

2008 Professional Systems

**Models PLS3.75, PLS4.75,
PLS6.75, & PLS6.150D**

Laser Engraving and Cutting System

Safety, Installation, Operation,
and Basic Maintenance Manual

System Serial Number: _____

(Located on the back of the machine and inside the front door)

Universal Laser Systems, Inc.
16008 North 81st Street
Scottsdale, AZ 85260 USA
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Web Based Email Support: www.ulsinc.com



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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, 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.

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

support@ulsinc.com

Specifications

System Operating Environment Requirements (user provided)

| | Models | | | |
|---|--|---------|---------|-----------|
| | PLS3.75 | PLS4.75 | PLS6.75 | PLS6.150D |
| Operating Environment | Well-ventilated office (recommended) or clean, light-duty manufacturing | | | |
| Operating Temperature | 50°F (10°C) to 95°F (35° C) capable 73°F (22°C) to 77°F (25° C) for best performance | | | |
| Storage Temperature | 50°F (10°C) to 95°F (35° C) | | | |
| Operating Humidity | Non-condensing | | | |
| Electrical Power | Single Phase 110/230V AC, 10/5 Amp, 50/60 Hz Grounded (earthed) and stable (surge and spike protected) | | | |
| Particulate/Odor Outside Ventilated Exhaust System | High-pressure vacuum blower capable of 250 CFM (cubic feet per minute) @ 6 inches static pressure (425m3/hr at 1.5kPa) | | | |
| Computer Requirement | Windows XP or Windows Vista (32-bit version only) | | | |
| Software Requirement | Graphics or CAD based (See manual for recommendations) | | | |

| | Model System Specifications | | | |
|------------------------|---|---|--|---|
| | PLS3.75 | PLS4.75 | PLS6.75 | PLS6.150D |
| Laser Safety | CO2 Laser, Interlocked Safety Enclosure = Class I Red Diode Pointer = Class IIIa | | | |
| Work Area | 24 x 12 Inch (609.6 x 304.8 mm) | 24 x 18 Inch (609.6 x 457.2 mm) | 32 x 18 Inch (812.8 x 457.2 mm) | |
| Table | 29 x 17 Inch (736.6 x 431.8 mm) | 29 x 23 Inch (736.6 x 584.2 mm) | 37 x 23 Inch (939.8 x 584.2 mm) | |
| Max Part | 29 x 17 x 9 Inch (736.6 x 431.8 x 228.6 mm) | 29 x 23 x 9 Inch (736.6 x 584.2 x 228.6 mm) | 37 x 23 x 9 Inch (939.8 x 584.2 x 228.6 mm) | |
| Raster Speed | 75 IPS | | 100 IPS | |
| Vector Speed | 25 IPS | | | |
| Resolutions | 1000, 500, 333, 250, 200, 166 dpi/lpi | | | |
| Interface | Keypad/small LCD display shows current file name, laser power, engraving speed, PPI and run time | | | |
| Control | Requires a dedicated PC to operate. Requires Windows XP or Windows Vista (32-bit version only). | | | |
| Interconnection | USB 2.0 High Speed port | | | |
| Cabinet Style | Floor Standing | | | |
| Laser Options | 10, 25, 30, 35, 40, 45, 50, 55, 60 and 75 watts | | | 10, 25, 30, 35, 40, 45, 50, 55, 60 and 75 watts (equipped for two lasers) |
| Power Requirements | 110V/10A 230V/5A | | | 230V/15A |
| Size (inch) | 36W x 38T x 30D (91.4cm W x 96.5cm T x 76.2cm D) | 36W x 39T x 36.5D (91.4cm W x 99.1cm T x 92.7cm D) | 44W x 39T x 37.5D (111.8cm W x 99.1cm T x 95.3cm D) | |
| Weight | 235 lb (107 kg) | 270 lb (122 kg) | 325 lb (147 kg) | 345 lb (156 kg) |
| Exhaust Hookup | One 4" (10.16 cm) port | | Two 4" (10.16 cm) ports | |
| Laser Cartridge Weight | 25/30 Watt = 20 lbs (9 kg) 35/40 Watt = 23 lbs (10 kg) 45/50/55/60/75 Watt = 26 lbs (12 kg) | | | |
| Available Options | Rotary Fixture, Air Assist (standard or computer controlled), Air Compressor (desiccant or refrigerated dryer options), Honeycomb Cutting Table, Dual Head, Assorted Focal Length Lens Kits | | | |

Specifications subject to change without notice

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Section 1

Safety



Description of Appropriate Use

This device is designed for laser cutting and engraving, 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 ETCHING 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.
- **NEVER LEAVE MATERIALS IN THE LASER SYSTEM AFTER LASER PROCESSING HAS FINISHED.** Materials may ignite after laser processing has finished. Thoroughly inspect the interior of the laser system and remove any particulate materials before leaving the workstation. 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 3 or 4 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.

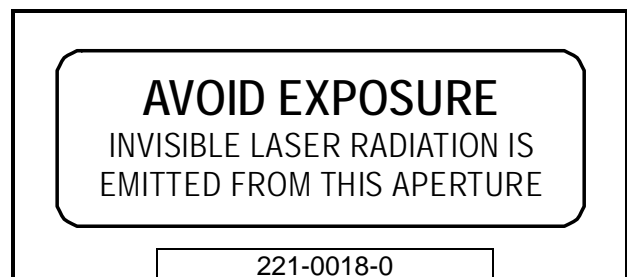
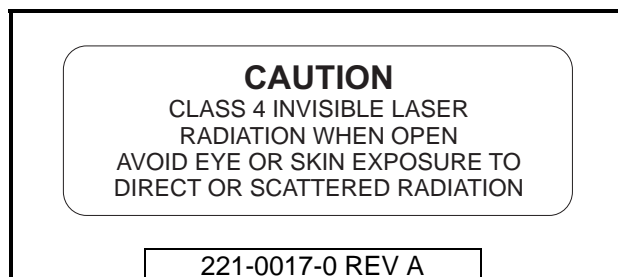
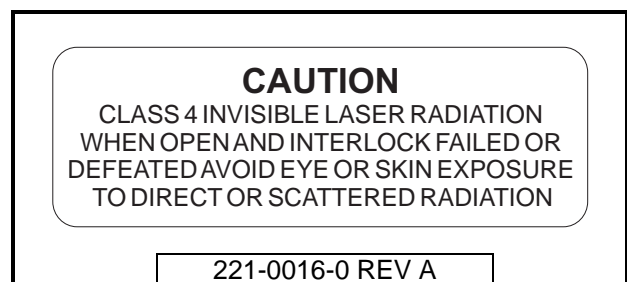
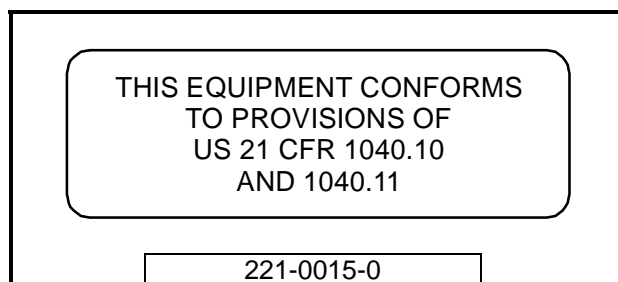
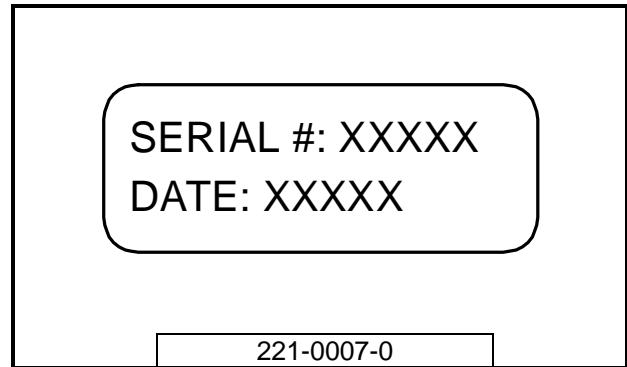
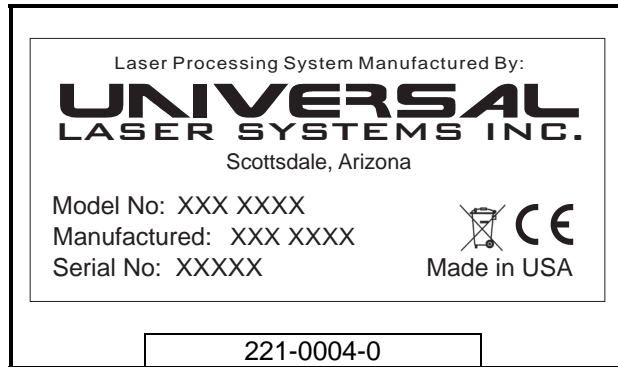
Laser Safety

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.

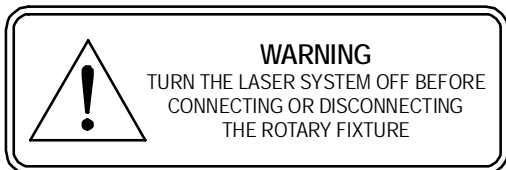
- The intense light that appears during the engraving or cutting process is the product of material combustion or vaporization. **DO NOT STARE AT THE BRIGHT LIGHT OR VIEW DIRECTLY WITH OPTICAL INSTRUMENTS.**
- This device may contain a visible Red Dot Pointer (Class IIIa). **DO NOT STARE AT THE RED LIGHT 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 automatically activated with the door(s) either open or closed.
- **DO NOT OPERATE THE LASER SYSTEM IF ITS SAFETY FEATURES HAVE BEEN MODIFIED, DISABLED OR REMOVED.** This may lead to accidental exposure to invisible and visible CO₂ laser radiation which may cause permanent blindness and/or severe burns to your skin.

Safety Labels

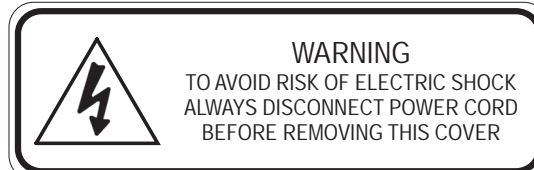
CDRH and CE regulations require that all laser manufacturers affix warning labels in specific locations throughout the equipment. The following warning labels are placed on the laser system for your safety. **DO NOT** remove them for any reason. If the labels become damaged or have been removed for any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



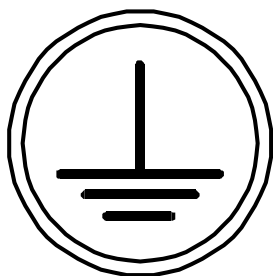
SAFETY



221-0019-0



221-0020-0



221-0021-0 REV A

INPUT POWER:
110 VAC; 50/60 Hz; 10 A

221-0022-0 REV A

INPUT POWER:
230 VAC; 50/60 Hz; 15 A

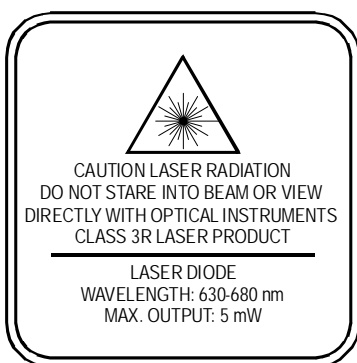
221-0024-0 REV B

THIS LASER MANUFACTURED BY
UNIVERSAL LASER SYSTEMS
16008 N. 81ST ST
SCOTTSDALE, AZ 85260 USA

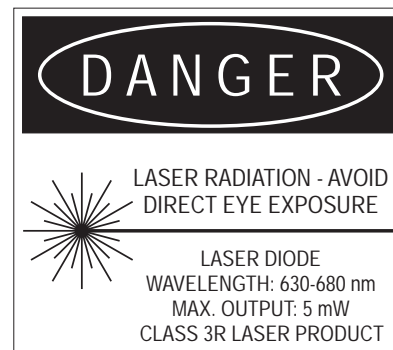
IS DESIGNED FOR USE ONLY AS A COMPONENT IN A
ULS LASER SYSTEM. THIS LASER IS A CLASS 4 DEVICE AND
DOES NOT COMPLY WITH U.S. CODE 21 CFR SUBCHAPTER J
OR EUROPEAN STANDARD EN 60825-1:1994.

THIS LASER PRODUCT IS MANUFACTURED UNDER ONE
OR MORE OF U.S. PATENTS 5,661,746; 5,754,575; 5,867,517;
5,881,087; 5,894,493; 5,901,167; 5,982,803; 6,181,719; 6,983,001
OTHER U.S. AND INTERNATIONAL PATENTS PENDING.

221-0031-0 REV E



221-0033-0 REV B



221-0034-0 REV B

SAFETY

INPUT POWER:
230 VAC; 50/60 Hz; 5 A

221-0036-0 REV A



WARNING
THIS SYSTEM IS DESIGNED FOR
USE WITH INERT AND
NON-OXIDIZING GASES ONLY
(i.e. DRY CLEAN AIR, CARBON
DIOXIDE, HELIUM, NITROGEN).
CONNECTING FLAMMABLE OR
OXIDIZING GASES TO THIS
SYSTEM CREATES A SERIOUS
SAFETY AND/OR FIRE HAZARD.
DO NOT CONNECT ANY GAS
SOURCES EXCEEDING 75 PSI
(5 ATM) PRESSURE.
UNIVERSAL LASER SYSTEMS
ASSUMES NO RESPONSIBILITY
ARISING FROM THE IMPROPER
USE OF THIS SYSTEM.

221-0037-0

THIS PRODUCT IS MANUFACTURED UNDER ONE
OR MORE OF U.S. PATENTS 5,051,558; 5,661,746; 5,754,575;
5,867,517; 5,881,087; 5,894,493; 5,901,167; 5,982,803; 6,181,719;
6,313,433; 6,342,687; 6,423,925; 6,424,670; 6,983,001;
D517,474; 7,060,934
OTHER U.S. AND INTERNATIONAL PATENTS PENDING.

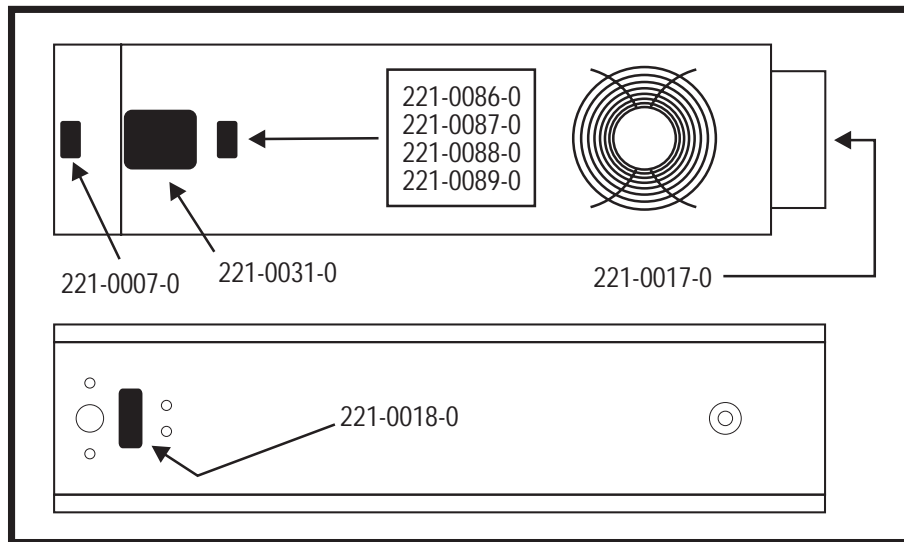
221-0065-0 REV C



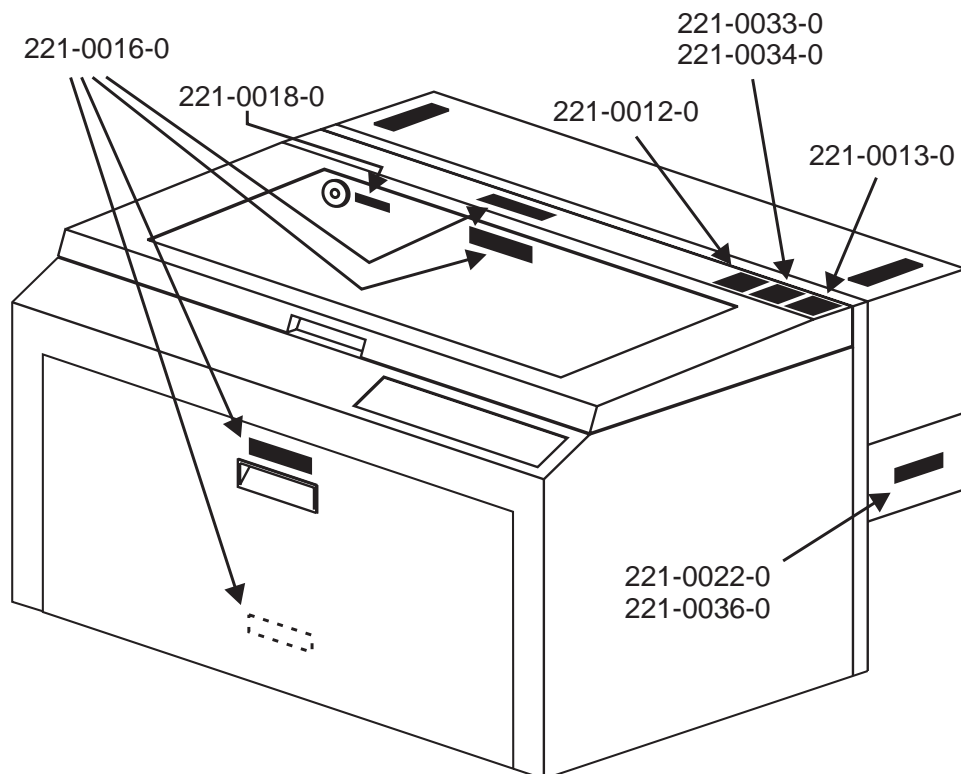
WARNING
Do **NOT** use in medical or surgical
applications or to manufacture
medical devices. See the Safety,
Installation, Operation, and Basic
Maintenance Manual, or the OEM
Laser Integration Manual for
further information.

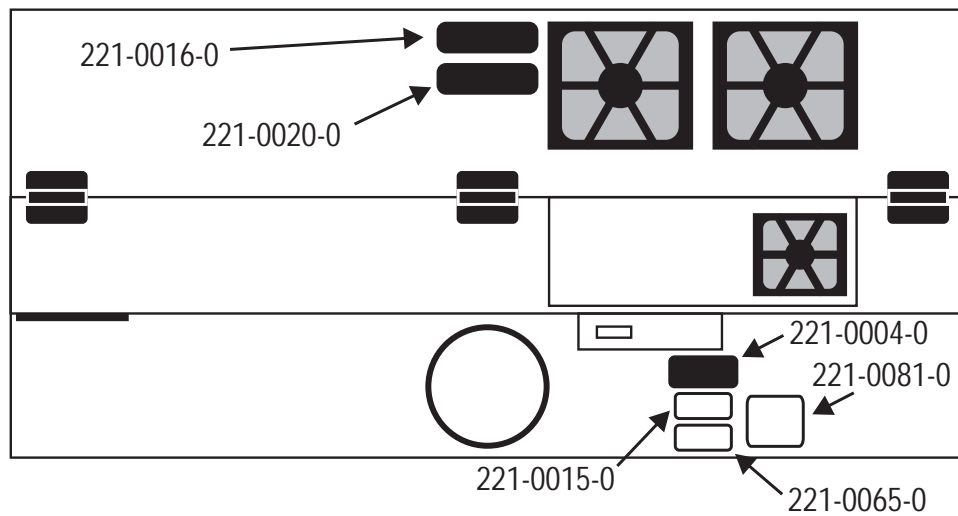
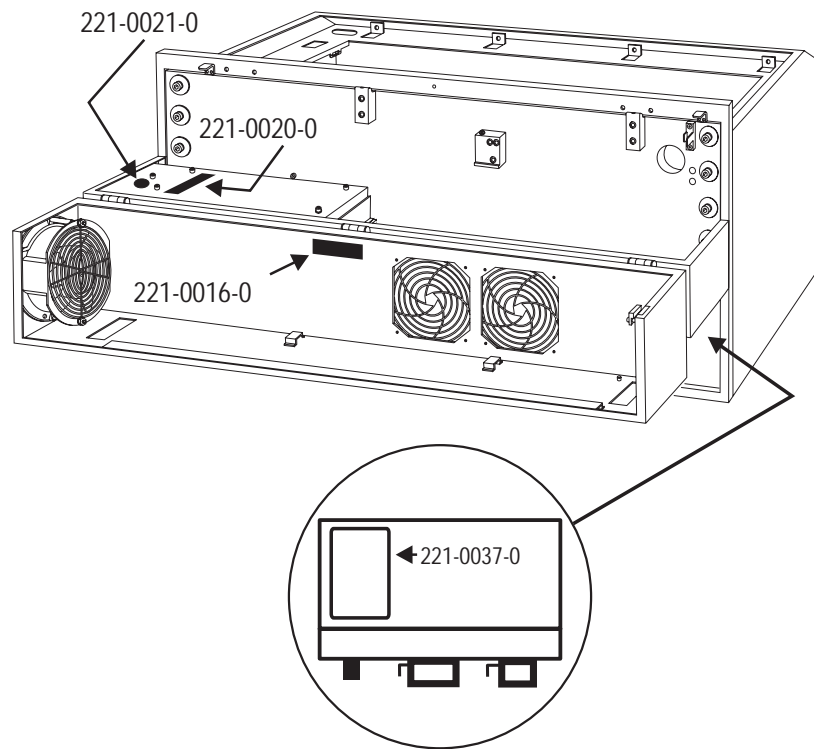
221-0081-0

