Tunable Laser System

TLS

Operation Manual

Ver 1.0

This device complies with part 18 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

SLi
SPECTROLIGHT

TABLE OF CONTENTS

Tunable Laser System (TLS)

Fully tunable pico-second pulsed laser system by Spectrolight

Spectrolight's tunable laser system (TLS) is an innovative, continuously tunable laser that combines a super-continuum laser and a tunable bandpass filter in VISIBLE, IR, and SWIR ranges.

The **TLS-RED** offers a wide wavelength range of approximately 400 to 1700 nm and can allow for FWHM 2 to 15 nm (nominal). In contrast, the **TLS-BLUE** covers the same broad wavelength range but with a fixed FWHM of 10 or 20 nm. The TLS-RED is ideal for applications requiring precise scanning, while the TLS-BLUE is better suited for fields demanding high output. With Spectrolight's TLS systems, users can freely select the output power and wavelength ranges to meet their specific needs.

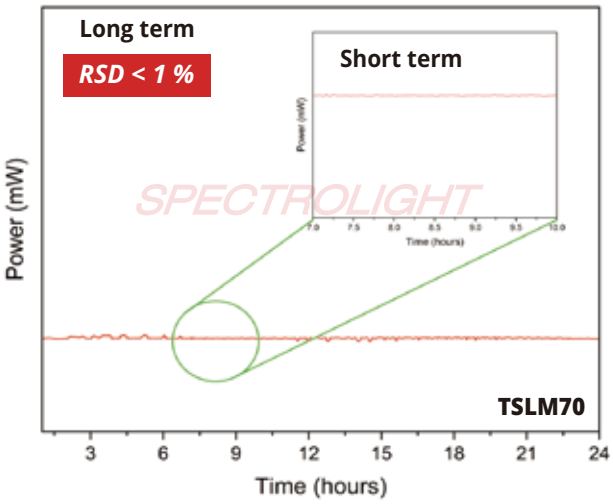
TLS is a pico-second tunable laser that can be applied to various fields, from fluorescence microscopy to time-resolved spectroscopy, such as TCSPC, Hyperspectral imaging, Machine vision, Semiconductors, Sensors, and other applications.

Power Fluctuation Stability

RSD is < 1 % at 650/15 nm
*RSD = Relative Standard Deviation

TLS-RED
(Tunable bandwidth)

TLS-BLUE
(Fixed bandwidth)

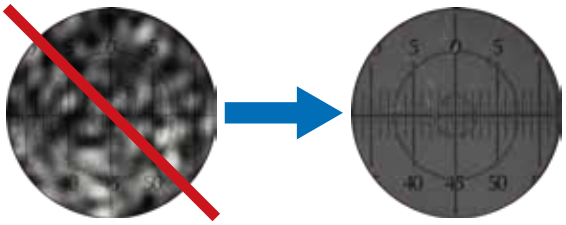


Speckle Reduced Option for Imaging

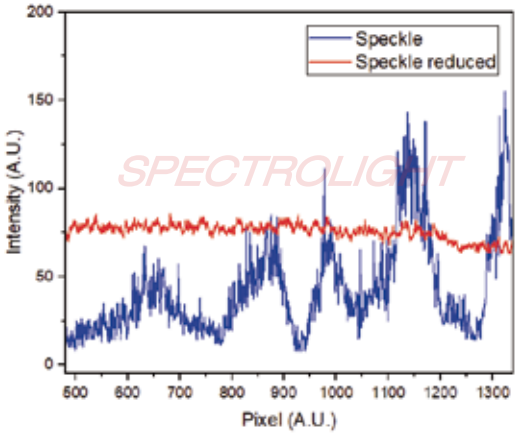
TLS products feature an option to dramatically reduce laser speckle noise, a capability not typically found in conventional lasers. When this option is applied, TLS facilitates clear imaging. The image segmentation results on the right clearly show the significant difference in speckle noise across the entire image.

Speckle
(Typical laser)

Speckle Reduced
(SLi's TLS)



Low S/N ratio imaging with speckle noise using conventional laser (left), clear imaging with reduced speckle noise using TLS (right)



1.1 TLS-RED

Each TLS-RED model covers distinct spectral ranges from 410 to 1700 nm. The bandwidth(FWHM) of TLS-RED is nominally tunable from 2 to 15 nm, with the exact tunable range dependent on the selected wavelength. Users can choose laser types and variable wavelength ranges to suit their specific applications. Please refer to the detailed specifications table below for more information.

TLS-RED (Tunable bandwidth)

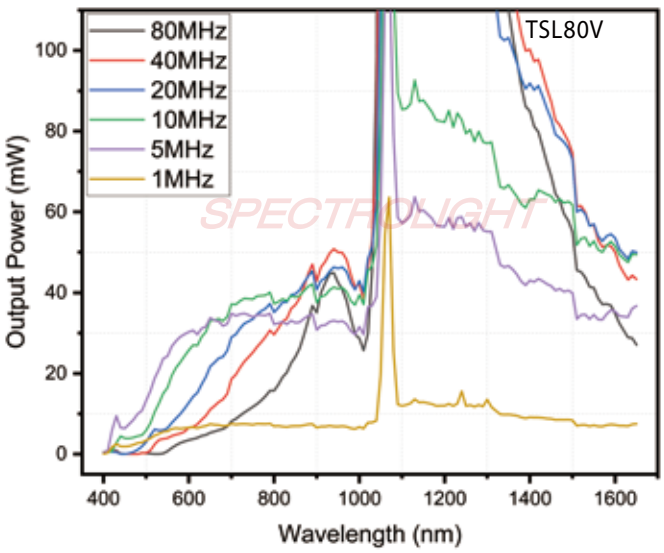
General Specifications

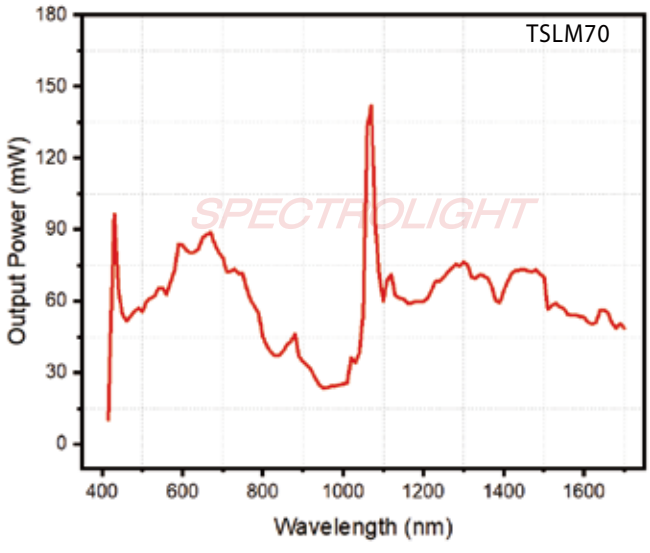
Tunable Laser System (*TLS-RED*) : Each TLS has VIS, IR, SWIR and Custom wavelength selection

Model	Laser output power (mW, W)		Repetition Rate (MHz)	Output pulse width (ps)	CW Tuning Range (nm)	Bandwidth (FWHM) (nm)
	Visible	Total				
TSL10-RED	100 mW	1 W	5 MHz	< 300 ps	450 - 1700 nm	2 - 15 nm (nominal)
TSLM10-RED	250 mW	1 W	10 MHz	< 50 ps	410 - 1700 nm	
TSLM20-RED	500 mW	2 W	20 MHz	< 50 ps	410 - 1700 nm	
TSLM40-RED	1 W	4 W	40 MHz	< 50 ps	410 - 1700 nm	
TSLM35V-RED	1 W	3.5 W	0.01 to 40 MHz	< 50 ps	410 - 1700 nm	
TSL80V-RED	1 W	8 W	0.01 to 200 MHz	< 300 ps	430 - 1700 nm	
TSLM70-RED	2 W	7 W	80 MHz	< 50 ps	410 - 1700 nm	

The option for customizable repetition rates is available for an extra cost, allowing adjustment up to each product's maximum fixed rate.

Output Power of TLS-RED





** Measured at 15 nm bandwidth (FWHM)*

1.2 TLS-BLUE

Each TLS-BLUE model covers distinct spectral ranges from 410 to 1700 nm. The bandwidth(FWHM) of TLS-BLUE is fixed at either 10 or 20 nm. Users can choose laser types and variable wavelength ranges to suit their specific applications. Please refer to the detailed specifications table below for more information.

TLS-BLUE (Fixed bandwidth)

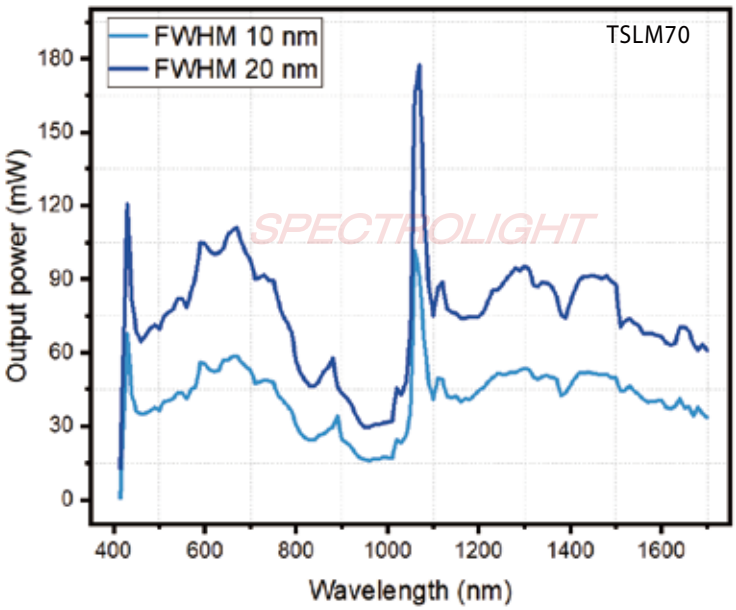
General Specifications

Tunable Laser System (*TLS-BLUE*) : Each TLS has VIS, IR, SWIR and Custom wavelength selection

Model	Laser output power (mW, W)		Repetition Rate (MHz)	Output pulse width (ps)	CW Tuning Range (nm)	Bandwidth (FWHM) (nm)
	Visible	Total				
TSL10-BLUE	100 mW	1 W	5 MHz	< 300 ps	450 - 1700 nm	10 or 20 nm fixed (nominal)
TSLM10-BLUE	250 mW	1 W	10 MHz	< 50 ps	410 - 1700 nm	
TSLM20-BLUE	500 mW	2 W	20 MHz	< 50 ps	410 - 1700 nm	
TSLM40-BLUE	1 W	4 W	40 MHz	< 50 ps	410 - 1700 nm	
TSLM35V-BLUE	1 W	3.5 W	0.01 to 40 MHz	< 50 ps	410 - 1700 nm	
TSL80V-BLUE	1 W	8 W	0.01 to 200 MHz	< 300 ps	430 - 1700 nm	
TSLM70-BLUE	2 W	7 W	80 MHz	< 50 ps	410 - 1700 nm	

The option for customizable repetition rates is available for an extra cost, allowing adjustment up to each product's maximum fixed rate.

