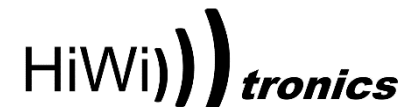


Integrated components, systems and architectures for efficient adaption and conversion of commercial vehicle platforms to 3rd generation BEVs for future CO2-free city logistics

Webinar 4:  
**E-AXLE for N2 CATEGORY VEHICLES**

Elaphe



The main objective of Elaphe's involvement in N2 category vehicle was to support the communication between two AVL inverters and consequently e-motors. For this reason Elaphe provide the PCU – Propulsion Control Unit



# Smart systems

Elaphe PCU enables::

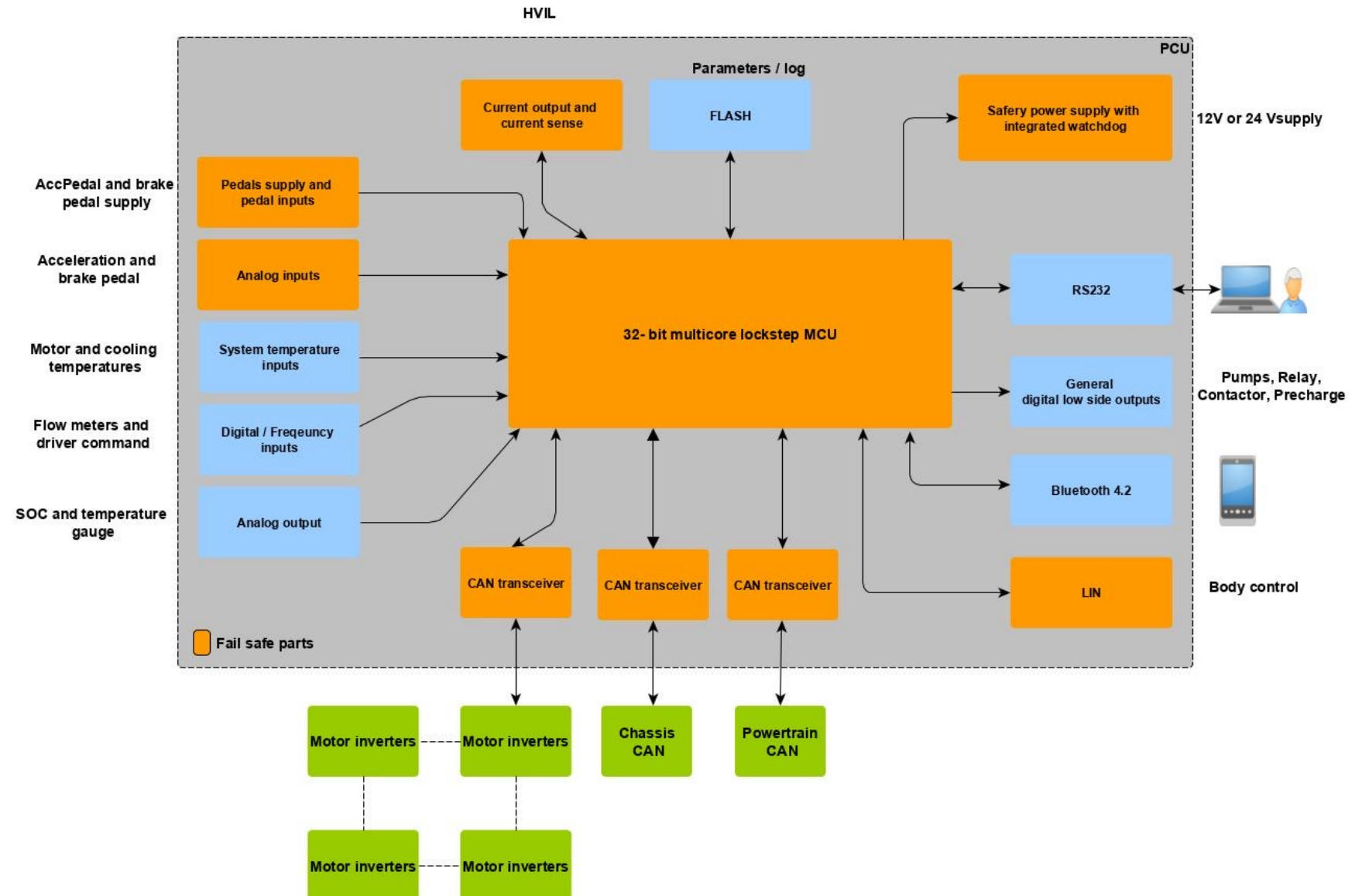
- Product: PCU 2.0
- Rich, intelligent data
- Condition monitoring & logging
- Torque distribution



