X7 DSP Build Log

This is log of activities performed during the upgrade of my K40 laser cutter.

This is the laser cutter before the upgrade.

The reason I wanted the upgrade was because the controller in the cutter was unable to engrave and cut in one operation. I found this to be a little annoying because I could never get my engraving to be positioned on the work piece in exactly the right place.

I bought the X7 DSP Upgrade Kit from LightObject.com

The controller I replaced with the X7 DSP was this one:

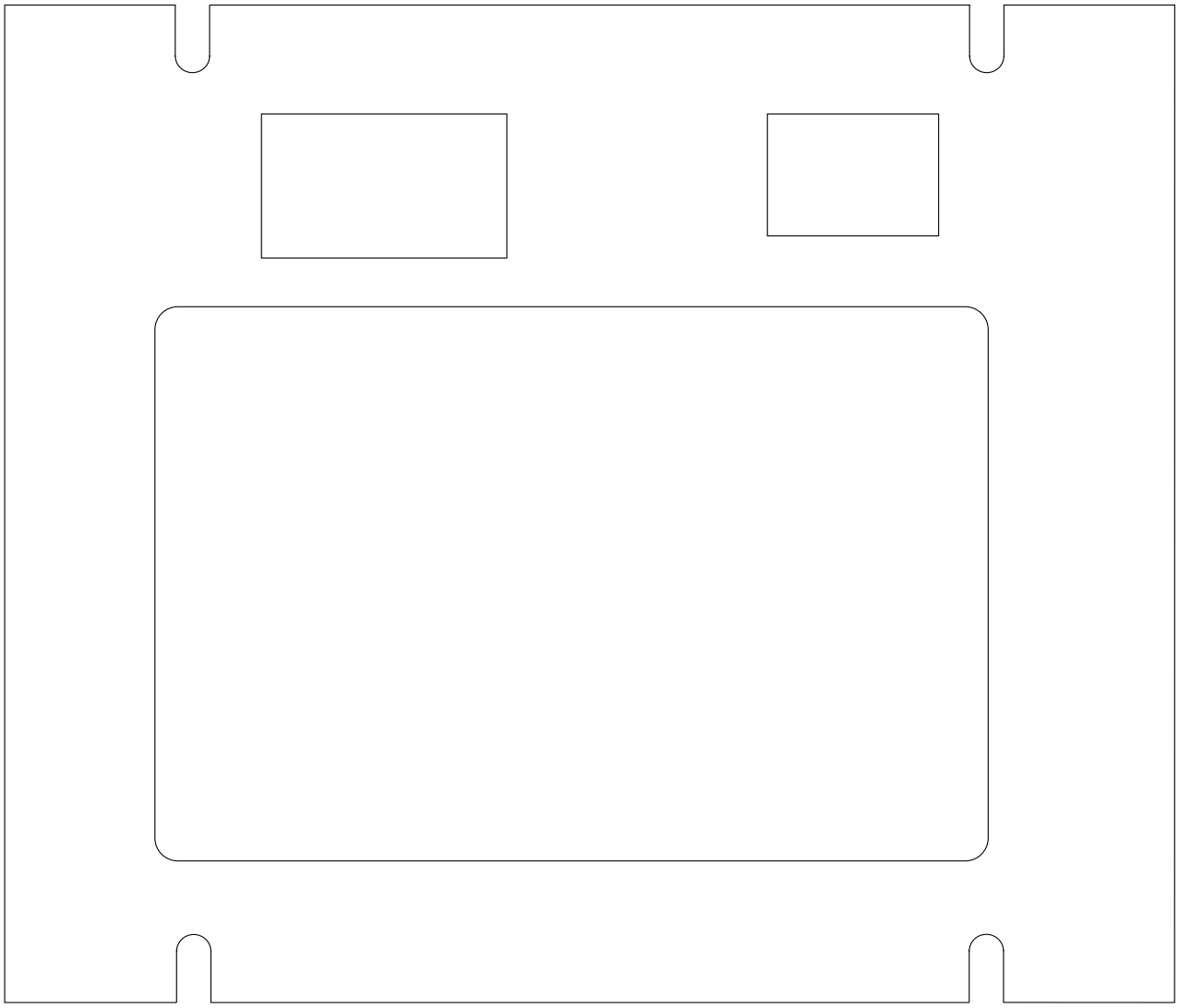
I received the DSP in record time. I took my time and read as much as I could on the upgrade.
I gleaned most of my information by reading many posts in the forum on the LightObject web site.

There is no documentation specifically for the X7 so I had to make do with the Upgrade manual for the AWC608 DSP.

After a week of study and planning I began the upgrade.

The first order of business is the front panel. LightObject does not supply one in the kit so I had to design and cut my own. (Good thing I didn't tear the laser cutter apart yet.)

I planned and measured and sketched what I thought would work.



The top left square is for the AMP meter, the top right square is the power switch mounted sideways with On to the left and Off to the right. The big square is the DSP display module.

I cut this first in White 3 mm acrylic but the material turned out to be too brittle. So I re-cut it again using green acrylic (the only color I had other than white).

All the components fit nicely but if I were to do it again I might make the power switch hole and the AMP meter hole smaller. Maybe .5 mm smaller all the way around.

I'm going to introduce you to an item that you may think is strange. But you will (maybe) understand why I used this.

I went to my local Radio Control airplane hobby shop and bought 2 rolls of servo tape.

The brand I purchased was "Trinity" and I bought the "narrow" which is about 1 inch wide.

I bought 2 rolls because I knew I was going to use it for just about everything.

I used it to fasten the stepper motor drivers to the inside of the cabinet as well as the 24 volt power supply and the screw terminals for my 24 volt buss.

You might say WHAT ! Are you nuts ? But think about it. This tape is used to mount servos to the inside of an RC airplane and it is expected to hold up under constant stress as well as differences in heat and cold.

You just need to clean the surface on both objects (I used Windex)

But more on this later.

Here is a picture of the old DSP display panel

Note: The two green buttons on the right controlled a z-table I purchased from light object just after I got my new cutter.

Here is a picture of the front panel with the new DSP display mounted and powered up.

As you can see the panel looks pretty good. Note the DSP display unit overlaps the original display opening for the old DSP.

The back of the unit shows the wiring.

I could not for the life of me figure out how to use the brackets and screws to hold the DSP display unit into the panel. So I used……. Yes, you guessed it “Servo Tape”

I piled a stack of three strips under the front overlapping plastic bezel.

