



ULTRA R Series Laser Systems

User Guide

UNIVERSAL[®]
LASER SYSTEMS
www.ulsinc.com

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Dear Customer:

Thank you for choosing Universal Laser Systems®. We appreciate innovative customers like you who have made us an integral part of your business. Universal Laser Systems® (ULS) is committed to providing the highest level of customer satisfaction and support. To ensure a favorable customer experience, we urge you to thoroughly read the documentation provided with your equipment.

Your satisfaction is essential to us, and we welcome your feedback. Tell us about your experience with Universal Laser Systems and our products at moreinfo@ulsinc.com.

Should you have any questions, please email the ULS Support Team at support@ulsinc.com.

Again, thank you for choosing ULS.

Sincerely,

Universal Laser Systems

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Universal laser systems are protected under one or more U.S. Patents: 6,983,001; 7,060,934; 7,415,051; 7,469,000; 7,715,454; 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; 10,456,875; 9,737,958; 10,391,345. Other U.S. and international patents pending.

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ULTRA R Series Platforms Overview 1

The ULTRA series consists of the R5000 and R9000 platforms and offers laser material processing for a wide range of materials. These platforms are designed and ideally suited for material processing in manufacturing, research and development, academic research, and prototyping environments. With their unique modular architecture, customizable solutions can be easily reconfigured with a wide array of options for enhancing performance, capability, and safety to complete the perfect solution to meet present and future business needs.

The ULTRA R5000 and R9000 platforms have materials processing envelopes of 32 x 24 in (813 x 610 mm) and 48 x 24 (1219 x 610 mm) respectively, with support for materials with a thickness up to 12 in (305 mm).



Configure the customizable ULTRA R5000 and R9000 platforms with up to two laser sources consisting of two interchangeable CO₂ lasers or one CO₂ laser and one fiber laser. When the platform is configured with two lasers, users can take advantage of MultiWave Hybrid technology™ enabling up to two of three wavelengths from 9.3 μm, 10.6 μm, and 1.06 μm – to be simultaneously combined into a single coaxial beam. Each spectral component of the beam is independently controlled and can be modulated in real time.

Major features and options include multiple laser support, rapid laser beam positioning, precision material-independent autofocus, controllable laser power density, automation interface, multi-camera vision & registration, over temperature detection, and support for fire suppression.

Specifications, Features, and Options¹

FEATURE	ULTRA R5000 DESCRIPTION	ULTRA R9000
Material Processing Envelope (X, Y, Z)	32 x 24 x 12 in. (813 x 610 x 305 mm)	48 x 24 x 12 in. (1219 x 610 x 305 mm)
Multiple Laser Support	<p>UP TO 2 LASER SOURCES CAN BE USED INDIVIDUALLY OR IN COMBINATION</p> <p><i>Laser Sources Available:</i> CO₂: 10.6 μm 10, 30, 40, 50, 60, 75 and 150 watt laser sources CO₂: 9.3 μm 30, 50 and 75 watt laser sources Fiber: 1.06 μm 50 watt laser source</p> <p><i>Laser Sources Combinations:</i> Up to (2) CO₂ laser sources (10-75 watts) or up to (1) CO₂ laser sources (10-150 watts) and up to (1) permanently mounted Fiber laser source</p> <p>SUPPORTS RAPID RECONFIGURATION OF CO₂ LASERS</p>	
Maximum Laser Power	CO ₂ : 150W Fiber: 50W	
Rapid Reconfiguration™ (CO₂ Laser Sources only)	A patented technology that enables users to install and reinstall any supported ULS CO ₂ laser source onto any ULS laser system without tools or optical alignment to optimize laser processing for the widest variety of materials.	
Multi-Wave Hybrid™ Technology*	A patented technology that enables a combination of laser wavelengths (up to two wavelengths) to be focused to the same focal point within the same focal plane and used either sequentially or simultaneously.	
SuperSpeed™ Technology*	A patented feature that produces two focal spots (one for each laser beam) to enable the system to deliver two independently controlled raster lines at a time. SuperSpeed requires a laser system equipped with two CO ₂ lasers of the same wavelength and power.	
Maximum Effective Raster Material Processing Speed	>200 in./sec (5080 mm/sec) [Requires SuperSpeed™ operation]	
Precision Material-Independent Autofocus	A motorized Z-axis and high-resolution touch sensor with repeatability of ± .005 in (125 μm).	
21" Touch Screen Control Panel*	A fully integrated 21" (533 mm) touch panel command and control console used to control laser system operation.	
Controllable Laser Power Density 4X 1X / 13X*²	A patent pending feature that provides the unique ability to control laser power densities while maintaining a high degree of alignment accuracy of	

	<p>the focal plane with the material surface as well as a Gaussian beam distribution.</p> <p>Power Densities: 1X (Optional), 4X (Included) or 13X (Optional) for 10.6 μm and 9.3 μm wavelengths; 52X for 1.06 μm Fiber wavelength (Included).</p> <p>Normalized power density (watts/cm²) = power density coefficient x 10³ x average laser power (watts). Normalized power density is the power of the material processing laser(s) divided by the area of the focal spot measured at 1/e².</p>
Dynamic Energy Stabilization	A feature that maintains even laser energy delivery regardless of the speed of the motion system.
Design File Geometry Preservation	A feature that maintains curves in a design file, i.e., circles, ellipses, b-splines, Bezier, and NURBS, and ensures curves are kept throughout the path planning process rather than using linear interpolation.
Intelligent Path Planner	A comprehensive path planning algorithm that minimizes laser processing completion time.
Multifunction Material Support Structure	<p>A built-in aluminum honeycomb work surface designed to keep materials stationary and in focus during laser processing. Reduces back reflection and enables exhaust of laser processing byproducts from underneath materials. Includes a full-field masking material dispenser.</p> <p>Configurable using Machined Aluminum Tiles, Material Support Pins and Vacuum Booster.</p>
Machined Aluminum Tiles*	An accessory that provides a rigid and smooth work surface for laser material processing. When used with cutting processes, the compatible Material Support Pins are recommended.
Material Support Pins*	A set of custom machined pins for laser cutting that can be inserted into either the Multifunction Material Support Structure or the Machined Aluminum Tiles. Pins add sufficient space between the target material and the work surface to eliminate back reflection.
Rotary Axis Module*	An accessory that enables 360° rotation laser processing of cylinders, spherically-shaped, and tapered objects. The addressable resolution is 13 arc seconds.
Class 4 Conversion Module for Pass-Through*	A patented technology that enables the laser system to facilitate material pass-through in compliance with CDRH and international safety regulations for operating Class 4 laser systems. This optional, add-on module converts a fully enclosed Class 1 system into an open Class 4 system.
Supplemental Exhaust*	Exhaust plenums on left and right sides of processing area help capture exhaust in class 4 mode. (required with Class 4 Pass-Through).

Vacuum Booster*	An external accessory that dramatically increases the pressure differential between the surface of the Multifunction Material Support Structure and ambient/atmospheric pressure to keep materials stationary.
Programmable Gas Assist	A feature that allows the user to program gas type and flow rate on a process-by-process basis within a control file.
Optics Protection	A barrier of clean air that protects optical components during processing.
Coaxial Gas Assist Attachment	A gas assist attachment that directs air (or gas) perpendicular to the material's surface.
Lateral Gas Assist Attachment*	An adjustable gas assist attachment that directs air (or gas) laterally or at an angle to the material's surface.
Air Compressor*	A compressed air source that delivers optimally conditioned, clean, dry, and oil-free air for optics protection and gas-assisted laser processing.
Intelligent Air Filtration UAC 4000*	An external accessory that uses a patented dual carbon filter and sensor suite (for CO and VOCs) that filters out laser processing byproducts, monitors filtration performance at every stage, and alerts the operator when predefined contaminant thresholds have been reached. Connects directly to the laser system to turn filtration on and off with laser processing and communicates the status of all aspects of the UAC 4000.
Automation Interface*	An addressable device that can receive input signals and provide output signals. Enables the laser system to control external devices and allows external devices to initiate laser system functions.
E-Stop	A highly visible standards-compliant pushbutton. Once depressed, DC power to all laser sources, the motion system, and other control mechanisms are immediately shut off, while aborting all system operations.
Laser Safety Classification	Class 1 for material processing lasers Class 2 overall due to red laser pointer Can convert to Class 4 with optional Class 4 module
Safety Interlocks	A safety feature that disables the laser source when access doors are open as required by all major international safety standards.
Overtemperature Detection	A safety feature designed to disable all laser sources, home the motion system, and trigger an audible alarm in the event it detects an unusually high temperature in the laser processing area. Warning: All laser processing requires constant supervision while the laser system is in use; exposure to the laser beam may cause combustible materials to ignite, which may lead to a fire hazard.
Laser Blocking Laminated Safety Glass	A shatterproof multi-layer laminated safety glass with appropriate wavelength filter media. Meets laser safety requirements OD 5+ for 10.6 μm , 9.3 μm and 1.06 μm wavelength laser radiation.

Metal Enclosure with Labyrinth Seals	A design feature consisting of overlapping flanges that all enclosure doors or access panels must have to prevent direct line of sight into the enclosure, as required by international safety regulations.	
Fire Suppression*	A patented accessory that deploys fire suppressant into the laser material processing area if self-sustained combustion is detected. Warning: All laser processing requires constant supervision while the laser system is in use; exposure to the laser beam may cause combustible materials to ignite, which may lead to a fire.	
System External Dimensions	Width: 55.0 in. (1397 mm) Width with Touch Screen: 83.75 in. (2172mm)	Width: 71.0 in. (1803 mm) Width with Touch Screen: 99.75 in. (2534 mm)
	Depth: 46.50 in. (1181 mm)	Depth: 46.50 in. (1181 mm)
	Height: 48.0 in. (1219 mm) Width with Touch Screen: 54.12 in. (1375 mm)	Height: 48.0 in. (1219 mm) Width with Touch Screen: 54.12 in. (1375 mm) w/ Touch Screen
Weight	400 lbs. (182 Kg) Weight is approximate and varies with laser selection.	500 lbs. (228 Kg) Weight is approximate and varies with laser selection.
Power Requirements	220V-240V/16A	
Exhaust Requirements	Intelligent Air Filtration (UAC 4000) or External Exhaust Blower Capable of >700 CFM at 6 in. WG Static Pressure (1190 m3/hr. at 1.5 kPa) 6 in. (152mm) Exhaust Port	
Computer Requirements	Minimum: Intel I3 processor (or equivalent) with at least 8 Gb of memory, Windows 10 operating system, and connection to laser system with USB cable. Computer is not required if configured with optional 21" Touch Screen Control Panel	

Note: *Denotes Optional Feature

Disclaimers

1. Universal Laser Systems® reserves the right to change these specifications at any time, and without notification.
2. Normalized power density (watts/cm²) = power density coefficient x 103 x average laser power (watts). Normalized power density is the power of the material processing laser(s) divided by the area of the focal spot measured at 1/e².

Laser System Manager Control Software

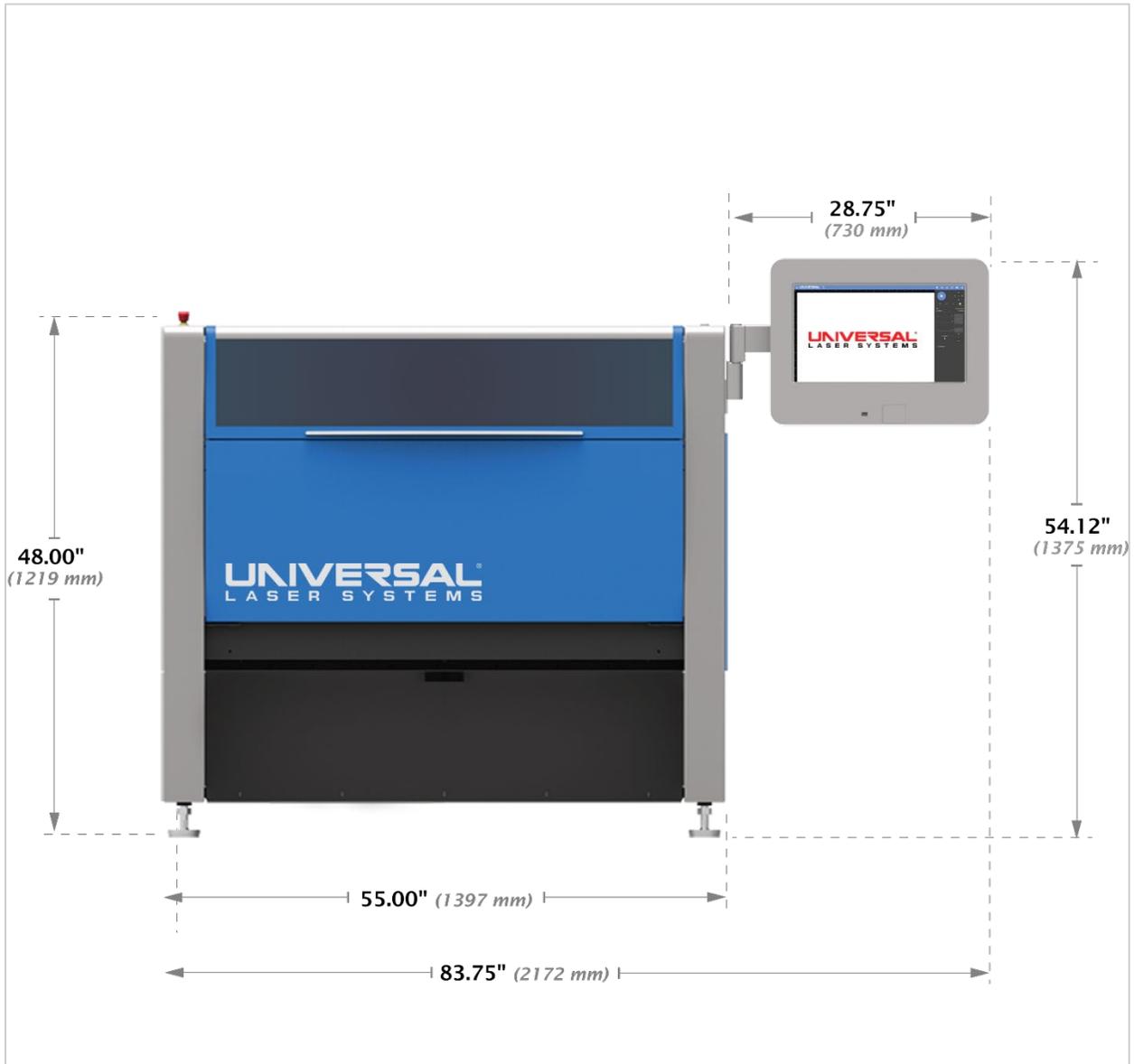
FEATURE	DESCRIPTION
Laser System Manager (LSM)	An advanced user interface with a high degree of functionality and control that allows users to efficiently manage design files and laser material processing parameters.
Intelligent Materials Database	A powerful and unique database that generates laser processing parameters for a wide variety of materials and laser system configurations. If the system configuration changes, the database automatically recalculates the parameter values.
Design File Relocation and Duplication Controls	A set of user controls to reposition or duplicate design files anywhere within the material processing field.
Multi-Camera Vision & Registration*	<p>A patent pending feature that provides an augmented reality user interface by superimposing design files on images of the material placed on the material support surface and captured by multiple cameras built into the laser system.</p> <p>The AR user interface facilitates precise alignment of design files using controls that allow the design file to be positioned, rotated and scaled with real time visual feedback made possible through advanced machine vision algorithms.</p> <p>This feature also supports traditional camera registration work flow using printed registration marks.</p>
True Width Raster Processing	A feature that eliminates the need for motion system over-travel beyond the edges of the raster image.
Vector Acceleration Control	A user adjustable control to define acceleration of vector motion for each control file.
Kerf Compensation	A user adjustable control that compensates for material width removed during laser cutting in order to achieve desired dimensions without changing the design file. It maintains true arc and circle geometry if present in the design.
Path Deviation Control	A user control to adjust the allowable deviation from the intended path to increase throughput.
Line Segment Reduction	A user control to reduce excessive line segmentation contained in some design files.
Industry Standard Interchange Format Support	A software feature that supports industry standard graphic interchange formats including DXF, PDF, and G-Code.
Flexible Connectivity	Enables remote design file transfer and monitoring over Ethernet or Wi-Fi via a web browser when optional 21" Touch Screen Control Panel is installed.
User Access Administration	A software administration feature for managing multiple user accounts and permissions.

ULTRA R Series Platform Dimensional Drawings



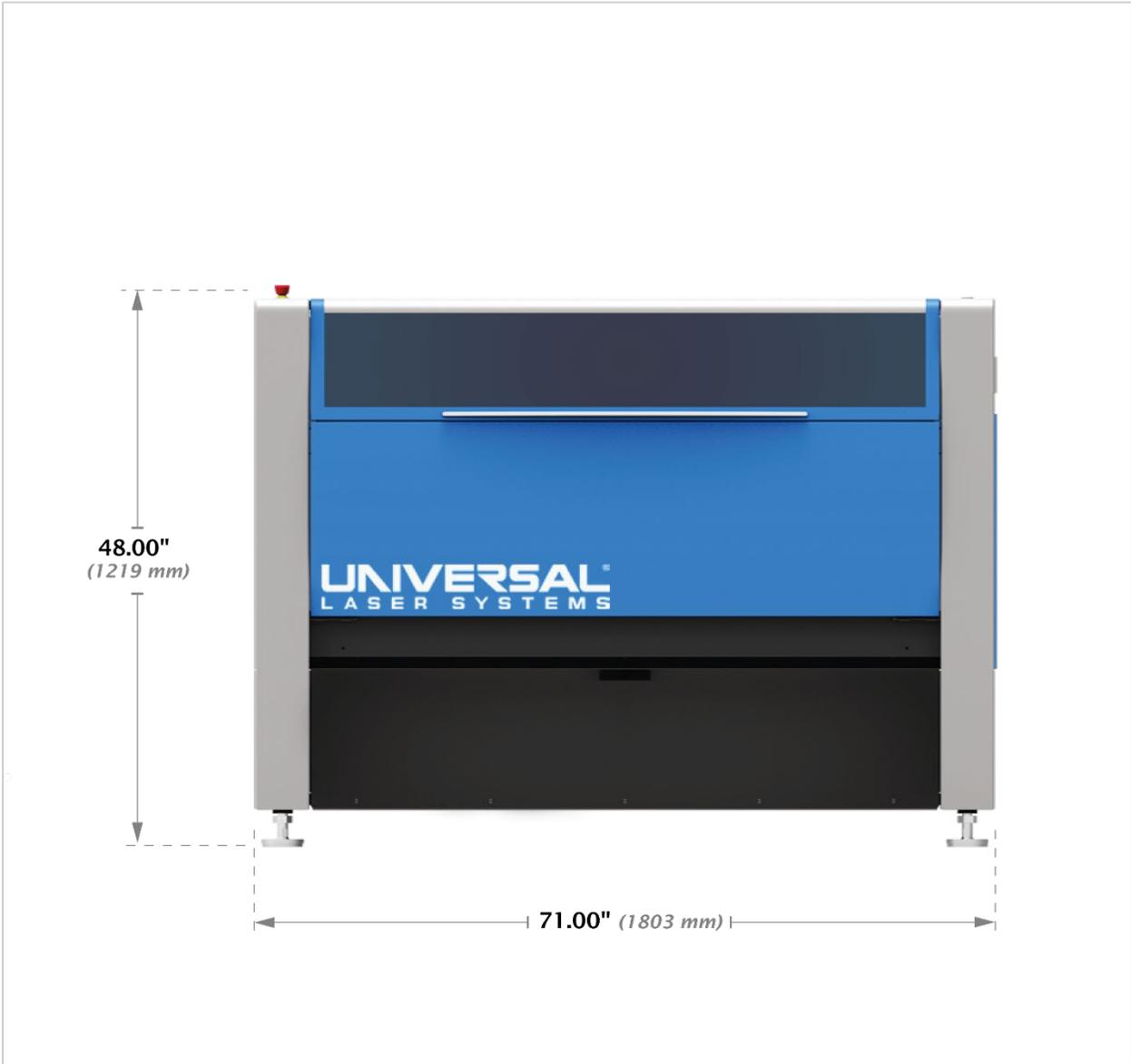
ULTRA R5000 Platform (Front View)

All dimensions are indicated in inches and millimeters.

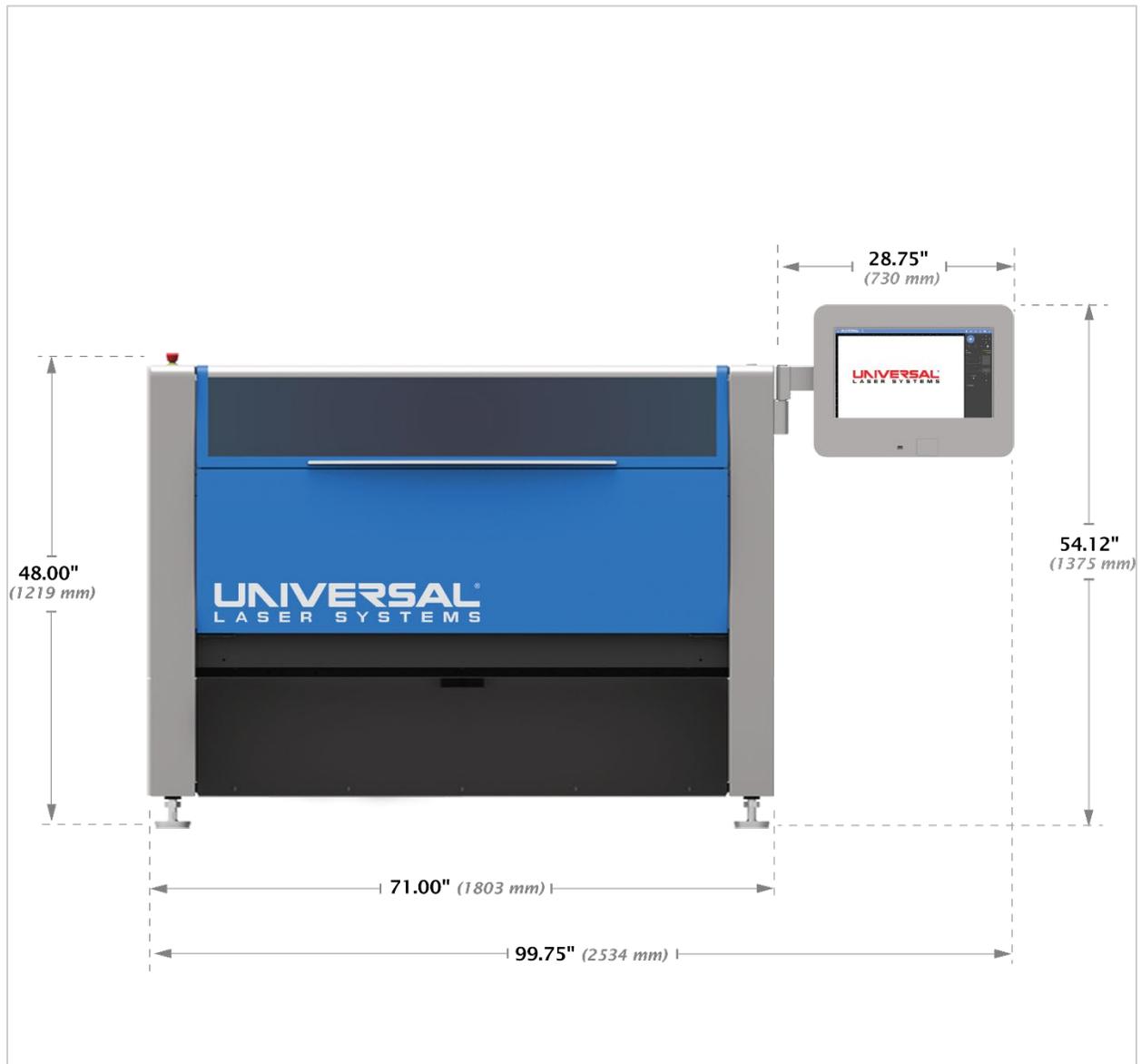


ULTRA R5000 Platform with optional Touch Screen Control Panel (Front View)

All dimensions are indicated in inches and millimeters.

