UNIVERSAL
LASER SYSTEMS INC.

OPERATION MANUAL

ULS-25E
LASER SYSTEM

INTERNATIONAL EDITION

Universal Laser Systems, Inc.
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Notice

Table of Contents

Introduction

The ULS-25E is designed to combine flexibility and full featured performance with simplicity and ease of use. Using advanced engineering and design, the ULS-25E offers finer control, higher precision, more versatility, better resolution, faster speed, and overall greater quality than any other laser system in its class. It combines the performance of high speed engraving and cutting capabilities with the ease of a user friendly, specially designed, Windows or Macintosh printer driver interface. Actually, the ULS-25E is such a breakthrough in technology that it is more than just a laser system, it is a precision engraving and cutting device used as a tool for the imagination.

To begin with, we highly recommend that this entire manual be read before attempting to use the laser system. The manual includes important information about the safety, assembly, use, and maintenance of the ULS-25E. **We cannot overemphasize the importance of reading the owner's manual completely.**

Where to get HELP:

If it is necessary to call for technical assistance, please call our **TECHNICAL SUPPORT** at (**602)483-1214**. Please be prepared to answer our questions by following the procedures below, as this will allow us to provide assistance in a prompt and efficient manner:

❍ Take a moment to write down all of the pertinent information about the computer being used with the laser cutting and engraving system such as software, operating system and computer type.

❍ Our technical support staff will ask you for your company name and the laser systems serial number. The serial number tag is located on the back of the machine in the lower right corner. There is a second serial tag located behind the front door on the right side when you open it. This will prevent you from having to get to the back of the machine to read the serial number.

❍ Try to recreate the problem and write down the circumstances in which the problem occurred. This will help our technical staff tremendously.

❍ If possible call from a phone that is close to the laser engraving system so that the system can be operated while talking with our technical support staff.

Section 1 - Safety

1.1 Laser Safety

The laser system contains a sealed carbon dioxide laser that produces intense and **invisible** laser radiation (at a wavelength of 10.6 microns in the infrared spectrum). The laser system is designed as a CLASS I device, meaning that the system is equipped with a protective housing and safety devices to completely contain the laser under normal use. Do not at any time attempt to modify or disassemble any part of the system and do not attempt to operate a system that has been modified or disassembled. Improper use of controls and adjustments or performance of procedures other than those specified in this manual may invalidate the Class I rating and result in exposure to the laser beam.

Please remember the following safety precautions when operating the laser system:

1. Exposure to laser radiation may produce physical burns and can cause severe eye damage. Proper use and care of this system is very important to the safety of all people in the surrounding area.

2. **NEVER** operate the laser system without constant supervision of the cutting and engraving process. Exposure to the laser beam may cause ignition of combustible materials. A properly maintained fire extinguisher should be kept on hand at all times.

3. Operation and care of the laser system must be performed in accordance with this manual.

4. 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 **UNPLUG THE MACHINE FIRST**.

5. Never operate the laser system without properly exhausting the fumes generated by the cutting and engraving process.

6. Please contact Universal Laser Systems Inc. with any questions concerning laser safety before operating this system.

Note: The laser system is specifically designed to comply with CDRH performance requirements under 21CFR 1040.10 and 1040.11. No guarantees of suitability or safety are provided for any use other than those specified by Universal Laser Systems Inc.

1.2 Safety Labels

According to CDRH standards, all interlocked and non-interlocked covers that allow access to a laser beam **MUST** have appropriate laser safety labels attached to them. These labels must be visible to personnel prior to the removal of the covers. Additional labels must be installed inside the machine and be visible if the covers are removed from the machine. Labels that provide the manufacturer's name, date of manufacture, description of product, model number, serial number and compliance statement must also be visible on the outside of the machine.

All CDRH required labels are properly affixed to the machine in the appropriate locations at the time of manufacture. These labels are not to be removed. If they become damaged or removed for any reason, please request additional labels from Universal Laser Systems Inc.(they will be provided free of charge). Below is a list of all the labels and their locations on the system.

Laser Processing System Manufactured By:

UNIVERSAL
LASER SYSTEMS INC.

Scottsdale, Arizona

Model No: ULS-25E

Manufactured: XXXX

Serial No: XXXX   Made in USA

CE

Manufacturer's Label
Location: On the back of the machine in the lower right corner.

This equipment conforms
to provisions of
US 21 CFR 1040.10
and 1040.11

CDRH Compliance Label
Location: On the back of the machine above the Manufacturer's Label.

DANGER
INVISIBLE LASER RADIATION WHEN OPEN
AND INTERLOCK FAILED OR DEFEATED.
AVOID EYE OR SKIN EXPOSURE TO
DIRECT OR SCATTERED RADIATION.
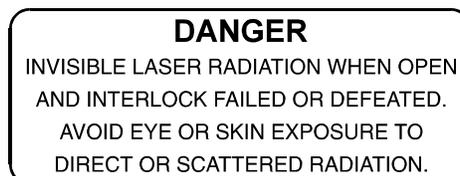
Warning Label for Interlocked Panels and Doors
Location: On the outside of the top door, on the inside of the top door, and next to the interlock defeat tool receptacle (visible when door is open). On the outside of the front door and on the inside of the front door (visible when door is open).

```
┌─────────────────────────────────────┐
│          AVOID EXPOSURE             │
│       INVISIBLE LASER RADIATION     │
│      EMITTED FROM THIS APERTURE     │
└─────────────────────────────────────┘
```

Exposure Warning Label
Location: To the right of the beam window inside the system where the laser beam enters the work area. On the laser mounting bracket before the first mirror and next to the aperture where the beam exits the laser tube.

```
┌─────────────────────────────────────┐
│             DANGER                  │
│   INVISIBLE LASER RADIATION WHEN OPEN│
│      AVOID EYE OR SKIN EXPOSURE TO  │
│     DIRECT OR SCATTERED RADIATION.  │
└─────────────────────────────────────┘
```

Warning Label for Non-interlocked Panels
Location: On the inside and outside of the first mirror cover (visible when the fan cover is removed).

1.3   The Safety Interlock System

The laser system incorporates a safety interlock circuit that automatically shuts off the power supplied to the laser whenever the front or top door is opened. This interlock system is connected in series with a red indicator light on the control panel of the system. The red indicator light will flash when the laser system is powered on and the top door or the front door is opened. If the red light is flashing, all electrical power to the laser tube itself is turned off. If, at any time, the flashing red light does not turn **ON** when either the top door or the front door is opened, **IMMEDIATELY** unplug the laser system and call Universal Laser Systems Inc. technical support for service instructions. **DO NOT** operate the laser system if any safety feature is malfunctioning.

The laser system comes equipped with a safety interlock defeat tool. Do not use this tool unless you have been properly trained by Universal Laser Systems Inc. This tool is only to be used for maintenance and repair procedures and should only be used when instructed to do so by Universal Laser Systems Inc. and all safety precautions have been followed.

WARNING:
Do not attempt to modify or defeat the safety interlock system for any reason as this could result in exposure to hazardous laser radiation. When using the interlock defeat tool, wear appropriate laser safety goggles. Failure to wear appropriate goggles can result in severe eye damage.

1.4   EMI Compliance

This ULS laser system has been tested and found to comply with both Federal Communication Commission (FCC) and European Union (EU) 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 insure compliance with FCC regulations.

EU Declaration of Conformity

Universal Laser Systems, Inc. hereby declares that the equipment specified below is in conformity with Directive 89/336/EEC based on test results using the harmonized standards listed.

Product Identification: ULS-25E laser cutting and engraving system

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

Standards Used: EN 50081-1, EN 50082-1, EN55022

Section 2 - Installation

2.1   Unpacking and Assembling the Laser System

The laser system is shipped in one crate that contains the system, a cart with casters and various accessories. The following steps outline the unpacking and assembly of the system. Please follow these steps carefully.

IMPORTANT

Save the shipping crate.   If the system must be returned for service,   it will have to be packed in its original shipping crate.

1. Unscrew and remove the top portion of the crate. Reach inside and pull out the cart panel which is located in front of the machine, packed between foam inserts.

2. Unscrew and remove the side panels. Remove the accessories box from the crate. The accessories box is located underneath the laser systems fan enclosure.

3. Remove the cart legs from underneath the laser system. It is not necessary to lift the machine at this time. The legs should slide out easily.

4. Open the accessories box and remove the four black casters and the bag of hardware. The hardware bag should contain the following:

(6)	10-32 Allen head screws
(6)	#10 lock washers
(4)	1/4-20 Allen head screws
(4)	1/4 " ID flat washers
(1)	5/32 inch Allen wrench
(1)	3/16 inch Allen wrench
(1)	3/4 inch open end wrench

5. Using the smaller Allen wrench, attach the two legs to the center panel with the six 10-32 Allen head screws and #10 lock washers as shown on the next page.

6. Attach the four black casters to the cart by threading the casters into the nuts that are welded onto the bottom of each leg. Tighten each caster in place with the 3/4 inch wrench. There are two locking and two non-locking casters provided. Make sure when attaching the casters that the locking casters are installed on the front of the cart. Refer to the diagram on the next page.

WARNING:
The laser system weighs about 170 lbs (77kg). **DO NOT** attempt to lift it alone. Get assistance from one or two other people.

CHAMFERED EDGE

USE 10-32 SCREWS
AND LOCK WASHERS

VIEW IS FROM THE
BACK SIDE OF THE CART

ASSEMBLE CART WITH LOCKABLE
CASTERS IN FRONT
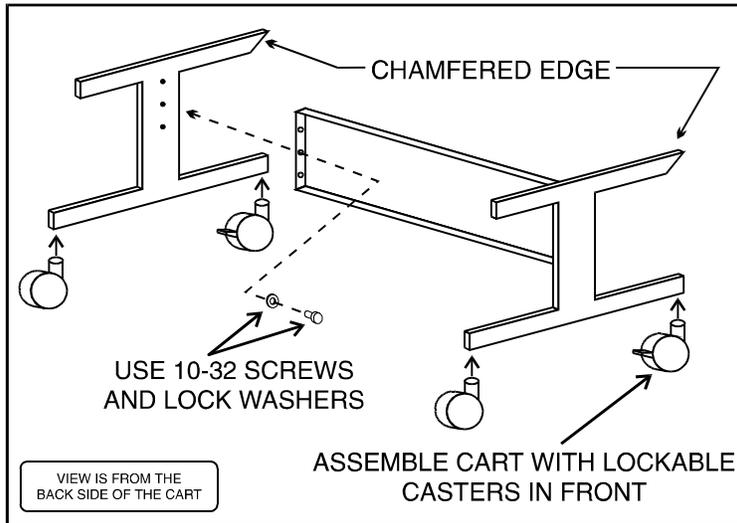
Cart Assembly

7. Engage the front caster lock downs to prevent the stand from rolling when placing laser system on it. Gently lift the laser system from the crate and place it on the cart. Make sure that the orientation of the machine is such that the front of the machine, the locking casters, and the chamfered edge of the cart legs are all positioned to the front as the following diagram illustrates:

USE 1/4-20 SCREWS
AND FLAT WASHERS

VIEW IS FROM THE
BACK SIDE OF THE CART
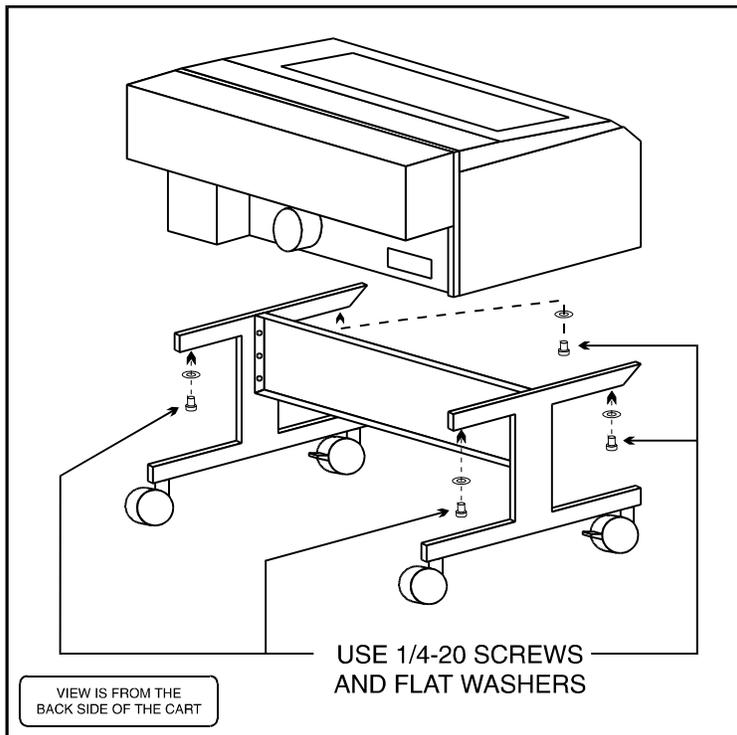
Attaching Cart to Laser System

10

8. Using the larger Allen wrench, attach the system to the cart using the four 1/4-20 Allen head screws and flat washers. The screws pass through the cart legs and into the bottom of the system as shown.

9. Once all of the screws are tight, adjust the thin nut on each of the casters so that all four wheels are touching the ground evenly. If desired, use a level gauge placed on the engraving table and adjust the casters until the laser system is completely level. Once level, tighten the thicker nut on the casters upwards against the bottom of the leg frame to lock in this adjustment.

2.2   Operating Environment

Before the system is installed, choose a suitable location. Follow these guidelines:

- ❍   Avoid places where the system may be exposed to high temperatures, dust, or high humidity (humidity exceeding 70% or where the temperature is near the dewpoint). The laser system should be installed in an office type environment.

- ❍   Avoid places where the system may be exposed to high levels of vibration or electrical noise. We recommend using a high quality surge protector to protect the laser engraving system's electronics.

- ❍   Avoid small enclosed areas where ventilation is poor.

- ❍   Choose a place where the ambient operating temperature will remain between 60 and 80 degrees Fahrenheit or between 15 and 25 degrees Celsius.

- ❍   Choose a place which provides a short and direct path to the exhaust duct work (not provided).

- ❍   If planning to connect the laser engraving system to a computer through the parallel port, choose a location where the computer can be placed within 10 feet of the machine since this is the maximum recommended parallel cable length.

- ❍   If planning to have another laser system or other type of printer connected to the same computer, we recommend installing an additional parallel port into the computer system. **DO NOT** use a manual A/B type switch box. This creates electrical noise which can cause an engraving problem or can damage the laser system's electronics.

- ❍   Try to have a work table or storage area next to or nearby the laser system. This prevents the operator from using this precision machine as a table or storage facility.

2.3   Exhaust System Requirements

To properly exhaust fumes and smoke from the laser engraving system during operation, it is necessary to provide an exhaust unit moving a minimum of 235 CFM at 6 inches of static pressure. Many industrial supply companies carry blowers that should meet these requirements.

THROUGH OUR RESEARCH WE HAVE ESTABLISHED GUIDELINES ON THE PROPER CFM RATINGS REQUIRED FOR THE EXHAUST SYSTEM. THESE RATINGS ARE BASED ON THE MEASURED DISTANCE BETWEEN THE EXHAUST OUTLET ON THE LASER SYSTEM AND THE INLET OF THE EXHAUST BLOWER. WE HAVE FOUND A SUITABLE SUPPLIER FOR THIS TYPE OF EQUIPMENT   IF YOU CHOOSE NOT TO USE THIS SUPPLIER,   PLEASE ENSURE THAT THE BLOWER THAT YOU PURCHASE MEETS OR EXCEEDS THE FOLLOWING SPECIFICATIONS.

DISTANCE BETWEEN BLOWER AND LASER	CFM RATING AT 6 INCHES STATIC PRESSURE
UP TO 10 FEET	235 @ 6 INCHES STATIC PRESSURE
10 - 20 FEET	410 @ 6 INCHES STATIC PRESSURE
21 - 30 FEET	535 @ 6 INCHES STATIC PRESSURE
31 - 40 FEET	625 @ 6 INCHES STATIC PRESSURE

The blower must be mounted on the **OUTSIDE** of the building either on the roof or on a cement pad next to the building. Rigid duct work should be used between the blower unit and the laser system. The exhaust tubing should be smooth walled and have as few bends as possible. Use duct work with a diameter that matches the blower unit and reduce the duct work to four inches just before the point where it attaches to the laser system. Also consider installing a gate to control air flow and to close off the exhaust from the outside environment when the laser is not in use. This is especially useful in colder climates where it is not good to have cold air coming into the laser from the outside. Do not connect the rigid duct work directly to the laser system. Use a short piece of industrial grade, wire reinforced rubber tubing to connect the end of the gate, or tubing, to the laser system. This will provide mobility and will dampen blower vibrations. Do not use a very long piece because it's spiral construction reduces air flow. Install a hose clamp on both ends of the hose to prevent leaks and to prevent the hose from slipping off.

We recommend installation of the exhaust system by a licensed contractor to meet safety and local code requirements. Please contact a local air quality control specialist. Having the blower wired to a wall switch, by a licensed electrician, in the same room will make it easy to turn it off and on.

WARNING
Do not attempt to operate the laser engraving system without a properly installed and operating exhaust system. Some materials when cut or engraved can produce fumes that are hazardous in concentrated amounts.

TYPICAL ROOF MOUNT INSTALLATION

SHIELD BLOWER
FROM THE WEATHER
WITH PROTECTIVE ENCLOSURE

EXHAUST

ROOF

EXHAUST BLOWER

WIRE BLOWER TO
A WALL SWITCH

USE SMOOTH WALL TUBING SUCH AS SHEET
METAL OR PVC THAT IS THE SAME DIAMETER
AS THE BLOWER INLET. SEAL ALL JOINTS
TO PREVENT FUME LEAKS. KEEP TUBING AS
STRAIGHT AS POSSIBLE. BENDS REDUCE
AIR FLOW.

SHUT OFF
GATE

REDUCE TO 4 INCHES WITH
A REDUCING COUPLER

4 INCH DIAMETER FLEXIBLE RUBBER HOSE

TYPICAL OUTSIDE MOUNT INSTALLATION

INSIDE | OUTSIDE

WIRE BLOWER TO
A WALL SWITCH

USE SMOOTH WALL TUBING SUCH AS SHEET
METAL OR PVC THAT IS THE SAME DIAMETER
AS THE BLOWER INLET. SEAL ALL JOINTS
TO PREVENT FUME LEAKS. KEEP TUBING AS
STRAIGHT AS POSSIBLE. BENDS REDUCE
AIR FLOW.

REDUCE TO 4 INCHES WITH
A REDUCING COUPLER

EXHAUST

SHUT OFF
GATE

SHIELD BLOWER
FROM THE WEATHER
WITH PROTECTIVE ENCLOSURE

4 INCH DIAMETER FLEXIBLE RUBBER HOSE

EXHAUST BLOWER

Sample Exhaust System Layouts

2.4   Computer Recommendations and Setup

The following computer configuration is the **minimum** requirement necessary to operate in the Windows environment. Using a computer with more speed, memory and storage capacity will enable the graphic images to be produced faster. A faster computer will perform calculations quicker and will shorten download time to the laser.

- ❍ 486-33 Mhz or higher PC compatible computer
- ❍ 8 MB of RAM
- ❍ 250 MB hard drive
- ❍ One floppy disk drive
- ❍ Color VGA monitor
- ❍ Mouse
- ❍ Microsoft Windows version 3.1
- ❍ Windows compatible graphics program

The following is our **recommended** computer configuration:

- ❍ Pentium 90 or higher
- ❍ 32 MB of RAM
- ❍ 1 Gigabyte hard drive or bigger
- ❍ 17 inch color VGA monitor
- ❍ One floppy disk drive
- ❍ CD-ROM Drive
- ❍ Mouse
- ❍ Microsoft Windows 3.11 for Workgroups or Windows 95
- ❍ CorelDraw 3.0, 4.0, 5.0 (see appendices for anomalies)
- ❍ 600 DPI Optical Resolution Scanner
- ❍ Adobe Photoshop 2.5LE or 3.0
- ❍ Adobe Streamline (for raster to vector conversion)

CAD users do not necessarily need Windows or Windows compatible programs. The laser system is compatible with any program that can output HPGL commands whether it is Windows based or not. Check with your salesperson for specific details on DOS based CAD programs compatibility and recommendations.

The following is our **recommended** Macintosh computer configuration:

- ❍ Any system capable of running System 7.0 or higher.
- ❍ 32 MB of RAM or higher
- ❍ 1 Gigabyte hard drive or bigger
- ❍ 17 inch color monitor
- ❍ 600 DPI Optical Resolution Scanner
- ❍ Adobe Photoshop
- ❍ Aldus Freehand

2.5   Laser System Installation

CAUTION: Please make the following connections in the exact order described otherwise static electricity can damage the computer and/or the laser system's electronics.

1.   Connect the laser system's power cord to a good quality surge suppresser and then the surge suppresser to a grounded outlet. Do the same for the computer system.