PLS3.75, PLS4.75, PLS6.75 Label Placement



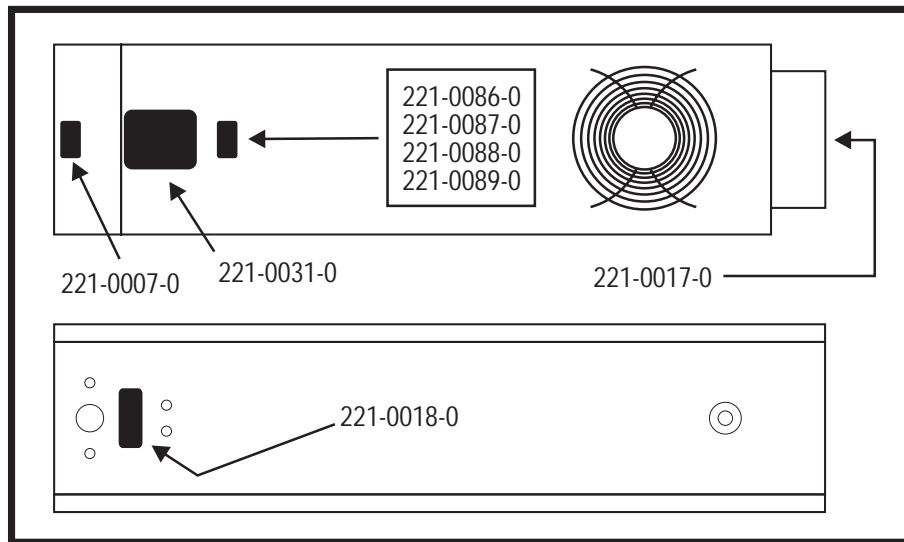
Laser Tube



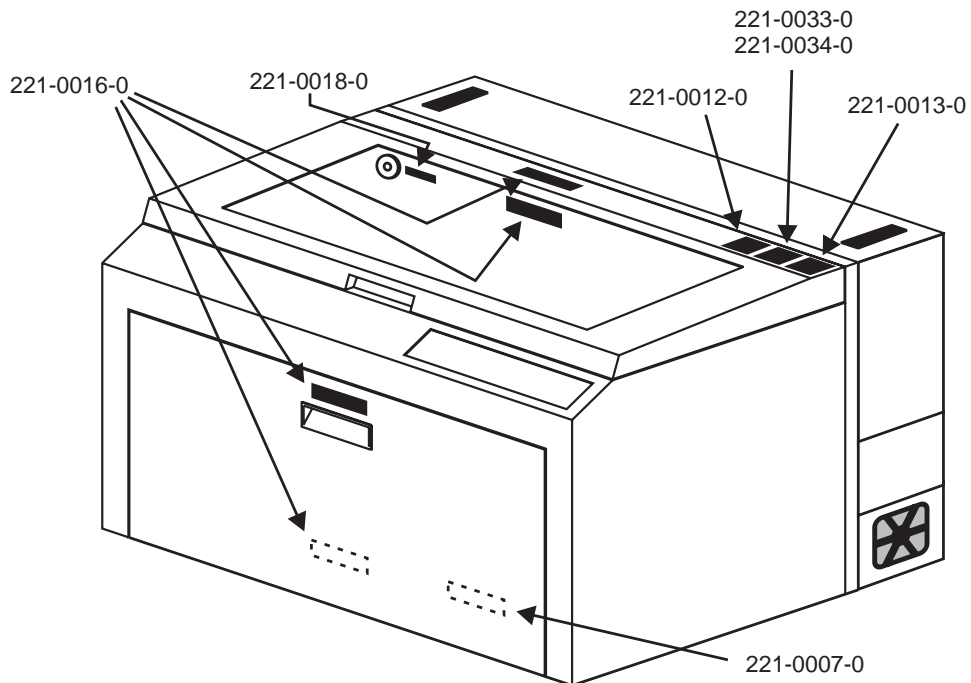


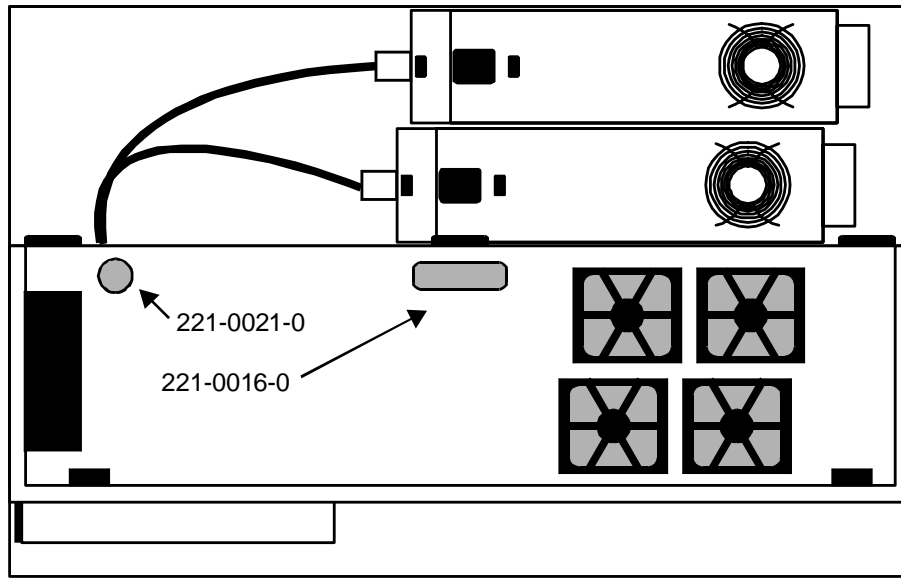
Back View of laser system

PLS6.150D Label Placement

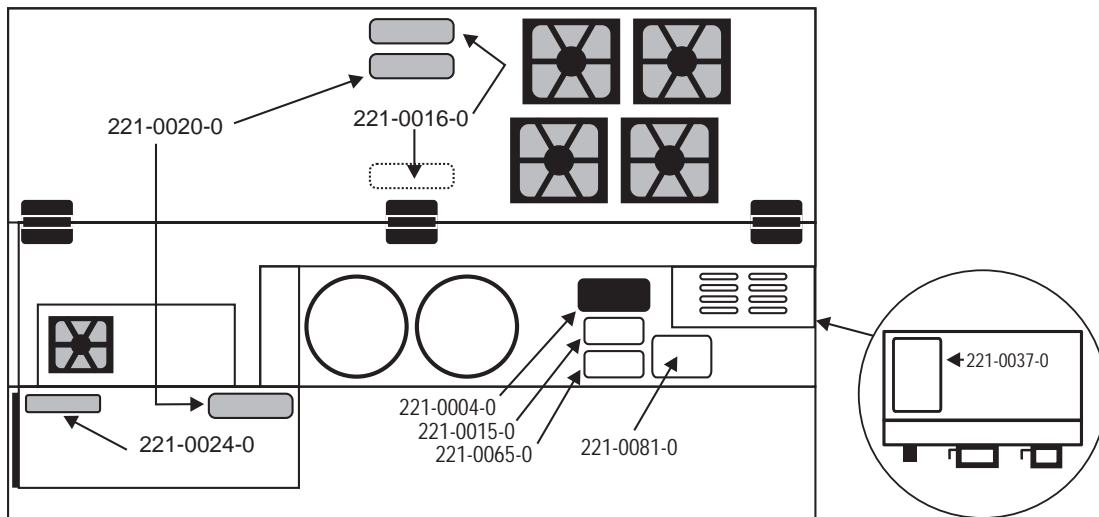


Laser Tube





Back View of laser system - Rear cover open



Back View of laser system - Rear cover closed

EU Declaration of Conformity

UNIVERSAL LASER SYSTEMS INC.

Product Identification: PLS3.75, PLS4.75, PLS6.75, and PLS6.150D
Laser Engraving and Cutting Systems

Manufacturer:
Universal Laser Systems, Inc.
16008 N. 81st St.
Scottsdale, AZ 85260
USA

European Office:
Universal Laser Systems GmbH
Lerchenfelder Guertel 43
A-1160 Vienna/Austria

The manufacturer hereby declares that the equipment specified below is in conformity with the following directives:

| | |
|-------------|-------------------------|
| 89/336/EEC | (EMC Directive) |
| 73/23/EEC | (Low Voltage Directive) |
| 98/37/EEC | (Machinery Directive) |
| 2002/95/EEC | (ROHS Directive) |
| 2002/96/ECC | (WEEE Directive) |

based on the standards listed.

Standards Used:

Safety:

EN 60950: 2002
EN 60825-1: 2002 (Class 3R)

EMC:

EN 55024 1998 (Class A)
EN 55022: 2003 (Class A)
EN 61000-3-2: 2001 (class A)
EN 61000-3-3: 2002
EN 61000-4-2: 2001 (4kV CD, 8kV AD)
EN 61000-4-3: 2003 (3 or 10 V/m)
EN 61000-4-4: 2002 (1 or 2 kV power line)
EN 61000-4-5: 2001 (class 3)
EN 61000-4-6: (3 or 10Vrms)
EN 61000-4-8
EN 61000-4-11

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.

SAFETY

Part 1 - Initial Setup

Section 2

Installation



The following operational guidelines are vital to a safe and productive environment. It is your responsibility to provide a proper operating environment. This section will also give you step-by-step instructions for site preparation, and computer and software setup. Please follow the instructions in the order shown:

1. Establishing a Proper Operating Environment
2. Providing a Suitable Electrical Power Source
3. Extracting Fumes and Particulates
4. Software Installation and Operating System Requirements (Sections 2 & 3)
5. Assembling the PLS (Section 4)



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.

1. Establishing a Proper Operating Environment

Environment (user supplied)

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

2. Providing a Suitable Electrical Power Source

Electrical (user supplied)

- For your system's electrical requirements, please refer to the "INPUT POWER" label near the ON/OFF switch and/or power inlet.
- **NEVER REMOVE THE GROUND LEAD TO THE ELECTRICAL CORD AND PLUG THE SYSTEM INTO A NON-GROUNDED OUTLET.** This is very dangerous and can lead to a severe, if not fatal, electrical shock. Always plug the system into a properly grounded (earthed) outlet. Also, without proper grounding, the laser system may exhibit sporadic or unpredictable behavior.
- Noisy or unstable electricity as well as voltage spikes may cause interference and possible damage to the electronics of the laser system. If electrical power fluctuations, brown outs, or



constant power outages are a problem in your area, an electrical line stabilizer, UPS (Uninterruptible Power Supply), or backup generator might be required. You may also need to connect the laser system to a dedicated electrical line to resolve the problem.

- The laser system is designed as a Class I, Group A, pluggable device. It is also designed for connection to IT power systems which provides the most flexibility to the user.

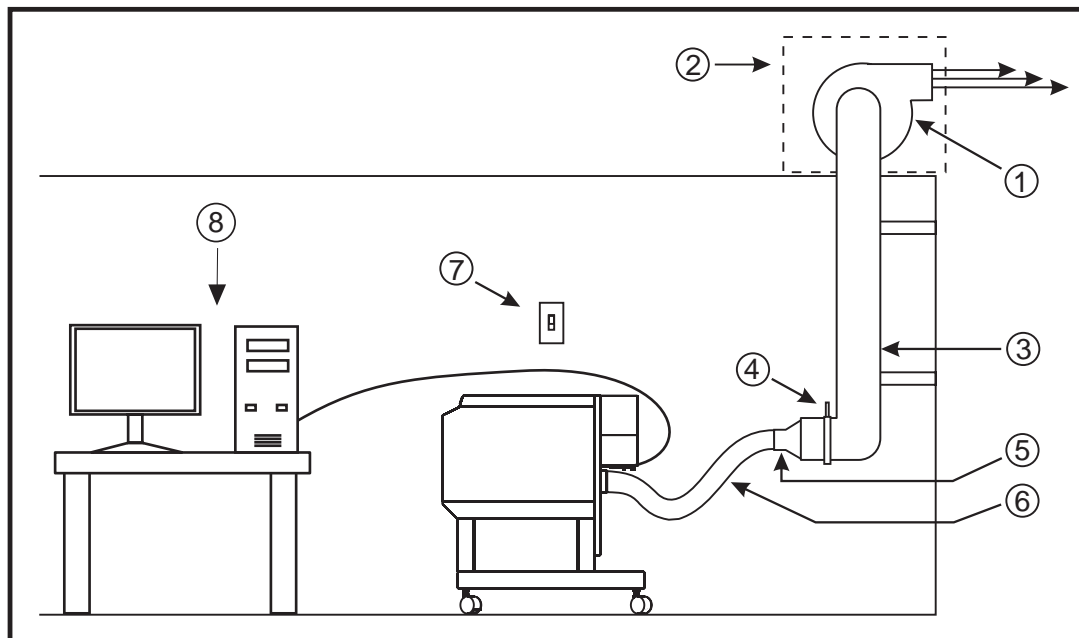
3. Extracting Fumes and Particulates

Exhaust System (user supplied)

- The exhaust system **MUST** be capable of supplying a minimum of 250 CFM (cubic feet per minute) of airflow while under a load of 6 inches of static pressure (425m³/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.
- For personal safety and noise control reasons, we recommend that the blower be mounted **OUTSIDE** 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.

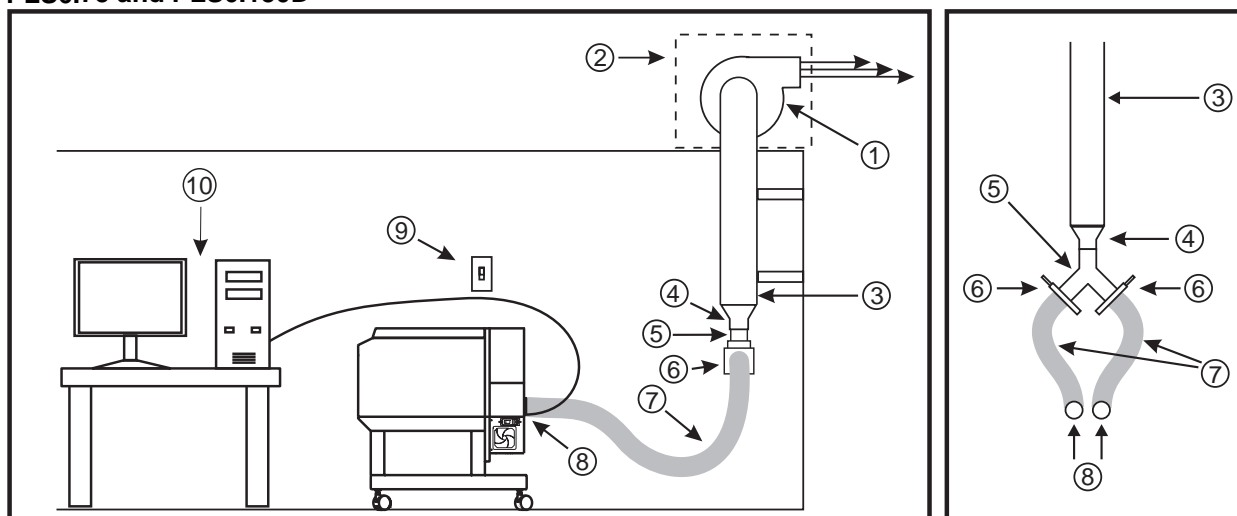
Note: The following diagram shows a typical exhaust system layout. Use this as a guideline to proper exhaust system installation. Although this diagram just serves as an example, we recommend installation of the exhaust system by a licensed contractor to meet safety and local code requirements as well 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.

PLS3.75 and PLS4.75



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

PLS6.75 and PLS6.150D



- (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
- (10) Computer (user supplied)

4. Software Installation and Operating System Requirements

Your computer is critical component in the operation of the PLS. In fact, you cannot operate the PLS if your computer is not connected, powered on, running Windows, and running the Universal Control Panel software (UCP).

Only **ONE** PLS per computer is allowed. You will need to purchase a separate computer for each PLS you own. Also, the PLS is **NOT** designed to be a network printer. **YOU MUST** operate the PLS using the computer that is directly attached to it via the **PROVIDED**, 6 foot, USB cable. **USB cables longer than 6 feet may cause the PLS to malfunction.**

A. Computer Requirements

Minimum PC Configuration (user supplied)

| | |
|--|--|
| 2.0 GHz processor | Mouse and keyboard |
| Windows XP Home, Professional Edition, or Windows Vista**. Macintosh computers not compatible with VersaLASER. | Available USB 2.0 High Speed compliant port |
| 1 GB of RAM | Computer speakers |
| 40 GB hard drive (15 GB free space) | 600 DPI scanner (optical) |
| VGA monitor (minimum 1024 x 768 resolution) | Internet connection and email address (optional) |
| CD-ROM Drive/Burner | |

**The PLS machine is compatible with a 32 bit Windows Vista version. See www.microsoft.com for the minimum computer requirements to run Windows Vista.

NOTE: Some computer motherboard manufacturers USB ports DO NOT comply with USB 2.0 High Speed standards. This may cause erratic behavior from the PLS such as freezing and lock-ups.

Other USB peripheral devices that demand a large amount of computer processing power may slow down the operation and productivity of the PLS. We recommended not using these devices while operating the PLS.

NOTE: Laptop computers are known for having low powered USB ports. If using a laptop most likely you will need to use an external USB port hub, that has its own AC power adapter, and install it between the computer's USB port and the PLS's USB port.


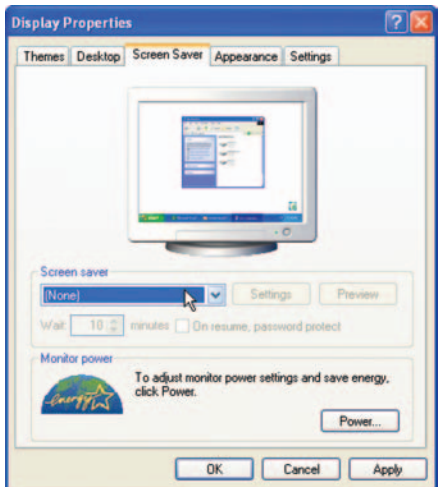
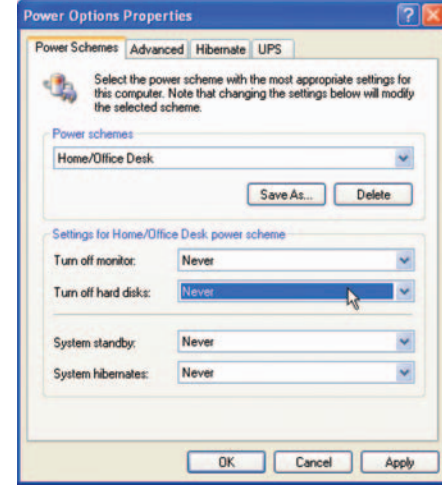
Optimizing Windows XP Performance

Windows XP, by default, displays many "visual effects" that slow down the computer by utilizing RAM and processor time. We recommend that you turn **OFF** these effects by right-clicking on the My Computer icon on your desktop, then click Properties and then click the Advanced tab. In the Performance section, click Settings, then click Adjust For Best Performance, and then click Apply.



Computer Power Management

Power management is a configuration setting in Windows XP that reduces the energy consumption of computers and monitor by shutting them down after a period of inactivity. However, since your computer is a critical component in the operation of the PLS, you **MUST NEVER** allow your computer to go into the Standby or Hibernate mode.

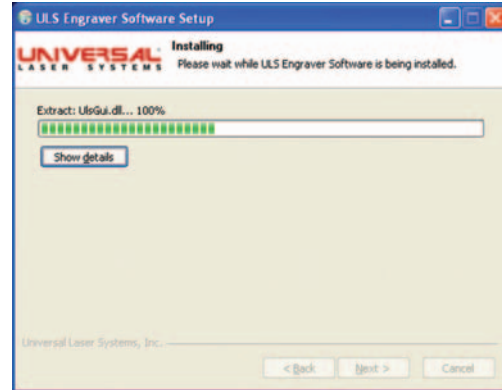
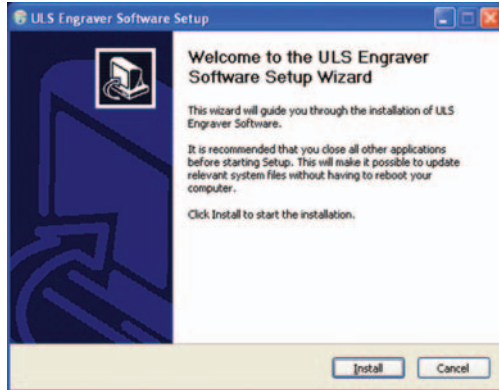
| | |
|--|--|
|  <ol style="list-style-type: none"> 1. To properly configure Power Management in your Windows XP computer, right-click on your desktop. 2. From the list of options, select "Properties". The "Display Properties" box will open. |  <ol style="list-style-type: none"> 3. In Display Properties, select the Screen Saver tab. Set the Screen saver to "(None)". 4. Then in the box "Monitor power", Click the button "Power..." |
|  | <ol style="list-style-type: none"> 5. Select the tab "Power Schemes". 6. For the Power Scheme in use, select "Never" for all the setting options: Turn off monitor, Turn off hard disks, System standby, and System hibernates. 7. Click "Apply", then "OK" on both open windows. |

If you have further questions on how to configure or upgrade Windows XP, please contact Microsoft Corporation.

NOTE: Your chosen graphical software AND PLS software MUST be installed and operational before operating the machine.

B. Software Installation CD-ROM

At this point you need to install the Windows XP printer driver. In order to install the software you **NEED** to have administrative privileges on the user account that is currently logged on. The Software Installation CD-ROM can be found in a pocket on the inside of the back cover of this manual.



1. Insert the Software Installation CD-ROM into your PC's CD drive. It should automatically open the "ULS Engraver Software Setup" window. Read the instructions and then click the "Install" button.
 - a. If the window does not automatically open, you can open it from Windows Explorer through your CD drive. Double-click on the file *Setup.exe*. The software will automatically begin to load.
2. The installation process will begin indicated by a progress bar. Be patient. Loading the files can take a few minutes depending on your processor speed.



3. You will be prompted to select your model. Select the laser engraver you are installing on the computer then click on "Ok". The software will continue loading as indicated by a progress bar.
 - a. If the incorrect model is selected you will receive an error message later in the engraving process. Uninstall the printer driver and reinstall it by choosing the correct model.
4. When the installation process is finished the "Completing the ULS Engraver Software Setup Wizard" window will appear. Read the instructions and make your proper selection. If you Reboot Now save all your work prior to rebooting. Click on the "Finish" button to complete installation. The window will automatically close. Remove the Software Installation CD-ROM. All the files required to operate your machine have been loaded onto your computer.

C. Recommended Software Programs

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

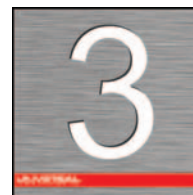
- **Vector Graphics Programs (user supplied)**
CorelDRAW 12 or X3**, Adobe Illustrator CS
- **Bitmap / Scanning Software (user supplied)**
Corel PHOTO-PAINT or Adobe Photoshop
- **Raster to Vector Conversion Software (user supplied)**
CorelTRACE
- **CAD Software (user supplied)**
AutoCAD for Windows
- **FONTS (user supplied)**
Use True Type fonts **ONLY**. Do not use PostScript or bitmapped fonts.

****Most users purchase the CorelDRAW 12 or CorelDRAW X3 Graphics Suite package which contains all the software necessary to operate the PLS 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 PLS. As a result ULS recommends CorelDRAW 12 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 PLS. While ULS has made reasonable efforts to make the PLS 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.**

Once you have installed your preferred software according to the manufactures instructions you will need to configure your graphics software according to our instructions.

Proceed to section 3 to continue with the software configuration.

Section 3



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 your software correctly is essential to running the laser system properly.

The following examples assume that you are configuring the software for a PLS Series machine. If you have a different Platform machine, substitute the correct maximum page size. For example:

PLS3.75 = 24 x 12 inches (609.6 x 304.8 mm)
PLS6.75, PLS6.150D = 32 x 18 inches (812.8 x 457.2mm)

NOTE: We have provided specific instructions for setting up CorelDRAW 11/12/X3, AutoCAD 2000i/2002/2004, and Adobe Illustrator CS in order for these programs to work well with the laser system. You will find them at the end of this section.

General Software Setup

There are many 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. For now, consider that the laser system's origin is fixed in the upper left corner of the engraving area and cannot be altered. Later on you will learn how to relocate the origin. But for right now, change the ruler position on screen to match the laser system with the origin (0,0) in the upper left corner. It is also possible to use a page size smaller than the maximum engraving area. For example, if you desire an 8-inch (203.2 mm) x 10-inch (254 mm) page size, set this page size in the graphics software as well as in the printer driver. The laser system will automatically move the engraving area to the origin so place the object all the way up into the left-hand corner against the rulers 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 Software Installation CD-ROM. Please refer to the software setup instructions for your specific version of CorelDRAW. If you are using other graphics software and need to mix your own colors, use the chart below to create them.

| | | RED (R) | GREEN (G) | BLUE (B) |
|--------|---------|---------|-----------|----------|
| COLORS | 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 correct 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 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 Section 2-9 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 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 an image in 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 Raster sub-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 and 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.

