QuikLaze-50 ST2

Operator's Manual

October 2014

Part No. 90-1536D

Contact Information

ESI New Wave Research Division

New Wave Research, a Division of ESI
740 Kifer Road
Sunnyvale, CA 94086-5121
Phone: 510.249.1550
Fax: 510.249.1551
E-mail: info@esi.com
Web: http://www.esi.com

ESI World Headquarters: Portland, Oregon
13900 NW Science Park Drive
Portland, OR 97229-5497
Phone: 800-331-4708
Fax: 503-671-5551
E-mail: americasupport@esi.com
Web: http://www.esi.com

Preface

This manual contains information for proper installation and operation of the QuikLaze-50 ST2 and accessories. The QuikLaze-50 ST2 laser systems comply with the CDRH (Center for Device and Radiological Health) Standard 21 CFR 1040.

The QuikLaze-50 ST2 systems are Class 3B and Class 4 lasers and emit laser radiation that can be harmful to your eyes and skin. It is essential that the safety section of this manual is read and understood before installing this laser and that the operator follows the instructions given for safe laser operation.

Do not attempt to repair the laser, Report all problems to Electro Scientific Industries, Inc. for repair.

Note: This product is sold for Original Equipment Manufacturer (OEM) use only. This product is not intended for direct end-use. This laser is intended as a component for integration into larger system. System integrator manufacturer is responsible for ensuring this product, when incorporated into their product, meets applicable national regulations where their product is sold.

Note: This product is intended only for use in Large Scale Industrial Tools as defined in the RoHs directive 2011/65/EU: `large-scale industrial tools' means a large scale assembly of machines, equipment, and-or components, functioning together for a specific application, permanently installed and de-installed by professionals at a given place, and used and maintained by professionals in an industrial manufacturing facility or research and development facility.

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CAUTION: Refer to documentation for further explanation.

CAUTION: The power cord provides the mains disconnect. Ensure the power cord can be accessed during operation.

CAUTION: Use product only as specified. If product is used in a manner not specified, the protection provided by the equipment may be impaired resulting in injury or death.

Use only the power cord specified for this product and certified for the country of use. Replacement power cord must meet or exceed product ratings (voltage & current).

To reduce the risk of fire or electric shock, do not expose the system to rain, water or other liquids, or moisture. Do not install or operate the system in a location in which it may be exposed to water, flammable liquids or vapors, or condensing humidity.

This laser doesn't contain any operator serviceable parts. To reduce the risk of electric shock, do not remove covers.

Use of laser on certain materials may produce toxic fumes. To prevent exposure, special ventilation will need to be provided at the point of use.

All personnel must wear eye protection suitable for this radiation. ESI recommends the use of dedicated eye wear during laser installation and during laser operation. Refer to Laser Specification section for optical density & irradiance to help in determining proper eyewear. The selection of laser eyewear depends on the wavelength and intensity of the radiation, consult ANSI standard for eyewear selection guidance.

All personnel should be trained in laser safety before operating this equipment, failure to do so may result in injury.

When integrating the laser into a larger system, ensure all laser safety controls are not compromised and function as intended

WARNING: USE OF CONTROLS, ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE.

Safety Precautions

Read the following safety precautions and operator's manual prior to powering up or operation to avoid injury and prevent damage to the QuikLaze Laser Cutting System or any interfacing devices. Use the system only as specified.

The QuikLaze Laser is available as a Class 3B or as a Class 4b laser system.

WARNING: VISIBLE AND INVISIBLE LASER RADIATION.
AVOID EYE OR SKIN EXPOSURE
TO DIRECT OR SCATTERED RADIATION.
CLASS 4 LASER PRODUCT
or
WARNING: VISIBLE AND INVISIBLE LASER RADIATION.
AVOID EXPOSURE TO BEAM
CLASS 3B LASER PRODUCT.

Class 4 and Class 3b lasers can produce instantaneous and permanent blindness or serious injury to the eye or skin and require stringent safety measures during operation and maintenance.

- Follow the instructions and precautions in this manual for proper installation and safe operation of your laser.
- Use protective eyewear. Selection of laser safety goggles depends on the energy and wavelength of the laser beam as well as operating conditions.

Consult ANSI, ACGIH and OSHA standards for safety guidance.

WARNING: Improper operation can result in death, blindness, other injury or material damage. Only qualified personnel should operate this equipment.

WARNING: No operator serviceable parts inside. The QuikLaze laser system contains internal components that present severe electrical and radiation hazards. Improper maintenance or servicing can result in death, blindness, other injury or material damage. Only qualified service personnel should perform service on this equipment.

WARNING: CLASS 4 or CLASS 3B LASER RADIATION.
Always wear protective eyewear when installing, operating, and servicing the laser.

Laser Safety

This manual contains information for the proper installation and operation of the QuikLaze Laser Cutter System. The term QuikLaze refers to the QuikLaze-50 ST2 laser systems unless otherwise noted. This system is designed for semiconductor design and failure analysis, micro-electronics machining and research applications. The QuikLaze complies with the CDRH (Center for Devices and Radiological Health) CFR (Code of Federal Regulations) Title 21, Part 1040.10

- Follow the instructions and precautions in this manual for proper installation and safe operation of your laser.
- Use protective eyewear. Selection of laser safety goggles depends on the energy and wavelength of the laser beam as well as operating conditions.
- Consult ANSI (American National Standards Institute), ACGIH (American Conference of Industrial Hygienists) and OSHA (Occupational Safety and Health Administration) standards for safety guidance.
- Make sure that the eyepiece filter is properly installed on the microscope before installing the laser on to the microscope.

WARNING: Operation of the QuikLaze-50 ST2 laser without the eye protection filter installed on microscope may result in **SEVERE EYE DAMAGE OR BLINDNESS.**

Contact factory for UV4 microscope requirements.

WARNING: The QuikLaze emits laser radiation that can be harmful to human eyes and skin. To avoid blindness or skin damage you must completely read and understand the SAFETY section of this manual before installing the system.

Before attempting to operate the QuikLaze, it is essential that you completely read and understand the OPERATION section of this manual.

Do not attempt to repair the QuikLaze. Report all problems to your supplier or Electro Scientific Industries.

Optical Safety

The QuikLaze Nd:YAG laser generates high energy infrared radiation that can pose serious risks to eye safety. Infrared radiation is invisible to the eye, so the hazard is not immediately obvious, but the radiation can be focused onto the retina. For this reason it is very important to always wear protective eye wear as appropriate and to be aware of any possible reflections. Refer to ANSI 136.2 "Standards for the Safe Use of Lasers," available from the Laser Institute of America, tel. 1.800.345.2737, or 407-380-1553.

WARNING: The 532 (GN) nm output beam is visible and is dangerous. Extreme care and precaution must be taken.

WARNING: The 1064 (IR), 355 (UV3), AND 266 (UV4) nm output beams are invisible and are extremely dangerous. Extreme care and precaution must be taken.

IR (Infrared radiation) passes easily through the cornea, which focuses it on the retina of the eye, where it can cause instantaneous permanent damage including blindness.

UV (Ultraviolet radiation) can be harmful to the lens and the cornea of the eye, where it can cause instantaneous permanent damage including blindness.

Follow the instructions contained in this manual for proper installation and safe operation of your laser.

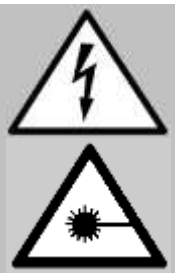
Wear protective eye wear; selection depends on the energy and wavelength of the laser beam as well as operating conditions. Consult ANSI, ACHIG or OSHA standards for guidance.

CAUTION: USE OF CONTROLS, ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE.

CAUTION: At all times during installation, operation, maintenance or service of your laser, avoid exposure to laser or collateral radiation exceeding the accessible emission limits listed in "Performance Standards for Laser Products," 21 CFR 1040 10(d). or EN60825-1.

Electrical Safety

The laser head and power supply contain electrical circuits operating at lethal voltage and current levels. Do not attempt to operate the laser with the power supply cover or laser head cover removed. For service, please contact a service person trained by Electro Scientific Industries.



WARNING: No operator serviceable parts inside. The QuikLaze Yd:YAG laser system contains internal components that present severe electrical and radiation hazards. Improper maintenance or servicing can result in death, blindness, other injury or material damage. Only qualified service personnel should perform service procedures on this equipment.

Warning! Hazardous live voltages up to 850 VDC present inside the main umbilical connector when the unit is energized and operating. User and/or service personnel must remove all power to the unit before connecting or disconnecting this connector.

Safety Features

The following features are built into the QuikLaze Nd:YAG lasers to conform to government regulations and provide safe laser operation.

Laser Covers

The QuikLaze laser head is enclosed in a protective housing that prevents access to radiation in excess of Class 1 limits, except for the output beam aperture, which is Class 3B or Class 4 if so marked. The cover also protects against stray radiation from the QuikLaze**.**

WARNING: Do not remove the cover, except to perform service procedures by a trained service person. Refer to Chapter 7, Service for more details.

Interlocks

The QuikLaze Nd:YAG laser system has a series of interlocks to prevent accidental exposure to dangerous levels of electricity or radiation. In addition, there are interlocks designed to interrupt laser operation if the laser may be damaged. The interrupts are laser head cover opened, laser head/microscope interlock, remote interlock (2) interrupted (if installed), water temperature too high or cooling water flow too low.

Exit Shutter

The QuikLaze has an exit beam shutter located on the laser head housing. The laser beam may be blocked by closing the manual shutter; however the laser continues to operate.

Government Regulations

Electro Scientific Industries suggests that laser users purchase a copy of the *American National Standard for the Safe Use of Lasers* (ANSI Z136.1-1993) from the Laser Institute of America. This publication provides recommendations for the safe use of lasers and laser systems that operate at wavelengths between 180 nm and 1 mm.

Laser Institute of America
13501 Ingenuity Drive
Orlando, FL 32826
(407) 380-1553
www.laserinstitute.org

Laser Classification

The governmental standards and requirements specify that the laser must be classified according to the output power or energy and the laser wavelength. The QuikLaze is classified as Class 3B or Class 4, depending on the orderable configuration, and is appropriately marked. Laser Classifications are based on measurements of EN60825-1, Clause 9 and 21 CFR, subchapter J, part II, section 1040-10 (d). This manual and other documentation for the QuikLaze refers to the classification as Class 3B (IIIb) or Class 4 (IV), depending on which standard is referenced, EN60825-1 (US CFR Title 21, 1040.10).

Laser Classification

The governmental standards and requirements specify that the laser must be classified according to the output power or energy and the laser wavelength. The QuikLaze is classified as Class IIIb based on 21 CFR, subchapter J, part II, section 1040-10 (d). In some configurations the laser is a Class IV laser product and is appropriately marked on the laser head. According to the European Community standards, the QuikLaze is classified as Class 3B or Class 4 if so marked based on EN 60825. This manual and other documentation for the QuikLaze refers to the classification as Class 3B (IIIb) or Class 4 (IV).

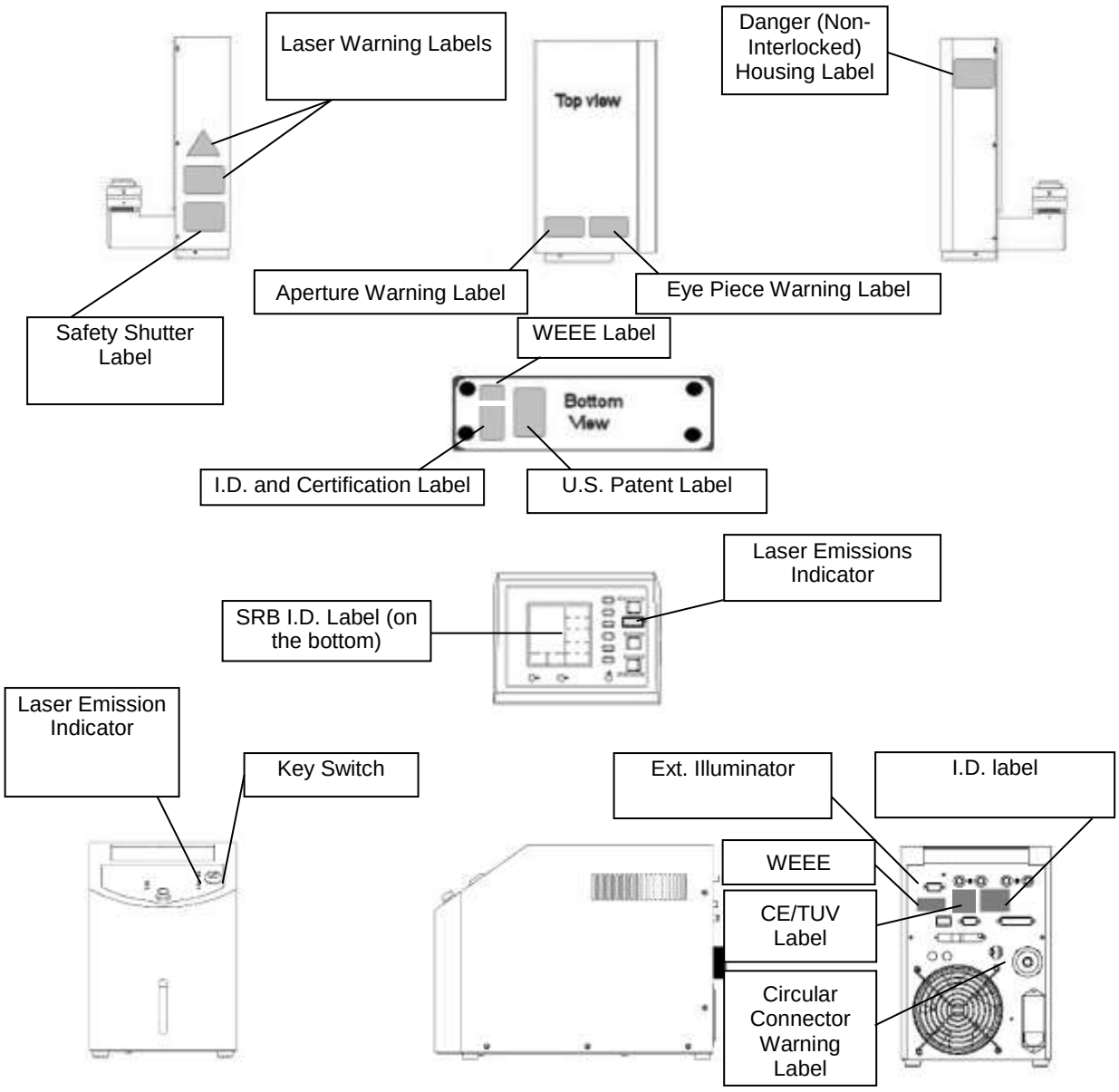


Figure 2-1: CDRH Safety Label Locations

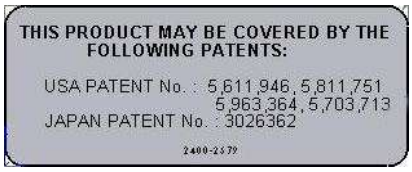
SRB ID Label

ID Label

ID/Certification Label

Aperture Warning Label

Aperture Warning Label



Patent Label

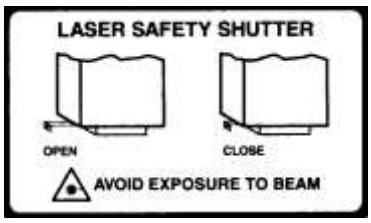
Eyepiece Filter Label

Eyepiece Filter Warning Label

Non-Interlocked Housing Label

WEEE Label

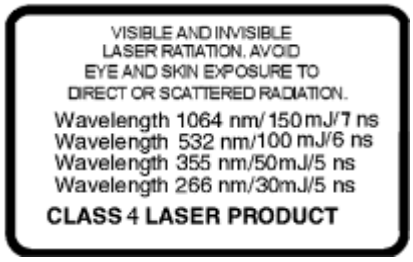
CE/TUV Label



Laser Safety Shutter Label

Laser Warning Label

Class 3B Warning Label



Class 4 Warning Label

Circular Connector Warning Label

Figure 2-2: Label Samples

US & Canada

The QuikLaze conforms to the requirements of UL 3101 and CAN/CSA-C22.2 No. 1010.1

Chapter Three

System Description

Description and Specifications

This section provides an introduction to the QuikLaze Nd:YAG laser. Also, a summary of system specifications is given.

	Model	Wavelength
Mitutoyo	FS60	Green, UV3
	FS60Y	IR, Green, UV3
	FS70ZS	Green, UV3
	FS70LS	IR, Green, UV3
	VM Zoom	IR, Green, UV3
Optem	A-Zoom I, II	IR, Green, UV3
Seiwa	PS-888L	IR, Green, UV3
Motic	PSM1000	IR, Green, UV3

Table 3-1: Microscopes the QuikLaze may be mounted to.

Local or Remote Control

The QuikLaze Nd:YAG laser system can be controlled via an included GUI or user may develop their own software using the RS232 commands provided.

System Interlocks

Two internal interlocks in the laser head (laser head cover off and laser removed from microscope); two internal interlocks in the power supply (water over temperature and low cooling water flow); two external interlocks, and one mechanical shutter on the laser head provide safeguards for the users and equipment.

> NOTE: The laser head cover interlock inside the laser head does not meet all the criteria to be considered a “Safety Interlock” by the FDA (CDRH) and CE.

The two external interlock connectors are located at the rear of the power supply, which can be shorted with the supplied connectors. The interlock connectors include two interlocks:

1) Work piece interlock, "Laser Standby".

2) External remote interlock, "System Stop."

The work piece interlock is designed to stop the laser from firing if the interlock is opened. When it is closed the laser can resume firing after the Fire button has been pressed. This interlock is labeled "Laser Standby" on the rear of the power supply. The second external interlock labeled "System Stop" is designed to shut down the laser when a switch attached to this interlock is interrupted. Such a switch may be attached to a laboratory door. When the door is opened the laser will shut down.

The laser enters a STOP mode and cannot be restarted until the EMISSION button has been pressed, the 10 second delay elapsed and the Fire laser button has been pressed. The status of interlocks may be viewed on the interlock page of the remote control panel, which is shown in Figure 5-9.

Power Supply

The power supply provides the QuikLaze Nd:YAG laser system with power, control electronics and cooling.

The upper portion of the power supply contains the control electronics and power supplies to run the laser.

Water Cooling System

The water-cooling system is required to keep the laser system running within an acceptable temperature range. The over-temperature protection point is set to 50 °C or 122 °F. The cooling system consists of a water pump, flow switch, reservoir, DI cartridge, heat exchanger and fan. The status of interlocks may be viewed on the Interlocks page of the remote control panel, which is shown in Figure 5-9.

Chapter Four

Installation and Setup

Introduction

The QuikLaze requires some preparation before it can be used. This chapter provides the information needed to install the complete system for safe operation. The chapter includes the modifications to the microscope and laser preparation. You will need a set of metric hex wrenches, 3, 2.5, 2 and 1.5 mm.

Power Line Fuse

Two power line fuses are installed on the back panel near the power cord. For 100 - 240 VAC operation two 5.0 amp/250V, SPT, 5 x 20 mm, Time Lag (T.L.), High Breakage Capacity (HBC) fuses are installed. Acceptable fuses are the following:

Table 4-1: Power line fuse

Manufacturer	100-240 VAC
Schurter	0001.2511 (5.0A)

NOTE: The multi-function PC board (middle shelf PC board closest to rear of power supply) also contains a time lag micro fuse, but is only service replaceable. Contact a trained service person for service or replacement. The fuse is a Schurter 1A/250V micro fuse, part number 0034.6615.

