XL9200 / XL12000

Laser Engraving and Cutting Systems

Safety, Installation, Operation,
and Basic Maintenance Manual

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MARCH 2006

CE

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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

XL Laser Systems

Specifications:

	XL-9200	XL-12000
Laser Power	See Laser Options	See Laser Options
Field Size	36”x24” (41.5”x29.5” max part)	48”x24” (53.5”x29.5” max part)
Z axis	8.5” motorized	8.5” motorized
Overall dimensions	56”w x 48”d x 48”t	68”w x 48”d x 48”t
Weight	500 lbs (without laser)	600 lbs (without laser)
Max Speed	100 in/sec	100 in/sec
Max Resolution	1016 dpi	1016 dpi
Computer interface	Ethernet	
File storage	40 Gb hard drive built in	
Controls	Active Matrix color display with job preview and navigation keypad	
Power	See Laser Options	See Laser Options
Cooling	Air Cooled	
Z-Axis load	60 lbs	60 lbs
Software compatibility	Windows XP only	

Laser Configurations:

	MP120 and MP120 SuperSpeed	HP400
Laser Power	Up to 120 watts (2 x 60 watts)	300 watts (2 x 150 watts)
Laser Weights	UL 25/30 (20 lb) UL-35/40 (23 lb) UL-45/50/60 (26 lb)	180 lb
Machine Power Requirements	15 amps @ 220V	35 Amps @220V

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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.

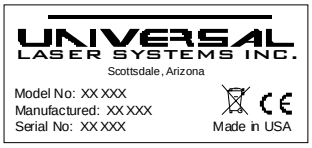
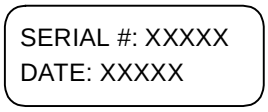
Laser Safety

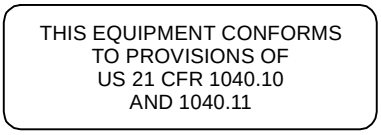
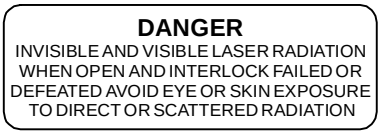
The device contains a sealed carbon dioxide (CO2) laser in a Class I enclosure that produces intense invisible and visible laser radiation at a wavelength of 10.6 microns in the infrared spectrum. For your protection, this enclosure is designed to completely contain the CO2 laser beam. Improper use of 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.

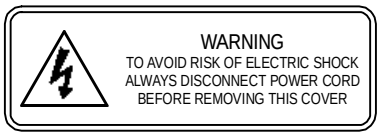
Safety Labels

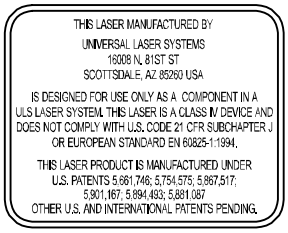
CDRH and CE regulations require that all laser manufacturers affix warning labels in specific locations throughout the equipment. The following warning labels are placed on the laser system for your safety. **DO NOT** remove them for any reason. If the labels become damaged or have been removed for any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

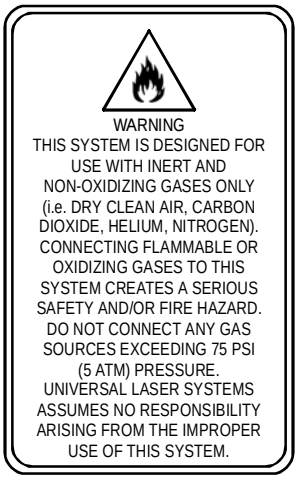
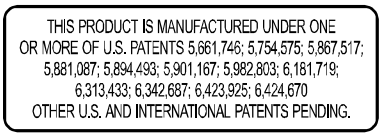
		
221-0004-0	221-0007-0	221-0012-0

		
221-0013-0	221-0015-0	221-0016-0

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	
221-0017-0	221-0018-0	221-0034-0

	 Located inside electrical enclosure next to main ground lug	INPUT POWER: 220 VAC; 50/60 Hz; 15 A *** Will vary depending on model. Please refer to the sticker located on the back of the machine ***
221-0020-0	221-0021-0	221-0024-0

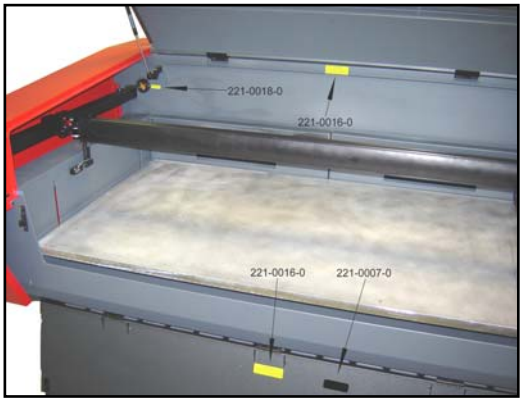
		
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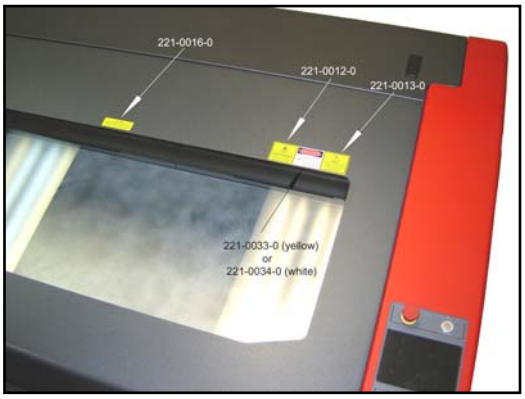
		
221-0037-0	221-0065-0	221-0081-0


221-0020-0
221-0024-0 (220VAC 50/60Hz 15A)
221-0078-0 (220VAC 50/60Hz 25A)
221-0079-0 (220VAC 50/60 Hz 20A 3 Phase)

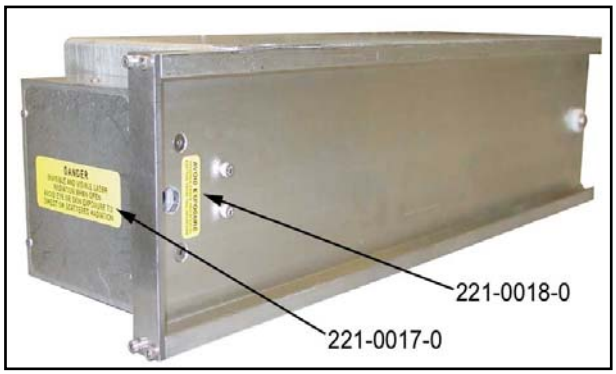

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221-0065-0
221-0004-0

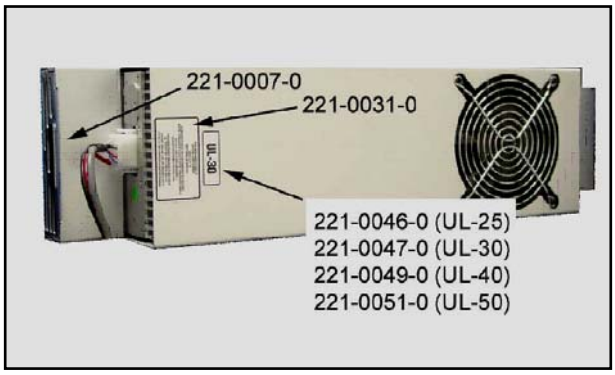

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221-0018-0
221-0016-0
221-0016-0
221-0007-0


221-0016-0
221-0012-0
221-0013-0
221-0033-0 (yellow)
or
221-0034-0 (white)


221-0016-0
VERSAL
SYSTEMS INC.





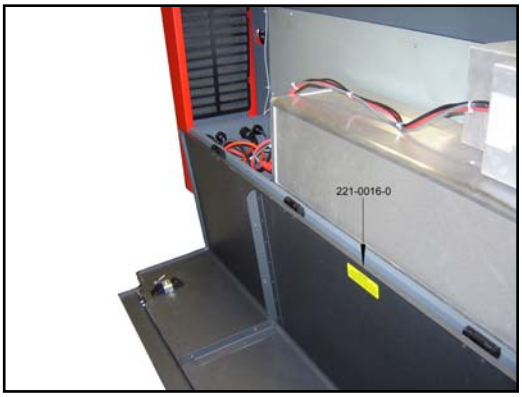


10 Watt Labels



150 Watt Tube





EU Compliance (CE)

UNIVERSAL
LASER SYSTEMS INC.

Product Identification: XL9200/XL12000
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

System 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.

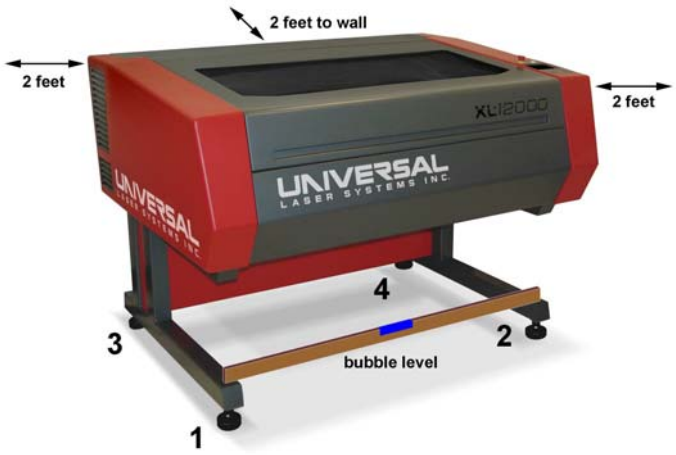
Facility

- The device **MUST** be installed in an office-type or light duty manufacturing environment. Airborne pollutants can damage the device. Keep the device isolated from any sandblasting, sanding or machining equipment or any other machinery that produces airborne particles. Also, do not operate or store this device near sources of water, saltwater, or oil vapor.
- For best results, we recommend operating this air-cooled device in the ambient temperature range of 73ºF (22ºC) to 77ºF (25º C). It may operate, however, in certain conditions if the ambient temperature is between the range of 50ºF (10ºC) to 95ºF (35º C).
- Avoid storing the device outside the temperature range 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.
- The facility must be able to accommodate receiving the system, fully assembled. The system CANNOT be disassembled nor turned on its side to facilitate the placement of the system in a particular location. The system dimensions can be found in the specifications section in the beginning of this manual.
- Choose a location for your laser system where you will be routing your exhaust system piping, your electrical power supply, and your computer system.
- The laser system MUST be placed on a firm, hard surface. Concrete or hard tile is recommended. DO NOT place on an unsupported floor that may sag. From the weight of the machine.
- For servicing reasons, make sure that the system is located in a place where it can reside at least 2 feet from the wall and 2 feet from any obstruction to the left and right sides of the machine. The rear as well as the side panels must have enough room to fold downwards for service.



ONCE THE SYSTEM IS LOCATED IN ITS FINAL RESTING POSITION, IT IS CRITICAL THAT THE SYSTEM IS LEVELED USING THE FOLLOWING PROCEDURE. DO NOT USE ANY OTHER METHOD OF LEVELING. AN IMPROPERLY LEVELED MACHINE WILL HAVE LASER BEAM ALIGNMENT AND ACCURACY PROBLEMS.

- Level the feet by placing a bubble level across the top of the legs at position 1 and 2. Using a wrench, adjust the feet until the bubble is level. Do the same across the top of the rear legs at position 3 and 4. DO NOT adjust the legs between positions 3 and 1 and between positions 2 and 4. This adjustment has been pre-set at the factory and further adjustment may twist the body of the system.



WARNING

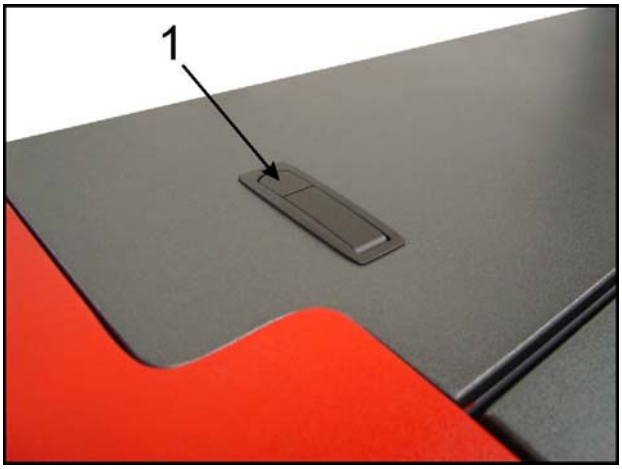
DO NOT REPLACE THE LEVELING FEET WITH CASTERS. THE LEVELING FEET PROVIDE A STURDY SUPPORT FOR THE SYSTEM WHILE IT IS OPERATING. THE ADDITION OF CASTERS WILL CAUSE ENGRAVING AND/OR CUTTING QUALITY PROBLEMS.

