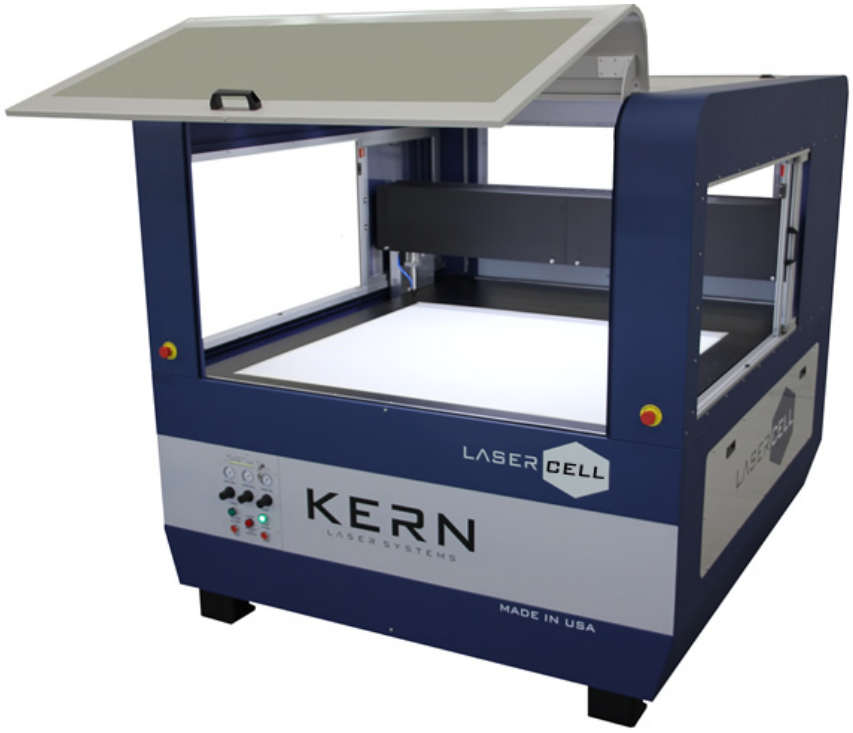
KERN
LASER SYSTEMS

LaserCELL System Manual



Kern Electronics & Lasers, Inc. d.b.a. Kern Laser Systems
Wadena, Minnesota 56482

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NOTICE

The purchase of the KCAM© software grants the purchaser the license to use the software, not the ownership of the KCAM© software.

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Kern Electronics & Lasers, Inc. makes no warranty as to the usefulness of its products for any particular application. It is the Buyer's responsibility to develop processes within the operating envelope of Kern products.

The user must understand the hazards of motion control systems and lasers before operating the software and hardware. Kern Electronics & Lasers, Inc. will not assume responsibility for failure to operate the Kern Laser System automated equipment in a safe manner. If you, the customer, have questions about operating a Kern Laser System, please call the factory for written assistance.

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KERN
LASER SYSTEMS

A Message from our President

Thank you for choosing a Kern Laser Cutting and Engraving System. All of our systems are designed, built, tested, and delivered with quality, productivity and customer satisfaction in mind. With proper care and minimal maintenance of your system, you should receive years of productivity from your laser system. If you encounter any problems or have any questions about your system please call us for assistance.

Thank You,

Derek Kern
President

1 Getting Started

Congratulations on the purchase of your KERN LASER SYSTEM!

Everyone at Kern takes great pride in manufacturing a quality laser system and providing the best technical support for years after the sale. Feel free to give us a call when in need of assistance with your Kern Laser System.

Please take time to review the instructional videos posted on the kernlasers.com website. This will aid in connecting all the components of the system and get everything aligned and calibrated before operation can begin. All connections are labeled at the factory to help simplify the process. Everyone operating the laser system must read and understand the Kern laser manual before using the system.

Installation of a phone next to the laser system is encouraged and will help in expediting troubleshooting and answering any technical questions that may arise about our software or operation of the system.

All components need to be inspected during setup and installation of the system to make sure damage did not occur in the shipping process. Please call Kern immediately at 218-631-2755 with any questions or concerns.

Safety

Please read through these basic safety guidelines before operating the laser system:

- Never leave the laser system unattended while cutting or engraving.
- Always wear rubber gloves or finger gloves when handling the optic lens. Lenses are made of zinc solenoid and can be harmful to your health.
- Cutting acrylic or thicker material at slow speeds and/or low air pressure may cause fires.
- The 1” honeycomb grid and 1” ecolite grid must be cleaned on a regular basis and replaced if needed. If material residue buildup accumulates in the grid work, materials may catch on fire during the cutting and/or engraving process. Clean with detergent and water.
- Clean and remove any material buildup from the bottom of the table’s vacuum chamber. If the black painted surface is worn, remove the grid work and recoat the worn spots inside of the table’s vacuum chamber with hi-temp flat black spray paint. Wait for the paint to dry and fumes to subside before operating the system.
- The LaserCELL is a Class I laser system. Never override the machines interlock system to allow operation of the equipment with the doors or windows open.
- Laser cutting and engraving are extremely high temperature burning processes. Many materials may emit harmful gasses when cut or engraved with a laser. Refer to the materials MSDS safety sheet to verify if the material is safe to laser cut or engrave before proceeding.
- Use proper ventilation within the room housing the laser system. The exhaust air from the vacuum blower may need to be filtered for certain types of materials.
- At least one person must be assigned as the Laser Safety Officer (LSO). Their duty is to fully understand and train all other personnel on safe operating procedures and aspects of the laser system. Call Kern with additional information regarding LSO training.
- It is imperative to understand the hazards of operating a motion control system equipped with a laser without proper training.
- Do not stare at the laser beam when cutting or engraving. Small amounts of ultra-violet light can be emitted from the vaporized material.
- Operators are not to be under the influence of drugs or alcohol.
- If safety questions arise, please call Kern at 218-631-2755 for assistance.

Guards and Covers

Operators and maintenance personnel are protected from hazards on the machine by close fitting sheet metal doors, fixed metal panels and sliding polycarbonate access windows. Fixed sheet metal doors are located at each end of the machine and are interlocked. Sliding access windows are located on each side of the machine and are interlocked. The interlock circuits are considered a necessary part of this machine and should never be compromised to allow for system operation if the front doors, side windows or gantry lid are in the open position. The bottom portion of the machine has fixed metal panels which are secured in place with bolts. These panels are a necessary component of the machine and should not be removed when there is power to the laser. Authorized personnel can remove these panels for maintenance procedures if the main electrical breaker for the system is OFF. Inside the system enclosure is there a hinged lid that runs the full length of the gantry which can be lifted to gain access to the optical assembly of the laser and X axis drive system.

Operating Modes

Kern's LaserCELL model is normally operated in Automatic mode. In Manual mode it is possible to fire the laser source, operate X and Y motion systems and check air pressure. Manual mode can only be used if all safety interlocks are in operation. Manual Mode is normally used to test or calibrate the laser system.

Access to Manual mode is password protected

Manual mode can be password protected so operators cannot enter this mode without password permission.

Laser Processed Materials and Applicable Standards

Laser material processing can generate by-products as air contaminants that can be noxious, toxic and even fatal. The resulting vapors, fumes, and/or particles should be thoroughly evaluated and the adequacy of your provisions for fume extraction, filtering and venting should be carefully considered.

Refer to Section 7.3 of the ANSI Z136.1-2007 "American National Standard for Safe Use of Lasers", to the exposure criteria in 29 CFR 1910 Subpart Z from the United States Government, and to the Threshold Limit Values (TLV'S) published by the American Conference of Governmental Industrial Hygienists (ACGIH).

It may also be necessary to consult with state or local government agencies regarding restrictions on the outdoor venting of vapors.

Before cutting or engraving any material, acquire the MSDS Safety Data Sheet for the material to verify the product is safe to cut or engrave. Fumes from the cut material may be toxic.

CDRH Standards

This laser system complies with the requirements of the current version of the following:

U.S. Department of Health and Human Services, Title 21 *Code of Federal Regulations*, Subchapter J, Part 1040.10, Performance Standard for Laser Products.

The above regulation is sometimes referred to as the CDRH regulation, the FDA regulation or 21CFR 1040.

It is recommended to strictly follow the user requirements in the ANSI Z136.1-2007 "American National Standard for Safe Use of Lasers". These standards deal with such subjects as the appointment of a laser safety officer, the operation of the system in a limited access area by trained authorized personnel and the posting of signs warning of the potential hazard. The ANSI Standard manual is available from the Laser Institute of America. Call 1-407-380-1553 or visit www.laserinstitute.org to obtain a copy.

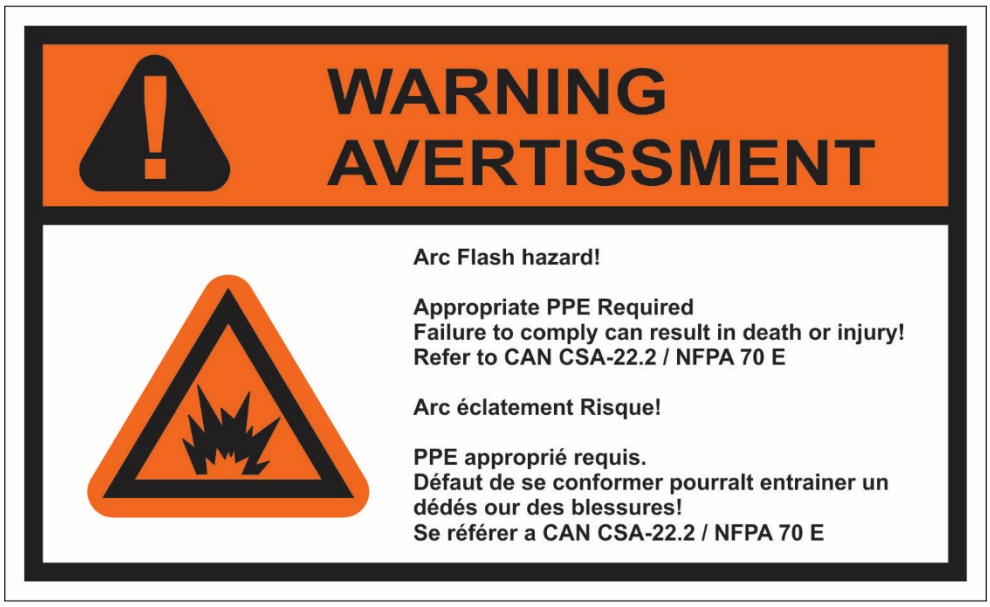
Material Capability and Fume Extraction

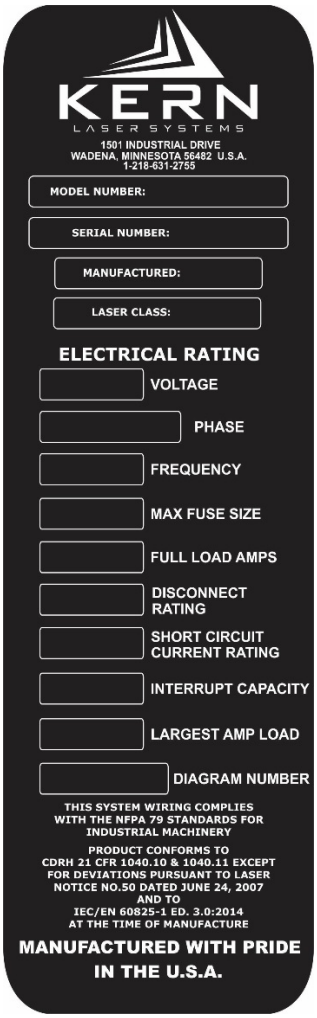
This is a list of common materials which can be processed with the laser system. If your material is not listed please contact Kern for fume extraction requirements.

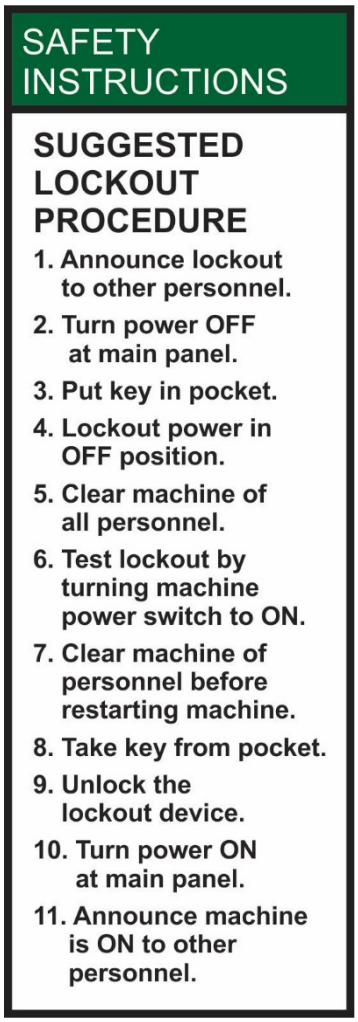
	Vector	Raster
Acrylic	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
Aluminum	42,475 L/min (1500 cfm)	19,821 L/min (700 cfm)
Brass	42,475 L/min (1500 cfm)	19,821 L/min (700 cfm)
Cardboard	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
Carpet	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
Ceramic	NO	42,475 L/min (1500 cfm)
Corian	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
Foam	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
Glass	NO	42,475 L/min (1500 cfm)
Granite	NO	42,475 L/min (1500 cfm)
G10	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
HDPE	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
Kevlar	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
Leather	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
Limestone	NO	42,475 L/min (1500 cfm)
Marble	NO	42,475 L/min (1500 cfm)
MDF Board	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
Mild Steel	42,475 L/min (1500 cfm)	19,821 L/min (700 cfm)
Mirror	NO	42,475 L/min (1500 cfm)
Mylar	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
Paper	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
PETG	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
Phenolic	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
Polyester	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
PVC	NO	NO
Rubber	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
Sentra	NO	NO
Shimstock	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
Slate	NO	42,475 L/min (1500 cfm)
Stainless Steel	42,475 L/min (1500 cfm)	19,821 L/min (700 cfm)
Titanium	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
Vinyl	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)
Wood	42,475 L/min (1500 cfm)	42,475 L/min (1500 cfm)

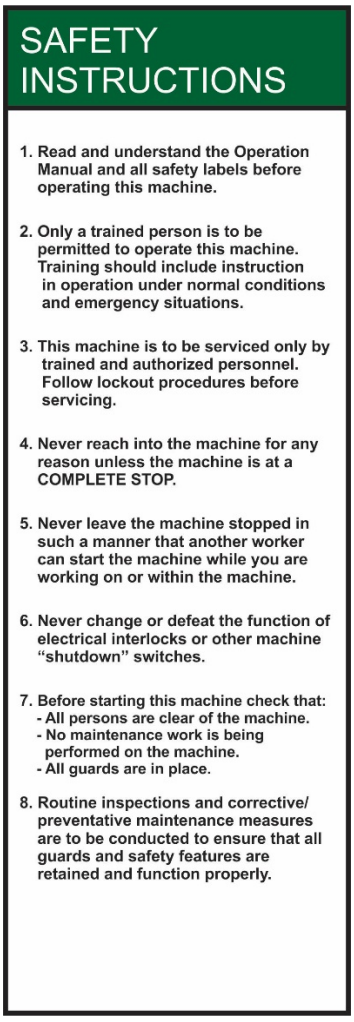
Mandated Safety Labels

The following labels have been affixed to the laser system and should be plainly visible to the operator.









CDRH Procedures for Compliance

Beam Shutter / Attenuator

Closing the shutter on the back of the gantry will mechanically block the path of the laser beam output and electronically disable the laser signal to the KLMC box. The Shutter LED on the KLMC box turns red when the shutter is in the closed position.

Key Switch

To enable the laser, the key switch on the front of the KLMC box must be cycled from OFF to ON. After a 5 second delay the Laser Enable LED will turn green signifying the laser is capable of being enabled. The laser will not fire with the key switch in the OFF position.

Indicator Lights

The KLMC box will power on when the 'Laser System Start' button is pressed on the system's main electrical panel. Refer to the KLMC section in this manual for a complete description of each indicator light.

Class 1 Interlocked System

The LaserCELL is a Class 1 system with a complete protective housing and interlocked access doors and windows. If a door or windows is opened during operation the systems motion will pause and the laser signal disabled.

ID/Cert. Label

Lists model and serial numbers, manufacture date, electrical ratings and compliance codes.

System Requirements

Listed are the requirements for your system to run properly. Failure to adhere to the following requirements will void all warranty of the laser tube and system.

Computer (Minimum Requirements)

Windows 7 or 10.
Quad Core, 8MB, 8T, 2.8GHz
8GB RAM, 256 GB Solid State Hard Drive

NOTE: The computer used must be dedicated to the laser system. While the system is operating, all programs not associated with the laser or CAD programs must be shut down. Any additional programs running in the background may cause interruption in the data flow to the laser system which may cause errors in the KCAM software. All screen savers must be disabled as well.

Air Supply (Minimum Requirements)

65 – 90 PSI of clean, dry air (Volume of 3 CFM)

Air must be filtered before it reaches the laser system for both oil and water.

Recommend 5 micron pre-filter and 0.1 micron filter.

Oxygen and nitrogen may be used for metal cutting (regulated for 0-150 PSI output).

Must use separate air lines for compressor air and oxygen/nitrogen to back of laser system.

Power Requirements

Due to electrical panel variations please contact your salesman for the exact electrical requirement of your system.

Purge Gas

Laser systems of 250 watts and greater require a 2.8 lpm (5.85 scfh) flow rate of purge gas to the ¼" air push connector located at the back of the laser system.

It is the responsibility of the customer to provide nitrogen or compressed air that meets the specifications mentioned in the **Purge Gas Section** of the **System Setup Chapter**. Failure to comply with these specifications will void the warranty and the customer is responsible for all cost of repair or damage to the laser.

Laser System Environmental Specifications

Ambient Temperature: Temperature controlled to 73.5 degrees Fahrenheit.

Relative Humidity: < 95% non-condensing for laser coolant inlet temperature

Operating Altitude: < 6,600 feet

Chiller Coolant Set point: 69.8 Degrees Fahrenheit – 77 Degrees Fahrenheit

Operations in Humid Environments

The cooling fluid of the laser can condense moisture from the air when the temperature of the cooling fluid is lower than the dew point of the air. Condensation may form on any component surface when the surface temperature is at or below the dew point. The system must not operate under these conditions since it will lead to failure of the laser head and will void the warranty of the laser. Failure to comply with these specifications will void the warranty and the customer is responsible for all costs of repair to the laser. The laser will need to be returned to the manufacture for repair.

The conditions that lead to a situation where there can be condensation are warm and humid weather combined with chiller fluid that is cooler than the surroundings. High risk conditions that will lead to condensation are:

- Operating the laser in a room that is not air conditioned in high humidity conditions.
- Using cooling fluid that is not temperature controlled.
- Leaving the cooling fluid on when the laser is not operating for extended time periods.

Risk of Condensation: The information required to determine if the cooling fluid temperature will lead to condensation is:

- Room Temperature
- Relative Humidity

Since weather conditions change, these factors need to be periodically checked especially in the spring and summer seasons. In environments that are air conditioned, we recommend setting the cooling fluid to 73.5 degrees Fahrenheit.

Warranty

In the event that a laser or RF module is determined to have failed due to improper purge gas use and/or environmental specifications, the warranty of the unit will be voided by the laser manufacturer. It will be the customer's responsibility to pay for the needed replacement parts and to ensure the proper purge system is in place before new parts are installed.

Additional Components

Additional components the end user may need to purchase are: distilled water for chilling unit, power cord for connection to the electrical panel, air compressor with hose connection, venting hardware for exhaust system, additional hose for the blowers and paper for sealing the table top vacuum.

2 System Setup

Refer to the Kern website link http://www.kernlasers.com/customer-login/ for system setup videos.

Description

The LaserCELL machine consists of a rectangular frame that is constructed from heavy angle section steel. The frame has four uprights on each corner, which act as legs and additional support beams along the length of the stand. These support a worktop table that is made of steel plates. The table has a flat base and is welded on top of the legs. There are ribs that run the full length of the worktop to stiffen the table. These are structural members and are deep enough to create a plenum for the extraction of dust or toxic fumes generated during engraving or cutting operations. Aluminium ecolite and honeycomb grid layers form the worktop. Flexible ventilation hoses are connected to ducts at the rear of the machine which provides fume removal and vacuum hold down for the table top. Blowers are provided to create the vacuum and collect dust and toxic fumes. Worktop grids are designed to suit the various materials that can be cut or engraved by the laser system. Materials to be cut or engraved must be flat to within 1 mm to 2 mm. This flatness will ensure that the material will be held under vacuum. Crossbeams run between the legs at a lower level. These are positioned above floor level and are covered by flat plates on three sides. The flat plates receive the control system enclosure and a DC power supply and guide a roll track.

A gantry runs above the honeycomb grid and spans the full width of the table. The gantry is able to travel the full length of the worktop table. The top gantry has two vertical columns at each end. These are connected to a bearing block assembly at each side of the machine. The bearing block is specially shaped and each block runs along guide rails that are secured to the underside of the worktop table. Each bearing assembly is on a linear rail which is driven by a servo motor and rack and pinion drive.

The front of the gantry carries an optical head that travels the full width of the worktop table. The optical head consists of a laser tube containing a lens, a means of injecting an assist gas that is used to keep the lens clean and an optical nozzle. The optical head is optically connected to a laser source. The optical head is mounted on a linear bearing that runs the full width of the gantry. A bearing block is mounted on one side of the carrier. The bearing block is specially shaped and runs in a guide on the side of the carrier. The bearing block is bolted to the top gantry frame. A direct drive servo motor is mounted on the other side of the carrier bolted to the top gantry frame. A timing belt runs around the bearing block pulley and the servo motor pulley and is connected to the optical head on each side. This enables the optical head to be traversed in the X-axis.

The optical head moves in a vertical plane and is adjustable in the Z-axis by loosening the nylon lock handle on non-metal cutting system.

The optical head on a metal cutting system is guided by linear bearings that are supported by the optical head. The optical head is connected to a lead screw and a timing belt connects the lead screw to a stepper motor. The stepper motor is mounted on the carrier enabling the optical head to be traversed in the Z-axis. The lead screw has a spring loaded ant backlash nut that is mounted on the side of the optical head. The lead screw runs in a sealed bearing at the top of the carrier. Two limit switches are used to determine when the optical head has been driven to its maximum upper and lower limits of travel.

The top of the gantry carries a CO_2 laser source. The laser source is excited by a DC RF power source. On water cooled models, the RF source must be water cooled. A chiller provides cooling water and must be set to operate at a temperature of 20 to 21°C (68 – 70 °F). The LaserCELL machine must not be operated in a room at a temperature in excess of 27 °C (80 °F).

The laser is first directed at a mirror that turns the beam through 90°. The beam is then directed at a second mirror that turns the beam another 90°. The beam is then directed to a further mirror that turns the beam 90° down towards the table top. These three mirrors can be adjusted to align the

beam to the center of the mirrors with the help of alignment disks. On leaving the optical head the beam is thereafter directed at the work piece.

The LaserCELL laser system operates from instructions that are loaded onto a computer. Various operating menus are accessible through the computer and are presented in different windows. The control system manages the position of the laser head, laser intensity, rates of acceleration and deceleration, cutting speed and many other fine adjustments.

Cutting or engraving instructions on the computer are converted with the KCAM software into information that is recognized by the machine. KCAM software is used to control all movements of the machine and the intensity of the laser.

Any safety limitations such as maximum laser intensity, cutting speeds or limits of travel are controlled by software and independently backed up by electromechanical control systems or firmware to establish Category-3 architecture as detailed in EN13849-1.

The acceptable engraving speed range is from 0.1 inches per second to 150 inches per second for non-metallic materials and 0.1 inches per second to 130 inches per second for metals. The acceptable cutting speed range is from 0.1 inches per second to 10 inches per second. In one mode of operation the modulation frequency sets the intensity of the laser. This ranges from 50 – 100,000 Hz. In another mode of operation a pulse rate sets the intensity of the laser. This ranges from 0 to 600 pulses per inch.

The 100W and larger machines must be configured with metal cutting hardware to successfully cut metal. High pressure assist gas must be passed through the optics to initiate a cut and achieve a clean edge. The KCAM software and a pressure regulator valve control the use of this assist gas.

The 250 and 400 watt machines have a beam protection system that compensates for reflective metals like aluminium. When cutting or engraving non-metallic materials aluminium honeycomb or aluminium ecolite grids must be used to receive the work piece. A metal cutting grid must be used when cutting or engraving metals. The optical nozzle must also be replaced with a ceramic isolator nozzle. The plastic safety shield for the optical nozzle must be removed because the higher temperatures involved can create a fire hazard.

Blower pulls through three ports at the back of the system. This blower removes fumes and small debris that drops into the table chamber.

Intended Purpose

The LaserCELL machine in principle is a high speed machine capable of operating at speeds of up to 150 inches per second using a laser beam that operates at a consistent power level to provide high quality laser cutting or engraving over the entire area of the laser worktop. A gantry, which spans the full width of the worktop, carries one optical head. This head can span the width of the table in less than one second and accelerate at a rate of 5G. The machine can achieve resolutions from 50 dpi to 1200 dpi. Normally the machine is offered with resolutions from 300 dpi and 600 dpi.

Cutting and engraving speeds are determined by the laser size, material being processed, and the desired edge quality. The machine operates at its highest speed when cutting in straight lines, and slows down when cutting patterns as they become more intricate. Typical cutting speeds range from 150 mm (6 inches) per minute up to 15 m (600 inches) per minute. Cutting speeds and laser power are adjusted by selecting line colors that are generated by KCAM software.

The LaserCELL model is designed to cut wood, metal, and plastic. Other materials can be cut, but a MSDS sheet must first be reviewed first. As a result of laser cutting and engraving operations, many of these materials produce toxic fumes when they are heated therefore blowers are provided to remove such material. Material that is collected must be removed by a dust extraction system provided by the user. The required extraction rate is 42,475 Liters/minute (1500 cfm). See Material

Capability and Fume Extraction page. If there are any doubts, users should perform a hazard and risk assessment on given material or contact Kern for advice.

The machine is capable of receiving flat material up to a thickness of 75mm (3 inches). Operating instructions identify full details of the dimensions of the materials that can be handled.

This Kern LaserCELL model is designed for use indoors in a normal working environment. The intended operating temperature range is 16 - 32 degrees Celsius and a relative humidity range from 50 - 75%.

Lighting

LED lighting is installed inside of the machine to provide sufficient light for operators to view all parts inside of the machine.

Internal lighting should achieve a light intensity of 100 to 200 Lux (Lumens/m^2).

It is recommended that local ambient lighting should achieve a light intensity of 300 Lux (Lumens/m^2) around the LaserCELL machine and in the immediate vicinity of those parts of the machine where maintenance must be performed.

Uncrating

Carefully inspect the crate before it is unloaded from the delivery truck. Note any damage to the crate with the shipping company driver and call Kern immediately.

Open the crate using a drill with a Phillips head bit. First remove the screws from the top of the crate, next remove the 2”x4” roof supports, then the ends and sides. Once inside the crate inspect the laser system and all boxes inside for any visible damage. All boxes may then be removed from the crate. Remove lag screws that hold the system to the pallet.

Material Handling, Floor Space and Leveling

The center of gravity is located at the center point of the crate. A forklift with extensions may be needed to move the wooden crate the machine is shipped in. The chart below shows the dimensions and weight of the laser machine.

Table Size	Length	Width	Height	Weight
52” x 50”	82 inches 2083 mm	74 inches 1880 mm	76 inches 1930 mm	3700 lbs 1679 kg

Footprint Chart (access doors closed, computer arm not considered)

Approximately 4 – 6 feet of clearance around the machine is needed to safely operate and perform maintenance on the laser system. The front and back access doors also extend beyond the noted footprint when they are in the open position. The computer arm also extends beyond the noted footprint and can be positioned to the side or front of the machine. Complete footprint schematics are available online and in the Systems Diagrams chapter.

Leveling the table may be necessary using shims or leveling pads underneath the legs. Make certain the bottoms of all legs are tight to the floor. Do **NOT** bolt the stand to the floor as this may twist the table.

Computer / Monitor / Arm

Remove the keyboard portion of arm from its box and install onto the arm assembly. Remove the computer and monitor from their boxes. Place the computer into its sleeve located on the arm. Mount the monitor on the arm using the four small bolts provided.

Verify that the computer and monitor are able to be connected to a 230V supply. Power information can typically be found on the back of the computer and monitor. Connect the power cables to both the computer and monitor. Two 230V cords are provided at the arm to connect the monitor and computer.

The mouse and keyboard can connect to the USB ports on the back of the computer tower.

Plug in the monitor cable to the computer tower and also to the back of the monitor. Wires that run through the monitor arm can be accessed by removing the screws from the plastic plates on the underside of the arm.

