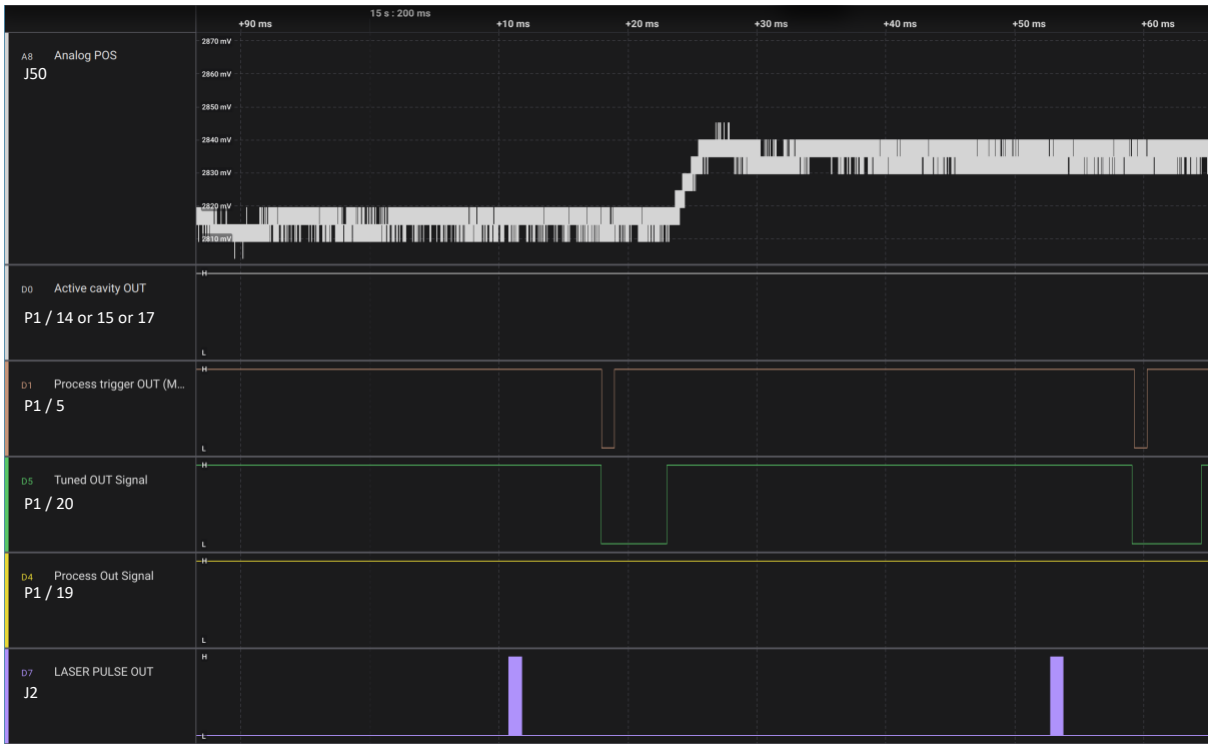
J16- SMA Female			
Pin number	Name	Level	Function & Description
1	Laser_Pulse_OUT	0-3.3 VDC	Laser pulse image, High when lasing

J17- SMA Female			
Pin number	Name	Level	Function & Description
1	User_Interlock	0-3.3 VDC	User interlock, active low, bridge to GND to enable operation (Supplied with a bridging cap)