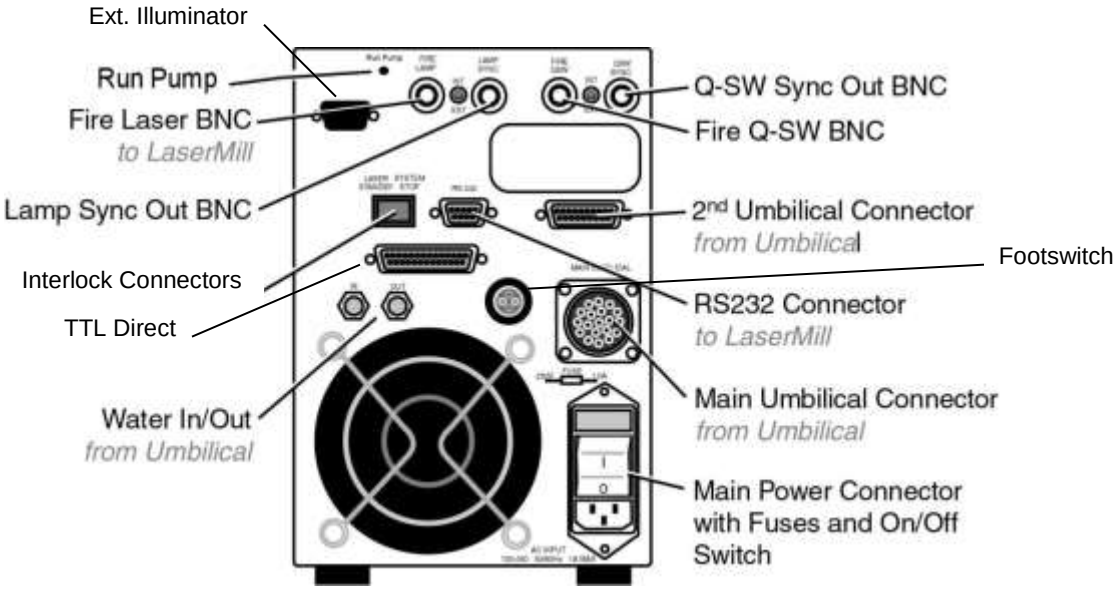
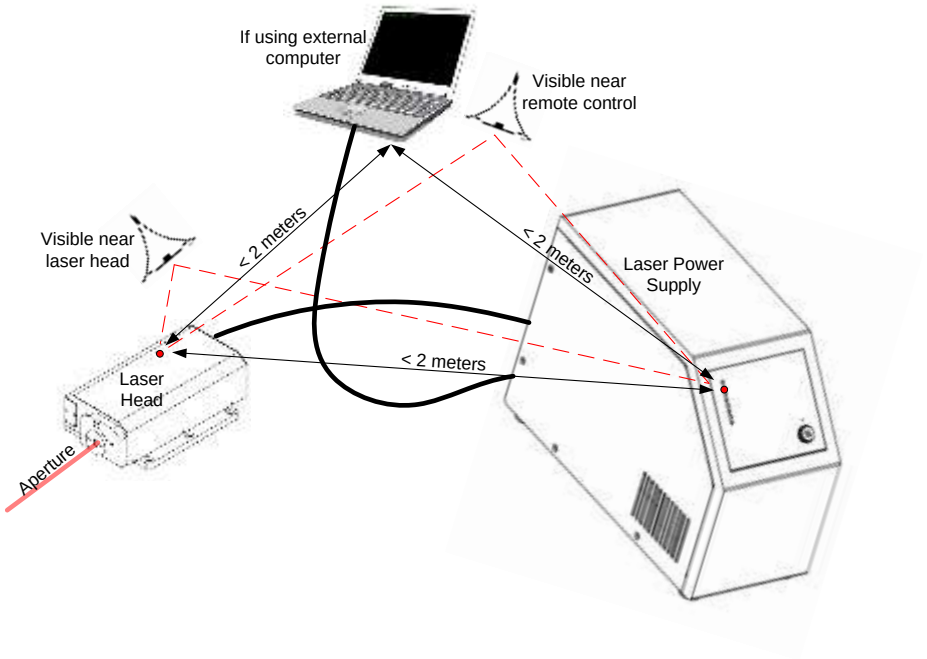


Figure 4-1: Power Supply

Stand-alone Installation

1) The laser power supply and laser head must be within 2 meters of each other
2) The laser power supply and laser head emission indictors ( ) must be within direct visual sight of one another when viewed near the laser aperture or near the operational control unit (i.e. remote serial box or external computer).
3) When using an external computer, make sure the laser power supply and laser head emission indictors ( ) are visible and within 2 meters from the terminal interface.

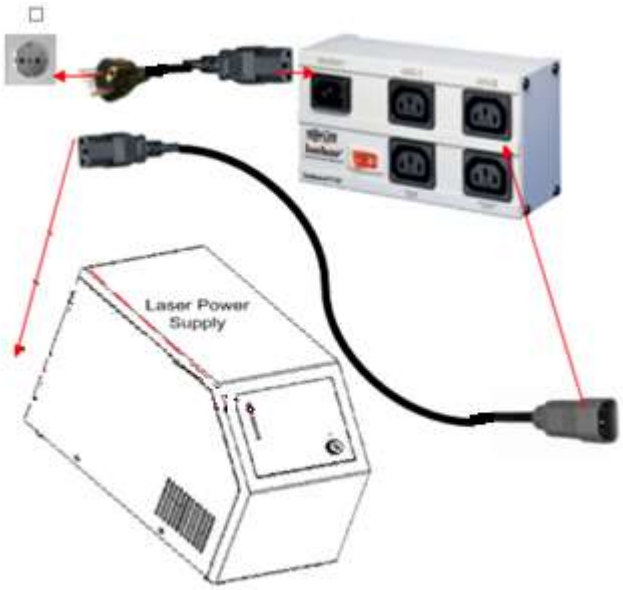


System Integration laser installation

1) When installing the laser into another system, additional emission indication may be required for EN60825-1 compliance (not provided).
2) Optional cable extensions allow the laser head, laser power supply, and operational control unit to be separated by more than 2 meters. In this case, each operational control unit and aperture will require fail-safe or redundant emission indication (not provided).

NOTE: The Quiklaze 50 ST2 power supply provides a terminal for external LED emission indication. It can used for redundant indication, but not intended to be fail-safe when used individually. The selection of LED wavelength must be considered when to ensure it is still visible with protective eyewear.

- In order to comply with EN61000-4-5 Industrial Immunity requirements, the laser power supply must be connected through the Tripp-lite ISOBAR® Series, EURO-4 surge suppressor (see the figure down below).



Using the provided C13 to C14 interconnection cable:

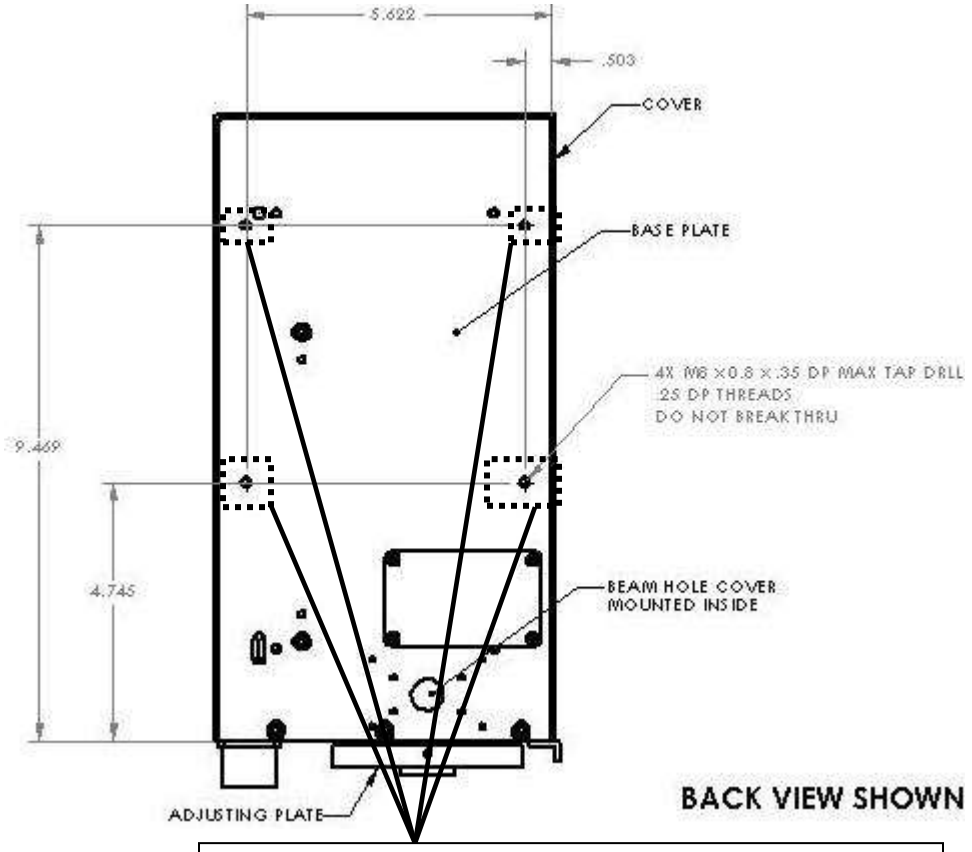
Connect the female plug end to the back of the laser power supply.
Connect the male plug end to the Euro-4 top isolated filter bank 2 socket.

Using the provided European power cord:

Connect the female plug end to the male socket of the Euro-4.
Connect the male plug end to the wall outlet.

Gantry mounting

If this system is to be used on a moving gantry system, it must be securely fastened to the laser using the 4 mounting holes. The front plate mounting by itself is not adequate for non-stationary applications. However, the mounting scheme using these 4 holes must be approved by Electro Scientific Industries prior to implementation. Failure to do so will void the warranty. Please contact Electro Scientific Industries Customer Service for more specific information.



Four mounting holes can be used to support the QuikLaze laser head onto the gantry.

Figure 4-2: Mounting holes drawing

The power supply should be placed on the floor, near the microscope.

Microscope Conversion

The QuikLaze is designed to operate on specially modified Mitutoyo FS70, FS60, FS50 (Green only) and VM Zoom Microscopes or the Optem A-Zoom microscope. Become familiar with your microscope before attempting to install the QuikLaze. Order laser adapter kits from Mitutoyo for the VM Zoom and from Optem for the A-Zoom.

Table 4-2: Microscope Compatibility

	Mitutoyo					Optem	Seiwa
Model	FS60	FS60Y	FS70ZS	FS70LS	VMZoom	AZoom	PS888L
IR		,		,	,	,	,
Green	,	,	,	,	,	,	,
IR/Green		,		,	,	,	,
Green/UV3	,	,	,	,	,	,	,
Green/UV4					,*	,*	,*
TriLite		,		,	,	,	,

*Contact factory for UV4 microscope requirements

WARNING: Operation of the QuikLaze-50 ST2 laser without the eye protection filter installed may result in **SEVERE EYE DAMAGE OR BLINDNESS.**

Eye Protection Filter

All microscopes must be fitted with an eye protection filter or a beam blocking mechanism before the laser head unit is installed on the scope. Optem installs the eye protection filter for the A-Zoom when fitted with the laser adapter kit. Mitutoyo installs the eye protection filter in the VM Zoom when fitted with the laser adapter kit. **ENSURE THAT THE EYE PROTECTION FILTER IS INSTALLED BEFORE OPERATING THE LASER.**

To install the eye protection filter on the Mitutoyo FS50, FS60 or FS70, follow these steps:

- Remove the eyepiece assembly and the three screws that secure the eyepiece to the body of the microscope (see Figure 4-3).
- Place the filter assembly over the eyepiece hole, with the flat side facing out and align the mounting holes with those in the microscope body.
- Secure the eye protection filter assembly between the body and the eyepiece using the cap screws provided (use a 2 or 2.5 mm hex wrench).

Laser Adapter Ring

To install the laser on the microscope the adapter ring must be installed on the microscope video port. This system includes the correct laser adapter ring for this system. Do not try to use any other ring with this system.

The laser adapter ring supplied includes a pin that activates an interlock switch. If the pin is not present, the laser will not fire.

Note: Install the eye protection filter before installing the laser adapter ring.

- Remove the three cap screws (use a 2.5 mm hex wrench) that secure the old adapter ring to the microscope (see Figure 4-3).
- Install the new laser adapter ring with the interlocking pin positioned slightly to the right of front-center of the microscope.
- Use the three original cap screws to secure it to the microscope.

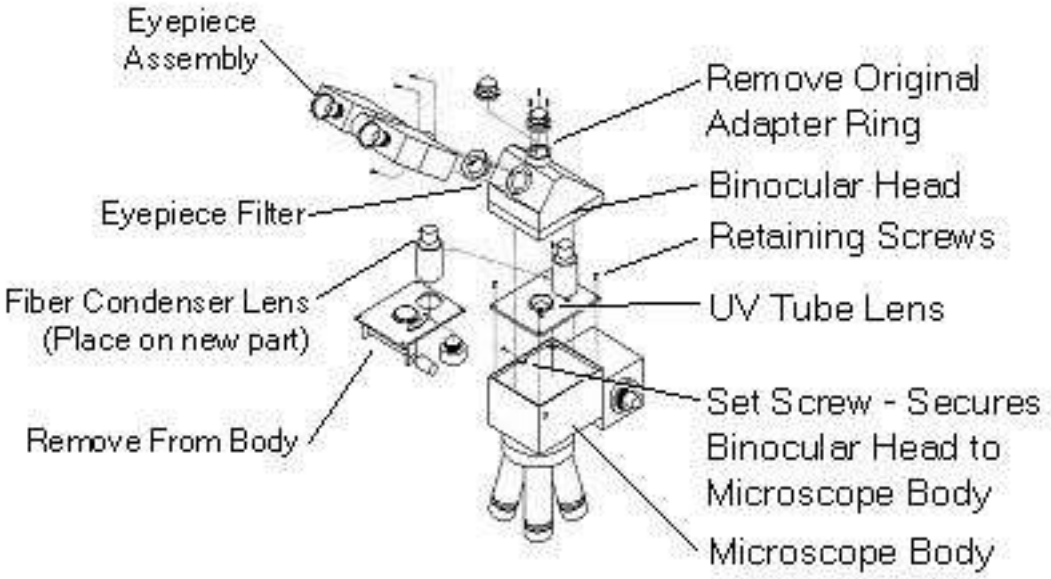


Figure 4-3: FS60 Microscope modifications

Microscope UV Conversion Kit

A UV tube lens kit allows UV3 (355 nm) energy to be transmitted through the Mitutoyo FS70ZS, FS60 and FS60Y. IR (1064 nm) energy cannot be transmitted through the FS60 or FS70ZS. The FS70LS and FS60Y transmit IR energy, so no conversion is required if only the IR or green wavelengths will be used.

The A-Zoom and VMZoom microscope must be ordered with a laser adapter kit suitable for the wavelengths produced by the laser.

FS60 UV Tube Lens Kit Installation

Remove the binocular head by loosening the set screw on the left side of the microscope (2.5 mm hex). The screw is located in the seam separating the binocular head from the main body of the microscope. After the screw has been loosened, the binocular head can be lifted from the microscope body.

Remove the plastic zoom control knob and c-clip from the zoom shaft. Newer Mitutoyo microscopes require that the plastic cap be removed from the zoom knob and a set screw inside the knob loosened to release the knob.

Remove the four screws (3 mm hex) that secure the zoom mechanism plate or tube lens to the FS60 microscope body.

Remove the zoom mechanism by lifting the back of the zoom mechanism plate while tilting it to the right.

Unscrew the ring nut that secures the fiber optic condenser lens assembly to the zoom mechanism plate. The lens assembly is often glued and sufficient force must be applied to break the glue.

Reinstall the fiber optic condenser lens assembly onto the FS60 UV tube lens kit mounting plate. Ensure that the aperture lever is facing the back edge of the mounting plate so it is accessible once the microscope has been reassembled.

Install the replacement UV tube lens kit plate.

Reinstall the binocular head on the microscope body.

FS60Y UV Tube Lens Kit Installation

Remove the binocular head by loosening the set screw on the left side of the microscope (use a 2.5 mm hex wrench). The screw is located in the seam separating the binocular head from the main body of the microscope. After the screw has been loosened, the binocular head can be lifted from the microscope body.

Remove the tube lens plate and the four screws that secure it to the microscope body (use a 3mm hex wrench).

Unscrew the ring nut that secures the fiber optic condenser lens assembly to the zoom mechanism plate. The lens assembly is often glued and sufficient force must be applied to break the glue.

Reinstall the fiber optic condenser lens assembly onto the FS60Y UV tube lens kit mounting plate. Ensure that the aperture lever is facing the back edge of the mounting plate so it is accessible once the microscope has been reassembled.

Install the UV tube lens kit plate.

Reinstall the binocular head on the microscope body.

FS70ZS UV Tube Lens Kit Installation

Remove the binocular head by loosening the two set screws on the right and left sides of the microscope (use a 1.5 mm hex wrench). The screws are located just above the seam separating the binocular head from the main body of the microscope. After the screws have been loosened, the binocular head can be lifted from the microscope body.

Unscrew and remove the zoom shaft. Remove the four screws (use a 3.5 mm hex wrench) that secure the zoom mechanism plate to the FS70ZS microscope body.

Remove the two screws securing the small zoom control gear. Remove the three set screws (use a 1.5 mm hex wrench) holding the large plastic gear to the zoom mechanism.

Unscrew the three screws securing the zoom mechanism to the zoom mounting plate.

Install the replacement FS70ZS UV tube lens kit into the large threaded hole in the middle of the zoom mechanism plate.

Reinstall the zoom plate on to the microscope body. Reinstall the binocular head on the microscope body.

Laser Preparation

This section provides power requirements information for the laser. Turn the key switch to the **OFF** position before installing the laser.

Voltage Requirements

The power supply operates on nominal 100-240VAC, 50/60Hz and can require up to 500W MAX.

The external spot marker is set for 100-120VAC or 220-240VAC 50/60Hz and requires about 250 watts.

Laser Installation

This section describes laser and power supply connections.

Laser Head Mounting

Before installing the laser head, remove the eyepiece filter warning label from the laser head's aperture.

The laser head may now be mounted on the microscope.

Tighten the set screws that secure the base of the laser head to the laser adapter ring. See Figure 4-3 on page 222. Use a 2 mm (5/16" standard) hex wrench to tighten the two set screws. The red emission LED should face the operator when standing in front of the Mitutoyo FS microscope. The emission LED faces to the right when mounted on an A-Zoom or VMZoom.

The PS888L is a laser version microscope from Seiwa. The PS888L is capable of supporting IR, Green and UV wavelengths without any modifications to the body of the microscope. The only modification required is the addition of the mounting ring and eyepiece filter.

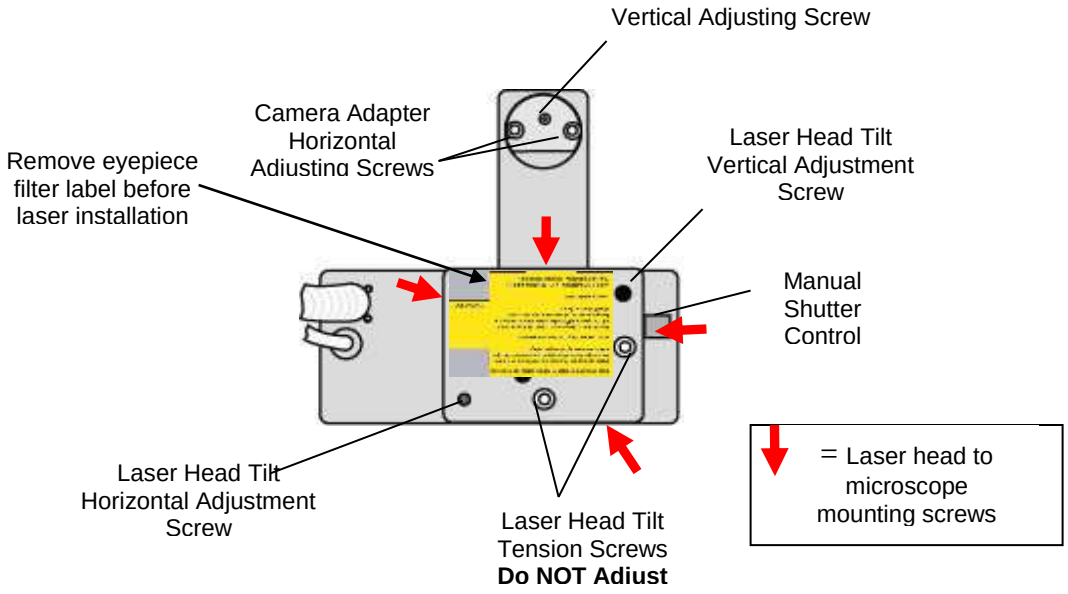


Figure 4-4: Laser Head Mounting/Adjusting Screws – bottom view

Electrical Connections

Turn the power supply AC power entry line switch and front panel key switch to the "OFF" position before making any electrical connections.

