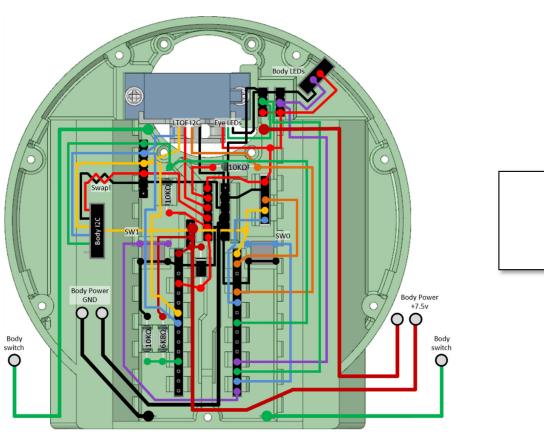
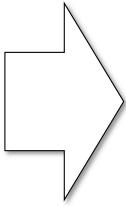
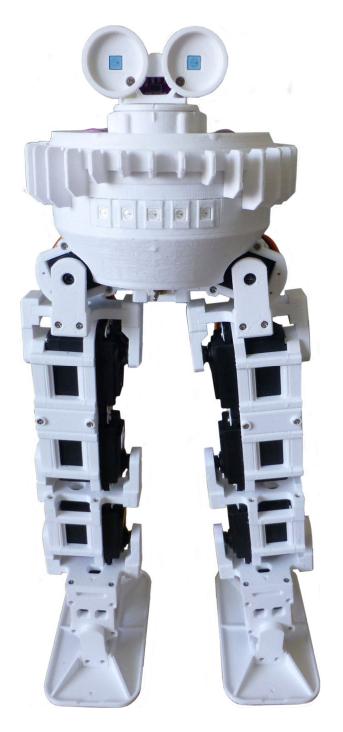
# **Biped Droid**

# **Circuits & Wiring**









## **Hand Tools:**

Fine Nosed Pliers
Side Cutters
M3 Tap
M4 Tap
1.5 mm Drill
2.0 mm Drill
Needle Files
Screwdriver
Craft Knife

Note: Not all items are shown here.



### **Tools & Materials:**

Temperature controlled iron Solder flux Resin cored solder 6mm adhesive copper tape Screw drivers Wire wrapping tool Wire wrapping wire 30 AWG

















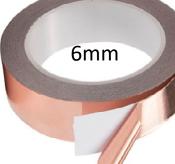














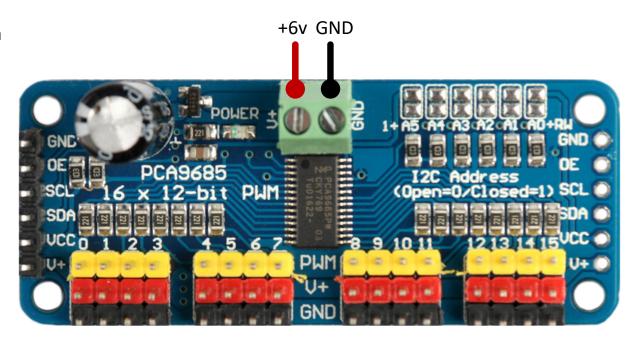
#### **PCA9685** power lines

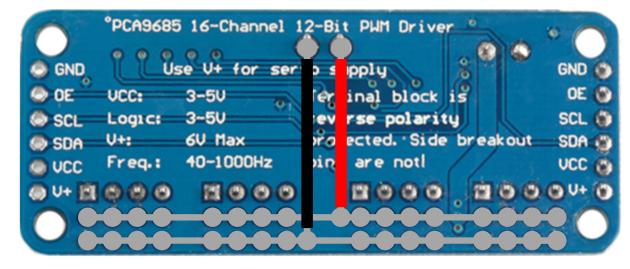
It is recommended that the GND and V+ lines on the PCA9685 are strengthened using insulated wire if significant currents are to be draw from this pcb. This modification needs to be done in advance of assembling your robot.

The assignment of servos to PWM channels has been done symmetrically in such a way as to ease the cable runs to the servos in each leg. See a later slide that details this.

