Cruise Control Application Build

EMTRON

Contents

DISCLAIMER

(1) Cruise Control is designed to assist the driver and is not a substitute for safe and attentive driving practices. Please review the Cruise Control Application Build - Emtron, for important configuration instructions and cautions.

(2) Any failure to follow the directions provided in the Cruise Control Application Build- Emtron is at the sole risk of the user. In no event shall Emtron Australia be liable for any physical or financial injury, loss or damage or consequential loss or damage of any kind arising out of or relating to the use or misuse of this product in contravention of the specified instructions and cautions presented in the Cruise Control Application Build- Emtron.

(3) Not all vehicle configurations allow the use of Cruise Control due to hardware limitations. Please see your Cruise Control Application Build - Emtron, for further details and important safety information. Emtron Australia will not be liable for the improper use or improper setup of this function or product, and any physical or financial injury, loss or damage or consequential loss or damage, of any kind, arising from or relating to that improper use or improper setup.

1.0 Introduction

The Cruise Control Application Build is available for all Emtron ECUs. This build allows unique application specific firmware to be installed into the ECU.   The strategy involves the ECU managing engine torque (Nm) by calculating the correct throttle area for the target vehicle speed. The speed error is then corrected using a PID controller. It is important that the throttle body model is calibrated, and the engine model is correctly configured. The air flow model using the throttle mass flow calculation (TMF) requires a pressure reference pre and post throttle. In naturally aspirated applications the use of barometric pressure for the pre throttle channel will be enough to achieve reasonable results however it is recommended to install a pressure sensor pre throttle. Turbocharged applications must run a pre throttle pressure sensor. As shown in Table 1.0, any three boost pressure input channels may be used for the pre throttle pressure.

Table 1.0 Input Channels for a Boost Pressure Sensor

For further information on Throttle Mass Flow (TMF) refer to the Help Topic "Throttle Mass Flow Setup" located in the Emtune software package for a detailed explanation on how to configure and tune this system properly. **DO NOT** attempt to use the Cruise Control function until TMF calibration is complete.

2.0 Build Setup

The Cruise Control Application Build needs to be enabled by an authorised Emtron dealer before it may be installed into the ECU. Each build is locked to an ECU serial number, then available for installation from the Emtron online server.

2.1 Installation procedure:

1. Internet access is required for the build installation allowing Emtune to access the Emtron online server.
2. Connect Emtune to the ECU.
3. Firmware Version **2.17.0** or later should be used.
4. Select the File -> Build Management menu. A window will open and display all build options.
5. Select the Cruise Control option which should be listed as **INSTALL**. Press Ok.
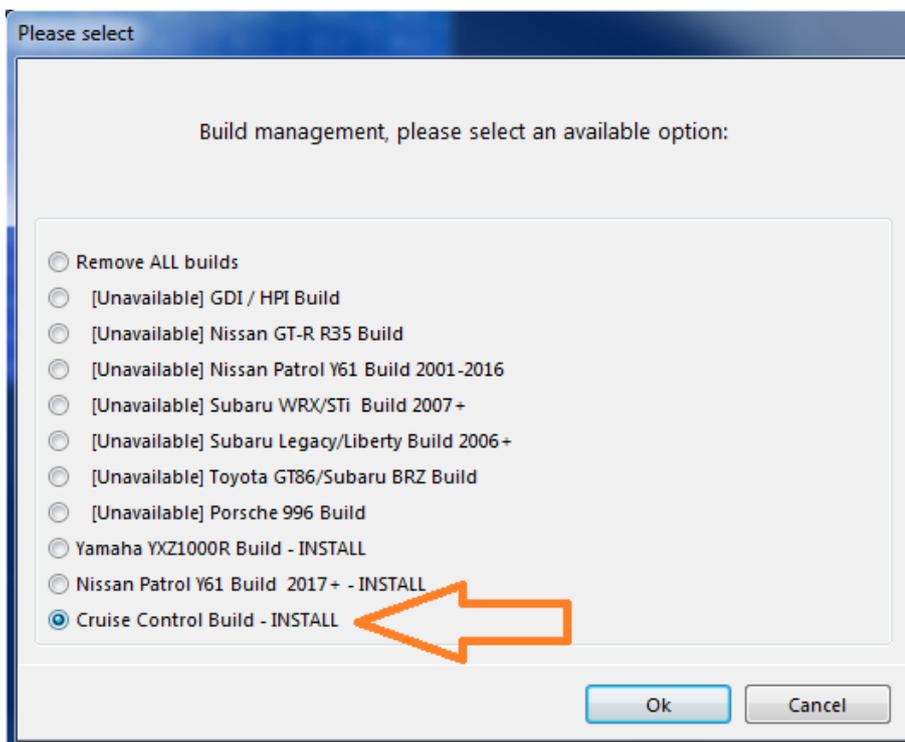
6. The installation process will take 5 -10 seconds. A message box will confirm a successful installation.
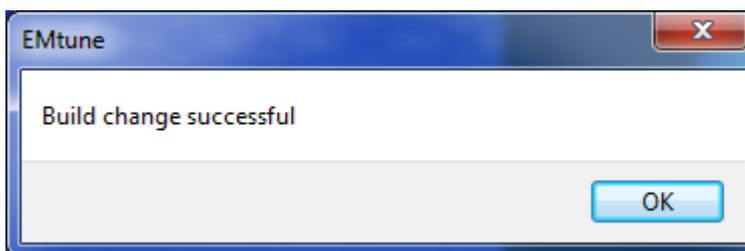
7. To further verify the installation of the build was successful and to view the status of all available builds, open the Runtime menu (F3 Button) and select the "ECU Internal" tab.

