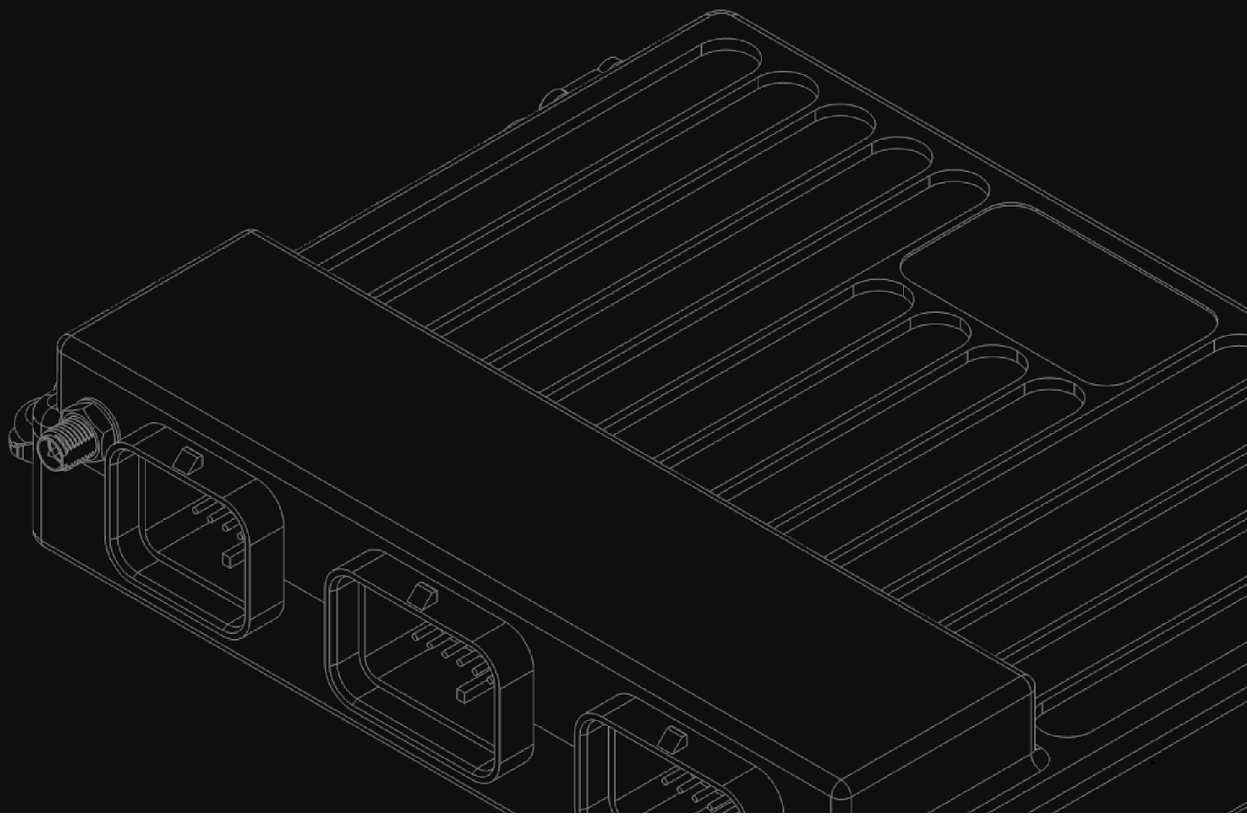
DYNAM LABS

>VCU+

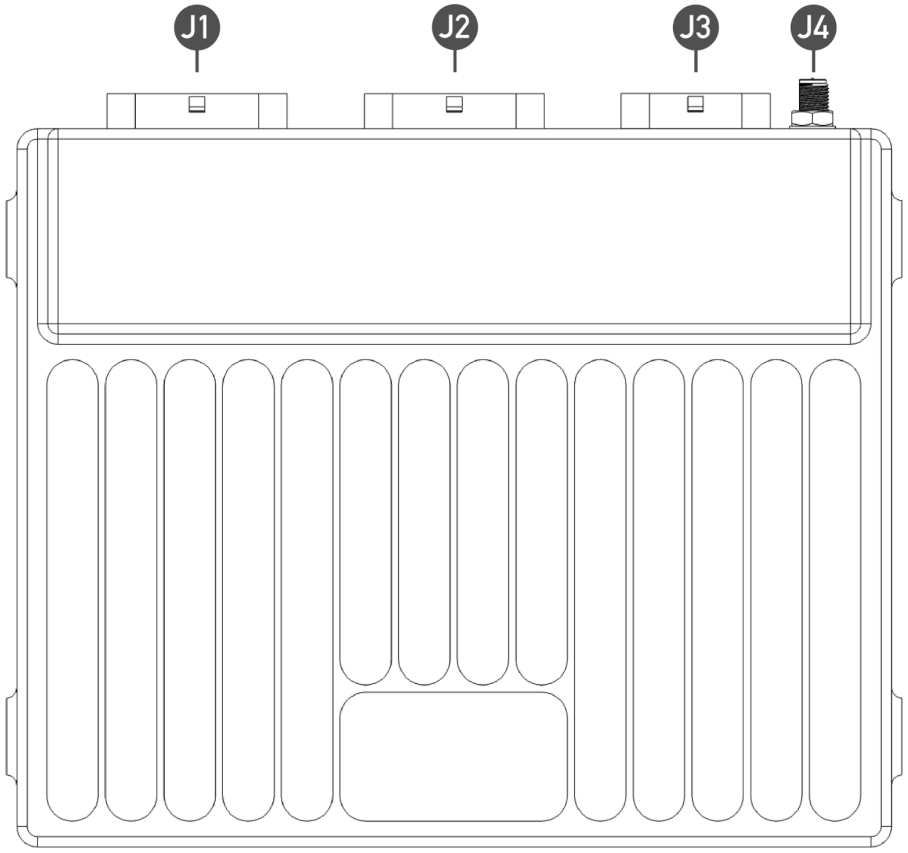


Mar 21, 2025

Quick Start Guide

Hardware Overview

The VCU+ has 3x SUPERSEAL plugs and one SMA connector.



