FSL1030X1
Ytterbium Femtosecond Fiber Laser

User Guide

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Chapter 1 Safety

All statements regarding safety of operation and technical data in this instruction manual will only apply when the unit is operated correctly in accordance with this user manual.

Warning: Risk of Electrical Shock
High voltage inside. To avoid electrical shock, before powering the unit on, make sure that the protective conductor of the 3-conductor power cord is correctly connected to the protective earth contact of the socket outlet. Improper grounding can cause electric shock resulting in severe injury or even death. Do not operate without cover installed.

Explosion Warning
This instrument must not be operated in an explosion endangered environment.

Laser Warning
The FSL1030X1 laser is a Class IV laser. Avoid Eye or Skin Exposure to Direct or Scattered Radiation.

Laser Warning
Always wear appropriate laser safety eyewear during laser setup and operation.

Laser Warning
Disabling or removing interlocks may result in severe injury.

Caution
This instrument should be kept clear of environments where liquid spills or condensing moisture are likely. It is not water resistant. To avoid damage to the instrument, do not expose it to spray, liquids, or solvents.

Caution
Do not operate the laser unless the chiller is connected and running within nominal parameters. Failure to follow these instructions can cause severe and permenant damage to the laser.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

1.1 Laser classification

Per 21 C.F.R. §1040.10 and IEC 60825-1:2014, the FSL1030X1 laser is classified as a Class IV or Class 4 laser. In compliance with this standard, certain performance features and laser safety labels are provided on the product.

Class 4 lasers such as the FSL1030X1 laser may cause damage to the skin, and also to the eye, even from the viewing of diffuse reflections. These hazards may also apply to indirect or non-specular reflections of the beam, even from apparently matte surfaces. Great care must be taken when handling these lasers. They also represent a fire risk, because they may ignite combustible material.

Safe practices and proper usage of safety equipment should be taken into consideration when operating lasers. The eye is susceptible to injury, even from very low levels of laser light. Laser emission in the visible and near infrared spectral ranges has the greatest potential for retinal injury, as the cornea and lens are transparent to those wavelengths, and the lens can focus the laser energy onto the retina.

Follow all safety precautions in the operator's manual.

Never aim the laser at a person's eye, skin, or clothes.

Always use proper laser safety eyewear.

Avoid wearing watches, jewelry, or other objects that may reflect or scatter the laser beam.

Keep the laser beam paths above or below eye level for both sitting and standing positions.

Ensure that individuals do not look directly into a laser beam.

Eliminate all unnecessary reflective surfaces from the vicinity of the laser beam path.

Ensure that all individuals who operate Class 4 lasers are trained in laser safety and authorized to operate a laser. Do not leave a running laser unattended if there is a chance that an unauthorized user may attempt to operate the laser. A key switch should be used if untrained persons may gain access to the laser. A warning light or buzzer should be used to indicate when the laser is operating.

Use low power settings, beam shutters, and laser output filters to reduce the beam power to less hazardous levels when the full output power is not required.

Make sure that spectators are not exposed to hazardous conditions.

Operate the laser only in a well-controlled area (for example, within a closed room with covered or filtered windows and controlled access).

Label the laser and the room with appropriate Class 4 laser warning signs.

Mount the laser on a firm support to ensure that the beam travels along the intended path.

Because of its weight (see specifications), the FSL1030X1 Laser Head should always be lifted by two people using proper lifting technique. Refer to appropriate regulations, standards, and/or workplace resources for instructions on proper technique.

The unit is supplied with a region-specific power cord. If using your own power cord, make sure it is IEC 320 compatible.

Make sure that the line voltage rating marked on the rear panel agrees with your local supply and that the appropriate fuses are installed.

Do not operate in wet or damp conditions. Do not obstruct the air ventilation slots in the housing.

This device can only be returned when packed into the complete original packaging, including all foam packing inserts.

All statements regarding operational safety and technical data in this manual will only apply when the unit is operated correctly.

1.2 Laser safety labels

Figure 1 Laser Safety Label per IEC 60825-1:2014 §7

Figure 2 Laser Aperture Label per 21 C.F.R §1040.10(g)(5)(i) and (g)(8) and IEC 60825-1:2014 §7

The American National Standards Institute publishes a laser safety standard for users, entitled American National Standard for the Safe Use of Lasers (ANSI Z136.1). Copies may be obtained from:

A.N.S.I. Washington, DC. Headquarters
1819 L Street, NW (between 18th and 19th Streets), 6th floor
Washington, DC 20036
Tel: (202) 293-8020
Fax: (202) 298-9287
www.ansi.org

Laser Institute of America
13501 Ingenuity Drive, Suite 128
Orlando, FL 32826
Toll Free: (800) 345-2737
Telephone: (407) 380-1553
Fax: (407) 380-5588
www.laserinstitute.org

1.3 System Power Requirements

The unit can operate from any single-phase AC power source that supplies 120, 230, or 100VAC at a frequency range of 50 to 60Hz. It draws 10A maximum. The maximum power consumption is dependent on the operating parameters of the laser system, with a peak power draw of less than 400W and a typical operational power draw of 100W. The FSL1030X1 chiller requires 100/240VAC, 50/60Hz, 5A max.

1.4 Laser Output Parameters

The output parameters for the laser system are outlined in the table below, followed by classification warning labels, shown in Figure 3. For further information, please refer to the specification tables for laser classifications specified by the Center for Devices and Radiological Health (CDRH), a division of the Food and Drug Administration (FDA).

Output Parameter	**FSL1030X1 Output**
Wavelength	1020 - 1080 nm
Laser Classification	**Class IV**
Max Output Power	25 W
Beam Diameter	2.0 – 2.5 mm (TEM00, $1/e^2$ points)

Figure 3 Laser Safety Warning Labels

1.4.1 Operation

Prior to initializing and operating your FSL1030X1, please consult the following list to ensure that the unit can be safely operated.

Read the user's manual thoroughly.

Inspect the unit for any signs of damage.

Install the unit as described in Chapter 3.

Ensure that both the unit and any connected devices are properly grounded.

Install the laser in an enclosed area with access restricted to trained personnel. Clearly label the area and mark the entrance with the class of laser (Class IV).

1.4.2 Safety During Operation

While operating your FSL1030X1 laser, it is highly recommended that you follow the precautions listed below to ensure safety for all personnel.

Regions of the laser output from this device are not possible to see with the unaided eye. Use optical aids such as IR cards or IR viewers to view the laser output.

Eye and skin exposure to direct or scattered laser radiation is hazardous and is considered potentially extremely harmful. Wear appropriate personal protective equipment such as **laser safety glasses** and lab coats. OD 5+ at 950 - 1120 nm laser safety glasses are recommended.

Never leave the laser on without proper notification posted.

The laser has a key switch on the power supply front panel. The key must be inserted and turned to enable the laser to operate. The key is captive in the operational position. Cycling the key On-Off-On is required to initialize the laser on start-up and to recover after a Remote Interlock fault. Remove the key from the laser when not in use or unattended. Store the key in a safe place.

Limit access to the laser to personnel who are familiar with the equipment. Ensure that the laser is not assembled, operated, or repaired by inexperienced or untrained personnel.

Ensure that all mirrors and optics used to steer the laser beam are securely positioned and fixed to prevent movement. Control all stray reflections or transmissions of the laser beam, as these may also be Class IV beams.

Do not allow reflective objects to be placed in the laser beam. Laser light scattered from a reflective surface can be as damaging as the original beam.

Terminate the laser beam path (or paths) with a suitable power meter or non-reflecting beam stop. Enclose beam with beam blocks or beam tubes where possible. Consult a power meter or the beam stop manufacturers' operating manual for proper usage.

Suitable eye protection must be worn at all times when laser output is possible.

Connect the power cord only to a power outlet or extension cord equipped with a protective earth contact.

Never remove covers or panels from the units.

Do not perform any operating or maintenance procedure that is not described in the user's manual.

Chapter 2 Description

2.1 Introduction

The Thorlabs FSL1030X1 Femtosecond Fiber Laser is a high power (Class IV) femtosecond fiber laser consisting of a femtosecond oscillator, pulse picker, fiber amplifier, and tunable compression for amplifying femtosecond pulses up to 3.0 µJ.

Thorlabs' Ytterbia FSL1030X1 laser emits <250 fs pulses (<220 fs typical) with a center wavelength of 1035 nm at a user selectable repetition rate between 1 - 11 MHz. This fiber laser is based upon an oscillator, pulse picker, and a chirped pulse amplifier, yielding reliable turn-key operation and exceptional long-term reliability. The FSL1030X1 has a collimated free-space output with a 2.0 – 2.5 mm mode field diameter ($1/e^2$ intensity diameter). The laser is controlled through a graphical user interface (GUI). The laser is used in applications where high peak and average power are required. The product is intended to be used in an indoor laboratory environment.

The pulse picking system is based on frequency division of the femtosecond oscillator, which operates at 56 MHz. Only integer multiples of the 56 MHz are attainable. For example, a frequency divisor of 56 produces an amplified pulse train at 1 MHz, where 1 pulse out of every 56 is passed through the pulse picker and on to the amplifier. For smaller divisors however, the spacing between accessible repetition rates becomes more coarse. Consider divisors of 7 and 6, the resultant amplified pulse train repetition rates are 8 and 9.3 MHz. The available repetition rates, 1 – 11 MHz, for which the laser is qualified are populated in a drop-down menu in the GUI.

A unique feature of the Ytterbia FSL1030X1 laser is the pulse energy as a function of repetition rate, which is nearly constant across tuning range. From 1 – 5 MHz, the pulse energy is 3.0 µJ, so the average power increases linearly depending on the user selected repetition rate. Above 5 MHz, the laser power trends towards its maximum of approximately 20 W, with the pulse energy at the maximum repetition rate of 11 MHz being 2 µJ.

An enable key switch must be cycled from "lock" to "unlock" to put the laser into a Ready state on startup, where the Ready state simply means the user can turn on the laser through the GUI. Keep in mind, this usually will mean cycling the key from "unlock" to "lock" and back to "unlock" to access the Ready state, since the laser is often powered down with the key in the "unlocked" position.

Once in the Ready state the first step in turning the laser on, is to toggle the "Seeder Power" radio toggle, which energizes the oscillator. This is effectively a Simmer state, and the laser can remain in this condition safely for prolonged periods of time. LED indicators displays the current state of the unit. When the Seeder Power radio toggle is engaged, there is a 3 second delay before the seeder turns on, and the user is warned by the blinking LEDs. In the Simmer state the user can change the repetition rate of the pulse picker.

Before turning on the main amplifier, the user should determine if they want the full power or an alignment (low) power. For power sufficient to align with, the Diode Current can be set to 1 - 1.5 A. Otherwise, the GUI will default to the recommended current to achieve full performance of the laser, where the current is set to this default when the repetition rate is changed. Before turning on the main amplifier, the user should ensure the output beam path is safe or the shutter is closed. To turn on the main amplifier, the user selects the "Laser Power" radio toggle to turn it to energize the pump diodes.