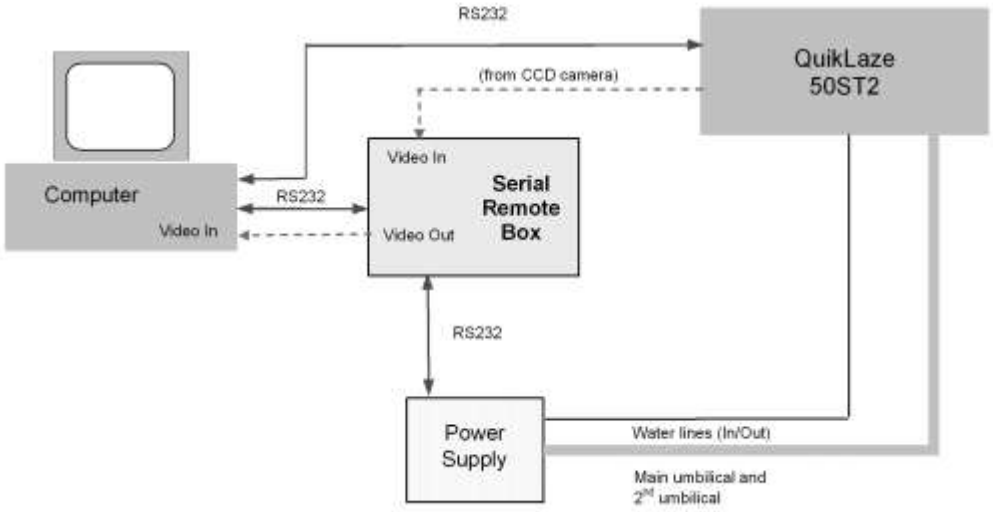


Figure 4-5:– QuikLaze-50 ST2 Cable Connection Diagram (w/ Serial Remote Box) for Computer w/ two COM ports.

Laser Umbilical

Connect the large Main Umbilical and smaller Secondary Umbilical to the appropriate connectors on the rear panel of the power supply. Be sure to tighten the connector screws to the chassis. Connect the cooling system hoses to the cooling system fittings on the back panel of the power supply. See Figure 4-5.

NOTE: The umbilical connects to the power supply via a quick connect adapter. It is very important that the umbilical is tightly connected to the power supply. If it is not tightened damage will occur to the high voltage contacts in the connector causing the system to fail.

Remote Control Panel

Either the remote control panel or a PC (but not both) may be connected to the RS232 connector on the Power Supply.

If using the remote control panel, connect the RS232 cable between the back of the remote control panel and the back of the Power Supply.

If using a computer, connect the RS232 cable between the back of the Power Supply and a computer COM port. If using a USB to RS232 adapter it is best to configure virtual COM port to either COM1 or COM2.

If the laser system is to be operated by a computer, it can be linked to the RS232 (Update) DB-9 port on the back of the Remote Control Panel. The Remote Control Panel will detect an operating computer connected to this port and deactivate while passing the incoming signals through to the Power Supply.

Alternatively, the computer can be connected directly to the RS232 (DB-9) port on the rear panel of the Power Supply.

Secure the cable at both connectors with the thumbscrews. Attach the foot switch to the two-pin connector on the back of the power supply. See Figure 4-6.

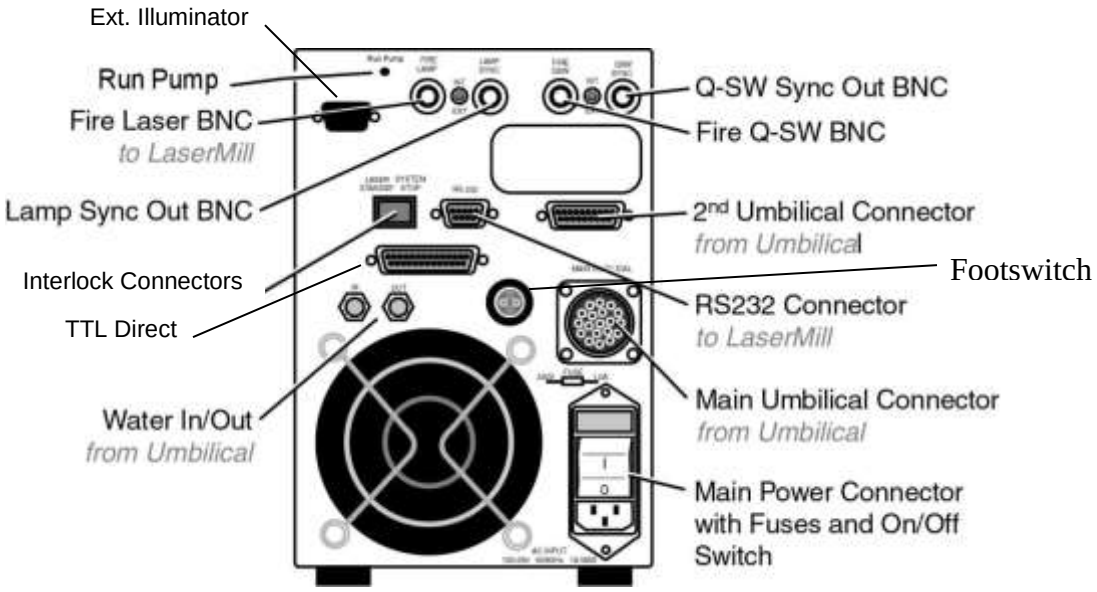


Figure 4-6: Power supply back panel - Mini Tower

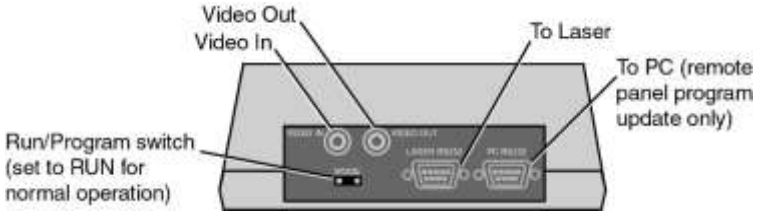


Figure 4-7: Remote Control Panel Connections

Interlock Connector

Two interlock connectors are supplied with the system and must be installed before the system may be operated. The purpose of the interlock connector is to provide a method of interlocking the operation of the laser with a safety switch that may be installed on dark box or a laboratory door or other location. See Figure 4-6 for the location of the interlock connector.

Once a switch has tripped the interlock circuit, operation of the laser is stopped, and the laser must be restarted. If the "Laser Standby" Interlock is opened the laser stops firing. When this interlock is closed the laser may be fired by pressing the Fire button. If the "System Stop" interlock is opened the laser stops firing. To fire the laser the interlock must be closed, the EMISSION button must be pressed, the 10 second delay completed and then the Fire button must be pressed. An external switch may be added to the interlock circuit by cutting the wire in the interlock connector and soldering the switch in series with the interlock wire.

Plug the laser power cord into a utility outlet.

Video Marker

The video spot marker system inserts an artificial representation of the laser spot into the video camera output signal. Under some conditions, this marker may be easier to see than the projected spot markers. Frame grabber card, tower PC and StageLase GUI or Remote Control Panel are required to add a Video marker.

The electrical connections to activate the video spot marker on the Remote Control Panel are as follows. See Figure 4-7. Using a BNC cable, connect the output from the video camera to the VIDEO IN connector on the remote control panel. Connect a BNC cable from the VIDEO OUT connector on the remote control panel to the video monitor input connector.

Cooling System

Prior to operating the laser, the cooling system must be filled with de-ionized/distilled water. Carefully read and understand the SAFETY section of this manual before filling the cooling system. Take utmost caution to avoid spilling water inside the power supply.

Remove the water-fitting cap on the front panel of the power supply. Use the plastic squeeze bottle to fill the reservoir 80% full with de-ionized or distilled water. If the reservoir is overfilled water will enter the overflow tube and flow out through the bottom of the power supply chassis.

CAUTION: Never use tap (sink) water, filtered, or spring (drinking) water, or sterile water to fill or top off the cooling system. Use only distilled water or deionized water with a maximum resistivity of 5MΩ (megohm). Use of any other water will damage the system and void the warranty.

Turn the key switch on the power supply to the ON position. Close the manual shutter on the laser head.

Press the EMISSION button on the GUI to activate the pump. If the pump stops operating, push the EMISSION button repeatedly until the laser head fills with water and the pump stays on. The water level may be seen through the water level window on the front of the power supply. The pump will stay on at high speed for about 5 seconds and change to a lower speed. If the water temperature exceeds 35°C the pump and fan speed will change to the high-speed setting.

Add additional de-ionized (distilled) water until the reservoir is at least 80% full.

Press the STOP button. Replace the water fitting cap.

> Note: The pump may require priming to initiate water flow. This may be done by disconnecting the water hose at the WATER OUT connector on the back of the power supply and forcing water into the system from this connector when the pump is not operating.

Laser Head Alignment

The laser head is internally aligned at Electro Scientific Industries. The output beam is aligned to exit the center of the aperture and run along the axial path. No adjustment of the optics inside the laser head is necessary.

The purpose of the alignment procedure is to center the laser beam through the optical path of the microscope. Adjustment screws tilt the laser head, thus affecting alignment. See Figure 4-4 for location of laser head tilt adjusting screws. The procedure to align the laser to the microscope optics is described below. See Installation for complete instructions on Starting and Stopping the laser.

Adjust the Energy setting to 20 and select energy level and set level to LO on the remote control panel.

Make sure the X and Y aperture are set to 50, which is the default, and select the green (532 nm) wavelength.

Fully open the manual shutter on the laser head. See Figure 4-4 for location of shutter control.

Place a white card (see cutout on next page) on the working surface beneath the objective lens, Figure 4-10: White card for laser alignment.

Select a 50x, 80x or 100x objective.

Turn the microscope source light to minimum intensity.

Raise the microscope with the focus adjustment knob, or lower the stage if possible, to increase the size of the white light spot to about one inch (25 mm). See Figure 4-8.

Figure 4-8: Place illumination in center circle on target

Turn the power supply key to the ON position and press the EMISSION button. Set the trigger switch to CONT and select a repetition rate of 10 Hz. Press the FIRE button and the laser will begin firing.

Adjust the position of the green laser beam on the white card by slightly tilting the laser head. See Figure 4-99. This is done by adjusting the laser head tilt adjustment screws (use a 2.5 mm hex wrench) in the back left corner (Y adjustment) and front right corner (X adjustment) of the base plate. See Figure 4-4. Adjust the laser head tilt screws until the square green laser beam is in the center of the round white microscope spot.

Figure 4-9: Aligning the green laser spot on the white card

If the green laser spot is not visible, change to a lower magnification objective lens and center the laser beam. Then switch back to a 50x or 100x objective for the final alignment.

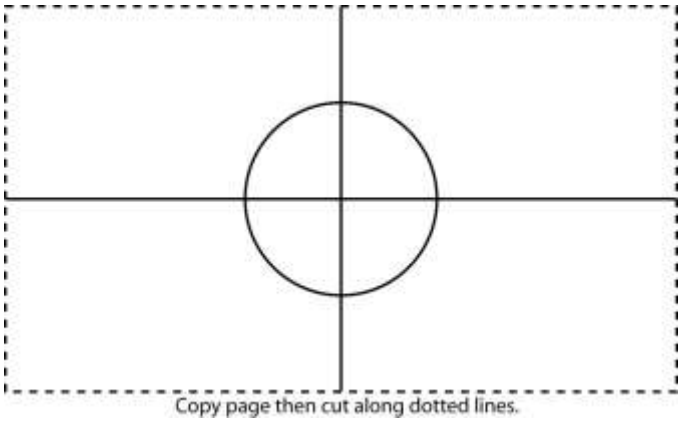


Figure 4-10: White card for laser alignment

Note: Failure to properly align the laser will result in poor cutting quality.

Spot Marker

The spot marker illumination is provided by an external 150 watt white light that is fiber coupled to the laser head. It can be installed using the following instructions.

Connect the fiber optic cable from the laser head into the external illuminator.

Plug the external illuminator power cord into a utility strip. The illuminator is turned on and off and the light intensity is increased and decreased by the front panel switch on the illuminator.

If the system was ordered with the LED spot marker, then the illumination is provided by an internal LED.

The LED intensity can be adjusted on the Remote Control Panel. See Table 5-1.

Spot Marker Adjustments

The spot marker provides a preview of the cutting region. The location of the spot marker on the video monitor and parfocality with the eyepiece may be adjusted when viewed via the video camera.

Camera Focus

The camera focal plane can be matched to the eyepiece focal plane (parfocality) by adjusting the camera adapter focus ring.

Bring a sample material into focus through the eyepiece. Loosen the focus ring set screw (use a 1.5 mm hex wrench) on the camera adapter. Turn the focus ring to lower or raise the camera until the image is in focus on the video monitor. Retighten the focus ring set screw.

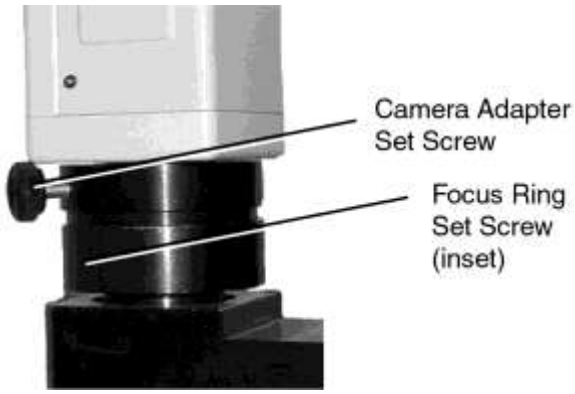


Figure 4-11: Camera Adapter Focus Ring

Centering the Spot Marker

Center the spot marker on the video monitor by adjusting the video camera adjusting screws. The video camera adjusting screws are located on the bottom side of the camera adapter.

Adjust the location of the spot marker image by releasing the two horizontal socket head screws and moving the mounting plate. When the image is properly positioned, re-tighten the screws.

Video Marker Adjustment

The video marker is adjusted at the factory to closely match the size of the laser cut. However, if the video marker does not closely match the size of the laser cut (PAL vs. NTSC) or the location, the video marker may be adjusted from the Video Marker page that may be accessed from the Laser Info page, which is described on Page 58.

Computer Interface

If the laser system is to be operated by a computer, it can be linked to the RS232 (Update) DB-9 port on the back of the Remote Control Panel. The Remote Control Panel will detect an operating computer connected to this port and deactivate while passing the incoming signals through to the Power Supply.

Alternatively, the computer can be connected directly to the RS232 (DB-9) port on the rear panel of the Power Supply.

A straight-through cable should be used when connecting the computer to the laser, DO NOT USE A NULL-MODEM CABLE. Pinouts for the laser and computer are supplied below for reference.

Laser RS232 Port Pinout

The RS232 port on the back of the laser is a female DB9 connector. The pins are numbered as shown here (as viewed when looking at the back of the laser):

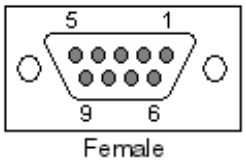


Figure 4-12: Female DB9 connector

Pin No.	Name	Description
1	+12VDC	Power for remote box. 1A maximum current
2	Tx	RS232 Transmit
3	Rx	RS232 Receive
4	NC	No connection
5	Gnd	Ground
6	NC	No connection
7	NC	No connection
8	NC	No connection
9	NC	No connection

Table 4-3: DB9 female pin number, name and description

PC Serial Port Pinout

Most PC's come with at least one serial port; usually it is a male DB9 (9-pin) connector on the back of the computer. Some older computers use a DB25 (25-pin) connector, which have a different pinout.

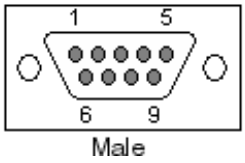


Figure 4-13: DB9 Male connector

Pin No.	Name	Description
1	DCD	Data Carrier Detect †
2	Rx	RS232 Receive
3	Tx	RS232 Transmit
4	DTR	Data Terminal Ready †
5	Gnd	Ground
6	DSR	Data Set Ready †
7	RTS	Request to Send †
8	CTS	Clear to Send †
9	RI	Ring Indicator †
† denotes signal not used by the laser interface		

Table 4-4: DB9 male pin number, name and description

Making an Interface Cable

To make your own cable to connect a PC to the laser, connect pins 2, 3 and 5 on the laser RS232 port to the same pins on the DB9 serial connector on the PC, as shown in Figure 4-14.

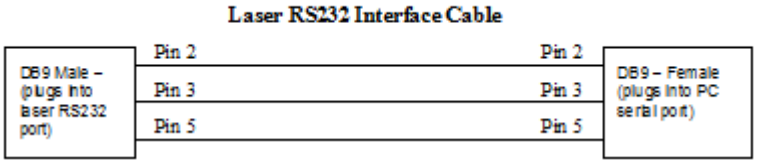


Figure 4-14: Laser RS232 Interface Cable

Chapter Five

Controls and Operation

Starting the Laser

After the installation procedure is completed and the laser safety section is thoroughly understood, the laser may be started. All covers must be installed and the reservoir filled with de-ionized (distilled) water. The key switch on the power supply must be turned to the ON position prior to operation of the laser.

Ensure that the QuikLaze has been properly installed, including the eyepiece filter, and that you have read and understand the SAFETY section of this manual.

- Ensure that the safety shutter on the bottom of the laser head is closed.
- Press the AC power switch on the back panel of the power supply to the ON position. The front panel AC ON LED illuminates.
- Turn the power supply key switch on the front panel of the power supply clockwise to the ON position. QuikLaze-50 ST2 initializes. All the Power Supply Front Panel LED's blinks once and then shuts off. Only the AC ON LED and RS-232 LED remains on.

Note: When the AC ON LED on the front panel of power supply and the LASER EMISSION LED on the Remote Control Panel are illuminated, there is a ten second (10 blinks) delay before laser firing can occur. The Remote Control Panel also displays the ten second delay period prior to operation.

- Ensure that the energy setting is set to the LO position.
- Set the attenuator energy setting to 20.
- Press the EMISSION button The Power Supply LASER EMISSION LED blinks for ten seconds before laser firing can occur.
- Select the desired trigger setting. Three trigger settings are available:

1 SHOT	1 shot is fired
BURST	1 – 200 shots @ 1 ~ 50 Hz
CONTINUOUS	Continuous shots @ 1 ~ 50 Hz

- Open the manual shutter when ready to operate safely (see safety section).
- Open the X-Y aperture to the desired dimension when you are ready to fire the laser.
- Press the FIRE button or the foot switch when ready to fire laser.

Turning the Laser Off

The laser can be turned off at any time. The standard way to turn the laser off is the following:

- Press the STOP button on the Remote Control Panel.
- Close the manual shutter control at the base of the laser head. See Figure 4-4 on page 25.
- Turn the power supply key switch to the OFF position.
- If the laser is being turned off at the end of the day, turn the AC power line switch OFF.

Energy HI/LO Switch

The energy HI/LO switch is a power adjusting feature that changes the maximum transmitted energy available. This switch operates independently from the variable attenuator. The switch has the following two settings:

HI Full energy is available from the laser. Variable attenuation is about 30:1 for green and about 20:1 for IR and UV. GUI display indicates 000 – 100 across the full range.

LO Approximately 30% of maximum energy for green and 40% of maximum energy for IR and UV is available. Variable attenuation is about 100:1 for IR and 40:1 and UV. The GUI indicates 00 – 100 across the reduced energy range. The Low Range is not available for IR-only systems.

Note: The GUI display shows 000 – 100 in both the HI and LO Energy settings. This display is a non-linear indication of what portion of the available energy will be emitted. An indication of 80 with the energy switch in the LO position corresponds to a setting of 30 with the energy switch in the HI position for the Green wavelength and approximately 40 for the IR & UV3 wavelengths.