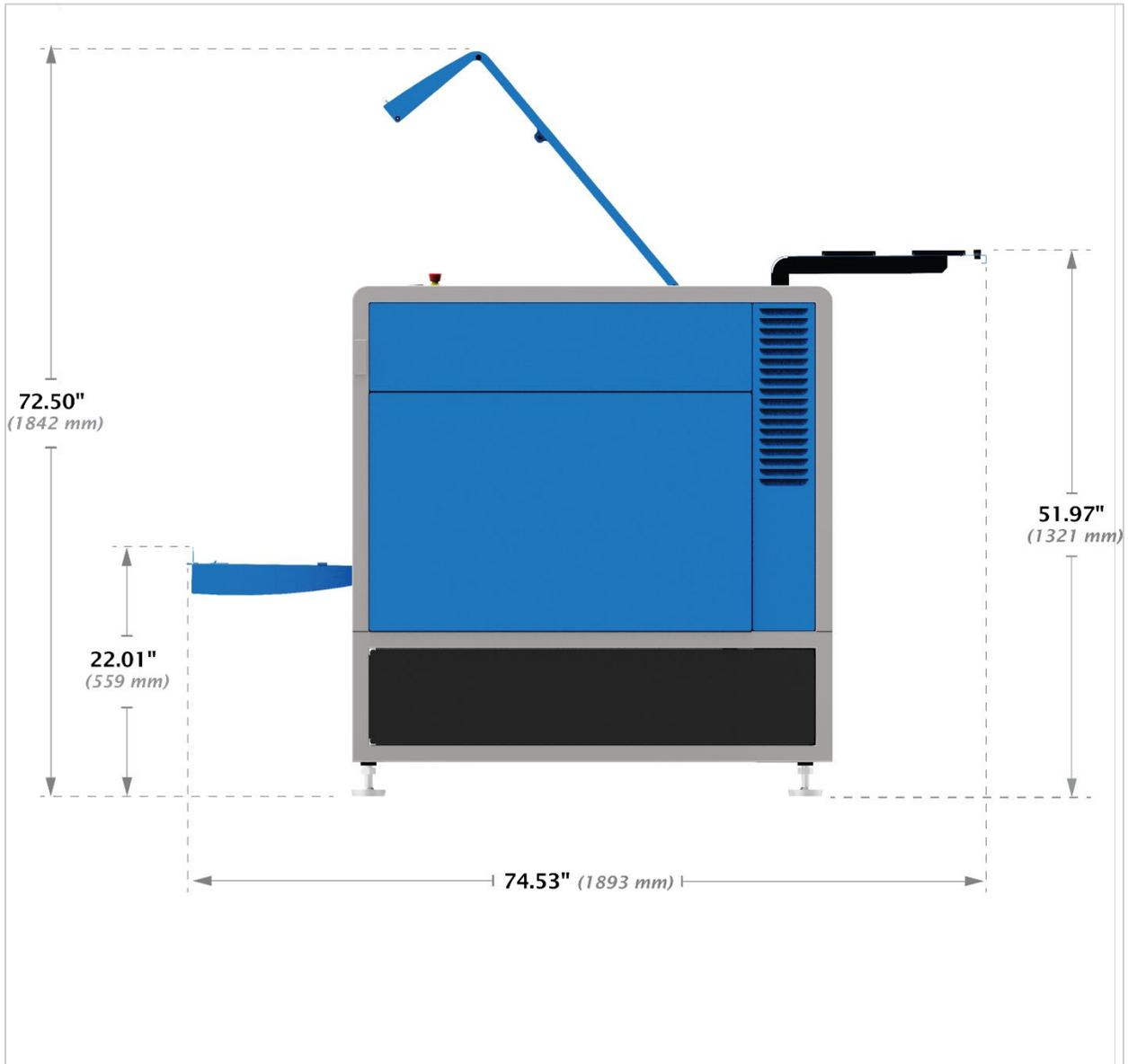


ULTRA R9000 Platform (Front View)
All dimensions are indicated in inches and millimeters.



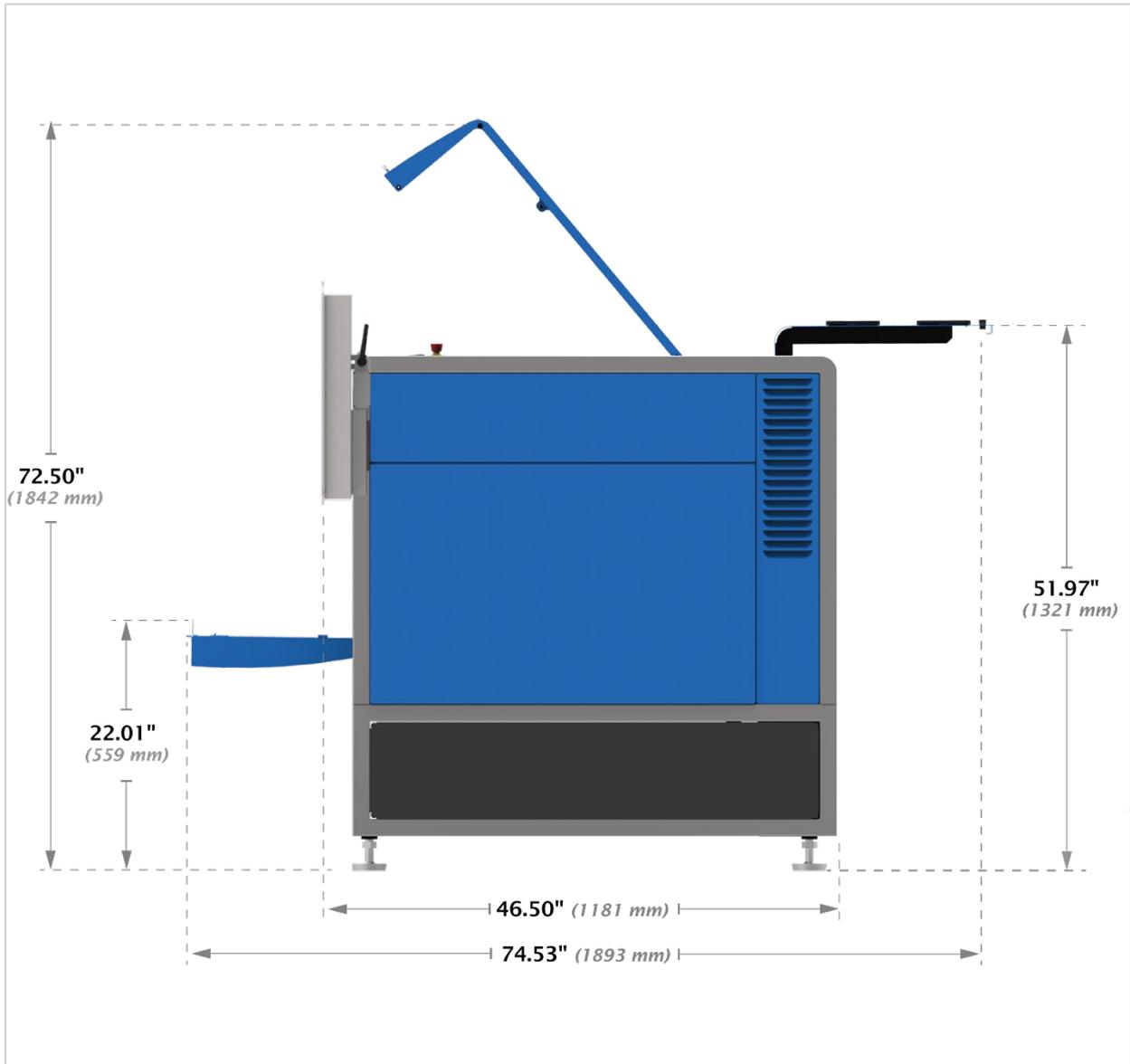
ULTRA R9000 Platform with optional Touch Screen Control Panel (Front View)

All dimensions are indicated in inches and millimeters.



ULTRA R5000 and R9000 Platform (Side View)

All dimensions are indicated in inches and millimeters.



ULTRA R5000 and R9000 Platform with optional Touch Screen Control Panel (Side View)

All dimensions are indicated in inches and millimeters.

DESCRIPTION OF APPROPRIATE USE

Designed for digital laser material processing (cutting, engraving, marking, surface modification), the ULTRA R5000 and R9000 platforms are suitable for use in an office, laboratory, workshop, or light-duty manufacturing environment. Materials to be processed must fit entirely inside the system for proper operation (Class 1 laser safety). If using the optional Class 4 Pass-Through module, refer to the Class 4 Pass-Through Laser Safety section of this user guide.

CAUTION: 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 (FDA) or other similar governmental entities.

General Safety

Use of the ULTRA R5000 and R9000 platforms in a manner other than described in this manual or failure to follow the operational instructions and safety guidelines listed in this manual can result in personal injury and may cause damage to the operator, the equipment, and the surrounding property. **Carefully read and observe the important safety information set out in this safety section before operating the equipment.** If you have any safety questions, please email the ULS Support Team at support@ulsinc.com.



EXPOSURE TO THE LASER BEAM CAN RESULT IN BURNS TO THE SKIN AND SEVERE EYE DAMAGE. Proper use and care of this system are essential to safe operation. Use of controls, adjustments, or performance of procedures other than those specified herein may result in exposure to hazardous laser radiation.

WHEN USING THE OPTIONAL CLASS 4 PASS-THROUGH MODULE, PROPER EYEWEAR MUST BE USED AT ALL TIMES WHEN THE BEAM INDICATOR IS ILLUMINATED ON CLASS 4 CONTROL PANEL. Eyewear must be properly certified for use with and protection from all material processing laser wavelengths in use (10.6 μm , 9.3 μm , and 1.06 μm , and at least an optical density 5+. If unsure of proper eyewear requirements, do not operate the laser system with Class 4 Pass-Through installed, and consult your certified Laser Safety Officer (LSO) or a ULS Service Team member for more information.



SOME MATERIALS CAN PRODUCE TOXIC AND CORROSIVE FUMES DURING LASER PROCESSING. Obtain the Material Safety Data Sheet (MSDS) from the manufacturer for every material to be processed in the laser system. The MSDS discloses all hazards when handling or processing a particular material.

DISCONTINUE PROCESSING ANY MATERIAL THAT CAUSES CHEMICAL BREAKDOWN OF THE LASER SYSTEM. Damage to the laser system such as rust, metal etching, or pitting, peeling paint, etc. from corrosive fumes is **NOT** covered under warranty.



NEVER LEAVE THE LASER SYSTEM UNATTENDED WHILE IN OPERATION. AN OPERATOR MUST BE PHYSICALLY PRESENT IN FRONT OF THE LASER SYSTEM AT ALL TIMES TO SUPERVISE LASER PROCESSING. Exposure to the laser beam may cause combustible materials to ignite, which may lead to fire. **A PROPERLY MAINTAINED FIRE EXTINGUISHER SHOULD ALSO BE KEPT ON HAND AT ALL TIMES.**

THE OPTIONAL FIRE SUPPRESSION MODULE DOES NOT NEGATE THE NEED FOR CONSTANT SUPERVISION OF ALL LASER CUTTING, MARKING AND ENGRAVING PROCESSES. Fire Suppression is intended to reduce or eliminate damage to the laser system due to sustained material combustion during laser processing resulting from improper setup or absence of constant operator supervision. It is not certified for life safety, nor is it intended as a replacement for certified fire suppression equipment required by local or national laws and regulations.



REMOVE ALL MATERIAL, INCLUDING SCRAP MATERIAL, FROM THE MACHINE AFTER EACH USE. Scrap material left in the laser system, including materials that collect in the Multifunction Material Support Structure, can become a fire hazard. **CAUTION WHEN HANDLING MATERIAL IMMEDIATELY AFTER LASER PROCESSING, THE MATERIAL MAY BE HOT.**



DANGEROUS VOLTAGES ARE PRESENT WITHIN THE ELECTRONICS ENCLOSURES OF THIS LASER SYSTEM. Access to these areas (marked with safety labels) is not necessary during normal operation. If it becomes necessary to open one of these enclosures, the laser system must first be disconnected from the power source.

NEVER REMOVE THE GROUND LEAD TO THE ELECTRICAL CORD AND PLUG THE LASER SYSTEM INTO A NON-GROUNDED OUTLET. Without proper grounding, a laser system is hazardous, can cause severe or fatal electrical shock, and may exhibit sporadic or unpredictable behavior. **ALWAYS PLUG A LASER SYSTEM INTO AN EARTHED OUTLET.**

THE POWER SUPPLY CORD IS THE LASER SYSTEM'S MAIN DISCONNECT DEVICE. THE EQUIPMENT SHOULD BE LOCATED NEAR AN EASILY ACCESSIBLE POWER OUTLET.

To disconnect the equipment from the supply mains, the power cord should be unplugged from the power outlet or main power inlet (appliance coupler).

THIS LASER SYSTEM IS DESIGNED AS A CLASS I, GROUP A, PLUGGABLE DEVICE.

It is also designed for connection to IT power systems. To satisfy European Standard EN 61000-3-11 for Voltage Fluctuation and Flicker, the ULTRA R5000 and R9000 laser systems must be connected to an AC supply with a low impedance ($Z_{max}=0.049$ OHMs) or less. End users may consult with a power supply authority to ensure their AC supply line impedance meets the requirements of EN 61000-3-11:2000 Annex B for low impedance connections.



DO NOT ATTEMPT TO MOVE OR LIFT THE LASER SYSTEM WITHOUT PROPER EQUIPMENT. The ULTRA R5000 and R9000 platforms should only be moved with the assistance of a forklift or a pallet jack. Before moving, ensure that the motion system and doors are secured. Do not attempt to move by hand. Injury may occur if improper lifting techniques are used or if the system is dropped. If unsure how to move the ULTRA platform, consult a professional rigging company or the ULS Factory Support Team at:

support@ulsinc.com.

Laser Safety

The ULTRA R5000 and R9000 platforms are designed to support both sealed carbon dioxide (CO₂) laser sources, which produce intense invisible infrared laser radiation at 10.6 μm and 9.3 μm wavelengths, and fiber laser sources that produce intense invisible infrared laser radiation at 1.06 μm wavelength. For optimal safety, all ULS lasers are enclosed within a Class 1 laser safety enclosure designed to completely contain CO₂ or fiber laser energy. This enclosure 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.

CAUTION: 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.

CAUTION: DO NOT OPERATE THE LASER SYSTEM WITH A DAMAGED VIEWING WINDOW, WITH ANY DOORS OPEN OR REMOVED (EXCEPT WHEN PROPERLY OPERATING AS CLASS 4), OR WITH ANY SAFETY INTERLOCKS MODIFIED OR DEFEATED.

- Laminated safety glass is employed in the viewing window to block 10.6 μm and 9.3 μm laser radiation from CO₂ lasers. This viewing window will block transmission of CO₂ laser radiation enabling safe observation of laser material processing. For laser systems configured with fiber lasers, a special blue tinted material is used in conjunction with the laminated safety glass to block both 10.6 and 9.3 μm CO₂ and 1.06 μm fiber laser energy. **DO NOT OPERATE THE LASER SYSTEM IF THE VIEWING WINDOW IS DAMAGED, OR WITH ANY OF THE DOORS REMOVED, OR IF ANY SAFETY INTERLOCKS ARE DEFEATED.**
- The intense light that appears during laser material processing is the product of material combustion or vaporization. **DO NOT STARE DIRECTLY AT THIS INTENSE LIGHT FOR LONG TIME PERIODS OR VIEW INDIRECTLY WITH OPTICAL INSTRUMENTS SUCH AS BINOCULARS OR MICROSCOPES.**
- This device also contains a visible, Class 2 red laser pointer to aid in material positioning. **DO NOT LOOK DIRECTLY INTO THE INTENSE LIGHT OF THE RED ALIGNMENT POINTER FOR LONG TIME PERIODS OR USE A REFLECTIVE SURFACE TO REDIRECT OR VIEW THE RED LASER LIGHT. NEVER ATTEMPT TO VIEW THE RED LASER LIGHT USING OPTICAL INSTRUMENTS SUCH AS BINOCULARS OR MICROSCOPES.**
- The access door(s) are safety-interlocked, which will prevent the material processing laser beam (CO₂ and fiber) from firing when an access door is opened. **THE RED LASER POINTER IS NOT SAFETY INTERLOCKED AND CAN BE ACTIVATED AUTOMATICALLY WITH THE DOORS OPEN OR CLOSED.**
- **DO NOT OPERATE THE LASER SYSTEM IF ANY OF THE BUILT-IN SAFETY FEATURES HAVE BEEN MODIFIED, DISABLED, OR REMOVED.** This may lead to accidental exposure to invisible CO₂ or fiber laser radiation, which can result in severe eye damage and/or burns to the skin.
- **ALWAYS USE CAUTION WHEN OPERATING A LASER SYSTEM.**

ULS Laser Sources

For safety reasons, ULS laser sources are not field-serviceable and are not to be disassembled by the user. All Universal Laser Systems laser sources bear tamper-evident devices to prevent disassembly. Damage to the tamper-evident devices may void the laser source warranty. If a ULS laser source needs service, contact the ULS Support Team at support@ulsinc.com.

Laser System Owner Responsibility and Safety Measures

The "Owner" of a laser system is the individual or entity who maintains ultimate control over and rights to the product and is fundamentally responsible to ensure the safe use of lasers owned by, and/or operated in facilities under their control. This includes the establishment and maintenance of an adequate program for the control of laser hazards.

Many of the mandatory safety measures are outlined in *ANSI Standard Z136.1 American National Standard for the Safe Use of Lasers* or in similar standards in most foreign countries, such as *the European Standard EN 60825-1*. State and local authorities may require other safety measures, for example, *Regulation BGV B2 for Safe Laser Usage* put forth by the German Employer's Liability Insurance Association. It is the responsibility of the Owner to understand and adhere to these laws.

Laser Safety When Using Class 4 Pass-Through

The ULTRA R5000 and R9000 laser systems are equipped with interlocked access panels on either side of the unit. An Optional Class 4 Pass-Through Module is available to enable the user to operate the laser system with the side access panels open by bypassing their safety interlocks. With this optional device in place, the protective system housing will not fully contain the infrared laser radiation produced by the laser source(s), creating the potential for exposure to laser energy. Use of this optional device redefines the safety classification of the ULTRA R5000 and R9000 laser systems from Class 1, considered safe for use under all conditions of normal use, to Class 4, considered potentially hazardous.

EXPOSURE TO THE LASER MATERIAL PROCESSING BEAM CAN RESULT IN BURNS TO THE SKIN AND CAN CAUSE SEVERE EYE DAMAGE. Proper use and care of this system are essential for safe operation. Use of controls or adjustments or performance of procedures other than those specified herein may result in exposure to hazardous laser radiation



WHEN USING OPTIONAL CLASS 4 PASS-THROUGH, PROPER EYEWEAR MUST BE USED AT ALL TIMES WHEN THE BEAM INDICATOR IS ILLUMINATED ON THE CLASS 4 CONTROL PANEL. Eyewear must be properly certified for protection from all material processing laser wavelengths in use (10.6 μm , 9.3 μm , and 1.06 μm) and must be at least optical density 5+. If unsure of proper eyewear requirements, do not operate the laser system with Class 4 Pass-Through installed and consult your certified LSO or contact ULS Support Team.

When operating in Class 4 mode, with the side access door(s) open, the system housing can no longer fully contain flames or by-products from potential ignition of the materials being processed. Additional safety precautions may be necessary. It should also be noted that reflected infrared laser radiation that escapes the housing of a laser system operating in Class 4 mode can cause ignition of nearby flammable materials.

When operating in Class 4 mode, the environment around the laser system should be carefully organized to ensure that there are no flammable materials in its immediate vicinity.

Mandatory safety measures set by national and international laws and standards exist that must be complied with when operating a Class 4 laser system. Certain safety measures are provided by the manufacturer and incorporated into the optional Class 4 Pass-Through module while other operational safety measures are the responsibility of the ULTRA R5000 and R9000 laser system Owner.

MANUFACTURER PROVIDED CLASS 4 SAFETY MEASURES

- **Remote Interlock Connection** – A means of remotely connecting to the interlock circuit of the laser system enabling the connection of remote switches for deactivating the laser source. This feature can be used to connect an interlock switch to the doors of the designated room in which the laser system will be operated so that the laser source is automatically deactivated when the side access panels are opened.
- **Key Control** – A removable key that prevents unauthorized operation of the laser system.
- **Laser Radiation Emission Warning Device** – A visible warning light that indicates when the laser system is capable of emitting laser radiation.
- **Attenuator** – A mechanical device to block emission of laser radiation. This device takes the form of a mechanical shutter opened and closed by the key control.
- **Class 4 Warning Label** – A Class 4 warning label to indicate the laser system is classified as Class 4.

OWNER PROVIDED CLASS 4 SAFETY MEASURES

THESE SAFETY MEASURES ARE THE RESPONSIBILITY OF THE OWNER AND ARE MANDATORY FOR OPERATION OF CLASS 4 LASER SYSTEMS UNDER FEDERAL AND STATE LAW IN THE UNITED STATES AS WELL AS UNDER THE LAWS OF MOST FOREIGN COUNTRIES.

A brief synopsis of the most common safety requirements addressed to Owners of Class 4 laser systems is outlined below:

- In any facility in which a Class 4 laser system is operated, the owner must designate a Laser Safety Officer (LSO) who will assume the authority and responsibility to monitor and enforce the control of laser hazards. The LSO should be trained in laser safety and be aware of all safety measures set by law. There are many avenues available to acquire this training. Recognized sources of this training are the Laser Institute of America (www.laserinstitute.org), the Employer's Insurance Liability Associations in European countries, or laser safety associations within the Owner's country/territory.
- The LSO will be responsible for creation of a controlled area in which the Class 4 laser system will be operated. A controlled area is designed to fully contain laser radiation that can potentially escape from a Class 4 laser system, with measures in place to prevent unauthorized personnel from entering the area, including lighted warning signs and interlocks on all entryways.
- The LSO will be responsible for designating and training all personnel authorized to operate, maintain, or service a Class 4 laser system. It will also be the responsibility of the LSO to take measures to inform and to restrict all unauthorized personnel from access to a Class 4 laser system.
- The LSO will be responsible to identify and provide all authorized personnel any protective equipment such as specially designed eyewear and clothing needed when operating, maintaining, or servicing a Class 4 laser system.

