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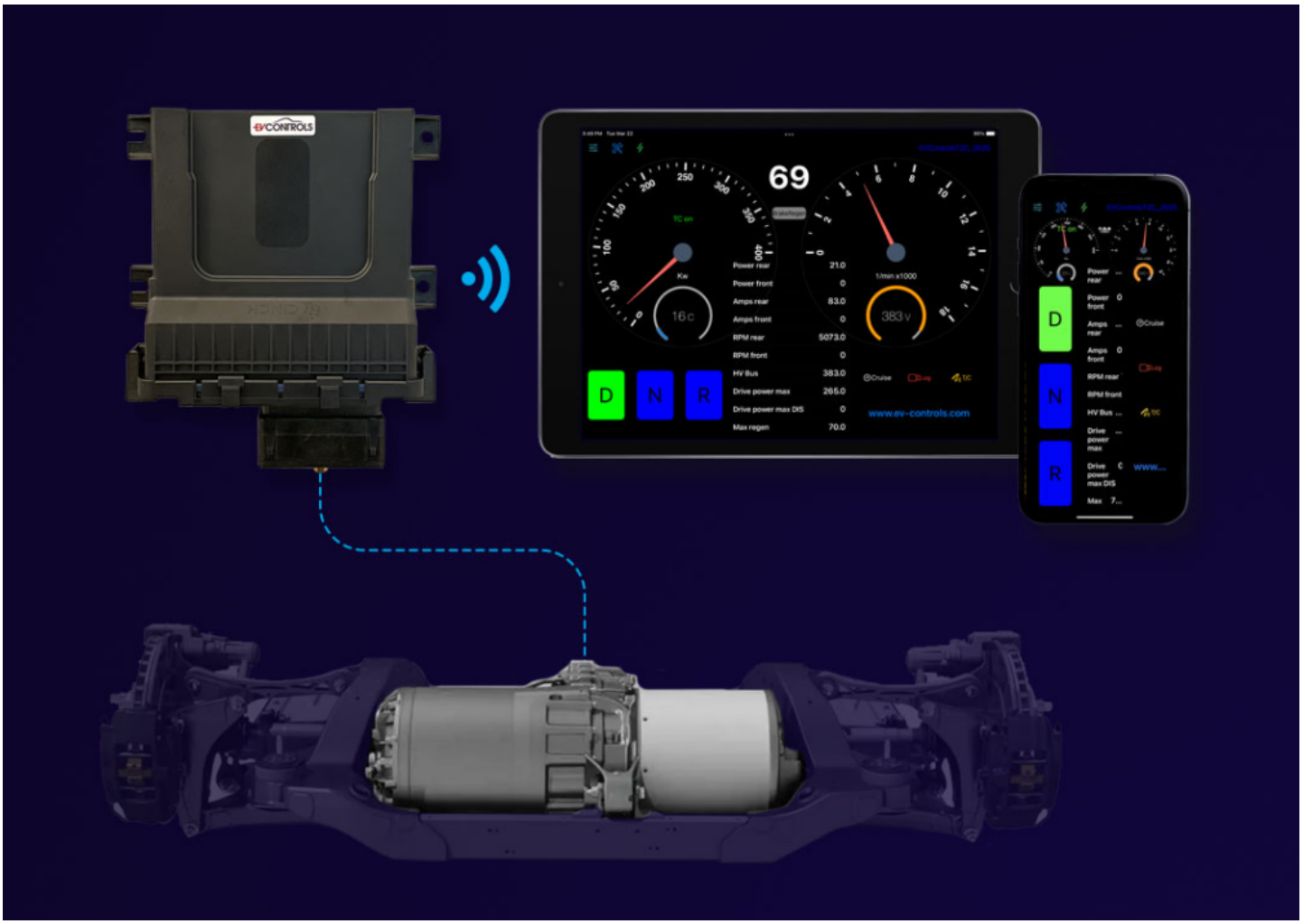
EV Controls Manual V1.5



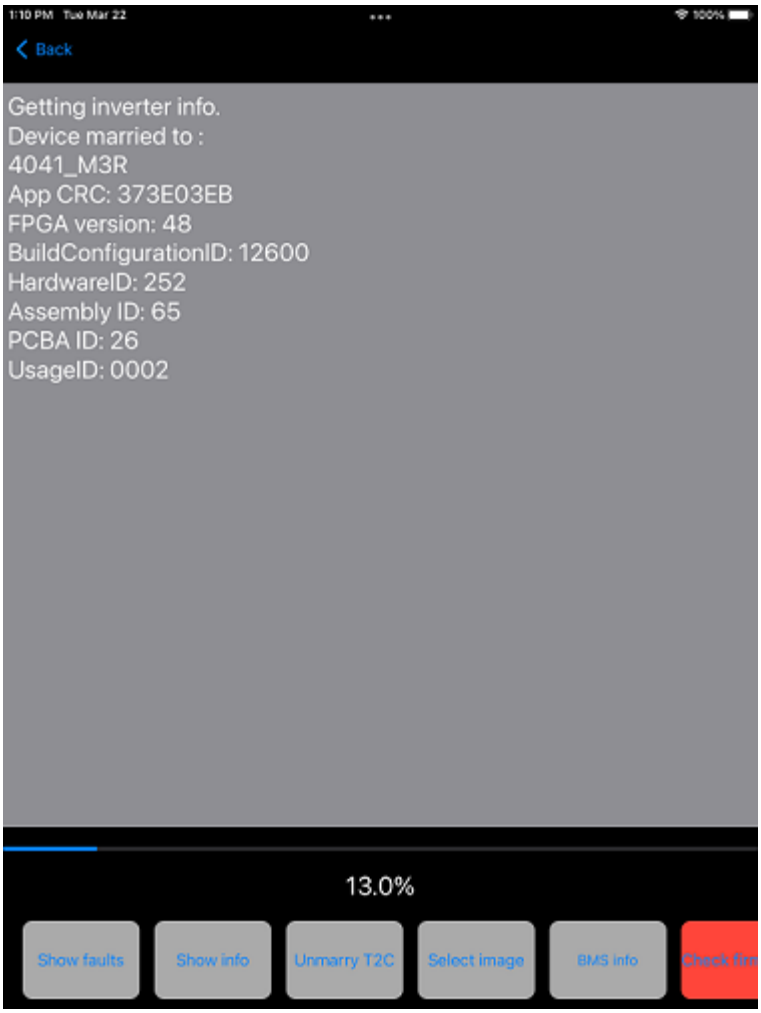
Initial setup

In order for the T2C to control your drive unit properly, the firmware on the drive unit must be the correct version. This generally means the inverter will need to be reflashed. Once you have wired the T2C and inverter according to the wiring diagrams elsewhere in this guide, you will need to get the inverter info and send it to us so we can verify it, and assist with flashing the inverter if required. The flash procedure is simple but varies depending on the drive unit type and firmware currently on the drive unit. Please do not contact us about reflashing until you have completely wired up the inverter and high voltage as per the wiring diagrams.
On the Model 3/Y drive units, this includes the oil pump, which must be connected and powered.

Once you have done this, start the app, and navigate to the utilities screen using the icons at the top left.
Click "show info", and send a screenshot of the information that comes up to support@ev-controls.com along with your order number.
If the information shows all blank info or zeroes, there are a couple possible causes.

1) You have a Model 3/Y drive unit and the controller has Model S/X firmware on it. If this is the case, e-mail support@ev-controls.com and we will assist.
2) You have a problem with the CAN communications to your inverter or a 12V supply problem. If this is the case you will need to sort this out first.

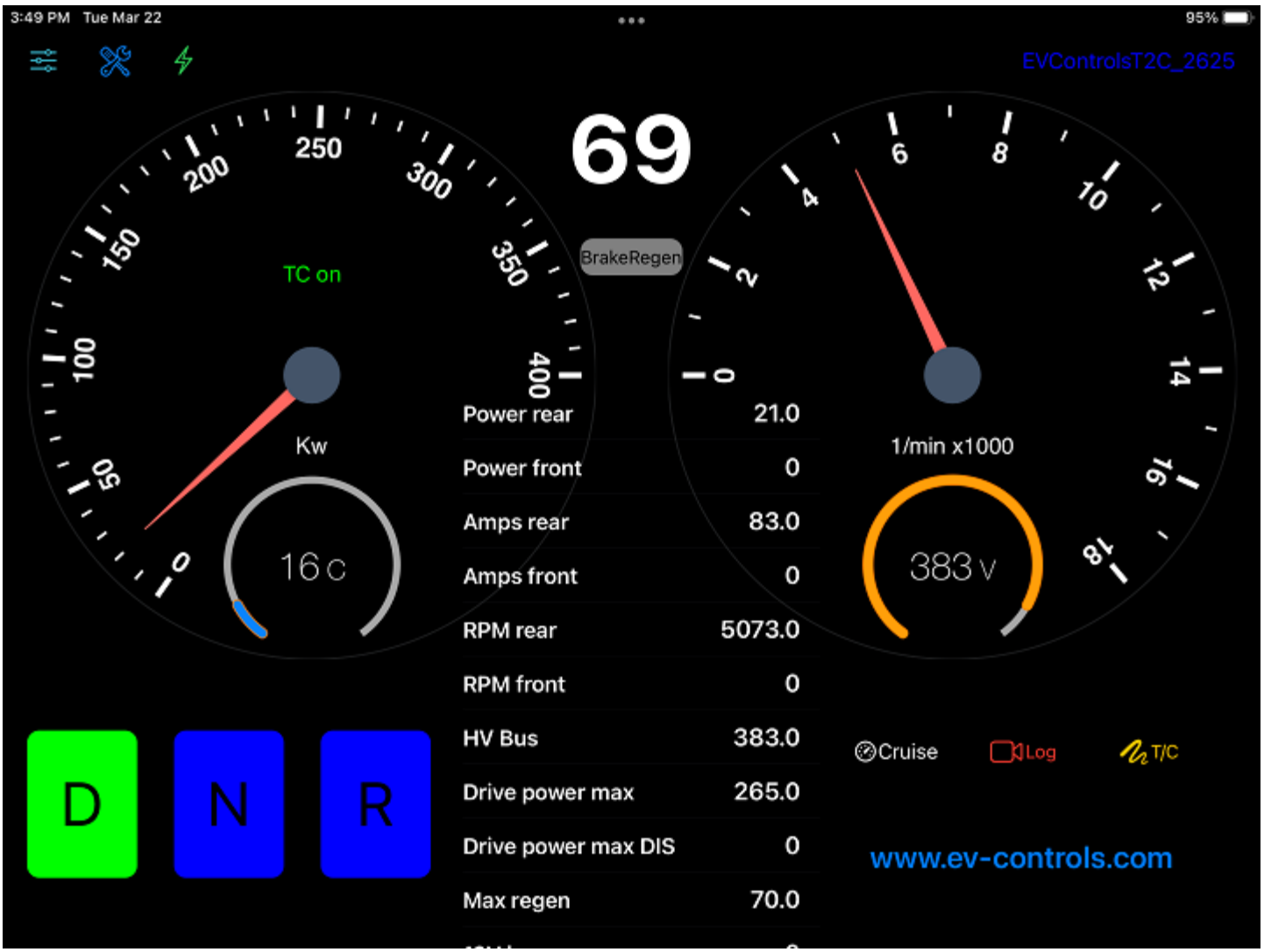
We will reply by e-mail with the next steps required for your specific hardware. Never try flashing the inverter yourself without specific instruction to do so from ev-controls support, this will not work and likely cause other problems and delays.
We will only flash one inverter per controller sold.



Dash app

The EV-controls dash app is available for free in the apple app store.
This provides the user with a very versatile dashboard they can use in their vehicle, and also has a variety of other functionality that is outlined elsewhere in this manual.
We find that an iPad mini makes great display that will fit in almost any vehicle. See this video on our youtube channel for instructions on how to have your iPad and dash app power on and off with the ignition key using an automation. In our opinion this solution outperforms any other options for an in vehicle display, in terms of functionality, reliabilty and appearance. Plus new features will be added over time and made available in the app store. We also offer a version for the iPhone now, so users can quickly access settings and other features from their phone.

The **main screen** will be the default screen and functions as a dashboard.



At the top left are navigation icons that allow you to access the settings and utilities screens, and charging mode.
At the top right is the T2C connection status , it will either display "Not connected" or the unique ID of the T2C controller it is currently connected to.

On the left is a power gauge that displays drive power in kW. It also has indicators for traction control status, and vehicle hold status.
At the bottom of this gauge is an inverter temperature display.

On the right is a motor RPM gauge. It also has indicators for cruise control, and logging status that will come on when either of these features are active. At the bottom of this gauge, battery pack voltage is displayed.

Top center is a vehicle speed display (speedometer).

Below that is a brake/regen indicator that will turn red when the brake light output is active. This will occur when the brake pedal is depressed, or when the regen is slowing the vehicle enough that brake lights should be illuminated. You can use this indicator to confirm your brake switch is functioning properly. Tapping this indicator will also return the T2C to driving mode if it is in charging mode.

Under the brake/regen indicator in the center is a BMS warning indicator that will normally be off.

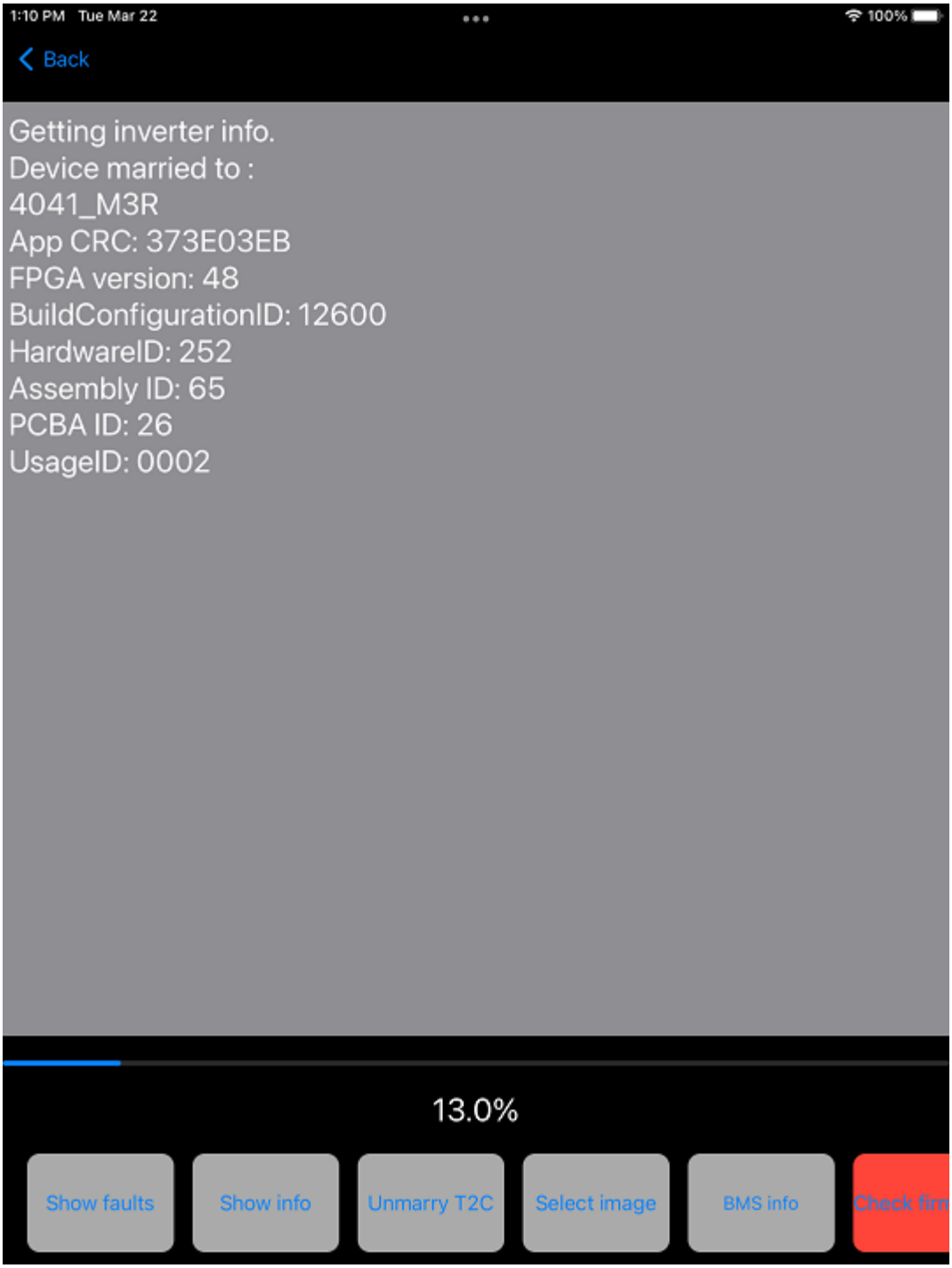
below this, in the center, is a scroll view of all the data coming back from the T2C. This data can be datalogged using the logging features.

At the bottom left are shift buttons that also display the current gear, turning green when that gear is engaged. You cannot shift into drive or reverse from neutral unless the brake is depressed.

At the bottom on the right are buttons for cruise control, datalogging and traction control.
tapping the cruise button engages the cruise control. To disengage cruise control, tap the brake pedal.
Tapping the Log button starts the datalogger and logs data to a .csv file. Tap the log button again to stop the logger.
Tapping the T/C button disables and enables the traction control if it is available.

Utilities screen

This screen will give you access to various utilities and functions used for setup and troubleshooting.



Show faults

You can read out fault codes by clicking "show faults" under the utilities screen. This feature is helpful for troubleshooting.
The fault codes themselves have descriptive names that will help you pinpoint the source of problems. We do not have extra information on the fault codes beyond what you see in the fault code text itself.

Show info

Tapping this button while connected will show the current T2C firmware version, the unique ID from the T2C that that app is currently married to (if it is married to one), and a list of information used to ID the drive inverter hardware and software versions.
This is the button we will ask you to use during the initial firmare setup process for your T2C.

Unmarry T2C

when you first power on your T2C and start the app, you should be presented with an option to "Marry" the app to that particular T2C.
Once you tap "Marry", the app will remember that particular T2C controller's unique ID, and will not look for or detect other T2C controllers. This is so that you do not connect to any other T2C controllers that might be within range. If you want the app to detect other T2C controllers within range, tap the "Unmarry T2C" button in the utilities screen. This will cause the app to forget the controller it was married to, and search for other controllers again.

Select image

We added the ability for a user to select a background image that will be shown briefly on power up when the T2C connects. This allows you to customize your dashboard with an image or logo of your choice. When the T2C powers on and is detected by the app, the image will be displayed and fade out during the gauge sweep sequence.

BMS info

We have added some BMS support features to the T2C software. The simplest and most versatile feature is a "BMS warning" light that will come on when the SPARE 1 input is grounded. This will allow you to be notified of a BMS fault on that dash app, and will be compatible with any BMS you can configure to ground this input when it detects a fault condition.
We also have added CAN bus support for the Dilithium BMS. (Old style BMS, not the MCU) If you connect the Dilithum CAN output to CAN 1, set the baud rate to 500kbs, and configure the termination resistor in the BMS to disabled, the T2C should read out and display cell voltages (up to 96), fault status, highest and lowest cells, and illuminate the "BMS warning" light in the dash app when the BMS detects a fault. This is accessible under the utilities screen, if you tap "BMS info".
We cover BMS support for the newer style Dilithium MCU and Orion BMS elsewhere in this manual.

Check firmware

Clicking this button will get the current T2C firmware version on your controller, and compares it to the latest version available on our servers. If there is a newer version available, you will be presented with the option to upgrade, just follow the prompts. Obviously never click this button unless you are parked, your iOS device is connected to the internet, and you are prepared to do a firmware update.

