

APS

ADVANCED PHOTONIC SCIENCES

SmartLaser™ **Operating Manual & Datasheet**

Version 1.0.1



05/02/2022

1 Introduction

Advanced Photonic Sciences' new SmartLaser™ product is a plug-and-play device used to operate laser diodes of various size and power.

The SmartLaser™ product is universal in nature, allowing quick and easy operation and swift interchangeability of any laser diode from our Smart Sub-Mount Series. With fine temperature adjustment and integrated convective cooling, this device offers laser sources of ranging powers and tunable wavelengths for various applications.

The Smart Sub-Mount Series features an array of diode choices including 3.8mm, 5.6mm and 9mm TO-style package sizes. The Sub-Mounts are preset and are interchangeable, allowing the user to operate various diodes with just a single SmartLaser device. Use of this device requires minimal experience and very few adjustments. Important parameters are shown in Section 2.

Operating procedures remain constant regardless of the diode Sub-Mount selected. They are discussed in Section 3. The removal and replacement of Smart Sub-Mounts (changing Laser Diodes) is a seamless process, and is explained in Section 3.4.

The compact assembly, which includes a 3D printed enclosure, aluminum heat sink, TEC, and integrated circuitry, is further described in Section 5. Dimensional drawings are shown in Section 6.

This product is designed to be partially dis and re-assembled when replacing the Sub-Mount. The device should not be disassembled any further than described in Section 3.4 as to avoid risking functionality and/or warranty. This is expanded upon in Section 7. This document should be read thoroughly before attempting operation of this device in order for the user to get the most of their new product.

Features

- Plug-and-Play Diode Modules with Swift Interchangeability
- Integrated Air Cooling
- TEC Based Temperature Control
- Automatic Current Control
- Push-Button Activated
- USB-C Powered
- Adjustable Aspheric Collimation

Applications

- Laser Testing and Experimentation
- Alignment Systems
- Spectroscopy
- Environmental Testing
- Biology and Biochemistry
- And More...

Contents

1	Introduction	1
2	Specifications	2
3	Operation	3
3.1	Standard Operation	3
3.2	Temperature Control	3
3.3	Measuring Laser Current	4
3.4	Interchanging Smart Sub-Mounts	4
4	Troubleshooting	6
5	Mechanical	7
5.1	SmartLaser™ Assembly	7
5.2	Smart Sub-Mount Assembly	7
6	Drawings/Dimensions	8
6.1	Drawing	8
7	Packaging and Handling	9

2 Specifications

Discipline	Parameter	ILS-445-50	
Mechanical	Width	3.50in.	
	Depth	2.50 in.	
	Height	2.67 in.	
	Weight	1 lb.	
	Beam Height	2.15 in.	
	Operating Temperature	0 - 85 ⁰ C	
	Storage Temperature	0 - 100 ⁰ C	
Electrical	Max Operating Current	3 A	
	Operating Voltage	5.5 V	
	Connector Type	USB-C	
	Bandwidth	C.W.	
	Current Setpoint	Internally Configured	
	Monitoring Pins	Pin 1	Ground
		Pin 2	Current Set (Is)
Pin 3		Temperature Set (Ts)	
Optical	Wavelength	Diode Dependent*	
	Max CW Output Power	Diode Dependent*	

* **NOTE:** "Diode Dependent" parameters are reliant on the Diode Sub-Mount that is selected. Please refer to it's accompanying data sheet for specifications. A full list of available Smart Sub-Mounts can be found at www.apslasers.com

3 Operation

This section goes through the various controls and auxiliary functions of the Smart-Laser™ device.

IMPORTANT: Always ensure that the Laser Safety Shutter is in place before applying power or operating this device. Practice proper laser handling procedures.

3.1 Standard Operation

This device was designed to be easily operated by even those with limited laser expertise. Ensuring the shutter is in place, apply power to the device using any standard USB-C type cable, drawing power any source which include but are not limited to a wall outlet, computer or vehicle. Cooling fans will begin operating as an indication that power is supplied to your device.

In a safe environment, the shutter can then be removed. The laser is turned on using the red push button. Controls are shown in Figure 1.

