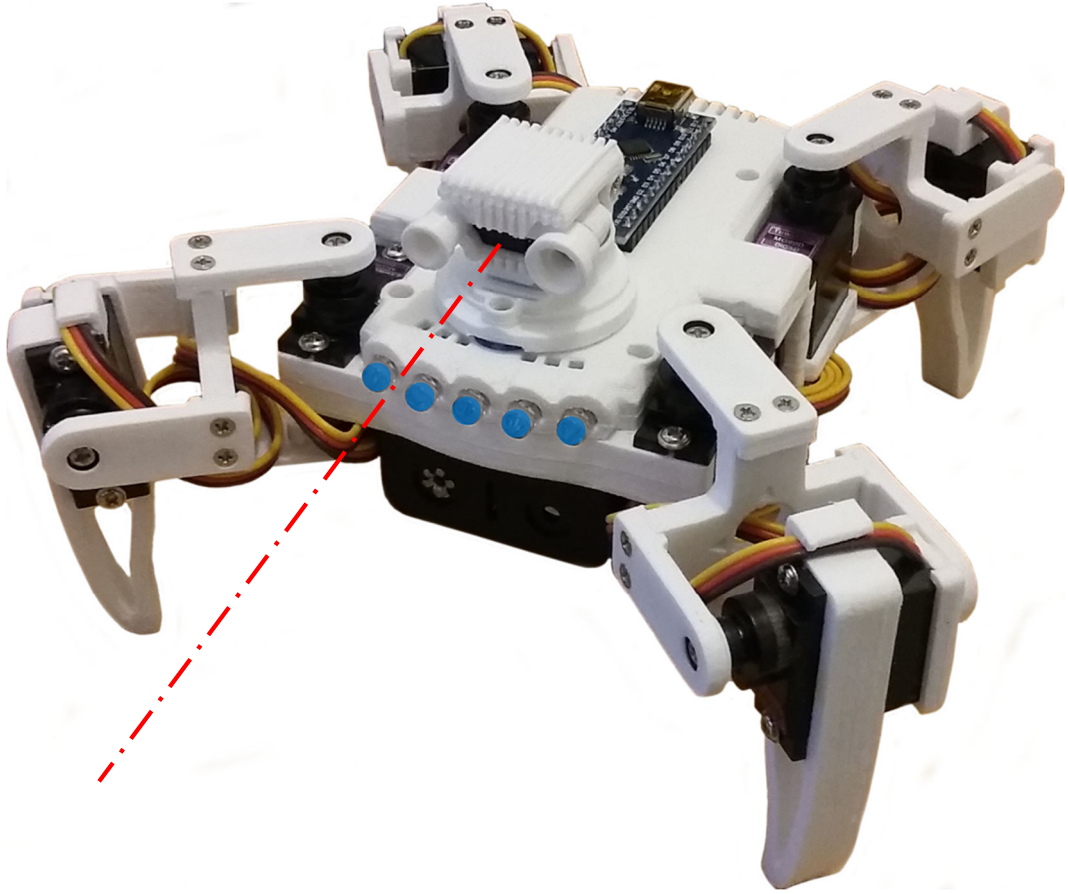
Autonomous Quadruped Robot

Wiring Diagrams



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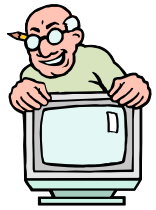
CAUTION



Lithium batteries can be extremely dangerous, if not handled and cared for properly. This design does not include any form of current limiting circuit, like a fuse. So, care must be taken to ensure that the wiring guidelines are followed accurately, that checks are made for short-circuits, and that battery polarities are marked, and they are inserted the correct way round. Failure to do so, could result in an explosive fire.

Charging Practices: Always remove batteries from your project to charge them. Use a charger, designed for the battery used, and from a trusted supplier. Choose a flat, non-flammable surface to charge on, away from flammable materials. Never leave unattended when charging. Don't charge overnight. Monitor charging to ensure charge characteristics are as expected. Only pair batteries with similar characteristics. Do not overcharge, or leave charging for prolonged periods. This increases the risk of damage and fire.

Battery care & maintenance: Stop using a battery if it is swollen, damaged, dented or leaking. Never charge a damaged battery. Never allow a Lithium battery to discharge below 3.2 volts, as cell damage will occur. Avoid extreme temperatures. Do not charge or store batteries in very hot or cold environments. Don't cover batteries whilst charging, as this can trap heat, causing overheating.

In case of fire: Get out and stay out. If a fire starts, leave immediately, and call the fire brigade. For low voltage Lithium batteries, water is a safe extinguisher.

Built-in Monitoring: Most of my project designs include code, and circuitry, to monitor battery voltage, whilst in use. This code then seeks to alert the operator, when the battery has reached a critical low voltage, before shutting down power consuming circuitry; including the micro. Time should therefore be spent on calibrating this feature, as a precaution, for good battery management and maintenance.

Carefully dispose of batteries that damaged, or discharged below their critical voltage.

Hand Tools:

Recommended:

- Fine nosed pliers
- Side cutters
- 1.5 mm Drill
- 2.0 mm Drill
- 4.0 mm Drill
- Needle files
- Screwdrivers
- Craft knife

Note: Not all items needed are shown here.

Some printed components act as aids and gauges. Use them.

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Tools & Materials:

Temperature controlled iron
Solder flux
Resin cored solder
Hot melt glue gun {optional)
2-part epoxy resin glue
Screw drivers
Tweezers
Wire wrapping tool
Wire wrapping wire 30 AWG
24 AWG stranded wire (red, black & yellow)
Multimeter

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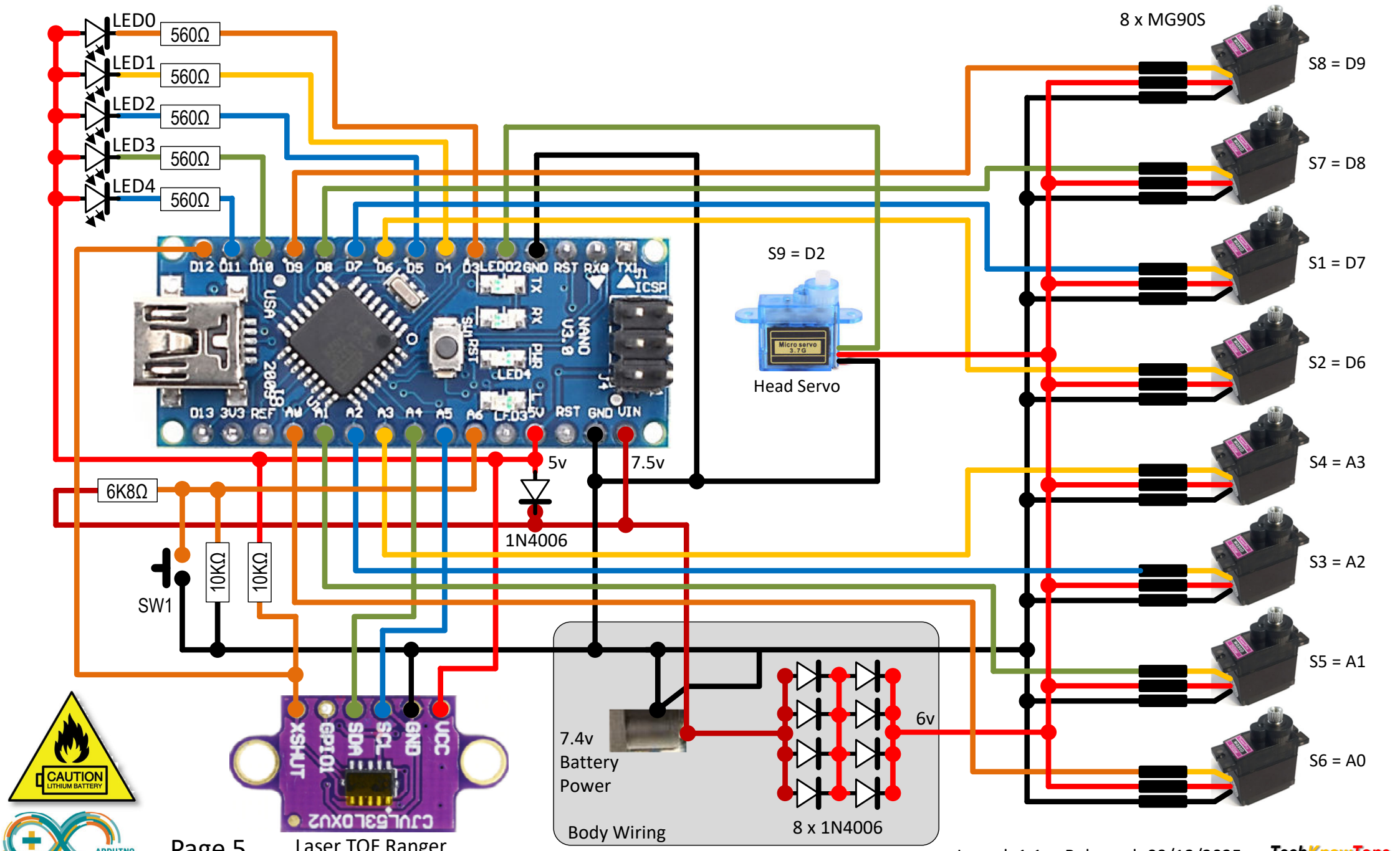
Quadruped 'Auto' – Wiring Plan



