TLX3
O-Band Tunable Laser Source
User Guide

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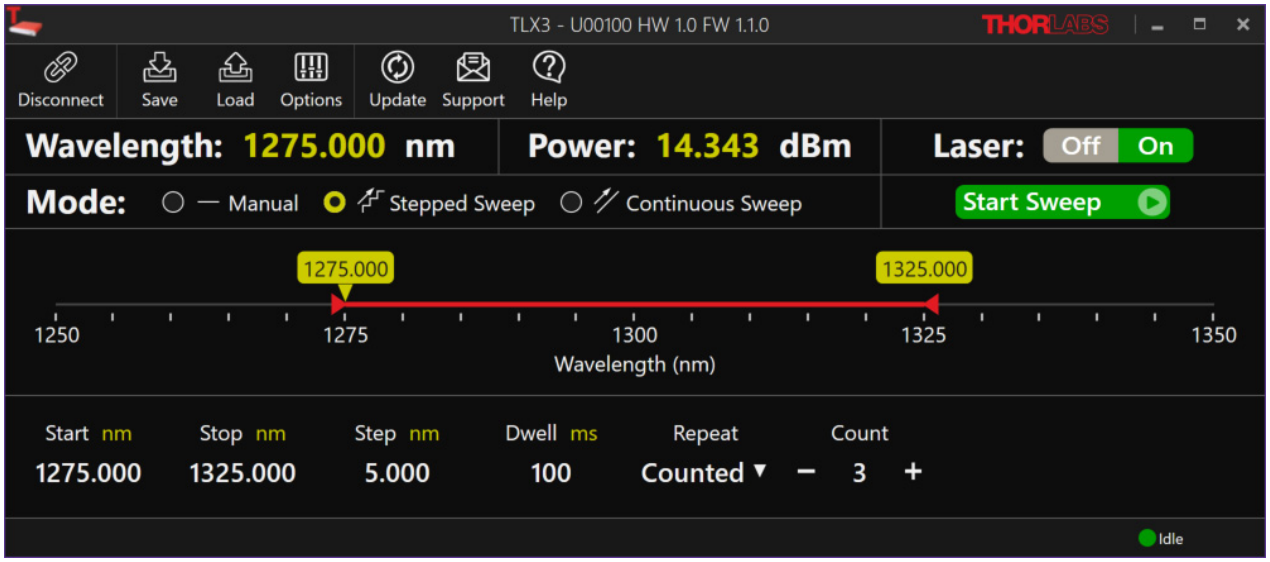
Chapter 1 Introduction

The TLX3 is a turn-key, self-contained, tunable laser for the O-Band (1250 nm to 1350 nm) based on the use of a fiber-coupled, semiconductor gain module and an intracavity tunable filter. It has no moving parts, which enables fast, continuous tuning of wavelength. With output power in the 10 mW to 40 mW range, and PM single-mode output, it is an ideal source for communication applications and manufacturing testing. The output connection uses PM fiber with an FC/APC connector. BNC connectors on the back panel provide analog output signals for synchronizing the operation of the laser to external instrumentation.

The laser has three main modes it can operate in: Manual, Stepped Sweep, and Continuous Sweep. These are easily selected and controlled by the supplied Windows GUI (see sample window below) which connects to the TLX3 via USB or RS-232 connections. The GUI also provides direct readout of wavelength and power.



The user can also control the laser using their own software via a full command set. All documentation for this product is available for download on the Thorlabs website at **www.thorlabs.com/manuals**. A separate Programming Guide provides detailed information about how to connect and control the TLX3 via external user programs.

Chapter 2 Safety and Compliance

The safety of any system incorporating this equipment is the responsibility of the assembler of the system. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. Only with written consent from Thorlabs may changes to single components be carried out or components not supplied by Thorlabs be used. There are no user serviceable components inside this device.

Warning: Risk of Electrical Shock
Before applying power to the instrument, make sure that the protective conductor of the 3 conductor mains power cord is correctly connected to the protective earth contact of the socket outlet. Improper grounding can cause electric shock with damage to your health or even death. Only use mains cable with sufficient current and voltage ratings for this instrument. The local supply voltage must be in the range specified on the rear panel, and the correct fuse must be installed in the fuse holder. If not, please replace the main fuse (see Maintenance Section). Do not position equipment in a way that makes it difficult for the user to operate the disconnecting device. Do not remove covers. Refer servicing to qualified personnel.

Warning: Risk of Explosion
The instrument must not be operated in explosion endangered environments.

Warning: Laser Radiation
Avoid Exposure – Radiation emitted from apertures. Do not look into the laser aperture while the laser is on. Injury to the eye may result. Laser should not be turned on unless there is an optical fiber connected to the laser output port.
Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Caution: ESD Sensitive Component
The components inside this instrument are ESD sensitive. Take all appropriate precautions to discharge personnel and equipment before making any connections to the unit.

Caution: Components not Water Resistant
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: Follow Intended Usage Guidelines
Inputs and outputs must only be connected with shielded connection cables.

Do not obstruct the air ventilation slots in housing.