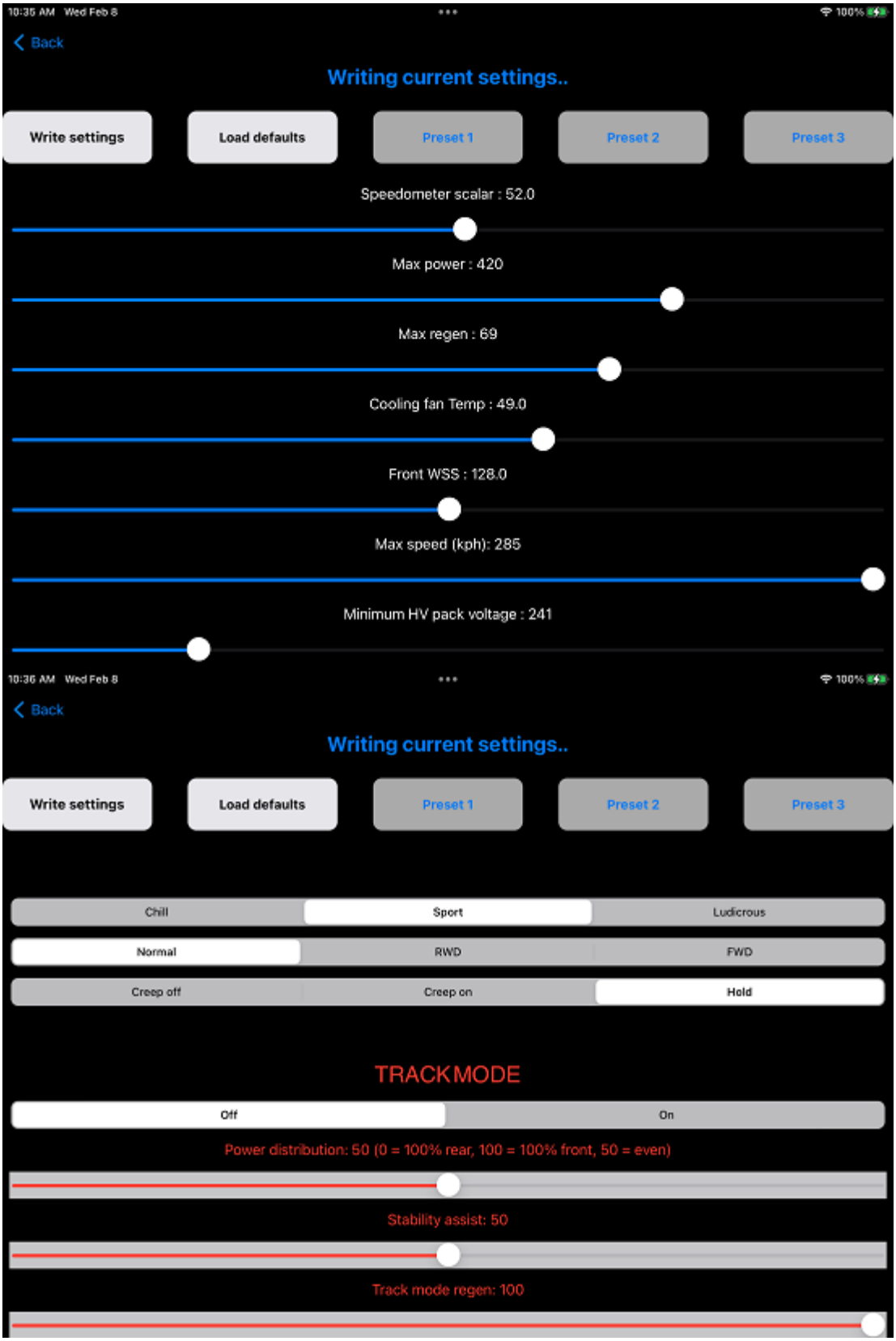
Change config, Flash DI/ PM/ DIS/ PMS/ FPGA

These buttons are only to be used if we directly instruct you to, and are for initial setup of your T2C and inverter. Using them under any other conditions will result in a best case scenario of nothing happening, or serious problems like a non functional inverter or T2C. Never tap these unless we specifically tell you to.

BMS Demo

This shows a demo of the BMS display screen that is currently only available for a properly configured the Dilithium BMS. (This is the old style BMS, not the MCU)

Under the **settings screen**, you can set various parameters and write the settings to the T2C to make them active.



Speed scalar

This should be set to a value that makes the speed readout in the top center of the main screen read accurately. Increase or decrease this value until the speed readout on the main display matches the speed displayed on a GPS you use for

reference. This value will be stored in the app so you should only need to set it once per iOS device used. It is used to account for differences in drive wheel diameter.

Max power

This is the max power the drive will develop, in kW, when the accelerator is fully depressed. This can be limited of course by other factors like battery capability and voltage sag, and the drive unit's maximum power output capability.

Max regen

This is the same as the above max power setting, but applies under regen conditions. Set it according to your needs and the battery pack's ability to absorb charging current.

Cooling fan temp

This is the value (in degrees C) at which the cooling fan output (E2) will be energized, and is generally used to trigger a cooling fan on the inverter cooling system radiator (through a relay of course). The output will turn off again once the inverter temp decreases to 2 degrees below the value you have set.

Front WSS

This value is used for traction control. In the case of the new GPS based traction control released in 2022, it should be set so that the displayed "TC slip measured" value is as close to zero as possible when driving in a straight line under no wheelspin conditions. It is used to account for differences in drive wheel diameter. On dual motor applications it is used to adjust for differences in front and rear drive wheel diameters. A good starting point is 128, which translates to a multiplier of 1 (no correction).

Max speed

Self explanatory, this is a maximum speed limiter.

Write settings

At the top of the settings screen, you have a button that will write the current settings to the T2C (all but the wheel speed scalar setting, which is stored in the app itself). The settings will then stay stored in the T2C, and will be read back out and displayed when you navigate to the settings screen next time.

Preset buttons

We have also added 3 "**Preset**" buttons at the top, which allow you to store and quickly change between settings profiles you may want to choose between on a regular basis. To store a preset, select the values you want to store using the sliders, then press and hold the preset button for a few seconds. The label at the top should say "Preset XX saved" once that profile has been saved. You can do this for all 3 presets. Then, when you tap the preset button next time, that settings profile will be loaded and written to the T2C.

Minimum pack voltage

This limit will be the lowest voltage value the inverter will draw the pack down to under load. Tesla use a value of 241V for their 96S packs.
You can adjust this to suit the minimum voltage you want to use for your battery pack if you want to. This value must account for sag under load.
We cannot provide this value for you, so please do not contact us about this.

Maximum pack voltage

This limit will be the highest voltage value the inverter will regen up to while decelerating. Tesla use a value of 401V for their 96S packs.
You can adjust this to suit the maximum voltage you want to use for your battery pack if you want to. This setting is not a complete substitute for regen derating by the BMS.
We cannot provide this value for you, so please do not contact us about this. If you want to prevent the inverter from charging the battery pack when it is close to fully charged, you might want to set it 10% lower than your fully charged pack voltage.

CHILL/SPORT/LUDICROUS settings

This will toggle between the different power levels your drive unit(s) supports. This varies depending on the drive unit, powertrain type and hardware version.

NORMAL/RWD/FWD

This will switch between AWD, RWD and FWD on dual motor powertrains that support the feature.
Once you set the powertrain to RWD or FWD you generally need to power it off and on again to go back to default settings.

CREEP OFF/ON/ HOLD

Enables and disables creep mode on all supported powertrains, and enables hold mode on PMSR type powertrains (Model 3 and Y).

TRACK MODE

These settings allow you to adjust the track mode features available with performance Model 3 powertrains.
The vehicle must be in neutral and you must write the settings to turn track mode on.
You must click write settings to make changes to the other parameters before they take effect.

There are two versions of the **BMS screen** that the Dash app can display.

One is for the Model 3 BMS, the Dilithium MCU, and Orion BMS. The other is for the older style Dilithium BMS.
The information displayed on these screens will vary depending on which of BMS you are using.
The older style Dilithium BMS is accessed through the utilities screen, and is covered erlier in the manual.

The newer style screen can be accessed by clicking the BMS icon on the main screen, or by swiping downwards on the right side of the main screen. The different pages can be accessed using the buttons at the bottom, you can scroll the button bar to access the full range.

The Model 3 BMS will populate all the pages.

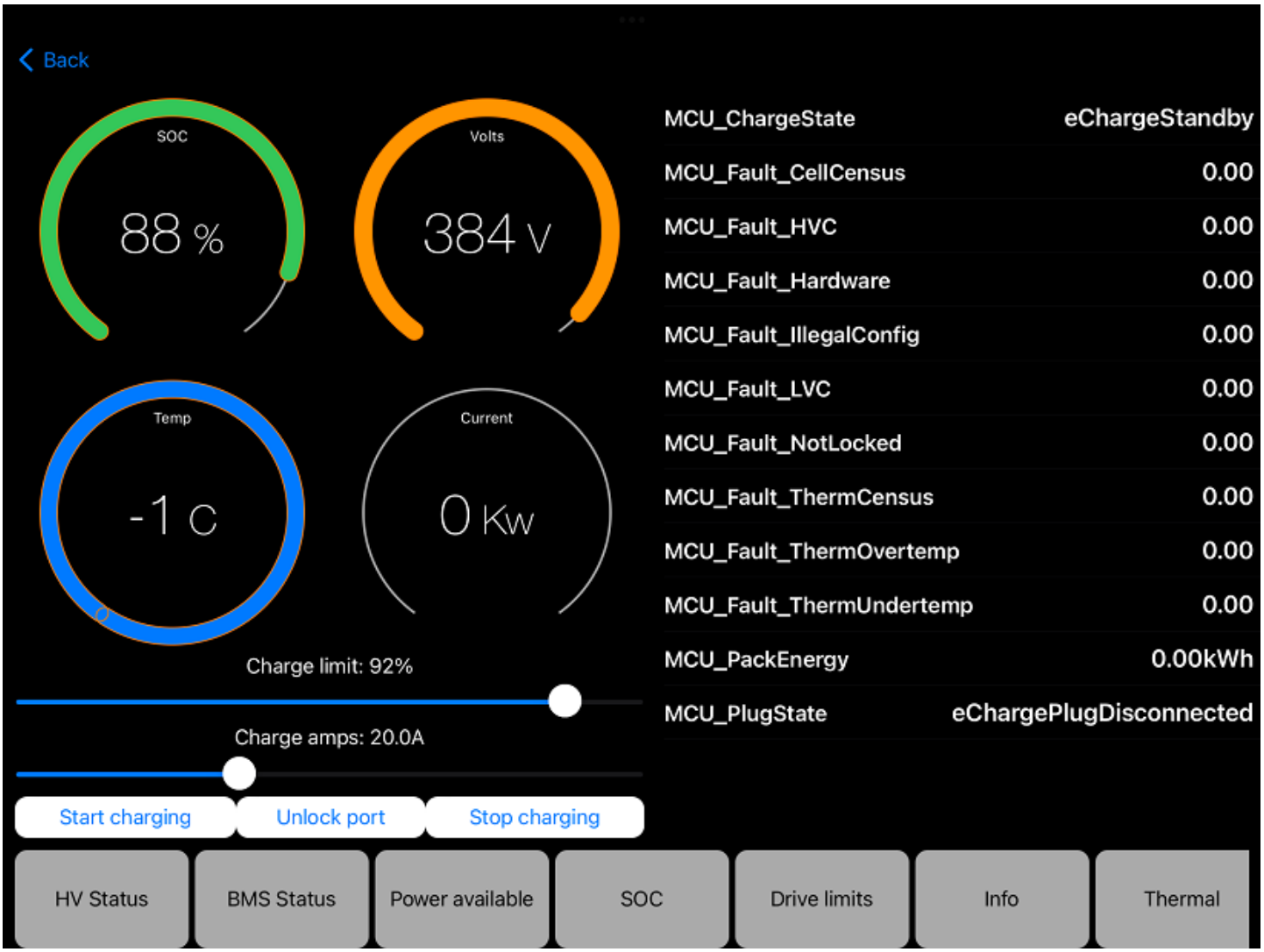
The Orion BMS will populate the SOC and drive limits page, and uses the default Orion 0x6B0 and 0x6B1 message structure. The CCL and DCL limits are implemented in T2C firmware version 5000 and up for the Orion BMS.

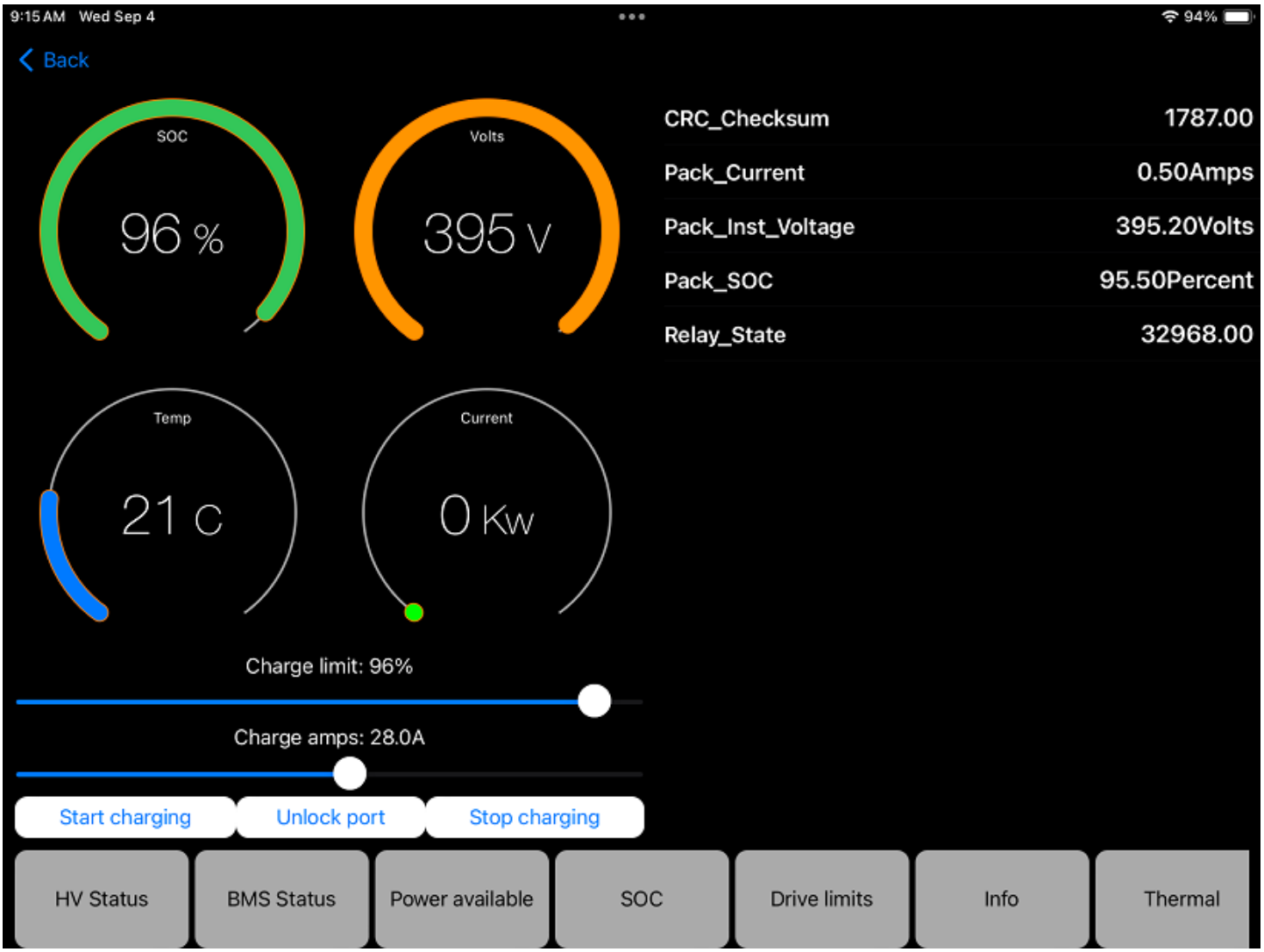
The Dilithium MCU will populate the HV Status, BMS status, SOC, Thermal, MinMax and Cell voltages pages, and uses the J1939 protocol. The Dilithium MCU will trigger the BMS warning indicator on the main Dash screen if any faults are present in the BMS status page.

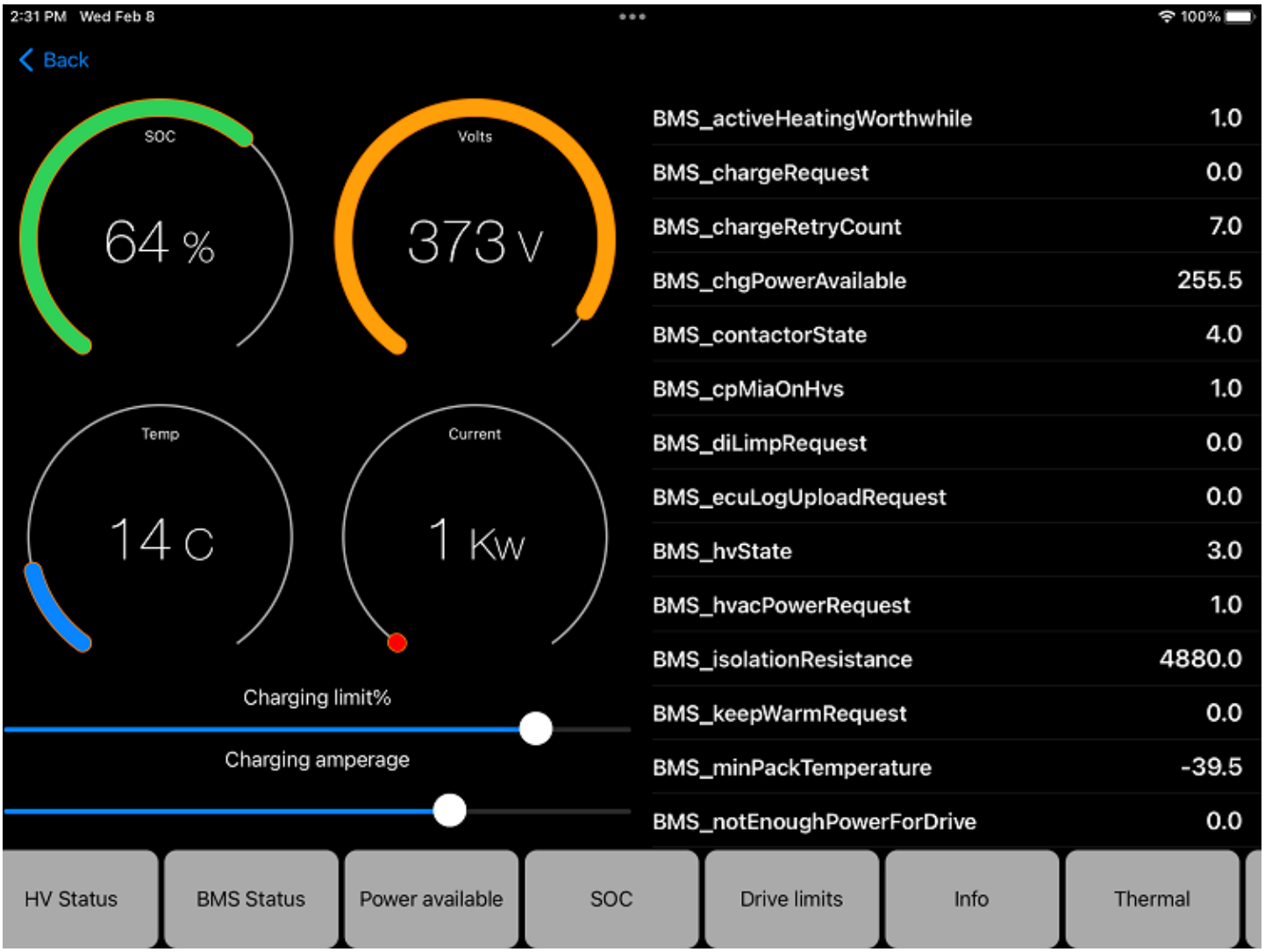
The Orion or Dilithium BMS should be wired to CAN2 on the T2C in order to enable this functionality, baud rate is 500kbs. The CAN termination resistor shoud be enabled in the BMS or MCU, the T2C already has a termination resistor on CAN 2.
The Model 3 should be wired to CAN 1 as per the wiring diagram in the manual. You need the Model 3 battery control option or TBC to use the Model 3 BMS features.