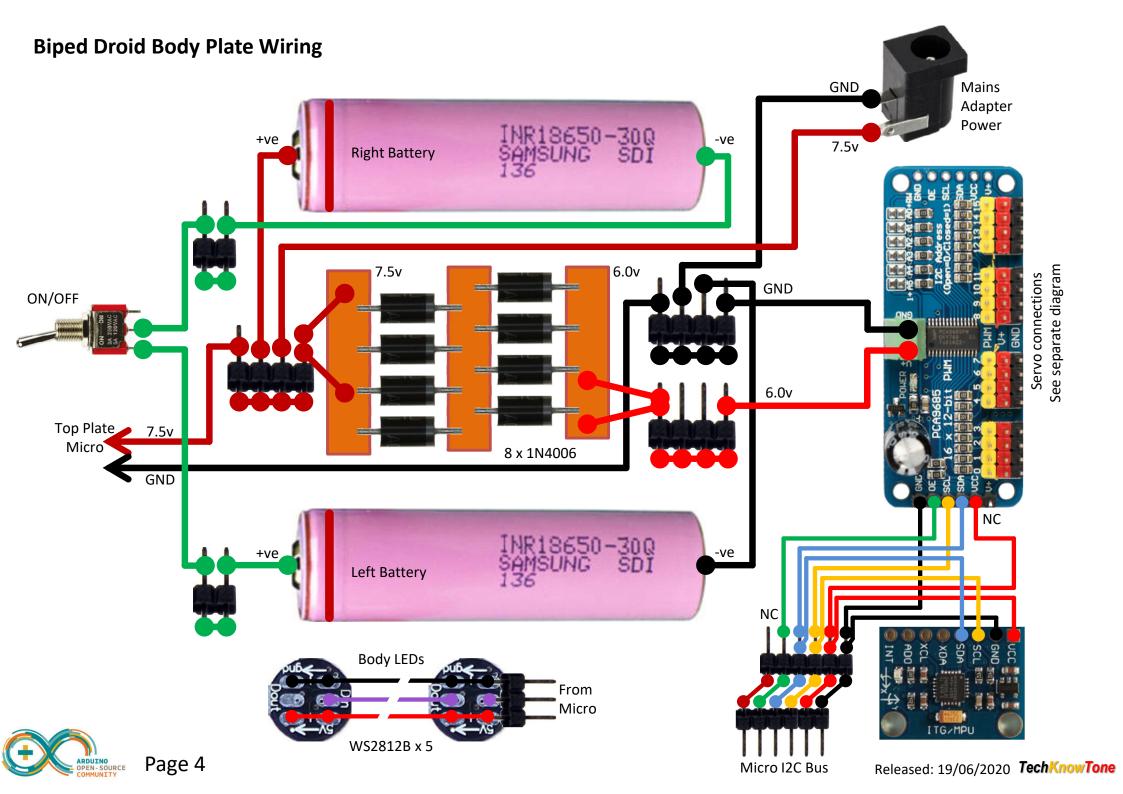
Only 11 of the 16 available channels have been used in this project, leaving scope for additional servos, used in arms, etc.

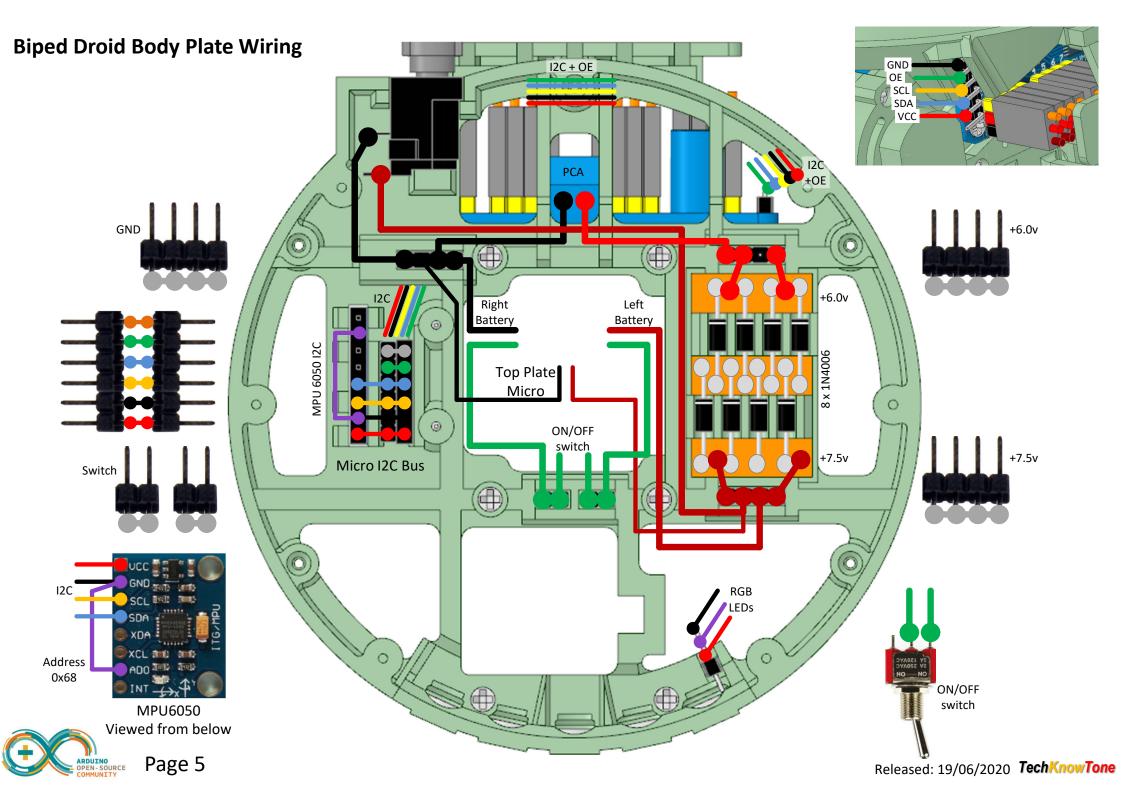
The interface to the board is serial I2C bus. If more than 16 channels are needed then more PCA9685 boards can be connected in series, by simply extending the I2C bus and changing the default address of each board that is added.

