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Cool & Control Series

CCM Multi-Mode laser diode driver



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1. General information

Please read this manual carefully, it describes the hazard the user might be exposed to while using the product. It also explains in details how to use the product in the safest and more efficient way possible.

The safety of any system incorporating the product is the responsibility of the assembler of the system.

Any actions taken by the user that is not clearly described in this user manual might present a risk and is the sole responsibility of said user.

This product is to be used in laboratory or industrial tasks, and only by personnel who have followed a training in laser hazard.

1.1. Definitions

Caution : A caution is advised when dealing with hazardous situations, tasks or objects, to prevent harm or death and avoid material damage or failure.

Warning : A warning is given for potentially dangerous situation for people which cause them harm or lead to death

Note : A note is a complementary piece of advice that must be acknowledged by the user.

1.2. General warning

WARNING

The compatible laser diodes used with the CCM can deliver up to several Watts of coherent LASER radiation. Always wear protective goggles and observe the safety instructions provided by the laser diode supplier when using the CCM driver with your laser diode.

WARNING

Operating the CCM with respect to laser radiation directive (2006/25/CE) is the responsibility of the owner of the system and the product should not be put in operation before the machine or system in which it will be integrated has been declared to be compliant with the relevant requirements (NF EN 60825-1).

WARNING

Do not try to open or remove the cover of the CCM module.



WARNING

Avoid all chocs and strains when handling the CCM.

WARNING

Handle the fiber-optics cable with care as it is fragile. Do not bend or pinch it.

WARNING

Any software settings or hardware tinkering that is not described in this user manual or in the usage recommendation may put the user or its environment at risk.

WARNING

The maintenance and servicing of the CCM should not be executed by the end user : only AERODIODE is able to maintain the CCM.

Note

Only use the supplied USB cable.

2. Safety Instructions

2.1. Wiring

Caution

- Please use cable of length inferior to 3m to power the CCM in order to avoid EMC compatibility (according to IEC61326-1)
- Please first connect the input pins to the board and then plug the 24V DC Power Supply
- Make sure that the pins are correctly screwed in
- Use caution when connecting the Power Supply
- Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the CCM module

2.2. Operating Environment

Caution

- Do not install near any heat sources such as radiators, heat registers, stoves, or other equipment (including amplifiers) that produce heat.
- To reduce the risk of fire or electric shock, do not expose the CCM to rain or moisture.

WARNING

Not following the safety recommendations and the caution mentioned above can lead to eye damage.



2.3. Contact

If you have any question about the CCM module, please contact AERODIODE.

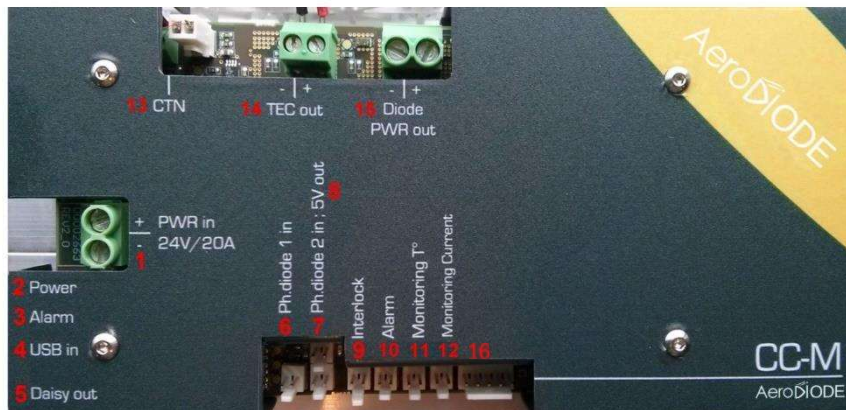
3. Product overview

3.1. Physical properties*

Length	240	mm
Width	120	mm
Height	108	mm
Weight	2,8	kg

* The values stated above are for an CCM equipped with a standard cooling system (up to 60W) without diode(s). Other sizes are available, please contact AERODIODE for more information

