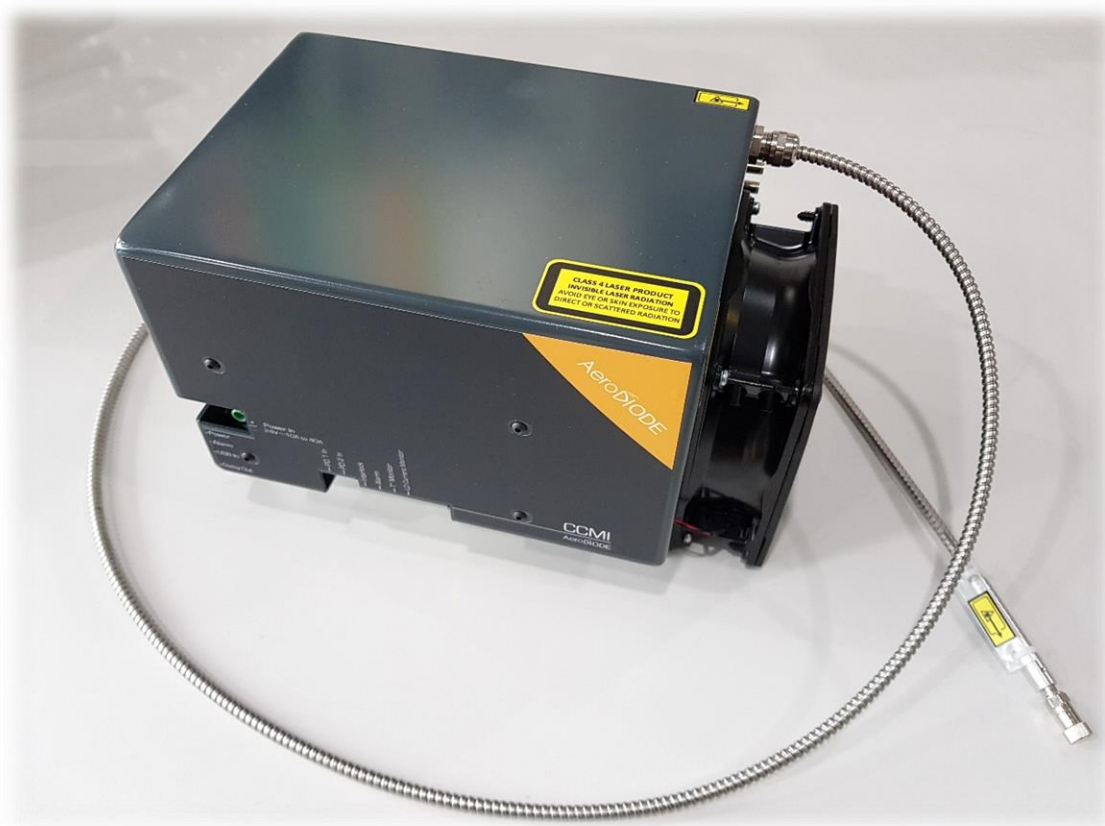


## Cool & Control Series

*CCMI Integrated multimode 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. Laser hazard and general warning

#### **WARNING**

**The compatible laser diodes used with the CCMI can deliver up to several Watts of coherent LASER radiation. This product contains a CLASS 4 laser. Always wear protective goggles and observe the safety instructions with respect to laser radiation directive (2006/25/CE).**



**WARNING**

**Closing the software or removing the USB cable between the product and the PC do not stop the laser emission.**

To stop the laser emission, open the interlock or disconnect the power supply of the CCMI.

**WARNING**

Operating the CCMI 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 CCMI module.

**WARNING**

Avoid all chocs and strains when handling the CCMI.

**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 CCMI should not be executed by the end user : only AERODIODE is able to maintain the CCMI.

**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 CCMI 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 CCMI 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 CCMI 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 CCMI module, please contact AERODIODE.



### 3. Fiber optic cleaning

The optical path after the connector must be completely under control before laser activation.

Please remove the power supply and the interlock of the product before each disconnection.

Always place the protective cap when the fiber is not connected to any accessory.

Before connecting the fiber, the end face must be cleaned.

If the end face is not clean, there is a risk of deterioration, permanent damage of the product with loss of power and burn connector.

During the connector cleaning operation, make sure that laser emission is not possible (remove the power supply and the interlock).

