

LightObject DSP

Setup for BuildLog.net Laser 2.x

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By Tim Wehr

DSP configuration consists of relatively few, but very critical steps. Remember, this is a commercial controller originally intended for manufactures to install, configure, and deliver with their own proprietary laser systems. The configuration is extremely flexible, but that flexibility induces complexity. The steps outlined below, along with the configuration files supplied, are an attempt to minimize the complexity by providing specific configuration steps directed solely at the BuildLog.net Laser 2.x.

This document will walk you through the process of configuring the LightObject.com DSP (v2 Blue Panel) Controller for use with the standard [BuildLog.net](http://buildlog.net) Laser 2.x. While mention of physical connections and wiring of the DSP may be mentioned, the intent of this document is solely the configuration phase of DSP operation. For specific wiring information, you should refer to the appropriate documentation that came with your DSP. You can also access the documentation at <http://lightobject.info/viewforum.php?f=16>.

If you need help figuring out exactly how to connect the DSP to your system and the standard LightObject DSP documentation is not sufficient, or if you need additional clarification of anything contained in this document, you are welcome to contact me at tim.wehr@gmail.com. Please note that I am not directly associated with either BuildLog.net or LightObject.com. I simply believe that anyone taking time to build a great laser (and the BuildLog.net Laser 2.x IS a great laser), should also have what I consider to be the best available laser controller, which the LightObject DSP definitely is. So, I volunteer to help the customers and users of both sites. As such, the effort I put in is, at times, limited by work, family, and the occasional bike ride. However, I always assist those with questions as soon as possible – though it may not be as soon as you would like. Typically, I respond within a few hours during the day (weekdays) or at least within 24 hours when questions come overnight or on the weekend.

STOP

Don't do anything with the LightObject DSP until you have read this entire document. Jumping ahead or assuming that what you already know is going to make the process easier or faster, may cause you problems. OK, you can open the package and look at it, but then **STOP AND READ**.

Assumptions

These instructions assume a standard build of the laser according to BuildLog.net Laser 2.x build instructions. If your system is modified from the original design, you will likely have to make some changes in the DSP setup procedure to accommodate your unique build.

It is also assumed that you have tested movement of the x and y axis using Mach3 or some other method to ensure that the entire system is mechanically and electrically functional.

Wiring the DSP to Your Laser

It is ALMOST time to wire the DSP into your laser. First read the following notes. They provide information that will likely be useful when you wire it up. AFTER reading the notes, follow the basic wiring steps listed.

Notes

1. The configuration of the LightObject DSP does not depend on the specifics of how you wire your DSP controller to the various electronic and electrical components of the BuildLog.net Laser 2.x. In other words, it neither requires nor prohibits the use of the BuildLog.net Laser Interface (rev 1 or rev 2).
2. If your DSP is wired directly to the drives and laser power supply, you are working in the same environment as the author of this document. In this case, the front panel of the laser is completely DISconnected and is, therefore, non-functional. With the DSP, you need neither the potentiometer to control laser power level nor the push button to test fire the laser. Both are contained on the control panel of the DSP controller. Similarly, the E-Stop button is not needed, as the DSP's control panel also has a stop button.
3. If your DSP is wired in via the BuildLog.net Laser Interface, revision 1, you will need to ensure the following steps have been taken:
 - a. Wire the laser PS connections directly from the DSP, bypassing the connections from the BuildLog.net Laser Interface. This first version of the interface board does not handle PWM so you will need to wire that up directly.
 - b. Ensure that any other safety switches (lid, water, e-stop, etc) are wired such that they will work in your environment.
4. If your DSP is wired in via the BuildLog.net Laser Interface, revision 2, you should be able operate normally. It is assumed that all connections have been made from the DSP via a cable with a parallel connector for final connection to the interface board. For a complete schematic of how the DSP is wired into the Laser 2.x, check out Appendix I of this document. You will find a link there to the schematic. Well worth the viewing.
5. Check your home limit switch wiring. The DSP expects the switches to be wired Normally Open, Close to Ground. That means, when the switch is NOT closed, there is no connection through the switch. When the switch is closed, the ground signal should be present through the switch.

Wiring Steps

1. Before you do anything else, DISconnect power from your entire laser box.
2. DISconnect the motors from the stepper drives (the connectors that are attached to the ends of the motor wires). Just pull the plugs and let them hang free.
3. Now go ahead and wire the DSP according to the DSP instructions and, if using the BuildLog.net Interface board (rev 1 or 2), the Interface Board documentation.

