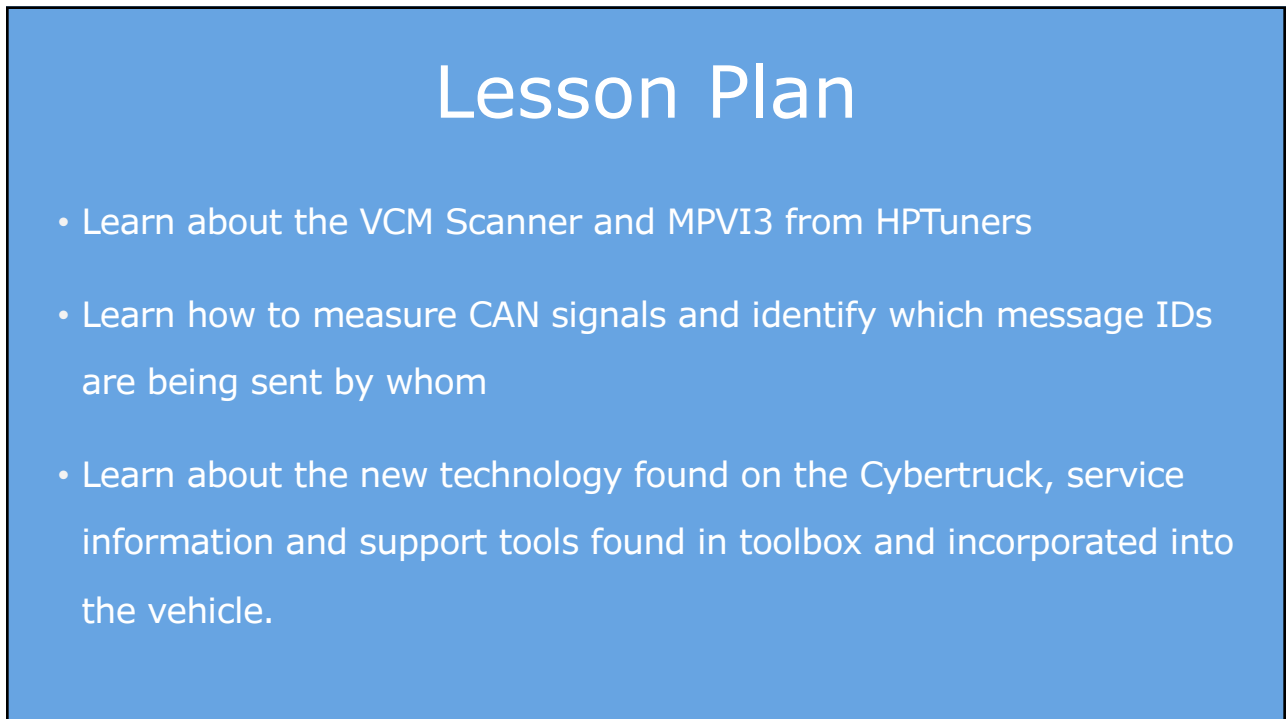


1



2

VCM Scanner

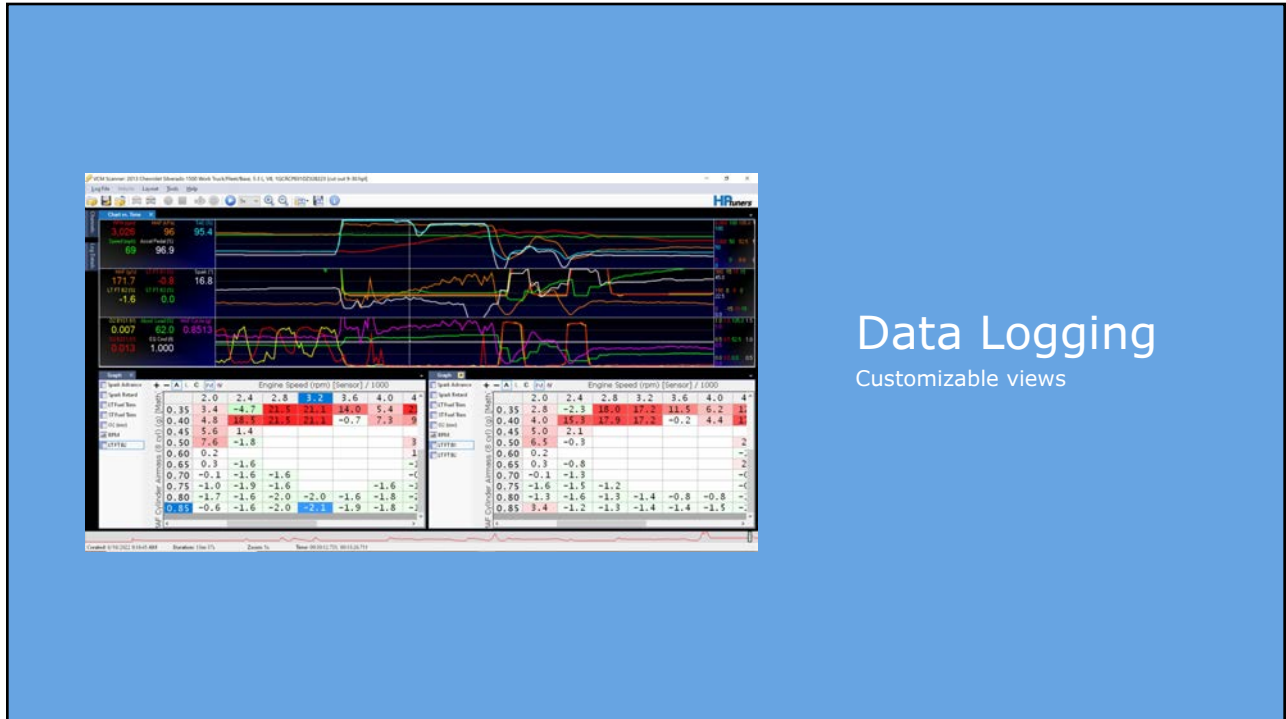
- Scantool software used with interfaces like the MPVI3 from HPTuners
- Heavily used in the “tuning world” (but that’s not why we’re here)
- Powerful tool on many carlines, exceptional on GM & Ford vehicles

3

VCM Scanner

- logging whenever scanning – always saves
- Read DTCs and monitor status on a single click
- Bi-directional controls on certain manufacturers
- Advanced graphing, math channels and more!