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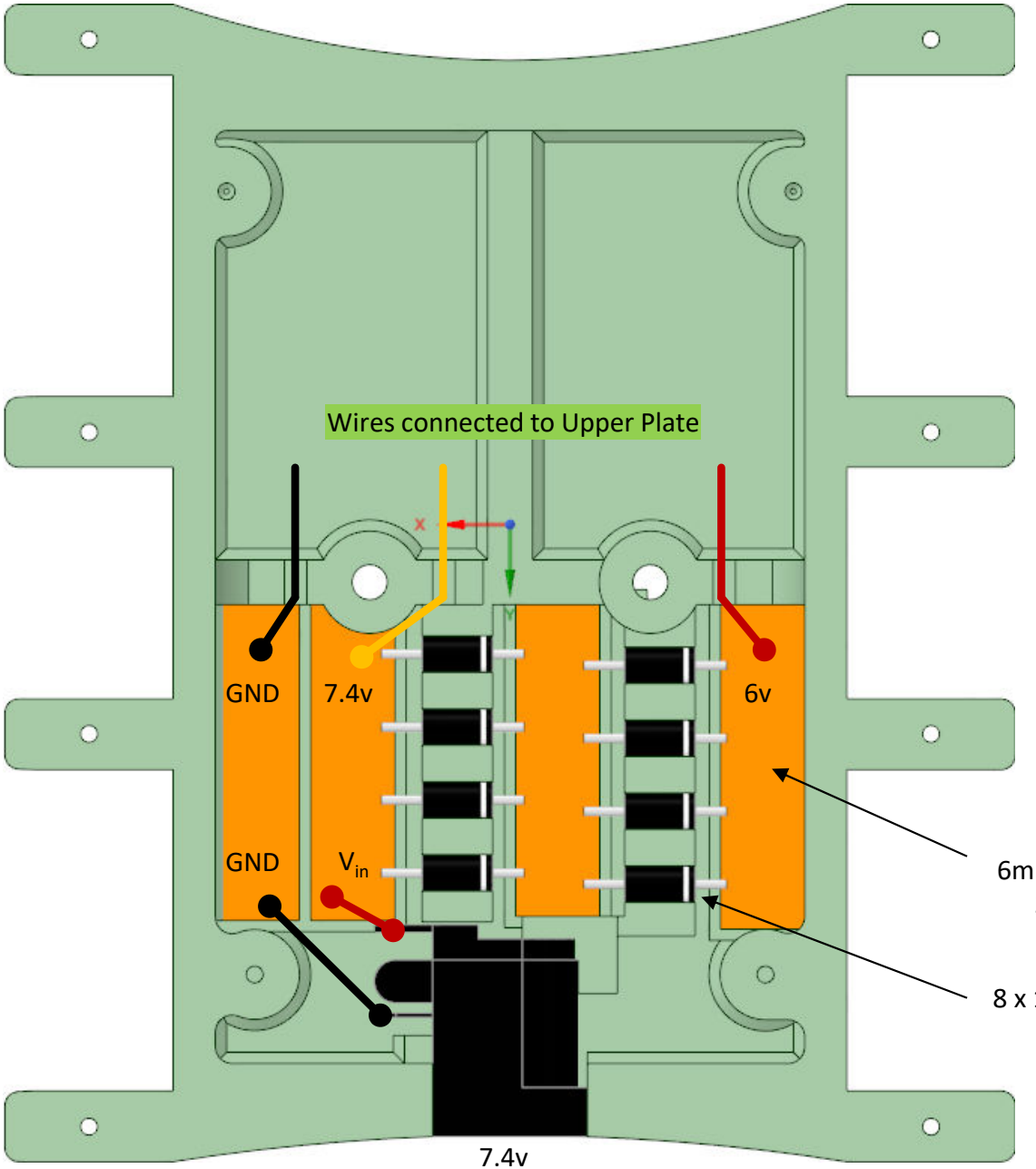
Quadruped ‘Auto’ - Body Wiring Plan



Viewed from above.

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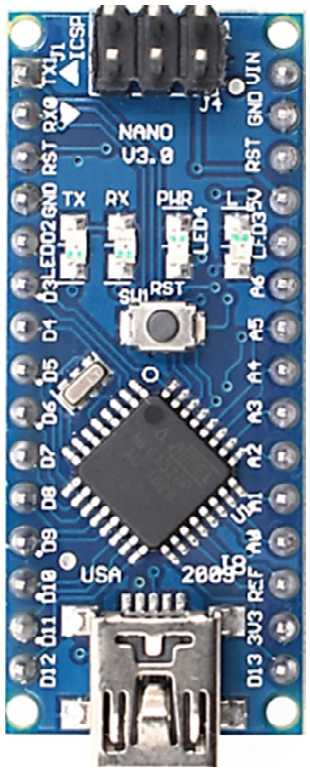
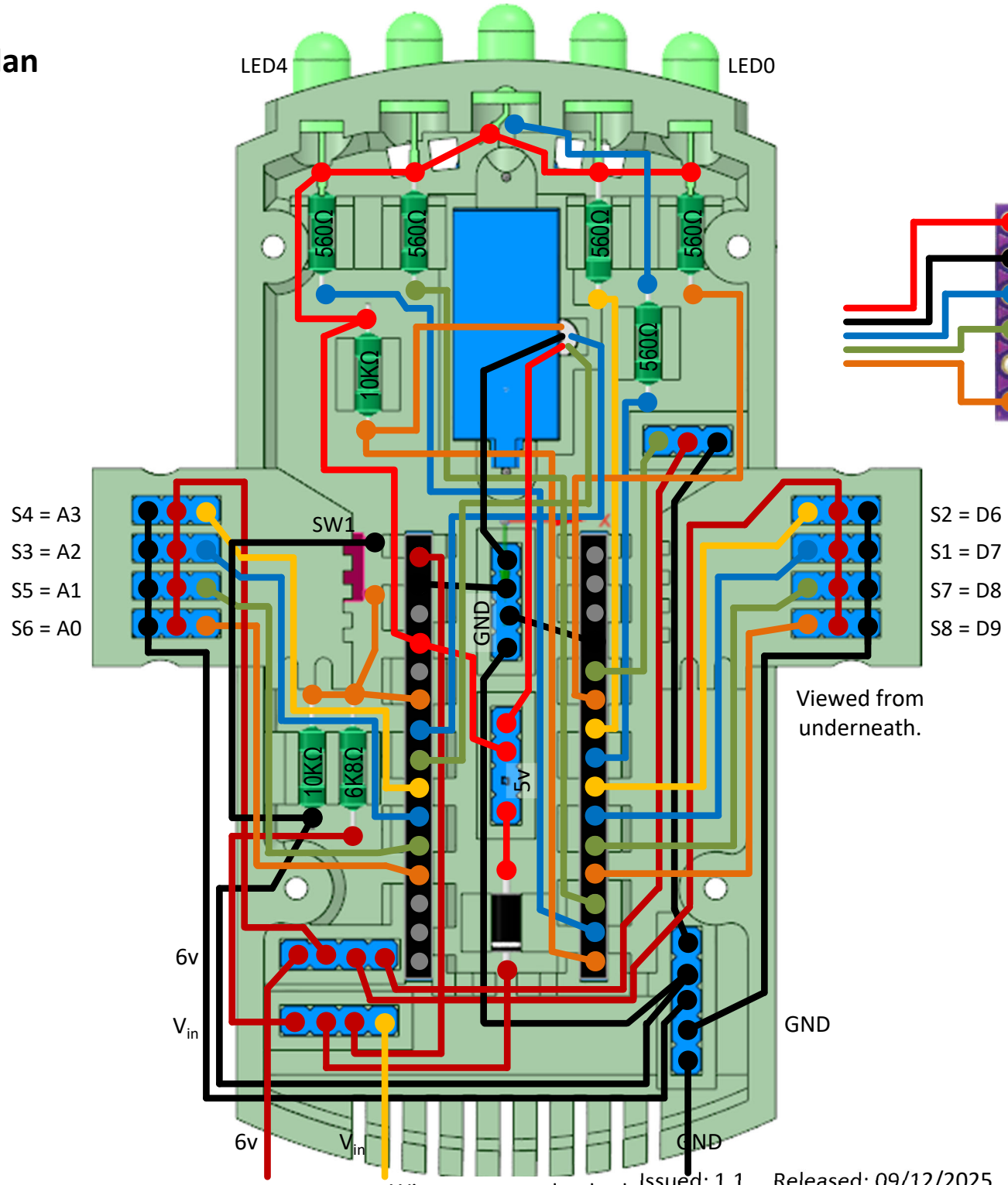
Quadruped ‘Auto’ Cover Wiring Plan

