Section 5.3
Cruise Control

Cruise Control maintains a targeted speed (mph) by increasing or decreasing fueling. The targeted speed can be selected and adjusted with dash-mounted switches. Up to five digital inputs are required (four for automatic transmission) for Cruise Control operation. A Vehicle Speed Sensor (VSS) or an output shaft speed message over the J1939 data link is required for Cruise Control.

Section 5.3.1
Operation

Cruise Control operates to control vehicle speed. A Vehicle Speed Sensor (VSS) must be installed or output shaft speed is received over J1939. Engine speed and power are varied under Cruise Control to maintain the set vehicle speed. The vehicle speed must be above “Min Cruise Set Speed” and below “Max Cruise Set Speed.” It is recommended that “Max Cruise Set Speed” be set to the default to allow proper operation of other features such as Fuel Economy Incentive and PasSmart. The “Max Road Speed” should be used to limit vehicle throttle speed.

Cruise Control can be overridden at any time with the throttle pedal if the vehicle is operating at less than the programmed Max Road Speed.

Clutch pedal and service brake pedal, if configured, are monitored to abort fueling the engine in Cruise Control Active Mode if there is driver action.

Note: DDEC 10 must see a change of state of the Cruise Master Switch, Clutch Switch (if configured) and Service Brake Switch before Cruise Control can become active upon every ignition cycle.

There are three Cruise Control operation modes as listed in Table "Three Cruise Control Operation Modes" .

Cruise Control Mode	Conditions	Set Speed	Engine Fuel Controlled By Cruise Control
Off	Cruise Control ON/OFF switch is in OFF position or Cruise Control ON/OFF is switched to ON position although Cruise Control is not initiated.	0 mph	No
Active	Cruise Control ON/OFF switch in ON position and Cruise Control is initiated and set speed has already been set. The set speed can be increased or decreased by using the Resume/Accel and Set/Coast switches.	Set Speed (+/-)	Yes
Standby	Cruise Control ON/OFF switch in On position and Cruise Control formerly active but not allowed anymore or no set speed has been set after switching Cruise Control On and Cruise Control is initiated.	Last Set speed on Hold in Memory	No

Table 1. Three Cruise Control Operation Modes

Section 5.3.1.1
Engine Brakes in Cruise Control (Optional)

If driving conditions cause the vehicle speed to exceed the Cruise Control set speed, engine brakes (if

configured) are activated to keep the desired road speed based on engine brake dash switches.

Section 5.3.1.2
Cruise Auto Resume (Optional)

The Cruise Auto Resume feature will resume Cruise Control based on the calibration setting.

1 = Cruise Control is resumed immediately after the clutch pedal is released.

2 = Cruise Control is resumed if the clutch has been pushed twice and released within three (3) seconds.

Section 5.3.1.3
Adaptive Cruise (Optional)

Adaptive Cruise systems will send a "heart beat" message on the SAE J1939 Data Link. Manual Cruise Control and Adaptive Cruise will be disabled if the message is not received over the data link or the message indicates that there is a failure in Adaptive Cruise. To enable standard Cruise Control, the driver must toggle the Cruise Master Switch twice within 10 seconds.

Adaptive Cruise uses a third party system to maintain a range between vehicles.

Section 5.3.1.4
Cruise Power

Cruise Power is an optional engine rating which operations on a higher horsepower during Cruise Control. DDEC10 automatically switches to the cruise power rating when Cruise Control is turned on. This extra power gives the driver an incentive to run in Cruise Control whenever possible. Cruise Power can be selected with DRS, DDDL or VEPS. For more information, refer to "5.8 Engine Ratings" , “Engine Ratings.”

Section 5.3.1.5
Cruise Enable

Cruise Control is in standby, but not active when the Cruise Control Enable digital input is switched to battery ground.

The Cruise Enable switch is a normally open switch.

Section 5.3.1.6
Set / Coast

The Set/Coast switch is a momentary switch.

Set:	Cruise Speed is set by momentarily contacting the switch to the ON position (switching the digital input to battery ground). Cruise Control will become active and maintain the vehicle speed present at the time.
Coast:	When Cruise Control is active, the Set/Coast input can be used to reduce power and speed by toggling the switch. Momentarily toggling and releasing the Set/Coast switch will decrease the set point by 1 mph (1.6 km/h) increments for Cruise Control. Holding the Set/Coast will decrease the set point by 1 mph (1.6 km/hr.) per second. When released the Cruise Control set point will be at the current speed.

