

THORLABS

QSL103A Q-Switched Pulsed Microchip Laser

User Guide



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Chapter 1 Introduction

1.1. Parts List

Inspect the shipping container for damage. If the shipping container appears damaged, retain it until all contents have been inspected and the unit has been mechanically and electrically tested. Verify receipt of all items:

Quantity	Part
1	Laser Head
1	Laser Controller
1	Power Cord According to Local Power Supply
2	Laser Interlock Keys
1	Interlock Pin (Installed)
1	Umbilical Cable

1.2. Description

The QSL103A is a robust, high-powered source of picosecond pulses delivered from a compact laser head. This turn-key, alignment-free laser source produces microjoule-level pulses capable of material processing or harmonic generation. Other applications include laser-range finding and spectroscopy through laser-induced breakdown. With an SM05 thread on the shutter housing and 30-mm cage mounting built into the laser head, this system integrates easily within our compatible line of cage components.

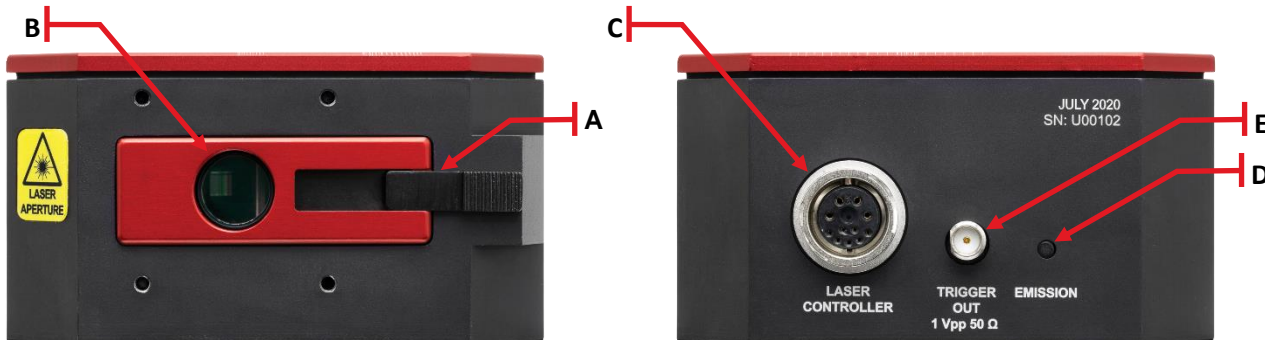


Figure 1 QSL103A Laser Head Front and Back

Callout	Description
A	Manual Slide Shutter
B	Laser Aperture
C	Umbilical Cable Receptacle to Laser Controller
D	Laser Emission Indicator LED
E	Trigger Out



Figure 2 QSL103A Laser Controller, Front View

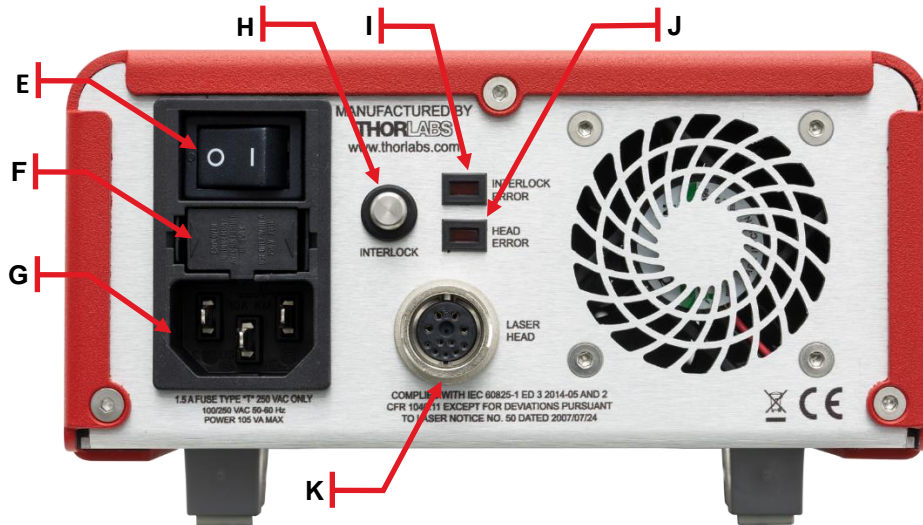


Figure 3 QSL103A Laser Controller, Rear View

Callout	Description
A	Interlock Key Switch
B	TEC Status LED
C	Laser Emission Status LED
D	Laser Enable Momentary Switch
E	Main Power Switch
F	Fuse Holder
G	AC Power Cord Connector
H	Interlock Connector
I	Interlock Error Status LED
J	Head Error Status LED
K	Umbilical Cable Receptacle to Laser Head

