X-660 / X2-660
SuperSpeed-660

Laser Engraving and Cutting Systems

Safety, Installation, Operation,
and Basic Maintenance Manual

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August 2005

CE

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ULS Platforms are protected under one or more of U.S. patents 5,661,746; 5,754,575; 5,867,517; 5,881,087; 5,894,493; 5,901,167; 5,982,803; 6,181,719; 6,313,433; 6,342,687. Other U.S. and International patents pending.

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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**.** 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 81st Street
Scottsdale, AZ 85260
Phone: 480-609-0297
Fax: 480-609-1203
M-F 8am – 5pm Arizona Time

Specifications

System Operating Environment Requirements (user provided)	
Operating Environment	Well-ventilated office (recommended) or clean, light-duty manufacturing
Operating Temperature	50ºF (10ºC) to 95ºF (35º C) capable 73ºF (22ºC) to 77ºF (25º C) for best performance
Storage Temperature	50ºF (10ºC) to 95ºF (35º C)
Operating Humidity	Non-condensing
Electrical Power	Single Phase 100/220V 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 95/98 or Windows 2000/XP compatible
Software Requirement	Graphics or CAD based (See manual for recommendations)

System Specifications	
Laser Safety	CO2 Laser, Interlocked Safety Enclosure = Class I Red Diode Pointer = Class IIIa
Laser Source	25,30,35,40,45,50,55,or 60 watt CO2 Laser Cartridge 1 or 2 Laser Cartridges can be installed on the X2-660 or the SuperSpeed-660 Platforms
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)
System Weight	System = 325 lbs. (147 kg)
Laser Cartridge Weight	25/30 Watt = 20 lbs (9 kg) 35/40 Watt = 23 lbs (10 kg) 45/50/55/60 Watt = 26 lbs (12 kg)
Available Options	Rotary Fixture, Air Assist (standard or computer controlled), Air Compressor (desiccant or refrigerated dryer options), Honeycomb Cutting Table, Dual Head, Assorted Focal Length Lens Kits

Specifications subject to change without notice

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Section 1

Safety

Description of Appropriate Use

This device is designed for laser cutting and engraving of the materials listed in this manual, in a laboratory, workshop, or light duty manufacturing environment. Materials to be processed must fit completely inside the system for proper operation.

Notice: This device is not designed, tested, intended or authorized for use in any medical applications, surgical applications, medical device manufacturing, or any similar procedure or process requiring approval, testing, or certification by the United States Food and Drug Administration or other similar governmental entities. Please see the Notice herein for further information regarding such uses.

General Safety

Use of the equipment in a manner other than what is described in this manual can result in injury to yourself, others, or may cause severe damage to the equipment and your facility. Failure to follow the operational requirements and safety guidelines, listed in this manual, may increase this risk.

- **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 particulate/fume 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. Damage to the laser system from caustic materials is **NOT** covered under warranty.
- **Care should be taken when moving or lifting this device**. 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.
- **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.
- **This device 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) in the USA. It 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.

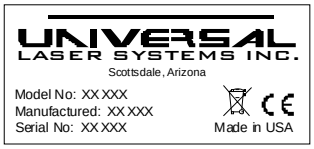
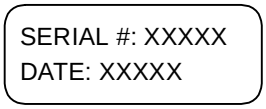
Laser Safety

The device contains a sealed carbon dioxide (CO2) laser in a Class I enclosure that produces intense invisible and visible laser radiation at a wavelength of 10.6 microns in the infrared spectrum. For your protection, this enclosure is designed to completely contain the CO2 laser beam. Improper use of controls and adjustments, or performance of procedures other than those specified, may invalidate the safety of this system.

- 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.**
- This device may contain a visible Red Dot Pointer (Class IIIa). **DO NOT STARE AT THE RED LIGHT OR VIEW DIRECTLY WITH OPTICAL INSTRUMENTS.**
- The user door(s) are safety interlocked and will disable the CO2 laser beam from firing when the user door(s) are opened. The Red Dot Pointer is **NOT** safety interlocked and can be activated with the door(s) either open or closed.
- 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 CO2 laser radiation which can cause permanent blindness and/or severe burns to your skin.

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.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	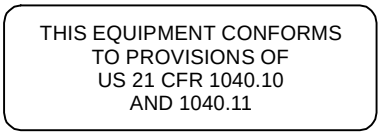	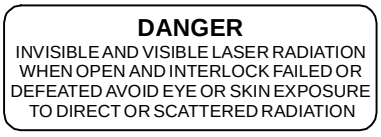
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DANGER INVISIBLE AND VISIBLE LASER RADIATION WHEN OPEN AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION	AVOID EXPOSURE INVISIBLE LASER RADIATION IS EMITTED FROM THIS APERTURE	WARNING TURN THE LASER SYSTEM OFF BEFORE CONNECTING OR DISCONNECTING THE ROTARY FIXTURE
221-0017-0	221-0018-0	221-0019-0

WARNING TO AVOID RISK OF ELECTRIC SHOCK ALWAYS DISCONNECT POWER CORD BEFORE REMOVING THIS COVER		INPUT POWER: 220 VAC; 50/60 Hz; 15 A
221-0020-0	221-0021-0	221-0024-0

THIS LASER MANUFACTURED BY UNIVERSAL LASER SYSTEMS 16008 N. 81ST ST SCOTTSDALE, AZ 85260 USA IS DESIGNED FOR USE ONLY AS A COMPONENT IN A ULS LASER SYSTEM. THIS LASER IS A CLASS IV DEVICE AND DOES NOT COMPLY WITH U.S. CODE 21 CFR SUBCHAPTER J OR EUROPEAN STANDARD EN 60825-1:1994. THIS LASER PRODUCT IS MANUFACTURED UNDER U.S. PATENTS 5,661,746; 5,754,575; 5,867,517; 5,901,167; 5,894,493; 5,881,087 OTHER U.S. AND INTERNATIONAL PATENTS PENDING.	DANGER LASER RADIATION - AVOID DIRECT EYE EXPOSURE LASER DIODE WAVELENGTH: 630-680 nm MAX OUTPUT: 5 mW CLASS 3R LASER PRODUCT	WARNING THIS SYSTEM IS DESIGNED FOR USE WITH INERT AND NON-OXIDIZING GASES ONLY (i.e. DRY CLEAN AIR, CARBON DIOXIDE, HELIUM, NITROGEN). CONNECTING FLAMMABLE OR OXIDIZING GASES TO THIS SYSTEM CREATES A SERIOUS SAFETY AND/OR FIRE HAZARD. DO NOT CONNECT ANY GAS SOURCES EXCEEDING 75 PSI (5 ATM) PRESSURE. UNIVERSAL LASER SYSTEMS ASSUMES NO RESPONSIBILITY ARISING FROM THE IMPROPER USE OF THIS SYSTEM.
221-0031-0	221-0034-0	221-0037-0

THIS PRODUCT IS MANUFACTURED UNDER ONE OR MORE OF U.S. PATENTS 5,661,746; 5,754,575; 5,867,517; 5,881,087; 5,894,493; 5,901,167; 5,982,803; 6,181,719; 6,313,433; 6,342,687; 6,423,925; 6,424,670 OTHER U.S. AND INTERNATIONAL PATENTS PENDING.	WARNING Do **NOT** use in medical or surgical applications or to manufacture medical devices. See the Safety, Installation, Operation, and Basic Maintenance Manual, or the OEM Laser Integration Manual for further information.
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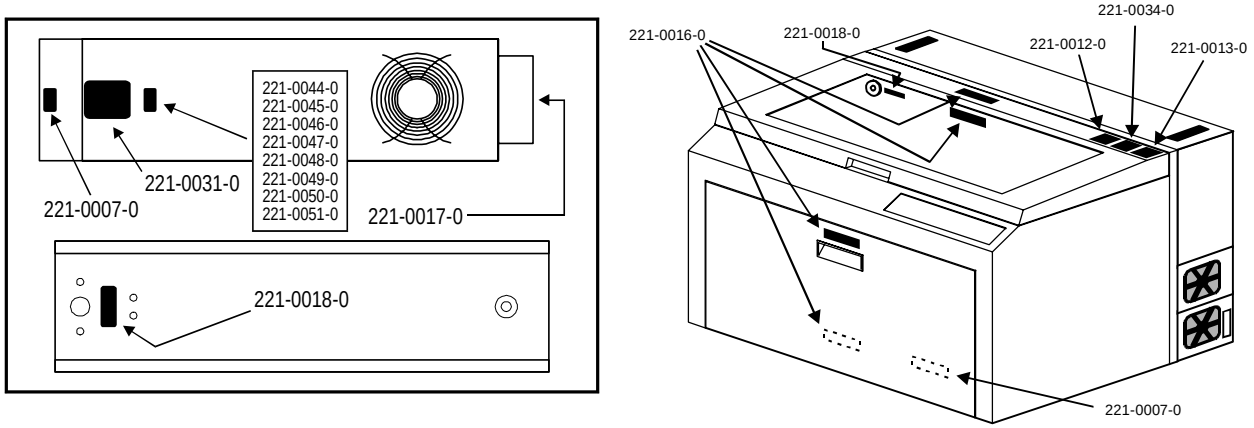
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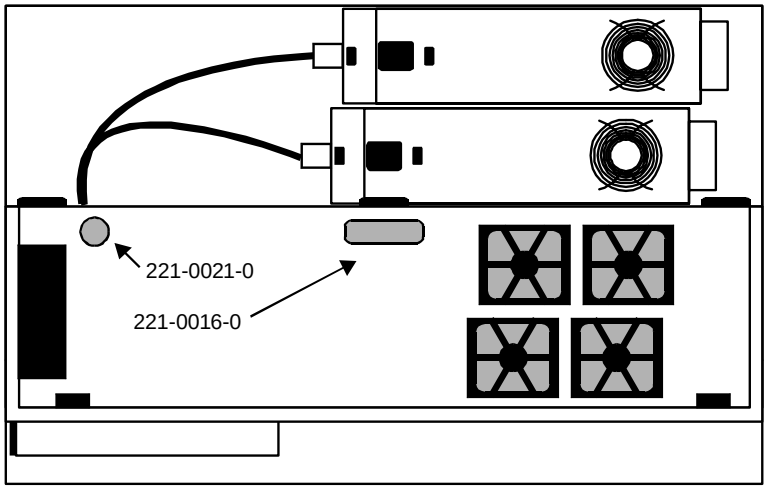
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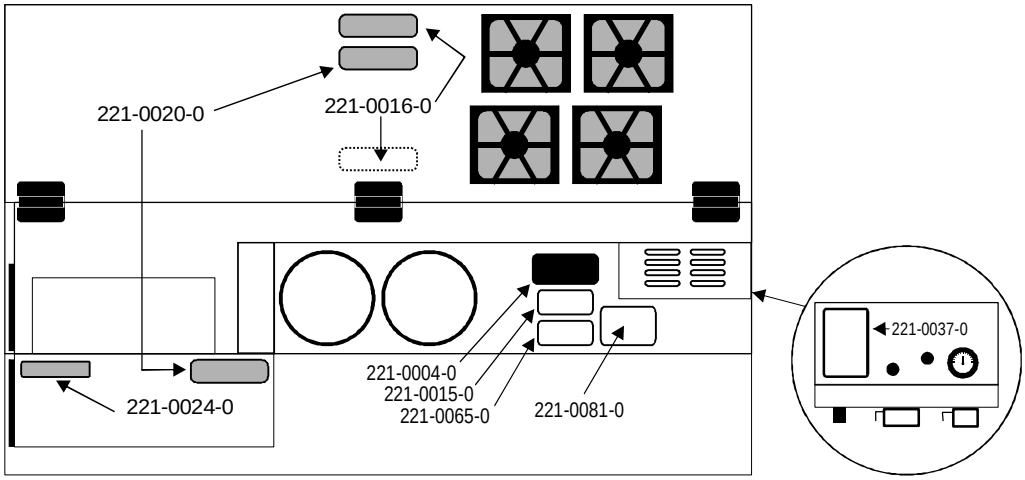
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221-0065-0
221-0081-0
221-0037-0

EU Compliance (CE)

UNIVERSAL
LASER SYSTEMS INC.

Product Identification: X-660, X2-660, and SuperSpeed-660
Laser Engraving and Cutting Systems

Manufacturer: Universal Laser Systems, Inc.
16008 N. 81st 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)
98/37/EEC (Machinery Directive)

based on the standards listed.

Standards Used:

Safety:
EN 60950: 2002
EN 60825: 2001 (Class 3R)

EMC:
EN 55022: 2003 (Class A)
EN 50082-1: 1998
EN 61000-3-2: 2001 (class A)
EN 61000-3-3: 2002
EN 61000-4-2: 2001 (6kV CD, 8kV AD)
EN 61000-4-3: 2003 (3 V/m)
EN 61000-4-4: 2002 (2 kV power line, 0.5 kV signal line)
EN 61000-4-5: 2001 (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.

Recycling

By placing the above symbol on our products and accessories Universal Laser Systems is indicating that we are committed to helping reduce the amount of waste electronics ending up in municipal landfills. Therefore Universal Laser Systems urges consumers to recycle this product and its accessories. Universal Laser Systems is equipped to recycle any of its electronic products and accessories and will assist our customers with their recycling options. To arrange for recycling of your ULS product or accessory, please contact Universal Laser Systems for more information.

Section 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.
- For best results, since the lasers are air-cooled, we recommend operating the laser system between the ambient temperatures of 73ºF (22ºC) to 77ºF (25º C). However, the system can operate between the temperatures of 50ºF (10ºC) to 95ºF (35º C).
- Avoid storing the laser system outside the temperatures of 50ºF (10ºC) to 95ºF (35º C) as excessively cold or hot temperatures can damage the laser cartridge or reduce its lifetime.
- Ambient humidity levels must be non-condensing.

Electrical (user supplied)

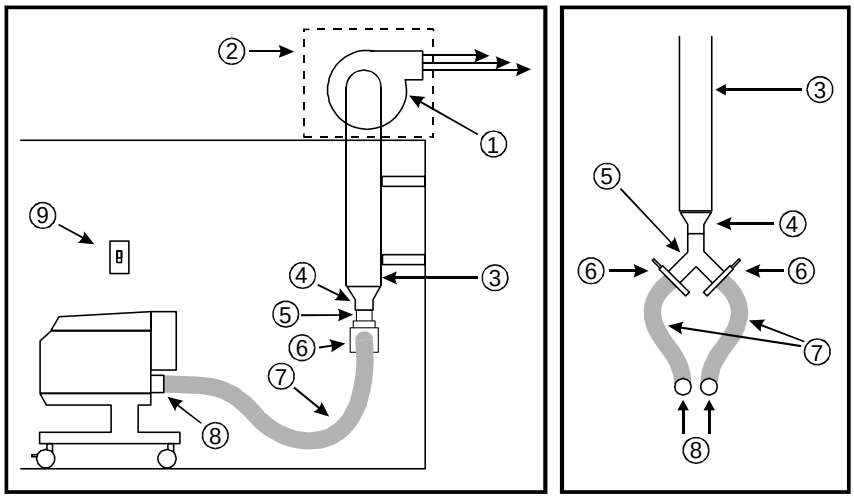
- For your system's electrical requirements, please refer to the "INPUT POWER" label near the ON/OFF switch and/or power inlet.
- **Never remove the ground lead to the electrical cord and plug the system into a non-grounded outlet**. This is very dangerous and can lead to a severe, if not fatal, electrical shock. Always plug the system into a properly grounded (earthed) outlet. Also, without proper grounding, the laser system may exhibit sporadic or unpredictable behavior.
- Noisy or unstable electricity as well as voltage spikes may 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.
- The laser system is designed as a Class I, Group A, pluggable device. It is also designed for connection to IT power systems which provides the most flexibility to the user.

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 (850m3/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.
- 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 PC Computer Configuration (user supplied)

500 MHz using Windows 95/98 or 2000/XP	CD-ROM Drive/Burner
256 MB of RAM	Mouse or other pointing device
2 Gigabyte hard drive or bigger	600 DPI Optical Resolution Scanner (optional)
17 inch color VGA monitor	Internet connection and email address (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

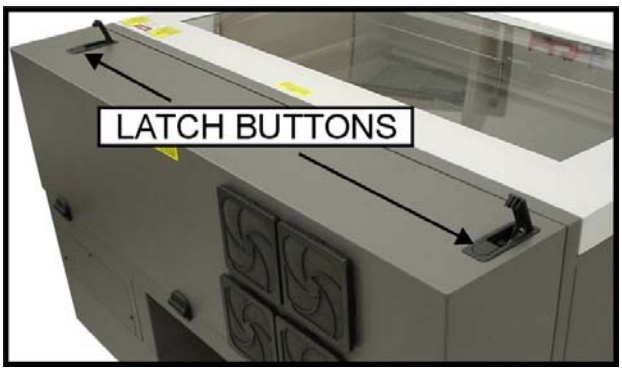
- **Raster to Vector Conversion Software (user supplied)**
  Adobe Streamline or CorelTRACE
- **CAD Software (user supplied)**
  AutoCAD or AutoCAD LT for Windows
- **FONTS (user supplied)**
  Use True Type fonts **ONLY**. Do not use PostScript or bitmapped fonts.

System Assembly

If the doorway is not wide enough to allow to you roll the laser system through it, the system **MUST** be detached from the cart stand, rotated sideways, passed through the doorway, then re-attached to the cart stand. If your doorway is wide enough, you can skip the following procedure and proceed to "Leveling the System". It would help if you had a **PADDED** floor dolly to transport the machine through the doorway. If one is not available, it will need to be carried through the doorway.

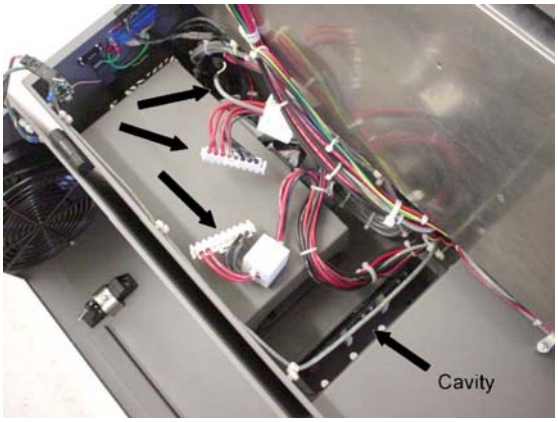
The laser system without the cart stand weighs approximately 200 lbs. Obtain assistance from as many people as possible (3 or 4 people). Always use a back-support device when lifting. Do not attempt lifting the machine if you are physically handicapped or are injured in any way. Seek the advice of a physician if you are unsure.

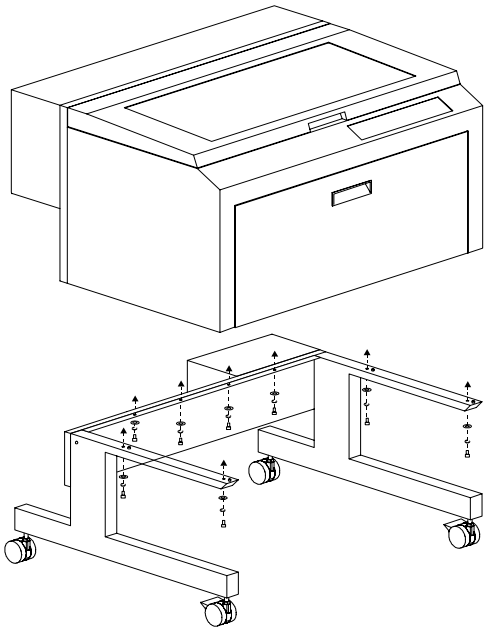
1. Make sure unit is unplugged from an electrical outlet.
2. At the back of the system, locate the four screws; remove them and the cover plate.



