

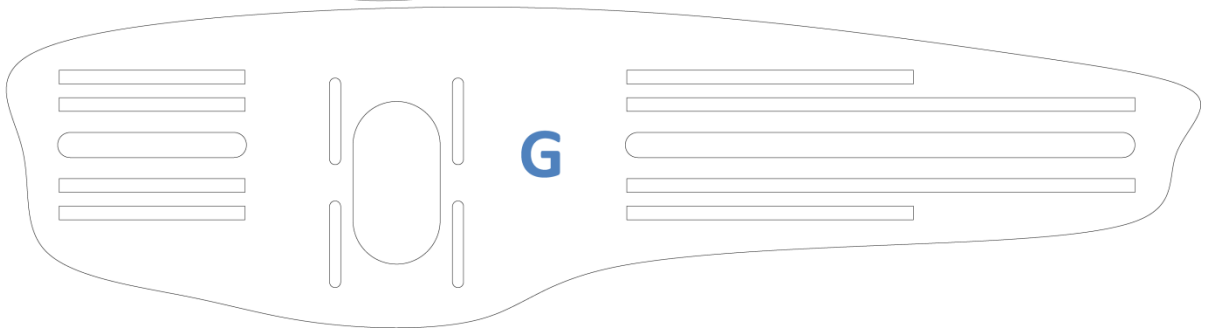
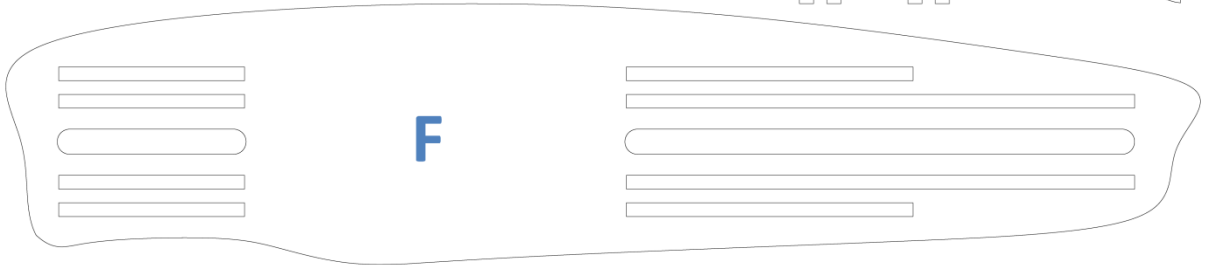
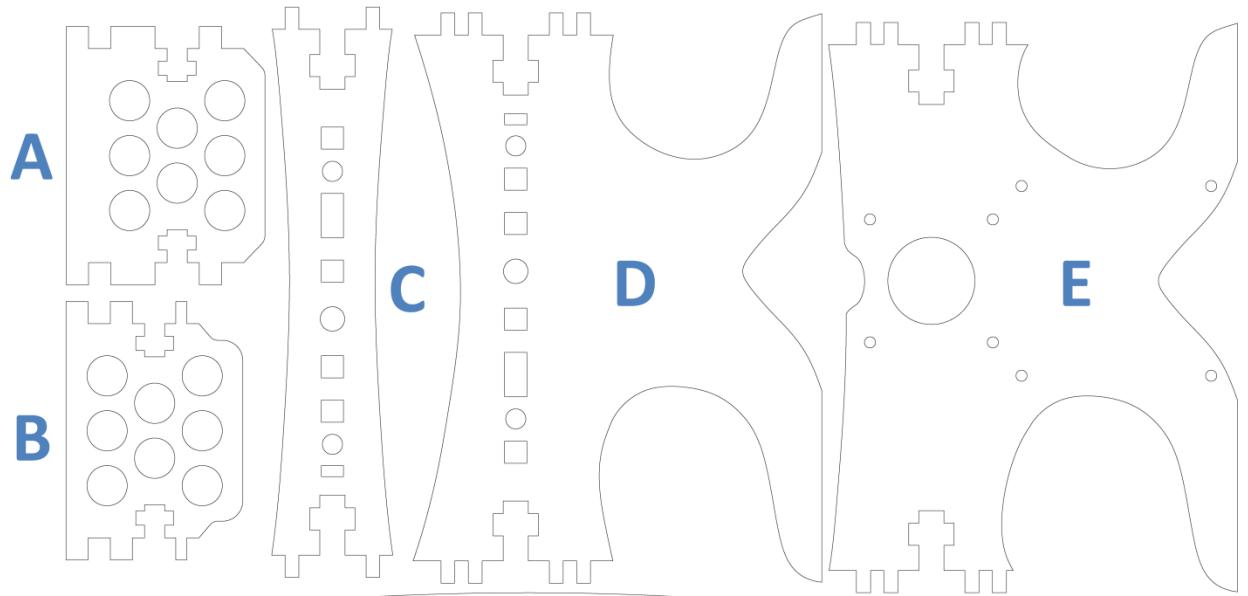
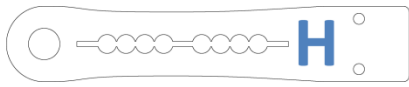
# eggbot<sub>beta</sub>

