OceanOptics


# Raman Laser Multi-Mode Narrow Linewidth

# Locations


## Americas

**Manufacturing & Logistics**
3500 Quadrangle Blvd.,
Orlando, FL 32817, USA

**Sales:** info@oceanoptics.com
**Orders:** orders@oceanoptics.com
**Support:** support@oceanoptics.com

**Phone:** +1 727-733-2447
**Fax:** +1 727-733-3962

**Photonic Systems**
176 Anderson Avenue, Suite F304,
Rochester, NY 14607 USA

www.oceanoptics.com

## Europe, Middle East & Africa

**Sales & Support**
Geograaf 24, 6921 EW Duiven,
The Netherlands

**Logistics**
Maybachstrasse 11,
73760 Ostfildern,
Germany

**Email:** emeasales@oceanoptics.com

**Netherlands:** +31 26-319-0500
**Netherlands Fax:** +31 26-319-0505
**Germany:** +49 711-341696-0
**UK:** +44 1865-819-922
**France:** +33 442-386-588

## Asia

**Ocean Optics China**
3F, Building 16, No. 155
Yuanke Road, Minhang District
Shanghai 200336
People's Republic of China

**Email:** asiamkt@oceanoptics.com

**China:** +86 400-623-2690
**China Fax:** +86 21-6295-6708
**Japan & Korea:** +82 10-8514-3797
**Ocean Optics India:** +91 81 7847-0108
Prestige Shantiniketan, Gate No. 2,
Tower C, 7th Floor, ITPL Main Road,
Whitefield, Bengaluru, Karnataka 560 048, India

# TABLE OF CONTENTS

# 1 Product Introduction

## 1.1 Overview

ORL Series Multi-Mode Narrow Linewidth Lasers cover multiple laser wavelengths ranging from 532 nm to 1064 nm. These lasers utilize proprietary technologies including the short-cavity method, volume Bragg grating (VBG) external cavity mode locking, and directional optical feedback to achieve stable narrow linewidth output. The lasers feature an all-metal housing integrated with a TE cooler, ensuring stable and reliable spectral and optical power outputs across a wide range of operating conditions.

The ORL product series is divided into two versions: Integrated diode laser, compatible with externally modulated laser power supplies; Integrated diode-pumped solid-state laser, compatible with external modulation-free laser power supplies.

The ORL Series Multi-Mode Narrow Linewidth Lasers deliver narrow linewidth, stable power, and stable wavelength outputs, making them widely applicable in fields such as Raman spectroscopy, fluorescence detection, and material analysis. The lasers include PC-based control software to monitor operational status and support online firmware updates. Additionally, Ocean Optics offers the ORP Series Raman probes to meet your application requirements for integrated solutions.

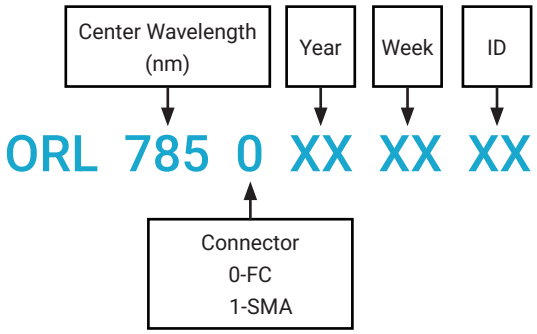

*ORL Series Multimode Single-Wavelength Laser*

## 1.2 Part Number

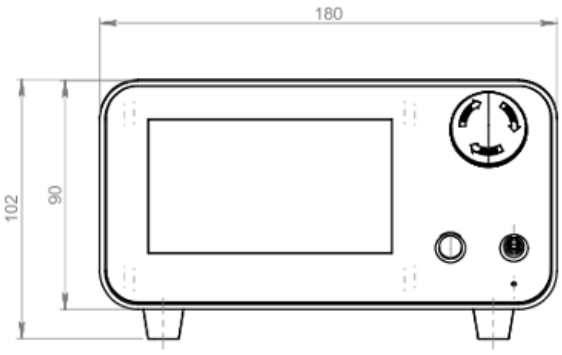
### ORL Series Multimode Single-Wavelength Laser