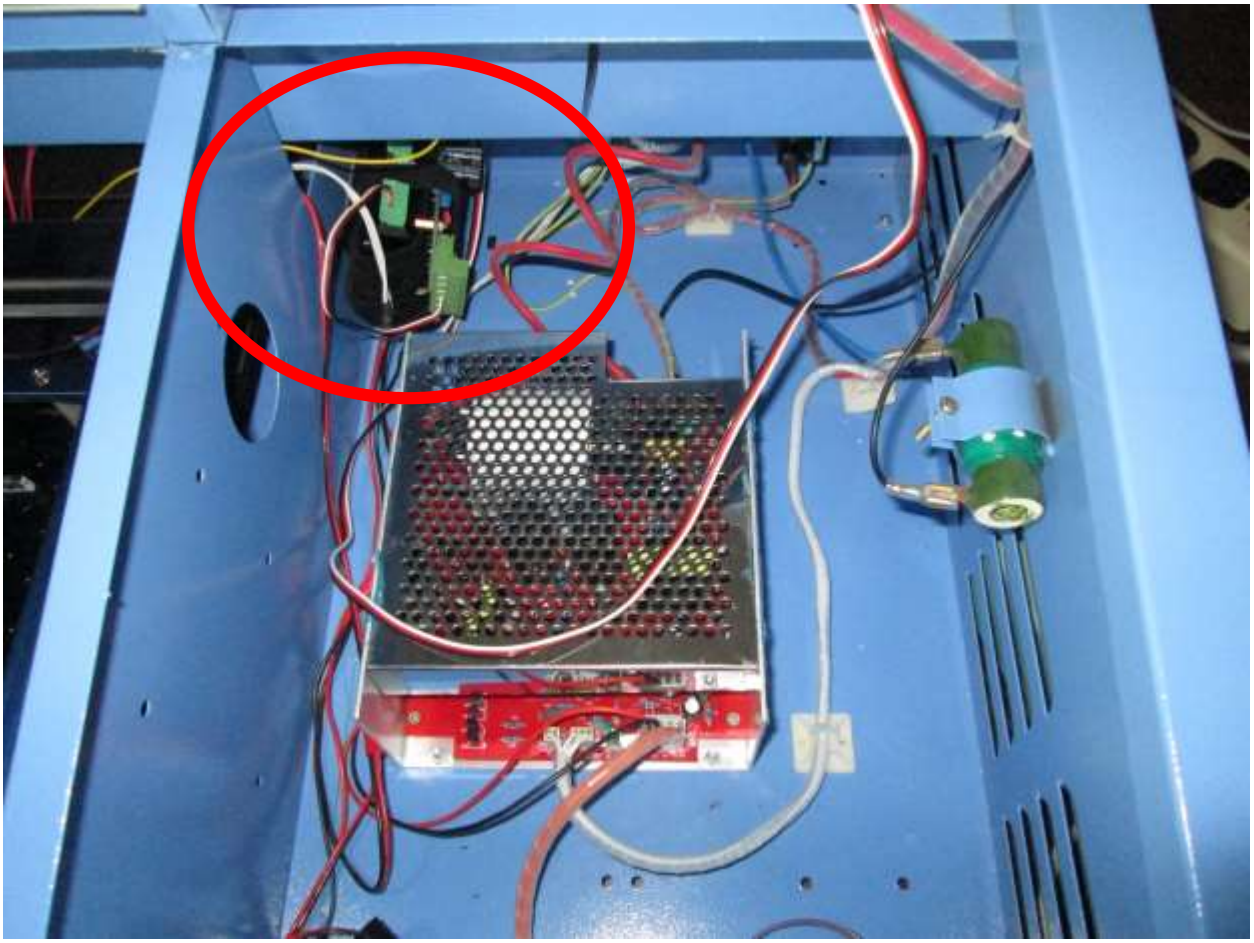
And…….

The next thing to do was to strip out all of the old components.

This is the power supply that came with the original laser. I re- used it.

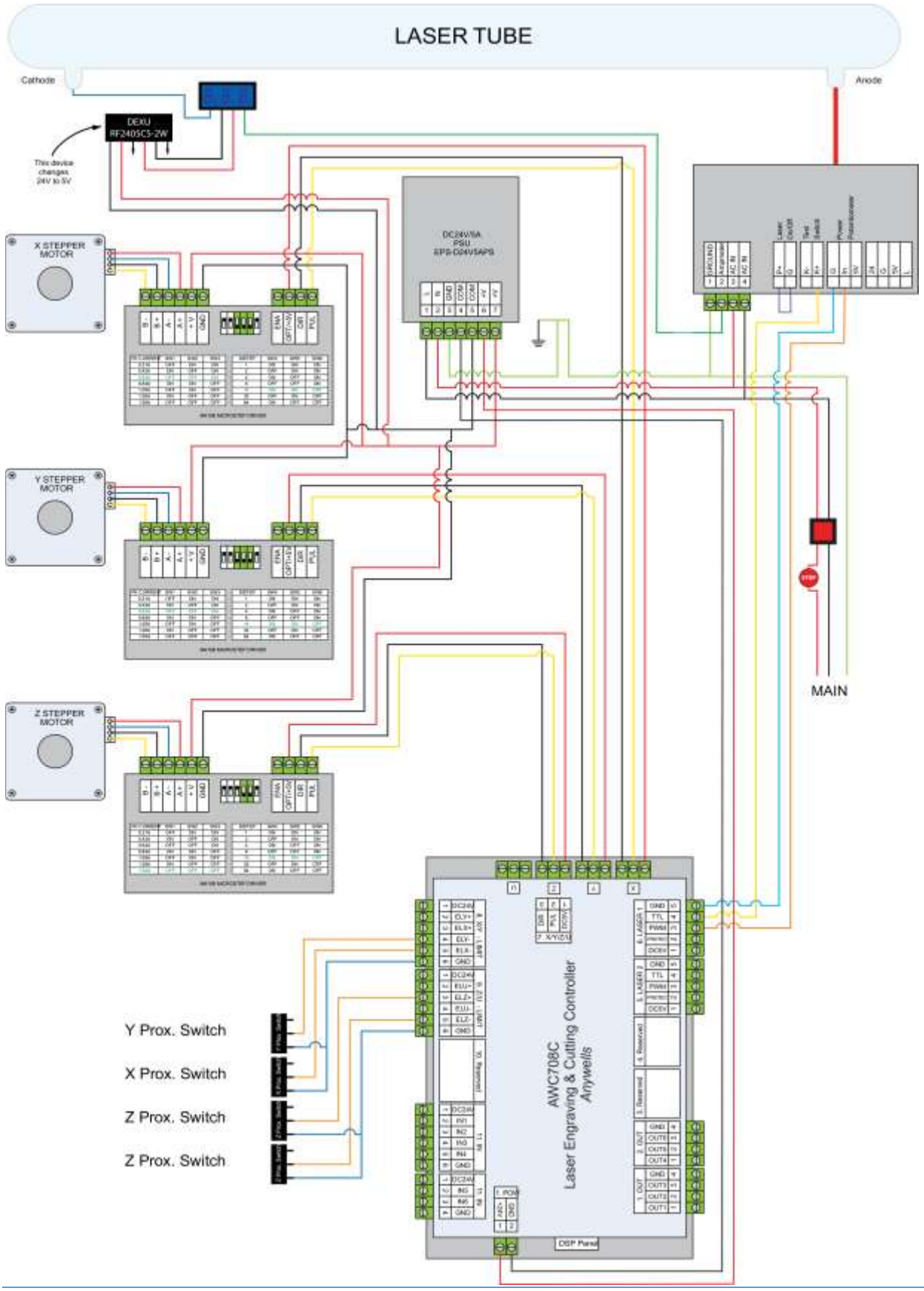
The clump of hardware in the upper left of the picture is the stepper driver and controller board for the z-table that I purchased a year ago from Light Object. I re-used the stepper driver with the new DSP.

I stripped out everything spelled out in the AWC608 conversion document. Except for the head assembly. I left that in place. I'll tell you why in a minute.



