

Tunable Laser System

TLS

Operation Manual

Ver 24-09



SLI
SPECTROLIGHT Inc.

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1. Introduction

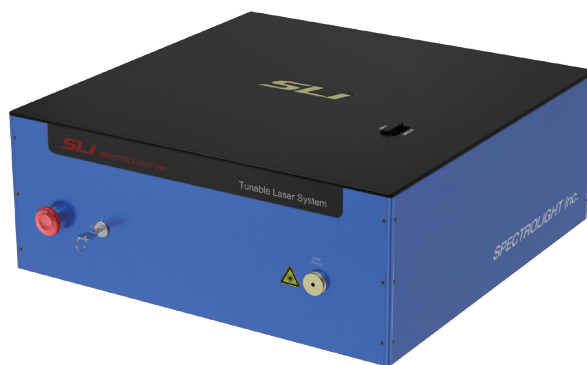
Spectrolight's tunable laser system (TLS) is an innovative, continuously tunable laser that combines a supercontinuum laser and a tunable bandpass filter in VISBLE, IR, and SWIR ranges.

TLS-RED can generate wide wavelength ranges of approximately 400 nm to 1700 nm and can control the FWHM 2 to 15 nm (nominal), and **TLS-BLUE** has the same wide wavelength ranges with fixed FWHM at 10 or 20 nm. TLS-RED is suitable for fields that require precise scanning, and TLS-BLUE is ideal for fields that require high output. By using Spectrolight's TLS, users can freely select the output power and wavelength ranges according to their needs.

TLS is a picosecond 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. .

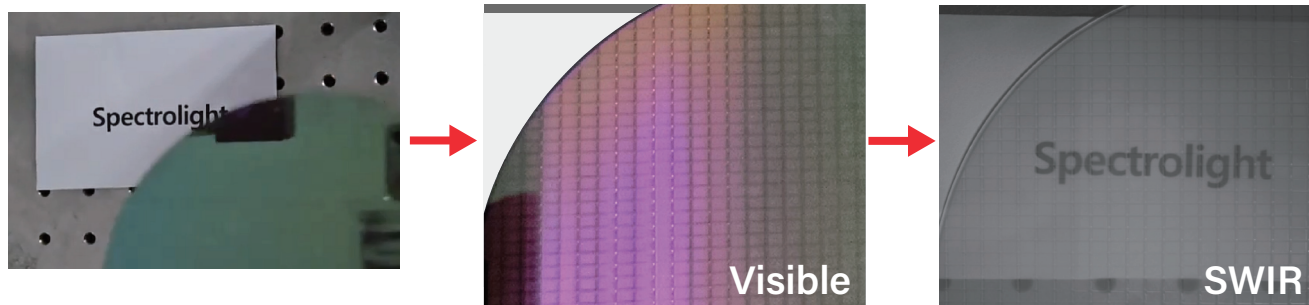


TLS-RED (Tunable bandwidth)



TLS-BLUE (Fixed bandwidth)

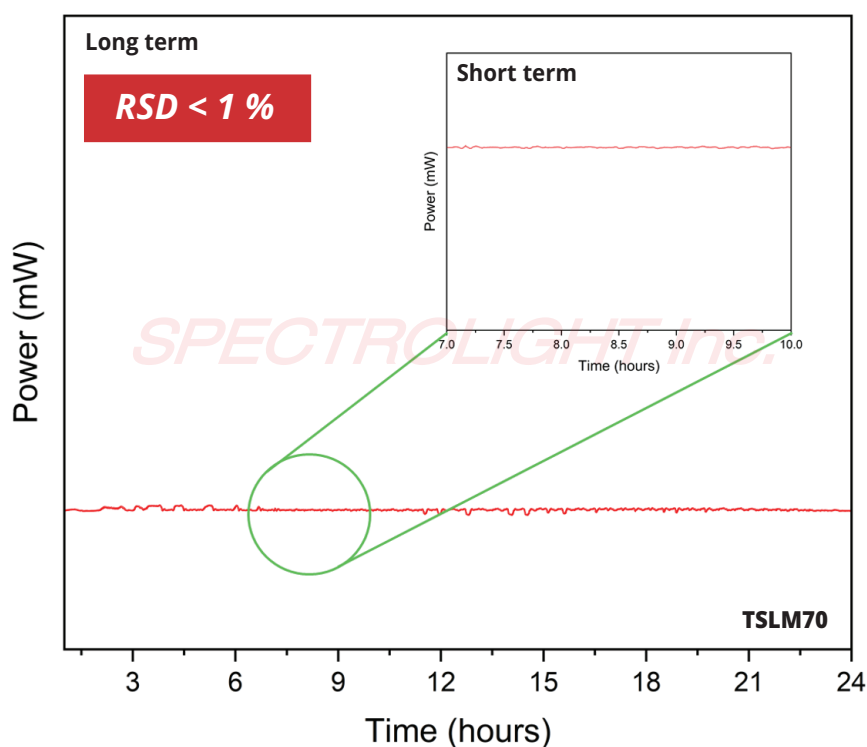
| Application example (Si wafer inspection)



Stable Long-term Power Fluctuation

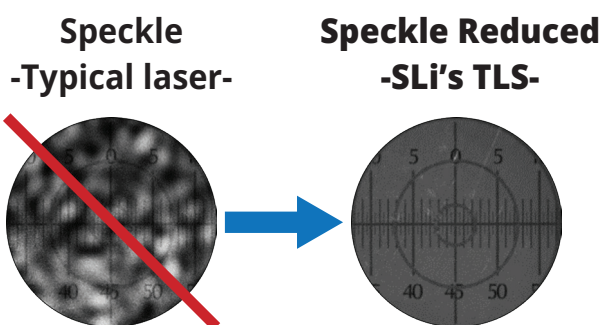
RSD is < 1 % at 650/15 nm

*RSD = Relative Standard Deviation

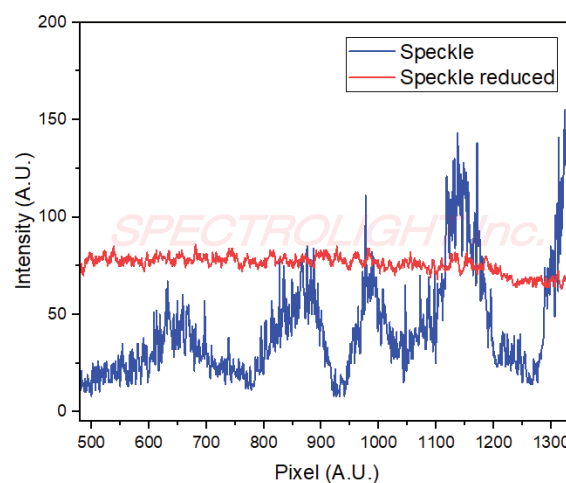


Speckle reduced Laser

TLS products are designed to reducing the laser speckle noise found as a noise pattern in typical lasers, ensuring their compatibility with imaging applications. Moreover, image segmentation reveals that stability is maintained even across varying intensity levels.



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 can cover different spectral ranges from 410 to 1700 nm. The FWHM bandwidth of TLS Red is tunable from 2 to 15 nm (nominal). The exact tunable bandwidth depends on the wavelength range. Users can select laser types and variable wavelength ranges according to the user’s applications. Please refer to the detailed specifications table below.

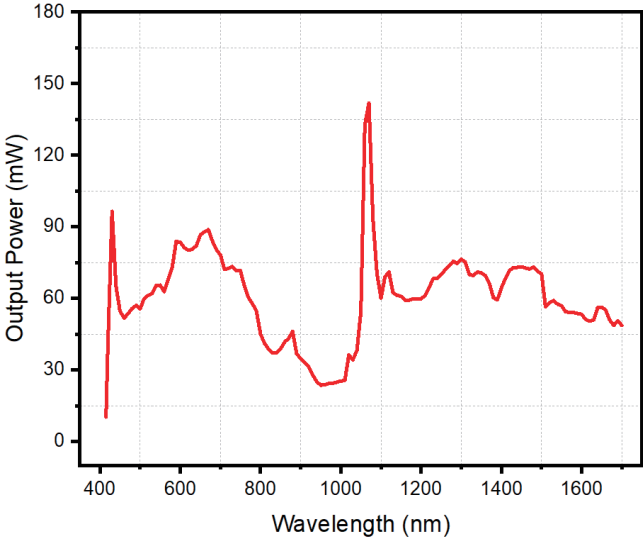
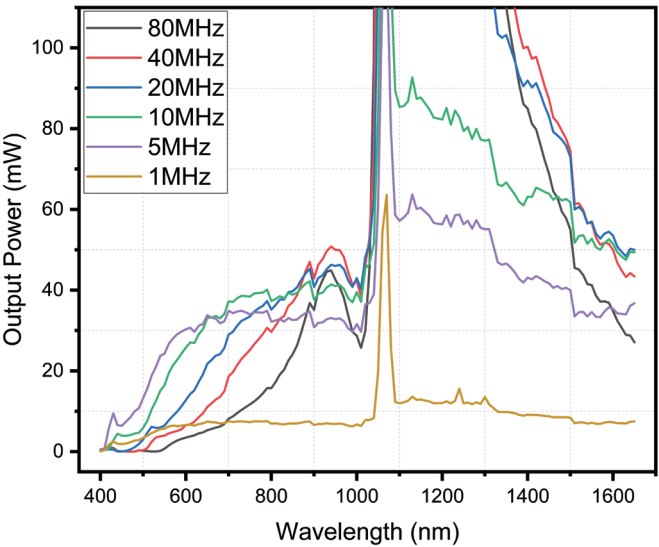


TLS-RED (Tunable bandwidth)

General Specifications

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

Model	Supercontinuum output power		Repetition Rate	Output pulse width (ps)	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	



* Measured at 15 nm bandwidth (FWHM)

Detailed Specifications

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

For the Custom models, users can select a supercontinuum laser model and variable wavelength ranges according to the user's applications. Please refer to the table below for supercontinuum laser models and wavelength ranges. For example, if the user selects the supercontinuum laser model as SL10 and the wavelength range of 690 – 1310 nm, then the model name of the TLS will be TSL10-RED-Custom (690 -1310 nm).

