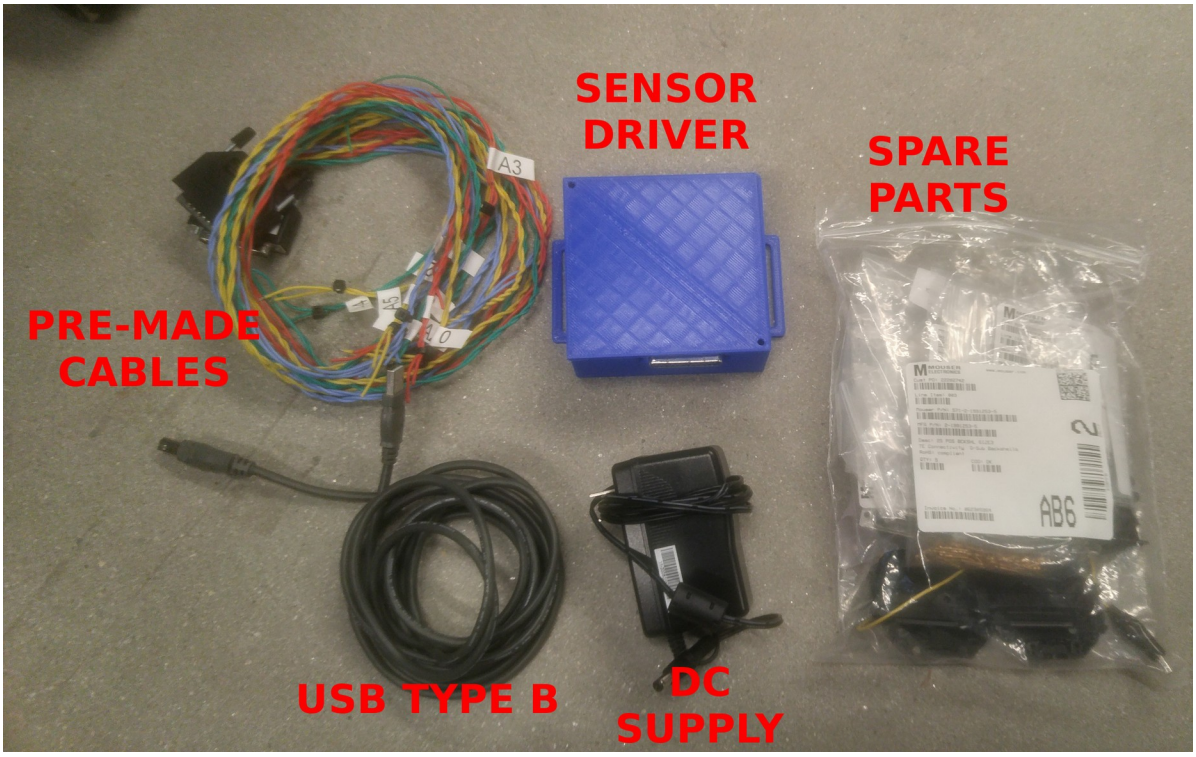
Sensor Driver Documentation

Overview

This sensor driver box is designed to be an all-in-one solution to driving all types of sensors one might need to test. It is in a small cased designed to be strapped to the subject with minimal encumberment. There are three connectors on the box. The USB type B is a connection between the host computer and the Arduino. The barrel jack is for Arduino power if the data has too much electrical noise. The DB25 connector is used to connect the sensors to the driver box.

The box uses entirely capacitive sensing technology. It is intended to drive at least the polyester sensor, the liquid metal sensor, an the 3/5/7 layer rubber sensors.

