

# **X-650 YAG**

**Laser Engraving System**  
Safety, Installation, Operation,  
and Basic Maintenance Manual

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**September 2002**



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# Introduction

We would like to thank you for your laser system purchase. Universal Laser Systems, Inc. (ULS) is the pioneer, and highest volume manufacturer, of large field, computer controlled laser engraving, marking, and cutting systems. ULS has devoted years of research and development to further the quality of our products that has resulted in a number of remarkable innovations within the laser industry. Since 1988, the staff at ULS has been dedicated to total customer satisfaction. When you buy Universal you get more than a laser - you get a team of talented, experienced, enthusiastic people who are focused on your satisfaction. Our commitment is to help you now and in the future.

To begin with, we highly recommend that this entire manual be read before attempting to use your laser system. The manual includes important information about safety, assembly, use, troubleshooting, and basic maintenance.

## How To Get Help

Before contacting our Technical Support Department, make sure that you have read this entire manual as well as any other accompanying manuals included with your laser system. The Troubleshooting Guide, found within this manual, is very comprehensive and provides the answers to frequently asked questions.

### Step 1:

Try to recreate the problem and write down the circumstances in which the problem occurred. Try to recall if the problem began all of a sudden, worsened over time, or began after you performed any recent maintenance. Also be prepared to describe all pertinent information about the computer being used such as software, ULS printer driver version, computer operating system and computer type.

### Step 2:

Make sure that you have the serial number of the laser system available. The serial number tags are located on the back of the machine, next to the exhaust port, and inside the front door, visible when you open it. The Technical Support Department may not be able to assist you without this number.

### Step 3:

Contact your local ULS Representative. They may have more details about your particular installation and applications. If possible, call from a phone that is close to the laser system so that it can be operated while talking to our representative.

### Step 4:

If your local Sales Representative cannot assist you and you would like to use our **FREE**, email based support system, log on to our website: [www.ulsinc.com](http://www.ulsinc.com). Click on the "Technical Support" link, then click on the "Technical Support Request Form" and follow the instructions.

### Step 5:

If you are unable to obtain Internet access, you may contact our Technical Support Department at:

### **Universal Laser Systems, Inc.**

Technical Support Department

16008 North 81<sup>st</sup> Street

Scottsdale, AZ 85260

Phone: 480-609-0297

Fax: 480-609-1203

M-F 7am – 6pm Arizona Time

# Specifications

<b>System Operating Environment Requirements (user provided)</b>	
Operating Environment	Well-ventilated office (recommended) or clean, light-duty manufacturing
Operating Temperature	50°F (10°C) to 95°F (35° C) capable 73°F (22°C) to 77°F (25° C) for best performance
Storage Temperature	50°F (10°C) to 95°F (35° C)
Operating Humidity	Non-condensing
Electrical Power	Single Phase 220V AC, 10/5 Amp, 50/60 Hz Grounded (earthed) and stable (surge and spike protected)
Particulate/Odor Outside Ventilated Exhaust System	High-pressure vacuum blower capable of 500 CFM (cubic feet per minute) @ 6 inches static pressure (850m3/hr at 1.5kPa)
Computer Requirement	Windows 2000/XP compatible
Software Requirement	Graphics or CAD based (See manual for recommendations)

<b>System Specifications</b>	
Laser Safety	Nd-YAG Laser, Interlocked Safety Enclosure = Class I
Laser Source	50 watt Diode Pumped Nd-YAG laser
Work Area	32" x 18" (812.8 x 457.2 mm)
Printer Driver	Windows 95/98 and Windows 2000/XP compatible
Hardware Interface	Centronics Parallel (included) RS232C Serial, USB, or Ethernet adapter options available
Memory Buffer	16 MB standard, single and multiple file storage modes with automatic data compression
Dimensions	36.5"L x 44"W x 39.5"H (92.7cm L x 111.8cm W x 100.3cm H)

Specifications subject to change without notice

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## Section 1

# Safety



## Description of Appropriate Use

ULS laser systems are designed for cutting and engraving of the materials listed in this manual and the Nd:YAG laser manual, in laboratory, workshop or light duty manufacturing environments. This laser system must be properly installed and connected to an appropriate exhaust system meeting the specifications outlined. Materials to be processed must fit completely inside the system for proper operation.

## General Safety

Failure to follow these guidelines can result in injury to yourself, others, or may severely damage the equipment and your facility. Using the system in a manner other than what is described in this manual may increase this risk. System care and operation must be followed in strict accordance to this manual.

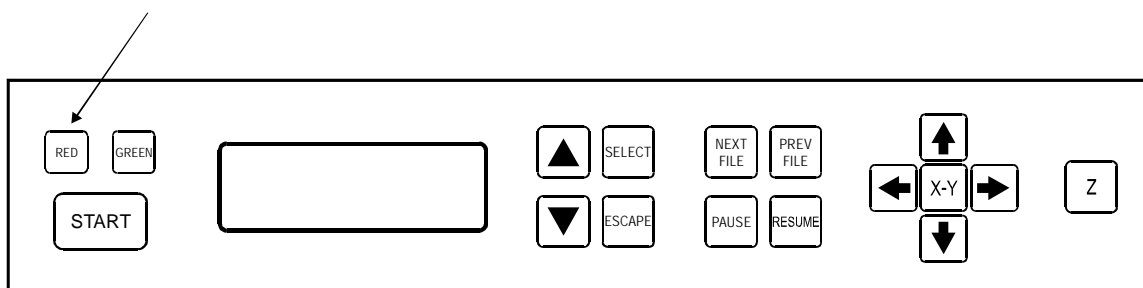
- **Exposure to the laser beam may cause physical burns and can cause severe eye damage.** Proper use and care of this system are essential to safe operation.
- **Never operate the laser system without constant supervision of the cutting and engraving process.** Exposure to the laser beam may cause ignition of combustible materials and start a fire. A properly maintained fire extinguisher should be kept on hand at all times.
- **A properly configured, installed, maintained, and operating fume/smoke exhaust system is mandatory when operating the laser system.** Fumes and smoke from the engraving process must be extracted from the laser system and exhausted outside.
- **Some materials, when engraved or cut with a laser, can produce toxic and caustic fumes.** We suggest that you obtain the Material Safety Data Sheet (MSDS) from the materials manufacturer. The MSDS discloses all of the hazards when handling or processing that material. **DISCONTINUE** processing any material that shows signs of chemical deterioration of the laser system such as rust, metal etching or pitting, peeling paint, etc.
- **Dangerous voltages are present within the electronics and laser enclosures of this system.** Although access to these areas is not necessary during normal use, if it becomes necessary to open one of these enclosures for service reasons please remember to disconnect the power cord from your electrical supply.
- **Care should be taken when moving or lifting the laser system** Obtain assistance from 1 or 2 additional people when lifting or carrying (secure motion system and doors). Severe bodily injury may occur if improper lifting techniques are applied or the system is dropped.
- **The laser system is specifically designed to comply with CDRH performance requirements under 21 CFR 1040.10 and 1040.11.** CDRH is the Center for the Devices of Radiological Health division of the Food and Drug Administration (FDA). This laser system also complies with CE (European Community) safety regulations. No guarantees of suitability or safety are provided for any use other than those specified by Universal Laser Systems Inc. Please contact Universal Laser Systems Inc. with any questions concerning laser safety before operating this system.

## Laser Safety

The device contains an Nd:YAG laser in a Class I enclosure that produces intense and invisible laser radiation at a wavelength of 1.064 microns in the infrared spectrum. For your protection, this enclosure is designed to completely contain the Nd:YAG laser beam. Improper use of controls and adjustments, or performance of procedures other than those specified, may invalidate the safety of this system.

- The entire system is completely enclosed with a protective housing. This will completely contain the invisible YAG laser beam under normal use. **DO NOT STARE INTO BEAM OR VIEW DIRECTLY WITH OPTICAL INSTRUMENTS.**
- The user door(s) are safety interlocked and will disable the Nd:YAG laser beam from firing when the user door(s) are opened. The control panel will also display a flashing "RED" light to visually indicate that the safety interlock system has been activated.

### Nd:YAG INTERLOCK INDICATOR LIGHT






- The intense light that appears during the engraving or cutting process is the product of material combustion or vaporization. **DO NOT STARE AT THE BRIGHT LIGHT OR VIEW DIRECTLY WITH OPTICAL INSTRUMENTS.**
- Do not operate any system that has had its safety features modified, disabled, or removed as this can expose your eyes and skin to invisible and visible laser radiation which can cause permanent blindness and/or severe burns to your skin.

## Machine Safety Labels

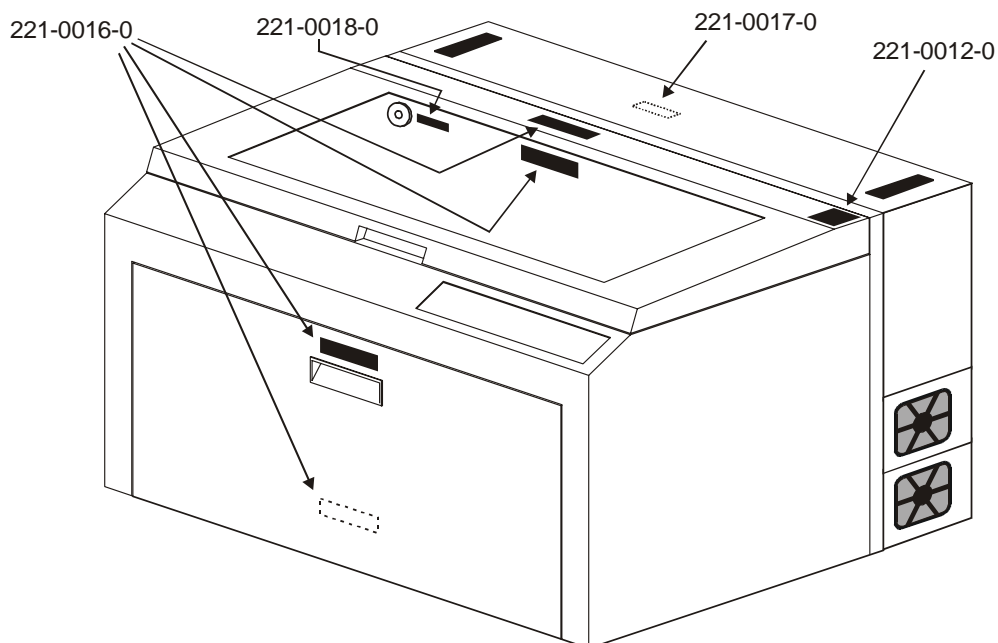
CDRH and CE regulations require that all laser manufacturers affix warning labels in specific locations throughout the equipment. The following warning labels are placed on the laser system for your safety. **DO NOT** remove them for any reason. If the labels become damaged or have been removed for any reason, **DO NOT OPERATE** the laser system and immediately contact Universal Laser Systems, Inc. for a free replacement. Labels are NOT to scale.

