AeroDIODE

Cool & Control Series
CCS-*Low-Noise*
TDLAS

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Contents

Revision Sheet

Release No.	Date	Author	Revision Description
V1.0	22/07/2020	AMU	First version
V1.1	11/01/2020	AMO	Detailed description for type 2

Disclaimer

Information in this document is subject to change without notice.

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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

Caution
The compatible laser diodes used with the CCS-LN / TDLAS 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 CCS-LN / TDLAS driver with your laser diode.

WARNING
Do not try to open or remove the cover of the CCS-LN / TDLAS module

Note
Only use the genuine power supply, and the supplied USB cable

WARNING

Avoid all chocs and strains when handling the CCS-LN / TDLAS

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 CCS-LN / TDLAS should not be executed by the end user : only AERODIODE is able to maintain the CCS-LN / TDLAS.

2. Safety Instructions

2.1. Wiring

Caution
- Please first connect the input pin to the board and then plug the DC Power Supply to the power grid.
- 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 CCS-LN / TDLAS module.
- Connect the ground completely. Electric shock may occur if the ground is not connected correctly.

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 CCS-LN / TDLAS 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 CCS-LN / TDLAS module, please contact AERODIODE.

3. Package Content

The CCS-LN / TDLAS package comes with:

- 1 CCS-LN / TDLAS board
- 1 DC Power Supply (+24V DC / 2A)
- 1 USB type A to type B cable
- 1 USB Key with "AeroDIODE Control Software Suite" & User manual in .pdf
- 1 User Manual

4. Product overview

Physical characteristics		
Length	170	mm
Width (edge to edge)	107	mm
Width (Connector to connector)	141	mm
Height (top plate)	17	mm
Height with fins	30	mm
Weight	486	g

4.1. Front view of the product

1 **Modulation (SMA)**
   a. *In: Analog voltage input (-10V/+10V) to modulate the laser power (< 500 kHz)*
   b. *Out: Analog voltage output (50 ohm) to view the laser modulation*

2 **Power control (input SMA with 10kohm impedance)**
   a. CW: Laser continuous power adjustment (analog input). Apply a voltage between 0 and +5V for power adjustment.

3 **Laser status (blue LED)**
   a. On: The laser is ON in the software
   b. Ready: The laser is ready for emission (no alarm, interlock closed)

4 **Status (red/green LED)**
   a. Alarm: Red LED indicates that the product detects an alarm (temperature, power, …). Please check in the software interface the type of alarm
   b. Interlock: Red LED indicates that the product is not ready for laser emission. The BNC interlock on the rear is open, or an alarm is activated
   c. Power: Green LED indicates that the product is powered

5 **CW power adjustment (manual knob)**
   Knob for CW power adjustment. In order to use the knob, the current source should be selected to "POT" in the software (see §7.3).

4.2.   Rear view of the device

1. **DC power input (+24 VDC)**
Input connector for DC power. Use only the provided DC power supply.
2. **Earth connection of the product (4mm test patch cord)**
Input the earth into the jack connector to ground the product. This connection is not required for normal operation but can be used for maintenance purpose by AeroDIODE
3. **Daisy output (3.5mm jack)**
It is used to chain multiple AeroDIODE products with different addresses. Use jack input/output to serial chain products with a single USB connection to the computer
4. **USB input (3.5mm jack)**
Use a "FTDI 3,3V RS232" USB/jack (jack/jack if products are chained) to connect the product to a computer
5. **USB input (mini-USB B Type)**
Connect the product to the computer with a USB/USB cable
6. **Interlock (BNC)**
Input connector for interlock control. It must be shunt in order to have a laser emission.
7. *External temperature (not used for this application)*   *(SMA input with 10kohm impedance)*
Input a voltage between 0 V and +5 V to change the laser internal temperature
8. **Alarm monitor (SMA output, high impedance)**
Output a signal for alarm status (Power or Temperature) monitor. The signal is a direct LVTTL, so a +3.3 V output voltage level corresponds to alarm ON.

9. **BMF output (SMA with 50 ohm)**
Back facet monitor output. This analog signal gives an electrical signal that is a view of the laser optical output.

