

doric

# **Connectorized Laser Diode Module and Driver**

User Manual

Version 1.1.4

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## Safety Information

### 1.1 Laser Safety Information

If you are not familiar with laser light sources, ask for advice to qualified personnel **BEFORE FIRST USE** and **READ CAREFULLY** the application note **Important Laser Safety Information** that can be found on the USB key. You can also contact directly Doric Lenses by email ([sales@doriclenses.com](mailto:sales@doriclenses.com)) to obtain a copy of this application note.



**DANGER!**  
**The Laser Diode Module is a Class 3B laser product.**  
**Read the application note *Important Laser Safety Information***  
**BEFORE FIRST USE.**



The *Doric's Laser Diode Module* are Class 3B and Class 4 laser product emitting visible light at sufficiently high power levels to **PERMANENTLY DAMAGE THE EYES. NEVER LOOK** directly into the optical beam exiting from the output FC connector or from any optical fiber connected to the output FC connector. **NEVER LOOK** directly at specular or diffuse reflections of the output beam.

It is important to **WEAR LASER SAFETY GLASSES** (goggles) certified for the wavelength and power level of the light source. Also follow all safety procedures to protect anyone working in the area. Even when wearing laser safety glasses, **NEVER LOOK** directly into the beam or any specular reflection of the optical beam exiting from the *Laser Diode Module* or from any optical fiber connected to its beam aperture.

The *Laser Diode Module* is provided with a safety interlock connector on the rear panel. When the interlock circuit is shorted and the power key is inserted, the driver is enabled (see Chapter 2). For a safe use of the *Laser Diode* light source, the safety interlock connector should be connected to the laser safety interlock circuit of the laboratory. You should contact the laser safety officer (LSO) of your institution or company to set a proper laser safety interlock circuit for your application and laboratory installation.

### 1.2 Safety Labels

The laser class labels are provided with the system and the laser aperture is clearly identified by laser warning label and/or the text *LASER APERTURE*.



(a) Laser Classification Label Example



(b) Laser Warning Label

**LASER APERTURE**

(c) Laser Aperture Identification

Figure 1.1: Safety Labels

### 1.3 Activation Safety Features

The drivers for all Doric Lenses light sources come with a number of safety features. These are built into the driver circuits, as shown in the block diagram (Fig. 1.2).

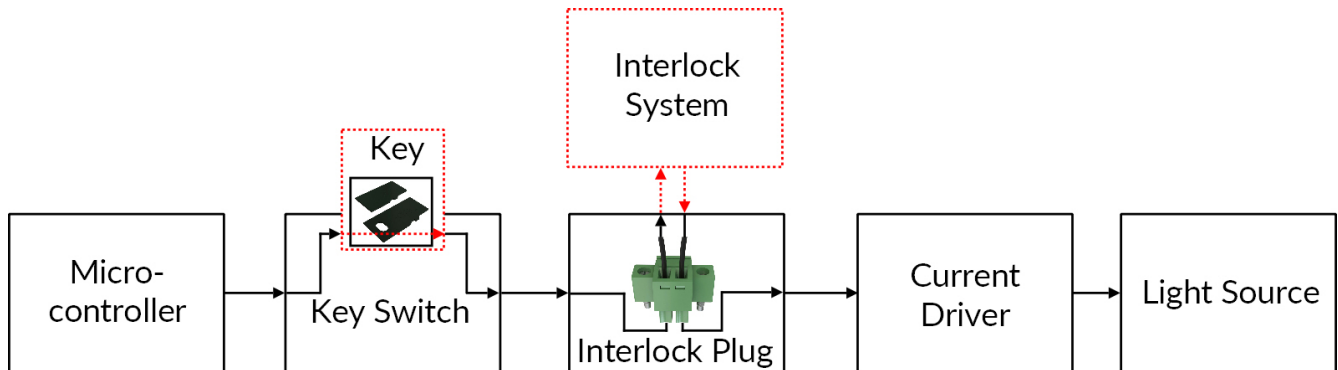
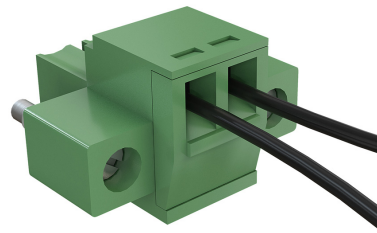


Figure 1.2: Safety feature block diagram

- The **Micro-controller**, **Key Switch**, **Interlock Plug** and **Current Driver** are connected in series. This means that if any single safety feature is not properly in place, the light source cannot be activated.
- The **Micro-controller** is used to control the light source driver.



(a) Key Switch



(b) Interlock Plug

Figure 1.3: Safety Feature Elements

- The **Key Switch** (Safety feature 1) (Fig. 1.3a), located on the left side of the driver, is required to activate any light source. If removed, no data can be sent from the micro-controller to the **Current Driver**.
- The **Interlock plug** (Safety feature 2) (Fig. 1.3b) is used to integrate the driver into an **Interlock Circuit**.
  - The **Interlock Plug** comes with a small wire short-circuiting it. This wire must be removed before integrating it into an **Interlock Circuit**.
  - Connect the **Interlock circuit** in series with the **Interlock Plug** so the circuit may function properly.
- The **Current Driver** sends current to any connected light source. If the **Key** is absent or the **Interlock Plug** has an open circuit, it cannot receive signals from the micro-controller, preventing it from sending out current.

### 1.4 Emission Indicator

For light sources emitting invisible laser radiation, a dedicated LED indicator is ON when the driver is outputting an electrical current. When the driver is outputting current, the light source will emit light from the aperture.

## Devices Overview

### 2.1 Connectorized Laser Diode Module

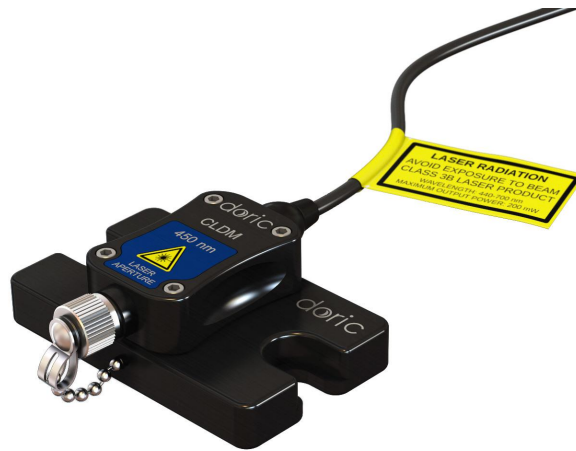


Figure 2.1: Connectorized Laser Diode Module

The *Connectorized Laser Diode (LD) Module* (Fig. 2.1) is a compact single laser diode source connectorized for use with FC/APC-connectorized patch cords. These modules are available for wavelengths from 405 nm to 638 nm.

- The output laser beam exits the **Beam Aperture**. It is integrated into an FC/APC receptacle. In the absence of a patch cord, it is recommended to leave the metal cap in place to block the laser beam. The *Laser diode modules* are not intended for use without an optical fiber patch cord.
- The **M8 electric cable** links the diode with its driver. The pin-out is found in Figure 5.1a.