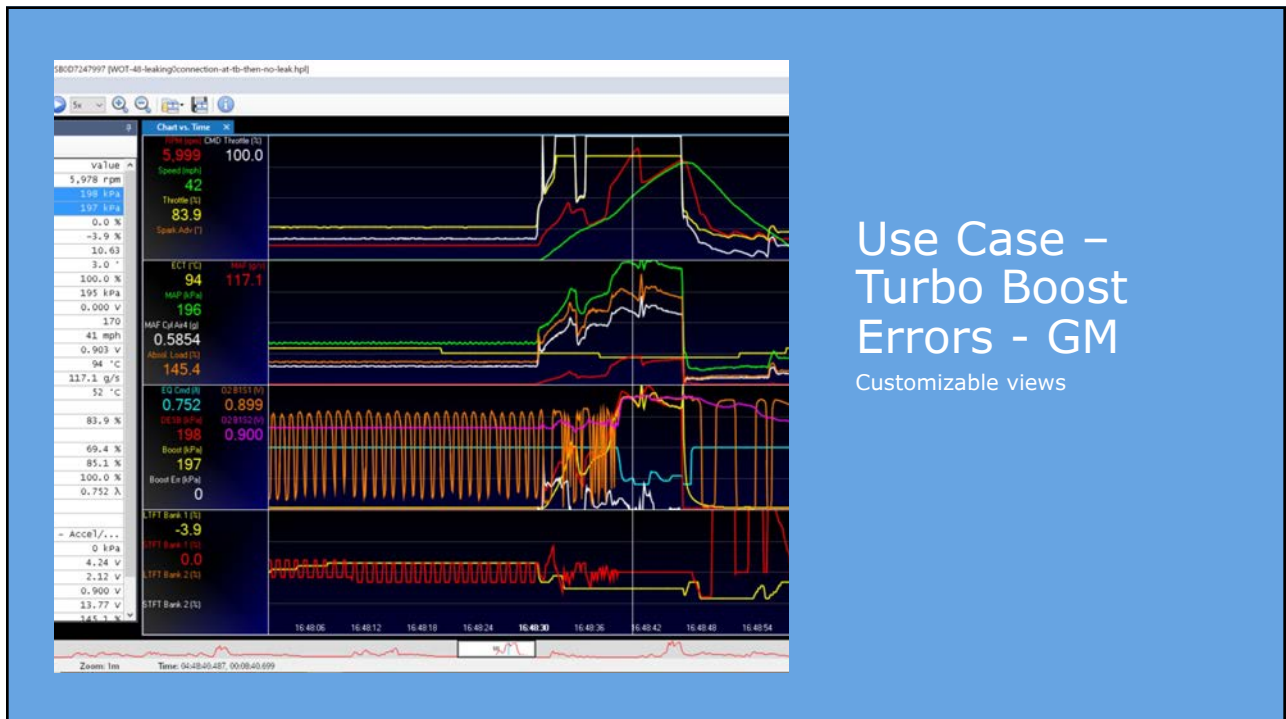
4



Data Logging

Customizable views

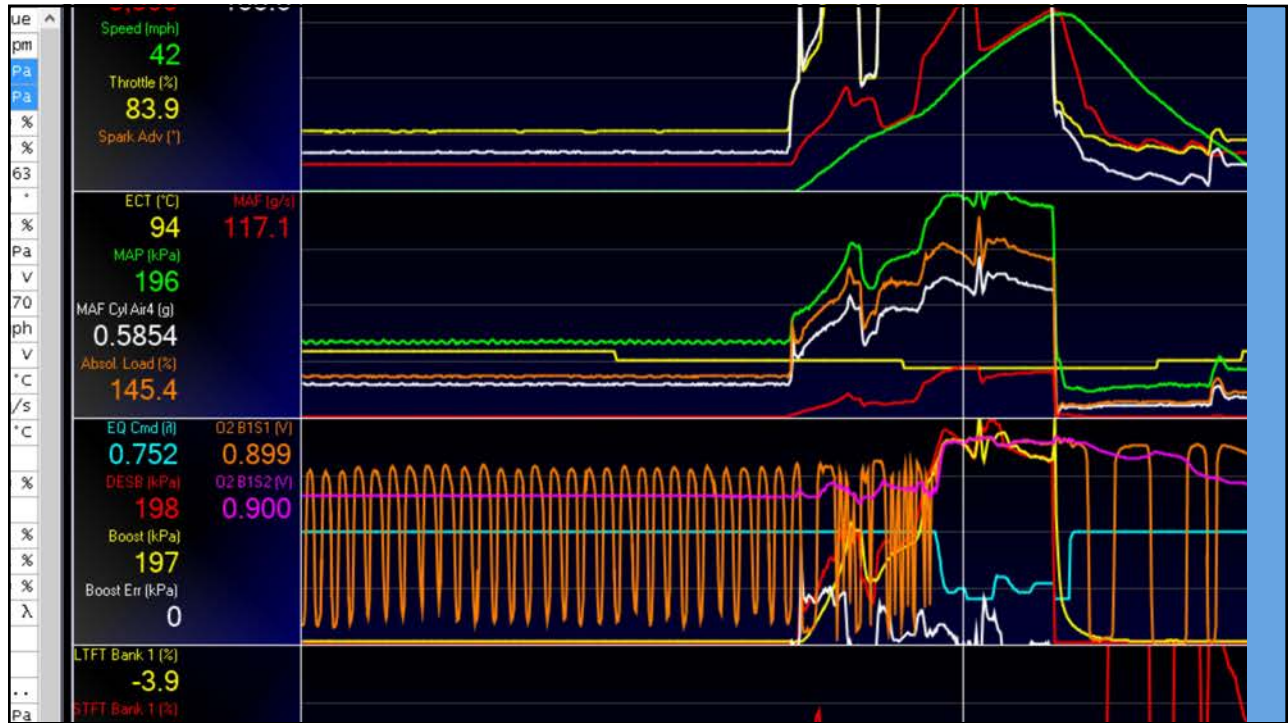
5



Use Case – Turbo Boost Errors - GM

Customizable views

6



7

There is a better way
Let's explore

8

The screenshot shows the 'Math Parameters Manager' window. The 'Boost Error' parameter is selected in the tree view. The configuration fields are: ID: 61000, Name: Boost Error, Abbreviation: Boost Err, Notes: (empty), Expression: $[2360.91] - [2336.91]$, and Unit: Kilopascal (kPa). A table at the bottom lists parameters: ID 2360, Name 'Desired Boost', Unit 'kPa'; and ID 2336, Name 'Boost Pressure', Unit 'kPa'.