2.   Make sure both the computer and laser system are plugged in and turned **OFF**, then connect the laser system to the computer using either a serial or parallel connection. Refer to the following diagram:
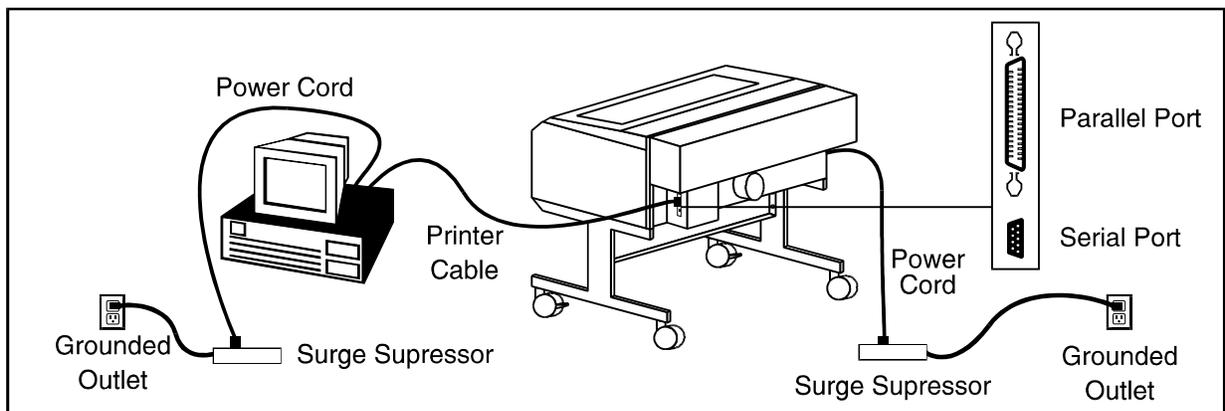
Cabling Connections

2.6   Installing the ULS Printer Driver for Windows 3.1 or 3.11

Installation of the ULS Printer Driver will allow Windows to interface with the laser system. This driver is installed the same way as most other Windows 3.1 or 3.11 printer drivers and a simple step-by-step installation procedure is outlined below. Complete understanding of how Windows works is essential to the operation of the laser system. Please consult the Windows owner's manual on its installation, use, and operation before continuing.

1.   Start Windows, double click on "Main" in "Program Manager" and double click on "Control Panel".

2.   Double click on "Printers" from inside "Control Panel". The "Printers" dialog box will now appear.

15
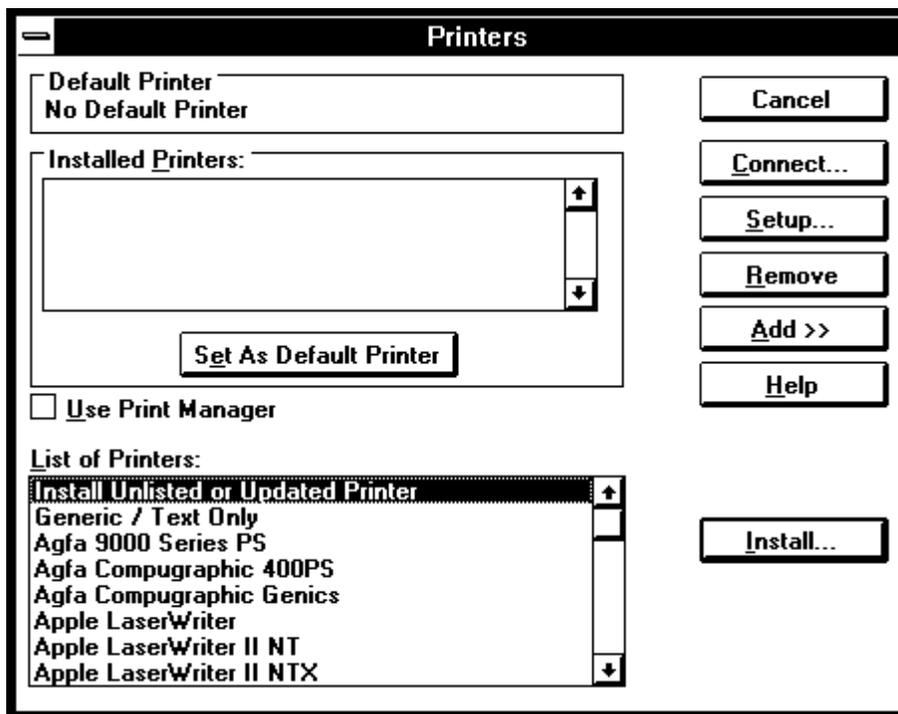
Printers Dialog Box

3. Click on the "Add" button if other drivers are present in the "Installed Printers" dialog box.

4. Click on "Install Unlisted or Updated Printer" and click on "Install".
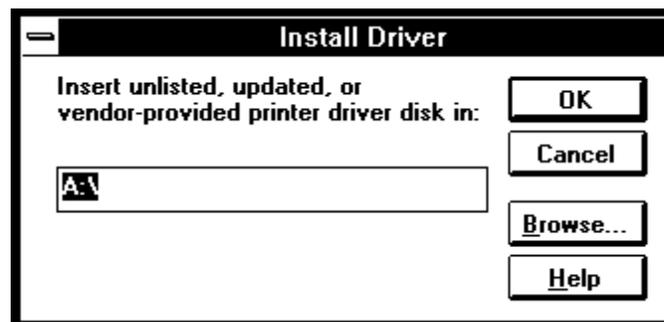
Add Unlisted Printers Dialog Box

5. The "Install Driver" dialog box will appear asking for the location of the new driver.

6. Insert the floppy disk containing the ULS Printer Driver into the appropriate disk drive and type in the correct drive letter.

7. Click on "OK" and a new dialog box called "Add Unlisted or Updated Printer" will appear.

Add Unlisted or Updated Printer

List of Printers:
- ULS-25
- **ULS-25E**
- ULS-25PS
- ULS-50PS

OK
Cancel
Help
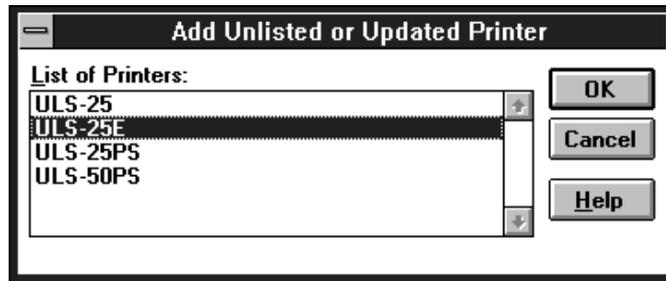
Add Unlisted or Updated Printer Dialog Box

8. Select the ULS-25E from the list and click on the "OK" button. The driver will now install itself to your c:\windows\system directory and the ULS-25E will appear in the "Installed Printers" section of the "Printers" dialog box.

Printers

Default Printer
ULS-25E on LPT1:

Installed Printers:
ULS-25E on LPT1:

Set As Default Printer

☐ Use Print Manager

List of Printers:
- **Install Unlisted or Updated Printer**
- Generic / Text Only
- Agfa 9000 Series PS
- Agfa Compugraphic 400PS
- Agfa Compugraphic Genics
- Apple LaserWriter
- Apple LaserWriter II NT
- Apple LaserWriter II NTX

Close
Connect...
Setup...
Remove
Add >>
Help

Install...

Printers Dialog Box

9. Select the ULS-25E and click on "Connect" if connecting to a port other than LPT1. Now select the appropriate port.

NOTE: A check box named "Fast Printing Direct to Port" located on the bottom of the dialog box should **NOT** be checked, otherwise file transmission errors can occur.
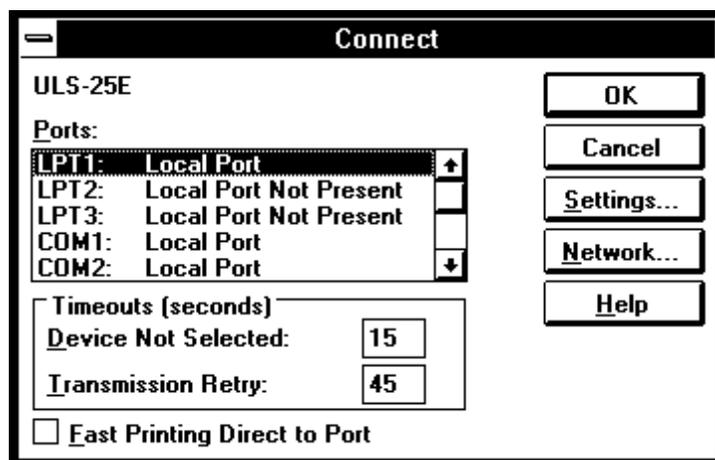
Connect Dialog Box

10. Click on "OK" and the "Printers" dialog box will re-appear.
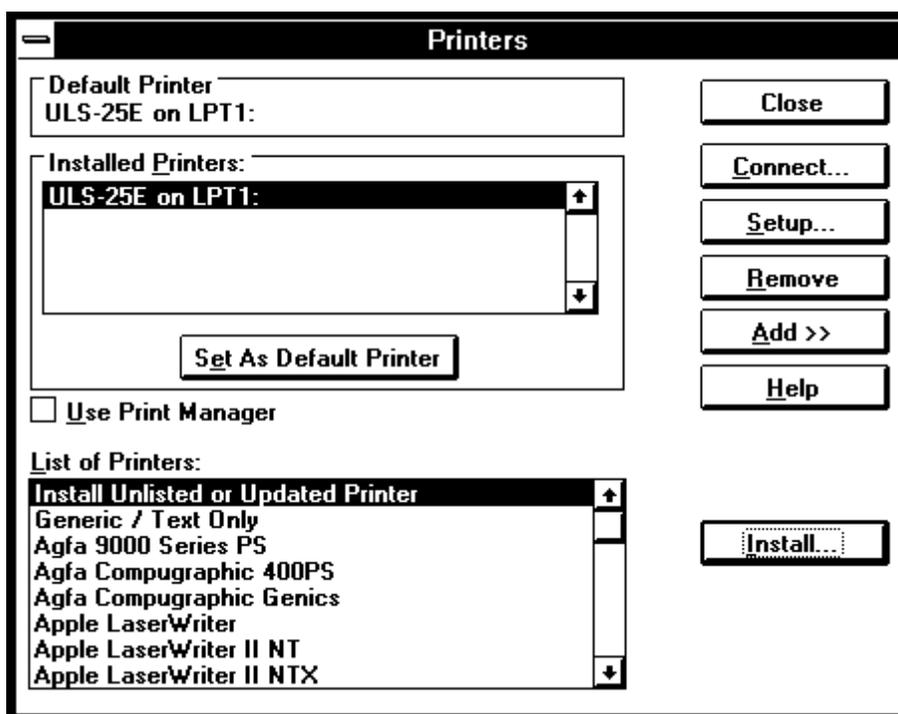
Printers Dialog Box

11. Selecting "Set As Default Printer" and "Use Print Manager" are of personal preference. Refer to the Windows manual on how to use Print Manager, if desired. We recommend that you do not use Print Manager because it serves no use to the laser system and it can become a nuisance.

12. Now you **MUST** click on "Setup" to initiate the installation of the driver. If you do not, the driver will not store your power settings correctly. The driver settings dialog box will now appear.

```
┌──────────────────────────────────────────────────────────────┐
│ ■                    ULS-25E on LPT1: *                       │
├──────────────────────────────────────────────────────────────┤
│ File   Help                                                   │
│ ┌─System──────────┐ Color    Power Speed  PPI ┌─Laser Control─│
│ │                 │ 1 Black    50   100  auto │ Power Speed PPI│
│ │ ULS-25E         │ 2 Red      50   100  auto │  ↑    ↑    ↑   │
│ └─────────────────┘ 3 Green    50   100  auto │                │
│ □ Corel Bitmaps     4 Yellow   50   100  auto │                │
│ □ B/W Raster        5 Blue     50   100  auto │                │
│                     6 Magenta  50   100  auto │                │
│                     7 Cyan     50   100  auto │  ↓    ↓    ↓   │
│                     8 Orange   50   100  auto │                │
│ ┌─Page Setup──┐  ┌─Resolution─────┐           │  %    %    PPI │
│ │ □ Metric    │  │ 500 DPI      ↓ │           │     Set        │
│ │ ○ Portrait  │  └────────────────┘           │                │
│ │ ◉ Landscape │                               │ □ Advanced     │
│ │ Width Height│  □ Rotary Fixture             │ ┌────┐ ┌──────┐ │
│ │ 24.000 12.000│    Diameter                  │ │ OK │ │Cancel│ │
│ │ inches inches│     inches                   │ └────┘ └──────┘ │
│ └──────────────┘                              └────────────────│
└──────────────────────────────────────────────────────────────┘
```

Driver Settings Dialog Box

13. How to adjust the settings will be covered in a later chapter. Now you **MUST** click on "OK" in order for the driver to create a file called "Laser.ini" which the driver will install to your c:\windows directory. This file stores all of the driver settings as you change them. If you do not perform this procedure, any settings that get changed later on will not be stored in when the computer gets shut down. Upon reboot, the default settings like the ones shown above will appear instead of the settings you used before computer shut down. To prevent this, make sure that the "OK" button is clicked and **NOT** the "Cancel" button.

14. At this point, exit the "Printers" dialog box and the "Control Panel" window. Printer driver installation is now complete. Store the driver disk in a safe place.

2.7   Installing the ULS Printer Driver for Windows 95

Installation of the ULS Printer Driver will allow Windows 95 to interface with the laser system. This driver is installed the same way as most other Windows 95 printer drivers and a simple step-by-step installation procedure is outlined below. Complete understanding of how Windows 95 works is essential to the operation of the laser system. Please consult the Windows 95 owner's manual on its installation, use, and operation before continuing.

1. Power **ON** your PC.

2. From the Task Bar click "Start".

3. Point the mouse to the "Settings" icon, and then click the "Printers" icon.

4. Double-click on the "Add Printer" icon.

5. When the "Add Printer Wizard" appears click "Next".

6. Select "Local Printer" and click "Next".

7. When the "Manufacturer" and "Printers" menu list appears click "Have Disk"
    (Do not look for the printer in the menu).

8. Insert the driver disk.

9. Make sure the dialog box matches the floppy drive you are using: "A:\" or "B:\".

10. Click on "OK".

11. When the list of "Printers" appears choose "ULS-25E".

12. Click on "Next".

13. Choose the port your laser system is connected to and click on "Next".

14. If you would like to name the laser system a different name then rename it now.

15. Choose if you would like to set it as your default printer and click on "Next".

16. Select "No" when it asks to print a test page, and then click on "Finish".

17. Click on the laser system, then click on "File" and drag the mouse to "Properties".

18. Click on "Details" and then click on "Setup".

19. The driver settings screen will appear. Click on "OK" and then "OK" once again.
    This step is important because it will allow the driver to write the Laser.ini file to
    your c:\windows subdirectory. This file is essential for proper driver operation.

20. Driver installation is now complete. Store your driver disk in a safe place.

2.8   Installing the ULS Printer Driver for Macintosh

Installation of the ULS Printer Driver for Macintosh will allow Macintosh computers
running system 7.0 or higher to interface with the laser engraving system. This driver is
installed in the same way most other Macintosh printer drivers are, and a simple step-
by-step installation procedure is outlined below. A complete understanding of how the
Macintosh operating system works is essential to the operation of the laser system.
Please consult your Macintosh owner's manual for answers to any question you might
have on operating your Macintosh computer.

1. Turn on your Macintosh computer and insert the ULS Macintosh driver disk in the computer's disk drive.

2. Copy the ULS-25E and Engrave Monitor onto your Macintosh computer by dragging these items from the floppy disk folder into the "Extensions" folder located inside the "System" folder on your computers hard drive.

3. Copy the "Preferences" file (if present) from the floppy disk onto your Macintosh computer by dragging this item from the floppy disk folder into the "Preferences" folder also located inside the "System" folder on your computers hard drive.

4. Click on the "Apple" menu and drag the mouse pointer to "Chooser". Click on the ULS-25E as your output device by clicking on it with the mouse.

5. Click on the "Modem Port" in the "Connect To" dialog box and close the "Chooser" dialog box.
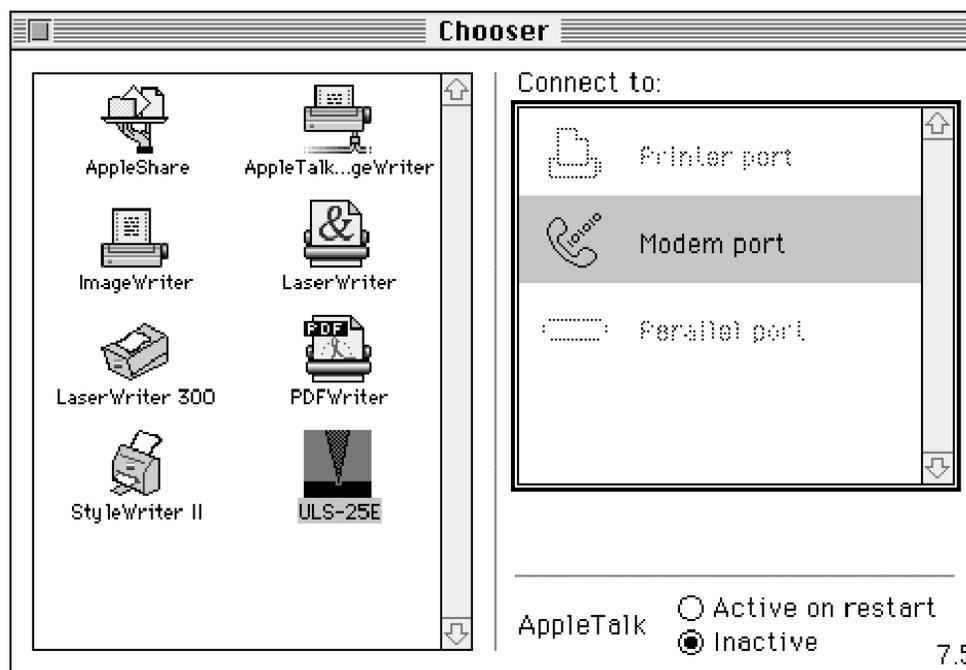
Chooser Dialog Box

6. Make sure that AppleTalk is set to "Inactive".

7. Driver installation is now complete. Store the driver disk in a safe place.

Section 3 - Software Setup and Operation

3.1   Using Graphics Software

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 a horizontal length of 24 inches(609.6 mm) and vertical height of 12 inches(304.8 mm). The ULS Printer 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 ULS Printer Driver 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. The laser system's origin is fixed in the upper left corner of the engraving area and cannot be altered. It is necessary to 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 an 8 inch(203.2 mm) x 10 inch(254 mm) page size is desired, set this page size in the graphics software as well as the ULS 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. This feature is controlled by the ULS Printer Driver. When using this power change feature with the ULS Printer 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 CMYK percentages. If the eight driver colors are not automatically provided in the software, use the chart below to create the eight driver colors by specifying the appropriate CMYK values:

COLOR	CYAN	MAGENTA	YELLOW	BLACK
BLACK	0 %	0 %	0 %	100 %
RED	0 %	100 %	100 %	0 %
GREEN	100 %	0 %	100 %	0 %
YELLOW	0 %	0 %	100 %	0 %
BLUE	100 %	100 %	0 %	0 %
MAGENTA	0 %	100 %	0 %	0 %
CYAN	100 %	0 %	0 %	0 %
ORANGE	0 %	60 %	100 %	0 %

If using a color other than the exact colors listed above, the driver will attempt to match it to a color in the driver that it most closely resembles. The driver will then use that color's power setting and apply a halftone pattern to represent the original color's shade. For example, if using a color like pink to fill a rectangle, the driver takes a reading of the percentage of different colors used to create that color and will use the power setting assigned to one of the eight colors of the driver that it most closely resembles. It might be expected that the driver will use the power setting assigned to the color red but instead the driver may choose the magenta setting and halftone the rectangle as a representation of the pink color's lighter shade. To prevent the incorrect assignment of laser power, be sure to use the right colors. If using graphics with colors other than the eight listed above or to simplify the assignment of power settings, try using the B/W Raster 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 ULS Printer Driver distinguishes between raster mode (engraving) and vector mode (cutting) by the type of graphic artwork being used. Basically all graphics other than outlines of very thin line widths will be interpreted as engraved images and the raster mode will be used for output. If laser cutting is desired, set the line thickness of the lines that are drawn in the graphics software to .001 inches (.1 mm) or the smallest possible line thickness that is available. The printer driver will interpret these objects as vectors and will cut them out. 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 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, then proceed to cutting. 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 cut any outlines present in the artwork. Unlike engraving, cutting will proceed in the order from which the outlines are drawn regardless of color. There are several different ways to control the order in which the outlines are cut. One way is to draw them in the exact order in which they need to be cut, but this is not always practical. Another way is to select the outline in the graphics software and "send it to the back", behind the other objects, to cause the outline to be cut first. Bringing the outline "to the front" will cause that outline to cut last. A final way is to cut and paste each outline in the cutting order desired. This effectively works the same way as the two previous suggestions.

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.

Overlapping Outlines

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

Hidden Vector Lines in Artwork

The ULS Printer 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 B/W Raster feature in the driver. This feature disables the cutting mode and converts all visible outlines to engraved objects and ignores all hidden outlines.

Optimizing Speed

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, a greater engraving speed can be achieved by rotating the graphic 90 degrees and placing the material in the laser system sideways. Be aware that some graphics programs do not allow the rotation of bitmaps. In this case, it may be necessary to use 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.

Bitmaps

There are three types of bitmaps available. They are monochrome, grayscale, and color. Bitmaps are patterns of dots blended to form pictures. Most bitmaps are created by scanning artwork into a computer through a scanner. Others are created by drawing them in a bitmap image processing program. Only monochrome or grayscale bitmaps are used by the laser system. The driver handles color bitmaps the same as grayscale bitmaps. Since color bitmaps use more memory, they are unnecessary and are therefore **NOT** recommended. Monochrome bitmaps are used when scanning and engraving line art or camera ready black and white images. Grayscale bitmaps are used for scanning and engraving photographs even if they are color.

When scanning black and white images, scan at least 600 DPI. The higher the DPI, the smoother the image will be. Scanning in at 300 DPI is the minimum resolution for scanning line art (monochrome bitmaps), but 600 DPI provides a significant improvement in the image quality. Grayscale bitmaps (photographs) usually should be scanned at no more than 300 DPI. Scanning at a higher DPI for photographs does not effectively improve image quality but consumes more memory. As a rule of thumb, scan photographs at 300 DPI and line art images at 600 DPI.