"Madjalopeno" (a member of the forum on the LightObject web site) did a wonderful job at drawing up the wiring diagram for the X7 DSP. I included the diagram on the next page but you can get a better copy of it on the lightobject.info web site. Just make sure you get the correct one. (Note the AWC708C controller). You can find it here:
http://www.lightobject.info/viewtopic.php?f=8&t=2534&hilit=x7+wiring+diagram

The switch settings for the stepper motor drivers in the diagram are correct. So feel free to set them as shown.

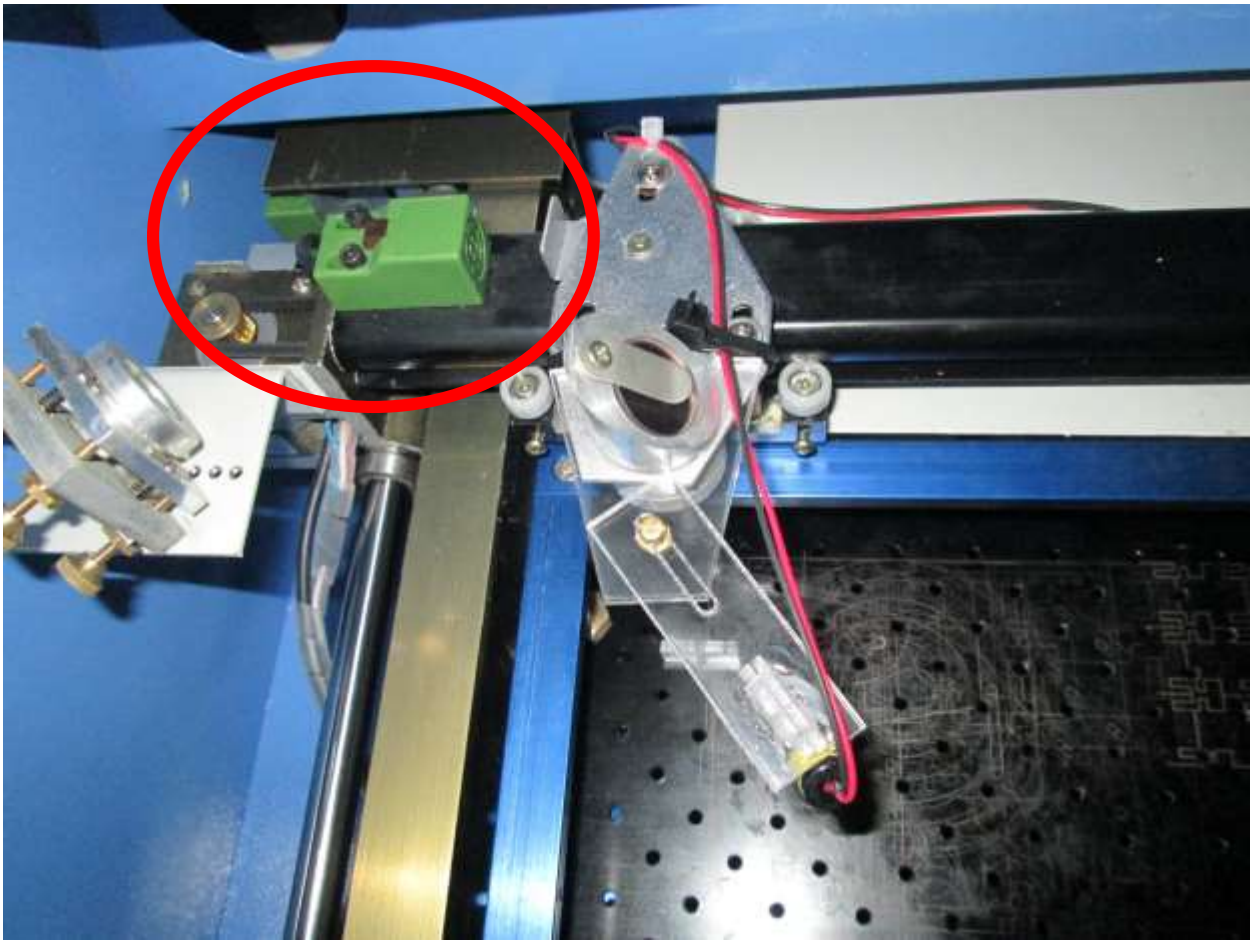

LASER TUBE
Cathode
Anode
DEKU
RF2405C3-2W
This device changes 24V to 5V
DC24V/5A
PSU
EPS-D24V5APS
X STEPPER MOTOR
Y STEPPER MOTOR
Z STEPPER MOTOR
MAIN
Y Prox. Switch
X Prox. Switch
Z Prox. Switch
Z Prox. Switch
AWC708C
Laser Engraving & Cutting Controller
Anywells

I left the head assembly in place because it had these very nice “Inductive Limit Switches”.

They are three wire switches. The orange goes to +24 (or 5 volts). The blue wire is ground and the black wire is the signal wire. I measured the signal wire and when the head is in the parked (0,0) position the signal wire measures +24 volts When the head is away from parked (or in use) the signal wire measures 0 volts.

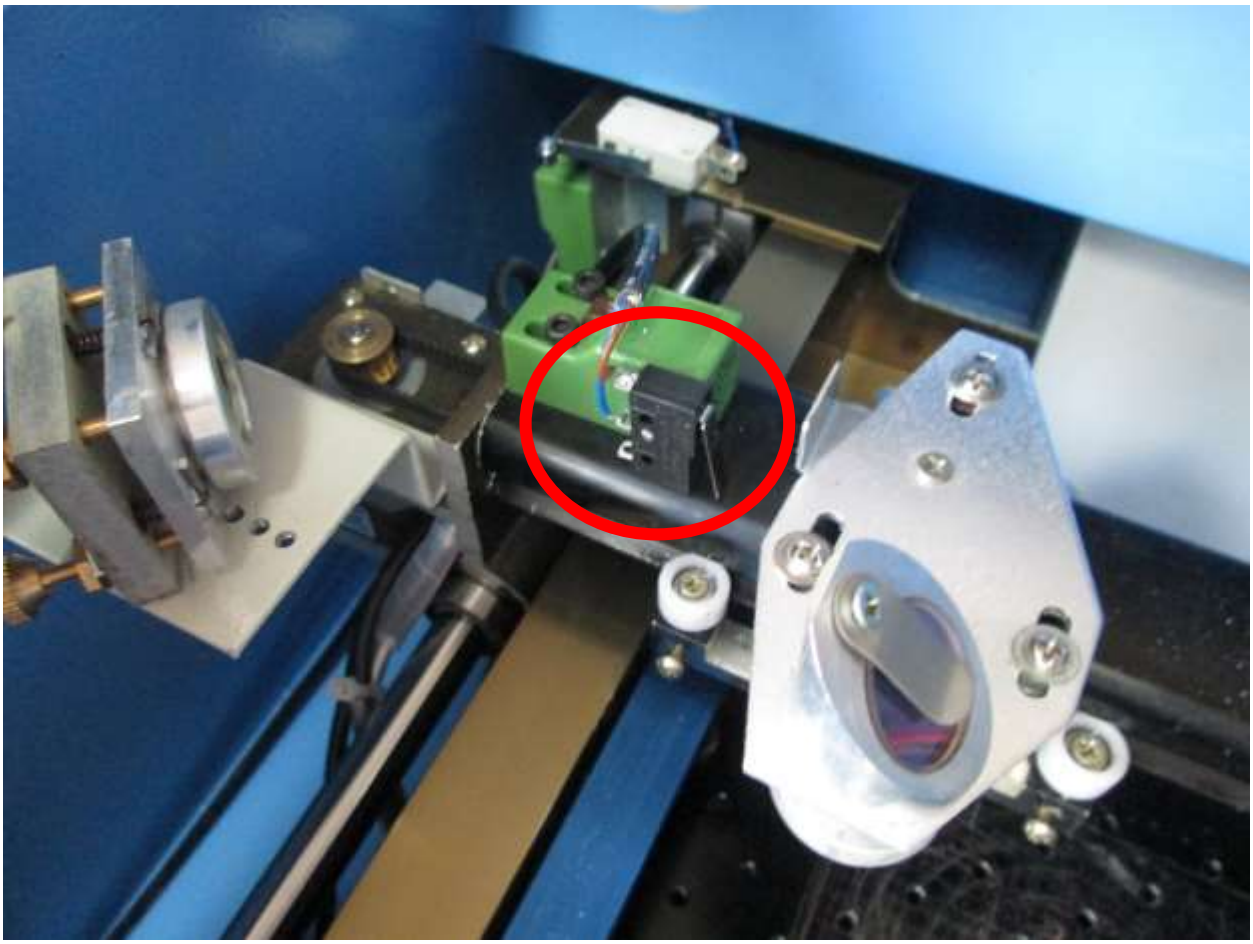
It looked like the new DSP controller board should work with this arrangement. But…. I just could not make it work. I played with it for a full day and finally gave up.