# PCU – HW system architecture

## Hardware:

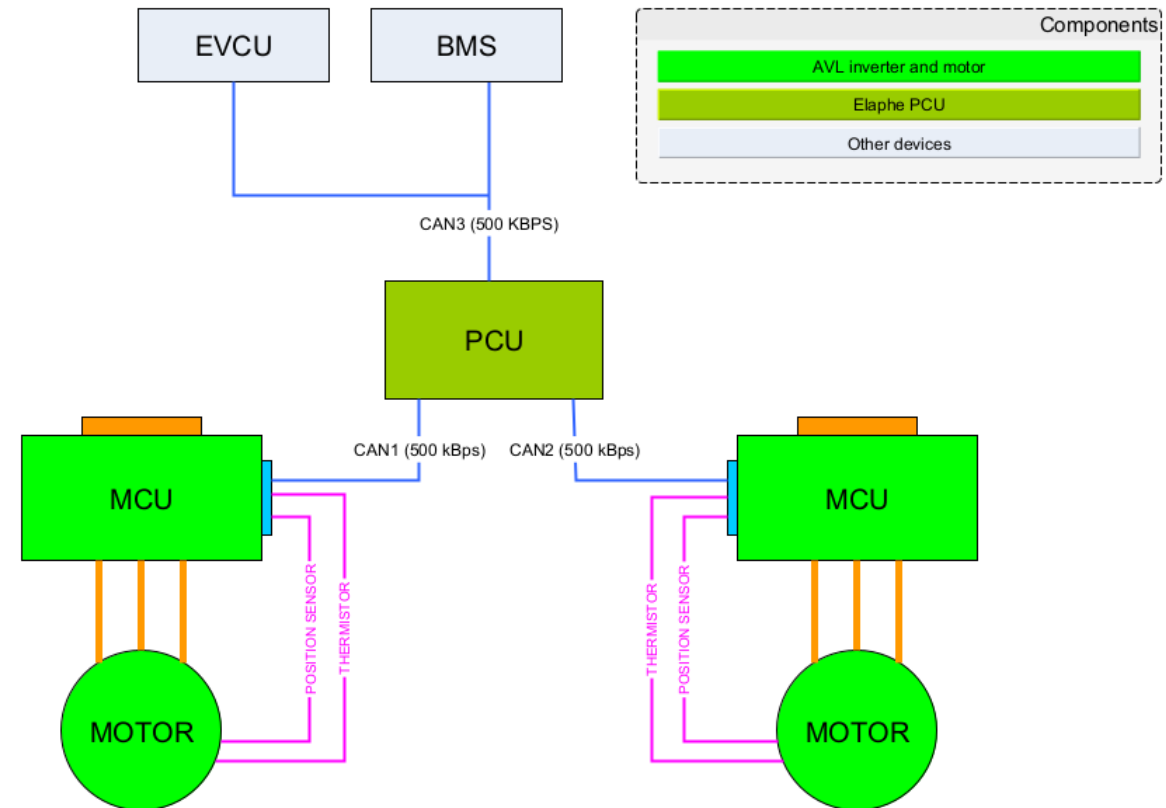
- 3 x CAN interfaces
- Control over CAN
- Diagnostic over RS232



# Sys2wheel CAN system architecture

Key components:

- PCU – SW adopted for each system architecture
- MCU– APG SW for optimum operation of the motor
- Motor – APG geared motor
- VECU – Iveco control unit for passing driver input