Output Power of TLS-BLUE

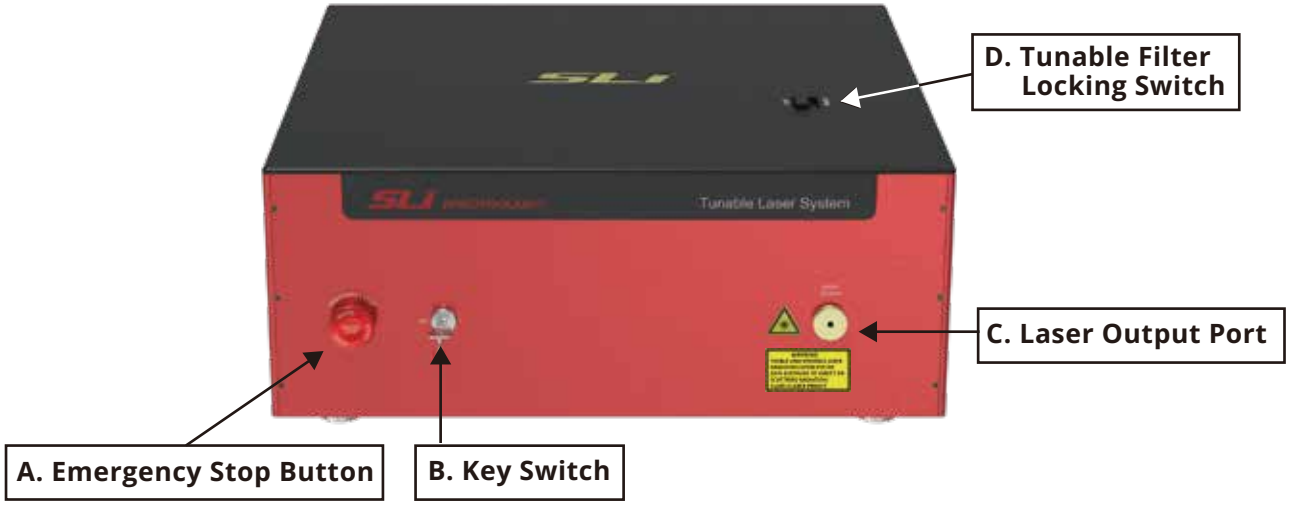


2.1 System Main Components

1	**TLS**	Main body
2	**Power cable**	AC power cable (1 ea)
3	**USB cable**	USB A to B cable (1 ea)
4	**Key switch**	Key switch (2 ea)
5	**Interlock plug**	External safety device (1 ea)
6	**Laptop**	Product software, product user manual, etc.

2.2 Front Panel Functions

(Example: TLS-RED)



A. Emergency Stop Button : Press it in an emergency situation, and it can be restored by rotating it clockwise.

B. Key Switch : Rotate precisely 90 degrees clockwise to power on, and rotate 90 degrees counterclockwise to power off the laser.

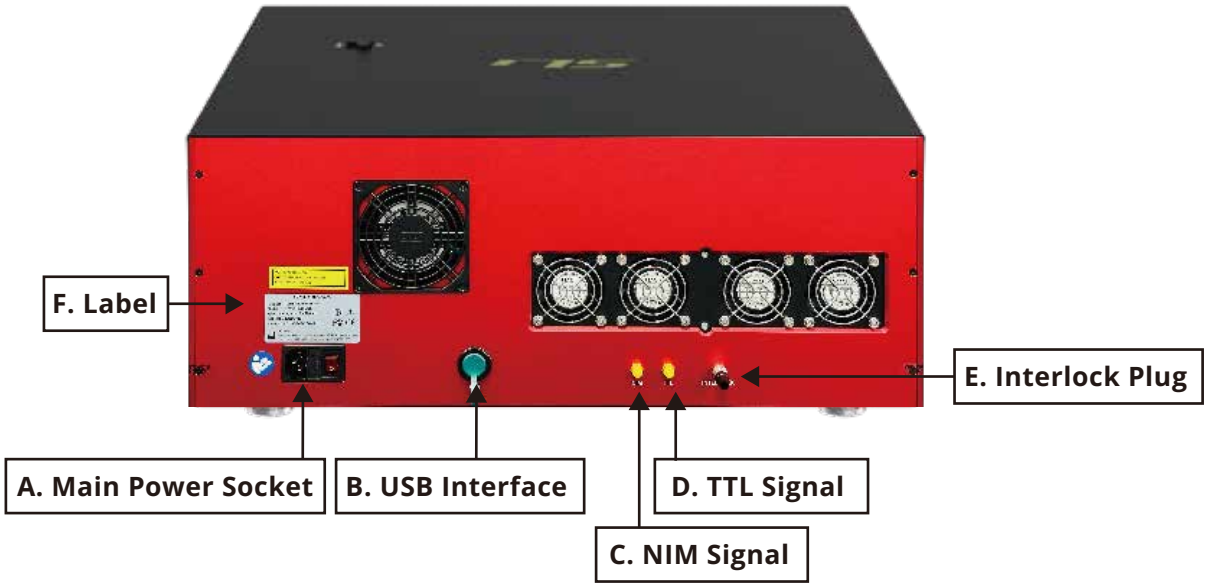
C. Laser Output Port : The default output is free-space. To connect to optical fibers or fiber bundles, appropriate coupling accessories are required (e.g., fiber adapter)

D. Tunable Filter Locking Switch : When the equipment is not in use or being moved, the tunable filter must be locked.

E. Labels : Laser safety

2.3 Back Panel Functions

(Example: TSL80V-RED-VIS)



A. Main Power Socket : Plug the power cord into the main socket.

B. USB Interface : Connect a USB cable to the computer to control the laser.

C. NIM Signal : The SMA interface will output a pulse square wave signal loaded 50 Ω with the same pulse and the same frequency; NIM Voltage: 0 to -1 V

D. TTL Signal : The SMA interface will output a pulse square wave signal loaded 50 Ω with the same pulse and the same frequency; TTL Voltage: 0 to 3.3 V

E. Interlock Plug : Connect the interlock plug when using the laser.

F. Label : Laser specifications

Product : Tunable Laser System
Model : TSL80V-RED-VIS
Spectral range : 430 - 790 nm
S/N : RT80VVIS0000
Ratings : AC 100 - 240V, 50/60 Hz

iiSM Inc.
402, 7-16, naseongnam-ro,Sejong-si, 30129, Republic of Korea
Tel : (+82)44-863-9852 web : www.spectrolightinc.com

OUTPUT POWER : ≤ 8 W
WAVELENGTH RANGE : 430 - 2400 nm
REPETITION RATE : 0.01 to 200 MHz adjustable

2.4 Specifications

TLS-RED (Tunable bandwidth)

		TSL10-RED	TSLM10-RED	TSLM20-RED	TSLM40-RED	TSLM35V-RED	TSL80V-RED	TSLM70-RED
Output power	Visible	100 mW	250 mW	500 mW	1 W	1 W	1 W	2 W
	Total	1 W	1 W	2 W	4 W	3.5 W	8 W	7 W
Repetition rate		5 MHz	10 MHz	20 MHz	40 MHz	0.01 to 40 MHz adjustable	0.01 to 200 MHz adjustable	80 MHz
Output pulse width		< 300 ps	< 50 ps	< 50 ps	< 50 ps	< 50 ps	< 300 ps	< 50 ps
Fundamental pulse width		~ 100 ps	~ 6 ps	~ 6 ps	~ 6 ps	~ 6 ps	~ 100 ps	~ 6 ps
Tuning spectral range [1]		450-1700 nm	410-1700 nm	410-1700 nm	410-1700 nm	410-1700 nm	430-1700 nm	410-1700 nm
Bandwidth(FWHM) [2]		2 - 15 nm(nominal)						
Power stability		< 1 %						
Intensity control		0 - 100						
Output type [3]		Free space						
Beam diameter & quality		~ 2 mm @ 633 nm; M^2 < 1.1						
Beam divergence		< 1 mrad (half angle)						
State of polarization		Unpolarized						
Sync(trigger) output		NIM output 0 - (-1) V, TTL output 0 - 3.3 V						
Electric requirement		AC 100 - 240 V, 50/60 Hz						
Power consumption		< 280 W						
Software		TLS ver.2						
Data interface		USB 2.0						
Dimension (L x W x H)		584.3 mm x 583.6 mm x 246 mm						
Weight		< 37 kg						

1) Specified center wavelength(CWL) tolerance: ±1 nm.

2) Specified full width at half maximum(FWHM) tolerance: ±1 nm

3) Various output accessory configurations such as fiber and fiber bundle are available. Please contact us for custom options or detailed specifications.

TLS-BLUE (Fixed bandwidth)

		TSL10-BLUE	TSLM10-BLUE	TSLM20-BLUE	TSLM40-BLUE	TSLM35V-BLUE	TSL80V-BLUE	TSLM70-BLUE
Output power	Visible	100 mW	250 mW	500 mW	1 W	1 W	1 W	2 W
	Total	1 W	1 W	2 W	4 W	3.5 W	8 W	7 W
Repetition rate		5 MHz	10 MHz	20 MHz	40 MHz	0.01 to 40 MHz adjustable	0.01 to 200 MHz adjustable	80 MHz
Output pulse width		< 300 ps	< 50 ps	< 50 ps	< 50 ps	< 50 ps	< 300 ps	< 50 ps
Fundamental pulse width		~ 100 ps	~ 6 ps	~ 6 ps	~ 6 ps	~ 6 ps	~ 100 ps	~ 6 ps
Tuning spectral range [1]		450-1700 nm	410-1700 nm	410-1700 nm	410-1700 nm	410-1700 nm	430-1700 nm	410-1700 nm
Bandwidth(FWHM) [2]		10 nm or 20 nm (nominal)						
Power stability		< 1 %						
Intensity control		0 - 100						
Output type [3]		Free space						
Beam diameter & quality		~ 2 mm @ 633 nm; M^2 < 1.1						
Beam divergence		< 1 mrad (half angle)						
State of polarization		Unpolarized						
Sync(trigger) output		NIM output 0 - (-1) V, TTL output 0 - 3.3 V						
Electric requirement		AC 100 - 240 V, 50/60 Hz						
Power consumption		< 280 W						
Software		TLS ver.2						
Data interface		USB 2.0						
Dimension (L x W x H)		584.3 mm x 583.6 mm x 246 mm						
Weight		< 37 kg						

1) Specified center wavelength(CWL) tolerance: ±1 nm.