J1

34-pin. Mating connector: TE 4-1437290-1 *

J2

34-pin. Mating connector: TE 4-1437290-0 *

J3

26-pin. Mating connector: TE 3-1437290-7 *

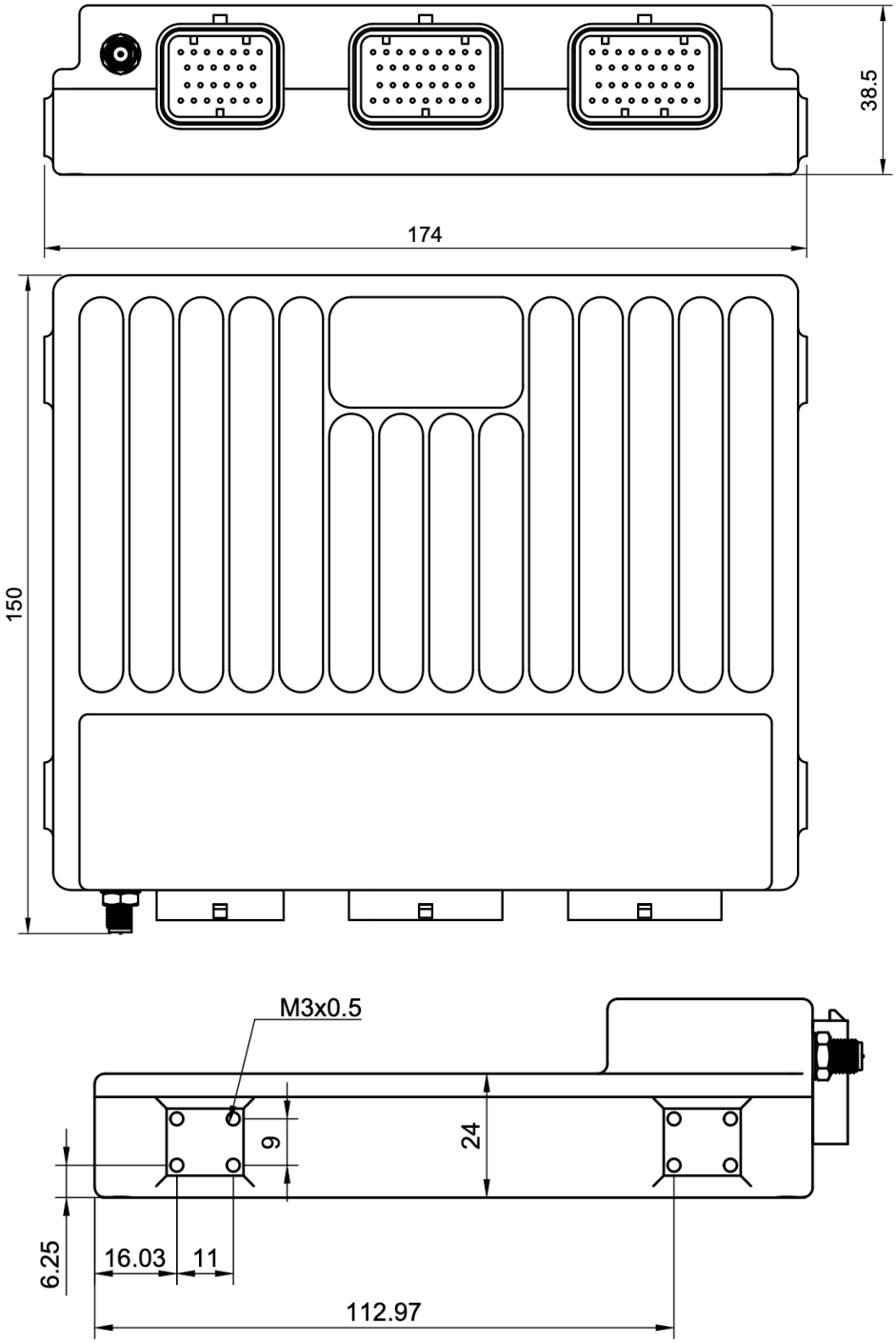
J4

RP-SMA connector for GPS antenna.

*Connector contacts: TE 3-1447221-4 (AWG 20, 1.5mm²)

Cavity plugs for unused pins: TE 4-1437284-3

Dimensions



Pinout

J1

Pin Number	Function
J1-1	PWM/PFM output 1
J1-2	PWM/PFM output 2
J1-3	PWM/PFM output 3
J1-4	PWM/PFM output 4
J1-5	PWM/PFM output 5
J1-6	PWM/PFM output 6
J1-7	PWM/PFM output 7
J1-8	PWM/PFM output 8
J1-9	PWM/PFM output 9
J1-10	PWM/PFM output 10
J1-11	Analog Ground
J1-12	SENT 1
J1-13	SENT 2
J1-14	GND
J1-15	GND
J1-16	+5VDC B (150 mA max)
J1-17	+12V output

Pin Number	Function
J1-18	DIN-L 1
J1-19	DIN-L 2
J1-20	DIN-L 3
J1-21	DIN-L 4
J1-22	DIN-H 1
J1-23	DIN-H 2
J1-24	DIN-H 3
J1-25	DIN-H 4
J1-26	DIN-H 5
J1-27	Wakeup
J1-28	+5VDC A
J1-29	+5VDC B
J1-30	HVIL out *
J1-31	HVIL in *
J1-32	+5VDC A (150 mA max)
J1-33	Logic PWR GND
J1-34	Logic PWR +12VDC

PWM outputs are low current outputs, max 250mA per channel.
* Function currently not supported. Please wait for future FW updates. Leave pins disconnected.