MATH Channels

Derived PIDs

Boost Error example shown for a 2013 Chevrolet Cruze

9

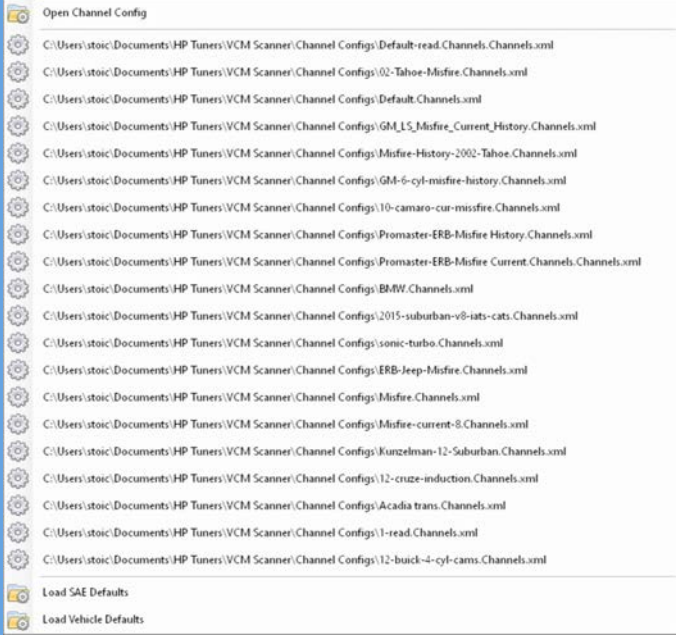
The screenshot shows the 'Graph Display Layout Editor' window. The 'Boost-err' graph is selected in the tree view. The configuration fields are: Label: Boost-err, Parameter: Boost Error (Math - Used), Unit: Kilopascal (kPa), Decimals: 0, Cell Hits Required: 25, Shading High Value: 25 (Red), Shading Low Value: 5 (Green), Column Axis Parameter: Desired Boost, Column Axis Unit: Kilopascal (kPa), Column Axis Values: 100 120 140 160 170 180 190 200 220, Row Axis Parameter: Engine Speed [Sensor], Row Axis Unit: Revolution Per Minute (rpm), Row Axis Values: 1000 1500 2000 2500 3000 3500 4000 4500 5000 6000.

CUSTOM GRAPH

Boost Error

- Select your math pid and units
- Select averaging in view
- Cell hits required = >~5
- Shading range
- Define Column
- Define Row

10



Open Channel Config

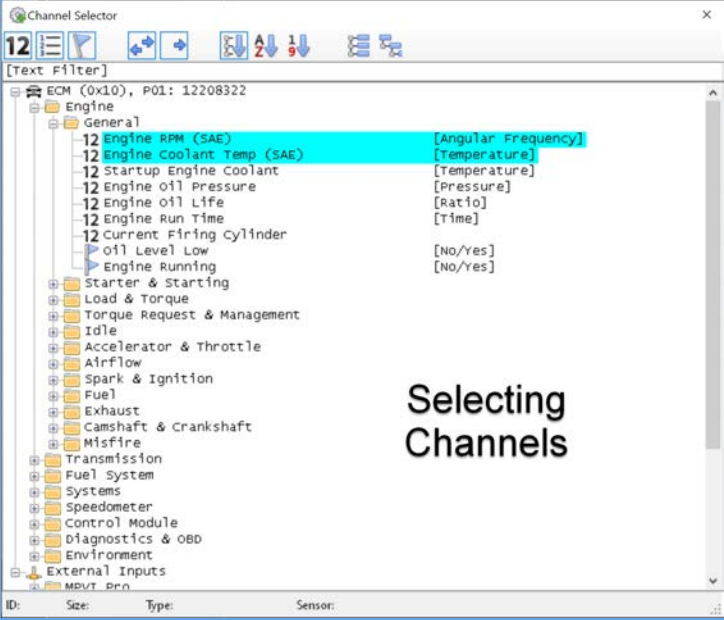
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\Default-read.Channels.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\02-Tahoe-Misfire.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\Default.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\GM_L5_Misfire_Current_History.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\Misfire-History-2002-Tahoe.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\GM-6-cyl-misfire-history.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\10-camaro-cur-misfire.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\Promaster-ERB-Misfire History.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\Promaster-ERB-Misfire Current.Channels.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\BMW.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\2015-suburban-v8-iats-cats.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\sonic-turbo.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\ERB-Jeep-Misfire.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\Misfire.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\Misfire-current-8.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\Kunzelman-12-Suburban.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\12-cruze-induction.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\Acadia trans.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\1-read.Channels.xml
- C:\Users\stoic\Documents\HP Tuners\VCM Scanner\Channel Configs\12-buick-4-cyl-cams.Channels.xml

Load SAE Defaults
Load Vehicle Defaults

Channels

- Load Vehicle Defaults
- Load Custom Channel List

11



Channel Selector

[Text Filter]

ECM (0x10), P01: 12208322

- Engine
 - General
 - 12 Engine RPM (SAE) [Angular Frequency]
 - 12 Engine Coolant Temp (SAE) [Temperature]
 - 12 Startup Engine Coolant [Temperature]
 - 12 Engine oil Pressure [Pressure]
 - 12 Engine oil Life [Ratio]
 - 12 Engine Run Time [Time]
 - 12 Current Firing cylinder
 - Oil Level Low [No/Yes]
 - Engine Running [No/Yes]
 - Starter & Starting
 - Load & Torque
 - Torque Request & Management
 - Idle
 - Accelerator & Throttle
 - Airflow
 - Spark & Ignition
 - Fuel
 - Exhaust
 - Camshaft & Crankshaft
 - Misfire
- Transmission
- Fuel System
- Systems
- Speedometer
- Control Module
- Diagnostics & OBD
- Environment
- External Inputs
- MPVT Pro