2) Specified full width at half maximum(FWHM) tolerance: ±1 nm

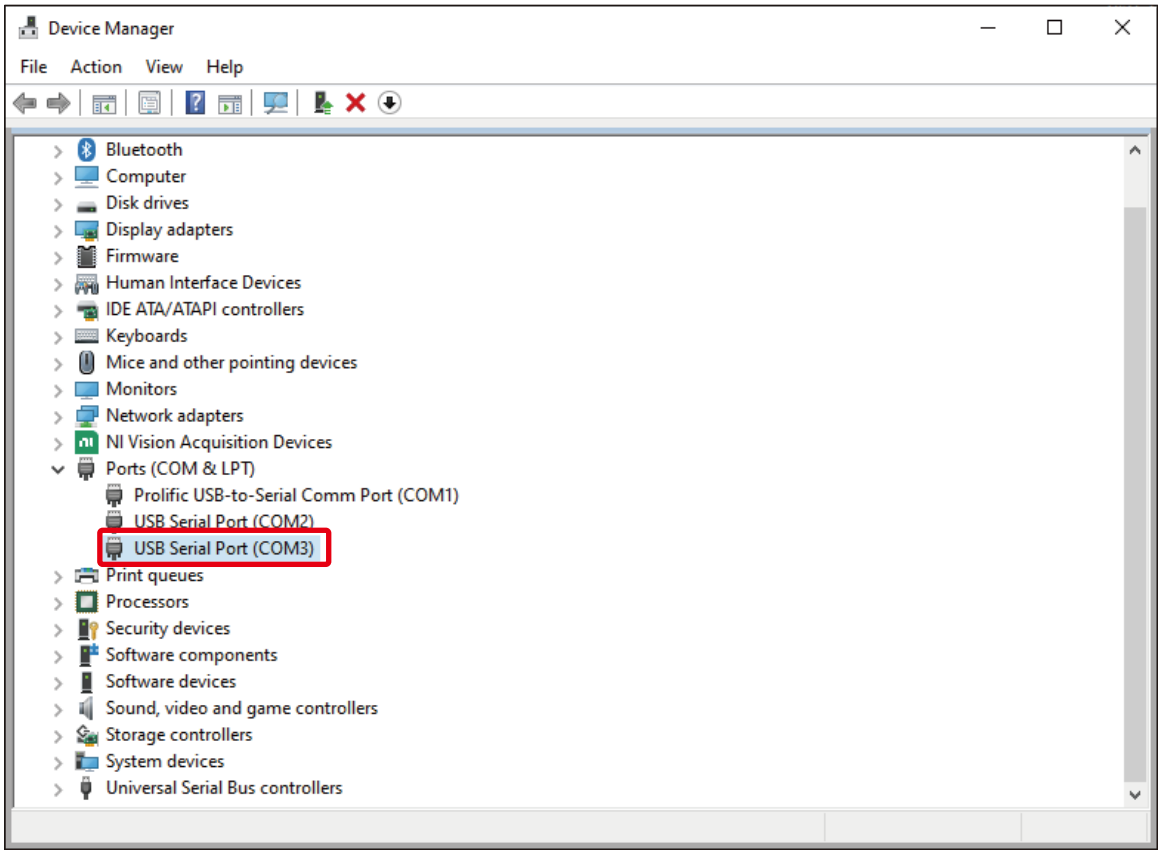
3) Various output accessory configurations such as fiber and fiber bundle are available. Please contact us for custom options or detailed specifications.

3.1 Turning On Laser

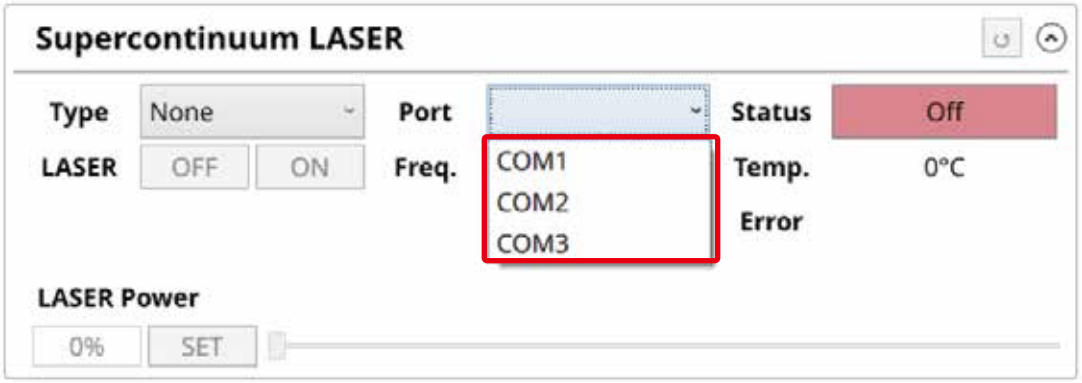
1. **Connect the AC power cable to the TLS.**
2. **Insert the interlock plug into the panel at the back of the TLS.**
3. **Set the tunable filter locking switch to UNLOCK.**
4. **Turn on the power switch.**
5. **Turn on the key switch on the TLS front panel.**

3.2 Laser Connection

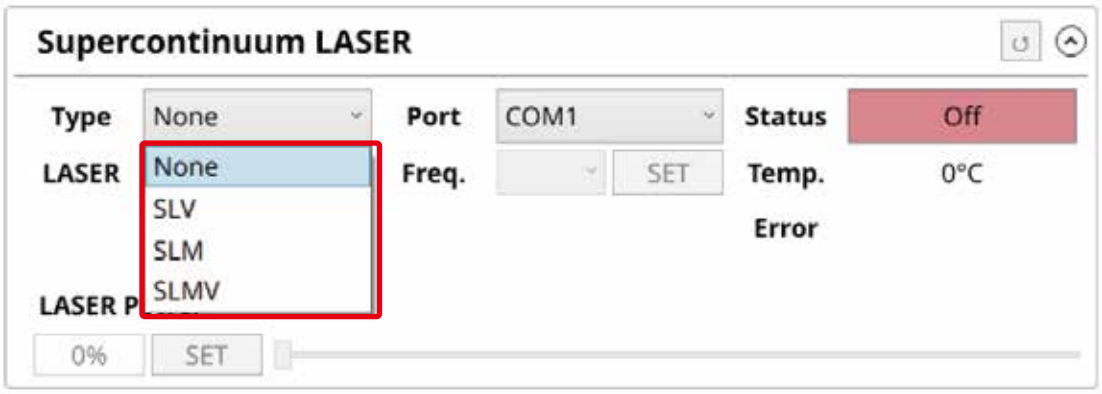
1. Once the TLS is connected to the PC, open the "Device Manager"
Look under the Ports tab to find the "Prolific USB-to-Serial Comm Port" and check the COM number
(If you cannot find the "Prolific USB-to-Serial Comm Port", please go to 6. Trouble Shooting in this manual)
Once you have checked the COM number, open the TLS software.



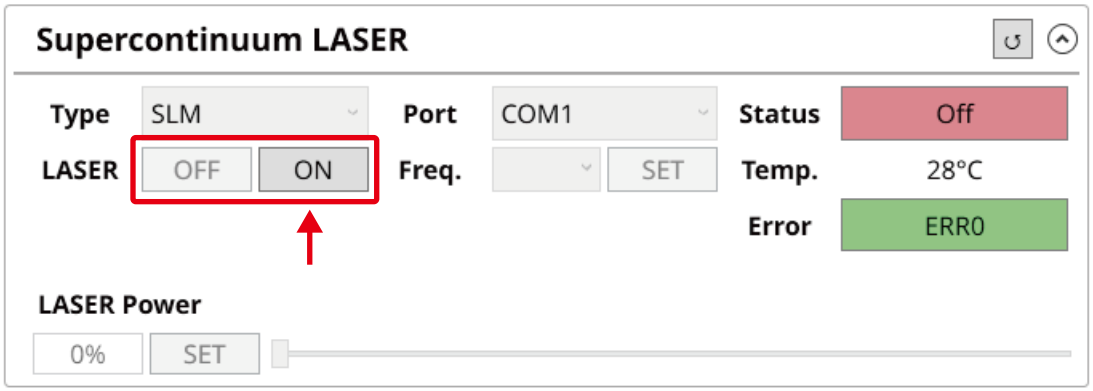
2. Set the Port number same as the COM number.