J2

Pin Number	Function
J2-1	Ethernet RX-
J2-2	Ethernet RX+
J2-3	Ethernet TX-
J2-4	Ethernet TX+
J2-5	BMS IM
J2-6	BMS IP
J2-7	Analog Output 1
J2-8	Analog Output 2
J2-9	Analog Ground
J2-10	Analog Temperature 1
J2-11	Analog Temperature 2
J2-12	Analog Temperature 3
J2-13	Analog Temperature 4
J2-14	DIN-L 5
J2-15	DIN-L 6
J2-16	DIN-L 7
J2-17	DIN-L 8

Pin Number	Function
J2-18	Analog Input 1
J2-19	Analog Input 2
J2-20	Analog Input 3
J2-21	Analog Input 4
J2-22	Analog Input 5
J2-23	Analog Input 6
J2-24	Analog Input 7
J2-25	Analog Input 8
J2-26	DIN-L 9
J2-27	DIN-L 10
J2-28	Analog Ground
J2-29	CAN1 High *
J2-30	CAN1 Low *
J2-31	CAN2 High *
J2-32	CAN2 Low *
J2-33	CAN3 High *
J2-34	CAN3 Low *

* Each CAN bus is terminated at the VCU+

J3

Pin Number	Function
J3-1	GND for LS Outputs *
J3-2	High Side Output 1
J3-3	High Side Output 2
J3-4	High Side Output 3
J3-5	High Side Output 4
J3-6	+12VDC for HS Outputs *
J3-7	+12VDC for HS Outputs *
J3-8	GND for LS Outputs *
J3-9	GND for LS Outputs *
J3-10	N/C
J3-11	High Side Output 5
J3-12	High Side Output 6
J3-13	High Side Output 7

Pin Number	Function
J3-14	Low Side Output 1
J3-15	Low Side Output 2
J3-16	Low Side Output 3
J3-17	Low Side Output 4
J3-18	Low Side Output 5
J3-19	High Side Output 8
J3-20	Low Side Output 6
J3-21	Low Side Output 7
J3-22	Low Side Output 8
J3-23	Low Side Output 9
J3-24	Low Side Output 10
J3-25	Low Side Output 11
J3-26	Low Side Output 12

Maximum current per Low-Side Output: 1.5A

Maximum current per High-Side Output: 1.5A

* These pins supply power to the High-Side / Low-Side outputs. Ensure that the input wires are capable of carrying sufficient current to support the connected outputs.

Required Connections

- Power/Wakeup
- Throttle pedal
- Shifter
- Brake Switch
- Drive Unit
- Contactors & Pre-charge
- Ethernet (for calibration with **Bolt**)

Power/Wakeup
Power and Wakeup signal must be present for the VCU to boot. In most cases these are simply connected to the switched +12VDC from the ignition switch (KL15).

Throttle pedal
The VCU currently supports 2 types of throttle pedal. Analog and SENT. In both cases, only dual channel pedals are supported.

Shifter
Currently supported shifter types are:
- Digital Input (push button or switches)
- CAN Keypad
- Generic CAN (as defined in .dbc file)
- BMW F-series
- Porsche Taycan/992.
- Custom, such as analog input etc. (through plugins)

Brake Switch
Brake switch status can be sourced from Tesla Drive Inverters (LDU/SDU) via CAN. In case of Tesla FDU or Cascadia, the brake switch must be wired into a Digital Input (DINH* or DINL* pins) on the VCU. A brake switch is necessary as it is a crucial component in the shift lockout logic.

Drive Unit
Currently supported:
- Tesla Large Drive Unit (Normal and Sport)
- Tesla Small Drive Unit Rear (SDU)
- Tesla Small Drive Unit Front (FDU)
- Tesla Dual Motor Drivetrain (LDU + FDU, SDU + FDU)
- Cascadia Motion CM/PM series

Pre-charge circuit
A basic pre-charge circuit typically consists of 2 Contactors (one for each HV battery side) and one pre-charge resistor. A total of 3 outputs need to be dedicated for pre-charge & contactor control. Any VCU output can be utilized for that. Contactors should have economizers built in.

Ethernet
An Ethernet connection to the VCU is required for calibration. Once calibration is complete, it can remain disconnected. Wiring it to a panel-mount connector is recommended to allow for easy reconnection if needed.