The supercontinuum laser model table

SL-Pico: Supercontinuum laser

Model	Supercontinuum output power		Repetition Rate	Output pulse width (ps)	Spectral Range (nm)
	Visible	Total			
SL10	100 mW	1 W	5 MHz	< 300 ps	450 - 2400 nm
SLM10	250 mW	1 W	10 MHz	< 50 ps	410 - 2400 nm
SLM20	500 mW	2 W	20 MHz	< 50 ps	410 - 2400 nm
SLM40	1 W	4 W	40 MHz	< 50 ps	410 - 2400 nm
SLM35V	1 W	3.5 W	0.01 to 40 MHz	< 50 ps	410 - 2400 nm
SL80V	1 W	8 W	0.01 to 200 MHz	< 300 ps	430 - 2400 nm
SLM70	2 W	7 W	80 MHz	< 50 ps	410 - 2400 nm

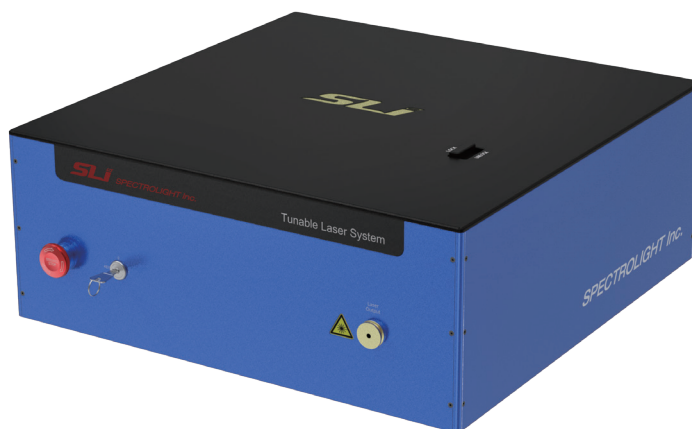
Wavelength range table

User specified custom wavelength range selectable from 410 - 1700 nm (nominal)

FWHM	2-15					3-15		5-15				7-13
CWL	410 - 435	430 - 490	485 - 550	545 - 620	615 - 700	690 - 790	775 - 890	880 - 1015	1000 - 1150	1140 - 1310	1300 - 1500	1475 - 1700

1.2 TLS-BLUE

Each TLS-BLUE model can cover different spectral ranges from 410 to 1700 nm. The FWHM bandwidth of TLS-BLUE is fixed at 10 or 20 nm (nominal), which is selectable by the user. Users can select laser types and variable wavelength ranges according to the user's applications. Please refer to the detailed specifications table below.

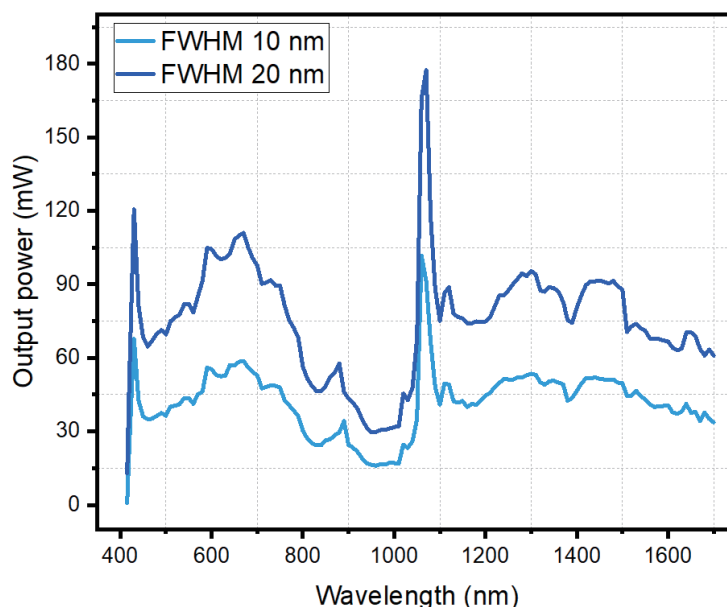


TLS-BLUE (Fixed bandwidth)

General Specifications

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

Model	Supercontinuum output power		Repetition Rate	Output pulse width (ps)	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	



Detailed Specifications

<i>Model</i>	<i>Laser Specifications</i>	<i>Optical Specifications</i>
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 430 - 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))

1. Introduction

For the Custom models, users can select a supercontinuum laser model and variable wavelength ranges according to the user's applications. Please refer to the table below for supercontinuum laser models and wavelength ranges. For example, if the user selects the supercontinuum laser model as SL10 and the wavelength range of 690 - 1310 nm, then the model name of the TLS will be TSL10-BLUE-Custom (690 -1310 nm).

The supercontinuum laser model table

SL-Pico: Supercontinuum laser

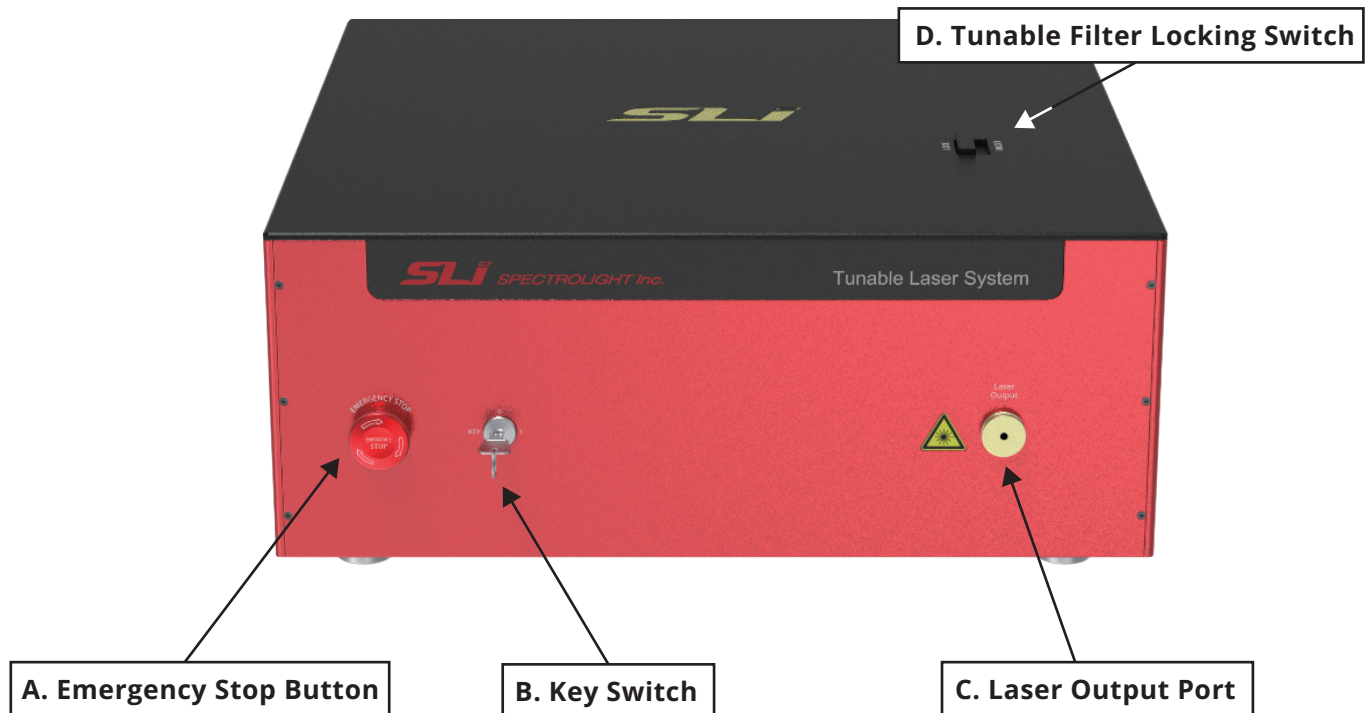
Model	Supercontinuum output power		Repetition Rate	Output pulse width (ps)	Spectral Range (nm)
	Visible	Total			
SL10	100 mW	1 W	5 MHz	< 300 ps	450 - 2400 nm
SLM10	250 mW	1 W	10 MHz	< 50 ps	410 - 2400 nm
SLM20	500 mW	2 W	20 MHz	< 50 ps	410 - 2400 nm
SLM40	1 W	4 W	40 MHz	< 50 ps	410 - 2400 nm
SLM35V	1 W	3.5 W	0.01 to 40 MHz	< 50 ps	410 - 2400 nm
SL80V	1 W	8 W	0.01 to 200 MHz	< 300 ps	430 - 2400 nm
SLM70	2 W	7 W	80 MHz	< 50 ps	410 - 2400 nm

Wavelength range table

User specified custom wavelength range selectable from 410 - 1700 nm (nominal)

FWHM	Fixed 10 or 20 (nominal)											
CWL	410 - 435	430 - 490	485 - 550	545 - 620	615 - 700	690 - 790	775 - 890	880 - 1015	1000 - 1150	1140 - 1310	1300 - 1500	1475 - 1700

