



MAKO

CO2 LASER



LASER CUTTER USER MANUAL



WARNINGS

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InkSmith cannot be held responsible for any direct or indirect damages, which result from using or working with the products electrical circuits or software described herein. The apparatus must be used only by trained and skilled personnel. This Operation Manual must be read and followed prior to operating the laser machine.

Furthermore, InkSmith reserves the right to change or alter any product described herein without prior notice.

In case of failure, please check the device first according to section 6.1 Tips for Troubleshooting. If unsuccessful, please note all data of the device (year of manufacture, software version, etc.) and call us from a telephone next to the switched on device.

For queries or technical problems please contact InkSmith directly at the above address.

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1.0 MACHINE OVERVIEW

1.1 GENERAL ACKNOWLEDGMENTS

Please read and follow this Operation Manual carefully before installation and operation of the laser cutting machine. Damage to persons and/or material can result from not following the Operation Manual. Operation of the machine is only permitted with consumables listed in the Approved Materials lists.

It is extremely important that the laser cutter is only operated after the machine has been properly adjusted. Use of the laser cutter with unapproved materials is not recommended. The manufacturer does not admit liability for damage to personnel and/or equipment resulting from such use.

The laser cutting machine must only be operated, maintained and repaired, by personnel that are familiar with the correct operation and dangers of the machine.

Failure to follow the operation, maintenance and repair instructions described in this Operation Manual excludes any liability of the manufacturer if a defect occurs.

Please note, when processing conductive materials, conductive dust or particles in the air might damage electrical components and lead to short circuits. Please note, such use is not covered in the machine warranty.

Please retain a copy of this manual for reference.



1.0 MACHINE OVERVIEW

1.2 TECHNICAL SPECIFICATIONS

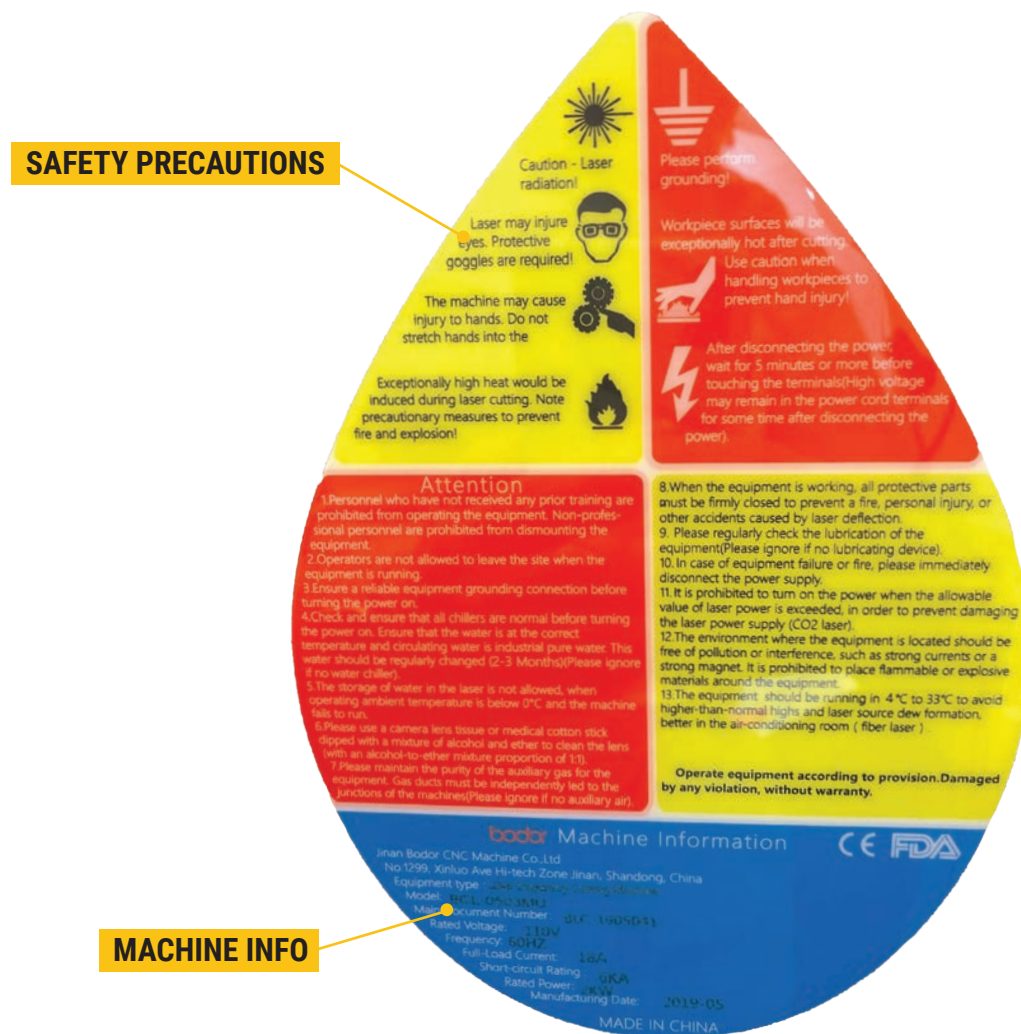
TECHNICAL SPECIFICATIONS			
MODEL	Mako40	Mako40 XL	Mako80 XL
WORKSPACE	500mm x 300mm	600mm x 500mm	600mm x 500mm
LASER POWER	40W	40W	80W
LASER TYPE	CO2 Sealed Laser Tube, 10.6µm		
COOLING TYPE	Water Cooling		
ENGRAVING SPEED	100-200mm/sec		
CUTTING SPEED	50-100mm/sec		
LASER OUTPUT CONTROL	(0-100% Set by Software)		
MIN. ENGRAVING SIZE	Text Size: 1.0mm*1.0mm		
HIGHEST SCANNING PRECISION	4000DPI		
LOCATING PRECISION	≤+0.01mm		
CONTROLLING SOFTWARE	DSP Control System		
GRAPHICAL FORMAT SUPPORTED	DST PLT BMP DXF DWG AI LAS,etc		
COMPATIBLE SOFTWARE	TAJIMA, CORELDRAW, PHOTOSHOP, AUTOCAD, etc.		
COLOUR SEPARATION	Yes		
DRIVE SYSTEM	High-precision 3-phase Stepper Motor		
POWER SUPPLY	110V AC/220V+10%, 50HZ/60HZ		
WORKING ENVIRONMENT	Temperature: 0-45°, Humidity 5-95%		
OPTIONAL SPARE PARTS	Honeycomb Worktable, Rotary Device, Auto-focus Device		
AIR FILTRATION UNIT	Optional Air Filtration Unit: Contact InkSmith for more information		

1.0 MACHINE OVERVIEW

1.3 MACHINE INFO

The Mako Laser Cutters are a series of high precision laser cutting machines capable of delivering professional results quickly and efficiently. The Mako Laser Cutters are able to cut and engrave on a variety of materials including wood, cardboard, fabric, leather, and acrylic.

Information about your specific machine can be found on the Equipment Name Plate located on the back of the laser cutting machine. This Name Plate will detail the model number, series number, input supply, power supply, manufacturer, and factory date. Please do not change or remove the Equipment Name Plate from the machine.





2.0 SAFETY

2.1 GENERAL SAFETY

All persons involved in the installation, set-up, operation, maintenance of the machine, must have read and understood the Operation Manual and specifically the “Safety” section. It is recommended that organizations generate a internal qualification process for operating the laser cutting machine. Personnel who complete laser safety training should be recognized with written proof of qualification (see section 6.2).

To ensure the safety of all operators and performance of the laser cutting machine, only those individuals who have read this Operation Manual may operate the laser cutting machine.

Safety Information for Operating Personnel

1. All persons involved in the installation, set-up, operation, maintenance of the machine, must have read and understood the Operation Manual.
2. Machine operators must ensure no unauthorized individuals install, set-up, operate, maintain and/or repair the laser cutting machine.
3. It is the duty of the operator to check the machine before operation and to immediately report defects that may affect the safety of the machine.
4. The operator must ensure that the machine is only operated in perfect working condition.
5. Modifying or removing safety components of the laser machine will void the machine warranty and may result in undue risk for the operator.
6. If the removal of safety components is required during the repair or service of the machine, the replacement of the safety components must be performed immediately after completion of the service and repair activities.
7. Preparation, retooling, maintenance and repair activities must only be performed with equipment switched off, by trained personnel.
8. It is forbidden to perform unauthorized modifications or changes to the machine.

2.0 SAFETY

2.2 LASER SAFETY PRECAUTIONS

The Mako Laser Cutter contains a powerful CO2 laser tube, which is used to cut, etch and engrave materials on its cutting bed. Once focused, the 40W laser has sufficient power to vaporize up to 6mm of plywood in a single pass. It is a very powerful machine and should be treated as such.

For this reason, there are interlocks in place to prevent injury by shutting off the power to the laser whenever the interlocking cover is in the open position. With the cover closed, the machine is considered a class 2 laser (lowest hazard level), as any active beam is fully enclosed. This is a classification that requires no special safety considerations.

WARNING: It is not only dangerous and irresponsible to over-ride or undermine a safety interlock system, it is also an offense under the Occupational Health and Safety Act.

While this power is 100% contained within the machine during normal usage, it is possible, through the use of keys that open access panels on the side of the machine, to become exposed to the laser beam or radiation scattered from it. These keys should be kept in a secure location during normal laser use as they should never be accessed by untrained personnel.