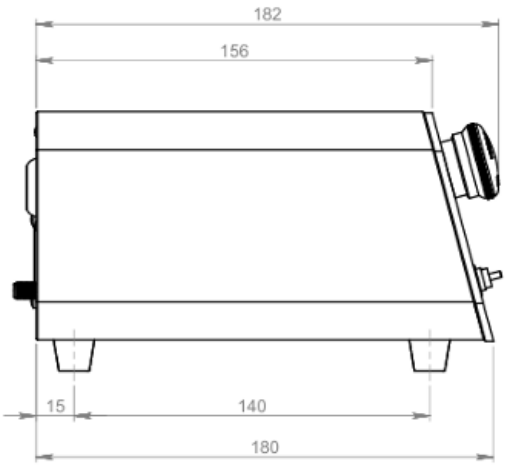
| Wavelength(nm) | Power(mW) | Part Number | Connector |
|---|---|---|---|
| 532 | 100 | ORL-532-FC | FC/PC |
| | 100 | ORL-532-SMA | SMA905 |
| 638 | 500 | ORL-638-FC | FC/PC |
| | 500 | ORL-638-SMA | SMA905 |
| 785 | 500 | ORL-7875-FC | FC/PC |
| | 500 | ORL-785-SMA | SMA905 |
| 1064 | 500 | ORL-1064-FC | FC/PC |
| | 500 | ORL-1064-SMA | SMA905 |

## 1.3 Part Numbering Schema




## 1.4 Mechanical Dimensions



## 1.5 Technical Specifications and Laser Safety Classification

## ORL Multimode Single-Wavelength Laser Specifications

| Optical Parameters | | | | |
|---|---|---|---|---|
| Center Wavelength(nm) | 532 | 638 | 785 | 1064 |
| Output Power(mW) | 100 | 500 | 500 | 500 |
| Wavelength Tolerance(nm) | | ±0.5 | | |
| Linewidth(nm) | <0.1 | <0.1 | <0.1 | <0.1 |
| Wavelength Stability | ±5 pm@4hTyp. | ±7pm@4h typ. | | |
| Power Stability@4h | ±2%@4h Typ. | | | |
| SMSR(dB) | - | >35 | >40 | |
| **System Parameters** | | | | |
| Adjustability % Full Power | 0~100% | | | |
| Warm Up Time(min) | 15 | | | |
| Modulation Input | Analog signal 0~5V | | | |
| Control Interface | USB , SMA | | | |
| Connector | SMA905, FC/PC | | | |
| Output Fiber | 105 μm, NA 0.22 | | | |
| Supply Voltage | +12VDC | | | |
| Power Consumption(W) | <20 WTyp. | | | |
| Storage Temperature($^0$C) | 10~60 | | | |
| Storage Humidity(RH) | 0~80% | | | |
| Operating Temperature($^0$C) | 10~35 | | | |
| Weight(kg) | 1.2 | | | |
| Dimensions(mm) | 180X90X180 | | | |

### ORL Multimode Single-Wavelength Laser Safety Classification

| Laser Safety Classification | | | |
|---|---|---|---|
| **Wavelength(nm)** | **Power(mW)** | **Part Number** | **Safety Classification** |
| 532 | 100 | ORL-532-FC | 3B |
| | 100 | ORL-532-SMA | 3B |
| 638 | 500 | ORL-638-FC | 3B |
| | 500 | ORL-638-SMA | 3B |
| 785 | 500 | ORL-7875-FC | 3B |
| | 500 | ORL-785-SMA | 3B |
| 1064 | 500 | ORL-1064-FC | 3B |
| | 500 | ORL-1064-SMA | 3B |

# 2 Safety Instructions

## 2.1 Safety Symbols

The following symbols can be marked on the unit or used in this document. To ensure safe operation, please follow all safety instructions that are associated with the symbols.

| | |
|---|---|
|  | **CAUCTION!**<br>Refers to a hazard. Ensure correct operation, or, could result in damage of the unit. Do not proceed beyond an attention until the indicated conditions are fully understood. |
|  | **WARNING!**<br>This symbol indicates that users should take care of the damage which is easily caused by visible and invisible laser radiation. |
|  | **CAUCTION ESD!**<br>This symbol indicates that users should pay attention to the operation failure caused by ESD. Users should take actions for ESD protection. |

## 2.2 Laser Safety

Laser poses safety hazards different than light from other sources, all laser users and persons near the laser must be aware of the hazards involved in laser operation.