If anyone ever makes theirs work please share.



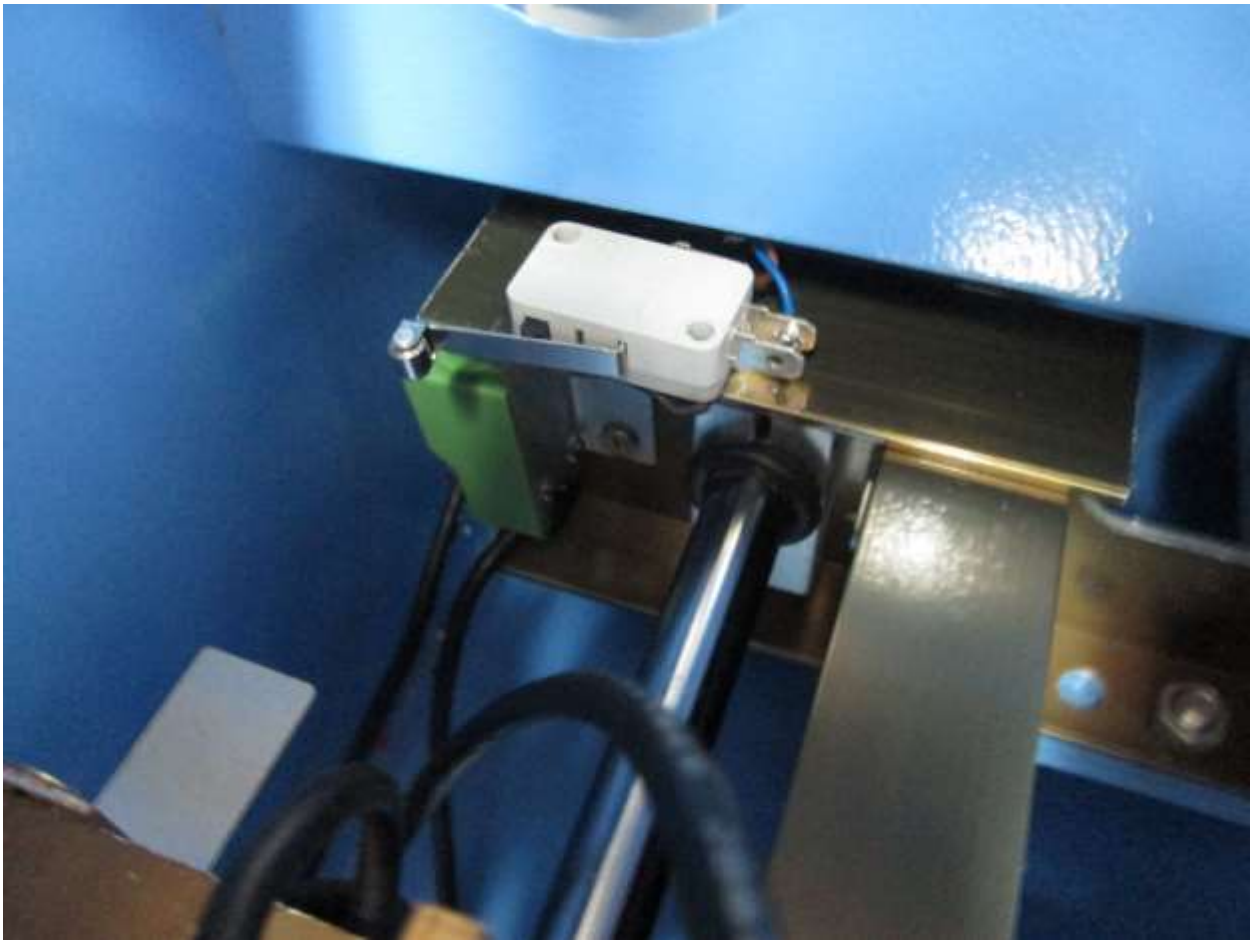
So I installed the Light Object supplied limit switches.

I didn't want to remove the old switches because I am still hoping that I can get the induction switches to work. So I mounted the mechanical limit switch to the induction switch with…. You guessed it, "Servo Tape".



I did the same thing with the “Y” mechanical limit switch.

I mounted it just above the old switch with “Servo Tape”



I ran the wires to the controller and connected them up using the diagram on page 10.

The next thing I wired up was the front panel.

But first I mounted the 24 to 5 volt converter to the panel with “Servo Tape”

Then I soldered the AMP meter connector to the converter.

