5 FEATURES

Section **Page**

5.1 ACCELERATION LIMITER

TBD

5.1.1 PROGRAMMING REQUIREMENTS AND FLEXIBILITY

The parameters and options for Acceleration Limiter are listed in Table 5-1.

Parameter Group	Parameter	Description	Options	Default	Series 60 Setting	HDE/MBE Setting	Access
23	Noise Max Engine Speed	Maximum engine speed for noise trigger control	0 – 4000 rpm	1600 rpm	1800 rpm	1600 rpm	VEPS, DRS
23	Noise Min Engine Speed	Minimum engine speed for noise trigger control	0 – 4000 rpm	1400 rpm	1350 rpm	1400 rpm	VEPS, DRS
23	AL Min Engine Torque	Minimum engine torque during accelerations	0 – 100%	100%	15%	100%	VEPS, DRS
23	Enable Noise Control	Enable noise control function	0 – VCU Style 1 – DDEC Style	1 – DDEC Style	1 – DDEC Style	1 – DDEC Style	VEPS, DRS
23	AL Ramp Up Rate	Sets acceleration rate while in noise control	0 – 8191 rpm/s	160 rpm/s	120 rpm/s	160 rpm/s	VEPS, DRS

Table 5-1 Acceleration Limiter Parameters and Options

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5.2 COLD START – MBE 900 AND MBE 4000

The MCM has optional support for an electric Grid Heater for use as a cold start aid. The Grid Heater element is operated by a high current relay. If the heater is enabled, the MCM will turn the Grid Heater relay on and off as required.

5.2.1 OPERATION

The cold start procedure has several states. The cold start states and outputs during a successful engine start are listed in Table 5-2 and described in the following sections.

State	Grid Heater	
	Wait to Start Lamp	Grid Heater Relay
Initialization	Off	Off
Preheating	On	On - Preheat Time
Ready for Engine Start	Off	Off
Engine Starting	Off	Off
Post-heating	Off	On - Post Heat Time
Cooling Off	Off	Off
OFF	Off	Off

Table 5-2 Cold Start States and Outputs

NOTE:
If ignition switch off is detected, the MCM remains in the current state for 5 seconds. If the ignition is switched on again, cold start proceeds. Otherwise the MCM changes to the cooling off state.

Initialization

When ignition is switched on and engine speed is 0 rpm, the MCM determines preheating time, post-heating time and the coolant switch off temperature. The preheating time is shortened when the cold start device is not cold.

A preheating time of 0 indicates, that no cold start is needed for the following engine start. If the preheating time is greater than 0, the MCM enters the preheating state.

Preheating State

Engine cranking detection during preheating will stop the Preheating process and the canceling of the Cold Start function. The Cold Start function will also be canceled when low battery voltage codes are active.

When the Preheat time has elapsed, the Wait to Start lamp will go off and the engine is ready to start.

Waiting for Engine Start

A cranking detection before the end of time waiting for start leads to the engine starting state. If the engine does not start then Cold Start is canceled.

Engine Start

If engine start is successful or if the engine starting time ends, the post-heating state starts.

Post-heating State

When the engine start is successful, the grid heater will be switched on until the post-heating time expires or the coolant temperature exceeds the switch off temperature.

Cooling Off

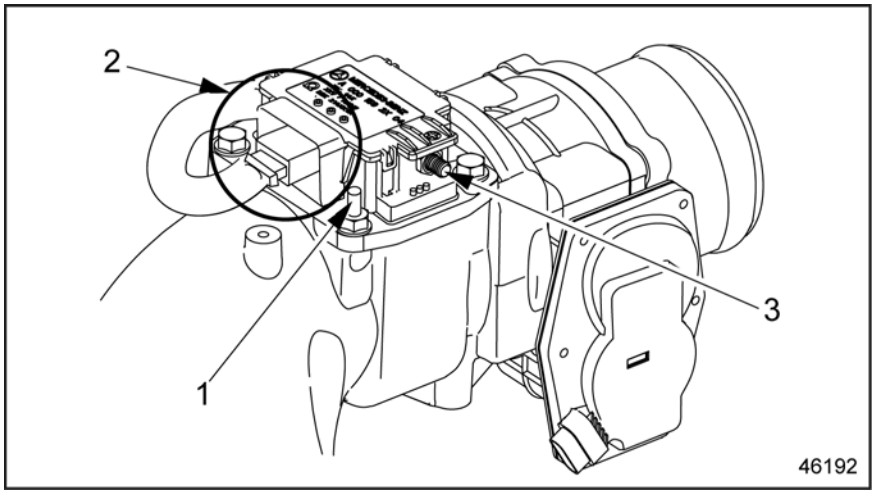
This time is used to determine the preheating time at the beginning of the next cold start.

Off

End of the Cold Start procedure, all outputs are switched off.

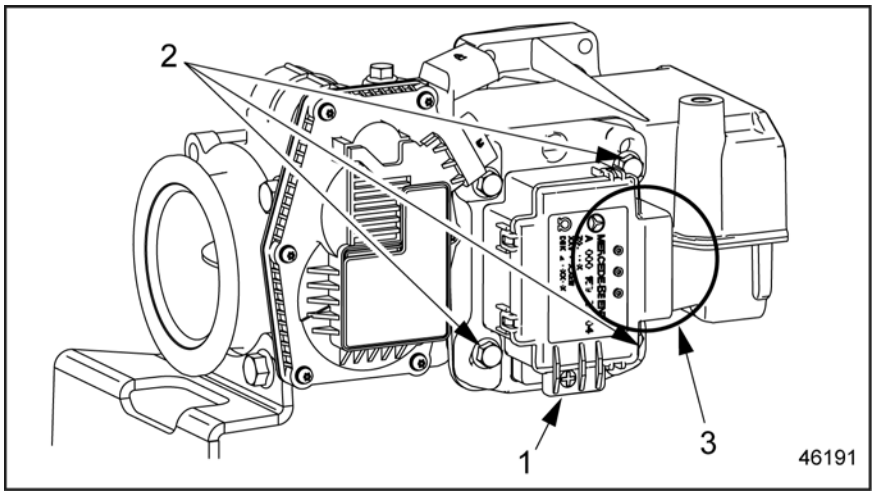
5.2.2 INSTALLATION

The Engine Harness has the grid heater connector. The OEM is responsible for wiring power and ground to the grid heater. See Figure 5-1 for the MBE 4000, Figure 5-2 for the MBE 900 and Figure 5-3 for the heavy-duty engine.



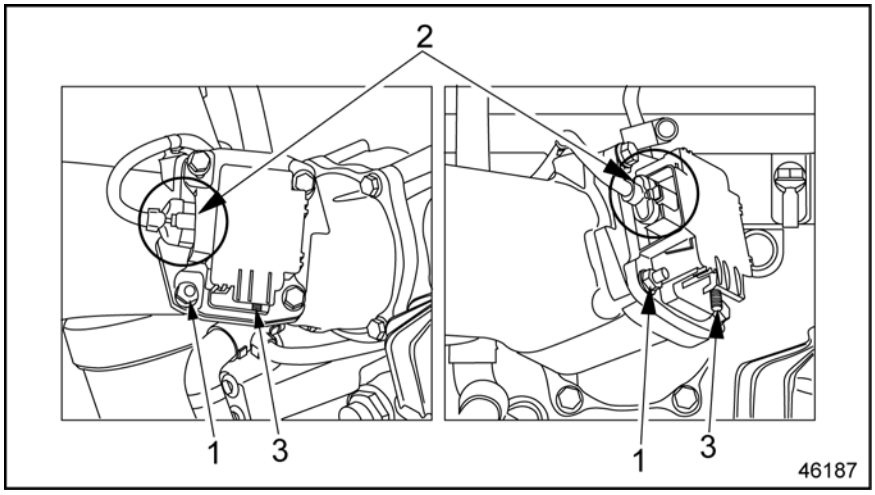
1. Battery Ground
2. Connector to MCM (included in on-engine harness)
3. Battery Supply (+12 V)

Figure 5-1 Grid Heater – MBE 4000



1. Battery Supply (+12 V)
2. Possible Battery Ground Connection
3. Connector to MCM (included in on-engine harness)

Figure 5-2 Grid Heater – MBE 900



1. Battery Ground
2. Connector to MCM
3. Battery Supply (+12 V)

Figure 5-3 Grid Heater – Heavy-duty Engine

The Wait to Start Lamp is driven by a low side output on CPC pin 4/6.

5.2.3 PROGRAMMING REQUIREMENTS AND FLEXIBILITY

The Cold Start parameters are listed in Table 5-3.

Parameter Group	Parameter	Setting	Options	Default	Access
MCM – 8	Cold Start Type	1 – Grid Heater	0 – Disabled 1 – Grid Heater 2 – Ether Injection	0 – Disabled	VEPS, DRS
MCM – 1	PWM3 Configuration	3 – Grid Heater	0 – No Function 3 – Grid Heater	0 – No Function	VEPS, DRS
35	4 06 DO Selection	1 – Grid Heater Lamp	0 – Disabled 1 – Grid Heater Lamp 2 – Accelerator Pedal Idle Position 3 – Starter Lockout/Run Signal	1 – Grid Heater Lamp	VEPS, DRS
35	4 06 Fault Detection	1 – Enabled	0 – Disabled 1 – Enabled	0 – Disabled	VEPS, DRS

Table 5-3 Cold Start Parameters

5.2.4 DIAGNOSTICS

The digital output for the grid heater relay is monitored for high/low state conformity. At the beginning of the preheating state and the starting state, and the first two seconds of the preheating state, the intake air manifold temperature is measured to check if the cold start device works.

A fault code (PID 45) is recorded if one of the errors listed in Table 5-4 occurs.

Failure	Action Taken
Output relay grid heater is not valid	Cold Start is cancelled
Voltage drop below switch off voltage	Cold Start is cancelled
No increase of intake air manifold temperature during preheating state	Cold Start is cancelled

Table 5-4 Cold Start Failures and Action Taken

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.

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 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 5-5.

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 5-5 Three Cruise Control Operation Modes

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.

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.

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.

Cruise Power

Cruise Power is an optional engine rating which operations on a higher horsepower during Cruise Control. DDEC VI 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 section 5.9, “Engine Ratings.”

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.

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.

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.

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.

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.

5.3.2 INSTALLATION

The following is a list of switches and CPC 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 5-4 for a diagram of the Cruise Control circuit.

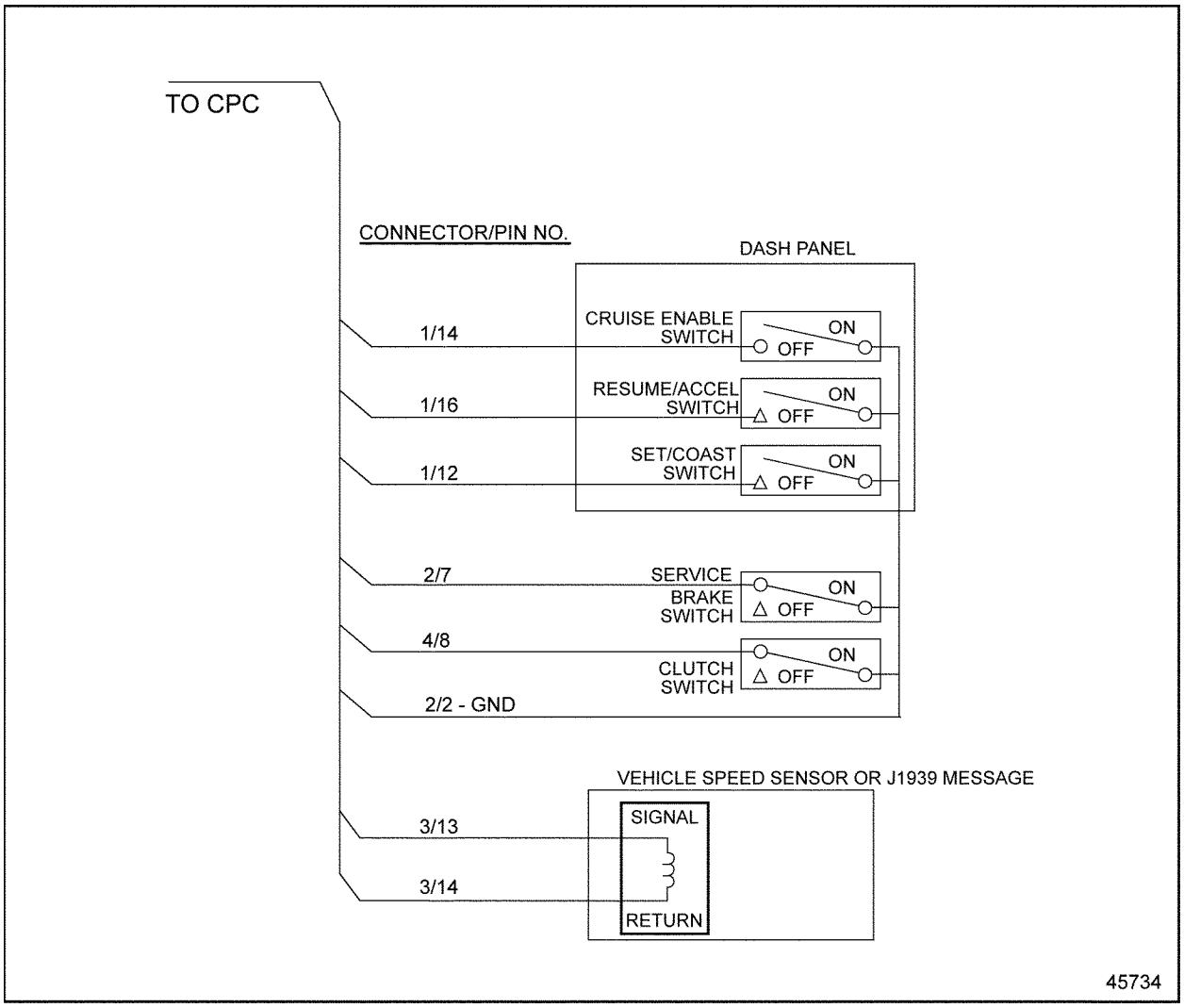


Figure 5-4 Cruise Control Circuit

5.3.3 PROGRAMMING REQUIREMENTS AND FLEXIBILITY

To configure an engine for Cruise Control, the digital inputs listed in Table 5-6 must be selected. These parameters can be set with VEPS or DRS. Refer to section 4.1, “Digital Inputs,” for more information.

Parameter Group	Parameter	Options	Default	Access
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	0 = Hardwired	VEPS, DRS
13	Clutch Switch Config	0 = No Clutch Switch 1 = 1 Clutch Switch 2 = 2 Clutch Switch* 3 = CCVS1 4 = CCVS2 5 = CCVS3 6 = ETC1	0 = No Clutch Switch	VEPS, DRS
13	CC Pause Switch Config	0 = Disabled 1 = CCVS1 2 = CCVS2 3 = CCVS3 4 – CCVS1 or CCVS2 5 – CCVS2 or CCVS3 6 – CCVS1 or CCVS3 7 — CCVS1 or CCVS2 or CCVS3	0 = Disabled	VEPS, DRS
13	4 08 DI Selection	0 = Disable 1 = 1Clutch Switch 2 = PTO Request for AGS2	1 = 1Clutch Switch	VEPS, DRS
13	Trans Neutral Input Config	0 = Hardwired 1 = Info from J1939 255 = Not Available	0 = Hardwired	VEPS, DRS

* Not supported in NAFTA

Table 5-6 Cruise Control Input Configuration

A Vehicle Speed Sensor must be configured for Cruise Control. Refer to section 3.6.6, "Vehicle Speed Sensor," for additional information.

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

The Cruise Control parameters are listed in Table 5-7.

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 7.0, DRS, VEPS
15	Max Cruise Set Speed	Cruise Control vehicle set speed cannot be faster than this value.	48–152 km/hr	152 km/hr	DDDL 7.0, 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 7.0, 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 7.0, 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	0	DDDL 7.0, 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 7.0, DRS, VEPS
43	Adaptive Cruise Control	Enables/Disables the feature.	0 – Disable 1 – Enable	0	DRS, VEPS

Table 5-7 Cruise Control Parameters

5.3.4 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.

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5.4 DIAGNOSTICS

Diagnostics is a standard feature of DDEC VI. The purpose of this feature is to provide information for problem identification and problem solving in the form of a code. The MCM and CPC continuously perform self diagnostic checks and monitors the other system components. Information for problem identification and problem solving is enhanced by the detection of faults, retention of fault codes and separation of active from inactive codes.

5.4.1 OPERATION

The engine-mounted MCM includes control logic to provide overall engine management. System diagnostic checks are made at ignition on and continue throughout all engine operating modes.

Sensors provide information to the MCM and CPC regarding various engine and vehicle performance characteristics. The information is used to regulate engine and vehicle performance, provide diagnostic information, and activate the engine protection system.

The instrument panel lamps are listed in Table 5-8.

NOTE:
The MCM and CPC save error codes into memory after the ignition is turned off. The codes will not be stored if there is an interruption of battery power or recycling of the ignition.

The AWL is illuminated and a code is stored if an electronic system fault occurs. This indicates the problem should be diagnosed as soon as possible. The CPC illuminates the AWL and RSL and stores a malfunction code if a potentially engine damaging fault is detected. These codes can be accessed in one of three ways:

- Commercially available J1587/J1939 diagnostic tools
- Detroit Diesel Diagnostic Link® (DDDL 7.0)
- Flashing the AWL and RSL with the SEO/Diagnostic Request Switch

There are two types of diagnostic codes:

- An *active code* - a fault present at the time when checking for codes
- An *inactive code* - a fault which has previously occurred; inactive codes are logged into the CPC and time stamped with the following information:

The dashboard panel lamps listed in Table 5-8 alert the driver of different conditions.

Lamp	Lamp Name	Description	Driver Action
	Amber Warning Lamp (AWL)	Indicates a fault with the engine controls.	Truck can be driven to end of shift. Call for service.
	Red Stop Lamp (RSL)	Indicates a major engine fault that may result in engine damage Engine derate and / or shutdown sequence will be initiated.	Move the truck to the nearest safe location and shutdown the engine. Call for service
	DPF Regeneration Lamp	Solid yellow indicates a manual regeneration is required. Blinking yellow and derate or shutdown are possible if back pressure exceeds limits. Blinking yellow during stationary regeneration	Truck may be driven to end of shift. Call for service. Blinking light indicates attention required now.
	High Exhaust System Temperature Lamp (HEST)	Lamp may be red or yellow. Indicates exhaust temperature is above a preset limit. Illuminates during regeneration process if speed below 30 mph and during stationary regeneration	Truck may be driven. If lamp remains illuminated for an extended period – longer than 40 minutes call for service.
	Malfunction Indicator Lamp (MIL)	Yellow lamp Indicates a failure of an Emission Control device. May illuminate at the same time as the Amber Warning Lamp	Truck may be driven to end of the shift. Call for service

Table 5-8 Instrument Panel Lamps

Flashing Fault Codes with AWL / SEL

The Stop Engine Override (SEO)/Diagnostic Request Switch is used to activate the AWL/RSL to flash codes. Active codes are flashed on the RSL and inactive codes are flashed on the AWL. All codes (inactive and active) are flashed in numerical order. Active faults are flashed first, followed by inactive.

Flashing codes provide a four digit number (see Figure 5-5). Each fault code is flashed twice in order to help with counting the flashes.

If there are no active faults or if there are no inactive faults the number “3” is flashed once followed by an ~3s delay.

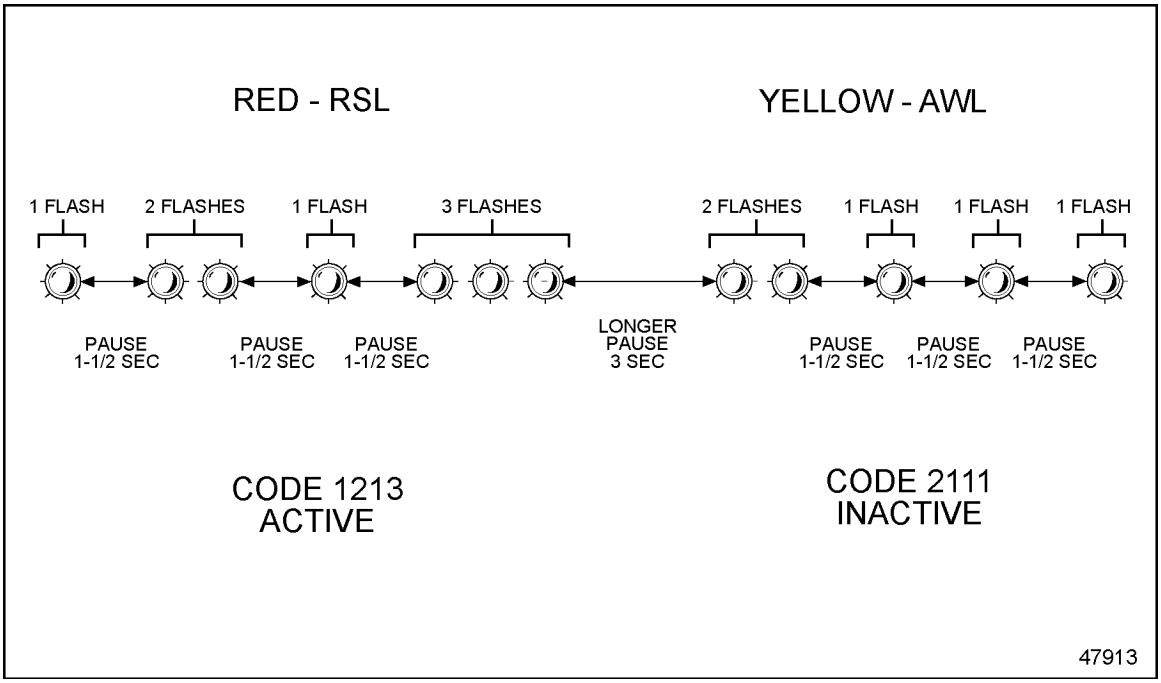

Figure 5-5 Flashing Fault Codes

The SEO/Diagnostic Request is used to flash codes in the following circumstances:

- Engine Speed is < 100 RPM and the SEO switch is transitioned from the OFF to the ON position
- Idle governor is ACTIVE and the SEO switch is transitioned from the OFF to the ON position
- Vehicle Speed is < 3 mph and the Park Brake is activated and the SEO switch is transitioned from the OFF to the ON position
- The engine is not running and ignition is ON
- The engine is idling and not in an "engine protection" condition

The feature is deactivated once the SEO switch is returned to the OFF position or the above conditions are no longer satisfied.

In the applications where SEO is a momentary push-button, the button shall have to be pressed and held in the ON position for an uninterrupted period of three seconds in order to activate the feature. The feature can be deactivated after the SEO push-button is first released (off) for three seconds and then held in the on position for another three seconds.

Programming Requirements & Flexibility

The flashing fault code parameters are listed in Table 5-9.

Parameter Group	Parameter	Description	Options	Default	Access
35	Fault Code Flashing Enable	Enables / Disables the fault code flashing feature.	0 – Disabled 1 – Enabled	1 – Enabled	VEPS, DRS
13	1 15 DI Selection	Digital Input function for Diagnostic Request feature	0 – Disabled 1 – Stop Engine Override Switch / Diagnostic Request Switch 2 – CC Cancel* 3 – Diagnostic Request Switch	1 – Stop Engine Override Switch / Diagnostic Request Switch	VEPS, DRS

* Not available in NAFTA

Table 5-9 Flashing Fault Code Parameters

5.5 DUAL SPEED AXLE

The Dual Speed Axle feature allows a digital input to be configured to switch between two axle ratios for calculation of vehicle speed.

5.5.1 OPERATION

When the digital input is open the first axle ratio will be used. When the switch is grounded, the second axle ratio will be used. The vehicle must be stopped before switching the axle ratios.

5.5.2 INSTALLATION

The Dual Speed Axle Switch is pin 1/1 on the CPC.

5.5.3 PROGRAMMING FLEXIBILITY & REQUIREMENTS

The digital input listed in Table 5-10 can be configured by VEPS or DRS.

Parameter Group	Parameter	Options	Default	Access
13	2nd Axle Speed Switch Config	0 = Hardwired 1 = CCVS1 2 = CCVS2 3 = CCVS3	0 = Hardwired	VEPS, DRS
13	1 01 DI Selection	0 = Disable 1 = Enable Dual Speed Axle 2 = Enable Transmission Retarder Input 3 = FUSO Auxiliary Brake Cut Switch	0 = Disable	VEPS, DRS

Table 5-10 Dual Speed Axle Digital Input

Both axle ratios listed in Table 5-11 must also be programmed with VEPS, DRS or DDDL 7.0.

Parameter Group	Parameter	Description	Range	Default
8	Axle Ratio	Indicates the first axle ratio of the vehicle.	1.0 – 20.00	5.29
8	Two Spd Axle Second Axle Ratio	Indicates the second axle ratio of the vehicle.	1.0 – 20.00	5.29

Table 5-11 Programming the Axle Ratios

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5.6 ENGINE BRAKE CONTROLS – MBE 900 AND MBE 4000

The Engine Brake option converts a power-producing diesel engine into a power-absorbing air compressor. This is accomplished by opening the constant throttle valve over all cylinders near the top of the normal compression stroke and releasing the compressed cylinder charge to exhaust. The release of the compressed air to atmospheric pressure prevents the return of energy to the engine piston on the expansion stroke, the effect being a net energy loss. Fueling is cut off when this occurs. The constant throttle valves are open over all cycles, not just the exhaust cycle.

5.6.1 OPERATION

A dash mounted On/Off Switch is used to enable the Engine Brake option. Engine Brake operations are allowed only when all of the following conditions are met:

- Percent throttle <4%
- Driveline open – engine speed >1100 rpm
- Driveline closed – engine speed >800 rpm
- Road Speed > 0 mph (programmable)
- ABS not active
- Clutch pedal released (if equipped)
- Engine not fueling
- Engine not in PTO mode
- Torque converter locked up (automatic transmission)

If all of these conditions are met, engine brake can be activated when the engine brake switches are on. Engine brakes will be deactivated when at least one of these conditions is no longer met or the engine brake switch is turned back to the OFF position.

The following are features and options for Engine Brake:

- Cruise Control or Road Speed Limit with Engine Brake
- Engine Brake Disable
- Engine Brake Active
- Engine Fan Braking
- Clutch Released Input
- Service Brake Control of Engine Brakes
- Min MPH for Engine Brakes

Cruise Control or Road Speed Limit with Engine Brake

The Engine Brake option can also provide Engine Brake capability when the vehicle is in Cruise Control or Road Speed Limit. For example, if the vehicle is going down hill in Cruise Control while the engine brake is selected, the ECU will control the amount of Engine Brake with respect to the Cruise Control set speed. The level of Engine Brake (low, medium, high) selected with the dash switches will be the maximum amount of engine braking the ECU allows.

Each engine braking level has a hysteresis for actuating the engine brake or for deactuating the engine brake.

Service Brake Control of Engine Brakes

This option allows the engine brakes switches to be ON but not engage the engine brakes until the service brake is pressed.

Engine Brake Active

The Engine Brake Active option uses a digital output that can be used to drive an Engine Brake Active Lamp. This output is switched to battery ground whenever the engine brake is active.

Engine Brake Disable

The Engine Brake Disable option uses an input which is switched to ground whenever a vehicle system, such as a traction control device, does not allow engine braking to occur. This option is required for most automatic transmissions.

DDEC VI also supports the J1939 message to disable engine brakes (TSC1 command to source address 15).

Engine Fan Braking

The Engine Fan Braking option turns on the cooling fan when the engine brake level is high and DDEC fan control is enabled. This creates about 20 to 40 hp additional engine braking power depending on the size of the cooling fan. For additional information, refer to section 5.12, "Fan Controls."

Clutch Released Input

The Clutch Released input will prevent the engine brakes from being turned on when the clutch is pressed. This input is required for use with manual transmissions. Refer to section 4.1, "Digital Inputs," for additional information.

Min Vehicle Speed for Engine Brakes

This option will disable the engine brakes until a minimum vehicle speed is reached. A Vehicle Speed Sensor (VSS) is required. Refer to section 3.6.6, "Vehicle Speed Sensor," for additional information.

5.6.2 PROGRAMMING REQUIREMENTS AND FLEXIBILITY

Engine Brake must be specified at the time of engine order or by contacting Detroit Diesel Technical Service.

Configuration for MBE 900 Exhaust Flap Applications

The MCM **Exhaust Flap** configuration parameters are listed in Table 5-12.

MCM Parameter Group	Parameter	Setting	Options	Default	Access
1	PWM7 Configuration	0 – No Function	0 – No Function 6 – Jake Brake 1 or Decompression Valve	0 – No Function	VEPS or DRS
2	SW4 Configuration	7 – Jake Brake 2 or Exhaust Flap or Brake Gate	0 – No Function 7 – Jake Brake 2 or Exhaust Flap or Brake Gate	0 – No Function	VEPS or DRS

Table 5-12 MCM Configuration Parameter for Exhaust Flap Applications - MBE 900 Engine

The CPC **Exhaust Flap** configuration parameters are listed in Table 5-13.

CPC Parameter Group	Parameter	Description	Options	Setting	Access
10	Engine Brake Configuration	Enables the type of engine brake required	0 = No Engine Brake 1 = Decompression Valve Only or Exhaust Flap Only 2 = Decompression Valve & Exhaust Flap 3 = Jake Compression Brake or Brake Gate	1	VEPS or DRS
10	Stage 1 Mask Engine Brake	Mask determines which device turns on for low braking	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	0	VEPS or DRS

CPC Parameter Group	Parameter	Description	Options	Setting	Access
10	Stage 1 Factor Engine Brake	Factor determines the amount of low braking	0 – 100%	100	VEPS or DRS
10	Stage 2 Mask Engine Brake	Mask determines which device turns on for medium braking	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	16	VEPS or DRS
10	Stage 2 Factor Engine Brake	Factor determines the amount of medium braking	0 – 100%	100	VEPS or DRS
10	Stage 3 Mask Engine Brake	Mask determines which device turns on for high braking	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	0	VEPS or DRS
10	Stage 3 Factor Engine Brake	Factor determines the amount of high braking	0 – 100%	100	VEPS or DRS
10	Trans Mask Engine Brake	—	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	16	VEPS or DRS
10	Trans Factor Engine Brake	Factor determines the amount of high braking	0–100%	100	VEPS or DRS
13	4 18 DI Selection (Optional)	—	0 = Disable 1 = Enable Engine Door Bus* 2 = Enable Engine Hood Tilt Switch 3 = AGS2 PTO Feedback 4 = RPM Freeze 5 = Engine Brake Disable 6 = Fast Engine Heat-up Switch	0 = Disable	VEPS or DRS

CPC Parameter Group	Parameter	Description	Options	Setting	Access
13	Engine Brake Switch Config	—	0 = Hardwired 1 = Info from J1939 255 = Not Available	0 = Hard-wired	VEPS or DRS
13	J1939 Steps Engine Brake	—	0 = Variable Controlled Brake 1 = 1 Step 2 = Low/High Steps 3 = Low/Med/High Steps 255 = Not Configured	1 = 1 Step	VEPS or DRS
13	J1939 Engine Retarder Config	—	3 = Jake or Constant Throttle Brake 4 = Exhaust Flap 255 = Not Configured	4 = Exhaust Flap	VEPS or DRS

Table 5-13 CPC Configuration Parameter for Exhaust Flap Applications - MBE 900 Engine

See Figure 5-6 for the MBE 900 exhaust flap only schematic.

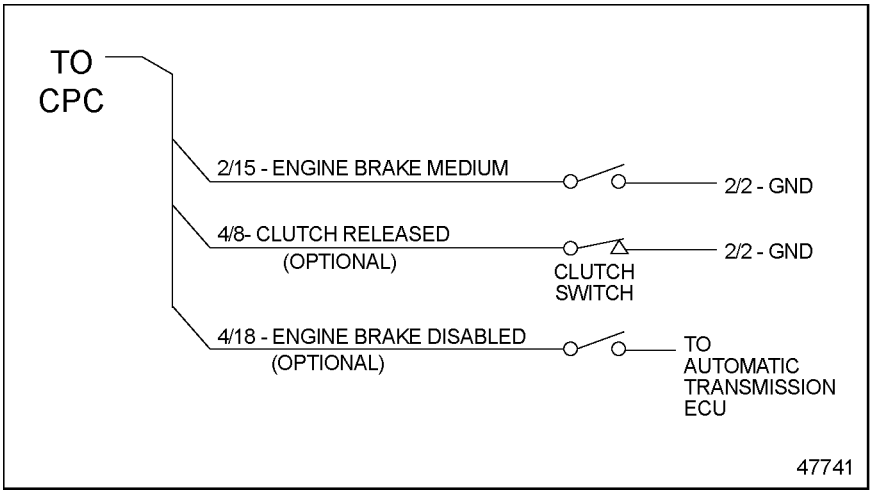

Figure 5-6 Exhaust Flap Only – MBE 900

Configuration for MBE 900 Compression Brake Only Applications

The MCM **Compression Brake** configuration parameters are listed in Table 5-14.

MCM Parameter Group	Parameter	Setting	Options	Default	Access
1	PWM7 Configuration	6 – Jake Brake 1 or Decompression Valve	0 – No Function 6 – Jake Brake 1 or Decompression Valve	0 – No Function	VEPS or DRS
2	SW4 Configuration	7 – Jake Brake 2 or Exhaust Flap or Brake Gate	0 – No Function 7 – Jake Brake 2 or Exhaust Flap or Brake Gate	0 – No Function	VEPS or DRS

Table 5-14 MCM Configuration Parameter for Compression Brake Applications - MBE 900 Engine

The CPC **Compression Brake** configuration parameters are listed in Table 5-15.

CPC Parameter Group	Parameter	Description	Options	Setting	Access
10	Engine Brake Configuration	Enables the type of engine brake required	0 = No Engine Brake 1 = Decompression Valve Only or Exhaust Flap Only 2 = Decompression Valve & Exhaust Flap 3 = Jake Compression Brake or Brake Gate	1	VEPS or DRS
10	Stage 1 Mask Engine Brake	Mask determines which device turns on for low braking	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	64	VEPS or DRS
10	Stage 1 Factor Engine Brake	Factor determines the amount of low braking	0 – 100%	100	VEPS or DRS
10	Stage 2 Mask Engine Brake	Mask determines which device turns on for medium braking	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	0	VEPS or DRS

CPC Parameter Group	Parameter	Description	Options	Setting	Access
10	Stage 2 Factor Engine Brake	Factor determines the amount of medium braking	0 – 100%	100	VEPS or DRS
10	Stage 3 Mask Engine Brake	Mask determines which device turns on for high braking	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	0	VEPS or DRS
10	Stage 3 Factor Engine Brake	Factor determines the amount of high braking	0 – 100%	100	VEPS or DRS
10	Trans Mask Engine Brake	—	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	64	VEPS or DRS
10	Trans Factor Engine Brake	Factor determines the amount of high braking	0–100%	100	VEPS or DRS
13	4 18 DI Selection (Optional)	—	0 = Disable 1 = Enable Engine Door Bus* 2 = Enable Engine Hood Tilt Switch 3 = AGS2 PTO Feedback 4 = RPM Freeze 5 = Engine Brake Disable 6 = Fast Engine Heat-up Switch	0 = Disable	VEPS or DRS
13	Engine Brake Switch Config	—	0 = Hardwired 1 = Info from J1939 255 = No Available	0 = Hard-wired	VEPS or DRS

CPC Parameter Group	Parameter	Description	Options	Setting	Access
13	J1939 Steps Engine Brake	—	0 = Variable Controlled Brake 1 = 1 Step 2 = Low/High Steps 3 = Low/Med/High Steps 255 = Not Configured	1 = 1 Step	VEPS or DRS
13	J1939 Engine Retarder Config	—	3 = Jake or Constant Throttle Brake 4 = Exhaust Flap 255 = Not Configured	3 = Jake or Constant Throttle Brake	VEPS or DRS

* Not supported in NAFTA

Table 5-15 CPC Configuration Parameter for Compression Brake Applications - MBE 900 Engine

See Figure 5-7 for the MBE 900 compression brake only schematic.