There are several different bitmap formats available: TIF, BMP, PCX, and others. The format makes no difference to the laser system. The difference in formats involves how they are stored on the 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 an image processing software to perform a dot by dot editing or rotation of the bitmap.

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. In order to engrave a photograph however, a halftone pattern must be created. A halftone is a series of dots arranged in a specific pattern. By varying the size and intensity of these dots, shading can be simulated in a process that is similar to that used to generate newspaper photographs. Sometimes this is referred to as setting the screen for printing. Usually, imaging software gives the choice of using different halftone patterns including frequency of lines per inch and pattern angles. The size of the dots decreases as the line frequency increases. Experiment to see which pattern looks the best. Big dots look good on some materials and small dots look better on others. If it is not possible to assign a halftone pattern in the imaging or graphic software, the ULS Printer Driver will automatically default to a predetermined pattern based on the Resolution setting in the driver.

RESOLUTION	ANGLE	SHAPE	LINES PER INCH
1000	45 DEGREES	ROUND	180
500	45 DEGREES	ROUND	90
333	45 DEGREES	ROUND	60
250	45 DEGREES	ROUND	45
200	45 DEGREES	ROUND	36

Bitmap images cannot be cut by the laser system only engraved. The only way to have the laser system cut out 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.

Postscript Files

The laser system does not support Encapsulated Post Script (EPS) printing directly. EPS files can only be edited and printed if they are first imported into a graphics program. However, since EPS files do 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. 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 ULS Printer Driver. The laser system is not a postscript device. This means that postscript fills, postscript textures, and postscript fonts will not be able to print to the laser system.

Working with Fonts in the Windows Environment

We recommend the use of True Type fonts with the laser system. TrueType fonts are the most versatile and should be used whenever possible. They provide the best print quality and will print well at any size. Other types of fonts might not print correctly to the laser system.

Post Script fonts will not print correctly on the laser system unless you have the Adobe Type Manager (ATM) installed. Even with ATM installed, a Postscript font will print but the quality will usually be slightly lower than that of a comparable TrueType font. Some ATM fonts will not print correctly at all to the laser system especially if they are rotated 90 degrees. If you are having trouble printing a particular ATM font, we recommend that you use it's True Type equivalent.

Bitmap fonts only print well when used at the specific point size they were designed for. This point size is usually indicated in the font name such as Times Roman 12. If a font is only available in bitmap form, you must print it at the size it was created for.

3.2   The ULS Printer Driver for Windows
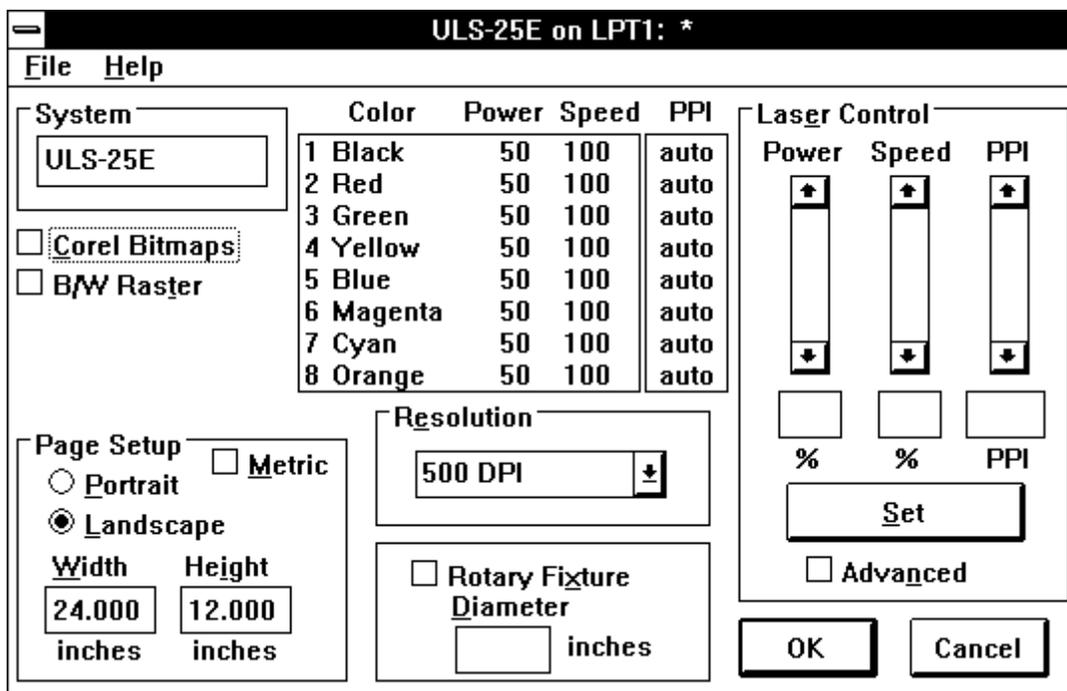
The ULS Printer Driver for Windows

NOTE: When the following sections refer to turning a switch ON, this means putting an "X" in the box next to the driver selection desired. Turning a switch OFF signifies removing the "X" from the box. To change the Power, Speed, and PPI of a color, position the mouse arrow on the color and click once with the left mouse button. This

will highlight the color and allow changing of the settings by using the scroll bars or highlighting out and typing in each setting. It is possible to set one color at a time or click on additional colors to set more than one at a time.

Power Setting

Laser power is controlled by assigning the percentage of power from 0 - 100% to each color used in the graphic drawing. Since the laser is proportionally pulsed, this percentage represents how long the laser remains on for each laser pulse fired. Basically, the power setting is directly related to how deep the engraving will be.

Speed Setting

This setting controls how fast the motion system moves in a percentage of the maximum speed of the system. For example, 100% Speed is equivalent to 25 inches per second straight line velocity. Therefore, 10% Speed is equal to 2.5 inches per second. When engraving, this is the rate in which the motion system moves back and forth. When cutting, this is the speed of the straight lines. If cutting curves or circles, the motion system automatically slows down. For example, there is no speed difference when cutting a circle at 50% or 100% Speed because curves will run slower than straight lines even if it is set to 100%. Proportional pulsing of the laser will ensure that there is no difference in the depth of cut from straight lines to curves. Power and speed work together in determining how deep the engraving will be. Higher power settings and slower speeds will produce deeper engraving.

PPI

PPI stands for laser pulses per inch. This setting determines how many laser pulses, per linear inch, the laser system will fire. Again, since the laser system is proportionally pulsed, all pulses will fire equally spaced from one to the next regardless of changes in Speed, Power, acceleration, deceleration, or the cutting of curves. For example, when setting the PPI to 500 and using a standard lens that has a laser spot size of seven thousandths of an inch, significant pulse overlap will occur. The laser system fires a laser pulse and moves over two thousandths of an inch (that is 1 inch divided by 500). It then fires the next pulse and so on, overlapping the pulses significantly. Lines are formed by pulsing the laser pulses so close together and slightly overlapping each other that it appears to be a continuous line. Dot matrix printers work the same way except the laser system uses laser pulses instead of ink dots. When engraving, it is advisable to use a PPI setting of 500 or higher. If using less, the image resolution of the engraving is reduced. For cutting, a PPI of 150 and above can be used. Using less than 150 will result in the pulses being spread so far apart that they will not touch one another. This is a good example on how to perforate paper. Increasing or decreasing the PPI setting has absolutely no effect on engraving speed. The laser must either fire more quickly or slowly. Experiment with using different PPI settings on some scrap material when cutting or engraving and note the results.

Set

This button must be pressed after adjusting the Power, Speed, and PPI settings in order for these changes to take effect. If forgetting to click on "Set", and clicking on the "OK" button instead, the settings will go back to the previous ones and will engrave the object with the incorrect settings.

Advanced

Turning this switch ON will permit the changing of the PPI settings. If the switch is turned OFF, the word "Auto" will appear in the PPI column and will be colored gray. Since 500 PPI is the setting that is used most often, "Auto" sets the PPI to 500 automatically and does not allow change unless the "Advanced" switch is turned back ON.

Resolution

This setting is the image resolution of the engraving in DPI or dots per inch. There are six DPI settings to choose from: 1000, 500, 333, 250, 200 and DRAFT. The resolution can also be referred to as horizontal lines per inch or fill spacing. This is how many raster strokes per vertical inch of travel that the motion system steps down to produce an engraving. Higher resolutions will produce cleaner and deeper engraving but take longer to engrave. Lower resolutions produce a coarser and shallower image but are quicker to engrave. Experiment with the different settings and note the results.

Corel Bitmaps

This switch is for CorelDraw! users **ONLY**. Turn this switch ON only when there is an imported monochrome or grayscale bitmap in CorelDraw!. If printing any drawing that has a bitmap in it and forgetting to turn this switch ON, everything else except the bitmap will print. If the bitmap does not engrave, go back and turn the switch ON, select the bitmap only, and print Selected Objects Only in the software. Make sure to leave this switch OFF if there is no bitmap present. This switch should remain **OFF** if using software other than CorelDraw!.

B/W Raster

This switch 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 switch ON when using ClipArt because there may be some underlying cutting lines hiding behind some filled areas. Having this switch ON gives a what-you-see-is-what-you-get output very similar to laser printer output. The entire drawing will be engraved, including all outlines, and only one power level will be used which is black. The color change ability of the driver is essentially turned off and all colors are engraved as

different shades of gray. The laser system represents different shades of gray by producing a halftone pattern when engraving. The halftone pattern is based upon the Resolution setting of the driver the same way grayscale bitmaps are interpreted. Refer to the chart on page 25 for specific details. Since ClipArt images use a wide variety of colors, shades, and outlines, the only effective way of engraving these images is to have this switch turned ON. B/W RASTER mode also provides greater compatibility with Windows software that do not work well with vector devices such as the ULS laser system. Call our technical support if there seems to be a compatibility problem with a particular software program.

Page Setup and Orientation

Input here lets the ULS Printer Driver know what page size and orientation is being used in the graphics software. These settings **MUST** match the graphics software settings **EXACTLY** otherwise no output, partial output, or misalignment of the graphic will occur. It is up to the operator to enter in the correct settings. Not only must the page size be **EXACT**, but the orientation must be the same also. Remember, the maximum page size horizontal length of 24 inches(609.6 mm) and vertical length of 12 inches(304.8 mm) in the Landscape mode. Select the "Metric" box if metric units are desired.

Rotary Fixture

It is only necessary to use this selection if the optional Rotary Fixture has been purchased.   For full details on how to use this option, please refer to section 4.5. Do not skip over to that section until the rest of this manual, up to that section, has been read. There is important information about the operation of the laser system that must be read before being able to fully understand how to operate the Rotary Fixture.

File

A unique feature of the driver is being able to store the power settings that are currently on screen. By selecting "File" and then "Save Setup File", all settings will be stored in a file that can be named as desired. The file extension, however, must remain as .LAS for the driver to recognize this file as a setup file. These files can be stored in any directory and may be retrieved by selecting "File" and then "Load Setup File".

The Laser.ini file can be thought of as being a file that stores the current power settings when the "OK" button is pressed. This gives the driver the ability to restore these settings every time the driver is accessed. Without this file, the power settings would have to be entered in every time the graphic is sent to print. Selecting "File" then "Load Laser.ini" will restore the settings that were saved the last time the "OK" button in the driver was pressed. Once the "OK" button is selected, the current power settings will be stored in the "Laser.ini" file and the original ones will be erased.

Help

Select this option to access Help on the use of the ULS Printer Driver. Selecting "Help" and then "About" will display the current driver version number and our copyright notice.

3.3   Using DOS Based Programs

When using DOS based programs, there are a few things to keep in mind. DOS software is not standardized and each application will work differently. When using DOS applications, it is not possible to print through the ULS Printer Driver and for this situation, the system has been designed to automatically emulate a Hewlett Packard plotter. Plotters use a special language called HPGL which the laser system has been designed to accept. When configuring the DOS based program, select the HP7475 plotter as the printing device. Set the maximum paper size to 24 inches(609.6 mm) wide by 12 inches(304.8 mm) tall (refer to the DOS software manual for how to configure the printing device). Once configured properly, the laser system should interface with the program very nicely and act just like a plotter. The following are a few points to remember when printing from DOS based programs:

1. Some DOS programs will not allow the page size to be set at 24 inch(609.6 mm) x 12 inches(304.8 mm) in the Landscape mode. If this is not possible, the full engraving field cannot be utilized. If a smaller page size is used, determine where the program will place the graphic on the engraving table by running a few tests to see where the laser system will output.

2. Some DOS programs use the lower left corner of the engraving field as the origin so remember this when setting up the graphic drawing.

3. When assigning power settings to the graphic, it will be necessary to assign an HPGL plotter pen to the different colors in which the graphic was drawn. In most cases the pen numbers should match the power setting numbers in the laser systems "Power Settings" display.

4. Some DOS programs may allow the setting of pen speed for the different plotter pens. These speeds will be ignored by the laser system so do not be concerned with making those settings in the software. The only place that the settings can be made is in the "Power Settings" display section of the laser systems control panel.

5. Make sure that you set all of your line widths to .001 inches otherwise the laser system may go into raster mode instead of the desired vector mode.

6. After every file download, an "End of File" marker must be inserted at the laser system so that the buffer control will work properly.

7. Power setting for plotter pens can only be done at the laser system itself through the main control panel display. Section 4.2 of this manual will explain how to set the Power, Speed, and PPI settings for plotter pens. It will also describe how to insert an "End of File" marker and why it is necessary after every file download. Please refer to that section for more explicit details. If having trouble with using DOS based programs, please contact our technical support.

3.4   The ULS Printer Driver for Macintosh

The ULS Printer Driver for Macintosh consists of three parts: the Printer Driver, the Engrave Monitor, and the Page Setup. Many features of this driver function the same as they do for the Windows based Printer Driver.

The Printer Driver
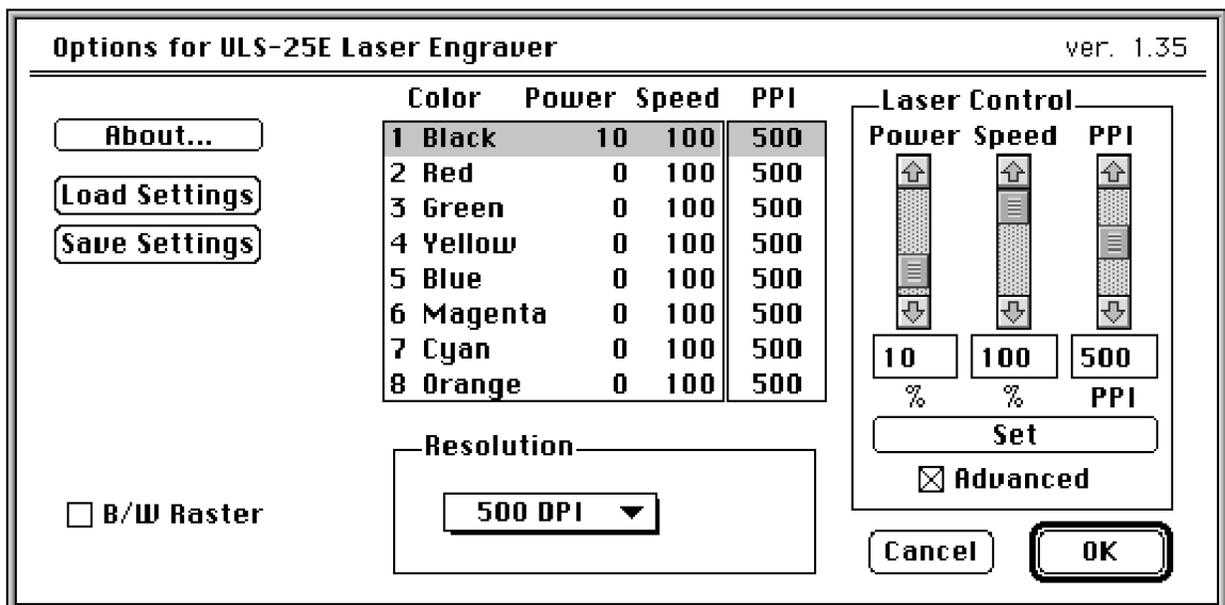
The ULS Printer Driver for Macintosh

In the ULS Printer Driver for Macintosh there is only one switch, the "Corel Bitmaps" switch, that is not present in this driver because it is not necessary to have this switch for the Macintosh computer system. Please refer to the section on "The ULS Windows Printer Driver" to understand the function and selection of the different settings the driver has to offer.

The Engrave Monitor

```
┌──────────────────────────────────────────────┐
│ ULS Engrave Monitor                           │
│                                    ver. 1.35  │
│  ☞ ┌──────────────┐   Filename  Canvas:Untitled-1 │
│    │              │   Sent      0        bytes │
│    │              │   Bands                    │
│    │              │   Band                     │
│    │              │   Color     1        Black │
│    │              │                            │
│    └──────────────┘   [Cancel]   Start  [Engrave] │
│                                               │
└──────────────────────────────────────────────┘
```
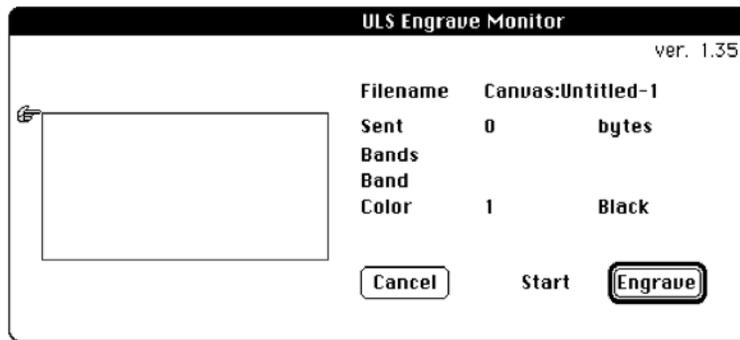
Engrave Monitor

The Engrave Monitor provides a graphical preview of the printed image and allows you to send the image to the printer or cancel printing at any time during the process by selecting the cancel button.

While the image is being printed a pointer travels down the length of the page indicating printing progress and a counter indicates how many bytes of information have been sent. You can also pause printing by selecting the pause button and then resume printing at any time.

The Page Setup

Page setup for the printer driver is specified in the Page Setup dialog box which can be accessed through the file menu of the graphic software you are using. The page setup you specify in this dialog box only applies to the printed output and won't effect the graphic. For proper printing you **MUST** match the settings of the graphic page on your computer screen **EXACTLY** with the printed page settings otherwise no output, partial output, or misalignment of the graphic will occur. It is up to the operator to enter in the correct settings. Not only must the page size be **EXACT**, but the orientation must be the same also.

```
┌────────────────────────────────────────────────────┐
│ Page Setup for ULS-25E Laser Engraver    ver. 1.35 │
│ ┌─Format──┐ ┌─Size──────────┐ ┌─Units──────┐ ┌────┐ │
│ │         │ │               │ │            │ │ OK │ │
│ │ ○ A 3   │ │ horizontal 24.00 │ │           │ └────┘ │
│ │ ○ A 4   │ │               │ │ ○ centimeters│[Cancel]│
│ │ ○ A 5   │ │ vertical 12.00 │ │ ◉ inches   │ │
│ │ ◉ custom│ │               │ │            │ │
│ │ ⊠ Landscape│ ☐ Rotary Fixture │ ○ points  │[Options]│
│ │         │ │ diameter [   ] │ │            │ │
│ └─────────┘ └───────────────┘ └────────────┘ │
└────────────────────────────────────────────────────┘
```
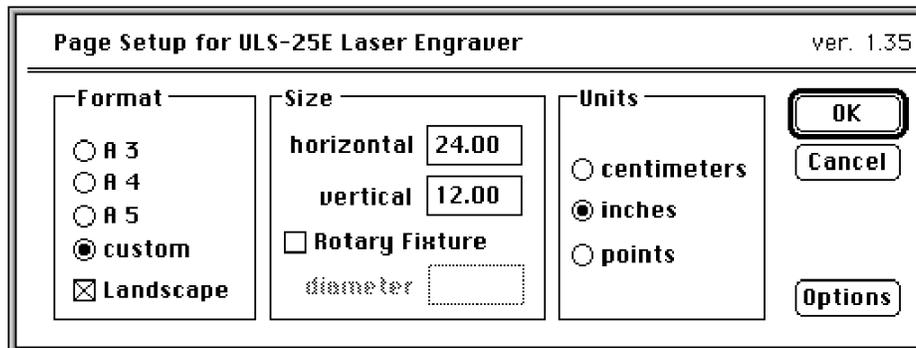
Page Setup

Working with Fonts in the Macintosh Environment

We recommend the use of True Type Fonts. TrueType fonts are the most versatile and should be used whenever possible. They provide the best print quality and will print well at any size.

Post Script fonts will not print correctly on the laser system unless your Macintosh has the Adobe Type Manager (ATM) extension loaded. Even with the ATM extension loaded, a Postscript font will print but the quality will usually be slightly lower than that of a comparable TrueType font. Some ATM fonts will not print correctly to the laser system especially if they are rotated 90 degrees.

Bitmap fonts only print well when used at the specific point size they were designed for. This point size is usually indicated in the font name such as Times Roman 12. If a font is only available in bitmap form, you must print it at the size it was created for.

Font types can only be identified by looking in the Fonts folder which is found in the System folder. Each font has its own icon in the Fonts folder and the font type can be identified by the icon. Refer to the Macintosh System 7 Reference Manual for an explanation of the font icons and their meanings.