3.2. Ports description



1. 24 Vdc / 20 A Power IN

Power supply location for the CCM device (24 Vdc  / 20 A)

2. Power ON indicator

Blue LED indicates that the device is powered

3. Alarm indicator

Red LED indicates that an extreme condition is reached and has triggered the laser extinction (Interlock open, CPU dysfunction or overheating)



- 4. USB input**
3.5 mm input jack used to connect the CCM driver to the PC. Use the specific USB cable supplied with your device
- 5. Daisy output**
3.5mm output jack used to chain multiple CCM drivers or any other device from the AERODIODE line (CCM, Central, CCS)
- 6. Photodiode 1 input** [left: signal / right : GND]
Input connector for a first photodiode entrance signal. This signal is used for the Automated Power Control mode (APC)
- 7. Photodiode 2 input** [left: signal / right : GND]
Input connector for a second photodiode entrance signal (provision)
- 8. 5 V output** [left: signal / right : GND]
5 Vdc output connector allowing the supply of an external device (300 mA max). Typically this supply can be used for biasing and amplifying the photodiode signal
- 9. Interlock** [left: signal / right : GND]
Connector interlock that must be shunted or connected to any interlock security system of the machine/installation in order to allow laser activation and thermal regulation. The signal is a 3.3V DC pull-up signal that must be grounded in order to allow emission.
- 10. Alarm output** [left: signal / right : GND]
Output connector for alarm status monitoring (power, current, temperature) (low level indicates alarm)
- 11. Monitoring electronic component temperature**
Allows temperature monitoring when using the device on external monitoring mode (25°C corresponds to 1.125 V) [left: signal / right : GND]
- 12. Monitoring current**
Allows current monitoring when using the device without the software (185 mV/A) [left : signal / right : GND]
- 13. CTN**
CTN connector input for measuring and controlling the laser diode temperature
- 14. TEC output**
Electrical output location for thermoelectric cooler supply
- 15. Laser Diode power output**
Electrical output location for the laser diode supply



16. Analog 0-2.5 V signal input for Ext Mode

Set here the relative laser diode current using a 0-2.5V signal input when CCM has been previously set in “Ext-Mode” in the “Current Source” panel of the software (the operating mode should be kept to CW).



This signal could be used to make a current modulation (continuous, modulated or pulsed).

0 V = Minimum current

2.5 V = Maximum current

- Left : Reserved
- Middle Left : Analog voltage input 0-2.5V
- Middle : Reserved
- Middle right : Reserved
- Right : Ground



4. Installation

The CCM driver is able to drive any type of laser diode until 150W / 36 V / 21 A

4.1. Laser diode installation for efficient thermal regulation

Caution

Care must be taken in order to properly cool the laser diode. In case of bad thermal contacts of the diode and thermistor, the regulation may be unstable.