Specific Software Setup

Some graphics software programs require a special setup procedure in order for the software to function correctly with the ULS printer driver. In the following pages you will find setup instructions for the most popular software programs that our customers use. If you are having trouble with other software programs not included in this document, you may want to switch to one of them. As a reminder, ULS provides no warranties whatsoever on any software used in connection with a ULS Laser Engraving System, express or implied. Neither does it guarantee software compatibility with any off-the-shelf software package or any software program that has not been written by ULS.

CorelDRAW 11

Windows XP

Note: CorelDRAW 11 is not compatible with Windows Vista. Therefore, we have only included setup instructions for Windows XP.

1. Make sure that you have installed all Service Releases and software patches from Microsoft. For Windows XP, install Service Pack 2. If you are reading this document from the Software Installation CD-ROM, as a service to you, you can find the file on this CD. 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. 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. The ULS Windows Printer Driver must be loaded before continuing. Please refer to Section 2-8 on the manual on how to install the driver. If you have already installed the printer driver, you will need to re-insert the Software Installation CD-ROM back into your CD drive at this time.
5. Using Windows Explorer, locate the file named "ULS.CPL" and "ULS.PAL" on the Software Installation CD-ROM, and copy this file over to the C:\Program Files\Corel\Corel Graphics 11\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\Graphics11\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 about 30 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 palette pop-up box appears, from the "Files of type" dropdown list, choose either "Custom Palette (*.cpl)" or "Process Palette (*.pal)", then double-click on the ULS palette. The color palette will now appear on the right side of the screen. Directly above the Black-colored square there is a box, click on this box and then click "Set as Default".
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 a PLS3.60 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. Then double-click on "Printing" to expand the list. 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, 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 11 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.

Next proceed to section 4 for laser system assembly.

CorelDRAW 12

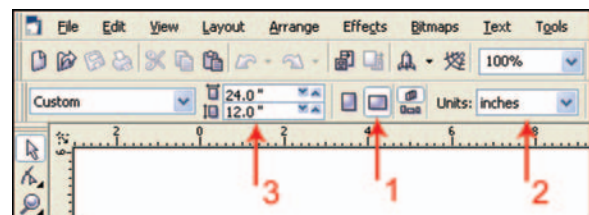
Windows XP

Note: CorelDRAW 12 was optimized for Windows XP and is not compatible with Windows Vista. We also suggest not running it under Windows 95/98. Therefore, we have only included setup instructions for Windows XP.

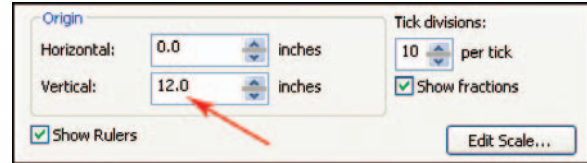
1. Make sure that you have installed all Service Releases and software patches from Microsoft. For Windows XP, install Service Pack 2. If you are reading this document from the Software Installation CD-ROM, as a service to you, you can find the file on this CD. For the latest releases, check Microsoft's 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. 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. The ULS Windows Printer Driver must be loaded before continuing. Please refer to Section 2-8 on the manual on how to install the driver. If you have already installed the printer driver, you will need to re-insert the Software Installation CD-ROM back into your CD drive at this time.
5. Using Windows Explorer, locate the file named "ULS.CPL" and "ULS.PAL" on the Software Installation CD-ROM, and copy this file 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 about 31 lines to the line that reads "FontRasterizer=1". Change the 1 to a 0 (this is a zero, not an o), save the file, and exit Notepad.


```
FountainPresets=coreldrw.ffp
Language=English
FontRasterizer=0
TTFOptimization=1
TextureMaxSize=257
```
7. Open CorelDRAW 12 and start a new graphic.
8. In the menu bar, click on "Window", then "Color Palettes", and then click "None". Once again click "Window", then "Color Palettes", and then "Open Palette". In the pop-up box, double-click on "ULS.CPL" which allows it to appear on the right side of the screen.

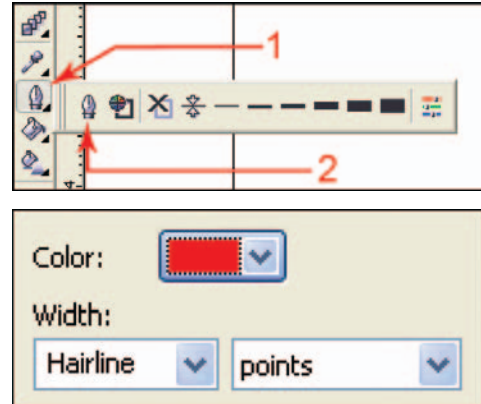
9. On the property bar, click on the landscape orientation (the sideways rectangle) (1). Now type in the page width and height that matches your laser platform (3). If you wish you can change the units from inches to millimeters (2).



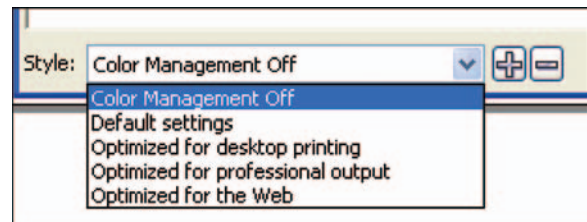
10. The rulers on screen need to match the rulers in the PLS. Adjust the ruler's vertical origin by double-clicking directly on the vertical (side) ruler. The "Options" dialog box will appear. In the vertical origin box, type in the length of the vertical ruler of your PLS. In this example the vertical ruler is 12 inches. Click OK.



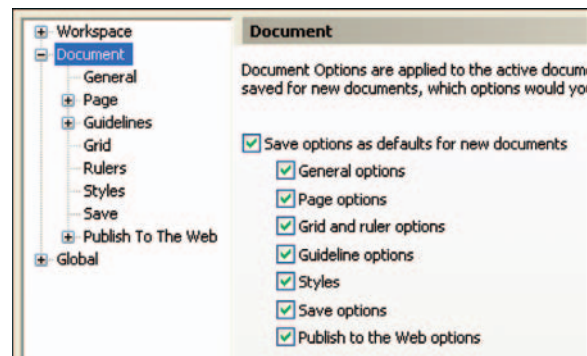
11. Set the default value for line width and color of the graphic objects, by clicking the outline tool (1) and then the outline pen dialog in the flyout (2). With "Graphic" being the only selection checked, click "OK". Click the down arrow in the Color dropdown box to expand the list and click on the color **RED**. Click the down arrow in the "Width" dropdown box and click "Hairline". The units can be "inches", "millimeters" or anything else you prefer. Click OK to close the Outline Pen dialog box.



12. In the top menu, click "**Tools**", and then click "**Color Management**". Click on the down arrow to expand the "**Style**" dropdown list. Click "**Color Management Off**", and then click "OK".



13. 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".



14. 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.

Remove the Software Installation CD-ROM from your CD-ROM drive and store it either back into the pocket of the rear cover of the manual or in a safe place.

Next proceed to section 4 for laser system assembly.

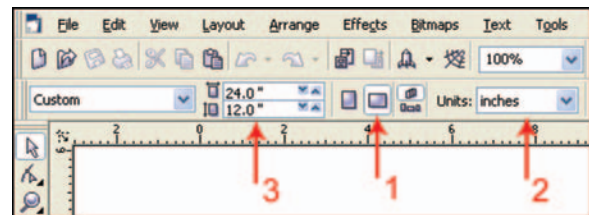
CorelDRAW X3

Windows XP and Windows Vista

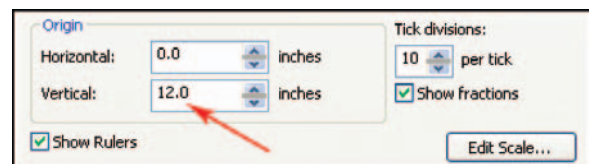
Note: CorelDRAW X3 was optimized for Windows XP and is compatible with Windows Vista. We also suggest not running it under Windows 95/98. Therefore, we have only included setup instructions for Windows XP and Windows Vista.

1. Make sure that you have installed all Service Releases and software patches from Microsoft. For Windows XP, install Service Pack 2. If you are reading this document from the Software Installation CD-ROM, as a service to you, you can find the file on this CD. 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. 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. The ULS Windows Printer Driver must be loaded before continuing. Please refer to Section 2-8 on the manual on how to install the driver. If you have already installed the printer driver, you will need to re-insert the Software Installation CD-ROM back into your CD drive at this time.
5. Using Windows Explorer, locate the file named "ULS.CPL" and "ULS.PAL" on the Software Installation CD-ROM, 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.**
6. Open CorelDraw and start a new graphic.
7. 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.

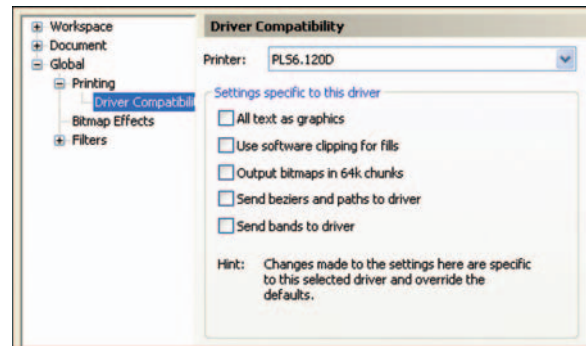
8. On the property bar, click on the landscape orientation (the sideways rectangle) (1). If you would like the drawing units in metric, choose millimeters from the drop down list (2). Now type in the page width and height that matches your laser platform (3).



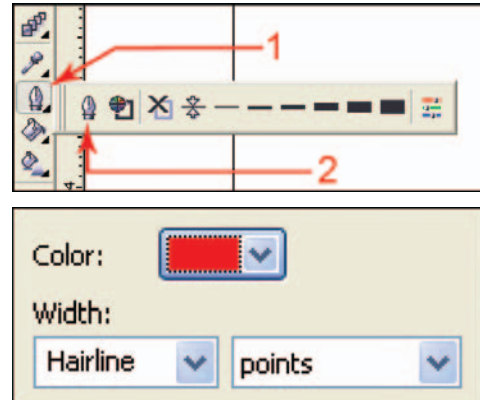
9. We now need to adjust the vertical ruler, on the left side of the screen, to match the rulers in the laser system. To do this, we need to adjust the ruler's vertical origin. Double-click directly on the vertical (side) ruler. The "Options" dialog box will appear. In the vertical origin box, type in the same height value as you did when you set up the page height in the previous step. For example, 12 inches for a PLS3.60. If you would like the scale to be displayed in tenths, choose "10 per Tick" in the "Tick Division" drop-down list box.



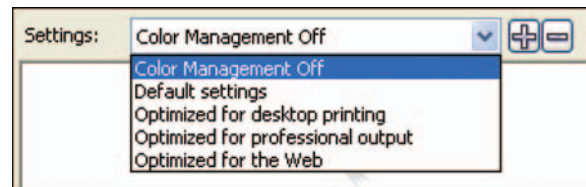
10. While still in the “Options” dialog box, double-click on “Global” to expand the list. Double-click on “Printing” to expand the list. Now click on “Driver Compatibility”. Make sure that the laser system's name is displayed in the printer drop-down list. In the settings specific for this driver dialog box, make sure that **ALL** the check boxes are **UNCHECKED**. Now click on “OK” to close the “Options” dialog box.



11. 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 (1), then the outline pen dialog in the flyout (2). 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.



12. 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”.



13. Finally, at the top of the screen, click on “Tools”, then “Save settings as Defaults”.
14. 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.

Remove the Software Installation CD-ROM from your CD-ROM drive and store it either back into the pocket of the rear cover of the manual or in a safe place.

Next proceed to section 4 for laser system assembly.

AutoCAD 2000i, 2002 and 2004 for Windows XP

NOTE: AutoCAD version 2000 is not compatible with ULS laser systems. You must upgrade to version 2000i or higher. Also, we recommend installing ULS printer driver version 2.8.4 or higher.

1. Make sure the ULS Printer driver is installed prior to setting up AutoCAD.
2. 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. PLS360.pc3).
 - Next, search for files with a .pmp extension and delete all ULS Printer .pmp files (i.e. PLS360.pmp).
 - Reboot the PC.
3. Start AutoCAD and open a new drawing.
4. 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.
5. Click Next. Select System Printer, and then click Next.
6. Select the appropriate ULS Printer Driver, and then click Next.
7. **DO NOT** click the Import file button, simply click Next.
8. You may edit the plotter name, if desired, and then click Next.
9. 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.
10. 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.
11. Click File>Page Setup, and then select the Plotter Configuration name, pc3 name (not the driver) from the dropdown list.
12. 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.
13. 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.
14. Click the Layout Settings tab and set the Plot Scale to 1:1.
15. AutoCAD is now set up properly to work with the ULS printer driver.

Next proceed to section 4 for laser system assembly.

Adobe Illustrator CS for Windows XP

Adobe Illustrator CS, in combination with the new ULS printer driver version 2.8.4 or later, is now capable of both raster and vector output as well as full-field engraving capability. The following procedure assumes that you are familiar with the use and operation of Windows XP, and Adobe Illustrator CS.

Procedure

1. Close all Windows programs.
2. Upgrade to Adobe Illustrator CS but do not launch it yet.
3. Upgrade to ULS printer driver version 2.8.4 or later.
4. Set your Windows default printer to the ULS printer driver.
5. Launch Adobe Illustrator CS and start a new graphic.
6. You will now need to set the Page Setup, in Adobe, to the largest square page that is equal to the width of your laser systems field. For example, if your laser system has a 24 x 12 inch field, then set the page setup in Adobe to 24 x 24 inch Portrait mode (not Landscape). If your laser system has a 32 x 18 inch field, set the page setup in Adobe to 32 x 32 Portrait.
7. Now, place your graphics ONLY within the top portion of your page in Adobe. Don't use the bottom portion that extends below the physical size of the engraving area of your machine. Since your laser system truly doesn't have a usable area as big as the page size you created, the only way to make Adobe work is to trick it into thinking it is outputting to a larger, square-fielded, device.
8. If you would like vector output, in Adobe, set your stroke weight to either .001 inches or .1 points. You will have to type in this setting because it is not available from the dropdown list.

Next proceed to section 4 for laser system assembly.

Section 4

Assembling the PLS

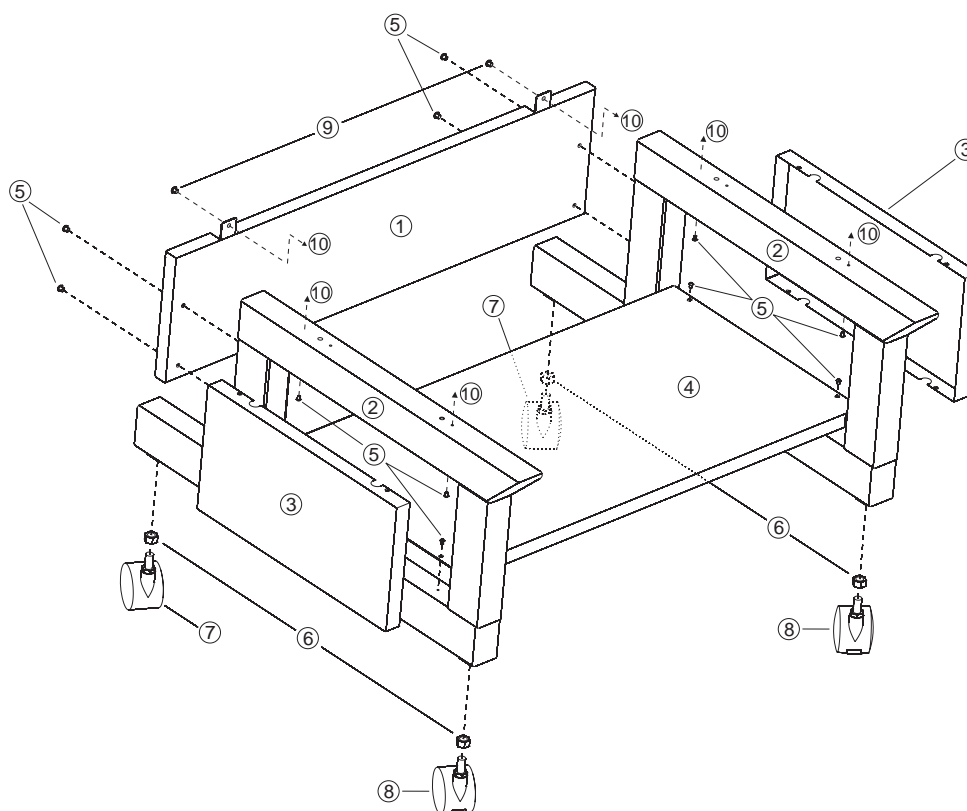


Depending on what model PLS you have purchased assembly of your laser system maybe required. Once the system has been assembled it is necessary to install the laser tube on the back of the machine and perform a beam alignment check. **DO NOT** power up your laser system until the final step, "Checking Beam Alignment".



CARE SHOULD BE TAKEN WHEN MOVING OR LIFTING THIS DEVICE. Obtain assistance from 3 or 4 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.

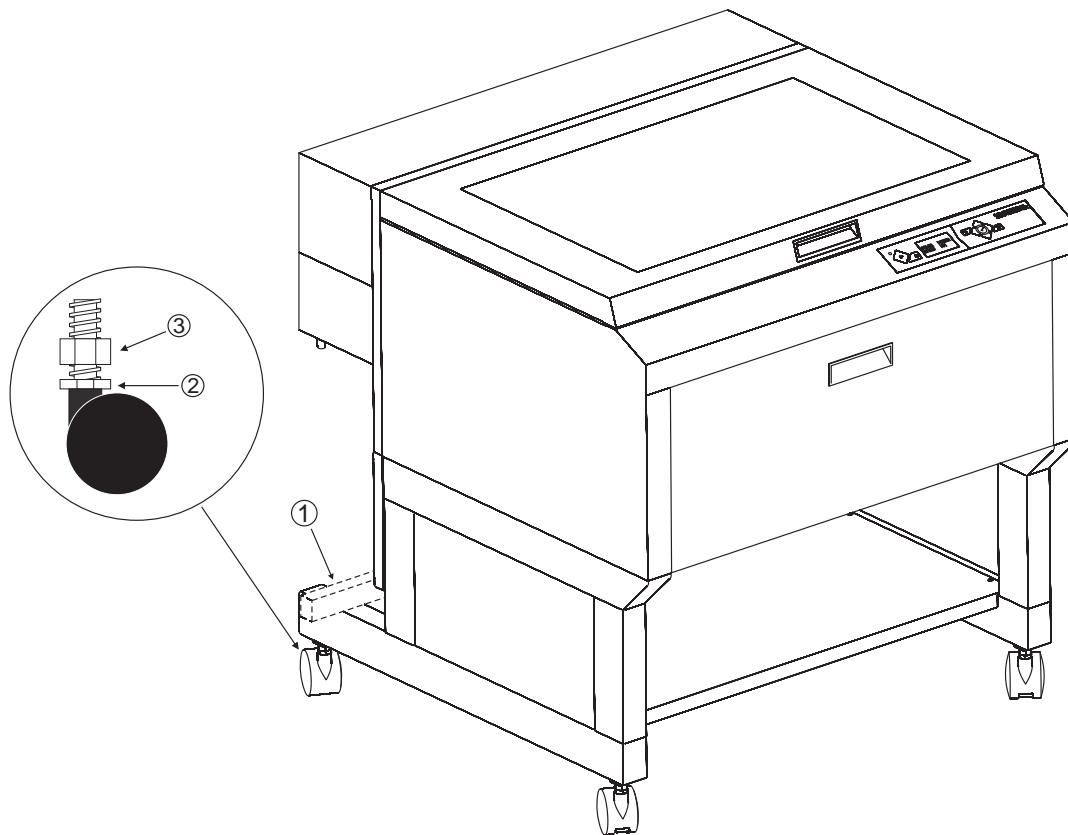
System Assembly - PLS3.75 and PLS4.75



Cart

- (1) Back panel
- (2) Legs (both are identical)
- (3) Side Panels (2)
- (4) Shelf Panel
- (5) 1/4-20 x 1/2, socket head screws with lock and flat washers
- (6) Nuts (4)
- (7) Non-locking casters
- (8) Locking casters
- (9) 10-32 x 3/8 socket head screws with lock and flat washers
- (10) Connect to main enclosure

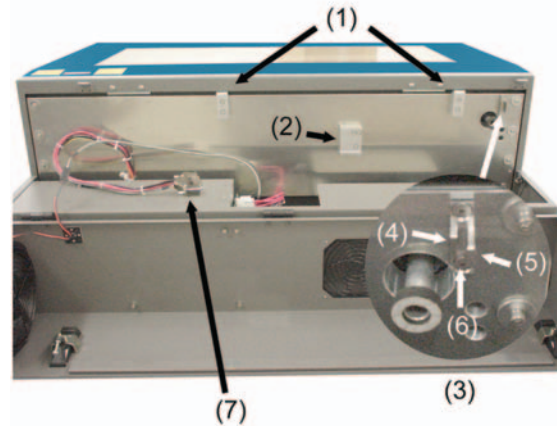
1. Unpack the laser system from its packaging.
2. Remove the unassembled cart from the top of the laser system.
3. Assemble the cart as it appears in the diagram on the previous page but leave all of the screws slightly loose except for the casters, which should be tightened as far as it can go into the cart leg.
4. With the assistance of three or four other people, place the system on top of cart and secure with the screws provided.
5. Open front door all the way to ensure that it does not come in contact with the cart legs. If it does, gently spread the legs apart. Securely tighten all the screws and re-check.
6. Attach your exhaust system's flexible rubber hose to the exhaust port at the rear of the laser system and secure with a hose clamp.
7. Locate the laser system in its final resting location.
8. Place a bubble level across the rear legs (1). Adjust the caster height using the adjustment screw (2) until both the rear part and the front part of the legs are level with respect to each other. Once the system is level, secure all casters by tightening the nut (3) up against the cart leg.
9. Open the top door and remove the rubber band that is holding the arm in place.
10. Remove any remaining packing materials, accessories or any other items that may be located inside the cabinet or on top of the engraving table.



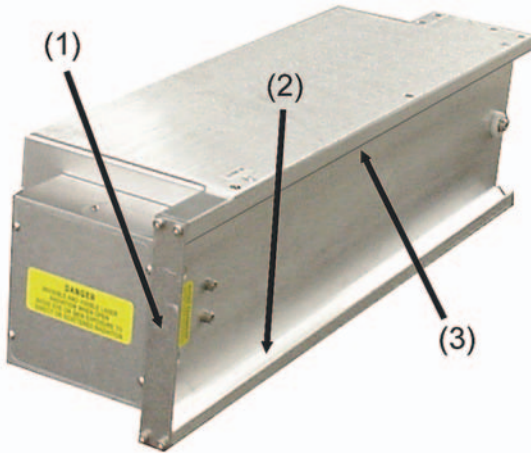
Laser Cartridge Installation



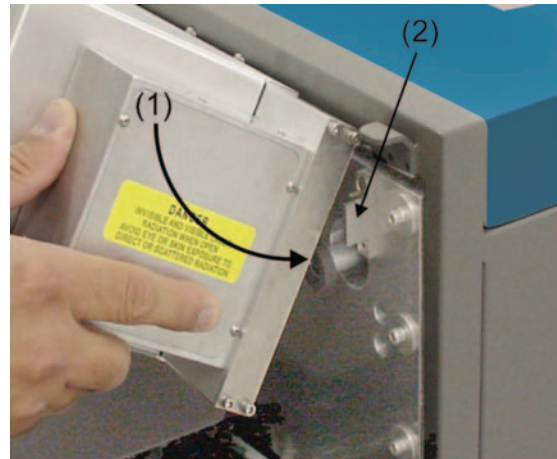
1. Make sure that your power cord **IS NOT** plugged in at this time. Press on the backside of the two hinges to release the latch. Gently fold back the rear cover.