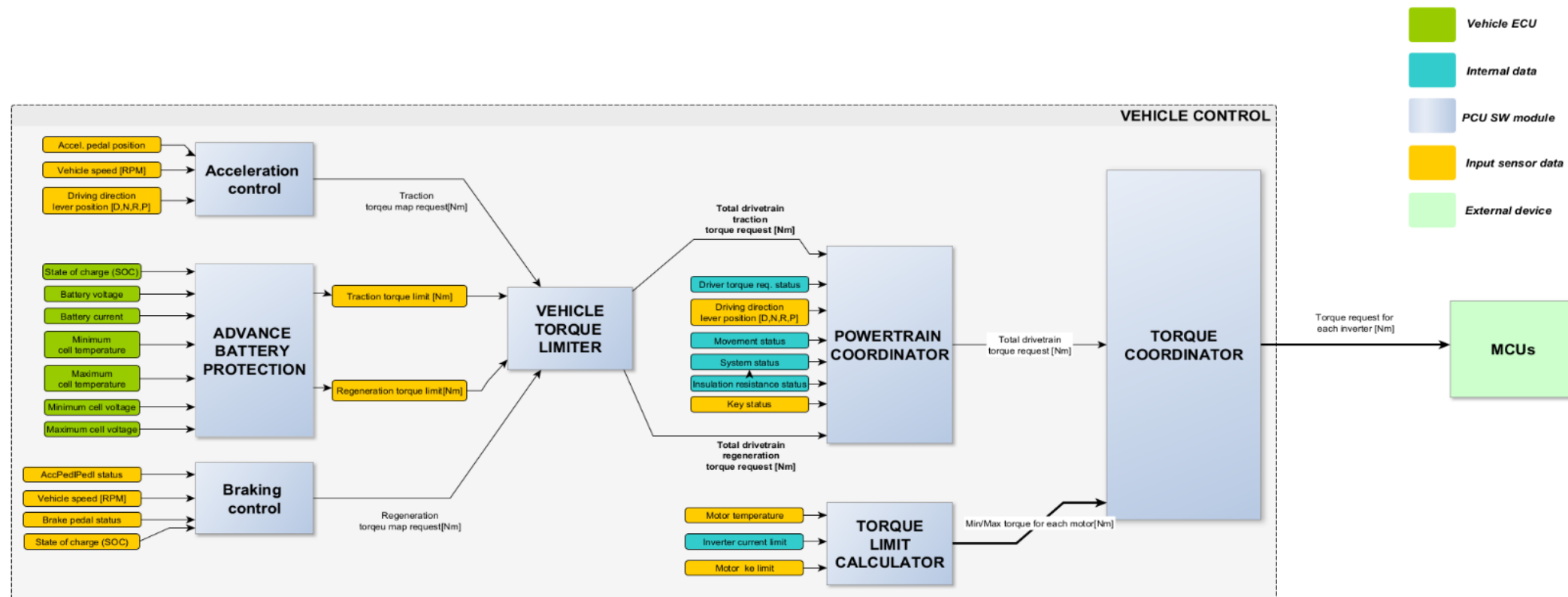




# PCU SW system architecture

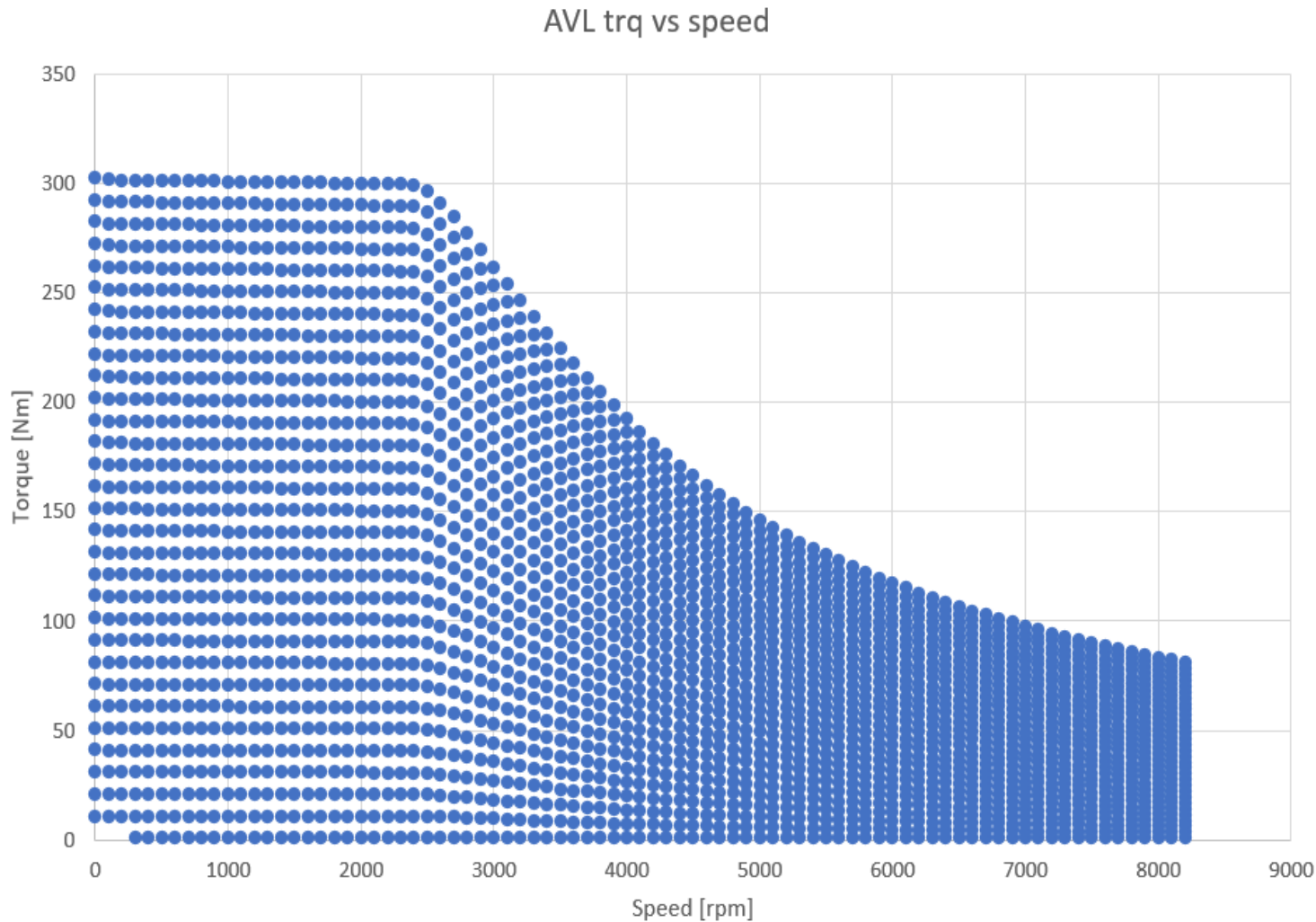
Take away:

- **Advance battery protection** - kept the battery current inside safety boundaries. BMS provide DC current proposed value.
- **Acceleration control** - limiting to motor and battery performance
- **Braking control** - limiting to motor and battery performance
- **Torque coordinator** - splitting torque to each motor
- **Functional safety** - CAN monitoring, watchdog



## Key function:

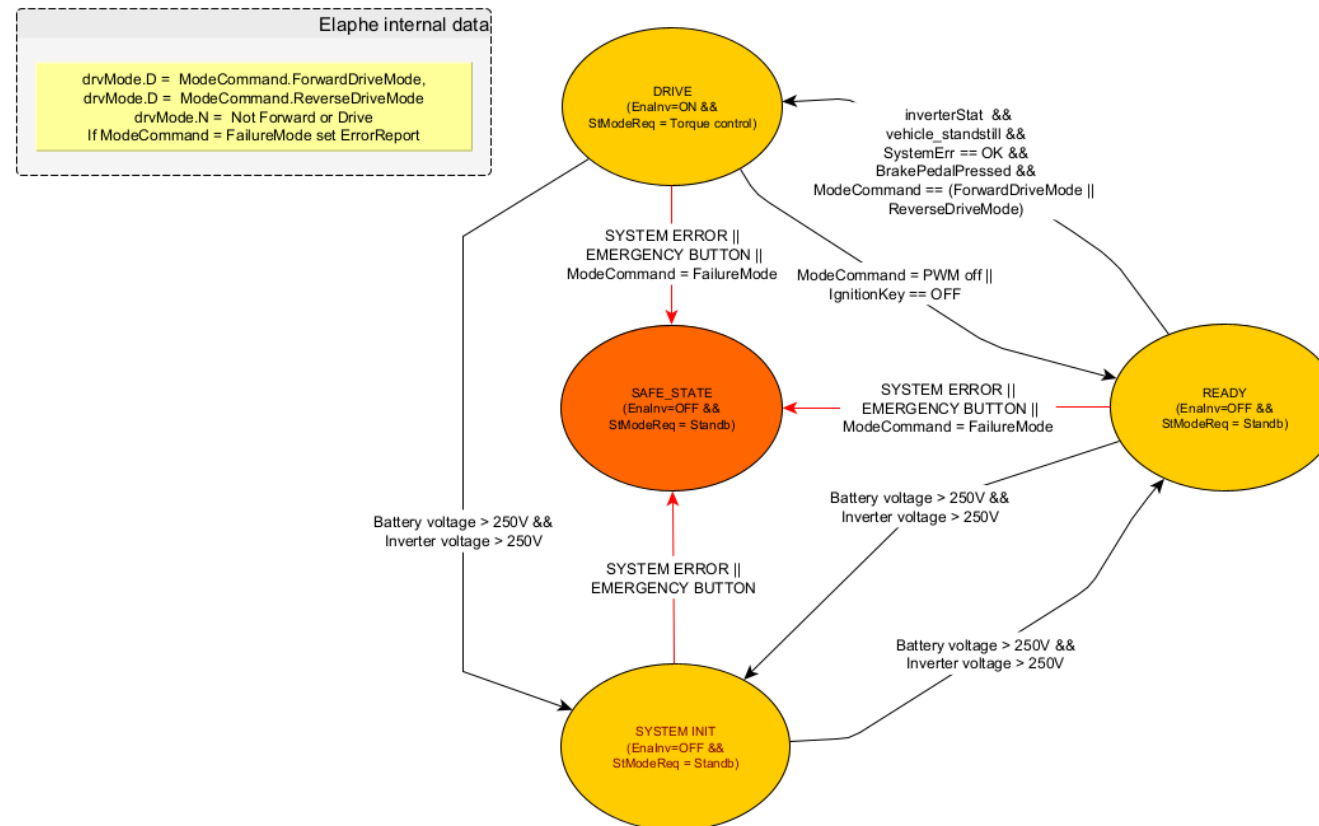
Limitation – torque limitation based on motor capabilities.