2.1 System Main Components



2.2 Front Panel Functions

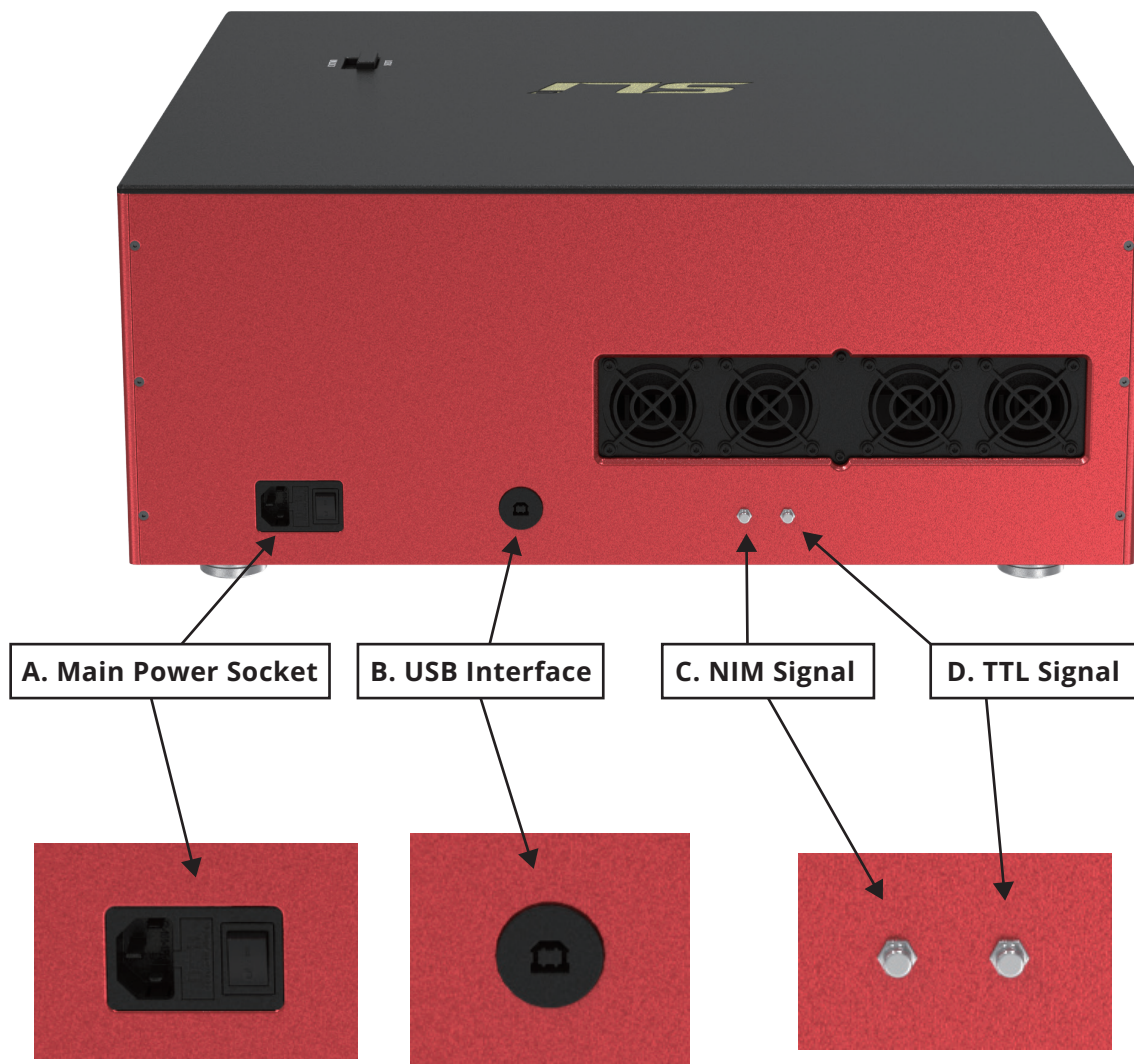
A. Emergency Stop Button : Press it in an emergency situation, and you can restore it by rotating it clockwise.

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 : Collimator output for the laser. It can be connected to the FWS's input linker (WS-CAY) accessory.

D. Tunable Filter Locking Switch : When not using equipment or moving equipment, you must lock the tunable filter. When the equipment is not in use, the tunable filter can be locked.

2.3 Back Panel Functions



A. Main Power Socket : Connect the power cable to supply power.

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

C. NIM Signal : 0 to -1, square wave with same frequency. 50 Ω .

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

2.4 Specifications

Interfaces

PC and micro process interfaces	USB 2.0 – Type B Female connector
Pulse Synchronization	NIM Pulse: BNC – NIM synchronization pulse (Seed and post-VRR)
	Pulse Monitor – 0 to 0.9 V synchronization pulse (Seed and post-VRR)
Door interlock	2 pin Connector - ?

Mechanical dimensions

Size (H x W x D)	585 x 585 x 230 mm
Weight	45 kg (approx.)
Operating Temperature	18°C to 30°C(64°F to 86°F)
Operating Humidity (non-condensing)	20 to 80%
Storage Temperature	-10°C to 55°C(14°F to 140°F)
Maximum Operating Altitude	2000 m
Output Type	Free space, SMA Fiber, Liquide Light guide

Electrical

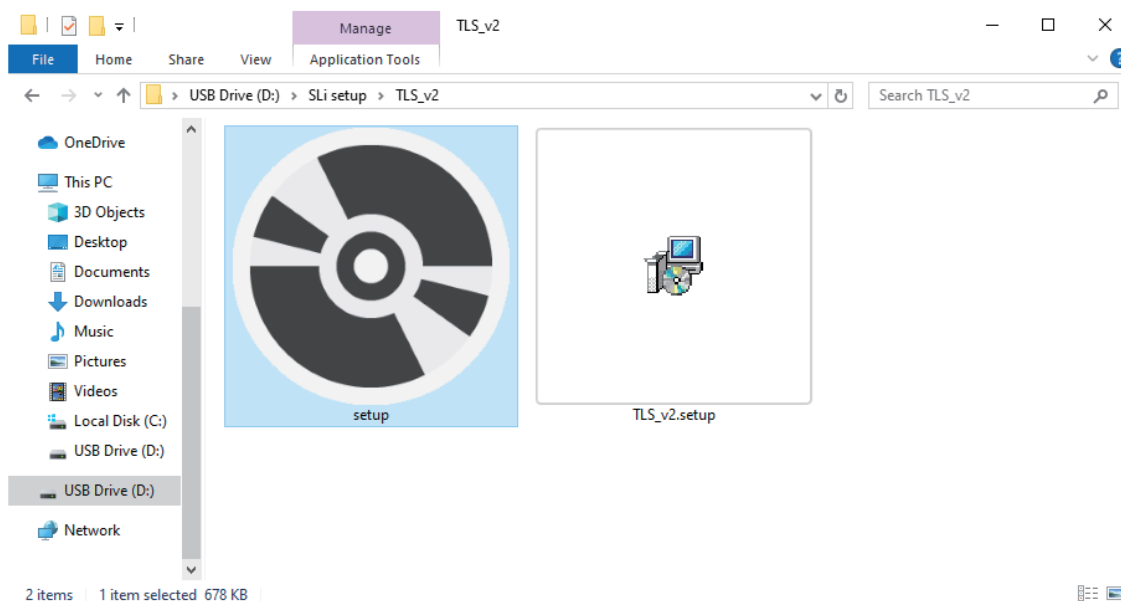
AC power	Input 100-240 VAC 50-60 Hz
Maximum Power Consumption	< 175 W
Fuse	5 x 20 mm cartridge fuse

3. Installation

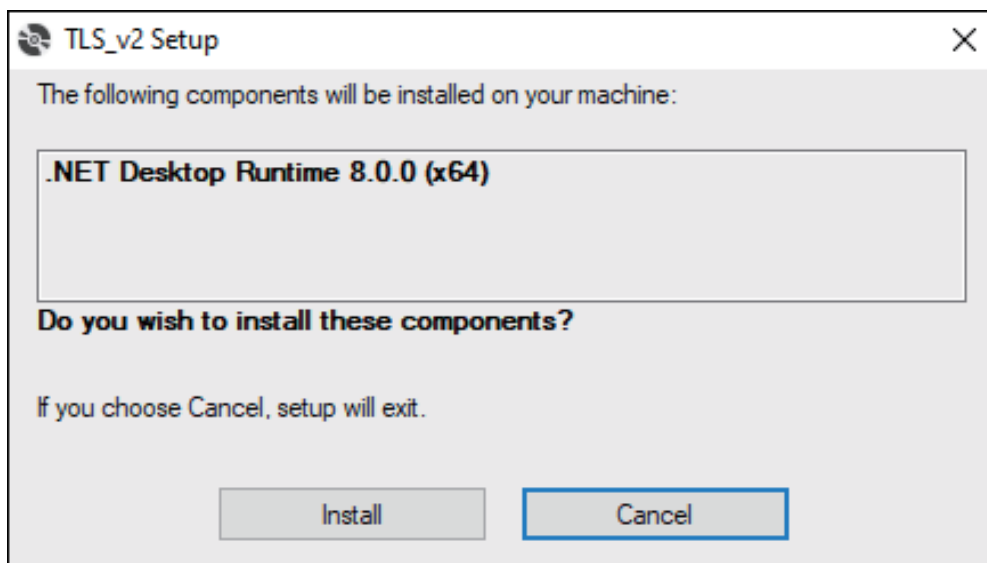
3.1 Software Installation

Download the software from the USB we have provided, or download it from our website - <https://www.spectrolightinc.com/shop/lists/002007>