Mounting Laser on Gantry

Make sure to save all boxes for the laser and its components for future servicing. If the laser is not returned in its original box, you will be charged for a new one to ensure proper packaging during shipping. **All power to the laser system must be disabled/off at this time.**

ULR-30/ULR-50 Universal Lasers

Remove laser from the box. Set the laser on the backside of the gantry on the two metal mounting brackets. Snug the laser forward so that the beam output of the laser is pushed up against the black metal tube of the shutter block. From underneath the top gantry plate, use a hex wrench to tighten the four bolts inside of the mounting brackets to the bottom of the laser plate. Make sure the bolts are tight and that the laser has no movement.

Unplug the DC power supply plug from the outlet underneath the laser table. Plug the laser harness into the connector on the back of the laser. Tighten the screws on each side of the connector to ensure that it will not come loose.

The laser is now installed and is ready for beam alignment. Reconnect the DC power supply plug underneath the laser table before powering up the system.

Universal Laser Mount

Kern 100/150/200 Lasers

Remove the laser from the box. Remove plug from laser output. Attach the output block to laser with screws provided.

Remove three screws from laser blocks ensuring the two spherical washers stay flat after removing each bolt. Slide laser into place and verify both washers stayed in place at all three bolt locations. Tighten the three bolts into laser block to secure the laser in place. Make sure that the laser has no movement.

Unplug the DC power supply plug from the outlet underneath the laser table. Connect the **Black (-)** and **Red (+)** power cables from the power supply to the lasers **44 VOLT GROUND (-)** and **+44 VOLTS DC (+)** terminal posts on the back of the laser. A wrench for both nut sizes is provided in the Kern optics kit.

Plug the laser harness into the connector on the back of the laser. Tighten the screws on each side of the connector to ensure that it will not come loose.

Insert the "Water In" and "Water Out" water lines to the fittings on the back of the laser. The water lines circulate cooled water between the laser and chilling unit to prevent overheating.The laser is now installed and is ready for beam alignment. Reconnect the DC power supply plug underneath the laser table before powering up the system.

Back of Kern Laser

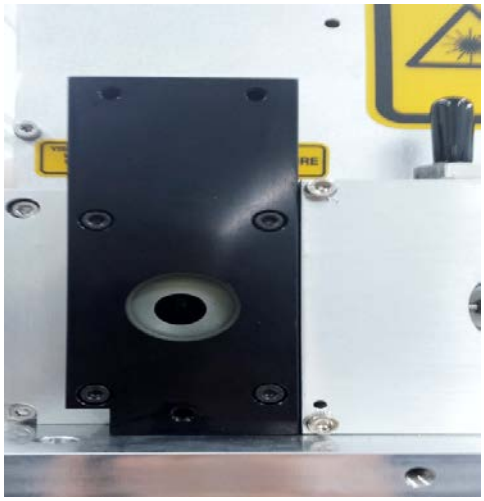

Kern 100/150/200 Laser Mount

J3 250W / J5 400W Coherent Laser

Open the crate containing the laser and locate the Coherent Unpacking Guide for additional instructions. Remove the laser from its box and set it on a stable surface to prepare it for mounting.

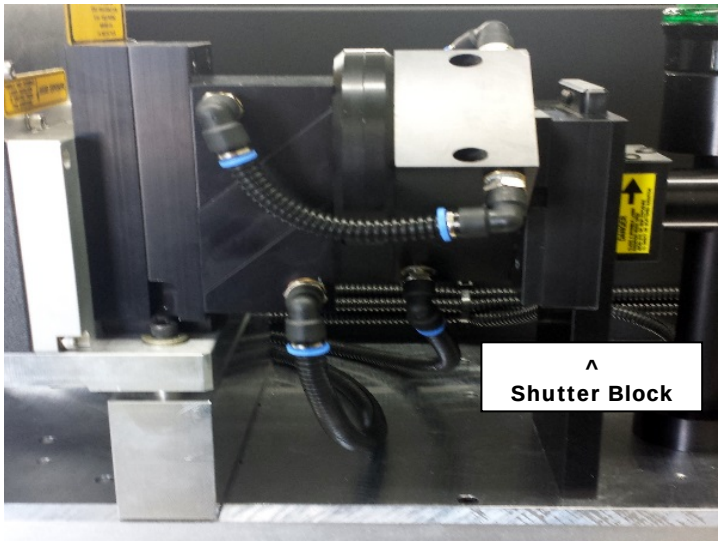
Remove the "red" beam cover from the laser. Install Polarizer/Isolator mount with four bolts. Attach the polarizer/isolator to polarizer/isolator mount with three bolts.

E250 Front


Polarizer/Isolator Mount

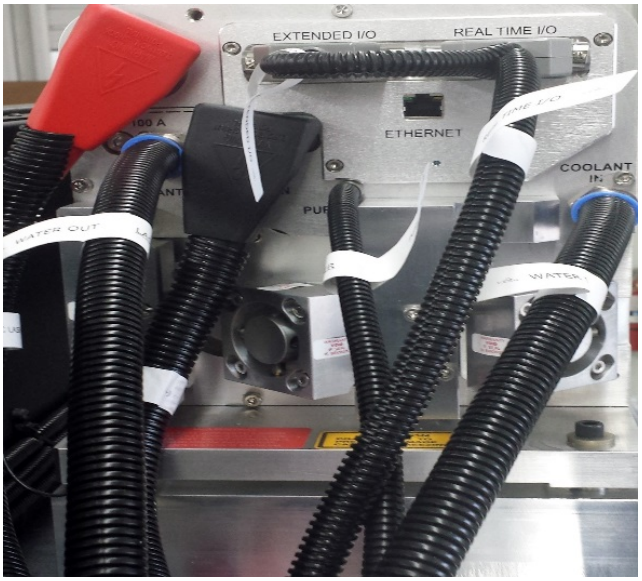
Lift the laser onto the back of the gantry and gently snug the polarizer/isolator to the shutter block entrance. Set laser into place and verify both washers stayed in place at all three bolt mounting locations. Tighten the three bolts into laser block to secure the laser in place. Torque the laser

mounting bolts to 100 in.-lbs. to prevent distorting the mounting feet. Make sure that the laser has no movement.



Polarizer/Isolator Mount to Shutter Block

Install the three bolts between the polarizer/isolator to the shutter block to complete the mounting of the laser.



Back of J Series Laser

Unplug the DC power supply plugs from the outlet underneath the laser table.

Connect the **Black (-)** and **Red (+)** power cables from the DC power supply to the laser power posts on the back of the laser.

Connect the two DB15 plugs to EXTENDED I/O and REAL TIME I/O connectors. Tighten the screws on each side of the connectors to ensure that it will not come loose.

Insert the “Water In” and “Water Out” water lines to the fittings on the back of the laser. The water lines circulate cooled water between the laser and chilling unit to prevent overheating.

The laser is now installed and is ready for beam alignment. Reconnect the DC power supply plug underneath the laser table before powering up the system.

Chilling Unit

All laser systems of 100 watts or greater will come with a chilling unit for cooling the laser. The chilling unit will automatically turn on and off with the main power of the laser system. Please review the chiller's Operators Manual before setting up the chilling unit.

100, 150 & 200 Watt Systems

1. Remove the chiller from its box and place next to the rear of the laser system.
2. Hook up the water lines from the laser system to the back of the chiller. The water lines should be labeled for connection to the correct inlet/outlet fittings.
3. Fill the tank with a 1/2 gallon of propylene glycol and top off with distilled water.
4. Connect the power plug into its labeled outlet on the back of the laser system.
5. Verify that the circuit breaker on the back of the chiller is in the ON position.
6. When the system is first powered up, verify that no leaks are present at any of the water line fittings or along the water lines.
7. Refer to the laser's Operator Manual for proper cooling fluid temperature.

250 Watt System

1. Remove the chiller from its box and place next to the rear of the laser system.
2. Hook up the water lines from the laser system to the back of the chiller. The water lines should be labeled for connection to the correct inlet/outlet fittings.
3. Fill the chiller reservoir with 1/2 gallon of the included OPTISHIELD® Plus and top off with distilled water.
4. Connect the power plug into its labeled outlet on the back of the laser system.
5. Verify that the circuit breaker on the back of the chiller is in the ON position.
6. When the system is first powered up, verify that no leaks are present at any of the water line fittings or along the water lines.
7. Refer to the laser's Operator Manual for proper cooling fluid temperature.

400 Watt System

1. Remove the chiller from its box and place next to the rear of the laser system.
2. Refer to the chiller's Operators Manual for connection of the electrical power.
3. Hook up the water lines from the laser system to the back of the chiller. The water lines should be labeled for connection to the correct inlet/outlet fittings. Mount the supplied filter on the chiller unit to prevent particles from getting trapped inside of the laser coolant lines. Replacement filters can be purchased from Kern.
4. Fill the chiller reservoir with 3/4 gallon of the included OPTISHIELD® Plus and top off with distilled water.
5. Verify that the circuit breaker on the back of the chiller is in the ON position.
6. Connect the remote cable into the 'Remote ON/OFF' plug on the back of the chiller. Connect the grounding wire underneath one of the nearby bolts.
7. When the system is first powered up, verify that no leaks are present at any of the water line fittings or along the water lines.
8. Refer to the laser's Operator Manual for proper cooling fluid temperature.

Electrical Panel

The electrical panel at the rear of the laser system must be hooked up by a certified electrician. Failure to follow through will void the system warranty. The main power cable is not included and should be available from your certified electrician. A complete panel schematic is located inside of

the electrical panel. This schematic is strictly to assist the electrician. If a schematic cannot be found, please contact Kern for a copy.

Air / Assist Gas

Connect 60-95 PSI of clean, dry air from an air compressor to the air quick connector located on the back of the laser system. Air must be filtered before it reaches the laser system for both oil and water. Recommend 5 micron pre-filter and 0.1 micron filter. Connect optics and knife air tubing to optics assembly.

Recommended air supply volume is 3 CFM with a 20 gallon reserve tank.

For metal cutting, assist gases such as oxygen and nitrogen may be used. Use the same connection on the back of the system for connection of these gases as well. A regulator will be needed on the gas tanks and allow for up to 150 PSI of pressure.

Must use separate air lines for compressor air and oxygen/nitrogen to back of laser system.

Vacuum System

Blower Electrical Connection

The blowers included with the laser system operate on 230 volts AC. All LaserCELL systems have power outlets on the back for connection of the blowers. The blower operation can then be controlled from the control panel at the front of the laser system. If blowers of different sizes (horsepower) are used, the electrical outlets may be labeled for proper connection.

Blower Hose Connections

The hosing, metal clamps, extensions, and all other plastic fittings are included to hook up the blowers. The exhaust from the blowers must be run through a fume extractor or to the outside of the building. This may require the purchase of additional parts. Refer to the Blower Installation in the **Systems Diagrams** chapter for proper installation of the blower hoses/tubes/adapters.

Purge Gas

NOTICE! The use of purge gas is required on lasers of 250 watts and greater. It will extend the life and reduce cost of ownership of the laser source. If a proper purge gas is not used and maintained with routine maintenance the warranty of the laser may be voided. Please contact a Kern technician if you have any questions regarding the purge gas system.

The laser system requires a 2.8 lpm (5.8 scfh) flow rate of purge gas to the ¼" air push connector located at the back of the laser system. If this ¼" air push connector is not installed please contact Kern for a no charge upgrade kit.

Passing purge gas through the laser head and RF power module can prevent component damage by creating an internal positive pressure. Also under some conditions of high humidity, the laser beam can be distorted by optical absorption of the laser beam by fluid vapors and optics internal to the laser can be permanently damaged. This effect can be totally eliminated by use of a proper purge gas.

The quality of the purge gas is an extremely important factor for trouble free operation of the laser. While the preferred purge gas is nitrogen with a purity of 99.95%, clean dry air (CDA) is also acceptable as specified below.

Please refer to the laser owner's manual for full description of purge requirements for the laser head.

Guidelines for Use of Compressed Air for Purge

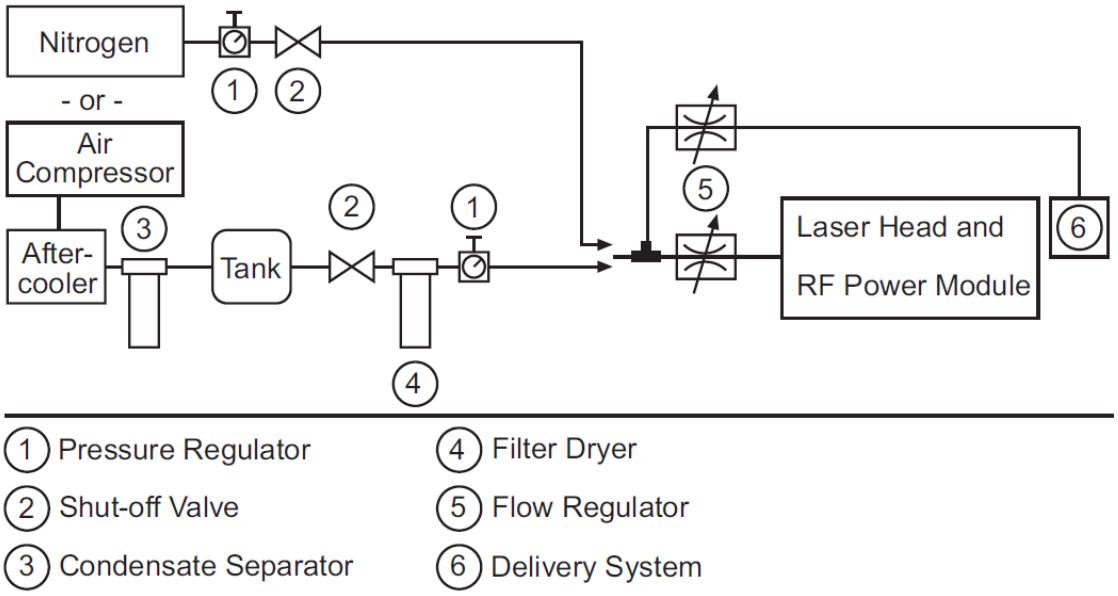
If nitrogen is not available, the alternative is clean, dry, oil-free compressed air. Compressed air is available in many facilities but typically is contaminated with water and oil vapors. The purity requirements for the compressed air are:

1. Filtered to remove particles larger than 1 micron.

2. Dried so that the dew point is 18 degrees Fahrenheit lower than the chiller's inlet cooling fluid temperature.

3. Oil free to better than 99.995%.

Recommended Purge Gas Configuration



A pre-filter(s) is recommended to be located before the finer filters to help prevent the finer micron filters from clogging in a short time. The following is a photo showing an acceptable purge filter setup that is available for purchase from Kern Laser Systems.

Whichever filter system is used, it is the customer's responsibility to ensure the purge gas is being filtered to 1 micron or lower and proper routine maintenance is being performed. Due to the variation of compressed air configurations that customers have, Kern recommends that a purge gas / filter expert be consulted. This expert can determine the correct filter system needed to obtain the purity specifications of filtered to remove particles larger than 1 micron, dried so that the dew point is 18 degrees Fahrenheit lower than the chiller's inlet cooling fluid temperature and oil free to better than 99.995%.

If the purge system becomes contaminated at any point please contact Kern's technical support for assistance. Parts of the purge system may have to be replaced.

Routine Maintenance

Routine preventive maintenance is required for the purge gas filters. If filters become clogged they will not meet the purity specifications. Maintenance will depend upon the type of purge gas system used. Please contact the supplier for specific maintenance instructions.

Laser Setup Purge Use

Purge is required in order to eliminate moisture from the system prior to use. This is required even though the system packaging is designed to ship the laser in a 'dry condition'. Note that system purge is required whenever the system has been off for an extended period of time without purge.

Purge the system with nitrogen or clean, dry air for a minimum of two hours. Failure to purge the system leaves the system at substantial risk of optics failure.

Mirrors and Lenses

Before using the laser system for the first time, alignment of the mirrors is required to align the beam through the nozzle. Also make sure that the lens is properly focused to ensure optimal cutting and engraving. These procedures are outlined in the **System Calibration** section of this manual.

Height Follower Controller (Optional)

Systems equipped with the metal cutting option will have a Height Follower Control Box that will need to be installed behind the left side of the gantry. The control box will slide back into the connector. A green plug from the capacitive sensor also plugs into the back of the box. Refer to the **Metal Cutting** chapter for operation of the controller.

K-Vision Controller (Optional)

Systems equipped with the K-Vision camera option will have a K-Vision Control Box installed inside of the electrical panel. Refer to the **K-Vision** chapter for operation of the K-Vision syste

3 Running the System

All laser system operators or bystanders must completely read this manual to understand the operation and safety needed when in the vicinity of the laser system. Knowledge of the controls, adjustments and performance of the system is needed to prevent exposure to hazardous radiation exposure. All persons that have visible access to that laser system must wear laser safety glasses at all times, even when the laser system is not in use. One person must be designated the laser safety officer and oversee the operators of the laser system.

Daily Startup

1. Walk around the system and check for any obstacles in the way of the motion of the table or the motion of the laser. Check also for any water leaks, frayed cords, or anything that does not look proper.
2. Visually inspect the Lexan laser shield for any damage, which could permit a reflection of the beam to escape.
3. Press the START button on the electrical panel for the laser system and vacuum blower. The chiller should automatically turn on when you START the laser system.
4. Cycle the key switch on the KLMC box from “OFF” to “ON”. There will be a 5-second delay before the laser will operate. All lights should turn green except for the Laser Enable and DSP Enable. The Laser Enable and DSP Enable will turn green once you have started cutting or engraving. To troubleshoot a red light, refer to the KLMC section of the Troubleshooting chapter.
5. The laser system should now be ready to load a file and begin cutting and engraving.

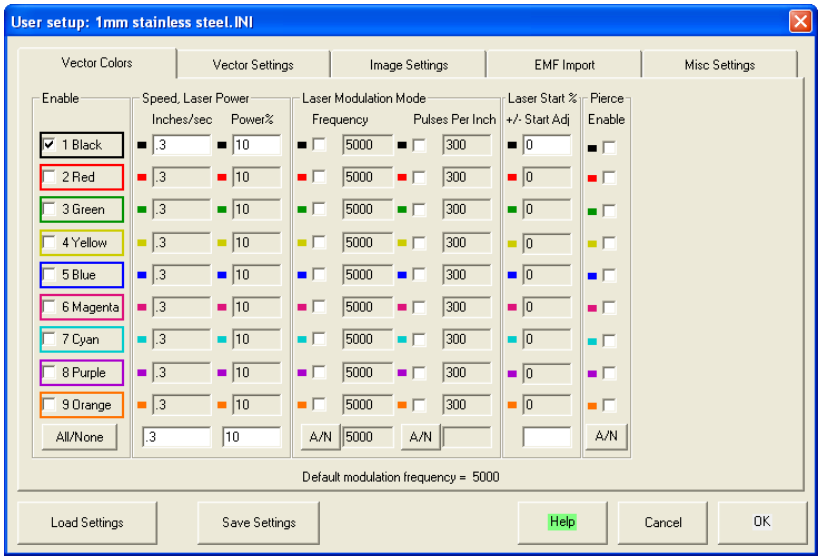
EMF Printer Driver

The Kern EMF Printer Driver is compatible with CorelDRAW, Illustrator and AutoCAD LT. The Kern EMF printer driver allows for creation of an .EMF file that combines cutting and engraving into one common file. The file is created in a folder and then automatically opened into KCAM. To use the driver use the following steps:

Open KCAM. Draw a black hairline circle in CorelDRAW. **File** > **Print**

Select the **Kern EMF Printer Driver** and click **Print**. The EMF file will automatically load into KCAM.

Click on the **Setup** button to set your speeds and power in the **Vector Colors** tab. This screen will be displayed:



KCAM, EMF Driver

Under the color Black, set the speed to 1 Inch/sec and power to 10% to cut this file in the paper. Click OK.

Click the **Cut** button to load the **Cut and Engrave Menu**. The nozzle air must be turned on for the laser to fire. Click the **Air On/Off** button to turn on the nozzle air and adjust the regulator to approximately 20 PSI of compressed air. Check the **Cut vector files** box and then press Continue to start the cutting of the file. The laser head will first align itself to and then move to the file on your tabletop.

The motion will pause at the start position of the deer on the table. Next the beam focus can be set to the material surface by placing the supplied Kern Laser Spacer. Place the spacer on the top of the material to be cut and slowly lower the focus optics down until it gently touches the spacer. Lowering of the nozzle is done by loosening the lever on the optics tube. Tighten the lever, remove the spacer and press the ENTER key or click Continue on your screen.

Note: If the metal cutting option is installed, the Height Follower Motor can be powered off and the knob next to the optics tube can be used to lower the nozzle down to the spacer.

The system will follow the programmed path at 1 Inch Per Second (IPS) that you previously set in the Vector Settings tab, while firing the laser at 10% power. At this speed and power, the system will cut the paper. Once the cut is done the laser will return to its home position.

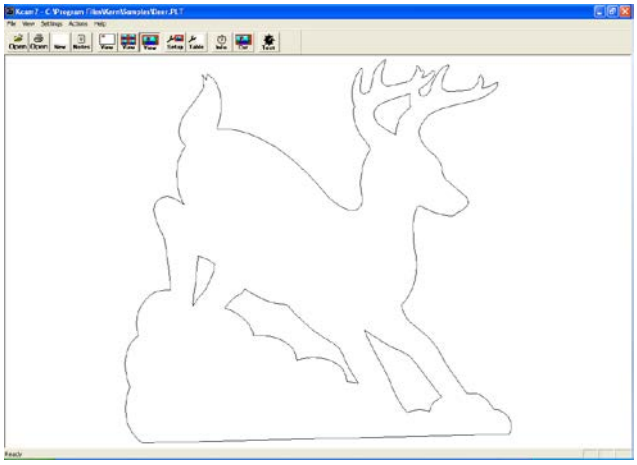
Do not stare at the laser beam in the cut area or permit others to do so. If laser system makes a grinding noise or acts out of the ordinary press the Emergency Stop switch and contact a Kern technical staff member.

Cutting a .PLT file

Open the KCAM software by double clicking the KCAM shortcut on your desktop.

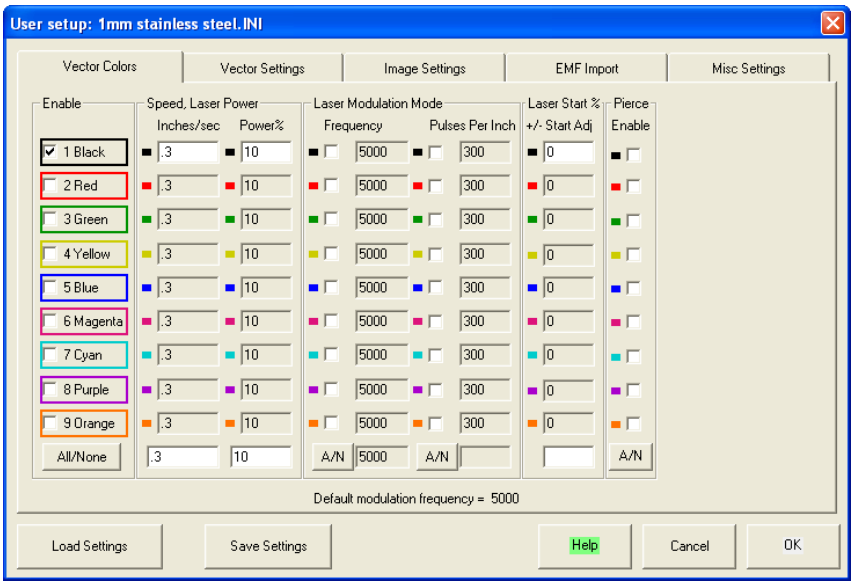
Click the NEW button to clear the screen, then click the first Open icon and select the **Deer.plt** file located at **C:\Program Files\Kern\Samples\Deer.plt**.

Click Open to load the .PLT file into KCAM. Next click the most right View button to view the extents of the file. The screen should appear like this:



Cutting a .PLT file

Click on the **Setup** button to set your speeds and power in the **Vector Colors** tab. This screen will be displayed:



KCAM, Cutting a .PLT file

Under the color Black set the speed to 1 Inches/sec and power to 10% to cut this file in the paper. Click OK.

Click the **Cut** button to load the **Cut and Engrave Menu**. The nozzle air must be turned on for the laser to fire. Click the **Air On/Off** button to turn on the nozzle air and adjust the regulator to approximately 20 PSI of compressed air. Check the **Cut vector files** box and then press Continue to start the cutting of the file. The laser head will first align itself to and then move to the file on your tabletop.

The motion will pause at the start position of the deer on the table. Next the beam focus can be set to the material surface by placing the supplied Kern Laser Spacer. Place the spacer on the top of the material to be cut and slowly lower the focus optics down until it gently touches the spacer. Lowering of the nozzle is done by loosening the lever on the optics tube. Tighten the lever, remove the spacer and press the ENTER key or click Continue on your screen.

Note: If the metal cutting option is installed, the Height Follower Motor can be powered off and the knob next to the optics tube can be used to lower the nozzle down to the spacer.

The system will follow the programmed path at 1 inch per second and 10% power. At this speed and power, the system will cut the paper.

Once the cut is done the laser will return to its home position.

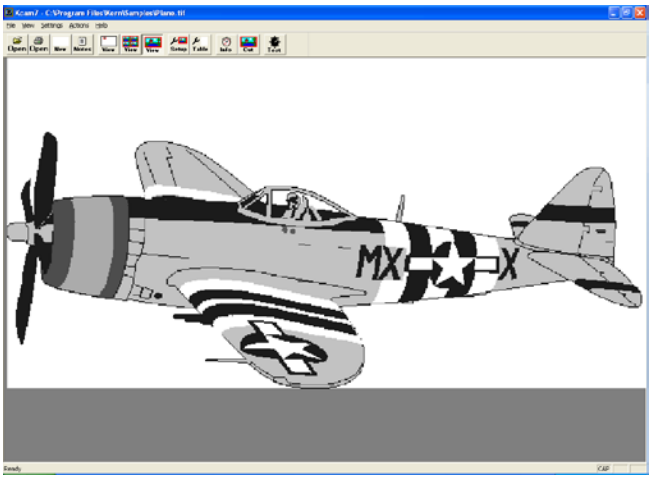
Do not stare at the laser beam in the cut area or permit others to do so. If laser system makes a grinding noise or acts out of the ordinary press the Emergency Stop switch and contact a Kern technical staff member.

Engraving a .TIF file

Open the KCAM software by double clicking the KCAM shortcut on your desktop.

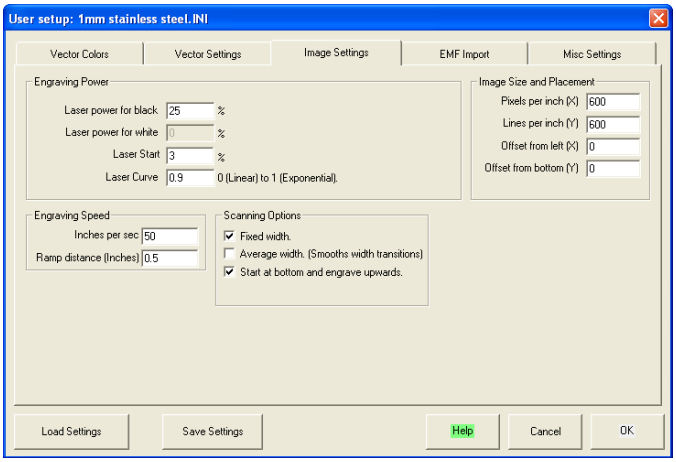
Click the **New** button to clear the screen, then click the first **Open** icon and select the **Plane.tif** file located at **C:\Program Files\Kern\Samples\Plane.tif**.

Click **Open** to load the .TIF file into KCAM. Next click the most right **View** button to view the extents of the file. The screen should appear like this:



Engraving a .TIF file

Click on the **Setup** button to set your speeds and power in the **Image Settings** tab. This screen will be displayed:



KCAM, Engraving a TIF file

Set **Laser power for black** between 10-25% and your **Engraving Speed** to 40”/sec. Click OK.

Click the **Cut** button to load the **Cut and Engrave Menu**. Make sure you have air coming out of the laser nozzle by clicking the **Air On/Off** button and adjusting the regulator to approx 40 PSI of air. Check the **Engrave image files** box and then press Continue to start the engraving of the file.

The laser will first home itself and then move to the file on your tabletop.

The motion will stop at the position of the airplane on the table. This will allow you time to set the focal point by placing the laser spacer on the top of your material and slowly lowering the focus optics down to the spacer. Now press the ENTER key or click Continue on your screen.