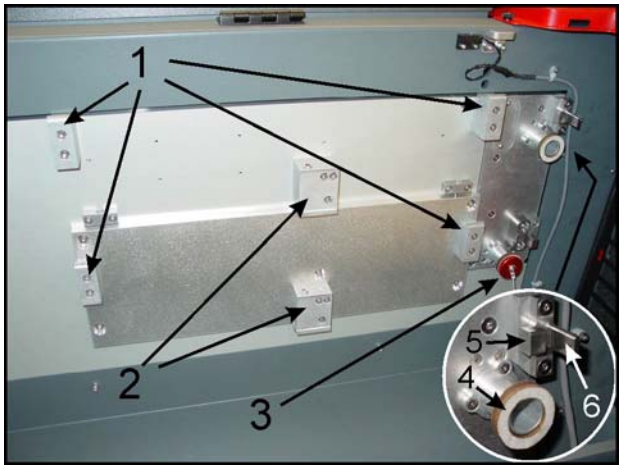
System Installation

- Open the top door and remove any tie-downs, straps, or any packing materials that is holding the arm in place.
- Remove any remaining packing materials, accessories or any other items that may be located inside the cabinet or on top of the engraving table.

Laser Cartridge Installation

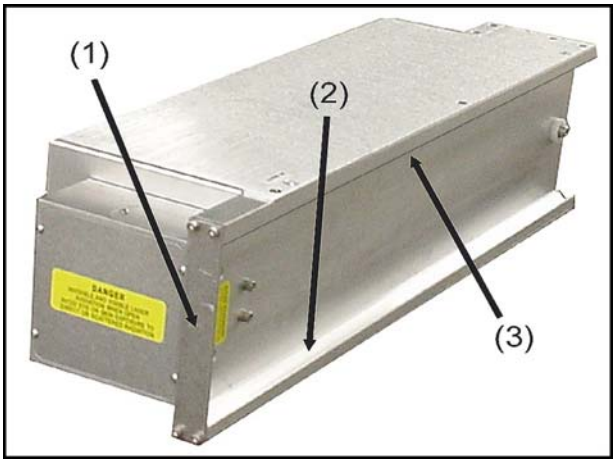
Before connecting and powering on your system, you must install the laser cartridge(s).





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

Visually locate the mounting blocks (1), the laser latches (2), bottom laser plug (3), gasket (4), and the alignment forks (5 & 6). Notice that the alignment fork has two plates, one small (5) and one large (6). Locate the gap between the two plates (5&6).



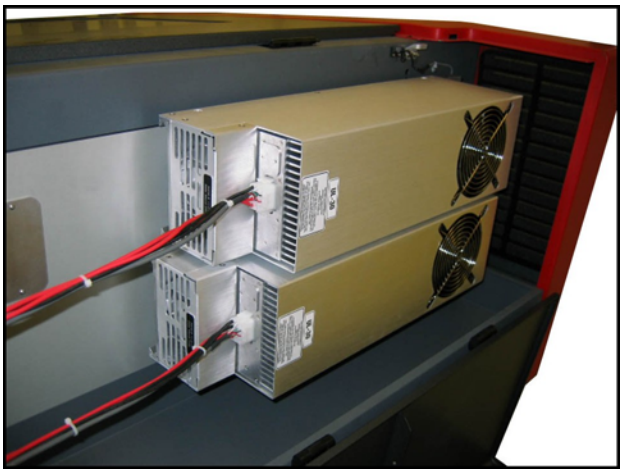


Observe the “V” groove along the upper (3) and lower (2) part of the laser cartridge and the alignment plate (1) at the end.

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. Before you can mount the lower laser, you MUST remove the red, beam tube plug. If removing the plug, simply grasp it by the sides and gently twist it clockwise and counter-clockwise while pulling it towards you. Be careful not to damage or remove the gasket behind it. If you are only mounting one laser, you MUST leave the plug installed, otherwise the internal optics will become damaged from contamination.

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”.



Electrical Power Source

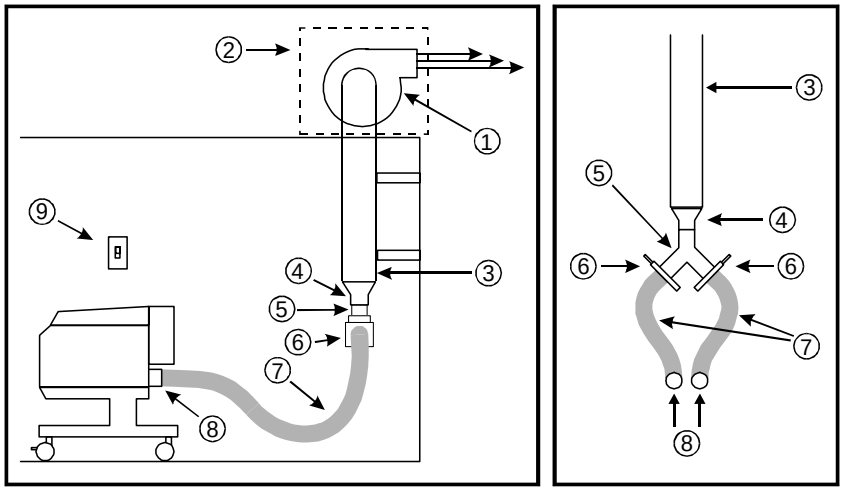
- The electrical power requirements can be found printed on the sticker next to the power inlet of the laser system.
- Noisy or unstable electricity as well as voltage spikes may cause interference and possible damage to the device's electronics. If electrical power fluctuations, brown outs, or constant power outages are a problem in your area, an electrical power stabilizer, UPS (Uninterruptible Power Supply), or backup generator may be required.
- To prevent the overload of your electrical power circuit or to control an unstable or noisy electrical power source, it may be necessary to connect the device to a dedicated electrical circuit.
- The system is supplied with a power connector but not a power cord. You will need to supply the power cord based on the length of cord you need as well as a properly rated one.
- You will need to connect the laser system to your electrical power source using the connector ULS supplied and the power cord that you supply. We suggest that this be done by a qualified electrician.
- Never remove the ground (earth) nor plug the system into a non- grounded (non-earthed) outlet. Operating the device without the ground connection is very dangerous and can lead to a severe, if not fatal, electrical shock. It may also cause the device to exhibit unpredictable behavior.

Fume and Particulate Extraction (Exhaust)

- The exhaust system **MUST** be capable of supplying a minimum of 700 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



Computer and Operating System

Minimum Computer Requirement

- Windows XP Home or Professional Edition computer. Macintosh computers are not compatible
- 1.5GHz processor with 256 MB RAM and a 40 GB hard drive
- Writable CDROM drive
- Monitor (minimum 800 x 600 resolution)
- Mouse or other pointing device
- Ethernet port 10/100 Ethernet connection
- Ethernet hub or Ethernet switch (see below)
- Internet connection and email address (not required, but recommended)

If the external computer is part of a network, the Laser System's Ethernet cable can be connected directly to a computer network. However, in the case of a stand-alone external computer, a hub or switch is required between the computer and the laser system.

Printer Driver Installation

- Do not connect an Ethernet cable to or power on the laser system at this time otherwise unexpected results will occur.
- Attached to the inside rear cover of this manual you will find a CD-ROM that contains the XL Series Print Driver and Firmware. Place this CD into your computer's CD-ROM drive.
- Using Windows Explorer, locate and double click on file xlinst.exe
- The installation software will execute and the ULS Network Printer Installation dialog box will appear. Remove the checkmark in the "Install Printer Firmware" checkbox so that ONLY "Install Printer Driver" is checked and click Next.
- Select which XL Series Model Printer you wish to install and then click Next.
- You will be prompted to enter the network address for your printer. Choose between DHCP (Server Assigned IP Address) and IP Address (manually assigned IP Address). If you do not know which one to choose, contact your network specialist.
- If choosing DHCP, choose a network ID from the dropdown list and then click Next. However, if choosing an IP Address, select IP Address, enter a Printer IP Address, and then click Next.
- The printer driver files will now be copied to your computer's hard drive. Once it finishes, click the Finish button to complete the installation.

Recommended Software Programs

The following is a list of recommended software programs.

- **CorelDraw 12 or X3**
- **AutoCAD 2000i or higher**
- **Adobe Photoshop (for photo editing)**

****Most users purchase the CorelDRAW12 Graphics Suite package which contains all the software necessary to operate the laser system to its fullest capability. Earlier versions of CorelDRAW have experienced problems with the XP operating system, which in turn, causes problems with the operation of the laser system. As a result ULS recommends CorelDRAW12 over earlier versions. Whether you decide to use CorelDRAW12 or a different graphics software package, it is critical that you fully understand how to use the software in order to successfully operate the laser system. While ULS has made reasonable efforts to make the laser system as compatible as possible with graphics and CAD software written for the Windows XP operating systems, ULS cannot guarantee complete compatibility with any software not manufactured by ULS.**

When a software company updates their version of their programs, it can sometimes cause conflicts with our printer driver. Our programmers constantly test new software programs and updated versions for compatibility. We will update our printer driver to address issues that we have control of. For bugs or problems with your software not related to the laser system, please contact the software manufacturer. We recommend checking with the software manufacturer for the latest patches and revisions.

Software Setup

There are many software programs that you can purchase off-the-shelf that will work with the laser system. **We recommend the use of CorelDRAW 12 with Service Pack 1 or CorelDRAW X3.** Other software programs might not be able to access all of the features of the laser system. Whichever program you choose, it must be set up to work with the laser system otherwise **unexpected results may occur**.

CorelDRAW 12 Windows 2000 or Windows XP

1. Make sure that you have installed all Service Releases and software patches from Microsoft. If you are reading this document from the ULS Windows Printer Driver CD, as a service to you, you can find the file on this CD. There is an update available for Windows XP included in the ULS Windows Printer Driver CD, but it is not mandatory that you install it. For the latest releases, check Microsoft's website, www.microsoft.com. Please contact Microsoft if you have any questions regarding these upgrades. ULS is not responsible for any problems as a result from the usage of these patches.
2. If you have not already done so, install CorelDraw on your computer, but do not open it yet.
3. It is important that your version of CorelDraw is updated with the latest patches and service releases. For the latest patches and updates go to CorelDraw's website, www.corel.com. As of the date of this publication there are no updates available for CorelDraw 12. Be sure to check for any updates from time to time to keep your version up to speed. Please contact CorelDraw if you have any questions regarding these upgrades. ULS is not responsible for any problems as a result from the usage of these patches.
4. Re-insert the ULS Printer Driver Disk back into your CD drive at this time.
5. Using Windows Explorer, locate the file named "ULS.CPL" and "ULS.PAL" on the ULS Windows Printer Driver CD, and copy these files over to the C:\Program Files\Corel\Corel Graphics 12\Languages\EN\Custom Data\Palettes folder. **Note: ULS.CPL may not show up with a .CPL file extension. It may be listed as ULS with "Control panel extension" shown as a detail.**
6. While still in Explorer, locate a file named "corelapp.ini" located in the C:\Program Files\Corel\Graphics12\Config folder. Double-click on the file it will open up in Notepad. Scroll down past the semi-colons to the [Config] header. Then scroll down 22 lines to the line that reads "Fontrasterizer=1". Change the 1 to a 0 (this is a zero, not an o). Save this file and then close Notepad.
7. Open CorelDraw and start a new graphic.
8. In the main menu at the top of the screen, click on "Window", then "Color Palettes", and then click on "None". Once again click on "Window", then "Color Palettes", and then click on "Open Palette". After the "Open Palette" pop-up box appears, double-click on "ULS.CPL". The color palette will now appear on the right side of the screen. **Note: You can use either the ULS.CPL palette or the ULS.PAL palette, however, to use the ULS.PAL palette you must first select the PAL file type in the open palette screen.**
9. On the property bar, click on the landscape orientation (the sideways rectangle). If you would like the drawing units in metric, choose millimeters from the drop down list. Now type in the page width and height that matches your laser platform.
10. We now need to adjust the vertical ruler, on the left side of the screen, to match the rulers in the laser system. To do this, we need to adjust the ruler's vertical origin. Double-click directly on the vertical (side) ruler. The "Options" dialog box will appear. In the vertical origin box, type in the same height value as you did when you set up the page height in the previous step. For example, 12 inches for an M-300 machine. If you would like the scale to be displayed in tenths, choose "10 per Tick" in the "Tick Division" drop-down list box.
11. While still in the "Options" dialog box, double-click on "Global" to expand the list. Double-click on "Printing" to expand the list. Now click on "Driver Compatibility". Make sure that the laser system's name is displayed in the printer drop-down list. In the settings specific for this driver dialog box, make sure that **ALL** the check boxes are **UNCHECKED**. Now click on "OK" to close the "Options" dialog box.

