

VLS3.60ES Desktop Laser System

User Guide

UNIVERSAL LASER SYSTEMS

www.ulsinc.com

Version 2026.10.0102 – LSM16

Dear Customer,

Thank you for choosing Universal Laser Systems®. We appreciate innovative customers like you who have made Universal Laser Systems an integral part of their business.

Universal Laser Systems is committed to providing the highest level of customer satisfaction and support. To ensure your satisfaction, we urge you to read the documentation provided with your equipment.

Since 1988, Universal Laser Systems has been committed to continually improving our technology and customer-driven laser solutions. Your satisfaction is very important to us, and we welcome your feedback. Tell us about your experience with Universal Laser Systems and our systems at moreinfo@ulsinc.com.

Should you have any questions, please contact the **Universal Laser Systems (ULS) Service & Support Team** at one of the following locations:

Scottsdale, AZ USA	**Vienna, Austria**	**Yokohama, Japan**
support@ulsinc.com	support@uls.at	japansales@ulsinc.com
+1 (480) 609-0297	+43 1-402-22-50	+81 45-224-2279
Serving North America, South America, India, Australia and New Zealand	*Serving Europe, Middle East and Africa*	*Serving Asia, excluding India*

Again, thank you for choosing Universal Laser Systems.

Sincerely,

Universal Laser Systems

© 2026 Universal Laser Systems, Inc. All rights reserved. Universal Laser Systems logo and name are registered trademarks of Universal Laser Systems, Inc. All other company and product names are trademarks or registered trademarks of their respective companies.

Universal laser systems are protected under one or more U.S. Patents: 7,723,638; 7,947,919; 8,101,883; 8,294,062; 8,599,898; 8,603,217; 9,155,988; 9,263,844; 9,263,845; 9,281,649; 9,346,122; 9,354,630; 9,694,448; 9,737,958; 10,391,345; 10,456,875; 11,198,193. Other U.S. and international patents pending.

Contents

Chapter 1 – Specifications 3
Operating Environment Requirements 4
Specifications 5
Chapter 2 – Safety 7
Description of Appropriate Use 8
General Safety 8
CO_2 Laser Safety 10
Fire Safety when Processing Materials with a Laser System 11
Tamper Proof Labels 19
Safety Labels 19
EU Declaration of Conformity 23
FCC Compliance 24
Recycling 24
Chapter 3 – Installation 25
Overview 26
Step 1: Site Preparation 26
Step 2: Computer Requirements and Software Installation 29
Step 3: Assembling and Connecting Your Laser System 31
Running Your First Control File 38
Chapter 4 – Operation 42
Laser Material Processing Workflow Overview 43
Laser System Manager Overview 48
Control Panel 95
Loading and Processing Materials 98
Third-Party Graphic Software Configuration 100
Chapter 5 – Accessories 103
Gas Supply and Assist 104
Lateral Gas (Air) Assist Attachment 104
Coaxial Gas (Air) Assist Attachment 106
ULS Compressed Air Source 108
Air Cleaner Cart 110
Flow-Through Cutting Table 110

HPDFO™ 114
Lens Kits 114
Automation Interface 115
Rotary Fixture 120
Fire Suppression Assistance Module 126
Chapter 6 – Maintenance 130
Overview 131
Motion System Components Diagram 131
Cleaning and Maintenance Supplies 132
System Cleaning and Maintenance 132
Optics 134
Exhaust Plenum 137
Adjustments and Lubrication 137
Maintenance Schedule 137
Chapter 6 – Service & Support Resources 138
User Guide 139
Software 139
Warranty 139
Parts 139
Service Requests 139
Material Processing Application Support 139
ULS Service & Support Team Contact Information 139
Laser Exchange Program 140

Chapter 1 – Specifications

Operating Environment Requirements

OPERATING ENVIRONMENT REQUIREMENTS	
Operating Environment	Well-ventilated office (recommended) or clean, light-duty manufacturing
Operating Temperature	50 ºF (10 ºC) to 95 ºF (35 ºC) capable 73 ºF (22 ºC) to 77 ºF (25 ºC) for best performance
Storage Temperature	50 ºF (10 ºC) to 95 ºF (35º C)
Operating Humidity	Non-condensing
Electrical Power	Single Phase 100-240 VAC, 10 A (100-120 V) / 5 A (200-240 V), 50/60 Hz Grounded (earthed) and stable surge and spike protected)
Facility Exhaust	High-pressure vacuum blower capable of 250 CFM (cubic feet per minute) @ 6 inches static pressure (425m3/hr. at 1.5kPa)*
Computer Requirements	Requires dedicated PC with Windows® 10/11 32/64 bit or Mac running MacOS 10 or higher and one available USB port (2.0 or higher)

**Optional air filtration units are available from ULS to filter the exhaust from laser processing. Contact the ULS Service & Support Team for more details.*

Specifications

SPECIFICATIONS*	
Cabinet Style	Desktop
Laser Material Processing Area (W x H)	24 x 12 in. (610 x 305 mm)
Maximum Part Size (W x H x D)	26.75 x 14.6 x 4 in. (679 x 370 x 102 mm)
Rotary Capacity	Max. Diameter 5 in. (127 mm) Min. Diameter 0.5 in. (12.7 mm)
Motorized Z-Axis Lifting Capacity	20 lbs. (9 kg)
Focus Lens**	2.0 in. (50 mm)
Focus Method	Programmable and Manual Focus
Laser Options	Air-cooled Laser Sources: 10.6 µm wavelength CO_2: 10, 30, 40, 50 and 60 watts 9.3 µm wavelength CO_2: 30 and 50 watts
Optics Protection	Integrated with included Gas Assist
Gas Assist	Manual Gas Assist (with Optics Protection) (requires air source)
Safety	Overtemperature Detection (audible alarm) E-Stop Push-Button (emergency stop push-button) Automatic Fault Detection
Desktop Interface Panel	Push-Button Control Pad
Control Software	Laser System Manager (LSM) with Intelligent Materials Database
Camera Vision System	Door-mounted camera for visual alignment of design files
Computer Requirement	Dedicated PC with Windows® 10/11 32/64 bit or dedicated Mac running MacOS 10 or higher and one available USB port (2.0 or higher)
Overall Dimensions (W x H x D)	34 x 14 x 25 in. (864 x 356 x 635 mm)
Approximate Weight	95 lbs. (43 kg)
Power Requirements	100-240 VAC, 10A (100-120 V) / 5A (200-240 V)
Exhaust Connection	One 3 in. (76 mm) port 250 CFM @ 6 in. static pressure (425 m^3/hr. at 1.5 kPa)

Laser Safety	CO_2 Laser, Interlocked Safety Enclosure = Class 1 Red Diode Laser = Class 2
Standard Warranty	1 year for system / 2 years for laser sources
AVAILABLE OPTIONS	
Focus Lenses**	HPDFO™ (High Power Density Focusing Optics)
Gas Supply and Assist	Coaxial Gas Assist Attachment Lateral Gas Assist Attachment Compressed Air Source
Air Filtration and Handling	UAC 2000 Filtration System Rotary Fixture
Operational Integration Module	Automation Interface
Fire Suppression	Fire Suppression Assistance Module
Software	1-Touch Laser Photo™
Extended Warranty	Up to 5 years for system and laser sources

**Specifications are based on the 2.0 in. (50 mm) focus lens. Full specifications are available on the ULS website and are subject to change.*

***Consult ULS for 1.5 in. (38 mm) focus lens.*

Chapter 2 – Safety

Description of Appropriate Use

This device is designed for laser cutting and engraving in an office, laboratory, workshop or light duty manufacturing environment. Materials to be processed must fit completely inside the system for proper operation.



WARNING: This device is not designed, tested, intended or authorized for use in any medical applications, surgical applications, medical device manufacturing or any similar procedure or process requiring approval, testing or certification by the United States Food and Drug Administration or other similar governmental entities.

General Safety

Use of the equipment in a manner other than described in this manual or failure to follow the instructions and safety guidelines listed in this manual may result in injury, equipment damage, or property loss.



WARNING LASER RADIATION HAZARD

The laser system is classified as a Class I device for CO_2 lasers, designed to prevent harmful radiation exposure under normal operation. Misuse, such as improper adjustments, bypassing safety features, or failing to follow instructions in this manual, can expose the user to hazardous laser radiation with the potential to cause permanent vision loss, severe skin burns, or other serious injuries. Always wear laser-rated safety glasses and never bypass safety interlocks.



WARNING FIRE HAZARD

Never operate the laser system without constant supervision during cutting and engraving operations. Laser beams can ignite combustible materials, leading to fires. Remove all materials, including scrap, after processing. Scrap materials, particularly in the removable cutting table, pose a significant fire risk. Failure to follow these precautions may result in equipment damage, facility fires, or injury. Always keep a properly maintained fire extinguisher nearby.



WARNING FUME AND PARTICULATE HAZARD

A properly configured, installed, maintained, and operational exhaust system is mandatory when operating the laser system. Fumes and smoke generated during the engraving process must be filtered or exhausted outside. Failure to adhere to these guidelines may result in health risks, including respiratory issues or exposure to toxic fumes.



WARNING TOXIC AND CORROSIVE FUMES

Certain materials processed with the laser may emit toxic or corrosive fumes. Always review the Material Safety Data Sheet (MSDS) for each material before use. Discontinue processing materials that cause visible corrosion or damage to the laser system, such as rust, peeling paint, or etching. Failure to adhere to these guidelines may result in health risks, including respiratory issues or chemical exposure, as well as permanent damage to the laser system. Damage to the laser system caused by corrosive fumes is not covered under warranty.



CAUTION LIFTING HAZARD

Do not lift or move the laser system alone. Always secure the motion system and doors before lifting. Use proper lifting techniques and seek assistance or use mechanical lifting aids to prevent injury or equipment damage. Failure to follow proper lifting practices may result in personal injury, such as strains or sprains, and damage to the equipment. Equipment weights are listed in the manual for reference.



DANGER ELECTRICAL HAZARD

High voltages are present within the electronic enclosures of this laser system. Access to these areas is not required during normal operation. Disconnect the power cord from the electrical supply before servicing or opening any electronics enclosures. Failure to adhere to these precautions may result in fatal electric shock.



WARNING ELECTRICAL SHOCK HAZARD

Never remove the ground lead from the electrical cord or plug the system into a non-grounded outlet. Proper grounding is essential to prevent severe or fatal electrical shock and ensure the system operates safely and predictably.

The power supply cord serves as the main disconnect device. Place the laser system near an easily accessible power outlet. To disconnect the system, unplug the power cord from the outlet or the appliance coupler. The laser system is a Class I, Group A, pluggable device and is designed for connection to IT power systems. Ensure proper installation and compliance with local electrical standards.

THIS DEVICE IS SPECIFICALLY DESIGNED TO COMPLY WITH CDRH PERFORMANCE REQUIREMENTS UNDER 21 CFR 1040.10 AND 1040.11 AND TO COMPLY WITH EUROPEAN LASER SAFETY REGULATIONS UNDER EN60825-1. CDRH is the Center for the Devices of Radiological Health division of the Food and Drug Administration (FDA) in the USA. No guarantees of suitability or safety are provided for any use other than those specified by Universal Laser Systems, Inc.

CO_2 Laser Safety

ULS Laser systems are designed to support a sealed carbon dioxide (CO_2) laser source that produces intense invisible laser radiation at a wavelength of 9.3 or 10.6 microns in the infrared spectrum. For your protection, the laser is contained within a Class 1* enclosure designed to completely contain the CO_2 laser beam.



WARNING: Use of controls or adjustments or performance of procedures other than those specified herein may result in exposure to hazardous levels of invisible laser radiation.

- Laminated safety glass is employed in the viewing window to block 9.3- or 10.6-micron laser radiation from CO_2 lasers. This viewing window will block transmission of CO_2 laser radiation allowing safe observation of laser processing. Do not operate the laser system if the view port is damaged, with any of the doors removed or if any of the safety interlocks are defeated.
- The intense light that appears during the engraving or cutting process is the product of material combustion or vaporization. **DO NOT STARE AT THIS INTENSE LIGHT FOR LONG PERIODS OF TIME OR VIEW DIRECTLY WITH OPTICAL INSTRUMENTS SUCH AS BINOCULARS OR MICROSCOPES.**
- This device contains a visible Red Diode Laser (Class 2) to aid in positioning material for laser processing. **DO NOT LOOK DIRECTLY INTO THE RED LASER BEAM OR USE A REFLECTIVE SURFACE TO REDIRECT OR VIEW THE RED LASER BEAM. NEVER ATTEMPT TO VIEW THE RED LASER BEAM USING OPTICAL INSTRUMENTS SUCH AS BINOCULARS OR MICROSCOPES.**
- The user door(s) are safety interlocked which will prevent the CO_2 laser beam from firing when the user door(s) are opened. The Red Diode Laser is **NOT** safety interlocked and can be automatically activated with the door(s) either open or closed.
- **DO NOT OPERATE THE LASER SYSTEM IF ANY SAFETY FEATURES HAVE BEEN MODIFIED, DISABLED OR REMOVED.** This may lead to accidental exposure to invisible CO_2 laser radiation which may cause severe eye damage and/or severe burns to your skin.
- Always use caution when operating a laser system.

**An enclosure which does not permit human access to laser radiation in excess of the accessible emission limits of Class 1 for the applicable wavelength and emission duration.*

Fire Safety when Processing Materials with a Laser System

Laser material processing utilizes thermal energy to modify materials through heating and disintegration. ULS laser systems, when properly configured, maintained, and operated according to ULS user manuals, can safely process materials. However, due to the thermal nature of the process, continuous user monitoring is essential to ensure safety.

Some materials selected for laser processing are flammable and, under certain conditions, may ignite and sustain combustion (self-sustained combustion) even after laser processing has stopped. If unaddressed, self-sustained combustion poses a risk of escalating into a fire, potentially causing property damage, personal injury, or even loss of life.

Although self-sustained combustion is a rare occurrence, it remains a possibility whenever thermal energy is used. By adhering to ULS safety guidelines and continuously observing the process, as outlined in user manuals and on safety warning labels, users can promptly extinguish self-sustained combustion, preventing harm to themselves or the equipment.



WARNING: The user has primary responsibility for constant, close, attentive supervision of the laser system's material processing area during laser processing, and for immediately addressing material ignition should it occur. Failure to do so may lead to fires, resulting in property damage, personal injury, or even loss of life.

Owner Responsibility

Owners are responsible for ensuring that all users adhere to safety practices described in this user guide and product warning labels and can properly operate the laser system. To assist owners with meeting this responsibility, the following are recommended:

- Develop training to ensure users read, understand and follow the instructions and warnings provided in the user guide and on the product warning labels, can properly operate the laser system and adhere to safety practices.
- Train users to properly use a fire extinguisher.
- Assign personnel to be responsible for enforcing and ensuring users adhere to safe practices and guidelines.
- Train users on how to identify, respond to and report potential fire hazards.

Material Fire Hazards

It's important to be aware of and avoid hazards associated with material fires that may result in property damage, personal injury, or loss of life.

- Never leave the laser system unattended during operation.

- Always provide constant, close, and attentive supervision of the laser system's material processing area during operation.
- Only properly trained users should operate the laser system.
- Read, understand and follow all safety warning labels and manufacturer guidelines.
- Use fire extinguishers as intended.
- Remove excess material inside the laser system which can add fuel to a potential fire.
- Perform regular cleaning and maintenance of the laser system (see Maintenance section of this user guide). Excess debris inside the laser system from lack of cleaning and maintaining the laser system can add fuel to a potential fire.
- Only use a properly configured and working laser system fume exhaust system (see Installation section of this user guide).
- Turn on the laser system fume exhaust system while laser processing to remove fumes and reduce risk of a material fire.
- Use appropriate laser processing settings for the specific material being processed and ensure the laser system is properly focused.

Before using the laser system, read, understand and follow the operating instructions and guidelines to mitigate potential material fires.

Fire Mitigation Recommendations

1. **Read the Entire Manual:** Every user must thoroughly read and understand the laser system user manual before operating the equipment. Familiarity with the system and the procedures outlined in the manual is essential for minimizing the risk of material ignition and fires.
2. **Supervise Inexperienced Users:** Individuals unfamiliar with the laser system or laser processing must always be supervised by a trained, experienced user while using the system. The supervisor must actively monitor the activity, enforce safety protocols, and promptly address any potential issues.
3. **Material Selection:** Always verify a material's compatibility with laser processing. The best method is to check if the material is listed in the Intelligent Materials Database of the Laser System Manager (LSM) control software. If the material is not in the database and you are unsure of its compatibility, contact the ULS Advanced Material Processing Center (AMPC) for guidance.
4. **Proper Setup:** Use the appropriate laser processing settings for the specific material and ensure the laser system is properly focused on the material surface. Following the recommended settings reduces the risk of material ignition. Laser processing settings for a wide range of materials can be found in the Intelligent Materials Database located in the LSM. If the material is not in the database and you are unsure how to optimize the settings, contact the ULS Advanced Material Processing Center (AMPC) for assistance.

5. **Material Storage:** Do not store materials intended for laser processing inside the laser system. Excess materials within the system can increase the risk of fueling a potential fire and hinder access to the material being processed in the event of ignition.

6. **Laser System Access:** Keep the area surrounding all sides of the laser system free of obstructions. Clear access is crucial for addressing material ignition if it occurs. A minimum clearance of 4 feet (1219 mm) around the laser system is recommended.

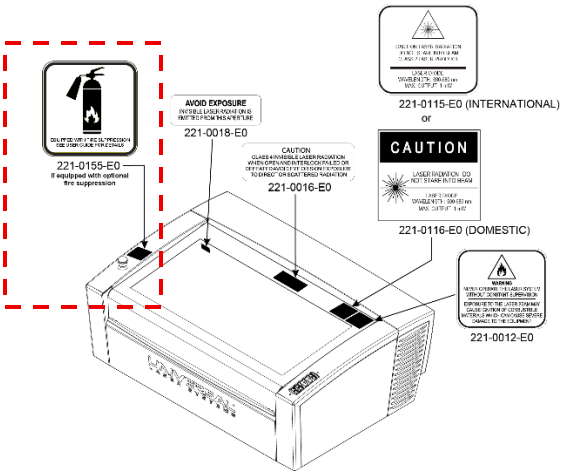
7. **Close and Constant Monitoring:** Never leave the laser system unattended during operation. If material ignition occurs, address it immediately following the instructions provided in the user manual.

8. **Laser System Fume Exhaust:** Ensure the laser system is equipped with a properly configured and functioning fume exhaust system (see Installation section of this user guide). The exhaust system must be operational during laser processing to remove fumes and reduce the risk of material fires.

9. **Fire Extinguisher:** Always keep an ABC powder-type fire extinguisher within easy reach when operating the laser system. A minimum size of 5 lbs. (2.27 kg) is recommended. Ensure all users are familiar with the location and proper use of the fire extinguisher. Avoid using water or water-based fire extinguishers, as they pose a risk of life-threatening electrical shock and can damage the laser system.

Steps for Extinguishing Ignited Materials **without** Optional Fire Suppression Assistance Module Installed

The instructions below are only for laser systems without the optional Fire Suppression Assistance Module. Separate instructions are provided on page 18 for laser systems equipped with the option. To determine if the laser system is equipped with the Fire Suppression Assistance Module, refer to the following label as outlined in red below. A system equipped with the Fire Suppression Assistance Module will have this label, and systems without the label will not.



If a material being processed with a laser system ignites, it typically begins as a small flame that can be easily extinguished if addressed promptly. Follow the instructions below to minimize the risk of material ignition and to respond immediately if ignition occurs.

1. **Stop Laser Processing Immediately:** At the first sign of material ignition, open the top door of the laser system to stop processing. Opening the top door will also return the motion system to the home position. In many cases, if material ignition occurs and laser processing is stopped immediately, the flames will self-extinguish, eliminating the need for further action.

    - Avoid pressing the Emergency Stop Push Button (E-Stop) in response to material ignition, because it will cut all power to the system, preventing the motion system from returning to the home position and hindering access to any material that continues to burn. If flames are present, manually moving the motion system can be unsafe and may cause injury.

    - An Overtemperature Alarm is installed in all ULS laser systems. If laser processing is not stopped promptly by opening the top door, the temperature in the processing chamber will rise as the material continues to burn. Once the temperature reaches 120 ° F (49 ° C), the Overtemperature Alarm will sound, automatically stopping laser processing, moving the motion system to the home position, and alerting the user. Typically, material must burn for several minutes before the temperature reaches above 120 ° F (49 ° C) to trigger the alarm. With constant supervision, material ignition can be detected and addressed early, well before the Overtemperature Alarm activates.

    If the material continues to burn after laser processing is stopped (whether manually by opening the top door or automatically through the Overtemperature Alarm) ensure the top door remains open and proceed to the next step.

2. **Turn Off Laser System Fume Exhaust:** Turn off the laser system's fume exhaust, as it may draw in fire suppressant, reducing the effectiveness of a fire extinguisher if one needs to be used.

3. **Use a Fire Extinguisher, If Necessary:** If the flames do not self-extinguish immediately after laser processing is stopped, use an ABC powder-type fire extinguisher to extinguish the flames. Follow the fire extinguisher manufacturer’s instructions for proper use. Never use water or water-based fire extinguishing agents, as they may cause life-threatening electrical shock and damage the laser system.

    If the material fire in the laser system is extinguished by the fire extinguisher:

    - Remove and clean up any residue or debris from the ignition. Inspect the laser system for any damage, paying particular attention to heat-sensitive components such as belts, bearings, and optics. Make any necessary repairs before resuming laser processing. Consult with ULS Service & Support prior to performing any repairs.

- Remove all fire suppressant residue from the interior of the laser system using the method recommended by the fire extinguisher manufacturer. Inspect and clean all optics as needed.

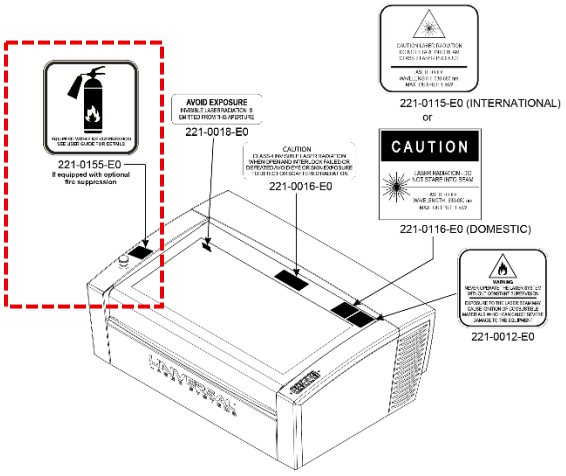
4. **If the Fire Extinguisher Does Not Extinguish the Fire, Follow Your Organization's Safety and Fire Protocols:** If the fire is not extinguished by the fire extinguisher, immediately follow the protocols as defined by your company to address fires. Alert the nearest fire department by calling the emergency contact number for your area.

    - After the material fire has been extinguished, remove and clean up any residue or debris from the ignition. Inspect the laser system for any damage, paying particular attention to heat-sensitive components such as belts, bearings, and optics. Make any necessary repairs before resuming laser processing. Consult with ULS Service & Support prior to performing any repairs.

    - Remove all residue from the interior of the laser system using the method recommended by the fire extinguisher manufacturer. Inspect and clean all optics as needed.

Steps for Extinguishing Ignited Materials **with** Optional Fire Suppression Assistance Module Installed

The instructions below are only for laser systems equipped with the optional Fire Suppression Assistance Module. Separate instructions are provided starting on page 16 for laser systems equipped with the option. To determine if the laser system is equipped with the Fire Suppression Assistance Module, refer to the following label as outlined in red below. A system equipped with the Fire Suppression Assistance Module will have this label, and systems without the label will not.



The optional Fire Suppression Assistance Module is available for certain ULS laser systems and is an operational integration module that provides automated fire suppressant deployment in response to sustained elevated temperatures within the laser processing chamber. This module is automatically activated when the temperature reaches above 120 ° F (49 ° C) in the laser processing system. However, it is important to note that the Fire Suppression Assistance Module

does not replace fire extinguishing equipment, established fire response procedures, or constant supervision during laser processing.

The Fire Suppression Assistance Module provides automated fire suppressant deployment in response to elevated temperatures associated with a material fire. Additional user response actions may be required if the material fire is not fully suppressed.

When the Fire Suppression Assistance Module deploys fire suppressant, it leaves no residue, minimizing the need for extensive cleanup typically required after using manual fire extinguishers.

The Fire Suppression Assistance Module is intended to assist with suppression of material fires that may occur during laser material processing; however, fire suppressant deployment does not guarantee that a material fire will be fully suppressed. If a fire is not fully extinguished, additional user response actions may be required, allowing the user to address the fire with a fire extinguisher if necessary.

How It Works

If a material being laser processed ignites and continues to burn, thermal sensors in the laser system's processing chamber activate at elevated temperatures in the range of 115 to 125 °F (46 to 52° C). The first set of sensors detects the temperature rise and initiates a sequence to halt laser processing, return the motion system arm to its home position, and activate an audible Overtemperature Alarm.

A second set of sensors, triggered at a higher temperature of 130 to 140 °F (54 to 60 ° C), releases a fire suppressant into the processing chamber. The suppressant evaporates after deployment. The fire suppressant is safe for humans and environmentally friendly. Detailed safety and technical data on the fire suppressant used in the Fire Suppression Assistance Module can be found or requested on the manufacturer’s website at envirotechint.com under the product name Ensolv Flouro FS.

Fire suppressant deployment occurs only when system conditions and deployment thresholds are met.

If material ignition escalates into a fire, follow the steps outlined below:

1. **Stop Laser Processing Immediately:** At the first sign of material ignition, open the top door of the laser system to stop processing. Opening the top door will also return the motion system to the home position. In many cases, if material ignition occurs and laser processing is stopped immediately, the flames will self-extinguish, eliminating the need for further action.

    - Avoid pressing the Emergency Stop Push Button (E-Stop) in response to material ignition, as it will cut all power to the system, preventing the motion system from returning to the home position and hindering access to any material that continues to burn. If flames are present, manually moving the motion system can be unsafe and may cause injury.

    If the material continues to burn after laser processing is stopped by opening the top door, close the top door and proceed to the next step.

2. **Keep the Laser System Fume Exhaust Turned On:** Laser system fume exhaust will remove fumes and smoke from the material fire until the Fire Suppression Assistance Module is activated.

3. **Monitor the Laser Processing Chamber for Activation of the Fire Suppression Assistance Module:** Continuously monitor the laser processing chamber and listen for the Overtemperature Alarm. When the temperature inside the system reaches 120 ° F (49 ° C), the Overtemperature Alarm will sound. Typically, materials must burn for several minutes or longer before the temperature reaches this level. Once activated, the Overtemperature Alarm will automatically stop laser processing and move the motion system to the home position.

   Continue observing the laser processing chamber for activation of the Fire Suppression Assistance Module. The module will activate when the chamber reaches a higher temperature, releasing fire suppressant into the material processing chamber. The fire suppressant evaporates after deployment, leaving no residue to clean up. The fire suppressant is intended to assist with suppression of material fires; however, deployment does not guarantee that a material fire will be fully suppressed.

   - If the material fire is extinguished by the Fire Suppression Assistance Module, remove and clean up any residue or debris from the material ignition. Inspect the laser system for any damage, paying particular attention to heat-sensitive parts such as belts, bearings, and optics. Make any necessary repairs before resuming laser processing. Consult with ULS Service & Support prior to performing any repairs.

4. **If the Fire Suppression Assistance Module Does Not Extinguish the Fire or Does Not Activate, Use a Fire Extinguisher:** If the Fire Suppression Assistance Module does not extinguish the fire, or does not activate after 10 minutes of the Overtemperature Alarm being triggered, open the laser system's top door and turn off the laser system exhaust. Leaving the exhaust on may reduce the effectiveness of a fire extinguisher by drawing in the fire suppressant.

   Apply an ABC powder-type fire extinguisher to put out the material fire. Follow the manufacturer’s instructions for proper use. Never use water or water-based fire extinguishing agents, as they may cause life-threatening electrical shock and damage to the laser system.

   - If the material fire is extinguished by a fire extinguisher, remove all residue from the interior of the laser system using the method recommended by the fire extinguisher manufacturer. Inspect and clean all optics as needed.

   - Remove and clean up any residue or debris from the ignition. Inspect the laser system for any damage, paying particular attention to heat-sensitive components such as belts, bearings, and optics. Make any necessary repairs before resuming laser processing. Consult with ULS Service & Support prior to performing any repairs.

5. **If the Fire Extinguisher Does Not Extinguish the Fire, Follow Your Organization's Safety and Fire Protocols:** If the fire is not extinguished by the fire extinguisher, immediately follow the protocols as defined by your company to address fires. Alert the nearest fire department by calling the emergency contact number for your area.

    - After the material fire has been extinguished, remove and clean up any residue or debris from the ignition. Inspect the laser system for any damage, paying particular attention to heat-sensitive components such as belts, bearings, and optics. Make any necessary repairs before resuming laser processing. Consult with ULS Service & Support prior to performing any repairs.
    - Remove all residue from the interior of the laser system using the method recommended by the fire extinguisher manufacturer. Inspect and clean all optics as needed.

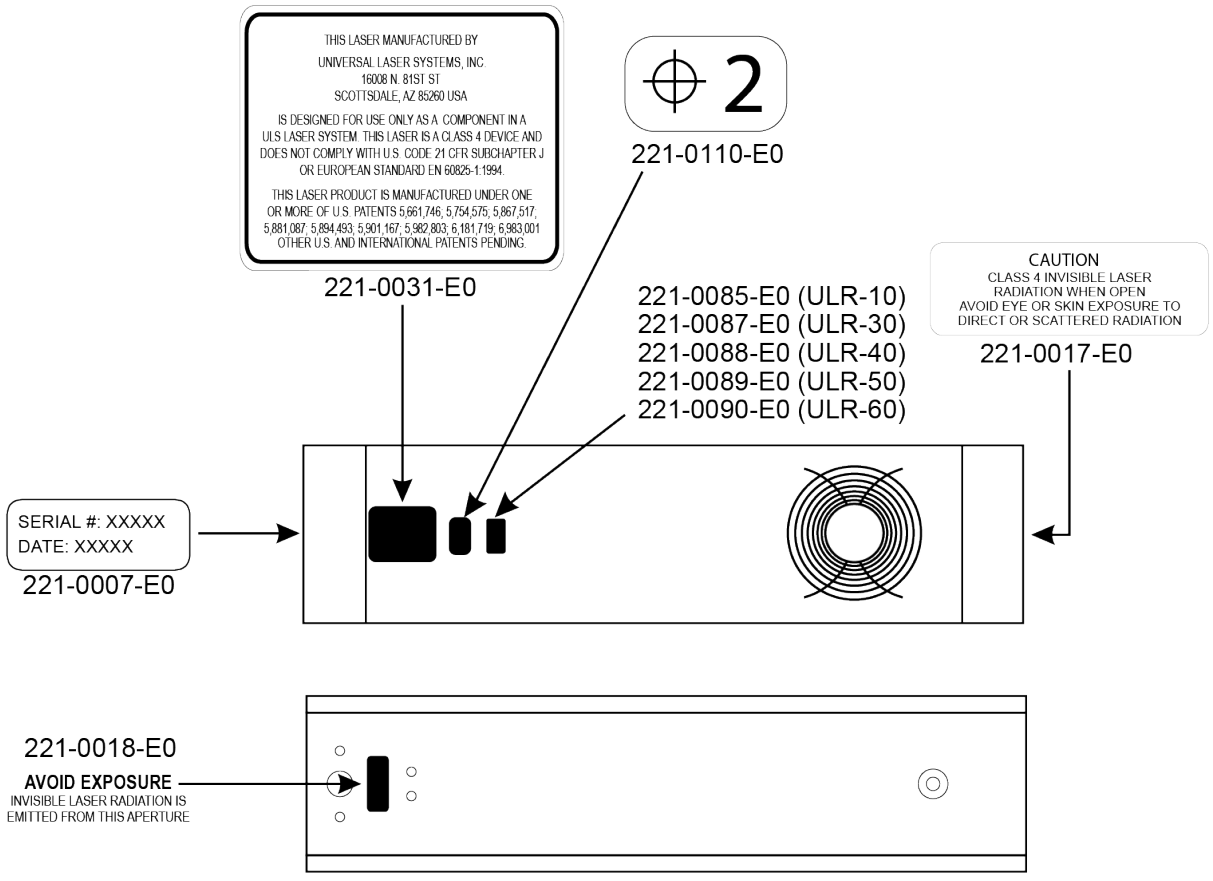
Notice: *This user guide provides general guidance for the safe use of the laser system. Users are responsible for understanding the fire risks associated with the materials they choose to process. Universal Laser Systems assumes no liability for damages or injuries resulting from improper use or failure to follow safety precautions.*

Tamper Proof Labels

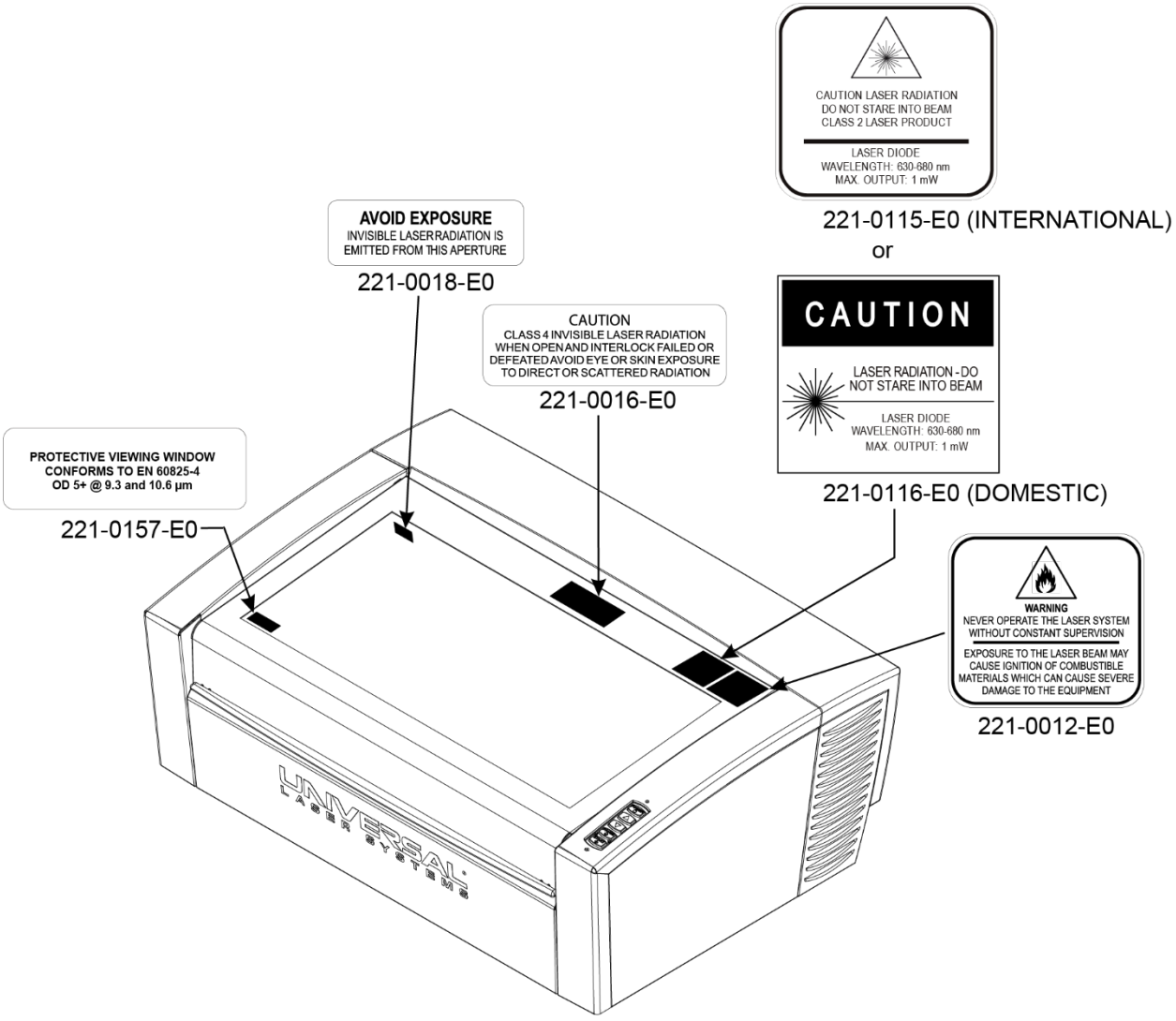
All laser sources are equipped with tamper proof labels. There are NO field serviceable parts inside a Universal Laser System, Inc. (ULS) laser source. If your laser source needs service, please contact the ULS Service & Support Team via the contact information provided at the beginning of this User Guide.

