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AEM EV
Tesla SDU Inverter Control Board
Installation Manual

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Disclaimer

DANGER!

USE THIS PRODUCT WITH EXTREME CAUTION. MISUSE AND/OR IMPROPER INSTALLATION CAN CAUSE SIGNIFICANT DAMAGE TO YOUR VEHICLE AND PROPERTY BELONGING TO YOU OR OTHERS, AS WELL AS PERSONAL INJURY OR DEATH. IF YOU ARE NOT TRAINED IN ELECTRICAL ENGINEERING OR COMPLETELY FAMILIAR WITH THE SAFETY REQUIREMENTS OF HIGH VOLTAGE ELECTRIC VEHICLES, AND/OR ARE NOT WELL-VERSED IN CONFIGURING THE NECESSARY CONTROL CALIBRATIONS IN THE AEM VEHICLE CONTROL UNIT (VCU), DO NOT UNDER ANY CIRCUMSTANCES ATTEMPT TO INSTALL OR USE THIS PRODUCT. REFER THE INSTALLATION AND CALIBRATION TO A REPUTABLE INSTALLATION FACILITY, OR CONTACT AEM EV FOR A REFERRAL IN YOUR AREA. IT IS THE RESPONSIBILITY OF THE INSTALLER TO ULTIMATELY CONFIRM THAT THE INSTALLATION AND CALIBRATIONS ARE SAFE FOR ITS INTENDED USE.

THE AEM LDU INVERTER CONTROL BOARD (“ICB”) WAS DEVELOPED TO ENABLE QUALIFIED INSTALLERS AND USERS TO INSTALL A USED TESLA LARGE DRIVE UNIT (“LDU”) INTO ANY VEHICLE. TESLA LDU’S USED IN EV CONVERSIONS AND PURPOSE-BUILT RACE VEHICLES ARE USED PRODUCTS AND THEIR CONDITION CANNOT BE EASILY VERIFIED. AEM’S ICB MAKES MORE TORQUE, ALLOWS HIGHER MOTOR SPEED AND MAY ALLOW FOR HIGHER DC CURRENT DRAWS THAN THOSE OF A STOCK TESLA LDU INVERTER. AEM HOLDS NO RESPONSIBILITY FOR ANY DAMAGE OR MECHANICAL DEGRADATION TO A TESLA LDU AND RELATED DRIVETRAIN COMPONENTS, OR VEHICLE HIGH VOLTAGE SYSTEMS AS A RESULT OF THE INSTALLATION OR USE OF THIS PRODUCT.

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Introduction

This document describes the installation, setup and configuration of the AEM EV Tesla Inverter Control Circuit Boards (Control Boards). It describes the new functionality and required configuration that exists with the replacement of the OE Tesla Control Board.

The OE Tesla inverter works by taking “throttle” commands directly from the accelerator pedal along with commands via CAN to control vehicle direction, etc. All torque mapping and limiting is hard coded within the Tesla inverter itself and can never be changed.

The AEM Inverter Control Board works differently in that no direct accelerator pedal input to the inverter is required and that all control commands are executed via CAN with an AEM VCU. The AEM VCU is the main vehicle control module that receives all driver control inputs (accelerator pedal, drive direction, variable regen, etc) that allows for direct user adjustable torque mapping and then executes the motor torque control commands to the inverter purely by CAN.

The scope of this document is limited to just the install and setup of the AEM Inverter Control Board. It is assumed that all other e-propulsion systems including HV ESS (including management, charging & safety systems), contactors, driver interface devices, thermal management and other general vehicle requirements (drivetrain integration, steering, brakes, safety, etc) are already established and correctly installed into the vehicle.

Information

Revision History

Revision	Date	Change Description
A	9/13/2021	Initial Release

Document Conventions

Information Type	**Font Convention**
VCU calibration *options*, *tables*, *maps*, and *channels*	*Italics*
VCU calibration option **value**	**Bold**

Symbol	**Information**
	When you see this sign, ***PAY ATTENTION!*** This indicates that something important is about to be said that concerns your safety and the proper operation of the product. Use caution and be conservative. Use the product in the manner described.
	When you see this sign, you are being alerted to an ***IMMEDIATE DANGER***. You MUST review these sections carefully and do everything possible to comply with installation and operation requirements or you risk injury or even death. Failure to comply with safety requirements will void all warranties and could expose you as the installer to liability in the event of an injury.

Reference Files and Documents

File Name	**Location**
AEM EV Tesla Inverter Control Board CAN Protocol	AEM LDU ICB 30-8402 CAN Protocol

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Cautions and Warnings

Working on tractive systems (which includes but is not limited to motor(s), inverter(s), high voltage battery packs and high voltage cables) requires special experience and training. AEM EV has implemented fault detection and failsafe logic into its vehicle control units ("VCU"), however this does not mean that your VCU installation will be safe or effective, or that your VCU installation will not interfere with other systems on your vehicle and create a hazardous situation. It is the responsibility of the installer to understand the implications of each stage of tractive system installation and testing and to recognize what might be unique about your application that presents potential hazards or safety issues – and it is the responsibility of the installer to solve or address any such hazards or issues.

The following list includes basic recommended practices. ***This is not a comprehensive list; as noted below, if you are not well-versed in the appropriate installation and testing procedures, you should refer the installation and calibration to a reputable installation facility or contact AEM EV for a referral in your area.***

- When access is required near the battery pack, the cell segments must be separated by using an appropriate maintenance disconnect plug.
- When working on the battery pack or tractive system, safety gloves with side shields and appropriate insulated tools must be used.
- Always wear Class 0 gloves rated at 1000V with leather protectors.
- Only use CAT III rated digital multimeters (DMM) and test leads.
- When working on the battery pack or tractive system, work with one hand while keeping the other behind your back.
- During initial system power up and testing, the vehicle must be raised off the ground and supported appropriately. Wheels and tires should be removed.
- During the VCU firmware upgrade process, battery cell segments must be separated using an appropriate maintenance disconnect plug.
- Do not make calibration changes when the inverter pulse width modulation (PWM) is enabled.

USE THIS VCU WITH EXTREME CAUTION. MISUSE AND/OR IMPROPER INSTALLATION CAN CAUSE SIGNIFICANT DAMAGE TO YOUR VEHICLE AND PROPERTY BELONGING TO YOU OR OTHERS, AS WELL AS PERSONAL INJURY OR DEATH. IF YOU ARE NOT WELL VERSED IN THE INSTALLATION OF TRACTIVE SYSTEMS OR CONFIGURING THE CALIBRATIONS IN THE AEM EV VCU THAT ARE NECESSARY TO CONTROL THE VEHICLE, YOU SHOULD REFER THE INSTALLATION AND VCU CALIBRATION TO A REPUTABLE INSTALLATION FACILITY, OR CONTACT AEM EV FOR A REFERRAL IN YOUR AREA. IT IS THE RESPONSIBILITY OF THE INSTALLER TO ULTIMATELY CONFIRM THAT THE INSTALLATION AND CALIBRATIONS ARE SAFE FOR ITS INTENDED USE.

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Electrical Safety Insulation Monitoring

The high voltage system in an electric vehicle is designed to be ungrounded (floating) with respect to the vehicle chassis (frame). Insulation faults can cause electric shock, personal injury and even death. An insulation monitoring device (IMD) must be used to protect against these faults. See Bender https://www.benderinc.com/ for more information.