12. The next step is to set the default value for the line width and color when drawing graphic objects. To do this, click on the outline tool, then the outline pen dialog in the fly out. With “Graphic” being the only one selected, click “OK”. Click the down arrow in the Color dropdown box to expand the list and click on the color red. Click the down arrow in the “Width” dropdown box to expand the list and click “Hairline”. The units can be “Inches”, “millimeters” or anything else you prefer. Click “OK to close the Outline Pen dialog box.
13. In the top menu, click “Tools, then click “Color Management”. Click on the down arrow to expand the “Style” dropdown list. Click “Color Management Off”, and then click “OK”.
14. Finally, at the top of the screen, click on “Tools”, then “Options”, then “Document”, and then select “Save Options as Defaults for New Documents”. Make sure **ALL** the options listed are **CHECKED** then click “OK”.
15. The setup defaults for CorelDraw 12 are now complete. Whenever you start a new document, all of the default settings that we had setup will automatically apply to the new document.

CorelDRAW X3 Windows 2000 or Windows XP

1. Make sure that you have installed all Service Releases and software patches from Microsoft. For Windows 2000, install Service Pack 3. If you are reading this document from the ULS Windows Printer Driver CD, as a service to you, you can find the file on this CD. There is an update available for Windows XP included in the ULS Windows Printer Driver CD, but it is not mandatory that you install it. For the latest releases, check Microsoft’s website, www.microsoft.com. Please contact Microsoft if you have any questions regarding these upgrades. ULS is not responsible for any problems as a result from the usage of these patches.
2. If you have not already done so, install CorelDraw on your computer, but do not open it yet.
3. It is important that your version of CorelDraw is updated with the latest patches and service releases. For the latest patches and updates go to CorelDraw’s website, www.corel.com. As of the date of this publication there are no updates available for CorelDraw X3. Be sure to check for any updates from time to time to keep your version up to speed. Please contact CorelDraw if you have any questions regarding these upgrades. ULS is not responsible for any problems as a result from the usage of these patches.
4. Re-insert the ULS Printer Driver Disk back into your CD drive at this time.
5. Using Windows Explorer, locate the file named “ULS.CPL” and “ULS.PAL” on the ULS Windows Printer Driver CD, and copy these files over to the C:\Program Files\Corel\Corel Graphics SUITE X3 (13)\Languages\EN\Custom Data\Palettes folder. **Note: ULS.CPL may not show up with a .CPL file extension. It may be listed as ULS with “Control panel extension” shown as a detail. If you own a VersaLASER the name of the file is VersaLASER.CPL.**
6. While still in Explorer, locate a file named “corelapp.ini” located in the C:\Program Files\Corel\Graphics12\Config folder. Double-click on the file it will open up in Notepad. Scroll down past the semi-colons to the [Config] header. Then scroll down 22 lines to the line that reads “Fontrasterizer=1”. Change the 1 to a 0 (this is a zero, not an o). Save this file and then close Notepad.
7. Open CorelDraw and start a new graphic.
8. In the main menu at the top of the screen, click on “Window”, then “Color Palettes”, and then click on “None”. Once again click on “Window”, then “Color Palettes”, and then click on “Open Palette”. After the “Open Palette” pop-up box appears, double-click on "ULS.CPL". The color palette will now appear on the right side of the screen. **Note: You can use either the ULS.CPL palette or the ULS.PAL palette, however, to use the ULS.PAL palette you must first select the PAL file type in the open palette screen.**
9. On the property bar, click on the landscape orientation (the sideways rectangle). If you would like the drawing units in metric, choose millimeters from the drop down list. Now type in the page width and height that matches your laser platform.
10. We now need to adjust the vertical ruler, on the left side of the screen, to match the rulers in the laser system. To do this, we need to adjust the ruler's vertical origin. Double-click directly on the vertical (side) ruler. The “Options” dialog box will appear. In the vertical origin box, type in the same height value as you did when you set up the page height in the previous step. For example, 12 inches for an M-300 machine. If you would like the scale to be displayed in tenths, choose “10 per Tick” in the “Tick Division” drop-down list box.
11. While still in the “Options” dialog box, double-click on “Global” to expand the list. Double-click on “Printing” to expand the list. Now click on “Driver Compatibility”. Make sure that the laser system's name is displayed in the printer drop-down list. In the settings specific for this driver dialog box, make sure that **ALL** the check boxes are **UNCHECKED**. Now click on “OK” to close the “Options” dialog box.

12. The next step is to set the default value for the line width and color when drawing graphic objects. To do this, click on the outline tool, then the outline pen dialog in the flyout. With “Graphic” being the only one selected, click “OK”. Click the down arrow in the Color dropdown box to expand the list and click on the color red. Click the down arrow in the “Width” dropdown box to expand the list and click “Hairline”. The units can be “Inches”, “millimeters” or anything else you prefer. Click “OK to close the Outline Pen dialog box.
13. In the top menu, click “**Tools**”, and then click “**Color Management”.** Click on the down arrow to expand the **“Settings”** dropdown list. Click **“Color Management Off**”, and then click “OK”.
14. Finally, at the top of the screen, click on “**Tools**”, then “**Save settings as Defaults**”.
15. The setup defaults for CorelDRAW X3 are now complete. Whenever you start a new document, all of the default settings that we had setup will automatically apply to the new document.

AutoCAD 2000i, 2002 and 2004 for Windows 2000/XP

NOTE: AutoCAD version 2000 is not compatible with ULS laser systems. You must upgrade to version 2000i or higher.

- Make sure the ULS Printer driver is installed prior to setting up AutoCAD.
- If AutoCAD is already installed and you are just upgrading ULS printer drivers:
- Close all open programs. In Windows, Click Start>Printers & Faxes.
- Delete ALL ULS drivers from the Printers (Printers and Faxes) folder.
- With the Printers and Faxes folder still open, click File>Server Properties>Drivers and remove ALL ULS printer drivers from the list. Close Printers & Faxes.
- Using Windows Explorer, search for all files and folders with a .pc3 extension then delete all ULS Printer pc3 files (i.e. M-360.pc3).
- Next, search for files with a .pmp extension and delete all ULS Printer .pmp files (i.e. M-360.pmp).
- Reboot the PC. Start AutoCAD and open a new drawing.
- Click File>Plotter Manager, and double-click Add a Plotter Wizard. If the Autodesk Hardcopy System window appears, select the version of AutoCAD you are using, and then click Continue.
- Click Next. Select System Printer, and then click Next.
- Select the appropriate ULS Printer Driver, and then click Next.
- DO NOT click the Import file button, simply click Next.
- You may edit the plotter name, if desired, and then click Next.
- Click on Modify Standard Paper Sizes (Printable Area) in the Device and Document Settings Tab window, and then click the Modify button. Change ALL margins to 0.00, and then click Next.
- Edit the PMP file name if you desire then click Next. DO NOT click the Print a Test Page button, click Finish. Click OK to exit the Plotter Configuration Editor window and then click Finish.
- Click File>Page Setup, and then select the Plotter Configuration name, pc3 name (not the driver) from the dropdown list.
- If you would like to change the drivers settings, click the Properties button, then click the Custom Properties button. Make your changes and then click OK and then OK again.
- Click New to create a new Plot Style table to set your pen widths. As a default, the ULS print driver produces vector output when pen widths are set to 0.001 inches (0.025 mm). If the pen widths are set between 0.002 – 0.008 inches (0.050 – 0.20 mm), then the ULS print driver may or may not convert the lines to raster images – this will depend on the image being plotted. Therefore it is recommended that for colors requiring vector output, set the pen widths to 0.001 inches (0.025 mm), and for colors requiring raster output, set pen widths greater than 0.008 inches (0.20 mm). So now, select Start from scratch, and then click Next. Enter a name and then click Next. Click the Plot Style Table Editor button. Click Color 1, hold the shift key on your keyboard and click colors 2 through 7. You can only use colors 1 through 7 with the ULS printer driver. With all 7 colors highlighted, click the Edit Lineweights button and then select the units desired. Add a lineweight of 0.001 inches (0.025 mm) to the Value column by clicking on Edit Lineweight and entering 0.001 (or 0.025 for metric settings). Click OK, click Save & Close, and then click Finish. Click the Layout Settings tab and set the Plot Scale to 1:1.
- AutoCAD is not set up properly to work with the ULS printer driver.

Graphics Software Setup

Choosing the right graphics software program to run the laser system is essential for maximum usage and control of the laser system. Not all software can be used to run the laser system because many have limitations. Because you may be using word processing software to output to your laser printer does not mean you should use it to output to your laser engraving system. Setting up you software correctly is essential to running the laser system properly.

XL9200 = 36 x 24 inches (914.4mm x 609.6mm)
XL12000 = 48 x 24 inches (1219.2mm x 609.6mm)

NOTE: Since we have provided specific instructions for setting up CorelDRAW 12 and AutoCAD 2000iand higher, in the previous section, some of the following steps have already been taken. Please read through the rest of this section, in its entirety, to make sure your software is configured properly.

There are many other software programs that you can purchase off-the-shelf that will work with the laser system. Some of them can access more features of the laser system than others may. Whichever program you choose, it must be set up to work with the laser system otherwise unexpected results may occur. Use the following **GENERAL** guidelines when configuring your software program.

Page Setup

To properly generate and position artwork, most graphics software will permit the customization of the page size and orientation. Set the page orientation, in the graphics software to Landscape, and the page size to match your maximum engraving area of your Platform. The driver's orientation and page size MUST then be set to match these specifications EXACTLY, otherwise the artwork may not print correctly. When setting page orientation and driver orientation to Landscape mode, the laser system will operate in the horizontal direction, left to right. If page orientation and driver orientation is set to Portrait mode, the laser system will operate in the vertical direction, front to back. The laser system is designed to operate best in the Landscape mode and this orientation is highly recommended. The page size may also be reduced to match the size of the engraving material, but remember to adjust the page size in the driver's to correspond to the graphics software's page size. Note that in production situations it is often more efficient to leave the page size at its maximum page size and engrave or cut more than one object at a time. This is accomplished by duplicating the image on screen as many times as necessary to fill up the entire page.

Ruler Setup

Usually the graphics software will provide on-screen rulers, which can be configured to match the rulers in the laser system. Using rulers in the software and matching them with the ones provided in the laser system gives the ability to correctly align the graphic on the screen with the material in the laser system.

Power Control through Color Selection

The laser system allows the use of 8 different colors to access 8 different power settings when cutting and engraving. The printer driver controls this feature. When using this power change feature with driver, the colors that are used MUST exactly match the colors listed in the driver. The colors are black, red, green, yellow, blue, magenta, cyan, and orange. Some programs will provide these basic colors pre-defined and other programs may require the creation of each of the colors by defining them in RGB. If you are using CorelDRAW we have made our own custom palette and placed the file on the printer driver disk. Please refer to the software setup instructions. If you are using other graphics software and need to mix your own colors, use the chart below to create them.

COLOR	RED	GREEN	BLUE
BLACK	0	0	0
RED	255	0	0
GREEN	0	255	0
YELLOW	255	255	0
BLUE	0	0	255
MAGENTA	255	0	255
CYAN	0	255	255
ORANGE	255	102	0

If using a color other than the exact colors listed above, the driver will attempt to match it to a color in the driver that it most closely resembles. The driver will then use that color's power setting and apply a halftone pattern to represent the original color's shade. For example, if using a color like pink to fill a rectangle, the driver takes a reading of the percentage of different colors used to create that color and will use the power setting assigned to one of the eight colors of the driver that it most closely resembles. It might be expected that the driver will use the power setting assigned to the color red but instead the driver may choose the magenta setting and halftone the rectangle as a representation of the pink color's lighter shade. To prevent the incorrect assignment of laser power, be sure to use the right colors. If using graphics with colors other than the eight listed above or to simplify the assignment of power settings, try using the Clipart Mode feature in the driver. This feature will cause the system to only use the power setting assigned to the color black and halftone all of the other colors.

Outlines and Fills

The printer driver distinguishes between raster mode (engraving) and vector mode (cutting) by the type of graphic artwork being used. Basically, all graphics other than outlines of very thin line widths will be interpreted as engraved images and the raster mode will be used for output. If laser cutting is desired, set the line thickness of the lines that are drawn in the graphics software to .001 inches (.025 mm) or the smallest possible line thickness that is available. The printer driver will interpret these objects as vectors and will cut them out providing that your software has the capability of vector output. Basically, all software programs have the ability to provide raster output. However, not all programs have the ability to provide vector output even if you set the line width to the smallest thickness possible. Check with Software Anomalies section in the back of this manual for software that can vector output. The use of color fills or bitmaps will cause the laser system to engrave. The combination of engraving and cutting is available in most graphics software. We suggest that when combining engraving and cutting objects, use different colors for the fills and outlines since engraving requires different power settings than cutting objects. One thing to keep in mind when creating cutting objects is that if the outline thickness is set too thick, the driver might interpret the outline as a filled object and will engrave the outline instead of cutting. This might be desirable if engraving thick outlines is necessary. The outline thickness at which the driver will interpret cut lines as filled objects is dependent on the software used. Usually, any line thickness .008 inches (.2 mm) or greater will engrave. The only way to determine the cross over point for line thickness is to experiment with different line widths. Software programs that do not have outline capabilities definitely will not have the ability to cut.