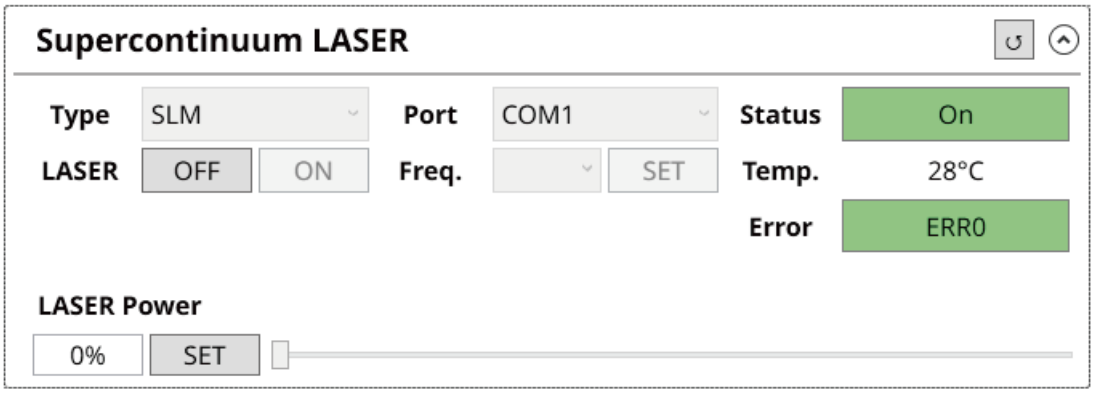
3. Select the type of laser by clicking the [Type] tab.
(If you are not sure of the laser type, please contact us at support@spectrolightinc.com)



4.
SLM models
Once the laser is connected, the [LASER] tab should be activated.

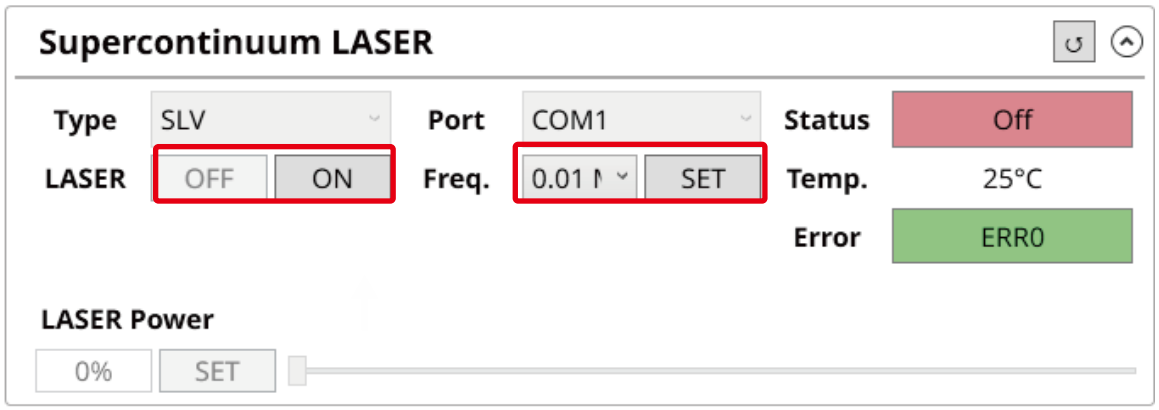


The laser is now ready for use.

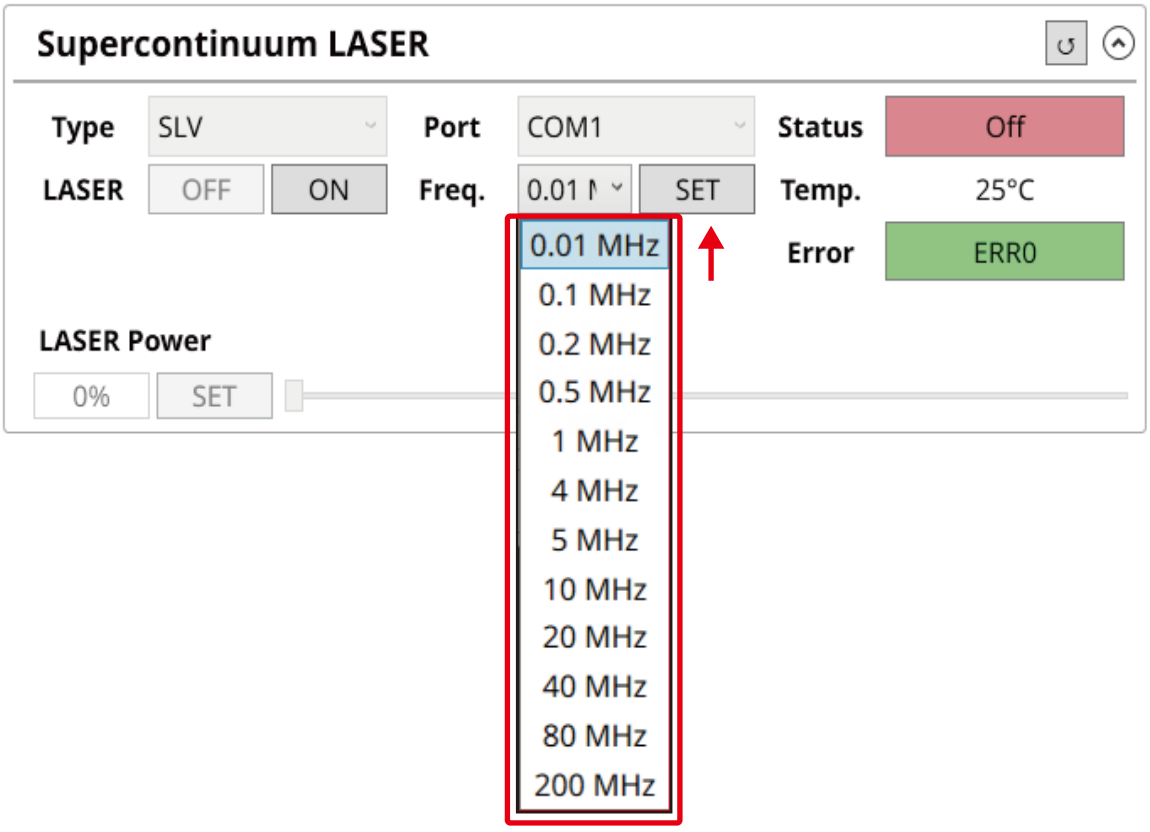


SLV and SLMV models
Once the laser is connected, the [LASER] and [Freq.] tab should be activated.

For SLMV models, the operation is the same as SLV, with the only difference being the selection of SLMV in the 'Type' tab.

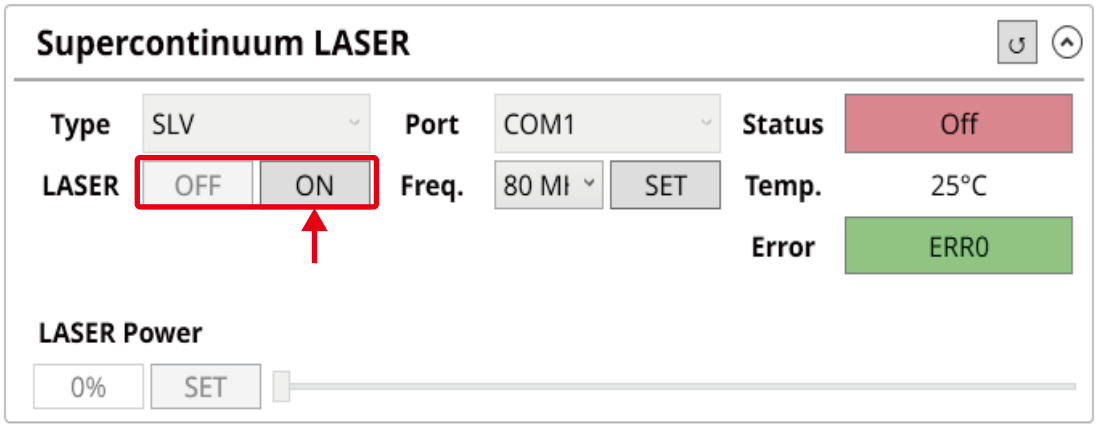


Select the desired frequency on the [Freq.] tab, then click the "SET" button.

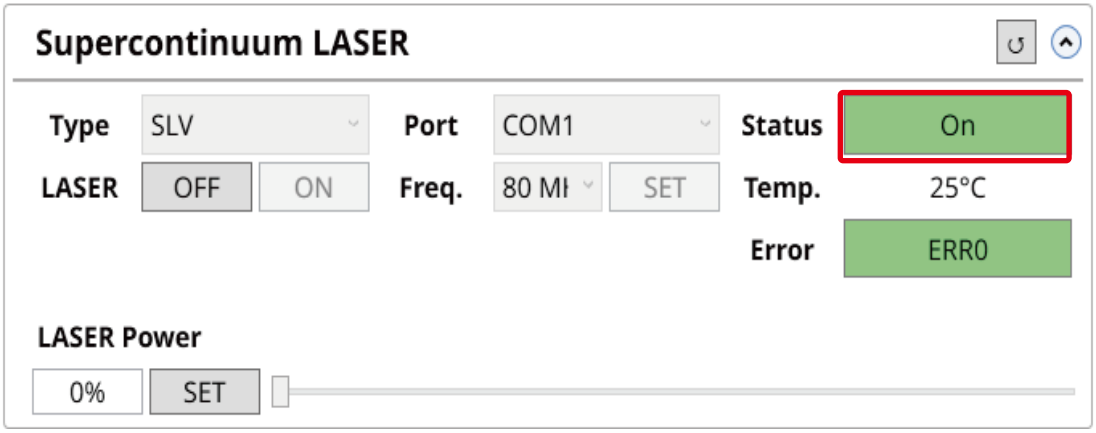


The frequency can be changed only when the [LASER] is "OFF".

After setting the desired frequency, click the "ON" button of the [LASER] tab to turn the laser on.