In order to ensure the safe operation and optimal performance of the product, please follow these warnings and cautions in addition to the other information contained elsewhere in this document.

| | |
|---|---|
|  | **Warning: Laser beam** |
|  | **WARNING!**<br>Laser Output! Visible and/or invisible laser radiation is emitted from this aperture |
|  | **WARNING! Laser radiation!**<br>This is a Class 3B laser product! Avoid exposure to the beam!<br>Follow safety instructions! |
|  | **DANGER: Laser radiation!**<br>This is a Class 4 laser product! Avoid eye or skin exposure to direct or scattered radiation!<br>Follow safety instructions! |

**NOTES:**

1. Do not allow untrained or not experienced personnel to handle this laser.
2. NEVER LOOK DIRECTLY INTO THE MAIN LASER BEAM! DO NOT REFLECT THE BEAM INTO LIGHT SOURCE!
3. Always avoid placing reflective objects in the laser beam. Laser light scattered from a reflective surface can be as damaging as the original beam.
4. Turn the laser power to a low level to minimize intensity of accidental stray reflections or refractions when aligning the optical system.
5. Ensure that the laser beam is not at eye level.
6. Post warning signs when laser is in operation, limit access to the laser area.
7. All personnel in working area must use laser safety eyewear when operating the laser.
8. NEVER LEAVE THE LASER SYSTEM ON, OPEN, AND UNATTENDED!
9. Never open the protective housing of this laser without permission. Warranty void if seal broken or removed.

## 2.3 Electrical Safety

### 2.3.1 Notes for electrical safety:

Although this laser system includes safety features in its design, the users still have to follow the safety precautions as below:

1. Ensure that the fiber is connected well to the fiber connector of laser system before laser operation.
2. For the sake of safety, make sure that all power is off before working on electrical connections of the laser system. Do not depend on the electrical safety device or interlock.
3. The Power Adapter connector may be used to disconnect the laser controller from the mains. It must remain accessible by the user at any time.
4. No electrical maintenance on the laser is allowed by anyone.
5. The mains cord must be plugged in a socket comprising the earth connection. Disconnection of the earth is forbidden as it may impair the electrical protection and renders the equipment dangerous.

### 2.3.2 Safety recommendations for using a laser

Please review the following precautions before operating the laser system:

1. Safety key switch: please remove the key from key switch when the laser system is not in operation but still accessible to untrained personnel.
2. Do not allow untrained or not experienced personnel to handle this laser system.
3. NEVER LEAVE THE LASER SYSTEM ON, OPEN, AND UNATTENDED!

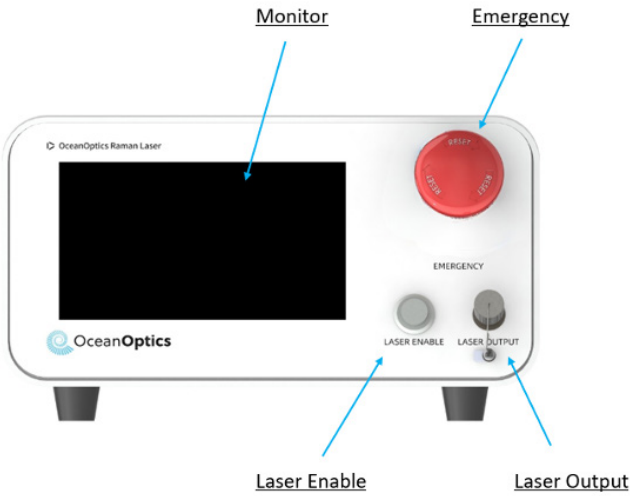
# 3 Electrical Instructions

## 3.1 Operating Modes

This system features two control modes.

1. Local mode: Control laser power output using the front-panel display and computer.
2. Remote mode: Control the laser output power remotely by computer signals or modulated signals via a SMA interface on the rear panel.