## 2.2 Laser Diode Module Driver



Figure 2.2: Laser Diode Module Drivers, 1-, 2- & 4- channel (from top to bottom)

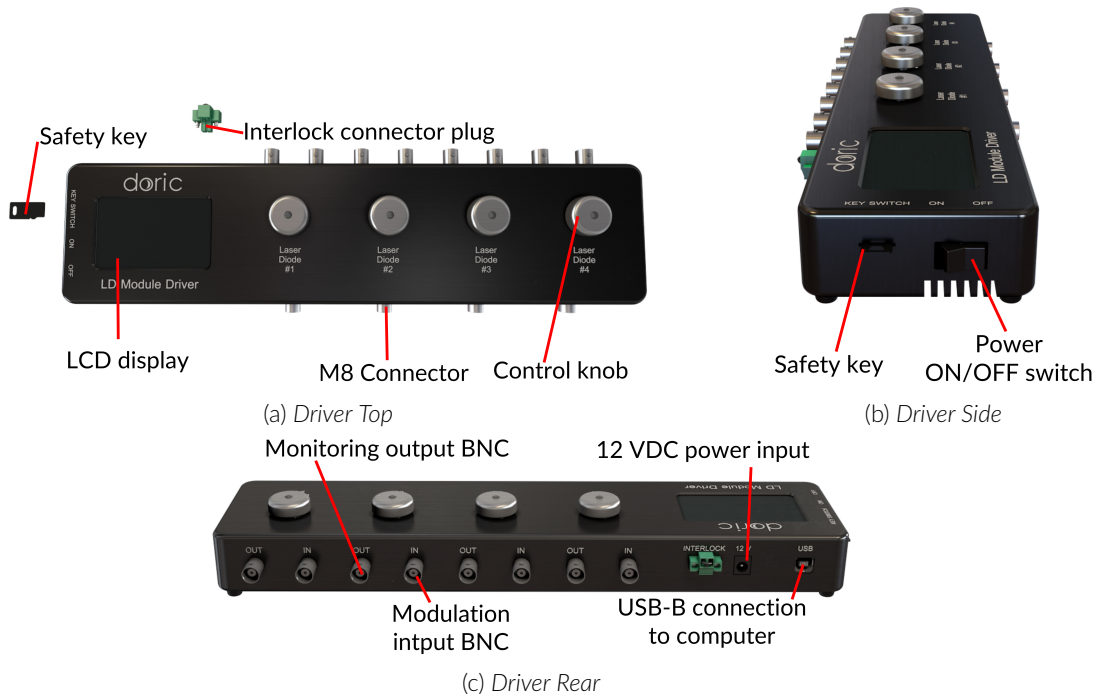


Figure 2.3: Laser Diode Module Driver Views

The *Laser Diode Module Drivers* (Fig. 2.2) come in 1-, 2- or 4- channel models and are used to control the *Connectorized Laser Diode Module*. The different components of the driver are presented below.

- The **M8-4 female connectors** (Fig. 2.3a) are used to connect the driver to the *Laser Diode Modules* with an M8 cable (See Fig. 5.1b for pin-out).
- The **Control Knob** allows the user to change the laser diode driving current, which is shown on the **LCD Display** (Fig. 2.3a). Each knob is assigned to the corresponding channel. For drivers with multiple channels, each is controlled independently with its own knob.

- The **LCD Display** (Fig. 2.3a) displays the status of each channel.
- The **Key Switch** (Fig. 2.3b) can be removed to disable activation of all laser sources connected to the driver.
- The **On/Off Switch** (Fig. 2.3b) activates/deactivates the *Laser diode module driver*.
- Each channel has an **Output BNC** port (Fig. 2.3c). This allows the user to monitor the laser diode driving current.
- Each channel has an **Input BNC** port (Fig. 2.3c). These allow the user to control the laser diode driving current through an outside, analog source.
- The green **Interlock Connector Plug** (Fig. 2.3a) allows the device to be attached to a laboratory's safety interlock system.
- The *Laser diode module driver* has a **12 VDC** (Fig. 2.3c) power input to which the user connects the power supply provided with the system.
- The **USB-B** port (Fig. 2.3c) connects the system to a computer using a USB-A/USB-B cable and allows the diode current to be controlled by a computer.

## Operations Guide

This chapter explains how to set-up and operate the Connectorized Diode Laser Module. The procedure below should be followed carefully.

### 3.1 Getting Started



#### **Warning!**

**The Connectorized Laser Diode Module is sensitive to electrostatic discharges. Wear a properly grounded ESD wrist strap when handling.**



1. Unpack the *Connectorized Laser Diode Module*.
  - Remove the *Connectorized Laser Diode Module* from the ESD protective bag.
  - Allow sufficient time for the *Connectorized Laser Diode Module* to reach ambient temperature.
2. Secure the *Connectorized Laser Diode Module* on a proper heat sink.
  - For optimal performance, the laser diode module should be mounted on a proper heat sink.
  - Secure the *Connectorized Laser Diode Module* on an optical table.



#### **CAUTION!**

**The proper heat sink is a function of operating conditions. An improper thermal management may shorten the lifetime of the *Laser Diode Module*.**



**⚠ DANGER! DO NOT OPEN the driver enclosure. Electrical hazards may result. The driver contains no user-serviceable components.**



## 3.2 Connecting the System

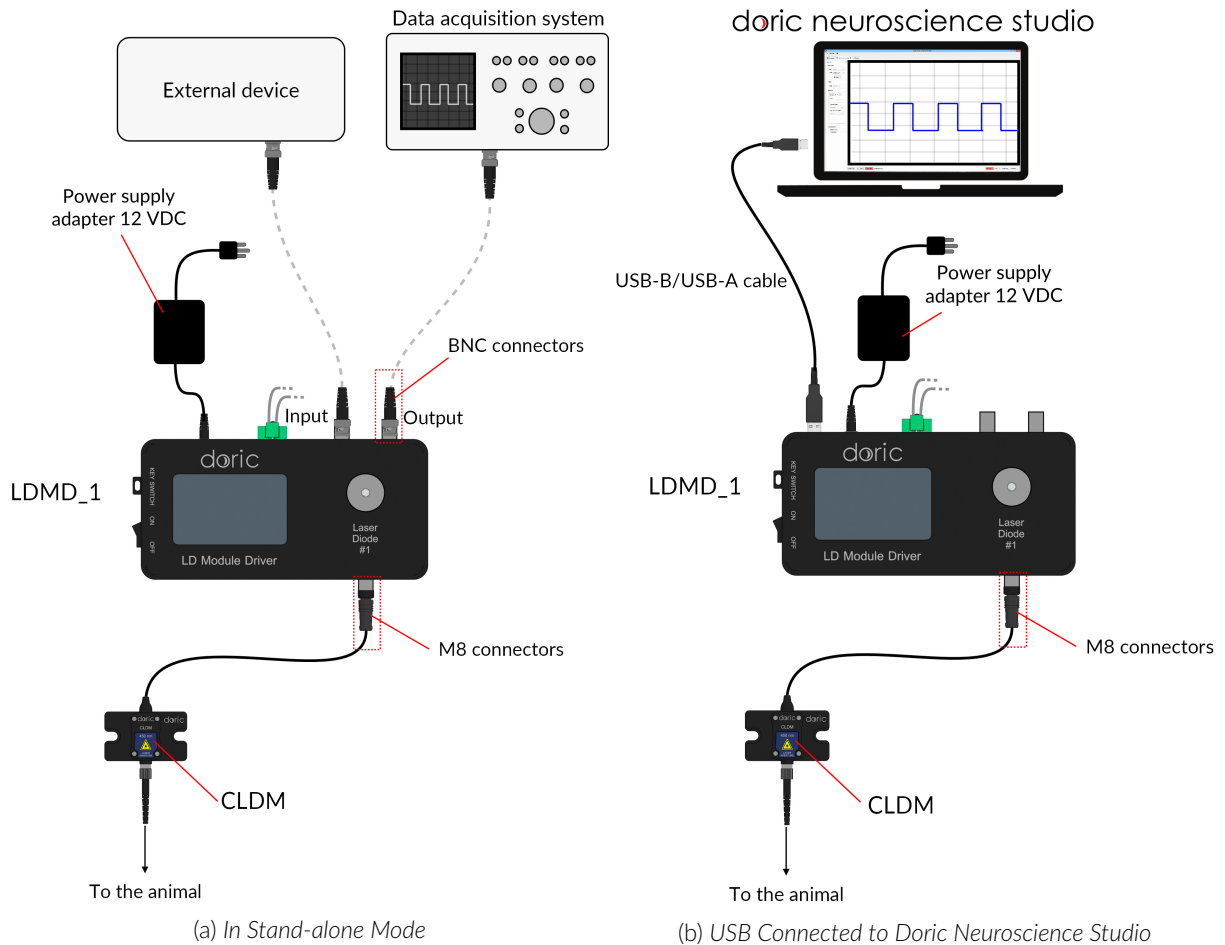


Figure 3.1: Connections of a Connectorized Laser Diode Module and a 1-channel Laser Diode Module Driver.

1. Connect the *Connectorized Laser Diode Module* to the *Laser Diode Module Driver* M8 Connector.
2. Connect the interlock circuit to the *Laser Diode Module Driver*.
  - The driver CAN NOT be operational if the safety interlock circuit is open.
  - When unpacking, a temporarily shorted interlock connector plug is already secured in the green interlock connector.
  - It is highly recommended to remove the shorting black electric wire and connect the interlock connector to a proper interlock circuit of the laboratory.
  - See the *Important Safety Information* section (Chapter 1) for more information.