Top View



Underside View

VIN	TX1
GND	RX0
RST	RST
5V	GND
LED3	LED2
A6	D3
A5	D4
A4	D5
A3	D6
A2	D7
A1	D8
A0	D9
REF	D10
3V3	D11
D13	D12



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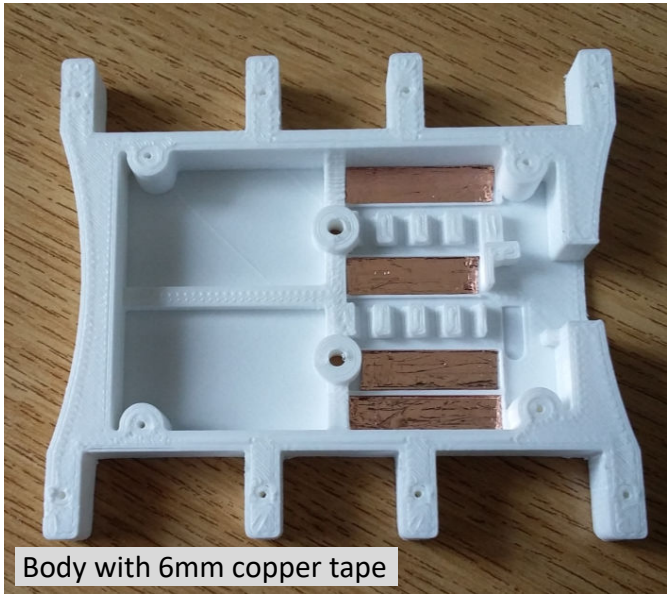
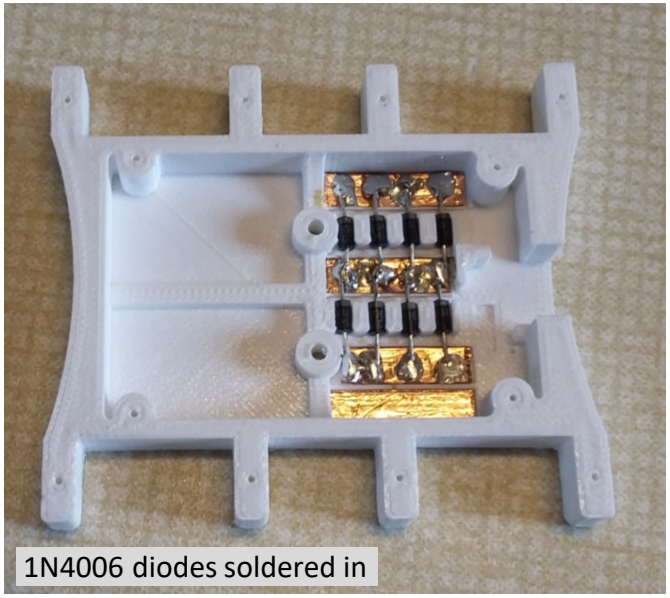
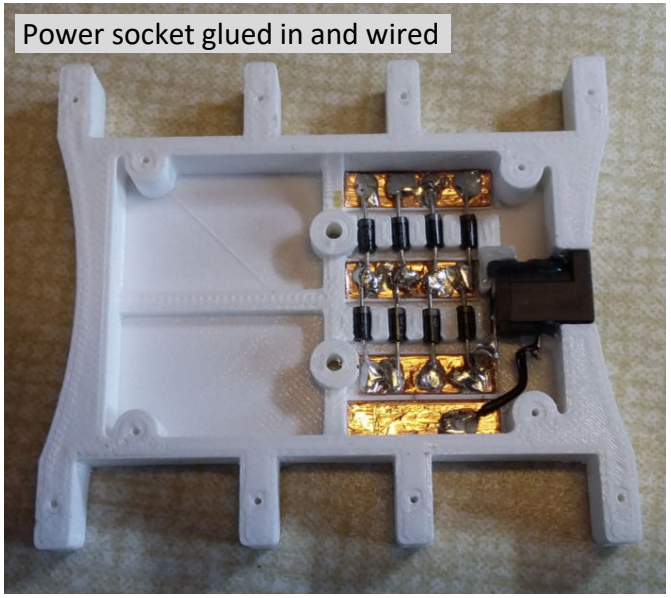


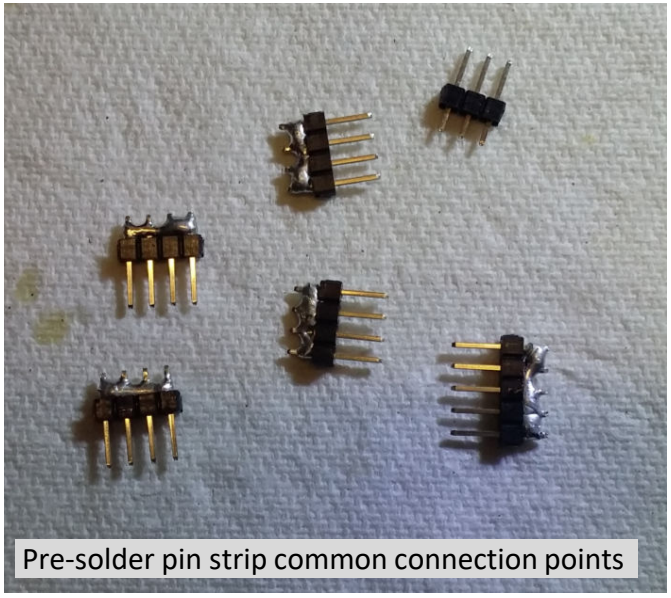
Body with 6mm copper tape



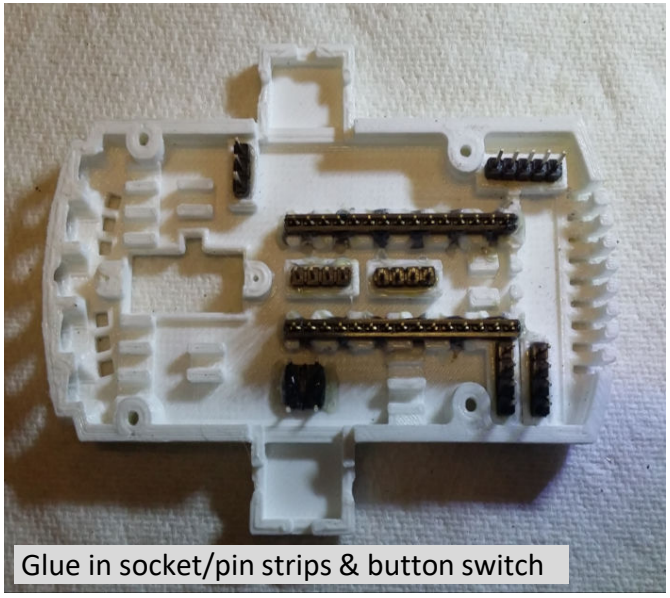
1N4006 diodes soldered in



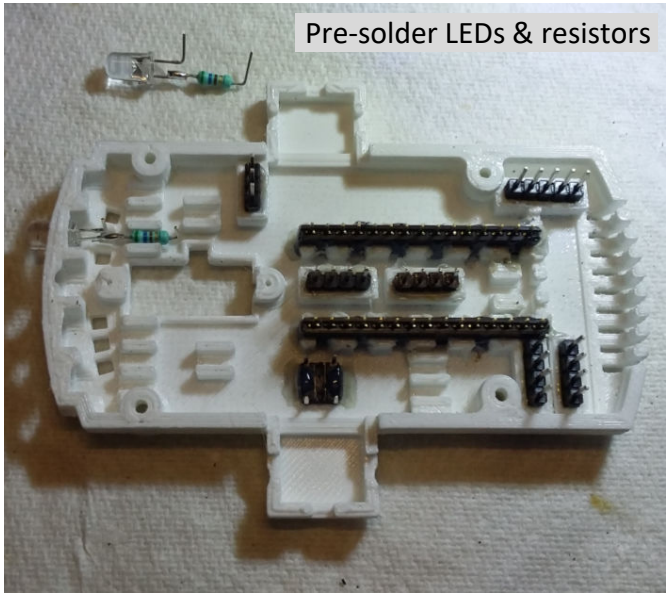
Power socket glued in and wired



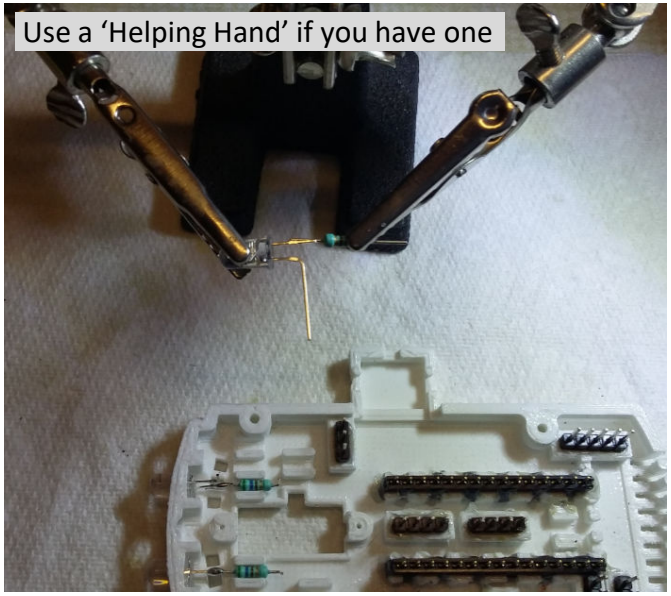
Pre-solder pin strip common connection points