2. Visually locate the two mounting blocks (1), the laser latch (2), alignment fork (3), and power connector (7). Notice that the alignment fork has two plates, one small (4) and one large (5). Locate the gap between the two plates (6).



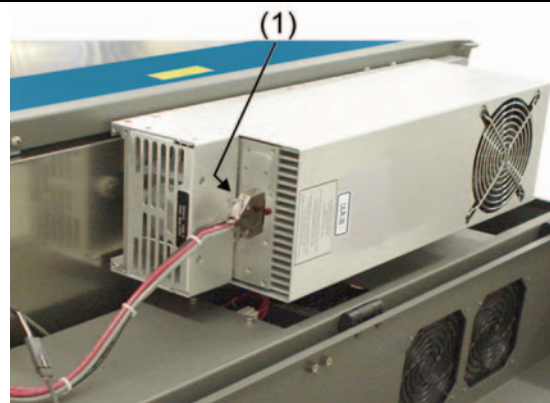
3. Observe the "V" groove along the upper (3) and lower (2) part of the laser cartridge and the alignment plate (1) at the end.



4. Pick up the laser cartridge by the sides and tilt it downward on a 30-degree angle. Mount the cartridge onto the mounting blocks by placing the upper "V" groove on top of the mounting blocks. Slide the cartridge to the right until the **OUTER EDGE** of the alignment plate contacts the **INSIDE EDGE** of the large plate of the alignment fork.



5. Slowly rotate the laser cartridge making sure that the alignment plate is centered in the gap of the alignment fork between the small and large plates. 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. Once installed, verify that the alignment plate is centered within the alignment fork.



6. Plug in the power connector (1). Slowly close the rear cover and **making sure that wires or hoses become pinched when the cover is closed**. Push down on the latches until they “click”.

Proceed to Section 4-8 once the laser tube has been installed.

System Assembly - PLS6.75 and PLS6.150D

Unpack the laser system from its packaging.

If the doorway is not wide enough to allow to you roll the laser system through it, the system **MUST** be detached from the cart stand, rotated sideways, passed through the doorway, then re-attached to the cart stand (Section 4-5).

If your doorway is wide enough, you can skip the following procedure and proceed to “Leveling the System” (Section 4-6). It would help if you had a **PADDED** floor dolly to transport the machine through the doorway. If one is not available, it will need to be carried through the doorway.

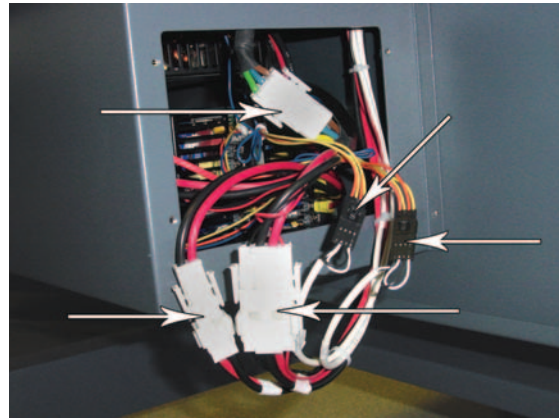


The laser system without the cart stand weighs approximately 200 lbs. Obtain assistance from as many people as possible (3 or 4 people). Always use a back-support device when lifting. Do not attempt lifting the machine if you are physically handicapped or are injured in any way. Seek the advice of a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

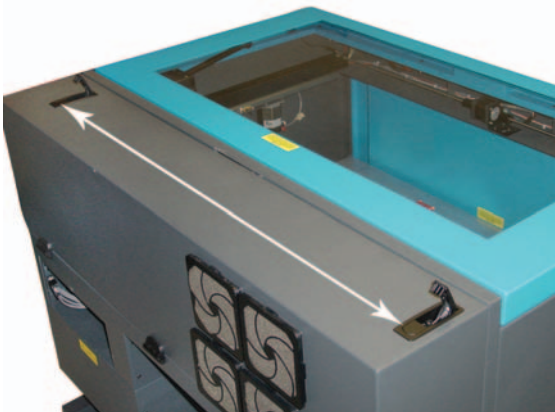
Detaching laser system from cart



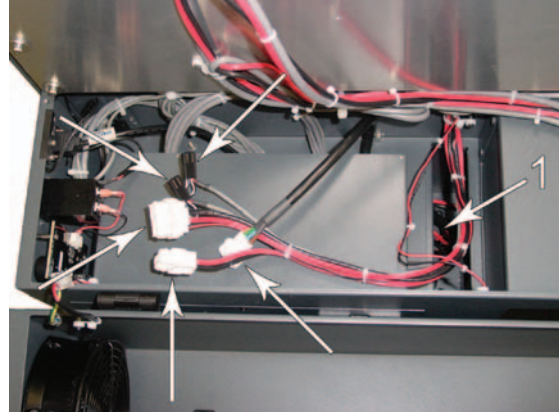
1. Make sure unit is unplugged from an electrical outlet.
2. At the back of the system, locate the four screws; remove them and the cover plate.



3. Locate the three white connectors and the two black connectors. Unplug all five connectors. They are held in place by latches so you will squeeze on the sides in order to release the latches to pull the connectors off.

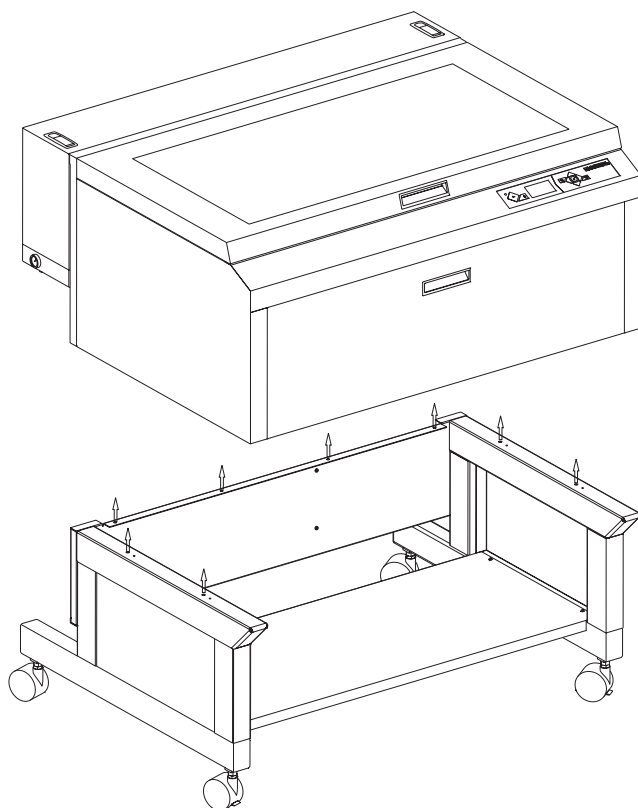


4. Open the rear cover by pressing down on the button part of the latches until the latches pop up.
5. Fold the rear cover down to a resting position.



6. Locate the cavity (1) where the cables reside. Gently pull the cables upwards and rest them on top as the diagram indicates.
7. Close and re-latch the rear cover.
8. Remove any packing materials or accessories from inside the laser system.
9. Using strong shipping tape or rope, tape the front door closed so that it does not open up when you tilt it.

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

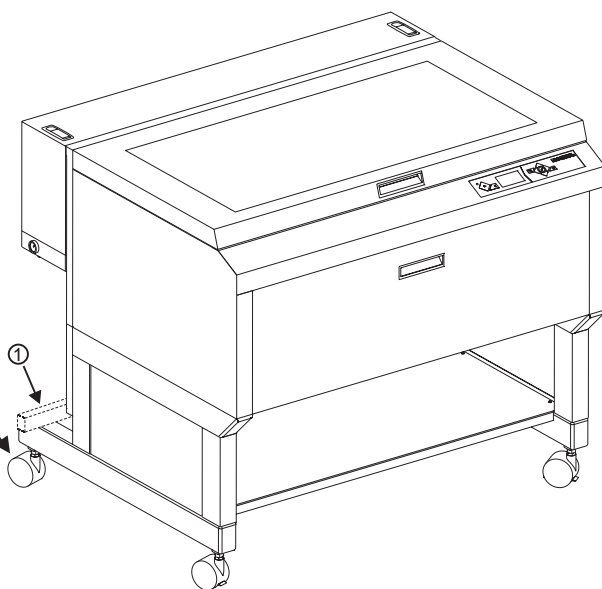
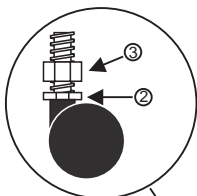


Leveling the System

Move the laser system to the desired operating location. If the floor underneath the laser system, at this location, is uneven, the casters must be adjusted.

Uneven flooring can cause mechanical problems with the operation of the motion system, which can seriously affect engraving or cutting quality.

1. Place a bubble level across the back (1) legs. Adjust the caster height using the adjustment screw (2) until the rear parts are level with respect to each other. Once the system is level, secure all casters by tightening the nut (3) up against the cart leg.
2. Open the top door and remove the rubber band that is holding the arm in place.
3. If you haven't already done so, remove any remaining packing materials, accessories or any other items that may be located inside the cabinet or on top of the engraving table.
4. Gain access to the rear of the laser system to install the laser cartridge(s).

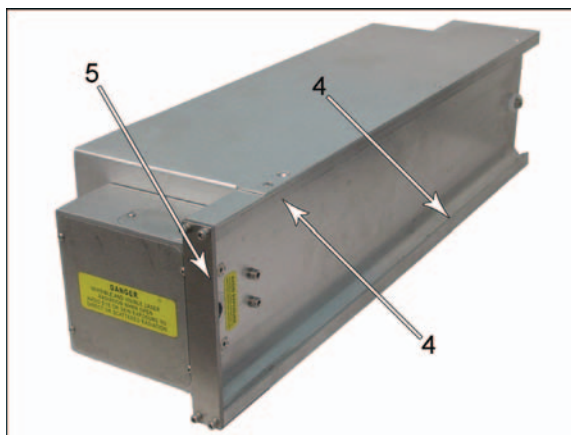
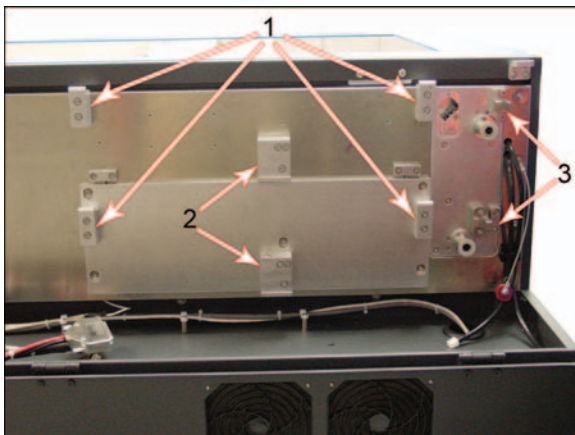


Laser Cartridge Installation

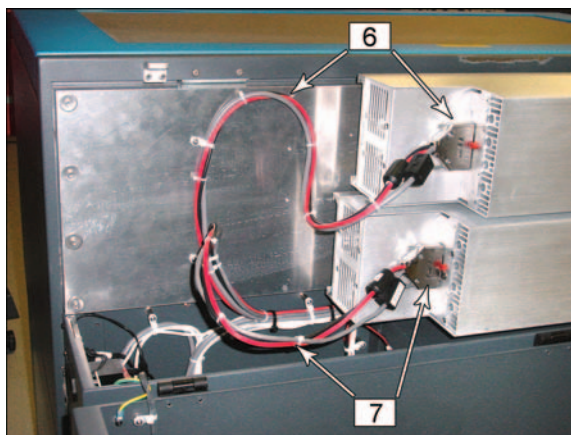
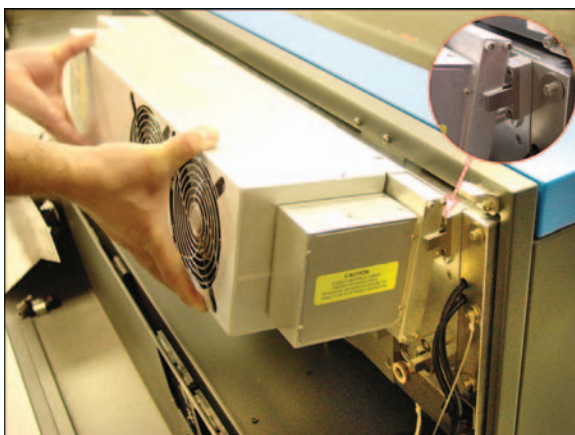
Note: The following images illustrate a PLS6.150D laser system. If you have purchased a PLS6.75 laser system ignore the mention of the two laser system setup and install the single laser tube.

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

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



2. Locate the laser mounting blocks (1), the laser latches (2), and alignment forks (3). Notice that the alignment forks have two plates, one small and one large. Locate the gap between the two plates. Observe the "V" groove (4) along the upper and lower part of the laser cartridge and the alignment plate (5) at the end.



3. If you have purchased two lasers, mount the first cartridge onto the **LOWER** mounting blocks first. Single laser users should mount the laser in the top position. Tilt the laser cartridge downward on a 30-degree angle. Place the upper "V" groove (4) of the cartridge on top of the mounting blocks (1). Slide the cartridge to the right until the alignment plate (5) of the laser cartridge makes contact with the inside of the large plate of the alignment fork (3). Slowly rotate the laser cartridge making sure that the alignment plate (5) 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 (5) are centered within the alignment forks (3).

The power connectors are labeled “Top” (6) and “Bottom” (7). 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”.

You are now done installing the laser tube(s) and need to Finalize the Connections.

Finalizing the Connections

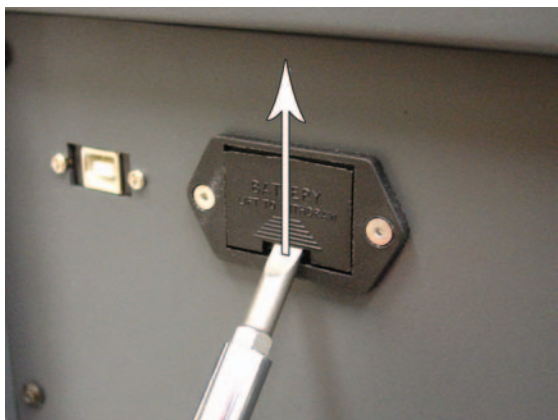
Make the following connections in the exact order described otherwise static electricity can damage the computer and/or the laser systems electronics.

1. Connect your 4-inch flexible rubber exhaust system hose to the 4-inch outlet found at the rear of the laser system. Use a hose clamp so that it doesn't fall off.
2. Connect the laser systems power cord and your computers power cord to a grounded electrical source. International users may need to connect an adapter to the power cord to be able to plug it into their power source. **MAKE SURE THAT YOU ATTACH THE ADAPTER CORRECTLY TO THE POWER CORD AND THAT YOUR POWER SOURCE IS PROPERLY GROUNDED (EARTHED) OTHERWISE SERIOUS DAMAGE CAN OCCUR TO THE LASER SYSTEM. DO NOT POWER ON EITHER DEVICE AT THIS TIME.**



Having a 9 volt battery installed into the PLS is necessary to operate the laser system. The laser system will not function without a battery or if the battery is low in power. Keep a spare 9 volt battery at hand at all times.

3. Install the Thermal Sensor battery into the PLS system.



- a. Remove the Thermal Sensor battery holder from the side of the PLS by inserting a small screwdriver in the hole and **GENTLY** push upward.



- b. Once you push upward pull the screwdriver towards you to withdraw the battery holder.

- c. Insert the 9 volt battery provided into the black battery holder according to the diagram inside the encasing.
- d. Reinsert the battery holder into the cavity until it makes a “click” sound.

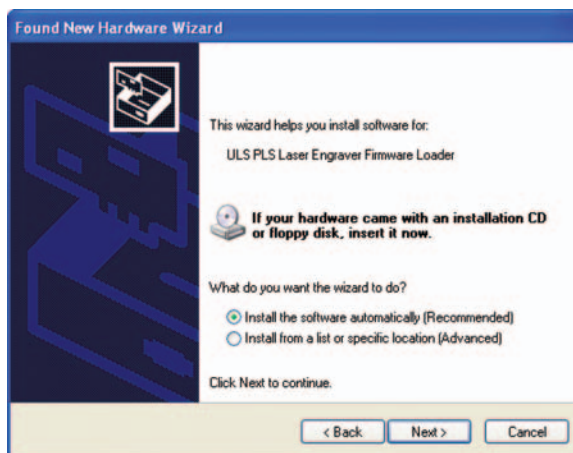
4. USB 2.0 High Speed (only)

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

- a. Connect the USB cable provided between the USB port of the computer and the USB port on the side of the PLS. **Do not use a USB cable longer than 6 feet (2 meters).**



- b. After connecting the USB cord, the Found New Hardware Wizard will open. You will be asked if Windows should connect to the Windows Update to search for software. Select "No, not at this time". Then click "Next" to continue.

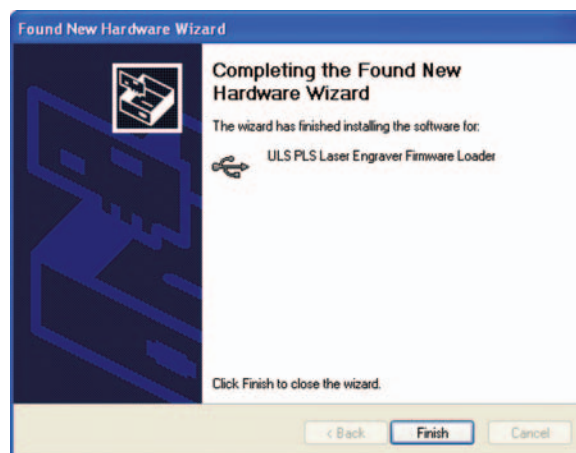


- c. Select "Install the software automatically". Then Click "Next" to continue. You **DO NOT** need to insert the Software Installation CD-ROM.



- d. A message will appear, "The ULS PLS Engraver Firmware Loader has not passed Windows Logo testing". Select "Continue Anyway". Do not be concerned. Installing the ULS Firmware **WILL NOT** harm your computer in any way! The firmware will begin to load.


- e. The New Hardware Wizard will indicate when the installation is complete. Click "Finish" to close the Wizard.

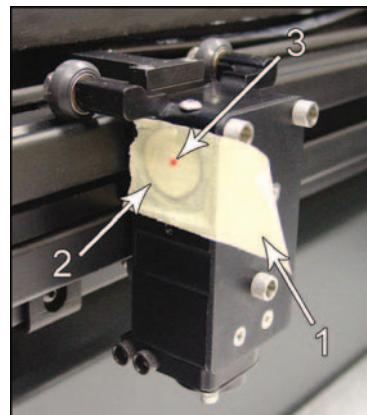


- f. You may notice a small pop up appear on the bottom right hand corner of your display screen saying "Found New Hardware PLS USB Printing Support."
- g. Another set of New Hardware Wizard windows will appear after the initial USB connection. Follow the same instructions as the ones mentioned above. Once completed your new hardware is installed and ready to use.

Checking Beam Alignment - All PLS laser systems

Note: You will not engrave anything at this time.

1. Open the top door.
2. Place a small piece of masking tape across the 3/4" hole in the focus carriage (1). Gently rub the tape around the edge of the hole so that you can see the outline of the hole through the tape (2) and then close the top door.
3. Power ON the laser system (switch on the back right-hand side).
4. Power on your computer and verify that the blue shaped icon  is present on the taskbar. If not, activate it by double-clicking on the ULSEngraver icon on your desktop.
5. After a few seconds have passed a red dot will appear on the masking tape (3). The red dot should appear centered, or close to the center of the hole, within 1/8 inch. If not, remove and re-install the laser cartridge(s) and try again. If the red dot still does not appear within 1/8" of the center of the hole, please contact our Technical Support Department.
6. Laser beam alignment is now complete. Power OFF the laser system and remove the masking tape.



Finally, proceed to section 5 to learn how to make a sample with your newly installed laser system.

Section 5

Making a Sample

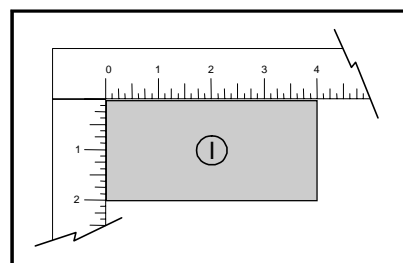


We will now illustrate how to use the laser system to create a product from start to finish. As an example, we will raster engrave and vector cut a key chain from a 2 by 4 inch, 1/8 inch thick piece of hardwood. It is preferable to use a hardwood such as Cherry or Walnut as opposed to grainy wood such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

NOTE: In order to make a proper sample verify you have followed all Installation instructions up to this point.

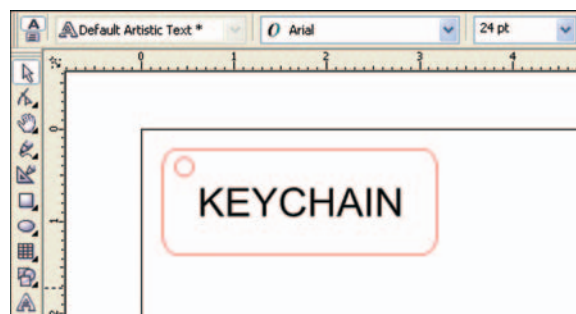
Step 1 – Loading and Positioning the Material

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



Step 2 – Creating the Graphic

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



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

If you are not familiar with your graphics program run a few tutorials and become familiar with the graphics program. If tutorials were not provided you may have to learn the software on your own by experimenting with the software.

Step 3 – Printing to the Laser System (Materials Database Tab)

The following steps assume that CorelDraw X3 is being used as your graphics software and using the Materials Database Tab in the printer driver. Other graphic software programs may differ.

When you are ready to print the file to the laser system, click FILE and then click PRINT. Make sure that the laser system appears in the DESTINATION NAME dropdown list, and then click PROPERTIES (Figure 4) to display the PLS printer driver settings (Figure 5).

Choose your material by selecting the appropriate category from the material categories on the left (in this case wood) and then select the correct material type from the material types on the right (in this case hardwood) (Figure 5). Since we are placing the material directly on the work surface, leave the Fixture Type set to NONE.