As with all types of radiation, the damage to human tissue is a result of the wavelength, the flux (the amount of radiation impacting each square meter of tissue) and the duration of the exposure. The invisibility of infrared radiation to the human eye means that it is impossible to detect an exposure visually to limit one's exposure time. As such, the first indication of exposure to a CO2 laser beam would be the detection of damaged tissues. Should this tissue be a cornea or retina, the damage could be permanent and debilitating.

The beam should never be operated while the interlocking door is open, or if the interlock switch or key on the main door is damaged or disabled in any way.

Laser Safety Information

- To assess the potential dangers laser systems pose, they are classified into 5 safety classes: 1, 2, 3a, 3b and 4. The InkSmith Mako Laser Cutter is a device of class 2 (USA: Class II). This is guaranteed by the protective housing and the safety installations. Please note that improper operation of the device can override the status of safety class 2 and can cause the emission of harmful radiation.

2.0 SAFETY

- This laser system contains a carbon dioxide (CO₂) laser source of class 4 that emits intensive and invisible laser radiation. Without safety precautions the direct radiation or even diffuse reflected radiation is dangerous!
- Without safety precautions, the following risks exist with exposure to laser radiation:
 - Eyes: Burns to the retina for NIR (Near Infra Red) LASER
 - Burns to the cornea for CO₂ Laser
 - Skin: Burns
 - Clothing: Danger of fire
- Never try to modify or disassemble the laser and do not try to start up a system that had been modified or disassembled!
- **Dangerous radiation exposure can result from the use of operation or adjustment equipment other than that described here, and if different operational methods are performed.**
- Dangerous radiation exposure can result from the use of prohibited materials such as:
 - blank or polished metals
 - metals with very high reflectivity like copper, brass, gold, silver
 - any materials with highly reflecting coatings
- Other highly reflecting materials, especially in combination with high laser power, low processing speed and/or work pieces with curved or inclined surfaces, laser radiation might be reflected towards the protection cover. With a very low probability this protection cover could be damaged if the reflected radiation is FOCUSED onto the surface of the protection cover. Therefore visual inspection for point-like defects on the protection cover should be done if the aforementioned conditions are given.
- If you detect such effects on the protection cover, immediately turn off the laser machine and contact InkSmith to get a new protection cover.

2.0 SAFETY

2.3 OPERATIONAL SAFETY

As the machine fully encloses the beam and ventilation protects the user from smoke and vapours created during operation of the machine, no special personal protective equipment is required to operate the Laser Cutter.

However, it is mandatory to have a fire extinguisher nearby at all times during operations, and that all operations are performed under the direct supervision of a person trained in Fire Safety and the use of fire extinguishers.

Although it is not required, your organization may suggest the use of safety glasses during operation of the laser.

Regardless of safety glasses use, do not stare directly at the bright light produced from the laser beam when interacting with the materials it is cutting or etching.

The red dot pointer is a low power visible light laser that can run even when the loading door is open. Never point the red dot pointer directly at any person's eyes. Be aware of potential surface reflections. There is always a risk of fire present when laser cutting combustible materials, therefore the laser is never to be operated without direct supervision of trained personnel.

A tiny flame is normal for some materials during laser operations. Any flame that continues to burn after the laser has moved positions is an indication that the material is on fire. Such a situation must be addressed immediately. Very small flames can be extinguished by blowing them out like a candle, or by smothering with a suitable material. If a flame gets larger than your fist, the nearest supervisor should be notified immediately. If they use the fire extinguisher, all other lab personnel must immediately evacuate the building and the nearest pull station must be activated.

WARNING: Never leave the immediate area of the laser while it's operating. Do not work/play on mobile devices or read books while supervising the machine. Regular, line of sight supervision is necessary as a fire in the machine will make no sound to draw attention to the machine. Due to the inward-drawing ventilation, there will also be no smell of smoke to indicate a fire. If such a fire builds to the point where it ignites wiring, paint or plastic in the laser cutter before it is put out, it poses an extreme danger to the operator and the entire building.

DANGER: Only trained and qualified personnel are allowed to operate the laser cutter.

2.0 SAFETY

2.4 APPROVED/NOT APPROVED MATERIALS

Never use the laser cutter on materials that are not on the approved list for cutting/etching/engraving. Toxic fumes and/or risk of fire may result.

Approved Materials:

- Acrylic
 - Cast–good for engraving
 - Extruded–good for cutting,less expensive
- Aeroply/Birchply
- Basswood
- Brown Cardboard
- Cloth
- Natural fibers–cut, but will scorch on edges
- Synthetic fibers–only non-chlorinated, edges will self seal
- Corian
- Cork
- Delrin (Seal Press)
- Leather
- Mat Board (used as border on pictures, thin card board)
- Melamine plastic
- Micro surfaced rubber Stamps
- Natural Wood – up to 1/2"
- MDF that is free from Formaldehyde
- Paper
- Plywood – up to 12 mm
- Silicone Sheet

NOT Approved Materials:

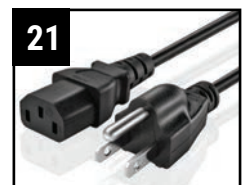
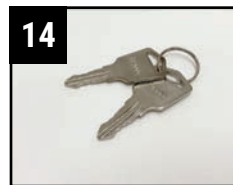
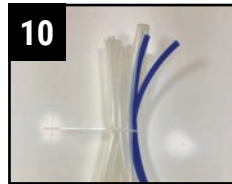
- ABS
- Crystal
- Glass
- Metal or Composites thereof
- Marble
- MDF that is manufactured using Formaldehyde (if uncertain, assume that the material contains formaldehyde)
- Teflon
- Polyurethane
- Polystyrene and Styrofoam
- PVC
- Polyurethane and Polyurethane Foams



3.0 INITIAL SETUP

3.1 WHAT'S INCLUDED

1. Mako Laser Cutter
2. CO2 Tube
3. Water Cooling Unit
4. Air Pump
5. Exhaust Hose
6. Hose Clamps
7. USB Cable
8. Ethernet Cable
9. Heavy Duty Electrical Tape
10. Flexible Water Tubing
11. Heat Shrink
12. USB Drive
13. Proximity Sensor
14. Housing Keys
15. Socket and Accessories
16. Allen Keys
17. Wrenches
18. Air Regulator
19. Fuse
20. Focal Measurement Blocks
21. Power Cables and Adapters



3.0 INITIAL SETUP

3.2 LOCATION CONSIDERATIONS

Before you install the laser cutting machine, it is important to select an appropriate location. Follow the guidelines listed below:

- Avoid locations where the machine may be exposed to high temperatures, dust and high humidity (The humidity must not exceed 70% and the temperature must not be close to the dew point).
- Avoid locations where the machine may be exposed to mechanical shocks
- Avoid locations with poor air circulation.
- Select a location where the room temperature is between 15 °C and 25 °C (59° – 77° F).
- Avoid higher ambient temperatures and strong exposure of the machine to the sun. Use blinds, if required.
- Select a location close to ventilation (if available).
- Select a location that is not more than 2.5m away from your computer (max. cable length to avoid disturbing interferences).

3.3 ELECTRICAL REQUIREMENTS

Make sure that your electrical outlet is capable of providing the proper voltage, frequency and amperage that the laser system requires. It is highly recommended that you use a surge suppression plugs to protect your computer equipment.