Hardware Overview

AEM EV Part Number	30-8403	
Inverter LV DC Voltage	10-16	Volts
Inverter LV DC Current	6[1]	Amps
	SDU	
Min HV DC Voltage	200	Volts
Max HV DC Voltage	420[2]	Volts
Nominal HV DC Voltage	350	Volts
Max Speed	18000[3]	RPM
Max DC Current, Motoring	650	Amps
Max DC Current, Generating	140	Amps
Max DC Power, Motoring	220	kW
Max DC Power, Generating	45	kW
Max Torque Command, Motoring	330	Nm
Max Torque Command, Generating	70[4]	Nm
Max Stator Temp	180	°C
Max Inverter Temp	80	°C
Pre-Charge Resistor, Resistance	30-100	Ohms

[1] *10 amp fuse recommended.*

[2] *SDU inverter DC link capacitors show rating of 450v. DC voltages >400v have not been tested by AEM.*

[3] *Possible drive unit degradation due to extended high rpm motor usage has not been thoroughly tested by AEM.*

[4] *Inverter Control Board is hardcoded with variable regen torque limit based on rpm - see Regen Torque Limit Profile.*

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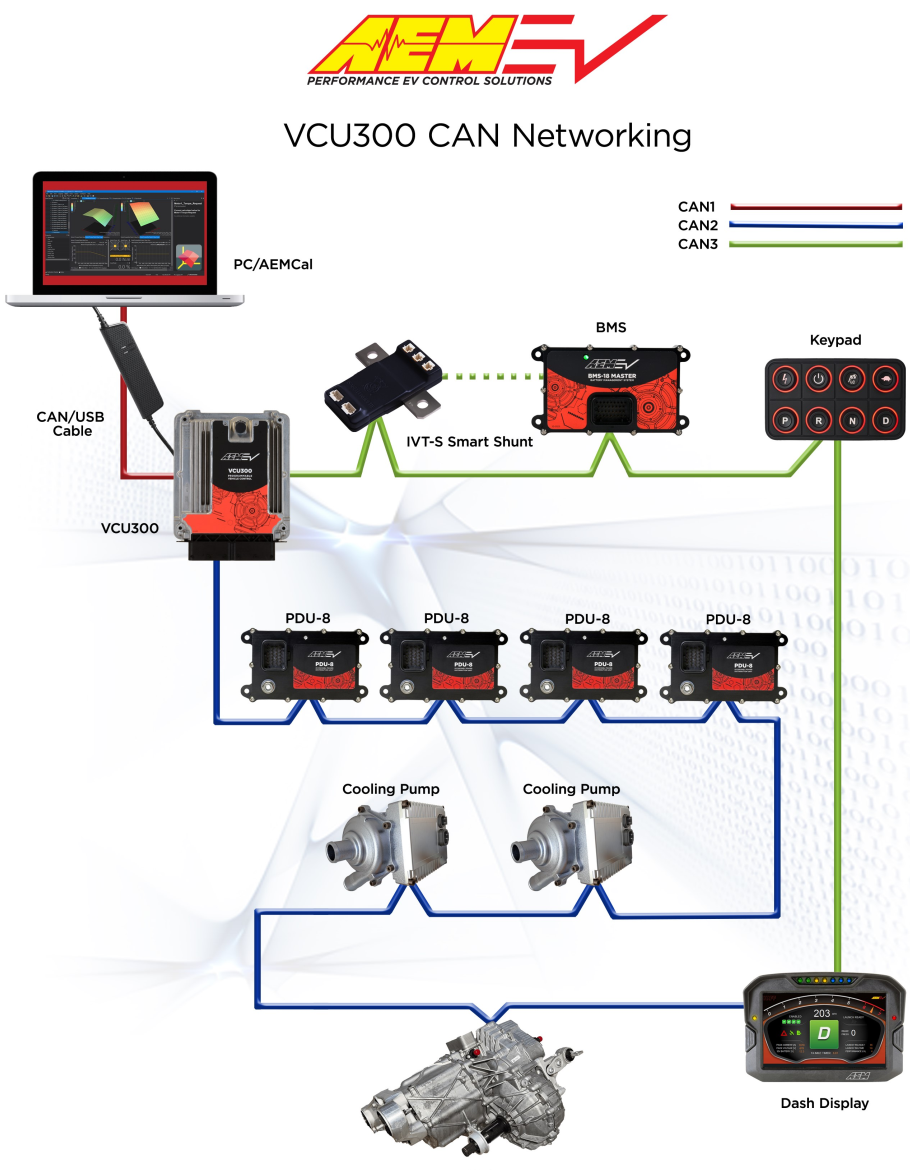
VCU300 CAN Network Configuration

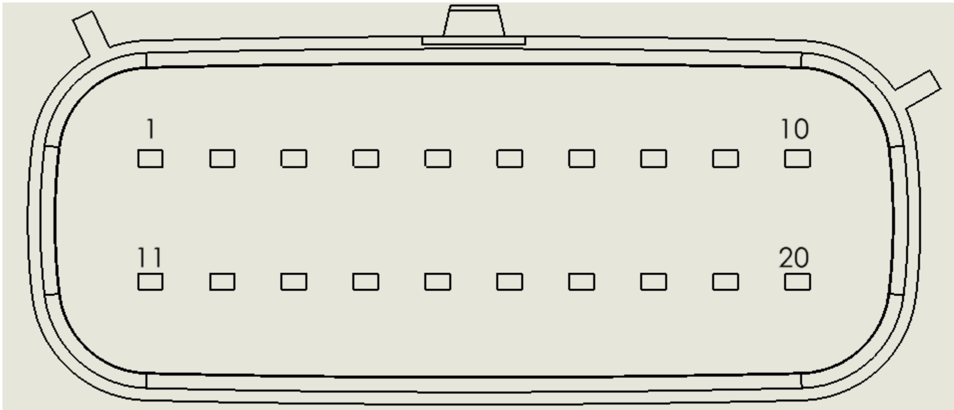
The following diagram describes the basic network requirements. Four separate CAN networks are represented. The network channel assignment for each device is not reconfigurable by the end user. All CAN channels in the VCU200 are internally terminated. The VCU must always be located at the physical end of a bus. All busses must be terminated with a 120 ohm resistor at the physical end. CAN network wiring should be accomplished by a skilled harness builder familiar with vehicle networking.

Network Summary

CAN1 – PC comms
CAN2 – Inverter, EMP Pump(s), PDU-8(s) & AEM CD Dash Port 1
CAN3 – CAN Keypad, AEM BMS,IVT-S Current Sensor, VCU Data Transmit & AEM CD Dash Port 2



Hardware Pinout



Pin #	Pin Function	Application Notes
1	CAN LO	Connect to VCU CAN 2 LO
2	CAN HI	Connect o VCU CAN 2 HI
3	-	Not used
4	-	Not used
5	-	Not used
6	-	Not used
7	-	Not used
8	HVIL OUT	High Voltage Interlock Loop safety Output
9	HVIL IN	High Voltage Interlock Loop safety Input
10	12V Power	Switched 12v power, fuse to 10A
11	-	Not used
12	-	Not used
13	12V Power	Switched 12v power, fuse to 10A
14	-	Not used
15	-	Not used
16	RS232 RX	Encoder Ch. B/RS232 Serial Rx
17	RS232 TX	Encoder channel A, serial comms tx in program or GUI mode
18	RS232 GND	PROGRAMMING GROUND
19	GND	Chassis ground
20	RS232 ENABLED	PROGRAMMING POWER

Tesla SDU Inverter Control Board Installation

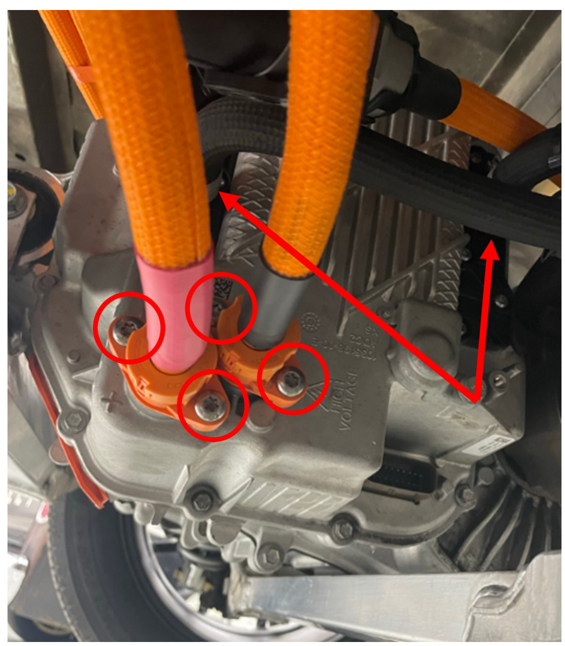
The following describes how to install the Control Board into the Tesla inverter. Start by putting the drive unit on a steady work surface in a position that allows access to the bottom side of the inverter. The motor end of the drive unit is very heavy and will allow the drive unit to be placed on a strong work bench with the inverter end hanging off. Alternatively, the drive unit can be suspended using an engine hoist, etc.