The laser pulse intensity is NOT invariant with pulse energy, i.e. Diode Current setting. The laser is designed for optimal performance at the full power allowed at each repetition rate, and the pulse characteristics are only qualified at the full power/energy. If an experiment requires less power, then they need to either ensure the pulses at lower Current and power/energy are suitable for their experiment through their own characterization OR to use a waveplate polarizer to attenuate the laser while it runs at its specified Diode Current per the set repetition rate.

A manual aperture shutter allows blocking the output beam even when the laser emission is on.

For added safety, there is a Remote interlock connector located on the rear panel that must be shorted in order for the output to be enabled. This can easily be configured to be triggered by doors or an emergency push button to disable the fiber amplifier in unsafe conditions.

Figure 4 FSL1030X1 Laser Head

Chapter 3 Front and Rear Panels

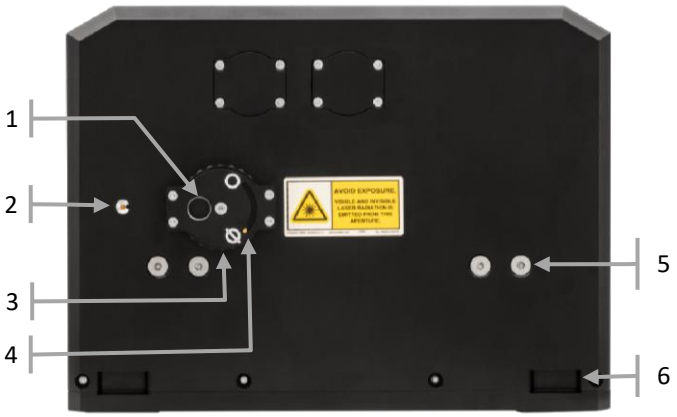


Figure 5 FSL1030X1 Laser Front Panel

Front Front Panel	
Callout	**Description**
1	Laser Output Aperture
2	Emission Indicator
3	Manual Aperture Wheel to Open/Close Shutter
4	Aperture Shutter Position Indicator
5	Mounting Location for Removable Handles (4 Places)
6	Included CL5A Clamp Location (2 Places)

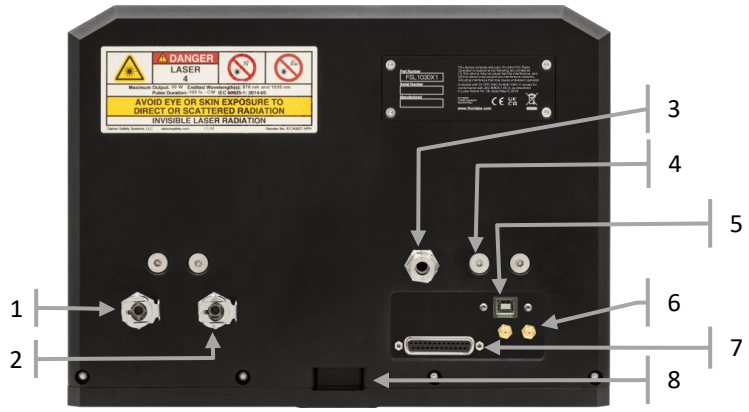


Figure 6 FSL1030X1 Laser Front Panel

Back Laser Panel	
Callout	**Description**
1	Water In
2	Water Out
3	Fixed Optical Umbilical
4	Mounting Location for Removable Handles (4 Places)
5	USB 2.0 Type-B Connector
6	For Manufacturer Only (2 Places)
7	Sub-D 25 Pin Umbilical to Controller
8	Included CL5A Clamp Location

Figure 7 FSL1030X1 Laser Controller Front Panel

Laser Controller Front Panel	
Callout	**Description**
1	Emission Indicator
2	Laser Enable Switch
3	Laser Synchronization Signal (BNC Female, TTL)
4	Remote Interlock (BNC Female, Open/Closed)

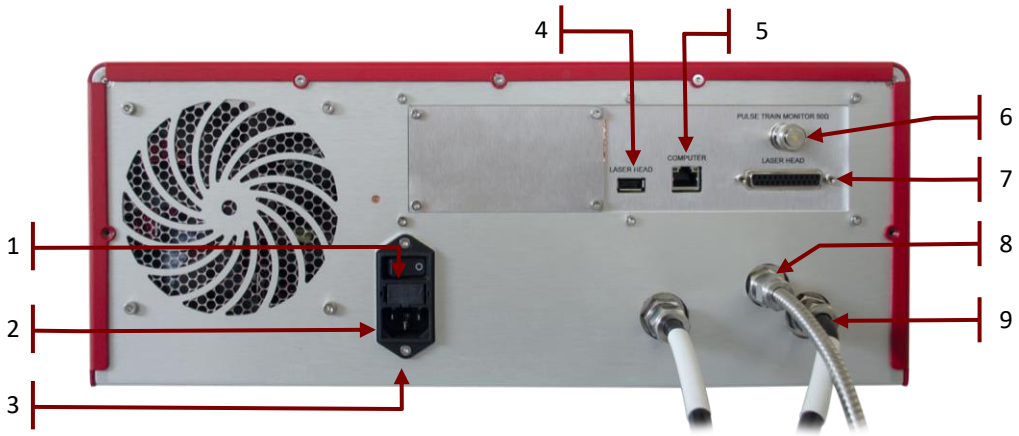


Figure 8 FSL1030X1 Laser Controller Back Panel

Laser Controller Back Panel	
Callout	**Description**
1	AC Power On/Off Switch
2	Fuse Tray
3	AC Power Cord Connector
4	USB 2.0 Type A Connector to Laser
5	Ethernet Port to Computer
6	Oscillator Pulse Train Monitor (BNC Female, 50 Ω, <1 V)
7	Sub-D 25 Umbilical to Laser
8	Fixed Optical Umbilical to Laser
9	Fixed Water Lines (2 Places)

Chapter 4 Setup

The FSL1030X1 laser system is designed for ease of use. Installation is straightforward, but all steps should be followed carefully to ensure the best FSL1030X1 laser performance.

4.1 Unpacking

Please exercise caution when unpacking the FSL1030X1 laser crate as it contains sensitive electronic and optical components. A simple shipping inventory should be performed when unpacking in order to ensure all parts are present and accounted for before beginning the installation process.

The FSL1030X1 laser system includes:

Laser Head and Electronics Unit (Connected via Non-Detachable Umbilical, 2.5 m)

Air-to-Water Chiller and Water Lines, with Valved Quick-Disconnect Fittings, 2.5 m in length

Pre-Mixed Anti-Corrosion Fluid for the Chiller, Thorlabs Item # CDTX

2x Electronic Power Cords, Region-Specific, 6’

1x 2.5 m Ethernet cable, 1x 2.5 m USB 2.0 cable, and 1x Ethernet to USB converter.

3x CL5A Table Clamps for Mounting

4.2 Laser Head Mounting

Once you have verified that all components of your FSL1030X1 system are present, transport the system into the installation location.

Place the FSL1030X1 laser head (Figure 9) in the desired position on the optical table.

Figure 9 FSL1030X1 Laser Head, Front (Left) and Back (Right)

Secure the laser head on the optical table through the three mounting locations shown with blue circles in Figure 9, using the included CL5A clamps.

4.3 Electronics Setup

Once the FSL1030X1 laser head has been properly secured to the table, it is advised that you take time to route the electric cables and components in order to ensure easy operation of the unit without introducing unnecessary

hazards to the system. The stainless steel optical umbilical has a minimum bend radius of 140 mm and should be routed carefully. This section will describe the proper installation of the additional system components.

Place the electronics box (Figure 10) and chiller (Figure 11) in their desired locations.

Figure 10 Electronics Unit

Figure 11 Chiller

Connect the water lines from the chiller unit to the optical head/electronics box. The water lines will be labeled for the correct orientation.

Fill the chiller with the provided coolant and turn on the chiller. Once circulating, verify there are no leaks from the water line connections. Refill the chiller reservoir if necessary once the coolant has circulated for 2 minutes.

Connect all the appropriately cables from the Laser Head to the back of the electronics unit (Figure 12 and Figure 13). And unlabeled connections on the electronics unit are for technician diagnostics only.

Figure 12 Laser Head (Back) – User Connections are a Sub-D 25 and a USB 2.0 Type B Connector

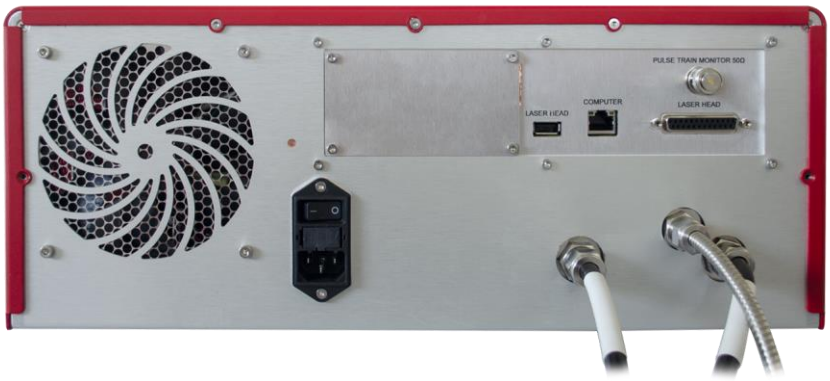


Figure 13 Electronics Unit (Back) – User Connections are sub-D 25, USB 2.0 Type A, and Ethernet

Turn on the FSL1030X1 Controller via the power switch next to the AC plug on the back of the electronics box (Figure 13). Note it takes ~1.5 minutes for the system to initialize after receiving AC power.

Figure 14 Electronics Unit (Front)

Install the key switch and ensure the BNC shorting cap is installed on the Remote interlock (Figure 14). Turn the key switch to the enabled location.

Connect a laptop/desktop to the controller using the Ethernet cable. If the user's computer does not have an Ethernet port, they can use the Ethernet to USB adapter included with the laser. The instructions to configure the network adapter to the static IP address necessary to communicate with the controller are in 9.5.

Launch the FSL1030X1 software (downloaded from the Thorlabs website) on the computer and connect to the device.

Connect the diagnostic signals ("Pulse Train Monitor" and "Laser Synchronization" in Figure 13 and Figure 14, respectively) as desired:

Pulse Train Monitor – This BNC output is a fast diagnostic output of the ~56 MHz oscillator pulse train. Connect this output to an oscilloscope (50 Ω) to verify the oscillator pulse train is stable.

Laser Synchronization – The BNC output is a TTL signal synchronized with the output of the laser amplifier (~50 Ω or ~1 MΩ). This signal can be used to trigger other equipment, if desired.

Chapter 5 Software Overview

This section covers only the options and controls accessible through the FSL1030X1 software. Please consult Chapter 6 for actual system operation instruction.