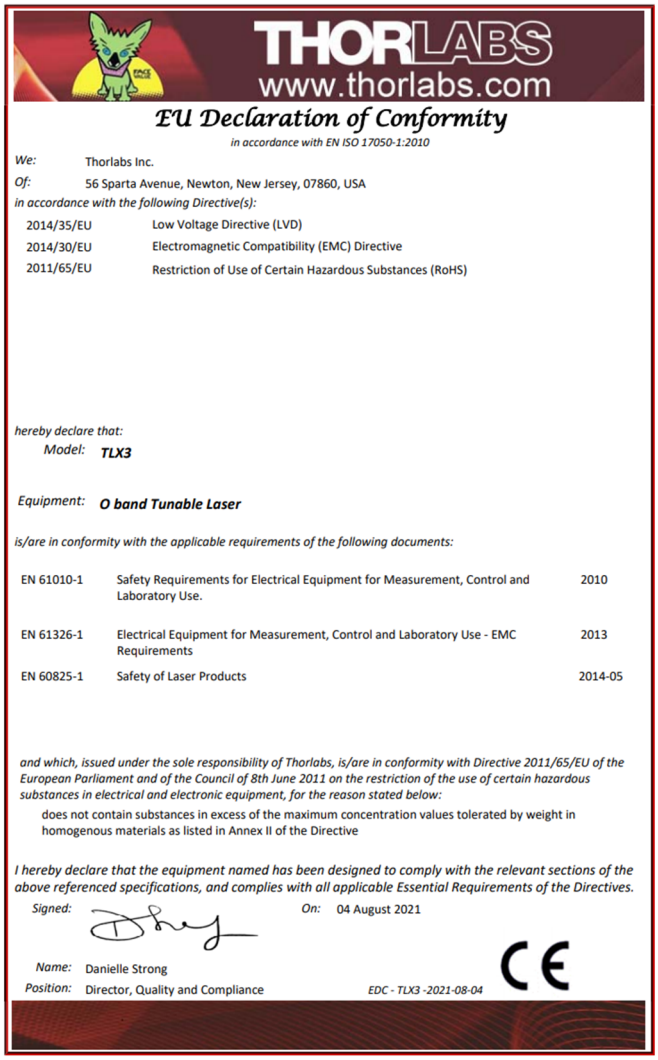
Mobile telephones, cellular phones or other radio transmitters are not to be used within the range of three meters of this unit since the electromagnetic field intensity may then exceed the maximum allowed disturbance values according to IEC 61326-1.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

This product has been tested and found to comply with the limits according to IEC 61326-1 for using connection cables shorter than 3 meters (9.8 feet).

Thorlabs is not responsible for any radio or television interference caused by modifications of this equipment or the substitution or attachment of connecting cables and equipment other than those specified by Thorlabs. The correction of interference caused by such unauthorized modification, substitution or attachment will be the responsibility of the user. The use of shielded I/O cables is required when connecting this equipment to any and all optional peripheral or host devices. Failure to do so may violate FCC and ICES rules.

The EU Declaration of Conformity as also available as part of the documentation library for the TLX3.



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: ***TLX3***

Equipment: ***O band Tunable 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
EN 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements	2013
EN 60825-1	Safety of Laser Products	2014-05

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:

does not contain 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:* 04 August 2021

Name: Danielle Strong

Position: Director, Quality and Compliance

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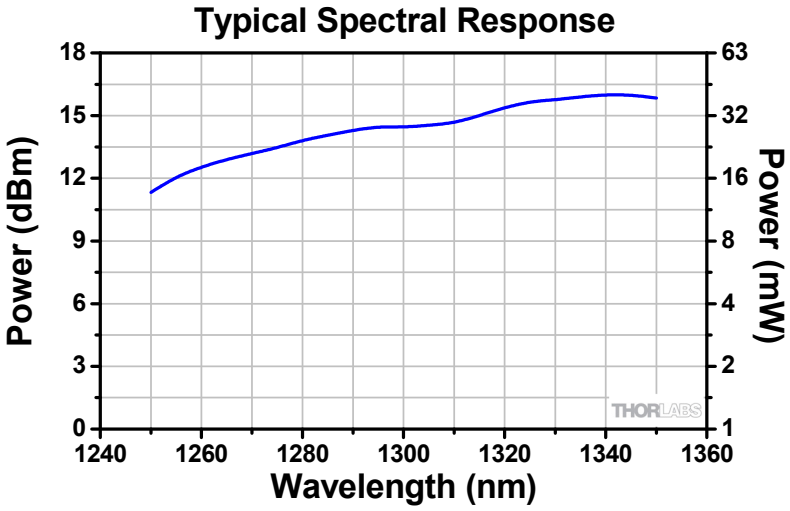
CE

Chapter 3 TLX3 Specifications

All specifications are typical at 25 °C after 1-hour warm-up time.