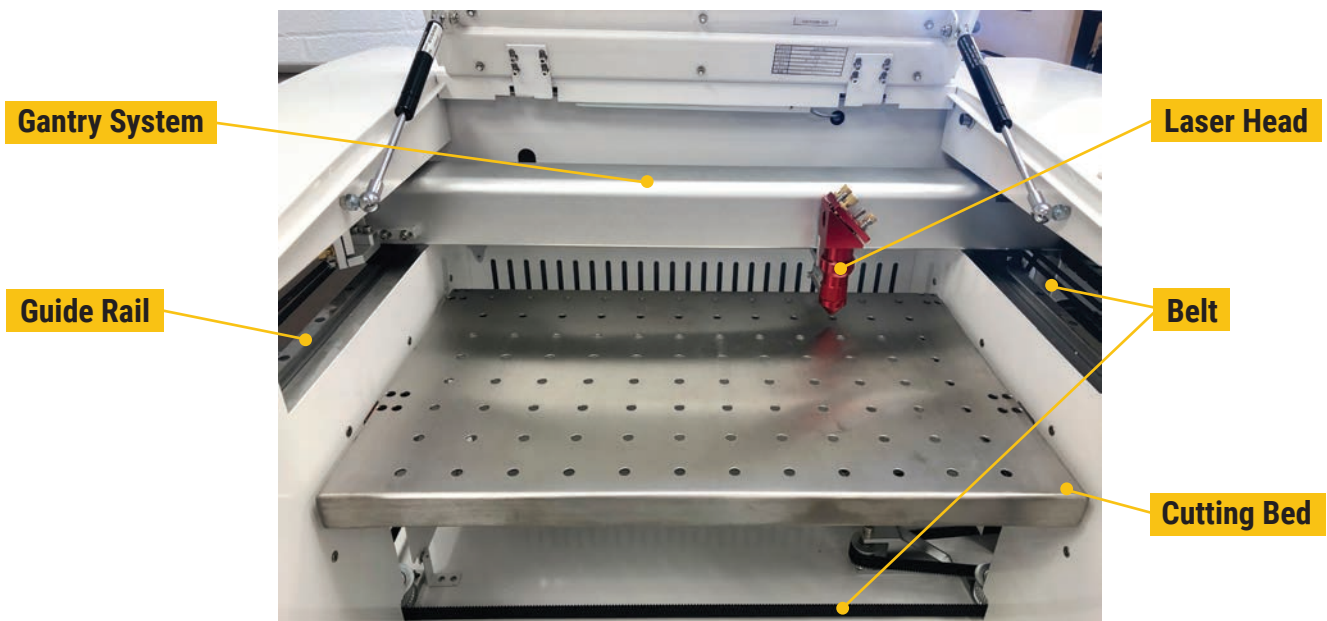
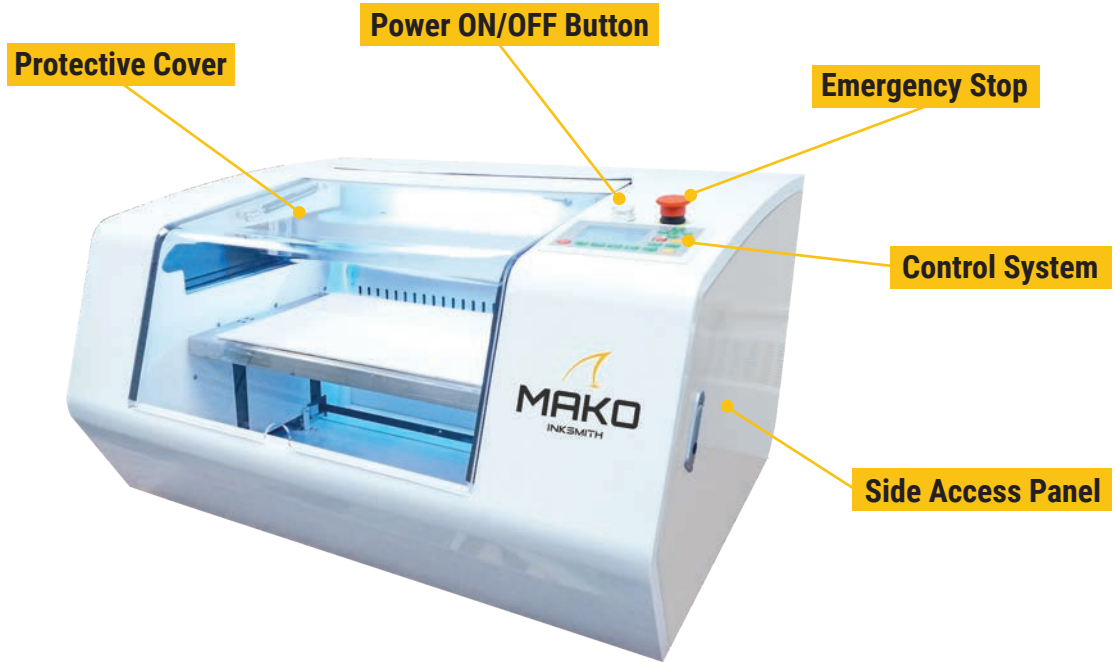
DAMAGES FROM AN INADEQUATE OR INAPPROPRIATE POWER SOURCE ARE NOT COVERED UNDER WARRANTY. IT IS YOUR RESPONSIBILITY TO PROVIDE A SUITABLE ELECTRICAL SUPPLY.

3.4 EXHAUST REQUIREMENTS

Please refer to the specific exhaust requirements found in the operation manual included with your air filtration unit. If you are not using a separate air filtration unit it is suggested that the laser cutting machine be filtered using the included flexible aluminum duct piping into an existing exhaust ventilation unit.

3.0 INITIAL SETUP

3.5 MACHINE DIAGRAM



3.0 INITIAL SETUP

3.6 CONNECTING COMPONENTS

Start by plugging in your laser machine to a suitable power outlet. Please refer to the Electrical Requirements in section 3.3.

Water Chiller

First, hook up your water chiller using the two clear water hoses. Connect each of the water hoses to the barbed connectors labeled "INLET" and "OUTLET" on the water chiller. Then, connect the inlet hose to the "WATER OUT" connector on the laser machine. Connect the outlet hose to the "WATER IN" connector on the machine. Ensure the water chiller is filled with 6-8L of distilled water. Next locate the gray alarm output cable which is already attached to the machine. Attach the cable to the "ALARM OUTPUT" connector on the water chiller. Secure the connection by screwing the fastening collar. Plug in the water chiller to a power outlet.

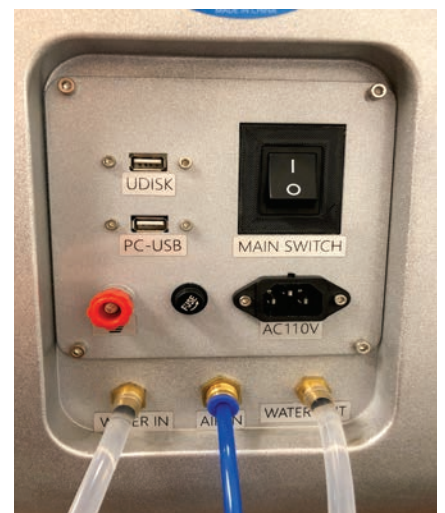


Hook Up Air Compressor

Plug in the air compressor hose to the blue "AIR IN" socket located on the back of the machine. Plug in the air compressor to a power outlet.

Connect Air Filtration System

Follow the specific instructions included with your air filtration unit to install it on your laser machine. Alternatively, connect the included flexible aluminum hose to the machine and pipe it in to your existing exhaust ventilation unit.





4.0 OPERATION

4.1 POWERING MACHINE ON/OFF

Before powering on, do a visual inspection of the laser cutter. Open the lid and gently move the laser gantry system side to side and back and forth. Ensure the cables and connections are intact, and that all moving parts do so smoothly.

Turning ON Mako Laser Cutter

1. To turn on the laser, flip the main power switch on the back of the machine to the ON position.
2. Ensure the red Emergency Stop button is disengaged (rotate the button to ensure it releases into the up position).
3. Press the secondary power button next to the emergency stop button to energize the control system.
4. Turn the water chiller on. (Note: the chiller will alarm until water is flowing at full speed. If the alarm does not stop, discontinue setup and proceed to the Troubleshooting section.)
5. Plug in and turn on the air pump.
6. Power on the filtration unit or exhaust fan, depending on your configuration.

Turning OFF Mako Laser Cutter

1. Power off the filtration unit (if the machine is still a little smoky, this can be left on).
2. Switch off the air pump.
3. Turn off the chiller unit.
4. Engage the emergency stop button, and press the adjacent power button.
5. Turn off the main power switch.

4.2 CALIBRATING THE LASER CUTTER

The gantry system is made up of the motors and linear rails that allow for the laser head to travel during operation. Make sure that all body parts are out of the path of travel of any moving parts. Once the machine is powered on, use the direction keys on the control keypad to move the laser head around. It should do so relatively quietly, and at the same rate in all directions. If this is not the case, proceed to Troubleshooting before moving on to the next steps.

Testing of Laser Tube

Ensure that the flow of water within the laser tube is in the high to low voltage direction (from the end with the red connector to the end with the black connector). Trace the water hose from the Outlet port on the Water Chiller, ensuring it connects to the Inlet port on the machine, and that the flow path

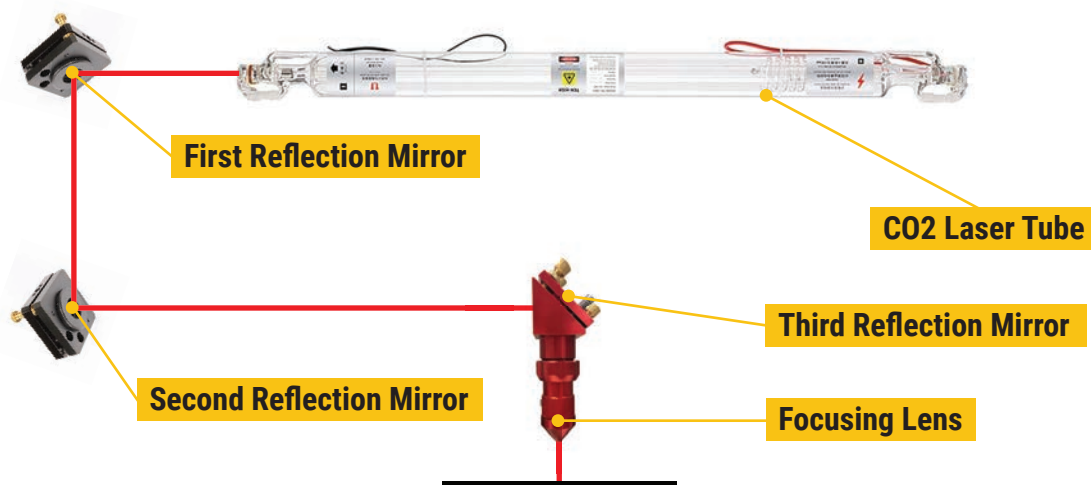
4.0 OPERATION

is free of kinks with all hoses connected firmly. It is critical that no air bubbles are left within the tube prior to energizing the laser.

Debugging the Light Path

The light path of the laser tube is calibrated during the manufacturing process, however it's a good idea to recalibrate the laser after transportation to ensure the safety and performance of the machine.

The Optical system of the laser cutter consists of a laser tube, 3 reflection mirrors, 1 focus lens, a laser head and red dot position system. Please refer to the diagram below.