5.1 FSL1030X1 Laser Control

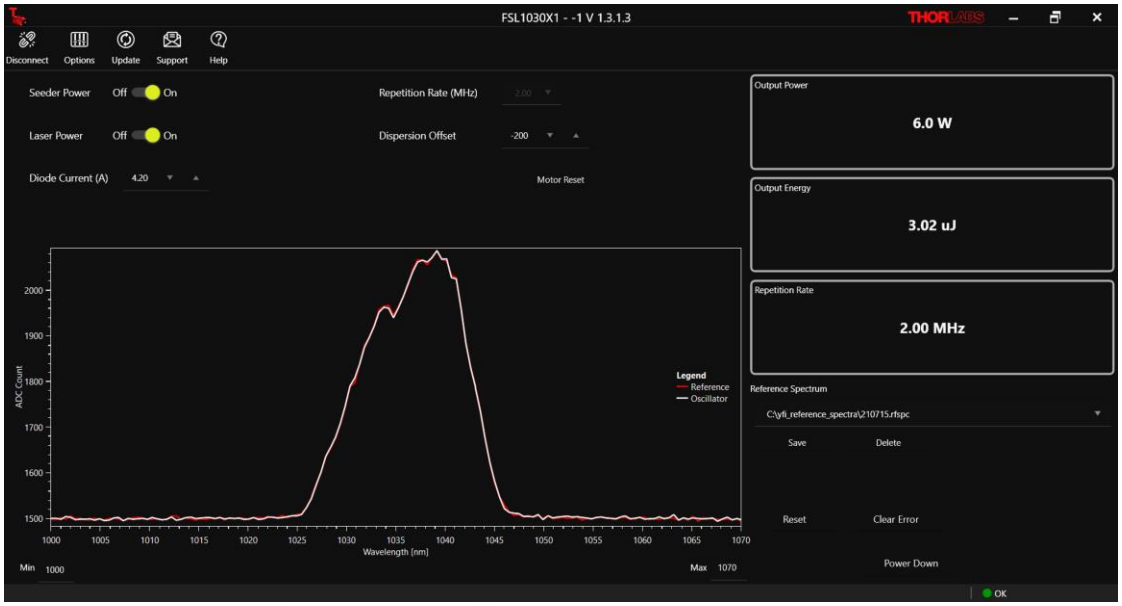


Figure 15 FSL1030X1 Laser Control

The FSL1030X1 software gives the user control of the laser while providing system feedback on the amplifier seed spectrum, system power levels, temperatures and other diagnostics built into the laser system which will be described in detail below.

5.2 Seeder

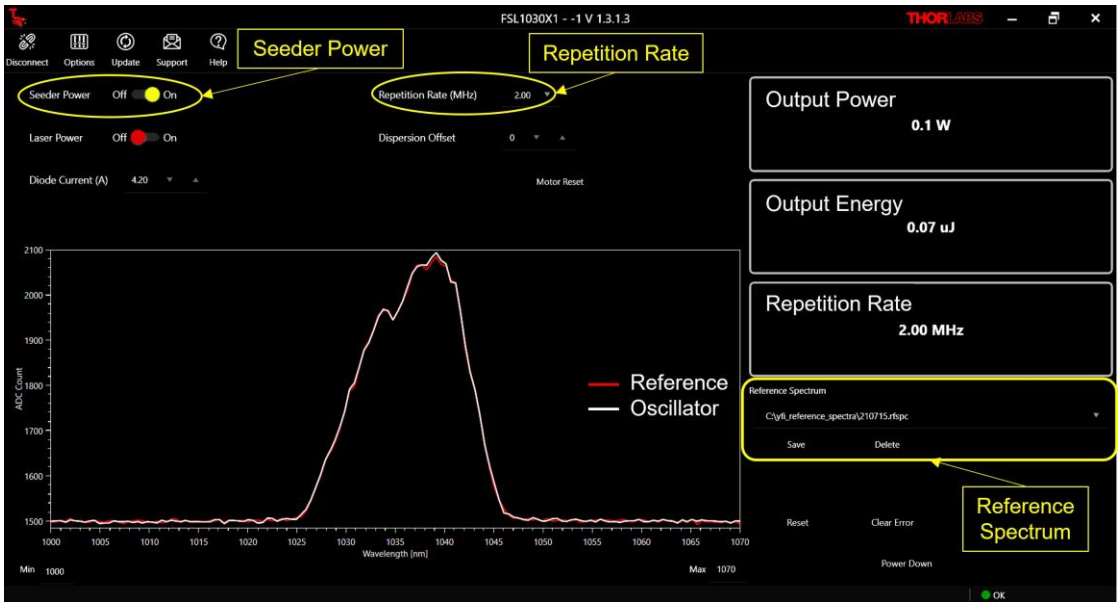


Figure 16 Seeder ON

Seeder Power – This toggle button will turn the seeder on or off. The seeder must be turned on before the amplifier. The seeder is on when the slide bar is set to the "ON" direction, also indicated with the button turning yellow.

Repetition Rate – In this section the user may select the desired repetition rate.

Reference Spectrum – The seeder reference spectrum will be displayed in red. When the seeder is on, the live spectrum will be displayed in white. A reference spectrum can be saved through the section indicated by a yellow rectangle on the right side of the window in Figure 16.

5.3 Laser Amplifier

This section allows the user to turn on the amplifier and provides information on the amplifier power and energy.

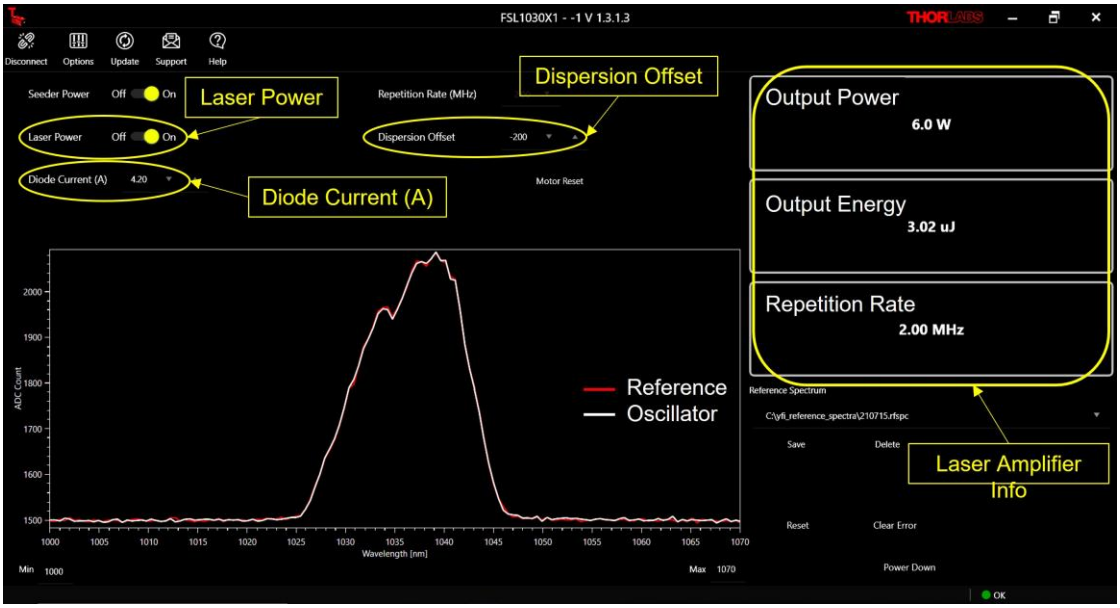


Figure 17 Laser Amplifier

Laser Power – This toggle button will turn the laser amplifier on or off. The amplifier is on when the slide bar is set to the "ON" direction, also indicated with the button turning yellow.

Diode Current – This section sets the current applied to the amplifier diodes and changes the output power. The value may be set to anything within the allowable range.

Dispersion Offset – This section allows the user to adjust the laser dispersion. The factory setting will be an offset of zero.

Output Power – Displays the amplified 1035 nm output power. Adjusting the diode current will change the output power.

Output Energy – Displays the amplified 1035 nm output energy. Adjusting the diode current will change the output energy.

Repetition Rate – Displays the repetition rate of the amplified 1035 nm pulses.

Chapter 6 System Operation

This section details the typical day-to-day operation of the FSL1030X1 laser. The system is controlled primarily through the software loaded onto the provided computer. If you have questions regarding safe operation of the laser, please contact Thorlabs.

6.1 Initial Laser Startup

To turn on your laser for daily operation:

Insert the master key in the electronics unit and turn it to the “Unlock” position to put the laser into the Ready State. After an AC power cycle, the key switch must go through a transition from the “Lock” to “Unlock” position to access the laser Ready State.

Verify the remote interlock (BNC connection) is either shorted externally (e.g. into a door interlock) or shorted via the provided BNC cap.

Start the FSL1030X1 control software by double-clicking the desktop link. The following window will appear. Make sure the Ethernet cable is properly connected to the laptop.

Click on the Connect button on the menu bar to find the FSL1030X1 Laser.

Figure 18 Start-Up Window

The search window will appear. Select the FSL1030X1 laser and press ok.

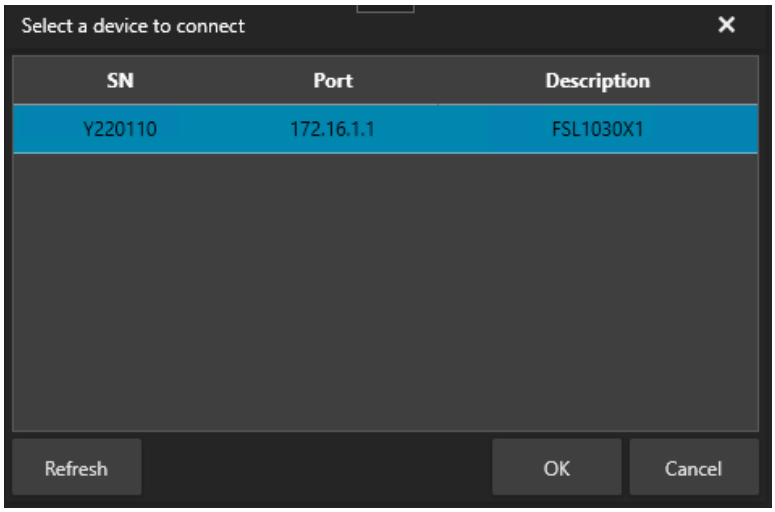


Figure 19 Connecting to the System

The following window (Figure 20) confirms a successful connection to the Laser.