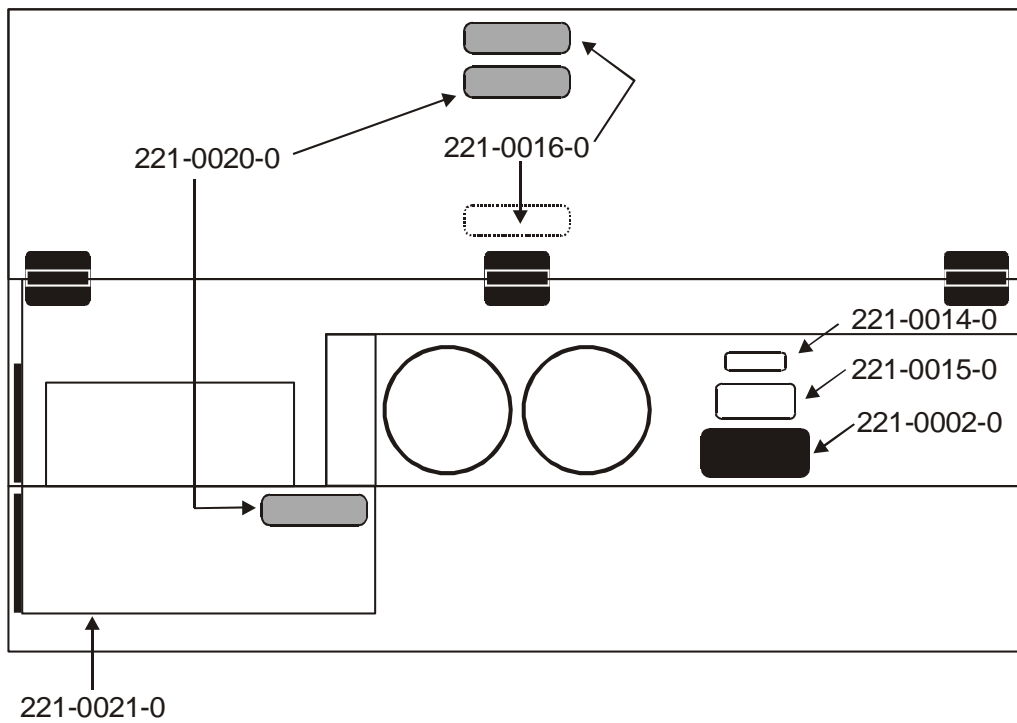
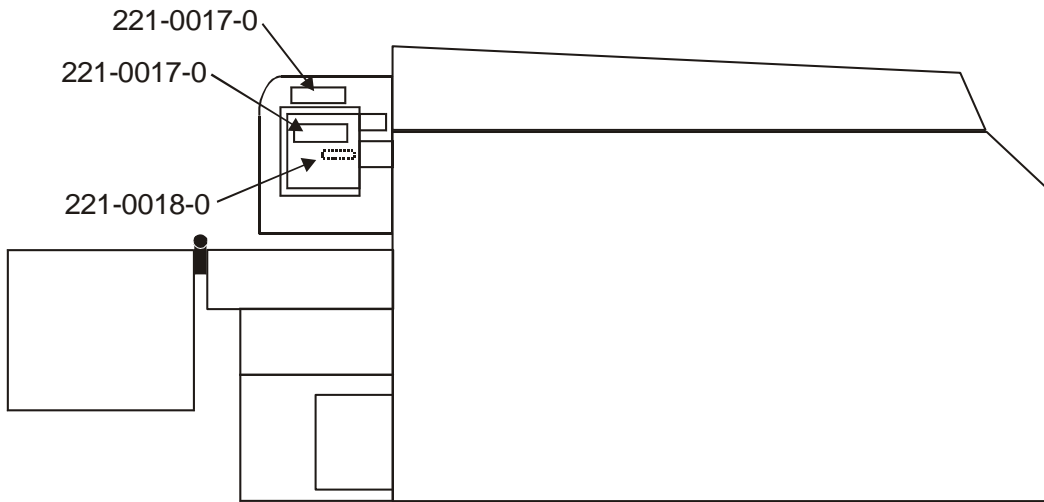


## SAFETY

<p style="font-size: small;">Laser Processing System Manufactured By:</p> <p style="font-weight: bold; font-size: large;">UNIVERSAL LASER SYSTEMS INC.</p> <p style="font-size: x-small;">Scottsdale, Arizona</p> <p>Model No: XXXXX Manufactured: XXXXX Serial No: XXXXX</p> <p style="text-align: right; font-weight: bold; font-size: large;">CE</p> <p style="text-align: right; font-size: x-small;">Made in USA</p> <p style="text-align: center; font-weight: bold; font-size: large;"># 221-0002-0</p>	<div style="border: 1px solid black; padding: 5px; text-align: center;">  <p style="font-weight: bold; font-size: small;">WARNING</p> <p style="font-size: x-small;">NEVER OPERATE THE LASER SYSTEM WITHOUT CONSTANT SUPERVISION</p> <p style="font-size: x-small;">EXPOSURE TO THE LASER BEAM MAY CAUSE IGNITION OF COMBUSTIBLE MATERIALS WHICH CAN CAUSE SEVERE DAMAGE TO THE EQUIPMENT</p> </div> <p style="text-align: center; font-weight: bold; font-size: large;"># 221-0012-0</p>	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p style="font-weight: bold; font-size: large;">CLASS 1 LASER PRODUCT</p> </div> <p style="text-align: center; font-weight: bold; font-size: large;"># 221-0014-0</p>
<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p style="font-size: x-small;">THIS EQUIPMENT CONFORMS TO PROVISIONS OF US 21 CFR 1040.10 AND 1040.11</p> </div> <p style="text-align: center; font-weight: bold; font-size: large;"># 221-0015-0</p>	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p style="font-weight: bold; font-size: large;">DANGER</p> <p style="font-size: x-small;">INVISIBLE AND VISIBLE LASER RADIATION WHEN OPEN AND INTERLOCK FAILED OR DEFEATED AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION</p> </div> <p style="text-align: center; font-weight: bold; font-size: large;"># 221-0016-0</p>	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p style="font-weight: bold; font-size: large;">DANGER</p> <p style="font-size: x-small;">INVISIBLE AND VISIBLE LASER RADIATION WHEN OPEN AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION</p> </div> <p style="text-align: center; font-weight: bold; font-size: large;"># 221-0017-0</p>
<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p style="font-weight: bold; font-size: large;">AVOID EXPOSURE</p> <p style="font-size: x-small;">INVISIBLE LASER RADIATION IS EMITTED FROM THIS APERTURE</p> </div> <p style="text-align: center; font-weight: bold; font-size: large;"># 221-0018-0</p>	<div style="border: 1px solid black; padding: 10px; text-align: center;">  <p style="font-weight: bold; font-size: small;">WARNING</p> <p style="font-size: x-small;">TO AVOID RISK OF ELECTRIC SHOCK ALWAYS DISCONNECT POWER CORD BEFORE REMOVING THIS COVER</p> </div> <p style="text-align: center; font-weight: bold; font-size: large;"># 221-0020-0</p>	<div style="border: 1px solid black; padding: 10px; text-align: center;">  </div> <p style="text-align: center; font-weight: bold; font-size: large;"># 221-0021-0</p>

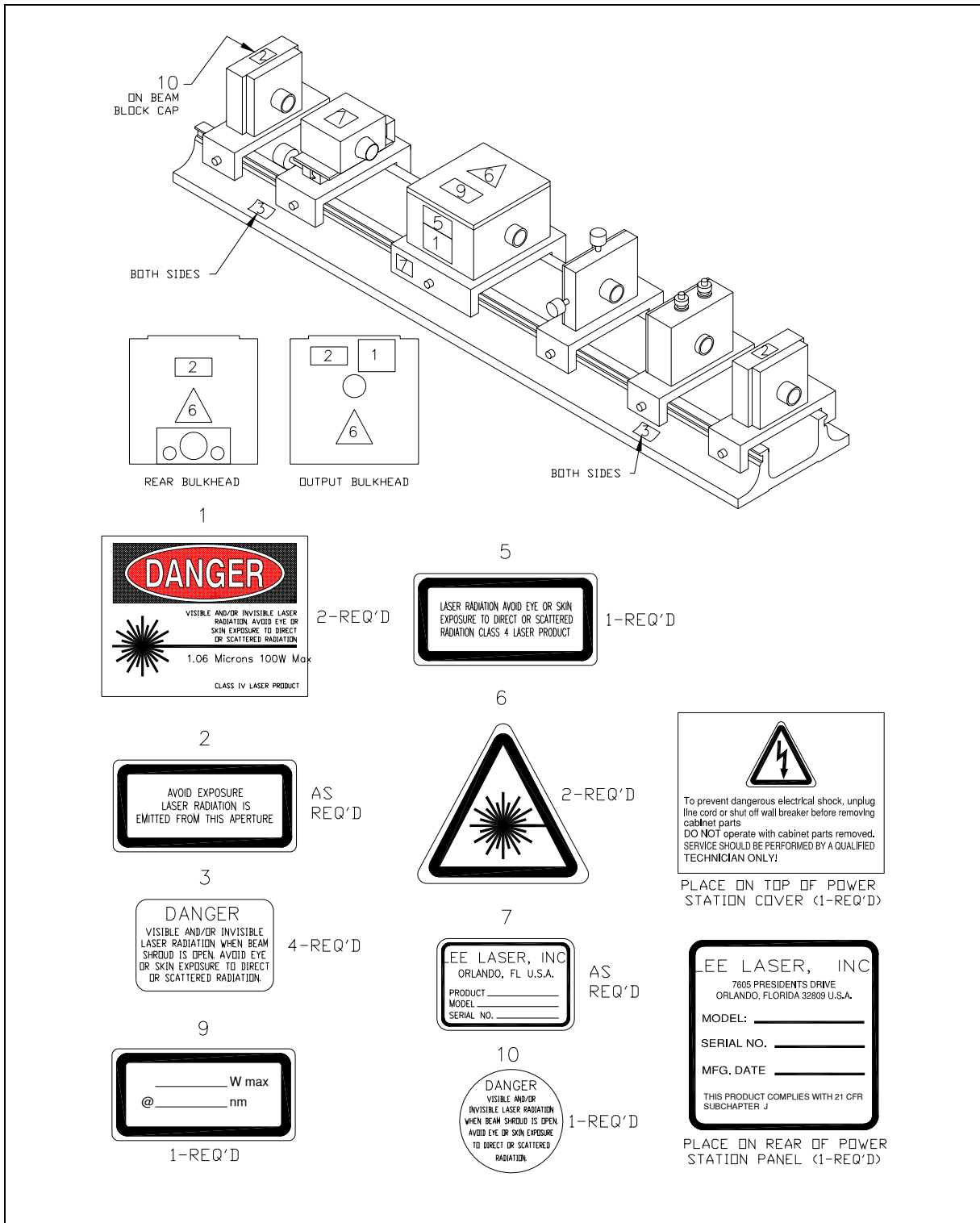
### Machine Safety Label Locations





# Laser Safety Label Locations

The ND:YAG laser located inside the machine under the back laser cover also displays safety labels applied by its manufacturer. The figure below illustrates the proper locations and quantities for these labels.



