Kiwi-Drive Testbed Assembly Manual

Edge Device Build Manual

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Overview

This Kiwi-Drive testbed is designed as a versatile, omnidirectional platform for evaluating our custom C++ API in tight spaces. Its unique wheel arrangement allows smooth lateral, longitudinal, and rotational motions, making it perfect for rapid prototyping and control algorithm testing.

1. Tools & Materials

1.1 Tools

- 3D printer (PLA filament, ≥2 walls, 30% infill)
- M3 Allen wrench
- Soldering iron (rosin-core solder)
- Wire strippers (22 AWG)
- Flush cutters (zip tie trimming)

1.2 Software

- VS Code with PlatformIO extension
- PlatformIO CLI (for firmware upload)

1.3 Consumables & Fasteners

- M3×12 mm SCHS bolts ×6
- M3×10 mm SCHS bolts ×4
- Jumbo 2″ steel paperclips ×25
- Heat-shrink tubing
- Lead-free rosin-core solder

1.4 Electronic Components

- Turnabot N20 gear motors ×3
- Flysky FS-i6A6 Receiver ×1
- Teensy 4.0 microcontroller + USB cable ×1
- Pololu DRV8874 motor drivers ×3
- WolfWhoop 5 V Buck Regulator ×1
- 100 nF ceramic capacitors ×9
- 100 µF electrolytic capacitor ×1
- XT60 male & female connectors ×1 set
- 24 AWG prototyping wire (≥4 ft, multicolor)
- 22 AWG hookup wire (≥4 ft, multicolor)
- 2S 1300 mAh LiPo battery ×1
- 4000 mA USB-C power bank ×1
- 2× 400-point solderless breadboards
- 3D-printed mounts: MotorMount.stl ×3, DoombaMk1Base.stl ×1

- 3D-printed wheels: 5Wheel.stl ×3, 5wheelroller.stl ×15

2. Pre-Assembly

2.1 Workspace Setup
- Choose a clean, well-lit bench.
- Organize printed parts, electronics, and tools within easy reach.

2.2 Firmware Flashing
- Connect Teensy 4.0 via USB.
- Open VS Code → PlatformIO and upload the test firmware.
- Confirm correct firmware version on Teensy startup.

3. Electrical Preassembly

Terminate and insulate the motor wires using paperclip terminals:

3.1 Wire Preparation
- Cut 6 lengths of 22 AWG wire, 4.5 in each (3 for positive, 3 for ground).
- Strip 1/8 in of insulation from both ends.
- Cut 6 paperclip segments, 3/8 in long.

3.2 Terminal Attachment
- Solder a paperclip segment to one stripped end of each wire (red = +, black = −).
- Slide heat-shrink over the joint and heat to insulate, leaving the segment exposed.

3.3 Motor Wiring
- Orient the N20 motor vertically: ensure the gearbox opening (notch) points upward to fit the mount notch (see Figure 1).
- Solder one prepared wire to each motor terminal.
- Solder a 100 nF capacitor across the two terminals, and one 100 nF from each terminal to the motor casing.
- Limit soldering time to <3 s per joint to avoid overheating.

4. Drivebase Assembly

Perform this step **after** completing Section 3 Electrical Preassembly.

4.1 Prepare Motor Mounts

• Examine the MotorMount parts and locate the key notch that interfaces with the gearbox (see image below).

• Ensure the notch is oriented correctly before inserting the motor.

4.2 Insert Motors into Mounts

• Slide each N20 motor straight into its MotorMount until it seats snugly.
• Verify the gearbox gap aligns with the mount notch (see the red-arrow image).