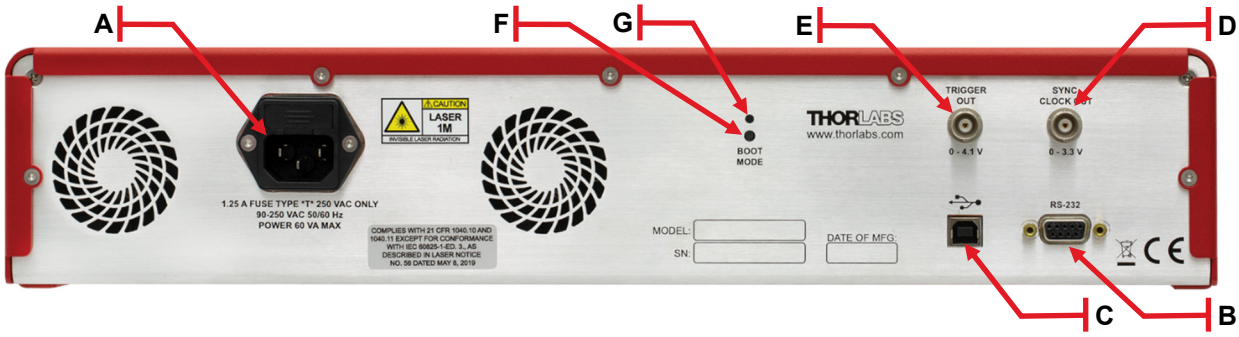
Parameter	Specification	Note
Wavelength Range	1250 - 1350 nm	
Output Power	10 - 40 mW	Depends on Wavelength (See Graph)
Power Stability	±0.02 dB	-
Power Repeatability	±0.05 dB	-
Wavelength Accuracy	±50 pm	-
Wavelength Stability	±30 pm	-
Wavelength Repeatability	±20 pm	-
Tuning Resolution	10 pm	-
ASE Ratio	>60 dB	0.1 nm Bandwidth, 1 nm from Center
RIN Noise	-145 dB/Hz	-
Linewidth	<100 kHz	-
Tuning Time (Manual Mode)	100 ms	Between Any Two Wavelengths
Transition Time (Step Mode)	300 ms	In Stepped Mode
Dwell Time (Step Mode)	100 ms - 60 s	Does Not Include Transition Time
Sweep Speed Range	50 - 400 nm/s	Continuous Sweep Mode
Output Connector	(PM) FC/APC	Polarization-Maintaining Fiber
Output Fiber	Single-Mode PM	Aligned to Slow Axis and Key
Polarization Extinction Ratio	>15 dB	-
Operating Conditions	10 - 35 °C, 5 - 85% RH	-
Housing Size	19.0" x 16.9" x 3.4" 483 mm x 429 mm x 86 mm	2U Rack Mount Chassis
Supply Voltage	100 - 250 VAC	50/60 Hz
Trigger Out Levels (Digital)	0 - 4.1 V	See Rear Panel
Clock Out Levels (Digital)	0 - 3.3 V	See Rear Panel



Chapter 4 TLX3 Front and Rear Panel Functions

The TLX3 comes in a 2U height rack-mount sized box with rack-mount hardware as shown here. Screw-on feet for the bottom of the box are also available for bench placement.

Callout	Description
A	Power Switch
B	Indicator Light for Laser Power
C	Indicator Light for Laser Output
D	PM FC/APC Fiber Output



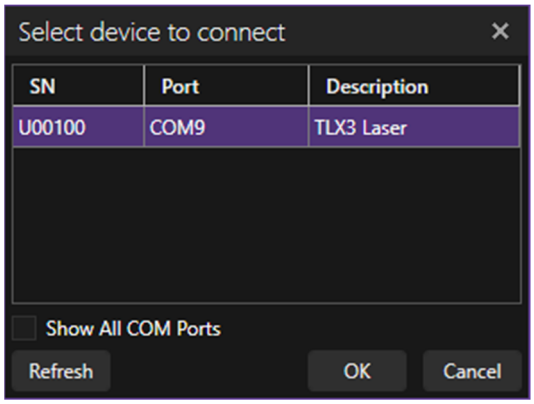
Callout	Description
A	Main Power Connection
B	RS-232 Port (DB9 Female Connector)
C	USB Port (USB Type B Connector)
D	Clock Output (BNC Female Connector)
E	Trigger Signal (BNC Female Connector)
F	Boot Mode Button[a]
G	Indicator LED for Firmware Upgrades

a. The Boot Mode button is NOT a “Reset” button

Chapter 5 TLX3 Quick Start Guide

1. Plug the TLX3 laser into the wall supply and turn on the front panel switch.
2. Install the GUI software onto a PC. The software is available here: **https://www.thorlabs.com/Software**
   The software is also supplied on a memory stick in the shipping box. Note that the software also installs the Windows driver required for programming the TLX3 via USB.
   A desktop shortcut should appear that looks like this:

3. Connect the PC to the TLX3 laser via standard USB cable.
4. Run the GUI application by clicking on the desktop shortcut.
5. First, select the COM port associated with the TLX3 laser and press OK.



6. The GUI window will open in the OFF state as shown below. You can resize it as you prefer.
   The laser is now ready to be turned ON and operated.

7. Connect a clean PM FC/APC patch cord to the laser output on the front panel.
   NOTE: Cleaning the patch cord is essential to avoid damage to the connectors.
8. Click on the ON/OFF button to enable laser output and check the power output.
9. Make sure to observe all laser safety procedures.

Chapter 6 TLX3 Full Operating Instructions

Follow the Quick Start Guide to get the laser connected to a PC and turned ON. The GUI should appear as shown in this image (in Manual Mode). The laser can always be turned ON and OFF using the button in the top right. The indicator light on the front panel of the actual laser should also confirm the ON/OFF state.

There are three operating modes described below: Manual, Stepped Sweep, and Continuous Sweep. These are selected by clicking on the radio buttons as shown in the image above.

6.1. Manual Mode

This mode (as shown in the image above) allows you to simply set the operating wavelength and step it manually using on-screen buttons. The wavelength can be set directly by typing into the “Wavelength Target” box at the lower left or by clicking and dragging the wavelength indicator label above the wavelength scale. Specific step sizes can also be entered in the “Wavelength Step” box. In that case, the wavelength can be precisely stepped up or down by clicking on the + or – indicators. The actual wavelength and output power are always reported near the top of the GUI window in large, yellow font. The units of the power measurement can be set (either mW or dBm) via the Options menu button.

6.2. Stepped Sweep Mode

This mode allows you to program the laser to automatically step across a wavelength range at a user-defined step size. Click on the Stepped Sweep Mode button to enter this mode. The GUI should appear similar to the image below. Note that the “Start Sweep” button has appeared on the right.