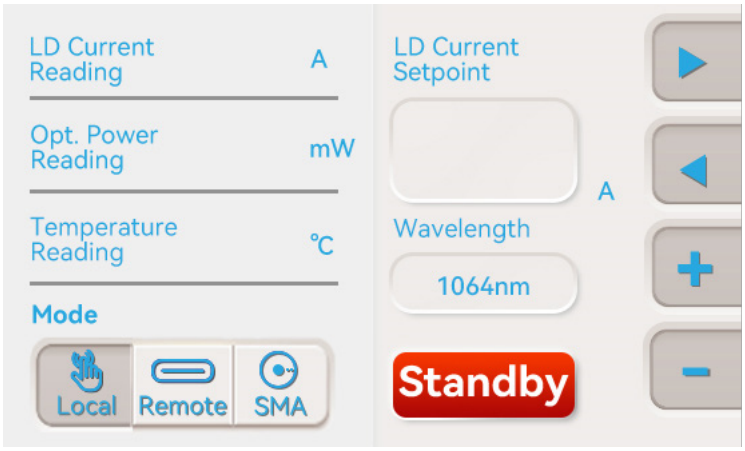
## 3.2 Operating Instructions for the Front Panel




**a. Emergency Stop Button**

Press this button to stop laser emission when there is an emergency. Rotate it clockwise when the emergency is lifted, and the laser system will reset the laser current to its zero state.

## b. Monitor




*ORL Series Multimode Single-Wavelength Laser Display Interface*

LD Current Reading: Displays the current LD operating current value.

Opt. Power Reading: Shows the real-time optical output power value.

Temperature Reading: Indicates the laser module's working temperature, which stabilizes around 25°C

seconds after startup.

Int Mode/Ext Mode: Indicates whether the system is in internal control mode or external control mode.

When selecting External Mode, laser operation is controlled via the rear-panel SMA interface signal.

LD Current Setpoint: Sets the laser diode operating current value. Users can refer to the test report to

determine the corresponding current values under different power conditions.

Ready: Clicking this icon switches the display to "Standby" mode. Laser emission is only permitted

when in "Ready" mode, after pressing the front-panel Enable button.

LD1/LD2: Select the output wavelength of the laser. LD1 corresponds to the laser with the shorter wavelength.

+/- Icon: Coarse adjustment of the set current value

△▽ Icon: Fine adjustment of the set current value

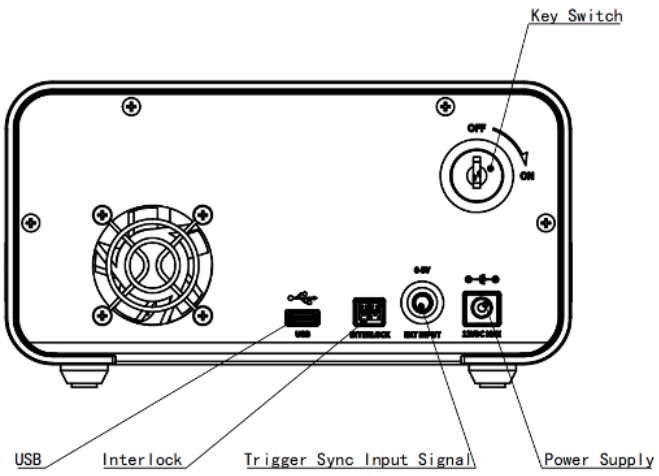
**c. Enable Button**

When the touch screen is pressed and in Ready state, pressing this button will activate laser emission. A laser warning icon will pop up to the left of the "Ready" text on the screen.

**d. Output Interface**

This interface is for connecting mating fiber, and is compatible with Ocean Optics's ORP Series Raman probes.

## 3.3 Operating Instructions for the Rear Panel




## a. Key Switch

When the key switch is in the OFF position, the power input is disabled.
When the key switch is rotated to the ON position, if the emergency stop switch on the front panel is in the popped-up state, the power will be enabled and the LCD touch control panel will illuminate.
Otherwise, the laser system will remain powered off.

### b. Power Input Interface

This interface is powered by a +12VDC adapter.

### c. External Modulation Input Interface

This interface can be enabled by switching to Ext external trigger mode via the screen settings.