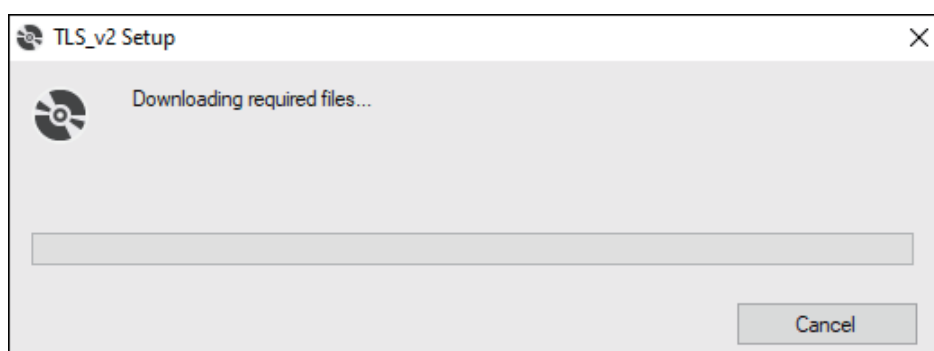
1. Run the “setup” program



2. Click “Install”

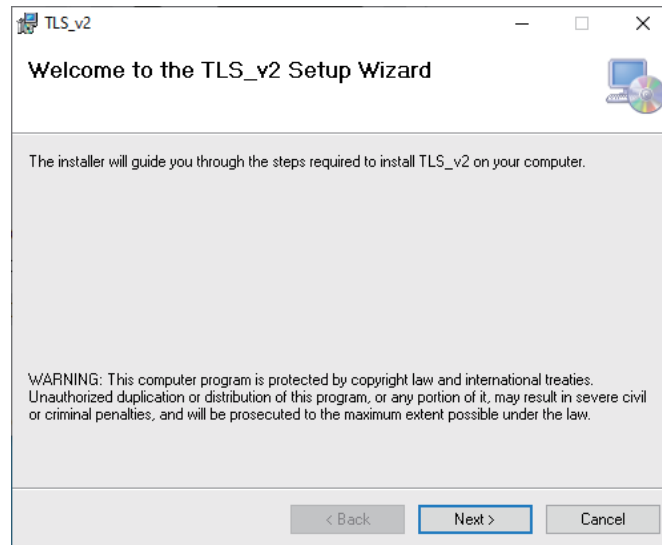


3. During installation if a windows pops up, click “Yes”

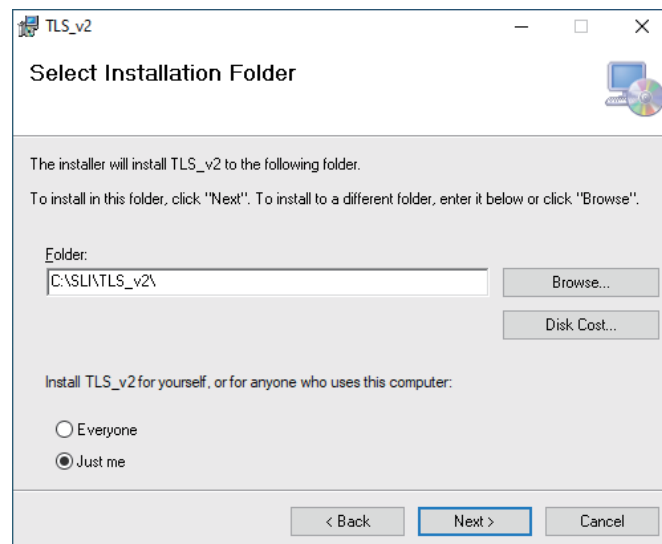


3. Installation

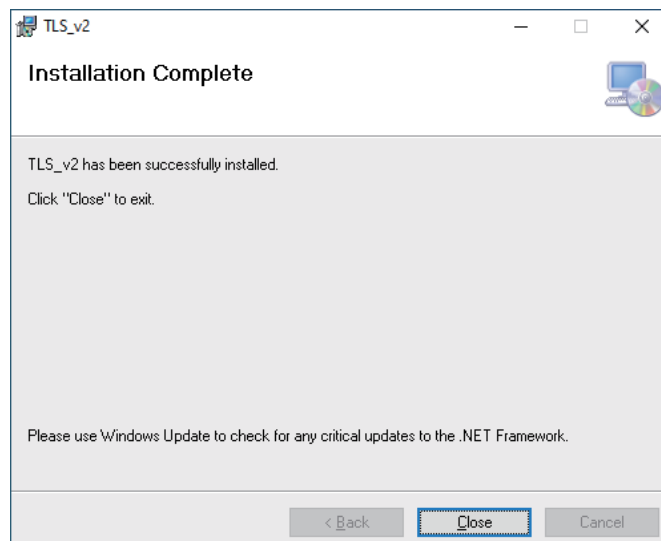
4. Click "Next"



5. Click "Next"



5. Installation complete



3. Installation

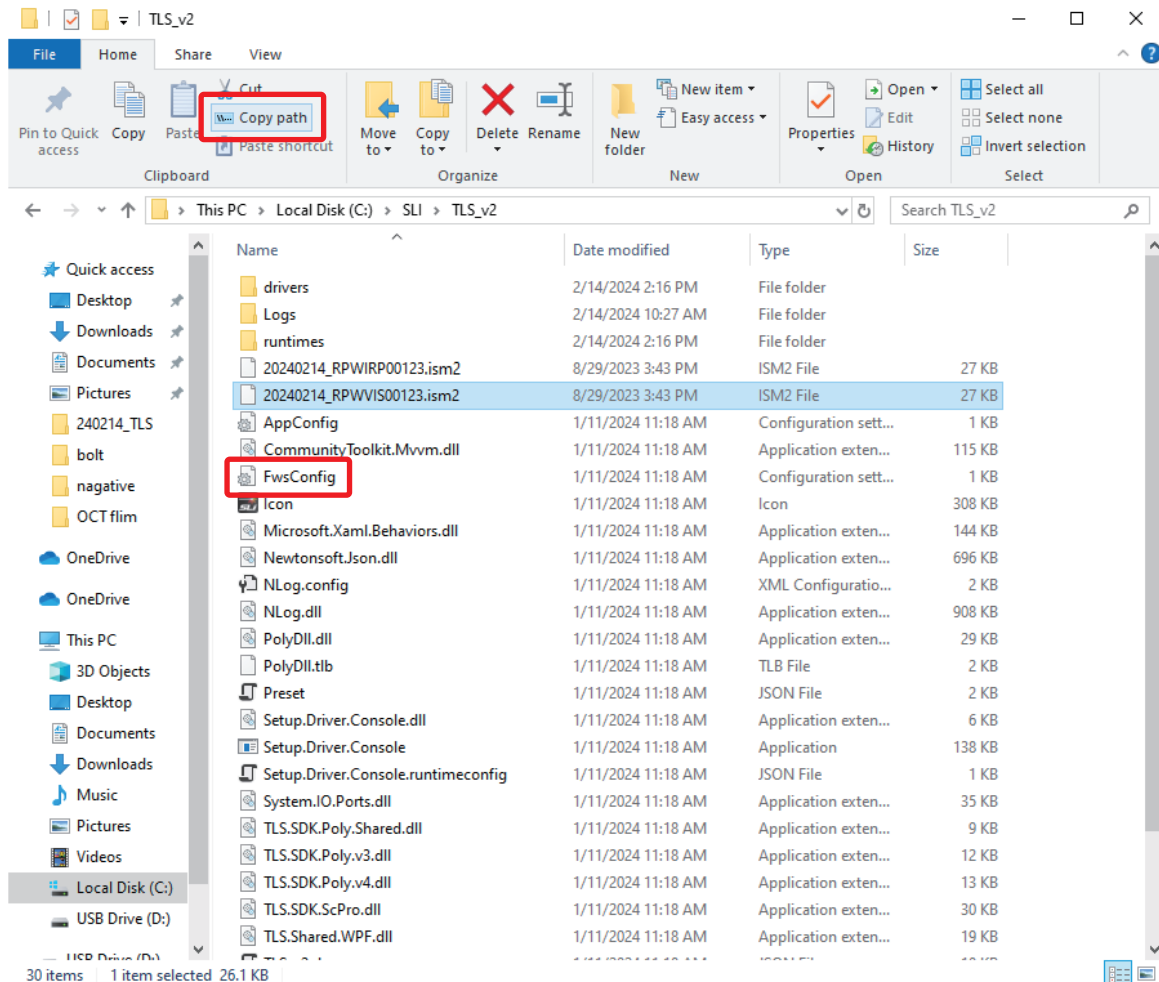
5. Copy the calibration file (.ism2 extension file) and FwsConfig file provided by the distributor or manufacturer to the default location

→ C:\SLI\TLS_v2

If the calibration file is not provided to you, please contact us by email at support@spectrolightinc.com
This file should be copied to your installation directory.

Please select this file and click on **Apply** after you run the Poly software.

The original “FwsConfig” file should be overwritten with the one provided by the distributor or manufacturer



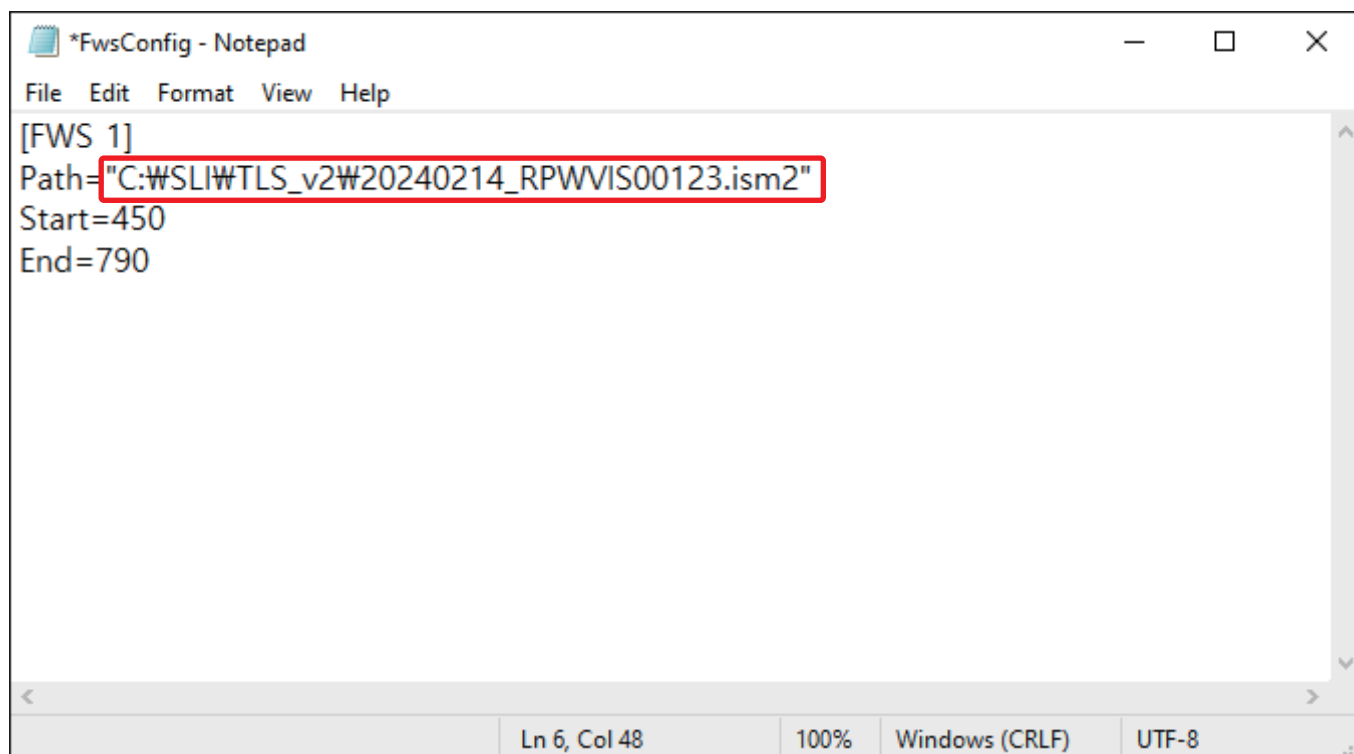
6. After selecting the calibration file click “copy path” on the top part of the windows and then open the “FwsConfig”

3. Installation

7. Paste the path in the following location

The example below is the VIS model (Start = 450 nm, End = 790 nm)

For Custom models we can provide the FwsConfig file so please contact us if you need.