If you were using an optional accessory or custom fixture you would choose it from the fixture list. Using a calipers or similar measuring device, enter the thickness of the material (in this case .125 inch). For this sample there is no need to make changes to the INTENSITY ADJUSTMENT or AIR ASSIST boxes. If you have purchased two laser tubes and would like to make your sample using both laser tubes select BOTH in the “Which Laser?” box (PLS6.120D only). When you have made all the appropriate selections and entered the material thickness, click OK. The printer driver closes and reverts back to the Print Dialog box and now click on PRINT (Figure 4). As the print job is being created, a small printer icon will appear in your taskbar in the lower right corner of your computer screen. Once the icon disappears the print job is completed

and is now stored on your hard drive. Click on the PLS icon in the taskbar and the current print job will appear in the Viewer Tab of the Universal Control Panel (Figure 6). Now click on the System Tab and verify that the Auto Z box is checked. Return to the Viewer Tab and proceed to the next step.

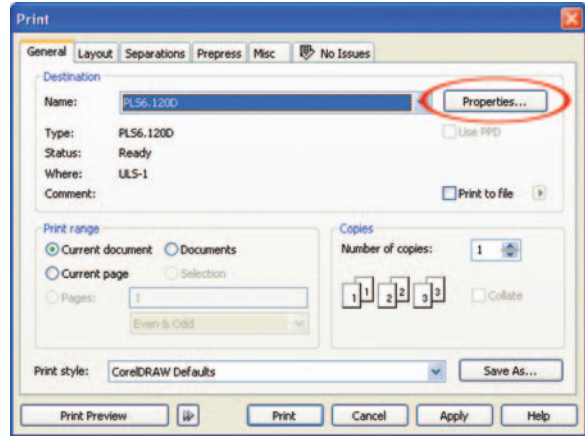


Figure 4



Figure 5



Figure 6

Step 4 – Starting the Engraving Process

- Turn ON the exhaust system and PLS machine. Laser tube fans will stop spinning once the laser system has been turned on. This is normal and the fans will start spinning once engraving has started.
- Make sure the material is positioned correctly within the engraving area.
- Make sure the top door is closed.
- Click the green START button on the UCP to begin laser processing (Figure 6).



WARNING: Observe that the laser system is functioning as desired. If any abnormalities are present, including but not limited to, flaming, sparking, melting, or excessive smoking of the material you are engraving, **STOP THE ENGRAVING PROCESS IMMEDIATELY BY EITHER PRESSING THE PAUSE BUTTON OR OPENING THE TOP DOOR!** Re-check the settings in the printer driver as well as the laser system. If everything seems to

be correct, the material is not suitable for laser engraving or cutting and you **MUST DISCONTINUE** processing this material or any material that may cause damage to the laser system. **NEVER LEAVE THE LASER SYSTEM UNATTENDED DURING THE ENGRAVING OR CUTTING PROCESS.**

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

Step 5 – Material Removal and Reloading

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

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



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

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



Congratulations! You have just completed your first engraving and cutting project with your new PLS machine.

Section 6 explains the PLS keypad, Universal Control Panel (UCP), and Printer Driver in further detail. If you have accessories or have questions about system maintenance, sections 7-8 answer these questions. If you are an advanced user refer to the last section of this manual.

Part 2- Laser System Essentials

Section 6

Basic System Features



From the Universal Control Panel menus and buttons to the PLS Keypad and basic printer driver features, this section describes many of the features of the laser system. If you have done so already, power ON your computer and let it boot up completely **BEFORE** powering ON the laser system otherwise your laser system can “lock up” when attempting to run the first file and the only way to clear this error is to power the system OFF and then ON again. You do not need to turn on your exhaust system at this time.

The Universal Control Panel (UCP)

The Universal Control Panel on the computer provides access to all of the controls necessary for cutting and engraving operations. When the laser system has finished initializing and homing, and if all the doors are closed the red light on the Keypad will be illuminated and ready to accept files.

Once you have installed the UCP using the installation disk, a blue square-shaped icon (Figure 1) will appear in the lower right corner of your Windows taskbar. This icon indicates that the UCP is active. It will automatically activate itself every time you power on your computer. If for any reason the UCP is deactivated you can reactivate it by double-clicking on the shortcut (Figure 2) found on your computers desktop screen. You can access the UCP at anytime by left-clicking once on the icon in the taskbar. The following describes the features of each tab of the UCP:




Figure 1

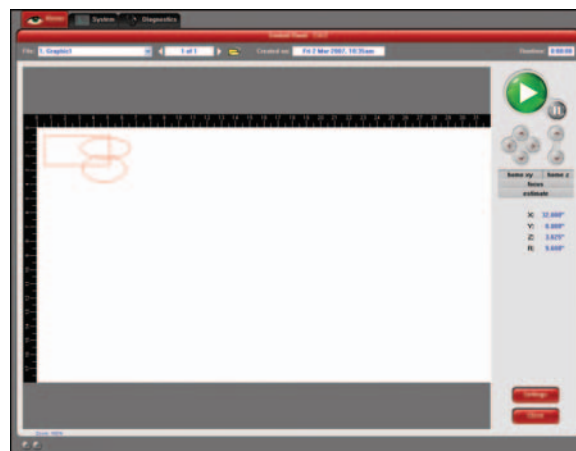


Figure 2

Viewer Tab



Selecting this tab will allow you to preview your file and control features of the laser system.

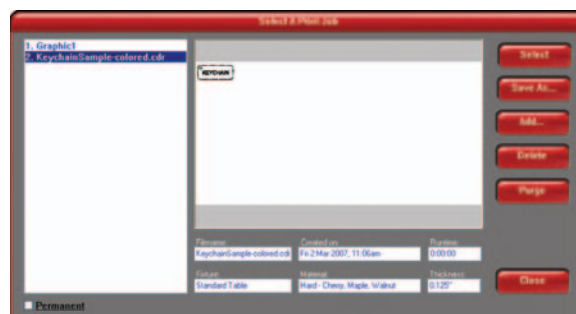
- Shows a preview window of the currently selected job.
- The cursor becomes a magnifying glass (Zoom Tool) if you pass it over the preview window. Left-clicking your mouse zooms in and right-clicking zooms out.
- Clicking the Settings button  takes you back to the printer driver. If mistakes where made or would like to make additional changes clicking this button allows for those changes. Further information about the printer driver can be found in Section 6-7 of this manual.



File Management

Displays the name of current job, the number of files stored, the date and time it was stored on your hard drive, and the run time near the top of the window.

- The print job navigation buttons  allow you to preview the print jobs stored on your hard drive. If you navigate through the files using the UCP the file name on the Keyboard display changes accordingly and visa versa.
- The “open folder” button  displays and allows you to select your print jobs in a file management style. It also allows you to delete print jobs stored from your hard drive, and save print jobs as .efm files.
 - The PURGE button deletes **ALL** cached print jobs stored on your hard drive.
 - If the Permanent box is marked this indicates that the selected file will not be deleted from your hard drive even after clicking the PURGE button.



System Controls

The upper right side contains the software version of the Keypad buttons found on the PLS laser system. These buttons operate identically to the physical buttons on the PLS.

- The green START button begins the engraving process.
- The PAUSE button stops the engraving process and clicking the PAUSE button again resumes the engraving process where it was last stopped.

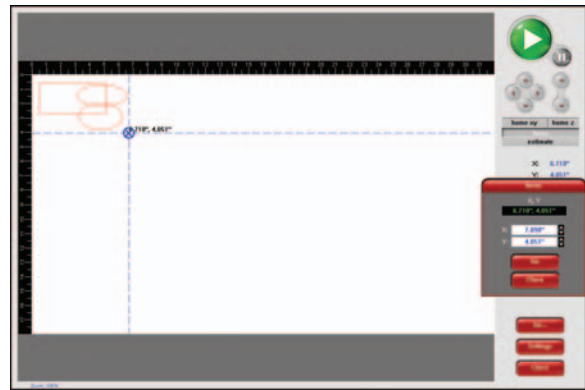


- The four Navigation buttons move the focus carriage back and forth or left and right.



- The red Z-Axis buttons moves the engraving table up or down.
- The Home XY button re-home's/moves the focus carriage to the upper right hand corner. The Home Z button re-home's/moves the Z-Axis table towards the bottom of the laser system.
- The focus button gives you the opportunity to move the focus carriage to a desired position on the laser systems table. To have a full range of motion of the X-Axis arm verify that you are zoomed out in the preview window by right-clicking on the mouse before entering the manual focus window.

- Moving the cursor over the preview window once the focus button has been clicked, changes your cursor to a blue target with dashed vertical and horizontal lines. Clicking once on the preview window moves the focus carriage to that position. Clicking the focus button while the focus feature is activated terminates the feature and re-home's the focus carriage. To move the focus carriage to a specific location click the GO button and type in the X and Y coordinates.



- The button labeled "estimate" approximately calculates the amount of time it will take the PLS to finish the engraving job.

System Tab

Selecting this tab will allow the configuration of certain features of the laser system.

- The PRINT CACHE number is adjustable. It indicates the maximum number print jobs that you would like to be stored on your hard drive. If you exceed the number shown, the software will automatically begin deleting the oldest jobs as newest ones enter the cache.
- LANGUAGE allows you to switch between multiple languages according to your preference.
- UNITS allow you to choose between Metric or Inches.
- AUTO Z should be enabled if you would like the device to focus the laser beam by automatically adjusting the height of the Z-axis table. This operating principle is based on the material thickness that you specify in the PLS Printer Driver (Section 6-9). If it is disabled, you will need to set focus manually by using the included Focus Tool (Section 9-17).
- The TUNING (UNIVERSAL) number is a value set by the PLS manufacturing factory for your particular machine. In the future, as your system gets broken in, it may be necessary to change this value to sharpen the resulting image. Do not change this number unless instructed to do so by our Technical Support Department.
- The LENS SIZE selected from the list should be the same as the number printed on the lens assembly on the front of your PLS Focus Carriage. If you change lenses (available accessory) other than the standard 2.0, then you **MUST** select the value that matches your installed lens and calibrate the focus lens to the top surface of a table by clicking the red CALIBRATE button, otherwise the PLS will not focus the laser beam properly. Contact the Technical Support Department if you have any question about lens calibration.
- The ALIGNMENT Launch button opens the Alignment Mode window.



- **CUTTING TABLE** allows you to calibrate a new Z-height to the top surface of Honeycomb Cutting Table. You need to have the Honeycomb Cutting Table installed in the PLS to activate the FOCUS button.
- **ROTARY** is activated once the rotary accessory is installed. Rotary calibration should be done once when the rotary is installed for proper engraving. For more information about the rotary read the Accessories section on this manual.
- If the **SOUNDS** box is checked the computer will play the sound shown indicated once the file has finished engraving. Be sure that your computer speakers are on and at an appropriate volume.
- **MANUAL FOCUS POSITION** automatically moves the focus carriage to the coordinates entered by the user once the Z-Axis menu is entered or if the Auto-Focus button is pressed on the PLS keypad.

Diagnostics Tab

The Diagnostics Tab displays important information about your laser system and personal computer.

- **ENGRAVER** shows the current Firmware and FPGA version being used. It also displays the Serial Number of your laser system. The Serial Number is needed when calling the Technical Support Department at ULS.
- **AIR ASSIST** displays the current device being used, shown by a green check mark, to supply compressed air to the laser system. According to the Air Assist device being used it may show if a Low or High setting is being used and the firmware version.
- **LASERS** displays if the Top or Bottom laser tube (if applicable) is being used and the watts being produced by the laser. It also displays the current version being used. If a red 'x' appears this indicates that the laser tube is not functioning properly or a door is opened on the laser system.
- **OTHER DEVICES** displays the current firmware version of the Keypad/Display on the laser system. It also displays the current firmware version of the Homing Sensor on the laser system.
- **SYSTEM** displays information about your personal computer.
- **INTERLOCKS** show you if the Top, Front, or Rear Doors are Opened or Closed.
- **ALARMS** alert you if the inside the laser system is above the recommended temperature or if the Thermal Sensor battery is low in power. If the Thermal Sensor inside the laser system is triggered an alarm will sound and shut down your laser system.
- **FIXTURES** indicate if a cutting table or rotary is installed and properly working.



The PLS Keypad

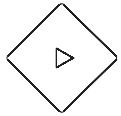
The Keypad on the laser system provides limited access to controls necessary for cutting and engraving operations. When the laser system has finished initializing and homing, and if all the doors are closed, the red light on the keypad will be illuminated and ready to run a file.



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

Red LED

| CONDITION | REASON |
|-----------|---|
| ON | The system has initialized. |
| | The top, front, and laser cover doors are closed and the system is ready to receive a file. |
| | The system is running a file. |
| OFF | The system is turned off. |
| | The system is initializing. |
| FLASHING | The top, front, or laser cover door is open. |



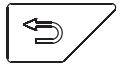
START: Begins laser processing of the current file displayed on the keypad screen. If any of the doors are opened when you press this button, the motion system will start to move as if it is processing the file, however, the CO2 laser beam is disabled and the red diode pointer will be enabled to simulate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



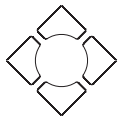
PAUSE: If a file is running, the PAUSE button halts the engraving or cutting process and the focus carriage will move to its home position in the upper right corner of the engraving area. If the PAUSE button is pressed again after the initial pause it will resume cutting or engraving again at the location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



SELECT: This button enters the menu item the cursor is currently on.



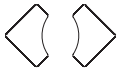
ESCAPE: This button exits you back to the previous menu or it cancels any changes that you have made to that menu item.



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



UP and DOWN: Moves the cursor up or down on the display. These buttons also move the X-Axis arm back and forth when on the XY menu of the display. When in the Z-Axis menu these buttons move the table up and down.



LEFT and RIGHT: While in the XY menu, the LEFT and RIGHT buttons move the focus carriage left and right. While on the FILE menu the buttons scroll through the files in memory, changes Colors, increases or decreases Power, Speed and PPI settings on the fly. While on the Z-Axis menu the LEFT and RIGHT buttons moves the cursor between the tenths and hundreds decimal place.



AUTO-FOCUS: This button has two purposes: Manual Focus and Auto-Focus. While on the main menu of the display, pressing the AUTO-FOCUS button once will move the focus carriage to the predetermined position as entered in the Manual Focus Position box under the System Tab. While on the main menu of the display, holding the AUTO-FOCUS button for one second will move the table up and down automatically in order to find the top surface of the material being engraved. Auto focusing is complete once the table stops moving. To exit Auto-Focus press the ESCAPE button.

Keypad Menu System

MAIN MENU

After the system is powered ON, the laser systems model name will appear, along with the model version, copyright date, company name, and if the Universal Control Panel is not running, DISCONNECTED will be displayed. After the Universal Control Panel is launched and after a few seconds pass it will home to the upper right corner. The display on the keypad will automatically change to the main menu which will display the last printed file, FILE, XY, and Z. If a file is sent to the laser system for cutting or engraving the display will change with the Color, Power, Speed, and PPI settings of the file.

FILE

This menu appears automatically after the first file has been sent to the laser system. Utilizing the LEFT or RIGHT buttons while on the File Name (A) displays the appropriate downloaded file and pressing the START button will begin laser processing. Utilizing the UP and DOWN buttons allow you to scroll through the File Name and timer (A), Color (B), Power (C), Speed (D), and PPI (E). The Power, Speed, and PPI of the file being engraved can be changed, on the fly, by pressing the LEFT and RIGHT buttons as the file is being processed. The timer will pause when the PAUSE button is pressed and starts up again when PAUSE is pressed.



XY

This menu displays the current position of the focus carriage according to the engraving table rulers and allows you to move the focus carriage back and forth and left to right.

Z

This menu displays the current position of the engraving table relative to the inside base of the laser system and allows you to move the table up and down.

Printer Driver Controls

This part of the section describes the use of the Materials Database Tab of the printer driver.

Materials Database Tab

This tab of the printer driver is for the beginning user and requires little knowledge about the laser system.

Category List

This section allows you to choose from 8 original types of material categories.

Material List

Once you choose a category a variety of material types will appear to the right of the category section.

Intensity Adjustments

Intensity Adjustments give you the opportunity to change the intensity of your Raster Engraving, Vector Marking, and Vector Cutting. The default settings are set to 0% but they can be changed from -50% to +50%. Increasing the settings increases the intensity of the engraving process giving you deeper results. Decreasing the intensity decreases the engraving process and gives you shallower results. Always start at 0% on a scrap piece of material and make any appropriate changes accordingly. There is not need to make changes to these controls only if undesired results are produced.



Air Assist

If you have the Air Assist accessory on the laser system you can activate it through this option. You are able to turn on Air Assist for Raster Engraving, Vector Marking, and Vector Cutting. If you activate this feature adjust the air flow according to your desired results. If the laser system does not come equipped with Air Assist turn **OFF** the feature.

Material

The NEW button allows you to add a custom Category and Material to the printer driver. The EDIT button gives you the opportunity to modify the selected Material by creating a copy of the original.

NOTE: This part of the Materials Database requires you to have knowledge of the Manual Control features. You can learn about the Manual Control Tab in Section 9 of this manual.

Material Editing

This feature gives you further control over the Materials Database and has similar features as the Manual Control Tab in the printer driver (Section 9). Custom categories and materials can be added and deleted. They can also be modified to your specific requirements. Once you have added the new material the printer driver will add the new material to the list. This new material will be available for you to use for future jobs.



To access this window you will need to select a current category or material and click the NEW or EDIT button. The Materials Editing window and the Manual Control Tab have similar features. You can refer to Section 9-4, Manual Control Tab, for further explanation on these features.

Material Code

The Material Code box will automatically be made when making a new material and category. You can add a custom Material Code from 9000-9999 if desired.

Taper

This drop down menu is activated when Print Mode is set to Rubber Stamp. This feature is similar to the one in the Raster sub-tab for Rubber Stamping.

3D Power

This button can be activated by setting the Print Mode to 3D. This feature can be modified similarly to the Raster sub-tab for 3D.

Vector Marking - Blue Pen

These settings are similar to the ones on the Raster Sub-Tab under the Manual Control Tab.

Vector Cutting - Red Pen

This section of the Material Editor window allows the user to input preliminary numbers for the Material Editor to properly calculate future power and speed settings. To properly configure the Vector Cutting - Red Pen section you will need to vector cut 2 materials in the laser system so the Material Editor can calculate the appropriate percentage amounts for different thicknesses.

If the material being added to the Material Editor can be vector cut check the empty box called "Material Can Be Vector Cut" and input the percentages it asks for.

The Shallow Cut Settings and Deep Cut Settings sections are similar to one another. First measure two identical material types but of different thicknesses for example a 1/8" piece of acrylic and a 1/2" of acrylic. Input the thinnest material measurement in the Cut Depth box of the Shallow Cut Settings. Next, type in the thickest material measurement in the Cut Depth box of the Deep Cut Settings section. The Power and Speed in both settings refer to the least amount

of percentage power required to cut through the material without causing undesired results. You may have to experiment with this section several times to get the exact results you desire.

Max Depth

The number inputted in this box refers to the maximum thickness you would like the laser system not to cut.

PPI

Available settings are 1 to 1000. For further explanation about this setting read Section 9-4.

Shallow Cut Settings

These parameters set the starting point for the Printer Driver's Material Editor.

Deep Cut Settings

These parameters set the starting point for the Printer Driver's Material Editor.

How to create a new Category and Material

In order to create a new Category and Material you need to have your Materials Database Tab active. Select one of the existing Categories on the left and click on the NEW button. The Material Editing window appears. From the Category drop down menu list on the left select ****New Category**. The Material Category window appears allowing you to type a name of the new category in the blank space. A Category ID (900-999) will automatically be assigned once a new category is made. Click on the OK button. Once a category is made you can add a material name to the new category by typing in a name in the Material Name blank area. Once that is done you can make your necessary modifications to each area in the Material Editing window. To save your new category and material you must click the APPLY button then click the CLOSE button. If you click the CLOSE button your changes will not be saved in the Materials Database Tab.

To verify that your new category and material have been made you will be able to see your new category on the left hand side of the Materials Database Tab. Click once on your new category and your new material will appear to the right of the Category list. Select your new material, make your necessary adjustments on the Materials Database Tab and click the OK button. Turn on your laser system and start the Universal Control Panel and print your job.

Which Laser? (PLS6.150D only)

If you would like to only use the top or bottom laser tube to engrave or vector cut select from TOP or BOTTOM. If you only purchased one laser tube, select the appropriate laser tube according to the set up of your laser system. If you would like to use both laser tubes for your project select both boxes.

Material Thickness

In order for the laser system to properly vector cut and/or engrave on the material it needs to know the thickness of the material before it starts engraving. Using a caliper or similar measuring device, measure the thickness of your material and enter it into the Material Thickness box.

Units

This section allows you to switch between Metric and Inches.

Fixture Type

None

If you are not using any type of fixture set the drop down menu to NONE.

Rotary

If you have purchased this accessory read how to install and operate this fixture in the ASSECCORIES section of this manual.

Custom

If you prop up the material you are going to engrave on a surface other than the table provided, you will need to add the height of the prop in the Custom Height field.

NOTE: The Materials Database is meant for the novice and beginning user. As a user operates the laser system and understands how it works he or she may edit the existing Materials Database for further control. Editing the Materials Database is not necessary but you can add many different materials to the existing database if desired.

If you would like to use the Manual Control Tab refer to Part 4 - Advanced User for further information.

Section 7

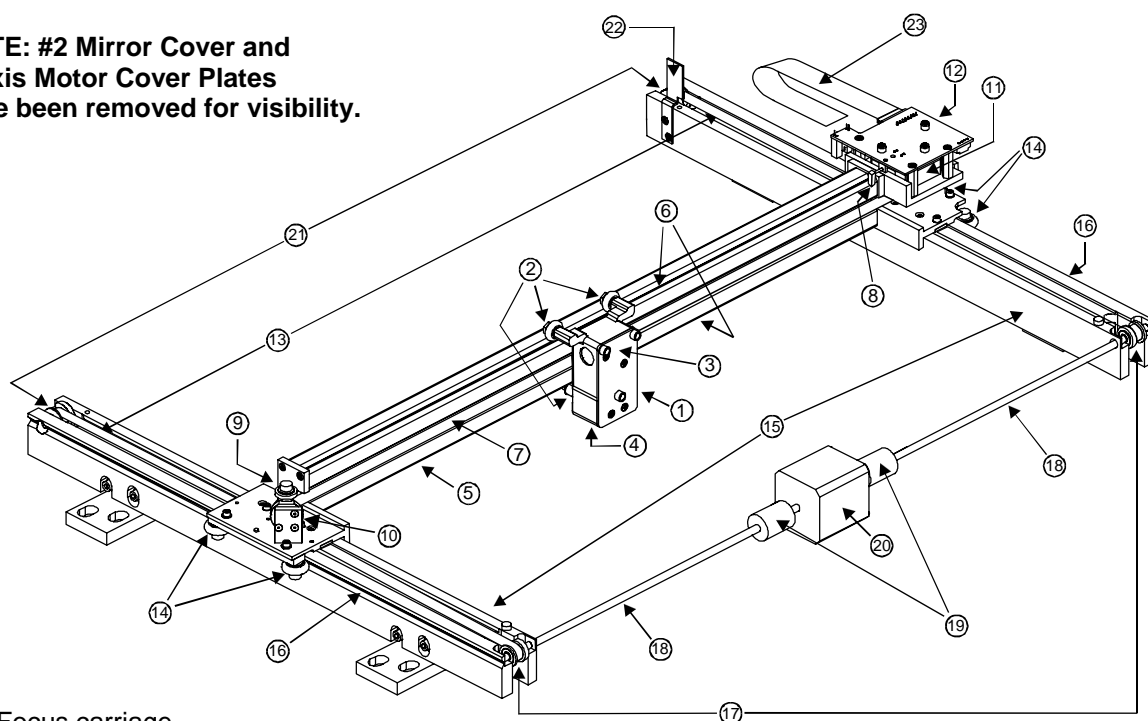
Basic Maintenance



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

Motion System Components Diagram

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



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

- 17) Y-axis drive gear (2) (one on right side, one on left side)
- 18) Y-axis shaft (2) (one on right side, one on left side)
- 19) Y-axis shaft flex coupler (one on right side, one on left side)
- 20) Y-axis motor
- 21) Y-axis idler pulley (2) (one on right side, one on left side)
- 22) Y-axis home sensor flag
- 23) Flex cable

Cleaning and Maintenance Supplies

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

CAUTION

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

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

System Cleaning and Maintenance

Motion System

- Turn off and unplug the laser system.
- Open the top door and thoroughly remove all loose dirt and debris from inside the machine with a vacuum cleaner.
- Clean the engraving table surface with either a soap solution, or alcohol or acetone, and paper towels. **NEVER** pour or spray any solution directly into the laser system. Always dampen your paper towel or cloth outside of the machine with the cleaning solution and then wipe down the parts you are cleaning with the dampened cloth.
- Clean X-rail and the Y-rails by using either the cotton swabs or paper towels, and alcohol or soap solution. Pay close attention to the bearing tracks since any debris left to build up in these bearing tracks will cause the bearings to wear and the engraving quality to become rough.
- After the rails and tracks are cleaned, use a clean swab or paper towel, and alcohol to clean all of the bearings by holding the swab against each bearing and moving the motion system by hand to roll the bearings against the swab. There are seven bearings in the system, three (3) on the focus carriage, two (2) on the left side of the X-rail, and two (2) on the right side of the X-rail.