The wavelength range can be set by typing the start and stop wavelengths in the boxes at the lower left of the GUI. Alternately, the start and stop wavelengths can be set by simply dragging the wavelength indicator labels on the wavelength scale. The step size and dwell time at each step can be specified in the boxes at the bottom of the GUI. You can also select the number of cycles to sweep in the box at the bottom right of the GUI. If you want to sweep continuously, then clicking on the “Repeat” menu will allow you to select “Counted” or “Infinite” sweeps.

Once the parameters are set, the sweeps are initiated by clicking the “Start Sweep” button. The button will then change to “Stop Sweep”. Clicking on “Stop Sweep” will terminate the sweep function and reset the controls to the start wavelength. (Note, the laser will still finish its last sweep before resetting).

Note that if the wavelength range is not set to be an integer of steps, then the laser will end its sweep at the last integral number of steps and return to the Start wavelength.

Note also that each step is comprised of a transition time followed by a dwell time. The transition time allows for the laser wavelength to stabilize after tuning. It is the same for all dwell times. Please see the Trigger section of this guide for more details about how to use the Trigger Output function in the Stepped Sweep Mode.

Note that the Power readout will be blanked during this sweep mode because it’s changing too rapidly to be read accurately.

6.3. Continuous Sweep Mode

This mode allows you to program the laser to automatically sweep continuously across a user-defined wavelength range. Click on the Continuous Sweep Mode button to enter this mode. The GUI should appear similar to the image below. Note that the “Start Sweep” button appears on the right.

The wavelength range can be set by typing the start and stop wavelengths in the boxes at the lower left of the GUI. Alternately, the start and stop wavelengths can be set by simply dragging the wavelength indicator labels on the wavelength scale. The sweep speed and number of cycles to sweep can also be specified at the bottom of the GUI. Similar to the Stepped Sweep Mode, you can select whether the number of sweeps is a fixed number or infinite. In this image, it shows the “Infinite” selection.

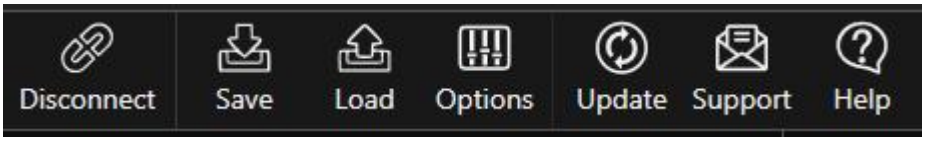
Once the parameters are set, the sweeps are initiated by clicking the Start button. To stop or reset the sweep function, simply click on the Stop Sweep button that appears. The sweeping will stop, and the laser will return to the start wavelength.

See the Trigger and Synchronization sections for more information about how to synchronize external equipment with the TLX3 in the Continuous Sweep Mode.

Note that the Power readout will be blanked during this sweep mode because it’s changing too rapidly to be read accurately.

6.4. Additional Utility Functions

Additional Functions are available using the buttons across the top of the GUI as shown here:



Disconnect:
This button is used to disconnect any communication between the laser and the PC. Communication can be established again by pressing the “Connect” button and selecting the correct COM port again.

Save & Load:
The Save & Load buttons can be used to store and recall the complete instrument settings for any particular mode of operation. The settings are stored in a local directory on your PC as .XML files that can be named according to standard Windows OS conventions. There is no limit to the number of set-ups that can be stored and recalled.

The Options Window

1. Select a Light or Dark theme for the GUI (image is a sample of Light theme)
2. Select the language preferred (Chinese or English)
3. Select the Power Units to be displayed: linear (mW) or logarithmic (dBm)