Chapter 2 Safety

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

2.1. Warnings and Cautions



Danger: Laser Radiation – avoid exposure to the beam. This is a Class 4 laser system. Observe all safety precautions and wear protective eyewear appropriate for this type of device. Align system at lower output power if possible. Do not position device so that is difficult to access the emission switch and interlock. Keep shutter closed when not in use.



Operate this device only when laser head is securely mounted in a fixed location. Failure to secure laser could result in injury to the user and bystanders, damage to materials, or fire.

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 replace the supplied AC power cord with an inadequately rated power cord.

The safety of any system incorporating the 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.

2.2. Precautions

The following statement applies to the products covered in this manual, unless otherwise specified herein. The statement for other products will appear in the accompanying documentation.

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, and meets all requirements of the Canadian Interference Causing Equipment Standard ICES-003 for digital apparatus. These limits are designed to provide reasonable protection against harmful interference in an industrial 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. Thorlabs is not responsible for any radio 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.

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).

Chapter 3 Quick Start Guide



1. Mount the laser head securely to a thermally and mechanically stable, flat surface.
2. Orient the laser to ensure the output beam will be safely contained within the work surface.
3. Connect the laser controller to the head using the supplied cable, making sure the twist-lock mechanism is engaged in both receptacles. Position the controller so the power switch is accessible, and the vent fan is not blocked.
4. Connect the power supply located on the back of the controller into mains power.
5. Make sure the shutter is in the closed position and the interlock pin is in place at this time. An external interlock circuit can be added for more convenient integration of the interlock safety feature.
6. Put on laser safety goggles for 1030 nm wavelength (e.g. *Thorlabs LG11*) if your situation requires them.
7. Turn the power switch located on the controller rear panel to “On”.
8. The dual color TEC Status LED will blink until the laser temperature has stabilized. Initial warm up can take 45 - 90 seconds.
9. The TEC Status LED will then glow continuously at which point the key can be turned and laser activated by the emission switch. This switch should be pressed and held in for 1 second to enable laser output.
10. Emission is indicated by the Laser Emission Status LEDs on the front of the controller and the back of the laser head.
11. Ensure the laser is pointing in a safe direction, and then open the shutter. After a brief ramping period, the laser output should stabilize.

Note that the laser output beam is not collimated internally but can be collimated with an external lens, which can be mounted using either the SM05 threads on the shutter or the 30-mm cage mounting on the front face of the laser head.



Figure 4 Laser Head Mounted with External Collimating Lens

Chapter 4 Operation

4.1. Block Diagram

The laser system and interlock controls are outlined in the schematic shown in Figure 5. This block diagram depicts the internal architecture of the laser control system with drive electronics, safety interlocks, and temperature stabilization. The dual color LED indicator (red/green) is designed to be visible through most laser safety glasses. It blinks during the 45 - 90 second warm up and glows continuously when temperature stability has been achieved.