The Main Enclosure

- Clean the top window with a cotton cloth or paper towel and window cleaner. The top window is made out of glass; therefore, **DO NOT** use abrasive cleaning clothes because they will scratch the glass. Also, **DO NOT** use abrasive chemicals as these chemicals will damage the glass. Only use cleaners compatible with glass.
- Use a soft cloth or paper towels and the soap solution to clean the enclosure. **DO NOT** use alcohol, acetone, or any other harsh chemical, as this will damage the paint.

Optics

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

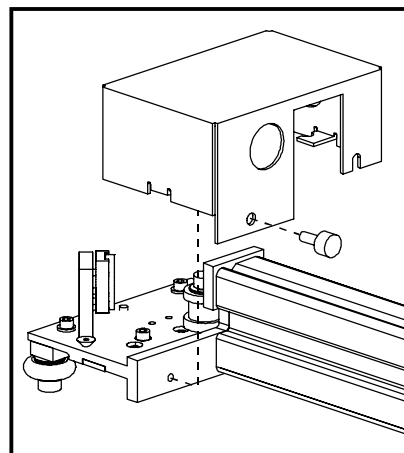
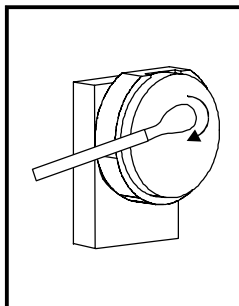


DO NOT clean an optic that is visually clean. Excessive cleaning can damage the optic. To prevent contamination, wash your hands thoroughly before cleaning any optic. **NEVER** touch any optic with your fingers. The acids from your skin can destroy the optical coatings. **NEVER** clean any optic right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

#2 Mirror

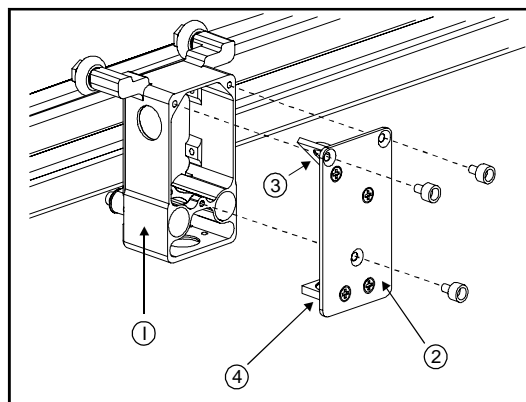
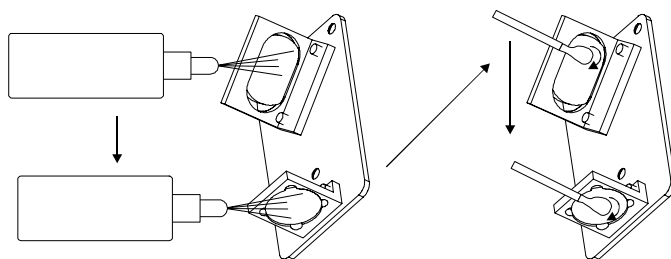
To gain access to the #2 mirror, the mirror cover must be removed. Remove the thumbscrew and slide the cover to the right and then lift the cover straight up.

Inspect the #2 mirror and clean it only if there is debris present. To clean the #2 mirror with a cotton swab, moisten the cotton swab with the lens cleaning solution supplied with the laser system. **DO NOT** use other types of cleaners or solutions. Gently roll the cotton swab across the mirror once. **DO NOT** drag the swab or roll it back and forth as this can scratch the mirror. If the mirror did not come clean, use a fresh cotton swab and repeat the procedure. Do not be concerned about small pieces of lint that come off of the cotton swab. They will be vaporized as soon as the laser hits it. You can cause more damage to the mirror by trying to remove the lint than by leaving it alone.



#3 Mirror and Focus Lens

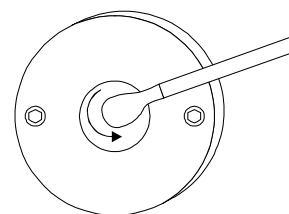
To gain access to the #3 mirror (3) and the focus lens (4), hold the front cover (2) with one hand, and remove the three thumbscrews with the other hand. Pull the front cover straight out. The #3 mirror and the focus lens are both mounted to the front cover.

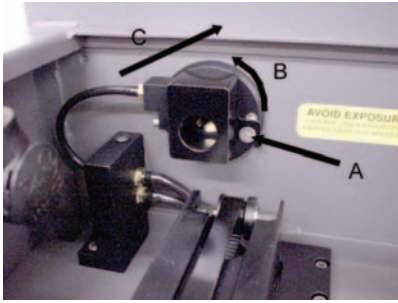


Tilt the front cover enough to enable you to apply the lens cleaning solution directly to the #3 mirror and to the focus lens. Flood the reflective surface of the #3 mirror with the solution. If heavy debris is present, let the solution soak in for a minute. Roll a fresh cotton swab across the mirror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

Beam Window

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

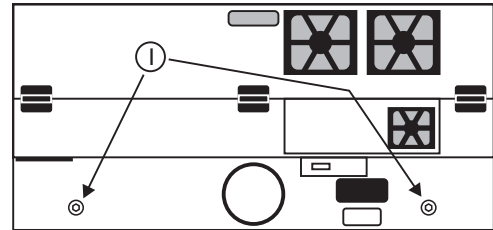




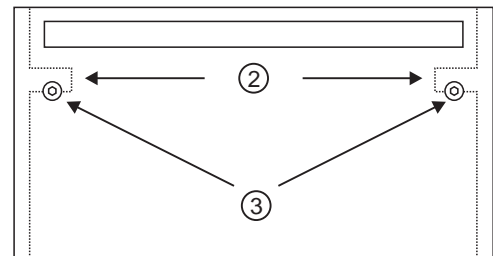
If your system is equipped with Air Assist, using your fingers, rotate the beam window cover counter-clockwise (B) and then off at a 45-degree angle (C). If the beam window cover is stuck use a 1/16 Allen wrench to loosen or remove the screw (A) and try again. Set the cover off to the side and clean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

Exhaust Plenum Cleaning (PLS3.75 and PLS 4.75)

- Power the laser system and UCP 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.



Back View

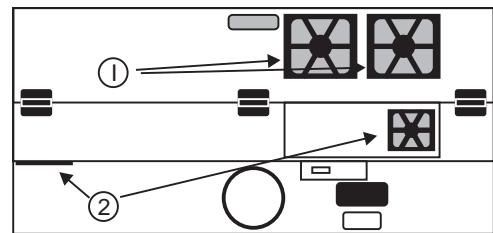


Inside Front View

NOTE: The PLS6.75's and PLS6.150D's exhaust plenums are removed in the same fashion but these two laser systems come with two exhaust plenums.

Cooling Fan Filters (PLS3.75 and PLS 4.75)

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



Back View

The cooling fan filters are located on the back of the laser system. To service the filters, first turn OFF and unplug the laser system. There are two large filters (1) and two small filters (2). To remove the filter(s), simply snap off the black cover and remove the foam element. Wash the element in a soap and water solution, dry, and re-install.

NOTE: The PLS6.75 AND PLS6.150D has a total of 6 filters. Four large and one small filter(s) located on the back, and one large filter located on the side near the power switch.



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

Adjustments and Lubrication

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

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

Maintenance Schedule

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

As a starting point, we recommend the following schedule:

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

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

Part 3- Accessories

Section 8

Accessories



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



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

Air Assist

The Air Assist System consists of a nozzle that attaches to the focus carriage, Optics protection adapters, tubing, mounting brackets, needle valve, and pressure gauge. The purpose of this system is to force air or other types of gases directly onto the surface of your material to reduce the burning effects of the laser beam and helps disperse the smoke and gases created when cutting or engraving materials. The optics protection parts assist in helping keep the optics cleaner from flying debris created from the pressurized nozzle. Use of this system requires a minimum compressed air source capable of 60 PSI @ 2.5 cfm. This supply **MUST** be free from oil, water, and particulate matter. Another accessory called the “Air Assist Compressor”, can supply this source.

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

Standard and Computer Controlled styles

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

Requirements (both styles)

The Air Assist option requires compressed air supplied from the Air Assist Compressor Unit (optional) or from a user supplied compressed air source. If you choose to provide your own source, it must be capable of supplying 60 PSI (pounds per square inch) at a constant rate of 2.5 CFM (cubic feet per minute). **The air supply MUST be oil-free, moisture-free, and particulate filtered.**



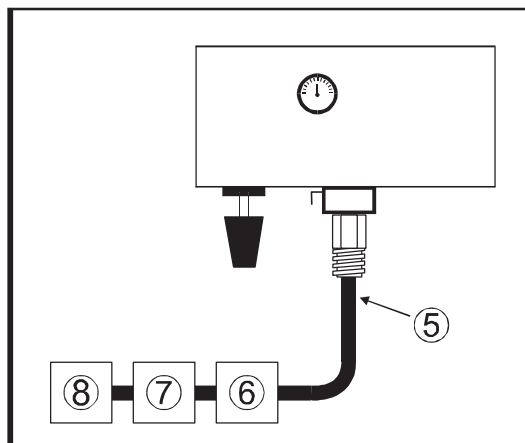
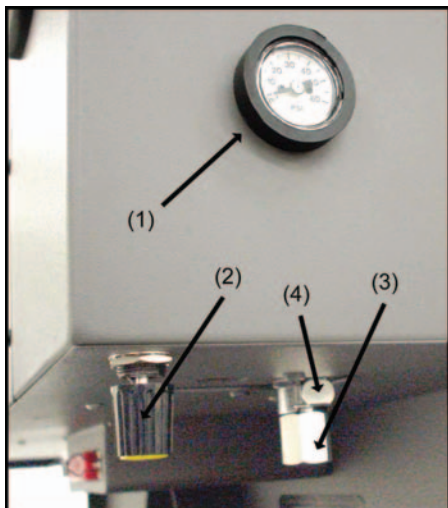
A contaminated air supply will cause severe damage to the laser system.

Air or gas supply pressures higher than 60 PSI can rupture the internal hoses of the control box and can possibly damage the valves.

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

Making the Connections

Standard Air Assist style



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

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

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

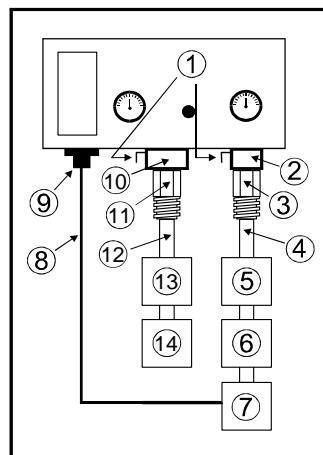
Computer Controlled Air Assist style

In the left rear part of the system you will find the Air Assist control box. Attached to the box (not shown in picture) there should be two special quick release couplings secured with plastic tie wraps (1). Using a pair of scissors or wire cutters, cut off the plastic tie wraps and discard.

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

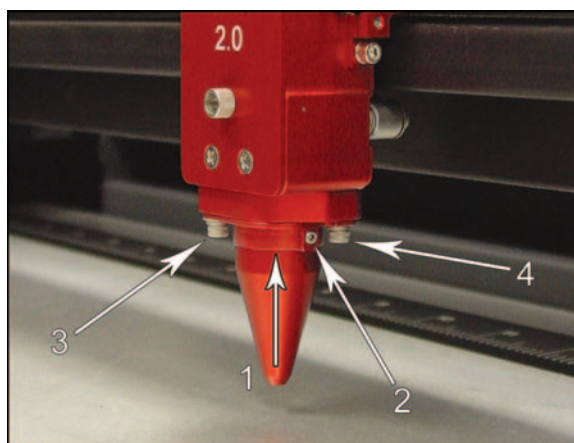


Locate the locking lever (1) attached to both fittings. Push in the lever until it clicks. Attach the larger quick release coupling (3) (1/4 NPT threads) to your compressed air supply line (4). Use Teflon tape on the threads to prevent leaks. Push the quick release coupling (3) into the fitting (2) until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



Cone Installation and Removal (both styles)

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

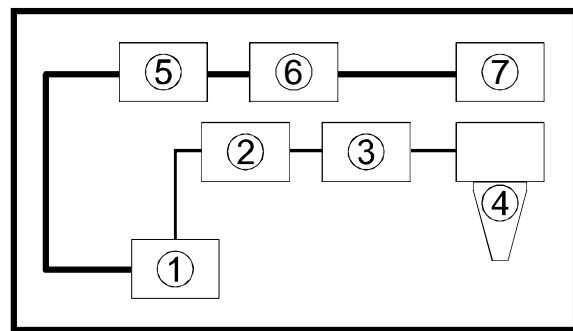


DO NOT install the cone unless you plan on using Air Assist. Leaving the cone attached to the cone base and running the laser system without either air or gas flowing through the cone will destroy the focus lens within a few minutes. If you are not using Air Assist, **REMOVE THE CONE**. Damage of this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

How it Works

Standard Air Assist

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



The control box also has built in pressure sensors that will detect insufficient supply pressure and will shut down the laser system. An error message, "The air pressure is low or unstable" will appear on the computer monitor, indicating that there is a problem with your supply of either air or gas.

Programming the PC Printer Driver

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



Windows XP printer driver

Power up your PC and open up or create a graphic to print to the laser system. When ready to print, go to the laser system printer driver and set all of your parameters. After selecting a color, choose which pathway you desire by selecting from "OFF", "AIR", or

"GAS" from the dropdown list for the "Flow" option which is on the right hand side of the printer driver.

Choose the rest of your parameters and send the file to the laser system. Make sure the cone is installed. Insert your material into the laser system and set the focus by using one of the focus methods in Section 9-17. Make sure that your air and gas supplies (if using) are ON. Turn on your exhaust blower and press the START button.

Air Flow Setting Guidelines (both styles)

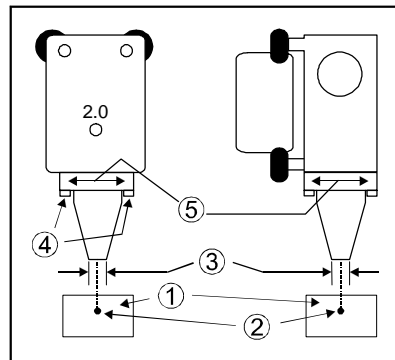
Use as much or as little air flow necessary to produce the desired results. There are no particular settings that we can offer to you. As a rule of thumb, start with low flow and adjust upward until flaming is suppressed. Setting the flow too high can result in excessive particulate matter being blown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

Maintenance (both styles)

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

Cone Alignment Check and Adjust (both styles)

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



Air Assist Compressor

The Air Assist Compressor option is a 60 PSI @ 2.5 cfm source for oil-free, water-free, and particulate matter-free compressed air. It contains a sound insulated air compressor, water dryer (desiccant), and coalescent particulate filter. This compact and custom designed unit is a great compliment to the Air Assist System option.

Installation

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

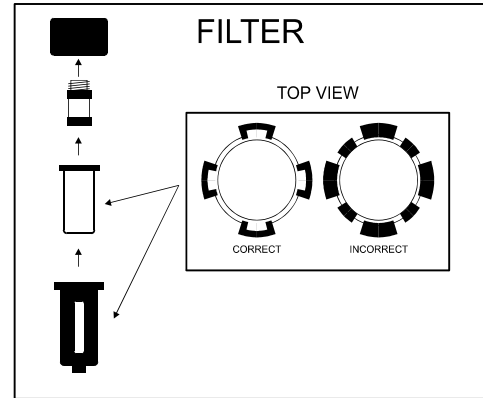
Maintenance

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

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

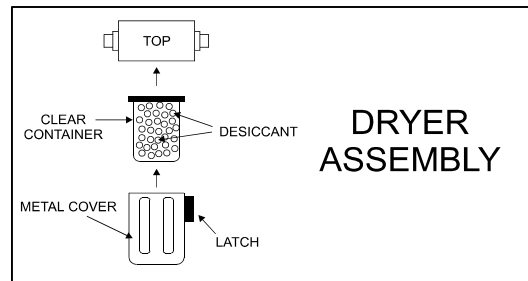
Removal, Cleaning, and Replacement of the Filter

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



Removal, Cleaning, and Replacement of the Desiccant

- Turn the Air Compressor OFF and unplug it.
- Pull down on black lever and rotate metal cover 1/8 turn counterclockwise. Remove the metal cover by pulling it straight down.
- With a gentle and slight twisting motion, pull the clear container downward slowly. Pour out and discard old desiccant.
- Refill clear container with fresh desiccant from a sealed bag. Fill to about 1/4 inch from top of container.
- Clean off rubber o-ring on the top of the container.
- Insert container up into the top.
- Install metal cover and turn 1/8 turn until lever clicks into place.



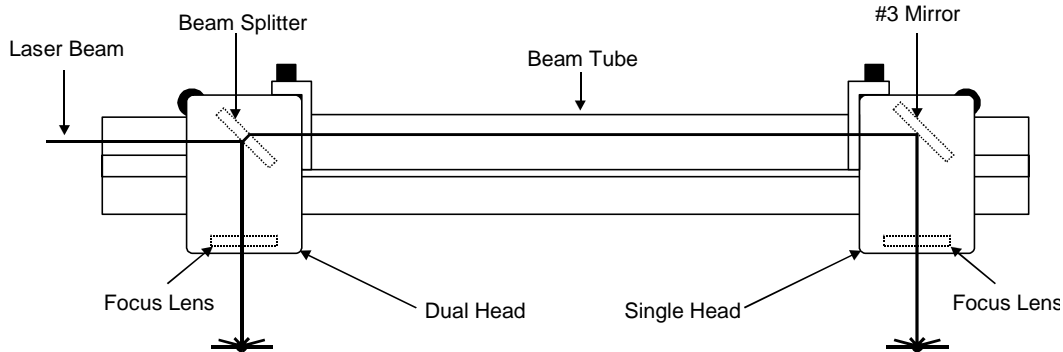
Dual Head

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

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

How it Works

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



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

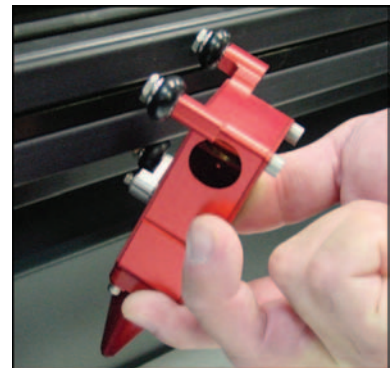
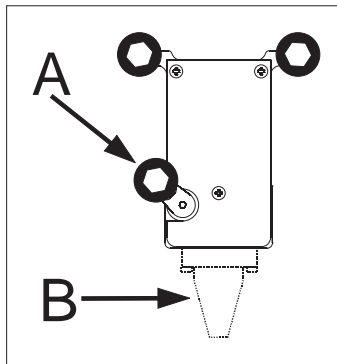
Installation

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

- If your laser system is not off right now, turn it **OFF**.

- **The Dual Head will be installed to the left side of the single head.**

Pick up the Dual Head assembly and note that the lower X-axis bearing pivot arm should be in about the 10 o'clock position (A) (from the backside view, and 2 o'clock from the front side.) Starting with the Dual Head rotated about 30-45 degrees clockwise and tilted back towards you, slightly position the lower X-axis bearing in the lower bearing track of the X-axis rail. Gently pull up on the Dual Head while turning it counter-clockwise back to the 0 degree position and “hooking” the top two X-axis bearings into the upper bearing track of the X-axis rail.

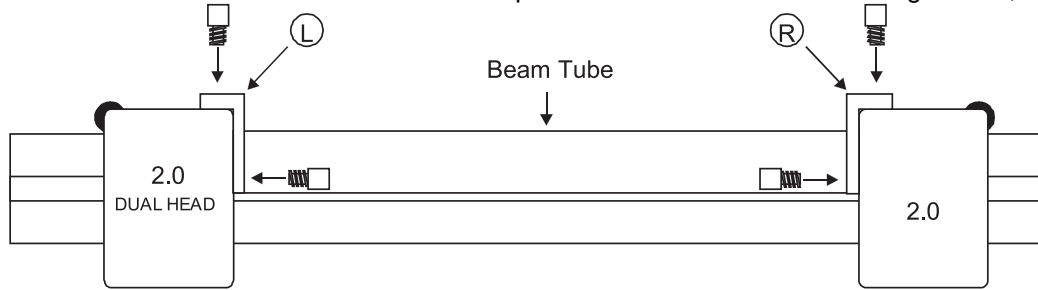


- Verify that all three bearings are in their respective track. Gently push the carriage to the left and then back to the right. It should roll smoothly, if not, verify and/or re-install the Dual Head.

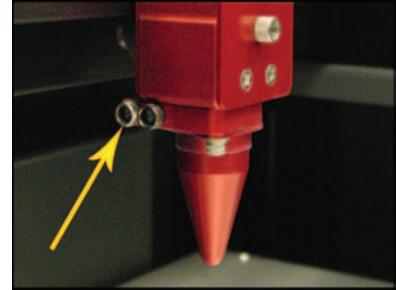
NOTE: B in the above image shows the Air Assist version.

ACCESSORIES

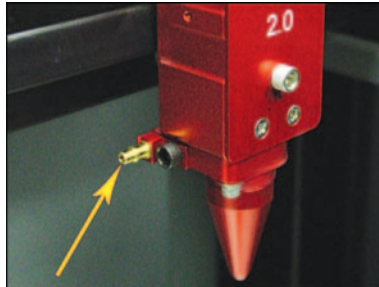
- If there is a button head screw located on the top of the Dual Head and or the single head, remove it.