**Warning!**  
**Be aware that a shorted interlock plug DISABLES this safety feature AT YOUR OWN RISKS. A safety interlock circuit is highly recommended.**



3. Connect the power supply to the driver.
  - Verify that the main power switch is set to OFF.
  - Using the proper adapter, connect the electrical plug of the power supply to the wall outlet.

- Connect the 12 V power jack of the power supply to the driver.
4. Connect the optical fiber to the *Connectorized Laser Diode Module*.
    - Use a FC/APC connectorized patch cord on the *CLDM* receptacle.
    - These can be identified by their green strain relief.



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**DANGER!**  
**The laser beam exiting the *Laser Diode Module* or any connected optical fiber should be confined BEFORE turning ON the driver.**

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5. Ensure that all laser safety procedures are followed.
6. Insert one of the safety keys in the key switch.
7. Turn ON the *Laser Diode Module Driver*.
  - The system is ready for stand-alone operation or software installation.
  - For stand-alone operation (see Fig. 3.1a), see the section *Stand-alone Operating Instructions* (Section 3.4).
8. If the system is used with computer control (see Fig. 3.1b), the driver must be connected to the computer using a USB-A/USB-B cable instead of an analog source through the BNC connector. See Chapter 4 for details on using the *Doric Neuroscience Studio* software.

### 3.3 FC Connector Installation

1. Clean the optical fiber connector before insertion. Use isopropanol and a lint-free wipe.
2. With an FC connector, the connector key must be oriented to enter within the receptacle slot to ensure proper connection (Fig. 3.2).

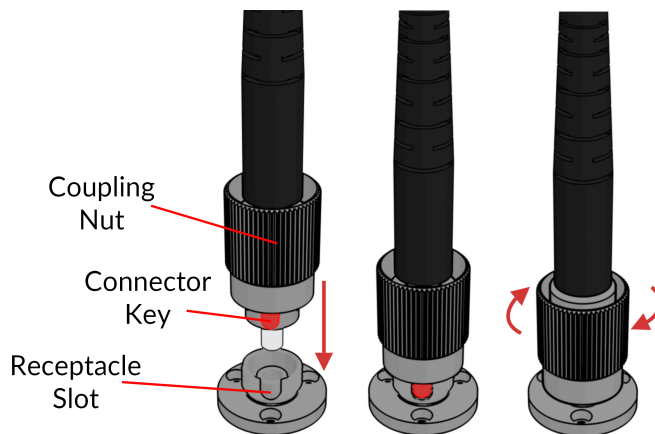


Figure 3.2: FC connector, Fiber Installation

**⚠** To reduce the risk of eye injury, **it is sound practice to NOT CONNECT/DISCONNECT OPTICAL FIBERS when the light source is turned on.**

### 3.4 Stand-alone Mode (without Doric Neuroscience Studio Software)

The following sections details stand-alone operation of the *LD driver*. For installation of the *CLDM* in stand-alone mode, see sections 3.1 and 3.2.

If the light source driver is used as a stand-alone device, 3 modes are available: Continuous Wave (CW), External TTL (Ext. TTL), and External Analog (Ext. Ana). The operating mode is changed by pressing the **Control Knob** and the maximal driving current is set by turning the Control knob. Use a fast/slow rotation for coarse/fine adjustment. The operating mode and the maximum driving current setting are independently adjusted for each channel.

#### 3.4.1 Continuous Wave (CW)

When using the CW mode, the user simply sets the driving current applied to the light source. The light source is activated and an output beam will be visible as long as the driving current is above the minimum driving current (Fig. 3.3).

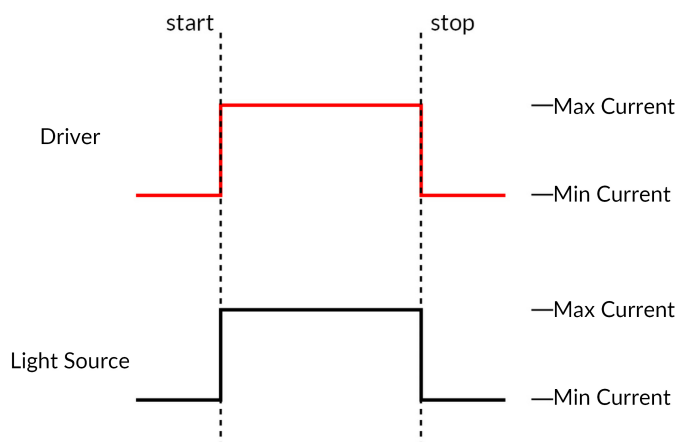


Figure 3.3: Continuous Wave Mode Driver Signal

#### 3.4.2 External TTL (TTL)

In the External TTL mode, the driver is activated by an input TTL signal coming from an external device. This activation will follow the TTL pulse waveform. The driving current is set with the control knob, and is constant during each TTL activation pulse (Fig. 3.4).

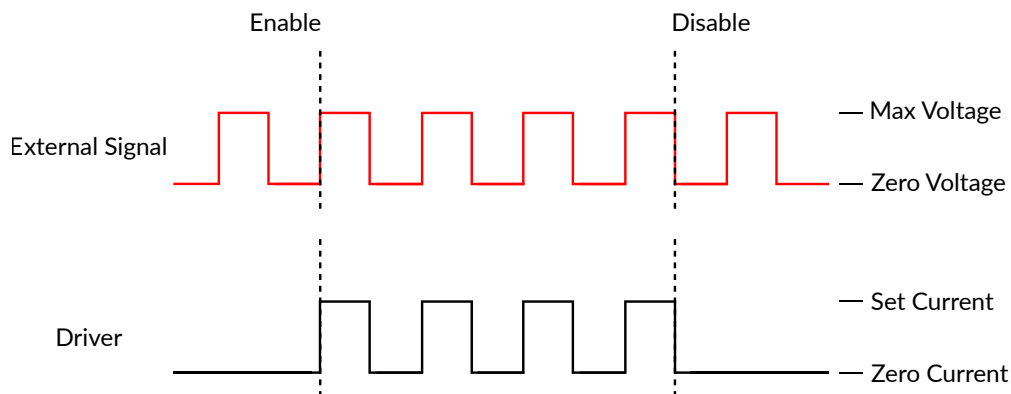
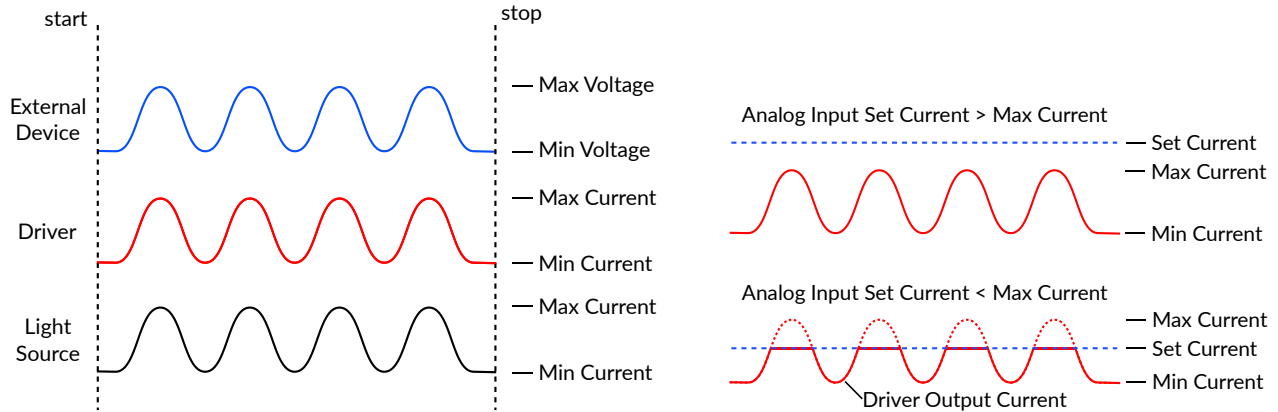


Figure 3.4: Driver Signal Response to External Source in External TTL Mode

### 3.4.3 External Analog (Ext. Ana.)

The External Analog mode is similar to the External TTL, except that the driving current is proportional to the voltage applied on the BNC input connector (Fig. 3.5a). On the input BNC, a maximum voltage signal corresponds to a maximum driver current. Should the current set on the light source be less than the maximum current, any voltage corresponding to a higher current will clip the output waveform (Fig. 3.5b, bottom). To avoid any clipping of the output waveform, the maximum current setting must be equal to or greater than the corresponding maximum analog input voltage (Fig. 3.5b, top). For square modulations, it is preferable to use External TTL mode instead of External Analog mode.