# instructions

[www.egg-bot.com](http://www.egg-bot.com)

Version 1.0

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## BEFORE YOU START

### SAFETY

Eggbot runs on low voltage so there is no risk of electrocution from the power supply. Because eggbot does not draw any power from the USB connection, there is no risk of damaging your computer through the usb connection. However, you still should follow common sense safety guidelines. This means: don't modify the power supply, and replace it only if you know what you're doing. You can use a different power supply (between 6V and 30V DC) to produce more motor torque, but you may need to change motors if you change the power supply, so ask first if you are unsure. If you have any questions or need a replacement part, please check our forum at <http://forum.egg-bot.com> or e-mail us at [support@egg-bot.com](mailto:support@egg-bot.com).

### PROTECTING YOUR EGGBOT

The eggbot is pretty robust, but a few things to note:

- Be careful when installing the EggBotBoard (EBB) since can be damaged by static electricity. Before remove it from the anti-static bag, discharge any static electricity that is in your body by touching a grounded metal object (like your computer's case) and then touching the metal case around the USB connector on the EggBotBoard.
- Always **hand-tighten** the plastic bolts. If you use a wrench you can crack the acrylic. Hand-tightening is sufficient to keep your eggbot strong.
- **Avoid loose connections** to the motors. The driver chips on the EBB can be damaged by intermittent connections to the motors. Do not disconnect the motors while the power is on.
- The acrylic in your eggbot is strong, but it will still crack or shatter if dropped.

## ASSEMBLING THE KIT

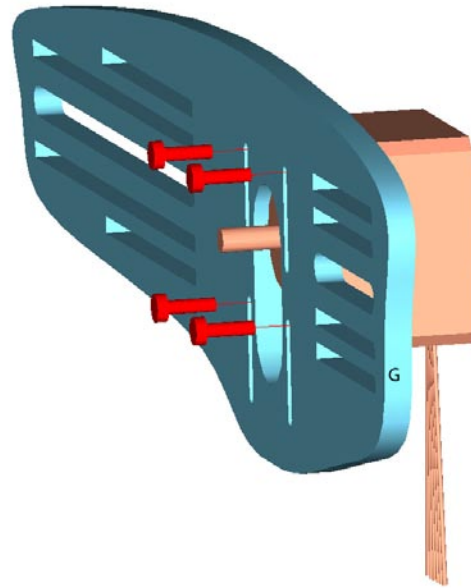
Please refer to the diagram on the back of the cover page, where the parts are labeled A through J.

There are two sizes of metal screws in the kit. There are eight M3 screws and four 4-40 screws. The 4-40 screws are slightly longer.

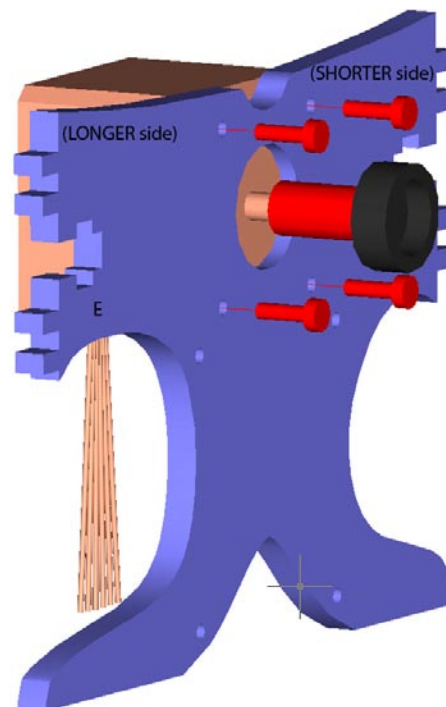
The only tool you should need is a small Phillips head screwdriver.