To clean the connector output, use a clean optical paper and acetone solution. Fold the optical paper to make a rectangle and put acetone on it. Then place the end-face of the connector in contact with the optical paper with a perpendicular position to the paper (you can rotate the connector on the paper but don't scrub the connector on the paper).



## 4. Product overview

### 4.1. Physical properties\*

| Product            | Length(mm) | Width(mm) | Height(mm) | Weight(kg) |
|--------------------|------------|-----------|------------|------------|
| CCM 60W            | 232        | 92        | 92         | 2.7        |
| CCM 120W           | 240        | 120       | 123        | 4.7        |
| CCM 200W           | 320        | 120       | 123        | 5.8        |
| CCMI 30W           | 232        | 123       | 135        | 3          |
| CCMI 70W           | 240        | 155       | 162        | 5.1        |
| CCMI 180W          | 320        | 155       | 188        | 6.5        |
| CCMI 100W + TOMBAK | 240        | 180       | 162        | 6.7        |

\* The values stated are some examples of CCM/CCMI configurations. For any other configuration, please contact AERODIODE for more information. For the TOMBAK option, you have to add 25mm on the width.

### 4.2. Ports description



#### 1. 24 Vdc / 10 to 40 A Power IN

Power supply location for the CCMI device (24 Vdc  / up to 40A\*)

\*depends on laser diode power

#### 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 CCMI driver to the PC. Use the specific USB cable supplied with your device

**5. Daisy output**

3.5mm output jack used to chain multiple CCMI drivers or any other device from the AERODIODE line (CCMI, 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. 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.

**9. Alarm output** [left: signal / right : GND]

Output connector for alarm status monitoring (power, current, temperature) (low level indicates alarm)

**10. Monitoring electronic component temperature**

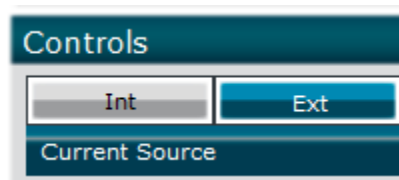
Allows temperature monitoring when using the device on external monitoring mode (25°C corresponds to 1.125 V) [left: signal / right : GND]

**11. Monitoring current**

Allows current monitoring when using the device without the software (185 mV/A)  
[left : signal / right : GND]

**12. 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 CCMI 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



## 5. Getting Started

### 5.1. Installation

#### Caution

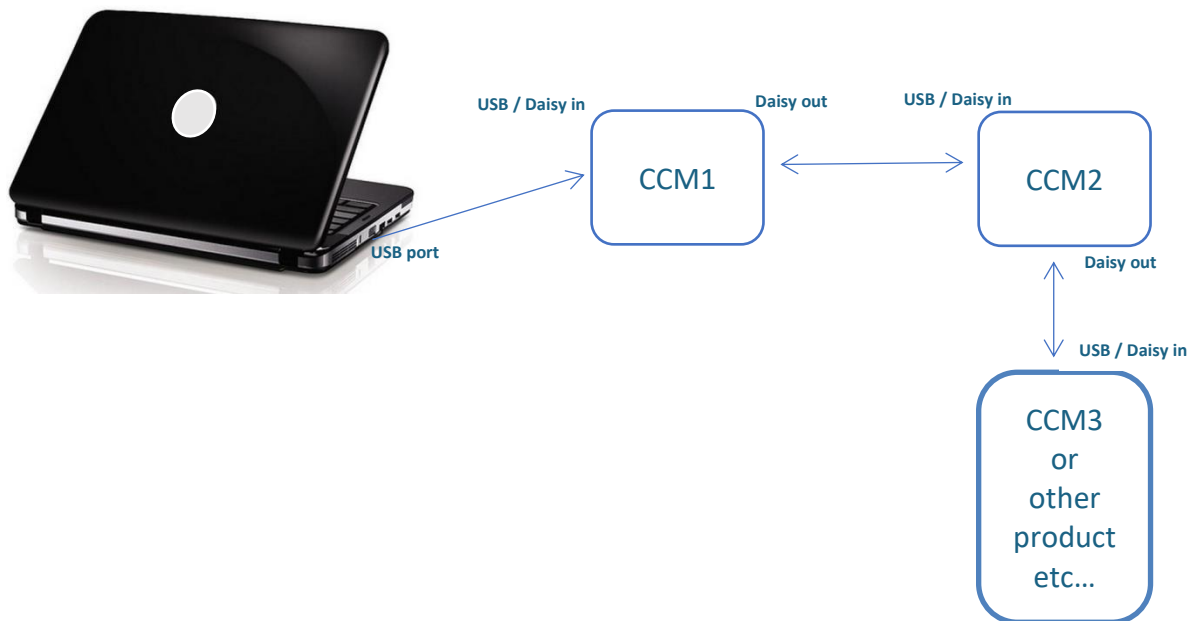
The CCMI USB specific cable should be unplugged during the installation.