- The LSO will ensure that no juveniles operate the laser.
- The LSO will regularly audit all safety measures including: regular retraining of authorized personnel, serialization and regular inspection and replacement of all special eyewear and clothing, and monitoring of all safety measures surrounding the controlled area in which a Class 4 laser system is operated. The LSO may be required to maintain records as necessary to prove compliance.
- The LSO will be responsible for regular medical surveillance of all authorized personnel operating a Class 4 laser system. For example, this may include but is not limited to, mandatory annual eye exams.
- Class 4 lasers systems must not be used at trade shows or exhibitions.

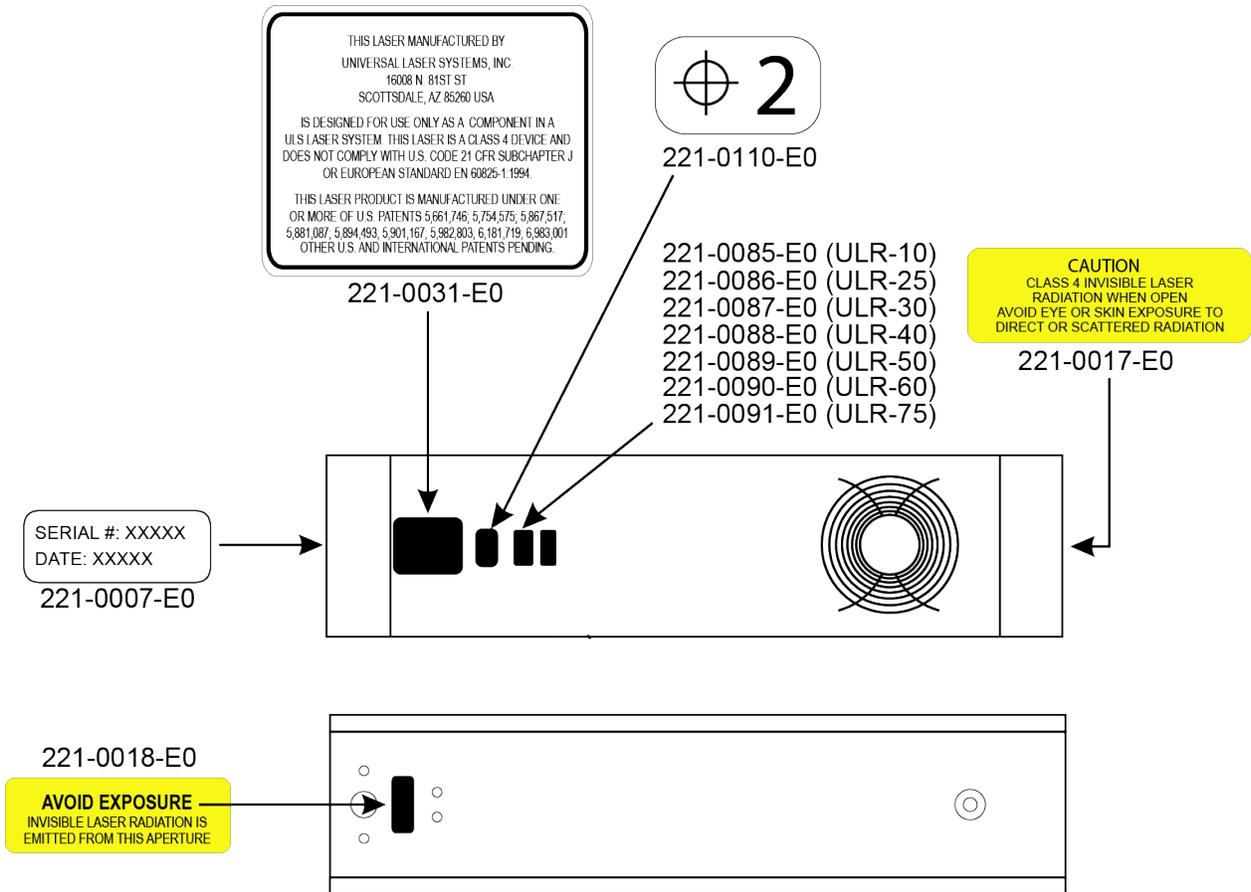
The above list is not to be considered all-inclusive. Other mandatory safety measures may be applicable and will vary from state-to-state and country-to-country. **IT IS THE RESPONSIBILITY OF THE OWNER OF A CLASS 4 LASER SYSTEM TO IDENTIFY AND COMPLY WITH ALL PERTINENT REGULATIONS.**

In some states, for example, anyone wishing to operate a Class 4 laser system must register with the state radiation regulatory agency, pay annual fees, and submit to annual inspections. There may be penalties involved for non-compliance. The United States Occupational Safety and Health Administration (OSHA) has also adopted rules for safe use of lasers in the workplace. The LSO must comply with all rules and regulations set by law.

To reiterate, the safety measures relating to operation of a Class 4 laser system are mandatory under Federal and State law in the United States as well as in most foreign countries. If an owner is unable or unwilling to comply with all safety measures required for safe operation of a Class 4 laser system, the optional Class 4 Pass-Through module must not be used.

Laser System Safety Labels

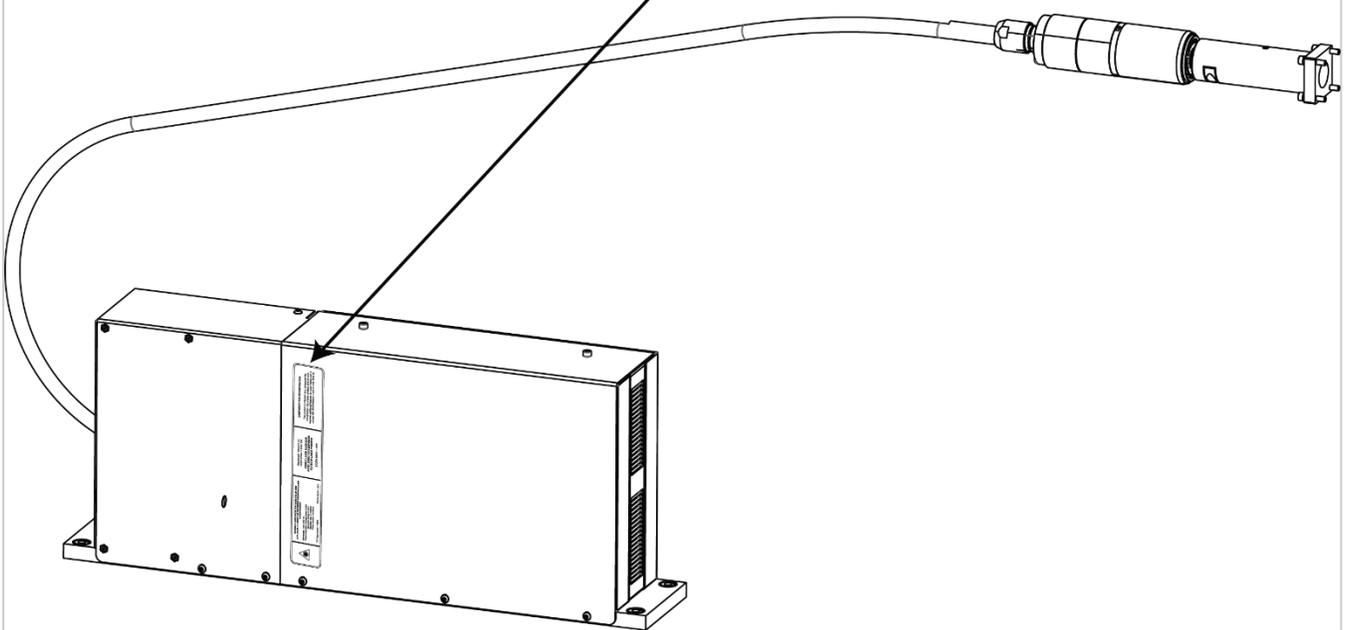
CDRH and CE regulations require that all laser manufacturers affix warning labels in specific locations throughout the equipment. Do not remove these labels for any reason. If the label(s) become damaged or have been removed for any reason, do not operate the laser system and immediately contact the ULS Support Team for replacements at support@ulsinc.com.



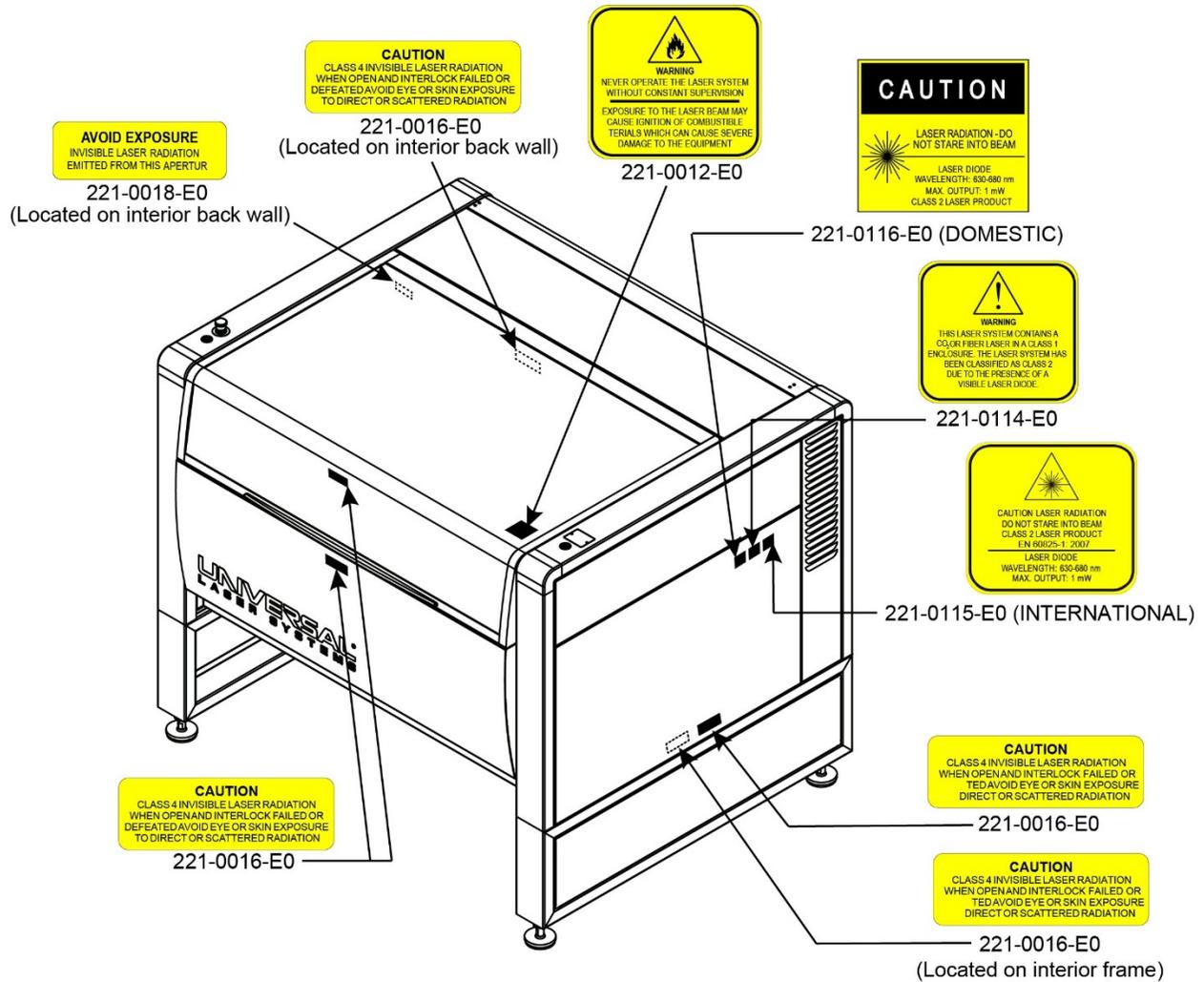
ULS CO₂ Laser Source Safety Labels

	<p>INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS4 LASER PRODUCT</p> <p>Wavelength: 1040-1200 nm Pulsed output-Max average power <120W Max pulse energy <2.0mJ Repetition freq. 1-1000kHz Pulse duration 1ns-500ns</p> <p>CW Output power < 120W EIC/EN 60825-1: 2007</p>	<p>Wavelength: 630-670 nm Output power < 5mW CW</p> <p>VISIBLE LASER RADIATION AVOID DIRECT EYE EXPOSURE CLASS 3R LASER PRODUCT</p> <p>EIC/EN 60825-1: 2007</p>	<p>COMPONENT FOR INCORPORATION</p> <p>This product is intended as a component for incorporation into a laser product, and as such requires additional features for Laser Safety and to comply with IEC/EN60825-1 and 21CFR 1040.10</p>
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SPI FiberLaser Label
(comes with laser sources from SPI)



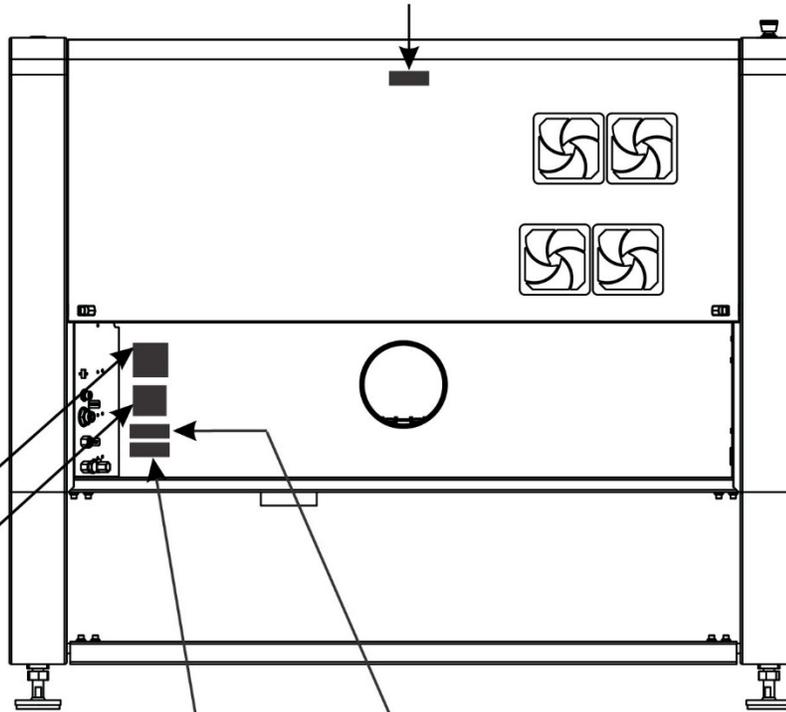
ULS Fiber Laser Source Safety Label



ULTRA R5000 and R9000 Platforms Safety Labels (Isometric Side View)

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 (4 PLACES)



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 PRODUCT IS MANUFACTURED UNDER ONE
 OR MORE OF U.S. PATENTS 5,661,746; 5,754,575;
 5,867,517; 5,881,087; 5,894,453; 5,901,167; 5,952,853; 6,181,719;
 6,313,433; 6,342,687; 6,423,926; 6,424,670; 6,983,001;
 D617,474; 7,060,584; 7,715,454; 7,723,538; 7,947,919
 OTHER U.S. AND INTERNATIONAL PATENTS PENDING.

221-0065-E0

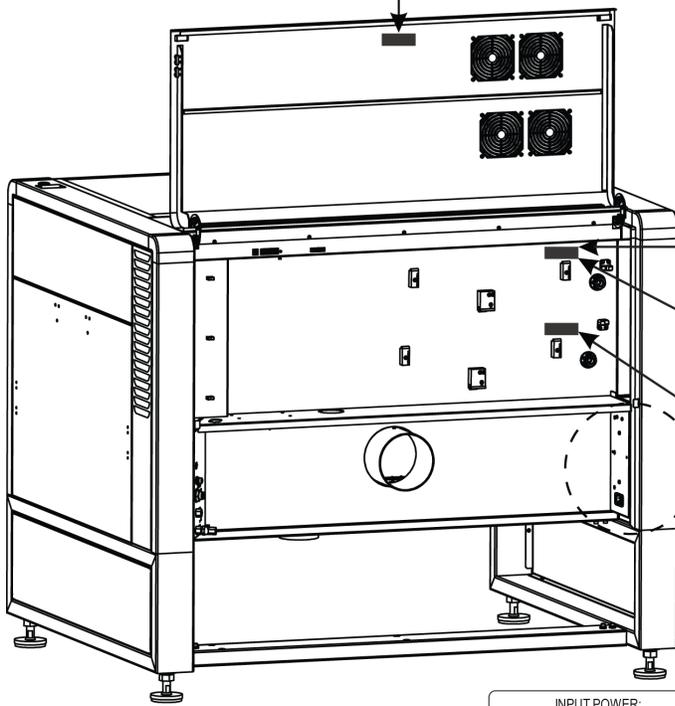
THIS EQUIPMENT CONFORMS
 TO PROVISIONS OF
 US 21 CFR 1040.10
 AND 1040.11

221-0015-E0
 (DOMESTIC ONLY)

ULTRA R5000 and R9000 Platforms Safety Labels (Rear View)

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 (2 PLACES)

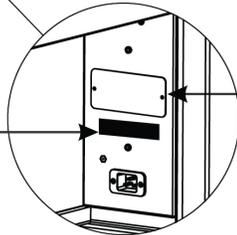


9.3 micron laser only FOR:
 131-1052-00
 221-0145-E0

10.6 micron laser only FOR:
 131-1051-00
 221-0144-E0

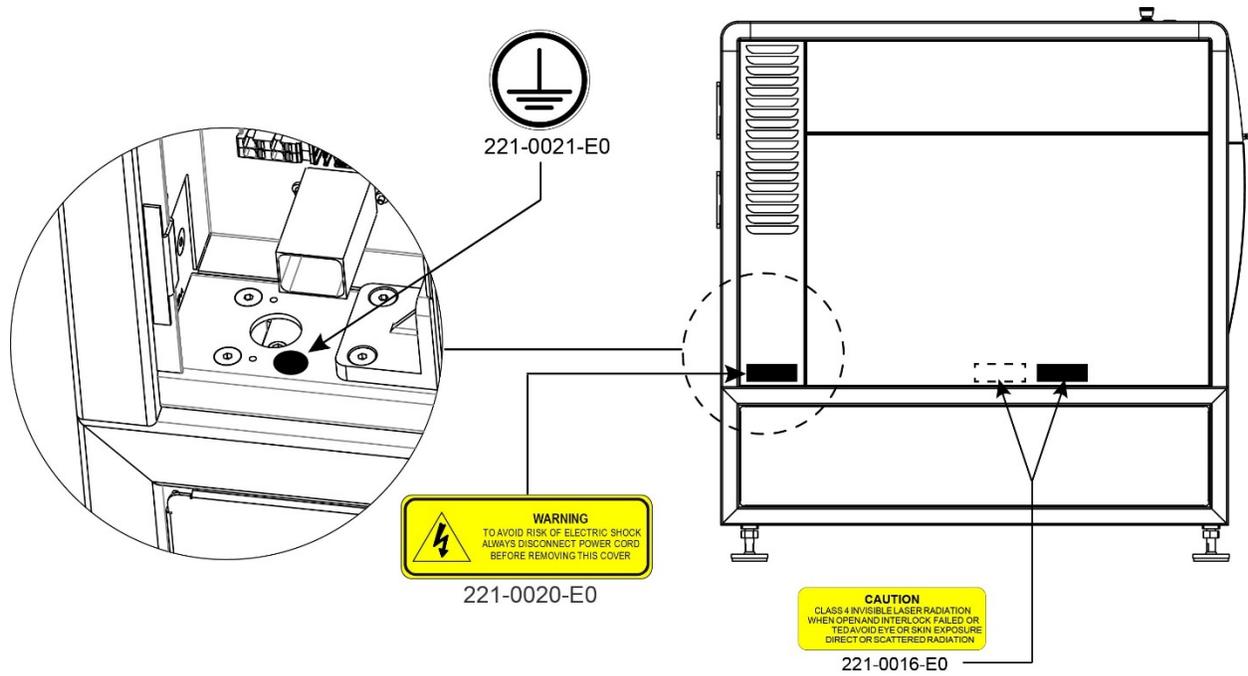
9.3 or 10.6 micron laser FOR:
 131-1051-00
 131-1052-00
 221-0143-E0

INPUT POWER:
 230 VAC; 50/60 Hz; 15 A
 221-0024-E0

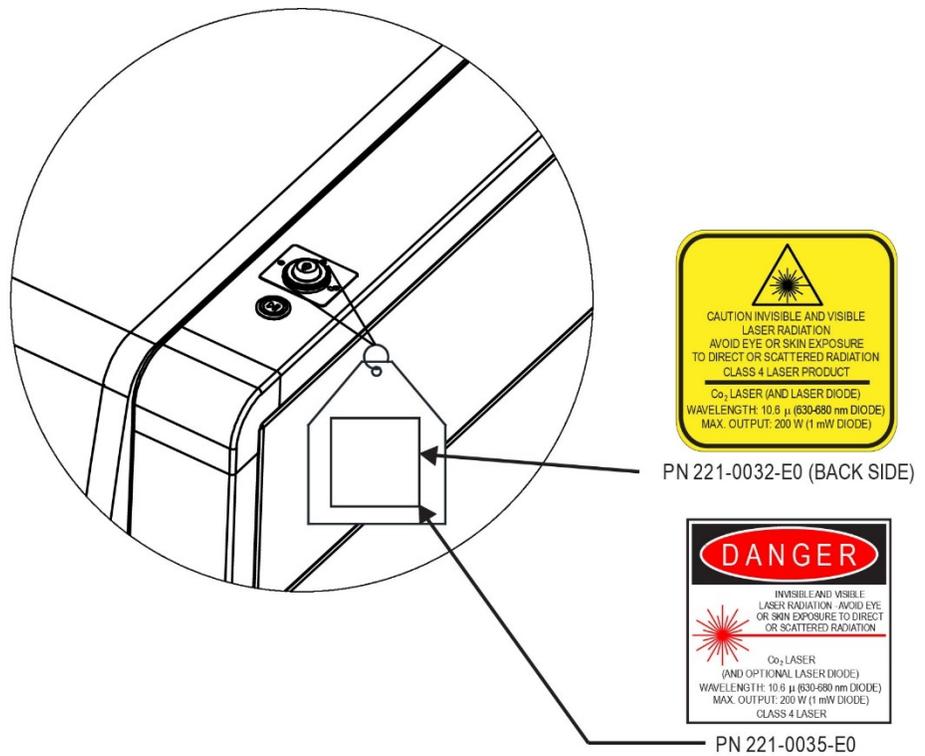


UNIVERSAL
 LASER SYSTEMS
 MANUFACTURED: JANUARY 2010
 www.ulslinc.com
 © 2010 Universal Laser Systems, Inc. All rights reserved. Universal Laser Systems logo and name are registered trademarks of Universal Laser Systems, Inc.
 Made in USA
 CE
 221-0002-E0

ULTRA R5000 and R9000 Platforms Safety Labels (Rear View with laser cover open)



ULTRA R5000 and R9000 Platforms Safety Labels (Left View)



Class 4 Pass-Through Safety Labels

EU Declaration of Conformity



Product Identification: ULTRA R5000 and R9000 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 is in conformity with the following directives:

2014/30/EU (EMC Directive)
2014/35/EU (Low Voltage 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 60950-1: 2013
EN 60825-1: 2014 (Class 2)

EMC:
EN 61000-6-2: 2019
EN 61000-6-4:2007 (Class A)
EN 61000-3-2: 2006 (Class A)
EN 61000-3-3: 2008
EN 61000-4-2: 2008
EN 61000-4-3: 2006
EN 61000-4-4: 2012
EN 61000-4-5: 2014
EN 61000-4-6: 2013
EN 61000-4-8: 2009
EN 61000-4-11: 2004
CISPR 11:2009

Note: This is a sample Declaration of Conformity. The importer of this equipment supplies a signed declaration of conformity.