The LO setting is safer for testing and is also used for low energy applications such as polyimide removal with a UV beam. Ask your Electro Scientific Industries representative for guidelines and useful techniques.

Interlocks

The QuikLaze Nd:YAG laser system is equipped with both internal and external interlock switches. The internal interlocks ensure that the laser itself is within operating parameters and will not be damaged. The external interlock can be used to interlock laboratory doors or microscope lifts that can turn off the laser if the interlock switch is tripped.

Internal Interlocks

The QuikLaze Nd:YAG laser system has the following internal interlocks: laser head cover, microscope/laser head mounting, cooling system- water temperature, and the cooling system low flow.

External Interlocks

The laser may be interlocked so that laboratory or room doors cannot be opened while the laser is running continuously. The connectors on the back of the power supply may be wired so as to disable the laser if an external interrupt switch has been tripped.

If the "STOP LASER" external interlock circuit is opened the laser will stop. The remote control panel LCD screen will display the Interlock status page. To restart the laser, reset the external interlock switch. The laser may then be started using the procedure given above in the section "Starting the Laser." If the LASER STANDBY" interlock is interrupted, reset the interlock switch and press the FIRE button to begin firing the laser.

Triggering and Timing

The process to fire the QuikLaze laser requires two steps. The first step is to trigger the Flashlamp, and the second step is to trigger the Q-Switch. Both the Flashlamp and the Q-Switch can be triggered either internally or externally, resulting in four operating modes. The trigger mode is determined by the position of the toggle switches on the back of the power supply. The laser can also be controlled using the external trigger source, with inputs through the BNC connectors on the rear of the power supply. The inputs, outputs and implications of the triggering mode are discussed in this section.

Inputs and Outputs

Four external BNC connectors are located on the rear of the power supply. Two of the connectors are inputs for triggering the laser. The other two are outputs used for synchronizing the laser to other equipment. The location of the BNC I/O connectors is shown in Figure 4-6: Power supply back panel - Mini Tower, with detail in Figure 5-1.

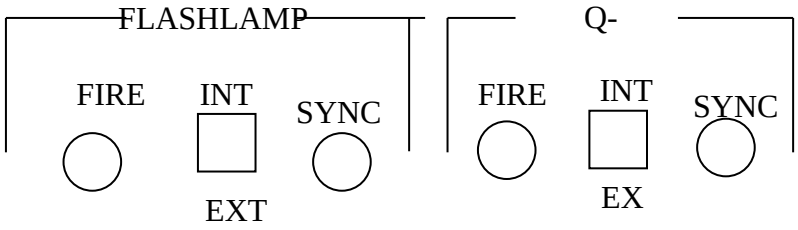


Figure 5-1 Power Supply BNC input/output Connections

"FLASHLAMP Source (INT/EXT)":

"INT" – The Fire Flashlamp signal will be generated by the internal control electronics at the repetition rate set through the control panel.

"EXT" – The Flashlamp will be fired at a user defined time with user provided Fire Flashlamp Input signal.

"Q-SWITCH Source (INT/EXT)":

"INT" – The Fire Q-Switch signal will be generated by the internal timing circuitry. The default Q-Switch delay is 200 µs for internal mode.

"EXT" – The Q-Switch will fire at a user defined time at the rising edge of the Fire Q-Switch Input signal.

Fire Flashlamp Input – A positive 5 volt, ≥100 µs, 5 mA pulse. The Flashlamp will be fired at the rising edge of the trigger pulse. For optimal performance, keep the rising edge of the trigger signal < 1 µs.

Fire Q-Switch Input – A positive, 5 volt, ≥100 µs, 5 mA pulse. This pulse should follow the fire laser pulse by about 200 µs. The output laser energy and stability will vary depending upon the timing between the "Fire Flashlamp" signal and the "Fire Q-SW" signal. For optimal performance, keep the rising time of Fire Q-Switch Input < 1 µs in order to meet the Jitter specification of 1 ns.

"Q-Switch Sync out" – A 5 volt, 15 µs pulse. A positive transition from 0 volts to +5 volts occurs when the Q-Switch is fired. The laser pulse will exit the laser head approximately 130 ns after the rising edge of the Q-Switch Sync out signal. When the Q-Switch is fired, the Q-Switch Sync out BNC will generate a 5V, 15 µs pulse for the user to synchronize the timing of the firing to the equipment.

Internal Triggering

The default mode for the QuickLaze is internal triggering. Internal triggering is the simplest way to run the QuikLaze. The flashlamp and Q-switch toggle switches should both be up, in the INT position.

In this mode, the control electronics provide the necessary triggers to fire the laser. The repetition rate and energy can be changed by the GUI controls on. Use the GUI to determine the operating mode, 1 shot, burst, or continuous. In 1 shot mode, the laser is fired once each time the Fire button on the GUI is pressed. In burst mode, the laser fires at a specified repetition rate for x number of shots. In continuous mode, the laser fires continuously at the repetition rate set on the GUI.

Internal triggering will send out the signal per Figure 5-2. The two output signals are available to the user. The relationship between the Q-Switch Sync out pulse and the actual laser pulse are also shown in Figure 5-2.

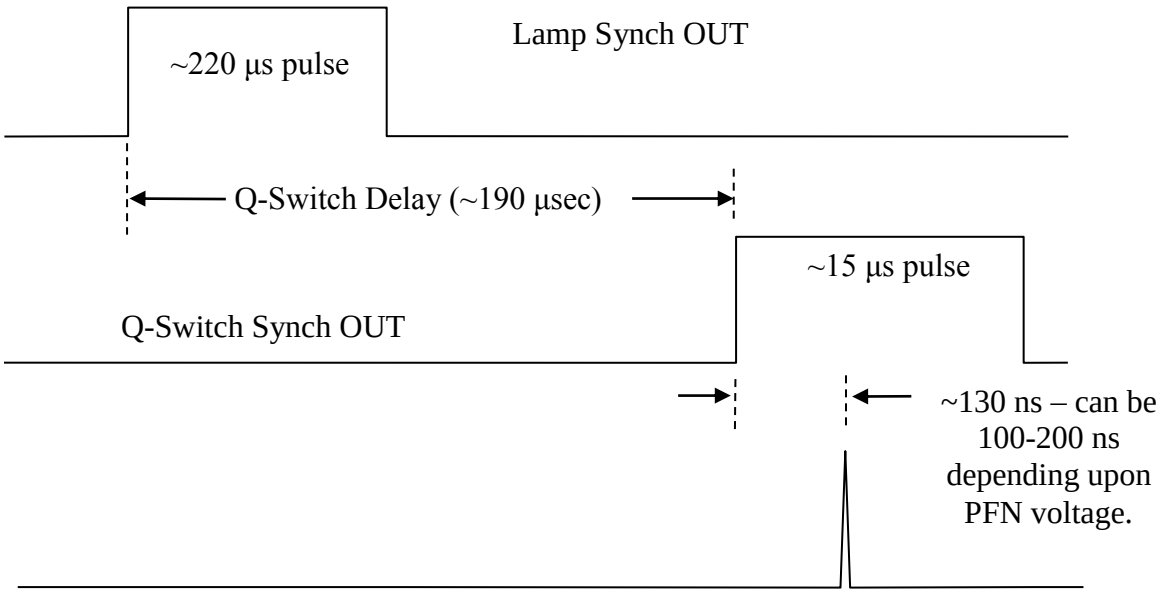


Figure 5-2 Timing Diagram for Internal Triggering

External Triggering

In majority of the cases, internal triggering is used to run the laser. If external triggering is required, users can use the external triggering. This gives the user control over the timing of the laser pulse. In this case, the user must supply TTL pulses to both the flashlamp fire and Q-switch fire inputs with the appropriate delay. The delay between the flashlamp and the Q-switch TTL fire pulses is important in getting the best laser performance. See Figure 5-3.

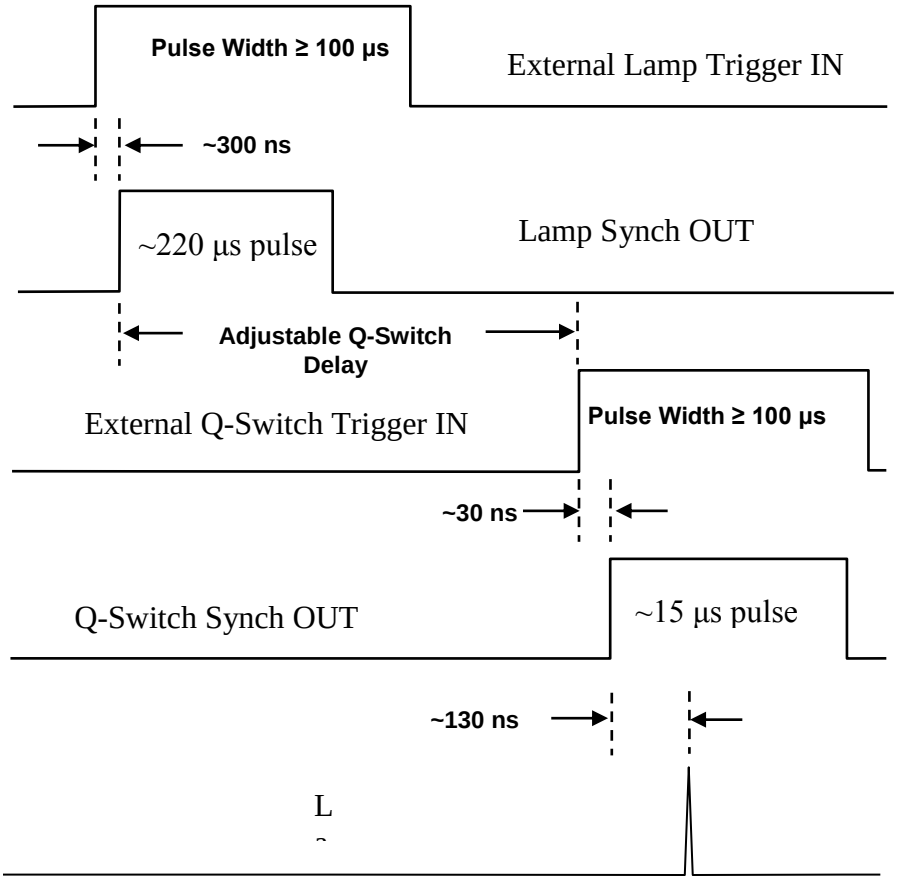


Figure 5-3 Timing Diagram for External Triggering

Laser Controls

Power Supply

The power supply has an ON/OFF switch on the rear panel and the key switch on the front panel. The power switch and key switch must be in the ON position for the laser to operate. The front panel also includes LED indicators showing the status of the laser system. See Figure 5-4.

AC Power Power entry module switch is in the ON position and the AC line fuses are good.

Laser ON Blinks for 10 seconds and turns on to indicate the laser is ready to fire.

Water Flow Indicates that the cooling water flow is too low.

Water Temp Indicates that the water temperature is too high.

Interlock Indicates that the external or work piece interlock is open.

RS232 Indicates that the Laser is under control from a device (remote control panel or PC) connected to the RS232 port.

Flash Lamp Indicates that the flash lamp switch has been set to EXT. The laser cannot be fired in this mode unless an external trigger signal is supplied to the Flash Lamp BNC.

Q-Switch Indicates that the Q-switch trigger switch has been set to EXT. The laser cannot be fired in this mode unless an external signal is supplied to the Q-switch BNC and the Flash Lamp BNC with the correct timing.

Figure 5-4 Power Supply Front Panel

Remote Control Panel

The Remote Control Panel is a microprocessor-based device which connects to the Power Supply through a 6 ft. cable attached to the 9-pin D-sub RS-232 port and allows operators to control and operate the EzLaze 3 laser system from a convenient location. The multiple screens viewable on the 3”x3”LCD display give access to a wide range of operating parameters and stored user-defined laser setup pages. Control is affected through soft buttons and knobs whose functions are defined by the screen being displayed and four fixed-use buttons.

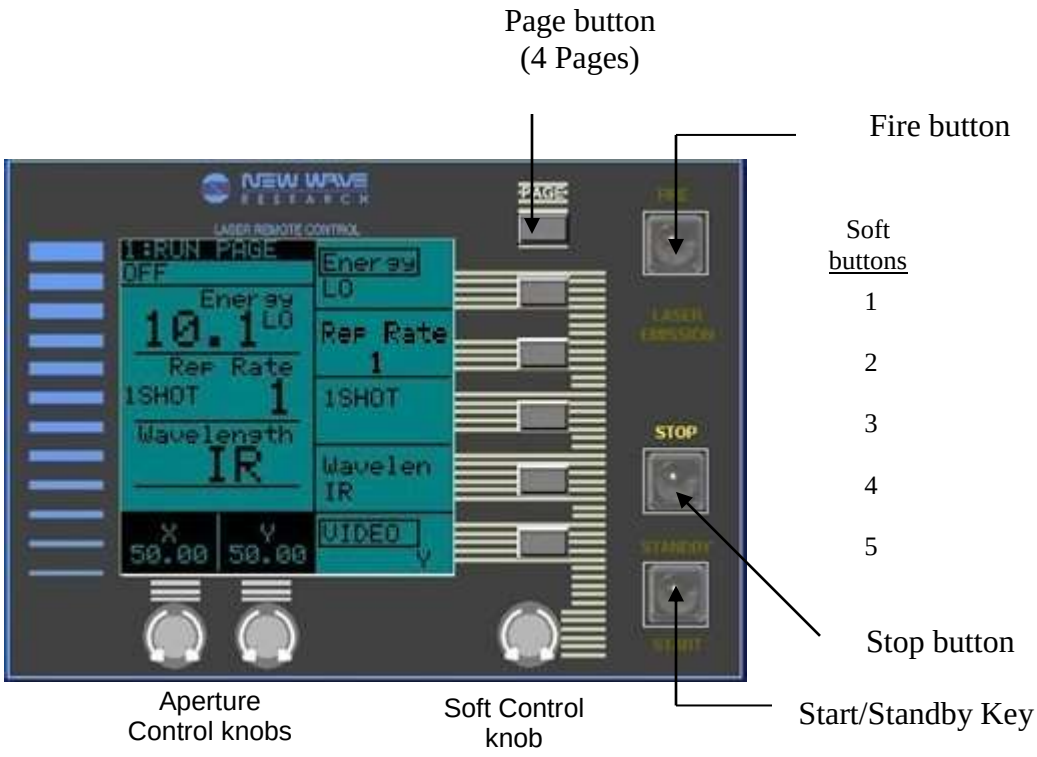


Figure 5-5 Remote Control Panel

Fixed Function Controls

The Remote Control Panel has four fixed-function buttons located on the right side of the front panel. Their functions are described below:

START / STANDBY button — Places the laser in the STANDBY mode from the STOP or RUN modes. In STANDBY, the laser is not firing but the fire button is enabled. Once the laser is in STANDBY mode, pushing this button again has no effect. This button is functional regardless of the page displayed on the LCD and will return the screen to the Run page when pressed.

When pressed in the STOP mode, the laser will go into STANDBY after a safety interval of 10 seconds. The following will illuminate immediately:

- LASER EMISSION indicator on the Remote Control Panel
- Laser Enabled light on the Laser Head
- START indicator on the Remote Control Panel.

After the 10 second safety interval, the START indicator will go out and

the STANDBY indicator will illuminate.
When pressed in the RUN mode, the laser goes into the STANDBY mode immediately. The FIRE indicator will stop blinking. The LASER EMMISSION indicator and the Laser Enabled light on the Laser Head remain illuminated.

STOP button — Used to place the system in the STOP mode from the STANDBY or RUN mode. This button is functional regardless of the page displayed on the LCD.
FIRE button — Used to fire the laser, placing it in the RUN mode, according to the parameters shown on the Run Page. The laser can only be fired from the Standby mode with the Run Screen displayed on the LCD, and pressing the button outside of these conditions will recall the LCD to the Run page but will not fire the laser. When the system is in the RUN mode, the FIRE indicator will illuminate.
PAGE button — Used switch between the four pages of the LCD display.
Aperture Control Knobs — The two aperture control knobs, located beneath the LCD screen, control the X and Y dimension of the XY Shutter from the Run page as indicated on the screen.

Soft Controls

The five soft buttons are located to the right of the LCD screen directly below the Page key. This manual will identify them as buttons #1 (top) thru #5 (bottom), although the actual buttons are unmarked. The functions of these buttons are indicated on the adjacent section of the LCD and change with each page displayed.

The Soft Control Knob is located below the soft buttons. It controls the parameter selected thru the soft buttons and highlighted on the LCD screen.

The functions of each of the soft controls is described for each LCD page in the following sections:

LCD Pages

The four LCD screens (pages) may be sequentially selected by pressing the PAGE button. The LCD pages are:

RUN Page – allows control of the laser. The laser may be fired only from this page.

SETUPS Page – allows up to 10 sets/recipes of laser parameters to be stored and recalled.

INTERLOCKS Page - shows the status of internal and external laser interlocks.

LASER INFO Page– shows laser system information including laser model, serial #, firmware version, manufacturing date, wavelengths, maximum repetition rate, and shot count.

VIDEO Setup – Accessed from the LASER INFO page. Allows setup of the video marker.

XY APERTURE Setup - Accessed from the LASER INFO page. Allows software adjustment of the XY shutter so that 0 = closed and 120 = fully open.

Note: To change laser parameters, the parameter of interest (i.e. Repetition Rate, etc.), must first be selected on the LCD display by pressing the adjacent soft button. When the parameter is selected, the value is highlighted on the display. After the parameter is selected, it may be changed using the soft Control Knob on the lower right side of the control panel. Please refer to the Run Page in the following section.

Page 1: Run Page

The Run Page as shown in Figure 5-6 below displays and permits control of laser parameters. The laser may be fired only from the Run Page.

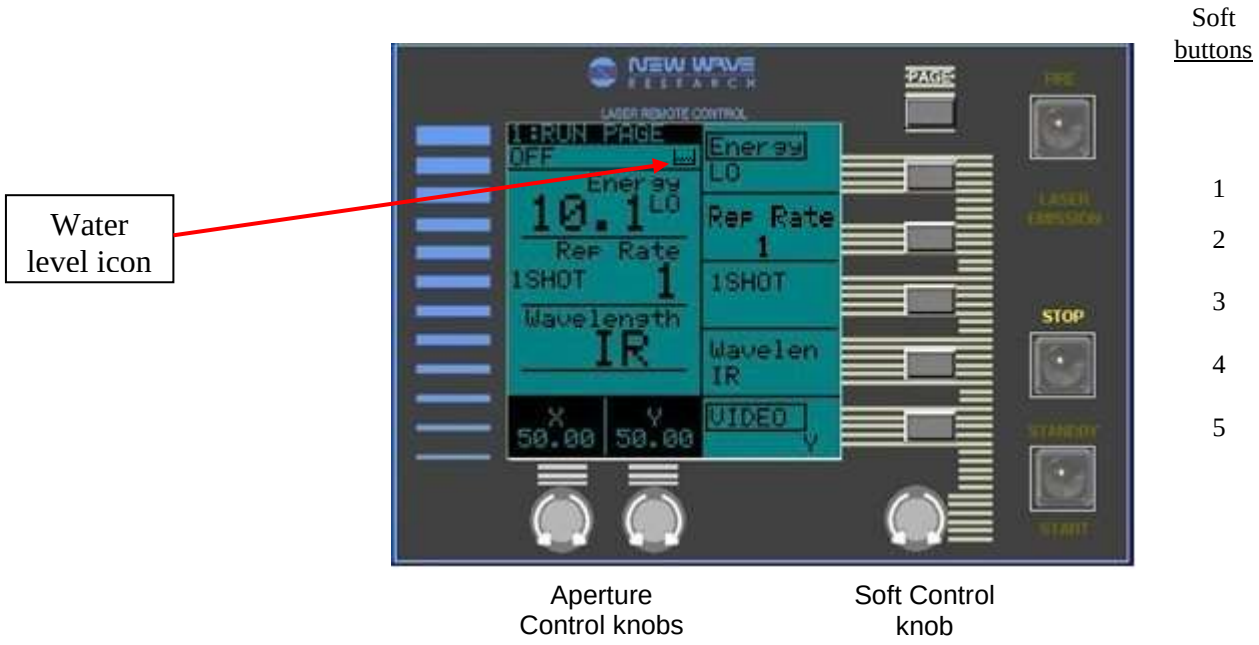


Figure 5-6 Run Page

Table 5-1 summarizes soft button control of laser Parameters from the Run Page

Soft button	Assignment	Variable	Control Method
#1	Energy HI/LO Setting Laser Output Energy	HI/LO 0-100 (non-linear, not a percentage) 100 setting produces maximum energy output	Soft button – select and toggle Control knob - input
#2	Repetition Rate	1-50 Hz	Soft button – select Control knob - input
#3	Trigger Mode – Switches between the laser firing modes.	- 1 Shot - Burst (1-200 shots) - Continuous	Soft button – select Control knob - input (Burst mode only)
#4	Wavelength – laser wavelength selection	IR / Green / UV (depending on model)	Soft button – select and input
#5 Present if option is fitted	Video Marker	On / Off	Soft button – select Control knob - input
	LED Spot Marker	On / Off	
	Spot Marker brightness	0-100	
	LED Spot Marker blink	On / Off	
	XY Shutter Rotation	+/- 90˚	
	Polarizer Rotation	0 - 180˚	

Table 5-1 Run Page Soft Key Summary

Do not use standard objective lenses with IR or UV wavelengths. These wavelengths may damage standard objectives.