# PCU state machine

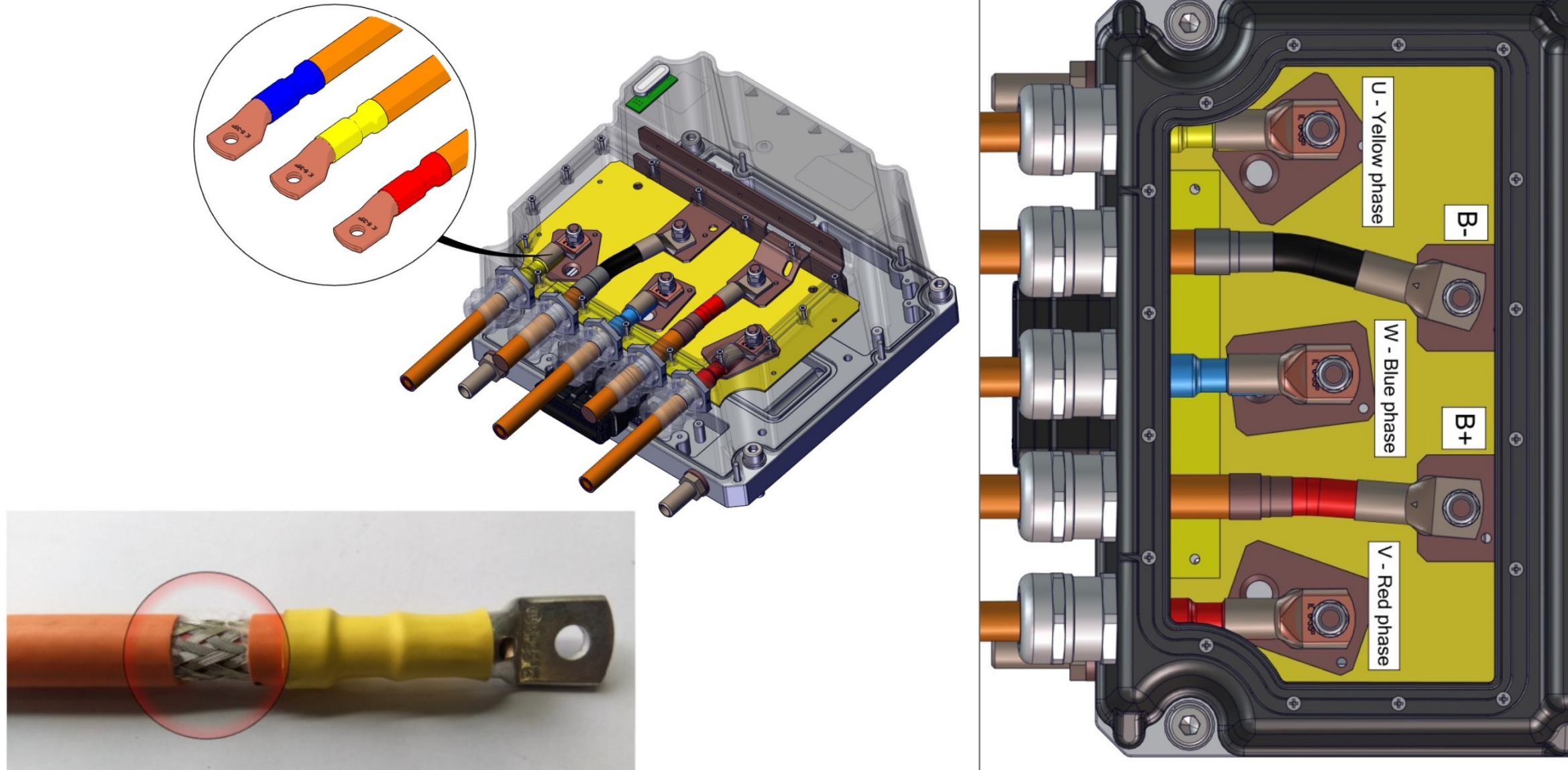
Key functions:

- **Synchronization** – components needs different amount of time to perform initialization and device self-test
- **FuSa** – avoid unintended vehicle movement
- **HV safety** – enabled only when driving or charging request is active
- **Notification** – inform driver and store all incorrectness in memory