CAUTION: 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 corrective measures.

FCC Compliance Statement and Warnings

This ULS laser system has been tested and found to comply with the 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:

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

1. This device may 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 is found to comply within 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 the 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.

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

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

CDRH Compliance

This device is specifically designed to comply with CDRH performance requirements under 21 CFR 1040.10 and 1040.11, and 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 uses other than those specified by Universal Laser Systems, Inc.

Recycling



By placing this 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, we urge consumers to recycle this product and its accessories. Universal Laser Systems is equipped to recycle any of its electronic products and accessories and will assist our customers with their recycling options.

To recycle a ULS product or accessory, please email the ULS Service Support Team at support@ulsinc.com.

Meet the ULTRA R Series Platforms 3



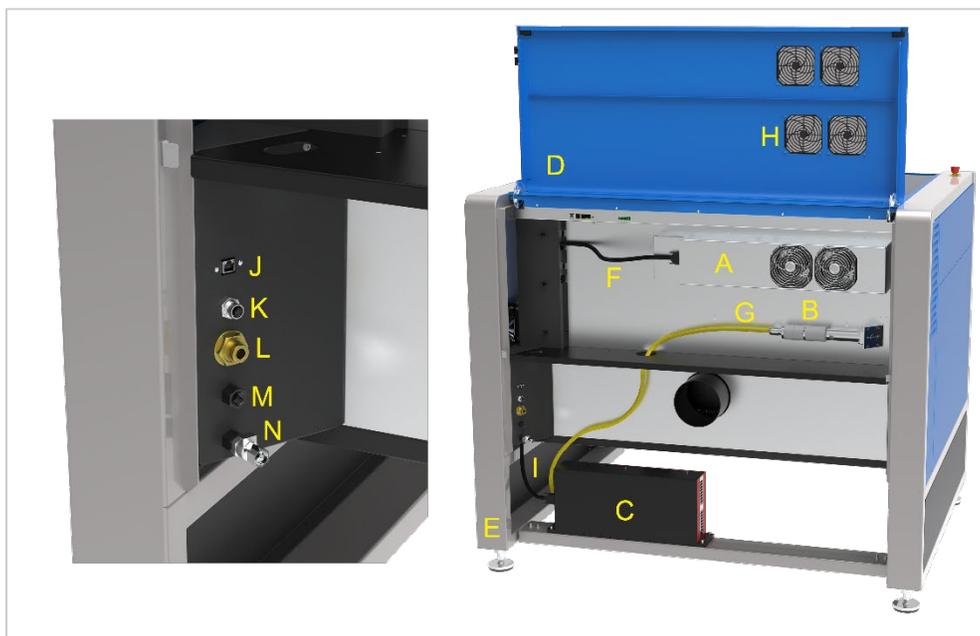
THE ULTRA R5000 AND R9000 PLATFORMS (FRONT VIEW)



	FEATURE	DESCRIPTION
A	Top Door	Enables safe viewing of the laser process and materials loading.
B	Front Door	Provides access to easily load large materials and fixtures and to clean the debris tray in the multifunction material support structure.
C	Touch Screen Control Panel	Optional accessory that provides operational controls.
D	Emergency Stop (E-Stop)	Instantly de-energizes the system when depressed. USE THIS BUTTON IN CASE OF EMERGENCY ONLY. To reset the system after executing an E-Stop, twist the red button clockwise until it releases then press the On/Off Button to turn the system back on.
E	On/Off Switch	Serves as the main power switch for the laser system. Press once to power on and press a second time to turn the laser system off.
F	Beam Delivery System	Positions the carriage in the laser processing field.
G	Carriage	Contains the final focusing optic, autofocus sensor, and the camera.

H	Multifunction Material Support Structure	Holds the material in place during laser material processing, supports the elevating pins and aluminum tiles and provides vacuum hold-down. The support surface also provides motorized adjustment with 12 in. (305 mm) of travel to accommodate materials of different thicknesses.
I	ULS Air Compressor	Optional accessory that provides clean, dry, and oil-free compressed air for optics protection and computer-controlled gas assist.
J	Vacuum Booster	Optional accessory that provides vacuum hold-down functionality for the multi-function material support structure.

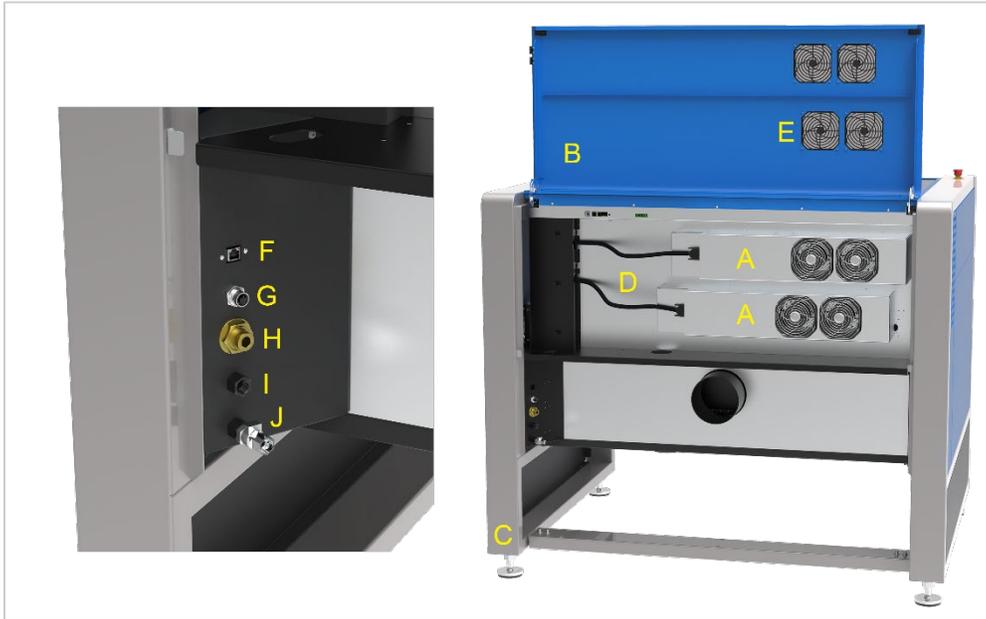
THE ULTRA R5000 AND R9000 PLATFORMS (REAR VIEW)



	FEATURE	DESCRIPTION
A	CO ₂ Laser Sources	Provides 10.6 μm and/or 9.3 μm wavelengths of CO ₂ laser radiation for material processing.
B	Fiber Laser Source Collimator	Collimates the laser beam from fiber laser source.
C	Fiber Laser Source	Provides 1.06 μm wavelength of laser radiation for material processing.
D	Laser Cover	Provides access to the Laser Source(s). This cover is interlocked, meaning the laser system will not fire while it is open. This cover also provides access to some connection ports on the ULTRA CPU.
E	Vibration Dampening Leveling Feet	Supports the laser system and provides four-point laser system leveling.
F	CO ₂ Laser Source Cable	Provides power and signal to the CO ₂ Laser Sources.
G	Fiber Laser Delivery Cable	Delivers the fiber laser beam from the fiber laser source to the fiber laser collimator through a ruggedized optical fiber.
H	Removable Laser Fan Filters	Prevents dust and debris from entering the laser cooling fans.
I	Fiber Laser Source Cable	Provides power and signal to the Fiber Laser Sources.
J	Ethernet connection	(Optional) Allows ULTRA R lasers systems with the optional embedded control panel to be connected to external networks.
K	Fire Suppression Electrical connection	Communicates with optional fire suppression module.
L	Fire Suppression Suppressant Connection	Connects the suppressant supply from optional fire suppression module to the laser system.

M	Gas Assist- Gas Connection	Allows compressed air to be connected to the ULTRA R laser system for gas assisted laser processing.
N	Gas Assist-Air Connection	Allows compressed gas to be connected to the ULTRA R laser system for gas assisted laser processing.

THE ULTRA R5000 AND R9000 PLATFORMS (REAR VIEW)



	FEATURE	DESCRIPTION
A	CO ₂ Laser Source(s)	Provides 10.6 μm and/or 9.3 μm wavelengths of CO ₂ laser radiation for material processing.
B	Laser Cover	Provides access to the Laser Source(s). This cover is interlocked, meaning the laser system will not fire while it is open. This cover also provides access to some connection ports on the ULTRA CPU.
C	Vibration Dampening Leveling Feet	Supports the laser system and provides four-point laser system leveling.
D	CO ₂ Laser Source Cables	Provides power and signal to the CO ₂ Laser Source(s).
E	Removable Laser Fan Filters	Prevents dust and debris from entering the laser cooling fans.
F	Ethernet Connection	(Optional) Allows ULTRA R lasers systems with the optional embedded control panel to be connected to external networks.
G	Fire Suppression Electrical Connection	Communicates with optional fire suppression module.
H	Fire Suppression Suppressant Connection	Connects the suppressant supply from optional fire suppression module to the laser system.
I	Gas Assist- Gas Connection	Allows compressed air to be connected to the ULTRA R laser system for gas assisted laser processing.
J	Gas Assist-Air Connection	Allows compressed gas to be connected to the ULTRA R laser system for gas assisted laser processing.

ULTRA R5000 AND R9000 PLATFORM CONNECTIONS (UNDER REAR LASER COVER)



	FEATURE	DESCRIPTION
A	USB Connection	The communication connection between the laser system and the user's computer. If the optional control panel is installed, the control panel will be plugged into this connection port.
B	Accessory Connection Point 1	Communications port for connecting with laser system accessories such as the optional ULS Air Compressor, the optional UAC 2000/4000, and the optional Vacuum Booster.
C	Accessory Connection Point 2	Communications port for connecting with laser system accessories such as the optional ULS Air Compressor, the optional UAC 2000/4000, and the optional Vacuum Booster.
D	SD Card Slot	A slot in the system for access to the SD card. This card contains the laser system configuration and should not be removed.
E	Excessive Temperature Alarm Test Button	This button allows the user to test the audible alarm that is triggered when the temperature sensors in the laser processing area detect excessive temperatures potentially caused by material fires.
F	Remote Interlock Connection	Provides a connection point for user-provided external interlock devices when operating in Class 4 mode. Typically used to prevent laser system operation when user-provided laser barriers or room doors are open.

Remote interlock pinout and function:

Pin	Name	Description
1	+24VDC EXT I-LOCK	Remote interlock (main loop): connect to a door switch or other external interlock device (jumper when not in use) both loops must be closed to enable laser
2	EXT I-LOCK GND	

3	+24VDC EXT I-LOCK	Remote interlock (secondary loop): connect to a door switch or other external interlock device (jumper when not in use) both loops must be closed to enable laser
4	EXT I-LOCK GND	
5	Not connected	Not used
6	Not connected	

NOTE: For connecting remote interlocks to the ULTRA X use the provided Amphenol screw terminal connector PN TJ0631530000G. Jumpers must be in place if not used for remote interlock connections.

Software Installation

ULTRA R laser systems purchased without the optional embedded control panel will require a dedicated computer in order to operate. This computer must be attached to the laser system USB port located on the back of the laser system under the rear laser cover. The Laser System Manager Software (LSM) must be installed on this computer. Follow the instructions below to install the LSM on the PC attached to the laser system. Both Mac and Windows 10 PCs are supported.

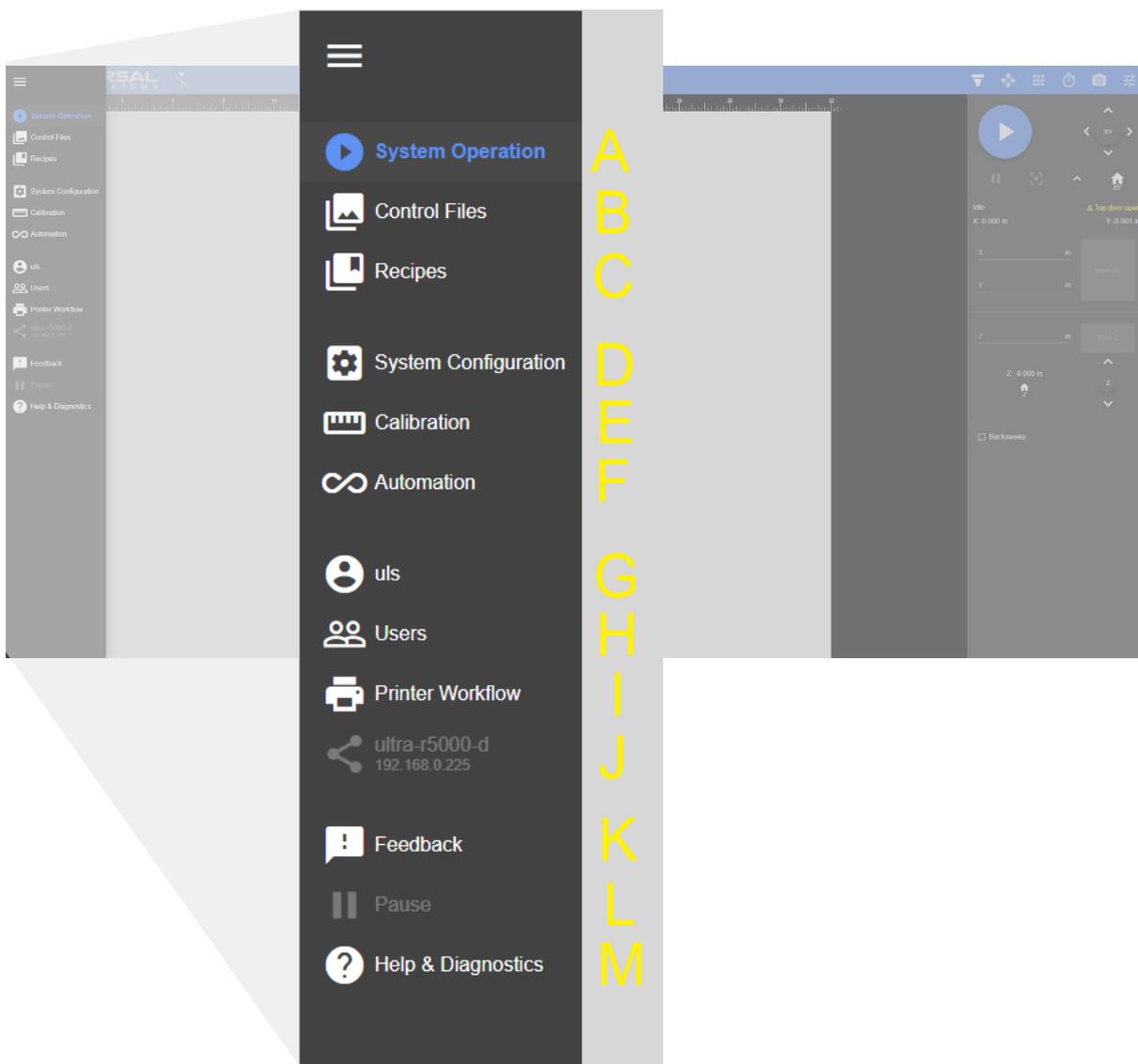
1. Locate the serial tag on the inside of the front door of the laser system. The set of letters and numbers at the beginning of the serial number before the series of X's indicate the product family and model of your laser system (e.g., UR5000, UR9000, UX6000).
2. Download the Installation Software and product family User Guide for your laser system at www.ulsinc.com/support/technical-downloads.
3. Run the Installation Software on your computer and follow the on-screen prompts.

Laser System Manager Overview

The LSM (Laser System Manager) is the software interface used to control the ULTRA R Series laser systems, manage control files, setup processes, etc. The following Quick Reference Guide provides a brief overview of the functionality of the LSM.

Main Menu

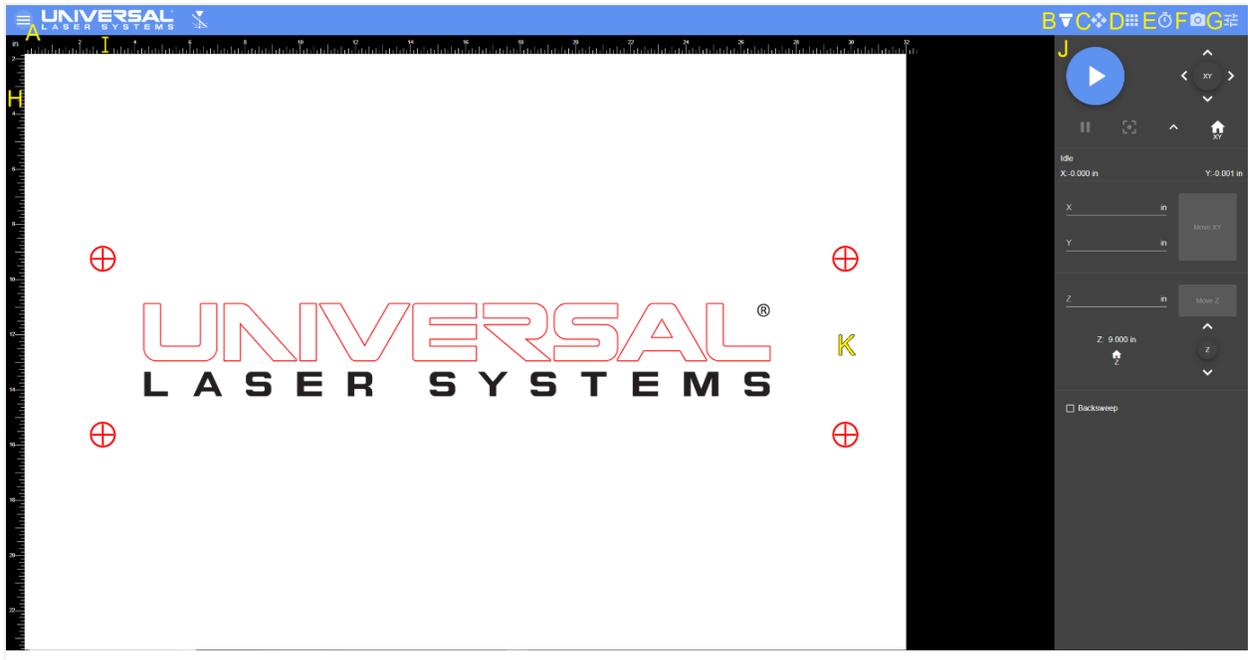
The Main Menu of the LSM is accessible by pressing the *Main Menu Button*, three horizontal lines in the upper left-hand corner of the LSM. It provides quick access to a wide variety of software features. Most of the items accessible from this menu open a new page of the LSM software.



	FEATURE	DESCRIPTION
A	Systems Operation Page	Opens the <i>System Operation Page</i> to control the laser system setup control files, adjust settings, etc. This page is the default page for the LSM.
B	Control File Page	Opens the <i>Control File Page</i> to manage the queue of control files stored in the LSM and to import new files.
C	Recipes Page	Opens the <i>Recipes Page</i> to access a list of all of the 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	Opens the <i>System Configuration Page</i> to adjust general system and software settings such as the laser diode behavior, the LSM units, and the Z Axis speed setting.
E	Calibration Page	Opens the <i>Calibration Page</i> to access a series of <i>wizards</i> and <i>dialogs</i> to aid in system calibration.
F	Automation Page	Opens the <i>Automation Page</i> to configure the automation ports.
G	User Detail Page	Opens the <i>User Details Page</i> where a currently logged in user may change their passwords and view their operational permissions.
H	User Management Page	Opens the <i>User Management Page</i> where users may be added, removed, and configured.
I	Printer Workflow Download	When viewed from a remote computer, select this option to initiate the download of a <i>Printer Driver</i> which, once installed, will enable a user to print their design files directly to the system over the network.
J	Network Management Page	Opens the <i>Network Management Page</i> where the wired and wireless networks of the laser system may be configured (only valid when optional control panel is present).
K	Feedback Page	Opens the <i>Feedback Page</i> where users can submit reports of software errors directly to ULS for review (requires an internet connection).
L	Pause System	Pauses the laser system for both convenience and safety. This pause control is needed for safety if the user becomes logged out of the system while the system is processing material.
M	Help & Diagnostics Page	Opens the <i>Help & Diagnostics Page</i> , which contains information regarding the system's state, provides access to <i>Remote Diagnostics</i> , and enables the user to update the LSM software.

System Operation Page

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



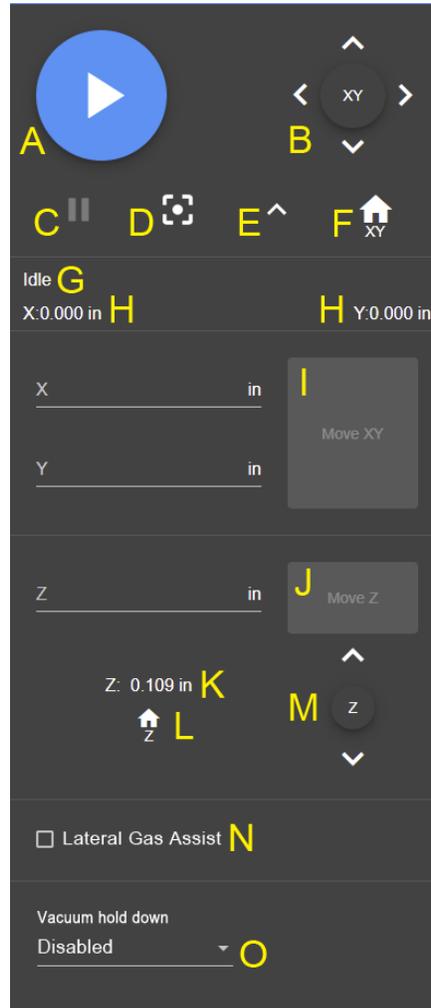
The system controls screen

	FEATURE	DESCRIPTION
A	Menu Button	Opens the <i>Main Menu</i> on the left-hand side of the LSM. While opened, no other buttons will be enabled. For further details, refer to the <i>Main Menu</i> section of this manual.
B	Focus View	Opens the <i>Focus View</i> as the current menu on the right-hand side of the LSM. For further details, refer to the <i>Focus View</i> section of this manual.
C	Relocation View	Opens the <i>Relocation View</i> as the current menu on the right-hand side of the LSM. For further details, refer to the <i>Relocation View</i> section of this manual.
D	Duplication View	Opens the <i>Duplication View</i> as the current menu on the right-hand side of the LSM. For further details, refer to the <i>Duplication View</i> section of this manual.
E	Run-time View	Opens the <i>Run-time View</i> as the current menu on the right-hand side of the LSM. For further details, refer to the <i>Run-time View</i> section of this manual.