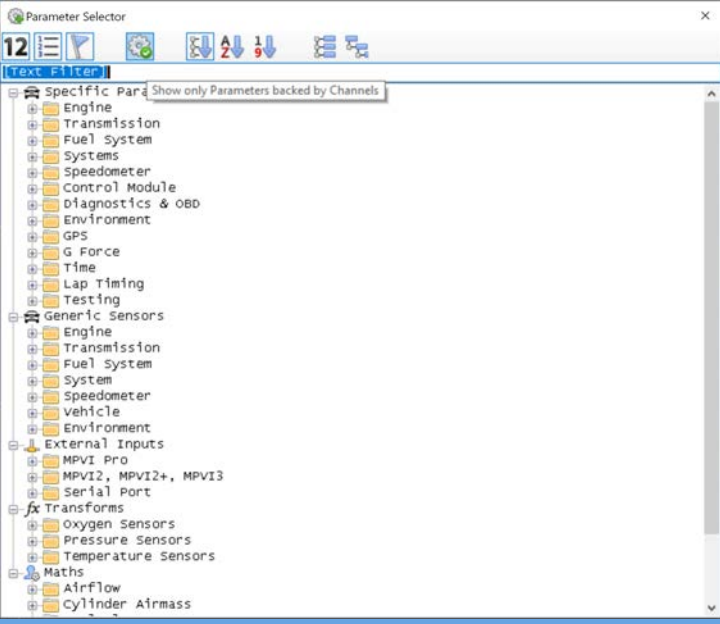
ID:	Size:	Type:	Sensor:
-----	-------	-------	---------

Selecting Channels

Channels

- Load Vehicle Defaults
- Load Custom Channel List

12



The screenshot shows the 'Parameter Selector' window with a search filter '12' and a 'Text Filter' field. The main area displays a tree view of parameters categorized by system, including Engine, Transmission, Fuel System, Systems, Speedometer, Control Module, Diagnostics & OBD, Environment, GPS, G Force, Time, Lap Timing, Testing, Generic Sensors, External Inputs, and Maths.

Parameter Selector

- Selecting PIDs base on your channel list
- Load Custom Channel List

13

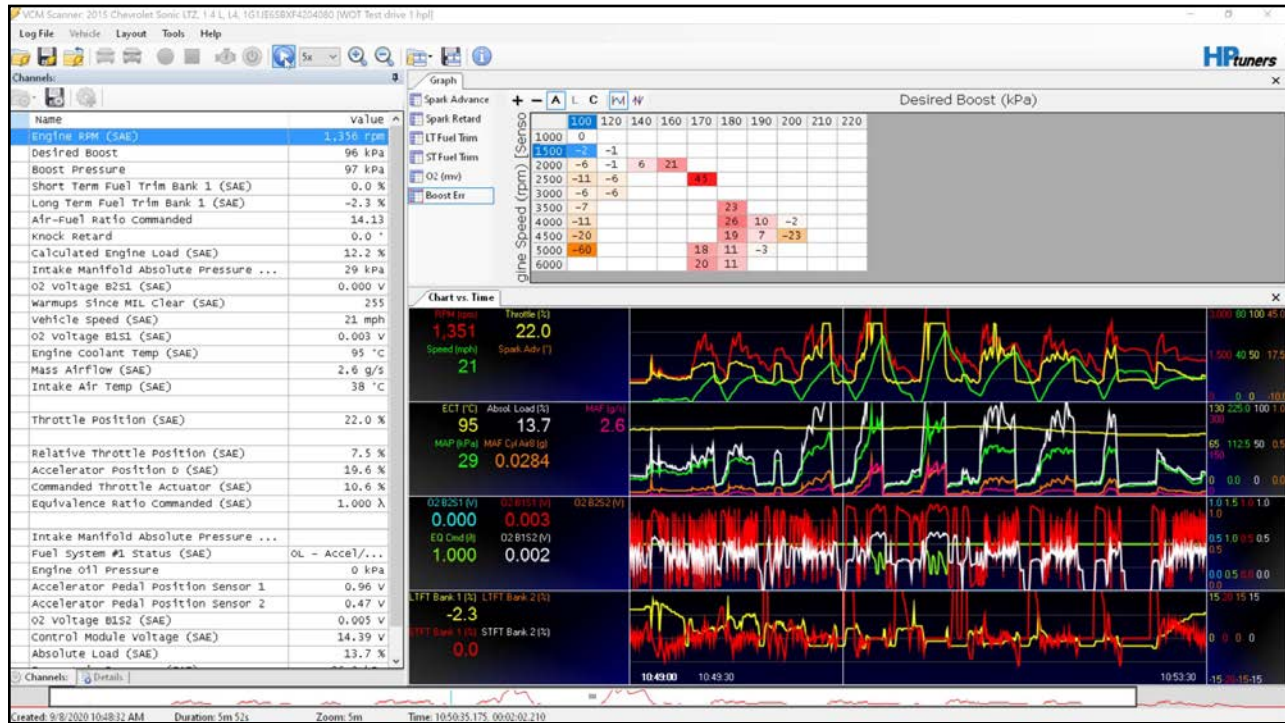


The screenshot shows the 'Controls and Special Functions' window with tabs for Engine, Engine Diagnostics, Transmission, Fuel System, System, and Speedometer. The 'Fuel System' tab is active, showing controls for 'Idle', 'Exhaust', 'Fuel', 'Spark', and 'Special Functions'. The 'Fuel' section includes 'Disable Injector #1' through '#8' and 'Fuel Trim Reset'. The 'Special Functions' section includes 'Command Closed Loop', 'LTFT Learn', and 'LTFT Reset'.

Bi-Di

- Bidirectional controls
- Fuel
- Spark
- Speed
- Timing

14



15

VCH SCANNER USER GUIDE

HP Tuners

Standalone Data Logging lets you log data directly to internal storage of your MPVI Pro, MPV2iZ+, or MPV3 without being tethered to a laptop. It is now easier than ever to collect data while driving. Once the feature is configured, you can start and stop recording with the simple press of a button.

MPVI PRO STANDALONE DATA LOGGING

The standalone data logging feature of the MPVI Pro is available for late model GM vehicles only.

SETUP

Follow the steps below to set up the standalone datalogging feature for the first time on a new vehicle or when switching from another vehicle:

1. Put the vehicle's ignition in the ON/RUN state
2. Connect the MPVI Pro to your vehicle's OBD-II port and to your laptop's USB port.
3. Open VCH Scanner.
4. Click the icon in the toolbar.
5. Ensure that channels that you wish to log are listed in the Channel display (add or delete channels as necessary).
6. (Optional) Click to save your channel configuration for later use.
7. In the menu bar select **Vehicle > MPVI Pro Data Logging**. The MPVI Pro Standalone Data Logging Functions window appears.