3. Locate the two, white connectors and the one, black connector that attaches the wire harness to the power supply. Unplug all three connectors. They are held in place by latches so you will need to release the latches to pull the connectors off.
4. Open the rear cover by pressing down on the button part of the latches until the latches pop up.
5. Fold the rear cover down to a resting position.

6. Locate the cavity where the cables reside. Gently pull the cables upwards and rest them on top of the gray-colored plate as the diagram indicates.
7. Close and re-latch the rear cover.
8. Remove any packing materials or accessories from inside the laser system.
9. Using strong shipping tape or rope, tape the front door closed so that it does not open up when you tilt it.

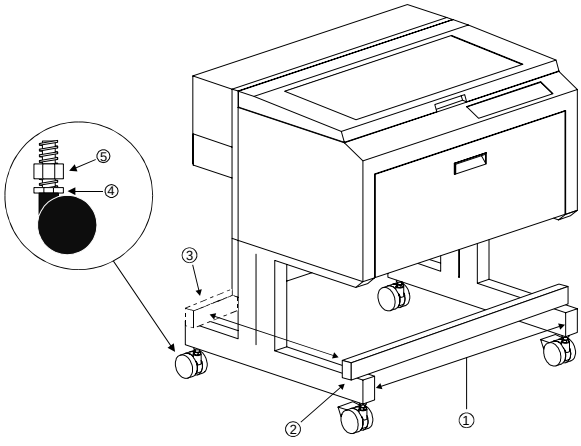




10. Remove the eight (8) screws, flat washers, and lock washers that attach the cart stand to the laser system from the bottom.
11. Lift the laser system straight up, clearing the cart stand.
12. Place the laser system face down on the dolly and roll it through the doorway. If you do not have a dolly, you will need to carry it through.
13. After you get the laser system and the cart stand through the door, carefully line up the laser system and place it back on top of the cart stand. **Be careful not to pinch your fingers**.
14. Attach your screws, flat washers, and lock washers. Gently push the cables back into the cavity, re-connect the three power supply connectors, re-attach the cover plate, close the rear cover, and push down on the latches until they “click”.

Leveling the System

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.**

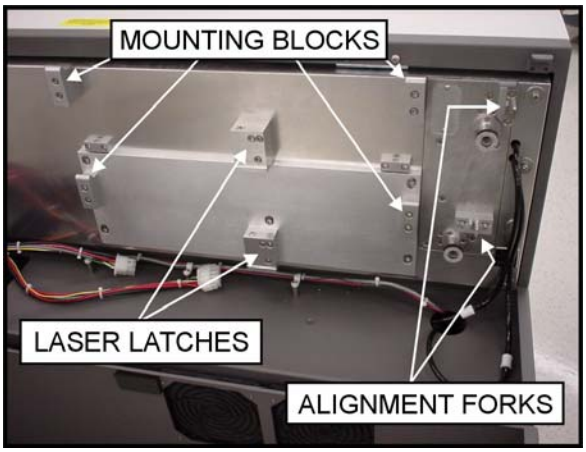


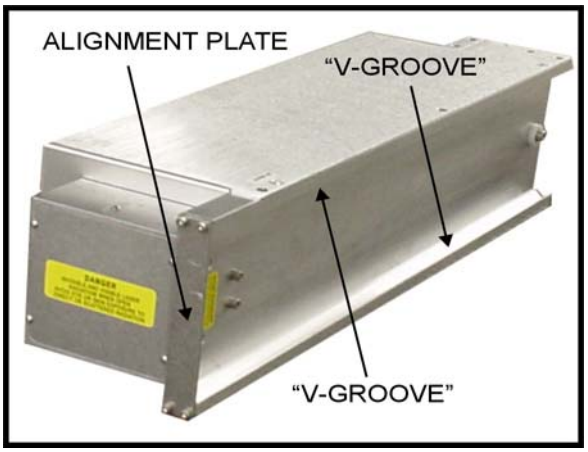
1. Place a bubble level across the front (2) and rear legs (3). Adjust the caster height using the adjustment screw (4) until both the rear part and the front part of the legs are level with respect to each other. Once the system is level, secure all casters by tightening the nut (5) up against the cart 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. Gain access to the rear of the laser system to install the laser cartridge(s).

Laser Cartridge Installation

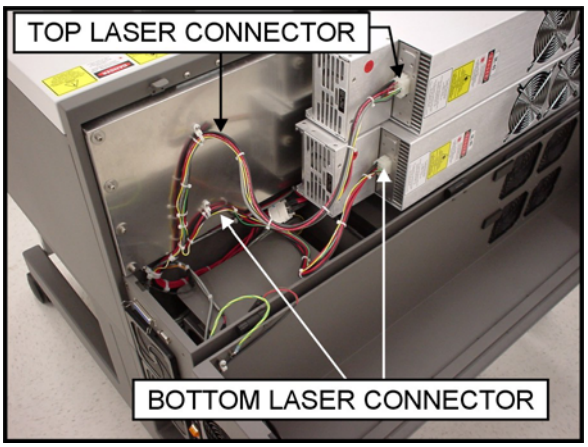
Before connecting and powering on your system, you must install the laser cartridges.

1) Make sure that your power cord **IS NOT** plugged in at this time. Press on the backside of the two hinges to release the latch. Gently fold back the rear cover.





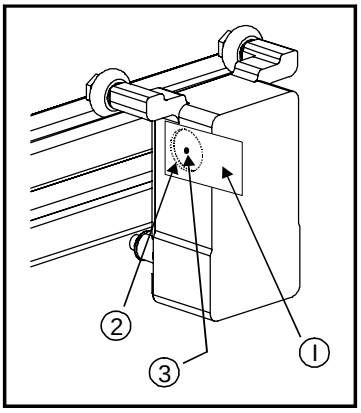
2) Locate the laser mounting blocks, the laser latches, and alignment forks. Notice that the alignment forks have two plates, one small and one large. Locate the gap between the two plates. Observe the "V" groove along the upper and lower part of the laser cartridge and the alignment plate at the end.



3) If you have purchased two lasers, mount the first cartridge onto the **LOWER** mounting blocks first. Single laser users should mount the laser in the top position. Tilt the laser cartridge downward on a 30-degree angle. Place the upper "V" groove of the cartridge on top of the mounting blocks. Slide the cartridge to the right until the alignment plate of the laser cartridge makes contact with the inside of the large plate of the alignment fork. Slowly rotate the laser cartridge making sure that the alignment plate is centered in the fork. As you slowly release the weight of the laser, you should feel it lock (clunk sound) itself smoothly into place, parallel to the mounting surface. NEVER FORCE THE LASER INTO POSITION. If the laser does not install smoothly, check for obstructions such as pinched wires or hoses or a binding laser latch. Mount the second laser on the top mounts in the same manner as the bottom. Once installed, re-verify that the alignment plates are centered within the alignment forks.

The power connectors are labeled "Top" and "Bottom". It is very important that you plug in the correct connector into the appropriate laser, otherwise the laser system will not function properly. The power connectors are keyed so it will only insert one way. Single laser users should just leave the bottom connector unplugged and out of the way. Close the rear cover slowly, making sure that you do not pinch any wires, and push down on the latches until they "click".

Checking Beam Alignment



- Open the top door of the laser system. Locate the power cord and plug it into the system and your grounded electrical outlet. International users may need to connect an adapter to the power cord to be able to plug it into their power source. **MAKE SURE THAT YOU ATTACH THE ADAPTER CORRECTLY TO THE POWER CORD AND THAT YOUR POWER SOURCE IS PROPERLY GROUNDED (EARTHED) OTHERWISE SERIOUS DAMAGE CAN OCCUR TO THE LASER SYSTEM.**
- Place a small piece of masking tape across the 3/4" hole in the focus carriage (1). Gently rub the tape around the edge of the hole so that you can see the outline of the hole through the tape (2) and then close the top door.
- Power ON the laser system and after the system finishes initializing, open the top door.
- Press the X-Y button on the control panel and a red dot will appear on the masking tape (3). The red dot should appear centered, or close to the center of the hole, within 1/8 inch. If not, remove and re-install the laser cartridge and try again. If the red dot still does not appear within 1/8" of the center of the hole, please contact our Service Department.
- Laser cartridge installation is complete. Power OFF the laser system and remove the masking tape.

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 laser systems 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

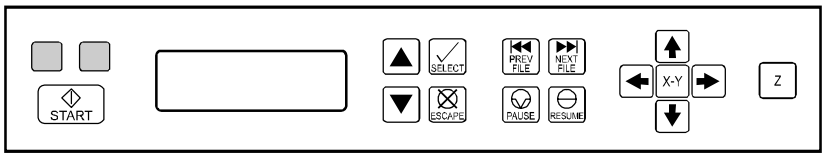
At this point you need to install either the Windows 95/98 or the Windows 2000/XP printer driver. Please refer to the Computerized Controls manual. This manual describes the installation and use of the ULS printer driver. It also contains information regarding the setup and proper use of the recommended graphics software and CAD programs. As a convenience, we have also included the latest software patches for CorelDRAW and Microsoft Windows 95/98 and Windows 2000/XP. Please read the Computerized Controls manual completely before proceeding to the next section. The printer driver CDROM is located in a pouch attached the rear cover of the Computerized Controls Manual.

Section 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. When the 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.

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

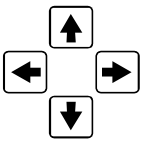
START: Begins laser processing of the current file displayed in the "FILE DISPLAY" menu. If any of the doors are open when you press this button, the motion system will start to move as if it is processing the file, however, the CO2 laser beam is disabled and the red diode pointer will be enabled to simulate the laser process.

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. It also activates the red laser diode and displays the current X-Y position of the focus carriage.

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

Air Assist is an optional accessory. If you have purchased this option, please refer to the OPTIONS and ACCESSORIES section of the manual for more information.

DUAL HEAD

Dual Head is also an optional accessory. If you have purchased this option, please refer to the OPTIONS and ACCESSORIES section of the manual for more information.

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
Used to manually fire the laser beam to determine if the laser systems optical alignment is correct and check for maximum output power.

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 the red laser diode will appear on the engraving table. Using the directional arrow buttons, move the focus carriage to position the red dot at 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.

WARNING: If you intentionally or unintentionally go into the CONFIGURATION menu and then back out, the NEW ORIGIN position will be stored permanently in memory, even if you turn the system OFF. To reset the origin back to the factory default value, go into the ORIGIN POSITION menu. Then, using two fingers, press the UP and DOWN triangle buttons at the same time. This will move the focus carriage into the upper left corner of the field. 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. Finally, escape of this menu and go into the CONFIGURATION menu and back out again. This will store the value in permanent memory.

This menu is also used to find the exact position of an object placed anywhere in the field. By using the motion control keys, and the Red Diode Pointer as a reference, move the focus carriage to the desired position. The display will show you the exact X-axis and Y-axis position of where the Red Diode Pointer is located. Use this coordinate to appropriately position your graphic within your graphics software.

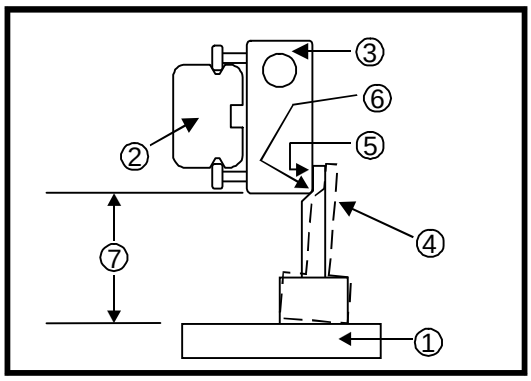
At the bottom of the menu you will find RE-HOME X &Y. Selecting this menu item will re-home the focus carriage to the upper right corner of the field. This feature is useful if you accidentally nudged the focus carriage and you need to re-home the machine without turning it off and on again otherwise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

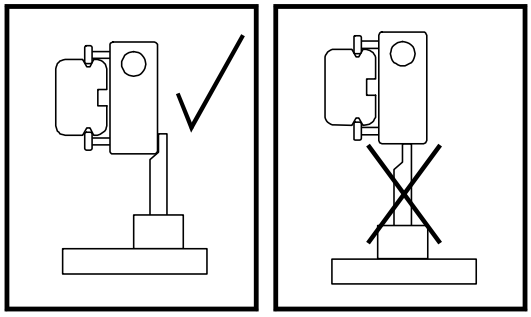
Focus Tool Method

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.



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

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.



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.

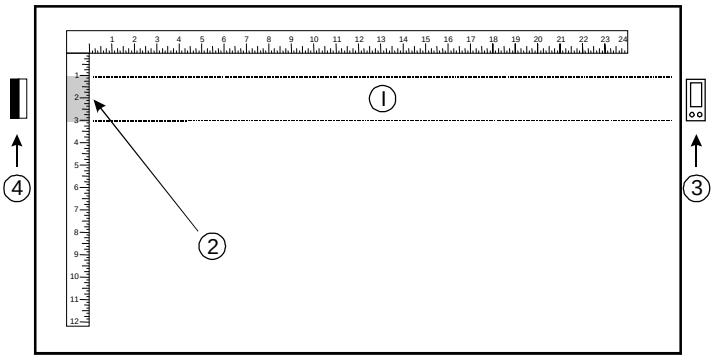
SET FOCAL HEIGHT (Calibration) menu

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.

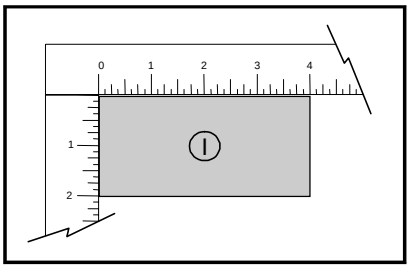
To verify that AUTOFOCUS is correctly calibrated, place an AUTOFOCUS qualified material in the upper right corner of the engraving field and AUTOFOCUS on it. Then, **WITHOUT EXITING OUT OF THE AUTOFOCUS MENU**, place the focus tool on top of the material and use the UP and DOWN buttons to set focus using 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.

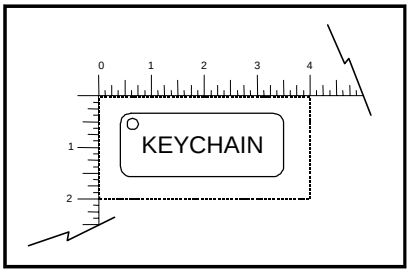
Step 1 – Loading and Positioning the Material

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.

NOTE

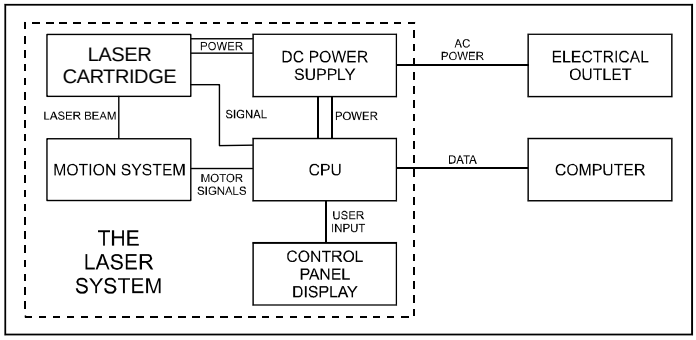
If you start a file with the top or front door open you may notice that a red dot pointer appears on the Z-axis table simulating where the CO2 laser beam will fire. However, please note that the red dot pointer is NOT triggered like the laser beam itself and while the system is simulating raster engraving or vector cutting, the area in which the Red Dot moves actually represents the complete motion of the mechanical assembly, and is not an exact indication of where the CO2 laser beam will burn. The laser beam will be activated somewhere within that motion depending on the graphic itself.

How it All Works

There are five (5) basic components that make up a laser system, the control panel, the CPU, the DC power supply, the laser cartridge, and the motion system.

DC Power Supply

The DC power supply converts the incoming AC electricity to 48 volts DC. This is used to power both the laser cartridge and the CPU.



CPU

The CPU is the "brains" of the system and controls everything. Located on the CPU are standard computer memory SIMMS. This is where incoming files, from the computer, are stored while the power is on. The CPU gets input from the computer and the control panel. It outputs precisely timed signals to fire the laser beam and to move the motion system simultaneously.

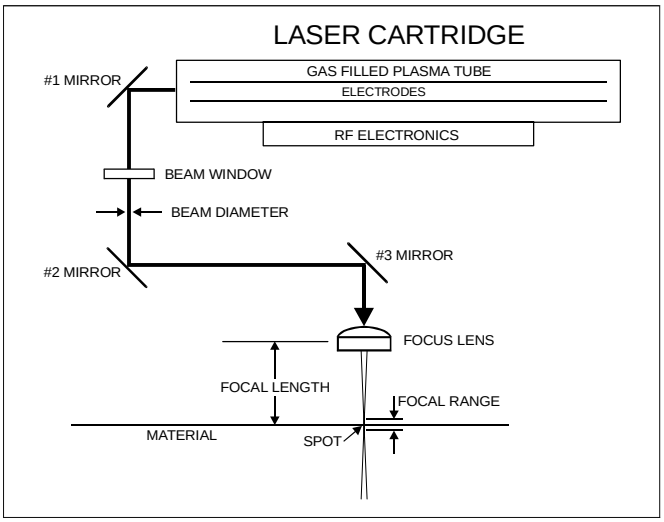
Control Panel

This is where the operator controls the laser system. It is composed of tactile feel push buttons and a LCD display. From this panel, the operator can position the motion system, move around through the menu system in the LCD display, and run the laser system.

NOTE: Before describing the complex functionality of the SUPERSPEED, in the following diagram, we demonstrate how a typical single-laser system works. We will then show how the SUPERSPEED builds upon this foundation and utilizes two laser cartridges to operate in a dual laser single mode or dual laser dual beam mode.

Laser Cartridge

The laser cartridge is a very sophisticated device. It is composed of a plasma tube filled with a special mixture of CO2 and other gases, and RF (radio frequency) electronics. The function of the entire assembly is to turn electrical energy into concentrated light energy. The word LASER is an acronym for Light Amplification by Stimulated Emission of Radiation.



The laser cartridge receives power from the 48VDC power supply and its "trigger signal" from the CPU. When the laser system is power on and the trigger signal comes from the CPU, the RF electronics produce a 40 MHz signal across the electrodes located inside the plasma tube. This causes spontaneous photon emissions from the gas mixture that produces an invisible, infrared light beam at a frequency of 10.6 microns.

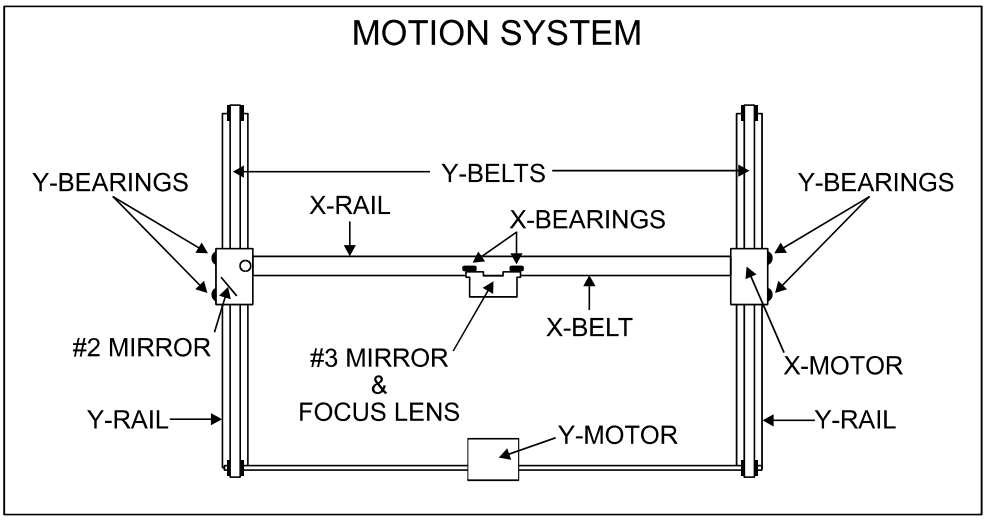
The laser beam exits the laser cartridge through its output optics, reflects off the #1 mirror, passes through the beam window, reflects off the #2 and #3 mirrors and then finally passes through the focus lens. The #2 and #3 mirror and the focusing lens are all mounted to the motion system. The width of the laser beam as it exits the tube, called the "Beam Diameter", is about 4 mm. The focus lens focuses the beam into a very small spot where the spot size is dependent on the focal length of the lens. The focal length is the distance from about the center of the lens to the point where the beam converges into the smallest spot possible. Using a standard 2-inch focal length lens, the spot size produced is approximately .005 inches.

