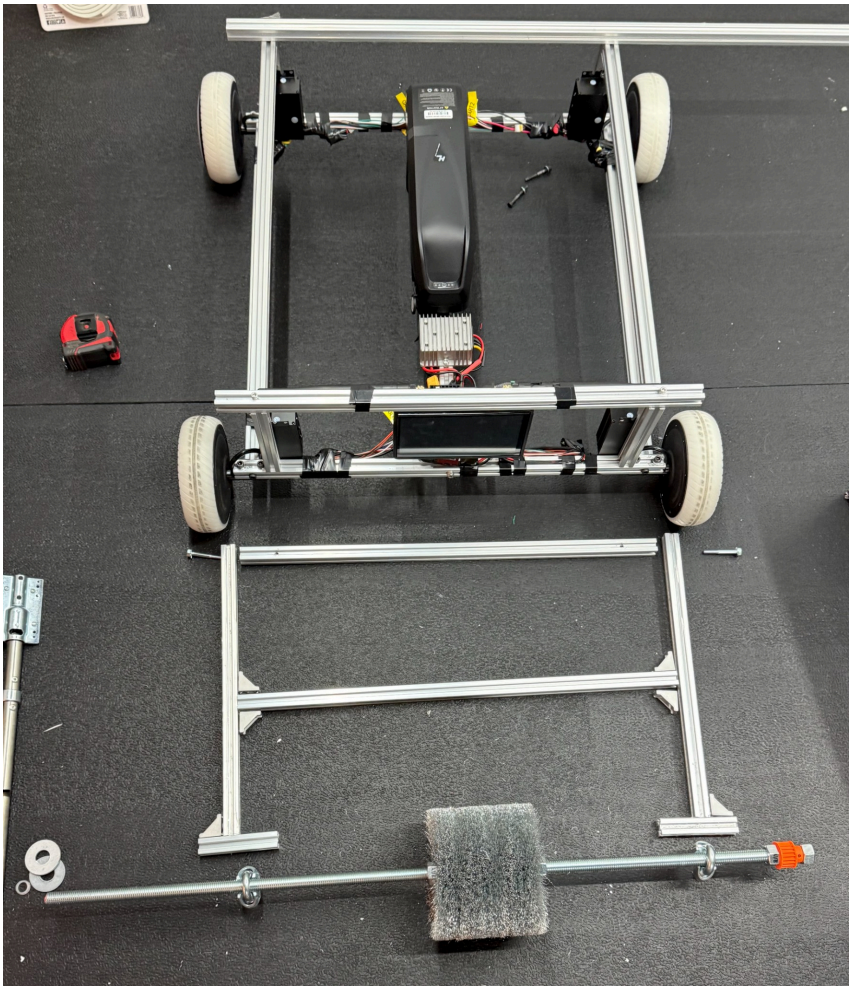
Technical Manual

BVR0

Base Vectoring Rover



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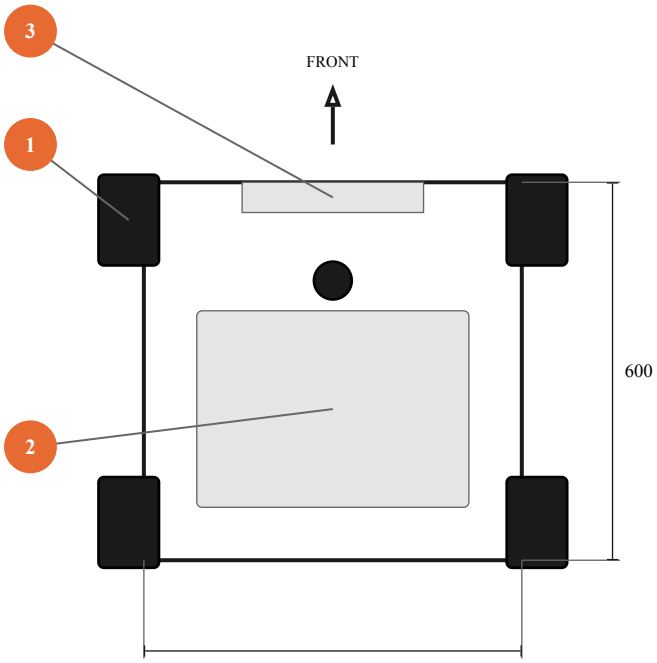
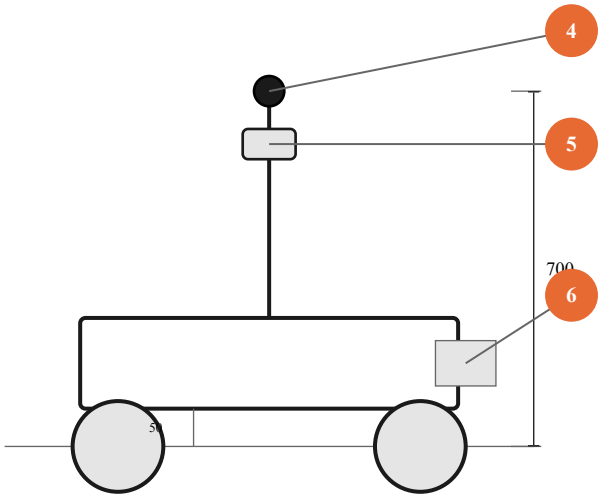
Municipal Robotics
Cleveland, Ohio
muni.works