4.3 Secure Motors to Base

• Position the DoombaMk1Base.stl on your bench.
• Place each motor+mount assembly at the three tripod corners.
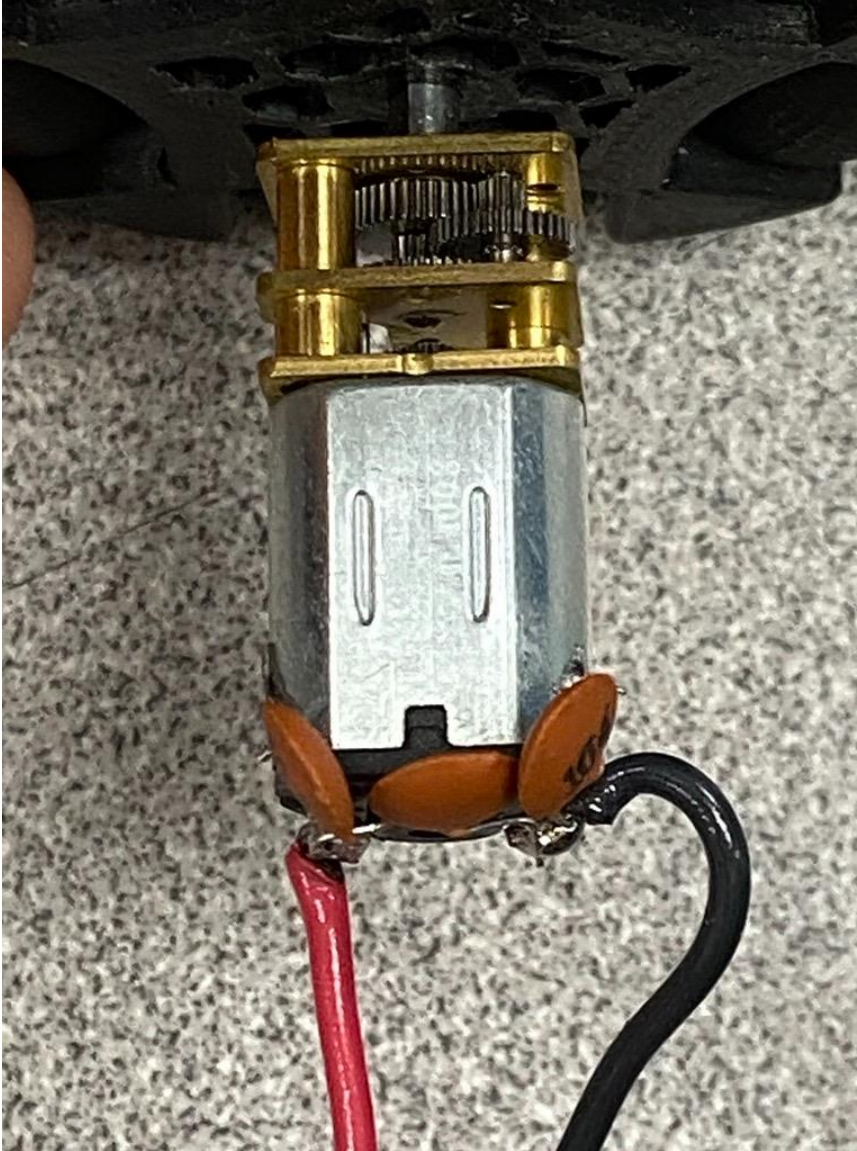• Fasten with M3×12 mm SCHS bolts; tighten until snug.
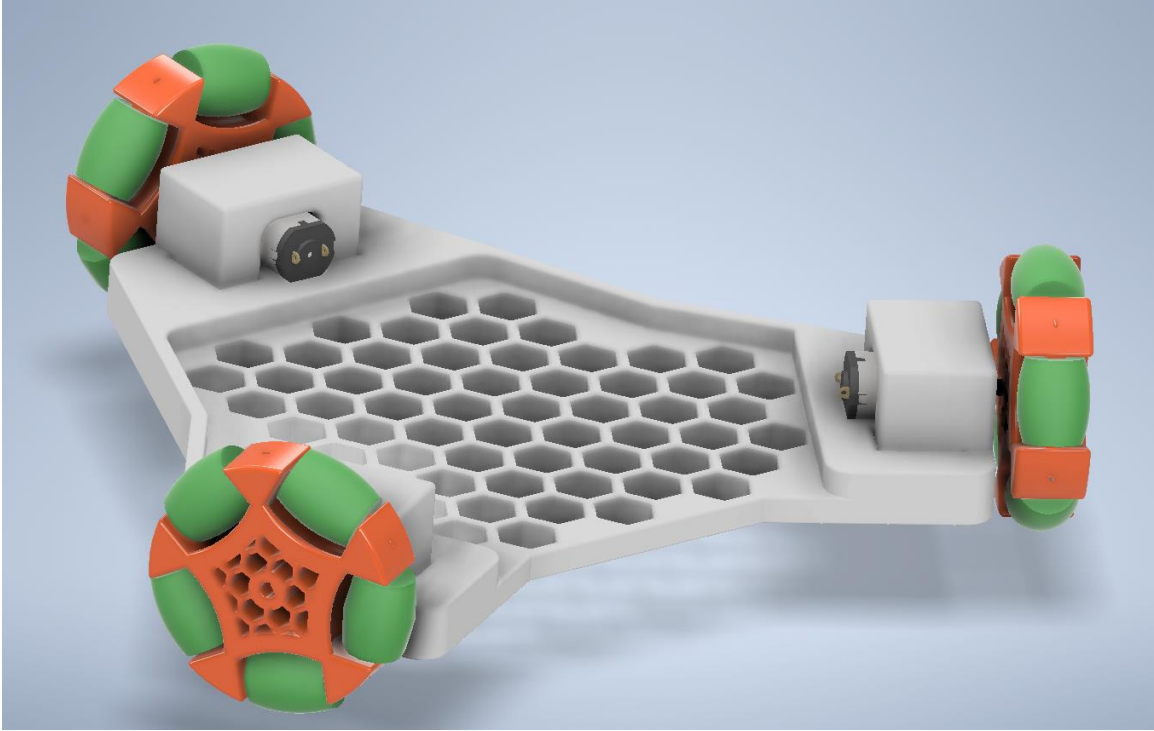
4.4 Electrical Assembly

• Reference the wiring diagram and example photo to place breadboards, drivers, and Teensy.

• Mount the stacked breadboards, receiver, and batteries to the base using zip ties through the honeycomb cutouts.

• Secure the LiPo and USB-C battery pack as low and centered as possible for stability.

• Fasten Flysky receiver antennas upward with a zip tie to improve range.

5. Final Inspection & Testing

1. Confirm mechanical fasteners are tight and wheels spin freely.
2. Inspect all solder joints and insulation.
3. Power on the system (batteries → buck regulator → Teensy).
4. Run the test firmware and verify motor directions and responsiveness.
5. Monitor for unusual noise or heat; shut down immediately if issues occur.

6. Tips & Troubleshooting

- Always align the gearbox notch upward before seating the motor.
- Test each motor individually on 5 V before full assembly.
- Use minimal solder to prevent bridges and reduce heat stress.
- Trim zip ties and keep wiring neat to prevent snags.

7. Final Drive base look