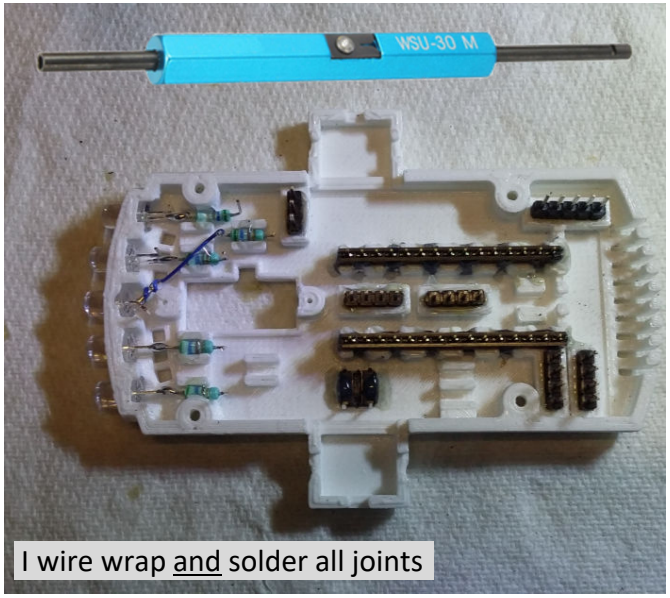


Glue in socket/pin strips & button switch

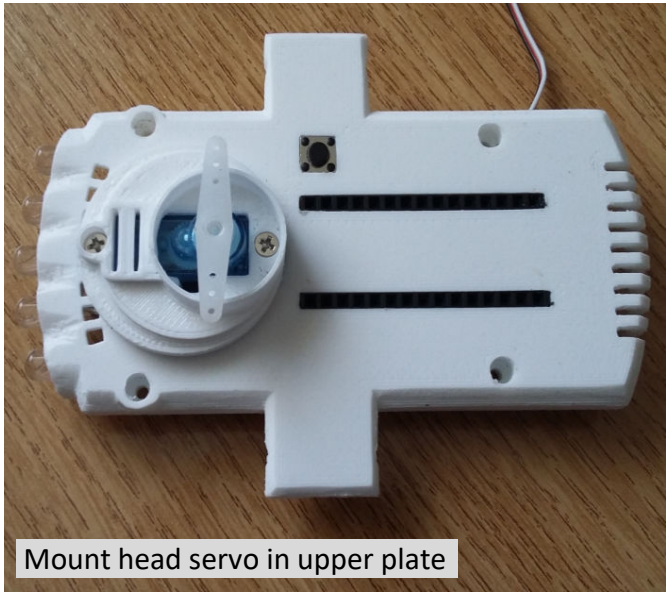


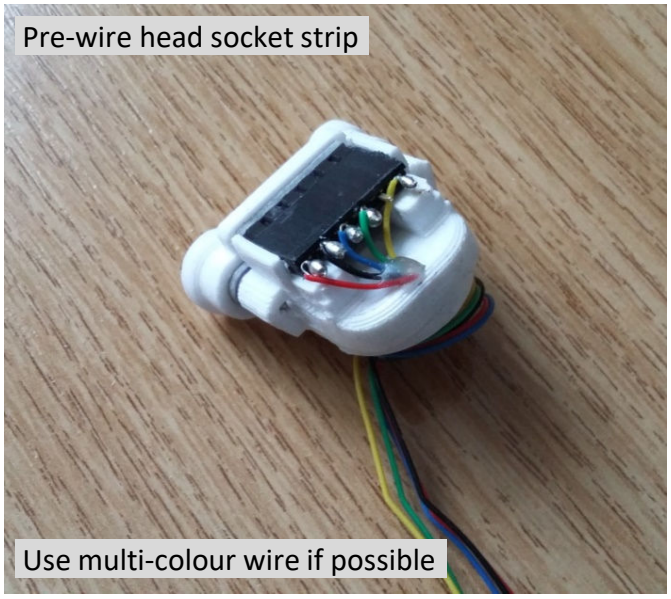
Pre-solder LEDs & resistors


Use a ‘Helping Hand’ if you have one

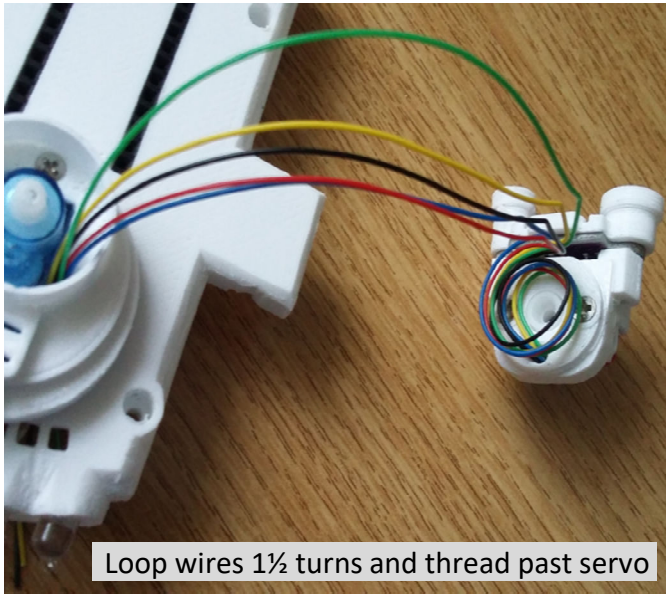


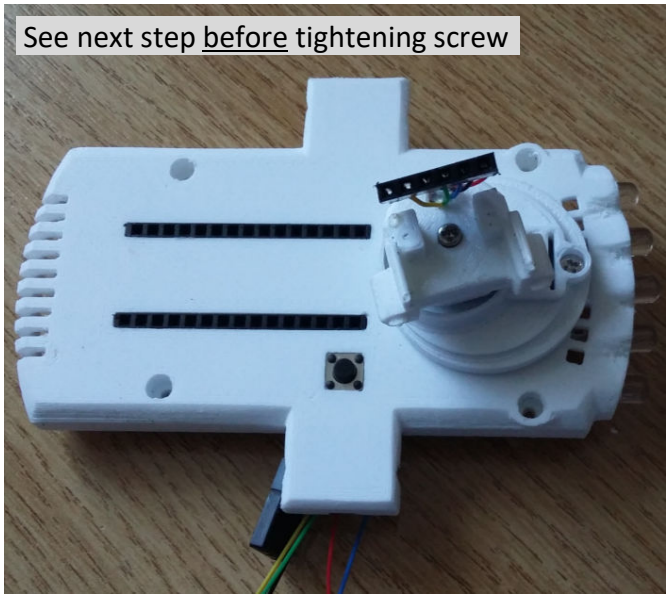
I wire wrap and solder all joints

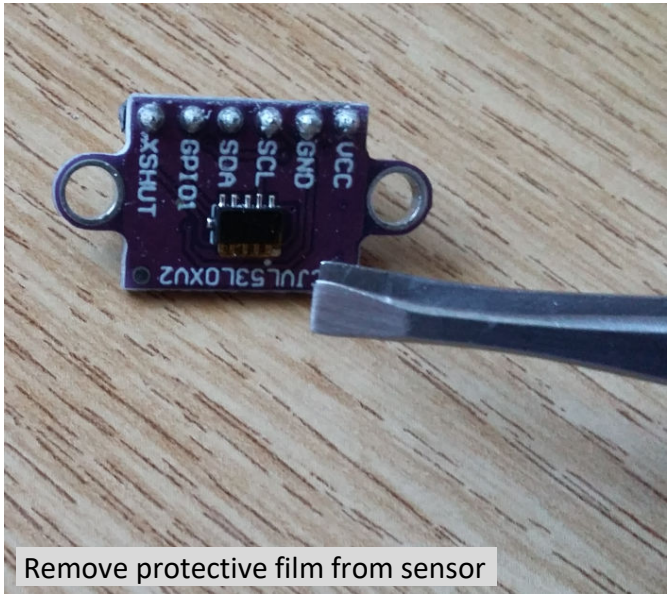

Mount head servo in upper plate


Pre-wire head socket strip

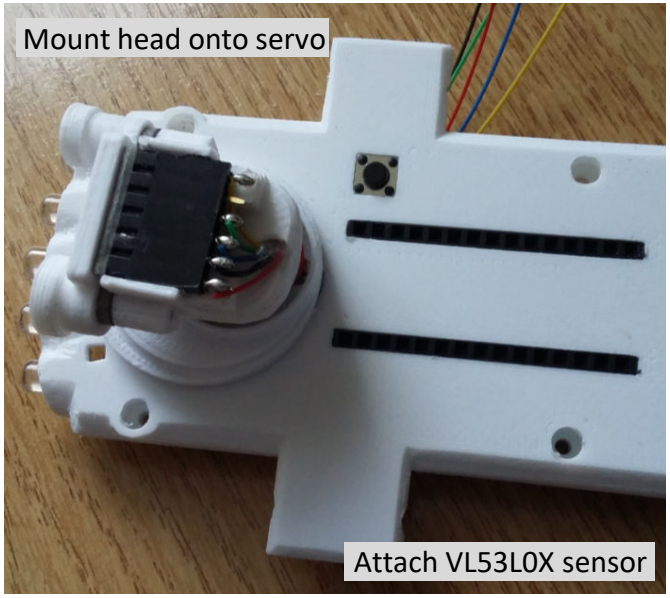
Use multi-colour wire if possible