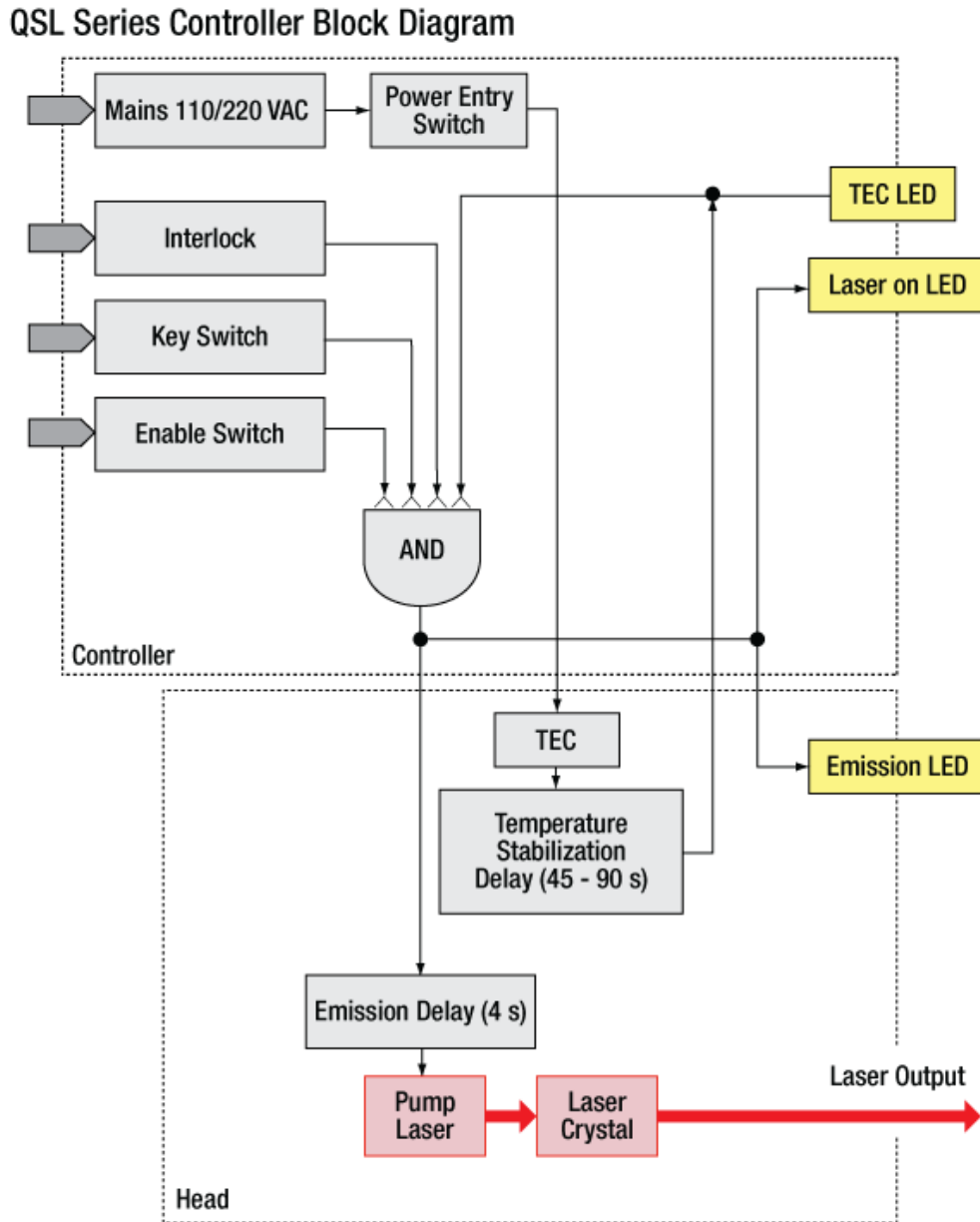


Figure 5 Schematic of the QSL Series

4.2. Interlock Circuit

The laser is equipped with a phono-type interlock jack located on the back panel. To enable the laser source, a short circuit must be applied across the terminals of the interlock connector. The shorting device (interlock pin) installed in all units shipped from Thorlabs performs this function. Leave the shorting device installed unless using an external safety circuit or other type of remotely controlled switch to enable laser output.

Making use of the Interlock feature requires the appropriate 2.5 mm phono-type plug, which is shown in Figure 6. The plug should be wired to the external safety circuit or switch and then plugged into the back panel's interlock jack in place of the shorting device. The electrical specifications of the interlock jack are listed in the following table.

Parameter	Specification
Interlock Switch Requirements	Must be Normally Open Dry Contacts, Apply no External Voltages to the Interlock Input
Type of Mating Connector	2.5 mm Mono Phono Jack
Connector Polarity	Ring is Ground, Center Pin is 5 VDC Max
Open Circuit Voltage	5 VDC
Short Circuit Current	8 mA (Typical)

The user's safety circuit must be attached to the phono plug and wired such that the ring and center pin are shorted when it is safe to enable the laser. The laser will be enabled when the connection is closed. If it changes to an open state, the laser source will turn off and the INTERLOCK ERROR LED will light up on the back panel of the controller.

