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Step 3

Building North Paw V2.0

Step 3: Final Assembly

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In this, the final step, you'll stuff the motor array into the armature, put the electronics into the plastic enclosure, position the controller and battery onto the exterior of the armature, and hook them all on up together.

Supplies (incl. in kit / made by you already)

- **Completed North Paw V2.0 board**
- **Black plastic box (2 pieces, top and bottom, plus screws**
- **LiPo Battery**
- **Pager motor array on Veltex backing**
- **Ultra-chic velvet North Paw anklet**
- **Two pieces of velcro**
- **Ribbon snap, AKA IDC: insulation displacement connector**

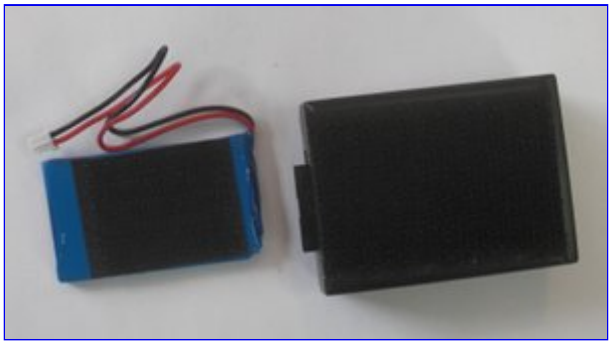
Tools (not incl.)

- **Pliers**
- **A second pair of pliers (highly recommended)**
- **— or —**
- **A vise (insted of the two pairs of pliers)**

Note: these instructions were originally made for V1.6 Kits, the procedure for V2.0 kits is identical, except that there is now a handy way to recalibrate the compass, should you so desire.

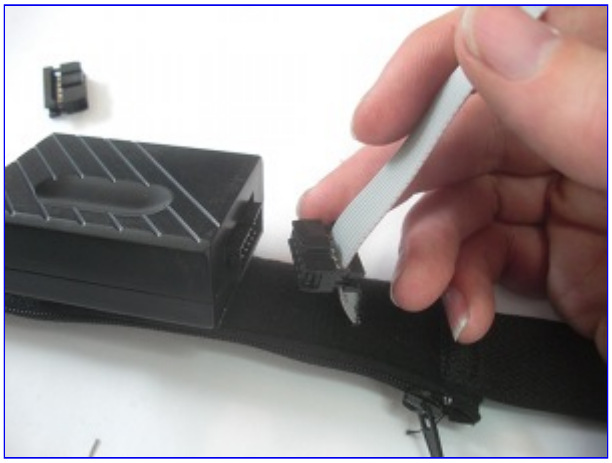
We're going to start by putting the electronics into the enclosure. There are two possible orientations, and only one is right. You want to put the board in such that the holes in the enclosure are correctly aligned with the devices on the board. The "bottom" piece of the enclosure is the one without the finger indentation. In the correct orientation, the USB port goes into the side with the extra, deeper cut in the plastic: this enables USB cables which have larger plastic bits to still reach the USB port once the enclosure is all closed up.

Once you're sure you've got it placed right, screw in three screws to hold the board tightly in place. Don't put a 4th screw in the corner with the compass – these iron screws can distort the compass reading a little bit, so you'll get better performance if you don't put that one in. (note that the switch is aluminum, so it's proximity to the compass matters much less)



Once you're got the board screwed in, snap the plastic top on, and then apply the velcro to the *bottom* of the enclosure as well as to one of the sides of the battery (it doesn't matter which).

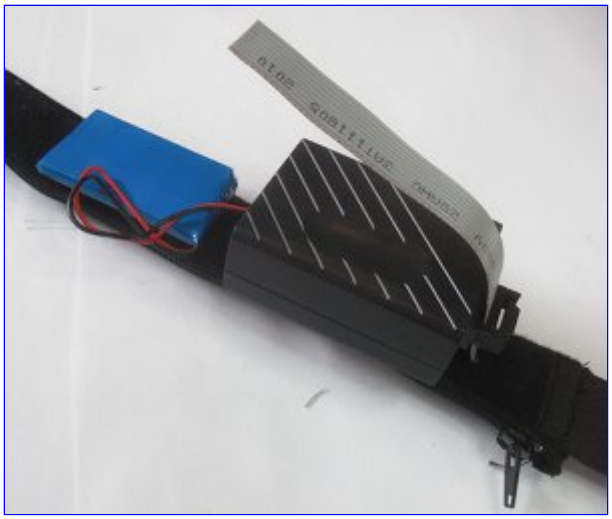
Moving on, let's assemble the display. Place the display assembly partially inside the armature (the fabric anklet). The side of the armature with the velcro coming off it should have a hole near the velcro. Thread the ribbon cable out the hole, and then make sure that the motors are facing the thin (velvet) side of the armature. Stuff all the motors in and zip up the armature.