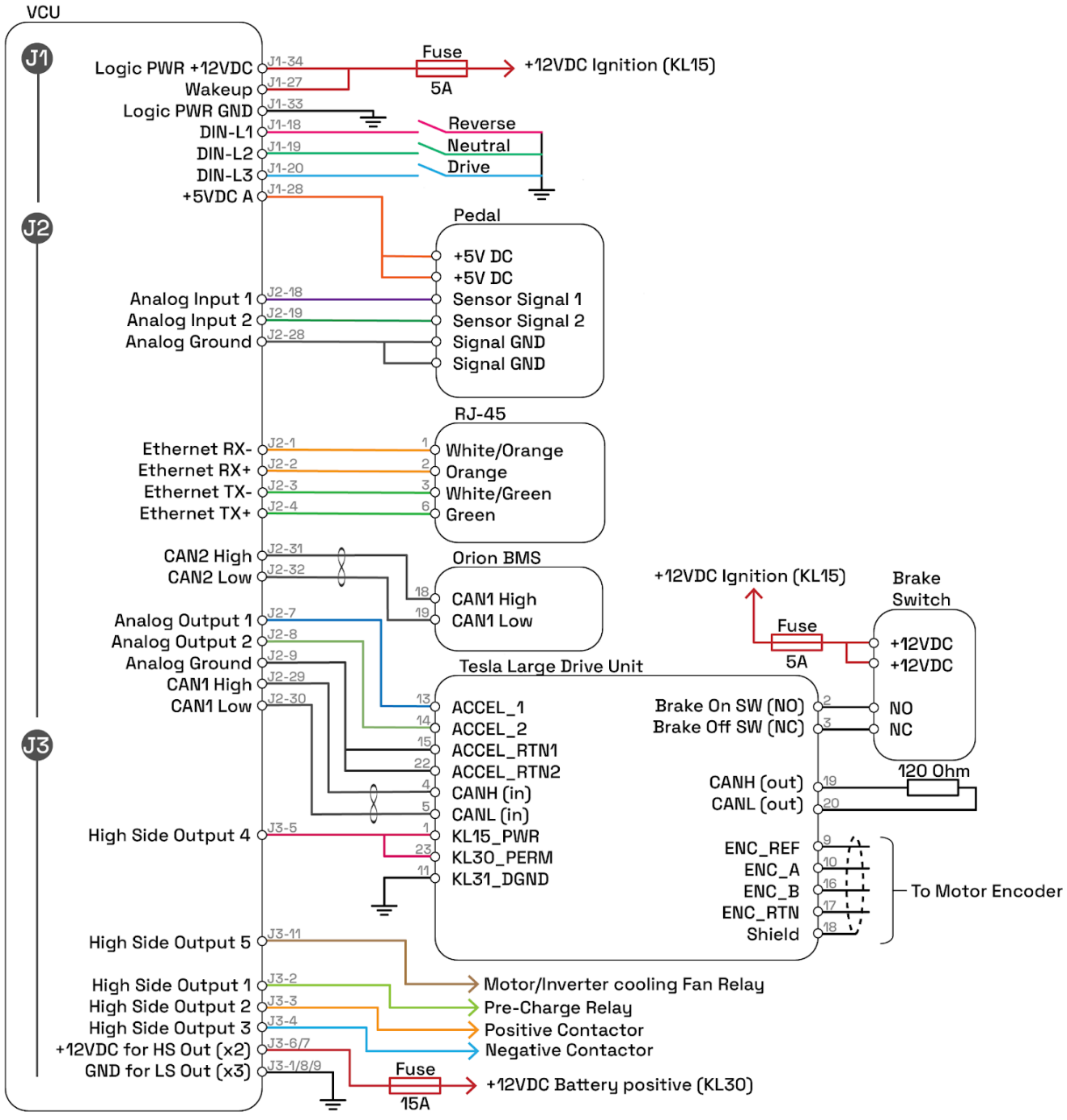
General Wiring
Proper wiring is essential for reliable VCU operation.
Keep signal wires separate from power and high-voltage lines to prevent interference.
Use only shielded HV cables to avoid excessive EMI.
CAN bus must use twisted pair wiring with 120Ω termination at both ends, each CAN bus is terminated at the VCU+.
Ethernet wiring should be CAT5 or higher.
Following these best practices ensures optimal performance and system integrity.