Left Screen

1: RUN PAGE – screen identifier
Laser Mode display – OFF, WAIT, READY, *-------- (laser firing), BURST LOCK
Water Level – When the coolant is low, the “Water-Level” icon flashes near the top of the current LCD page.

Energy – displays laser Energy HI/LO setting and energy level

Rep Rate – displays selected mode and repetition rate (repetition rate displays in 1 Shot mode, but has no effect)

Wavelength - displays the selected wavelength

XY Aperture – displays current X and Y settings
X setting is controlled by the left control knob
Y setting is controlled by the right control knob

Energy HI/LO Switch

The energy HI/LO switch is a power adjusting feature that changes the maximum transmitted energy available. This switch operates independently from the variable attenuator. The switch has the following two settings:

HI Full energy is available from the laser. Variable attenuation is about 30:1 for green and about 20:1 for IR and UV. LCD/GUI display indicates 000 – 100 across the full range.

LO Approximately 30% of maximum energy for green and 40% of maximum energy for IR and UV is available. Variable attenuation is about 100:1 for IR and 40:1 and UV. The LCD/GUI indicates 00 – 100 across the reduced energy range. The Low Range is not available for IR-only systems.

Note: The LCD/GUI display shows 000 – 100 in both the HI and LO Energy settings. This display is a non-linear indication of what portion of the available energy will be emitted. An indication of 80 with the energy switch in the LO position corresponds to a setting of 30 with the energy switch in the HI position for the Green wavelength and approximately 40 for the IR & UV3 wavelengths.

The LO setting is safer for testing and is also used for low energy applications such as polyimide removal with a UV beam. Ask your New Wave Research representative for guidelines and useful techniques.

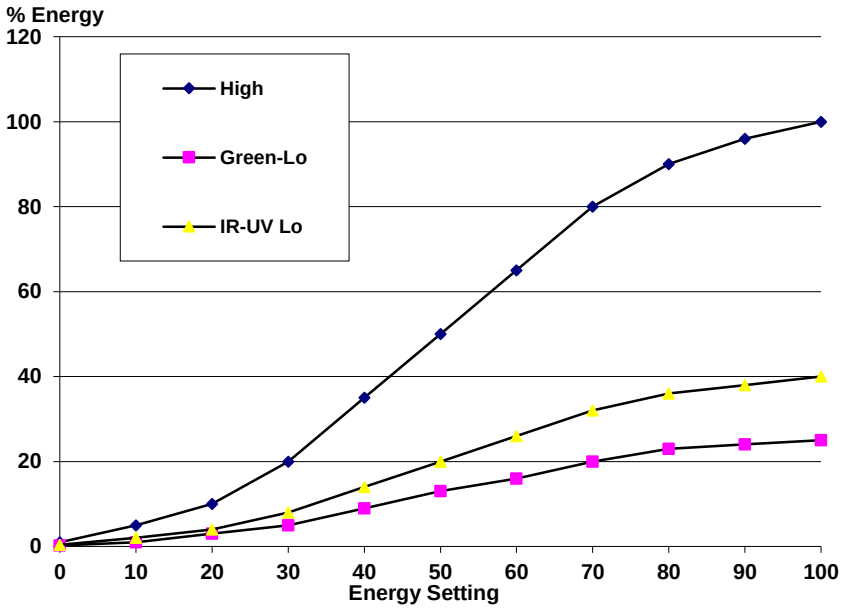


Figure 5-7 Energy level vs. Energy control setting

Page 2: Setups Page

The Setups Page as shown in Figure 5-8 allows up to 10 laser configurations to be stored or recalled. Each configuration needs to be created on the Run Page then stored/saved on the Setups Page.

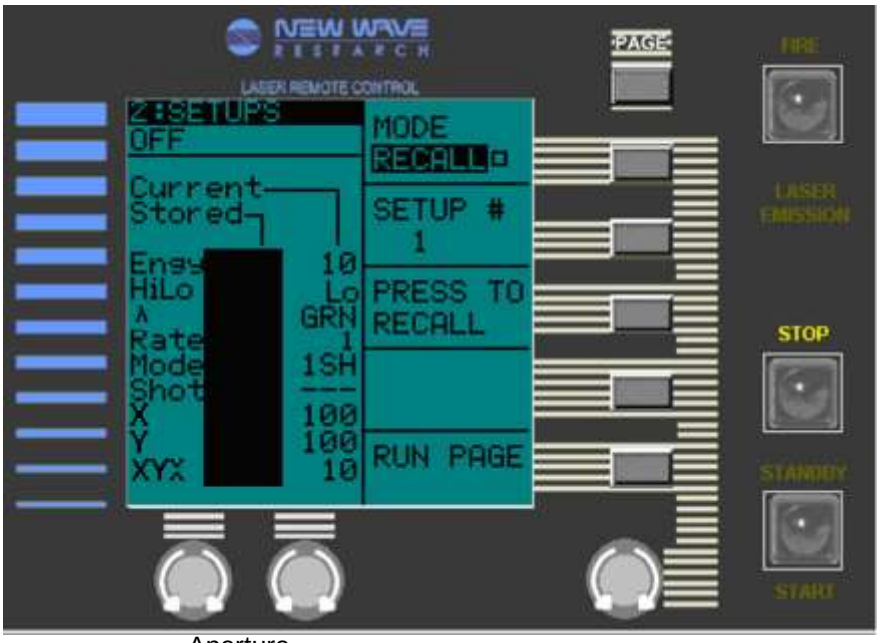


Figure 5-8 Setups Page

Table 5-2 below summarizes the soft keys assignments for the Setups Page:

Soft button	**Assignment**	**Variable**	**Control Method**
#1	Control Panel Mode – Switches the Control Panel between the following modes: Store - allows storage of new setup configurations Recall – allows retrieval of previously stored setup configurations	Store or Recall	Soft button – select & input
#2	Memory Location – Selects the setup configuration to be displayed in the **Stored** window when in Recall mode	1-10	Soft button – select Control knob - input
#3	Memory Input / Output – pressed to update or apply selected Setup # In **Recall** mode - Press to accept the Stored setup configuration. Accepted configuration will then replace the setup in Current window. In **Store** mode – Press to save the Current setup configuration. Current configuration will then replace the setup in Stored window.	none	Soft button – input
#4	Not used		
#5	Run Page – Press to call up the RUN page		Soft button – initiate

Table 5-2 Setups Page Soft Key Summary

Left Screen

2: SETUPS – screen identifier
Laser Mode display – OFF, WAIT, READY *-------- or BURST LOCK

Current – this column displays the current setup configuration as entered on the RUN page
Stored – this column displays the setup parameters stored in the selected memory location.

Engy – displays Laser energy level
HiLo – displays Energy HiLo setting
Λ – displays wavelength
Rate – displays Repetition Rate
Mode – indicates the Trigger mode selected:
1SH – 1 shot
BUR – Burst mode
CON – Continuous mode
Shot – displays the number of shots commanded in the Burst mode
X - displays Shutter X-axis setting
Y - displays Shutter Y-axis setting
XYΘ - displays XY Shutter rotational setting

Page 3: Interlocks Page

The Interlock Page as shown in Figure 5-9 below displays the status of internal and external laser interlocks. The Interlock Page is automatically displayed whenever an interlock is tripped, indicating the fault condition. Pressing the Start/Standby button from the Interlock page will recall the Run Page if the laser successfully starts.

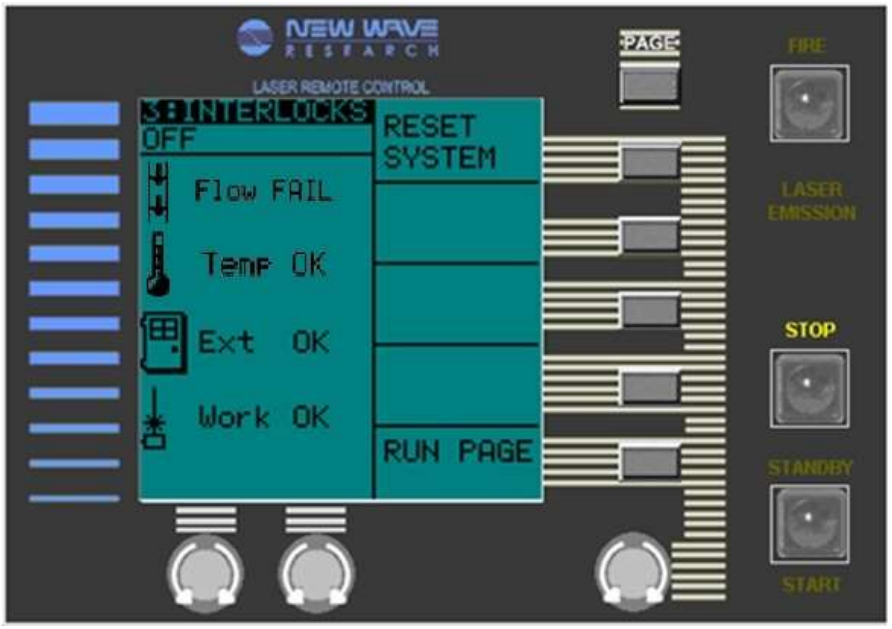


Figure 5-9 Interlock Page

Soft button	Assignment	Variable	Control Method
#1	Reset System – pressed to cause the Control Panel microprocessor to reload its program. Stored setup configurations are not lost during this process	none	Soft button – initiate
#2	Not used		
#3	Not used		
#4	Not used		
#5	Run Page – Press to call up the RUN page		Soft button – initiate

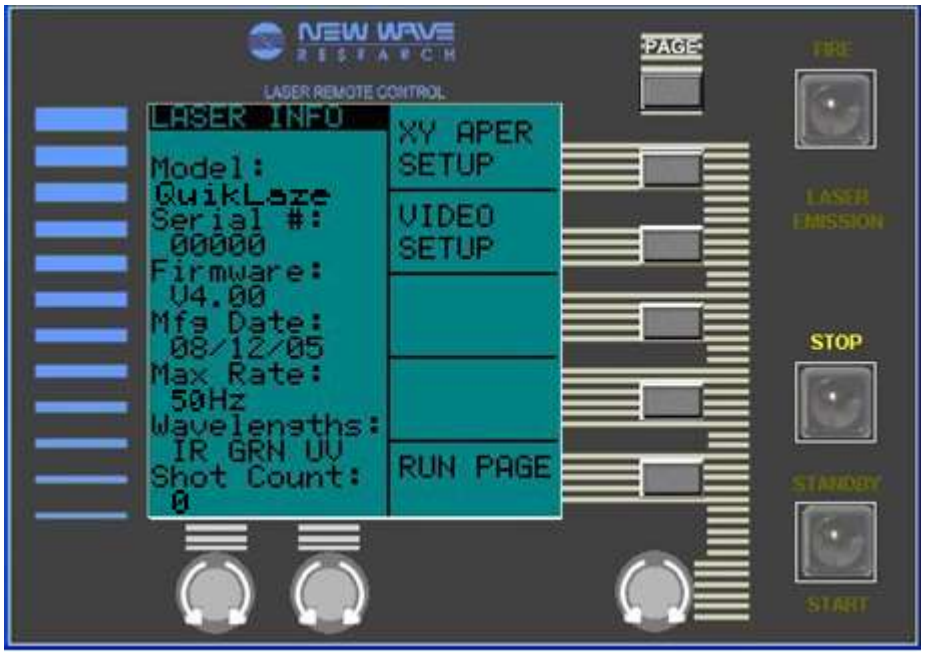
Table 5-3 Laser Interlock Page Soft Key Summary

Left Screen

3: INTERLOCKS – screen identifier
Laser Mode display – OFF, WAIT, READY *-------- or BURST LOCK

Flow -Indicates the status of the Water Flow interlock: FAIL or OK.
Temp -Indicates the status of the Water Temperature interlock: FAIL or OK.
Ext - Indicates the status of the System Stop (External) Remote interlock: FAIL or OK.
Work - Indicates the status of the Laser Standby (Work Piece) Remote interlock: FAIL or OK.

Page 4: Laser Info Page



Soft buttons

1

2

3

4

5

Aperture Control knobs

Soft Control knob

Figure 5-10 Laser Info Page

Soft button	Assignment	Variable	Control Method
#1	Go to **XY Aperture Setup page**		Soft button – initiate
#2	Go to **Video Setup page**		Soft button – initiate
#3	Not used		
#4	Not used		
#5	Run Page – Press to call up the **RUN page**		Soft button – initiate

Table 5-4 Info Page Soft Key Summary

Left Screen LASER INFO – screen identifier

Model - identifies system model
Serial # - serial number of the EzLaze 3 Laser Cutting System. This number applies to all components of the system (Laser Head, Power Supply and Remote Control Panel)
Firmware # - software version
Max Rate - Maximum repetition rate (Hz) specified for the laser
Wavelengths - lists the laser output wavelengths produced in the shipped configuration. Reconfigurations performed in the field will not be reflected in this display.
Shot Count – Counts the total number of laser shots produced by the system. This number should be recorded each time the flashlamp is changed so that the flashlamp aging can be tracked.

Page 4-1: Apertures Setup Page

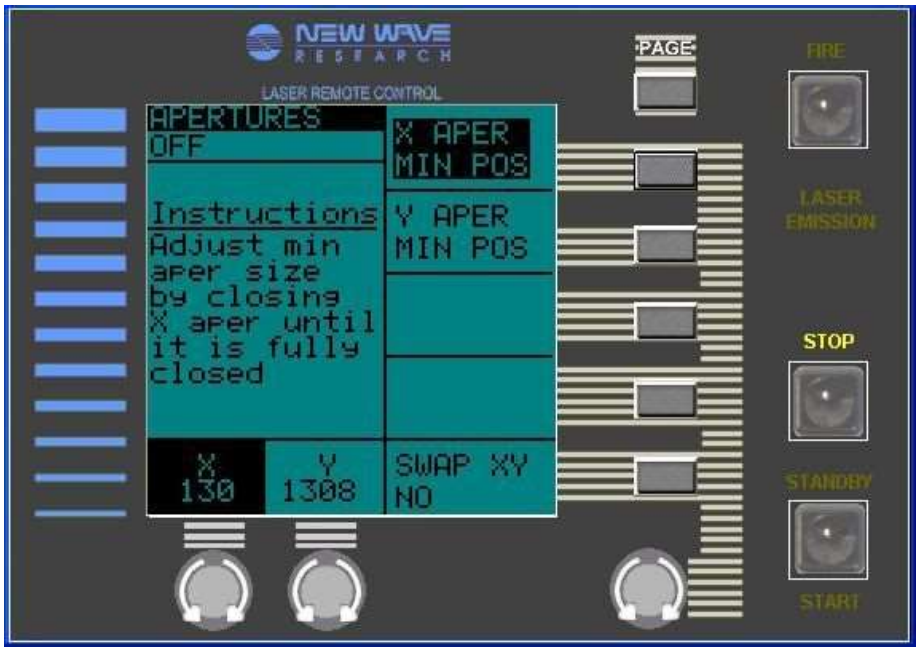


Figure 5-11 Apertures Setup Page

Soft button	Assignment	Variable	Control Method
#1	X axis Aperture calibration		Soft button – select Left Aperture Control knob - calibrate
#2	Y axis Aperture calibration		Soft button – select Right Aperture Control knob - calibrate
#3	Not used		
#4	Not used		
#5	Swap XY	Yes / No	Soft button – select Control knob - input

Table 5-5 Apertures Page Soft Key Summary

Left Screen

APERTURES – screen identifier
Laser Mode display – OFF, WAIT, or READY *--------
_____

XY Aperture Calibration Instructions

XY Shutter position windows

Page 4-2: Video Marker Setup Page

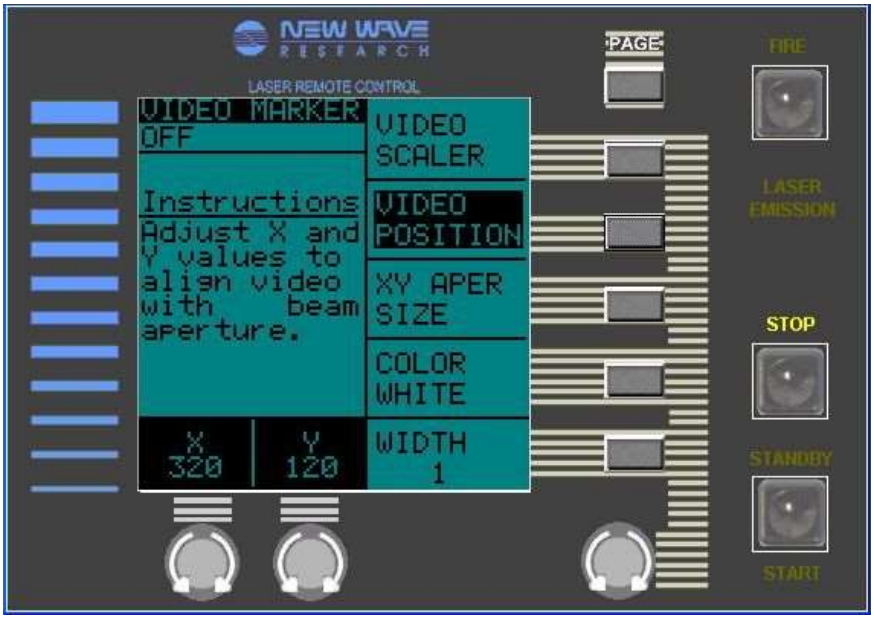


Figure 5-12 Video Marker Setup Page

Soft button	Assignment	Variable	Control Method
#1	Marker Gain		Soft button – select Left Control knob - calibrate
#2	Marker Position		Soft button – select Middle Control knob - calibrate
#3	XY Aperture Size		Soft button – select Left & Middle Control knobs - adjust
#4	Color Selection		Soft button – select and toggle
#5	Line Width Selection		Soft button – select Control knob - calibrate

Table 5-6 Video Marker Page Soft Key Summary

Left Screen

MARKER – screen identifier
Laser Mode display – OFF, WAIT, READY or *--------

Video Calibration Instructions

XY Shutter position windows

Rear Panel

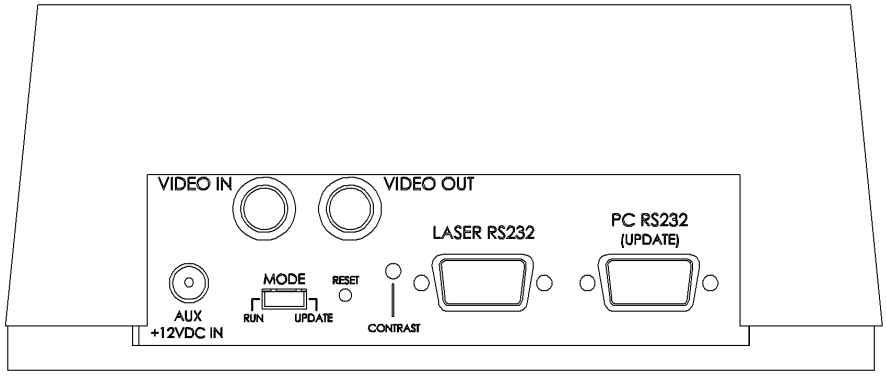


Figure 5-13 Serial Remote Box, Rear Panel

AUX +12VDC IN — Power input for use when updating the Remote Control Panel software. Power to the Remote Control Panel is normally provided by the Power Supply via the RS232 port, but this port is provided so that software updates may be accomplished remotely from the Quiklaze 50 ST2 Power Supply.
MODE — Switches the Remote Control Panel between the RUN mode (the normal position) and the UPDATE position (used to load software updates).
RESET — Pushing this recessed button causes the Remote Control Panel microprocessor to reload its software without erasing any of the stored setup configurations.
Contrast — Adjusts the contrast of the LCD display.
LASER RS232 — Control interface with the Power Supply.
PC RS232 — This port is used when controlling the Orion laser system with an external computer or when downloading software. The Control Panel will detect this connection and all front panel controls (including the STOP button) will be disabled. The LCD will display a LOCKOUT screen.