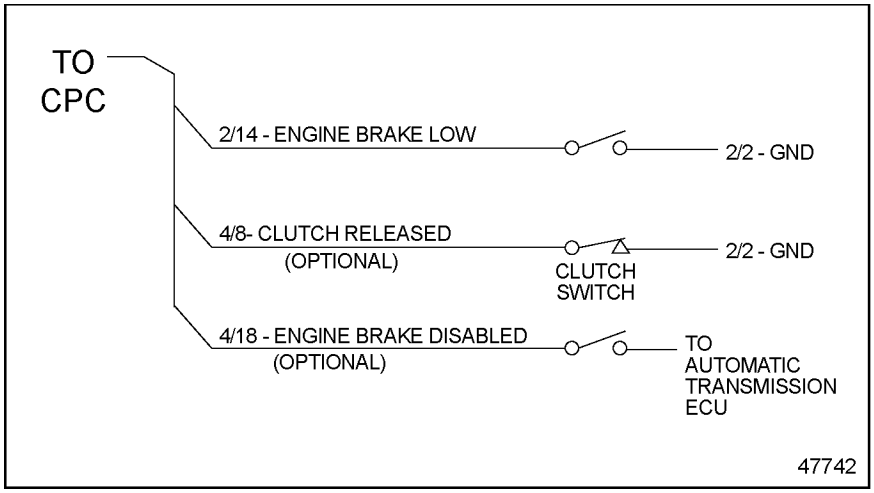

Figure 5-7 Compression Brake Only – MBE 900

Configuration for MBE 900 Compression and Exhaust Brake Applications

The MCM **Compression and Exhaust Brake** configuration parameters are listed in Table 5-16 .

MCM Parameter Group	Parameter	Setting	Options	Default	Access
1	PWM7 Configuration	6 – Jake Brake 1 or Decompression Valve	0 – No Function 6 – Jake Brake 1 or Decompression Valve	0 – No Function	VEPS or DRS
2	SW4 Configuration	7 – Jake Brake 2 or Exhaust Flap or Brake Gate	0 – No Function 7 – Jake Brake 2 or Exhaust Flap or Brake Gate	0 – No Function	VEPS or DRS

Table 5-16 MCM Configuration Parameter for Compression and Exhaust Brake Applications - MBE 900 Engine

The CPC **Compression and Exhaust Brake** config parameters are listed in Table 5-17.

CPC Parameter Group	Parameter	Descrip-tion	Options	Setting	Access
10	Engine Brake Con-figuration	Enables the type of engine brake required	0 = No Engine Brake 1 = Decompression Valve Only or Exhaust flap Only 2 = Decompression Valve & Exhaust Flap 3 = Jake Compression Brake or Brake Gate	2	VEPS or DRS
10	Stage 1 Mask Engine Brake	Mask determines which device turns on for low braking	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	64	VEPS or DRS
10	Stage 1 Factor Engine Brake	Factor determines the amount of low braking	0 – 100%	100	VEPS or DRS
10	Stage 2 Mask Engine Brake	Mask determines which device turns on for medium braking	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	80	VEPS or DRS

CPC Parameter Group	Parameter	Description	Options	Setting	Access
10	Stage 2 Factor Engine Brake	Factor determines the amount of medium braking	0 – 100%	100	VEPS or DRS
10	Stage 3 Mask Engine Brake	Mask determines which device turns on for high braking	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	80	VEPS or DRS
10	Stage 3 Factor Engine Brake	Factor determines the amount of high braking	0 – 100%	100	VEPS or DRS
10	Trans Mask Engine Brake	—	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	80	VEPS or DRS
10	Trans Factor Engine Brake	Factor determines the amount of high braking	0–100%	100	VEPS or DRS
13	4 18 DI Selection (Optional)	—	0 = Disable 1 = Enable Engine Door Bus* 2 = Enable Engine Hood 3 = AGS2 PTO Feedback 4 = RPM Freeze 5 = Engine Brake Disable 6 = Fast Engine Heat-up Switch	0 = Disable	VEPS or DRS
13	Engine Brake Switch Config	—	0 = Hardwired 1 = Info from J1939 255 = Not Available	0 = Hard-wired	VEPS or DRS

CPC Parameter Group	Parameter	Descrip-tion	Options	Setting	Access
13	J1939 Steps Engine Brake	—	0 = Variable Controlled Brake 1 = 1 Step 2 = Low/High Steps 3 = Low/Med/High Steps 255 = Not Configured	2 = Low/High Steps	VEPS or DRS
13	J1939 Engine Retarder Config	—	3 = Jake or Constant Throttle Brake 4 = Exhaust Flap 255 = Not Configured	4 = Exhaust Flap	VEPS or DRS

* Not supported in NAFTA

Table 5-17 CPC Configuration Parameter for Compression and Exhaust Brake Applications - MBE 900 Engine

See Figure 5-8 for a schematic of the MBE 900 compression brake and exhaust flap.

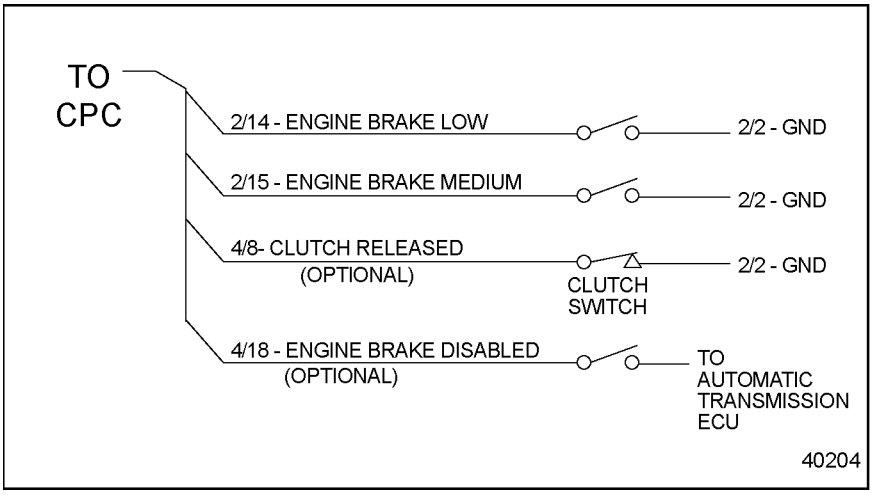

Figure 5-8 Compression Brake and Exhaust Flap – MBE 900

Configuration for MBE 4000 Compression Brake and Brake Gate Applications

The MCM **Compression Brake and Brake Gate** configuration parameters are listed in Table 5-18.

MCM Parameter Group	Parameter	Setting	Options	Default	Access
1	PWM7 Configuration	6 – Jake Brake 1 or Decompression Valve	0 – No Function 6 – Jake Brake 1 or Decompression Valve	0 – No Function	VEPS or DRS
2	SW4 Configuration	7 – Jake Brake 2 or Exhaust Flap or Brake Gate	0 – No Function 7 – Jake Brake 2 or Exhaust Flap or Brake Gate	0 – No Function	VEPS or DRS

Table 5-18 MCM Configuration Parameter for Compression and Brake Gate Applications - MBE 4000 Engine

The CPC **Compression Brake and Brake Gate** configuration parameters are listed in Table 5-19.

CPC Parameter Group	Parameter	Description	Options	Settings	Access
10	Engine Brake Configuration	Enables the type of engine brake required	0 = No Engine Brake 1 = Decompression Valve Only or Exhaust Flap Only 2 = Decompression Valve & Exhaust Flap 3 = Jake Compression Brake or Brake Gate	3	VEPS or DRS
10	Stage 1 Mask Engine Brake	Mask determines which device turns on for low braking	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	64	VEPS or DRS
10	Stage 1 Factor Engine Brake	Factor determines the amount of low braking	0 – 100%	100	VEPS or DRS
10	Stage 2 Mask Engine Brake	Mask determines which device turns on for medium braking	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	81	VEPS or DRS

CPC Parameter Group	Parameter	Description	Options	Settings	Access
10	Stage 2 Factor Engine Brake	Factor determines the amount of medium braking	0 – 100%	75	VEPS or DRS
10	Stage 3 Mask Engine Brake	Mask determines which device turns on for high braking	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	81	VEPS or DRS
10	Stage 3 Factor Engine Brake	Factor determines the amount of high braking	0 – 100%	100	VEPS or DRS
10	Trans Mask Engine Brake	—	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	81	VEPS, DRS
10	Trans Factor Engine Brake	Factor determines the amount of high braking	0–100%	100	VEPS, DRS
10	ACC Mask Engine Brake	—	0 = No Engine Brake 16 = Exhaust Flap Only 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	81	VEPS, DRS
10	OI Mask Engine Brake	—	0 = No Engine Brake 16 = Exhaust Flap Only 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	64	VEPS, DRS
13	4 18 DI Selection (Optional)	—	0 = Disable 1 = Enable Engine Door Bus 2 = Enable Engine Hood Tilt Switch 3 = AGS2 PTO Feedback 4 = RPM Freeze 5 = Engine Brake Disable 6 = Fast Engine Heat-up Switch	0	VEPS, DRS

CPC Parameter Group	Parameter	Description	Options	Settings	Access
13	Eng Brake Switch Config	—	0 = Hardwired 1 = Info from J1939 255 = Not Available	0	VEPS, DRS
13	J1939 Steps Engine Brake	—	0 = Variable Controlled Brake 1 = 1 Step 2 = Low/High Steps 3 = Low/Med/High Steps 255 = Not Configured	3 = Low/Med/High Steps	VEPS or DRS
13	J1939 Engine Retarder Config	—	3 = Jake or Constant Throttle Brake 4 = Exhaust Flap 255 = Not Configured	4 = Exhaust Flap	VEPS or DRS

Table 5-19 CPC Configuration Parameter for MBE 4000 Compression Brake and Brake Gate Applications

See Figure 5-9 for a schematic of the MBE 4000 compression brake and brake gate.

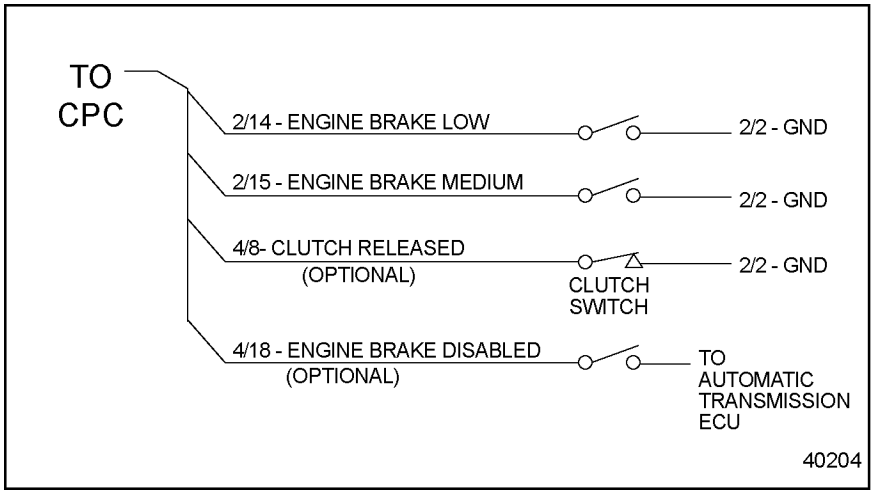

Figure 5-9 Compression Brake and Brake Grate – MBE 4000

Cruise Control of Engine Brake Option

The parameters listed in Table 5-20 are options for the Engine Brake with Cruise Control.

CPC Parameter Group	Parameter	Description	Options	Default	Access
10	Cruise Control Enable Eng Brk	Allows the engine brake to be used while on cruise control or the road speed limit if the vehicle exceeds the cruise set speed or road speed limit. Automatic engine brake operation with Cruise Control.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS, DDDL 7.0
10	Hi Eng Brk Max Cruise RSL Spd	CC/RSL vehicle-over-speed for engine brake stage 3 activation	0–48 km/h	10 km/h	VEPS, DRS, DDDL 7.0
10	Hi Eng Brk Min Cruise RSL Spd	CC/RSL vehicle-over-speed for engine brake stage 3 deactivation	0–48 km/h	6 km/h	VEPS, DRS, DDDL 7.0
10	Low Eng Brk Max Cruise RSL Spd	CC/RSL vehicle-over-speed for engine brake stage 1 activation	0–48 km/h	5 km/h	VEPS, DRS, DDDL 7.0
10	Low Eng Brk Min Cruise RSL Spd	CC/RSL vehicle-over-speed for engine brake stage 1 deactivation	0–48 km/h	2 km/h	VEPS, DRS, DDDL 7.0
10	Med Eng Brk Max Cruise RSL Spd	CC/RSL vehicle-over-speed for engine brake stage 2 activation	0–48 km/h	7 km/h	VEPS, DRS, DDDL 7.0
10	Med Eng Brk Min Cruise RSL Spd	CC/RSL vehicle-over-speed for engine brake stage 2 deactivation	0–48 km/h	5 km/h	VEPS, DRS, DDDL 7.0
10	Min Eng Spd for Engine Brakes	Minimum engine speed for Engine Brake operation.	0 — 4000 rpm	1100 rpm	VEPS, DRS, DDDL 7.0

Table 5-20 Cruise Control and Road Speed Limit Engine Brake Parameters

The optional digital output listed in listed in Table 5-21 can be used to drive an Engine Brake Active Lamp.

CPC Parameter Group	Parameter	Setting	Options	Default	Access
35	3 09 DO Selection	3 = Engine Brake Active	0 = Disabled 1 = Grid Heater Hardwired* 2 = AGS2 Backup Lamp 3 = Engine Brake Active 4 = Not Used 5 = FUSO Engine Brake Active Lamp*	0 = Disabled	VEPS, DRS

*Not Supported in NAFTA

Table 5-21 Optional Digital Output for Engine Brakes

The Engine Fan Braking option parameter is listed in Table 5-22.

CPC Parameter Group	Parameter	Description	Options	Default	Access
19	Eng Brake Enable Auto Fan	Provides additional engine braking by activating the DDEC controlled fan whenever the engine brakes are active in high. This function requires both DDEC engine brake controls and DDEC fan controls.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS, or DDDL 7.0

Table 5-22 Optional Fan Braking for Engine Brakes

Engine Brake Option with Service Brake

The Service Brake control of Engine Brake parameter is listed in Table 5-23.

CPC Parameter Group	Parameter	Description	Options	Default	Access
10	Service Brk Enable Eng Brakes	When this function is enabled, an input from the service brake is required in order to activate the engine brake.	0 = Disable 1 = Enable automatic engine brake when applied service brake 2 = Operator selection and service brake for engine brake activation	0	VEPS, DRS, or DDDL 7.0

Table 5-23 Service Brake Control of Engine Brake Parameter

Engine Brakes Option with Minimum Vehicle Speed

The minimum vehicle speed for the Engine Brakes option is listed in Table 5-24.

CPC Parameter Group	Parameter	Description	Options	Default	Access
10	Min Road Spd Eng Brk Operation	The minimum vehicle speed required before engine braking will occur.	0-200 km/hr	0 km/hr	DDDL 7.0, DRS, VEPS

Table 5-24 Minimum Vehicle Speed for Engine Brakes Option

5.6.3 INTERACTION WITH OTHER FEATURES

DDEC VI will respond to requests from other vehicle systems via the J1939 data link to disable or enable engine brake.

5.7 ENGINE BRAKE CONTROLS – SERIES 60

The Engine Brake option converts a power-producing diesel engine into a power-absorbing air compressor. This is accomplished by opening the cylinder exhaust valves near the top of the normal compression stroke and releasing the compressed cylinder charge to exhaust. The release of the compressed air to atmospheric pressure prevents the return of energy to the engine piston on the expansion stroke, the effect being a net energy loss. Fueling is cut off when this occurs.

5.7.1 OPERATION

A dash mounted On/Off Switch is used to enable the Engine Brake option. DDEC VI will directly control the engine brake solenoids and turbocharger VGT position to produce the desired low, medium, or high braking power. This braking power is based on the driver selected intensity switch for a Series 60 engine.

The following conditions must be met for engine brakes to be activated:

- □ Percent throttle <4%
- □ Driveline open – engine speed >1100 rpm
- □ Driveline closed – engine speed >800 rpm
- □ Road Speed > 0 mph (programmable)
- □ ABS not active
- □ Clutch pedal released (if equipped)
- □ Engine not fueling
- □ Engine not in PTO mode
- □ Torque converter in lockup (automatic transmission)

The following are features and options for Engine Brake:

- □ Cruise Control or Road Speed Limit with Engine Brake
- □ Engine Brake Disable
- □ Engine Brake Active
- □ Engine Fan Braking
- □ Clutch Released Input
- □ Service Brake Control of Engine Brakes
- □ Min. MPH for Engine Brakes

Service Brake Control of Engine Brakes

This option allows the engine brakes switches to be ON but not engage the engine brakes until the service brake is pressed.

Cruise Control or Road Speed Limit with Engine Brake

The Engine Brake option can also provide Engine Brake capability when the vehicle is in Cruise Control or Road Speed Limit. For example, if the vehicle is going down hill in Cruise Control while the engine brake is selected, the ECU will control the amount of Engine Brake with respect to the Cruise Control set speed. The level of Engine Brake (low, medium, high) selected with the dash switches will be the maximum amount of engine braking the ECU allows.

Each engine braking level has a hysteresis for actuating the engine brake or for deactivating the engine brake.

Engine Brake Disable

The Engine Brake Disable option uses an input which is switched to ground whenever a vehicle system, such as a traction control device, does not allow engine braking to occur. This option is required for most automatic transmissions.

DDEC VI also supports the J1939 message to disable engine brakes (TSC1 command to source address 15).

Engine Brake Active

The Engine Brake Active option uses a digital output that can be used to drive an Engine Brake Active lamp. This output is switched to battery ground whenever the engine brake is active.

Engine Fan Braking

The Engine Fan Braking option turns on the cooling fan when the engine brake level is high and DDEC fan control is enabled. This creates about 20 to 40 hp additional engine braking power depending on the size of the cooling fan. For additional information, refer to section 5.12, "Fan Controls."

Clutch Released Input

The Clutch Released input will prevent the engine brakes from being turned on when the clutch is pressed. This input is required for use with manual transmissions. Refer to section 4.1, "Digital Inputs," for additional information.

Min Vehicle Speed for Engine Brakes

This option will disable the engine brakes until a minimum vehicle speed is reached. A Vehicle Speed Sensor (VSS) is required. Refer to section 3.6.6, "Vehicle Speed Sensor," for additional information.

5.7.2 INSTALLATION

See Figure 5-10 for a DDEC VI internal engine brake schematic.

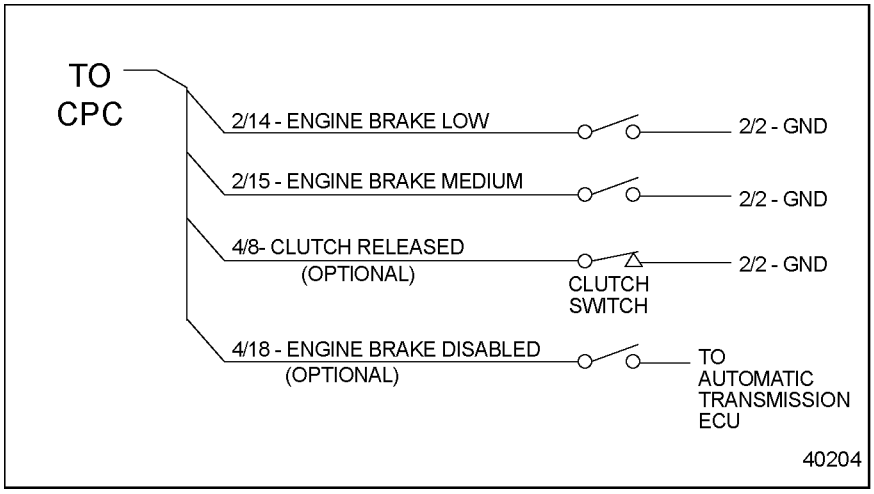

Figure 5-10 Engine Brake for DDEC VI – Series 60

5.7.3 PROGRAMMING REQUIREMENTS AND FLEXIBILITY

Engine Brake must be specified at the time of engine order. This enables the two digital outputs required in the MCM. The **Jake Brake** configuration parameters are listed in Table 5-25.

CPC Parameter Group	Parameter	Description	Options	Settings	Access
10	Engine Brake Configuration	Enables the type of engine brake required	0 = No Engine Brake 1 = Decompression Valve Only or Exhaust Flap Only 2 = Decompression Valve & Exhaust Flap 3 = Jake Compression Brake or Brake Gate	3	VEPS, DRS
10	Stage 1 Mask Engine Brake	Mask determines which device turns on for low braking	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	64	VEPS, DRS
10	Stage 1 Factor Engine Brake	Factor determines the amount of low braking	0 – 100%	100	VEPS, DRS
10	Stage 2 Mask Engine Brake	Mask determines which device turns on for medium braking	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	17	VEPS, DRS
10	Stage 2 Factor Engine Brake	Factor determines the amount of medium braking	0 – 100%	100	VEPS, DRS
10	Stage 3 Mask Engine Brake	Mask determines which device turns on for high braking	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	81	VEPS, DRS
10	Stage 3 Factor Engine Brake	Factor determines the amount of high braking	0 – 100%	100	VEPS, DRS

CPC Parameter Group	Parameter	Description	Options	Settings	Access
10	Trans Mask Engine Brake	—	0 = No Engine Brake 16 = Exhaust Flap Only 17 = Jake Brake 2nd Stage 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	81	VEPS, DRS
10	Trans Factor Engine Brake	Factor determines the amount of high braking	0–100%	100	VEPS, DRS
13	4 18 DI Selection (Optional)	—	0 = Disable 1 = Enable Engine Door Bus 2 = Enable Engine Hood 3 = AGS2 PTO Feedback 4 = RPM Freeze 5 = Engine Brake Disable 6 = Fast Engine Heat-up Switch	0	VEPS, DRS
13	Eng Brake Switch Config	—	0 = Hardwired 1 = Info from J1939 255 = Not Available	0	VEPS, DRS
13	J1939 Steps Engine Brake	—	0 = Variable Controlled Brake 1 = 1 Step 2 = Low/High Steps 3 = Low/Med/High Steps 255 = Not Configured	2 or 3	VEPS or DRS
13	J1939 Engine Retarder Config	—	3 = Jake or Constant Throttle Brake 4 = Exhaust Flap 255 = Not Configured	3	VEPS or DRS
13	ACC Mask Engine Brake		0 = No Engine Brake 16 = Exhaust Flap Only 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	81	VEPS or DRS
13	OI Mask Engine Brake		0 = No Engine Brake 16 = Exhaust Flap Only 64 = Decompression Valve Only or Jake Brake 1st Stage 80 = Decompression Valve & Exhaust Flap 81 = Decompression Valve & Brake Gate or Jake Brake 3rd Stage	64	VEPS or DRS

Table 5-25 CPC Configuration Parameter for Jake Brake Applications

The parameters listed in Table 5-26 are for the Cruise Control and Road Speed Limit Engine Brake option.

CPC Parameter Group	Parameter	Description	Options	Default	Access
10	Cruise Control Enable Eng Brk	Allows the engine brake to be used while on cruise control or the road speed limit if the vehicle exceeds the cruise set speed or road speed limit. Automatic engine brake with Cruise Control.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS, DDDL 7.0
10	Hi Eng Brk Max Cruise RSL Spd	CC/RSL vehicle-over-speed for engine brake stage 3 activation	0–48 km/h	10 km/h	VEPS, DRS, DDDL 7.0
10	Hi Eng Brk Min Cruise RSL Spd	CC/RSL vehicle-over-speed for engine brake stage 3 deactivation	0–48 km/h	6 km/h	VEPS, DRS, DDDL 7.0
10	Low Eng Brk Max Cruise RSL Spd	CC/RSL vehicle-over-speed for engine brake stage 1 activation	0–48 km/h	5 km/h	VEPS, DRS, DDDL 7.0
10	Low Eng Brk Min Cruise RSL Spd	CC/RSL vehicle-over-speed for engine brake stage 1 deactivation	0–48 km/h	2 km/h	VEPS, DRS, DDDL 7.0
10	Med Eng Brk Max Cruise RSL Spd	CC/RSL vehicle-over-speed for engine brake stage 2 activation	0–48 km/h	7 km/h	VEPS, DRS, DDDL 7.0
10	Med Eng Brk Min Cruise RSL Spd	CC/RSL vehicle-over-speed for engine brake stage 2 deactivation	0–48 km/h	5 km/h	VEPS, DRS, DDDL 7.0
10	Min Eng Spd for Engine Brakes	Minimum engine speed for Engine Brake operation.	0–4000 rpm	1100 rpm	VEPS, DRS, DDDL 7.0

Table 5-26 Cruise Control and Road Speed Limit Engine Brake Parameters

The optional digital output listed in Table 5-27 can be used to drive an Engine Brake Active Lamp.

CPC Parameter Group	Parameter	Setting	Options	Default	Access
35	3 09 DO Selection	3 = Engine Brake Active	0 = Disabled 1 = Grid Heater Hardwired* 2 = AGS2 Backup Lamp 3 = Engine Brake Active 4 = Oil Temp High Lamp* 5 = FUSO Engine Brake Active Lamp*	0 = Disabled	VEPS, DRS

*Not Supported in NAFTA

Table 5-27 Optional Digital Output for Engine Brakes

The Engine Fan Braking option parameter is listed in Table 5-28.

CPC Parameter Group	Parameter	Description	Options	Default
19	Eng Brake Enable Auto Fan	Provides additional engine braking by activating the DDEC controlled fan whenever the engine brakes are active in high. This function requires both DDEC engine brake controls and DDEC fan controls.	0 = Disable 1 = Enable	0 = Disable

Table 5-28 Optional Fan Braking for Engine Brakes

The parameter listed in Table 5-29 is for Service Brake Control of the Engine Brakes option.

CPC Parameter Group	Parameter	Description	Options	Default
10	Service Brk Enable Eng Brakes	When this function is enabled, an input from the service brake is required in order to activate the engine brake.	0 = Disable 1 = Enable automatic engine brake when applied service brake 2 = Operator selection and service brake for engine brake activation	0 = Disable

Table 5-29 Service Brake Control of Engine Brakes Parameter

The parameter listed in Table 5-30 is the Minimum Vehicle Speed needed for engine braking to occur.

CPC Parameter Group	Parameter	Description	Options	Default
10	Min Road Spd Eng Brk Operation	The minimum vehicle speed required before engine braking will occur.	0–200 KPH	0 KPH

Table 5-30 Minimum MPH for Engine Brakes Option

5.7.4 INTERACTION WITH OTHER FEATURES

DDEC will respond to requests from other vehicle systems via SAE J1939 Data Link to disable the engine brakes.

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5.8 ENGINE PROTECTION

The DDEC VI Engine Protection system monitors all engine sensors and electronic components, and recognizes system malfunctions. If a critical fault is detected, the Amber Warning Lamp (AWL) and Red Stop Lamp (RSL) illuminate. The malfunction codes are logged into the CPC's memory.

The standard parameters which are monitored for engine protection are:

- □ Low coolant level
- □ High coolant temperature
- □ Low oil pressure
- □ High soot level (DPF)
- □ Uncontrolled DPF Regeneration

5.8.1 OPERATION

Engine Protection is a vital part of MCM/CPC programming and software. DDEC VI monitors coolant level, various pressures and temperatures, and compares these parameters against the allowable limits to determine when a critical fault is reached. The AWL is illuminated and a code logged if there is an electronic system fault. This indicates the problem should be diagnosed as soon as possible. The CPC illuminates the AWL and RSL and stores a malfunction code if a potentially engine damaging fault is detected. Once a critical fault is reached, the AWL and RSL are illuminated and a 60 (coolant temp, coolant level, oil level) or 30 (oil pressure or DPF) second timer starts a countdown to the desired level of protection. The AWL will flash for 20 – 30 seconds and the RSL will flash for 10 seconds before the engine shuts down. The flashing will occur only if protection shutdown is enabled. Temperature and pressure limits are established in the engine calibration and may differ slightly from one engine model to another.

Engine Protection consists of different protection levels:

- □ Warning
- □ Shutdown

Warning

The AWL illuminates when the parameter value falls below the pre-warning level. Speed and/or torque may be limited based on the engine protection parameter. The operation has the responsibility to take action to avoid engine damage. No shutdown will occur.

Shutdown

Speed and/or torque may be limited based on the engine protection parameter. The engine shuts down 60 seconds (for coolant level or coolant temperature) or 30 seconds (oil pressure or DPF) after the RSL is illuminated. The AWL will flash 20–30 seconds before the shutdown. The RSL will flash 10 seconds before the shutdown.

5.8.2 STOP ENGINE OVERRIDE OPTION

The Stop Engine Override Switch is used for a momentary override. DDEC VI will record the number of times the override is activated after a fault occurs.

NOTE:
This switch is REQUIRED for all applications except fire truck.

Momentary Override - An SEO switch is used to override the shutdown sequence. This override resets the 60 second (30 seconds for oil pressure) shutdown timer. The switch must be recycled after five seconds to obtain a subsequent override.

NOTE:
The operator has the responsibility to take action to avoid engine damage.

An additional override will occur when a DPF soot load or diagnostic shutdown is in progress and the CPC is requesting a DPF regeneration. This will give a blocked or sooty DPF the chance to be cleared before determining whether to shutdown the engine.

5.8.3 PROGRAMMING FLEXIBILITY

DDEC VI is programmed with pressure, temperature, and level protection limits for each parameter monitored. Rampdown is always enabled. Shutdown can be configured for certain parameters.

DDEC VI engine protection system parameters are listed in Table 5-31 .

Parameter Group	Parameter	Description	Options	Default	Access
18	Coolant Temp Eng Protect Shtn	Enable/Disable shutdown for high coolant temperature	0 = Warning 1 = Engine Shutdown	1 = Engine Shutdown	DDDL 7.0, DRS, VEPS
18	Coolant Level Eng Protect Shtn	Enable/Disable shutdown for low coolant level	0 = Warning 1 = Engine Shutdown	1 = Engine Shutdown	DDDL 7.0, DRS, VEPS
18	Oil Press Eng Protect Shtn	Enable/Disable shutdown for low oil pressure	0 = Warning 1 = Engine Shutdown	1 = Engine Shutdown	DDDL 7.0, DRS, VEPS
18	Oil Level Eng Protect Shtn	Enable/Disable shutdown for low oil level	0 = Warning 1 = Engine Shutdown	1 = Engine Shutdown	DDDL 7.0, DRS, VEPS

Table 5-31 Engine Protection

The Stop Engine Override Switch /Diagnostic Request Switch can be configured as listed in Table 5-32.

Parameter Group	Parameter	Options	Default	Access
13	1 15 DI Selection	0 – Unconfigured 1 – Stop Engine Override Switch /Diagnostic Request Switch (fault code flashing) 2 – CC Cancel (FUSO)* 3 – Diagnostic Request Switch (fault code flashing)	1 – Stop Engine Override Switch /Diagnostic Request Switch (fault code flashing)	VEPS or DRS

* Not supported in NAFTA

Table 5-32 Diagnostic Request Switch Programming Options

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5.9 ENGINE RATINGS

Engine ratings are designed by horsepower and engine speed. The Cruise Power parameter in the CPC must be set up to the designated horsepower requested by the customer. This can be changed with VEPS, DRS or DDDL.

5.9.1 PROGRAMMING REQUIREMENTS AND FLEXIBILITY

The Series 60 engine ratings are listed in Table 5-33.

Rating	D Group	M Group	FL Sales Code	Series 60 Cruise Power Setting
425 HP @ 1800 RPM - 1450 LBFT @1200 RPM	6N4D-7533	6N4M-8231	101-2F2	1 - Low Power
445 HP @ 1800 RPM - 1450 LBFT @1200 RPM	6N4D-7533	6N4M-8230	101-2F3	0 - High Power
425/445 HP @ 1800 RPM - 1450 LBFT @1200 RPM	6N4D-7533	6N4M-8232	101-2F4	2 - Cruise Power
455 HP @ 1800 RPM - 1550 LBFT @1200 RPM	6N4D-7534	6N4M-8234	101-2EW	1 - Low Power
490 HP @ 1800 RPM - 1550 LBFT @1200 RPM	6N4D-7534	6N4M-8233	101-2EX	0 - High Power
455/490 HP @ 1800 RPM C/P - 1550 LBFT @1200 RPM	6N4D-7534	6N4M-8235	101-2E4	2 - Cruise Power
515 HP @ 1800 RPM - 1550 LBFT @1200 RPM	6N4D-7536	6N4M-8236	101-2EY	0 - High Power
490/515 HP @ 1800 RPM C/P - 1550 LBFT @1200 RPM	6N4D-7536	6N4M-8240	101-2F6	2 - Cruise Power
470 HP @ 1800 RPM - 1650 LBFT @1200 RPM	6N4D-7537	6N4M-8242	101-2E0	1 - Low Power
515 HP @ 1800 RPM - 1650 LBFT @1200 RPM	6N4D-7537	6N4M-8241	101-2E3	0 - High Power
470/515 HP @ 1800 RPM C/P - 1650 LBFT @1200 RPM	6N4D-7537	6N4M-8243	101-2E1	2 - Cruise Power
455 HP @ 1800 RPM - 1550 LBFT @1200 RPM	6N4D-7535	6N4M-8234	101-2FT	1 - Low Power

Table 5-33 Series 60 Engine Ratings

MBE 900 and MBE 4000 engines have one rating in the fuel map. CPC parameter Cruise Power should be set to 0 - High Power.

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5.10 ENGINE STARTER CONTROL

Engine starters may be enabled by either the ignition-run key switch (KL-50) (see Figure 5-11) or the MCM (see Figure 5-12).