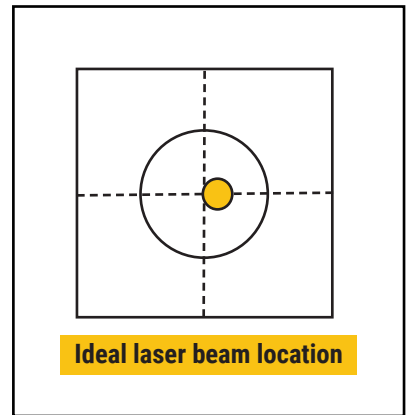
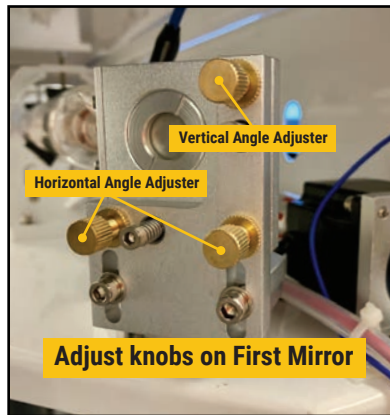
The laser cutter works by shooting a beam of light from the laser tube, which is then reflected by the first, second, and third mirrors. After reflecting off of the third mirror the light beam is shot through the focus lens and reaches the work table.

It's through the process of reflecting and focusing that we're able to achieve the best cutting and engraving results. If the light path isn't properly calibrated, it may damage the laser tube, reflectors, lens or result in poor cutting and engraving outcomes. Please calibrate the laser tube using the following steps.

4.0 OPERATION

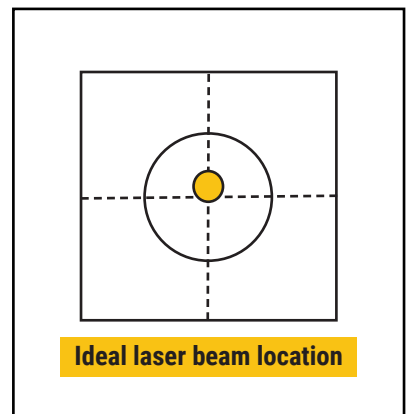
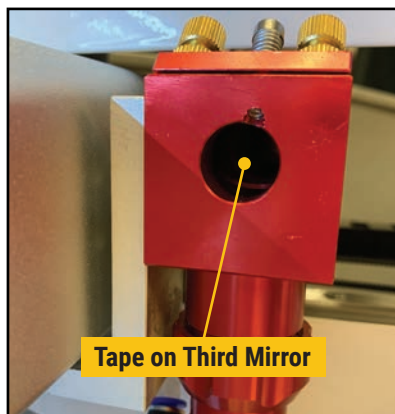
Mirror 1 Adjustments

Open the machine lid and move the gantry system to the front of the machine. Use the Housing Keys to open the side panel of the machine to access the laser mirrors. To align the reflection of Mirror 1, place a small amount on masking tape over the aperture of Mirror 2. With the cover and side panel closed, use the pulse button on the control panel to send a beam of light from the laser. After a quick pulse, open the lid and side panel to examine the location of the laser pulse on the tape of Mirror 2. Use the knobs on Mirror 1 to make small adjustment as needed in order to align the laser beam according to the diagram below.



Mirror 2 Adjustments

To align the reflection of Mirror 2, repeat the previous steps but place the masking tape on Mirror 3. Adjust the knobs on Mirror 2 as necessary in order to align the laser beam according to the diagram below.

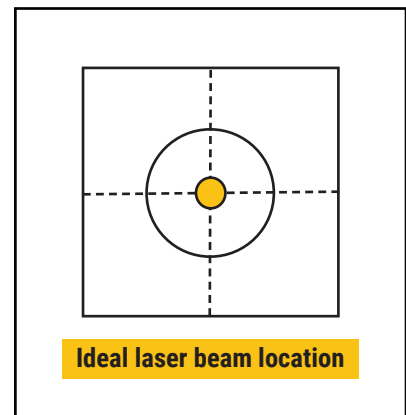
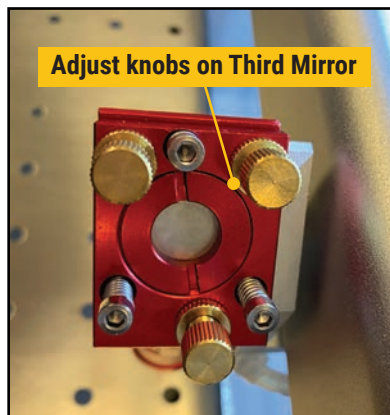
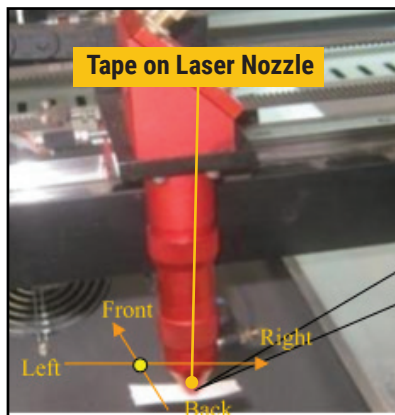


4.0 OPERATION

Mirror 3 Adjustments

To align the reflection of Mirror 3 you will again use the masking tape, but instead place it on the bottom of the red, metal laser nozzle. Adjust the knobs on the top of the laser head accordingly to align with the diagram pictured below.

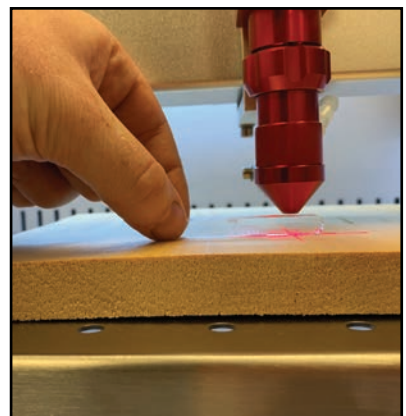
It is important to ensure all three mirrors on the laser machine are adjust accordingly in order to ensure optimal machine performance and the life of the laser tube.



Focusing the Laser

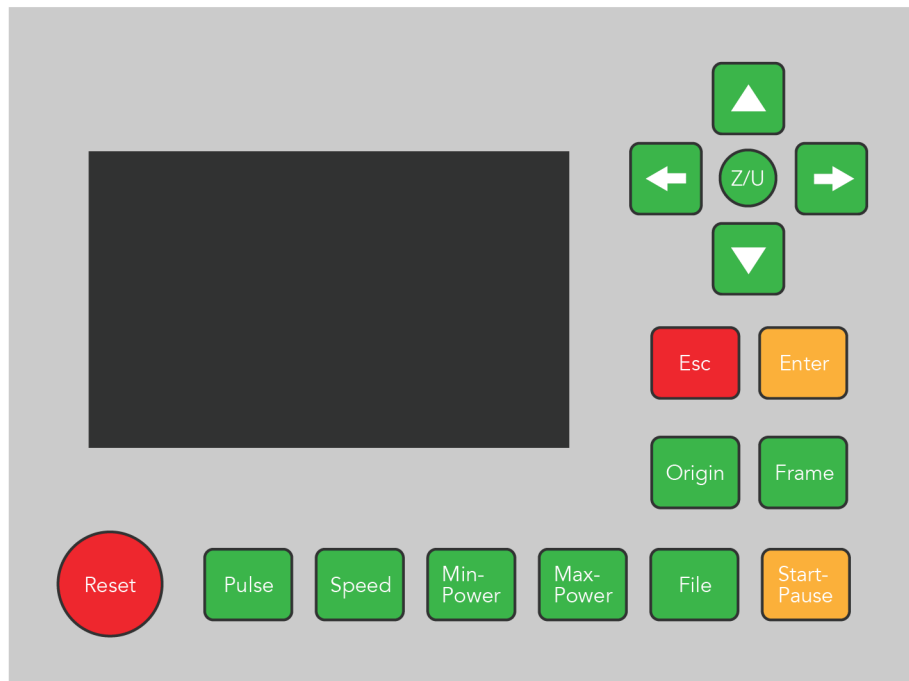
Depending on the thickness of the material you are cutting you will need to focus the laser nozzle using the 7mm Focal Measurement Blocks. These measurement blocks ensure the proper distance is achieved for optimal laser cutting power. It is important to adjust this spacing every time you use the laser cutter.

To make this adjustment use the Z/U button on the control system panel and navigate to the "Z move" option. Using the left and right arrow keys, move the cutting bed up and down so that the laser nozzle is just touching the acrylic measurement block. Remove the measurement block while moving the cutting bed - the gantry system can become miscalibrated or damaged by running the laser nozzle into the block.



4.0 OPERATION

4.3 CONTROL SYSTEM NAVIGATION



The **Reset button** will reset the laser head back to the last set X,Y coordinates if the laser head has been moved.



The **Pulse button** will temporarily activate the laser and create a short burst of laser power. Holding down the Pulse button and using the arrow keys to navigate the laser head will allow you to make cuts freehand without a .dxf file.



The **Speed button** allows you to change the speed at which the laser cuts. This is useful because different thicknesses of materials need deeper cuts. Deeper cuts need to have a slower speed. To change the speed at which the laser moves, press the Speed button, then use the Min-Power and Max-Power buttons to adjust the speed accordingly. Press the Enter button to confirm.



The **Min-Power button** is used to set the minimum power that the laser will output. This is useful for when you are working with engraving and need a variety of powers for the different depths engraving. For more information, please see the RD Works Section.

4.0 OPERATION

Max-Power

The **Max-Power button** is used to set the maximum power that the laser will output. This is useful for when you are working with engraving and need a variety of powers for the different depths engraving. For more information, please see the RD Works Section.