The focal range of the lens, where the beam is considered to be “in focus”, is equivalent to +/- 5% above and below the focus point. Shorter lenses produce a smaller spot size but also have a very narrow focal range. This means that it would only be useful for engraving very flat objects. The longer lenses have a much wider range of focus but also produce a larger spot size that would prohibit the engraving of fine detail. This can be related to trying to write small text with a wide, felt tip marker. There are pros and cons to the different lenses that are available for different applications. Please refer to the Appendices section on available lenses and their operating characteristics.

Wattage signifies the amount of heat energy that the laser light is producing over a period of time. Laser energy is measured with a laser power meter that measures the unfocused laser beam’s heat output over a calibrated period of time.

Motion System

The motion system consists of the mechanically moving parts of the laser system. It is made up of rails, motors, bearings, belts, mirrors, a lens, and other parts. There are two directions of motion, left and right, referred to as the “X” direction, and front to back, referred to as the “Y” direction.



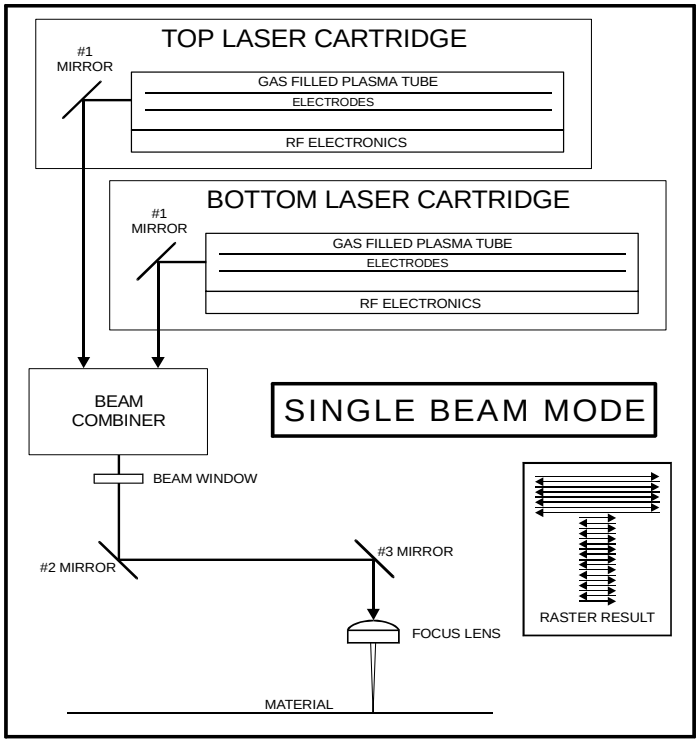
The CPU controls the movement of the motors, which moves the mirrors and focus lens across the engraving area and over the material. At the same time, it is synchronizing the laser pulses with the position of the focus lens. It is this precise positioning and timing of the laser pulses that produces the highest quality and fastest speed of engraving.

In summary, the five (5) components work together to take the graphic image that is downloaded to the laser system from your computer and burn it into the material located on the engraving table inside of the laser system.

Single/Dual Laser Single Beam Mode

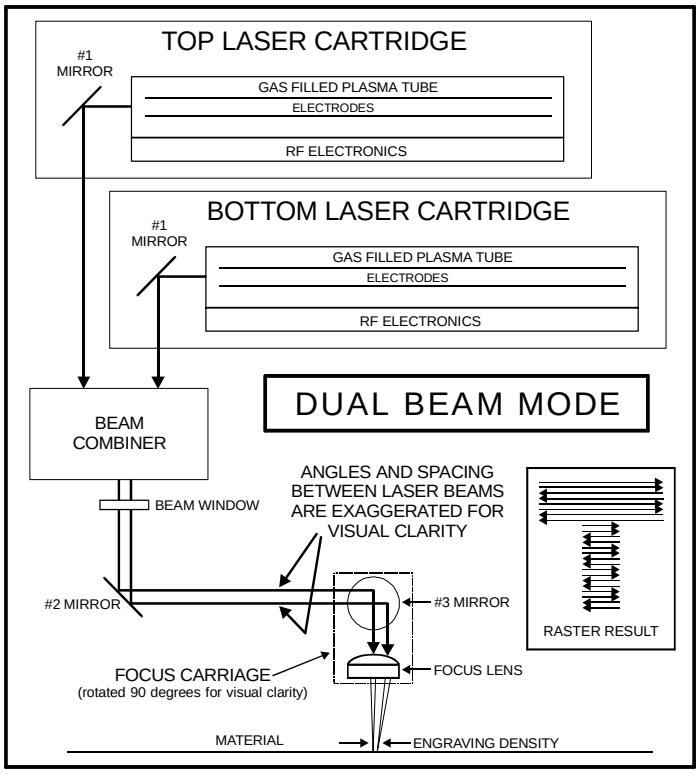
In the X-600 model, there is only one laser present so the system will always operate in Single Laser Single Beam mode. If you have an X2-600 and only purchased one laser, your system also operates the same as the X-600, but gives you the opportunity to add a laser in the future. X2-600 systems with two lasers installed, operate in the Dual Laser Single Beam mode where the system will combine the two laser beams into one beam that has the total wattage power of both laser cartridges added together. For example, if there are two, 50-watt laser cartridges installed, the output in this mode will be the same as a single 100-watt laser cartridge.

As the diagram of the raster engraving of the letter “T” demonstrates, the net raster result will be a single-beam, bi-directional, one-step-at-a-time engraving.



Dual Laser Dual Beam Mode

Only available in the SuperSpeed model, in the printer driver, if the “Dual Beam” checkbox **IS** selected, the system will separate the two laser beams to produce two separate raster engraving lines and engrave them at the same time. When raster engraving, the motion system steps down twice the distance it normally does and engraves the next two raster lines. Since the CPU separately controls the pulsing of each laser cartridge, the Dual Beam mode provides faster throughput at the same resolution settings a running the system in Single Beam mode. Keep in mind that the power settings you use will be about the same as if in Single Beam mode. Each laser will engrave their respective raster line using its own power. For example, if there are two, 50-watt Laser Cartridges installed, the power output in this mode will be as if you only had one 50-watt Laser Cartridge that has throughput of two, 50-watt laser systems running at the same time.



When vectoring, Dual Beam mode automatically turns off, even if you have the checkbox selected. This is because you would never want to vector engrave or cut with two separate beams.

In the diagram, the engraving density is the separation distance between each laser beam relative to the top and bottom of the engraving field. The illustration of the focus carriage has been rotated 90 degrees for clarity.

In the dual beam dialog box located within the printer driver, moving the slider bar up will increase the engraving density, which increases the resolution but decreases throughput. Lowering the slider bar, decrease the engraving density, which lowers the resolution but increases throughput.

In the diagram, refer to the example of the raster engraving of the letter “T” and notice how the two laser beams raster the two, separate raster engraving lines at the same time, bidirectionally. Since the focus carriage reverses direction ½ as many times in this mode as opposed to Single Beam mode, throughput is much faster.

Experiment with the different throughput settings in the printer driver to find the best balance of speed and engraving quality that your application needs. Refer to the Computerized Controls Manual on how to adjust the settings in the printer driver.

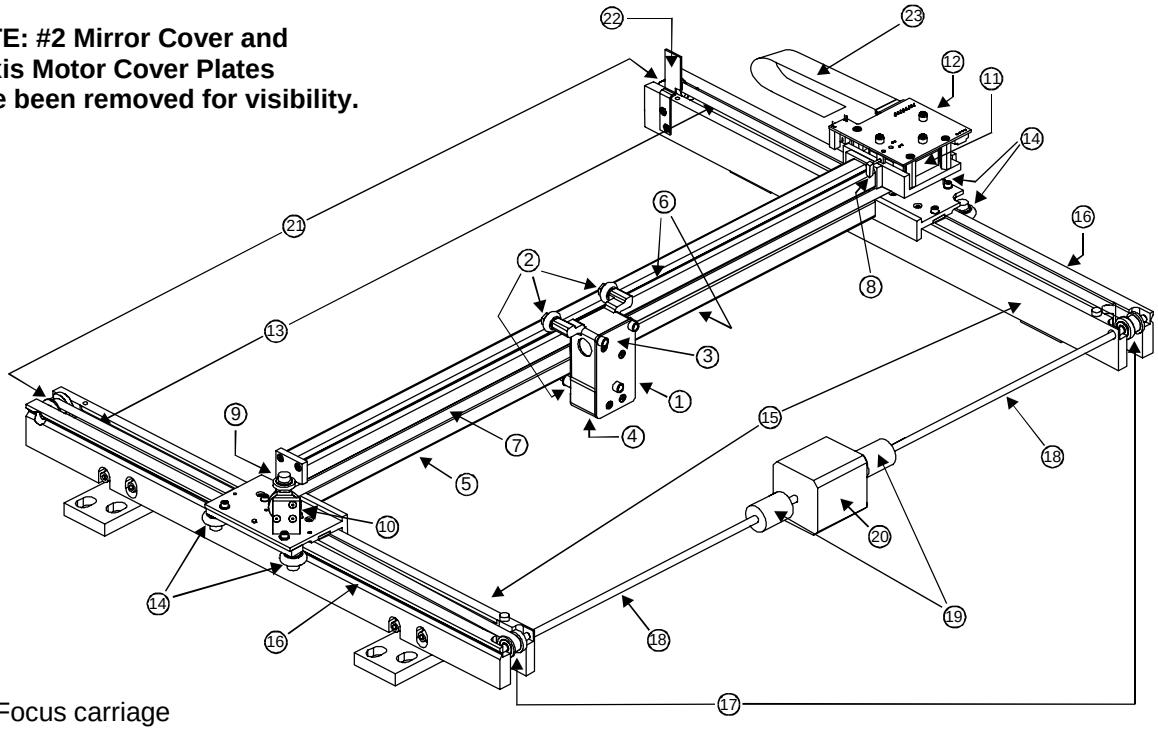
Section 4

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.

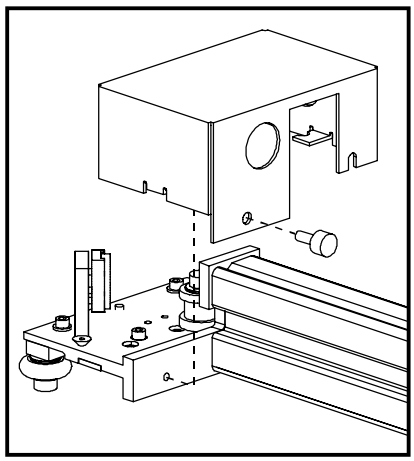
Optics

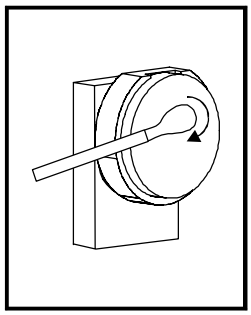
A visual inspection of the #2 and #3 mirrors, beam window, and focus lens should be performed at least once a day.

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.

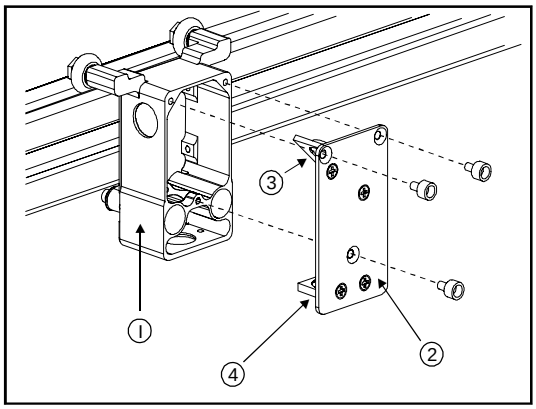


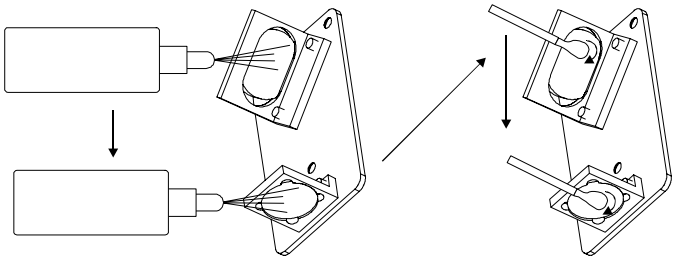


Inspect the #2 mirror and clean it only if there is debris present. To clean the #2 mirror with a cotton swab, moisten the cotton swab with the lens cleaning solution supplied with the laser system. **DO NOT** use other types of cleaners or solutions. Gently roll the cotton swab across the mirror once. **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.

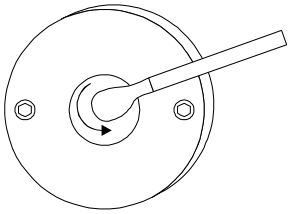


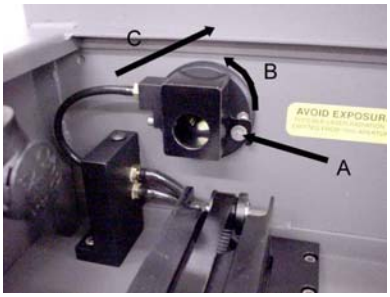


Tilt the front cover enough to enable you to apply the lens cleaning solution directly to the #3 mirror and to the focus lens. Flood the reflective surface of the #3 mirror with the solution. If heavy debris is present, let the solution soak in for a minute. Roll a fresh cotton swab across the mirror 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

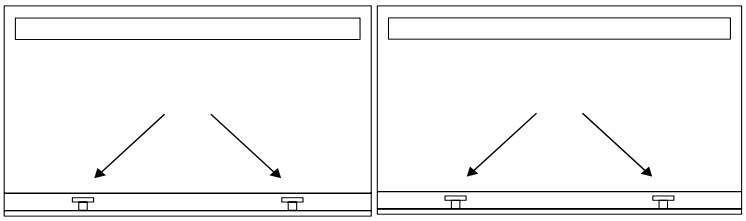
The beam window is where the laser beam enters into the engraving area. It is located in the upper left hand corner of the engraving area against the back wall and is yellow in color. It is only necessary to clean the front side of the beam window. Do not remove the optic to clean it, simply clean it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

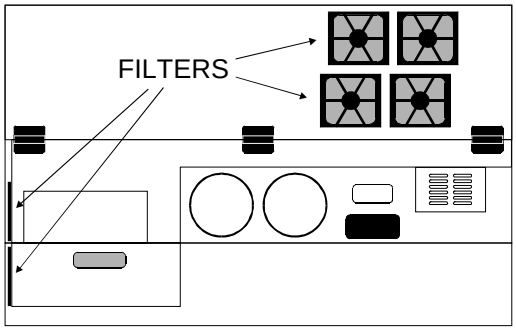
Exhaust Plenum Cleaning



- 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

This air-cooled laser system will require periodic cleaning of the cooling fan filters. Since ambient air is used to cool the laser cartridge, the air must be filtered before it enters the inside of the laser system. Dirt or dust contamination may reduce the cooling fan's ability to keep the laser cartridge, as well as the CPU and power supply, from overheating. An overheated laser cartridge will lose laser power during engraving and will eventually shut down completely.



The cooling fan filters are located on the back, and side of the laser system. 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

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.

Troubleshooting Guide

Engraving Quality

Problem	Possible Cause	Possible Solution
"Fuzzy" looking raster engraving or small text appears like a "double image"	• Dirty laser system	• Clean all optics, rails, bearings and belts
	• Graphic, graphic software, graphic software setup, color palette, monitor display colors, or driver settings have changed	• Check to see what has changed. Refer to the "Computerized Controls" manual to properly setup the graphics software. Check driver settings.
	• Speed to fast for the material	• Slow down engraving speed
	• Out of focus	• Re-focus
	• System needs tuning	• Run "Tuning" feature in printer driver
	• Worn X-axis belt and/or drive gear	• Replace belt and/or drive gear, and run "Tuning" feature
	• Laser Tube is faulty	• Replace laser tube
Fine detail is missing such as the serif's of characters or thin lines of script fonts when raster engraving	• Speed too fast for the material	• Slow down engraving speed
	• Laser cannot respond to low duty-cycle, high speed engraving	• Run enhancement feature in the printer driver
	• Out of focus	• Re-focus
	• System needs tuning	• Run "Tuning" feature in printer driver
	• Laser spot size too big	• Use shorter focal length lens
Vertical or diagonal background pattern present when raster engraving large areas and/or large amounts of material	• Dirty laser system	• Clean all optics, rails, bearings and belts
	• Slight pattern is normal	• 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
	If the pattern is excessive:	
	• Loose motion system components	• Check X-axis bearings, belt, optics
	• Worn or damaged X-axis bearings	• Replace X-axis bearings
	• Worn or damaged X-axis rail	• Replace X-axis arm
Horizontal background pattern present when raster engraving large areas and/or large amounts of material	• Dirty laser system	• Clean all optics, rails, bearings and belts
	• Slight pattern is normal	• 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
	If the pattern is excessive:	
	• Laser is too cold or hot	• Check and/or clean filters
		• Make sure ambient temperature is within specifications
	• Laser tube is faulty	• Replace laser tube
Engraving disappears, becomes "lighter", or appears "choppy" when raster engraving at high speeds within ½ inch of Y-axis ruler	• Normal condition. The laser system needs to accelerate and decelerate within this area	• Move graphic and/or material to the right, outside of this area
		• Slowing the raster speed down reduces the effect

Raster engraving appears sharp on both ends of the engraving but fuzzy in the middle	• Dirty laser system • Something is loose • System needs tuning • Worn X-axis belt and/or drive gear • Faulty laser tube	• Clean all optics, rails, bearings, belts • Check X-axis bearings, drive gear, idler pulley, belt, and optics • Run “Tuning” feature in printer driver • Replace belt and/or drive gear, and run “Tuning” feature • Replace laser tube
Engraving does not appear as deep as it normally does	• Graphic, graphic software, graphic software setup, color palette, monitor display colors, or driver settings have changed • Out of focus • Material or material density has changed • Settings have changed • Dirty laser system • Laser tube cooling fan filters are dirty • Ambient temperature not within specifications • Laser beam out of alignment with the optics • Air Assist cone misaligned (air assisted versions only) • Faulty laser tube	• 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. • Re-focus • Check material • Check power, speed, PPI, and DPI settings • Clean all optics, rails, bearings and belts • Check and/or clean • Adjust ambient temperature to within specifications • Check and/or adjust laser beam alignment • Check and/or adjust cone so that laser beam is in center • Replace laser tube
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	• Out of focus • Dirty laser system • Material is not level or varying in thickness • Table is not level • Laser beam out of alignment with the optics • Air Assist cone misaligned (air assisted versions only) • Faulty laser tube	• Re-focus • Clean all optics, rails, bearings, belts • Check focus point of material and different places, adjust height by shimming material or using more thickness-consistent material • 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. • Check and/or adjust laser beam alignment • Check and/or adjust cone so that laser beam is in center • Replace laser tube
Engraving appears “halftoned” and not solidly filled when using colors other than black	• Graphic, graphic software, graphic software setup, color palette, monitor display colors, or driver settings have changed	• Check to see what has changed. Refer to the “Computerized Controls” manual to properly setup the graphics software. Check driver settings.