The system will engrave the programmed path at 40 IPS that you previously set in the Image Settings tab, while firing the laser at 25% power. At this speed and power, the system will engrave a piece of wood.

Once the file is done the laser will return to its Home position.

If laser system makes a grinding noise or acts out of the ordinary press the Emergency Stop switch and contact a Kern technical staff member.

4 System Calibration

New systems come fully tested and calibrated from the Kern factory. It is necessary to check the beam alignment of your system upon initial setup of the laser system. Please refer to the **System Diagrams** section of this manual for optics and mirror alignment diagrams.

Mirror Alignment

To align the flying optics assembly on your laser system you will need the following:

- Masking tape and Teflon tape.
- 7/64", 1/16", and 3/32" Allen wrenches.
- Aluminum alignment disks.
- Alignment sheet at the back of this manual.
- A small piece of wood approximately 4" x 4" and thicker than 1/4".

Instructions for checking and adjusting the alignment of your optics mirror are as followed:

1. Open the manual screen in KCAM.
2. Set the power level to 25%.
3. Place the large alignment disc at Stage 1(refer to the Mirror Alignment diagram in the System Diagrams chapter).
4. Place a piece of masking tape over the disc.
5. The doors and windows must be closed for the laser beam to operate.
6. Turn on the air and fire the laser with an "on time" of .5 seconds.
7. Adjust the laser mounting by positioning the laser to burn the center of the disc.
8. Place the small alignment disc at Stage 2.
9. Turn on the air and fire the laser.
10. Remove the top metal plate at Stage 1 with a 7/64" Allen wrench. Loosen the set screws with a 1/16" Allen wrench. Adjust the mirror cap screws with a 3/32" Allen wrench to center the burn into the alignment disc.
11. Lightly screw the set screws back into place without tightening too far to adjust the alignment of the mirror.
12. Replace the top metal plate.
13. Fire the laser once again to make sure the mirror is still aligned.
14. Drive the optics down the rail to the far end and place the small alignment disc at Stage 3.
15. Place masking tape over the disc.
16. Turn on the air and fire the laser.
17. At Stage 2 loosen the set screws with a 1/16" Allen wrench. Adjust the mirror cap screws with a 3/32" Allen wrench to center the burn into the alignment disc.
18. Lightly screw the set screws back into place without tightening too far to adjust the alignment of the mirror.
19. Fire the laser once again to make sure the mirror is still aligned.
20. Remove the optics nozzle from the assembly and lower the laser tube so that it covers one of the crosshairs on your Beam Alignment diagram (in the back of manual).
21. Raise the optics tube 3 inches above the alignment sheet. Make sure to keep the wood block steady so that it stays directly centered below your optics.
22. Fire the laser at 5-10% power and observe where the laser beam has hit the alignment sheet. If it is centered on the crosshairs no further alignment will be needed. If it is not exactly centered you will need to adjust the alignment of your optics mirror at Stage 3 to burn the center of the crosshair.
23. Reinstall the optics nozzle back onto the laser tube.
24. Place Teflon tape over the laser nozzle.
25. Fire the laser at 5 -10% power and observe where the beam is leaving the nozzle with your mirror tool. The hole in the Teflon tape should be very small like a pin prick. If it is larger than this you may have clipping and need to further adjust the mirror. If it appears centered coming out of the nozzle then your mirror is properly aligned. If it is not centered then further adjustments to the mirror will be needed.

26. Click the close button or the ESC key to get back to your regular KCAM screen.

NOTE: *The optics tube assembly should not get hot. If it does, that may indicate your beam is clipping inside the optics assembly. The above procedure may be needed to correct the beam alignment.*

Focusing the Optics

A lens focuses the laser beam to a very small invisible point of light. This point of light is very intense in temperature and will vaporize many materials. The lens has a focal point or focal length. This is the distance from the center of the lens to its smallest spot.

Focal lengths (FL) that are commonly used are 1.5", 2.5", 5.0" and 7.5".

The optics nozzle will come focused from our factory. If for some reason the optics loses focus you will need to cut into a piece of paper or wood at 1 inch per second and 10% power. Follow these steps:

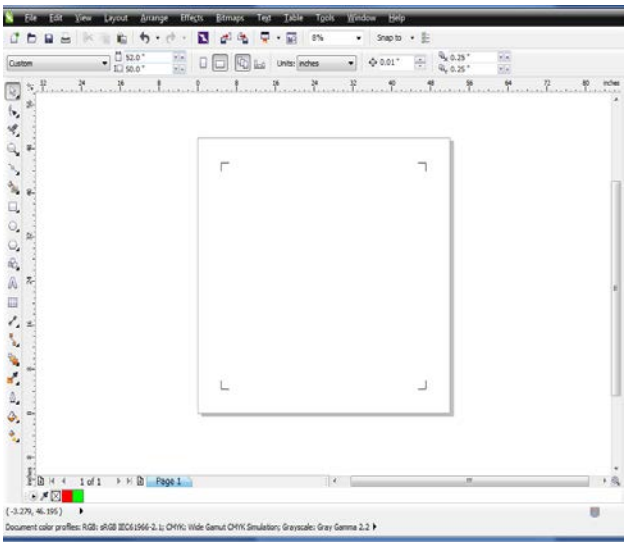
1. Open Test Mode in KCAM.
2. Lower the nozzle and use the Kern Laser Spacer to focus the nozzle to the paper.
3. Make sure you are cutting with shop air and NOT oxygen when setting the focus height.
4. Cut into the material and drive the laser in one direction. Adjust the nozzle up or down until you have the narrowest line in the material. When you are cutting with the narrowest line width this is when the focus height is set.
5. If your narrowest line is at the same distance of the Kern Laser spacer you are in focus.

Adjusting the lens to get back into focus:

1. Unhook the air hose from the laser nozzle.
2. Remove your laser optics nozzle from the laser system.
3. With your lens removal tool unscrew the first black lock ring screw.
4. Gently remove the lens from the assembly, place on a clean cloth.
5. Remove the O-ring.
6. Adjust the bottom black lock ring up or down depending on where you need to get in focus.
7. Place the O-ring back into the optics.
8. Gently place the lens back into the optics.
9. Screw the top black lock ring back into the optics and gently snug to the lens.
10. Hook up the air hose and screw the laser nozzle back into the laser tube.
11. Cut the file again and verify that the narrowest cut on the paper is at a width of the Kern Laser Spacer.
12. Begin laser operation if the focus is now correct. Readjust the bottom black lock ring if you are still out of focus.

Squaring the Table

1. Open Corel Draw. Draw a hairline box "see diagram" about 75% of your table size in the center of the table.
2. Use the Virtual Segment Delete tool to keep just the corners.
3. Print to Kcam and cut file on paper with vacuum on.
4. Measure corner to corner diagonally. If the cut is not square, loosen the three bolts on each side of the gantry and adjust the limit switch on the right side of the machine. Retighten the (3) bolts, realign the system, cut the file and measure again. Repeat until cut is square.



Only black corners

Setting Zero-Zero Point

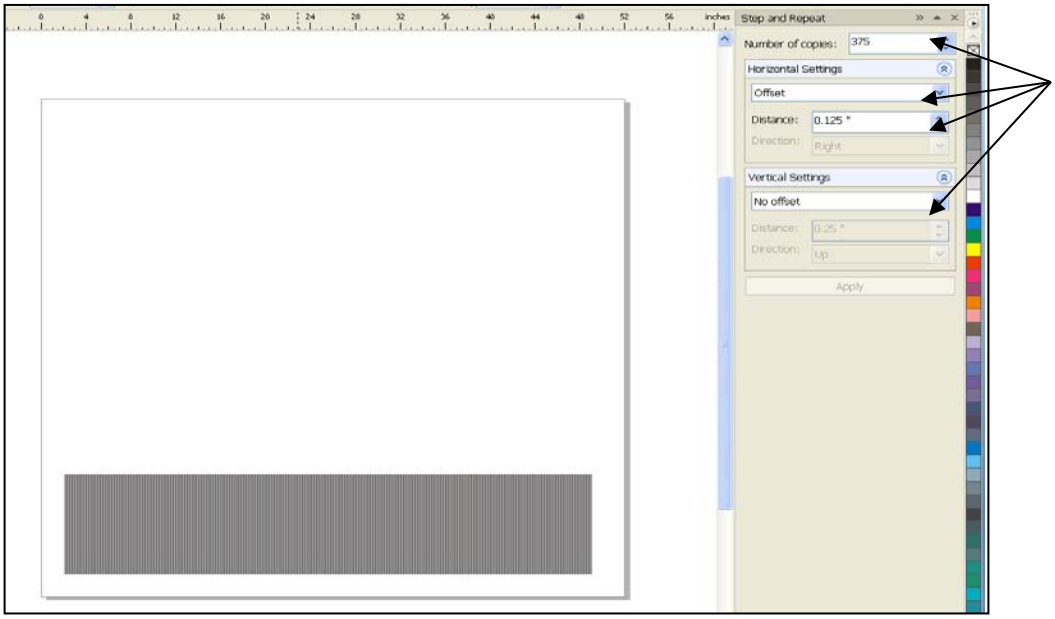
The objective is to align the laser to have the 0, 0 reference point in the lower left corner of the table, inside the aluminum frame. The 0, 0 point is set at the factory. It is a good idea to test this when receiving your laser system. Follow these steps:

1. Open KCAM
2. Open the **Match1000.plt** file at C:\Program Files(x86)\Kern\Samples\Test Files\Match1000.
3. Place file in zero corner of table by selecting Setup\Misc. Settings. Check User Offset box enable and set X and Y to -3. Verify Page Lower Left (default) is applied.
4. Cut the file out of the table top paper.
5. The box should be flush with the front and left rail.
6. If it is not flush go to the Table tab in Table Settings and adjust the **Alignment offset distance** until the square is flush with both aluminum rails.

Aligning the Engraving Pixels "Dot Calibration"

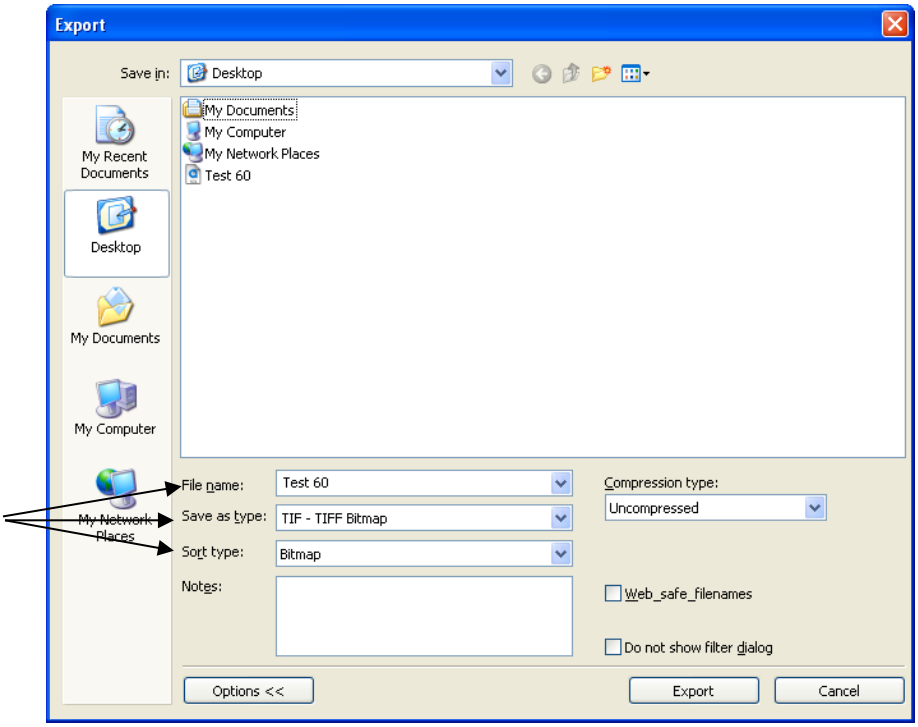
These parameters are set at the factory before shipping the system. Normal wear of the belts and pulleys may require realigning.

STEP 1 The first step is to create a .TIF file in CorelDraw. To do this, open CorelDraw. Select the freehand tool from the left toolbox. Draw a vertical line on the table 10 inches in length. With the line selected that was just created, go to Edit→ Step and Repeat. Enter 375 for the number of copies and select Offset under the Horizontal settings. Enter a distance of .125. Under Vertical settings, select No offset then click Apply.

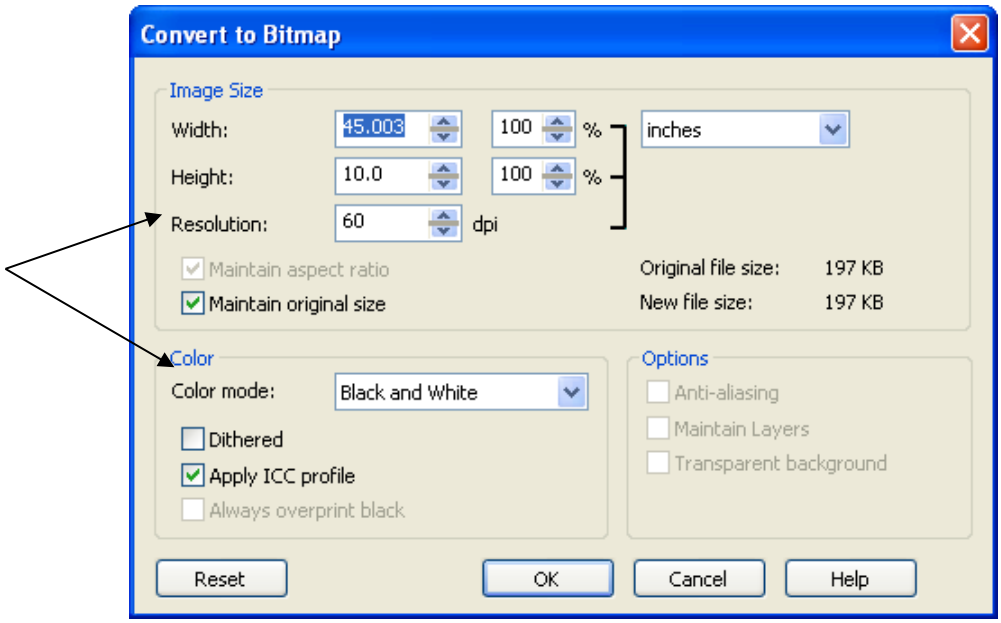


Step and Repeat

STEP 2 Go to File →Export. Select a location to export the file to and give the file a name (Example: Test 60). The save as type must be a .TIF file and the sort type must be Bitmap. Click on Export. A second screen will appear. Maintain original size needs to be checked and the color mode must be black and white. The resolution needs to be 60 dpi. Once done, click OK.

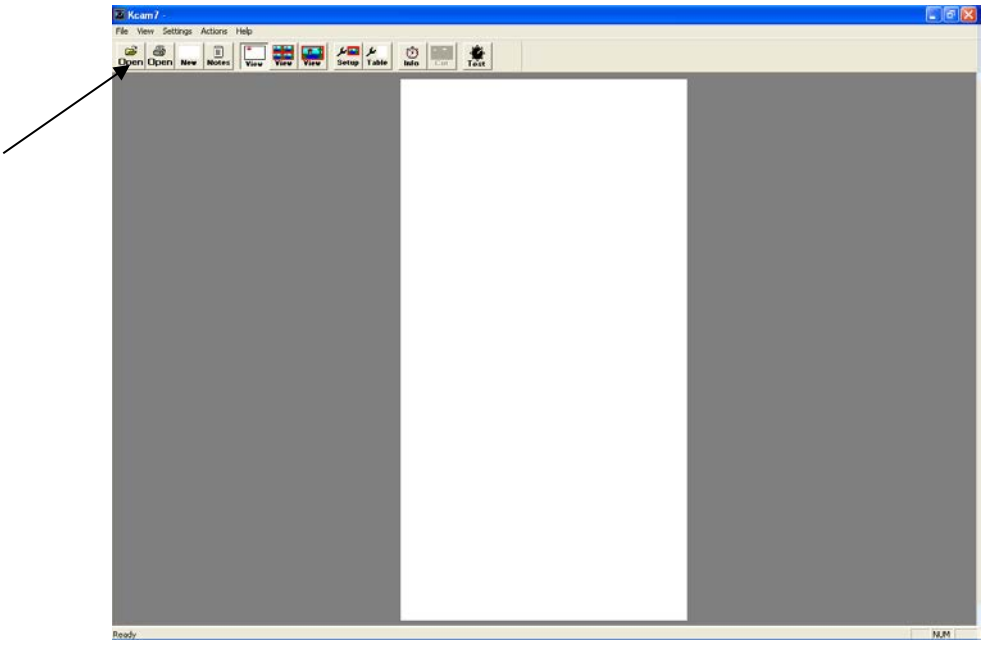


Save as type



Export

STEP 3 Open KCAM. Select the first open button located in the upper left corner. Locate the .TIF file just created. Click open.


Open

STEP 4 With the file opened, click on Setup→ Image Settings. The pixels per inch need to be set at 60 for both the X and Y. Set the speed to 10 inches per second and the power for black at 10%. Next click on Misc. Settings and enable the user offset. Move the file up and over from zero, zero (Example: 1 and 1) Click OK.

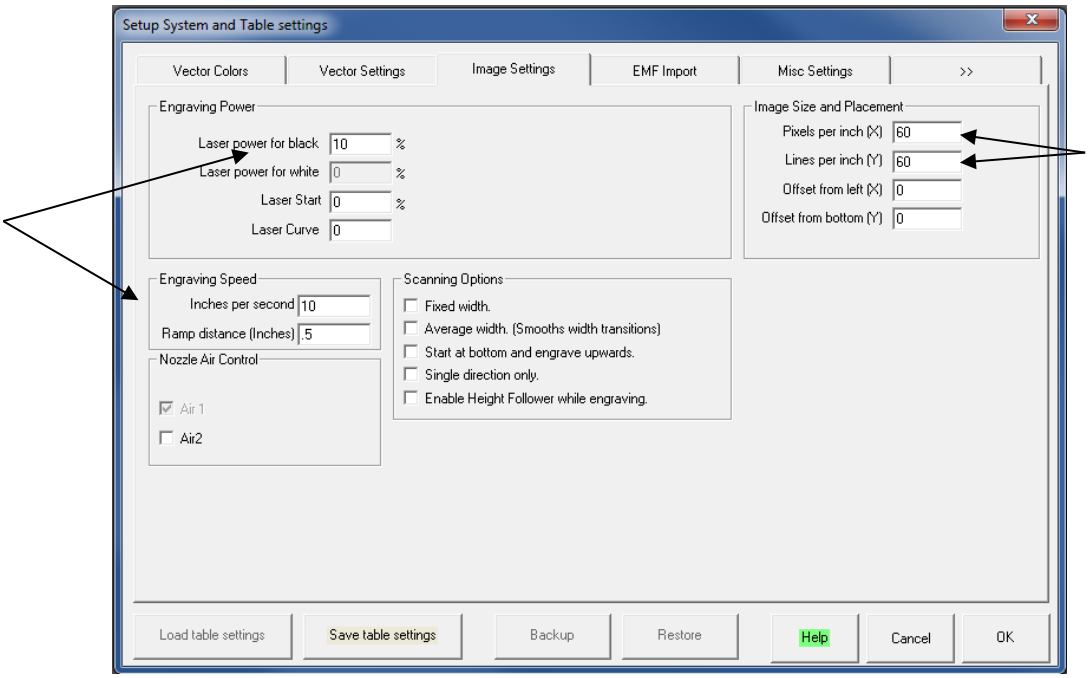
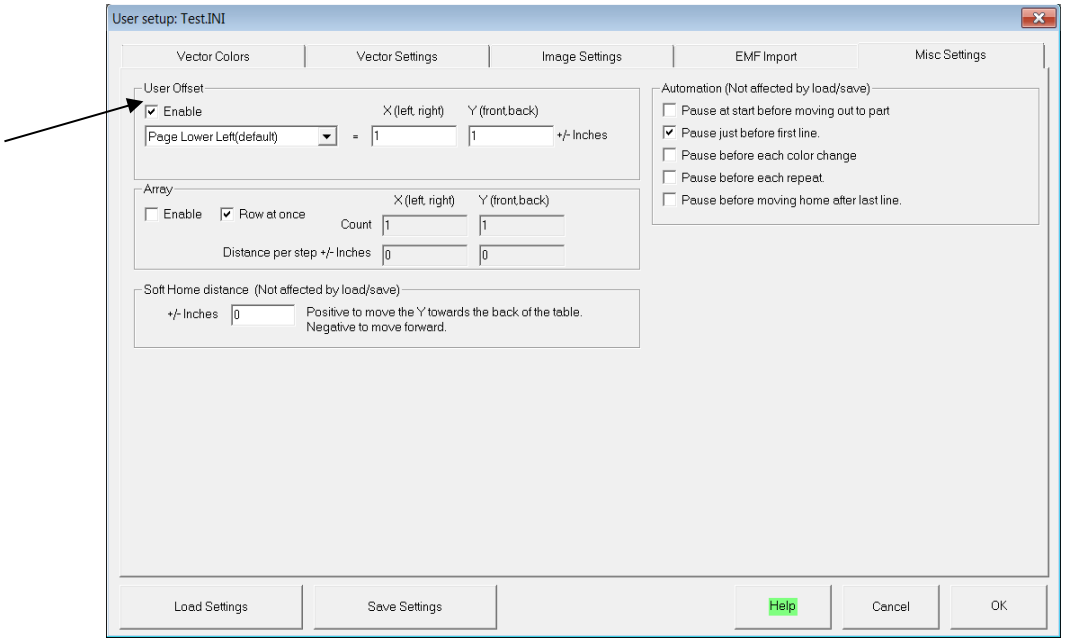
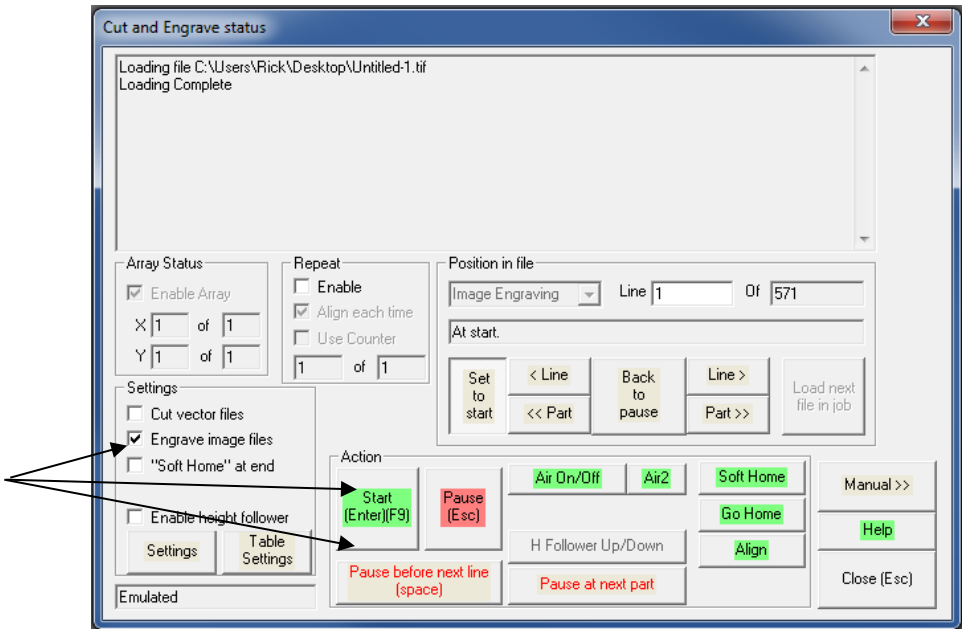


Image Settings



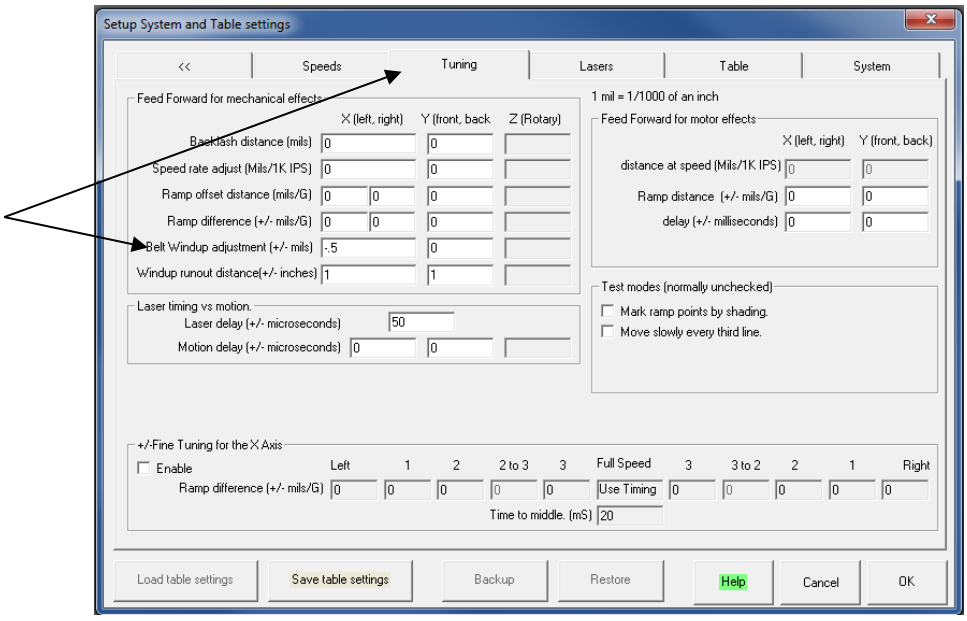
Misc Settings

STEP 5 Click on Cut at the top of the screen. With this screen open, make sure engrave image files is checked. Once checked, click Start.



Cut

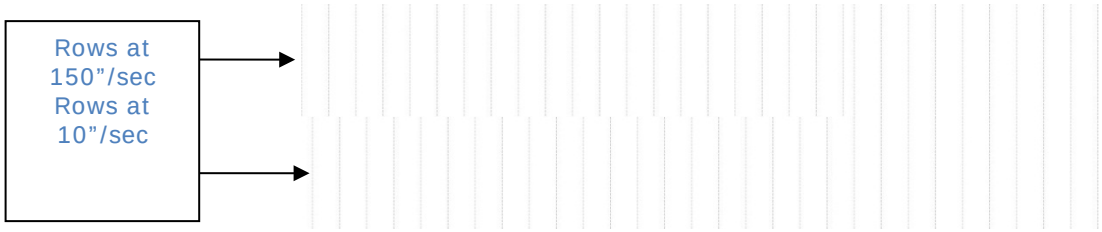
STEP 6 After the machine has engraved a couple passes, pause the machine at the end of a line. With a magnifier, look at the dots. The middle half to two thirds of the table should be vertically lined up. If they appear to be offset, click on Table Settings→ Tuning. The setting that needs to be adjusted is the Belt Windup Adjustment. (This number can be negative or positive and has a range of +/- 4). Start by entering -.5. Click OK and continue. Recheck the dots. If the dots are still offset, continue to increase/decrease the Belt Windup Adjustment.

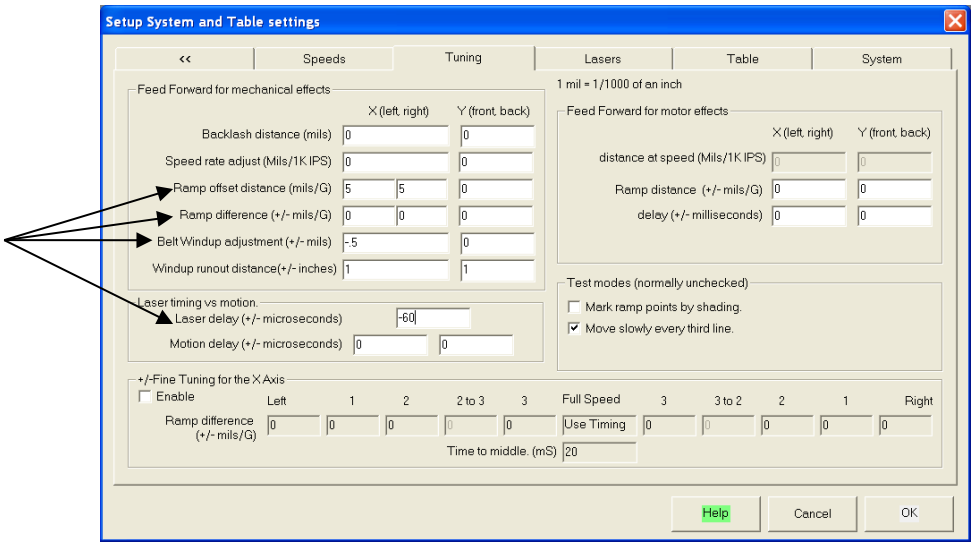


Tuning

STEP 7 Once the dots are lined up at 10”/sec, increase the speed to 150”/sec and power to 60% (Use 130”/sec for Metal Cutting head). Continue the engraving. After a couple passes, pause at end of line. Look at the first 12 inches or so on both the left and right sides of the table. The dots will appear offset from each other, but also the rows that were made at 10”/sec. To align the row of dots made at 10”/sec to the dots made at 150”/sec, go to Table→ Tuning→ Ramp Offset Distance. The left box controls the left side of the table and the right box controls the right side of the table (The numbers will be positive and have a range of 0 to 10). Start by entering 1 in both boxes. Continue the engraving. After a couple passes, check the dots. Either increase or decrease the Ramp Offset Distance to align the rows of dots made at slow speed to the rows of dots made at fast speed.

