CRUMBLE ROBOTIC VEHICLE©
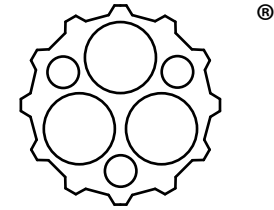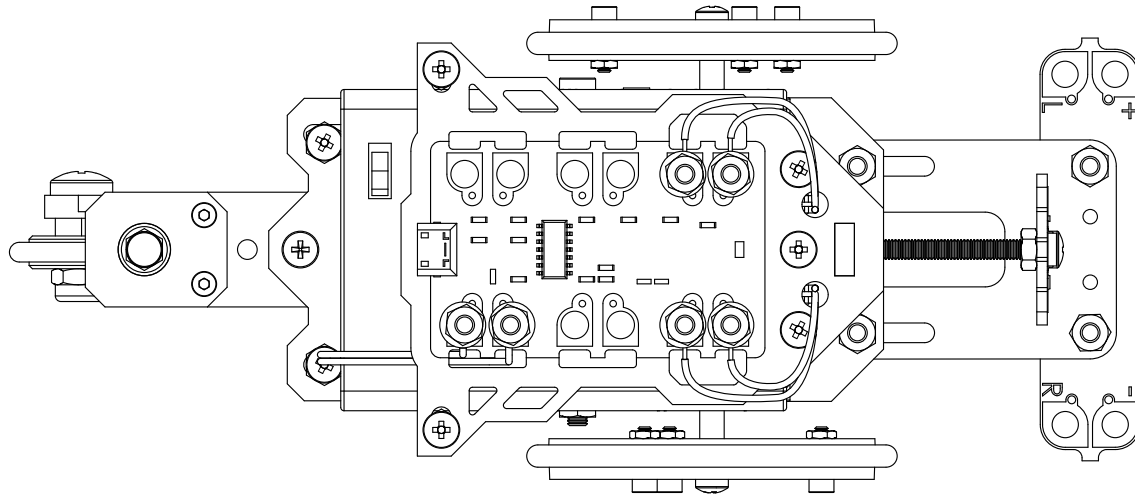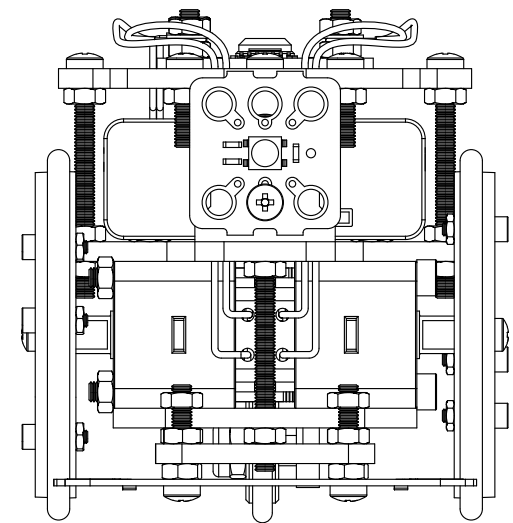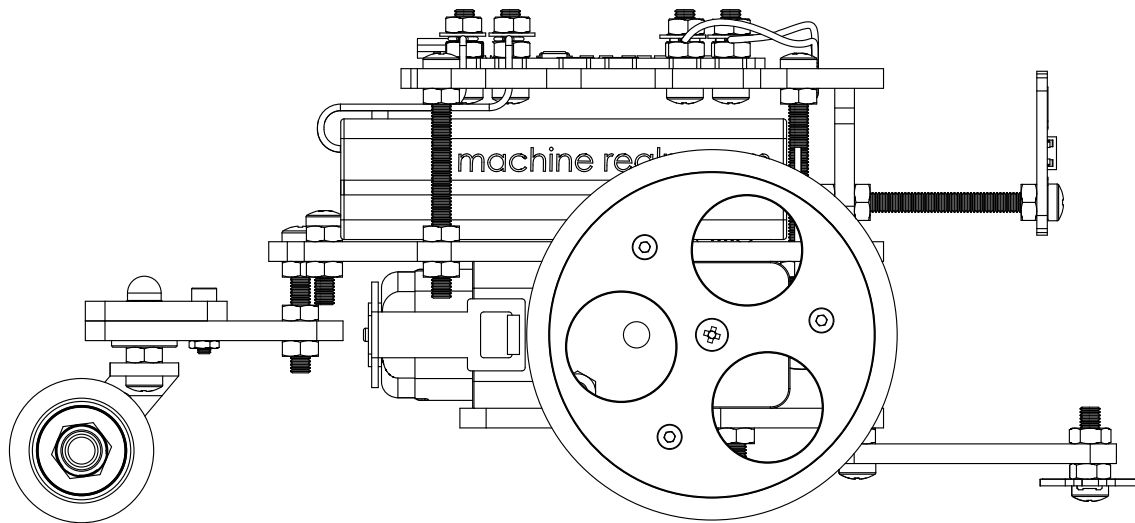
FEATURING SCRATCH INSPIRED PROGRAMMING AND LINE SENSOR TECHNOLOGY

