Performance Vehicle Telemetry Displays

www.btigauges.com

TFT CAN Bus Gauge for AEM V2
Plug and Play Installation Manual
Doc version 1.0

Notice: This product is intended for Off-Road use only. Never take your eyes off of the road while using this device. If you are uncomfortable with wire termination, please have this device installed by a competent shop.

**** Notice! This device should be configured by competent personnel. Raising the BOOST too much, reducing the Traction Control too much, improper use of nitrous, or improper use of a line lock can have severe consequences. You could blow your engine and or lose control of your vehicle****

Wiring harness installation:

Plug and play wiring harness for Infinity V2 ECUs with the AEM wiring harness:

Locate the 4 pin AEM NET wiring connector on the V2 harness. Connect the Plug and play harness into the AEMnet 4 pin harness and run the cable to the desired gauge installation location. Note that the gauge gets power and the CAN signal from this cable and no other wiring is necessary.

AEMnet CONNECTORS

The AEMnet has four wires, two are for communication (white pin 1 and green pin 2) and two are for powering (red pin 3 and black pin 4) certain AEMnet devices. Only the two communication wires (white pin 1 and green pin 2) are needed for the Series 2 EMS to send/receive data as the EMS is not powered by AEMnet. The red and black wires will need to be connected when using the Series 2 EMS with devices that are powered by AEMnet such as the Dyno-Shaft (see individual instructions for details). The AEMnet connectors are shown below in figure 1. See table 1 for the AEMnet connection pinout.

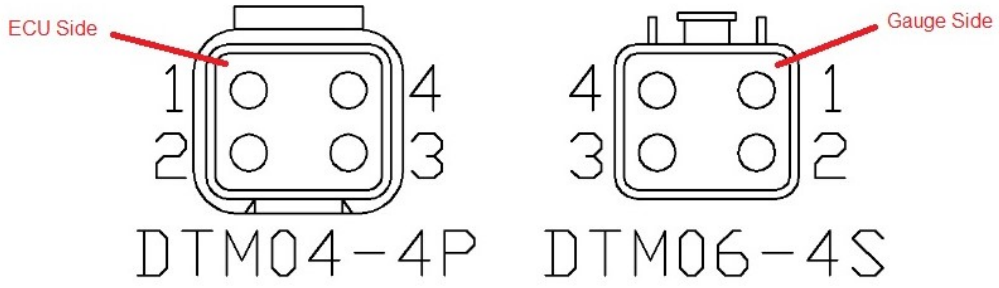


Figure 1: AEMnet connectors, wire entry view

AEMnet Connector		Series 2 EMS Connector
Pin 1	White	CAN1H
Pin 2	Green	CAN1L
Pin 3	Red	AEMnet Power (switched 12 volts)
Pin 4	Black	AEMnet Ground

Table 1: AEMnet connector pinout

INSTALLING THE AEMnet ADAPTER HARNESS

4. Table 2 below lists the corresponding CAN1L and CAN1H pin locations for each Series 2 EMS.

		CAN1L (Green wire)	CAN1H (White wire)
EMS	Adapter p/n	LOCATION	LOCATION
30-6100	30-3433	11A	12A
30-6101	30-3433	11A	12A

Table 2: CAN1L and CAN1H pin locations

Figure 6 below shows the connectors for the Series 2 EMS.

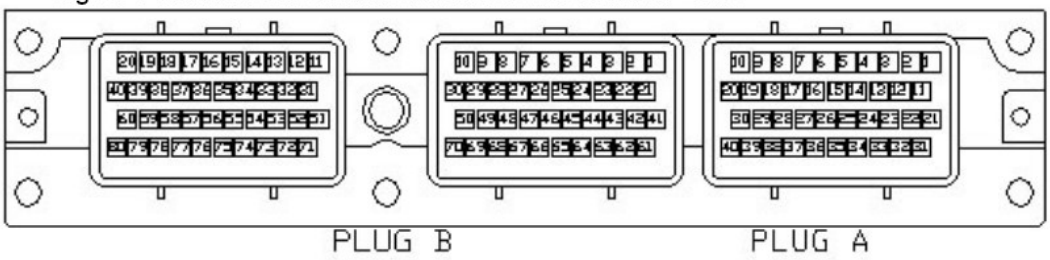
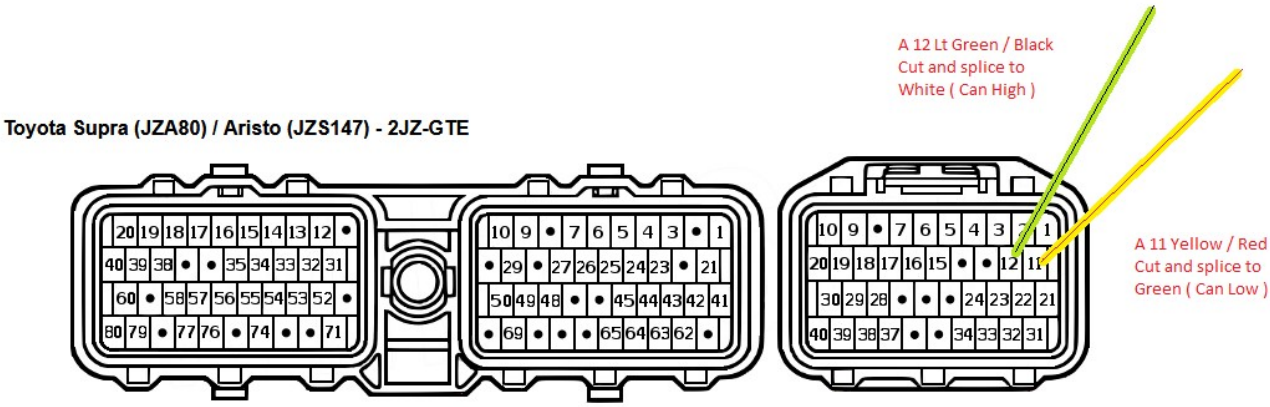


Figure 6: Wire-side view of pinout for 6100 and 6101 EMS



Notice: Not all 2JZ wiring harnesses have pins a 11 and a 12 populated. In the event this should occur, pins or pre-terminated pins with wires are available from Toyota.

The PIN part number is TE Connectivity 175197-2
or if you insist on OEM Toyota parts: Toyota 82998-24060

4. Table 2 below lists the corresponding CAN1L and CAN1H pin locations for each Series 2 EMS.

		CAN1L (Green wire)	CAN1H (White wire)
EMS	Adapter p/n	LOCATION	LOCATION
30-6030	30-3430	C22	C21
30-6050	30-3432	D14	D10
30-6051	30-3432	D14	D10
30-6052	30-3432	D14	D10
30-6053	30-3432	D14	D10
30-6060	30-3432	C28	C29
30-6310	30-3431	77	87
30-6311	30-3431	57/77	67/87
30-6320	30-3435	33	13

Table 2: CAN1L and CAN1H pin locations

Figures 7, 8, 9, and 10 below show the connectors for each Series 2 EMS.