Wavy lines when vector engraving or cutting	• Running too fast • Dirty laser system • Worn or faulty bearings • Arm is out of square • Firmware needs to be updated	• The highest quality vectors are obtained by running less than 5% speed • Clean all optics, rails, bearings and belts • Check and/or replace X and/or Y axis bearings • Square arm re-adjust left side Y-axis bearings so both are contacting Y-rail equally • Firmware advancements have been improving vector quality
Angled cuts when cutting through thick materials such as ¼" acrylic	• Angled cuts are a normal condition if they are equal on all sides of the object. The topside of the object will always be slightly smaller than the backside of the object due to the material "spreading more" at the focal point. • Angled cuts on only one or two sides indicates a slight beam misalignment at the #3 mirror or focus lens	• Cut a square and observe that each side is slightly tapered inward. • Check and adjust the beam alignment at the #3 mirror position and the focus lens
The start and stop points of circles, when cutting, do not meet up	• Slight "notching" when cutting circles is a normal condition due to the beam starting and stopping at the same point If the pattern is excessive: • Dirty laser system • Mechanical problem	• 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. • Try rotating the circle 90 or 180 or 270 degrees. Sometimes this helps reduce the effect • Clean all optics, rails, bearings and belts • Turn machine off and check for binding in the x & y directions. Check for excessive belt tension.
Flat edges on curves when vector cutting	• DPI setting too low • PPI setting too low • Software limitation	• 1000 DPI produces the smoothest edges when cutting • Higher PPI settings produce smoother edges but may cause excessive burning or melting • The graphic software you are using has limited vector smoothness capability

Operational

Focus carriage looses X-axis position and slams into the left or right side of the rail during high speed raster engraving	• Mechanical interference • Dirty laser system • CPU overheating • X-belt too tight • Worn or binding X-axis bearings • Worn or binding X-axis idler pulley • Worn or binding X-axis motor • Firmware needs updating	• Check if focus carriage makes contact with material or other objects • Clean all optics, rails, bearings and belts • Clean CPU filters, correct ambient temperature to be within specifications • Check and/or adjust • Check and/or replace • Check and/or replace • Check and/or replace • Check with Service Department
When homing, the arm slams repeatedly for a few seconds	• Bent Y-flag • Dirty or faulty home sensor(s)	• Check and/or straighten • Replace upper flex board
When focusing, the Z-axis table only moves in one direction	• Dirty or faulty Z-axis sensor	• Try to clean sensor(s) with compressed air, otherwise replace sensor
When using Autofocus, the table moves all the way down to the bottom and gets stuck	• Autofocus sensor or reflector is dirty • Autofocus sensor is misaligned	• Clean sensor and/or reflector • 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.
When printing to the laser system, the computer gives an error message "Printer out of paper" or "Printer offline and not responding"	• Laser not turned on • Computer is locked up • Parallel port cable not connected or not connected properly • Laser system is out of memory • Single file is too large for memory installed in laser system • Bad parallel port in computer system • Damaged port in CPU	• Turn on laser system • Re-boot computer and laser system • Connect cable or reseat connection at computer and/or laser system • Check "Free Memory" in laser system control panel. Clear laser system memory and try again • Purchase more memory • Try printing to another printer using the same port • Replace laser system's CPU
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.	• Incorrect BIOS setting in computer • Using a printer cable longer than 6 ft. • Bad printer cable • Usage of device in between computer and laser system • Some other parallel port driver interfering with the laser system printer driver • Bad Parallel port in the computer • Damaged port in CPU	• Refer to manual on proper setting • Use only a 6 ft., IEEE1284 compliant printer cable • Replace printer cable • Connect the laser system directly from computer with the printer cable • Remove all other parallel port drivers and try again • Try another computer or change parallel ports • Replace laser system's CPU

Section 5

Material Settings Guide

This section provides sample driver settings and helpful hints to get started engraving and/or cutting the materials listed.

Safety

NEVER LEAVE THE LASER SYSTEM RUNNING UNATTENDED FOR ANY REASON. Exposure to the laser beam can cause ignition of combustible materials. All laser cutting and engraving should be constantly supervised.

NEVER OPERATE THE LASER SYSTEM WITHOUT A PROPERLY INSTALLED AND OPERATING EXHAUST SYSTEM. Some materials when cut or engraved can produce fumes that are hazardous in concentrated amounts. Also make sure that your room is adequately ventilated as some materials will continue to produce fumes for several minutes to possibly hours after the cutting or engraving process has been completed. Since many materials can produce toxic and possibly caustic fumes or residue, it is advisable to obtain the Material Safety Data Sheet (MSDS) from the materials manufacturer. The MSDS discloses all of the hazards when handling or processing that material. The law requires all manufacturers to provide this information to anyone who requests it.

DO NOT ENGRAVE OR CUT PVC (Polyvinylchloride) BASED MATERIALS. The fumes are extremely toxic if you inhale them. The fumes are so caustic that it can chemically destroy the metal parts of the laser system. Damage to the laser system from this type of abuse **ARE NOT** covered under warranty.

DO NOT ENGRAVE OR CUT UNCOATED METALS OR REFLECTIVE SURFACES. The laser beam can reflect off of these materials causing damage to the laser system as well as being a safety hazard. Damage to the laser system from this type of abuse **ARE NOT** covered under warranty.

- Laser engraving or cutting materials other than those described in this manual can be a safety hazard and can damage the laser system.
- Damages to the laser system due to neglect, misuse, or operator error ARE NOT covered under warranty.
- Damage to the laser system due to an inadequate or improper operating environment is considered abuse and **ARE NOT** 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.

Materials

There are many variables that can affect the cutting and engraving process such as differences in the thickness of the material, density of the material, composition of the material, and the manufacturing processes used to make the material.

Please use these settings as a guideline or starting point, in most cases these settings should work out well, but sometimes may have to be adjusted to produce desirable results.

PRINTER DRIVER SETTING TIPS

Power Setting

- Higher burns deeper. Too much power sacrifices detail. Has no effect on running time.
- Lower burns shallower. Too little power sacrifices detail. Has no effect on running time.

Speed Setting

- Higher saves time. Burns shallower and reduces detail.
- Lower increases time. Burns deeper but too deep may reduce detail.

PPI Setting

- Higher increases the burning or melting effect. Produces finer detail if speed is not too fast. Has no effect on running time and very little effect on depth.
- Lower decreases the burning or melting effect. Reduces image detail if set too low. Has no effect on running time and very little effect on depth. Very low settings are used to perforate the material.

Rule of Thumb

- Doubling the power doubles the depth and halving the power halves the depth.
- Halving the speed doubles the depth and doubling the speed halves the depth.

NOTE

When engraving very small objects, top speed cannot be achieved because acceleration and deceleration of the motion system requires time and distance. The laser system will automatically adjust itself to a maximum engraving speed that it can achieve due to the size and position of the graphic. This is why you might notice that there might be no difference in engraving time on certain graphics whether you choose 100% speed or less.

The following materials were tested with the laser system set at an Image density of 5 and in Single Beam mode using one laser (except where noted otherwise). The following pages will fully describe the results of these tests and will offer helpful hints when choosing materials, setting parameters, and using different techniques to provide the best laser cutting and engraving results.

If your system is equipped with two lasers, total the power of the two lasers and refer to the charts. For example, if you have two 30-watt lasers, refer to the settings of a single 60-watt laser. If the total wattage is more that the charts show, then refer to the setting of one laser and either reduce the power setting in half or double the speed (if speed is 50% or less). If you are using a SuperSpeed, and running in Dual Beam mode, use the settings of the wattage of one laser.

Please use these settings as a guideline or starting point, in most cases these settings should work out well, but sometimes may have to be adjusted to produce desirable results.

ACRYLIC - CAST AND EXTRUDED

ACRYLIC – MIRRORED

ALUMINUM – ANODIZED
BRASS – PAINTED

CORK

CORIAN / AVONITE / FOUNTAINHEAD

DELRIN (SEAL PRESS)

GLASS / CRYSTAL

LEATHER

MARBLE

MAT BOARD

MELAMINE

PLASTIC – MICROSURFACED

RUBBER STAMPS

VINYL – SIGN (3 MIL)

WOOD / WOOD INLAY

ACRYLIC - CAST AND EXTRUDED

LIGHT RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	53	100	500	1	.002”
30	44	100	500	1	.002”
35	38	100	500	1	.002”
40	34	100	500	1	.002”
45	30	100	500	1	.002”
50	27	100	500	1	.002”
55	24	100	500	1	.002”
60	22	100	500	1	.002”

DEEP RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	60	500	1	.010”
30	100	64	500	1	.010”
35	100	68	500	1	.010”
40	100	73	500	1	.010”
45	100	77	500	1	.010”
50	100	81	500	1	.010”
55	100	86	500	1	.010”
60	100	90	500	1	.010”

VECTOR ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	6	4.0	1000	1	.005””
30	5	4.0	1000	1	.005””
35	4	4.0	1000	1	.005””
40	3	4.0	1000	1	.005””
45	3	4.0	1000	1	.005””
50	3	4.0	1000	1	.005””
55	2	4.0	1000	1	.005””
60	2	4.0	1000	1	.005””””

VECTOR CUTTING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	0.1	1000	1	.25”
30	100	0.4	1000	1	.25”
35	100	0.6	1000	1	.25”
40	100	0.9	1000	1	.25”
45	100	1.2	1000	1	.25”
50	100	1.5	1000	1	.25”
55	100	1.7	1000	1	.25”
60	100	2.0	1000	1	.25”

COMMENTS

There are two types of acrylic available, cast and extruded. Cast turns white or frosted and extruded remains clear when engraved. Use extruded acrylic for paint filled engraving and cast for regular engraving. Cast engraves better without masking. Lightly engrave the surface to frost it with a low power setting such as the first setting listed above. If deep engraving is desired, it is necessary to mask the acrylic with transfer tape to prevent the smoke from damaging the clear surface of the acrylic. However, another problem with deep acrylic engraving is that the intense heat creates a white, crusty, deposit that accumulates along the edges of the area that was just engraved and is impossible to remove without causing damage. Engraving lightly and without masking seems to be the better all around alternative.

If only cutting acrylic, extruded works better and is less expensive than cast. The cut edges of extruded acrylic will appear to be more highly polished and clearer than cast acrylic when laser cut. When cutting acrylic, it might be necessary to remove both sides of the original masking and re-mask with transfer tape if cutting through the original masking produces flaming. The original masking is coated with wax and will not absorb water. If cutting through very thick acrylic, re-mask both sides with transfer tape and dampen the masking on both sides of the acrylic with water from a spray bottle. Elevate the acrylic off the table at least 1/2 inch, re-focus, and then proceed to cut. Elevating the acrylic will allow the beam to completely pass through the material which allows the smoke and heat to escape from underneath. If cutting directly on the engraving table, the trapped heat might cause the bottom edge of the cut to pit and distort. Re-masking and dampening with water will act as a heat sink to pull the laser heat away from the cutting area resulting in less distortion or heat affected zones (HAZ). When dampening, be sure not to leave puddles of water. Puddles of water will reduce cutting depth significantly. For the best results when combining engraving and cutting on the same piece, first engrave lightly and unmasked. Then mask with transfer tape, dampen, elevate, re-focus, and cut as a second step.

Paint filling the engraved area is possible by first masking the acrylic or leave on the original masking then engraving through the masking. Before removing the masking, brush or spray on some acrylic based or water based paint right on to the masking. When the paint is dry, remove the masking and the paint will remain in the recessed area of the engraving. Remember to use extruded acrylic when paint filling and cast acrylic when simply engraving.

Acrylic is extremely flammable. Do not leave the laser system unattended when cutting or engraving.

ACRYLIC - MIRRORED

LIGHT RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	58	100	500	1	.003”
30	49	100	500	1	.003”
35	43	100	500	1	.003”
40	40	100	500	1	.003”
45	35	100	500	1	.003”
50	32	100	500	1	.003”
55	29	100	500	1	.003”
60	27	100	500	1	.003”

DEEP RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	60	500	1	.010”
30	100	64	500	1	.010”
35	100	68	500	1	.010”
40	100	73	500	1	.010”
45	100	77	500	1	.010”
50	100	81	500	1	.010”
55	100	86	500	1	.010”
60	100	90	500	1	.010”

VECTOR ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	6	4.0	1000	1	.005””
30	5	4.0	1000	1	.005””
35	4	4.0	1000	1	.005””
40	3	4.0	1000	1	.005””
45	3	4.0	1000	1	.005””
50	3	4.0	1000	1	.005””
55	2	4.0	1000	1	.005””
60	2	4.0	1000	1	.005””””

VECTOR CUTTING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	0.1	1000	1	.25”
30	100	0.4	1000	1	.25”
35	100	0.6	1000	1	.25”
40	100	0.9	1000	1	.25”
45	100	1.2	1000	1	.25”
50	100	1.5	1000	1	.25”
55	100	1.7	1000	1	.25”
60	100	2.0	1000	1	.25”

COMMENTS

Engraving mirrored acrylic is similar to engraving regular acrylic. The idea is to engrave through the mirrored backing enough to begin to penetrate into the acrylic. Engraving deeply will cause a crusty residue to form just like with non-mirrored acrylic. A double image will appear if engraving on the front side of the mirror. It is not necessary to mask the backside when engraving because the mirrored backing shields the acrylic from smoke damage. To cut mirrored acrylic, it might be necessary to remove all original masking, re-mask with transfer tape, and dampen the tape with water from a spray bottle. Next, place the acrylic in the laser with the mirrored surface facing upwards and elevate at least 1/2 inch above the table. The laser beam will not reflect off of the mirrored surface because it is absorbed by the acrylic first. Sometimes cutting the acrylic from the backside will cause the mirrored backing to distort and crack from the intense heat required to cut. If the combination of engraving and cutting is desired, our suggestion is to engrave the backing, unmasked, remove the acrylic, mask both sides with transfer tape, flip the acrylic over, dampen, elevate, re-focus, and cut from the front side. When paint filling the engraved area, make sure to use an acrylic-based paint or paint that does not contain acetone or alcohol, as these chemicals will crack the acrylic. Water based paints also work very well. Since the mirrored backing serves as a masking, it is not necessary to mask the backside before engraving.

Acrylic is extremely flammable. Do not leave the laser system unattended when cutting or engraving.

ANODIZED ALUMINUM

RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	72	100	500	1	.001”
30	60	100	500	1	.001”
35	52	100	500	1	.001”
40	45	100	500	1	.001”
45	40	100	500	1	.001”
50	36	100	500	1	.001”
55	32	100	500	1	.001”
60	30	100	500	1	.001”

VECTOR ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	12	4.0	1000	1	.001”
30	10	4.0	1000	1	.001”
35	9	4.0	1000	1	.001”
40	8	4.0	1000	1	.001”
45	7	4.0	1000	1	.001”
50	6	4.0	1000	1	.001”
55	5	4.0	1000	1	.001”
60	4	4.0	1000	1	.001”

COMMENTS

There is a process called Laser Color Marking, which enables the color filling of anodized aluminum. First, coat or spray the aluminum with a clear acrylic finish. After the finish has thoroughly dried, laser engrave the graphic onto the aluminum. Then take a water based marker, such as those found in an art supply store, and swab on the ink into the engraved area. You can actually see the ink get absorbed into the engraved area but not the unengraved area. The ink will appear lighter in color because the white engraved area tends to lighten the shade. Use a darker tint marker to compensate for the lighter effect. Wipe off the excess with a soft, lint free cloth. Finish the piece by applying another coat of clear acrylic finish and let dry.

DO NOT ATTEMPT TO ENGRAVE DEEPLY OR ATTEMPT TO CUT THIS MATERIAL WITH THE LASER SYSTEM. High Power and low Speed settings can cause the laser beam to reflect off of this material, which can damage the laser system and can be a safety hazard. Damage caused by this type of abuse **ARE NOT** covered under warranty.

ENGRAVING THIS MATERIAL PRODUCES ABRASIVE PARTICLES. Clean the laser system more frequently to reduce wear and tear on the motion system components and optics. Damage to the laser system from inadequate or insufficient maintenance **ARE NOT** covered under warranty.

BRASS - PAINTED

RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	29	100	500	1	.001”
30	27	100	500	1	.001”
35	25	100	500	1	.001”
40	23	100	500	1	.001”
45	21	100	500	1	.001”
50	19	100	500	1	.001”
55	17	100	500	1	.001”
60	15	100	500	1	.001”

VECTOR ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	6	4.0	1000	1	.001”
30	5	4.0	1000	1	.001”
35	4	4.0	1000	1	.001”
40	3	4.0	1000	1	.001”
45	3	4.0	1000	1	.001”
50	3	4.0	1000	1	.001”
55	2	4.0	1000	1	.001”
60	2	4.0	1000	1	.001”

COMMENTS

The manufacturing process for coated brass varies from one vendor to another. Some manufacturers do not polish the brass before coating it. Since CO_2 lasers at this power level do not engrave into metals when the coating is removed, the tarnished brass underneath will have a dull appearance that will need to be polished with a brass polishing compound. This type of brass is designed for mechanical engravers that actually remove the metal when engraving which gives the brass a shine without polishing. Brass that is produced for the laser engraving industry is polished, then clear coated, and finally coated with paint. When laser engraving this type of material, adjust the power so that the laser beam removes the painted coating but not the clear coating. This will expose the polished, clear-coated brass without penetrating all the way down to the metal. Since the brass is already clear coated and polished, it will not require any cleanup after engraving nor will it ever oxidize. If too much laser power is used, the brass the clear coat will be removed and the brass underneath will be exposed to the heat of the laser beam causing instant tarnish. If polishing the brass, use a soft, non-abrasive cloth or tissue (not paper towels) and good quality brass polish. Do not rub too hard, as this will scratch the painted coating.

DO NOT ATTEMPT TO ENGRAVE DEEPLY OR ATTEMPT TO CUT THIS MATERIAL WITH THE LASER SYSTEM. High power and low speed settings can cause the laser beam to reflect off of this material, which can damage the laser system and can be a safety hazard. Damage caused by this type of abuse **ARE NOT** covered under warranty.

CORIAN / AVONITE / FOUNTAINHEAD

RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	44	500	1	.005”
30	100	53	500	1	.005”
35	100	61	500	1	.005”
40	100	70	500	1	.005”
45	100	79	500	1	.005”
50	100	88	500	1	.005”
55	100	95	500	1	.005”
60	100	100	500	1	.005”

DEEP RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	13	1000	1	.015”
30	100	15	1000	1	.015”
35	100	18	1000	1	.015”
40	100	20	1000	1	.015”
45	100	23	1000	1	.015”
50	100	26	1000	1	.015”
55	100	28	1000	1	.015”
60	100	30	1000	1	.015”

VECTOR ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	60	4.0	1000	1	.010”
30	50	4.0	1000	1	.010”
35	43	4.0	1000	1	.010”
40	38	4.0	1000	1	.010”
45	34	4.0	1000	1	.010”
50	30	4.0	1000	1	.010”
55	27	4.0	1000	1	.015”
60	25	4.0	1000	1	.015”

COMMENTS

If paint filling, mask the material first, then engrave through the masking. In this way, when ready to paint fill, the material is already masked. Spray painting seems to be the easiest. Use the paint sparingly. Excess paint can accumulate on the edges of the engraving, which will make mask removal difficult and leave unsightly ridges. It is best to apply several lighter coats than one heavy coat of paint. Remove the masking after the paint has dried.

ENGRAVING THIS MATERIAL PRODUCES ABRASIVE PARTICLES. Clean the laser system more frequently to reduce wear and tear on the motion system components and optics. Damage to the laser system from inadequate or insufficient maintenance **ARE NOT** covered under warranty.