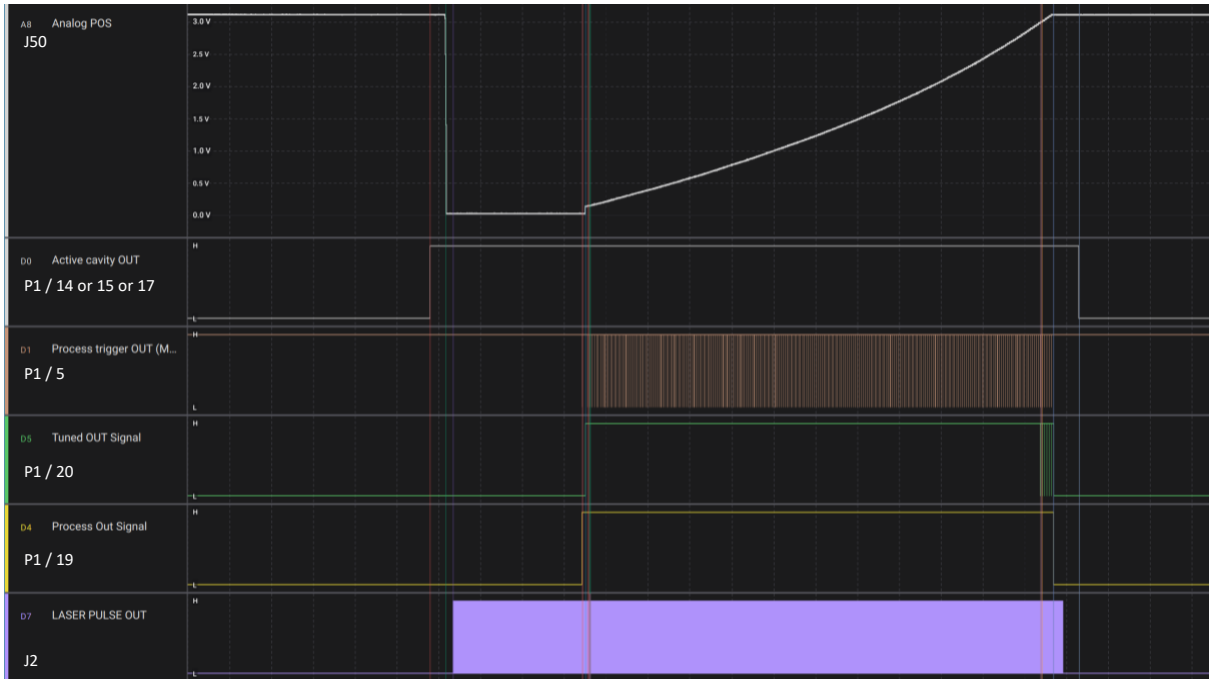
a- Example of signal scheme for execution with Internal burst pulsing:



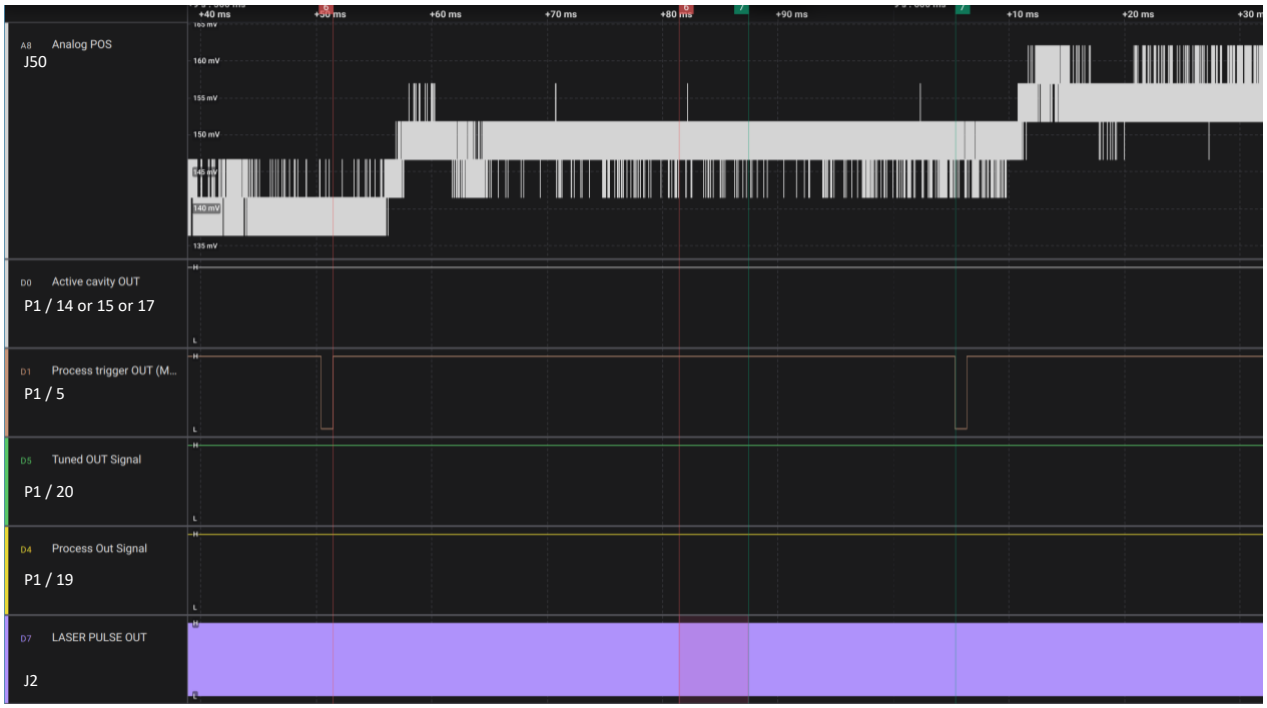
Zoom in a single step:



b- Example of signal scheme for execution with Internal continuous pulsing:



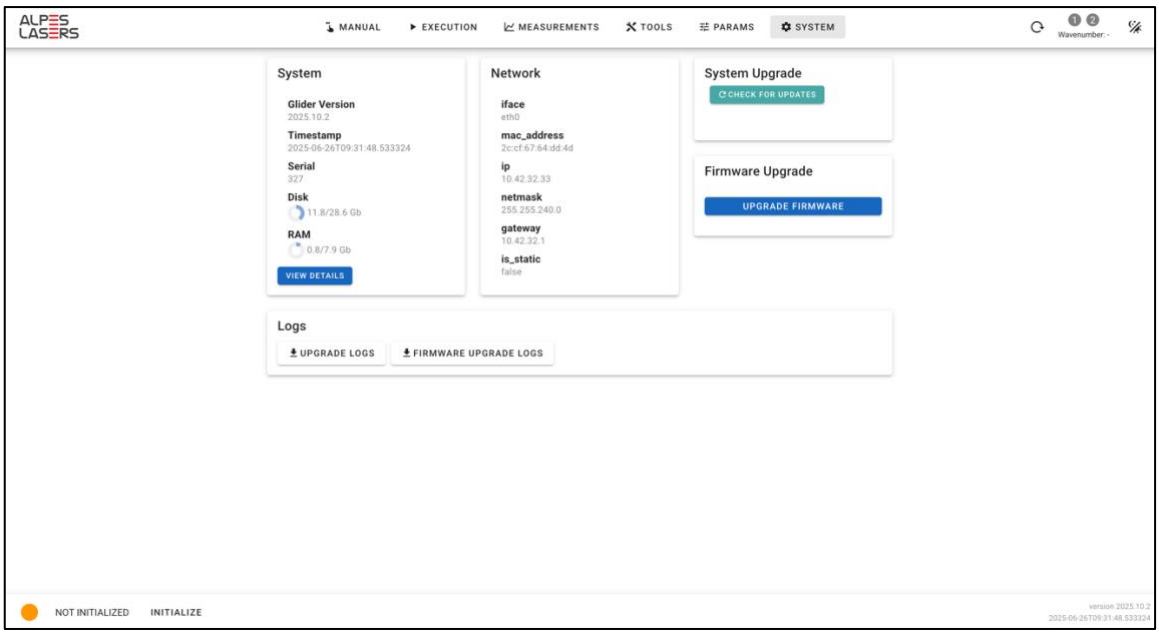
Zoom in a single step:



I. System

The system page is available anytime via the menu.

In this page, the user can see the current system version and information's, network configuration and perform systems and firmware upgrade available in the public repository.



J. Application Public Interface (API)

The **Application Public Interface (API)** provides a structured and documented way for external applications to interact programmatically with the Glider external-cavity system.

It enables users to automate measurements, configure system parameters, retrieve results, and integrate Glider into larger experimental or industrial workflows.

All interactions are performed using the official Python client library **glider_client**, which exposes a clear and stable interface to the system.

1. Overview

An **API (Application Programming Interface)** is a defined set of methods and data structures that allow software components to communicate with each other.

The Glider API gives users direct but safe programmatic access to the device's capabilities, without requiring knowledge of internal implementation details.

Typical uses include:

- Running automated scans
- Reading device status and configuration
- Uploading or modifying profiles
- Executing measurement sequences
- Retrieving analog acquisition data
- Integrating Glider into laboratory automation frameworks

The API communicates over the network with the Glider controller in a controlled, versioned manner.

2. Installing the glider-client library

The Python API is distributed via PyPI, the public python package index.

⚠ **Important:** Always install the version of glider_client that matches the version of your Glider system.