Loop wires 1½ turns and thread past servo

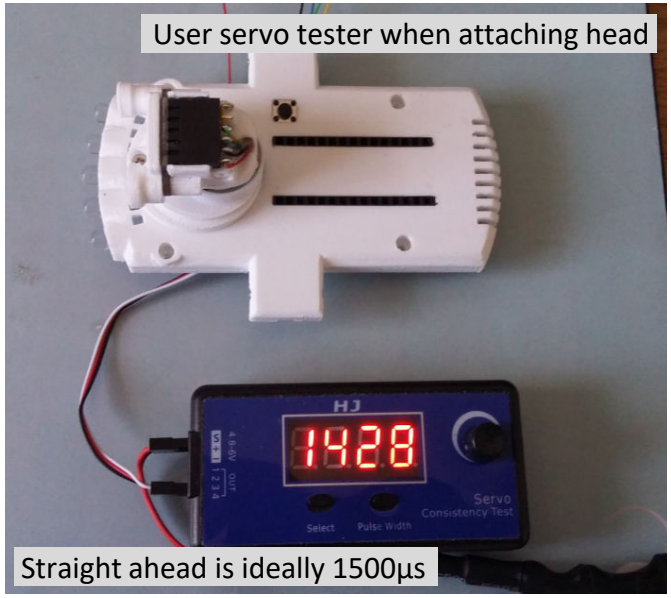

See next step before tightening screw



Remove protective film from sensor

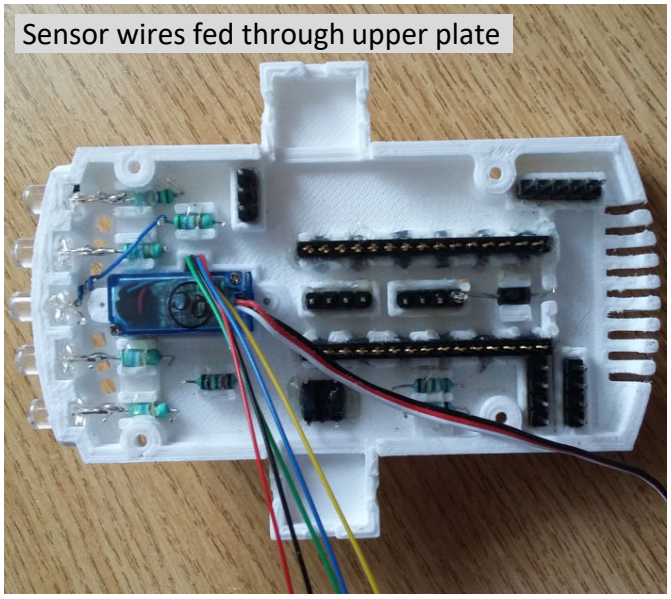

Mount head onto servo

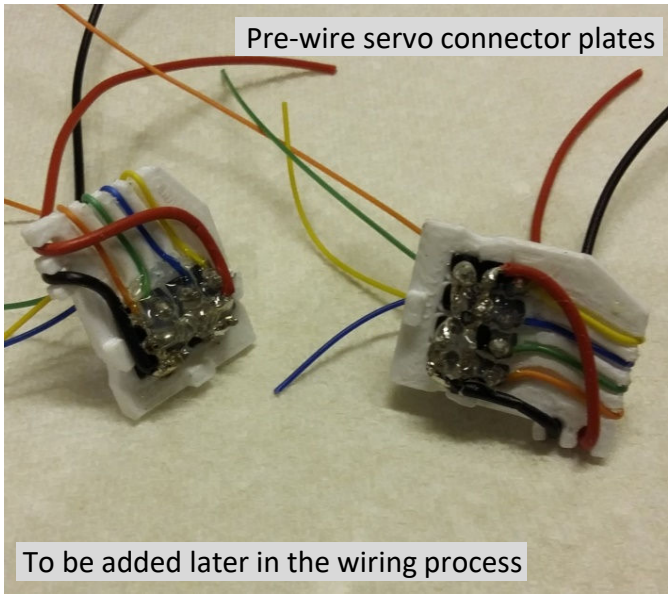
Attach VL53L0X sensor



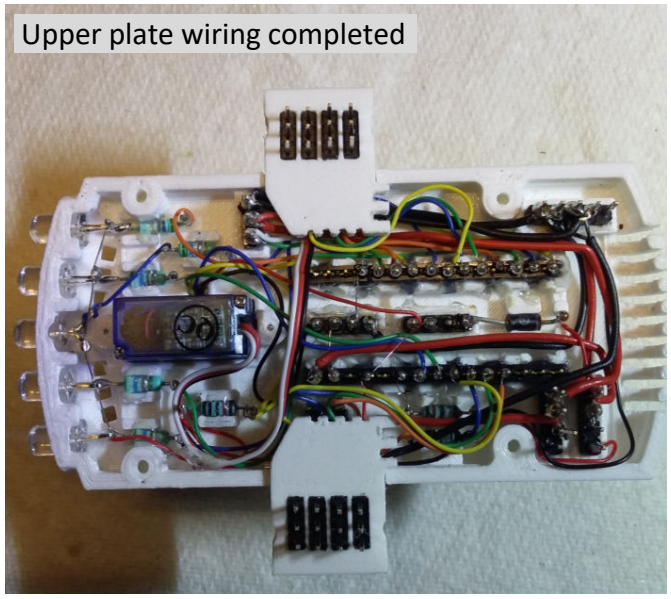
User servo tester when attaching head

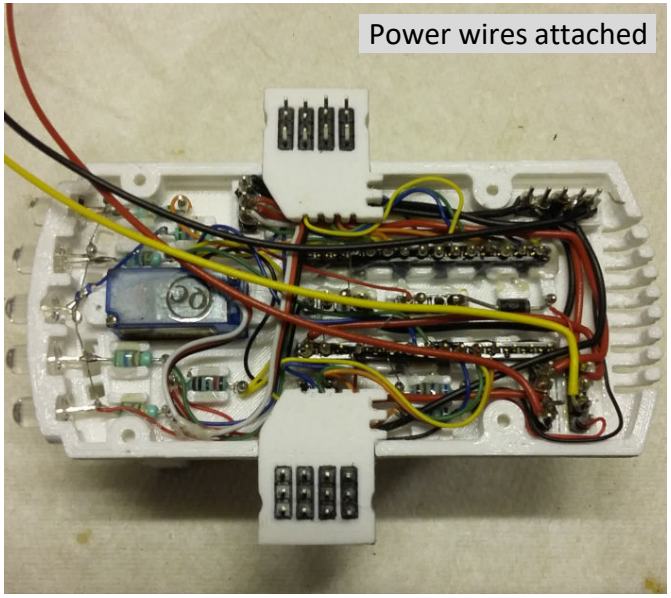
Straight ahead is ideally 1500µs

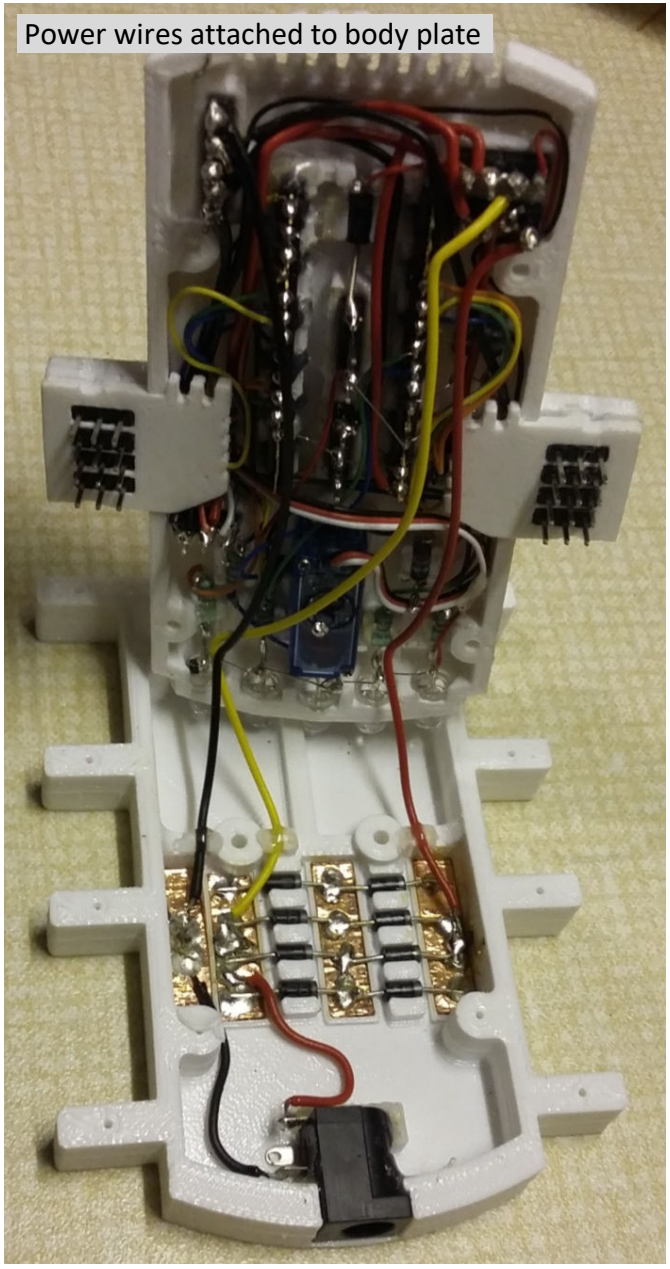

Sensor wires fed through upper plate