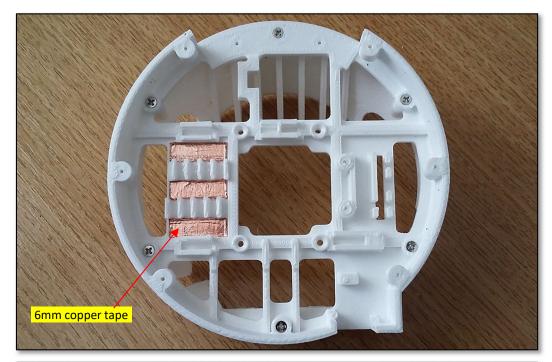


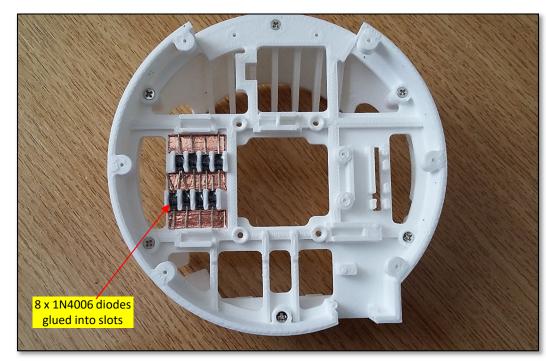


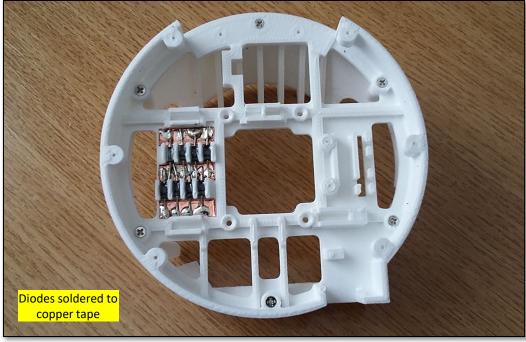


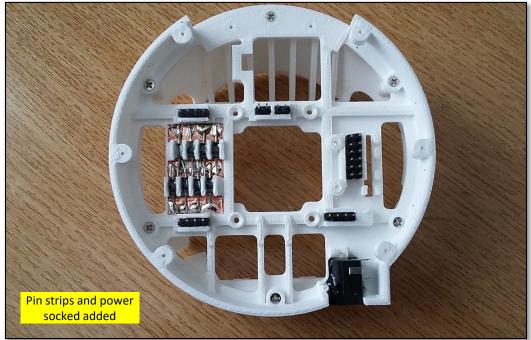




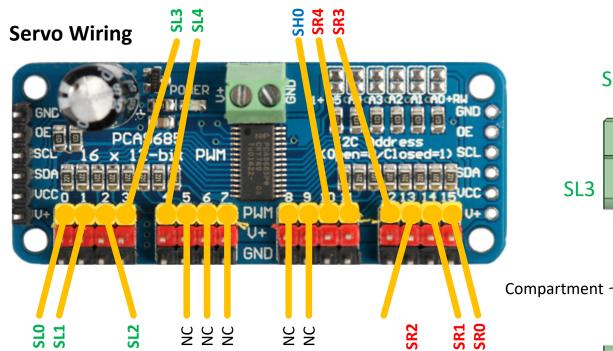










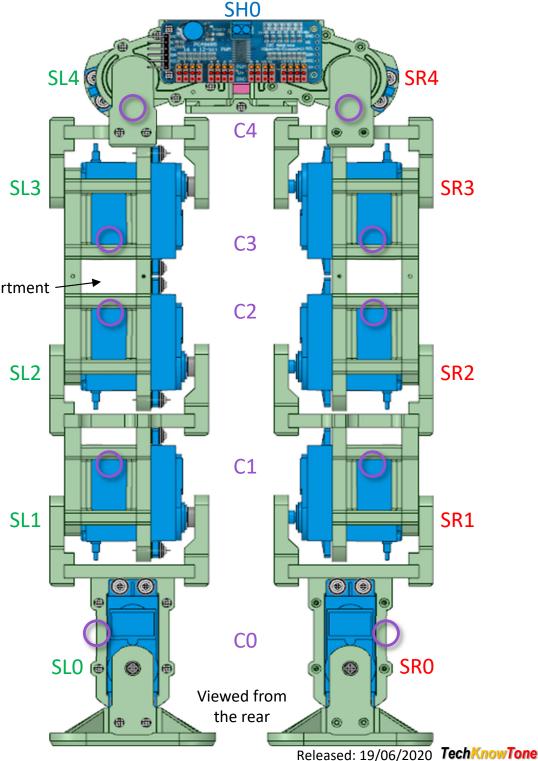


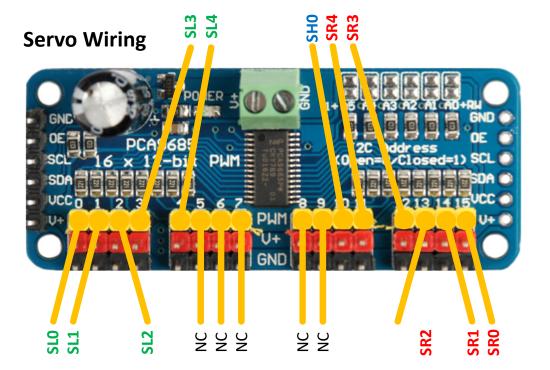
#### Wiring order:

- 1. Fit the front compartment covers.
- 2. Place the robot face down on a flat surface.
- 3. Pass SLO lead through the 3 clips (C0,C1,C2) before attaching the 100mm extension cable. Then pass that lead through clip C4. Then pass SL1 through the 4 clips (C1,C2,C3.C4). Manipulate the left foot and knee joint to pull SLO lead to its maximum extension. Now tie SLO to SL1 between clips C1 and C2.
- 4. Pass SL2 leader through the 3 top clips (C2,C3,C4). Bend the knee joint with the foot as far forward as possible to pull on the leads, then tension SL2 before applying cable ties.
- 5. Bring the SL3 lead down through clip C3, loop it into the compartment and then back through clips C3 and C4. The compartment acts as a space within which spare cable length can be gathered and hidden from view.
- 6. Lead SL4 will pass over the servo and under the body to the top centre, then out through the back of the body to connect to the driver board from above.
- 7. Repeat these steps for the right-hand side servos SRO to SR4.

Also view the photo on the following slide

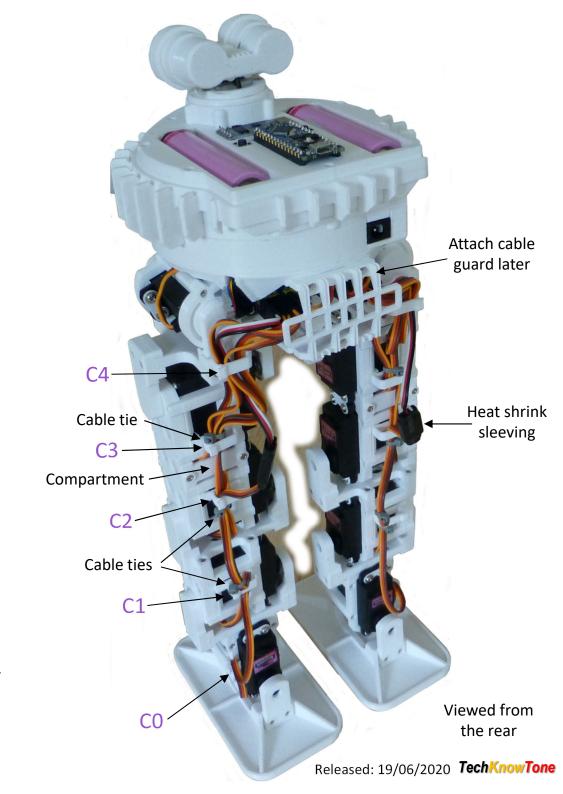




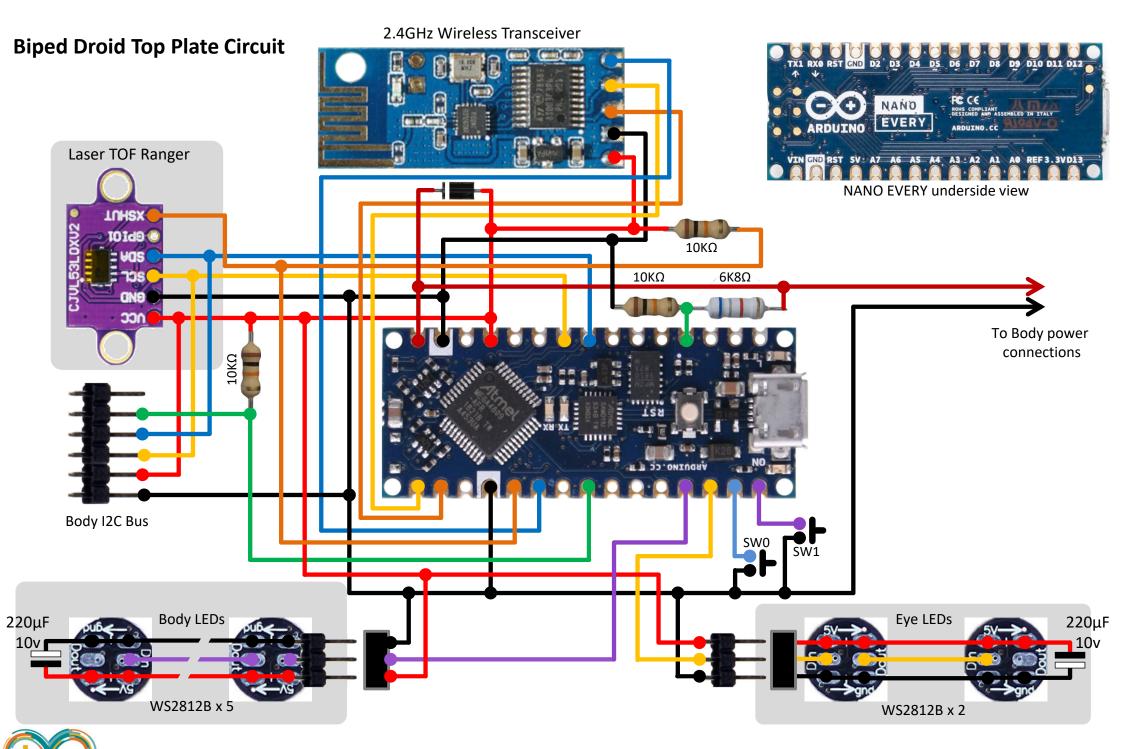


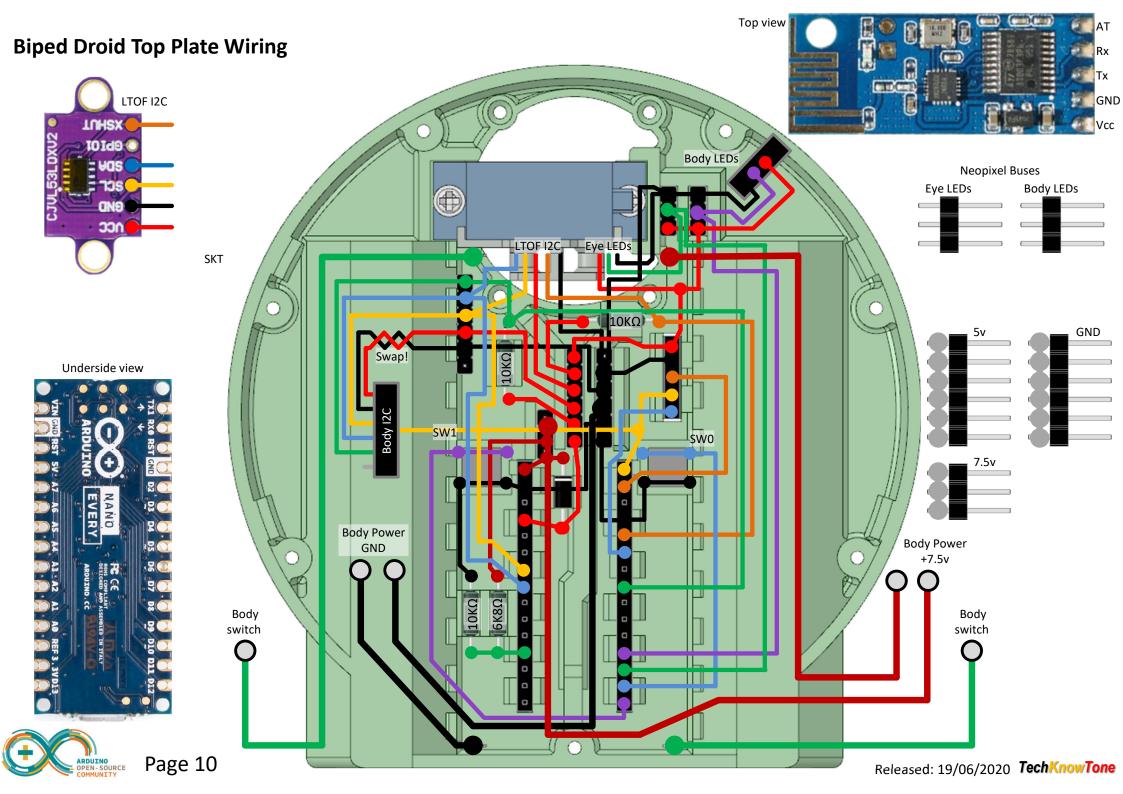