File

The **File button** pulls up all the available files and file folders on the laser machine. Use this button to find and select the files that you would like to cut/etch/engrave. To move through these files use the arrow buttons and press Enter to select a file.

Start-Pause

The **Start-Pause button** is used to start a file or to pause a file during operation.

Origin

The **Origin button** is used to set particular X and Y coordinates. This can be done by using arrow buttons to move the laser head to where you want it, and then pressing Origin. This origin position is the exact position from which the laser will start cutting. This can be useful if you have an odd sized piece of material from which you would still like to cut from. The origin can be located anywhere on the bed's surface.

Frame

The **Frame button** allows you to see whether or not the piece you want to cut will fit on the amount of material you have. When pressing Frame, the laser head will show you the exact rectangular size of the file. You can do this before starting the file, to see if you have a large enough material surface.

Esc

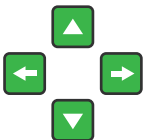
Pressing the **Esc (Escape) button** will allow you to exit, or cancel the current operation. This is useful if you would like to cancel the current cut/engraving job before it starts.

Enter

Use the **Enter button** to select files, variables, folders, etc.

Z/U

The **Z/U button** will bring up all the sub menus, such as how to raise and lower the bed. This is needed to properly position the bed depending on the material you are using.



The **Arrow buttons** are used to navigate through the various menus and settings.

4.0 OPERATION

4.4 PREPARING FILES FOR PRINT

Laser Cutting

The first step to preparing a laser cut part is to prepare the CAD file that will create the shape that is to be cut out on the laser.

Drawing CAD Files for Laser Cutting

Laser cut CAD files are simple, 2D line drawings that represent the outline of the parts you want to create from stock materials. The final product will have a thickness that is predetermined by the thickness of the stock material you are cutting.

Note: For materials that need to interlock, it is a good practice to measure the thickness of the material prior to designing as the nominal thickness does not always exactly match the measured thickness.

Any part that exceeds the size of your cutting bed will need to be broken into sections to cut.

When drawing parts for laser, keep in mind that the kerf (amount of material lost to the cut) is approximately the thickness of a piece of paper. Therefore, any designs that have lines closer together than the kerf will result in a larger hole, rather than two individual cuts.

Another design consideration is whether the parts should immediately fall free, or should remain in the stock wood held by small tabs. A small number of large parts can be removed more conveniently if designed to fall out, however a large number of smaller parts can be problematic if they fall from the sheet during cutting process. Parts that fall out can require access to the trap underneath the cutting table. Alternately, if the parts are designed to remain tabbed into the stock materials, the parts are easy to remove from the laser cutter and are protected by the stock wood during storage and shipping. These tabs are easily created by cutting small gaps along the cut lines in strategic places. The thicker the material, the smaller these tabs need to be.

Preparing a Photo or Drawing for Etching: Adobe Photoshop

Note: If preparing a photo for etching on to a surface, a dot graphic in gray scale will be needed.

Since most modern cameras work at very high resolution, the resolution of photos is well beyond what is needed or what the laser is capable of reproducing. The minimum size of a dot that can be burned into a surface is such that beyond 150 DPI the burned dots would overlap, leading to poor quality and strange patterns in the etching caused by interference effects between the successive rows of dots. A minimum interval between rows of 0.1693 mm (1/150") is about the minimum row spacing to avoid overlap. As such, 150 DPI (dots per inch) is the maximum useful resolution for this process, even though up to 600 DPI can be selected in RDWorks.

4.0 OPERATION

Open the photo you wish to etch in Adobe Photoshop on your computer.

Note: for photo etching, photos with strongly contrasting lights and darks will give the best results, as will selecting materials that have strong contrast between burned and unburned areas.

Select the photo by clicking on it in the main window. Then in the drop-down menus at the top of the screen select image, mode, then grayscale. A box will giving the option to discard the colour information. Select discard. This will convert the photo into a black-and-white photo.

From the drop down menus, select image, adjustments, then posterize. Change slider to 10-16. Beyond that point, there will be little change in the photo. Below that point, the photo will start to lose resolution badly.

Once again select image, adjustments and then levels. Adjust level to lighten up dark areas a bit, but not so much that definition starts to get lost.

Select image, adjustments and then Brightness/Contrast. Adjust the two controls to maximize the detail that is visible.

Select Filter, Blur, then Gaussian Blur. Set the controls to the sharpness you wish from the photo. If the photo needs to have extraneous elements cropped out of it, do so at this time. Select the crop tool from the left hand vertical tool bar beside the main image window.

Finally, set the size and resolution of the photo. Select Image, Image Size and set the image size. If it is desired to maintain the aspect ratio (height to width), activate the "lock" on the line leading from the word Height to the word Width. Below those boxes, the desired resolution can be typed in. 150 is the maximum needed for laser cutting, though sometimes a person may want to choose a lower resolution to create an etched photo with a blurred effect.

For etching, the best outcome is achieved if there is a strong contrast on details and somewhat exaggerated contrast vs the original grayscale conversion.

When satisfied, save the photo using the file, save as tool. Select BMP as the file type.

Close Photoshop and open RDWorks.

RD Works will open to show a large central area with a grid on it. This area is surrounded by tool bars with various functions. This represents the cutting table on the laser. It should be marked as the width and height of your machine's bed size. If it is not, select the Config(s) drop down menu, then select page size. In the box that opens, set the page width and the page height to the corresponding bed size.

4.0 OPERATION

WARNING! If a file is prepared using a table size setting larger than your bed size, it may cause the axis to attempt to travel beyond their physical limitations, resulting in damage to the laser machine.

Preparing a Photo Etch: RDWorks

Import the pre-prepared photo to RDWorks. Select File, Import, then select the JPG or BMP that you prepared earlier.

RDWorks will open the photo right in the middle of the grid (representing the cutting bed), and will zoom in until the photo is maximized on your screen. To see how the photo actually fits on the laser table, move the cursor to the top horizontal tool bar, and hover over the 4th magnifying glass from the left. A bubble will pop up with the words Show Page in it. Click to select this function. The zoom will be restored to a zoom that shows the entire laser cut table area.

Click on the photo. Hover your mouse over the now-selected photo. As you approach the middle of the photo, your cursor will change to one with 4 arrow heads at 90° to each other. Left click and hold to drag your photo to anywhere on the grid. It is a good practice to work from the upper right, as this is the "0,0" point of the laser.

NOTE: The laser cutter itself will interpret the green square seen at the top right corner of the top right object as the origin for that cut/etch/engrave or group of operations. Thus, regardless of where you place your objects in RDWorks, the laser will begin wherever you set your temporary origin on the laser cutting machine and will match the top right point of any and all of the entities you've placed in your RDWorks file to that location on the table.

Click on the photo to select it once more.

From the drop-down menus, select Handle(W), Bitmap Handle. A pop-up will open that will allow you to adjust brightness, contrast, set resolution, invert the colours, and select various types of dithering. Check the box that says dither, and then select dot graphic. Press the button apply to view. The appearance of the photo within the pop-up will change to reflect this selection.

Brightness, contrast, resolution and lines per inch (maximum 150 for good performance) are adjusted in this menu to optimize the photo for etching. Best results will be achieved if the photo has exaggerated differences between the lightest and darkest areas, but not so much as to lose detail. The example to the right is a good starting point, though some experimentation will still be needed.

4.0 OPERATION

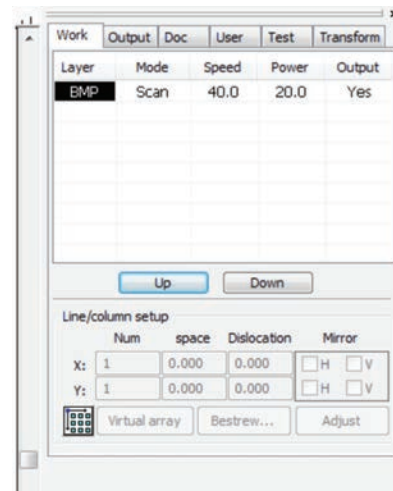
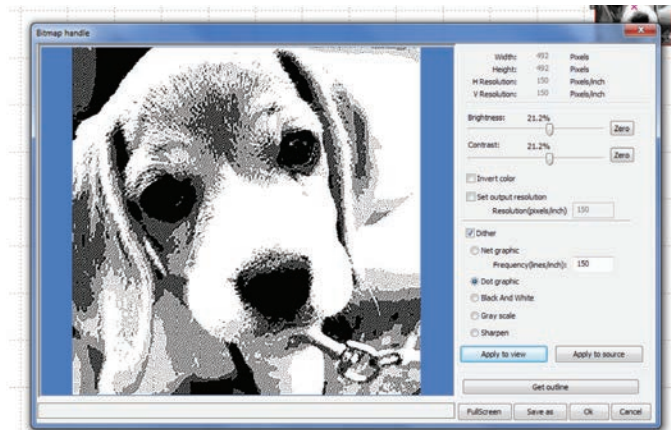
When satisfied, click Apply to Source to transfer your changes to the photo on the virtual cutting table. Click OK. The next time the photo on the virtual cutting table is selected, the changes will be applied and the appearance will change.

In the upper right of the RDWorks screen, there are 6 tabs. Select Work. The table shown to the right will appear.

The layer with the photo on it will be named BMP and should default to SCAN Mode. There may also be other layers for cutting (for example if you wanted to cut out the photo etch from the stock material).