## CONNECTING THE MOTORS AND EGGBOTBOARD (EBB) TO THE ACRYLIC

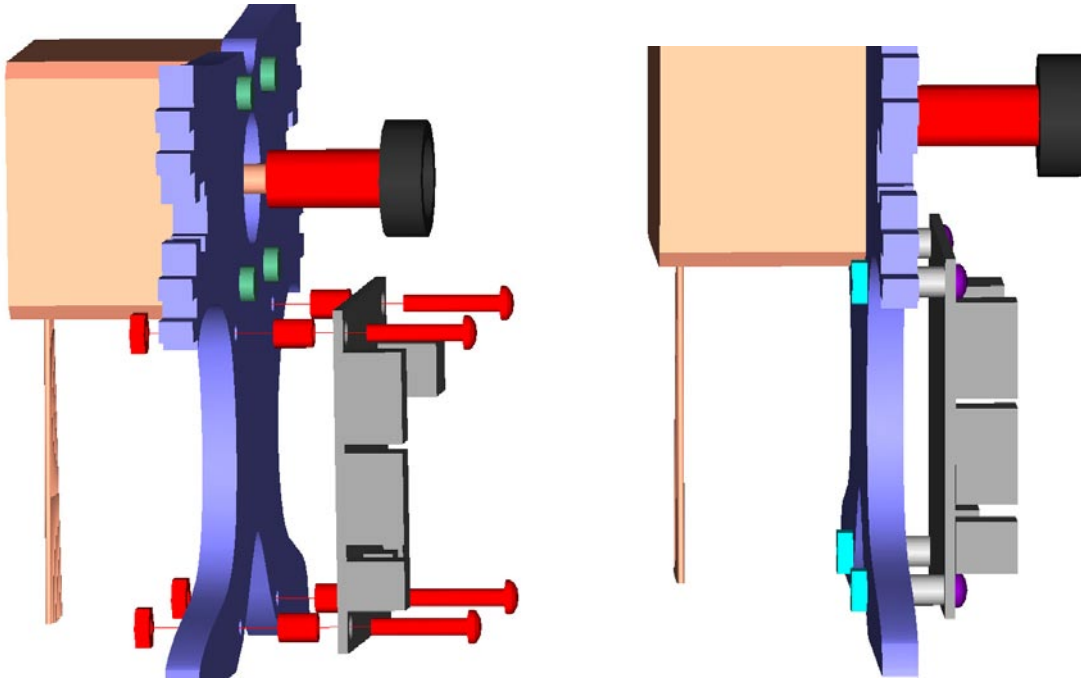
First connect the pen motor to part G, using four of the eight M3 metal screws. The pen motor does *not* have a rubber cap already attached to it. Make sure the wires point down. Tighten the screws until the motor is firmly in place, in the upper-most position.



Next attach the egg motor to part E, using the remaining four M3 metal screws. Again, be sure the wires are facing down. Notice that part E is not symmetrical, so make sure the motor is oriented like the image below.

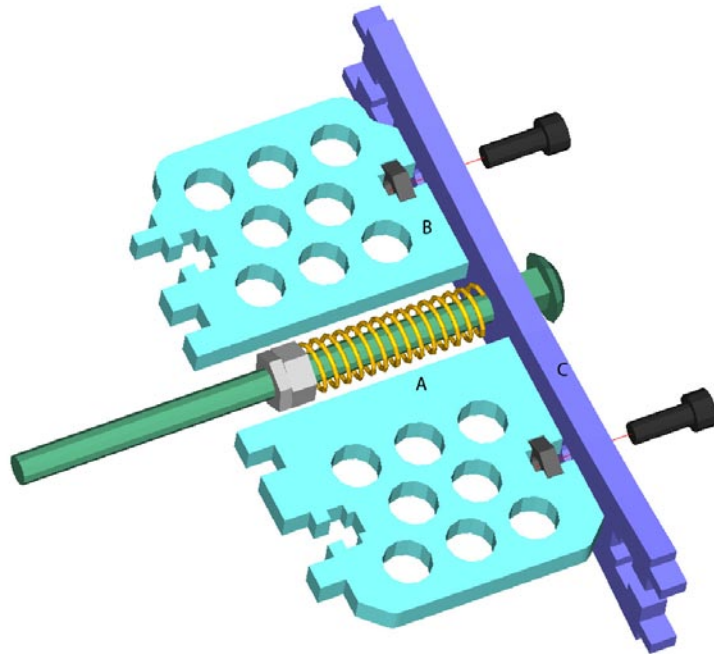


Now connect the EggBotBoard (EBB) to part E, using four 4-40 metal screws, plastic standoffs, and 4-40 nuts. The EBB should be placed on the opposite side of the acrylic from the egg motor, and the side with the parts facing out so you can read the words “EggBotBoard” without looking through the acrylic. Also, the motor and solenoid screw terminals should be located on the left.