(a) External Analog output is proportional to the External Device voltage (b) External Analog output is dependent on the Set Current

Figure 3.5: External Analog Pulse Sequence Behavior

## Doric Neuroscience Studio

Doric Light Sources can be controlled by the Doric Neuroscience Studio. These include *LED Modules*, *Laser Diode Modules* and *Ce:YAG Fiber Light Source*. The interface is separated into two main sections, **Control & settings** and the **Acquisition View**. Each light source driver has a number of **Channels**, each one controlling a light source of its given type. These channels, accessible using the **Add Channel** will be the first detailed.

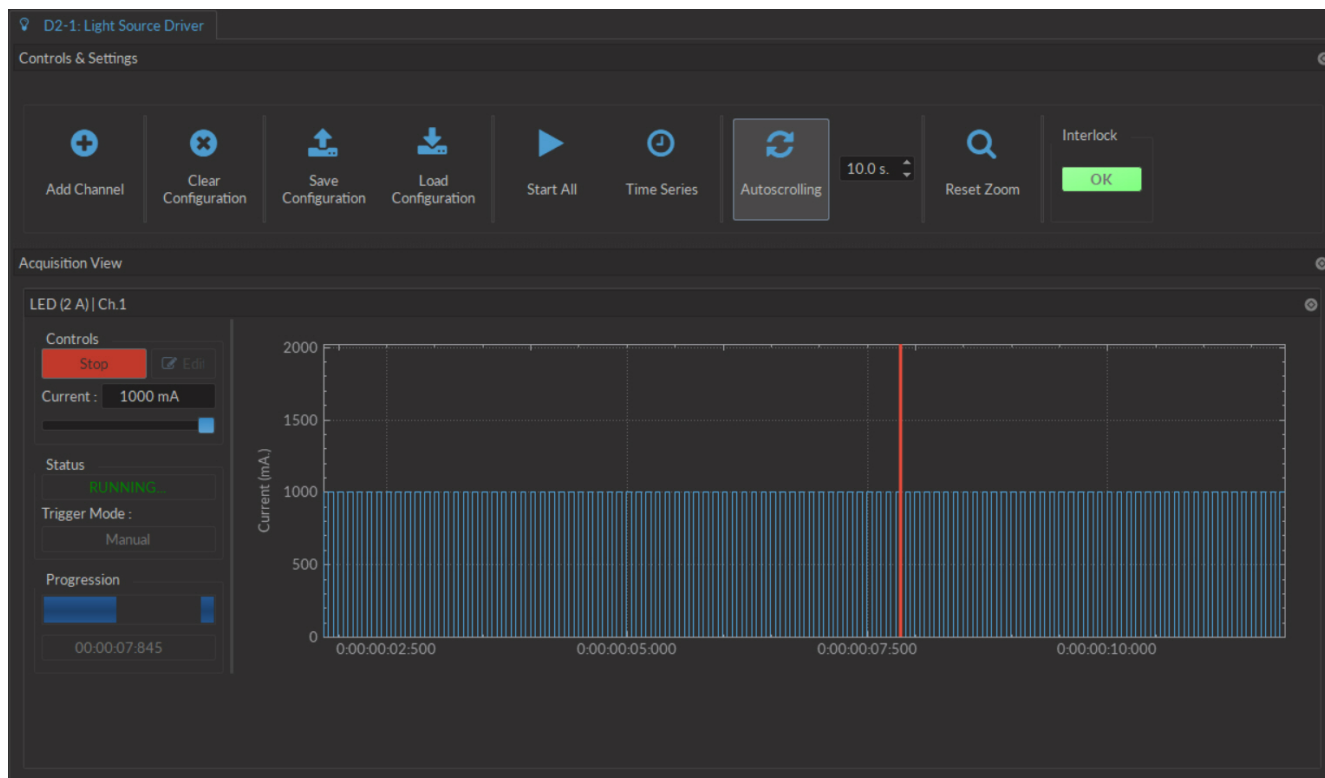


Figure 4.1: Light Source Driver Tab

### 4.1 Channels

Each light source driver is separated into a number of **Channels**. Each channel controls a single light source. While each channel can be controlled in **Stand-alone** mode by the driver, additional functions can be accessed for these channels when the driver is connected to the Doric Neuroscience Studio. These functions are used through the **Channel Configuration** window (Fig. 4.2).

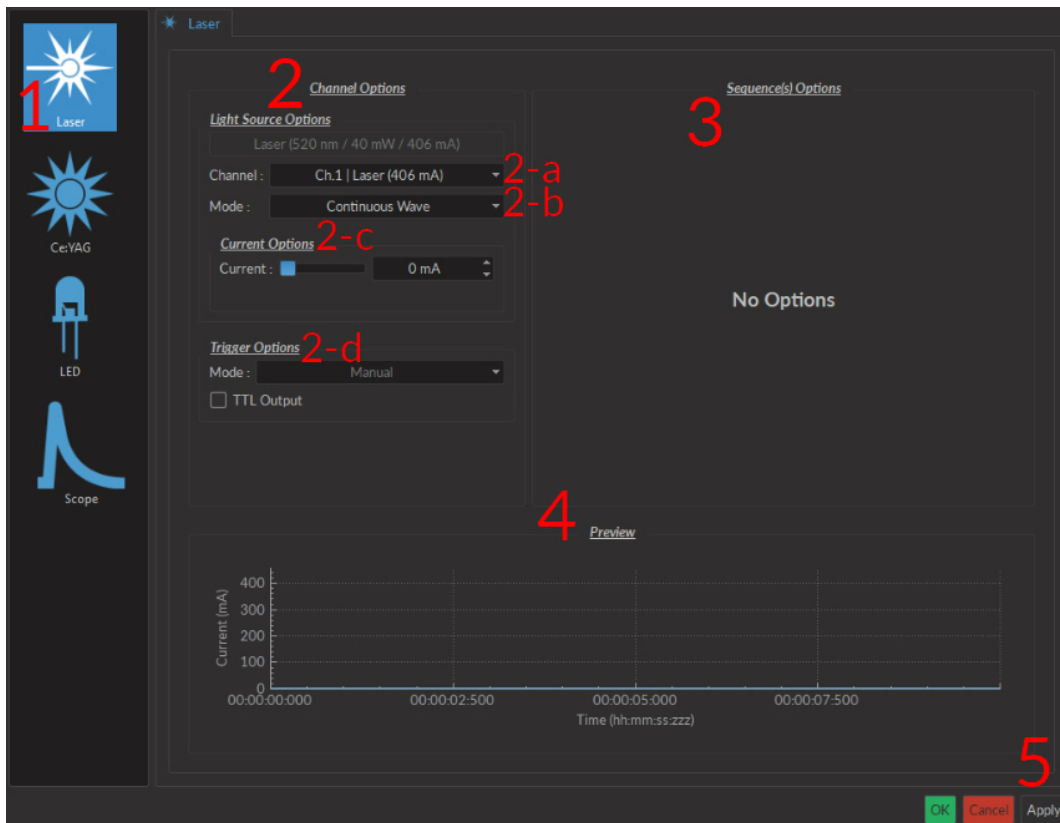


Figure 4.2: Light Source Channel Configuration Window

1. The **Channel Types** (Fig. 4.2) are displayed on the left side of the window. These include **Laser** light sources, **Ce:YAG** light sources and **LED** light sources, as well as the **Scope** to measure signal using the driver.
2. The **Channel Options** box (Fig. 4.2) includes **Light Source Options** and **Trigger Options** for the given channel.
  - a) The **Channel** (Fig. 4.2) drop-down list identifies which driver channel is currently being edited, assuming a driver with multiple channels.
  - b) The **Mode** (Fig. 4.2) drop-down list includes each possible driver mode. These are used to control the pulse sequences emitted by the light source. The options related to this mode are detailed with the **Sequence Options**.
  - c) The **Current Options** (Fig. 4.2) includes the slider used to control the current sent to the light source.
    - When using a **LED Driver** module, the **Overdrive** checkbox will appear. When selected, this allows the system to exceed the normal safe current limit of the light source. **THIS SHOULD ONLY BE USED WITH PULSED SIGNALS, AS IT CAN OTHERWISE DAMAGE THE LIGHT SOURCE.**
    - When using a **LEDD**, the **Low-Power** checkbox will appear. When selected, this allows reduced-power signaling for the same voltage. This mode is only available for **CLED** modules. This allows low-power signals to be more stable in time. The maximal current is reduced to one tenth of light source's normal maximal current. If the **BNC Output** is used, the voltage of the signal is proportional to the current passing through the light source, and not the voltage sent to it. For example, a driver with a normal maximum current of 2000 mA for a 5 V signal (400 mA/V) will have a maximum current of 200 mA for a 5 V signal (40 mA/V). The **BNC output** of the driver will still relate LED current with a 400 mA/V conversion factor.
  - d) The **Trigger Options** (Fig. 4.2) allow the selection of a number of trigger modes to activate a pulse sequence.
    - The **Manual** trigger mode is standard, and allows direction activation by the user.
    - The **Triggered** trigger mode is active when an input greater than 4 V is detected on the BNC input. Following input pulses will be ignored while the sequence is running. The sequence will restart with the arrival of the first input pulse after the sequence has finished.