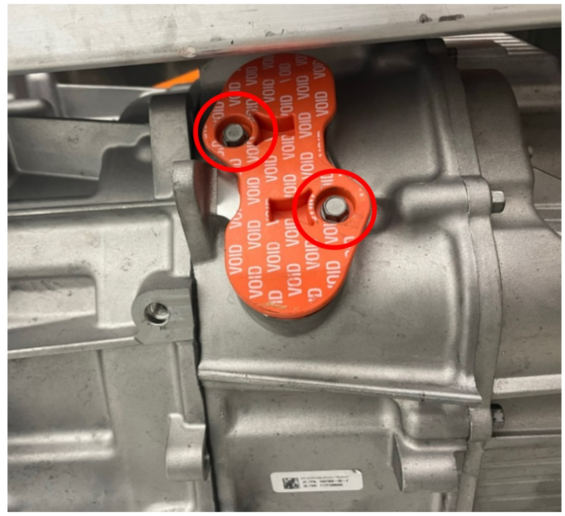
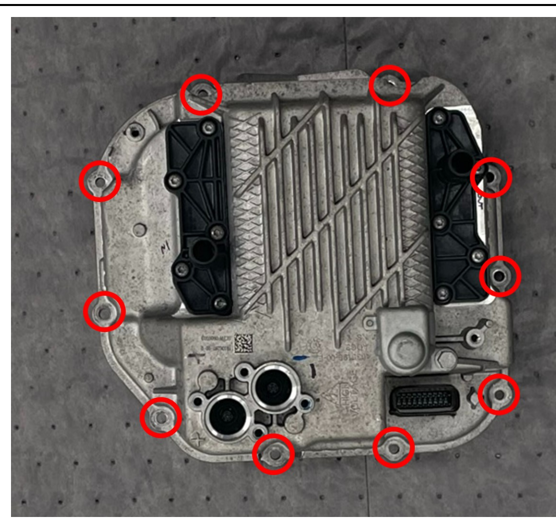
Be sure to exercise great caution when working beneath the drive unit.

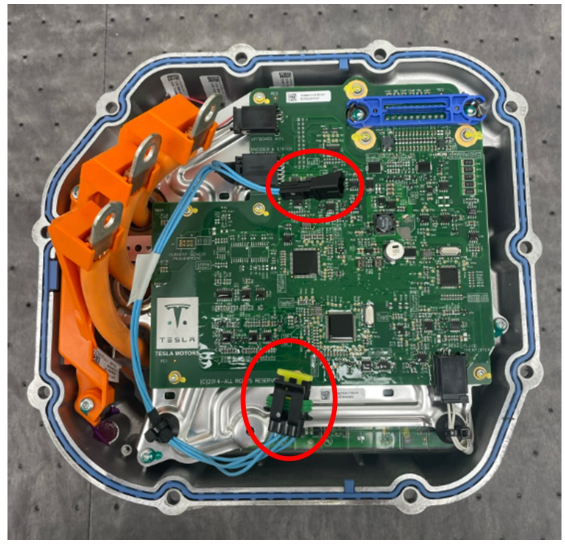
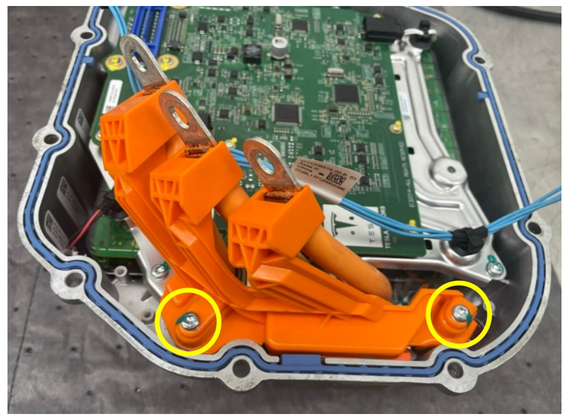
The drive unit must be completely disconnected from any high voltage source.

Tools Required

- Pry Tool
- 8 mm Socket
- 10 mm Socket
- 13mm Socket
- T-30 Torx
- T-20 Torx
- T-10 Torx

1. Remove DC input cables from inverter using T30 bit (4 screws). At this time, it is also necessary to remove the two coolant hoses from the inverter. See arrows in image. Take care to keep coolant from entering the DC input cable ports	

2. Remove phase connection cover using 8mm socket (2 screws). Note that the factory sticker must be removed to gain access to the screws.	
3. Remove the phase screws from the internal inverter cables via the access ports that are now accessible from the removal of the cover. (3 screws) will require a 10mm socket.	
4. Remove inverter housing screws with 8mm socket (10 screws). Support inverter housing after all screws have been removed as there are two wired connections that must be released internally before the inverter is free. If the inverter is not fully supported damage to the inverter may result.	

5. Pull the inverter housing away from the drive unit and reach into the cavity to release the encoder and temperature connectors. Once both connectors are free the inverter housing can be removed from the drive unit.	
6. Remove the 2 screws (T20) that hold the orange phase cable housing to the inverter case.	
7. Pull the phase cable housing free of the inverter case by bending the phase cables inward toward the board. Then slide each of the phase cables out of the front of the orange housing.	

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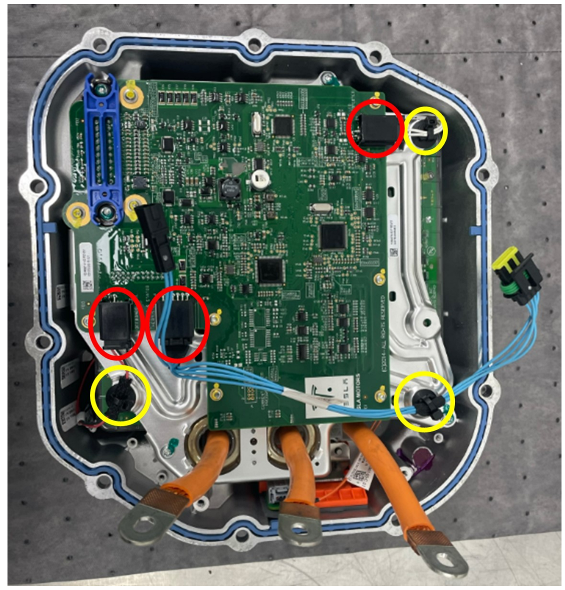
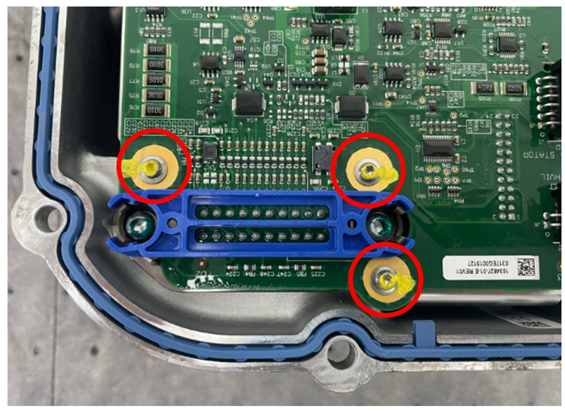
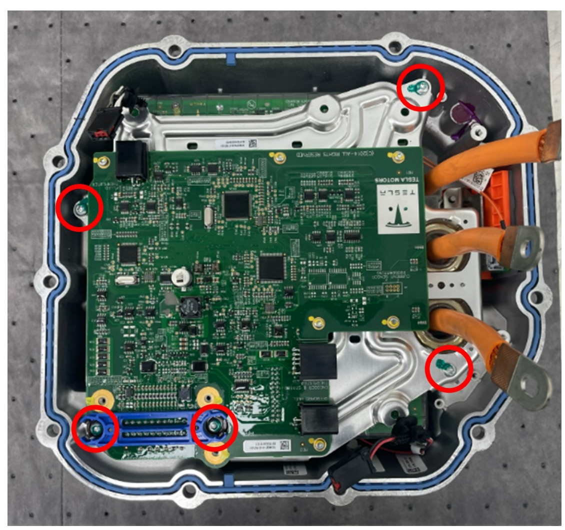
8. Using a panel removal tool, pop the 3 cable retention clips (yellow circles) free from the metal EMI chassis. At this time the 3 connectors (red circles) can be unplugged. Remove the blue harness from the assembly and set aside.	
9. Remove the 3 screws that secure the main inverter board connector to the housing using T10.	
10. Remove the 5 screws from the metal EMI chassis that hold the inverter board in place using T20. Gently remove factory inverter board and chassis from housing assembly by sliding past phase cables. Set housing aside.	