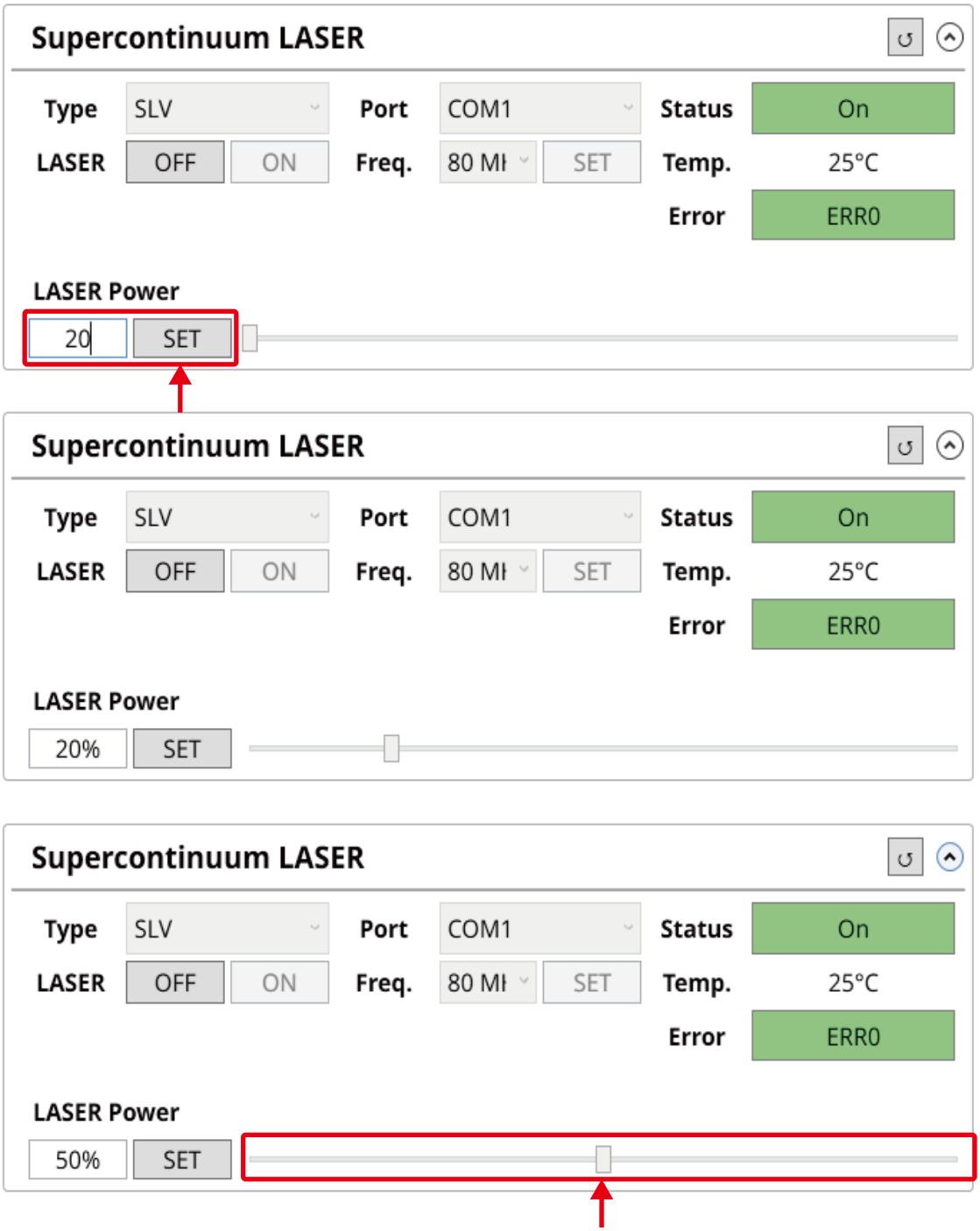


The laser is now ready for use.



3.3 Laser Operation

Once the laser is ready for use, use the [LASER Power] tab to set its desired power.
Users can manually input the power directly and click "SET" button or use the scroll bar on the right.



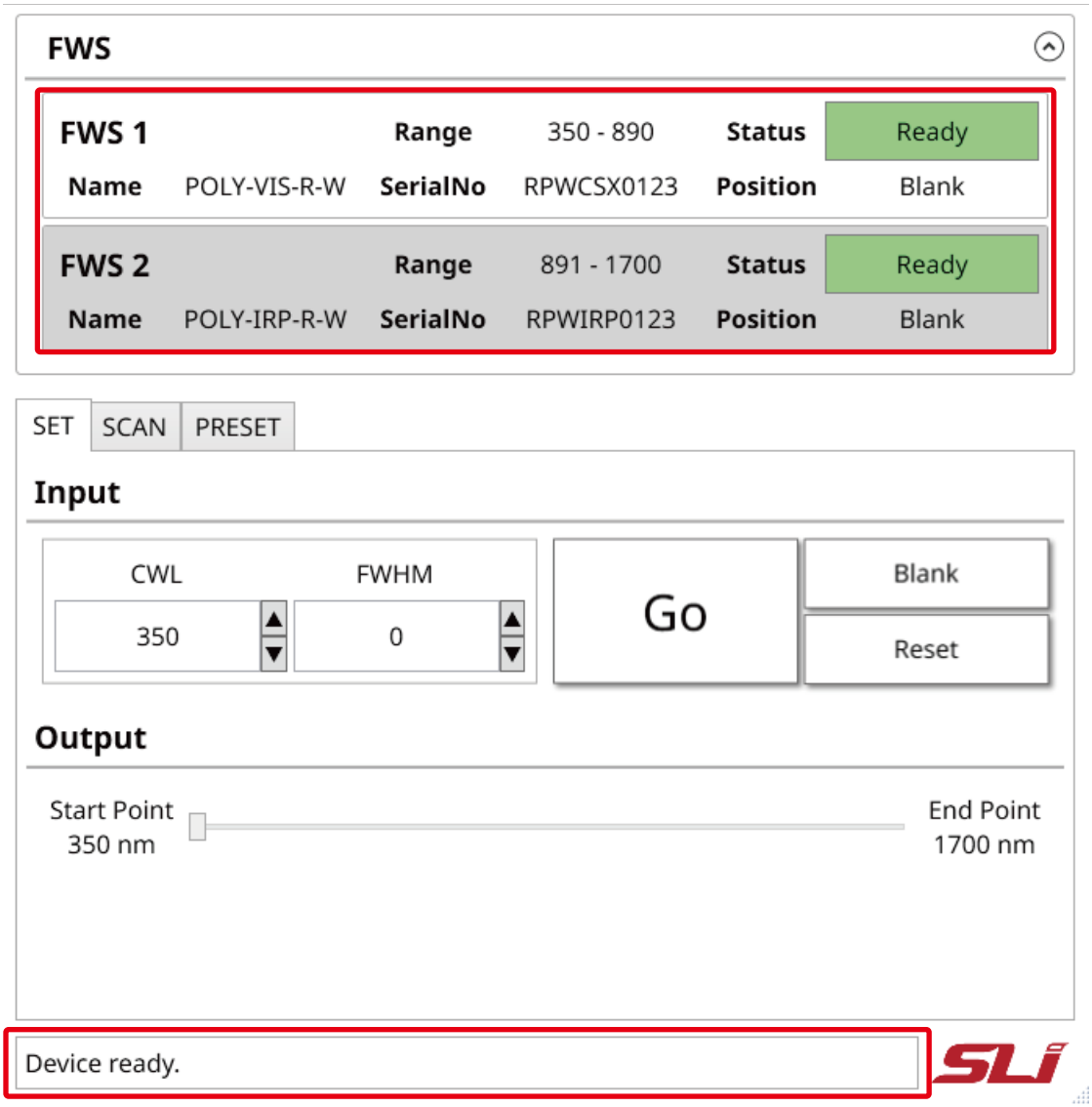
***NOTE : When increasing the power of the laser output, it should be gradually raised from 0% to 100%.**
For example : 0% → 30% → 50% → 80% → 100%

***NOTE : When decreasing the power of the laser output, it should be gradually reduced from 100% to 0%.**
For example : 100% → 80% → 50% → 30% → 0%

3.4 FWS Connection

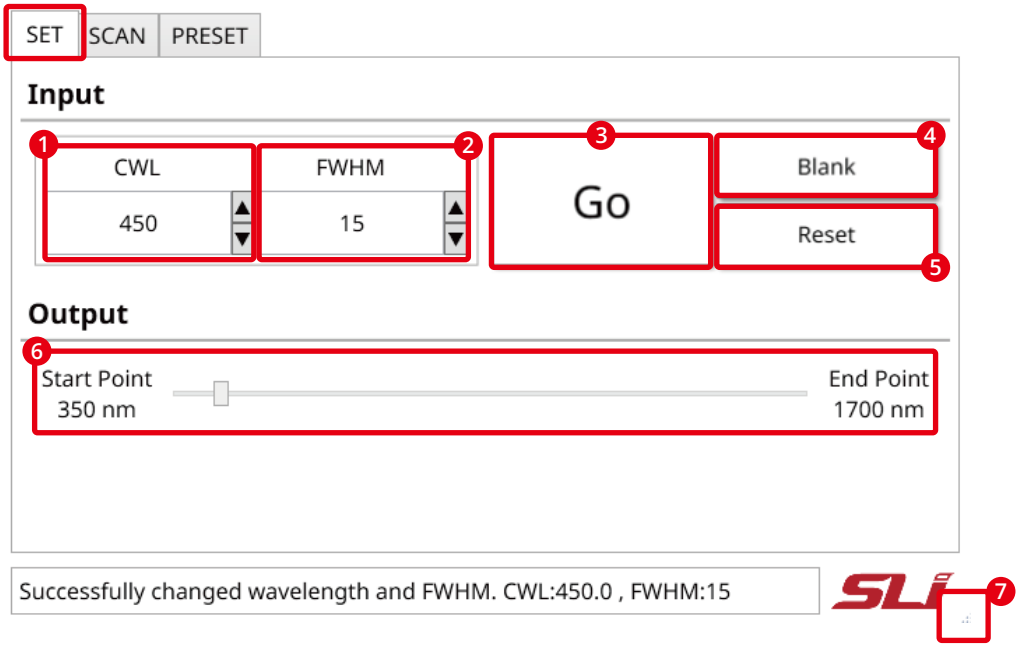
1. If the calibration file is located in the software directory and the path of the calibration file was correctly copied onto the "FwsConfig" file, the FWS should connect automatically.

To check that the FWS is successfully connected, check that the [Status] tab displays "Ready", and the "Device ready." message at the bottom of the software.



3.5 FWS Operation : Setting the center wavelength and bandwidth

1. **CWL (nm)** : enter the desired CWL (center wavelength)
2. **FWHM (nm)** : enter the desired FWHM (full-width at half maximum)
3. **Go** : click to start wavelength tuning
4. **Blank** : click to set blank mode
5. **Reset** : click to reset filter
6. **Scroll bar** : drag the scroll bar to control the CWL
7. **Resize bar** : click and drag to resize the software window



3.6 FWS Operation : Scanning across a certain wavelength range

1. **Enter the following values**
- **START (nm)** : wavelength to start scanning
- **END (nm)** : wavelength to end scanning
- **FWHM (nm)** : bandwidth during the scanning
- **STEP (nm)** : step size of the scan in nm
- **Time delay (sec)** : set the time delay between each individual wavelength steps
- **Repeat time (count)** : number of full scans
2. **Go** : click to start scanning
3. **Stop** : click to stop scanning

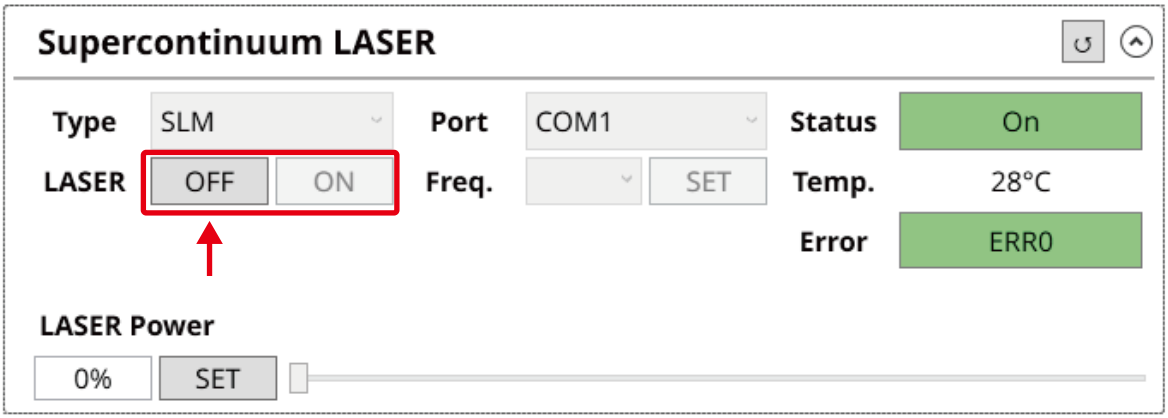
3.7 FWS Operation : Setting or editing the preset wavelength and bandwidth

- In the PRESET tab, you can set your frequently used wavelength and bandwidth for easy access.