Different entities on the virtual cutting table can be set to different layers by selecting them individually or in groups, and then clicking on a new colour in the colour bar (at the bottom of the screen). Each "colour" will be given its own layer in the Work Table. As the laser is set to cut in order of layer, the scan operations should always be above the cut operations in this table. Select a row and move it up or down using the buttons below the table to change the order of cut operations.

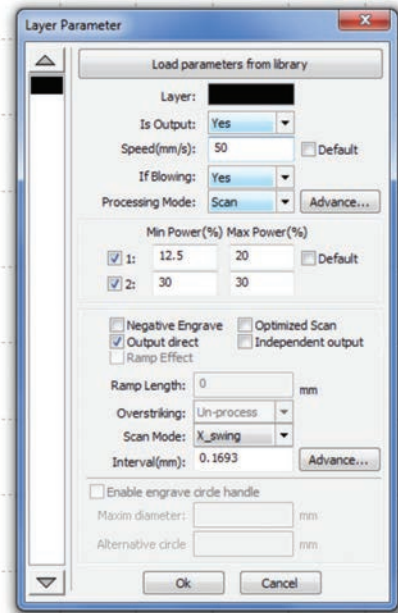
The laser will do the operations in order from top to bottom. Scanning before cutting ensures that the workpiece doesn't shift during the scanning operation. Shifting during scanning could cause problems with the location or resolution of the photo/lettering. To set the laser power and speed parameters, double click on the row to be adjusted. The Layer Parameter box (shown below) will appear on the screen. This box is where the user sets up all of the commands that control the movement and power of the laser during a given process.



- Layer – will show the layer by colour
- Is Output – set to Yes
- Speed – Max 400 – set 50-200 for dot scanning (faster requires more power and possible offset adjustment). Max is 400, but it is difficult to get good etching results at that speed.
- If Blowing – controls cutting head air. If set to Yes, the blow-off air at the laser tip will operate whenever a program is running.
- Always set to Yes.

4.0 OPERATION

- Max and Min Power – set both to about 15% for 50 mm/s, ranging to about 25% for 200 mm/sec. Note that this will also vary by material, depending on how much power it takes to darken that material
- Check boxes – leave them all unchecked for etching (check output direct for laser engraving)
- Ramp Length – 0
- Overstriking – set to unprocess
- Scan Mode – set to X-swing (will go back and forth, unilateralism settings will scan in only 1 direction and take twice as long). If your scan is much taller than it is wide, set it to Y-swing
- Interval – set to 0.08 to 0.1963 mm. The former has better resolution. The latter is faster
- Click OK when done



The set up is complete and the RDWorks is ready to export the laser file.

In the lower right of the RDWorks window, there is a box called Laser Work. In this box, there is a button called Save to UFile. Ensure that a USB stick is installed in your computer and then press Save to Ufile.

A Save As pop-up box will appear. Ensure that the file is routed to the parent directory of the USB stick. Files that are located in folders can not be found on the Mako Laser Cutter.

Choose a short but clear name (Less than 8 characters with no special characters! – RD works will truncate anything longer). Check that the file type is *.rd and click save. A pop up box with a yellow triangle with an exclamation point and a line of gibberish will appear (there is an error in the software that causes it to use a symbolic font for this dialogue box). This means that the file has been successfully saved to the USB. Press OK.

Use the controls in the lower right of the Windows screen to “safely eject” the USB stick. The file is now ready to transfer to the Mako Laser Cutter.

Once transferred, the etching should display on the Mako Laser Cutter screen so that you can see the photo (it will look like the brightness and contrast are a bit too high, this is normal). It will display in the colour of the layer that the engraving was set to in RD Works.

4.0 OPERATION

Setting up a photo/graphic for engraving in RDWorks

Import your pre-prepared photo to RDWorks. Select File, Import, then select the JPG or BMP that you prepared earlier.

RDWorks will open the photo right in the middle of the grid (representing the cutting bed) and will zoom in until the photo is maximized on your screen. To see how the photo actually fits on the laser table, move your cursor to the top horizontal tool bar, and hover over the 4th magnifying glass from the left. A bubble will pop up with the words Show Page in it. Click to select this function. The zoom will be restored to a zoom that shows the entire laser cut table area once more.

Click on the photo. Hover your mouse over the now-selected photo. As you approach the middle of the photo, your cursor will change to one with 4 arrow heads at 90° to each other. Click on the left mouse button and hold it. You can now drag your photo to whatever point on the grid that you want to move it. It's good practice to work from the upper right, as this is the "0,0" point of the laser

NOTE: The laser cutter itself will interpret the top right corner of the top right object as the origin for that cut/etch/engrave or group of operations. Thus, regardless of where you place your objects in RDWorks, the laser will begin wherever you set your temporary origin on the laser cutting machine and will set the top right point of any and all of the entities you've placed in your RDWorks file to that point.

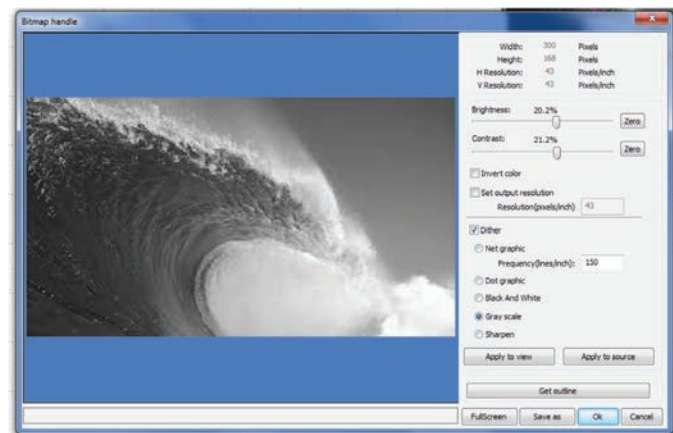
Click on the photo to select it once more.

From the drop-down menus, select Handle(W), Bitmap Handle. A pop-up will open that will allow you to adjust brightness, contrast, set resolution, invert the colours, and select various types of dithering.

Check the box that says dither, and select grayscale. Press the button view. The appearance of the photo the pop-up will change to reflect this selection.

You can now adjust brightness, contrast, resolution and lines per (maximum 150 for good performance) to optimize the photo engraving. Best results for engraving achieved with moderate contrast between the darker and lighter.

NOTE: Photos or graphics with very large differences between the lighter and darker areas will be more difficult to engrave successfully. For engraving, slightly washed out looking is better than more contrast than the original photo.

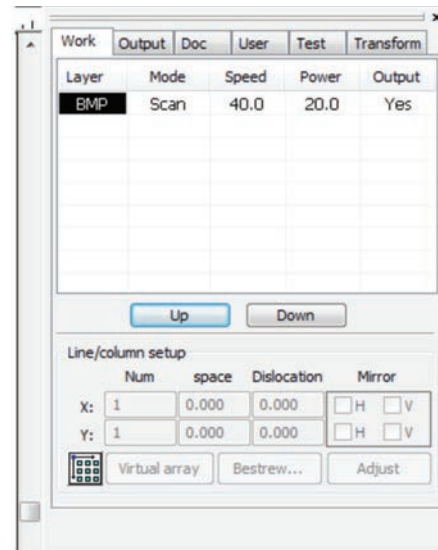


4.0 OPERATION

When satisfied, click Apply to Source to transfer your changes to the photo on the virtual cutting table. Click OK. The next time you select the photo on the virtual cutting table, the changes will be applied and the appearance will change.

In the upper right of the RDWorks screen, there are 6 tabs. Select Work. The table shown to the right will appear.

The layer with the photo on it will be called BMP and should default to SCAN Mode. There may also be other layers for cutting (for example if you wanted to cut out the photo etch from the stock material). Entities on the virtual cutting table can be set to different layers by selecting them, and then clicking on a new colour in the colour bar (at the bottom of the screen). Each "colour" will be given its own layer in the Work Table. The scan operations should always be above the cut operations in this table. You can select a row and move it up or down using the Up/Down buttons below the table. The laser will do the operations from top to bottom. By scanning before cutting, you ensure that the workpiece doesn't shift during the scanning operation and cause problems with the location or resolution of the photo.



When satisfied, click Apply to Source to transfer your changes to the photo on the virtual cutting table. Click OK. The next time you select the photo on the virtual cutting table, the changes will be applied and the appearance will change.

In the upper right of the RDWorks screen, there are 6 tabs. Select Work. The table shown to the right will appear.

The layer with the photo on it will be called BMP and should default to SCAN Mode. There may also be other layers for cutting (for example if you wanted to cut out the photo etch from the stock material). Entities on the virtual cutting table can be set to different layers by selecting them, and then clicking on a new colour in the colour bar (at the bottom of the screen). Each "colour" will be given its own layer in the Work Table. The scan operations should always be above the cut operations in this table. You can select a row and move it up or down using the Up/Down buttons below the table. The laser will do the operations from top to bottom. By scanning before cutting, you ensure that the workpiece doesn't shift during the scanning operation and cause problems with the location or resolution of the photo.

4.0 OPERATION

To set the laser power and speed parameters for your scan, double click on the row you want to adjust. The Layer Parameter box (shown below) will appear on your screen. In this box, you can set up all of the commands that control the movement and power of the laser during a given process.