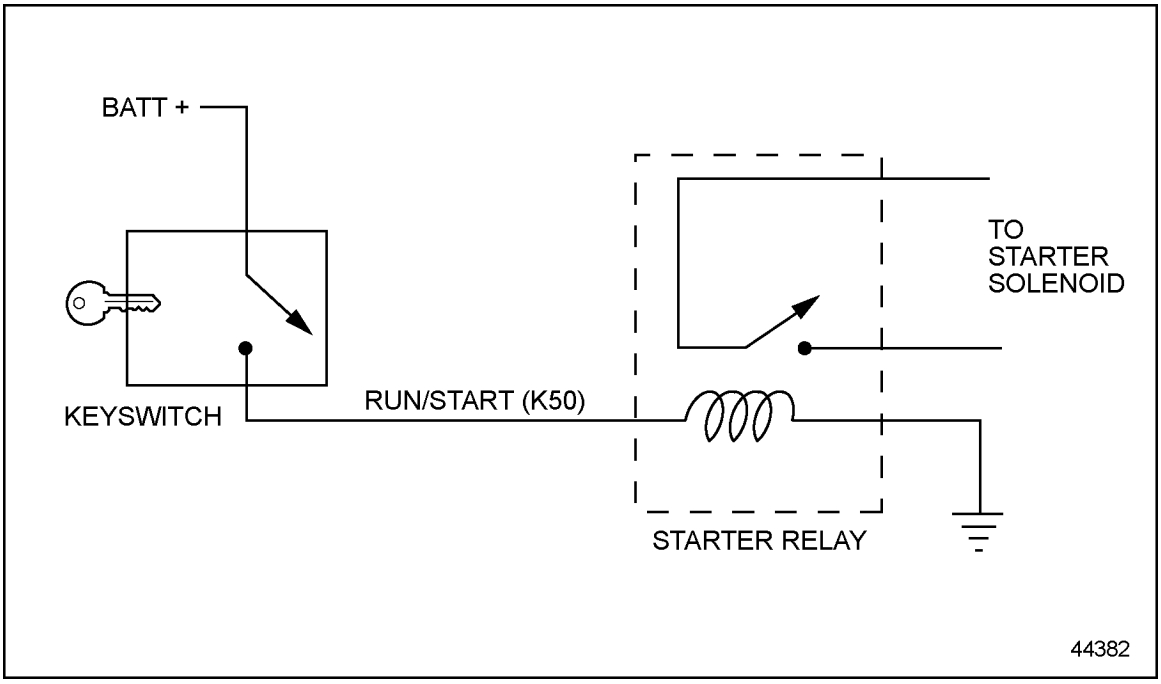

Figure 5-11 Key Switch Starter Control

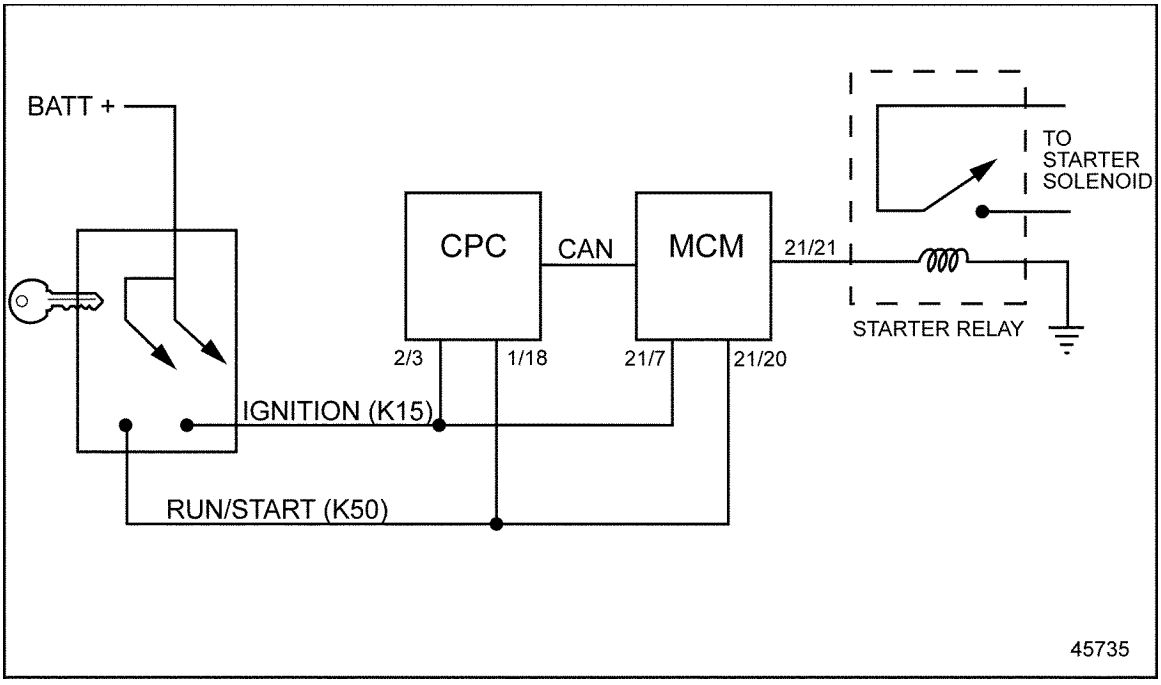

Figure 5-12 MCM Starter Control

5.10.1 PROGRAMMING REQUIREMENTS AND FLEXIBILITY

The Engine Starter Control settings are listed in Table 5-34.

Parameter	Options	Default
Starter Type Control	0 = Starter activated via key switch 1 = Starter activated via MCM 2 = Starter activated via MCM with modified diagnostics (V 7.74 MBE MCM software or later)	0

Table 5-34 Engine Starter Control Settings — MCM

NOTE:
If the parameter is set for MCM Starter Control and the starter is wired for Key Switch control, the engine will crank but will not start.

The starter relay specifications are:

- Min Relay Resistance >4 Ω
- Max Relay Resistance <500 Ω

Current vs inductance is listed in Table 5-35.

Max Inductance (mH)	Current (amps)
30	4
65	3
150	2
600	1

Table 5-35 Current vs Inductance

5.11 ETHER STARTING – SERIES 60

Information not available at this time.

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5.12 FAN CONTROL

The purpose of the Fan Control feature is to electronically control engine cooling fan activation and to provide a load for vehicle retardation, when required. DDEC VI Fan Controls are designed to optimally control the engine cooling fan(s) based on engine cooling requirements. Fan Controls are designed to use other system inputs such as A/C pressure switches and operator requested fan operation.

5.12.1 OPERATION

DDEC VI continuously monitors and compares the coolant and intake manifold air temperature, engine torque, engine operation mode, and various optional inputs to calibrated levels stored within DDEC VI. These limits are factory configured based on application.

When these temperature levels exceed the preset fan ON temperature value, DDEC VI will enable the fan control output(s) that activate the fan. The fan will remain on, cooling the engine with the increased air flow until the temperature levels reach the preset fan OFF temperature.

DDEC VI provides fan control for four different fan configurations:

- □ Single-speed fan (two outputs) (refer to section 5.12.2)
- □ Single-speed fan (one output) (refer to section 5.12.3)
- □ Dual fans (refer to section 5.12.4)
- □ Two-speed fan (refer to section 5.12.5)
- □ Variable speed fan without fan speed feedback (refer to section 5.12.6)
- □ Variable speed fan with fan speed feedback (refer to section 5.12.7)

5.12.2 SINGLE–SPEED FAN (FAN TYPE 4)

This fan type must be used if the current exceeds 2A. The two outputs (Fan Control #1 and Fan Control #2) must be wired together. The single-speed fan control uses two digital outputs to drive a single-speed fan. Fan Control #1 and #2 are open circuit to turn the fan ON. The fan will remain ON for a minimum of 30 seconds. The fan output will not be enabled until five seconds after the engine has started.

NOTE:
Fan output circuits are designed to sink no more than 2.0 A (DC) current.

Fan Control #1 and #2 are open circuit when at least one of the following conditions occur:

- □ Coolant temperature above factory set levels
- □ Intake manifold temperature above factory set levels
- □ Air conditioner is active (OEM supplied A/C switch is opened) – optional
- □ Coolant or intake manifold air temperature sensor fails
- □ Engine Brake is active at high level (optional)
- □ Fan Control Override Switch is grounded (ON)
- □ PTO is enabled and active – optional

Single-Speed Fan Installation

This section provides a schematic of the specific connection from DDEC VI to the fan. See Figure 5-13. Compatible fans may be obtained from several vendors.

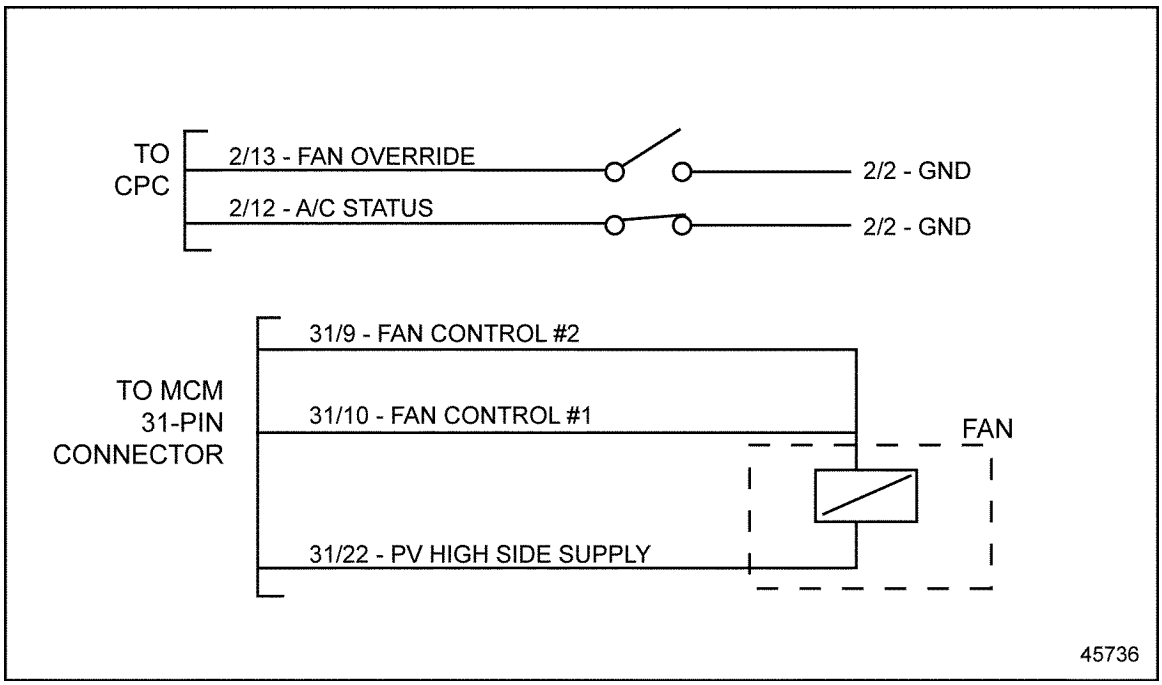

Figure 5-13 Single-speed Fan – Fan Type 4

Programming Requirements and Flexibility

The MCM options for the single-speed fan – Type 4 are listed in Table 5-36.

Parameter	Setting	Options	Default	Access
Fan Type	4 – Single-Speed Fan – 2 Outputs	0 = 2–Speed Fan with Ambient Temp Offset 1 = 2–Speed Fan 2 = Variable Speed Fan with Fan Speed Feedback 3 = Variable Speed Fan without Fan Speed Feedback 4 = Single-Speed Fan – 2 Outputs 5 = Variable Speed Fan without Fan Speed Feedback with Ambient Temp Offset 6 = Dual Fan 7 = Single-speed Fan – 1 Output 8 = Variable Speed Fan with Fan Speed Feedback 9 = Variable Speed Fan without Fan Speed Feedback with Ambient Temp Offset 255 = No Fan	255 – No Fan	VEPS, DRS
SW3 Configuration	17 = Single-speed Fan or Two-speed Fan Low	0 = No Function 17 = Single-speed Fan or Two-speed Fan Low	0 = No Function	VEPS, DRS
PWM6 Configuration	5 = Two-speed Fan High or PWM Fan	0 = No Function 5 = Two-speed Fan High or PWM Fan	0 = No Function	VEPS, DRS
Dyn Fan Brake Enable	—	0 = Disabled 1 = Enabled	0 = Disabled	VEPS, DRS

Table 5-36 Single-speed Fan – Type 4 MCM Options

The CPC options for the single-speed fan – Type 4 are listed in Table 5-37.

Parameter Group	Parameter	Description	Options	Default	Access
19	AC Fan Vehicle Speed Enable	Enables/disables the road speed threshold for AC fan.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	AC Fan Vehicle Speed Thresh	Road speed threshold above which the A/C fan request is not using the hold time	0 – 250 km/h	32 km/h	VEPS, DRS
19	PTO Enable Auto Fan Activation	Enables/disables turning on the fan when the PTO is active.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Air Condition Enable Auto Fan	Enables/disables turning on the fan when the air conditioning is on.	0 = Disable 1 = Enable	1 = Enable	VEPS, DRS
19	J1939 Fan Request Enable	Enables the fan based on a J1939 CM1 fan request.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Fan AC Hold Time	Minimum fan on time for AC	0–600 sec	180 sec	VEPS, DRS
19	Hold Time Fan	Minimum fan on time	0–600 sec	10 sec	VEPS, DRS
19	Fan Vehicle Speed Enable	Activates the road speed threshold feature	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Fan Vehicle Speed Threshold	Vehicle speed threshold below which the fan request will be ignored.	0–250 km/h	0 km/h	VEPS, DRS
6	Mode of AC Status Input	Defines type of input for A/C switch	0 = Disable 1 = AC Active Closed 2 = AC Active Open 3 = LIM Active Closed 4 = LIM Active Open	2 = AC Active Open	VEPS, DRS

Table 5-37 Single-speed Fan – Type 4 CPC Options

5.12.3 SINGLE–SPEED FAN (FAN TYPE 7)

The single-speed fan control (type 7) uses one digital output (Fan Control #1) to drive a single-speed fan. This fan type can be used if the current is less than 2.0 A. Fan Control #1 is an open circuit to turn the fan ON. The fan will remain ON for a minimum of 30 seconds. The fan output will not be enabled until five seconds after the engine has started.

NOTE:
Fan output circuits are designed to sink no more than 2.0 A (DC) current.

Fan Control #1 is open circuit when at least one of the following conditions occur:

- □ Coolant temperature above factory set levels
- □ Intake manifold temperature above factory set levels
- □ Air conditioner is active (OEM supplied A/C switch is opened) – optional
- □ Coolant or intake manifold air temperature sensor fails
- □ Engine Brake is active at high level (optional)
- □ Fan Control Override Switch is grounded (ON)
- □ PTO is enabled and active – optional

Single-Speed Fan Installation

This section provides a schematic of the specific connection from DDEC VI to the fan. See Figure 5-14. Compatible fans may be obtained from several vendors.

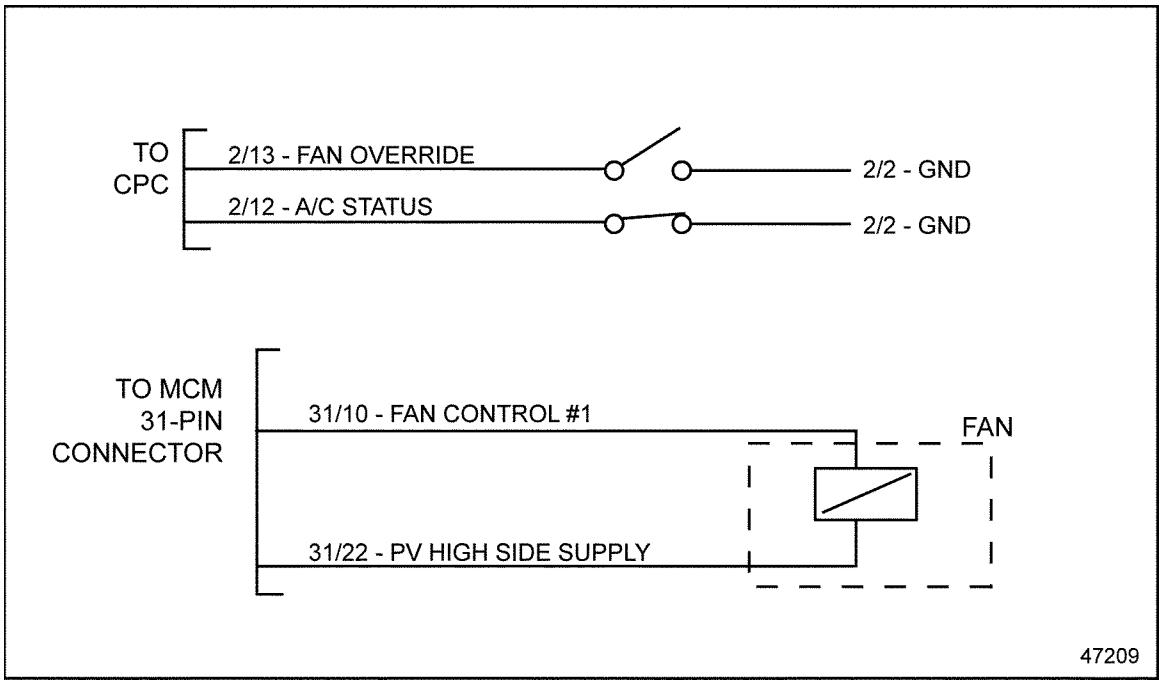

Figure 5-14 Single-speed Fan – Fan Type 7

Programming Requirements and Flexibility

The MCM options for the single-speed fan – Type 7 are listed in Table 5-38.

Parameter	Setting	Options	Default	Access
Fan Type	7 = Single-speed Fan – 1 Output	0 = 2–Speed Fan with Ambient Temp Offset 1 = 2–Speed Fan 2 = Variable Speed Fan with Fan Speed Feedback 3 = Variable Speed Fan without Fan Speed Feedback 4 = Single-Speed Fan – 2 Outputs 5 = Variable Speed Fan without Fan Speed Feedback with Ambient Temp Offset 6 = Dual Fan 7 = Single-speed Fan – 1 Output 8 = Variable Speed Fan with Fan Speed Feedback 9 = Variable Speed Fan without Fan Speed Feedback with Ambient Temp Offset 255 = No Fan	255 – No Fan	VEPS, DRS
SW3 Configuration	17 = Single-speed Fan or Two-speed Fan Low	0 = No Function 17 = Single-speed Fan or Two-speed Fan Low	0 = No Function	VEPS, DRS
Dyn Fan Brake Enable	—	0 = Disabled 1 = Enabled	0 = Disabled	VEPS, DRS

Table 5-38 Single-speed Fan – Type 7 MCM Options

The CPC options for the single-speed fan – Type 7 are listed in Table 5-39.

Parameter Group	Parameter	Description	Options	Default	Access
19	AC Fan Vehicle Speed Enable	Enables/disables the road speed threshold for AC fan.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	AC Fan Vehicle Speed Thresh	Road speed threshold above which the A/C fan request is not using the hold time	0 – 250 km/h	32 km/h	VEPS, DRS
19	PTO Enable Auto Fan Activation	Enables/disables turning on the fan when the PTO is active.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Air Condition Enable Auto Fan	Enables/disables turning on the fan when the air conditioning is on.	0 = Disable 1 = Enable	1 = Enable	VEPS, DRS
19	J1939 Fan Request Enable	Enables the fan based on a J1939 CM1 fan request.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Fan AC Hold Time	Minimum fan on time for AC	0–600 sec	180 sec	VEPS, DRS
19	Hold Time Fan	Minimum fan on time	0–600 sec	10 sec	VEPS, DRS
19	Fan Vehicle Speed Enable	Activates the road speed threshold feature	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Fan Vehicle Speed Threshold	Vehicle speed threshold below which the fan request will be ignored.	0–250 km/h	0 km/h	VEPS, DRS
6	Mode of AC Status Input	Defines type of input for A/C switch	0 = Disable 1 = AC Active Closed 2 = AC Active Open 3 = LIM Active Closed 4 = LIM Active Open	2 = AC Active Open	VEPS, DRS

Table 5-39 Single-speed Fan – Type 7 CPC Options

5.12.4 DUAL FANS (FAN TYPE 6)

This configuration uses two digital outputs, Fan Control #1 and Fan Control #2, to drive two separate single-speed fans. Fan Control #1 and Fan Control #2 are an open circuit to turn ON each fan respectively. The fan remains on for 30 seconds. The fan outputs will not be enabled until five seconds after the engine has started.

NOTE:
Fan output circuits are designed to sink no more than 2.0 A (DC) current.

The two fans are independent of one another and are controlled by different conditions. Both fans will be activated when either the Fan Control Override is enabled or when the conditions are met for Fan Engine Brake.

Fan Control #1 is an open circuit when at least one of the following conditions occur:

- □ Intake manifold or coolant temperature above factory set levels
- □ Intake manifold or coolant temperature sensor fails
- □ Air conditioner is active (OEM supplied A/C switch is opened) – optional
- □ Engine Brake level is active at high level – optional
- □ Fan control override switch is grounded (ON)
- □ PTO is enabled and active – optional

Fan control #2 is an open circuit when one of the following conditions occur:

- □ Intake manifold or coolant temperature above DDC factory set levels
- □ Intake manifold or coolant temperature sensor fails
- □ Engine Brake level is active at high level – optional
- □ Fan control override switch is grounded (ON)
- □ PTO is enabled and active – optional

Dual Fans Installation

See Figure 5-15 for dual fan installation.

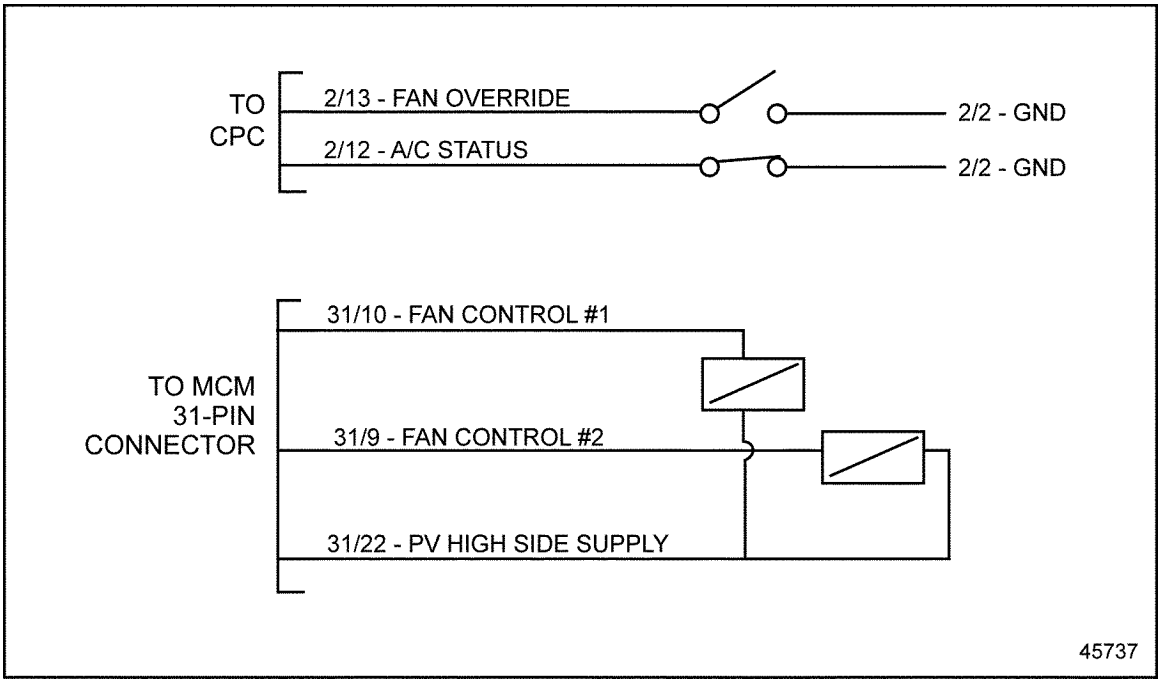

Figure 5-15 Dual Fan (Fan Type 6)

Programming Requirements and Flexibility

The MCM options for dual fans – Type 6 are listed in Table 5-40.

Parameter	Setting	Options	Default	Access
Fan Type	6 – Dual Fan	0 = 2–Speed Fan with Ambient Temp Offset 1 = 2–Speed Fan 2 = Variable Speed Fan with Fan Speed Feedback 3 = Variable Speed Fan without Fan Speed Feedback 4 = Single-Speed Fan – 2 Outputs 5 = Variable Speed Fan without Fan Speed Feedback with Ambient Temp Offset 6 = Dual Fan 7 = Single-speed Fan – 1 Output 8 –= Variable Speed Fan with Fan Speed Feedback 9 = Variable Speed Fan without Fan Speed Feedback with Ambient Temp Offset 255 = No Fan	255 – No Fan	VEPS, DRS
SW3 Configuration	17 = Single-speed Fan or Two-speed Fan Low	0 = No Function 17 = Single-speed Fan or Two-speed Fan Low	0 = No Function	VEPS, DRS
PWM6 Configuration	5 = Two-speed Fan High or PWM Fan	0 = No Function 5 = Two-speed Fan High or PWM Fan	0 = No Function	VEPS, DRS
Dyn Fan Brake Enable	—	0 = Disabled 1 = Enabled	0 = Disabled	VEPS, DRS

Table 5-40 Dual Fan – Type 6 MCM Options

The CPC options for the dual fan – Type 6 are listed in Table 5-41.

Parameter Group	Parameter	Description	Options	Default	Access
19	AC Fan Vehicle Speed Thresh Enable	Enables/disables the road speed threshold for AC fan.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	AC Fan Vehicle Speed Thresh	Road speed threshold above which the A/C fan request is not using the hold time	0 – 250 km/h	32 km/h	VEPS, DRS
19	PTO Enable Auto Fan Activation	Enables/disables turning on the fan when the PTO is active.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Air Condition Enable Auto Fan	Enables/disables turning on the fan when the air conditioning is on.	0 = Disable 1 = Enable	1 = Enable	VEPS, DRS
19	J1939 Fan Request Enable	Enables the fan based on a J1939 CM1 fan request.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Fan AC Hold Time	Minimum fan on time for AC	0–600 sec	180 sec	VEPS, DRS
19	Hold Time Fan	Minimum fan on time	0–600 sec	10 sec	VEPS, DRS
19	Fan Vehicle Speed Enable	Activates the road speed threshold feature	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Fan Vehicle Speed Threshold	Vehicle speed threshold below which the fan request will be ignored.	0–250 km/h	0 km/h	VEPS, DRS
6	Mode of AC Status Input	Defines type of input for A/C switch	0 = Disable 1 = AC Active Closed 2 = AC Active Open 3 = LIM Active Closed 4 = LIM Active Open	2 = AC Active Open	VEPS, DRS

Table 5-41 Dual Fan – Type 6 CPC Options

5.12.5 TWO-SPEED FAN

This configuration uses two digital outputs, Fan Control #1 and Fan Control #2, to drive a two-speed fan. When Fan Control #1 output is open, the fan operates in low-speed mode. When Fan Control #1 and Fan Control #2 are both open, the fan operates in high-speed mode.

NOTE:
Fan output circuits are designed to sink no more than 2.0 A (DC) current.

Fan Control #1 is an open circuit when at least one of the following conditions occur:

- □ Coolant temperature above factory set levels
- □ Intake manifold air temperature above factory set levels

Fan control #2 is an open circuit when one of the following conditions occur:

- □ Coolant temperature above factory set levels
- □ Intake manifold air temperature above factory set levels
- □ Coolant, or intake manifold air temperature sensor fails
- □ Air conditioner is active (OEM supplied A/C switch is opened) – optional
- □ Engine Brake level is active at high level
- □ Fan control override switch is enabled
- □ PTO enabled and active – optional

Two-speed Fan Installation

See Figure 5-16 for two-speed fan installation.

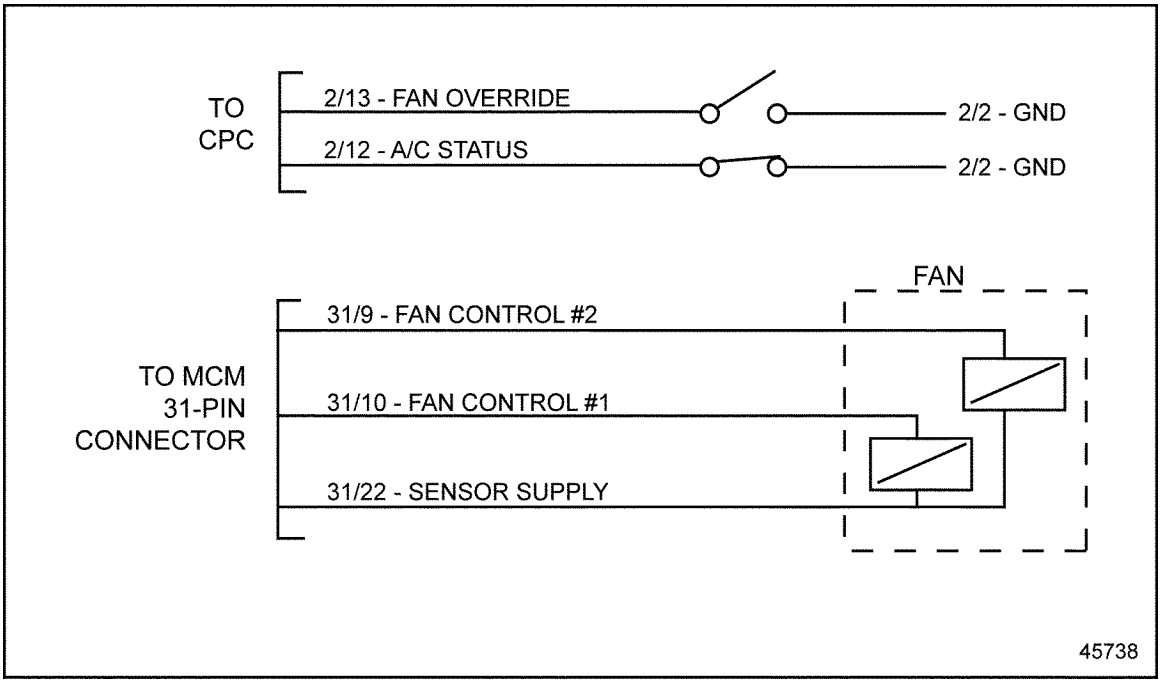

Figure 5-16 Two-speed Fan (Fan type 0 or 1)

Programming Requirements and Flexibility

The MCM options for two-speed fans – Type 1 are listed in Table 5-40.

Parameter	Setting	Options	Default	Access
Fan Type	1 = 2–Speed Fan	0 = 2–Speed Fan with Ambient Temp Offset 1 = 2–Speed Fan 2 = Variable Speed Fan with Fan Speed Feedback 3 = Variable Speed Fan without Fan Speed Feedback 4 = Single-Speed Fan – 2 Outputs 5 = Variable Speed Fan without Fan Speed Feedback with Ambient Temp Offset 6 = Dual Fan 7 = Single-speed Fan – 1 Output 8 = Variable Speed Fan with Fan Speed Feedback 9 = Variable Speed Fan without Fan Speed Feedback with Ambient Temp Offset 255 = No Fan	255 – No Fan	VEPS, DRS
SW3 Configuration	17 = Single-speed Fan or Two-speed Fan Low	0 = No Function 17 = Single-speed Fan or Two-speed Fan Low	0 = No Function	VEPS, DRS
PWM6 Configuration	5 = Two-speed Fan High or PWM Fan	0 = No Function 5 = Two-speed Fan High or PWM Fan	0 = No Function	VEPS, DRS
Dyn Fan Brake Enable	—	0 = Disabled 1 = Enabled	0 = Disabled	VEPS, DRS

Table 5-42 Two-speed Fan – Type 1 MCM Options

The CPC options for the two-speed fan – Type 1 are listed in Table 5-43.

Parameter Group	Parameter	Description	Options	Default	Access
19	AC Fan Vehicle Speed Thresh Enable	Enables/disables the road speed threshold for AC fan.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	AC Fan Vehicle Speed Thresh	Road speed threshold above which the A/C fan request is not using the hold time	0 – 250 km/h	32 km/h	VEPS, DRS
19	PTO Enable Auto Fan Activation	Enables/disables turning on the fan when the PTO is active.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Air Condition Enable Auto Fan	Enables/disables turning on the fan when the air conditioning is on.	0 = Disable 1 = Enable	1 = Enable	VEPS, DRS
19	J1939 Fan Request Enable	Enables the fan based on a J1939 CM1 fan request.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Fan AC Hold Time	Minimum fan on time for AC	0–600 sec	180 sec	VEPS, DRS
19	Hold Time Fan	Minimum fan on time	0–600 sec	10 sec	VEPS, DRS
19	Fan Vehicle Speed Enable	Activates the road speed threshold feature	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Fan Vehicle Speed Threshold	Vehicle speed threshold below which the fan request will be ignored.	0–250 km/h	0 km/h	VEPS, DRS
6	Mode of AC Status Input	Defines type of input for A/C switch	0 = Disable 1 = AC Active Closed 2 = AC Active Open 3 = LIM Active Closed 4 = LIM Active Open	2 = AC Active Open	VEPS, DRS

Table 5-43 Two-speed Fan – Type 1 CPC Options

5.12.6 VARIABLE SPEED FAN (FAN TYPE 3) WITHOUT FAN SPEED FEEDBACK

DDEC VI uses a pulse width modulated (PWM) output to drive a variable speed fan. The fan may be enabled by specific engine temperature sensors and various other inputs. The fan will ramp up to the requested speed in order to reduce noise, shock-loading, and belt slippage. If the fan is turned on for any reason other than high temperature, it will ramp up to the full fan speed (i.e. 5% or 10% duty cycle, application dependent). A decrease in fan speed will occur after a short time delay and will step down to the value dictated by the highest sensor request. If the A/C switch is opened, the fan will increase speed at the ramp rate until it is at a maximum. After the A/C switch is grounded the fan will remain on for a short time delay and then turn off.

NOTE:
Fan output circuits are designed to sink no more than 2.0 A (DC) current.

The PWM output is initiated when at least one of the following conditions occur:

- □ Intake manifold or coolant temperatures above factory set limits
- □ Air conditioner is active (OEM supplied A/C switch is opened) – optional
- □ Intake manifold or coolant temperature sensor fails
- □ Fan Control Override Switch is grounded (ON)
- □ PTO is enabled and active – optional

Installation

See Figure 5-17 for variable-speed fan without fan speed feedback (Fan Type 3) installation.

