Integrated Laser Systems, Inc.™

Laser Alignment Guide

Once the laser has been installed, you must align it. The alignment procedure is very precise and delicate. It is important to understand how the alignment is done and why it must be done in a very precise way. The alignment of the laser cutter directly affects its ability to cut consistently and reliably. It also affects the cutting speed of the laser cutter.

It is important that you always start with the mirror closest to the laser. If you start anywhere else, you will ruin the alignment of the other mirrors. If the mirror is not clean, then clean it now. There is no sense starting an alignment with dirty optics.

The following are the procedures for each machine type. While the basic alignment procedure is the same, the way the laser is fired will vary due to different control systems.

Zeus:

Firing the laser:

The original Zeus:
1) load the full width of the machine by a length of at least 500mm.
2) After the area is loaded, take the machine offline.
3) Now, push the Tool up / Tool Down button.
4) When you push this button, it will fire the laser while you jog the head.
5) If it does not work the first time, then try it again.
6) It may fire the laser in the left, right, or forward, backward jogs.

“Zeus Upgrade” machine:
1) The first generation of upgraded machines had the stock Zeus keypad and display.
2) This machine works similarly to the original Zeus.
3) Hit the tool/up button, and it will ask wether you want to fire the laser or not. “1" fires, and “2" ends the routine.
4) It fires with the jog routine as well. However, we have seen some machines that will fire the laser without jogging.

Latest generation “Zeus Upgrade” machines:
1) It has no display and a different style keypad. This change is because the original Zeus keypads are no longer produced.
2) This machine has a start up routine you must follow in order to fire the laser manually.
3) Hold the down arrow while you turn the machine on.
4) Continue to hold the down arrow until the machine completes its loading routine.
5) Once the head has stopped moving, and the load light is “**out**,” you may release the down arrow.
6) Press the up and down arrows quickly at the same time. You should hear **three beeps** from the control board, and the lights should start flashing.
7) The machine is now in alignment mode.
8) When you press the load button, the control board will **beep once** and the laser will fire at low power.
9) Press the load button again; it will stop firing and the control board will **beep twice**.
10) The machine will be in an offline state; you may jog the head to the right or left and then press the load button to fire the target.

It should take only a quick blip of the laser to make a good burn spot on the target. The length of the blip will vary with each machine. You only want to make a small brown dot.

Laser Alignment

Zeus:

You should always start at the left side of the machine. Insert the alignment barrel and do a test burn. If the laser is severely out of alignment, you may need to see how far off it is by placing a piece of paper near the shutter assembly. If it is way out, you will need to shift the laser right or left, or up and down to get the beam close enough to pass through the shutter and burn the target.

On the Zeus machine, right and left adjustment is done by moving the entire laser mount right and left. You must loosen the four allen bolts on the mount, and then slide the mount in the direction you need. Then, tighten the four bolts and do another test burn. You will find that it takes very little movement of the mount to make a drastic change in the burn spot.

The up and down adjustment is made by first loosening the main mirror allen bolt. Then, slide the mirror assembly up or down as needed. This is a delicate adjustment as well. Burn a test target to get it in the center.

It is very important to get the alignment perfect on the left side of the machine. The more accurate this alignment is, the better the machine will cut. As stated earlier, this will dramatically affect the machine's speed and cut quality.

Once you are happy with the alignment on the left side of the machine, jog the head to the right and burn a new target. This is where you use the three screws on the mirror assembly. These screws will seem confusing at first, but once you understand how they work it make setting the right side very easy. The bottom screws move the burn spot diagonally. The left screw moves the burn spot up and right. The right screw moves the burn spot up and left. The center screw moves the burn spot up and down.

DO NOT USE THESE SCREWS TO ADJUST THE LEFT SIDE!!!

You will need to burn several targets to get the machine dialed in. The Zeus alignment barrel takes a 21 mm paper target. You can make as many as you need with the laser cutter. I recommend using an old manilla folder. This is slightly heavier paper, and will brown instead of bursting into flames. It is best to always cut the cross hair before you cut the target out. This way there can be no chance of the crosshair being out of registration and ruining your alignment.
I always tape the right and left targets to the machine. This tells the operator that the machine was aligned, and the quality of the alignment.

CCT Flatbed 700 or 1500 Series:

Firing the laser:

There were two different systems used on the CCT flatbed laser cutters. The first system used a keypad just like the late Zeus machine. The procedure is exactly the same.