NOTE - The standard BuildLog.net assembly instructions have you wire up the home limit switches with Normally Closed Ground, Open (disconnected) to activate. It is opposite of what the LightObject DSP is expecting. **The DSP wants to see Normally Open, Closed to Ground** to activate. While it is possible to deal with this in a number of ways, it is honestly easiest and fastest at this point to just change the wiring on your switches.

Do NOT apply power to laser or the DSP until instructed to do so.

Software Installation

It is not my intent to rewrite the entire DSP software installation manual at this time. However, the following overview of the installation process may be useful.

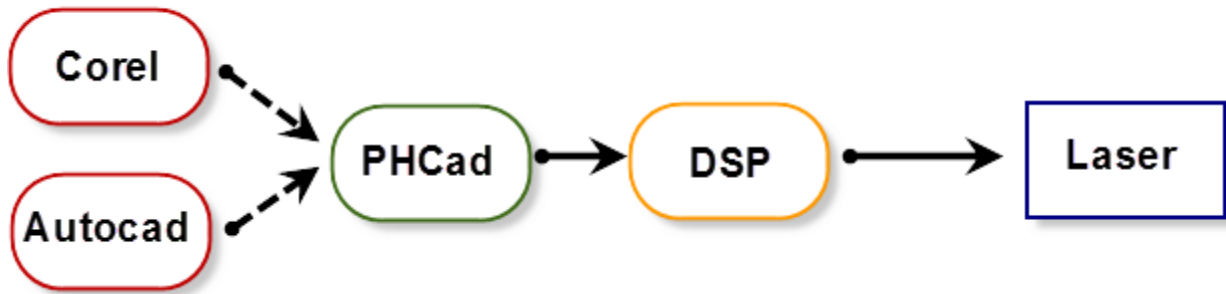
Installation Steps

(The following installation steps were taken from the DSP software manual and I have added a few comments where I believe they will be useful.)

1. Double click "Setup.exe" in the installation directory; the following dialog will pop up.
2. Click "**Driver_install**" to install USB driver. The following dialog will pop up when USB driver is successfully installed.
3. Choose version of software and the language you need. please refer to the following picture:

NOTE: There are 3 versions of the software. PHCad, CorelDraw, and Autocad. You are likely going to be using either CorelDraw or Autocad as your primary design solution, so choose the "Type" from the dialog window accordingly. If you choose not to use either of these applications, you CAN install the PHCad software only, but selecting it in the dialog. REGARDLESS of which you install, the PHCad stand alone software will ALSO be installed for you. Ultimately, the stand alone software (PHCad) is the interface to the DSP controller. The CorelDraw and Autocad installations only provide a link between their respective applications and the PHCad application. See the diagram below to see what the normal workflow is.

LightObject DSP Design/Control Flow



Note: Corel and Autocad are optional.

During the configuration of the DSP, you will be working solely from the PHCad application. Later, when it is time to begin actual design work, you can read the PHCad manual, beginning on page 41 for CorelDraw or page 49 for Autocad to learn how to set up those applications to communicate with PHCad.

4. Click “Install” to install laser software. The following dialog will pop up when software is successfully installed.

DSP Configuration

To get your BuildLog.net Laser 2.x up and running with the LightObject DSP controller as quickly and easily as possible:

Connect the Computer to the DSP

1. Connect the Computer and DSP via the extra long USB cable that is supplied with the DSP. (Make sure you connect it to the correct USB port on the controller – the one located in the **MIDDLE** of one side of the controller, not the one near the end on the opposite side.

Prepare DSP to talk with PHCad

In a moment you are going to apply power to the DSP Controller. When power is applied, it will do an automatic “reset” – attempting to move the laser head to it’s last known “home” position and then to it’s last known “origin”. Since we do not know where these places are, we must have the motors disconnected for this initial power up. Failing to disconnect the motors could cause damage to your laser by forcing the laser head to move too far in one or both directions.