Section 5.3.1.7
Resume / Accel

The Resume/Accel switch is a momentary switch.

Resume:	If Cruise Control has been disabled with the service brake or the clutch switch, momentary contact to the ON position (switching the input to battery ground) restores the previously set cruise speed.
Accel:	When Cruise Control is active, the Resume/Accel input can be used to increase power and speed by toggling the switch. Momentarily toggling and releasing the Resume/Accel switch will increase the set point by 1.24 mph (2 km/hr.) increments for Cruise Control. Holding the Resume/Accel will increase the set point by 1.24 mph (2 km/hr.) per second. When released the Cruise Control set point will be at the current speed.

Section 5.3.1.8
Pause Switch

In addition to these main controlling switches, Cruise Control may be temporarily disabled by pressing the Pause Switch. Depending on configuration, the switch is either hardwired or evaluated from the J1939 CCVS message. When disabled through the Pause Switch, Cruise Control can be resumed at the previous set point by toggling the Resume Switch.

Section 5.3.1.9
Clutch Released (Manual Transmissions)

This input indicates that the clutch is released and is used for suspending Cruise Control and Auto Resume.

When the clutch is released, the input is at battery ground.

The digital input logic for the Clutch Switch disables Cruise Control in the unlikely event of a broken clutch switch wire.

This switch is a normally closed switch.

Section 5.3.1.10
Service Brake Released (Automatic and Manual Transmissions)

This input indicates that the brake is released when switched to battery ground. If the brake is activated, then the input is not grounded and Cruise Control is suspended. Cruise Control is resumed by using the Resume/Accel Switch.

The input logic for the Brake Switch disables Cruise Control in the unlikely event of a broken brake switch wire.

This switch is a normally closed switch.

Section 5.3.1.11
Soft Cruise

Soft Cruise feature reduces the available torque at the cruise set speed. Full-load torque curve ramps

back up only after the vehicle speed drops below the cruise set speed down to a calibrated delta. This effectively pre-filters the Cruise Control system's torque requests and reduces the overall fuelling required to operate the vehicle. Preliminary test results show potential for fuel economy improvement using this feature.

The Soft Cruise feature also introduces an alternate set of engine retarder switch ON/OFF speeds (vehicle speed triggers) based on the estimated grade of the road:

- Steeper grades result in more aggressive engine retarder behavior
- Mild grades reduce engine retarder engagement to maximize vehicle inertia

Diagnostic Name	Parameter Group	Min	Max	Default	Range	Access
SCruise Eng Ret1 On Thres Spd	10	0	31.75	3	Soft Cruise alternative engine brake activation threshold stage 1	DRS, VEPS, DDDL 7.X
SCruise Eng Ret2 On Thres Spd	10	0	31.75	5	Soft Cruise alternative engine brake activation threshold stage 2	DRS, VEPS, DDDL 7.X
SCruise Eng Ret3 On Thres Spd	10	0	31.75	8	Soft Cruise alternative engine brake activation threshold stage 3	DRS, VEPS, DDDL 7.X
SCruise Eng Ret1 Off Thres Spd	10	0	31.75	1	Soft Cruise alternative engine brake deactivation threshold stage 1	DRS, VEPS, DDDL 7.X
SCruise Eng Ret21 Off Thres Spd	10	0	31.75	3	Soft Cruise alternative engine brake deactivation threshold stage 2	DRS, VEPS, DDDL 7.X
SCruise Eng Re3 Off Thres Spd	10	0	31.75	5	Soft Cruise alternative engine brake deactivation threshold stage 3	DRS, VEPS, DDDL 7.X
Soft Cruise Enable	15	0	8	0	0 = disable 4 = Soft Cruise enabled 8 = Soft Cruise enabled with alternative engine brake thresholds	DRS, VEPS, DDDL 7.X

Table 4. Soft Cruise

Section 5.3.1.12
Cruise V Speed May Exceed RSL

The CPC calculates the initial maximum vehicle speed. Normally, Max Road Speed is used as the vehicle speed threshold. A higher vehicle speed is executed only when Cruise V Speed may exceed RSL is enabled, otherwise Max Road Speed is used.

The logic is the CPC is based on detected accelerator pedal override events (override the current cruise speed by means of the accelerator pedal). Whenever the calibration is set, Max Cruise Set Speed is used as the maximum vehicle speed when in Cruise Control instead of Max Road Speed if the vehicle speed is at or below Max Road Speed.