## EU Compliance (CE)

### **UNIVERSAL** LASER SYSTEMS INC.

**Product Identification:** X-650Y  
Laser Engraving and Cutting Systems

**Manufacturer:** Universal Laser Systems, Inc.  
16008 N. 81<sup>st</sup> St.  
Scottsdale, AZ 85260  
Phone: (480) 483-1214 Fax: (480) 483-5620  
USA

This equipment is manufactured in conformity with the following directives:

89/336/EEC (EMC Directive)  
73/23/EEC (Low Voltage Directive)  
89/392/EEC (Machinery Directive)

based on the standards listed.

**Standards Used:**

Safety:

EN 60950: 1995  
EN 60825: 1994 (Class IIIa)

EMC:

EN 55022: 1995 (Class A)  
EN 50082-1: 1992  
EN 60801-2: 1993 (6kV CD, 8kV AD)  
EN 61000-3-2: 1996 (class A)  
EN 61000-3-3: 1995  
EN 61000-4-3: 1997 (3 V/m)  
EN 61000-4-4: 1995 (2 kV power line, 0.5 kV signal line)  
EN 61000-4-5: 1996 (class 2)

Note: This is not a declaration of conformity. The importer of this equipment supplies the declaration of conformity.

**Warning -** This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

# FCC Compliance

This ULS laser system has been tested and found to comply with Federal Communication Commission (FCC) directives regarding Electromagnetic Compatibility (EMC). In accordance with these directives ULS is required to provide the following information to its customers.

## **FCC Compliance Statement and Warnings**

This device complied with FCC Rules Part 15. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

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

Users should be aware that changes or modifications to this equipment not expressly approved by the manufacturer could void the user's authority to operate the equipment.

This equipment has been type tested and found to comply with the limits for a Computing Device per FCC part 15, using shielded cables. Shielded cables must be used in order to insure compliance with FCC regulations.

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## Section 2

# 2

# Installation

The following operational guidelines are vital to a safe and productive environment. It is your responsibility to provide a proper operating environment.



Damage to the laser system due to an inadequate or improper operating environment is considered abuse and **WILL NOT** be covered under warranty. In no event will ULS be liable for any damages caused, in whole or in part, by customer, or for any economic loss, physical injury, lost revenue, lost profits, lost savings or other indirect, incidental, special or consequential damages incurred by any person, even if ULS has been advised of the possibility of such damages or claims.

## System Operating Requirements

### Environment (user supplied)

- The laser system **MUST** be installed in an office-type or light duty manufacturing environment. Dusty or dirty air environments can damage the laser system. Keep the laser system isolated from any type of sandblasting, sanding, oily, or any other machinery that produces airborne particles.
- Avoid small, enclosed, non-ventilated areas. Some materials, after laser engraving or cutting, continue emitting fumes for several minutes after processing. Having these materials present in a confined, unventilated room can contaminate the room.
- Operate the laser system between the ambient temperatures of 73°F (22°C) to 77°F (25° C). However, the system can operate between the temperatures of 50°F (10°C) to 95°F (35° C).
- Avoid storing the laser system outside the temperatures of 50°F (10°C) to 95°F (35° C) as excessively cold or hot temperatures can damage the system.
- Ambient humidity levels must be non-condensing.

### Electrical (user supplied)

- Refer to the label on the rear of the power supply unit your system's electrical requirements.
- **Never remove the ground lead to the electrical cord and plug the system into a non-grounded outlet.** This is very dangerous and can lead to a severe, if not fatal, electrical shock. Always plug the system into a properly grounded (earthed) outlet.
- Noisy or unstable electricity as well as voltage spikes can cause interference and possible damage to the electronics of the laser system. If electrical power fluctuations, brown outs, or constant power outages are a problem in your area, an electrical line stabilizer, UPS (Uninterruptible Power Supply), or backup generator might be required. You may also need to connect the laser system to a dedicated electrical line to resolve the problem.

### Exhaust System (user supplied)

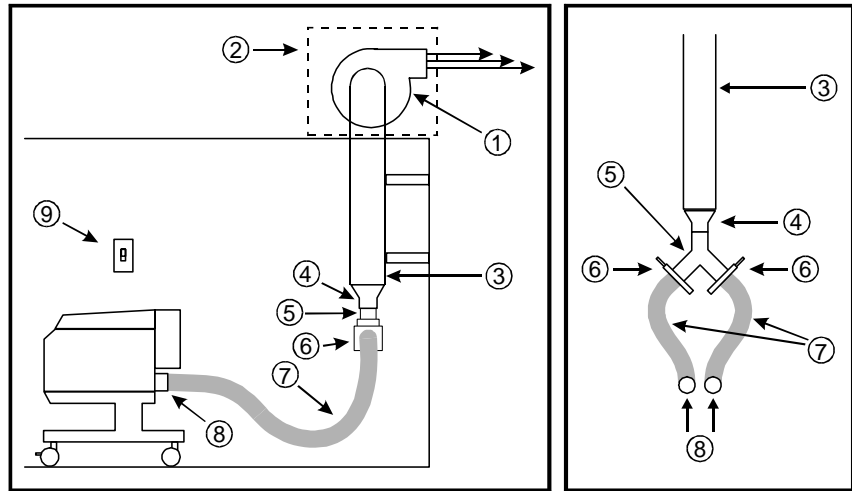
- The exhaust system **MUST** be capable of supplying a minimum of 500 CFM (cubic feet per minute) of airflow while under a load of 6 inches of static pressure (850m<sup>3</sup>/hr at 1.5kPa). **DO NOT** install forward incline, backward incline, in-line, or ventilator fans because these types of air handlers are inadequate and inappropriate for this type of installation. A high-pressure blower **MUST** be used to meet minimum airflow requirements.
- The blower **MUST** be mounted on the **OUTSIDE** of the building.
- Rigid tubing should be used for 90% of the distance traveled between the blower and the laser system. The tubing should be smooth walled and have as few 90 degree bends as possible.
- Install a gate to control airflow and to close off the exhaust from the outside environment when the laser is not in use. Place this gate within 5 – 10 feet from the laser system.

## INSTALLATION

- Use a short piece of industrial grade, wire reinforced rubber tubing to connect the end of the gate to the laser system. This will provide mobility and will dampen blower vibrations.
- Have the blower electrically wired to a wall switch in the same room for easy ON/OFF control.

The following diagram shows a typical exhaust system layout. Use this as a guideline to proper exhaust system installation. Although this diagram just serves as an example, we recommend installation of the exhaust system by a licensed contractor to meet safety and local code requirements as well as being able to calculate the correct size blower required for your particular installation. Length of exhaust pipe, exhaust pipe diameter, number of 90-degree angles, and other restrictions must be calculated when determining the correct exhaust blower unit. Installing an undersized or oversized blower is not only unsafe, but it can also lead to premature and excessive wear and tear to the laser system.

- (1) Exhaust blower mounted outside.
- (2) Weatherproof shield
- (3) Rigid ducting matching the diameter of the blower inlet
- (4) Reducer to 4 inches
- (5) Y-pipe
- (6) Shut-off or air-flow gate(s)
- (7) Flexible, wire-reinforced, industrial grade rubber hose
- (8) Connection to laser
- (9) On/Off switch



### Minimum Computer Configuration (user supplied)

Pentium 300 MHz using 2000/XP	CD-ROM Drive
256 MB RAM	Mouse or other pointing device
2 Gigabyte hard drive or bigger	3.5" floppy disk drive
17 inch color VGA monitor	600 DPI Optical Resolution Scanner (optional)

### Suggested Software (user supplied)

ULS does not guarantee software compatibility with any off-the-shelf software program that has not been written by ULS. However, the following suggested programs are widely used by ULS customers and are considered to be the most functional and compatible programs to use with the laser system.

### Graphics Programs (user supplied)

CorelDRAW, Macromedia Freehand, or Canvas

### Bitmap / Scanning Software (user supplied)

Corel PHOTO-PAINT or Adobe Photoshop

### Raster to Vector Conversion Software (user supplied)

Adobe Streamline or CorelTRACE

### CAD Software (user supplied)

AutoCAD or AutoCAD LT for Windows

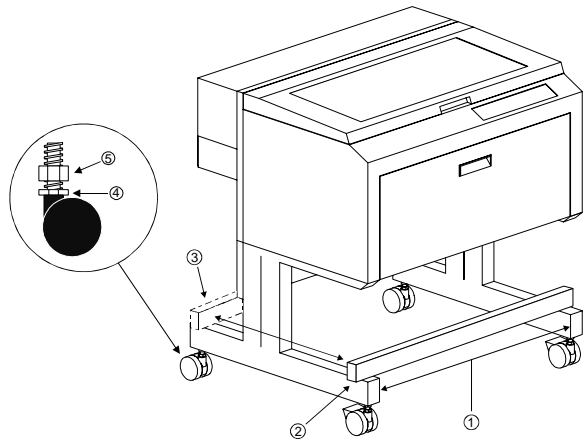
### FONTS (user supplied)

True Type fonts **ONLY**. Do not use PostScript or bitmapped fonts.

## System Setup

Move the laser system to the desired operating location. If the floor underneath the laser system, at this location, is uneven, the casters must be adjusted. **Uneven flooring can cause mechanical problems with the operation of the motion system, which can seriously affect engraving or cutting quality.**

1. Place a bubble level across the front (2) and rear legs (3). Adjust the caster height using the adjustment screw (4) until both the rear part and the front part of the legs are level with respect to each other. Once the system is level, secure all casters by tightening the nut (5) up against the cart leg.
2. Open the top door and remove the rubber band that is holding the arm in place.
3. If you haven't already done so, remove any remaining packing materials, accessories or any other items that may be located inside the cabinet or on top of the engraving table.
4. Attach all the connections from the system to the Power Supply Cabinet. Refer to the labels on each connection and the back of the power supply cabinet. Also refer to the "Lee Laser" manual for more details.



## Finalizing the Connections

Make the following connections in the exact order described otherwise static electricity can damage the computer and/or the laser systems electronics.

- Connect your 4-inch flexible rubber exhaust system hoses to the 4-inch outlets found at the rear of the laser system. Use a hose clamp so that it doesn't fall off.
- Connect the power supply cabinet's power cord (already done) and your computers power cord to the electrical power source. **DO NOT POWER ON EITHER DEVICE AT THIS TIME.**
- The laser system is standard equipped with a parallel printer cable. You may have purchased the optional USB or Ethernet adapter. Follow the instructions below pertaining on the cable you received.