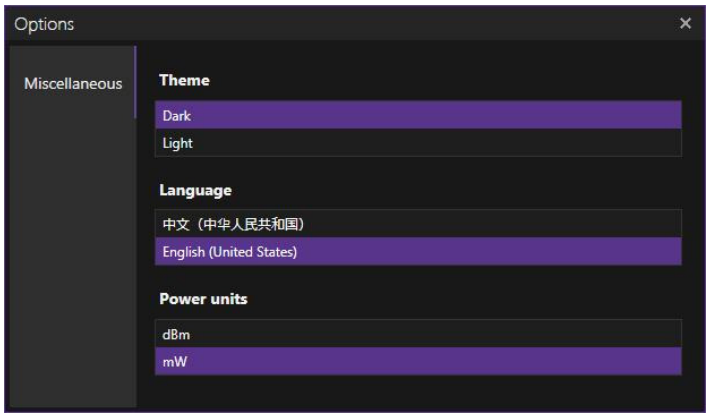


Figure 1 Options Window

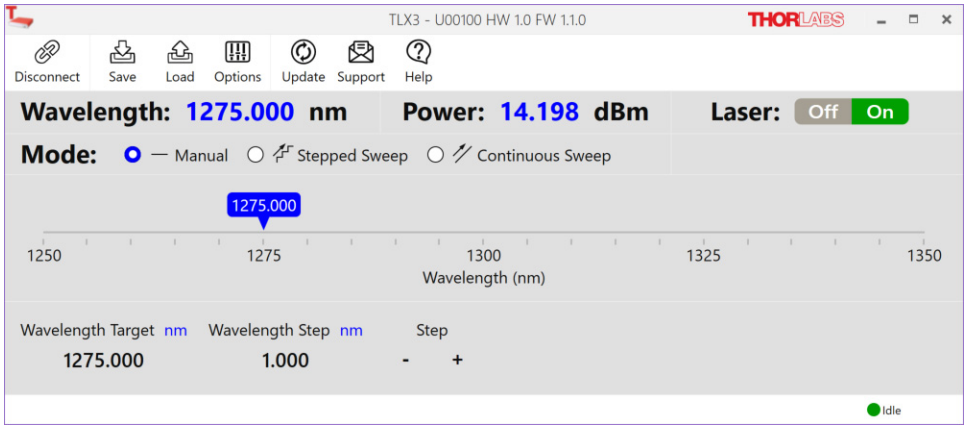
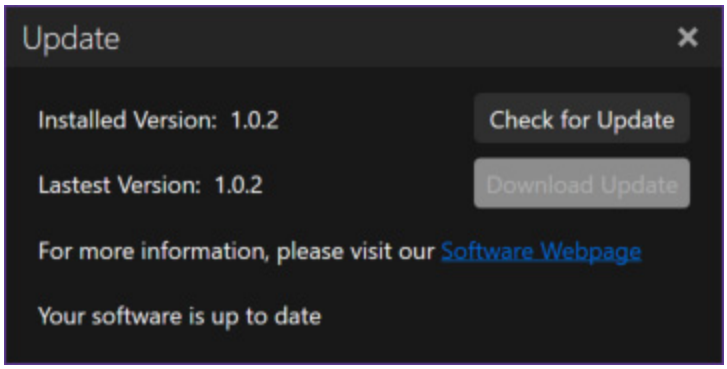
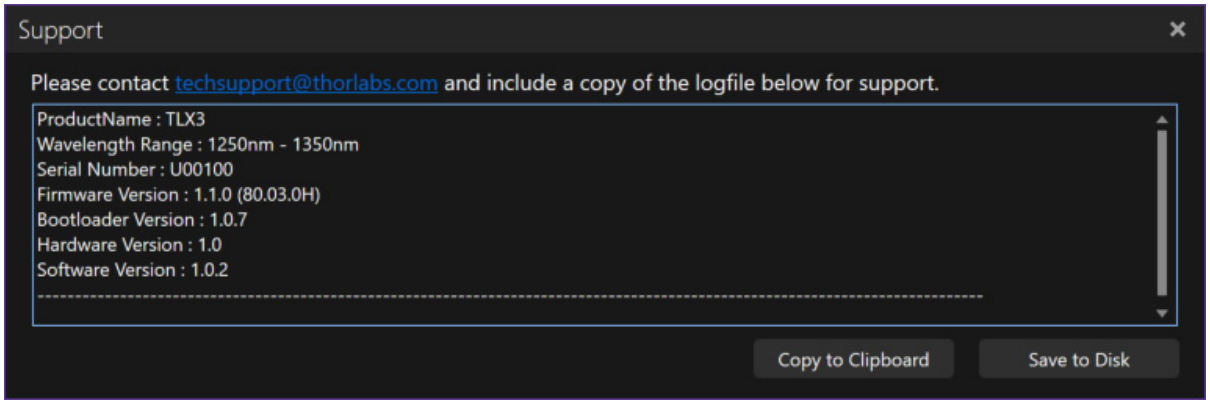


Figure 2 Light Theme for the GUI

Update:
The Update button provides a window for automatically checking the current version of the software. If it is current, then the Installed Version will be the same as the Latest Version and nothing else needs to be done. If the Latest Version is newer then the Installed Version, then the Download Update button will become active. Simply press the button and follow the instructions.



Support:
The Support button provides an email address should you need technical support. Use the “Copy to Clipboard” button to capture the logfile information and then paste it into an email to **techsupport@thorlabs.com**. They will get back to you promptly to follow up with any problem you might have.

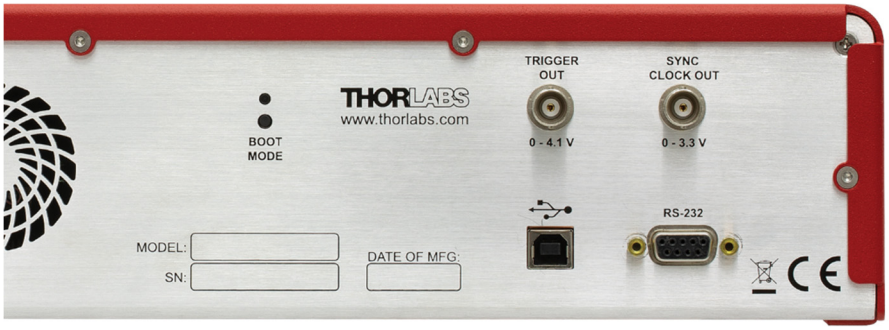


Help:
The Help button provides system information as well as several useful links to the TLX3 laser webpage, the User Manual, the Programming Guide, and any License Documentation.

The TLX3 webpage provides complete specifications as well as all other documentation.

Chapter 7 Trigger and Sync Clock Outputs

These BNC (Female) outputs are found on the back of the unit as shown here:

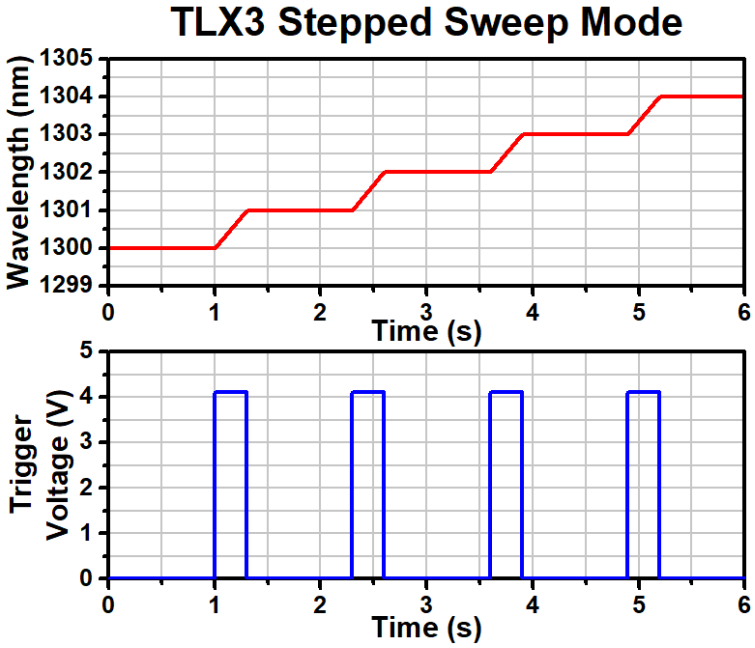


7.1. Trigger Output

The Trigger Out connector (BNC) provides a signal for synchronizing the sweep functions with external equipment. The port normally is held at 0 V. It is used for both Stepped Sweep and Continuous Sweep modes.

Stepped Sweep Mode:

In this mode, the Trigger Output provides a 4.1 V pulse when the laser steps to the next wavelength. The rising edge indicates the beginning of the transition to the next wavelength, then 300 ms later, the falling edge indicates the laser is stable at the new wavelength. In the example shown below, the laser is set to step from 1300 nm to 1304 nm in 1 nm increments and 1 sec dwell times. Note that the transition times (300 ms) are not included in the dwell times.

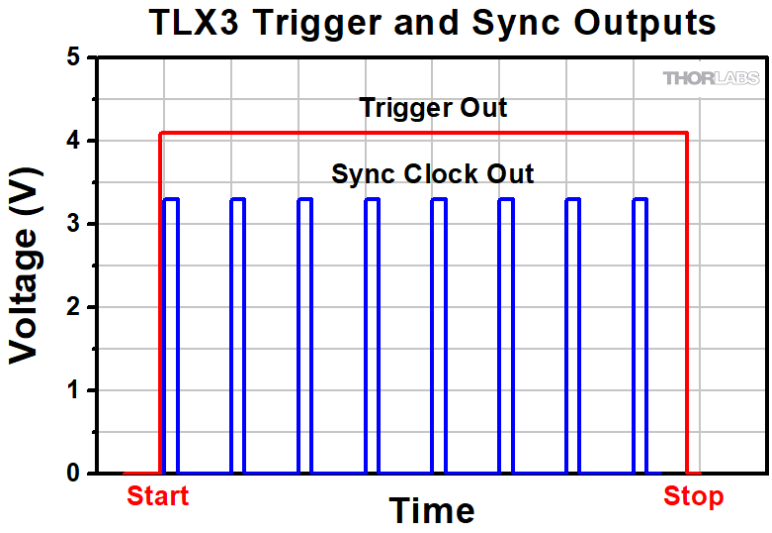


Continuous Sweep Mode:
In this mode, the Trigger Output provides a 4.1 V rising edge at the beginning of the sweep, and a falling edge back to 0 V at the end of the sweep. The signal stays at 0 V while the laser resets to the starting wavelength. See the next section on Clock Sync Output for a more detailed description of the signals.

7.2. Sync Clock Output

The Sync Clock Output provides a series of 3.3 V pulses that can be used to synchronize external instruments to the continuous sweep of the laser. The pulses are produced at a rate that depends on the sweep speed setting, and thus can also be specified in terms of picometers per pulse period. Note that it is the rising edge of the pulse that should be used for timing. The rising edge signifies the laser is stable and external measurements can be reliably made. The pulse width is variable and should be ignored.

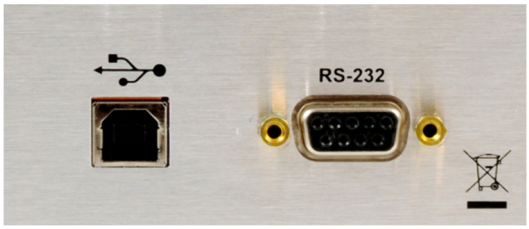
The graph below shows the relationship between the Trigger and Sync outputs for the Continuous Sweep Mode. The Trigger goes high (4.1 V) at sweep start and stays high until sweep end. The table below the graph shows the values of these parameters as a function of sweep speed.



Sweep Speed	Pulse Frequency	Wavelength Shift per Pulse Period
50 nm/sec	12.5 kHz	4 pm
60 nm/sec	12 kHz	5 pm
80 nm/sec	20 kHz	4 pm
100 nm/sec	20 kHz	5 pm
120 nm/sec	12 kHz	10 pm
150 nm/sec	15 kHz	10 pm
160 nm/sec	16 kHz	10 pm
200 nm/sec	20 kHz	10 pm
300 nm/sec	15 kHz	20 pm
400 nm/sec	20 kHz	20 pm

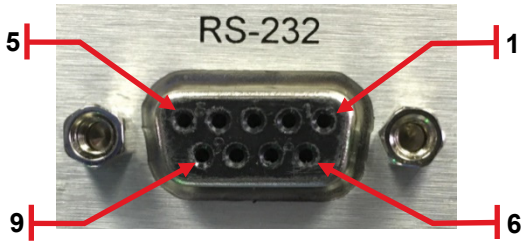
Chapter 8 Remote Control Features

The TLX3 provides two communication methods for remote control, USB and RS-232. Note that a custom Windows driver is required for programming via the USB interface. This driver is installed automatically with the GUI software package included with the TLX3.