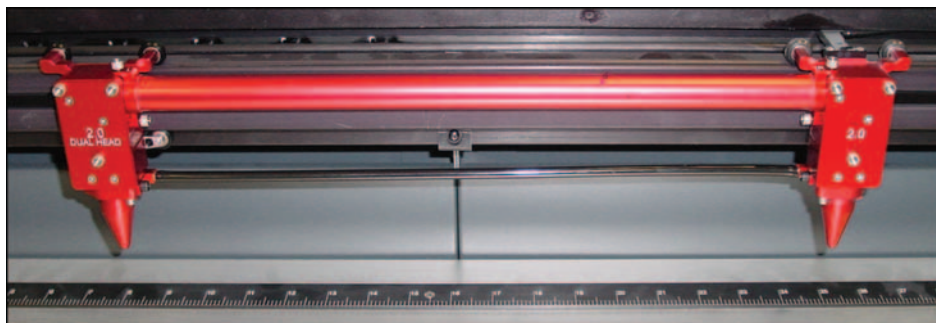
- Pick up the Dual Head tube and note the "L" (Left) and "R" (Right) markings. Install the tube using the supplied thumbscrews and tighten securely.
- If you have the Air Assist option, locate the 1 (one) black thumbscrew on the side of the Single Head. This thumbscrew serves two purposes, it blocks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



Brass Tube with bracket



- Remove the thumbscrew from the previous step and attach the end of the air hose to the single head by inserting the brass tube with bracket into the hole where the thumbscrew was removed. Attach the thumbscrew into the other threaded hole (right next to the original hole), and tighten securely.
- Installation is now complete. Turn the laser system ON.



- Open the top door to illuminate the Red Diode Pointer. You will notice that the Single Head's red dot will be brighter than the Dual Head's red dot. This is because the Beam Splitter, inside the Dual Head does not reflect/pass visible light at a 50/50 ratio. Using the Motion Control buttons, position the Dual Head all the way as far as it will go into the upper left corner of the engraving area (0,0). It should be relatively close to (0,0) with $\pm 1/16^{\text{th}}$ of an inch. Now observe the position of the Single Head red dot. This is the (0,0) position of the second object and your reference point for placing your material.

Operation

NOTE: In the following example, we will assume that your laser engraving system is a PLS4.75 that has a maximum engraving area of 24" x 18" Landscape mode.

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

Removal

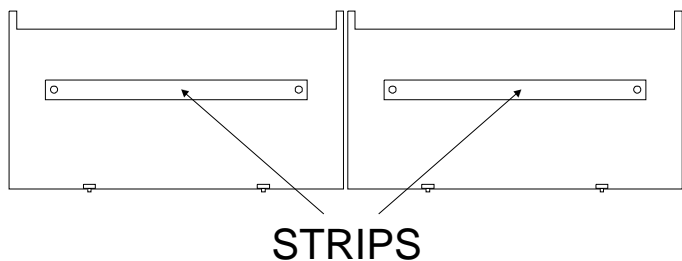
When finished using the Dual Head, you must remove the option opposite of its installation. In the printer driver, uncheck the "Dual Head" option. If you have the Air Assist option, remember to put the black thumbscrew back into its original hole. This will prevent the loss of air pressure in the cone of the single head.

Honeycomb Cutting Table

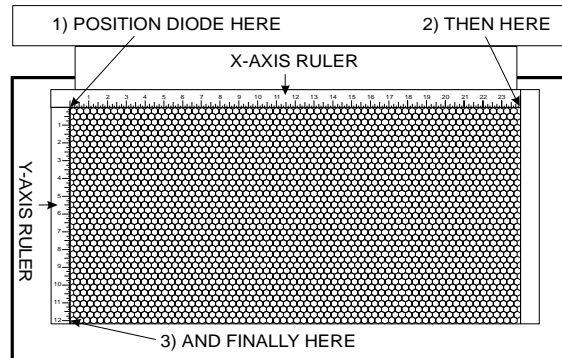
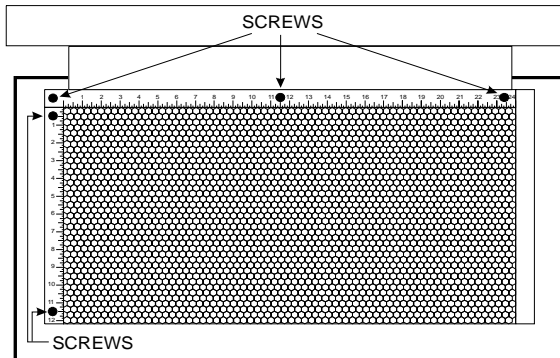
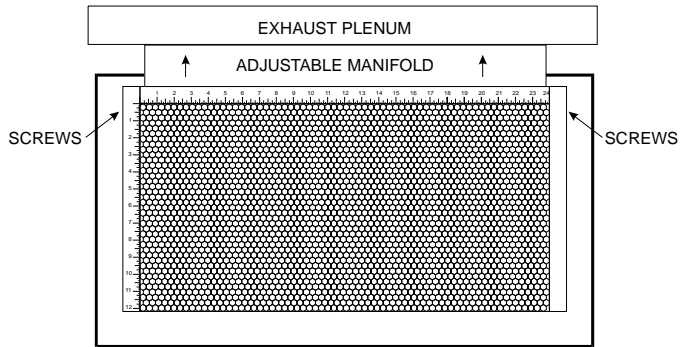
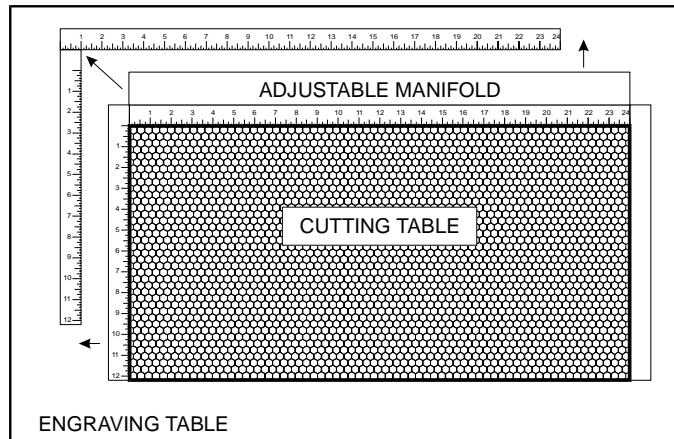
The purpose of the Honeycomb Cutting Table is to support the material that you are cutting off of the engraving table's surface to minimize surface contact area. It also redirects exhaust airflow below and above the material for better smoke removal. The cutting table is installed directly on top of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

Installation

1. Turn on your PLS machine.
2. Lower the table down all the way down.
3. Remove the strip(s) from the exhaust plenum(s) with an Allen wrench. **There is one (1) exhaust plenum on the PLS3.75, PLS4.75, and PLS6.75 models and two (2) on the PLS6.150D model (as the diagram indicates).**
4. Before installing the cutting table into the laser system, loosen the screws, without removing them, on the side of the cutting table, just enough to allow the adjustable manifold to slide in and out. Extend the adjustable manifold out as far as it can go.



5. Open the front door of the laser system and carefully slide the cutting table into the laser system so that its body is squarely pushed up against the engraving table rulers on the top and the side of the table. The rulers of the cutting table should now overlap the rulers on the engraving table.
6. Slide the adjustable manifold squarely up against the exhaust plenum and tighten the four (4) screws on the side of the cutting table. Be careful not to move the cutting table while tightening the screws. The objective is to have the cutting table fit snugly up against the rulers of the engraving table and the adjustable manifold fit tightly against the exhaust plenum.
7. We now need to adjust the rulers of the cutting table so that they match the engraving field of the laser system. Using the focus tool method (Section 9-17), adjust the Z Axis and focus directly onto the surface of the honeycomb.
8. Loosen slightly, but do not remove, the five (5) screws that hold down the rulers.



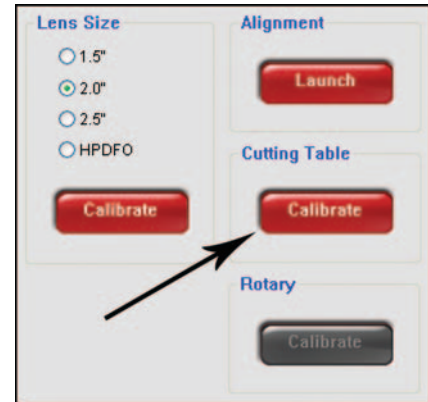
9. Activate the red diode pointer by opening the top door. Position the focus carriage at (0,0). With the red diode pointer still ON, slide the X-axis ruler so that its zero (0) point lines up with the red diode pointer and tighten down the left side screw.
10. Now position the red diode pointer at the (32,0) position for the PLS6.75 and PLS6.150D series machines or (24,0) position for the PLS3.75 and PLS4.75 series machine. Adjust the right side of the X-axis ruler until it is lined up with the diode. Tighten down the right side screw of the X-axis ruler. Now tighten down the middle screw.
11. Line up the right edge of the Y-axis ruler with the zero (0) line of the X-axis ruler and tighten down the top screw of the Y-axis ruler.
12. Finally, position the red diode pointer at the (0,18) position for the PLS6.75 and PLS6.150D series machine or the (0,12) position for the PLS3.75 and PLS4.75 series machine. Align the bottom of the Y-axis ruler with the red diode pointer and tighten down the bottom screw of the Y-axis ruler. The cutting table is now installed but lens calibration is needed.

Focus Lens Calibration



To properly use the Honeycomb Cutting Table you **NEED** to calibrate your focus lens to the top of the Honeycomb Cutting Table surface. If you do not calibrate the focus lens the focus carriage may cause damage to your Honeycomb Cutting Table and focus carriage.

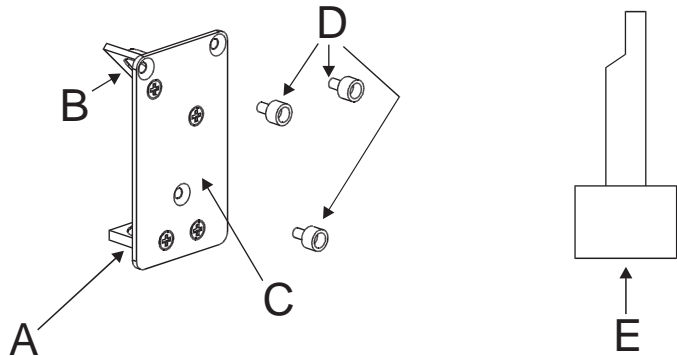
13. After you have installed the Honeycomb Cutting Table into the PLS, manually focus to the Honeycomb Cutting Table surface by following the Focus Tool Method instructions in Section 9-17.
14. Once that is complete, go directly to your System Tab of the UCP and you will notice that the red CALIBRATE button for the Cutting Table box will be activated. Click on the CALIBRATE button. A window will appear. To accept the new Z-height click on SAVE. You are now done calibrating the new Z-height for engraving or cutting on the Honeycomb Cutting Table.



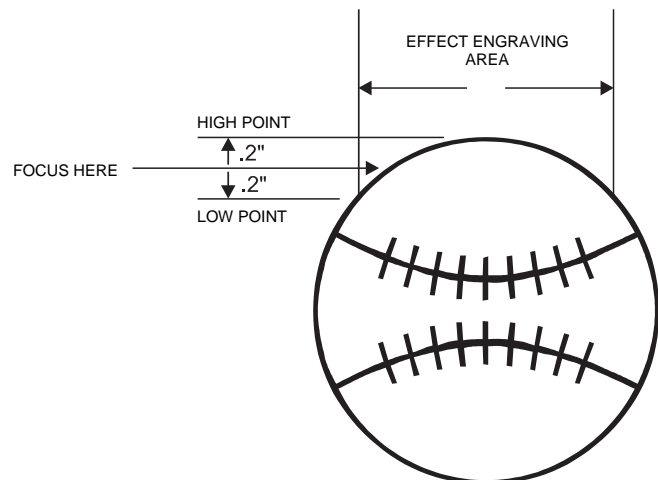
When removing the cutting table, lower the engraving table and slide the table out of the front door. Re-install the exhaust plenum strip(s). As long as you followed the installation instructions exactly, it is designed so that you will **NOT** need to adjust the adjustable manifold or the X or Y-axis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

Focus Lens Kits

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



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

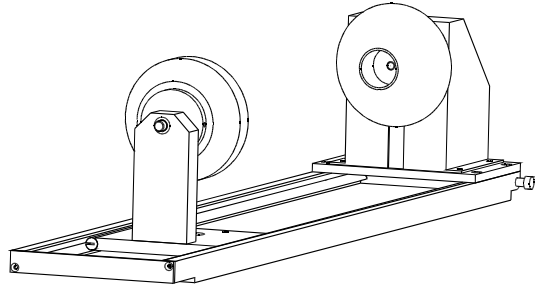


Refer to the following chart for spot sizes and focal ranges of the lenses available.

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

Rotary Fixture

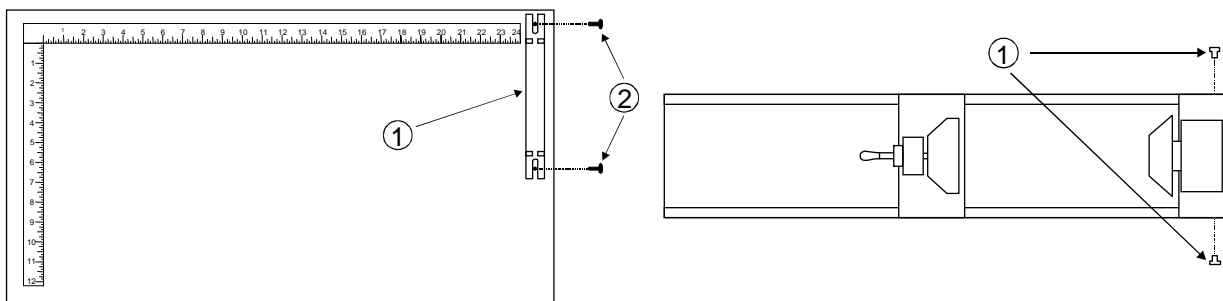
The Rotary Fixture has been designed to engrave cylindrical objects. Two attachments come with the fixture, a cone shaped disk attached to the motorized end of the fixture and an inverted cone shaped disk attached to the adjustable end of the fixture. These attachments are used to hold wineglasses, mugs,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



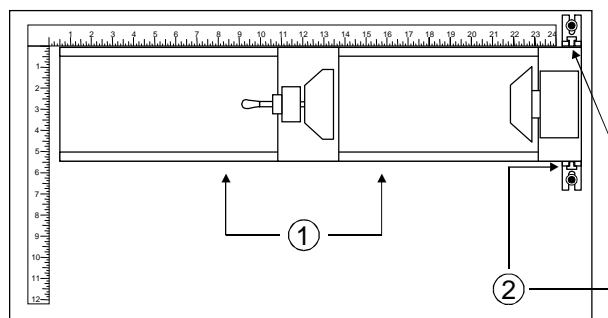
NOTE: These instructions apply to many different models even if your system has a smaller or larger field size. If the rotary is installed and mounted on the table in any other manner than the one mentioned below please contact the Technical Support Department for further instructions on calibrating the rotary.

Installation

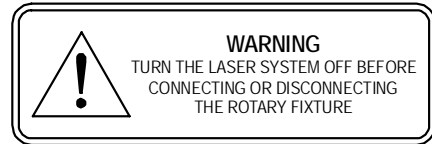
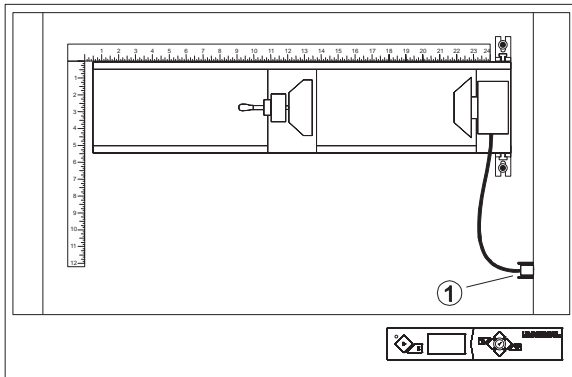
1. Turn the UCP and laser system **ON**.
2. Make sure AUTOFOCUS is **NOT** activated because the Rotary Fixture was not designed to work with AUTOFOCUS.
3. Remove any materials that may be underneath the engraving table and lower the table **ALL THE WAY** down to the bottom or at least far enough down so that the focus carriage will clear the top of the Rotary Fixture when it is installed on the table.
4. Now, turn the UCP and laser system **OFF**.
5. Open the top door. Place the bracket on the table (1). Insert the thumbscrews and washers (2) into the screw holes but do not tighten down completely. Leave the thumbscrews loose enough so that the bracket can slide.



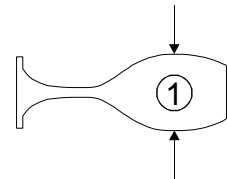
6. Place the Rotary Fixture on a flat surface. Using an Allen wrench, attach the two socket head shoulder screws (1) to the side of the base plate.
7. Place the Rotary Fixture on top of the bracket so that its pivot bolts set into the forks in the bracket. Gently push the fixture (1) flat up against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



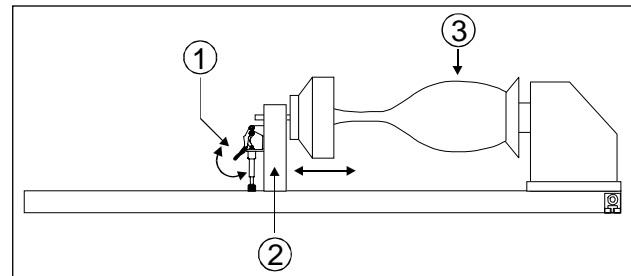
8. With the power to the system still **OFF**, connect the 7-pin Rotary Fixture control cable to the receptacle on the laser engraving system (1).



9. Before loading the glass into the fixture, measure the diameter (1) of the glass in the area where the engraving is to be located by using a caliper or similar measuring device. Either remember this number or write it down.

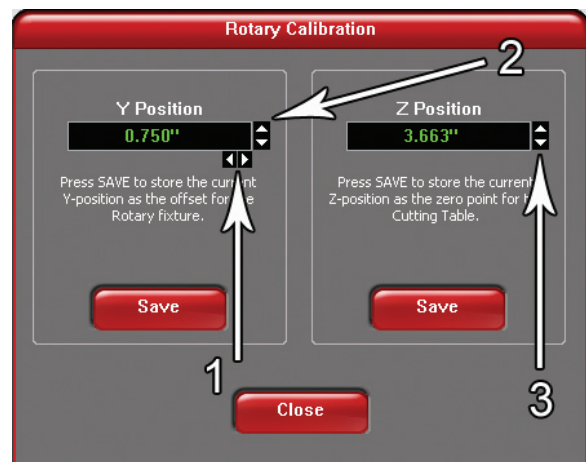


10. Place the open end of the glass (3) on the right side of the Rotary Fixture. Lift the lever (1) on the adjustable end of the fixture and slide it up against the base of the glass so the glass rests firmly centered inside of the inverted cone. Push the adjustable end of the fixture (2) to the right, firmly against the bottom of the glass. Do not apply too much pressure, especially with glass. You only need enough pressure to prevent the object from slipping on the cone while it rotates. Lower the lever on the end of the fixture to lock it in place.



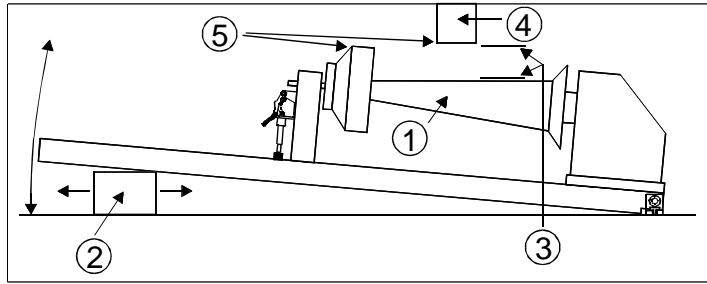
11. Power **ON** the laser system and wait for the display to show the Model #, copyright year, Universal Laser Systems, INC, and (DISCONNECTED). The rotary will run through a self test and will slightly rotate. This movement is normal. Next start up the UCP.

12. Select the System Tab and click on the CALIBRATE button in the Rotary box. After the button has been clicked a Rotary Calibration window will appear with Y Position and Z Position boxes. Now, in the Y Position box use the Y Axis buttons (2) to move the focus carriage back and forth. Place the focus carriage exactly at 2.625". Next, use the X Axis buttons (1) to move the focus carriage left and right and place the red LED over the flat part of the concave metal fixture normally located on the left hand side on the rotary. Now, use the Z Axis buttons (3) to move the table up and down and use the Focus Tool method (Section 9-17) to focus on top of the flat part of the concave metal fixture with the focus tool. **DO NOT** focus on top of the black metal cover that is located on the left hand side of the rotary. Ignore any mention to the MANUAL FOCUS POSITION feature and carefully focus on the top of the concave metal fixture using the Z-Axis buttons (3). After focusing is complete click both SAVE buttons on the Rotary Calibration window. Once complete click the CLOSE button and the focus carriage will re-home once you exit the window. Calibration is now complete.



The rotary option on the printer driver has to be set and the rotary has to be installed properly and calibrated in order for this accessory to function correctly.

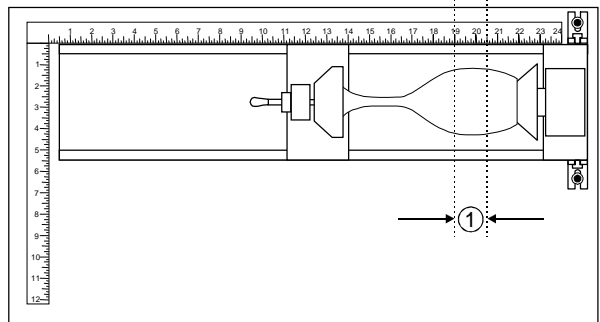
If engraving a tapered object (1), the Rotary Fixture can be rotated to maintain proper focus. To do this, lift up the left end of the fixture and place some sort of spacer underneath the fixture (2) to prop it up. Slide the spacer left and right until the surface of the object is parallel (3) to the Focus Carriage. Be careful not to raise the Rotary Fixture too high (5), otherwise parts of it might interfere with the Focus Carriage (4). **NOTE:** If you operate the fixture in this manner, you might need to taper your graphic in your software so that it matches the taper angle of your object. Otherwise, your graphic might appear to be tapered when it is engraved.



Determining Graphic Placement

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

To activate the Red Diode Laser Pointer, open the top door, if it's not already open. Using the MOTION CONTROL buttons on the PLS keypad, position the Focus Carriage above the glass and observe the Red Diode Lasers position by entering the XY menu. Stop movement where you would like the top of the graphic (the right dotted line in the engraving area) to begin. Look at the XY menu and read the "X" position. Remember this number or write it down. Ignore the "Y" position. Now, position the red dot at the lowest point (the left dotted line in the engraving area) on the glass where you would like the engraving to end. Remember this "X" coordinate or write it down.