When the SMA interface receives 0V, the laser output current will approximate 0.0A.

When the SMA interface receives 5V, the laser operates at its rated maximum output power.

The SMA interface accepts square wave modulation signals with a rise time < 100μs.

### Notes:

- Make sure that the input signal must not exceed 0-5V.
- Input sinusoidal or pulsed modulation signals through SMA interface, the average value of driving current is shown on the front-panel display screen.

### d. USB Interface

The USB Type-C interface is used for PC software communication and control. It adopts a serial communication protocol and incorporates the CP2102 chip as a USB-to-UART bridge chip. Ocean Optics provides the control software and communication protocol documentation. For details, refer to Chapters 5 and 6.

# 4 Operating Instructions

## 4.1 Prepare Procedures

Connect the +12V DC adapter to laser controller, make sure the connection is secure.

**Note:** Make sure that the adapter is appropriate before connection.

- Before connecting to the 220V power supply, please check and confirm the system is in the following status.

  A. Key switch is in the Position “OFF”.

  B. Emergency Stop button is released.

  C. Modulation Enable button is released.

  D. Take off the laser output interface cap and connect well to the fiber patch cord. Do not point at

people or flammable materials with the output fiber when the system is working. The excitation end fiber of the Ocean Optics® ORP Series Raman Probe can be directly connected to this laser output interface.

**Attention:** Need to protect the fiber well before connecting the fiber patch cord or in the process of use,

make sure to keep the fiber end clean and avoid contamination. Otherwise, the power loss could be caused after connection, and laser output connector could be burnt.

## 4.2 Laser Output Control

a: Rotate the key switch to the “ON” position to power on the system. The front-panel display will illuminate, and the system fan will start operating.

b: After monitoring the temperature display on the front-panel screen until it stabilizes, adjust the current setting. Click the “Standby” icon, it will change to “Ready”. Subsequently press the front-panel ENABLE button to activate the laser, which will then operate at the preset current.

c: To control the laser via external signals, click the “Ext Mode” button on the screen and provide the external signal according to the requirements in Section 3.3.

d: For host computer control, connect the PC's host software via the Type-C interface cable. Both the host software interface and the front-panel controls can independently manage the laser.

### 4.3 Laser Shutdown Procedure

a: Press and maintain the front-panel ENABLE button in the depressed state; the button's indicator light will extinguish.

b: Click the "Ready" icon on the screen, which will then display "Standby".

c: Set the laser current to 0A or disconnect the SMA control signal on the rear-panel.

d: Rotate the rear-panel key switch to the "OFF" position, powering down the system.

e: Disconnect the +12V power interface of the adapter.

f: Remove the mating fiber and install the protective cap on the laser output interface.

# 5 Laser Control Software

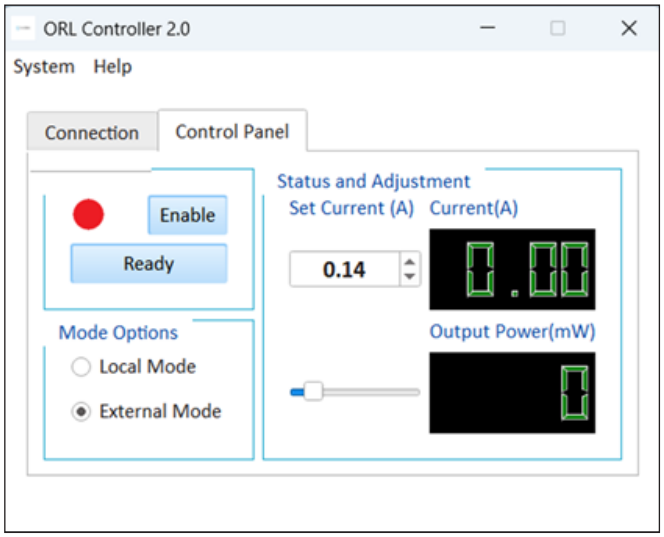
## 5.1 Driver Installation

This laser's communication chip uses the CP2102 chipset for USB-to-UART conversion, supporting multiple operating system versions. Before use, install the corresponding driver software for your OS. Contact Ocean Optics for an installation package or download it from the link below.

www.oceanopitcs.com

The communication part is USB-powered, enabling direct connection to a PC via USB cable for virtual COM port recognition. Post-installation verification: In Windows Device Manager > Ports (COM & LPT), successful driver installation is confirmed by detecting the assigned COM port number.