You can check available versions at:

https://pypi.org/project/glider-client/

To install a specific version:

```
pip install glider-client==<version>
```

3. Example scripts

After installation, the package includes an examples/ directory that demonstrates:

- Basic connectivity
- Running commands
- Cavity profile interactions
- Analog data acquisition
- Synchronous and asynchronous command execution
- Handling errors and timeouts

These examples are an excellent starting point for developing your own applications.

4. Basic Usage: connecting to the API

A simple example for connecting to a Glider system and reading its status:

```
from glider_client.glider import Glider

glider = Glider(hostname="192.168.1.10")

status = glider.get_status()
print(status)
```

If the connection works, the device is reachable and responding to API commands.

5. Example: Running a Stepping POI Scan

The following script (adapted from the examples/ directory) shows how to:

- Connect to the Glider system
- Inspect configured profiles
- Build a list of Points of Interest (POIs)
- Execute a **Stepping POI scan** asynchronously
- Poll until completion
- Retrieve acquisition results

```
import logging
from dataclasses import asdict
from time import sleep, time

from glider_client.commands import (
    SteppingPoiDataset,
    STEPPING_POI_S2_TRIGGER_MODE_INT_CONTINUOUS,
)
from glider_client.glider import Glider, GliderTimeout
```

```
REPETITIONS = 10

def run():
    # Connect to the Glider system API
    glider_client = Glider(hostname='192.168.1.10’)

    # Read system status and initialise
    glider_status = glider_client.get_status()
    glider_client.initialize()

    # Build POI list from cavity profiles
    wavenumbers = []
    for cp in glider_status.config.profiles[1].cavityProfiles.values():
        wavenumbers.append(min(cp.calibWnInvCm) + 1)
        wavenumbers.append(max(cp.calibWnInvCm) - 1)

    poi_list = [
        {
            'wavenumber': wn,
            'laserDwellMs': 0,
            'postDwellMs': 0,
            'numberOfPulses': 10,
            'analog1PGA': 4,
            'analog2PGA': 4,
        }
        for wn in sorted(wavenumbers)
    ]

    parameters = {
        'poi': poi_list,
        'tuned_window_invcm': 1,
        'stable_time_in_poi_ms': 1,
        'use_analog1': True,
        'use_analog2': True,
        'analog1_delay_s2m_trigger_ns': 200,
        'analog1_oversampling': 3,
        'analog1_oversampling_shift': 2,
        'analog1_sampling_time_ns': 9,
        'analog2_delay_s2m_trigger_ns': 200,
        'analog2_oversampling': 3,
        'analog2_oversampling_shift': 2,
        'analog2_sampling_time_ns': 9,
        's2_trigger_mode': STEPPING_POI_S2_TRIGGER_MODE_INT_CONTINUOUS,
        'repetitions': REPETITIONS,
    }

    command_proxy = None
    timeout = 3 * 60  # seconds
```

```
    try:
        # Run scan asynchronously
        command_proxy = glider_client.execute_command_async(
            command_dataset=SteppingPoiDataset(**parameters)
        )

        # Poll for completion
        start_time = time()
        while True:
            if time() - start_time > timeout:
                raise GliderTimeout

            command_proxy.update()
            if command_proxy.hasExecuted:
                break

            sleep(0.1)

        command_proxy.update()
        if command_proxy.hasErrors:
            print("Error executing the scan")

    finally:
        # Ensure command is stopped on exit
        if command_proxy:
            command_proxy.stop()

    # Retrieve results
    status = glider_client.get_status()
    results = glider_client.get_results(
        command_proxy.status,
        result_indexes=list(range(REPETITIONS)),
    )

    print(results)
    print(asdict(status))
```

6. Error Handling & Timeouts

The API provides clear error types such as:

- GliderTimeout
- Command-level errors (available in command_proxy.hasErrors)
- Communication failures

Best practices:

- Always wrap long-running commands in a try / finally block
- Always call command_proxy.stop() to release the system
- Use reasonable timeouts for automated scripts

7. Recommendations for Application Developers

- Keep communication on a dedicated control PC or environment
- Do not directly manipulate low-level components; always use glider_client
- Validate configuration parameters before sending them
- Use asynchronous commands for long scans
- Retrieve status regularly for safety-critical applications

8. Getting Help

If you have questions about API usage, workflows, or integration with third-party systems, please contact us.

We can also assist with custom scripting and automation setups.