2.2 Uninstall procedure:

If the build has been previously installed it can be uninstalled at any time.
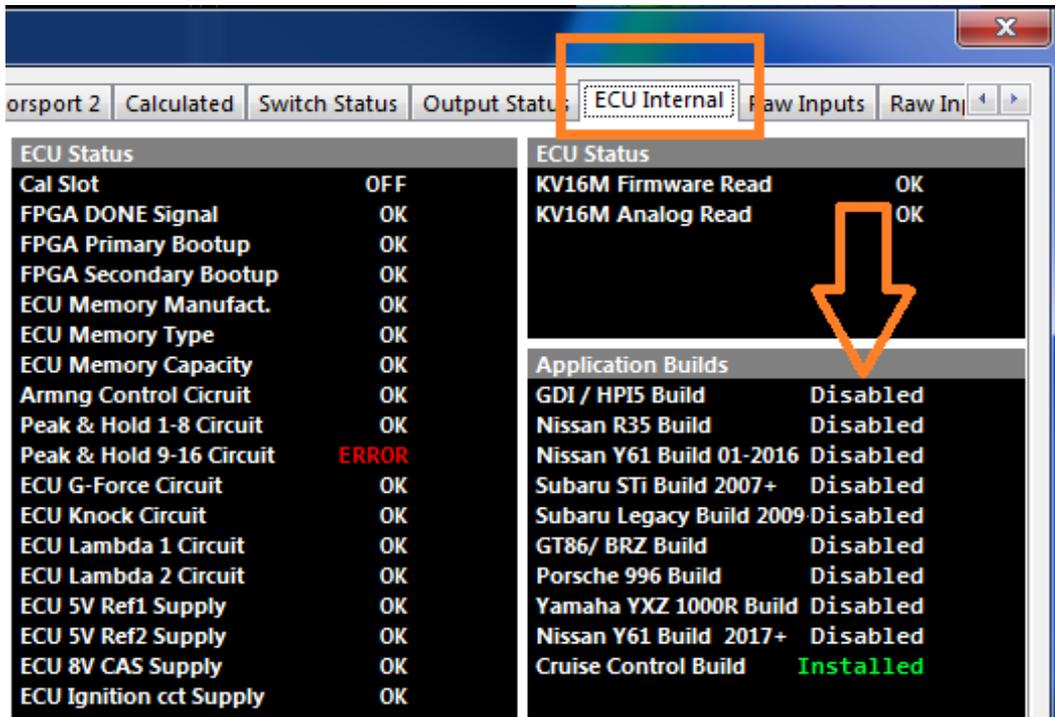
1. Internet access is required for the build uninstall, allowing Emtune to access the Emtron online server.
2. Connect Emtune to the ECU
3. Select the File -> Build Management menu. A window will open and display all build options.
4. Select the Cruise Control option which should be listed as **UNINSTALL**. Press Ok.