### Parallel Printer Cable (standard)

The laser system comes equipped with a high quality 6-foot IEEE1284 compliant Centronics parallel printer cable. Please use this cable and do not substitute it with any other. Connect the printer cable directly from your computers parallel printer port to the port in the rear of the laser system. **DO NOT USE ANY ADAPTERS, EXTENSION CABLES, SWITCH BOXES, PARRALEL PORT CD-ROM, PARALLEL PORT SCANNER, ZIP DRIVE, OR ANY DEVICE BETWEEN THE COMPUTERS PARALLEL PRINTER PORT AND THE PORT ON THE LASER SYSTEM OTHERWISE DAMAGE TO THE COMPUTER OR THE LASER SYSTEM CAN OCCUR AS WELL AS FILE TRANSMISSION PROBLEMS.**

Power ON your computer and check your computers BIOS setting for its parallel port mode. You must set the parallel port mode to "Standard Parallel Port (SPP)", "Normal", or "Output Only". If these choices are not available, set it to "ECP". **DO NOT SET IT TO "EPP" or "Bi-directional"**. The laser system does not support these modes. If your computer is set to an incorrect configuration, erroneous data will be sent to the laser system during printing. This can cause the system to lock up, print garbage information, or not print at all. For information on how to check or adjust your computers BIOS setting, please refer to your computers owner manual or contact their technical support department.



**USB to Parallel Printer Cable Adapter**

To use this device, you must have one USB port available in your computer or from a USB hub. The laser system does not have a built-in USB port. However, you can use this adapter to connect the USB part of the adapter to your computer (or hub) and the parallel port end to the laser system. This adapter comes complete with installation software. Please follow the manufacturer's instructions on how to install and use this device.

**Ethernet to Parallel Printer Cable Adapter**

To use this device, you must have one Ethernet port available in your computer or from an Ethernet hub. The laser system does not have a built-in Ethernet port. However, you can use this adapter to connect the Ethernet part of the adapter to your computer (or hub) and the parallel port end to the laser system. This adapter comes complete with installation software. Please follow the manufacturer's instructions on how to install and use this device.

**Printer Driver Installation**

At this point you need to install either the Windows 95/98 or the Windows 2000/XP printer driver. Included with your laser system in another manual called "Computerized Controls" which describes the installation and use of the ULS printer driver and also contains information regarding the setup and proper use of the recommended graphics software and CAD programs. Please read the "Computerized Controls" manual completely before proceeding to the next section.

## Section 3

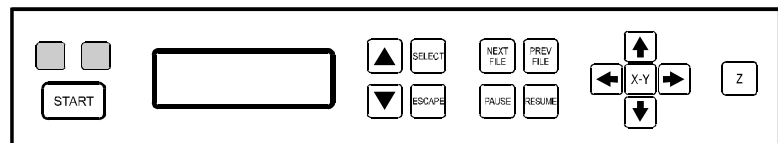
# 3

# System Operation

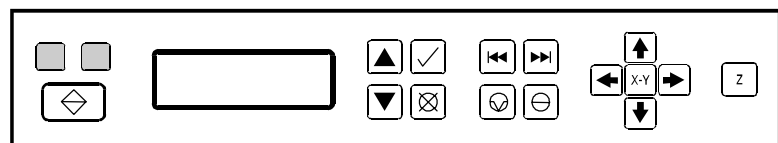
From the control panel menus and buttons to focusing, loading and unloading materials, this section covers the actual laser engraving and cutting process. If you have done so already, power ON your computer and let it boot up completely **BEFORE** powering ON the laser system otherwise your laser system can “lock up” when attempting to run the first file and the only way to clear this error is to power the system OFF and then ON again. You do not need to turn on your exhaust system at this time.

## The Control Panel

The control panel on the laser system provides easy access to all of the controls necessary for cutting and engraving operations. There are two versions of keypads, the CE (European Community) symbolic keypad and the English version keypad. When your laser system has finished initializing and homing, and if all the doors are closed, the green light, on the control panel will be illuminated and the display will indicate READY.



CE version



English version

The RED LED and GREEN LED (Light Emitting Diode) will act differently depending on the current state of the laser system. Please refer to the chart below.

### Red LED

CONDITION	REASON
ON	The system is initializing
	The system is firing the beam in the Alignment Mode
OFF	The system has finished initializing and is ready to receive a file
	The top, front, or laser cover door is closed
FLASHING	The top, front, or laser cover door is open

### Green LED

CONDITION	REASON
ON	The top, front, and laser cover doors are closed and the system is ready to receive a file
	The system has finished processing a file and has returned to the home position
	The system has been paused while running a file
OFF	The top, front, or laser cover door is open
	The laser system is firing the beam in the Alignment Mode
FLASHING	The system is running



**START:** Begins laser processing of the current file displayed in the “FILE DISPLAY” menu. If any of the doors are open when you press this button, the motion system will start to move as if it is processing the file, however, the laser beam is disabled.



**UP and DOWN:** Moves the cursor up or down in the display. Also used to increase or decrease the value of the number that the cursor is positioned on top of.



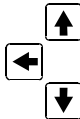
**SELECT and ESCAPE:** Depending on which menu you are in at the time, SELECT (left) either enters you into that menu item the cursor is currently on, or it toggles that menu item to display different choices. Also depending on which menu you are in at the time, ESCAPE (right) either exits you back to the previous menu or it cancels any changes that you have made to that menu item.



**PREVIOUS and NEXT FILE:** While in the FILE DISPLAY menu, NEXT FILE (right) advances the next file in the systems memory, makes it the current file, and will stop incrementing when you reach the last file in memory. PREVIOUS FILE (left) displays the previous file in the systems memory, makes it the current file, and will stop decrementing when you reach the first file in memory.



**PAUSE and RESUME:** If a file is running, the PAUSE button (left) halts the engraving or cutting process and the focus carriage will move to its home position in the upper right corner of the engraving area. RESUME (right) will begin cutting or engraving again at the location where the motion system was paused. Please wait for the motion system to stop and move to the home position before opening any door otherwise the laser beam will not resume from the position it stopped at.



**MOTION CONTROL:** Pressing and holding down one or two adjacent, arrow buttons will cause the Focus Carriage to move in the respective direction. The focus carriage will start to move slowly and will accelerate to a faster speed until you release the button(s).



**X-Y POSITION:** Selectable only while the READY menu or FILE DISPLAY menus are displayed. It enables the ORIGIN POSITION menu to appear



**Z:** This is the “focusing” button. The READY menu or the FILE DISPLAY menu must be the current menu for this button to be operable. This button positions the focus carriage at the default (1,1) position in the engraving area and activates the “Z Position” menu. Pressing the button again, or the PAUSE button, will move the focus carriage back to the home position.

## The Menu System

### READY

After the system is powered ON, INITIALIZING will appear, along with the model name, until it has completed performing its initialization and homing routine. READY will then appear indicating that the system is ready to accept files. Without downloading any files, pressing ESCAPE will bring you to the MAIN menu display. If you just download a file, without pressing ESCAPE, the MAIN menu will be bypassed and the FILE DISPLAY menu will appear, displaying the name of the first file downloaded.

### FILE DISPLAY

This menu appears automatically after the first file has completely downloaded into the laser system's memory. Utilizing the NEXT FILE and PREVIOUS FILE buttons, display the appropriate downloaded file and press the START button to begin laser processing. The current power, speed, PPI, and Image Density setting are displayed as well as a timer and COPIES function. The timer will pause when the PAUSE button is pressed and starts up again when RESUME is pressed. The COPIES feature shows you how many copies of that file were completed.

## MEMORY CONTROL

The laser system is equipped with 16 Megabytes standard and is expandable to 32 Megabytes to store downloaded files while the system is powered ON. Eventually the memory will fill up with files that will need to be deleted to free up space for more files. To delete one file at a time, display the desired file by using PREVIOUS FILE or NEXT FILE buttons. Use the UP or DOWN arrow button to position the cursor on the DELETE THE FILE menu item and then press SELECT. Select a CANCEL or YES response to the ARE YOU SURE question. To completely clear out all files at the same time, position the cursor on the DELETE ALL FILES option and press SELECT.

## DOS POWER SETTINGS

Use this menu selection ONLY if you are printing from a DOS based CAD program that can output pure HPGL. Here you can assign POWER, SPEED, and PPI to the pen numbers as if you were assigning pen colors to a flatbed plotter. Since using this menu feature has many limitations, we suggest using only Windows based software.

## PREFERENCES

Options, diagnostic, and maintenance features are found within this menu selection. If you change anything within this menu, and would like those changes to remain, next time you power ON the system, make sure you ESCAPE back to the MAIN menu before turning off the laser

## OPTIONS

Select this menu to access optional features that your system may have.

### ONE FILE MEMORY

Pressing SELECT will toggle the setting ON (ONE FILE MEMORY enabled) and OFF (MULTIPLE FILE MEMORY enabled). The purpose of ONE FILE MEMORY is to store only one file in the laser system's memory. Successive file downloads erase the previous file in memory, avoiding the need to constantly clear the memory or press the NEXT FILE button. This feature is useful if you only run files only once. However, if you want to repeat the file that is memory, you may do so as many times as you want providing that you do not download a new file or power the system off. While this mode is ON, we recommend that you do not print to the laser system until it has finished processing the current file, otherwise you may get a "printer timeout" error displayed on your computer. This is because that while the laser system is running, the parallel port blocks the incoming file from erasing the file you are running. When the file is finished running or you PAUSE the file, the port opens and allows the new file to replace the current file. Be careful when using this feature.

### AUTOFOCUS

The SELECT button will toggle this setting ON (AUTOFOCUS enabled) and OFF (manual focus enabled). Refer to the FOCUSING METHODS section on how to use this feature.

### AIR ASSIST

Not available in this model.

### DUAL HEAD

Not available in this model.

## CONFIGURATION

Selecting this menu will allow the reconfiguration of certain features of the laser system.

**SET FOCUS POSITION**

Allows you to set the focus position anywhere in the field other than the factory default setting of (1 inch, 1 inch). To change this setting, use the motion control arrow buttons to position the focus carriage in the desired position. Then, bring the cursor down to the YES SAVE POSITION line and press the SELECT. Press the ESCAPE button twice to exit back to the MAIN menu to store this new setting.

**SET ROTARY AXIS**

This setting is pre-set at the factory. It is not necessary to change this setting unless you are positioning the Rotary Fixture in a location in the engraving area other than the factory default position. If you have purchased this option, please refer to the OPTIONS and ACCESSORIES section of the manual for more information.

**TICKLE**

This is the term used to define the small pulses sent to keep the plasma inside the laser, energized. It is not necessary to adjust this setting unless directed to so. Altering this setting can produce adverse results.