Safety Labels

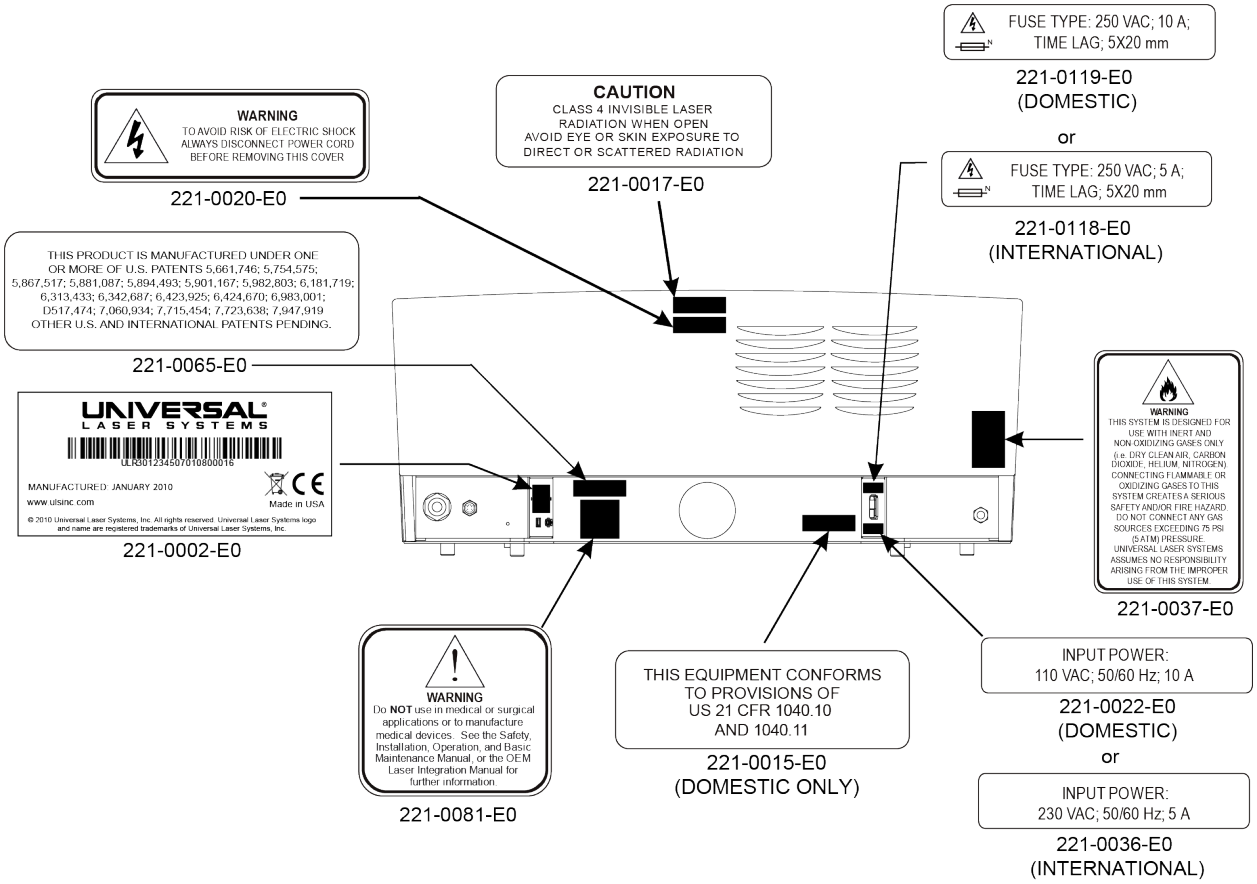
CDRH and CE regulations require that all laser manufacturers affix warning labels in specific locations throughout the equipment. The following warning labels are placed on the laser system for your safety. Do not remove these labels for any reason. If the labels become damaged or have been removed for any reason, do not operate the laser system and immediately contact the ULS Service & Support Team via the contact information provided at the beginning of this User Guide.



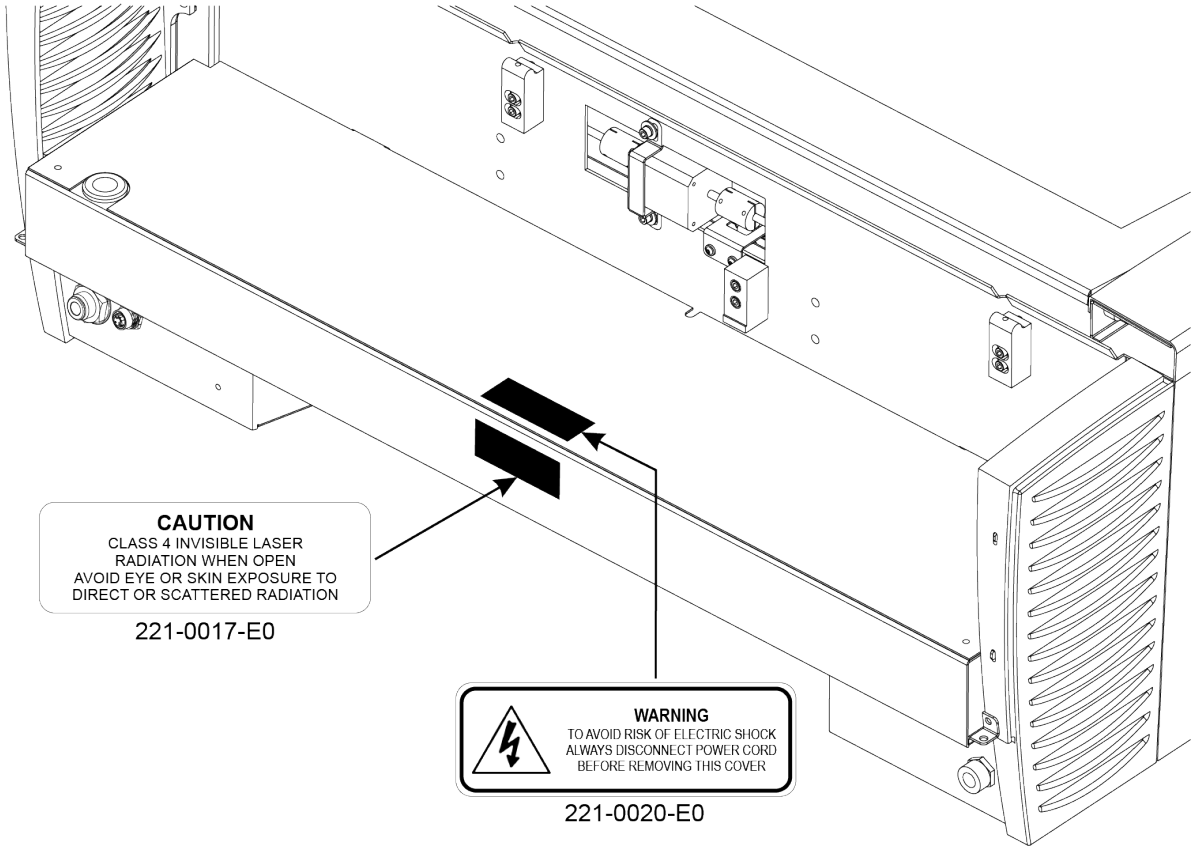
ULS CO_2 Laser Source Labels


CAUTION LASER RADIATION
DO NOT STARE INTO BEAM
CLASS 2 LASER PRODUCT
LASER DIODE
WAVELENGTH: 630-680 nm
MAX. OUTPUT: 1 mW
221-0115-E0 (INTERNATIONAL)
or
AVOID EXPOSURE
INVISIBLE LASER RADIATION IS
EMITTED FROM THIS APERTURE
221-0018-E0
CAUTION
CLASS 4 INVISIBLE LASER RADIATION
WHEN OPEN AND INTERLOCK FAILED OR
DEFEATED AVOID EYE OR SKIN EXPOSURE
TO DIRECT OR SCATTERED RADIATION
221-0016-E0
CAUTION
LASER RADIATION - DO
NOT STARE INTO BEAM
LASER DIODE
WAVELENGTH: 630-680 nm
MAX. OUTPUT: 1 mW
221-0116-E0 (DOMESTIC)
PROTECTIVE VIEWING WINDOW
CONFORMS TO EN 60825-4
OD 5+ @ 9.3 and 10.6 µm
221-0157-E0
WARNING
NEVER OPERATE THE LASER SYSTEM
WITHOUT CONSTANT SUPERVISION
EXPOSURE TO THE LASER BEAM MAY
CAUSE IGNITION OF COMBUSTIBLE
MATERIALS WHICH CAN CAUSE SEVERE
DAMAGE TO THE EQUIPMENT
221-0012-E0

Front View


FUSE TYPE: 250 VAC; 10 A;
TIME LAG; 5X20 mm
221-0119-E0
(DOMESTIC)
or
FUSE TYPE: 250 VAC; 5 A;
TIME LAG; 5X20 mm
221-0118-E0
(INTERNATIONAL)
WARNING
TO AVOID RISK OF ELECTRIC SHOCK
ALWAYS DISCONNECT POWER CORD
BEFORE REMOVING THIS COVER
221-0020-E0
CAUTION
CLASS 4 INVISIBLE LASER
RADIATION WHEN OPEN
AVOID EYE OR SKIN EXPOSURE TO
DIRECT OR SCATTERED RADIATION
221-0017-E0
THIS PRODUCT IS MANUFACTURED UNDER ONE
OR MORE OF U.S. PATENTS 5,661,746; 5,754,575;
5,867,517; 5,881,087; 5,894,493; 5,901,167; 5,982,803; 6,181,719;
6,313,433; 6,342,687; 6,423,925; 6,424,670; 6,983,001;
D517,474; 7,060,934; 7,715,454; 7,723,638; 7,947,919
OTHER U.S. AND INTERNATIONAL PATENTS PENDING.
221-0065-E0
UNIVERSAL
LASER SYSTEMS
MANUFACTURED: JANUARY 2010
www.ulsinc.com
Made in USA
221-0002-E0
WARNING
THIS SYSTEM IS DESIGNED FOR
USE WITH INERT AND
NON-OXIDIZING GASES ONLY
(i.e. DRY CLEAN AIR, CARBON
DIOXIDE, HELIUM, NITROGEN).
CONNECTING FLAMMABLE OR
OXIDIZING GASES TO THIS
SYSTEM CREATES A SERIOUS
SAFETY AND/OR FIRE HAZARD.
DO NOT CONNECT ANY GAS
SOURCES EXCEEDING 75 PSI
(5 ATM) PRESSURE.
UNIVERSAL LASER SYSTEMS
ASSUMES NO RESPONSIBILITY
ARISING FROM THE IMPROPER
USE OF THIS SYSTEM.
221-0037-E0
WARNING
Do NOT use in medical or surgical
applications or to manufacture
medical devices. See the Safety,
Installation, Operation, and Basic
Maintenance Manual, or the OEM
Laser Integration Manual for
further information.
221-0081-E0
THIS EQUIPMENT CONFORMS
TO PROVISIONS OF
US 21 CFR 1040.10
AND 1040.11
221-0015-E0
(DOMESTIC ONLY)
INPUT POWER:
110 VAC; 50/60 Hz; 10 A
221-0022-E0
(DOMESTIC)
or
INPUT POWER:
230 VAC; 50/60 Hz; 5 A
221-0036-E0
(INTERNATIONAL)

Back View



Back View with Laser Cover Removed

EU Declaration of Conformity

Product Identification: All VLS and PLS Model Laser Systems

Manufacturer:

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

European Office:

Universal Laser Systems GmbH
Lerchenfelder Guertel 43
A-1160 Vienna
Austria

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

2014/35/EU	(Low Voltage Directive)
2014/30/EU	(EMC Directive)
2006/42/EC	(Machinery Directive)
2015/863/EU	(2011/65/EU ROHS2 Amended)
2012/19/EU	(WEEE Directive)

based on the standards listed.

Standards Used:

Safety:
EN 62368-1: 2023
EN 60825-1: 2014 (Class 2)

EMC:
EN 55024 2010 (Class A)
EN 55022: 2010 (Class A)
EN 61000-3-2: 2006 (class A)
EN 61000-3-3: 2008
EN 61000-4-2: 2008 (4kV CD, 8kV AD)
EN 61000-4-3: 2006 (3 or 10 V/m)
EN 61000-4-4: 2012 (1 or 2 kV power line)
EN 61000-4-5: 2014 (class 3)
EN 61000-4-6: 2013 (3 or 10Vrms)
EN 61000-4-8: 2009
EN 61000-4-11:2004

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



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

FCC Compliance

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

FCC Compliance Statement and Warnings:

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

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

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

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

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

Recycling



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

Chapter 3 – Installation

Overview

This section provides step-by-step instructions for site preparation, computer/software setup and laser system assembly and connection. Follow the instructions in the order shown.

1. **Site Preparation**
2. **Computer Requirements and Software Installation**
3. **Assembling and Connecting Your Laser System**

Note: *Make sure to complete step 2 (software installation) prior to plugging the laser system into a USB port on your PC.*



WARNING: Damage to the laser system due to inadequate or improper installation or operation is not covered under the Universal Laser Systems (ULS) Warranty. See the ULS Warranty for additional information. A ULS Warranty document is supplied with your laser system. Should you require a copy of the Warranty, please contact the ULS Service & Support Team.



Please refer to the Safety section before operating your laser system.

Step 1: Site Preparation

Operating Environment *(User Supplied)*

- The laser system must be installed in an office, laboratory, workshop or light duty manufacturing environment.
- Dusty or dirty environments can damage the laser system. Keep the laser system isolated from any processes that produce airborne particles such as sandblasting, sanding, and machining. Also, keep the laser system isolated from any equipment requiring mists of oil or water for lubrication. Airborne dust and liquids can coat and damage optics and motion system components.
- Avoid small, enclosed, non-ventilated areas. Some materials, after processing, continue emitting fumes for several minutes. Having these materials present in a confined, unventilated room can create a health hazard.
- For best results, since the laser sources are air-cooled, we recommend operating the laser system between the ambient temperatures of 70°F (21°C) and 78°F (25°C).
- Avoid storing the laser system outside the temperatures of 50°F (10°C) and 95°F (35°C) as excessively cold or hot temperatures can damage the laser source or reduce its lifetime.
- Ambient humidity levels must be non-condensing to protect optics.

- The laser system should be at least 2 feet (600 mm) away from any wall or obstruction to allow for access and proper ventilation.

Electrical Power Source *(User Supplied)*

- For your system's electrical requirements, please refer to the "INPUT POWER" label near the power inlet.



WARNING: Never remove the ground lead to the electrical cord and plug the laser system into a non-grounded outlet. A laser system that is not properly grounded is hazardous and has the potential to cause severe or fatal electrical shock. Without proper grounding, the laser system may exhibit sporadic or unpredictable behavior. Always plug the system into a properly grounded (earthed) outlet.

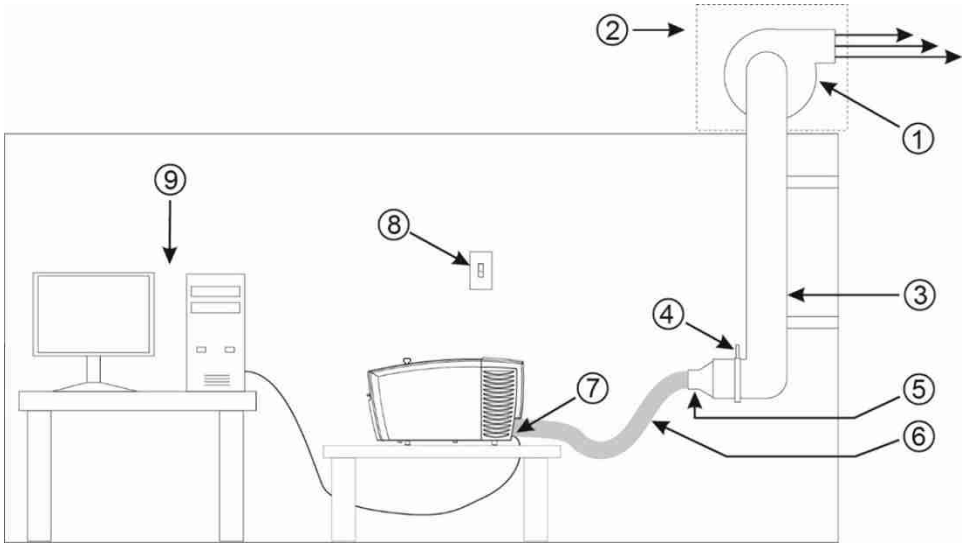
- Noisy or unstable electricity and voltage spikes may cause interference and possible damage to the electronics of the laser system. If electrical power fluctuations, brown outs or constant power outages are a problem in your area, please contact your local Electrician to supply a power isolation and regulation module. Electrically noisy equipment, such as equipment with large motors, can also cause interference if plugged into the same outlet. It may be necessary to attach the laser system to a dedicated electrical line to resolve the problem.
- The laser system is designed as a Class I, Group A, pluggable device. It is also designed for connection to IT Power systems which provide the most flexibility to the user.

Exhaust System *(User Supplied if not using an optional ULS Air Filtration Unit)*

- We recommend you consult with a licensed contractor to meet local safety and building code requirements when installing an exhaust system in your facility.
- The exhaust system vacuum blower must be capable of supplying a minimum of 250 CFM (cubic feet per minute) of airflow while under a load of 6 inches of static pressure (425m3/hr. at 1.5kPa).
- Do not install forward incline, backward incline, in-line or ventilator fans because these types of air handlers are inadequate and inappropriate for this type of installation. A high-pressure blower must be used to meet minimum airflow requirements.
- For personal safety and noise control, we recommend that the exhaust blower be mounted outside the building.
- Rigid tubing should be used for the majority of the connection between the blower and the laser system. The tubing should be smooth-walled and have as few 90-degree bends as possible.
- Install an exhaust gate to adjust airflow and to close off the exhaust when the laser is not in use. Place this gate near the laser system within 5 to 10 feet (1.50 to 3.00 meters).

- Use a short piece of industrial grade, wire-reinforced rubber tubing to connect the laser system's exhaust port to the exhaust gate and secure with a hose clamp. This will provide some mobility for your laser system and will isolate exhaust blower vibrations from your laser system.
- Wire the exhaust blower electrically to a wall switch in the same room for easy ON/OFF control.

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



Exhaust System Layout Example

1. Exhaust blower mounted outside* (User Supplied)
2. Weatherproof shield (User Supplied)
3. Rigid ducting matching the diameter of the blower inlet (User Supplied)
4. Shut-off or air-flow gate (User Supplied)
5. Adapter to the hose reduces from 4 in. to 3 in. (User Supplied)
6. Flexible, wire-reinforced, industrial grade rubber hose (User Supplied)
7. Connection to laser system
8. Exhaust On/Off switch (User Supplied)
9. Computer (User Supplied)

**Exhaust blower illustration may differ according to your region.*

Step 2: Computer Requirements and Software Installation

Your computer is a critical component in the operation of your laser system. In fact, you cannot operate the laser system if it is not connected to your computer and running the Laser System Manager (LSM) software.

You can only run one laser system per computer. You will need to purchase a separate computer for each laser system you own. You must operate the laser system using the computer that is directly attached to it via the provided 6-foot (2 meters) USB cable. USB cables longer than 6 feet (2 meters) may cause the laser system to malfunction.

Note: *Your laser system will work best when attached to a USB 3.0 (USB SuperSpeed) port.*

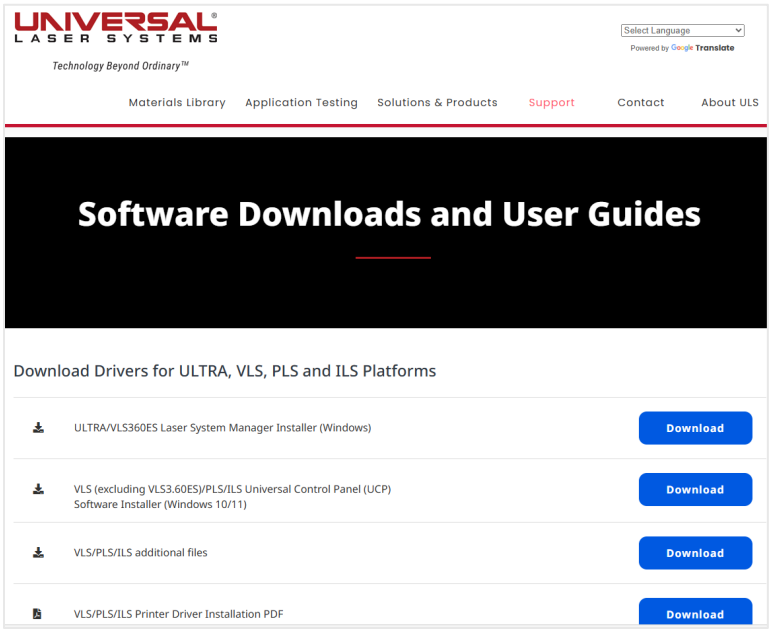
Computer Power Management

Power management settings on your computer can interfere with proper operation of the laser system by putting the computer in standby or sleep mode while the laser system is processing material. The settings can be controlled through the power options in the Windows control panel on your PC or the system settings on your Mac. Make sure to change your setting to never allow the computer attached to the laser system to go to sleep.

Software Installation

Next, install the Laser System Manager (LSM) software. Please note that to install the software, you need to have administrative privileges on the computer before starting installation.

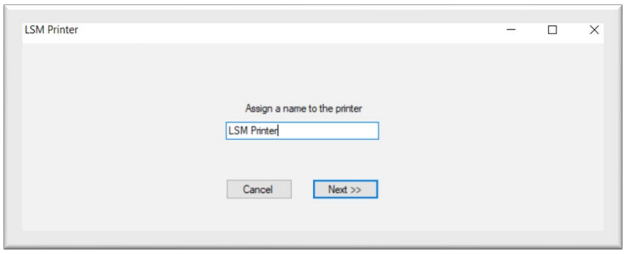
1. Download the latest LSM software package from the Software Downloads and User Guides web page at www.ulsinc.com/support/software-download. Locate the "ULTRA/VLS360ES Laser System Manager Installer" in the list of available files and click the Download button.



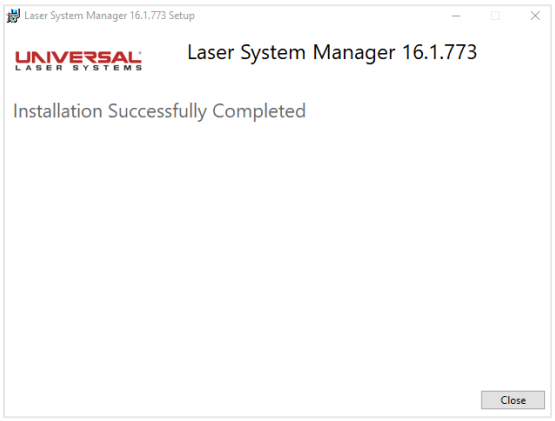
2. Once the installation package has been successfully downloaded, launch the LSM software installer and agree to the licensing terms to start the installation.



3. A prompt will display, and the installer will offer to install the LSM printer driver. The printer driver enables printing design files to the LSM software for laser material processing. This is a convenient way to create laser material processing tasks for the VLS3.60ES Desktop Laser System. However, you can also import design files into the LSM, so the printer driver is not required. If you want to print to the LSM, change the printer driver name as desired and press next, otherwise, press cancel. You can always load the printer driver later by running the installation package again. See example dialog box on the following page.



4. When installation is complete you will be prompted to close the installer.



Step 3: Assembling and Connecting Your Laser System



Familiarize yourself with the instructions before getting started.

Important: *the final step in installation is to assemble your laser system, install the laser source, make final connections and perform a beam alignment check. Do not power up your laser system until the final step, "Checking Beam Alignment."*

Exhaust Air Filtration Unit Assembly *(Optional)*

If you do not have a ULS exhaust air filtration unit (either the Air Cleaner Cart or UAC 2000 Intelligent Air Filtration unit, described further in the Accessories chapter), skip to the next section, Laser System Assembly.

Air Cleaner Cart assembly information is below. For UAC 2000 Intelligent Air Filtration unit assembly, see the UAC 2000 & 4000 Air Filtration Systems User Guide (separate document).

Air Cleaner Cart Assembly

1. Unpack the Air Cleaner Cart and place it on a level surface.
2. Push down on the tabs of the locking casters so that the Air Cleaner Cart does not roll.



3. Unpack the laser system.

4. With the assistance of another person, lift the laser system and place it on top of the Air Cleaner Cart so that the feet of the laser system rest within the four depressions on top of the Air Cleaner Cart.





5. Bend and connect the short exhaust hose (1) provided with the Air Cleaner Cart to the exhaust port on the back of the laser system and secure it with the hose clamps provided. Once the hose is attached, install the provided sheet metal cover over the exhaust hose.

6. Attach a power cord to the Air Cleaner Cart's power inlet (5), but do not plug into power outlet at this point.

7. Connect the provided 3 ft. (30 cm) communications cable between one of the two serial ports (2) of the laser system and the Serial port connector on the air filtration unit (3). Secure the serial cable using the retainer clips (4).

8. Attach a power cord to the laser system's power inlet (6), but do not plug into power outlet at this point.



9. Continue to next section.

Laser System Assembly

1. Unpack the laser system, place it on the table or desktop where you intend to operate it (if not using an optional exhaust air filtration unit), open the top door and remove any packing materials from inside the machine.

2. Gently move the X-Axis arm (1) back and forth. It should slide freely if all packing material has been removed.

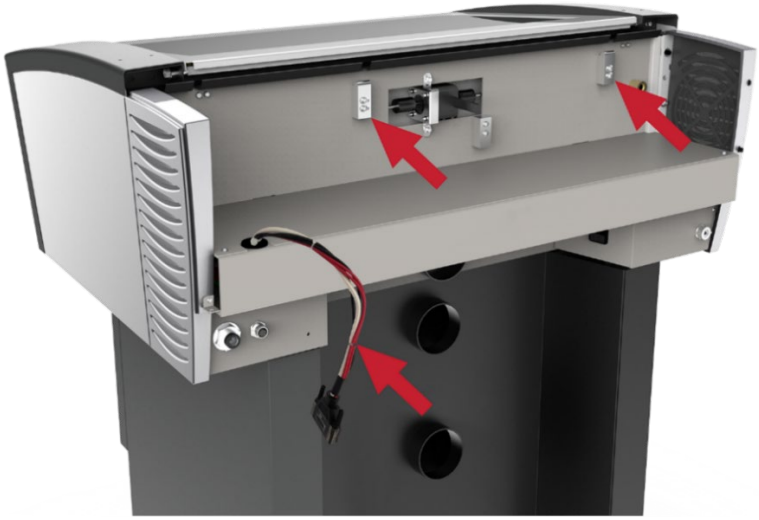


3. The laser source for your laser system may be shipped separately. If the laser source is not already installed in the VLS3.60ES Desktop Laser System, locate the laser and follow these instructions to install it, otherwise skip to the next numbered step.

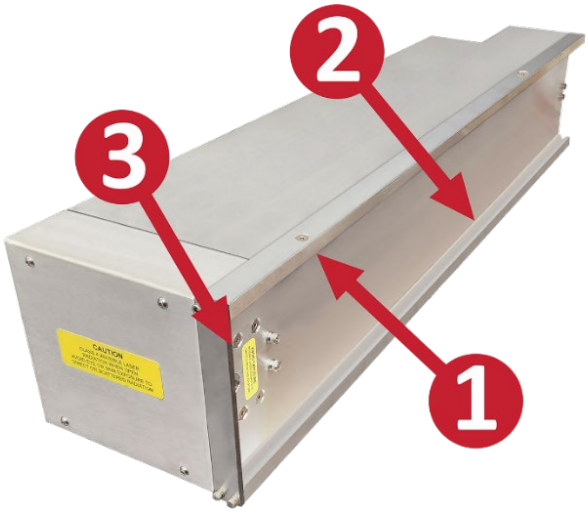
    a. Remove the back cover from the laser system by removing the two screws on the left and right side of the cover.



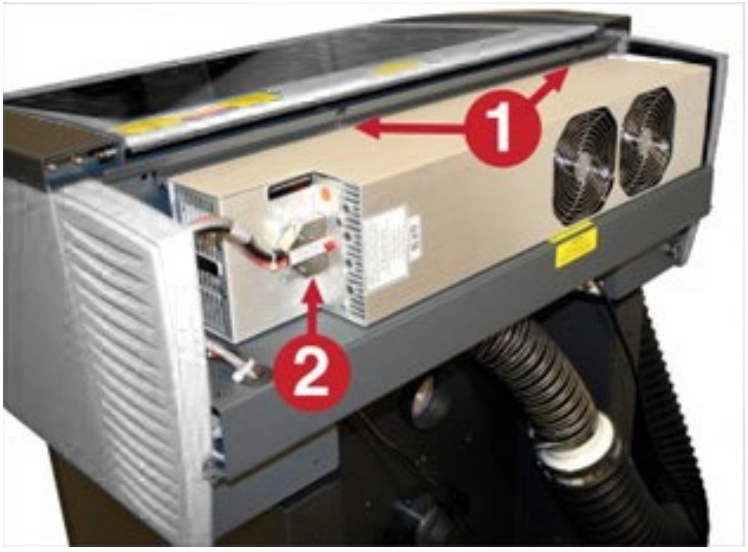
b. Locate the two mounting blocks shown with arrows below and the laser connector on the left side of the laser compartment.



c. Locate the “V” grooves along the upper (1) and lower (2) part of the laser source base plate and the alignment plate (3) at the end of the base plate.



d. Pick up the laser source by both ends and mount the source onto the mounting blocks shown in step b. above by placing the upper “V” groove on top of the mounting blocks. Slide the source to the right or left as necessary until the mounting holes (1) in the top of the laser line up with the mounting holes in the top of the laser mounting blocks.



e. Install the two supplied mounting screws in the mounting holes (1) and connect the laser connector (2) to the laser as shown.

f. Replace the back cover.

4. Plug the laser system and optional Air Cleaner Cart or UAC 2000 Intelligent Air Filtration unit, if present, into appropriate power outlets.

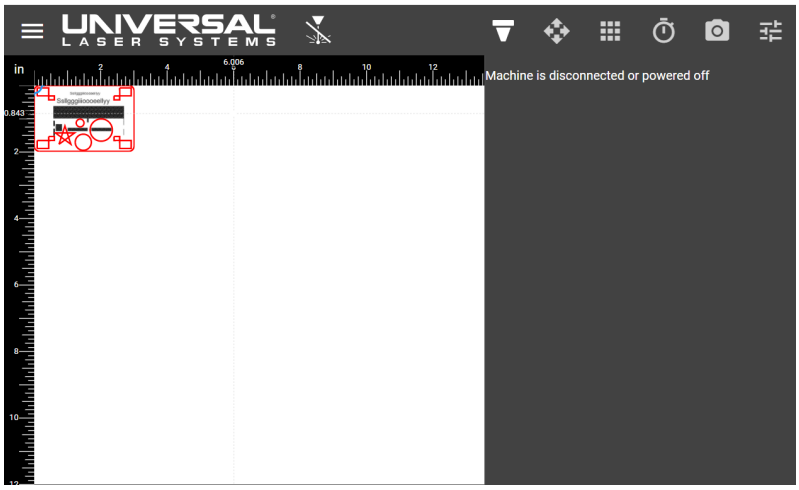
5. Connect the USB cable provided with the laser system between a USB port of the computer and the USB port on the back of the laser system.



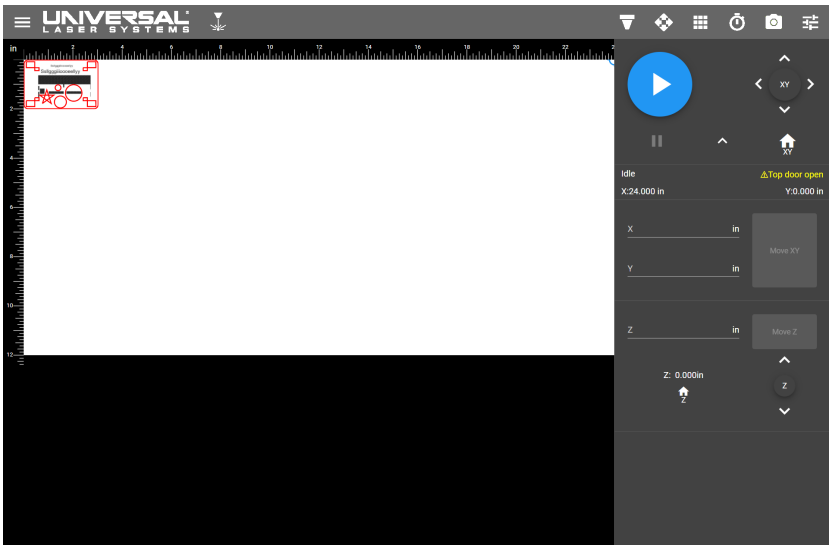
WARNING: The laser system is USB 2.0 Hi-Speed and must be attached to a USB 2.0 or preferably a USB 3.0 port. The laser system comes equipped with a high quality, 6-ft (2.0 meter) USB 2.0 certified cable. We recommend you use this provided cable. Please note that longer USB cables or USB extension cables may induce sporadic behavior.



6. After connecting the USB cable, launch the LSM software. The LSM will launch and indicate that the laser system is disconnected or powered off.



7. Press the Power button on the VLS3.60ES Desktop Laser System to turn the laser system on. The laser system should connect to the LSM software and after initializing and homing the motion system, the laser system should be ready to operate and the LSM controls will display as shown below. If the laser system does not initialize, check all connections and make sure the E-Stop emergency stop push-button is not depressed, then try to power on the laser system again. Contact ULS support if the laser system fails to power on and connect to the LSM.

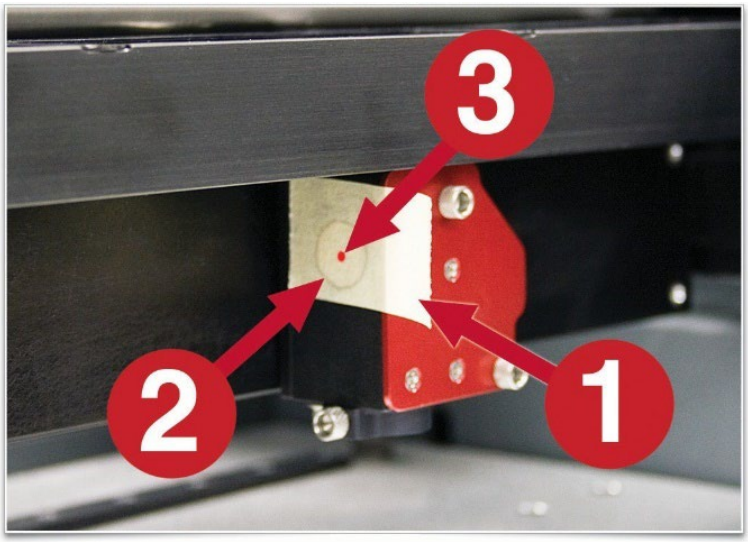


8. If you have multiple users, set up individual user logins and permissions from the User Page of the LSM Main Menu.

Checking Beam Alignment

As a final step in the installation process, check your beam alignment. Do this using the Red Diode Laser built into the laser source.