Whenever a Cruise Control accelerator pedal override situation occurs and the current cruise set speed is already above Max Road Speed, the current vehicle speed is maintained as vehicle speed threshold for the Road Speed Limiter governor.

The parameters for Cruise V Speed are Max Road Speed (the vehicle speed limit not in cruise), Max Cruise Set Speed (active Cruise Control with no accelerator pedal override) and Cruise V Speed May exceed RSL (Cruise control driving above the legal speed limit and accelerator pedal override by driver). These parameters are listed in the table.

Parameter Group	Parameter	Description	Options	Default	Access
15	Min Cruise Set Speed	Minimum road speed for Cruise Control	8 – 152 km/hr	32 km/hr	DDDL 7.X, DRS, VEPS
15	Max Cruise Set Speed	Cruise Control vehicle set speed cannot be faster than this value.	48–152 km/hr	104.6 km/hr	DDDL 7.X, DRS, VEPS
15	Increment Cruise Set Speed	Set Speed increment for every Resume/Accel switch momentary press.	0–10 km/hr	1.6 km/hr	DDDL 7.X, VEPS, DRS
15	Decrement Cruise Set Speed	Set Speed decrement for every Set/Coast switch momentary press.	0–10 km/hr	1.6 km/hr	DDDL 7.X, VEPS, DRS
15	Enable Cruise Auto Resume	Enables or disables the auto resume feature.	0 – Disable 1 – Enable automatic cruise resume function after clutch has been released once 2 – Enable after clutch released twice 3 – Resume ZF Astronic Style	0	DDDL 7.X, DRS, VEPS
15	Cruise Power	Enables Cruise Power function	0 – High Power 1 – Low Power Only 2 – Cruise Power Enabled	0 – High Power	VEPS, DRS
10	Cruise Control Enable Engine Brk	Enables or disables the engine brakes during Cruise Control.	0 – Disable 1 – Enable automatic engine brake operation with Cruise Control	0	DDDL 7.X, DRS, VEPS
10	Road Spd Limit Max Stage Num	Enables engine brake on road speed limiter. Engine brake will come on automatically if value >0.	0 = Off 1 = Low 2 = Medium 3 = High	0	DRS, VEPS

Table 5. Cruise Control Parameters

Section 5.3.2
Predictive Cruise Control (PCC)

The PCC was developed to improve fuel economy. The basic idea is using the vehicle's inertia or momentum by going downhill or uphill by changing the drivers cruise set speed according the topology of the terrain. The Software allows the CPC (Common Powertrain Controller) to support predictive cruise control (PCC) functionality.

The PCC ECU is a unit which has road map data stored and a GPS sensor. By comparing current position with the stored map data, the PCC unit is able to "foresee" a coming hill and therefore change the driver's cruise set speed.

Changing the driver's cruise set speed is done via CAN communication. The PCC unit communicates with the GPS sensor over a serial link and the rest of the vehicle over the J1939 CAN link.

Section 5.3.2.1
PCC State Transition

The state diagram that describes the PCC logic is demonstrated in the graphic below.

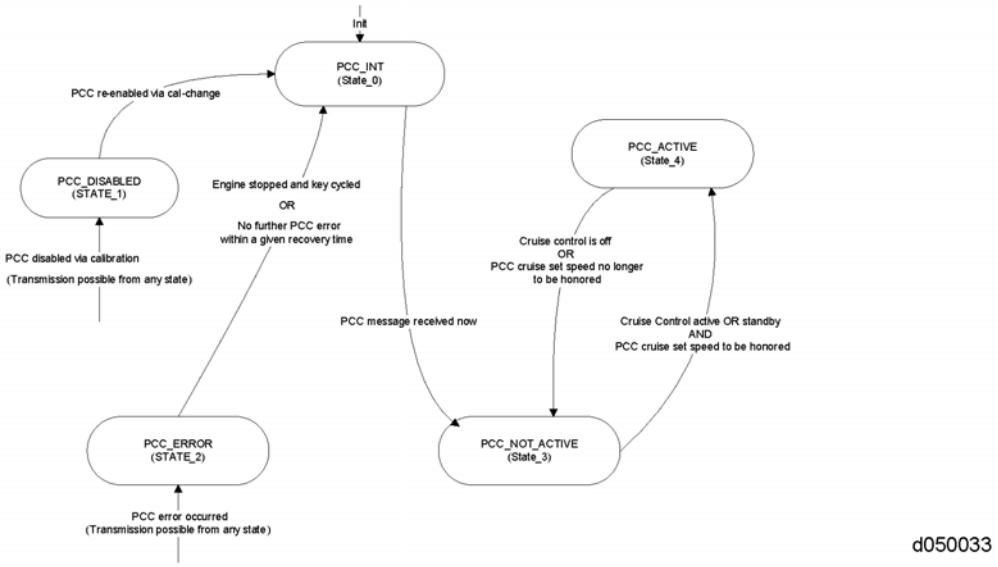

Figure 1. PCC State Diagram

Section 5.3.2.2
PCC Set Speed Calculation

CPC will only honor a PCC desired cruise set speed when the PCC is in active state.