**PORTS**

Two ports are provided on the back of the system for interface with a computer, a serial and a parallel port. The factory default is already set to PARALLEL. Only one port can be used at a time. If you would like to use the SERIAL port a special cable is required. Please contact our Customer Service Department for more details.

**LANGUAGE**

Use the SELECT button to toggle through many different language choices. When the desired setting is displayed, press the ESCAPE button twice to exit back to the MAIN menu to store this setting before you power off the laser system.

**UNITS**

Use the SELECT button to toggle between INCHES and METRIC units. Once the desired unit is displayed, press the ESCAPE key twice to exit back to the MAIN menu. When the desired setting is displayed, press the ESCAPE button twice to exit back to the MAIN menu to store this setting before you power off the laser system.

**DIAGNOSTICS**

This menu leads to other menus that help our Customer Service Department diagnose problems with the laser system. Do not use this menu unless assisted by our Customer Service Department or you have been trained on how to use it properly.

**ALIGNMENT MODE**

Is not used with this model.

**MEMORY TEST**

Tests the on-board RAM memory in the laser system.

**MOTOR STATUS**

Displays the condition of the stepper motors in the motion system.

**ABOUT**

Displays the model, our copyright notice, and the current version of firmware.

The following menu is only accessible while the cursor is located in either the **READY** or the **FILE DISPLAY** menus. It is not accessible if the cursor is in the **DOS POWER SETTINGS** or the **PREFERENCES** menus.

### ORIGIN POSITION Menu (X-Y button)

The default origin position is the (0,0) position of the rulers. To position the origin to any other point in the engraving area, press the X-Y button and using the directional arrow buttons, move the focus carriage to position the carriage to the new origin location, bring the cursor down to the SET NEW ORIGIN menu item and press the SELECT button. Move the cursor down to YES, SET NEW ORIGIN, and press SELECT again. Since setting a new origin other than the default (0,0) position will shrink your field size, we suggest that you use this feature cautiously and make sure that you do not set a new origin that would cause you graphic to print off the engraving area. This setting is temporary and will reset after you power the system OFF.

At the bottom of the menu you will find RE-HOME X & Y. Selecting this menu item will re-home the focus carriage to the upper right corner of the field. This feature is useful if you accidentally nudged the focus carriage and you need to re-home the machine without turning it off and on again otherwise your files would have to be re-sent.

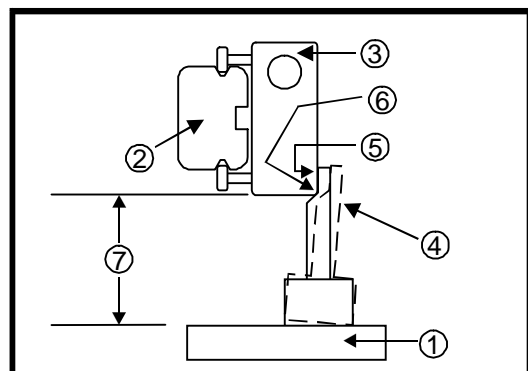
## Focusing Methods

The laser beam passes through the focus lens and converges to a small spot, called the focus point, approximately 2 inches from the bottom of the focus carriage when using a 2.0 lens. In order to engrave or cut properly with the laser beam, the material must be placed exactly at that focus point. To accomplish this, the Z-axis engraving table moves up and down. There are three methods used to focus the laser beam to the surface of the material, using the focus tool, using the Z -AXIS POSITION display, and using AUTOFOCUS. **The Z -AXIS POSITION menu is only accessible while the cursor is located in either the READY or the FILE DISPLAY menus. It is not accessible if the cursor is in the MEMORY CONTROL, DOS POWER SETTINGS or the PREFERENCES menus.**

### Focus Tool Method

Place your material into the upper left corner of the engraving field against the rulers. Visually make sure that the height of the material will not interfere with the focus carriage when it moves over the material. While either the **READY** or **FILE DISPLAY** menu is displayed, press the Z button.

The focus carriage will move to the upper left corner of the engraving area. Use the MOTION CONTROL buttons to position the focus carriage elsewhere if your material is not positioned at (1,1). You can move the Z-axis Table up or down, at a fast rate, by pressing once or holding down either the UP or DOWN arrow button while the display cursor is positioned on top of the first digit to the right of the decimal point digit. To move the table slowly, press the SELECT button to bring the cursor over to the rightmost digit and again use the UP or DOWN button. You should practice moving the table up and down before using the focus tool.

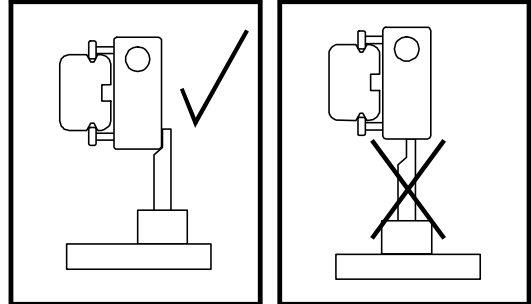


- 1) Material
- 2) X-axis Rail
- 3) Focus Carriage
- 4) Focus Tool
- 5) Flat Edge
- 6) Top of Beveled Edge
- 7) Focal Length

Place the focus tool (4) on top of the material (1) and position the focus carriage (3) directly above it. Raise or lower the table so that the flat edge (5) the tool rests against the front side of the focus carriage. Slowly raise the table until you observe the tool either tilting or sliding away from the focus carriage. This will occur when the bottom edge of the focus carriage meets with the top of the beveled edge (6) of the focus tool. The objective is to stop moving the table at the point where the tool just starts to move or tilt. The focal length (7) distance should be approximately the length (in inches) engraved on the front side of the focus carriage. The standard and most common lens to use is the 2.0-inch focal length lens. Press the Z or the ESCAPE button to move the focus carriage back to the home position.



**WARNING:** To avoid damage to the focus lens, avoid positioning the focus tool underneath the focus carriage.



Sometimes it is desirable to be slightly out of focus when engraving or cutting. It widens the beam at the surface of the material to soften the image or create a wider cut line.



**WARNING:** DO NOT engrave or cut too far out of focus, as this can be a potential fire hazard. A maximum of .05 inches above or below precise focus should be the absolute limit.

From a physics point of view, there is no difference between raising the Z-axis table a specified distance from the focal point and lowering the table the same distance from the focal point. However, from an applications point of view, we recommend lowering the Z-axis table when intentionally **RASTER ENGRAVING** out of focus and raising the Z-axis table when intentionally **VECTOR CUTTING** out of focus.

### Material Thickness (Z POSITION) Method

Press the Z button. Verify that the CURRENT LENS displayed is the same as the one being used. If not, position the cursor on the second line in the display and press the SELECT button to toggle through the choices. When the correct lens is displayed, re-position the cursor to the top line and then over to the first or second digit. Raise or lower the table until the display shows the material thickness either in inch or metric units. Focusing using this method is now complete.

Periodically you should check if the Z POSITION method is calibrated with your focus tool. Since your focus tool is your absolute reference, make sure that you do not lose it. The SET FOCAL HEIGHT menu is used to recalibrate the Z POSITION method.

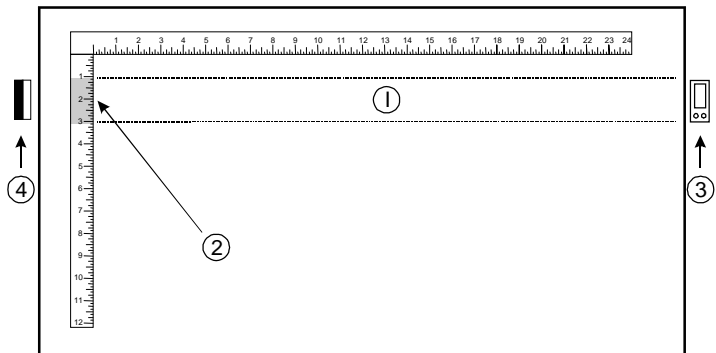
### SET FOCAL HEIGHT (Calibration) menu

To re-calibrate, the Z-axis must first be re-homed. Make sure all items are removed from underneath the Z-axis table. Position the cursor to the last line, RE-HOME Z-AXIS and press SELECT. The table will quickly move down to the bottom of its travel and then stop after it makes a few up and down moves.

Using the focus tool that matches the CURRENT LENS displayed, position the Z-axis table so that the laser will be focused on the table's surface. If the display does not read 0.00, move the cursor down to the SET FOCAL HEIGHT menu item and press the SELECT button. Respond YES to the ARE YOU SURE? question to complete the calibration. The Z POSITION display will now read 0.00 and will be **PERMANENTLY STORED IN MEMORY** until you do this procedure again. If you have purchased other lenses, you can set each of their focal heights by making that lens the CURRENT LENS and repeating this procedure.

### AUTOFOCUS Method

This option **CAN ONLY BE USED WITH QUALIFIED MATERIALS**. Qualified materials are materials that are very flat, non-transparent, non-elevated, and at least 2 inches tall in the Y-axis direction. To activate AUTOFOCUS, go to the "OPTIONS" menu, move the cursor to AUTOFOCUS and press SELECT. Then press ESCAPE two times to get back to the "FILE DISPLAY" menu. Place your material anywhere within the AUTOFOCUS zone (1), which spans across the table where the Y-axis ruler is indented (2). Your material must completely obstruct the AUTOFOCUS zone (1) in the Y-axis direction (be at least 2 inches tall in the Y-axis) or it may not operate properly.



To activate the process, press the Z button once and observe the Z-axis table automatically adjust the table to the proper focusing height. Be sure that the CURRENT LENS choice in the menu system is the same as the lens installed, if not, choose the correct lens, escape out of the Z POSITION menu and AUTOFOCUS again.

Periodically you should check if the AUTOFOCUS method is calibrated with your focus tool. Your focus tool is your absolute reference, so make sure that you do not lose it.

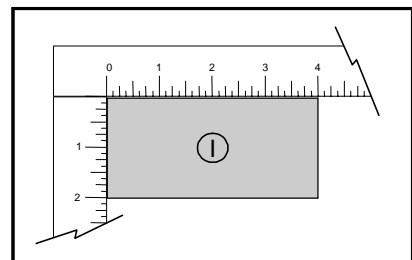
To verify that AUTOFOCUS is correctly calibrated, place an AUTOFOCUS qualified material in the upper right corner of the engraving field and AUTOFOCUS on it. Then, **WITHOUT EXITING OUT OF THE AUTOFOCUS MENU**, place the focus tool on top of the material and use the UP and DOWN buttons to set focus using the tool (as in the FOCUS TOOL method). When completed, observe the number in the Z AXIS POSITION menu. If it displays 0.00, then AUTOFOCUS is calibrated. If not, move the cursor down to "SET FOCAL HEIGHT" menu item and press the SELECT button. Respond YES to the ARE YOU SURE? question to complete the calibration. The Z AXIS POSITION menu should now display 0.00. If additional focus lens kits were purchased, then you will need to repeat this procedure for each lens but make sure that the CURRENT LENS menu matches the lens installed and the focus tool.