1. **CWL, FWHM (nm)** : enter the desired CWL and FWHM value
2. **Preset Selection** : select the presets that are to be scanned
3. **Go (individual)** : click to scan individual presets
4. **Time delay (sec)** : set the time delay between each individual presets
5. **Repeat time (count)** : number of full scans
6. **Go** : click to scan all selected presets
7. **Stop** : click to stop scanning
8. **Add, Delete, Save** : click respective buttons to add, delete and save current presets

3.8 Turning Off Laser

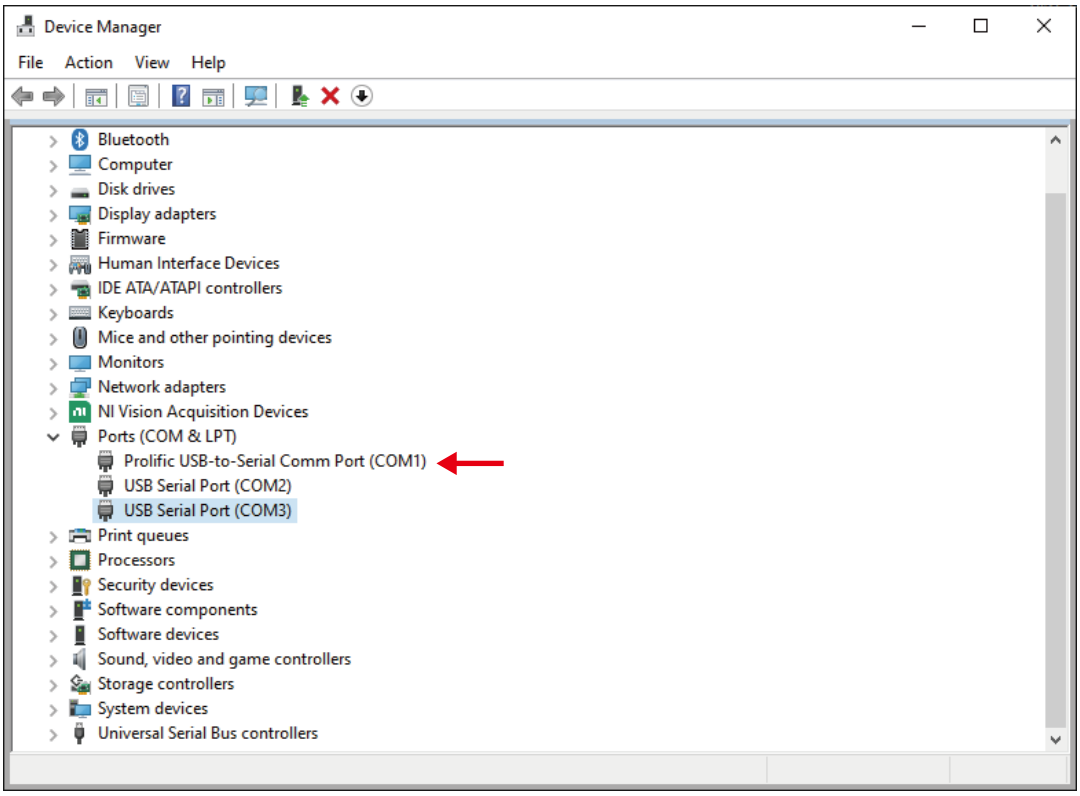
1. **Gradually decrease the power of the laser output.** (*For example : 100% → 80% → 50% → 30% → 0%*)
2. **Click "OFF" on the [LASER] tab.**



3. **Turn off the key switch on the front panel of the TLS. (0 : OFF, 1 : ON)**
4. **Turn off the power switch on the back panel of the TLS.**
5. **If the TLS will not be used for long time, disconnect the power cord and interlock plug.**

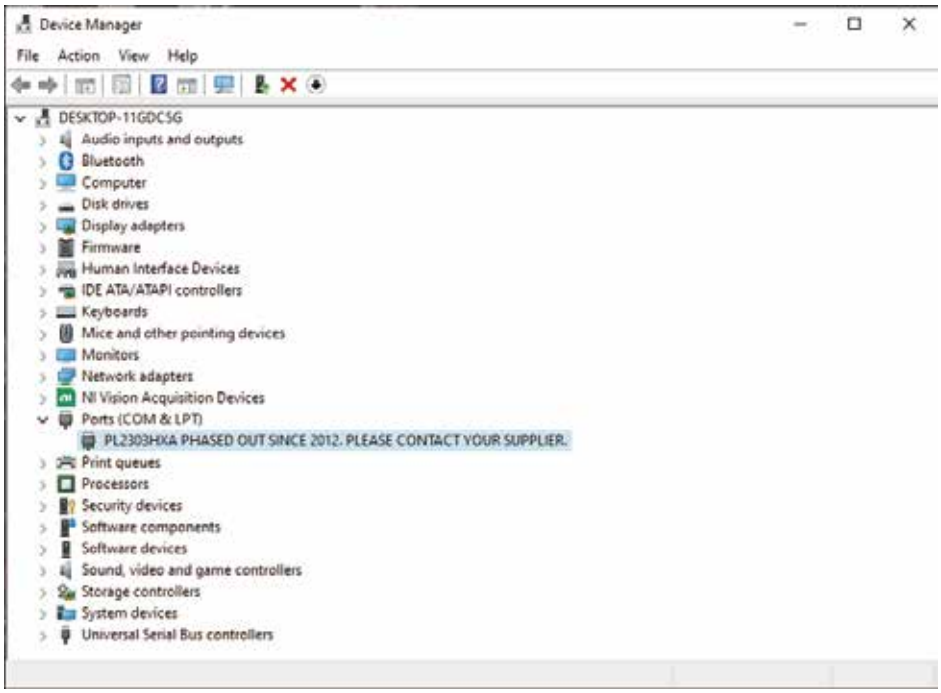
4.1 Device Connection Error

- If you're experiencing issues with the connection between the device and software, ensure the communication driver is correctly installed and displayed in the Device Manager.
- If there is a problem with the communication driver, install the latest FTDI USB driver suitable for your OS from the following website - **https://ftdichip.com/drivers/**

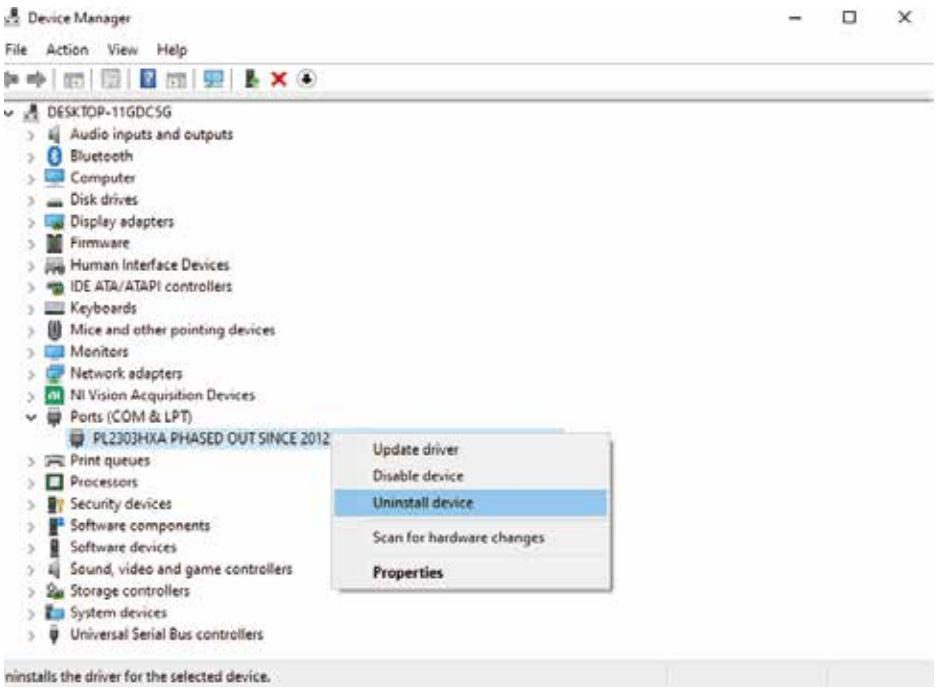


4.2 Laser Connection Error

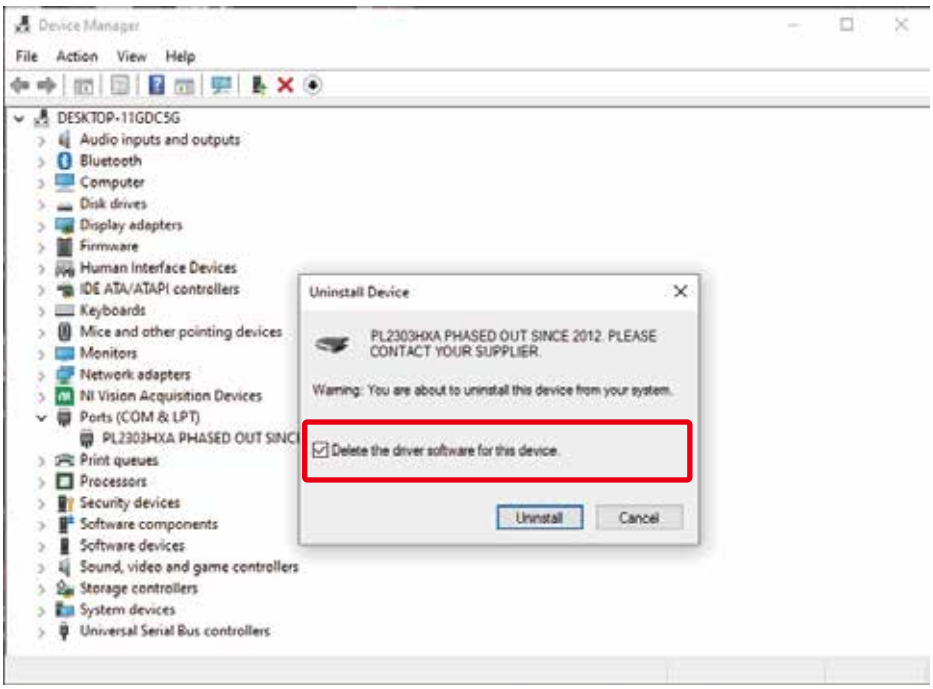
- If you are having difficulty setting up a laser connection, check the "Ports (COM & LPT)" section of Device Manager for the presence and proper configuration of the laser.