CORK

RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	80	38	500	1	.010”
30	80	45	500	1	.010”
35	80	52	500	1	.010”
40	80	60	500	1	.010”
45	80	67	500	1	.010”
50	80	75	500	1	.010”
55	80	84	500	1	.010”
60	80	90	500	1	.010”

VECTOR ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	12	4.0	500	1	.010”
30	10	4.0	500	1	.010”
35	9	4.0	500	1	.010”
40	8	4.0	500	1	.010”
45	7	4.0	500	1	.010”
50	6	4.0	500	1	.010”
55	5	4.0	500	1	.010”
60	4	4.0	500	1	.010”

VECTOR CUTTING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	60	1.6	100	1	.060”
30	50	1.6	100	1	.060”
35	43	1.6	100	1	.060”
40	38	1.6	100	1	.060”
45	33	1.6	100	1	.060”
50	30	1.6	100	1	.060”
55	27	1.6	100	1	.060”
60	25	1.6	100	1	.060”

COMMENTS

Cork is not very popular for engraving but it does engrave and cut nicely. Cork is mainly used for making gaskets by vector cutting the gasket patterns.

LASER CUTTING THIS MATERIAL CAN CAUSE FLAMING AND SPARKING. Use caution when attempting to cut this material. It would be better to use a longer focal length lens to prevent the lens from being damaged during processing. **NEVER** leave the machine unattended while processing any material. Damages caused by processing any material **ARE NOT** covered under warranty.

DELRIN

RASTER ENGRAVING

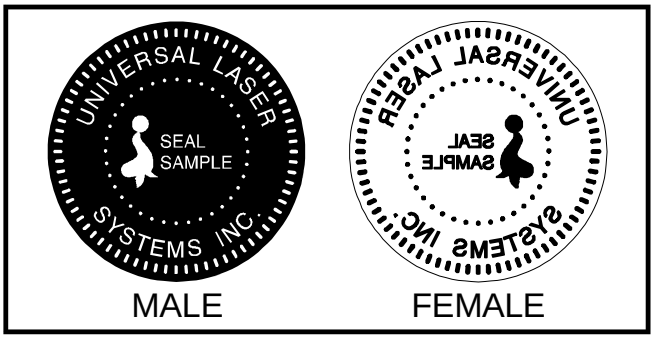
LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	22	500	1	.015”
30	100	26	500	1	.015”
35	100	30	500	1	.015”
40	100	35	500	1	.015”
45	100	39	500	1	.015”
50	100	44	500	1	.015”
55	100	48	500	1	.015”
60	100	52	500	1	.015”

VECTOR CUTTING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	75	2.0	200	1	.060”
30	75	2.4	200	1	.060”
35	75	2.8	200	1	.060”
40	75	3.2	200	1	.060”
45	75	3.6	200	1	.060”
50	75	4.0	200	1	.060”
55	75	4.4	200	1	.060”
60	75	4.8	200	1	.060”

COMMENTS

The laser system can be used to make dies for seal presses. It can engrave and cut out a typical Notary Seal in less than 5 minutes. Create the male with a white graphic and a black background. Mirror the image and invert it by making the background white and the graphic black. Add a .010 inch black outline to the graphic portion of the female side. This will give the greater clearance to the female side to prevent the paper from piercing through when the male side of the seal presses into the female side. Once the seal is made and fastened to the press, make several impressions onto 400-grit sandpaper to smoothen out the edges of the plastic. Make sure you turn the sandpaper over to get both sides of the seal.



LASER CUTTING THIS MATERIAL CAN CAUSE FLAMING. Use caution when attempting to cut this material. Make sure that the flame does not come in contact with any part of the laser system. **NEVER** leave the machine unattended while processing any material. Damages caused by processing any material **ARE NOT** covered under warranty.

GLASS / CRYSTAL

RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	13	300	1	.001
30	100	15	300	1	.001
35	100	18	300	1	.001
40	100	20	300	1	.001
45	100	23	300	1	.001
50	100	26	300	1	.001
55	100	28	300	1	.001
60	100	30	300	1	.001

COMMENTS: Engrave at Image Density 4.

VECTOR ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	10	3.3	300	1	.001
30	10	4.0	300	1	.001
35	10	4.6	300	1	.001
40	10	5.3	300	1	.001
45	10	5.9	300	1	.001
50	10	6.6	300	1	.001
55	10	7.3	300	1	.001
60	10	7.9	300	1	.001

COMMENTS

Glass engraving is different from other types of engraving. A CO_2 laser cannot engrave into the glass nor can it cut glass. Instead, laser interaction with glass causes the surface of the glass to appear frosted. Sometimes, placing a piece of newspaper on the glass and dampening is with water will improve the appearance of the engraving. Another method is to apply transfer tape to the glass, wet it with water from a spray bottle, and laser engrave it. The transfer tape and water will act as a heat sink and pull the heat away from the glass as the laser system engraves it. This helps reduce chipping or flaking of the glass.

Be especially careful when engraving leaded crystal. The lead in crystal conducts heat, which can cause much more flaking or even the cracking of the crystal. Use a lower power setting to try to reduce the chance of damage. It is always good to have at least one extra piece to use as a test piece to get the right settings especially if you have never tried to engrave that material before.

ENGRAVING THIS MATERIAL PRODUCES ABRASIVE PARTICLES. Clean the laser system more frequently to reduce wear and tear on the motion system components and optics. Damage to the laser system from inadequate or insufficient maintenance **ARE NOT** covered under warranty.

LEATHER

RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	45	100	500	1	.001”
30	38	100	500	1	.001”
35	33	100	500	1	.001”
40	28	100	500	1	.001”
45	25	100	500	1	.001”
50	23	100	500	1	.001”
55	20	100	500	1	.001”
60	19	100	500	1	.001”

VECTOR ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	6	4.0	500	1	.001”
30	5	4.0	500	1	.001”
35	4	4.0	500	1	.001”
40	4	4.0	500	1	.001”
45	3	4.0	500	1	.001”
50	3	4.0	500	1	.001”
55	3	4.0	500	1	.001”
60	3	4.0	500	1	.001”

VECTOR CUTTING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	50	1.7	200	1	.1”
30	50	2.0	200	1	.1”
35	50	2.4	200	1	.1”
40	50	2.7	200	1	.1”
45	50	3.1	200	1	.1”
50	50	3.4	200	1	.1”
55	50	3.7	200	1	.1”
60	50	4.1	200	1	.1”

COMMENTS

Leather is a very simple material to engrave and most types of leather engrave very well with the laser system. Simulated leather engraves well also, but the results are not as nice as with the real thing. Engraving lightly will turn the surface of the leather dark brown giving it a high contrast in appearance. Try engraving at a light power setting first. If the result is not deep enough the job can be run again over the same spot. Experiment with different depths of engraving and note the results.

MARBLE

RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	35	500	1	.003”
30	100	42	500	1	.003”
35	100	48	500	1	.003”
40	100	55	500	1	.003”
45	100	62	500	1	.003”
50	100	69	500	1	.003”
55	100	77	500	1	.003”
60	100	82	500	1	.003”

VECTOR ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	24	4.0	500	1	.003”
30	20	4.0	500	1	.003”
35	17	4.0	500	1	.003”
40	15	4.0	500	1	.003”
45	13	4.0	500	1	.003”
50	12	4.0	500	1	.003”
55		4.0	500	1	.003”
60		4.0	500	1	.003”

COMMENTS

Most marble and polished stones will turn white when engraved. Masking is not necessary and light engraving works out better than heavy and deep engraving. Engraving deeply will cause a highly detailed image to appear washed out. The objective is to engrave deep enough to turn the marble white and provide a good contrast. Too much power can also cause the material to discolor and turn brown as if it were burned. Photographs look great when engraved on marble, especially darker marbles where the whiteness of the engraving really stands out. Avoid using marble that is very textured looking. The texture washes out the details of the engraving. Try to use uniformly colored marble and related stones. Marble can also be paint filled by using a wax based paint. Rub the paint on with a fingertip, let dry and then buff with a soft cloth. The paint will only adhere to the engraved surface and not the surrounding areas.

ENGRAVING THIS MATERIAL PRODUCES ABRASIVE PARTICLES. Clean the laser system more frequently to reduce wear and tear on the motion system components and optics. Damage to the laser system from inadequate or insufficient maintenance **ARE NOT** covered under warranty.

MAT BOARD

RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	72	80	250	1	.005”
30	60	80	250	1	.005”
35	52	80	250	1	.005”
40	45	80	250	1	.005”
45	40	80	250	1	.005”
50	36	80	250	1	.005”
55	32	80	250	1	.005”
60	30	80	250	1	.005”

VECTOR ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	24	4.0	250	1	.005”
30	20	4.0	250	1	.005”
35	17	4.0	250	1	.005”
40	15	4.0	250	1	.005”
45	13	4.0	250	1	.005”
50	12	4.0	250	1	.005”
55	11	4.0	250	1	.005”
60	10	4.0	250	1	.005”

VECTOR CUTTING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	60	3.2	200	1	.050”
30	50	3.2	200	1	.050”
35	43	3.2	200	1	.050”
40	38	3.2	200	1	.050”
45	34	3.2	200	1	.050”
50	30	3.2	200	1	.050”
55	27	3.2	200	1	.050”
60	25	3.2	200	1	.050”

COMMENTS

Mat board (thick cardboard) is an excellent material to use for architectural modeling and for picture framing. It cuts and engraves very neatly and cleanly. It comes in a variety of shades and colors. Patterns can be engraved on the surface with a power setting for light engraving, which just breaks through the very thin top layer and exposes the lighter colored underlying substrate. When engraving, a low PPI setting is used to prevent overexposure of the underlying substrate material, which causes excessive dark discoloration. Masking is not necessary on the top surface when engraving. When cutting, both sides might need to be masked and the material elevated above the engraving table. This will produce an extremely clean edge on both sides of the material.

MELAMINE - STANDARD ENGRAVING

LIGHT RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	25	500	1	.015”
30	100	30	500	1	.015”
35	100	34	500	1	.015”
40	100	39	500	1	.015”
45	100	44	500	1	.015”
50	100	50	500	1	.015”
55	100	55	500	1	.015”
60	100	59	500	1	.015”

DEEP RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	17	500	1	.020”
30	100	21	500	1	.020”
35	100	24	500	1	.020”
40	100	27	500	1	.020”
45	100	31	500	1	.020”
50	100	35	500	1	.020”
55	100	38	500	1	.020”
60	100	41	500	1	.020”

VECTOR ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	24	4.0	500	1	.010”
30	20	4.0	500	1	.010”
35	17	4.0	500	1	.010”
40	15	4.0	500	1	.010”
45	13	4.0	500	1	.010”
50	12	4.0	500	1	.010”
55	11	4.0	500	1	.010”
60	10	4.0	500	1	.010”

COMMENTS

Engraving melamine is very similar to engraving regular wood with the added benefit of a consistent surface finish and uniform base material composition. Unlike regular wood that has grain patterns and density variations, melamine, when laser engraved, produces a flat and even engraved area. This characteristic gives this material superior engraving and paint filling qualities. Masking can be used if desired but it is just as easy to spray the engraved area with water and wipe down with a chamois cloth to remove the smoke residue. Since the top surface material is consistent in texture and color, engraving photographs or highly detailed images produces exceptional results. Refer to the next example on engraving photographs and/or ClipArt.

MELAMINE - PHOTO/CLIPART ENGRAVING

RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	80	38	500	1	.008”
30	80	45	500	1	.008”
35	80	52	500	1	.008”
40	80	60	500	1	.008”
45	80	67	500	1	.008”
50	80	75	500	1	.008”
55	80	84	500	1	.008”
60	80	90	500	1	.008”

COMMENTS: Engrave unmasked. Use an Image Density of 5.

RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	80	25	500	1	.008”
30	80	30	500	1	.008”
35	80	35	500	1	.008”
40	80	40	500	1	.008”
45	80	45	500	1	.008”
50	80	50	500	1	.008”
55	80	56	500	1	.008”
60	80	60	500	1	.008”

COMMENTS: Engrave unmasked. Use an Image Density of 3.

COMMENTS

Engraving photographs can be challenging at first but becomes easier once there is an understanding of what to look for and how to achieve the desired results. In an image processing software, scan the image in at 300 DPI. Adjust the brightness and the contrasts to brighten the light colors and darken the dark colors. The photo might look better by using a sharpening filter to sharpen up the image slightly. The next step is to select a halftone pattern. Usually, imaging software gives the choice of using different halftone patterns including frequency of lines per inch and pattern angles. Use a line frequency above 20 and below 100. The size of the dots decreases as the line frequency increases. Experiment to see which pattern looks the best. Big dots look good on some materials and small dots look better on others. If it is not possible to assign a halftone pattern in the imaging software, the printer driver will automatically default to a predetermined pattern based on **Image Density**. When using the Clipart mode switch, which prints all Clipart or drawings as grayscale bitmaps, use the same parameters and techniques as for engraving photographs.

PLASTIC - ENGRAVERS MICROSURFACED

RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	29	100	500	1	.001”
30	27	100	500	1	.001”
35	25	100	500	1	.001”
40	23	100	500	1	.001”
45	21	100	500	1	.001”
50	19	100	500	1	.001”
55	17	100	500	1	.001”
60	15	100	500	1	.001”

VECTOR CUTTING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	60	1.2	150	1	.060”
30	50	1.2	150	1	.060”
35	43	1.2	150	1	.060”
40	38	1.2	150	1	.060”
45	34	1.2	150	1	.060”
50	30	1.2	150	1	.060”
55	27	1.2	150	1	.060”
60	25	1.2	150	1	.060”

COMMENTS

Laser engraveable plastic comes in many different colors, thickness, coatings, and surface textures. Most engravers plastic will engrave and cut well with the laser system as long as it is microsurfaced and formulated for laser engraving. Removal of large amounts of material will warp the plastic. You might need to tape it down or hold it down flat somehow to prevent it from curling as you engrave. Since these plastics have low melting point, a low PPI setting is used when cutting to reduce the possibility of melting. Masking and dampening with water also helps to reduce melting and keeps the plastic clear of smoke residue. Always remove the original clear masking from the plastic because it does not react well with the laser. Since there are so many types of engravers plastics, the only true way to find out if a particular brand and type will work well with the laser is to experiment. Use these power settings as a guideline for experimentation and adjust as necessary. Thicker top coated plastics are not recommended because it requires too much power to remove the material and the large amount of smoke created usually stains the substrate.

LASER ENGRAVING OR CUTTING PLASTIC CAN IGNITE THE MATERIAL. Never leave the laser system running unattended for any reason.

RUBBER STAMPS

RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	10	500	1	.030”
30	100	12	500	1	.030”
35	100	14	500	1	.030”
40	100	16	500	1	.030”
45	100	17	500	1	.030”
50	100	20	500	1	.030”
55	100	22	500	1	.030”
60	100	23	500	1	.030”

PERFORATED VECTOR CUTTING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	60	1.3	90	1	.040”
30	60	1.6	90	1	.040”
35	60	1.8	90	1	.040”
40	60	2.1	90	1	.040”
45	60	2.3	90	1	.040”
50	60	2.6	90	1	.040”
55	60	2.9	90	1	.040”
60	60	3.1	90	1	.040”

COMMENTS

To create a rubber stamp, use the Rubber Stamp Mode the printer driver. In the above example, only one pass is necessary to achieve a deeply engraved rubber stamp. When cutting out the rubber stamp, we recommend using a very low PPI setting. This setting spreads the laser pulses far enough apart that they just touch at the edges. The result is a perforated cut that allows the rubber stamp to remain attached to the entire sheet but easily removed by simply tearing it off. The advantage to this is that the possibility of distortion or melting while cutting is virtually eliminated and the entire sheet of rubber stamps can be removed from the machine at one time instead of having to pick them up one by one.

- **LASER ENGRAVING OR CUTTING RUBBER CAN IGNITE THE MATERIAL.** Never leave the laser system running unattended for any reason.
- **LASER ENGRAVING OR CUTTING RUBBER CAN PRODUCE FOUL ODORS.** You might need to particulate filter and/or odor filter your exhaust depending on your environment, installation location, and/or your local air quality control laws.
- **LASER ENGRAVING OR CUTTING RUBBER PRODUCES ABRASIVE DUST.** Clean the laser system more frequently to reduce wear and tear on the motion system components and optics. Damage to the laser system from inadequate or insufficient maintenance **ARE NOT** covered under warranty.

SIGN VINYL

RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	19	500	1	.015”
30	100	23	500	1	.015”
35	100	26	500	1	.015”
40	100	30	500	1	.015”
45	100	34	500	1	.015”
50	100	38	500	1	.015”
55	100	42	500	1	.015”
60	100	45	500	1	.015”

VECTOR CUTTING (KISS CUT)

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	5	3.3	500	1	.003”
30	5	4.0	500	1	.003”
35	5	4.7	500	1	.003”
40	5	5.3	500	1	.003”
45	5	6.0	500	1	.003”
50	5	6.7	500	1	.003”
55	5	7.4	500	1	.003”
60	5	8.1	500	1	.003”

COMMENTS

Sign vinyl comes in a wide variety of colors, patterns, thickness, finishes, and reflectivity. There are a few methods for using sign vinyl with the laser system. One method is to vector cut (unmasked) through the vinyl but not through the backing. This technique provides results equivalent to a vinyl cutter machine. Once the vinyl has been cut, remove the excess vinyl, apply transfer tape and use a squeegee to remove trapped air bubbles. The transfer tape can then be lifted off and the vinyl lettering or objects that were vector cut will be stuck to the transfer tape and maintain their correct spacing with respect to each other. Now apply the tape to the desired surface and squeegee, peel off the transfer tape, and the lettering will remain adhered to the surface. The other method is to apply a piece of vinyl to the desired surface (unmasked) and adjust the laser power so as to cut through the vinyl without engraving into the material below. Another example is to cover the entire surface of a wooden plaque with vinyl, use a squeegee to remove all air bubbles, and then mask the entire surface with transfer tape to protect the vinyl from smoke damage. In the graphics software, color the background black and place white filled text on top of the colored background. Since the laser system does not engrave white filled objects, the background will be engraved and the lettering will be untouched. Peel off the excess vinyl and transfer tape to reveal the final product.

MOST SIGN VINYL IS MADE FROM PVC (Polyvinylchloride). DO NOT USE PVC BASED VINYL. The fumes are extremely toxic if you inhale them. The fumes are also caustic and can chemically destroy the metal parts of the laser system. Damage to the laser system from this type of abuse **ARE NOT** covered under warranty.

WOOD

RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	25	500	1	.020”
30	100	30	500	1	.020”
35	100	34	500	1	.020”
40	100	39	500	1	.020”
45	100	44	500	1	.020”
50	100	50	500	1	.020”
55	100	55	500	1	.020”
60	100	59	500	1	.020”

VECTOR ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	80	4.2	500	1	.030”
30	80	5.0	500	1	.030”
35	80	5.9	500	1	.030”
40	80	6.7	500	1	.030”
45	80	7.6	500	1	.030”
50	80	8.4	500	1	.030”
55	80	9.2	500	1	.030”
60	80	10.1	500	1	.030”

VECTOR CUTTING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	50	1.3	250	1	.125”
30	50	1.6	250	1	.125”
35	50	1.8	250	1	.125”
40	50	2.1	250	1	.125”
45	50	2.3	250	1	.125”
50	50	2.6	250	1	.125”
55	50	2.9	250	1	.125”
60	50	3.1	250	1	.125”

COMMENTS

When engraving wood with a laser, a brown, maple syrup like residue will deposit on the surface of the wood. This is normal and impossible to eliminate by **POWER**, **SPEED**, or **PPI** changes. More residue will be present when engraving deeper and/or slower. This residue washes off with water and a sponge. We recommend using a kitchen sponge with a nylon string mesh wrapped around it. Dampen the sponge and wipe off the residue. A damp chamois cloth works well also. Do not use paper towels or a regular sponge because these materials will get lodged in the engraved area when wiping and are extremely difficult to remove. A method to avoid cleanup is to mask the wood with transfer tape and peel off the tape after engraving. If desired, after engraving and before peeling off the tape, spray paint can be applied to color fill the engraved areas. After the paint dries, peel off the tape. If an intricate drawing has been engraved and there are many small pieces of tape to remove, it may be easier to flood the masking, after engraving, with water. This will loosen the tape and it can be easily removed by rubbing it off by hand. In the vector cutting example, the wood was elevated from the table to let smoke and heat escape from underneath. If you elevate the wood, mask and/or dampen the bottom side of the wood very lightly, in which the water acts as a heat sink to prevent the underside from flaming and charring.