#### Wiring order repeated:

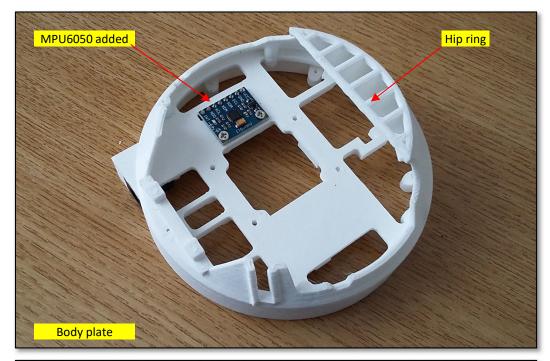
- 1. Place the robot face down on a flat surface.
- 2. Pass SLO lead through the 3 clips (C0,C1,C2) before attaching the 100mm extension cable. Then pass that lead through clip C4. Then pass SL1 through the 4 clips (C1,C2,C3.C4). Manipulate the left foot and knee joint to pull SLO lead to its maximum extension. Now tie SLO to SL1 between clips C1 and C2.
- 3. Pass SL2 leader through the 3 top clips (C2,C3,C4). Bend the knee joint with the foot as far forward as possible to pull on the leads, then tension SL2 before applying cable ties.
- 4. Bring the SL3 lead down through clip C3, loop it into the compartment and then back through clips C3 and C4. The compartment acts as a space within which spare cable length can be gathered and hidden from view.
- 5. Lead SL4 will pass over the servo and under the body to the top centre, then out through the back of the body to connect to the driver board from above.
- 6. Repeat these steps for the right-hand side servos SRO to SR4.
- 7. Fit the rear compartment covers to hide the excess cables once you are happy with the slack in the cables, when the legs are bent over.