4.3. Top view of the device

10. **PD_Ext connector**

Molex connector to connect an external photodiode

5. Installation

5.1.   Butterfly Laser diode installation

The CCS-LN / TDLAS driver is made to drive butterfly type 1 (or type 2 on request) laser diodes (14 pins) with internal monitoring photodiode and thermoelectric cooler. The laser diode output fiber must go through the CCS-LN / TDLAS package.

WARNING

Please read carefully paragraph §10 for details about compatible pining and how to mount a type 2 laser diode.

Note

Use a torque screwdriver for the diode and please refer to the maximum allowed torque given in the diode specification (usually around 15 to 18cNm).

CCS-LN / TDLAS must be adapted to the type of butterfly laser diode : Standard CCS-LN / TDLAS are adapted for type-pinning laser diode (see §10).


**Fiber output direction
For SOA see bellow**

- Non-butterfly laser diode installation

In case a standard non butterfly laser diode is used (like TO form factor), It is relevant to order a CCS-LN/TDLAS without the Butterfly mounting sockets. This allows to solder the laser diode directly on the Board soldering pads.
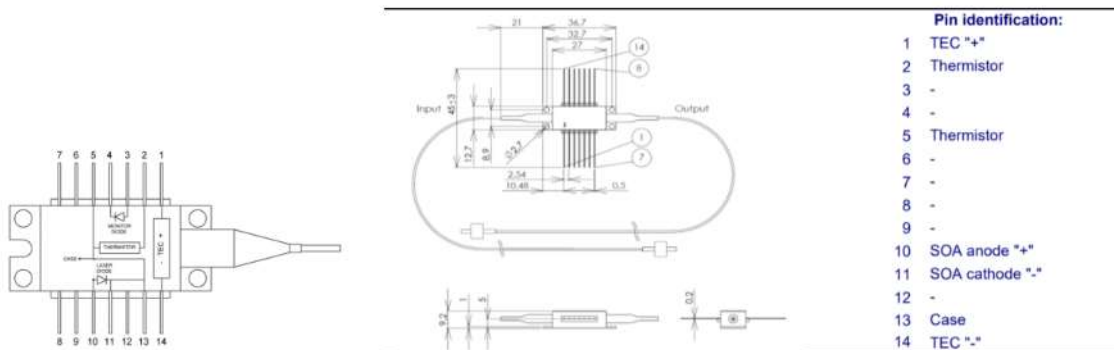
The anode must be soldered on pin 10 and the cathode on pin 11 (see the figure bellow showing pin 10 and 11 by analogy with a butterfly form factor pinning)
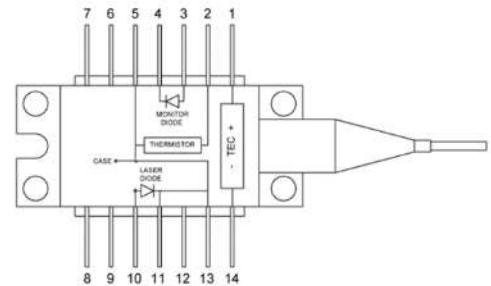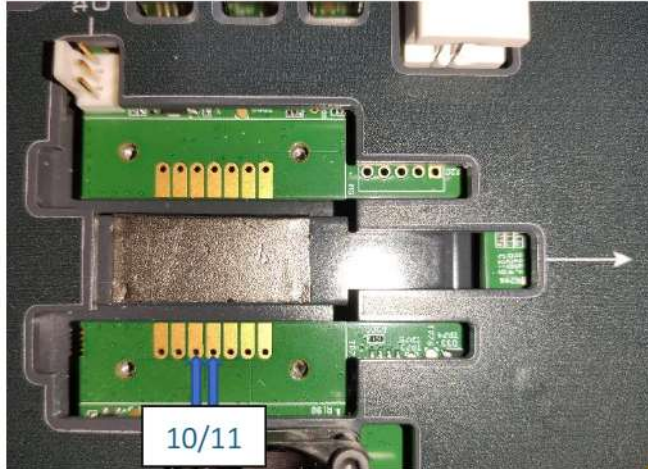
Note that the CCS-LN / TDLAS can be held vertically so that the laser diode emit horizontally.