Early Style Keypad, No Display

1) It has no display and a different style keypad. This change is because the original Zeus keypads are no longer produced.
2) This machine has a start up routine you must follow in order to fire the laser manually.
3) Hold the down arrow while you turn the machine on.
4) Continue to hold the down arrow until the machine completes its loading routine.
5) Once the head has stopped moving, and the load light is "**out**," you may release the down arrow.
6) Press the up and down arrows quickly at the same time. You should hear **three beeps** from the control board, and the lights should start flashing.

7) The machine is now in alignment mode.
8) When you press the load button, the control board will **beep once** and the laser will fire at low power.
9) Press the load button again; it will stop firing and the control board will **beep twice**.
10) The machine will be in an offline state; you may jog the head to the right or left and then press the load button to fire the target.

Later style Keypad:

1) The second generation of CCT machines had a new style keypad with a display.
2) This machine works similarly to the original Zeus.
3) Hit the #2 button, and it will ask whether you want to fire the laser or not. "1" fires, and "2" ends the routine.
4) It will fire with the jog routine. However, we have seen some machines that will fire the laser without jogging.

It should take only a quick blip of the laser to make a good burn spot on the target. The length of the blip will vary with each machine. You only want to make a small brown dot.

Alignment:

You should always start your alignment at the left side of the machine. Insert the alignment barrel and do a test burn. To insert the alignment barrel you will need to remove the small arm that holds the mirror in the mount. Loosen the 2.5mm allen holding the arm, and swing it out of the way. Gently push the mirror from the inside of the assembly to remove it from the holder. *(This is a really good time to clean or replace the mirror)*

Simply replace the mirror with an alignment barrel. Make a test burn and check it.

If the laser is severely out of alignment, you may need to see how far off it is by placing a piece of paper near the shutter assembly. If it is way out, you will need to shift the laser right or left, or up and down to get the beam close enough to pass through the shutter and burn the target.

You will need to set the alignment on the first mirror. On the CCT machines, this adjustment is made by shimming the laser up or down, and by shifting the first mirror right or left on it's slotted mount. The CCT series mirror system is much easier to set up and adjust compared to the Zeus, but you have three mirrors to adjust.

The shims are usually set at the factory and are very close to what you will need. The shims can be made from any non-compressible substance. You can use paper, card stock, and metal shim stock. Plastic shims may also be used. You will need to be very precise with this alignment. Any error here will be exponential in the other mirrors.

Once you are satisfied with this alignment, move the barrel to the second mirror. Make a test burn with the carriage all the way to the left. The burn should be close to the center of the target. If it is not, then loosen the three mounting screws on the first mirror assembly and gently turn the mirror assembly to get the burn in the center.

Once you are satisfied with this alignment, jog the carriage to the right about half way. Make a test burn here. If the burn spot is drifting right or left adjust the three screws on the back of the mirror assembly. These screws work just like the Zeus mirror screws. The bottom screws move the burn spot diagonally. The top screw moves the burn spot up and down. The left bottom moves the burn spot up and right. The right bottom screw moves the burn spot up and left.

Now move the carriage all the way to the right. Make a test burn here. Adjust as necessary with the three screws to get the burn spot centered.

Once you are satisfied with this alignment, replace the second mirror. Now install the head barrel. Make a test burn with the head all the way forward and the carriage all the way right. Again, adjust this mirror the same way as the first. If the burn spot is right or left, loosen the three mounting screws on the mirror mount and gently turn the assembly to get the burn in the center.

Now, jog the head about half way and make another test burn. Adjust the three screws on the mirror assembly as you did before. Jog the head all the way to the back of the machine; make a test burn here. Adjust the mirror to get the burn spot centered.

To make sure the alignment is consistent, make several test burns across the back of the machine. Also, make some test burns at random points in the bed. You may find that some additional adjustment will be needed to make the burn spot consistent across the bed.

DO NOT USE THE THREE SCREWS TO ADJUST THE LEFT SIDE OR HEAD FORWARD!!!

You will need to burn several targets to get the machine dialed in. The Flatbed alignment barrel takes a 19 mm paper target. You can make as many as you need with the laser cutter. I recommend using an old manilla folder. This is slightly heavier paper, and will brown instead of bursting into flames. It is best to always cut the cross hair before you cut the target out. This way there can be no chance of the crosshair being out of registration, and ruining your alignment.

I always tape the right and left targets to the machine. This tells the operator that the machine was aligned, and the quality of the alignment.