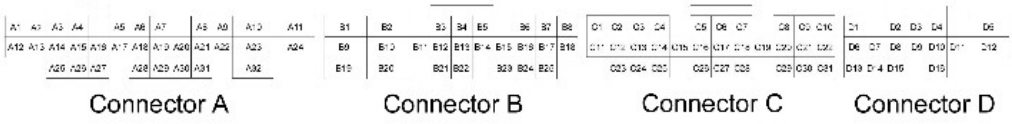


Figure 7: Wire-side view of pinout for 6030

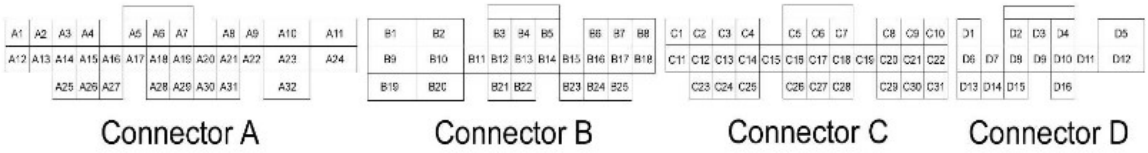


Figure 8: Wire-side view of pinout for 6050, 6051, 6052, 6053, and 6060 EMS

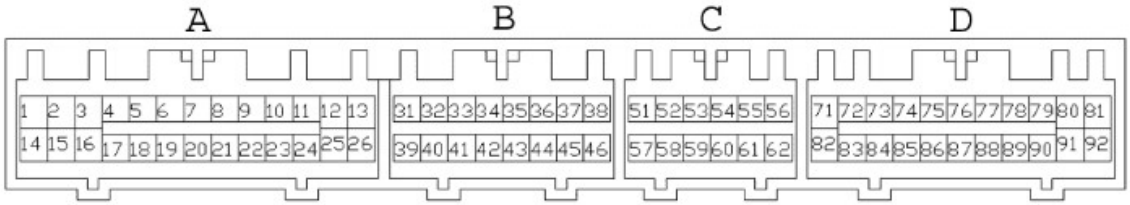


Figure 9: Wire-side view of pinout for 6310 and 6311 EMS

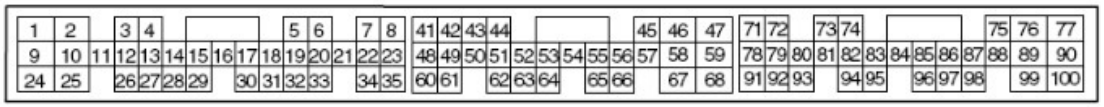
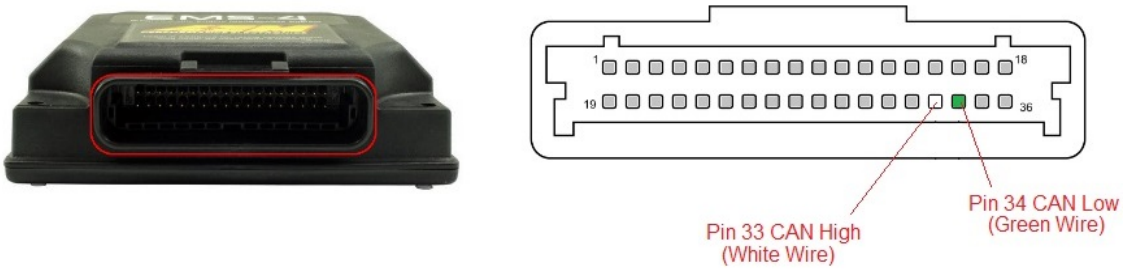


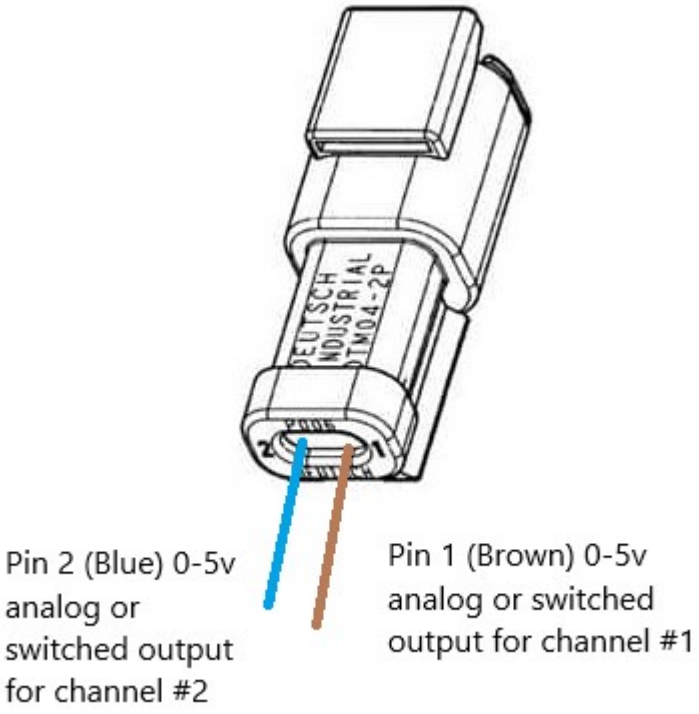
Figure 10: Wire-side view of Pinout for 6320 EMS

EMS-4 CAN Bus wiring:

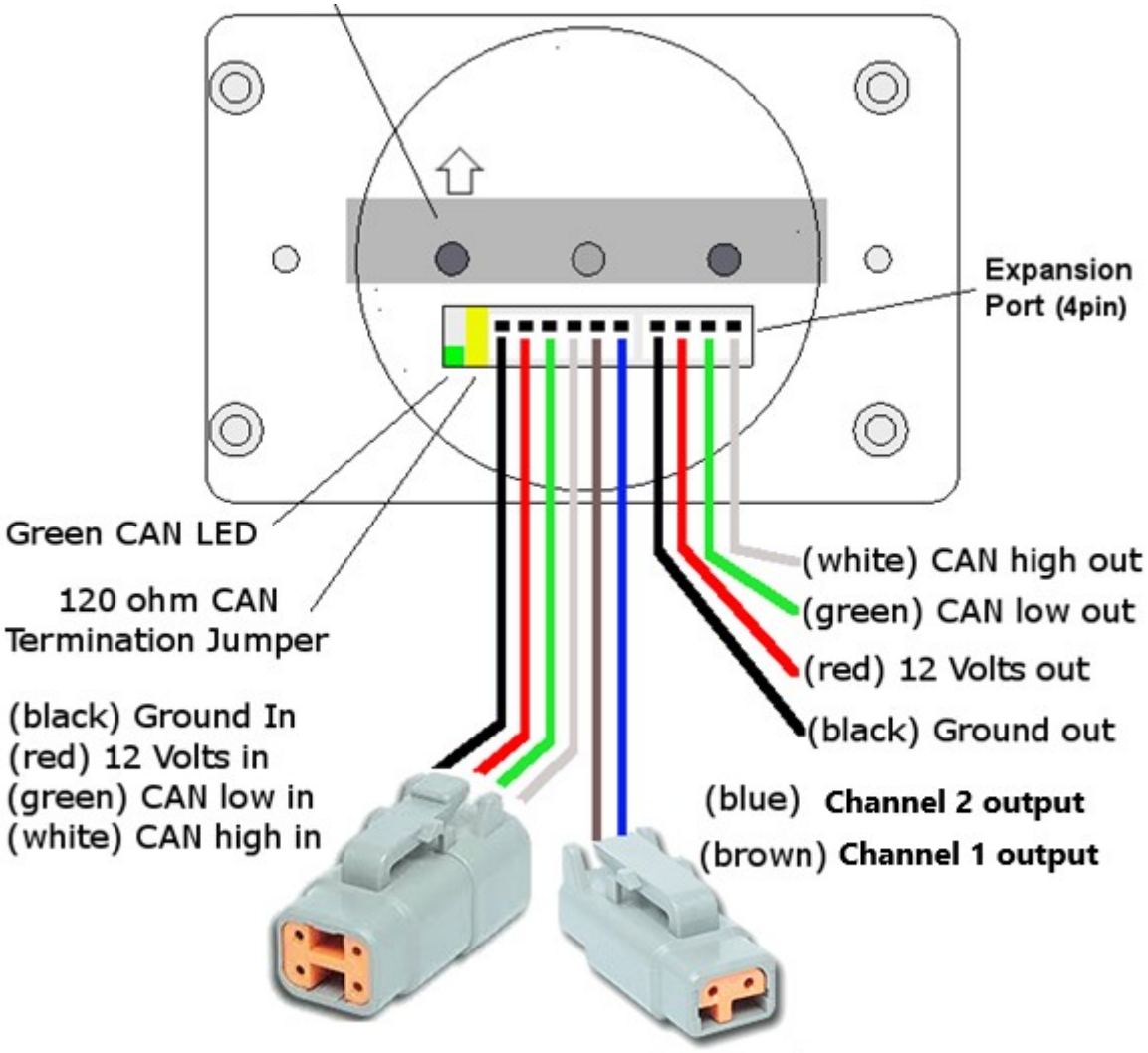


2 Pin Analog Out Connector (Brown and Blue Wires)

The termination of these two wires is dependent on the inputs that are assigned in the AEM Tuner software. If you are using one of these gauge outputs for boost control, tie the output to the V2 **"ModeSwitch Input".** Either output may be connected to a different input on V2 (5 volt low current) or used with a 5 volt relay for Nitrous Arm / Purge or a line lock if desired. We offer both 1 channel and 2 channel optically isolated 5 volt relay for these scenarios listed on page 19 of this manual.