The BMS features have been tested here and work as outlined on our test vehicles. We used a Dilithium MCU and an Orion BMS2 for our testing. We cannot provide tech support for aftermarket BMS from other companies so the features are provided as-is.

These screenshots are from the newer style screen on the MCU, Orion BMS2 and Model 3 BMS.


Back
SOC
88 %
Volts
384 V
Temp
-1 C
Current
0 Kw
Charge limit: 92%
Charge amps: 20.0A
Start charging
Unlock port
Stop charging
MCU_ChargeState eChargeStandby
MCU_Fault_CellCensus 0.00
MCU_Fault_HVC 0.00
MCU_Fault_Hardware 0.00
MCU_Fault_IllegalConfig 0.00
MCU_Fault_LVC 0.00
MCU_Fault_NotLocked 0.00
MCU_Fault_ThermCensus 0.00
MCU_Fault_ThermOvertemp 0.00
MCU_Fault_ThermUndertemp 0.00
MCU_PackEnergy 0.00kWh
MCU_PlugState eChargePlugDisconnected
HV Status
BMS Status
Power available
SOC
Drive limits
Info
Thermal

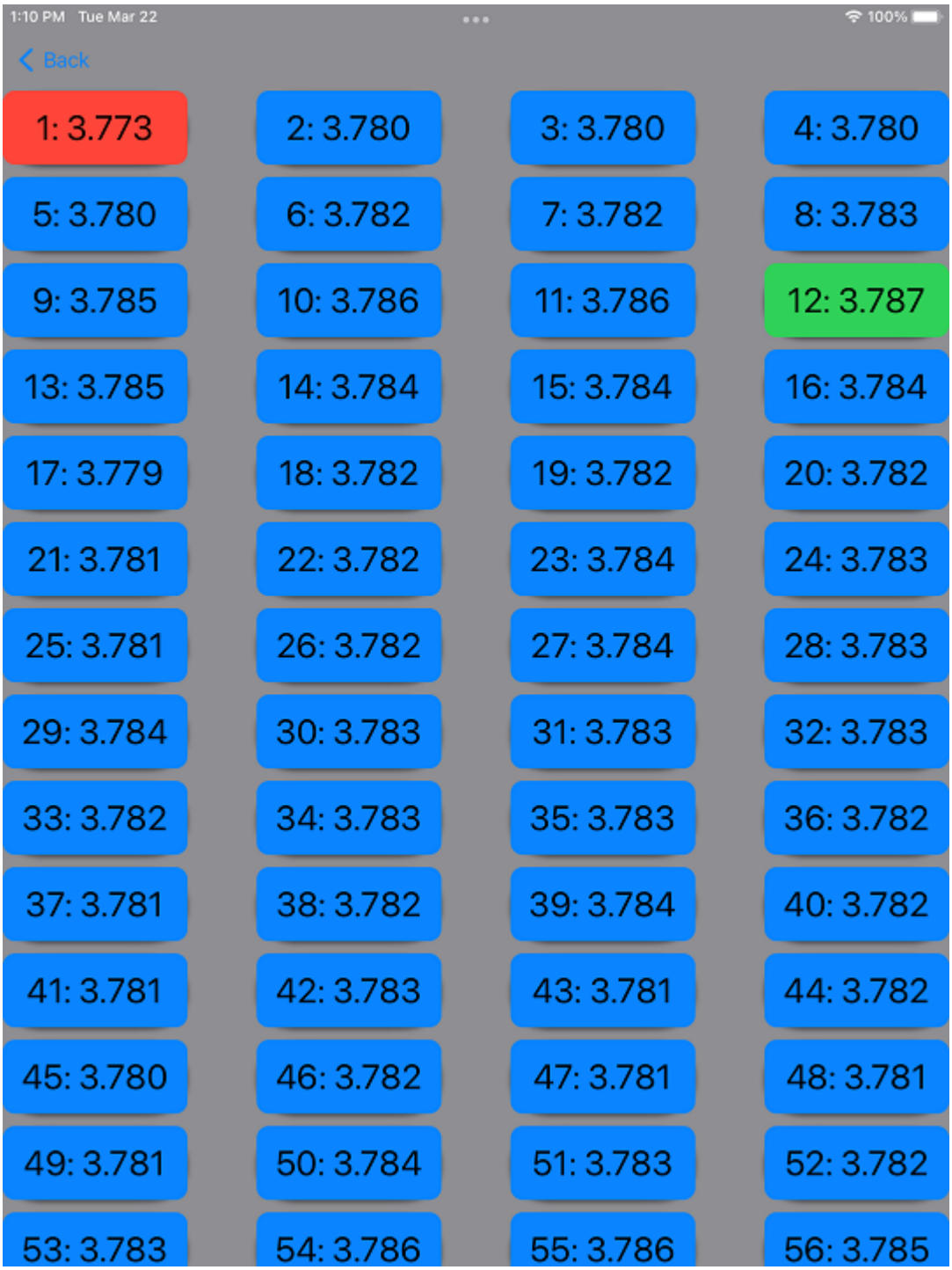

9:15 AM Wed Sep 4
94%
Back
SOC
96 %
Volts
395 V
Temp
21 C
Current
0 Kw
CRC_Checksum 1787.00
Pack_Current 0.50Amps
Pack_Inst_Voltage 395.20Volts
Pack_SOC 95.50Percent
Relay_State 32968.00
Charge limit: 96%
Charge amps: 28.0A
Start charging
Unlock port
Stop charging
HV Status
BMS Status
Power available
SOC
Drive limits
Info
Thermal



The old style **BMS screen** will give you a graphic display of cell voltages, highlighting the highest and lowest in read and green, if you have a properly configured Dilithium BMS connected to CAN 1.

See the CAN control functions elsewhere in this manual for details on how users can configure other BMS systems to derate power and regen over CAN.

We cannot assist with programming BMS systems beyond providing the format the T2C requires for these messages.

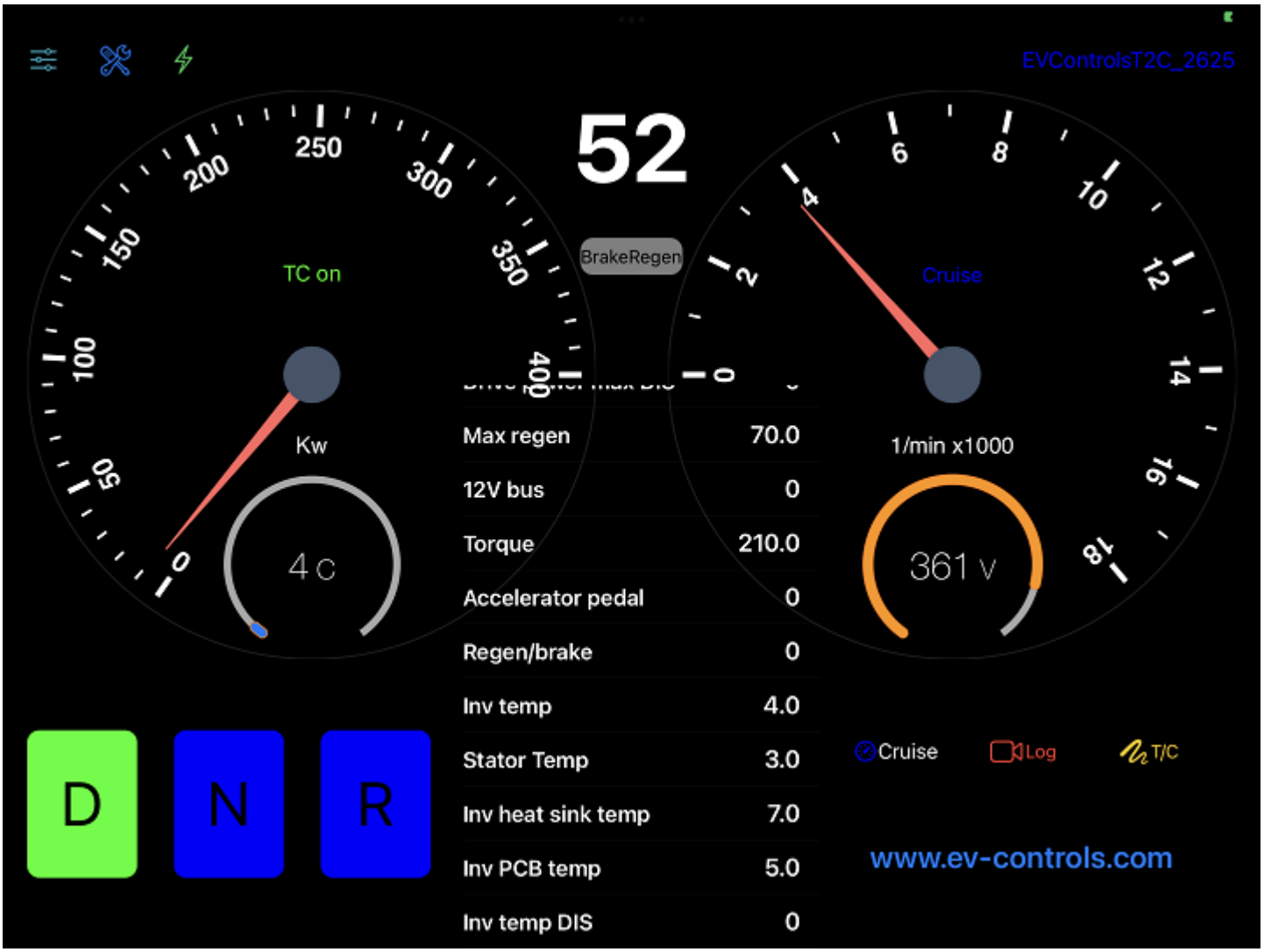

1:10 PM Tue Mar 22
100%
Back
1: 3.773
2: 3.780
3: 3.780
4: 3.780
5: 3.780
6: 3.782
7: 3.782
8: 3.783
9: 3.785
10: 3.786
11: 3.786
12: 3.787
13: 3.785
14: 3.784
15: 3.784
16: 3.784
17: 3.779
18: 3.782
19: 3.782
20: 3.782
21: 3.781
22: 3.782
23: 3.784
24: 3.783
25: 3.781
26: 3.782
27: 3.784
28: 3.783
29: 3.784
30: 3.783
31: 3.783
32: 3.783
33: 3.782
34: 3.783
35: 3.783
36: 3.782
37: 3.781
38: 3.782
39: 3.784
40: 3.782
41: 3.781
42: 3.783
43: 3.781
44: 3.782
45: 3.780
46: 3.782
47: 3.781
48: 3.781
49: 3.781
50: 3.784
51: 3.783
52: 3.782
53: 3.783
54: 3.786
55: 3.786
56: 3.785

Traction control

We are releasing traction control features for the T2C in early 2022. Our traction control system uses a high resolution GNSS module we developed, along with our software, to modulate torque under acceleration and regen conditions and maintain drive wheel traction at the limit of what is available.
To use the traction control features, you need to install the EV-controls GNSS module and connect it to the CAN bus (CAN 1), 12v power and ground. The T2C software monitors data coming from the module, and when a valid signal is available, traction control will be enabled. You can monitor the status of the traction control in the dash app. An icon at the top of the left power gauge will either display "no TC", "TC on", or "TC active" when the system is limiting torque for longer periods.
You can monitor the satellites available to the GNSS module, and the difference in speed between the driven wheels and actual vehicle speed (kph) in the center information scroll view. These values are near the bottom, so scroll down to see them. You can also use the logging features to monitor these parameters.
You must adjust the "front wheel speed scalar" value under the T2C settings so that the "TC slip measured" parameter is as close as possible to zero while driving straight at low power. The value is high resolution and measures in hundredths of a kph, so it is normal for it to vary slightly above and below zero under these conditions. You can also disable/enable the traction control by using the TC icon in the bottom right of the screen. This can be useful to satisfy juvenile tendencies that may present themselves, and perform emergency maneuvers (ie. burnouts and doughnuts).
Traction control will never be enabled unless a valid GPS signal is available, so you can disable traction control entirely by simply switching off the GNSS module.

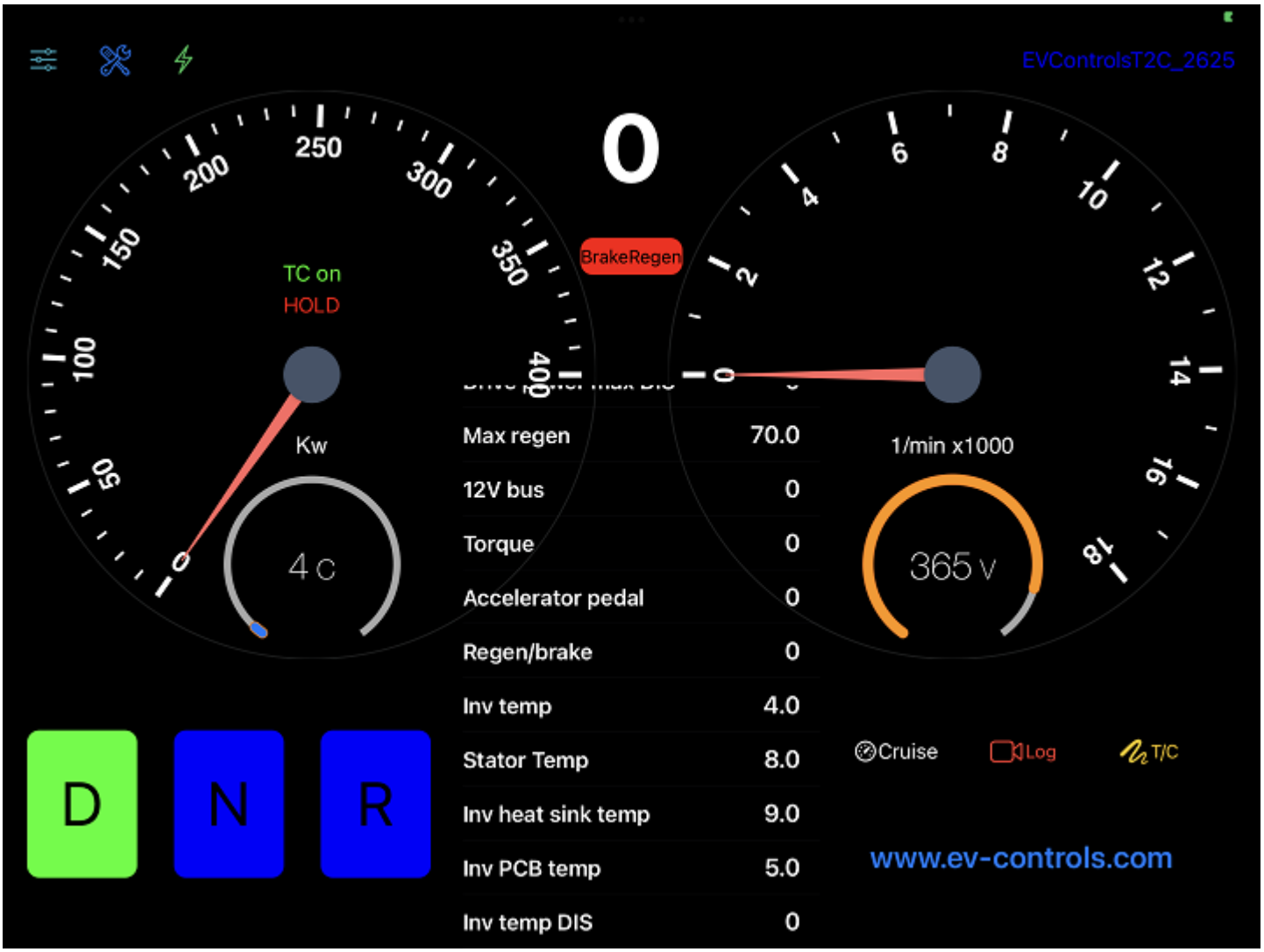
Cruise control

We have added cruise control features for most applications recently. To engage cruise control, tap the "Cruise" icon at the bottom right of the main screen. The current speed should be maintained until you tap the brake pedal. you can also engage cruise by grounding the "Spare 2" input on the T2C for customers who want to use a dedicated button. When the cruise control is active, the blue "Cruise" icon should be visible near the top of the RPM gauge.



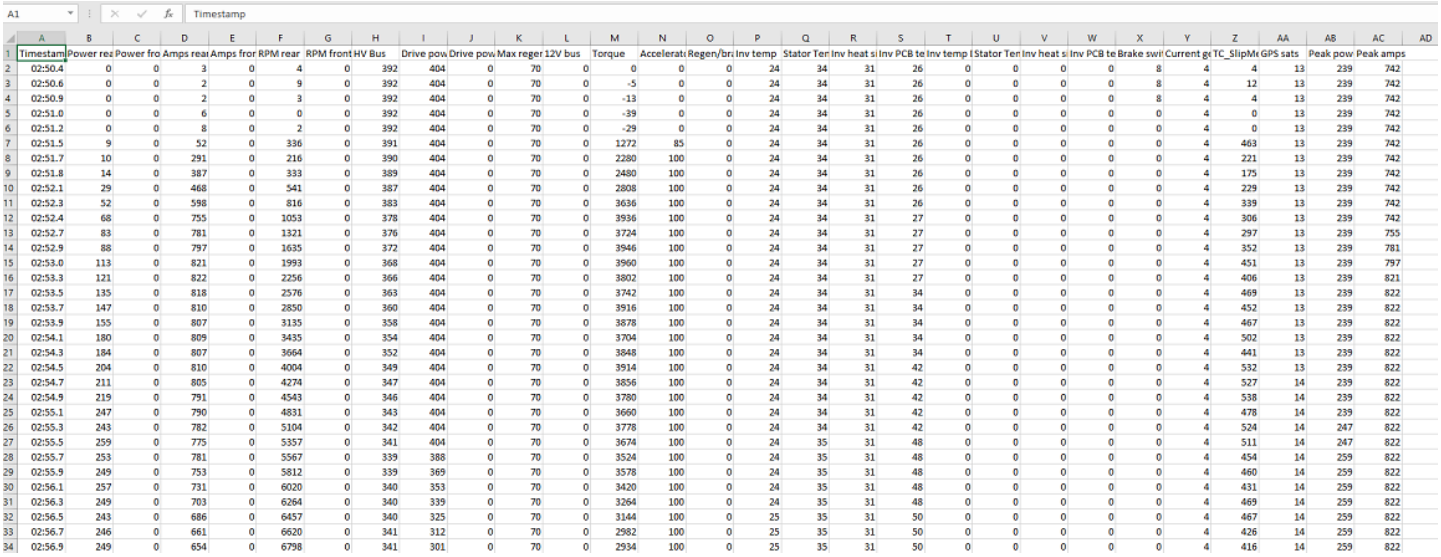
Vehicle hold

On Model 3/Y drive units, the vehicle hold feature should be functional under normal conditions. This will help hold the vehicle stationary when at a stop, without the need to hold the brake pedal down. When the vehicle hold is active, a red "HOLD" icon will be visible near the top of the power gauge on the left.