5.2. SOA installation

In case a SOA is used, make sure the SOA is mounted in the correct direction. Refer to the pin of the SOA (below, right hand side) and compare with a standard Type 1 laser diode (below, left hand side) :

Pin identification:	
1	TEC "+"
2	Thermistor
3	-
4	-
5	Thermistor
6	-
7	-
8	-
9	-
10	SOA anode "+"
11	SOA cathode "-"
12	-
13	Case
14	TEC "-"

In the example above, one can see that the fiber output of the laser diode above (see CCS-LN / TDLAS picture with fiber direction) corresponds to the input of a SOA.

- Software installation

**The product USB specific cable should be unplugged during the installation.**
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.

6. Getting started

- When the software is installed, plug the USB cable into a USB port of your computer.
- Next, plug the USB cable in the USB input of the CCS-LN / TDLAS.
- Plug-in the CCS-LN / TDLAS power supply to turn on the CCS-LN / TDLAS laser diode driver

Click on the item "ALPhANOV Control Software" located in the Start Menu to run the CCS-LN / TDLAS control software.

A window will appear:
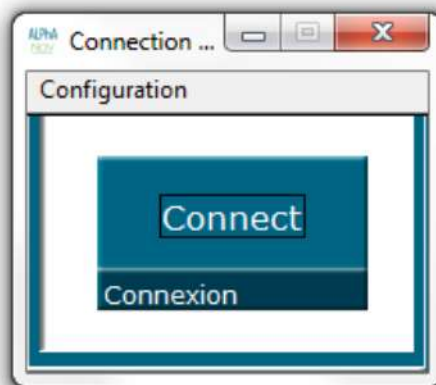
Click on Connect to start the product detection. The software will automatically detect any USB-connected AeroDIODE product.

A new window will appear for each CCS-LN / TDLAS driver.

The window for laser controls is shown below:

The window is divided in six parts:
1. **Maximum levels** : three numerical boxes change maximum allowed current (power)

2. Triggers in the **Control** part are used to select the operating mode

3. The **Configurations** part is for advanced options

4. Numerical boxes in the **Settings** part are used to configure the pulse width, amplitude and repetition rate and laser diode temperature

5. The **Measures** part contains read only numerical boxes used to monitor the module

6. The **Alarms** part shows green/red indicators for various status and a button to open a complete measure window

7. User interface description

This section describes all functions that could be used for CCS-LN / TDLAS product. Most of functions not described here are for pulsed mode operation which is not accessible with the CCS-LN/TDLAS.

7.1. Maximum levels

Use those numerical boxes to configure the maximum current (power). The values which can be entered in these numerical boxes are factory limited. The limits depend on various parameters such as the wavelength and the maximum allowed optical power.
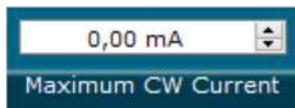
The absolute maximum continuous current in mA can be reduced here.

7.2. Control : control laser emission and operating mode


Enables/Disables the laser emission

ACC (automatic current control) mode must be used in order to drive the laser with a fixed current.
APC (automatic power control) mode is for driving the laser based on a fixed power (Not used for this application in pulsed regime).

7.3. Configuration

Click on the Input button in the configuration part to open a new window for advanced configuration settings
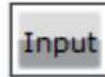
Input

In this window the user can change the source for adjusting the current from:

- INT: internal (software)
- POT: external adjustment with the manual knob (see control number 5 on §4.1.)
- EXT: external adjustment with the SMA input (see control number 2 on §4.1
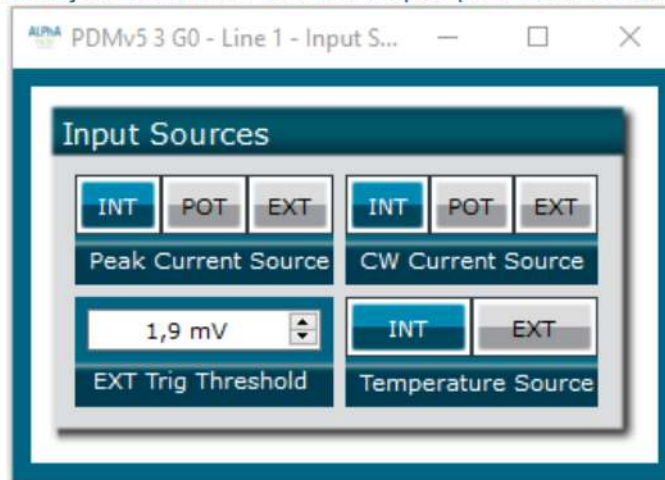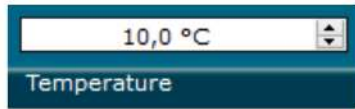