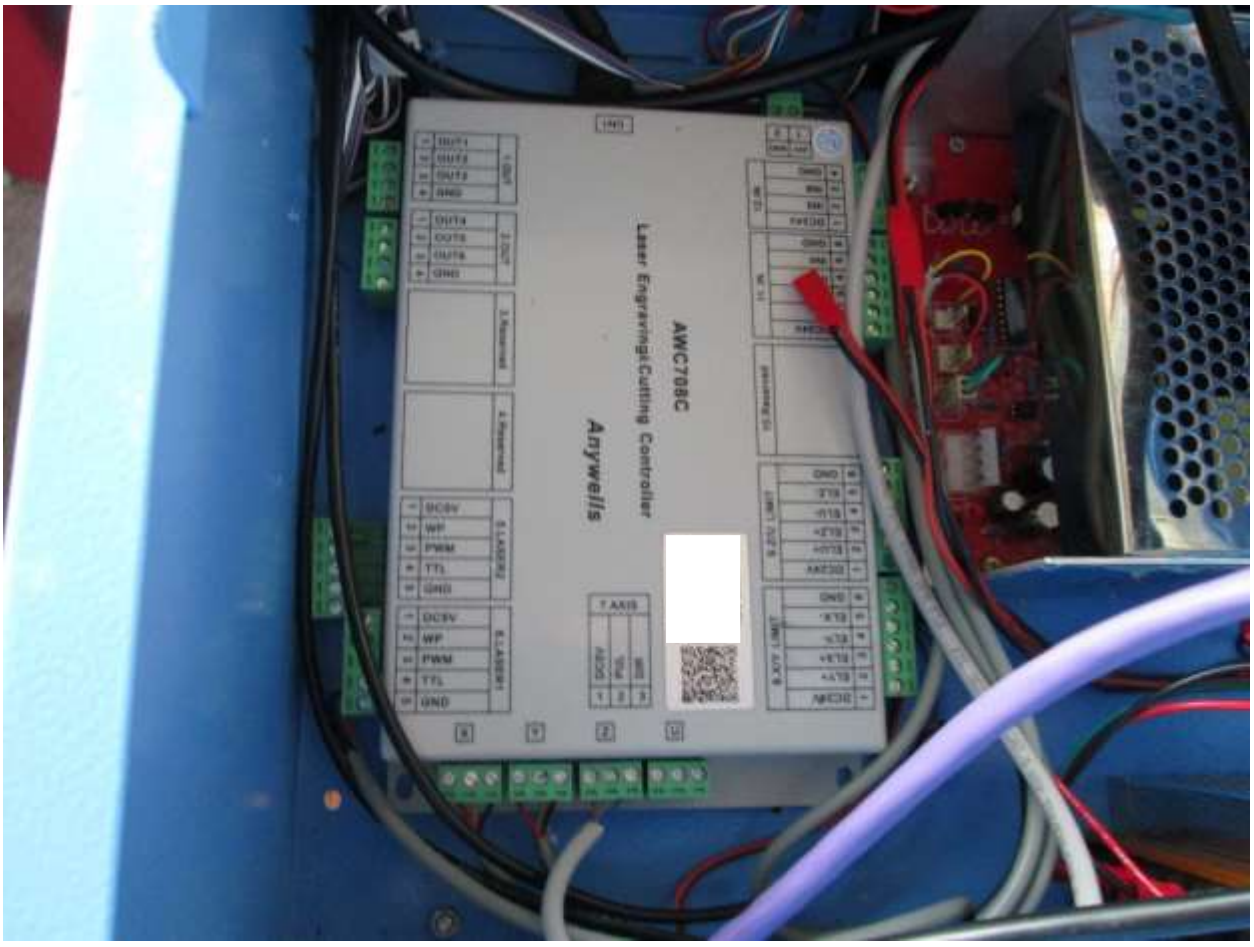
I used the original power switch wires and connected them up. I ran the thick DSP display cable from the “Laser 1” connector on the display to the “CN 1” connector on the DSP controller.

I ran the USB cable at the end of the project (shown here too early in the project).

Here you can see the DSP controller mounted to the bottom of the chassis. It is mounted with a strip of “Servo Tape” on the two wings with the mounting holes in it.

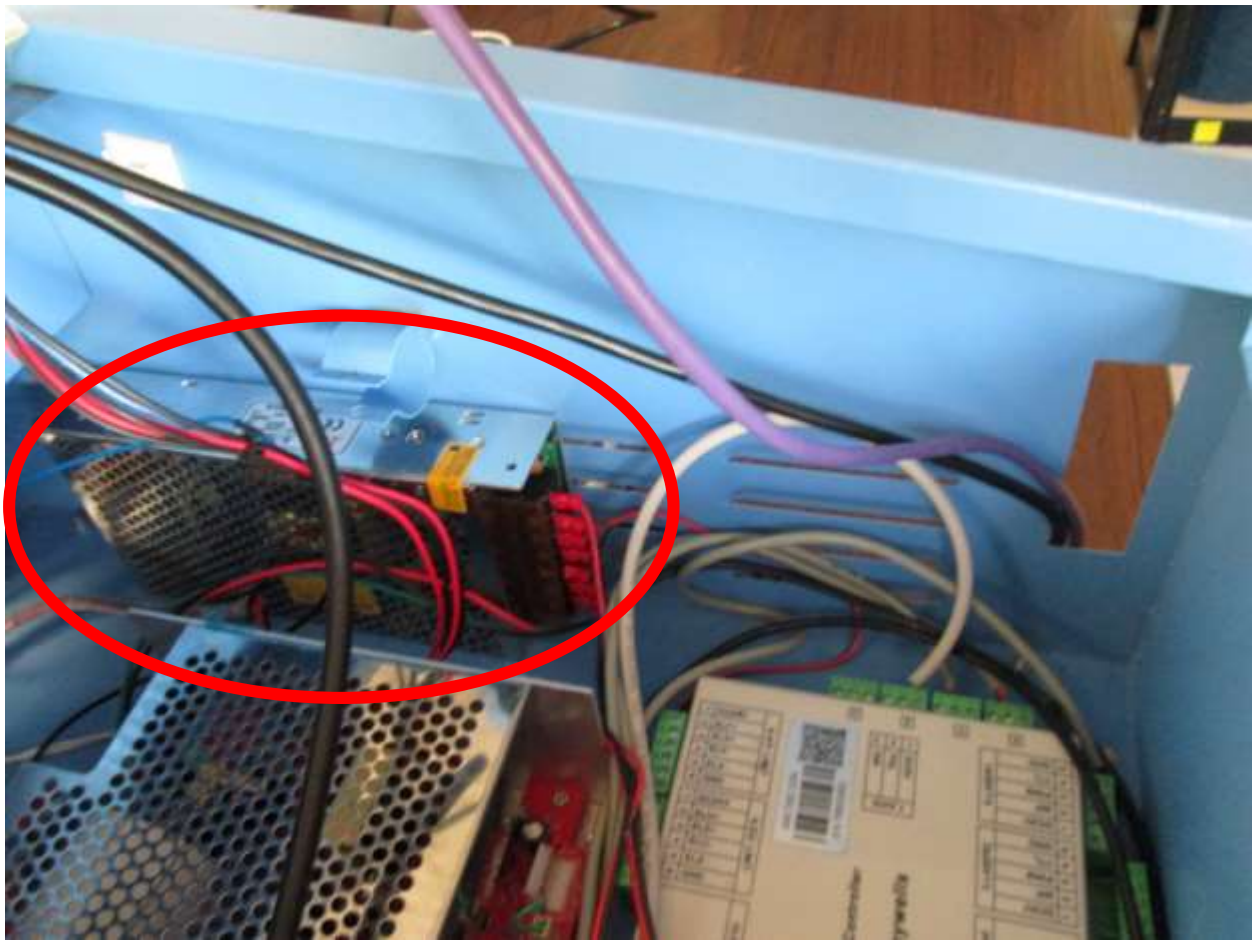
You can see that it is a little close in here. This is because I did not move the laser power supply back as suggested by Light Object. I just didn’t want to disturb the laser wiring at the back of the power supply.

Everything worked out because it is simple to do all of the wire connections using the supplied screw in wire fastener connectors.



I added the new 24 volt supply and located it where Light Object suggested. I didn't fasten it in (using servo tape) until the end of the project.