Section 4 - Laser System Operation

4.1   General System Overview
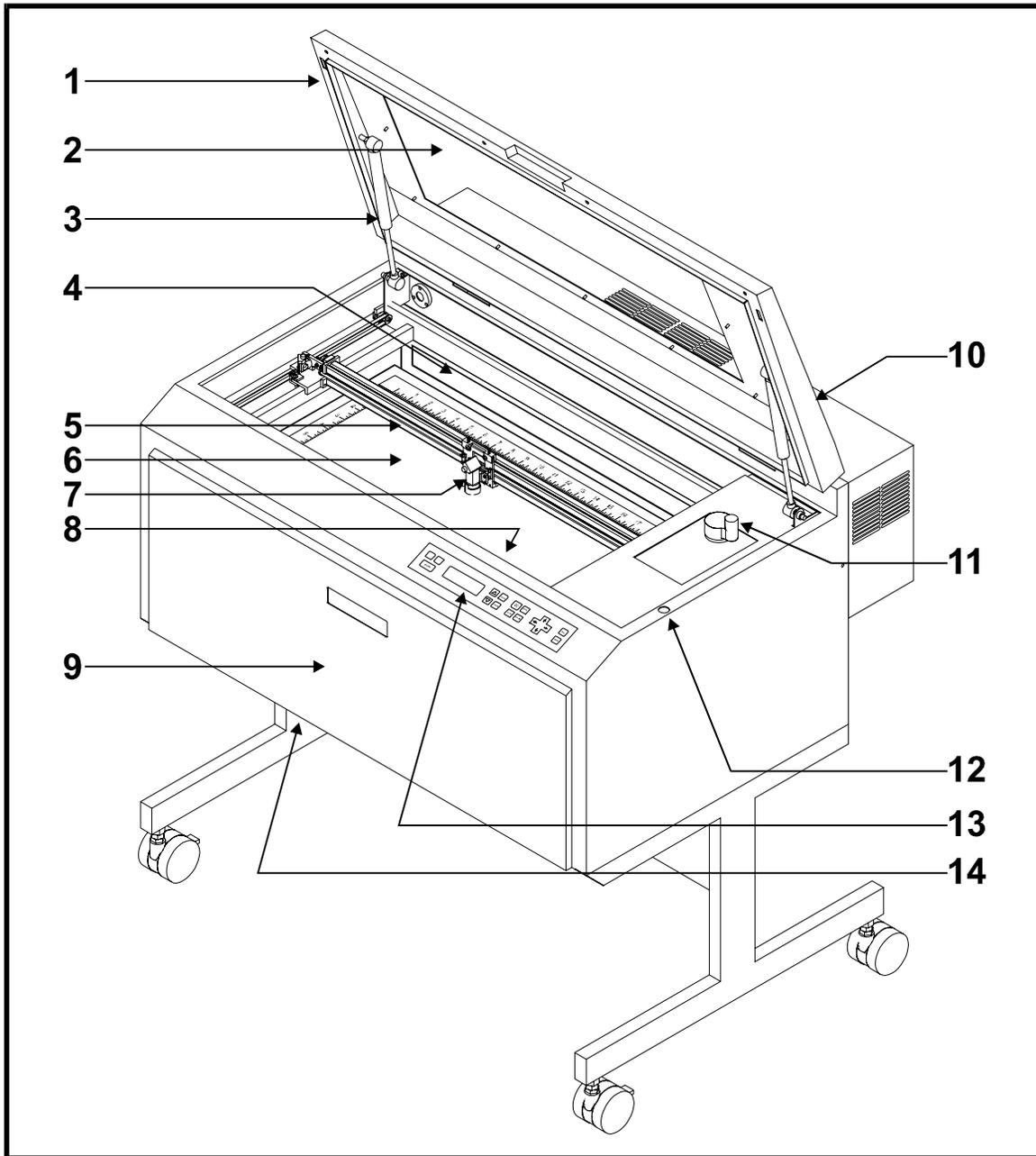
1. Top Door
2. Top Door Window
3. Top Door Gas Assist Shocks
4. Exhaust Plenum Opening
5. Motion System X-Axis Arm
6. Engraving Table
7. Focus Lens Holder Assembly
8. Rotary Fixture Socket
9. Front Door
10. Fan Enclosure
11. Z-Axis Adjustment Knob
12. Interlock Defeat Tool Socket
13. Control Panel
14. Air Intake Filter

4.2   The Control Panel

OPERATIONS DISPLAY
BUFFER CONTROL
DOS POWER SETTINGS
PREFERENCES

RED   GREEN   START   ▲ SELECT   ▼ ESCAPE   NEXT FILE   STANDBY   PAUSE   RESUME   TEST   SETUP
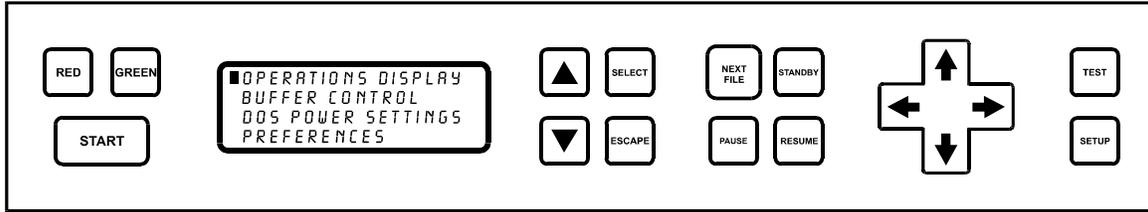
Control Panel

The control panel on the laser system provides easy access to all of the controls necessary for cutting and engraving operations. The control panel consists of a liquid crystal display (LCD), indicator lights, and selection buttons. The following sections will describe, in detail, how to get around in the menu control system and the significance of each item in the control panel.

The Menu Control System

The four buttons to the right of the liquid crystal display give complete access to the menu control system. Use the up and down arrow buttons to move the cursor up or down through the items on the display and press the "SELECT" button to choose an item. Some items on the display lead to other menus and some are settings that can be adjusted. After positioning the cursor on the desired item, press the "SELECT" button to access that item. The "ESCAPE" button allows backing up through the menu system to the main menu. The "ESCAPE" and "SELECT" buttons also function for changing a setting. The "SELECT" button accepts and stores the change and the "ESCAPE" button exits without changing the setting.

When the laser system is powered on, the laser system will perform a series of routines. The "INITIALIZING" display will show until the motion system and electronics have initialized. When completed, the display will read "READY" signifying that the laser system is ready to accept jobs.

Refer to the diagram on the next page for a detailed view of the menu control system's flow chart:

POWER ON

```
INITIALIZING
```

```
READY
```

MAIN MENU   **SETUP KEY**

```
■OPERATIONS DISPLAY        ■001)FILENAME.XXX                      ADJUST FOCUS    OR    ■HEIGHT ADJ.   COARSE
 BUFFER CONTROL             PWR  100%   0:00:00
 DOS POWER SETTINGS         SPD  100%   COPIES  0
 PREFERENCES                PPI  500    500  DPI
```

```
 OPERATIONS DISPLAY        ■001)FILENAME.XXX             001)FILENAME.XXX       ■
■BUFFER CONTROL             DELETE THE FILE              DELETE THE FILE
 DOS POWER SETTINGS         INSERT END-OF FILE           INSERT END-OF FILE
 PREFERENCES                BUFFER SPACE  15.9MB         BUFFER SPACE  15.9MB
```

```
                           001)FILENAME.XXX             001)FILENAME.XXX
                          ■DELETE THE FILE              --- ARE YOU SURE ---
                           INSERT END-OF FILE          ■CANCEL
                           BUFFER SPACE  15.9MB         YES DELETE THE FILE
```

STANDBY

```
                           001)FILENAME.XXX             STANDBY
                           DELETE THE FILE              --- ARE YOU SURE ---
                          ■INSERT END-OF FILE          ■CANCEL
                           BUFFER SPACE  15.9MB         YES. ACCEPT
```

```
                           001)FILENAME.XXX             DELETE ALL FILES             STANDBY SELECTED
                           DELETE THE FILE              --- ARE YOU SURE ---
                           INSERT END-OF FILE          ■CANCEL                       PRESS STANDBY OR
                          ■BUFFER SPACE  15.9MB         YES CLEAR THE BUFFER          ESCAPE TO RESUME
```

```
 OPERATIONS DISPLAY        ■POWER SETTING    1#
 BUFFER CONTROL             POWER          100%
■DOS POWER SETTINGS         SPEED          100%
 PREFERENCES                PPI            500
```

```
 OPERATIONS DISPLAY        ■TICKLE                      ■TICKLE RATE     5KHZ
 BUFFER CONTROL             CONFIGURATION                TICKLE WIDTH     1 US
 DOS POWER SETTINGS         DIAGNOSTICS
■PREFERENCES                RETAIN SETTINGS
```

```
 TICKLE                    ■PORTS                       PARALLEL                     SERIAL
■CONFIGURATION              SET ROTARY AXIS                                           BAUD RATE    9600
 DIAGNOSTICS                ALIGNMENT MODE                                            STOP BITS       1
 RETAIN SETTINGS            LOAD DEFAULTS                                             PARITY       NONE
```

```
                           PORTS                        SET ROTARY AXIS
                          ■SET ROTARY AXIS              PLACE 24000X 12000Y
                           ALIGNMENT MODE              ■CANCEL
                           LOAD DEFAULTS                YES SAVE Y AXIS
```

```
                           PORTS                        ■POWER          3%
                           SET ROTARY AXIS               KHZ            2
                          ■ALIGNMENT MODE
                           LOAD DEFAULTS
```

```
                           PORTS                        CHANGE ALL SETTINGS
                           SET ROTARY AXIS              --- ARE YOU SURE ---
                           ALIGNMENT MODE              ■CANCEL
                          ■LOAD DEFAULTS                YES LOAD DEFAULTS
```

```
 TICKLE                    MEMORY TEST                  ■TEST MEMORY
 CONFIGURATION             PAGE 63      FAILS 0          PLACE 24000X 12000Y
■DIAGNOSTICS              ■CANCEL                        UNIVERSAL LASER SYS.
 RETAIN SETTINGS           YES (CLEARS BUFFER)          COPYRIGHT 1995 59-85
```

```
 TICKLE                    RETAIN SETTINGS
 CONFIGURATION             --- ARE YOU SURE ---
 DIAGNOSTICS              ■CANCEL
■RETAIN SETTINGS           YES ACCEPT
```

Menu Control System Flow Chart

The "OPERATIONS DISPLAY" submenu

As soon as the first job that is sent from the computer to the laser system is in the laser system's buffer, the "OPERATIONS DISPLAY" submenu will appear displaying the job's filename and associated power settings the were set in the ULS Printer Driver.

```
■001)FILENAME.XXX
 PWR  100%   0:00:00
 SPD  100%   COPIES  0
 PPI   500   500  DPI
```

This is the "OPERATIONS DISPLAY" submenu which will probably remain on most of the time during normal operation. It has been designed to show all pertinent operating information at a glance so that constantly jumping from menu to menu is not needed. The first line indicates the first job's filename. To move to the next job in the buffer press the "NEXT JOB" button, if more than one job has been downloaded. Page through the list of jobs available in the buffer by placing the cursor on the first line of this display and pressing the "SELECT" button. The up and down arrow buttons can then be used to move through the list of jobs in the buffer. When the desired job is found, simply press the "SELECT" button to make that job the current job. This will move the cursor back to the left hand side of the display. To run the currently selected job simply press the "START" button. Changing the current job is not possible while running the laser system. For experimental purposes, Power, Speed, and PPI settings can be altered while the file is running allowing you to adjust these settings until the desired depth or effect is achieved. To adjust these settings, press the up or down arrow button until the cursor is on the desired selection. Press the "SELECT" button which moves the cursor to the right and then use the arrow buttons to increase or decrease the values. Pressing the "SELECT" button again will accept the change and pressing the "ESCAPE" button will restore it to the original setting. It is possible to adjust the settings while engraving on some scrap material until the desired "POWER", "SPEED", and "PPI" settings are obtained. Note these settings, change them in the ULS Printer Driver and re-send the job to the laser system for the final run.

The display contains a timer to time jobs as they are run (this is useful for costing jobs). The timer will pause when the "PAUSE" button is pressed and starts up again when cutting or engraving has been "RESUME"d. If the same job is run again, the timer will count backwards displaying how much remaining time is left. The "COPIES" feature indicates the number of times the current job has been used since it was loaded into the buffer (the system keeps a running count of the number of times each job in the buffer has been processed). The DPI section displays the current DPI that the job is running at. The "TIMER", "COPIES", and "DPI" readouts are for display purposes only and cannot be altered.

The "ADJUST FOCUS" or "HEIGHT ADJ". display can be accessed by pressing the "SETUP" button on the control panel while in the "OPERATIONS DISPLAY" submenu. This will assist you in setting the focus of the laser beam. Please refer to the section on "Loading and Focusing the Laser System" for specific details.

To access the "MAIN MENU" from the "OPERATIONS DISPLAY" submenu, keep pressing the "ESCAPE" button until it appears on the display.

The "MAIN MENU"

```
■OPERATIONS DISPLAY
 BUFFER CONTROL
 DOS POWER SETTINGS
 PREFERENCES
```

The "MAIN MENU" is the menu that allows access to all other submenus.

The "BUFFER CONTROL" submenu

```
 OPERATIONS DISPLAY
■BUFFER CONTROL
 DOS POWER SETTINGS
 PREFERENCES
```

Then

```
■001)FILENAME.XXX
 DELETE THE FILE
 INSERT END-OF FILE
 BUFFER SPACE  3.7MB
```

The laser system comes standard equipped with an intelligent memory buffer that has built-in file compression. The ULS Printer Driver actually compresses the file while it downloads to the laser system and the laser system decompresses the file while it runs. The amount of compression can be as little as 4 to 1 or as great as 64 to 1. This means that with 4 MB of RAM in the laser system, the buffer could hold the equivalent of 256MB worth of files provided they can be compressed 64 to 1. This gives the laser system the ability to store either larger or more jobs in the buffer. It also provides for quicker downloading because the files are much smaller than normal. The buffer can hold up to 999 files providing that the buffer space is not exceeded. The buffer also has built in file handling intelligence enabling each individual job in the buffer to be run in any order. The jobs are stored sequentially based on the order in which they were transferred from the computer and each one is assigned a number to help for tracking. A running total of the free space left in the buffer is provided at the bottom of the display.

The file name displayed is always the currently active job and there are two methods for looking through the list of jobs and choosing another job. The first method is to press the "NEXT JOB" button on the control panel. Each time the "NEXT JOB" button is pressed, the next job in the buffer becomes the current job. The second method is to point the screen cursor at the job name and press the "SELECT" button which will move

the cursor to the right, then use the arrow buttons to move backward or forward through the list until the job desired is displayed and then press the "SELECT" button again.

Eventually the buffer will fill up with jobs that will need to be removed from memory. It is possible to select each individual job and delete them one at a time. To accomplish this, make the desired job for deletion the current job in the same manner as previously described, then select the "DELETE THE FILE" option from the menu. To do this, use the up or down arrow buttons until the cursor is pointing to that menu choice and then press the "SELECT" button.

```
 001)FILENAME.XXX
■DELETE THE FILE
 INSERT END-OF FILE
 BUFFER SPACE  3.7MB
```

Then

```
 001)FILENAME.XXX
 --- ARE YOU SURE ---
■CANCEL
 YES DELETE THE FILE
```

The display will then ask if you are sure and will expect a "CANCEL" or a "YES" response. To completely clear out the entire buffer all at once, bring the cursor down to the "BUFFER SPACE" option and press the "SELECT" button. The laser system will again ask if you are sure so respond accordingly.

```
 001)FILENAME.XXX
 DELETE THE FILE
 INSERT END-OF FILE
■BUFFER SPACE  3.7MB
```

Then

```
 DELETE ALL FILES
 --- ARE YOU SURE ---
■CANCEL
 YES CLEAR THE BUFFER
```

Since the laser system is equipped with a unique way of storing multiple jobs in memory, special provisions are made to distinguish one job from the next. When using the ULS Printer Driver, an end-of-file(EOF) marker is automatically sent to the laser system after each job is downloaded. An end-of-file marker is needed by the buffer in order for it to recognize the end of one job, the beginning of the next job, and to calculate the remaining free buffer space. Without an EOF, the buffer will not operate properly.

There are two ways that a downloaded job will have a missing EOF. The first is if printing through the ULS Printer Driver and printing is canceled, interrupted, or file size

exceeds the remaining free buffer space. When this occurs, chances are that the EOF never made it to the buffer and the buffer will show that it is empty or that the job does not exist. If this happens, part of the job might still remain in the buffer and that part might become mixed up with other jobs. This is when having an "INSERT-END-OF-FILE" option becomes important. In order to delete that partial file, the buffer must either be cleared entirely or an EOF must be manually inserted into the buffer by simply bringing the cursor down to the appropriate menu choice and pressing "SELECT".

```
001)FILENAME.XXX
 DELETE THE FILE
■INSERT END-OF FILE
 BUFFER SPACE  3.7MB
```

This provides an alternative to clearing out the entire buffer by inserting the EOF marker at the end of the unwanted file fragment. Next, press the "NEXT JOB" button and this fragment will then show up on the display as "NONAME" and will allow its solitary deletion without having to delete the other jobs in the buffer.

Secondly, when using DOS based programs, a printer driver other than the ULS Windows Printer Driver must be used. That particular driver does not know to send down to the laser system the required EOF marker at the end of file downloading. Again, the buffer will not recognize that the job exists because it does not see the end of it. In this case, an EOF must be manually entered into the buffer after each and every file download from a DOS based program. Since the job name is not sent to the laser system by a DOS based printer driver, every job will be called "NONAME". To distinguish one "NONAME" job from the next, the display will number the jobs in the order from which they were downloaded.

The "DOS POWER SETTINGS" submenu

```
 OPERATIONS DISPLAY
 BUFFER CONTROL
■DOS POWER SETTINGS
 PREFERENCES
```

Then

```
■POWER SETTING    1#
 POWER          100%
 SPEED          100%
 PPI            500
```

The laser system allows eight different power settings to be saved in memory and used when processing a DOS based file. Since a DOS based printer driver is not available, the 8 power settings must be set manually on the laser system. Think of it as being able to assign laser "POWER", "SPEED", and "PPI" to the pens on a flatbed plotter. This is not necessary when using Windows or the Macintosh since all settings can be set in the driver.

To access the power settings, press the "SELECT" button when the cursor is on DOS "POWER SETTINGS",   then use the up and down arrow buttons to scroll through settings 1 through 8.   When the desired power setting number is found, press the "SELECT" button again to bring the cursor over to the left hand side of the display, and proceed to make the adjustments as previously described

The "PREFERENCES" submenu

```
┌────────────────────────┐
│  OPERATIONS DISPLAY    │
│  BUFFER CONTROL        │
│  DOS POWER SETTINGS    │
│ ■PREFERENCES           │
└────────────────────────┘
```

The "PREFERENCES" submenu choice allows laser system reconfiguration.   It also allows access to certain diagnostic and maintenance features. Selecting this option will lead to other menu choices some of which are adjustable and others that are display only.

The "TICKLE" submenu

```
┌────────────────────────┐
│ ■TICKLE                │
│  CONFIGURATION         │
│  DIAGNOSTICS           │
│  RETAIN SETTINGS       │
└────────────────────────┘
```

Then

```
┌────────────────────────┐
│ ■TICKLE RATE     5KHZ  │
│  TICKLE WIDTH     1US  │
│                        │
│                        │
└────────────────────────┘
```

Tickle is the term used for small pulses which are fed to the laser to keep the plasma inside energized. This allows the laser to respond quickly and strongly for high speed cutting and engraving.   As the laser tube ages it may become necessary to change these settings to maintain peak performance.

Tickle keeps the laser "warmed up" at times when the laser system is powered ON but not firing and the top and front doors are closed. We suggest keeping the doors closed at all times when the laser system is powered ON as this keeps the laser warmed up. If the door(s) are open, the power to the laser tube itself is turned OFF and the tube will cool down.   The laser runs best after being warmed up for a couple of minutes. Optimally,   we can adjust the Tickle to maintain the plasma excitation level at a threshold so that upon demand, the laser will fire instantaneously upon request from the computer, and at greater average power levels. Having Tickle can actually extend the life of the laser tube between gas re-charges.

Since every laser has its own personality, Tickle is adjustable through the control panel on the laser system. Tickle is set for each individual laser at the factory, but from time to time, the Tickle setting may need to be adjusted as the internal characteristics of the laser change over several months or several years of operation. Adjustments need only to be done if necessary. There are two main symptoms of a laser that needs Tickle adjustment.

Tickle Setting-Low
If the Tickle setting is too low, the laser will appear to hesitate before firing. Vectored lines may appear to start off weak at the beginning of the line, get stronger in the middle of the line, then get weak again at the end of the line. If the setting is really off, parts of the line may be missing entirely. If you are rastering, the laser may make some raster strokes without firing and then start to fire a couple of strokes later.

Tickle Setting-High
If the Tickle setting is too high, shadows and extra faint lines will appear in blank areas. Vectored text, for example, will appear to be connected by very light lines from one letter to the next as if the laser was supposed to turn off but stayed on slightly. Rastered images will appear to have a shadow to the left and right of the raster stroke about 1/2" from the edge of the rastered area.

Faint start and stop points

Vectored lines (Low Tickle)

The laser made the motion for the raster stroke but the laser did not turn on.