Both the RS-232 and the USB connections can be used for remotely controlling the TLX3 laser via SCPI type serial commands. Which connector to choose for remote control operation depends on the demands of the application and the user's preference. See the Programming Guide for information about the commands and connecting the laser to a PC. (**https://www.thorlabs.com/manuals**)

Pin	Description
1	N/C
2	Transmit (Output)
3	Receive (Input)
4	N/C
5	Digital Ground
6	N/C
7	N/C
8	N/C
9	N/C

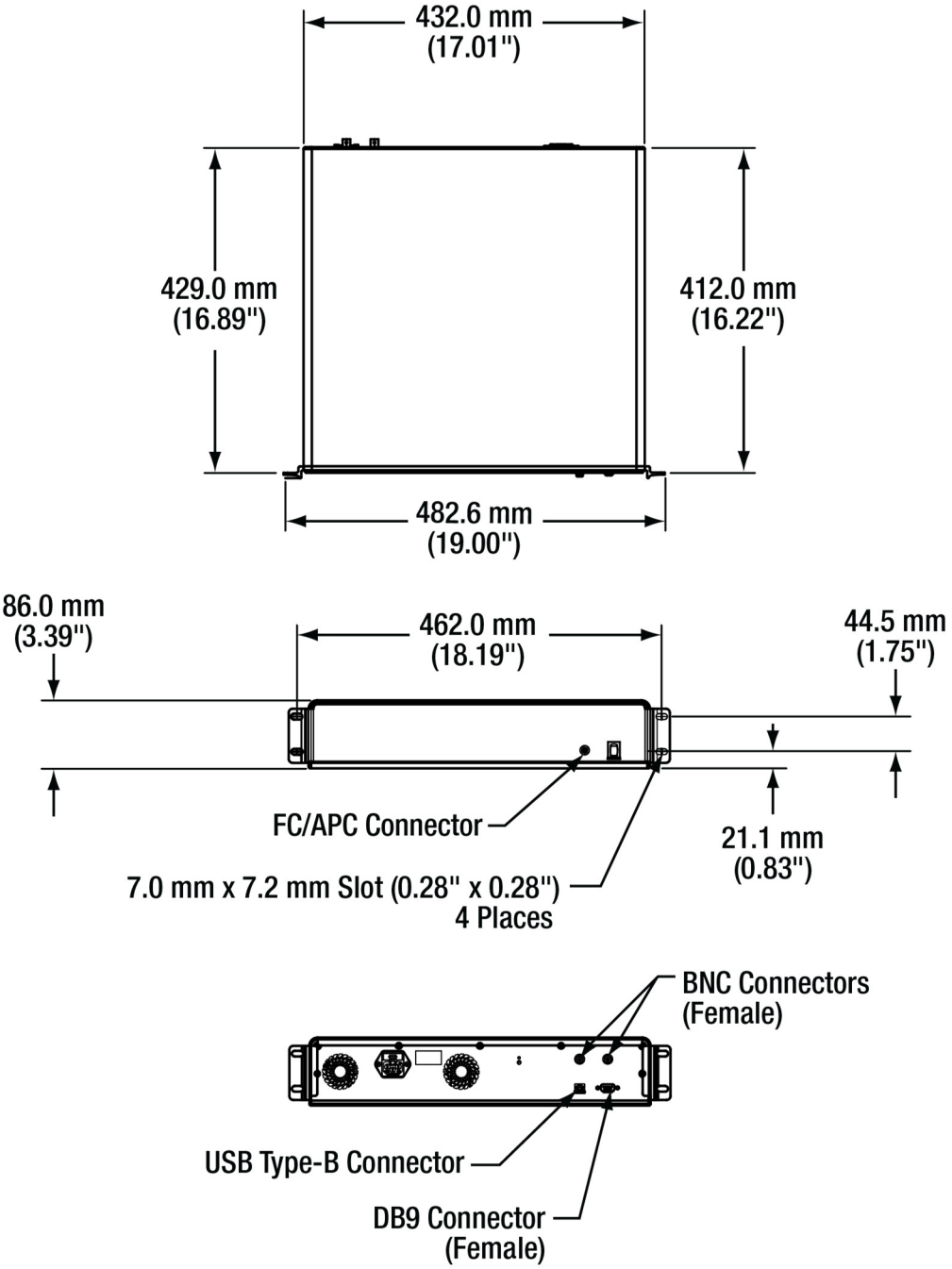


Boot Mode Indicator

In normal operation mode, the indicator LED will glow a steady green color. The recessed "Boot Mode" button is never used in normal operation. It is not a "RESET" button. It is used to place the instrument into special modes to allow installation of firmware updates.

Documentation explaining how to use these modes will be included with any future firmware update files, which will be made available as needed on the Thorlabs web site. Please contact Thorlabs technical support if you have any questions.

Chapter 9 Mechanical Drawings



Chapter 10 Maintenance, Repair, & Fuses

The instrument should not need regular maintenance by the user. If necessary, the display, housing, and front panel can be cleaned using a soft cloth moistened with normal, mild glass cleaner. Do not use any chemical solvents or harsh cleaners on the display. Do not spray any cleaning solutions directly onto any part of the unit.

The instrument does not contain any modules that can be repaired by the user. If a malfunction occurs, please contact Thorlabs Technical Support and arrangements will be made to investigate the problem. Do not remove the cover. There are no user serviceable components inside.

Optical patch cords used to connect to the front panel of the instrument should have their end faces cleaned every time a new connection is made. The end faces of the internal fiber connectors can easily be damaged by the use of dirty fiber ends. If damage occurs, the instrument will need to be sent back for repair. We suggest using a fiber end-face cleaning product such as the Thorlabs FCC-7020 shown below. Alternatively, a lint-free cloth moistened with isopropyl alcohol or methanol can be used. Never use acetone.