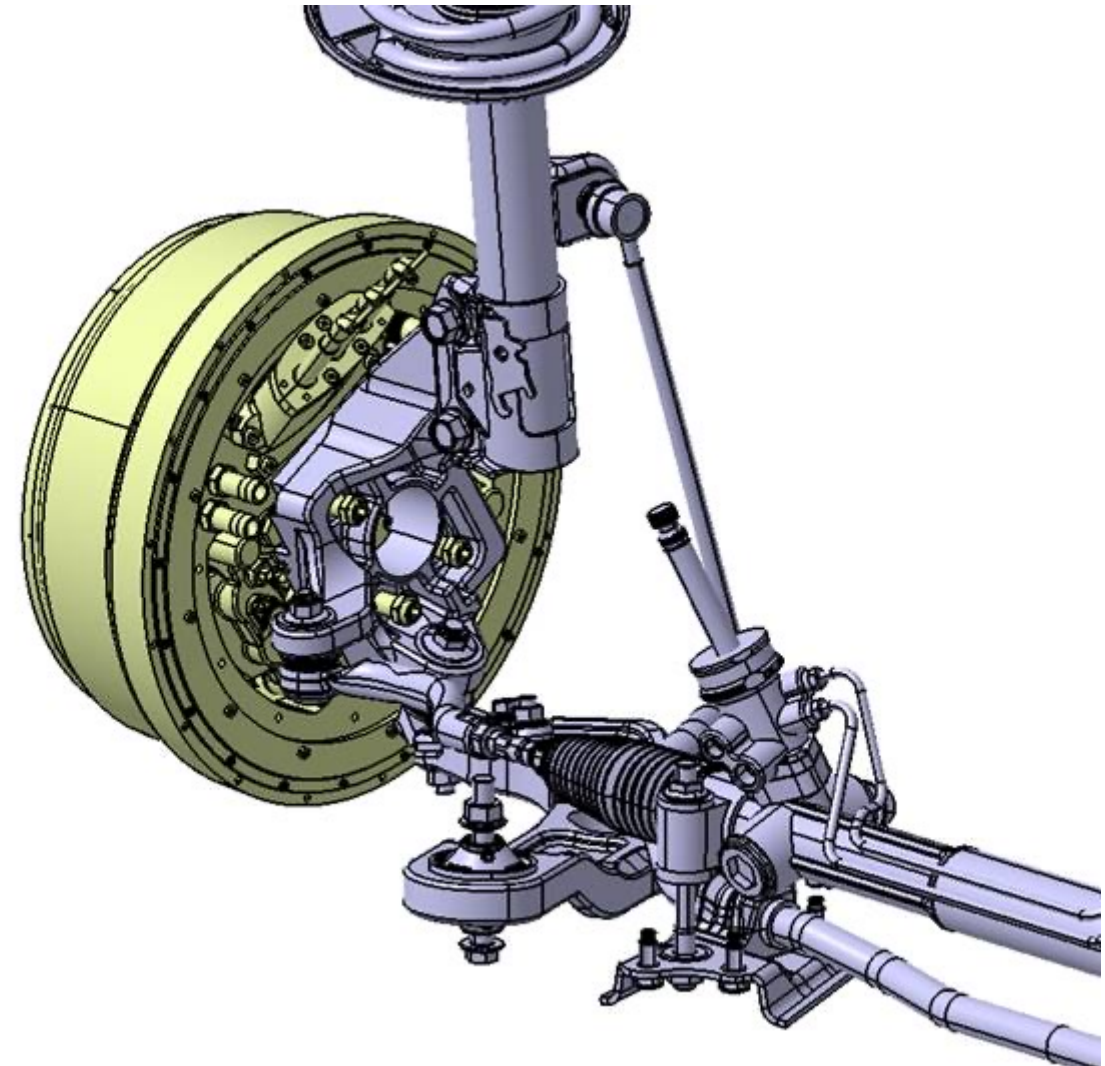
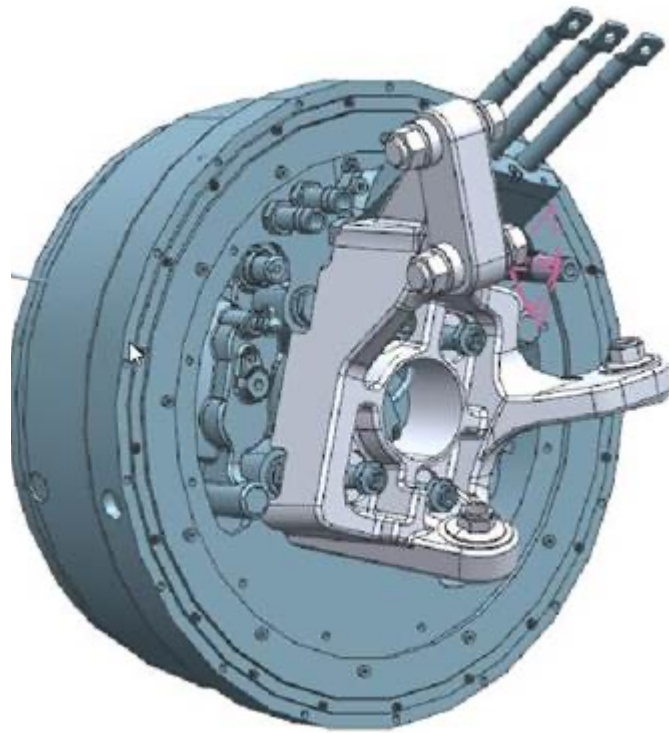