Rastered square (Low Tickle)

Text

Some more text

Faint lines as if the laser did not turn off completely (High Tickle)

Shadows about 1/2 " to the left and right of the raster strokes.

| TEXT |

Rastered objects (High Tickle)
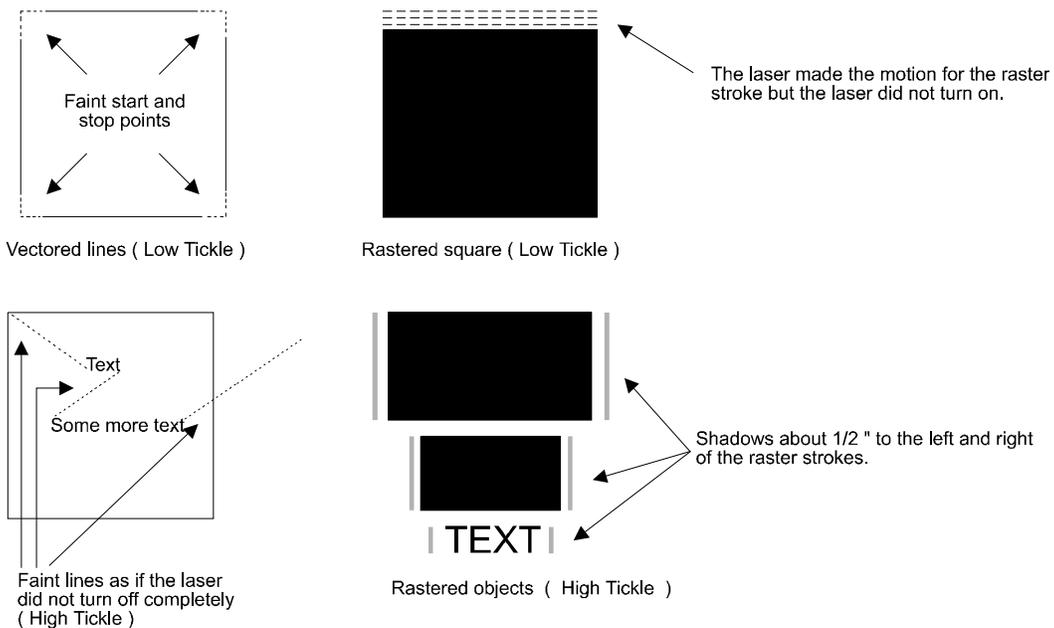
To set the Tickle, go to the Preferences menu in the Control Panel of the laser system, then select "Tickle". There are two numbers, the Tickle Rate in khz(or kilohertz) and the other is Tickle Width in us(or microseconds). The Tickle Rate is a fine adjustment and the Width is a more coarse adjustment. To set the Tickle, warm up the laser by running a graphic at full power and full speed on some scrap material for about 15 minutes. Then draw a rectangle and raster engrave that rectangle on a very sensitive material that will show the shadows of Tickle if it is set too high. If the Tickle setting is

too high, reduce the Rate setting, while observing the file as it is running, until the shadows disappear. If the Rate setting gets down to zero and the shadows are still present, then put the Rate back to its original number and reduce the Width by one. If the shadows still appear, keep reducing the Rate again until it does disappear. If the setting is too low, increase the Rate setting until the shadows appear, then back it off one or two numbers. Once the Tickle is set properly, escape out of the menu and "Retain Settings" which will make the changes permanent.

The "CONFIGURATION" submenu

```
TICKLE
■CONFIGURATION
 DIAGNOSTICS
 RETAIN SETTINGS
```

The "CONFIGURATION" submenu allows the reconfiguration of certain features of the engraving system. Selecting this option will lead to other menu choices.

The "PORTS" submenu

```
■PORTS
 SET ROTARY AXIS
 ALIGNMENT MODE
 LOAD DEFAULTS
```

Two ports are provided on the right side of the system for interface with a computer, a serial and a parallel port. Only one port can be used at a time. To activate a port, select "PORTS" from this menu and one of the following submenus will appear:

```
PARALLEL


```

Or

```
SERIAL
BAUD RATE       9600
STOP BITS          1
PARITY          NONE
```

The menu that appears indicates the currently active port on the laser system. To switch to the other port press the "SELECT" button. In order to use the "SERIAL" port, the communication settings **MUST** match those of the computer. Refer to the computer's hardware and software manuals for details on setting up the computer's serial port.

If using the "SERIAL" port, select the fastest possible "BAUD" rate for communication since this effects how quickly the computer can send files to the laser system. For "BAUD" rates of "9600" and above, set the number of "STOP BITS" on the computer to a higher value than the number of "STOP BITS" selected on the laser system. For example if the number of "STOP BITS" on the laser system is set to "1", then set the computer's stop bits to "1.5" or "2".

"PARITY" of the laser system and the computer MUST match exactly and the choices are "ODD", "EVEN", or "NONE". Pressing the "SELECT" button while the cursor is on "PARITY" will toggle through these choices.

The "SET ROTARY AXIS" submenu

```
PORTS
■SET ROTARY AXIS
 ALIGNMENT MODE
 LOAD DEFAULTS
```
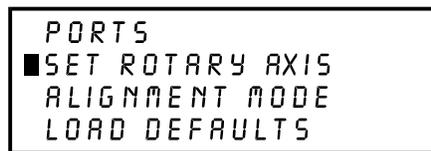
The Rotary Fixture Axis is a setting that is pre-set at the factory. The laser system will sense when the Rotary Fixture is plugged in and will position the X-Axis arm directly over the centerline of rotation automatically when it begins to engrave. This setting can be altered if you position the Rotary Fixture in a location **OTHER** than the pre-drilled screw holes on the engraving table.

To change this setting, turn the laser system OFF, place the Rotary fixture on the engraving table in the desired position, and **DO NOT** plug the Rotary Fixture into the electrical socket. Now turn the laser system ON and with the motion system arrow buttons, position the X-Axis arm's focal lens carriage directly over the Rotary Fixture's centerline of rotation as the following diagram demonstrates:

TOP VIEW
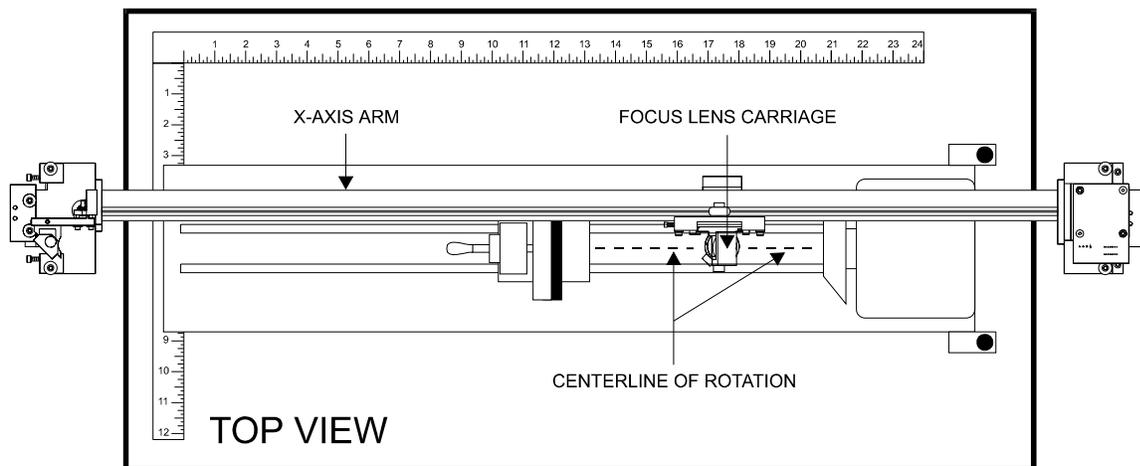
The left and right position (X-position) of the focus carriage is irrelevant in this setting. It's position is determined by where the graphic is placed in the graphics program, therefore, it's position is ignored by the laser system and cannot be set in this procedure.

Now, select the "YES SAVE Y AXIS" choice. If you change your mind and do not wish to alter the "ROTARY AXIS" position, select "CANCEL" instead and the original settings will be restored.

```
┌─────────────────────────────┐
│  SET ROTARY AXIS            │
│  PLACE 1725.7X 6125.Y       │
│ ■CANCEL                     │
│  YES SAVE Y AXIS            │
└─────────────────────────────┘
```

NOTE: To save this setting in the laser systems memory configuration, "RETAIN SETTINGS" must be performed. This procedure is defined later in this section. If you do not "RETAIN SETTINGS", all changes that you made, even after selecting "YES SAVE Y AXIS", will be lost and the previous settings will remain.

To restore the Rotary Fixture back into it's original factory condition, locate the Rotary Fixture in it's normal position and repeat this entire procedure.

The "ALIGNMENT MODE" submenu

```
┌─────────────────────────────┐
│  PORTS                      │
│  SET ROTARY AXIS            │
│ ■ALIGNMENT MODE             │
│  LOAD DEFAULTS              │
└─────────────────────────────┘
```

Then

```
┌─────────────────────────────┐
│ ■POWER                3%    │
│  KHZ                   2    │
│                             │
│                             │
└─────────────────────────────┘
```

This submenu allows access to firing the laser beam to determine if the laser systems optical alignment is correct. **DO NOT** attempt adjustment unless you have had proper training from Universal Laser Systems Inc. If you are experiencing trouble with the laser system and cannot resolve the problem, please call our technical support.

The "LOAD DEFAULTS" submenu

```
┌─────────────────────────────┐
│  PORTS                      │
│  SET ROTARY AXIS            │
│  ALIGNMENT MODE             │
│ ■LOAD DEFAULTS              │
└─────────────────────────────┘
```

Then

```
┌─────────────────────────────┐
│  CHANGE ALL SETTINGS        │
│  --- ARE YOU SURE ---       │
│ ■CANCEL                     │
│  YES LOAD DEFAULTS          │
└─────────────────────────────┘
```

The "LOAD DEFAULTS" selection on the last line resets the laser systems motherboard to its originally manufactured settings. Settings such as "TICKLE" and "SET ROTARY AXIS" will **NOT** be restored to the same settings that were in the laser system when you first received it. Chances are, these two settings were altered by the production department before the laser system was shipped. "LOAD DEFAULTS' nullifies those settings made by our production department. If you inadvertently made this adjustment, you will need to reset the Tickle and the Rotary Axis adjustments.

The "DIAGNOSTICS" submenu

```
 TICKLE
 CONFIGURATION
■DIAGNOSTICS
 RETAIN SETTINGS
```

The "DIAGNOSTICS" selection allows the testing of certain features of the engraving system. Selecting this option will lead to other submenus.

The "TEST MEMORY" submenu

```
■TEST MEMORY
 PLACE 24000X 12000Y
 UNIVERSAL LASER SYS.
 COPYRIGHT 1995 59-85
```

Then

```
 MEMORY TEST
 PAGE 63      FAILS 0
■CANCEL
 YES (CLEARS BUFFER)
```

It may be necessary to use the diagnostic tests if instructed to do so by a member of our technical support staff. The "MEMORY TEST" is a buffer memory test to test the RAM in the laser system. This is very similar to the RAM test that your computer performs when it first gets powered on. In the process of testing memory, all jobs in the buffer will be erased. Once the "MEMORY TEST" is started it will continue to run until it is canceled. To start the test select "YES (CLEARS THE BUFFER)". To end the test, select "CANCEL". This test will continuously pass through the memory. If it finds memory that is bad, it will show up as a failure and the SIMM module will need to be replaced.

The second line of the "TEST MEMORY" submenu displays the current position of the motion system in motion system units (thousandths of an inch). Each unit represents a single step of the motion system motors. The final two lines are a copyright notice and the current version numbers of the OROM (Output Read Only Memory) and the IROM(Input Read Only Memory).

The "RETAIN SETTINGS" submenu

```
 TICKLE
 CONFIGURATION
 DIAGNOSTICS
■RETAIN SETTINGS
```

Then

```
 RETAIN SETTINGS
 --- ARE YOU SURE ---
■CANCEL
 YES ACCEPT
```
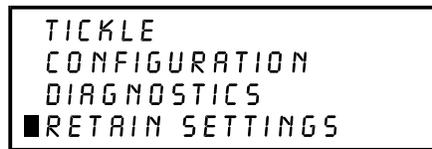
By selecting "RETAIN SETTINGS", any and all changes made to the display settings will be permanently stored even if power is turned off to the laser system. Those settings will be retained in the laser system until they are changed and "RETAIN SETTINGS" is selected again.

The Process Controls

```
┌──────────────────────────────────────────────────────────────────────────────────┐
│  [RED] [GREEN]   ┌──────────────────┐  [▲] [SELECT]   [NEXT] [STANDBY]    ┌─┐      [TEST]   │
│                  │■001)FILENAME.XXX │                  [FILE]             [↑]              │
│  [START]         │ PWR 100%  0:00:00│                              [←]    [→]             │
│                  │ SPD 100%  COPIES 0│ [▼] [ESCAPE]  [PAUSE] [RESUME]     [↓]      [SETUP]  │
│                  │ PPI 500  500 DPI │                                                     │
│                  └──────────────────┘                                                    │
└──────────────────────────────────────────────────────────────────────────────────┘
```
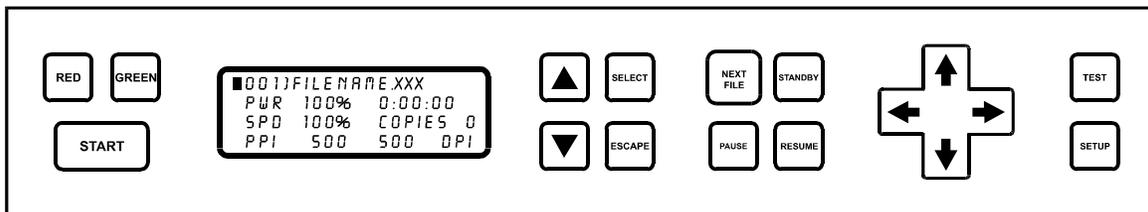
Process Controls

START
The "START" button runs the current job displayed.

PAUSE AND RESUME
If a job is running, the "PAUSE" button halts the engraving or cutting process. When paused, the motion system arm will move to its home position in the upper right corner of the engraving area. When ready to continue operation, press the "RESUME" button and the system will begin cutting or engraving again where it left off. If you wish to run the file from the beginning after pressing the "PAUSE" button, press the "START" button.

NEXT JOB
Pressing the "NEXT JOB" button brings up the next job in the system buffer and makes it the current job. This button is inoperative if a job is currently running.

STANDBY

```
STANDBY
--- ARE YOU SURE ---
■CANCEL
 YES. ACCEPT
```

Then

```
STANDBY SELECTED

PRESS STANDBY OR
ESCAPE TO RESTORE
```

The "STANDBY" button allows the laser system to shut down the power to the laser tube and the cooling fans. This is very useful when the user wants to shut down the laser system without losing the files in the memory buffer. To activate the "STANDBY" mode, press the "STANDBY" button and the bring the cursor down to the "YES, ACCEPT" line and press "SELECT". Files can be downloaded to the laser system while in the "STANDBY" mode. To restore the laser system to full operation, press the "STANDBY" or "ESCAPE" button.

The Indicator Lights

The "GREEN" indicator light will glow solid for the following conditions:
- The laser system is first powered on and ready to receive a file.
- The laser system has finished processing a job and has returned to it's home position. The Beeper will also sound off two short beeps.
- The laser system has been paused while running a job.

The "GREEN" indicator light will remain off for the following conditions:
- The top or front door is open.
- The laser system is firing the beam in the Alignment Mode.

The "GREEN" indicator light will flash on and off when a job is running.

The "RED" indicator light will glow solid for the following conditions:
- The laser system is initializing.
- The laser system is firing the beam in the Alignment Mode.

The "RED" indicator light will remain off for the following conditions:
- The laser system has finished initializing and is ready to receive a file.
- The top and front doors are closed.

The "RED" indicator light will flash on and off when the top or front door is open.

The Motion Control System

The motion control section of the control panel (the four directional arrow buttons) enables the user to manually control motion system movement. Pressing and holding down an arrow button will cause the focus lens holder assembly to move in the respective direction. Pressing two adjacent arrow buttons will move the assembly in a diagonal direction. This part of the control panel is primarily used for focusing the laser beam on the engraving material using the focus tool. Refer to the next section on focusing for a thorough explanation on how to set focus.

SETUP

The "SETUP" button positions the focus carriage in the upper left hand corner of the engraving area where the majority of focusing will be done. Once the focus carriage is positioned, the motion system can still be moved by using the motion control arrow buttons. Pressing the "SETUP" button again will move the focus carriage back to the home position. Refer to the next section for a more detailed explanation on how to focus.

4.3   Loading and Focusing the Laser System

The first step to laser engraving is loading the material and focusing the laser beam on the top surface. Let's use a wooden plaque as an example. Open the top door and place the wood on the engraving table. Rotate the wood so that the longest direction is in the horizontal direction.   Slide the wood into the upper left hand corner of the engraving table against the horizontal and vertical rulers.

Materials larger than the maximum engraving area can be processed provided they can be fit into the machine and allow all the doors to be closed properly. If you have an application of this type, load the material through the front door of the system. However, all the doors must be able to close before cutting and engraving.

WARNING:
Do not attempt to defeat the interlock system in order to process materials too large to fit into the system as this could result in exposure to laser radiation.

To process more than one piece of material at a time, such as in a production application, a template can be easily made to help in loading the system. To make a template draw a slightly oversized outline of the material to be processed and duplicate it as many times as will fit into the engraving area. Place a large piece of paper, cardboard, or acrylic on the engraving table and cut the outlines into the material. Position the engraving objects within the template outlines. Now position the graphics on screen so that they are aligned within the template outlines. Finally, print only the graphics and not the outlines to the laser system. A convenient template has now been made for quickly loading the system.

In order to cut and engrave with precision the laser beam in the laser engraving system is focused to a small spot by the focus lens. There are two types of Z-Axis engraving table controls, manual (standard) and electric (optional).

Manual

To focus using the manual Z-axis Adjustment Knob, open the top door. Load your material into the upper left hand corner of the engraving table up against the rulers. Now press the "SETUP" button and the focus lens holder assembly will move into the upper left hand corner of the engraving table right over your material. If the focus lens is not directly over your material, reposition it by using the motion control arrow buttons.

NOTE: The Z-axis controls (pressing the "SETUP" button) are only accessible when the display is showing the "MAIN MENU" or the "OPERATIONS DISPLAY" menu. If the either is not displayed, repeatedly press the "ESCAPE" button until it does.

Position the engraving table up or down until the base of the focusing tool can be placed on the top surface of the material to be processed and the flat of the focusing tool can be placed flat against the lens holder as in the following diagram:
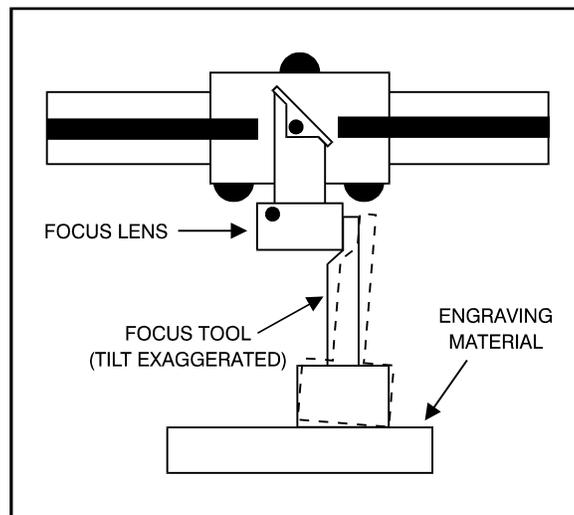
Observe the top of the focusing tool. Now raise the engraving table using the Z-Axis Adjustment Knob until the focusing tool just starts to tilt away from the lens holder as shown in the diagram above. Back the engraving table down again slightly so the focusing tool again sets flat against the side of the lens holder. Remove the focus tool and press the "SETUP" button again to get out of this menu and return the focus carriage to the home position.

Electric (optional)

To focus using the electric Z-axis table adjustment, open the top door. Load your material into the upper left hand corner of the engraving table up against the rulers. Now press the "SETUP" button and the focus lens holder assembly will move into the upper left hand corner of the engraving table right over your material. If the focus lens is not directly over your material, reposition it by using the motion control arrow buttons. Note that the following menu will appear on the display:

```
┌─────────────────────────────┐
│  HEIGHT ADJ.   COARSE       │
│                             │
│                             │
│                             │
└─────────────────────────────┘
```

By pressing and holding the "UP ARROW" button, the table will move up rapidly and by pressing and holding the "DOWN ARROW" button the table will move down rapidly. This is due to the "COARSE" setting on the display. If you quickly depress and release the arrow button, the table will move in smaller increments. Use the focus tool in the same manner as adjusting the Z-Axis table manually. When you get close enough to being in focus by using the focus tool, press the "SELECT" button to change the "HEIGHT ADJ." to "FINE".

```
┌─────────────────────────────┐
│  HEIGHT ADJ.     FINE       │
│                             │
│                             │
│                             │
└─────────────────────────────┘
```

This will allow even finer adjustments of the Z-Axis table. Practice using the controls until you get a feel for how to use this easy method of focusing.

Remove the focus tool and press the "SETUP" button again to get out of this menu and return the focus carriage to the home position.

4.4   Running a Sample

The following outline is a step by step procedure used to produce a laser engraved object. Please follow this procedure to understand the steps necessary for laser engraving.

Step 1   Turn on the computer and then the laser system. Be sure to turn the equipment on in this order.

Step 2   Load the object that will be engraved into the laser system and position it in the desired location in the engraving area. Usually, the object is placed up against the rulers in the upper left hand corner of the engraving area. Use the rulers to determine the size of the engraving object. Use either the top door or the front door for loading.

Step 3   Press the "SETUP" button and by using the motion control buttons, position the focus lens assembly over the engraving material. Adjust focus by using the focusing tool and adjusting the height of the engraving table.

Step 4   Create a graphic using the graphics software program and position the graphic on screen so that it matches the placement of the object in the laser system.

Step 5   Before printing, go to the ULS Printer Driver and assign the power settings. If using DOS based programs, go to the laser system and enter in the power settings on the control panel in the "DOS POWER SETTINGS" submenu.

Step 6   Now send the job down to the laser system.