The optical connectors on the front panel may be cleaned using a 2.5 mm bulkhead cleaner such as the Thorlabs FBC250. This allows the user to clean the fiber end-face without removing it from the internal bulkhead adapter.

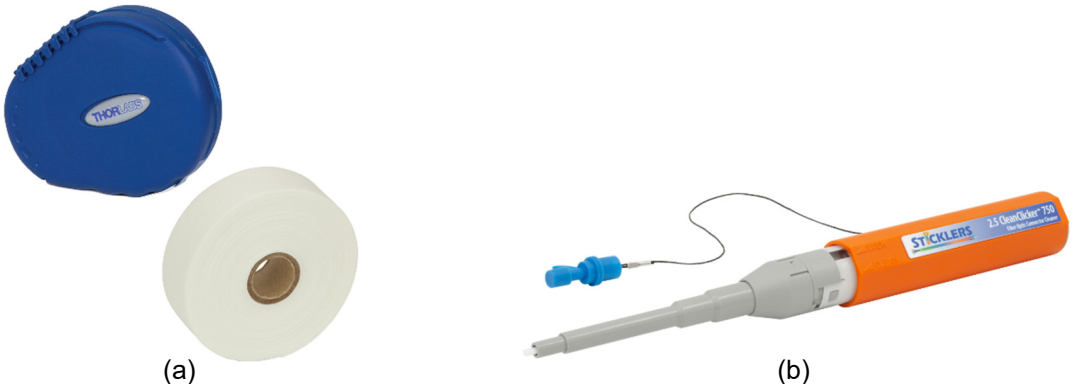
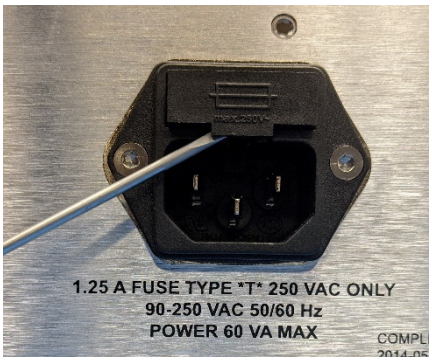


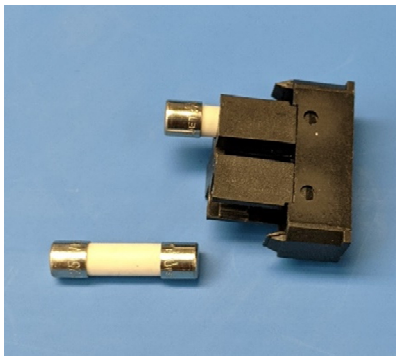
Figure 3 (a) FCC-7020 Fiber Connector Cleaner and FCC-7021 (b) FBC250 2.5 mm Bulkhead Cleaner

10.1. Replacing the Main Fuses

The system is protected by a main fuse block located in the power entry module where the main power cable plugs into the back panel of the instrument. If the instrument does not appear to power-up, especially after a power outage or storm, you can check the condition of the main power fuse without removing the cover of the instrument by following the following steps.

1. Turn the instrument OFF using the front panel switch
2. Unplug the main power cable.
3. Carefully remove the fuse holder slide from the power entry module (use a flat screwdriver) and remove the fuses.





4. Check the fuses for continuity. If in doubt, replace both fuses. Additional replacement fuses can be purchased from Thorlabs or an electronics supply house. **Always use fuses of the same type as the original**.
5. Reinstall the fuse holder slide into the power entry module, taking care that it fully seats until the top is flush with the rest of the power entry module.
6. Plug the main power cable back into the unit and power up using the front panel switch.

If the fuse blows repeatedly, it is likely that an internal failure has occurred. Do not attempt to bypass the fuse as this can create a dangerous situation that could further damage the instrument or harm personnel. In this case, please contact Technical Support for directions.

10.2. Replacement Parts

The following parts can be obtained by contacting Thorlabs Technical Support

- 1.25 A, Type T, 250 VAC fuse for main power
- Instrument IEC main power cord

Chapter 11 Troubleshooting

In case you experience any problems, below are a few checks to help in troubleshooting the problem. If you have any additional questions, please contact your local Thorlabs Technical Support office.

If the unit does not appear to turn on correctly, please check the following items:

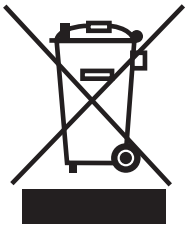
- Ensure that the main AC receptacle has power
- Ensure that main power cable is fully seated at both ends
- Check the main power fuse (see Maintenance & Repair section)
- Make sure the front panel switch is in the ON position and indicator is illuminated

If the optical power output is lower than expected or indicated in the GUI, always start by cleaning the optical fiber connectors, as this is a very common issue when using single mode fibers. Follow the suggestions provided in the Maintenance section of this manual.

Chapter 12 Regulatory

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return “end of life” units without incurring disposal charges.

- This offer is valid for Thorlabs electrical and electronic equipment:
- Sold after August 13, 2005
- Marked correspondingly with the crossed out “wheelie bin” logo (see right)
- Sold to a company or institute within the EC
- Currently owned by a company or institute within the EC
- Still complete, not disassembled and not contaminated



Wheelie Bin Logo

As the WEEE directive applies to self-contained operational electrical and electronic products, this end of life take back service does not refer to other Thorlabs products, such as:

- Pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM laser driver cards)
- Components
- Mechanics and optics
- Left over parts of units disassembled by the user (PCB’s, housings etc.).

If you wish to return a Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

Waste Treatment is Your Own Responsibility

If you do not return an “end of life” unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

Ecological Background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future. The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of life products will thereby avoid negative impacts on the environment.

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.

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