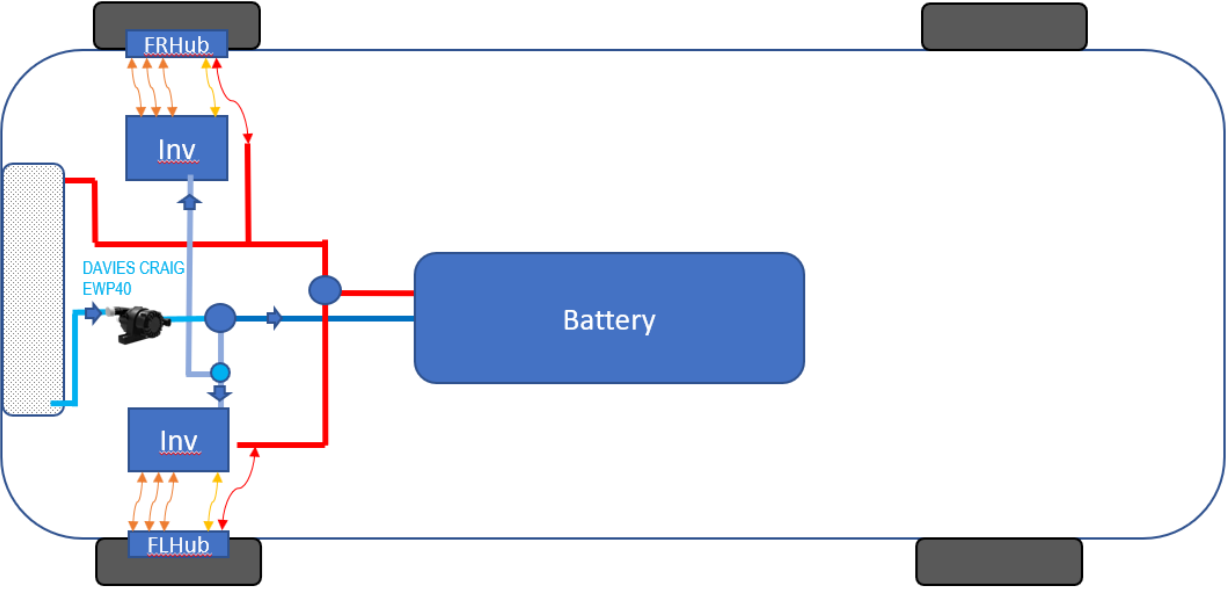
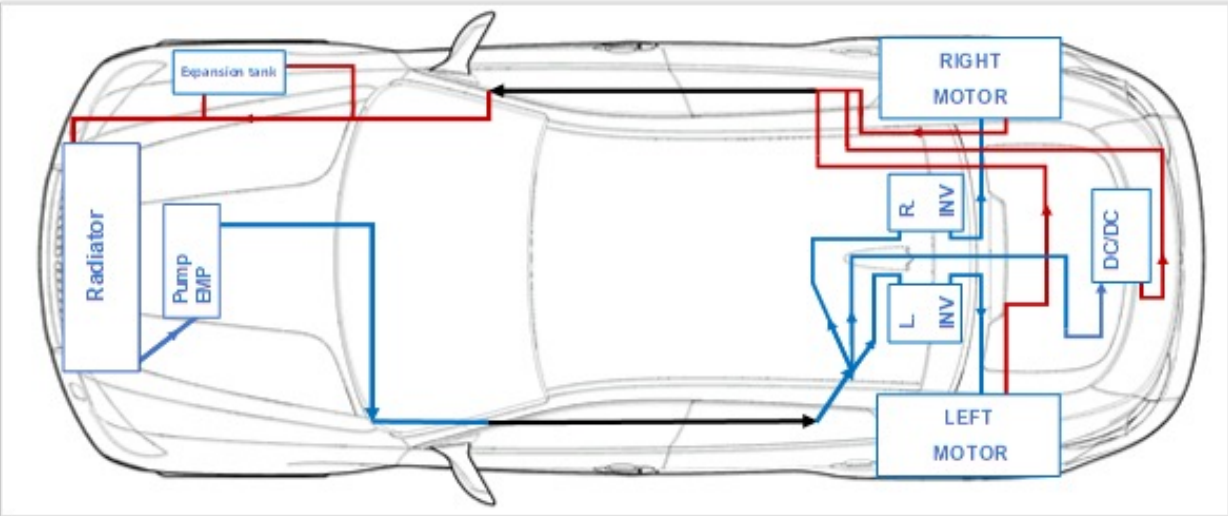
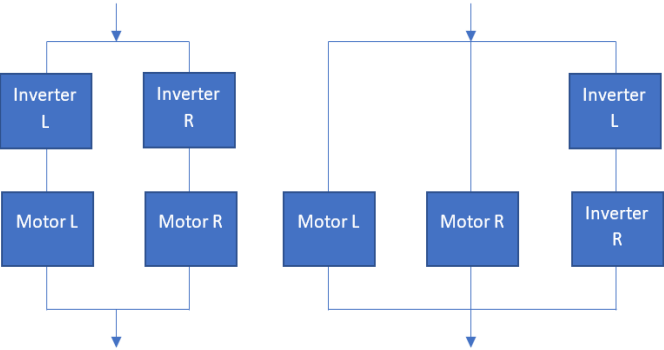
# Phase cable routing



The cables and hoses shall be routed in such a way which ensures enough play for suspension movement. Sharp bending of the cables and hoses shall be avoided. If cables or hoses are in contact with sharp edges, additional protection must be added to avoid cable or hose damage.