F	Camera View	Opens the <i>Camera View</i> as the current menu on the right-hand side of the LSM. For further details, refer to the <i>Camera View</i> Section of this manual.
G	Settings View	Enters the <i>Settings View</i> as the current menu on the right-hand side of the LSM. For further details refer to the <i>Settings View</i> section of this manual.
H	Vertical Rule	Provides a horizontal position reference in the processing area for the <i>Design File Preview</i> . Units are adjustable in the <i>Systems Configuration Page</i> .
I	Horizontal Rule	Provides a vertical position reference in the processing area for the <i>Design File Preview</i> . Units are adjustable in the <i>Systems Configuration Page</i> .
J	Focus View Menu	Contains the controls associated with locating and moving the motion system. For further details, refer to the <i>Focus View</i> section in this manual.
K	Design File Preview	Shows a preview of the design file and its current location in the processing area. The preview is touch responsive and will pan, zoom, and manipulate the control files based on the UI context view.

FOCUS VIEW CONTROLS

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 views.



System controls.

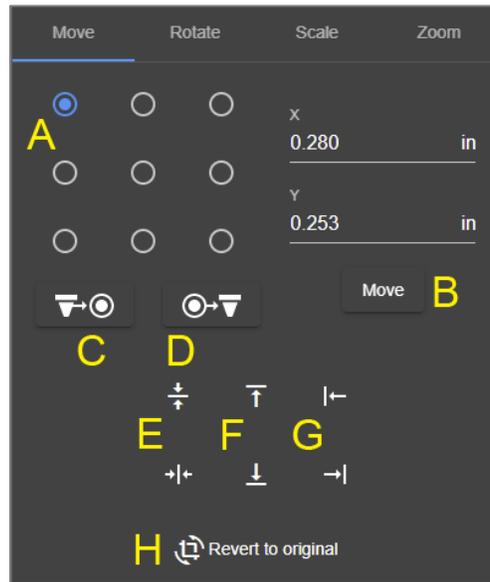
	FEATURE	DESCRIPTION
A	Begin Processing Button	Initiates laser material processing, during which time, the button will be disabled.
B	XY Axis Joystick	Moves the system along the X and Y Axes simultaneously. Touch and drag the central button to manually adjust the system position. Tapping on any of the four arrows will generate incremental movements in the associated direction (<i>Up, Down, Left, and Right</i>). The size of these movements is determined by the <i>Tap Sensitivity Adjustment Button</i> (H).

C	Pause, Resume and Stop Process Buttons	The <i>Pause</i> button causes the system to pause during processing. When paused, the <i>Pause</i> button will be replaced by a <i>Resume</i> and a <i>Stop</i> button. The <i>Resume</i> button will cause the system, to resume processing where it was paused. The <i>Stop</i> button will clear the paused state.
D	Autofocus Button	Initiates the Autofocus procedure, causing the Material-Independent Autofocus Touch Probe to deploy and the Z Axis to move. This procedure will place the top surface of the material to be processed at the focal plane of the installed focus lens.
E	Tap Sensitivity Adjustment Button	Adjusts the sensitivity of movement of the arrow buttons between <i>Low</i> , <i>Medium</i> , and <i>High</i> on each joystick. The current sensitivity level is indicated by the number of chevrons on the button. More chevrons indicate larger movement distances.
F	Home XY Button	Simultaneously performs the homing routine on the X and Y Axes, causing the system to move towards the upper left-hand corner of the processing area and reestablish the home position.
G	System Status Indicator	Displays a brief written description of the system's status. The text will change as the system state is modified and will turn yellow if warnings are associated with the current state.
H	System Location Indicators	Provides the exact location of the system in the X and Y Axes. Units are adjustable in the <i>Systems Configuration Page</i> .
I	Move XY Axes Dialog & Button	Enables manual entry of the X and Y Axes locations. Entering a value into each text field followed by depressing the <i>Move XY Button</i> will cause the system to move to the specified location. Units are adjustable in the <i>Systems Configuration Page</i> .
J	Move Z Axis Dialog & Button	Enables manual entry of the Z Axis location. Entering a value into the text field followed by depressing the <i>Move Z Button</i> will cause the material support structure to move to the specified location. Units are adjustable in the <i>Systems Configuration Page</i> .
K	Z Axis Location Indicator	Provides the exact location of the material support structure (Z Axis). Units are adjustable in the <i>Systems Configuration Page</i> .
L	Home Z Axis Button	Performs the homing routine on the Z Axis. This will cause the material support structure (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 structure (Z Axis) up and down. Touch and drag the central button to manually adjust the C Axis position. Tap the <i>Up</i> and <i>Down</i> arrows to generate incremental movements. The size of these movements is determined by the <i>Tap Sensitivity Adjustment Button</i> (H).

N	Lateral Gas Assist selector	Informs the laser system that a lateral gas assist attachment is installed. The operator must check this box when the lateral gas assist is installed.
O	Vacuum Booster Drop-Down Menu	Enables adjustment of the flow rate of the optional Vacuum Booster in increments of 25%.

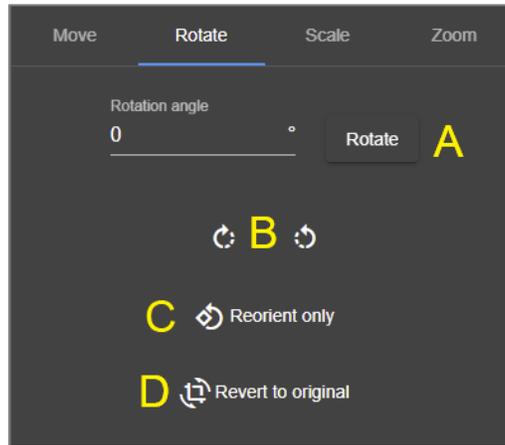
RELOCATION VIEW CONTROLS

This set of controls manages the location, rotation angle and scale of the design file within the *Design Preview Area*. Design files may be manipulated by dragging the control handles around the design itself in the preview area, or by using the controls provided in the right-hand side bar menu. Each type of manipulation (location, rotation, and scale) has its own set of controls selectable as tabs on the side bar.



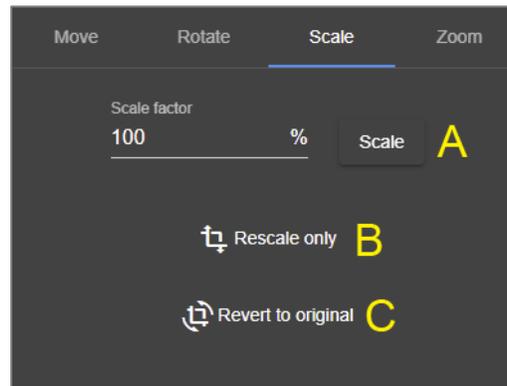
Move Tab

	FEATURE	DESCRIPTION
A	Relocation Anchors	Acts as both indicators and buttons for the nine anchor points on the design file. Select an anchor point to make it active. The anchors shown in the <i>Design Preview Area</i> are synchronized with these anchors and serve the same function.
B	Anchor to Location Dialog & Button	Moves the active anchor to the specified X and Y locations. Units are adjustable in the <i>Systems Configuration Page</i> .
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	Center Design File Buttons	Centers the design file in either the vertical or horizontal direction.
F	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.
G	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.
H	Revert to Original Button	Reverts all changes (location, rotation, and scale) to that of the original design file.



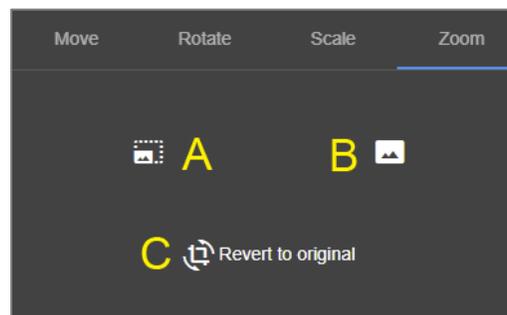
Rotate Tab

	FEATURE	DESCRIPTION
A	Rotate Dialogue and Button	Rotates the design file to the specified angle.
B	Quick Rotation Buttons	Rotate the design file in 90 degree increments in the specified direction, clockwise or counterclockwise.
C	Reorient Only Button	Reverts to the original rotation angle of the design file but preserves location and scale changes.
D	Revert to Original Button	Reverts all changes (location, rotation, and scale) to that of the original design file.



Scale Tab

	FEATURE	DESCRIPTION
A	Scale Dialogue and Button	Scales the design file by the specified percentage.
B	Rescale Only Button	Reverts to the original scale of the design file but preserves location and rotation changes.
C	Revert to Original Button	Reverts all changes (location, rotation, and scale) to that of the original design file.

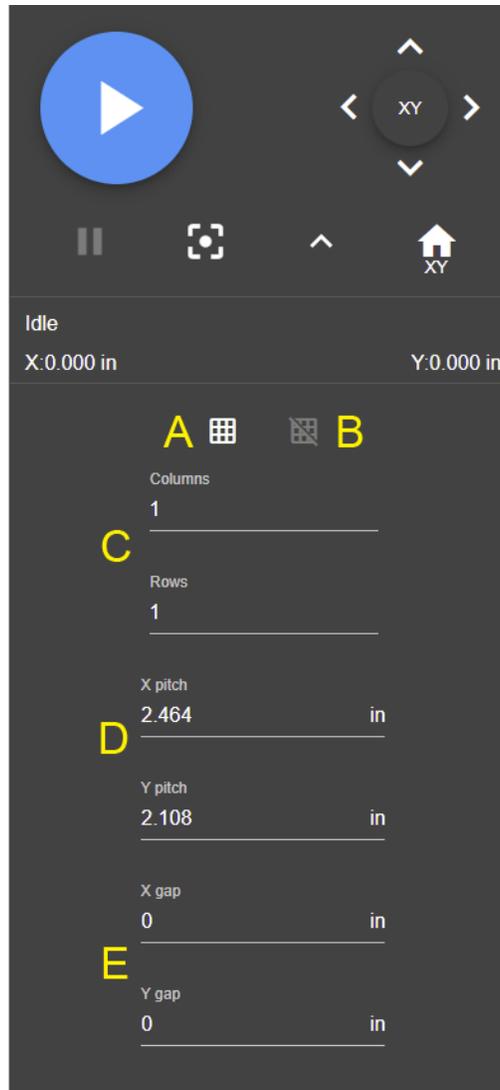


Zoom Tab

	FEATURE	DESCRIPTION
A	Zoom Full Field Button	Shows the full extent of the processing area in the <i>Design Preview Area</i> .
B	Zoom to Design File Button	Shows only the region occupied by the design file in the <i>Design Preview Area</i> .
C	Revert to Original Button	Reverts all changes (location, rotation, and scale) to that of the original design file.

DUPLICATION VIEW CONTROLS

These controls relate to duplication of a design file within the *Design Preview Area*. They provide a convenient method to create multiple impressions of a single design file within the LSM.

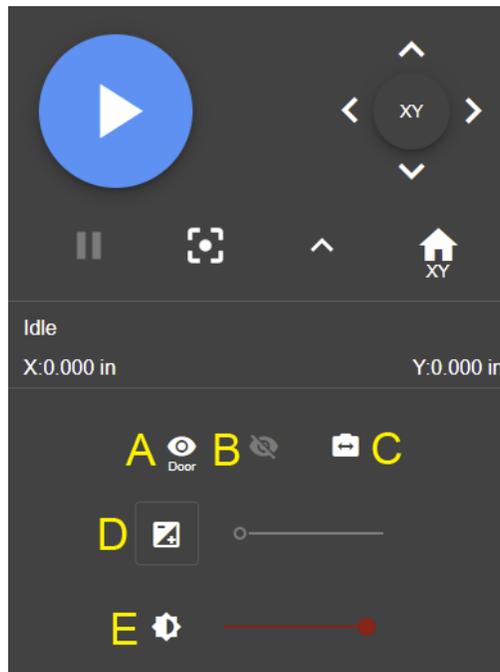


	FEATURE	DESCRIPTION
A	Duplicate to Fill Button	Generates duplications to fill the field rightwards and downwards from the location of the original design file. To maximize the number of instances, place the original design file in the upper left-hand corner of the processing area before duplication.
B	Remove Duplicates Button	Removes all duplicate design files and returns the <i>Row</i> and <i>Column</i> counts to a value of one.

C	Row & Column Count Dialog	<p>Provides fields to Indicate the number of <i>Columns</i> and <i>Rows</i> desired for duplication of the current design file. Duplicates will be placed to the right and below the location of the current design file.</p> <p>To maximize the number of instances, place the original design file in the upper left-hand corner of the processing area before duplication.</p>
D	Duplication Pitch Dialog	<p>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.</p> <p>Changing either the pitch or gap will override any previous pitch and gap settings. Units are adjustable in the <i>Systems Configuration Page</i>.</p>
E	Duplication Gap Dialog	<p>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.</p> <p>Changing either the pitch or gap will override any previous pitch or gap settings. Units are adjustable in the <i>Systems Configuration Page</i>.</p>

CAMERA VIEW CONTROLS

If the Multi-Camera Vision and Registration Option is installed, this right-hand side bar menu provides controls for interacting with the cameras installed in the ULTRA R. One 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. A second camera is installed on the carriage and provides for camera registration functions as well as tiled higher resolution images to aid in manual alignment of design files with materials.



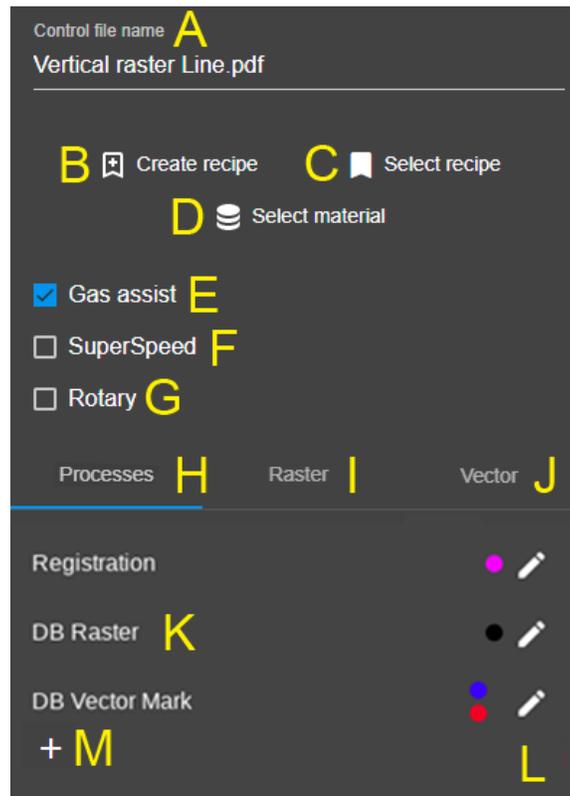
	FEATURE	DESCRIPTION
A	Image Capture Button	Captures an image from the selected camera and displays the image in the background of the design file preview window. If the carriage camera is selected, multiple images will be taken and tiled together. The carriage camera will only take images of the portion of the processing area shown in the design file preview window.
B	Remove Image Button	Clears any camera images from the background of the design file preview window.
C	Camera Selection Button	Switches between cameras. The selected camera will be indicated under the <i>Image Capture Button</i>
D	Camera brightness	Allows manual adjustment of camera image brightness if supported by the selected camera. This allows the operator to adjust the gain of the camera to brighten up an image for better visibility when using the camera for design file alignment with materials or for camera registration operations.

E	Lighting Brightness Adjustment	Adjusts the brightness of the LED lighting in the processing area. This allows the operator to adjust lighting within the laser system to improve camera performance when using camera for registration operations.
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PROCESSING SETTINGS VIEW CONTROLS

Process Settings Tab

The *Process Settings Tab* is the primary location used for setup, ordering, and configuration of the various processes that are possible on the ULTRA R5000 and R9000 laser systems. Individual processes are assigned a set of colors that correspond to graphical elements within the design file.

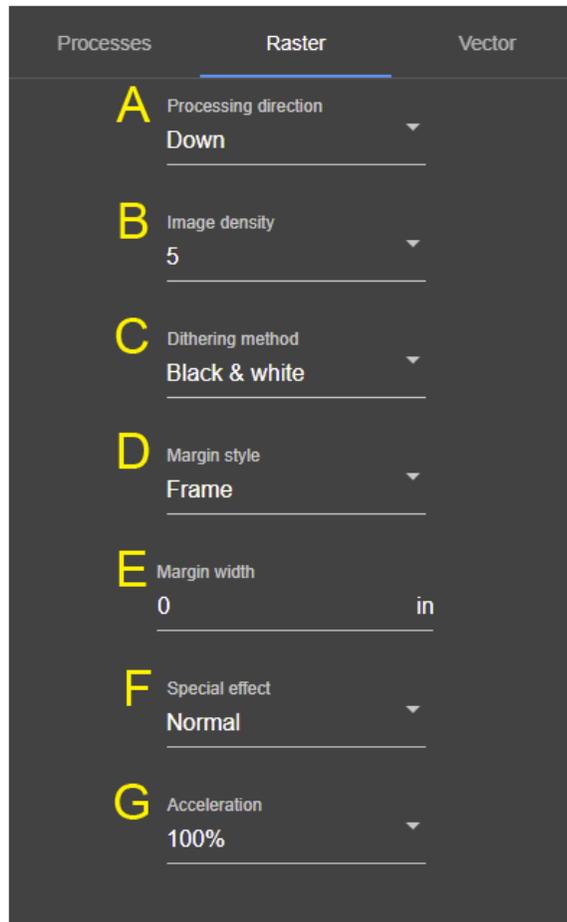


	FEATURE	DESCRIPTION
A	Control File Name	Displays the name of the control file. When importing a new design file, this field is automatically populated with the newly imported file's name. Tap in this field to edit the name of the control file.
B	Create New Recipe Button	Opens the <i>Create a New Recipe Wizard</i> , enabling the creation of a recipe from the current processing settings. These settings can be later recalled and applied to another control file.
C	Select a Recipe Button	Selects a recipe from saved recipes and applies the recipe to the current control file.
D	Select Material	Selects a material from the materials database and applies it to the current control file.

E	Gas Assist Selector	Selects gas assisted laser processing. When selected, additional controls in each process can be used to select compressed air or gas and the flow rate on a process-by-process basis. When using gas assist, a coaxial or lateral gas assist attachment must be installed on the carriage.
F	SuperSpeed Selector	Selects SuperSpeed mode for raster processes (a SuperSpeed module and dual CO ₂ lasers of the same power must be installed in the system). When selected, all raster processes will be performed using the SuperSpeed module to split the laser beams from two equal power lasers to process two lines of a raster image simultaneously for higher productivity.
G	Rotary Selector	Selects the rotary axis module to process round materials (the rotary axis module must be installed in the system). When selected, a yellow horizontal line will be displayed in the preview area showing the rotational axis.
H	Process Settings Tab	Lists all of the processes, assigned colors, and the processing order in the selected file. This is the main tab used for editing laser processing settings.
I	Raster Settings Tab	Contains the specific settings for the raster elements of a design file. For more detail, refer to the <i>Raster Settings Tab</i> section of this manual.
J	Vector Settings Tab	Contains the specific settings for the vector elements of a design file. For more detail, refer to the <i>Vector Settings Tab</i> section of this manual.
K	Process List	Lists all 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.
L	Process Edit Buttons	Opens the associated process settings. The exact settings will depend on the process type. See the following sections for process-specific settings.
M	Add New Process Button	Creates a new process. Press this button to open <i>the New Process Dialog</i> where process type, settings, and color assignments can be made.

Raster Settings Tab

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

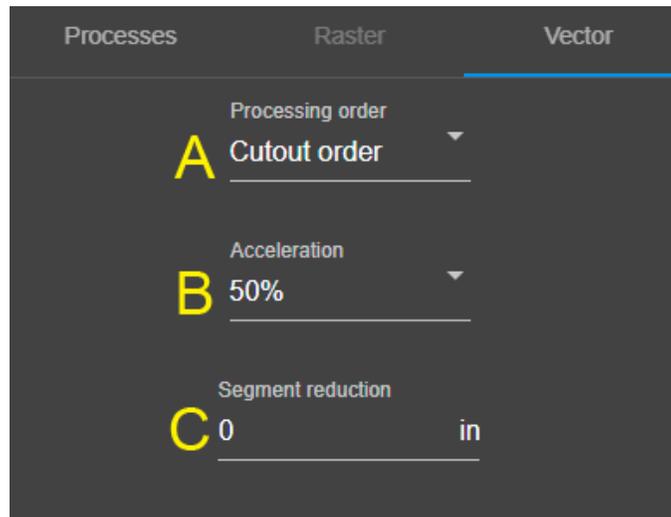


	FEATURE	DESCRIPTION
A	Processing Direction	Determines the direction the raster motion will progress throughout the control file. <i>Down</i> will start at the top of the control file and make its way downward. <i>Up</i> will start near the bottom of the control file and progress upward.
B	Image Density	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.
C	Dithering Method	Uses the rasterization dithering method to adjust the appearance of color and grayscale image data in the design file.

D	Margin Style	Indicates the type of margin to be used for the raster process. <i>Tight</i> will reduce the overall processing time by moving only the required amount in the X direction for each raster stroke. <i>Frame</i> 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 marked or engraved process.
F	Special Effect	Enables selection of special raster modes used in <i>3D Engraving</i> and <i>Rubber Stamp</i> production.
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.

Vector Settings Tab

Contains settings common to all Vector Processes set up in the *Processes Tab* (Database and Custom).



	FEATURE	DESCRIPTION
A	Processing Order Settings	Determines the processing order of the vector graphical elements <i>Inner-Outer</i> will produce.
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.
D	Segment Reduction	Merges or eliminates segments of vector artwork that are smaller than the size specified. Eliminates tiny pieces of geometry that are below the set threshold. This is useful for control files that have excessive detail. Higher values of this parameter will increase throughput, lower values will be more faithful to the original design file. .001" is the default and is suitable for most tasks. Units are adjustable in the <i>Systems Configuration Page</i> .

DATABASE VECTOR MARK SETTINGS

Uses the Intelligent Materials Database to generate laser processing settings for a Vector Marking process.