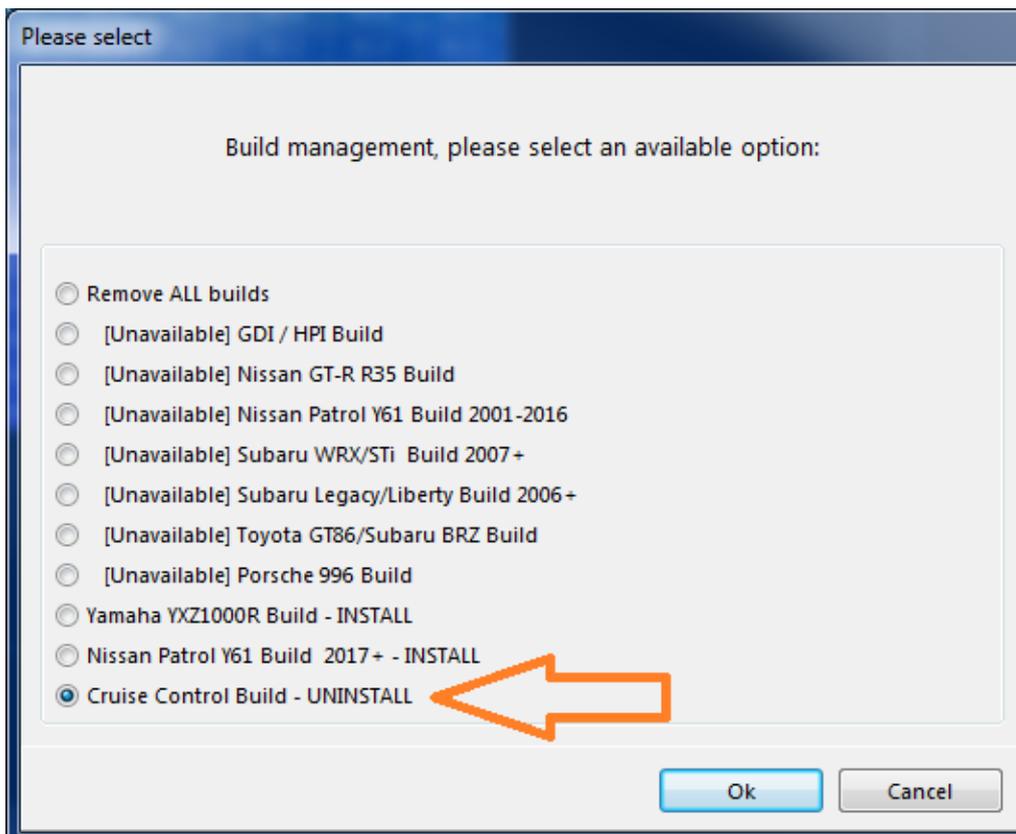5. The uninstall process will take 5 -10 seconds. A message box will confirm a successful uninstall.
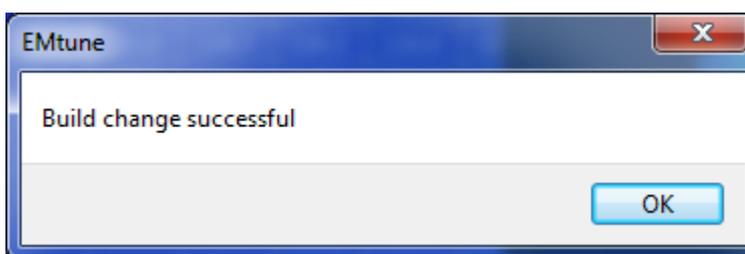
3.0 Configuration