NOTE: The left side may have a different number entered than the right side.





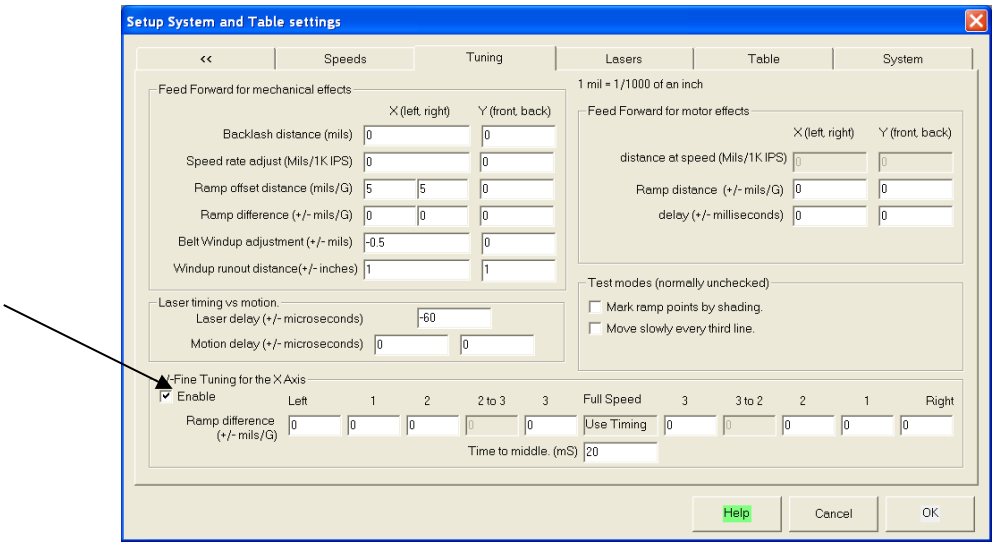
Tuning

STEP 8 Next, move to the middle portion of the table. The dots will look offset to each other, but should appear lined up with the dots made at 10”/sec. Click on Table Settings→ Tuning→ Laser Delay. Start by entering -60 (This setting is typically negative and ranges from 0 to -100). Click continue. After a couple passes, check the dots. Either increase or decrease the Laser Delay to align the dots in the middle of the table at fast speed.

STEP 9 If the first row of dots on the far left and right are not lined up, (If first row on left and right look good, skip to **STEP 10**) go to Table→ Tuning→ Ramp difference. The left box controls the left side of the table and the right box controls the right side of the table (This setting has a range of +/- 2). Start by entering .1 for both boxes. Click continue for the engraving. After a couple passes, pause at end of line and check the outside dots. Slowly increase/decrease the Ramp difference until the outside left and right dots are aligned.

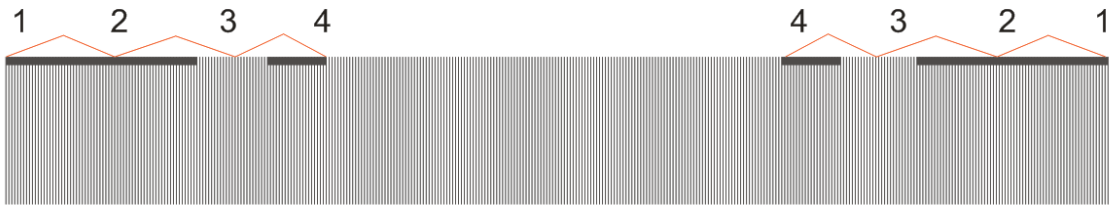
NOTE: The left side may have a different number entered than the right side.

STEP 10 Lastly, align the dots on the left and right sides of the table, minus the first row on the left and right sides. Click on Table Settings→ Tuning→ and enable Fine Tuning. The first four boxes control the left side of the table and the next four control the right side of the table. The numbers entered here can be positive or negative, whichever makes the dots align. The first box controls approximately the first three inches. The second box controls the next three inches. The third box controls the next three inches passed the second and the fourth box controls the next three inches passed the third. All in all, the Fine Tuning controls approximately the first twelve inches on both the left and right sides of the table. If too large of a number is entered into one of the boxes, it will affect dots outside of its specified area. Each box has a range of +/- 5. Numbers outside this specified range can cause the motors to hum or make irregular noises. Check the box next to mark ramp points by shading. Click Ok and continue the engraving. After a couple passes, pause the system at end of line. There will be shaded regions on both the left and right sides of the table. These shaded regions correspond to where the Fine Tuning boxes will be effective. Uncheck the mark ramp points by shading. Begin by entering a number in one of the boxes and see how it affects the dots. Adjust the numbers in each of these boxes to get the dots to align. The goal is to get the dots to line up as vertical as possible.



Tuning

NOTE: Not all the boxes may be needed. Numbers may differ from the left side of the table to the right side.



STEP 11 Once dots look acceptable, engrave a file to verify results.

NOTE: If any difficulties occur in aligning the dots, contact Kern Electronics & Lasers Inc. at 1-888-660-2755 and a technician will assist you.

5 KCAM

The KCAM software will be preinstalled on your laser system computer. All parameters for the KCAM software and servo motors are saved on a USB stick in your laser tool kit. Kern has also backed up these parameters at our facility.

Installation

The KCAM software is available online at http://www.kernlasers.com/customer-login. If you do not have a username and password please contact our technical support team to receive one.

Upgrades

Updates are periodically available for the KCAM software. Please give notice to the fine print on the download page as certain upgrades may require you to do a full reinstall rather than just placing the upgrade file into the KCAM7 folder.

To locate your current KCAM version number select the 'Help' tab at the top of the KCAM screen and select 'About KCAM7'.

Overview

KCAM is a Windows based motion and laser control program created by Kern's software engineering department. The image below is the main screen of KCAM7. KCAM can directly open .TIF (raster), .PLT (vector) and .EMF (combined raster and vector) files. The Kern EMF Printer Driver can be used to print from software packages such as CorelDRAW®, AutoCAD LT® and Adobe® Illustrator®.

Opens .PLT (vector) and .TIF (raster) files.

Opens .EMF (combined vector and raster) files.

Clears all open files from the preview screen.

Opens a text notepad for saving notes.

Displays the entire table.

If an array is set, this option will show the extents of the entire array.

Displays the extents of the opened file.

Opens Setting menu. The speeds and power levels are set here.

Opens Table menu. Options in this menu are preset for your system. Please DO NOT edit these settings without consulting a Kern technical staff member.

Opens the Time Estimator, File History, Process Log and System Usage tab.

Opens the Cut and Engrave status menu. This menu allows you to start cutting and/or engraving.

Opens the Manual Test screen. This screen allows you to manually fire the laser and run the motion of the laser system.

File

New: Clears all open files on the table preview.

Open: Opens .PLT (vector) and .TIF (raster) files.

Import EMF files: Opens .EMF (combined vector and raster) files.

Exit: Closes KCAM

View

Notes: Opens a notepad for you to enter information on the files you are cutting and engraving, such as material, power, speed, etc.

Normal preview shader: Default setting for viewing table.

Fast (darker): Loads larger images faster and with less resolution. No resolution is lost in the actual cut or engrave file.

View glass or granite errors: Errors in your raster file are highlighted. Errors could be caused from using a different software design DPI compared to the DPI you printed to KCAM at.

Invert Image Colors: Inverts colors in previewer.

Draw lines as dashes, Show line nodes, Show Grid: Miscellaneous viewing options.

Zoom Table: Displays the entire table top.

Zoom Array: If an array is set the extents are shown.

Zoom Extents: Displays the extents of the open file.

Toolbar and Status Bar: Hides or displays these two bars.

Settings

Edit Setting: Opens Setting menu. The speeds and power levels are set here.

Edit System and Table Settings: Opens Table menu. Options in this menu are preset for your system. Please DO NOT edit these settings without consulting a Kern technical staff member.

Lock Settings: Password protects various aspects of KCAM.

Actions

File Time Info: Opens the Time Estimator, File History, Process Log and System Usage tab.

Cut and Engrave: Opens the Cut and Engrave status menu. This menu allows you to start cutting and/or engraving.

Activate on "Enter Key": Allows cutting and engraving to start by pressing Enter key.

Manual: Opens the Manual Test screen. This screen allows you to manually fire the laser and run the motion of the laser system.

Table Map: Mapping program to increase table accuracy. These settings are preset and should not be adjusted without the help of a Kern support technician.

Tcp Control: Used for Kern technician troubleshooting.

Debug/Scope Windows: Used for Kern technician troubleshooting.

Help

KCAM7 Help Contents: Brings you to the top of the Help page.

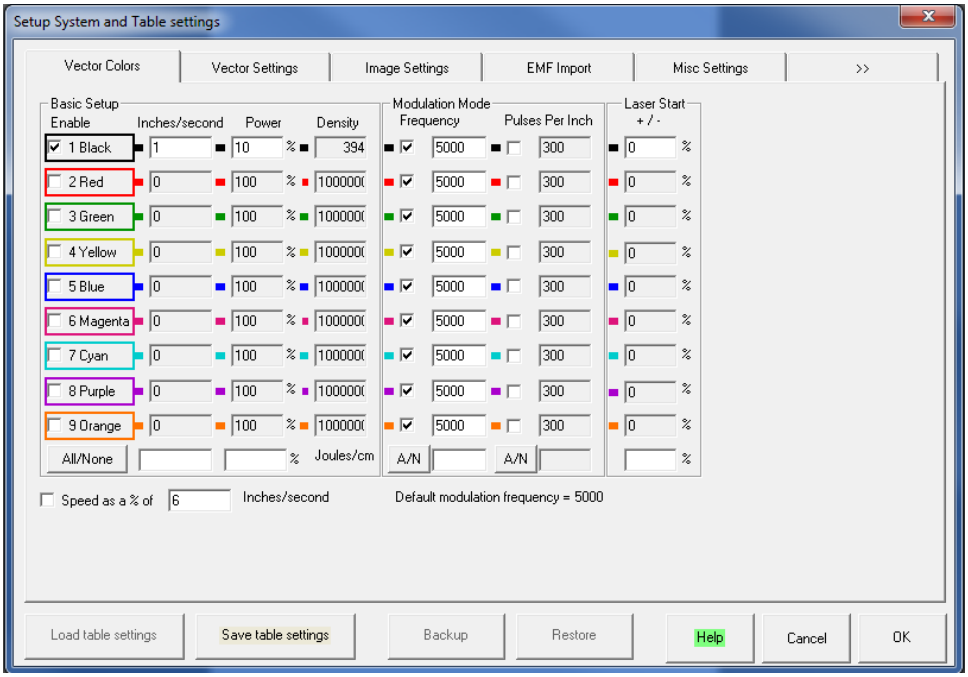
Online Help: Sends you to the Kern Technical Support page.

About KCAM 7: Displays details on the version of KCAM you are running.

Setup Icon

Vector Colors Tab

The Vector Colors tab is where you set cutting power levels, speeds, modulation mode and to enable/disable up to 9 different colors of vector lines.



Vector Colors

Enable (Colors)

The checkboxes to the left of the colors list will enable or disable its corresponding vector line color.

All/None: Allows you to quickly enable or disable all colors.

Speed

Vector cutting speeds for nine different colors can be set in the Speed column. The range of acceptable speeds is from .01 inches per second to 10 inches per second.

Laser Power

The laser power level for each color can be adjusted from 0 to 100%.

Density

The density is measured in Joules. This is used as a reference for matching different speed and powers.

Modulation Mode

One of two modulation modes can be set:

Laser Modulation Frequency
Setting Range: 50 – 10000 Hz.
Default Setting: 5000 Hz

Pulses Per Inch
Range: 0 – 600 pulses.

Laser Start %

Adjust the laser start for individual line colors. This setting will affect the power of the laser when ramping in corners and arcs. It will adjust the minimum laser power from 0 to a value that will cut through in the corners.

Tool Offset

Offsets the cutting line to the inside or outside of the original file.

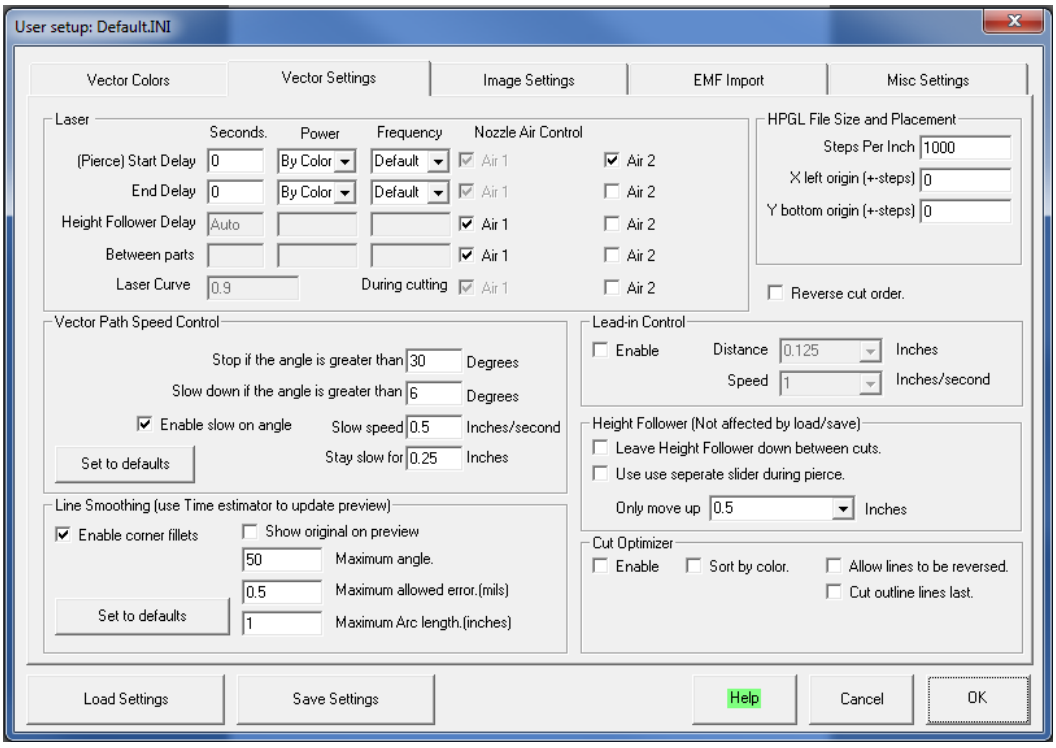
Load / Save Settings

Load Settings: Loads saved cutting and engraving parameters.

Save Settings: User defined parameter list. Once cut and engrave parameters are optimized for a material, the Save Settings tab can be used to save the current parameters as a unique name. This allows past parameters to be accessed for future use.

Vector Settings Tab

The Vector Settings tab is where you can set various cutting delays and other options.



Setup, Vector Settings

Laser

Pierce Start Delay: Sets a delay which will give the laser a chance to penetrate the material to be cut. This setting should be left at 0 for normal operation. This setting is typically used when cutting thicker materials and metal cutting applications. The two boxes to the right allow the laser power % and frequency to be set to a custom level during piercing.

End Delay: Sets a variable pause which will give the laser a chance to 'catch-up' with itself at the end of a cut. This setting should be left at 0 for normal operation. This setting is typically used when cutting thicker materials and metals.

Height Follower Delay: A delay that allows the height follower to move up or down into position when starting or finishing a cut.

Laser Curve: Controls the laser power between the Laser % when starting and stopping and the set laser power. A laser curve of 0 will map the power levels in between linearly. A laser curve of 1 will use a curve with a power of two (a = b Default is .9. This feature is used mostly when cutting partially into materials to give you desired cutting depth in the corners and on straight lines.

Nozzle Air Control: Enable Air 1 and Air 2 during different settings.

Lead in Control

Enable: Turns ON and OFF the Lead-In Control. This will allow you to cut at a slower speed for a set distance.

Distance: Distance the lead-in is effective for.

Speed: Speed to go for this lead-in distance.

HPGL File Size and Placement

Steps Per Inch: Match this setting to the output setting of your design software. Typically set to 1000.

X left origin and Y bottom origin: Moves the placement of your file on the tabletop.

Example: Set X left origin to 5 and Y bottom origin to 5 and all vector images move up and over 5 inches from its present location. Negative numbers will move the file in opposite direction.

Cutting Optimizer

Enable: When checked, this feature will cut the line segments of your file in a way that will minimize the time needed to complete the file (must reload file to activate).

Sort by color: Cuts all vector lines of one color before moving onto the next color.

Allow lines to be reversed: Will reverse vector cutting direction if calculated as a faster alternative. If you are cutting a material where lead-ins are used you may want to disable this setting.

Cut outside lines last: Cuts out the inside pieces of your file first. This will ensure that your material does not shift while cutting the smaller pieces inside your main cut profile.

Cut Options

Reverse Cut Order: Reverses the part order during cutting.
Example: Parts are normally cut in order of A, B, C. When this option is checked the order the parts are cut is now reversed to: C, B, A.

Line Smoothing

Enable corner fillets: Extra nodes added to arcs allowing for smoother cut edges. This is very noticeable in acrylic (must reload file for changes to take effect after this setting is checked).

Maximum angle: The maximum angle of a curve before the software will add nodes. This setting decides if smoothing will be used based on the setting here. Typically set to 30.

Maximum allowed error: The allowable error. Typically set between 0.5 & 1.0 mil.

Maximum arc length: Smoothing in corners.

Vector Path Speed Control

These numbers relate to the ramping of the machine when it approaches corners, circles and radiuses. It is a very helpful setting to reduce vibration in these areas.

Stop if angle is greater than: This refers to a change in angle of a vector cut. If the machine recognizes a change in angle of the number entered or greater, it will stop for a brief moment and then continue its cut.

Slow down if the angle is greater than: When performing a vector cut and the machine comes to an angle that is greater than the angle entered, it will slow down to the speed entered in the slow speed setting.

Example: If an angle of 10 is entered in the Slow down if angle is greater than box and .2”/sec is entered in the Slow speed box, than each time the machine recognizes a change in angle of 10 degrees or more, it will slow to .2”/sec.

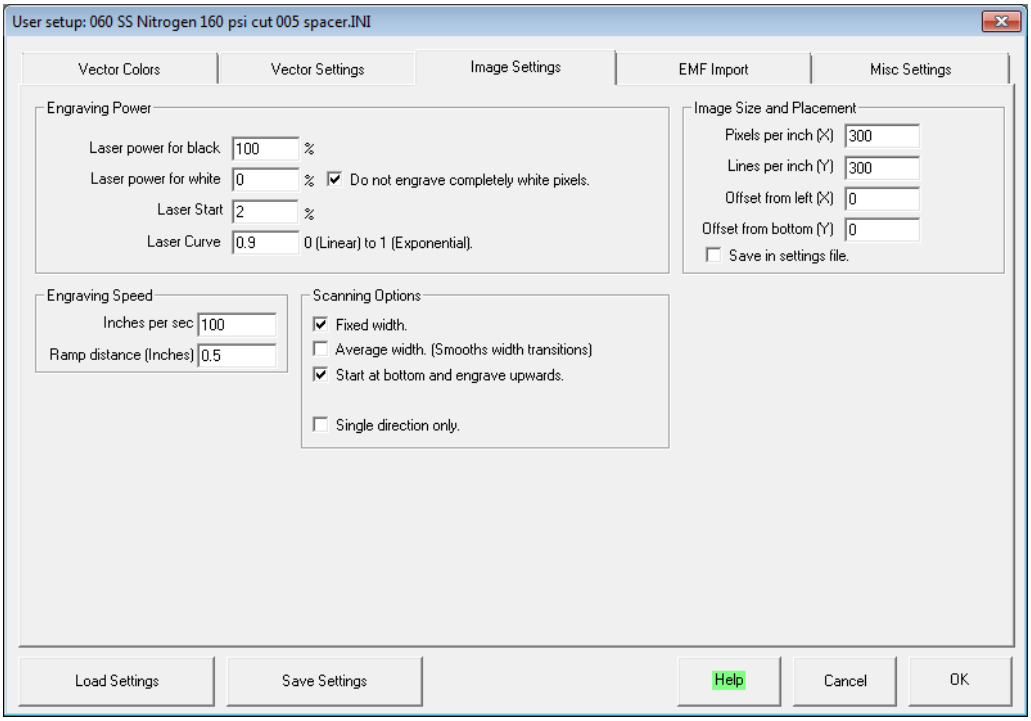
Slow speed: Each time the machine slows down for a change in angle, it will slow down to the speed entered here. This speed can range from .01 to 10 inches/sec. The intricacy of the cut will determine the speed entered. The more intricate, the slower the speed needs to be set.

Stay Slow for: When the machine enters a corner or a radius, it will slow to the speed entered in the slow speed setting. As it comes out of the corner or radius, it will stay at that slow speed for the distance that is entered for this setting.

Example: The machine is cutting a 0.25" radius on a part and the Stay slow for is set at 0.2" and the Slow speed is set at 0.4"/sec. The machine will slow to the 0.4"/sec for the radius and will keep that speed for a distance of 0.2" passed the radius.

Image Settings Tab

The Image Settings tab is where you can set engraving laser power, engraving speed, scanning options and a user offset.



Setup Menu, Image Settings

Engraving Power

Laser power for black: Black represents full power, or 100%. Laser power for black can be set from 0 - 100%.

Laser power for white: White represents no power, or 0%. Typically set to 0%.

Laser Start: This setting adds additional laser power when the laser is ramping up or down in speed (edges of your file).

Example: Your marble etching is coming out good but a little dark on the outsides. Increase this number to laser the outsides with more power. For most materials this number is left at 3%. Typical setting is from 0 - 60.

Laser Curve: Controls the laser power between the Laser Start and the black laser power. A laser curve of 0 will map the power levels in between linearly. A laser curve of 1 will use a curve with a power of two ($a = b^2$). Most materials use a laser curve setting of 0.8.

Image Size and Placement

When you export a .TIF file from the design software, you can select the image DPI. This same DPI must be set in KCAM to match your drawing. Set your DPI (dots per inch) in KCAM by setting pixels per inch: in the X-axis and lines per inch in the Y-axis.

NOTE: The DPI is automatically set for you if you are using the Kern Printer Driver. Your image will be saved from your design software and opened in KCAM with the correct DPI. The DPI is set in the EMF Import tab.

Offset from left and offset from bottom: Shifts the open image anywhere on the table top.

Example: Setting the X and Y offsets both at 5 will move the image towards the back 5 inches and to the right 5 inches.

Engraving Speed

Sets the raster engraving speed of the laser system.

Engraving Speed Chart

Engraving Speed Chart		
System Model	Min Speed	Max Speed
LaserCELL	.1”/sec	150”/sec
LaserCELL w/ metal cutting	.1”/sec	130”/sec

Engraving Speed Chart

Ramp Distance: This feature sets the travel distance off the right and left edge of the engraving. Typical setting is 0.5”.

Example: If engraving a 5 inch wide box with the ramping set at 1”, the laser head will travel 1” past the extents of the engraving file on both left and right. This is helpful to get the laser up to speed on small parts so that the laser is firing when the head is at a constant speed.

Scanning Options

Fixed Width: The laser will scan out to the width of the files furthest extent.

Average width: Similar to Fixed Width, except that the laser nozzle will gradually move in with the file if it gets narrower.

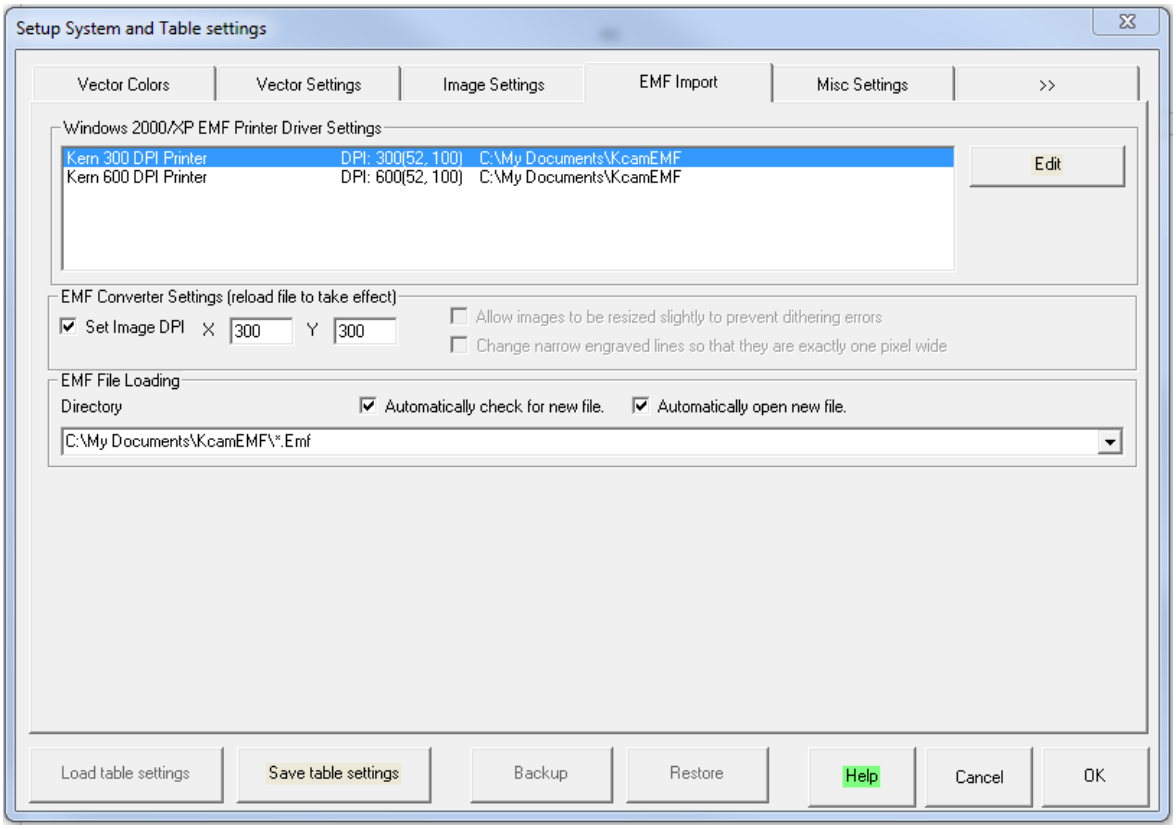
Start at bottom and engrave upwards: When checked, the laser starts engraving from bottom of the image and finishes at the top.

Single Direction: This option allows the laser to engrave left to right and traverse back without firing the laser from right to left. This can eliminate banding in some instances.

Enable Height Follower while engraving: When checked, the Height Follower will be active while engraving. (When enabled, maximum engrave speed of 20” per second)

EMF Import Tab

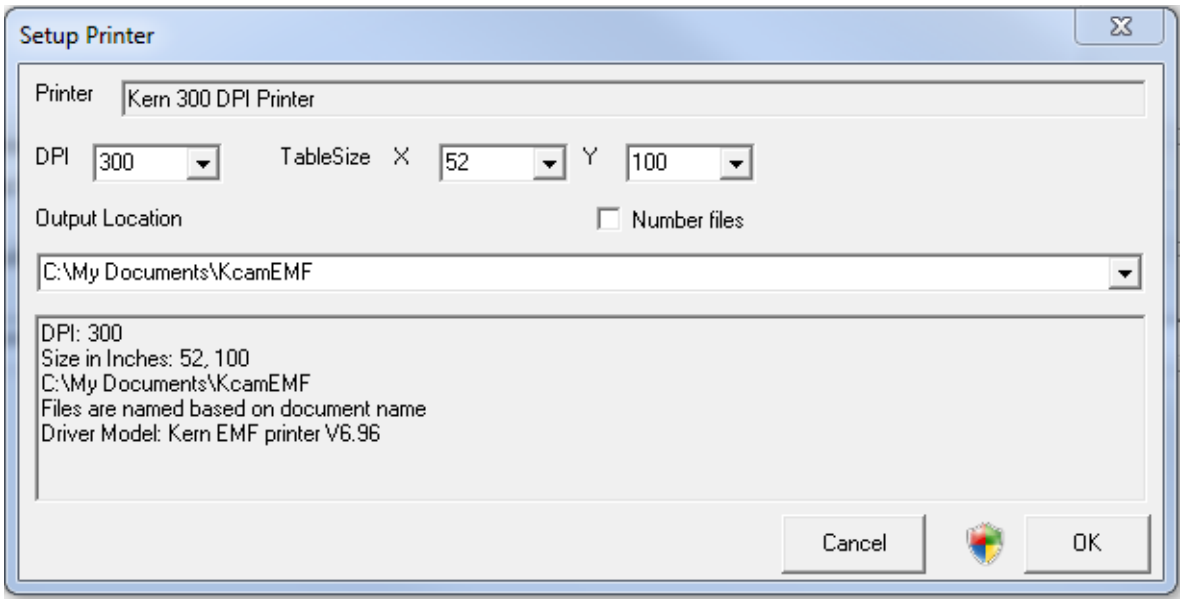
This tab lets you choose the path in which your EMF files are saved to, and the DPI of your file.