1. Launch the LSM software, if it is not already running, and turn the laser system on by pressing the power button on the keypad.
2. Open the top door and the Red Diode Laser should automatically turn on.
3. Place a small piece of masking tape across the 3/4 in. (19 mm) hole in the focus carriage (1). Gently rub the tape around the edge of the hole so that you can see the outline of the hole through the tape (2).
4. Observe the Red Diode Laser on the masking tape (3). The red dot should appear centered to within 1/8 inch (3 mm) or better from the center of the hole in the carriage. If not, turn off the laser system, remove and re-install the laser source and try again. If the red dot still does not appear centered, please contact the ULS Service & Support Team.
5. Once you have completed laser beam alignment verification, make sure to remove the masking tape.



Focus Carriage Beam Alignment

Accessories

Your laser system may include various optional accessories such as the Flow-Through Cutting Table, Rotary Fixture, Fire Suppression Assistance Module, and computer-controlled ULS Air Compressor for manual Gas Assist with Optics Protection, also available with optional Coaxial Gas Assist and Lateral Gas Assist attachments. The Accessories chapter of this user guide details how to install and use these and more accessories.

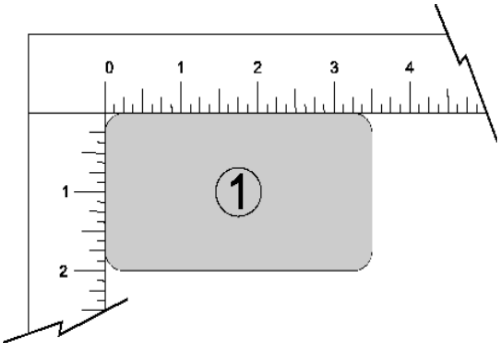
Running Your First Control File

This example will walk you through the process of engraving an image on a 2 x 3.5 inch (50 x 89 mm), 0.020 inch (0.5 mm) thick anodized aluminum test card supplied with your laser system. For additional test cards please contact the ULS Service & Support Team.

This example uses a ULS-supplied design file called “ULSTest” (available in several formats). The file can be downloaded from the same Software Downloads and User Guides web page as the LSM installation software at www.ulsinc.com/support/software-download. From the files listed under the available downloads, locate “VLS/PLS/ILS additional files” and click the corresponding Download button. Once downloaded, open the download and locate the ULSTest design file in the Sample File subfolder.

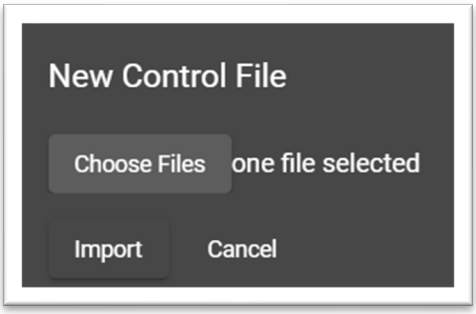
Step 1 – Loading and Positioning the Material

Position the piece of anodized aluminum (1) in the upper left corner of the Material Support Table, against the rulers.

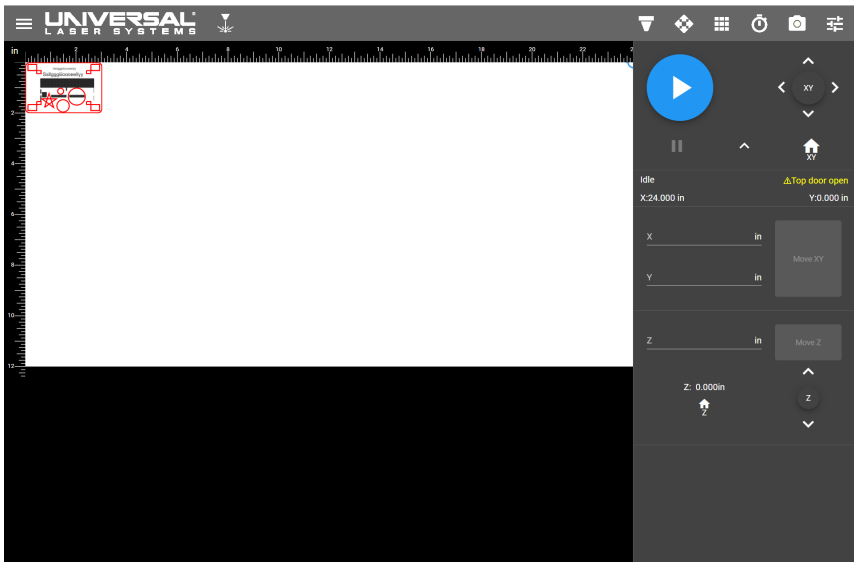


Step 2 – Importing the Test File

1. Select Control Files from the Main Menu in the upper left corner of the LSM.
2. Press the + sign in the lower right corner of the Control Files Page of the LSM to launch the import dialogue.
3. Select Choose Files and locate the ULSTest file you downloaded from the website listed in the note above to import the test file into the LSM.

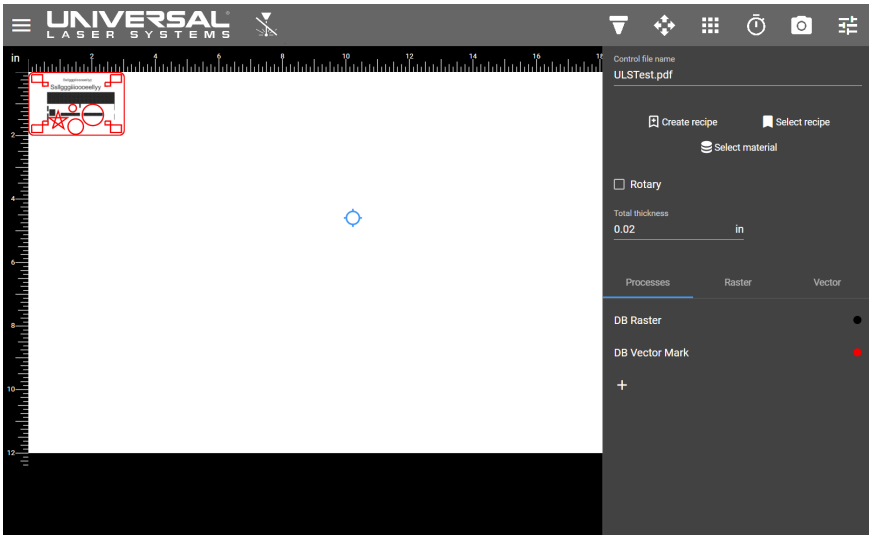


4. The test file should import and appear in the upper left corner of the System Operation Page of the LSM as shown.



5. Measure the thickness of the material (a digital caliper is recommended for this task).

6. Press the Sidebar Control for Settings ( ) in the upper right corner of the System Operation Page to view the process settings for the Control File you imported into the LSM. Enter the thickness you measured in the previous step in the total thickness field. This value will be used by the laser system to position the top surface of the anodized aluminum card at the focal plan of the installed focus lens. Note the two processes already set up for this control file: DB Raster and DB Vector Mark. The DB Raster process will use the Intelligent Materials Database settings to raster mark the black parts of the artwork and the DB Vector Mark process will use the Intelligent Materials Database settings to vector mark the red parts of the artwork.



Step 3 – Starting the Process

1. Before initiating laser processing, make sure exhaust is turned if using external exhaust and turn the laser system on if not already on, by pressing the power button on the laser system keypad. Wait for the laser system to home before proceeding.

   Note: *Laser system cooling fans are variable speed and may speed up and slow down during operation as needed to cool the lasers*.

2. Make sure the material is positioned correctly within the engraving area as instructed in Step 1.

3. Close the top door.

4. Press the Start button on the keypad or of the laser system or in the LSM to begin laser processing.



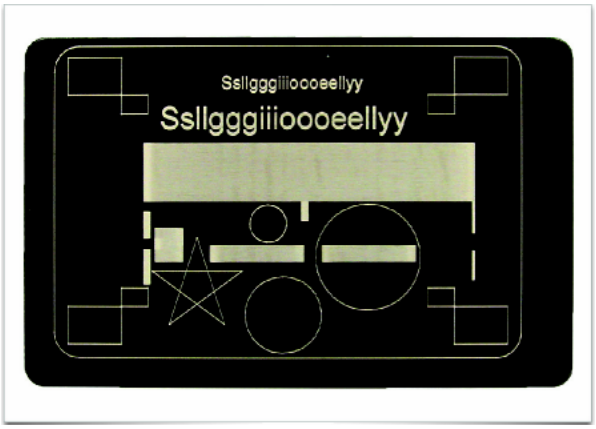
WARNING: Observe that the laser system is functioning properly. If everything is working properly, an image should appear on the test card as the laser system runs the control file. If no image appears, check focus manually as described in this User Guide and adjust if necessary. If you cannot resolve the issue, please contact the ULS Service & Support Team. Never leave the laser system unattended while laser processing.

Step 4 – Material Removal and Reloading

Once the laser system has completed processing the material, the focus carriage will move to the home position in the upper right-hand corner of the processing field.

Before opening the top door, wait a few seconds to allow any remaining fumes that are left from laser processing to evacuate through the exhaust system.

Congratulations! You have just completed your first laser processing control file. Below is an image of the sample test card as it should look after laser processing. If your results are not satisfactory, please contact the ULS Service & Support Team.

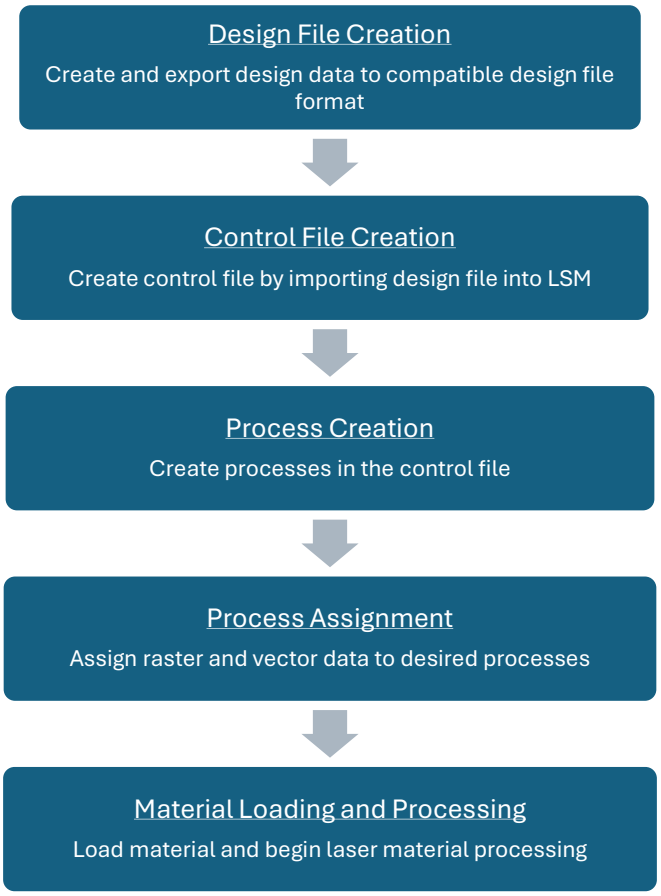


Chapter 4 – Operation

Laser Material Processing Workflow Overview

WARNING: Please refer to the Safety section before operating the laser system.

Processing materials on the VLS3.60ES Desktop Laser System is a simple five-step procedure outlined in the diagram below. This section details each step including term definition, procedures, and best practices.



Laser Material Processing Workflow

Design File Creation

Laser System Manager (LSM)

The software that runs the VLS3.60ES Desktop Laser System is the Laser System Manager (LSM). It handles all aspects of importing, planning, arranging, organizing, and running design files to completion.

Design Files

A design file contains the design information (shapes, lines, images, and more) that will be used to create a control file for laser material processing. A design file can be created using any software capable of outputting or exporting raster and/or vector data to an appropriate file format. Supported file types include PDF, DXF, SVG, BMP, JPG, TIFF, GIF, and G-code.

Elements of a Design File

The LSM interprets elements of a design file as either raster or vector data. The VLS3.60ES Desktop Laser System uses these raster and vector elements to modify materials using either of two modes: a raster mode or a vector mode.

- Raster Mode – The raster mode is used primarily for surface modification. In this mode, images or shapes from a design file are reproduced on the surface of a material by moving the carriage of the beam delivery system back and forth on the X Axis arm while moving the Y Axis arm in small increments. As the carriage moves across the material surface, laser energy is applied in a grid of discrete pulses at resolutions up to 2000 dpi. Material is either removed or modified in some way (annealed or oxidized, for example) depending on the kind of material being processed and the amount of laser energy being deposited. Raster image data must be present in the design file to employ this mode of laser material processing. Raster image data can either be in the form of color or greyscale bitmap images or solid filled areas.
- Vector Mode of Operation - The vector mode of operation is used for both cutting and marking materials. In this mode, vector shapes or outlines from design files are used to simultaneously direct the X and Y Axes of the beam delivery system to follow a vector path, while applying controlled amounts of laser energy to partially or completely cut through a material. This mode can also be used to create thin marks on the surfaces of some materials without penetrating the surface. Vector path data must be present in the user's design file to use this mode of laser material processing.

Control File Creation

Control Files

To begin modifying materials, a control file must first be created in the LSM. A control file contains the collection of raster image and vector path data in addition to the laser material processes needed for a particular laser material processing application. A control file is created by importing a design file into the LSM using either the Importing or Printing process.

- Importing Process

  Importing a design file to create a control file is accomplished by pressing the large plus symbol on the Control File Page of the LSM. A remote connection to the VLS3.60ES Desktop LSM via a browser provides users with this same capability. This is the preferred method of creating

  control files and transferring them to the VLS3.60ES Desktop Laser System since it does not require installation of additional software and works on any operating system that supports a modern browser.

  During the import process, the import engine maps each vector and raster data element from its original color to one of sixteen colors supported by the LSM based on a color matching algorithm. Multicolor or shaded raster data is dithered to allow the laser processing to recreate and assign the shading to the black color.

- Printing Process

  Printing a design file to create a control file requires that a printer driver be installed on the computer containing the design file. The VLS3.60ES Desktop Laser System acts as a network printer and can receive a design file by simply using the print dialog of the design software. Once printed, the design file will be sent to the LSM, and a control file is generated.

Process Creation

Once a control file is created in the LSM, a process must be defined for each task (for example, laser cutting, laser marking, laser engraving, and laser surface modification).

Default Processes

When a new design file is imported into the LSM, the material thickness and type must be selected from the ULS Intelligent Materials Database. Each material in the database contains up to three predefined default processes: a raster process, a vector cutting process, and a vector marking process. (If a material does not support a process, it will not appear.) The default processes are called database processes (abbreviated as DB processes), and they use the Intelligent Materials Database to calculate the optimal settings for each process type for the current system configuration. These default processes can be used as-is or modified as needed.

Custom Processes

If a material being processed is not found in ULS Intelligent Materials Database, custom processes can be created. Laser settings for custom processes will need to be established through testing. If assistance is needed, contact the ULS Service & Support Team.

Process Assignment

After processes have been created for each laser material processing task, each element of the imported raster and vector data must be assigned to a process. Raster and vector data are assigned to processes based on the colors of the raster or vector elements. Although the LSM supports up to 16 different colors for process assignment, only the colors present in the control file will be

displayed. Additionally, if a color does not contain compatible data, it will not be displayed for assignment within a process. For example, if a color does not contain vector data, it will not be available for assignment to a vector process.

Material Loading and Processing

Once the processes have been set up for each color and colors assigned to each process, laser material processing can begin.

Alignment of Material and Design File Data

One of the following support structures must be used to support the material and the material positioned to align with the raster and vector data in the control file:

- Material Support Table

  The standard Material Support Table of the system can be used for any surface modification process, such as engraving.

- Flow-Through Cutting Table

  The optional Flow-Through Cutting Table can be used for cutting processes. If some of the laser processes are cutting processes, it is recommended to install the Flow-Through Cutting Table prior to processing. The Material Support Table must be removed prior to the installation of the Flow-Through Cutting Table. See the Flow-Through Cutting Table section of the Accessories chapter for further instructions.

- Rotary Fixture

  The optional Rotary Fixture can be used for round and cylindrical objects. The Material Support Table must be removed prior to the installation of the Rotary Fixture. See the Rotary Fixture section of the Accessories chapter for further instructions.

Rulers are visible in the preview window of the LSM and on the Material Support Table and can be used for approximate alignment. For more precise alignment, the Red Diode Laser can be used to relocate the control file data to the material or vice versa using the relocation tools in the LSM. The system is equipped with a Camera Vision System with a built-in, door-mounted camera that can be used to visually align control files with materials.

Focusing the Beam

The laser must be properly focused on the top surface of the material for optimal results. This is done by moving the Material Support Table (or optional Flow-Through Cutting Table or Rotary Fixture) which the material sits on up and down. The VLS3.60ES Desktop Laser System automatically focuses the system on the surface of the material if the total material thickness is entered into the process settings for the control file being run. Alternatively, the manual focus tool can be used to manually focus on the surface of the material before processing.

Setting Up Gas/Air Assist

The VLS3.60ES Desktop Laser System controls and directs a source of compressed gas/air onto the material which can aid in material processing for certain materials and applications. Two

attachments are available for directing the gas/air to the material, a coaxial gas/air assist attachment that directs gas/air down onto the material coaxially with the focused laser energy, and a lateral gas/air assist attachment that directs air along the material surface at an angle to the focused laser energy. Coaxial gas/air assist works best for certain vector processing tasks and lateral gas/air assist works best for certain raster processing tasks. Air/gas flow rate can be controlled using the small manual needle valve attached to the lateral or coaxial air/gas assist fitting.

Initiating Processing

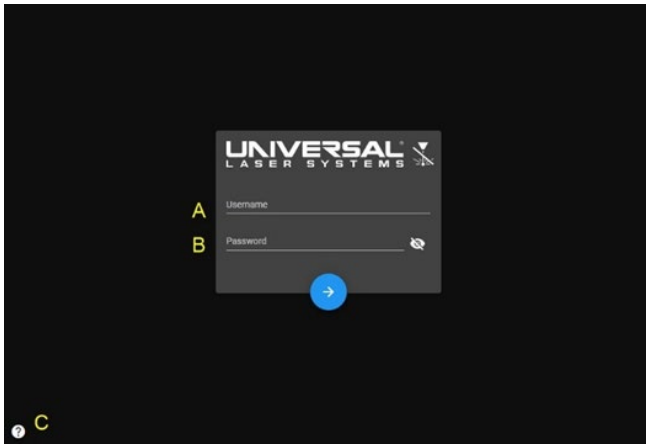
Once the control file is properly set up and material is loaded and aligned with the control file data, processing is initiated by pressing the process start button in the LSM. Once processing is initiated it can be paused, if necessary, then resumed or restarted as desired. Laser processing tasks (5 possible processes) occur in the order listed in the control file and by the order of the colors assigned within each process. Colors are run from left to right in the order they were added to the process. The order of processes can be changed using the cursor to move or drag them into the desired order.

Laser System Manager Overview

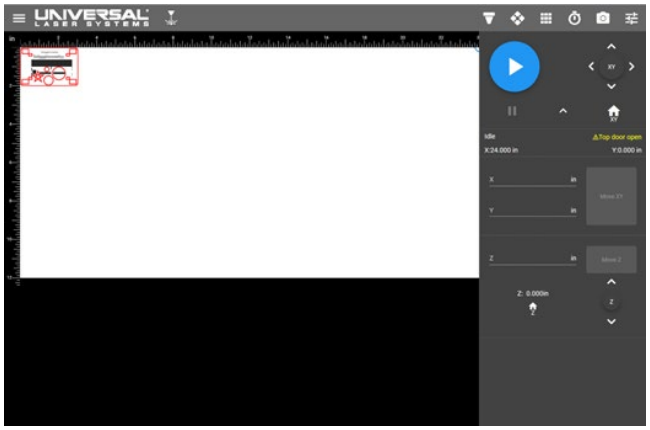
The Laser System Manager (LSM) is the software interface used to control the VLS3.60ES Desktop Laser System. Through the LSM, functions such as management of control files, setup, system configuration, calibration, and diagnostics can be done. Full descriptions of the functions are provided in this section.

Launching the LSM

Upon starting the LSM, either the LSM Home Screen will display as described in the next section or, if "require login" is selected in the user settings, a LSM Login Scree*n* will display with a username and password required to proceed to the home screen. For more information see the User Login section later in this chapter.



LSM Login Screen



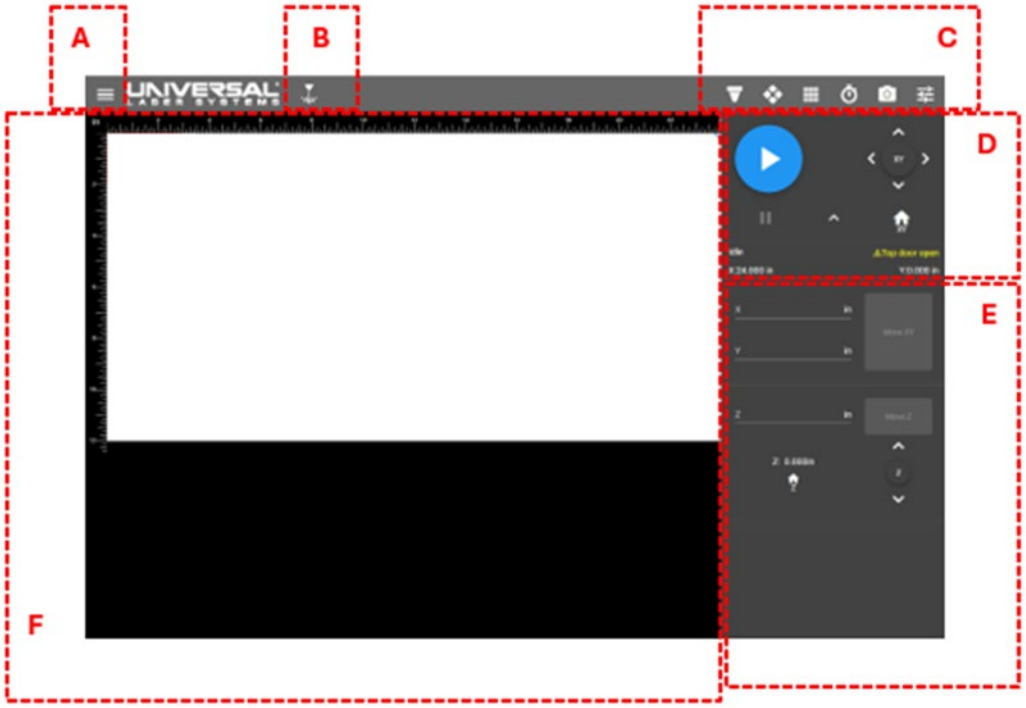
LSM Home Screen

A. USERNAME - Enter a valid username here. Usernames are created in the LSM Users Page by any LSM user who has previously been assigned the user creation and change privilege.

B. PASSWORD - Enter the valid password for the username selected.

C. ? (HELP) - This control provides a mechanism for recovering access to the LSM if a valid username and password are not known. This process involves contacting a ULS Service & Support Team representative with a one-time code. The ULS representative will provide further instructions for recovering access to the LSM.

LSM Home Screen Overview *(Default)*



LSM Home (Default) Screen

A- MAIN MENU - Provides quick access to a variety of LSM software features and pages. Available from any screen.

B- LASER EMISSION INDICATOR - Depicts the current emission status of the laser system. If any of the interlocks are opened (for example if the top or front doors are open) a diagonal slash will appear through the indicator.

FIRE SUPPRESSION INDICATOR – Indicates that the system has a fire suppression system installed and the status of the fire suppression system. If the Fire Suppression Indicator is present, the system has a fire suppression system. If there is a slash through the indictor, pressure in the fire suppression tank is not adequate for proper operation. If the Fire Suppression Indicator is not present, then a fire suppression system is not installed.



C- Sidebar Controls - Access the various sidebar controls available by clicking the desired icon. (The Focus Sidebar is the default sidebar control.) All sidebar controls and their corresponding menus (E below) are described in detail later in this chapter.

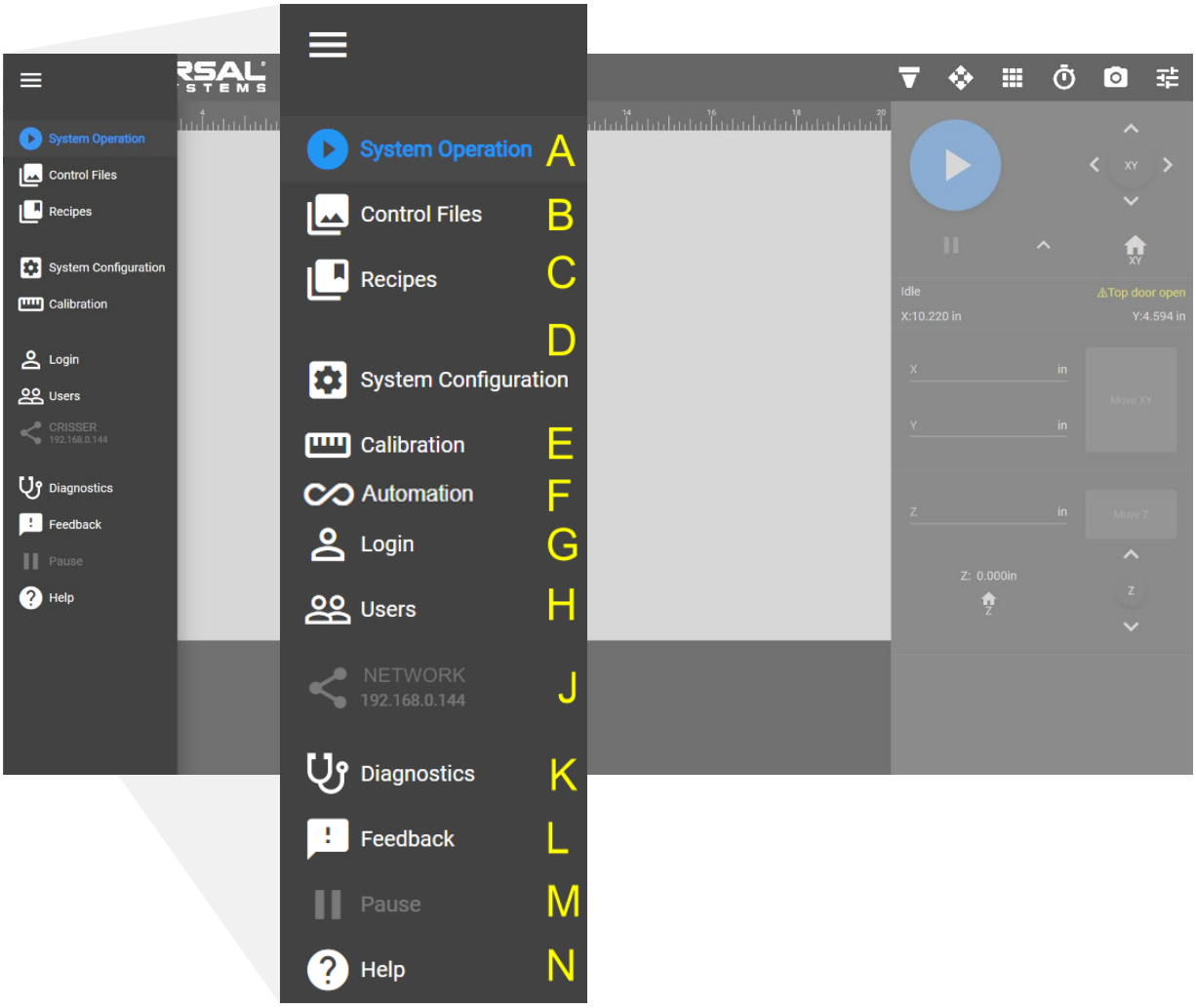
D- Primary Laser System Controls - Primary controls for the positioning of the motion system. These controls are provided on all LSM Main Menu pages (A) and sidebar controls (C) when needed.

E- Sidebar Menu - Displays the menu for the corresponding sidebar control (C above) selected. (The Focus Sidebar Menu is the default.) All sidebar controls (C) and their menus are described in detail later in this chapter.

F- Work Area - Content for the page selected from the Main Menu. Allows for navigation between controls of a given screen.

Main Menu

The Main Menu of the LSM is accessible by pressing the Main Menu button, 3 horizontal lines in the upper left-hand corner of the LSM. It provides quick access to a wide variety of software features. Most of the items accessible from this menu open a new page of the LSM software.



Main Menu

A- System Operation Page (default) – Control the laser system, set up control files, adjust settings, and more. The System Operation is the default page / home screen for the LSM unless no control files exist, in which case, the Control Files Page will appear.

B- Control Files Page – Manage the control files stored in the LSM and import new files.

C- Recipes Page – Access a list of all recipes currently stored on the system. Recipes are saved collections of laser processing settings that can be applied to design files.

D- System Configuration Page – Adjust general system and software settings such as Red Diode Laser functionality, LSM units, and Z axis speed setting.

E- Calibration Page – A series of wizards and dialogs to aid in system calibration.

F- Automation Page (if optional Automation Interface is installed) – Page to configure the automation ports. See the Accessory chapter, Automation Interface section for more details.

G- Login (User Detail) Page – Controls for setting up users and requiring logins.

H- Users Page – Where users may be added, removed, and configured.

J- Network Information - Displays the IP address of the computer directly connected to the VLS3.60ES Desktop Laser System through USB. This IP address is displayed so it can be used to log into the LSM remotely on any other device on the local network by typing the IP address into any internet browser.

K- Diagnostics Page – Access diagnostics tools for various components of the laser system and accessories to aid in troubleshooting problems.

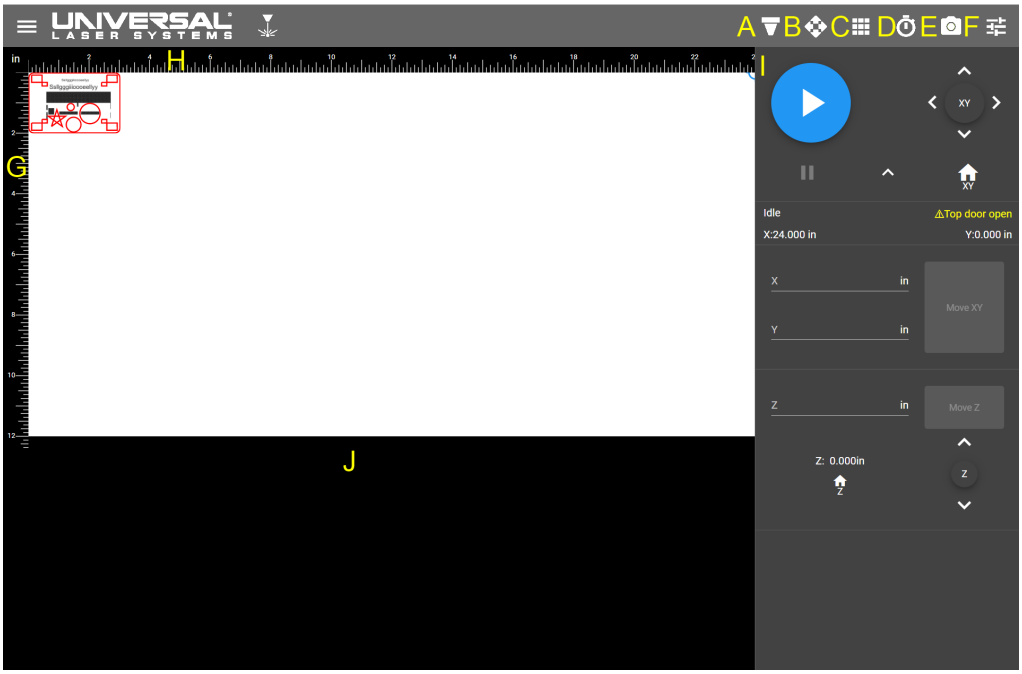
L- Feedback – Dialog to submit reports of software errors directly to the ULS Service & Support Team for review (requires an internet connection).

M- Pause - This pause control is needed for safety if the user becomes logged out of the system while the system is processing material.

N- Help Page – Contains information regarding the system's state, provides access to Remote Diagnostics and LSM software updates.

System Operation Page *(Default)*

The System Operation Page available from the Main Menu is the default home screen and primary location for laser system controls. The system may be positioned, set up, and run from this page. This default page is the most used in the LSM.



System Operation Page

A- Main Sidebar Controls (Default Sidebar) - Opens the Focus Sidebar and is the default sidebar control menu to display on the LSM System Operation Page. For further details, refer to the Focus Sidebar Controls section of this chapter. Alternatively, sidebars C through F described immediately below can be selected.

B- Relocation Sidebar Controls - Opens the Relocation Sidebar as the sidebar control menu to display on the right-hand side of the LSM. For further details, refer to the Relocation Sidebar Controls section of this chapter.

C- Duplication Sidebar Controls - Opens the Duplication Sidebar as the current sidebar control menu on the right-hand side of the LSM. For further details, refer to the Duplication Sidebar Controls section of this chapter.

D- Estimation Sidebar Controls - Opens the Estimation Sidebar as the current sidebar control menu on the right-hand side of the LSM.

E- Camera Sidebar Controls - Opens the Camera Sidebar as the current control menu on the right-hand side of the LSM. For further details, refer to the Camera Sidebar Controls section of this guide.

F- Settings Sidebar Controls - Opens the Settings Sidebar as the current control menu on the right-hand side of the LSM. For further details refer to the Settings Sidebar Controls section.

G- Vertical Rule - Provides a vertical position reference in the processing area for the design file preview (J below). Units are adjustable on the Systems Configuration Page from the Main Menu.

H- Horizontal Rule - Provides a horizontal position reference in the processing area for the design file preview (J below). Units are adjustable on the Systems Configuration Page from the Main Menu.

I- Start Button - This button begins the processing of the control file.

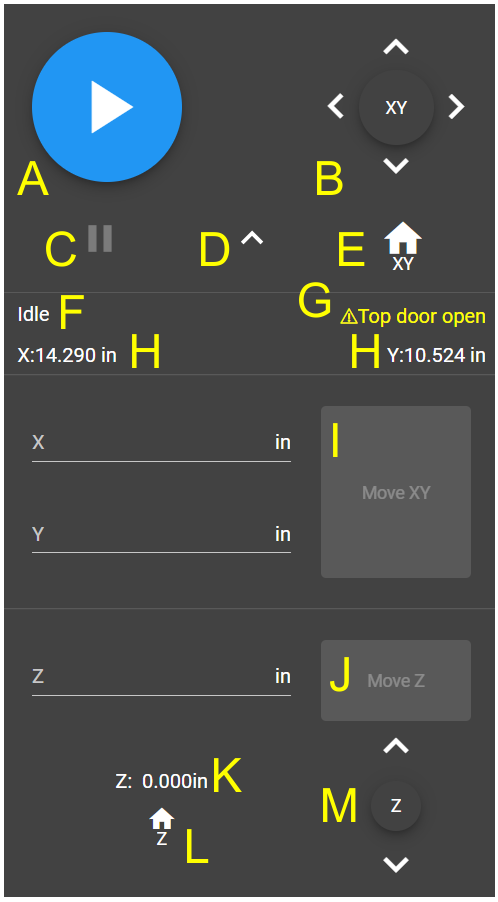
J- Design File Preview - Shows a preview of the design file and its current location in the processing area. This area is contextual and performs different functions depending on the sidebar controls menu displayed on the right of the preview.