For the function to operate correctly the following minimum requirements MUST be adhered to:

3.1 Input Switches

Brake Switch
Clutch Switch *
Cruise Enable Switch
Cruise SET/COAST Switch
Cruise RESUME/ACCEL Switch
Cruise CANCEL Switch

*Manual Transmission with mechanical clutch

Channel Name	Abrv	Input	Sensor Type	Active	ON	ON Threshold	OFF	OFF	Pullup	Engine
Power Steer Switch	**PSSw**	**DI 4**	**Switch**	**Off**	**Less Than**	**2.000V**	**Greater**	**3.000V**	**ON**	
Clutch Switch	ClutSw	OFF								
Neutral Switch	NeuSw	OFF								
Start Position Switch	StartSw	OFF								
Start/Stop Switch	SrtStpSw	OFF								
Ignition Switch	**IgnSw**	**Dedicated - Ign Sw**	**Switch**	**Falling**	**Greater**	**6.000V**	**Less Than**	**5.000V**	**OFF**	
Dual Boost Switch	D-BoostSw	OFF								
ECU Logging Enable Switch	LogENSw	OFF								
Speed Limit Enable Switch	SpdENSw	OFF								
Handbrake Switch	HndBkSw	OFF								
Brake Switch 1	**Brk1Sw**	**CAN BUS OEM**								
Brake Switch 2	Brk2Sw	OFF								
IC Spray Switch	IC1Sw	OFF								
IC Spray Switch 2	IC2Sw	OFF								
Oil Pressure Switch	OilPSw	OFF								
Dual DBW Switch	D-DBWSw	OFF								
Immobiliser Switch	ImmbSw	OFF								
Dual Tune Switch	D-TuneSw	OFF								
Fuel Used Reset Switch	UsedFRSw	OFF								
Distance Reset Switch	DistRSw	OFF								
Gear Request Switch 1	GearRqSw	OFF								
Gear Request Switch 2	GearRqSw	OFF								
Gear Request Switch 3	GearRqSw	OFF								
Gear Request Switch 4	GearRqSw	OFF								
Gear Request Switch 5	GearRqSw	OFF								
Hill Start Switch	HillSrtSw	OFF								
Cruise Enable Switch	**CruiseEN**	**Emtron Keypad Button 1**	**Switch**	**Off**	**Greater**	**0.000V**	**Greater**	**0.000V**	**OFF**	
Cruise SET/COAST Switch	**CruiseSET**	**Emtron Keypad Button 6**	**Switch**	**Off**	**Greater**	**0.000V**	**Greater**	**0.000V**	**OFF**	
Cruise RESUME/ACCEL Switch	**CruiseRS**	**Emtron Keypad Button 2**	**Switch**	**Off**	**Greater**	**0.000V**	**Greater**	**0.000V**	**OFF**	
Cruise CANCEL Switch	**CruiseCA**	**Emtron Keypad Button 5**	**Switch**	**Off**	**Greater**	**0.000V**	**Greater**	**0.000V**	**OFF**	

Table 3.0 Input Setup form input channels

3.2 Sensors

Speed Sensor
Boost Pressure Sensor (Pre plate pressure sensor)
Inlet Manifold Pressure Sensor (After plate pressure sensor)
Pedal Position Sensor Main
Pedal Position Sensor Sub
Servo Position Sensor Main
Servo Position Sensor Sub

3.3 Hardware

Electronic Throttle Body (DBW)
Throttle Pedal with two (2) position sensors

3.4 Function Lockouts

The ECU is constantly monitoring the required channels and will lockout cruise control if one (1) of these are either not configured, in fault or are not selected. See below:

Critical Lockouts:

1. "X-TMF1 Sensor Before Fault": Sensor in fault or is not selected for DBW 1
2. "X-TMF1 Sensor After Plate Fault": Sensor in fault or is not selected DBW 1
3. "X-TMF2 Sensor Before Fault": Sensor in fault or is not selected for DBW 2
4. "X-TMF2 Sensor After Plate Fault": Sensor in fault or is not selected DBW 2
5. "X-TMF Disabled" : Throttle Mass Flow function is off so Cruise Control is disabled
6. "X- Cruise Enable Sw Config". The Cruise Control Enable (Off/On) switch is not configured
7. " X- Cruise SET Sw Config". Cruise Control Set switch is not configured
8. " X- Cruise RESUME Sw Config" Cruise Control Resume switch is not configured
9. "X- Cruise CANCEL Sw Config". Cruise Control Cancel switch is not configured
10. " X- Cruise No Sw Config". There are no Cruise Control switches configured
11. "X-Speed Source Config". There is no Cruise Speed channel configured
12. "X-Brake Input Config. There is no Brake switch configured
13. "X-Firmware Lockout". Application build is disabled.

Non-Critical Lockouts

1. OFF-Cruise Enable Sw
2. OFF-Cruise Cancel Sw
3. OFF-Engine Speed Zero
4. OFF-Ref Speed Zero
5. OFF-Limiting Active
6. OFF-Brake Switch
7. OFF-Neutral
8. OFF-Clutch Switch

The Cruise Control Status runtime will update to indicate which condition is locking out the function. An example is shown in Figure 3.0.
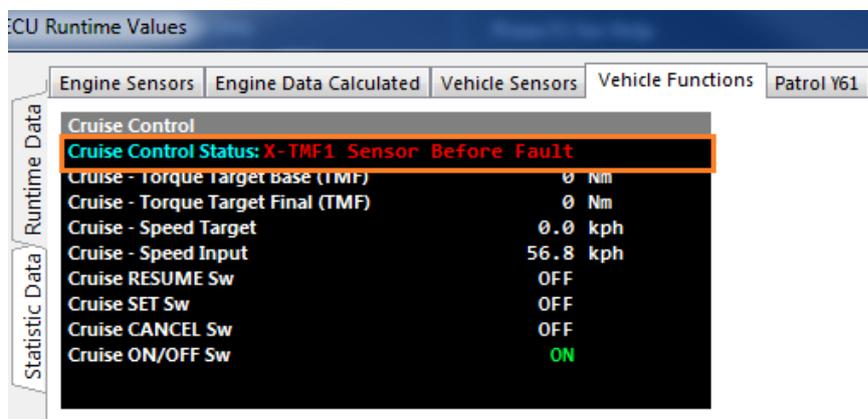

Figure 3.0. Runtime menu, Cruise Control Runtimes

3.5 Function Enable

Once the Cruise Control Build is enabled the function needs to be enabled. Config->Functions->Function Output Setup->Vehicles Functions 2->Cruise Control . See Table 3.1.

Table 3.1 Function Output Setup form

4.0 Tuning System

Calibration of the Cruise Control system is done in the Emtune Tuning View tab.