Setup Menu, EMF Import

Win 2000/XP EMF Printer Driver Settings

This menu will be displayed when you click the **Edit** button. Here you set your DPI, table size, and output location.



Setup Printer

Number Files: Check to name each file with a specific time.

The code behind the save name is:

Example: Plane.cdr_20080408135603_EMF.EMF

Plane.cdr = name of the file
2008 = year
04 = month
08 = day
13 = hour
56 = minute
03 = second
EMF =file type
.EMF = file extension

Output location: This must be set to:
C:\My Documents\KcamEMF

EMF Converter Settings

When checked, will automatically save your files with the selected X and Y DPI. Both DPI's must be increments of the DPI in the table section above for best results. If split, X=600 and Y=300, the X would have twice the resolution while keeping the engraving time in the Y axis to half or 300 lines per inch. For best results use the same DPI for the X and Y.

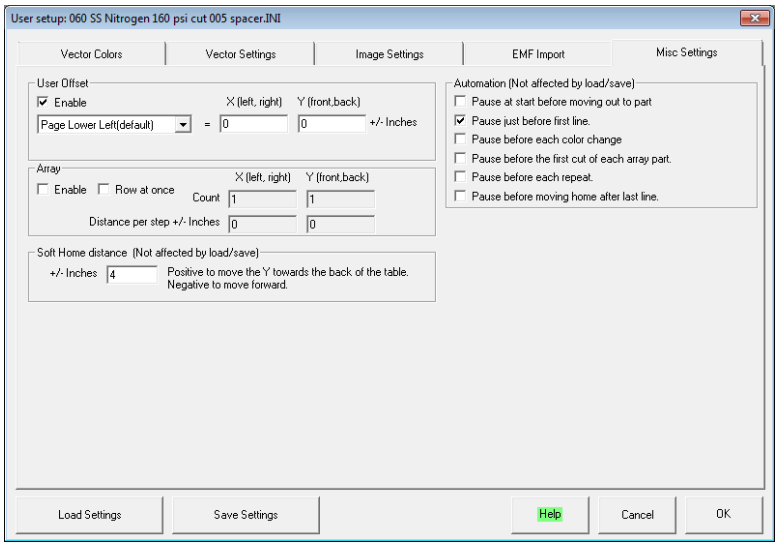
NOTE: It does not matter what Kern Printer Driver you select when this is checked, you will always print at the DPI entered here. When you uncheck this box the Kern Printer Driver from the **Win 2000/XP EMF Printer Driver Settings** section will take effect.

Post Processor (k-vision)

This section is only used if the k-vision camera system is installed and being used. Please call a KERN technical support member for correct settings.

Misc Settings Tab

The Misc Settings tab lets you set a user offset, create an array, set a soft home position and set a variety of pauses.



Setup Menu, Misc Settings

User Offset

Enabled: Allows you to move your vector and images file in the X and Y direction.

By typing a positive number, you can move artwork from the left side of the table to the right side of the table in the X direction. By typing a negative number, you can move artwork from the right side of the table to the left side of the table in the X direction.

By typing a positive number, you can move artwork from the front side of the table to the back side of the table in the Y direction. By typing a negative number, you can move artwork from the back side of the table to the front side of the table in the Y direction.

This feature can be used with any file type, .TIF, .PLT or .EMF. If left checked all future loaded files will have this offset.

Array

Enabled: Allows you to make copies of a single file across and up or down the table. To use the Array feature you must **enable array** on the **Cut and Engrave Menu**.

X and Y distance per step: Determines how far, in inches the files are spaced apart.

Row at once: If checked will engraves all images as one (faster). If unchecked, engraves each individual part separately in the array.

X and Y Count: Number of copies you want in each direction of the array.

Soft Home Distance

By default when a job is completed the laser system will return to the back, left home position. If a soft home distance is entered the laser will now move back behind your file and not go completely home. This will decrease travel time between cuts.

Automation

Pause at start before moving out to part: Pauses at the home position before moving out to the part.

Pause just before first line: When the laser has moved out of its home position and ready to cut/engrave, it will pause at the start of the file. This pause is used when you want to adjust the focus point with your spacer. Systems are sent out with this pause on. If the pause is unchecked, the laser will start to engrave or cut as soon as it is at the start of the file.

Pause before each color change: If you have vector lines of different colors, the laser pauses before cutting the next colored line.

Pause before the first cut of each array part: If you are cutting an array of parts, the laser pauses before each part.

Pause before each repeat: The laser pauses before each repeat of a file. The **Enable Repeat** box must be checked on the **Cut and Engrave Menu**.

Pause before moving home after last line: When the laser has finished engraving/cutting, the laser will pause before moving home.

Example: If you need to engrave inside an object like a box that has 2” edges, use the Pause just before first line to set your focal point down inside the box. Then use the Pause before moving home after laser line to raise your optics back up to clear the 2” edge.

Table Icon

All table settings are calibrated at the factory. Contact Kern before making any changes to these parameters. Some adjustments may cause damage to the laser system. Please DO NOT exceed the maximum speeds listed below. The warranty of the system and laser will be voided if maximum speeds below are exceeded.

Speeds Tab

NOTE: CONTACT KERN SUPPORT FOR CORRECT SETTINGS

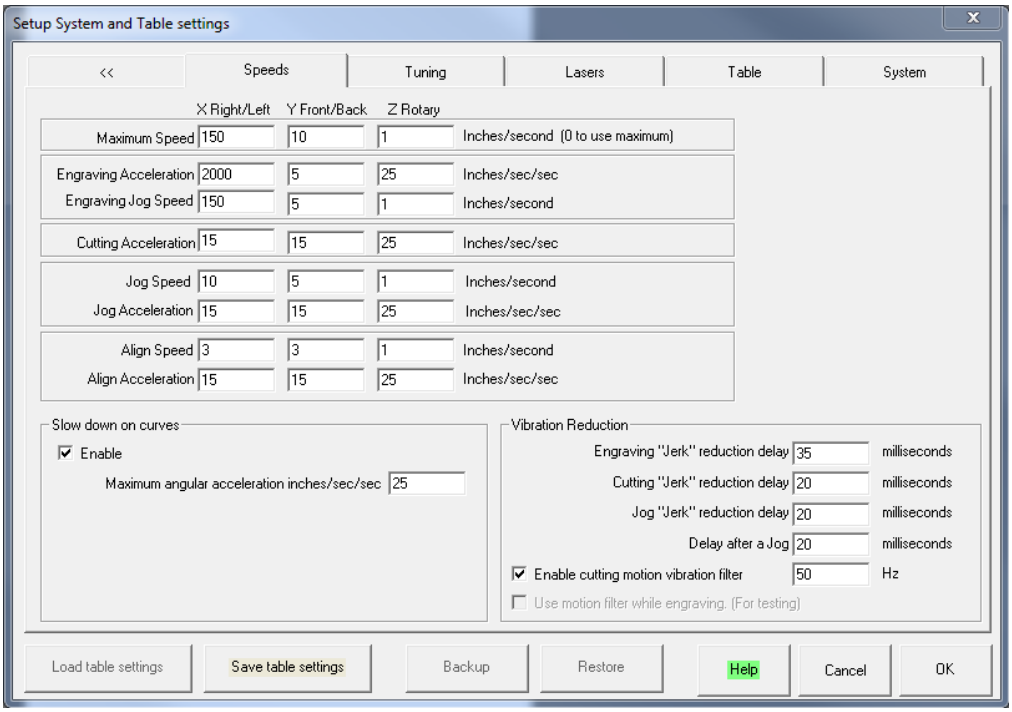


Table Settings, Speeds

Maximum Speed: Sets the maximum speed that the motors will move in the X and Y directions. These numbers are set at the factory. If these numbers are set higher than the factory defaults, errors or malfunctions of the motors may occur.

Engraving Acceleration: Sets the acceleration rate for engraving.

Engraving Jog Speed: Sets the jog speed for engraving.

Cutting Acceleration: Sets the acceleration rate for cutting.

Jog Speed: Sets the speed while moving between parts.

Jog Acceleration: Sets the acceleration rate for the jog speed.

Align Speed: Sets the align speed back to the limit switches.

Align Acceleration: Sets the acceleration rate for the align speed.

Vibration Reduction

Jerk reduction plays a role in both vector cutting and raster engraving. “Jerk” reduction delay and Delay after a Jog are measured in milliseconds. By increasing these two numbers, it allows the

motors to have a slight delay between accelerating and decelerating. In Vector cutting, it will make smoother cuts and in Raster engraving it will allow for crisper images. The max this number can be set to 100.

Slow down on curves

When enabled, allows for smooth transitions when cutting square corners, arcs and radiuses.

Tuning Tab

This section is for aligning your system when it is raster engraving. Please refer to the System Calibration section of this manual for complete instructions on how to perform the dot alignment test.

NOTE: CONTACT KERN SUPPORT FOR CORRECT SETTINGS

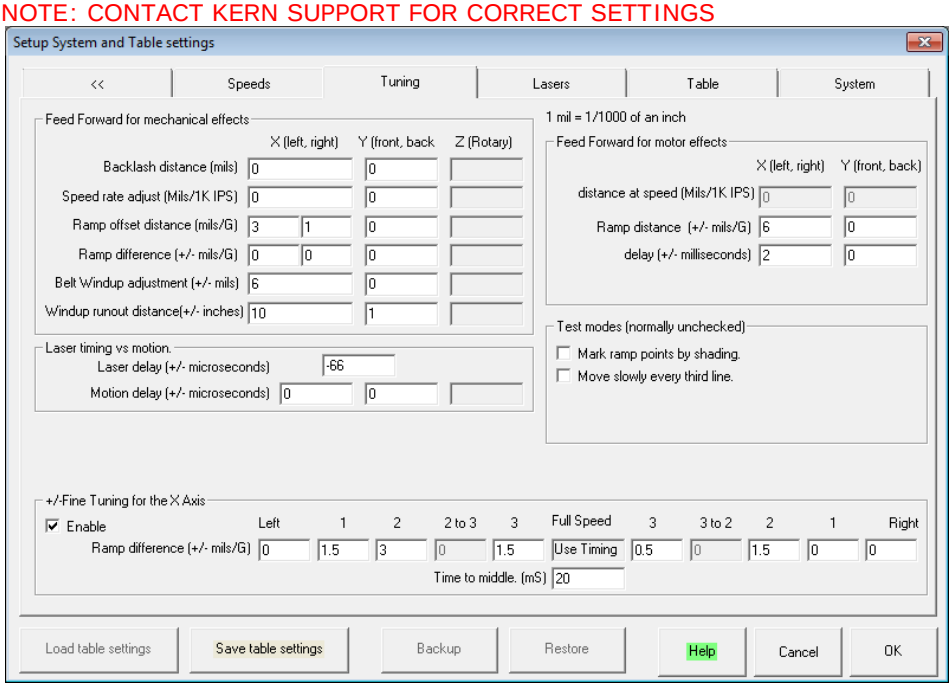


Table Settings, Tuning

Feed Forward (For Mechanical Effects)

Backlash Distance: Not currently used.

Speed Rate Offset: Not currently used.

Ramp Offset Distance: Used for the dot alignment, but at a speed of 130 inches/sec or 150 inches/sec, depending upon if the metal cutting option is prevalent. This offset adjusts the lines when switching from a slow speed to a fast speed on both the left and right sides of the table as the laser head is accelerating.

Ramp Difference: The Ramp Difference will align the dots on the left and right sides of the table.

Belt Windup Adjustment: This setting is used for aligning the dots when performing a dot alignment test. The dot alignment test is done at the factory, but may need to be done by the customer if they have changed a laser or mechanical part. The distance offset is used to align the dots at a slow speed (10”/sec). This number should affect the dots the full width of the table.

Windup Runout Distance: Call Kern

Laser Timing vs. Motion

Laser Delay: The laser delay will align the dots in the center of the table when switching from a slow speed to a fast speed. It delays the firing of the laser to match the motion of the machine. It's measured in microseconds. This setting has a range of 0 to -100. This number will vary on each laser that is mounted, regardless if it's the same wattage or not.

Motion Delay: Not currently used.

Feed Forward for Motor Effects

Distance at speed: Not currently used.

Ramp Distance: Works together with Ramp Offset Distance.

Delay: Works together with Fine Tuning.

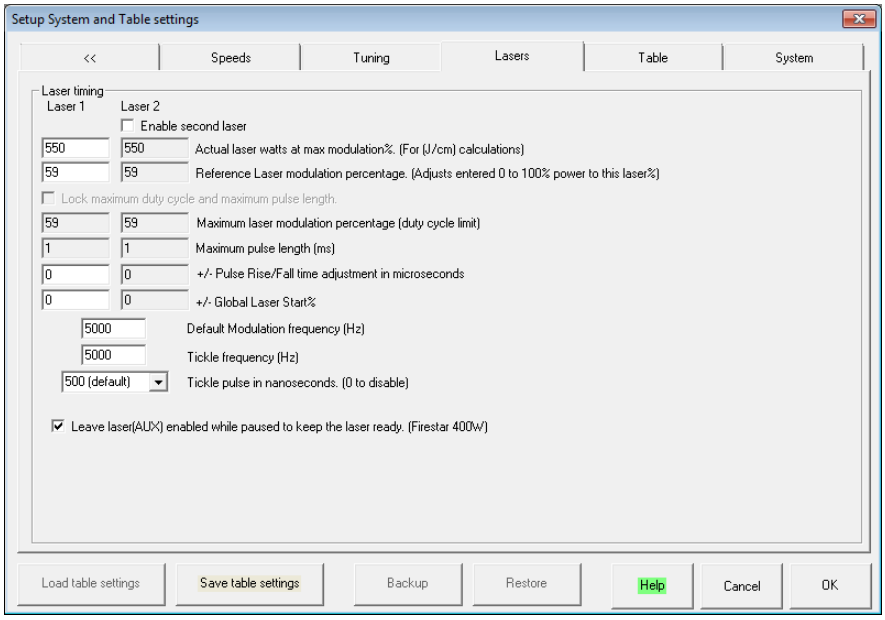
Feed Forward Fine Tuning for the X Axis

Ramp difference: This setting is used to fine tune the dots on the outer left and right sides of the table at a fast speed. The numbers entered here can be positive or negative, whichever makes the dots align. The first box controls approximately the first three inches. The second box controls the next three inches. The third controls the next three inches passed the second and the fourth controls the next three inches passed the third. All in all, this setting controls approximately the first twelve inches on both the left and right sides of the table. The right side of the table works the same as the left. If too large of a number is entered into one of the boxes, it will affect dots outside of its specified area. A number shouldn't be entered larger than 10 or smaller than -10. Numbers outside of this range can cause the motors to hum or make irregular noise. These numbers are set at the factory and should not be changed unless any parts or a laser has been changed on the machine.

Time to Middle: The time to middle will either increase or decrease the effective area of the fine tuning numbers. The larger the number entered, the larger the effective area. This setting has a range of 0 to 30 milliseconds.

Lasers Tab

NOTE: CONTACT KERN SUPPORT FOR CORRECT SETTINGS



Laser Timing

Actual Laser Wattage: The actual wattage of a laser after being checked with a power meter is set at the factory. Not to be changed unless the laser tube is replaced.

Reference Laser Modulation: The modulation duty cycle of the laser mounted on the machine is entered here. This is set at the factory. The software will reference the percentage entered in both Vector cutting and Raster engraving to this number. Not to be changed unless a different laser is mounted. If you get a SWR alarm try lowering the modulation by 1% and see if the alarm goes away.

Maximum Laser Modulation: This setting will limit the lasers duty cycle on the Laser System to the entered modulation percentage. A SWR alarm may occur if this setting is not correct. If you get a SWR fault try lowering the modulation by 1% and see if the alarm goes away. This is set at the factory and should not be changed unless a different laser is mounted.

Maximum Pulse Length: This setting is not used at this time.

Tickle Frequency: The tickle frequency helps excite the laser so it will fire quicker. This frequency should match the laser modulation frequency. Not all lasers require a tickle frequency, some may have a built in tickle.

Tickle Pulse: The tickle pulse is used to help keep the gas inside of the laser ionized. This setting is preset at Kern. The default value is 500.

Table Tab

NOTE: CONTACT KERN SUPPORT FOR CORRECT SETTINGS

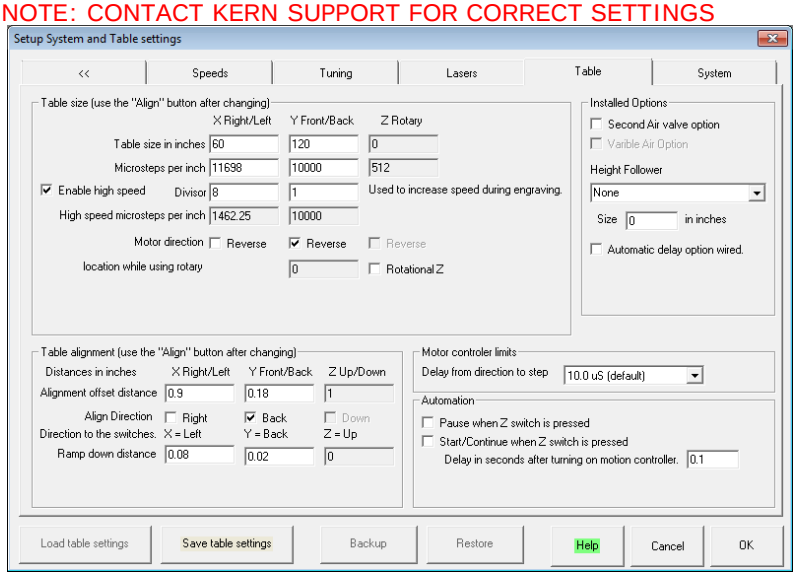


Table Settings, Table

Table Size

Table size: This relates to the actual cutting area of the machine in inches.

Microsteps Per Inch: This setting matches the motor driver steps to the KCAM software. These numbers are critical for files to be cut and engraved at their actual size. These numbers are preset at the factory.

Divisor, Enable Highspeed and High speed micro steps: Set at the factory and should not be adjusted.

Motor Direction: The X and Y motors can move in two directions, forward and reverse. This setting allows the motors to reverse direction. The setting is preset at the factory. If a new motor or wiring harness is installed you may need to change this setting.

Installed Options

Second Air Valve: Call Factory

Height Follower: Call Factory

Table Alignment

Alignment Offset Distance: Sets the 0,0 point of the machine. When both the X and Y limit switches, it moves away from the switch the distance set here. This offset distance is set at the factory. Refer to the System Calibration chapter for directions on how to 0,0 your table.

Align Direction: The align direction tells the motors which direction they need to turn for the machine to align itself. If the machine aligns the wrong direction in either the X or the Y, check the boxes here.

Ramp down Distance: Set at the factory and should not be adjusted.

Motor Controller Limits

Delay from Direction to Step: Measured in uS. 10.0 is default.

System Tab

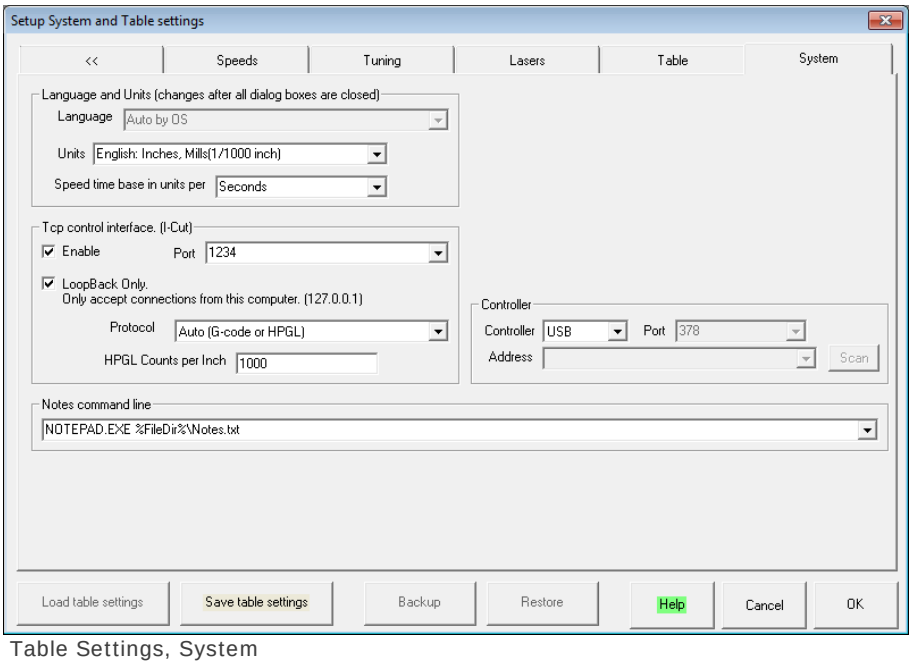


Table Settings, System

Language and Units

Units and Speed base in units.

Tcp control interface

For k-vision. Call Kern factory for correct settings.

Controller

Controller: Parallel or USB

Controller Port: Set to 378 if using Parallel Port.

Note command line

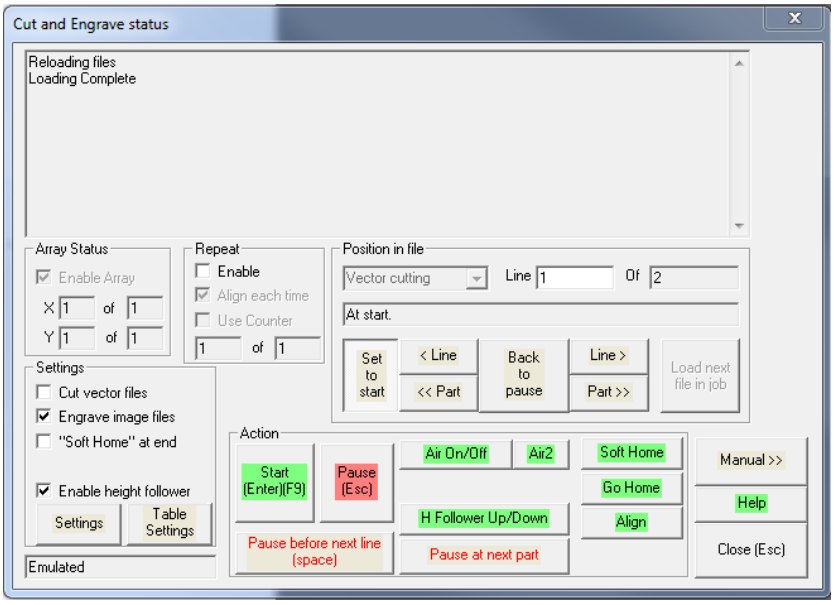
Directory for note pad.

TCP XPS Printer Server

Call Kern factory for correct settings.

Cut Icon

This screen allows you to start the cutting and/or engraving of a file.



Cut and Engrave Menu

Array Status

Enable: When checked, this will create an array if you have enabled and set distances in the Misc Settings tab under the Setup button. The X and Y boxes allow you to run a file from the beginning, or skip certain rows and columns to start at a different arrayed part.

Repeat

Enable: When checked the laser will pause when finished with a file. By pressing the Enter key you can start the file over again. The pause can be removed under the Setup button, Misc settings tab, Automation section.

Align each time: When checked, the system will go to the home position and align the table before repeating the file again.

Use Counter: Sets a count of how many repeats of the file you want to process.

Settings

Cut vector files: Check to cut a vector file.

Engrave image files: Check to engrave a raster file.

Check both boxes for a cut and engrave combination. Laser will engrave first, then cut.

"Soft Home" at end: By checking this you are enabling the new home position, set at Misc Settings in the Setup Menu.

Enable Height Follower: Enables or disables Height Follower feature.

Action

Start/Continue (Enter) (F9): Starts or resumes the cutting or engraving of the file.

Pause: Pauses motion immediately (Hard Pause). Use mouse to click or press ESC key.

Air On/Off: Turns optics air on to test for proper setting.

Height Follower Up/Down: Moves height follower head down to set proper gap from nozzle to metal part.

Go Home: Drives to the Home position.

Soft Home: Drives to the Soft Home position.

Align: Table returns to the Home position and presses the limit switches.

Pause at end of line: Pauses at the end of the line it is currently on (Soft Pause).

Pause at next part: Finishes current vector line or part then pauses.

Manual: Opens the Test Screen

Position in File

The display window shows what line of the file you are on. By editing the Line box you can skip ahead or move back to any line in the file.

Set to start: Starts cutting or engraving at beginning of the file.

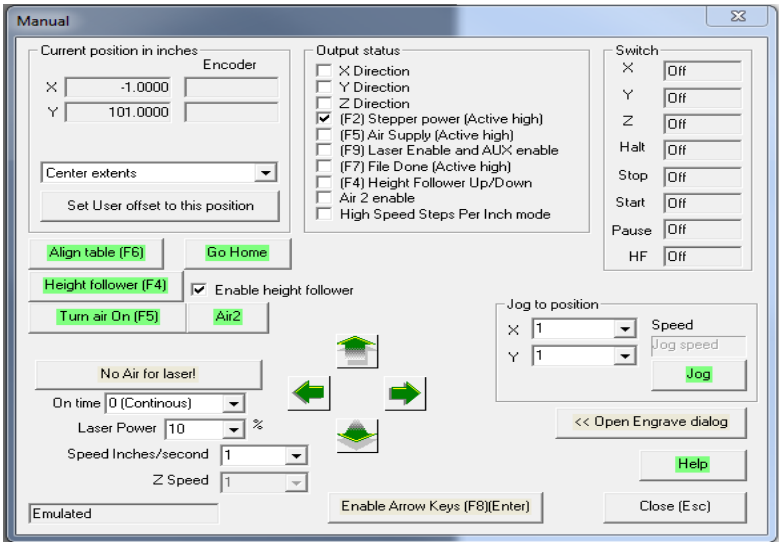
Line: Starts cutting or engraving at beginning of previous/next line.

File: Starts cutting or engraving at the beginning of previous/next file.

Back to pause: Resumes cutting or engraving where last paused.

Test Icon (Test / Manual Mode)

The Test Mode allows users to manually test the motion, laser and other aspects of the laser system. This mode is also used when aligning the laser beam and setting the focal height of the nozzle.



Manual Mode

Current Position: Displays the current X and Y coordinates of the laser on the table top. If your current position is invalid you must align your table (F6) before you can use manual mode.

Set User Offset Position: By selecting one of the ten options under the drop down menu, the file will move to the set location.

Align Table: Sends the table to the home position to contact the X and Y limit switches which will set the correct alignment.

Go Home: Moves the laser back to the home position, does not align.

Height Follower: Enables the height follower to lower and start sensing.

Air: Turns the air to the nozzle on and off. The air pressure is adjustable on the front of the machine with regulators. Air must be on for the laser to fire.

Air2: Allows the nozzle air2 to be set to a different pressure during the laser pierce time.

Fire Laser: Turns the laser ON. Press again to shut off the laser or press ESC key.

On Time: Pulses the laser for a set amount of time. A setting of zero will keep the laser on until you turn it off.

Laser Power: Sets the laser power for testing.

Speed: Sets the motor speed for testing motion. Do not exceed 10 IPS.

Directional Pad: Moves the laser anywhere on the table top by using the mouse to click the directional pad or by using the directional keys on your keyboard.

Enable Arrow Keys: Enables the keyboard directional pad.

Jog to Position: Jog to a position on the table by entering X and Y coordinates.

Open Engrave Dialog: Opens the Cut Screen

Output Status: Shows the state of the switches on the system.

6 Metal Cutting

An optional metal cutting option can be installed with a 150 watt or larger laser. This option includes the hardware and software needed to successfully cut some thin gauge sheet metals.