Image Processing Order

When cutting or engraving a graphic image, the laser system will perform all engraving first, and then proceed to vector cutting. Raster engraving will proceed in the exact order of the colors listed in the driver. For example, all black filled objects will engrave first, then all red filled objects, then all green filled objects and so on. When all engraved objects have been completed, the laser system will proceed to vector cut any outlines present in the artwork. Vector output order is dependent on your operating system, printer driver version, and your software. Refer to the printer driver controls for more details.

Overlapping Fills

If the artwork created has overlapping filled areas, the driver will automatically filter these fills to prevent the overlapped area from being engraved twice. This is similar to color separation in the printing industry. The entire filled area of the object on top will be engraved and only the visible part of the underlying filled area will be engraved. The final result is a what-you-see-is-what-you-get output. In this way the color white can be used as an effective drawing tool. Since the laser system will not engrave the color white (this is the background color), it can be used to block out the undesired engraving areas of filled regions and/or bitmaps. However, you cannot use a white fill to cover an outline, the outline will vector cut even though you cannot see it on screen.

Overlapping Outlines

The driver does not filter outlines that overlap each other. If placing one outline one on top of another, both outlines will be cut by the laser system. This is a useful feature that will allow deeper cutting by passing the laser over a single outline path twice or more. To take advantage of this feature, duplicate the outline on top of itself.

Hidden Vector Lines in Artwork

The driver does not automatically filter out outlines that are overlapped by engraved objects such as fills. If there are filled objects with some hidden outlines underneath, the laser system will then engrave out the fill and cut the hidden outline on top of the fill. This is a common occurrence when using pre-drawn clipart designed for laser printers. To prevent this from happening, turn on the **Clipart Mode** feature in the driver. This feature disables the cutting mode and converts all visible outlines to engraved objects and ignores all hidden outlines.

Speed Optimizing

It is advantageous to engrave an object in its longest direction because total engraving time will be reduced when the motion system has to make fewer stops and starts. If the engraving object is longer than it is tall, rotating the graphic 90 degrees and placing the material in the laser system sideways can achieve a greater engraving speed. Be aware that some graphics programs do not allow the rotation of bitmaps. In this case, it may be necessary to use a bitmap image processing software to first rotate the bitmap before importing the bitmap into the graphics program. If the artwork contains engraved objects of the same color with a great deal of space between them in the engraving direction, processing time can be longer since the laser must make long strokes to engrave both objects at the same time. To reduce engraving time in cases like these, use different colors for each of the objects but assign the same power setting to both colors. This will cause the laser to engrave one object at a time, skipping over all blank space, which in many cases will reduce engraving time. On the other hand, if the objects are relatively close together in the engraving direction, then leave them the same color because it will be quicker to engrave them both at the same time. Experiment with these techniques to optimize the speed of engraving.

Bitmapped / Scanned Images

There are primarily three types of bitmaps available. They are monochrome (black and white), grayscale, and color. Bitmaps are patterns of dots (pixels) blended to form pictures. Scanning artwork into a computer through a scanner creates most bitmaps. Drawing them in a bitmap image-processing program creates others.

The laser system can print all three types of bitmaps providing that either the driver or the bitmap image-processing program converts the grayscale and/or color bitmaps into a monochrome bitmap. Essentially, the laser system is a monochromatic printer, either it fires the beam to burn a dot or it does not fire the beam to leave an empty dot on the material.

There are several different bitmap storage formats available: TIF, JPG, BMP, PCX, and others. The format makes no difference to the laser system. The difference in formats involves how they are stored on your computer's hard disk. Bitmaps cannot be edited in most graphics software. Some basic functions such as cropping, scaling, or mirroring might be possible but it is usually necessary to use a bitmap image processing software to perform a dot by dot editing, rotation, or scaling of the bitmap.

Monochrome Bitmaps
If you scan the image in monochrome (black and white) mode, set your scanner to at least 600 DPI. The higher the DPI, the smoother the image will be. Scanning monochrome images at 300 DPI is the minimum recommended resolution but scanning them at 600 DPI will provide a significant improvement in the image quality. Clean it up in your bitmap image-processing program and save it to your hard disk. You can now either print the image directly from your bitmap image processing program, or import the bitmap into a graphics program and print it from there. Monochrome bitmaps are engraved in the same manner as black filled text. The black area will turn the laser on and the white area turns the laser off.

Grayscale Bitmaps
When scanning image in the grayscale mode, you should scan the image at no more than 300 DPI. Scanning at a higher DPI does not improve image quality but it consumes more memory and will take longer to print. Grayscale images cannot be printed directly to the laser system. Since the laser system actually works like a black and white printer, grayscale images must be converted into black and white images. To do this, either the driver will do it automatically or you can convert the grayscale image to a black and white image in your bitmap image-processing program.

The two, primary grayscale image conversion techniques are Halftone or Error Diffusion. The printer driver can print either one and it is selected in the driver under the “Graphics” tab. Please refer to the section on the printer driver for more details on how to set these parameters. Since the driver has a fixed method of conversion, you may want to experiment by using your bitmap image-processing program to make the conversion. These software programs usually have more options for controlling the size, angle, shape, and the amount of black and white dots (pixels) created when converting the image. Experiment with all of the controls to see which looks the best. Big dots look good on some materials and small dots look better on others. Once the image is converted by your program, save it and either print it directly from that program or import it into your graphics program and print it from there. Essentially, a Halftone image and an Error Diffusion image are actually both monochrome images and can be treated as such. If you decide not convert the grayscale image to a monochrome image in your bitmap image editing program, then the driver will do it automatically and will use settings based on the Resolution settings in the driver.

Color Bitmaps
The printer driver handles color bitmaps the same as grayscale bitmaps. Since color bitmaps use more memory, they are unnecessary and are therefore NOT recommended, however, you can still use them.

Encapsulated Postscript (EPS) Images

Bitmap images cannot be cut by the laser system only engraved. The only way to have the laser system cut out or vector a bitmap is to first convert it to a vector file format such as an EPS. Raster to vector conversion programs are available that trace the bitmap (this only works well with monochrome bitmaps) and creates a separate EPS vector file. These EPS files can then be imported into the graphics program and printed out from there. Since tracing programs have many adjustments, some practice with them is necessary to produce desirable results.

The laser system does not support Encapsulated PostScript (EPS) printing directly. EPS files can only be edited and printed if they are first imported into a graphics program. However, since EPS files support engraving and cutting objects, they are therefore useful for transferring artwork from one graphics program to another. Once an EPS file has been imported into a graphics program, the objects can be outlined, stretched, rotated, mirrored, filled with different colors, or anything else desired just as long as your graphics software can edit EPS images. Be careful when using EPS files in layout software as opposed to true graphics software. Layout software may allow the placement of EPS files in the artwork but may not actually import and convert the EPS file to a useful format for the printer driver and therefore may not print correctly. Please refer to your graphics software’s documentation on whether or not it can edit and print EPS images to a non-Postscript printer.

Postscript (PS) Images

The laser system is NOT a postscript device. This means that postscript fills, postscript textures, and especially POSTSCRIPT FONTS WILL NOT be able to print to the laser system. Sometimes using Adobe Type Manager (ATM) will allow some postscript fonts to print correctly but most of the time does not work properly.

Helpful Tip

If you are having any problems printing a font and you cannot figure out what is going on, select the font and “convert to curves” or “convert to paths” in your graphics software. This will convert the font into a bitmapped image and will print correctly to the laser system. Refer to your graphics software on how to convert fonts. However, postscript textures and postscript fills cannot be converted and will not print to the laser system.

Section 3

OPERATION AND PRINTER DRIVER CONTROLS

System Operation

Powering On the System

To power on the system, first switch on the main circuit breaker located at the rear of the machine. This turns on the DC power supplies. Then, momentarily press the ON button located on the system control panel.

The Control Panel

The control panel of the laser system provides easy access to all of the controls necessary for cutting and engraving operations.



1. **Emergency Stop**
2. **On / Off**
3. **File Name**
4. **Number of Copies**
5. **Open Interlock Indicator**
6. **Cycle Time**
7. **Display**
8. **Quit / Zoom**
9. **XY/Z Manual Motion**
10. **Camera / Auto Focus**
11. **Select**
12. **Start Mark**
13. **Directional / Scroll Keys**
14. **Pause / Resume**

Control Panel Functions

Emergency Stop
Depressing the Emergency Stop button instantly disconnects all AC power to the system. This button should only be used in case of emergency. To reset the system after executing an E-stop, twist the red button clockwise to release the button. Then, reset the main circuit breaker at the rear of the machine.

On / Off
When the main circuit breaker is switched on, pressing this button will initialize the system and enter the ready state.

File Name
Indicates the file name presently loaded or in the process of being engraved.

Number of Copies
Indicates the number of times the file name displayed has been engraved.

Open Interlock Indicator
A visible RED dot indicates an open interlock (door or panel).

Cycle Time
The amount of time displayed in minutes and seconds to complete one engraving cycle.

Display Screen
The display shows file and system information, provides access to the system controls.

Quit / Zoom
While mark file is visible on display, press to zoom, while in menus, press once will allow you to exit.

XY/Z Manual Motion
The motion button provides access for manual movement of the axes.

Camera / Auto Focus
Pushed once this button will turn on the camera, pushed a second time will allow Auto Focusing of the Z-axis.

Select
Press once to confirm a choice in any menu.

Start Mark
Starts laser processing of the file displayed on the Display Screen.

Direction / Scroll Keys
These keys serve to control manual motion of the axes when used in conjunction with the XY/Z button. They also can be used to scroll through the Display menu.

Pause / Resume
If a file is running, the Pause button halts the file execution and the focus carriage will move back to the home position in the upper right corner of the engraving field. Press Pause a second time will resume the file from the last point processed.

The Menu System

The Viewer Mode

When first powered on, the system will initialize and the display will enter the Viewer Mode. In this mode, the display will automatically show the last file entered into memory. This indicates the system is ready for operation. The file name, the number of cycles executed (copies) and the execution time will be displayed in the Viewer mode.

The system has on-board hard-drive memory, capable of storing up to 100 job files in a print cache. The number of jobs to be stored is adjustable, and can be set by the user in the System Options menu. When the maximum number of files is exceeded, the software will automatically begin deleting the oldest jobs as the new jobs are entered into the cache. The entire cache can also be cleared from this menu.

The left and right scroll keys allow the user to navigate the jobs currently stored in the print cache. When the desired job is displayed in the viewer, the details of that job can be accessed by pressing the Select key (✓) to open the File Editor. In the File Editor, job settings and parameters can be accessed and edited, even during execution of the file. **Changes made to a job in this way will be permanently saved with the job in the print cache!** The file will not revert to the original settings.

File Editor

To use the File Editor, use the Scroll keys to highlight the item to be edited, and then press the Select Key
(✓) to select the item. This will open additional options for editing the selected item.

Color

Select from the list of available colors:

- Black
- Red
- Green
- Yellow
- Blue
- Magenta
- Cyan
- Orange

Mode

Options are Raster, Vector, Raster/Vector and Skip.

Power

Power can be set from 0 to 100%

Speed

Speed can be set from 0 to 100%.

PPI

PPI can be set from 0 to 1000.

Z-Axis

The material thickness can be entered for focusing purposes.

Air / Gas Valve

Gas, Air or Off can be selected.

Air/ Gas Flow
The air or gas flow rate can be set from 10% to 100%, in 10% increments.

Image
The Image Density set in the print driver is displayed, but cannot be edited.

Which Laser
Both / Top / Bottom

Red Dot Pointer
On / Off

Delete This File
Yes / No, used to delete selected file.

System Options Menu

About
SW: Software Version Vx.xx
FW: Firmware Version Vx.xx
HW: Hardware Version Vx.xx

Language
English
Espanol
Francais
Deutsch
Italiano

Units
Inches
Metric

Connection
IP: Fixed IP Address Input.
DHCP: Network Assigned IP Address.

Auto Z
On / Off: Allows Z height to be programmed in the printer driver.

1. Enable the Z Axis in the printer driver.
2. Using the slide scale in the printer driver set material thickness.
3. Press set in the printer driver.
4. Table will lower to the edited Z height before mark starts.

Red Dot Pointer
On / Off: This option is used for test marking, when active the diode pointer is on, laser beam will not be emitted. All doors must be closed before motion will move.

Lens Type
Not selectable, all lens types are detected automatically; all must be calibrated in the Set Lens Focus section of the System Options Menu.

Cutting Table (Optional)

Installed Yes / No: Used for calibration of an optional cutting table.

1. Home Z axis.
2. Press XY/Z to enter the motion menu.
3. Press XY/Z again until Z axis is highlighted.
4. Press ✓ to accept.
5. SYSTEMS OPTIONS MENU will appear.
6. Scroll down to the CUTTING TABLE INSTALLED.
7. Press ✓ to enter.
8. Press ✓ again to toggle CUTTING TABLE INSTALLED.
9. Press ✓ to accept.
10. Press the DOWN SCROLL ARROW too choose CALIBRATE.
11. Press ✓ to open CALIBRATE MENU, using the focus tool, focus to the top of the cutting table by pressing either the up or down arrow.
12. Press ↩, you will be prompted to save new Z position, choose yes or no.
13. You have now completed focus to the CUTTING TABLE.