- The **Gated** trigger mode is active as long as there is a high TTL signal (4 V or more) on the input modulation BNC. This signal comes from a different light source or device driver. When the TTL signal is low (0.4 V or less), the sequence stops and waits for another high TTL signal to continue.
- If the **TTL Output** option is checked, the output BNC channel can be used as a TTL generator. The monitoring signal will provide a TTL signal instead of an analog voltage output proportional to the LED current. The output will send out a 5 V signal whenever the input current is >0 mA. This can be used even if a light source is not connected.

3. The **Sequence options** box (Fig. 4.2) is where sequence options are defined depending on the mode. The **Continuous wave**, **External TTL** and **External Analog** modes have no additional sequence options.

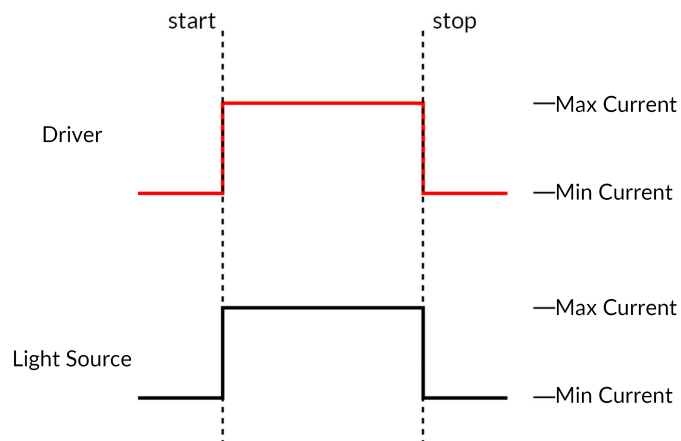


Figure 4.3: Continuous Wave Mode Driver Signal

a) The **Continuous Wave** mode (Fig. 4.3) produces a continuous signal at the chosen current. This mode can only be triggered manually. When this mode is active, the driver channel will show **CW** under **MODE**. This mode has no additional sequence options.

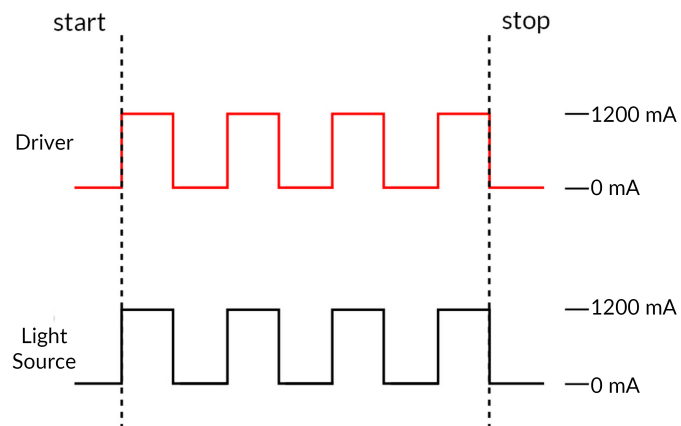


Figure 4.4: Driver Signal Response to External Source in External TTL Mode

- b) The **External TTL** mode (Fig. 4.4) has the light source follow a TTL signal provided by an external source connected to the **BNC Input**. When this mode is active, the driver channel will show **TTL** under **MODE**. This mode has no additional sequence options.
- c) The **External Analog** mode (Fig. 4.5) is similar to the External TTL, except that the current will be set by the voltage on the BNC input (Fig. 4.5, top). On the input BNC, a maximum voltage signal corresponds to a maximum driver current. Should the current set on the light source be less than the maximum current, any voltage corresponding to a higher current will clip the output waveform (Fig. 4.5, bottom). To



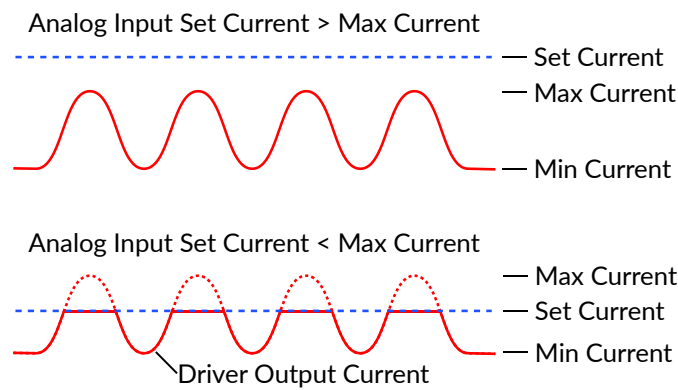


Figure 4.5: Driver and Light Source in External Analog Mode

avoid any clipping of the output waveform, the maximum current setting must be equal to or greater than the corresponding maximum analog input voltage. See the corresponding light source manual to find the voltage/current relationship. This mode has no additional sequence options.

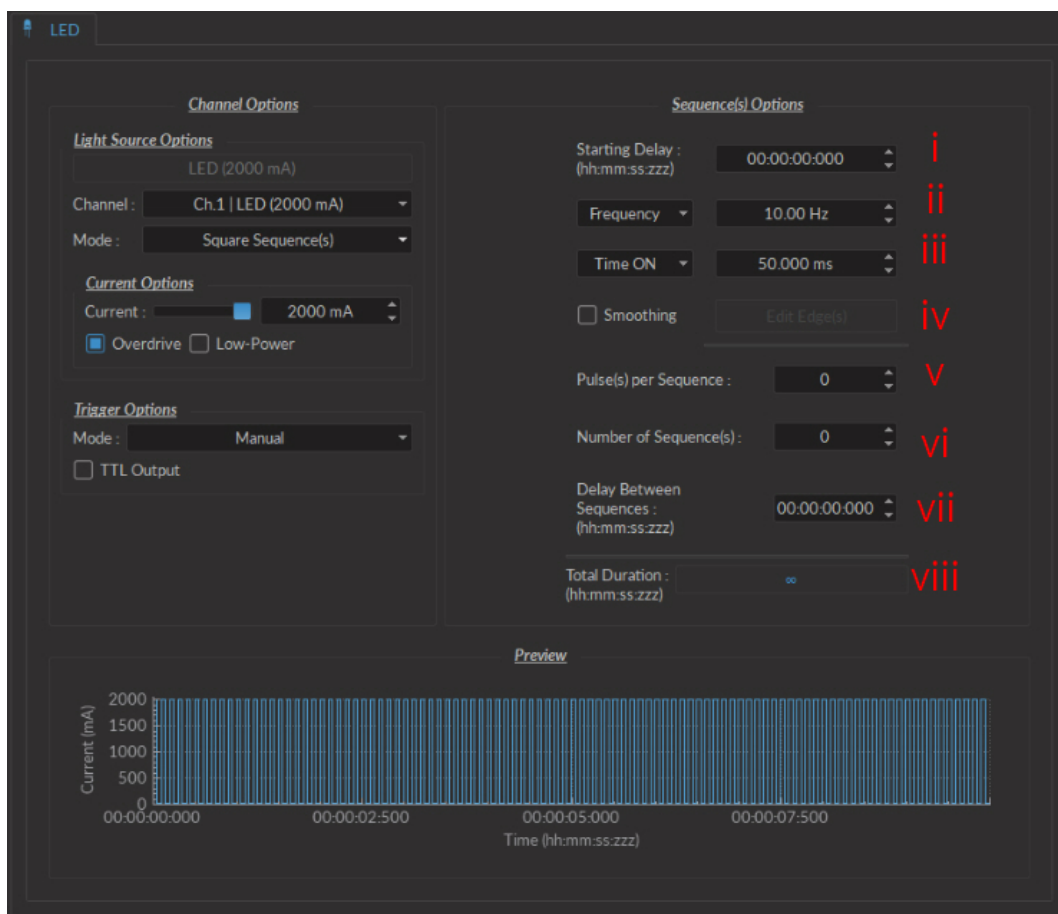


Figure 4.6: Light Source Channel Configuration Window, square sequence options

- d) The **Square sequences** mode has the light source follow a square pulse sequence.
- i. The **Starting Delay** (Fig. 4.6) sets the delay (in hh:mm:ss.zzz format) before the first pulse.
  - ii. The **Frequency/Period** (Fig. 4.6) sets the frequency (in Hz) or period (in ms) for the pulse sequence. For example, a signal at 10 Hz (frequency) will output one pulse every 100 ms (period), whereas a pulse sequence at 0.5 Hz (frequency) will output one pulse every 2000 ms (period).