Note

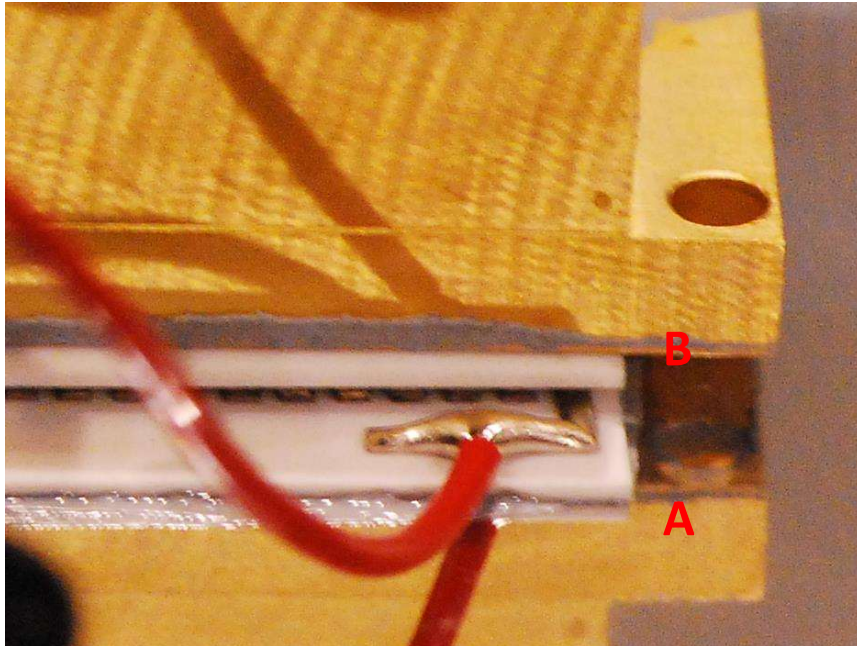
Some laser diodes can contain an internal thermistor in their assembly. The CCM product is optimized to deal with the external furnished thermistor and so the thermal regulation will not work properly with integrated thermistors.

Please find the following advices in order to install the laser diode and TEC (Thermoelectric cooler) :

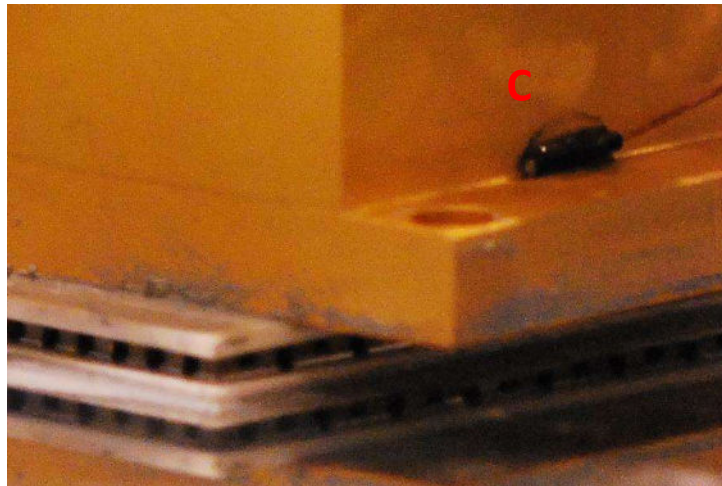
(A) Spread some thermal grease on the heat sink's surface to guarantee a good thermal contact, and then lay down the thermoelectric cooler above. **The thickness of thermal grease should be as low and uniform as possible.** After placing some drops, the grease could be spread with a spatula or a blade before placing the thermoelectric cooler. **Please take care not to introduce any thermal contact between both sides of the TEC.**

(B) Spread some thermal grease on the top surface of the thermoelectric cooler and then lay down the diode above. **Please take care not to introduce any thermal contact between both sides of the TEC.**