#### 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 CCMI.
- If you have several CCMI's or other AeroDIODE electronic modules, you can connect them together on a unique USB port by chaining them :



- Finally, connect the product to a 24 Vdc  power supply.

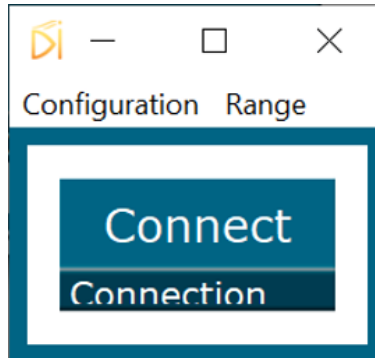


**WARNING**

**Use adapted electrical wires that can handle enough current to connect the CCMI to the power supply.**

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

A window appears:



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

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



## 5.2. Software overview



CCM 19B999999 - Line 1 - Aerodio...
— □ ×

File Config Info

Maxima

0,00 A

Max Current

Laser

On

Off

Laser Activation

Controls

|                |      |              |     |                   |       |
|----------------|------|--------------|-----|-------------------|-------|
| Int            | Ext  | DCC          | APC | CW                | Pulse |
| Current Source |      | Control Mode |     | Functionment Mode |       |
| Man            | Auto | 5,000 V      |     | Pulse Settings    |       |
| Voltage Adj.   |      | APC Setpoint |     |                   |       |

Settings

|             |             |             |             |
|-------------|-------------|-------------|-------------|
| 0,00 A      | 0,00 V      | 3 μs        | 14,50 °C    |
| Diode Curr. | Set Voltage | Laser Slope | Laser Temp. |

Measures

|             |             |             |          |
|-------------|-------------|-------------|----------|
| 0,00 A      | 0,00 V      | 0,00 °C     | 0,000 V  |
| Diode Curr. | Diode Volt. | Laser Temp. | PD_EXT_1 |
| 0,00 °C     | 0,00 A      | 0,00 V      | 0,000 V  |
| Elec. Temp. | TEC Current | TEC Voltage | PD_EXT_2 |

Alarms

EXT/CPU

Laser T°C. Max

Elec. T°C Max

PD\_EXT\_1

PwrSup

Laser T°C Csg

Diode Voltage

Max. level ←


Controls

Parameters

Measurements

→ Laser Enable

Alarms



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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 CCMI module (see bellow). The floppy disk logo indicates that these values can be stored into the CCMI 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 CCMI 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 =  $12.1 \times 1.10 = 13.3\text{ A}$
- Max voltage =  $13.4 + 2.0 = 15.4\text{ V}$

### 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 12 of Page 9). 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)

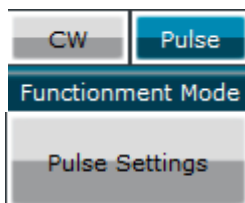


Direct Current Control / Automatic Power Control

Save the photodiode signal level for the constant power mode (see Page 9)

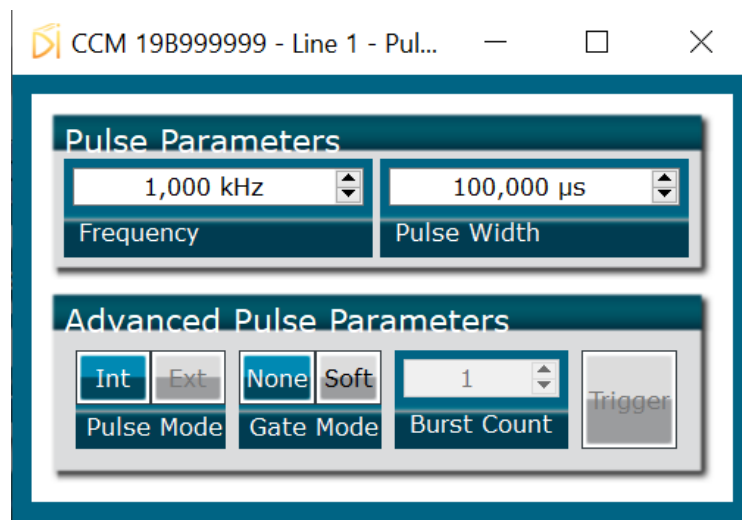
## 5.6. CW/pulse operation

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 CCMI hardware. **External** is not available at this time
- **Gate Mode:** if set to **None**, the CCMI 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