Please note the offset post holes in the aluminum bracket.
Ensure that the bracket does not cover the connectors.



Data LED: This indicator will flash when ever the gauge is energized and CAN communications are present. Use this to confirm communications.

CAN Bus Termination Jumper: Remove this jumper if the gauge is not the last device on the CAN Bus. If there are multiple gauges, the last gauge should be the only gauge with the jumper installed.

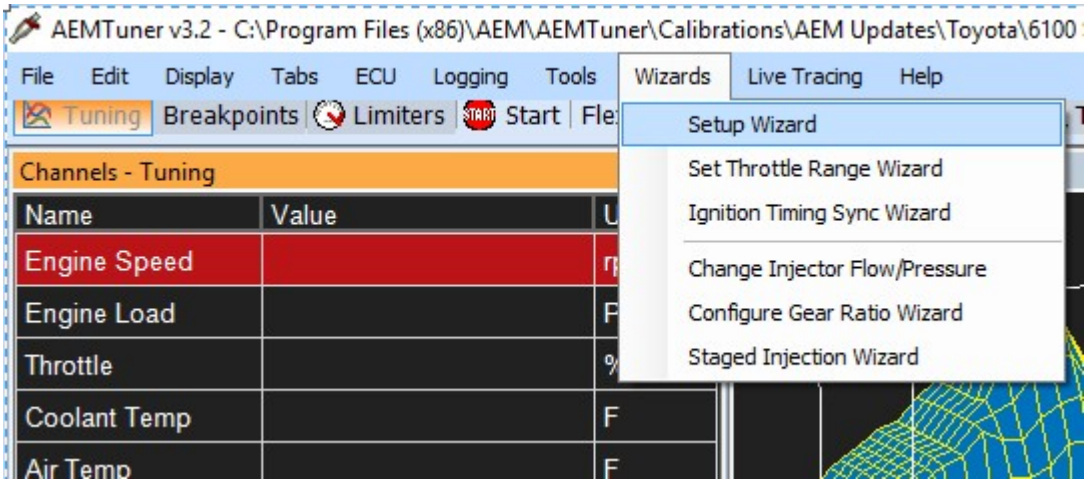
Leave the jumper installed if the gauge is a stand alone installation and there is nothing else on the CAN Bus.

AEM Tuner software configuration:

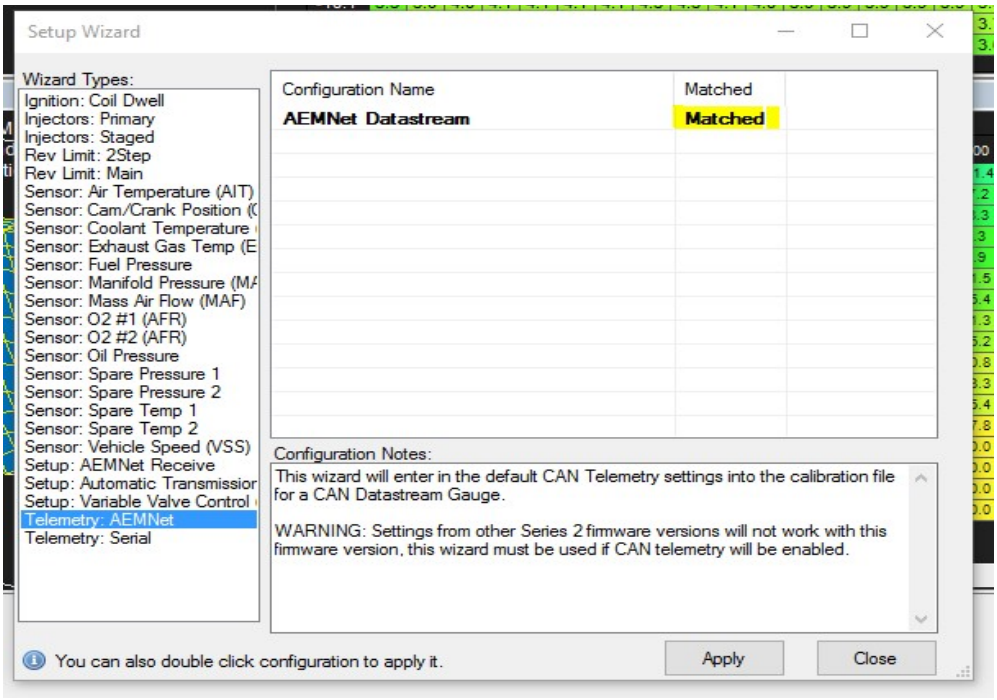
In order to have a properly functioning gauge, it is mandatory that the CAN protocol is configured in the AEM Tuner software.

Steps to create the protocol and generate the multipliers:

1. Open the AEM Tuner software and proceed to the Wizard / Setup Wizard:

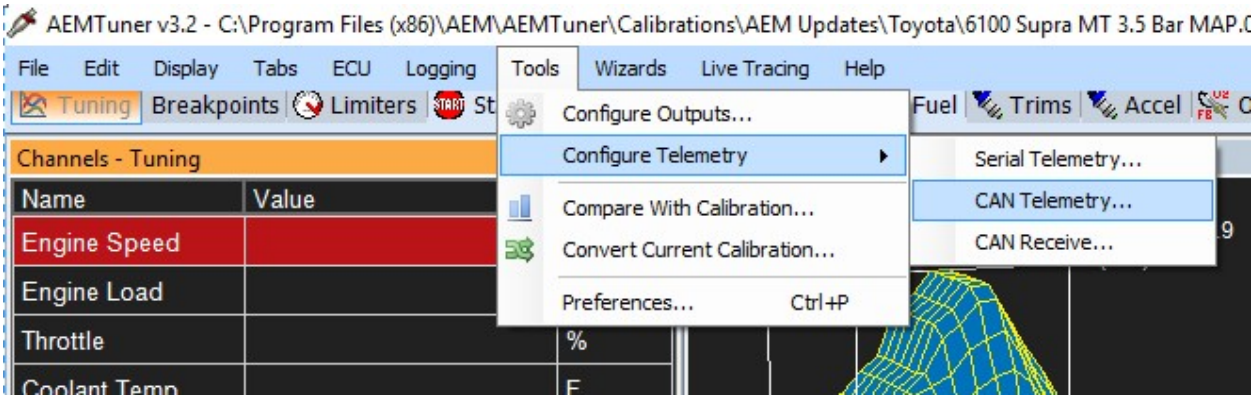


1. Now select “Telemetry: AEMNet” and click on the space under “Matched”. This should insert the word “Matched” if the datastream is not linked.



Now that the datastream is matched, this will build the basis for the standard transmit and save some time in configuration.