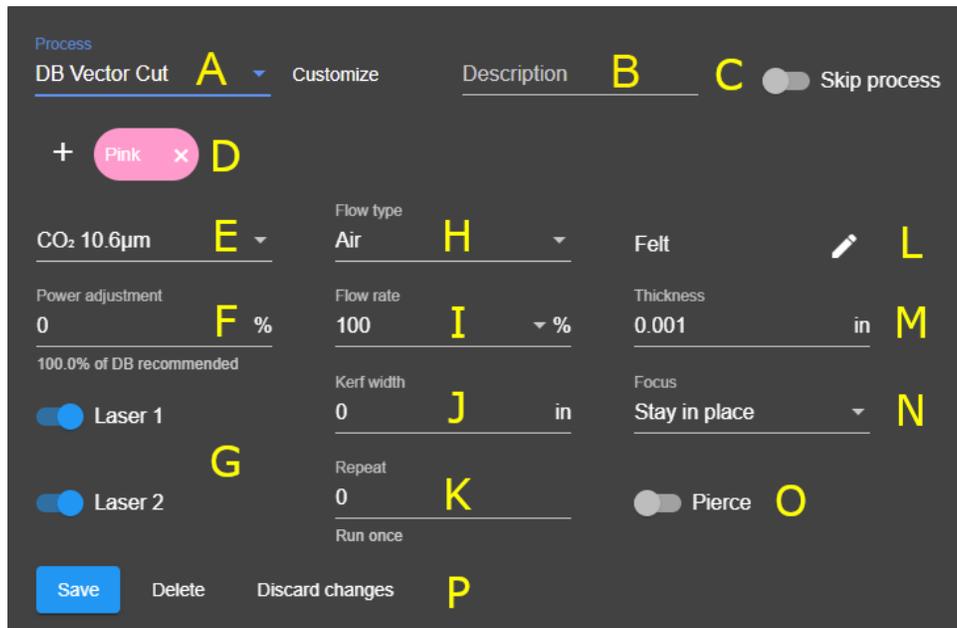


	FEATURE	DESCRIPTION
A	Process Type Selector	Indicates the process type. The interface above shows the <i>Database Vector Mark</i> settings. If changed, the available settings will change to reflect the new process type.
B	Process Description	Provides a field to enter a description of the <i>DB Vector Mark</i> process. In addition to the text box shown above, this description will appear in the <i>Process Settings Tab</i> 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 selected process will be greyed out in the <i>Process Settings Tab</i> , indicating that it will currently be skipped when the laser system processes the selected file.
D	Assigned Colors	Displays the 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 for adding to each process.

E	Laser Type	If the system has multiple laser sources available for the selected material, this drop-down menu may be used to select the laser type to be used for the selected process.
F	Power Adjustment	The Intelligent Materials Database determines the appropriate laser power based on the material type, thickness, and selected laser type. This adjustment enables fine-tuning of the power value to accommodate deviations in material thickness or chemical formulations.
G	Laser Enable Disable Toggle Buttons	Enables or disables individual lasers if more than one laser source is available for the selected laser type.
H	Gas Assist Type	Enables selection of the type of Gas Assist to be applied. Options include <i>Gas</i> , <i>Air</i> , and <i>None</i> . If using <i>Coaxial Gas Assist</i> , or the optional <i>Lateral Gas Assist</i> , either the <i>Gas</i> or <i>Air</i> option must be selected. If <i>Gas</i> or <i>Air</i> has been selected for any process, all processes must have one or the other selected. If no Gas Assist is desired, the <i>Coaxial</i> or <i>Lateral</i> Gas Assist attachment must be removed, and no process can be selected to use either <i>Gas</i> or <i>Air</i> .
I	Gas Assist Flow Rate	Enables target flow rate adjustment for the Gas Assist source. This option is not available when <i>None</i> is selected for Gas Assist.
J	Repeat Count	The number of times to repeat the selected process.
K	Material Selection	Indicates the currently selected material in the current database process. The <i>Pencil Button</i> launches the Intelligent Materials Database's <i>Material Selection Dialog</i> that categorically lists all materials in the database compatible with the current system setup.
L	Auto-focus Mode	Determines autofocus mode. Can be set to perform an autofocus procedure before performing the process, stay in place to perform process at current Z height, or go to a specific Z height before processing. If a single material height is used, it is often more efficient to enable Autofocus for the first process only, then leave subsequent processes disabled.
M	Save / Delete / Discard Changes Buttons	Select one of these options to: <i>Save</i> the process settings, <i>Delete</i> the current process and move the assigned colors to the unassigned category, or <i>Discard</i> any changes and return to the <i>System Operations Page</i> .

DATABASE VECTOR CUT SETTINGS

Uses the Intelligent Materials Database to generate laser processing settings for a Vector Cutting process.

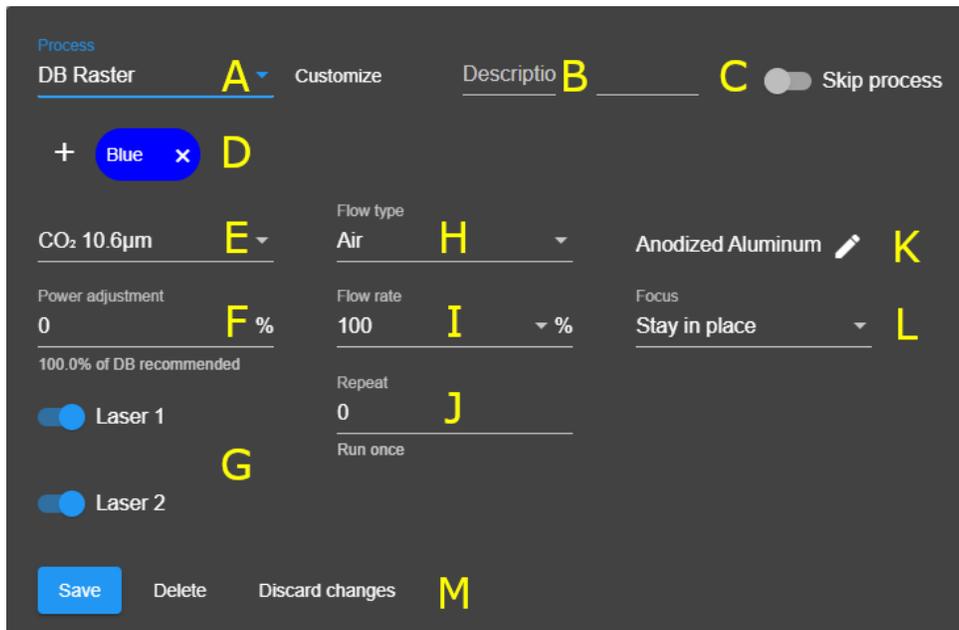


	FEATURE	DESCRIPTION
A	Process Type Selector	Indicates the process type. The interface above shows the <i>Database Vector Cut</i> settings. If changed, available settings will change to reflect the new process type.
B	Process Description	Provides a field to enter a description of the selected process. In addition to the text box shown above, this description will appear in the <i>Process Settings Tab</i> 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 selected process. If toggled on, the selected process will be greyed out in the <i>Process Settings Tab</i> , indicating it will currently be skipped. When the laser system processes the selected file.
D	Assigned Colors	Displays the 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.
E	Laser Type	If the system has multiple laser sources available for the selected material, this drop-down menu may be used to select the laser type to be used for the selected process.
F	Power Adjustment	The Intelligent Materials Database determines the appropriate laser power based on the material type, thickness, and selected laser type. Power adjustment enables users to fine-tune this value to accommodate deviations in material thickness or chemical formulations.

G	Laser Enable Disable Toggle Buttons	Enables or disables each laser individually if more than one laser source is available for the selected laser type.
H	Gas Assist Type	Enables selection for the type of Gas Assist to be applied. Options include <i>Gas</i> , <i>Air</i> , and <i>None</i> . If using <i>Coaxial Gas Assist</i> , or optional <i>Lateral Gas Assist</i> , either the <i>Gas</i> or <i>Air</i> option must be selected. If <i>Gas</i> or <i>Air</i> has been selected for any process, all processes must have one or the other selected. If no Gas Assist is desired, the <i>Coaxial</i> or <i>Lateral Gas Assist</i> attachment must be removed and <u>no</u> process can be set to use either <i>Gas</i> or <i>Air</i> .
I	Gas Assist Flow Rate	Enables target flow rate adjustment for the Gas Assist source. This option is not available when <i>None</i> is selected for Gas Assist.
J	Kerf Width	Enables <i>Kerf Compensation</i> , which provides users the ability to compensate for the width of a cut or mark when set to any non-zero value. Note that <i>Kerf Compensation</i> will only be applied to shapes in the design file of the selected process that are completely closed. Kerf compensation will not be applied to shapes that are open, even by a small amount.
K	Repeat Count	The number of times to repeat a selected process.
L	Material Selection	Indicates the currently selected material for the current database process. The <i>Pencil</i> button launches the database's <i>Material Selection Dialog</i> that categorically lists all of the materials compatible with the current system setup in the Intelligent Materials Database.
M	Material Thickness	Displays the thickness of the material to be processed. This information is required for <i>Database Vector Cut</i> processes. Units are adjustable in the <i>Systems Configuration Page</i> .
N	Autofocus Mode	Determines autofocus mode. Can be set to perform an autofocus procedure before performing the process, stay in place to perform process at current Z height, or go to a specific Z height before processing. It is more efficient to only enable Autofocus for the first process and leave subsequent processes disabled. In the case shown above, Autofocus is disabled, so the system is instructed to <i>Stay In Place</i> at the beginning of the selected process.
O	Pierce Toggle Button	Enables piercing at the beginning of each graphical element. <i>Pierce</i> settings can be adjusted in the <i>Advanced</i> section of the <i>Configuration Page</i> .
P	Save / Delete / Discard Changes	Select one of these three options to: <i>Save</i> the process settings, <i>Delete</i> the current process and move the assigned colors to the unassigned category, or <i>Discard</i> changes and return to the <i>System Operations Page</i> .

DATABASE RASTER SETTINGS

Uses the Intelligent Materials Database to generate laser processing settings for a Raster Marking Process.

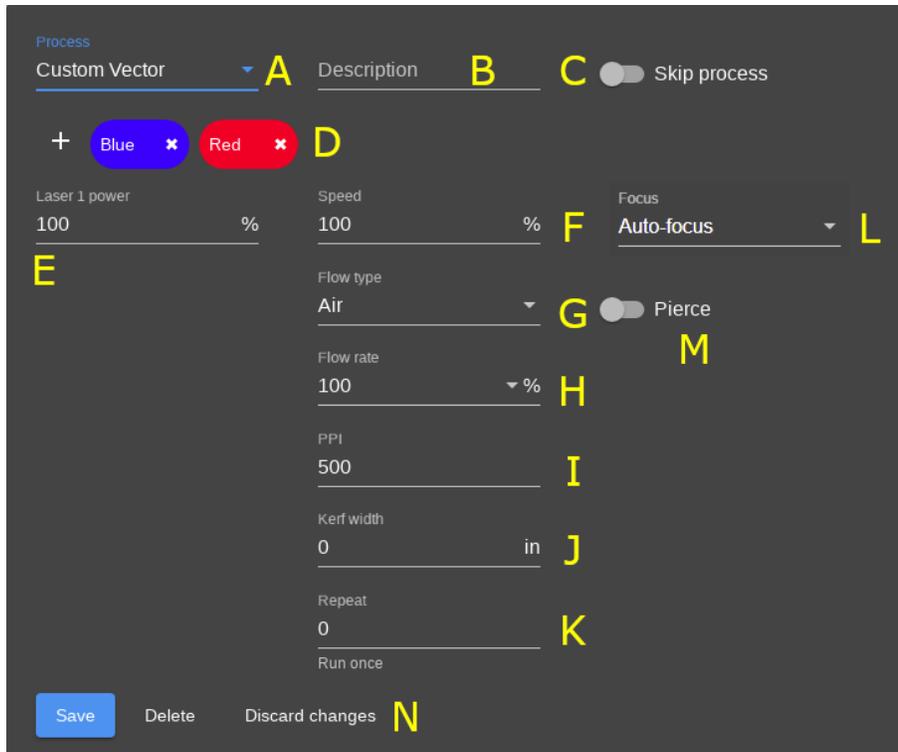


	FEATURE	DESCRIPTION
A	Process Type Selector	Indicates the process type. The interface above shows the <i>Database Vector Cut</i> settings. If changed, the available settings will change to reflect the new process type.
B	Process Description	Provides a field to enter a description of the process. In addition to the text box shown above, this description will appear in the <i>Process Settings Tab</i> 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 <i>Process Settings Tab</i> , indicating that it will currently be skipped when the laser system processes the selected file.
D	Associated Colors	Displays the 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.
E	Laser Type	If the system has multiple laser sources available for the selected material, this drop-down menu may be used to select the laser type to be used for the selected process.

F	Power Adjustment	The Intelligent Materials Database determines 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	Laser Enable / Disable Toggle Buttons	Enables or disables individual lasers if more than one is available for the selected laser type.
H	Gas Assist Type	Enables selection of the type of Gas Assist to be applied. Options include <i>Gas</i> , <i>Air</i> , and <i>None</i> . If using <i>Coaxial Gas Assist</i> or the optional <i>Lateral Gas Assist</i> , either the <i>Gas</i> or <i>Air</i> option must be selected. If <i>Gas</i> or <i>Air</i> has been selected for any process, all processes must have one or the other selected. If no Gas Assist is desired, the <i>Coaxial</i> or <i>Lateral</i> Gas Assist attachment must be removed, and no process can be set to use either <i>Gas</i> or <i>Air</i> .
I	Gas Assist Flow Rate	Enables target flow rate adjustment for the Gas Assist source. This option is not available when <i>None</i> is selected for Gas Assist.
J	Repeat Count	The number of times to repeat the selected process.
K	Material Selection	Indicates the currently selected material for the current database process. The <i>Pencil</i> button launches the database's <i>Material Selection Dialog</i> that categorically lists all materials in the Intelligent Materials Database compatible with the current system setup.
L	Autofocus Mode	Determines autofocus mode. Can be set to perform an autofocus procedure before performing the process, stay in place to perform process at current Z height, or go to a specific Z height before processing. If a single material height is used, it is more efficient to only enable Autofocus for the first process and leave subsequent processes disabled. In the case shown above, Autofocus is disabled, so the system is instructed to <i>Stay In Place</i> at the beginning of the process.
M	Save / Delete / Discard Changes Buttons	Select one of these three options to: <i>Save</i> the process settings, <i>Delete</i> the current process and move the assigned colors to the unassigned category, or <i>Discard</i> changes and return to the <i>System Operations Page</i> .

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.

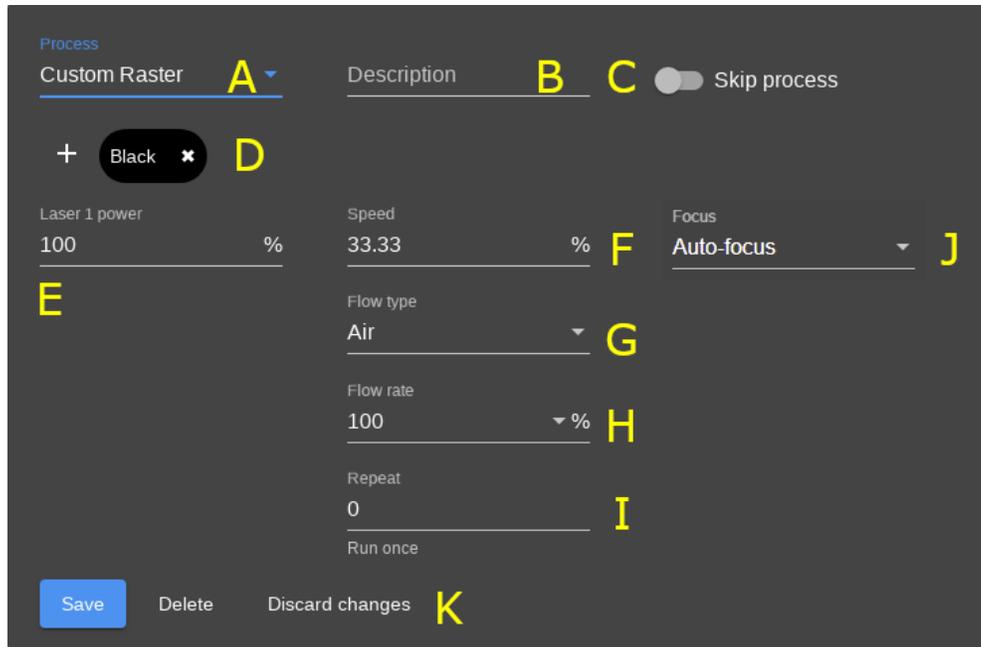


	FEATURE	DESCRIPTION
A	Process Type Selector	Indicates the process type. The interface above shows <i>Custom Vector</i> settings. If changed, the available settings will change to reflect the new process type.
B	Process Description	Provides a field to enter a description of the process. In addition to appearing in the text box shown above, this description will also appear in the <i>Process Settings Tab</i> 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 selected process. If toggled on, the process will be greyed out in the <i>Process Settings Tab</i> , indicating that it will be skipped when the laser system processes, the selected file.
D	Assigned Colors	Displays the 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.

E	Power Setting	Displays the power percentage to be used for each laser. A power setting may be set for each installed laser source. A separate setting will be displayed for each laser installed. In this example the laser system has only one laser installed.
F	Speed Setting	Displays the percentage of process speed applied to all colors in the process.
G	Gas Assist Type	Enables selection of the type of Gas Assist to be applied. Options include <i>Gas</i> , <i>Air</i> , and <i>None</i> . If using <i>Coaxial Gas Assist</i> , or the optional <i>Lateral Gas Assist</i> , either the <i>Gas</i> or <i>Air</i> option must be selected. If <i>Gas</i> or <i>Air</i> has been selected for any process, the user must select either <i>Gas</i> or <i>Air</i> for all processes. If no Gas Assist is desired, the <i>Coaxial</i> or <i>Lateral Gas Assist</i> attachment must be removed, and <u>no</u> process can be set to use either <i>Gas</i> or <i>Air</i> .
H	Gas Assist Flow Rate	Enables the target flow rate adjustment for the Gas Assist source. This option is not available when <i>None</i> is selected for Gas Assist.
I	Pulses Per Inch	Displays the number of laser pulses per inch for the selected process.
J	Kerf Width	Enables <i>Kerf Compensation</i> , which allows users to compensate for the width of a cut or mark when the value is set to any non-zero value. Note that <i>Kerf Compensation</i> will only be applied to shapes in the design file that are completely closed. Shapes that are open, by even a small amount, will not have the kerf compensation applied.
K	Repeat Count	The number of times to repeat the selected process.
L	Autofocus Mode	Determines autofocus mode. Can be set to perform an autofocus procedure before performing the process, stay in place to perform process at current Z height, or go to a specific Z height before processing. If a single material height is used, it is often more efficient to enable Autofocus for the first process only, leaving subsequent processes disabled.
M	Pierce Toggle Button	Enables piercing at the beginning of each graphical element. <i>Pierce Settings</i> may be adjusted in the <i>Advanced Section</i> of the <i>System Configuration Page</i> .
N	Save / Delete / Discard Changes Buttons	Select one of these options to: <i>Save</i> the process settings, <i>Delete</i> the current process and move the assigned colors to the unassigned category, or <i>Discard</i> any changes and return to the <i>System Operations Page</i> .

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.

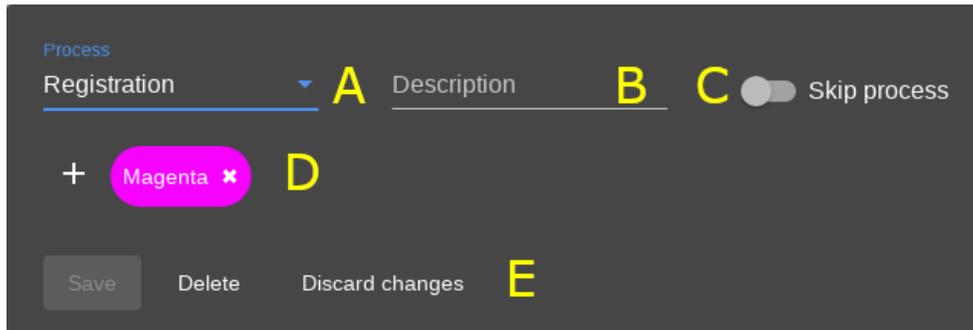


	FEATURE	DESCRIPTION
A	Process Type Selector	Indicates the process type. The interface above shows the <i>Custom Raster</i> settings. If changed, the available settings will change to reflect the new process type.
B	Process Description	Provides a field to enter a description of the process. In addition to the text box above, this description will also appear in the <i>Process Settings Tab</i> 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 <i>Process Settings Tab</i> , indicating that it will be currently skipped when the laser system processes, the selected process.
D	Assigned Colors	Displays the 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.
E	Power Setting	Displays the power percentage to be used for each installed laser source. A separate setting will be displayed for each laser installed. In this example the laser system has only one laser installed.

F	Speed Setting	Displays the process speed setting percentage to be applied to all colors in the process.
G	Gas Assist Type	Enables selection for the type of Gas Assist to be applied. Options include: <i>Gas</i> , <i>Air</i> , and <i>None</i> . If using <i>Coaxial Gas Assist</i> or the optional <i>Lateral Gas Assist</i> , either the <i>Gas</i> or <i>Air</i> option must be selected. If <i>Gas</i> or <i>Air</i> has been selected for any process, all processes must have one or the other selected. If no Gas Assist is desired, the <i>Coaxial</i> or <i>Lateral Gas Assist</i> attachment must be removed, and no process can be set to use either <i>Gas</i> or <i>Air</i> .
H	Gas Assist Flow Rate	Enables target flow rate adjustment for the Gas Assist source. This option is not available when <i>None</i> is selected for Gas Assist.
I	Repeat Count	The number of times to repeat the selected process.
J	Autofocus Mode	Determines autofocus mode. Can be set to perform an autofocus procedure before performing the process, stay in place to perform process at current Z height, or go to a specific Z height before processing. If a single material height is used, it is often more efficient to only enable Autofocus for the first process, then leave subsequent processes disabled.
K	Save / Delete / Discard Changes Buttons	Select one of these options to: <i>Save</i> the process settings, <i>Delete</i> the current process and move the assigned colors to the unassigned category, or <i>Discard</i> changes and return to the <i>System Operations Page</i> .