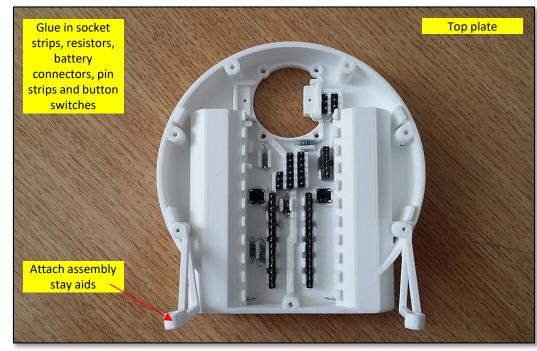


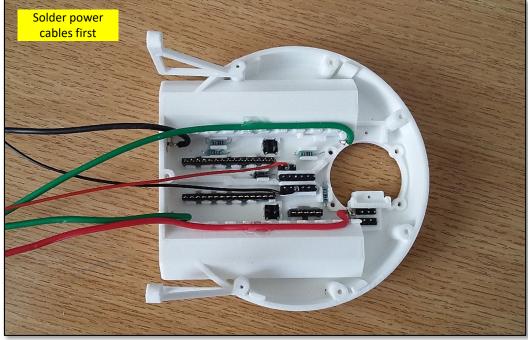


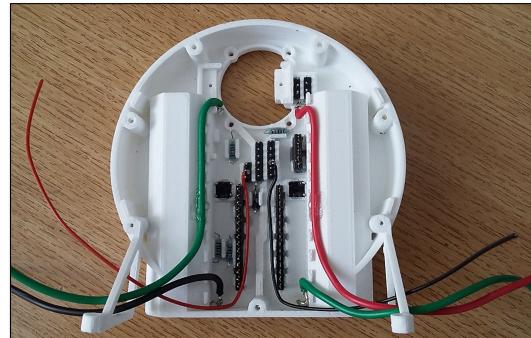




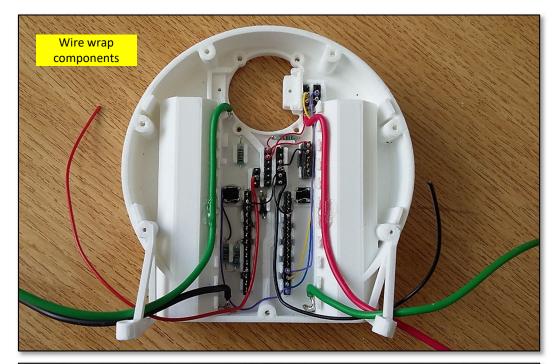


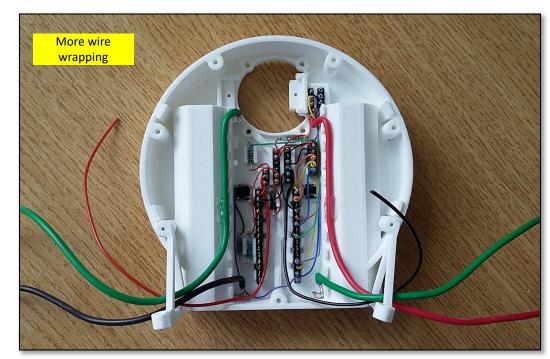


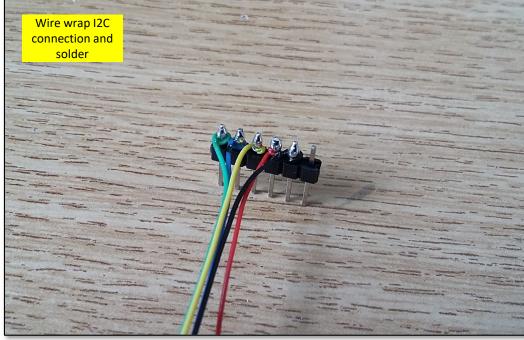


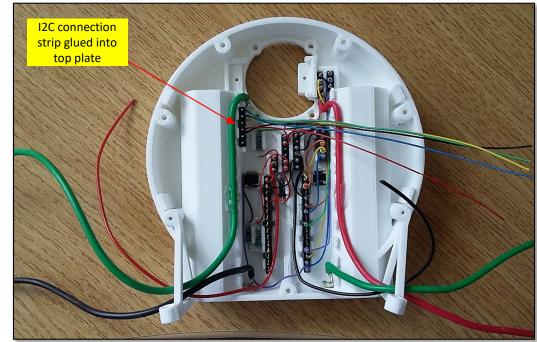




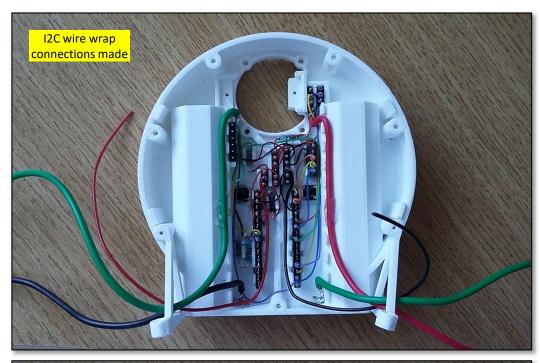


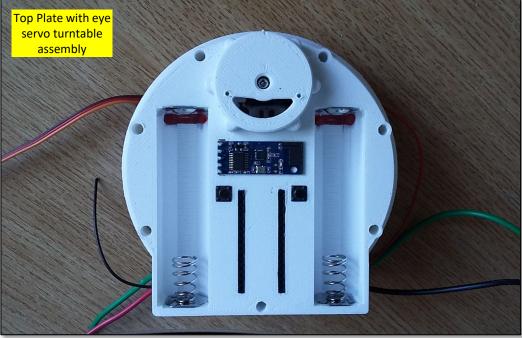


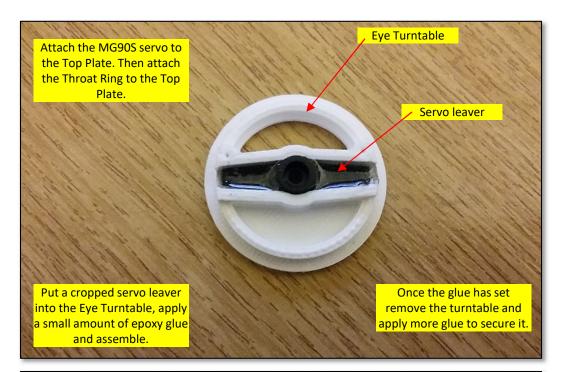








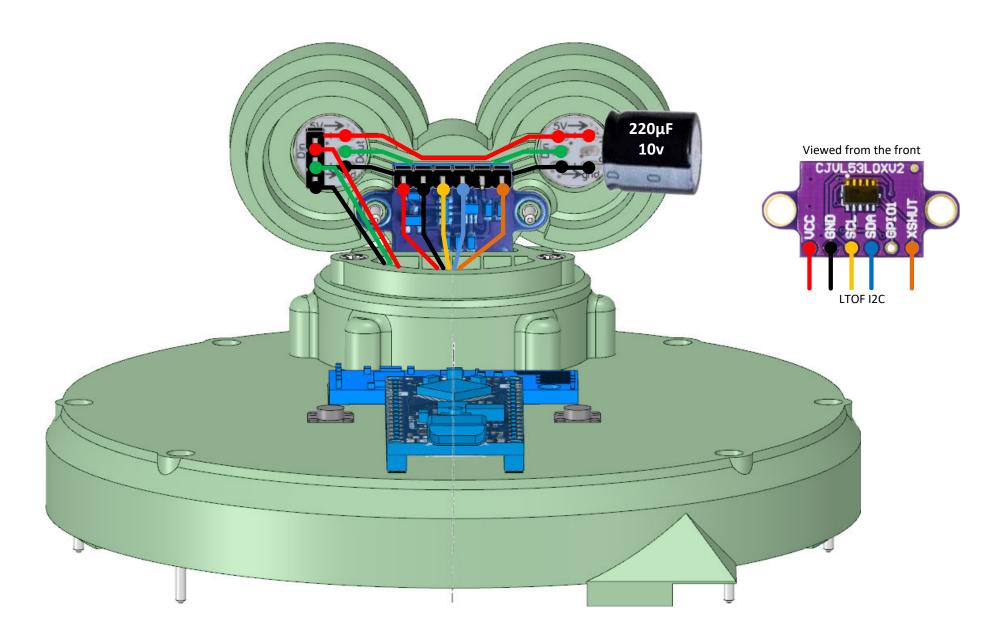




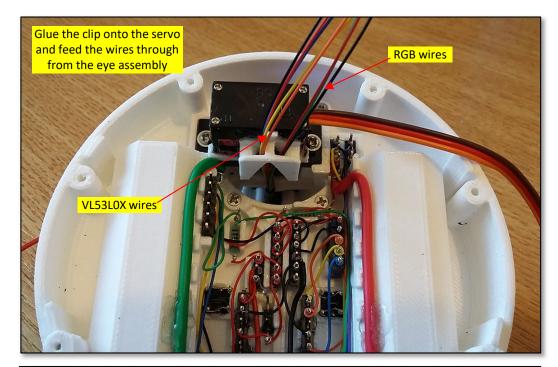


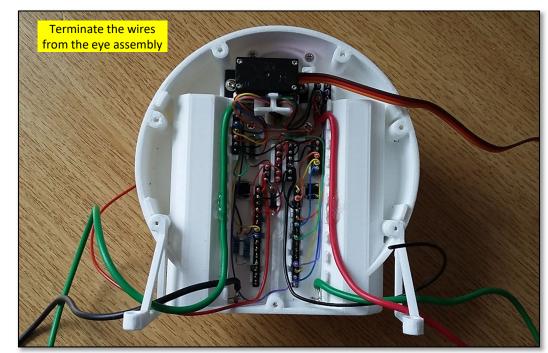