Datalogging features

The T2C dash app allows you to log data to .csv files to record data during acceleration runs or for other purposes. This can be very useful to monitor things like amperage, battery voltage sag under peak power, or wheel slip under acceleration. To log to a file, just tap the logging icon at the bottom right of the main screen. The "logging" icon will appear at the top of the RPM gauge, and the T2C dash app will record to a .csv file until you tap the logging icon again. Once you tap the logging icon a second time, you will be given options to send the .csv log file you have created by e-mail, text etc..

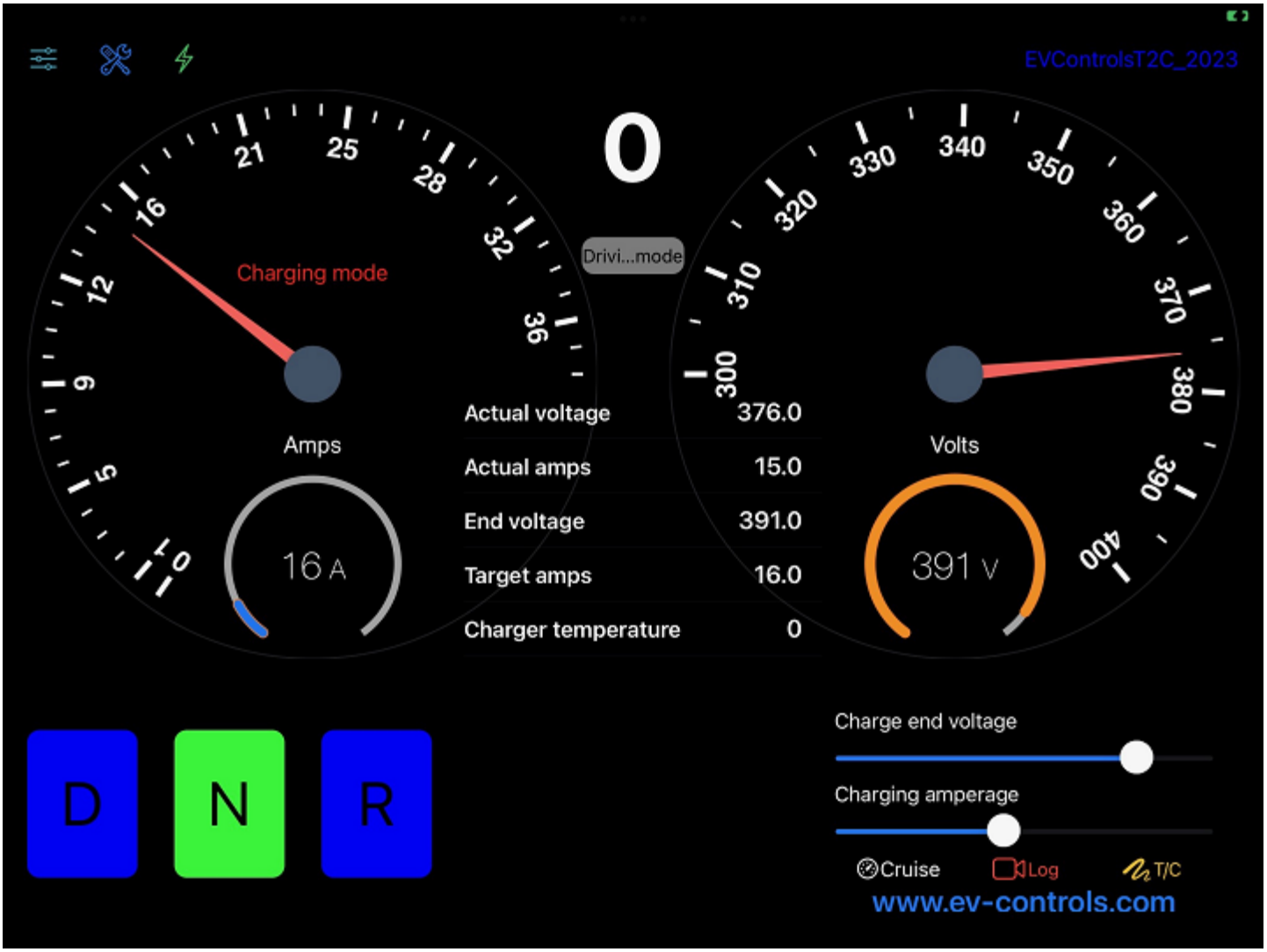


A1 Timestamp

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD
1	Timestam	Power rea	Power fro	Amps rea	Amps fror	RPM rear	RPM front	HV Bus	Drive pow	Drive pow	Max reger	12V bus	Torque	Accelerat	Regen/bra	Inv temp	Stator Ter	Inv heat si	Inv PCB te	Inv temp	Stator Ter	Inv heat si	Inv PCB te	Brake swit	Current ge	TC_SlipMc	GPS sats	Peak pow	Peak amps	
2	02:50.4	0	0	3	0	4	0	392	404	0	70	0	0	0	0	24	34	31	26	0	0	0	0	8	4	4	13	239	742	
3	02:50.6	0	0	2	0	9	0	392	404	0	70	0	-5	0	0	24	34	31	26	0	0	0	0	8	4	12	13	239	742	
4	02:50.9	0	0	2	0	3	0	392	404	0	70	0	-13	0	0	24	34	31	26	0	0	0	0	8	4	4	13	239	742	
5	02:51.0	0	0	6	0	0	0	392	404	0	70	0	-39	0	0	24	34	31	26	0	0	0	0	0	4	0	13	239	742	
6	02:51.2	0	0	8	0	2	0	392	404	0	70	0	-29	0	0	24	34	31	26	0	0	0	0	0	4	0	13	239	742	
7	02:51.5	9	0	52	0	336	0	391	404	0	70	0	1272	85	0	24	34	31	26	0	0	0	0	0	4	463	13	239	742	
8	02:51.7	10	0	291	0	216	0	390	404	0	70	0	2280	100	0	24	34	31	26	0	0	0	0	0	4	221	13	239	742	
9	02:51.8	14	0	387	0	333	0	389	404	0	70	0	2480	100	0	24	34	31	26	0	0	0	0	0	4	175	13	239	742	
10	02:52.1	29	0	468	0	541	0	387	404	0	70	0	2808	100	0	24	34	31	26	0	0	0	0	0	4	229	13	239	742	
11	02:52.3	52	0	598	0	816	0	383	404	0	70	0	3636	100	0	24	34	31	26	0	0	0	0	0	4	339	13	239	742	
12	02:52.4	68	0	755	0	1053	0	378	404	0	70	0	3936	100	0	24	34	31	27	0	0	0	0	0	4	306	13	239	742	
13	02:52.7	83	0	781	0	1321	0	376	404	0	70	0	3724	100	0	24	34	31	27	0	0	0	0	0	4	297	13	239	755	
14	02:52.9	88	0	797	0	1635	0	372	404	0	70	0	3946	100	0	24	34	31	27	0	0	0	0	0	4	352	13	239	781	
15	02:53.0	113	0	821	0	1993	0	368	404	0	70	0	3960	100	0	24	34	31	27	0	0	0	0	0	4	451	13	239	797	
16	02:53.3	121	0	822	0	2256	0	366	404	0	70	0	3802	100	0	24	34	31	27	0	0	0	0	0	4	406	13	239	821	
17	02:53.5	135	0	818	0	2576	0	363	404	0	70	0	3742	100	0	24	34	31	34	0	0	0	0	0	4	469	13	239	822	
18	02:53.7	147	0	810	0	2850	0	360	404	0	70	0	3916	100	0	24	34	31	34	0	0	0	0	0	4	452	13	239	822	
19	02:53.9	155	0	807	0	3135	0	358	404	0	70	0	3878	100	0	24	34	31	34	0	0	0	0	0	4	467	13	239	822	
20	02:54.1	180	0	809	0	3435	0	354	404	0	70	0	3704	100	0	24	34	31	34	0	0	0	0	0	4	502	13	239	822	
21	02:54.3	184	0	807	0	3664	0	352	404	0	70	0	3848	100	0	24	34	31	34	0	0	0	0	0	4	441	13	239	822	
22	02:54.5	204	0	810	0	4004	0	349	404	0	70	0	3914	100	0	24	34	31	42	0	0	0	0	0	4	532	13	239	822	
23	02:54.7	211	0	805	0	4274	0	347	404	0	70	0	3856	100	0	24	34	31	42	0	0	0	0	0	4	527	14	239	822	
24	02:54.9	219	0	791	0	4543	0	346	404	0	70	0	3780	100	0	24	34	31	42	0	0	0	0	0	4	538	14	239	822	
25	02:55.1	247	0	790	0	4831	0	343	404	0	70	0	3660	100	0	24	34	31	42	0	0	0	0	0	4	478	14	239	822	
26	02:55.3	243	0	782	0	5104	0	342	404	0	70	0	3778	100	0	24	34	31	42	0	0	0	0	0	4	524	14	247	822	
27	02:55.5	259	0	775	0	5357	0	341	404	0	70	0	3674	100	0	24	35	31	48	0	0	0	0	0	4	511	14	247	822	
28	02:55.7	253	0	781	0	5567	0	339	388	0	70	0	3524	100	0	24	35	31	48	0	0	0	0	0	4	454	14	259	822	
29	02:55.9	249	0	753	0	5812	0	339	369	0	70	0	3578	100	0	24	35	31	48	0	0	0	0	0	4	460	14	259	822	
30	02:56.1	257	0	731	0	6020	0	340	353	0	70	0	3420	100	0	24	35	31	48	0	0	0	0	0	4	431	14	259	822	
31	02:56.3	249	0	703	0	6264	0	340	339	0	70	0	3264	100	0	24	35	31	48	0	0	0	0	0	4	469	14	259	822	
32	02:56.5	243	0	686	0	6457	0	340	325	0	70	0	3144	100	0	25	35	31	50	0	0	0	0	0	4	467	14	259	822	
33	02:56.7	246	0	661	0	6620	0	341	312	0	70	0	2982	100	0	25	35	31	50	0	0	0	0	0	4	426	14	259	822	
34	02:56.9	249	0	654	0	6798	0	341	301	0	70	0	2934	100	0	25	35	31	50	0	0	0	0	0	4	416	14	259	822	

Charging mode

We use the Elcon 6600w 500kbs CAN controlled charger in several of our test vehicles, and have added CAN control capabilities for it to the T2C and app. If you are using the same model charger in your project, you should be able to use these capabilities if you choose to.
Clicking the lightning bolt icon in the top left of the main screen will put the T2C and app in charging mode.
In this mode, the contactors will open, and the pin B1 "charger" output will be powered with 12v. you can use this output to turn the charger on and close a charging contactor if you are using one.
The display will change to show charging current and HV battery voltage. You can set charge current and charging end voltage using the sliders on the screen. Clicking the "drive/regen" button between the main gauges will switch back into driving mode.



T2C outputs

The D/N/R indicator light, brake/regen light, reverse light and spare relay outputs are 12v outputs, and can drive low current draw indicator lamps directly. So are the positive and negative contactor, precharge relay and charger outputs. The cooling fan output is a 12v output but should drive an external relay in every case because of the high current draw.

The total current draw of all outputs should be kept under 8 amps, and should be no more than 4 amps for any single output.

12vBank1 supplies the following outputs with 12v;
[Positive contactor, negative contactor, precharge relay, Reverse lights, Spare relay bank 1]

12VBank2 supplies the following outputs with 12v;
[Charger output, Brake/regen lights, Cooling fan, Inverter 12v power, Spare relay bank 2]

T2C inputs

The current firmware requires momentary ground signals for the shift buttons, regen disable and spare (BMS warning and cruise switch) inputs. Current firmware allows these inputs to be held to ground if you want to use a shift selector that opearates this way. With earlier firmware, holding them to ground can cause the T2C to be unresponsive on boot up.

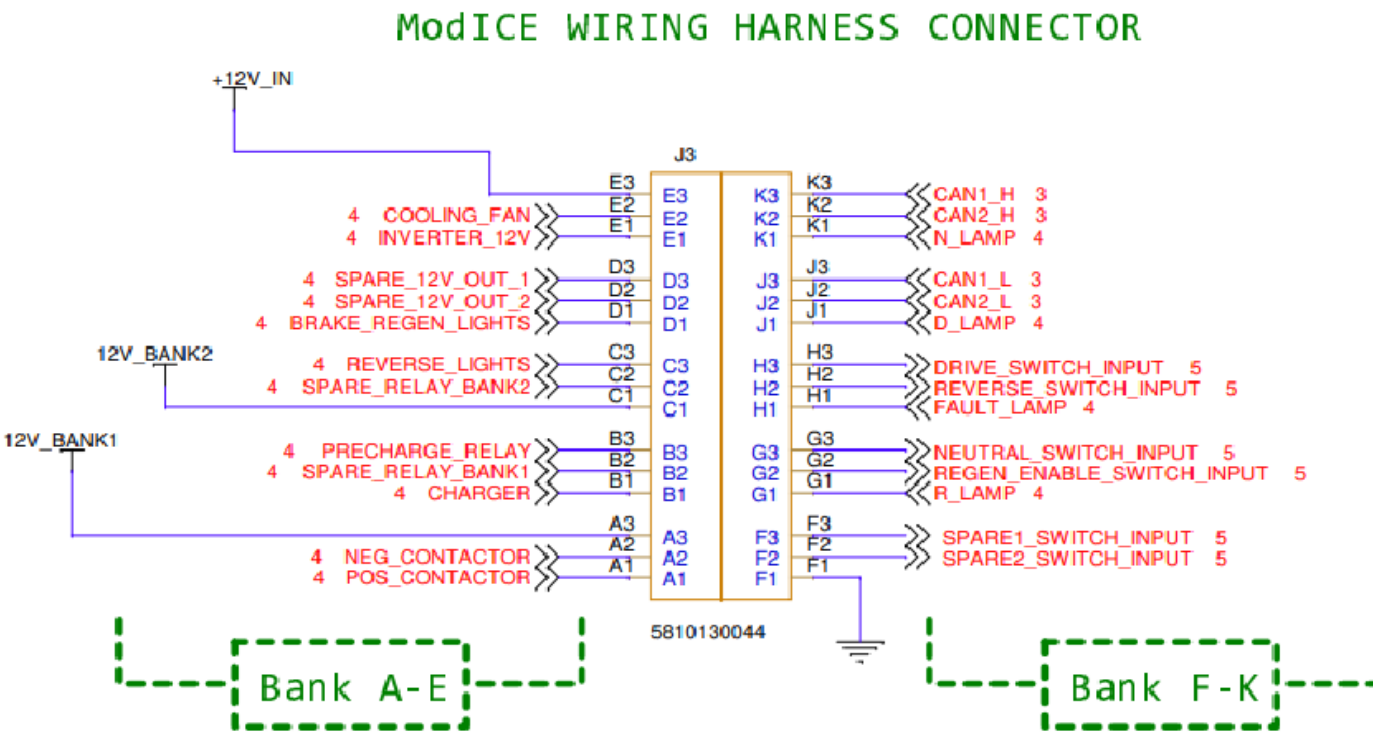
Wiring Guidelines

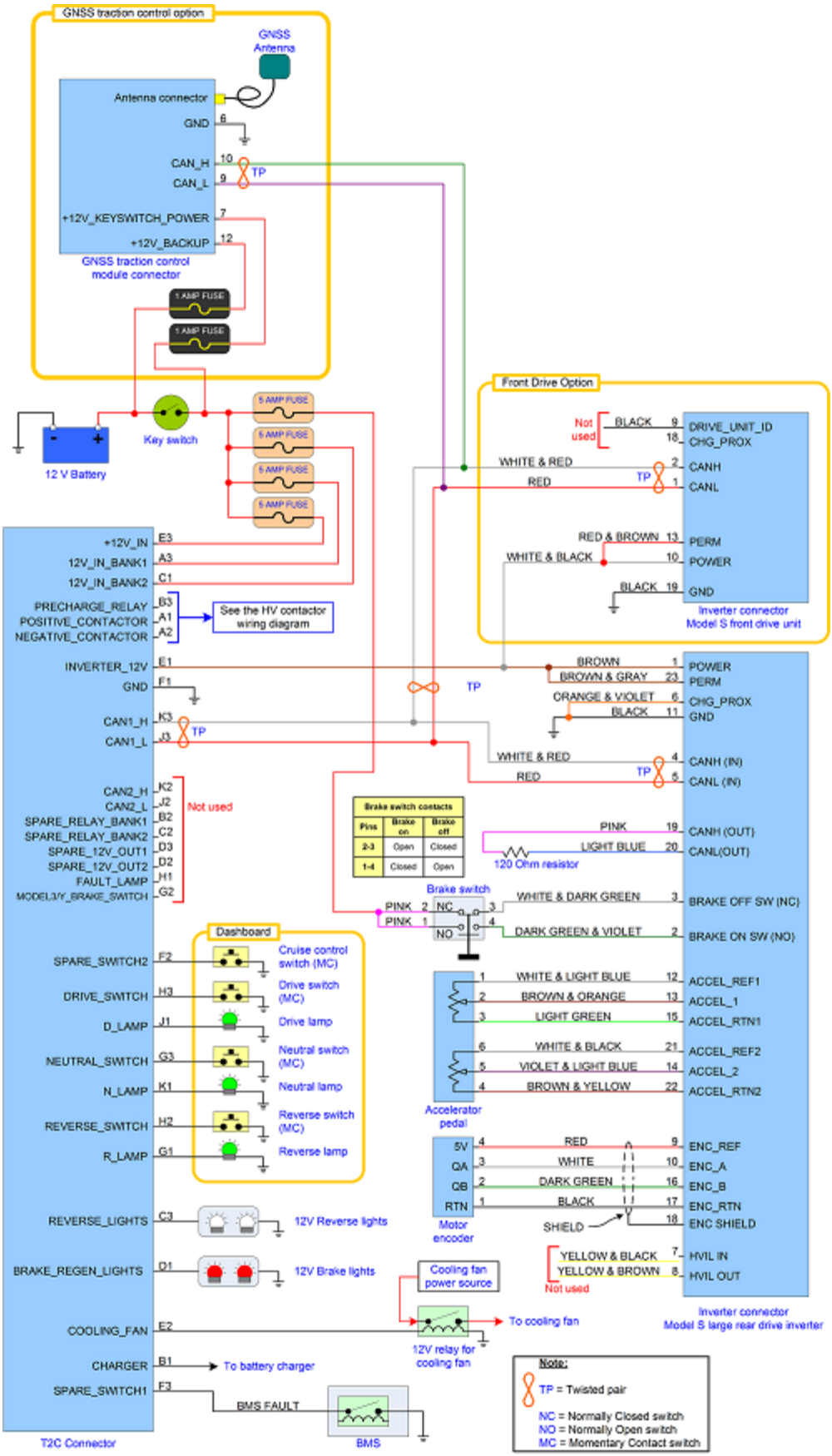
- The following diagrams use Tesla color codes where possible, but these vary, so use pin numbers for the most accurate reference. This assumes that you will be using Tesla connectors for:
    - The drive inverter
    - Accelerator pedal
    - Brake switch
- The wiring diagrams show all connections, but you will not need to wire things like the resolver etc.. if you use the Tesla motor harness.
- The controller is equipped with the female side of a multi pin connector
- Your purchase includes a matching male side for the connector and required crimp connectors
- Connection details for the connector are included in the controller pinout diagram
- You must observe the fusing information provided in the included drive inverter diagram failure to do so may result in controller damage
- All CAN communication wiring must be twisted pairs
- Can communication wiring must be located as far as possible from high voltage wiring to prevent CAN communication interference
- It is recommended that you begin your project by drawing a color coded wiring diagram for your completed project