<mission information contained within - authorized personnel only>

machine realm

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No. Component Part — Qty

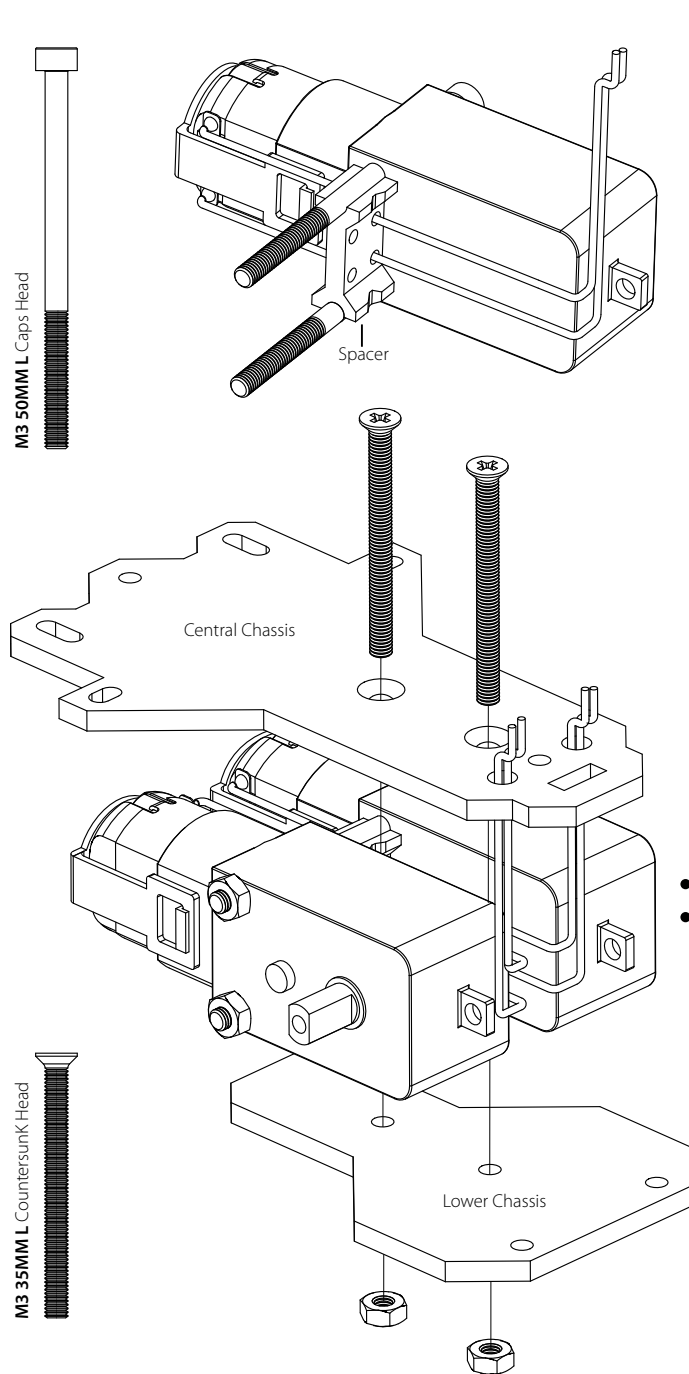| No.	Component Part	Qty
01.	M2 Caps L8	8
02.	M2.5 Pozi-Drive L6	2
03.	O-Ring Front Tyre	2
04.	Wheel Rim Outer	2
05.	Wheel Rim Inner	2
06.	Motor/Gearbox Wires	4
07.	Crumble Controller	1
08.	M3 Pozi-Drive L20	1
09.	M3 Pozi-drive L35	4
10.	M3 Pozi-drive L12	15
11.	3AA Battery Pack	1
12.	Upper Chassis	1
13.	Central Chassis	1
14.	Motor/Gearbox Spacer	1
15.	M3 Pozi - CSK L35	2
16.	M3 Caps Head 50L	2
17.	M3 Dome Head	1
18.	Bearing Retainer	1
19.	M3 Washer	7
20.	3 X 10 X 4 Bearing	1
21.	Castor Mount	1
22.	M2 Chamfer Nut	14
23.	M3 Castor Bracket	1
24.	M5 Pozi-Drive L16	1
25.	M5 Thin Nut	1
26.	Castor Wheel	1
27.	Castor Wheel Tyre	1
28.	M5 Nyloc Nut	1
29.	LFB Mount	1
30.	Line Following Board	1
31.	M3 Chamfer Nut	44
32.	Lower Chassis	1
33.	Motor/Gearbox	2
34.	Sparkle Module	1
35.	Sparkle Module Mount	1

Key Points throughout build:

A. Throughout this build; to ensure the correct use of fasteners -
- reference part numbers on the **Exploded Drawing** and in
the **Inventory**.

B. The fastener drawings are drawn **1:1**. To check size, place
fastener over drawing.

C. Remove protective film from acrylic components.

D. Additional tools needed: Pozi-Drive screwdriver, Long nose plyers and 5.5 MM and 8MM Spanners.

Machine Screws and Nuts
Scale 1:1

M3 35 MM L Countersunk Head / **QTY: 2**

M3 50 MM L Caps Head / **QTY: 2**

M3 Washer / **QTY: 7**

M2 Nut / **QTY: 14**

M3 20 MM L Pozi-Drive / **QTY: 1**

M3 35 MM L Pozi-Drive / **QTY: 4**

M3 Nut / **QTY: 44**

M3 12 MM L Pozi-Drive / **QTY: 15**

M2 8 MM L Caps Head / **QTY: 8**

M3 Dome Nut / **QTY: 1**

M2.5 6 MM L Pozi-Drive / **QTY: 2**

M5 16 MM L Pozi-Drive / **QTY: 1**

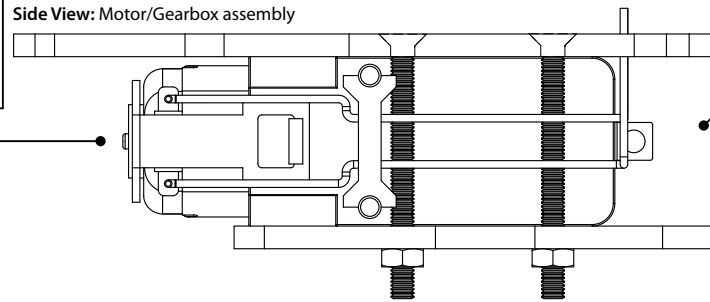M5 Thin Nut / **QTY: 1**

M5 Nyloc Nut / **QTY: 1**

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1. Push through two **M3 50MM L** Caps Head machine screws through the holes in the motor/gearbox and slide spacer between them. Feed electrical wires through the spacer holes.
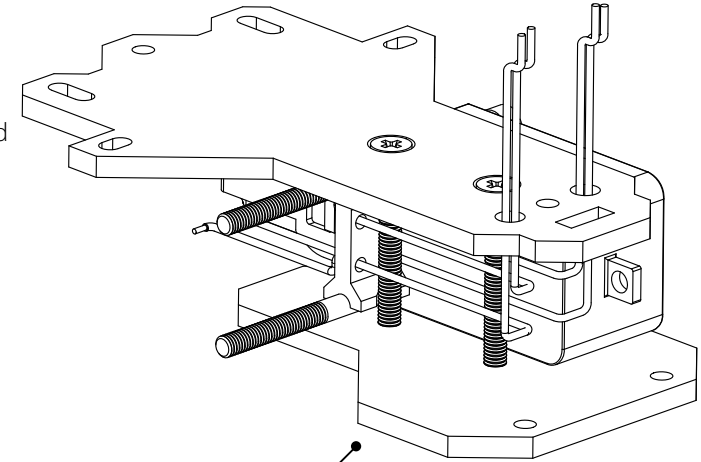
2. Slide the other motor/gearbox onto the **M3 50MM L** Caps Head machine screws and retain with M3 nuts. Feed electrical wires through the spacer holes.

M3 50MM L Caps Head

Spacer
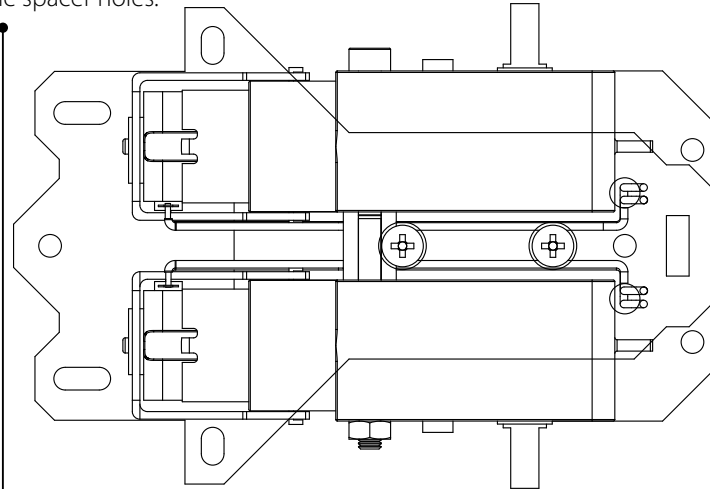
Central Chassis

Side View: Motor/Gearbox assembly

Hidden motor/gearbox to show the correct position of the **M3 Countersunk** machine screws. Note that the rear M3 Countersunk machine screw is touching the motor/gearbox **spacer**.