Traveling Exhaust (Optional)

On / Off: Activates optional traveling exhaust blower.

Tuning

Used for raster engraving only**.** Shifts right to left and left to right raster lines for better quality engraving. Set automatically through print driver or manually at display.

Alignment Mode

Used for performing beam alignment and to test for max power.

1. Remove the lens kit from the focus carriage by removing thumb screws.
2. Using masking tape, tape over the beam entrance hole on left side of carriage.
3. Press XY/Z then ✓ to access the System Options Menu.
4. Scroll down to Alignment Mode, press ✓ to select.
5. A screen will appear with defaults of 5% power and 2 KHz and Both for laser option.
6. If changes need to be made to the default settings, press XY/Z to edit, then using the arrow keys select which setting you wish to edit. Press ✓ to confirm.
7. Press ↩ to return to the previous window.
8. Using the arrow keys, move the carriage to the upper left corner.
9. Press ✓ to fire the laser, press again to stop firing the laser. Fire the laser only long enough to discolor the tape.
10. Using the arrow keys, move the carriage to the lower right corner.
11. Press ✓ to fire the laser, press again to stop firing the laser. Fire the laser only long enough to discolor the tape.
12. Both burns should be overlapping and in the center of the tape.
13. If not, make adjustment to the #2 mirror assembly until 2nd burn covers the 1st.
14. Press ↩ to quit. Motion will return home.

Print Job Cache

System will store up to 100 jobs.
Jobs downloaded to system are permanently stored on the internal hard drive; jobs can be accessed from the main screen (job preview screen).

Clear Cache
Yes / No: Permanently deletes **ALL** stored jobs from system hard drive.

Screen Saver
Sets delay in screen saver on time.

Align Camera (Optional)
Used for calibrating offset from center of focus lens to center of camera.

1. Focus on material.
2. Press xyz / ✓ / Align Camera /✓.
3. Place material in lower right corner.
4. Press ✓ OK, a cross hair will be engraved. DO NOT MOVE MATERIAL.
5. After cross hair appears scroll down to ALIGN CROSS HAIR, press✓.
6. Wait 5 seconds then move arm by hand. Align cross hair over marked cross hair.
7. Press ✓ to save.
8. Offset will appear.
9. Press ⮌ to quit.

Home XY Axis
Homes motion in both the X and Y axis.

Home Z Axis
Homes Z table by lowering table to the bottom sensor.

Detect Collision
No / Yes: When enabled anything protruding above the focal plane will cause collision sensors to stop motion.

Allow Auto Focus
Yes / No: Allows the use of sensor to set focal height.

1. Press ▽ focus mode.
2. Wait 10 seconds.
3. Move carriage over object to be engraved using your hand.
4. Press ▽ focus a 2nd time.
5. You will be asked if you would like to SET FOCUS, press ✓ for yes.

Set Lens Focus
Set Z height for use with Auto Z.

1. Remove all objects from underneath the Z axis table.
2. Scroll down to Home Z Axis, then press✓. Z table will lower to bottom sensor.
3. Press⮌ to return to the motion menu, press xyz again to toggle to Z Axis.
4. Using the arrow keys ✥ focus to the top of the table using the appropriate focus tool.
5. Scroll down to SET LENS FOCUS, choose yes.
6. Z axis will now read 0 on the display.

Diagnostics (This section used for service only)

Manual Motion

When in the Viewer mode, the Manual Motion screen can be accessed by pressing the **XY/Y** button. Once opened, you can toggle between X-Y motion and Z- Motion. The selected axes can then be moved manually using the Direction Keys.

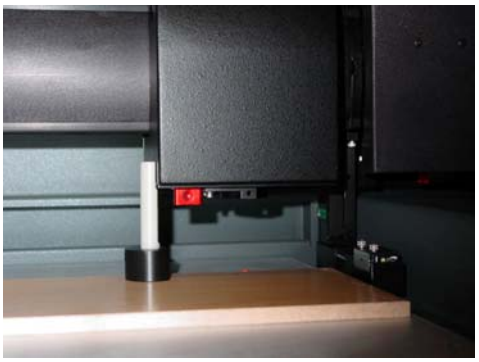
Focusing the Laser

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 currently 3 methods used to focus the laser beam to the surface of the material: 1) manually by using the focus tool, 2) the Z Position Method using the Auto-Z feature, and 3) Auto Focus Sensor.

Focus Tool Method

First, select *Auto-Z Disabled* in the System Options menu or the print driver. This will insure the Z-table will not move unless intentionally commanded by the operator. Place your material on the engraving or cutting table. Visually make sure that the height of the material will not interfere with the focus carriage when it moves over the material. Select **XY/Z** and use the Motion Control buttons to position the focus carriage. Again using the XY/Z button to select Z, move the Z-axis Table up or down.

Place the focus tool on top of the material and with the focus carriage directly above it, raise or lower the table so that the flat edge 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 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 procedure must be repeated whenever a material of a different thickness is required.



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.

Z Position Method and Focus Position Calibration

The Z position method enables the operator to set focus position by entering the thickness of the material in the printer driver.

When using the Z Position method, it is best to first calibrate the Focus position of the focus lens installed. This will insure that the focus position is correct. To do this, open the System Options Menu, and select Home Z-axis. Make certain that there is nothing under the Z-table that could obstruct the table motion. Select **XY/Z** and use the Motion Control buttons to position the focus carriage to the focus tool. Again using the XY/Z button to select Z, move the Z-axis Table up or down and set the focus position directly on top of the engraving table. Once you are satisfied that the focus height is exactly correct, open the System Options menu and select Set Lens Focus. Set the current calibrated position as the lens focus.

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 Lens Focus option is used to recalibrate the Z POSITION method.

Once the calibration is set, the focus can be set in the print driver. In the driver, select *Z-axis Auto*. For each color used in the layout it will be necessary to specify the material thickness by either using the z-axis slider, or entering the thickness value directly into the Z-axis text box. When executing the file, the system will automatically compensate for the specified material thickness by positioning the Z-axis accordingly.
See Auto Z / Set Lens Focus.

Auto Focus (Sensor)

Auto Focus will allow you to place your material to be engraved under the focus lens. By pressing the Auto Focus Button on the display the system will focus on to the material using a sensor. **See Allow Auto Focus.**

Printer Driver Controls

Definitions and Terminology

Vector Graphic: An image generated from mathematical descriptions that determine the position, length, and direction in which lines are drawn. Vector graphics are composed of fills and/or outlines.

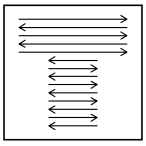
Fill: A color, bitmap, fountain, or pattern applied to the interior area of a vector graphic.

Outline: The line that defines the shape of a vector graphic.

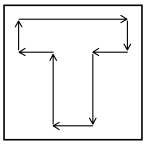
Bitmap: An image composed of grids of pixels or dots.

Motion System: The mechanical/electrical system that delivers the laser beam by moving the focusing lens directly above the application material.

Laser Beam Delivery Method (Mode): Three distinct ways the laser system can deliver the laser beam to the application material called raster engraving, vector marking, and vector cutting.



Raster: The process where the laser beam makes a series of bi-directional, horizontal scan lines to produce an image. Fills and Bitmaps are automatically raster engraved by the laser system.



Vector: The process where the laser beam follows the path of the outline (if present) of the graphic.

Marking: Setting the laser power low enough to only penetrate the surface of the material.

Cutting: Setting the laser power high enough to cut all the way through the material (if the material can be cut).

NOTE: When adjusting the printer driver settings, it is highly recommended that you practice engraving or cutting on a scrap portion of that material in case the settings need to be re-adjusted to obtain the desired results.

Laser Settings

Pen Mode

The driver uses the word "PEN" because the laser system works similar to the operation of a pen plotter output device. A pen plotter physically selects a colored pen that matches the same colored objects in your graphic, called "color mapping", and draws the graphic, on paper, in that color. The laser system, however, applies a Mode, % Power, % Speed, PPI, Z Axis and Flow (Air or Gas) setting to the individually colored objects in your graphic. Up to eight (8) sets of user-adjustable parameters, which control laser beam delivery to your application material, can be "mapped" to the respectively colored filled or outlined objects in your graphic.

NOTE: Black and white, grayscale, and color bitmaps are all mapped to the black color's settings.

Clicking the square button toggles through the following laser beam delivery modes for the each of the eight respective pen colors.

- ***RAST/VECT*** (default) rasters fills and vector marks or cuts proper outlines.
- ***RAST*** rasters all fills **AND** outlines regardless of outline thickness.
- ***VECT*** only vector marks or cuts proper outlines. It will skip all fills and will skip all outlines with line weights thicker than a hairline.
- ***SKIP*** ignores all fills and outlines.

Color, Power, Speed, and PPI

To change the % Power, % Speed, and/or PPI of a color, position the mouse arrow on the color name and click once. This will highlight the color's parameters and will allow the changing of the settings by using the scroll bars or by typing in each setting in the appropriate control box. It is possible to click on more than one color to set them to the same setting at the same time.

% Power

Available settings are from 0 to 100%. This setting is directly related to how deep the engraving will be. The higher the setting, the deeper it engraves, marks, or cuts, and vice-versa.

% Speed

Available settings are from 0 to 100%. **For optimal engraving quality we recommend never exceeding 70% speed.** This setting determines the maximum rate of travel of the motion system. Actual engraving time (throughput) is not only dependent on the % Speed setting, but is also dependent on the size and the placement of the graphic in the engraving field. The motion system will accelerate/decelerate as fast as it can up to the chosen speed. If the motion system cannot achieve the chosen speed based on the size of the graphic or graphical placement in the field it will automatically adjust its speed internally to the maximum speed it can achieve. This is evident when you see the motion system automatically slow down while cutting curves or circles as opposed to straight lines.

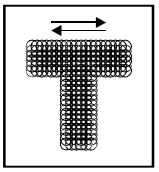
Automatic proportional pulsing (see PPI) of the laser beam will ensure that there is no difference in the depth of cut from straight lines to curves. Remember that depending on the graphic and your chosen settings, increasing or decreasing the speed setting will not necessarily process the file faster or slower, respectively. We will discuss how to optimize the throughput of the system later in this manual.

% Power and % Speed work together in determining how deep the engraving or cutting will be. Higher power and slower speeds produce deeper results. Lower power and higher speeds produce shallower results.

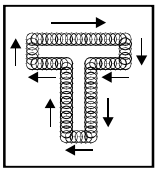
NOTE: 100% raster speed is different than 100% vector speed. Due to the inertia of the X-axis arm, movements in the Y-direction, the speed range is one-third raster speed.

PPI

Available settings are 1 to 1000. The laser beam is always pulsed and never "on" continuously even though it may appear that way. The PPI setting indicates how many laser pulses, per linear inch, the laser cartridge will emit. The pulsing of the laser beam is electronically linked to the motion system. These pulses will always fire, equally spaced, from one to the next, regardless of changes in speed.



In raster mode, the laser pulses are applied in bi-directional, horizontal scan lines just like a dot matrix printer. If you set the PPI to 500 and use the standard focusing lens (2.0") which has a laser spot size of five thousandths of an inch (.005"), pulses will fire every .002 inches (500 PPI), which will produce pulse overlap. Raising the PPI higher, such as 1000, the pulses will overlap more whereas lowering the PPI to something like 150 will spread the pulses out far enough where they may not overlap at all. When raster engraving filled objects, it is advisable to use a PPI setting of 500 or higher. If using less, the image resolution of the engraving is reduced. In some rare cases, using less than 500 PPI may produce better results.



In vector mode, laser pulsing follows the path of the outline of the object. Imagine the laser system working like a sewing machine where the stitching always remains consistent whether you sew fast, slow, or around curves. The setting you use will be application material dependent. Using less than 150 PPI may result in the pulses being spread so far apart that they may or may not touch one another. Perforated paper has this characteristic. Higher PPI settings may cause more of a melting or burning effect on the edges whereas lower PPI settings may reduce the burning, melting, or charring, but may result in a serrated or perforated-looking edge. Increasing or decreasing the PPI setting does not affect engraving speed, only the frequency of the pulses.

Z Axis

By selecting YES, the Z axis will automatically compensate for material thickness. Using calipers, measure the thickness of material to be engraved or cut. Using the slider, set the thickness measured.

Flow (Air / Gas)

All XL Series Engravers come equipped with the air and gas option standard. Simply choose from Air or Gas in the Pen Mode. Using the slider, set the % of pressure desired.

Set Button

After making % Power, % Speed, and PPI adjustments, you must click the Set button to register the change. If you do not click on Set, but click the OK button instead, the settings will revert back to the previous settings.