Laser Head

Manual Laser Beam Shutter — The shutter mounted externally at the beam aperture can be operated manually to block the laser beam. It should not be used for this purpose for more than a few seconds at a time.

Software

Laser Exec is a Windows™ application supplied by New Wave Research a Division of ESI ™ for controlling a laser over the RS232 port. It replaces the SRB and is useful for doing simple, interactive control of the laser from the PC.

System Requirements

To install Laser Control you need the following:

- Intel-compatible PC running Windows™ 95, 98, NT 4, 2000, XP and Windows 7.
- A serial port on the PC (a USB-to-RS232 adapter may be used).
- A cable for connecting the PC serial port to the laser's RS232 port.
- Approximately 1.5MB free disk space.

Getting the Latest Version

Go to New Wave Research ™'s web site at www.esi.com to check for updates.

Installation

LaserExec can also be installed on any computer by copying the LaserExec.EXE file.

Using Laser EXEC

Before starting the program, make sure the Lasers RS232 port is connected to the computers serial port and that the laser is turned on. When the program is started, LaserExec will check for a laser connected to any of the available serial ports on the computer and initialize the laser.
Press F1 at any time to view the on-line help and get detailed instructions on operating the software.

Getting Technical Support

If you have any questions, contact New Wave Research a Division of ESI ™ via any of the following methods:

Internet

Check New Wave Research a Division of ESI ™'s web site at www.esi.com for software and documentation updates.

Email

americasupport@esi.com

Phone/Fax

Phone 1800-331-4708
Fax 503-671-5551

Controls and Operations

Figure 5-14 shows the Laser Exec main screen for QuikLaze. It consists of Main Menu, Tool Bar, Interlock Indicators, Detected Laser and Window Message. Their functions will be described in details in the following sections.

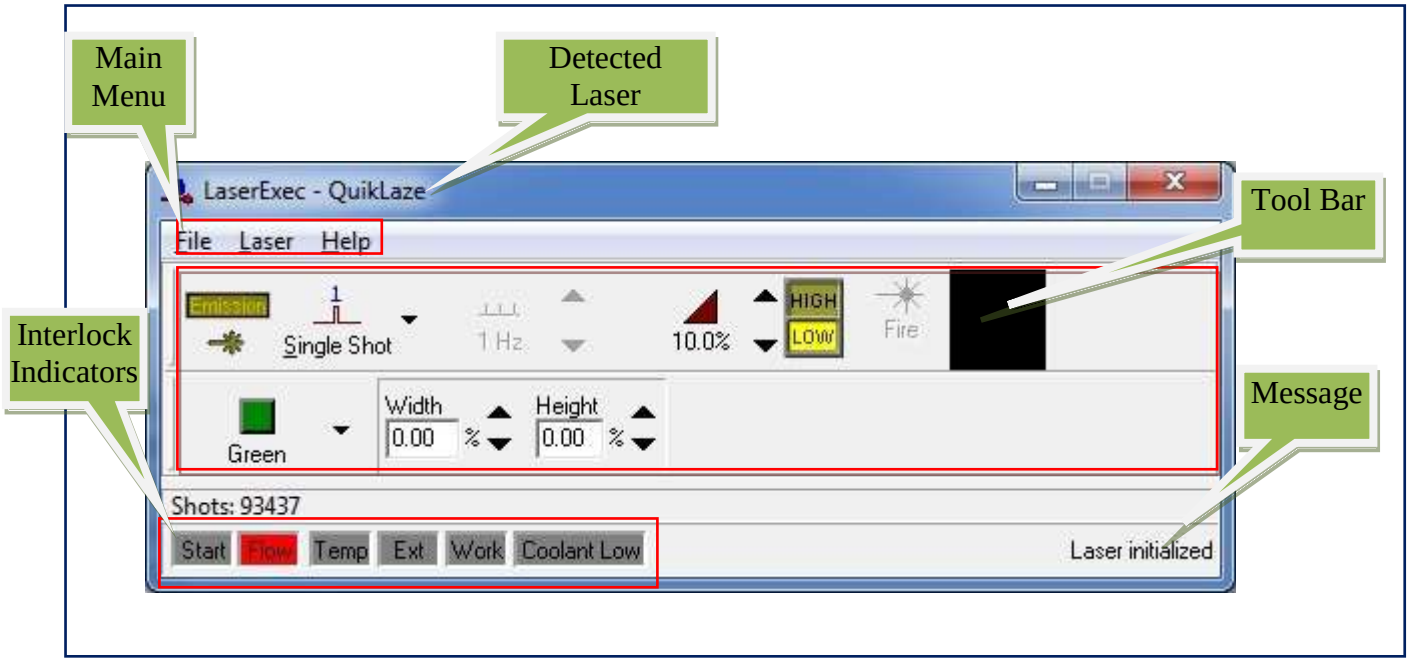


Figure 5-14 Laser Control Main Screen

- ***Main menu***

  The main Menu includes menu File, Laser and Help.

  - **File Menu**

    File menu is used to save and recall laser settings. For more details please see LaserExec Help.

  - **Laser Menu**

    Laser menu is used to initialize the laser, change the number of shots per burst and connect to the laser over the network.

  - **Help Menu**

    Allows user to access help, check software revision and check for a new version. It also allows the user to connect to the laser over a HyperTerminal and control the laser via RS232 commands.

- ***Tool Bar***

  Tool Bar gives access to the following laser controls:

- **Emission (stand by)**

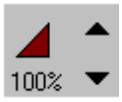
This switch turns the laser power supply on and off (it does NOT fire the laser). When the power supply is turned on, the coolant pump and fan will run. The switch will light up in bright yellow when the laser is on. The laser must be turned on for at least 10 seconds before it can be fired.

- **Laser Fire Mode Button**

Used to select the laser firing mode. Click on the button to cycle through the choices, or click on the down arrow to pick a choice from the drop-down list. Available modes are:

· Continuous - continuous pulse output at predefined repetition rate.
· Burst - will fire a preset number of pulses at a predefined rep rate, and then stop. You can set the number of shots to fire by selecting Shots per Burst from the Laser menu, or by right-clicking on the mode button and choosing the Shots per Burst menu.
· One-shot - will fire a single pulse.

- **Laser Output Control**



Use this control to set the laser output energy to a value between 0% (minimum output) and 100% (maximum output). You click on the up/down arrows to change the output level, or click on the control and type in a value.

- **Laser Rep Rate Control**

Sets the pulse-repetition rate of the laser. You can either click on the up/down arrows to increment/decrement the rep. rate, or click on the button and then type in a value. The rep. rate is only valid when the laser is in Continuous or Burst fire mode.

- **Output Range Switch**

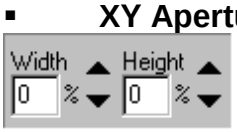
Some lasers are equipped with an optical filter wheel which has filters with two different levels of energy attenuation for each wavelength. On these lasers, the output range switch is used to switch between the High energy filter, and the Low energy filter, allowing for finer control of the laser energy at both the upper and lower range.

THIS CONTROL WILL ONLY APPEAR IF YOUR LASER IS EQUIPPED WITH THE NECESSARY OPTIONS.

- **Wavelength Selector**

On lasers with multiple output wavelengths, click directly on this control to switch wavelengths, or click on the down arrow to select the wavelength from a drop-down list.

- **XY Aperture Controls**



On systems equipped with XY shutter apertures, use these controls to set the shutter positions. 0% = fully closed, 100% = fully opened

- ***Interlock Indicators***

  Interlock bar shows the status of the interlocks.

- ***Laser Type***

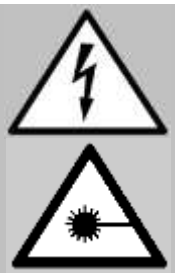
  The Laser Type on top of the screen indicates the laser types the LaserExec finds by scanning all the COM ports connected to the PC. Currently LaserExec supports the following lasers:
  - EzLaze II/EzLaze III
  - QuikLaze

- ***Window Message***

  This is the generic window message area for Laser Control software to display useful application information or debug information.

Chapter Six

Maintenance and Troubleshooting



WARNING: No operator serviceable parts inside. The QuikLaze Yd:YAG laser system contains internal components that present severe electrical and radiation hazards. Improper maintenance or servicing can result in death, blindness, other injury or material damage. Only qualified service personnel should perform service procedures on this equipment.

Introduction

The QuikLaze Nd:YAG laser system will provide years of reliable service if it is kept clean and well maintained. This section describes several procedures that should be performed on a regular basis. The QuikLaze system is designed such that the head and power supply need to be opened only for service.

WARNING: The Laser Head and Power Supply of the QuikLaze Nd:YAG laser system contain electrical circuits operating at lethal levels of voltage and current. Do not operate the laser system with either Power Supply or Laser Head covers removed.

Maintenance Summary

Following is a summary of weekly and monthly maintenance procedures. These items should be performed according to the schedule below to ensure proper operation of the QuikLaze.

CAUTION: Before any maintenance is performed, be sure to read and understand the complete Safety section starting on page 1**.**

Weekly –

- Circulate the cooling system water by operating the laser at least 30 minutes per week. This is necessary to help prevent a buildup of contaminants in the cooling system.

Monthly --

- Check cooling water level in the power supply. Keep the water level at 80% of full. Add only de-ionized or distilled water.
- Check laser head alignment on the microscope.
- Check under the power supply and laser head for signs of leakage from the cooling system.
    - If water leakage is discovered, turn off the power to the laser and contact trained service personnel or Electro Scientific Industries for support.

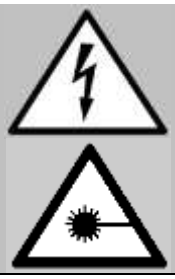
WARNING. To reduce risk of shock or fire, do not operate the laser until the source of the leakage has been found and fixed.

Cooling System

The cooling system is an important part of the QuikLaze Nd:YAG laser system. The cooling system must be maintained periodically to ensure reliable performance. Running the pump allows the de-ionizing filter to purify the water.

Circulate the cooling water by running the laser power supply and pump at least 30 minutes each week. This is essential to prevent the build-up of contaminants in the system, which will be deposited on the flash lamp and laser rod resulting in decreased output energy. If you cannot run the laser at least 30 minutes each week, you must completely drain the cooling system and blow clean dry air through the lines.

CAUTION: Never use tap (sink) water, filtered, or spring (drinking) water, or sterile water to fill or top off the cooling system. Use only distilled water or deionized water with a maximum resistivity of 5MΩ (megohm).



WARNING: No operator serviceable parts inside. The QuikLaze Yd:YAG laser system contains internal components that present severe electrical and radiation hazards. Improper maintenance or servicing can result in death, blindness, other injury or material damage. Only qualified service personnel should perform service procedures on this equipment.

De-ionization Cartridge Replacement

The de-ionization (DI) cartridge replacement is a service procedure. Refer to Chapter 7, Service for details.

Flash Lamp Replacement

The flash lamp replacement is a service procedure. Refer to Chapter 7, Service for details.

Trouble-shooting

This section lists a number of conditions that may be observed during the lifetime of the QuikLaze Nd:YAG laser system. Following the list of conditions is a set of procedures that may be used for resolving specific conditions to improve laser performance.

Observed Conditions

To use this section, find the observed condition in this section that matches the condition of the laser. Follow the recommended procedure to correct the situation.

> Note: If the problem cannot be resolved by following the procedure, contact a qualified service person or Electro Scientific Industries to get technical support for the laser.

Observed Condition	Recommended Procedure
Laser does not start	Procedure 1
Laser does not fire	Procedure 2
Low output energy	Procedure 3
Unstable laser energy	Procedure 4
Clipped laser beam	Procedure 5
Non-uniform beam	Procedure 6
No laser output	Procedure 7
Laser cannot connect to the GUI	Procedure 8

Table 6-1: Observed Conditions

Recommended Procedures

The following procedures should be followed to resolve the observed conditions listed in the section above.

Procedure 1 Laser does not start

If the laser does not start, please check the following points.

The laser AC power cord is plugged in, the outlet has power and the power entry switch has been turned ON.

The key switch on the power supply is turned to the ON position, and the AC power light is illuminated.

Check interlock indicators & fault LED's, for indication of interlock or fault that is active. Check external connections and ensure covers are still securely in place.

Procedure 2 Laser does not fire	Check the Fire Flashlamp and Fire Q-Switch toggle switches on the back of the power supply between the BNC connectors. The switches should be in the INT position for normal operation.
Procedure 3 Low output energy	Make sure that the Hi/Lo switch is in the Hi position. Check the setting of the attenuator. Increase to at least 50%. Make sure a 50x or higher magnification objective lens is being used. Test other locations on the sample for consistency. Flush the cooling system.
Procedure 4 Unstable laser energy	The pulse stability for the QuikLaze Nd:YAG laser is specified as ±7% at 532 nm this is measured at maximum 532 nm energy with the XY aperture fully open and the laser removed of the microscope. If the pulse stability at 532 nm does not meet this specification then check the following: Check the number of shots on the flash lamp. This can be estimated from the date of the last flash lamp change and the average usage per day. If the number of shots fired exceeds 30 million shots, the flash lamp requires changing, please contact trained service personnel or New Wave Research for service replacement. Refer to Chapter 7, Service for details. Experiment with samples of different materials. Call New Wave Research if it is not possible to improve laser pulse stability by this procedure.
Procedure 5 Clipped laser beam	The output beam of the QuikLaze Nd:YAG laser should be square and symmetric with even energy distribution. Some object in the beam path may clip the laser beam; then the output will appear asymmetric, with a sharp edge. If the output beam is clipped, check the following: Check the beam path to ensure that there are no foreign objects in the path. Check that the manual shutter is fully open and completely removed from the beam path and is not clipping the beam. Check the microscope alignment for each individual objective used for laser cutting. When you have found the object that is responsible for clipping the beam, correct the situation and ensure that the beam path is fully clear.

Procedure 6 Non Uniform Energy Distribution

If the energy distribution does not appear to be uniform across the cut areas check the following:

Check that the laser beam is not clipping a mount or some other object, and that there are no foreign objects in the beam path.

Check microscope alignment.

Check that the microscope optics are clean, with no dust particles on any surface. Clean the optics if necessary.

If the beam still appears to be non-uniform try cuts on different samples. Try increasing the energy setting. If the laser still makes non uniform cuts call Electro Scientific Industries for service information.

Procedure 7 No Laser Beam Output

Check to ensure the safety shutter on the lower left side of the laser head is in the Open position.

Check to make sure the X and Y controls are set to at least 30.

Switch to the Green wavelength.

Set the Energy switch to LO and the Energy attenuator to at least 20.

Select a 10x or 20x objective lens, set the Rep. Rate to at least 10 Hz, and then set the trigger switch to CONT.

Press the Fire button. Correct the microscope alignment if necessary.

Procedure 8 Laser unable to connect to the GUI

When GUI is unable to connect to the laser try the following:
-Make sure the laser is connected to the PC with an RS232 cable
-Cycle AC power and make sure the laser is ON and the key is in the enable position
-If using a laptop with a USB to RS232 adapter it is best to change the virtual COM port number to either COM 1 or COM 2
-Make sure the COM port is not being used by other hardware or software.

Chapter Seven

Service

WARNING: Service procedures expose the interior of the system and must be performed by service personnel trained by Electro Scientific Industries. Service personnel must be fully adept at Lock Out Tag Out (LOTO) procedures, general electrical safety, and laser safety practices.

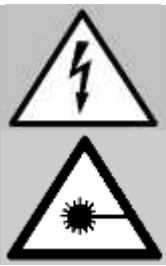
WARNING Before any service is performed, be sure to read and understand the complete Safety section of this manual and all warnings. During servicing, make sure an additional person is available to render assistance in case of emergency. **DO NOT SERVICE ALONE**.

Introduction

This section describes service procedures that should be performed by a service personnel trained by Electro Scientific Industries.

WARNING: The Laser Head and Power Supply of the QuikLaze Nd:YAG laser system contain electrical circuits operating at lethal levels of voltage and current. Do not operate the laser system with either Power Supply or Laser Head covers removed, unless specified to do so.

Always use caution when working around the laser system with covers removed.



WARNING: No operator serviceable parts inside. The QuikLaze Yd:YAG laser system contains internal components that present severe electrical and radiation hazards. Improper maintenance or servicing can result in death, blindness, other injury or material damage. Only qualified service personnel should perform service procedures on this equipment.

WARNING: To prevent eye injury or blindness, protective eye wear should be worn at all times when servicing the laser with covers removed and power on. Both visible and invisible Class 4 laser radiation may be present.

Service Summary

Following is a summary of yearly and as needed service procedures. These items should be performed according to the schedule below to ensure proper operation the QuikLaze.

Yearly –

- Replace DI cartridge*. (* - Schedule varies; see De-ionization Cartridge Replacement for more details.)
- Check the energy level of all wavelengths through the appropriate objective lens. Measure energy with a calibrated energy meter after the objective lens, with all controls set to maximum and the XY shutter fully open. Do not focus the laser beam on the detector.
    - Raise the microscope up so that the laser beam fills at least 50% of the detector surface. Energy measurement

should be greater than: 1064 nm - 200 uJ; 532 nm - 150 uJ; 355 nm - 60 uJ; and 266 nm - 90 uJ.

As needed –

- Replace flash lamp. The need for replacement will depend upon usage. The flash lamp should be good for about 30,000,000 shots.
- Replace spot marker illuminator lamp - Type EKE lamp, 21 volts, 150 watts.
- Replace cooling system pump.
- Check the Mylar shield for condensation.

Note: Certain procedures such as changing the flash lamp, water filter or cleaning optical components require removal of the protective systems. It is important that all safety precautions outlined in this manual are observed by anyone servicing the laser. The most important rule when servicing this laser is to turn off the AC line switch and perform every step as outlined in the LOTO (Lock out and Tag out) procedure.

LOTO (Lock out and Tag out) procedure

Most service procedures which require removing portions of the protective housings, (such as changing the water filter or cleaning optical components) require no power and no operation of the laser system. For the safety of yourself and those in the immediate area (affected persons), perform the following LOTO steps before any repair or service is conducted.

Ensure that all persons in the area are aware that the system will be shut down and that repair or service will be performed.

Place signage or tape in the area of the repair or service to ensure that no unauthorized persons enter the area.

After the system has been shut down, unplug the laser from the wall outlet and from the laser.

Keep the power cord in the exclusive control of the person doing the repair or service at all times.

Place a tag on the system with the repair or service persons' name and date on the tag to identify that this system is under repair or service.

After the system has been shut down, push the ON button several times to ensure that there is no energy to the system.

With a volt meter, check the voltage across the PFN capacitor to ensure that there is no residual energy stored.

At the conclusion of the task, clear the surrounding area of any tools and signage (tags or perimeter tape).

Before the tool is restarted, notify affected persons in the area that LOTO has been terminated and that the tool will be turned on.