During the “reset”, the DSP will also be waiting for signals from the X and Y home limit switches. If those signals do not come (and they won’t since the motors are disconnected and the head is not moving), it **SHOULD** time out in about 30 seconds or so. If it does not, you can manually move the

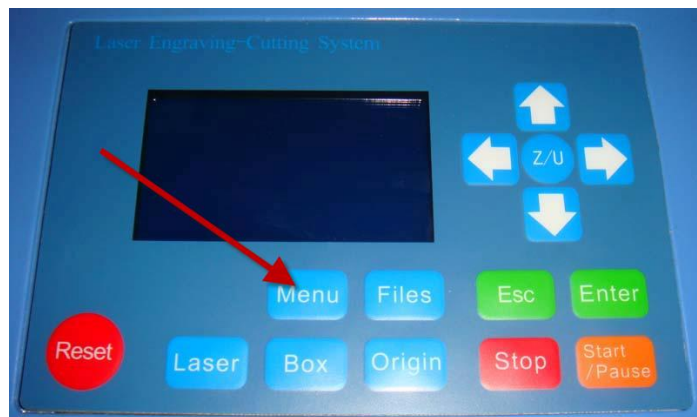
head to your laser's home position to engage both the home limit switches.

Once the limit switch have been closed (or the reset has timed out), the screen on the DSP control panel will change to the default display. (It will likely be in Chinese. Don't panic. We will fix it.)

2. Ensure that the motors are **DIS**connected from the drives (or interface board).
3. Manually move the laser head to a position about 6" in the x and y directions away from your laser's home position.
4. Insert the power cord into the back of the laser.
5. Turn the laser power on and **WAIT**.
6. IF the DSP does not complete its reset automatically (by timing out – 30 seconds or so), manually move the laser head to the home position and engage the two home limit switches.

Set the language

1. On the control panel, press the **Menu** button.

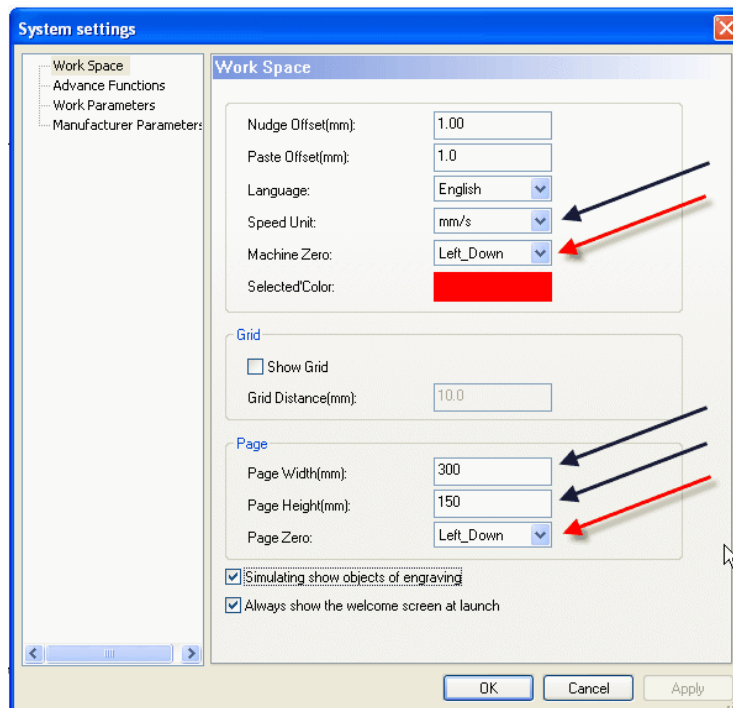


2. Press the **Down Arrow** 7 (seven) times to get to the Language menu.
3. Press green **Enter** button.
4. With the arrow keys, select **English**.
5. Press green **Enter** button.

Configuration Steps

1. AGAIN, ensure that the stepper motor connectors are disconnected and are hanging free.
2. Ensure that the DSP control panel is properly and securely attached to the DSP controller card.
3. Ensure that you have the (unzipped) configuration file(s) available on your computer.
4. Ensure that you have installed the current version of PHCad software on your computer.