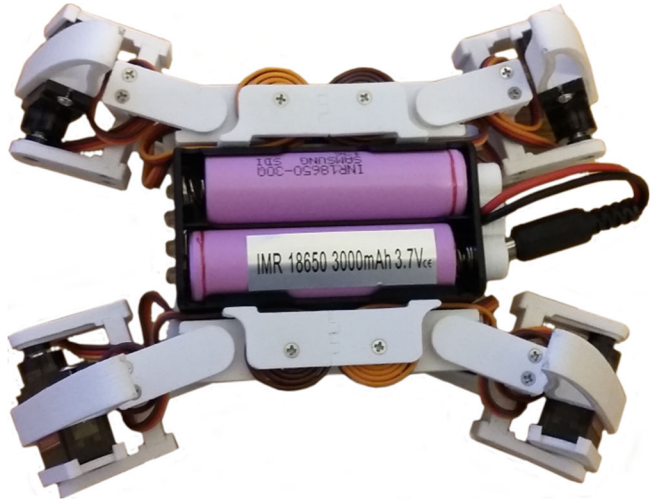

Pre-wire servo connector plates

To be added later in the wiring process

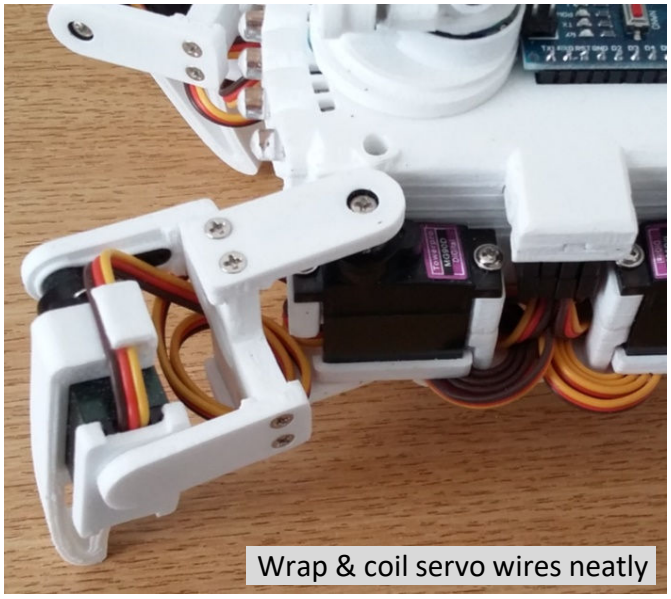

Upper plate wiring completed

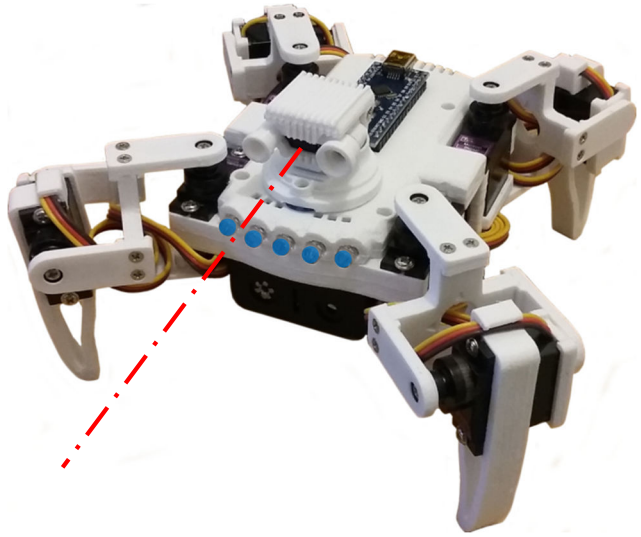

Power wires attached


Power wires attached to body plate



Cover plates protect wire coils


Wrap & coil servo wires neatly



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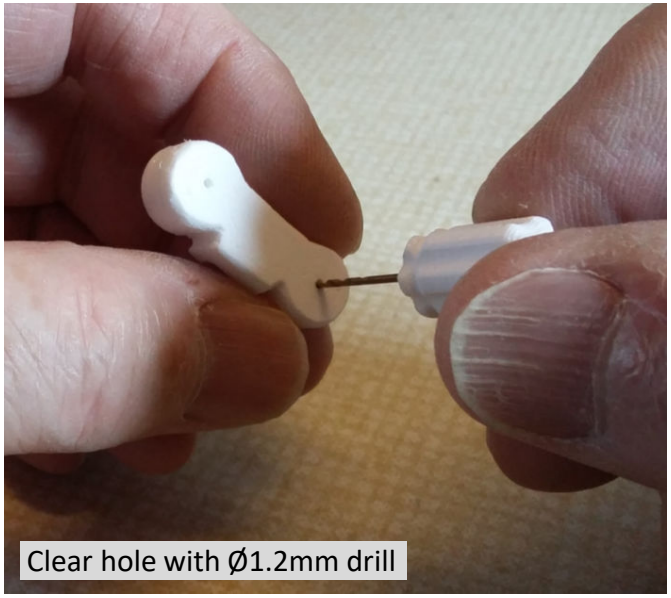
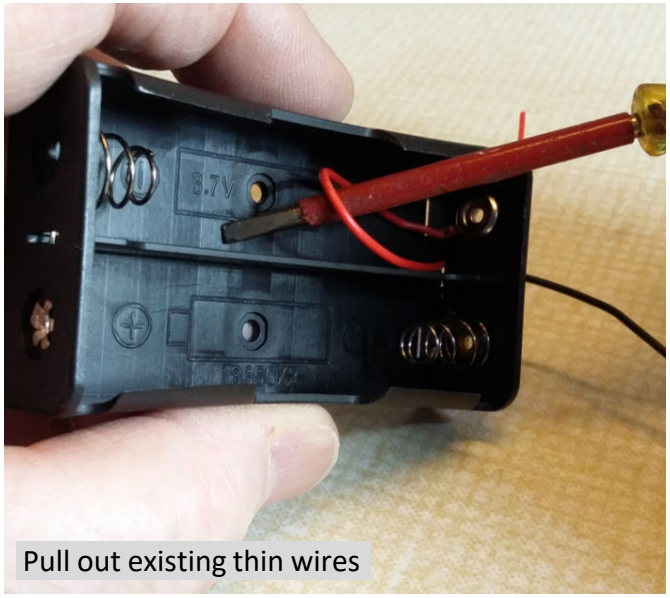
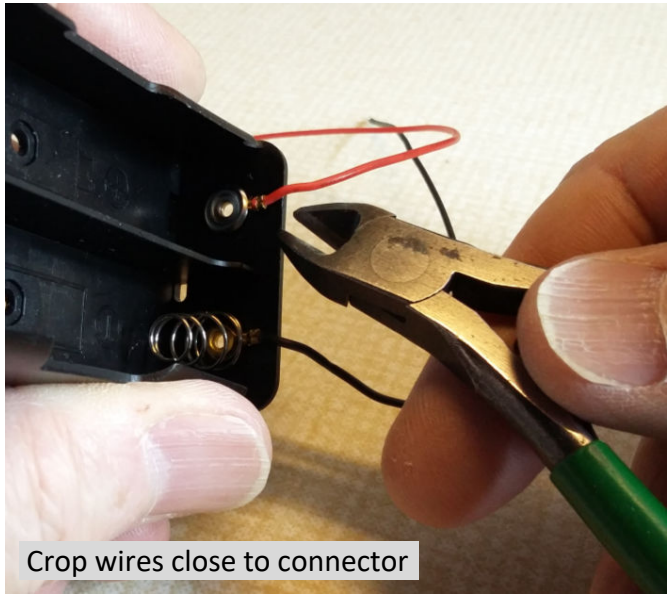