## BEGIN THE PLUNGER ASSEMBLY

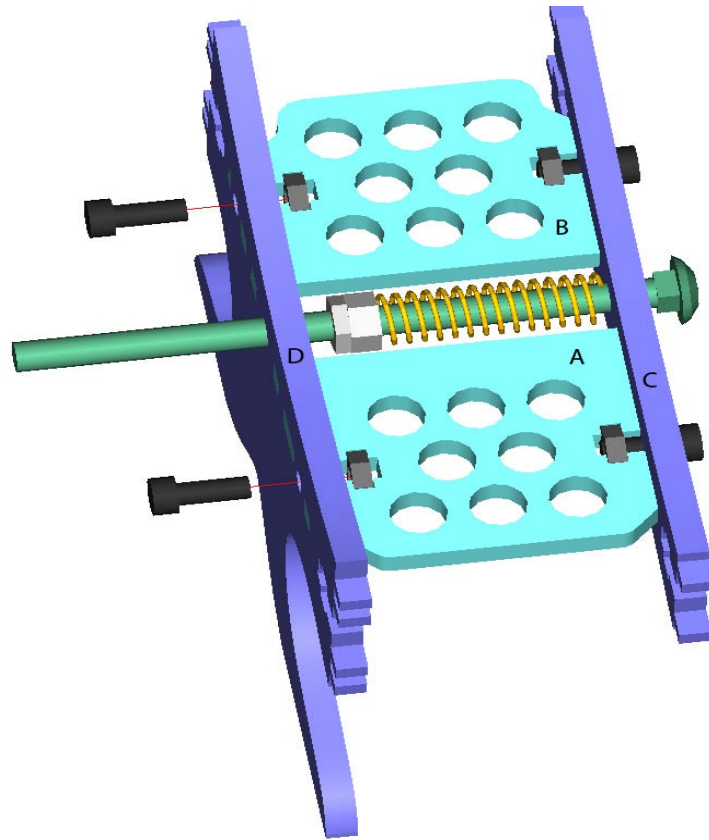
Attach parts A, B, and C as shown, using the #10 (smaller) plastic bolts and nuts, as shown:



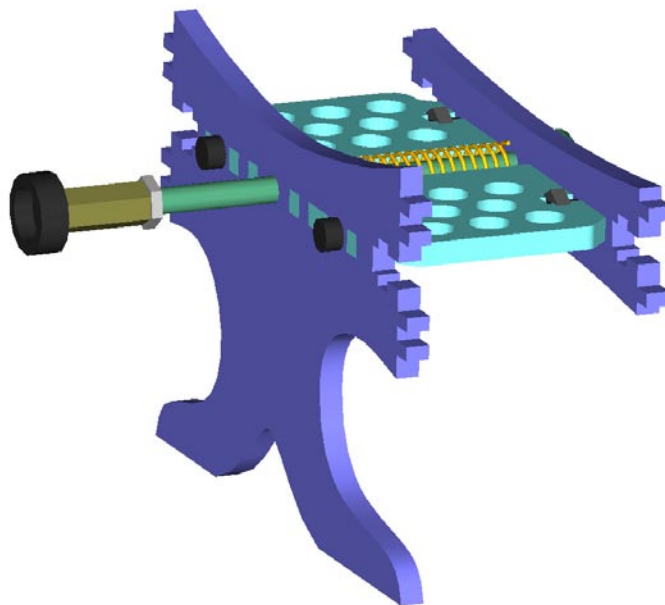
Next insert the plunger (large steel bolt) through the center hole in part C. Place the spring onto the plunger, followed by the plastic  $\frac{1}{4}$ " nut and finally the thinner steel  $\frac{1}{4}$ " locking nut. The plunger should now be assembled as shown above.

## FINISH THE PLUNGER ASSEMBLY

Attach part D as shown:



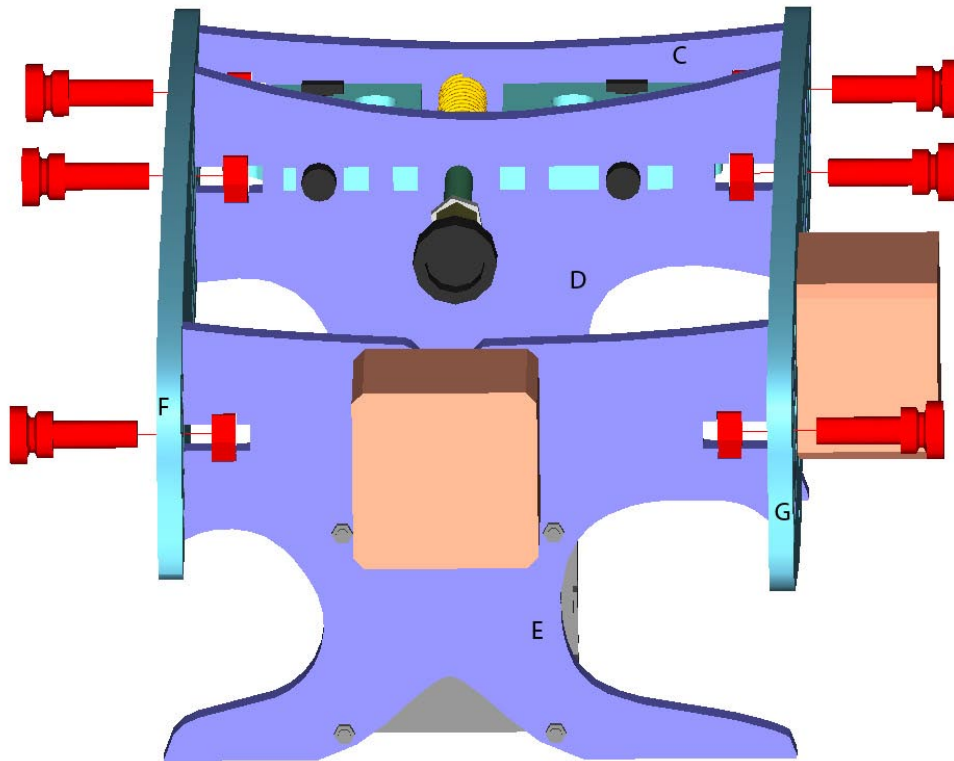
Add another locking nut, a coupling nut, and finally black rubber cup:



The plunger bolt should extend into the coupling nut about halfway. Hold the coupling nut in one hand, and screw the rubber cup into the end until it sits flush.

## ASSEMBLING THE CHASSIS

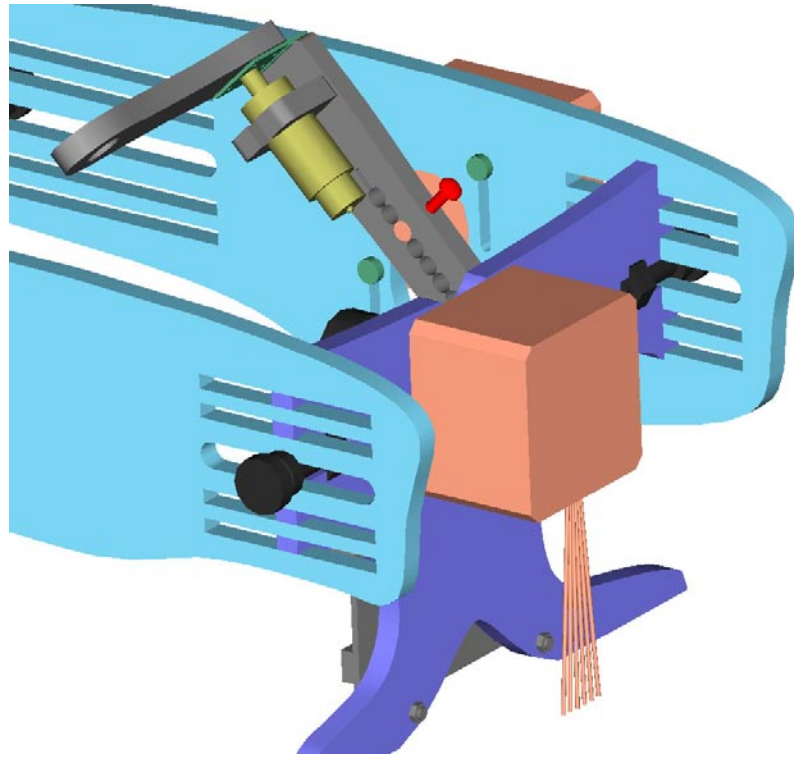
Using the large plastic thumb-bolts, attach part E (with the egg motor), part G (with the pen motor), part F and the plunger assembly as shown:



You can adjust your eggbot's length to accommodate large objects like light bulbs and small objects like eggs. When you adjust, you should first move the part D (with the egg motor) so the object's center is lined up with the pen motor. You should then adjust the plunger assembly so it holds the object securely. You can make finer adjustments by screwing or unscrewing the plunger bolt while holding the nylon and steel nuts.

## ATTACHING THE PEN ARM

Attach the pre-assembled pen-arm to the pen motor, using the third hole from the solenoid. Try to push it onto the motor shaft so that it is flush with the shaft end. Make sure that you can rotate the arm back and forth without hitting the bolts that hold the pen motor to part G.