7.4. Settings: configure power and pulses

The values which can be entered in these numerical boxes are limited by maximum level (described in §7.1).
The user could apply a continuous power and a pulse power at both times. The continuous power applied will not change the peak power, it will act like a DC bias power (the only limitation will come from the maximum average current allowed).
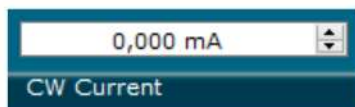
Continuous current in mA. This item can only be modified when the internal CW current source is selected
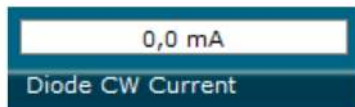
10,0 °C	⬍
Temperature	

This item configures the internal temperature of the laser diode (on the range 10°C/50°C). The typical value is 25°C and it is not recommended to change it for this application
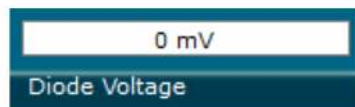
7.5. Measures: read only product monitoring

The numerical boxes below are read-only and can't be modified by the user.
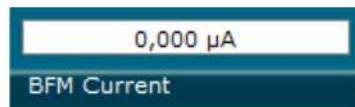
0,0 mA
Diode CW Current

Hardware measurement of continuous current (when a non-null continuous current is applied)

0 mV
Diode Voltage

Hardware measurement of the diode voltage

0,000 µA
BFM Current

Hardware measurement of average optical power returned by the laser's internal photodiode. The value is not calibrated and depends on the laser source

0,000 µA
PD_EXT Current

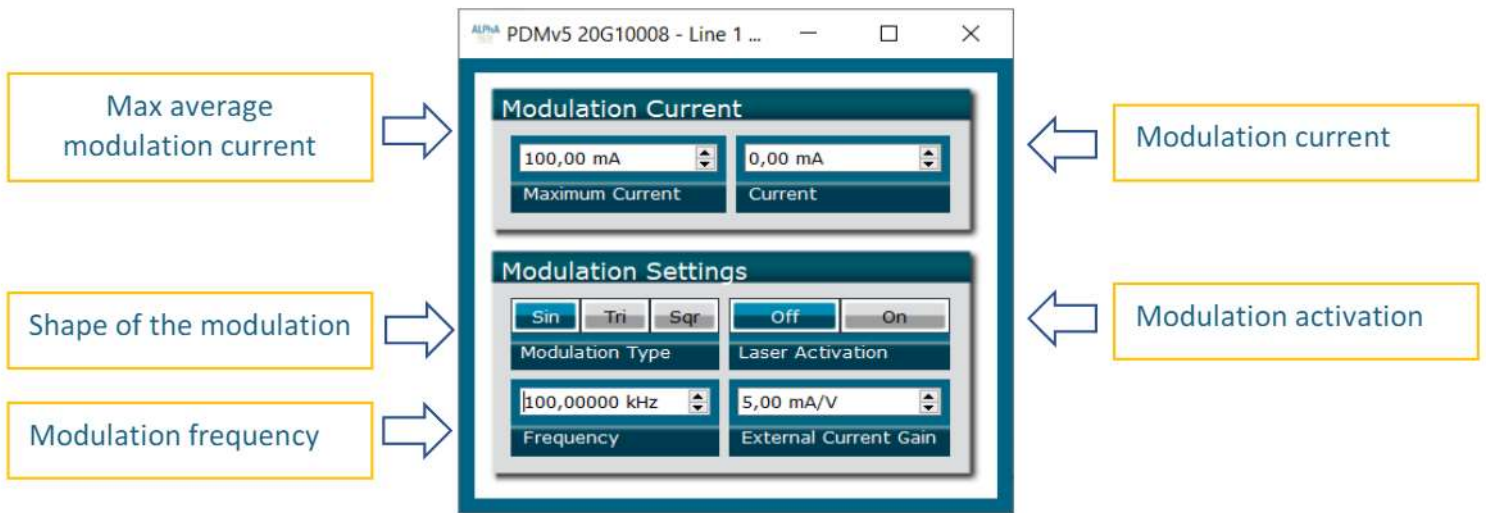*Optional.* If present, hardware measurement of average optical power returned by external photodiode

0,000 °C
Diode INT Temp.