Sidebar Controls Menus

From the System Operation Page, various sidebar controls menus are available from the selected Sidebar Control- Main, Relocation, Duplication, Estimation, Camera, and Settings. (See LSM Home Screen areas C and E referenced in the previous section.)

Main Sidebar Controls *(Default)*

These controls are primarily used to position and locate the motion system across each axis, and for positioning the material to be laser processed. Several of these controls are duplicated in other sidebar menus. When in the System Operation Page's Control Files Sidebar view, clicking the mouse within the work area will move the beam delivery motion system to that location.



Main Sidebar Controls

A- BEGIN PROCESSING BUTTON - Initiates laser material processing, during which time, the button will be disabled.

B- XY AXIS JOYSTICK - Moves the system along the X and Y Axes simultaneously. Touch and drag the central button labeled XY to manually adjust the system position. Tapping on any of the four arrows will generate incremental movements in the associated direction (Up, Down, Left, and Right). The size of these movements is determined by the Tap Sensitivity Adjustment Button (D below).

C- Pause, Resume and Stop Process Buttons - The Pause button causes the system to pause during processing. When paused, the Pause button will be replaced by a Resume button and a Stop button. The Resume button will cause the system to resume processing where it was paused. The Stop Button will clear the paused state.

D- Tap Sensitivity Adjustment Button - Adjusts the sensitivity of movement of the arrow buttons in the XY and Z joysticks between Low, Medium, and High on each joystick. The current sensitivity level is indicated by the number of chevrons on the button. More chevrons indicate larger movement distances.

E- Home XY Button - Simultaneously performs the homing routine on the X and Y Axes, causing the system to move towards the upper right-hand corner of the processing area and reestablish the home position.

F- System Status Indicator - Displays a brief written description of the system's status. Primary examples are Idle, Running, and Paused. The text will change as the system's state is modified and will turn yellow if warnings are associated with the current state.

G-Warning State Indicator - Displays a brief written description of warnings about the state of the system that might prevent laser processing from occurring such as interlocked doors being open to the laser processing area.

H- System Location Indicators - Provides the exact location of the carriage in the X and Y axes. Units are adjustable on the System Configuration Page.

I- Move XY Axes Field & Button - Enables manual entry of the X and Y axes locations. Entering a value into each text field followed by depressing the Move XY button will cause the carriage to move to the specified location. Values entered outside of range will produce a warning. Units are adjustable on the System Configuration Page.

J- Move Z Axis Field & Button - Enables manual entry of the Z axis location. Entering a value into the text field followed by depressing the Move Z button will cause the Material Support Table to move to the specified location. Units are adjustable on the System Configuration Page.

K- Z Axis Location Indicator - Provides the exact location of the Material Support Table (Z axis). Units are adjustable on the System Configuration Page.

L- Home Z Axis Button - Performs the homing routine on the Z axis. This will cause the Material Support Table (Z axis) to move downwards and reestablish the home position. Note that this procedure may take up to one minute to complete.

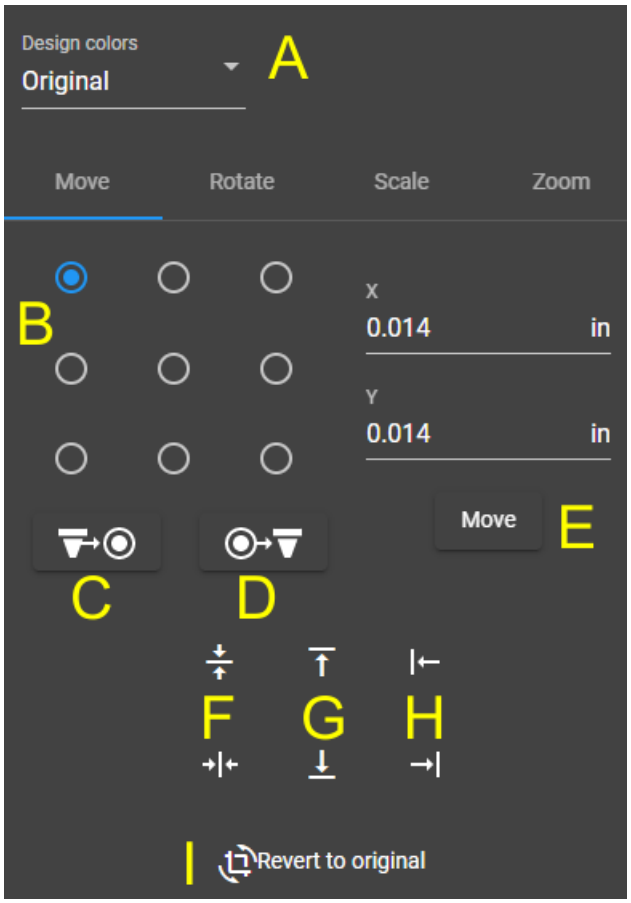
M- Z Axis Joystick - Moves the Material Support Table (Z axis) up and down. Touch and drag the central button labeled Z to manually adjust the Z axis position. Tap the Up and Down arrows to generate incremental movements. The size of these movements is determined by the Tap Sensitivity Adjustment button (D).

Relocation Sidebar Controls

This set of controls manages the location, rotation angle, and scale of the design file within the design file preview area. Design files may be manipulated by moving the control handles around the design itself in the preview area, or by using the controls provided in the right-hand sidebar. Each type of manipulation, Move, Rotate, Scale, and Zoom, has its own set of controls, selectable as tabs on the sidebar.

- ### Relocation Sidebar Controls-Move

  This set of controls can be used to move the design file around in the laser processing field.



Move Tab

A- Design Colors - Improves ability to see design files when superimposed on materials of different colors by temporarily switching the design preview to one selectable bright color to create contrast.

B- Relocation Anchors - Acts as both indicators and selectors for the nine anchor points on the design file. Select an anchor point to make it active. The anchors shown in the design file preview area are synchronized with these anchors and serve the same function.

C- Carriage to Anchor Button - Moves the carriage to the current location of the active anchor on the design file.

D- Anchor to Carriage Button - Moves the active anchor on the design file to the current location of the carriage.

E- Anchor to Location Form & Button - Displays the current location of the selected anchor and allows that location to be moved. To move the selected anchor, overwrite the current X and Y positions with desired X and Y positions and press Move. Units are adjustable on the System Configuration Page.

F- Center Design File Buttons - Centers the design file in either the vertical or horizontal direction.

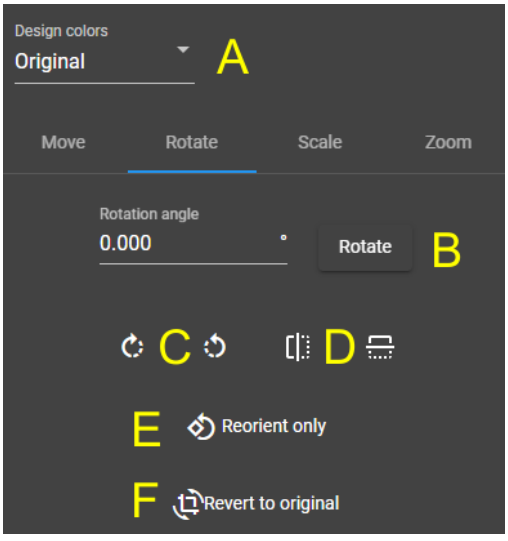
G- Vertical Min-Max Placement Buttons - Moves the design file to the top or bottom of the processing area. The X axis location of the design file remains unchanged.

H- Horizontal Min-Max Placement Buttons - Moves the design file to the far right or far left of the processing area. The Y axis location of the design file remains unchanged.

I- Revert to Original Button - Reverts all changes (location, rotation, and scale) to that of the original design file.

- Relocation Sidebar Controls-Rotate

  This set of controls can be used to rotate the design file around its center as well as mirror the design file.



Rotate Tab

A- Design Colors - Improves ability to see design files when superimposed on materials of different colors by temporarily switching the preview of the design to one selectable bright color.

B- Rotate Form and Button - Rotates the design file to the specified angle.

C- Quick Rotation Buttons - Rotate the design file in 90-degree increments in the specified direction, clockwise or counterclockwise.

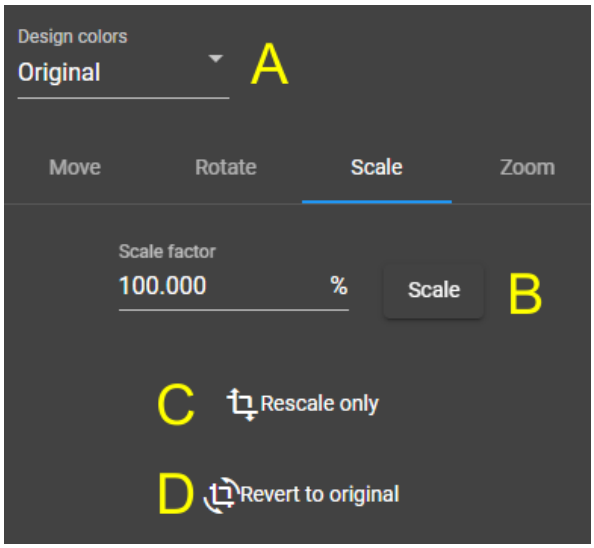
D- Mirror Buttons - Mirrors the design file about the horizontal or vertical axis.

E- Reorient Only Button - Reverts to the original rotation angle of the design file but preserves location, scale and mirroring changes.

F- Revert to Original Button - Reverts all changes (location, rotation, and scale) to that of the original design file.

- Relocation Sidebar Controls-Scale

  This set of controls can be used to scale the design file.



Scale Tab

A- Design Colors - Improves ability to see design files when superimposed on materials of different colors by temporarily switching the preview of the design to one selectable bright color.

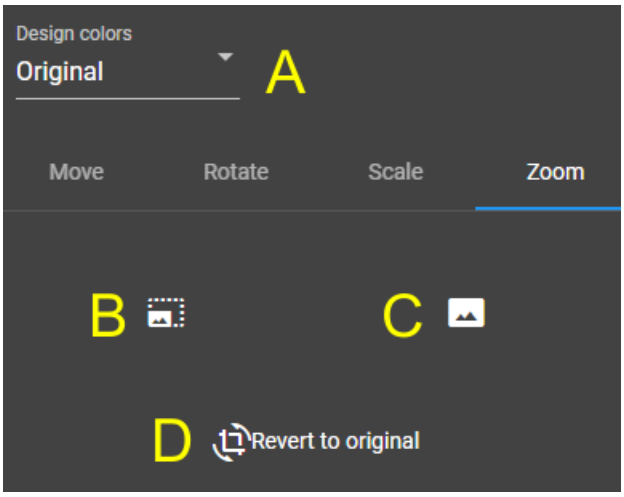
B- Scale Form and Button - Scales the design file by the specified percentage.

C- Rescale Only Button - Reverts to the original scale of the design file but preserves location and rotation changes.

D- Revert to Original Button - Reverts all changes (location, rotation, and scale) to that of the original design file.

- Relocation Sidebar Controls-Zoom

  This set of controls allows the user to zoom into and out of the design file as well as pan.



Zoom Tab

A- Design Colors - Improves ability to see design files when superimposed on materials of different colors by temporarily switching the preview of the design to one selectable bright color.

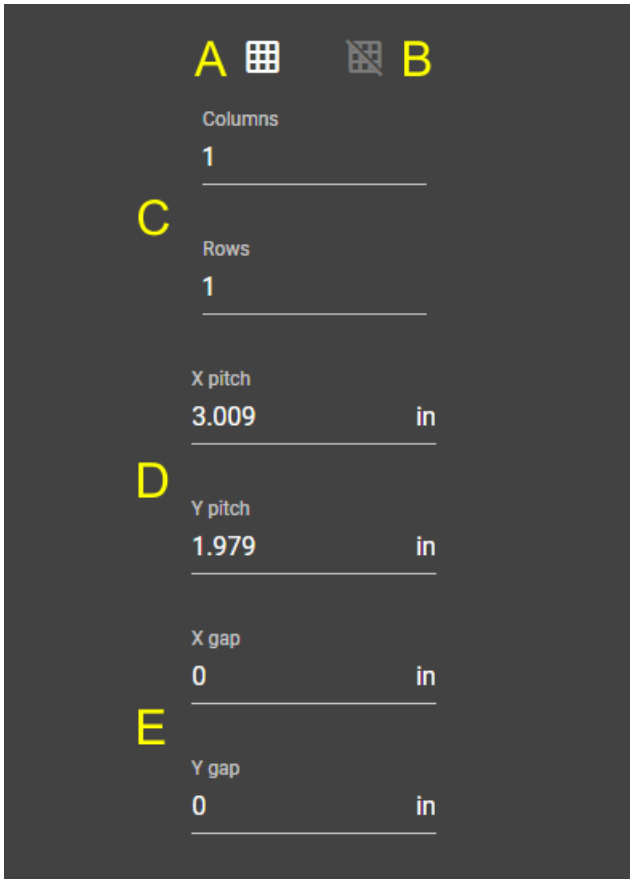
B- Zoom Full Field Button - Shows the full extent of the processing area in the design file preview area.

C- Zoom to Design File Button - Shows only the region occupied by the design file in the design file preview area. Zooms to the extents of your design file.

D- Revert to Original Button - Reverts all changes (location, rotation, and scale) to that of the original design file.

Duplication Sidebar Controls

These controls relate to duplication of a design file within the design file preview area. They provide a convenient method to create multiple impressions of a single design file within the LSM.



Duplication Sidebar Controls Menu

A- Duplicate to Fill Button - Generates duplications to fill the field to the right and down from the location of the original design file. To maximize the number of instances, place the original design file in the upper left-hand corner of the processing area before duplication.

B- Remove Duplicates Button - Removes all duplicate design files and returns the Row and Column counts to a value of one.

C- Row & Column Count Form - Provides fields to Indicate the number of Columns and Rows desired for duplication of the current design file. Duplicates will be placed to the right and below the location of the current design file. To maximize the number of instances, place the original design file in the upper left-hand corner of the processing area before duplication.

D- Duplication Pitch Form - Provides fields to adjust the design file duplication pitch in both the X and Y directions. The pitch is the total spacing from edge to edge of each duplication instance.

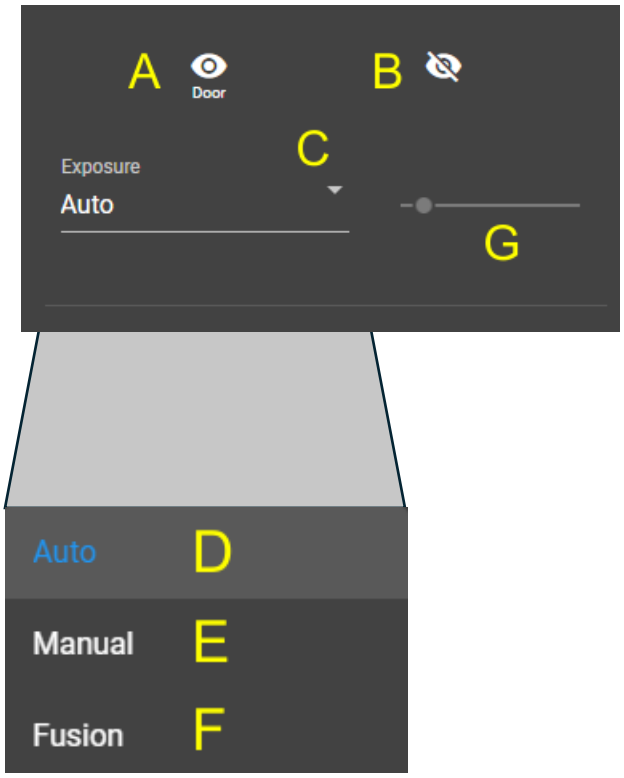
Changing either the pitch or gap will override any previous pitch and gap settings. Units are adjustable in the Systems Configuration Page.

E- Duplication Gap Form - Provides fields for adjustment of the design file duplication gap in both the X and Y directions. The gap is the space between the outermost extents of the design file. Changing either the pitch or gap will override any previous pitch or gap settings. Units are adjustable in the Systems Configuration Page.

Special Note: *Specific cells in the duplicate array can be skipped when laser processing by long pressing on the cell in the control file preview area. Deactivated cells will be grayed out. Long pressing again will re-activate the cell.*

Camera Sidebar Controls

This menu provides controls for interacting with the door-mounted Camera Vision System. The camera is installed on the top door of the laser system and provides a panoramic view of the laser processing area and allows for manual alignment of design files with materials placed in the processing area.



Camera Sidebar Controls Menu

A- Image Capture Button - Captures an image of the laser processing area from the door-mounted Camera Vision System and displays the image in the background of the design file preview window.

B- Remove Image Button - Clears any camera images from the background of the design file preview window.

C- Camera Exposure - Selects an exposure method for the Camera Vision System. Ambient lighting can affect the image captured by the camera. Different methods of controlling the exposure settings for the Camera Vision System can be selected to compensate for ambient lighting and optimize the image. Each is explained below.

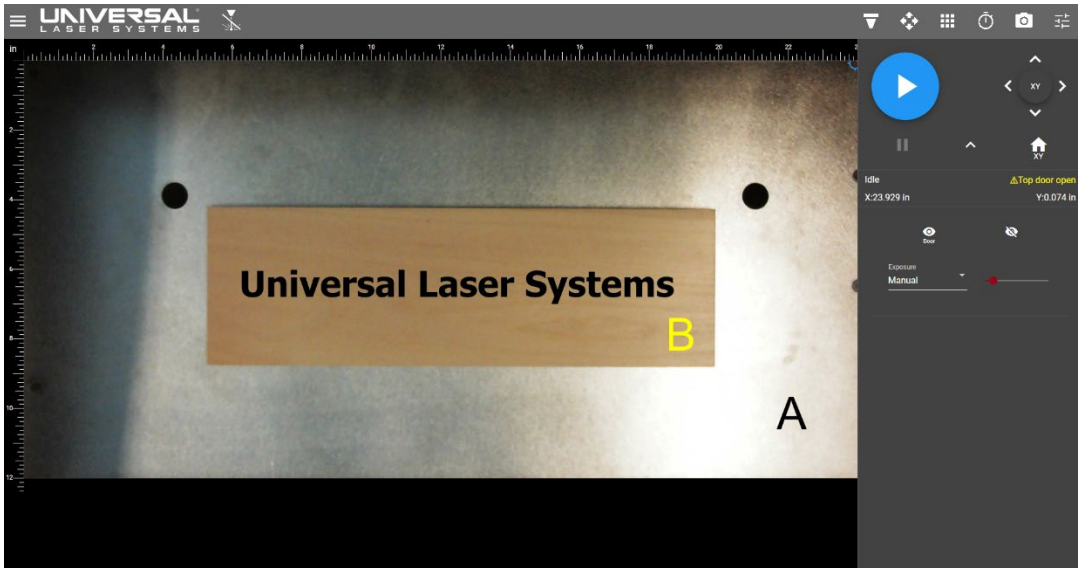
D- Auto Exposure - Allows the Camera Vision System to set the exposure level. This method should be used when there is no direct overhead lighting which can cause bright reflections on the Material Support Table, or highly reflective materials placed on the Material Support Table.

E- Manual Exposure - Allows the user to set the exposure level using the Manual Exposure Slider control (G) to the right of the Exposure selection control (C). This method can compensate for bright reflections from overhead lighting but may leave some areas of the image too dark if reflections are too bright.

F- Fusion Exposure - This method automatically takes multiple pictures at different exposure levels and combines the images to produce a composite image that flattens out the effects of different lighting conditions in different areas of the material processing area. This method produces the best image but takes a few seconds to generate.

G- Manual Exposure Slider - This slider adjusts the manual exposure level when manual exposure is selected. When Auto or Fusion Exposure is selected, this slider is grayed out.

- Camera Preview Results

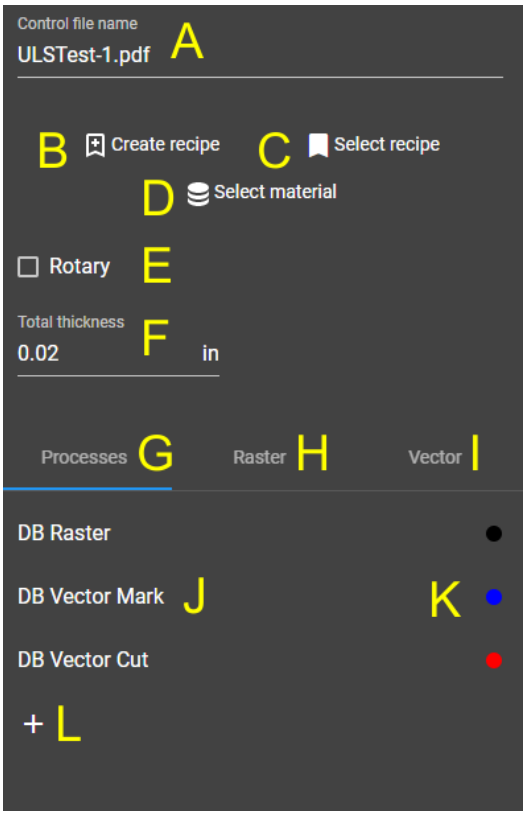


A- Camera Image - The door-mounted Camera Vision System camera image is displayed as the background in the control file preview area with the control file design superimposed on the camera image. A new image can be captured at any time by pressing the door Camera Vision System button.

B- Superimposed Design File - The design file, in this case the text "Universal Laser Systems" is superimposed on the camera image to allow visual alignment of designs with materials placed on the Material Support Table using the relocation tools to reposition, rotate, and scale the design as needed before laser processing begins.

Settings Sidebar Controls

The Settings Sidebar is the primary location used for setup, ordering, and configuration of the various processes that are possible, such as cutting, marking, and engraving. The user can assign colors to individual processes that correspond to graphical elements within the design file.



Settings Sidebar Controls Menu

A- Control File Name - Displays the name of the control file. When importing a new design file, this field is automatically populated with the newly imported file's name. Tap in this field to edit the name of the control file.

B- Create Recipe Button - Opens the Create a New Recipe Wizard, enabling the creation of a recipe from the current processing settings. These settings can be later recalled and applied to another control file. A recipe is a snapshot of all the current process settings the user has configured for the selected control file.

C- Select Recipe Button - Selects a recipe from saved recipes and applies the recipe to the current control file.

D- Select Material Button - Selects a material from the Intelligent Materials Database and applies its database settings globally to all database processes in the control file. If the newly selected material does not support cutting, any database cut processes will be removed from the control file.

E- Rotary Selector - Selects the Rotary Fixture to process round materials. When selected, a yellow horizontal line will be displayed in the preview area showing the rotational axis. If a Rotary Fixture is selected for a control file but the Rotary Fixture is not installed an error message will be displayed that the Rotary Fixture is not installed in the system.

F- Total Thickness - Enter the thickness of the material to be processed and this value will be used to position the top surface of the material at the focal plane of the installed final focus lens (the installed lens is chosen in the System Configuration Page) if the focus mode in a process is set to "Focus on Surface."

G- Processes Tab - Lists all of the laser processes settings, assigned colors, and the processing order in the selected control file. This is the main tab used for editing laser processing settings.

H- Raster Settings Tab - Contains the specific settings for the raster elements of a design file. For more details, refer to the Raster Settings Tab section of this manual.

I- Vector Settings Tab - Contains the specific settings for the vector elements of a design file. For more details, refer to the Vector Settings Tab section of this manual.

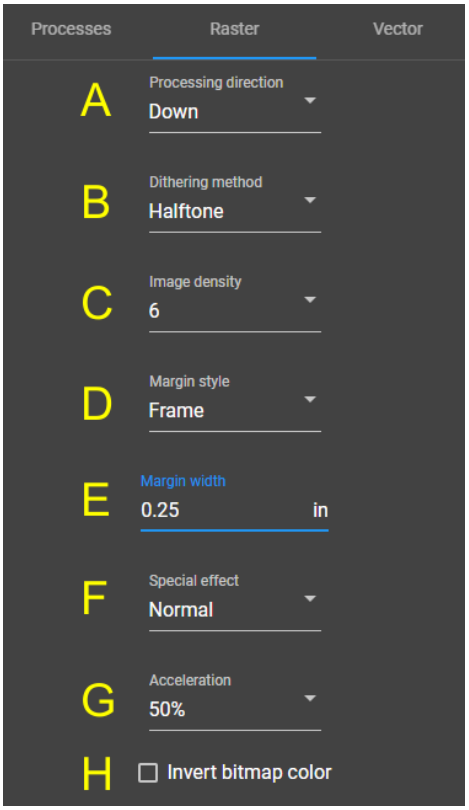
J- Process List - Lists all laser processes with their assigned colors. Processes will be executed from top to bottom. Colors within the same process will be executed from left to right. To edit a process, select that process and the process editing form will pop up. The settings displayed in the process editing form will differ depending on the process type selected. Process editing forms for each process are described below.

K- Colors Assignments - Indicates what colors in the design file have been assigned to a process. All colors assigned to a process will have those process settings assigned to them for laser processing.

L- Add New Process Button - Creates a new process. Press this button to open the new process dialog where process type, settings, and color assignments can be made.

- Raster Settings Tab

  Contains settings common to all raster elements of a design file.



Raster Settings Tab

A- Processing Direction - Determines the direction the raster motion will progress throughout the control file. Down will start at the top of the control file and make its way downward. Up will start at the bottom of the control file and progress upward.

B- Dithering Method - Provides a selection of dithering methods for laser processing of bitmap images. Dithering methods are used when laser engraving or marking graphics that contain grayscale or color bitmaps such as photographs in all printing modes except 3D Mode. (See F- Special Effects below.) A dither pattern is a special screen filter that is used to convert a grayscale or color image to monochrome (black and white). The screen filter reduces the image to black and white while preserving the illusion of shades of gray by varying the spacing of pixels (dots) in the image. Darker areas have more dots spaced closer together and lighter areas have fewer dots spaced farther apart. Since the laser system does not directly reproduce color or shades of gray, this is the method used to mimic shades of gray in order to engrave or mark photographs onto material. There are a variety of dithering methods to select from:

- *Black and White Mode*
  The black and white dither pattern is a thresholding pattern that thresholds at 50% black. Each pixel in a grayscale image that is greater than 50% black will be converted into black and each pixel that is less than 50% black will be converted into white. This dither pattern should not be selected for reproducing photographs but is very useful when printing images that should be black and white yet may have some unintended grayscale pixels in them. A good example is a scanned image of a text document that was scanned into a computer using a grayscale scanner setting. Ideally the scanned image of text should be black text on a white background, but if a grayscale scanner setting was used there may be very light gray pixels at the edges of the characters of text. This dither pattern will remove those gray pixels.

- *Error Diffusion*
  The error diffusion dither pattern uses a random scatter filter to place pixels in order to represent shades of gray image. The pattern created will vary with density chosen. Higher density settings, such as 5, will produce a more densely packed, finer pattern and lower resolution settings, such as 2, will produce a loosely packed, coarser pattern.

- *Halftone*
  The halftone dither pattern is a line-type filter which applies a 45° line screen to a color or grayscale image to convert it to black and white. The line spacing of the line screen varies with the density chosen so at lower densities the line screen is more coarse.

Image Density	Lines Per Inch
6 through 9	180
5	90
4	60
3	45
2	36

- *Fine/Medium/Coarse*
  These dither patterns are specially optimized for laser photo engraving or marking on a variety of materials. The use of Fine, Medium or Coarse depends on the size of the mark made by the laser in a particular material. If the laser tends to make small marks in material such as stone or metal, use Fine. If the laser tends to make larger marks on the material such as soft wood, use a Medium or Coarse filter.

  Helpful Tip: *Laser marking or engraving grayscale or color bitmaps onto materials requires a bit of trial and error to achieve good results. Results will vary on different materials. As a rule, use the Fine/Medium/Coarse patterns for photo*

engraving/marking and the other dither patterns for grayscale designs such as clipart and logos.

C- IMAGE DENSITY - Selects image density. Higher numbers will result in more raster passes per unit distance while lower numbers will increase throughput. Selecting the lowest number that meets the quality requirements will result in optimal processing results.

D- MARGIN STYLE - Indicates the type of margin to be used for the raster process. Tight will reduce the overall processing time by moving only the required amount in the X direction for each raster stroke. Frame will make each raster stroke the same length over the entire process – the length of the widest single raster line.

E- MARGIN WIDTH - Specifies the amount of additional motion system travel beyond the right and left edge of raster image data when raster processing. Adding a non-zero margin may be necessary on some materials to produce even and consistent marking at the right and left edges of a raster marking or engraving process.

F- SPECIAL EFFECT - Enables selection of special raster modes used in 3D engraving and rubber stamp production as well as a reduction mode.

- *Normal Mode*
  In this mode all single-color raster data is mapped to the closest color in the color table and processed using the process settings that color is assigned to. All grayscale or multicolor bitmaps are converted to black and white and have a dither pattern applied to them based on the dithering method specified in the raster settings of the control file.

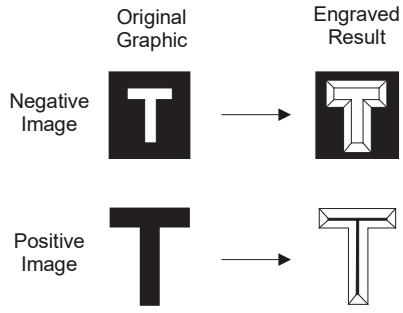
- *Reduction Mode*
  Raster block reduction mode (also known as print growth management) is specifically for engraving or marking barcodes and adjusts the barcode elements for readability by removing pixels from the edges of each element of the barcode being printed to adjust them for readability. This is necessary because most barcodes are generated from barcode fonts so that the widths of the elements in the barcode are not adjustable. This mode allows you to adjust the widths of the elements at time of engraving or marking to make the barcodes more readable with barcode scanners.

- *3D Mode*
  This mode affects raster elements of your image. In this mode all raster objects regardless of color will be converted to 256 color grayscale and then during processing the laser power level is varied pixel by pixel in accordance with the grayscale levels in the image. Lighter parts of the image will receive less laser power and darker parts more laser power resulting in a contoured depth and a three-dimensional look. The grayscale to laser power mapping can be adjusted

using the 3D Setup button. Several passes may be required to create enough relief in the engraving to get the desired 3D results.

3D Setup Button:
This button accesses controls to adjust the grayscale to laser power level mapping table. It only appears when 3D Mode is selected. All pixels in grayscale images in the control file will have laser power levels assigned to them based on this mapping table which indicates the percent laser power mapped to the percent gray. Higher values result in deeper engraving than lower values. Linear mapping works for most applications (adjust the sliders in a diagonal line going up from left to right), but in some cases the setting can be varied as a sort of gamma correction for depth of engraving.

- *Rubber Stamp Mode*
This mode is specifically for rubber stamp creation and is used for creating shoulders on characters and graphics when processing rubber stamps. The shoulder is created by gradually ramping the laser power up or down near the edges of each element in the graphic being printed creating a tapered edge around each graphic element that produces a pyramid-like effect in the material being processed. Most rubber stamp applications will require the graphic to be an inverted image with black representing the material to be removed by the laser. The invert function in the LSM raster process settings can be used to invert images after importing if necessary. The shape of the taper or shoulder can be varied as desired using the rubber stamp profile setup controls accessed from the Rubber Stamp Setup Button. In this mode all non-black raster data is



Shoulder applied to
negative and positive images

converted to grayscale and a halftone dither pattern is applied to it.

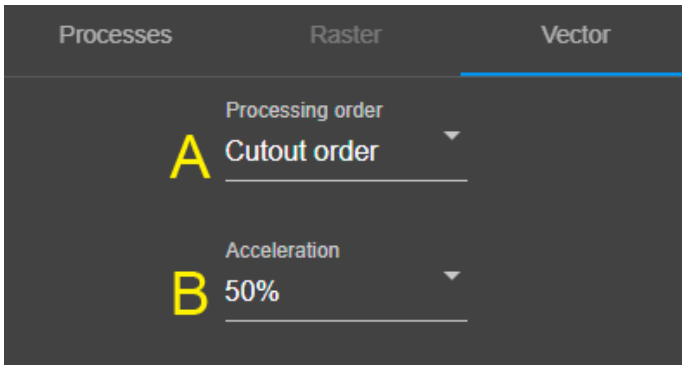
Rubber Stamp Setup Button:
This button accesses controls to adjust the rubber stamp taper. It only appears when Rubber Stamp Mode is selected. Select the desired predefined shoulder angles for specific rubber stamp applications.

G- Raster Acceleration - This value corresponds to the amount of acceleration the system will undergo during raster processing. Higher percentages will yield faster completion times. Lower percentages will yield higher quality results.

H- Invert Bitmap Color - This switch will invert the colors in a raster image. This is especially useful for engraving bitmaps onto material where the surface color is dark, and the raster marked color is light or for processing rubber stamps where the background needs to be removed to leave the stamp text and graphics raised.

- Vector Settings Tab

  Contains settings common to all vector processes set up in the Processes tab.



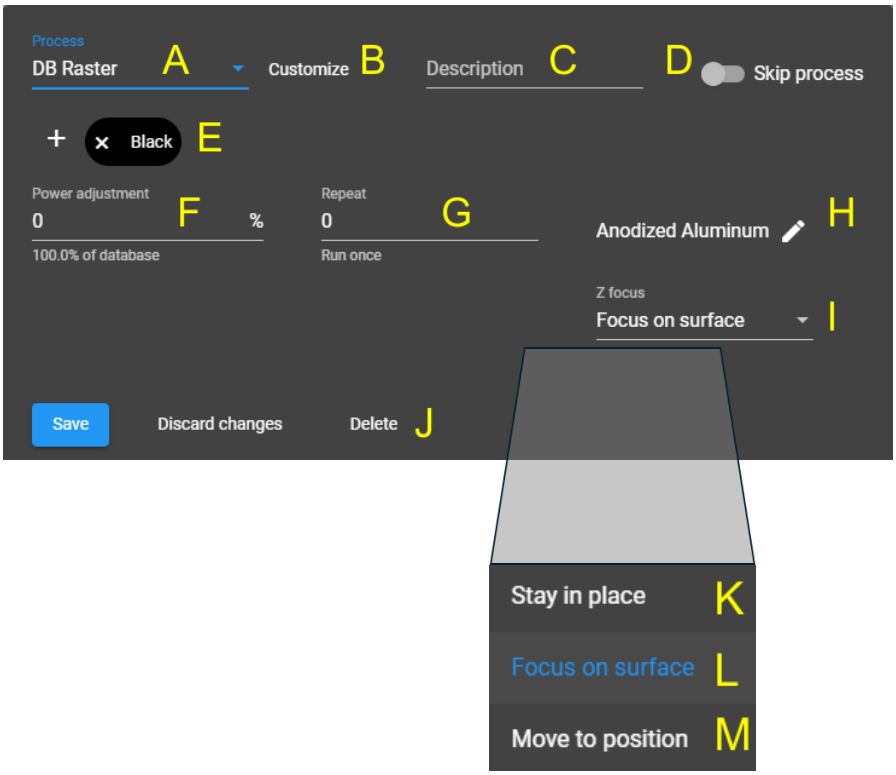
Vector Settings Tab

A- Processing Order - Determines the processing order of the vector patterns. “As designed” will process vectors in the order they were created in the design software. “Cutout order” will process vectors from innermost to outermost closed shape, which is useful when material is elevated to avoid back reflection when being cut and parts fall out as they are cut. “Minimum time” processes vectors in an order that tries to minimize completion time.