Image Density

This setting determines how many raster strokes per vertical inch of travel the motion system steps down to produce the engraving. It can also be referred to as the vertical lines per inch or fill spacing. There are six DPI settings to choose from 1000, 500, 333, 250, 200 and DRAFT. In the Windows XP driver it is termed Image Density; there are 6 Image Density choices. Higher Image Density (DPI) settings produce better quality raster images, but reduce productivity by increasing engraving time. Lower Image Density (DPI) settings produce lower quality raster images, but increase productivity by decreasing engraving time.

Image Density (DPI) settings will also have an effect on vector quality and vector speeds when vectoring other than straight horizontal or vertical lines. For example, a circle is made up of very small straight-line segments linked together at very small angles. If you choose a high quality setting such as 6 (1000 DPI), then these segments are as small as possible and they are high in quantity. The result is the smoothest looking circle but will take longer to vector engrave or cut because the focus carriage must start and stop at the ends of each line segment.

Since there are many segments, it will take longer to process, but the quality will be the highest that the machine can produce. If using a low quality setting such as 1 (DRAFT), these segments become longer, but there are less of them resulting in more flat-edged looking curves that will process faster. By running samples on scrap materials and practicing with different settings, you can find a compromise between throughput and engraving quality.

Settings

A unique feature of the printer driver is the ability to store all of its settings in a file without you having to write them down. These settings files are what we call LAS files.

Save

By clicking Save, the "Save Engraving Setup" dialog box will appear and will allow you to enter in a file name. All settings will be stored in this file that has a ".LAS" extension. DO NOT rename the extension; the driver will not recognize the file as a laser settings file if it does not have the ".LAS" extension name. These files can be stored in any directory on your hard drive or floppy disks and you can have as many setting files as your disks can hold.

Load

To recall printer driver settings that have been previously saved, click on the "Load" button and choose the desired .LAS settings file. The settings that are currently on screen will be replaced by the settings from the .LAS file. You may abort this change by clicking Cancel; clicking OK will approve the change.

Default

This button will reset the driver settings to the originally installed values.

Print Special Effects

In this dropdown list, you can choose from 4 different printing modes, Normal (default), Clipart, 3D, and Rubber Stamp.

Clipart Mode

This control simulates laser printer output and is very useful if using a drawing with many colors, shades of gray, or many outlines. It is recommended to turn this control ON when using DRAWN clipart because there may be some underlying cutting lines hiding behind filled areas. Having this control ON gives a what-you-see-is-what-you-get output very similar to laser printer output. The entire drawing will be raster engraved, including all outlines, and only the Black color setting is used. The driver automatically turns OFF its color-mapping feature and all colors are engraved as different shades of gray, represented by a halftone pattern. The type of halftone pattern is based upon the "Quality" setting of the driver the same way grayscale bitmaps are interpreted. Since clipart images use a wide variety of colors, shades, and outlines, the only effective way of engraving these images is to have this control turned ON. Clipart mode also provides greater compatibility with Windows software that does not work well with vector devices such as the laser system. Do not activate this control when printing photographs or bitmapped images; use it **ONLY** with **DRAWN** clipart.

3D

There are two ways to use this feature. The first method is used produce an engraving that has a contoured depth, giving it a three dimensional feel. It is used in combination with grayscale bitmaps by automatically assigning laser power levels to the shades of gray of the bitmap **WITHOUT** converting the image to a halftone. These power settings are based off the setting you entered for the color black, in the printer driver. The darkest shades of gray (black) will be assigned the value of the setting for the black color. The lightest shade of gray (white) will automatically be assigned a 0% power. All other shades of gray that fall between black and white will automatically be assigned an appropriate power level that matches the darkness of the color. The engraving will appear "3D" because the depth of the engraving will vary according to the image. Sometimes it takes several passes to create enough relief in the engraving to get the desired results.

Special 3D software is required to produce the type of grayscale images that are compatible with this mode. You cannot simply use ANY grayscale bitmap to produce a "3D" effect. Please contact our Applications Department for the latest 3D software recommendations.

The second way to use the 3D feature is to engrave any photograph, lightly onto the surface of hard materials such as black marble, anodized aluminum, painted brass, micro-surfaced engravers plastic, etc., to produce unbelievable photographic quality. Using the appropriate materials and settings, the end result is an engraving that looks more like a photograph than a halftone or diffusion dithered image does. To use the 3D feature in this method you must first set up a few things.

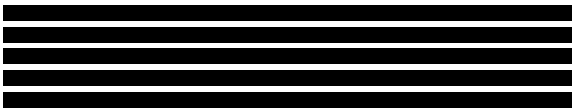
Choose Your Material

The best material to use is one that has the highest contrast such as black anodized aluminum, black marble, or black cored engravers plastic with a white micro surfaced coating. While other materials may work ok, they might not produce the highest quality.

Establishing Nominal Power

Choose your %Speed and you Image Density settings. Set the PPI to 1000 but don't set the %Power setting just yet. The objective is to use the **LOWEST** %Power setting that produces the most contrast such as the whitest (as in black anodized aluminum) or the darkest (as in black cored engravers plastic with a white micro surfaced coating) results. This is what we call the "nominal" power setting. Over-powering the material will produce poor results.

In your graphics software, create a series of 5 rectangles that are about ¼ inch high and 6 inches wide as in the following diagram:



Starting with the top rectangle set the power setting to a value that you know will be too low. For example, engrave the first rectangle at 5% power, increasing the power for each subsequent rectangle 5% finishing the series off at 25% power and note the results. Choose the rectangle that uses the lowest %Power setting to achieve the most contrast. If 25% is not enough power, then engrave the rectangles once again, this time starting at 25% and incrementing by 5% and so on.

In this particular example, we'll say that 20% power looks over-burned but 15% appears under-burned. Since the material may be sensitive to small power changes, you may need to narrow it down a bit further. Engrave a new series of rectangles, but this time start the top rectangle at 15% then add 1% for the next rectangle, and so forth, until you find the best setting between 15% and 20%.

The setting that produces the highest contrast using the least amount of %Power is called the nominal power setting.

Defaults
When you click this button, the ULS 3D Power Calibration screen will appear. Notice that there are 16 slider bars representing the 16 shades of gray of the calibration scale. The 00 and the 15 are not adjustable as they represent white and black. The 14 other ones can be adjusted. The objective is to go back and forth between adjusting the corresponding slider bars and re-engraving the calibration scale until you can duplicate the appearance of the calibration scale as best as you can. As you are progressing **MAKE SURE YOU KEEP SAVING YOUR SETTINGS IN AN LAS FILE** just in case your computer crashes, etc. This is a lengthy procedure so you do not want to have to do it twice.

Once you have duplicated the Calibration Scale onto your material, calibration is now complete. You only need to do this calibration one time for each material you intend on using to produce photographs.

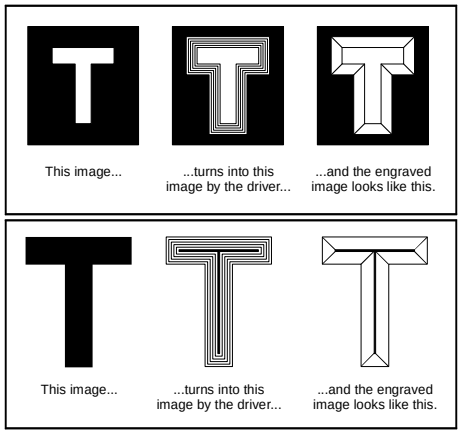
NOTE: If you are using a type of material that becomes lighter when you engrave, such as black marble, you will need to invert the photograph first (make a negative image), in your photo editing software, otherwise when you engrave the image, it will appear like a negative image.

APPLY Button
Click this button to enable the settings that you just set.

CLOSE Button
This closes the 3D Power Calibration settings window and cancels any changes you made to the scale if you didn't click the APPLY button.

DEFAULTS Button
Applies the factory default settings to the 3D Power Calibration settings

Rubber Stamp



This mode causes a "shouldering" effect when raster engraving rubber stamp material or any other material that requires a "shouldered" engraving. The effect looks as if the laser beam engraved the material on an angle, but in actuality it is the precise control of laser power that creates this appearance. This is a "raster only" feature that only works with black colored graphics and uses the power setting of the black color in the printer driver. Vectors are processed normally and can be used for vector engraving or cutting by assigning any of the seven other printer driver colors to the outline desired.

To obtain a "raised" engraving such as a rubber stamp, simply create a "negative" graphic so that the background is black and the text or graphic objects are white. This way, the background engraves and the text or objects remain untouched, producing a "pyramid" effect.

To obtain a "chiseled" or "sunken" engraving, create a "positive" graphic so that the background is white and the text or objects are black. This way, the text or graphic engraves and the background remains untouched, producing a "chiseled" effect.

Defaults

Selecting it brings up a pop-up window so you can choose from the following settings:

Taper Selection

Choose from various types of shoulder angles. Experiment with each setting and note the result.

Invert Page

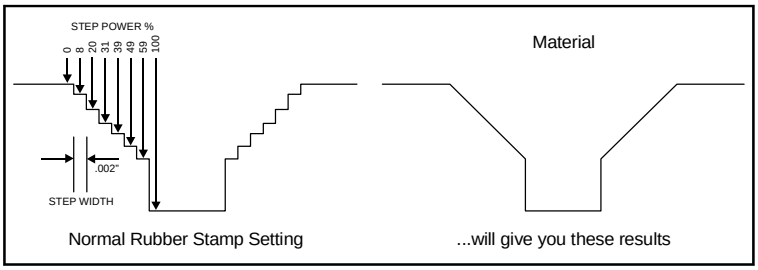
This converts all black objects into white and all white objects into black for the ENTIRE PAGE. This is very useful for engraving a full sheet of rubber stamps.

Mirror Page

This mirrors the ENTIRE PAGE from left to right (horizontally). It will not mirror individual objects or selections. This is very useful for engraving full sheets rubber stamps because the graphics on screen are non-mirrored and can be proof read easily.

Power

Notice that when you click on different Taper Selections, that the power table changes. This is because the laser applies power in different profiles to produce different styles of taper. You will notice that you cannot adjust the pre-defined Taper, however, if you would like to create a custom taper of your own, first select the Taper Selection that you would like to start with and then click the "NEW" button. This will copy the taper as a "Custom Shoulder" that you can rename by typing a new name in the dialog box and clicking "Rename". You can also adjust the profile however you desire. Each slider bar controls the lasers power for that step. The numbers at the bottom of that slider bar define the width of the step in .001 inches (mils). The square at the top of each slider bar is it activate/deactivate button. Always deactivate the steps you are not using so that it will apply 100% power to that level.



The diagram above is an example of the Normal Rubber Stamp Taper Selection. You can see that there are 8 steps used to create the shoulder. The surface of the material is considered the first step and the bottom of the engraving is considered the last step. You can define as many as 16 steps but the first or the last steps are not definable because they are fixed at a power setting of 0% and 100% respectively. You can only define the parameters for the steps in between the first and last steps in which there are 14 of them. By adjusting the power setting for each step, the width in (.001) inches for each step, and the number of steps, different shoulder profiles can be created. **NOTE:** The maximum shoulder width is .056 inches.

Language

Select from many different languages in this drop down list. Some language changes will not take effect until the printer control panel is closed and then re-opened.

About

Clicking Version will display a pop-up dialog box containing information on the current driver version number as well as the driver's copyright notice. If contacting technical support, it is important to have the version number of your driver available.

Print Direction

Your choices are Down or Up. The default direction is Down which begins engraving at the top of the field and finishes at the bottom. On some materials you may get better results by starting at the bottom and engraving towards the top of the field (Up). This is because the engraving smoke is being drawn towards the top of the field. On some materials engraving Down causes the smoke or debris from the engraving to be deposited onto the previously engraved surface, possibly damaging the engraved area. Experiment with the different directions using different materials and choose the best method for your application.

NOTE: The Up direction is especially useful when engraving rubber stamps and utilizing the Back Sweep Air Assist option.

Rotary Fixture

This option is available for most models. Please refer to operations manual on how to install and use the Rotary Fixture.

Image Enhancement

These controls allow the user to "fine tune" the image which will enable the laser system to produce the highest quality, highest detailed images at high or low speeds. Image Enhancement may be used at any engraving speed and with any application material.

The following procedure may appear lengthy, but when you actually learn how to use the controls, establishing the correct parameters is easy and quick. Once you have established those parameters you can "SAVE" them in the ULS printer driver as .LAS settings and recall them when needed. Many users choose to name these saved setting according to the application material's name. Before stepping you through the procedure we must first define the parameters.

NOTE: The Image Enhancement settings are designed to work with the BLACK pen color in the printer driver. However, the other 7 pen colors of the printer driver will use the same Image Enhancement settings. Keep in mind that those settings will have a different resulting effect on if the other colors %power, %speed, and PPI are different than the black pen color's setting.

Definitions

CONTRAST: Adjusts the difference between the non engraved and engraved areas in the high density part of the graphic or where there is the most concentration of graphic pixels (in between the dotted lines) as the following diagram illustrates:



Within this effective area, using too little CONTRAST may cause some parts of the letters to appear thin, faint, fuzzy, or even non-existent. Having too much CONTRAST will cause the effective area to appear thick, bold, or over powered.