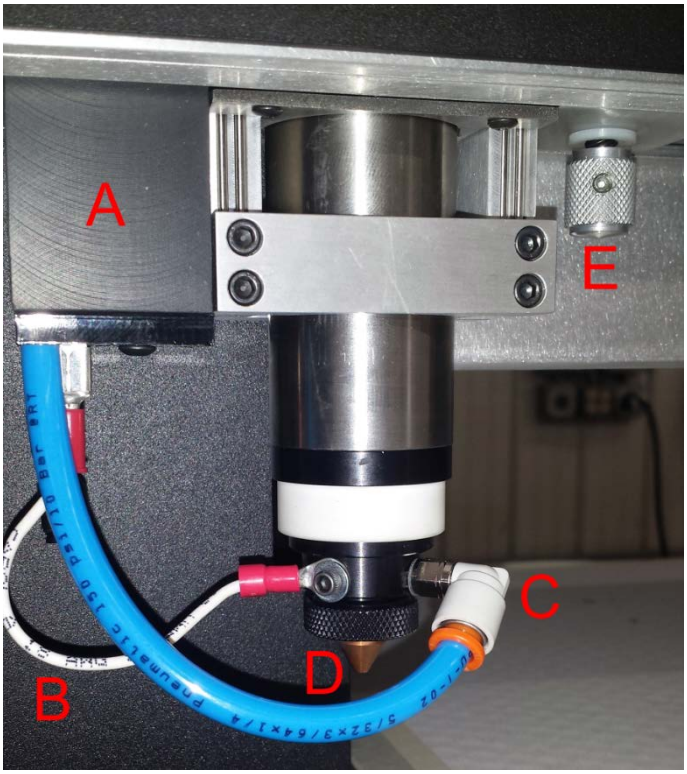
When cutting metal please remove the honeycomb bed and insert the more durable black gridwork.

For 150W and 200W lasers do not attempt to cut thicker than .075” stainless steel and .090” mild steel.

For a 250W laser do not attempt to cut thicker than .090” stainless steel and .125” mild steel.

For a 400W laser please do not attempt to cut thicker than .125” stainless steel and .1875” mild steel. Some 400W lasers are equipped with a beam protection system for cutting up to .060” aluminum.

Optics Assembly



Metal Cutting Optics Assembly

(A) Capacitance Sensor: Senses the capacitance from the tip of the nozzle to the metal being cut.

(B) Height Follower Wire: Connects capacitance sensor to nozzle.

(C) Optics Air: An assist gas is hooked up to the nozzle to flush the optics and assist in cutting metal.

(D) Metal Cutting Nozzle: Copper nozzle to be adjusted .020” away from the metal being cut.

(E) Focus Adjustment Knob: Adjusts the Optic assembly up or down.

Setting the Focus Height

The focus height of the metal cutting optics assembly should be set prior to its first use. To do this:

1. Turn OFF the Height Follower box.
2. Find a flat surface that you can lightly cut into, a piece of polished marble or flat wood will work. Place a piece of masking tape horizontally across the material (12” across).
3. Turn the focus adjustment knob so the tip is .020” above the masking tape.
4. In the manual mode of KCAM set the laser power to 5% and the speed to .5”/sec. A light air should be set so no smoke from the burning tape gets into the nozzle assembly.
5. Make sure you are cutting with shop air and NOT oxygen when setting the focus height.

6. Turn ON the laser beam and move the laser head left or right over the tape while turning the focusing adjustment up or down until you have the narrowest line width in the material.
7. When you are cutting with the narrowest line width turn OFF the laser and stop motion.
8. Measure the gap between the bottom of the nozzle and the tape.
9. If your narrowest line is at approximately .020" above the tape your lens is focused properly for metal cutting.
10. If the gap is less than or greater than .020" please move onto the next step.

Adjusting the lens to get back into focus:

11. Unplug the Height Follower wire and airline and remove the metal cutting optic assembly.
12. Using the lens removal tool from your laser tool kit unscrew the top black lock ring.
13. Gently remove the lens and O-ring from the assembly and place them on a clean cloth.
14. Adjust the bottom black lock ring up or down to move the lens in focus. Small adjustments of about ¼ to ½ turn should be made.
15. Insert the plastic O-ring back into the optics assembly.
16. Gently insert the lens back into the optics with the flat surface facing down towards the nozzle and the convex side up towards the ceiling.
17. Screw the top lock ring back into the optics and gently snug to the lens. Do not over tighten or the bottom black ring will move along with it.
18. Repeat steps 1-7 to verify that the narrowest cut is now at .020" above the tape. If it is still off repeat step 11–17.

Programming the Height Follower Sensor

1. Turn the Height Follower switch OFF.
2. Verify that the sensor wire is connected.
3. Position the Height Follower knob to the 12 o'clock position.
4. Place a flat sheet of metal on the laser table and manually adjust the nozzle so it is about 1" above the sheet of metal.
5. Open the gantry lid and press the sensor button at the top of the height follower card. The light should blink a few times and then stay green.
6. Turn the Height Follower switch ON.
7. In KCAM click the Height Follower Up/Down and adjust the Height Follower slider bar so that the nozzle is .020" above the sheet of metal.
8. If the nozzle will not adjust to .020" above the metal, repeat steps 1–5 and use a different distance for step 4.

Setting the Focus Gap

The focus gap of the metal cutting optics assembly should be set prior to its first use. To do this please:

1. Place a sheet of metal under the nozzle assembly.
2. Open the gantry hood and position the Height Follower between the upper and lower limit switches.
3. Set the Height Follower knob at the 12 o'clock position and Turn ON the Height Follower box.
4. The lens assembly will now move up until it hits the upper limit switch.
5. In KCAM click the Height Follower Up/Down and the optics assembly will move down and pause just above the metal.
6. Adjust the slider bar so that the nozzle is .020" above the metal.
7. If the nozzle drives into the piece of metal turn OFF the Height Follower sensor and reprogram the sensor with the instruction above.

How to Cut Sheet Metal

If you have no experience cutting metal with a Kern laser system it is recommended to start with a thin gauge steel about .020"-.040" in thickness.

1. Remove the aluminum honeycomb and insert the more durable steel grid work.
2. Hook up the regulated oxygen supply into the air inlet.
3. Insert the metal cutting optics assembly.
4. Do not install the round Lexan Aperture shield to the laser nozzle. This will interfere with the height follower sensor and could also be a fire hazard as sparks could ignite the plastic casing.
5. Connect the sensor wire from the Height Follower sensor to the metal cutting optic assembly.
6. Connect the air to the metal cutting optic assembly.
7. Turn ON the Height Follower box.
8. Open KCAM and select the left *Open* icon to open: *C:\Program Files\Kern\Samples\Moose.plt*
9. When ready to cut click the **Cut** button.
10. Set your cutting speed, laser power, frequency, etc. in the Settings Menu and verify that the *cut vector files* option is checked.
11. Set the air pressure to the correct setting. About 80 PSI should be adequate for .040" steel.
12. When you are ready to cut click Continue and the laser will move out to the file location and then pause.
13. Click Continue once again and the nozzle will lower to the metal and start sensing (.020" away) and then start cutting after the Height Follower Delay.
14. Once the moose is cut out the Height Follower will move back to the upper limit switch and home position.
15.
16. Make sure to close the oxygen tank when done cutting.

7 K-Vision

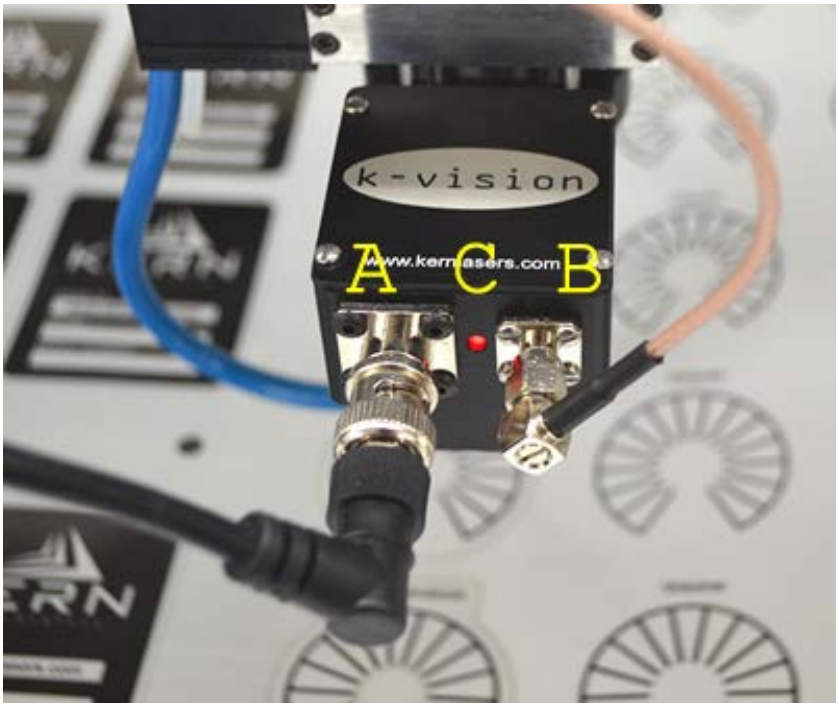
The k-vision package is a fully integrated hardware and software solution that allows for accurate registration and cutting of printed materials. This process starts with a nozzle mounted camera which automatically measures the dimensions between registration marks on a printed material. The system then uses these measurements and the registration marks of the original cutting file to compensate for shift, rotation and distortion. The slight adjustments that k-vision makes to the cutting file results in a perfectly matched cutout in the material being processed.

Overview

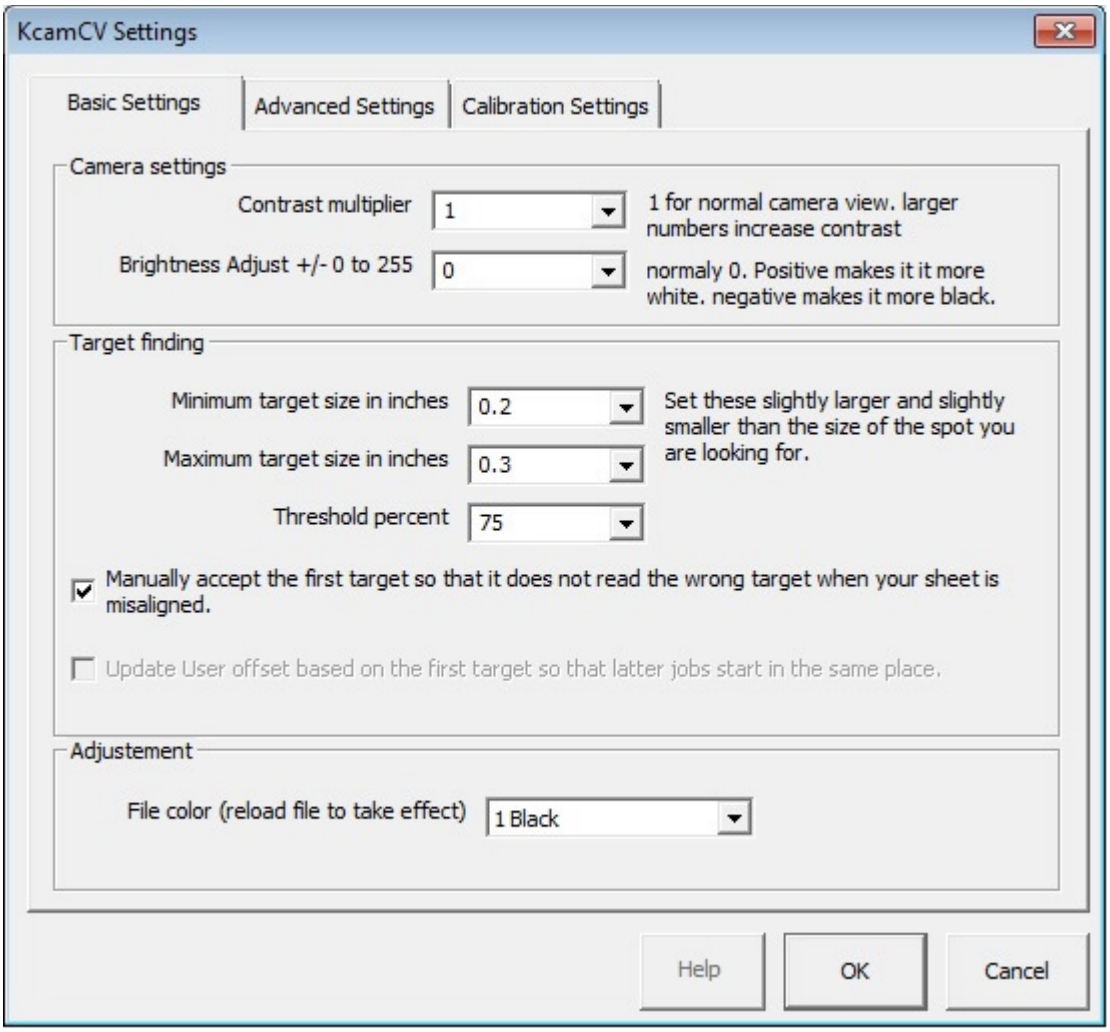
(A) Camera Video Cable

(B) Camera Power Cable

(c) Camera Power Light



BASIC SETTINGS TAB



Contrast Multiplier: Sets the camera contrast setting.

Brightness Adjust: Sets the camera brightness setting.

Minimum Target Size: Sets the smallest target size the camera will accept. Set this slightly smaller than the actual printed target size.

Maximum Target Size: Sets the largest target size the camera will accept. Set this slightly larger than the actual printed target size.

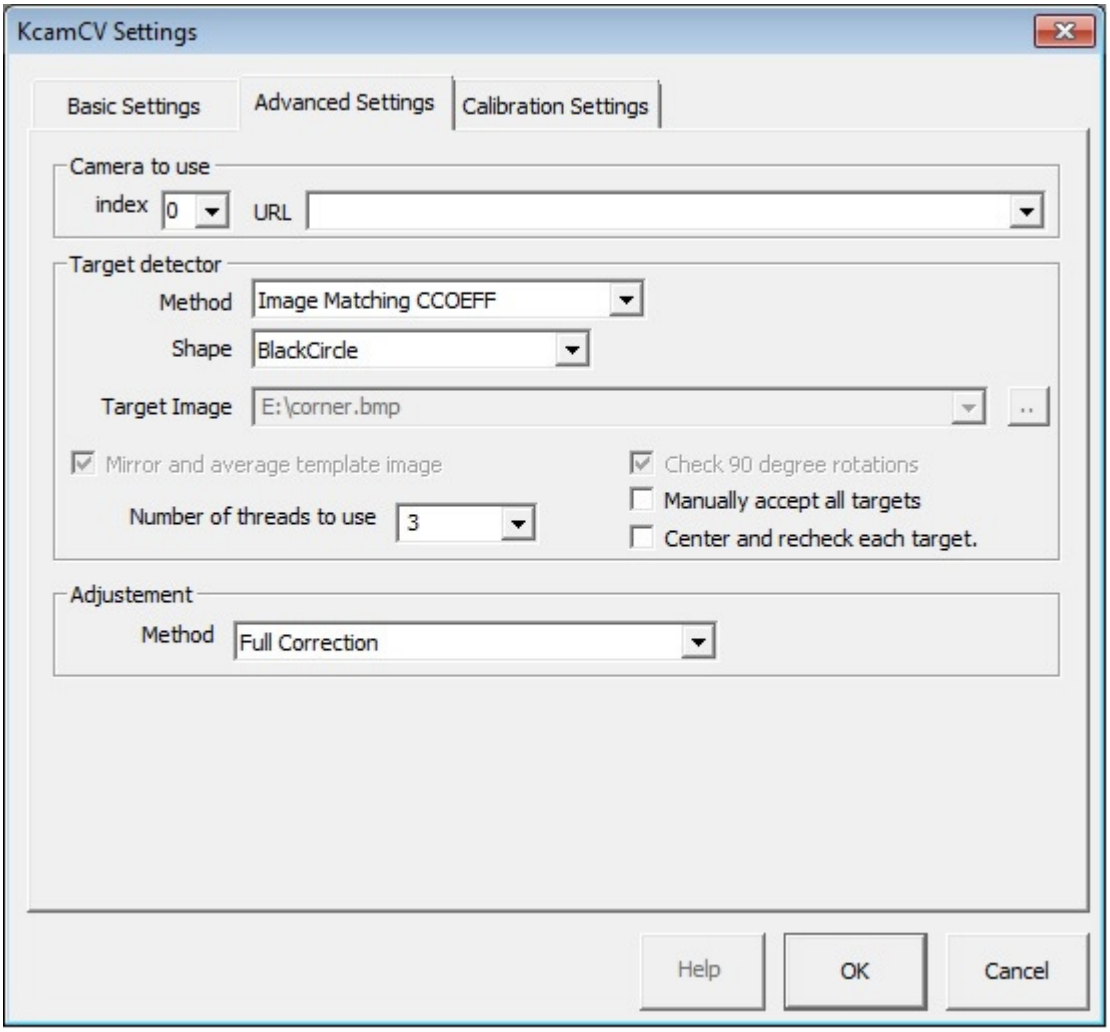
Threshold Percent: Accuracy percentage at which the camera picks up targets.

Manually accept first target: When checked, must click accept for the first target being found.

Update User Offset:

File Color: Set to the hairline color of the target in your file.

ADVANCED SETTINGS TAB



Camera to use:

Target Detector Method: Matching algorithm used for calibration tests.

Target Detector Shape: Preloaded image files for calibration tests. Default is BlackCircle.

Target Detector Image: Custom .BMP file used for calibration tests.

Mirror and average template image:

Check 90 degree rotations:

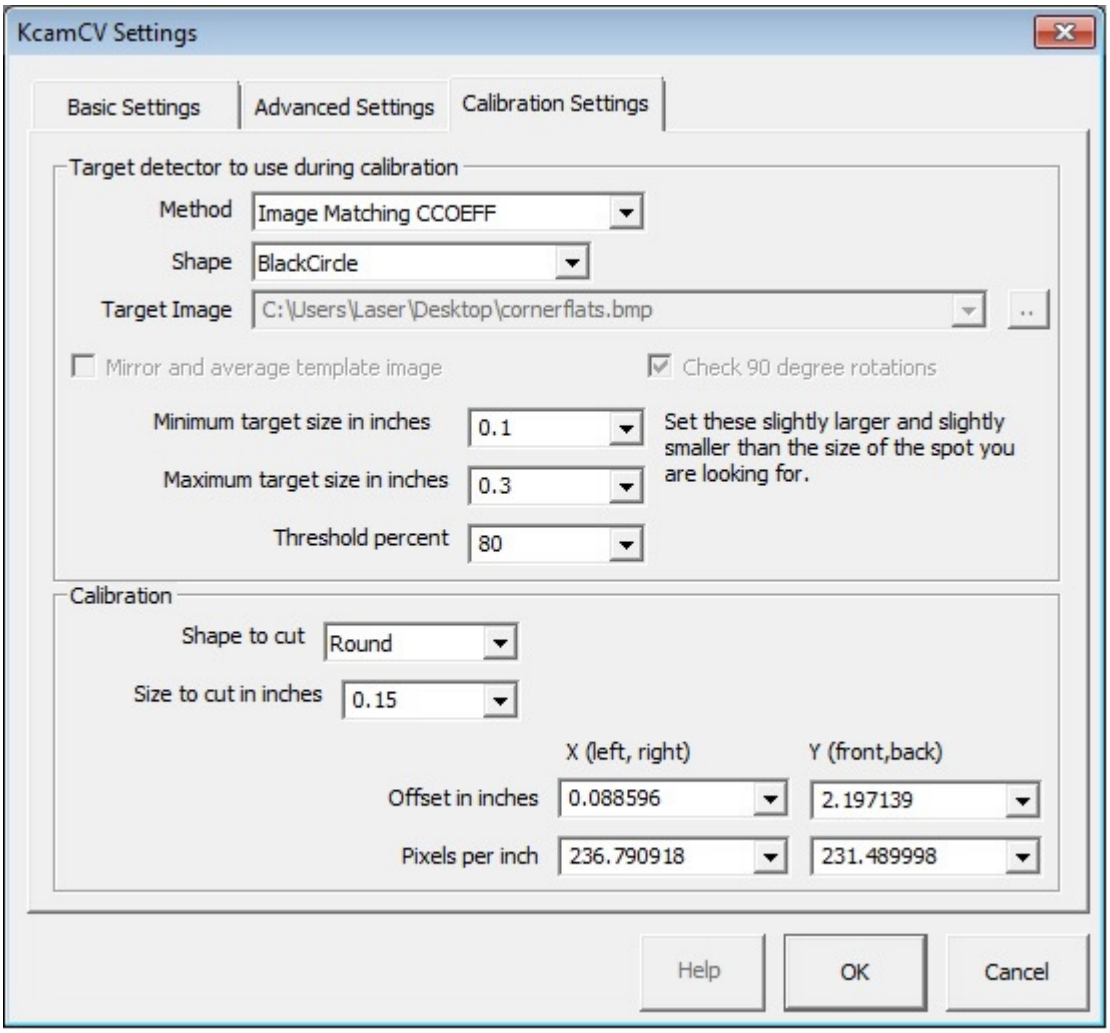
Manually accept all targets: When checked, must click accept for each target being found.

Center and recheck each target: When checked, each time the camera locks onto a target, it will find it a second time before moving to next target.

Number of threads: Sets how much processing speed K-Vision uses on the computer. Default is 4.

Adjustment Method: Select how the file is orientated once the targets are found. Full Correction is the default method.

CALIBRATION SETTINGS TAB



Target Detector Method: Matching algorithm used for calibration tests.

Target Detector Shape: Preloaded image files for calibration tests. Default is BlackCircle.

Target Detector Image: Custom .BMP file used for calibration tests.

Mirror and average template image:

Check 90 degree rotations:

Minimum Target Size: Sets the smallest target size the camera will accept. Set this slightly smaller than the actual printed target size.

Maximum Target Size: Sets the largest target size the camera will accept. Set this slightly larger than the actual printed target size.

Threshold Percent: Accuracy percentage at which the camera picks up targets.

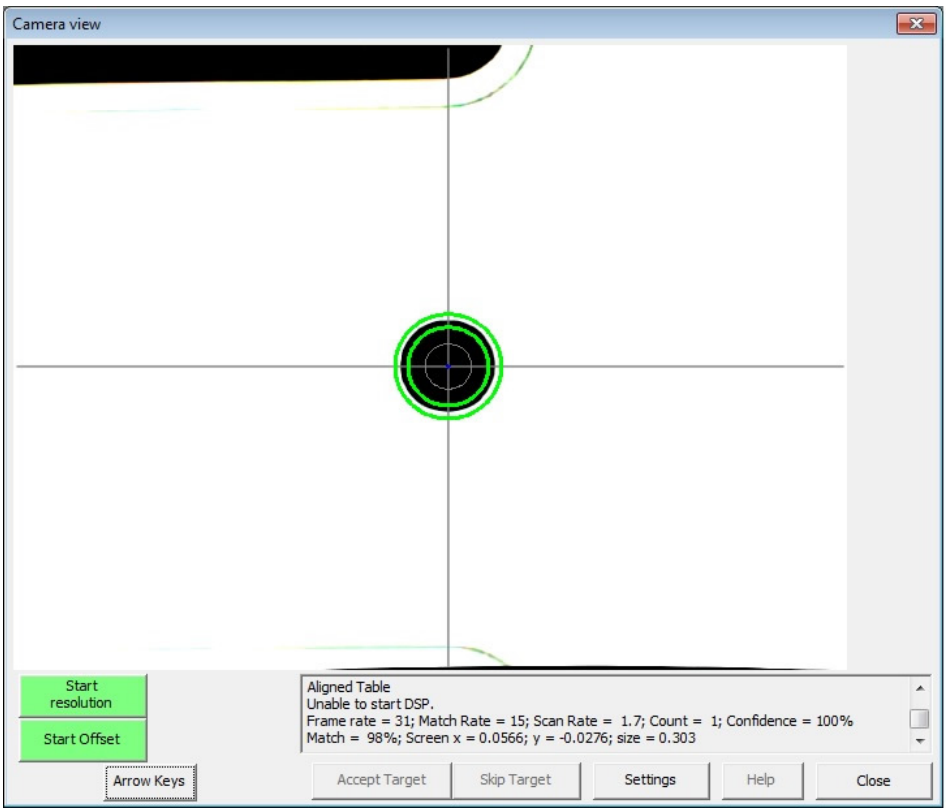
Calibration Cut Shape: Sets the targets shape when using the offset calibration. Default is round.

Calibration Shape Size: Sets the size of the target shape to cut when using the offset calibration.

Offset X,Y: Automatically set after the offset calibration is completed.

Pixels per inch X,Y: Automatically set after the resolution calibration is completed.

CALIBRATION SCREEN



Start Resolution: The Start Resolution feature compensates for fish eye and distortion. This procedure should be ran anytime the vertical distance from the camera to the nozzle tip has changed. To enter the calibration screen click Actions > Calibrate Vision Camera.

1.) Click Start Resolution. Instructions will appear in dialogue window. Follow the instructions. (A small black circle approximately .1" to .125" is required.)
2.) Move to where the camera can see the small black circle. Once the camera has locked onto the circle, click accept target.
3.) The camera will go through a routine to set the resolution. Once finished, a message will appear in the dialogue window.

Start Offset: The Start Offset feature sets the distance from the center of the nozzle to the center of the camera for both X and Y. This procedure needs to be ran anytime the Camera assembly is taken off and put back on. To enter the calibration screen click Actions > Calibrate Vision Camera.

1.) Click Start Offset. Instructions will appear in the dialogue window. The system will cut a circle. The speed and power for the circle is set by the color black in the Vector Colors tab. The size of the circle is controlled in the Settings button on this screen.
2.) Remove the circle cut in the paper. Click next. The camera will move to the cut circle. Once locked onto the circle, click accept target.

Note: The circle created in the Start Offset feature can be used for the Start Resolution feature.

Arrow Keys: Clicking this allows the arrow pad to be accessed. This enables the user to manually move the camera/focusing head around.

Accept Target: Manually accept targets when locating registration marks**.**

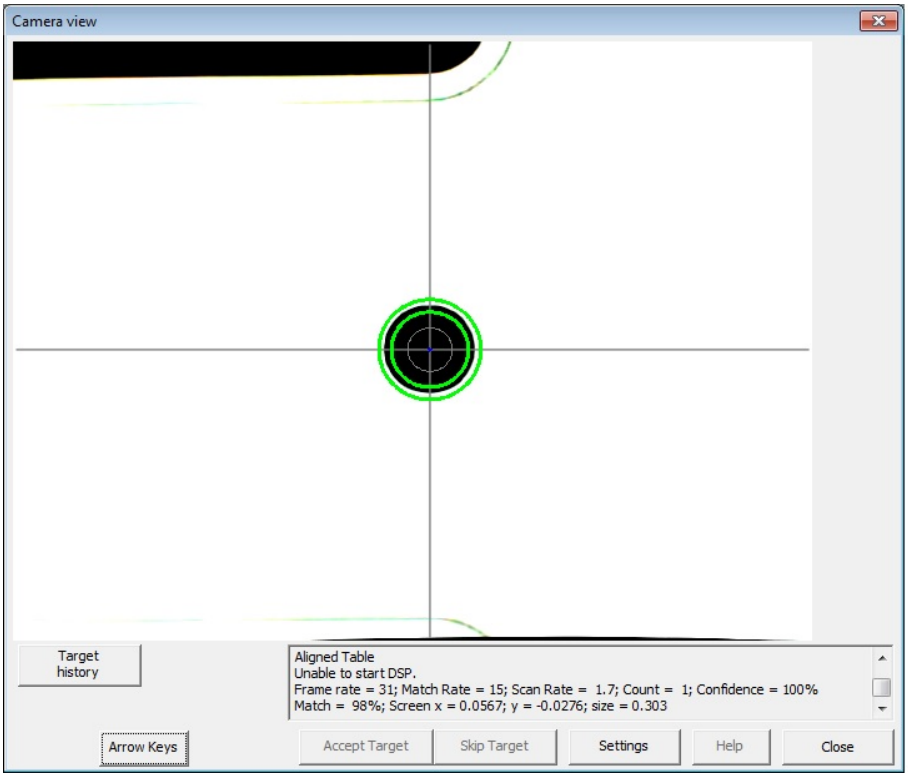
Skip Target: Skips the current registration target K-Vision is looking for.

Settings: This accesses the different parameters the K-Vision program has.

Help:

Close: Closes the Calibrate Vision Camera window.

CAMERA VIEW SCREEN



Target History: K-Vison keeps a history of the different targets that have been used. These targets can be accessed here.

Arrow Keys: Clicking this allows the arrow pad to be accessed. This enables the user to manually move the camera/focusing head around.