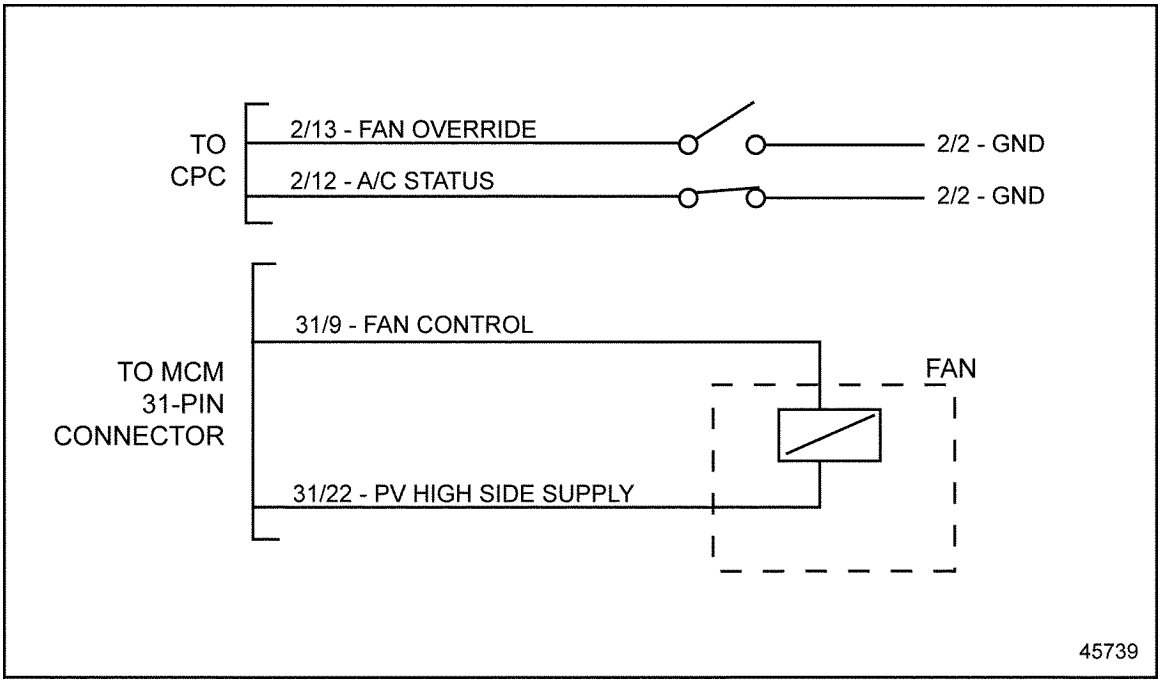

Figure 5-17 Variable Speed Fan without Fan Speed Feedback (Fan Type 3)

Programming Requirements and Flexibility

The MCM options for variable speed fans without fan speed feedback – Type 3 are listed in Table 5-44.

Parameter	Setting	Options	Default	Access
Fan Type	3 = Variable Speed Fan without Fan Speed Feedback	0 = 2–Speed Fan with Ambient Temp Offset 1 = 2–Speed Fan 2 = Variable Speed Fan with Fan Speed Feedback 3 = Variable Speed Fan without Fan Speed Feedback 4 = Single-Speed Fan – 2 Outputs 5 = Variable Speed Fan without Fan Speed Feedback with Ambient Temp Offset 6 = Dual Fan 7 = Single-speed Fan – 1 Output 8 = Variable Speed Fan with Fan Speed Feedback 9 = Variable Speed Fan without Fan Speed Feedback with Ambient Temp Offset 255 = No Fan	255 – No Fan	VEPS, DRS
PWM6 Configuration	5 = Two-speed Fan High or PWM Fan	0 = No Function 5 = Two-speed Fan High or PWM Fan	0 = No Function	VEPS, DRS
Dyn Fan Brake Enable	—	0 = Disabled 1 = Enabled	0 = Disabled	VEPS, DRS

Table 5-44 Variable Speed Fan Without Fan Speed Feedback – Type 3 MCM Options

The CPC options for the variable speed fan without fan speed feedback – Type 3 are listed in Table 5-45.

Parameter Group	Parameter	Description	Options	Default	Access
19	AC Fan Vehicle Speed Thresh Enable	Enables/disables the road speed threshold for AC fan.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	AC Fan Vehicle Speed Thresh	Road speed threshold above which the A/C fan request is not using the hold time	0 – 250 km/h	32 km/h	VEPS, DRS
19	PTO Enable Auto Fan Activation	Enables/disables turning on the fan when the PTO is active.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Air Condition Enable Auto Fan	Enables/disables turning on the fan when the air conditioning is on.	0 = Disable 1 = Enable	1 = Enable	VEPS, DRS
19	J1939 Fan Request Enable	Enables the fan based on a J1939 CM1 fan request.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Ramp Fan	Specifies the ramp rate for a variable speed fan	1 – 100%/sec	25%/sec	VEPS, DRS
19	Trans Retarder Fan Percent	Specifies the fan speed when the trans retarder is active via a hardwired input or J1939 ERC1 message	0 = 100%	100%	VEPS, DRS
19	Fan AC Hold Time	Minimum fan on time for AC	0–600 sec	180 sec	VEPS, DRS
19	Hold Time Fan	Minimum fan on time	0–600 sec	10 sec	VEPS, DRS
19	Fan Vehicle Speed Enable	Activates the road speed threshold feature	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Fan Vehicle Speed Threshold	Vehicle speed threshold below which the fan request will be ignored.	0–250 km/h	0 km/h	VEPS, DRS
6	Mode of AC Status Input	Defines type of input for A/C switch	0 = Disable 1 = AC Active Closed 2 = AC Active Open 3 = LIM Active Closed 4 = LIM Active Open	2 = AC Active Open	VEPS, DRS

Table 5-45 Variable Speed Fan Without Fan Speed Feedback – Type 3 CPC Options

5.12.7 VARIABLE SPEED FAN (FAN TYPE 2) WITH FAN SPEED FEEDBACK

DDEC VI uses a pulse width modulated (PWM) output to drive a variable speed fan. The fan may be enabled by specific engine temperature sensors and various other inputs. The fan will ramp up to the requested speed in order to reduce noise, shock-loading, and belt slippage. If the fan is turned on for any reason other than high temperature, it will ramp up to the full fan speed (i.e. 5% or 10% duty cycle, application dependent). A decrease in fan speed will occur after a short time delay and will step down to the value dictated by the highest sensor request. If the A/C switch is opened, the fan will increase speed at the ramp rate until it is at a maximum. After the A/C switch is grounded the fan will remain on for a short time delay and then turn off.

NOTE:
Fan output circuits are designed to sink no more than 2.0 A (DC) current.

The PWM output is initiated when at least one of the following conditions occur:

- □ Intake manifold or coolant temperatures above factory set limits
- □ Air conditioner is active (OEM supplied A/C switch is opened) – optional
- □ Intake manifold or coolant temperature sensor fails
- □ Fan Control Override Switch is grounded (ON)
- □ PTO is enabled and active – optional

Installation

See Figure 5-18 for variable-speed fan with fan speed feedback (Fan Type 2) installation.

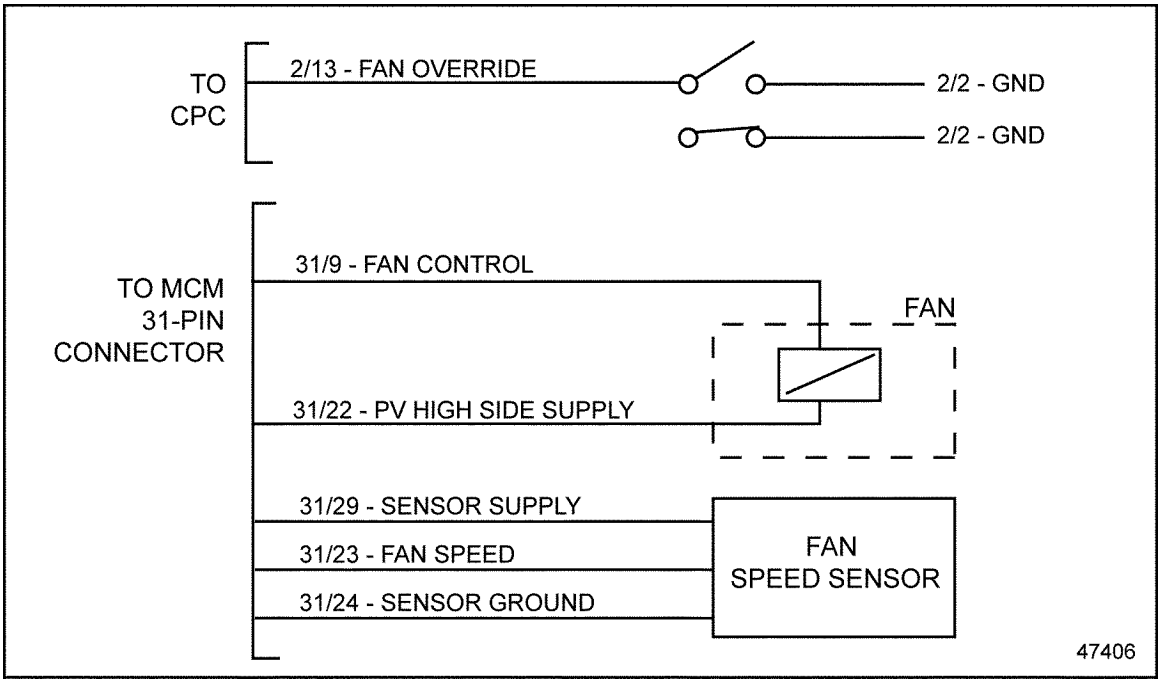

Figure 5-18 Variable Speed Fan with Fan Speed Feedback (Fan Type 2)

Programming Requirements and Flexibility

The options for variable speed fans without fan speed feedback – Type 2 are listed in Table 5-46.

Parameter	Setting	Options	Default	Access
Fan Type	2 = Variable Speed Fan with Fan Speed Feedback	0 = 2–Speed Fan with Ambient Temp Offset 1 = 2–Speed Fan 2 = Variable Speed Fan with Fan Speed Feedback 3 = Variable Speed Fan without Fan Speed Feedback 4 = Single-Speed Fan – 2 Outputs 5 = Variable Speed Fan without Fan Speed Feedback with Ambient Temp Offset 6 = Dual Fan 7 = Single-speed Fan – 1 Output 8 = Variable Speed Fan with Fan Speed Feedback 9 = Variable Speed Fan without Fan Speed Feedback with Ambient Temp Offset 255 = No Fan	255 – No Fan	VEPS, DRS
PWM6 Configuration	5 = Two-speed Fan High or PWM Fan	0 = No Function 5 = Two-speed Fan High or PWM Fan	0 = No Function	VEPS, DRS
Type 2 Fan Ratio	—	0 – 1.75	0	VEPS, DRS
Type 2 Fan PWM Max	—	0 – 100	0	VEPS, DRS
Type 2 PWM Freq	—	0 – 1000	0	VEPS, DRS
Type 2 Maximum Fan Slip	—	0 – 10000	0	VEPS, DRS
Type 2 Fan Pulses Per Rev	—	0 – 255	0	VEPS, DRS
Dyn Fan Brake Enable	—	0 = Disabled 1 = Enabled	0 = Disabled	VEPS, DRS

Table 5-46 Variable Speed Fan With Fan Speed Feedback – Type 2 Options

The CPC options for the variable speed fan with fan speed feedback – Type 2 are listed in Table 5-47.

Parameter Group	Parameter	Description	Options	Default	Access
19	AC Fan Vehicle Speed Thresh Enable	Enables/disables the road speed threshold for AC fan.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	AC Fan Vehicle Speed Thresh	Road speed threshold above which the A/C fan request is not using the hold time	0 – 250 km/h	30 km/h	VEPS, DRS
19	PTO Enable Auto Fan Activation	Enables/disables turning on the fan when the PTO is active.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Air Condition Enable Auto Fan	Enables/disables turning on the fan when the air conditioning is on.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Enable J1939 Fan Request	Enables the fan based on a J1939 CM1 fan request.	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Fan Ramp Rate	Specifies the ramp rate for a variable speed fan	1 – 100%/sec	25%/sec	VEPS, DRS
19	Trans Retarder Fan Percent	Specifies the fan speed when the trans retarder is active via a hardwired input or J1939 ERC1 message	0 – 100%	100%	VEPS, DRS
19	Fan AC Hold Time	Minimum fan on time for AC	0–600 sec	180 sec	VEPS, DRS
19	Hold Time Fan	Minimum fan on time	0–600 sec	10 sec	VEPS, DRS
19	Fan Vehicle Speed Enable	Activates the road speed threshold feature	0 = Disable 1 = Enable	0 = Disable	VEPS, DRS
19	Fan Vehicle Speed Threshold	Vehicle speed threshold below which the fan request will be ignored.	0–250 km/h	0 km/h	VEPS, DRS
6	Mode of AC Status Input	Defines type of input for A/C switch	0 = Disable 1 = AC Active Closed 2 = AC Active Open 3 = LIM Active Closed 4 = LIM Active Open	2 = AC Active Open	VEPS, DRS

Table 5-47 Variable Speed Fan with Fan Speed Feedback – Type 2 CPC Options

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5.13 FLEET MANAGEMENT

The Fleet Management Products provide flexible data extraction and communication capabilities. DDEC Data collects the data (refer to section 5.13.2). DDEC Reports is the PC software for data analysis and reporting (refer to section 5.13.3).

5.13.1 OPERATION

Fleet Management is designed to provide feedback to the driver. These driver-friendly features help provide an understanding of the effect of the driver's actions on the engine and vehicle performance. The MCM provides engine control and monitoring; the CPC stores a summary of engine performance.

Data in these devices can be extracted and analyzed with the PC software products. DDEC Reports extracts data from all hardware devices and analyzes DDEC Data extracts data from all hardware devices and analyzes data from all devices. All these products allow printing of comprehensive reports for managing vehicle operation.

5.13.2 DDEC DATA

DDEC Data is a standard part of the CPC. DDEC Data utilizes available memory and processing speed, along with a built-in, battery-backed clock/calendar to document the performance of the driver and vehicle. Data is stored in three monthly records and in a trip file that may be reset at extraction. Data on periodic maintenance intervals, hard brake incidents, last stop records, daily engine usage, and CPC diagnostics is also stored.

DDEC Data can be extracted onto a PC hard disk through a wide range of options:

- Direct extraction using an industry standard translator box and cables connected to a PC running DDEC Reports.
- Wireless extraction via cellular telephone, satellite radio communications equipment. The PC can be operating DDEC Reports or DDEC Communications.

Programming Requirements and Flexibility

DDEC Data parameters for fleet management are listed in Table 5-48.

Parameter Group	Parameter	Description	Options	Default	Access
27	FM Alert Update Enable	Enables/Disabled the Fleet Management Alert data	0 – Disable 1 – Enable	1 – Enable	VEPS, DRS, DDDL
27	FM Daily Usage Enable	Enables/Disabled the Fleet Management daily usage data	0 – Disable 1 – Enable	1 – Enable	VEPS, DRS, DDDL 7.0
27	Fleet Management Enable	Enables/Disabled the Fleet Management data	0 – Disable 1 – Enable	1 – Enable	VEPS, DRS, DDDL 7.0
27	FM Incident Update Enable	Enables/Disabled the Fleet Management incident data	0 – Disable 1 – Enable	1 – Enable	VEPS, DRS, DDDL 7.0
27	FM Monthly Trip Enable	Enables/Disabled the Fleet Management monthly trip data	0 – Disable 1 – Enable	1 = Enable	VEPS, DRS, DDDL 7.0
27	FM Serv Interval Update Enable	Enables/Disabled the Fleet Management service interval data	0 – Disable 1 – Enable	1 – Enable	VEPS, DRS, DDDL 7.0
27	FM Fuel Density	Enables/Disabled the Fleet Management fuel density data	0-65.535	0.835	VEPS, DRS, DDDL 7.0

Table 5-48 DDEC Data Parameters for Fleet Management

5.13.3 DDEC REPORTS

After the data is extracted, DDEC Reports software produces a wide range of diagnostic and management reports. DDEC Reports produces comprehensive trip reports in both on-highway and nonroad markets.

The on-highway reports are:

- □ Trip Activity
- □ Vehicle Speed/RPM
- □ Overspeed / Over Rev
- □ Engine Load/RPM
- □ Vehicle Configuration
- □ Periodic Maintenance
- □ Hard Brake Incident
- □ Last Stop
- □ DDEC Diagnostic
- □ Profile
- □ Monthly Activity
- □ Daily Engine Usage
- □ Life to Date

See Figure 5-19, Figure 5-20, Figure 5-21, and Figure 5-22 for examples of on-highway DDEC Reports.

DDEC® Reports - Trip Activity

Print Date: Mar 14, 2007 10:29 AM (EDT)

DETROIT DIESEL

Trip: 02/01/2007 to 02/01/2007 (EST)
Vehicle ID: TEST 01
Driver ID:
Odometer: 14523.4 mi

Trip Distance	462.1 mi
Trip Fuel	75.00 gal
Fuel Economy	6.16 mpg
Avg Drive Load	57 %
Avg Vehicle Speed	62.5 mph
Driving Time	7:23:38
Driving Percent	89.74 %
Driving Fuel	70.54 gal
Driving Economy	6.55 mpg
Vehicle Speed Limiting	
Time	0:00:00
Percent	0.00 %
Distance	0.0 mi
Fuel	0.00 gal
Top Gear	
Time	7:00:04
Percent	94.69 %
Distance	452.1 mi
Fuel	67.75 gal
Top Gear - 1	
Time	0:04:33
Percent	1.03 %
Distance	3.7 mi
Fuel	0.88 gal
Cruise	
Time	6:05:32
Percent	82.40 %
Distance	397.0 mi
Fuel	60.88 gal
Top Gear Cruise	
Time	6:04:54
Percent	82.25 %
Distance	396.3 mi
Fuel	60.63 gal
Speeding A(>=70 mph and <75 mph)	
Count	5
Time	0:01:08
Percent	0.26 %
Speeding B(>=75 mph)	
Count	0
Time	0:00:00
Percent	0.00 %
Highest Speed	73.5 mph
Occurred	02/01/07 14:17:51 (EST)
Coasting Time	0:00:00
Coasting Percent	0.00 %
DPF Regeneration	
Parked Regen Count	0
Driving Regen Count	2
Parked Regen Fuel	0.00 gal
Driving Regen Fuel	4.08 gal

Trip Time	8:14:21
Fuel Consumption	9.10 gal/h
Idle Time	0:50:43
Idle Percent	10.26 %
Idle Fuel	0.38 gal
Parked Regen Time	0:00:00
VSG(PTO) Time	0:00:00
VSG(PTO) Percent	0.00 %
VSG(PTO) Fuel	0.00 gal
Stop Idle Time	0:42:31
Stop Idle Percent	8.60 %
Stop Idle Fuel	0.25 gal
Over Rev Limit	1800 rpm
Count	0
Time	0:00:08
Percent	0.03 %
Highest RPM	1987 rpm
Occurred	02/01/07 13:17:23 (EST)
Diag. Records	3
Hard Brake Count	0
Brake Count	27
Eng. Brake Time	0:08:05
Optimized Idle Time	
Active	0:00:00
Run	0:00:00
Battery	0:00:00
Engine Temp.	0:00:00
Thermostat	0:00:00
Extended Idle	0:00:00
Continuous	0:00:00
Optimized Idle Battery Charging Starts	
Normal Count	0
Alternate Count	0
Continuous Run	0
Fan On Time	
Total Time	0:00:00
Engine System	0:00:00
Manual	0:00:00
A/C	0:00:00
Pump On Time	
Time	0:00:00
Distance	0.0 mi
Fuel	0.00 gal
Engine Utilization	98.74 %
Vehicle Utilization	88.61 %

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Figure 5-19 DDEC Reports, Trip Activity Report

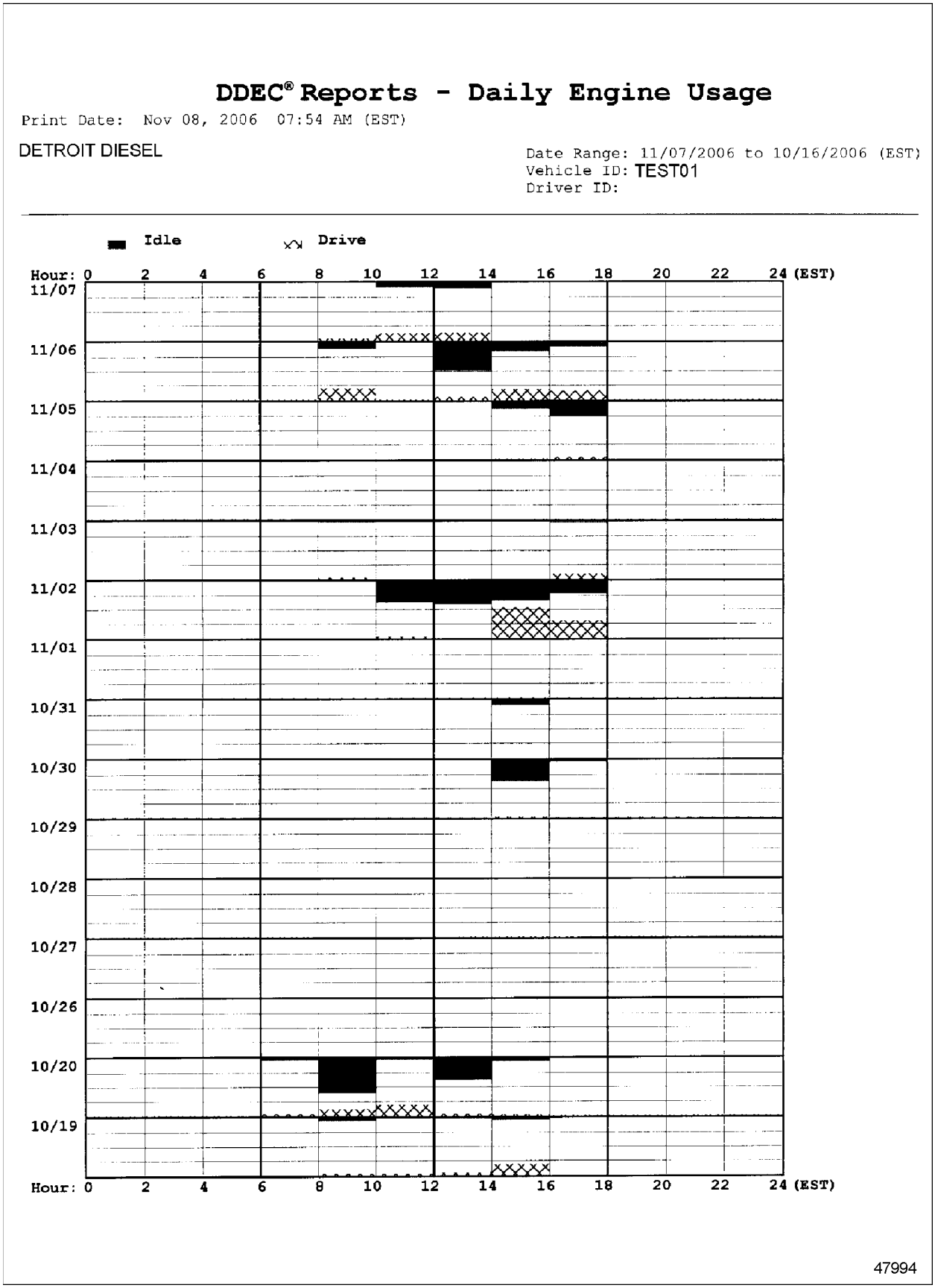


Figure 5-20 DDEC Reports, Daily Engine Usage

DDEC® Reports - Engine Load/RPM

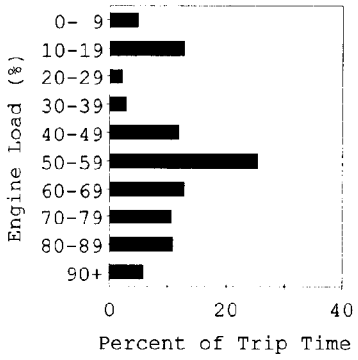
Print Date: Mar 14, 2007 10:29 AM (EDT)

DETROIT DIESEL

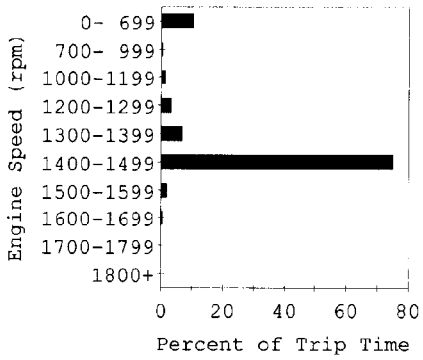
Trip: 02/01/2007 to 02/01/2007 (EST)
Vehicle ID: TEST 01
Driver ID:
Odometer: 14523.4 mi

Trip Distance	462.1 mi	Trip Time	8:14:21
Trip Fuel	75.00 gal	Fuel Consumption	9.10 gal/h
Fuel Economy	6.16 mpg	Idle Time	0:50:43
Avg Drive Load	57 %	Idle Percent	10.26 %
Avg Vehicle Speed	62.5 mph	Idle Fuel	0.38 gal
		Parked Regen Time	0:00:00

Engine Load Histogram



Engine Speed Histogram



Percent of Trip Time in Load and RPM Table

	Engine Load (%)										
Engine RPM	0- 9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-100	Total
0- 699	0.1	10.4									10.5
700- 999	0.1	0.2	0.1								0.5
1000-1199	0.6	0.2	0.1	0.1	0.1	0.1	0.1			0.1	1.2
1200-1299	0.9	0.3	0.3	0.2	0.4	0.4	0.4	0.3	0.2	0.1	3.4
1300-1399	1.1	0.4	0.4	0.5	1.4	1.2	0.8	0.5	0.3	0.6	7.1
1400-1499	2.0	1.3	1.3	1.9	9.8	23.4	11.2	9.5	10.2	4.3	75.0
1500-1599	0.2	0.1	0.1	0.1	0.1	0.2	0.3	0.2	0.1	0.3	1.7
1600-1699										0.2	0.5
1700-1799										0.1	0.2
1800+											
Total	4.9	12.9	2.2	2.9	11.9	25.4	12.8	10.6	10.8	5.7	

Note: This table contains values <0.005 percent of trip time

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Figure 5-21 DDEC Reports, Engine Load/RPM

DDEC® Reports - Vehicle Speed/RPM

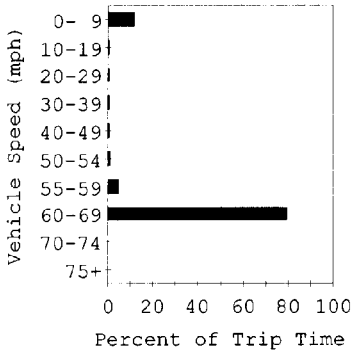
Print Date: Mar 14, 2007 10:29 AM (EDT)

DETROIT DIESEL

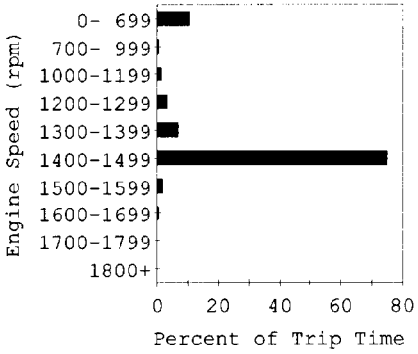
Trip: 02/01/2007 to 02/01/2007 (EST)
Vehicle ID: TEST 01
Driver ID:
Odometer: 14523.4 mi

Trip Distance	462.1 mi	Trip Time	8:14:21
Trip Fuel	75.00 gal	Fuel Consumption	9.10 gal/h
Fuel Economy	6.16 mpg	Idle Time	0:50:43
Avg Drive Load	57 %	Idle Percent	10.26 %
Avg Vehicle Speed	62.5 mph	Idle Fuel	0.38 gal
		Parked Regen Time	0:00:00

Vehicle Speed Histogram



Engine Speed Histogram



Percent of Trip Time in Speed and RPM Table

Vehicle Speed (mph)

Engine RPM	0- 9	10-19	20-29	30-39	40-49	50-54	55-59	60-69	70-74	75+	Total
0- 699	10.5	0.1									10.5
700- 999	0.4										0.5
1000-1199	0.3	0.1	0.2	0.1	0.1	0.4					1.2
1200-1299	0.2	0.1	0.1	0.2	0.2	0.5	2.1				3.4
1300-1399	0.1	0.1	0.1	0.2	0.3		2.6	3.6			7.1
1400-1499	0.1	0.1		0.2	0.2			74.4			75.0
1500-1599	0.1	0.1	0.1	0.1		0.1		1.2	0.1		1.7
1600-1699						0.1			0.1		0.5
1700-1799					0.1		0.1				0.2
1800+											
Total	11.7	0.6	0.6	0.8	0.9	1.1	4.9	79.2	0.2		
Brakes	5	3	1	4	2	4	2	6			27
Hard Brakes											

Note: This table contains values <0.005 percent of trip time

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Figure 5-22 DDEC Reports, Vehicle Speed/RPM

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5.14 FUEL ECONOMY INCENTIVE

The purpose of Fuel Economy Incentive (FEI) is to allow the fleet manager to set a fuel economy target while providing the driver an incentive to meet the target.

5.14.1 OPERATION

Using the Fuel Economy Incentive option, a fleet manager can set a target fuel economy for each engine. If this fuel economy is exceeded, the driver will be awarded a slight increase to the vehicle speed limit.

In this example the following limits are set as listed in Table 5-49.

Parameter	Set Limit
Maximum Road Speed	60 MPH
FEI Max Vehicle Speed Reward	5 MPH
FEI Conversion Factor	20 MPH/MPG
FEI Minimum Fuel Economy	7 MPG

Table 5-49 Fuel Economy Limits

If the driver has an average fuel economy of 7.1 MPG then the new vehicle speed limit is 62 MPH.

Vehicle Speed Limit + (Average Fuel Economy — FEI Minimum Fuel Economy) x FEI Conversion Factor = New Vehicle Speed Limit

60 MPH + (7.1-7.0 MPG) x (20 MPH/MPG) = 62 MPH

The maximum vehicle speed obtainable regardless of the fuel economy is 65 MPH.

5.14.2 PROGRAMMING REQUIREMENTS AND FLEXIBILITY

The Fuel Economy Incentive parameters are listed in Table 5-50.

Parameter Group	Parameter	Definition	Options	Default	Access
23	Fuel Economy Incentive Enable	Enables/disable the feature.	0 = Disable 1 = Enable	0	DDDL 7.0, DRS, VEPS
23	FEI Minimum Fuel Economy	Indicates the minimum economy for fuel economy incentive.	4 to 20 mpg	7	DDDL 7.0, DRS, VEPS
23	FEI Max Vehicle Speed Reward	Indicates customer set maximum speed increase for vehicle.	0 to 20 km/h	0	DDDL 7.0, DRS, VEPS
23	FEI Conversion Factor	The miles per hour you want to allow for each full mile per gallon above the minimum MPG.	0 to 20 MPH/MPG	2	DDDL 7.0, DRS, VEPS
23	FEI Use Trip Mileage	FILT ECON bases the calculations on the fuel information, by periodic sampling of fuel consumption. TRIP ECON bases the calculation on the trip portion of the fuel usage information.	0 = Based on Filtered Fuel Economy* 1 = Based on Trip Fuel Economy†	0	DDDL 7.0, DRS, VEPS

* Filtered fuel economy calculates the fuel economy based on periodic sampling of fuel consumption. It allows rewards over a shorter time period.

† Trip fuel economy calculates fuel economy over the entire trip. Rewards may take longer to achieve.

Table 5-50 Fuel Economy Incentive Parameters

5.14.3 INTERACTION WITH OTHER FEATURES.

Fuel Economy Incentive will increase the Cruise Control and vehicle speed limits.

A vehicle can be have with both PasSmart and Fuel Economy Incentive, but the extra speed increments provided by the two features do not add together. For example, if Fuel Economy Incentive is set for 7 MPH of extra speed when the driver hits the maximum fuel economy target and the same vehicle has a 5 MPH PasSmart increase, the resulting speed increase is 7 MPH, not 12 MPH.

5.15 IDLE ADJUST

This function increases and/or decreases the engine idle speed up to a programmable limit (Max Adjusted Idle Speed).

5.15.1 OPERATION

Engine idle speed can be varied by the operator using the Cruise Control switches if the following conditions are satisfied:

- □ Engine is running
- □ Vehicle speed is less than 6 mph (10 km/h)
- □ Cruise Control master switch is turned OFF
- □ PTO is not active and enable switch is OFF
- □ If an automatic transmission is in use, it is in neutral and no shift is in progress
- □ Clutch pedal is not pressed
- □ Throttle inhibit is not active

If any of the above conditions are not satisfied, Idle Adjust is cancelled and the normal idle speed is restored.

The current desired speed is increased by 16 rpm (Single Step Adjusted Idle Speed) when the Resume/Accel switch is toggled. Speed change is active after the switch is released. Holding the Resume/Accel switch for more than one second the current desired speed will be increased by 100 rpm/sec (Ramp Rate Adjusted Idle Speed) as long as the switch is pressed and the programmed Max Adjusted Idle Speed for idle increment is not exceeded.

Toggling the Set/Coast switch will decrease the current desired idle speed by 16 rpm (Single Step Adjusted Idle Speed). Speed change is active after the switch is released. Holding the Set/Coast switch for more than one second will decrease the current desired speed by 100 rpm/sec (Ramp Rate Adjusted Idle Speed) as long as the switch is pressed and the minimum low idle speed is not yet reached.

Once the desired idle speed has increased or decreased again, the new desired idle speed will be stored until the ignition has been switched off.

5.15.2 PROGRAMMING REQUIREMENTS AND FLEXIBILITY

The Idle Adjust parameters are listed in Table 5-51.

Parameter Group	Parameter	Description	Options	Default	Access
3	Max Adjusted Idle Speed	Max idle speed that will be allowed by the user	0-4000 RPM	850 RPM	VEPS, DRS, DDDL 7.0
3	Single Step Adjusted Idle Speed	Single step rpm for adjusted idle speed	0-100 RPM	16 RPM	VEPS, DRS, DDDL 7.0
3	Ramp Rate Adjusted Idle Speed	Ramp rate for the adjusted idle speed	0-8191 RPM/sec	100 RPM/sec	VEPS, DRS, DDDL 7.0

Table 5-51 Idle Adjust Parameters

5.16 IDLE SHUTDOWN TIMER AND PTO SHUTDOWN

The Idle Shutdown Timer will shutdown the engine if it remains idling for a specified period of time. The options that can operate with Idle Shutdown Timer are Idle Shutdown Override, Vehicle Power Shutdown or Shutdown on Power Take-off (PTO).

5.16.1 OPERATION — IDLE SHUTDOWN NON-PTO MODE

There are four modes of operation for Idle Shutdown:

- Disabled – in this mode, idle shutdown will not occur.
- Park Brake – in this mode, idle shutdown will be enabled only when the park brake is applied, the accelerator pedal position is at zero and the engine is idling.
- No Park Brake – this mode is the same as Park Brake Mode above, except there is no requirement for the park brake to be applied.
- Edge Triggered Accelerator Pedal – this mode has no requirement on the park brake or on the engine being at idle. The operator may reset the Idle Shutdown procedure by moving the accelerator pedal from below 40% to above 80%.

The idle shutdown period can range from 1 to 5000 seconds (approximately 83 minutes).

Certain conditions must be met for the entire time-out period for shutdown to occur. These conditions include:

- Coolant temperature above 50°F (–10°C)
- Engine operation at idle
- The parking brake ON, digital input switched to battery ground (optional)
- Ignition ON
- Vehicle Speed Less than 3 mph (5 kph)

Fueling is stopped after the specified idle time; the ignition circuit remains active after the engine shuts down. The AWL will flash 20 seconds before the shutdown occurs. The RSL will flash 10 seconds before shutdown occurs. The AWL will continue flashing until the ignition is turned off to indicate shutdown has occurred. The RSL will turn off. The ignition switch must be cycled to OFF (wait 10 seconds) and back to ON before the engine will restart, if shutdown occurs.