#### **Biped Droid Head Wiring**

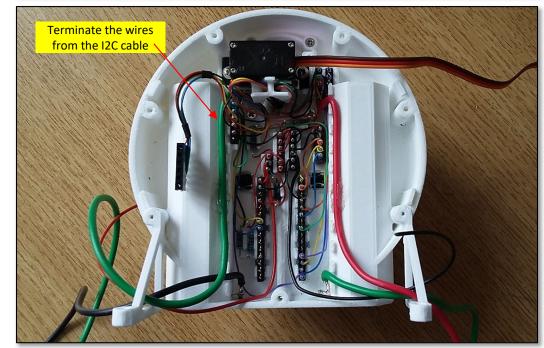




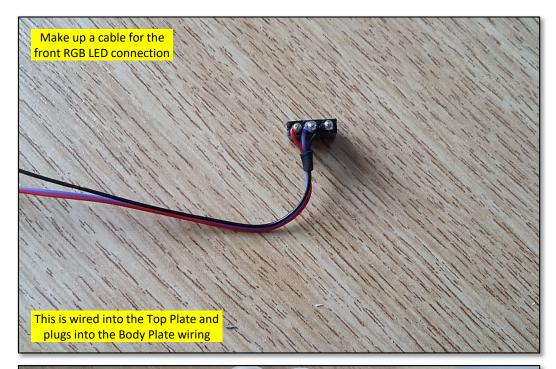


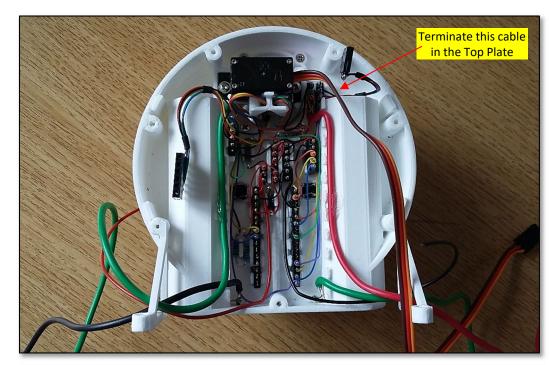


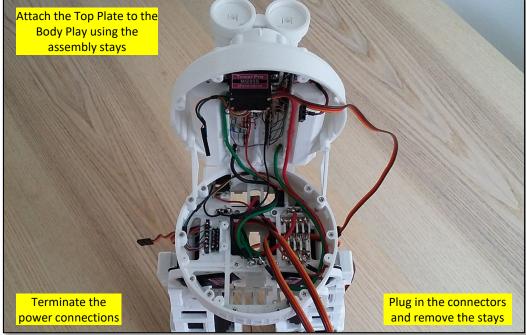


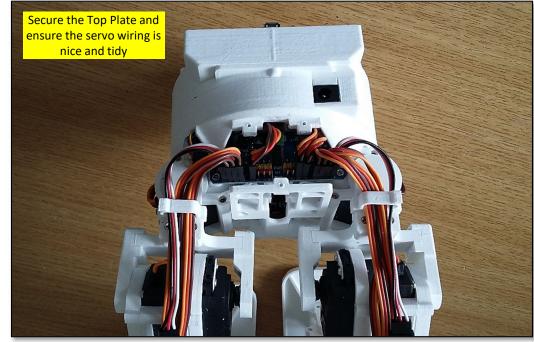






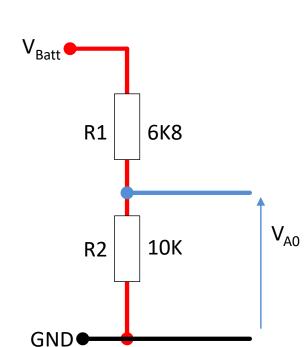








#### **Biped Droid Battery Monitor (Protection)**



$$V_{A0} = \frac{V_{Batt} \times R2}{R1 + R2}$$

$$V_{A0} = \frac{V_{Batt} \times 10 K}{16 K8}$$

$$V_{Batt} = V_{A0D} \times 5.0$$

$$608.9$$

$$V_{FSD} = 8.4v @ V_{A0} = 5v$$