Contents

1 Overview



TOP VIEW



SIDE VIEW

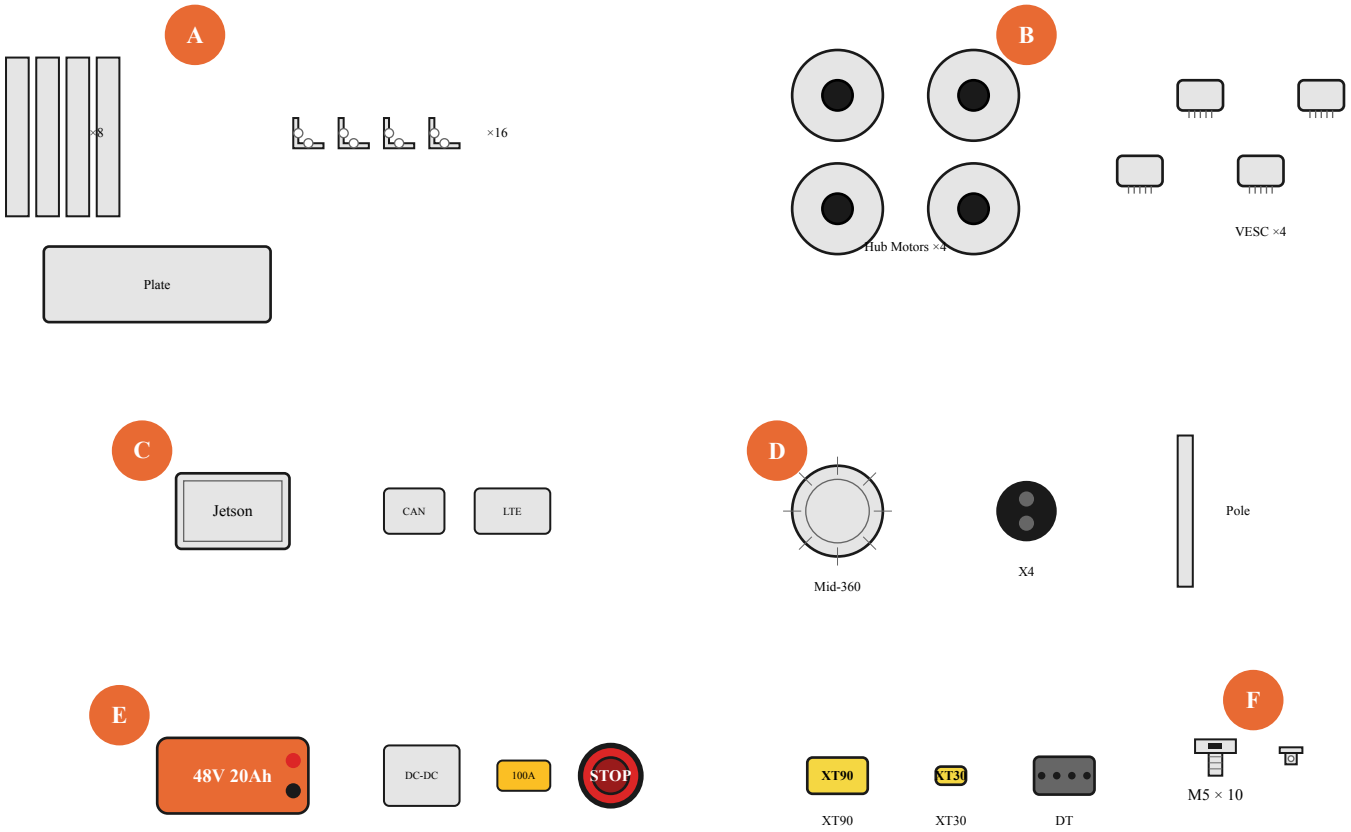
Components

1. Hub motor wheels (×4) — 350W each
2. Electronics bay — Jetson, VESCs, power
3. Tool mount — quick-attach interface
4. 360° camera — Insta360 X4
5. LiDAR — Livox Mid-360
6. Tool attachment point

Specifications

Dimensions	600 × 600 × 700 mm
Weight	30 kg with battery
Battery	48V 20Ah (960 Wh)
Motors	4× 350W hub motors
Speed	1.0–2.5 m/s
Runtime	4 hours
Temp range	−20°C to +40°C

2 Bill of Materials



Parts Key

A	Chassis: extrusions, brackets, plate	$150