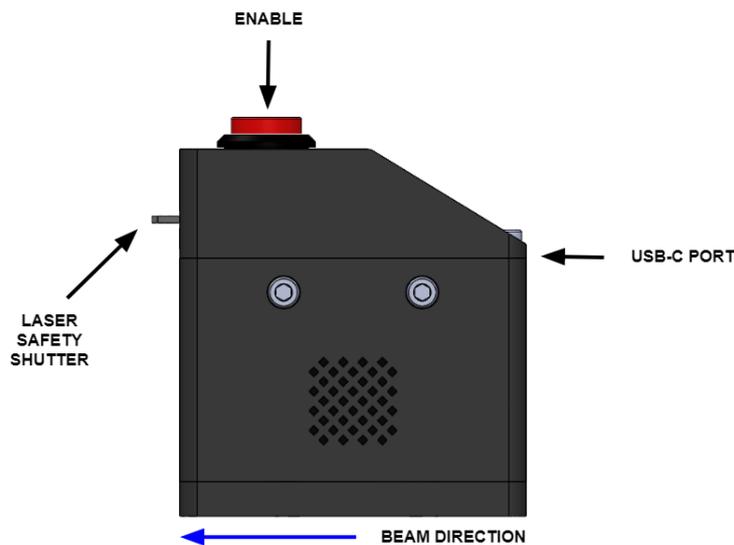


Figure 1: Standard Operation

3.2 Temperature Control

The temperature is controlled through a TEC and heatsink which is convectively cooled through internal fans. The TEC is controlled electrically via a PID (Proportional, Integral, Derivative) loop which allows the user to have precise temperature operation without electrical fluctuations. To measure the temperature, connect a multi-meter between Ts

and Ground (Pins 3 and 1). The resulting voltage, V_T , will be a function of the thermal resistance from the thermistor:

$$R_{th} = - \left[\frac{19,100 \cdot \left[\frac{V_T}{63875} - \frac{1}{51,100} + \frac{1}{42,200} \right]}{\left[\frac{V_T}{63875} - \frac{1}{51,100} + \frac{1}{42,200} \right]} \right] \quad (1)$$

Use Equation 1 to determine the thermal resistance and apply it to the well-known and application specific Steinhart-Hardt Equation:

$$T = \left[(1.1279 * 10^{-3}) + (2.3439 * 10^{-4} \cdot \ln R_{th}) + (8.7298 * 10^{-8} \cdot (\ln R_{th})^3) \right]^{-1} - 273. \quad (2)$$

These equations, 1 & 2, provide the user with temperature (in Degrees Celsius) information of the Smart Sub-Mount assembly, and can be changed by using the potentiometer on the main circuit card of the device. If erroneous values occur, ensure that the Smart Sub-Mount is properly connected and the spring contacts are activated. If there is still an issue, contact **APS** for support.

3.3 Measuring Laser Current

The current on this device is solely controlled through each Smart Sub-Mount assembly. This means that the user cannot change the current for the laser diode that is being used, but can measure it to make sure the device is functioning properly or to gather data for experimentation. To measure current, use the Is and Ground (Pins 2 and 1) with a multimeter to get V_I . V_I is a voltage that can be converted to current as follows:

$$I_{Laser} = 10 \cdot V_I. \quad (3)$$

Contact **APS** for additional information or to request the ability to change the current for each Smart Sub-Mount.

3.4 Interchanging Smart Sub-Mounts

The system was designed for easy diode removal and replacement. As mentioned, laser diodes are housed in the Smart Sub-Mount, shown in Figure 2. The Sub-Mount can be accessed by removing the four #4-40 bolts securing the cover to the device. Upon removing the cover, the user can then access and remove the Sub-Mount.

A new Sub-Mount can be reassembled via the same method. Ensure the Sub-Mount is secured evenly to register the spring-pin connectors with the main control board. The Sub-Mounts are designed to stay assembled and are preset. They require no user input.

The user can make temperature adjustments on the PCB and monitor parameters prior to reassembling the device cover. A diagram of the Sub-Mount removal is shown in Figure 3.