### Making a Sample, Step-by-Step

We will now illustrate how to use the laser system to create a product from start to finish. As an example, we will raster engrave and vector cut a key chain from a 2 by 4 inch, 1/8 inch thick piece of hardwood. It is preferable to use a hardwood such as Cherry or Walnut as opposed to grainy wood such as Oak or a manufactured product such as plywood or melamine.

#### Step 1 – Loading and Positioning the Material

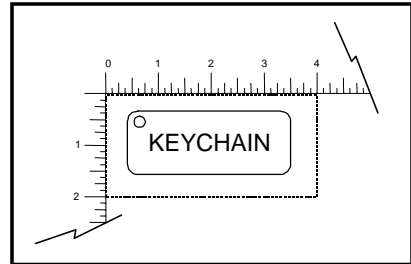
Open the top door and position the piece of wood (1) into the upper left corner of the table, against the rulers, as the diagram indicates. If the piece of wood is more than the example then use the rulers to measure the size of the piece.





## Step 2 - Creating the Graphic

Verify that the page size, in your graphic software, matches the ULS printer driver's maximum page size. We recommend that you always leave the page size set to the maximum for your system and position your graphic accordingly. Create some text with a **BLACK** colored fill and **NO** outline. For example, type in the word "KEYCHAIN". Draw an outline box around the text, color the outline **RED**, give the outline a thickness of .00005 inches (or the smallest possible line width), remove the fill color (if any), and round the edges if desired. Now add a circle with the same **RED** outline .00005 inches (or the smallest possible line width) and **NO** fill, for the key ring.



Position the graphic, on your computer screen, relative to size of the wood and how the piece of wood is positioned in the engraving area.

## Step 3 - Printing to the Laser System

The following steps assume that CorelDraw 10 is being used as your graphics software. Other graphic software programs may differ.

When you are ready to print the file to the laser system, click FILE and then click PRINT. Make sure that the laser system appears in the DESTINATION NAME dropdown list, and then click PROPERTIES to display the ULS printer driver settings.

Adjust the settings using the MATERIAL SETTINGS GUIDE section of this manual. Once you have completed entering the desired parameters, click OK to exit the printer driver, and click PRINT to begin printing to the laser system.

A status screen may now appear showing a percentage of completion. Once this status screen disappears, it does not mean that the file is totally in the laser systems memory. Normally, Windows will spool the print file (the little printer icon located in the lower right-hand side taskbar) so it may take several seconds to even minutes, depending on your file size and the speed of your computer, before the entire file completely loads into the laser system's memory. Assuming that you have no other files loaded into the laser system, once this file is downloaded, it will automatically appear in the Control Panel display of the laser system. If already have other files loaded into the laser system, the file that you just sent will not appear until you press the NEXT FILE button. Use the NEXT FILE and PREVIOUS FILE buttons to toggle through your files until you find the one you want to print. If you put the laser system into ONE FILE mode, then the file displayed is always the last file that you sent, providing that the file has completed downloading.

## Step 4 - Starting the Engraving Process

- Turn ON the exhaust system.
- Make sure the material is positioned correctly within the engraving area.
- Make sure the system is properly focused.
- Make sure the top door is closed.
- Press the START button to begin laser processing.



**WARNING:** Observe that the laser system is functioning as desired. If any abnormalities are present, including but not limited to, flaming, sparking, melting, or excessive smoking of the material you are engraving, **STOP THE ENGRAVING PROCESS IMMEDIATELY BY EITHER PRESSING THE PAUSE BUTTON OR OPENING THE TOP DOOR!** Re-check the settings in the printer driver as well as the laser system. If everything seems to be correct, the material is not suitable for laser engraving or cutting and you **MUST DISCONTINUE** processing this material or any material that may cause damage to the laser system. **NEVER LEAVE THE LASER SYSTEM UNATTENDED DURING THE ENGRAVING OR CUTTING PROCESS.**

While the laser system is processing the material, you may stop the process by pressing the PAUSE button and waiting for the system to finish what it was doing and move to the home position (upper right corner). As long as you do not move the material inside the laser system, you can resume processing by pressing the RESUME button. **As a safety feature, if at any time you open either the top or front door, the laser beam will shut off first, and then the focus carriage will pause and move to the home position.** However, this method of stopping the process may ruin your application material because you will be unable to resume operation exactly where it paused.

### Step 5 - Material Removing and Reloading

Once the laser system has completed processing the material, the laser beam will turn off, the focus carriage will move to the home position in the upper right hand corner, and the green light on the control panel will turn OFF.

Before opening the top door, wait a few seconds to let any remaining fumes that are leftover from the laser engraving or cutting process, to evacuate through the exhaust system. Open the top door and remove the material. Some materials will continue to emit fumes, from several minutes to sometimes hours, after the engraving or cutting process is completed. We recommend that you relocate these materials to a well-ventilated and unoccupied area.



**WARNING:** Some materials, when engraved or cut with a laser, can produce toxic and caustic fumes. We suggest that you obtain the Material Safety Data Sheet (MSDS) from the materials manufacturer. The MSDS discloses all of the hazards when handling or processing that material.

## Section 4

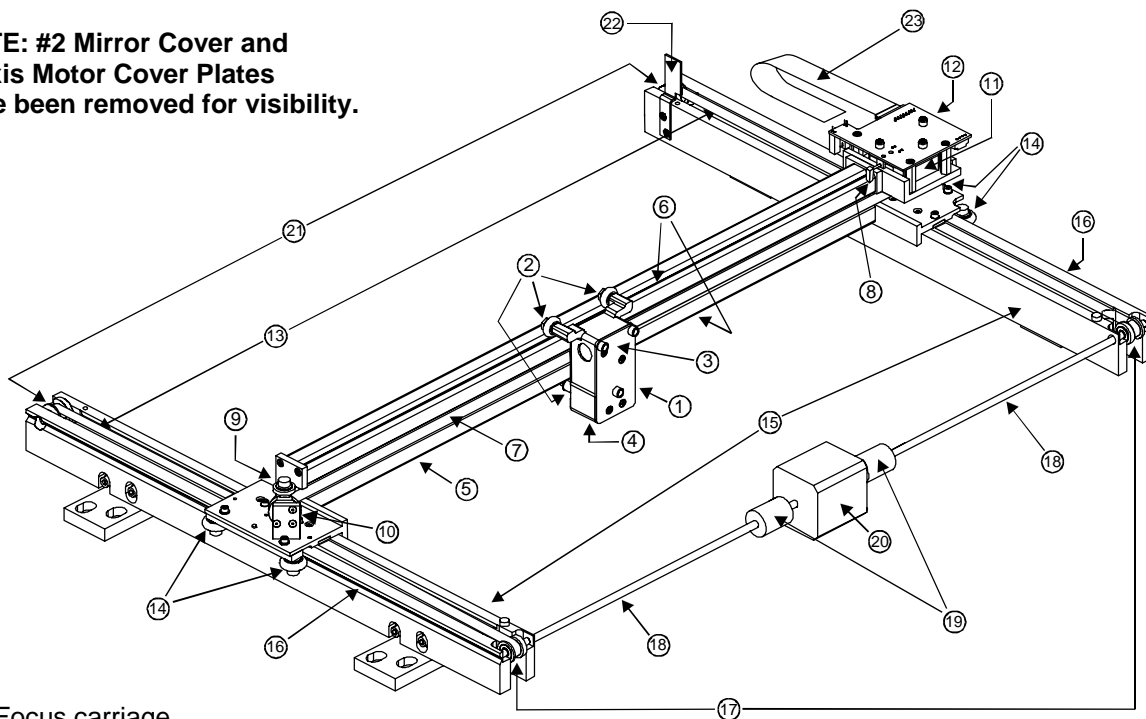
# 4

# Basic Maintenance

Keeping the laser system clean will ensure the highest quality engraving. The frequency of cleaning will depend entirely on the type of material being engraved, the performance of your exhaust system, the operating environment, and the amount of laser system usage over a given period of time. Dirt or debris that is allowed to build up on the motion system components will cause uneven or rough engraving, or loss of engraving position as well as premature component failure. Smoke or dirt buildup on the optics can cause damage to them, loss of laser power, or premature failure of these components. Use good judgment and keep in mind that a clean machine is the best performing machine. Always turn the laser engraving system OFF and unplug it before performing any cleaning procedures.

## Motion System Components Diagram

**NOTE: #2 Mirror Cover and X-axis Motor Cover Plates have been removed for visibility.**



- 1) Focus carriage
- 2) X-axis bearing (3)
- 3) #3 mirror (inside cover plate)
- 4) Focus lens (inside cover plate)
- 5) X-axis rail (arm)
- 6) X-axis bearing track (2)
- 7) X-axis belt
- 8) X-axis home sensor flag
- 9) X-axis idler pulley
- 10) #2 mirror and holder
- 11) X-axis motor and drive gear
- 12) X-Y home sensor board (upper flex board)
- 13) Y-axis belt (2)
- 14) Y-axis bearing (4) (2 on right side Y-axis rail, 2 on left side Y-axis rail)
- 15) Y-axis rail (2)(one right side and one left side)
- 16) Y-axis rail bearing track (2) (one on right side, one on left side)
- 17) Y-axis drive gear (2) (one on right side, one on left side)
- 18) Y-axis shaft (2) (one on right side, one on left side)
- 19) Y-axis shaft flex coupler (one on right side, one on left side)
- 20) Y-axis motor
- 21) Y-axis idler pulley (2) (one on right side, one on left side)
- 22) Y-axis home sensor flag
- 23) Flex cable

## Cleaning and Maintenance Supplies

- Soap solution mixture of 1 tablespoon (2 cl) liquid soap and 1 quart (liter) of water in a spray bottle
- Paper towels
- Cotton cloth
- Denatured alcohol (**NOT** to be used on any painted surface, plastic, or the Top Window)
- Acetone (can be used on the engraving table but nowhere else)

### CAUTION

**When using acetone or denatured alcohol, please follow the instructions on the printed label of these materials for safe handling procedures.**

- Cotton swabs (supplied)
- Lens cleaner (supplied)
- Vacuum cleaner
- Set of Allen wrenches sized from .050 to 3/16 inch

## System Cleaning and Maintenance

### Motion System

- Turn off and unplug the laser system.
- Open the top door and thoroughly remove all loose dirt and debris from inside the machine with a vacuum cleaner.
- Clean the engraving table surface with either a soap solution, or alcohol or acetone, and paper towels. **NEVER** pour or spray any solution directly into the laser system. Always dampen your paper towel or cloth outside of the machine with the cleaning solution and then wipe down the parts you are cleaning with the dampened cloth.
- Clean X-rail and the Y-rails by using either the cotton swabs or paper towels, and alcohol or soap solution. Pay close attention to the bearing tracks since any debris left to build up in these bearing tracks will cause the bearings to wear and the engraving quality to become rough.
- After the rails and tracks are cleaned, use a clean swab or paper towel, and alcohol to clean all of the bearings by holding the swab against each bearing and moving the motion system by hand to roll the bearings against the swab. There are seven bearings in the system, three (3) on the focus carriage, two (2) on the left side of the X-rail, and two (2) on the right side of the X-rail.
- Clean the top window with a cotton cloth and the soap solution. The top window is made out of acrylic. **DO NOT** use paper towels because they will scratch the acrylic. Also, **DO NOT** use window cleaner, alcohol, or acetone, as these chemicals will crack the acrylic. Only use cleaners compatible with acrylic.
- Use a soft cloth or paper towels and the soap solution to clean the enclosure. **DO NOT** use alcohol, acetone, or any other harsh chemical, as this will damage the paint.