A Park Brake Switch may be installed (see Figure 5-23).

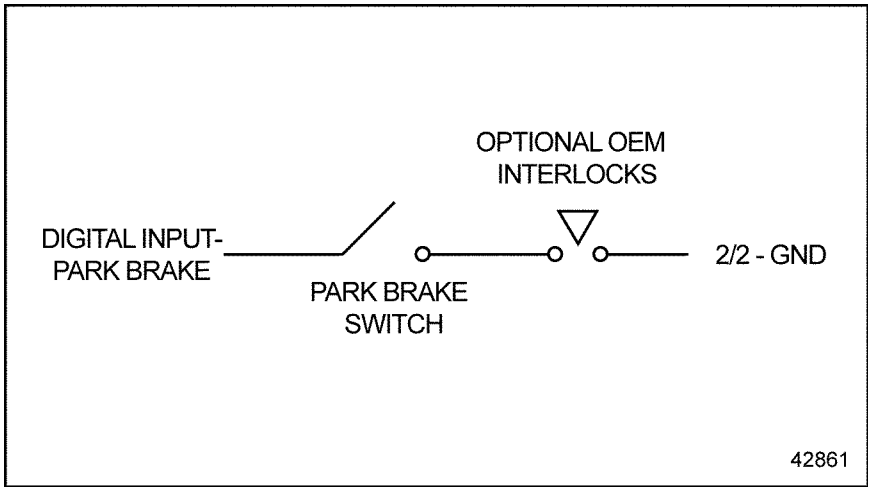

Figure 5-23 Park Brake Digital Input

5.16.2 OPERATION — PTO SHUTDOWN

There are four modes of operation for PTO shutdown:

- □ Disabled – in this mode, PTO shutdown will not occur.
- □ Park Brake – in this mode, PTO shutdown will be enabled only when the park brake is applied, the accelerator pedal position is at zero and the actual engine torque is less than 100 nm (Max Engine Load PTO Shutdown)..
- □ No Park Brake – this mode is the same as Park Brake Mode above, except there is no requirement for the park brake to be applied.
- □ Edge Triggered Accelerator Pedal – this mode has no requirement on the park brake or the actual torque. The operator may reset the PTO shutdown procedure by moving the accelerator pedal from below 40% to above 80%.

The PTO shutdown period can range from 1 to 5000 seconds (approximately 16 minutes).

A Park Brake Switch may be installed (see Figure 5-23).

5.16.3 IDLE SHUTDOWN TIMER AND PTO SHUTDOWN OPTIONS

The following options are available with Idle Shutdown Timer and PTO Shutdown.

Idle / PTO Shutdown Override

Idle / PTO Shutdown Override allows the operator to temporarily override the idle shutdown timer or PTO shutdown timer.

Idle/PTO shutdown will be overridden if any of the following conditions occur:

- □ The accelerator pedal is in limp-home mode

- Operator override is enabled (Enable Idle PTO Shtdn Override) and any of the following operator override conditions are present:
  - The SEO Override Switch is on
  - The service brake is applied
  - The clutch is pressed (switch is open)
- 'High idle' DPF regeneration is in progress. After regeneration completes, the override will remain in place for an additional 5 minutes to allow the particulate filter to cool down after the regeneration cycle has completed.

Idle Shutdown with Ambient Air Temp

This option allows the override to be disabled based on ambient air temperature. If the upper and lower temperature limits are set and the ambient temperature is within limits, the override will be disabled and the engine will hbe shutdown after the specified time limit is met. If the ambient air temperature is outside the specified range, the override would be allowed by increasing the percent throttle to greater than 1%.

For example, if the upper limit is set to 80°F and the lower limit is set to 65°F, the override would be disabled if the ambient air temperature was between 65°F and 80°F (see Figure 5-24).

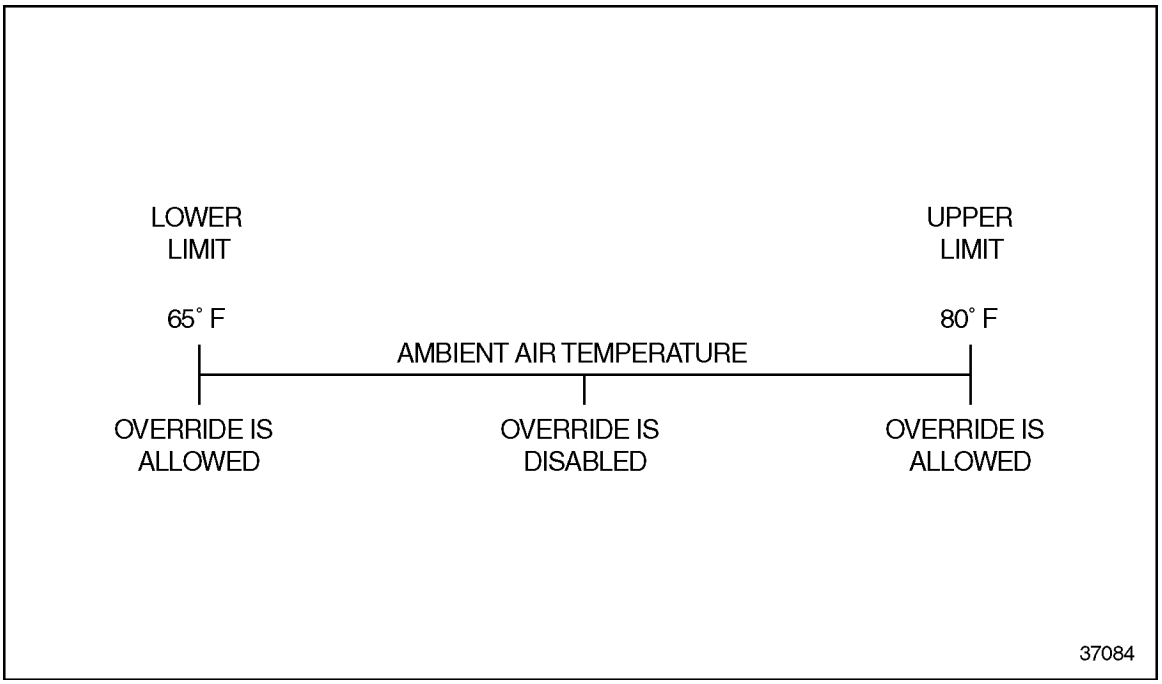

Figure 5-24 Ambient Air Temperature Override

An ambient air temperature sensor must be installed for this feature.

Idle Shutdown with Ambient Air Temp Continuous Override

It is possible for idle shutdown to be overridden continuously based on ambient air temperature. This allows the engine to continue to run while the temperature is such that power from the engine is required to heat or cool the air to keep the cab temperature comfortable.

Continuous override is only available if an ambient air temperature sensor is configured for use (Ambient Air Temp Sensor Enable) and overrides are enabled (Enable Idle PTO Shtdn Override).

There are two modes of operation: operator override and automatic override. In both cases, the override will only be allowed if the ambient air temperature is reading extreme (i.e. it is outside the limits “Lo Amb Air Override Temp” and “Hi Amb Air Override Temp”.

If automatic override is enabled (“Idle Shutdown Auto Override”), idle shutdown will always be overridden while the ambient air temperature is reading extreme. If automatic override is not enabled and operator override is, the operator may explicitly activate the override by pumping the accelerator pedal while idle shutdown is in progress and the CEL is flashing.

Note that the definition of a ‘pump’ of the accelerator pedal depends upon the idle/PTO shutdown mode:

- Idle/PTO shutdown with/without park brake status – in either of these modes, pumping the accelerator pedal is done simply by pressing the pedal.
- Idle/PTO shutdown with edge triggered accelerator pedal – in this mode, pumping the accelerator pedal is done by moving it from below 40% to above 80%.

The continuous operator override will remain active until the ambient air temperature is no longer extreme, the park brake is not applied, the ignition is turned off, or the operator pumps the pedal again. Note that pumping the pedal will only cancel the override if it has already been in effect for at least 10 seconds.

Vehicle Power Shutdown

Vehicle Power Shutdown is used with Idle Timer Shutdown or Engine Protection Shutdown. After the idle timer times out or engine protection shuts the engine down, the Vehicle Power Shutdown relay shuts down the rest of the electrical power to the vehicle.

A Vehicle Power Shutdown relay can be installed to shutdown all electrical loads when the engine is shutdown (see Figure 5-25).

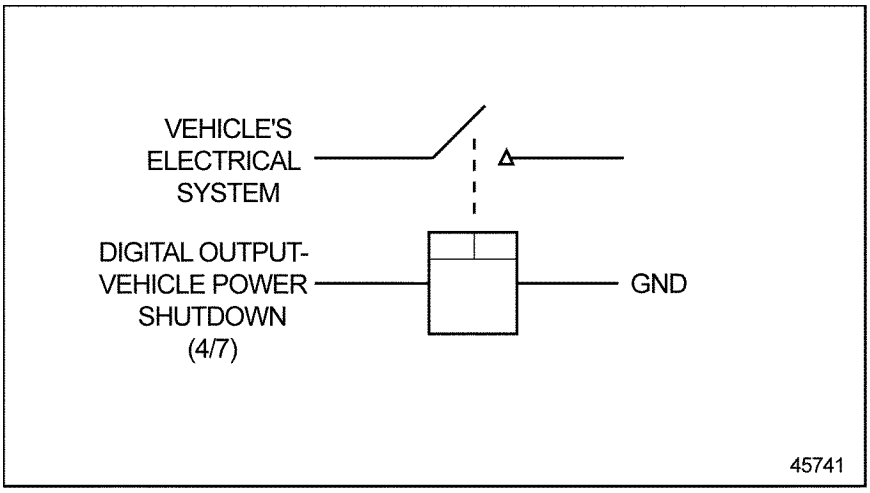

Figure 5-25 Vehicle Power Shutdown Relay

All electrical loads that should be turned OFF when the engine shuts down should be wired through this relay.

Maximum Engine Load Shutdown

This option, when enabled (Max Engine Load for PTO Shutdown), allows the setting of a maximum load above which Idle/PTO Shutdown is disabled.

5.16.4 PROGRAMMING REQUIREMENTS AND FLEXIBILITY

All the Idle Shutdown timer options are listed in Table 5-52.

Parameter Group	Parameter	Description	Options	Default	Access
13	1 02 DI Selection	Configure pin 1/02 on CPC	0 = Disabled 1 = Enable Park Brake Interlock 2 = FUSO Auxiliary Brake Cut Switch*	1 = Enable Park Brake Interlock	VEPS, DRS
13	Park Brake Switch Config	Park Brake Configuration	0 = Hardwired 1 = CCVS1 2 = CCVS2 3 = CCVS3	0 = Hardwired	VEPS, DRS
17	Enable Idle Shutdown	Enables or Disables the Idle Shutdown feature.	0 = Disable 1 = Enable with Park Brake 2 = Enable without Park Brake 3 = Enabled with Edge Triggered Accel Pedal	0 = Disable	DDDL 7.0, DRS, VEPS
17	Idle Shutdown Time	The amount of engine idle time that is allowed before the Idle Shutdown feature stops fueling the engine.	1 to 5000 seconds	60 sec	DDDL 7.0, DRS, VEPS
17	Enable PTO Shutdown	Enables or disables the Idle Timer Shutdown feature when operating in PTO mode.	0 = Disable 1 = Enable with Park Brake 2 = Enable without Park Brake 3 = Enabled with Edge Triggered Accel Pedal	0 = Disable	DDDL 7.0, DRS, VEPS
17	PTO Shutdown Time	The amount of engine idle time that is allowed before the PTO shutdown feature stops fueling the engine.	1 to 5000 seconds	60 sec	DDDL 7.0, DRS, VEPS
17	Min Coolant Temp	Minimum coolant temperature before an idle shutdown will occur	-40°C to 200°C	10°C	VEPS, DRS
17	Enable Idle PTO Shtdn Override	Enables/disables override of Idle or PTO Shutdown	0 = Disable 1 = Enabled, allows SEO/Diagnostic Request Switch to override Engine Idle/PTO Shutdown 2 = Enable without clutch and service brake	1 = Enabled, allows SEO/Diagnostic Request Switch to override Engine Idle/PTO Shutdown	DDDL 7.0, DRS, VEPS
17	Max Engine Load PTO Shutdown	PTO shutdown disabled for engine loads greater than this value	0–5000 Nm	100 Nm	VEPS, DRS

Parameter Group	Parameter	Description	Options	Default	Access
31	Ambient Air Temp Sensor Enable	Configures the ambient air temp sensor.	0 = Disabled 1 = Hardwired 2 = Reserved for J1939 3 = Reserved for J1587 4 = Reserved for ECAN	0 = Disabled	VEPS, DRS
17	Lo Amb Air Override Temp	Extreme low ambient air temp to allow override.	-40°C – 75°C	-4°C	DDDL 7.0, DRS, VEPS
17	Hi Amb Air Override Temp	Extreme high ambient air temp to allow override.	-40°C – 75°C	75°C	DDDL 7.0, DRS, VEPS
17	Idle Shudown Auto Override	Enables auto override of Idle/PTO Shutdown based on ambient air temperature.	0 = No automatic override performed 1 = Automatic override performed	0 = No automatic override performed	DDDL 7.0, DRS, VEPS

*Not supported in NAFTA

Table 5-52 Idle Shutdown Timer Programming Options

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5.17 LIMITERS

The CPC supports two optional programmable engine limiters: Limiter 0 (LIM0) and Limiter 1 (LIM1). These Limiters are each associated with a digital input. When the input is switched to ground, the limiter becomes active. If more than one Limiter input is grounded at the same time, the Limiter with the lowest limitation parameter setting will prevail.

The CPC can also limit the minimum and maximum engine speeds.

5.17.1 OPERATION

When the appropriate input is grounded, Limiters can decrease the speed/load/torque from the setting of the Common Limiter parameters, but cannot increase them beyond the Common Limiter settings.

Each Limiter can set:

- Maximum engine speed (speed limiting applications)
- Minimum engine speed (switched high idle applications)
- Maximum engine torque (torque limiting applications)
- Road speed limit (alternate road speed limit)
- Maximum vehicle acceleration

“Maximum Engine Speed” will limit the upper engine speed all the time. Limiter switches can further limit the maximum engine speed if programmed. “Minimum Engine Speed” defines the lower limit of engine speed operation . Limiter switches can increase the limit if programmed and installed.

5.17.2 INSTALLATION

The Limiter pin assignments are listed in Table 5-53.

Limiter	Pin
Limiter 0	1/11
Limiter 1	2/11

Table 5-53 Limiter Pin Assignments

NOTE:
Due to VSS signal quality at low speeds, it is recommended that the vehicle speed limit be set above a minimum of 48 kph to insure smooth road speed limiting. DDC cannot guarantee smooth speed limiting for maximum speeds set below 48 kph.

DDEC will exit the Minimum Engine Speed Mode for Automated/Automatic Transmissions for the following:

- □ Shift in Progress message received over j1939
- □ Valid TSC1 command received from the transmission
- □ Transmission in gear (selected gear or current gear)

5.17.3 PROGRAMMING REQUIREMENTS AND FLEXIBILITY

Limiter 0 and Limiter 1 parameters are listed in Table 5-54.

Parameter Group	Parameter	Range	Default	Access
3	Adjusted Idle Config	0 = Disabled 1 = Enabled 2 = Enabled if neutral 3 = Enabled if neutral and Park Brake 4 = Enabled if Park Brake	0 = Disabled	DDDL 7.0, DRS, VEPS
5	Limiter0 Min Eng Speed Enabled	0-4000 rpm	500 rpm	DDDL 7.0, DRS, VEPS
5	Limiter0 Max Eng Speed Enabled	0-4000 rpm	4000 rpm	DDDL 7.0, DRS, VEPS
5	Limiter0 Max Road Spd Enabled	0-152 kph	152 kph	DDDL 7.0, DRS, VEPS
5	Limiter0 Max Eng Trq Enabled	0-5000 Nm	5000 Nm	DDDL 7.0, DRS, VEPS
5	Limiter1 Min Eng Speed Enabled	0-4000 rpm	500 rpm	DDDL 7.0, DRS, VEPS
5	Limiter1 Max Eng Speed Enabled	0-4000 rpm	4000 rpm	DDDL 7.0, DRS, VEPS
5	Limiter1 Max Road Spd Enabled	0-152 kph	152 kph	DDDL 7.0, DRS, VEPS
5	Limiter1 Max Eng Trq Enabled	0-5000 Nm	5000 Nm	DDDL 7.0, DRS, VEPS
5	Limiter0 Max Vehicle Accel	-15.625 — 15.625m/s^2	10m/s^2	DDDL 7.0, DRS, VEPS
5	Limiter1 Max Vehicle Accel	-15.625 — 15.625m/s^2	10m/s^2	DDDL 7.0, DRS, VEPS
5	Limiter0 Max Eng Trq Curve Select	0 = PLD torque curve (max torque) 1 = Power Rating Curve #1 2 = Power Rating Curve #2 3 = Power Rating Curve #3	0 = PLD torque curve (max torque)	DDDL 7.0, DRS, VEPS

Table 5-54 Limiter 0 and Limiter 1 Parameters

The parameters for min and max engine speed are listed in Table 5-55.

Parameter Group	Parameter	Range	Default	Access
3	Min Engine Speed	0–4000 rpm	592 rpm	DRS, VEPS
3	Max Engine Speed	0–4000 rpm	3000 rpm	DRS, VEPS

Table 5-55 Minimum and Maximum Engine Speed Parameters

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5.18 LOW GEAR TORQUE REDUCTION

Low Gear Torque Reduction is an optional feature that allows a transmission to be used with engines capable of producing more torque than the transmission's peak torque rating.

5.18.1 OPERATION

Low Gear Torque Reduction reduces the available torque if the ratio of vehicle speed to engine speed is below a set point. This limits full torque in lower gears and allows a transmission to be used with engines above the transmission's regular torque rating. Two torque limits can be programmed.

Example 1 – One Torque Limit

The customer wants to hold the torque to 550 ft lbs (on an engine rated at 860 ft lbs) up to 8th gear. The transmission operates with the ratios listed in Table 5-56.

Gear	Ratio	Low Gear Threshold* CPC – Output/Input Shaft Speed
5	3.57	0.280
6	2.79	0.358
7	2.14	0.467
	Desired Gear Down Protect Ratio	Gear Down Protect Ratio Parameter
8	1.65	0.606
9	1.27	0.787
10	1.00	1.0

*The low gear threshold is determined by taking the inverse of the gear ratios and choosing a value in between the gears you want to limit.

Table 5-56 Transmission Ratios

The "torque factor" is determined by dividing the desired torque by the rated torque. The “threshold” is determined by taking the inverse of the gear ratios and choosing a value in between the gears you want to limit.

To summarize, the customer wants to limit torque up to the 8th gear to 550 ft·lb. Estimate the “threshold” between 7th and 8th (0.5). From 8th gear on up, the full rated torque will be available. Set Gear Ratio Gear Down Protect to 0.5 and set the Torque Factor Gear Down Protect to 0.64 (550/860).

Example 2 – Two Torque Limits

The customer wants to hold the torque to 450 ft lbs (on an engine rated at 860 ft lbs) up to 6th gear and up to 550 ft lbs up to 8th gear. The transmission operates with the ratios listed in Table 5-57.

Gear	Ratio	Low Gear Threshold* CPC – Output/Input Shaft Speed
5	3.57	0.280
	Desired Gear Down Protection Ratio	Gear Down Protection Ratio Parameter
6	2.79	0.358
7	2.14	0.467
	Desired Gear Ratio for High Gear Power	Gear Ratio for High Gear Power Parameter
8	1.65	0.606
9	1.27	0.787
10	1.00	1.0

*The low gear threshold is determined by taking the inverse of the gear ratios and choosing a value in between the gears you want to limit.

Table 5-57 Transmission Ratios

The "torque factor" is determined by dividing the desired torque by the rated torque. The “threshold” is determined by taking the inverse of the gear ratios and choosing a value in between the gears you want to limit.

To summarize, the customer wants to limit torque up to the 6th gear to 450 ft·lb and 550 ft lbs up to 8th gear. Estimate the “threshold” between 5th and 6th (0.32) and 7th and 8th (0.5). From 8th gear on up, the full rated torque will be available.

Set “Gear Ratio for Gear Down Protection” to 0.32 and set the “Torque Factor for Gear Down Protection to 0.52 (450/860). Set “Gear Ratio for High Gear Power” to 0.5 and the “Torque Factor High Gear Power” to 0.64 (550/860).

5.18.2 PROGRAMMING REQUIREMENTS AND FLEXIBILITY

A VSS or output shaft speed message over SAE J1939 is required (refer to section 3.6.6, "Vehicle Speed Sensor"). VEPS or DRS can enable the parameters listed in Table 5-58.

Parameter Group	Parameter	Description	Range	Default	Access
23	Torque Factor* Gear Dwn Protect	Provides a limit on the available torque if the ratio of vehicle speed to engine speed is below a set point.	0.00 to 1.00	1.00	VEPS or DRS
23	Gear Ratio Gear Down Protect	The gear ratio below which torque is limited. (output shaft rpm/input shaft rpm)	0.000 to 2.00	0.01	VEPS or DRS
23	Torque Factor* High Gear Power	Provides a limit on the available torque if the ratio of vehicle speed to engine speed is below a set point.	0.000 to 1.00	1.00	VEPS or DRS
23	Gear Ratio for High Gear Power	The gear ratio below which torque is limited. (output shaft rpm/input shaft rpm)	0.00 to 2.00	0.02	VEPS or DRS

* % of maximum torque at the current engine speed

Table 5-58 Low Gear Torque Limiting Parameters

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5.19 OPTIMIZED IDLE

Optimized Idle® with DDEC VI reduces engine idle time by running the engine only when required. Optimized Idle automatically stops and restarts the engine to accomplish the following:

- □ Keep the engine oil temperature between factory set limits 60°F (16°C) - 104°F (40°C)
- □ Keep the battery charged>12.2 V (12 V system)
- □ Keep the cab/sleeper or passenger area at the desired temperature (using the optional thermostat) - On-highway truck and coach applications

Other benefits include overall reduction in exhaust emissions and noise, and improved starter and engine life (by starting a warm engine and eliminating starting aids). Idle time and fuel savings information stored in the ECU memory can be read with DDDL, ProDriver Reports or DRS. Optimized Idle run times can be accessed through DDEC Reports. The Optimized Idle Active Lamp is steadily illuminated when Optimized Idle run times are logged.

5.19.1 OPERATION

To activate Optimized Idle, the following conditions must be met:

- □ Ignition ON with the vehicle idling
- □ Hood and cab closed
- □ Transmission in neutral
- □ Park brake set
- □ Idle shutdown timer must be enabled

Once the above conditions are met:

- □ Turn the Cruise Master Switch to the ON position (if in the ON position, turn to OFF then to ON), the Optimized Idle Active Lamp will flash.
- □ Turn on Thermostat Mode (if equipped and the mode is desired) by turning ON the thermostat, setting the fan controls in the bunk and cab to HIGH and enabling the vehicle heating and cooling system.

Once these conditions are met, the Optimized Idle Active Lamp will flash until the Idle Shutdown timer expires. Optimized Idle allows the operation of all DDEC features such as VSG, throttle control, and Cruise Switch VSG, while the active light is flashing.

Once Optimized Idle becomes active, the engine will either shutdown if Optimized Idle parameters are satisfied or ramp to 1100 RPM. While the system is active (OI Active Lamp is steadily illuminated), the throttle, PTO, Cruise Switch PTO functions are disabled and the engine speed is controlled by DDEC VI.

Optimized Idle Start Up Sequence

The following occurs during every OI engine start:

1. Optimized Idle Active Light is ON. DDEC VI determines when the engine needs to start to charge the battery, warm the engine, or heat/cool the vehicle interior.
2. The alarm (mounted in the engine compartment) will sound for five seconds.
3. After a short delay, the starter will engage and the engine will start. If the engine does not reach a specified RPM within a few seconds, the system will be disarmed for the rest of the ignition cycle. If the engine does not start, Optimized Idle will attempt a second engine start in 45 seconds. The alarm will sound again prior to the second engine start.
4. Once the engine starts, it will ramp up to 1100 RPM (default). This value is customer selectable with DDDL or DRS.
5. Vehicle accessories will be turned on thirty seconds after any thermostat based engine start and will not be turned on for an engine mode start. If the engine is running in engine mode, and the thermostat mode is requested, the vehicle accessories will be turned on thirty seconds after the request.

If two or more conditions exist at the same time, DDEC will satisfy all parameters before shutting down the engine. For example, if the engine started due to battery voltage, the engine will run for a minimum of two hours. If the thermostat becomes unsatisfied and requests the engine to run during this time, DDEC will control the HVAC fans through the Vehicle Power Shutdown relay, turning them on and off as required by the thermostat. At the end of the two hours, if the thermostat was not satisfied, the engine would continue to run.

Engine Mode

Engine Mode automatically stops and restarts the engine to maintain oil temperature and battery voltage. The Optimized Idle Active Light is illuminated whenever Engine Mode is active. Optimized Idle starts and stops the engine to keep the following parameters within limits while in Engine Mode.

Battery Voltage - The engine will start when the battery voltage drops below 12.5 Volts for 12 Volt systems. This is the default. If an Ambient Air Temperature Sensor (AAT Sensor) is installed, the customer can select an option to use a AAT Sensor vs. voltage table to determine the start threshold for the battery. The thresholds are listed in Table 5-59.

Ambient Air Temperature	Voltage Threshold
–40°C	12.5 V
–17.77°C	12.4 V
4.44°C	12.3 V
26.66°C	12.2 V
48.86°C	12.2 V

Table 5-59 Voltage Threshold Based on Ambient Air Temperature

There are three battery run modes: Normal Battery Run Mode, Alternate Battery Run Mode, and Continuous Battery Run Mode.

Normal Battery Run Mode –While in normal battery run mode, all battery voltage Optimized Idle starts are two hours long. This mode is customer selectable by setting the Alternate Time to 0, the default mode as listed in Table 5-60.

Alternate Time	Battery Time	Single Event	First Consecutive Event	Second Consecutive Event
0	2 Hours	2 Hours	2 Hours	2 Hours

Table 5-60 Normal Battery Run Mode

Alternate Battery Run Mode –This mode is allowed only when the Alternate Time is set to a non-zero value. This parameter is customer selectable. While in Alternate Battery Run Mode, all voltage starts are based on Alternate Time unless a critical battery restart event is detected. A critical battery restart event is detected when the engine starts and runs to recharge the battery for the alternate time and then detects another battery start within one hour after the engine stops. At this point, the run time will change to two hours. The Alternate Battery Run Mode parameters are listed in Table 5-61.

Alternate Battery Run Time	Battery Time	Single Event	First Consecutive Event	Second Consecutive Event
a (Customer Selectable)	2 Hours	a	2 Hours	2 Hours

Table 5-61 Alternate Battery Run Mode

Continuous Battery Run Mode – In this mode, the engine continues to idle without shutting down when two consecutive critical battery restart events have occurred. This feature is customer selectable. The parameters for Continuous Battery Run Mode are listed in Table 5-62. A fault code is logged when this move is initiated (PID 168 FMI 14).

Alternate Battery Run Time	Battery Time	Single Event	First Consecutive Event	Second Consecutive Event	Further Events
0	2 Hours	2 Hours	2 Hours	Continuous	Continuous
a (Customer Selectable)	2 Hours	a	2 Hours	2 Hours	Continuous

Table 5-62 Continuous Battery Run Mode

Oil Temperature - The engine will start when the oil temperature drops below 60°F (15.55°C) and will run until the oil temperature reaches 104°F (40°C).

Thermostat Mode

Thermostat Mode automatically stops and restarts the engine to maintain oil temperature, battery voltage and cab temperature. For on-highway applications, Thermostat Mode is used to keep the cab/sleeper (on-highway truck) and passenger area (coach) at the desired temperature and maintain the Engine Mode parameters. The optional thermostat must be turned ON for Thermostat Mode to be active. The Optimized Idle Active Light is illuminated whenever Thermostat Mode is active.

Engine mode parameters as well as the interior temperature are monitored in Thermostat Mode. The thermostat informs the ECU when to start/stop the engine to keep the interior warm/cool based on the thermostat setting. Ambient temperature is also monitored to determine if the ambient temperature is extreme enough that the engine should run continuously.

Any accessories (HVAC fans) connected to the Vehicle Power Shutdown relay will turn ON for Thermostat Mode engine starts. The HVAC fans will remain OFF for Engine Mode starts.

If Optimized Idle starts the engine for Engine Mode, and Thermostat Mode is then requested, the HVAC fans will turn ON approximately 30 seconds after the Thermostat Mode is requested.

Thermostat Mode can be enabled for a maximum amount of time. After which, the engine will ignore any requests from the thermostat.

Two automatic conditions which help keep the operator comfortable and reduce engine cycling are Continuous Run Mode and Extended Run Mode.

Continuous Run Mode - This mode allows the engine to run continuously if the outside temperature (determined by the skin temperature sensor or AAT Sensor if installed and configured) falls outside the hot or cold set limits and the thermostat set point can not be met. The default set limits are 25°F (-3.9°C) for heat mode and 90°F (32°C) for cool mode. When a skin temperature sensor is installed, these values are customer programmable in the thermostat and are password protected. When an ATT Sensor is installed these limits can be set by DDDL or DRS. When the thermostat is in the Continuous Run Mode, the thermometer icon will flash along with the heat or cool icon on the thermostat if a skin temperature sensor is installed. If the thermostat set point is satisfied, the engine will shutdown regardless of the outside temperature.

Extended Idle Mode - If the Continuous Run Mode is not needed and the thermostat set point is not met within 45 minutes, the engine will shutdown for fifteen minutes and restart and run for fifteen minutes. This fifteen-minute on and off cycle will continue until the thermostat set point is reached or until the thermostat is turned off. This may be an indication that the heat or cool setting on the thermostat does not match the vehicle heating or cooling system setting. It could also be an indication of low freon, blockage in the heater system or system tampering.

Extended Idle Mode can be disabled with a customer selectable parameter. After running 45 minutes, the engine will shutdown instead of cycling at 15 minute intervals.

5.19.2 INSTALLATION

Optimized Idle utilizes the following inputs: Park Brake, Neutral Switch, Hood Tilt Switch, OI Thermostat (optional), and Cruise Enable. Optimized Idle utilizes three digital outputs: Vehicle Power Shutdown Relay, OI Alarm, and the Optimized Idle Active Light. A hardwired Vehicle Speed Sensor is required. See see Figure 5-26 for the Optimized Idle overall system schematic.

Prior to installation, check the following items:

- □ The transmission must provide a reliable neutral signal (switch) — hardwired or via J1939.
- □ A Vehicle Speed Sensor (VSS) must be installed.
- □ There must be an electric starter; air starters cannot be used with Optimized Idle.
- □ Automatic transmissions may be used, but they must have a Starter Lockout Feature installed based on a reliable neutral signal.

New installations must be approved by Detroit Diesel. See Figure 5-26 for the Optimized Idle overall system schematic.

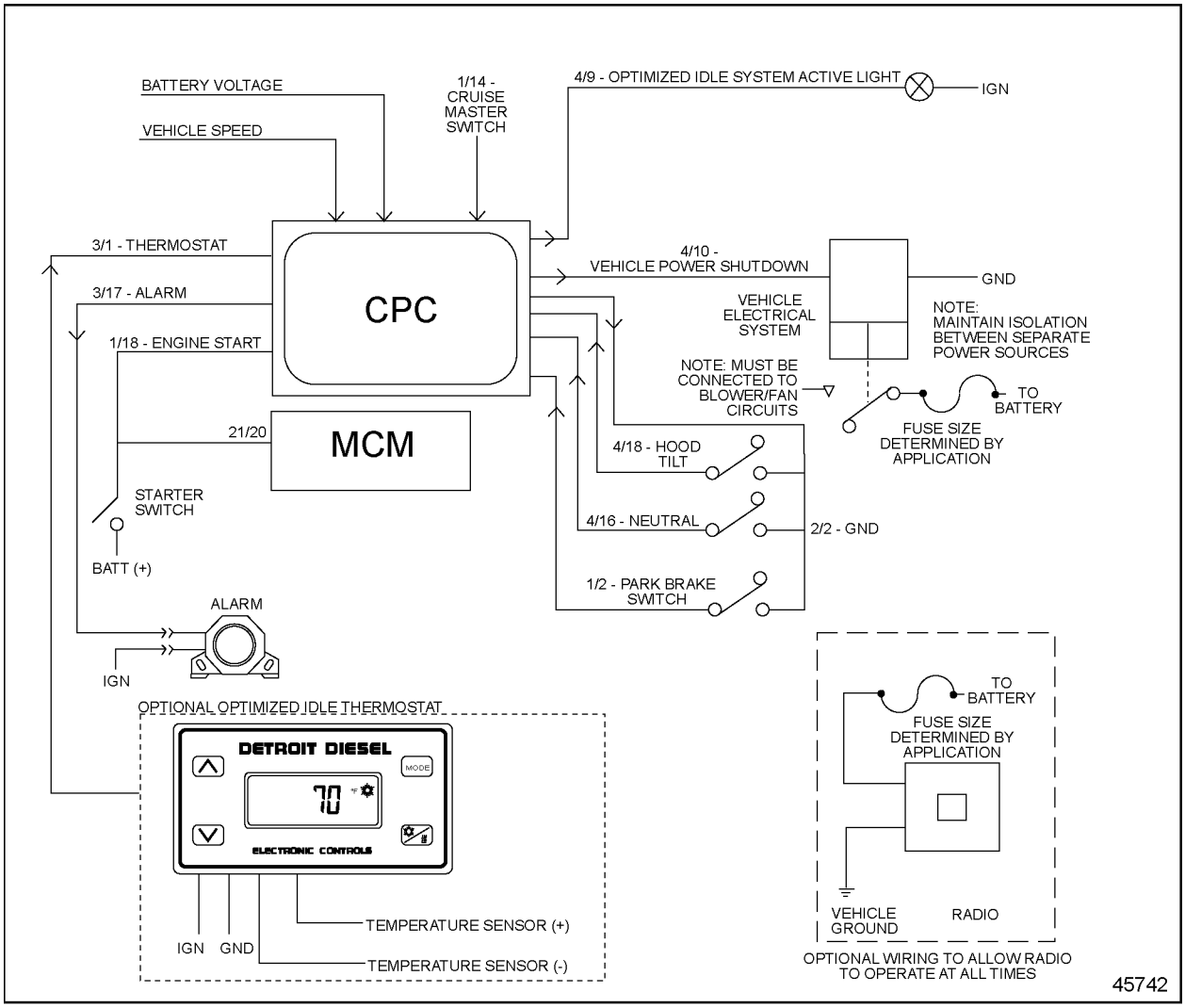

Figure 5-26 Optimized Idle System

5.19.3 PROGRAMMING REQUIREMENTS AND FLEXIBILITY

The digital inputs and outputs listed in Table 5-63 can be programmed.