4. Stage 01 completed - Well Done!
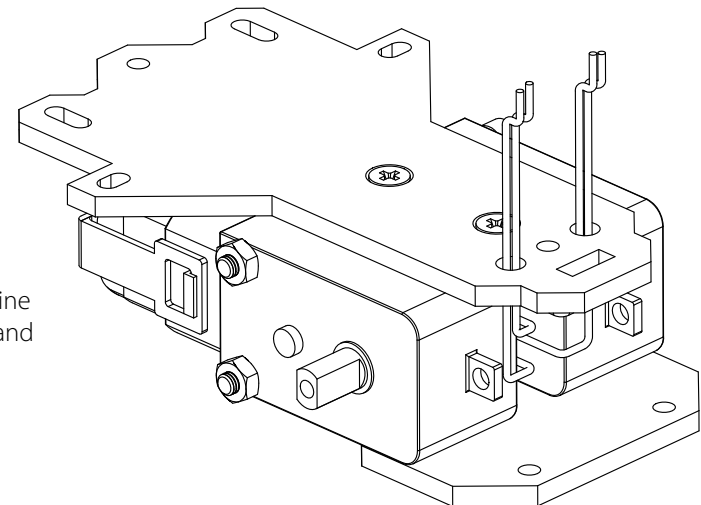
M3 35MM L Countersunk Head

Lower Chassis

3. Using two **M3 35MML** Countersunk machine screws - Clamp both the **central chassis section** and **lower chassis section** to the motor/gearboxes. Ensure that the rear **M3 35MML** Countersunk machine screw is located in the groove of the spacer. Retain with two M3 nuts and do not over tighten.

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5. Attach Crumble board to upper chassis section with six **M3 12MML** Pozi-Drive machine screws and M3 nuts. All Pozi - Drive screws need to face upwards. Do not over tighten.

M3 12MM **L** Pozi-Drive

Side View: Crumble assembly

6. Secure two **M3 12MML** Pozi-Drive machine screws to upper chassis with two M3 nuts.
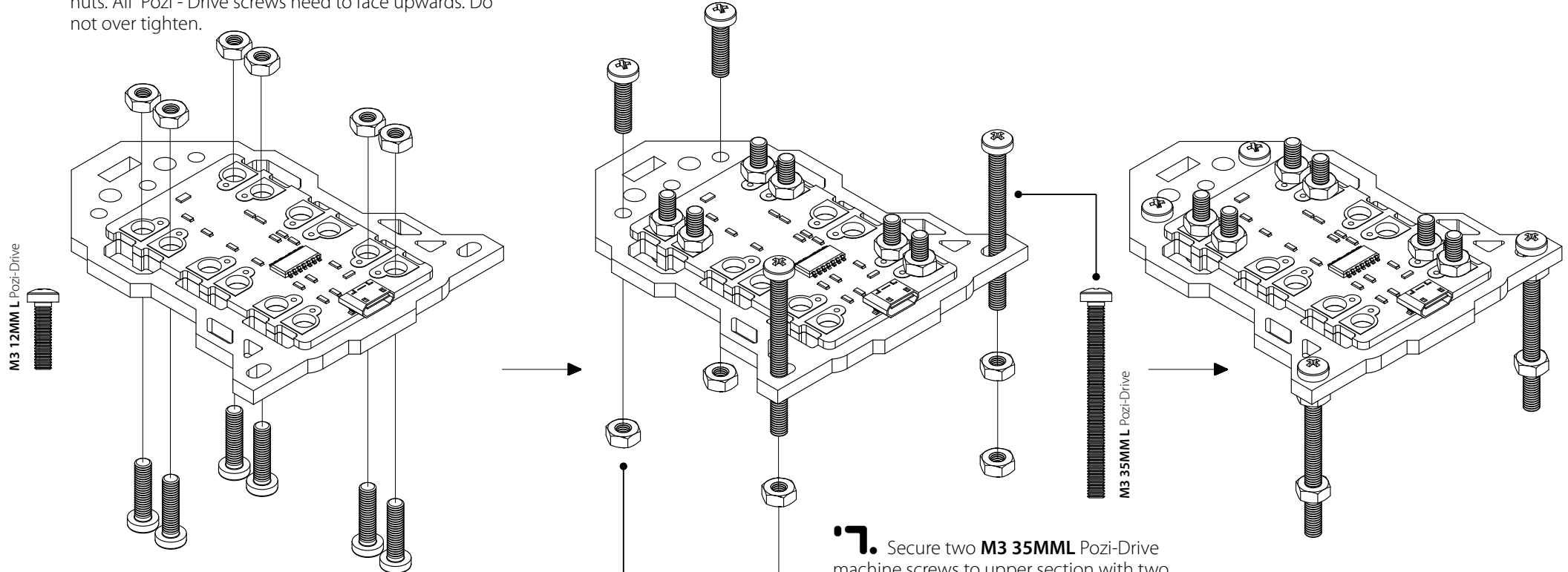
M3 35MM **L** Pozi-Drive

7. Secure two **M3 35MML** Pozi-Drive machine screws to upper section with two M3 nuts. Wind on another M3 nut.

9MM
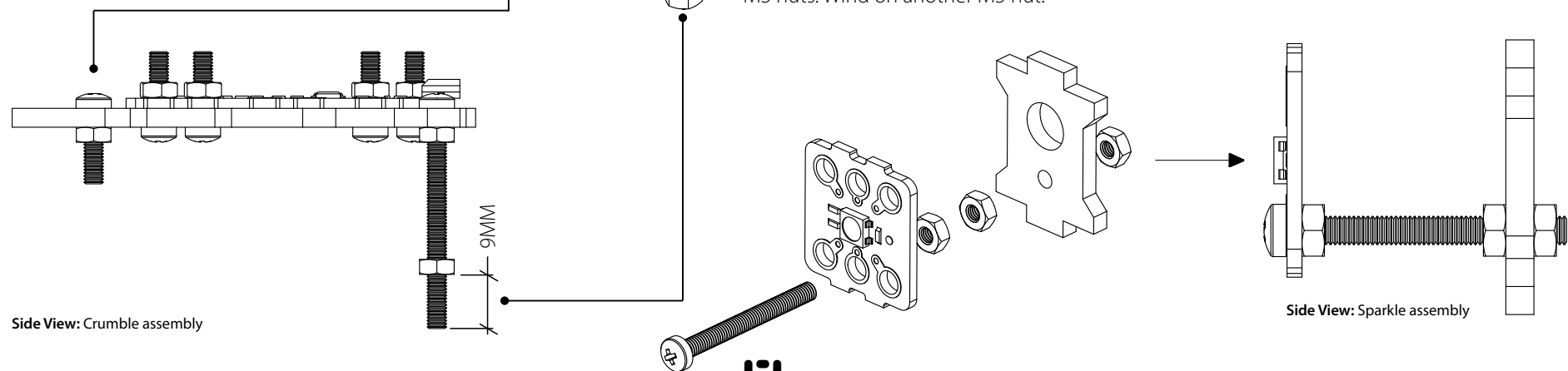
8. Using an **M3 35MML** Pozi-Drive machine screw - assemble the sparkle assembly as shown in the diagram.
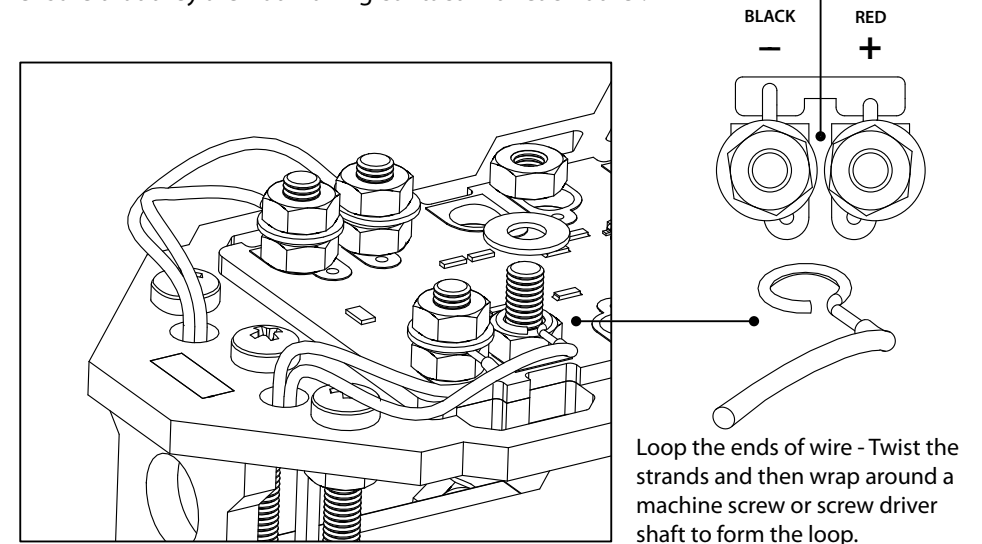
Side View: Sparkle assembly