Example Configurations

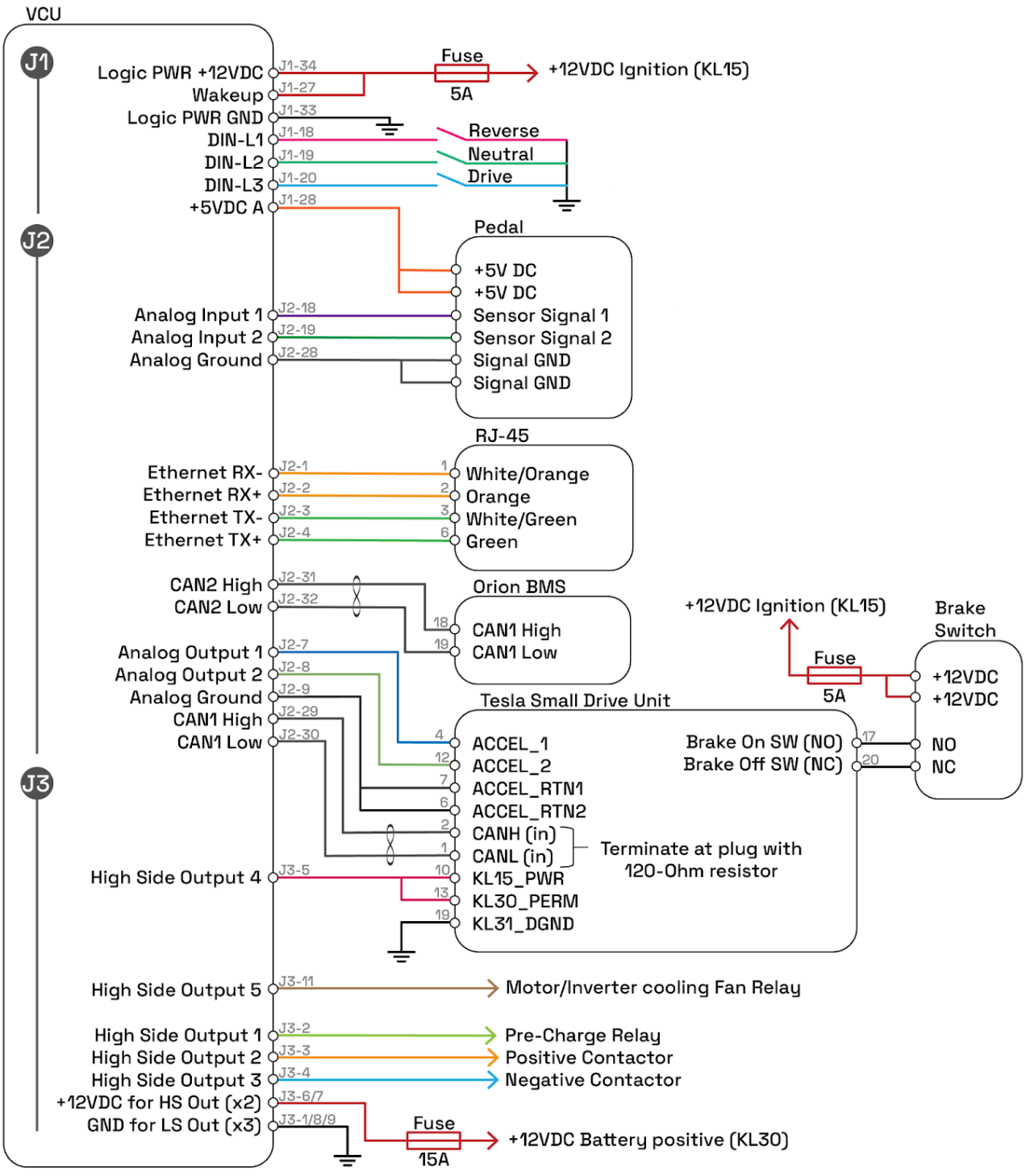
This section provides example wiring diagrams for interfacing the VCU with various inverter setups, including connections to essential peripherals. These diagrams serve as a starting point for users and are by no means exhaustive, as the VCU's full capabilities extend well beyond the examples provided.