- iii. The **Time ON/Duty Cycle** (Fig. 4.6) sets the time (in ms) or the duty cycle (in %) for each pulse. The **Time ON** must be lower than  $(1/\text{frequency})+0.005$  ms, while the **Duty cycle** must be below 100 %. These squares will appear red should an impossible **Frequency/time ON** be selected. Should the **Smoothing** option be selected, this feature becomes inaccessible.
- iv. The **Smoothing** option is used to change the pulse slope in square pulse sequences. The **Edit Edges** button opens the **Smoothing Edge(s)** window (Fig. 4.7).

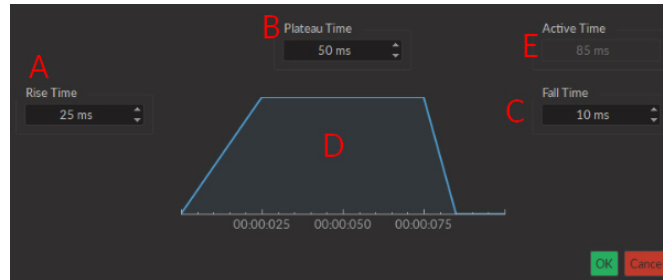


Figure 4.7: Light Source Smoothing Edge(s) Window

- A. The **Rise Time** box is used to define the duration to rise from 0 to the pulse maximum.
- B. The **Plateau Time** box is used to defined the duration the pulse is at its maximum value.
- C. The **Fall Time** box is used to define the duration to descend from the pulse maximum to 0.
- D. The **Pulse Graph** displays the pulse shape.
- E. The **Active Time** box displays the total duration of the pulse. While the **Smoothing** option is active, the **Time ON** is fixed at this value.
- v. The **Pulses per sequence** (Fig. 4.6) sets the number of pulses per sequence. If it is set to 0, the pulse will be repeated indefinitely.
- vi. The **Number of sequences** (Fig. 4.6) sets the number of times that the sequence will be repeated. If it is set to 0, the sequence will be repeated indefinitely.
- vii. The **Delay between sequences** (Fig. 4.6) sets the delay (in hh:mm:ss:zzz format) between each sequence if the **Number of Sequences** is greater than 1.
- viii. The **Total Duration** (Fig. 4.6) displays the total time of the experiment. The different values can be *Inf* for infinite, a valid time value or *Err* if the **Time ON** value is greater than  $1/\text{frequency}$ .

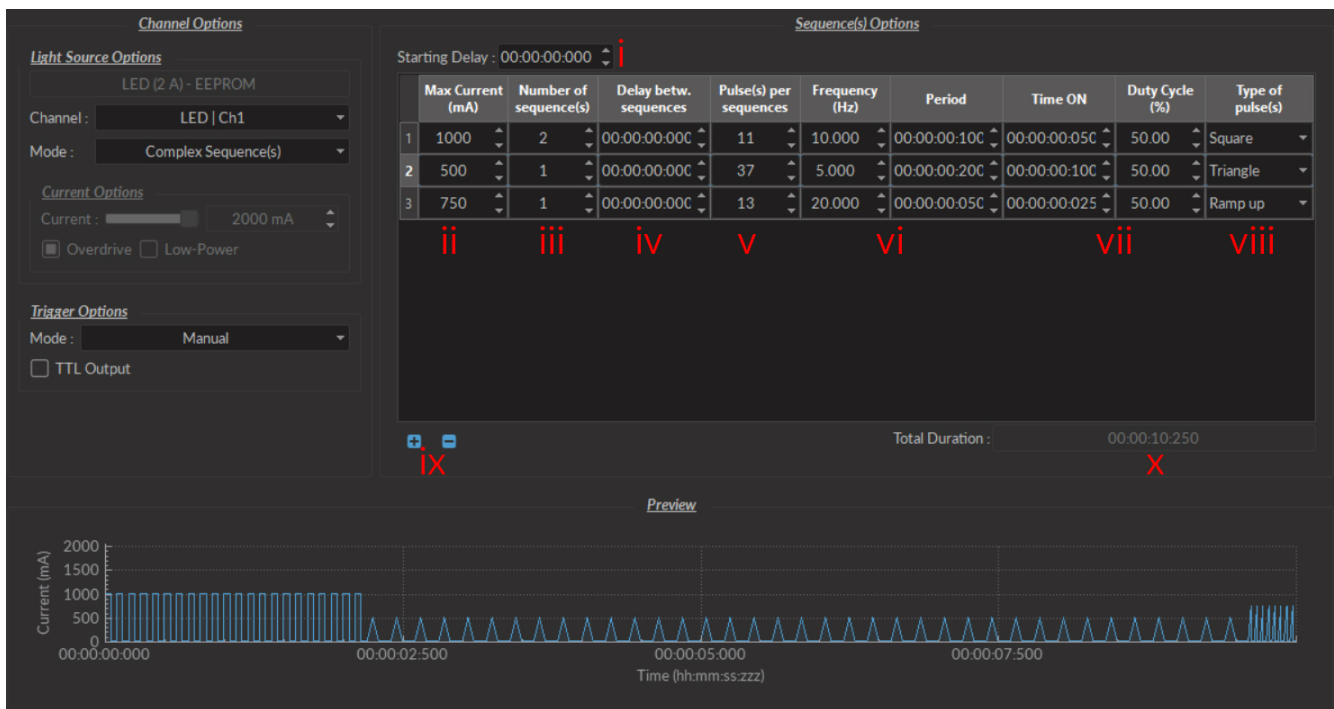


Figure 4.8: Complex Sequences Window

- e) The **Complex Sequences** mode mode allows the design of complex pulse sequences. Multiple sequences can be combined to create a more elaborate pulse sequence. These are displayed in a spreadsheet format.
- i. The **Starting Delay** (Fig. 4.8) sets the delay (in hh:mm:ss:zzz format) before the first pulse sequence.
  - ii. The **Max Current** (Fig. 4.8) sets the maximum current (in mA) for the given sequence.
  - iii. The **Number of sequences** (Fig. 4.8) sets the number of times that the sequence will be repeated, with a minimum of 1.
  - iv. The **Pulses per sequence** (Fig. 4.8) sets the number of pulses per sequence, with a minimum of 1.
  - v. The **Delay between sequences** (Fig. 4.8) sets the delay (in hh:mm:ss:zzz format) between each sequence if the **Number of Sequences** is greater than 1.
  - vi. The **Frequency/Period** (Fig. 4.8) sets the frequency (in Hz) or period (in ms) for the pulse sequence. These two values are linked, and when one is changed the other will adjust automatically. For example, a signal at 10 Hz (frequency) will output one pulse every 100 ms (period), whereas a pulse sequence at 0.5 Hz (frequency) will output one pulse every 2000 ms (period).
  - vii. The **Time ON/Duty Cycle** (Fig. 4.8) sets the time (in ms) or the duty cycle (in %) for each pulse. These two values are linked, and when one is changed the other will adjust automatically. The **Time ON** must be lower than  $(1/\text{frequency})+0.005$  ms, while the **Duty cycle** must be below 100 %.