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09. Place Sparkle assembly in the front slot of the central chassis section and then attach Crumble assembly to the central chassis section - It is secured in place with three M3 35MML Pozi-Drive machine screws - two of which were fitted in stage 02/07. The front M3 35MML is secured with only one M3 nut.

M3 35MM L Pozi-Drive

Attach Crumble upper chassis assembly to motor/gear box assembly with three M3 nuts.
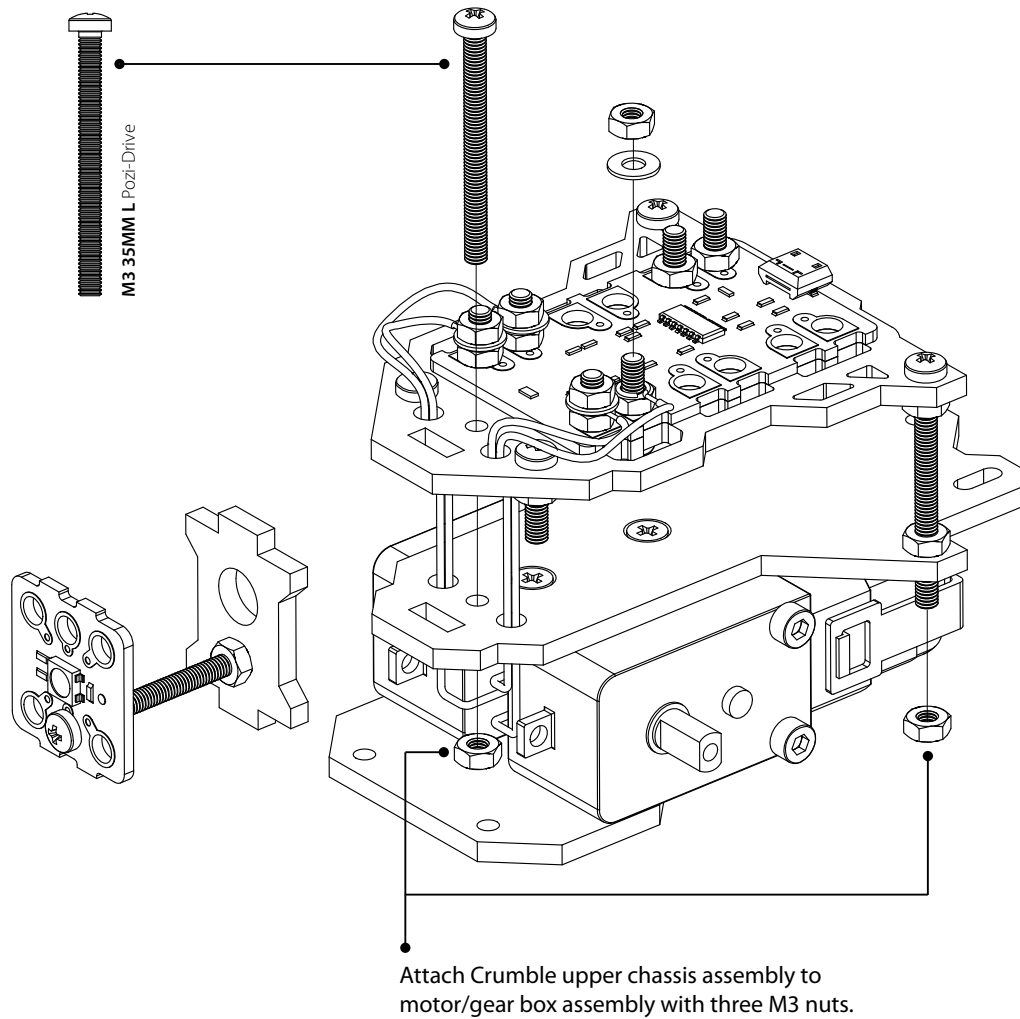
10. Check the rotational direction of the motor output shafts by touching the postive (red) and negative (black) battery wires. Both motor/gearbox shafts need rotate in the same direction. Once you have established the direction of rotation of both motor/gearboxes - attach wires to the terminal posts.
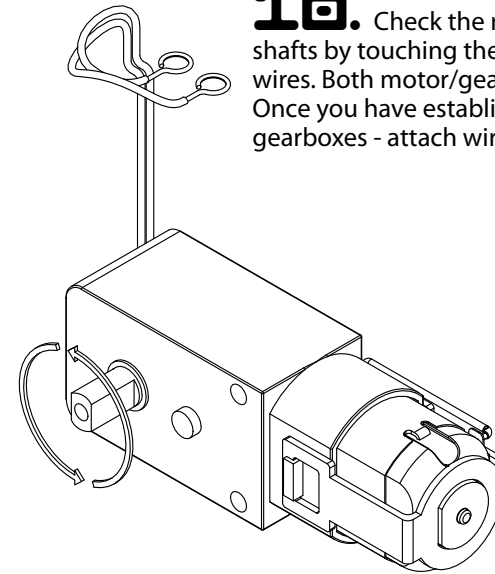
11. Loop the ends of the four motor/gearbox wires and secure to the Crumble board with four M3 nuts. As shown in the diagram, use washers and ensure that they are not making contact with each other.
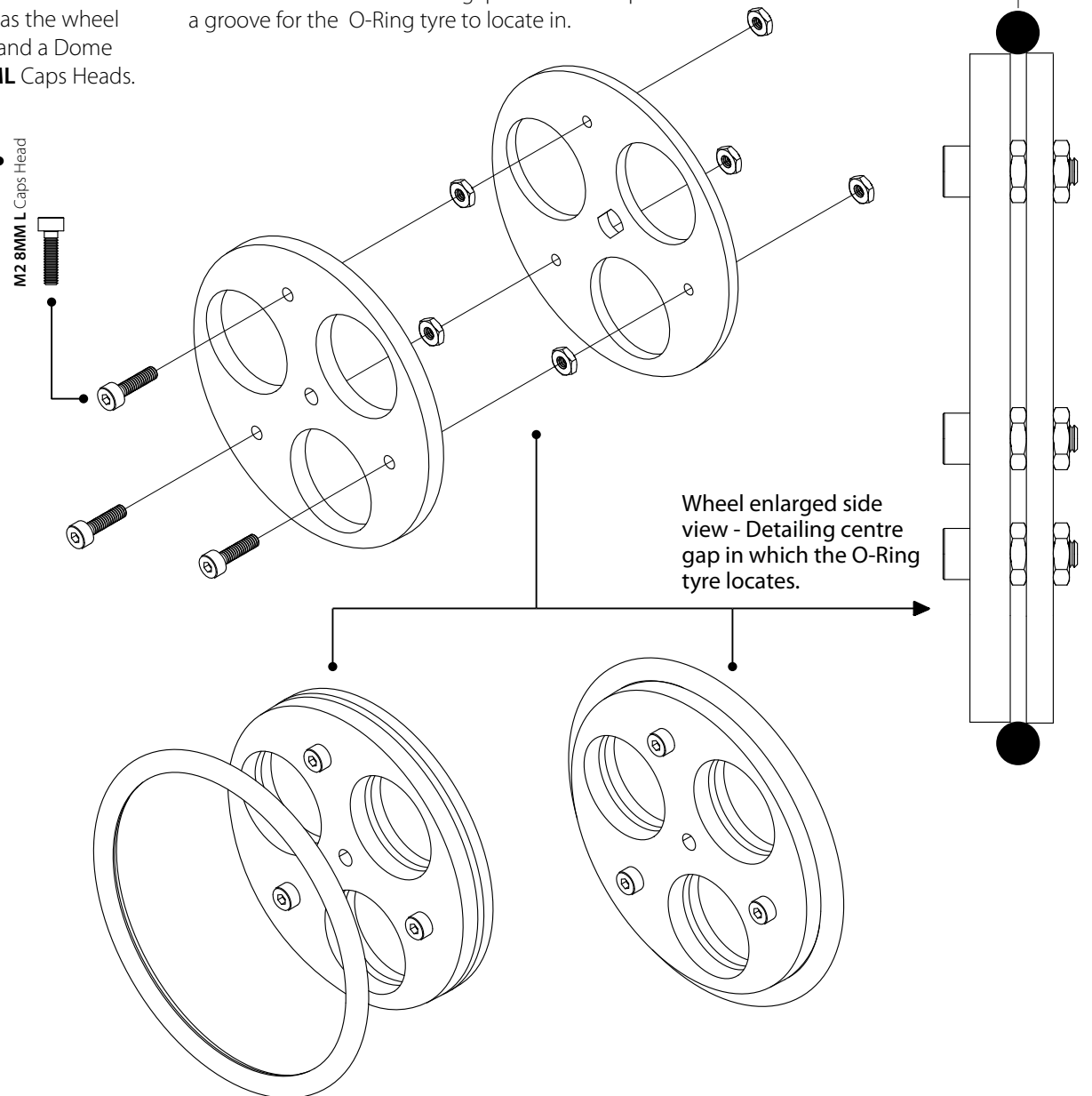
BLACK —   RED +