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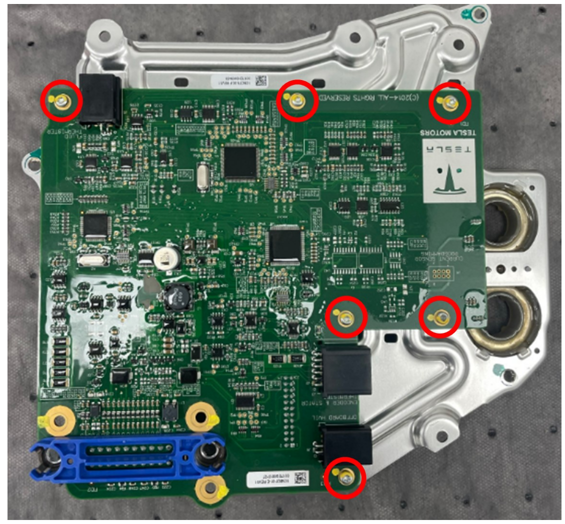
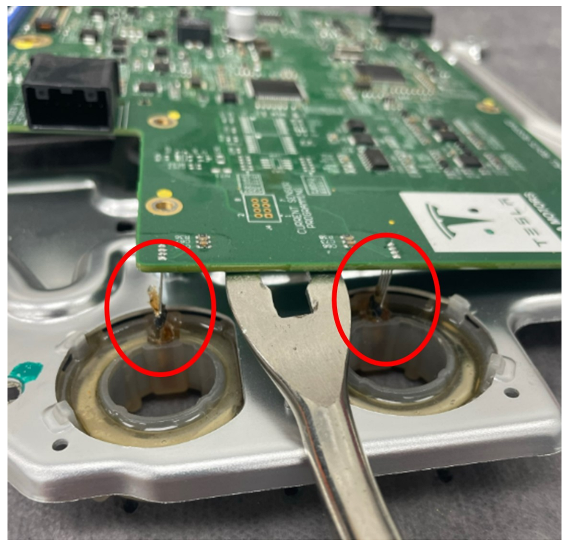
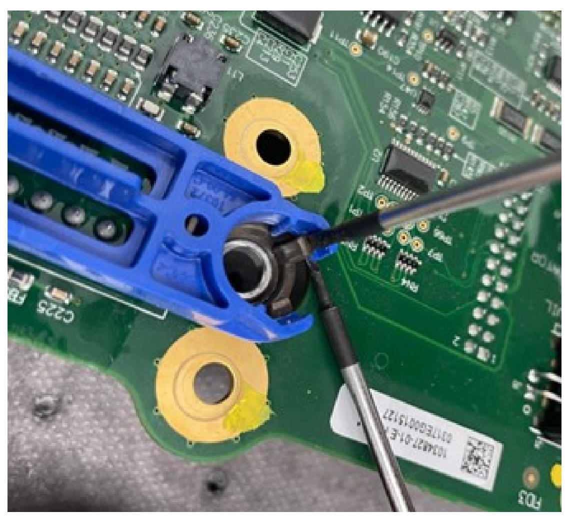
11. Remove 6 screws that secure the inverter board to the metal EMI chassis using T10.	
12. Using a pry tool use gentle force to pry the current sensors free from their ultra viscous clear sealing compound. It is best to pry between the current sensors as there are no critical components located under the board in that location. Once free set the factory inverter board aside.	
13. Remove blue connector position assurance lock from brown main connector. This can be achieved by gently prying the snap hooks on the connector inward with a small screwdriver while simultaneously prying upward on the blue lock. Work you way around one lock at a time. Care must be taken or the small fragile snap hooks can be broken. Once all 4 locks are released the blue CPA lock and brown connector can be removed from the factory inverter board and set aside.	