Included Components



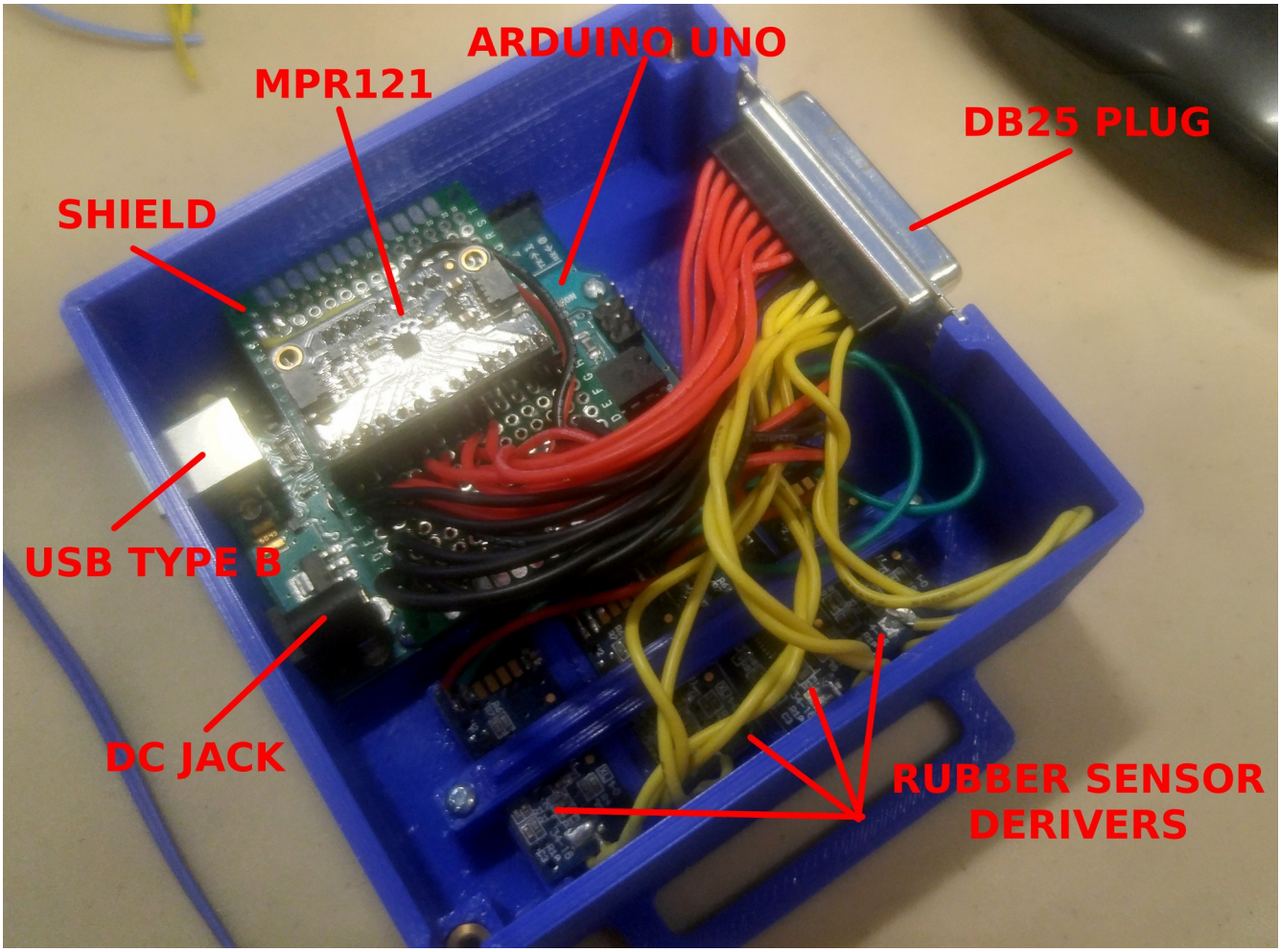
Everything included is the driver box, USB type B cable, 12v power supply, two sensor cables: one for the MPR121 one for the 3/5/7 layer, and a bag of parts.

Operation

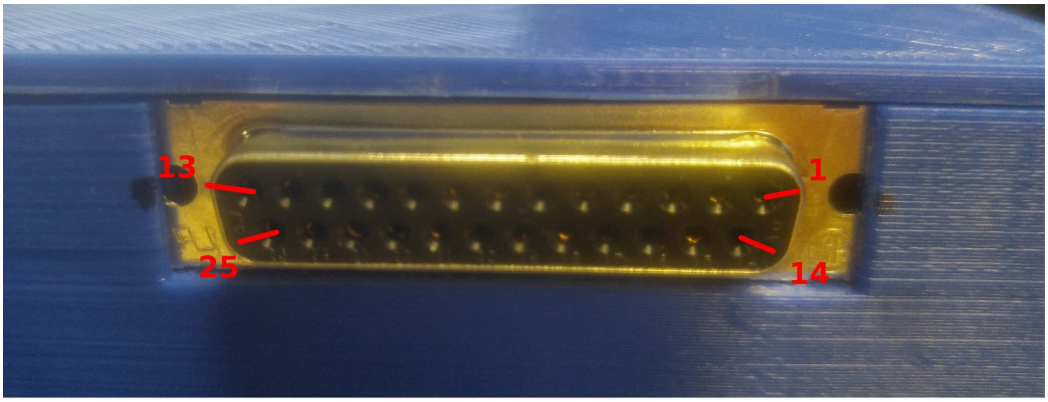
The sensor driver was designed to minimize the amount of electronic hardware that needs to be shuffled around and assembled before each test. The box is first strapped to the subject. Next, the proper sensor(s) are attached to the subject and plugged securely into the driver box. USB, and optionally DC power, is hooked up up to the box. The test administrator will load the correct code onto the Arduino. The test may now begin and whatever necessary data collected.