The cruise set speed evaluation is determined by the driver's cruise set speed plus an offset, which is calculated from the PCC requested cruise set speed. The CPC will then calculate the difference between PCC desired cruise set speed and the driver's cruise set speed, where the driver's cruise set speed is identical to the display value. The difference vehicle speed is then limited by a lower speed bound and an upper speed bound.

If PCC is switched off or if the PCC desired cruise set speed changes fast, a gradient limitation with an

adjustable ramp rate, is applied to the difference vehicle speed allowing a smooth transition. The final cruise set speed is determined by the driver's cruise set speed plus the calculated offset.

Section 5.3.2.3
PCC Heartbeat

The PCC is required to periodically transmit a 'heartbeat' message over the j1939 link in the PCC status 1 message, to inform the CPC 2 of its status. The pccs1 message is expected to arrive every 40 ms, which in turn increments a rolling counter.

Section 5.3.2.4
Programming Requirements And Flexibility

Parameter Group	Parameter	Description	Options	Default	Access
54	PCC Eng Brake Mode	Predictive Cruise Engine Brake Activation	0=OVS with standard thresh., 1=OVS with alternate thresh.	0	DDDL 7.X, DRS, VEPS
54	PCC RSL Mode	Predictive Cruise Road Speed Limiter Mode	0=RSL limit only, PCC offset ignored, 1=RSL limit add PCC offset	0	DDDL 7.X, DRS, VEPS
15	Cruise Control Mode Selection	Regular Cruise Control/Active Cruise Control Mode	0=Normal Cruise Control, 1=Soft Cruise Enabled, 2=Predictive Cruise / Normal Cruise as backup, 3=Predictive Cruise / Soft Cruise as backup	0	DDDL 7.X, DRS, VEPS

Section 5.3.3
Installation

The following is a list of switches and CPC2+ sensors that are required for Cruise Control operation.

- Cruise Control ON/OFF (Switch or J1939)
- Service Brake (Switch or J1939)
- Clutch Released for Manual Transmission (Switch or J1939)
- Set/Coast (Switch or J1939)
- Resume/Accel (Switch or J1939)
- Vehicle Speed Sensor (or J1939)

See Figure "Cruise Control Circuit" for a diagram of the Cruise Control circuit.