Elevating the wood also helps to determine whether the laser has passed completely through since the cut pieces will fall through to the table when cutting is finished. Also, set up the drawing so that the inner pieces of the drawing are cut first, otherwise pieces may fall through at the wrong time.

Not all wood finishes are created equal. When ordering wood from a supplier, be sure to specify that it is being used for laser engraving. Some finishes cannot handle the heat from the laser and will bubble, blister, and possibly turn white. For engraving softer woods such as pine or balsa, reduce the power settings to acquire the best depth. Engraving too deep on soft woods will reduce quality. Every type of wood will engrave differently. It is better to engrave woods that are finished. If engraving unfinished wood and it is not masked with transfer tape, the smoke residue tends to embed in the wood and is impossible to remove without sanding. To prevent this, mask all unfinished wood with transfer tape.

WOOD INLAYS - VENEERS

Create a drawing with no outlines, only filled areas. Engrave the filled areas almost as deep as the thickness of the veneer (usually about .003 inches (.1 mm) or less). With some water and a nylon brush, remove all residue from the engraved area. When cutting veneers make sure they are lying absolutely flat. In the drawing, give the objects an outline of .001 inches (.1 mm) and remove the fill. Adjust the power so that there is just enough power to cut completely through the veneer. Overpowering the cut will cause too much material removal and the fit will not be snug. Some software programs allow outline offsetting to compensate for the thickness of the beam called contouring. Usually, a contour to the outside of the vector line of .006 inches provides a tight fit. Remember if using more power to cut through the veneer, compensate for the thicker width of the laser cut by contouring a little further to the outside.

Another method is to first create your graphic and fill it with the color black. Then give it a white outline of .012 inches (.3 mm). If you look at the graphic when you add the outline, you will see that it appears to shrink. Now raster engrave the graphic to a depth slightly shallower than the thickness of the veneer. When the engraving is finished, place the veneer into the laser system. Remove the black fill and change the outline to a different color. Cut out the veneer with the laser system, add glue to the veneer, and apply the veneer into the engraved area of the other piece of wood and let dry. After the glue has thoroughly dried, sand the veneer until it is flush with the base wood. A good veneer to use is one with an adhesive backing. Once cut, place the veneer into its proper place on the engraved wood block and with a clothes iron, and iron the veneer into the engraved wood. This melts the glue and causes the veneer to stick to the engraved area. Finish the wood as you desire and the finished product will look fantastic. The veneer can now be sanded flush with the surface and a finish coat applied.

LASER ENGRAVING OR CUTTING WOOD CAN IGNITE THE MATERIAL. Never leave the laser system running unattended for any reason.

Section 6

Accessories

There are optional accessories, not included with the basic laser system, that are available at additional cost. Instructions on how to use these accessories are included in this section. The user can purchase and install all accessories, except Air Assist, which is a factory installed option ONLY.

CAUTION: Before attempting to use any accessory, make sure that you have read the entire manual up to this point. It is vital that you have a complete understanding of how the laser system works before attempting to use an accessory. Incorrect or inappropriate usage of an accessory may be a safety hazard and may cause severe damage to the system.

Air Assist

The Air Assist System consists of a nozzle that attaches to the focus carriage, Optics protection adapters, tubing, mounting brackets, needle valve, and pressure gauge. The purpose of this system is to force air or other types of gases directly onto the surface of your material to reduce the burning effects of the laser beam and helps disperse the smoke and gases created when cutting or engraving materials. The optics protection parts assist in helping keep the optics cleaner from flying debris created from the pressurized nozzle. Use of this system requires a minimum compressed air source capable of 50 PSI @ 2.5 cfm. This supply **MUST** be free from oil, water, and particulate matter. Another accessory called the "Air Assist Compressor", can supply this source.

Air Assist **IS NOT** intended to decrease maintenance of the laser system. The use of this Air Assist has been known to increase the frequency of cleaning maintenance due to debris being blown around, inside the engraving area, during laser processing.

Standard and Computer Controlled styles

There are two styles of Air Assist, standard and computer controlled. The computer controlled option uses three solenoids to control low-pressure air, high-pressure air, and an external gas supply and is selectable in the printer driver. Because these solenoids work with the running of the laser system, the air and/or gas supply is only used when needed and shut down automatically when laser processing stops. The standard system does not have solenoids, is not computer controlled, and can only deliver only one air pressure per file. It is also not gas compatible. The standard Air Assist accessory is acceptable in most applications, however, for the ultimate control, the computer controlled Air Assist is highly recommended.

Requirements (both styles)

The Air Assist option requires compressed air supplied from the Air Assist Compressor Unit (optional) or from a user supplied compressed air source. If you choose to provide your own source, it must be capable of supplying 50 PSI (pounds per square inch) at a constant rate of 2.5 CFM (cubic feet per minute). **The air supply MUST be oil-free, moisture-free, and particulate filtered.**

A contaminated air supply will cause severe damage to the laser system.

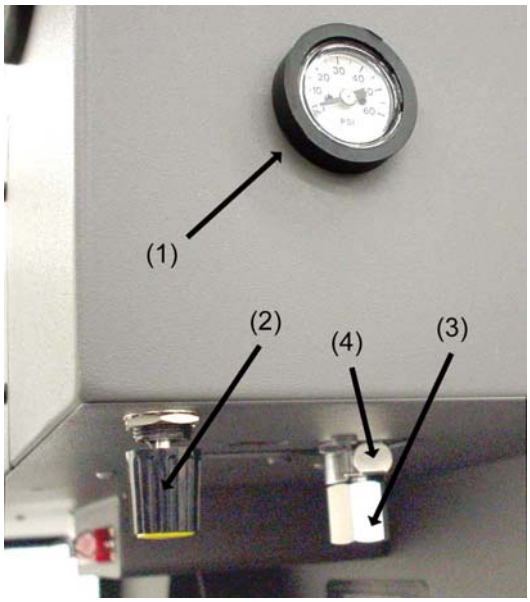
Air or gas supply pressures higher than 50 PSI can rupture the internal hoses of the control box and can possibly damage the valves.

Damages to the laser system from contaminated or improper air or gas supply is considered abuse and IS NOT covered under warranty.

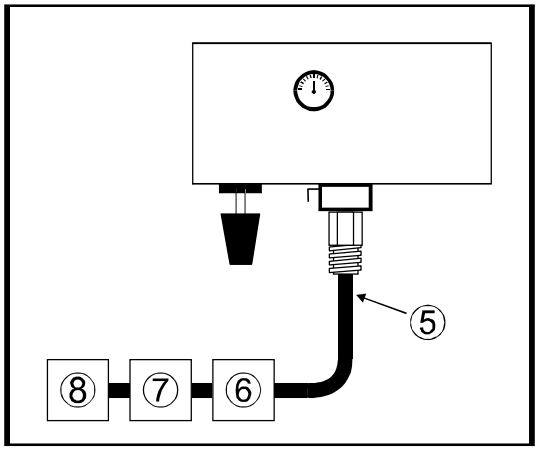
Making the Connections

Standard Air Assist style

In the left rear part of the system you will find the pressure gauge (1), flow adjustment valve (2), quick release coupling (3), and release lever (4).



Push in the release lever and pull down on the quick release coupling to remove it from the machine. Attach your compressed air supply hose to this fitting (1/4 NPT threads) and use Teflon tape on the threads to prevent leaks. Re-insert the fitting until it "clicks" into place.

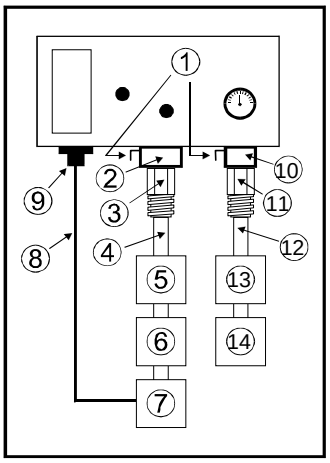


Attach the other end of the supply line (5) to a particulate filter (6), desiccant/dryer (7), and then to an oil-free compressed air source (8).

Computer Controlled Air Assist style

In the left rear part of the system you will find the Air Assist control box. Attached to the box, there should be two special quick release couplings secured with plastic tie wraps (1). Using a pair of scissors or wire cutters, cut off the plastic tie wraps and discard.

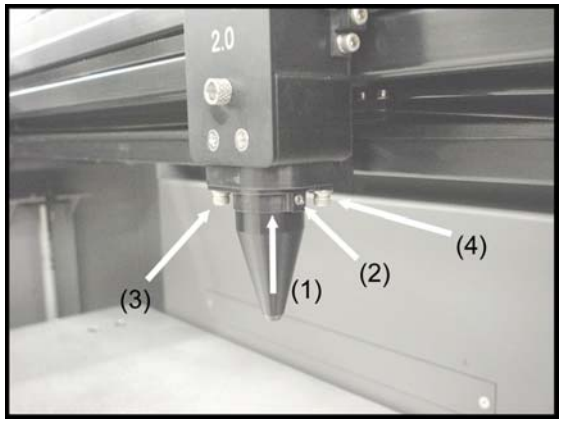
The AIR IN (2) fitting is where you attach the compressed air supply. The GAS IN (3) fitting is where you would attach an inert gas supply (optional). If you purchased the optional Air Compressor, you would connect the control wire to the AUX OUT (4) connector (refer to the Air Compressor instructions for more details). The HIGH (5) and LOW (6) pressure adjustment screws are used to adjust airflow to the work piece (through the cone) during operation. You can monitor the pressure by observing the pressure gauge (7) during operation.



Locate the locking ever (1) attached to both fittings. Push in the lever until it clicks. Attach the larger quick release coupling (3) (1/4 NPT threads) to your compressed air supply line (4). Use Teflon tape on the threads to prevent leaks. Push the quick release coupling (3) into the fitting (2) until it clicks into place. Attach the other end of the supply line (4) to a particulate filter (5), desiccant/dryer (6), and then to an oil-free compressed air source (7). If you have purchased the optional Air Compressor, connect the control wire (8) from the compressor (7) to the AUX IN connector (9). If using an inert gas, attach the smaller quick release coupling (11) (1/4 NPT threads) to the supply line (12) using thread sealant or Teflon tape. Push the quick release coupling (11) into the fitting (10) until it clicks into place. Attach the other end of the supply line (12) to an external pressure regulator (13) and then on to the gas tank (14).

Cone Installation and Removal (both styles)

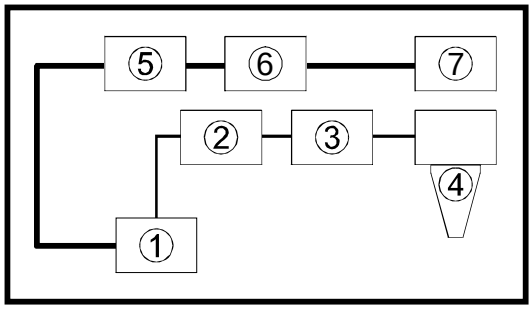
The cone must be attached to direct the air or gas supply to the laser beam's focus point. To install the cone, insert the cone (1) into the cone base completely until it bottoms out. Using a .050 inch Allen wrench, tighten the setscrew on the side of the cone base (2) until it is snug. Re-check to make sure that the cone is all the way into the base and is not tilted. To remove the cone, simply loosen the setscrew (2) and pull the cone straight down. **DO NOT** remove or loosen the cone base mounting screws (3) & (4) to mount or dismount the cone. These screws keep the cone base aligned with the laser beam.



DO NOT install the cone unless you plan on using Air Assist. Leaving the cone attached to the cone base and running the laser system without either air or gas flowing through the cone will destroy the focus lens within a few minutes. If you are not using Air Assist, **REMOVE THE CONE**. Damage of this nature is due to neglect and **WILL NOT** be covered under warranty.

How it Works

Standard Air Assist



The Quick Release Fitting (1) is the entry point into the rear enclosure of the laser system. From there, the air lines branch off into two paths, the optics protection path and the cone path. The optics protection path is a direct path from the quick release fitting (1) to the beam window (5), the #2 mirror (6), and the #3 mirror (7). Since this is a direct path, the amount of air pressure and flow that is coming from your compressed air source will be applied to the optics to help keep them clean from flying debris. The cone path goes through the adjustment valve (2), to the gauge (3), and then to the cone (4). The amount of air, flowing through the cone, is adjusted using the adjustment valve (2) and monitoring the pressure displayed on the gauge (3). The cone path protects the focus lens and provides a downward flow directly into the beam path at the focus point.

NOTE: Air will always be flowing through the system as long as the compressed air source is turned ON. We recommend installing a shut off valve in between your compressed air supply and the laser system.

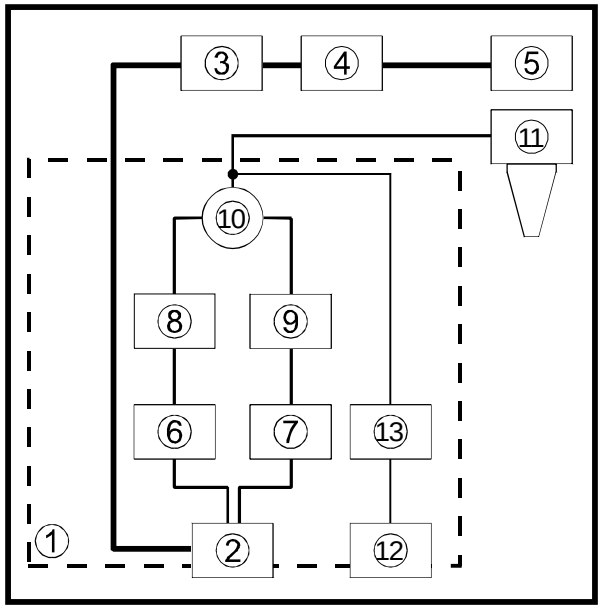
Before you run your material, we suggest that you adjust your air and/or gas flow. To do this, you must first turn on your compressed air source so that there is flow through the system. Now, either turn the laser system ON or leave it OFF.

With the top door of the laser system open, pass a piece of paper underneath the cone and use it to note the amount of air flowing through the cone and against the paper or place your finger underneath the cone to try to feel the pressure.

As a safety precaution, you should place your finger underneath the cone ONLY when power to the system has been turned OFF. If the power is ON, you should use the paper method.

Turn the adjustment valve knob clockwise or counterclockwise until either the desired airflow or PSI reading on the gauge is achieved. Clockwise adjustments reduce flow while counterclockwise adjustments increase flow.

Computer Controlled Air Assist



The control box (1) (represented by the dotted lines) directs the compressed air source to the optics protection path and also to the cone. The optics protection path is a direct path from the entry point of the compressed air source (2) to the beam window (3), the #2 mirror (4), and #3 mirror (5). The air supply for the cone comes from either the HIGH (6) or LOW (7) solenoid valves, through the HIGH (8) or LOW (9) pressure adjustment valves, through the pressure gauge (10) and finally to the cone. The cone path protects the focus lens (11) and provides a downward flow directly into the beam path at the focus point. You choose which solenoid valve (6 or 7) to open through the laser systems printer driver. The gauge (10) will ONLY show a reading when either the HIGH (6) or LOW (7) solenoid valve is opened and air is flowing to the cone. If you choose to use an inert gas to supply the cone, the supply must go through the GAS coupling (12), through the gas solenoid valve (13) and finally to the cone. The GAS path bypasses the pressure adjustment valves and the gauge so it must be regulated externally. Only one solenoid valve (6,7, or 13) can operate at one time.

As the diagram indicates, the optics protection path is neither regulated nor solenoid valve controlled. If you are using your own compressor, the optics protection air will always be flowing regardless of whether the laser system is running or not. You must install either a manual shut off valve (not supplied) or an external electronic solenoid valve system (not supplied). If you purchased the Air Compressor option the optics protection air will turn ON and OFF as the compressor turns ON and OFF respectively.

When you press the “Start” button on the laser system, the Air Assist control box will send out a +5 VDC signal through the AUX OUT control wire, which can be used to turn ON the Air Compressor (optional) and will keep the Air Compressor ON until the file completes. This type of control saves electricity, reduces the running time of the compressor, and reduces ambient noise when the laser system is not running.

The control box also has built in pressure sensors that will detect insufficient supply pressure and will shut down the laser system. An error message, “Warning Air Pressure?” will appear on the display, indicating that there is a problem with your supply of either air or gas.

Control Panel Selections

Before you run your material, we suggest that you adjust your air and/or gas flow. To do this, you must first power ON your laser system, activate your compressed air supply, and your gas supply (if applicable). After the laser system finishes “INITIALIZING” and goes to “READY”, press the ESCAPE button once. Bring the cursor down to “PREFERENCES” and press SELECT. While the cursor is on the “CONFIGURATION” line, press SELECT again. Position the cursor on the “AIR ASSIST” line. Now, by pressing SELECT you can toggle that option through four choices, “AUTO”, “AIRL”, “AIRH”, and “GAS”.

AUTO

This is the default selection. It allows the control box to be automatically controlled by printer driver selections. It also serves as an “OFF” selection if you choose “OFF” in the printer driver.

AIRL

Manually activates the “LOW” valve solenoid when the “START” button, on the laser systems control panel, is pressed.

AIRH

Manually activates the “HIGH” valve solenoid when the “START” button, on the laser systems control panel, is pressed.

GAS

Manually activates the “GAS” valve solenoid when the “START” button, on the laser systems control panel, is pressed.

Adjusting Air or Gas Flow

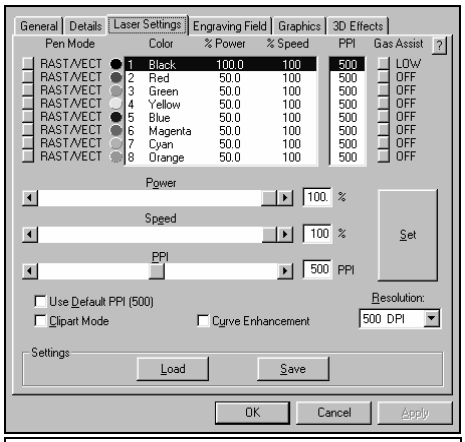
We now need to set the flow rate through the cone. We can do this by manually activating a solenoid valve and adjusting the needle valve to achieve desired flow through the cone. With your laser system powered ON and NO files downloaded to the laser, select “AIRL” in the control panel. Press the ESCAPE button several times to get back to the “FILE DISPLAY” menu. Now press the START button. You will hear and audible “click” and the air will start flowing through the cone. With the top door of the laser system open, pass a piece of paper underneath the cone and use it to note the amount of air flowing through the cone and against the paper. Adjust the LOW pressure adjustment valve until either the desired airflow or PSI reading on the gauge is achieved. Clockwise adjustments reduce flow while counterclockwise adjustments increase flow. If you close the pressure adjustment valve too much, there might not be enough flow to keep the pressure sensor inside of the control box activated. This can trigger a “Warning Air Flow?” message to appear on the display of the laser system. If this happens, press ESCAPE, open the needle valve, and try it again. **DO NOT** adjust the pressure adjustment valve while there is NO air flowing as air flow through the cone is required for the gauge to display actual flow. Once desired flow is achieved, press the PAUSE button to deactivate the solenoid valve. Repeat the above procedure to set the “AIRH” (HIGH) solenoid valve pathway to the cone.