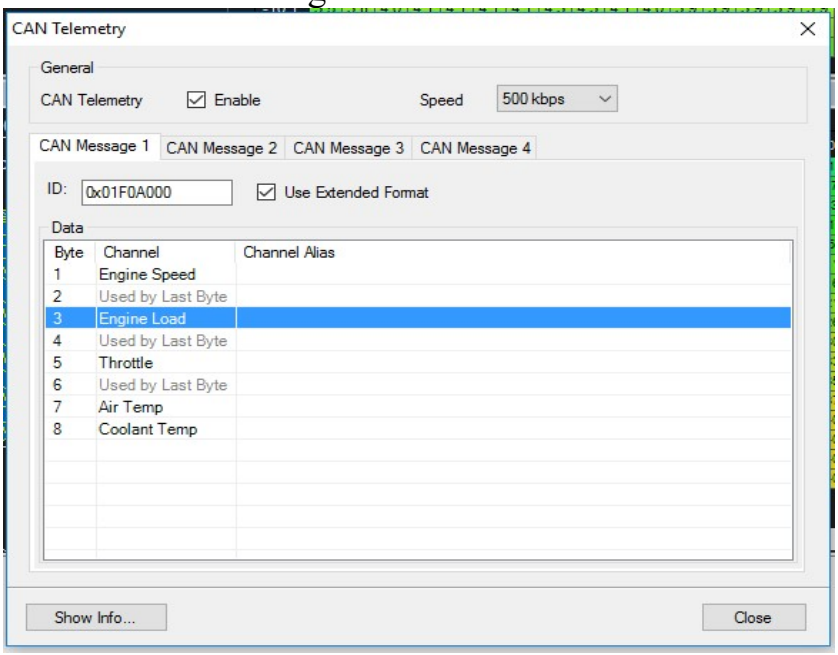
2. Now we must create the CAN Message Data. Note that there will be different CAN transmissions for cars using the AEM V2 to control an automatic transmission vs cars running Flex Fuel. We do this in order to get the most amount of Data out of V2 given it's limited communication size. In order to do this, navigate to Tools / Configure Telemetry / CAN Telemetry:



Standard CAN transmission:

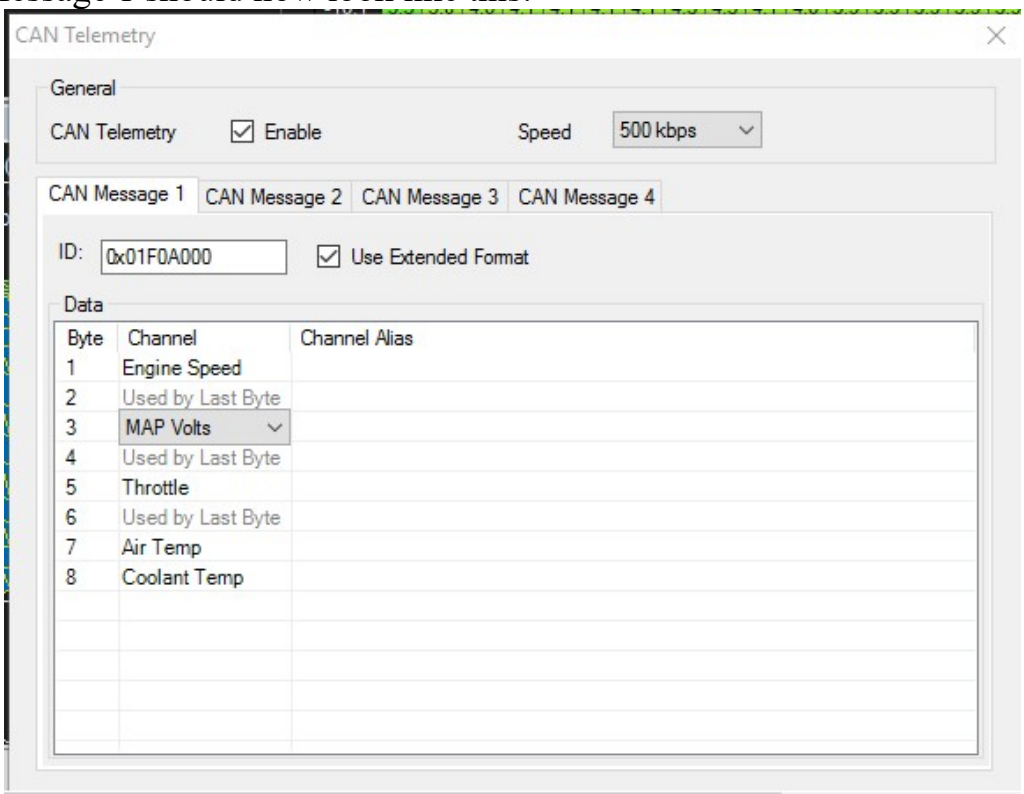
(Manual transmission cars with or without flex fuel) :

Can Message 1 should look like this:

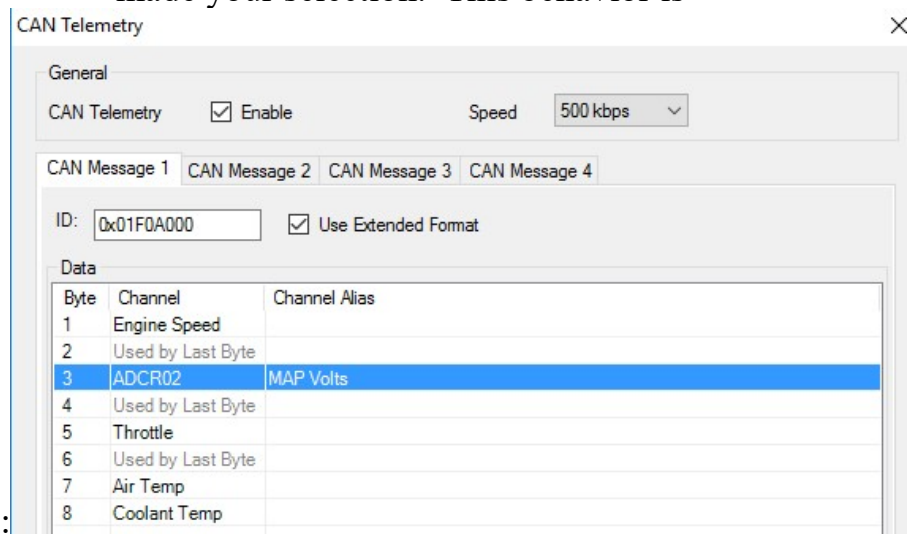


Change Byte 3 from “Engine Load” to “MAP Voltage” AEM V2 is not capable of outputting the MAP pressure on the CAN bus, so we will need to put in a scalar and offset in the gauge in order to get our MAP Pressure.

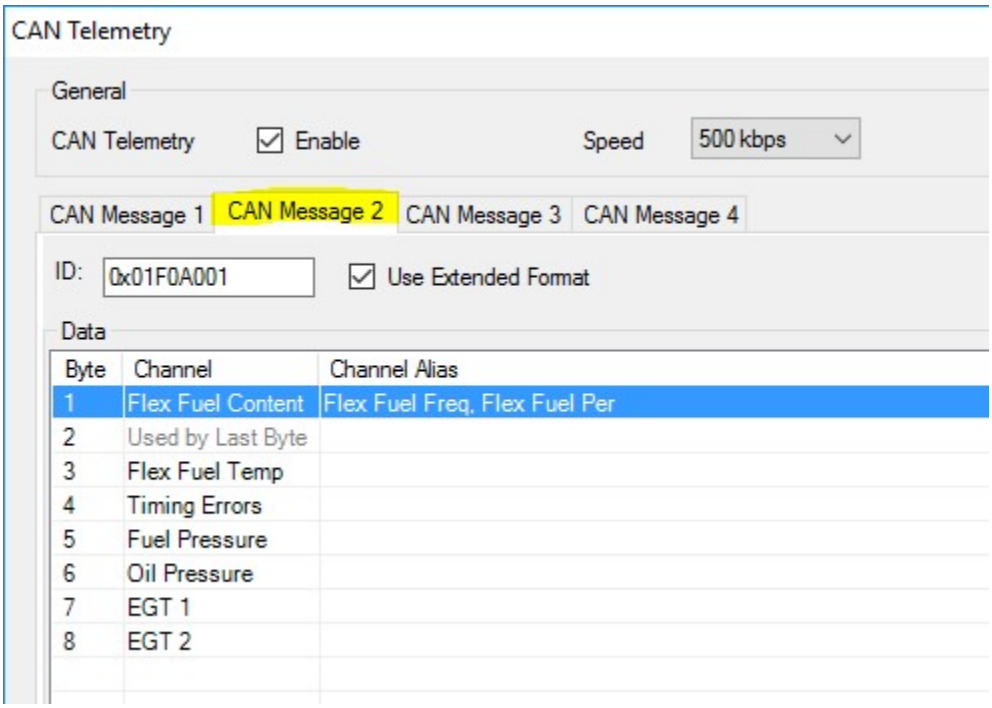
CAN Message 1 should now look like this:



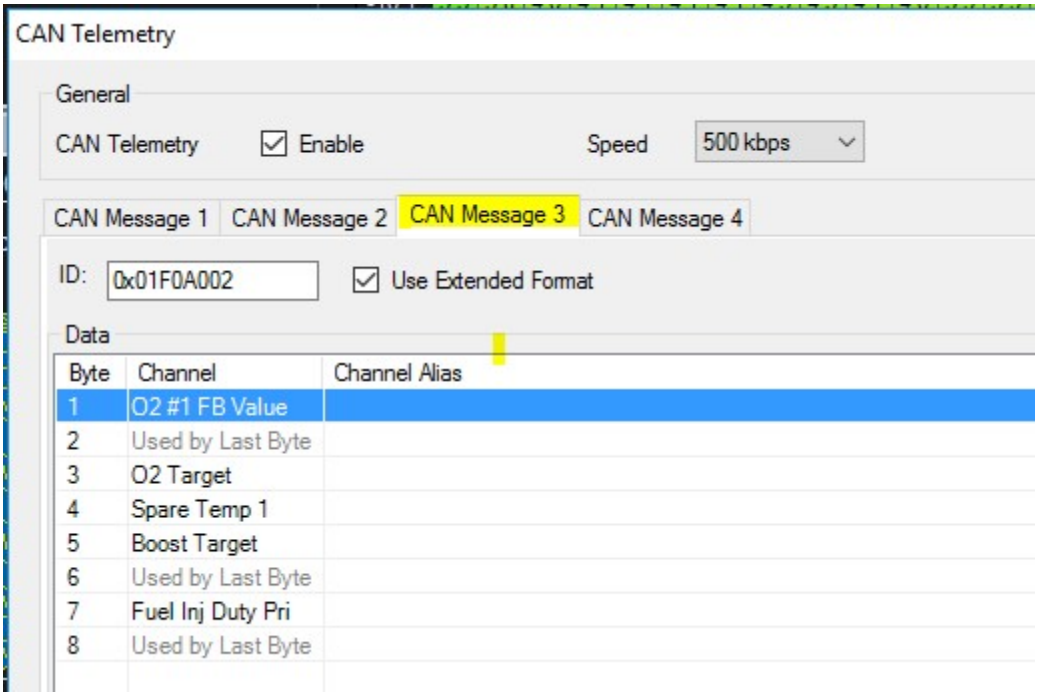
Notice that “MAP Volts” may change to one of the ADCR channels once you have made your selection. This behavior is normal:



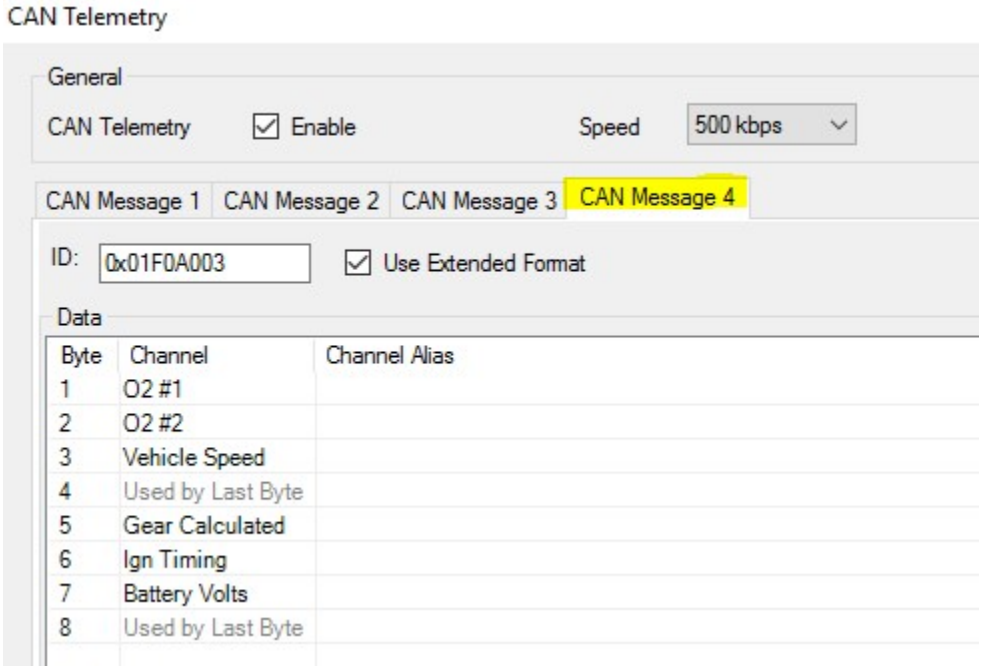
1. Now we must create CAN Message 2. Match CAN message 2 to the following:



2. Now create CAN Message 3 to match the following:



3. Now given the wizard's auto configuration, CAN Message 4 should already look like the following:



4. Skip the Automatic Transmission CAN protocol configuration and proceed to step # 7 on generating the CAN multiplier sheet on the bottom half of page 14 in this document.

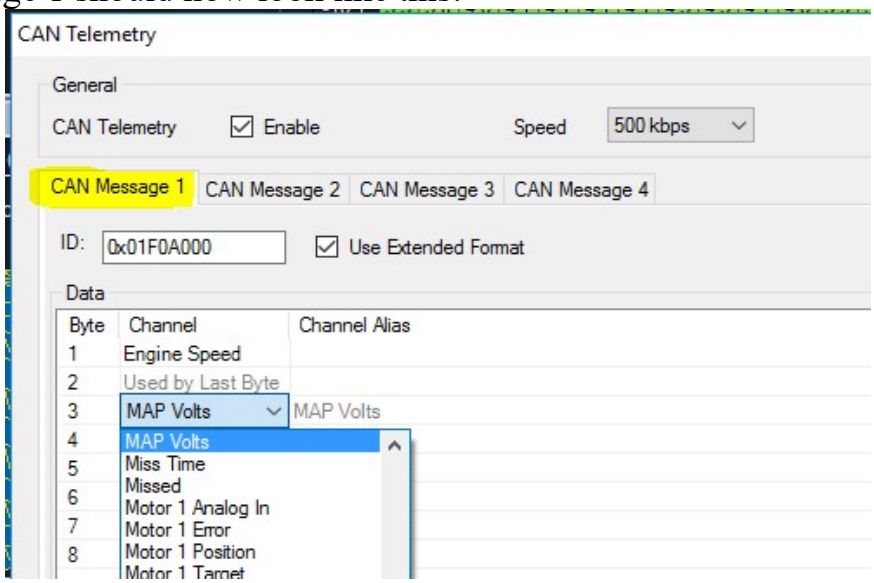
Auto CAN transmission:

(Automatic transmission cars) :