Lock-out and tag-out of the system

Before any service or repair is performed on the laser, please employ the following guidelines if the system will be opened or if power to the system is terminated:

1. Ensure that all persons in the area are aware that the system will be shut down and that repair or service will be performed.
2. Place signage or tape in the area of the repair or service to ensure that no unauthorized persons enter the area.
3. After the system has been shut down, unplug the laser from the wall outlet and from the laser.
4. Keep the power cord with the person(s) doing the repair or service at all times.
5. Place a tag on the system with the repair or service persons' name and date on the tag to identify that this system is under repair or service.
6. After the system has been shut down, push the ON button several times to ensure that there is no energy to the system.
7. With a volt meter, check the capacitor (PFN) to ensure that there is no residual energy stored.

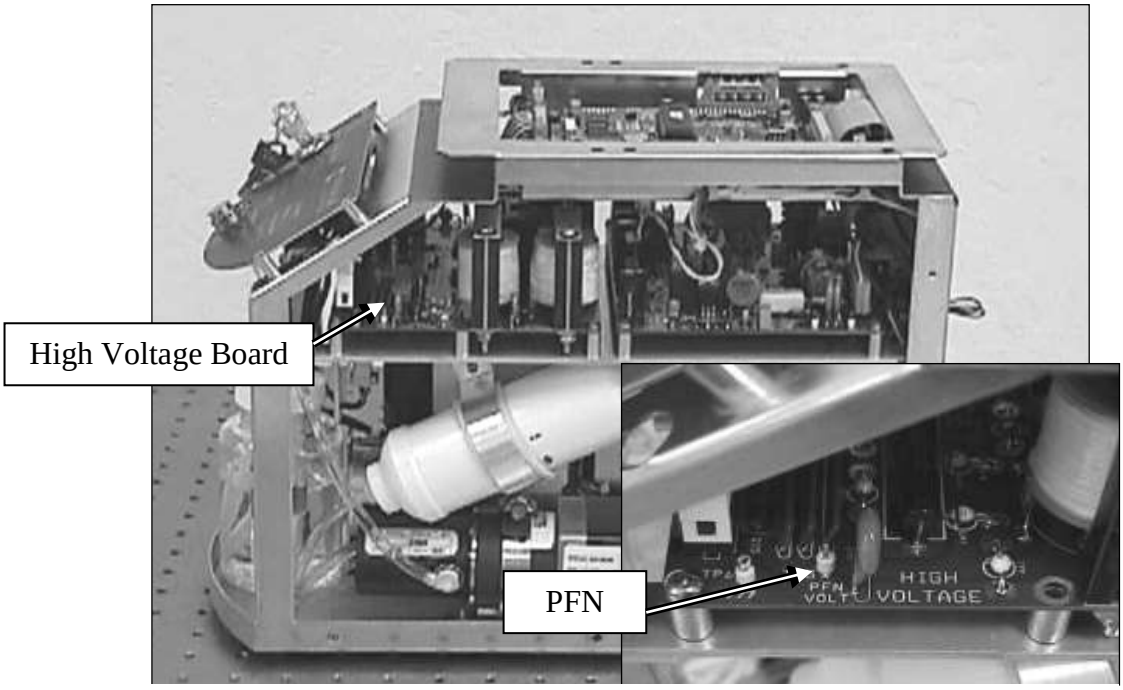


Figure 7-1: Connect the Volt meter to the PFN and to a ground

Cooling System

The cooling system is an important part of the QuikLaze Nd:YAG laser system. The cooling system must be maintained to ensure reliable performance.

De-ionization Cartridge Replacement

The de-ionization (DI) cartridge must be replaced according to how much the system is used:

If the systems is used…	Replace the DI cartridge every…
less than 40 hours/week	12 months
40-80 hours/week	6 months
more than 80 hours/week	3 months

The following procedure can be used to replace the de-ionization cartridge.

- Press the STOP button on the remote control panel.
- Disconnect the WATER RETURN hose from the back of the power supply and hold it over a drain container.
- Depress and hold the Run Pump button on the back of the power supply to start the pump. The pump will force the cooling water from the hose into the drain container. See Figure 4-6.
- Turn the power supply off with the key, and disconnect the power cord from the power supply.
- Open access door by removing screws.
- Disconnect the hose from the top of the de-ionization cartridge, disconnected by pulling gently on the hose.
- Disconnect the hose by pushing in the locking mechanism so that it is touching the bottle ridge and pull gently on the hose.

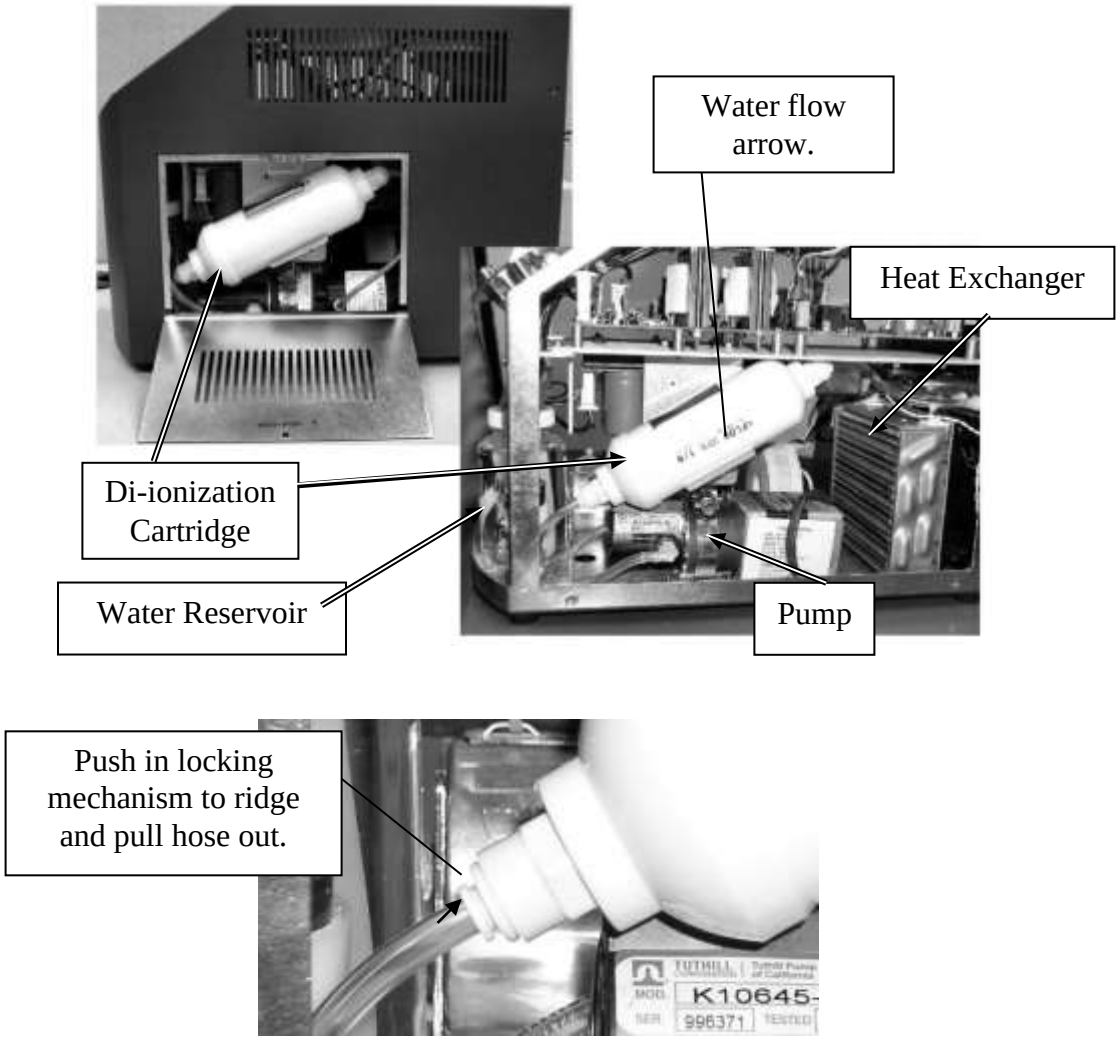


Figure 7-2: Cooling System in the Power Supply

- Remove the old de-ionization cartridge by carefully pulling out from the C-Clamp of the power supply.
- Connect the hose to the bottom of the new de-ionization cartridge. Install the new de-ionization cartridge. Reconnect the water hose to the top of the cartridge.

Note: when re-installing the cartridge, it is important to pay attention to the direction of the water flow arrows.

- Close the access door.
- Refill the cooling system with de-ionized or distilled water and run the system briefly to check for leaks before replacing the power supply cover. Disconnect power before replacing cover.

Checking the Mylar Shield

In the QuikLaze-50 ST2, there is a protective, Mylar panel between the water storage and the electrical source. Check the Mylar shield for condensation. If condensation is detected, it is important to shut down the laser, discontinue use and contact Electro Scientific Industries to report this problem.

WARNING: To reduce risk of shock or fire, do not operate the laser from this point until the source of the condensation has been found and fixed.

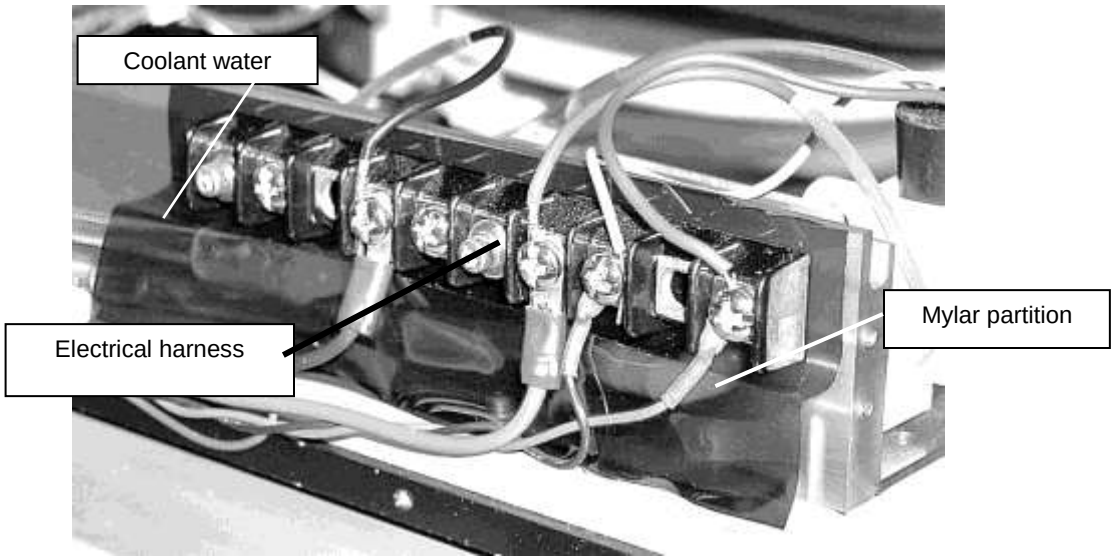


Figure 7-3: Check the Mylar for condensation

Flash Lamp Replacement

The flash lamp must be changed when the specified energy cannot be achieved or if the laser energy fluctuates significantly from shot to shot. This can be seen over the course of several hundred pulses. The flash lamp should be useful for at least 30 million shots. Use the following procedure to install a new flash lamp.

- Place the power supply at a lower elevation than the laser head.
- Disconnect all power to the laser and remove the laser head cover.
- Disconnect both water hoses from the back of the power supply and place them into a drain container. This will allow water to drain from the pump chamber and minimize leakage in the laser head. Connect the two ends of the hoses together after sufficient water has drained from the pump chamber so that you see air in the water line.

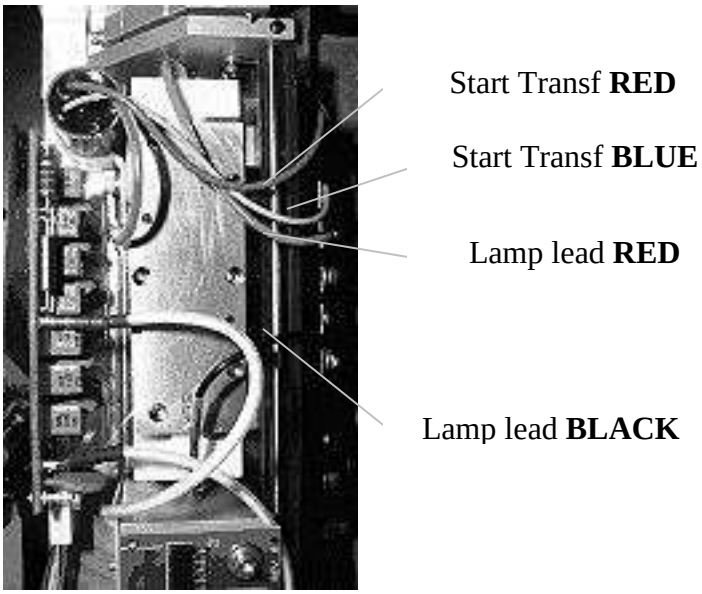


Figure 7-4: Removing Leads to Replace Flash Lamp

- Remove the small RED and BLUE start transformer leads from the terminal strip
- Remove the RED and BLACK flash lamp leads from the terminal strip.

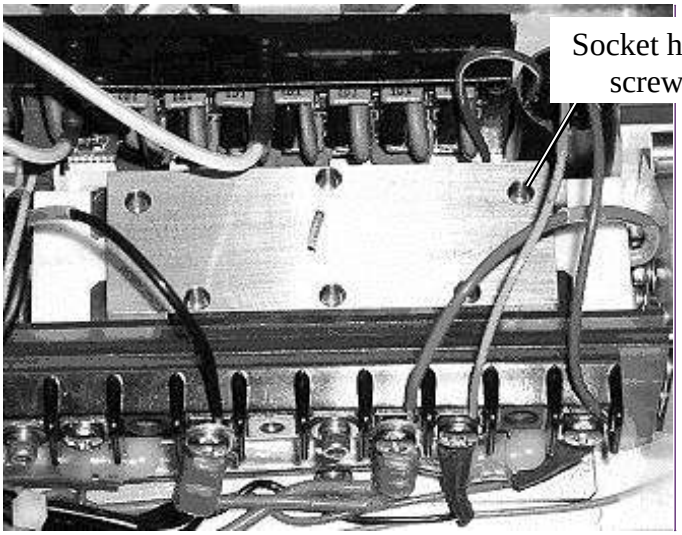


Figure 7-5: Recessed Pump Chamber Screws

- Loosen the six head cap screws located on the top of the pump cavity. Locate one of the two through holes. Insert a 3/32 hex ball screw driver in one of the holes to remove the top cover.
- Remove the two end caps on each side of the pump cavity.

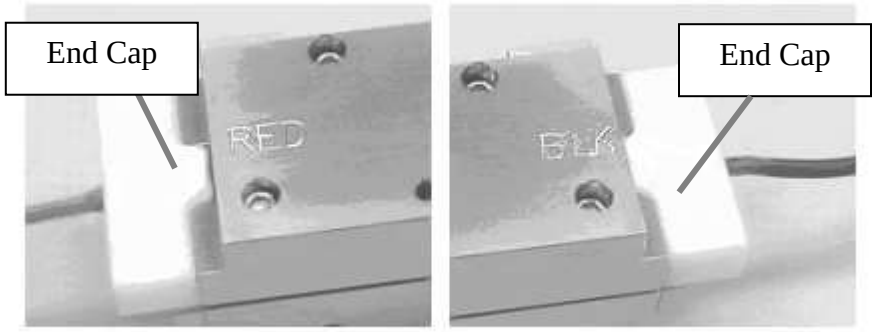


Figure 7-6: Six recessed screws located on the top of the cavity

- Carefully straighten the lamp leads and remove the flash lamp from the pump chamber by carefully pushing the lamp block to the left or right.
- Place the old lamp on a clean surface to remove the o-rings.

CAUTION: Avoid all contact with the glass surface of the lamp and the surrounding ceramic. This may leave grease marks that will degrade the lamp performance and may shorten the lamp life.

- Carefully remove a new flash lamp from the package.
- Place one new o-ring on the black lead of the new lamp about 0.2" from the base.

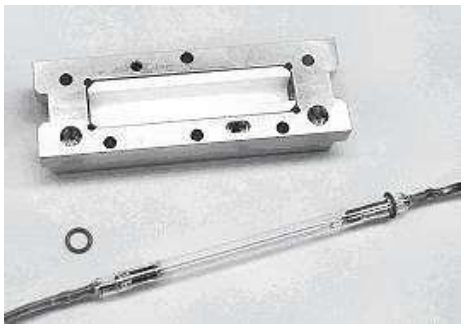


Figure 7-7: Installing o-ring on new flash lamp

- Insert the lamp back into the top cavity. Make sure the color of the wires match the name of the color printed on the top of the cover.

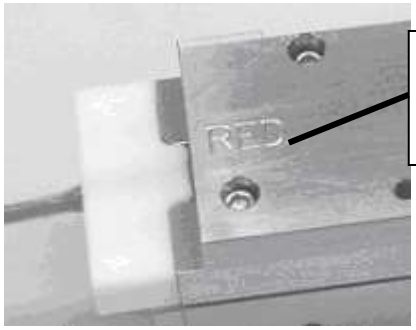


Figure 7-8: Name of color imprinted on top of cover

- Slide the remaining o-ring on the other side.
- Evenly space the lamp within the cavity.

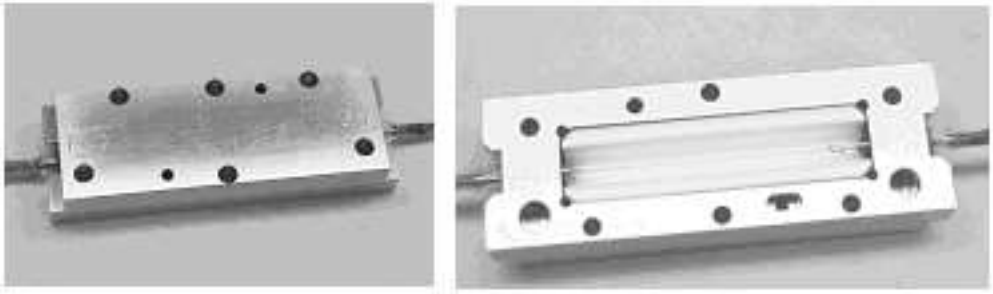


Figure 7-9: Ensure flash lamp is evenly spaced in the cavity

CAUTION: Avoid all contact with the glass surface of the lamp. This may leave grease marks that will degrade the lamp performance and may shorten the lamp life.

- Replace the two end caps on the lamp cavity. Tighten the screws on the end caps evenly.
- Replace the gasket on the other half of the pump chamber. The gasket should fit snugly in the groove.

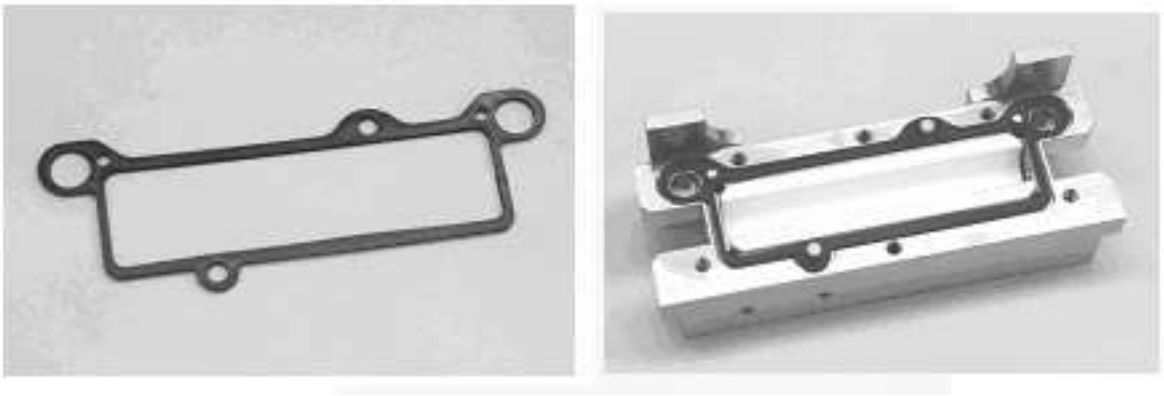


Figure 7-10: Replacing the gasket in the chamber

- Replace the top cover of the cavity and align the two dowel pins on the bottom of the cavity.
- Tighten the six socket head cap screws on the top cover of the pump chamber evenly. Double check the screws but do not over tighten.
- Reconnect the flash lamp leads.
- Reconnect the cooling water hoses to the power supply.
- Start the power supply and check the cooling system for leaks and adequate water level before replacing the laser head cover. Disconnect before replacing the laser head cover.