B- Vector Acceleration - This value corresponds to the amount of acceleration the system will undergo during vector processing. Higher percentages will yield faster completion times. Lower percentages will yield higher quality results.

- DB Raster and DB Vector Mark Marking Settings

  Uses the Intelligent Materials Database to generate laser processing settings for DB (database) Raster and DB Vector Mark processes.



DB Raster Settings

(Alternatively, DB Vector Mark may be selected)

A- Process Type Selector - Indicates the process type such as DB Raster, DB Vector Cut, DB Vector Mark, Custom Vector, and Custom Raster. The interface above shows the Intelligent Materials Database DB Raster settings. If changed, the available settings will change to reflect the new process type. When using the Intelligent Materials Database settings, the LSM will use the rated power of the installed laser and its wavelength to calculate the appropriate settings for the selected process on the selected material type (and thickness for cutting processes). If the material or laser is changed, the database will automatically adjust the settings for the new laser or material selection.

B- Customize - This button will retrieve the database settings for the currently installed laser and selected material and convert those settings to a custom raster or vector process. Once the process has been converted to a custom process using the customize button, the process is decoupled from the Intelligent Materials Database and will not be automatically adjusted if the laser or material is changed. Customization is useful for developing new settings for new materials by using a similar material as a starting point or for developing new non-standard processes for an existing material by

providing a starting point from the Intelligent Materials Database and adjusting the settings as needed.

C- Process Description - Provides a field to enter a description of the process. In addition to the text box shown above, this description will appear in the Processes tab along with any recipe information that may be saved.

D- Skip Process Toggle Button - Provides an easy way to store the process settings while enabling the user to quickly disable a process. If toggled on, the process will be greyed out in the Processes tab, indicating that it will currently be skipped when the laser system processes the selected file.

E- Associated Colors - Displays the design file colors assigned to the selected process. Colors may be removed by selecting the X next to the color's name or added by selecting the + sign. Only colors found in the design file will be available to add to each process. If multiple colors are assigned to a process, colors will be processed left to right. The order in which the colors will be processed can be changed by dragging the color in front or behind other colors as desired.

F- Power Adjustment - The Intelligent Materials Database calculates the appropriate laser power based on the material type, thickness, and selected laser type. Power adjustment enables fine-tuning of this value to accommodate deviations in material thickness or chemical formulations.

G- Repeat Count - The number of times to repeat the selected process.

H- Material Selection - Indicates the currently selected material for the current database process. The pencil button launches the database's Material Selection Dialog that categorically lists all materials in the Intelligent Materials Database compatible with the current system setup. Changing material for a specific process will not change the material selection for the other database processes. This is useful for setting up processes for layered composite materials when processing a specific layer or if processing multiple materials at once. To change the material selection for all processes in a control file, use the material selection tool at the top of the Settings Sidebar Controls instead.

I- Focus Mode - Determines focus mode used before the process is started. See K, L, and M below for a description of the available focus modes.

J- Save/Delete/Discard Changes Buttons - Select one of these three options:

- Save new/changed process settings.
- Delete the entire process and move the assigned colors to the unassigned category. (The delete key will not be present when creating new processes.)
- Discard the changes and return to the System Operations Page. (If the process is new, Discard Changes will Delete the entire process.)

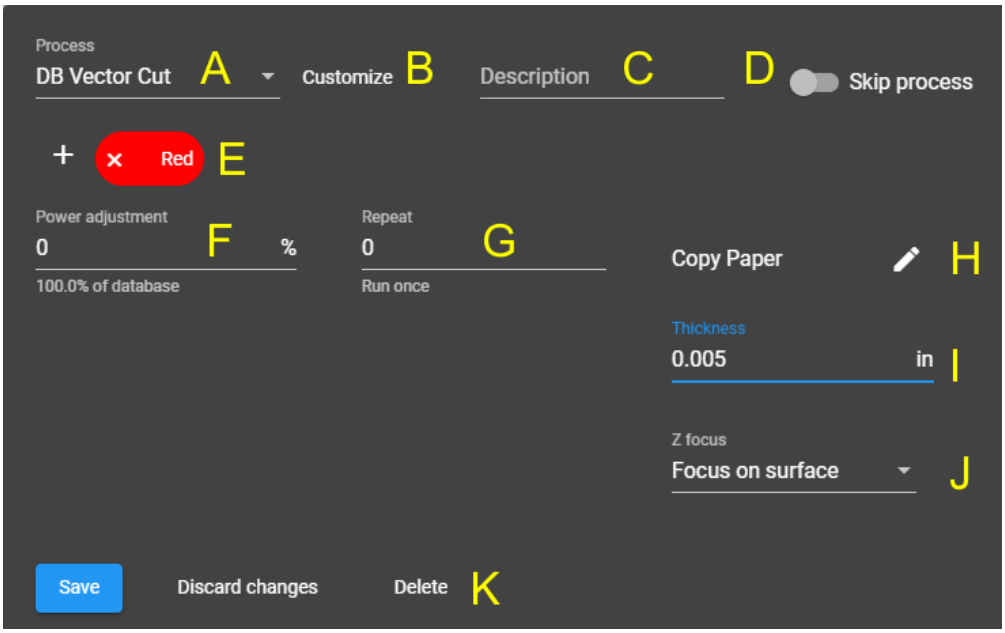
K- Focus Mode – Stay in Place - This mode will not move the Z axis before processing. The Z axis will remain in the position it was in when the process started.

L- Focus Mode – Focus on Surface - This mode will move the Z axis to the position that puts the top surface of the material at the focal plane of the selected lens by moving the Z axis down from the calibrated focal plane by the thickness specified in the Total Thickness setting at the top of the Settings Sidebar. For the most efficient operation, the Focus on Surface mode should be selected for the first process and all subsequent processes can be set to Stay in Place mode.

M- Focus Mode – Move to Position - When this mode is selected, a control will appear to enter a specific Z position. The system will move the Z axis to this position before processing.

- DB Vector Cut Settings

Uses the Intelligent Materials Database to generate laser processing settings for a DB (Database) Vector Cut process.



Database Vector Cut Settings

A- Process Type Selector - Indicates the process type such as DB Raster, DB Vector Cut, DB Vector Mark, Custom Vector, and Custom Raster. The interface above shows the Intelligent Materials Database DB Vector Cut settings. If changed, the available settings will change to reflect the new process type. When using Intelligent Materials Database settings, the LSM will use the rated power level of the installed laser and its wavelength to calculate the appropriate settings for the selected process on the

selected material type (and thickness for cutting processes). If the material or laser is changed, the database will automatically adjust the settings for the new laser or material selection,

B- Customize - This button will retrieve the database settings for the currently installed laser and selected material and convert those settings to a custom raster or vector process. Once the process has been converted to a custom process using the customize button, the process is decoupled from the Intelligent Materials Database and will not be automatically adjusted if the laser or material is changed. Customization is useful for developing new settings for new materials by using a similar material as a starting point or for developing new non-standard processes for an existing material by providing a starting point from the Intelligent Materials Database and adjusting the settings as needed.

C- Process Description - Provides a field to enter a description of the process. In addition to the text box shown above, this description will appear in the Processes tab along with any recipe information that may be saved.

D- Skip Process Toggle Button - If toggled on, provides an easy way to store the process settings while enabling the user to quickly disable a process. The process will be greyed out in the Processes tab indicating that it will currently be skipped when the laser system processes the selected file.

E- Associated Colors - Displays the design file colors assigned to the selected process. Colors may be removed by selecting the X next to the color's name or added by selecting the + sign. Only colors found in the design file will be available to add to each process. If multiple colors are assigned to a process, colors will be processed left to right. The order in which the colors will be processed can be changed by dragging the color in front or behind other colors as desired.

F- Power Adjustment - The Intelligent Materials Database calculates the appropriate laser power based on the material type, thickness, and selected laser type. Power adjustment enables fine-tuning of this value to accommodate deviations in material thickness or chemical formulations.

G- Repeat Count - The number of times to repeat the selected process.

H- Material Selection - Indicates the currently selected material for the current database process. The Pencil button launches the database's Material Selection Dialog that categorically lists all materials in the Intelligent Materials Database compatible with the current system setup. Changing material for a specific process will not change the material selection for the other database processes. This is useful for setting up processes for layered composite materials when processing a specific layer or if processing multiple materials at once. To change the material selection for all processes in a control file, use the material selection tool at the top of the Settings Sidebar instead.

I- Thickness - The thickness entered here is used by the Intelligent Materials Database to calculate the appropriate settings to cut through the selected material using the installed laser. Please note that this thickness is not used for focusing when Focus on Surface is selected. The total thickness entered in the control at the top of the process menu is used for focusing. Typically, the total thickness and process thickness will be the same value, but they are separate controls to allow for process thickness to be varied from total thickness for cutting layers of multilayer materials.

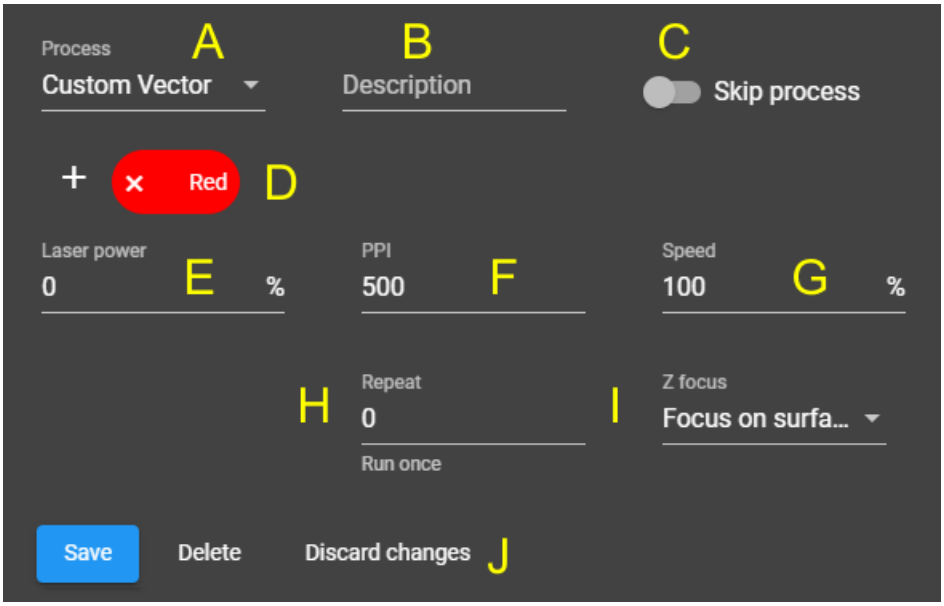
J- Focus Mode - Determines focus mode used before the process is started. (See the previous section, DB Raster and DB Vector Mark Settings for a description of the available focus modes.)

K- Save/Delete/Discard Changes Buttons - Select one of these three options:

- Save the new/changed process settings.
- Delete the entire process and move the assigned colors to the unassigned category. (The delete key will not be present when creating new processes.)
- Discard changes and return to the System Operations Page. (If the process is new, Discard Changes will Delete the entire process.)

- Custom Vector Settings

This screen contains the controls needed to configure a Custom Vector process. This process could be used to cut a material that is not found in the Intelligent Materials Database.



Custom Vector Settings

A- Process Type Selector - Indicates the process type such as DB (database) Raster, DB Vector Cut, DB Vector Mark, Custom Vector, and Custom Raster. The interface above shows the Custom Vector settings. If changed, the available settings will change to reflect the new process type. When using Intelligent Materials Database settings, the LSM will use the rated power of the installed laser and its wavelength to calculate the appropriate settings for the selected process on the selected material type (and thickness for cutting processes). If the material or laser is changed, the database will automatically adjust the settings for the new laser or material selection.

B- Process Description - Provides a field to enter a description of the process. In addition to the text box shown above, this description will appear in the Processes settings tab along with any recipe information that may be saved.

C- Skip Process Toggle Button - If toggled on, provides an easy way to store the process settings while enabling the user to quickly disable a process. The process will be greyed out in the Processes settings tab, indicating that it will currently be skipped when the laser system processes the selected file.

D- Associated Colors - Displays the design file colors assigned to the selected process. Colors may be removed by selecting the X next to the color's name or added by selecting the + sign. Only colors found in the design file will be available to add to each process. If multiple colors are assigned to a process, colors will be processed left to right. The order in which the colors will be processed can be changed by dragging the color in front or behind other colors as desired.

E- Power Setting - Displays the power percentage to be used for the laser. This setting will modulate the laser to reduce average power applied to the material to the selected percentage of the rated power of the laser.

F- Pulses Per Inch - Displays the number of laser pulses per inch for the selected process.

G- Speed Setting - Displays the percentage of process speed applied to all colors in the process.

H- Repeat Count - The number of times to repeat the selected process.

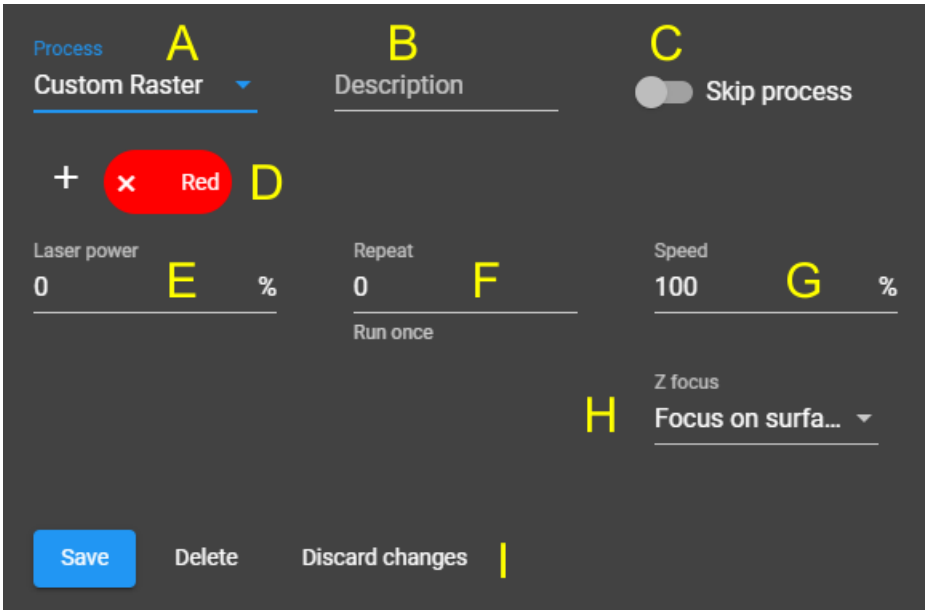
I- Focus Mode - Determines focus mode used before the process is started. (See the previous section, DB Raster and DB Vector Mark Settings for a description of the available focus modes.)

J- Save / Delete / Discard Changes Buttons - Select one of these three options:

- Save the new/changed process settings.
- Delete entire process and move the assigned colors to the unassigned category. (The delete key will not be present when creating new processes.)
- Discard changes and return to the System Operations Page. (If the process is new, Discard Changes will Delete the entire process.)

- Custom Raster Settings

  This screen contains the controls needed to configure a Custom Raster process. This process could be used to mark or engrave materials that are not found in the Intelligent Materials Database.



Custom Raster Settings

A- Process Type Selector - Indicates the process type such as DB (database) Raster, DB Vector Cut, DB Vector Mark, Custom Vector, and Custom Raster. The interface above shows the Custom Raster settings. If changed, the available settings will change to reflect the new process type. When using intelligent database settings, the LSM will use the rated power of the installed laser and its wavelength to calculate the appropriate settings for the selected process on the selected material type (and thickness for cutting processes). If the material or laser is changed, the database will automatically adjust the settings for the new laser or material selection.

B- Process Description - Provides a field to enter a description of the process. In addition to the text box shown above, this description will appear in the Processes tab along with any recipe information that may be saved.

C- Skip Process Toggle Button - Provides an easy way to store the process settings while enabling the user to quickly disable a process. If toggled on, the process will be greyed out in the Processes tab, indicating that it will currently be skipped when the laser system processes the selected file.

D- Associated Colors - Displays the design file colors assigned to the selected process. Colors may be removed by selecting the X next to the color's name or added by

selecting the + sign. Only colors found in the design file will be available to add to each process. If multiple colors are assigned to a process, colors will be processed left to right. The order in which the colors will be processed can be changed by dragging the color in front or behind other colors as desired.

E- Power Setting - Displays the power percentage to be used for the laser. This setting will modulate the laser to reduce average power applied to the material to the selected percentage of the rated power of the laser.

F- Repeat Count - The number of times to repeat the selected process.

G- Speed Setting - Displays the percentage of process speed applied to all colors in the process.

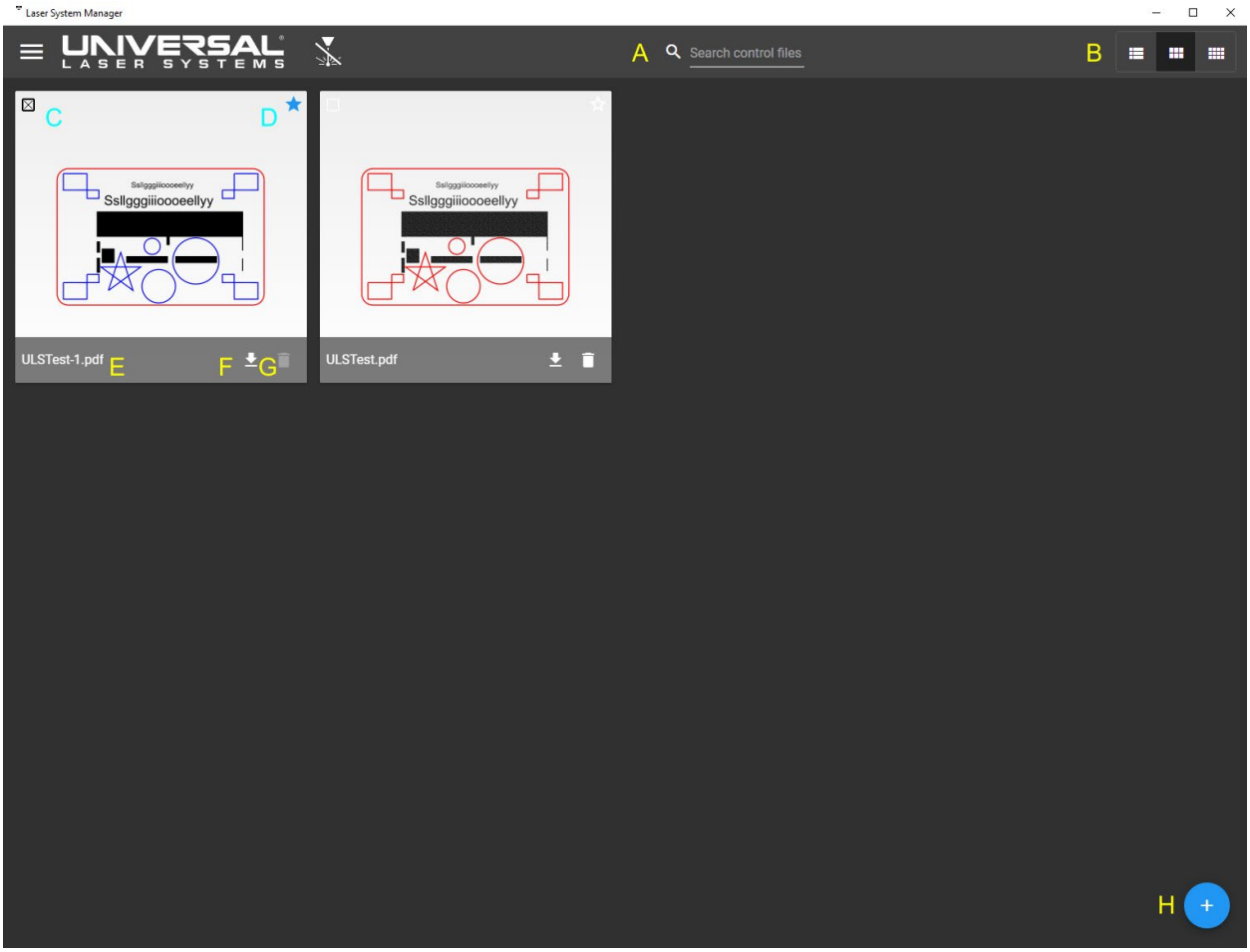
H- Focus Mode - Determines focus mode used before the process is started. (See DB Raster and DB Vector Mark Settings section above for a description of the available focus modes.)

I- Save/Delete/Discard Changes Buttons - Select one of these three options:

- Save the new/changed process settings.
- Delete entire process and move the assigned colors to the unassigned category. (The delete key will not be present when creating new processes.)
- Discard changes and return to the System Operations Page. (If the process is new, Discard Changes will Delete the entire process.)

Control Files Page

The collection of control files stored on the system is managed and selected through the Control Files Page available from the Main Menu. To select a control file for processing, press the thumbnail or name of the control file and the view will automatically switch to the System Operation Page, showing a preview of the selected control file.



Control Files Page

A- Search Control Files – The Search Control Files search box can be used to search for specific control files in the queue. The search supports partial matches and fuzzy matches.

B- Control File Display Settings – The Control File Display Settings can be used to select between a Large Thumbnail view, a Small Thumbnail view and a List view.

C- Multi-Selector for Control Files - This checkboxes can be used to select more than one file for deletion.

D- Star Button - This button flags a file as permanent. These files cannot be deleted until the star button is deactivated. This prevents accidental deletion of important control files.

E- Control File Name - Displays the name of the control file.

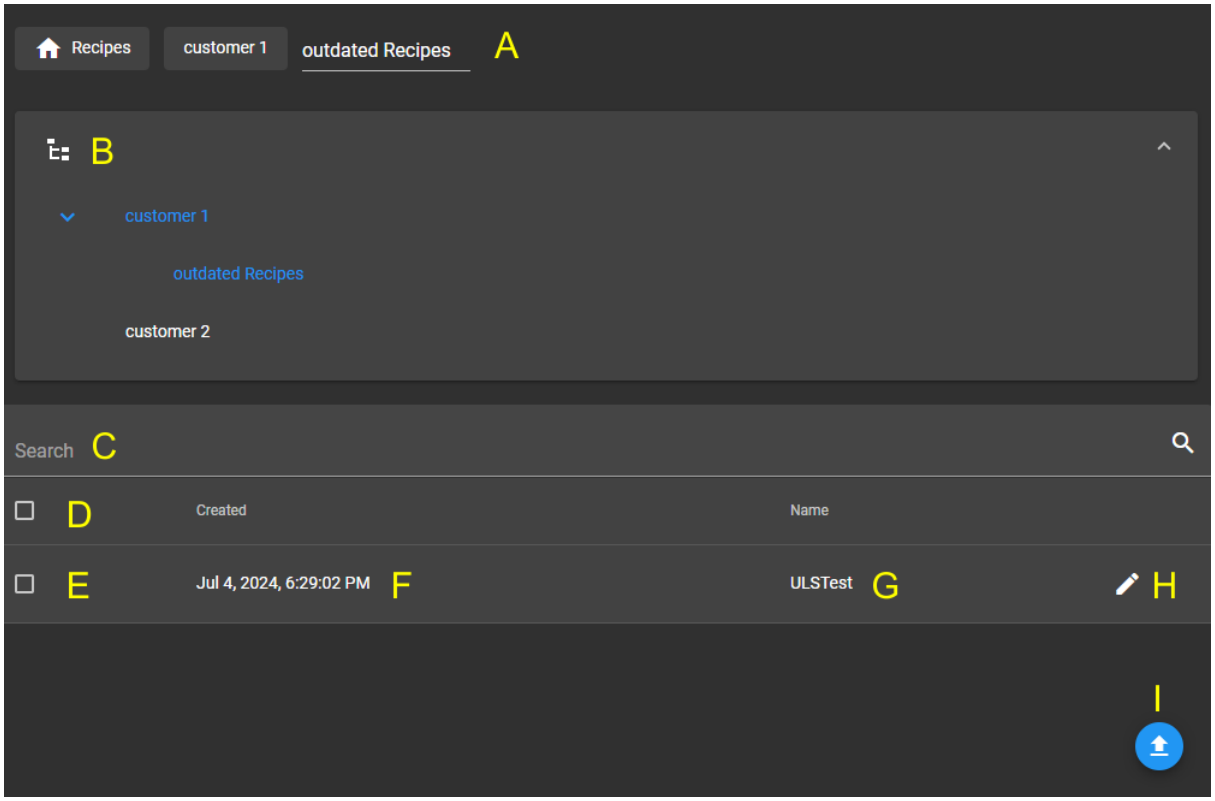
F- Export Control File Button - The export Control File button can be used to export a control file for backup or to import to another ULS laser system.

G- Delete Control File Button - The Delete Control File button can be used to delete a control file. To delete multiple control files, use the multi-selector check box.

H- Import Control File Button - The Import Control File button can be used to import new control files. The LSM can import multiple file formats including PDF, DXF, SVG, BMP, JPG, TIFF, GIF, and G-Code files. Control files from other laser systems running the LSM can also be imported.

Recipes Page

Recipes are copies of all the laser processing settings from a particular control file. They provide a convenient method to store and apply process settings for commonly used setups and materials to new control files, making setup more efficient. They can also be exported for transfer to other laser systems controlled by LSM software. Recipes can be organized in folder structures to make it easier to manage and find a particular recipe.



Recipes Page

A- Recipe Folder Location - Displays the current path within the recipe folder storage structure where recipes are listed at the bottom of the page are found. Selecting a portion of the folder path allows navigation to parent folders in the path. You can change the current folder name by typing over the folder name with a new name.

B- Recipe Folder Structure - Displays the entire recipe folder storage structure created to store and organize the recipes on a particular computer. Selecting any folder in the structure will cause the LSM to navigate to that folder. By default, a new LSM installation will have only one root folder called Recipes. This folder name cannot be changed. All recipes created will be stored in that root folder unless subfolders are created. New folders and subfolders can be created as needed and recipes can be moved to those new folders and subfolders at any time.

C- Recipe Search Tool - A tool for searching recipes. The search tool can accommodate incomplete or fuzzy name search and can also search by recipe creation dates.

D- Recipe List - Lists the recipes stored in the selected folder.

E- Multi-Selector for Recipes - This checkbox can be used to select multiple recipes to move, delete or export. When one or more recipes in the list is selected, tools will appear in the upper left corner of the page to move, delete or export the selected recipes.

F- Recipe Creation Date - Lists the creation date of each recipe in the list.

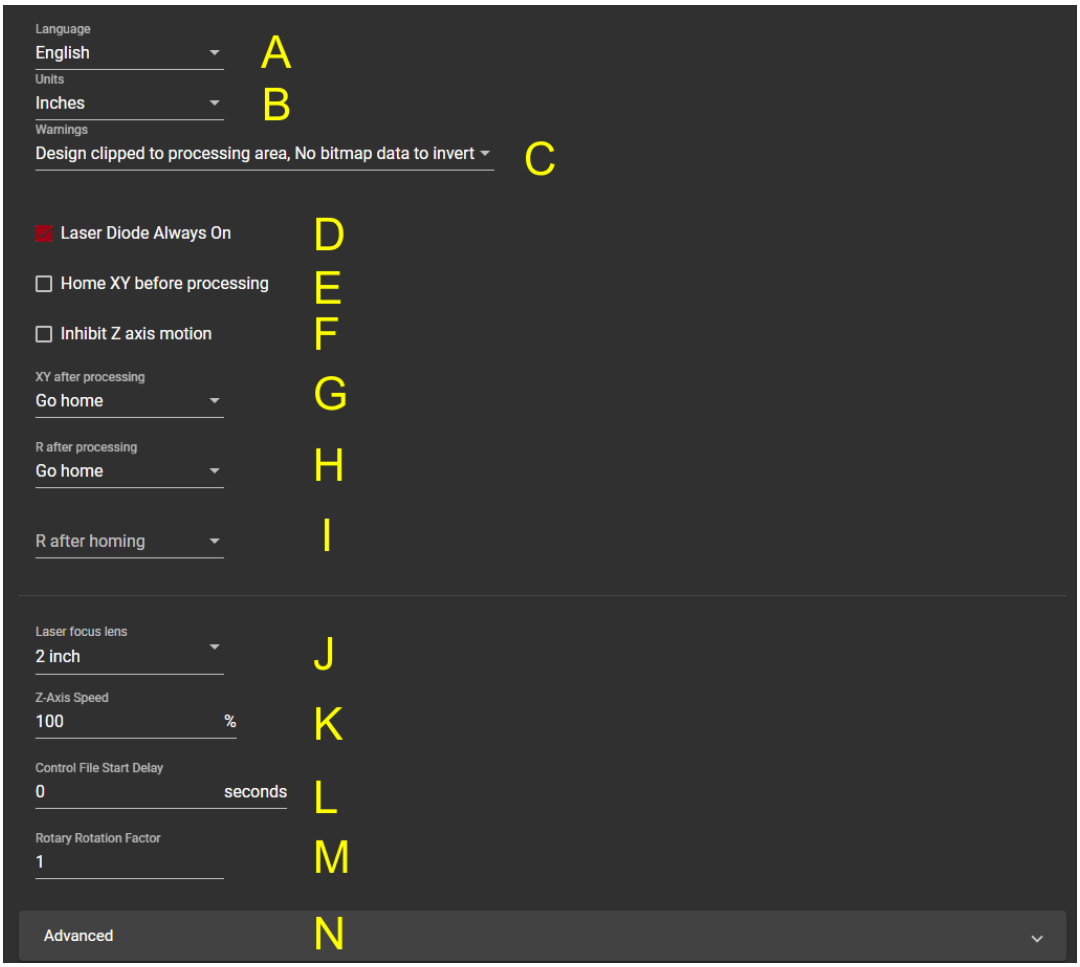
G- Recipe Name - Lists the name of each recipe in the list.

H- Recipe Name Edit - Select this button to edit a recipe name.

I- Recipe Import - Press this button to import recipe(s) from other laser systems.

System Configuration Page

This page provides access to system-wide configuration options.



System Configuration Page

A- Language Selection - Select desired Language for the LSM.

B- Units Selection - Select desired unit of measure: Inches or Millimeters.

C- Warning Silencer - Lists several warnings that can be silenced if desired. The default mode is for all warnings to be active.

D- Laser Diode Always On Checkbox - Laser Diode Always on checkbox will force the Red Diode Laser to be on at all times. The default behavior when this switch is off is for the Red Diode Laser to be on only when the top door is open.

E- Home XY Before Processing Checkbox - The Home XY Before Processing checkbox forces the LSM to rehome the laser system each time a control file is run. This can improve repeatability for very high accuracy applications but adds time to processing a control file.

F- Inhibit Z Motion Checkbox - The Inhibit Z Motion Checkbox is used to globally inhibit Z motion during laser processing regardless of the Z motion focus mode selected in each process in the control files.

G- XY After Processing Behavior - The XY After Processing behavior selector can be used to specify the desired behavior for the beam delivery motion system after processing a control file. The options are: Go Home which moves the beam delivery motion system to the home position, Stay in Place which leaves the beam delivery motion system at the last position it moved to during laser processing of the control file, and Go to Position which allows the user to enter the X and Y coordinates of a desired location for the beam delivery motion system to move to after processing a control file.

H- R After Processing Behavior - The R After Processing behavior selector can be used to specify the desired behavior for the Rotary Fixture axis after processing a control file. The options are: Go Home which moves the Rotary Fixture axis to the home position, Stay in Place which leaves the Rotary Fixture axis at the last position it moved to during laser processing of the control file, and Go to Position which allows the user to enter the R position of a desired location for the Rotary Fixture axis to move to after processing a control file.

I- R After Homing Behavior - The R After Homing behavior selector can be used to specify the desired behavior for the Rotary Fixture axis after homing or rehoming the Rotary Fixture axis. The options are: Remain in Place which keeps the top of the Rotary Fixture axis lined up with the middle of the processing field facing straight up and Go to Position which allows the user to enter the R position of a desired location for the Rotary Fixture axis to move to after homing or rehoming.

J- Laser Focus Lens - This selector is used for the user to inform the LSM of the final focus lens that is currently installed in the laser system. The user must select the installed lens from the drop down to indicate such to the LSM. A separate focal plane position is stored for each lens available. Rotary Fixture rotation axis and Flow-Through Cutting Table focal planes are stored separately for each lens as well.

K- Z- Axis Speed - Set the Z axis max speed. This is defaulted to 100% on new installations but can be reduced if desired. This can be helpful when positioning heavy loads.

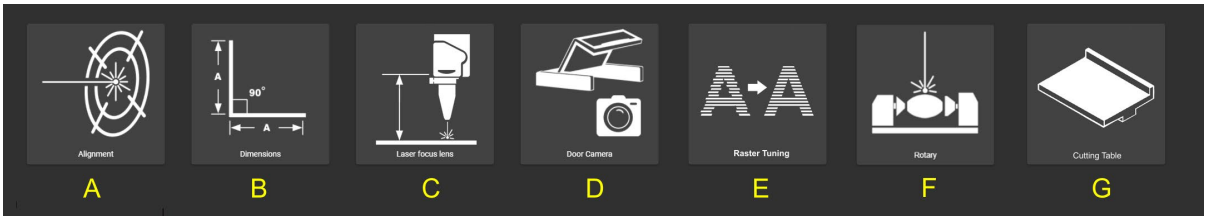
L- Control File Start Delay - Can be used to add a delay before processing. This can be useful for automated processes to wait for certain events to occur before processing begins.

M- Rotary Rotation Factor - Can be used to compress or expand artwork to prevent or force a small amount of overlap.

N- Advanced Configuration - Advanced configurations settings. Only use upon recommendation of the ULS Service & Support Team.

Calibration Page

The VLS3.60ES Desktop Laser System provides a series of Wizards and Dialogs to aid system calibration. All system calibration is performed first at the factory, then again during system installation. It is atypical to require use of these options frequently.



Calibration Page

A- ALIGNMENT CALIBRATION - Launches the Laser Alignment Calibration dialog. This dialog provides tools for checking the alignment of the laser with the beam positioning system. The beam positioning system can be quickly moved between the corners of the laser processing field and the pointer can be turned on and off and CO_2 laser pulsed in short bursts to burn marks on masking tape placed over the carriage aperture to check laser alignment.

B- DIMENSIONS CALIBRATION - Launches the Dimensional Calibration dialog. This dialogue can be used to draw a pattern of a certain size which can then be measured, and the measurements entered into the dialogue so the LSM can compensate for inaccuracies in scale and skew.

C- LENS CALIBRATION - Launches the Lens Calibration Wizard

D- DOOR CAMERA CALIBRATION - Launches the Door Camera calibration wizard. This wizard will walk the user through the calibration process for the door-mounted Camera Vision System so that the camera image is accurately aligned with the laser processing area.