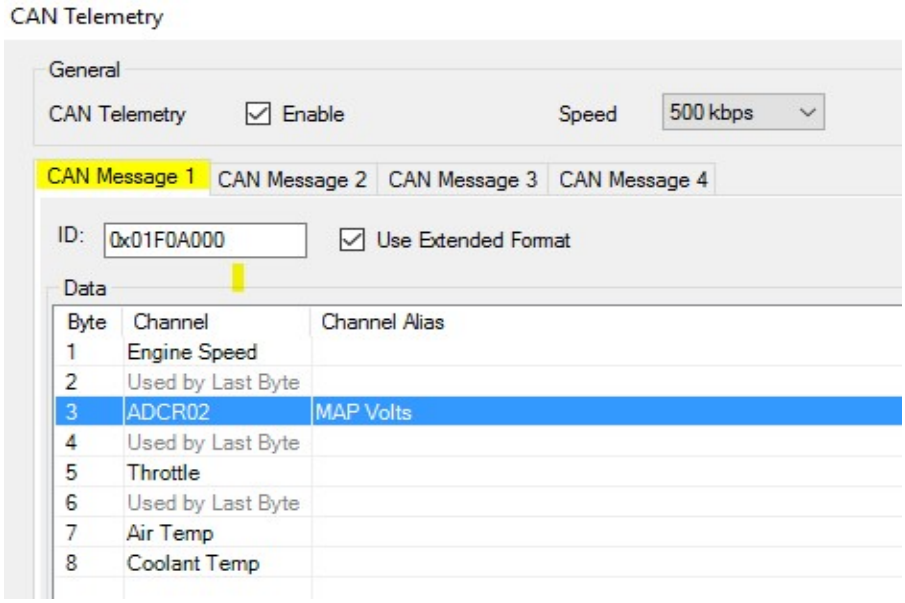
Can Message 1 should look like this:

Change Byte 3 from “Engine Load” to “MAP Voltage” AEM V2 is not capable of outputting the MAP pressure on the CAN bus, so we will need to put in a scalar and offset in the gauge in order to get our MAP Pressure.

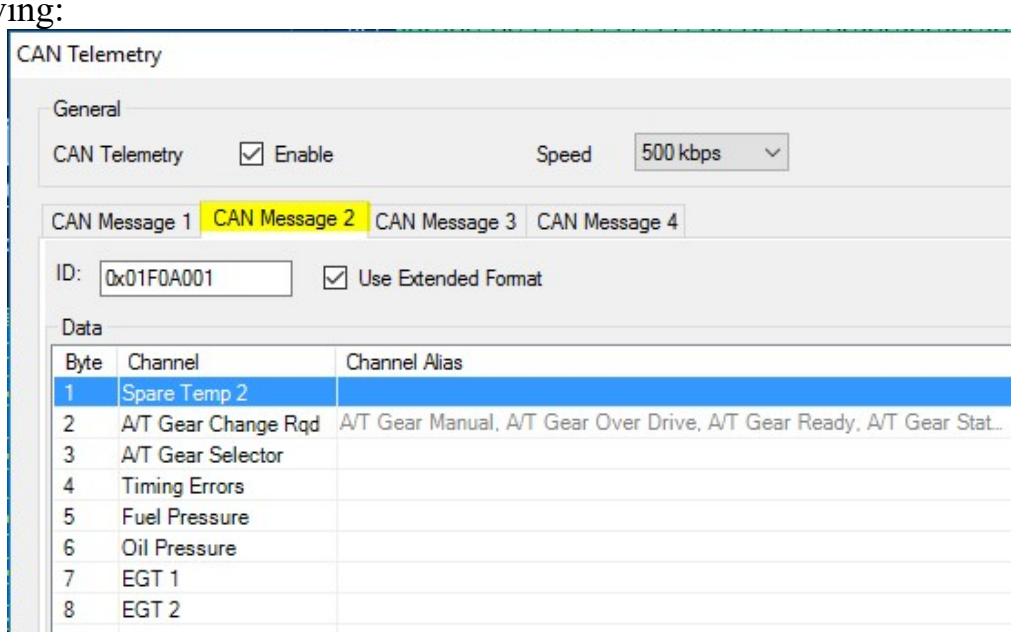
CAN Message 1 should now look like this:



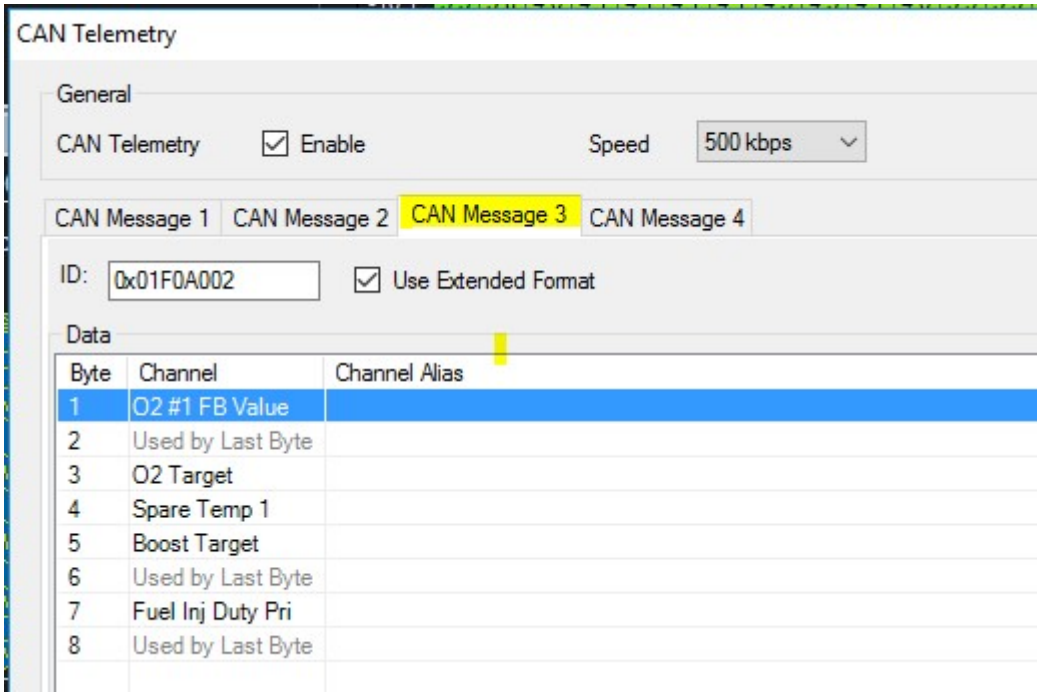
Notice that “MAP Volts” may change to one of the ADCR channels once you have made your selection. This behavior is normal:



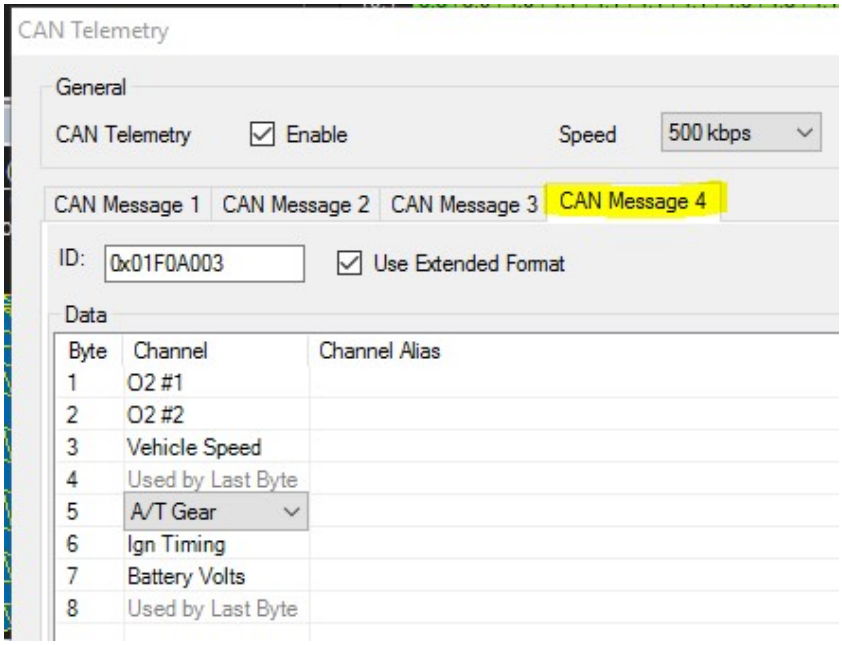
4A. Now we must create CAN Message 2. Match CAN message 2 to the following:



5A. Now create CAN Message 3 to match the following:

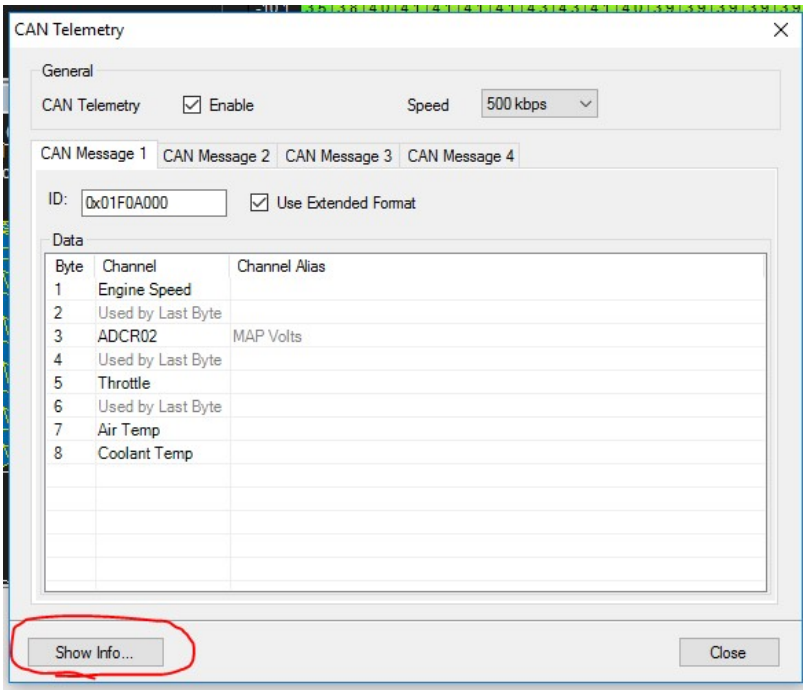


6A. Now given the wizard's auto configuration, CAN Message 4 should already look like the following, with exception of the "Gear Calculated". Change this to "A/T Gear".

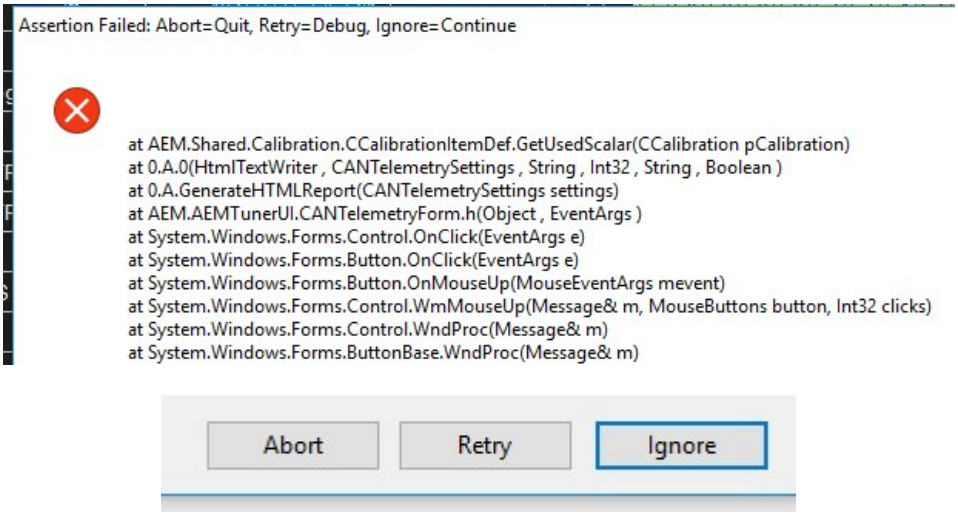


7. Generate the Multiplier Sheet:

Click on “Show Info” in order to generate the CAN Configuration Sheet with the Scalars and Offsets. We will need this info in order to ensure that the displays are accurate. Click “Show Info…” to generate the sheet.



Notice that sometimes it is possible to get an error when generating this sheet. You may have to click “Ignore” up to 3 times in order to get past this.



Telemetry Info

CAN Telemetry Settings

CAN Telemetry:	Enabled
Speed:	500 kbps

CAN Message Data

CAN Message 1

ID: 0x01F0A000

Byte	Name	Units	Scalar	Offset	Min	Max	Signed?	Bitmask
1	Engine Speed [msb]	rpm	0.390625	0	0.0	25599.6	No	
2	Engine Speed [lsb]							
3	ADCR02 [msb]	Volts	7.78198227635585E-05	0	0.0000	5.0999	No	
	(MAP Volts [msb])	Volts	7.78198227635585E-05	0	0.0000	5.0999	No	
4	ADCR02 [lsb]							
5	Throttle [msb]	%	0.00152587890625	0	0.000	99.998	No	
6	Throttle [lsb]							
7	Air Temp	°C	1	0	-128	127	Yes	
8	Coolant Temp	°C	1	0	-128	127	Yes	

'() indicates alias channels.'

CAN Message 2

ID: 0x01F0A001

Byte	Name	Units	Scalar	Offset	Min	Max	Signed?	Bitmask
1	Flex Fuel Content [msb]	%	1	-49	-31	1253083	No	
	(Flex Fuel Freq [msb])	Hz	1	1	19.1	1253132.9	No	
	(Flex Fuel Per [msb])	ms	0.000798000022768974	0	0.0000	52.2969	No	
2	Flex Fuel Content [lsb]							

Once the CAN Telemetry Settings Sheet is generated, the Fuel Pressure Scalar, Oil Pressure Scalar, Boost Target Scalar, O2 Scalar, and O2 Offset must be verified

Operation:

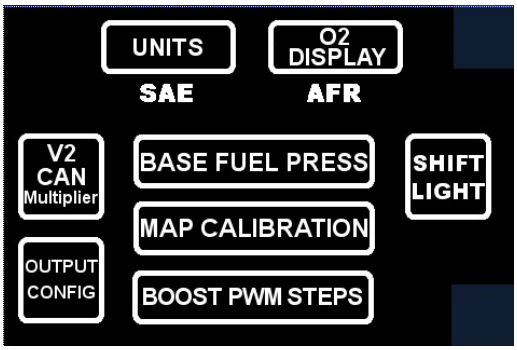
Upon powering up a properly terminated gauge, the Gauge will display the interface and version number.

Gauge Setup Options:

Touch the cog wheel on the touch screen in order to configure the gauge.

This will bring you into a screen where the Boost Control and Settings can be accessed.

Press the SETTINGS button will allow you to make the following changes:



UNITS button will allow the user to toggle between SAE and SI units. This applies to temperature, pressure, speed, and distance.

O2 DISPLAY button will change how the Oxygen sensor data is displayed.
The options are AFR and Lambda.

V2 CAN Multiplier:

This setup is critical in how the gauge functions and determines what data is brought in and how accurate it is.

First, select what type of setup this is:
Select “MANUAL/FLEX” or “AUTO” and press “NEXT” to continue.
Now we will need to refer to the CAN Telemetry info sheet that we generated earlier. Use this to adjust the Fuel Pressure Scalar, Oil Pressure Scalar, Boost Target Scalar, O2 Scalar, and O2 offset. Proceed through the menu and press next if the current value is correct. If the value needs to be adjusted, make the adjustments and press “NEXT” until the configuration is complete.