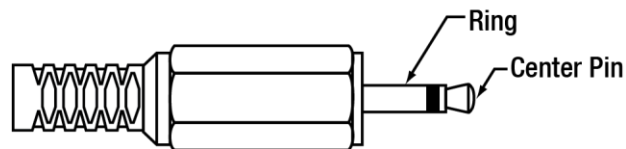


Figure 6 The interlock circuitry internal to the laser head applies a 5 VDC bias across the ring and center pin of the phono-type plug. An external circuit that shorts the ring and center pin enables the laser.

Chapter 5 Specifications

5.1. Optical Specifications

Parameter	Specification
Average Output Power	350 - 450 mW
Repetition Rate	8 - 10 kHz
Pulse Energy	40 - 50 μ J
Output Peak Power	>80 kW
Pulse Duration	500 ps \pm 100 ps
Center Wavelength	1030 nm \pm 1 nm
Power Stability	<1% over 8 hours
Beam Diameter ($1/e^2$), @ 100 mm	3 mm
Beam Divergence ($1/e^2$), Typical	10 mrad
Beam Quality (M^2)	<1.2

5.2. Power, Environmental, and Physical Specifications

Parameter	Specification
AC Input Frequency Range to Power Supply	50 - 60 Hz
AC Input Voltage to Power Supply	100 V to 250 VAC
Power Consumption (Typical)	22 W
Trigger Out	1 V _{pp} , 50 Ω
Relative Trigger Jitter	<10 ps
Optical Repetition Rate Jitter	200 - 300 Hz
Operating Temp Range	10 to 45 $^{\circ}$ C
Storage Temp Range	0 to 60 $^{\circ}$ C
Weight Laser Head	0.8 kg
Weight Laser Controller	1.7 kg
Dimensions Laser Head	136.3 mm x 88.9 mm x 47.1 mm (5.37" x 3.50" x 1.85")
Dimensions Laser Controller	307.4 mm x 299.9 mm x 84.0 mm (12.10" x 11.81" x 3.31")