B	Drivetrain: motors, VESCs, mounts	$800
C	Electronics: Jetson, CAN, LTE	$900
D	Perception: LiDAR, camera, pole	$1,800
E	Power: battery, DC-DC, fuse, E-stop	$400
F	Hardware: bolts, T-nuts, wire, connectors	$100

Cost Summary

Chassis	$150
Drivetrain	$800
Electronics	$900
Perception	$1,800
Power	$400
Hardware/Wiring	$100
Total	**$4,150**

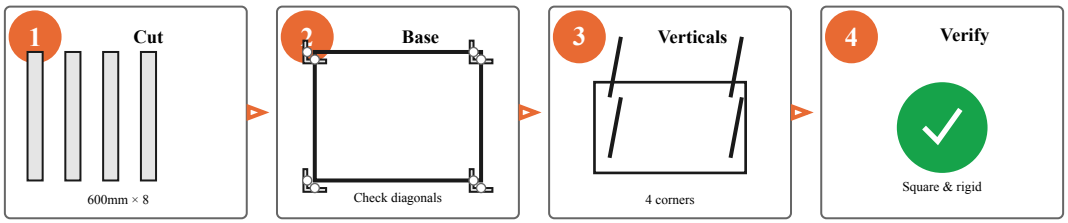
All parts commercially available. Custom fab limited to plate cutting.

3 Assembly

Required Tools

Hex Keys	Screwdriver	Wrenches	Multimeter	Torque
2.5, 3, 4, 5mm	Phillips 2	8, 10, 13mm	V / Ω / Cont.	All M5 bolts