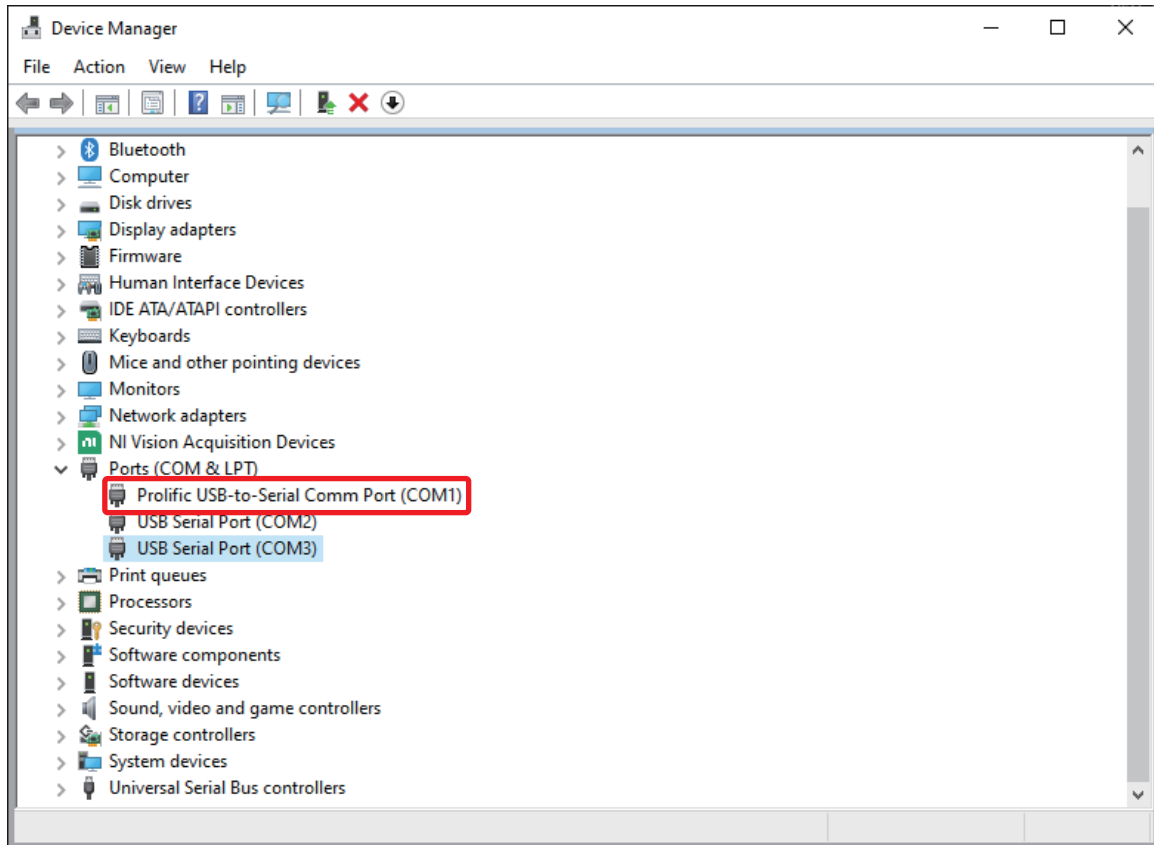
```
*FwsConfig - Notepad
File Edit Format View Help
[FWS 1]
Path="C:\WSLI\TLS_v2\W20240214_RPWVIS00123.ism2"
Start=450
End=790
Ln 6, Col 48 100% Windows (CRLF) UTF-8
```

4. Operation

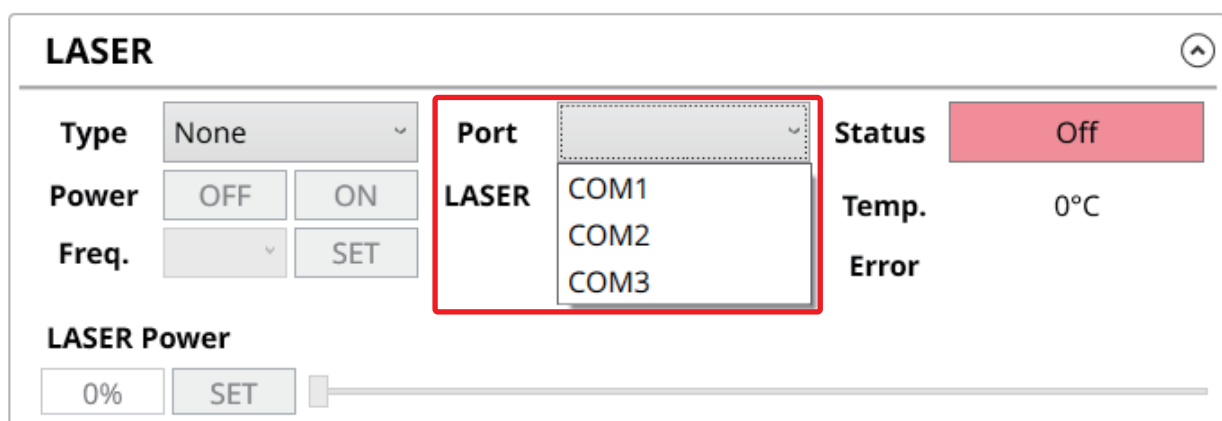
4.1 Laser Connection

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.



4. Operation

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)

LASER

Type	None	Port	COM1	Status	Off
Power	None	LASER	OFF ON	Temp.	0°C
Freq.	SLV SLF			Error	

LASER Power
0% SET

4. SLM models -

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

Click the "ON" button of the [LASER] tab to turn on the laser.

LASER

Type	SLF	Port	COM1	Status	Off
Power	OFF ON	LASER	OFF ON	Temp.	0°C
Freq.				Error	

LASER Power
0% SET

The laser is now ready for use.

LASER

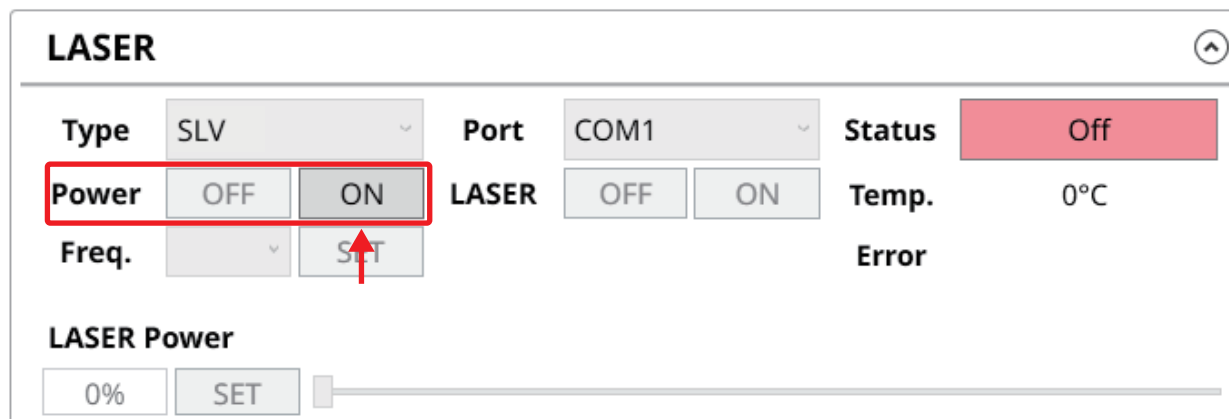
Type	SLF	Port	COM1	Status	On
Power	OFF ON	LASER	OFF ON	Temp.	27°C
Freq.				Error	ERR0

LASER Power
0% SET

4. Operation

SLV models -

Once the laser is connected, the [Power] tab should be activated.
Click the "ON" button of the [Power] tab to activate the [LASER] tab.

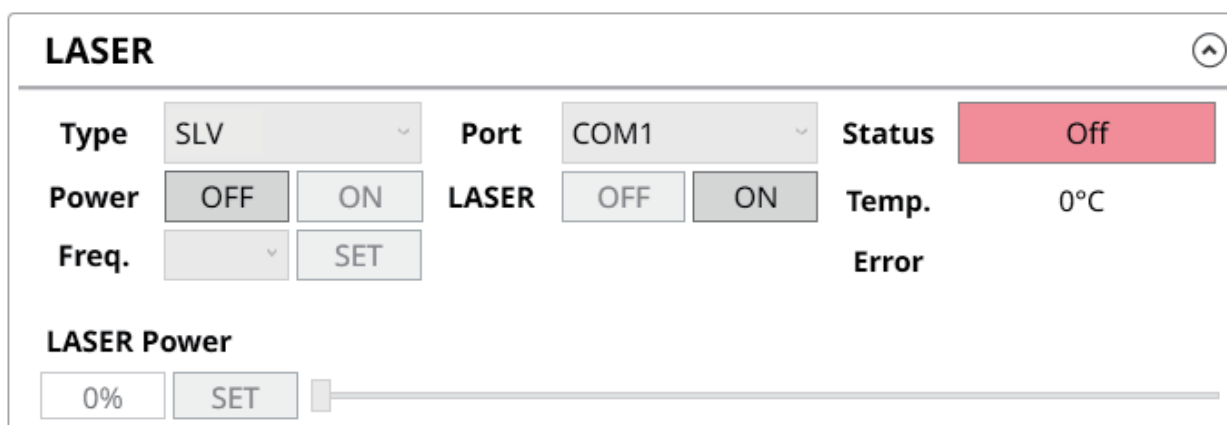


LASER

Type	SLV	Port	COM1	Status	Off
Power	OFF	ON	LASER	OFF	ON
Freq.		SET		Temp.	0°C
				Error	