5.3. Representative Pulse Waveform

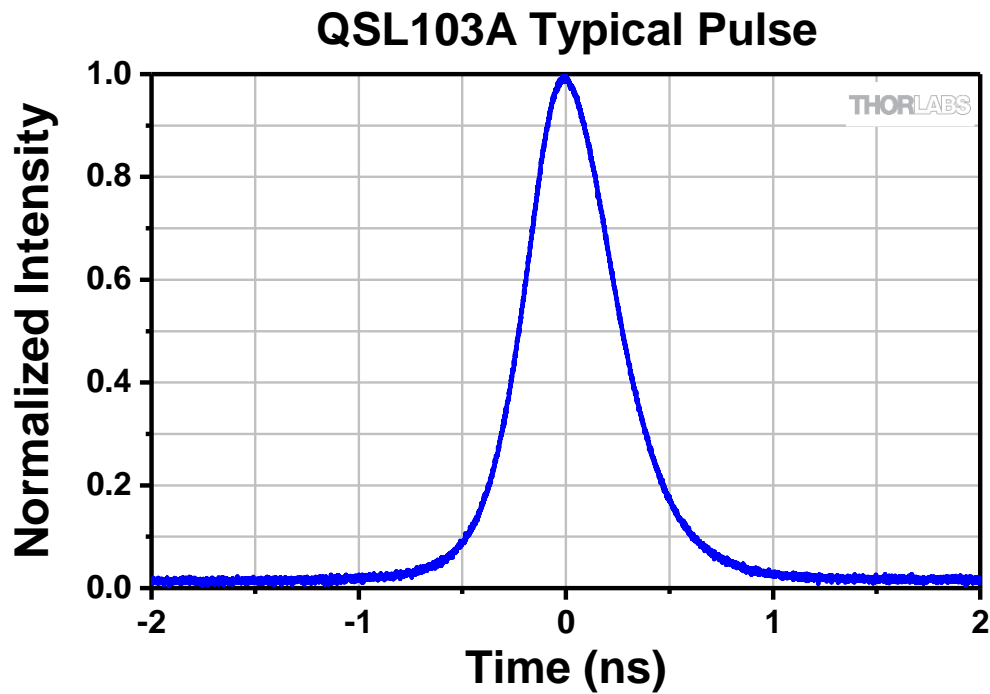


Figure 7 Typical Pulse Waveform of the QSL103A Laser

5.4. Representative Output Spectrum

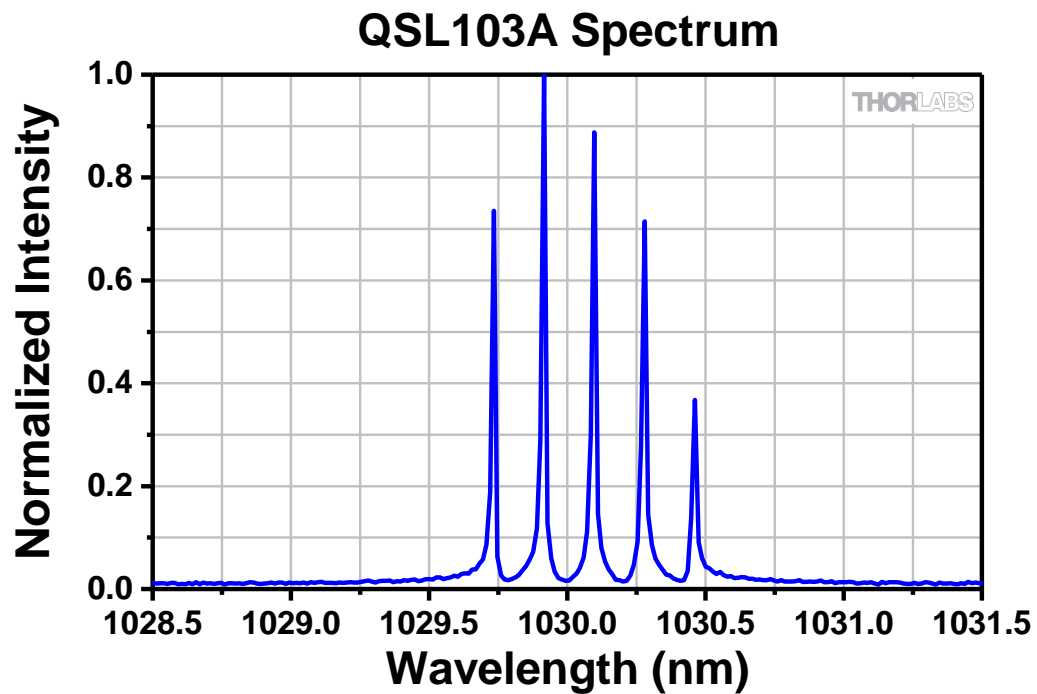


Figure 8 Typical Spectral Profile of the QSL103A Laser

5.5. Representative Output Beam Profile

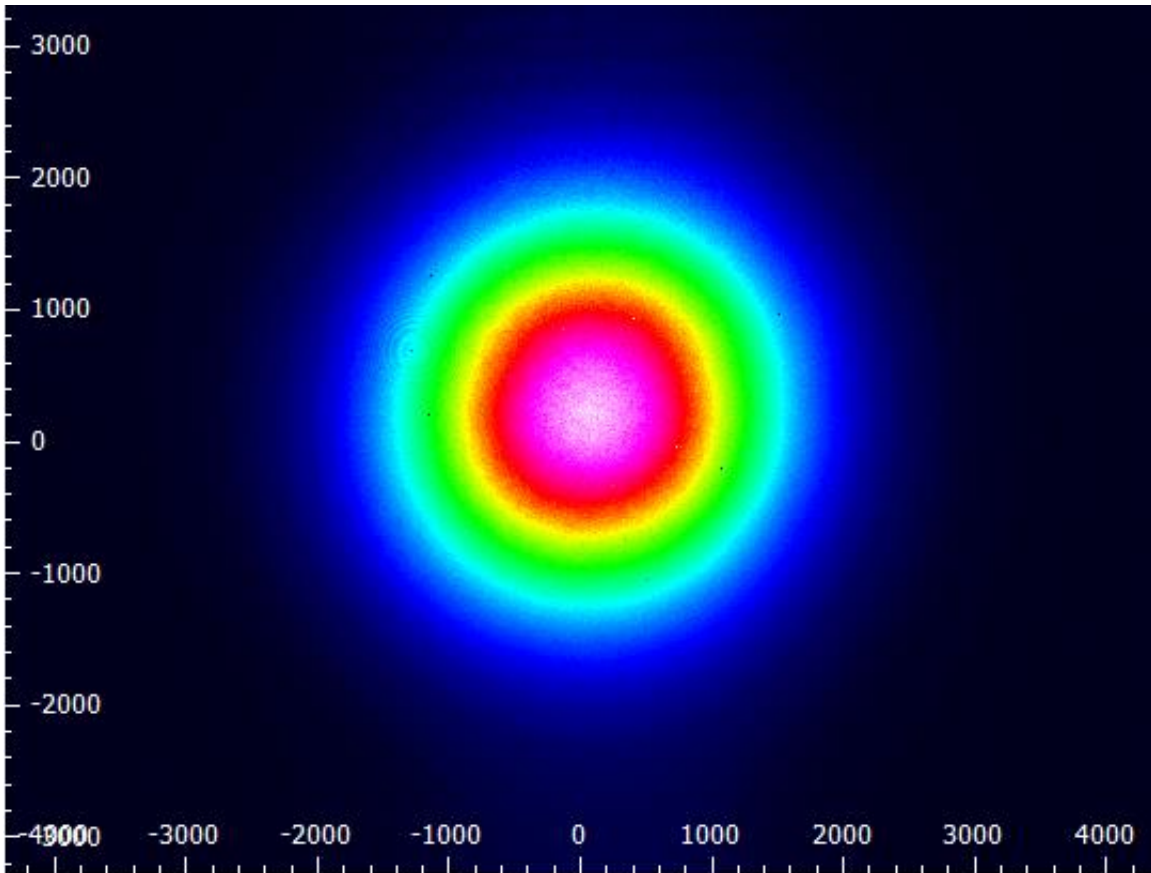


Figure 9 Typical 2D Beam Profile for QSL103A Laser Output

Chapter 6 Mechanical Drawings

QSL Laser Head

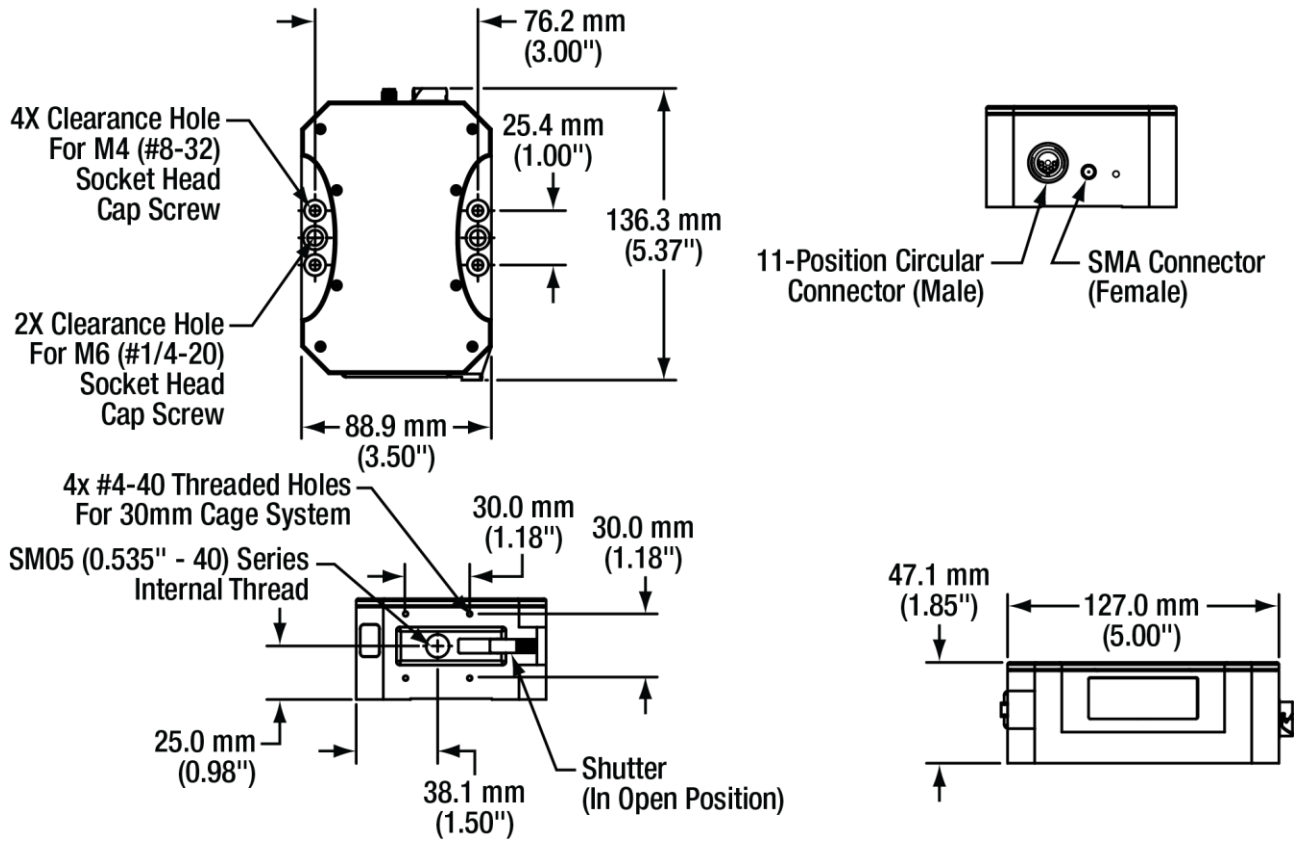


Figure 10 Mechanical Drawing of the Laser Head

QSL Laser Controller

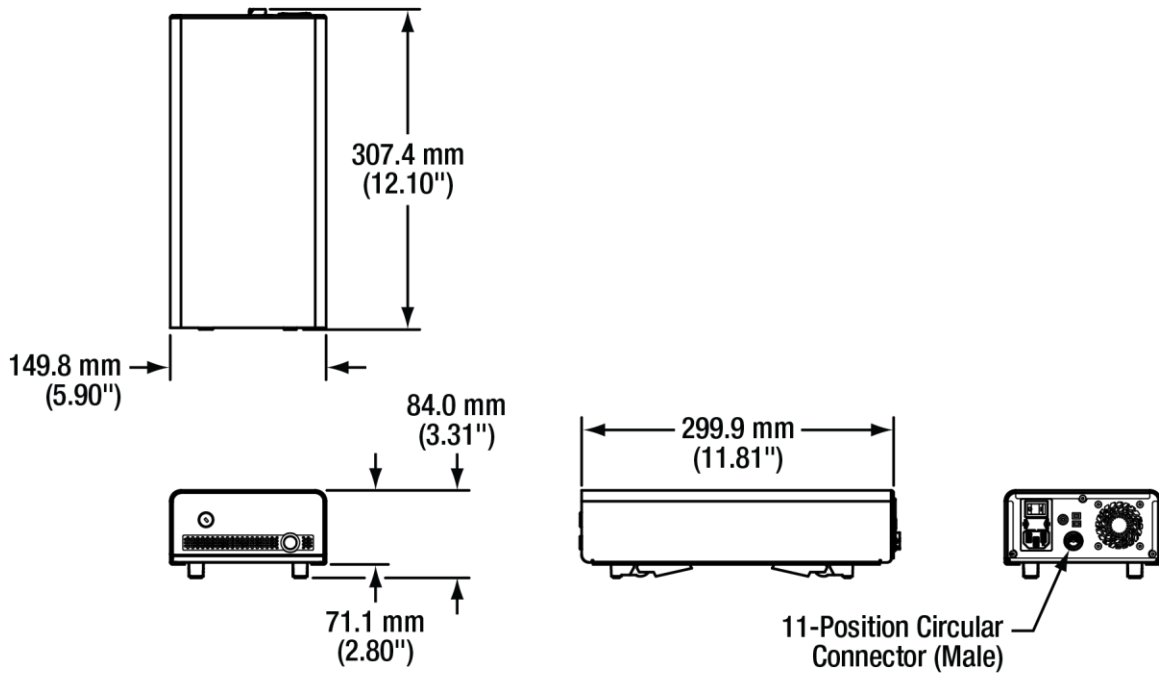


Figure 11 Mechanical Drawing of the Laser Controller

Chapter 7 Maintenance, Repair and Fuses

7.1. Maintenance & Repair

The instrument should not need regular maintenance by the user. If necessary, the controller housing can be cleaned using a soft cloth moistened with a mild glass cleaner. Do not spray any cleaning solutions directly onto any part of the unit.

If a malfunction occurs, please contact Thorlabs Technical Support (techsupport@thorlabs.com) and arrangements will be made to investigate the problem. Do not remove the cover. There are no user serviceable components inside the instrument.