|             |     |
|-------------|-----|
| 0.00 A      | ▲ ▼ |
| Diode Curr. |     |
| 0.00 V      | ▲ ▼ |
| Set Voltage |     |
| 3 μs        | ▲ ▼ |
| Laser Slope |     |
| 25.00 °C    | ▲ ▼ |
| Laser Temp. |     |

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.

0.00 V  
Diode Volt.

Indicates the current passing through the laser diode

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

1.00 V  
TEC Voltage

1.072 V  
PD\_EXT\_1

1.247 V  
PD\_EXT\_2

Indicates the current passing through the TEC

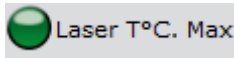
Indicates the total voltage applied to the TEC

Indicates the Photodiode 1 voltage

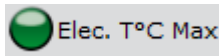
Indicates the Photodiode 2 voltage



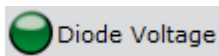
## 5.9. Alarms



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



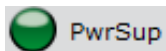
Red light indicates that a sensitive electronic component has reached a critical high temperature.  
Orange light indicates that the CTN cable is disconnected



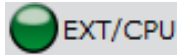
Red light indicates that the chosen voltage differs from the diode's nominal voltage.



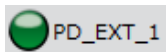
Red light indicates an issue with the temperature regulation.



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 CCMI 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. Configuration examples

### 6.1. How to run the laser in CW/pulse mode with the GUI\*

In CW mode :

- Make sure that the "Fonctionment Mode" is on "CW".
- Write in "Diode Curr." The diode current you would like to apply in the laser diode.
- Choose between "Man" or "Auto" in "Voltage Adj." to adjust the diode voltage.
- Press "ON" on "Laser Activation".

In Pulse mode :

- Make sure that the "Fonctionment Mode" is on "Pulse"..
- Write in "Diode Curr." the diode current you would like to apply in the laser diode.
- Choose between "Man" or "Auto" in "Voltage Adj." (recommended you in pulse mode to use you the "Man" in Pulse mode)
- Press " ON" on "Laser Activation".



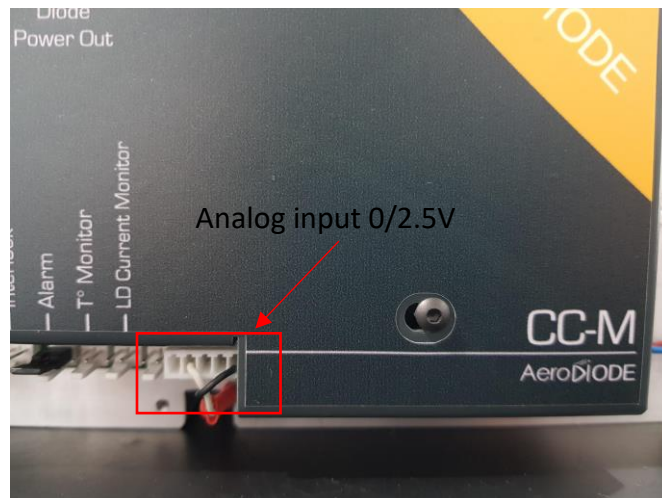
## 6.2. Use of optional TOMBAK to generate full adjustable pulses

The CCMI could be used with a TOMBAK product to pulsed the high power laser diode.

In this case, the TOMBAK can be mounted/unmounted on the other side of the heat sink as shown below. The TOMBAK is a synchronization electronic board usable as standalone pulse generator, delay-pulse generator, frequency divider and synchronization of various equipment (analog triggering to digital pulses). Please refer to the TOMBAK user-manual for full description.