LASER Power

0% SET



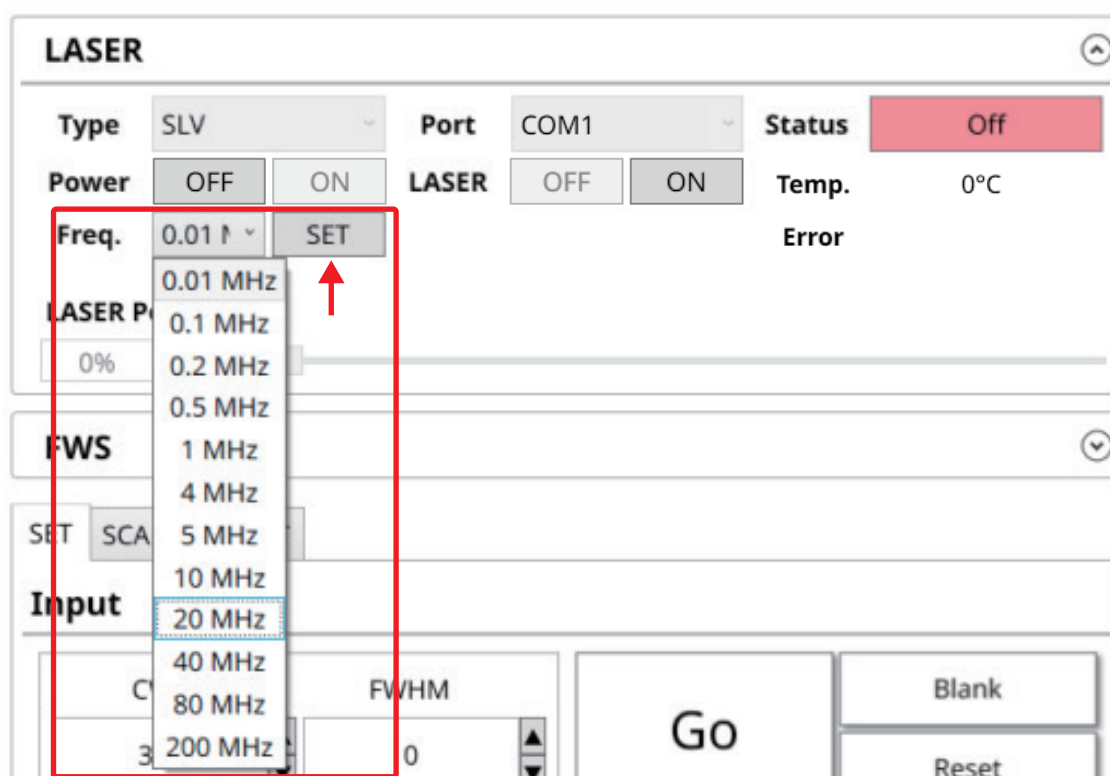
LASER

Type	SLV	Port	COM1	Status	Off
Power	OFF	ON	LASER	OFF	ON
Freq.		SET		Temp.	0°C
				Error	

LASER Power

0% SET

Once the [LASER] tab is activated, select the desired frequency on the [Freq.] tab, then click "SET".



LASER

Type	SLV	Port	COM1	Status	Off
Power	OFF	ON	LASER	OFF	ON
Freq.	0.01 MHz	SET		Temp.	0°C
				Error	

LASER Power

0% SET

FWS

SET SCA

Input

20 MHz

FWHM

Go Blank

Reset

4. Operation

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

LASER

Type	SLV	Port	COM1	Status	Off
Power	OFF	ON	LASER	OFF	ON
Freq.	20 MHz	SET		Temp.	0°C
				Error	

LASER Power

0% SET

The laser is now ready for use.

LASER

Type	SLV	Port	COM1	Status	On
Power	OFF	ON	LASER	OFF	ON
Freq.	20 MHz	SET		Temp.	27°C
				Error	ERR0

LASER Power

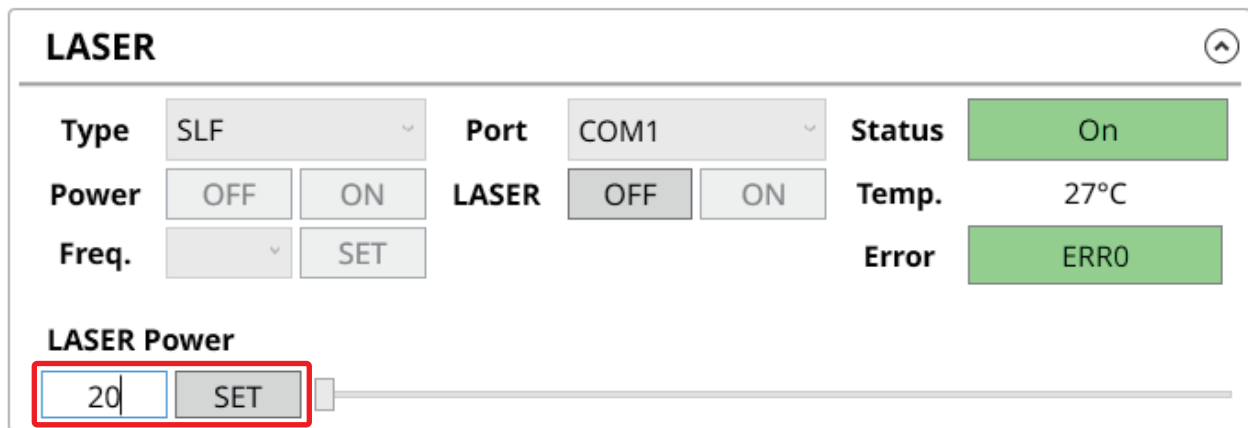
0% SET

4. Operation

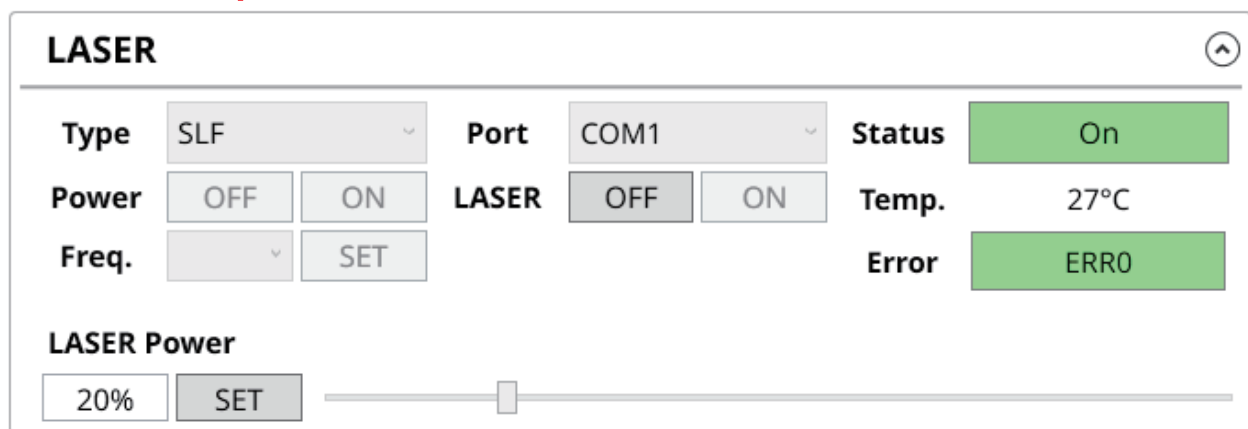
4.2 Laser Operation

Once the laser is ready for use, use the [LASER Power] tab to set its desired power.

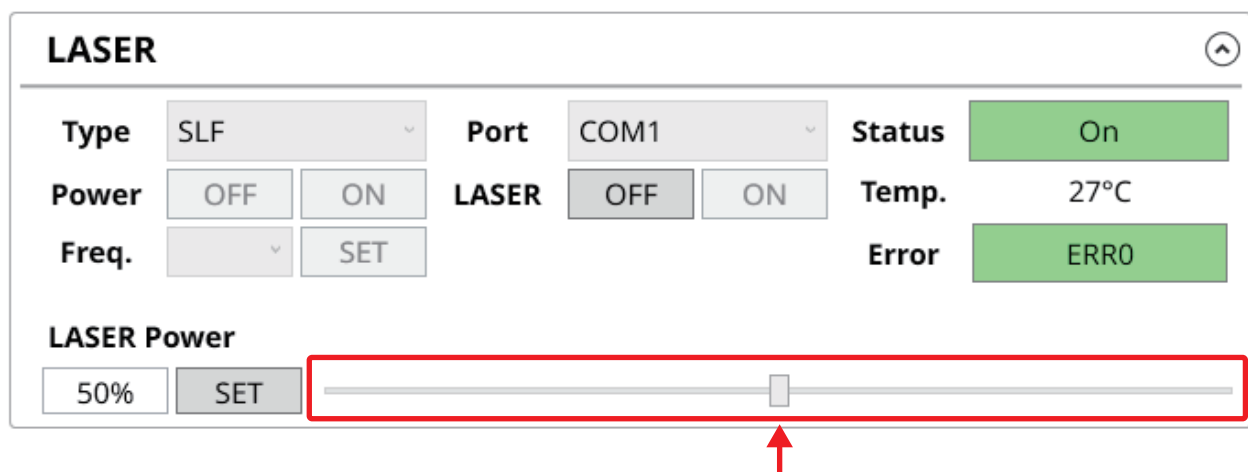
Users can manually input the power directly and click the "SET" button or use the scroll bar on the right.



The screenshot shows the 'LASER' control panel. At the top, there are dropdown menus for 'Type' (SLF) and 'Port' (COM1), and buttons for 'Power' (OFF, ON) and 'Freq.' (SET). Below these are status indicators for 'Status' (On), 'Temp.' (27°C), and 'Error' (ERR0). The 'LASER Power' section features a text input field containing '20', a 'SET' button, and a horizontal slider bar. A red rectangle highlights the '20' input and the 'SET' button, with a red arrow pointing to the 'SET' button.



This screenshot is identical to the previous one, but the text input field in the 'LASER Power' section now displays '20%'. The 'SET' button and slider bar remain visible.



This screenshot is identical to the previous ones, but the text input field in the 'LASER Power' section now displays '50%'. A red rectangle highlights the entire 'LASER Power' section, including the '50%' input, the 'SET' button, and the slider bar. A red arrow points to the slider bar.

***NOTE :** When increasing the power of the laser, be sure to increase power steadily from 0 to 100%.
For example : 0% → 30% → 50% → 80% → 100%

***NOTE :** When turning the power off of the laser, be sure to decrease power steadily from 100 to 0%.
For example : 100% → 80% → 50% → 30% → 0%
Then click "OFF" of the [LASER] tab.

4.3 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.

FWS

FWS 1	Range	350 - 890	Status	Ready	
Name	POLY-VIS-R-W	SerialNo	RPWCSX0123	Position	Blank
FWS 2	Range	891 - 1700	Status	Ready	
Name	POLY-IRP-R-W	SerialNo	RPWIRP0123	Position	Blank

SETSCANPRESET

Input

CWLFWHM

3500


Go

BlankReset

Output

Start Point350 nmEnd Point1700 nm

Device ready.