<Diagrams follow on the next page>

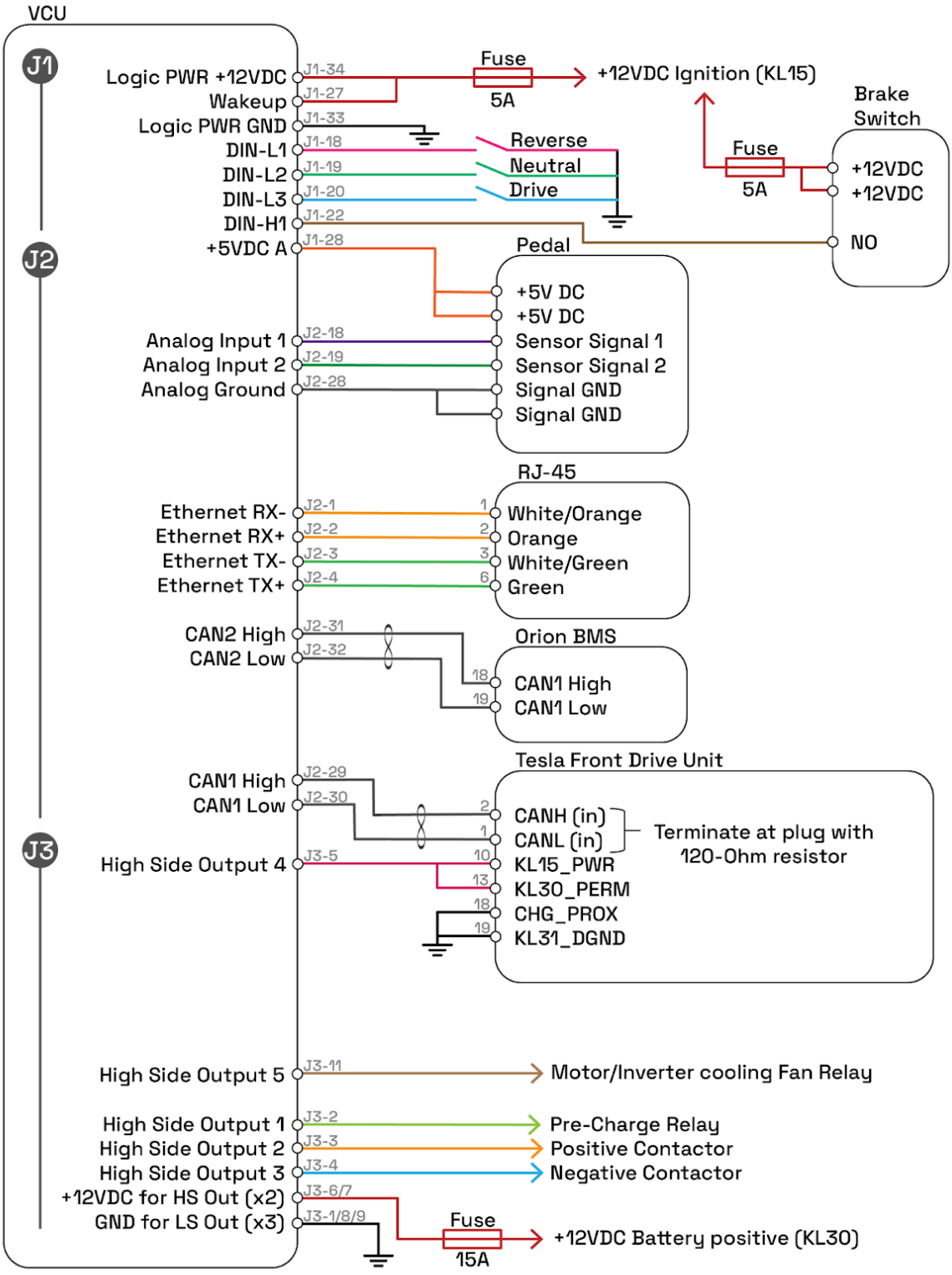
Tesla Large Drive Unit



Tesla Small Drive Unit, Rear (SDU)



Tesla Small Drive Unit, Front (FDU)



Bolt

The Dynam Labs **Bolt** app is available for Windows, macOS and Linux. It handles VCU+ calibration as well as firmware updates.