DEFINITION: Adjusts the difference between low density and the high density part of the graphic. The low density part of the graphic can be considered such as the ascenders and decenders of text, or single pixels that may be horizontally spaced far from other pixels, or the start of the graphic in the direction of the raster stroke. Refer to the following diagram:

Setting this parameter too low may cause the effective part of the graphic to appear thin, faint, fuzzy, or non-existent. Too high of a parameter will cause these objects to appear thicker, bolder, or more powered than the high density areas of the graphic.

DENSITY: Adjusts the difference between the entire non engraved and engraved areas. If the parameter is too high, then the entire engraved image may appear thick, bold or over powered. Too low of a setting may cause the image to appear thin and pixels or parts of characters may disappear altogether. The opposite effect would occur on inverted images such as white text on a black background.

TUNING: Adjusts the image so that the pixels vertically line up with each other during the left and right, bi-directional raster strokes, will line up properly. A misadjusted TUNING value will cause the image to appear double-imaged or inadvertently bolder than normal. A typical non-Image Enhanced TUNING value can be from -4 up to 0, whereas a typical Image Enhanced TUNING value generally averages around 0. Yes, TUNING will be different if you have Image Enhancements enabled or disabled. Saving the printer driver settings will also save the TUNING value.

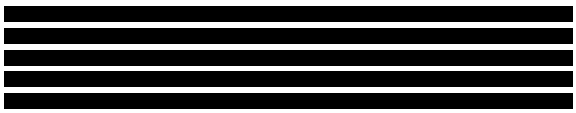
Procedure

The following procedure assumes that you have some experience working with the laser system and you have a general idea of the Power, Speed, PPI, and Image Density settings that you intend to use for the chosen application material.

In the following example, we will be engraving painted brass choosing 100% speed for good throughput, and Image Density 5 for good quality.

Step 1: ***Establish the nominal power setting.***

In your graphics software, create a series of 5 rectangles that are about ¼ inch high and 6 inches wide as in the following diagram:



Starting with the top rectangle set the power setting to a value that you know will be too low. For example, set it to 5% power and the rest of the parameters to 100% speed, 1000 PPI, and Image Density 5. At this time, ensure that Image Enhancement is **NOT** enabled. Engrave the first rectangle at 5% power, increasing the power for each subsequent rectangle 5% finishing the series off at 25% power and note the results. What you are looking for is the **LOWEST** power setting that has the cleanest removal of material. This would be the nominal power setting. While higher than nominal settings may also produce clean engraving, it will overpower the material and may cause highly detailed engraving, unlike these rectangles, to appear too thick, bold or washed-out. If 25% is not enough power, then engrave the rectangles again, this time starting at 25% and incrementing by 5% and so on. In our particular example, we'll say that 20% power looks good but 15% appears underpowered. Since we know that this material happens to be sensitive to small power changes, we'll need to narrow it down a bit further. Engrave the rectangles once again, but this time start the top rectangle at 15% then add 1% for the next rectangle and so on until you reach 20%. The results now indicate that nominal power setting of 17% power looks as if it is the **LOWEST** power setting that produces the cleanest results at 100% Speed, 1000 PPI, and Image Density 5.

Step 2: ***Using text to set the CONTRAST parameter.***
Type in a random line of text, using the Times New Roman font, set at 8 or 10 points in size. Make sure that the text string is at least 6 inches long and that the characters used include punctuation marks, spaces, and lower and upper case as in the following example:

Universal Laser Systems, Inc. produces the "BEST" laser systems in the world!

Engrave it with the settings determined in step one but this time ENABLE Image Enhancement and set CONTRAST to 0, DEFINITION to 0, DENSITY to 100 and the TUNING value to +4. You should expect the results to appear fuzzy, having parts of the characters missing, and overall engraving quality to be not as good as expected. This is normal. Move the line of text, slightly downward in your graphics software so that you will engrave a clean part of the material but keeping it close enough to the previous engraving so that you have something to compare it to. Keep engraving samples and adjusting the CONTRAST upwards in increments of 5 and note the results. The objective is to adjust the CONTRAST just enough to cause the high density areas of the text to be sharp and clear.

Ignore the appearance of the ascenders (like quotation marks or the tops of h's) and decenders (like commas or the bottom of lower case p's) as they will appear faint and unclear. This is to be expected. **DO NOT** adjust the CONTRAST setting to try to force these to appear, we will use the DEFINITION adjustment for those. Right now, **ONLY** concentrate on the high density part of the characters. Setting CONTRAST too high can cause the characters to appear "fat" or "bold". Adjusting the CONTRAST by just one number can make a big difference in appearance so continue adjusting the setting by first incrementing in 5's until you get close, but then fine tune the setting by incrementing or decrementing by 1's until the exact setting is achieved.

Step 3: ***Adjusting DEFINITION to enhance the ascenders and decenders.***
Now, increase the DEFINITION in increments of 5 at a time until the ascenders, decenders, commas, quotation marks and any other low density area characters begin to appear. The objective is to increase the setting just enough to cause these parts of the graphic to match the appearance of the high density areas. Setting the DEFINITION too high will result in ascenders and decenders appearing too "fat" or "bold" compared to the rest of the graphic.

Step 4: ***Reducing DENSITY as needed.***
Once CONTRAST and DEFINITION have been set to the appropriate levels, the graphic may or may not appear to be "fat" or "bold". In most cases, the appearance will look great without making any more adjustments. However, if everything appears overpowered or bold, try reducing the DENSITY down from 100 in increments of 5 and note the results. If the characters begin appear to be "chunky" or appear as if pixels have been eliminated, then you have reduced it too much. Normally you can leave the DENSITY at 100. However, there may be cases where you need to reduce it. Reducing DENSITY can be very useful when the image is inverted such as white text with a black background. In this case, if the engraved area (the background) is overpowering the text (foreground) then reducing the DENSITY may help thicken the text.

TUNING

Step 5: ***Fine tuning the raster strokes.***
At this point, we are finished with Image Enhancements. Make sure that you save your settings. But your graphic may need a little more "fine tuning". The typical TUNING setting is 0 when Image Enhancement is enabled. However, this may or may not be the best setting for your system. To check this setting, you should perform this last test. Engrave the same text, with all your Image Enhancement settings but this time set the TUNING value to 0. Then move the graphic down and engrave it again with TUNING setting +1, then +2 and so forth all the way to +8. Compare each one to the other and find the one that is the sharpest and clearest. Go back and set the TUNING value to the appropriate number and SAVE your settings once again.

The Image Enhancement settings for that material are now complete. If you feel that you can “tweak” it a little more, go back to step 2 and try again, but this time start with your current Image Enhancement settings that you saved. It is not necessary to reset your nominal power setting and we recommend that you leave it the same as the value you determined in step 1.

Setting the Image Enhancement parameters using this procedure will cause all of your graphics, whether big or small, inverted or not, dense or highly detailed, to appear better than ever. We suggest that you run this procedure for all your materials and save your parameters. This may sound like a big job, but the additional productivity and engraving quality that your system is capable of producing is well worth the small amount of time spent.

NOTE: Image Enhancement will cause files to take longer to print. Since most materials do not require the use of Image Enhancement, use this feature only as needed. Also, Image Enhancement and 3D Effects cannot be selected at the same time. The printer driver will automatically notify you if you attempt to do so.

More

Engraving Field

Metric or Inches

Width and Height
The page size that you enter here **MUST** match the page size in your graphics software program **EXACTLY** and it is up to the operator to enter in the correct settings. Select the metric box if metric units are desired.

NOTE: Incorrect use of this feature may cause no graphics, partial graphics, erroneous graphics, or a misaligned graphics output, relative to the application material, to occur. To avoid problems, we recommend that set it to the maximum field size of your laser system (click the Maximum Page Size button) and also set your graphics software programs page size to match.

Maximum Page Size Button
Clicking on this button restores the driver back to the default maximum page size that your model can accept.

Dithering

Dithering settings are used when printing grayscale or color bitmapped images such as TIF, JPG, and BMP formatted images. Since the laser system is essentially a black and white printer (black turns the laser ON and white turns the laser OFF), and if you choose the correct settings, the driver will automatically convert the grayscale or color bitmap into a 1-bit “halftoned” black and white image. This process is very similar to how newspaper photographs as well as laser printer photographs are printed. For a more detailed explanation of the terms “grayscale”, “bitmap”, “halftone”, or “dither”, please refer to the “Graphic Software Setup” section in this manual.

Halftone
This halftone pattern generator converts grayscale bitmaps into a halftoned image based on your Image Density choice in the driver.

IMAGE DENSITY	ANGLE	SHAPE	LINES PER INCH
6	45 DEGREES	ROUND	180
5	45 DEGREES	ROUND	90
4	45 DEGREES	ROUND	60
3	45 DEGREES	ROUND	45
2	45 DEGREES	ROUND	36

Error Diffusion
Unlike halftoning, error diffusion scatters the black pixels in a random pattern to represent shading. It uses the quantity of black dots instead of the size of the black dots to represent the different shades of gray. The pattern created will be dependent on the quality setting that you choose in the driver with the exception that there is no chart to reference. Higher quality settings such as 5 will produce a more densely packed, higher dot quantity pattern whereas lower resolution setting such as 2 will produce a loosely packed, lower quantity dot pattern

NOTE: DO NOT use Error Diffusion when engraving rubber stamps otherwise dots will appear in the background. Choose only Halftone.

Black and White Mode
This mode thresholds the image at 50% black. Each pixel that is greater than 50% black will be converted into white and each pixel that is 50% black or less will be converted into black. This effect is very similar to trying to duplicate a photograph using a photocopier.

Helpful Tip
Engraving grayscale bitmaps using a dithering pattern requires some practice and a bit of trial and error to achieve perfection. It also requires some knowledge of bitmap editing software. These images will visually appear different on one material as opposed to another material even if you use the same driver settings. As a rule of thumb, use an Image Density setting of 5 using halftone or diffusion pattern on harder materials such as marble, anodized aluminum or microsurfaced engraver's plastic. Use an Image Density setting of 3 using the halftone or diffusion pattern for softer materials such as wood or materials that you intend on engraving very deeply.

Vector Optimizer

The four available selections apply to vector output only and have no effect on raster images. Regardless of which of the following selections you choose, vectors are grouped by pen color and will always output in the color order listed in the printer driver.

OFF
Turns off this feature.

ENHANCE ONLY
The printer driver collects all the vectors from the application software and reconstructs them (so to speak) by removing start and stop points within the vector curves so that they run smoother with less jitter. It has no effect on straight, horizontal or vertical, lines

SORT ONLY
The printer driver collects all the vectors from the application software, stores them in temporary memory, sorts them, and the outputs them in the following order:

- All open path vectors are output first (not closed path vectors like circles and squares) beginning with the end point of the vector path that is closest to the current position of the focus carriage. All subsequent open vector paths are output using the same "nearest neighbor" starting point method which eliminates the random "vector hopping" that causes longer processing times.
- Closed paths will follow, beginning with the innermost closed path and ending with the outermost closed path. This is particularly useful in an elevated cutting application to prevent the outer piece from falling first. The beginning point of a closed path is automatically selected by the printer driver by the "nearest neighbor" vector path that has the steepest angle in the Y-axis direction.

ENHANCE AND SORT
This turns on both features simultaneously.

Vector Scaling

This feature allows you to calibrate vector cutting or vector engraving to your particular application. To calibrate the system, as an example, draw a precise, 5" x 5" square in your graphics software. In the printer driver, set the laser power and speed setting to vector mark (do not cut through) this square onto some scrap material. After marking, remove the material and with a precision measuring device such as a caliper, measure the square in both the horizontal (X) and vertical (Y) directions. Let's say that the measurement was 4.997"x and 4.996"y. Use the formula (desired length/measured length) and enter the result into the X-axis and Y-axis boxes respectively. In this example, the result would be X-axis = 1.0006 to 1.0000 and Y-axis = 1.0008 to 1.0000. The printer driver will scale the images larger for numbers greater than 1.0000 and will scale the image smaller for numbers less than 1.0000. After changing the numbers, repeat the marking procedure and verify that the square is scaled correctly.

We used a 5" by 5" square just as an example but you can use any size object that is smaller than the maximum size of the engraving field. Using the Vector scaling feature with larger images produces more accurate results. Keep in mind that this feature **DOES NOT** scale raster images so if you combine raster and vector images in one file, the raster image may not align with your vectors. You will need to manually position your raster images in their desired position.

CAUTION: Do not attempt to use the vector-scaling feature when your graphic extends out to the absolute edge of the engraving field. You may accidentally cause the driver to attempt to print past the edge of the maximum allowable page size. Unexpected results may occur. If you use this feature, the actual allowable page size decreases by the same amount that you are attempting to offset.