Loop the ends of wire - Twist the strands and then wrap around a machine screw or screw driver shaft to form the loop.

Enlarged view - Detailing the motor/gearbox wire connection points.

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12. Attach the **M3 12MML** Pozi-Drive machine Screw to the castor bracket with an M3 nut. Attach the **M5 16MML** Pozi-Drive machine screw to the castor bracket and secure with the M5 Thin nut. Slide O-Ring tyre onto the clear castor wheel and then retain on the M5 machine screw with the Nyloc nut. **Top Tip:** Do not over tighten the Nyloc nut, as the wheel needs to rotate freely. Attach the castor assembly to the bearing with a washer and a Dome head nut. Complete this stage by attaching the bearing plate with the **M2 8MML** Caps Heads.
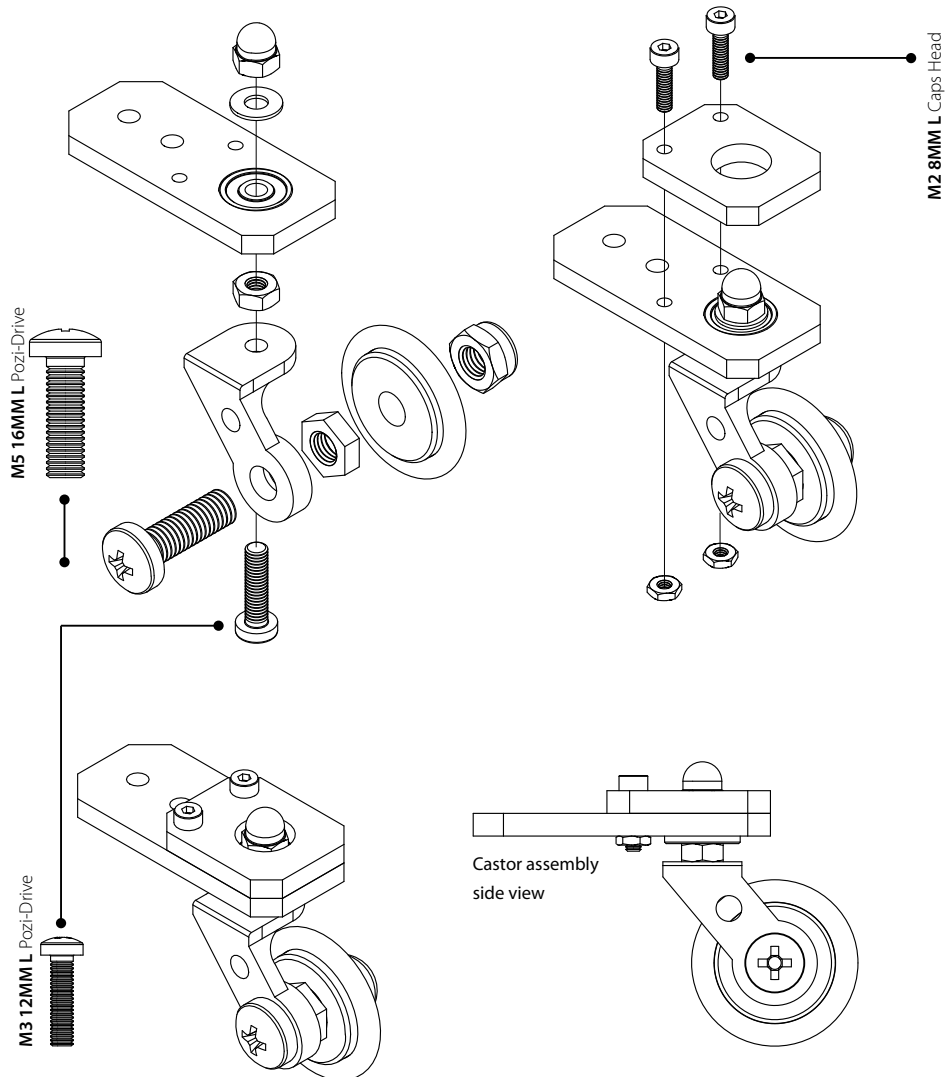
13. Fit three **M2 8MML** Caps Heads to Outer Rim (Black 3MM) with M2 nuts. Then slide Inner Rim (Clear 2MM) onto the M2 Caps heads threads and retain with M2 nuts. The gap in the centre provides a groove for the O-Ring tyre to locate in.