Hardware measurement of internal temperature of the laser. It should be near the temperature setpoint.

7.6. Modulation (available only on the TDLAS)

Max average modulation current	⇒
Shape of the modulation	⇒
Modulation frequency	⇒

A CW current could be also applied on the main window to obtain a complete positive current modulation.

7.7. Alarms

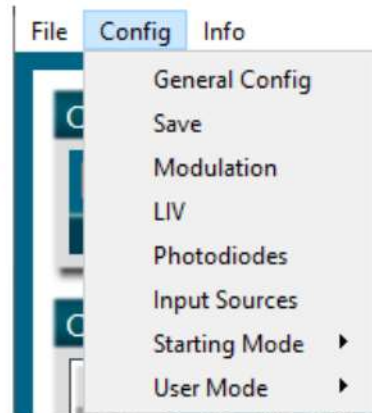|	
Key	*(Legacy indicator)* Red light indicates that the key is on the OFF position.
Ext Interlock	*(Optional)* Red light indicates that an external interlock is detected
System	Red light indicates that the product returns an internal alarm
Power	Red light indicates that the product is limited by the maximum average current (power). When alarm is ON the laser is temporally OFF until the average current reach below the maximum
Temperature	Red light indicates the temperature is too far from the setpoint (+/-1,5°C). When alarm is ON the laser is temporally OFF until the consign temperature is reached
More Measures	This button will open a new window to have more measures. It should be useful in case of technical support

8. Menu bar

The menu bar contains three main menus :

- **File:**
    - **Load parameters**: *prevision (does nothing)*
    - **Save parameters**: *prevision (does nothing)*
    - **Exit:** Close the window. The laser state can be either active or inactive after the software is stopped.

- **Config:**
  - **General Config**: *reserved*
  - **Save**: save all the current operating parameters into the product internal memory. These parameters will be saved as default parameters in the flash memory and will be retrieved by the product at the next power on (even if the product is not connected to the PC).
  - **Modulation**: *not used for this product*
  - **LIV**: *not used for this product*
  - **Photodiodes**: *not used for this product*
  - **Input source**: *same as described in §7.3*
  - **Starting Mode** can be used to change the way the product starts
    - ➢ **Previous OEM:** the product starts with the same parameters that were previously set. **So if the laser activation is set to ON and parameters saved into memory, the lasing will be effective after a shutdown.**
    - ➢ **Previous:** (default) the product starts with the same parameters that were previously set except the laser activation which is forced to OFF
    - ➢ Zero current: with the same parameters that were previously set except the current value that is set to zero and laser activation forced to OFF
    - ➢ Low Alarm with the same parameters that were previously set except the maximum values that are set to a minimum, the current value that is set to zero and laser activation forced to OFF
    - ➢ Central activation: *reserved, not used for this product*
    - ➢ MMD activation: *reserved, not used for this product*
  - **User Mode**: *reserved*

- **Info:** Displays information about the current version and the internal parameters and open the full measures window

9. Technical Specifications

9.1. General Data

Length	170	mm
Width (edge to edge)	107	mm
Width (Connector to connector)	141	mm
Height (top plate)	17	mm
Height with fins	30	mm
Weight	486	g
Power connector (Jack, positive tip)	5,5	mm
Power supply (DC)	24V / 2A	
Safety Features	Interlock	
	Over Temperature Protection	
	Laser Current Limit	

9.2. Detailed data

CCS-LN / TDLAS	Min	Max	Resolution	Impedance	Bandwidth
Operating temperature	-15°C	+40°C			
Storage temperature	-25°C	+70°C			
Operating Altitude	_	2000m			
Output current for CW mode	0 A	2000 mA	12 bits		
Output current for modulation	0 A	100mA			150kHz @3dB
Laser Diode Temperature	10°C	60°C	16 bits		
BNC peak power adjustment	0 V	5 V		47 KOhm	15 Hz
Alarms	0 V (active)	5 V (Not active)		1 KOhm	