4.4 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

The screenshot shows the FWS Operation software interface. At the top are three buttons: SET, SCAN, and PRESET. The SET button is highlighted with a red box and a red circle with the number 1. Below these buttons is the 'Input' section, which contains four controls: a CWL input field with the value 450 (circled with a red box and a red circle with the number 1), a FWHM input field with the value 15 (circled with a red box and a red circle with the number 2), a large Go button (circled with a red box and a red circle with the number 3), and a Blank button (circled with a red box and a red circle with the number 4). Below the Blank button is a Reset button (circled with a red box and a red circle with the number 5). The 'Output' section contains a scroll bar (circled with a red box and a red circle with the number 6) with 'Start Point 350 nm' on the left and 'End Point 1700 nm' on the right. At the bottom of the interface is a status bar that reads 'Successfully changed wavelength and FWHM. CWL:450.0 , FWHM:15'. To the right of the status bar is the SLI logo (circled with a red box and a red circle with the number 7) and a small square button with a red circle with the number 7.

4.5 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

The interface consists of three tabs: SET, SCAN, and PRESET. The SCAN tab is selected and highlighted with a red box. Below the tabs is the 'Input' section, which contains a table of parameters and two buttons. A red box labeled '1' encompasses the entire input table. A red box labeled '2' is over the 'Go' button, and a red box labeled '3' is over the 'Stop' button. The 'Output' section below shows a horizontal slider for the wavelength range, with 'Start Point 350 nm' and 'End Point 1700 nm' labels. Below the slider, 'CWL' is set to '350 nm'.

Start	End	Step	FWHM	Delay	Repeat
350	1700	10	10	1	1

Go Stop

Output

Start Point 350 nm End Point 1700 nm

CWL 350 nm

4.6 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 is 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

The screenshot shows the 'PRESET' tab of a software interface. At the top are three tabs: 'SET', 'SCAN', and 'PRESET' (which is highlighted with a red box). Below the tabs is the 'Input' section. It contains a table with four rows of preset data. Each row has a checkbox for selection, a 'CWL' (Center Wavelength) column with a numeric input and up/down arrows, a 'FWHM' (Full Width at Half Maximum) column with a numeric input and up/down arrows, and a 'Go' button. A red box labeled '1' encompasses the 'CWL' and 'FWHM' columns. A red box labeled '2' encompasses the selection checkboxes. A red box labeled '3' encompasses the 'Go' buttons for each row. To the right of the table are three stacked input fields: 'Delay' with a value of 1 (labeled '4'), 'Repeat' with a value of 1 (labeled '5'), and a 'Go' button (labeled '6'). Below these is a 'Stop' button (labeled '7'). At the bottom of the 'Input' section are three buttons: 'Add', 'Delete', and 'Save' (labeled '8').

	CWL	FWHM	
<input type="checkbox"/>	450	2	Go
<input type="checkbox"/>	500	3	Go
<input type="checkbox"/>	550	5	Go
<input type="checkbox"/>	600	7	Go

Delay: 1

Repeat: 1

Go

Stop

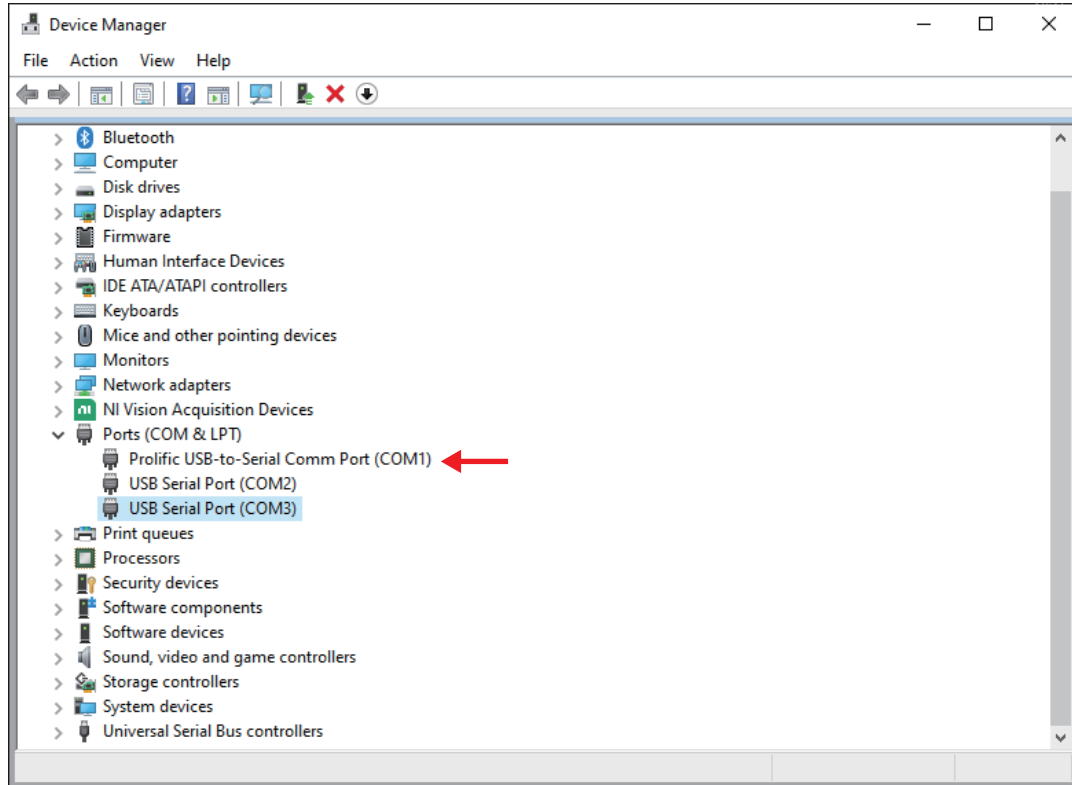
Add Delete Save

5.1 Error messages

- ERR0 , no error
- ERR1 , parameters alarm Cut 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 Cut off power and restart , if still alarm please contact SLi
- ERR7 , temperature alarm Switch off laser, laser temperature should less than 35℃ then you can use
- ERR8 , INTERLOCK alarm Please insert interlock, then cut off the power and restart
- ERR9 , voltage alarm Cut off power and restart , if still alarm please contact SLi
- ERR10 , time limited please contact SLi
- ERR19 , 24V voltage alarm Cut off power and restart , if still alarm please contact SLi
- ERR29 , 5V voltage alarm please contact SLi
- ERR39 , 10W pump and 2V voltage alarm please contact SLi
- ERR49 , 3.3V voltage alarm please contact SLi
- ERR59 , VCC5V voltage alarm please contact SLi
- ERR69 , 1.2V voltage alarm please contact SLi
- ERR79 , 27W pump and 11V voltage alarm please contact SLi
- ERR11 , parameters alarm Cut off power and restart , if still alarm please contact SLi
- ERR31 , parameters alarm Cut off power and restart , if still alarm please contact SLi
- ERR41 , parameters alarm Cut off power and restart , if still alarm please contact SLi
- ERR51 , parameters alarm Cut off power and restart , if still alarm please contact SLi
- ERR61 , parameters alarm Cut off power and restart , if still alarm please contact SLi
- ERR81 , parameters alarm Cut off power and restart , if still alarm please contact SLi

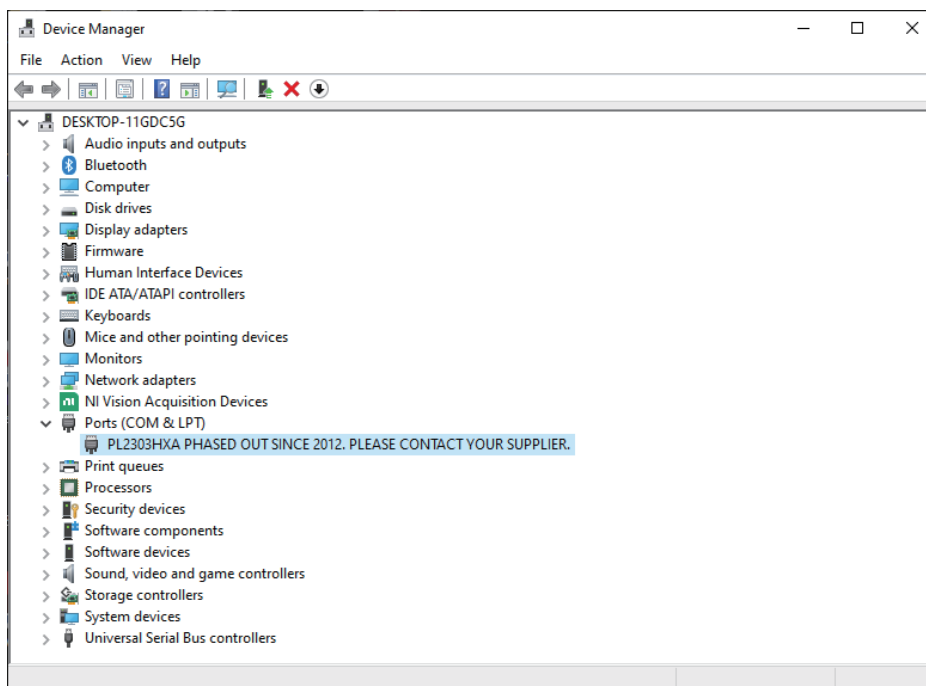
5.2 Device connection error

- 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/>

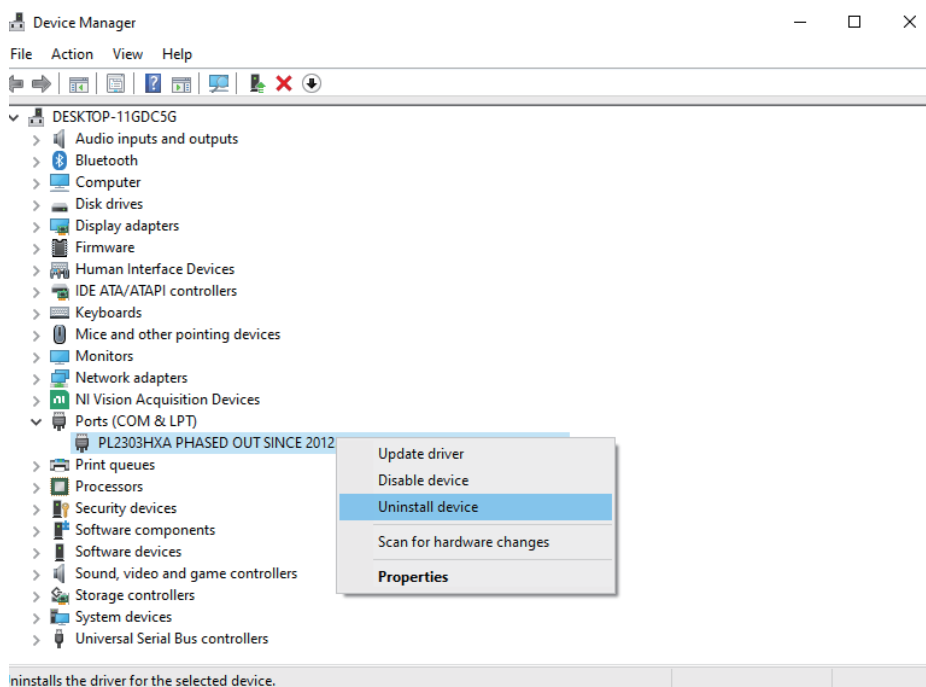


5.3 Laser connection error

- 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.