### 5.2 Interface Presentation




*Software Interface for Single-Wavelength Laser*

### 5.3 Software Details

**A. Device Recognition**

After connecting the USB communication cable between the computer and the device, ensure the device is powered by a stable 12V DC supply. Launch the software, which will automatically scan all available COM ports to detect connected devices. Upon successful recognition, the device will appear in the "Device List 1" as shown in the interface diagram above.

**B. Control Panel**

Press the “Prepare” button. Once it switches to “Standby” status, proceed to press the “Enable” button. When the “Enable” button turns “Disabled”, the laser initiates output. Real-time monitoring displays “Current Current” and “Current Power” values during operation.

**C. Mode Options**

Choose between Local Mode or External Mode:

- Local Mode: Laser power is regulated by an internal voltage signal generated by the MCU.
- External Mode: Laser power is controlled via an externally input voltage signal through the terminal.

**D. Output Control and Adjustment**

- Local Mode: Use the knob control to adjust current levels, corresponding to a laser power percentage range of 0%–100%. The maximum achievable power depends on the specific product model.
- External Mode: Output is governed by the externally supplied voltage signal.

**E. Temperature Monitoring**

The interface provides real-time monitoring and display of the internal laser operating temperature.

# 6 Communication Protocol

## 6.1 Serial Communication Format

6.1.1: Baud rate: 115200; Data bits: 8; Parity: None; Stop bits: 1.

6.1.2: In this document, the laser is referred to as the slave device, and the PC as the host device.

6.1.3: 11-digit fixed-length data communication, transmitted in hexadecimal format:

| Header | | Command ID | Parameter | Data Bits | | | | Checksum | Footer | |
|---|---|---|---|---|---|---|---|---|---|---|
| AA | 54 | CMD | PARAM | DATA0 | DATA1 | DATA2 | DATA3 | CRC | AA | 55 |

### Note:

**A. Operation Mode: Master-slave communication with host transmission and slave response.**
Host Transmission: **AA 54 [CMD] [PARAM] D0 D1 D2 D3 [CRC] AA 55**
Slave Response: **AA 54 [CMD|0x80] [PARAM] D0 D1 D2 D3 [CRC] AA 55**

**B. CRC Calculation: CRC = (CMD + PARAM + D0 + D1 + D2 + D3) % 256**

**C. Response Commands:**
**CMD|0x80**: Slave acknowledges successful frame reception.
If the slave detects a frame error, it returns **CMD = 0xFF**.

**D. Parameter (PARAM):**
Set by the host or echoed by the slave. Serves as an auxiliary parameter for data parsing.

**E. Four-byte Data Field Parsing:**
The least significant byte (LSB) is stored at the lowest address, while the most significant byte (MSB) is stored at the highest address.

**Examples:**
**32-bit integer 0x12345678** (memory layout from low to high address):

| **Address:** | **0x00** | **0x01** | **0x02** | **0x03** |
|---|---|---|---|---|
| Data: | 0x78 | 0x56 | 0x34 | 0x12 |

**Single-precision float 12.375** (hexadecimal 0x41460000):

| Address: | 0x00 | 0x01 | 0x02 | 0x03 |
|---|---|---|---|---|
| Data: | 0x00 | 0x00 | 0x46 | 0x41 |

**Reference: Using Union for Data Packing and Parsing**

```
typedef union {
    uint32_t u32v;w  // 32-bit unsigned integer
    int32_t  i32v;   // 32-bit signed integer
    float    fv;     // Single-precision floating point
    char     chars[4];  // Corresponds to 4 protocol bytes stored from low to high address
} TU_COMPLEX;
```