Settings: This accesses the different parameters the K-Vision program has.

Close: Closes the View Camera Vision window.

K-VISION OPERATION

1. Print or open a file into KCAM.
2. Set the speed and power for the cut under Vector Colors.
4. Check Enable Camera Vision and Cut Vector Files.
5. Click start. The camera will move towards the first target. The first target will be highlighted on the preview screen.
6. Use arrow keys to move camera over the first target.
7. Once camera has locked onto the first target, click Accept.
8. The camera will move to the next target.
9. Once all targets are found, the head assembly will move to the first cut.
10. Press Enter or click Start to begin cutting.
11. Repeat process for each file being processed.

8 Rotary Stage

A rotary attachment can be factory installed on Kern's laser systems for processing of pipes, rods and other cylindrical items. The rotary device is driven by a high resolution servo motor, resulting in smooth and accurate cutting performance.

INSTALLING THE CHUCK ROTARY STAGE

1. Turn ON the laser system and align the gantry.
2. Remove the paper, honeycomb and front two ecolite pieces.
3. Secure the rotary device to the front of the table with the four bolts provided.
4. Turn OFF the laser system.
5. Hook up the rotary harness to the rotary plug.
6. Turn ON the laser system, Open KCAM, Click Test and enable the **Z Rotary Mode** checkbox.

CORELDRAW SETUP

1. Measure the distance from the left side of the table to the right edge of the rotary chuck.
2. Open a new file and create a guide along the left side that is set at the distance determined in Step 1. Make sure to place all artwork on the right side of this guide so that the laser nozzle does not hit the chuck.
3. Print your artwork to KCAM.

KCAM SETUP

1. Measure the diameter of your pipe.
2. In KCAM go to **Setup**, Click on the **Misc. Settings** tab and enter the measurement from Step 1 in the **Diameter** box of the Rotary section.
3. Insert your pipe into the rotary stage.
4. Set the cut/engrave settings for the material you are processing.
5. Click the **CUT** button, enable the **Rotary Mode** checkbox and enable the vector and/or raster modes that you will use.
6. Click **Start**. The X axis will move to the right first and then the Y axis will move to the front of the machine. The rotary will stop over the rotary device and centered front to back over your pipe.
7. Set your focus on your material and click the **Continue** button.

9 CorelDRAW

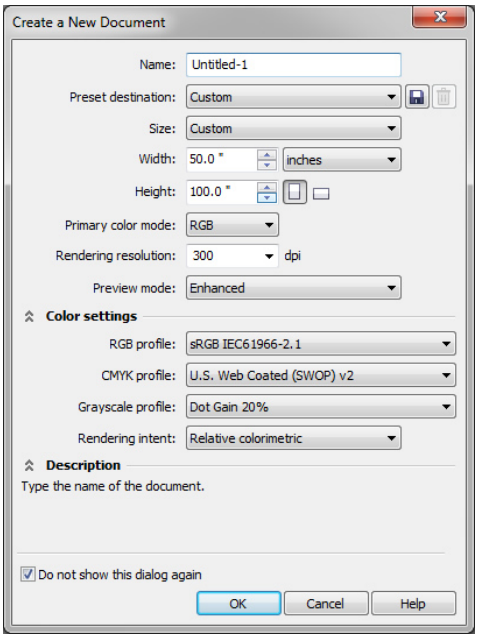
CorelDRAW is a graphics software that offers the ability to print over vector and raster files directly to KCAM through the Kern EMF Printer Driver. Files may also be saved as a .TIF or .PLT file and opened directly into the KCAM software.

Important Notice Regarding Color Fills: When using CorelDRAW X5 and X6 please set the preset for the default color management setting to “Simulate Color Management Off”.

Initial Setup

CorelDRAW will be setup correctly when you receive your laser system. If a fresh copy of CorelDRAW is installed on your computer please use the below steps to get your default settings back.

1. Open **CorelDRAW**
2. Uncheck both boxes at bottom of the **Quick Start** screen. Close the **Quick Start** screen.
3. Click **New Document,** check do not show again in lower left. Click **OK**
4. Set Table size. (Width and Height will vary by machine)



Create a New Document

5. **Windows** > **Color Pallets** > Select **RGB Pallet**.
6. **Windows** > **Color Pallets** > Unselect **Default Pallet**.
7. **Tools** > **Color Management** > **Default Settings** > **Presets** > **Simulate Color Management Off**
8. Click **Tools** > **Options** > **Global** > **Printing** > **Driver Compatibility**
9. Select the Kern EMF Printer and check the box **Send Beziers and paths to driver**.
10. Click **OK.**
11. Set Pen outline to Hairline **> Tools > Save Settings as Default.**
12. Close Document, Open new Document, Set Pen outline to Hairline **> Tools > Save Settings as Default**. (Takes two times to apply)
13. Delete any objects from your screen, **Tools** > **Save Settings as Default.**

Kern EMF Printer Driver

The printer driver will be preinstalled on your machine and ready for use. If for any reason the printer driver is not installed follow these steps to install the Kern EMF Printer Driver.

1. **Start** > **Devices and Printers**
2. **Add a Printer** > **Add a local printer** > Create a new port: **Local Port** > **Next**
3. **Name the port**: KERN > **OK** *(KERN must be capitalized)*
4. **Have Disk** > **Browse** > C:\Program Files(x86)\Kern\KCAM7\Printers\KernEMF.inf > **OK** > **Next**
5. Kern 600 DPI Printer > **Next** >Install this driver software anyways > **Finish**
6. **Add a Printer** > **Add a local printer** > Use existing port: **KERN** > **Next**
7. **Have Disk** > **Browse** > C:\Program Files(x86)\Kern\KCAM7\Printers\KernEMF.inf > **OK** > **Next**
8. Kern 300 DPI Printer > **Next** >Install this driver software anyways > **Finish**
9. **Table** > **EMF Port** > **EMF File Loading** -> select both checkboxes and set Directory to C:\My Documents\KcamEMF*.EMF > **OK**
10. Select the printer driver settings > **Edit**
11. Enter the correct **DPI**, **table size** and set the **output location** to: C:\My Documents\KcamEMF > **OK**
12. Restart computer

The Kern EMF printer driver allows for creation of an .EMF file that combines cutting and engraving into one common file. The file is created in a folder and then automatically opened into KCAM. To use the driver use the following steps:

1. **Open** KCAM
2. Create or open the CorelDRAW file you wish to send to the laser.
3. **File** > **Print**
4. Select the **Kern EMF Printer Driver**, set Page to **Use Printer Default** and click **Print**. The EMF file will automatically load into KCAM. (KCAM must be open)

Create a .PLT Cutting File

1. Create the black hairline shapes that will be cut.
2. **File > Export**.
3. Choose a name for your file and location to save to. Select PLT – HPGL Plotter for **Save as type**.
4. Click **Export**.
5. The first tab on the HPGL Export screen is the **Page** tab. In this tab set the **Size** to Custom, **Plotter Origin** to bottom left and **Plotter units** to 1,000 per inch.
6. The second tab is the **Pen** tab. Match the order of the colors here with the order from the **Vector Colors** tab in KCAM. The purple and orange need to be setup as custom. For purple use the last column, fourth row and for orange use the second column fourth row. Once these are all set name the pen library “Kern Colors” and click Save.
7. The last tab is the **Advanced** tab. In this tab please set the **Curve resolution** to .001 inches and check **No width or velocity commands**.
8. Click **OK** and your .PLT file will be created. On futures .PLT exports these settings will be set as default.

Creating a .TIF Engraving File

1. Create the image that will be engraved.
2. **File > Export**
3. Choose a name for your file and location to save to. Select TIF - TIFF Bitmap for **Save as type**.
4. Click **Export**.
5. The Convert to Bitmap screen will appear. Select your desired **DPI** and choose **Color mode**: Grayscale (8-bit). Uncheck Transparent Background.
6. Click **OK** and your .TIF file will be created. On future .TIF exports these settings will be set as default.

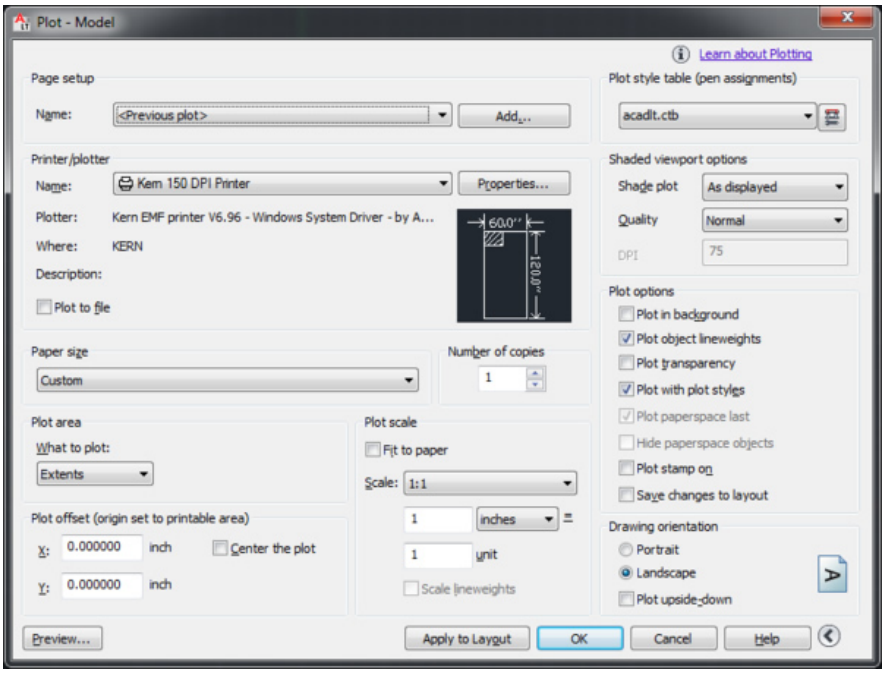
Setting the Cut Order

1. Once you have a file that you want to order go to the **Tools** tab and select **Object Manager**.
2. Your parts will show as a list at the right in the Object Manager box.
3. Highlight and drag the items to move them up or down the list.
4. KCAM will start cutting from the bottom of the list and move up.

10 AutoCAD

Printing to KCAM

1. Open AutoCAD and create or import your cutting file.
2. Open KCAM.
3. When done with AutoCAD drawing, go to File > Print.



AutoCAD Print Screen

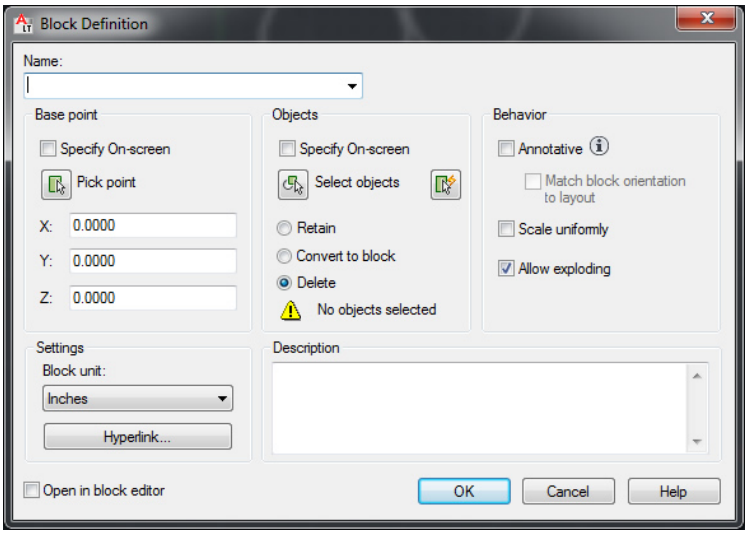
4. Use the following settings:

   Printer Name: Kern EMF Printer Driver (or similar name)
   Paper Size: Custom
   Plot Area: Extents
   Scale: 1:1, 1 inch = 1 unit
   Plot Style = acadlt.ctb
   Drawing Orientation = Landscape

5. Click OK.
6. The file should now be in KCAM.
7. On future prints you can select <Previous Plot> under page setup and the settings will automatically be set from the previous print.

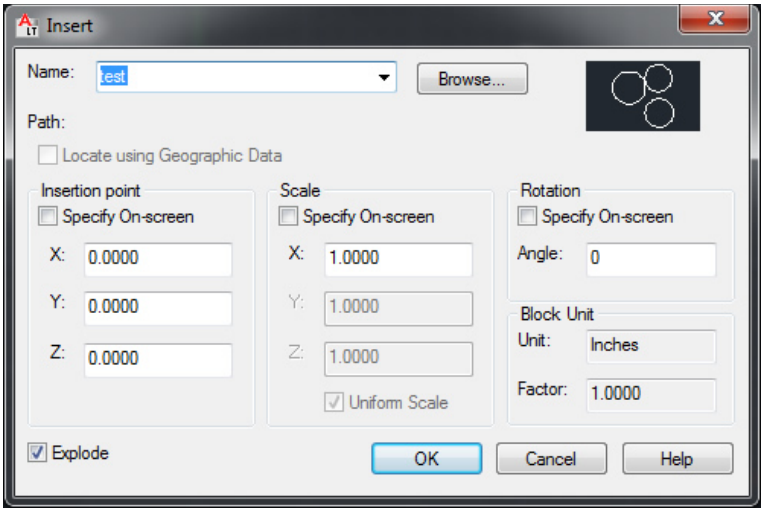
Selecting Cut Order

1. Draw cutting paths or open an existing file.
2. Insert > Create Block
   a. Name the Block
   b. Select Delete under Objects
   c. Click **Select Objects** and click on the parts one by one**.** (The order the objects are selected is the order they'll cut.)
   d. Click Enter.
   e. Click OK.



AutoCAD, Block Definition

3. Insert > Insert
   a. Name (choose block previously created)
   b. Insertion point (NOT selected)
   c. Scale (NOT selected)
   d. Rotation (NOT selected)
   e. Explode (selected)
   f. Click OK.



AutoCAD, Block Insert

Creating a Polyline

If your file is sent over to KCAM as multiple line segments and not one continuous cut you can use the polyline function to combine it into one continuous line segment.

1. Type command **pedit** and press <ENTER>
2. Select one of the line segments
3. Do you want to turn into one? (Y), press <ENTER>
4. Enter an option, Click **Join**
5. Select Objects by creating a window around all pieces or select each one individually.
6. <ENTER>
7. Exit Command. Type X
8. <ENTER>

11 PhotoGrav

The PhotoGrav software optimizes photographs for laser engraving. If you are installing a fresh copy of PhotoGrav please use the directions below to get started. If the software is preinstalled on your computer you may begin processing photos.

Installing PhotoGrav

1. State PhotoGrav and go to File > System Defaults > Select Machine.
2. Choose the KERN HSE machine with appropriate laser size.
3. Under the Machine Properties select your laser wattage, max speed and a turn time of .142 seconds.
4. Set your DPI, spot size (.005") and machine watts (same as laser power above).
5. Click OK.
6. The software is now setup with these default settings and the next time you open this software you can begin processing files immediately.

Processing a Photo

1. Start PhotoGrav and use the **Open Image** button to load your photograph.
2. Click **Select Material** and choose the material that you will be engraving on.
3. Click **Resize Image** to set your desired image size and DPI.
4. Click **Final Process.**
5. Click **Save Image** and save as an **engraved .BMP** file.
6. The file is now ready for importing into your favorite design software (CorelDRAW, Illustrator, etc.).

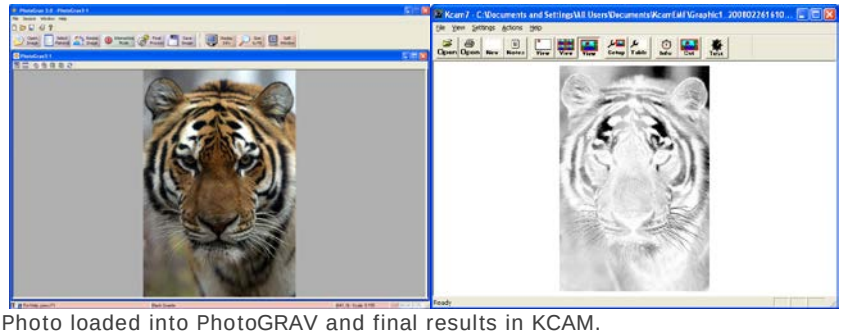


Photo loaded into PhotoGRAV and final results in KCAM.

12 Maintenance

Maintenance and service procedures of the laser beam optics assembly (cleaning and maintenance of the lens and mirror) are to be conducted only by personnel who are familiar with laser safety and with the potential laser hazards from the product.

Turn off the laser and close the shutter during lens and mirror cleaning, as operation of the laser without the lens or mirror installed can result in a potential laser hazard from the invisible output beam, even at distances of hundreds of feet away from the system.

Daily

1. Check for any frayed wires or leaking water lines.
2. Motion of table and laser should not interfere with any objects.
3. Verify that air is coming from the nozzle. If not, turn on the air compressor and turn up the air pressure to desired level.
4. Clean any dust and debris from the system including power supplies and any other components.
5. Replace paper table covering as needed with thin paper. Newspaper roll remnants work well for this.
6. Shut off power to the laser system each day.

Weekly

After starting the laser system, check the water level in the chiller unit (100 watt and above). Make sure all chiller filters are free of dust and debris.

Note: Refer to maintenance section of your chiller manual for complete description of your chillers maintenance schedule. Also, refer to your laser manual for additional information on required coolant additive and mixture ratio.

Remove the 1” aluminum honeycomb and the 1” aluminum Ecolite from the vacuum table top. Clean the top honeycomb, ecolite and bottom of the vacuum table with degreaser to remove any debris or water material buildup. If there is any waste material debris stuck in the honeycomb or Ecolite, use a portable vacuum cleaner to clean it.

Monthly

Top Gantry Rails

Use 4 in 1 oil to lubricate the bearings on the X axis rails once every month. This may be required more often with heavy use of the laser system. Wipe rails with a clean, dry cloth before lubricating the bearing.

Y Axis Rail and Rack and Pinion Drive

The Y axis features a dual rack and pinion drive and linear rails. Lubrication is critical. Failure to sufficiently lubricate will result in premature wear and/or component failure. There are six grease zerks, three on each gantry leg. Apply grease to all zerks once a month, when operating 40 hours per week. As run time increases, increase frequency of lubrication accordingly.

Chilling Unit

A chilling unit is typically supplied with lasers that are of 100 watts or greater. These units require a monthly maintenance check.

A dust/particle filter at the front panel of the chiller can be removed and cleaned with a compressed air gun. If the filter is clogged to the point where it cannot be cleaned out please contact Kern for a replacement filter.

The chiller reservoir tank requires distilled water and a cleaning solution to keep the lines clean. Over time the water can turn murky and contain sediment. Please refer to your chiller owner's manual for detailed instructions on filling your chilling unit with fresh distilled water and a cleaning solution.

A more detailed section on chiller maintenance is available in the chiller owner's manual. Please refer to this manual for a full maintenance schedule on the chilling unit.

Mirrors

The instructions below are for removal, cleaning, and installation of the mirrors. Refer to the optics assembly drawing in the System Diagrams section of this manual.

To remove the mirror for cleaning:

1. Turn OFF the laser machine.
2. Remove the four 7/64" Allen head screws on the mirror cover. The two mirrors inside the gantry will not have mirror covers.
3. **DO NOT** remove, tighten, or loosen the three Allen screws under the mirror cover that hold the mirror support in place as this will take the mirror out of alignment.
4. Use the small flat blade screwdriver to remove the three screws on the mirror retainer.
5. The mirror is now exposed and can be removed for cleaning. Carefully remove the mirror, handling it with a clean rag or rubber gloves by the side edges. Avoid touching the front side of the mirror, check it for any physical damage. The mirrors have a shiny gold surface. It is very important to clean the optics if you think they are dirty or they will become permanently damaged. If the mirrors are chipped or cracked, cleaning of the optics will not repair the damage.

To clean a mirror:

1. Flush the mirror with 99% isopropyl alcohol.
2. Remove visible debris from the mirror by wiping it with a Q-tip soaked in isopropyl alcohol (rubbing alcohol).
3. Flush the mirror with isopropyl alcohol.
4. Using a lens tissue soaked in isopropyl alcohol, wipe the optic lightly in a circular motion very lightly.
5. Repeat step 3 with a new lens tissue. The isopropyl alcohol dries very quickly. The surface of the mirror must be clean and shiny when cleaning is finished. If the mirror is chipped, cracked or will not clean up properly, replacement optics must be purchased to achieve optimum laser cutting and engraving performance.

To reinstall the mirror after cleaning:

1. Carefully place the mirror in the mirror retainer. The mirrored side of the mirror should face the side that the laser beam will reflect off of.
2. Replace the three slotted screws.
3. Replace the mirror cover with the four Allen screws.

NOTE: It is recommended to check the beam alignment after removing and reinstalling a mirror.

Lens

Below are instructions on removal, cleaning, and installation of your optics lens. Refer to the optics assembly drawing in the System Diagrams section of this manual.

To remove the lens for cleaning:

1. Turn OFF the laser machine.
2. Disconnect the air line, safety shield and HF sensor wire (metal cutting) from the optics assembly.
3. Unscrew the optic assembly from the beam path tube.

Optics Assemblies

4. Use the lens removal tool to unscrew the top lock ring.
5. The lens is now exposed and can be carefully removed by holding it by the sides only. Set the o-ring to the side. Use a clean rag or rubber gloves to carefully remove the lens. Avoid touching the front and back surface of the lens. Check for any scratches, pits and blemishes. The lens will have a yellowish color to it without any cracks or blemishes. It is very important for the optics to be clean. If a lens has blemishes or damage, cleaning of the optic may not repair the damage.

   NOTE: The lens may appear clean in the assembly, but may still be dirty. The lens must be taken out to check for cracks and blemishes.

To clean a lens:

1. Remove visible debris from the lens using a Q-tip soaked in isopropyl alcohol or rubbing alcohol (90% alcohol based).
2. Flush the lens with 99% isopropyl alcohol.
3. Using a lens tissue soaked in isopropyl alcohol, wipe the optic lightly in a circular motion.
4. Repeat step 3 with a new lens tissue. The isopropyl alcohol dries very quickly. The surface of the optic should be clean and spotless when cleaning is finished. If blemishes on the optic will not clean off, a replacement optic should be purchased to achieve optimum laser cutting and engraving performance.

To reinstall the lens after cleaning:

1. Carefully place the lens back in the optics assembly on top of the o-ring. The convex side of the lens must be facing upwards as it is placed back in the optics assembly.
2. Screw the black lock ring back into the assembly using the lens tool.
3. Reinstall the optic assembly back into beam path tube.
4. Reconnect the air line, shroud and the HF sensor wire (if present).

   NOTE: It is recommended to do a beam alignment through the nozzle after you reinstall the lens.

13 Troubleshooting

This section is for troubleshooting potential problems that occur with your laser system. It is very important that you follow the troubleshooting procedures exactly. If you don't understand the procedure contact the factory and a technician will work with you on troubleshooting the laser system.

Toll Free: (888) 660-2755 (US & Canada only)
Phone: (218) 631-2755
Fax: (218) 631-3476
Email: help@kernlasers.com
Office Hours: Monday–Friday, 8:00 AM–4:30 PM, Central Standard Time

KLMC Display

The Kern Laser Monitor Controller has multiple lights that monitor the status of the laser systems components. There are three different colors that you may see at any given time.

GREEN – This indicates that this function is satisfied and ready to laser cut or engrave.

AMBER – This indicates that there was an alarm but has been corrected. To clear this amber light simply cycle the key switch and wait five seconds for the light to turn green.

RED – This indicates an alarm. To troubleshoot the alarm please refer to its corresponding section below.

NOTE: *The DSP Enable and Laser Enable will not show green until the cut or engrave has started.*

KLMC Display

E-STOP

This light indicates that an emergency stop switch has been activated. Each system has from 2 to 4 emergency stop buttons depending on the table size. To disengage an emergency stop button, twist and pull back on the red knob.

Over Temp

This light indicates an over temperature signal has been received from the laser unit. The KLMC will shut off power to the laser to protect it from overheating. This fault may be caused by the room temperature being too warm. Room temperatures should be kept between 60 - 80 degrees. Also check that your chiller is set at a cooling temperature of 68–70 degrees Fahrenheit.

Ionized (KT model lasers only)

This light indicates the RF power supply circuit has encountered a mismatched RF signal. The KLMC will shut off power to the laser to protect the laser and power supply. If this fault occurs, contact Kern for further assistance.

SWR Fault

This light indicates the RF power supply circuit has encountered a mismatched RF signal. The KLMC will shut off power to the laser to protect the laser and power supply. If this fault occurs, contact Kern for further assistance.

Interlock

This light indicates that the interlock circuit is opened. The doors and windows are tied in series to this circuit to prevent the laser from firing while open.

Air Valve

This light indicates the main air switch is opened to allow air to be regulated.

Laser Pulse

This light indicates that the laser is cutting or engraving. It is normal for this light to stay a hard green or blink ON and OFF.

DSP Enable

This light indicates that the DSP box has communication with KCAM. The light will turn green once the laser starts the cut or engrave job.

Water Flow

This light indicates if there is no water flowing to the laser from the chilling unit. Please check to make sure that the chiller is ON and that the hoses are hooked up correctly to the inlet and outlet.

Air Supply

This will turn green when there is 65 lbs. of air coming into the laser system. Check to see that the air is plugged in at the back of the system and your air tank is open.

Shutter

This light indicates the status of the shutter. The shutter this is located on the back of the gantry between the laser unit and first mirror. Slide the shutter mechanism to the open position if you want to use the laser. Slide the shutter mechanism to the closed position if you wish to disable the laser beam. While doing maintenance within the beam path you should always close the shutter.

DC Sense

This light indicates if the DC voltage is hooked up to the laser. If there is a red light verify that the DC power is on and the power supply is hooked up correctly.

Laser OK

This light indicates when the laser is OK and not pulling a laser error signal.

Key Switch

This light indicates if the key switch for the KLMC is cycled from ON to OFF. When the machine is turned ON for use you must cycle the key switch to clear the red light. There is a five second delay for the light to turn to green.

Laser Enable

This light will turn green once the cut or engrave file has started.

DSP Box

This box is an interface between the computer and the KLMC. The three indicator lights on this box are POWER, USB/DATA and DSP ACTIVE.

The **POWER** light will turn green when the system is turned on. It will turn even brighter green when you enter the Cut and Engrave menu or the Manual screen.

The **USB/DATA** light will blink green upon entering the KCAM Cut and Engrave menu or the Manual/Test screen showing communications are taking place between the computer and DSP. It will continue to blink green when the laser is running and will turn off once you have exited out of KCAM or the laser system is turned off.

The **DSP ACTIVE** light will turn green when KCAM enables the DSP to operate.

Mechanical

Motion

The motion table has an X axis that travels left to right, and a Y axis that travels front to back. The travel must be smooth and unrestricted in both the X and Y directions.

X Motion Test

Verify that your system is turned OFF, the shutter is closed, and then unplug the cable labeled **X Motor Power** going into the servo amplifier at the front of your system. Open your gantry lid and move the optics head along the X axis. The optics head should move smoothly, without any restriction. If there is restriction, call the factory for further instructions. Shut the gantry lid and plug back in the **X Motor Power** cable to the servo amplifier.

Y Motion Test

Contact Kern for more information.

Travel Limit Switches

The Y axis has limit switches on the front and rear which prevent the gantry from over travelling.

Home Limit Switches

The motion table has a home X limit switch and two home Y limit switches. The X limit switch is momentarily depressed upon the laser moving to its left most position. The Y limit switches are momentarily depressed when the gantry moves the very back of the laser system. The table must home itself to these limit switches or the motion system will not have a known start reference.

To manually test the home limit switches follow these steps:

1. Open the Manual screen in KCAM.

2. Manually click the limit switches while someone is watching your Manual Screen. The limit switch box should toggle OFF to ON. If they do not toggle, you either have a broken wire going to the switch or DSP box is defective, call the factory for further instructions.

3. Press the **Align** button. If the table grinds, hit the ESC key or the Emergency Stop Switch. A grinding noise indicates an X or Y motor has lost its location. This can happen because of one of the following circumstances:

    - The motor has a broken wire leading to it or a defective motor driver module. Check for loose wires on the motor.
    - The limit switch has a broken wire leading to it or it is not physically being pressed to stop the motion.
    - The table has binding in that axis. Call Kern for technical assistance.

4. After the laser and gantry have reached the limit switches, they will stop and then move a set amount to zero the table. The laser nozzle will be just inside the upper left corner of the table. This is the home position. If a Soft Home is ON turn it off in the KCAM software. After a job is ran the nozzle will return to the home position.