O-Ring

M2 8MM L Caps Head

M5 16MM L Pozi-Drive

M3 12MM L Pozi-Drive

Castor assembly side view

Wheel enlarged side view - Detailing centre gap in which the O-Ring tyre locates.

Well done - Stage 04 completed - The build continues.......

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14. Attach wheel assemblies to motor/gearbox shaft with the **M2.5 6MML** Pozi - Drive machine screws. Using the **M3 20 MML** Pozi - Drive machine screw, attach the castor assembly to the central chassis section.
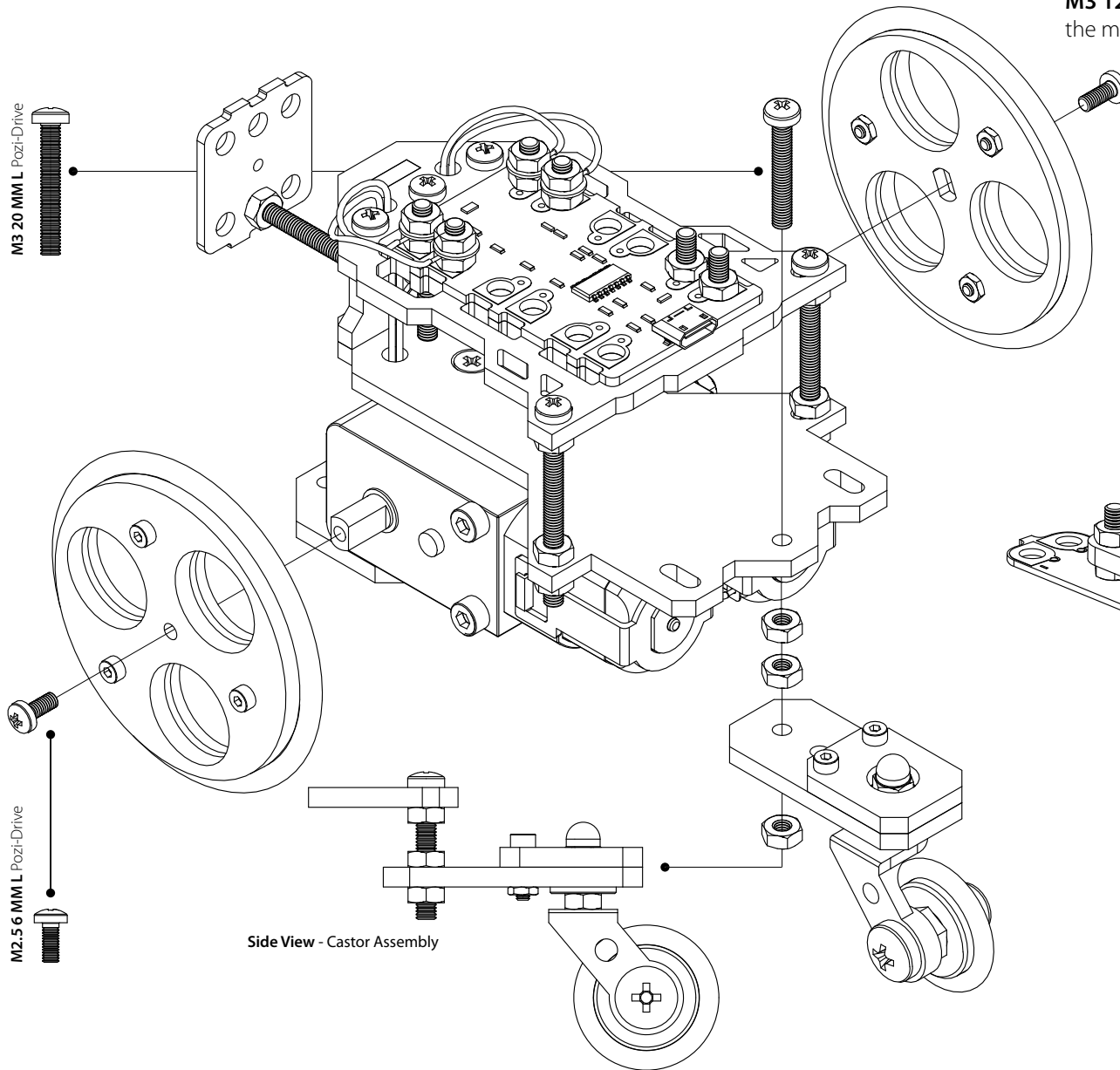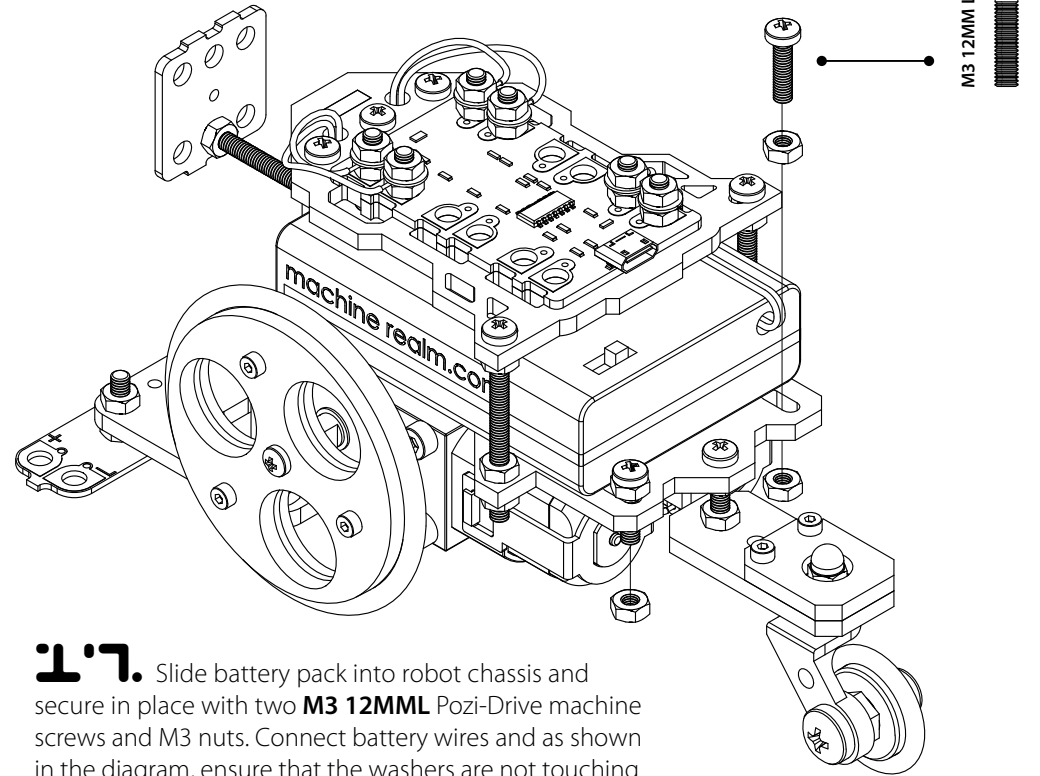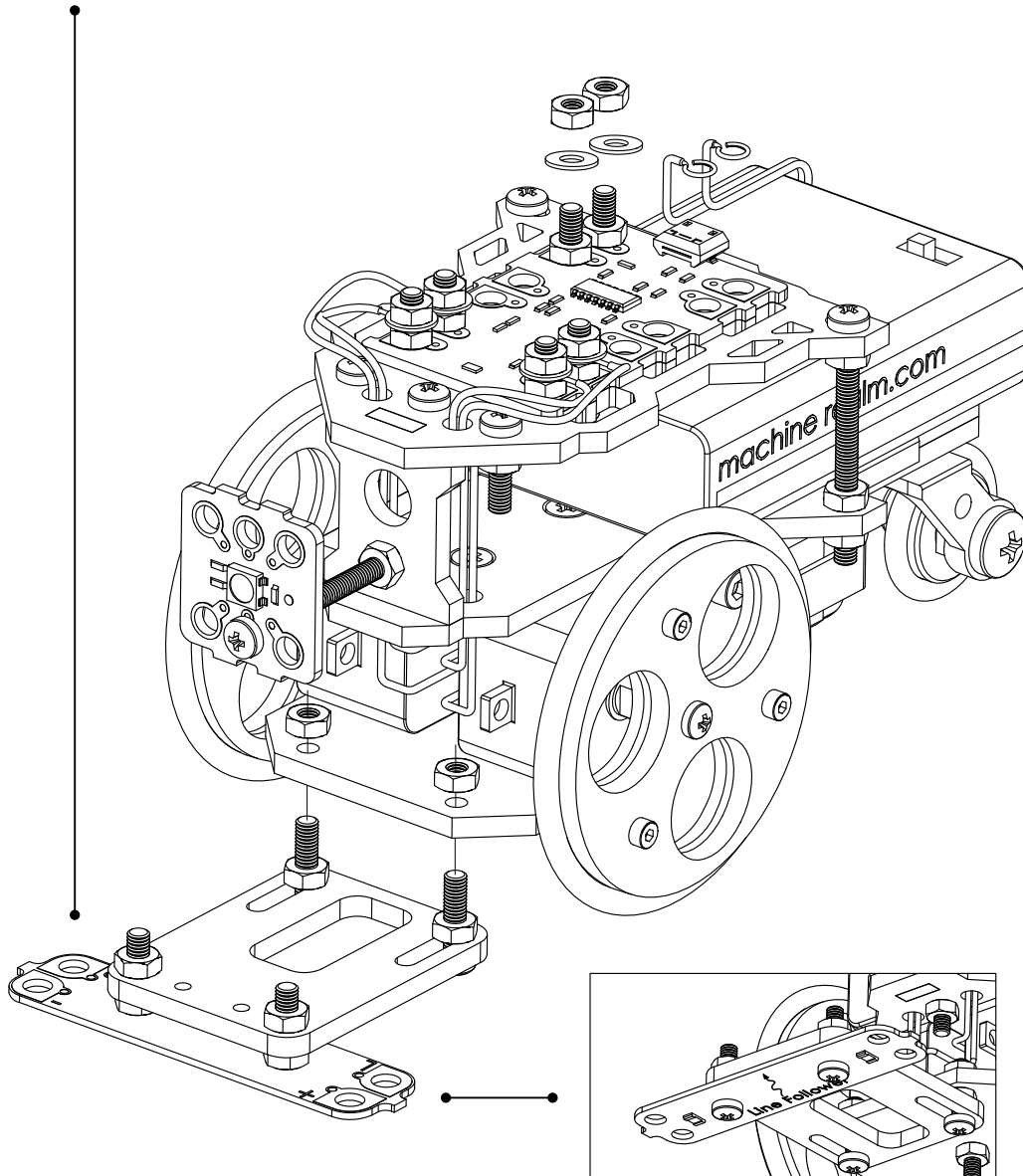
15. Secure two **M3 12MML** Pozi-Drive machine screws to Line Follower Board with M3 nuts - Then attach the Line Follower Board to mount with two M3 nuts. Fit two **M3 12MML** Pozi-Drive machine screws to the rear of the mount.