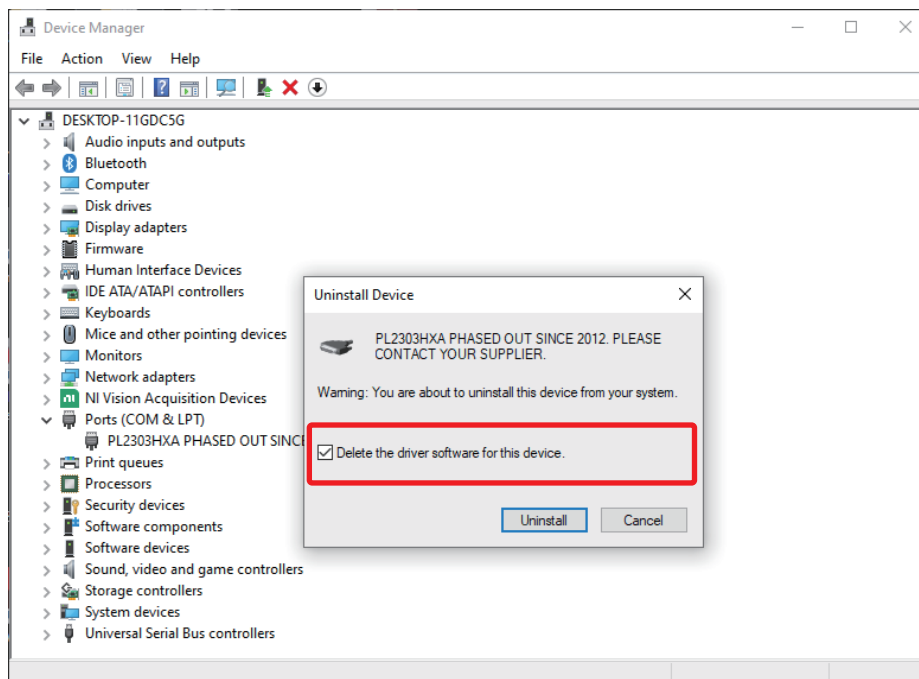


- If the name of the port is as follows, right click on the respective port and click "Uninstall device".

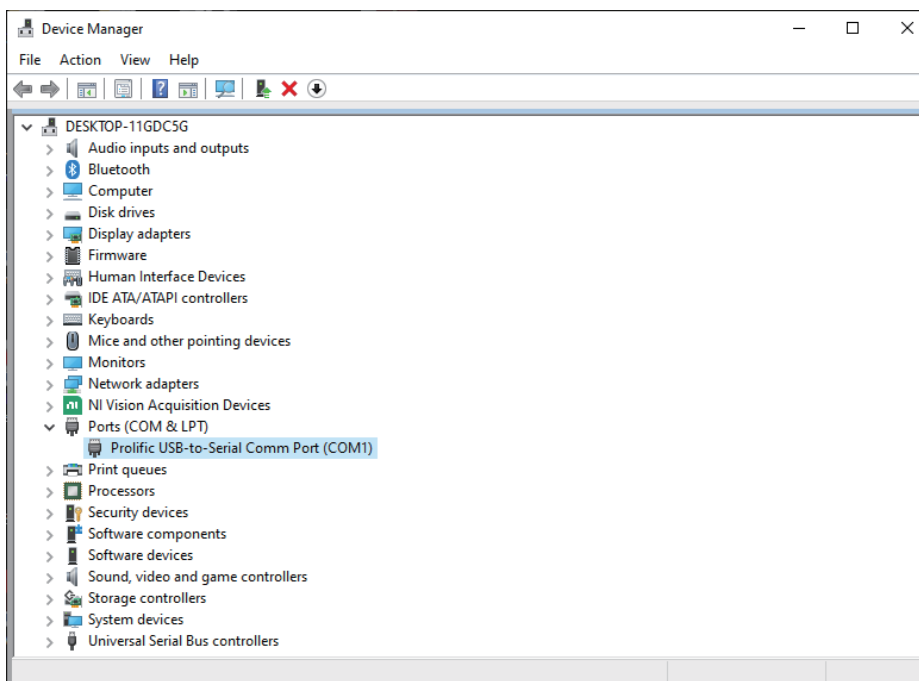


5. Trouble shooting

- 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.

6.1 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



Laser radiation emitted from this unit may be harmful. Avoid direct exposure to the beam.



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

Spectrolight 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.

If you need high visible light power, 5 MHz and more than 70 % power would be suggested.

If you need high pulse energy, 1 MHz and more than 80 % power would be suggested.

The higher the power, the more stable the spectrum.

[Safety considerations]

1. Strong reflected laser beam back into the SC output may damage the SC ;
2. Don't direct looking at the output of the SC at any time in any case ;
3. Don't put things in the air passage in case it's clogged;
4. Don't place heavy objects on the laser body;
5. Don't put the output collimator toward people or any other reflective surface in case causing any personal injury;
6. Don't check the laser directly with your eyes unless you sure the device is in power-down state while the laser may lunch infrared and ultraviolet light invisible but harmful to your eyes;
7. Be sure that the laser is out of power before checking the device;
8. Don't stare at the emission port directly even you wear the laser protective glasses;
9. Don't put any low ignition substance on the laser such as the flammable, explosive materials etc;
10. Be sure that the laser is placed in non-professionals can't touch;
11. Don't shoot the laser light to the glass since the normal glass with about 4% reflectivity and reflect light back to your eyes to cause harm;
12. Please take off your watch when you use the laser in case the watch surface reflecting light into your eyes;
13. Please use a detector or conversion film to locate the laser light since the light beyond 800nm is totally invisible;
14. We strongly recommend that you should wear a pair of laser goggles corresponding to laser in specific wavelength to protect your eyes when you using the laser for working;
15. We recommend that you wear a long suit of white clothes. For it will not burn your clothes then cause a fire even the laser irradiate to your body.

6.2 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

6.3 Environmental Considerations

Highlight any environmental conditions that may impact the system's performance or safety.

Environmental Concerns

To maximize the long-term performance and overall testing accuracy of this instrument, the following environmental safeguards should be considered.

1. Avoid dust and direct sunlight. The optical performance of the unit may be compromised by long-term exposure to direct sunlight and dust.
2. Avoid excess vibration that might compromise the mechanical integrity of the unit.
3. Avoid exposing the unit to situations or environments that may result in contact with corrosive gasses.
4. Do not block fan vents. If the unit is racked, make sure it has proper ventilation.
5. The recommended operating temperature is 10-35° C.
6. Keep original packing material for transport or shipment. If original packing is not available, call Spectrolight to have a factory-approved shipping case delivered to you.

7.1 Contact Information

Technical support:

Spectrolight, Inc.

19800 MacArthur Blvd. #300

Irvine, CA 92612

Tel: 949-800-7780

Email: support@spectrolightinc.com

7.2 Warranty Information

2 years from ship date.

8.1 Full Specifications

		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
Tuning range		450 - 1700 nm	410 - 1700 nm	410 - 1700 nm	410 - 1700 nm	410 - 1700 nm	430 - 1700 nm	410 - 1700 nm
FWHM range		2 - 15 nm (nominal)						
Power stability		< 1 %						
Sync(trigger) Output		(Optional) NIM Output 0 - (-1) V or TTL Output 0 - 3.3 V						
Beam diameter and quality		~ 2 mm@633 nm; M2<1.1						
Beam divergence (half angle)		< 1 mrad						
State of polarization		Unpolarized						
Length of output fiber		1.5 m						
Software		TLS ver.2						
Dimension (L x W x H, mm)		584.3 x 583.6 x 246						
Input power		AC 100 - 240 V, 50/60 Hz						
Data interface		USB 2.0						

		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
Tuning range		450 - 1700 nm	410 - 1700 nm	410 - 1700 nm	410 - 1700 nm	410 - 1700 nm	430 - 1700 nm	410 - 1700 nm
FWHM range		10 or 20 nm (fixed) (nominal)						
Power stability		< 1 %						
Sync(trigger) Output		(Optional) NIM Output 0 - (-1) V or TTL Output 0 - 3.3 V						
Beam diameter and quality		~ 2 mm@633 nm; M2<1.1						
Beam divergence (half angle)		< 1 mrad						
State of polarization		Unpolarized						
Length of output fiber		1.5 m						
Software		TLS ver.2						
Dimension (L x W x H, mm)		584.3 x 583.6 x 246						
Input power		AC 100 - 240 V, 50/60 Hz						
Data interface		USB 2.0						

DISCLAIMER

The Tunable Laser System is designed for selecting center wavelength and the bandwidth of input light.

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

WARNINGS AND PRECAUTIONS

- Operate the device using 100-240 V AC, 50/60 Hz, 1.5 A / Output 12 V DC, 5.0 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

Temperature: 10 - 40 °C, 50 - 104 °F

Humidity: 20 - 85 %

Pressure: 700 - 1060 hPa

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, don't let the body and power adapter touch water.

STORAGE CONDITIONS

Temperature: 25 °C(± 20 °C), humidity : 60% or less.

OPERATION CONDITIONS

Temperature: 25 °C(±5 °C), humidity: 60% or less.

ELECTRICAL CHARACTERISTICS

INPUT : 100 ~ 240VAC 50/60Hz 2A

Power dissipation : 100 ~ 130W

WARRANTY

2 years from delivery



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