Spare and Replacement Parts

Listed below are recommended Spare Parts for the QuikLaze-50 ST2.

Part Number	Description	Qty.
0002-0036	Flashlamp	1
0003-0005	Gasket, split pump cavity	1
1300-0001	De-ionization cartridge	1
9000-0016	EKE Lamp	1

Appendix A
Specifications

Environmental Requirements	
Voltage*	100 - 240 ~, 50/60 Hz
Temperature (operating)	21°C ± 5°C (70°F ± 10°F)
Temperature (non-operating)	0° – 50° C (32° – 122° F)
Relative Humidity	20% – 80% non-condensing
Power	500W MAX
Maximum Operating Altitude	2,000 m (~6,500 ft)
Pollution Degree	2 (indoor use only)
* Installation Overvoltage Category: CAT II, is for equipment intended to be supplied from the building wiring, applicable to plug-connected & permanently connected equipment.	

Table A-1 environmental requirements

Optical Safety				
Repetition rate	1 shot, 1-50 Hz continuous; burst 1-200 shots followed by a cool-down period			
Wavelength (nm)	1064	532	355	266
Beam Divergence (mrad)	3	3	3	3
Max Pulse Duration (ns)*	5	5	5	5
Maximum Exposure Energy (mJ)*	20	20	5	4
Maximum Exposure Peak Power (W)*	$5x10^6$	$5x10^6$	$1.25x10^6$	$1x10^6$
Nominal Ocular Hazard Distance (intrabeam) (m)**	5000	2000	150	150
Maximum Permissible Exposure (eye) (J/m^2)**	$1x10^{-2}$	$2x10^{-3}$	10	6.5
Maximum Permissible Exposure (Skin) (J/m^2)**	250	150	10	6.5
Protective Eyewear Optical Density ***	7	7	5	5
Irradiance (W/cm^2) ******	6.25	6.25	3.1	2.0
* These values are not guaranteed for performance, but indicate the maximum possible exposure levels for Safety purposes. ** Eye MPE values based on 10 seconds (1064 nm, 355nm, 266nm) and 0.25 second (523 nm) exposure durations. *** Optical Density values based on ANSI Z-136.1 (2000) standard, and based on intrabeam viewing only. Not suitable for use for extended viewing (i.e. use optical instruments). **CAUTION** - The use of optical instruments will increase eye hazard. **** Values based on levels that might be present on the surface of the eye protection equipment.				

Table A-2: Optical Safety Specifications

Wavelengths and Cutting Parameters

Laser Wavelengths for Optimum Material Removal

Success in laser trimming, cutting and ablation is usually determined by the choice of wavelength. Different materials react differently to various wavelengths. Effective removal of metals depends on how much energy is absorbed and how much is reflected. The more energy absorbed, the easier the metal will vaporize and be removed.

In general, metals absorb shorter-wavelength energy better. For example, gold is 1% absorbing at 1064 nm, 40% absorbing at 532 nm, and 45% absorbing at 355 nm. However, there are limits to the effectiveness of shorter wavelengths, which are determined by the microscope optics used.

In the foregoing examples, the Mitutoyo microscope transmitted about 45% of the 1064 nm laser energy, 35% of the 532 nm energy, and only about 17% of the 355 nm energy. In this example, even though gold is more absorbing at 355 nm than at 532 nm, the microscope transmission of laser energy at 532 nm usually makes it the preferred wavelength for cutting gold.

Aluminum can be cut using either 1064 or 532 nm. The absorption is relatively constant from about 1,100 nm to about 400 nm with a slight increase in absorption around 1µm.

A different process removes organic material, such as polyimide. UV energy is able to break the chemical bonds between the carbon-carbon, carbon-oxygen, and carbon-silicon atoms. These bonds break with sufficient energy in the range of 339-445 nm. The third harmonic of an Nd:YAG laser is 355 nm. It is an excellent wavelength for breaking the atomic bonds of the polyimide molecule.

The following table shows the preferred wavelength for vaporizing of ablating various materials commonly found in semiconductor and microelectronic devices.

Table 7-1: Recommended Wavelengths for Various Materials

	Infrared (1064nm)	Green (532nm)	UV (355nm or 266nm)
Metal/Conductors	Aluminum ITO Chrome	Aluminum ITO Chrome Ni-Chrome Ti-Tungsten Copper Gold	
Insulators		Silicon Nitride Silicon Dioxide	Polyimide Teflon Silicon Nitride Kapton
Semiconductors		Polysilicon	Polysilicon
Color Filter Materials	Red	Green	Blue

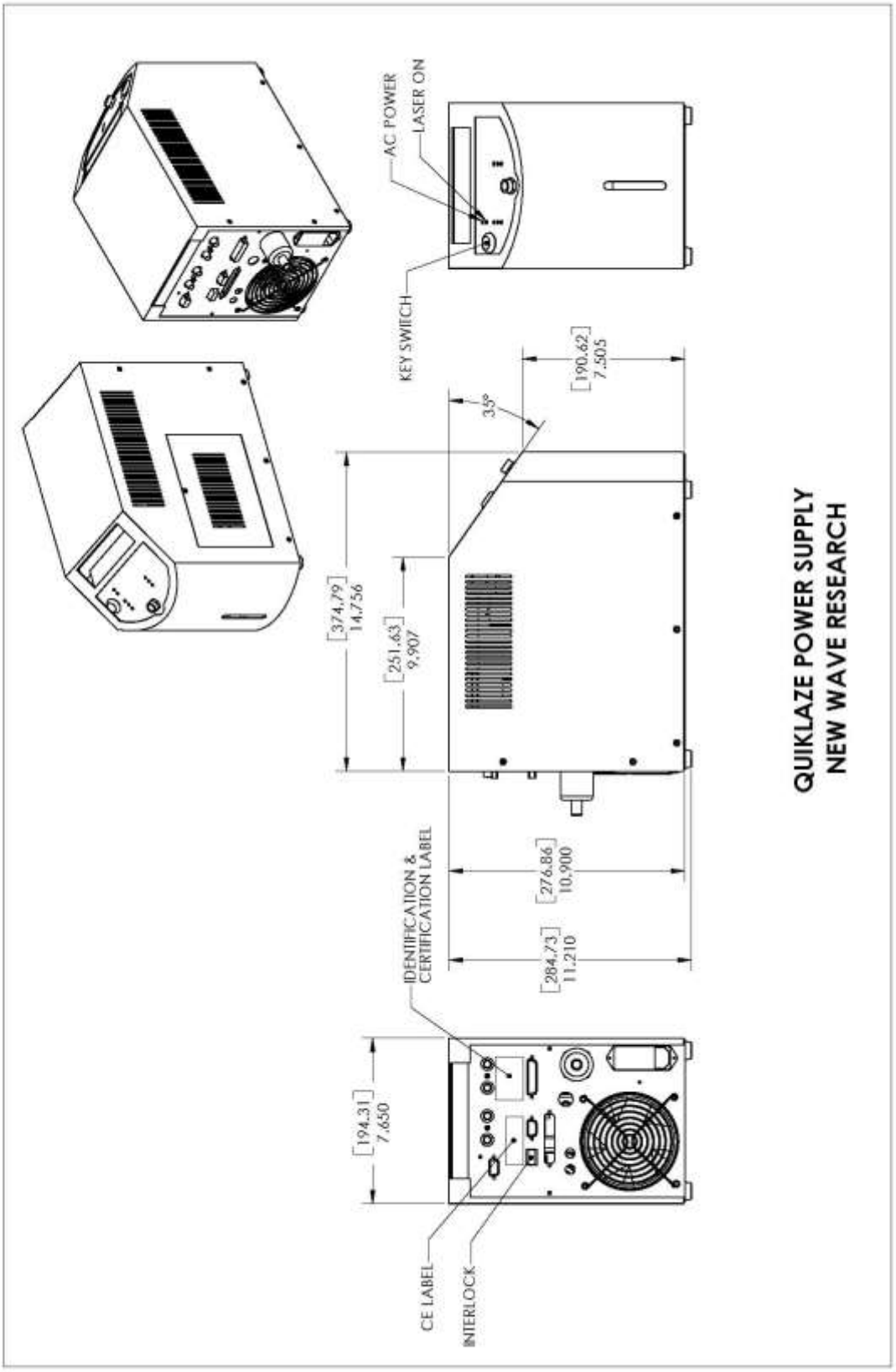
Laser Cutting Parameters

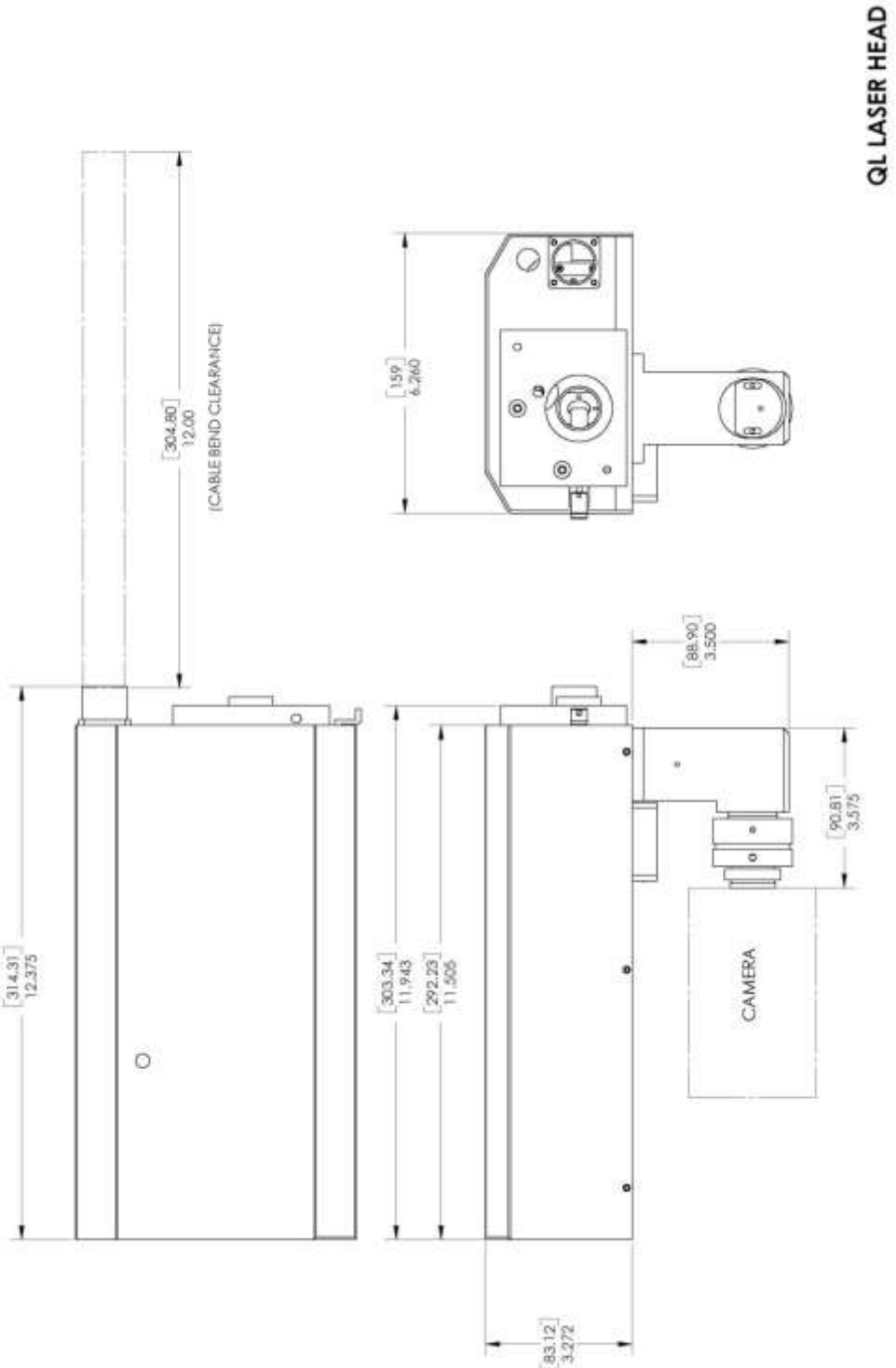
The following table presents a summary of recommended laser settings for various machining operations. The settings are for a New Wave QuikLaze laser system. These settings should be viewed as a starting point from which a finely tuned cutting process can be defined for a specific application. When tuning the cutting process, a non-critical area of the device should be selected for practice.

After the technique has been determined, the laser parameters can be saved as a Laser Micro using LaserExec, the laser control software package that is supplied with every QuikLaze system. LaserExec runs under Windows95, Windows 98, Windows 2000 and Windows XP. It requires a PC with a Pentium (or equivalent) CPU, at least 16MB of RAM, and one available RS232 serial port. For further information on QuikLaze and LaserExec, see the information in the following table or contact New Wave Research.

Table 7-2: Recommended Laser Settings for Various Laser Machining Operations

Sample Material	Cut Size	Microscope Lens	Wavelength	Energy Setting	Energy Range	No. of Shots
LCD repair: remove ITO short	15 x 110 µm	50X NIR	1064 nm	500	High	50
LCD repair: remove chrome short	15 x 220 µm	50X NIR	1064 nm	500	High	100
MCM module: cut gold line	20 x 300 µm 15 µm deep	50X	532 nm	800	High	1200
Thick film resister	30 x 4000 µm	20X	1064 nm	600	High	2000
Semiconductor device: Polyimide removal	130 x 200 µm 3 µm deep	50X NUV	355 nm	300	Low	2000
Trim gold capacitor	25 x 60 µm	20X	532 nm	600	High	3000
Flex circuit: remove Kapton	20 x 100 µm 20 µm deep	50X NUV	355 nm	800	High	1500
Flex circuit: cut copper line	15 x 10 µm	50X NUV	532 nm	800	High	1000


QUIKLAZE POWER SUPPLY
NEW WAVE RESEARCH
AC POWER
LASER ON
KEY SWITCH
3.5°
[190.62]
7.505
[374.79]
14.756
[251.63]
9.907
IDENTIFICATION &
CERTIFICATION LABEL
[276.86]
10.900
[284.73]
11.210
[194.31]
7.650
CE LABEL
INTERLOCK


QL LASER HEAD
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12.00
(CABLE BEND CLEARANCE)
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3.575
CAMERA
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Appendix B, Recommended External TTL Circuitry

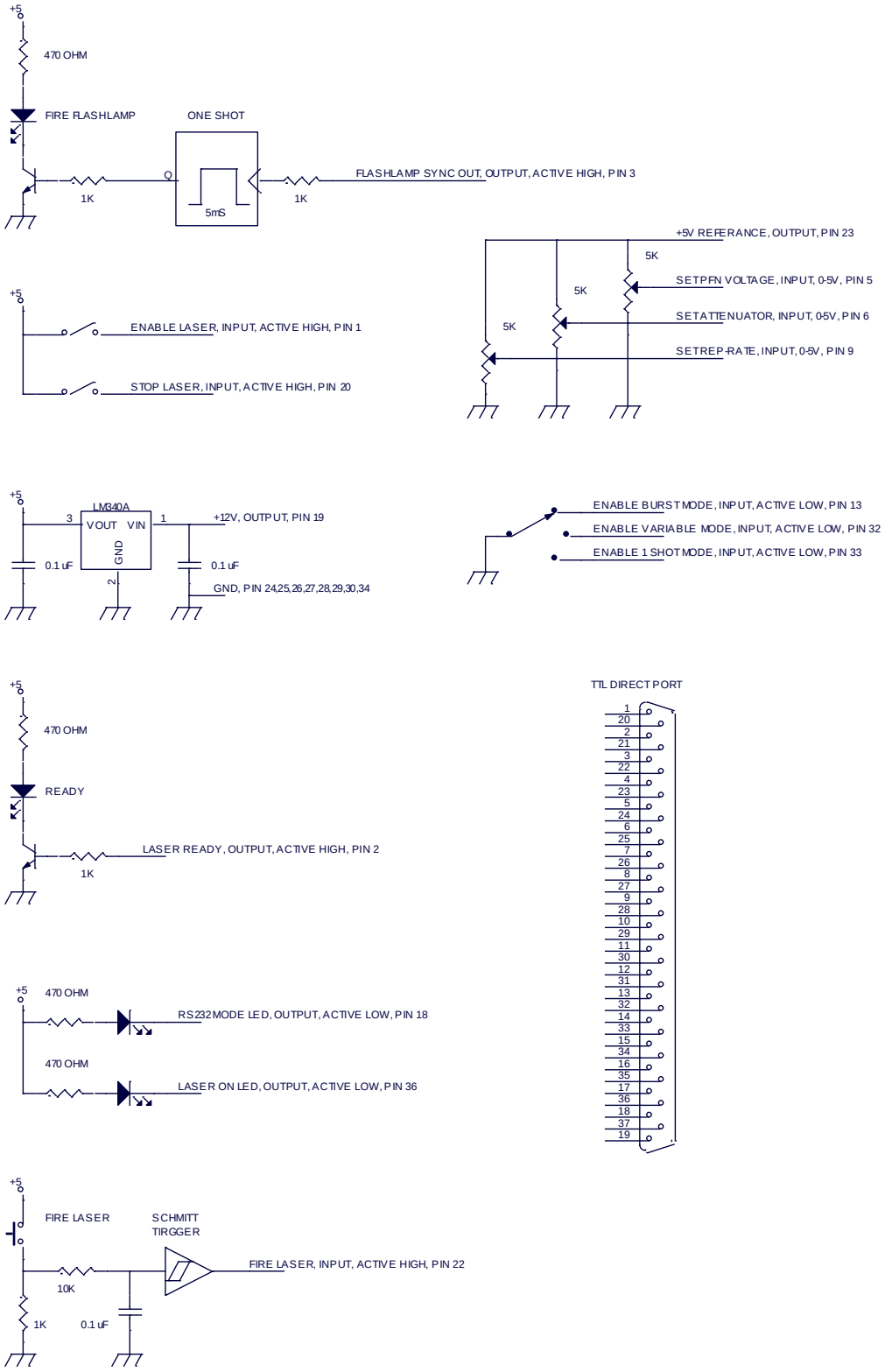

Figure 7-11: External TTL Circuitry

Service Contact Information

USA
New Wave Research
a division of esi

740 Kifer Road
Sunnyvale, CA 94086-5121
Phone: 510.249.1550
Fax: 510.249.1551
Email: americasupport@esi.com
Web: http://www.esi.com

Japan
New Wave Research
a division of esi

ESI Japan Technology Center
Moriichi Building 2F,
14-3 Takabashi, Koto-ku
Tokyo 135-0005 Japan
Phone: +81-3-5625-5100
Fax: +81-3-5625-5229
Email: JapanSupport@esi.com

Taiwan
New Wave Research
a division of esi.

2F, No 26, Tai Yuen Street
Jubei City 302, Hsinchu County
Taiwan
Phone: +886-3-552-6788
Fax: +886-3-552-6799
Email: TaiwanSupport@esi.com

Europe
New Wave Research
a division of esi

8 Avro Court, Ermine Business Park
Huntingdon, Cambridge
England PE29 6XS, UK
Phone: + 44-(0)1480 456566
Fax: + 44-(0)01480 456545
Email: eurosupport@esi.com

China
New Wave Research
a division of esi

Room 1701~1702, Information Tower,
No.1403 Min Sheng Road,
Pudong, Shanghai, China
P.R.C. 200135
Phone: + 86 21 3392 7070
Fax: + 86 21 5237 1289
Email: ChinaSupport@esi.com

Singapore
New Wave Research
a division of esi

1 Kaki Bukit View #02-07
Techview
Singapore 415941
Phone: +65-6455-5158
Fax: +65-6553-0958
Email:SingaporeSupport@esi.com