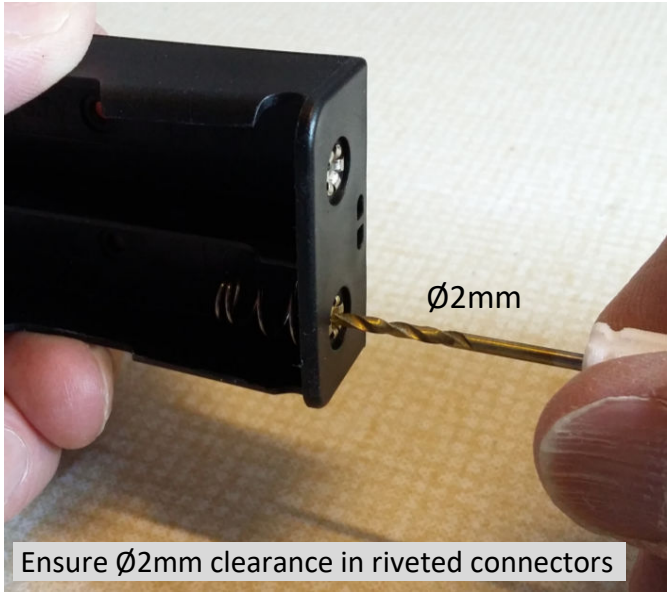
Clear hole with Ø1.2mm drill



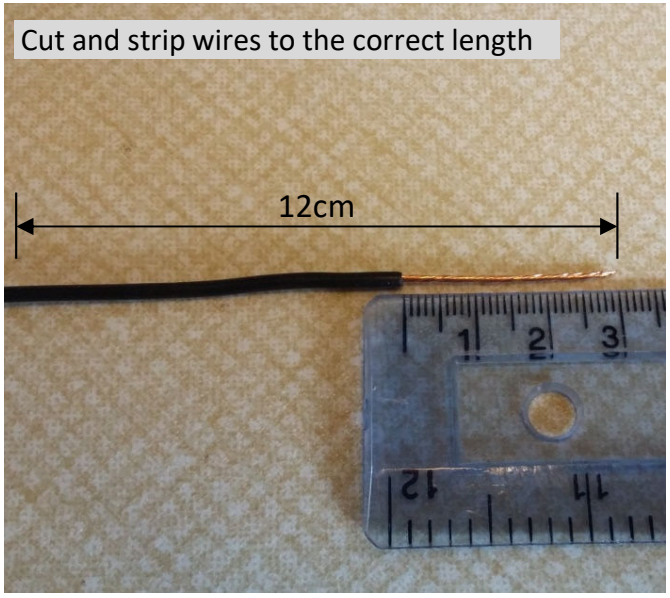
Pull out existing thin wires



Crop wires close to connector

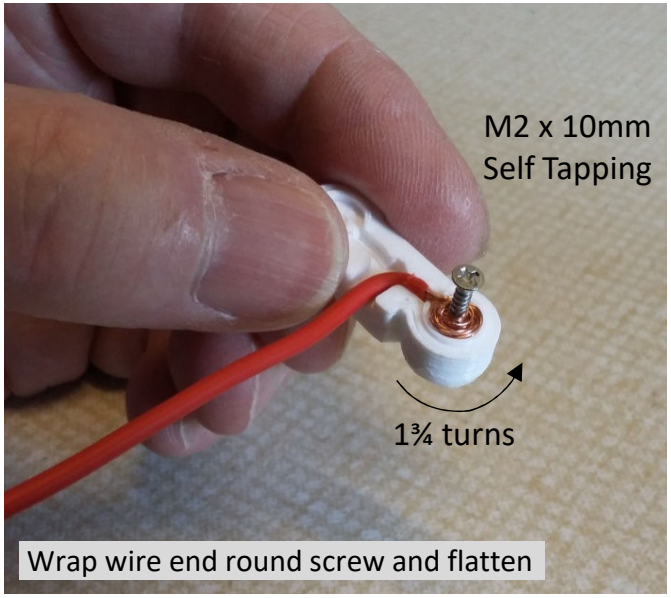


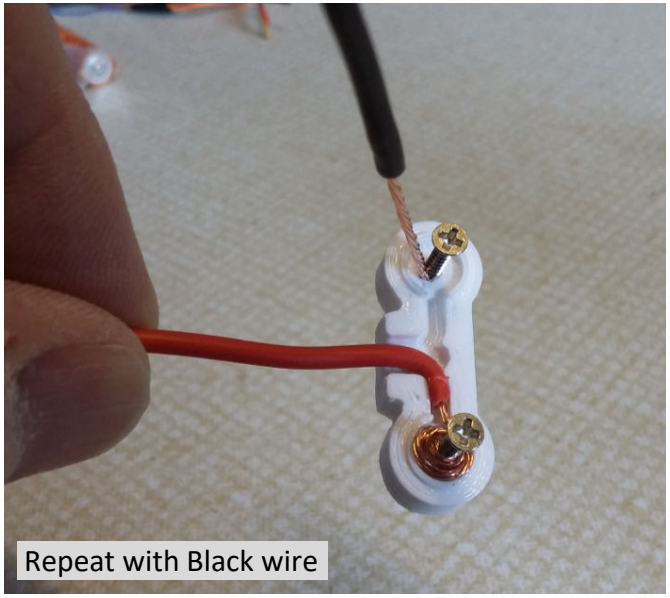
Ensure Ø2mm clearance in riveted connectors

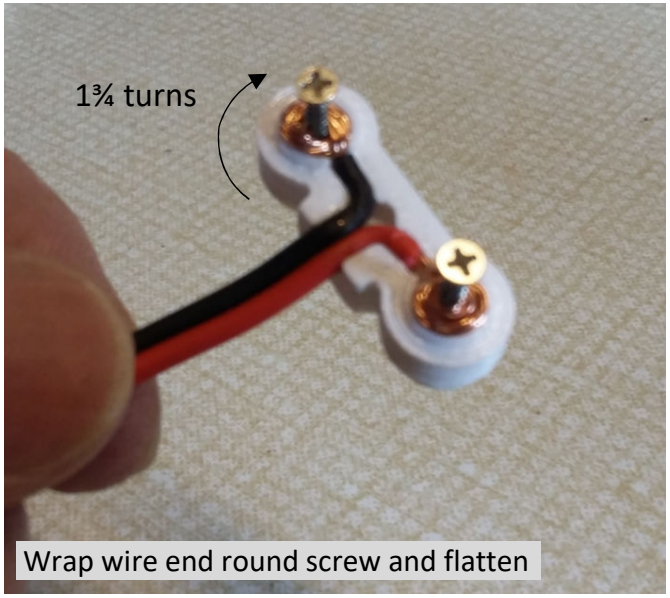


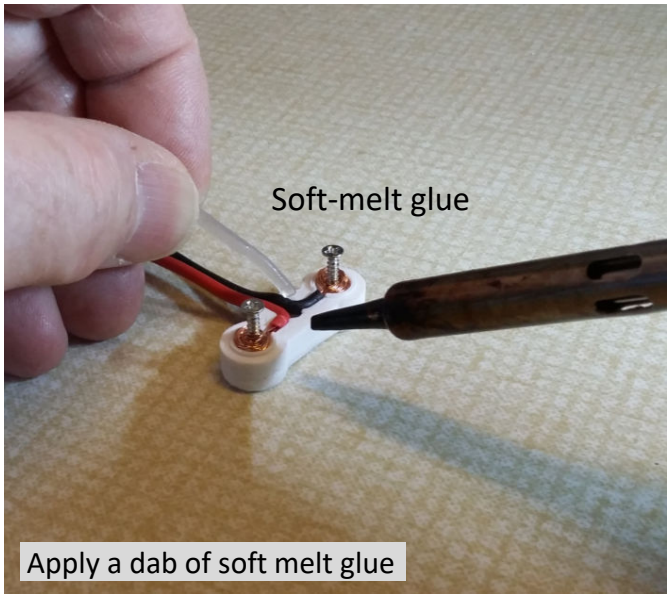
Cut and strip wires to the correct length