What you must provide

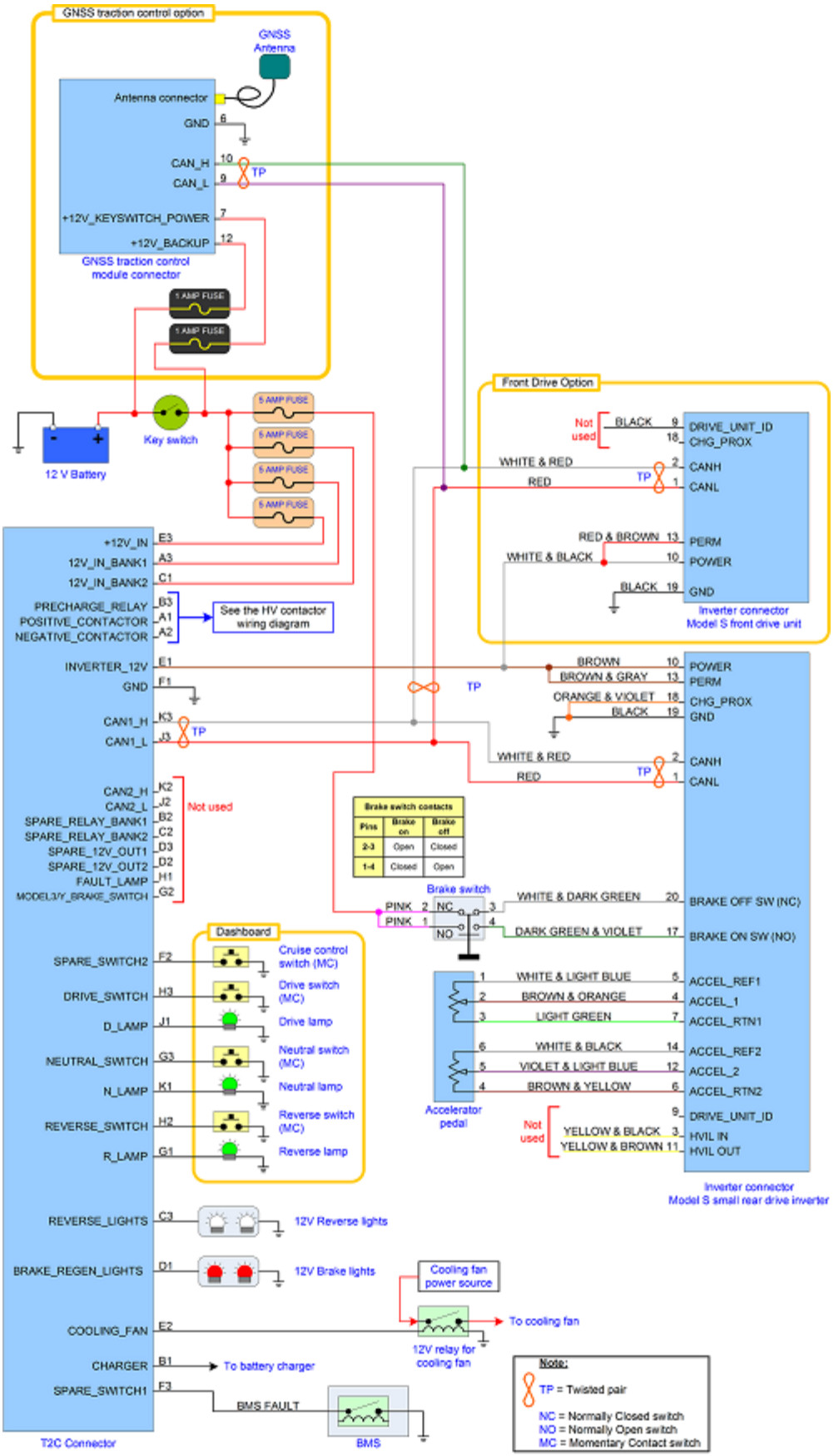
This guide is based on the assumption that you will have the following components in your possession

- Suitable drive unit (please email our support department to verify suitability)
- Drive unit wiring harness including inverter connector and shielded encoder harness with connector
- Tesla accelerator pedal with connector and a portion of the associated harness
- Brake switch with connector and a portion of the associated harness
- All associated wiring, fuses, contactors and switches
- A 12volt power source

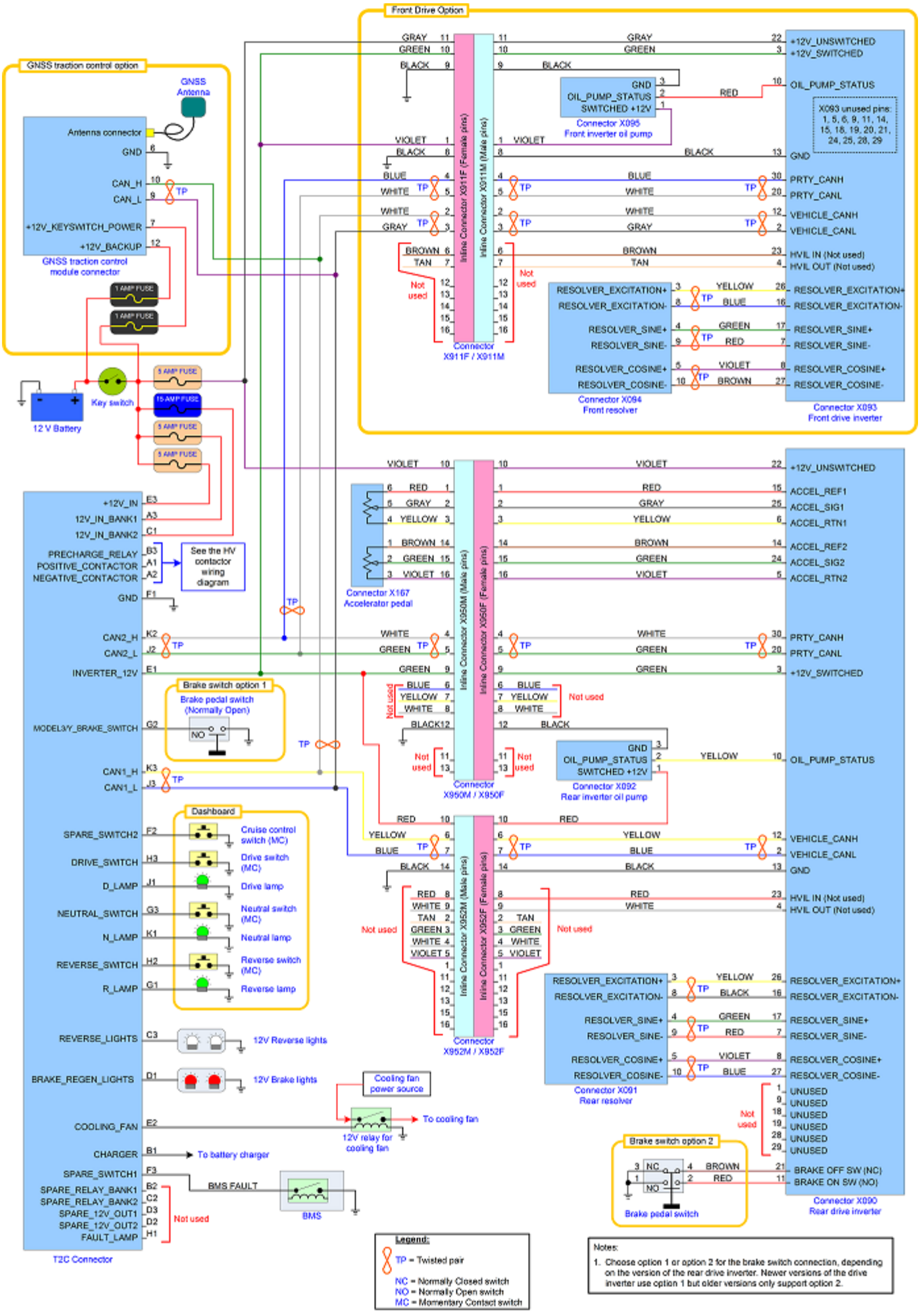

ModICE WIRING HARNESS CONNECTOR
+12V_IN
J3
E3
E2
E1
4 COOLING_FAN
4 INVERTER_12V
D3
D2
D1
4 SPARE_12V_OUT_1
4 SPARE_12V_OUT_2
4 BRAKE_REGEN_LIGHTS
12V_BANK2
C3
C2
C1
4 REVERSE_LIGHTS
4 SPARE_RELAY_BANK2
12V_BANK1
B3
B2
B1
4 PRECHARGE_RELAY
4 SPARE_RELAY_BANK1
4 CHARGER
A3
A2
A1
4 NEG_CONTACTOR
4 POS_CONTACTOR
K3
K2
K1
CAN1_H 3
CAN2_H 3
N_LAMP 4
J3
J2
J1
CAN1_L 3
CAN2_L 3
D_LAMP 4
H3
H2
H1
DRIVE_SWITCH_INPUT 5
REVERSE_SWITCH_INPUT 5
FAULT_LAMP 4
G3
G2
G1
NEUTRAL_SWITCH_INPUT 5
REGEN_ENABLE_SWITCH_INPUT 5
R_LAMP 4
F3
F2
F1
SPARE1_SWITCH_INPUT 5
SPARE2_SWITCH_INPUT 5
5810130044
Bank A-E
Bank F-K



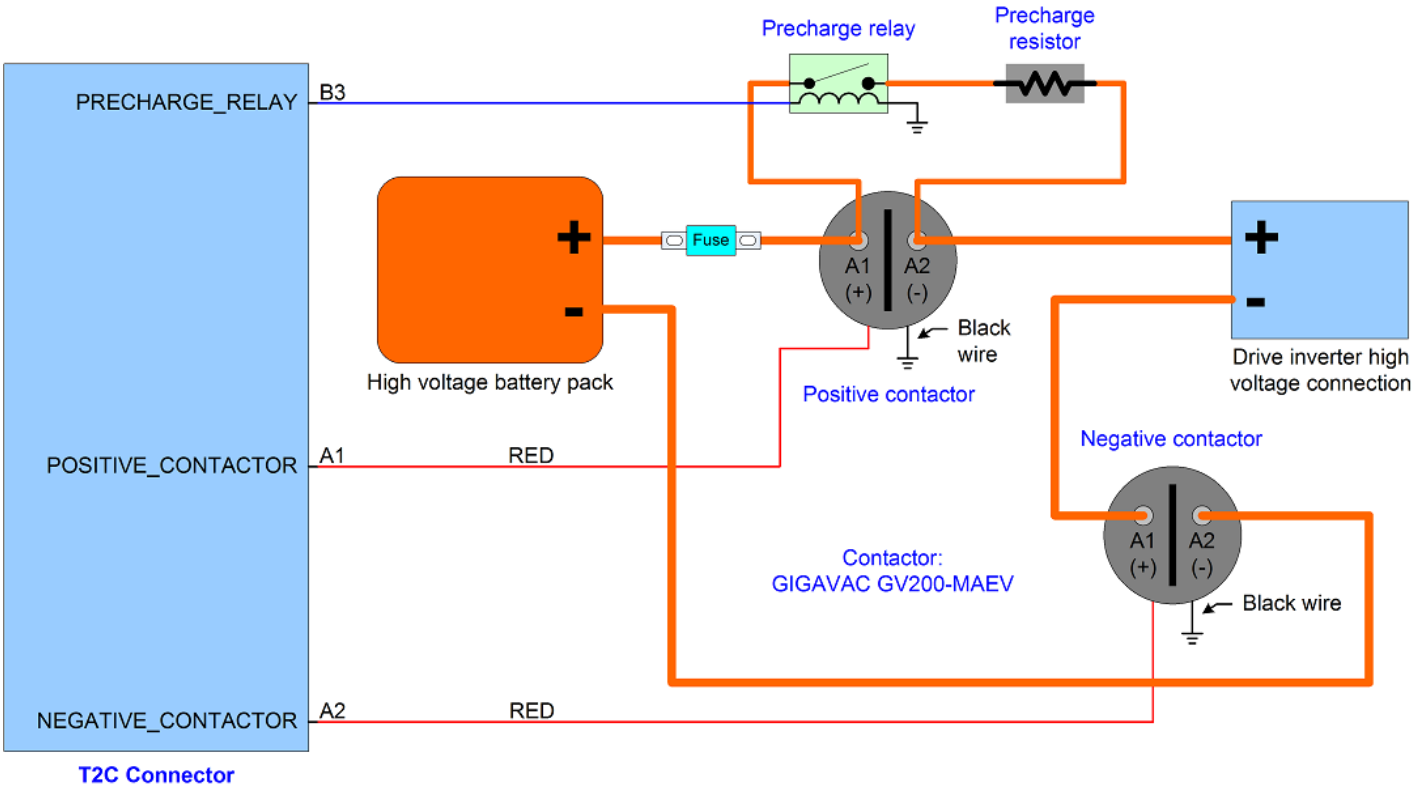
Wiring diagram: Model S with large rear inverter



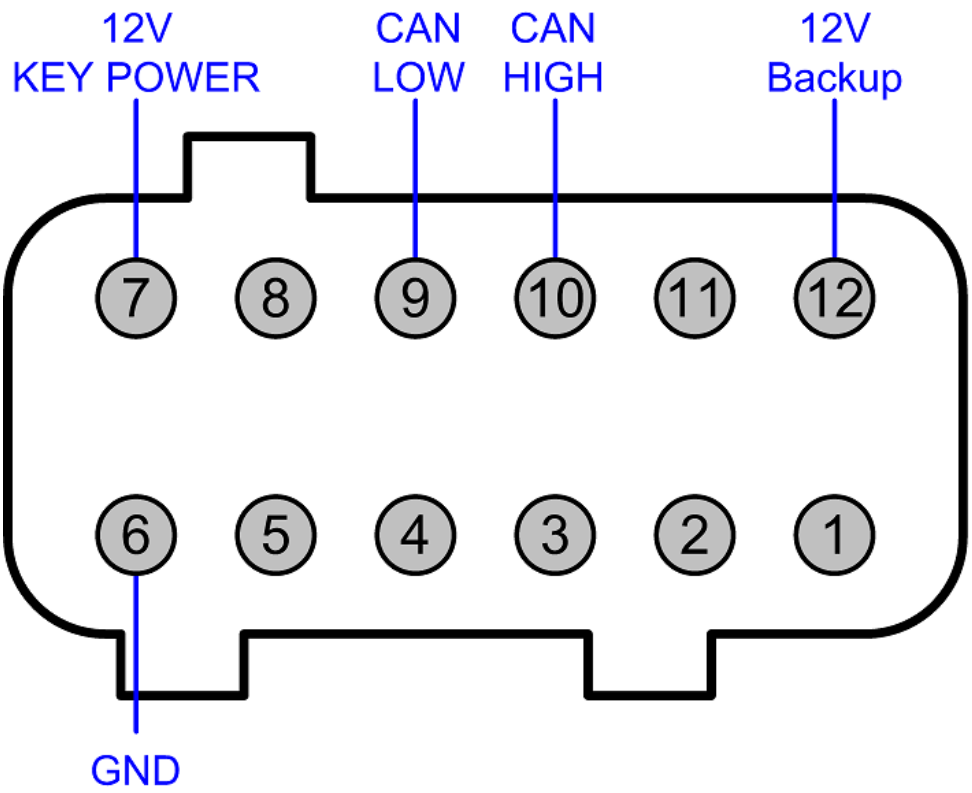
Wiring diagram: Model S with small rear drive inverter



Wiring diagram: Model 3



Wiring diagram: high voltage contactors

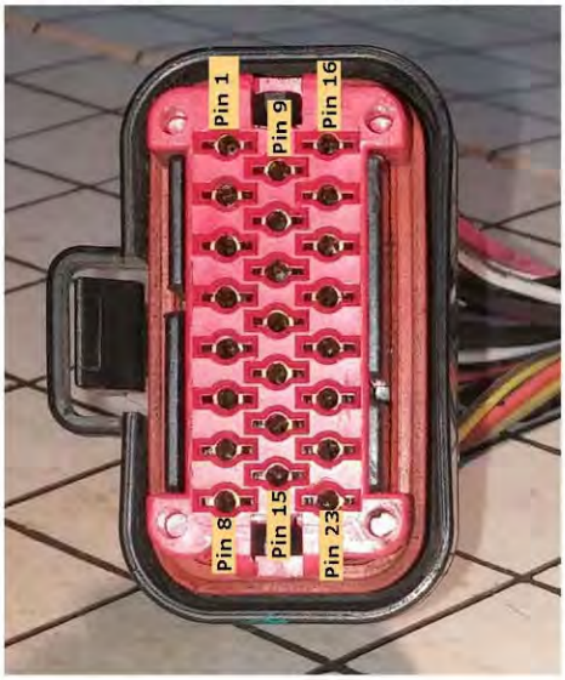


PIN 6 = GROUND
PIN 7 = 12V KEY POWER IN
PIN 9 = CAN LOW
PIN 10 = CAN HIGH
PIN 12 = 12V BACKUP POWER IN (SATELLITE MEMORY)

Note: Current into pin 12 is 0.4 mA maximum

GNSS Traction control module pinout

Drive inverter connector (Not Supplied)

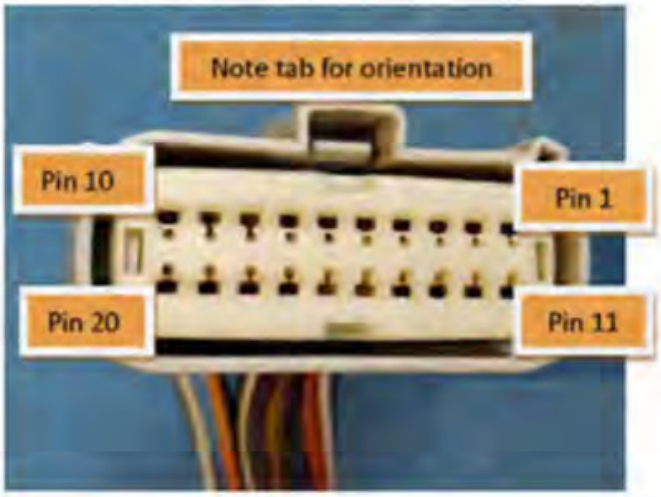


Cav	Col	Gauge
1	BN	1
2	DG/VT	0.5
3	WH/LG	0.5
4	PK/WH	0.5
5	LB/WH	0.5
6	OG/VT	0.5
7	YE/GY	0.5
8	YE/BN	0.5
9	RD	0.5
10	WH	0.5
11	BK	1
12	WH/LB	0.5
13	BN/OG	0.5
14	VT/LB	0.5
15	LG	0.5
16	DG	0.5
17	BK	0.5
18	SH	4.01
19	LG/RD	0.5
20	LG/DB	0.5
21	WH/BK	0.5
22	BN/YE	0.5