To set the GAS pressure (if applicable), repeat the above procedure again with the exception that your gas flow has to be regulated and adjusted by an external regulator mounted on the gas tank or in-line between the tank and the laser system.

Once you have set your flow rates for each pathway that you will be using, reset the laser systems control panel so that the “AIR ASSIST” option displays “AUTO”. This will allow your selections in the printer driver to activate the correct solenoid valve choices.

Programming the PC Printer Driver

The Air Assist option provides printer driver controlled activation and deactivation of solenoid valves that direct the flow through one of three paths with its final destination being the cone. It also has been designed to work in conjunction with the optional Air Compressor to turn it ON and OFF when the job starts and finishes, respectively. The needle valves control flow through the cone when the solenoid valves are activated. The gauge provides a visual indication of how much flow is going through the cone. You can choose between “LOW”, “HIGH”, or “GAS” valve activation setting for each one of the eight colors in the printer driver.



Windows 95/95 version shown (Windows 2000/XP may appear slightly different

Power up your PC and open up or create a graphic to print to the laser system. When ready to print, go to the laser system printer driver and set all of your parameters. Next to the color choice is the button for the “Gas Assist” option. Click once on it and it turns to “LOW”. A second time and it turns to “HIGH”. A third time and it turns to “GAS” and a fourth time turns it “OFF”. Choose which pathway you desire.

Choose the rest of your parameters and download the file to the laser system. Make sure the cone is installed. Insert your material into the laser system and set the focus. Make sure that you air and gas supplies (if using) are ON. Turn on your exhaust blower and press the START button.

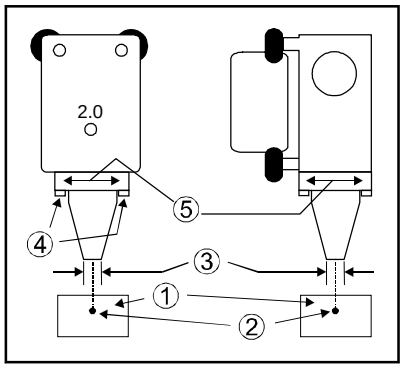
Air Flow Setting Guidelines (both styles)

Use as much or as little air flow necessary to produce the desired results. There are no particular settings that we can offer to you. As a rule of thumb, start with low flow and adjust upward until flaming is suppressed. Setting the flow too high can result in excessive particulate matter being blown around causing faster system contamination, which would require an increase in maintenance. It can also push the hot engraving or cutting smoke back onto the material or into the cut line and cause contamination of the surface or side edges of the material. On some scrap material play around with different flow settings to obtain the best results, then write down your settings for various materials. Remember, the intent of the Air Assist option is to suppress flaming and/or melting of the material during laser processing.

Maintenance (both styles)

- Keep you air supply and/or gas supply moisture free. Check your desiccant (water dryer) frequently. Replace desiccant when saturated or use the manufacturer’s recommendation to remove water moisture from the desiccant crystals. Water moisture may contaminate the air assist system and can cause malfunctions as well as damages to the unit.
- Clean your laser system more frequently when using Air Assist. You will need to check, and possibly clean, your optics frequently. Do not let the optics protection part of the Air Assist system lead you to a false sense of security. Since more debris gets kicked up by the downward air or gas flow through the Cone, the laser systems rails, bearings, and other motion system components will get dirtier faster than by not using the Air Assist option.
- Periodically check the cone alignment with the laser beam especially if you have replaced or adjusted the laser systems optics. You will know if your cone is not aligned if you suffer a substantial loss in laser power when laser cutting or engraving with the cone installed as opposed to the cone removed. A misaligned cone will cause the beam to make contact with the inside of the cone, possibly splitting the beam and/or reducing the power at the focus point.

Cone Alignment Check and Adjust (both styles)



- Power the laser system ON.
- Open the top door.
- Position the focus carriage in the middle of the field.
- Turn ON the red diode laser pointer.
- Place a piece of paper (1) underneath the cone and observe the position of the red beam (2) in relation to the center of the bottom of the Cone (3) and be sure to check it from the front and side.
- If the red beam is not centered, remove and reinstall the cone to see if it was due to an improperly installed cone.
- If the red beam is still not centered, check all your optics for looseness or mechanical misalignment.
- If still not centered, loosen the two base mounting screws (4) slightly (1/4 turn) and slide the base (5) around until the red diode laser comes out of the centered of the cone. Remember to check this from the front and side of the focus carriage.
- Tighten the base mounting screws (4) gently and re-check the cone's alignment.

Air Assist Compressor

The Air Assist Compressor option is a 50 PSI @ 2.5 cfm source for oil-free, water-free, and particulate matter-free compressed air. It contains a sound insulated air compressor, water dryer (desiccant), and coalescent particulate filter. This compact and custom designed unit is a great compliment to the Air Assist System option.

Installation

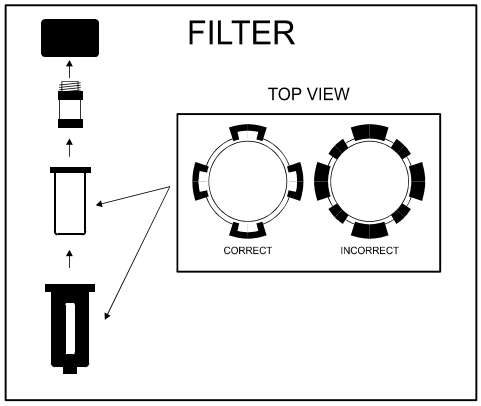
- Make sure the laser system is turned off.
- Plug one end of the blue coiled hose into the compressor fitting (push in the fitting lever until it clicks before inserting) and the other end into the air inlet fitting in the laser system.
- In the computer controlled version, plug one end of the control wire to the Air Compressor and the other end into the control box.
- Plug in the compressor into a wall outlet. Please check the rating on your air compressor for the proper power requirements.
- The compressor has a three way switch, ON, OFF, and AUTO. Push the switch to the left and it will turn the compressor on all of the time. This mode is useful for non-computer controlled models. OFF is obviously off. The AUTO position allows the compressor to turn on and off only when it receives a signal from the laser system that has the computer controlled option. If you have selected the LOW, HIGH, or GAS setting in the printer driver, the Air Compressor will automatically turn ON when the file runs and OFF when the file is complete.

Maintenance

The filter and desiccant should be inspected every 8 hours of use. It may be necessary to clean out the filter and change the desiccant that is inside the dryer assembly.

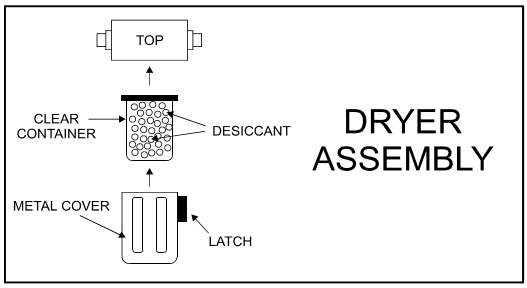
To inspect the filter, you must remove it. To inspect the desiccant you can observe the color of the crystals through the slots in the metal enclosure without having to remove it. If you start to see water droplets or moisture coming through the air lines, you will definitely need to change the desiccant inside of the dryer assembly but it should never get to that point. Indication that the desiccant needs changing is the lack of blue color pigments in the desiccant. The desiccant can be regenerated. Bake it in an oven at 350 degrees F until some of the crystals turn blue again.

Removal, Cleaning, and Replacement of the Filter



- Turn the Air Compressor OFF and unplug it.
- Unscrew the cover by turning it 1/8 turn counterclockwise like you were unscrewing a jar, and pull down. The clear plastic container might still remain attached to the top. Gently pull this part straight down.
- You will see a red colored foam filter. Unscrew the filter, and wash it out with water. Make sure that it is completely dry, then reinstall.
- Empty and clean out any residue or dust that may have accumulated on the bottom of the clear plastic container.
- Install the clear plastic container into the cover and line up the tabs so that they fit one inside of the other.
- Insert the combination of the cover and the clear plastic container into the top of the assembly. Gently twist the cover 1/8 turn clockwise to lock it into place.

Removal, Cleaning, and Replacement of the Desiccant



- Turn the Air Compressor OFF and unplug it.
- Pull down on black lever and rotate metal cover 1/8 turn counterclockwise. Remove metal cover by pulling straight down.
- With a gentle and slight twisting motion, pull the clear container downward slowly. Pour out and discard old desiccant.
- Refill clear container with fresh desiccant from a sealed bag. Fill to about ¼ inch from top of container.
- Clean off rubber o-ring on the top of the container.
- Insert container up into the top.
- Install metal cover and turn 1/8 turn until lever clicks into place.

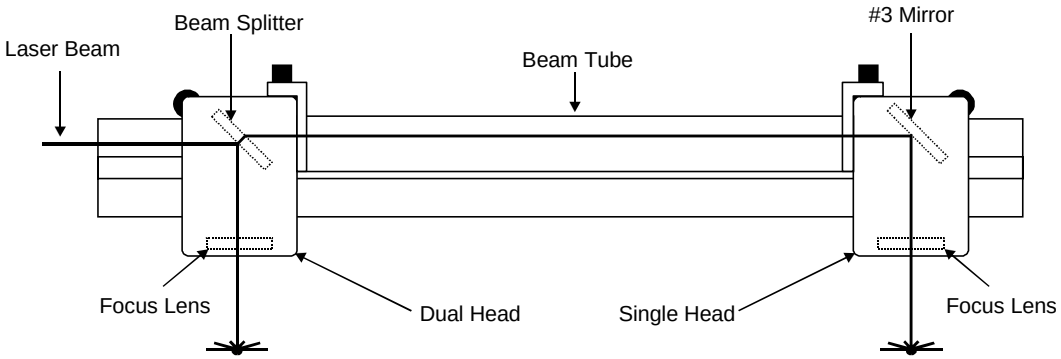
Dual Head

The Dual Head option was created to enhance productivity when engraving large quantities of the same item providing that two or more of the same item fit within the horizontal engraving area (X-axis) of your laser system. The Dual Head option can significantly reduce your overall engraving time if you divide the total processing time by the quantity of items engraved, however, there are limitations involved when using this option.

- It is not “twice as fast” than engraving with a single head. Typical productivity increases may vary from 25-75%
- In some applications, using the Dual Head option may reduce efficiency than engraving with a single head.
- There is an overall laser power loss due to additional optics ranging from 1% - 5%.
- The beam is not split EXACTLY 50/50 although it is close enough for most applications.
- Because of optical angles and the effect of passing the beam through splitting optics, the engraving field most likely WILL NOT be split EXACTLY in half. There may be a small tolerance in absolute beam positioning by as much as +/- 1/16th of an inch. In this case, you would need to compensate for the difference by adjusting the spacing between your objects in the engraving area.

How it Works

With the Dual Head installed, the special "Beam Splitter" optic inside of the Dual Head splits the laser beam in half. It reflects one half of the laser beam's energy down through the focus lens inside the Dual Head and passes the other half of the laser beams power through the beam splitter. The laser beam goes through the beam tube and then onward through to the single heads #3 mirror where the laser beam is reflected downward through the single head's focus lens.

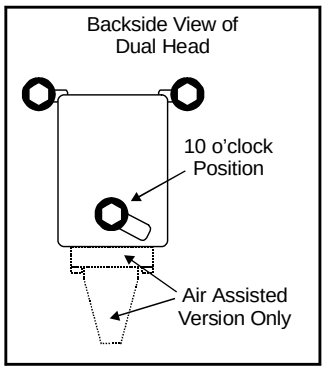


By splitting the laser beam's power in half, you effectively get approximately 50% of the power at the Dual Head and 50% at the single head. However, since the beam splitter absorbs some energy, and there are other losses involved, getting an exact 50/50 split is not possible, but the difference in most applications, is negligible.

Installation

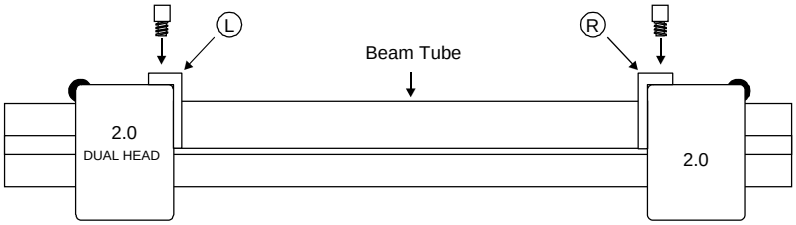
NOTE: The example below assumes that you have also purchased the Air Assist option. If you do not have the Air Assists option, please ignore any references to the "cone(s)" or "air hose" as these two items are the only differences between the regular Dual Head and the Dual Head with Air Assist option.

- If your laser system is not **ON** right now, turn it **ON**.
- Using the menu control keys, select the "Dual Head" option in the "Options" section of the "Preferences" menu. The display will ask you to confirm your choice so respond "Yes". It will then ask you to "Turn system **OFF**", then "Wait 15 seconds", and then "Turn system back **ON**". You should do this except you should install the Dual Head **BEFORE** turning the system back **ON**.
- **The Dual Head will be installed to the left side of the single head.** Pick up the Dual Head assembly and note that the lower X-axis bearing pivot arm should be in about the 10 o'clock position (from the backside view, and 2 o'clock from the front side. Starting with the Dual Head rotated about 30-45 degrees clockwise and tilted back towards you slightly, position the lower X-axis bearing in the lower bearing track of the X-axis rail. Gently pull up on the Dual Head while turning it counter-clockwise back to the 0 degree position and "hooking" the top two X-axis bearings into the upper bearing track of the X-axis rail.

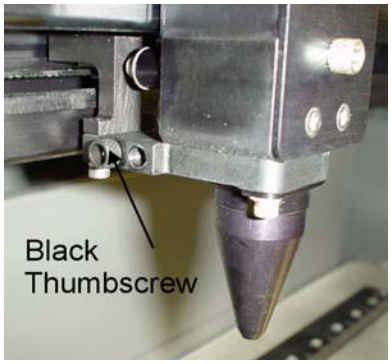


- Verify that all three bearings are in their respective track. Gently push the carriage to the left and then back to the right. It should roll smoothly, if not, verify and/or re-install the Dual Head.

- If there is a button head screw located on the top of the Dual Head and or the single head, remove it.



- Pick up the Dual Head tube and note the “L” (Left) and “R” (Right) markings. Install the tube using the supplied thumbscrews and tighten securely.
- If you have the Air Assist option, locate the 1 (one) black thumbscrew on the side of the Single Head. This thumbscrew serves two purposes, it blocks air from coming out when in Single Head operation and secures the Dual Head Air Hose when in Dual Head operation. Regardless of whether or not you will be using the Air Assist option, you should always attach the Air Hose to get it out of the way. **REMINDER: If you have the Air Assist option and will not be using it, you MUST remove the air assist cone(s) before operating the system otherwise damage to the Focus Lens will occur. Refer to your Air Assist documentation on how to remove the cone(s) properly**.



- Remove the thumbscrew and attach the end of the air hose to the single head by inserting the brass tube into the hole where the thumbscrew was removed. Attach the thumbscrew into the other threaded hole (right next to the original hole), and tighten securely.

- Installation is now complete. Turn the laser system ON and observe the control panel display. Above the “Initializing” statement you should see “(DH)” next to the model name indicating that you are now in “Dual Head” mode.

- Press the “X-Y” button to illuminate the Red Diode Pointer. You will notice that the Single Heads red dot will be brighter than the Dual Head’s red dot. This is because the Beam Splitter, inside the Dual Head does not reflect/pass visible light at a 50/50 ratio. Using the Motion Controls, position the Dual Head all the way as far as it will go into the upper left corner of the engraving area (0,0). It should be relatively close to (0,0) with +/- 1/16th of an inch. Now observe the position of the Single Head red dot**.** This is the (0,0) position of the second object and your reference point for placing your material.

Operation

NOTE: In the following example, we will assume that your laser engraving system is a “V Platform” that has a maximum engraving area of 24” x 18” Landscape mode.

- Turn ON your computer (if it is not ON already). Start your graphics program, create a new graphic or open an existing graphic.
- Select “Print”, choose your printer (if the laser system is not set as your default), and select “Properties” to bring up the Printer Driver settings.
- Click on the “Engraving Field” tab and then click the “Dual Head” option box. A pop-up message will appear asking you to verify your page size in your graphics software because the driver’s “Width” will now be half of what it was. Make the Height less than the Width. For example, Page Orientation = Landscape, Page Width = 12 inches, Page Height = 11 inches. **NOTE: Some graphics programs do not allow your “Width” to be smaller than your “Height” when in the Landscape mode and will force you page size in your graphics program to “Portrait” mode. If this is the case and you cannot get the laser to engrave in the proper location, you might need to reduce your “Height” to something slightly smaller than your “Width” in both the Printer Driver and the graphics software program. In this example, we set the “Height” to 11 inches just to be safe**.
- Adjust the page size and orientation in your graphics program to match the page size and orientation in the driver.
- Adjust your rulers in your graphics program so that the upper left corner of the page, on screen is the (0,0) position.
- Position your graphic, load your material(s) into the laser system and begin engraving.

Removal

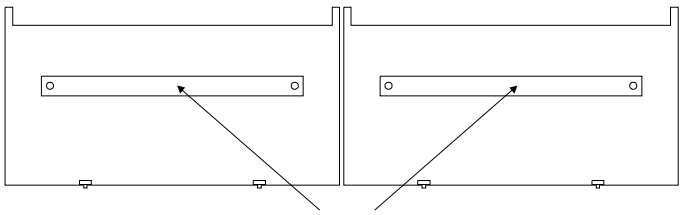
When finished using the Dual Head, you must remove the option opposite of its installation. In the menu system, turn the “Dual Head” option **OFF**. “If you have the Air Assist option, remember to put the black thumbscrew back into its original hole. This will prevent the loss of air pressure in the cone of the single head.

Honeycomb Cutting Table

The purpose of the Honeycomb Cutting Table is to support the material that you are cutting off of the engraving table’s surface to minimize surface contact area. It also redirects exhaust airflow below and above the material for better smoke removal. The cutting table is installed directly on top of the engraving table. It is composed of a sheet metal box, alignment rulers, and a replaceable honeycomb style bed. The honeycomb material is reflective only in the area that contacts your material to minimize laser beam reflection. It can also be used as a vacuum table, providing you have a very strong exhaust blower, to hold down slightly warped materials or materials that tend to warp during cutting or engraving.