- Layer – will show the layer by colour
- Is Output – set to Yes
- Speed – Max 400 – set 30-80 for engraving (faster requires more power and possible offset adjustment). Max is 400, but it is difficult to get good engraving results at that speed.
- If Blowing – controls cutting head air. Set to Yes.
- Max and Min Power – set minimum to between 12.5-14% power. Set maximum to between 17-40%, depending on speed and material. Similar results can be achieved by using lower speeds with lower maximum power, or higher speeds with higher maximum power. The minimum power does not need to be increased for higher speeds. Note that the progression between the engraving of the light and dark areas will be most linear in the 14-20% range.
- Check boxes – check Output Direct to select engraving mode.
- Ramp Length – 0
- Overstriking – set to unprocess
- Scan Mode – set to X-swing (will go back and forth, unilateralism settings will scan in only 1 direction and take twice as long)
- Interval – set to 0.1963 mm. This is 1/150th of an inch and matches the resolution we set earlier. It is also about the minimum we can use without running into double burn scenarios due to overlap of dots.
- Click OK when done

You are now ready to export your engraving file so that it can be cut on the laser. In the lower right of the RDWorks window, there is a box called Laser Work. In this box, there is a button called Save to UFile. Ensure that a USB stick is installed on your computer and then press Save to Ufile.

A Save As pop-up box will appear. Ensure that the file is routed to the USB stick, chose a short, but clear name (8 characters max., no special characters!), check that the file type is *.rd and click save. A pop up box with a yellow triangle with an exclamation point and a line of gibberish will appear. This means that the file has been successfully saved to the USB. Press OK. Be patient. This can take about a minute for a medium sized engraving file or longer for a larger one.

You can now use the controls in the lower right of the Windows screen to “safely eject” the USB stick. It is ready for transfer to the laser cutter.

Once transferred, the photo will display as a solid in the colour of the layer that the engraving operation was set to in RD Works. If it has significant white area or you can see the photo in the Mako Laser Cutter display, the engraving will not be deep enough and you will not get smooth transition from high to low areas.

4.0 OPERATION

Another indication of this problem is a small file size. If the file loads quickly and has a small file size (should typically be in the hundreds of kilobytes or up) the photo will need to be darkened to successfully engrave.

Setting up a cut file for cutting in RDWorks

Import your pre-prepared DXF cut file to RDWorks. Select File, Import, then select the file that you prepared earlier. RDWorks has some limited drawing tools built in that are adequate for very simple shapes, if you prefer to simply open a new file in RDWorks and create your cut files within the program. When imported, RDWorks will open the file/drawing right in the middle of the grid (representing the cutting bed), and will zoom in until the photo is maximized on your screen. To see how the file/drawing actually fits on the laser table, move the cursor to the top horizontal tool bar, and hover over the 4th magnifying glass from the left. A bubble will pop up with the words Show Page in it. Click to select this function. The zoom will be restored to a zoom that shows the entire laser cut table area once more.

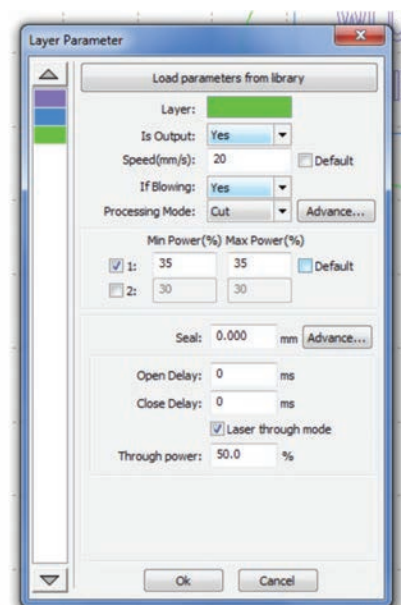
Click on the file/drawing. Hover your mouse over the now-selected file/drawing. As you approach the middle of the part, your cursor will change to one with 4 arrow heads at 90° to each other. Click on the left mouse button and hold it. You can now drag your file/drawing to whatever point on the grid that you want to move it. It is a good practice to work from the upper right, as this is the "0,0" point of the laser.

NOTE: The laser cutter itself will interpret the green square at the top right corner of the top right object as the origin for that cut/etch/engrave or group of operations. Thus, regardless of where you place your objects in RDWorks, the laser will begin wherever you set your temporary origin on the laser cutting machine and will set the top right point of any and all of the entities you've placed in your RDWorks file to that point.

Click on the photo to select it once more.

If the file is a simple series of cuts that will be executed at the same speed and power level as one another you can double click on the file's row in the Work tab at the upper right of the RDWorks window.

Within the Layer Parameter pop-up that is shown, ensure that cut mode is selected, If Blowing is set to yes, set the speed to the desired speed and set both maximum and minimum power for laser number one to the required level. For 5mm plywood 12 mm/s and 35% power generally works well.



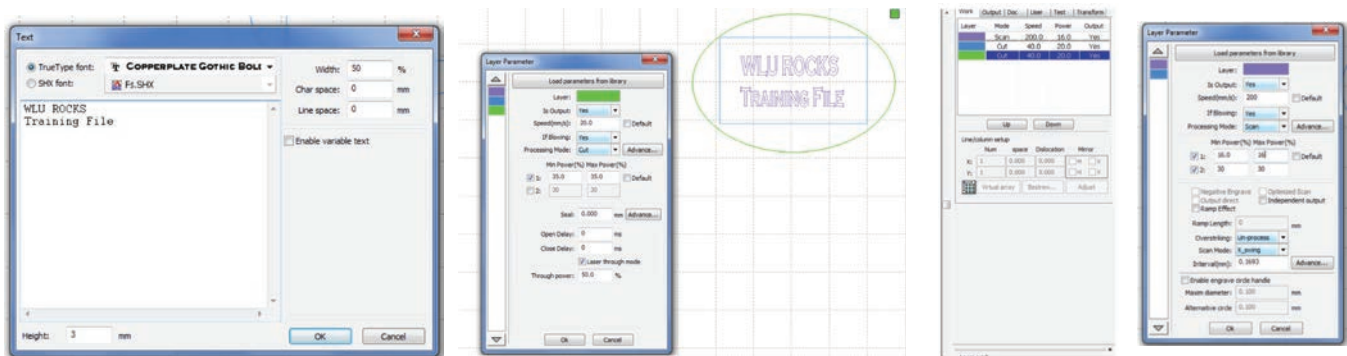
4.0 OPERATION

Note: Speed and Power work inversely for cutting. Less power is needed if lower speeds are used. It is good practice to use low speeds (5-25 mm/s) and lower power levels to do cutting.

Adding Text to your File in RDWorks

In the upper right corner of the RDWorks screen, there are 6 tabs. Select "Work". The table shown to the below will appear.

The layer with the photo on it will be called BMP and should default to SCAN Mode. There may also be other layers for cutting (for example if you wanted to cut out the photo etch from the stock material). Entities on the virtual cutting table can be set to different layers by selecting them, and then clicking on a new colour in the colour bar (at the bottom of the screen). Each "colour" will be given its



own layer in the Work Table. The scan operations should always be above the cut operations in this table. You can select a row and move it up or down using the keys below the table. The laser will do the operations from top to bottom. By scanning before cutting, you ensure that the piece doesn't shift during the scanning operation and cause problems with the location or resolution of the photo.

To set the laser power and speed parameters for your scan, double click on the row you want to adjust. The Layer Parameter box (shown above) will appear on your screen. In this box, you can set up all of the commands that control the movement and power of the laser during a given process.

- Layer – will show the layer by colour
- Is Output – set to Yes
- Speed – Max 400 – set 30-80 for engraving (faster requires more power and possible offset adjustment). Max is 400, but it is difficult to get good engraving results at that speed.
- If Blowing – controls cutting head air. Set to Yes.

4.0 OPERATION

- Max and Min Power – set minimum to between 12.5-14% power. Set maximum to between 17-40%, depending on speed and material. Similar results can be achieved by using lower speeds with lower maximum power, or higher speeds with higher maximum power. The minimum power does not need to be increased for higher speeds.
- Check boxes – check Output Direct to select engraving mode.
- Ramp Length – 0
- Overstriking – set to unprocess
- Scan Mode – set to X-swing (will go back and forth, unilateralism settings will scan in only 1 direction and take twice as long)
- Interval – set to 0.1963 mm. This is 1/150th of an inch and matches the resolution we set earlier. It is also about the minimum we can use without running into double burn scenarios due to overlap of dots.
- Click OK when done

You are now ready to export your engraving file so that it can be cut on the laser.

In the upper right of the RDWorks screen, there are 6 tabs. Select Work. The table shown to the right will appear.

In the lower right of the RDWorks window, there is a box called Laser Work. In this box, there is a button called Save to UFile. Ensure that a USB stick is installed on your computer and then press Save to Ufile.

A Save As pop-up box will appear. Ensure that the file is routed to the USB stick, chose a short, but clear name (no special characters!), check that the file type is *.rd and click save. A pop up box with a yellow triangle with an exclamation point and a line of gibberish will appear. This means that the file has been successfully saved to the USB. Press OK.

You can now use the controls in the lower right of the Windows screen to “safely eject” the USB stick.

It is ready for transfer to the laser cutter.

4.0 OPERATION

4.5 PREPARING THE MACHINE FOR WORK

Powering the Machine On

Before powering on the machine ensure that the protective cover is closed. Verify the safety Emergency Stop is not engaged (if it is, rotate it clockwise and it will extend to the non-engaged position). Flip the main power switch on the back of the machine. Press the secondary power button located to the right of the main control system.

Powering On the Chiller

Plug in the chiller to the wall outlet. Check that all the hose connections are secured and in the place they should be. Verify the water flow and temperatures are within proper operating limits.

Powering On the Air Compressor

Plug in the air compressor and turn it on.