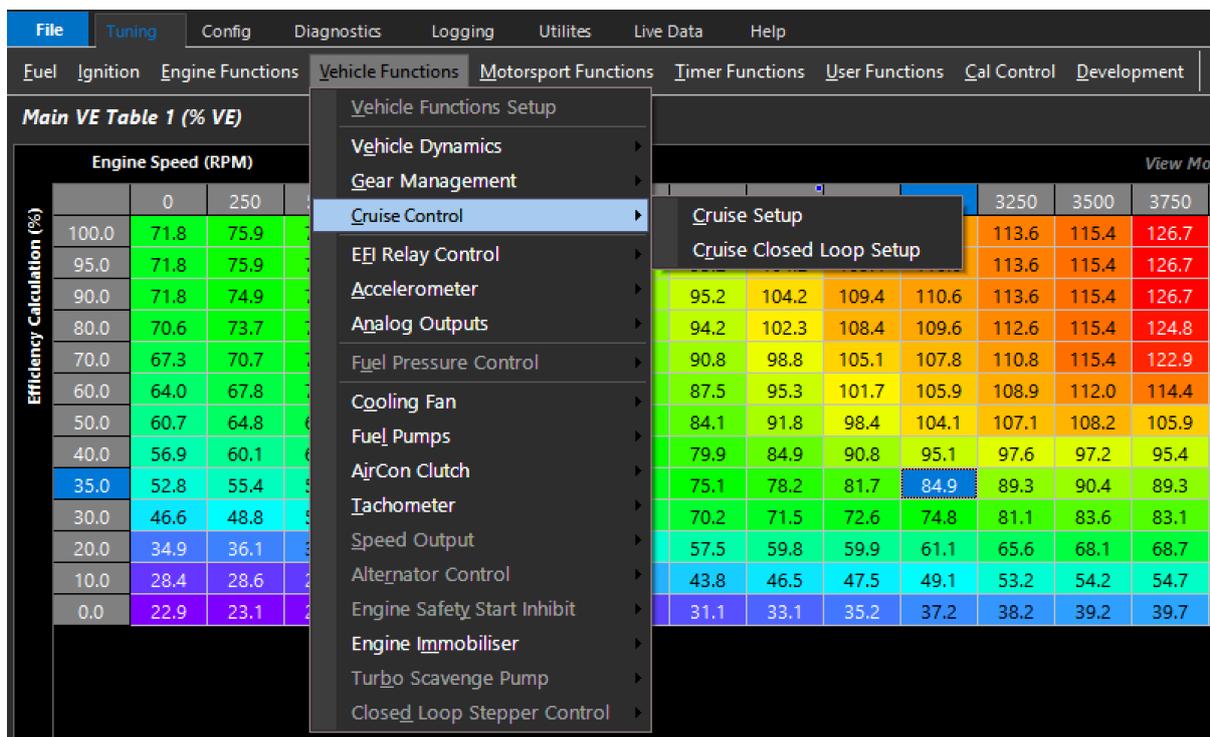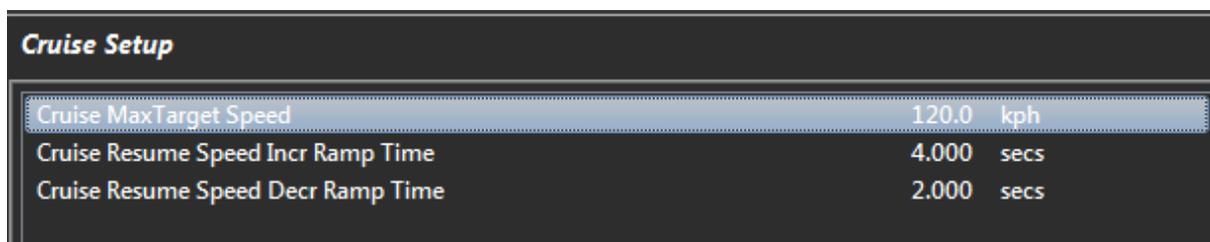Tuning->Vehicle Function->Cruise Control->Cruise Setup

Table 4.0 Tuning View Cruise Control Menu

4.1 Cruise Setup

Cruise Max Target Speed

This is the maximum target speed that can be set. The ECU clamps to this value.

Cruise Resume Speed Incr Ramp Time

This is the time the ECU will gradually increase the speed target back to the previously "Set" speed after a lockout has been invoked. This is to achieve a smooth acceleration rate back to the target speed.

Cruise Resume Speed Decr Ramp Time

This is the time the ECU will gradually decrease the speed target back to the previously "Set" speed after a lockout state has been cleared. This is to achieve a smooth transition back to the target speed.

4.2 Cruise Closed Loop Setup

The system relies on a combination of feedforward TMF torque based latching coupled with a PID system to control the speed.

Cruise Control Speed Channel

Any speed channel in the ECU may be used as the input channel. This is used by the speed target.