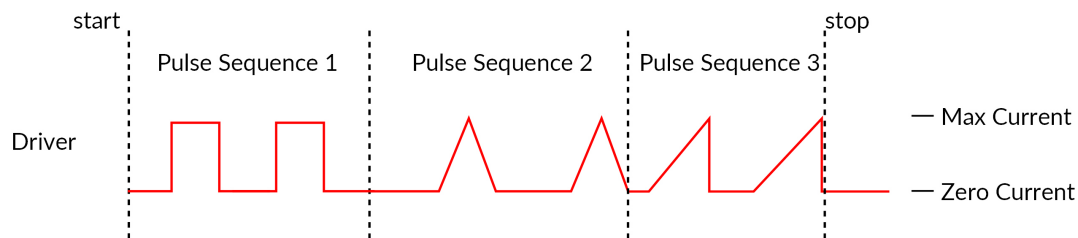


Figure 4.9: Internal Complex Mode Pulse Sequences

- viii. The **Types of pulses** (Fig. 4.8) sets the pulse type. Pulses can be **Square**, triangular (**Triangle**), **Ramp up** **Ramp down** or **Delay** (Fig. 4.9). The **Delay** pulse type is used to create a delay between different sequence

- ix. The **Sequence controls** (Fig. 4.8) allow the addition (+) or removal (-) of sequences to the spreadsheet.
  - x. The **Total Duration** (Fig. 4.8) displays the total time of the experiment. The different values can be *Inf* for infinite, a valid time value or *Err* if the **Time ON** value is greater than 1/frequency.
- f) The **Scope** mode allows the measurement of electrical signal using the driver (Fig. 4.10). The signal is received by the Input BNC of the chosen channel on the light source driver.

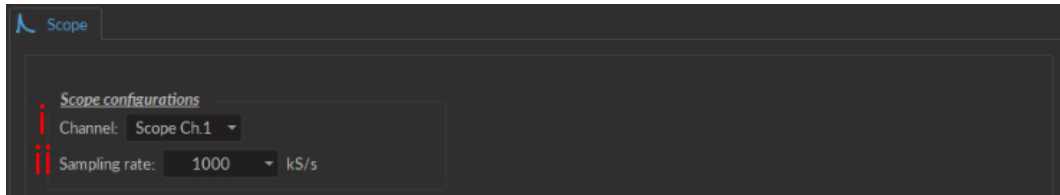


Figure 4.10: Scope

- i. The **Channel** drop-down list indicated which driver channel will be used to receive signal. The chosen can be used to drive a light source while serving as a scope.
  - ii. The **Sampling Rate** drop-down list allows the selection of the rate (in kilosamples per second) at which measurements are taken.
4. The **Preview** box (Fig. 4.2) displays a preview of the chosen sequence while in the **Continuous Wave**, **Square Sequences** and **Complex Sequences** mode.
5. The **Apply** button (Fig. 4.2) will generate the defined channel OR update an already configured channel with any changes.

## 4.2 Control & Settings

The **Control & settings** sections is used to control the light source. It includes the following elements.

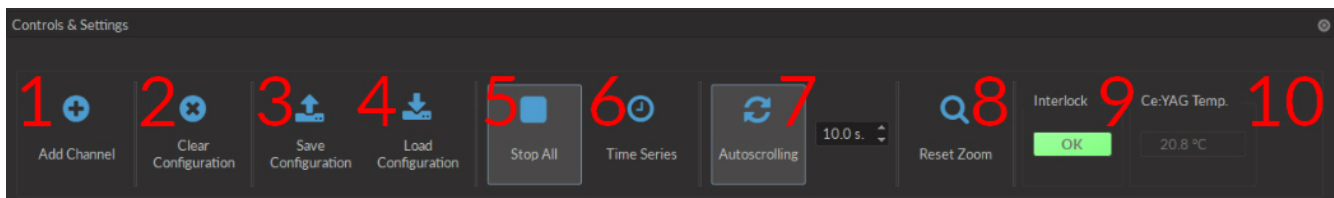


Figure 4.11: Control & Settings

1. The **Add channel** button (Fig. 4.11) opens the **Channel Configuration** window 4.2. See section 4.1 for more details.
2. The **Clear Configuration** button (Fig. 4.11) clears all configuration channels. Cleared channels cannot be recovered unless previously saved.
3. The **Save configuration** button saves all currently configured channels in **.doric** format.
4. The **Load configuration** button loads a file in **.doric** format that contains a previously saved set of configured channels.
5. The **Start All** button (Fig. 4.11) starts all currently configured channels.
6. The **Time Series** button opens the **Time Series** window. This tool allows all channels to share the same timing.

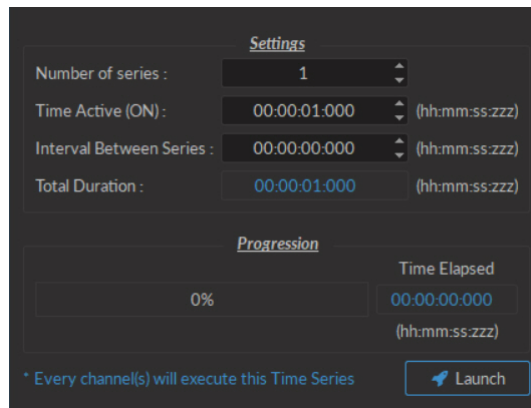


Figure 4.12: Control & Settings, Time Series Window

- The **Number of series** (Fig 4.12) sets the number of times that the sequence will be repeated, with a minimum of 1.
  - The **Time Active** sets the duration of each series in hh:mm:ss:zzz format. If the **Time series** is used in combination with a sequence, the **Time Active** should be greater than the sequence **Total Time**. If the **Time Active** is shorter, the sequence will be stopped after the **Time Active**.
  - The **Interval between series** sets the duration between each series in hh:mm:ss:zzz format.
  - The **Total Duration** displays the total duration of the sequence in hh:mm:ss:zzz format.
  - The **Progression** bar displays the progression of the sequence in %, while the **Time Elapsed** counter displays the progression in hh:mm:ss:zzz format.
  - The **Launch** button starts the sequence.
7. The **Autoscrolling** button activates the autoscroll function. When active, the **Graph** in the **Acquisition View** will follow a section as wide as the time defined beside the button.
  8. The **Reset Zoom** button resets the axes in the **Graph** to their standard values.
  9. The **Interlock** indicator displays OK when the interlock is correctly connected, and DISCONNECTED when disconnected.
  10. The **Ce:YAG Temp** indicator displays the temperature of the *Ce:YAG source* in real time. This indicator will only appear when a *Ce:YAG driver* is connected to the computer. Should the temperature be too high the temperature will appear in **red**. Should the temperature be too low, the temperature will appear in **blue**.

### 4.3 Experiment View

The **Experiment View** box is used to display information related to the usage of each channel. This section allows limited control of the light source while it is active.

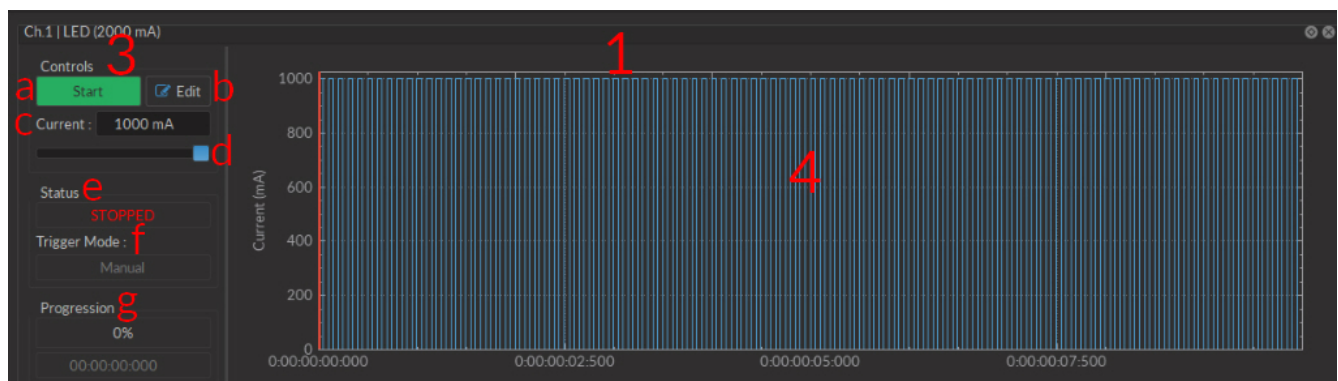


Figure 4.13: Experiment View, Light Source Channel

1. The **Light Source Channel** box (Fig. 4.13) contains all elements related to a single light source channel.
2. The **Scope Channel** box (Fig. 4.14) is used to control and configure an active **Scope**.