3.1 Phase 1: Chassis Frame



3.2 Phase 2: Motor Mounting

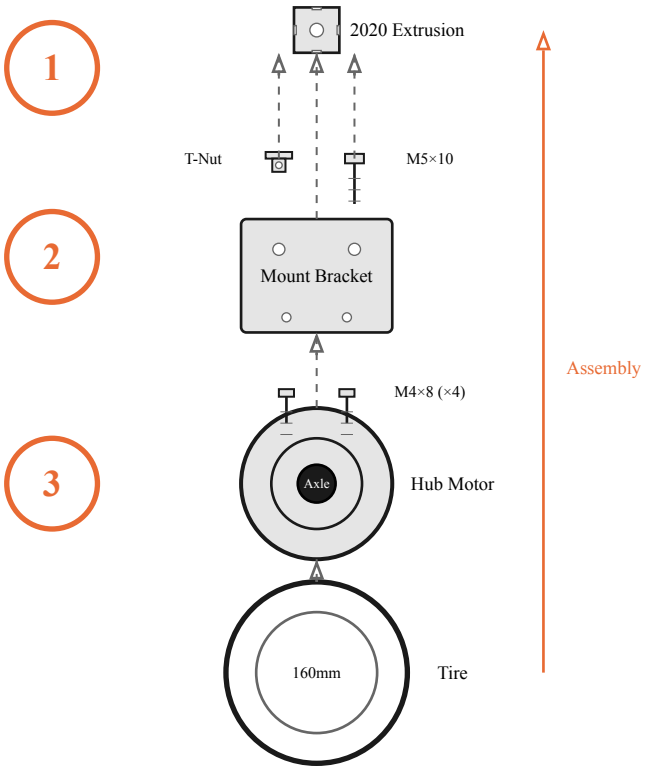


Figure 5: Exploded view: (1) Insert T-nuts into extrusion, (2) Bolt bracket to frame, (3) Attach motor and tire

3.3 Phase 3: Electronics Mounting

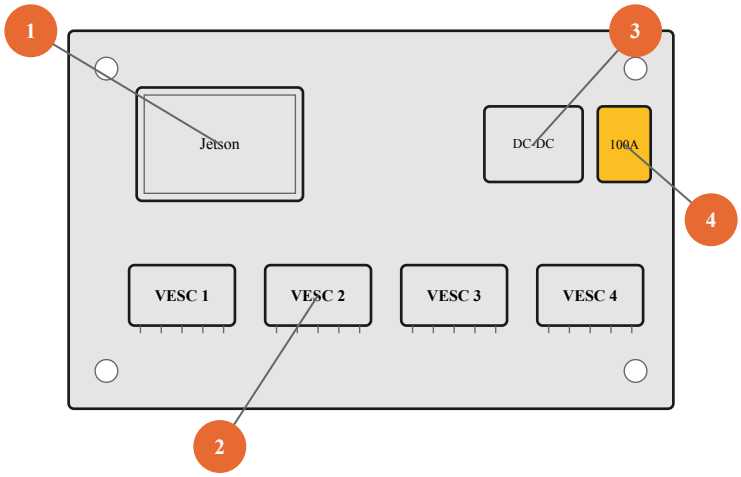


Figure 6: Electronics plate: (1) Jetson Orin NX, (2) VESC motor controllers, (3) DC-DC converter, (4) Main fuse

3.4 Phase 4: Wiring

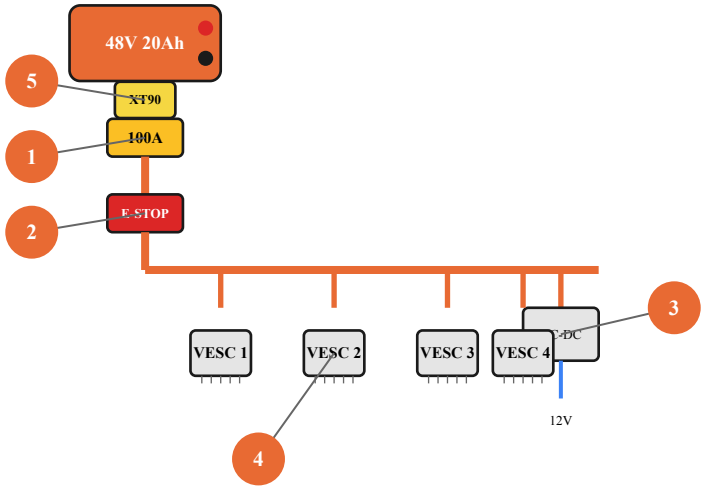


Figure 7: Power distribution: (1) Main fuse, (2) E-Stop relay, (3) DC-DC converter, (4) VESCs, (5) XT90 disconnect