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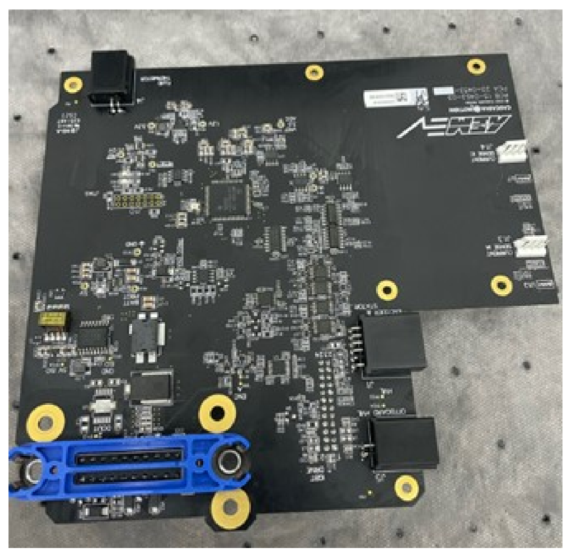
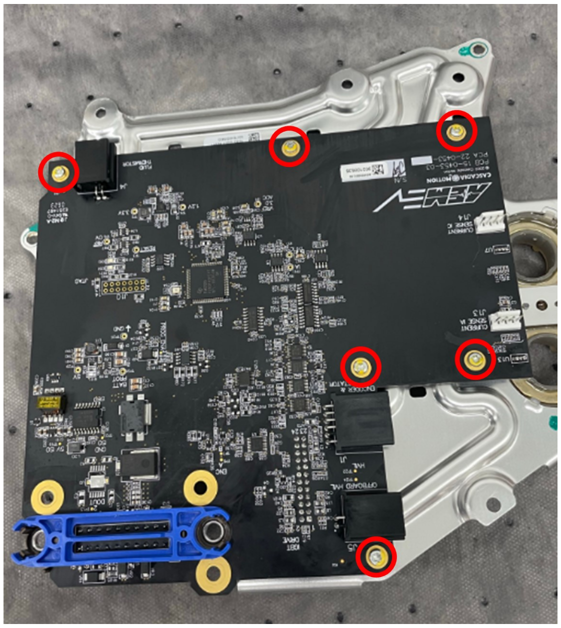
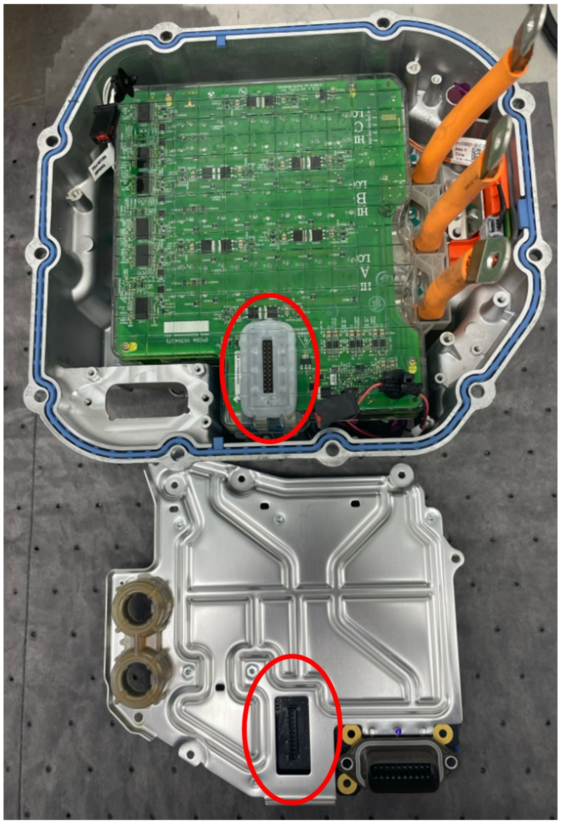
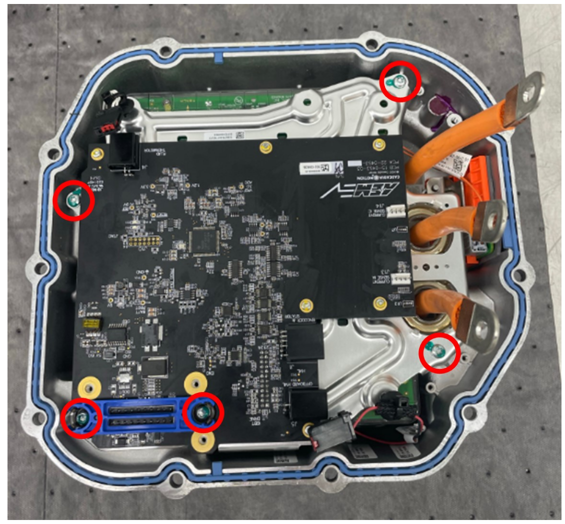
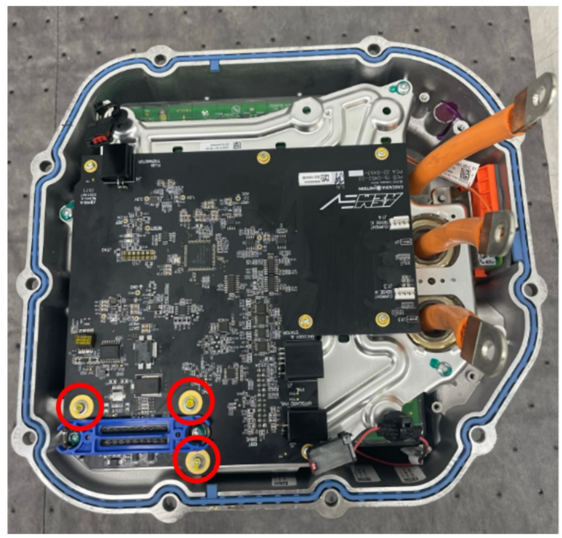
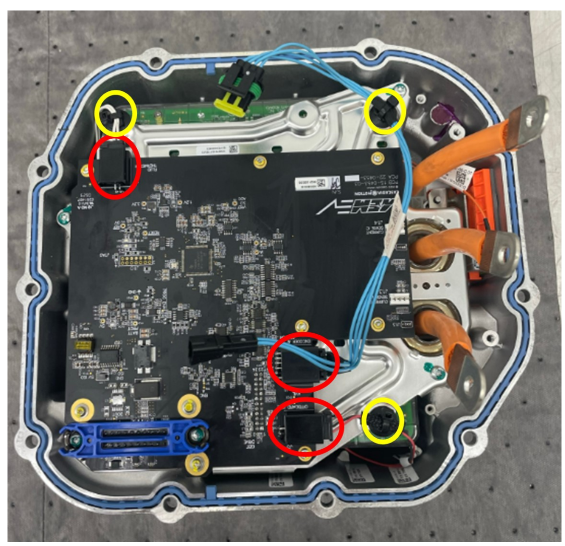
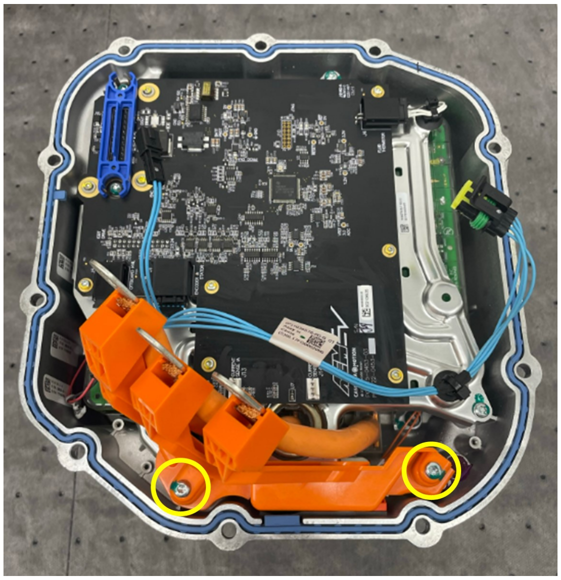
14. Using a small flat screwdriver or pick tool "dig" the ultra viscous clearsealing compound out of the cavity where the current sensors previously occupied. Take care not to damage the current sensor rings that are still embedded in the compound. Dig out a generous cavity and then use compressed air to blow any residual "crumbs" of the material free of the assembly. The image shows an enlarged cavity on the top and on the bottom is prior to compound removal.	
15. Reinstall the brown main inverter connector into the bottom of the AEM board. Secure connector by snapping the blue CPA lock onto the connector on the top side.	
16. Place the AEM inverter board onto the metal EMI chassis as shown. Make sure to position the current sensors into the small cavities that were created by removing the ultra viscous clearsealing compound. Some resistance is expected but if the current sensors on the new board feel like they are binding up the holes in the compound may need to be further enlarged. The compound will compress a fair amount as it is relatively soft.	

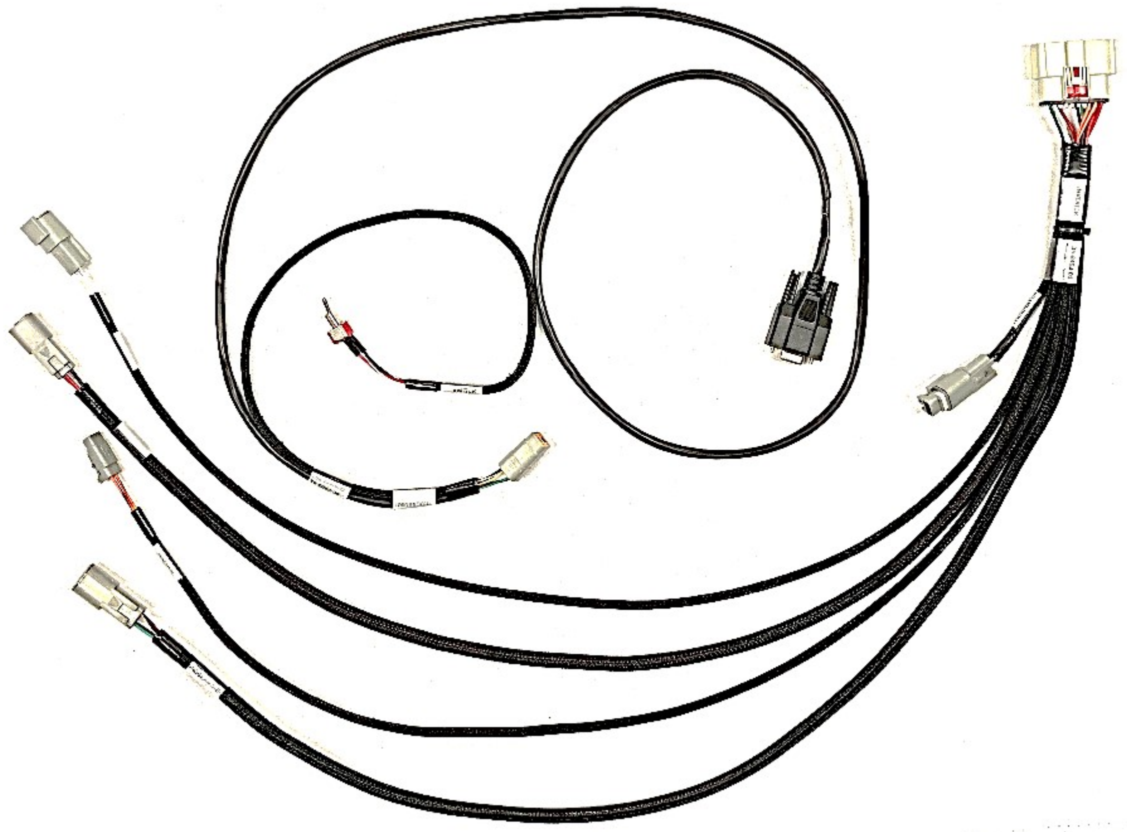
17. Reinstall the 6 small torx screws to attach the AEM inverter board to the metal EMI chassis using T10. DO NOT OVERTIGHTEN.	
18. When reinstalling the inverter board/EMI chassis to inverter housing take care to properly align the mating board connectors. The inverter board/EMI chassis is shown upside down to illustrate the male/female connector that must be aligned. The AEM inverter board/EMI chassis must be positioned by aligning the 5 chassis thru holes to the inverter housing as well as feeling the pins of the connector as they seat into the mating connector on the inverter housing.	