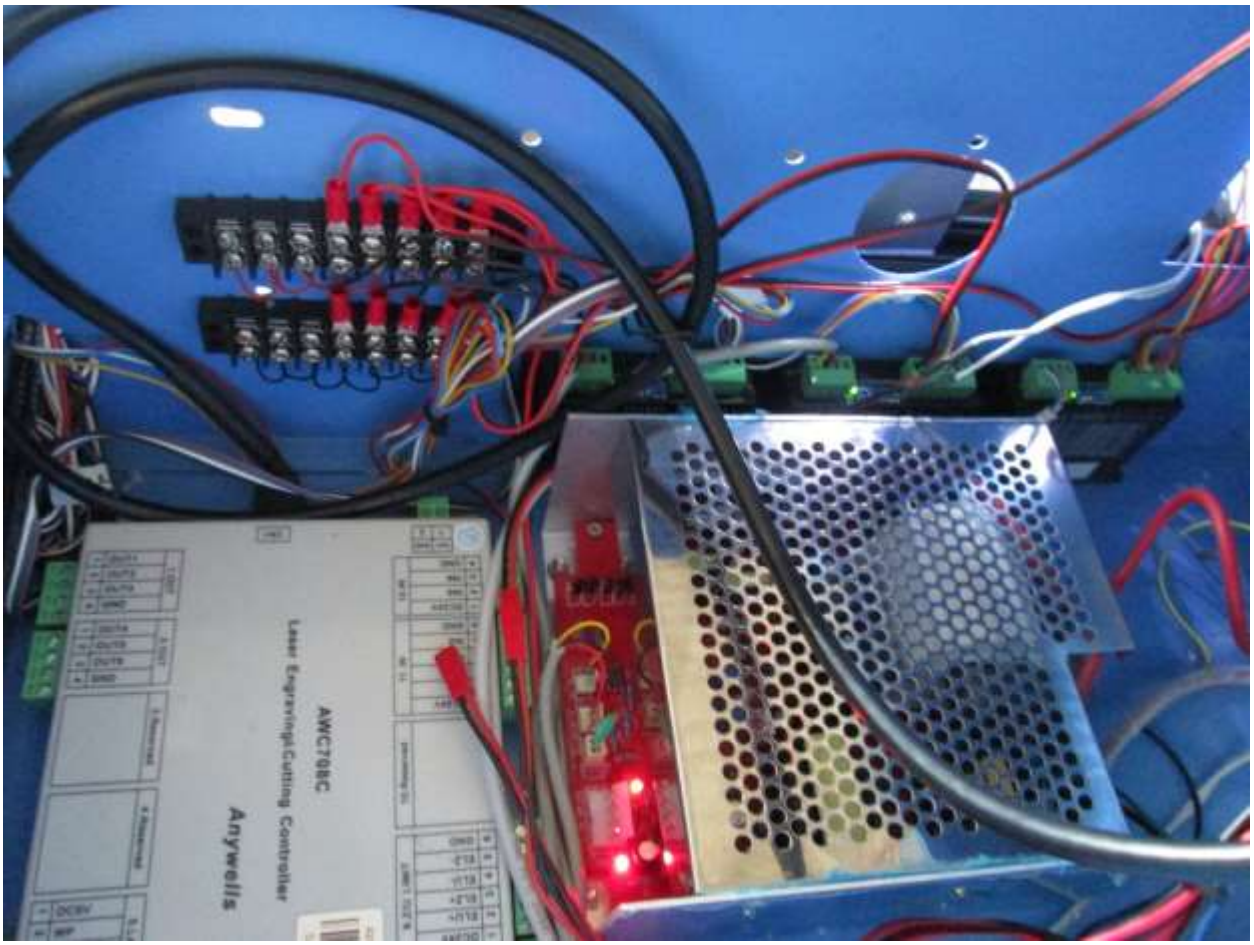
I added three wires from the Laser supply AC input to the three AC connections on the 24 volt supply. I used crimp on lugs for this.



Next I used jumpers and wired up the screw terminals.

One for the +24 and one for the 24 volt power supply ground.

I fastened these terminal strips to the chassis with servo tape.

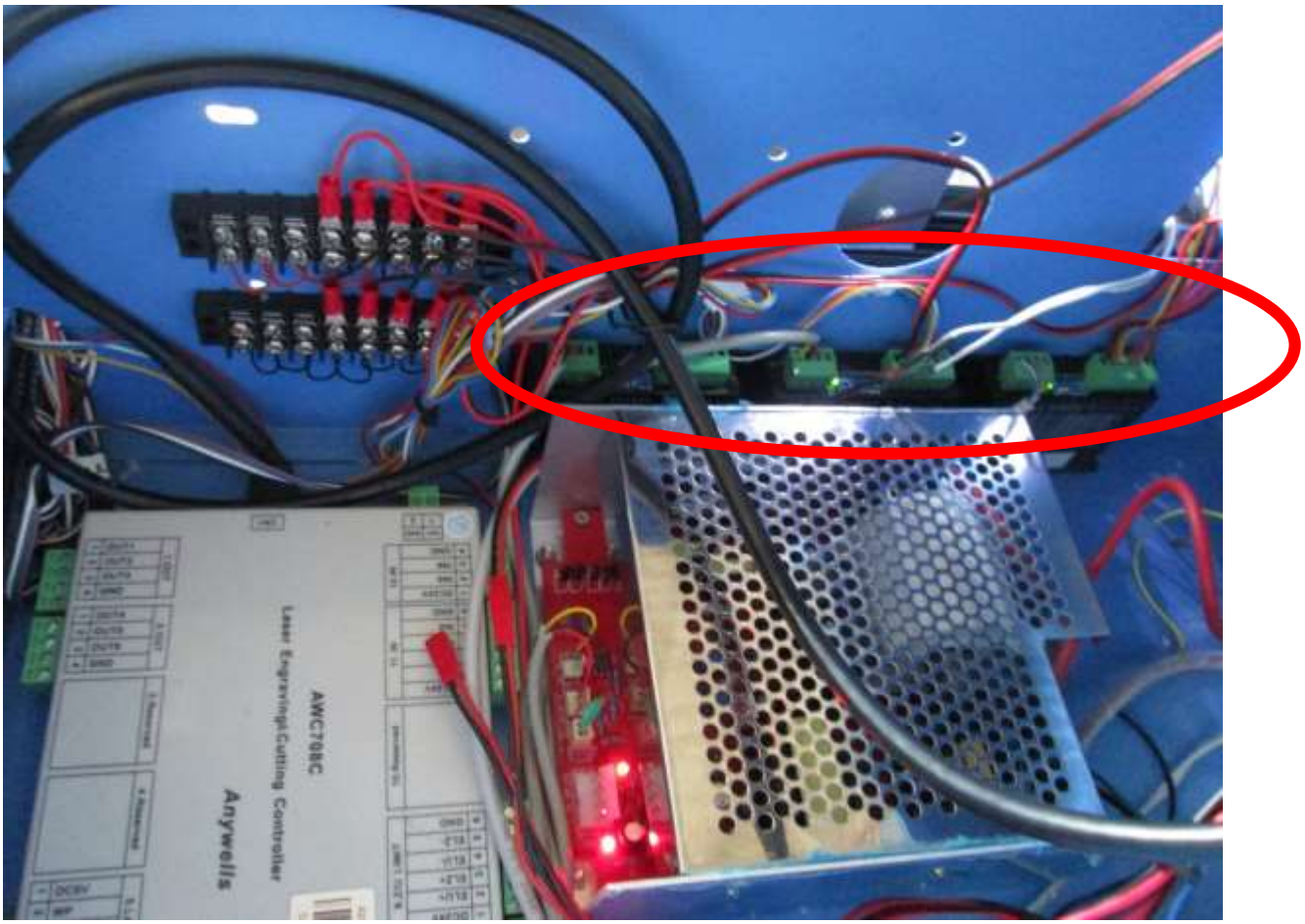


Then I ran the +24 lead and ground lead from the 24 volt power supply to their respective terminal strips.