HP Tuners, LLC
793 Eastwood Lane
Buffalo Grove, IL 60089, USA

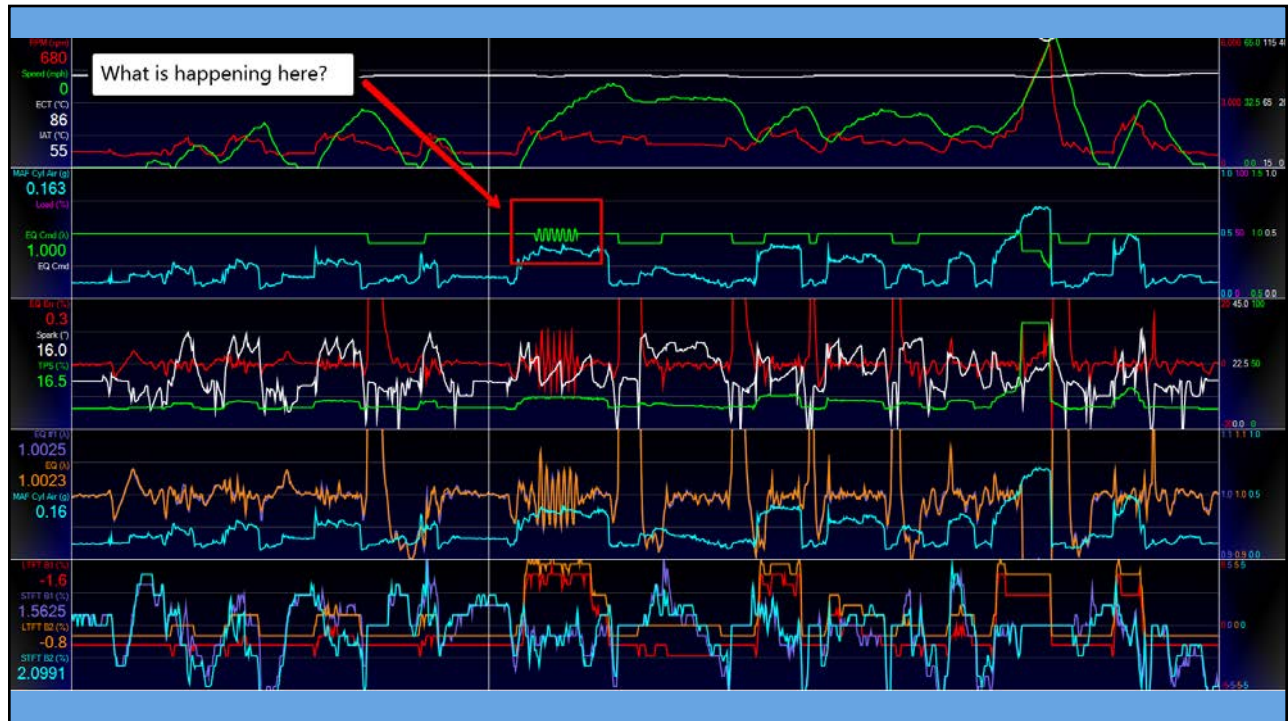
Page 46

Stand-alone Data Logging

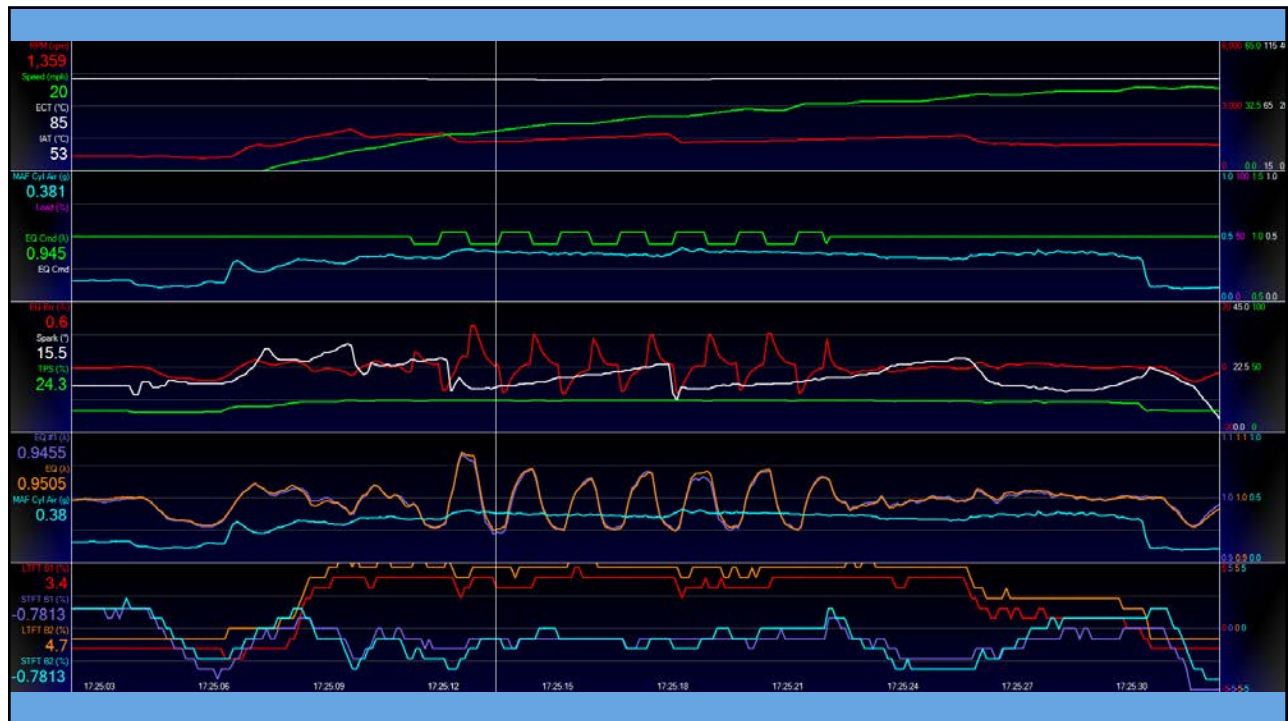
GM (gm) vehicles only

See help file at HPTuners.com

16



17



18

Calibration Verification Numbers

The screenshot displays a diagnostic tool interface with several panels. A red box highlights the 'Vehicle Info' section, which contains the following data:

- Protocol Info: Unknown; CAN, 500 kb/s
- ECM: 7E8, CAN, ECM_EngineCtrl
VIN: 1G1PC5S87E7118535 - 2014 Chevrolet Cruze 1LT, 1.4 L, L4
Serial: 86ABRLK13165GWEF
Programmed State: Unknown
DS: 12055298
- Calibration IDs: 12656286, 55598219, 55598216, 12643594, 55597380, 55595570, 55595579, 55597337
- Calibration VINs: 00002838, 0000564A, 00003A92, 0000EAC, 0000A015, 0000E108, 00002416, 0000B323
- Basic PID: 42
- Controller: Type ID By DS: 0
- Diagnostic Requirements: None
- Scanning Methods:

Below the ECM section, the TCM and PCM sections are also visible:

- TCM: 7EA, CAN, TCM_TransmiCtrl
Serial: DV81646315401DT
DS: 24268185
- Calibration IDs: 24268165, 24265551, 24265549, 24265552
- Calibration VINs: 0000AA4B, 000070B9, 00006831, 000093A9
- Basic PID: 4
- Controller: Type ID By DS: 0
- Diagnostic Requirements: None
- Scanning Methods:

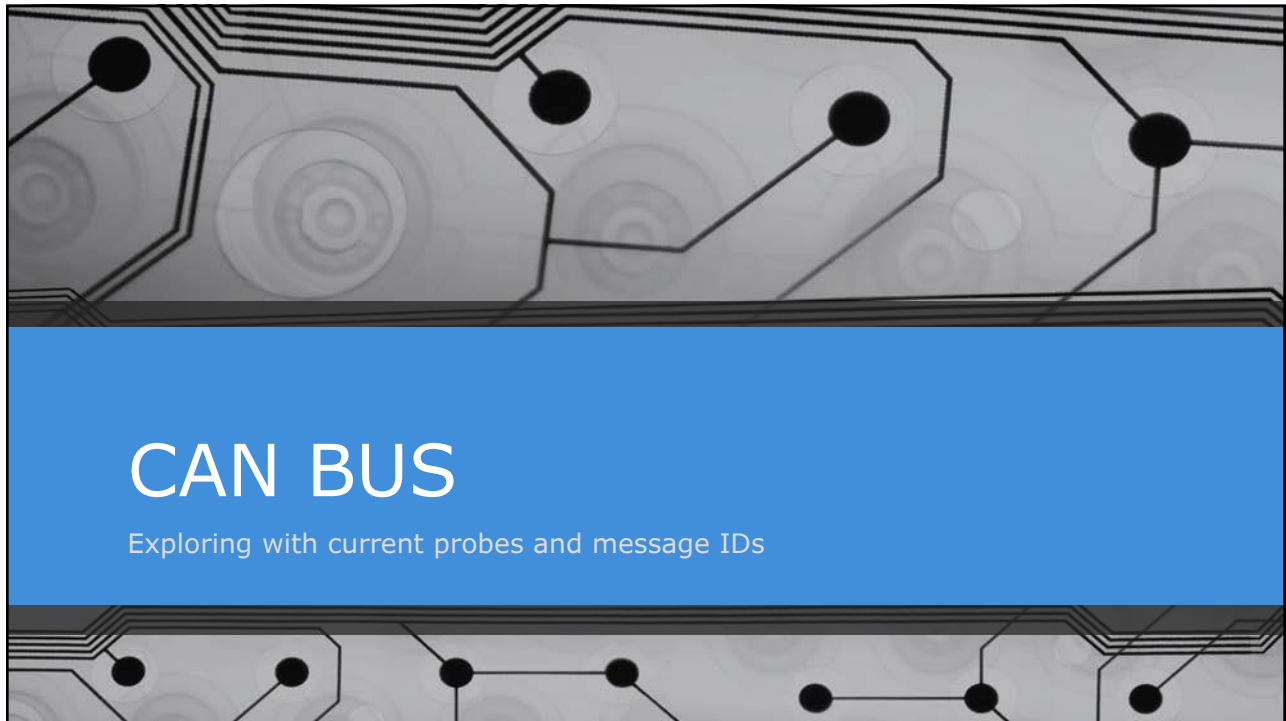
- PCM: 7EB, CAN, PCM_FuelPumpCtrl
Serial: GA42980831620960
DS: 22872238
- Calibration IDs: 22872238, 95134691, 22957277
- Calibration VINs: 000064B9, 000011C3, 000025D0

The interface also includes a data table and several graphs showing real-time sensor data and trends.

19

Segment 1 conclusion

20



CAN BUS

Exploring with current probes and message IDs

21



The waveform shows a series of CAN bus messages. The top trace is blue and the bottom trace is red. A central bar identifies the messages: ID - 1E5 (orange), 8 (green), Data - 9C (grey), Data - 00 (blue), Data - 00 (blue), and Da (blue).

Message IDs

Why would you need to know?

How do you know a module is communicating?

Hunting down an anomaly?

22

Summary

- Basic analysis will solve 90% of communication problems
- Exploring new ways to conquer
- Questions

23



Cybertruck

Technology Overview

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19

24

Cybertruck

Technology Overview



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- 800V Architecture
- 48V MV/LV
- Steer by Wire - 4 Wheel Steering - Redundancy, Service
- Comms: Etherloop, A2B, CAN, CANFD, LIN, LVDS, UART/CAN
- Modules: VCLEFT, INFO, APP, VCRIGHT, VCREAR, HVBATT
- Security, BLE, UWB,
- Service, Diagnostics, SI, EWD, Connectors and more!

25


Safety – MV/LV Connections

- Light Blue tape = 48v (mid voltage)
- Follow Service Procedures

Last modified: 02/12/2024 09:58:15

Disconnect MV Power



Correction code 17010200
FRT FRT 0.05

NOTE: Unless otherwise explicitly stated in the procedure, the above correction code and FRT reflect all of the work required to perform this procedure, including the linked procedures. Do not stack correction codes unless explicitly told to do so.