Rotary Rotation

If you have purchased the optional Rotary fixture, you may need to calibrate your fixture if your application requires you to engrave or cut completely around the cylinder precisely 360 degrees. Only use this option if you completely understand and have used the Rotary Fixture in the past. If you are familiar with the operation of the Rotary Fixture and as an application you create a vector line or raster graphic that extends from the top of the page (in your graphic software) all the way to the bottom of the page, you should expect that the Rotary Fixture would rotate a full 360 degrees. If the fixture comes up short or long by a few degrees, you can compensate for this in the driver. If your application comes up short, increase the number past 1.0000 as much as you need to and run your sample again. If your application rotates past 360 degrees, then decrease the number of degrees below 1.0000 to get the ends to line up. You can calculate the exact number (refer to the Vector Scaling technique in the next paragraph) but it may be difficult to measure circumference.

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.

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 or plastic surface)
- 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 or window cleaner.
- 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.



Figure 1

#2 Mirror

Locate the #2 Mirror Holder located on the left side of the X-rail. Grasp its protruding red handle with your thumb and forefinger and slide it out (Fig 1). Turn the #2 Mirror Holder over and inspect the optic for visual contamination. Clean as necessary. To re-insert the #2 Mirror Holder, slide it into the mounting slot until it stops.

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



Figure 2

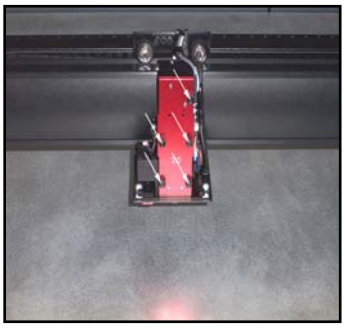


Figure 3



Figure 4

To gain access to the #3 mirror and the focus lens, remove the cover in by pulling the cover straight out (Fig 2). After cover has been removed the lens assembly kit will be exposed (Fig 3). Hold the cover with one hand, and remove the 5 thumbscrews with your other hand (Fig 3). Pull the front cover straight out (Fig 4). 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



Figure 5

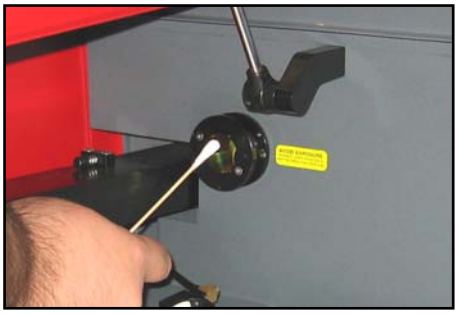
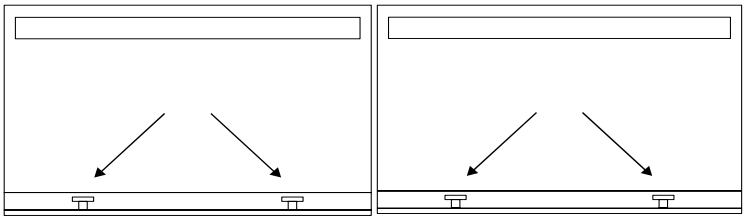


Figure 6

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. To clean you must remove the beam window diffuser by slightly rotating CCW until diffuser is free (Fig 5). Using a Cotton Tipped Applicator and Lens Cleaner lightly wipe debris away from beam window (Fig 6).

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.



Adjustments and Lubrication

There are no periodic adjustments normally required. The Guide Wheels 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.

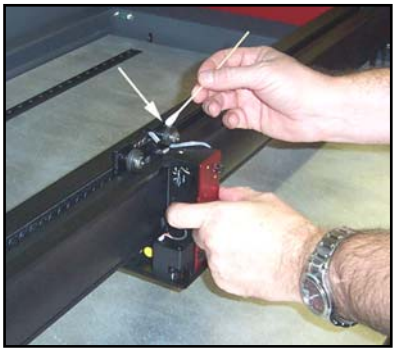


Figure 7

X Guide Wheels

All wheels in the system are sealed and do not require lubrication. **DO NOT** lubricate the tracks that the wheels ride in. The X Axis Carriage has 4 wheels, 2 located on top and 2 underneath. Clean all 4 wheels (Fig 7) using a Cotton Tipped Applicator. Press the applicator against the wheel and slowly move the carriage until bearing makes at least 1 complete revolution. Repeat on the 3 remaining wheels.

Y Guide Wheels

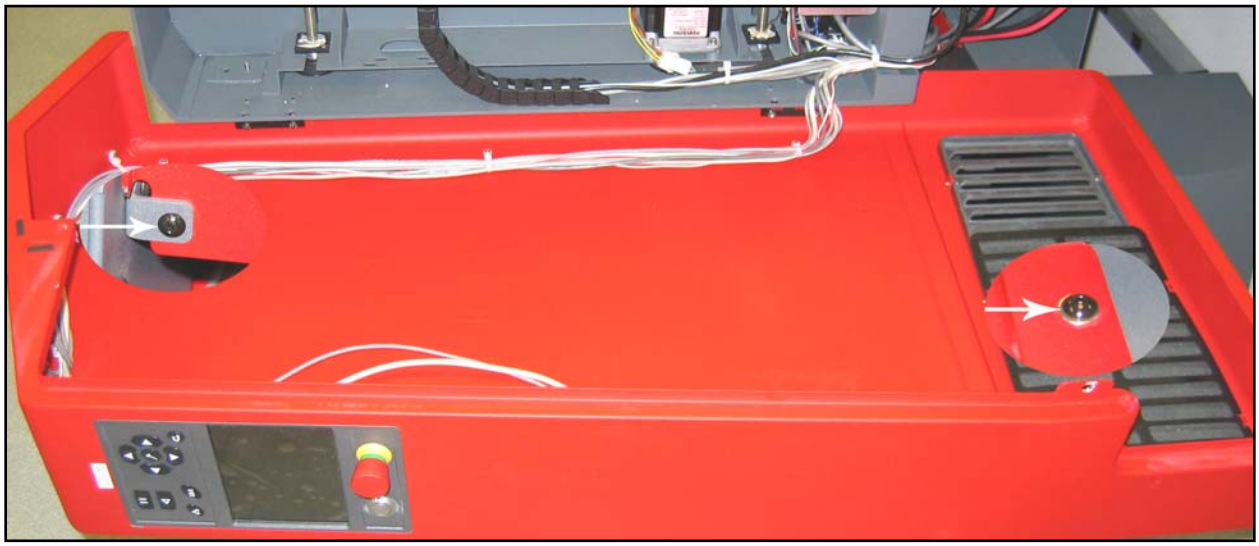


Figure 8

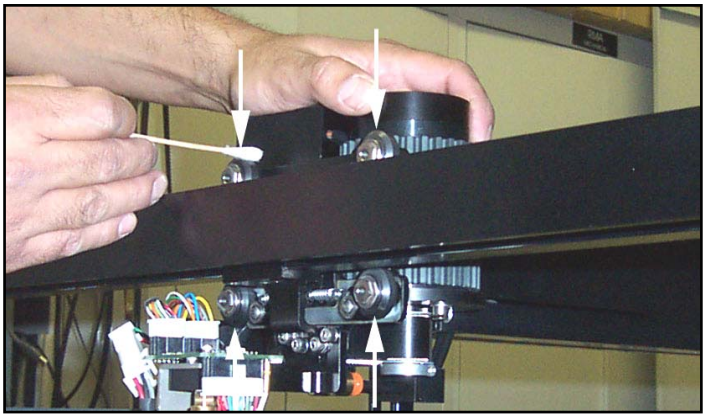


Figure 9

The Y Axis contains 4 wheels, 2 located on top of the right Y Axis Rail and 2 below. To properly clean the Y Axis wheels, you must lower the Right Side Panel. 1st lower the Rear Laser Cover by disengaging both latches. Locate and remove both front and rear 3/32" Button Head Screws (Fig 8). The Right Side Panel is mounted using hinges, slowly lower cover.

Press a Cotton Tip Applicator to the bearing a slowly move the arm from top to bottom until wheel makes at least 1 complete revolution (Fig 9).

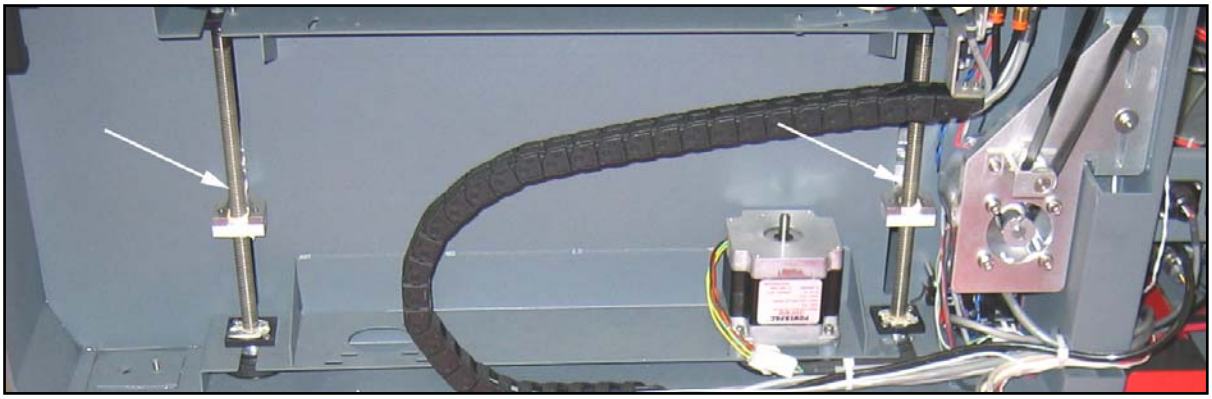


Figure 10

The only lubrication that may be required is the screw threads (Fig 10) 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.

Error Messages

ERROR	CAUSE	SOLUTION
Air/Gas Assist not connected.	Air/Gas Assist not connected.	Connect Air/Gas
Batteries.	Fire detection batteries in need of replacing.	Remove rear electronics panel. Replace the 3-9 volt batteries used for fire detection.
Collision Detected.	Collision Detector sensed material above focal height.	Inspect engraving table for obstruction and correct it. Press OK to re-home.
Compressor USB not detected.	1) Communication between Air Assist Board and CPU interrupted. 2) USB Air Assist Board defective.	1) Recycle power to the system. 2) Contact ULS Service.

ERROR	CAUSE	SOLUTION
Duplicate Address.	IP address was entered that already exists on network.	Contact System Administrator for alternative IP Address.
End of Travel Detected.	Caused by motion fault while the motors were de-energized.	Move the laser carriage by hand away from the side of the machine. Recycle power to the engraver. Motion will be enabled.
Engraver cannot detect a proper lens installed.	Lens magnets are incorrect or aren't attached properly.	1) Inspect lens for presence of magnet(s). Operation of the system is still possible without the use of Auto Z or Auto Focus and by focusing with the focus tool. If problem persists, contact ULS Tech Support.
Insufficient Flow Air / Gas assist device.	1) Filters are plugged. 2) Compressor pressure below 50 PSI. 3) Defective internal Air Assist flow valve.	1) Check desiccant filter and coalescing filter to see if plugged. 2) Adjust pressure 50-60 PSI. 3) Contact ULS Service.
No Camera.	Camera electronics not detected.	1) Option not installed. 2) Contact ULS Tech Support.
No Keypad.	Keypad USB error.	Contact ULS Tech Support.
No Processor.	No communication at all to the engraver electronics.	Contact ULS Service.
Please install the cone before using Air Assist.	Air Assist turned on in printer driver with no Air Assist Cone or Back Sweep installed.	Install Air Assist Cone or Back Sweep option or turn air assist off in printer driver.
Front Door Open.	1) Laser Cartridge is not connected 2) Interlock condition. 3) Interlock Sensor failed and/or Circuit problem	1) Electrically connect the laser cartridge. 2) Check door sensors for misalignment. 3) Contact ULS Tech Support.
Top Door Open.	1) Interlock condition. 2) Interlock Sensor failed and/or Circuit problem	1) Check door sensors for misalignment. 2) Contact ULS Tech Support.

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

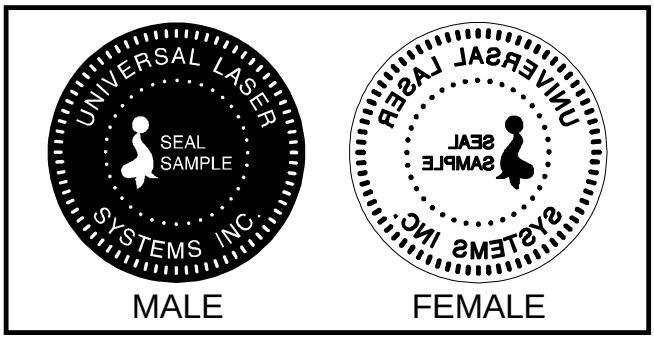
LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	22	500	1	.015”
30	100	26	500	1	.015”
35	100	30	500	1	.015”
40	100	35	500	1	.015”
45	100	39	500	1	.015”
50	100	44	500	1	.015”
55	100	48	500	1	.015”
60	100	52	500	1	.015”

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.



WARNING

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.