Cruise Proportional Gain

This is the gain due to the instantaneous error in speed. *Typical value 1.00*

Cruise Integral Gain

This is the gain due to the error with respect to time. *Typical value 0.010*

Cruise Derivative Gain

This is the gain due the rate of change of the error. *Typical value 12.00*

Cruise Deadband +/-

This is the speed range which will hold the output. *Typical value 0.2km/h*

Cruise Maximum Torque Clamp

The maximum clamp the system can use to attain the target speed. Set to allow the system enough torque to always achieve the target. *Typical value 200-300 Nm*

Cruise Minimum Torque Clamp

The minimum clamp the system can use to attain the target speed. Usually this will be set to ensure maximum deceleration. *Typical value -100 Nm*

The system employs an error counter which is triggered when the Cruise Minimum Torque Clamp and the Maximum Torque Clamp have been hit.   The larger the target error when the torque clamps are latched the faster the error counter will increment. The system will shut down once the counter reaches the pre-determined value set. This setting is not adjustable by the user.

4.3 Runtimes

The runtimes relating to the function may be accessed for quick viewing through the ECU Runtime Menu by pressing the F3 hotkey:

Runtime Data->Vehicle Functions->Cruise Control

ECU Runtime Values

Table 4.1 ECU runtime values for Cruise Control

Cruise Control Status: The current system status.

- **Disabled**: System is OFF
- **ON**: System is currently active
- **... Waiting SET/RESUME Sw**: System is armed however in a lockout state awaiting user input to re- engage
- **Starting-SET Pressed**: Set has been pressed and the system will become active. The current speed will be loaded as the "Speed Target"
- **Restarting-RESUME Pressed**: The system will resume and the last loaded Speed Target will be re engaged.
- **ON – Paused Pedal**: The system is active but the driver is inputting a higher throttle area demand than is being requested. Normal operation will resume after the driver input is removed. As this state is controlled by the pedal area demanded, it is important that the "Pedal to Throttle Area Translation Table" has a 0.0 setting in the "Pedal Position Demand" 0% axis.

Cruise – Torque Target Base (TMF)

When the system becomes active the TMF calculated torque value is loaded and used as the base torque reference. This is then converted into a throttle area demand.

Cruise – Torque Target Final (TMF)

The PID system adjusts the Torque output using the Torque Target Base as a feed forward. It will continue to adjust this value which is then converted into a throttle area demand in order to achieve the target speed.

Cruise – Speed Target

This is speed target loaded that the PID will attempt to achieve.

Cruise – Speed Input

This is the actual reported speed the system is referencing. The user selected channel speed is used and reported here.

Cruise RESUME Sw

Switch state for the RESUME switch. This should be monitored to confirm the correct button assignment.

Cruise SET Sw

Switch state for the SET switch. This should be monitored to confirm the correct button assignment.

Cruise CANCEL Sw

Switch state for the CANCEL switch. This should be monitored to confirm the correct button assignment.

Cruise ON/OFF Sw

Switch state for the ON/OFF switch. This is the main enable switch for the cruise control system. This should be monitored to confirm the correct button assignment.

Appendix A - Bit CAN Message Information

Bit CAN Message Information for "Cruise Control Status" runtime

0	Disabled
1	ON
2	... Waiting SET/RESUME Sw
3	Starting-SET Pressed
4	Restarting-RESUME Pressed
5	ON - Paused Pedal
6	-----
7	-----
8	-----
9	-----
10	-----
11	-----
12	-----
13	-----
14	-----
15	-----
16	-----
17	-----
18	-----
19	-----
20	OFF-Cruise Enable Sw
21	OFF-Cruise Cancel Sw
22	OFF-Engine Speed Zero
23	OFF-Ref Speed Zero
24	OFF-Limiting Active
25	OFF-Brake Switch
26	OFF-Neutral
27	OFF-Clutch Switch
28	-----
29	X- TMF Disabled
30	X-TMF1 Sensor Before Fault
31	X-TMF1 Sensor After Fault
32	X-TMF2 Sensor Before Fault
33	X-TMF2 Sensor After Fault
34	X-Cruise Enable Sw Config
35	X-Cruise SET Sw Config
36	X-Cruise RESUME Sw Config
37	X-Cruise CANCEL Sw Config
38	X-Speed Source Config
39	X-Brake Input Config
40	X-Firmware Lockout