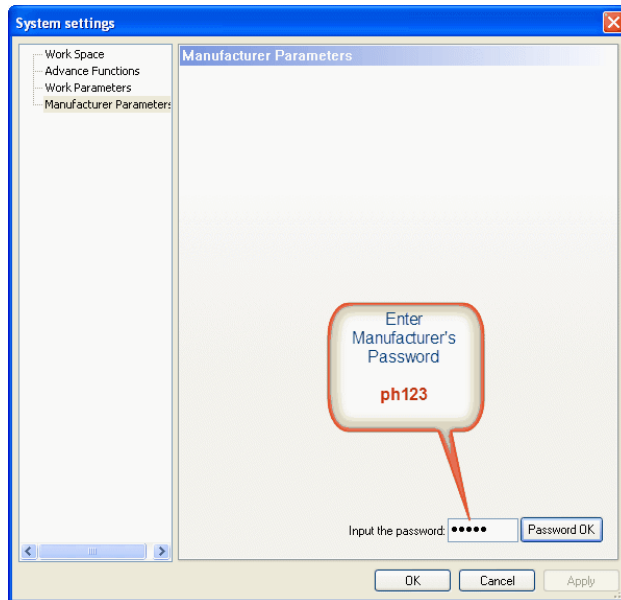
5. Ensure that you have the USB cable attached between the computer and the DSP controller.
6. If not already on, turn power to the laser (and DSP controller) ON.
7. **Launch PHCad** (there should be a shortcut on your desktop or launch from the Start -> Programs menu).
8. From the **Options Menu**, select **System Settings**.
9. **Set the Workspace Settings** (reference the image below)
 - a. If not already selected, click on the Work Space selector on the left side of the dialog.
 - b. In the upper part of the settings area, set Speed Unit to mm/s (millimeters per second).
 - c. Set Machine Zero to Left_Down.
 - d. In the lower part of the settings area, set Page Width to 300 and Page Height to 150. (I know this is smaller than your laser's work area. That is intentional. Until the stepper timing is set, it is safer to have it set too small, so that it we do not end up overrunning the systems physical bounds. We will correct the settings later.)
 - e. Also in the lower part, set Page Zero to Left_Down.
 - f. Click the Apply button (lower right of dialog) to have it accept the changes. (Note – IF the apply button is not activated – greyed out – don't worry. The next two steps will still make the changes “stick” for you.)



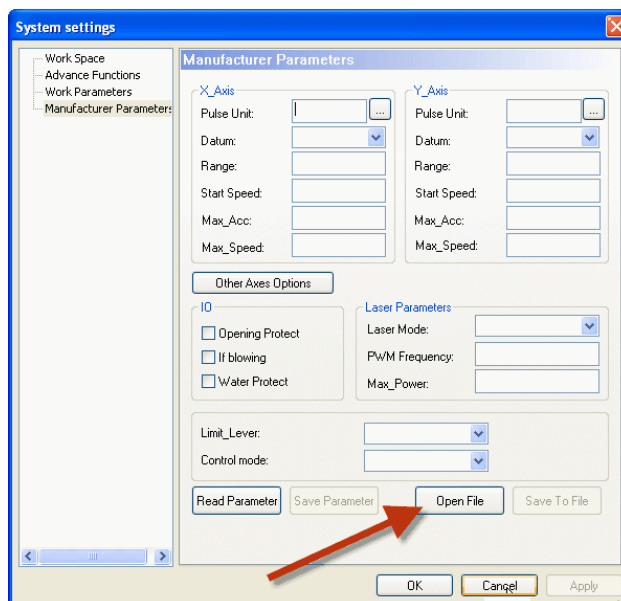
- g. Click the OK button to close the dialog.
- h. Quit the PHCad application. This ensures that new settings are applied when reopening the application or creating new documents.

10. Set the Manufacturer Parameters

- a. Start PHCad and open the Options->System Settings dialog.
- b. Select Manufacturer Parameters from the selectors at the left side of the dialog.
- c. Enter the Manufacturer's Password (**ph123**) and click Password OK.



- d. On the resulting settings screen, click the Open File button.



- e. Navigate to and open the configuration file that came with this document.
- f. The screen should now contain the basic settings for the use with the BuildLog.net Laser 2.x.

- g. Click the **Save Parameter** button, just to the **LEFT** of the Open file button you used to load the parameters in from the configuration file.
- h. Click **OK** button to close the System Settings window.

11. Set Control Parameters

The control parameters allow you to set important aspects of how the motors are driven. Most important of these is the acceleration values. If not set reasonably, your motors may chatter or even stall, making a whining noise instead.

- a. In the Machine Control section of the main screen, click the Settings button.
- b. In the dialog that opens, click the Read parameters button to get the current settings from the DSP.
- c. Set your values to match the values in the following image.