If the value in the gauge does not match the value on the sheet, adjust the value for said scalar or offset

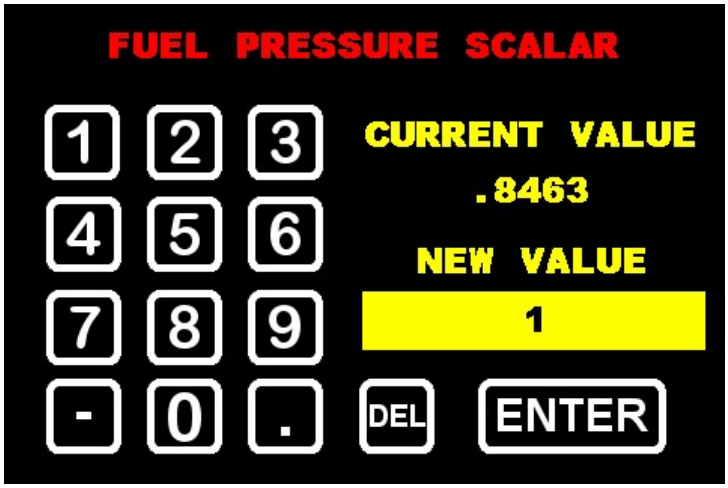
Example:

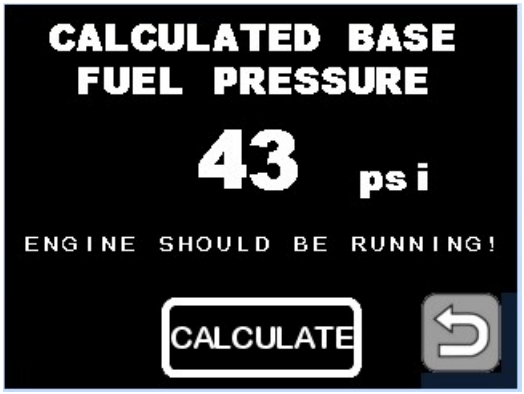
Telemetry Info

CAN Message 2

ID: 0x01F0A001

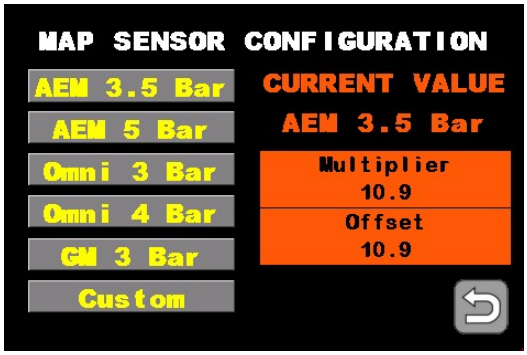
Byte	Name	Units	Scalar	Offset	Min	Max	Signed?	Bitmask
1	Flex Fuel Content [msb]	%	1	-49	-31	1253083	No	
	(Flex Fuel Freq [msb])	Hz	1	1	19.1	1253132.9	No	
	(Flex Fuel Per [msb])	ms	0.000798000022768974	0	0.0000	52.2969	No	
2	Flex Fuel Content [lsb]							
3	Fuel Pressure	psi	1	0	0	255	No	
4	Oil Pressure	psi	1	0	0	255	No	
5	Boost Target [msb]	%	0.863281291003659	0	0.0	25599.6	No	
6	Boost Target [lsb]							
7	EGT 1	°C	5	0	0	1275	No	
8	EGT 2	°C	5	0	0	1275	No	





Base Fuel Pressure configuration:

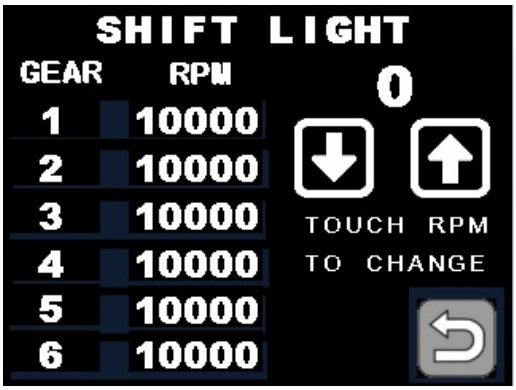
In order to calculate the base fuel pressure, the engine should be idling. Press the CALCULATE button and the base pressure will be calculated and displayed. This is used on the fuel screen in order to graph the fuel pressure vs. boost pressure for simple regulator function verification.



MAP CALIBRATION:

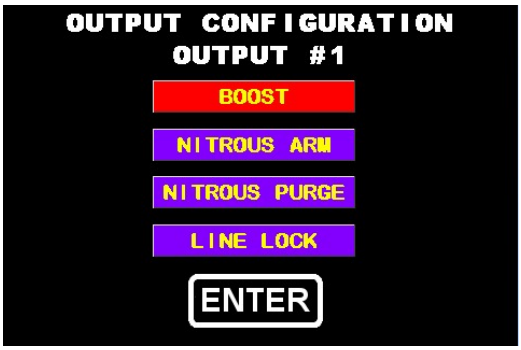
Given the nature of AEM V2's MAP sensor output on the CAN BUS, the proper MAP sensor that is being used must be selected here. Failure to do so, will result in improper MAP sensor readings.

***Pro tip** The number in the multiplier is the pressure value in psi that 1 volt will yield. The offset is the number needed to zero out the absolute pressure.*



Shift Light Configuration:

Touch the gear that you wish to change the shift light RPM on. That gear number will appear above the up and down arrows for verification. Use the up and down arrows to adjust the shift light RPM set-point of said gear. Press the back arrow button at the bottom right hand corner to save the settings. The shift light should flash once the settings are saved.



Output Configuration

The 2 outputs on the display may be configured to behave in different ways. This will determine what button options will be available to the user. Using the output for Boost Control, the output can be scaled dependant on the "Boost PWM Steps" This will make the output a 0-5 volt signal. Setting the output to be either "NITROUS ARM" or "LINE LOCK" will allow the use of a latching 5 volt output and selecting the "NITROUS PURGE" option will create a momentary 5 volt output.

Note that this is a **low current** output and is suitable for connecting to an input on the ECU.

If you wish to use the Nitrous Arm, Nitrous Purge, or Line Lock directly to the solenoid, relay or system, we do offer a low voltage to 12 volt 10 amp optically isolated relay in both 1 and 2 channels.

1 channel BTI part number: TTL-RLYx1

2 channel BTI part number: TTL-RLYx2

BOOST PWM Steps:

Use this feature to determine how many steps are to be programmed in the AEM Tuner software for

Boost . Typically the scale is from 0-5 volts and the max amount of steps allowed is 7 which give you 8 settings (0-7). Example: a value of 7 here would make each step would have a value of .71 volts. A value of 1 here would give the step a value of 5 volts. It is **imperative** to view each step in the AEM tuner software when configuring this as there could be a potential difference with regard to ground.

**** Note that these two settings should be configured by competent personnel. Raising the BOOST too much can have severe consequences. ****

Boost Control settings must be configured in the AEM Tuner software.

It is imperative to configure these inputs correctly. (if you are uncomfortable here, please take your vehicle to a competent shop)

Warranty:

All BTI Gauges carry a 1 year warranty effective at the time of purchase.

- This warranty extends only to products distributed and/or sold by BTI Gauges. It is effective only if the products are purchased and operated in the USA. (Within the USA including US 48 States, Alaska and Hawaii.)
- This warranty covers only normal use of the computer. BTI Gauges shall not be liable under this warranty if any damage or defect results from (i) misuse, abuse, neglect, improper shipping or installation; (ii) disasters such as fire, flood, lightning or improper electric current; or (iii) service or alteration by anyone other than an authorized BTI Gauge representative.
- You must retain your bill of sale or other proof of purchase to receive warranty service.
- No warranty extension will be granted for any replacement part(s) furnished to the purchaser in fulfillment of this warranty.
- Warranty claims must be sent to sales@btigauges.com.