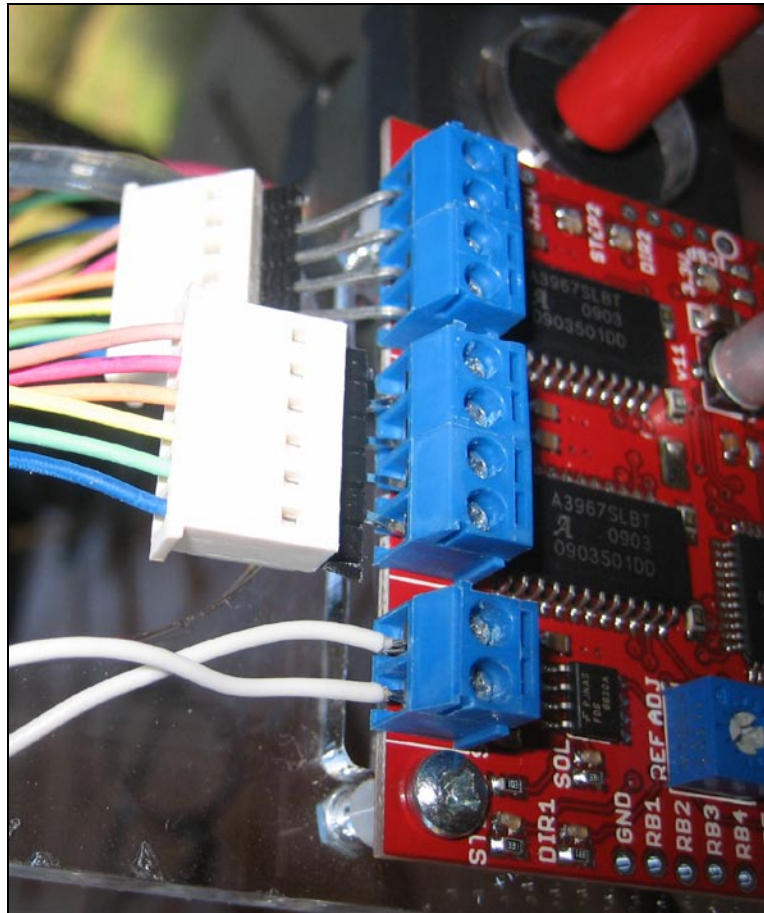
Tighten the set screw (red) so that the pen arm does not slip on the shaft—do not over tighten.

## CONNECT THE MOTORS AND SOLENOID TO THE EBB

First attach the egg motor to the top screw terminal on the EBB (the terminal closest to the egg motor, labeled “Motor 2”). Push the connector into the terminal, and then tighten each of the screws firmly to hold it in place. Make sure the brown wire is at the top (again, closest to the egg motor). It is important that the wires are securely in place, because an intermittent connection to the motor can damage the EBB. Make sure you have all six holes and pins lined up before pushing the connectors on.

Finally, attach the two solenoid wires to the EBB, using the screw-down connector. Make sure these wires do no wrap around the outside of the chassis before connecting. The solenoid's wires are not directional, so it doesn't matter which order you connect them.

Your EBB should look like this:



Congratulations, you've got an eggbot!

## INSTALLING THE SOFTWARE

Eggbot comes with a copy of Inkscape, a freeware vector graphics program that works on Windows, Mac, and most versions of Linux. Inkscape is a powerful and easy-to-use editor, and is capable of importing many formats including Adobe pdf. See [www.inkscape.org](http://www.inkscape.org) for details, tutorials, and help. We have added an extension to Inkscape which will plot a drawing to the eggbot.

You are not required to install Inkscape to run eggbot, but you will have to create your own script or program to export commands via the usb port. Read more at [www.egg-bot.com/support/software](http://www.egg-bot.com/support/software).

## WINDOWS

Insert the included CD into your computer, and double-click the file **eggbot.msi** in the root of the CD. This program will install Inkscape and the eggbot extension onto your computer. This program can later be uninstalled like any other software by going to Control Panel > Add/Remove Programs, or by running eggbot.msi again.

## MAC AND LINUX

Please visit the “Manually installing Inkscape with the eggbot extension” section of our software support page: [www.egg-bot.com/support/software](http://www.egg-bot.com/support/software). There you will find the steps to install Inkscape, and links to the required files.