Section	Parameter	Value
Work Parameters	Space speed:	200.00
	Space Acc:	1000.00
	Start Speed:	10.00
	Min_Acc:	1000.00
	Cut_Acc:	1000.00
	Engrave_Acc:	10000.00
ControlPanel Parameters	RunBox_Speed:	250.00
	ClipBox_Speed:	150.00
	Cut Mode:	PanelLocation
	Laser Mode:	Auto
	Push_Move:	No
	Move Distance(mm):	10.0
	ControlPanel Power:	Power1
Other Parameters	Speed Mode:	precision_cut
	Reset Speed:	20.00
	Broken delay(ms):	20
	Focal Length(mm):	55.00

- d. Click the Save Parameters button to save the values to the DSP
- e. Click the X in the upper right corner to close the dialog.

12. First Electro-Mechanical Test

Note about the configuration file you just loaded: One of the main reasons for using the supplied configuration file is to ensure that the **Pulse Unit** is set to a figure that is usable on your laser. Pulse Unit is the length of time that the pulse is sent to drive the stepper motor. By default (as shipped from the factory) this

number is often zero or some other very small number. As a result, the laser head will chatter and jerk and cause excessive vibration in the laser head movement mechanism. The Pulse Units in the configuration file are the ones that work for **MY** system. They **MAY NOT** be perfect for yours, but that is OK. They will, I think, at least be **SAFE**. After we get some reasonable movement, I will walk you through tweaking them to work perfectly with **YOUR** system.

- a. Turn the **power** to the laser **OFF**.
- b. Manually move the laser head to a point about 2"-3" (50mm – 75mm) in each direction away from the home position.
- c. Reconnect the **X** and **Y** motors to the appropriate drives (or interface board connectors). If you have a motorized Z (table), leave it DISconnected for now. We have not set up the Z configuration. We can do that later.
- d. **Being prepared to turn the switch OFF AGAIN if necessary**, turn the power **ON** to the laser and DSP controller.

The control panel should go into Reset mode and the head should start moving toward the home position. It may be moving slowly, but it should be relatively smooth.

IF the head is moving AWAY from the home position (in X or Y or both), STOP. Movement away from the home position indicates you have the motor associated with that incorrect axis movement wired differently than the controller is expecting. There are two different ways to correct for this. Do **ONLY ONE** of them.

Method 1 – Swap the wire connections for EITHER pair A or pair B (but NOT BOTH) of the affected axis.

Method 2 – In the Manufacturer Parameters, change the Datum setting for the affected axis.

Either of these methods will reverse the direction of the motor, thus reversing the direction of the head movement. Don't go further until the head homing/reset movement is correct.

With the head moving towards the home position for both axes, once the head reaches the home position, it MAY move away from the home position in an attempt to go to the last known Origin position. If that position is 0,0, then head will remain at the home position. If it moves away, just let it.

- e. Test moving the laser head with the Left, Right, Up, and Down arrow buttons on the control panel. If it moves, if it moves in a particular direction (away from the home position) and then refused to move any

more, it is OK. Remember we told it we only have a table size of 300x150. Because we have these “soft” limits, you will never need to worry about installing additional limit switches to protect your laser from traveling too far in either direction. We will reset the table size to fit your system a little bit later.

IF your movement buttons (arrows on the physical control panel and the software control panel) **are backwards** (movement is opposite of what you expect) **but the homing reset is correct**, then you need to make an adjustment to correct for that.

To change the direction of head movement from the arrow buttons (panel or software) only, meaning the head homes (resets) correctly but the buttons are wrong:

1) Do **BOTH Method 1 AND Method 2** above. (I know it sounds counter-intuitive, but it works – Method 1 reverses direction so head moves wrong – then Method 2 reverses again, so head moves correctly. But now the arrow buttons will also be correct.) Do **BOTH of these**, even if you have already done one of them previously to get the homing correct. We have to get the software, the motor wiring, and the buttons all to agree on the expected direction of movement.

13. Manual Laser Test

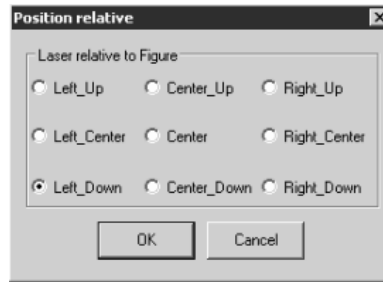
- a. Using the arrow keys, locate your laser head somewhere near the middle of your work area.
- b. Place a piece of paper or wood on the z table – about 3 inches beneath the laser head carrier plate.
- c. Close the lid to the laser.
- d. BRIEFLY press the Laser button on the control panel.