Step 7   Turn on the exhaust blower.

Step 8   Supervise the engraving or cutting function. **DO NOT** leave the job unattended.

Step 9   Finally, when the job is in the laser system's buffer, press the "START" button to start engraving.


4.5   Using the Optional Rotary Fixture

The Rotary Fixture controls in the ULS Printer Driver are used along with the optional Rotary Fixture to engrave onto round or cylindrical objects. In order to compensate for different diameter objects, the image must be adjusted. This is done automatically by the ULS Printer Driver when selecting "Rotary Fixture" and entering in the diameter of the object being engraved.

Two attachments come with the fixture, a cone shaped disk attached to the motorized end of the fixture and a flat disk with foam padding attached to the adjustable end of the fixture. These attachments are designed to hold wine glasses, mugs, cups, etc. The following is a step by step procedure in the installation and operation of the Rotary Fixture. We are going to use a glass as an example.

Installation of the Rotary Fixture

1. Turn the laser system ON and lower the table all the way down to the bottom. Next, turn the laser system OFF. Open the top door of the laser engraving system and place the Rotary Fixture on the engraving table with the black box on the Rotary Fixture to the right.

2. Attach the Rotary Fixture to the engraving table by aligning it with the screw holes on the table. Before tightening the thumbscrews, position the fixture so that it is squarely aligned with the rulers. Being square to the rulers will ensure that the

fixture is square to the engraving area. The rulers also provide a visual guide as to where to locate the graphic in the graphics software. Tighten the thumbscrews.
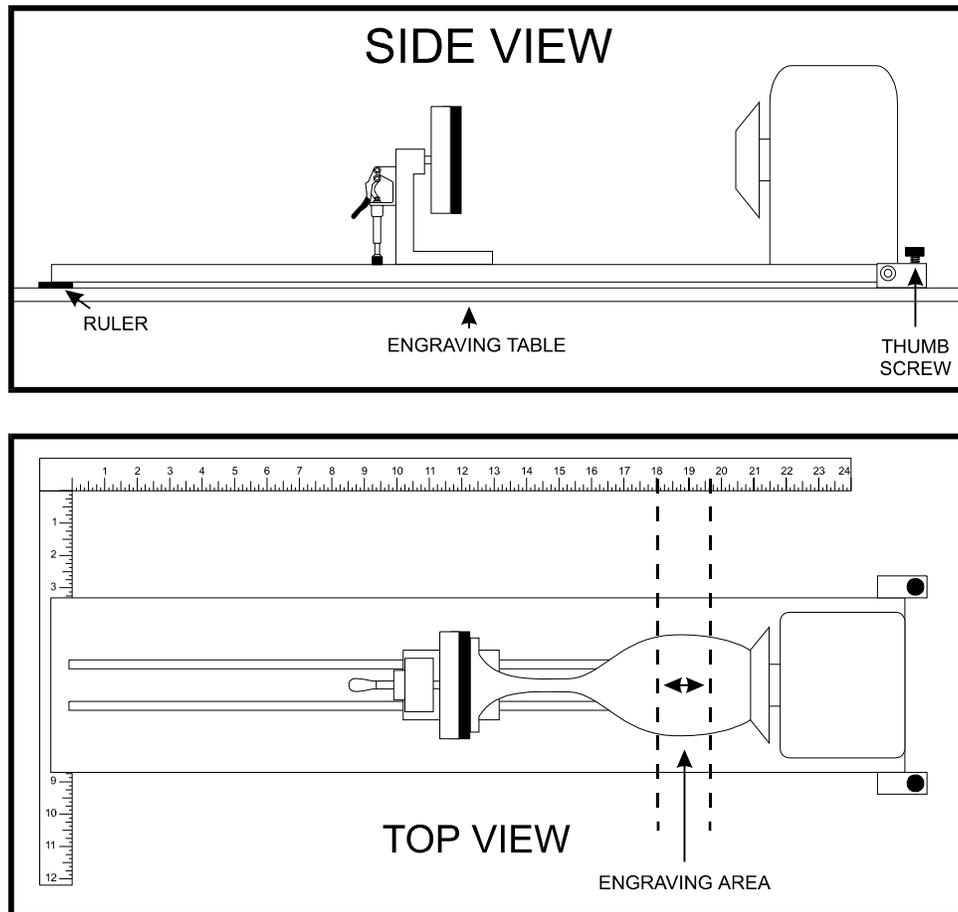

Installed Rotary Fixture

3. Next, connect the Rotary Fixture control cable to the receptacle on the laser engraving system. If necessary, refer to the diagram at the beginning of this chapter for the receptacle's location.

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

5. Place the open end of the glass on the right side of the Rotary Fixture. Lift the lever on the adjustable end of the fixture and slide it up against the other end of the glass so the glass rests firmly against the padded foam disk. Do not to apply too much pressure, especially with glass. Lower the lever on the adjustable end of the fixture to secure it in place.

6. Turn on the laser system and wait for it to home. Press one of the directional arrow buttons on the motion control panel and notice that the motion system will align to

the centerline of the Rotary Fixture automatically. Now focus on the glass by using the focus tool and adjusting the table up or down. If the glass slopes too much in the engraving area, the Rotary Fixture can be tilted upwards to make the surface of the glass parallel with the motion system. To do this, lift up the left end of the fixture and place some sort of spacer underneath the fixture to prop it up. Be careful not to raise the Rotary Fixture too high, otherwise it might interfere with the motion system. Press the "PAUSE" button to move the arm out of the way.

Operation of the Rotary Fixture in the Landscape mode

TOP VIEW
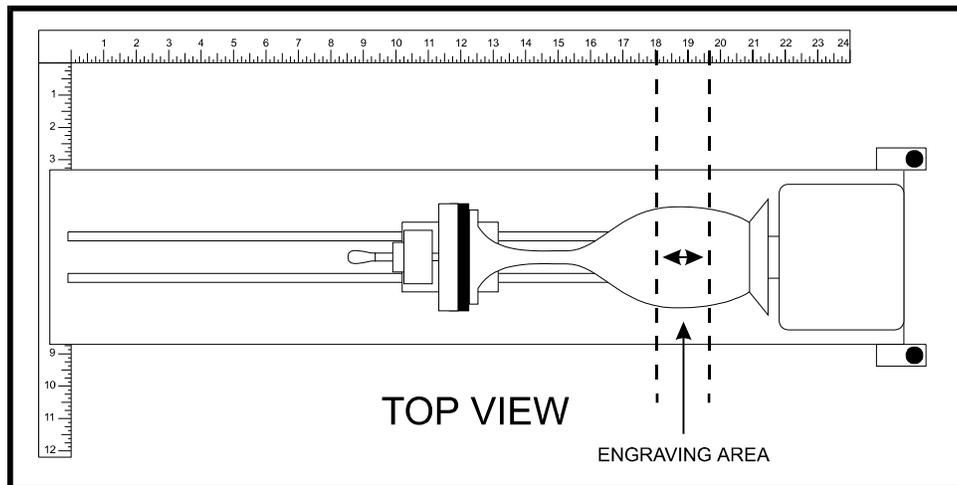
ENGRAVING AREA

1. Use the top ruler as a visual aid in referencing the engraving area of the glass. Sometimes using a ruler placed up against the glass and at a right angle to the table rulers will help with determining the engraving area. Note this area because is will be used in designating where to place the graphic on the computer screen.

2. In the driver, make sure that the Page Setup is set to Landscape and the size set to a width equal to 24 x 12 inches (609.6 mm x 304.8 mm). Then click on the "Rotary Fixture" selection box and type in the diameter that was measured. Notice that while typing in the diameter, the size of the height dimension changes automatically. Remember or write down this new page size. 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 ULS Printer Driver established when the diameter of the object was typed in.

3. This new vertical page size is now the actual circumference of the object that is going to be engraved. From the top of the engraving area (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 (and vertical page size) is 9.66 inches (245.4 mm).

```
    1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24
1
2
3          GRAPHICS SOFTWARE
4          PAGE LAYOUT
5          24 INCHES (609.6 mm) WIDE
6          9.66 INCHES (245.4 mm) TALL
7          LANDSCAPE MODE
8
9
```

ROTATE THE GRAPHIC 90 DEGREES. PLACE THE GRAPHIC IN THIS ENGRAVING AREA THAT WAS ESTABLISHED WHEN THE GLASS WAS FIRST LOADED INTO THE LASER
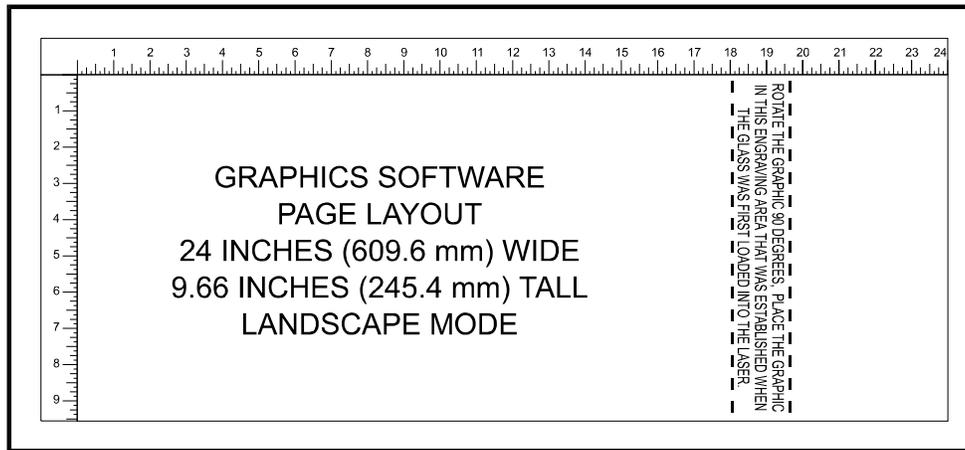
4. Position the graphic, on screen, so that it will fit vertically within the new page height and horizontally within the engraving area of the glass. If the graphic does not fit within the vertical page size limits, the portion that is outside the page limit will not engrave. Remember, the new page size that the driver calculates from the diameter of the glass is it's actual circumference. From the top of the page down to the bottom is one complete revolution of the glass. Since the Rotary Fixture will not turn more than 360 degrees, make sure that the graphic lies between the page limits.

5. If you will be engraving something that is not cylindrical such as a mug with a handle, or the engraving needs to put in a certain location on the glass proceed to the next step otherwise proceed to Step 10.

6. Let's use a mug with a handle as an example. Place the mug into the Rotary Fixture and lock it down. Make sure that the motion system is in it's home position by pressing the "PAUSE" button. By hand, rotate the mug until the handle points straight up. You can accomplish this by releasing the locking mechanism, rotating the mug until the handle is pointing straight up, and locking it back down. Or you can simply rotate the mug while it is locked down by turning it until the handle points straight up. It is no problem to do this even if you turn the cone of the Rotary Fixture. The laser system will use whatever position the Rotary Fixture is resting at as it's home position when it starts to engrave the file.

7. The Rotary Fixture rotates towards the back of the laser system as is starts to engrave. If the graphic extends from the top of the page (on screen) to the bottom, the Rotary Fixture will rotate 360 degrees until the handle comes to a stop, positioned straight up making one complete revolution.

8. If you would like the engraving positioned opposite the handle (180 degrees), place the graphic, on screen, centered between the top of the page and the bottom of the page. If you would like the engraving positioned between the handle and 180 degrees opposite the handle, then center the graphic, on screen, between the top of the page and the vertical center of the page. If you would like the graphic on the other side of the mug, position the graphic, on screen, centered between the vertical center of the page and the bottom of the page.

9. Experiment with some scrap materials to determine where the graphic will engrave when the graphic is located in different areas on screen.

10. Set the driver parameters, send the file to print, and begin engraving.

Operation of the Rotary Fixture in the Portrait mode

1. The Rotary Fixture can also operate in the Portrait mode providing that the engraving object is not too heavy. The Portrait mode will cause the Rotary Fixture to spin the object back and forth very quickly. The normal Landscape mode will rotate the object very slowly and raster the X-axis arm from left to right very rapidly. Landscape mode usually takes longer to engrave than Portrait mode. If using Portrait mode, make sure to engrave or cut at speeds lower than 50% otherwise the object might slip as the Rotary Fixture spins back and forth. If the object slips, it is either too heavy or the engraving speed is too fast. To use the Portrait mode, simply click on Portrait in the graphics software's page setup and then in the ULS Printer Driver.

2. The graphic on screen will now need to be adjusted. The graphic will have to be rotated another 90 degrees so that the graphic is upside down. Reposition it within the defined engraving area as the diagram below illustrates:

GRAPHIC SOFTWARE
PAGE LAYOUT
9.66 INCHES (245.4 mm) WIDE
24 INCHES (609.6 mm) TALL
PORTRAIT MODE

ROTATE THE GRAPHIC 180 DEGREES. PLACE THE GRAPHIC
IN THIS ENGRAVING AREA THAT WAS ESTABLISHED WHEN
THE GLASS WAS FIRST LOADED INTO THE LASER.
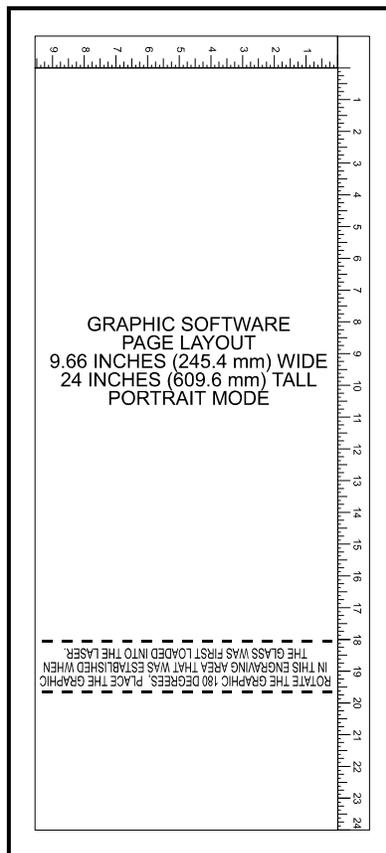
3. Do nothing to the Rotary Fixture inside of the laser. The setup on it is the same as in Landscape mode. Experiment with using both the Landscape and Portrait modes and note the results.

NOTE: Remember that the new page size that was established by the driver when the objects diameter was entered in indicates the circumference or distance around the outside of the object. Be sure to go back and adjust the graphics programs page size to match these new dimensions **EXACTLY** otherwise the graphic will engrave in the wrong place, engrave only partially, or not engrave at all.

4.7   Start Up Parameters for Various Materials

This section provides driver settings and helpful hints to get started engraving and/or cutting various materials. These settings are to serve as a starting point and are not necessarily optimized for each particular application. There are many variables that can affect the cutting and engraving process such as differences in the thickness of the material, density of the material, composition of the material, and the manufacturing processes used to make the material. Please use these settings as a guideline, in most cases these settings should work out well, but sometimes may have to be adjusted to produce desirable results.

In compiling these settings, all samples were run with the resolution set at 500 DPI(except were otherwise noted). When using a lower resolution in order to achieve greater engraving speeds, remember that the resolution will be reduced which in turn will reduce quality and depth. In order to compensate for lower resolution settings, lower the speed and/or increase the power to achieve the same depth. The opposite applies for higher resolution settings.

Below is a list of the various materials that were tested. The following pages will fully describe the results of these tests and will offer helpful hints when choosing materials, setting parameters, and using different techniques to provide the best laser cutting and engraving results.

<div align="center">

ACRYLIC - CAST AND EXTRUDED
ACRYLIC - MIRRORED
ALUMINUM - ANODIZED
BRASS - COATED
CORIAN OR AVONITE
CORK
DELRIN (SEAL PRESS)
GLASS
LEATHER
MARBLE
MAT BOARD
MELAMINE - PHOTO/CLIPART ENGRAVING
MELAMINE - STANDARD ENGRAVING
PLASTIC - ENGRAVERS
VINYL - SIGN
WOOD - FINISHED WALNUT
WOOD INLAY - VENEERS

</div>

WARNING:
Because exposure to the laser beam may cause ignition of combustible materials, all cutting and engraving should be constantly supervised.

ACRYLIC - CAST AND EXTRUDED

TYPE	POWER	SPEED	PPI	PASS	DEPTH
LIGHT RASTER ENGRAVING	25	100	500	1	.001"

COMMENTS:
Remove original factory masking from the engraving surface. Leave the masking on the non-engraved surface to prevent accidental scratches.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
DEEP RASTER ENGRAVING	100	70	500	1	.010"

COMMENTS:
This sample engraved deeper than the first sample. Engrave through original masking. Engraving too deep will lose detail.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR ENGRAVING	5	4.0	500	1	.2"

COMMENTS:
Engrave with or without masking.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR CUTTING	75	.8	500	1	.2"

COMMENTS:
For the best results, remove the original masking on both sides. Re-mask with transfer tape. Moisten both sides with water from a spray bottle. Elevate the material at least 1/8" off of the engraving table.

ADDITIONAL COMMENTS

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

If only cutting acrylic, extruded works better and is less expensive than cast. The cut edges of extruded acrylic will appear to be more highly polished and clearer than cast acrylic when laser cut. When cutting acrylic, it might be necessary to remove both sides of the original masking and re-mask with transfer tape if cutting through the original masking produces flaming. The original masking is coated with wax and will not absorb water. If cutting through very thick acrylic, re-mask both sides with transfer tape and dampen the masking on both sides of the acrylic with water from a spray bottle. Elevate the acrylic off the table at least 1/8 inch, re-focus, then proceed to cut. Elevating the acrylic will allow the beam to completely pass through the material which allows the smoke and heat to escape from underneath. If cutting directly on the engraving table, the trapped heat might cause the bottom edge of the cut to pit and distort. Re-masking and dampening with water will act as a heat sink to pull the laser heat away from the cutting area resulting in less distortion or heat effected zones (HAZ). When dampening, be sure not to leave puddles of water. Puddles of water will reduce cutting depth significantly. For the best results when combining engraving and cutting on the same piece, first engrave lightly and unmasked. Then mask with transfer tape, dampen, elevate, re-focus, and cut as a second step.

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

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

ACRYLIC - MIRRORED

TYPE	POWER	SPEED	PPI	PASS	DEPTH
LIGHT RASTER ENGRAVING	30	100	500	1	.003"

COMMENTS: Engrave unmasked and on the backside in reverse text. Engraving on the front side of mirrored acrylic will visually produce a double image.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
DEEP RASTER ENGRAVING	100	70	500	1	.010"

COMMENTS: Masking is not necessary because the acrylic is protected from smoke damage by the mirrored backing.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR ENGRAVING	5	4.0	500	1	.005"

COMMENTS: Again, masking is not necessary because the acrylic is protected from smoke damage by the mirrored backing.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR CUTTING	75	1.6	500	1	.1"

COMMENTS: Make sure both sides are masked. Dampen and elevate at least 1/8" above the engraving table. Two passes make a cleaner cut than one. Cut from the front side of the mirror to prevent heat distortion of the mirrored back surface.

ADDITIONAL COMMENTS

Engraving mirrored acrylic is similar to engraving regular acrylic. The idea is to engrave through the mirrored backing enough to begin to penetrate into the acrylic. Engraving deeply will cause, a crusty residue to form just like with non-mirrored acrylic. A double image will appear if engraving on the front side of the mirror. It is not necessary to mask the backside when engraving because the mirrored backing shields the acrylic from smoke damage. To cut mirrored acrylic, it might be necessary to remove all original masking, re-mask with transfer tape, and dampen the tape with water from a spray bottle. Next, place the acrylic in the laser with the mirrored surface facing upwards and elevate at least 1/8 inch above the table. The laser beam will not reflect off of the mirrored surface because it is absorbed by the acrylic first. Sometimes cutting the acrylic from the back side will cause the mirrored backing to distort and crack from the intense heat required to cut. If the combination of engraving and cutting is desired, our suggestion is to engrave the backing, unmasked, remove the acrylic, mask both sides with transfer tape, flip the acrylic over, dampen, elevate, re-focus, and cut from the front side. When paint filling the engraved area, make sure to use an acrylic based paint or paint that does not contain acetone or alcohol as these chemicals will crack the acrylic. Water based paints also work very well. Since the mirrored backing serves as a masking, it is not necessary to mask the back side before engraving.

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

ANODIZED ALUMINUM

TYPE	POWER	SPEED	PPI	PASS	DEPTH
RASTER ENGRAVING	30	100	500	1	.001"

COMMENTS: The power required is dependent on the thickness of the anodized coating. Do not overpower because the anodized will either be dull in appearance or the engraving lines will be too thick.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR ENGRAVING	10	4.0	500	1	.001"

COMMENTS: Different anodized coatings will require higher or lower power settings. Power must be increased if engraving at a faster speed.

ADDITIONAL COMMENTS

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

BRASS - COATED

TYPE	POWER	SPEED	PPI	PASS	DEPTH
RASTER ENGRAVING	30	100	1000	1	.002"

COMMENTS: Engrave unmasked. Use a light setting to engrave through the coating. Using 1000 PPI seems to have a cleaner removal of the coating. Some thicker coated brass will require more power. Too much power loses resolution and washes out finer detail.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR ENGRAVING	15	4.0	1000	1	.002"

COMMENTS: Engrave unmasked. Use enough power to expose the brass. Too much power will cause thicker engraving lines.