# Cooling system design





## Motor - Inverter

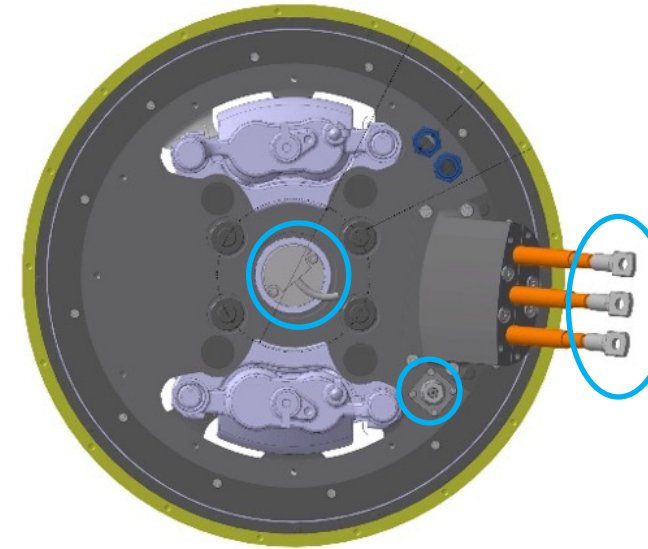
- Phase cables
- Position sensor

## Motor - PCU

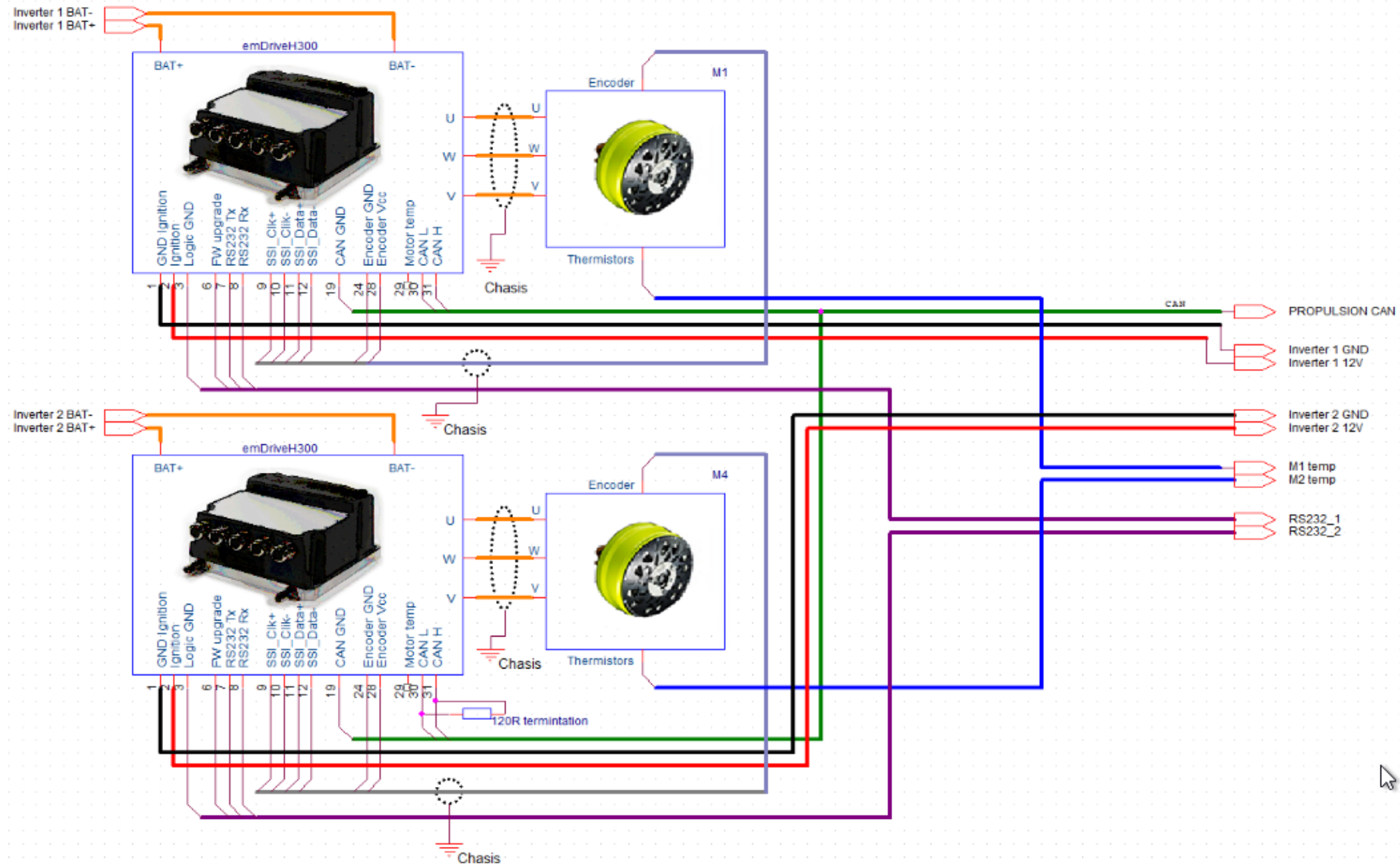
- Temperature sensor

## Inverter

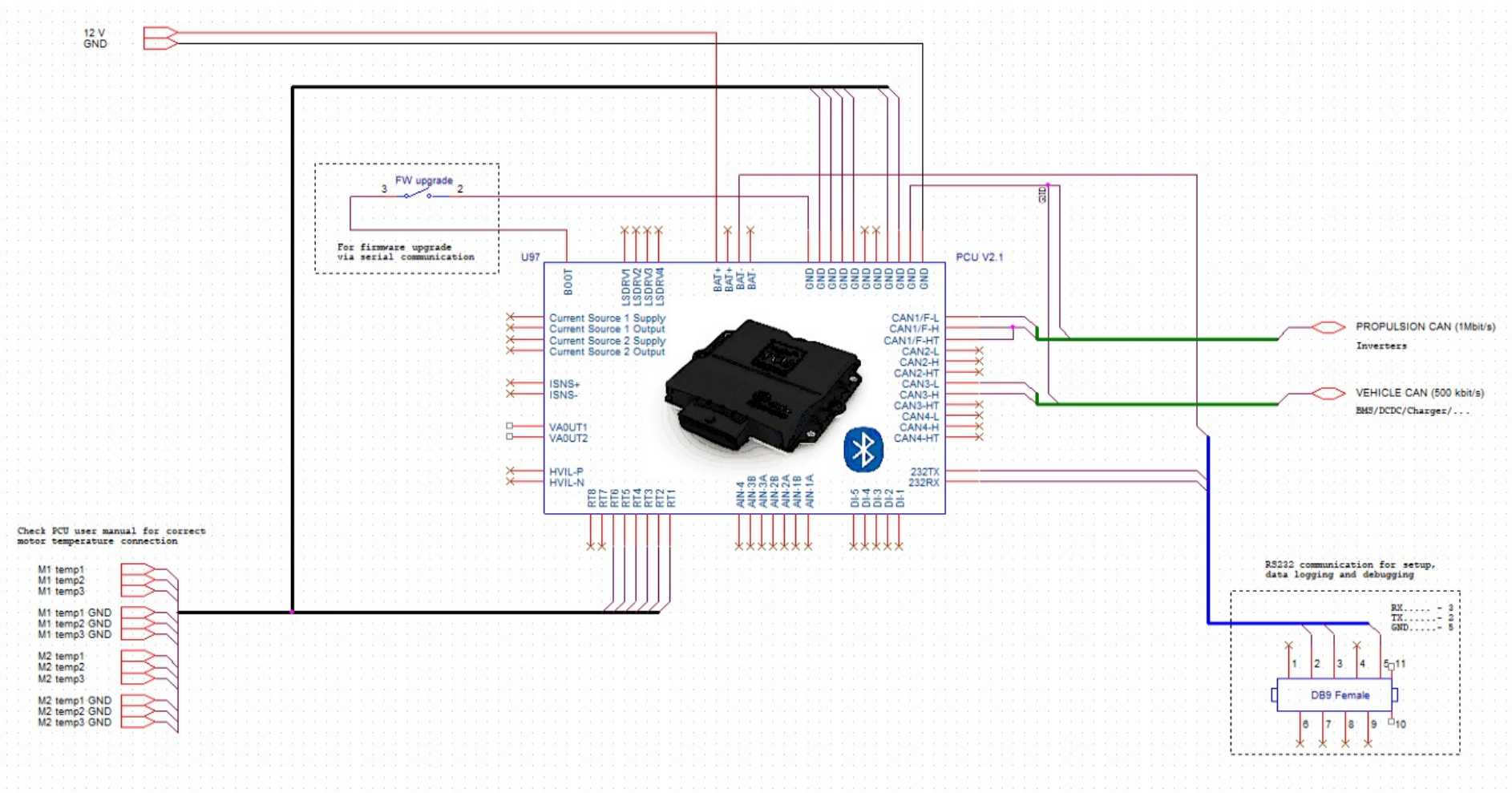
- High voltage connection
- 12 V (or 24 V) power supply
- CAN
- RS232 serial interface
- BOOT switch