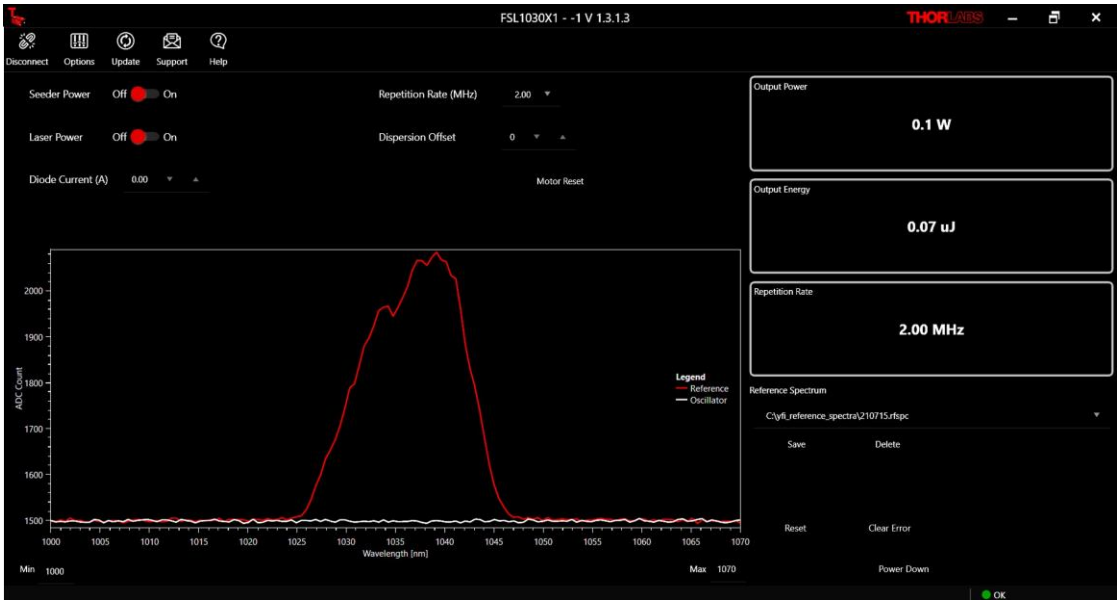


Figure 20 Successful Connection to the Laser

6.2 FSL1030X1 Start-Up and Tuning

Select a repetition rate from the provided values through the drop-down shown in Figure 21.

Figure 21 Repetition Rate Drop-down

Turn the seeder power on by toggling the on/off button.

Figure 22 Seeder Power

When the seeder is on, the live spectrum is displayed in white while the reference spectrum is displayed in red.

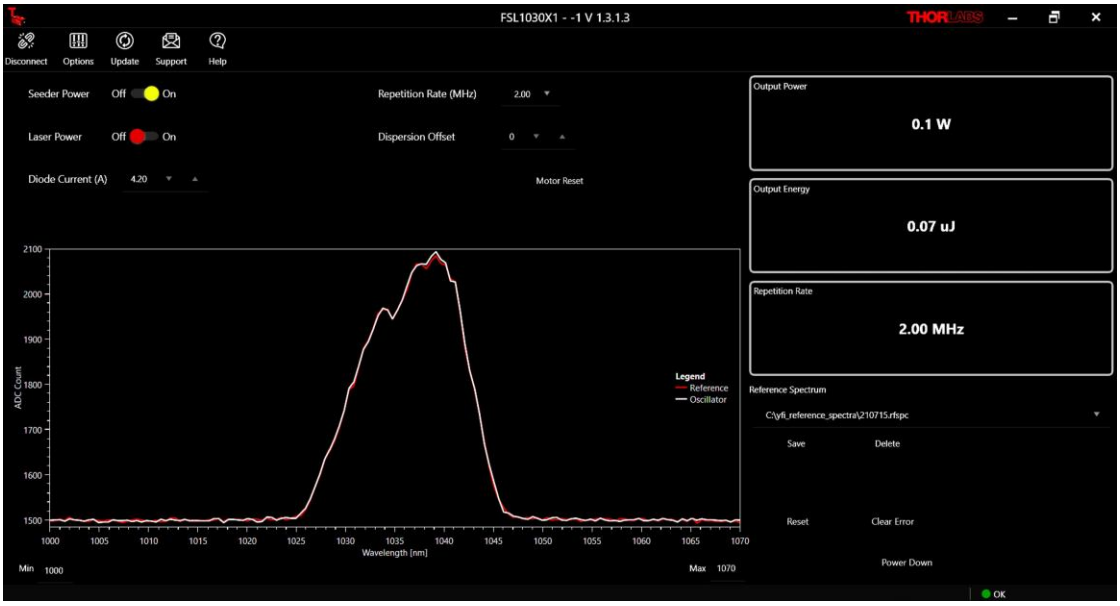


Figure 23 Seeder Spectrum

Note that you can choose the wavelength range of the spectrum by changing the minimum and maximum wavelengths located at the bottom of the graph.

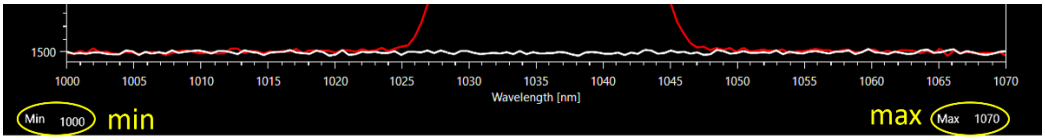


Figure 24 Changing Wavelength Limits

In the Diode Current section, set the diode current to the desired current. Please note that the current limit has been set for each individual repetition rate and will auto-populate when the repetition rate is changed.

Figure 25 Diode Current

Toggle the Laser Power on/off button to turn the amplifier on.

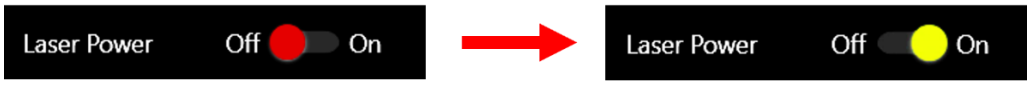


Figure 26 Laser Power

Verify the FSL1030X1 power reads out as expected.

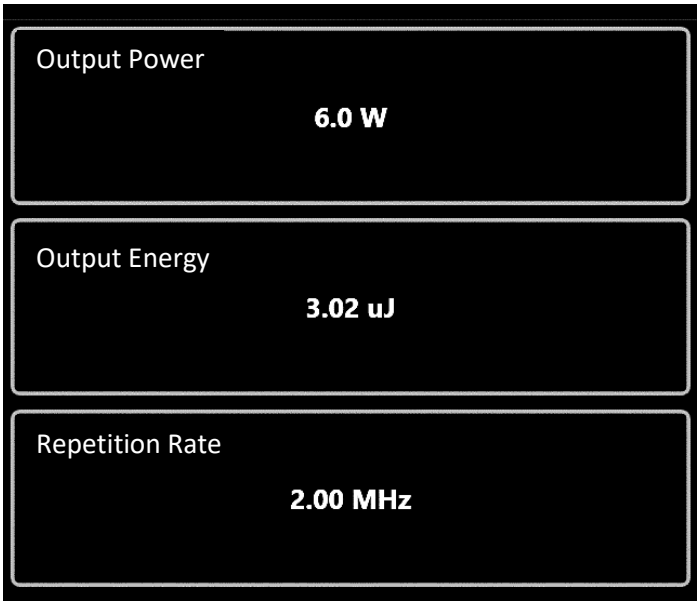


Figure 27 FSL1030X1 Parameters

6.3 FSL1030X1 Laser Power Down

Turn the laser power off.

Turn the seeder power off.

Click the Power Down button.

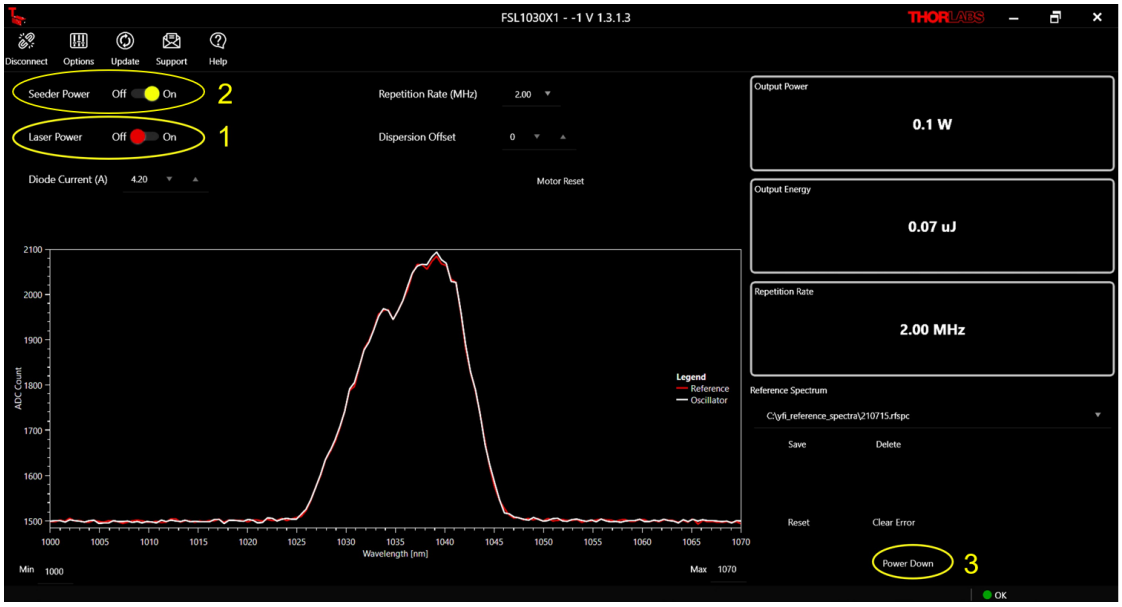


Figure 28 Power Down

Wait for the Controller Ready indicator on the controller screen goes off.

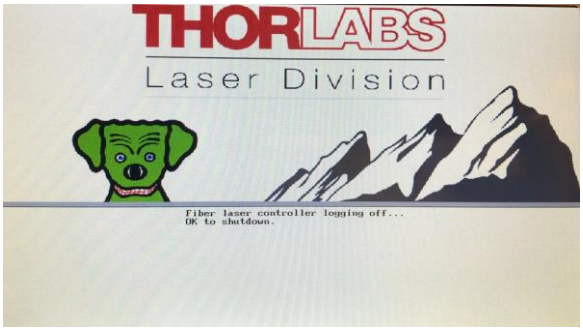


Figure 29 Shut Down Screen

Turn off the FSL1030X1 Controller via the power switch next to the AC plug on the back of the electronics box (Figure 26).