Figure 2: Smart Sub-Mount (Laser Diode Housing)

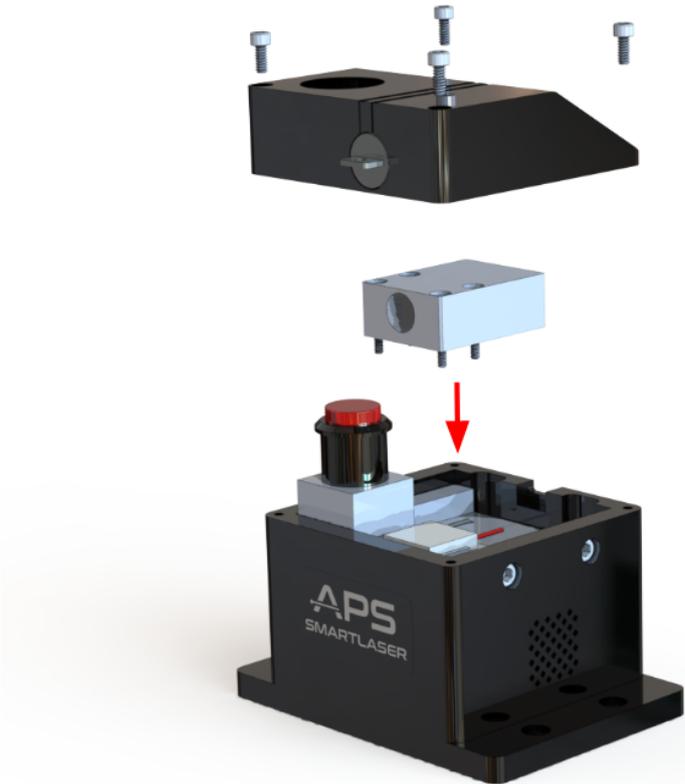


Figure 3: Smart Sub-Mount Replacement

4 Troubleshooting

Because the Smart Sub-Mounts connect to the SmartLaser™ via spring contacts, it is important to make sure that these two systems are properly attached. Over-tightening one bolt on the Sub-Mount and not evenly distributing the load across each mounting hole in a "star-pattern" could cause open circuits for each of the contacts. There could also be thermal runaway if the device is operating in an environment not within the specifications in Section 2. This will shut down the device not allow the laser to operate. If any other issues occur, contact **APS** for assistance.

5 Mechanical

5.1 SmartLaser™ Assembly

The SmartLaser assembly includes various components which together make a compact, lightweight and safe product. An exploded view of the assembly is shown in Figure X.

This product features an entirely 3D printed enclosure, comprising of a case and a removable cover. The polymer material keeps heat transfer to a minimum, resulting in a safe-to-touch device.

An aluminum heat sink is mounted within the case via four (4) #6-32 bolts such that the two cooling fans blow air through the extended heat sink fins, actively removing heat during operation.

Mounted to the surface of the heat sink is a peltier or thermoelectric cooler, the main PCB, and the push button. All components mentioned thus far are assembled prior to packaging and are not to be tampered with or disassembled.

The removable Smart Sub-Mount is mounted to the heat sink via four (4) #4-40 bolts, sandwiching the TEC beneath, and registering the 6 spring pin connectors to their corresponding ports on the PCB.

The 3D printed cover encloses the device, mounted by four (4) #4-40 bolts, and exposing only the push-button, USB-C port, and the laser aperture, which is fitted with an aluminum Laser Safety shutter.

Measures should be taken to prevent static from interfering with the device when the cover is removed, and during operation. As stated, the only components that should be disassembled are the cover and the Sub-Mount. Removal or tampering with of any other components present the risk of damaging your device or voiding warranty. All necessary inputs, outputs and controls are exposed to the user eliminating any need for disassembly of the enclosure during operation. Dimensions of this device are shown in Figure 3.

5.2 Smart Sub-Mount Assembly

The Smart Sub-Mount is a sub-assembly that houses the selected laser diode, thermistor, receptacle PCB and collimating lens. Dimensions of this component are shown in Figure 4.

The sub-assembly, manufactured by APS, includes the chosen laser diode which is mounted internally via epoxy. The thermistor is glued to the rear face of the diode in order to get the most accurate temperature reading. The receptacle board is tuned to the diode before being epoxied in place. A small 3D printed plug is inserted into the backside to seal the module as to prevent any particles from entry.

The collimating lens is threaded into the front face of the module, and can be inserted either before or after assembly to the SmartLaser device. Some may find it easier to insert the collimator through the device cover after the reassembly.

Similar to the SmartLaser device, the Sub-Mount assemblies are assembled at APS and are not to be tampered with by any means. If your device is not working as it should, please contact support.

