# 4WD Kids Ride-On – Teensy 4.1 Wiring & Hardware Reference (Final)

This document is the FINAL verified pin and hardware reference for the 4WD Kids Ride-On project. It matches the RideOnV2 KiCad netlist and schematic, with corrected steering pin mapping. Use this version for firmware development, PCB validation, and production wiring.

## Hardware Overview

|  |  |
| --- | --- |
| Component | Description |
| Microcontroller | Teensy 4.1 – 600 MHz ARM Cortex-M7, 3.3V logic, USB-C or VIN 5V input |
| Motor Drivers | 3 × BTS7960 dual half-bridge modules (M1: Steering, M2: Front, M3: Rear) |
| Logic Buffers | SN74AHCT244N (U1, U4) – 5V buffers to motor drivers |
| Signal Level Shifter | CD74HC4050 (U2) – 5V-tolerant input buffer, outputs 3.3V logic |
| Rotary Encoder | CUI Devices AMT102-V – 3-channel incremental encoder (A/B/Z) |
| Throttle Pedal | 20 kΩ linear potentiometer → analog input A9 (Teensy pin 3) |
| Steering Wheel | 20 kΩ linear potentiometer → analog input A13 (Teensy pin 27) |
| Remote Control | 2-channel parent override (Throttle/Steering) via logic converter U2 |

## M1 – Steering Motor (BTS7960, via U4 SN74AHCT244 – Corrected)

This motor driver controls the steering motor. Logic direction lines are buffered through U4 (bank 1).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Function | Teensy Pin | Buffer Path | Series R | Destination |
| STEER\_REN | 18 | U4 1A4 → 1Y4 (pin 12) | R4 33Ω | BTS7960 M1 REN |
| STEER\_LEN | 17 | U4 1A3 → 1Y3 (pin 14) | R3 33Ω | BTS7960 M1 LEN |
| STEER\_RPWM | 16 | U4 1A2 → 1Y2 (pin 16) | R2 33Ω | BTS7960 M1 RPWM |
| STEER\_LPWM | 15 | U4 1A1 → 1Y1 (pin 18) | R1 33Ω | BTS7960 M1 LPWM |

## M2 – Front Motors (BTS7960, via U1 SN74AHCT244 Bank 2)

Front motor pair driver signals buffered via U1 bank 2 (2A\*/2Y\*).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Function | Teensy Pin | Buffer Path | Series R | Destination |
| FRONT\_REN | 19 | U1 2A1 → 2Y1 (pin 9) | R20 33Ω | BTS7960 M2 REN |
| FRONT\_FEN | 20 | U1 2A2 → 2Y2 (pin 7) | R19 33Ω | BTS7960 M2 FEN |
| FRONT\_FPWM | 21 | U1 2A3 → 2Y3 (pin 5) | R10 33Ω | BTS7960 M2 FPWM |
| FRONT\_RPWM | 22 | U1 2A4 → 2Y4 (pin 3) | R9 33Ω | BTS7960 M2 RPWM |

## M3 – Rear Motors (BTS7960, via U1 SN74AHCT244 Bank 1)

Rear motor pair driver signals buffered via U1 bank 1 (1A\*/1Y\*).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Function | Teensy Pin | Buffer Path | Series R | Destination |
| REAR\_REN | 23 | U1 1A4 → 1Y4 (pin 12) | R18 33Ω | BTS7960 M3 REN |
| REAR\_FEN | 24 | U1 1A3 → 1Y3 (pin 14) | R17 33Ω | BTS7960 M3 FEN |
| REAR\_FPWM | 25 | U1 1A2 → 1Y2 (pin 16) | R16 33Ω | BTS7960 M3 FPWM |
| REAR\_RPWM | 26 | U1 1A1 → 1Y1 (pin 18) | R15 33Ω | BTS7960 M3 RPWM |

## Analog Inputs – Child Controls (Potentiometers)

Both use 10 kΩ linear potentiometers with RC filters (100Ω + 100nF).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Function | Teensy Pin | Connector | RC Filter | Power Pins |
| Car Throttle (Pedal) | 3 (A9) | J4-3 | R31 100Ω + C11 100nF→GND | +3.3V J4-2, GND J4-1 |
| Car Steering (Wheel) | 27 (A13) | J14-3 | R30 100Ω + C4 100nF→GND | +3.3V J14-2, GND J14-1 |

## Logic Inputs – Encoder (AMT102V) & Remote Control

Inputs buffered via CD74HC4050 (U2), powered at 3.3V. Encoder is AMT102V with A/B/Z channels.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Function | Teensy Pin | 4050 Path | Connector | Description |
| Encoder A | 0 | 3A → 3Y | J6-3 | AMT102V encoder channel A |
| Encoder B | 1 | 2A → 2Y | J6-4 | AMT102V encoder channel B |
| Encoder Index X | 2 | 1A → 1Y | J6-5 | AMT102V encoder Z/Index |
| Remote Throttle | 4 | 6A → 6Y | J5-3 | Parent RC throttle input |
| Remote Steering | 5 | 5A → 5Y | J5-4 | Parent RC steering input |

## Firmware Defines

#define PIN\_STEER\_REN 18  
#define PIN\_STEER\_LEN 17  
#define PIN\_STEER\_RPWM 16  
#define PIN\_STEER\_LPWM 15  
#define PIN\_FRONT\_REN 19  
#define PIN\_FRONT\_FEN 20  
#define PIN\_FRONT\_FPWM 21  
#define PIN\_FRONT\_RPWM 22  
#define PIN\_REAR\_REN 23  
#define PIN\_REAR\_FEN 24  
#define PIN\_REAR\_FPWM 25  
#define PIN\_REAR\_RPWM 26  
#define PIN\_THROTTLE1 3  
#define PIN\_STEERING1 27  
#define PIN\_ENC\_A 0  
#define PIN\_ENC\_B 1  
#define PIN\_ENC\_X 2  
#define PIN\_THROTTLE2 4  
#define PIN\_STEERING2 5

All components and pin mappings verified against RideOnV2 KiCad schematic and Bill of Materials. Teensy logic levels, driver interface, and sensor wiring are final for firmware integration.