## INKSCAPE BASICS

We have found Inkscape to be a pretty intuitive program, and there are many tutorials available at [www.inkscape.org](http://www.inkscape.org) or just by searching for “Inkscape tutorial.” However, there are some eggbot-specific pointers:

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### HOW THE DRAWING IN INKSCAPE SCALES TO THE EGG

The size of the document (in pixels) corresponds to the steps in the stepper motor. Each of eggbot’s motors moves in discrete steps, 3200 steps per revolution. The egg motor can move 360 degrees, so the width of the document is 3200 pixels. A horizontal line in Inkscape will be drawn horizontally around the egg (if the egg is standing up). The pen motor can only move about 1000 steps between the poles of the egg, so the height of the default document is 1000 pixels.

This means that if you use the default document, you can scale an object to the size you want it to be on the egg (or whatever you are plotting on). If you create a document wider than 3200 pixels, the image will wrap around the egg, and you can create tessellating patterns this way.

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### EGGBOT CAN ONLY PLOT PATHS IN INKSCAPE

Inkscape uses the SVG format to store vector images. SVG supports many different types of objects like circles and lines, but our script can only plot **path** objects. Since Inkscape creates

most objects as paths, this means that you need to manually convert all text and rectangles to paths. To do so, just select the object and go to Path > Object to Path... If you try to plot an object which is not a path, the script will return a warning, but will not continue running. If you import a drawing from a pdf or other format, you may have to manually convert some of the lines to paths.

The script will ignore the “style” of the path, meaning the line-width, dashes, patterns and fills.

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#### OTHER TIPS

Because of the large size of the canvas, an object might not be visible. To correct this you should set the fill to “none” and the line to a solid color with width at least 3px.

#### UPDATING THE FIRMWARE ON THE EBB

The EBB is programmed with Microchip's USB HID bootloader. This means that you can use the USB connection to your computer to put new code on the EBB in the future.

Follow these steps to update the firmware on your EBB:

1. If you installed our version of Inkscape, you can launch the bootloader from the Start Menu under Eggbot/Update EBB Firmware. Or you can download the HIDBootloader.exe application (you only need to do this once).
2. Download the new HEX file that contains the firmware you want to program from [www.egg-bot.com/support/ebb](http://www.egg-bot.com/support/ebb).
3. Connect your EBB to power, and connect the usb cable to your computer.
4. The EBB has two buttons labeled “PRG” and “RST”. While pushing the PRG button, push and release the RST button. Then release the PRG button.
5. If this is the first time you are updating the firmware, Windows will install the new HID device – you should not be prompted for any drivers, as Windows already comes with the right drivers.
6. The EBB has two LEDs labeled “USR” and “USB”. At this point these two LEDs should be alternating red and green. This indicates the EBB is in bootloader mode.
7. Run the HIDBootloader.exe application. In the window it should say “device attached.”
8. Click “Open Hex File” and navigate to the HEX file you downloaded in step 2.
9. Click “Program/Verify” and wait for the update to finish.
10. If no errors occurred during programming, click “Reset Device”.
11. Your new firmware should now be running on your EBB. To confirm that you are running the version you downloaded, open up a terminal emulator (we like Tera Term), and open the COM port that the EBB is on. Then type V and press enter. You should see a version string print out that tells you what version of firmware is currently on the EBB.