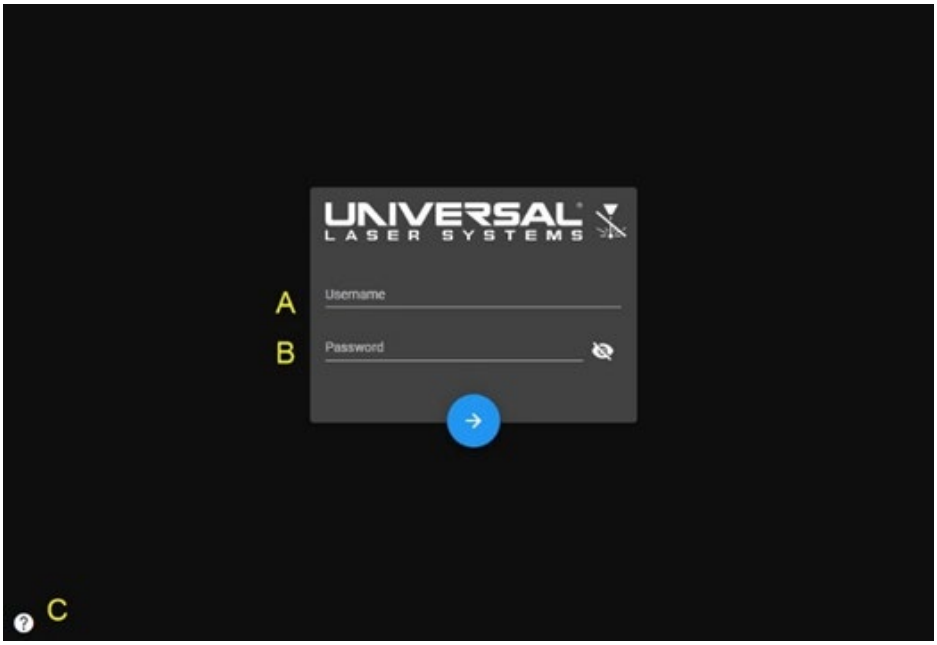
E- RASTER TUNING CALIBRATION - Launches the Raster Tuning calibration wizard. This wizard will walk the user through calibration of bidirectional raster strokes so that images are properly aligned.

F- ROTARY CALIBRATION - Launches the Rotary calibration dialog if a Rotary Fixture is installed. This dialogue sets the Y and Z positions of the Rotary Fixture axis.

G- CUTTING TABLE CALIBRATION - Launches the Cutting Table dialogue if the Flow-Through Cutting Table module is installed. This dialogue sets the Z position of the surface of the Flow-Through Cutting Table.

Login Page

When the laser system is configured to require login on startup or to access the VLS3.60ES Desktop Laser System from a remote location, the screen below will appear. (If login is not required, the LSM will default to the screen shown in the LMS Home Screen Overview section earlier in this chapter. See the Users Page section later in this chapter for details regarding setup of user logins and permissions.) The Login page requires a valid Username and Password to operate the laser system. For safety, remote users will have reduced permissions not allowing laser system operation, even if they have permission to operate the laser system allowed in their user account, unless the user logged in remotely is the same user logged in locally.



Login Page

A- Laser Emission Indicator - Depicts the current Emission Status of the laser system. If any of the interlocks are opened (for example, if the top or front doors are open) the laser will be disabled, and a diagonal slash will appear through the indicator. If a laser source is enabled, the indicator is shown as it is above.

B- Username Field - The Username of the account. Users may be added, removed, and configured in the Users Page of the Main Menu.

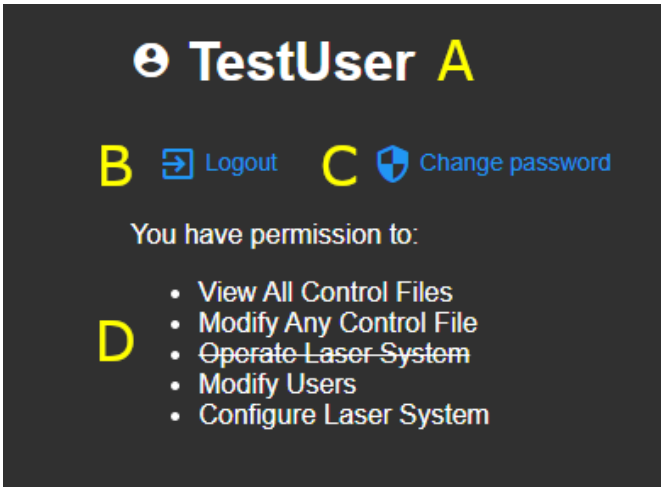
C- Password Field - The Password of the account. Passwords may be managed on the Users Page.

D- Hide Password Button – Show and hide the password when clicked as it is typed into the Password Field. The default state is to hide the password.

Note: *There is a password recovery mechanism available, if needed, by pressing the "?" button in the lower left corner of the Login page and following the instructions.*

User Details

A currently logged in user can access a summary of their permissions, log out, or change their password in the User Details page.



User Details (page for Logged In Users)

A- User Name - Indicates the currently logged in user.

B- Logout Button - Logs the current user out of the system.

C- Change Password Button - Enables the current user to change the password associated with their account.

D- Current User Permissions List - Lists the available permissions for the currently logged in user. Can be modified by a user with the Modify Users permissions on the Users Page. Operate Laser System will always be disabled for remote users even if they have this permission allowed in their account unless the same user is logged in locally. This is indicated in the figure above by the line crossing out the Operate Laser System permission.

Users Page

Select this page to manage the users who have access to the laser system, and to indicate various permissions and capabilities specific to each one. At least one user account must be created to access the laser system remotely. Remote access from other computers on the network is possible though an internet browser by entering the IP address of the computer connected to the laser system as the web address.



Users Page

A- REQUIRE LOGIN - When enabled, the LSM requires local users to login prior to interacting with the laser system. Note that LSM always requires login for remote users, even when this option is disabled.

B- ADD USER BUTTON - Creates a new user.

C- USER NAMES - Lists users who are authorized to interact with the laser system.

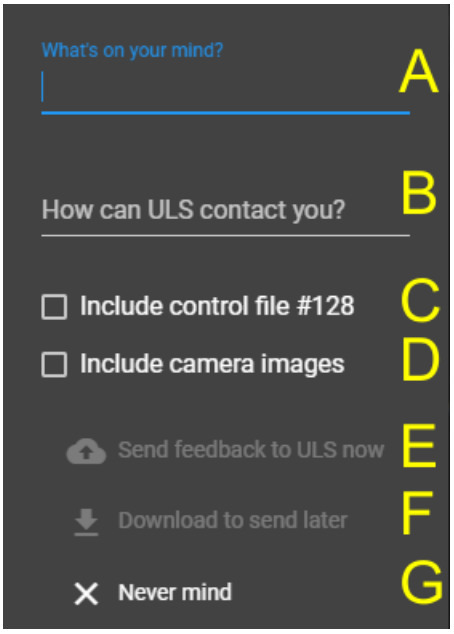
D- USER PRIVILEGES SELECTION - Provides a list to grant or revoke specific privileges for each user. Privileges may be modified by checking or unchecking each option.

E- DELETE USER BUTTON - Deletes the selected user.

F- USER PAGE CONTROLS - Provides buttons and drop-down menus to navigate between pages of users should the number of names exceed the maximum entries viewable on a single page.

Feedback Dialog Page

This dialog allows users to submit comments or software error reports directly to ULS for review. Error reports include the laser system log files for error diagnostics, but they do not include user's personal information or control/design files by default to protect privacy. Users can elect to include the currently selected design file, which is often very useful in resolving issues, as well as the Camera Vision System images generated and used during camera calibration, which are very useful for diagnosing camera related issues.



Feedback Dialog Page

A- Feedback Message Field - Provides a field for the user to enter a message to be left in the log file.

B- Contact Information - Provides a field for the user to enter contact information so ULS staff can contact the user to resolve issues.

C- Include currently active control file - Permits the system to send the currently active control file information with the error report. This is often very helpful for error resolution. If submitting an error related to a specific control file, make that file the active control file before submitting the report. Note, the # symbol and number referenced is that sequentially assigned to the file.

D- Include Camera Images - Permits the system to send the Camera Vision System images generated and used during Camera Vision System calibration which are very useful for diagnosing camera related issues.

E- Send Feedback Button - Submits the error report to ULS and exits the Feedback request dialogue. The laser system must be connected to the internet. This report is for ULS use. If you need

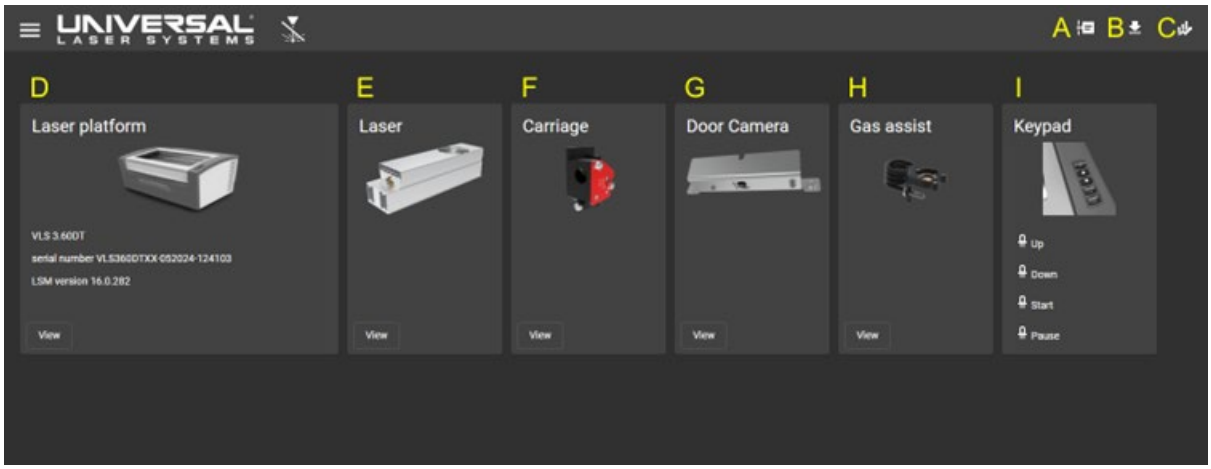
specific assistance with your laser system, please contact the ULS Service & Support Team directly to discuss.

F- Download Button - Creates a zip file of all of the diagnostics data which can be copied to the computer or a thumb drive and sent to the ULS Service & Support Team later. This is useful for submitting diagnostics files to ULS if the computer controlling the laser system is not connected to the internet.

G- Never Mind Button - Exits the Feedback dialog without sending any information to ULS or downloading any data.

Diagnostics Page

The Diagnostics age of the LSM Main Menu provides information and diagnostics tools for the various subsystems of the laser system the LSM attached to. Some information is provided on the diagnostics buttons and further information and diagnostics tools for each subsystem can be accessed by selecting each diagnostics button.



Diagnostics Page

A- Log File Storage Location - This button opens a file explorer window to the location where the log files are kept for the current installation of the LSM. This can be useful for viewing the diagnostic logs on the computer running the LSM.

B- Diagnostics Download - This button will create a zip file with all of the diagnostics data for the system. If ULS Service & Support staff requests it, this zip file can be emailed or sent to ULS for further troubleshooting help. This diagnostics zip file is the same file as the one automatically generated and sent to ULS when using the Feedback Dialogue Page from the LSM Main Menu. The Feedback function requires a connection to the internet to work, so this button can be used to manually generate and copy a diagnostics zip file to a thumb drive so it can be sent to the ULS Service & Support Team from another computer if the computer running the VLS3.60ES Desktop Laser System is not connected to the internet.

C- Usage Log - This button will create a comma separated data file of the usage log of the laser system during a specified data range. This CSV file can be imported into spreadsheet software such as Excel for viewing and manipulation. The log will contain a list of all control files run during the specified time period including a time stamp of when the control file was started, who was logged into the LSM at the time, the duration of laser processing and whether the control file went to completion or was stopped or paused before completion.

D- Laser Platform - This button shows the type of laser system the LSM is connected to, the serial number of the laser system and the version of the LSM software that is currently running. Pressing on the View button provides access to the various firmware versions running the laser system CPU.

E- Laser - This View button provides access to information on the currently installed laser source. Information includes the laser's rated power and wavelength and the version of firmware running in the laser. This button also provides access to tools to turn the laser diode on and pulse the laser source for checking function of the laser and alignment with the beam positioning system. Additionally, information on the status of the interlocks is displayed.

F- Carriage - This View button provides access to the final focus lens installed in the carriage and the Z position of the focal plane for that lens. The installed lens is not automatically sensed so for proper operation the user is responsible for selecting the currently installed lens on the System Configuration Page.

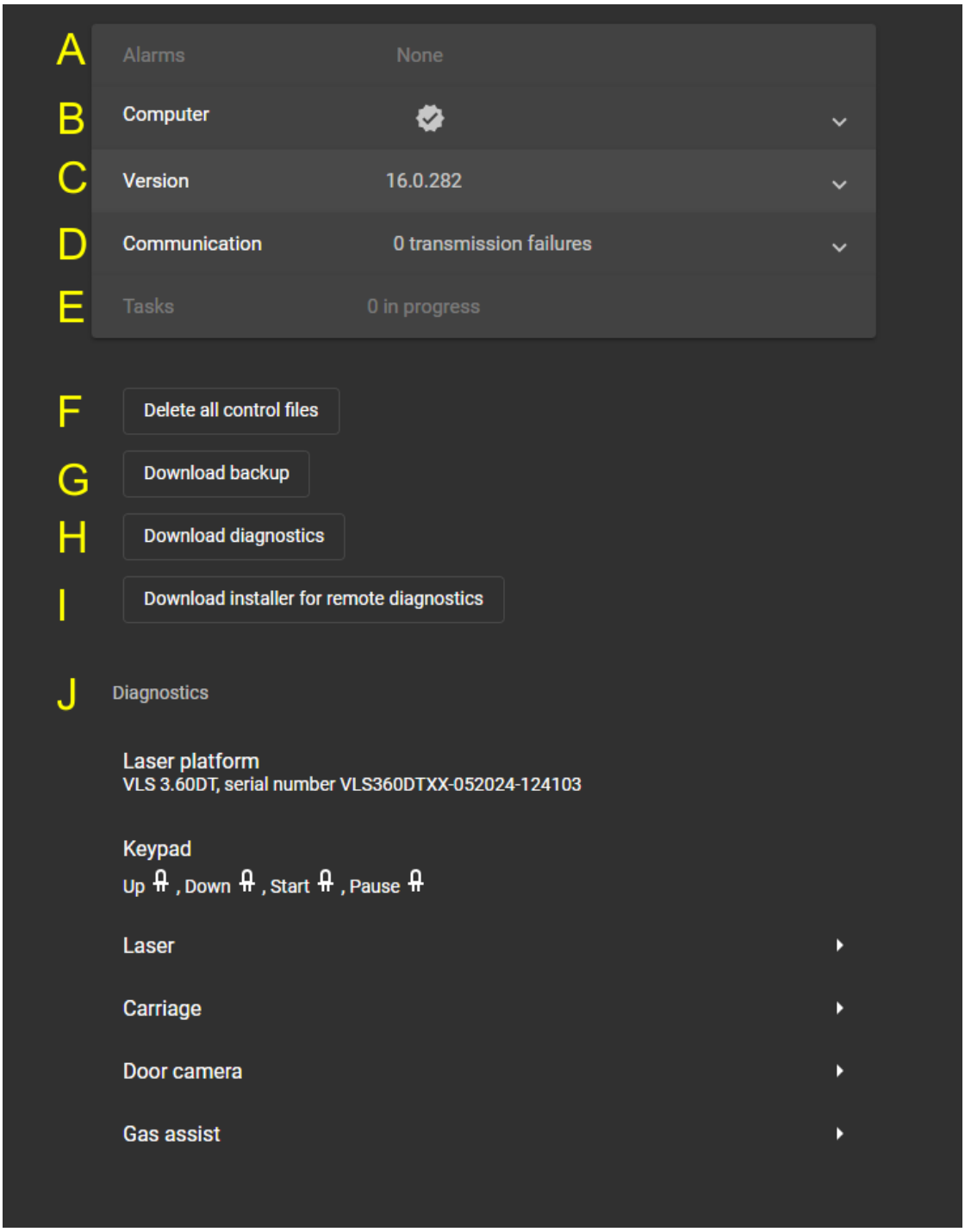
G- Door Camera - This button provides access to a live view of the door-mounted Camera Vision System. The user can select the exposure method for the live view to compensate for external lighting. Additional information is provided on whether the Camera Vision System is calibrated or not and provides access to the images captured and used during the last calibration. These images can be very valuable for diagnosing Camera Vision System calibration issues. These calibration images will also be sent to ULS when Feedback is submitted if the user gives permission to include them.

H- Gas Assist - This View button provides access to tools to test the ULS Compressed Air Source, if installed, along with a plumbing diagram of the gas assist system.

I- Keypad - This button shows the status of the buttons on the keypad on the VLS3.60ES Desktop Laser System. When each button is pressed on the keypad, the corresponding LED will light up if the keypress was successful. This is useful for testing the keypad if there is a suspicion that a button is not working or is stuck in the pressed state.

Help Page

This page provides useful information for addressing system problems should they arise.



A- ALARMS - This section lists any current faults with the laser system connected to the LSM.

B- Computer - This section lists details about the computer the LSM is running on that might be useful for diagnosing issues. It will also indicate any computer specifications that do not meet the minimum requirements for running the LSM.

C- Version - This section lists the version of the LSM that is currently running and provides tools for downloading new versions. See the software update section below for more details.

D- Communication - This section lists any transmission retries that have occurred between the LSM and any of the various subsystems and how many have occurred. The counts can be reset to determine how quickly and often any retries are occurring. This information is helpful for diagnosing issues with communications.

E- Tasks - This section lists any background tasks that may be running. Background tasks are launched whenever a new design file is imported into the LSM or when any changes are made to any control file settings of an existing control file that require re-rendering of the design file to accommodate new settings.

F- Delete All Control Files - This button purges the LSM of all control files. Backups of control files should be made before using this function if any control files need to be saved. Individual or select groups of control files can be exported using the export function in the Control Files Page, or the Download Backup button on the Help page can be used to backup all control files and recipes at once.

G- Download Backup - This button creates a backup file of all control files, which can be imported to restore the backed-up control files. It also creates a backup file of all recipes.

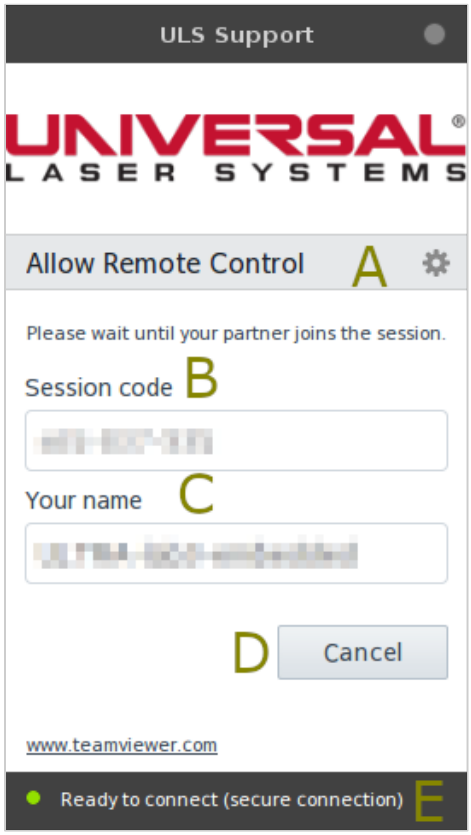
H- Download Diagnostics - This button creates diagnostic zip file that can be saved to the computer or a thumb drive. This diagnostic zip file is that same file that is created and transmitted to ULS support staff when using the feedback request function.

I- Download Installer for Remote Diagnostics - This button downloads the installer for the TeamViewer remote diagnostic tool that can enable ULS support staff to remotely connect to the computer and help diagnose issues with the LSM or VLS3.60ES Desktop Laser System. Download and install this software in order to launch a remote diagnostic session with a member of the ULS support team. Permission will have to be given to allow the connection. See Remote Diagnostics section below for more details on setting up and allowing a remote diagnostic session.

J-Diagnostics - This section provides links to the same diagnostics information and tools as the diagnostic section of the LSM. The information accessed in these sections is identical.

Remote Diagnostics

If a user is in contact with the ULS Service & Support Team and has been instructed by ULS, the user may initiate a remote session with the ULS Service & Support Team to aid in system troubleshooting. During a remote session, the system must maintain a robust connection to the internet.



A- Remote Access Controls - Enables a user to initiate a session that gives the ULS Service & Support Team remote access to the laser system for troubleshooting purposes.

B- Session Code - Grants remote access of a user's laser system to a ULS Service & Support Team member.

C- Your Name - Displays the name of the local party operating the system. This will appear in any chat dialogs which are opened while the system is being remotely controlled.

D- Cancel - Cancels the remote session and returns the user to the LSM.

E- Connection Status - Displays the current connection status.

Software Update

Software updates are routinely released to continuously improve the Laser System Manager (LSM) and laser system operation as well as add new features and laser material processing parameters to the Intelligent Materials Database. Software updates can be downloaded from this section of the help menu.



A- Currently Installed Software Version - Displays the current software version installed on the system.

B- Available Software Versions - Displays a list of the currently available software versions old and new. This list is pulled from ULS servers and therefore requires an internet connection to operate properly.

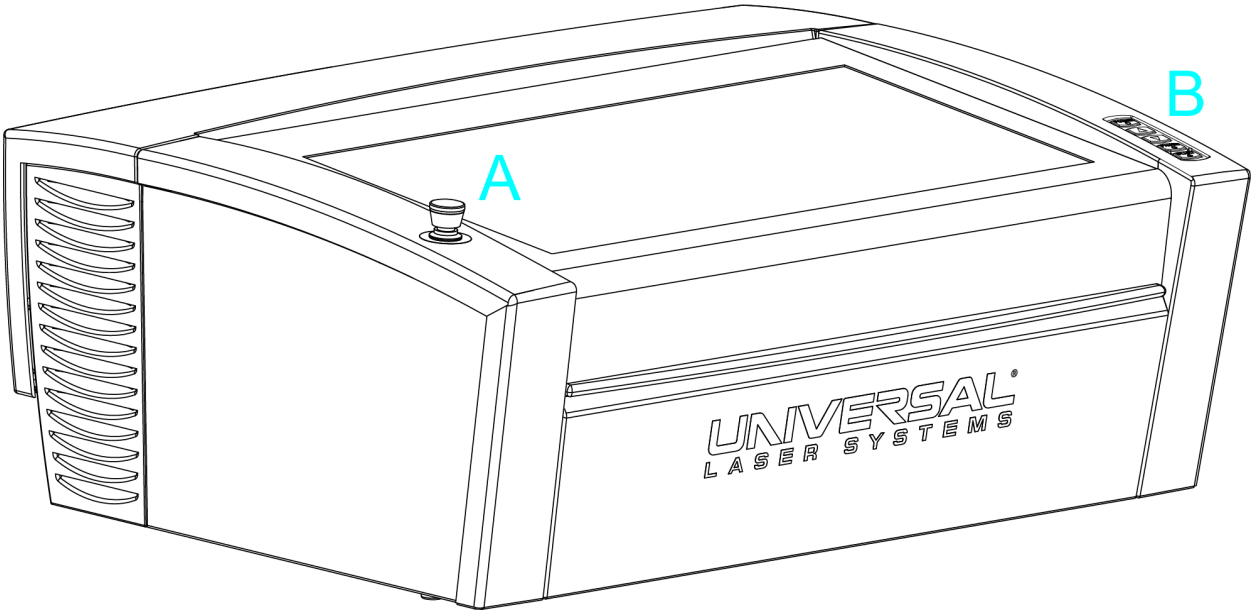
C- Hide Pre-Release Versions Button - Beta versions of software that contain experimental or early release features are sometimes made available for customer testing and feedback. This button shows or hides these prerelease versions as desired.

D- Release Notes - This button downloads the latest software release notes for LSM. The release notes include information on new features added and bugs fixed in each version. An internet connection is required in order to access the release notes.

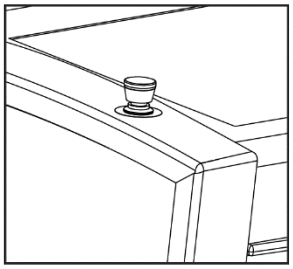
E- Copyright - This button provides access to the copyright notice for the LSM software. This is the copyright notice that was agreed to when the software was installed.

Control Panel

The control panel on your laser system provides the functions necessary to manually focus and initiate laser processing on your laser system.



A- E-STOP (EMERGENCY STOP) SWITCH - This switch can be depressed to cut power to the laser system, instantly stopping laser processing. If this switch is depressed, power can be restored by turning the E-Stop counter-clockwise to reset it. For safety, the system will not power on immediately. The POWER button must be depressed to restart the laser system.



Press the Emergency Stop (E-Stop) button immediately if any unsafe condition or malfunction occurs, including but not limited to:

- Uncontrolled, unexpected, or incorrect system motion
- Risk of collision between the Z-axis, material, fixtures, or system components
- Incorrect job execution that may damage material, tooling, or equipment
- Failure of a system component resulting in unsafe operation
- Any condition that presents an immediate risk of injury or equipment damage

Important Note: *The Emergency Stop (E-Stop) is intended to stop laser system operation during unsafe conditions or equipment malfunction. It is not a fire suppression device and should not be used to respond to material ignition, open flame, or other fire-related events. Follow guidelines in the Fire Safety when Processing Materials with a Laser System section of this manual.*

B- KEYPAD – The Keypad consists of the following:

SAFETY INTERLOCK STATUS

A Red LED on the keypad provides an indication of the status of the interlock system.

Indication	Condition
On	The top door to the laser system is closed. If laser processing is initiated in this state, the CO_2 laser will fire.
Flashing	The top door to the laser system is open and the safety interlock system has disabled the CO_2 laser. If laser processing is initiated in this state, the CO_2 laser will not fire and the Red Diode Laser will be on instead.

A Green LED indicates whether the machine is powered on or not.

KEYS



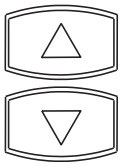
POWER: This button turns the Laser system ON and OFF, but only if the laser system is connected to a computer with the LSM installed on it. The laser system cannot power ON and function independently of the computer and LSM software. To power the laser system OFF, the power switch must be held down for five seconds.



START: Initiates processing of the laser control file currently selected and visible in the preview screen of the LSM.



PAUSE: If a control file is running, the PAUSE button stops laser processing and moves the focus carriage to its home position in the upper right corner of the material processing area. If the PAUSE button is pressed again, laser processing will resume at the point where the motion system was paused. If the START button is pressed while the machine is in a paused state, it will restart processing at the beginning of the control file.



UP/DOWN ARROWS: These buttons move the Z-axis up and down for loading material into the laser system and manually focusing. Pressing a button once will move the Z-axis .010 in. (.254mm) in the indicated direction. Holding a

button down will move the Z-axis continuously in the indicated direction until the button is released.

Loading and Processing Materials

Before laser processing material, you will need to load material into the laser system and then focus the laser system onto the top surface of the material.

Loading Material

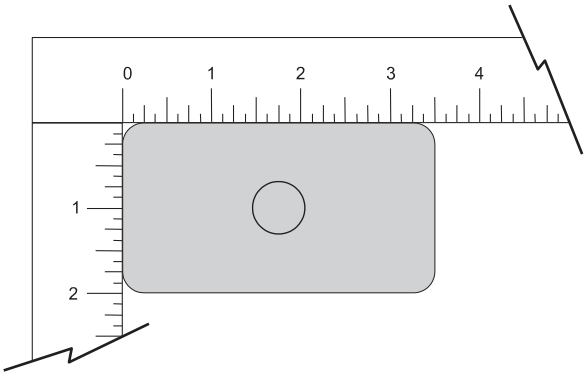
Open the top door to the laser system and place material to be laser processed onto the Material Support Table. You may need to manually move the Material Support Table down to allow clearance to fit thicker materials into the machine. If you are cutting, you can also use the Flow-Through Cutting Table. (Use of this accessory is described in the Accessories chapter of this manual.)



WARNING: Material to be laser processed must fit completely within the machine so that the top door to the laser system can be closed. The top door is safety interlocked and will not allow the laser to operate if the top door is not fully closed.

Position the material so that it is aligned with the design to be engraved, cut, or marked. There are a few methods that can be used to accomplish this:

- Use the rulers on the laser system Material Support Table and the corresponding rulers on the System Operation page of the LSM to align your material with the design in your laser control file. It is often useful to push the material up against the rulers and position your graphics accordingly before printing.



- Use the relocation feature in the LSM to move your design to your material. The Red Diode Laser can be used for locating on the material and then snapping a corner or center of the design to that location using the LSM. The door-mounted Camera Vision System can also be used to take a snapshot of the material on the Material Support Table. The snapshot will appear as the background of the design file preview on the System Operation page of the LSM with the design in the control file overlaid on top. The LSM relocation features can then be used to visually align, rotate and scale the design to fit your material.

- Use fixturing to position your material. This is especially useful for odd-shaped materials. The laser system can even be used to create the fixturing. For example, fixturing can be made out of acrylic by placing a piece of acrylic against the rulers in the laser system and cutting the shape of the material to be laser processed out of the acrylic. You can then place the material in the cut out to position it accurately.

Focusing

Once you have positioned the material, you will need to focus the laser system by adjusting the Z axis up or down until the top surface of the material to be laser processed is at the focal plane of the lens installed in the laser system. This can be done in one of two ways.

The first focusing method:

Measure the thickness of the material to be laser processed. (It is recommended to use calipers for accuracy.) Enter the material thickness into the "total thickness" control in the process settings of the control file you plan to run; select the "focus on surface" method within each process in the control file. The Z axis will move up or down to the appropriate height when you press the start button to initiate laser processing of the selected control file.

Important Note: *Make sure the lens specified in the system configuration of the LSM matches the lens installed in the laser system when using this feature and that Inhibit Z Axis Motion is disabled in the System Configuration page of the LSM Main Menu.*



WARNING: For this method to work correctly, the Z axis must be properly homed and calibrated to the lens being used. To verify this, with no material on the Material Support Table, move the Z axis position currently listed as the focus plan position for the installed lens in the focus lens calibration section of the LSM Calibration Page. While at this Z height, the manual focus tool can be used to check if the Material Support Table is at the focal plane for the lens installed. If necessary, re-home the Z axis using the home Z command in the LSM System Operation Page and re-check. If you are still having trouble, recalibrate the lens using the lens calibrate function in the Calibration Page of the LSM.

The second focusing method:

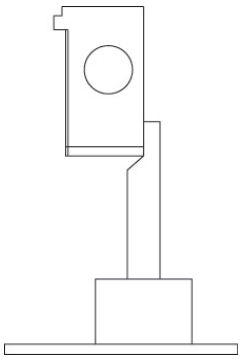
Use the calibrated focus tool provided with the Focus Lens Kit. Every Focus Lens Kit is provided with a calibrated focus tool so make sure to use the one provided with the lens being used.

Manual focusing steps:

1. Move the focus carriage over the material to be laser processed by using the XY axis joystick controls in the LSM or pointing and clicking on a location on the control file preview in the LSM.

2. Move the Material Support Table manually up or down in the Z axis as necessary until the base of the focus tool can be placed on the top surface of the material to be laser processed and the wedge-shaped notch at the top of the focus tool can be placed as shown with the edge of the carriage fitting in the corner of the notch.

   Laser processing results are very sensitive to focus so pay close attention to the fit of the focus tool.



3. Remove the focus tool from the material processing area.

Initiating Laser Processing

Once the material is placed and focused, you are ready to initiate laser processing of the selected control file. If you need to use gas assist for the material to be processed, make sure you have a Coaxial or Lateral Gas Assist Attachment installed on the carriage and the optional ULS computer-controlled Compressed Air Unit or clean, dry, oil free shop air is properly connected (see the Accessories chapter for details). Also ensure that your air filtration unit is plugged in to a power outlet and properly connected to the laser system. Then start the control file by pressing the start button on the control panel or in the LSM.



WARNING: Make sure the air filtration unit activates, and proper exhaust flow is present in the laser system during laser processing. If proper exhaust flow is not present, damage to optics and other laser system components can occur very quickly.

Third-Party Graphic Software Configuration

The LSM supports importing a wide variety of graphic interchange formats on Windows and Mac computers. A Windows printer driver for printing design files to LSM is also available. Every effort has been made to make the printing process as seamless as possible, however, to get the best results when printing through the LSM Windows Printer Driver, you should be aware of a few general guidelines for all software as well as some specific notes regarding some of the more popular graphics software for printing to the laser system.

General Software Guidelines

Use the following GENERAL guidelines when configuring Windows software applications to print to the LSM Windows Printer Driver.

Page Setup

To properly position graphics in the laser system processing field, most graphics software will permit the customization of the page size and orientation. As a rule of thumb try to set the page orientation in your software of choice to Landscape and the page size to 24 x 12 in to match the VLS3.60ES Desktop Laser System processing area. This should result in the upper left corner of the page aligning with the upper left corner or zero-zero of the laser system processing field.

Some graphics software will provide on-screen rulers. If this is the case, it is often possible to configure the rulers so they match those in the laser system. This can also help with positioning of graphics in the processing field of the laser system.

Power Control through Color Selection

Your laser system uses colors to assign laser settings to different elements of the design file you are printing.

Vector Output for Vector Cutting and Marking

The printer driver distinguishes between raster objects (raster engraving) and vector objects (vector cutting and marking) by the types of elements contained in the graphic being printed. All graphics, other than outlines of very thin line widths, will be interpreted as raster objects and the raster mode will be used for laser processing. Not all software is capable of printing vector output. If you want to create a control file for vector cutting, make sure your graphic software of choice allows creation of vector lines and that the line width can be 0.001 in. (0.0254 mm) or less. The printer driver will interpret these objects as vectors.

Overlapping Raster Objects

If the artwork created has raster objects that overlap, the driver will automatically filter out the portion of the object that is not visible so that only the visible part of the underlying filled area will be engraved to prevent the overlapped area from being engraved twice. This allows the color white to 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 raster objects. However, you cannot use a white fill to cover a vector outline, the outline will vector cut even though you cannot see it on screen.

Overlapping Vector Objects

The driver does not filter vector objects that overlap each other. If you place one thin vector outline on top of another, both outlines will be cut by the laser system. This can be useful for making multiple cutting passes in one laser control file for thicker materials.

Bitmapped Scanned Images

When printing raster objects such as photographs which are grayscale or color bitmaps, keep in mind that the printer driver uses a dither pattern filter screen to reduce the images to black and white (monochrome images) for laser processing using variable spacing between the dots to create the illusion of shades of gray. These dither patterns are relatively coarse, so it is not necessary to use high resolution bitmaps. Grayscale or color photos should be reduced to 300 to 600 dpi for purposes of laser processing and scanned images should be scanned into the computer at 300 to 600 dpi.

AutoCAD and AutoCAD LT

Vector Output

Line widths for printing from AutoCAD products are controlled by plot styles. Make sure you set the first eight pens in the plot style you use to .001in. (.0254 mm) or less in order to ensure vector objects are output.

Placement of Graphics

The easiest way to control placement of graphics in the processing field when using AutoCAD is to create a non-printing rectangle with a width and height equal to the processing field in the VLS3.60ES Desktop Laser System: 24 x 12 in. Then print using the Print Window feature and use the pick tool to pick the upper left and lower right corners of the rectangle as the print window. You can then treat the upper left corner of the rectangle as the zero-zero point in the processing field and lay out your graphics inside the rectangle as desired.

Make sure you print with a 1:1 scale and make the plotter margins zero in the print setup screen. Also make sure plotter offsets are set to zero.

CorelDRAW (All Versions)

CorelDRAW products have a color matching feature which interferes with the proper mapping of colors in graphics being printed with colors in the printer driver. Make sure to turn color matching feature off when using CorelDraw.

SolidWorks

When using 3D solid modeling software such as SolidWorks, you must keep in mind that the laser system is a 2D device, so you must create a 2D drawing view of the object you want to laser process. You cannot print 3D parts and assemblies directly to the laser system.