REGISTRATION SETTINGS

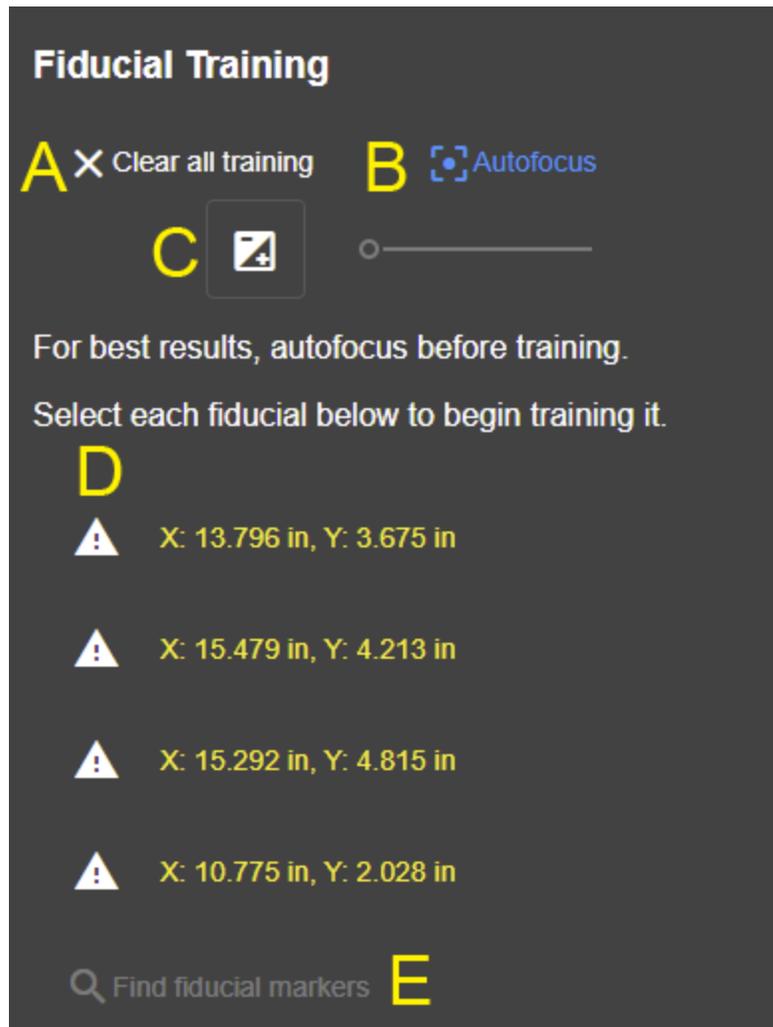
This screen contains the controls needed to configure a Camera Registration Process. When a registration process is added to a control file a train registration marks button will appear below the registration process to guide the user through the process of training the registration marks in the control file.



	FEATURE	DESCRIPTION
A	Process Type Selector	Indicates the process type. The interface above shows the <i>Registration</i> settings. If changed, the available settings will change to reflect the new process type.
B	Process Description	Provides a field to enter a description of the process. Along with the text box shown above, this description will appear in the <i>Process Settings Tab</i> 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 selected process. If toggled on, the process will be greyed out in the <i>Process Settings Tab</i> , indicating that it will currently be skipped when the system processes, the selected file.
D	Assigned Colors	Displays the colors assigned to the selected process. Colors may be removed by selecting the X next to the color's name or may be added by selecting the + sign. Only colors found in the design file will be available to add to each process. For Registration Processes, only one color may be selected and it must be the color used for the registration marks in the design file.
E	Save / Delete / Discard Changes Buttons	Select one of these options to: <i>Save</i> the process settings, <i>Delete</i> the current process and move the assigned colors to the unassigned category, or <i>Discard</i> changes and return to the <i>System Operations Page</i> .

TRAINING REGISTRATION MARKS

This side bar menu is used to train the registration marks (fiducials) for a control file containing a registration processes for camera registration. Training involves taking a tightly cropped picture of each registration mark for the system to use as a template for finding each registration mark automatically.

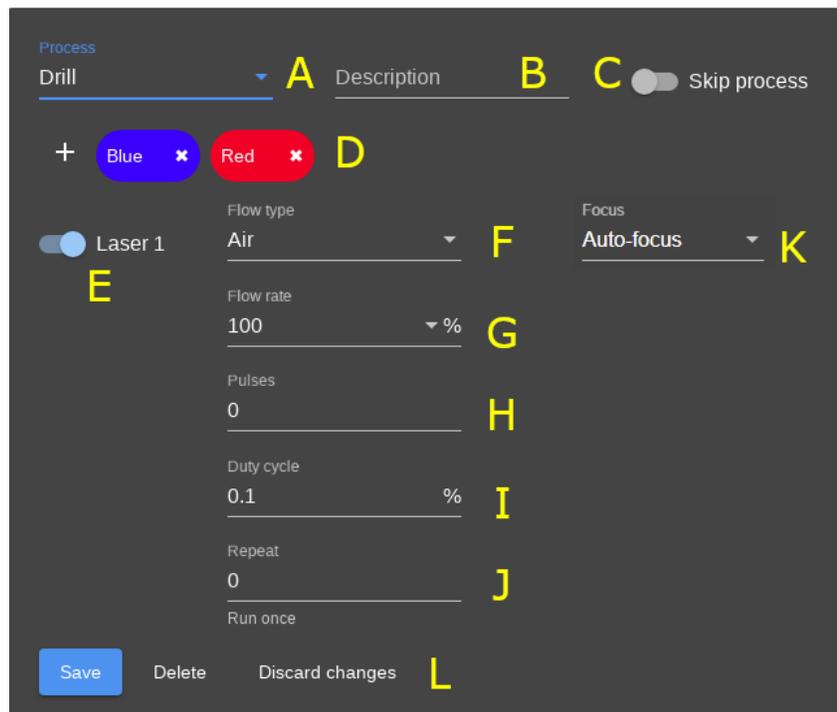


	FEATURE	DESCRIPTION
A	Clear All Training Button	Clears any previously trained images of each registration mark.
B	Autofocus Button	Performs an autofocus to make sure the camera is in focus before training registration marks. For accuracy, it is important that the registration marks be in the focal plane of the laser system.

C	Manual Contrast Button and Slider	Allows the camera contrast to be adjusted manually for best image capture when saving images of registration marks.
D	Registration Mark Selector	Selects each registration mark found in the control file for training. When a registration mark in the list is selected, the system moves to the default location of the registration mark and allows the user to manually center on, crop and save an image of each registration mark. A symbol indicates if the registration mark needs training or already has an image saved for it.
E	Find Fiducial Markers Button	Allows for a test run of the camera registration system after training to ensure that each registration mark can be properly found by the laser system.

DRILL SETTINGS

This screen contains the controls needed to configure a Laser Drilling Process.

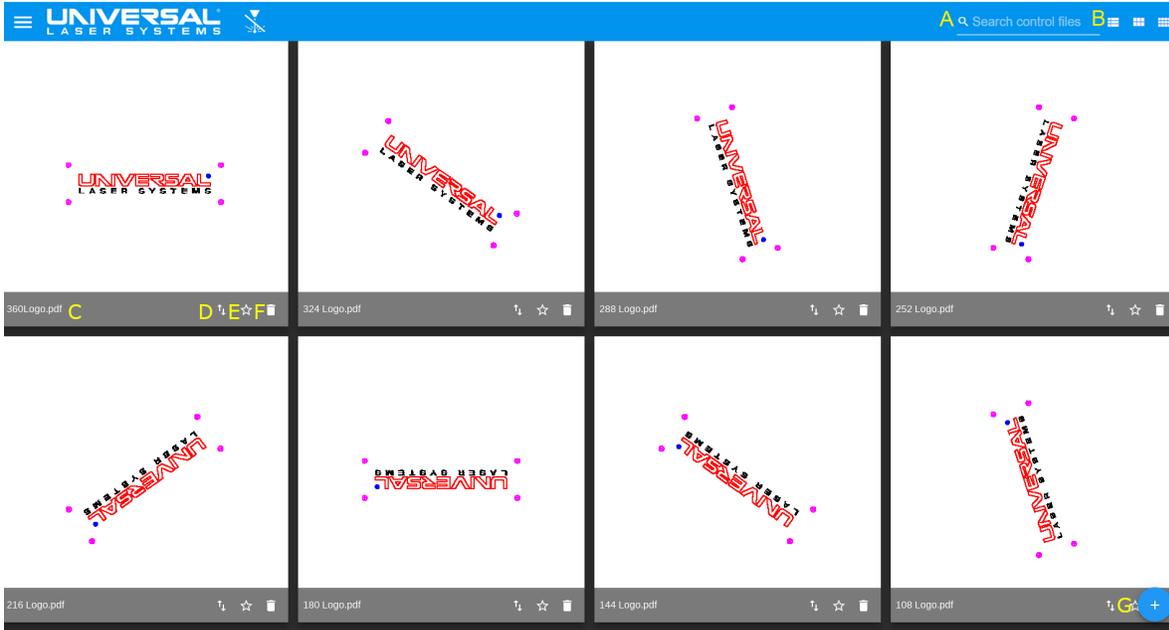


	FEATURE	DESCRIPTION
A	Process Type Selector	Indicates the process type. The interface above shows the <i>Drill</i> settings. If changed, the available settings will change to reflect the new process type.
B	Process Description	Provides a field to enter a description of the process. In addition to the text box shown above, the description will appear in the <i>Process Settings Tab</i> along with any recipe information that may be saved.
C	Skip Process Toggle Button	Provides an easy way to store process settings while enabling the user to quickly disable a selected process. If toggled on, the process will be greyed out in the <i>Process Settings Tab</i> , indicating that it will currently be skipped when the laser system processes the selected file.
D	Assigned Colors	Displays the 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 for adding to each process.
E	Laser Enable Toggle Button	Enables or disables individual lasers if more than one is available for the selected laser type. One toggle button will be available for each laser source. When enabled, the laser source will be used for the drill process.

F	Gas Assist Type	<p>Enables selection of the type of Gas Assist to be applied. Options include <i>Gas</i>, <i>Air</i>, and <i>None</i>. If using <i>Coaxial Gas Assist</i> or the optional <i>Lateral Gas Assist</i>, either the <i>Gas</i> or <i>Air</i> option must be selected.</p> <p>If <i>Gas</i> or <i>Air</i> is selected for any process, all processes must have one or the other selected. If no Gas Assist is desired, the <i>Coaxial</i> or <i>Lateral</i> Gas Assist attachment must be removed, and no process can be set to use <i>Gas</i> or <i>Air</i>.</p>
G	Gas Assist Flow Rate	Enables the target flow rate adjustment for the Gas Assist source. This option is not available when <i>None</i> is selected for Gas Assist.
H	Number of Drill Pulses	Indicates the number of drill pulses to be dispensed.
I	Duty Cycle	The percent of time the laser remains on for each pierce pulse.
J	Repeat Count	The number of times to repeat the selected process.
K	Autofocus Mode	Determines autofocus mode. Can be set to perform an autofocus procedure before performing the process, stay in place to perform process at current Z height, or go to a specific Z height before processing. If a single material height is used, it is often more efficient to enable Autofocus for the first process only, then disable subsequent processes.
L	Save / Delete / Discard Changes Buttons	Select one of these options to: <i>Save</i> the process settings, <i>Delete</i> the current process and move the assigned colors to the un-assigned category, or <i>Discard</i> any changes and return to the <i>System Operations Page</i> .

Control File Page

The queue of Control Files stored on the system is managed and selected through this page.

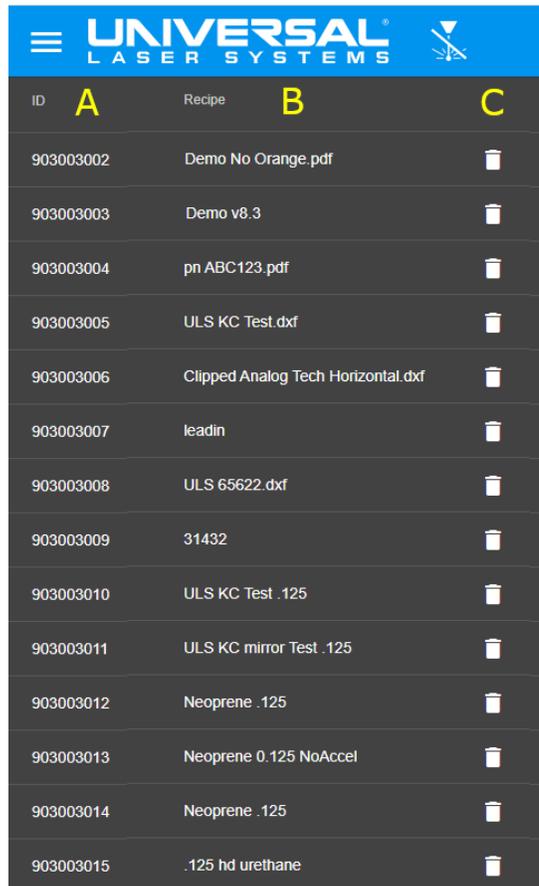


	FEATURE	DESCRIPTION
A	Control File Search Box	Searches stored control files that match the given search string.
B	Control File Display Settings	Manages how the control files will be displayed. Three display views are available: Large Grid (shown above), Small Grid that shows more control files at a time but with smaller thumbnails, and List view that arranges the control file names into a list.
C	Control File Names	Displays the name of each control file. These may be changed by selecting the control file and renaming it in the processing settings.
D	Export Control File Button	Exports the control file to either the local drive or to a USB flash drive. This feature is useful for archiving files or for transporting them between multiple systems.
E	Star Button	Enables the user to mark a control file with a star to help differentiate it from other control files. Flags a file as permanent so that it cannot be deleted unless this flag is removed first.
F	Delete Control File Button	Deletes the control file.

G	Import Control File Button	Starts the <i>New Control File Wizard</i> that enables the user to import design files into the system from either the local drive or a USB flash drive. For remote use, the local drive will be used to access the ULTRA R5000 and R9000.
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Recipes Page

Recipes are collections of settings generated by the user. They provide a convenient method to store and apply settings for commonly used setups and materials.

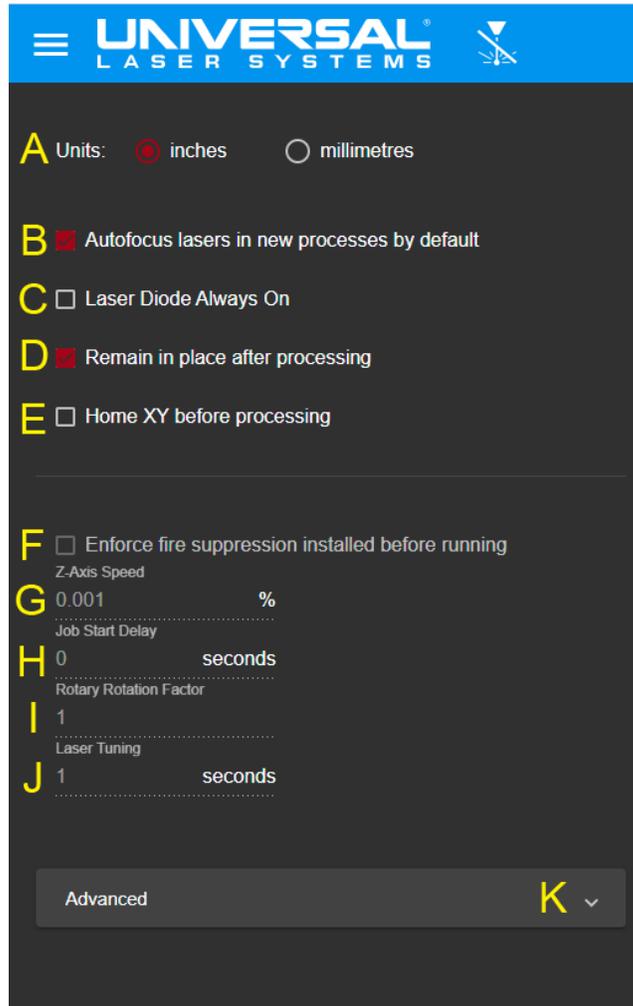


ID A	Recipe B	C
903003002	Demo No Orange.pdf	
903003003	Demo v8.3	
903003004	pn ABC123.pdf	
903003005	ULS KC Test.dxf	
903003006	Clipped Analog Tech Horizontal.dxf	
903003007	leadin	
903003008	ULS 65622.dxf	
903003009	31432	
903003010	ULS KC Test .125	
903003011	ULS KC mirror Test .125	
903003012	Neoprene .125	
903003013	Neoprene 0.125 NoAccel	
903003014	Neoprene .125	
903003015	.125 hd urethane	

	FEATURE	DESCRIPTION
A	Recipe ID	Displays a unique identifier for each recipe that is automatically assigned when the recipe is created.
B	Recipe Name	Displays the name the recipe is given upon creation.
C	Delete Recipe Button	Deletes the selected recipe.

System Configuration Page

This page provides access to system-wide configuration options.

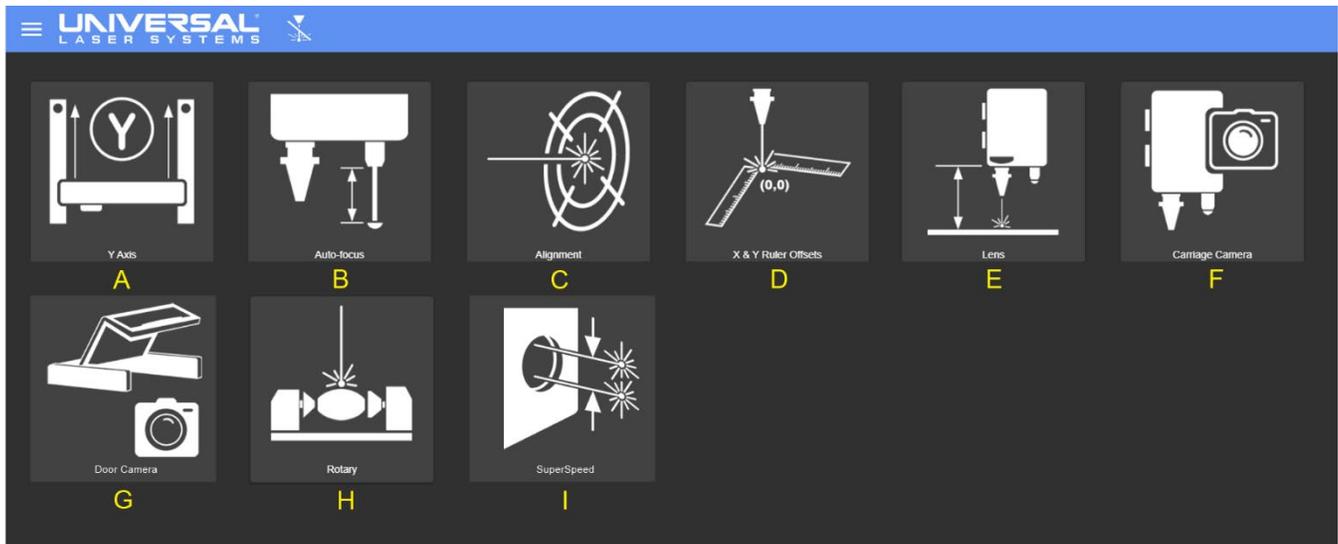


	FEATURE	DESCRIPTION
A	Units Selection Radio Buttons	Enables users to select the measurement units to be used throughout the LSM by selecting one of two radio buttons: inches and millimeters.
B	Autofocus by Default in New processes Checkbox	Forces Autofocus to the default focus mode when new processes are created.
C	Laser Diode Always On Checkbox	Keeps the laser diode on while the system is powered on. If unchecked, the diode will only illuminate when the system is powered on and the top door is opened.

D	Remain in Place After Processing Checkbox	Overrides the default carriage position. After laser processing has ended, the carriage defaults to the upper left-hand corner of the processing area to facilitate user access to the processing area. Checking this box keeps the system in place after processing ceases.
E	Home XY Before Processing Checkbox	Instructs the system to perform a homing routine prior to laser processing.
F	Enforce Fire Suppression Checkbox	Forces the system to check for the presence of a fully pressurized fire suppression module each time laser processing is initiated.
G	Z Axis Speed	Controls the maximum speed of the Z Axis, enabling the value to be reduced below the standard speed of 100%.
H	Delay Before Processing	Delays the start of processing by the value, in seconds, entered into this field.
I	Rotary Rotation Factor	This control adjusts full rotation of the rotary fixture when installed. Can eliminate or force a degree of overlap when processing round materials and attempting to process the complete circumference.
J	Laser Tuning	Can advance or delay laser pulsing when raster processing in order to align pulsing between bidirectional raster strokes.
K	Advanced Configurations	A set of advanced settings to only be used when instructed to by ULS support staff.

Calibration Page

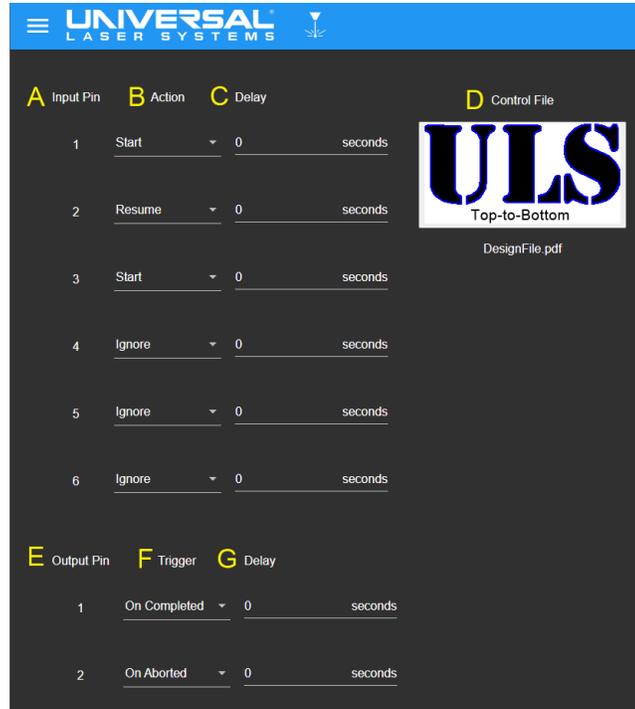
The ULTRA R5000 and R9000 laser systems provide a series of *Wizards* and *Dialogs* to aid in system calibration. All system calibration is performed first at the factory, then again during system installation. It is atypical to require use of these options frequently.



	FEATURE	DESCRIPTION
A	Y Axis Calibration	Launches the <i>Y Axis Calibration Wizard</i>
B	Auto-focus Calibration	Launches the <i>Autofocus Calibration Wizard</i>
C	Alignment Calibration	Launches the <i>Alignment Calibration Dialog</i>
D	X & Y Ruler Offsets Calibration	Launches the <i>X & Y Ruler Offsets Calibration Wizard</i>
E	Lens Calibration	Launches the <i>Lens Calibration Wizard</i>
F	Carriage Camera Calibration	Launches the <i>Carriage Camera Calibration Wizard</i> if a multi-camera module is installed
G	Door Camera Calibration	Launches the <i>Door Camera Calibration Wizard</i> if a multi-camera module is installed
H	Rotary Calibration	Launches the <i>Rotary Calibration Dialog</i> if a rotary axis module is installed
I	SuperSpeed	Launches the <i>SuperSpeed Calibration Wizard</i> if a SuperSpeed module is installed

Automation Page

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



	FEATURE	DESCRIPTION
A	Input Pin	Displays the pin number corresponding to the input wiring connection on the optional automation module. Connections may be accessed under the top laser cover on the back of the laser system.
B	Input Action	Defines the action that will performed by the laser system when this input is triggered. The actions available are: <i>Start</i> laser processing, <i>Pause</i> laser processing, <i>Resume</i> 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 the specify the control file that will be used if the <i>Start</i> action is triggered.
E	Output Pin	Displays the pin number corresponding to the output wiring connection on the optional automation module. 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 relay connected to the corresponding pin. Trigger events available are: On completion of laser processing, On Running and On abort.
G	Delay	Provides a field to specify a delay time after the selected trigger event occurs before the output is asserted.