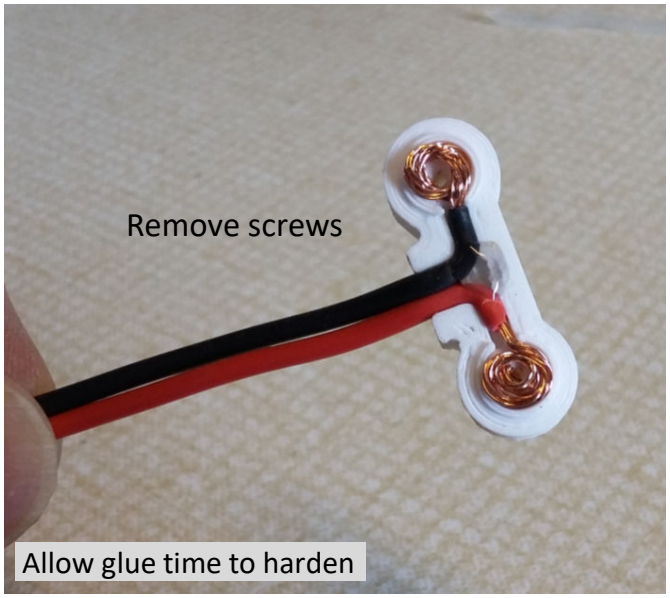
Trap wire end with Ø2mm screw

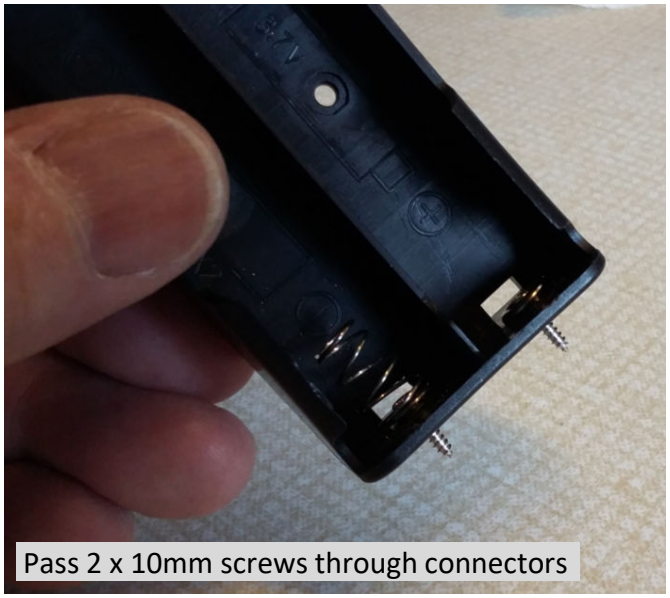

M2 x 10mm
Self Tapping
1¾ turns
Wrap wire end round screw and flatten

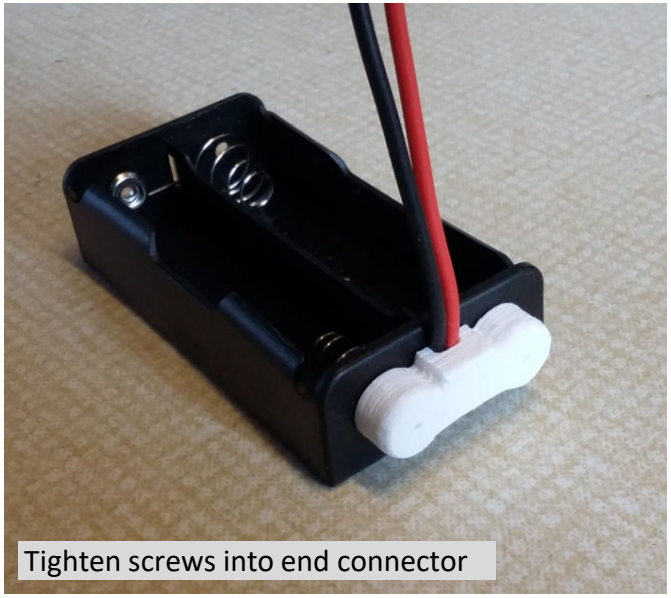

Repeat with Black wire


1¾ turns
Wrap wire end round screw and flatten

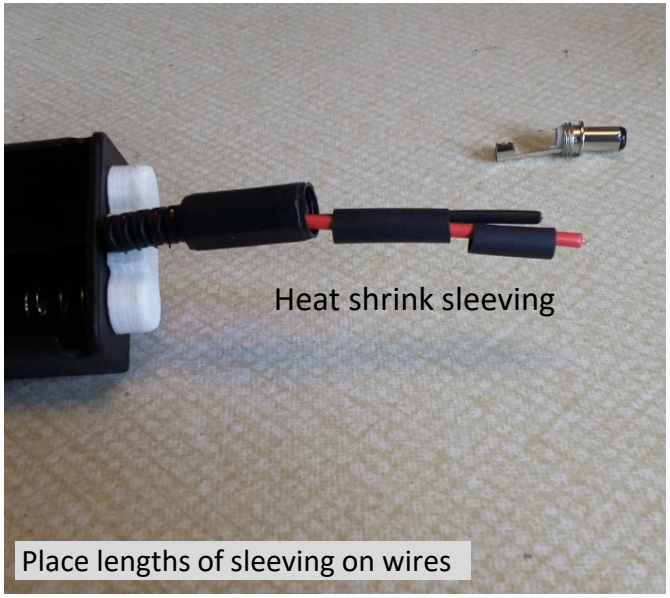

Soft-melt glue
Apply a dab of soft melt glue


Remove screws
Allow glue time to harden


Pass 2 x 10mm screws through connectors

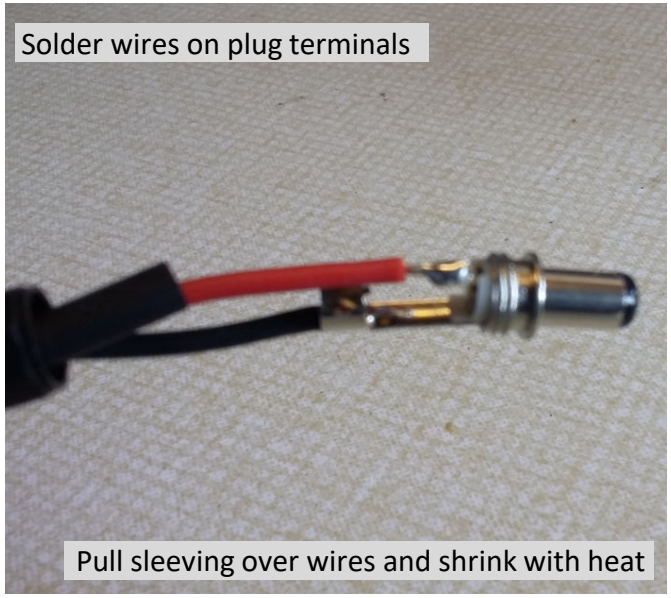


Tighten screws into end connector



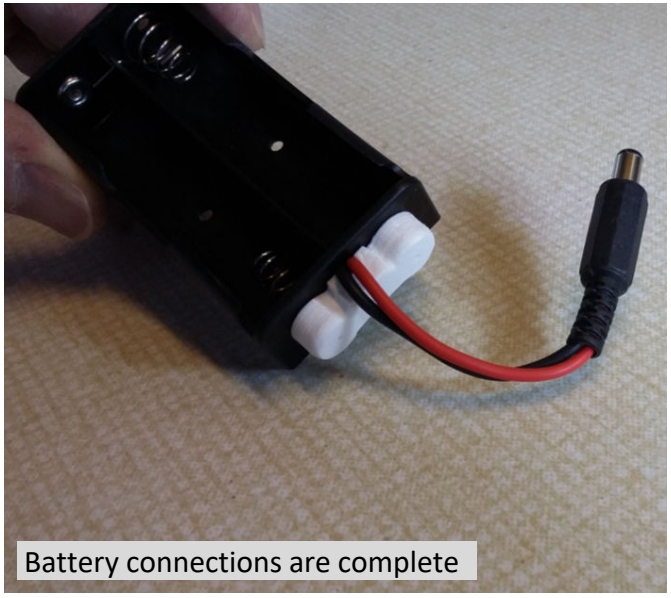
Heat shrink sleeving

Place lengths of sleeving on wires

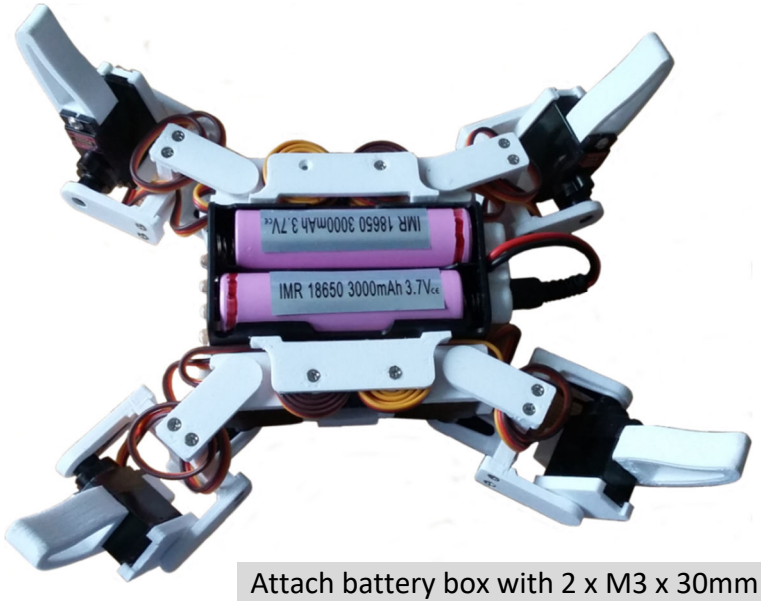


Solder wires on plug terminals

Pull sleeving over wires and shrink with heat

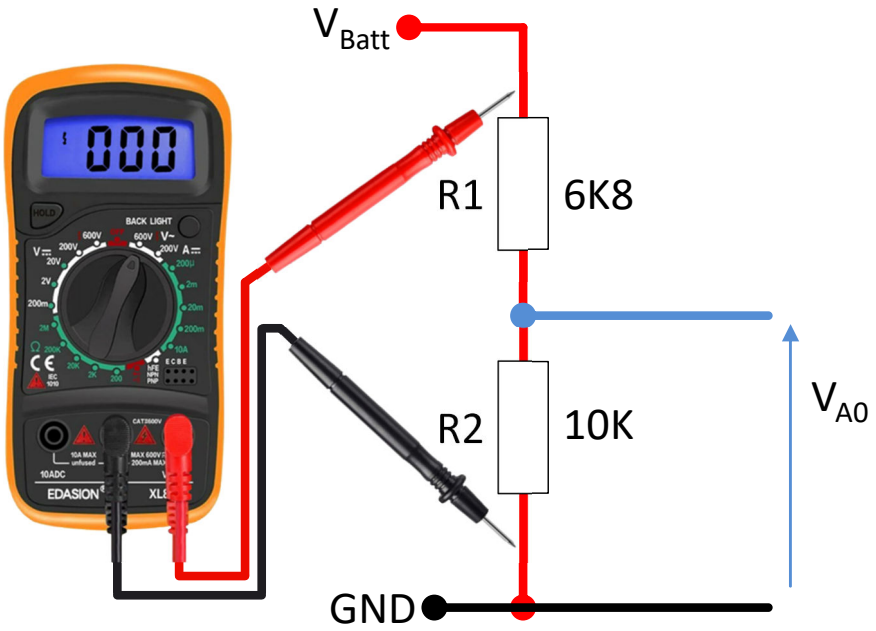


Battery connections are complete



Attach battery box with 2 x M3 x 30mm nylon screws

Quadruped Battery Monitor (Protection)



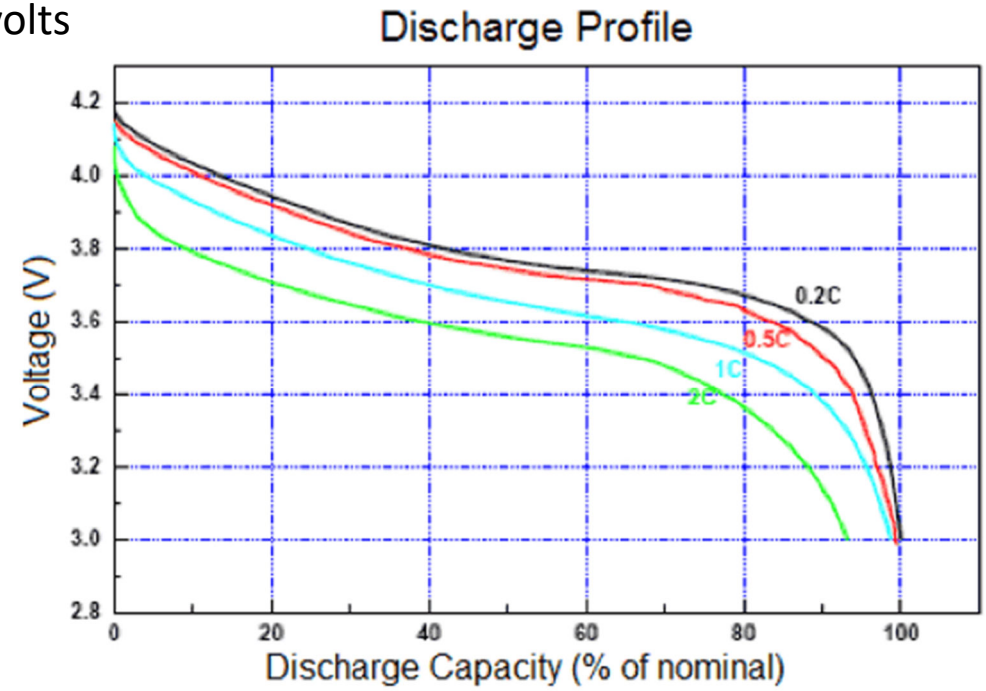
$$V_{A0} = \frac{V_{Batt} \times R2}{R1 + R2}$$

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

V_{FSD} = 8.4 volts

$$V_{A0D} = \frac{V_{A0} \times 1023}{5}$$

$$V_{A0D} = \frac{V_{Batt} \times 0.5952 \times 1023}{5}$$



Discharge: 3.0V cutoff at room temperature.

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

3.70 + 3.00 = 6.70v (one battery fades early)
3.30 + 3.30 = 6.70v (both batteries fade together)

Hence V_{A0D} = 804 @ V_{Batt} = 6.60v