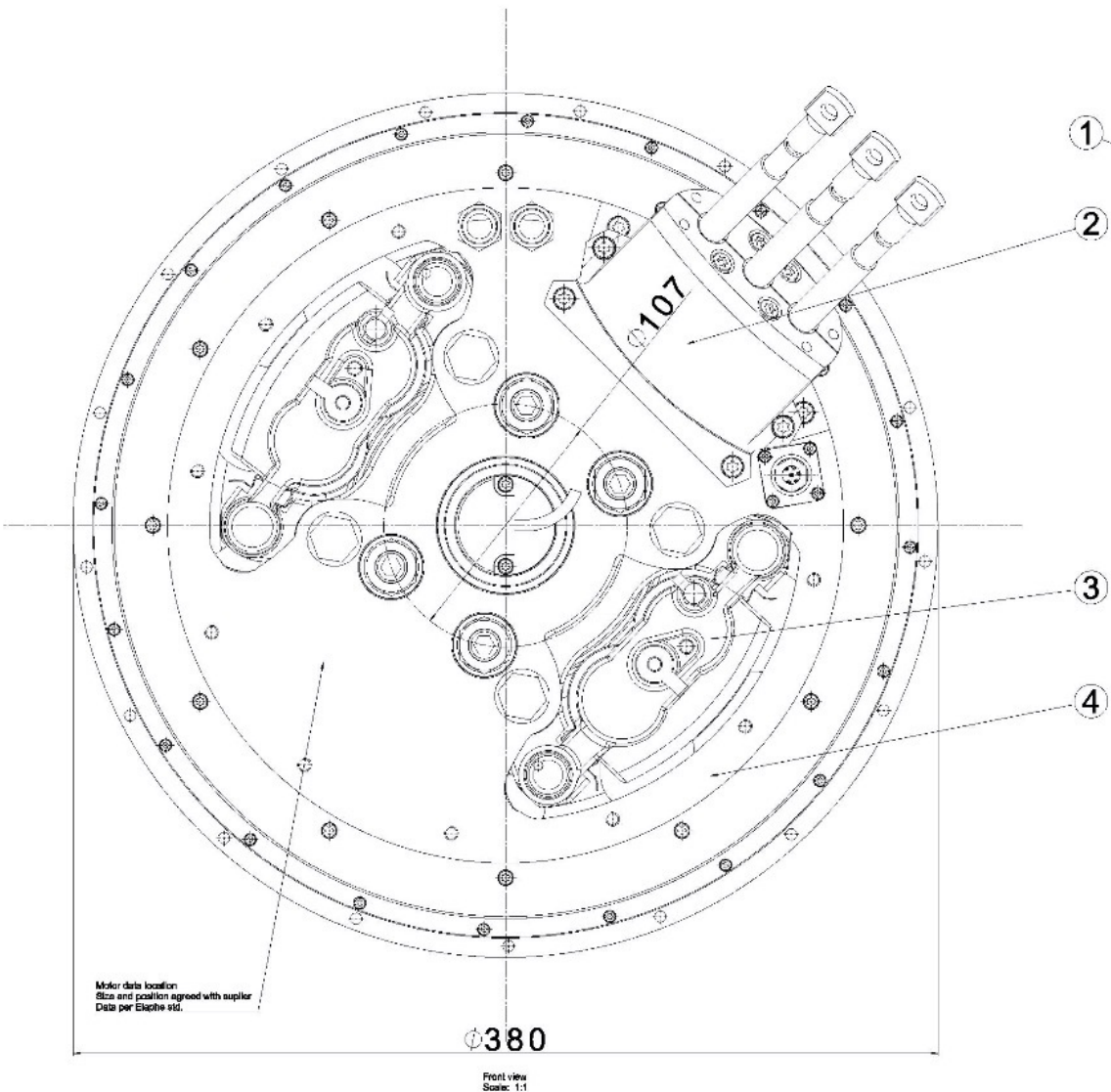


# Electrical schematics









① Mechanical connection of the motor to the vehicle chassis must be done with a calibrated torque wrench. The following tightening torques should be applied. Use DIN 934 class 10 nuts.

- Tightening torque for 10.9 grade, M10 bolts = 71,5 Nm
- Tightening torque for 10.9 grade, M12 bolts = 122 Nm
- Tightening torque for 10.9 grade, M15 bolts = 168 Nm

No	Part name/installation detail
1	Rotor
2	Connection Box
3	Disc Brake A caliper configuration
4	Stator – Disc version

- Improved efficiency on a COTS IWM
- Integrated ABS encoder into a COTS IWM
- Complete powertrain integrated to a delivery vehicle application for the first time
- Improved space for battery
- Improved retrofitting options with simplification of conversion to EV
- Reduced price of conversion to EV