ADDITIONAL COMMENTS

The manufacturing processes for coated brass varies from one vendor to another. Some of the manufacturers do not polish the brass before coating it. Since CO_2 lasers at this power level do not engrave into metals when the coating is removed, the tarnished brass underneath will have a dull appearance that will need to be polished with a brass polishing compound. This type of brass is designed for mechanical engravers that actually remove the metal when engraving which gives the brass a shine without polishing. Brass that is produced for the laser engraving industry is polished, then clear coated, and finally coated with paint. When laser engraving this type of material, adjust the power so that the laser beam removes the painted coating but not the clear coating. This will expose the polished, clear coated brass without penetrating all the way down to the metal. Since the brass is already clear coated and polished, it will not require any cleanup after engraving nor will it ever oxidize. If too much laser power is used, the brass the clear coat will be removed and the brass underneath will be exposed to the heat of the laser beam causing instant tarnish. The same goes for enamel coated pens, some are polished and clear coated underneath, and others are tarnished which will require polishing after engraving. If polishing the brass, use a soft, non-abrasive cloth or tissue and good quality brass polish. Be careful not to rub too hard as this will scratch the painted coating. Do not use paper towels either because they will scratch also. Clear coated brass can also be engraved and the engraved area turned black with an oxidizer giving exceptional results. Test clear coated brass from different vendors as not all of them will work properly. If the brass, after being engraved, does not oxidize with the acid solution, apply automotive fine grit rubbing compound to the engraved area with a soft cloth. This will remove any clear coat that is remaining and will allow the brass to oxidize with the acid. Apply the same parameters and engraving techniques when using coated aluminum.

CORIAN or AVONITE

TYPE	POWER	SPEED	PPI	PASS	DEPTH
RASTER ENGRAVING	100	70	500	1	.005"

COMMENTS: Mask first before engraving if planning to paint fill.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
DEEP RASTER ENGRAVING	100	35	500	1	.015"

COMMENTS: Mask first if planning to paint fill.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR ENGRAVING	50	4.0	500	1	.010"

COMMENTS: Mask first if planning to paint fill.

ADDITIONAL COMMENTS

Laser engraving this type of material produces spectacular results especially when the engraved area is paint filled. If paint filling, it is a good idea to mask first and then engrave through the masking. In this way, when ready to paint fill, the material is already masked. Spray painting seems to be the easiest. Using a paint brush is acceptable but time consuming. Use the paint sparingly. Excess paint can accumulate on the edges of the engraving which will make mask removal difficult and leave unsightly ridges. It is best to apply several lighter coats than one heavy coat of paint. Remove the masking after the paint has dried. Engraving this material without paint filling can work but most of the time there is very little contrast which makes the engraved area difficult to see.

CORK

TYPE	POWER	SPEED	PPI	PASS	DEPTH
RASTER ENGRAVING	75	100	500	1	.010"

COMMENTS: Engraved unmasked.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR ENGRAVING	10	4.0	500	1	.010"

COMMENTS: Engrave unmasked.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR CUTTING	50	1.6	100	1	.060"

COMMENTS: Unmasked. A low PPI setting is used to prevent flaming.

ADDITIONAL COMMENTS

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

DELRIN (SEAL PRESS)

TYPE	POWER	SPEED	PPI	PASS	DEPTH
RASTER ENGRAVING	100	60	500	1	.015"

COMMENTS: Engraved unmasked.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR CUTTING	75	2.4	200	1	.060"

COMMENTS: Unmasked. A low PPI setting is used to prevent flaming.

ADDITIONAL COMMENTS

Making a seal using plastic is revolutionizing the industry. The laser can engrave and cut out a typical Notary Seal in less than 5 minutes. A male and female die must be made as the diagram below indicates.
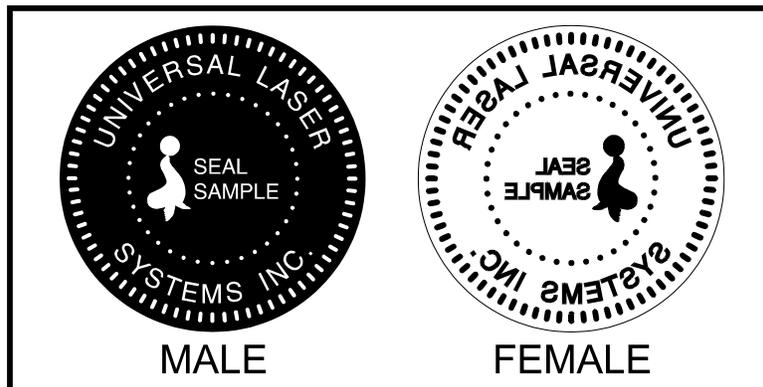
Seal Sample

Create the male with a white graphic and a black background. Mirror the image and invert it by making the background white and the graphic black. Add a .010 inch black outline to the graphic portion of the female side. This will give the greater clearance to the female side to prevent the paper from piercing through when the male side of the seal presses into the female side. Once the seal is made and fastened to the press, make several impressions onto 400 grit sandpaper to smoothen out the edges of the plastic. Make sure you turn the sandpaper over to get both sides of the seal.

GLASS

TYPE	POWER	SPEED	PPI	PASS	DEPTH
RASTER ENGRAVING	100	100	500	1	.001"

COMMENTS: Since glass will not vaporize when laser engraving, it does not require a lot of laser power.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR ENGRAVING	8	4.0	500	1	.001"

COMMENTS: Again, since glass will not vaporize, it does not require much laser power.

ADDITIONAL COMMENTS

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

If using the optional Rotary Fixture in the Portrait Mode use the following settings to minimize the chances of the object slipping in the fixture while running at high speeds. If engraving in the landscape mode, use the settings defined at the top of this page.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
RASTER ENGRAVING	50	50	500	1	.001"

LEATHER

TYPE	POWER	SPEED	PPI	PASS	DEPTH
LIGHT RASTER ENGRAVING	20	100	500	1	.001"

COMMENTS: Engrave unmasked.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
DEEP RASTER ENGRAVING	60	100	500	1	.010"

COMMENTS: Engrave unmasked. Deeper engraving will require masking to prevent smoke damage.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR ENGRAVING	5	4.0	500	1	.003"

COMMENTS: Engrave unmasked.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR CUTTING	50	2.0	200	1	.1"

COMMENTS: Mask top surface and use a low PPI setting when cutting.

ADDITIONAL COMMENTS

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

MARBLE

TYPE	POWER	SPEED	PPI	PASS	DEPTH
RASTER ENGRAVING	100	100	500	1	.003"

COMMENTS: Engrave unmasked. Too much laser power by running too slowly will engrave too deep and discolor.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR ENGRAVING	20	4.0	500	1	.003"

COMMENTS: Engrave unmasked.

ADDITIONAL COMMENTS

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

MAT BOARD

TYPE	POWER	SPEED	PPI	PASS	DEPTH
RASTER ENGRAVING	30	100	250	1	.005"

COMMENTS: Engrave unmasked. A low PPI setting is used to prevent discoloration.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR ENGRAVING	20	4.0	250	1	.005"

COMMENTS: Engrave unmasked and at a low PPI setting.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR CUTTING	60	4.0	200	1	.050"

COMMENTS: Mask on both sides and elevate above the table at least 1/8". Use a lower PPI setting to reduce discoloration of the cutting edge.

ADDITIONAL COMMENTS

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

MELAMINE - STANDARD ENGRAVING

TYPE	POWER	SPEED	PPI	PASS	DEPTH
RASTER ENGRAVING	100	70	500	1	.015"

COMMENTS: Engrave unmasked.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
DEEP RASTER ENGRAVING	100	50	500	1	.020"

COMMENTS: Engrave unmasked.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR ENGRAVING	20	4.0	500	1	.010"

COMMENTS: Engrave unmasked.

ADDITIONAL COMMENTS

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

MELAMINE - PHOTO/CLIPART ENGRAVING

TYPE	POWER	SPEED	PPI	PASS	DEPTH
RASTER ENGRAVING	75	100	500	1	.008"

COMMENTS: Engrave unmasked. Use a resolution of 500 DPI.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
RASTER ENGRAVING	100	70	500	1	.008"

COMMENTS: Engrave unmasked. Use a resolution of 250 DPI.

ADDITIONAL COMMENTS

Engraving photographs can be challenging at first but becomes easier once there is an understanding of what to look for and how to achieve the desired results. In an image processing software, scan the image in at 300 DPI. Adjust the brightness and the contrast to brighten the light colors and darken the dark colors. The photo might look better by using a sharpening filter to sharpen up the image slightly. The next step is to select a halftone pattern. Usually, imaging software gives the choice of using different halftone patterns including frequency of lines per inch and pattern angles. Use a line frequency above 20 and below 100. The size of the dots decreases as the line frequency increases. Experiment to see which pattern looks the best. Big dots look good on some materials and small dots look better on others. If it is not possible to assign a halftone pattern in the imaging software, the ULS Printer Driver will automatically default to a predetermined pattern based on **RESOLUTION**. Refer to the chart below.

RESOLUTION	ANGLE	SHAPE	LINES PER INCH
1000	45 DEGREES	ROUND	180
500	45 DEGREES	ROUND	90
333	45 DEGREES	ROUND	60
250	45 DEGREES	ROUND	45
200	45 DEGREES	ROUND	36

When using the B/W Raster mode switch, which prints all ClipArt or drawings as grayscale bitmaps, use the same parameters and techniques as for engraving photographs.

PLASTIC - ENGRAVERS

TYPE	POWER	SPEED	PPI	PASS	DEPTH
RASTER ENGRAVING	25	100	500	1	.003"

COMMENTS: Remove original masking and leave unmasked. Use enough power to remove the surface material and expose the underlying substrate.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
DEEP RASTER ENGRAVING	100	90	500	1	.015"

COMMENTS: On thicker plastics, remove the original masking and leave unmasked. Set the power high enough to assure the full removal of the top surface and to remove some of the substrate material. Sometimes it may be better to make two passes a lower power setting.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR CUTTING	60	1.6	150	1	.060"

COMMENTS: Remove original masking. Mask with transfer tape on both sides. Dampen both sides with water and elevate off the table. Make 1 to 2 more passes when cutting thicker plastics.

ADDITIONAL COMMENTS

Engravers plastic comes in many different colors, thickness, coatings, and surface textures. About 75 % of the available engravers plastic, including ADA signage materials, will engrave and cut well with the laser system. Microsurfaced plastics seem to work the best because there is less surface material to remove to uncover the substrate. Since most plastics have low melting points, a low PPI setting is used when cutting to reduce the possibility of melting. Masking and dampening with water also helps to reduce melting and keeps the plastic clear of smoke residue. Always remove the original clear masking from the plastic because it does not react well with the laser. Since there are so many types of engravers plastics, the only true way to find out if a particular brand and type will work well with the laser is to experiment. Use these power settings as a guideline for experimentation and adjust as necessary. Be creative when engraving this type of material because amazing results will be produced that cannot be reproduced with a mechanical engraver.

SIGN VINYL - 3 MIL

TYPE	POWER	SPEED	PPI	PASS	DEPTH
RASTER ENGRAVING	100	50	500	1	.015"

COMMENTS: These parameters are for engraving vinyl on wood. Apply the vinyl to the wood and squeegee out air bubbles. Mask with transfer tape. Engrave deep enough to go through the tape, vinyl, and into the wood. Make a second pass to go deeper. Engraving at a slower speed might cause the vinyl to melt.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR CUTTING	5	4.0	500	1	.003"

COMMENTS: Unmasked, cuts through vinyl and not the backing. Thicker vinyl requires more power and thinner ones require less. Adjust as necessary.

ADDITIONAL COMMENTS

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

WOOD - FINISHED WALNUT

TYPE	POWER	SPEED	PPI	PASS	DEPTH
RASTER ENGRAVING	100	70	500	1	.020"

COMMENTS: Engrave unmasked. If masking, reduce the speed setting to 50% to get the same depth.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR ENGRAVING	40	10	500	1	.030"

COMMENTS: Engrave unmasked.

TYPE	POWER	SPEED	PPI	PASS	DEPTH
VECTOR CUTTING	50	1.6	250	1	.125"

COMMENTS: Elevate at least 1/8" off of the engraving table. Lightly dampen bottom side with water. Both surfaces can also be masked and dampened with water. Elevating will let heat and smoke escape from underneath and prevent burning.

ADDITIONAL COMMENTS

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

pieces will fall through to the table when cutting is finished. If raising the wood, set up the drawing so that the inner pieces of the drawing are cut first, otherwise pieces may fall through at the wrong time.

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

WOOD INLAYS - VENEERS

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

Another method, which we believe is a better way, is to first create your graphic and fill it with the color black. Then give it a white outline of .012 inches (.3 mm). If you look at the graphic when you add the outline, you will see that it appears to shrink. Now raster engrave the graphic to a depth slightly shallower than the thickness of the veneer. When the engraving is finished, place the veneer into the laser system. Take the graphic on screen, remove the black fill and change the outline to the color red. Also make sure that the red outline thickness is set to .001 inches (.1 mm) so that it will vector cut. Cut out the veneer with the laser system, add glue to the veneer, apply the veneer into the engraved area of the other piece of wood, and let dry. After the glue has thoroughly dried, sand the veneer until it is flush with the base wood. A good veneer to use are those with an adhesive backing. Once cut, place the veneer into its proper place on the engraved wood block and with a clothes iron, iron the veneer into the engraved wood. This melts the glue and causes the veneer to stick to the engraved area. Finish the wood as you desire and the finished product will look fantastic.

The veneer can now be sanded flush with the surface and a finish coat applied.

Section 5 - Basic Maintenance

5.1   General Cleaning and Maintenance Supplies

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 blower, 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. Below is our suggested maintenance schedule.

WARNING
Always turn the laser engraving system off and unplug it before performing any cleaning procedures.

Suggested Cleaning and Maintenance Supplies

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

- Cotton swabs (supplied)
- Lens cleaner (supplied)
- Lens tissue (supplied)

- Vacuum cleaner
- Set of Allen wrenches sized from .050 to 3/16 inch

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

Please familiarize yourself with the motion system components in the following diagram. It will help you understand which components will need cleaning or adjustments that will be defined in these procedures:

X-AXIS MOTOR
(WITH X-AXIS DRIVE GEAR)

Y-AXIS BEARINGS
(2 OF THEM)

Y-AXIS BEARING
TRACK

Y-AXIS BELT

Y-AXIS DRIVE GEAR

Y-AXIS LIMIT SWITCH
(HOME SENSOR)

Y-AXIS IDLER PULLEY

X-AXIS LIMIT SWITCH
(HOME SENSOR)

X-AXIS BELT

#3 MIRROR

FOCUS LENS
(IN HOLDER)

Y-AXIS MOTOR

X-AXIS BEARINGS
(3 OF THEM)

X-AXIS BEARING TRACKS

FOCUS CARRIAGE

#2 MIRROR

Y-AXIS DRIVE GEAR

#2 MIRROR HOLDER

Y-AXIS BELT

Y-AXIS IDLER PULLEY

Y-AXIS
BEARING TRACK

Y-AXIS BEARINGS
(2 OF THEM)

5.2   System Cleaning

1.   Turn off and unplug the laser system.

2.   Open the Top Door and the Front Door. Thoroughly remove all loose dirt and debris from inside the machine with a vacuum cleaner.

3.   Clean the Engraving Table surface with either soap solution, 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.

4.   Remove the Cover Plate, located on the right side of the laser system below the Engraving Table Adjustment Knob, by removing the two Thumbscrews and lifting the Cover Plate straight up and out. This will allow access to the Y-axis Motion System Rail on the right side.

5.   Clean all of the rails of the Motion System by using either the cotton swabs or paper towels, and alcohol or soap solution. Pay close attention to the bearing tracks that the bearings roll in since any debris left to build up in these bearing tracks will cause the bearings to wear and the engraving quality to become rough.

6.   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-axis Arm, and two(2) on the right side of the X-axis Arm.

7.   Clean the Top Window with a cotton cloth and the soap solution. The Top Window is made out of acrylic. **DO NOT** use paper towels because they will scratch the acrylic. Also, **DO NOT** use window cleaner, alcohol, or acetone as these chemicals will crack the acrylic. Only use cleaners designed for acrylic.

8.   Check the Intake Air Filter on the inside of the Front Door jamb of the laser system. To remove it, reach in with your fingers and gently pull it out. If it is dirty, clean it by submerging it in a mild soap and water solution, rinsing it clean and wringing it dry. If the Intake Filter is allowed to become too dirty it can restrict air flow making the exhaust less effective.

5.3   Optics Cleaning (as necessary)

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 optics. The #2 and #3 Mirrors and the Focus Lens will need to be removed to clean them, the Beam Window does not.

Focus Lens Inspection and Cleaning (as necessary)

1. Remove the Thumbscrew from the side of the Focus Lens Holder. Hold the Focus Lens Holder while removing the Thumbscrew so the Focus Lens Holder does not fall.

HOLD HERE

FLOOD FOCUS LENS SURFACE
WITH LENS CLEANER

THUMBSCREW
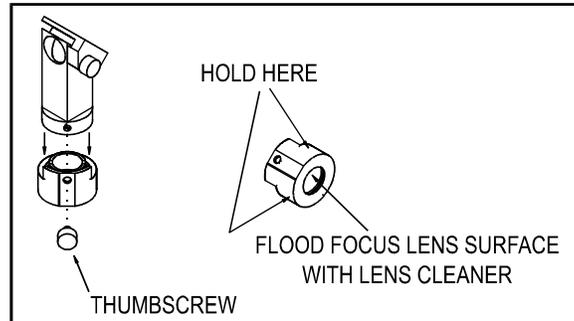
Focus Lens Holder

2. Inspect the Focus Lens while it remains in the Focus Lens Holder by holding it up to a light and looking through it. If the Focus Lens looks visibly clean, do not clean it, simply re-install it to the Focus Carriage by proceeding to Step 8.

3. To clean the Focus Lens while it is still in the Holder, hold it on a 45 degree angle and flood it with a few squirts from the Lens Cleaner bottle and let it drip off. With a cotton swab, gently dry off any remaining solution by rolling the cotton swab across the Focus Lens. **DO NOT** press down hard on the Focus Lens or slide the cotton swab across the Focus Lens as this may scratch it. Only roll the cotton swab across it to dry it off. If the inside of the Focus Lens is dirty, clean it the same way. If the Focus Lens does not clean easily or needs to be replaced, it will need to be removed from the Lens Holder so proceed to the next step. If the Focus Lens is clean proceed to Step 8.

4. Place a soft cloth on a table to prevent the Focus Lens from breaking in the event that you drop it. Place a piece of Lens Tissue on top of a soft cloth. Sit down in front of a table and remove the Focus Lens from the Focus Lens Holder by holding it in one hand and a unscrewing the Retainer with the other hand. Carefully turn the Focus Lens Holder upside down onto a piece Lens Tissue so that Focus Lens and Nylon Spacers drop out onto the Lens Tissue.

5. Inspect the Nylon Spacers and clean them if necessary with a swab or paper towel and Lens Cleaner. Re-install the bottom Nylon Spacer into the Focus Lens Holder.

6. Flood the Focus Lens with Lens Cleaner on one side, flip it over and flood the other side. By using a fresh sheet of Lens Tissue, pick up the Focus Lens and gently dry both sides. Keep your hands close to the soft cloth in case you drop the Focus Lens. **DO NOT** touch the Focus Lens with your bare hands.
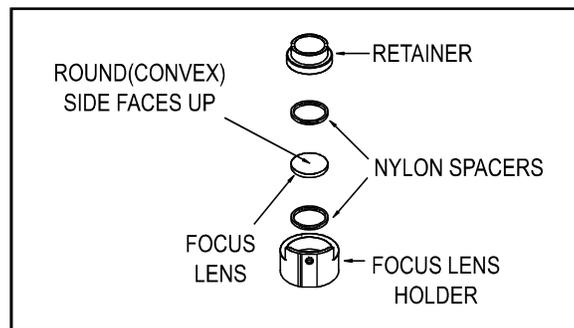
Focus Lens Holder Assembly

7. Place the Focus Lens back into the Focus Lens Holder with the convex side facing upwards. Installing the Focus Lens upside down will result in the engraving being out of focus. Then install the other Nylon Spacer and the Retainer. Make sure that the Focus Lens and the Nylon Spacers are properly aligned as the Retainer is tightened down snugly. **DO NOT** over tighten the Retainer. To make sure the Focus Lens and Nylon Spacers are installed correctly, hold it next to your ear and shake it back and forth. If the Focus Lens rattles, check the Focus Lens and Nylon Spacer alignment and re-adjust as necessary. A loose Focus Lens in it's Holder will cause the appearance of a double image when engraving.

8. To re-install the Focus Lens, place it back on to the Focus Carriage and tighten the Thumbscrew. There are two screw holes located on the Focus Carriage. The Thumbscrew can be installed into either hole, there is no difference except that one is for left-handed people, and the other is for right-handed people.

#2/#3 Mirror Inspection and Cleaning (as necessary)

NOTE: The following procedure refers to both the #2 and #3 Mirror. Remember, the laser system **MUST** be turned **OFF** and unplugged before performing this procedure.

Inspect the Mirrors by looking at their reflective surfaces through the hole in the Mirror Holder for signs of debris. We recommend this method of inspection because it will reduce the likelihood of accidental damage from constantly removing and replacing them. If the surface is hazy or showing signs of debris, then it must be removed for cleaning because it is not possible to clean the Mirror correctly while it is mounted to it's Holder. If the surface of the Mirror is not clearly visible, then the Mirror will need to be removed for inspection and possibly cleaning anyway.

When inspecting or cleaning the Mirrors by removal, remove them one at a time so they do not get mixed up. They appear identical, but sometimes there might be a very slight difference between them which can lead to a slight laser beam misalignment. Although this is highly unlikely, remove and replace them one at a time just as a precaution.