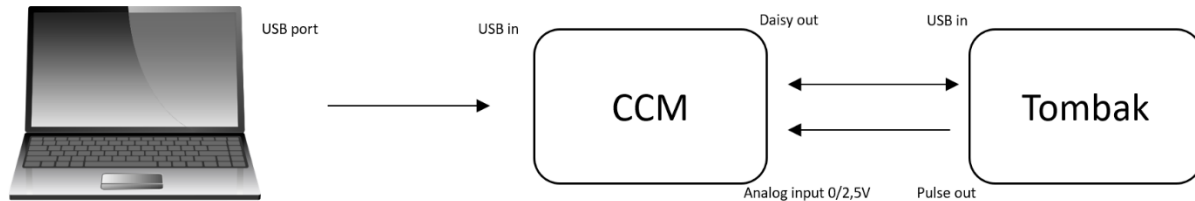


The output of the TOMBAK (Pulse Out) need to be connected to analog external current input of the CCMI using a SMA to Molex KK connector (5-pins) as show below. The “Pulse-Out” signal of the TOMBAK must be adapted to 2.5V high load.



The TOMBAK could then be powered up using the dedicated 5V DC power supply. The CCMI could also be powered up using the 24V DC power-supply. The products need to be connected to the

computer using two USB/jack cables or using one USB/jack cable to the computer and a jack/jack cable to the other product using the daisy chained functionality (Daisy-Out connector of a product to USB-In of the second). After managing cables and power, click on Connect of the Control Software to open the two GUI windows.



After managing cables and power, click on Connect of the Control Software to open the two GUI windows.

The TOMBAK could be used in “Gen” Mode and the output frequency is adjusted using the division factor shown in yellow below (output frequency = 200 MHz / Ndiv). The pulse-width could be also adjusted (500µs in the example below).

The CCMI must be used in “External current source” in order to be able to send current to the laser diode according to the analog voltage (2.5 V means 100% of maximum current). Manual voltage adjustment is best for pulsed operation and enter a non-zero voltage according to the diode requirement for the desired current. The current can be adjusted and limited using the “Max Current” at the top of the GUI.

Press “board ON” for the TOMBAK and “Laser ON” activation on the CCMI to get pulses.



CCM 20B10010 - Line 1 - Alphanov Control Sof...

File Config Info

**Maxima**

5,00 A 24,0 V

Max Current Max Voltage

**Laser**

On Off

Laser Activation

**Controls**

Int **Ext** DCC APC CW Pulse

Current Source Control Mode Functionment Mode

Man Auto 0,000 V

Voltage Adj. APC Setpoint Pulse Settings

**Settings**

0,00 A **5,00 V** 3  $\mu$ s 25,00  $^{\circ}$ C

Diode Curr. Set Voltage Laser Slope Laser Temp.

**Measures**

|                    |             |                    |          |
|--------------------|-------------|--------------------|----------|
| 0,05 A             | 0,00 V      | -1,00 $^{\circ}$ C | 0,970 V  |
| Diode Curr.        | Diode Volt. | Laser Temp.        | PD_EXT_1 |
| 25,22 $^{\circ}$ C | 0,00 A      | 0,01 V             | 1,211 V  |
| Elec. Temp.        | TEC Current | TEC Voltage        | PD_EXT_2 |

**Alarms**

EXT/CPU Laser T $^{\circ}$ C. Max Elec. T $^{\circ}$ C Max PD\_EXT\_1

PwrSup Laser T $^{\circ}$ C Csg Diode Voltage

PDG 20E10048 - Line 2 - Alphanov Control Software

File Config Info

**Working Mode**

On Off On Off On Off

Board Shaper Inverse

High Pick Gen Sync

Advanced Mode

ALPHA NOV  
Centre Technologique Optique et Lasers

**Input Pulse**

0,000 V 200,000 MHz

Threshold Pulse Freq.

200000000 Direct Daisy Intern Phot

Division Source

**Synchro Input**

Int Ext None Gate Burst Soft Trigger

Synchro Source Mode

100,000 kHz SMA Daisy 1

Frequency Gate Source Burst Size

**Output Pulse**

500,000  $\mu$ s 73,00 ns 4,50 ns

Width Delay Auto Fine Delay ☒

**Synchro Output**

Sync Trig Delay Pulse

Source Synchro 1

## 7. Technical specification

### 7.1. General Data

|                   |                     |    |
|-------------------|---------------------|----|
| Length            | 245                 | mm |
| Width             | 155                 | mm |
| Height            | 165                 | mm |
| Weight            | 6                   | kg |
| Power supply (DC) | 24 Vdc / 10 to 40 A |    |

### 7.2. Detailed data

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