Next I used “Servo Tape” and fastened the three stepper motor drivers to the chassis.

They are arranged (from left to right) X, Y, and Z.

I placed the Z near the back so it would be closer to the Z-table stepper motor.



I used the existing X and Y stepper motors.

The problem I had here was that I didn't know what each wire went to on the motor.

So I clipped the connectors off the motors wires and then used an ohm meter to find the two coils. One pair would be the "A" pair and the other pair would be the "B" pair

Once I got the pairs I decided to try them out on the "X" axis motor driver. I connected one pair from the "X" axis motor to the "A" plus and minus on the stepper motor driver and the other pair from the "X" axis motor to the "B" plus and minus on the stepper motor driver.

I connected up the "X" axis connections from the DSP controller to the "X" stepper motor driver.

Then I turned it the DSP unit on.

I observed the movement of the head.

If the head moved away from the limit switch, I would turn it off and reverse two pairs.

Luckily the head moved toward the limit switch.

So next I used the jog buttons on the DSP I pushed the right key and the head moved left.

So I disconnected both pairs of wires and swapped both pairs so that the pair that was in "A" is now in "B" and the pair that was in "B" is now in "A". I tried it again. This time left made the head move left and right made the head move right.

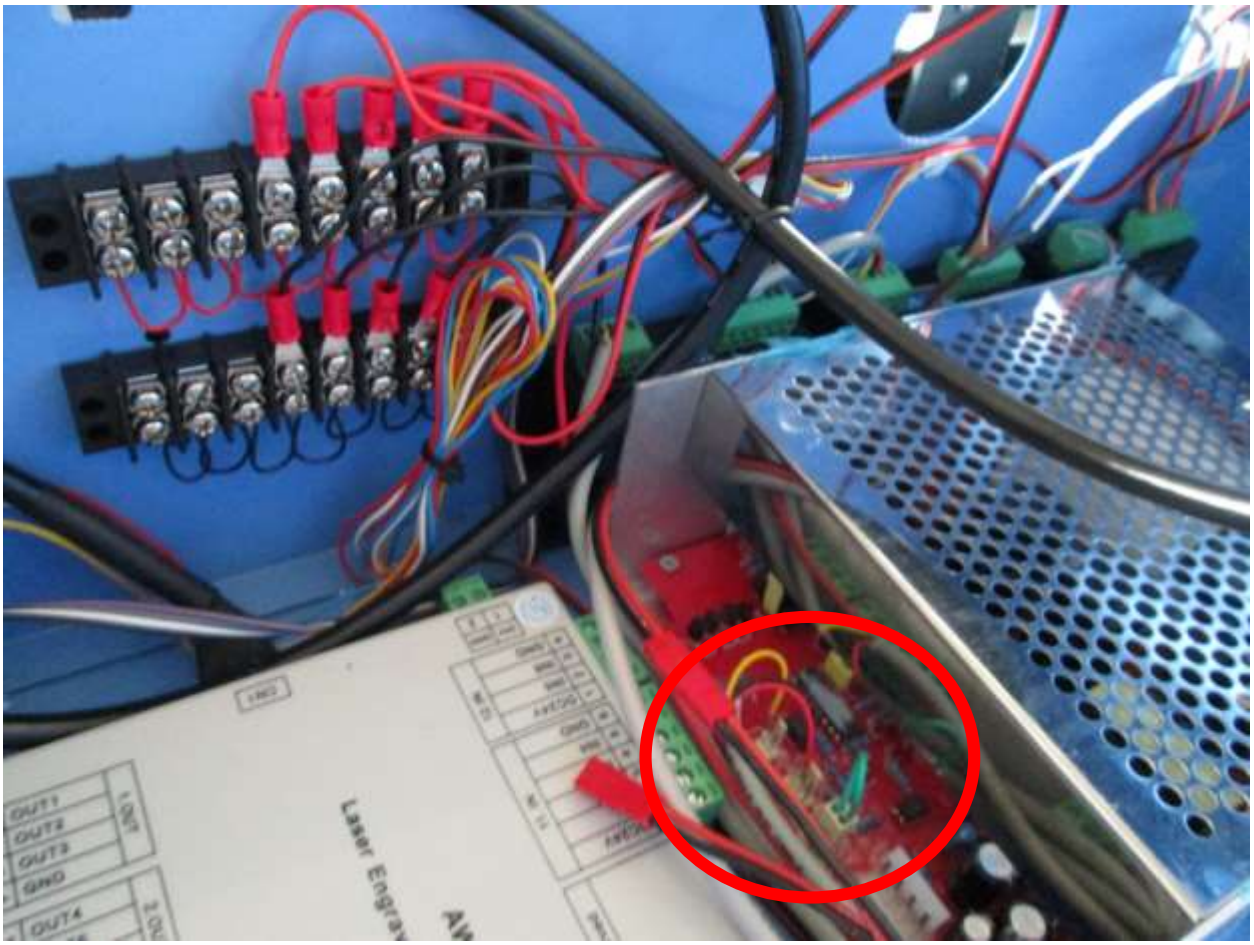
I then used the wire color combination I observed on the "X" driver and wired the "Y" motor in the same way.

Then I turned it on and tested both X and Y with the jog buttons on the DSP.