**F. Data Type Specifications:**

**D[0:3]**: Parse bytes D0-D3 individually as separate parameters

**D[0:2]**: Parse bytes D0-D2 individually as separate parameters

**D[3:3]**: Parse only byte D3

**FLOAT**: Interpret four bytes as a single-precision floating-point value

**Empty**: Defaults to 0; protocol ignores data state

## 6.2 Serial Communication Protocol Specification

| Command | Parameter | Data Type | Meaning/Description |
|---|---|---|---|
| 01 | 00 | Null | Send command to request circuit identifier.<br>Example: AA 54 01 00 00 00 00 00 01 AA 55 |
| 81 | 00 | D[0:3] | Response Data: {0x11, 0x13, 0x12, 0x14}<br>Example: AA 54 81 00 11 13 12 14 CB AA 55 |
| 02 | 00 | Null | Send command to read laser status.<br>Example: AA 54 02 00 00 00 00 00 02 AA 55 |
| 82 | 00 | D[3:3] | Response Data: Current laser status. 0=Off, 1=Standby, 2=Lasing, 3=Fault<br>Example 1: AA 54 82 00 00 00 00 00 82 AA 55 (Off)<br>Example 2: AA 54 82 00 00 00 00 01 83 AA 55 (Standby) |
| 0A | 00 | Null | Set Laser: Standby/Off.<br>The laser processes the command based on its current status reported by the 82 command.<br>Switches to Off if currently in Standby.<br>Switches to Standby if currently in Off.<br>Example: AA 54 0A 00 00 00 00 00 0A AA 55 |
| 8A | 00 | Null | Response to the 0A command.<br>Example: AA 54 8A 00 00 00 00 01 8B AA 55 |

| | | | |
|---|---|---|---|
| 0B | 00 | Null | Set Laser: Lasing/Standby.<br>The laser processes the command based on its current status reported by the 82 command.<br>Switches to Standby (stops lasing) if currently in Lasing mode.<br>Switches to Lasing mode if currently in Off.<br>Example: AA 54 0B 00 00 00 00 01 0C AA 55 |
| 8B | 00 | Null | Response to the 0B command.<br>Example: AA 54 8B 00 00 00 00 01 8C AA 55 |
| 0C | 00 | D[3:3] | Send command to set laser operation mode. 1=Local Mode, 2=External Mode.<br>Example: AA 54 0C 00 00 00 00 02 0E AA 55 (External Mode) |
| 8C | 00 | D[3:3] | Response: Current operation mode. 0=Local Mode, 1=External Mode.<br>Example: AA 54 8C 00 00 00 00 01 8D AA 55 |
| 0E | 00 | Float | Send command to set the current for Local Mode. Unit: A (Amperes).<br>Example: AA 54 0E 00 5C 8F 82 3F 6A AA 55 (Set current to 1.02A) |
| 8E | 00 | Null | Response.<br>Example: AA 54 8E 00 5C 8F 82 3F 3A AA 55 |
| 0F | 00 | Null | Send command to query the set current value for Local Mode. Unit: A.<br>Example: AA 54 0F 00 00 00 00 00 0F AA 55 |
| 8F | 00 | Float | Response: Set current for Local Mode. Unit: A.<br>Example: AA 54 8F 00 5C 8F 82 3F 3B AA 55 (1.02A) |
| 10 | 00 | Null | Send command to query the actual operating current.<br>Example: AA 54 10 00 00 00 00 00 10 AA 55 |
| 90 | 00 | Float | Response: Actual operating current. Unit: A.<br>Example: AA 54 90 00 00 00 00 00 90 AA 55 |
| 11 | 00 | Null | Send command to query the operating temperature.<br>Example: AA 54 11 00 00 00 00 00 11 AA 55 |
| 91 | 00 | Float | Response: Operating temperature. Unit: °C.<br>Example: AA 54 91 00 B1 C8 8E 41 D9 AA 55 (Temperature: 17.84799 °C) |
| 13 | 00 | Null | Send command to query the laser power.<br>Example: AA 54 13 00 00 00 00 00 13 AA 55 |
| 93 | 00 | Float | Response: Laser power. Unit: mW.<br>Example: AA 54 93 00 00 00 48 43 1E AA 55 (Current power: 200 mW) |

# 7 Copyright





## Questions?

Chat with us at www.oceanoptics.com.
info@oceanoptics.com

**US** +1 727-733-2447
**EUROPE** +31 26-319-0500
**ASIA** +86 400-623-2690