To dictate placement of your control file on the processing Material Support Table in the laser system, use a custom page size and make it the same size as your laser system's material processing area. Make sure to remove any drawing templates and borders from the page or they will print also and be part of your laser control file. Once your page size is set, match the material processing area in the laser system. Treat the upper left corner of the page as equivalent to the zero-zero point in the processing field of the laser system. SolidWorks does not give you the ability to precisely position sketch elements on the page, so you can use the relocate feature in the LSM to more precisely position your control file once you have printed them.

Set the thickness for the thin line font in document properties to .001 in. (.0254 mm) or less to force thin lines to be output as vector objects. Then assign all line segments in the drawing view the thin line font and change colors as necessary to later assign to desired processes.

Chapter 5 – Accessories

Gas Supply and Assist

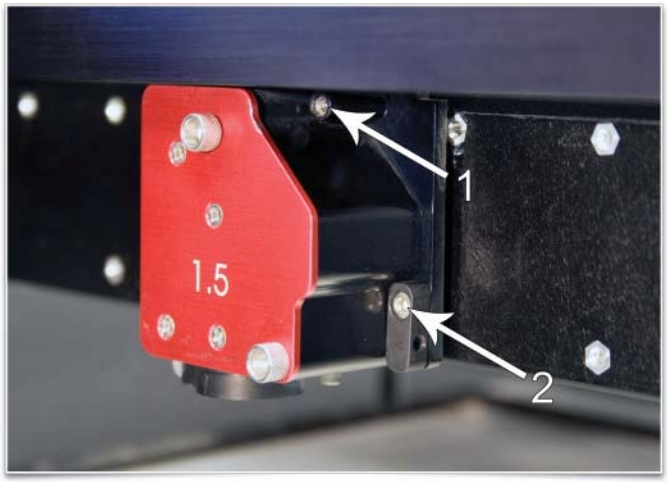
Air/Gas assist is employed to direct air flow onto the material being processed during laser material processing. This feature also provides compressed air/gas to the optics (mirrors and lenses) in the system, reducing contamination. Air/Gas assist aids in removing smoke and debris from the laser processing area and directing it to the exhaust. It also helps reduce the heat affected zone in the material being processed and helps to prevent flame up when processing certain materials. Use of this system requires a supply of 50 PSI max pressure and 2.0 cfm free air flow (3.2 bar and 3.2 cubic meters/hour), clean, dry, oil free compressed air or gas. Air can be provided by the optional ULS Computer Controlled Compressed Air Unit. The Air/Gas Assist System directs air/gas to the material through one of two fittings: a lateral or a coaxial fitting. The lateral fitting is geared more toward engraving applications and the coaxial is geared more toward cutting applications.

Lateral Gas (Air) Assist Attachment

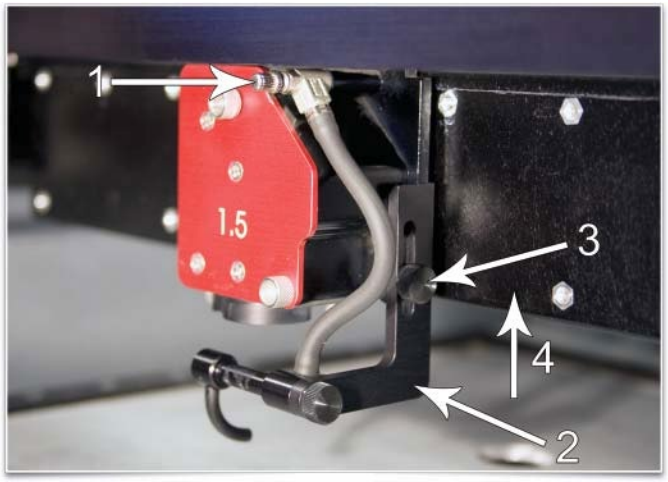
The Lateral Gas Assist Attachment directs debris and smoke away from cutting or engraving processes toward the exhaust at the back of the laser system. When using this attachment, you can adjust the angle of the air jet coming from the attachment as necessary to optimize the effect of the air assist.

Installation

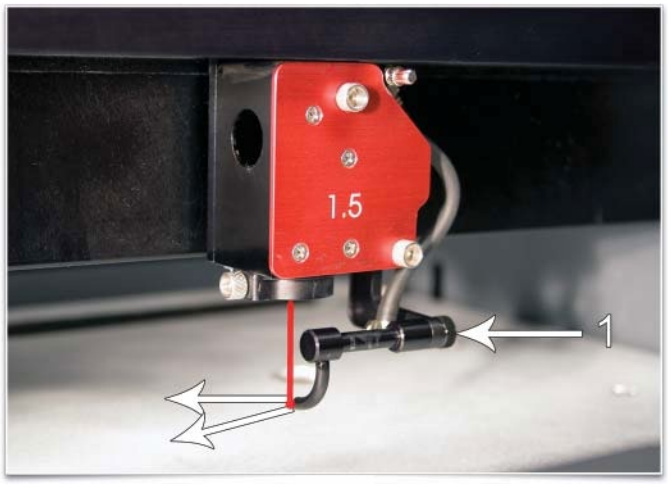
1. Remove (if present) the plug screw (1) with a flat bladed screwdriver. Attach the mounting block (2), if not already attached, with the provided mounting screw using a 3/32 Allen wrench (once the mounting block is installed, it can be left in place).



2. Using the provided 3/16 nut driver, attach the needle valve (1) to the port from which you removed the plug. Be careful not to cross-thread the small fitting when installing and do not over tighten it (the needle valve will be left permanently installed on the carriage from this point forward). Attach the air assist lateral attachment (2) to the mounting block using the thumbscrew (3) and adjust it up or down (4) as necessary. Tighten the thumbscrew once it is at the desired height.



3. Adjust the angle of the nozzle as necessary by loosening the thumbscrew (1), rotating the bracket and re-tightening the thumbscrew. A convenient way to align the air flow is to focus on the material to be processed and then align the nozzle using the angle and height adjustments toward the Red Diode Laser which is on when the laser system is powered on and the top door is open.



Air Flow Adjustment

The needle valve can be used to adjust air flow for different applications. It is best to start with the needle valve at maximum flow (turn the needle valve counterclockwise until it seats), then adjust as necessary.

Removal

Remove the height adjustment thumbscrew and detach the air assist lateral attachment from the mount. You can re-attach the thumbscrew to the mount so as not to lose it. Detach the hose from the needle valve by using a small wrench or needle nose pliers to loosen the nut that attaches the hose to the needle valve and unthreading the nut from the needle valve. The needle valve will stay with the carriage.

Coaxial Gas (Air) Assist Attachment

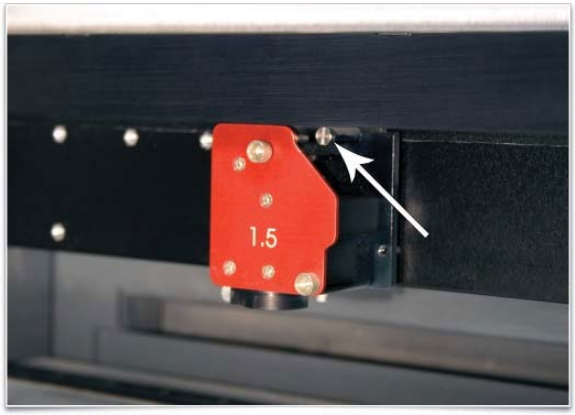
The Coaxial Gas Assist Attachment fitting attaches to the base of the focus carriage and will force air directly onto the surface of your material. It also helps to protect the lens from contamination.



WARNING: Do not install the Coaxial Gas Assist Attachment unless you plan on using Manual Air Assist and never use this attachment without proper airflow. Leaving this attachment in place and running the laser system without airflow will cause smoke from laser processing to be drawn up into the attachment and rapidly damage the focus lens.

Installation

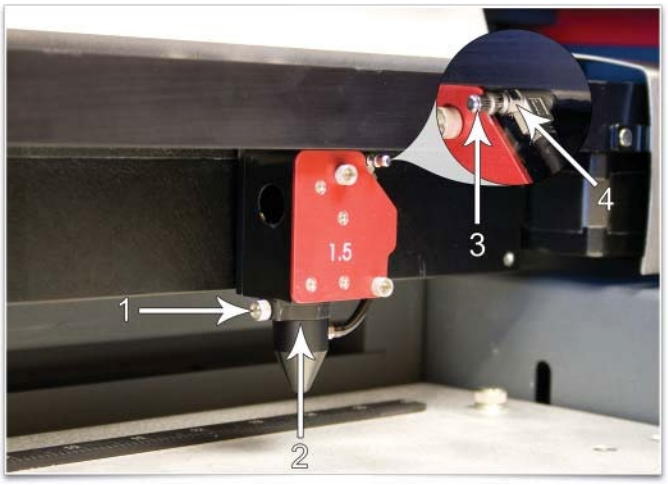
1. Remove (if present) the plug screw with a flat bladed screwdriver.



2. Using the provided 3/16 nut driver, attach the needle valve to the port from which you removed the plug. Be careful not to cross-thread the small fitting when installing and do not over tighten it (the needle valve will be left permanently installed on the carriage from this point forward).



3. Loosen the thumbscrew (1) on the side of the focus carriage (if already attached). Insert the coaxial attachment (2) into the circular opening in the base of the focus carriage until it bottoms out and gently tighten the thumbscrew.



Air Flow Adjustment

The needle valve can be used to adjust air flow for different applications. It is best to start with the needle valve at maximum flow (turn the needle valve counterclockwise until it seats), then adjust as necessary.

Removal

Loosen the thumbscrew and pull the attachment downwards. Leave the thumbscrew attached to the focus carriage by re-tightening. Detach the hose from the needle valve by using a small wrench or needle nose pliers to loosen the nut that attaches the hose to the needle valve and unthreading the nut from the needle valve. The needle valve will stay with the carriage.

ULS Compressed Air Source

The ULS Compressed Air Source is computer controlled and provides a 50 PSI max pressure and 2.0 cfm free air flow (3.2 bar and 3.2 cubic meters/hour) source of clean, dry, oil-free compressed gas/air for gas-(air-)assisted laser material processing. It can be used in conjunction with either the Coaxial Gas Assist or Lateral Gas Assist attachment accessories. It also supplies compressed gas for optics protection. It contains a sound-insulated air compressor.



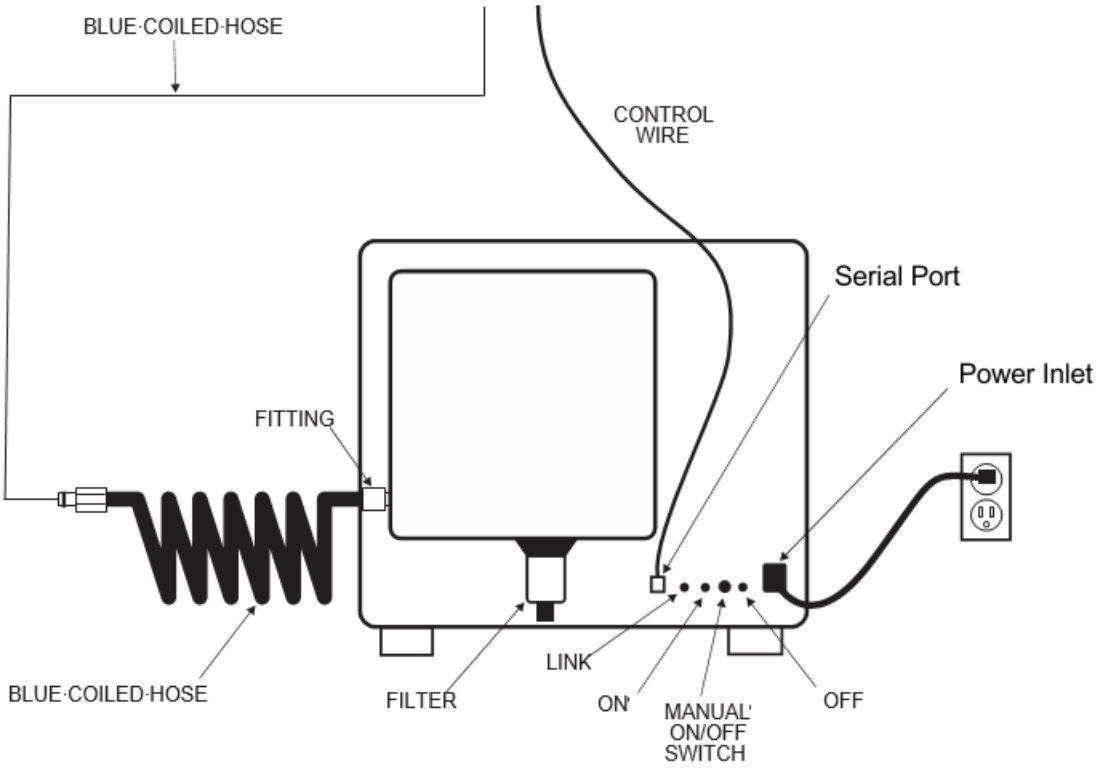
WARNING: Manual Gas Assist with Optics Protection can decrease the frequency of optics cleaning needed, but it will not decrease maintenance needs as a whole.

Installation

1. Insert one end of the provided, blue coil hose into the air supply fitting on the back of the laser system.



2. Then connect the other end of the blue coil hose to the ULS computer-controlled Compressed Air Source.
3. Connect a power cord to the power inlet and then connect the power cord to a grounded electrical outlet.



4. Connect the provided communications cable between one of the laser system's serial ports and the serial port on the ULS Compressed Air Source.

Controls

The computer-controlled ULS Compressed Air Source functions automatically when connected to the laser system and no operator intervention is necessary. Controls and indicators on the ULS Compressed Air Source are for diagnostics and provide the following information:

- **Link light** – blinks to indicate good communications link with the laser system.
- **ON and OFF lights** – indicate the state of the ULS Compressed Air Source. If the ON light is illuminated the compressor should be running and supplying compressed air. If the OFF light is illuminated the Compressed Air Source should be off and no compressed air is being supplied.
- **Manual ON/OFF switch** – turns ULS Compressed Air Source on or off manually to verify operation.

Operation

Operation of the ULS Compressed Air Source is automatic if all connections are properly made and the unit has power. The computer-controlled ULS Compressed Air Unit will automatically power on

when the laser system starts processing a control file and then power off automatically when the control file is finished processing.

Maintenance

The particle filter should be inspected every 8 to 16 hours of use. Clean out the filter as necessary. The filter can be inspected by unscrewing the lower bell-shaped portion of the filter housing (1/8 turn) and removing the red foam filter found inside. If it needs cleaning, wash it in water, dry it thoroughly and reassemble.

Air Cleaner Cart



The Air Cleaner Cart provides exhaust flow to remove the smoke and fumes generated during laser processing of materials. It also contains a three-stage filtration system to clean the exhaust air removed from the laser system. The three-stage filtration system consists of a pre-filter to remove coarse particulates, a HEPA filter to remove fine particulate, and an activated charcoal filter to remove fumes and odors. A high-pressure vacuum motor is employed to provide the air flow. The filtration unit also serves as a base for the laser system.

To reduce noise and prolong filter life, the filtration unit only operates while the laser system is running a control file.

The filtration unit has sensors to monitor the pre and HEPA filters and a consumption meter to monitor consumption of the carbon filter. The LSM provides warnings when it is time to change each filter.

Note: *Always keep a spare set of filters on hand to reduce downtime.*

Filter Replacement

The carbon filter is housed in the bottom drawer of the filter unit and the pre and HEPA filters are housed in the top drawer. To replace any of the filters, open the drawer and remove the drawer lid. Remove the filter and replace it with a new one. The HEPA filter is underneath the pre filter so you will have to remove the pre filter to gain access to it.

Maintenance

The area around the pre filter and the chamber above the HEPA filter may become dirty over time. It is a good idea to take an opportunity to clean these areas with a vacuum cleaner and/or a wipe down with a mild soap solution when replacing these filters.

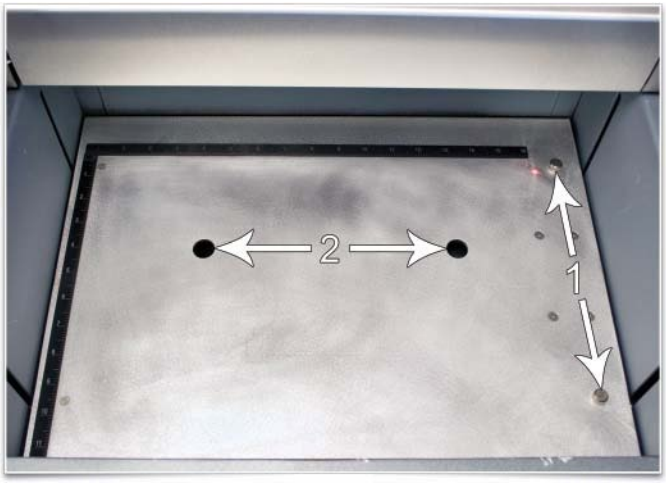
Flow-Through Cutting Table

The Flow-Through Cutting Table is used to support material when cutting so that exhaust flow is redirected both above and below the material for clean cuts. Without it, smoke and debris can build

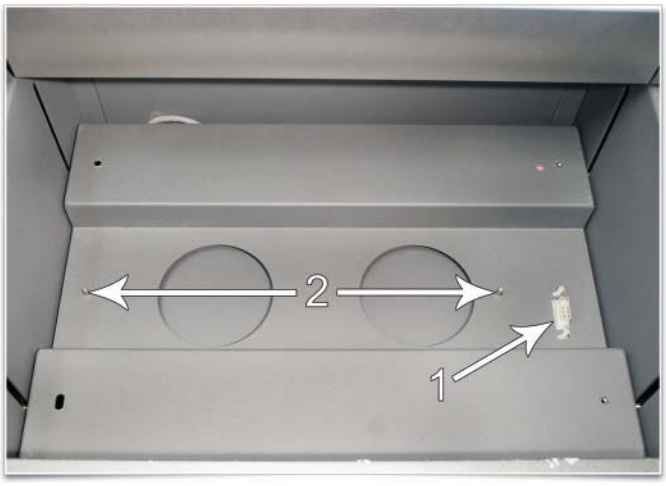
up underneath the material causing the surface of the material to be damaged. The Flow-Through Cutting Table also helps to reduce damage to the surface of the material from laser back reflection which can occur when the laser reflects off of the Flow-Through Cutting Table supporting the material if you attempt to cut without the Flow-Through Cutting Table.

Installation

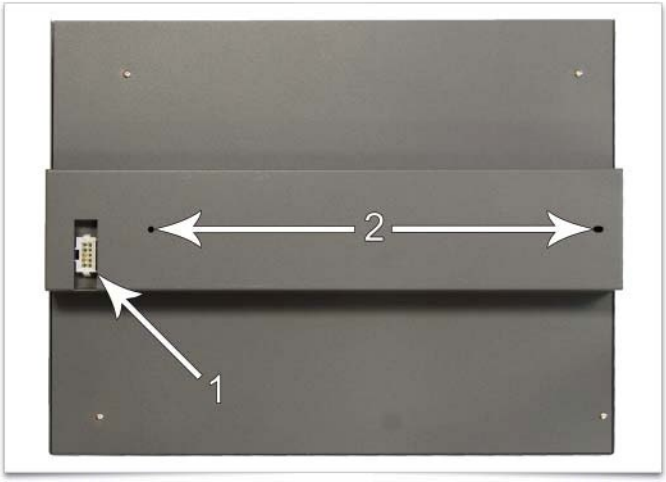
1. Turn on your laser system.
2. Lower the Material Support Table to the bottom of its travel.
3. Remove the Material Support Table by loosening the two captive thumbscrews (1). Then, using the finger holes (2), carefully lift the Material Support Table out of the laser system.



4. The table support platform underneath contains a self-aligning electrical connector (1) and the two alignment pins (2).



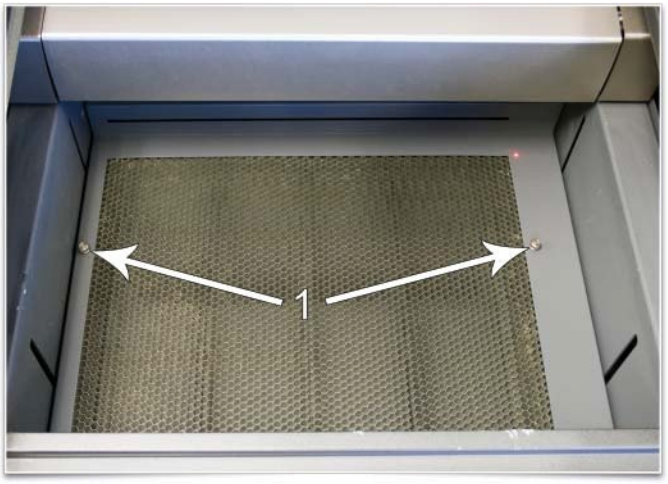
5. Locate the self-aligning electrical connector (1) and two alignment holes (2) on the underside of the Flow-Through Cutting Table.



6. Using the thumbscrews as handles (1), install the Flow-Through Cutting Table into the machine (the Flow-Through Cutting Table is hot swappable, so it is not necessary to turn power off to switch between Material Support Table and Flow-Through Cutting Table) and adjust it until it engages the connector and alignment pins. The Flow-Through Cutting Table will be detected automatically, and Z axis zero position will be adjusted automatically to the top surface of the Flow-Through Cutting Table.



WARNING: The Flow-Through Cutting Table must be calibrated to the laser system in order to function properly. Calibration is performed at the factory, however, if the zero position does not appear to be correct you may need to recalibrate the table. See the calibration instructions below.



Flow-Through Cutting Table Focus Lens Calibration

To properly use the Flow-Through Cutting Table with the focus on surface feature in the LSM, the Flow-Through Cutting Table must be calibrated to the lens you are using. This is done at the factory when the laser system ships. You can recalibrate the cutting table height by selecting the Cutting Table button in the Calibration page of the LSM and following the instructions.

Maintenance

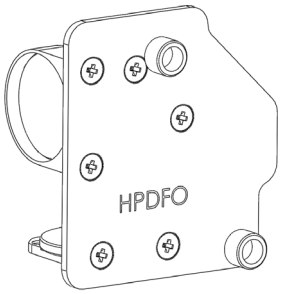
As you use the Flow-Through Cutting Table, material from the cutting process may fall through the honeycomb surface and collect in the bottom of the Flow-Through Cutting Table. Periodically check this area and remove any material that has collected there.



WARNING: If left to build up in the bottom of the Flow-Through Cutting Table, this scrap material can be a fire hazard.

The honeycomb material that makes up the support surface for materials being cut will wear out over time and can easily be replaced. New honeycomb can be purchased from the ULS Service & Support Team. To replace the material, remove the back panel of the Flow-Through Cutting Table. Remove the old honeycomb and replace it with a new one. Reinstall the back panel.

HPDFO™



HPDFO™ (High Power Density Focusing Optics) has a smaller focal spot size than a standard 2.0 in. (50 mm) lens. Depending on the type of material being processed, the effective spot size produced by the HPDFO can be as small as 1/4 the size of a standard 2.0 in. (50 mm) focusing lens.

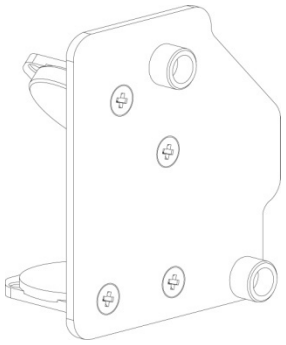
With a smaller spot size (higher power density), depending on your material, you can engrave smaller text, produce sharper graphics and photographs, and vector mark and cut thinner lines with the same laser power. With the HPDFO it is also possible to scribe and/or etch some uncoated metals, such as stainless steel, directly without the assistance of chemicals or coatings.

The HPDFO replaces the standard focus lens (see the next section, Lens Kit for more information) in the focus carriage, and comes with its own calibrated focus tool which should always be used when focusing with the HPDFO.

Installation

1. Turn off the laser system.
2. Rotate the X-axis arm cover up and out of the way.
3. Remove the two thumbscrews that hold the focus lens (see next section, Lens Kits) in place and slide the lens out.
4. Replace the standard lens with the HPDFO lens.
5. Before running a file, select HPDFO from the installed lens list on the LSM System Configuration page.

Lens Kits



There are two Focus Lens Kits available for your laser system- 2.0 in. (50 mm) and 1.5 in. (38 mm), with 2.0 in. considered standard, along with the High Power Density Focusing Optics (HPDFO™) optional accessory. Included with each Lens Kit is its own calibrated focus tool.

Different lenses produce different spot sizes and have different focal ranges. For example, the 1.5 in. lens produces a spot size of 0.003 in. (0.076 mm) and has an effective focal range of +/- 0.075 in. (1.91 mm). This lens can engrave very fine detail but can only be used on very flat materials. The 2.0 in. lens has a spot size of 0.007 in. (1.77 mm) but has an effective focal range of +/- 0.140 in. (3.5 mm) making it much less sensitive to flatness of material and accuracy of focus, but with the tradeoff of a larger spot size. Contact the ULS Service & Support Team for help in choosing the right focus lens for your application.

Automation Interface

The Automation Interface provides six inputs to initiate various laser system functions using signals from external devices, such as PLCs (programmable logic controller), and provides two outputs for polling laser system status. The Automation Interface is automatically detected upon power-up and is configured from the Automation page in the LSM Main Menu. If the Automation Interface is not present, the controls for the Automation Interface in the LSM will not be visible.



WARNING: ULS does not authorize or support third party safety devices such as air filtration devices via the Automation Interface.

Installation

1. Ensure power is off to the engraver and any accessories such as the compressor.
2. Using the supplied patch cable, plug into either one of the laser system accessory ports shown below.

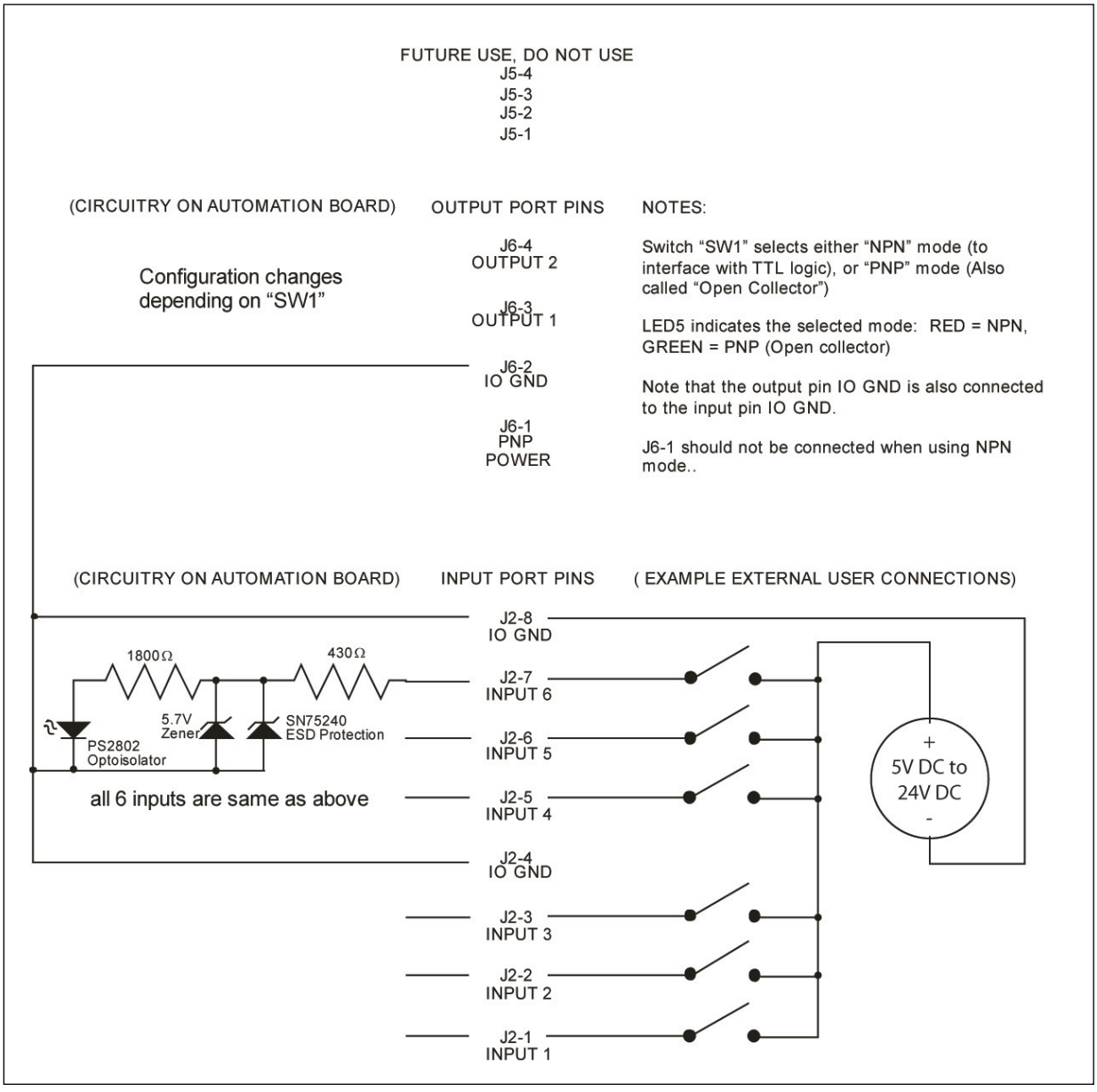




3. Then connect the other end of the patch cable to the PWR/COM IN RJ9 connector at top of Automation Interface module.
4. If you are using an ULS Air Compressor for gas-assisted laser processing, use the included RJ9-to-RJ9 cable to connect the compressor to the unused RJ9 PWR/COM OUT jack on the Automation Interface.

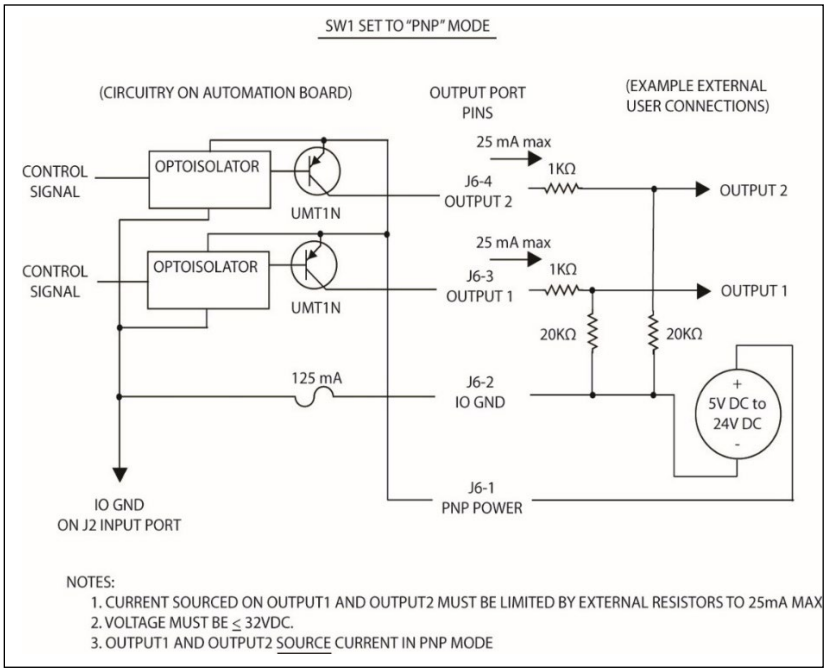
External Wiring

The Automation Interface connector J2 is used to wire external signals to six programmable inputs which can initiate various laser functions. To trigger a function, supply between 5V DC to 24V DC to one of the input pins as shown below. It is not necessary to limit current with a resistor to the input pins. The pulse on the input pins should be held high longer than 5 mS in order to register.

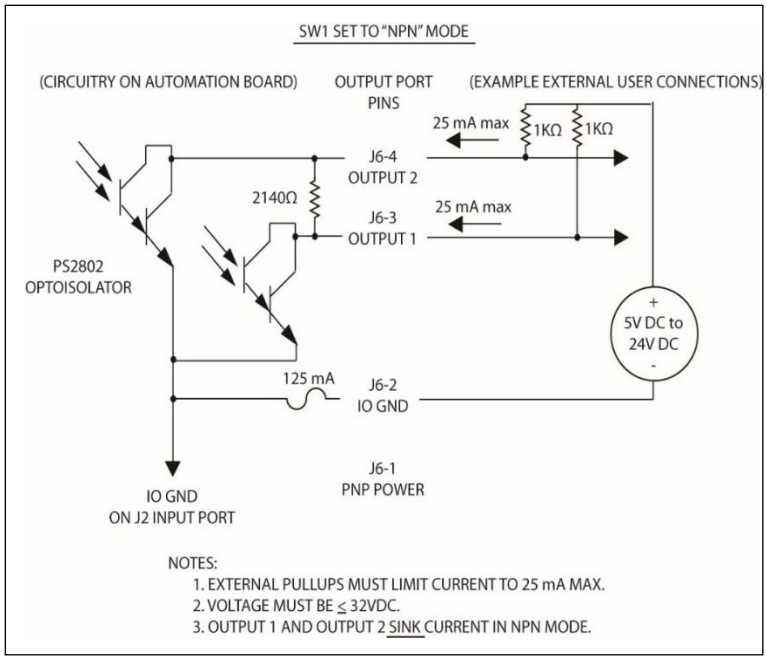


Automation Interface I/O Connections

The Automation Interface connector J6 is used to poll the two programmable status outputs. It can be used in two modes, selectable by the “PNP/NPN” switch on the top of the board. LED 5 indicates the position of this switch, lighting up green for PNP or red for NPN mode. Two example diagrams are shown below to indicate the difference between the modes. PNP (also known by the name “open-collector”) mode is recommended in most cases. In both modes, the user must supply correct value resistors to limit the current to 25mA or less. The voltage used should not exceed 32V DC.



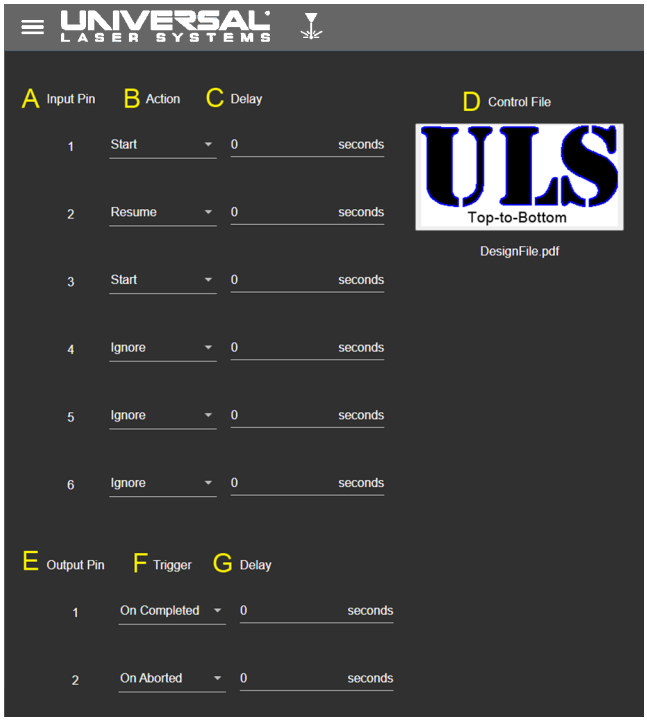
Example Connection for PNP Mode



Example Connection for NPN Mode

Automation Page

This page is used to configure the optional Automation Interface to communicate with other equipment through the optional Automation Interface module. This module must be installed to see this page.



A- Input Pin - Displays the pin number corresponding to the input wiring connection on the optional Automation Interface. Connections may be accessed under the top laser cover on the back of the laser system.