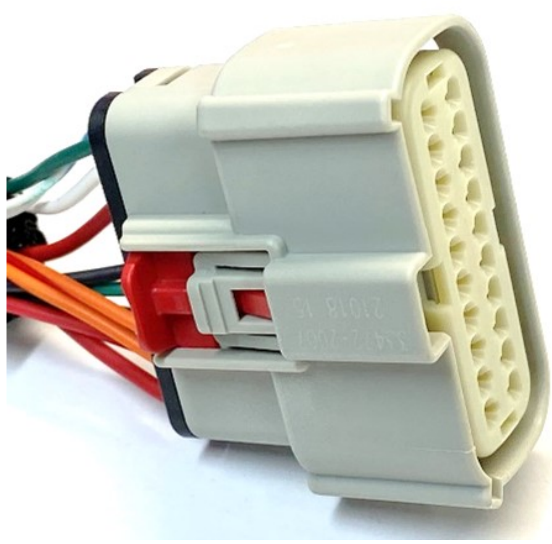
19. Install the AEM board assembly onto the inverter housing by passing the two lower phase cables thru the current sensors and aligning the connector on the bottom. Lightly press down on the metal EMI chassis that is exposed. A tactile click should be felt as the connector seats itself. Make sure there are no loose connectors or wires pinched and they are free on top of the board. Install the 5 screws that secure the board assembly to the inverter housing with T20. DO NOT OVERTIGHTEN.	
20. Install the 3 screws that secure the main inverter board connector to the housing using T10. DO NOT OVERTIGHTEN.	
21. Reinstall the blue wiring harness. Press strain relieving plugs into the holes in the metal EMI chassis (yellow circles). Plug in the three connectors to the AEM inverter board (red circles).	

22. Reinstall phase cable housing by bending cables inward and sliding them into the orange housing. Reinstall 2 screws using T20. DO NOT OVERTIGHTEN.	
23. The inverter assembly is now ready to be reinstalled in the drive unit. Position the inverter near the drive unit and reconnect the encoder and temperature connectors. Make sure they are fully connected.	
24. Reinstall the 10 housing screws with an 8mm socket.	
25. The three phase cables should be aligned with the bars on the stator and be visible thru the phase cable access ports. Reinstall the 3 screws using a 10mm socket. DO NOT DROP THE PHASE CABLE SCREWS INTO THE INVERTER.	
26. Reinstall the phase connection cover. If the O-Ring seals are too tight to start a small amount of lube can be used. Reinstall the 2 screws that secure the phase connection cover using an 8mm socket. DO NOT OVERTIGHTEN.	
27. Reinstall the DC input connectors/cables and tighten the 4 screws using a T30 bit. DO NOT OVERTIGHTEN.	
28. Reconnect coolant lines to inverter housing.	

Control Board installation complete. Re-install inverter cover, HV cables, all mounting screws and orange plastic protective cover. Installation is the reverse of removal.

SDU Harness Installation



INVERTER Plug 20 way connector into inverter. Route all other branches to most convenient location to make remaining connections.	

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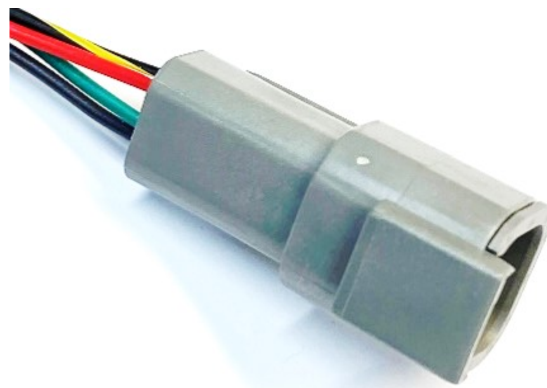
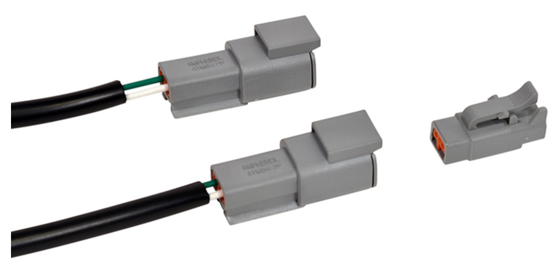
PWR/GND Connect RED to 10A fused power that turns on with VCU Wake. Connect BLACK to chassis ground. Do NOT power the inverter using the power/ground circuits from an AEMnet cable. Deutsch DT plug and terminals included in kit.	
ENCODER BREAK OUT The encoder break out connection serves two purposes. First is to connect to the encoder sensor itself. Second is to provide an interface point for directly programming the Control Board.	
CAN 1/2 High speed CAN bus network into and out of the inverter. One CAN lead will have 120 Ohm CAN termination plug installed. Other open CAN connection should be connected to VCU CAN 2 for inverter control. Leave the CAN termination plug in place if the inverter is the node that's physically furthest away from the VCU. Deutsch DTM plug and terminals included in kit.	
HVIL High Voltage Interlock Loop. Optional but highly recommended. ORG/RED is HVIL In and ORG/BLK is HVIL Out. Connect accordingly for VCU being used. Deutsch DTM receptacle and terminals included in kit.	
Programming Harness	

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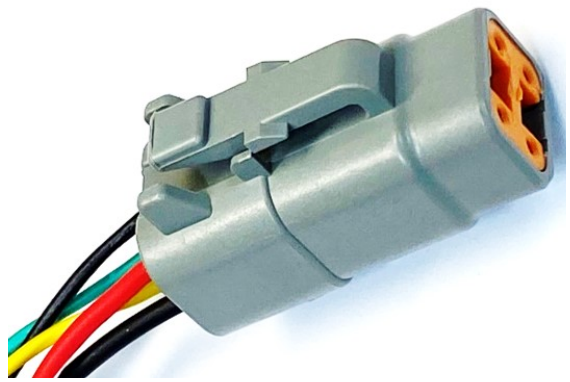
Serial Port Connection to Computer	
Programming Connection to Main Harness	
Program Enable Switch	

Temperature Output SDU

The Control Board uses the LDU's internal temperature sensors for referencing temperatures from different points within the drive unit. These temperatures are transmitted out over the Control Board CAN datastream – see Reference Files and Documents 4 for CAN protocol. Additional external temperature sensors are not required.

CAN Channel	Description
i1_Power_Stage_A_Temp	Phase A transistor temperature, limit to 70°C, inverter faults at 80°C
i1_Power_Stage_B_Temp	Phase B transistor temperature, limit to 70°C, inverter faults at 80°C
i1_Power_Stage_C_Temp	Phase C transistor temperature, limit to 70°C, inverter faults at 80°C
i1_Motor_1_Temp	Stator temperature, limit to 170°C, inverter faults at 180°C
i1_Motor_2_Temp	Stator temperature, limit to 170°C, inverter faults at 180°C
i1_Motor_Temp	The higher of Motor 1 & 2 Temp, used by VCU as motor temp reference
i1_Housing_Temp_Inlet	Coolant temperature before inverter, used by VCU as inverter temp reference
i1_Housing_Temp_Outlet	Coolant temperature after inverter
i1_Micro_Temp	Control Board temperature

Control Board Parameter Settings SDU

The Control Board comes from the factory pre-loaded with firmware and initial configuration parameter settings and is essentially ready to use right from the package. The following is a list of configurable parameters that may be adjusted using the Cascadia RMS GUI (Graphic User Interface) software. See Appendix at end of this manual for more info.