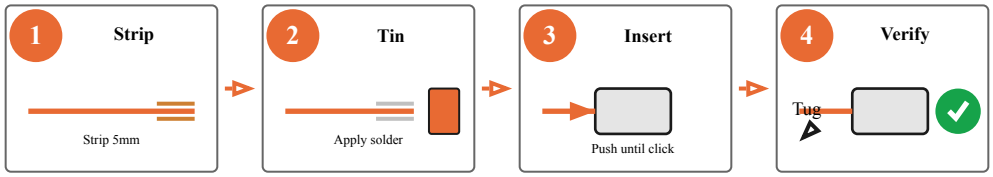
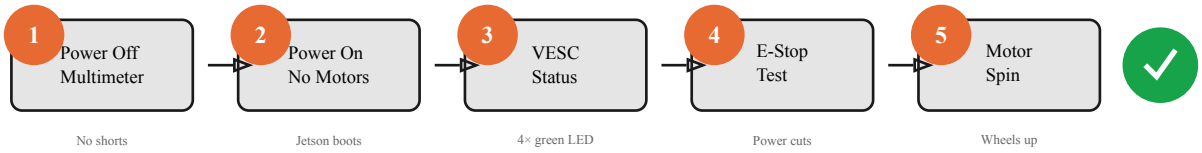


Figure 8: CAN wiring sequence: (1) Strip 5mm insulation, (2) Tin exposed wire, (3) Insert into JST connector, (4) Verify with gentle tug test

3.5 Phase 5: Testing



Quality Checklist

- [ ] All bolts torqued to 4 Nm
- [ ] No exposed wiring
- [ ] CAN bus termination verified
- [ ] E-Stop cuts power in 100ms
- [ ] All wheels spin freely
- [ ] Battery secure
- [ ] All connectors clicked
- [ ] Thermal management OK