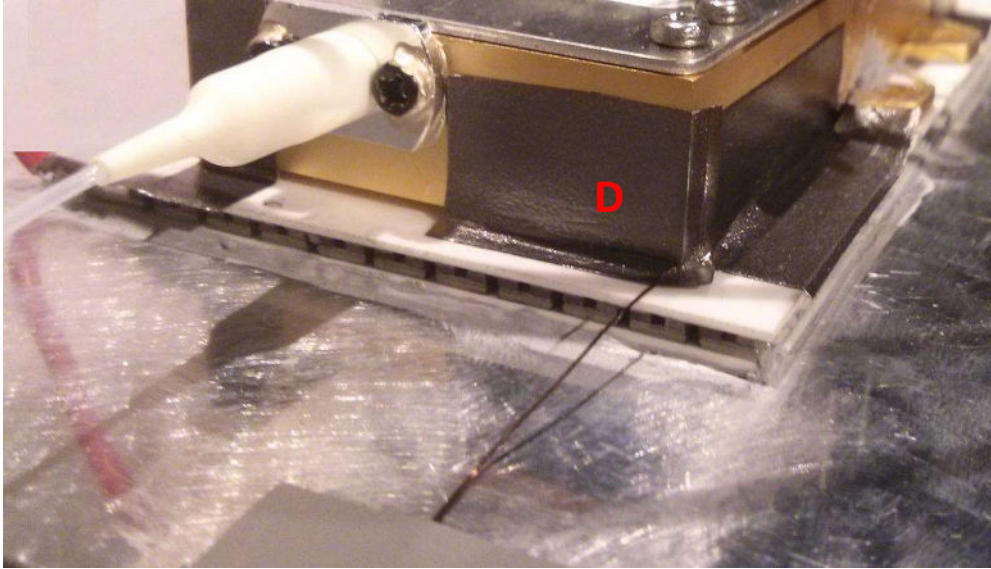
(C) Insert and paste the thermistor to the laser diode. **Take care that the thermistor is properly attached and in contact with the laser diode : use superglue or other efficient thermal glue to make sure the CTN is always in contact with the diode.** If several diodes are connected in serial, glue the thermistor on the diode farthest from the fan.



(D) To optimize thermal efficiency, if the diode is small compared to the thermoelectric cooler, you can paste a piece of thermal conductive sheet (graphite for example) going from the thermoelectric cooler to the laser diode sides.

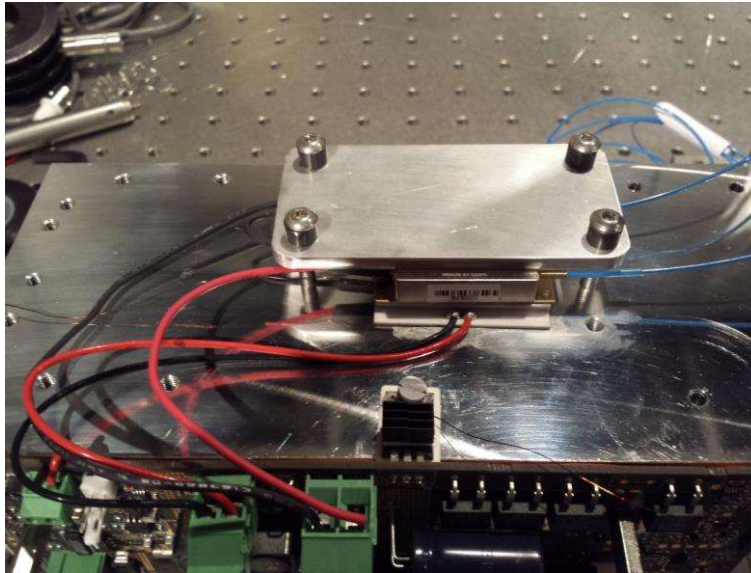
The ideal configuration is when laser diode and TEC have similar sizes.





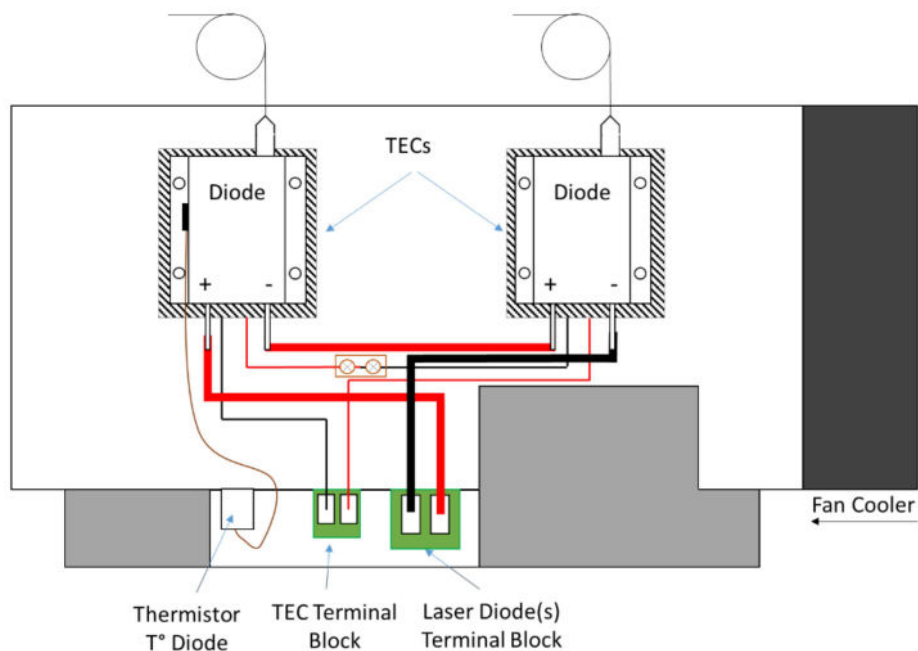
4.2. Example of multiple laser diodes and TEC connected to one CCM