Automation interface connections:

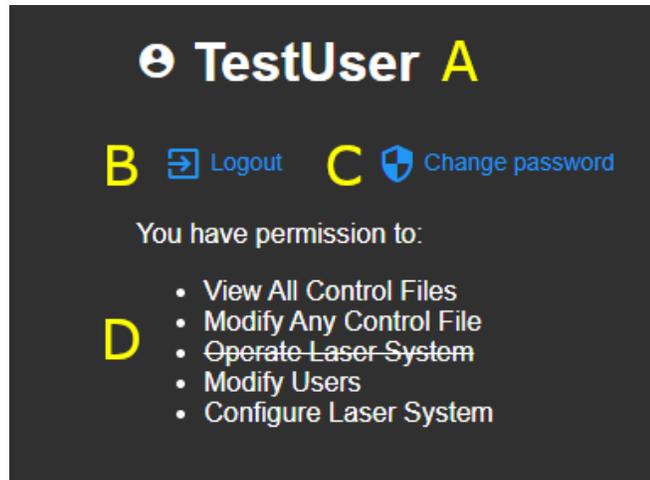
The optional automation interface connector for connecting devices or controls to the ULTRA R can be found on the back of the ULTRA R under the laser cover in a module attached to the lower shelf of the laser compartment. The provided connector is an Amphenol screw terminal connector PN TJ1631530000G)

Automation connector pinout and functions:

Pin	Name	Description
1	IN-1	Four Optically Isolated Inputs activated by supplying 3 – 24VDC (max 10mA) with the return connected to pin 7. Can be configured in the LSM to perform the following actions: Start Processing, Pause Processing or Resume Processing.
2	IN-2	
3	IN-3	
4	IN-4	
5	Not Connected	
6	Not Connected	
7	IN-COM	
8	OUT-3-NC	Three Output relays (each supporting NO and NC) designed to switch up to 60VDC @ 1A maximum. Can be configured in the LSM to be actuated by the following operating conditions: Process Running, Process Completed or Process Aborted.
9	OUT-3-COM	
10	OUT-3-NO	
11	OUT-1-NC	
12	OUT-1-COM	
13	OUT-1-NO	
14	OUT-2-NC	
15	OUT-2-COM	
16	OUT-2-NO	

User Details Page

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



	FEATURE	DESCRIPTION
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 <i>Modify Users</i> permissions in the <i>User Management Page</i> .

User Login Page

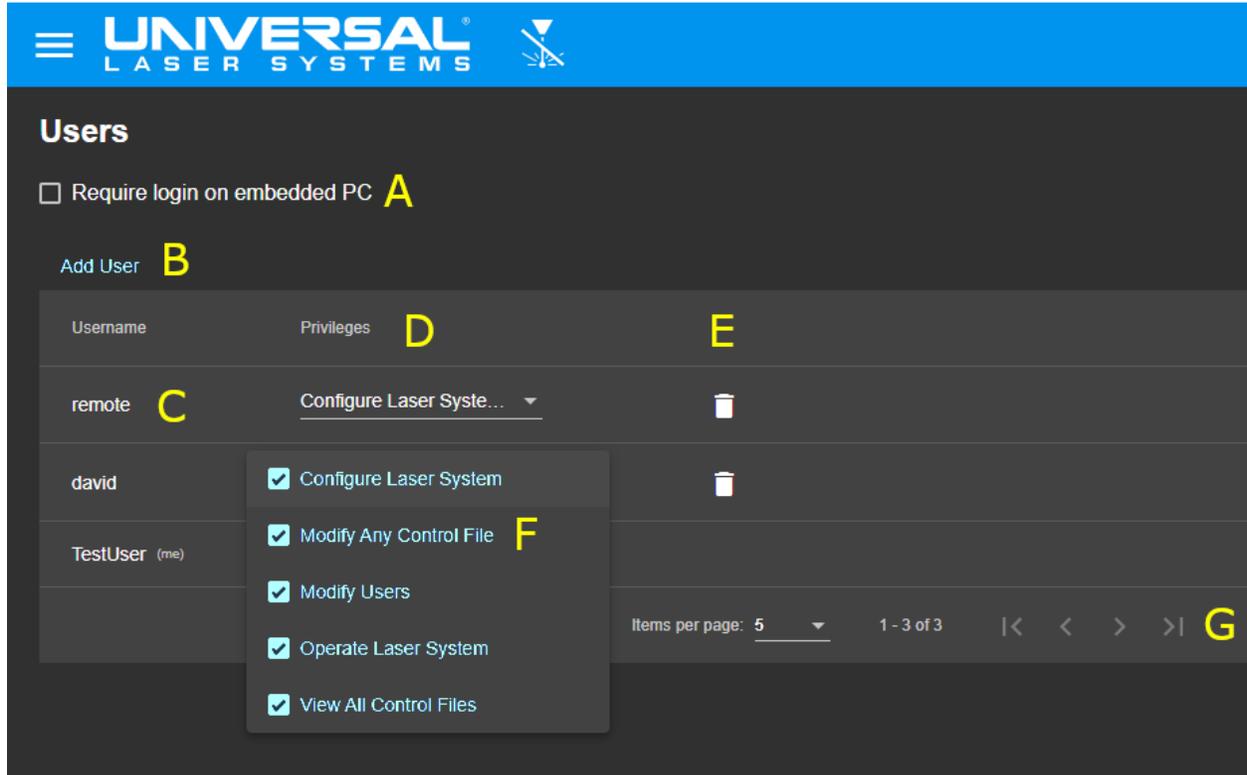
When the laser system is configured to require login on startup or to access the ULTRA R5000 or R9000 laser system from a remote location, this screen will appear. A valid *Username* and *Password* will be required to operate the laser system. For safety, remote users will have reduced permissions when they operate the laser system.



	FEATURE	DESCRIPTION
A	Laser Emission Indicator	Depicts the current Emission Status of the laser system. If a laser source could potentially start firing, the indicator is shown as it is above. 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.
B	Username Field	The <i>Username</i> of the account. Users may be added, removed, and configured in the <i>User Management Page</i> .
C	Password Field	The <i>Password</i> of the account. Passwords may be managed in the <i>User Management Page</i> .
D	Hide Password Button	Toggles between showing and hiding the password as it is typed into the <i>Password Field</i> .

User Management 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.



	FEATURE	DESCRIPTION
A	Require Login on Embedded PC	Overrides the default behavior of allowing anonymous laser system operation. When enabled, the LSM requires users to log in prior to operating the laser system.
B	Add User Button	Creates a new user.
C	User Names	Lists users who are authorized to operate the laser system.
D	User Privileges Drop-Down	Displays the permissions each user has been granted.
E	Delete User Button	Deletes the selected user.
F	User Privileges Selection	Provides a checklist to grant or revoke specific privileges for each user. Privileges may be modified by checking or unchecking each option.
G	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.

Network Management Pages

When the optional embedded control panel is present, this page enables the configuration of the ULTRA R5000 and R9000 laser systems to access either a wired or wireless network. Connection to a network is optional but enables several features such as *Remote Diagnostics* and *Remote Operation*.

	FEATURE	DESCRIPTION
A	Network Name of the System	Gives the system a name for easy identification on attached networks.
B	Wireless Network Enable Toggle Button	Enables or disables the wireless network. If this option is not enabled, then other options on this page may not be available.
C	Wired Network Enable Toggle Button	Enables or disables the wired network. If this option is not enabled, other options on this page may not be available.

D	Automatic Date & Time Toggle Button	When enabled, the system will automatically update the date and time. When disabled, time and dates can be manually entered and updated as needed.
E	IPv6 Wireless Address	The network address of the system on the Wireless Network.
F	IPv6 Wired Address	The network address of the system on the Wired Network.
G	IPv4 & IPv6 Labels	Read-only labels for the Wireless Network.
H	Wireless Network Connection Type	Read-only information regarding the Wireless Network.
I	IPv4 & IPv6 Labels	Read-only labels for the Wired Network.
J	Wired Network Connection Type	Read-only information regarding the connected network.
K	Date & Time	The settings for the system Date & Time.
L	Time zone	Sets the time zone for automatic Date & Time configuration.

Feedback Page

This page allows users to submit 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.

What's on your mind?

A

How can ULS contact you? **B**

Upload control file #234 **C**

If you have an internet connection, this feedback will be reported to ULS.

If you do not have an internet connection, download the `diagnostics.zip` from the Help & Diagnostics screen, and send it to ULS with your feedback.

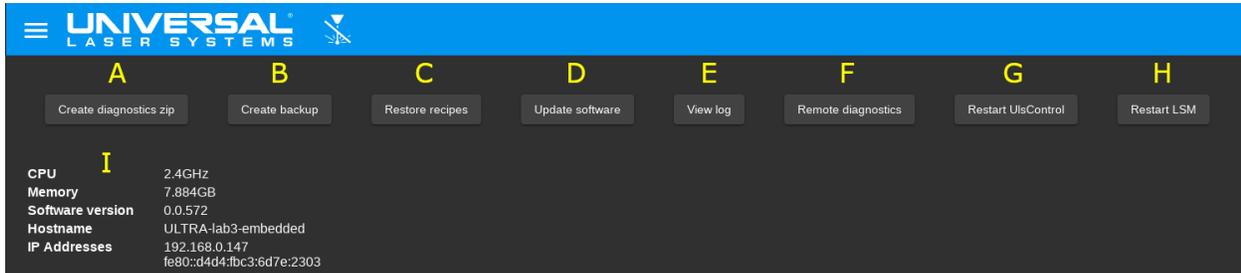
D  Record feedback

Never mind **E**

	FEATURE	DESCRIPTION
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	Upload control file check box	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.
D	Record Feedback Button	Submits the error report to ULS. The laser system must be connected to the internet.
E	Discard Feedback Button	Discards the error report and returns to the LSM.

Help & Diagnostics Page

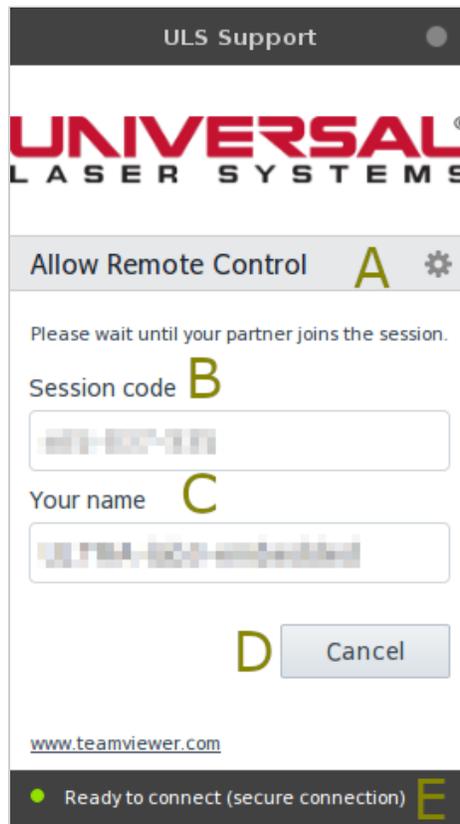
This page provides information useful for addressing system problems should they arise.



	FEATURE	DESCRIPTION
A	Create Diagnostics ZIP	Generates a diagnostics.zip file that may be used to troubleshoot system issues should they arise. May be stored locally or moved to a USB flash drive.
B	Create Backup	Generates a backup of all system settings, control files, recipes, etc. for later recovery or for transportation to another laser system.
C	Restore Recipes	Restores a selected set of recipes to the system.
D	Update Software	Opens the <i>Software Update Dialog Page (only optional control panel)</i> .
E	View Log	Opens the <i>System Log (only optional control panel)</i> .
F	Remote Diagnostics	Launches a <i>Remote Diagnostics</i> session, enabling ULS Technical Support to diagnose system issues by taking control of the laser system. Local user authorization and a robust internet connection are required to use Remote Diagnostics (<i>only optional control panel</i>).
G	Restart ULS Control	Restarts the server portion of the LSM (<i>only optional control panel</i>).
H	Restart LSM	Restarts the LSM (<i>only optional control panel</i>).
I	System Information Table	Shows a snapshot of the system information table. This is useful for diagnosing system problems should they arise.

Remote Diagnostics

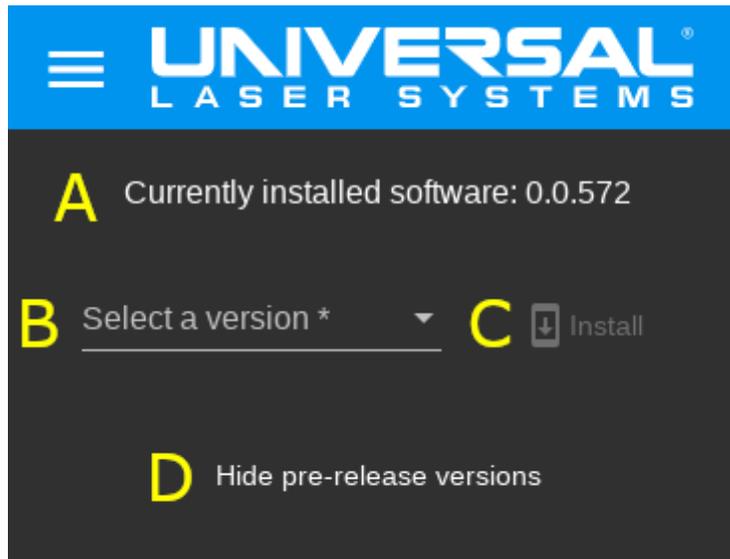
Remote Diagnostics enables a user to initiate a remote session with ULS Support to aid in system troubleshooting. During a remote session, the system must maintain a robust connection to the internet. This option is only available on the optional control panel.



	FEATURE	DESCRIPTION
A	Remote Access Controls	Enables a user to initiate a session that gives a ULS Service Technician 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 Technician.
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 systems 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. This option is only available on the optional control panel. Software updates for user's PC's running ULTRA R laser systems can be downloaded from the ULS website.



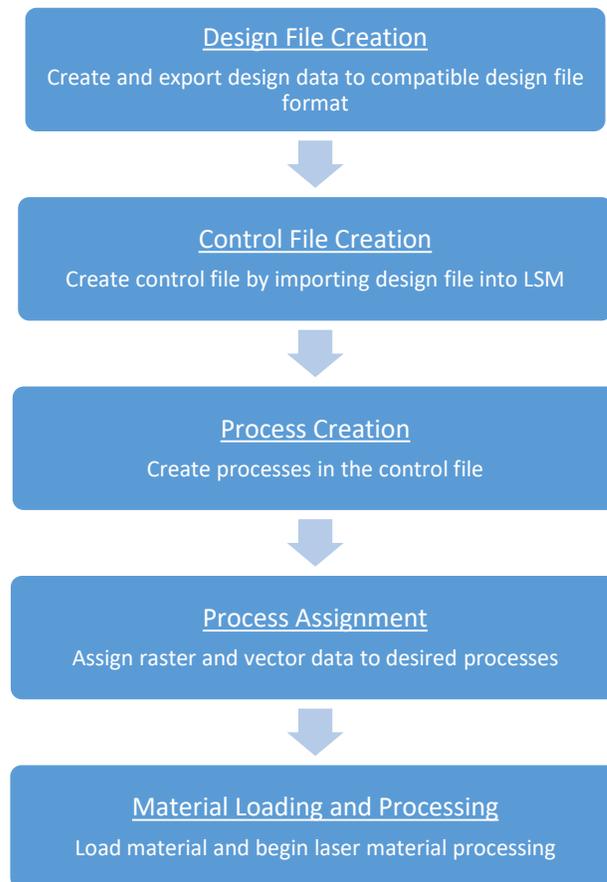
	TITLE	DESCRIPTION
A	Currently Installed Software Version	Displays the current software version installed on the system.
B	Available Software Versions	Displays a list of the currently available software versions. This list is pulled from ULS Servers and therefore requires an internet connection to operate properly.
C	Install Button	Begins the installation process for the selected version of software. Be sure you are aware of the ramifications of upgrading or downgrading software before changing versions.
D	Hide Pre-Release Versions Button	Certain versions of software contain experimental or early-release features that may not be suitable for all users. Select this button to show only stable versions of the LSM.

System Log

The system log contains events that are logged by the laser system and can be used by ULS Support to troubleshoot issues.

LASER MATERIAL PROCESSING OVERVIEW

Processing materials on the ULTRA R5000 and R9000 laser systems is a simple five-step procedure outlined in the diagram below. This section details each step including term definition, procedures, and best practices.



ULTRA R5000 and R9000 Laser Material Processing Workflow

Design File Creation

ULTRA R5000 AND R9000 LASER SYSTEM MANAGER

The software that runs the ULTRA R5000 and R9000 laser systems 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, etc.) 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, or G-code. There are two methods for turning design files into control files: Importing and Printing.

IMPORTING A DESIGN FILE

Importing a supported file type is accomplished by pressing the large plus symbol in the control file page within the LSM. A remote connection to the ULTRA R5000 and R9000 LSM via a browser provides users with this same capability. This is the preferred method of transferring design files to the ULTRA R5000 and R9000 laser systems since it does not require installing additional software and works on any OS that supports a modern browser.

PRINTING A DESIGN FILE

To print a design file, a printer driver must be installed on the computer on which the design file is generated. Once a printer driver is loaded on a PC, the ULTRA R5000 and R9000 laser systems act as a network printer and can receive design files by simply using the design software's *print dialog*. Once printed, the design file will be sent to the LSM and a control file is generated from the design file.

ELEMENTS OF A DESIGN FILE

The LSM interprets elements of a design file as either raster or vector data. The ULTRA R5000 and R9000 laser systems use these raster and vector elements to modify materials using either of two modes: a raster mode or a vector mode.

RASTER MODE OF OPERATION

The raster mode of operation is used primarily for surface modification. In this mode, images or shapes from a design file is reproduced on the surface of a material by moving (scanning) the carriage of the beam delivery system back and forth on the X Axis arm while stepping the Y Axis arm in small increments. As the carriage scans across the material surface, laser energy is applied in a grid of discrete pulses at high resolutions up to 2000 dpi. Material is either removed or modified in some way (annealed, oxidized, etc.) depending on the kind of material being processed and the amount of laser energy being deposited. Raster image data must be present in the user's 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 with ULTRA R5000 and R9000 laser systems, 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 processing parameters needed for a particular laser material processing application.

IMPORTING DESIGN FILES

Control files are created by importing design files into the LSM using the import or printer processes discussed above. 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. The black value has a special use -- to condition multicolor or greyscale data for raster processing. This is achieved by dithering the laser power to recreate the features of the original design file. The preview window displays the color or greyscale bitmap data in its original form and dithering occurs in the background.

Process Creation

Once a control file is created in the LSM by importing a design file, a process must be defined for each task (i.e. laser cutting, laser marking, laser engraving, laser surface modification, etc.).

DEFAULT PROCESSES

When a new design file is imported into the LSM, a material thickness and type must be selected from the ULS Intelligent Material 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 (non-supported processes will not appear for certain materials). These default processes can be used as-is or modified as needed. The default processes are called database processes and use the Intelligent Materials Database to calculate optimal settings for each process type for the current system configuration.

Process Assignment

After processes have been established 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 is assigned to a process based on the color of the raster or vector element. 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 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

ALIGNMENT OF MATERIAL AND DESIGN FILE DATA

Once the processes have been set up for each color and colors assigned to each process, laser material processing can begin. Material must be placed on the Multifunction Material Support Structure, and positioned to align with the raster and vector data in the control file. Corresponding rulers in the preview window of the LSM and on the multifunction table can be used for rough alignment. For more precise alignment, the red laser pointer can be used to relocate design file data to the material or vice versa using the relocation tools in the LSM. If the system is equipped with an AR vision system the built in cameras can be used to visually align design files with materials.

SETTING UP THE MULTIFUNCTION MATERIAL SUPPORT STRUCTURE

The Multifunction Material Support Structure has many features that can enhance material processing for various applications. A honeycomb support surface efficiently exhausts smoke and fumes when cutting through materials. To achieve optimum vacuum, unused portions of the material processing area can be covered with masking material, while an optional, sealed vacuum plenum applies vacuum hold-down to flexible materials. Two options are available for reducing back reflections when cutting sensitive materials: support pins for elevating materials above the honeycomb surface and antireflective porous tiles for processing thin films.

FOCUSING

The laser system must be properly focused to the material for optimal results. The ULTRA R5000 and R9000 laser systems automatically focus the system using a high accuracy touch probe that is configurable on a per-process basis. Alternatively, the user may perform the focusing operation any time they wish by pressing the Auto-focus button in the LSM.

SETTING UP GAS/AIR ASSIST

The ULTRA R5000 and R9000 laser systems control and direct 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's surface, perpendicular 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. Gas or air assisted laser processing can be selected independently for each process set up in a control file. Gas/air flow levels can also be programmed per process.

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 occur in the order of the processes in the control file and by the order of the colors assigned within each process. Process order can be changed by rearranging processes and colors within the control file.

It is essential to keep your laser system as clean as possible to ensure safe and trouble-free operation and to achieve the best results when laser processing. Accumulation of dirt and debris on the motion system components and failure to routinely perform maintenance on your laser system can impact performance or cause damage to the laser system. Accumulation of contaminants on the optics can result in loss of laser power.

CAUTION: Always turn OFF and unplug the laser system before cleaning.

Cleaning and Maintenance Supplies

- Mild soap solution –1 tablespoon (14.78 ml) liquid soap + 1-quart (1L) water in a spray bottle
- Window cleaner
- Paper towels
- Cotton cloth
- Denatured alcohol (do not use on any painted surface, plastic, or the top viewing window)
- Acetone (use only on the laser processing table)
- Optical quality cotton swabs (supplied – do not use Q-tips or personal hygiene cotton swabs)
- Lens cleaner (supplied)
- Vacuum cleaner with a soft bristle brush attachment
- Set of Allen wrenches sized from 0.050" (12.7 mm) to 3/16" (4.7625 mm)

Suggested Routine Maintenance Schedule

As necessary:

- Wipe down the inside of the main enclosure with soap solution (use alcohol for difficult to remove debris)
- Vacuum the inside of the main enclosure
- Vacuum the Multifunction Material Support Structure
- Vacuum the Multifunction Material Support Structure debris drawer
- Clean the top door windows inside & out with window cleaner only

After every 8 hours of processing:

- Check the mirrors on the left side of the X arm for debris and clean as necessary

- Check the carriage windows for debris and clean as necessary
- Check the inside of the carriage for debris and clean carriage optical surfaces as necessary
- Clean the optics ONLY if dirty (excessive cleaning can prematurely wear out the coatings on the optics)

Every month:

- Clean rear laser cover cooling fan filters
- Check for X Axis for belt wear
- Check the Y Axis for belt wear
- Replace belts as necessary

Every 6 months:

- ❑ Clean the Z-Axis lead screws with white lithium grease as necessary
- ❑ Remove and clean the inside of the exhaust plenum
- ❑ Regularly inspect and clean your exhaust ducting to the laser system (consult with HVAC professional)

Every 12 months:

- ❑ Open the X axis rail cover and clean the X axis carriage wheels and the V grooves that the wheels ride in
- ❑ Inspect the X axis wheels for wear and replace as necessary
- ❑ Clean left Y axis linear bearing rail
- ❑ Remove the X axis motor cover on the right side of the X rail and clean the right Y axis rail and wheels
- ❑ Inspect the Y axis wheels on the right side of the X rail and replace as necessary