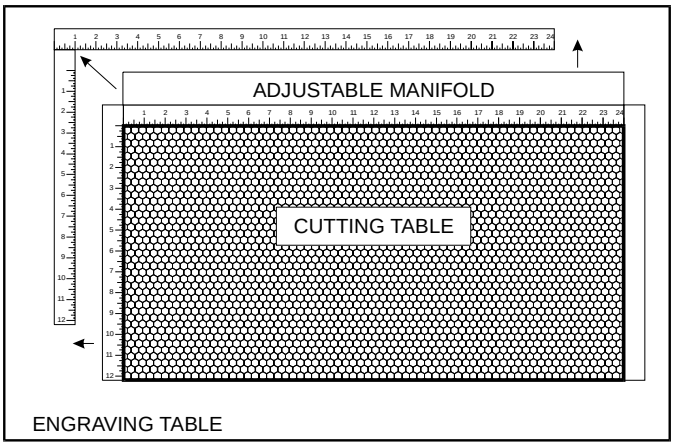
Installation

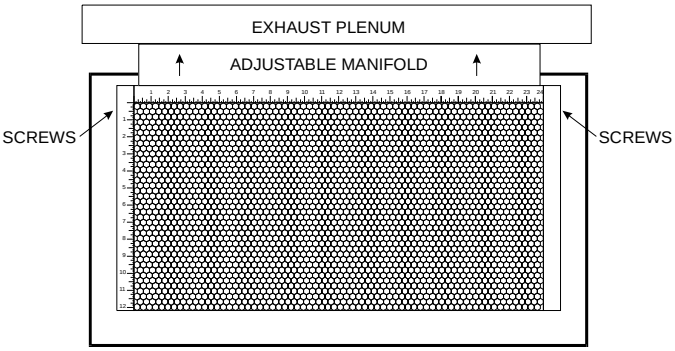
- Lower the table down all the way down.
- Remove the strip(s) from the exhaust plenum(s) with an Allen wrench. **There is one (1) exhaust plenum on the M and V models and two (2) on the X model (as the diagram indicates).**

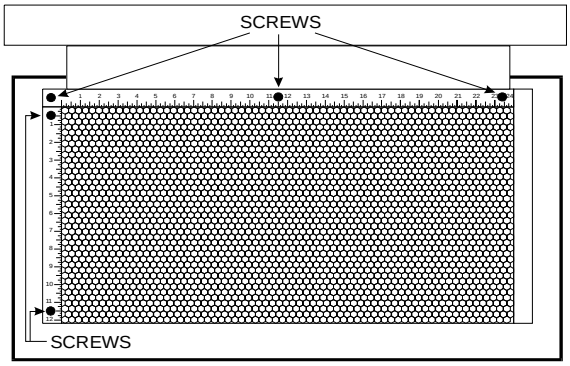


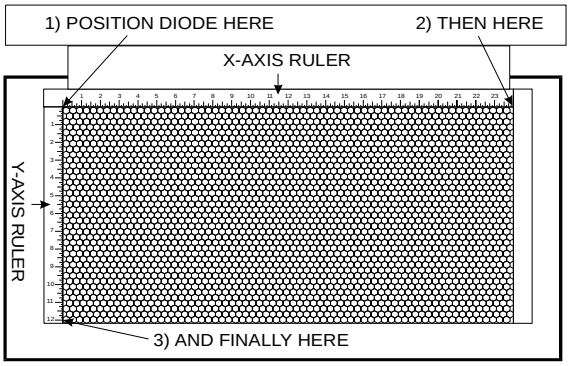
- Before installing the cutting table into the laser system, loosen the screws, without removing them, on the side of the cutting table, just enough to allow the adjustable manifold to slide in and out. Extend the adjustable manifold out as far as it can go.

- Open the front door of the laser system and carefully slide the cutting table into the laser system so that its body is squarely pushed up against the engraving table rulers on the top and the side of the table. The rulers of the cutting table should now overlap the rulers on the engraving table.
- Slide the adjustable manifold squarely up against the exhaust plenum and tighten the four (4) screws on the side of the cutting table. Be careful not to move the cutting table while tightening the screws. The objective is to have the cutting table fit snugly up against the rulers of the engraving table and the adjustable manifold fit tightly against the exhaust plenum.
- We now need to adjust the rulers of the cutting table so that they match the engraving field of the laser system. Using the focus tool method, adjust the Z Axis and focus directly onto the surface of the honeycomb.
- Loosen slightly, but do not remove, the five (5) screws that hold down the rulers.







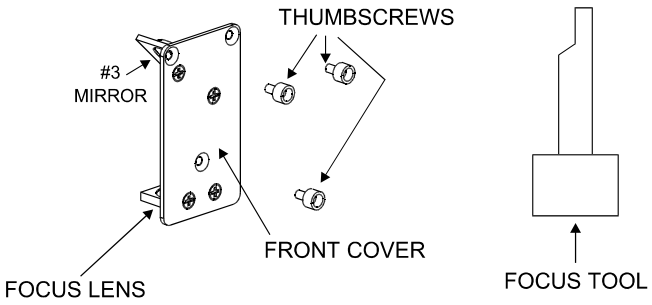


- Activate the red diode pointer. Position the focus carriage at (0,0). With the red diode pointer still ON, slide the X-axis ruler so that its zero (0) point lines up with the red diode pointer and tighten down the left side screw.
- Now position the red diode pointer at the (32,0) position for the X series machine or (24,0) position for the M or V series machine. Adjust the right side of the X-axis ruler until it is lined up with the diode. Tighten down the right side screw of the X-axis ruler. Now tighten down the middle screw.
- Line up the right edge of the Y-axis ruler with the zero (0) line of the X-axis ruler and tighten down the top screw of the Y-axis ruler.
- Finally, position the red diode pointer at the (0,18) position for the X series machine or the (0,12) position for the M or V series machine. Align the bottom of the Y-axis ruler with the red diode pointer and tighten down the bottom screw of the Y-axis ruler. The cutting table is now ready for use.

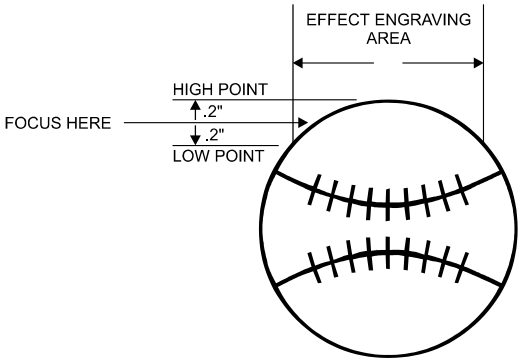
When removing the cutting table, lower the engraving table and slide the table out of the front door. Re-install the exhaust plenum strip(s). As long as you followed the installation instructions exactly, it is designed so that you will **NOT** need to adjust the adjustable manifold or the X or Y-axis rulers when re-installing the cutting table.

Focus Lens Kits

There are three optional Focus Lens Kits available other than the standard 2.0", they are the 1.5", 2.5", and the 4.0" kits. Included in these kits are the focus lens, #3 mirror, front plate, thumbscrews, and a focus tool.



Different lenses produce different spot sizes and have different focal ranges. For example, the 1.5" lens produces a spot size of .003" and has an effective focal range of +/- .075". This lens can engrave very fine detail but can only be used on very flat materials. On the opposite end, the 4.0" lens has a spot size of .013" but has an effective focal range of +/- .2". Although this lens cannot engrave very fine detail, its focal range allows you to engrave on slightly rounded or curved objects without the need for rotation. Using a baseball as an example, focus the beam halfway between the highest point and the lowest point of engraving. Since a 4.0" lens has a greater focal range than a shorter lens, you can engrave a considerable distance around the ball without having to rotate it. Attempting to engrave further around the ball will result in a loss of engraving power and a distorted image.

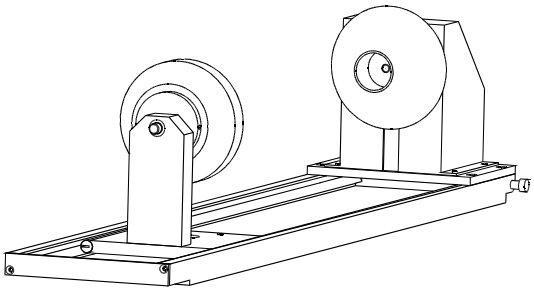


Refer to the following chart for spot sizes and focal ranges of the lenses available.

FOCAL LENGTH	SPOT SIZE	FOCAL RANGE
1.5 "	.003 "	+ / - .075 "
2.0 "	.005 "	+ / - .100 "
2.5 "	.007 "	+ / - .125 "
4.0 "	.013 "	+ / - .200 "

Rotary Fixture

The Rotary Fixture has been designed to engrave cylindrical objects. Two attachments come with the fixture, a cone shaped disk attached to the motorized end of the fixture and an inverted cone shaped disk attached to the adjustable end of the fixture. These attachments are used to hold wineglasses, mugs, cups, etc. To make it easier to understand, we will illustrate a step-by-step procedure to engrave an image on a glass.

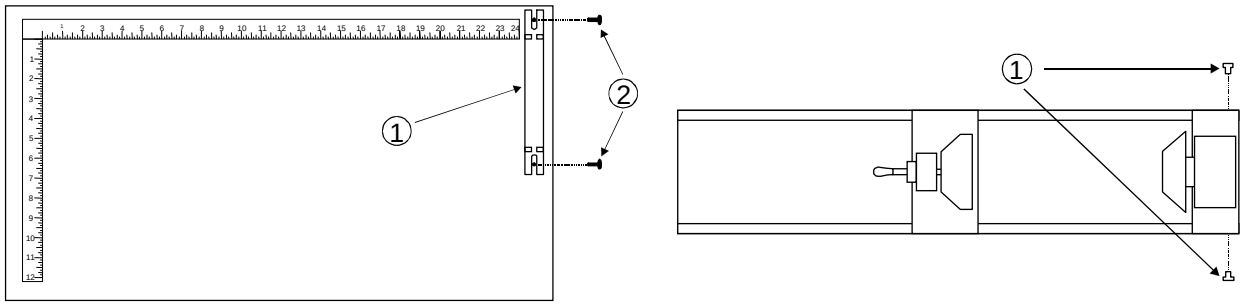


NOTE: These instructions apply to many different models even if your system has a smaller or larger field size.

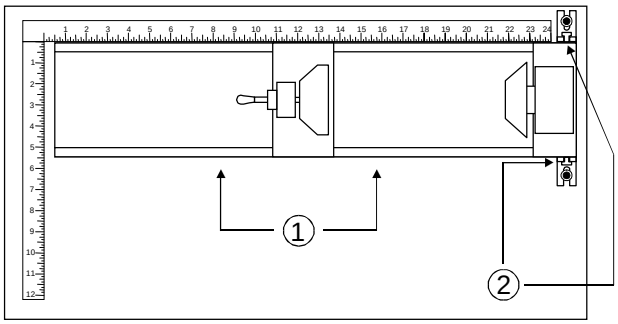
Installation

- Turn the laser system **ON**.
- Make sure AUTOFOCUS is turned OFF because the Rotary Fixture was not designed to work with AUTOFOCUS.
- Remove any materials that may be underneath the engraving table and lower the table **ALL THE WAY** down to the bottom or at least far enough down so that the focus carriage will clear the top of the Rotary Fixture when it is installed on the table. Now, turn the laser system **OFF**.

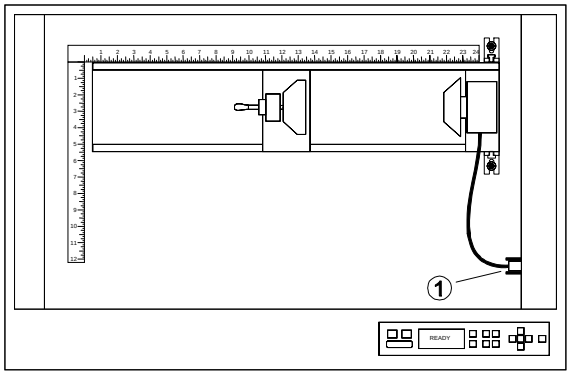
- Place the bracket on the table (1). Insert the thumbscrews and washers (2) into the screw holes but do not tighten down completely. Leave the thumbscrews loose enough so that the bracket can slide.

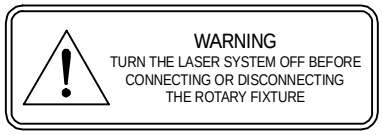


- Place the Rotary Fixture on a flat surface. Using an Allen wrench, attach the two socket head shoulder screws (1) to the side of the base plate.
- Place the Rotary Fixture on top of the bracket so that its pivot bolts set into the forks in the bracket. Gently push the fixture (1) flat up against the top ruler. **NOW**, tighten down the thumbscrews (2).

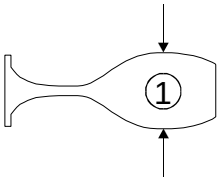


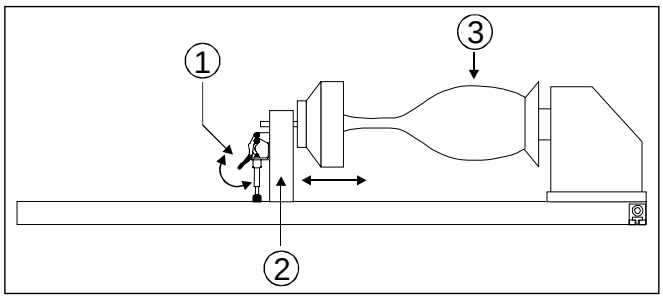
- With the power to the system still **OFF**, connect the 9-pin Rotary Fixture control cable to the receptacle on the laser engraving system (1).



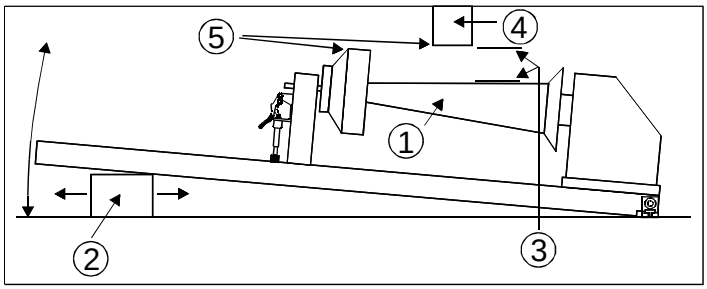


- Before loading the glass into the fixture, measure the diameter of the glass in the area where the engraving is to be located by using a caliper or similar measuring device. Either remember this number or write it down.
- Place the open end of the glass on the right side of the Rotary Fixture. Lift the lever (1) on the adjustable end of the fixture and slide it up against the base of the glass so the glass rests firmly centered inside of the inverted cone. Push the adjustable end of the fixture (2) to the right, firmly against the bottom of the glass. Do not to apply too much pressure, especially with glass. You only need enough pressure to prevent the object from slipping on the cone while it rotates. Lower the lever on the end of the fixture to lock it in place.





- You must now focus on the glass. Power **ON** the laser system and wait for the display to show "READY". Press the "Z" button on the control panel and notice that the motion system will align to the centerline of the Rotary Fixture automatically. You will also notice that the left and right arrow buttons will cause the focus carriage to move left and right respectively. This control is the same as when engraving a flat object on the table. However, the up arrow now causes the fixture to rotate the glass towards the front of the machine and the down arrow causes it to rotate towards the rear of the machine. What the Rotary Fixture actually does is remove the normal up and down Y-axis movement and replace it with a rotational movement. So instead of the system engraving down the flat page of a graphic, it takes that flat graphic and wraps it around the cylindrical object. Now, using the Focus Tool method, focus on the glass. After focusing is complete, press the "Z" button again and the arm will move back into its home position.
- If engraving a tapered object (1), the Rotary Fixture can be rotated to maintain proper focus. To do this, lift up the left end of the fixture and place some sort of spacer underneath the fixture (2) to prop it up. Slide the spacer left and right until the surface of the object is parallel (3) to the Focus Carriage. Be careful not to raise the Rotary Fixture too high (4), otherwise parts of it might interfere with the Focus Carriage (5). **NOTE:** If you operate the fixture in this manner, you might need to taper your graphic in your software so that it matches the taper angle of your object. Otherwise, your graphic might appear to be tapered when it is engraved.

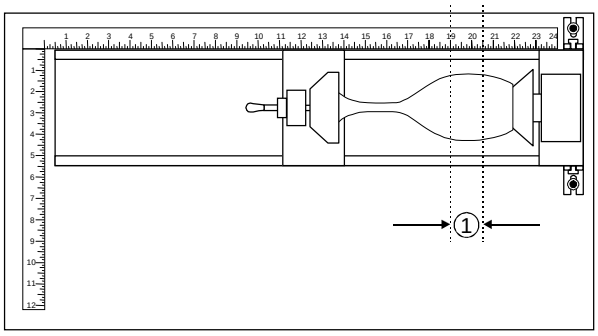


Determining Graphic Placement

We now need to determine where we want the engraving to appear on the glass. You can use the top ruler as a visual aid in referencing the engraving area of the glass or you can use the Red Diode Laser and the X-Y coordinate system to precisely place the graphic in your graphics program. To be more precise, we will use the Red Diode Laser Pointer.

To activate the Red Diode Laser Pointer, press the X-Y button while either in the "READY", "MAIN", or "FILE DISPLAY" menu. The following submenu will appear:

Using the Motion Control buttons, position the Focus Carriage above the glass and observe the Red Diode Lasers position. Stop movement where you would like the top of the graphic (the right dotted line in the engraving area) to begin. Look at the coordinate display and read the "POS" "X" position. Retain this number in memory or write it down. Ignore the "Y" position. Now, position the red dot at the lowest point (the left dotted line in the engraving area) on the glass where you would like the engraving to end. Remember this "POS" "X" coordinate or write it down.



In this example our upper limit is about 20500X and the lower limit is 19000X. This translates to 20.5 inches and 19.0 inches respectively because the coordinates are in 1/1000 inch units.

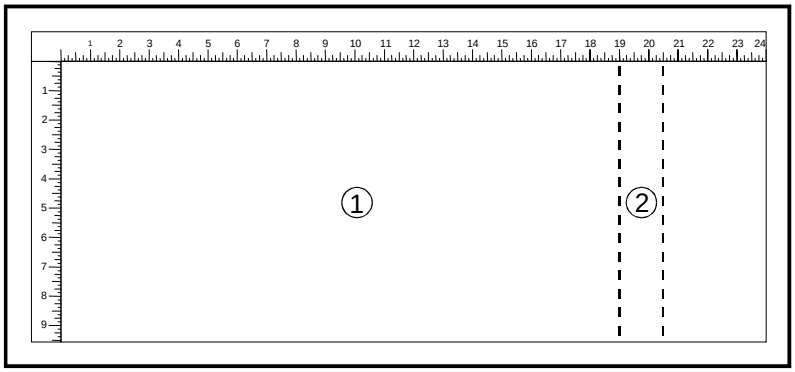
We have now set up the glass to be engraved. Close all doors of the laser system, go to your computer, and open your graphics software.

Printer Driver Settings

With your graphics software open, proceed immediately to “Printer Setup” and open the printer driver. In the printer driver, click on the “Engraving Field” tab, is set to page orientation to ”Landscape” and the size set to the maximum field size of the laser system. In this example, we will set it to 24 x 12 inches. Then, click on the “Rotary Installed” selection box and type in the diameter of the glass that was measured.

Notice that while typing in the diameter, the size of the height dimension changes automatically. Remember or write down this new page size. In this example, the diameter of the glass is 3.075 inches. After typing in this number, observe that the new page height is now 9.66 inches. Click on “OK” and go back to the graphics software’s page setup and change it to **EXACTLY** match the new page size that the Printer Driver established when the diameter of the object was typed in.

This new vertical page size is now the actual circumference of the object that is going to be engraved. From the top of the page (on screen) to the bottom represents one complete revolution of the Rotary Fixture. For example, if engraving a glass that has a diameter of 3.075 inches (78.1 mm), the driver calculates that the circumference of the glass (and vertical page size) is 9.66 inches (245.4 mm).



Position the graphic, on screen, so that it will fit vertically within the new vertical page height (circumference) and horizontally within the upper and lower engraving limits that we earlier determined with the Red Diode Laser Pointer. If the graphic does not fit within the vertical page size limits, the portion that is outside the page limit will not engrave. Remember, the new page size that the driver calculates from the diameter of the glass is it’s actual circumference. From the top of the page down to the bottom is one complete revolution of the glass. Since the Rotary Fixture will not turn more than 360 degrees, make sure that the graphic lies between the page limits.

You are now ready to print to the laser system. Make sure that you system is ready to engrave and then begin the process.

Rotary Fixture Removal

Turn the laser system **OFF**. Unplug the fixture’s power cable. Remove fixture from laser system by lifting it off the bracket. If you plan on using your fixture daily, you might want to leave the bracket attached to the table so that you can easily load and unload the fixture. If you seldom use the fixture, you might want to remove the bracket from the engraving table because the bracket may interfere with using “Autofocus”. If you use “Autofocus” and leave the bracket attached to the table, the thinnest piece of material that you can “Autofocus” on would be the thickness of the bracket because the “Autofocus” sensor can only detect materials taller than the bracket unless the bracket is removed. If you do not use “Autofocus”, then you can leave the bracket attached to the table, it is your choice.