### Optics

A visual inspection of the #2 and #3 mirrors, beam window, and focus lens should be performed at least once a day.

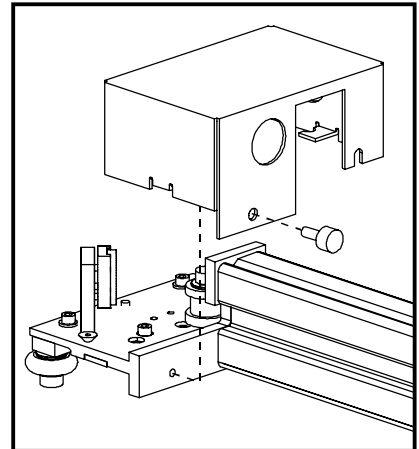
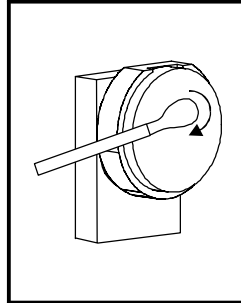


**DO NOT** clean an optic that is visually clean. Excessive cleaning can damage the optic. To prevent contamination, wash your hands thoroughly before cleaning any optic. **NEVER** touch any optic with your fingers. The acids from your skin can destroy the optical coatings. **NEVER** clean any optic right after engraving or cutting because the optic may be hot and the cool lens cleaning solution may thermally shock the optic and crack it.

### #2 Mirror

To gain access to the #2 mirror, the mirror cover must be removed. Remove the thumbscrew and slide the cover to the right and then lift the cover straight up.

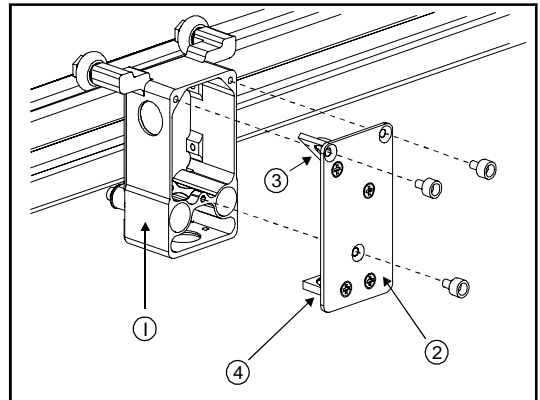
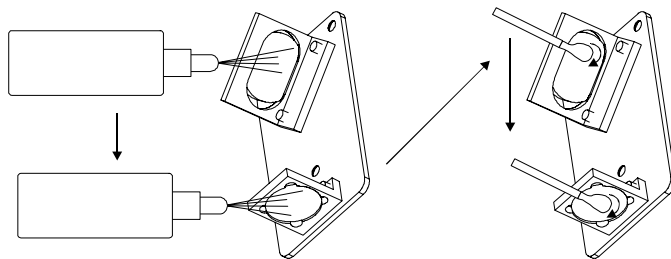
Inspect the #2 mirror and clean it only if there is debris present. To clean the #2 mirror with a cotton swab, moisten the cotton swab with the lens cleaning solution supplied with the laser system. **DO NOT** use other types of cleaners or solutions. Gently roll the cotton swab across the mirror once. **DO NOT** drag the swab or roll it back and forth as this can scratch the mirror. If the mirror did not come clean, use a fresh cotton swab and repeat the procedure. Do not be concerned about



small pieces of lint that come off of the cotton swab. They will be vaporized as soon as the laser hits it. You can cause more damage to the mirror by trying to remove the lint than by leaving it alone.

### #3 Mirror and Focus Lens

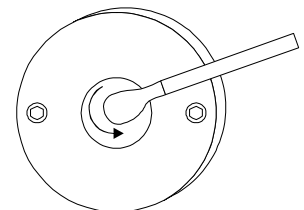
To gain access to the #3 mirror (3) and the focus lens (4), hold the front cover (2) with one hand, and remove the three thumbscrews with the other hand. Pull the front cover straight out. The #3 mirror and the focus lens are both mounted to the front cover.

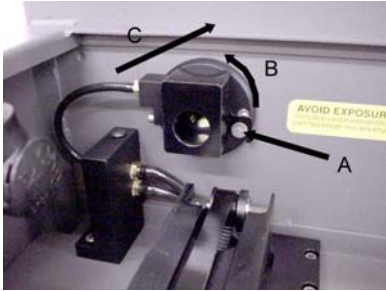


Tilt the front cover enough to enable you to apply the lens cleaning solution directly to the #3 mirror and to the focus lens. Flood the reflective surface of the #3 mirror with the solution. If heavy debris is present, let the solution soak in for a minute. Roll a fresh cotton swab across the mirror in one direction. Use a fresh swab for each pass. Be gentle when cleaning the optic to avoid scratching the surface. Repeat this procedure for the focus lens but make sure you clean both sides of the lens.

### Beam Window

The beam window is where the laser beam enters into the engraving area. It is located in the upper left hand corner of the engraving area against the back wall and is yellow in color. It is only necessary to clean the front side of the beam window. Do not remove the optic to clean it, simply clean it in the same manner as the #2 mirror.

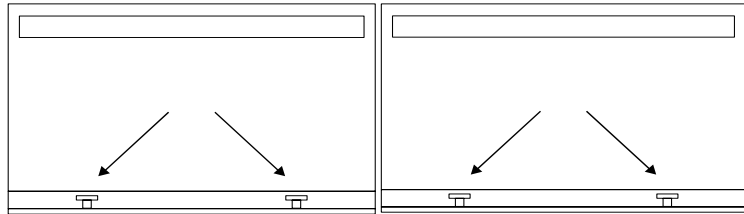




If your system is equipped with Air Assist, using your fingers, rotate the beam window cover counter-clockwise (B) and then off at a 45-degree angle. If the beam window cover is stuck use a 1/16 Allen wrench to loosen or remove the screw (A) and try again. Set the cover off to the side and clean the optic, if necessary. Reinstall the beam window cover opposite of removal being careful not to scratch the optic.

### Exhaust Plenum Cleaning

- Power system ON.
- Using the Z-axis controls, raise the Z-axis table as high as possible. Power the system OFF.
- Locate and remove the two button head screws (1) found on the back of the laser system.
- Open the front door. Using both hands, reach in and grab exhaust plenum. Lift the plenum straight up until the tabs (2) of the plenum clear the two flat head screws (3) they are resting on. Tilt the bottom of the plenum towards you and remove it from the system. Using your soap and water solution, clean the inside of plenum as well as the inside rear wall of the Laser System.
- Installation is opposite of removal. Make sure that the plenum tabs rest on the two flat head screws.



### Cooling Fan Filters

The cooling fan filters are located on the side of the laser system, near the back. They are used to filter the air used to cool the CPU and the power supply. To service the filters, first turn OFF and unplug the laser system. To remove the filter(s), simply snap off the black cover and remove the foam element. Wash the element in a soap and water solution, dry, and re-install.



**NEVER OPERATE THE LASER SYSTEM WITH THE COOLING FAN FILTERS REMOVED.** This can permanently damage the laser system. Damage to the laser system, from this kind of abuse **IS NOT** covered under warranty.

### Adjustments and Lubrication

There are no periodic adjustments normally required. The bearings in the motion system will self adjust to take up any clearances as they begin to wear. The belts are fiber reinforced and will not stretch under normal use so that periodic tension adjustment is not necessary. Optical alignment is not necessary because the laser and the #2 mirror are fixed.

All bearings in the system are sealed and do not require lubrication. **DO NOT** lubricate the tracks that the bearings ride in. The only lubrication that may be required is the screw threads for the table lifting mechanism. After some time, contaminants can adhere to the lubricant, which can cause the engraving table to bind up or sound squeaky. If this is the case, wipe off the contaminated grease with a soft cloth dampened with alcohol and apply fresh white lithium grease to the screw threads. **NEVER SPRAY ANY DEGREASING SOLUTIONS DIRECTLY ONTO THE THREADS.** Run the table up and down to work in the fresh grease. Repeat if necessary.

## Maintenance Schedule (Laser System)

Since the maintenance requirements of the laser system is dependent on the type of material being run, the quantity of material being removed, the hours of operation, and the quality of the exhaust blower, it must be user defined.

As a starting point, we recommend the following schedule:

- As necessary
  - Engraving table
  - Main enclosure
  - Top door window
- Every 8 hours of engraving
  - Clean X-axis and Y-axis bearings
  - Clean X-axis and Y-axis rails and bearing tracks
  - Clean X-axis belt.
  - Check beam window, #2 mirror, #3 mirror, and focus lens for debris. Clean **ONLY** if dirty.
- Every month
  - Clean cooling fan filters
  - Clean and re-lubricate Z-axis lead screws
  - Check for X-axis and Y-axis belt wear – replace as necessary
  - Check and/or clean X-axis and Y-axis drive gears
  - Check for X-axis and Y-axis bearing wear – replace as necessary
  - Inspect system for loose screws and mechanical parts – tighten if necessary
- Every 6 months
  - Exhaust plenum

**If you are noticing a considerable buildup of debris on the optics and the motion system, clean the system at more frequent intervals. If your system has remained relatively clean, you can extend your cleaning intervals. Keep in mind that a clean machine is a better performing machine and can extend the life of the parts as well as reduce the possibility of down time. If you have any questions about maintaining the laser system, please contact our Service Department.**

## Maintenance Schedule (Laser Head and Laser Power Supply)

Please refer to the Laser Head manual for maintenance information.