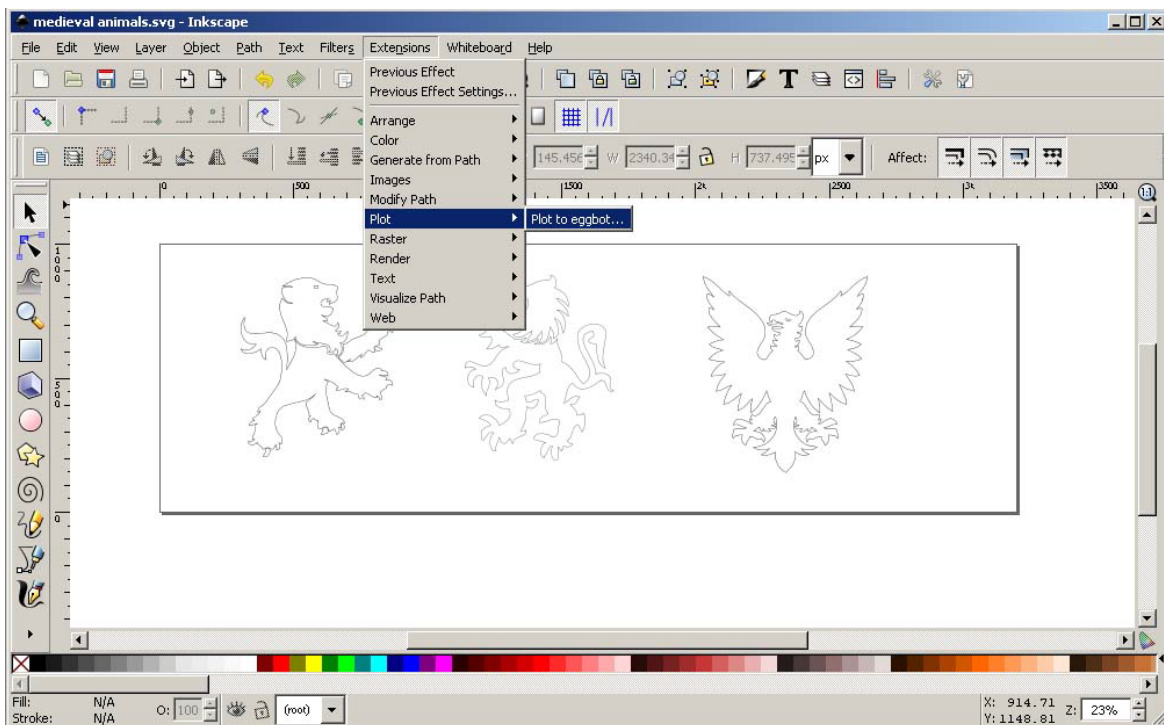
#### PLOTTING FROM INKSCAPE

Plug in the EBB. You should see a solid green light turn on at the top of the EBB.

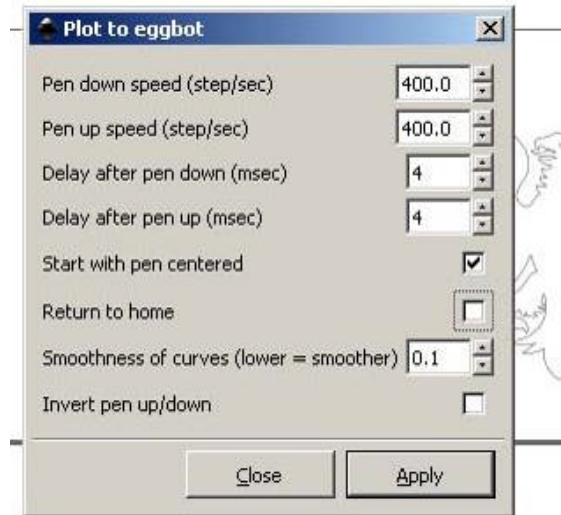
Attach the usb cable. After a moment, you should see the usb light begin to blink green. The first time you plug the EBB in you may be prompted to locate the drivers. These can be found in the Eggbot installation directory in the Eggbot\_inf folder.

Create a simple drawing in Inkscape, or use one of the included samples. If you created a drawing, or imported one from another program, remember to convert all text and shapes to paths or they won't be plotted!

To plot go to Extensions > Plot > Plot to eggbot...



This will bring up a set of options:



**Pen down speed** – the speed the pen will travel while drawing. In our experience, 400 is a safe speed, but you can go as fast as 1000 steps per second on simpler plots.

**Pen up speed** – the speed the pen will travel moving (usually this can be faster).

**Delay after pen down** – the pen will take a certain amount of time to fall, so you can say how long to wait before drawing the next line.

**Delay after pen up** – there is also a delay for the pen to go up, or you may end up drawing as the pen is rising.

**Start with pen centered** – if checked, the script will assume the pen is starting vertically, and will move it to the starting point before plotting. This is useful, because you probably will not know where the drawing starts.

**Return to home** – returns the pen to the starting position. This is useful for repeated plots.

**Smoothness of curves** – eggbot can only plot straight lines, so all smooth curves in Inkscape need to be broken up into smaller lines. The lower this number, the smoother the result.

**Invert pen up/down** – this will reverse pen up and down commands – you should not need this setting.

Hit “Apply” and the plot will begin!

If you are using Windows, you can hit “p” to pause the program, and “p” again to continue. While paused, you can lift the pen up by pushing “u”, and lower the pen down by pushing “d”. This is helpful when adjusting the height of the solenoid during a plot.

At any time you can quit by pushing ctrl-c or by closing the black shell window. When the plot finishes you will be returned to Inkscape.

## ADVANCED TIPS

As you will soon see, eggbot is capable of precise plots, but this will require some precise tuning on your part. To guarantee the best plot, you should center the object as exactly as possible, and adjust the height of the solenoid on the pen arm so that the pen can draw on the entire surface while down, and won't draw while up. This requires some experimentation, but you will get it. We'll be posting more advanced tips on our [www.egg-bot.com](http://www.egg-bot.com) as we answer questions from users.