The laser should fire and you will notice a burn mark on the paper or wood used for the test. If the laser is not firing, trace out your safety switches to ensure that the laser power supply is receiving a good ground signal at the Water Protection connector.

14. Setting Laser Head Position Relative to Output

The laser head always starts from the Origin point (which may be different than the home zero position). The position of the output from that origin point is determined by the Position Relative setting.

- a. From the Options menu select Position Relative.



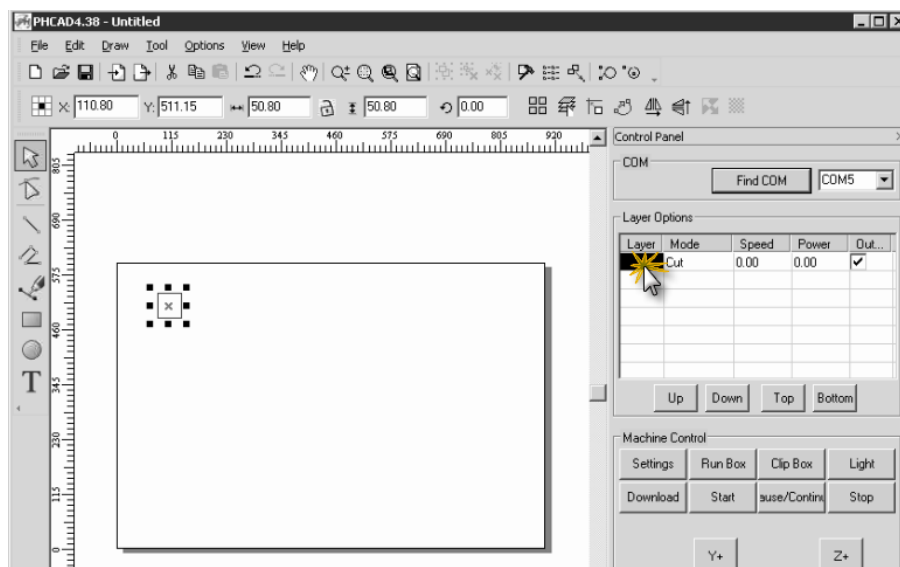
- b. In the dialog that appears, select Left_Down. This means that, at the beginning of a job, the start point (origin) is at the Left Down (bottom) of the output. In other words, the head will move UP and RIGHT to actually draw the output.

NOTE: You can change this on a job-by-job basis to suit your needs – you simply have to change it here and then download the job to run. It only changes when you download a job. You will be downloading a job as part of the following Laser Head Movement Calibration.

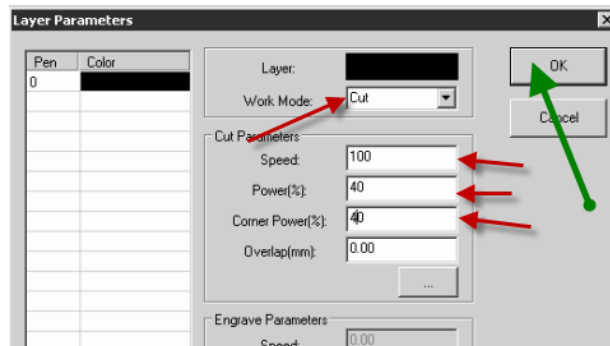
15. Calibrating Laser Head Movement.

Calibrating the laser head movement will ensure that the size and position of the output is correct – meaning the same size and position as your design.