THOR SERIES MACHINES:

Firing the laser:

The THOR SERIES Machines use an alternative method to fire the laser. In Corel Draw, simply draw a 1" circle. Set the speed to 100 %, and the power to 7%. Move the circle to the area on the bed you would like to check the alignment, and print. This is a very simple procedure.

Alignment:

You should always start your alignment at the left side of the machine. Insert the alignment barrel and do a test burn. To insert the alignment barrel you simply put the barrel over the mirror. Gently push the barrel over the mirror for a snug fit.

Make a test burn on the first mirror. If the laser is severely out of alignment, you may need to see how far off it is by placing a piece of paper near the shutter assembly. If it is way out, you will need to shift the laser right or left, or up and down to get the beam close enough to pass through the shutter and burn the target.

On the THOR machines, this adjustment is made by shimming the laser up or down, and by shifting the first mirror right or left on its slotted mount. The THOR series mirror system is much easier to set up and adjust compared to the CCT.

The shims are usually set at the factory and are very close to what you will need. The shims can be made from any non-compressible substance. You can use paper, card stock, and metal shim stock. Plastic shims may also be used. You will need to be very precise with this alignment. Any error here will be exponential in the other mirrors.
Once you are satisfied with this alignment, move the barrel to the second mirror. Make a test burn with the carriage all the way to the left. The burn should be close to the center of the target.

If it is not, then loosen the mounting screw on the first mirror assembly and gently turn the mirror assembly to get the burn in the center.

Once you are satisfied with this alignment, jog the carriage to the right about half way. Make a test burn here. If the burn spot is drifting right or left adjust the two thumb screws on the back of the mirror assembly. These screws work just like the Zeus mirror screws. The bottom screw moves the burn spot right and left. The top screw moves the burn spot up and down.

Now move the carriage all the way to the right. Make a test burn here. Adjust as necessary with the two thumb screws to get the burn spot centered.

Once you are satisfied with this alignment, replace the second mirror. Now install the head barrel. Make a test burn with the head all the way forward and the carriage all the way right. Again, adjust this mirror the same way as the first. If the burn spot is right or left, loosen the mounting screw on the mirror mount and gently turn the assembly to get the burn in the center.

Now, jog the head about half way and make another test burn. Adjust the two thumb screws on the mirror assembly as you did before. Jog the head all the way to the back of the machine, make a test burn here. Adjust the mirror to get the burn spot centered.

The THOR alignment barrel for the mirrors takes a 25 mm paper target. The THOR alignment barrel for the head takes a 19mm paper target. You can make as many as you need with the laser cutter. I recommend using an old manilla folder. This is slightly heavier paper, and will brown instead of bursting into flames. It is best to always cut the cross hair before you cut the target out. This way there can be no chance of the crosshair being out of registration, and ruining your alignment.

I always tape the right and left targets to the machine. This tells the operator that the machine was aligned, and the quality of the alignment.

Diode Lasers:

Some of the CCT and Thor machines were equipped with Diode Lasers. These are red dot pointer lasers to help with the loading of the machine. It is important to understand that this is a separate laser. The beam of the Diode and the CO2 are not in the same plane. Therefore, you cannot accurately align a laser cutter with the diode alone.

The diode can be used as an aid in aligning and machine. You will find that the diode is useful in making adjustment to the beam path. For example, if the burn spot is low and right, the diode may be centered. Therefore, you can use the diode and adjust the mirror so that the diode is high and left. This allows you to see your adjustment as you make it. You will also find that the farther you are from the actual laser tube the more the divergence of the beams will become.

DO NOT ALIGN YOUR MACHINE WITH THE DIODE ONLY!!!!

Conclusion:

Aligning a laser cutter is not an exact science. There are many tricks to make it go faster. It takes years of experience to align a machine quickly. (Less than one hour) The main point is that the alignment needs to be consistent across the entire bed. There will always be a slight power drop the further you are from the laser tube.

The newer machines have become easier to align as time and technology have improved the mirror designs. Also, CNC technology has dramatically improved the quality of the machines. The new quality has made the chassis, and optical pathways more consistent. This makes aligning the machine much easier.

The new THOR Series machines have a “Power Adder” algorithm that will automatically increase the power the farther the head travels from the tube. This helps to compensate for the inherit power loss in the far field.

If you need any assistance please call one of ILS’s field engineers at 706-857-5153. They will be glad to help you with any questions.