Parameter Group	Parameter / Description	Setting
12	Optimized Idle Enable	1 = Enable
8	Vehicle Speed Sensor	4 = Magnetic Pickup
13	3 01 AI Selection	0 = No Sensor 2 = OI Thermostat
13	Trans Neutral Input Config	0 = Hardwired (man8al trans) 1 = J1939 (J1939 trans)
13	Park Brake Switch Config	0
13	4 18 DI Selection	2 = Enable Engine Hood
35	4 09 DO Selection	10 = OI Active Lamp
35	4 10 DO Selection	3 = Vehicle Power Shutdown
35	3 17 DO Selection	4 = OI Alarm
17	Enable Idle Shutdown	1 = Enable with Park Brake
17	Enable PTO Shutdown	1 = Enable with park Brake
MCM	Starter Type Control	1 = Starter Activated via MCM
13	1 02 DI Selection	1 = Enable
35	3 17 DO Fault Detection	1 = Enable
35	4 09 DO Fault Detection	1 = Enable
35	4 10 DO Fault Detection	1 = Enable
17	Enable Idle PTO Shtn Override	0 = Disable

Table 5-63 Optimized Idle Digital Inputs and Digital Outputs

Optimized Idle options for battery charging and continuous run are listed in Table 5-64.

Parameter	Description	Range	Default
OI Continuous Batt Time Enable	When enabled and OI has started the engine for battery three consecutive times, the engine will run continuously in OI Mode	0 = Disable 1 = Enable	0 = Disable
OI Variable Volt Thres Enable	When enabled, the battery voltage threshold will be based on ambient air temperature.	0 = Disable 1 = Enable	0 = Disable
OI Alternate Battery Run Time	Sets the alternate run time for battery starts.	20 min to 2 hrs	0 min
OI Upper Limit Continuous Run Temp	Set the continuous run upper limit. When the ambient air temperature is above this limit, the engine will run continuously.	40°C-100°C	32°C
OI Lower Limit Continuous Run	Sets the continuous run lower limit. When the ambient air temperature is below this limit, the engine will run continuously.	40°C-100°C	—4°C
OI Thermostat Max Time	Maximum amount of time the engine can run in Thermostat Mode.	0–459000 sec	0 sec
OI Target Engine RPM	Sets the speed the engine will operate at in OI Mode.	800–1100 rpm	1100 rpm

Table 5-64 Optimized Idle Options

Optimized Idle installations should have the parameters listed in Table 5-65 set to Shutdown.

NOTICE:
DDC recommends that Shutdown be enabled for all Engine Protection parameters with Optimized Idle installations.

Parameter	Description	Setting
Coolant Temp Engine Protect Shtn	Indication of the type of engine protection based on high engine coolant temp.	1 = Engine Shutdown
Oil Press Eng Protect Shtn	Indication of the type of engine protection based on low engine oil pressure.	1 = Engine Shutdown
Coolant Level Engine Protect Shtn	Indication of the type of engine protection based on low coolant level.	1 = Engine Shutdown

Table 5-65 Engine Protection Parameters

5.19.4 INTERACTION WITH OTHER FEATURES

The Vehicle Power shutdown feature is used by Optimized Idle to turn off all accessory loads when the engine is shutdown. Optimized Idle will turn these loads on for Thermostat Mode starts.

No other DDEC VI features can be used when Optimized Idle is active.

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5.20 PARKED REGENERATION

Regeneration is the oxidation of soot in the Aftertreatment Device (ATD). This process happens during the normal operation cycle of the vehicle; it can occur both passively and actively. If the ATD is not capable of completing a successful regeneration due to duty cycle constraints or other restrictions, a parked regeneration may need to occur.

5.20.1 OPERATION

To initiate a parked regeneration, the following must occur:

- □ Cycle the park brake OFF to ON – once an ignition cycle
- □ Cycle the clutch pedal (if configured) – once an ignition cycle
- □ Park Brake must be ON and the clutch must be released
- □ Engine should be on the idle governor (can not be in Fast Idle or PTO Mode – not applicable for fire truck applications)
- □ The engine should be fully warmed up and operating on thermostat temperature (>60°C)
- □ For J1939 transmissions, the transmission must be in neutral (confirmed by the J1939 data link – current gear and selected gear is 0)
- □ Vehicle speed must be 0 mph
- □ Hold the Regen Switch to the ON position for five seconds and release
- □ Engine Speed < 1000 rpm (CPC R2.0 or later)

When the request is accepted, the DPF Regeneration Lamp will turn on for one second and then go off for the rest of the parked regeneration and the engine will increase. Once the stationary regen is completed successfully, the DPF Regeneration Lamp will remain off and the engine will return to base idle.

If any of the above requirements are removed, the engine will return to idle.

To cancel the manual regeneration, the driver can toggle the Regen Switch to ON for 5 seconds. The DPF Regeneration Lamp will turn on for one second to show acceptance of the cancellation request and then return to the appropriate state as defined by the current level of soot in the engine.

5.20.2 DPF PARKED (STATIONARY) REGENERATION FOR HAZARDOUS APPLICATIONS ONLY

The MCM should be configured to not allow automatically triggered over-the-road regenerations (DPF Manual Regen Only Enable = Enabled).

The appropriate options, based on the MCM, are listed in Table 5-66.

Application	MCM Setting	CPC Setting
Standard	DPF Manual Regen Only Enable – Disabled	DPF Stationary Regen Only – 1 Enabled
Hazardous	DPF Manual Regen Only Enable - Enabled	DPF Stationary Regen Only – 0 Disabled DPF Stationary Regen Only – 1 Enabled

Table 5-66 Parked Regeneration Options

There are two CPC options:

- □ DPF Stationary Regen Only = 0–Disabled
- □ DPF Stationary Regen Only = 1–Enabled

DPF Stationary Regen Only = 0-Disabled – This option allows the DPF Regeneration Switch to request a parked regeneration if the parked regeneration entry conditions are met (refer to section 5.20.1). This option also allows MCM initiated over-the-road regenerations to occur.

DPF Stationary Regen Only = 1-Enabled – This option ONLY allows a parked regeneration to occur using the DPF Regeneration Switch. The MCM will be unable to initiate an active over-the road regeneration when this is enabled.

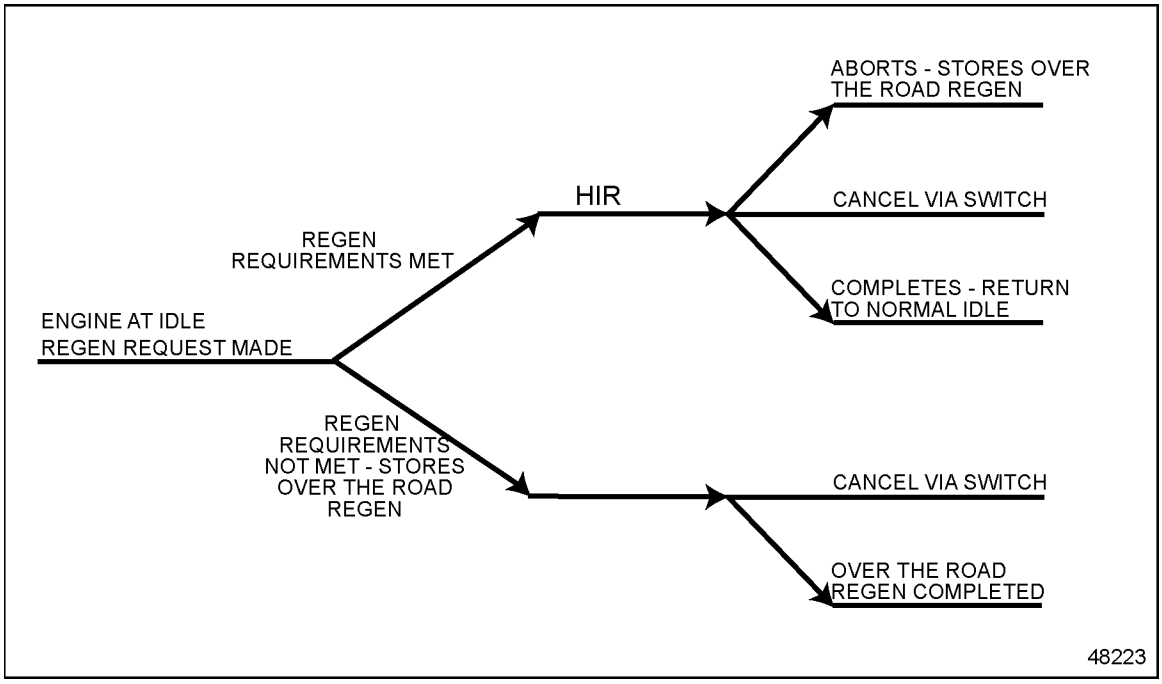

Figure 5-27 Parked Regeneration

Programming Requirements and Flexibility

The parameters listed in Table 5-67 must be set for manual transmissions.

Parameter Group	Parameter	Setting
13	Clutch Switch Config	1 – 1 Clutch Switch
13	4 08 DI Selection	1 – 1 Clutch Switch
13	Trans Neutral Input Config	0 – Hardwired 255 – Not Available (typical setting)
13	Park Brake Switch Config	0 – Hardwired (typical setting) 1 – CCVS1 2 – CCVS2 3 – CCVS3
13	1 02 DI Selection	1 – Enable Park Brake Interlock
8	Vehicle Speed Sensor	4 – Magnetic Pickup Vehicle Speed Sensor

Table 5-67 Parameter Settings for Manual Transmissions

The parameters listed in Table 5-68 must be set for Allison, Eaton UltraShift transmissions.

Parameter Group	Parameter	Setting
13	Clutch Switch Config	0 – No Clutch Switch
13	4 08 DI Selection	0 – Disable
13	Trans Neutral Input Config	1 – Info from J1939
13	Park Brake Switch Config	0 – Hardwired (typical setting) 1 – CCVS1 2 – CCVS2 3 – CCVS3
13	1 02 DI Selection	1 – Enable Park Brake Interlock
8	Vehicle Speed Sensor	3 – J1939 ETCI

Table 5-68 Parameter Settings for J1939 Transmissions (Allison, Eaton UltraShift, Eaton AutoShift)

The parameter listed in Table 5-69 is optional for hazardous applications.

Parameter Group	Parameter	Description	Default	Access
46	DPF Stationary Regen only	0 – DPF Regen Switch can request parked regen or over-the-road regen 1 – DPF Regen Switch can request parked regen only.	1 – Enabled	VEPS, DRS

Table 5-69 DPF Stationary Regen Only Parameter

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5.21 PASSMART

The PasSmart feature is available on selected on-highway engines equipped with a Vehicle Speed Sensor.

5.21.1 OPERATION

The PasSmart feature allows a fleet manager to enable a second Vehicle Speed Limit (VSL) above the normal VSL to assist while passing other vehicles on the highway. This second VSL is programmed for a limited duration (PS Pass Speed Duration)during a given time period (PS Pass Speed Interval). The passing speed interval starts when the feature is programmed. An interval of 8, 12, or 24 hours will always reset at midnight.

The driver activates PasSmart by double-pumping the accelerator pedal. Starting at the full throttle position, the driver releases the throttle completely, returns the throttle to the full throttle position, releases it again and then returns to full throttle. If the driver completes this action within five seconds, PasSmart is activated.

After double-pumping the accelerator pedal, the vehicle is given 20 seconds to accelerate to a speed above the normal VSL. If the vehicle speed does not exceed the normal VSL in 20 seconds, the driver must repeat the double-pump action. Once the normal VSL has been exceeded, a new higher VSL becomes the maximum vehicle speed limit. This limit is the normal VSL plus the PS Pass Speed Increment.

A passing speed duration timer starts when vehicle speed exceeds the normal VSL and continues to count until the vehicle speed drops back below the normal VSL. At the end of the passing event when the vehicle speed drops back below the normal VSL, PasSmart is automatically deactivated and the driver cannot exceed the normal VSL unless the Accelerator Pedal is double-pumped again.

PasSmart operates only with the foot pedal and not with the Cruise Control switches or hand throttle. However, activating PasSmart does not disturb or deactivate Cruise Control if it is on when the passing event begins. Once the driver has passed the other vehicles and PasSmart has deactivated, Cruise Control automatically takes over. To deactivate Cruise Control during the pass, the driver must turn the Cruise Control switch to off.

When the Passing Speed Duration time expires, the AWL will begin to flash one minute prior to ramping the VSL back down to the normal VSL. The rampdown event always takes 5 seconds regardless of the Passing Speed Increment programmed into the controller. The rampdown alert can be distinguished from an engine fault warning in that the AWL flashes for the PasSmart alert and remains on constantly for an engine fault.

If intervals of 8, 12, or 24 hours are selected, the interval will always reset after the chosen interval and at midnight. This allows fleets to synchronize the reset with driver change periods. All other intervals reset from the time they are selected. For example, if you select 4 hours, then a reset will occur every 4 hours from the time of programming but not necessarily at midnight.

PasSmart still operates when there is an active (non-shutdown) system fault. In this situation the AWL goes from constant illumination to flashing one minute before the VSL ramps down. At the end of the passing event when PasSmart is deactivated, the AWL will return to constant illumination if the fault is still active.

If there is an active stop engine fault, the rampdown/shutdown activity overrides PasSmart. The additional passing speed is not available until the fault is cleared.

For example, if the normal fleet speed limit is 65 MPH, the fleet manager can increase the VSL an additional 10 MPH for a maximum of 30 minutes per reset interval. An example of these limits is listed in Table 5-70.

Parameter	Setting
PS Pass Speed Duration	30 minutes
PS Pass Speed Interval	8 hours
PS Pass Speed Increment	10 MPH

Table 5-70 PasSmart Settings

Each time the driver exceeds 65 MPH, the 30 minute clock counts down as long as the speed remains above 65 MPH. He or she can continue to enter and exit the PasSmart extra speed zone to pass vehicles until the entire 30 minutes of higher VSL is used up. The driver is warned by the AWL one minute before the time expires. The vehicle speed is then limited to 65 MPH until the 8 hour period expires and an additional 30 minutes of passing time is available.

5.21.2 INSTALLATION

An OEM supplied Vehicle Speed Sensor or output shaft speed over the SAE J1939 Data Link is required. Refer to section 3.6.6, "Vehicle Speed Sensor," for additional information.

5.21.3 PROGRAMMING REQUIREMENTS AND FLEXIBILITY

The PasSmart parameters are programmable at engine order entry or with DDDL 7.0, Vehicle Electronic Programming System (VEPS), and DRS as listed in Table 5-71.

Parameter Group	Parameter	Description	Options	Default	Access
23	PasSmart Enable	Enables/disables the feature.	0 = Disable 1 = Enable	0	DDDL 7.0, VEPS or DRS
23	PS Pass Speed Duration	The duration of time per interval that is permitted at the higher speed. A value of zero will disable the feature.	0 to 255 minutes	0	DDDL 7.0, VEPS or DRS
23	PS Pass Speed Interval	The period of time when the CPC resets to begin a new period.	1 to 24 hours*	8	DDDL 7.0, VEPS or DRS
23	PS Pass Speed Increment	The additional vehicle speed permitted above the programmed vehicle speed limit. A value of zero will disable the feature.	0 to 250 KPH	0	DDDL 7.0, VEPS or DRS

* The time within which the road speed limit will return to the programmed road speed limit when the feature is deactivated.

Table 5-71 PasSmart Parameters

5.21.4 INTERACTION WITH OTHER FEATURES

PasSmart will increase the Vehicle Speed Limit.

A vehicle can be set up with both PasSmart and Fuel Economy Incentive, but the extra speed increments provided by the two features do not add together. For example, if Fuel Economy Incentive is set up to give 7 MPH of extra speed when the driver hits the maximum fuel economy target and the PasSmart increase is 5 MPH the resulting speed increase is 7 MPH, not 12 MPH.

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5.22 PASSWORDS

DDEC VI is capable of providing password protection for groups of parameters or a fleet password for all parameters.

5.22.1 OPERATION

A Password of zero is used to deactivate the protection. The lockout passwords may be up to 4 ASCII characters. Each level can have its own unique password.

Passwords can be activated with DDDL 7.0, VEPS or DRS. Once activated the parameters may not be changed until the correct password is reentered. The CPC is automatically locked at the next ignition cycle.

Groups selected for additional password protection are listed in Table 5-72.

Level	Parameters Protected
1	General Password – all parameters in all groups will be protected when this level is set
2	Vehicle Speed Settings – parameter groups that contain primary settings governing the speed of the vehicle. All parameters in following groups are protected when this password is set: □ PGR003 – Common Limiters □ PGR008 – Vehicle Speed Sensor □ PGR015 – Cruise Control (minus the “Cruise Power” parameter for rating changes)
3	PTO / Idle Settings – parameter groups that contain settings related to idle, idle shutdown, and PTO of the vehicle. All parameters in the following groups are protected when this password is set: □ PGR007 – PTO □ PGR017 – Idle and PTO Shutdown
4	System Settings – parameter groups that contain settings related to systems on the vehicle. All parameters in the following groups are protected when this password is set: □ PGR002 – Vehicle Parameters I □ PGR010 – Engine Brake □ PGR012 – Optimized Idle □ PGR019 – Automatic Fan Activation
5	Engine Protection Settings – the parameter group that contain settings for engine shutdown options and Engine Rating Selection – There is one parameter in this section, the “Cruise Power” parameter from group 15. This parameter allows the user to select from up to 3 different ratings within the same engine family (high power, low power, and cruise-power) where applicable are protected when this password is set: □ PGR018 – Engine Protection □ Cruise Power (Parameter 15 in Cruise Control Group)
6	TBD
7	Export Settings

Table 5-72 Protected Parameters

Back Door Password

In cases where the Password for a locked module is not available, a separate “back door” Password may be obtained from Detroit Diesel Technical Service. Detroit Diesel requires the VIN and Seed values read from the locked module with DDDL 7.0 or DRS. The new unlock code will be provided by Detroit Diesel Technical Service for entry into the tool. When the correct Back Door Password is entered, all parameters with write access by the Service tool may be changed.

Changing the Password

The Password itself may be changed. The CPC is automatically locked at the next ignition cycle. Changing the Password to a value of “0” will disable Password protection. When the Password is changed, the ignition must be off for at least 15 seconds.

5.23 PROGRESSIVE SHIFT

The Progressive Shift option offers a high range maximum Vehicle Limit Speed to encourage the use of high (top) gear during cruise operation. Progressive Shift encourages the driver to upshift from a lower to a higher gear prior to reaching the engine's governed speed. The resulting lower engine speed in high range should result in improved fuel economy. Progressive shifting techniques should be practiced by every driver, but can be forced if fleet management considers it necessary. The benefits from progressive shifting are best realized during stop-and-go driving cycles.

The rate of acceleration will be limited below the programmed MPH to encourage up shifting.

As the driver accelerates beyond a specified MPH speed, the rate of engine acceleration is limited in higher RPM, to encourage (force) the operator to select the top gear.

- □ Progressive Shift should be used with 2100 RPM rated engines in fleet applications where the reduced driveability will not impede trip times or productivity.
- □ Progressive Shift is not compatible with automatic transmissions.

NOTE:
Progressive Shift should be selected only when Spec Manager is run. Progressive Shift selection without Spec Manager could result in mismatched equipment, poor fuel economy, and poor performance. Your local Detroit Diesel Distributor will run the program.

5.23.1 OPERATION

The Progressive Shift option has two sets of low ranges and one set of high range parameters, which are programmable with DDDL 7.0, DRS, or VEPS. Refer to section 5.23.6. The example shift pattern chart (see see Figure 5-28) reflects default values when the Progressive Shift option is chosen and the low and high gear parameters are not modified.

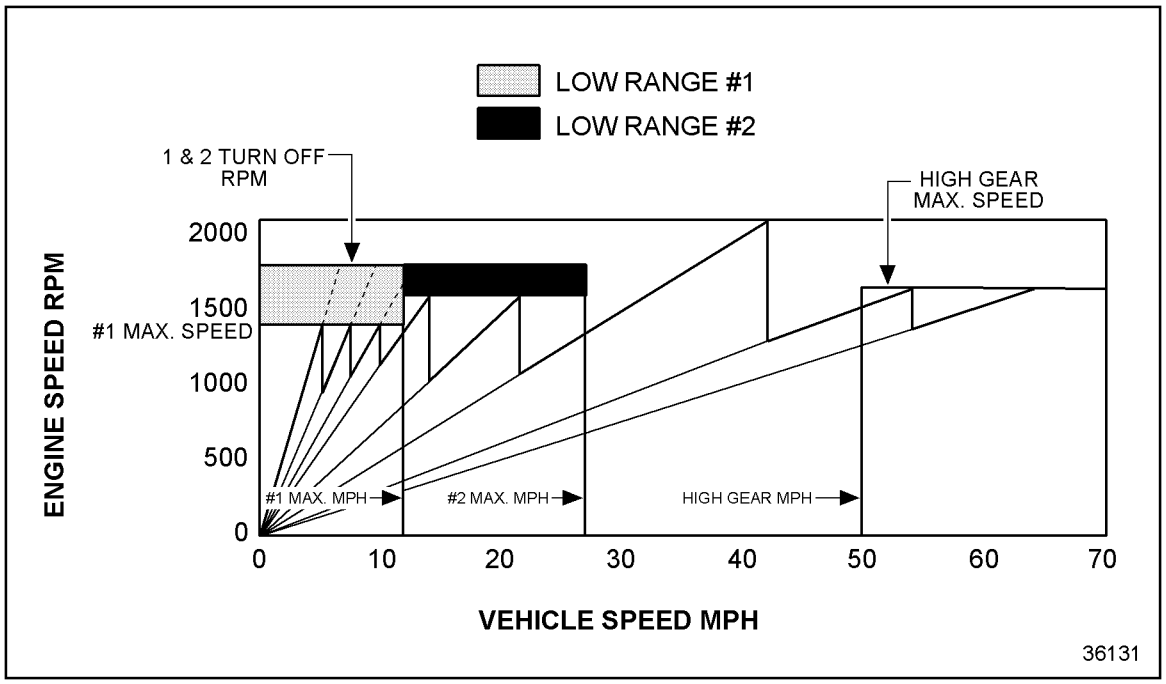

Figure 5-28 Progressive Shift Chart - Represents Default

An alternate use for the Progressive Shift option would be to encourage a driver (or force him/her) into top gear. Normally this condition exists when the gearing selected at the time of order allows a Vehicle Limit Speed to be reached in a gear lower than top gear. See see Figure 5-29.

5.23.2 LOW RANGE #1

The low range #1 area of operation is bound by a maximum vehicle speed, a maximum engine speed and a maximum turn-off speed. In the first illustration (see see Figure 5-28) the default values are 12 MPH (approximately 19.3 kmh), 1400 RPM and 1800 RPM, respectively. During vehicle acceleration, when the vehicle speed is below selected maximum vehicle speed for range #1, the maximum rate the engine can be accelerated is reduced to 33 RPM/s. During light load operation, the driver will feel this and be encouraged to up-shift to regain his/her rate of acceleration. If the engine continues to be operated above the low range #1 maximum speed, it may eventually reach the low range #1 turn-off speed. When the low range #1 turn-off speed is obtained, no additional increase in engine speed will be allowed. At this point, the transmission must be up-shifted if the vehicle is to continue accelerating.

5.23.3 LOW RANGE #2

The low range #2 area of operation is bounded by a maximum speed (MPH), a maximum vehicle speed and a maximum engine turn-off speed. In the first illustration (see see Figure 5-28) the default values shown are 27 MPH (approximately 43.5 km/h), 1600 RPM and 1800 RPM, respectively. (The lower vehicle speed boundary is the low range #1 maximum speed value.) The engine acceleration rate for low range #2 is 25 RPM/sec.

5.23.4 HIGH RANGE

Two high range parameters should be selected; a high range maximum vehicle speed (MPH) and a high range maximum engine speed (RPM). The default values shown in the first illustration (see see Figure 5-28) are 50 MPH (approximately 80.5 km/h) and 1650 RPM, respectively. Once the high range maximum engine speed is attained, the engine will not be allowed to operate above the high range maximum engine speed. This is meant to encourage up-shifting to high gear in order to increase vehicle speed (see see Figure 5-29). Spec Manager should be used if the HIGH GEAR MPH is set such that it reduces the vehicle speed and the engine MPH; this limit will not work as desired.

NOTE:
The HIGH GEAR maximum engine speed could change the maximum Vehicle Limit Speed if the high gear maximum engine speed (RPM) limits the Vehicle Limit Speed. With Progressive Shift enabled, the high gear RPM limit overrides the rated speed of the engine rating.

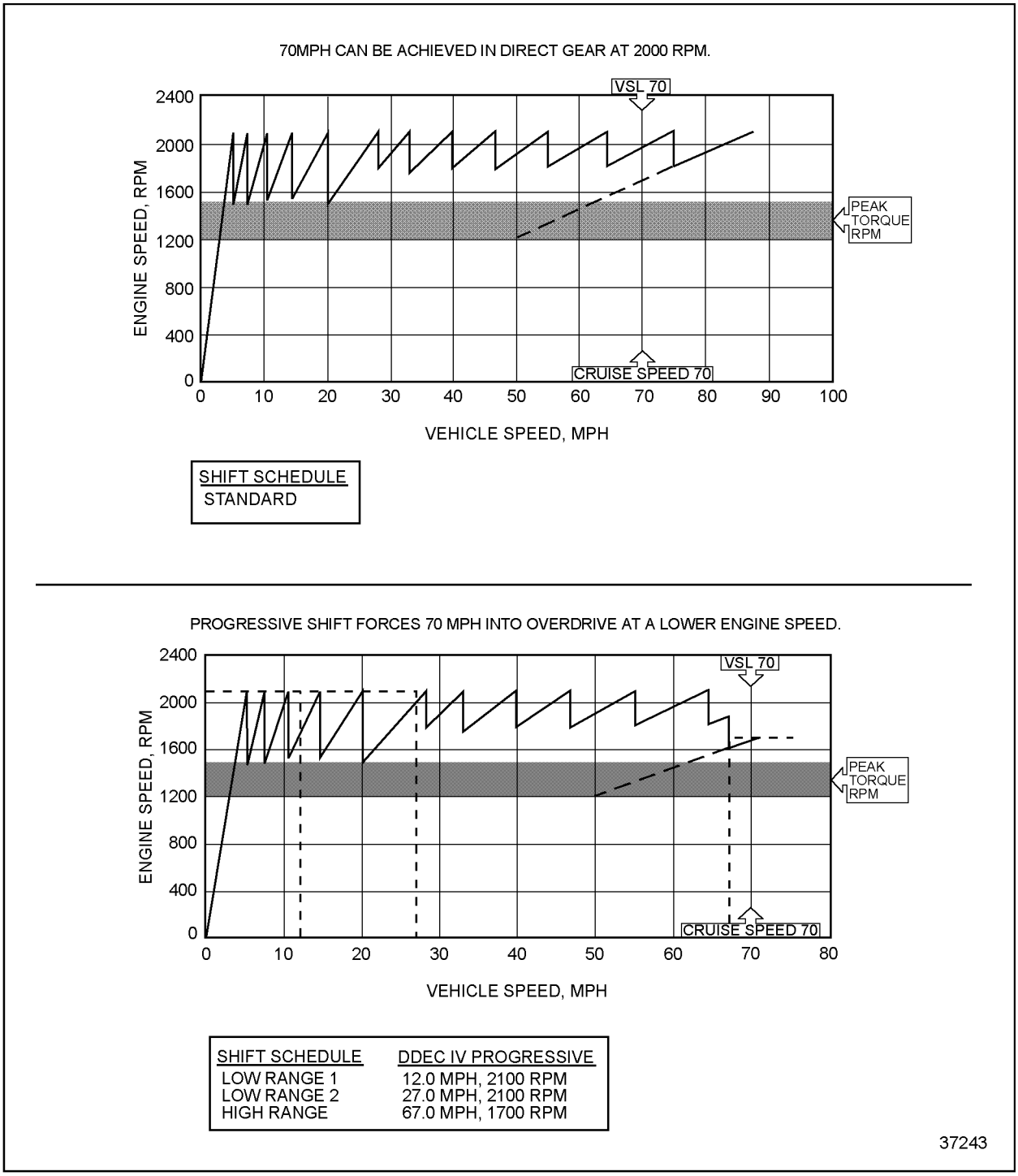

Figure 5-29 Progressive Shift Corrects Problem with High and Low Gears Modified

5.23.5 INSTALLATION INFORMATION

A Vehicle Speed Sensor (VSS) must be installed. It must be enabled, and all proper calculations entered into the ECU with DRS, DDDL 7.0, or VEPS. Refer to section 3.6.6, "Vehicle Speed Sensor," for additional information.

The Spec Manager program should be utilized to determine maximum vehicle speed for low range #1 and #2. If the maximum engine speed and maximum vehicle speed coincide, the Progressive Shift logic may not correctly compensate faster or slower on either side of the maximum vehicle speed. Spec Manager can alert the programmer to this dilemma and advise accordingly on maximum vehicle speed set points.

Example: If the maximum vehicle speed #1 was 12 MPH (approximately 19.5 kmh), the Progressive Shift logic may not determine if the maximum engine speed is 1400 or 1600 RPM. Spec Manager would advise moving the maximum vehicle speed #1 plus or minus 2 MPH (approximately 3.2 kmh) to eliminate any possible confusion.

5.23.6 PROGRAMMING FLEXIBILITY

Enabling all areas required for Progressive Shift can be performed with DDDL 7.0, VEPS, or DRS.

The Progressive Shift option has two sets of low gear and one set of high gear parameters as listed in Table 5-73.

Parameter Group	Parameter	Description	Range	Default
23	Progressive Shift Enable	Indicates the enabled/disabled status of the progressive shift feature.	0 = Disabled 1 = Enabled	0 = Disabled
23	PS Low Gear 1 Max Vehicle Spd	Sets the low gear #1 turn off speed.	0–250 km/h	19.3 km/h
23	PS Low Gear 1 RPM Limit	Sets the low gear #1 RPM limit.	0–4000 RPM	1400 RPM
23	PS Low Gear 1 Max RPM Limit	Sets the low gear #1 maximum RPM limit.	0–4000 RPM	1800 RPM
23	PS Low Gear 2 Max Vehicle Spd	Sets the low gear #2 turn off speed.	0–250 km/h	43.5 km/h
23	PS Low Gear 2 RPM Limit	Sets the low gear #2 RPM limit.	0–4000 RPM	1600 RPM
23	PS Low Gear 2 Max RPM Limit	Sets the low gear #2 maximum RPM limit.	0–4000 RPM	1800 RPM
23	PS High Gear On Vehicle Spd	Sets the high gear turn on speed.	0–250 km/h	80.5 km/h
23	PS High Gear RPM Limit	Sets the high gear RPM limit.	0–4000 RPM	1650 RPM

Table 5-73 Progressive Shift Programming

5.23.7 INTERACTION WITH OTHER FEATURES

When Progressive Shift is enabled DDEC VI will treat "HIGH GEAR RPM LIMIT" as the rated speed of the engine. Vehicle maximum speed or maximum Cruise Control settings can not be set higher then engine speed will allow based on the VSS data entered.

5.24 STARTER LOCKOUT

The Starter Lockout function protects the starter motor from over-speed damage, e.g. re-engaging the starter motor while the engine is running.

5.24.1 OPERATION

The Starter Lockout output circuit drives a normally closed relay, which interrupts the starting signal when the output has been activated.

If enabled, the Starter Lockout output will be activated when the engine speed exceeds the minimum speed for the starting motor for a maximum amount of time. To ensure that the engine would start even under worst conditions, the over-speed time condition will be added to the engine speed condition before the starter is locked out. Both values, maximum speed and minimum over-speed time, are dependent on the coolant temperature. The output is disabled when the ignition switch has been cycled to off or the engine is not running, i.e. the engine speed has a value of zero.

The cranking time is limited to a programmed value to keep the starting motor from over crank damage. The starter lockout relay will be activated when cranking time exceeds this lockout limit.

Since the starter signal is not available, the engine speed will be monitored to detect when the engine is cranking. When the starter engages, engine speed rises from zero to starter cranking speed. After this has been detected, engine speed will not be below the programmed speed for over-crank detection for the programmed maximum starter crank time.

If the driver is still turning the start key and the engine doesn't start while the maximum crank time expires, the starter lockout relay will be activated to shut off the starting engine. In this instance, the starter lockout relay will remain activated until the programmed lockout time expires and the engine has stopped. This allows the starting motor to cool down before the driver is permitted to start the engine again.

5.24.2 INSTALLATION

The Starter Lockout output circuit drives a normally closed relay, which interrupts the starting signal when the output has been activated. See Figure 5-30.

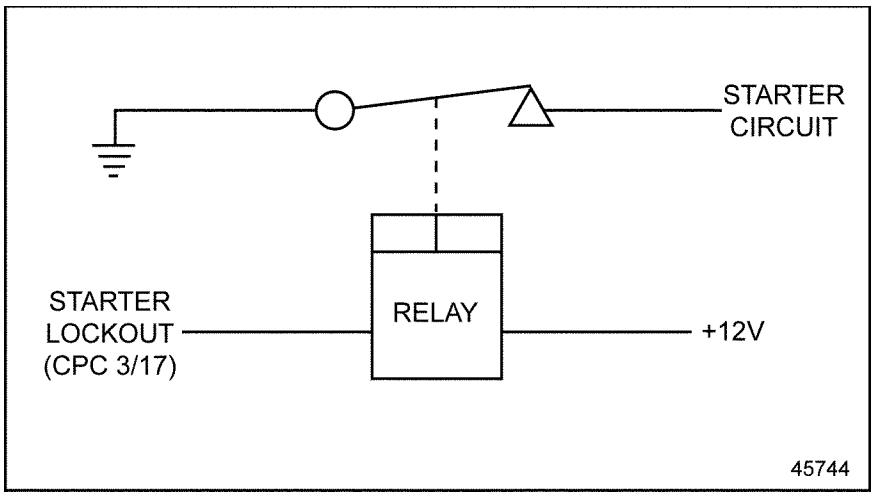

Figure 5-30 Starter Lockout

5.24.3 PROGRAMMING REQUIREMENTS AND FLEXIBILITY

Starter Lockout may be enabled or disabled as listed in Table 5-74 with VEPS or DRS.

Parameter Group	Parameter	Setting	Options	Default
35	3 17 DO Selection	1 – Enable Starter Lockout	0 – Disabled 1 – Enable Starter Lockout 2 – Enable kick down output* 3 – Not used 4 – Optimized Idle Alarm 5 – Split Valve* 6 – Starter Lockout + AGS2 7 – Engine brke disabled for over speed*	0 – Disabled
35	3 17 DO Fault Detection		0 = Enable 1 = Disable	0 – Disabled

* Not supported in NAFTA

Table 5-74 Starter Lockout

5.25 TACHOMETER DRIVE

DDEC VI uses the Camshaft Position Sensor (CMP Sensor) signals to compute engine speed. The engine speed is transmitted over the SAE J1708/J1587 and J1939 Data Links. Engine speed can be displayed by connecting a tachometer from the CPC connector pin 1/9. See Figure 5-31.