APENDIX

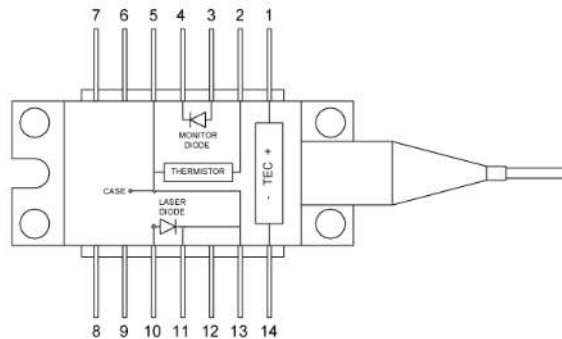## 10.   Supported laser diodes

### 10.1. Type 1 Butterfly laser : standard CCS-LN / TDLAS

Standard CCS-LN / TDLAS are well adapted for Type 1 Butterfly laser diodes :

10.2. Type 2 Butterfly laser: CCS-LN / TDLAS-Type2 ("Type 2" sticker on top of the product)
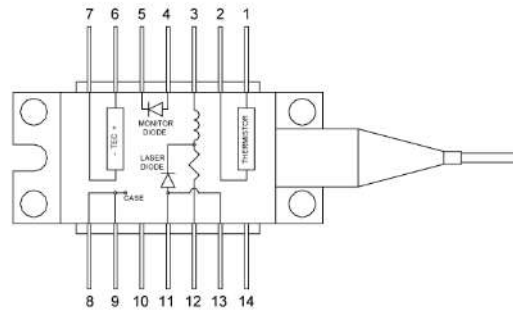
Type-2 and Type-2 Bias-T laser diode are compatible with the CCS-LN / TDLAS – Type 2. Standard two pinouts of type-2 with floating anode are shown below.

Type 2 laser diodes require the CCS-LN / TDLAS "Type-2" version :
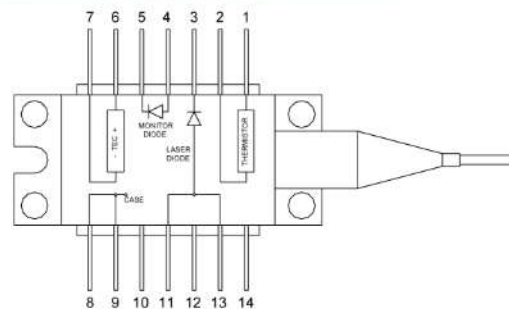
Type 2 with Bias-T laser diodes require the CCS-LN / TDLAS "Type-2" version :