M3 20 MM L Pozi-Drive

M2.5 6 MM L Pozi-Drive

M3 12MM L Pozi-Drive

Side View - Castor Assembly

Front View - Line Following Board Assembly
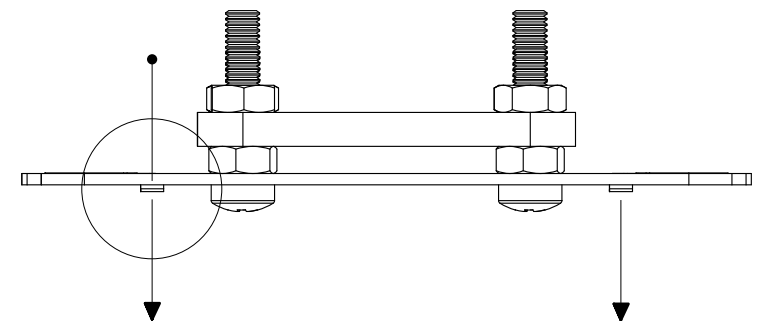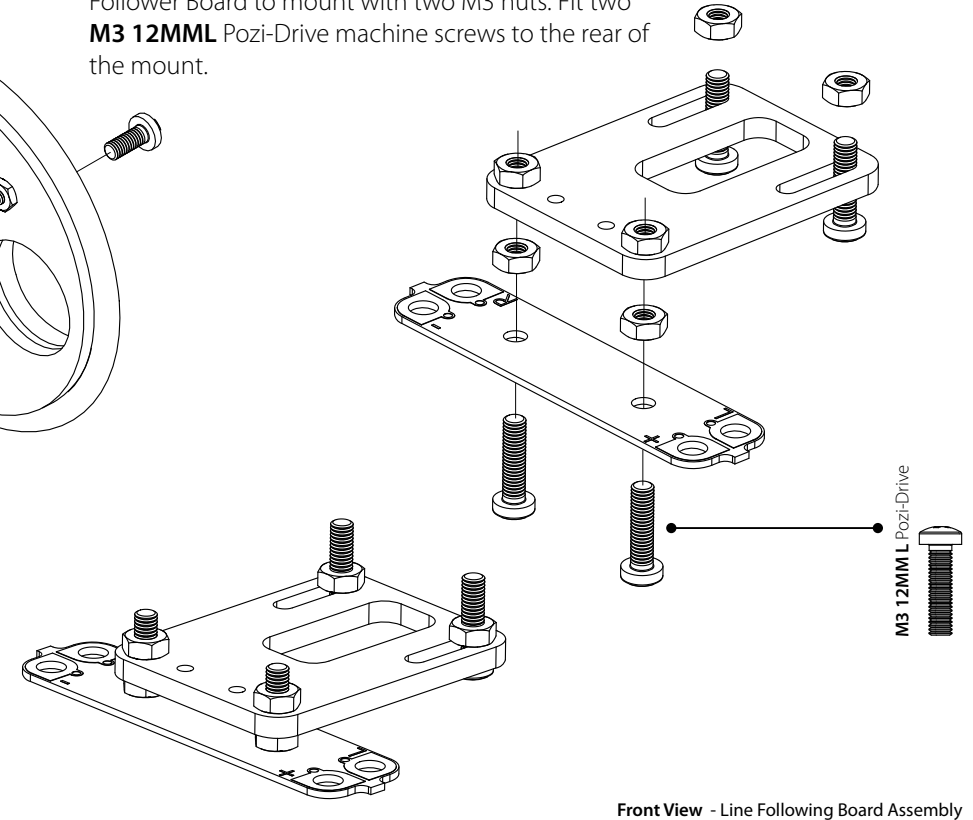
Take Note: As shown in the diagram - Ensure that line sensors are facing downwards.