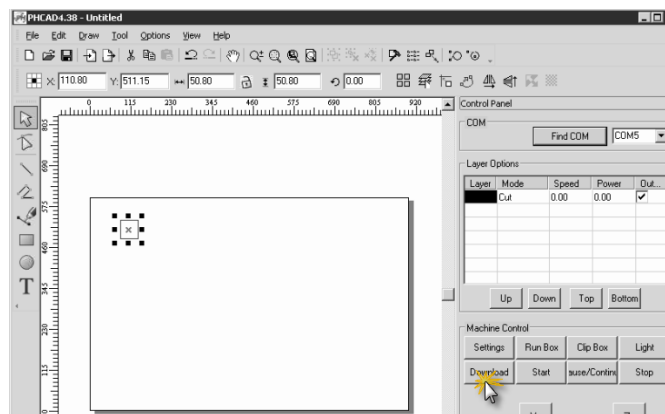
- a. In the PHCAd application, choose the rectangle tool from the drawing tools on the left.
- b. Anyplace in the drawing area, draw a small rectangle.
- c. Select the rectangle you just drew by clicking on its edge once.
- d. At the top of the screen, set the width and height of the rectangle to 50 mm (or 50.8 if you are going to be measuring your output in inches).
- e. Double Click the black Layer in the Layer Options list at the right.



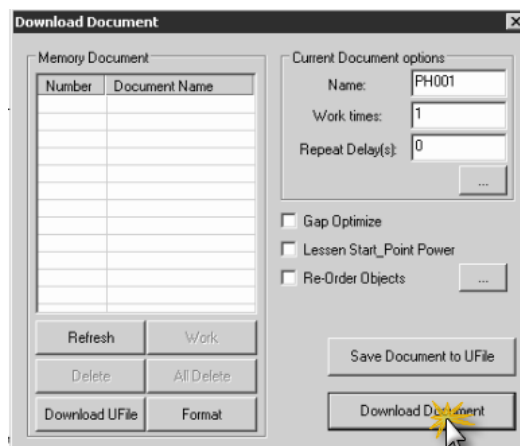
The following screen will open.



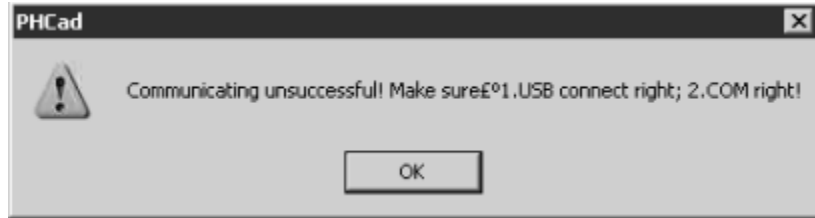
- f. Set the **Work Mode** to **Cut**.
- g. Set **Speed** to **100**.
- h. Set both **Power** and **Corner Power** to **40**.
- i. Click **OK**.
- j. Click the **Download** button in the main screen.



- k. Click the **Download Document** button in the screen that appears.

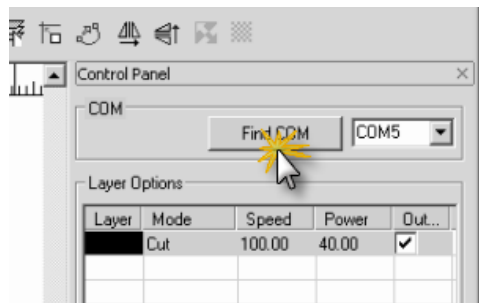


1. IF you get the following error message:



It means the application is trying to use the wrong port (or that your laser and DSP are turned off).

To set the correct port, make sure the laser and DSP are turned ON, and then click the Find Comm button. It should find the correct port and you can try the download again.



- m. Using the DSP control panel arrow buttons, move the head to the home position.
- n. On the DSP control panel, press the **Origin** button. (This tells the DSP to start the next job from this location.)
- o. Place a test work piece (paper or wood) about 3 inches below the laser head carrier plate.
- p. Close the laser lid.
- q. Press the **Start/Pause** button.

The DSP should run the job and cut/inscribe a square on your work piece.

- r. Measure the output in both directions (x and y). It should be exact the same as the box we drew (either 50mm or 2" if you put the 50.8 measurement in – I will assume you used 50.8 and are now measuring in inches).
- s. IF the measurement is correct, you are finished – no further calibration is necessary. Skip ahead to the next main point.
- t. IF the measurement is NOT correct you need to change the setting in the Manufacturer's parameters.