New testing demands will occasionally require new combinations of senors or even new types of sensors. This sensor driver intends to make that easy by providing empty DB25 connectors to make new plug assemblies. This document will include information to make these custom cables. When removing a cable assembly from the box it is important to pinch the connectors from the wide ends when pulling. The re-pinable connector housings can pop apart otherwise.

Inside the Box



Connector Pin-out

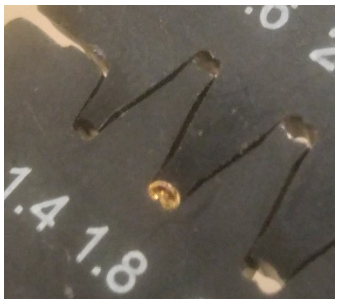


Pin	Use	Description
1	MPR121	Input 0
2	MPR121	Input 1
3	MPR121	Input 2
4	MPR121	Input 3
5	MPR121	Input 4
6	MPR121	Input 5
7	MPR121	Input 6
8	MPR121	Input 7
9		Not used
10	3/5/7 Layer Rubber Driver	Driver on Arduino A5
11	3/5/7 Layer Rubber Driver	Driver on Arduino A4
12	3/5/7 Layer Rubber Driver	Driver on Arduino A3
13	3/5/7 Layer Rubber Driver	Driver on Arduino A2
14	MPR121	Ground
15	MPR121	Ground
16	MPR121	Ground
17	MPR121	Ground
18	MPR121	Ground
19	MPR121	Ground
20	MPR121	Ground
21	MPR121	Ground
22	3/5/7 Layer Rubber Driver	Ground
23	3/5/7 Layer Rubber Driver	Ground
24	3/5/7 Layer Rubber Driver	Ground
25	3/5/7 Layer Rubber Driver	Ground

keep in mind it is reversed on the male connector!

Making A New Connector

1 Pinning Wire



Select a suitable length of wire 20 awg or smaller (silicone insulation with stranded core works best) and strip off a small section no more than 5mm long. Place a male pin into the crimper tool with the crimp ears facing away from the jaw. Apply light pressure to hold the pin in the jaw. With your free hand, insert the stripped wire into the crimp so that the outermost ears crimp on the insulation and the innermost ears crimp on the bare wire. Squeeze the crimper fully closed. Gently tug the wire and the pin apart to ensure good crimp.

2 Pinning Connector

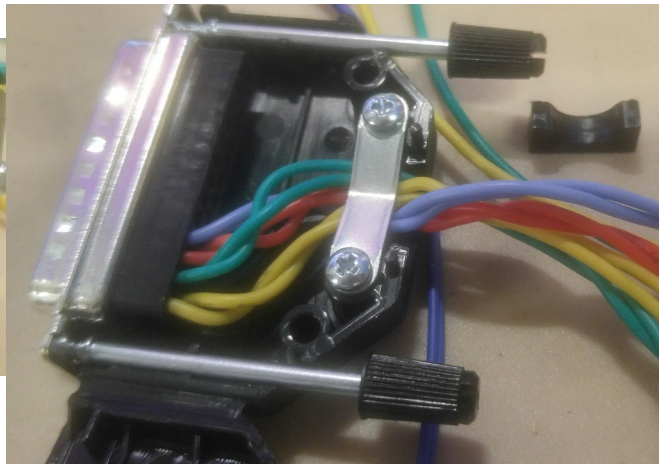
Once all the wires have been pinned, pay close attention to the pin-out listed in the Connector Pin-out section. Ensure the pins are straight and apply a gentle bend to the crimp section if it is not. Push the pins into the connector until a slight click is heard. If they do not go in all the way, use the red end of the pinning tool to gently push the pin home.