NOTE: See Flat Rate Times to learn more about FRTs and how they are created. To provide feedback on FRT values, email LaborTimeFeedback@tesla.com

NOTE: See Personal Protection to make sure wearing proper PPE when performing the below procedure.

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26

Voltages

Low Voltage	Mid Voltage	High Voltage
15V	24-58V	400V+

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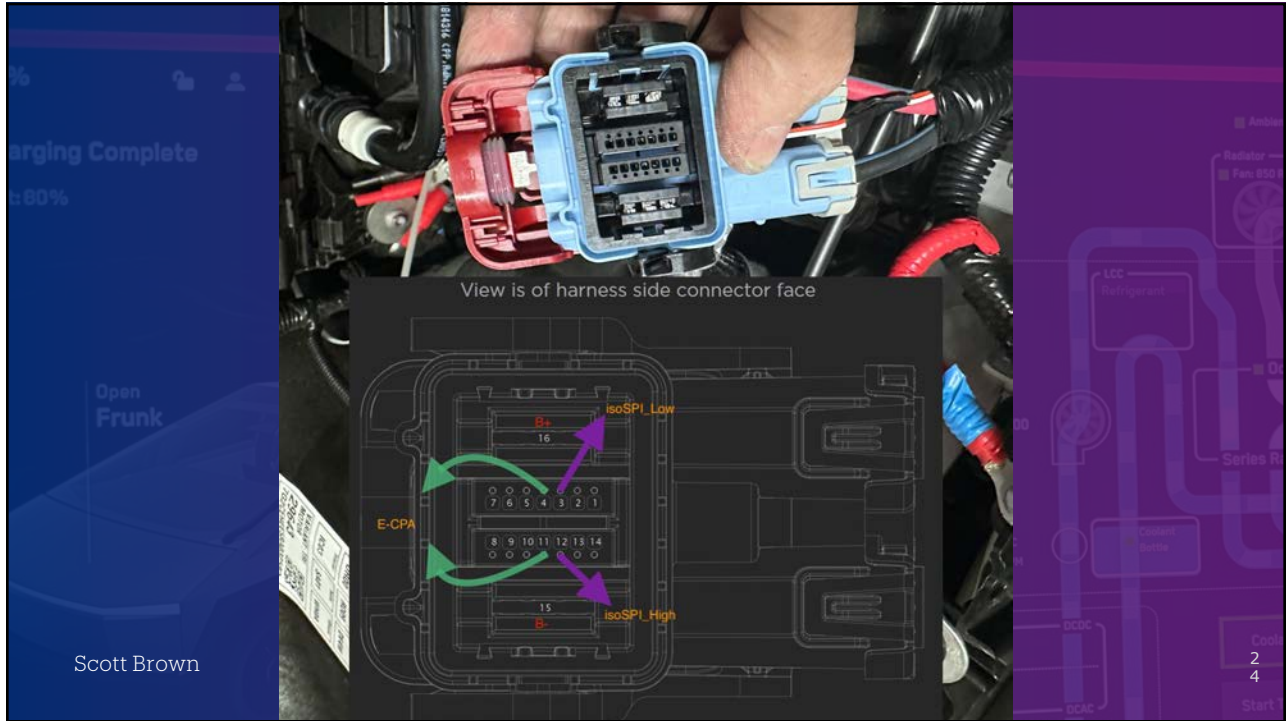
27

Safety - LV Connections

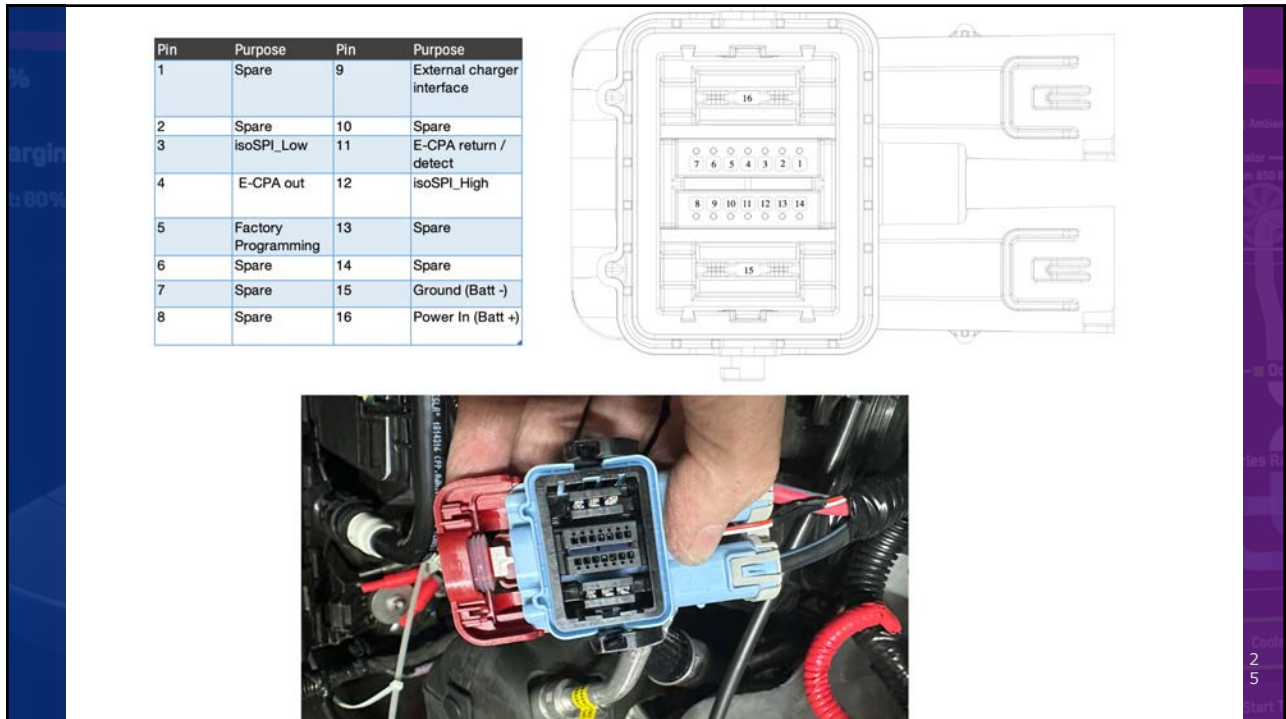
View Is of harness side connector face

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28



29



30

Security Authentication

6:17 pm 80°F ADI 68

- VSEC = Domain - LF Vehicle Controller

VCSECC

VCRIGHT

VCREAR

VCLEFT

Authentication Endpoint BLE + UWB

Authentication Endpoint BLE + UWB + UHF

Authentication Endpoint BLE + UWB + NFC

Authentication Endpoint NFC only

Power 10.5V

UART over CAN

Multidrop UART over CAN

26

Start

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31

VCRIGHT

VCREAR

VCSECC

VCLEFT

Authentication Endpoint BLE + UWB

Authentication Endpoint BLE + UWB + UHF

Authentication Endpoint BLE + UWB + NFC

Authentication Endpoint NFC only

Power 10.5V

UART over CAN

Multidrop UART over CAN

26

Start

32

By default, VCDOOR sub-usage is set to Front Left.