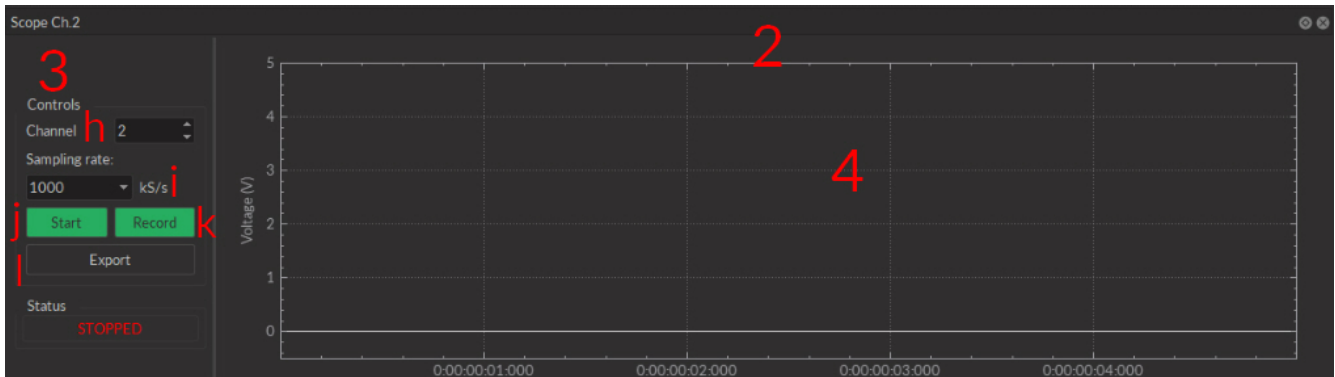


Figure 4.14: *Experiment View, Scope Channel*

3. The **Controls View** displays all elements to control/configure the channel.
  - a) The **Start/Stop** button activates/deactivates the light source connected to the **Light Source Channel**.
  - b) The **Edit** button opens the **Channel configuration** window to edit the pulse sequence. This button is only accessible when the channel is deactivated.
  - c) The **Current Box** allows the current to be changed exactly (in mA).
  - d) The **Current Slider** allows the light source current to be adjusted.
  - e) The **Status** box displays the status of the channel (**Light source** or **Scope**). The **Status** will display **RUNNING...** when active and **STOPPED** when deactivated.
  - f) The **Trigger Mode** of the light source is displayed in this box.
  - g) The **Progression** box displays the progression of the pulse sequence. The advancement of the sequence is displayed % on the **Progression bar**, and in hh:mm:ss:zzz format on the **Time Elapsed** box.
  - h) The **Channel** drop-down list is used to choose the channel used as a scope.
  - i) The **Sampling Rate** drop-down list allows the selection of the rate (in kilosamples per second) at which measurements are taken.
  - j) The **Start** scope channel button activates a live measurement sequence. Important measurements should not be made as a live measurement, as these only conserve a small amount (60 s) of data.
  - k) The **Record** scope channel button starts a recorded measurement sequence.
  - l) The **Export** scope channel button allows the recording of a live measurement sequence on the scope.
4. The **Graph View** displays either a preview of the pulse sequence for **Light Source Channels** or the received signal for the **Scope Channel**.

## Specifications

Table 5.1: General specifications for Laser Diode Module Drivers

SPECIFICATION	VALUE	NOTE
Power supply	110 - 240 VAC; 50 - 60 Hz	Power supply adapter included
DC Power Supply	12 V (positive center)	20 W (1-ch, 2-ch), 60 W (4-ch)
Weight		
1-channel	580 g (1.28 lbs)	
2-channel	757 g (1.67 lbs)	
4-channel	1155 g (2.55 lbs)	
Dimensions (L x H x D)		
1-channel	17,5 cm x 5,0 cm x 10,5 cm	Including connectors
2-channel	23,4 cm x 5,0 cm x 10,5 cm	Including connectors
4-channel	3,5 cm x 5,0 cm x 10,5 cm	Including connectors
TTL input voltage	0 to +5 VDC	
Display Current Accuracy	2% @ maximum rated current	Error increases at lower current.
Analog input voltage	80 mA/V light source current	If applicable: see datasheet
BNC output voltage	12.5 V/A	If applicable: see datasheet
Maximum Output Current Range	LD Model dependent	If applicable: see datasheet
Maximum Forward Voltage	10 V	-
Minimum output current	25 mA	Model dependent; see data sheet
Display Current Accuracy	2% @ maximum rated current	Error increases at lower current.
Rise/Fall time	<10 $\mu$ s	Typical
Modulation Minimum Frequency	0.01 Hz <sup>1</sup>	Internal complex mode : 0.000054 Hz
Modulation Maximum Frequency	50 kHz	-3 dB attenuation
Minimum ON or OFF time	0.005 ms <sup>1</sup>	Internal complex mode : 2 ms
Maximum ON or OFF time	100 s <sup>1</sup>	Internal complex mode : 5 h
Maximum number of pulses per sequence	16.68 millions <sup>1</sup>	Internal complex mode : 65 535
Maximum number of sequences	4.2 billions <sup>1</sup>	Internal complex mode : 65 535
Minimum step increments	39 $\mu$ sec <sup>1</sup>	Internal complex mode only
Number of steps per period	128 <sup>1</sup>	Internal complex mode only
Scope Acquisition speed	10 kS/s	Single channel

<sup>1</sup>For all operation modes, except the internal complex mode

Table 5.2: General Specifications of the Connectorized Laser Diode Module

SPECIFICATION	VALUE	NOTE
Electrical Connector	M8-4 pins	see pinout below
Optical Connector	FC/APC	
Mass	104 g	
Dimensions		
Width	64 mm	
Depth	56 mm	+ pigtailed electrical cable
Height	22 mm	
Output NA	< 0.22	
Output Optical Fiber Core Size	> 50 $\mu\text{m}$	

Table 5.3: Recommended Environmental Specifications

DESCRIPTION	OPERATION	STORAGE
Use	Indoor	-
Temperature	20 to 30 ° C	-20 to 60 ° C
Humidity	40-60% RH, non condensing	40-60% RH, non condensing

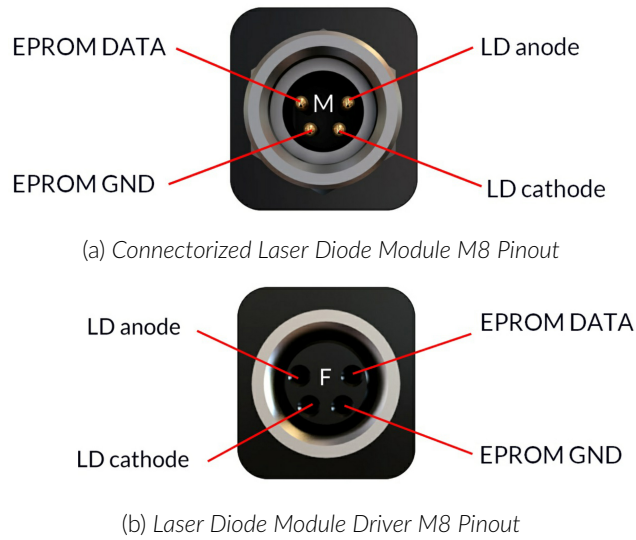


Figure 5.1: M8-4 Pinout



## Support

### 6.1 Maintenance

The product does not require any maintenance. Do not open the enclosure. Contact Doric Lenses for return instructions if the unit does not work properly and needs to be repaired.

### 6.2 Warranty

This product is under warranty for a period of 12 months. Contact Doric Lenses for return instructions. This warranty will not be applicable if the unit is damaged or needs to be repaired as a result of improper use or operation outside the conditions stated in this manual. For more information, see our [Website](#).

### 6.3 Contact us

For any questions or comments, do not hesitate to contact us by:

**Phone** 1-418-877-5600

**Email** [sales@doriclenses.com](mailto:sales@doriclenses.com)

The logo for Doric Lenses, featuring the word "doric" in a lowercase, sans-serif font. The letter 'o' is stylized with a white highlight on its upper left curve, giving it a three-dimensional appearance.

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