Active inverter HV discharge is disabled by default. It is imperative that active discharge only be enabled once correct VCU contactor sequencing control has been established. Having HV contactors closed with HV still present to the inverter will damage the inverter's discharge hardware. The active discharge is triggered via an on-board relay output. This output will go into an uncontrolled state during programming thus it is imperative that HV not be present to the inverter any time the inverter is put into programming mode.

Except for enabling active HV discharge, setup changes to the Control Board using the RMS GUI is typically not needed in most cases and the default settings should work very well as they are.

Motor Type EEPROM	Used to select different motor types (Base vs Sport) or different pre-programmed motor control settings. Base LDU = XXX
Relay Output State EEPROM	Relay output to trigger inverter HV discharge. Default setting is OFF. Must be enabled for active HV discharge to function – see WARNING above. Value is shown in Hex. Default value is 0x000C. Change to 0x002C to enable.
Discharge Enable EEPROM	Must be enabled for active inverter HV discharge to function – see WARNING above. Default setting is OFF.
CAN ID Offset EEPROM	Used to set CAN ID offset if using multiple controllers on the same CAN network. Default offset is 0x0A0. Range of CAN IDs is 0x0A0 – 0x0CF.
DC UnderVolt Thresh EEPROM	Sets the HV under-voltage fault threshold voltage. Set to 0 to disable HV under-voltage fault function. HV under-voltage protection typically handled by VCU.
Inv OverTemp Limit EEPROM	Sets the inverter temperature limit in °C x 10. The inverter temp is sampled from each of the 3 power phase module temp sensors. If temperature exceeds this value, the inverter will go into a fault state. Hard coded with a max value of 80°C.
Mtr OverTemp Limit EEPROM	Sets the motor temperature limit in °C x 10. There motor temp is sampled from each of the 2 stator temp sensors. If temperature exceeds this value, the inverter will go into a fault state. Hard coded with max value of 180°C.
Full Torque Temp EEPROM	Sets the temperature threshold below which full torque is available. As the motor temperature increases from Full Torque Temp to Zero Torque Temp, the allowed motor torque is decreased linearly. Temp based derating typically handled by VCU – can use this function as a backup.

Zero Torque Temp EEPROM	Sets the temperature where motor torque will be limited to zero. Temp based derating typically handled by VCU – can use this function as a backup.
Shudder Compensation Enable EEPROM	Used to enable or disable shudder compensation.
Kp Shudder EEPROM	Sets the control gain x 100 of the shudder compensation function. Default value is 20 (parameter setting of 2000).
TCLAMP Shudder EEPROM	Defines the maximum amount of shudder compensation torque x 10 to be applied. Default value is 19.1 (parameter setting of 191).
Shudder Filter Freq EEPROM	Defines the low-pass filter frequency x 10 used for shudder compensation calculation. Default value is 3.0 (parameter setting of 30).
Shudder Speed Fade EEPROM	Defines the point in RPM where maximum shudder torque compensation is applied for low RPM usage. Between this value and Shudder Speed Lo, full shudder torque is applied. Must be lower than Shudder Speed Lo value. Default value is 20.
Shudder Speed Lo EEPROM	Defines the start point in RPM where shudder torque begins to ramp out (decrease). Shudder torque ramp out is reduced linearly between Shudder Speed Lo & Shudder Speed Hi. Must be higher than Shudder Speed Fade but lower than Shudder Speed Hi. Default value is 300.
Shudder Speed Hi EEPROM	Defines the end point in RPM where shudder torque is reduced to zero and shudder compensation is turned off. Must be higher than Shudder Speed Lo. Default value is 400.

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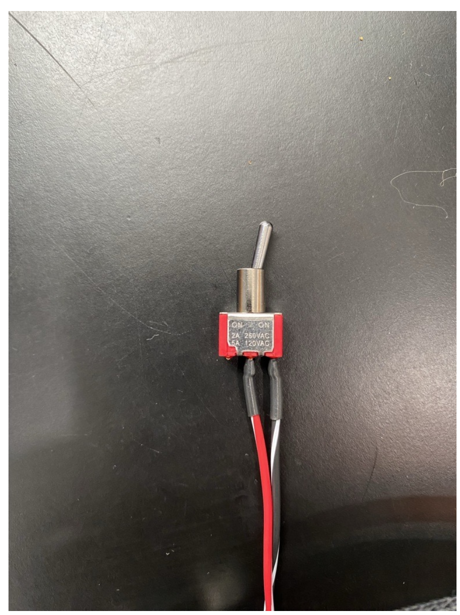
Using the Programming Cable SDU

HV must NOT be present at the inverter when in programming mode!

With the Control Board mounted inside the inverter cover, direct physical access for programming or firmware updates is not possible. Some means for communicating with the Control Board is necessary and this was accomplished by re-purposing the original header connector for the inverter. The main SDU harness has a connection break in the encoder branch that allows for SCI connection. This is where the programming cable is plugged in to interface with the control board.

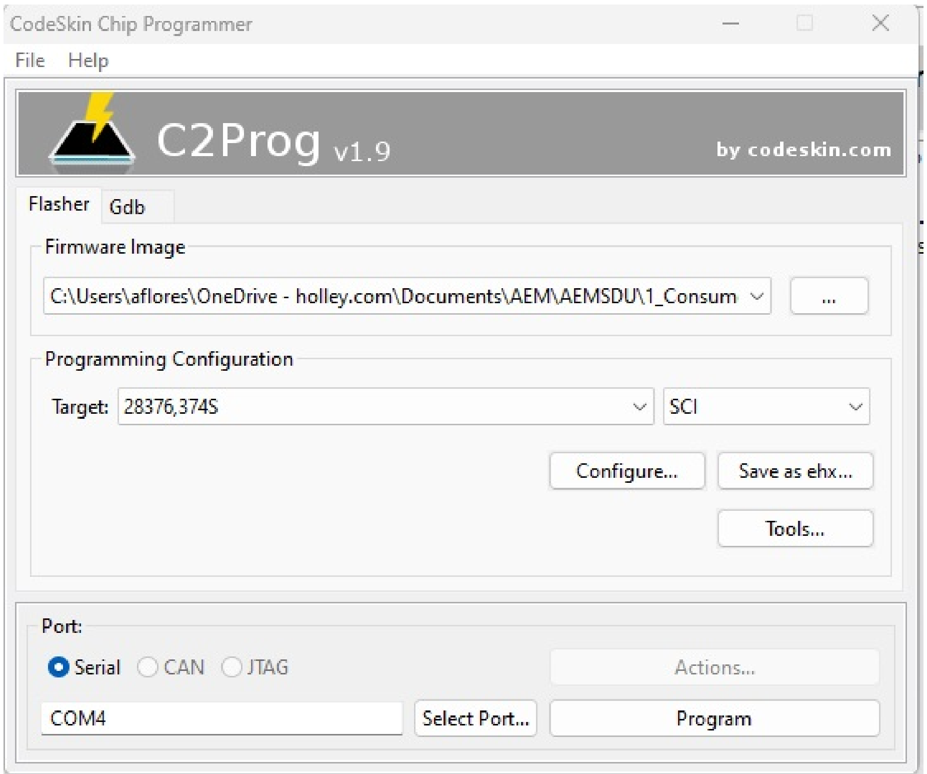
PROGRAMMING MODE Point switch away from the Red with White Stripe wire for PROGRAMMING mode.	
GUI MODE Point switch towards the Red with White Stripe wire for GUI mode.	

When putting the Control Board into programming mode, the programming cable switch should be put to PURPLE and the inverter must be power cycled before programming mode will be active.

Flashing Control Board Firmware SDU

Firmware is uploaded to the Control Board over SCI using C2Prog software. Use the following steps to load new firmware onto the control board.