Supplementary Start-up Tasks

Verify exhaust or filtration system is plugged in and turned on.

Transferring Files to the Laser Cutter

- Insert the USB stick into the upper of the two USB ports on the back side of the laser cutter.
- On the control panel of the laser, press the “file” button. The files currently stored in the internal memory in the laser will be displayed in a box with a series of smaller boxes to the right.
- Use the green arrow keys on the keypad to navigate over to the smaller boxes and navigate down until you reach the box called “UDisk+”.
- Press the “Enter” button on the keypad.
- The display will refresh with an empty window on the left and a new group of boxes on the right. Select “Read UDisk File”. The left window will populate with the names of all of the laser files stored in the parent directory of the USB stick.
- Use the arrow keys to highlight the file you want to use.
- Use the left and right arrow keys to toggle back to the boxes on the right side of the screen. Navigate down to “Copy to Memory” and highlight it. Press the “Enter” button.
- Press the “ESC” button on the interface twice. This will exit the machine from file displaying mode.
- Press the “File” button once more. The file that was copied will now be displayed in the list of files in the box at the left of the display screen. Use the cursor to scroll up or down until the file that is needed is highlighted.

4.0 OPERATION

- Press "Enter" – the file is now in the active memory of the machine and is ready to run.

Note: There is a limited number of file names which can be displayed on the screen at one time, so other files in memory may only become visible when the curser keys are used to scroll up or down through the list.

Note: The menu option displayed on the screen will cycle from the bottom. It is not necessary to reverse scrolling direction – the list will simply loop.

Caution: Do not leave too many files loaded in the machine at one time. It will slow the process of file selection and may completely fill the limited memory space of the on-board computer. To delete files, select them in the left window then navigate in the right boxes to highlight the "Delete" option. Then press "Enter".



5.0 MAINTENANCE

5.1 MACHINE CLEANING

To ensure the safety and performance of your machine, it is important to perform cleaning and maintenance on a regular basis. The laser cutting machine should always be kept in an environment that is between 18°C and 30°C. Please also be mindful of the amount of dust and air pollution in the operating environment as this can affect the various electronic parts of the machine.

General Cleaning Tips

1. The cutting bed and interior of the machine should always be kept clean and free of scraps or other material. Loose material scraps can interfere with the gantry system or other moving parts in the machine.
2. The top surface of the machine should never be used as a table or working surface. The acrylic machine cover should be free to open and close at all times.
3. Warm water and a sponge can be used to remove any charred markings on the work table. It is not recommend that any cleaning products be used on the machine, especially those that contain flammable substances.
4. The lenses and mirrors on the machine may need to be cleaned periodically. To do this, use a small amount of glass cleaner on white paper towel to gently wipe the surface. **PLEASE NOTE: After using glass cleaner on the machine, you MUST wait 1+ hour before operating the machine.** This is because the flammable alcohol substance found in glass cleaner must be fully dried before being exposed to the laser beam.

Changing Chiller Water

The temperature, quality, and age of the water used in the chiller will directly affect the lifespan of the laser tube. It is recommended that only distilled, room temperature water is used for the machine. Water that has sat too long, is too warm, or is un-distilled will negatively impact the quality, results and lifespan of the laser cutting machine.

To change the water in the chiller start by turning off and unplugging all machine components (laser cutter, water chiller, air compressor, filtration system). Next, unhook the water-inlet tube from the chiller to allow the distilled water from the laser machine to drain into a bucket. After the water from the machine is fully drained, open the chiller tank and discard of the old water.

With the old water removed, you can now fill up the chiller tank with new distilled water. Reconnect the water-inlet tube to the chiller and plug in all machine components. With all machine components turned on, allows the water chiller to cycle for 2-3 minutes. Lastly, ensure the laser tube is filled with water and free of any air bubbles.

5.0 MAINTENANCE

Cleaning Lens and Mirrors

If you find your laser is cutting poorly the lenses and mirrors may need to be cleaned. If the mirrors or lenses become smudge or dirty the laser beam will have a difficult time transmitting through the glass.

1. Soak a cotton swab (for lens) or tissue (for mirrors) in Isopropyl (rubbing alcohol)
2. Rub the cotton swab/tissue on lens until all the debris/dust is gone
3. You may need to do this several times, depending on how built up the debris is
4. Make sure all debris is gone and the lens is fully dry before use.
5. Any debris or dust left on the lens surface will be baked on if not cleaned off before use

WARNING: After using glass cleaner on the machine, you MUST wait 1+ hour before operating the machine. This is because the flammable alcohol substance found in glass cleaner must be fully dried before being exposed to the laser beam.

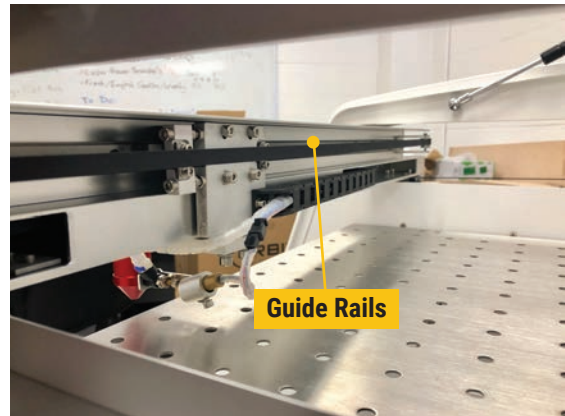
Gantry Maintenance

After extended use of the laser it is not uncommon for the gantry system to accumulate dust and debris. It is suggest that you clean the gantry system in your machine once to twice a month. Ensuring it is clean will allow the gantry system to move freely, resulting in higher precision and performance. To do this, turn off the machine and use a dry cloth to remove any excess dust or debris on the rails.

5.0 MAINTENANCE

Guide Rails Cleaning

The guide rails, which are covered by a metal protective cover, will occasionally need to be cleaned and lubricated. To clean the guide rails on the Gantry system, wipe them down with paper towel (no solvents) and lubricate them with a few drops of shredder performance oil. Move the laser head back and forth several times to ensure the oil is evenly distributed.



5.2 MAINTENANCE SCHEDULE

	Daily	Weekly	Monthly	Annually
Mirror 1		Check/Clean		
Mirror 2		Check/Clean		
Mirror 3	Check/Clean			
Lens	Check/Clean			
Table	As Needed			
Water Cooling Unit			Check/Replace Water	
Entire Working Area		As Needed		
Belts				As Needed
Tube			As Needed	
Linear Rails			As Needed	
Air Nozzle		As Needed		
Internal Memory				As Needed



6.0 ADDITIONAL INFO

6.1 TIPS FOR TROUBLESHOOTING

If the machine does not turn on:

- Check to see that the machine and all the components are connected
- Check the main fuse located behind the back panel

If the machine gives you a “Water Error” message:

- Check to see if the water chiller is turned ON
- Check to see that the gray signal wire is attached and not damaged in any way

If the alarm on the Water Chiller does not turn off:

- Check for kinks in the clear water tubing
- Check the temperature of the water to see if it is either too hot ($>29^{\circ}\text{C}$) or too cold ($<13^{\circ}\text{C}$)
- Check water level and refill if needed

If the machine loses cutting power:

- Calibrate the laser tube as per the instructions in section 4.2
- Turn off machine, unplug it and check the CO2 laser tube for defects

If the machine does not cut all the way through the material after the first pass:

- Do not move material at all or change origin location, restart cut job immediately after the first one is finished
- Increase the power on the next cut file (keep record for commonly used materials)

Note: When the laser cuts completely through a material, smoke can usually be seen coming through the bottom of the bed. If looking through the cutting bed's holes, smoke can be seen coming through the crack of the fresh cut material. If no smoke can be seen coming through bottom, a few more rounds of cutting may be necessary.

Mako Laser Cutter Tricks

- If you are not sure if the cut file will fit on the material you have on the bed, press “frame” button and it outline a rectangular area representing how large the cut will be.
- When moving the bed up and down in the Z/U menu, make sure that the “Z move” option is highlighted. There is no need to press ENTER. To move the bed up and down, use the left and right arrow keys on the keypad.
- When using the keypad to select files, the ENTER button does not need to be pushed, the item you wish to select only needs to be highlighted.

6.0 ADDITIONAL INFO

6.2 TRAINING COMPLETION FORM

Employee/Trainee: _____

Trainer: _____

Date of Training: _____

The above mentioned employee/trainee received instruction on the operation of the Mako Laser Cutter. The following topics were covered during the training:

- Machine Overview
- General Safety
- Laser Safety Precautions
- Operational Safety
- Approved/Not Approved Materials
- Powering ON/OFF the laser machine
- Debugging the Light Path
- Control System Navigation
- Preparing Files for Print
- Preparing the Machine for Work
- Machine Cleaning
- Maintenance Schedule
- Tips for Troubleshooting

Signature of Trainer

Signature of Trainee

6.0 ADDITIONAL INFO

6.3 TECHNICAL SUPPORT CONTACT

If you are having issues operating your laser machine and have gone through the Tips for Troubleshooting section in this manual please contact our Technical Support line.

InkSmith Technical Support

Phone: 1-844-465-7684 ext. 1

E-mail: tech@inksmith.ca

www.inksmith.ca

Technical Support Hours:

Monday-Friday
9:00am-5:00pm EST

NOTE: For complex problems please provide photograph or video evidence via email (tech@inksmith.ca) in order to help us better diagnose your issue.



QUESTIONS?

Denisa Dica
Customer Support

tech@inksmith.ca
1-844-465-7684 ext. 1

www.inksmith.ca