See the troubleshooting guide below for basic help.

7.2. Replacement Parts

The following parts can be obtained by contacting Thorlabs Technical Support

- 1.25A 250VAC fuse for main power
- Instrument IEC main power cord
- Laser Head Cable

7.3. Replacing the Main Fuse

The system is protected by a main fuse 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 power off using the switch on the front panel of the instrument.
2. Unplug the main power cable.
3. Carefully remove the fuse holder slide from the power entry module (push in both tabs until they release, then pull out fuse holder).



Figure 12 Removing Fuse Holder (1)



Figure 13 Removing Fuse Holder (2)

4. Investigate the fuse. This can be done with a simple continuity check. If in doubt, replace the fuse. A spare fuse is stored in the fuse holder. Additional replacement fuses can be purchased from Thorlabs. **Always use fuses of the same type as the original.**

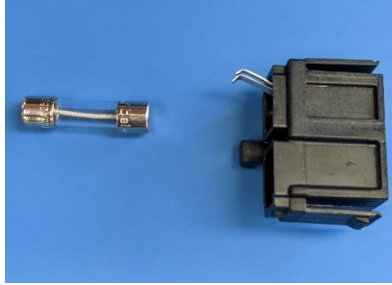


Figure 14 Fuse and Holder

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 on as described in the *Getting Started* section of the manual.