On the picture below, two IPG laser diodes are connected in Serial to a CCM device with only one TEC. On the front page of this manual, three BWT laser diodes are connected in serial to a CCM with three TEC (one for each laser diode) also connected in serial.



The diagram explain how to electrically connect in serial two laser diodes and TEC.

Top View



4.3. Mechanical holding

Screw the holding plate on top of the laser diode in order to hold the laser diode and guarantee good thermal efficiency.

WARNING

The Holding plates should be screwed with a torque of 15cN.m. Too much pressure may damage the TEC and too low pressure will not perform good uniform thermal contact with the TEC.

4.4. Electrical connection

Connect the laser diodes, TEC and power supply to the CCM by using the dedicated screws connectors mentioned in section 3.2.

Connect the CTN for laser diode temperature regulation to the dedicated connector mentioned in section 3.2.

WARNING

Use adapted electrical wires that can handle enough current to connect the laser diode(s) to the CCM and the power supply.

For a double board CCM version which allow independent control of two laser diodes, both boards must be powered in parallel (single power supply 24V dc) or with two different power supply outputs.

WARNING

Take care that the TEC is connected before connecting the power supply to the CCM



5. Getting Started

5.1. Software installation

Caution

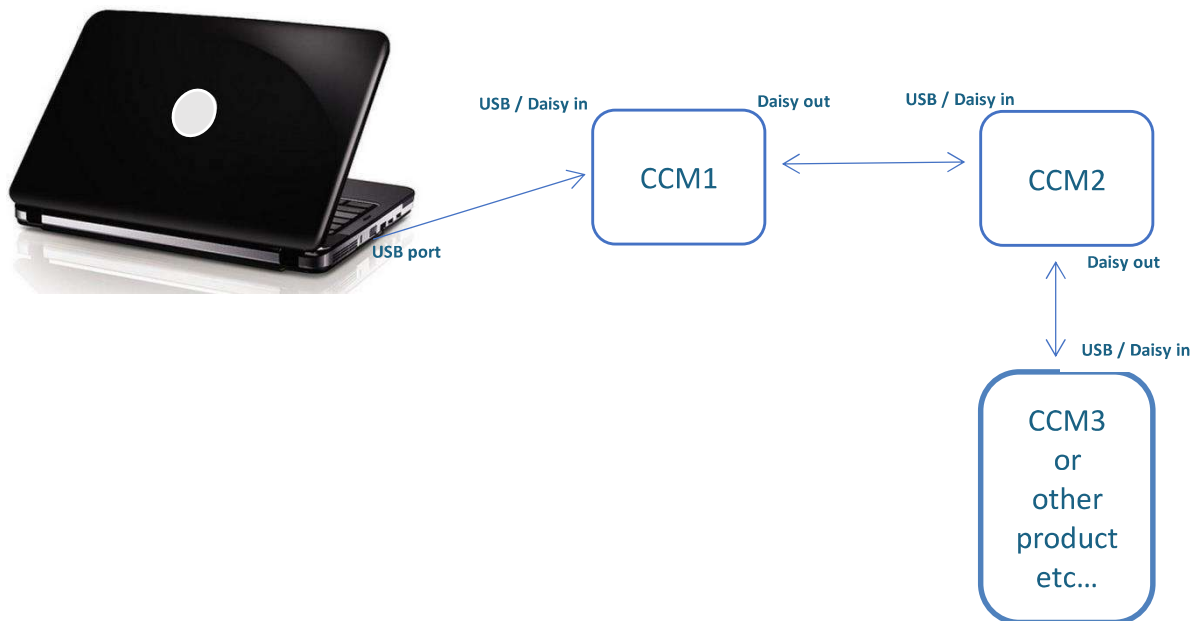
The CCM USB specific cable should be unplugged during the installation.