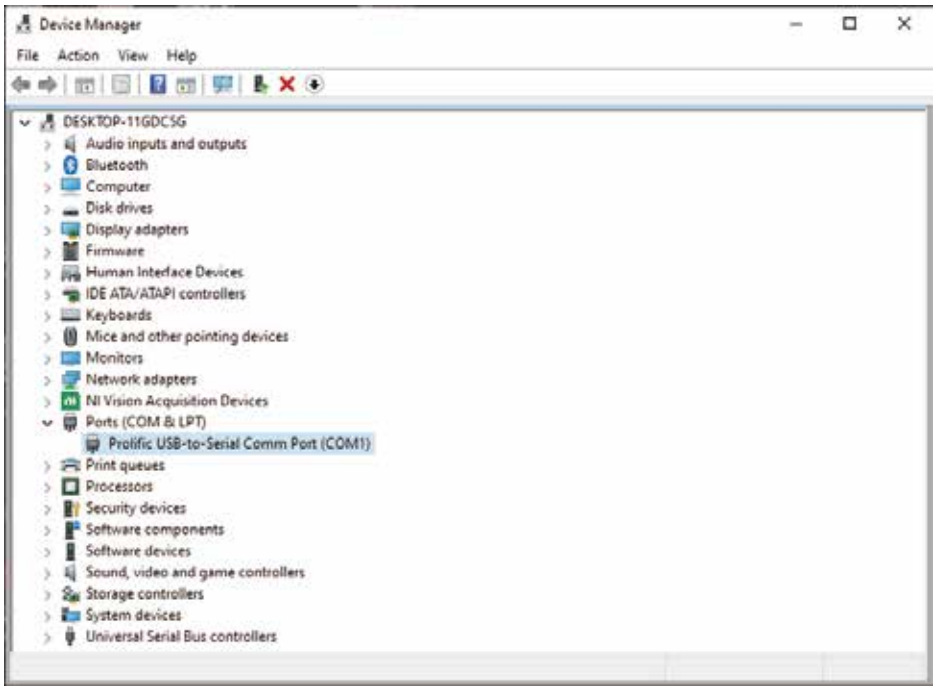
- If the name of the port is as follows, right click on the respective port and click “Uninstall device”.



- When the following screen pops up, be sure to check the box and click "Uninstall".



- Once the uninstall is complete, disconnect the USB cable of the TLS and reconnect.
- Reopen the Device Manager and check under "Ports (COM & LPT)".



- If the laser port name is "Prolific USB-to-Serial Comm Port", check the COM port number and choose the respective number in the TLS software.

4.3 Laser Error Messages

- ERR0 : No error
- ERR1 : Parameters alarm turn off power and restart, if still alarm please contact SLi
- ERR3 : Parameters alarm please contact SLi
- ERR4 : Parameters alarm please contact SLi
- ERR6 : Frequency alarm turn off power and restart, if still alarm please contact SLi
- ERR7 : Temperature alarm Switch off the laser and ensure the laser temperature is less than 40℃ before use
- ERR8 : INTERLOCK alarm Please insert interlock, then turn off the power and restart
- ERR9 : Voltage alarm turn off power and restart, if still alarm please contact SLi
- ERR10 : Time limited please contact SLi
- ERR19 : 24 V voltage alarm turn off power and restart, if still alarm please contact SLi
- ERR29 : 5 V voltage alarm please contact SLi
- ERR39 : 10 W pump and 2 V voltage alarm please contact SLi
- ERR49 : 3.3 V voltage alarm please contact SLi
- ERR59 : VCC 5 V voltage alarm please contact SLi
- ERR69 : 1.2 V voltage alarm please contact SLi
- ERR79 : 27 W pump and 11 V voltage alarm please contact SLi
- ERR11 : Parameters alarm turn off power and restart, if still alarm please contact SLi
- ERR31 : Parameters alarm turn off power and restart, if still alarm please contact SLi
- ERR41 : Parameters alarm turn off power and restart, if still alarm please contact SLi
- ERR51 : Parameters alarm turn off power and restart, if still alarm please contact SLi
- ERR61 : Parameters alarm turn off power and restart, if still alarm please contact SLi
- ERR81 : Parameters alarm turn off power and restart, if still alarm please contact SLi

5.1 Laser Safety

The following general safety precautions must be observed during all phases of the operation of this instrument. Failure to comply with these precautions or specific warnings elsewhere in this manual violates safety standards for the instrument's intended use.

Safety Symbols

Avoid Exposure : Do not expose yourself to the direct or reflected output beam. Direct exposure to the laser radiation emitted from this unit may be harmful.

Shielding and Optics : Ensure that the appropriate output beam shields and optics are properly installed before energizing the unit.

Interlocks : All interlocks must be satisfied prior to operation. Failure to comply may lead to hazardous conditions.

Always read and understand the manual before working on or with this device.

iiSM Inc. has no liability for the customer's failure to comply with these requirements.

1. Before the operation, review the instrument and manual for safety markings and instructions. You must follow these to ensure safe operation and to maintain the instrument in safe condition.
2. Avoid direct exposure to the beam.
3. Always wear protective goggles or eyeglasses appropriate for working with laser light.
4. Avoid looking at the beam directly.

Warning : A strong reflected laser beam back into the TLS output may damage the laser.

Safety Considerations

1. A strong reflected laser beam back into the TLS output may damage the laser.
2. Do not look directly at the output of the TLS at any time in any case.
3. Do not put things in the air passage in case it's clogged.
4. Do not place heavy objects on the laser body.
5. Do not put the output collimator toward people or any other reflective surface in case causing any personal injury.
6. Do not check the laser directly with your eyes unless you are sure the device is in power-down state as the laser may emit invisible infrared and ultraviolet light that can be harmful to your eyes.
7. Be sure that the laser is out of power before checking the device.
8. Do not stare at the emission port directly even you wear the laser protective glasses.
9. Do not put any low ignition substance on the laser such as the flammable, explosive materials etc.
10. Ensure the laser is placed out of reach of non-professionals.
11. Do not direct the laser light at glass surfaces, as normal glass has approximately 4 % reflectivity and can reflect light back into your eyes, causing harm.
12. Please remove your watch when using the laser to prevent the watch surface from reflecting light into your eyes.
13. Please use a detector or conversion film to locate the laser light since the light beyond 800 nm is totally invisible.
14. We strongly recommend wearing laser goggles with a specific wavelength protection rating to protect your eyes when operating the laser.
15. We recommend that you wear a long suit of white clothes. This will prevent your clothes from burning and potentially causing a fire if the laser irradiates your body.

5.2 Electrical Safety

1. The respective modules, boards, or RF inputs and outputs are susceptible to damage by electrostatic discharge (ESD) and require proper protection procedures for storage and handling.
2. To completely shut off electrical power to the unit, disconnect the power cord.

5.3 Environmental Considerations

To ensure optimal long-term performance, safety, and testing accuracy of the instrument, please consider the following environmental guidelines:

1. **Protect from Contaminants**: Avoid exposure to dust and direct sunlight, as these can compromise the unit's optical performance.
2. **Minimize Vibration:** Prevent excessive vibration, which may affect the mechanical integrity of the unit.
3. **Avoid Corrosive Environments**: Do not expose the unit to situations or environments containing corrosive gases.
4. **Ensure Proper Ventilation**: Do not block the fan vents. If the unit is rack-mounted, ensure it has adequate ventilation.
5. **Maintain Operating Temperature**: The recommended operating temperature is 10–30 ºC.
6. **Retain Packaging for Transport**: Keep the original packing material for future transport or shipment. If unavailable, contact support@spectrolightinc.com to obtain a factory-approved shipping case.

6. Technical Support

6.1 Contact Information

Technical support:
iiSM Inc.
402, 7-16, Naseongnam-ro,
Sejong-si, 30129, Republic of Korea
Tel: +82 44 863 9852
Email: support@spectrolightinc.com

6.2 Warranty Information

2 years from ship date.