How to connect

1. Install Bolt app

- Download the latest version of the **Bolt** app from: https://dynamlabs.com/downloads

Windows:

- After downloading the installer, double-click it to run.

macOS:

- After downloading, open the .dmg and drag the Bolt app into the Applications folder.

2. Ethernet connection setup (static IP)

To connect to the VCU+, you need to set your PC's Ethernet adapter to a static IP address within the same subnet. Make sure to avoid using `10.0.0.42`, as that is the VCU's IP address. Use any other IP address in the range `10.0.0.x` (e.g., `10.0.0.50`) and set the subnet mask to `255.255.255.0`, ensuring both the VCU and your PC are on the same network.

3. Running the Bolt app for the first time

- On the first run, Bolt will be waiting for the VCU+ to be discovered and connected. Initially, the app will appear.
- Once the VCU+ is connected, you'll likely see a **Calibration difference**. This is expected because Bolt does not have any calibration data yet. You can load the calibration data from the VCU+, which will have safe default settings preloaded.
- After loading the calibration from the VCU+, the app will be fully operational. You can now explore the dashboards and begin adjusting VCU parameters as needed.
- Firmware updates are easily accessible via the sidebar menu. To update, simply choose the firmware version you want and click **Update**.
- New versions of the Bolt app will show a notification when available, prompting you to download and install the latest version to ensure you have the most up-to-date features and fixes.

Network connection troubleshooting

If you experience connection issues, follow these steps:

1. **Open app Settings:**
   Navigate to the **Settings** tab and find the **Connection settings** section. Here you can try different modes to find the best match for your network configuration.

2. **Experiment with Connection Modes:**
   - **Start with Broadcast (Auto):** This is the default mode and is best for most users.
   - **Switch to Unicast Modes:**
     - **Unicast (Auto):** Allows you to manually choose the **Network interface**, which can resolve conflicts when using Ethernet for the VCU+ and WiFi for Internet.
     - **Unicast (Static):** Similar to Unicast (Auto), but with configurable static ports and IP; use this mode if other methods fail.
3. **Verify Your Network Interfaces:**
   Confirm that the correct network interfaces are active. For example, if you're connected via Ethernet to the VCU+ and using WiFi for Internet access, ensure that the chosen mode in the settings reflects the desired network interface.

By following these steps and switching between the available connection modes in the settings, you can troubleshoot and resolve most connection issues.

Flashing Tesla drive units

Before Tesla drive units can be used, they must be flashed with the correct firmware version.

Requirements for Flashing

To successfully flash the drive unit, ensure the following:

- The **VCU+** is connected to **Bolt**.
- A **CAN connection** is established between the VCU+ and the drive unit.
- **Power is supplied** to the drive inverter, either via the VCU+ or a direct 12V power source.
- **Internet connectivity** is available, as firmware files are retrieved from our servers.

Flashing Procedure

Each drive unit consists of two components that require flashing:

1. **DI (Drive Inverter)**
2. **PM (Pedal Monitor)**

Both components must be flashed before the drive unit can be controlled via the VCU+.

Pre-Flashing Checks

Before proceeding, verify that the drive unit is properly connected to the VCU+:

- Open **Bolt** and navigate to the **Main DI** screen.
- Ensure the **Connected Indicator** is **green**.
- For **dual-motor setups**, also check the **Secondary DI** screen to confirm that the secondary drive inverter is connected.

Flashing Process

1. **Navigate to the 'Tools & Utilities' page** in Bolt.

2. Select **'Flash TMS Drives'**.

3. The following flashing options will be available:
    - **Primary DI**
    - **Primary PM**
    - **Secondary DI** (Front Drive Unit)
    - **Secondary PM** (Front Drive Unit)

4. **Check the Build ID** for each component.
    - Each component should have a **non-zero Build ID**.
    - **Write down the Build ID** before flashing, as it uniquely identifies the component and cannot be retrieved if the process is interrupted or fails.

5. **Select a component and click 'Flash'**.

6. Wait for the process to complete. A notification will confirm when flashing is successful.

7. **Repeat the process** for all remaining components.

Once all components are flashed, the drive unit is ready for operation via the VCU+.