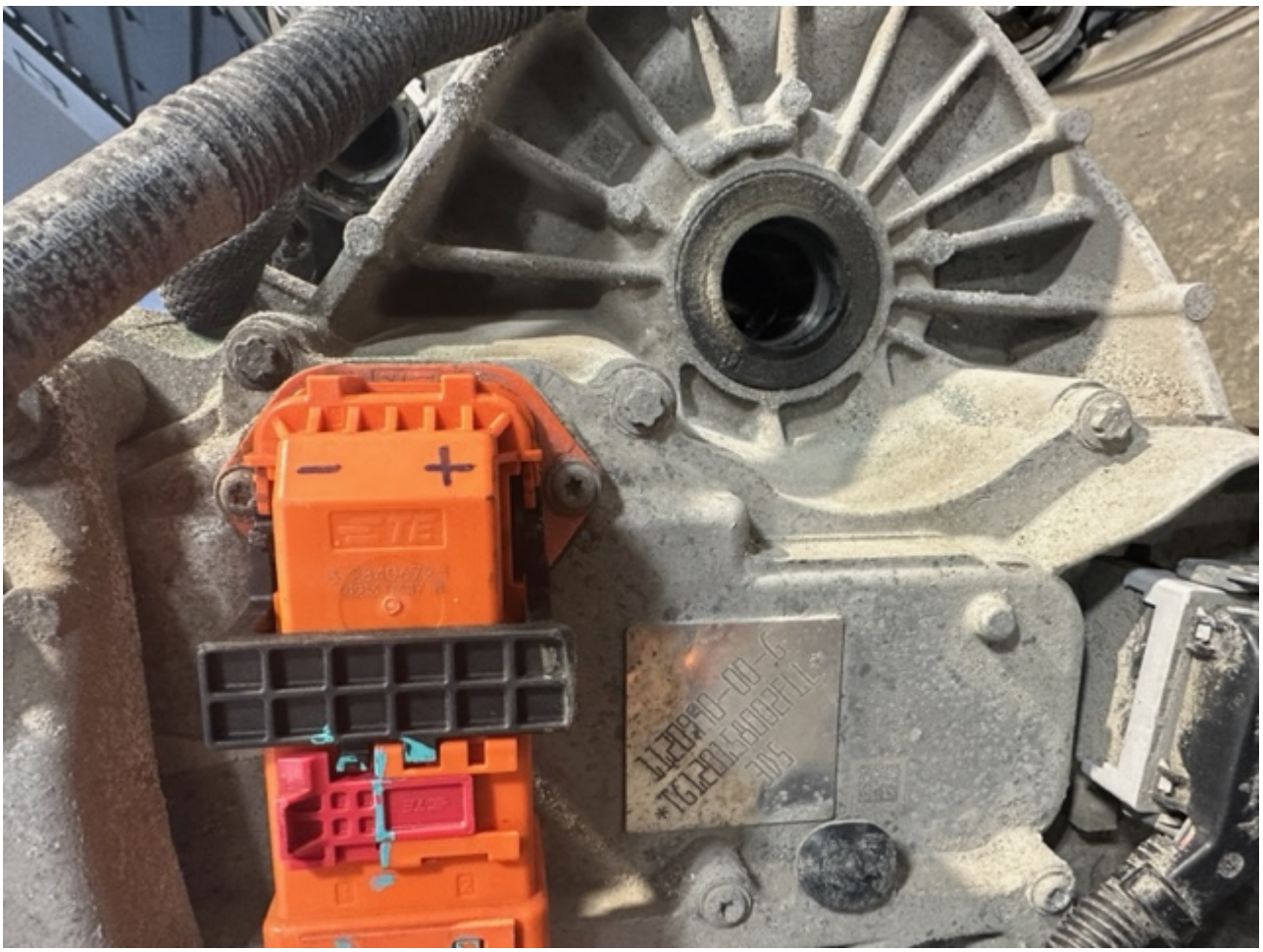
PIN NUMBER	Application
1	Key Power
2	BRAKE ON
3	BRAKE OFF
4	CAN HIGH IN +
5	CAN LOW IN -
6	NOT USED
7	NOT USED
8	NOT USED
9	ENCODER REF
10	ENCODER A
11	GROUND
12	ACCEL REF 1
13	ACCEL SIG 1
14	ACCEL SIG 2
15	ACCEL 1 SIG RTN
16	ENCODER B
17	ENCODER RETURN
18	ENCODER SHIELD -
19	CAN HIGH OUT
20	CAN LOW OUT
21	ACCEL REF 2
22	ACCEL SIG RTN

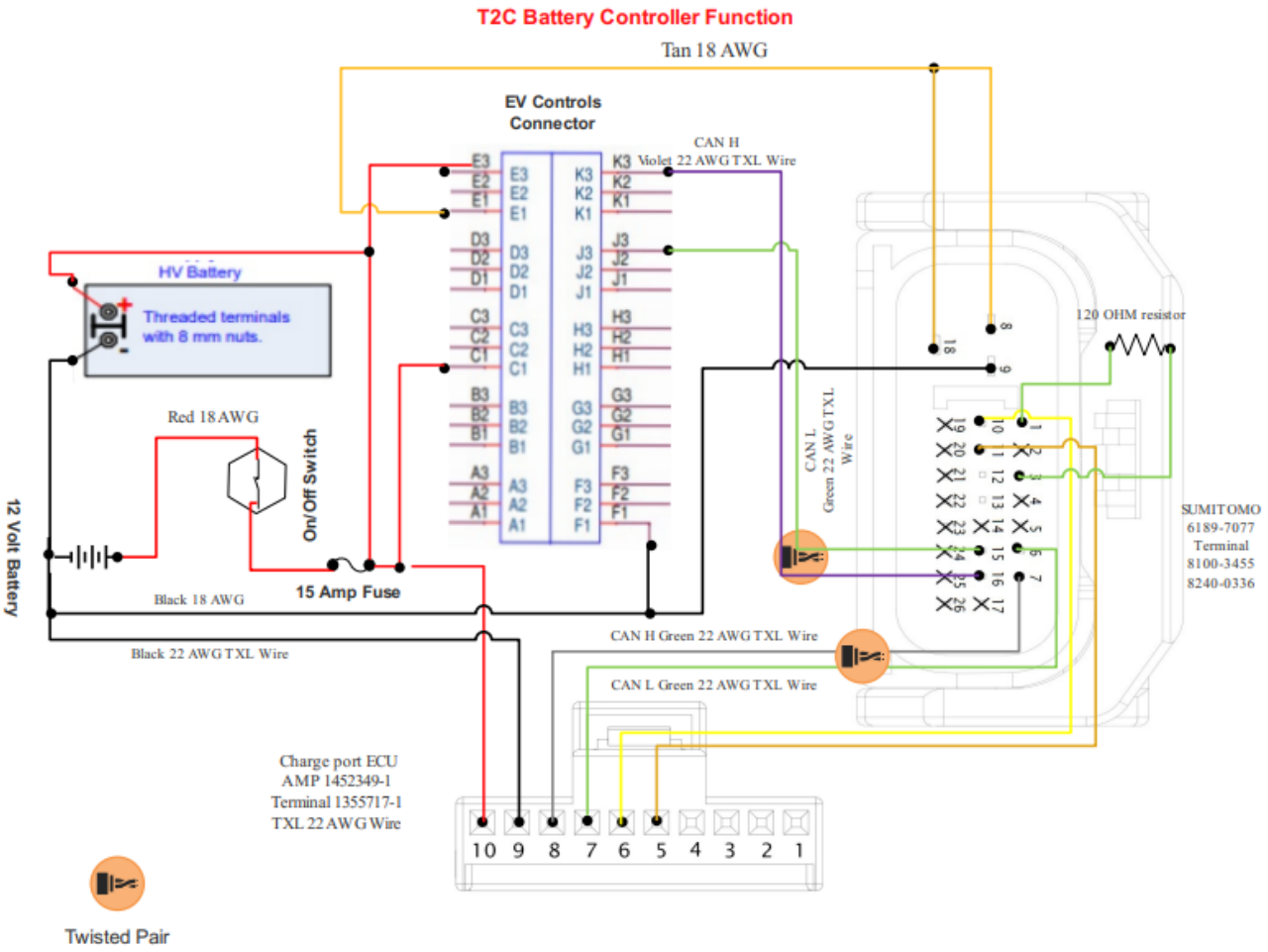
Pin Identification and Connection Points

For Small "D" Motor



Inverter Pin Number	Wire Color	Controller Connection
1	Red	Can Low to Controller terminal J3
2	White Red	Can High to Controller terminal K3
3	Yellow and Green	Not Used
4	Dark Blue	Accelerator Signal Voltage Accelerator Pin 2
5	White/Blue	Accelerator Reference Voltage Accelerator Pin 1
6	Brown/Yellow	Accelerator Signal Return 1 Accelerator Pin 4
7	Light Green	Accelerator Signal Return 2 Accelerator Pin 3
8	Empty	
9	Empty	
10	Brown	Inverter 12V Power from Controller Terminal E1
11	Yellow/Red	Not used
12	Violet/Light Blue	Accelerator Signal Voltage 2 to Accelerator Pin 5
13	Brown	Ignition switch power to controller terminal E3
14	White/Black	Accelerator Reference Voltage 2 to accelerator Pin 6
15	Empty	
16	Empty	
17	Dark Green/Violet	Brake On – Brake Switch Pin 4
18	Orange/ Violet	Charge Proximity – Ground to enable Drive
19	Black	Chassis Ground
20	White/Dark Green	Brake Off – Brake Switch Pin 3




T2C Battery Controller Function
Tan 18 AWG
EV Controls Connector
CAN H
Violet 22 AWG TXL Wire
HV Battery
Threaded terminals with 8 mm nuts.
120 OHM resistor
Red 18 AWG
On/Off Switch
CAN L
Green 22 AWG TXL Wire
SUMITOMO
6189-7077
Terminal
8100-3455
8240-0336
12 Volt Battery
Black 18 AWG
15 Amp Fuse
Black 22 AWG TXL Wire
CAN H Green 22 AWG TXL Wire
CAN L Green 22 AWG TXL Wire
Charge port ECU
AMP 1452349-1
Terminal 1355717-1
TXL 22 AWG Wire
10 9 8 7 6 5 4 3 2 1
Twisted Pair

Troubleshooting

Here we will list some problems and solutions for issues we have seen users have over the past years.

Brake switch; If you have a situation where you cannot engage drive or reverse, the most common cause is the brake switch being wired incorrectly.
The brake switch circuit is not a simple on/off circuit, but instead switches power or ground between two pins (depending on the drive unit used). You can use the main screen of the dash app to monitor for correct brake switch operation. The "brake/regen" near the top center should turn red when the brake is depressed, and be grey otherwise. You will not be able to engage any drive gears until this is working correctly.
We recommend using the Tesla brake switch to avoid problems with this.

Accelerator pedal; There have been a few cases where customers have wired this incorrectly. In these cases you will get fault codes for this. Using the Tesla harness pigtails on the pedal and inverter will help avoid problems here.

Encoder wiring; customers who make their own inverter wiring harness have had trouble with this, pay attention to pin numbers and not the order of the wires if you have trouble with this. You will get fault codes for the encoder if you get this wrong. Using the Tesla harness will help avoid these sort of issues.

Shift inputs (or other inputs) grounded; The shift inputs are momentary inputs in the earlier firmware versions. Keeping them permanantly grounded will interfere with the T2C boot sequence if you are running an earlier version of the T2C firmware.

CAN issues; CAN bus communications are very robust, but there are still some points you need to consider;
-All CAN wiring should be twisted pair, and should be routed as far from HV cabling as possible.
-There should be exactly two 120 ohm CAN termination resistors on any CAN bus. There is one in the T2C, and the other should be installed as per the manual on LDU applications. Model 3 drive units have an internal resistor.

Other CAN hardware on the T2C bus;
-If you have problems that may be related to CAN communications, the first thing we will tell you to do is disconnect all other CAN hardware you have connected to the bus (besides the T2C and inverter). So you may as well do this yourself before contacting us if you are having problems. There have been cases where aftermarket BMS, gauges or other hardware cause problems when connected to the same bus as the inverter and T2C.
Any other hardware you connect to the same bus should not have any termination resistors installed or enabled. Also, you should understand that if the other hardware is broadcasting messages on the bus, there may be a conflict with CAN ID's that the inverter or T2C is broadcasting or listening for. So these are potential sources of trouble. Best to put other CAN hardware on it's own bus unless you have a good reason to do otherwise.

HV isolation;
-This is an area where some customers have had problems. Poor HV isolation can cause problems with CAN communications, damage hardware, and of course be dangerous to your health. We have had cases where customers have blown up controllers and Tesla inverter control boards due to issues with poor isolation between the HV circuit and the chassis. Make sure you have done a good job isolating your HV circuit from the rest of the vehicle.

Testing the drive system "on the bench";

Many customers want to "test" their drive system while it is out of the vehicle. This is understandable, but the amount of useful testing that can be done with a drive unit on the shop floor with no axles/wheels/vehicle attached is limited, and you will not be able to determine much beyond confirming it goes into drive and reverse.
We have had customers contact us after the drive system does not behave the way they expect when they put it in drive and floor the accelerator without any driveline attached.
In particular, the Model 3/Y drive units and dual motor powertrains will detect that there is no vehicle attached pretty quickly, so restrict your testing to the basics until the drive system is installed in a vehicle.

GNSS Traction control unit

We now offer traction control for supported drive units. This requires our GNSS traction control module, which is available for sale on the EV-controls website.
Tesla large drive units and Model 3 and Y rear drive units are supported at the moment.
This module produces a high resolution vehicle speed signal, which the T2C uses to determine wheel slippage of the driven wheels. The T2C then calculates and applies the required torque adjustment to maintain optimum traction. This all happens on a millisecond level, and results in optimal traction for the current conditions.

To use the traction control features, you should wire the GNSS unit as per the pinout diagram elsewhere in this guide, connecting 12V ignition power, Ground, and CAN high and low to the CAN 1 bus on the T2C. You can also connect the 12V backup power directly to the battery. (it only draws 0.4 milliamps) This will allow the GNSS unit to remeber the last satellite fix, and will result in a reduced time before traction control is available each time you start the vehicle.

The traction control module can be mounted anywhere in the vehicle, the GPS antenna must have a clear view of the sky. We have had good results mounting the antenna on the dash of our test vehicles, pointing up through the windshield.

Once the T2C sees the GNSS unit online with a reliable speed signal and satellite fix, you will see a green "TC on" indication in the dash app at the top of the power gauge.
You can turn the traction control off and on using the button at the bottom right of the dash app. You can also turn the traction control off by shutting off power to the GNSS module.
When the traction control is off or not available, you will see a red "No TC" idication at the top of the power gauge in the dash app.

The only parameter you will need to set in order for the traction control to operate correctly is the "Front WSS" value in the T2C settings page.
This value compensates for wheel and tire diameter, and corrects the error between actual vehicle speed, and the road speed the T2C calculates from motor RPM.
When the "Front WSS" value is set correctly, you will see the "TC_SlipMeasured" parameter displayed on the main screen of the dash app hover around zero when the vehicle is driven in a straight line at a steady speed under no wheelspin conditions. It is normal for the "TC_SlipMeasured" value to switch back and forth between slightly positive and negative values under these conditions.
(it will never sit exactly at zero). Start with a value of 128, and adjust from there. You can do this while driving, by going to the settings page in the dash app, setting the front WSS value, writing the settings, and then checking the TC_SlipMeasured value on the main screen. You can also use the logging features of course.

We added a button in the settings page to automatically calibrate the scalar in the latest release. To use this feature, drive the car on a straight section of road with a good GPS signal (TC on illuminated in green) and tap the yellow button at the right side of the row of buttons. The T2C firmware will caculate the correct scalar and write it to the settings.

EVCONTROLS

CAN control of power and regen (typical use is derating by BMS)

The current firmware allows users to set power and regen limits in kW over CAN.
We can supply a .dbc file that describes the format, and we have included some examples below.
You must use the format defined below, and you cannot broadcast any CAN data on the T2C bus other than the ID's specified below.
The CAN node you use to transmit should have any termination resistor disabled. Baud rate is 500kbs.
There is no frequency check enforced, but we would recommend 500ms.
The power limits sent over CAN on ID 0x696 will override the power limts set in the T2C settings. If no messages are recived, the T2C defaults to the power limits set in the dash app settings.
On reboot, the T2C will also default to these settings.
We cannot troubleshoot problems caused by connecting any other CAN nodes to the bus.
We have tested the functionality here and can confirm it works as expected if the details outlined above are respected.

The examples below are to demonstrate the format.
The first 16 bits (big endian) is power limit in kW, factor is 0.01
The second 16 bits (big endian) is regen limit in kW, factor is 0.01

ID: 0x696 Std Bus: 0 Len: 8
Data Bytes: 0x1A 0xF4 0xA4 0x20 0x00 0x00 0x00 0x00
BMS_maxDischargePower: 420.16kW
BMS_maxRegenPower: 69kW

ID: 0x696 Std Bus: 0 Len: 8
Data Bytes: 0xA4 0x10 0x1A 0xF4 0x00 0x00 0x00 0x00
BMS_maxDischargePower: 69kW
BMS_maxRegenPower: 420kW

CAN control of shift functions

The current firmware allows users to control drive modes (Drive, neutral and reverse) over CAN.
We can supply a .dbc file that describes the format, and we have included some examples below.
You must use the format defined below, and you cannot broadcast any CAN data on the T2C bus other than the ID's specified below.
The CAN node you use to transmit should have any termination resistor disabled. Baud rate is 500kbs, and 11 bit ID 0x697 is used for shift commands.
Sending a single frame should trigger the drive mode change, but you could also send a small series of 4 for example.
We cannot troubleshoot problems caused by connecting any other CAN nodes to the bus.
We have tested the functionality here and can confirm it works as expected if the details outlined above are respected.

The first byte (8 bits) is what changes in the shift command message, the next 16 bits are used as an extra check by the T2C firmware.

ID: 0x697 Std Bus: 0 Len: 8
Data Bytes: 0x0D 0xBE 0xEF 0x00 0x00 0x00 0x00 0x00
ShiftCommand: DRIVE_SHIFT_COMMAND

ID: 0x697 Std Bus: 0 Len: 8
Data Bytes: 0x0E 0xBE 0xEF 0x00 0x00 0x00 0x00 0x00
ShiftCommand: NEUTRAL_SHIFT_COMMAND

ID: 0x697 Std Bus: 0 Len: 8
Data Bytes: 0x0F 0xBE 0xEF 0x00 0x00 0x00 0x00 0x00
ShiftCommand: REVERSE_SHIFT_COMMAND

Orion BMS message structure (CAN 2 on T2C)

```
BO_ 1712 MSGID_0X6B0: 8 BMS
 SG_ Pack_Current : 7|16@0+ (0.1,0) [0|0] "Amps"  Third_Party_Device
 SG_ Pack_Inst_Voltage : 23|16@0+ (0.1,0) [0|0] "Volts"  Third_Party_Device
 SG_ Pack_SOC : 39|8@0+ (0.5,0) [0|0] "Percent"  Third_Party_Device
 SG_ Relay_State : 47|16@0+ (1,0) [0|0] ""  Third_Party_Device
 SG_ CRC_Checksum : 63|8@0+ (1,1720) [0|0] ""  Third_Party_Device

BO_ 1713 MSGID_0X6B1: 8 BMS
 SG_ Pack_DCL : 7|16@0+ (1,0) [0|0] "Amps"  Third_Party_Device
 SG_ Pack_CCL : 23|8@0+ (1,0) [0|0] "Amps"  Third_Party_Device
 SG_ Blank : 31|8@0+ (1,0) [0|0] ""  Third_Party_Device
 SG_ High_Temperature : 39|8@0+ (1,0) [0|0] "Celsius"  Third_Party_Device
 SG_ Low_Temperature : 47|8@0+ (1,0) [0|0] "Celsius"  Third_Party_Device
 SG_ Blank : 55|8@0+ (1,0) [0|0] ""  Third_Party_Device
 SG_ CRC_Checksum : 63|8@0+ (1,1721) [0|0] ""  Third_Party_Device

BO_ 54 MSGID_0X36_CELLBCAST: 8 BMS
 SG_ CellId : 7|8@0+ (1,0) [0|0] "#"  Third_Party_Device
 SG_ CellVoltage : 15|16@0+ (0.0001,0) [0|0] "Volts"  Third_Party_Device
 SG_ CellResistance : 30|15@0+ (0.01,0) [0|0] "mOhms"  Third_Party_Device
 SG_ CellOpenVoltage : 47|16@0+ (0.0001,0) [0|0] "Volts"  Third_Party_Device
 SG_ Checksum : 63|8@0+ (1,0) [0|0] ""  Third_Party_Device
 SG_ CellBalancing : 31|1@1+ (1,0) [0|0] ""  Third_Party_Device
```