Computer

1. Turn off the screensaver.
2. Modify the computers Power Settings by going to: Control Panel > System and Security > Power Options
    a. At the left hand side click **Choose when to turn off the display** and set both settings to Never. Click **Save Changes**.
    b. Click **Change advanced power settings**. Choose **High Performance** from the drop down list.
    c. Scroll down and open the **Processor Power Management** and set **minimum and maximum processor state** to 100%. Click **Apply** and **OK**.
3. Make sure automatic updates and virus scans are set to perform when the laser is not in use.

KCAM requires a dedicated computer to properly run the system. Do not operate other computer programs on the laser computer while the laser is in use. The computer is communicating with the DSP at all times and any glitch in memory can cause a skip. Also, please make sure automatic updates and virus scans are set to occur at a time when you are not using the machine. Do not send or take files out of the laser computer through the network when the system is in operation.

Electrical

If any component of the laser machine is not working, first check that all plugs are in their socket and ON switches are set correctly. If the problem is not corrected have a certified electrician check to see if a breaker has been tripped in the electrical panel. If the problem still exists have a certified electrician call a Kern technician to troubleshoot the electrical problem. Kern can provide wiring diagrams and pin outs to assist.

Laser

The laser consists of a laser tube, RF power supply, DC power supply, control signal, and water-cooling. The following are requirements needed for the laser to fire.

- AC voltage for the DC power supply.
- DC voltage for the RF power supply
- Chilling unit powered on.
- The shutter needs to be in the open position.
- Air pressure to the nozzle via the automated air switch and regulator provided with the system.
- A five second delay reset. This is the key switch on the KLMC box.

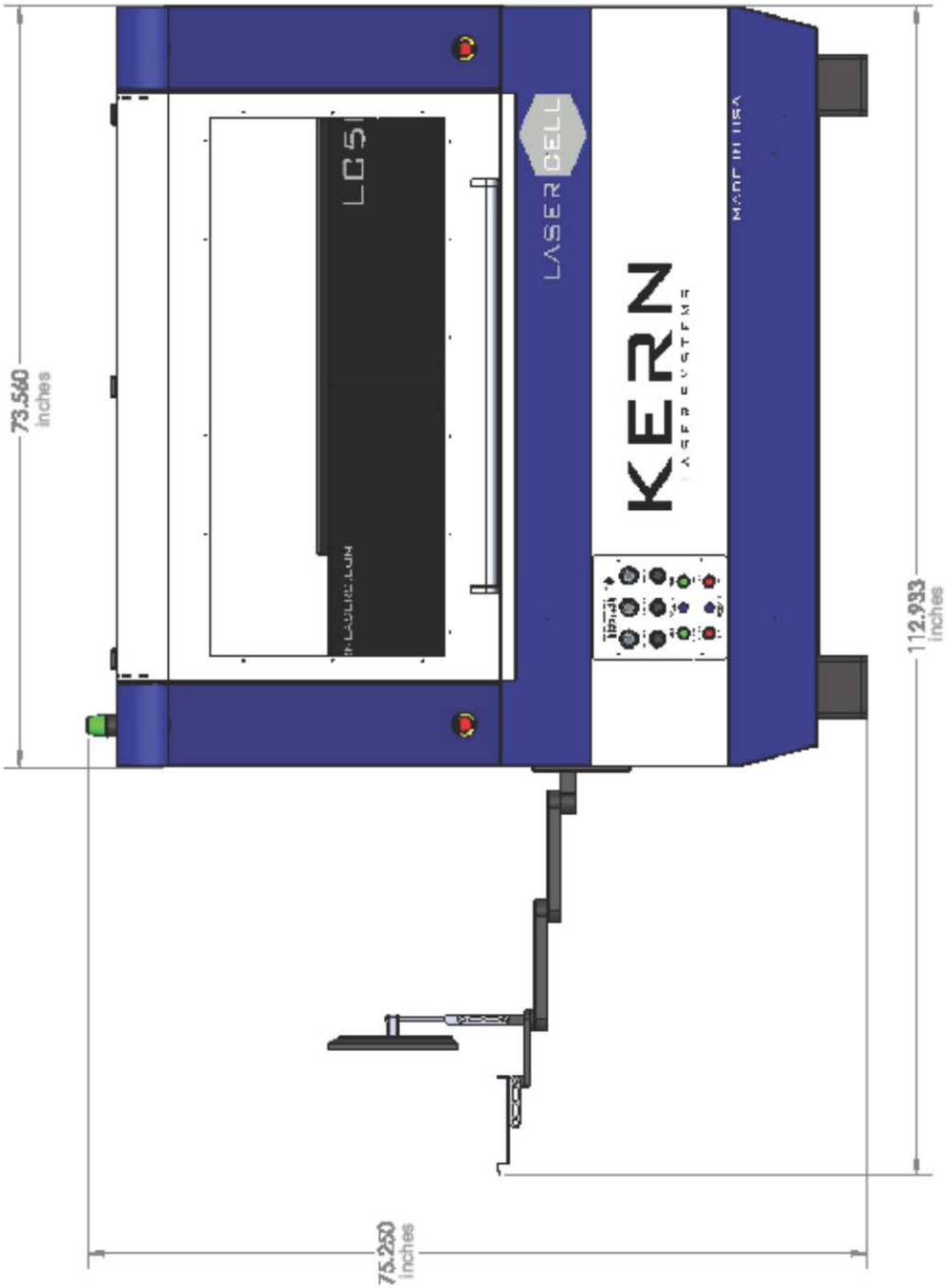
Failure of any of these will affect the performance of the laser and cause it to not fire.

Laser Power Testing Procedure

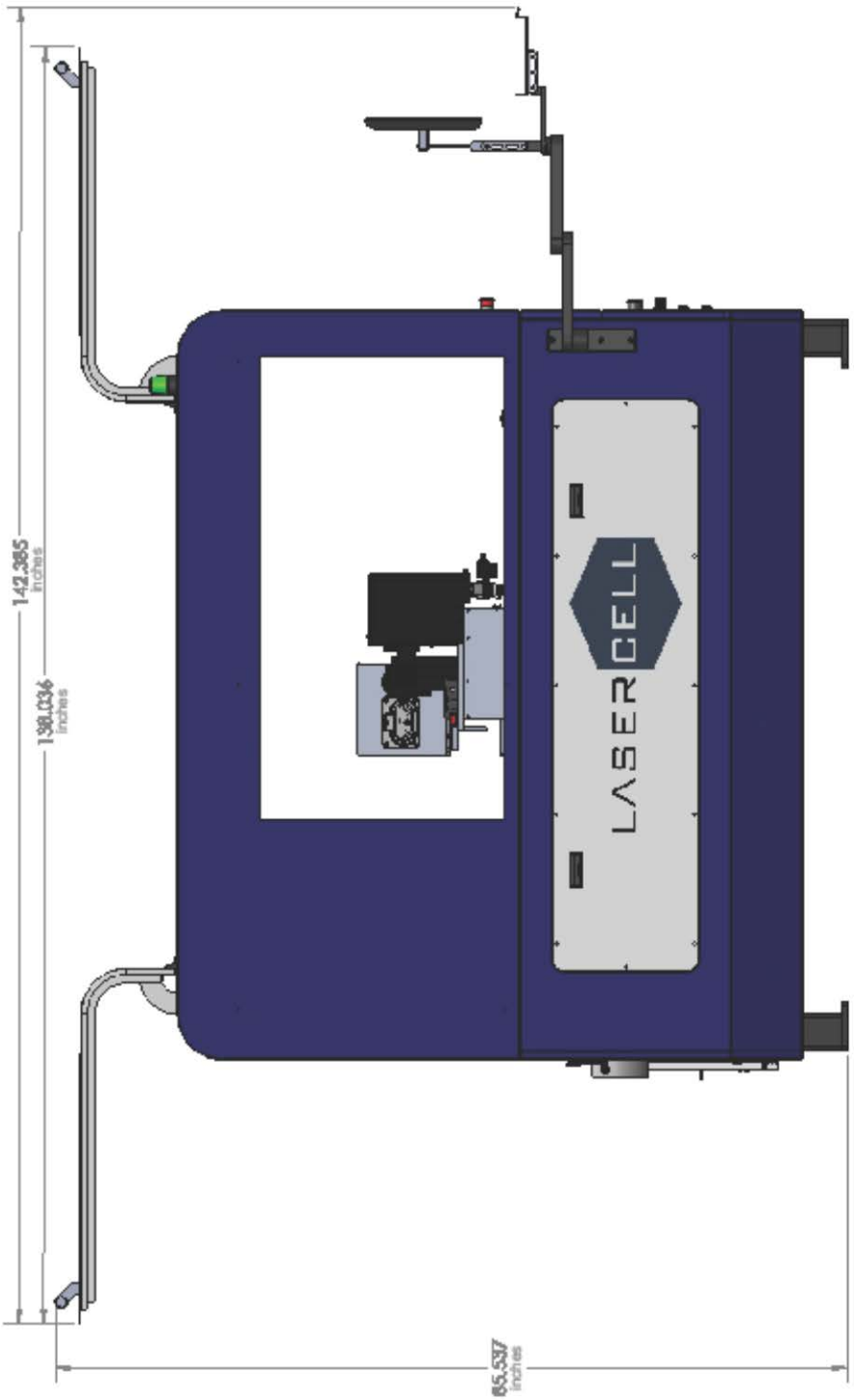
A laser power meter is required for this procedure. Please call a Kern sales associate for information on purchasing a laser power meter. These meters are great for troubleshooting and tracking the power of your laser over its lifetime.

14 System Diagrams

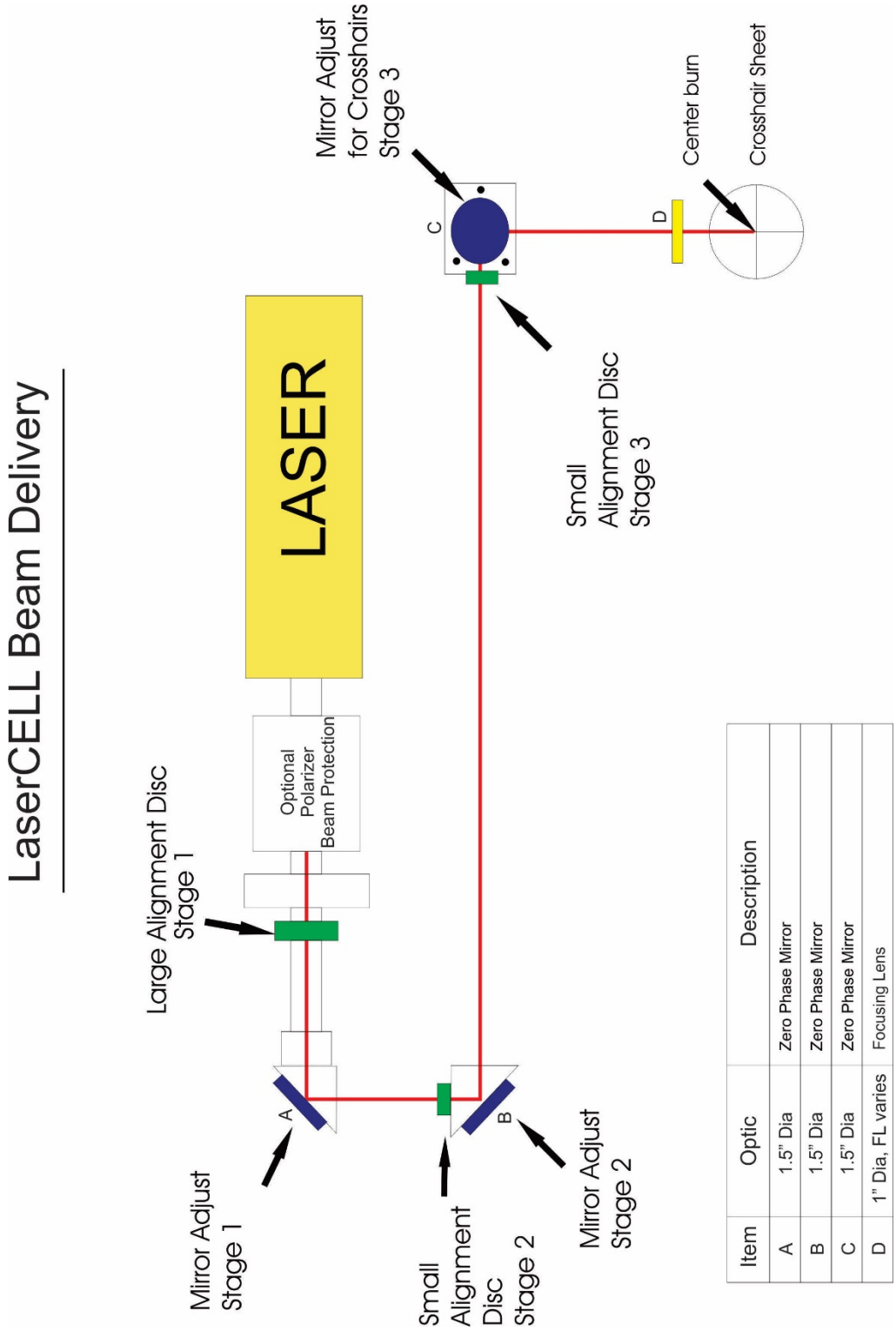
Front View Footprint



Side View Footprint

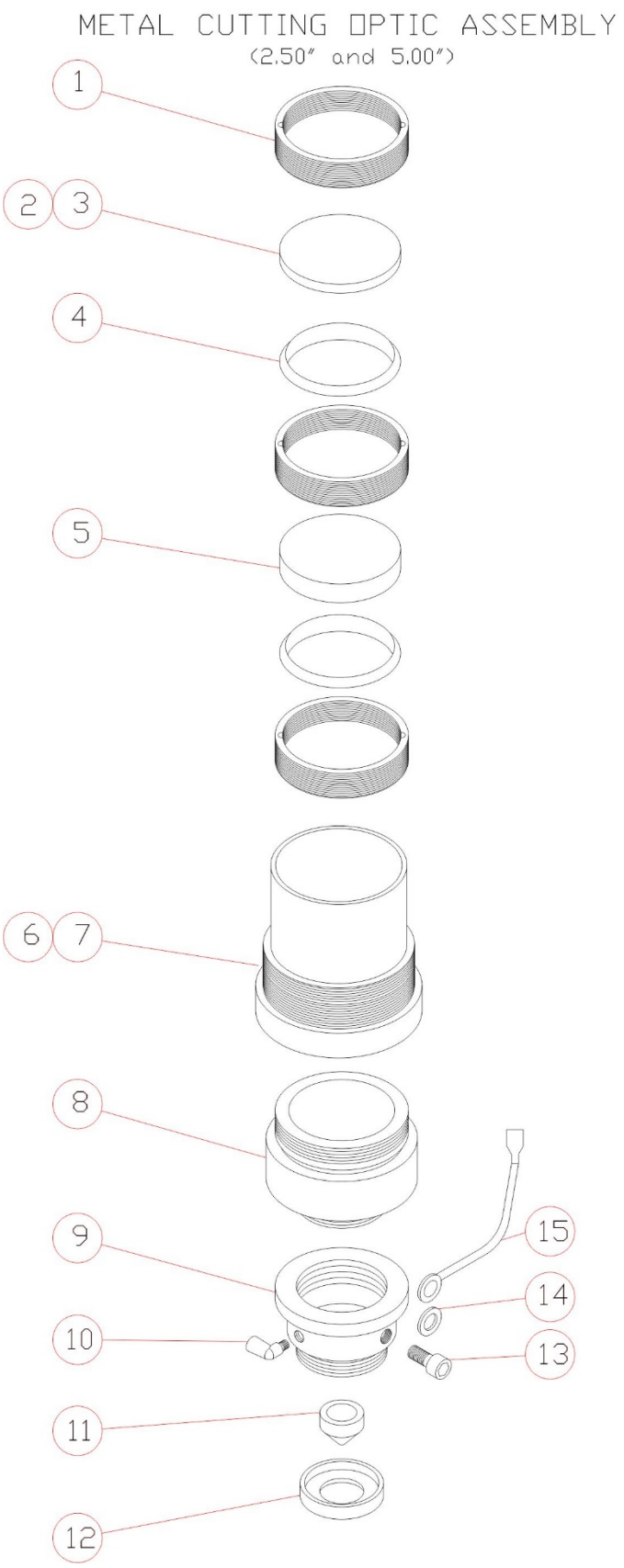


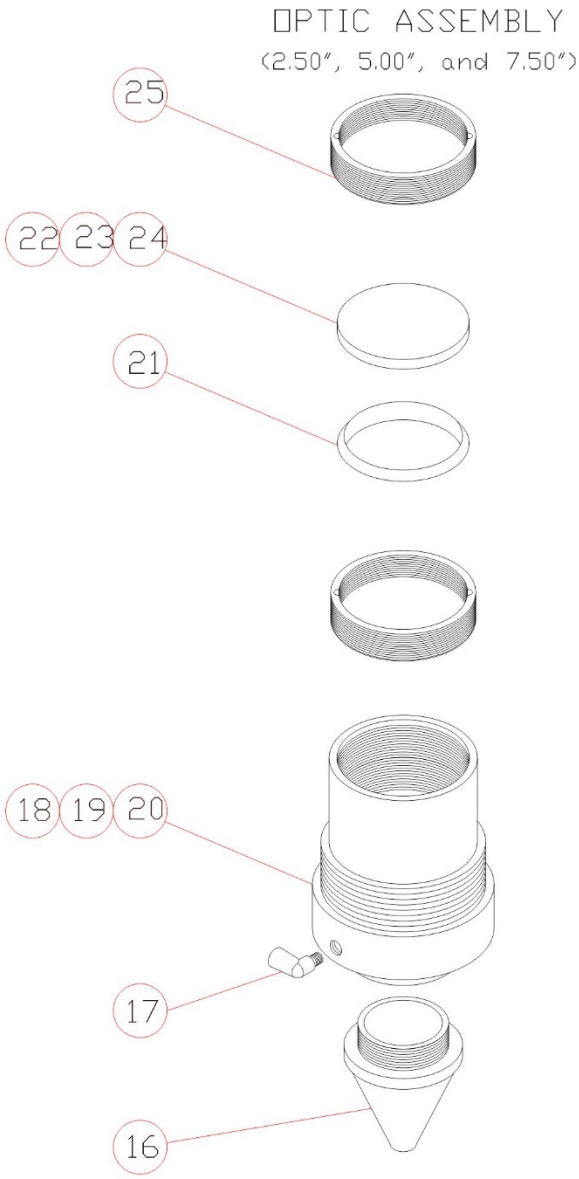
Mirror Alignment



Item	Optic	Description
A	1.5" Dia	Zero Phase Mirror
B	1.5" Dia	Zero Phase Mirror
C	1.5" Dia	Zero Phase Mirror
D	1" Dia, FL varies	Focusing Lens

LaserCELL Optics Assemblies





LaserCELL Optics Assemblies Parts List

NUMBER	QTY.	DESCRIPTION	PART NUMBER
1	3	Lens Lock Ring	HSE-1013
2	1	1.00" Diameter x 2.50" F.L. Lens	1585
3	1	1.00" Diameter x 5.00" F.L. Lens (not pictured)	1583
4	2	1.00" Stainless Steel Wave Washer	1898
5	1	K-Lens	1485
6	1	2.50" Lens Holder	N-HF-14
7	1	5.00" Lens Holder (not pictured)	N-HF-18
8	1	Ceramic Isolator	N-HF-13
9	1	Nozzle Retainer	N-HF-15
10	1	1/4 x 10-32 90 Elbow	1009
11	1	Copper Nozzle	1093
12	1	Tip Lock Ring	N-HF-19
13	1	#4-40 x .250 SHCS	91251A106
14	1	#4-40 Washer	90126A505
15	1	Sensor Wire	KERN1022
16	1	Nozzle	HSE-1016
17	1	1/4 x 10-32 90 Elbow	1009
18	1	2.50" Lens Holder	HSE-1015
19	1	5.00" Lens Holder (not pictured)	HSE-1018
20	1	7.50" Lens Holder (not pictured)	HSE-1019
21	1	1.00" O.D. O-RING/Wave Washer	1898
22	1	1.00" Diameter x 2.50"F.L. Lens	1585
23	1	1.00" Diameter x 5.00" F.L. Lens (not pictured)	1583
24	1	1.00" Diameter x 7.50" F.L. Lens (not pictured)	1688
25	2	Lens Lock Ring	HSE-1013

DESCRIPTION	PART NUMBER
2.5" METAL CUTTING OPTICS ASSEMBLY	KERN1001
5.0" METAL CUTTING OPTICS ASSEMBLY	KERN1002-1
2.5" OPTIC ASSEMBLY	KERN1011
5.0" OPTIC ASSEMBLY	KERN1012
7.5" OPTIC ASSEMBLY	KERN1011-1

LaserCELL Schematics

An exploded view and parts list of the LaserCELL's detailed footprint, gantry, blower system, height follower and other common parts is available online. Please visit the customer login page at http://www.kernlasers.com/customer-login. If you do not have a username and password please contact your salesman or technical support to receive one.

15 Warranty

The staff at Kern Electronics & Lasers, Inc. values our customers and takes great pride in the service we offer to our customers. The business relationships we have developed are very important to us. This page will clarify the service we offer to our customers after the purchase of a Kern Laser System.

In Warranty Systems

All systems have a one year warranty on the system parts, laser tube and laser power supply. This includes either the RF Power supply or the DC power supply, whichever is supplied with the laser system.

Warranty does not cover shipping costs from the customer's location to the Kern factory.

USA and Canada: For any parts sent out to the customer in warranty, Kern Electronics & Lasers, Inc. will pay for Ground UPS shipping only. If the parts are needed sooner (Next Day, 2nd Day, etc.) or by freight service the customer is responsible for the entire shipping costs. Any duties, customs and/or fees are the responsibility of the customer.

International: Shipping costs and duties/customs/fees to and from Kern Electronics & Lasers, Inc. are the responsibility of the customer.

Out of Warranty Systems

All parts shipped out of warranty will be charged repair or replacement costs plus all shipping charges. Out of warranty repairs of the laser vary by manufacturer.

Laser Power Meter

Please call a Kern sales associate for information on purchasing a laser power meter. These meters are great for troubleshooting and tracking the power of your laser over its lifetime.

LIMITED WARRANTY

Customer Name: Date of Purchase:

Model Number: Serial Number:

WARRANTY

Kern Electronics & Lasers, Inc. warrants your laser cutting and engraving system to be free from defects in material and workmanship for a period of 1 year from the original date of purchase. If you discover a defect in a product covered by this warranty, we will repair at our option using new or refurbished components, or if repair is not possible, replace the item. This warranty does not include labor to install the replacement parts.

EXCLUSIONS

This warranty covers defects in manufacturing discovered while using the product as recommended by the manufacturer. The warranty does not cover loss or theft, nor does coverage extend to damage caused by misuse, abuse, unauthorized modifications, improper storage conditions, lightening, or natural disaster. The warranty does not cover parts that are subject to normal wear and tear replacement requirements, such as the optical lens, mirrors, cutting beds, etc. This warranty is non-transferrable.

LIMITS OF LIABILITY

Should the product(s) fail, your sole recourse shall be repair or replacement, as described in the preceding paragraphs. We will not be held liable to you or any other party for any damages that result from the failure of this product. Damages excluded include, but are not limited to, the following: lost profits, lost savings, lost data, damage to other equipment, and incidental or consequential damages arising from the use, or inability to use this product. In no event will Kern Electronics & Lasers, Inc. be liable for more than the amount of your purchase price, and excluding tax, and shipping and handling charges.

Kern Electronics & Lasers, Inc. disclaims any other warranties, express or implied. By installing or using the product, the user accepts all terms described herein.

SERVICE

If you need technical support or service follow the outlined steps:

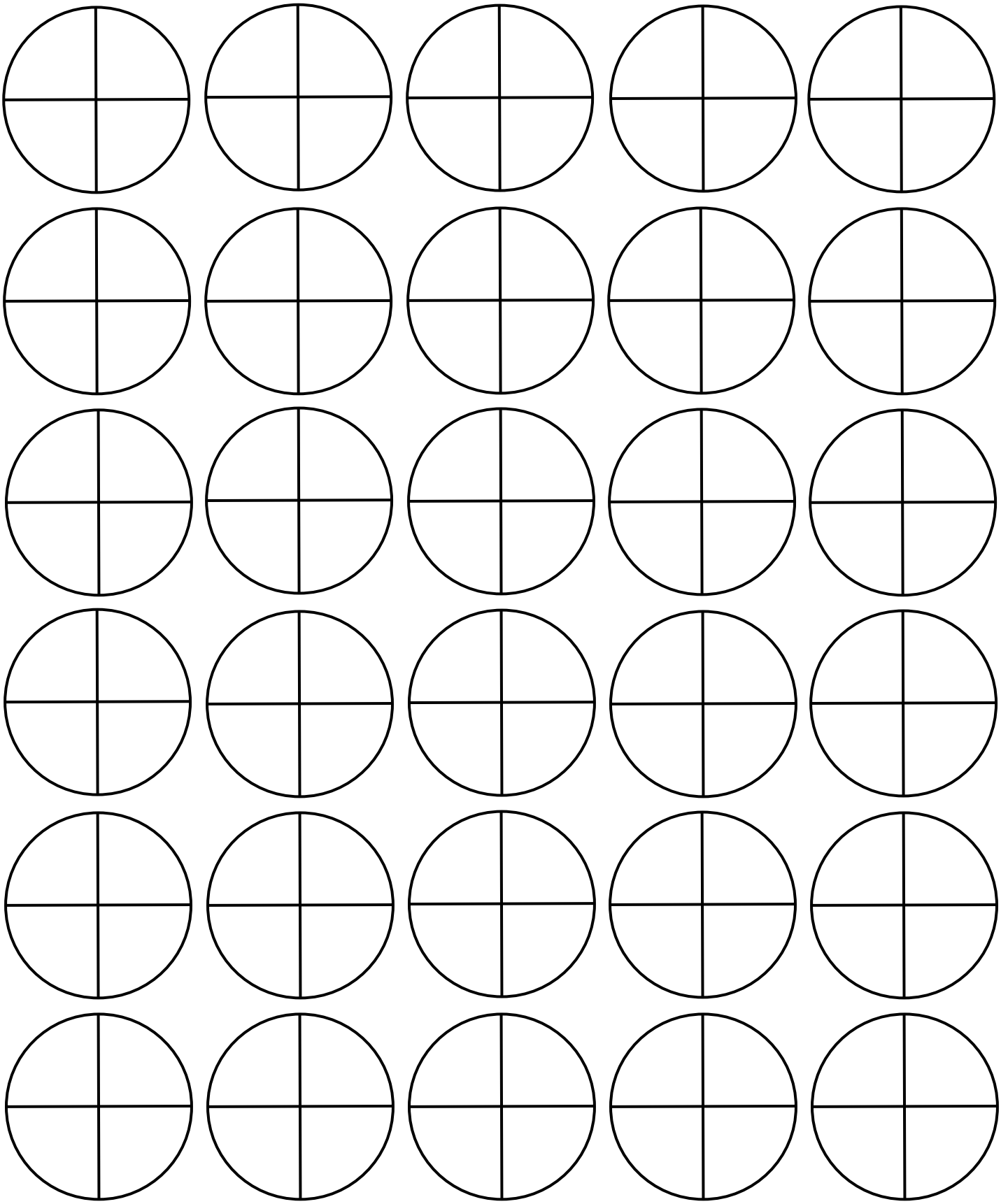
1. Refer to the laser manual or the Kern Laser System Manual for assistance.
2. Refer to our website, www.kernlasers.com/customer_support.htm.
3. Call Kern Electronics & Lasers, Inc. at 218-631-2755. Please have the following information ready:
    a. Name of your company.
    b. Name and phone number of the contact person in your company.
    c. Description of the symptoms, physical damage, or performance faults.

REQUIREMENTS

Warranty replacement parts will be shipped to customers at a standard Ground Rate. If the customer requires a faster service the entire shipping bill will be paid by the customer. Shipping defective parts back to Kern or the authorized repair center is the responsibility of the customer. The customer is always responsible for any customs clearance fees and/or duties. If Kern Electronics & Lasers, Inc. authorizes the return of parts, please ship them in well packaged containers. Lasers and RF power supplies must be returned in the original packaging and carton. The customer is responsible for insuring the product for shipping. Please call Kern if you are unsure of the correct insurance amount for a part. Upon receipt we will determine the warranty status of the product. If you are out of warranty you will be billed for parts, labor, and shipping costs.

Kern Electronics & Lasers, Inc.
1501 Industrial Drive, Wadena, MN 56482
Phone: 218-631-2755
Fax: 218-631-3476

LaserCELL BEAM ALIGNMENT SHEET



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