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.

Chapter 8 Troubleshooting

8.1. Troubleshooting

Problem	Suggested Checks
No Laser Output	<ul style="list-style-type: none"> • Check key switch is turned on • Confirm laser is warmed up (45 - 90 s). • Check the TEC indicator LED is glowing continuously. • Confirm there is no Interlock Error. • Hold the ENABLE button down for > 1 second • Check the shutter is open.
Interlock Error	<ul style="list-style-type: none"> • Confirm the interlock circuit is complete.
Head Error	<ul style="list-style-type: none"> • Check both ends of the umbilical cable are seated in the head and controller receptacle • Confirm the correct head is connected to the control unit
Beam is Distorted	<ul style="list-style-type: none"> • Turn laser off • Check to see if the output window is dirty. If so, • Blow any loose dust off with dry air. • If window requires further cleaning, gently wipe with lens tissue that is moistened with either isopropyl or methyl alcohol. Do not apply drops of solvent directly to the window. Do not use acetone or other aggressive solvents.

Chapter 9 Warranty

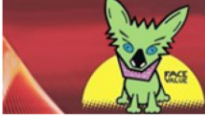
9.1. General Product Warranty

Thorlabs warrants that all products sold will be free from defects in material and workmanship and will conform to the published specifications under normal use, when correctly installed and maintained.

9.2. Specific Warranties and Repairs

All specific warranty and repair information can be found in the general terms and conditions located at https://www.thorlabs.com/Images/PDF/LG-PO-001_Thorlabs_terms_and_%20agreements.p

Chapter 10 Declaration of Conformity



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: **QSL103A**

Equipment: **Q-Switched Pulsed Microchip Laser**


is 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 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:** 17 February 2021

Name: Carmine Lencsak

Position: Chief Operating Officer

EDC - QSL103A -2021-02-17



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 disassembled 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.



Chapter 11 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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