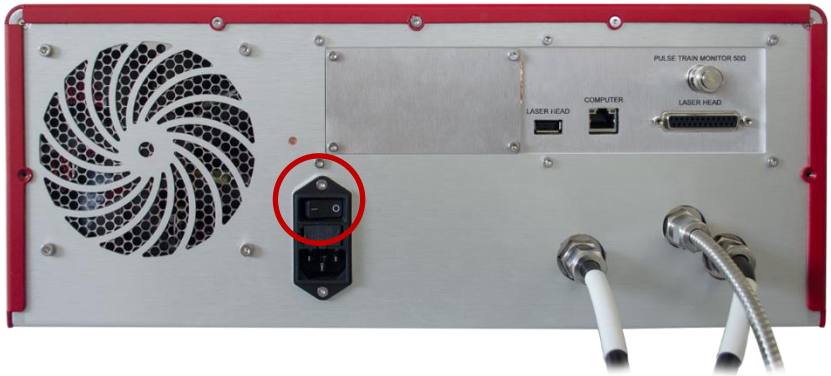


Figure 30 Power Off Controller

Chapter 7 Specifications

7.1 Optical Specifications

Optical Performance Specifications	
Center Wavelength	1035 nm ± 5 nm
User Tunable Repetition Rate[a]	1 – 11 MHz
Pulse Duration (FWHM)[b]	<220 fs (Typical) <250 fs (Max)
Temporal Strehl Ratio[c]	>0.90 (Typical) >0.85 (Min)
Pulse Energy from 1 - 5 MHz	3 µJ
Average Power at Max Rep Rate	>20 W (Min)
Mode Field Diameter ($1/e^2$)	2.0 – 2.5 mm (Typical)
Mode Ellipticity	>0.8 (Typical)
Beam Quality (M^2)	<1.15 (Typical) <1.2 (Max)
Polarization Extinction Ratio	>200:1
Power Stability[d]	<1% RMS over 12 hours
Polarization	Linear, Vertical
Pointing Stability[d]	<10 µrad/˚C (Typical)
Dispersion Compensation	-1×10^5 fs^2 to 1×10^5 fs^2
Beam Height	4.75"
Optical Head Dimensions (L x W x H)	569 mm x 320 mm x 238 mm (22.4" x 12.6" x 9.4")

a. The pulse picked repetition rate is given by dividing the oscillator repetition rate, 56 ± 2 MHz, by an integer, with a minimum value of 1 MHz and a maximum value given by the oscillator frequency divided by 5.
b. Measured by Second Harmonic Generation Frequency Resolved Optical Gating (FROG)
c. The Temporal Strehl Ratio is the ratio between the maxima of the measured intensity profile and the transform-limited intensity profile as determined by the power spectrum.
d. After 30 Minute Warm-Up

7.2 Electrical Specifications

Electrical Requirements	
Input Voltage	100 - 240 V
Frequency	50 - 60 Hz
Power Consumption Controller	400 W (Max)
Power Consumption Chiller	600 W (Max)

7.3 Laboratory Specifications

Environmental Requirements	
Room Temperature Range	17 °C to 25 °C
Room Temperature Stability	<3 °C over 24 Hours

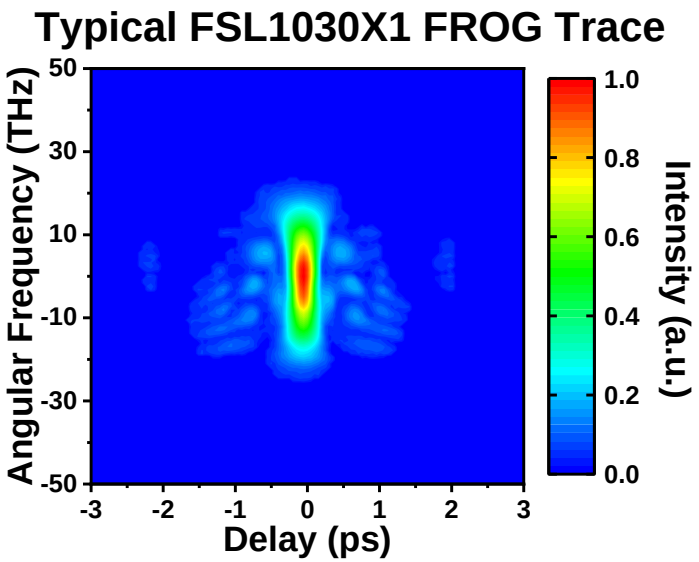


Figure 31 ***Second Harmonic Generation Frequency resolved optical gating (SHG-FROG) trace***

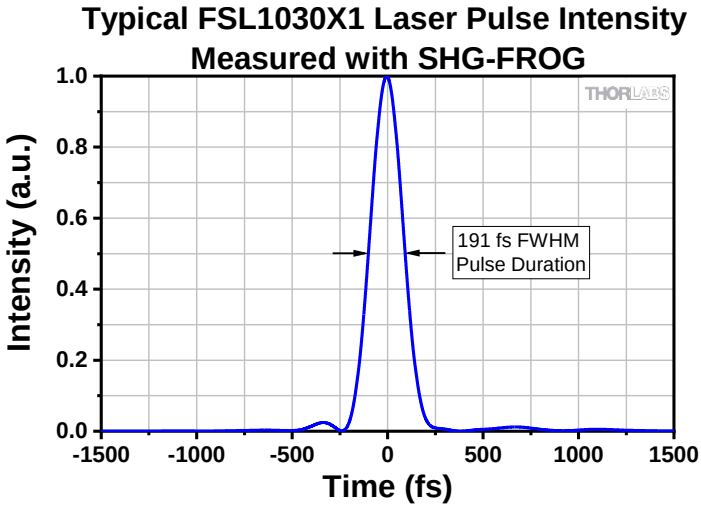


Figure 32 ***Pulse intensity profile reconstructed from SHG-FROG measurement***

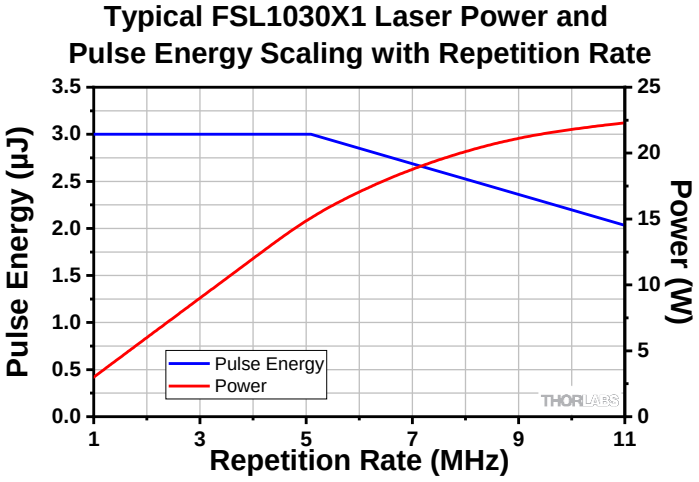


Figure 33 ***Average Power and Pulse Energy as a function of output pulse repetition rate***