7.1 TLS-RED Detailed Models

Model	Laser Specifications	Optical Specifications
TSL10-RED-VIS	Wavelength : 450 - 2400 nm Output power : 1 W VIS power : 0.1 W Repetition rate : 5 MHz	Tunable CWL : 450 - 790 nm FWHM : 2 - 15 nm (450 - 700 nm), 3 - 15 nm (701 - 790 nm)
TSL10-RED-IR		Tunable CWL : 775 - 1150 nm FWHM : 3 - 15 nm (775 - 890 nm), 5 - 15 nm (891 - 1150 nm)
TSL10-RED-SWIR		Tunable CWL : 1140 - 1700 nm FWHM : 5 - 15 nm (1140 - 1500 nm), 7 - 13 nm (1501 - 1700 nm)
TSL10-RED-Custom		USER SPECIFIED CUSTOM RANGE (Range selectable from 450 - 1700 nm)
TSLM10-RED-VIS	Wavelength : 410 - 2400 nm Output power : 1 W VIS power : 0.25 W Repetition rate : 10 MHz	Tunable CWL : 410 - 790 nm FWHM : 2 - 15 nm (410 - 700 nm), 3 - 15 nm (701 - 790 nm)
TSLM10-RED-IR		Tunable CWL : 775 - 1150 nm FWHM : 3 - 15 nm (775 - 890 nm), 5 - 15 nm (891 - 1150 nm)
TSLM10-RED-SWIR		Tunable CWL : 1140 - 1700 nm FWHM : 5 - 15 nm (1140 - 1500 nm), 7 - 13 nm (1501 - 1700 nm)
TSLM10-RED-Custom		USER SPECIFIED CUSTOM RANGE (Range selectable from 410 - 1700 nm)
TSLM20-RED-VIS	Wavelength : 410 - 2400 nm Output power : 2 W VIS power : 0.5 W Repetition rate : 20 MHz	Tunable CWL : 410 - 790 nm FWHM : 2 - 15 nm (410 - 700 nm), 3 - 15 nm (701 - 790 nm)
TSLM20-RED-IR		Tunable CWL : 775 - 1150 nm FWHM : 3 - 15 nm (775 - 890 nm), 5 - 15 nm (891 - 1150 nm)
TSLM20-RED-SWIR		Tunable CWL : 1140 - 1700 nm FWHM : 5 - 15 nm (1140 - 1500 nm), 7 - 13 nm (1501 - 1700 nm)
TSLM20-RED-Custom		USER SPECIFIED CUSTOM RANGE (Range selectable from 410 - 1700 nm)
TSLM40-RED-VIS	Wavelength : 410 - 2400 nm Output power : 4 W VIS power : 1 W Repetition rate : 40 MHz	Tunable CWL : 410 - 790 nm FWHM : 2 - 15 nm (410 - 700 nm), 3 - 15 nm (701 - 790 nm)
TSLM40-RED-IR		Tunable CWL : 775 - 1150 nm FWHM : 3 - 15 nm (775 - 890 nm), 5 - 15 nm (891 - 1150 nm)
TSLM40-RED-SWIR		Tunable CWL : 1140 - 1700 nm FWHM : 5 - 15 nm (1140 - 1500 nm), 7 - 13 nm (1501 - 1700 nm)
TSLM40-RED-Custom		USER SPECIFIED CUSTOM RANGE (Range selectable from 410 - 1700 nm)
TSLM35V-RED-VIS	Wavelength : 410 - 2400 nm Output power : 3.5 W VIS power : 1 W Repetition rate : 0.01 - 40 MHz adjustable	Tunable CWL : 410 - 790 nm FWHM : 2 - 15 nm (410 - 700 nm), 3 - 15 nm (701 - 790 nm)
TSLM35V-RED-IR		Tunable CWL : 775 - 1150 nm FWHM : 3 - 15 nm (775 - 890 nm), 5 - 15 nm (891 - 1150 nm)
TSLM35V-RED-SWIR		Tunable CWL : 1140 - 1700 nm FWHM : 5 - 15 nm (1140 - 1500 nm), 7 - 13 nm (1501 - 1700 nm)
TSLM35V-RED-Custom		USER SPECIFIED CUSTOM RANGE (Range selectable from 410 - 1700 nm)
TSL80V-RED-VIS	Wavelength : 430 - 2400 nm Output power : 8 W VIS power : 1 W Repetition rate : 0.01 - 200 MHz adjustable	Tunable CWL : 430 - 790 nm FWHM : 2 - 15 nm (430 - 700 nm), 3 - 15 nm (701 - 790 nm)
TSL80V-RED-IR		Tunable CWL : 775 - 1150 nm FWHM : 3 - 15 nm (775 - 890 nm), 5 - 15 nm (891 - 1150 nm)
TSL80V-RED-SWIR		Tunable CWL : 1140 - 1700 nm FWHM : 5 - 15 nm (1140 - 1500 nm), 7 - 13 nm (1501 - 1700 nm)
TSL80V-RED-Custom		USER SPECIFIED CUSTOM RANGE (Range selectable from 430 - 1700 nm)
TSLM70-RED-VIS	Wavelength : 410 - 2400 nm Output power : 7 W VIS power : 2 W Repetition rate : 80 MHz	Tunable CWL : 410 - 790 nm FWHM : 2 - 15 nm (410 - 700 nm), 3 - 15 nm (701 - 790 nm)
TSLM70-RED-IR		Tunable CWL : 775 - 1150 nm FWHM : 3 - 15 nm (775 - 890 nm), 5 - 15 nm (891 - 1150 nm)
TSLM70-RED-SWIR		Tunable CWL : 1140 - 1700 nm FWHM : 5 - 15 nm (1140 - 1500 nm), 7 - 13 nm (1501 - 1700 nm)
TSLM70-RED-Custom		USER SPECIFIED CUSTOM RANGE (Range selectable from 410 - 1700 nm)

7.2 TLS-BLUE Detailed Models

Model	Laser Specifications	Optical Specifications
TSL10-BLUE-VIS	Wavelength : 450 - 2400 nm Output power : 1 W VIS power : 0.1 W Repetition rate : 5 MHz	Tunable CWL : 450 - 790 nm FWHM : 10 or 20 nm (fixed)
TSL10-BLUE-IR		Tunable CWL : 775 - 1150 nm FWHM : 10 or 20 nm (fixed)
TSL10-BLUE-SWIR		Tunable CWL : 1140 - 1700 nm FWHM : 10 or 20 nm (fixed)
TSL10-BLUE-Custom		USER SPECIFIED CUSTOM RANGE (Range selectable from 450 - 1700 nm) (FWHM : 10 or 20 nm (fixed))
TSLM10-BLUE-VIS	Wavelength : 410 - 2400 nm Output power : 1 W VIS power : 0.25 W Repetition rate : 10 MHz	Tunable CWL : 410 - 790 nm FWHM : 10 or 20 nm (fixed)
TSLM10-BLUE-IR		Tunable CWL : 775 - 1150 nm FWHM : 10 or 20 nm (fixed)
TSLM10-BLUE-SWIR		Tunable CWL : 1140 - 1700 nm FWHM : 10 or 20 nm (fixed)
TSLM10-BLUE-Custom		USER SPECIFIED CUSTOM RANGE (Range selectable from 410 - 1700 nm) (FWHM : 10 or 20 nm (fixed))
TSLM20-BLUE-VIS	Wavelength : 410 - 2400 nm Output power : 2 W VIS power : 0.5 W Repetition rate : 20 MHz	Tunable CWL : 410 - 790 nm FWHM : 10 or 20 nm (fixed)
TSLM20-BLUE-IR		Tunable CWL : 775 - 1150 nm FWHM : 10 or 20 nm (fixed)
TSLM20-BLUE-SWIR		Tunable CWL : 1140 - 1700 nm FWHM : 10 or 20 nm (fixed)
TSLM20-BLUE-Custom		USER SPECIFIED CUSTOM RANGE (Range selectable from 410 - 1700 nm) (FWHM : 10 or 20 nm (fixed))
TSLM40-BLUE-VIS	Wavelength : 410 - 2400 nm Output power : 4 W VIS power : 1 W Repetition rate : 40 MHz	Tunable CWL : 410 - 790 nm FWHM : 10 or 20 nm (fixed)
TSLM40-BLUE-IR		Tunable CWL : 775 - 1150 nm FWHM : 10 or 20 nm (fixed)
TSLM40-BLUE-SWIR		Tunable CWL : 1140 - 1700 nm FWHM : 10 or 20 nm (fixed)
TSLM40-BLUE-Custom		USER SPECIFIED CUSTOM RANGE (Range selectable from 410 - 1700 nm) (FWHM : 10 or 20 nm (fixed))
TSLM35V-BLUE-VIS	Wavelength : 410 - 2400 nm Output power : 3.5 W VIS power : 1 W Repetition rate : 0.01 - 40 MHz adjustable	Tunable CWL : 410 - 790 nm FWHM : 10 or 20 nm (fixed)
TSLM35V-BLUE-IR		Tunable CWL : 775 - 1150 nm FWHM : 10 or 20 nm (fixed)
TSLM35V-BLUE-SWIR		Tunable CWL : 1140 - 1700 nm FWHM : 10 or 20 nm (fixed)
TSLM35V-BLUE-Custom		USER SPECIFIED CUSTOM RANGE (Range selectable from 410 - 1700 nm) (FWHM : 10 or 20 nm (fixed))
TSL80V-BLUE-VIS	Wavelength : 430 - 2400 nm Output power : 8 W VIS power : 1 W Repetition rate : 0.01 - 200 MHz adjustable	Tunable CWL : 430 - 790 nm FWHM : 10 or 20 nm (fixed)
TSL80V-BLUE-IR		Tunable CWL : 775 - 1150 nm FWHM : 10 or 20 nm (fixed)
TSL80V-BLUE-SWIR		Tunable CWL : 1140 - 1700 nm FWHM : 10 or 20 nm (fixed)
TSL80V-BLUE-Custom		USER SPECIFIED CUSTOM RANGE (Range selectable from 430 - 1700 nm) (FWHM : 10 or 20 nm (fixed))
TSLM70-BLUE-VIS	Wavelength : 410 - 2400 nm Output power : 7 W VIS power : 2 W Repetition rate : 80 MHz	Tunable CWL : 410 - 790 nm FWHM : 10 or 20 nm (fixed)
TSLM70-BLUE-IR		Tunable CWL : 775 - 1150 nm FWHM : 10 or 20 nm (fixed)
TSLM70-BLUE-SWIR		Tunable CWL : 1140 - 1700 nm FWHM : 10 or 20 nm (fixed)
TSLM70-BLUE-Custom		USER SPECIFIED CUSTOM RANGE (Range selectable from 410 - 1700 nm) (FWHM : 10 or 20 nm (fixed))

DISCLAIMER

This device is designed for use in laboratory and industrial environments. This is not a medical device and must not be used or applied to humans in any way.

WARNINGS AND PRECAUTIONS

- Operate the device using 100-240 V AC, 50/60 Hz, 2 A / Output 24 V DC, 6.67 A.
- Always use the grounded power supply cord set provided to connect the system to a grounded outlet.
- Do not expose the device to rain or moisture.
- Never look into the optical pathway of the light sources used.
- Do not connect or disconnect the cables while the device's power is turned ON.
- Always allow free flow of fresh air on all sides.
- Operating/Storage conditions: Indoor use only

CLEANING AND MAINTENANCE

Please cover the output head with the dust-cap to avoid dust pollution while it's in idle state.
Keep the laser body clean. Do not allow the body or power adapter to come into contact with water.

STORAGE CONDITIONS

Temperature: 25℃(± 20 ℃), Humidity: 60 % or less.

OPERATION CONDITIONS

Temperature: 25℃(± 5 ℃), Humidity: 60 % or less.

ELECTRICAL CHARACTERISTICS

INPUT: 100 – 240 V AC, 50/60 Hz, 2 A
Power consumption: < 280 W

SPECTROLIGHT

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