4 Electrical System

4.1 Power Distribution

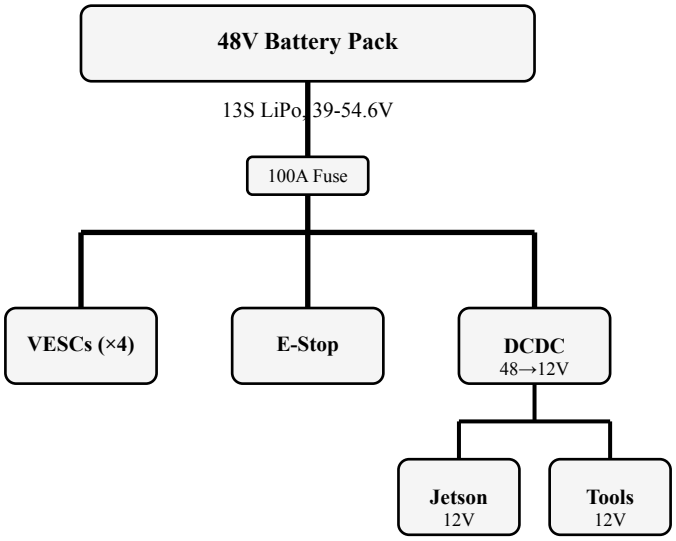


Figure 10: Power distribution from 48V battery to all subsystems

4.2 CAN Bus

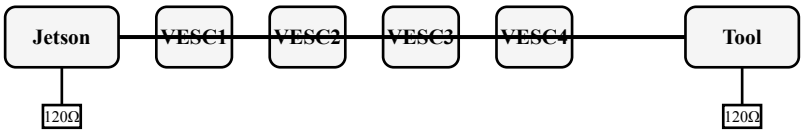


Figure 11: CAN bus daisy chain with 120Ω termination at each end

4.3 Connectors

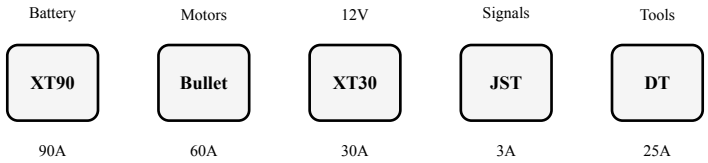


Figure 12: Connector types used throughout the rover

4.4 VESC Configuration

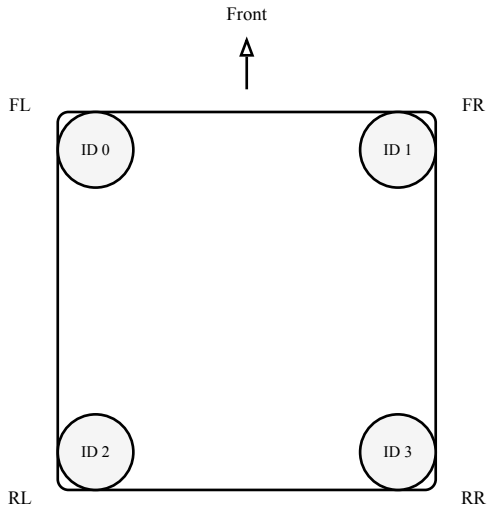


Figure 13: CAN ID assignment by wheel position

Setting	Value
Controller ID	0-3 (unique per VESC)
CAN Mode	VESC
CAN Baud Rate	CAN_500K
Send CAN Status	Enabled
CAN Status Rate	50 Hz

5 Operation

5.1 Startup

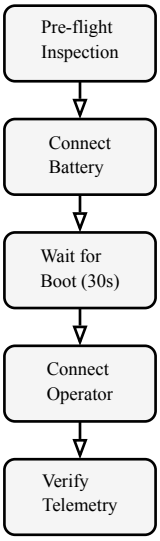


Figure 14: Startup sequence from inspection to operation

5.2 Controls

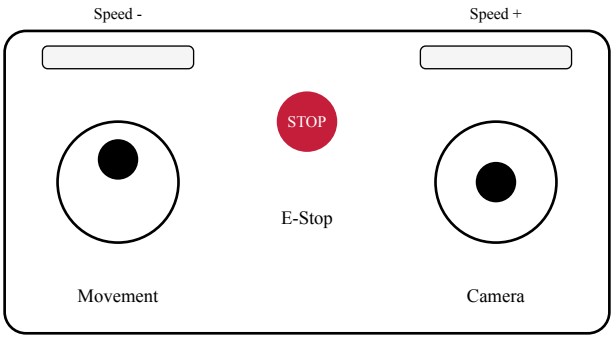


Figure 15: Gamepad control layout for teleoperation

5.3 Shutdown

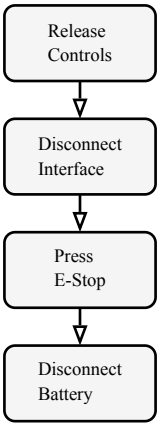


Figure 16: Shutdown sequence

5.4 Tool Attachment

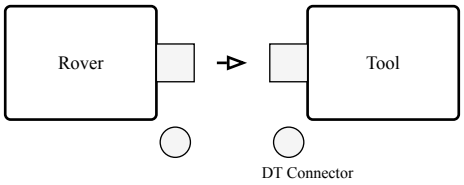


Figure 17: Tool attachment via quick-release mount and DT connector

6 Safety

> ⚠ **DANGER** Heavy powered machine. Can cause serious injury. Maintain situational awareness.