NOTE: If your square is half the size it should be, or twice the size it

should be, don't be concerned. My stepper motors are 400 step/revolution and you are likely using 200 step/revolution motors. That would explain any major differences. Regardless, the next few steps will correct any differences

- i. In PHCad, select **Options -> System Settings**.
- ii. Select the **Manufacturer Parameter** on the left.
- iii. Enter the password (**ph123**) and click **Password OK**.
- iv. Click the **Read Parameter** button (furthest left) to read the current settings from the DSP.
- v. Click the "... " button next to the X Pulse Units.
- vi. Enter the **original size** of 2 and the **actual size** (2.1 for example) and click the **OK** button. (It is expecting mm but we are entering inches. It does not matter, as long as both measurements are the same system – it is only looking to calculate a ratio between original and actual output.)
- vii. The corrected value for the x axis Pulse Unit is now set.
- viii. Follow the previous 3 steps for the **Y** axis, if needs to be adjusted as well.
- ix. Click the **Save Parameters** (second button from left) to save the info back to the DSP.
- x. **Rerun these test/adjustment** steps until you get an output that is the same as the original design.
- u. Your X and Y axis should now be calibrated.

16. Set Correct Work Area Size

- a. Open **Options->System Settings**.
- b. Click on **Work Space** at left.
- c. Enter new values for the Page Width and Page Height (545 and 275 are what I use. **YOURS MAY BE DIFFERENT**).

I suggest you go with smaller numbers and work your way up to the max your setup will handle. Once set, you never have to worry about going too far. Even if you tell it to move 10000mm, it will only move as far as the soft limits we are setting.

- d. Click Apply button
- e. Click OK button
- f. Close PHCad
- g. Reopen PHCad
- h. Press Reset button on the control panel
- i. Test movement to ensure you are getting full work area coverage.

Z Axis Setup

The Z axis has the same kinds of settings as the X and Y. Therefore you should be able to set them up in a similar manner without any detailed steps to follow. However, there are a couple of things you may want to know before you start.

To access the Z axis settings:

1. Launch PHCad (if not already running) and open the **Manufacturer Parameters** and read the current parameters from your controller (you should have these steps pretty well memorized by now).
2. Click the **Other Axes Options** buttons, just below the X axis settings.
3. Fill in the settings with values similar to the X (or Y) axis. The one that is going to be significantly different is the Range setting. Your total Z axis range is likely to be only about 3" to 4" (75mm to 100 mm). Set an appropriate and safe value and hone in on the exact value for your system.
4. It is BEST to **run your table midway between top and bottom** manually before applying power and control to the Z axis. This gives you room to move up or down without running out of room. It may be that you can only move in one direction. That would likely be due to the controller thinking that it is already at $Z_{0,0}$ or at Z_{max} .
5. Test and adjust your settings till you get it all correct.

Note – You may have to do some significant changing to the acceleration and speed to get a smooth start and run of the Z axis. You really don't want it to go too fast, as that will limit your ability to get fine adjustments.

Installation with CorelDraw X4

In the manual of the DSP controller card the directions are for CorelDraw 11 and 12. It will work with X4 (CorelDraw 14) as well (but NOT X5). You just have to know where to find the necessary options, etc. in CorelDraw.

1. Select **Tools/Options**
2. Navigate to **Workspace/Customization/Command bars**.
3. Select **Macros** (instead of Visual Basic, which is written in the manual).
4. Quit CorelDraw
5. Install the Coreldraw_Laser plugin by running DSP Installer
 - a. Select CorelDraw_Laser and English, then click Install.
6. Restart CorelDraw X4.

Note: The new toolbar will not pop-up like it is written in the manual.
7. Select **Tools/Options** again,
8. Navigate to **Workspace/Customization/Commands** (*not .../Command Bars!*)
9. Select the **Macros** toolbar from the dropdown menu on the top. There will be some strange grey icons, named Laser.UserInit, etc.

10. Drag-drop this command to any open toolbar, then click on it.

This will pop-up the LaserUsing toolbar, with the 3 commands needed to operate the control card, and this toolbar will remain on afterwards.

What's Next?

At this point, you should be pretty well ready to go. You should NOW go and read the entire PHCad manual. Most of it will make more sense to you now than it did or would have if you read it before going through this.

As always, if you have questions, let me know. If you have constructive comments, I want to hear them. (If you just want to complain, without some input on the problem or solution, keep it to yourself.)

Best of luck.

tim

Appendix I - Buildlog.net Laser 2x - DSP Schematic

bdring (Bart) over at Buildlog.net was kind enough to create a schematic of exactly how the DSP Controller is wired and interfaced with the BuildLog.net Laser 2.x. Below is a link to that schematic.

[DSP - Buildlog.net 2x Schematic](#)