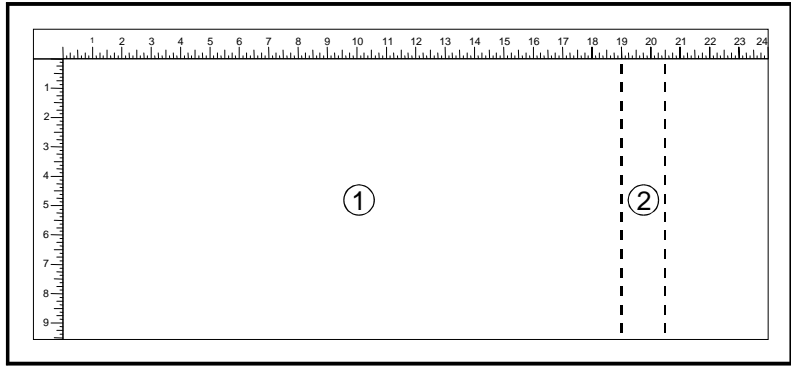
In this example our upper limit is about 20.500" and the lower limit is 19.000". We have now set up the glass to be engraved. Close all doors of the laser system, go to your computer, and open your graphics software.

Printer Driver Settings

With your graphics software open, proceed immediately to "Printer Setup" and open the printer driver. In the printer driver, click on the Engraving Field sub-tab within the Manual Control Tab, and set to the maximum field size of the laser system in the Engraving Field section by typing in the size or clicking on the "Max Size" button. In this example, we will set it to 24 x 12 inches. Then, click on the "Enable" selection box in the Rotary section and type in the diameter of the glass that was measured. Do not change the "Rotation Factor" number unless it needs to be changed or calculated the number according to Section 9-16.

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

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



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

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

Rotary Fixture Removal

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

Part 4- Advanced User

Section 9

Advanced System Operation



From the Universal Control Panel menus and buttons to focusing, loading and unloading materials, this section covers the actual laser engraving and cutting process for the advanced user.

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.

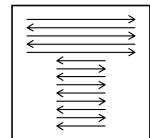
Outline: The line that defines the shape of a vector graphic.

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

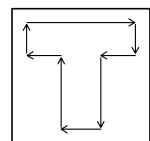
Motion System: The mechanical/electrical system that delivers the laser beam by moving the focusing lens directly above the application material.

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 in the Manual Control Tab, 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.

Manual Control Tab

The Manual Control Tab in the printer driver gives you full control of the engraving and vector settings. This tab of the printer driver is meant for the advanced user.

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, plus (+) or minus (-) buttons, 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%. 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.

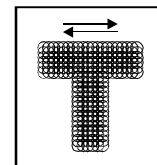
% Power and % Speed work together in determining how deep the engraving or cutting will be. Higher power and slower speeds produce deeper results. Lower power and higher speeds produce shallower results.

NOTE: 100% raster speed is different than 100% vector speed. Due to the inertia of the X-axis arm, movements in the Y-direction, and also depending on which model you have, vector speeds will range from one-third to one-half the maximum raster speed.

PPI

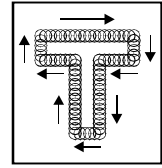
Available settings are 1 to 1000. The laser beam is always pulsing and never "on" continuously even though it may appear that way. The PPI setting indicates how many laser pulses, per linear inch, the laser cartridge will emit. The pulsing of the laser beam is electronically linked to the motion system. 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.



Mode (drop down menu)

The driver uses the word "MODE" 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, and Flow (computer controlled air assist models only) 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.

Selecting the appropriate color and clicking the drop down menu 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.

Laser (drop down menu) (PLS 6.150D only)

If your system comes equipped with more than one laser tube you are given the choice of using either both laser tubes or a single laser tube (Top or Bottom). If your laser system has one laser tube, select the appropriate laser tube according to your laser system setup.

Z-Axis (drop down menu)

This control on the Printer Driver lets you offset the Z-axis table from the current focal point. When the feature is turned on and a height is set the table lowers the height entered and starts engraving. This feature can be used as a Material Thickness focusing method as mentioned on Section 9-18 of the manual.

Flow (drop down menu)

If your system **DOES NOT** have the Air Assist option, you **MUST** leave the setting to OFF otherwise your system will hesitate up to 10 seconds after you press the start button on the machine. If you purchased the Air Assist option please refer to Section 8-7 for more detailed instructions on how to use the printer driver controls properly.

Flow Rate (drop down menu)

To control the Flow Rate of the Air Assist accessory the Flow on the drop down menu needs to be activated. The Flow Rate ranges from 0% - 100% in increments of 25%.

Set Button

After making % Power, % Speed, PPI, and any other adjustments for the Pen parameters you must click the SET button to register the changes. The changes will not be saved until the OK or APPLY buttons are clicked. If the CANCEL button is clicked after the SET button the changes will not be saved and reverted back to the previous settings.

Save Button

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 and you can have as many setting files as your disk can hold. Verify that you have clicked the SET button before you save any .LAS files to ensure you have properly saved your settings.

Load Button

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 Button

This button will reset the driver settings to the original manufacturer values.

Cancel Button

This button closes the printer driver window and takes you back to the previous window. If the SET, OK, or APPLY buttons were not clicked the changes will not be saved by the Printer Driver.

Apply Button

The APPLY button saves all changes made to the Manual Control Tab. These changes include any modifications made to the Raster, Vector, or Engraving Field sub-tabs.

Raster Sub-Tab

Print Special Effects

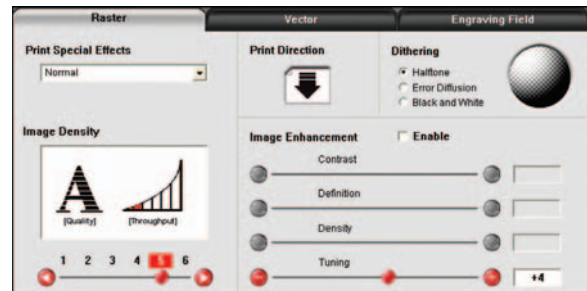
In this dropdown list, you can choose from 4 different printing modes, Normal (default), Clipart, 3D, and Rubber Stamp.

Clip Art

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 halftoned or diffusion dithered image does. To use the 3D feature in this method you must first set up a few things.

Choose Your Material

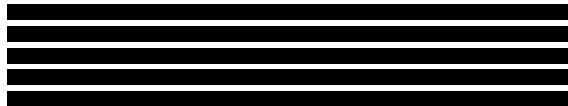
The best material to use is one that has the highest contrast such as black anodized aluminum, black marble, or black cored engravers plastic with a white micro surfaced coating. While other materials may work ok, they might not produce the highest quality.

Establishing Nominal Power

Choose your %Speed and your 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 in 5% increments 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.

Engraving a Calibration Scale

Now that you have established the nominal power setting, you will need to engrave a grayscale calibration scale. You can create one of your own or use the one provided for you which can be found on the Software Installation CD-ROM called “Calibration Scale.CDR”. This is a CorelDRAW 8 file so using versions 8 and higher will open the file.

The scale looks like this:



Each rectangle is .5 inches wide and .25 inches tall. Each successive shade of gray is incremented by 16 levels starting at 0 and ending at 255. The numbers below the scale are there as a reference to the 16 levels of power control (explained later) and do not need to be engraved if you do not want to.

You can also load a custom grayscale color palette into your CorelDRAW program. This file can also be found on your Software Installation CD-ROM and is named "ULS photo.cpl". Use this palette if you want to create your own calibration scale.

Engrave the calibration scale, onto your material, using the nominal power setting you established earlier. Compare it to the actual calibration scale that you see on screen or in this manual. If the response of your material to the laser beam was perfectly linear, then the result should look exactly like the calibration scale. Most likely you will find that several rectangles appear to have the same appearance of shading. The objective would be to engrave the calibration scale and produce a result that would appear as if each rectangle would have its own distinguishable level of gray, starting from white all the way to black. To help you achieve those results, the printer driver gives you the ability to calibrate the power level of each one of the rectangles. To access the feature, click on the "Setup" button.

Setup Button

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

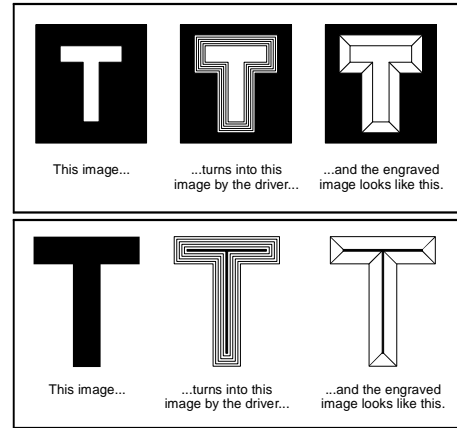
This closes the 3D Power Calibration settings window and cancels any changes you made to the scale if you didn't click the APPLY button.

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.

Setup Button

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.

Image Options

Invert Page

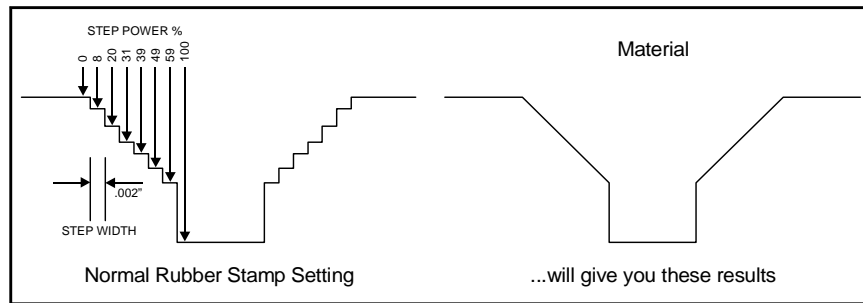
This converts all black objects into white and all white objects into black for the ENTIRE PAGE. This is very useful for engraving a full sheet of rubber stamps.

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.

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. In the Windows XP driver it is termed Image Density and there are 6 Image Density choices in all models. 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.

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.

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 halftone, 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.

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 unengraved 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:

Universal Laser Systems, Inc.

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 descenders 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:

Universal Laser Systems, Inc.

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 unengraved 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 +4. Yes, TUNING will be different if you have Image Enhancements enabled or disabled. Saving the printer driver settings will also save the TUNING value.

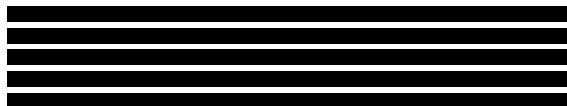
Procedure

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 in increments of 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 descenders (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 descenders.

Now, increase the DEFINITION in increments of 5 at a time until the ascenders, descenders, 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 descenders 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 +4 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.

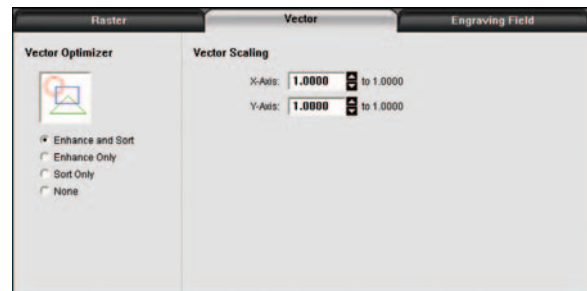
Setting the Image Enhancement parameters using this procedure will cause all of your graphics, whether big or small, inverted or not, dense or highly detailed, to appear better than ever. We suggest that you run this procedure for all your materials and save your parameters. This may sound like a big 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.

Vector Sub-Tab

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.



ENHANCE AND SORT

This turns on both features simultaneously.

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.

NONE

This selection turns off Vector Optimizer.

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.



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.

Engraving Field Sub-Tab

Units

This allows you to change between Metric and 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.



Engraving Field

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 Max Size button) and also set your graphics software programs page size to match.

Max Size Button

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

Dual Head

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

Rotary

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

Diameter

The diameter of the cylindrical object being engraved will be entered in this field.

Rotation Factor

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 on the previous page) but it may be difficult to measure circumference.



NOTE: If you are only using the Materials Database Tab and the Auto Z feature on the UCP to run your projects there is no need to follow any of the following focusing methods. These methods should only be used if you use the Manual Control Tab to print to the laser system.

Focusing Methods

The laser beam passes through the focus lens and converges to a small spot, called the focus point, approximately 2 inches from the bottom of the focus carriage when using a 2.0 lens. In order to engrave or cut properly with the laser beam, the material must be placed exactly at that focus point. To accomplish this, the Z-axis engraving table needs to be moved up or down. There are three methods used to focus the laser beam to the surface of the material, using the Focus Tool, using the Z -AXIS POSITION display, or using AUTOFOCUS.

1. Focus Tool Method

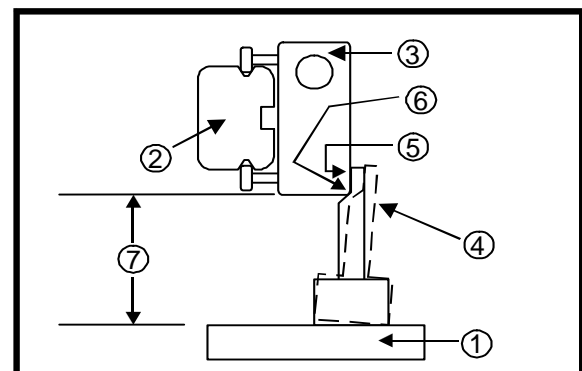
Place your material into the upper left corner of the engraving field against the rulers. The material can be placed anywhere on the table using this focusing method but for these purposes it's being placed on the upper left corner according to the values inputted on the MANUAL FOCUS POSITION on the System Tab. Visually make sure that the height of the material will not interfere with the focus carriage when it moves over the material. While on the main menu of the Keypad press the AUTO-FOCUS button once. The focus carriage will automatically move to a predetermined position according to the MANUAL FOCUS POSITION.

To move the table up or down, at a slow rate, move the cursor to the hundreds decimal place (B) using the RIGHT Motion Control button on the PLS keypad. Press the UP or DOWN Motion Control buttons on the PLS keypad to move the table up or down. To move the table up or down, at a fast rate, move the cursor back to the tenths decimal place (A) and use the UP and DOWN buttons on the keypad to move the table. After that is complete press the ESCAPE button to return to the main menu.



The focus carriage will home back to the upper right corner. You should practice moving the table up and down before using the focus tool.

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



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

After you have completed this method press the ESCAPE button on the keypad. The focus carriage re-homes back to the upper right hand corner.

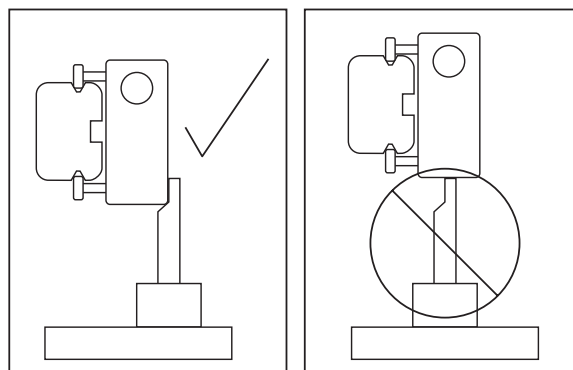


WARNING: To avoid damage to the focus lens, avoid positioning the focus tool underneath the focus carriage.

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.



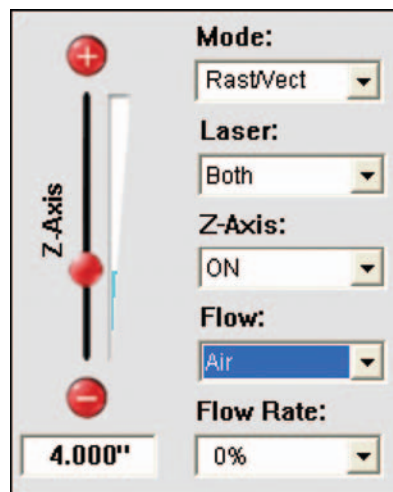
From a physics point of view, there is no difference between raising the Z-axis table a specified distance from the focal point and lowering the table the same distance from the focal point. However, from an applications point of view, we recommend lowering the Z-axis table when intentionally **RASTER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

NOTE: This focusing method can be done in a variety of ways. By using the Keypad, Universal Control Panel or a combination of both. The Keypad was used in this method because you have easier access to the engraving system. A combination of the UCP and Keypad or only using the UCP may require more than one person to complete the Focus Tool Method.

2. Material Thickness (Z-Axis) Method

Focus on **TOP** of the engraving table, not the material, using the focus tool as mentioned in the previous method. Create your graphic and go to File and select Print from the drop down list. On the Print window that opens select the laser system you own and then click the **PROPERTIES** button. Click on the Manual Control Tab. To the right hand side of the printer driver you will see a vertical sliding bar named Z-Axis with plus (+) and minus (-) buttons. In order to activate this feature select **ON** from the drop down list that is labeled Z-Axis that is located next to the Z-Axis vertical sliding bar. In the blank area underneath the minus (-) button type the material thickness of the object being engraved. Focusing using this method is now complete.

Make any necessary changes to your Manual Control driver as desired. At this point place the material in the appropriate location on the engraving table according to your graphic placement. Click the **OK** button located on the bottom right corner of the printer driver to send the file to the laser system. Start the Universal Control Panel, your laser system, and start printing your job.

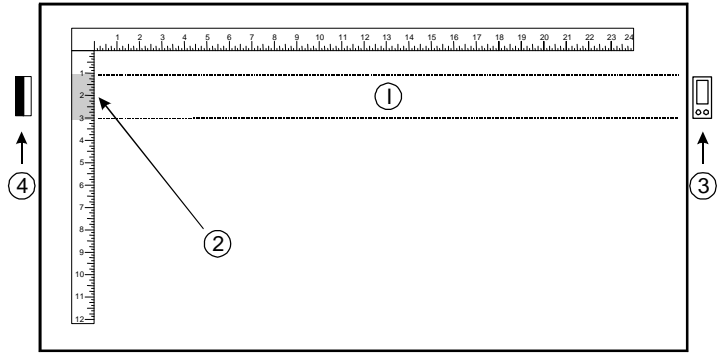


Periodically check if the Z POSITION method is calibrated with your focus tool. Since your focus tool is your absolute reference, make sure that you do not lose it.

3. AUTOFOCUS Method

This option **CAN ONLY BE USED WITH QUALIFIED MATERIALS**. Qualified materials are materials that are very flat, non-transparent, non-elevated, and at least 2 inches thick.

Place your material anywhere within the AUTOFOCUS zone (1), which spans across the table where the Y-axis ruler is indented (2). Your material must completely obstruct the AUTOFOCUS zone (1) in the Y-axis direction (be at least 2 inches thick) or it may not operate properly. To activate AUTOFOCUS, verify that you are on the Main Menu on the Keypad screen and press and hold the AUTOFOCUS button for one second. As soon as the process begins you can release the AUTOFOCUS button.



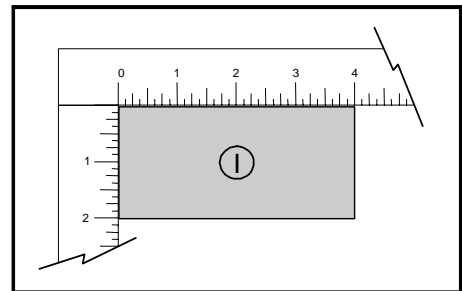
The laser system's engraving table will automatically adjust to its appropriate focusing height. Be sure that the appropriate lens size installed is the same lens selected in the System Tab of the UCP. Periodically check if the AUTOFOCUS method is calibrated with your focus tool. Your focus tool is your absolute reference, so make sure that you do not lose it.

Making a Sample - Manual Control Tab

The following steps assume that CorelDraw X3 is being used as your graphics software and are using the Manual Control Tab in the printer driver. Other graphic software programs may differ.

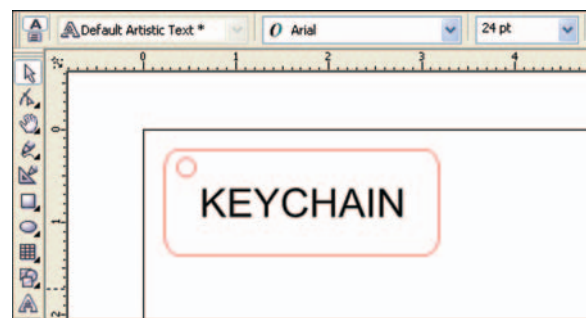
Step 1 – Loading and Positioning the Material

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



Step 2 – Creating the Graphic

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



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

If you are not familiar with your graphics program run a few tutorials and become familiar with the graphics program. If tutorials were not provided you may have to learn the software on your own by experimenting with the software.

Step 3 – Printing to the Laser System (Manual Control Tab)

When you are ready to print the file to the laser system, click FILE and then click PRINT. Make sure that the laser system appears in the DESTINATION NAME dropdown list, and then click PROPERTIES (Figure 3) to display the ULS printer driver settings.

Once you have completed entering the desired parameters on the Manual Control Tab, as described in the previous pages, click OK to accept the changes made. The printer driver closes and reverts back to the Print Dialog box (Figure 3). Now click on PRINT button to begin printing to the laser system.

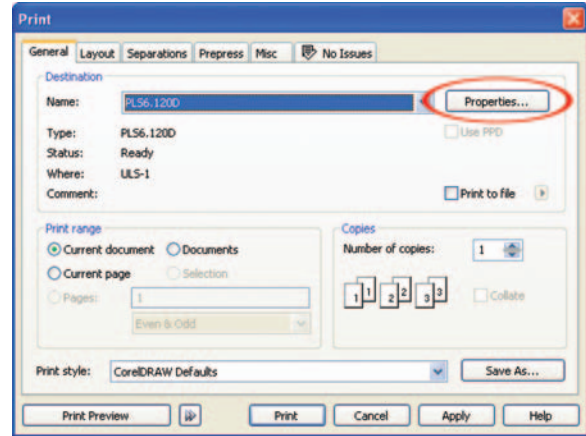


Figure 3

Normally, Windows will spool the print file (the little printer icon located in the lower right-hand side taskbar) so it may take several seconds or even minutes, depending on your file size and the speed of your computer, before the entire file completely loads into the laser system. Assuming that you have no other files loaded into the laser system, once this file is downloaded, it will automatically appear in the Keypad display of the laser system. If you already have other files loaded into the laser system, the file that you just sent will not appear until you enter the FILE Menu on the Keypad display and press the RIGHT button. Use the RIGHT and LEFT buttons to toggle through your files until you find the one you want to print.

Step 4 – Focusing your system

Choose from one of the three Focusing Methods mentioned in Section 9-17. We suggest you use your focus tool as a starting point.

Step 5 – Starting the Engraving Process

- Turn ON the exhaust system and PLS machine. Laser tube fans will stop spinning once the laser system has been turned on. This is normal and the fans will start spinning once engraving has started.
- Make sure the material is positioned correctly within the engraving area.
- Make sure the system is properly focused.
- Make sure the top door is closed.
- Press the green START button on the PLS keypad to begin laser processing.



WARNING: Observe that the laser system is functioning as desired. If any abnormalities are present, including but not limited to, flaming, sparking, melting, or excessive smoking of the material you are engraving, **STOP THE ENGRAVING PROCESS IMMEDIATELY BY EITHER PRESSING THE PAUSE BUTTON OR OPENING THE TOP DOOR!** Re-check the settings in the printer driver as well as the laser system. If everything seems to be correct, the material is not suitable for laser engraving or cutting and you **MUST**

DISCONTINUE processing this material or any material that may cause damage to the laser system. **NEVER LEAVE THE LASER SYSTEM UNATTENDED DURING THE ENGRAVING OR CUTTING PROCESS.**

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

Step 6 – Material Removal and Reloading

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

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



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

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