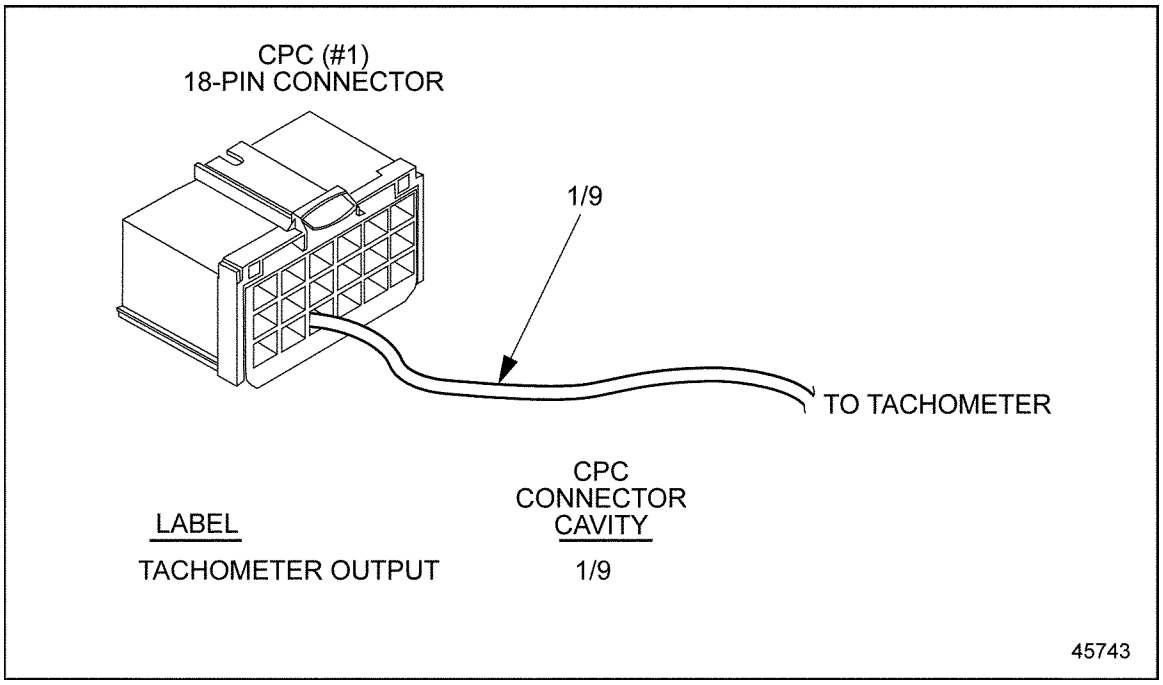

Figure 5-31 Tachometer Drive Installation

5.25.1 OPERATION

Pin 1/9 provides an engine speed signal for driving an external tachometer.

For engine speeds up to 120 rpm, no signal is output. Above 120 rpm the frequency of the signal is proportional to the engine speed with 16,040 pulses output per engine revolution.

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5.26 THROTTLE CONTROL/GOVERNORS

There are two types of engine governors that are used with throttle controls. The engine governors are:

- The Automotive Limiting Speed Governor (ALSG) for torque control, typical governor for on-highway applications (refer to section 5.26.1)
- The Power Take-off (PTO) for speed control, typical governor for off-highway applications (refer to section 5.26.2)

5.26.1 AUTOMOTIVE LIMITING SPEED GOVERNOR - ON-HIGHWAY

In on-highway applications and some nonroad applications, ALSG is the primary throttle source. The throttle input in a ALSG sets percent load. The amount of fuel input to the engine is determined by the throttle position. As the load on the engine varies the resulting engine speed will vary between idle speed and governed speed.

ALSG Accelerator Pedal

The accelerator pedal (AP) sends an input signal which the ALSG uses to calculate engine power. This assembly is also referred to as the Accelerator Pedal Sensor (AP Sensor) assembly.

ALSG Accelerator Pedal Installation

DDEC VI is compatible with an AP which has an output voltage that meets SAE J1843 and has less than 5% of voltage supply closed throttle variability.

The AP is an OEM supplied part. Vendor sources may be contacted for additional design and installation details.

NOTE:
An Idle Validation Switch is required.

See Figure 5-32 for installation requirements.

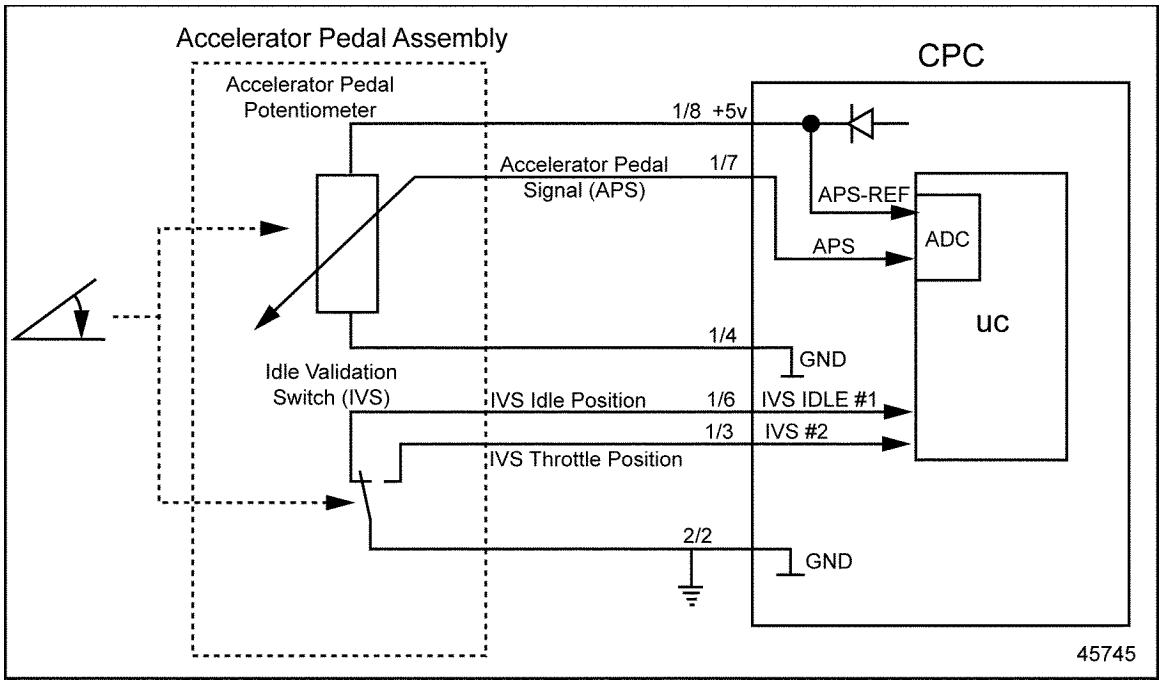

Figure 5-32 Accelerator Pedal Installation

An Idle Validation Switch is required and uses two digital inputs. Refer to section 4.1, "Digital Inputs," for additional information.

ALSG Accelerator Pedal Assembly Diagnostics

Idle Validation Switch inputs provide redundancy to assure that the engine will be at idle in the event of an AP in-range malfunction. The Idle Validation Switch is connected to two digital inputs on the CPC. When the IVS Idle Position Switch on the AP is switched to battery ground and the IVS throttle position is open, the engine speed will be at idle.

5.26.2 POWER TAKE-OFF

Power Take-off (PTO) control is available to fuel the engine in order to keep the selected PTO speed regardless of engine torque without driver interaction. The engine torque cannot exceed a programmed limit.

The PTO throttle control options are:

- □ Cab PTO – Cruise Switch PTO
- □ Remote PTO – Preprogrammed Set Speeds
- □ Remote Accelerator Control

See Figure 5-33 for a diagram of PTO logic.

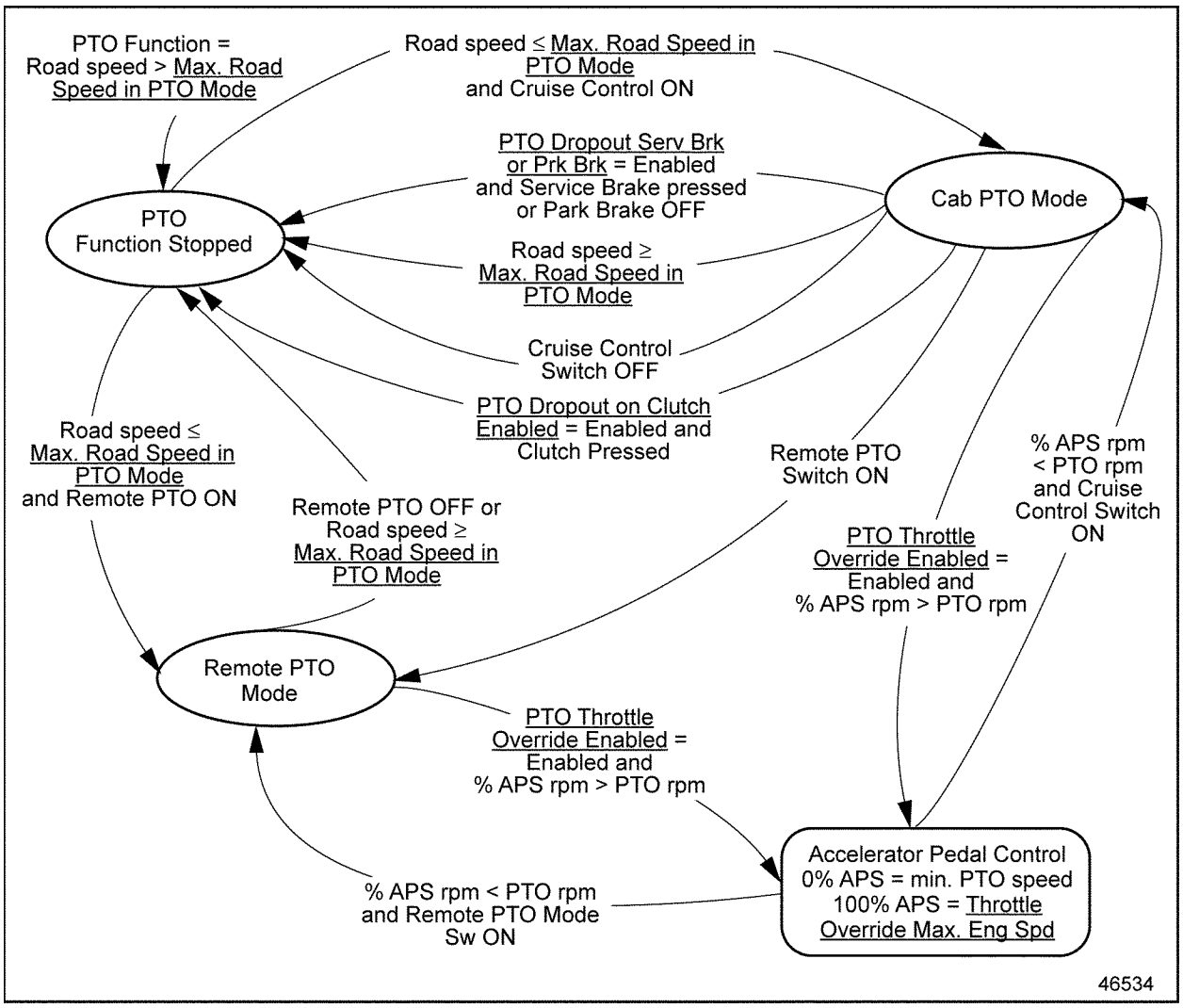

Figure 5-33 PTO Logic

Cab PTO – Cruise Switch PTO

The Cruise Control switches are used to activate and control the Cruise Switch PTO (Cab PTO) option. See Figure 5-34

NOTE:
Cab throttle and remote throttle can be overridden with the accelerator pedal unless PTO Throttle Override Enable is enabled.

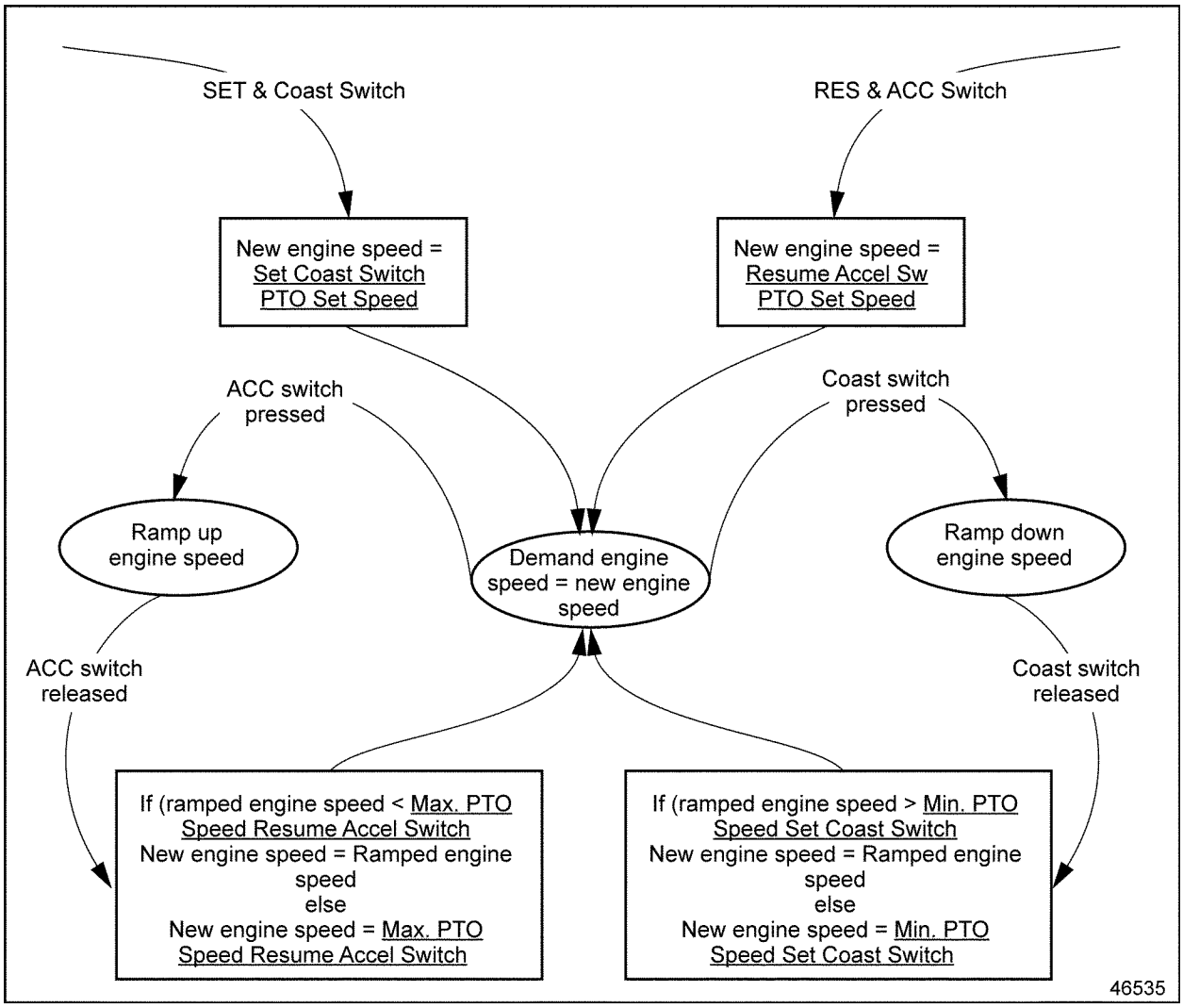

Figure 5-34 Cab PTO Mode

The Cruise On/Off switch must be turned ON and the park brake must be engaged (if configured). If Cruise Switch PTO is inactive and the Cruise Switch PTO conditions are met, pressing and releasing the Resume/Accel Switch will activate Cruise Switch PTO at the resume PTO speed (Resume Accel Switch PTO Set Speed). Pressing and releasing the Set/Coast Switch will activate Cruise Switch PTO at the set PTO speed (Set Coast Switch PTO Set Speed). The Resume PTO Speed and the Set PTO Speed cannot be greater than the PTO maximum speed (Max PTO Spd Resume Accel Sw) or lower than the PTO minimum speed (Min PTO Spd Set Coast Sw).

Once the PTO set speed is established, the Resume/Accel Switch can be used to increment the set speed at a programmable rate up to the maximum PTO speed (Max PTO Spd Resume Accel Sw). Releasing the Resume/Accel Switch will set the engine speed at the current operating speed.

The Set/Coast Switch will decrement the set speed at a programmable rate, down to the minimum PTO speed (Min PTO Spd Set Coast Sw). Releasing the Set/Coast Switch will set the engine speed at the current operating speed.

Cab PTO speed is disabled for any of the following:

- □ Turning the Cruise Master Switch off
- □ Vehicle speed is greater than "Max Road Speed in PTO Mode" (programmable – default 10 km/h)
- □ VSS fault
- □ Park Brake is off (if configured)
- □ Park Brake or Service Brake Applied (PTO Dropout Serv Brk Prk Brk)
- □ Clutch Pedal is pressed (PTO Dropout or Clutch Enabled)
- □ Cruise Switch Fault
- □ Optimized Idle is Active

If PTO Throttle Override is enabled (PTO Throttle Override Enabled), the throttle pedal can override the PTO engine speed up to the maximum engine speed for Throttle Override (Throttle Override Max Engine Spd). The previous PTO set speed will become active again, if it is greater than the engine speed equivalent to the throttle pedal percentage.

DDEC will exit the Cab PTO Mode for Automated/Automatic Transmissions for the following:

- □ Shift in Progress message received over J1939
- □ Valid TSC1 command received from the transmission
- □ Transmission in gear (selected gear or current gear)

Cruise Switch PTO Programming Requirement and Flexibility

The digital inputs listed in Table 5-75 are required for Cruise Switch PTO.

Parameter Group	Parameter	Options	Default	Access
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 Sw Config	0 = Hardwired 1 = CCVS1 2 = CCVS2 3 = CCVS3	0 = Hardwired	VEPS, DRS
13	Clutch Switch Config	0 = No Clutch Switch 1 = 1 Clutch Switch 2 = 2 Clutch Switch 3 = CCVS1 4 = CCVS2 5 = CCVS3 6 = ETC1	0 = Hardwired	VEPS, DRS
13	1 02 DI Selection	1 = Enable Park Brake Interlock 0 = Disable 2 = FUSO Auxiliary Brake Cut Switch*	1 = Enable Park Brake Interlock	VEPS, DRS
13	Park Brake Switch Config	0 = Hardwired 1 = CCVS1 2 = CCVS2 3 = CCVS3	0 = Hardwired	VEPS, DRS
13	Trans Neutral Input Config	0 = Hardwired 1 = Info from J1939 255 = Not Available	0 = Hardwired	VEPS, DRS

* Not supported in NAFTA

Table 5-75 Cruise Switch PTO Digital Inputs

The Cruise Switch PTO parameters are listed in Table 5-76 and Table 5-77.

Parameter Group	Parameters	Description	Options	Default	Access
7	Config PTO Speed Control	Enables/disables the PTO function	0 – Disabled 1 – Enabled 2 – Enabled if neutral 3 – Enabled if neutral and park brake 4 – Enabled if park brake 5 – PTO while driving	0 – Disabled	DDDL 7.0, DRS, VEPS
7	Max PTO Spd Resume Accel Sw	Sets the max PTO speed	500 – 3000 RPM	3000 RPM	DDDL 7.0, DRS, VEPS
7	Min PTO Spd Set Coast Sw	Sets the min PTO speed	500 – 3000 RPM	500 RPM	DDDL 7.0, DRS, VEPS
7	PTO Throttle Override Enable	Enables/disables the throttle pedal from overriding PTO mode.	0 = Disabled 1 = Enable engine speed in PTO mode to be increased with throttle input	1 = Enable	DDDL 7.0, DRS, VEPS
7	Throttle Override Max Eng Spd	Sets the max engine speed that the throttle can obtain when in PTO mode.	0 – 3000 RPM	3000 RPM	DDDL 7.0, DRS, VEPS
7	PTO Dropout Serv Brk Prk Brk	Enables/Disables the status of the Service Brake or Park Brake for disabling of PTO	0 – No PTO dropout with Service Brake or Park Brake activation 1 – PTO drops out on Service Brake or Park Brake activation 2 – PTO drops out on Service Brake activation 3 – PTO drops out on Park Brake activation	0 = No PTO dropout with Service Brake or Park Brake activation	DDDL 7.0, DRS, VEPS
7	PTO Dropout on Clutch Enabled	Enables/Disables the status of the Clutch Switch for disabling of PTO	0 – No PTO dropout with clutch pedal 1 – Causes PTO to dropout if the clutch is pressed	0 = No PTO dropout with clutch pedal	DDDL 7.0, DRS, VEPS

Table 5-76 Cruise Switch PTO Parameters (1 of 2)

Parameter Group	Parameters	Description	Options	Default	Access
7	Max Road Speed in PTO Mode	Sets the max vehicle speed over which PTO is disabled	0 – 128 km/h	10 km/h	DDDL 7.0, DRS, VEPS
7	Set Coast Switch PTO Set Speed	Sets the initial speed when the Set/Coast Switch is used to enable Cab PTO	0 — 3000 RPM	500 RPM	DDDL 7.0, DRS, VEPS
7	Set Coast Max PTO Torque	Sets the max engine torque that becomes active once the Set/Coast Switch is activated	0 – 5000 Nm	5000 Nm	DDDL 7.0, DRS, VEPS
7	Resume Accel Sw PTO Set Spd	Sets the initial speed when the Resume/Accel Switch is used to enable Cab PTO	0 — 3000 RPM	500 RPM	DDDL 7.0, DRS, VEPS
7	Resume Accel Max PTO Torque	Sets the max engine torque that becomes active once the Resume/Accel Switch is activated	0 – 5000 Nm	5000 Nm	DDDL 7.0, DRS, VEPS
7	PTO Ramp Rate	Sets the rate of increase or decrease.	25 – 2500 RPM/sec	200 RPM/sec	DDDL 7.0, DRS, VEPS

Table 5-77 Cruise Switch PTO Parameters (2 of 2)

5.26.3 REMOTE PTO — PREPROGRAMMED SET SPEEDS

The Remote PTO will override the Cab PTO mode when the Remote PTO Switch input on the CPC (2/9) is grounded. The active throttle will override Remote PTO if "PTO Throttle Override" is enabled.

Remote PTO speed is disabled for any of the following:

- □ Turning the Remote PTO switch off for more than two seconds
- □ Vehicle speed is greater than Max Vehicle Speed in PTO (programmable – default 10 km/h)
- □ VSS fault
- □ Clutch Released Pedal or Service Brake Pedal are pressed (if configured)
- □ Park Brake is OFF (if configured)
- □ Park Brake or Service Brake is applied (PTO Dropout Serv Brk Prk Brk)
- □ Cruise Switch fault
- □ Clutch Pedal is pressed (PTO dropout on clutch enabled)
- □ Optimized Idle is active

If "PTO Throttle Override Enable" is enabled, the throttle pedal can override the PTO Engine speed up to the Maximum Engine Speed for Throttle Override. If the throttle pedal or remote throttle engine speed is less than current PTO engine speed, the engine will not respond to throttle requests less than the current PTO engine set speed. The previous PTO set speed will become active again, if it is greater than the engine speed equivalent to the throttle pedal percentage.

NOTE:
If remote PTO is active and then disabled due to one or more disabling conditions, PTO mode will automatically reactivate when the disabling condition is removed.

There are three options using preprogrammed set speeds:

- □ Pulsed Input using pin 2/9
- □ Gray Coded using pins 2/9, 1/11, 2/11
- □ Binary Coded using pins 2/9, 1/11, 2/11

Pulsed Input Using Pin 2/9

Between one and three preset speeds can be set via "No of Speeds via Remote PTO". The first speed is selected by toggling 2/9 ON. The second speed is selected by toggling 2.9 OFF and ON within two seconds. The third speed is selected by toggling 2.9 OFF and ON within two seconds.

Remote PTO speed is disabled for any of the following:

- □ Turning the Remote PTO switch off for more than two seconds
- □ Vehicle speed is greater than Max Vehicle Speed in PTO (programmable – default 10 km/h)
- □ VSS fault
- □ Clutch Released Pedal or Service Brake Pedal are pressed (if configured)
- □ Park Brake is OFF (if configured)
- □ Park Brake or Service Brake is applied (PTO Dropout Serv Brk Prk Brk)
- □ Cruise Switch fault
- □ Clutch Pedal is pressed (PTO dropout on clutch enabled)
- □ Optimized Idle is active

NOTE:
If remote PTO is active and then disabled due to one or more disabling conditions, Remote PTO mode will automatically reactivate when the disabling condition is removed.

See Figure 5-35 for a diagram of Remote PTO Mode.

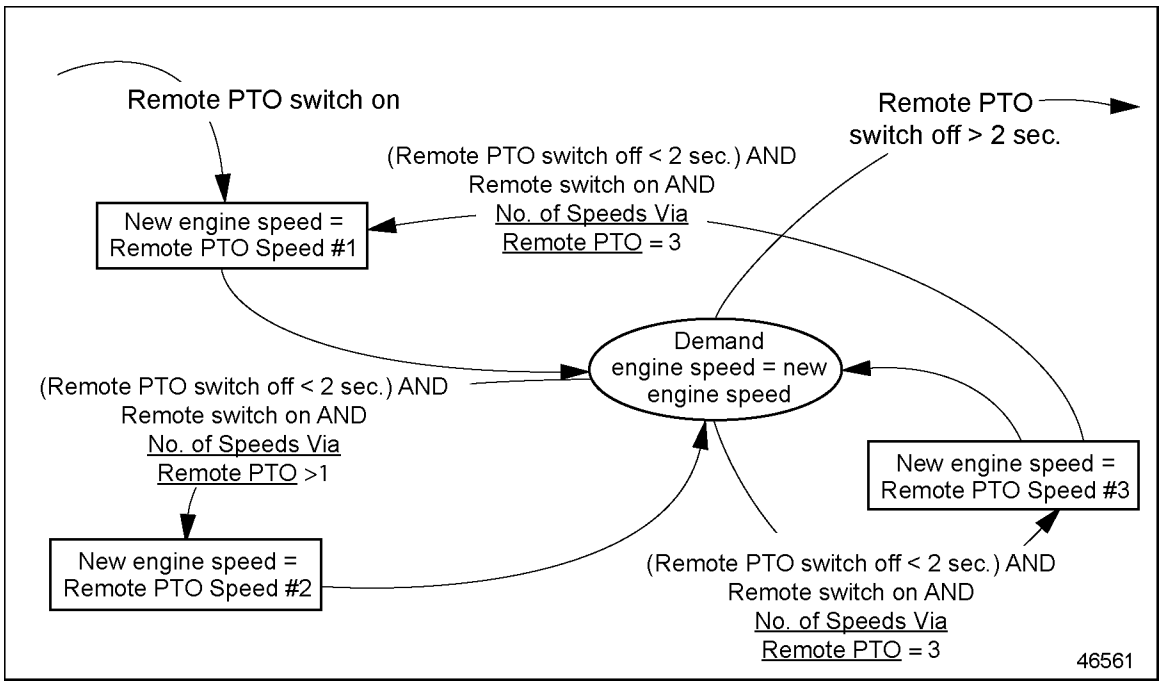

Figure 5-35 Remote PTO Mode – Pulsed Input Using Pin 2/9

Installation

The Remote PTO Switch is wired to pin 2/9 of the CPC. See Figure 5-36.

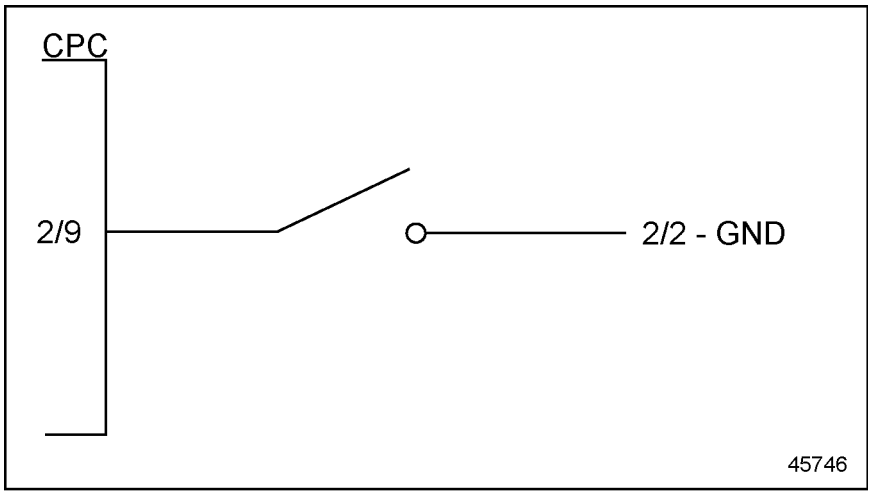

Figure 5-36 Remote PTO Switch

Gray Coded Using Pins 2/9, 1/11, 2/11 and Binary Coded

Gray Coded – In this mode, the engine speed set-point is received directly from two digital input pins (LIM0 AND LIM1) on the CPC. These digital inputs are used to read the status of the two remote PTO switches fitted to the vehicle. The inputs are usually sent to the CPC from a separate control unit hardwired directly to the CPC.

Gray code mode is the recommended interface for remote speed selection. Gray code mode has the advantage that only one switch changes for one set-point select to the next, thus alleviating the problem of switch bounce and non-synchronous switching. The coded inputs are listed in Table 5-78.

Remote PTO Enable Input (2/9)	LIM0 (1/11)	LIM1 (2/11)	Speed Selection
OFF (Open)	Don't Care	Don't Care	Remote PTO OFF
ON (Ground)	OFF (Open)	OFF (Open)	Remote PTO OFF
ON (Ground)	ON (Ground)	OFF (Open)	Remote PTO Speed 1
ON (Ground)	ON (Ground)	ON (Ground)	Remote PTO Speed 2
ON (Ground)	Ground	ON (Ground)	Remote PTO Speed 3

Table 5-78 Gray Coded Inputs

Binary Coded – This interfacing method is designed for devices which are not capable of generating “Gray Code” and uses the same two digital input signals (LIM0 AND LIM1). As mentioned previously, this method has a disadvantage. When switching from speed 1 to speed 2 or from speed 3 to OFF two bits must toggle synchronously. When the contacts bounce (as the usually do), an undesired speed set-point could be requested briefly. The preset speeds are selected with pin 1/11 and 2/11 as listed in Table 5-79.

Remote PTO Enable Input (2/9)	LIM0 (1/11)	LIM1 (2/11)	Speed Selection
OFF (Open)	Don't Care	Don't Care	Remote PTO OFF
ON (Ground)	OFF (Open)	OFF (Open)	Remote PTO OFF
ON (Ground)	ON (Ground)	OFF (Open)	Remote PTO Speed 1
ON (Ground)	OFF (Open)	ON (Ground)	Remote PTO Speed 2
ON (Ground)	Ground	ON (Ground)	Remote PTO Speed 3

Table 5-79 Binary Inputs

Installation for Gray Coded or Binary Input

See Figure 5-37 for the wiring of gray coded or binary input.

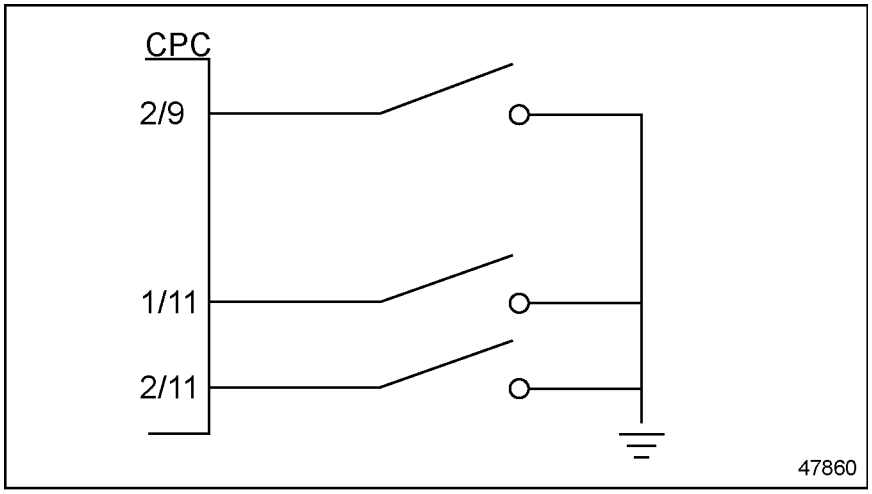

Figure 5-37 Remote PTO Gray Coded or Binary Input

Remote PTO Programming Requirement and Flexibility

The Remote PTO parameters are listed in Table 5-80 and Table 5-81.

Parameter Group	Parameters	Description	Options	Defaults	Access
7	Config PTO Speed Control	Enables/disables the PTO function	0 = Disabled 1 = Enabled 2 = Enabled if neutral 3 = Enabled if neutral & park brake 4 = Enabled if park brake 5 = PTO while driving	0 = Disabled	DDDL 7.0, DRS, VEPS
7	PTO Throttle Override Enable	Enables/disables the throttle pedal from overriding PTO mode.	0 = Disable PTO 1 = Enable engine speed in PTO mode to be increased with throttle pedal	1 = Enable	DDDL 7.0, DRS, VEPS
7	Throttle Override Max Eng Spd	Sets the max engine speed that the throttle can obtain when in PTO mode.	0 – 3000 RPM	3000 RPM	DDDL 7.0, DRS, VEPS

Table 5-80 Remote PTO Parameters (1 of 2)

Parameter Group	Parameter	Description	Options	Defaults	Access
7	Max Road Speed in PTO Mode	Sets the max vehicle speed over which PTO is disabled	0 – 128 km/h	10 km/h	DDDL 7.0, DRS, VEPS
7	PTO Ramp Rate	Sets the rate of increase or decrease when in PTO mode.	25 – 2500 RPM/sec	200 RPM/sec	DDDL 7.0, DRS, VEPS
7	No of Speeds via Remote PTO	Sets the number of remote PTO speeds that can be enabled	1 to 3	1	DDDL 7.0, DRS, VEPS
7	Spd 1 via Remote PTO	Sets the PTO #1 set speed	500 – 3000 RPM	950 RPM	DDDL 7.0, DRS, VEPS
7	Spd 1 Max Eng Trq Remote PTO	Sets the max engine torque for PTO Speed #1	500 – 5000 Nm	5000 Nm	DDDL 7.0, DRS, VEPS
7	Spd 2 via Remote PTO	#2 PTO set speed	500 – 3000 RPM	1250 RPM	DDDL 7.0, DRS, VEPS
7	Spd 2 Max Eng Trq Remote PTO	Sets the max engine torque for PTO Speed #2	500 – 5000 Nm	5000 Nm	DDDL 7.0, DRS, VEPS
7	Spd 3 via Remote PTO	#3 PTO set speed	500 – 3000 RPM	1850 RPM	DDDL 7.0, DRS, VEPS
7	Spd 3 Max Eng Trq Remote PTO	Sets the max engine torque for PTO Speed #3	500 – 5000 Nm	5000 Nm	DDDL 7.0, DRS, VEPS
7	Remote PTO Spd Selection Mode	Sets the PTO speed selection mode	0 = 1 pulsed input (VCU style) 1 = 2 gray coded inputs 2 = 2 binary coded inputs	0	DDDL 7.0, DRS, VEPS
20	Remote Accelerator Enable	Enable pin 314 for remote throttle	0 = Disabled 1 = Enabled	0 = Disabled	DRS, VEPS

Table 5-81 Remote PTO Parameters (2 of 2)

Remote Accelerator Control for PTO or ALSG

A Remote Accelerator Pedal can be installed to control either an analog Remote PTO (PTO) or analog Remote Accelerator Pedal (ALSG).