If the anode of type-2 laser (pin 11 or/and 13) is connected to the case (ground) (pin 8 or/and 9) the type-2 diode is called "anode grounded". As the product is intended for use with positive driven current, the current will go directly to the ground without going through the cathode of the laser diode. In this case, the user should mechanically isolated the laser diode by using furnished resin screws (M2,5 screws) and a thermal pad (electrical insulator) between the diode case and the base plate.
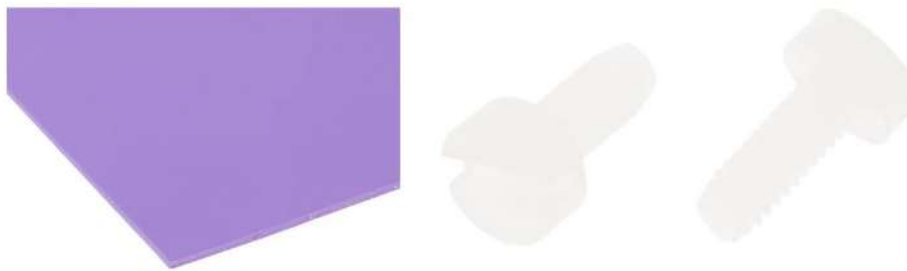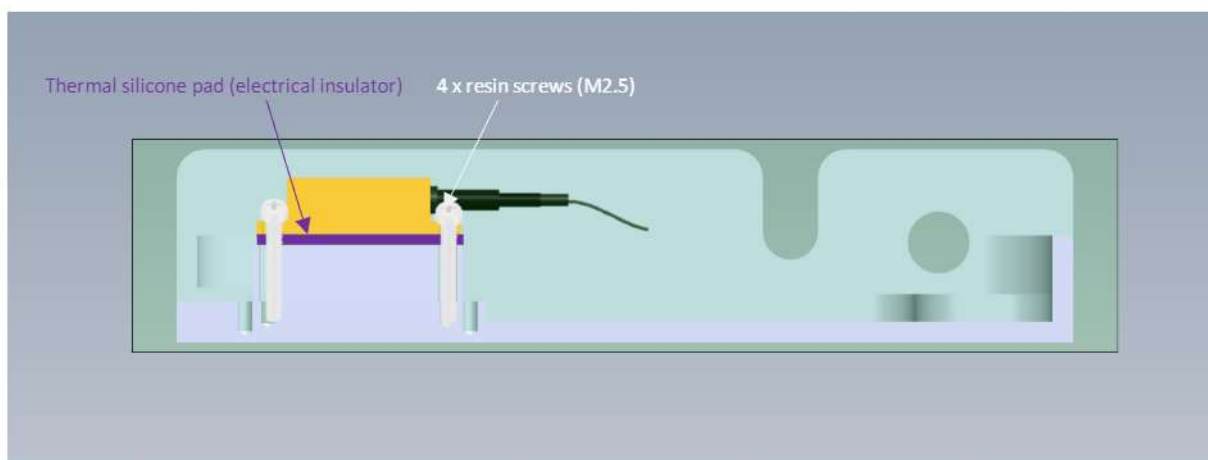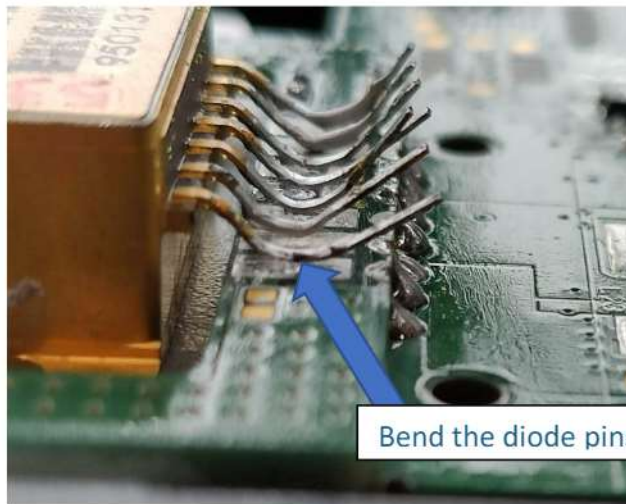

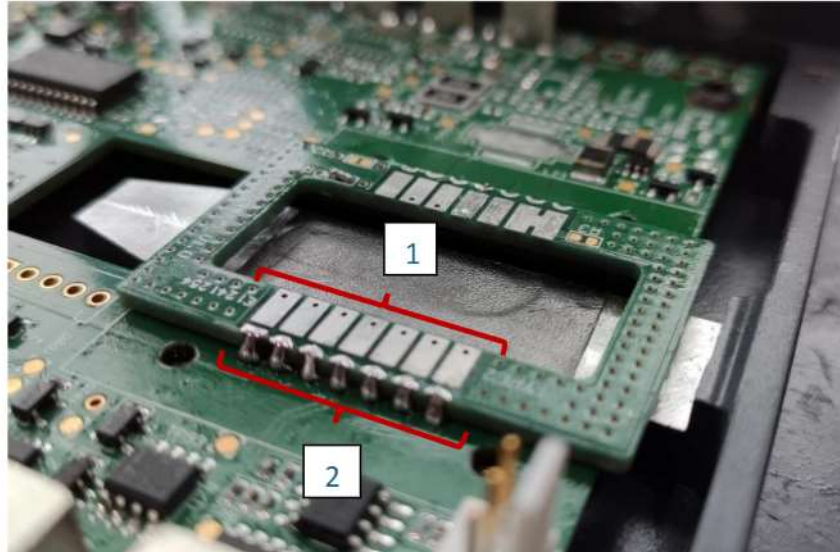**Figure 1 : Silicone thermal pad and resin screws**

Figure 2 : Cross-section view for mounting type-2 anode grounded laser diodes

The type 2 laser diode must be soldered to the product.

WARNING

Care must be taken not to connect the pads (1) to the holder's pins (2) when soldering the diode !

Bend the diode pins as shown