B- Input Action - Defines the action that will be performed by the laser system when this input is triggered. The actions available are: Start laser processing, Pause laser processing, Resume laser processing.

C- Delay - Provides a field to specify a delay time before performing the selected action after receiving a signal on the input.

D- Control File - Allows the user to specify the control file that will be used if the Start action is triggered.

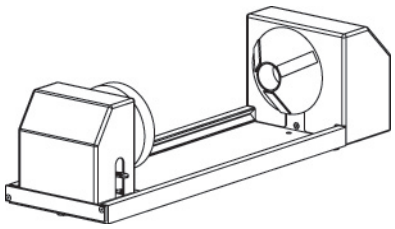
E- Output Pin - Displays the pin number corresponding to the output wiring connection on the optional Automation Interface. Connections may be accessed under the top laser cover on the back of the laser system.

F- Trigger - Defines the trigger event that will cause the output to assert closing the output replay connected to the corresponding pin. Tigger events available are: On Completed, On Running, and On Aborted.

G- Delay - Provides a field to specify a delay time after the selected trigger event occurs before the output is asserted.

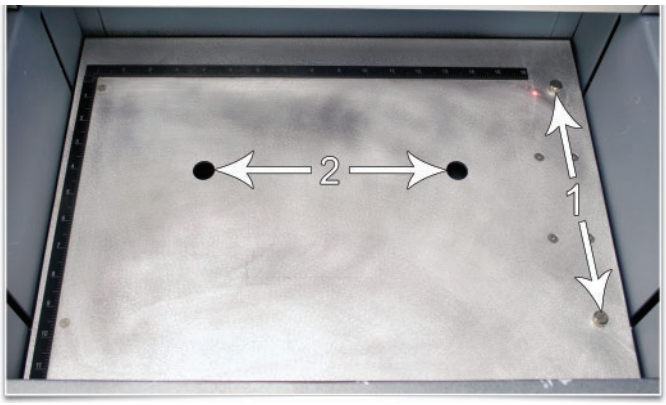
Rotary Fixture

The Rotary Fixture allows the laser system to engrave and mark on cylindrical objects. The Rotary Fixture is equipped with an external cone shaped fixture mounted to the fixed, motorized end and an internal cone shaped fixture attached to the adjustable end allowing the fixture to hold a variety of objects such as wine glasses, mugs, and cups. Additional internal and external cone fixtures can be purchased by contacting the ULS Service & Support Team.

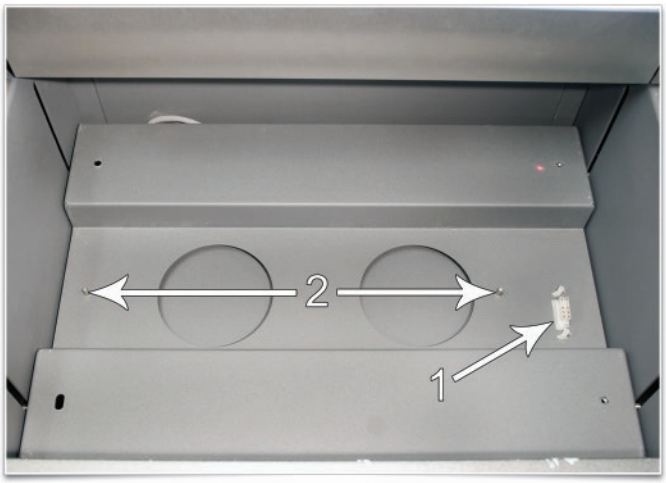


Installation

1. Remove the Material Support Table by loosening the two captive thumbscrews (1) and using finger holes (2) lift the Material Support Table out of the laser system.



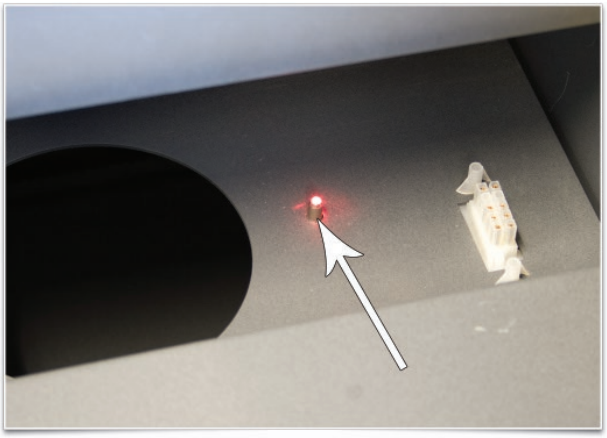
2. Underneath the Material Support Table you will find a large, recessed slot with a self-aligning rotary connector to the right side (1) and the two alignment pins (2). If you are using the Rotary Fixture for the first time or replacing the laser system's CPU, Rotary Fixture position calibration may be needed. If so, proceed to Rotary Fixture Position Calibration below. If Rotary Fixture calibration is not needed, proceed to step 3.



Rotary Fixture Position Calibration

a) Raise the Z-Axis platform to the top of its travel. (Material Support Table should be removed first).

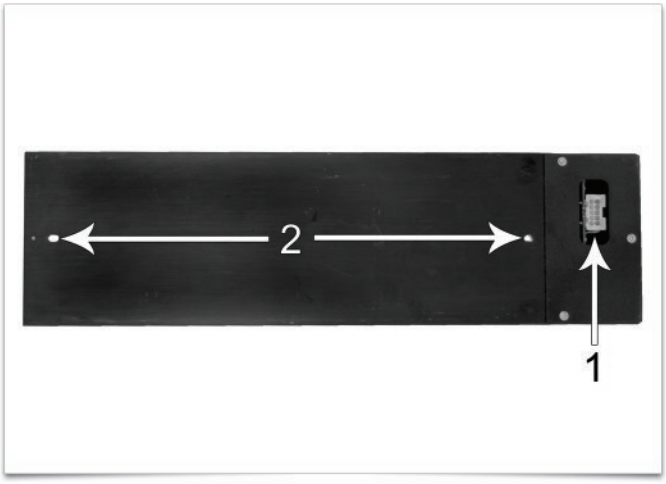
b) In the LSM Calibration page, select Rotary calibration, use the joystick controls to move the carriage manually and center Red Diode Laser on the right-side rotary alignment pin shown below.



c) Next, press the Y position SAVE button while the Red Diode Laser is still located on the right alignment pin to save the Y location of the rotary axis.

3) Lower the laser system Material Support Table enough to install the Rotary Fixture. Make sure the motion system will clear the top of the Rotary Fixture.

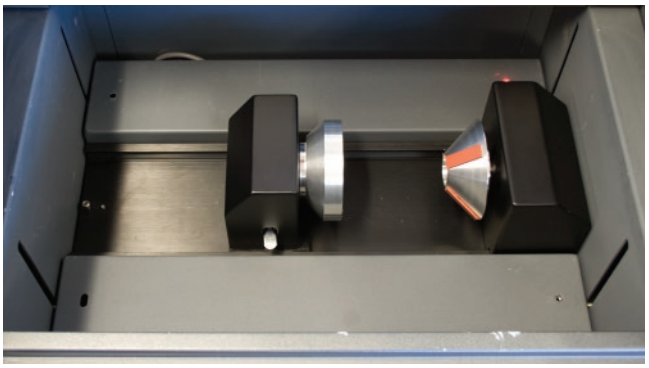
4) On the underside of the Rotary Fixture locate the self-aligning electrical connector (1) and two alignment holes (2).



5) Turn off the laser system. (Important: you risk damaging the electronics in the VLS3.60ES Desktop Laser System if you install the Rotary Fixture into the VLS3.60ES Desktop Laser System with the power on.)

6) Insert the Rotary Fixture into the recessed slot and adjust until the connector engages. The alignment pins protrude through the alignment holes in the base of the Rotary Fixture and the Rotary Fixture is sitting flat. The Rotary Fixture will indicate that it is installed properly by automatically rotating its cone slightly. If you are using the Rotary Fixture for the first time or replacing the laser system's CPU, Rotary Fixture focus calibration may also be needed. If so, proceed to Rotary Fixture Focus Calibration

below. If Rotary Fixture focus calibration is not needed the Rotary Fixture is ready for use.



Rotary Fixture Focus Calibration

a) In the LSM Calibration page, select Rotary. Using the joystick controls in the LSM, move the carriage manually and center Red Diode Laser over the top of the internal cone fixture. Use the focus tool and manually focus on top of the internal cone fixture as shown.



b) Next, press the Z position SAVE button ONLY to save the Z position of the rotation axis of the Rotary Fixture.

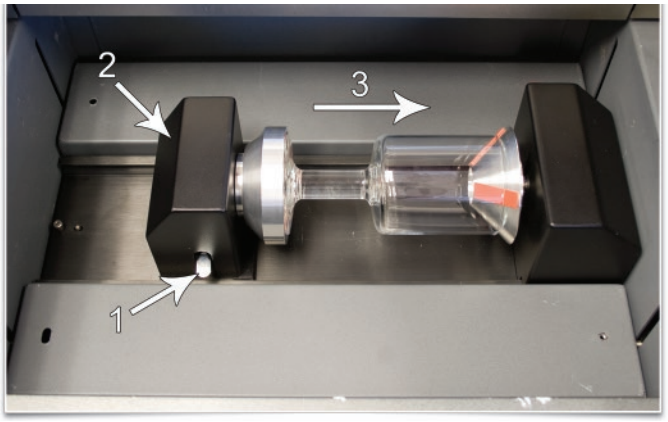
Loading Material

Before loading material into the Rotary Fixture, measure the diameter (1) of the material in the area where the engraving or marking is to be located, by using a caliper or similar measuring device. A wine glass is used for illustrative purposes here.



1. Place the open end of the material on the fixed end of the Rotary Fixture. Lift the lever on the adjustable end (2) of the fixture and slide it up against the base of the material so the material rests firmly centered inside of the inverted cone. Push the adjustable end of the fixture (3) to the right, firmly against the bottom of the material. Lower the lever (1) located on the end of the fixture to lock the material in place. The rubber pads should keep the material from slipping.

   Note: *If the material does not have an open end, you can purchase an additional internal cone fixture to hold the material. If the material has two open ends you can purchase an additional external cone fixture to hold the material. To change out fixtures, loosen the setscrew that holds the fixture to the rotary shaft, remove the un-needed fixture, and replace with the new fixture.*



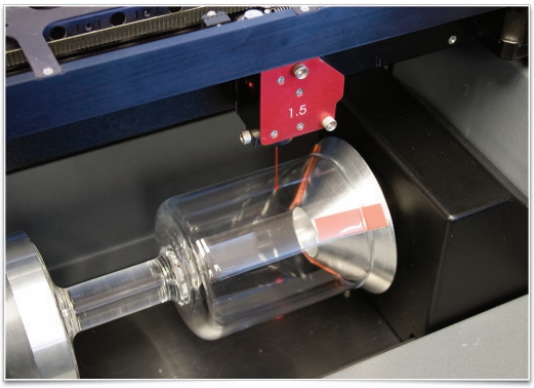
2. Power ON the laser system.

Determining Graphic Placement

The next step is to align the graphics to be printed with the material inserted in the rotary fixture. Again, a wine glass is used for illustration. You can use the X axis ruler or to be more precise use the Red Diode Laser and the X-Y coordinate display in the LSM to position the graphics in the X axis.

1) Using the joystick controls in the LSM, position the focus carriage above the material.

2) Move the carriage left or right until the red alignment laser is located where you would like the top of the graphic to start on the material as indicated in the picture below.



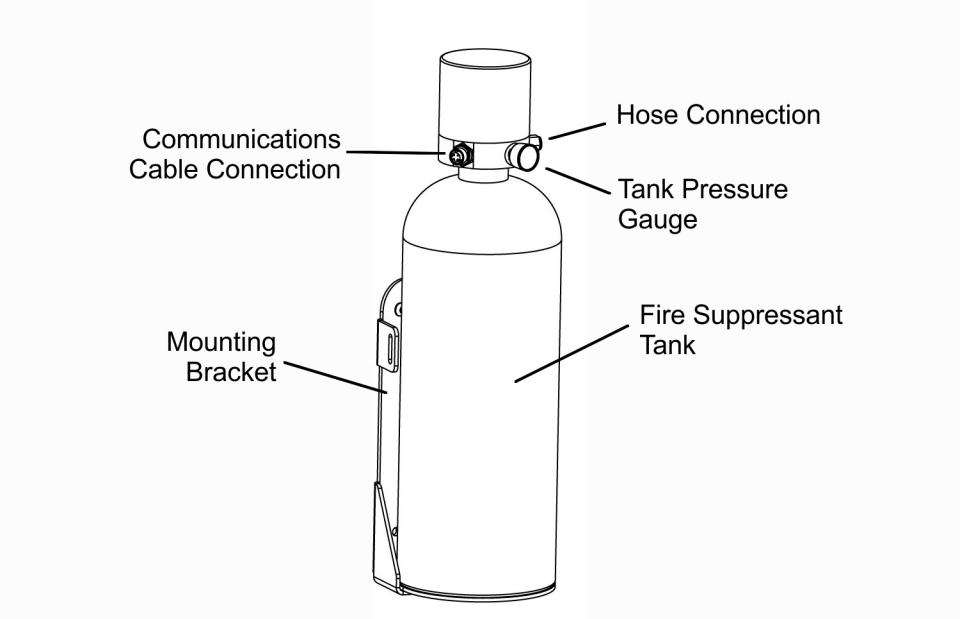
3) Select the control file in the LSM that you want to use for laser processing with the rotary fixture. In the process settings, select the rotary switch to indicate the control file can only be used with the rotary fixture and enter the diameter of the material to be processed. The preview window will change so that the vertical height of the processing area is equal to the circumference of the material and a red horizontal line will appear centered vertically indicating the position that is top center of the material.

4) Use the relocation function to position the design in the control file vertically (usually centered vertically) and horizontally so that top of the design is aligned with the pointer you positioned in step 2.

5) Finally rotate the material by hand until the position you want to be the vertical center of your design is facing directly up. Keep in mind that the rotary fixture does not have a home location in the rotational axis so the topmost part of the material (the part facing straight up) is always the center of the graphic when processing with the Rotary Fixture using LSM.

Fire Suppression Assistance Module

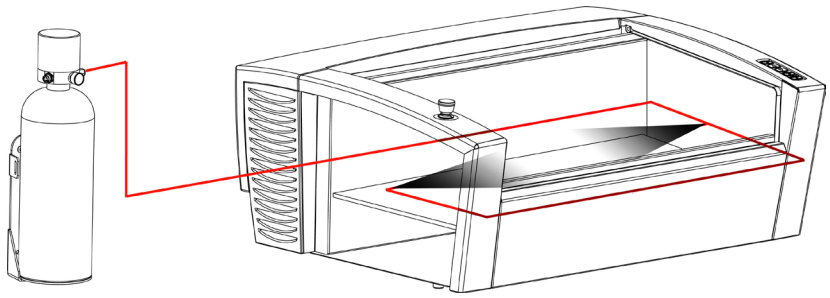
The VLS3.60ES Desktop Laser System is equipped to support the optional Fire Suppression Assistance Module. The Fire Suppression Assistance Module consists of a fire suppression tank with mounting bracket, hose, and communication cable for connecting the tank to the VLS3.60ES Desktop Laser System.



The Fire Suppression Assistance Module provides automated fire suppressant deployment in response to elevated temperatures associated with a material fire. Additional USER response actions may be required if the material fire is not fully suppressed. When the Fire Suppression Assistance Module deploys fire suppressant, it leaves no residue, minimizing the need for extensive cleanup typically required after using manual fire extinguishers. The Fire Suppression Assistance Module is intended to assist with suppression of material fires that may occur during laser material processing; however, fire suppressant deployment does not guarantee that a material fire will be fully suppressed. If a fire is not fully extinguished, it should be diminished, allowing the user to better address the fire with a fire extinguisher if necessary.

The Fire Suppression Assistance Module is automatically activated when the temperature reaches above 120 ° F (49 ° C) in the laser processing system. However, it is important to note that this option is not a substitute for constant, close, and attentive supervision of laser processing.

Two nozzles in the laser processing area of the VLS3.60ES Desktop Laser System, one on the left and one on the right of the processing area, will deploy suppressant from the suppressant tank onto the laser processing area.



There are two sensors in the laser system processing area that trigger when elevated temperatures in the processing area are detected.

One sensor, with a lower temperature setting of 120 °F ((49 ° C), will halt operation of the laser system upon detection of a temperature in the range of 115 to 125 °F (46 to 52° C), sound an audible alarm buzzer, and display an error message in the LSM. This will give the user an opportunity to stop the thermal event from escalating further.

A second set of sensors with a higher temperature setting of 130 to 140 °F ((54 to 60 ° C) will trigger if the temperature continues to increase above alarm temperature. This will cause a signal to be sent to a valve located on the Fire Suppression Assistance Module and fire suppressant will be deployed.

The suppressant will travel from the Fire Suppression Assistance Module to the laser system and out of the nozzles onto the material processing surface. The suppressant is deployed as a liquid and evaporates in contact with hot materials and surfaces, rapidly cooling the materials and extinguishing flames. No residue from the suppressant is left behind, minimizing the need for cleanup.

Once a tank is deployed, the laser system will not allow laser material processing, and an alarm will sound intermittently to indicate to the operator to replace the deployed fire suppressant tank with a new one before resuming operation. An error message will also be displayed in the LSM prompting the user to replace the spent tank.

Fire Suppressant Information

The Enviro Tech International Ensolv Flouro FS fire suppressant, per their website at envirotechnint.com, is a liquid that vaporizes quickly (50-times faster than water) when released, is non-corrosive and not electrically conductive, so that sensitive electronic systems are not damaged. In contrast to foam or powder, it does not leave any damaging residues, so the systems do not have to be cleaned and remain up and running after the release of suppressant.

This suppressant is not oxygen displacing, non-ozone depleting and does not contribute to global warming. It offers the highest known margin of safety for use around humans of any clean fire suppression agent under the NFPA 2001 standard (2022 edition).

Installation

1) There are three options for mounting/positioning the fire suppression tank:

   a) If the laser system is installed on a fixed surface such as a desk, counter, or table, the tank can be mounted on a wall near the laser system using the provided mounting bracket.

   b) Or the tank can be placed upright on the ground underneath or next to the laser system using the provided round pedestal base attached to the fire suppression bracket to prevent tipping.

   c) If the laser system is installed on the optional VLS Aire Cleaner Cart, mount the tank and bracket to the Air Cleaner Cart using the matching mounting holes on the back of the unit.



WARNING: The tank must be upright for proper operation. Do not lay the tank on its side. If the tank tips over, return it to an upright position.

2) After mounting/positioning the fire suppression tank, connect the communications cable between the communications port on the fire suppression tank and the corresponding connection on the back of the VLS3.60ES Desktop Laser System.

3) Connect the yellow suppression hose between the suppressant fitting on the fire suppressant tank and the corresponding fitting on the back of the VLS3.60ES Desktop Laser System. The connections are push-fittings. To connect the hose, press it into the fitting until the hose is seated. To remove the hose, press the small plastic ring around the fitting toward the fitting and pull the hose out.

Operation

A status indicator () will be visible in the upper left corner of the LSM near the interlock status indicator if the Fire Suppression Assistance Module is installed and active on the laser system. The indicator will have a slash through it if the tank pressure is insufficient for operation and the LSM will report the issue and not allow laser processing.



Operation of the fire suppression system is automatic. No user intervention is required. In the event the tank is deployed, a new tank will need to be installed before the laser system will allow laser processing.



WARNING: The Fire Suppression Assistance Module is not intended to promote unattended operation of the laser system. The laser system must be monitored by a user at all times during laser processing.

Maintenance

The LSM will monitor the pressure in the fire suppressant tank continuously and will cease operation and warn the user to replace the tank if it detects the pressure has dropped below the nominal pressure required for proper operation. A pressure gauge is also installed on the tank which users can periodically check if desired. The tank pressure should always be above 120 PSI for proper operation. Users are also advised to periodically check that the communications cable and yellow suppression hose are properly connected between the laser system and tank.



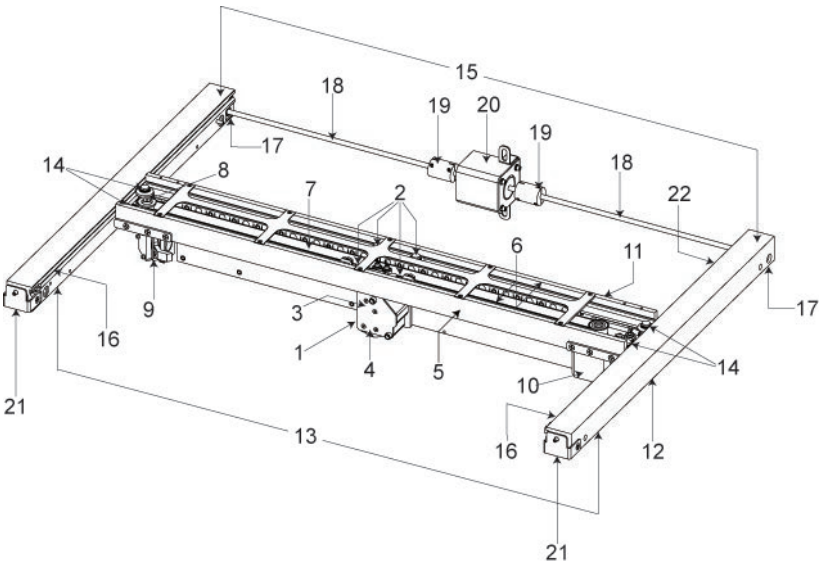
WARNING: The tank must be upright for proper operation. Do not lay the tank on its side. If the tank tips over, return it to an upright position.

Chapter 6 – Maintenance

Overview

Accumulation of dirt and debris on the motion system components will cause uneven or rough engraving, loss of engraving position, and premature failure. Accumulation of smoke or dirt on optics can result in loss of laser power and premature failure. It is important to keep your laser system as clean as possible to ensure trouble-free operation and best results from laser processing. Always turn the laser engraving system OFF and unplug it before performing any cleaning procedures.

Motion System Components Diagram



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

Note: *#2 Mirror Cover and X-Axis rail cover have been removed for visibility*

Cleaning and Maintenance Supplies

- Mild soap solution mixture of 1 tablespoon (14.78 ml) liquid soap and 1 quart (liter) of water in a spray bottle
- Window cleaner
- Paper towels
- Cotton cloth
- Denatured alcohol (do not use on any painted surface, plastic or the Top Window)
- Acetone (can be used on the Material Support Table but nowhere else)



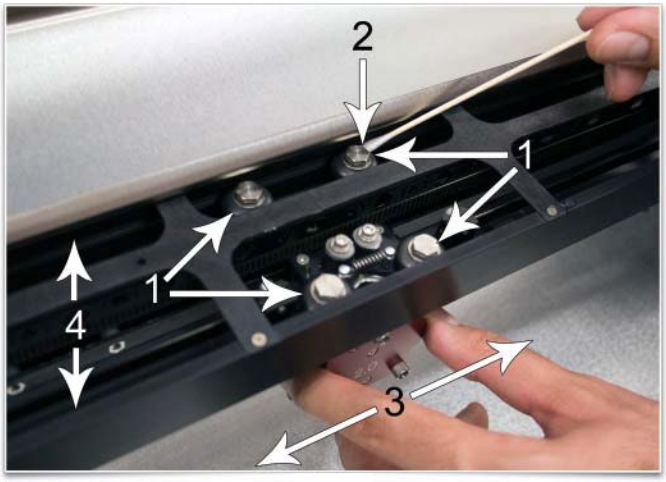
WARNING: When using acetone or denatured alcohol, please follow the instructions on the printed label of these materials for safe handling procedures.

- Cotton swabs (supplied)
- Lens cleaner (supplied)
- Vacuum cleaner
- Set of Allen wrenches sized from 0.050 to 3/16 inch

System Cleaning and Maintenance

Motion System

- Vacuum all loose dirt and debris from the inside of the device.
- Clean the Material Support Table surface with either a soap solution or alcohol and a cloth or paper towels (acetone can be used in extreme cases to remove gummy deposits but should be handled carefully as it will melt plastic components of the laser system). Never pour or spray any solution directly into the laser system. Always dampen your paper towel or cloth with the cleaning solution outside of the laser system and then wipe down the parts you are cleaning with the dampened cloth.
- Locate the four X-axis bearings (1). Dampen a cotton swab with a soap solution. Place and hold the dampened swab against each bearing as shown (2). Grasp the focus carriage (3) and move the focus carriage left and right, holding the swab on each bearing to roll the bearing against the swab. Also use a dampened swab to clean the length of the x-axis v-grooves (4).



- Dampen a cotton swab or cotton cloth with soap solution and clean the Y axis v-groove shown below. Slide the X-axis arm toward the front or rear of the device as necessary to gain access to the entire length of the Y-axis v-groove.



Main Enclosure

- Clean the glass top door with a non-abrasive cotton cloth, paper towel or facial tissue and window cleaner. The top window is made out of glass; therefore, do not use abrasive cleaning clothes because they will scratch the glass. Also, do not use abrasive chemicals that will damage the glass.
- Use a soft cloth dampened with the soap solution to clean the enclosure. Do not use alcohol, acetone, or any other harsh chemical as these will damage the paint.

Optics

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

WARNING: Do not clean an optic that appears clean. Excessive cleaning can damage the optical coatings. To prevent contamination, wash your hands thoroughly before handling and cleaning any optic. Try not to touch the optical surfaces with your fingers, handle optics only by the edge or optical housing. Fingerprints can damage the optical coatings.

Never clean any optic right after engraving or cutting because the optic may be hot and the cool lens cleaning solution may thermally shock the optic and crack it.

#2 Mirror

To gain access to the #2 mirror rotate the X axis rail cover up and out of the way. Locate the #2 mirror holder handle on the left end of the rail (red) and gently slide it out of the holder. It is held in place by magnets so you may feel a slight resistance as you are sliding it out.

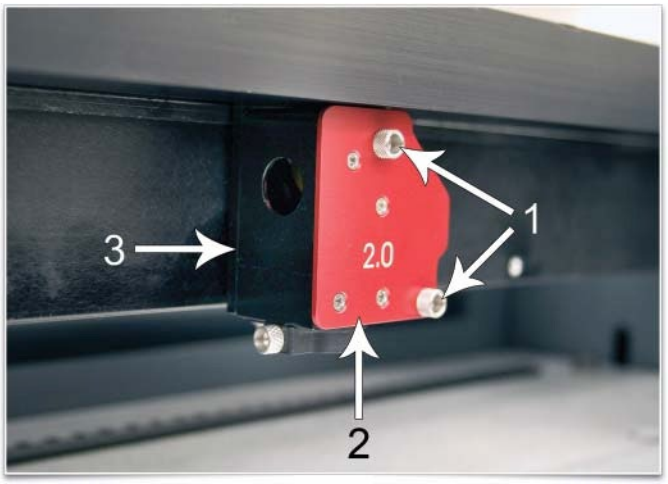


Inspect the #2 mirror and clean it only if there is debris present. To clean the #2 mirror with a cotton swab, moisten the cotton swab with the lens cleaning solution supplied with the laser system. Do not use other types of cleaners or solutions. Gently roll the cotton swab across the mirror once. Do not drag the swab or roll it back and forth as this can scratch the mirror. If the mirror did not come clean, use a fresh cotton swab and repeat the procedure. Reinstall the mirror by sliding it back into its holder until seated.

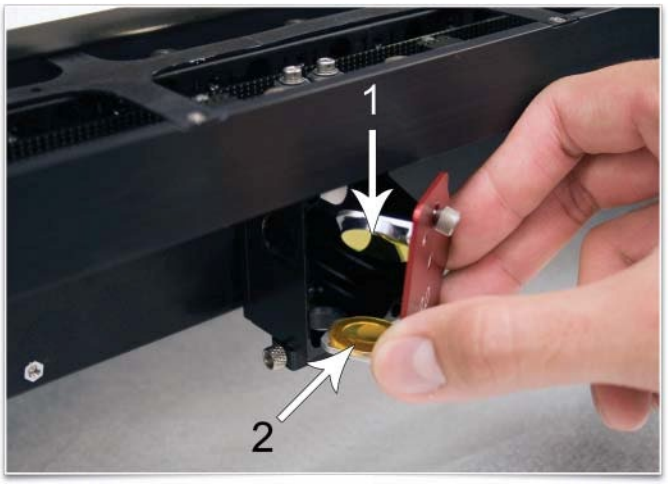
WARNING: When reinstalling the mirror make sure not to install it backwards.

#3 Mirror and Focus Lens

Loosen the two thumbscrews (1). They are held captive by retaining clips so they should remain with the cover. Grasp the front cover plate (2). Gently slide it forward and out of the focus carriage (3).

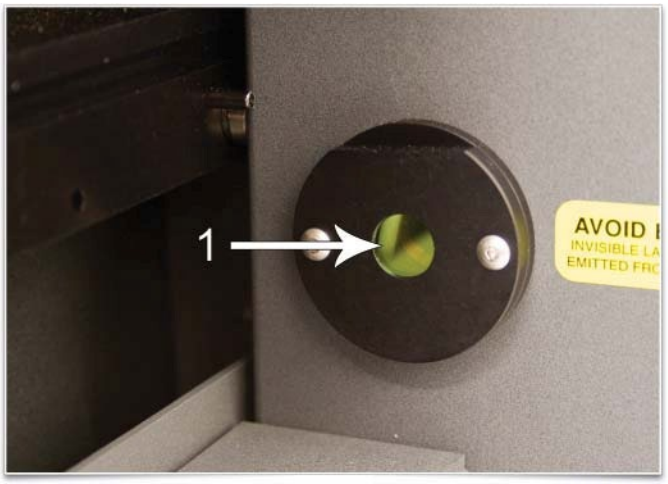


Inspect the #3 mirror (1) and Focus Lens (2) and clean as necessary. Be sure to inspect both the top and bottom of the Focus Lens. Use the same cleaning method described for the #2 mirror to clean the #3 mirror and lens. Make sure to use a fresh swab for each pass.



Beam Window

The beam window (1) is located where the laser beam enters into the processing area. It is located in the upper left-hand corner of the engraving area against the back wall and is yellow in color. It is only necessary to clean the front side of the beam window. Do not remove the optic to clean it; simply clean it in the same manner as the #2 mirror.



Cooling Fan Filters

The side (1) and rear (2) cooling fan filters are located inside the rear cover. To access them, remove the two mounting screws underneath the rear of the system. Lift the cover straight up and off. Locate the filters on the inside of the rear cover and on the inside of the side vent panel. Remove the plastic retainers and the filter media. Rinse the filter media with soap and water. Allow them to dry before re-installing.



Exhaust Plenum

The exhaust plenum should be routinely inspected and cleaned to ensure good exhaust flow. To access the inside of the exhaust plenum, lower the Material Support Table to the bottom of its travel and then remove the Material Support Table by loosening the thumbscrews on the right side and lifting the Material Support Table out. You can then remove the exhaust plenum cover on the inside back wall of the machine by gently pulling on it. It is held in place by snap fasteners. Clean the inside of the plenum with a mild soap solution and then reinstall everything in the reverse order.

Adjustments and Lubrication

Periodic adjustments are not normally required. The bearings in the motion system will self-adjust to take up any clearances as they begin to wear. The belts are fiber-reinforced and will not stretch under normal use so periodic tension adjustment is not necessary. All bearings in the system are sealed and do not require lubrication. Do not lubricate the tracks that the bearings ride in.

Maintenance Schedule

We recommend the following schedule:

As necessary

- Clean Material Support Table
- Clean main enclosure
- Clean top door window

Every 8 hours of engraving

- Clean X-axis and Y-axis bearings
- Clean X-axis and Y-axis rails and bearing tracks
- Clean X-axis belt
- Check beam window, #2 mirror, #3 mirror, and Focus Lens for debris. Clean ONLY if dirty.

Every month

- Clean cooling fan filters
- Clean Z-axis lead screws with white lithium grease
- Check for X-axis and Y-axis belt wear. Replace as necessary.
- Check and/or clean X-axis and Y-axis drive gears
- Check for X-axis and Y-axis bearing wear. Replace as necessary.
- Inspect system for loose screws and mechanical parts. Tighten as necessary.

Every 6 months

- Clean exhaust plenum

Note: *If you have any questions about maintaining the laser system, please contact the ULS Service & Support Team.*

Chapter 6 – Service & Support Resources

User Guide

You may download ULS system user guides on the ULS Software Downloads and User Guides web page at www.ulsinc.com/support/software-download. Any future user guide updates are published there upon release.

Software

ULS system software may be downloaded at www.ulsinc.com/support/software-download.

Warranty

Warranty documents pertaining to your purchase were included with the laser system when it is shipped from the factory. Should you require a copy of the warranty, please contact ULS Sales & Support.

Parts

To order parts for your Universal laser system, contact the ULS Sales & Support Team using the contact information in the ULS Service & Support Team Contact Information section below. Please have your system serial number available.

Service Requests

To submit a service request, visit www.ulsinc.com/support/contact-support and complete the online form or contact ULS Service & Support. Please supply your system serial number.

Material Processing Application Support

To engage the ULS Advanced Materials Processing Center (AMPC) for materials processing or Intelligent Materials Database support, contact ULS Service & Support.

ULS Service & Support Team Contact Information

Scottsdale, AZ USA

support@ulsinc.com

+1 (480) 609-0297

Serving North America, South America, India, Australia and New Zealand

Vienna, Austria

support@uls.at

+43 1-402-22-50

Serving Europe, Middle East and Africa

Yokohama, Japan

japansales@ulsinc.com

+81 45-224-2279

Serving all of Asia, excluding India

Laser Exchange Program

The Laser Exchange Program is available to existing system customers ready to service or upgrade their ULS laser source. Customers can trade their used laser for a like-new, refurbished ULS laser source at a fraction of a new laser's cost. This makes it easy and affordable for customers to maintain and keep their ULS systems operational.

How the Exchange Process Works

Contact ULS or an authorized representative to initiate a laser exchange order. A like-new, refurbished ULS laser is shipped to the customer as soon as possible. The customer ships their used return laser back to ULS using ULS-approved packaging.

Terms and conditions apply. Sequence of laser shipments may be determined solely by ULS.

About Refurbished ULS Lasers

Refurbished lasers undergo numerous steps to ensure they meet ULS operational specifications and cosmetic guidelines:

- Visual inspection
- Disassembly and high-pressure industrial wash of all major laser components
- Replacement of components if necessary
- Power supply and fans are tested and repaired, upgraded or replaced if necessary
- All optics are replaced
- Gas mixture is evacuated and refilled with new gas mixture
- After re-assembly, lasers are realigned and tested

Note: Program limitations and exclusions apply. Contact ULS for details.

For more details on the Laser Exchange Program, including order placement and easy laser return and receipt instructions, please contact your local the ULS Service & Support Team.

Laser Return Shipment Packaging Instructions

Laser Source Packaging

Save the laser box and accompanying foam inserts for your future laser service needs. ULS Service & Support may require the shipment of your laser to an authorized ULS facility.

This is the ULS-approved packaging recommended to minimize the possibility of damage to your laser source during shipping. Per ULS Terms and Conditions of Sale, customers are responsible for any loss or damage to their laser source upon original order release to the shipping carrier.

Should you dispose of this packaging, you may need to purchase new ULS-approved packaging for future service.

How to Pack a ULS Laser Source

The original packaging includes a box with specially designed foam inserts for placement on both sides of the laser source to secure it in place. Package your laser using the steps on the following page.

1) Use ULS supplied box and (8) foam inserts.



2) Place (4) half of the foam inserts on each side of the laser source as shown.



3) Place laser source with foam inserts in the box. Tape box securely closed.



Have Questions?

Contact the ULS Service & Support Team.