3 Prep the Wires

Before the connector can be closed, the wires must be prepared. I like to twist the wires that go to each sensor together to keep everything neat and reduce inductive coupling to other sensors. Clamp the pinned connector to the table. When twisting, I twist the cables over themselves in a counter-clockwise direction. While I do this, I add a slight counter-clockwise twist to each individual cable to help keep the bundle tight. At the end a zip tie tightly secures the twist.

4 Assemble the Connector

Place the connector into the housing behind the long tabs, but before the triangle corner braces. Place the plastic “half moon” spacer into its slot at the rear of the case. Lay the wires on this spacer. Determine which orientation of the metal bar gives a tight and complete clamp of the wires going into the housing and screw tightly. Lay the thumb screws into the slots on either side of the housing. Clip the case shut and pres the studs in the rear firmly into their holes.

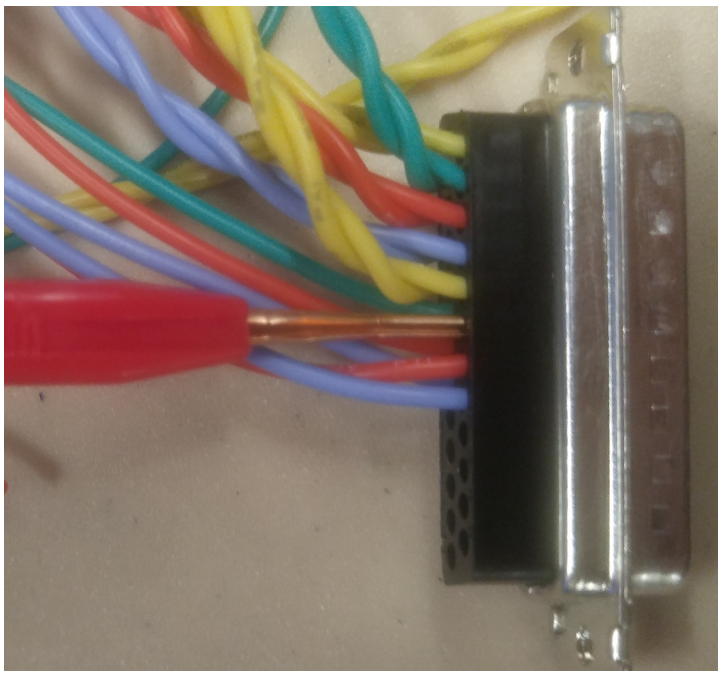


5 Attach Sensors

Attaching the sensors is an open-ended question that I will not provide a solution for. Alligator clips have presented some reliability issues, but they crimp similar to the pins in step 1. If you plan to solder, make sure you put the heat shrink on first. If not using heat shrink, wrap tightly with electrical tape. Whichever you choose, make sure the wires do not short together.

6 De-Pin Connector

If a situation should arise that a pin must be removed from the connector, the red and white pinning tool must be used. The red end of the tool must be inserted into the connector from the wire side. I had to bend mine open slightly to cope with the DB25 size. Push the tool into the connector and feel around to make sure the tool has surrounded the pin in the hole. Push the tool in until you feel the internal clip release. From the other side use a flat head screw driver or a paper clip to push the pin out.



Issues

From early testing it seems that the 3/5/7 layer rubber sensor drivers are not happy with the length of wire they have to also drive before the sensor. If the issue continues, it might be beneficial to move the drivers to the other end of the wire. This would require a repining of the driver box connector. I would suggest 10-13 directly into the analog input on the Arduino. 22-25 should go directly to ground on the shield. The unused pin 9 would be 5v power from the shield and some uncomfortable splicing would be done in the male connector housing to splice all four sensors together. This would result in a 3 wire bundle going to each sensor but likely a cleaner signal. I'll whip some up and also include the CAD files to test this theory.

The MPR121 may also prove to be unhappy with the length of wire its asked to drive. The Adafruit documentation provides a guide to tune the base capacitance out.

Part Numbers

Part Number	**Description**
66683-4	Female pins
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207463-1	Female connector
207464-2	Male connector
2-1991253-5	Connector housings
5207719-3	Female connector standoffs

These are TE's part numbers but will search fine on DigiKey and Mouser.