Dilthium MCU message structure (CAN 2 on T2C)

```
BO_ 2499748048 J1939_MCU_Summary: 8 MCU
 SG_ MCU_PackEnergy : 16|16@1+ (0.01,0) [0|655] "kWh" Vector__XXX
 SG_ MCU_ChargeState : 32|8@1+ (1,0) [0|16] "" Vector__XXX
 SG_ MCU_PlugState : 40|8@1+ (1,0) [0|16] "" Vector__XXX
 SG_ MCU_Fault_IllegalConfig : 63|1@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Fault_NotLocked : 55|1@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Fault_ThermUndertemp : 56|1@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Fault_ThermOvertemp : 57|1@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Fault_LVC : 58|1@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Fault_HVC : 59|1@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Fault_ThermCensus : 60|1@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Fault_CellCensus : 61|1@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Fault_Hardware : 62|1@1+ (1,0) [0|0] "" Vector__XXX

BO_ 2499748816 J1939_MCU_ThermSummary: 8 MCU
 SG_ MCU_ThermCount : 8|8@1+ (1,0) [0|255] "" Vector__XXX
 SG_ MCU_ThLowest : 16|8@1- (1,0) [-128|127] "C" Vector__XXX
 SG_ MCU_ThHighest : 24|8@1- (1,0) [-128|127] "C" Vector__XXX
 SG_ MCU_ThMin : 48|8@1- (1,0) [-128|127] "C" Vector__XXX
 SG_ MCU_ThMax : 56|8@1- (1,0) [-128|127] "C" Vector__XXX

BO_ 2498482392 J1939_MCU_ReadRequest: 8 Vector__XXX
 SG_ PGN : 0|16@1+ (1,0) [0|0] "" Vector__XXX
 SG_ RequestRate : 16|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ RequestRepeatCount : 24|8@1+ (1,0) [0|0] "" Vector__XXX
```

```
 SG_ ProfileNumber : 56|8@1+ (1,0) [0|0] "" Vector__XXX

BO_ 2499739856 J1939_MCU_Options: 8 MCU
 SG_ MCU_Enabled_FCharge : 19|1@1+ (1,0) [0|1] "" Vector__XXX
 SG_ MCU_Enabled_ZEVCCS : 22|1@1+ (1,0) [0|1] "" Vector__XXX
 SG_ MCU_Enabled_SlowStart : 21|1@1+ (1,0) [0|1] "" Vector__XXX
 SG_ MCU_Enabled_TopBalance : 20|1@1+ (1,0) [0|1] "" Vector__XXX
 SG_ MCU_Enabled_Balance : 32|1@1+ (1,0) [0|1] "" Vector__XXX
 SG_ MCU_Enabled_SpeedHutFuel : 48|1@1+ (1,0) [0|1] "" Vector__XXX
 SG_ MCU_Enabled_SpeedHutAmps : 49|1@1+ (1,0) [0|1] "" Vector__XXX
 SG_ MCU_Enabled_SpeedHutTemp : 50|1@1+ (1,0) [0|1] "" Vector__XXX
 SG_ MCU_Enabled_ISensorRev : 55|1@1+ (1,0) [0|1] "" Vector__XXX
 SG_ MCU_Enabled_3100R : 51|1@1+ (1,0) [0|1] "" Vector__XXX
 SG_ MCU_Enabled_SpeedHutAmps_Reverse : 57|1@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Enabled_IVTS_Factory : 56|1@1+ (1,0) [0|0] "" Vector__XXX

BO_ 2499743952 J1939_MCU_Config: 8 MCU
 SG_ MCU_Version : 16|8@1+ (1,0) [0|1] "" Vector__XXX
 SG_ MCU_Revision : 24|8@1+ (1,0) [0|1] "" Vector__XXX
 SG_ MCU_BMS_Arch : 32|8@1+ (1,0) [0|1] "" Vector__XXX

BO_ 2499744208 J1939_BMS_Config1: 8 MCU
 SG_ BMS_HVC : 16|16@1+ (0.1,0) [0|1] "mV" Vector__XXX
 SG_ BMS_LVC : 32|16@1+ (0.1,0) [0|1] "mV" Vector__XXX
 SG_ BMS_BVMin : 48|16@1+ (0.1,0) [0|1] "mV" Vector__XXX

BO_ 2499744464 J1939_BMS_Config2: 8 MCU
 SG_ BMS_HVCC : 16|16@1+ (0.1,0) [0|1] "mV" Vector__XXX
 SG_ BMS_LVCC : 32|16@1+ (0.1,0) [0|1] "mV" Vector__XXX
 SG_ BMS_HVCLoopDelay : 48|8@1+ (1,0) [0|1] "seconds" Vector__XXX
 SG_ BMS_LVCLoopDelay : 56|8@1+ (1,0) [0|1] "seconds" Vector__XXX

BO_ 2499746000 J1939_BMS_GroupMap0: 8 MCU
 SG_ BMS_GM0 : 16|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ BMS_GM1 : 24|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ BMS_GM2 : 32|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ BMS_GM3 : 40|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ BMS_GM4 : 48|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ BMS_GM5 : 56|8@1+ (1,0) [0|0] "" Vector__XXX

BO_ 2499746256 J1939_BMS_GroupMap1: 8 MCU
 SG_ BMS_GM11 : 56|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ BMS_GM10 : 48|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ BMS_GM6 : 16|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ BMS_GM7 : 24|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ BMS_GM8 : 32|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ BMS_GM9 : 40|8@1+ (1,0) [0|0] "" Vector__XXX

BO_ 2499746512 J1939_BMS_GroupMap2: 8 MCU
 SG_ BMS_GM12 : 16|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ BMS_GM13 : 24|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ BMS_GM14 : 32|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ BMS_GM15 : 40|8@1+ (1,0) [0|0] "" Vector__XXX

BO_ 2499748304 J1939_MCU_PackSummary: 8 MCU
 SG_ MCU_PackVoltage : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_PackCurrent : 32|16@1- (0.1,0) [0|0] "amps" Vector__XXX
```

```
BO_ 2499748560 J1939_MCU_CellSummary: 8 MCU
 SG_ MCU_CellCount : 8|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_LowestCellV : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_MeanCellV : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_HighestCellV : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX

BO_ 2499749072 J1939_MCU_SOCSummary: 8 MCU
 SG_ MCU_SOC : 8|8@1+ (1,0) [0|100] "%" Vector__XXX
 SG_ MCU_PackCurKwh : 16|16@1+ (0.1,0) [0|0] "kWh" Vector__XXX
 SG_ MCU_PackMaxKwh : 32|16@1+ (0.1,0) [0|0] "kWh" Vector__XXX

BO_ 2499780816 J1939_MCU_G1CellVoltages: 8 MCU
 SG_ multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_G1_Cell1 m0 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell2 m0 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell3 m0 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell4 m1 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell5 m1 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell6 m1 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell7 m2 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell8 m2 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell9 m2 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell10 m3 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell11 m3 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell12 m3 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell13 m4 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell14 m4 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell15 m4 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell16 m5 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell17 m5 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G1_Cell18 m5 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX

BO_ 2499781072 J1939_MCU_G2CellVoltages: 8 MCU
 SG_ multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_G2_Cell1 m0 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell2 m0 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell3 m0 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell4 m1 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell5 m1 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell6 m1 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell7 m2 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell8 m2 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell9 m2 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell10 m3 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell11 m3 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell12 m3 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell13 m4 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell14 m4 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell15 m4 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell16 m5 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell17 m5 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G2_Cell18 m5 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX

BO_ 2499781328 J1939_MCU_G3CellVoltages: 8 MCU
 SG_ multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_G3_Cell1 m0 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G3_Cell2 m0 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G3_Cell3 m0 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
```

```
 SG_ MCU_G3_Cell4 m1 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G3_Cell5 m1 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G3_Cell6 m1 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G3_Cell7 m2 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G3_Cell8 m2 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G3_Cell9 m2 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G3_Cell10 m3 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G3_Cell11 m3 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G3_Cell12 m3 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G3_Cell13 m4 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G3_Cell14 m4 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G3_Cell15 m4 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G3_Cell16 m5 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G3_Cell17 m5 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G3_Cell18 m5 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX

BO_ 2499781584 J1939_MCU_G4CellVoltages: 8 MCU
 SG_ multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_G4_Cell1 m0 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell2 m0 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell3 m0 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell4 m1 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell5 m1 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell6 m1 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell7 m2 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell8 m2 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell9 m2 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell10 m3 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell11 m3 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell12 m3 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell13 m4 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell14 m4 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell15 m4 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell16 m5 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell17 m5 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G4_Cell18 m5 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX

BO_ 2499781840 J1939_MCU_G5CellVoltages: 8 MCU
 SG_ multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_G5_Cell1 m0 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell2 m0 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell3 m0 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell4 m1 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell5 m1 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell6 m1 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell7 m2 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell8 m2 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell9 m2 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell10 m3 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell11 m3 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell12 m3 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell13 m4 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell14 m4 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell15 m4 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell16 m5 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell17 m5 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G5_Cell18 m5 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
```

```
BO_ 2499782096 J1939_MCU_G6CellVoltages: 8 MCU
 SG_ multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_G6_Cell1 m0 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell2 m0 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell3 m0 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell4 m1 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell5 m1 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell6 m1 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell7 m2 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell8 m2 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell9 m2 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell10 m3 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell11 m3 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell12 m3 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell13 m4 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell14 m4 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell15 m4 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell16 m5 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell17 m5 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G6_Cell18 m5 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX

BO_ 2499782352 J1939_MCU_G7CellVoltages: 8 MCU
 SG_ multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_G7_Cell1 m0 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell2 m0 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell3 m0 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell4 m1 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell5 m1 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell6 m1 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell7 m2 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell8 m2 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell9 m2 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell10 m3 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell11 m3 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell12 m3 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell13 m4 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell14 m4 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell15 m4 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell16 m5 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell17 m5 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G7_Cell18 m5 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX

BO_ 2499782608 J1939_MCU_G8CellVoltages: 8 MCU
 SG_ multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_G8_Cell1 m0 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G8_Cell2 m0 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G8_Cell3 m0 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G8_Cell4 m1 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G8_Cell5 m1 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G8_Cell6 m1 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G8_Cell7 m2 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G8_Cell8 m2 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G8_Cell9 m2 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G8_Cell10 m3 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G8_Cell11 m3 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G8_Cell12 m3 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G8_Cell13 m4 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G8_Cell14 m4 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
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 SG_ MCU_G8_Cell15 m4 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G8_Cell16 m5 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G8_Cell17 m5 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G8_Cell18 m5 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX

BO_ 2499782864 J1939_MCU_G9CellVoltages: 8 MCU
 SG_ multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_G9_Cell1 m0 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell2 m0 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell3 m0 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell4 m1 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell5 m1 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell6 m1 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell7 m2 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell8 m2 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell9 m2 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell10 m3 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell11 m3 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell12 m3 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell13 m4 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell14 m4 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell15 m4 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell16 m5 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell17 m5 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G9_Cell18 m5 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX

BO_ 2499783120 J1939_MCU_G10CellVoltages: 8 MCU
 SG_ multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_G10_Cell1 m0 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell2 m0 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell3 m0 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell4 m1 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell5 m1 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell6 m1 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell7 m2 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell8 m2 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell9 m2 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell10 m3 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell11 m3 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell12 m3 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell13 m4 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell14 m4 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell15 m4 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell16 m5 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell17 m5 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G10_Cell18 m5 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX

BO_ 2499783376 J1939_MCU_G11CellVoltages: 8 MCU
 SG_ multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_G11_Cell1 m0 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G11_Cell2 m0 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G11_Cell3 m0 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G11_Cell4 m1 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G11_Cell5 m1 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G11_Cell6 m1 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G11_Cell7 m2 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G11_Cell8 m2 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G11_Cell9 m2 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
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 SG_ MCU_G11_Cell10 m3 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G11_Cell11 m3 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G11_Cell12 m3 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G11_Cell13 m4 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G11_Cell14 m4 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G11_Cell15 m4 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G11_Cell16 m5 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G11_Cell17 m5 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G11_Cell18 m5 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX

BO_ 2499783632 J1939_MCU_G12CellVoltages: 8 MCU
 SG_ multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_G12_Cell1 m0 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell2 m0 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell3 m0 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell4 m1 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell5 m1 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell6 m1 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell7 m2 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell8 m2 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell9 m2 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell10 m3 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell11 m3 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell12 m3 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell13 m4 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell14 m4 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell15 m4 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell16 m5 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell17 m5 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G12_Cell18 m5 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX

BO_ 2499783888 J1939_MCU_G13CellVoltages: 8 MCU
 SG_ multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_G13_Cell1 m0 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell2 m0 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell3 m0 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell4 m1 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell5 m1 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell6 m1 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell7 m2 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell8 m2 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell9 m2 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell10 m3 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell11 m3 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell12 m3 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell13 m4 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell14 m4 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell15 m4 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell16 m5 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell17 m5 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G13_Cell18 m5 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX

BO_ 2499784144 J1939_MCU_G14CellVoltages: 8 MCU
 SG_ multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_G14_Cell1 m0 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G14_Cell2 m0 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G14_Cell3 m0 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G14_Cell4 m1 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
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 SG_ MCU_G14_Cell5 m1 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G14_Cell6 m1 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G14_Cell7 m2 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G14_Cell8 m2 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G14_Cell9 m2 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G14_Cell10 m3 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G14_Cell11 m3 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G14_Cell12 m3 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G14_Cell13 m4 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G14_Cell14 m4 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G14_Cell15 m4 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G14_Cell16 m5 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G14_Cell17 m5 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G14_Cell18 m5 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX

BO_ 2499784400 J1939_MCU_G15CellVoltages: 8 MCU
 SG_ multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_G15_Cell1 m0 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell2 m0 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell3 m0 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell4 m1 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell5 m1 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell6 m1 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell7 m2 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell8 m2 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell9 m2 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell10 m3 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell11 m3 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell12 m3 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell13 m4 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell14 m4 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell15 m4 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell16 m5 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell17 m5 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G15_Cell18 m5 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX

BO_ 2499784656 J1939_MCU_G16CellVoltages: 8 MCU
 SG_ multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_G16_Cell1 m0 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell2 m0 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell3 m0 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell4 m1 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell5 m1 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell6 m1 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell7 m2 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell8 m2 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell9 m2 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell10 m3 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell11 m3 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell12 m3 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell13 m4 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell14 m4 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell15 m4 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell16 m5 : 16|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell17 m5 : 32|16@1+ (0.1,0) [0|0] "mV" Vector__XXX
 SG_ MCU_G16_Cell18 m5 : 48|16@1+ (0.1,0) [0|0] "mV" Vector__XXX

BO_ 2499789008 J1939_MCU_G1Th: 8 MCU
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 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ G1_TH_die m0 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G1_TH_1 m0 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G1_TH_2 m0 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G1_TH_3 m0 : 40|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G1_TH_4 m0 : 48|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G1_TH_5 m0 : 56|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G1_TH_6 m1 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G1_TH_7 m1 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G1_TH_8 m1 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G1_TH_9 m1 : 40|8@1- (1,0) [0|0] "" Vector__XXX

BO_ 2499789264 J1939_MCU_G2Th: 8 MCU
 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ G2_TH_die m0 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G2_TH_1 m0 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G2_TH_2 m0 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G2_TH_3 m0 : 40|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G2_TH_4 m0 : 48|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G2_TH_5 m0 : 56|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G2_TH_6 m1 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G2_TH_7 m1 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G2_TH_8 m1 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G2_TH_9 m1 : 40|8@1- (1,0) [0|0] "" Vector__XXX

BO_ 2499789520 J1939_MCU_G3Th: 8 MCU
 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ G3_TH_die m0 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G3_TH_1 m0 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G3_TH_2 m0 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G3_TH_3 m0 : 40|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G3_TH_4 m0 : 48|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G3_TH_5 m0 : 56|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G3_TH_6 m1 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G3_TH_7 m1 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G3_TH_8 m1 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G3_TH_9 m1 : 40|8@1- (1,0) [0|0] "" Vector__XXX

BO_ 2499789776 J1939_MCU_G4Th: 8 MCU
 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ G4_TH_die m0 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G4_TH_1 m0 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G4_TH_2 m0 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G4_TH_3 m0 : 40|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G4_TH_4 m0 : 48|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G4_TH_5 m0 : 56|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G4_TH_6 m1 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G4_TH_7 m1 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G4_TH_8 m1 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G4_TH_9 m1 : 40|8@1- (1,0) [0|0] "" Vector__XXX

BO_ 2499790032 J1939_MCU_G5Th: 8 MCU
 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ G5_TH_die m0 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G5_TH_1 m0 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G5_TH_2 m0 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G5_TH_3 m0 : 40|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G5_TH_4 m0 : 48|8@1- (1,0) [0|0] "" Vector__XXX
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 SG_ G5_TH_5 m0 : 56|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G5_TH_6 m1 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G5_TH_7 m1 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G5_TH_8 m1 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G5_TH_9 m1 : 40|8@1- (1,0) [0|0] "" Vector__XXX

BO_ 2499790288 J1939_MCU_G6Th: 8 MCU
 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ G6_TH_die m0 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G6_TH_1 m0 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G6_TH_2 m0 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G6_TH_3 m0 : 40|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G6_TH_4 m0 : 48|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G6_TH_5 m0 : 56|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G6_TH_6 m1 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G6_TH_7 m1 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G6_TH_8 m1 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G6_TH_9 m1 : 40|8@1- (1,0) [0|0] "" Vector__XXX

BO_ 2499790544 J1939_MCU_G7Th: 8 MCU
 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ G7_TH_die m0 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G7_TH_1 m0 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G7_TH_2 m0 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G7_TH_3 m0 : 40|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G7_TH_4 m0 : 48|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G7_TH_5 m0 : 56|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G7_TH_6 m1 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G7_TH_7 m1 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G7_TH_8 m1 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G7_TH_9 m1 : 40|8@1- (1,0) [0|0] "" Vector__XXX

BO_ 2499790800 J1939_MCU_G8Th: 8 MCU
 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ G8_TH_die m0 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G8_TH_1 m0 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G8_TH_2 m0 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G8_TH_3 m0 : 40|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G8_TH_4 m0 : 48|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G8_TH_5 m0 : 56|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G8_TH_6 m1 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G8_TH_7 m1 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G8_TH_8 m1 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G8_TH_9 m1 : 40|8@1- (1,0) [0|0] "" Vector__XXX

BO_ 2499791056 J1939_MCU_G9Th: 8 MCU
 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ G9_TH_die m0 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G9_TH_1 m0 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G9_TH_2 m0 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G9_TH_3 m0 : 40|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G9_TH_4 m0 : 48|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G9_TH_5 m0 : 56|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G9_TH_6 m1 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G9_TH_7 m1 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G9_TH_8 m1 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G9_TH_9 m1 : 40|8@1- (1,0) [0|0] "" Vector__XXX
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BO_ 2499791312 J1939_MCU_G10Th: 8 MCU
 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ G10_TH_die m0 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G10_TH_1 m0 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G10_TH_2 m0 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G10_TH_3 m0 : 40|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G10_TH_4 m0 : 48|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G10_TH_5 m0 : 56|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G10_TH_6 m1 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G10_TH_7 m1 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G10_TH_8 m1 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G10_TH_9 m1 : 40|8@1- (1,0) [0|0] "" Vector__XXX

BO_ 2499791568 J1939_MCU_G11Th: 8 MCU
 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ G11_TH_die m0 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G11_TH_1 m0 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G11_TH_2 m0 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G11_TH_3 m0 : 40|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G11_TH_4 m0 : 48|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G11_TH_5 m0 : 56|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G11_TH_6 m1 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G11_TH_7 m1 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G11_TH_8 m1 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G11_TH_9 m1 : 40|8@1- (1,0) [0|0] "" Vector__XXX

BO_ 2499791824 J1939_MCU_G12Th: 8 MCU
 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ G12_TH_die m0 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G12_TH_1 m0 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G12_TH_2 m0 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G12_TH_3 m0 : 40|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G12_TH_4 m0 : 48|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G12_TH_5 m0 : 56|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G12_TH_6 m1 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G12_TH_7 m1 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G12_TH_8 m1 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G12_TH_9 m1 : 40|8@1- (1,0) [0|0] "" Vector__XXX

BO_ 2499792080 J1939_MCU_G13Th: 8 MCU
 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ G13_TH_die m0 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G13_TH_1 m0 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G13_TH_2 m0 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G13_TH_3 m0 : 40|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G13_TH_4 m0 : 48|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G13_TH_5 m0 : 56|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G13_TH_6 m1 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G13_TH_7 m1 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G13_TH_8 m1 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G13_TH_9 m1 : 40|8@1- (1,0) [0|0] "" Vector__XXX

BO_ 2499792336 J1939_MCU_G14Th: 8 MCU
 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ G14_TH_die m0 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G14_TH_1 m0 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G14_TH_2 m0 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G14_TH_3 m0 : 40|8@1- (1,0) [0|0] "" Vector__XXX
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 SG_ G14_TH_4 m0 : 48|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G14_TH_5 m0 : 56|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G14_TH_6 m1 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G14_TH_7 m1 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G14_TH_8 m1 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G14_TH_9 m1 : 40|8@1- (1,0) [0|0] "" Vector__XXX

BO_ 2499792592 J1939_MCU_G15Th: 8 MCU
 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ G15_TH_die m0 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G15_TH_1 m0 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G15_TH_2 m0 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G15_TH_3 m0 : 40|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G15_TH_4 m0 : 48|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G15_TH_5 m0 : 56|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G15_TH_6 m1 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G15_TH_7 m1 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G15_TH_8 m1 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G15_TH_9 m1 : 40|8@1- (1,0) [0|0] "" Vector__XXX

BO_ 2499792848 J1939_MCU_G16Th: 8 MCU
 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ G16_TH_die m0 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G16_TH_1 m0 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G16_TH_2 m0 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G16_TH_3 m0 : 40|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G16_TH_4 m0 : 48|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G16_TH_5 m0 : 56|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G16_TH_6 m1 : 16|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G16_TH_7 m1 : 24|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G16_TH_8 m1 : 32|8@1- (1,0) [0|0] "" Vector__XXX
 SG_ G16_TH_9 m1 : 40|8@1- (1,0) [0|0] "" Vector__XXX

BO_ 2499740112 J1939_MCU_OBCHG1: 8 MCU
 SG_ Multiplexor M : 8|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger1Model_P0 m0 : 16|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger2Model_P0 m0 : 24|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger3Model_P0 m0 : 32|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger4Model_P0 m0 : 40|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_TermCP0 m0 : 48|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_Charger1Model_P1 m1 : 16|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger2Model_P1 m1 : 24|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger3Model_P1 m1 : 32|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger4Model_P1 m1 : 40|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_TermCP1 m1 : 48|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_Charger1Model_P2 m2 : 16|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger2Model_P2 m2 : 24|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger3Model_P2 m2 : 32|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger4Model_P2 m2 : 40|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_TermCP1 m2 : 48|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_Charger1Model_P3 m3 : 16|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger2Model_P3 m3 : 24|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger3Model_P3 m3 : 32|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger4Model_P3 m3 : 40|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_TermCP1 m3 : 48|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_Charger1Model_P4 m4 : 16|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger2Model_P4 m4 : 24|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger3Model_P4 m4 : 32|8@1+ (1,0) [0|0] "" Vector__XXX
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 SG_ MCU_Charger4Model_P4 m4 : 40|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_TermCP1 m4 : 48|16@1+ (0.1,0) [0|0] "amps" Vector__XXX

BO_ 2499740368 J1939_MCU_OBCHG2: 8 MCU
 SG_ Multiplexor M : 8|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_MaxV_P0 m0 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_MaxC_P0 m0 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_TermT_P0 m0 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_MaxV_P1 m1 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_MaxC_P1 m1 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_TermT_P1 m1 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_MaxV_P2 m2 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_MaxC_P2 m2 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_TermT_P2 m2 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_MaxV_P3 m3 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_MaxC_P3 m3 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_TermT_P3 m3 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_MaxV_P4 m4 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_MaxC_P4 m4 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_TermT_P4 m4 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX

BO_ 2499740624 J1939_MCU_OBCHG3: 8 MCU
 SG_ Multiplexor M : 8|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_LineV_P0 m0 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_LineC_P0 m0 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_EVSEWaitT_P0 m0 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_LineV_P1 m1 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_LineC_P1 m1 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_EVSEWaitT_P1 m1 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_LineV_P2 m2 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_LineC_P2 m2 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_EVSEWaitT_P2 m2 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_LineV_P3 m3 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_LineC_P3 m3 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_EVSEWaitT_P3 m3 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_LineV_P4 m4 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_LineC_P4 m4 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_EVSEWaitT_P4 m4 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX

BO_ 2499740880 J1939_MCU_OBCHG4: 8 MCU
 SG_ Multiplexor M : 8|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger1Phase_P0 m0 : 16|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger2Phase_P0 m0 : 24|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger3Phase_P0 m0 : 32|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger4Phase_P0 m0 : 40|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger1Phase_P1 m1 : 16|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger2Phase_P1 m1 : 24|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger3Phase_P1 m1 : 32|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger4Phase_P1 m1 : 40|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger1Phase_P2 m2 : 16|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger2Phase_P2 m2 : 24|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger3Phase_P2 m2 : 32|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger4Phase_P2 m2 : 40|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger1Phase_P3 m3 : 16|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger2Phase_P3 m3 : 24|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger3Phase_P3 m3 : 32|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger4Phase_P3 m3 : 40|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger1Phase_P4 m4 : 16|8@1+ (1,0) [0|0] "ph" Vector__XXX
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 SG_ MCU_Charger2Phase_P4 m4 : 24|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger3Phase_P4 m4 : 32|8@1+ (1,0) [0|0] "ph" Vector__XXX
 SG_ MCU_Charger4Phase_P4 m4 : 40|8@1+ (1,0) [0|0] "ph" Vector__XXX

BO_ 2499741136 J1939_MCU_OBCHG5: 8 MCU
 SG_ Multiplexor M : 8|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_FinishingMaxV_P0 m0 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_FinishingMaxC_P0 m0 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_FinishingTermT_P0 m0 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_FinishingMaxV_P1 m1 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_FinishingMaxC_P1 m1 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_FinishingTermT_P1 m1 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_FinishingMaxV_P2 m2 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_FinishingMaxC_P2 m2 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_FinishingTermT_P2 m2 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_FinishingMaxV_P3 m3 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_FinishingMaxC_P3 m3 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_FinishingTermT_P3 m3 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_FinishingMaxV_P4 m4 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_FinishingMaxC_P4 m4 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_FinishingTermT_P4 m4 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX

BO_ 2499741392 J1939_MCU_OBCHG6: 8 MCU
 SG_ Multiplexor M : 8|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_FloatMaxV_P0 m0 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_FloatMaxC_P0 m0 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_FloatTermT_P0 m0 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_FloatMaxV_P1 m1 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_FloatMaxC_P1 m1 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_FloatTermT_P1 m1 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_FloatMaxV_P2 m2 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_FloatMaxC_P2 m2 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_FloatTermT_P2 m2 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_FloatMaxV_P3 m3 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_FloatMaxC_P3 m3 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_FloatTermT_P3 m3 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_FloatMaxV_P4 m4 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_FloatMaxC_P4 m4 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_FloatTermT_P4 m4 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX

BO_ 2498744536 J1939_MCU_WRITE: 8 Vector__XXX
 SG_ Multiplexor M : 0|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Profile : 8|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger1Model m1 : 16|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger2Model m1 : 24|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger3Model m1 : 32|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger4Model m1 : 40|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_TermC m1 : 48|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_MaxV m2 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_MaxC m2 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_TermT m2 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_LineV m3 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_LineC m3 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_EVSEWaitT m3 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_Charger1Phase m4 : 16|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger2Phase m4 : 24|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger3Phase m4 : 32|8@1+ (1,0) [0|0] "" Vector__XXX
 SG_ MCU_Charger4Phase m4 : 40|8@1+ (1,0) [0|0] "" Vector__XXX
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 SG_ MCU_FinishingMaxV m5 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_FinishingMaxC m5 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_FinishingTermT m5 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ MCU_FloatMaxV m6 : 16|16@1+ (0.1,0) [0|0] "volts" Vector__XXX
 SG_ MCU_FloatMaxC m6 : 32|16@1+ (0.1,0) [0|0] "amps" Vector__XXX
 SG_ MCU_FloatTermT m6 : 48|16@1+ (1,0) [0|0] "minutes" Vector__XXX
 SG_ BMS_HVC m17 : 16|16@1+ (0.1,0) [0|0] "mv" Vector__XXX
 SG_ BMS_LVC m17 : 32|16@1+ (0.1,0) [0|0] "mv" Vector__XXX
 SG_ BMS_BVMIN m17 : 48|16@1+ (0.1,0) [0|0] "mv" Vector__XXX
 SG_ BMS_HVCC m18 : 16|16@1+ (0.1,0) [0|0] "mv" Vector__XXX
 SG_ BMS_LVCC m18 : 32|16@1+ (0.1,0) [0|0] "mv" Vector__XXX
 SG_ BMS_HVCLoopDelay m18 : 48|8@1+ (1,0) [0|0] "seconds" Vector__XXX
 SG_ BMS_LVCLoopDelay m18 : 56|8@1+ (1,0) [0|0] "seconds" Vector__XXX



BA_DEF_ BO_  "matchingcriteria" INT 0 0;
BA_DEF_ BO_  "labelfilters" INT 0 0;
BA_DEF_DEF_  "matchingcriteria" 1;
BA_DEF_DEF_  "labelfilters" 1;
VAL_ 2499748048 MCU_ChargeState 0 "eChargeStandby" 1 "eChargeStartup" 2 "eChargeWarmdown" 10 "eChargeBulk"
11 "eChargeFinish" 12 "eChargeFloat" 13 "eChargeTopBalance" ;
VAL_ 2499748048 MCU_PlugState 0 "eChargePlugUnknown" 1 "eChargePlugDisconnected" 2 "eChargePlugConnected" 3
"eChargePlugLocked" 4 "eChargePlugWaitingfordisc" 5 "eChargePlugActive" ;
VAL_ 2499739856 MCU_Enabled_FCharge 0 "Disabled" 1 "Enabled" ;
VAL_ 2499739856 MCU_Enabled_ZEVCCS 0 "Disabled" 1 "Enabled" ;
VAL_ 2499739856 MCU_Enabled_SlowStart 1 "Enabled" 0 "Disabled" ;
VAL_ 2499739856 MCU_Enabled_TopBalance 1 "Enabled" 0 "Disabled" ;
VAL_ 2499739856 MCU_Enabled_Balance 1 "Enabled" 0 "Disabled" ;
VAL_ 2499739856 MCU_Enabled_SpeedHutFuel 1 "Enabled" 0 "Disabled" ;
VAL_ 2499739856 MCU_Enabled_SpeedHutAmps 1 "Enabled" 0 "Disabled" ;
VAL_ 2499739856 MCU_Enabled_SpeedHutTemp 1 "Enabled" 0 "Disabled" ;
VAL_ 2499739856 MCU_Enabled_ISensorRev 1 "Enabled" 0 "Disabled" ;
VAL_ 2499739856 MCU_Enabled_3100R 1 "Enabled" 0 "Disabled" ;
VAL_ 2499739856 MCU_Enabled_SpeedHutAmps_Reverse 1 "Enabled" 0 "Disabled" ;
VAL_ 2499739856 MCU_Enabled_IVTS_Factory 0 "Disabled" 1 "Enabled" ;
VAL_ 2499743952 MCU_BMS_Arch 1 "LTC12" 2 "A123" 0 "LTC18" ;
VAL_ 2499740112 MCU_Charger1Model_P0 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5
"ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14
"FCHARGE" ;
VAL_ 2499740112 MCU_Charger2Model_P0 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5
"ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14
"FCHARGE" ;
VAL_ 2499740112 MCU_Charger3Model_P0 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5
"ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14
"FCHARGE" ;
VAL_ 2499740112 MCU_Charger4Model_P0 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5
"ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14
"FCHARGE" ;
VAL_ 2499740112 MCU_Charger1Model_P1 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5
"ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14
"FCHARGE" ;
VAL_ 2499740112 MCU_Charger2Model_P1 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5
"ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14
"FCHARGE" ;
VAL_ 2499740112 MCU_Charger3Model_P1 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5
"ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14
"FCHARGE" ;
```