Note

Please note that the USB cable can also be unplugged after the board has been configured.

Double-click on setup.exe to run the installer. The control software will be installed, as well as the driver for the USB cable. A computer restart may be required to complete the installation.

- When the setup is completed, plug the USB cable into one of your computer's USB port.
- Then plug-in the 3.5 mm jack into the USB input of the CCM.
- If you have several CCMs or other AeroDIODE electronic modules, you can connect them together on a unique USB port by chaining them :

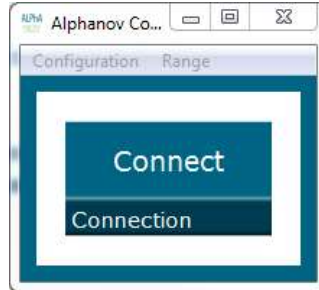


- Finally, plug-in the CCM power supply to switch on the laser diode driver.



Click on the “ALPhANOV Control Software” item located in the *Start Menu* in order to run the CCM control software.

A window appears:



Click on *Connect* to start the CCM hardware detection. The software automatically detects any USB-connected AeroDIODE devices.

A window will appear for each CCM driver connected to the computer.



5.2. Software overview

The screenshot shows the AeroDIODE software interface with several sections annotated with red brackets and arrows:

- Max. levels:** Points to the '5.0 A' and '10.0 V' input fields in the Maxima section.
- Laser Enable:** Points to the 'On' and 'Off' buttons in the Laser section.
- Controls:** Points to the 'Int', 'Ext', 'DCC', 'APC', 'CW', 'Pulse', 'Man', 'Auto', 'Voltage Adj.', 'Save APC', and 'Pulse Settings' buttons.
- Parameters:** Points to the '0.00 A', '0.00 V', '3 μs', and '25.00 °C' input fields in the Settings section.
- Measurements:** Points to the '0.03 A', '0.00 V', '-1.00 °C', '1.072 V', '22.84 °C', '0.00 A', '0.00 V', and '1.247 V' display fields in the Measures section.
- Alarms:** Points to the 'EXT/CPU', 'Laser T°C. Max', 'Elec. T°C Max', 'PD_EXT_1', 'PwrSup', 'Laser T°C Csg', and 'Diode Voltage' status indicators in the Alarms section.



The window is split in six parts:

1. **MAX LEVELS**: The maximum current and voltage values are settable in the **Max levels** part and must be chosen in accordance to the laser diode specifications and operating data everytime a new laser diode is mounted on the CCM module (see bellow). The floppy disk logo indicates that these values can be stored into the CCM memory (upon clicking)
2. **LASER ENABLE**: The On/Off toggle button enables or disables the laser emission
3. **CONTROLS**: Toggle buttons in the **Control** part are used to select the operating mode.
4. **SETTINGS**: is used to configure diode current/voltage, laser slope, and laser temperature.
5. **MEASUREMENTS**: The **Measurements** area displays real time data, such as the temperature measured by thermistors, or current and voltage values of diodes and thermoelectric coolers.
6. **ALARMS**: The **Alarms** part shows if any element is or not causing a dysfunction.