Two cells in series gives a nominal 7.4v constant discharge voltage. To prevent damage, stop using once the following conditions are reached:

$$3.60 + 3.00 = 6.60v$$
 (one battery fades early)

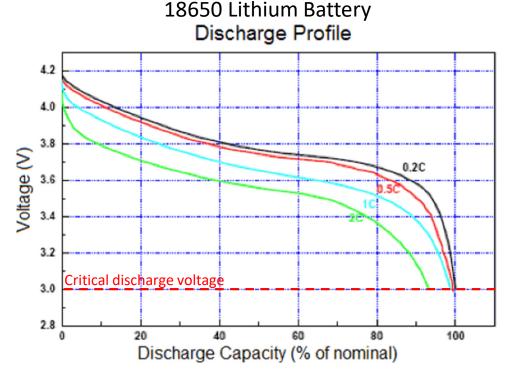
$$3.30 + 3.30 = 6.60v$$
 (both batteries fade together)

Hence 
$$V_{AOD} = 804 @ V_{Batt} = 6.60v$$

The code will shut down when the value drops to 804.

$$V_{AOD} = \frac{V_{AO} \times 1023}{5}$$
 voltage read by 10-bit ADC

$$V_{AOD} = \frac{V_{Batt} \times 0.5952 \times 1023}{5}$$



Discharge: 3.0V cutoff at room temperature.