VAL_ 2499740112 MCU_Charger4Model_P1 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5 "ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14 "FCHARGE" ;
VAL_ 2499740112 MCU_Charger1Model_P2 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5 "ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14 "FCHARGE" ;
VAL_ 2499740112 MCU_Charger2Model_P2 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5 "ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14 "FCHARGE" ;
VAL_ 2499740112 MCU_Charger3Model_P2 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5 "ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14 "FCHARGE" ;
VAL_ 2499740112 MCU_Charger4Model_P2 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5 "ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14 "FCHARGE" ;
VAL_ 2499740112 MCU_Charger1Model_P3 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5 "ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14 "FCHARGE" ;
VAL_ 2499740112 MCU_Charger2Model_P3 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5 "ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14 "FCHARGE" ;
VAL_ 2499740112 MCU_Charger3Model_P3 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5 "ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14 "FCHARGE" ;
VAL_ 2499740112 MCU_Charger4Model_P3 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5 "ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14 "FCHARGE" ;
VAL_ 2499740112 MCU_Charger1Model_P4 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5 "ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14 "FCHARGE" ;
VAL_ 2499740112 MCU_Charger2Model_P4 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5 "ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14 "FCHARGE" ;
VAL_ 2499740112 MCU_Charger3Model_P4 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5 "ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14 "FCHARGE" ;
VAL_ 2499740112 MCU_Charger4Model_P4 0 "None" 1 "CH4100" 2 "CH4100_41" 3 "CH4100_42" 4 "CH4100_43" 5 "ELCON_E5" 6 "ELCON_E7" 7 "ELCON_E8" 8 "ELCON_E9" 9 "LEAR" 10 "NLG5" 11 "VOLT" 12 "STEALTH" 13 "BASIC" 14 "FCHARGE" ;
VAL_ 2498744536 MCU_Profile 0 "FCharge" 1 "Profile 1" 2 "Profile 2" 3 "Profile 3" 4 "Profile 4" ;

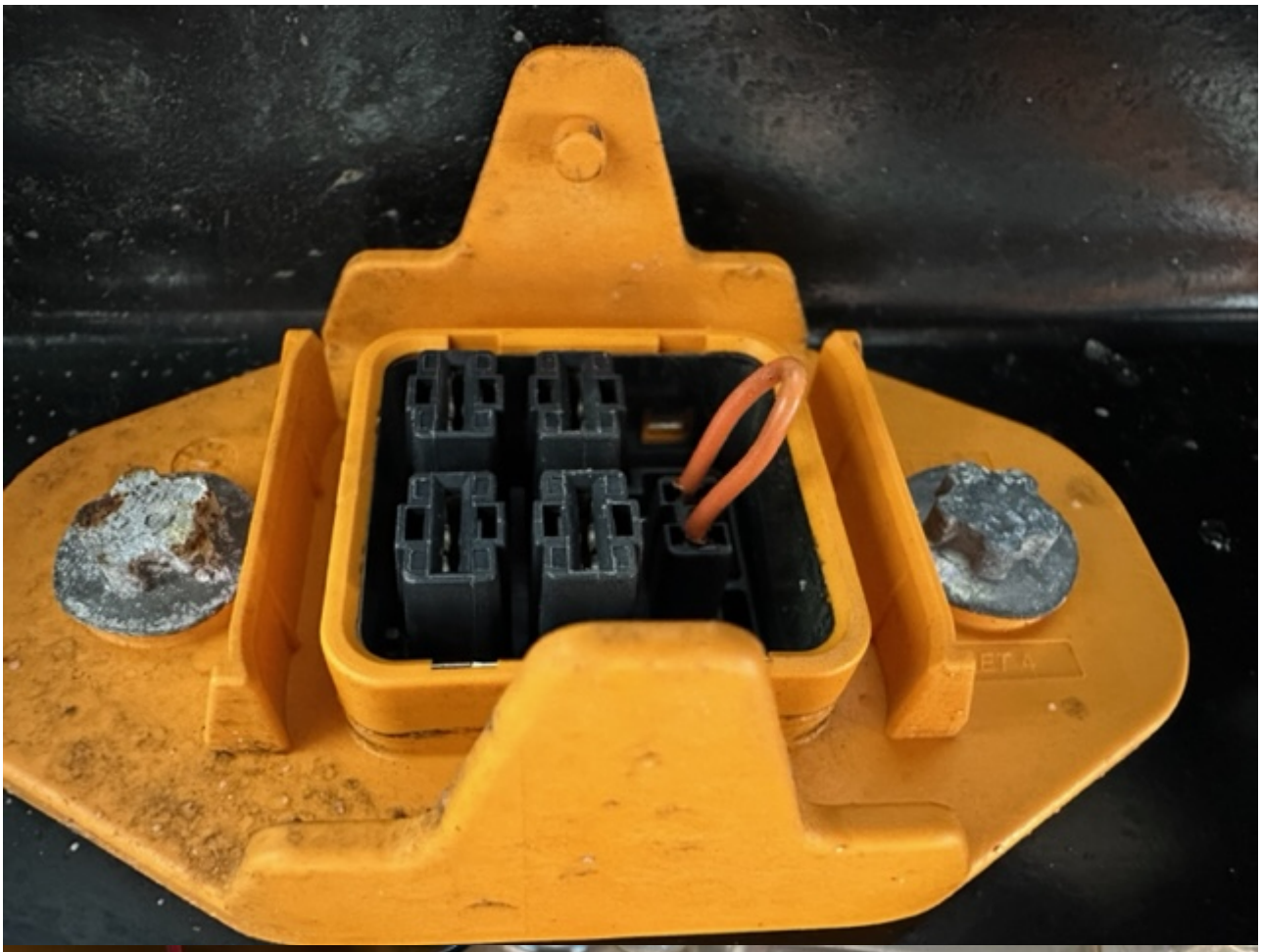
Here are some notes for users of the TBC Battery controller.

Generally the pyrofuse on battery packs sourced from wrecked vehicles will need to be replaced.
This involves opening the penthouse, the pyrofuse is available from Tesla. The contactors will not close until the pyrofuse is functional.

You will need somwhere between 650 and 1000 uF of capacitance across the main HV connectors before the precharge will succeed and the contactors will close. If you are using a capacitor, it will need to be rated for at least 400V. A capacitor this size will be very large, and store a potentially lethal charge, so treat it accordingly. If you have a Model 3 drive unit connected, this is obviously not neccessary.

You will need to jump the small gauge HVIL pins on all the HV connectors on the battery pack (HVAC connector, main motor connector, charge connector, and front motor connector if your pack has one) before the contactors will close.

You may need to flash the BMS/PCS/CP ECU depending on what firmware your pack came with. Contact support@ev-controls.com for help with this, include your order number.



C44U
1000µF ±10%
Un = 600 V-
-40..+85 °C
SH NO PCB's
21520061 B P3
C44U
650µF ±10%
Un = 600 V-
-40..+85 °C
SH NO PCB's
21520079 B P4