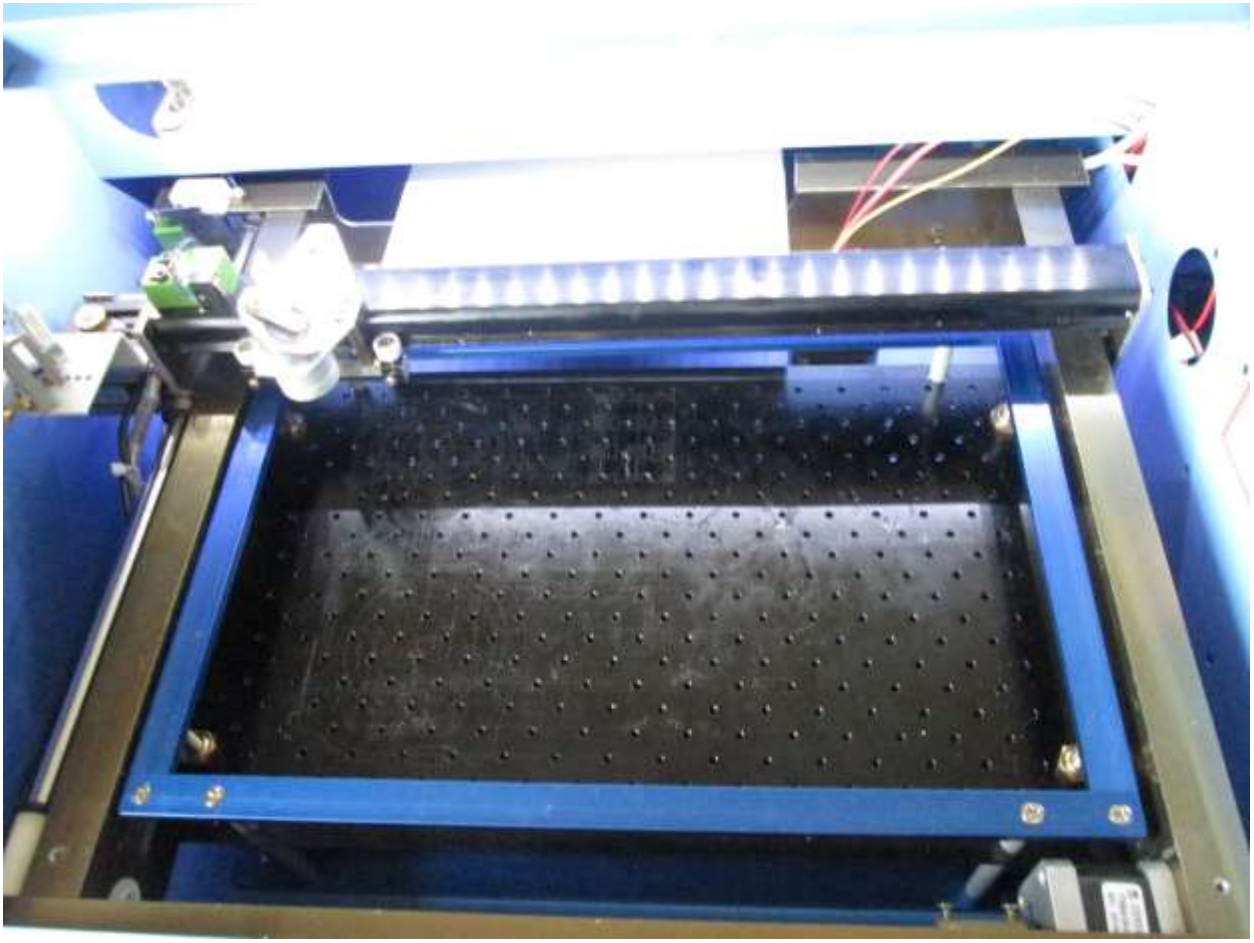
Everything worked.

I used some of the three wire cable and ran the laser control signals from the DSP controller.

I soldered the wires directly to each of the connector pins called out on the wiring diagram on page 10.



I ran the motor wires from the z-table to the “Z” stepper driver and wired it up.



I ran the z-table using the z up and z down buttons on the DSP display.

It worked just right.

At this point I was ready to try a test piece.

But before I could do that I needed to communicate with cutter. So I connected the supplied USB cable to my computer and to the DSP display unit.

I used LaserCad on the Windows 7 computer to run the head left and right.

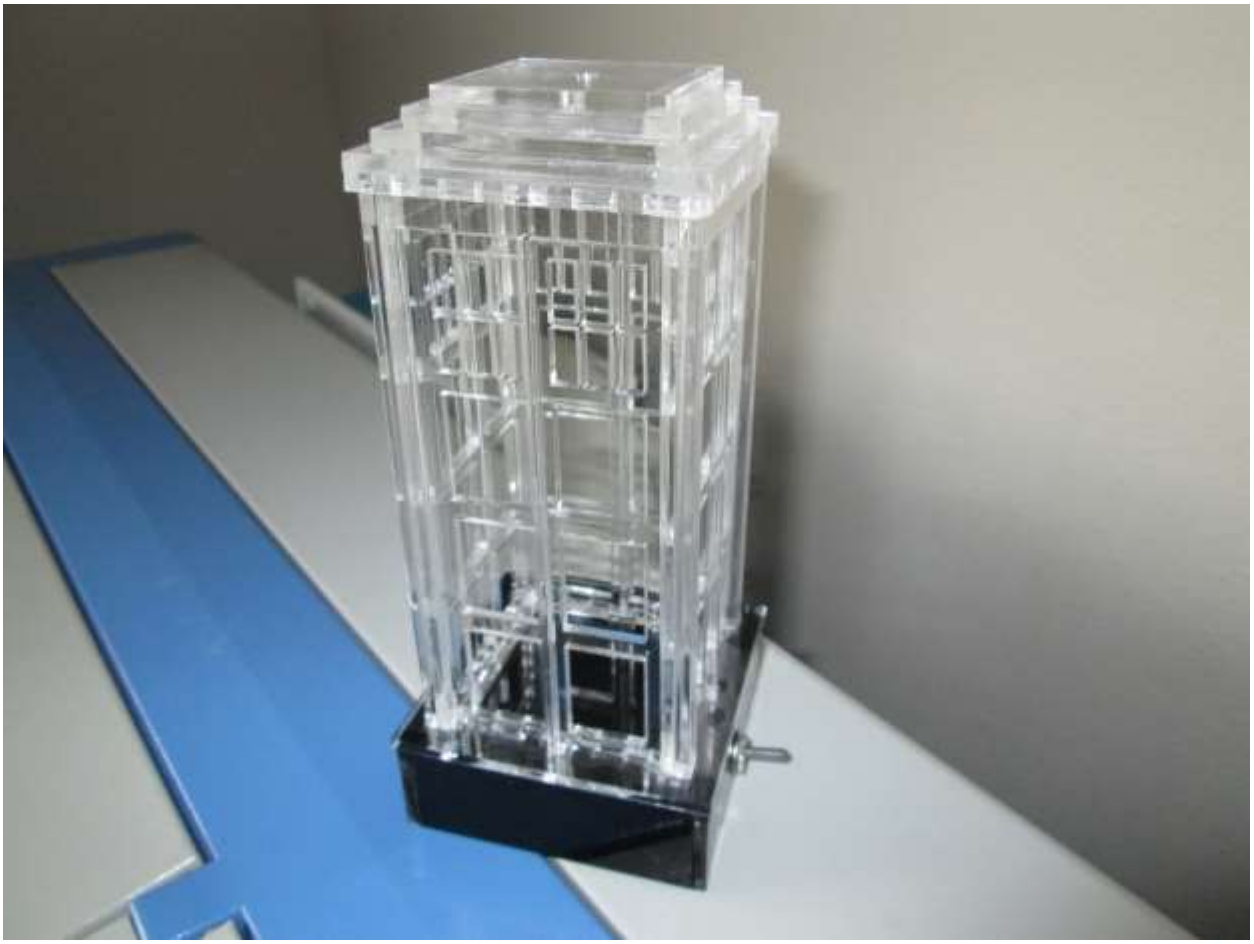
When I was happy with the operation I dressed the wires in the chassis and then tried out a simple cutting job. The device worked just as advertised. I noticed that the head movement was a little quieter and I was able to run it a little faster (instead of 5 mm / sec I could cut at 8 mm / sec).

Next I set the IP address on the DSP and connected the supplied Ethernet cable to a wireless bridge.

This allowed me to talk over wireless Ethernet from the computer (any in the house) to the cutter.

Here is the first project I completed using the new X7 DSP.

It is a “Tardis”. I found it on thingiverse.com. It was created by Markp a member of KwartzLab. I modified it so I could light it with 4 LED’s



The only thing I wish is that LaserCad could import CorelDraw files directly. Right now I have to take my CorelDraw projects and convert them to PLT files then import them into LaserCad.

Other than that…..

The upgrade was well worth the money.