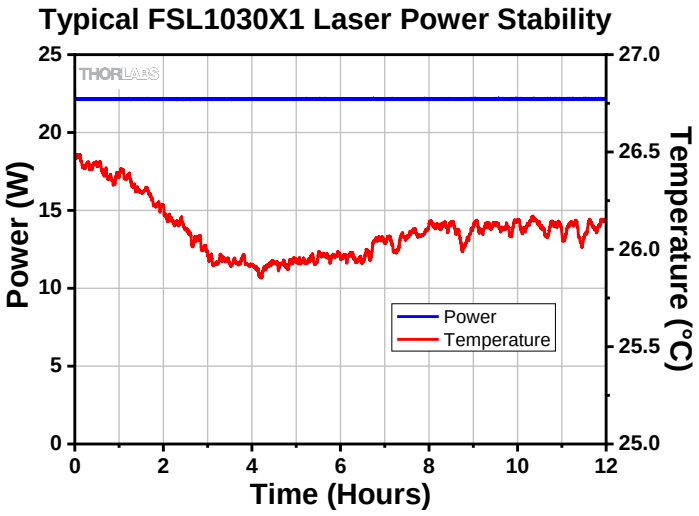


Figure 34 Power Stability

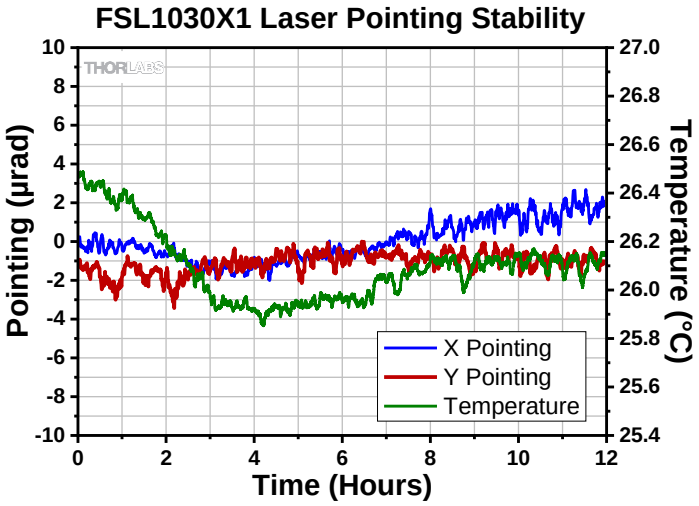


Figure 35 Pointing Stability

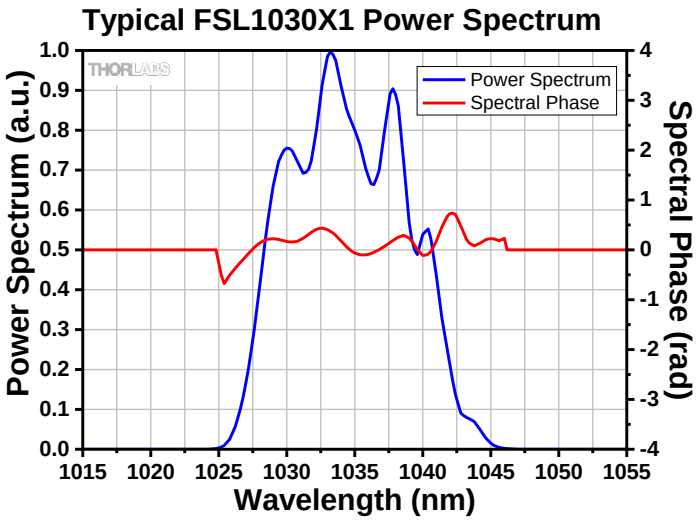
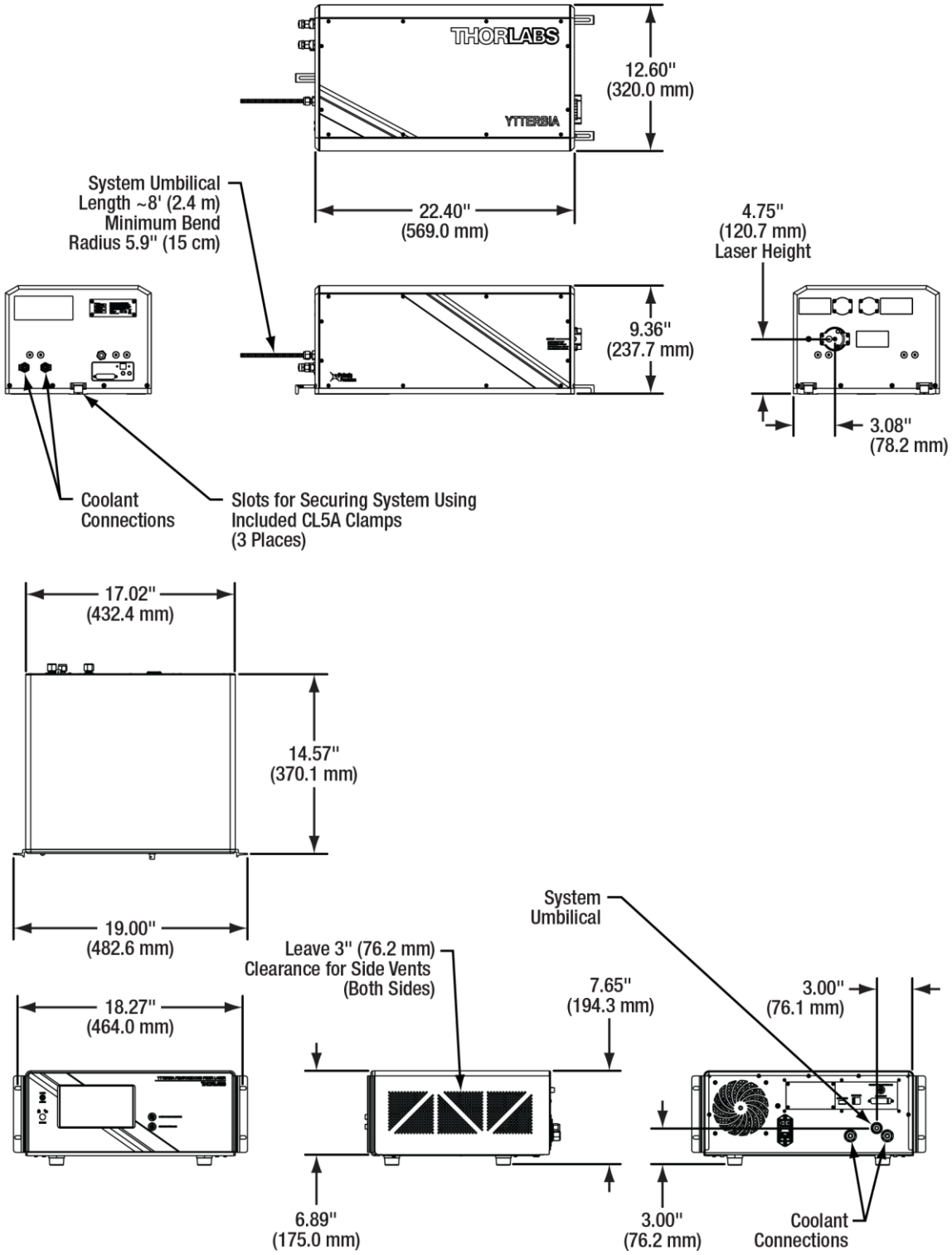
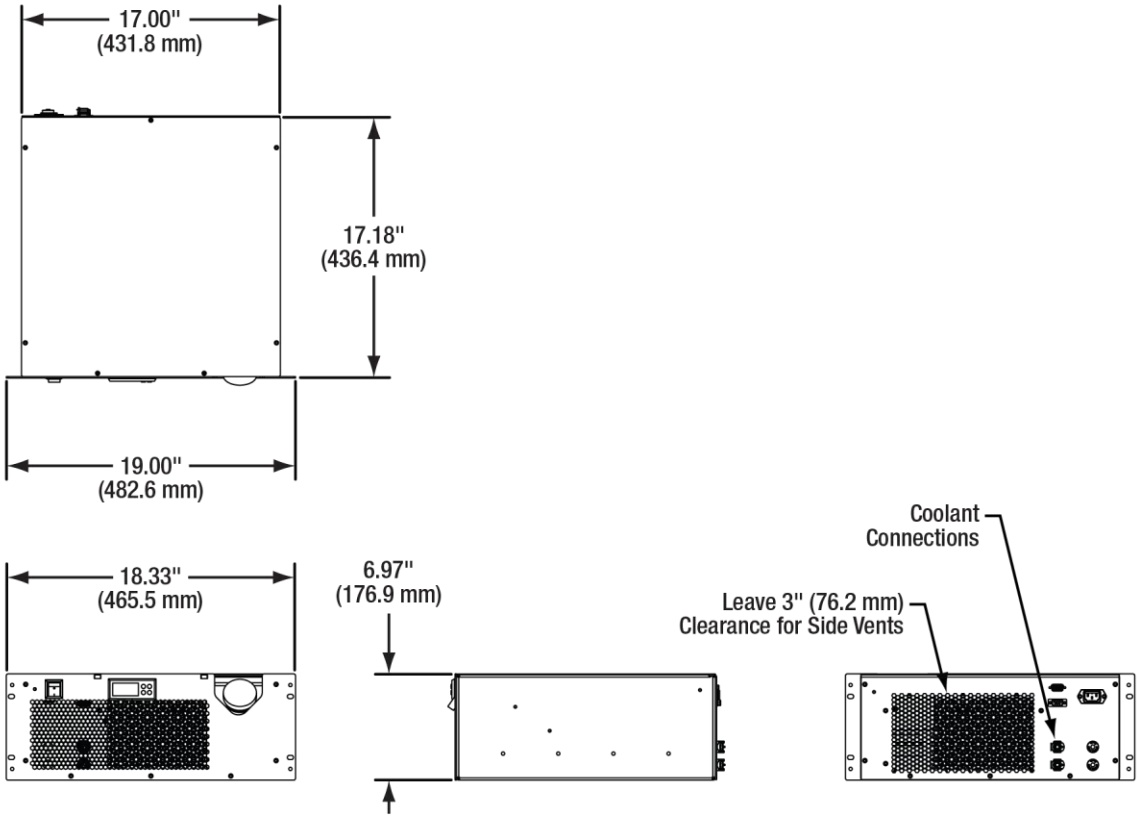


Figure 36 Power Spectrum

Chapter 8 Mechanical Drawing




17.00"
(431.8 mm)
17.18"
(436.4 mm)
19.00"
(482.6 mm)
18.33"
(465.5 mm)
6.97"
(176.9 mm)
Coolant
Connections
Leave 3" (76.2 mm)
Clearance for Side Vents

Chapter 9 Trouble Shooting

This section describes suggested procedures to address potential problems. If the guidelines below do not adequately solve the issues, contact Thorlabs for support.

9.1 General Guidelines

Always look at multiple diagnostics (oscilloscope, spectrometer, power meter, etc.).

Always do the “reversible” first.

Try to determine the source of a problem before making a blind adjustment.

If all troubleshooting steps have been followed and the problem persists, or if there is a problem outside of this subset, please contact Thorlabs.

9.2 There is an error code displayed at the bottom of the software

Press the “Clear Error” button in the bottom right corner of the screen to see if the error persists.

If the error persists, press the “Reset” button to reinitialize the devices.

If the error still persists, take note of the error code and contact Thorlabs for technical support.

9.3 The error “Master Key Open” is displayed on the software, and the seeder is unable to turn on

Toggle the Master Key from locked to unlocked

Press the “Clear Error” button in the bottom right corner of the software.

9.4 The Remote Interlock has been tripped

The Master Key Switch acts as a manual reset and must be cycled from unlocked to locked and back to unlocked to put the laser back in to a Ready State.

9.5 If Problems Persist

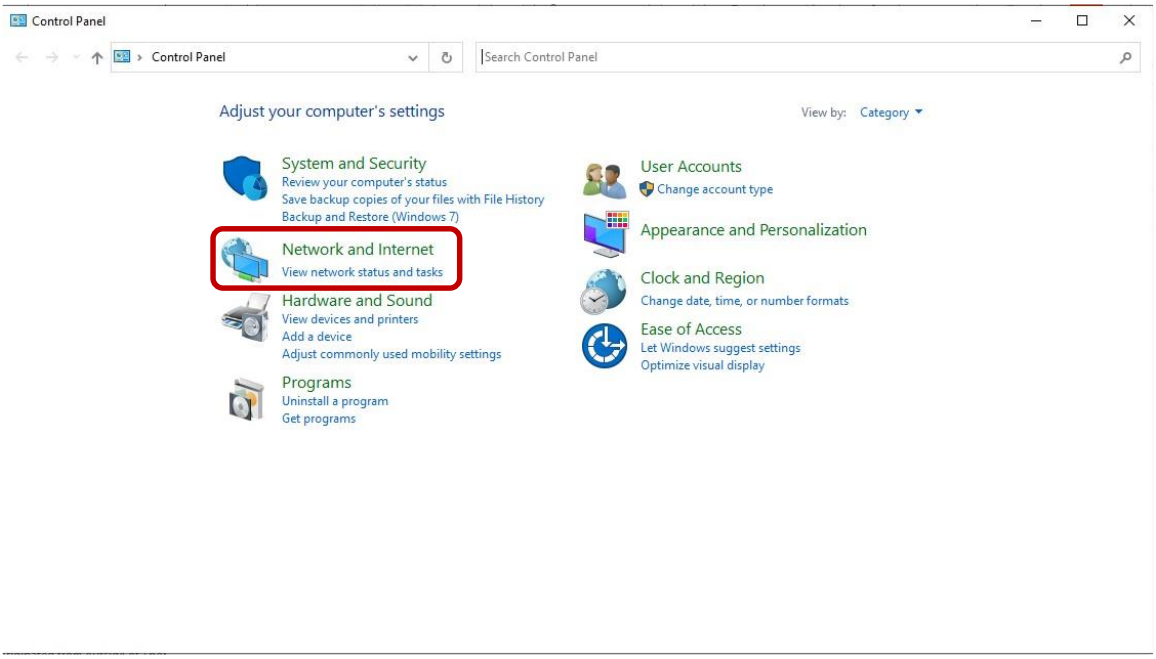
Please email our dedicated service inbox at **y-fi.service@thorlabs.com**