Now turn the armature over and stick the enclosure to it, with the motor jack side facing the ribbon cable hole. Slide the ribbon snap over the ribbon cable, but don't do anything yet. There are FOUR possible ways to put the snap on, and only one is correct. You need to have the key (the elevated piece of plastic in the middle of one side of the connector) facing towards the board, upward. It's also important that the red stripe on the ribbon cable is toward the zipper – if it's not as pictured, you need to figure out where you missed a rotation or flip – the most common location in my experience is to have no folded the ribbon cable over the veltex mounting piece in step two. Anyway, you should be able to see that your ribbon snap is aligned with the motor jack on the board before proceeding. If you mess up, there is a second ribbon snap (not required unless you mess up), so you will have another chance 🙂

Once you're sure you've got it all aligned correctly, use two pairs of pliers to squeeze the ribbon snap *tight* around the ribbon cable. A vice can also work, if you have access to one of those. This step will take much longer than you are expecting – it's not so easy to squeeze them tight, remember that you are cutting into some fairly hard plastic from both sides. You'll have to keep pressing and pressing.

Once you've got it tight, insert the snap into the board, and do the same for the battery. The shown picture also shows the strain relief device inserted,



but I recommend that before you do that, you test that things are working: at this point, you can turn on the device and verify that motors actually vibrate, and that different motors turn on in different orientations. If things don't go, you'll have to trouble shoot! Look carefully at your device and read over the instructions and see if you can find the problem. If you get super stuck feel free to email us for tech support: eric at sensebridge dot net.

At this point, if everything seems to be working, you are almost done!! Put in the strain relief device, and I also find it helpful to tape the extra wire of the battery as shown. If you haven't yet, you can also snip the extra ribbon cable off.

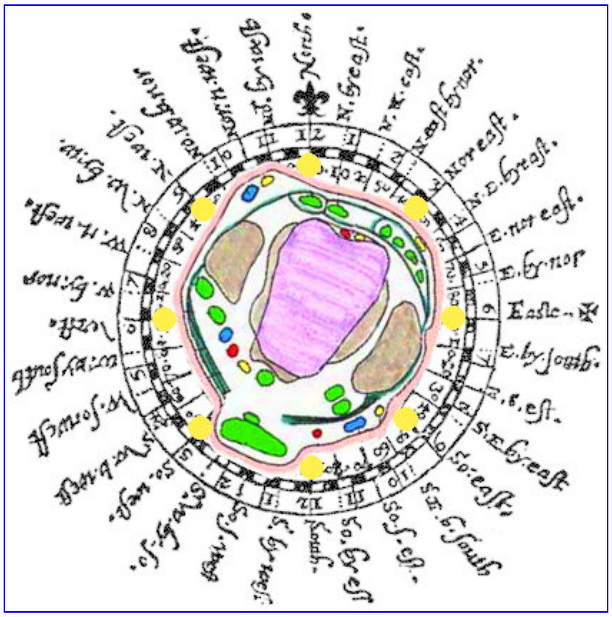
Put it on and see how it feels! If the compass doesn't always point exactly north, there are several things you can do. The first is the easiest, and often makes a surprisingly big difference. We've made a video showing how to trigger calibration mode: North Paw Calibration

Verbal explanation: The new V2.0 kits have a 3-axis compass with 3-axis accelerometer, and these compasses have an internal "calibration" system that we've exposed. To trigger this mode:

1. **Turn North Paw (NP) on, hold in your hands**
2. **Turn NP upside down, then upright again, and repeat this action 4 times.**
3. **You'll feel the device enter calibration mode: the motors will each buzz briefly in order, going twice around the circle, and then all the motors will go dead.**
4. **Rotate the NP in all directions, around each (of the three) rotational axis's. The compass is collecting data about magnetic fields, and needs to feel them in all orientations. This step**

lasts about 30 seconds, which seems like a really long time to be moving it about.

5. **The NP will start the motors buzzing again, this is the signal that calibration is done. New calibration settings are saved to the EEPROM of the microcontroller, where they will be loaded each time the NP turns on.**
6. **Mount on ankle, use normally.**



The second thing, likely to be helpful if you didn't build your own North Paw, or size the display quite correctly, is basically to "customize" the North Paw to your ankle specifically. You'll be configuring the positions of the motors and the method that you wear it to optimize your results. Grab a normal compass, or go somewhere that you know exactly where North is. Put your North Paw on, and turn around slowly. You'll notice that the motors will sometimes point in different directions. This is because in Step 2 (making the display) you spaced the motors out evenly, but actually this would only work if your ankle was perfectly cylindrical. It's not, so you now need to move the motors around until they all point to the same North. It's best to do this one motor at a time. Find a motor that points the same way as your compass does, and then turn until your North Paw changes to another motor. Feel and remember the amount at which that motor is pointing away from North. Take off your North Paw, unzip the motors, and move that motor over by the amount you felt. Put it back on, and repeat, this step will only work after a bit of trial and error. While you do this, be careful not to bend your solder joints too much as they can break.

Looking at the diagram to the left might give you a better spatial understanding of why the motors need to be spaced differently depending on each individual ankle's unique shape. Note the length of the arcs between the yellow dots, that's the space that should be between the motors those dots represent. You should also consider that spacing the motors in this way means that if you change ankles, or wear the North Paw turned from how you calibrated it, then it will no longer be perfectly calibrated. Keep that in mind!

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North Paw V2.0, for help contact eric@sensebridge.net

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