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16. Attach the Line Following Board assembly to the lower chassis with the two **M3 12MML** Pozi-Drive machine screws that were fitted in stage 05 and secure with two M3 nuts.

M3 12MM L Pozi-Drive

17. Slide battery pack into robot chassis and secure in place with two **M3 12MML** Pozi-Drive machine screws and M3 nuts. Connect battery wires and as shown in the diagram, ensure that the washers are not touching each other on the terminal posts.

BLACK **RED**
− +
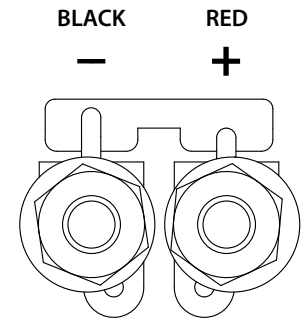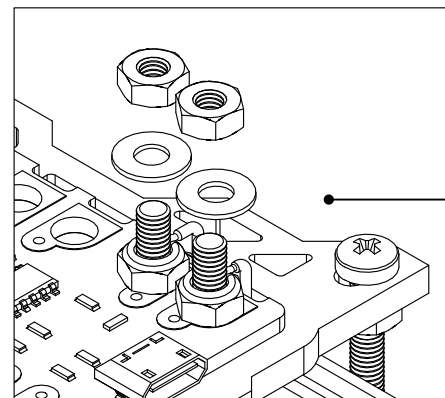
Top View - Battery Terminal Posts showing space between washers and positive and negative terminals.

Excellent - The build mission is complete - now on to the programming..........

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Excellent - The build mission is complete - now for the final pre-operational checks and the programming.
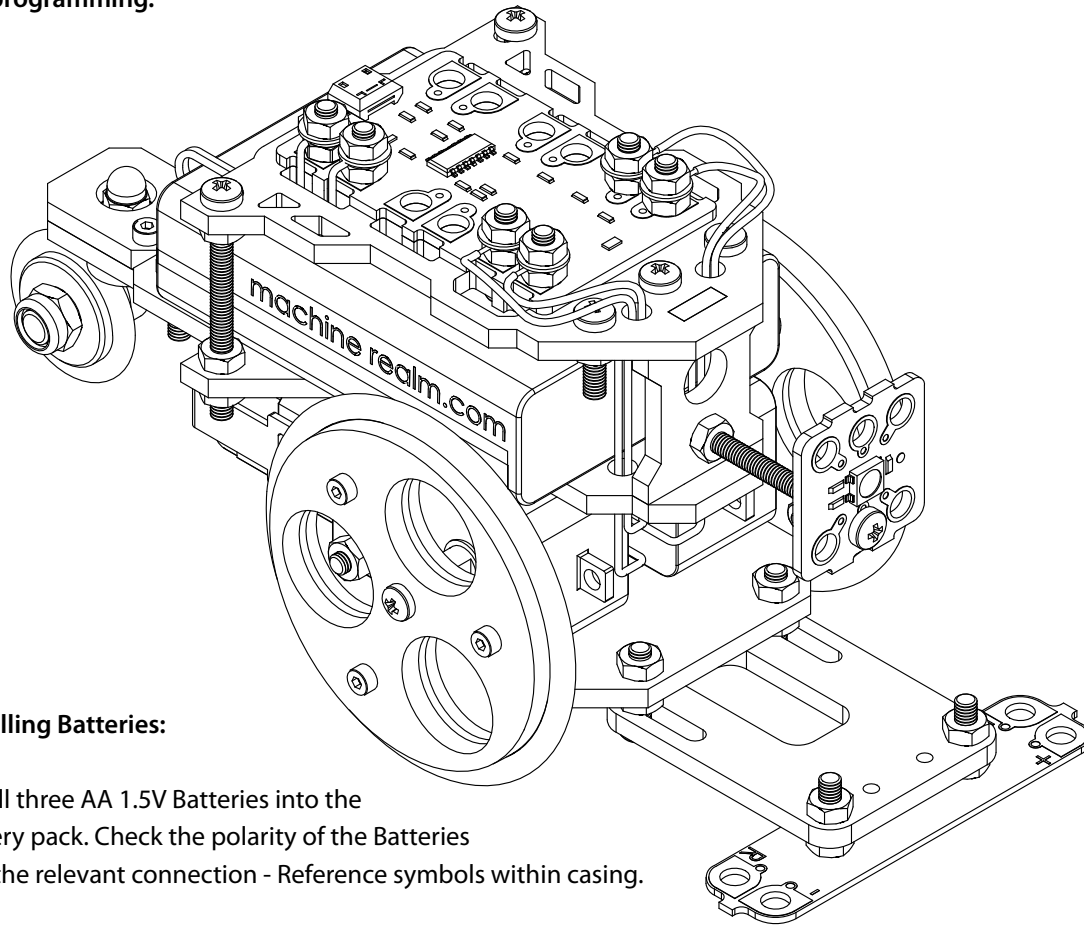
Installing Batteries:

Install three AA 1.5V Batteries into the battery pack. Check the polarity of the Batteries and the relevant connection - Reference symbols within casing.

Final Product Checks:

1. Check that all the wires and washers on the terminal posts are not touching.
2. If the motors are rotating in different directions - just simply swap over the wires on the terminal posts of one of the motors.
3. Check castor wheel is able to rotate freely.
4. Check sensors on Line Following Board are facing downwards.
5. Check final Crumble Robot against Orthographic Drawing on front page.
6. Ensure batteries have a charge.

BATTERY SAFETY

• Batteries can be hazardous - especially rechargeable batteries and alkaline batteries

• Never use rechargeable batteries in your kit

• Always take care that the battery leads do not touch together and short-circuit the battery. This can result in the battery getting hot and even melting the battery box

• Always remove the battery from your kit when you have finished using it

• Always store batteries safely where they cannot touch any metal objects

• Never dispose of batteries in a fire. Put them in a special battery collection unit or recycle at your local recycling centre.

IMPORTANT INFORMATION

This is not a toy. It has been designed and manufactured as an educational kit and for ages 14+. Not suitable for children under 3 years. This construction kit contains small parts that represent a potential ckoking hazard.	**14+** 0-3
If needed to,the CRV components and packaging can be recycled.	
Correctly dispose of AA batteries at your localrecyling centre.	
Designed and Manufactured by Machine Realm & Redfern Electronics.	

Thank you for buying this kit. Visit **www.machinerealm.com** to check out more exciting kits to build.

Visit **www.redfernelectronics.co.uk** to download the free software to program your Crumble Robot and for further information on using the Crumble.

www.redfernelectronics.co.uk/crumble-software

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