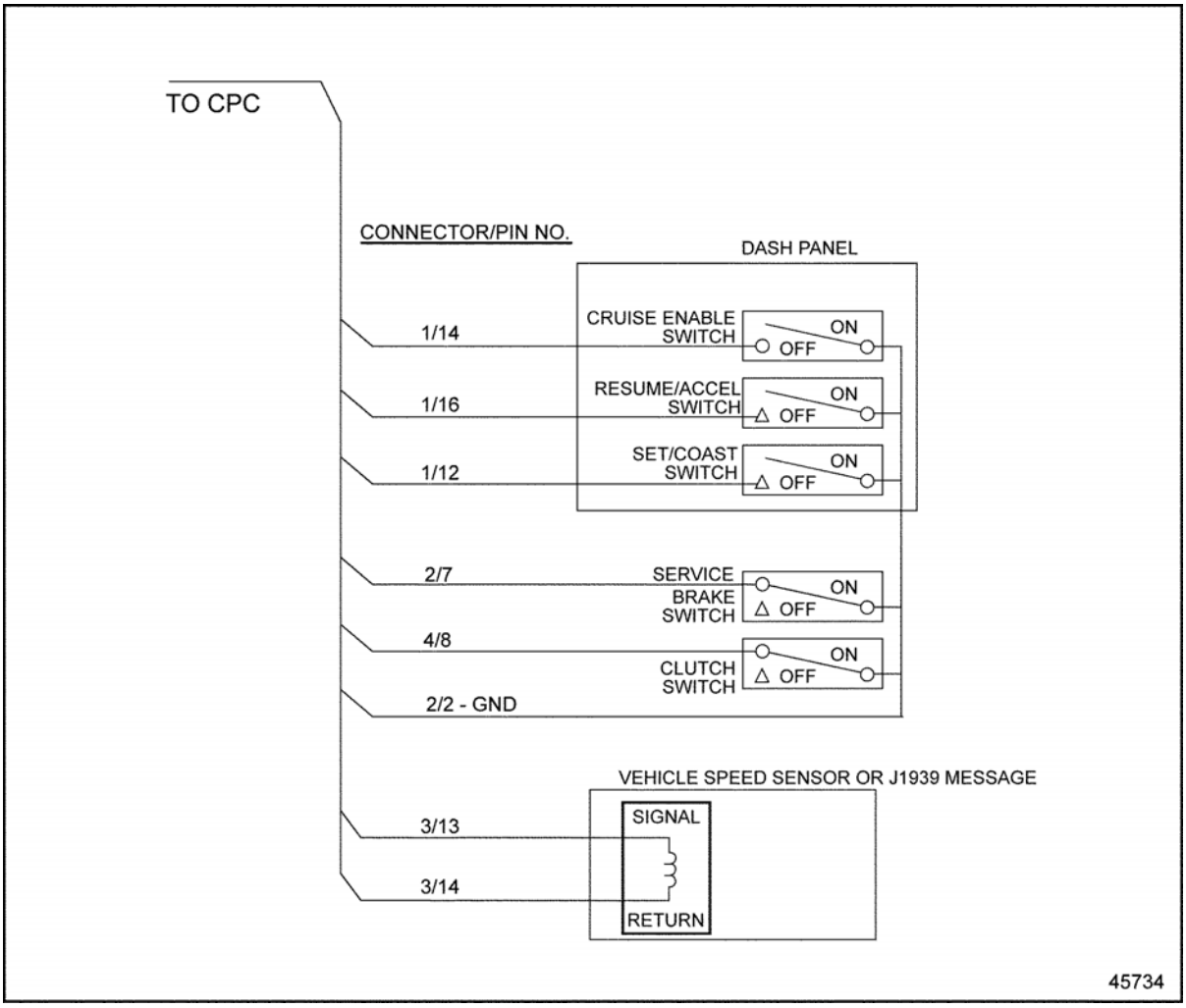

Figure 2. Cruise Control Circuit

Section 5.3.4
Programming Requirements and Flexibility

To configure an engine for Cruise Control, the digital inputs listed in Table "Cruise Control Input Configuration" must be selected. These parameters can be set with VEPS or DRS. Refer to "4.1 Inputs" , “ Inputs,” for more information.

Parameter Group	Parameter	Options	Default	Access
13	4 08 DI Selection	0 = Disable 1 = 1Clutch Switch 2 = PTO Request for AGS2	1 = 1Clutch Switch	VEPS, DRS
		0 = Hardwired		VEPS,

13	Trans Neutral Input Config	1 = Info from J1939 255 = Not Available	0 = Hardwired	DRS
13	Service Brake Switch Config	0 = Hardwired 1 = CCVS1 2 = CCVS2 3 = CCVS3	0 = Hardwired	VEPS, DRS
13	CC ON OFF Switch Config	0 = Hardwired 1 = CCVS1 2 = CCVS2 3 = CCVS3	0 = Hardwired	VEPS, DRS
13	CC Set Cst Res Accel Config	0 = Hardwired 1 = CCVS1 2 = CCVS2 3 = CCVS3 4 – CCVS1 or CCVS2 5 – CCVS2 or CCVS3 6 – CCVS1 or CCVS3 7 — CCVS1 or CCVS2 or CCVS3 8 – CCVS1 or hardwired 9 – CCVS2 or hardwired 10 – CCVS3 or hardwired 11 – CCVS1 or CCVS2 or hardwired 12 – CCVS2 or CCVS3 or hardwired 13 – CCVS1 or CCVS3 or hardwired 14 – CCVS1 or CCVS2 or CCVS3 or hardwired	0 = Hardwired	VEPS, DRS
		0 = No Clutch Switch 1 = 1 Clutch Switch		