6.1 Hazard Zones

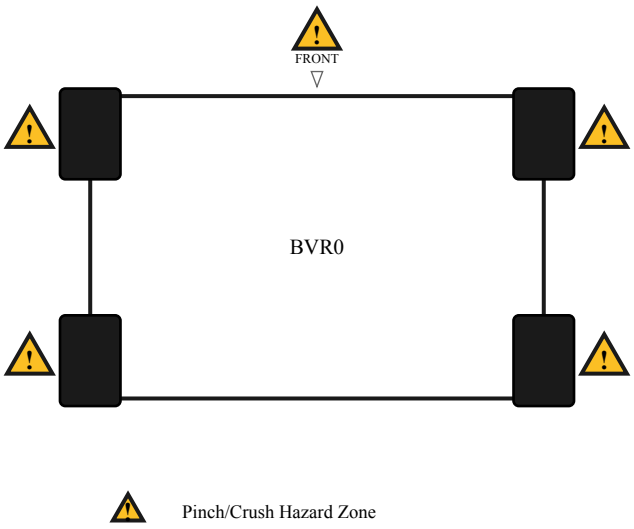


Figure 18: Hazard zones: wheel areas and tool mount require clearance during operation

6.2 Battery Safety

> ⚠ **WARNING** Li-ion batteries can catch fire if damaged or short-circuited.

Figure 19: Battery handling requirements

6.3 Emergency Stop

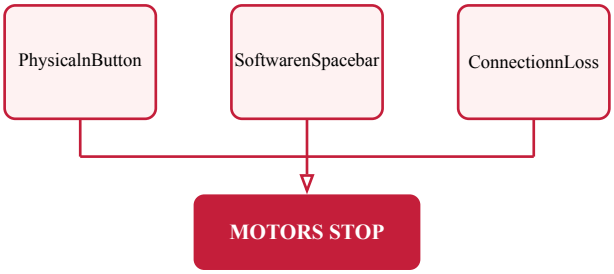


Figure 20: Three independent paths to emergency stop

> **i NOTE** To reset: resolve cause, release button, reconnect, verify dashboard.

7 Maintenance

7.1 Pre-Operation Inspection

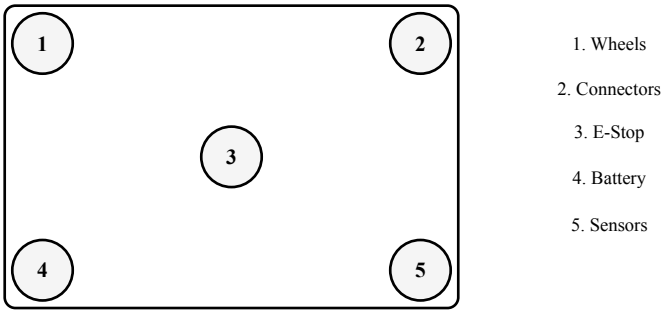


Figure 21: Pre-operation inspection points

- [ ] Battery voltage > 40V
- [ ] No visible damage to chassis or wheels
- [ ] All connectors secure
- [ ] Wheels spin freely
- [ ] E-Stop button functions
- [ ] Sensors clean and unobstructed

7.2 Maintenance Schedule

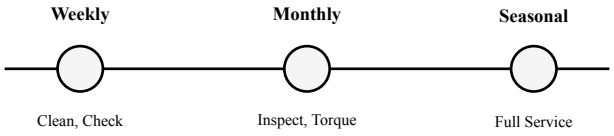


Figure 22: Maintenance schedule intervals

Weekly
- Clean wheels/chassis
- Wipe lenses
- Check connections

Monthly
- Inspect wiring
- Verify bolt torque
- Clean contacts

Seasonal
- Full electrical check
- Check bearings
- Replace worn parts

7.3 Storage

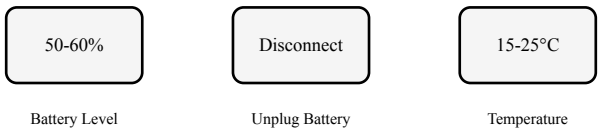


Figure 23: Storage preparation requirements

7.4 Troubleshooting

Symptom	Solution
Rover won’t power on	Check battery connection, verify fuse
No video feed	Check LTE connection, verify camera USB
Motor not responding	Check CAN wiring, verify VESC ID
E-Stop won’t release	Check relay wiring, verify button not stuck
Poor LTE signal	Relocate antenna, check SIM data plan
Erratic movement	Verify VESC IDs match wheel positions

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