1. While holding the Mirror, remove the Thumbscrew and pull the Mirror away from it's holder. Be careful not to slide the Mirror across it's Holder as it can scratch easily.
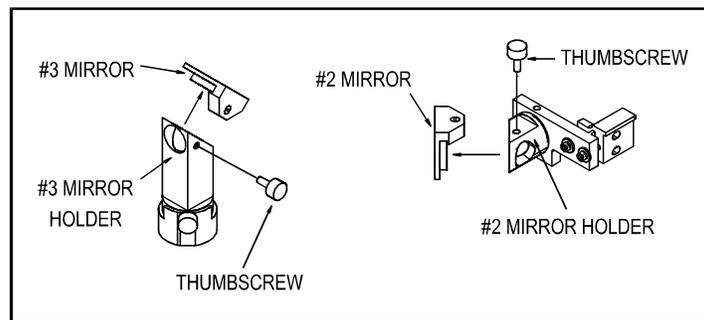
#2 and #3 Mirror Assemblies

2. Inspect the Mirror for signs of haze or debris. Since the Mirror is larger than it's Holder, you will notice scratches around the perimeter of the Mirror. This is normal and there is no need for concern. The laser beam reflects off of the middle area of the Mirror and as long as there is not dirt or scratches in the middle, the Mirror will perform correctly. If the center area of the Mirror looks visibly clean, do not clean it, simply re-install it to it's Holder by proceeding to Step 8.

3. To clean the Mirror, hold the Mirror on a 45 degree angle, flood the surface with a few squirts of Lens Cleaner, place it down on a soft cloth, and let it sit for one minute.
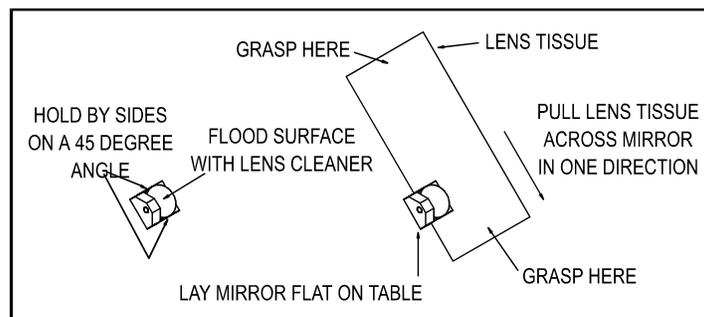
#2 and #3 Mirror Cleaning

4. Using a fresh piece of Lens Tissue, gently pull the Tissue across the Mirror in one direction to absorb the fluid. If fluid remains, use the other side of the tissue and repeat. **NEVER** use a Lens Tissue, or area of a Lens Tissue twice as dust build-up on the tissue may scratch the Mirror's surface and reduce it's life. Also remember to pull the Lens Tissue in **ONLY** one direction.

5. Repeat the cleaning procedure if the Mirror does not come clean on the first attempt. **DO NOT** use any finger pressure on the Mirror's surface as this can scratch the soft outer coating.

6. Re-install the Mirror by guiding the Mirror straight on to it's holder. Be careful not to slide the Mirror around while installing it as this can scratch the reflective surface and reduce the life of the Mirror.

CAUTION
The next step is very important. Please follow the directions otherwise a beam misalignment can occur.

7. Install the Thumbscrew, and before tightening it down all the way, gently press your finger against the back side of the Mirror so it rests flush against the Holder (refer to the next diagram). **.** Now tighten the Thumbscrew finger tight.
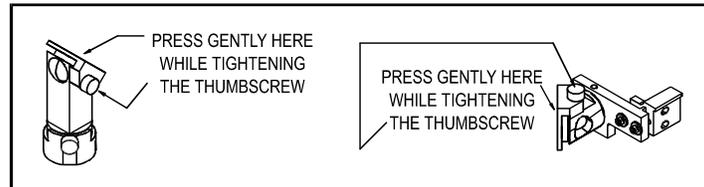
#2 and #3 Mirror Installation

Beam Window Inspection and Cleaning (as necessary)

The Beam Window is located inside the machine in the left hand corner. This window seals the engraving area off from the laser tube and #1 Mirror area. This prevents the need to clean the #1 Mirror or the laser tubes optics because it is in a sealed environment. Visually inspect the Beam Window for signs of dirt or debris. The Beam Window's front surface can be cleaned while remaining installed. There is no need to clean the back side of the Beam Window as it will not get dirty.

1. To clean the Beam Window, soak a cotton swab with Lens Cleaner.

2. Roll the cotton swab across the Beam Window in one direction.

3. Dry off any remaining solution by rolling a fresh, and dry, cotton swab across the Beam Window.

CAUTION
DO NOT press the cotton swab down with force, only roll it across the Window. DO NOT wipe it across as this can scratch the outer coating.

**5.4   Bearing Clearance Adjustments (as necessary)**

As the motion system undergoes heavy use, the outer bearing surface will start to wear. To compensate for this wear, the Bearing Clearance between the outer bearing surface and the bearing tracks will need to be adjusted to maintain peak performance and engraving quality. Since most of the motion is in the X-axis direction, the X-axis Bearings will need adjustment more often than the Y-axis bearings. It is not necessary to adjust any bearings as a preventive maintenance step, they only need adjustment if the engraving quality becomes reduced by excessive clearances between the bearing races and the rails of the motion system.

X-axis Bearing Adjustment

As the X-axis Bearings wear, there could be a reduction in the quality of the image that the laser produces because the Focus Carriage will rock back and forth as it reverses direction.

The X-axis Bearing Clearance can be adjusted to remove the looseness and restore quality. To do this, turn the laser system off and loosen the two(2) Lockdown Screws as the diagram indicates. Loosening the Lockdown Screws will allow the Tensioning Springs at the top of the X-axis Bearing Tensioning Bracket to push the bracket downwards. This downward push actually squeezes all three(3) bearings together to remove the clearance created by bearing wear. In other words, the bearings will self adjust when the Lockdown Screws are simply loosened (about ¼ to ½ turn counterclockwise). Now re-tighten the Lockdown Screws,. Do not tighten them too tight, just snug enough to hold the X-axis Bearing Tensioning Bracket in place. If you tighten the Lockdown Screws too tight the Tensioning Bracket might twist and cause an incorrect adjustment. The objective is to remove the clearance between the outer bearing surface and the bearing tracks, **NOT** to make the bearings tight. This is why we let the Tensioning Springs supply just a small amount of force to remove the clearance.

After making the adjustment, check to see if there is any more play in the Focus Carriage by grasping it and gently trying to rotate it in a clockwise and counterclockwise direction. If there is still clearance, repeat the procedure. It sometimes helps to move the Focus Carriage left and right a few times while the Lockdown Screws are loose to help settle the bearings in the bearing tracks.


X-axis Bearing Clearance Adjustment

88
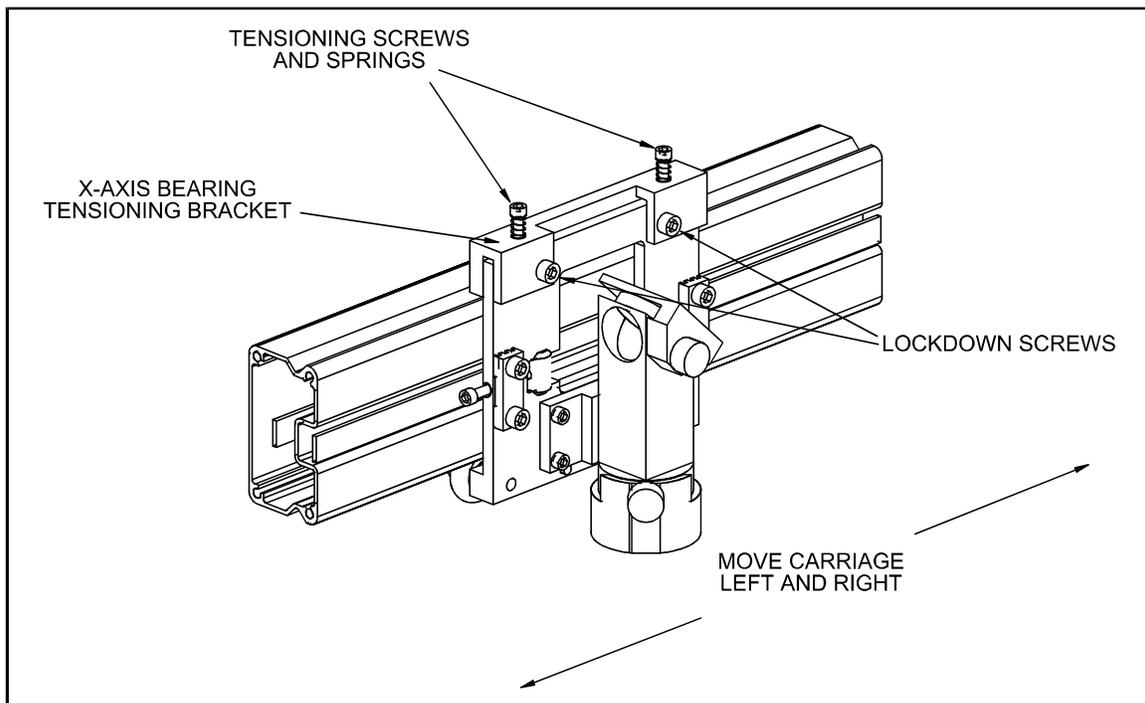
Y-axis Bearing Adjustment

To adjust the Y-axis Bearing Clearance, first make sure the laser system is turned off. Then, by hand, move the arm to the center of the engraving area. Loosen (only slightly) the Lockdown Screws located on the left side of the arm and the right side of the arm as the diagram below illustrates. DO NOT loosen them too much, only enough to break the bond (about ¼ turn counterclockwise).
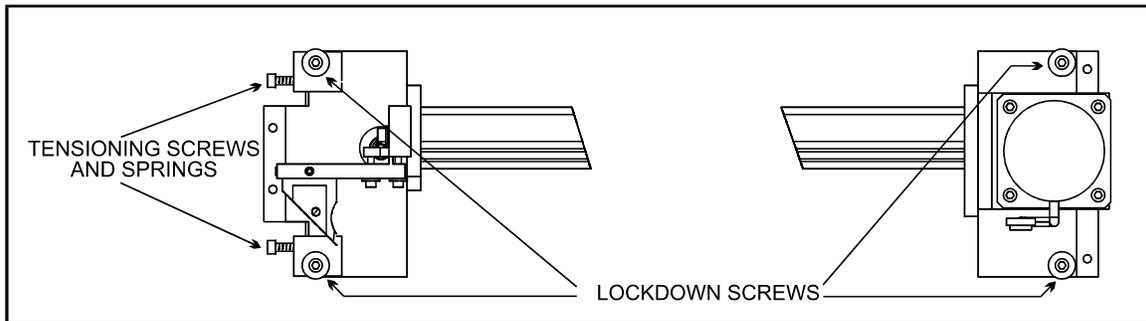
Y-axis Bearing Clearance Adjustment

After all four(4) Lockdown Screws are loose, push the arm towards the top of the field and then the bottom of the field back and forth several times to seat the bearings. The Tensioning Screws and Springs will force all four(4) bearings up against the Bearing Tracks to take up the clearance. Now tighten the two(2) Lockdown Screws on the right side first, then tighten down the two(2) on the left side.

Again, just tighten the Lockdown Screws just enough to lock them into place, if you tighten them too much, the bearing plate can twist and give you an incorrect adjustment.

To check your adjustment, slide the arm to the top of the engraving area and then to the bottom while holding a finger (with very slight finger pressure) up against one of the outer bearing surfaces. The bearing should roll in your finger while moving the arm towards you or away from you. What you are checking for is if the outer bearing surface is making contact with the Bearing Track from the top to the bottom of the engraving area and that is does not spin freely without any friction. Check this on all four bearings. If any of the outer bearing surfaces are not making contact with the Bearing Track completely, then repeat this procedure again until all four bearings are touching the Bearing Track throughout the range of the engraving area.

Remember, the objective is to remove the clearance between the outer bearing surface and the Bearing Tracks, **NOT** to make the bearings tight so this is why we let the Tensioning Screws and Springs supply the proper force.

Appendix A - Warranty

ULS warrants that all new ULS Laser Engraving Systems will be free from defects in material and workmanship under normal and proper use and service, for a period of one year from the date of shipment from ULS. Notwithstanding the foregoing, perishable components, (lenses, mirrors, indicator lamps, batteries, fuses, belts, bearings) are warranted for only 90 days from the date of shipment from ULS. The laser is only covered by a one-year laser manufacturer's warranty.

This limited warranty extends only to the original purchasers and is not transferable. During the applicable limited warranty period, ULS will repair or replace, at its option, any defective product or part at no additional charge to the customer, provided that the defective product or part is returned to ULS. This limited warranty does not extend to any products or parts that have been damaged as a result of lack of supervision of use, accident, misuse, abuse (including, without limitation, incorrect voltages, power surges, improper or insufficient ventilation, failure to follow ULS provided operating instructions, "acts of God" or other situations beyond the control of ULS), or as the result of service or modification by anyone other than ULS. This limited warranty does not extend to parts or components that are not installed by ULS, an authorized representative of ULS or in a manner not approved by ULS.

Universal Laser Systems reserves the right to request that a ULS Laser Engraving System be returned to the factory for repair, or to provide on-site repair. If determined by ULS that on-site repair is necessary and the nature of the repair is such that ULS believes that it can be done at the customer's facility, ULS will provide a field service technician free of charge during the applicable limited warranty period.

ULS provides no warranties whatsoever on any software used in connection with a ULS Laser Engraving System, express or implied.

Limitation of remedies and liabilities: ULS's entire liability and customer's exclusive and sole remedy for damages from any cause whatsoever (including without limitation any nonperformance, misrepresentation, or breach of warranty) shall be limited to repair or replacement of the specific products or parts that do not comply with the limited warranty given by ULS. Any products or parts repaired or replaced by ULS pursuant to this Paragraph shall be warranted as of the original date of delivery of the ULS Laser Engraving System in accordance with the terms and conditions herein for the duration of the applicable term of the limited 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.

THE WARRANTIES SET FORTH HEREIN ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Appendix B - ULS-25E Specifications

Model Number   ULS-25E

Maximum Engraving Area   24 x 12 inches (609.6 x 304.8 mm)

Maximum Engraving Speed   25 inches per second (635 mm/s)

Laser Source   25 Watt CO_2

Laser Beam Spot Size Diameter
- 1.5 inch Focal Length (optional)   0.003 inches (.08 mm)
- 2.0 inch Focal Length   0.005 inches (.13mm)
- 2.5 inch Focal Length (optional)   0.007 inches (.18 mm)
- 4.0 inch Focal Length (optional)   0.013 inches (.33 mm)

Repeatability   +/- 0.002 inches (+/- .06 mm)

Interfaces   Parallel = Centronics
                                          Serial = RS-232C (PC)
                                          Serial = Phone Jack (MAC)

Buffer Memory Size   4MB (upgradeable to 64MB)

System Dimensions   39" wide x 29" deep x 38" tall

System Weight   25 Watt - 170 lb.(77 kg)

Safety Classification   Class I

Focal Plane (Z axis) Adjustment   7.5 inches (190.5 mm)

Facility Requirements

Electrical Power:
25 Watt - Single phase, 120 VAC, 50/60 Hz, 10 Amp (US Version)
25 Watt - Single Phase, 220 VAC, 50/60 Hz,   5 Amp (International Version)

Exhaust:
235 CFM minimum at 6 inches of static pressure

Cooling:
25 Watt - Air cooled ambient temperature less than 78 degrees F (25 degrees C)

Specifications are subject to change without notice.

Appendix C - Serial Port Cable Requirements

PC

PC

LASER

1		1
2		2
3		3
4		4
5		5
6		6
7		7
8		8
9		9

9 PIN D SUB CONNECTOR (MALE)
TO 9 PIN D SUB CONNECTOR (MALE)
NULL MODEM SERIAL CABLE

MACINTOSH

MAC

LASER

1		1
2		2
3		3
4		4
5		5
6		6
7		7
8		8
		9

8 PIN MINATURE DIN CONNECTOR
TO 9 PIN D SUB CONNECTOR (MALE)
CONNECT TO PHONE PORT ON MAC
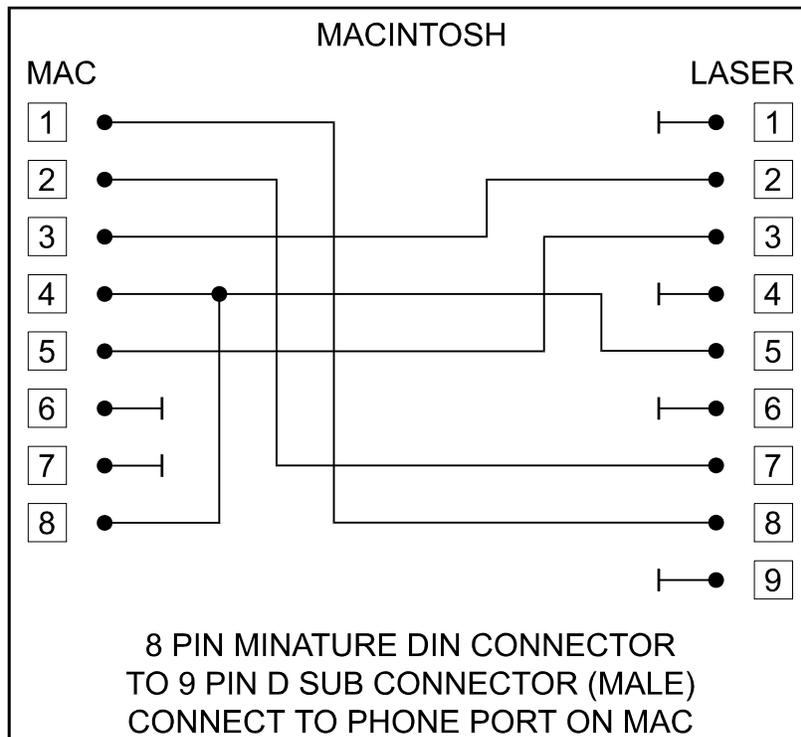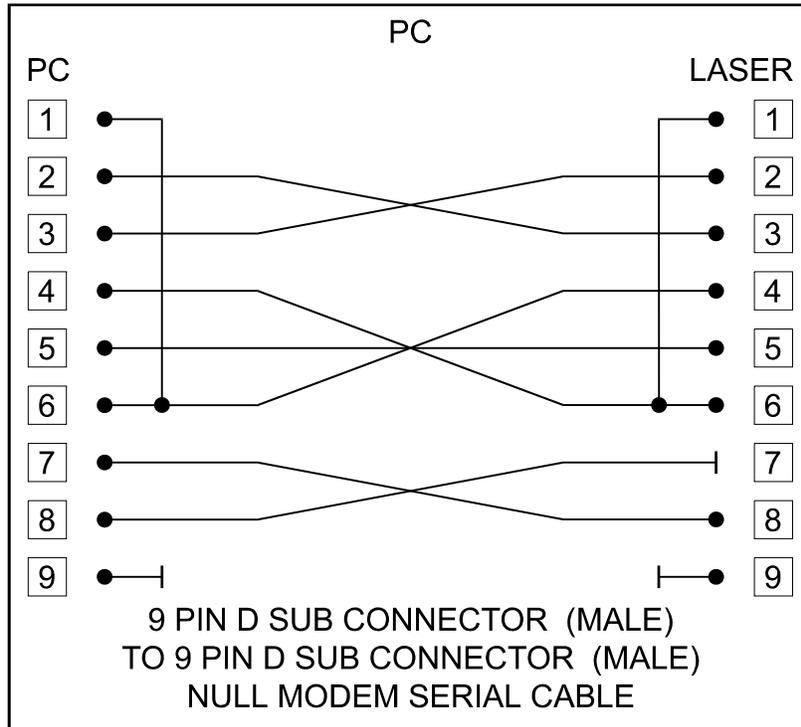
Appendix D - Laser.ini Modifications

Advanced Procedures

To speed up the download process to the laser system, a file modification can be made.

If the computer being used has 8 or more megabytes of RAM, open up the LASER.INI file in the Windows directory using a text editor. Scroll down to the bottom of the file and type in the following line exactly how it reads:

BandKBytes=2000

This line will allow the computer to use more of its memory for printing.

Save this file and restart Windows for the change to take effect.

Appendix E - Software Anomalies

In order for certain software to work properly with a Universal Laser System, some modifications might have to be made. If using the following software, be sure to follow these instructions. If having any difficulty making these adjustments, please contact our technical support.

CorelDraw

If experiencing problems printing text in CorelDraw!, especially mirrored text, make this modification to the files listed below:

COREL 3.0

Find the CORELDRW.INI file usually located in the c:\windows\coreldrw\draw\ subdirectory. Open this file up in a text editor such as NOTEPAD, which comes with Windows. Scroll down about 55 lines to find the line that reads:

FontRasterizer=1

and change it to read:

FontRasterizer=0

Save this file and restart CorelDraw! for the changes to take effect.

COREL 4.0

Find the CORELAPP.INI file usually located in the c:\windows\corel40\config\ subdirectory. Open this file up in a text editor such as NOTEPAD, which comes with Windows. Scroll down about 63 lines to find the line that reads:

FontRasterizer=1

and change it to read:

FontRasterizer=0

Save this file and restart CorelDraw! for the changes to take effect.

COREL 5.0
Find the CORELAPP.INI file usually located in the c:\windows\corel50\config\ subdirectory. Open this file up in a text editor such as NOTEPAD, which comes with Windows. Scroll down about 64 lines to find the line that reads:

FontRasterizer=1

and change it to read:

FontRasterizer=0

Save this file and restart CorelDraw! for the changes to take effect.

Printing photographs through CorelDraw!

Version release 3.0B and version 5.0 do not currently support our drivers halftone pattern generator. What this means is that if trying to print a grayscale photograph through these versions, it will come out as a solid black and white engraving with no halftone generation. There is no current solution available for this problem. Our suggestion is to use version 3.0A, and any of the 4.0 releases until this problem can be resolved or if it can be resolved. Please contact our technical support if there are any questions.