13	Clutch Switch Config	2 = 2 Clutch Switch* 3 = CCVS1 4 = CCVS2 5 = CCVS3 6 = ETC1	0 = No Clutch Switch	VEPS, DRS
13	CC Pause Switch Config	0 - Hardwired 1 – CCVS1 2 – CCVS2 3 – CCVS3 4 – CCVS1 or CCVS2 5 – CCVS2 or CCVS3 6 – CCVS1 or CCVS3 7 — CCVS1 or CCVS2 or CCVS3 8 – CCVS1 or hardwired 9 – CCVS2 or hardwired 10 – CCVS3 or hardwired 11 – CCVS1 or CCVS2 or hardwired 12 – CCVS2 or CCVS3 or hardwired 13 – CCVS1 or CCVS3 or hardwired 14 – CCVS1 or CCVS2 or CCVS3 or hardwired	0 = Disabled	VEPS, DRS
10	Road Spd Limit Max Stage Num†	0 = Off 1 = Low 2 = Medium 3 = High	0	VEPS, DRS

Table 7. Cruise Control Input Configuration

** Not supported in NAFTA*

† This parameter will enable engine brake on road speed limiter. Engine brake will come on automatically if the value of the option >0.

A Vehicle Speed Sensor must be configured for Cruise Control. Refer to "3.9.7 Vehicle Speed Sensor" , "Vehicle Speed Sensor," for additional information.

For multiplexed inputs, refer to "4.2 Switch Inputs Received Over J1939 Data Link" , “Switch Inputs Received Over the J1939 Data Link,” for additional information.

The Cruise Control parameters are listed in Table "Cruise Control Parameters" .

Parameter Group	Parameter	Description	Options	Default	Access
15	Min Cruise Set Speed	Minimum road speed for Cruise Control	16 – 152 km/hr.	32 km/hr.	DDDL, DRS, VEPS
15	Max Cruise Set Speed	Cruise Control vehicle set speed cannot be faster than this value.	48–152 km/hr.	104.6 km/hr.	DDDL, DRS, VEPS
15	Increment Cruise Set Speed	Set Speed increment for every Resume/Accel switch momentary press.	0–10 km/hr.	1.6 km/hr.	DDDL, VEPS, DRS
15	Decrement Cruise Set Speed	Set Speed decrement for every Set/Coast switch momentary press.	0–10 km/hr.	1.6 km/hr.	DDDL, VEPS, DRS
15	Enable Cruise Auto Resume	Enables or disables the auto resume feature.	0 – Disable 1 – Enable automatic cruise resume function after clutch has been released once 2 – Enable after clutch released twice 3 – Resume ZF Astronic Style	0	DDDL, DRS, VEPS
15	Cruise Power	Enables Cruise Power function	0 – High Power 1 – Low Power Only 2 – Cruise Power Enabled	0 – High Power	VEPS, DRS
10	Cruise Control Enable Engine Brk	Enables or disables the engine brakes during Cruise Control.	0 – Disable 1 – Enable automatic engine brake operation with Cruise Control	0	DDDL, DRS, VEPS
43	Adaptive Cruise Control	Enables/Disables the feature.	0 – Disable 1 – Enable	0	DRS, VEPS

10	Road Spd Limit Max Stage Num	Enables engine brake on road speed limiter. Engine brake will come on automatically if value >0.	0 = Off 1 = Low 2 = Medium 3 = High	0	DRS, VEPS

Table 8. Cruise Control Parameters

Parameter Group	Parameter	Description	Options	Default Setting	Access
43	Adaptive Cruise Control	Enables / Disables the feature	0 = Disable 1 = Eaton Vorad Adaptive Cruise Device 2 = Meritor Wabco Adaptive Cruise Device	0 2	DRS, VEPS

Table 9. Meritor Wabco Adaptive Cruise Control

Parameter Group	Parameter	Description	Options	Default Setting	Access
43	Adaptive Cruise Control	Enables / Disables the feature	0 = Disable 1 = Eaton Vorad Adaptive Cruise Device 2 = Meritor Wabco Adaptive Cruise Device	0 1	DRS, VEPS
15	Enable Cruise Auto Resume	Enables / Disables the auto feature	0 = Disable 1 = Enable automatic cruise resume function after clutch has been released once 2 = Release clutch twice 3 = Resume ZF ASTronic style	0 3	DRS, VEPS

Table 10. Eaton Vorad Adaptive Cruise Control

Section 5.3.5
INTERACTION WITH OTHER FEATURES

Cruise Control will be disabled for the following:

- Throttle Inhibit Switch is grounded
- VSS fault is detected

- Hard deceleration, failure of the brake switch
- Resume/Accel and Set/Coast switches are both grounded

If LIM0 OR LIM1 are grounded and programmed for a vehicle speed limit, the “Cruise Max Set speed” will be limited to this value.