Chapter 10 Configure Network Adapter

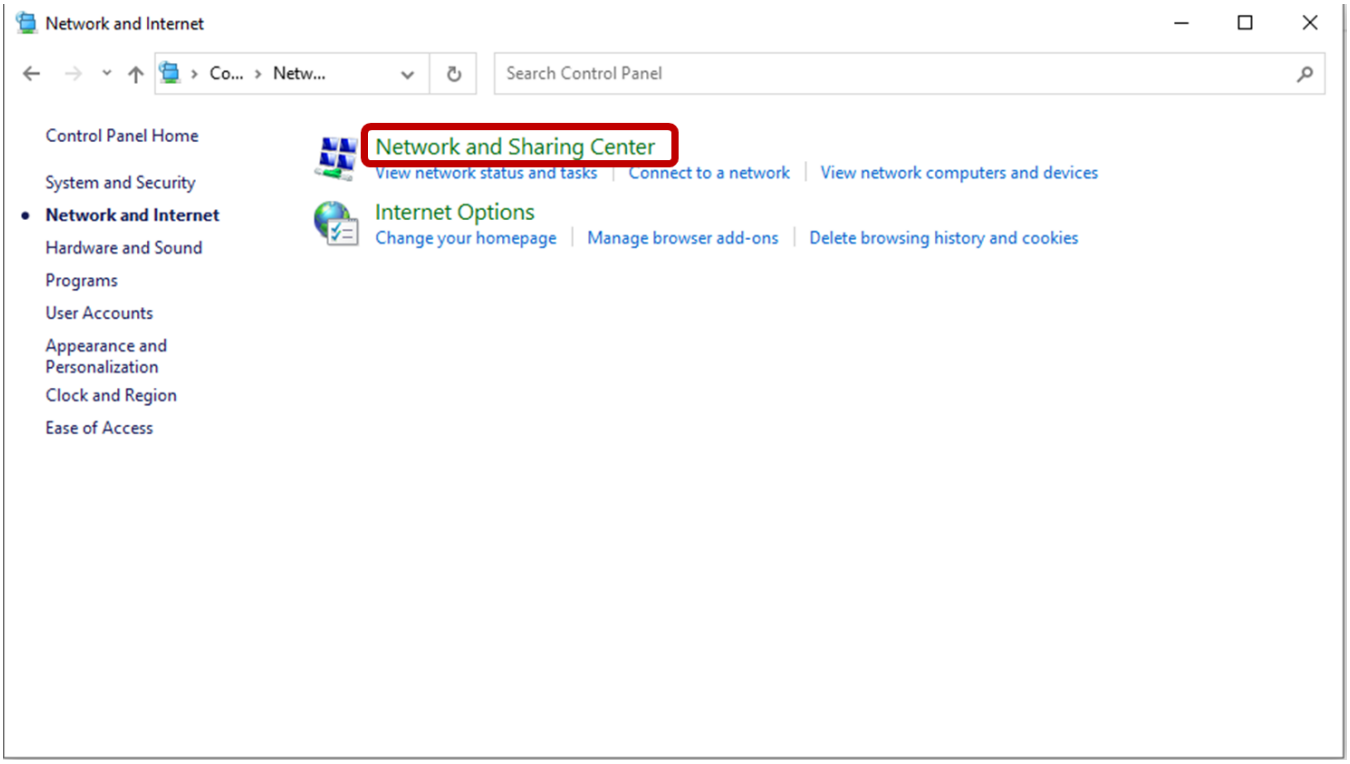
If using a USB to Ethernet adapter, connect the device and ensure that it configures properly. If using a network adapter integrated into the PC, for example the Ethernet RJ45 port on your laptop or desktop, it should already be available for configuration.

Press the start button on your desktop, in the search bar enter, “Control Panel”. Open the control panel.

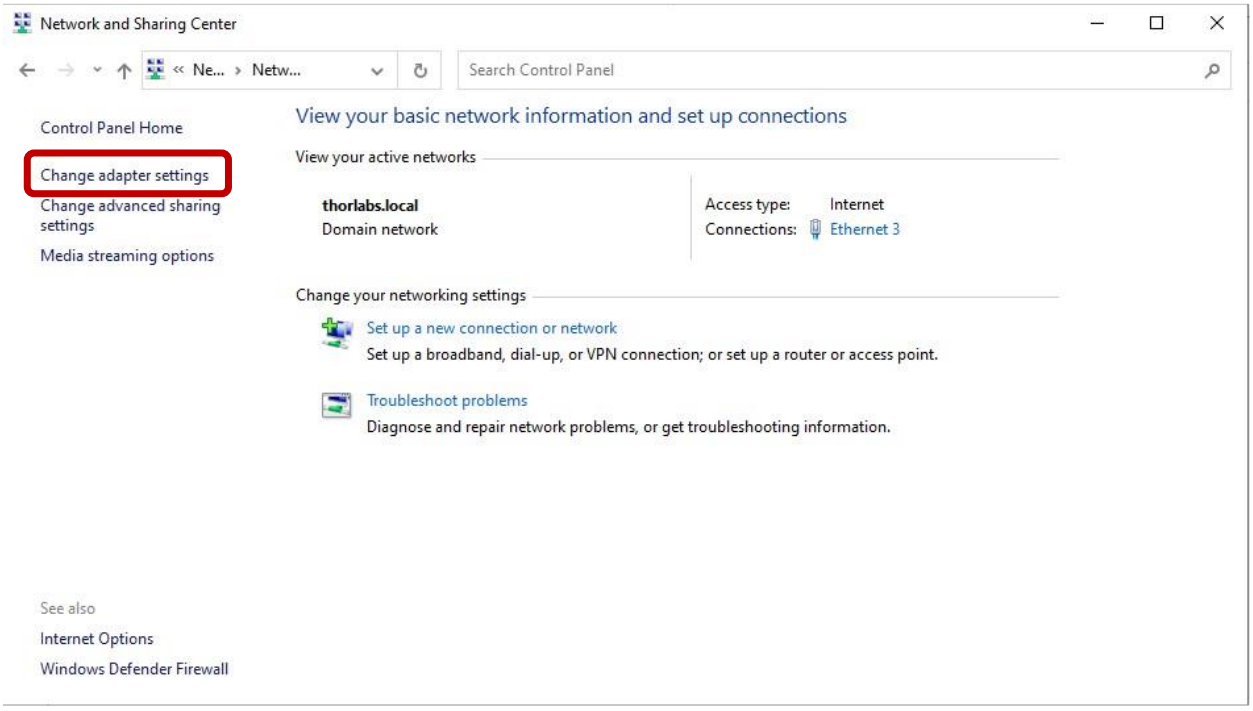
Select “Network and Internet”



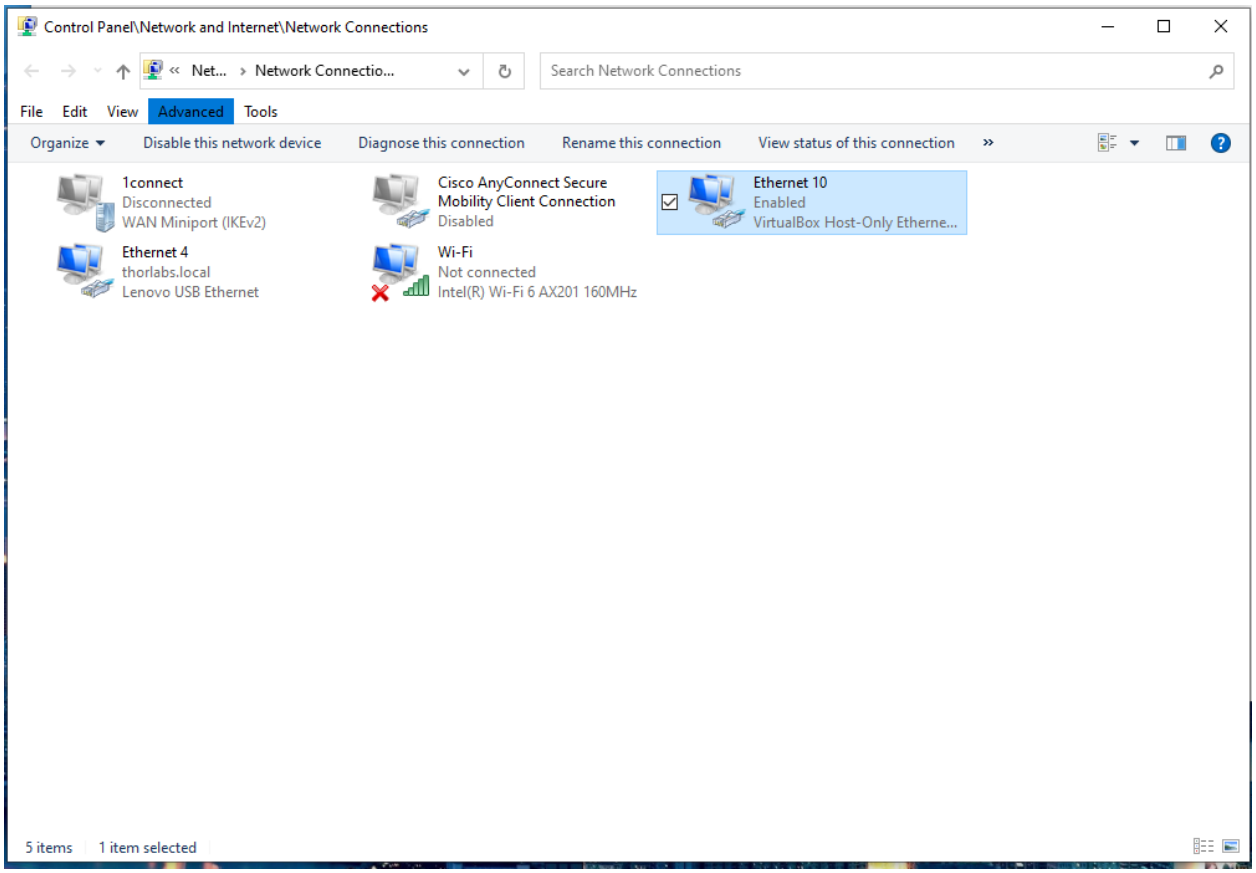
Select “Network and Sharing Center”



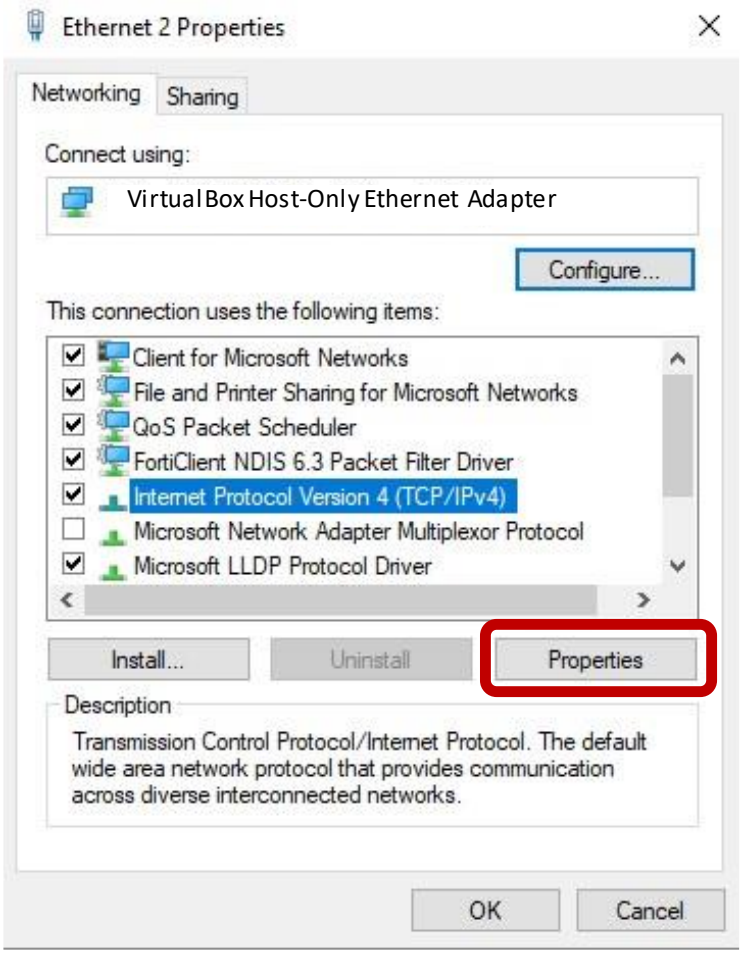
On the left-hand side, select “Change adapter settings”