5.3. Setting the limits

The CCM laser diode driver includes hardware overcurrent and overvoltage protections requiring to be set up before to drive any laser diodes.

Please mind to configure these values to their maximums as recommended by the laser diode supplier.

- As Max Current : Set laser diode nominal current + 10%
- As Max Voltage : Set laser diode nominal voltage + 2V

For example: If the laser diode has the following nominal levels:

- P = 60 W
- I = 12.1 A
- V = 13.4 V

Then you should set:

- Max current = $12.1 \times 1.10 = 13.3A$
- Max voltage = $13.4 + 2.0 = 15.4 V$

5.4. Current and voltage adjustments

These two-position switches control the current and voltage sources.



Internal/External current source

In External mode an analog signal could be applied in “Side connector input” to change externally the laser current (see details in point 16 of Page 7). It could be used for continuous, modulated or pulsed operation



Manual/Automatic voltage adjustment (*user value or software algorithm*)

Automatic Voltage adjustment mode is recommended when using <100W laser diodes total power



5.5. Control mode

This two-position switch controls the operating mode (current or power control)

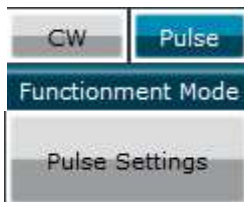


Direct Current Control / Automatic Power Control

Save the photodiode signal level for the constant power mode (see Page 6)

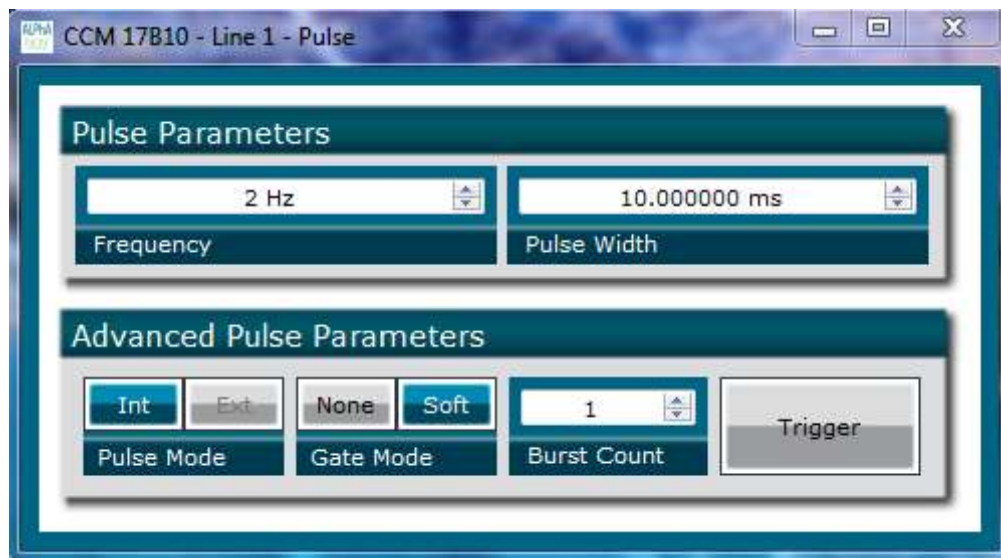
5.6. CW/pulse operation

This two-position switch controls the operating mode (CW or pulse).