6 Drawings/Dimensions

6.1 Drawing

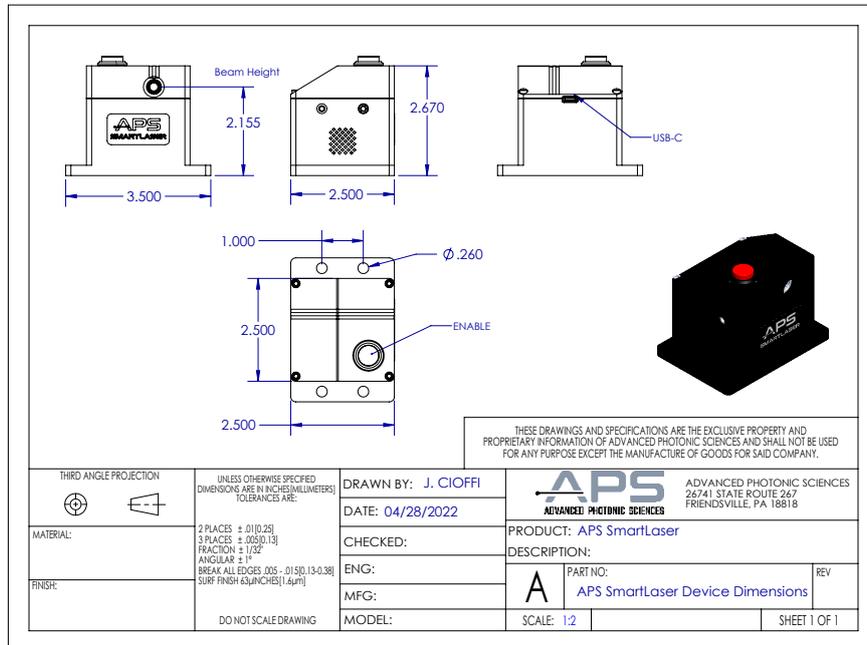


Figure 4: SmartLaser Device Dimensions

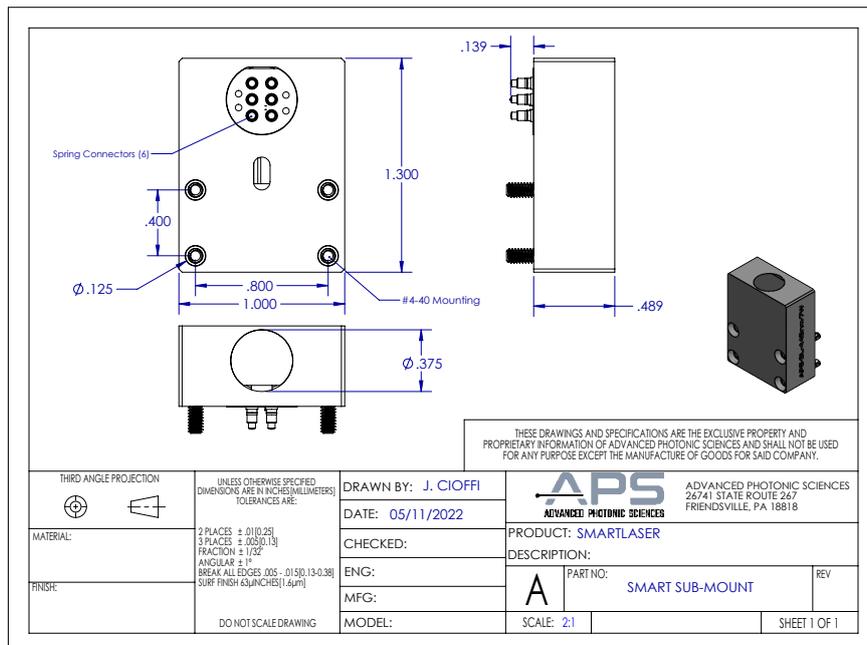


Figure 5: Replaceable Smart Sub-Mount Dimensions

7 Packaging and Handling

This product is assembled before packaging and shipping.
System Weight: 3 lbs

Revisions

Revision -	Initial Documentation
Revision 1	

Support

Please contact Advanced Photonic Sciences for technical support: www.apslasers.com



Advanced Photonic Sciences
26741 State Route 267
Friendsville, PA 18818
(570) 553-1120
info@apslasers.com