## Troubleshooting Guide

### Engraving Quality

Problem	Possible Cause	Possible Solution
"Fuzzy" looking raster engraving or small text appears like a "double image"	<ul style="list-style-type: none"> <li>• Dirty laser system</li> <li>• Graphic, graphic software, graphic software setup, color palette, monitor display colors, or driver settings have changed</li> <li>• Speed too fast for the material</li> <li>• Out of focus</li> <li>• System needs tuning</li> <li>• Worn X-axis belt and/or drive gear</li> </ul>	<ul style="list-style-type: none"> <li>• Clean all optics, rails, bearings and belts</li> <li>• Check to see what has changed. Refer to the "Computerized Controls" manual to properly setup the graphics software. Check driver settings.</li> <li>• Slow down engraving speed</li> <li>• Re-focus</li> <li>• Run "Tuning" feature in printer driver</li> <li>• Replace belt and/or drive gear, and run "Tuning" feature</li> </ul>
Fine detail is missing such as the serifs of characters or thin lines of script fonts when raster engraving	<ul style="list-style-type: none"> <li>• Speed too fast for the material</li> <li>• Laser cannot respond to low duty-cycle, high speed engraving</li> <li>• Out of focus</li> <li>• System needs tuning</li> </ul>	<ul style="list-style-type: none"> <li>• Slow down engraving speed</li> <li>• Run enhancement feature in the printer driver</li> <li>• Re-focus</li> <li>• Run "Tuning" feature in printer driver</li> </ul>
Vertical or diagonal background pattern present when raster engraving large areas and/or large amounts of material	<ul style="list-style-type: none"> <li>• Dirty laser system</li> <li>• Slight pattern is normal</li> </ul> <p>If the pattern is excessive:</p> <ul style="list-style-type: none"> <li>• Loose motion system components</li> <li>• Worn or damaged X-axis bearings</li> <li>• Worn or damaged X-axis rail</li> </ul>	<ul style="list-style-type: none"> <li>• Clean all optics, rails, bearings and belts</li> <li>• Don't remove so much material or try engraving shallower or deeper. Try changing PPI and or DPI. Use a 50% black fill to "halftone" the background which can hide the pattern</li> <li>• Check X-axis bearings, belt, optics</li> <li>• Replace X-axis bearings</li> <li>• Replace X-axis arm</li> </ul>
Engraving disappears, becomes "lighter", or appears "choppy" when raster engraving at high speeds within 1/2 inch of Y-axis ruler	<ul style="list-style-type: none"> <li>• Normal condition. The laser system needs to accelerate and decelerate within this area</li> </ul>	<ul style="list-style-type: none"> <li>• Move graphic and/or material to the right, outside of this area</li> <li>• Slowing the raster speed down reduces the effect</li> </ul>



## BASIC MAINTENANCE

<p>Raster engraving appears sharp on both ends of the engraving but fuzzy in the middle</p>	<ul style="list-style-type: none"> <li>• Dirty laser system</li> <li>• Something is loose</li> <li>• System needs tuning</li> <li>• Worn X-axis belt and/or drive gear</li> </ul>	<ul style="list-style-type: none"> <li>• Clean all optics, rails, bearings, belts</li> <li>• Check X-axis bearings, drive gear, idler pulley, belt, and optics</li> <li>• Run "Tuning" feature in printer driver</li> <li>• Replace belt and/or drive gear, and run "Tuning" feature</li> </ul>
<p>Engraving does not appear as deep as it normally does</p>	<ul style="list-style-type: none"> <li>• Graphic, graphic software, graphic software setup, color palette, monitor display colors, or driver settings have changed</li> <li>• Out of focus</li> <li>• Material or material density has changed</li> <li>• Settings have changed</li> <li>• Dirty laser system</li> <li>• Laser beam out of alignment with the optics</li> </ul>	<ul style="list-style-type: none"> <li>• Check to see what has changed. Use "Software Setup Guide" to properly setup the graphics software to work correctly with the laser system. Check driver settings.</li> <li>• Re-focus</li> <li>• Check material</li> <li>• Check power, speed, PPI, and DPI settings</li> <li>• Clean all optics, rails, bearings and belts</li> <li>• Check and/or adjust laser beam alignment</li> </ul>
<p>Engraving is sharp, clear and at a good depth on one side of the table and fuzzy and shallow on the opposite side of the table</p>	<ul style="list-style-type: none"> <li>• Out of focus</li> <li>• Dirty laser system</li> <li>• Material is not level or varying in thickness</li> <li>• Table is not level</li> <li>• Laser beam out of alignment with the optics</li> </ul>	<ul style="list-style-type: none"> <li>• Re-focus</li> <li>• Clean all optics, rails, bearings, belts</li> <li>• Check focus point of material and different places, adjust height by shimming material or using more thickness-consistent material</li> <li>• Using the focus tool, focus directly on the surface of the table in all four corners. Table should be within +/- .020 inches from one corner to the other. Adjust if necessary.</li> <li>• Check and/or adjust laser beam alignment</li> </ul>
<p>Engraving appears "halftoned" and not solidly filled when using colors other than black</p>	<ul style="list-style-type: none"> <li>• Graphic, graphic software, graphic software setup, color palette, monitor display colors, or driver settings have changed</li> </ul>	<ul style="list-style-type: none"> <li>• Check to see what has changed. Refer to the "Computerized Controls" manual to properly setup the graphics software. Check driver settings.</li> </ul>

## BASIC MAINTENANCE

<p>Wavy lines when vector engraving or cutting</p>	<ul style="list-style-type: none"> <li>• Running too fast</li> <li>• Dirty laser system</li> <li>• Worn or faulty bearings</li> <li>• Arm is out of square</li> <li>• Firmware needs to be updated</li> </ul>	<ul style="list-style-type: none"> <li>• The highest quality vectors are obtained by running less than 5% speed</li> <li>• Clean all optics, rails, bearings and belts</li> <li>• Check and/or replace X and/or Y axis bearings</li> <li>• Square arm re-adjust left side Y-axis bearings so both are contacting Y-rail equally</li> <li>• Firmware advancements have been improving vector quality</li> </ul>
<p>The start and stop points of circles, when cutting, do not meet up</p>	<ul style="list-style-type: none"> <li>• Slight "notching" when cutting circles is a normal condition due to the beam starting and stopping at the same point</li> </ul> <p>If the pattern is excessive:</p> <ul style="list-style-type: none"> <li>• Dirty laser system</li> <li>• Mechanical problem</li> </ul>	<ul style="list-style-type: none"> <li>• The laser beam has width and there is a heat effect from starting and stopping the laser system at the same point. Try extending the circle through the end point by adding a small line segment to reduce the effect. If cutting the material when elevated off the table, make sure that the center if the circles are supported.</li> <li>• Try rotating the circle 90 or 180 or 270 degrees. Sometimes this helps reduce the effect</li> <li>• Clean all optics, rails, bearings and belts</li> <li>• Turn machine off and check for binding in the x &amp; y directions. Check for excessive belt tension.</li> </ul>
<p>Flat edges on curves when vector cutting</p>	<ul style="list-style-type: none"> <li>• DPI setting too low</li> <li>• PPI setting too low</li> <li>• Software limitation</li> </ul>	<ul style="list-style-type: none"> <li>• 1000 DPI produces the smoothest edges when cutting</li> <li>• Higher PPI settings produce smoother edges but may cause excessive burning or melting</li> <li>• The graphic software you are using has limited vector smoothness capability</li> </ul>

## Operational

<p>Focus carriage loses X-axis position and slams into the left or right side of the rail during high speed raster engraving</p>	<ul style="list-style-type: none"> <li>• Mechanical interference</li> <li>• Dirty laser system</li> <li>• CPU overheating</li> <li>• X-belt too tight</li> <li>• Worn or binding X-axis bearings</li> <li>• Worn or binding X-axis idler pulley</li> <li>• Worn or binding X-axis motor</li> <li>• Firmware needs updating</li> </ul>	<ul style="list-style-type: none"> <li>• Check if focus carriage makes contact with material or other objects</li> <li>• Clean all optics, rails, bearings and belts</li> <li>• Clean CPU filters, correct ambient temperature to be within specifications</li> <li>• Check and/or adjust</li> <li>• Check and/or replace</li> <li>• Check and/or replace</li> <li>• Check and/or replace</li> <li>• Check with Service Department</li> </ul>
<p>When homing, the arm slams repeatedly for a few seconds</p>	<ul style="list-style-type: none"> <li>• Bent Y-flag</li> <li>• Dirty or faulty home sensor(s)</li> </ul>	<ul style="list-style-type: none"> <li>• Check and/or straighten</li> <li>• Replace upper flex board</li> </ul>
<p>When focusing, the Z-axis table only moves in one direction</p>	<ul style="list-style-type: none"> <li>• Dirty or faulty Z-axis sensor</li> </ul>	<ul style="list-style-type: none"> <li>• Try to clean sensor(s) with compressed air, otherwise replace sensor</li> </ul>
<p>When using Autofocus, the table moves all the way down to the bottom and gets stuck</p>	<ul style="list-style-type: none"> <li>• Autofocus sensor or reflector is dirty</li> <li>• Autofocus sensor is misaligned</li> </ul>	<ul style="list-style-type: none"> <li>• Clean sensor and/or reflector</li> <li>• With the Z-axis table out of the way of the Autofocus beam, check the sensor for only an illuminated green light. A red light, both lights, or no lights indicate a misalignment or dirty condition. Clean, re-check, and re-align the Autofocus sensor.</li> </ul>
<p>When printing to the laser system, the computer gives an error message "Printer out of paper" or "Printer offline and not responding"</p>	<ul style="list-style-type: none"> <li>• Laser not turned on</li> <li>• Computer is locked up</li> <li>• Parallel port cable not connected or not connected properly</li> <li>• Laser system is out of memory</li> <li>• Single file is too large for memory installed in laser system</li> <li>• Bad parallel port in computer system</li> <li>• Damaged port in CPU</li> </ul>	<ul style="list-style-type: none"> <li>• Turn on laser system</li> <li>• Re-boot computer and laser system</li> <li>• Connect cable or reseat connection at computer and/or laser system</li> <li>• Check "Free Memory" in laser system control panel. Clear laser system memory and try again</li> <li>• Purchase more memory</li> <li>• Try printing to another printer using the same port</li> <li>• Replace laser system's CPU</li> </ul>
<p>When running the laser system, the laser system will "freeze", the clock will keep advancing, but the operator will have no control over the system. The only way to restore the system is to power the laser off and then back on. This is a symptom of file corruption.</p>	<ul style="list-style-type: none"> <li>• Incorrect BIOS setting in computer</li> <li>• Using a printer cable longer than 6 ft.</li> <li>• Bad printer cable</li> <li>• Usage of device in between computer and laser system</li> <li>• Some other parallel port driver interfering with the laser system printer driver</li> <li>• Damaged port in CPU</li> </ul>	<ul style="list-style-type: none"> <li>• Refer to manual on proper setting</li> <li>• Use only a 6 ft., IEEE1284 compliant printer cable</li> <li>• Replace printer cable</li> <li>• Connect the laser system directly from computer with the printer cable</li> <li>• Remove all other parallel port drivers and try again</li> <li>• Replace laser system's CPU</li> </ul>