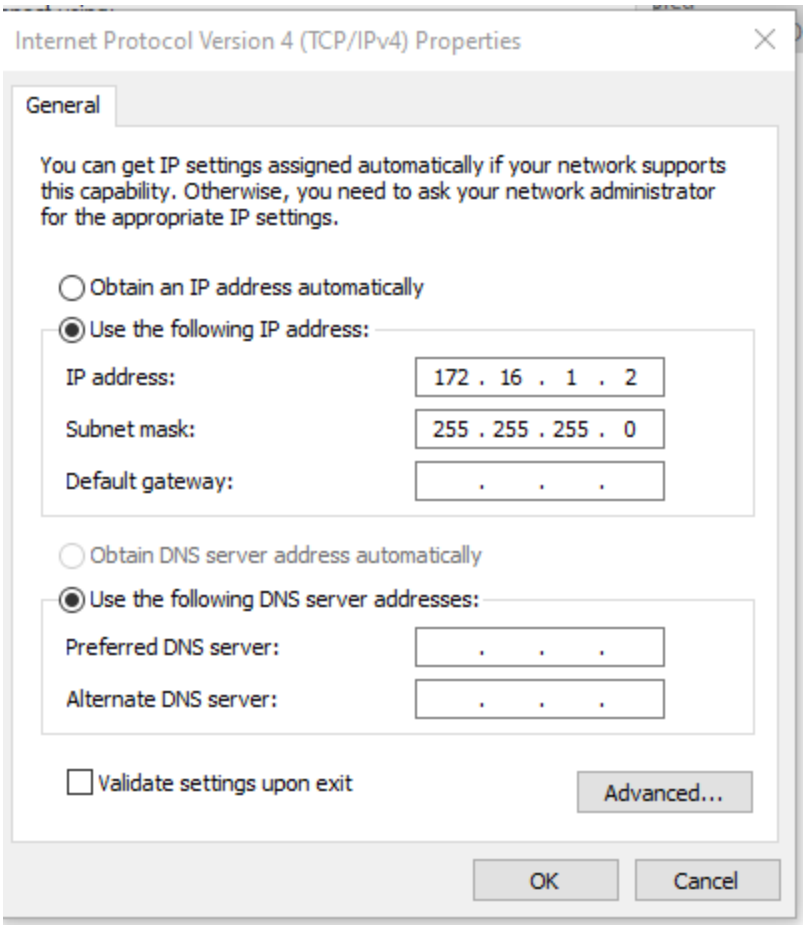
Select the adapter you wish to configure to connect to the laser. Right click on this adapter and click on “Properties”.



In the forthcoming menu, click on “Internet Protocol Version 4 (TCP/IPv4)” and then click on Properties.



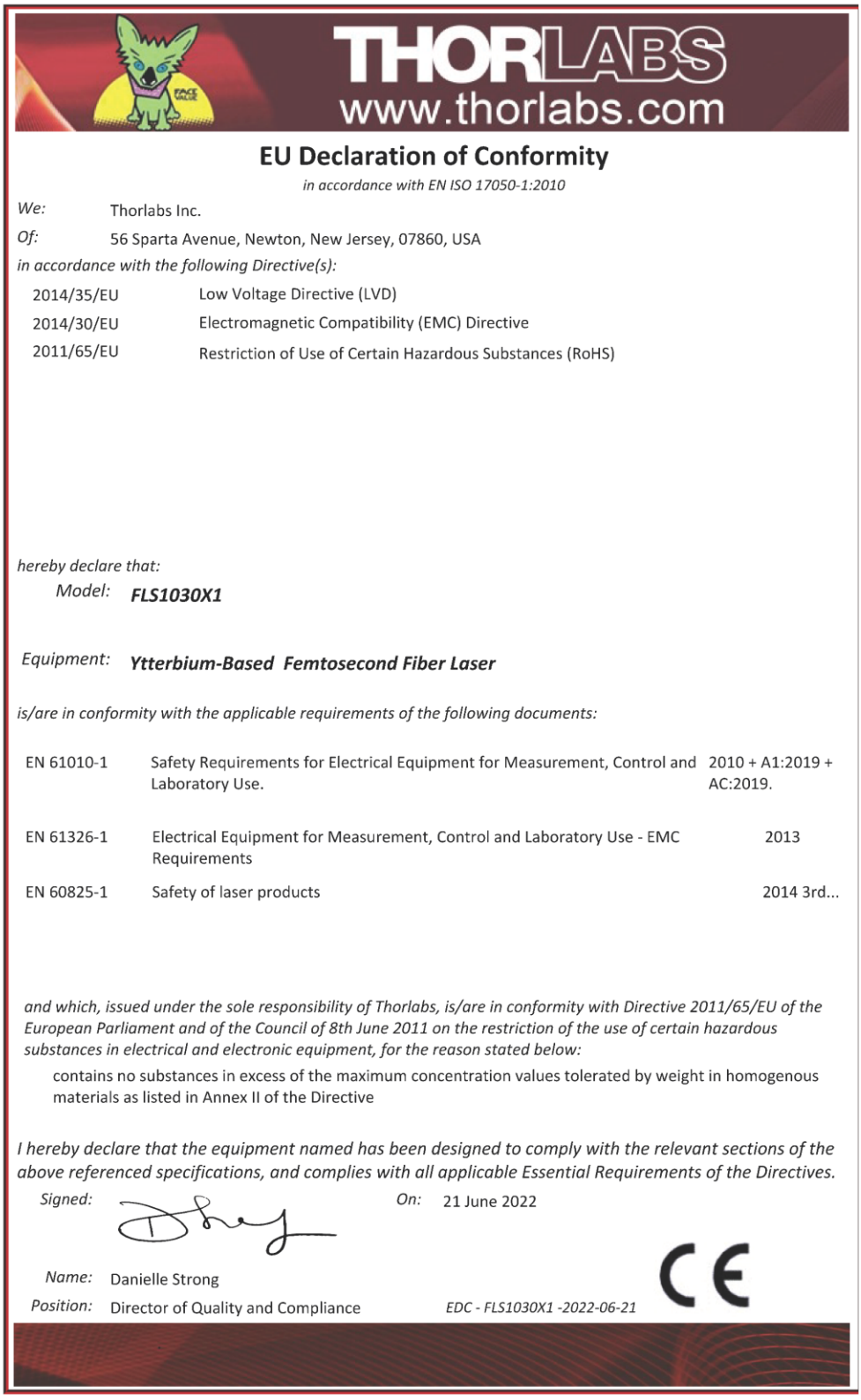
Select “Use the following IP Address:” and enter in the IP address entry field, “172.16.1.2”. The Subnet Mask field should default to 255.255.255.0.



Press OK on this menu and the Adapter Properties Menu from step 7.

The network adapter is now configured to communicate with the laser system.

Chapter 11 Certifications and Compliance



THORLABS
www.thorlabs.com

EU Declaration of Conformity

in accordance with EN ISO 17050-1:2010

We: Thorlabs Inc.

Of: 56 Sparta Avenue, Newton, New Jersey, 07860, USA

in accordance with the following Directive(s):

2014/35/EU	Low Voltage Directive (LVD)
2014/30/EU	Electromagnetic Compatibility (EMC) Directive
2011/65/EU	Restriction of Use of Certain Hazardous Substances (RoHS)

hereby declare that:

Model: ***FLS1030X1***

Equipment: ***Ytterbium-Based Femtosecond Fiber Laser***

is/are in conformity with the applicable requirements of the following documents:

EN 61010-1	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use.	2010 + A1:2019 + AC:2019.
EN 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements	2013
EN 60825-1	Safety of laser products	2014 3rd...

and which, issued under the sole responsibility of Thorlabs, is/are in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8th June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, for the reason stated below:

contains no substances in excess of the maximum concentration values tolerated by weight in homogenous materials as listed in Annex II of the Directive

I hereby declare that the equipment named has been designed to comply with the relevant sections of the above referenced specifications, and complies with all applicable Essential Requirements of the Directives.

Signed: *On:* 21 June 2022

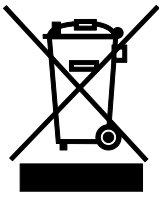
Name: Danielle Strong

Position: Director of Quality and Compliance

EDC - FLS1030X1 -2022-06-21

CE

Chapter 12 Warranty and RMA Information



Annex I

Thorlabs verifies our compliance with the WEEE (Waste Electrical and Electronic Equipment) directive of the European Community and the corresponding national laws. Accordingly, all end users in the EC may return "end of life" Annex I category electrical and electronic equipment sold after August 13, 2005 to Thorlabs, without incurring disposal charges. Eligible units are marked with the crossed out "wheelie bin" logo (see right), were sold to and are currently owned by a company or institute within the EC and are not dissembled or contaminated. Contact Thorlabs for more information. Waste treatment is your own responsibility. "End of life" units must be returned to Thorlabs or handed to a company specializing in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site. It is the user's responsibility to delete all private data stored on the device prior to disposal.

12.1 Return of Devices

This precision device is only serviceable if returned and properly packed into the complete original packaging including the complete shipment plus the cardboard insert that holds the enclosed devices. If necessary, ask for replacement packaging. Refer servicing to qualified personnel.

Chapter 13 Thorlabs Worldwide Contacts

For technical support or sales inquiries, please visit us at www.thorlabs.com/contact for our most up-to-date contact information.

USA, Canada, and South America
Thorlabs, Inc.
sales@thorlabs.com
techsupport@thorlabs.com

UK and Ireland
Thorlabs Ltd.
sales.uk@thorlabs.com
techsupport.uk@thorlabs.com

Europe
Thorlabs GmbH
europe@thorlabs.com

Scandinavia
Thorlabs Sweden AB
scandinavia@thorlabs.com

France
Thorlabs SAS
sales.fr@thorlabs.com

Brazil
Thorlabs Vendas de Fotônicos Ltda.
brasil@thorlabs.com

Japan
Thorlabs Japan, Inc.
sales@thorlabs.jp

China
Thorlabs China
chinasales@thorlabs.com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