In case of a vehicle power loss, VCDOOR will receive 12V from the jump post (if connected) to release the door latch. VCDOOR can also boost the jump post voltage to 48V using an internal buck converter. This will allow the window to short-drop since the window regulator operates at 48V.

Door presenter

The door presenter is an actuator that pushes the door out of the vehicle body by a few degrees, allowing the user to grab the door from the belt area and bring it to the desired position. It contains a DC motor connected to a clutch and gear mechanism, which converts the motor's rotational motion to linear motion to extend or retract the presenter. It also integrates a hall sensor to measure the position of the presenter.

The door presenter will operate between five positions:

Position name	Physical position
Fully retracted	Zero position
Homed	Body position minus 5 mm
Primed	Body position minus 0.5 mm
At Body	Body position
Extended	Extended position

Specifications

- Operation
 - Door vehicle controller (VCDOOR)
 - Door presenter
 - Latch
- Serviceability
 - Overview
 - VCDOOR
 - Diagnosis
 - Repair routine
 - Door presenter
 - Diagnosis
 - Repair routine
 - Latch
 - Diagnosis

As of 9-26-2024 I don't believe this statement is correct

VCDOOR receives 48V from the LFCONTROLLER
Jump Post is only connected to LFCONTROLLER

It contains a Boost converter that can make 48V from 12-16+ the jump post provides

33

6:17 pm 80°F AQI 68

Charging Complete 80%

Open Tonneau

Open Tailgate

Rescue

Reviving from the dead

Entry Ride Height

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Service Mode Plus

Supercharger

- PT Pump RPM: 6500
- PT Loop Inlet Temp: 33°C Flow: 28L/M
- LCC Refrigerant
- DCDC
- DCAC
- DCAC

Code 29

34

6:17 pm 80°F AQI 68

Charging Complete
80%

Open Tonne

HVBATT

Structural - 800v
123kWh
4680

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Entry Ride Height

- Structural Battery Pack

1 Fasteners

2 Ancillary Bay Cover

3 Ancillary Bay

4 Seal

35

Charging Complete
80%

Open Frunk

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1 Fasteners

2 Ancillary Bay Cover

3 Ancillary Bay

4 Seal

Bed Accessible

36

CLOSURES

- 48v Window Motors
- Door Modules -> Departure from norm
- All modules are the same - LF Master
- Opening Servos -
- Frameless - Service Caution

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37

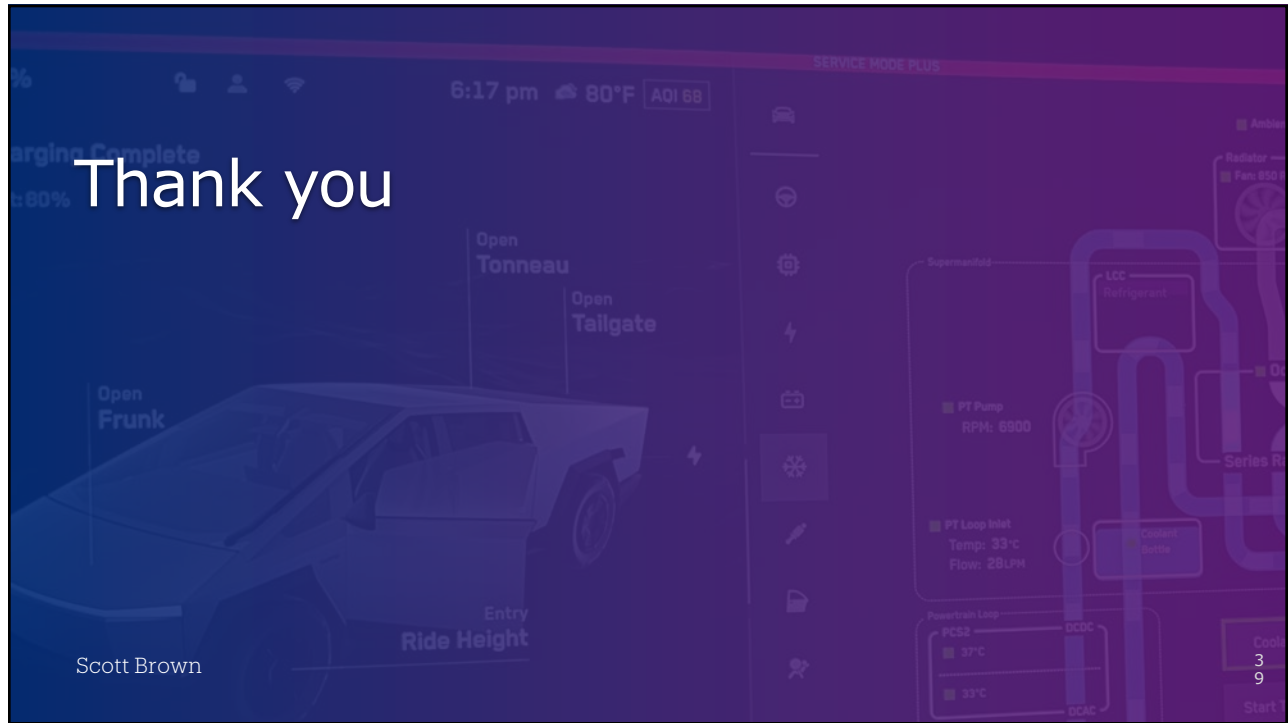
DIAGNOSTICS

2024 CT [BEAST]

- HVBATT_a042
- HVBATT_a039
- DIREL_a126
- DIREL_a149

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38



39