The Remote PTO will start when the Remote PTO switch (CPC, 2/9) is switched to battery ground. The Remote PTO logic will override the Cab PTO.

The Remote Throttle Select Switch input (CPC, 2/8) determines the active throttle control. When this pin is grounded, the engine will respond to the remote throttle input. When this input is not grounded, the engine will respond to the cab throttle pedal.

The PTO Enable input (CPC, 2/9) determines if the engine will be in PTO or ALSG mode.

If remote PTO is active and then disabled due to one or more disabling condition, PTO mode will automatically reactivate when the disabling condition is removed.

Remote Accelerator Control Example

Example: If a remote throttle is required to work from idle to rated speed, the parameters listed in Table 5-82 must be set.

Parameter	Set To
PTO Throttle Override Enabled	1
Spd #1 Via Remote PTO	Idle
Max PTO Spd Resume Accel Sw	Rated (or highest RPM for the engine)

Table 5-82 Remote Accelerator Control Parameter Settings

Installation

See Figure 5-38 for installation of a Remote Accelerator Control for PTO or ALSG.

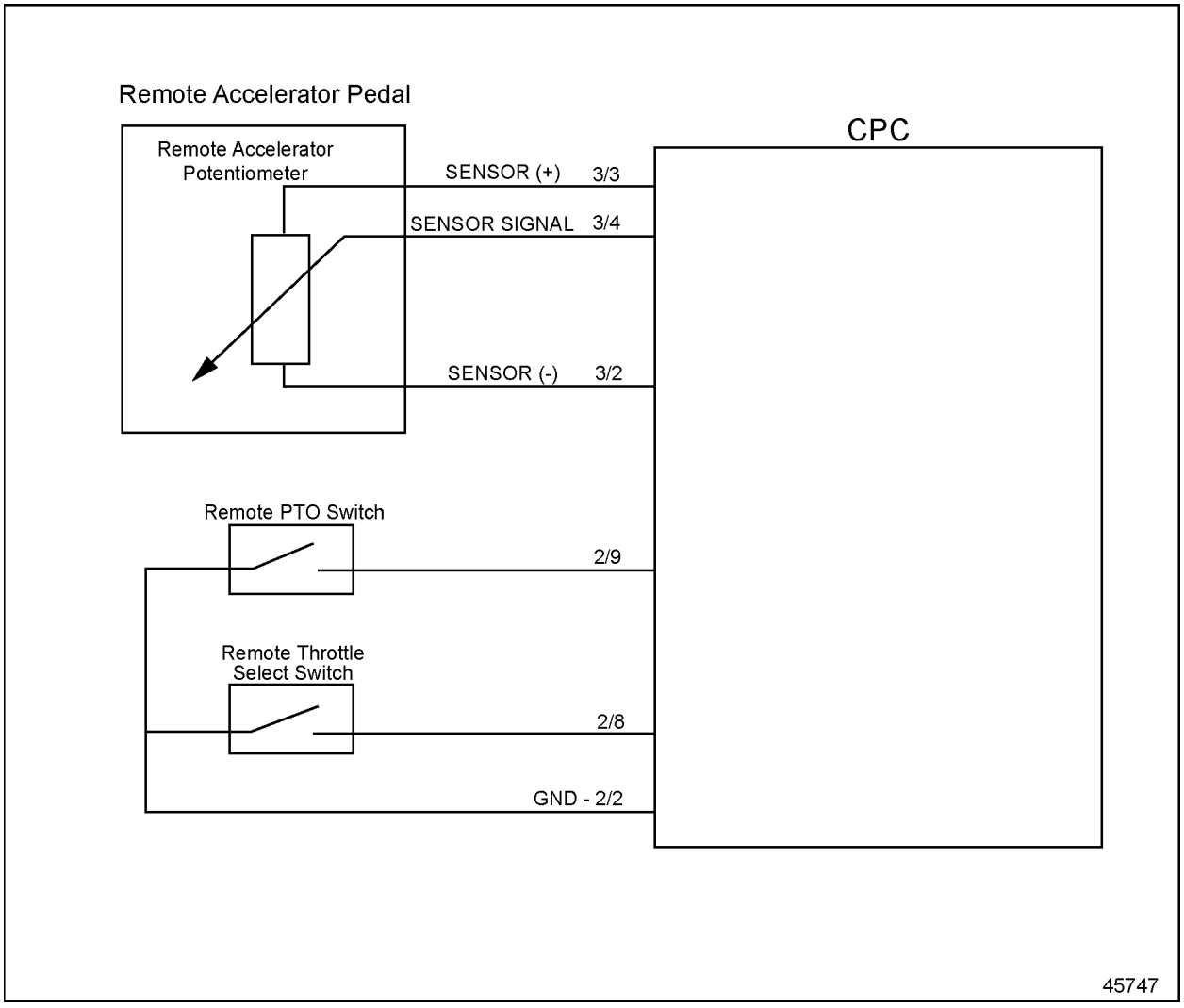

Figure 5-38 Remote Accelerator Control for PTO or ALSG

5.26.4 RPM FREEZE

When the RPM Freeze switch is ON (grounded), the current engine speed is maintained. The speed is held until the switch is turned OFF or PTO mode is deactivated.

Programming Requirements & Flexibility

The options for RPM Freeze are listed in Table 5-83.

Parameter Group	Parameter	Options	Default	Access
13	4 18 DI Selection	0 – Disable 1 — Enable Engine Door Bus* 2 — Enable Engine Hood 3 — AGS2 PTO Feedback 4 – RPM Freeze 5 — Engine Brake Disable 6 — Fast Engine Heat Up Switch	0 – Disable	VEPS, DRS

* Not supported in NAFTA

Table 5-83 RPM Freeze Programming Options

5.27 TRANSMISSION INTERFACE

DDEC VI can be interfaced to manual or automatic/automated transmission over the J1939 data link.

5.27.1 MANUAL TRANSMISSIONS

The interface for manual transmissions is provided through the J1939 data link.

Programming Requirements and Flexibility

The options for manual transmissions are listed in Table 5-84.

Parameter Group	Parameter	Setting
2	Transmission Type	DIRECT ENGINE START 0 – Manual Transmission without Neutral Switch MCM ENGINE START 3 – Manual Transmission with Neutral Switch
10	Eng Brk Driveline Clsd Min Speed	Series 60 – 800 rpm MBE 4000 (with neutral sw) – 800 rpm MBE 4000 (without neutral sw) – 1100 rpm MBE 900 – 800 rpm
13	Clutch Switch Config	1 – 1 Clutch Switch
13	4 08 DI Selection	1 – 1 Clutch Switch
13	Trans Neutral Input Config	Optional 0 – Hardwired 255 – Not Configured

Table 5-84 Manual Transmission Options

5.27.2 MERCEDES AGS2 TRANSMISSION

The AGS2 transmission is only used with the MBE 900 engine and has additional wiring requirements.

On non-multiplexed vehicles, the following outputs are required on the CPC:

- □ Neutral Start Function
- □ Backup Lamp Output
- □ Check Trans Lamp Output
- □ Trans Temp Lamp Output

Installation

See Figure 5-39 for the interface to the CPC and MCM for non-multiplexed transmissions and Figure 5-40 for multiplexed transmissions.

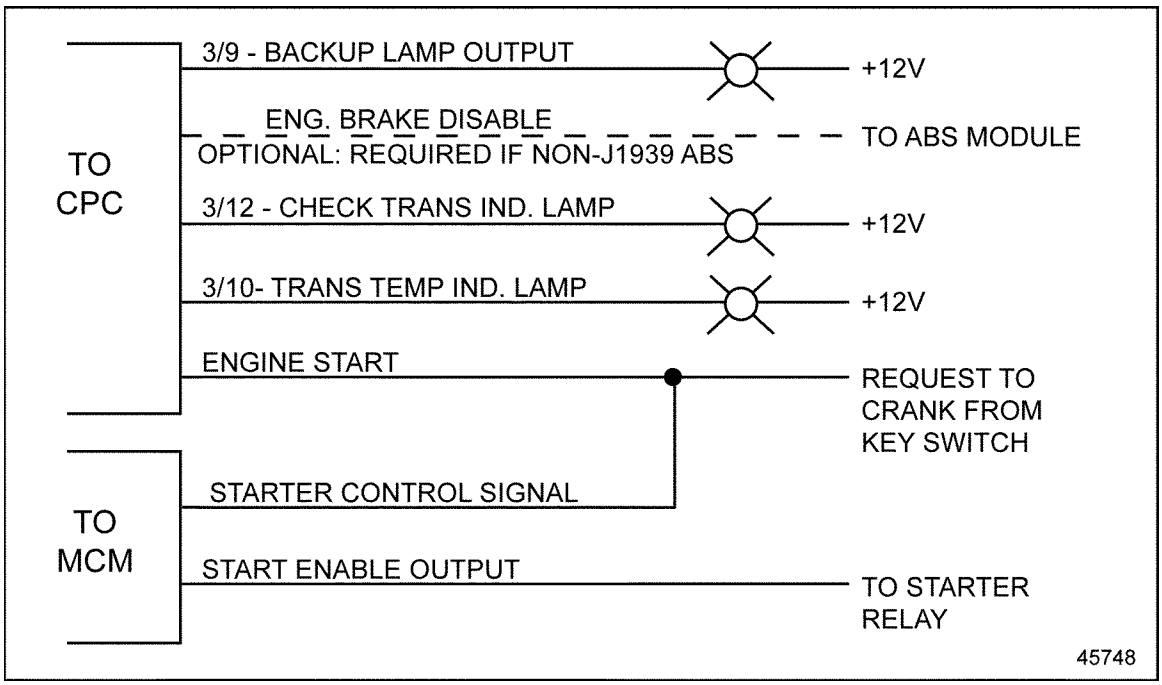

Figure 5-39 AGS2 Transmission Interface to CPC/MCM – Non-multiplexed

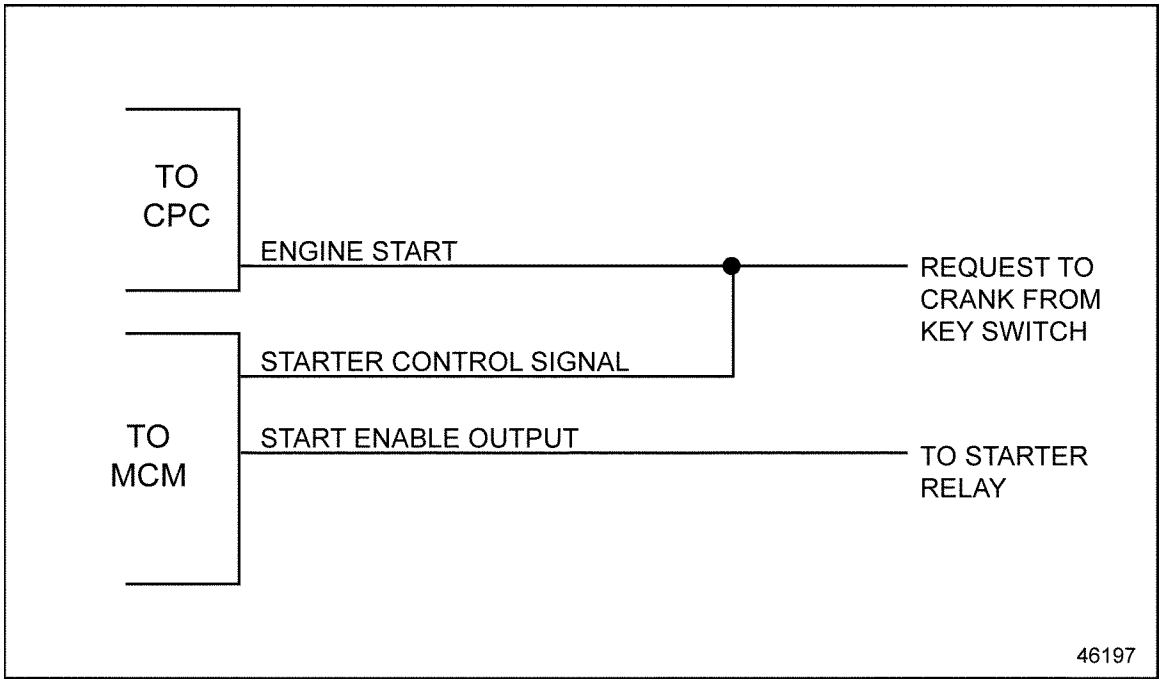

Figure 5-40 AGS2 Transmission Interface to CPC/MCM – Multiplexed

The AGS2 connector pinout is listed in Table 5-85.

Connector Pin	Description
1	SmartShift Lever Ground
2	CAN2 (+) (Proprietary)
3	Not Used
4	Not Used
5	CAN2 Low (Proprietary)
6	Not Used
7	J1939 (+)
8	Not Used
9	Ignition — +12V
10	Not Used
11	J1587 (-)
12	Battery (+) — +12V
13	J1939 (-)
14	J1587 (+)
15	Battery (+) — +12V
16	Not Used
17	SmartShift Lever Input A
18	Ground
19	SmartShift Lever Input B
20	Not Used
21	Ground

Table 5-85 AGS2 Connector

Programming Requirements and Flexibility

AGS2 transmissions have additional programming requirements on non-multiplexed vehicles as listed in Table 5-86.

Parameter Group	Parameter	Setting
2	Transmission Type	DIRECT ENGINE START 2 – AGS2 Direct Start MCM ENGINE START 5 – AGS2 MCM Start
35	3 09 DO Selection	2 – AGS2 Backup Lamp
35	3 10 DO Selection	2 – AGS2 Trans Temp Indicator Lamp
35	3 12 DO Selection	2 – AGS2 Check Trans Lamp
35	3 17 DO Selection	0 – Disabled
MCM	Starter Type Control	1 – Starter Activated via MCM
1	Transmit EBC1 for AGS2	2 = No EBC1, AGS2 Specific PTO Message (J1939 ABS) 3 = Transmit EBC1 and AGS2 Specific PTO Message (Non-J1939 ABS)
13	3 18 DI Selection	0 = Disable (J1939 ABS) 1 = Enable ABS Input (Non-J1939 ABS)
15	Enable Cruise Auto Resume	1 = Enable automatic resume function after clutch has been released once.
22	0 Speed Gov TSC1 Condition	16 = MBE
22	1 Speed Gov TSC1 Condition	16 = MBE
22	2 Speed Gov TSC1 Condition	16 = MBE
22	3 Speed Gov TSC1 Condition	16 = MBE

Table 5-86 AGS2 Transmission Programming Requirements for Non-Multiplexed Vehicles

AGS2 transmissions have additional programming requirements on multiplexed vehicles as listed in Table 5-87.

Parameter Group	Parameter	Setting
2	Transmission Type	DIRECT ENGINE START 2 – AGS2 Direct Start MCM ENGINE START 5 – AGS2 MCM Start
35	3 17 DO Selection	0 – Disabled
MCM	Starter Type Control	0 – Starter Activated via MCM*
1	Transmit EBC1 for AGS2	2 = No EBC1, AGS2 Specific PTO Message (J1939 ABS) 3 = Transmit EBC1 and AGS2 Specific PTO Message (Non-J1939 ABS)
13	3 18 DI Selection	0 = Disable (J1939 ABS) 1 = Enable ABS Input (Non-J1939 ABS)
15	Enable Cruise Auto Resume	1 = Enable automatic resume function after clutch has been released once.
22	0 Speed Gov TSC1 Condition	16 = MBE
22	1 Speed Gov TSC1 Condition	16 = MBE
22	2 Speed Gov TSC1 Condition	16 = MBE
22	3 Speed Gov TSC1 Condition	16 = MBE

* If starter type is not 0, then a different module must prevent the starter from engaging when the transmission is in gear.

Table 5-87 AGS2 Transmission Programming Requirements for Multiplexed Vehicles

5.27.3 EATON TOP2 OPERATION

The Top2 system automatically shifts between the top two gears of the Eaton Top2 Transmission to optimize drivetrain for best fuel economy or performance. Shifting between the two highest gears in the transmission is done by the CPC and requires no driver interaction. The system works with engine brakes and cruise control during automatic shifts. The torque demand from throttle or cruise control is smoothly ramped down before the shift and ramped up after the shift allowing the driver to maintain throttle position during shifts. Cruise Control is automatically resumed after the shift. When the transmission is shifted out of the two top gears, the driver has full manual control over the transmission. The engine will also detect skip shifts into the auto mode and still take control of the transmission's top two gears.

DDEC VI supports the Top2 RTLO-xx713A-T2 transmission.

NOTE:
This transmission is only available with a Series 60 engine.

Installation

See Figure 5-41 to install Top2.

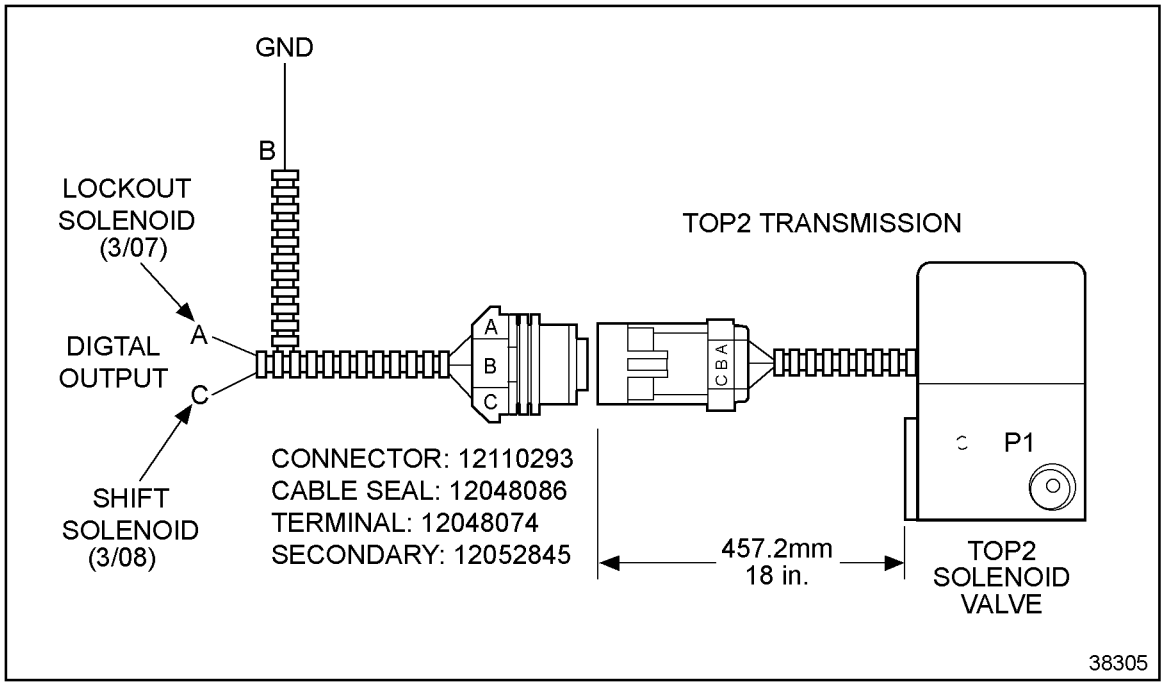

Figure 5-41 Top2 Transmission

Programming Requirements and Flexibility

The Top2 feature is enabled when the Top2 Shift Solenoid and the Top2 Lockout Solenoid digital outputs, listed in Table , 5-88 are configured as well as the transmission type. The digital outputs must be configured by the Vehicle Electronic Programming System (VEPS) or the DDEC Reprogramming System (DRS).

Parameter Group	Parameter	Setting
35	3 08 DO Selection	6 – Top2 Shift Solenoid
35	3 07 DO Selection	3 – Top2 Lockout Solenoid
35	3 07 Fault Detection	1 – Enable
35	3 08 Fault Detection	1 - Enable
2	Transmission Type	7 – Eaton Top2
42	TOP2 Cruise Control Sw Enable	0 – Disable (Top2 will work regardless of the state of the cruise master switch.) 1 – Enable (Top2 will work only if the cruise master switch is ON.)
13	Clutch Switch Config	1 – 1 Clutch Switch
13	4 08 DI Selection	1 – 1 Clutch Switch
8	Vehicle Speed Sensor	4 — Magnetic Pickup Speed Sensor

Table 5-88 Top2 Reprogramming Choices

Diagnostics

If a fault is detected on either the shift solenoid or shift lockout digital output, the CPC will leave the transmission in manual mode until the fault is repaired. When there is a fault in any of the following sensors, the driver will be left with manual control of the transmission and the CPC will turn ON the AWL.

- □ Vehicle Speed Sensor (VSS)
- □ Lockout and shift solenoid failures

When there is a fault in any of the following features, the driver will be left with manual control of the transmission. The AWL will be turned ON for these conditions.

- □ Failed splitter engagements
- □ Failed splitter disengagements
- □ Failed synchronizing attempts (possible in-gear)

5.27.4 EATON ULTRASHIFT TRANSMISSION

Programming Requirements and Flexibility

The parameters listed in Table 5-89 must be set for the Eaton UltraShift® transmission.

Parameter Group	Parameter	Setting
2	Transmission Type	DIRECT ENGINE START 2 – Eaton UltraShift Direct Start MCM ENGINE START 5 – Eaton UltraShift MCM Start
13	Clutch Switch Config	0 – Disabled
13	4 08 DI Selection	0 – Disabled
13	Trans Neutral Input Config	1 – Info from J1939
8	Vehicle Speed Sensor	3 – J1939 (ETC1)
3	Adjusted Idle Configuration	3 – Enabled if Neutral and Park Brake
3	Max Adjusted Idle Speed	<700 rpm
22	0 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
22	1 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
22	2 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
22	3 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
10	Eng Brk Stage 1 Off Delay Time	60 ms – Series 60 240 ms – MBE 900/4000
10	Eng Brk Stage 2 Off Delay Time	60 ms – Series 60 240 ms – MBE 900/4000
10	Eng Brk Stage 3 Off Delay Time	60 ms – Series 60 240 ms – MBE 900/4000
10	Stage 1 Eng Brk Off Delta Spd	250 rpm – Series 60 100 rpm – MBE 900/4000
10	Stage 2 Eng Brk Off Delta Spd	250 rpm – Series 60 100 rpm – MBE 900/4000
10	Stage 3 Eng Brk Off Delta Spd	250 rpm – Series 60 100 rpm – MBE 900/4000
10	Eng Brk Driveline Clsd Spd	Series 60 – 800 rpm MBE 900/4000 – 800 rpm
15	Enable Cruise Auto Resume	1– Enable automatic resume function after clutch has been released once
10	Min Eng Spd for Engine Brakes	1100 rpm
23	AL Conditions	1 — No AL During Shift
6	Fast Idle Spd Air Cond Input	<700 rpm

Table 5-89 Eaton UltraShift Transmission Parameters

5.27.5 EATON ULTRASHIFT ASW TRANSMISSION

Programming Requirements and Flexibility

The parameters listed in Table 5-90 must be set for the Eaton UltraShift® ASW transmission.

Parameter Group	Parameter	Setting
2	Transmission Type	DIRECT ENGINE START 2 – Eaton UltraShift Direct Start MCM ENGINE START 6 – Eaton UltraShift MCM Start
13	Clutch Switch Config	0 – Disabled
13	4 08 DI Selection	0 – Disabled
13	Trans Neutral Input Config	1 – Info from J1939
8	Vehicle Speed Sensor	3 – J1939 (ETC1)
3	Adjusted Idle Configuration	3 – Enabled if Neutral and Park Brake
3	Max Adjusted Idle Speed	<700 rpm
22	0 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
22	1 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
22	2 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
22	3 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
10	Eng Brk Stage 1 Off Delay Time	60 ms – Series 60 240 ms – MBE 900/4000
10	Eng Brk Stage 2 Off Delay Time	60 ms – Series 60 240 ms – MBE 900/4000
10	Eng Brk Stage 3 Off Delay Time	60 ms – Series 60 240 ms – MBE 900/4000
10	Stage 1 Eng Brk Off Delta Spd	250 rpm – Series 60 100 rpm – MBE 900/4000
10	Stage 2 Eng Brk Off Delta Spd	250 rpm – Series 60 100 rpm – MBE 900/4000
10	Stage 3 Eng Brk Off Delta Spd	250 rpm – Series 60 100 rpm – MBE 900/4000
10	Eng Brk Driveline Clsd Spd	Series 60 – 800 rpm MBE 900/4000 – 800 rpm
10	Min Eng Spd for Engine Brakes	1100 rpm
23	AL Conditions	1 — No AL During Shift
6	Fast Idle Spd Air Cond Input	<700 rpm

Table 5-90 Eaton UltraShift ASW Transmission Parameters

5.27.6 EATON AUTOSHIFT TRANSMISSION

Programming Requirements and Flexibility

The parameters listed in Table 5-91 must be set for the Eaton AutoShift® transmission

Parameter Group	Parameter	Setting
2	Transmission Type	DIRECT ENGINE START 2 – Eaton AutoShift Direct Start MCM ENGINE START 5 – Eaton AutoShift MCM Start
13	Clutch Switch Config	1 – 1 Clutch Switch
13	4 08 DI Selection	1 – 1 Clutch Switch
13	Trans Neutral Input Config	1 – Info from J1939
8	Vehicle Speed Sensor	3 – J1939 (ETC1)
3	Max Adjusted Idle Speed	<700 rpm
3	Adjusted Idle Speed Configuration	3 – Enable if Neutral and Park Brake
22	0 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
22	1 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
22	2 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
22	3 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
10	Eng Brk Stage 1 Off Delay Time	60 ms – Series 60 240 ms – MBE 900/4000
10	Eng Brk Stage 2 Off Delay Time	60 ms – Series 60 240 ms – MBE 900/4000
10	Eng Brk Stage 3 Off Delay Time	60 ms – Series 60 240 ms – MBE 900/4000
10	Stage 1 Eng Brk Off Delta Spd	150 rpm – Series 60 100 rpm – MBE 900/4000
10	Stage 2 Eng Brk Off Delta Spd	150 rpm – Series 60 100 rpm – MBE 900/4000
10	Stage 3 Eng Brk Off Delta Spd	150 rpm – Series 60 100 rpm – MBE 900/4000
10	Eng Brk Driveline Clsd Spd	Series 60 – 800 rpm MBE 900/4000 – 800 rpm
10	Min Eng Spd for Engine Brakes	1100 rpm
23	AL Conditions	1 — No AL During Shift
6	Fast Idle Spd Air Cond Input	<700 rpm

Table 5-91 Eaton AutoShift Transmission Parameters

5.27.7 ZF ASTRONIC TRANSMISSION

Programming Requirements and Flexibility

The parameters listed in Table 5-92 must be set for the ZF Astronic transmission.

Parameter Group	Parameter	Setting
2	Transmission Type	DIRECT ENGINE START 2 – ZF Astronic Direct Start MCM ENGINE START 5 – ZF Astronic MCM Start
13	Clutch Switch Config	6 – ETC1
13	4 08 DI Selection	0 – Disabled
13	Trans Neutral Input Config	1 – Info from J1939
8	Vehicle Speed Sensor	3 – J1939 (ETC1)
3	Adjusted Idle Configuration	3 – Enabled if Neutral and Park Brake
3	Max Adjusted Idle Speed	<700 rpm
22	0 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
22	1 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
22	2 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
22	3 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
10	Eng Brk Stage 1 Off Delay Time	60 ms – Series 60 240 ms – MBE 900/4000
10	Eng Brk Stage 2 Off Delay Time	60 ms – Series 60 240 ms – MBE 900/4000
10	Eng Brk Stage 3 Off Delay Time	60 ms – Series 60 240 ms – MBE 900/4000
10	Stage 1 Eng Brk Off Delta Spd	200 rpm – Series 60 100 rpm – MBE 900/4000
10	Stage 2 Eng Brk Off Delta Spd	200 rpm – Series 60 100 rpm – MBE 900/4000
10	Stage 3 Eng Brk Off Delta Spd	200 rpm – Series 60 100 rpm – MBE 900/4000
10	Eng Brk Driveline Clsd Spd	Series 60 – 800 rpm MBE 900/4000 – 800 rpm
10	Min Eng Spd for Engine Brakes	1100 rpm
23	AL Conditions	1 — No AL During Shift

Table 5-92 ZF Astronic Transmission Parameters

5.27.8 ALLISON TRANSMISSION

Low Range Torque Protection (LRTP) is an Allison feature supported by DDEC VI. If enabled, the CPC expects the TCFG2 J1939 message. A fault will be logged if the message is not received.

Programming Requirements and Flexibility

The parameters listed in Table 5-93 must be set for the Allison transmission

Parameter Group	Parameter	Setting
2	Transmission Type	DIRECT ENGINE START 2 – Allison Direct Start MCM ENGINE START 6 – Allison MCM Start
13	Clutch Switch Config	0 – Disabled
13	4 08 DI Selection	0 – Disabled
13	Trans Neutral Input Config	1 – Info from J1939
8	Vehicle Speed Sensor	3 – J1939 (ETC1)
3	Max Adjusted idle Speed	<800 rpm
3	Trans Torque Limit Enable	0 – Disabled (non-SEM) 1 – Enable (SEM)
3	Adjusted Idle Speed Configuration	3 – Enable if Neutral and Park Brake
22	0 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
22	1 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
22	2 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
22	3 Speed Gov TSC1 Condition	0 – Series 60 16 – MBE 900/4000
10	Eng Brk Stage 1 Off Delay Time	60 ms – Series 60 240 ms – MBE 900/4000
10	Eng Brk Stage 2 Off Delay Time	60 ms – Series 60 240 ms – MBE 900/4000
10	Eng Brk Stage 3 Off Delay Time	60 ms – Series 60 240 ms – MBE 900/4000
10	Stage 1 Eng Brk Off Delta Spd	200 rpm – Series 60 100 rpm – MBE 900/4000
10	Stage 2 Eng Brk Off Delta Spd	200 rpm – Series 60 100 rpm – MBE 900/4000
10	Stage 3 Eng Brk Off Delta Spd	200 rpm – Series 60 100 rpm – MBE 900/4000
10	Eng Brk Driveline Clsd Spd	Series 60 – 950 rpm MBE 900/4000 – 950 rpm
10	Min Eng Spd for Engine Brakes	1100 rpm
23	AL Conditions	1 — No AL During Shift
6	Fast Idle Spd Air Cond Input	<800 rpm

Table 5-93 Allison Transmission Parameters

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5.28 VEHICLE SPEED LIMITING

A Vehicle Speed Sensor is necessary for the Vehicle Speed Limiting feature.

5.28.1 OPERATION

Vehicle Speed Limiting discontinues engine fueling at any vehicle speed above the programmed limit. The CPC stops fueling when maximum vehicle speed is reached. If the Limiter 0 Switch is OFF, the Maximum Road Speed Limit will be the limit for the road speed. If the Limiter 0 Switch is ON, the Alternate Speed Limiter (Limiter 0) Speed will be the limit for the road speed. Setting any of the limits to the maximum value will disable that road speed limit.

5.28.2 INSTALLATION

An OEM supplied Vehicle Speed Sensor or output shaft speed over the SAE J1939 Data Link is required. Refer to section 3.6.6, "Vehicle Speed Sensor," for additional information. If the Limiter 0 switch is required, it is wired to CPC pin 1/11. This is a normally open switch.

5.28.3 PROGRAMMING REQUIREMENTS AND FLEXIBILITY

The Vehicle Speed Limit parameters are listed in Table 5-94.

Parameter Group	Parameter	Description	Options	Default	Access
3	Max Road Speed	Maximum vehicle speed. Alternate Road Speed Limiter 0 cannot exceed this speed.	10 – 152 km/hr	152 km/hr	VEPS, DRS or DDDL 7.0
5	Limiter0 Max Road Spd Enabled	Maximum vehicle speed when CPC pin 1/11 is connected to ground.	0 – 152 km/hr	152 km/hr	VEPS, DRS or DDDL 7.0
5	Limiter1 Max Road Spd Enabled	Maximum vehicle speed when CPC pin 2/11 is connected to ground.	0 – 152 km/hr	152 km/hr	VEPS, DRS or DDDL 7.0

Table 5-94 Vehicle Speed Limiting Parameters

For more information on limiters, refer to section 5.17, “Limiters.”

5.28.4 INTERACTION WITH OTHER FEATURES

The Cruise Control maximum set speed cannot exceed the Vehicle Speed Limit.

When Vehicle Speed Limiting is enabled and a VSS code is logged, the engine speed in all gears will be limited for the duration of the ignition cycle to engine speed at the Vehicle Speed Limit in top gear.

NOTE:
Due to VSS signal quality at low speeds, it is recommended that the vehicle speed limit not be set below a minimum of 48 kph to insure smooth road speed limiting. DDC cannot guarantee smooth speed limiting for maximum speeds set below 48 kph.

5.29 VEHICLE SPEED SENSOR ANTI-TAMPERING

VSS Anti-tampering can be used to detect fixed frequency oscillators or devices which track engine RPM and produce fewer pulses per revolution than a VSS wheel. These devices are used to trick the CPC into believing that vehicle speed is low.

A VSS fault will be logged if the sensor appears to be working improperly but the vehicle speed is not zero. The engine speed in all gears will be limited for the duration of the ignition cycle to the engine speed at the Vehicle Speed Limit in top gear.

This feature should only be enabled on installations with manual transmissions where a Vehicle Speed Sensor is wired directly to the CPC.

NOTE:
Do Not use VSS anti-tampering with SAE J1939, automatic, semi-automatic, or torque converter transmissions.

5.29.1 PROGRAMMING FLEXIBILITY

Vehicle Speed Limiting must also be enabled. The parameters are listed in Table 5-95.

Parameter Group	Parameter	Range	Default	Access
8	Anti Tamper	0 = Disable 1 = Enable Anti Tamper Function via ABS 2 = Enable Anti Tamper Function via Gear Ratio	0	DDDL 7.0, VEPS, DRS
8	Vehicle Speed Sensor	0 = No Sensor 1 = C3 Sensor 2 = Square Wave (Hall Sensor) 3 = J1939 (ETC1) 4 = Magnetic Pickup 5 = J1939 (TCO1) 6 = J1939 (CCVS) Source 1 87 = J1939 (CCVS) Source 2 8 = J1939 (CCVS) Source 3	4	DDDL 7.0, DRS, VEPS
8	Axle Ratio	1.00 - 20.00	5.29	DDDL 7.0, DRS, VEPS
8	Number of Output Shaft Teeth	0 - 250	16	DDDL 7.0, VEPS, DRS
8	Tire Revolutions per Distance	160 - 1599	312	DDDL 7.0, VEPS, DRS
8	Top Gear Ratio	0.1 - 2.55	1	DDDL 7.0, VEPS, DRS
8	Second Highest Gear Ratio	0.1 - 2.55	2.55	DDDL 7.0, DRS, VEPS

Table 5-95 VSS Anti-tampering Parameters

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