Select if the laser diode is operated continuously (CW) or pulsed

A new window will pop up on click: pulse settings



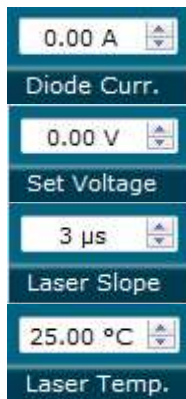
- **Frequency:** defines the pulse repetition rate
- **Pulse width:** defines the pulse width



- **Pulse Mode:** if set to **Internal**, the pulse trigger is provided by the CCM hardware. **External** is not available at this time
- **Gate Mode:** if set to **None**, the CCM laser driver will deliver pulses while the laser is enabled. If set to **Soft**, the laser emission will stop after reaching the burst count.
- **Burst Count:** number of pulses in Soft Gate Mode (1-255 range)
- **Trigger:** in Soft Gate Mode, the laser emission will begin upon clicking this button

For the example displayed in the window, a single pulse (width=10ms) is emitted when the user clicks on Trigger. If the burst count is set to 2, an additional pulse will be emitted 500ms (2 Hz) after the first pulse (same pulse width).

5.7. Settings



Set the laser diode current

Set the laser diode voltage

Set the laser diode current slope time (rise time)

Set the laser diode temperature

These values have to be defined carefully depending on various parameters fixed by the laser diode supplier. Excessive parameters could trigger alarms or even lead to permanent damage to the laser diode.

In case of Manual Voltage adjustment, set voltage ~1-1.5 V above desired laser diode voltage.



5.8. Measurements

0.03 A
Diode Curr.

Indicates the current passing through the laser diode

0.00 V
Diode Volt.

Indicates the laser diode voltage

25.00 °C
Laser Temp.

Indicates the laser diode temperature measured by the mobile CTN.

A negative value indicates that the CTN is disconnected

22.84 °C
Elec. Temp.

Indicates the electronic temperature measured by a CTN placed on a sensitive electronic component.

A negative value indicates that the CTN is disconnected.

If this value goes higher than 50°C, please lower the diode voltage consign

1.00 A
TEC Current

Indicates the current passing through the TEC

1.00 V
TEC Voltage

Indicates the total voltage applied to the TEC

1.072 V
PD_EXT_1

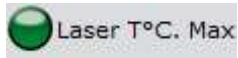
Indicates the Photodiode 1 voltage

1.247 V
PD_EXT_2

Indicates the Photodiode 2 voltage



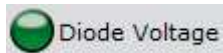
5.9. Alarms



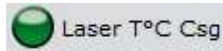
Red light indicates that the laser diode temperature has crossed over the maximum value (default is 45°C).
Orange light indicates that the CTN cable is disconnected



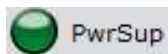
Red light indicates that a sensitive electronic component has reached a critical high temperature.
Orange light indicates that the CTN cable is disconnected



Red light indicates that the chosen voltage differs from the diode's nominal voltage.



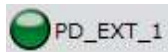
Red light indicates an issue with the temperature regulation.



Red light indicates a power supply issue (voltage drop for example). The device's red Alarm LED is triggered too.



Red light indicates an absence of Interlock or overheat issue



Red light indicates that the APC signal from Photodiode 1 is above the threshold value



5.10. Menu bar

- File

- **Load parameters**

Click on this item to load a .txt file which contains the operating parameters.

- **Save parameters**

Click on this item to save the current parameters into a .txt file. This file can be loaded using the “Load parameters” menu item.

- **Exit**

Close the window. A confirmation is asked before shutting down the software: the laser state can be either active or inactive after the software is stopped.

- Config

Use the login “Administrator” and no password in order to change the fan operating mode and voltage (in case of manual operation).

(Be careful with a double board CCM version, we recommend to use Manual Mode at 24V on board n°1, indeed, only the first board control the fan.)

Other internal configuration parameters are restricted; please only use this when asked by AeroDIODE.

- Info

Displays information's about the current version and the internal parameters



6. Technical specification

6.1. General Data

Length	240	mm
Width	120	mm
Height	108	mm
Weight	2,8	kg
Power connector (Wires)*	1.5	mm ²
Power supply (DC)	24 Vdc / 20 A	

*Minimum wire section

6.2. Detailed data

CCM	Min	Max
Operating temperature	-15°C	+40°C
Storage temperature	-25°C	+70°C
Operating Altitude	–	2000m