1. Download and install **C2Prog_v1.7e-b5721** from https://www.cascadiamotion.com/documents > General Link to All Files > 02 Tools > C2000Prog > C2Prog_v1.7e-b5721.zip
2. Launch C2Prog and configure as shown:



   a. Set Target to 28376, 374S and set Options to SCI.
   b. Click on Configure Ports… If comm port being used is known, select it from Serial port drop down otherwise click on Scan Ports to try and identify the port being used. Once port has been identified, click OK.
   c. Click on Select File… and navigate to directory where Control Board firmware is saved. Select appropriate file – contact AEM EV Tech Support for info on latest firmware files.
3. With programming cable connected and switch pointed toward purple wire for programming, turn on low voltage (12v) inverter power.
4. Click on Program to start programming. Monitor the programming status.
5. Once programming is complete, click OK to close the status window and turn the inverter off. Either disconnect the programming cable or if GUI changes are necessary, point the programming cable switch toward green wire for GUI mode. When the inverter is repowered, the new firmware will be operational.

Using RMS GUI Software SDU

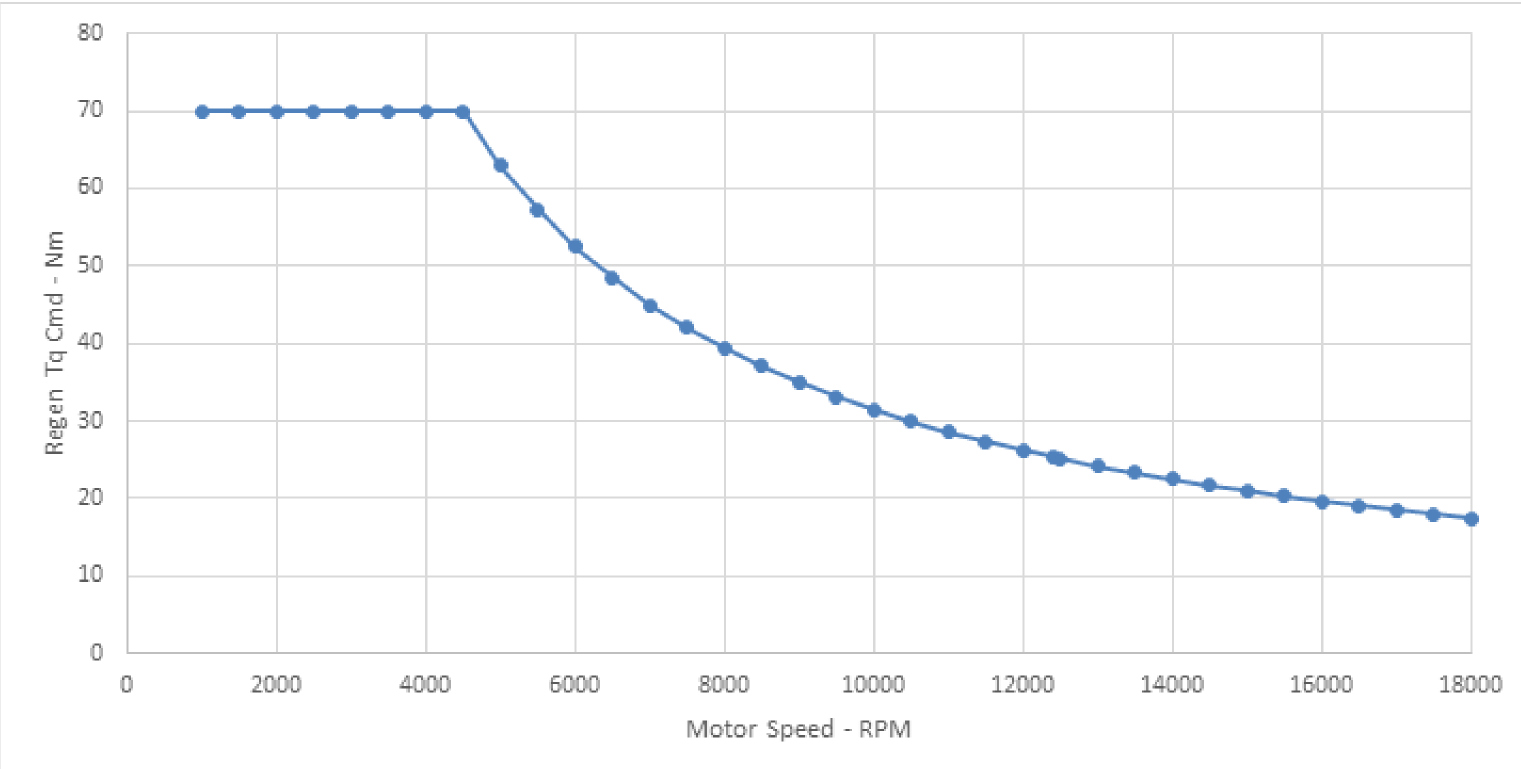
The RMS GUI (graphic user interface, “gooey”) is a Windows application that communicates with the Control Board via RS232 serial communications interface (SCI) to program certain EEPROM parameters. The list of adjustable EEPROM parameters is discussed in a previous section of this manual. A parameter “symbols” files that defines the EEPROM settings to be configured is required to match the Control Boards current firmware version. This file will be provided by AEM EV.

Use the following steps to change EEPROM parameters on the Control Board. This example will show how to enable the HV active discharge feature. Use the same steps to change other EEPROM settings.

1. Download and install **RMS GUI 148.exe** and **gtk+-2.8.9-setup-1.exe** from https://www.cascadiamotion.com/documents > General Link to All Files > 02 Tools > RMS GUI
2. With programming cable connected and switch pointed toward green wire for GUI mode, turn on low voltage (12v) inverter power.
3. Ensure appropriate symbols files is in the RMS GUI directory and then launch the GUI app.
4. The GUI app will open and display on the Memory View tab. To change EEPROM settings, click on **EEPROM View** tab.
5. Find the EEPROM parameter to be changed. – in this case, *Relay_Output_State_EEPROM* & *Discharge_Enable_EEPROM*.
6. Change *Relay_Output_State_EEPROM* from **0x000c** to **0x002c**. Change *Discharge_Enable_EEPROM* from **0** to **1**. Hit Enter on keyboard to commit parameter change.
7. Once EEPROM values have been change, click on Program **EEPROM** button. Status message will appear to confirm that programming has been completed.
8. Follow on-screen instructions to power cycle inverter, then click on the Refresh button.
9. Confirm that EEPROM values have successfully been changed.
10. Disconnect programming cable from inverter harness and reconnect encoder harness. The drive unit is now ready to be operated.

Regen Torque Limit Profile SDU

The Control Board has a variable regen torque command limit profile programmed into it. The regen torque command limit function compares the VCU's commanded regen torque value to the limit profile value and allows the lessor value to be the actual regen torque allowed. The regen torque limit profile is shown below.



For example, if the VCU's commanded regen torque value is 50Nm at 8000 rpm, the actual regen torque allowed will be limited to 40Nm. Alternatively, if the VCU's commanded regen torque value is 50Nm at 4000 rpm, the actual regen torque allowed will be 50Nm.

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Warranty

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In no event shall this warranty exceed the original purchase price of the AEM Electronics part nor shall AEM Electronics be responsible for special, incidental or consequential damages or cost incurred due to the failure of this product.

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Warranty returns will only be accepted by AEM Electronics when accompanied by a valid Return Merchandise Authorization (RMA) number and a dated proof of purchase. The product must be received by AEM Electronics within 30 days of the date the RMA is issued. Warranty claims to AEM Electronics must be shipped to us prepaid (we recommend a shipping service with package tracking capability). Once your package is received by our warranty and repairs department you will be notified and provided with updates.

PROCEDURES FOR ISSUANCE OF A RETURN MERCHANDISE AUTHORIZATION (RMA) NUMBER

Please note that before AEM Electronics can issue an RMA for any product, it is first necessary for the installer or enduser to contact our technical support team to discuss the problem. Most issues can be resolved over the phone. Under no circumstances should a system be returned, or an RMA requested before our support team is contacted. This will ensure that if an RMA is needed that our team is able to track your product through the warranty process.

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