Application and Installation

DDEC® VI

DETROIT DIESEL ®

ATTENTION

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DDEC VI APPLICATION AND INSTALLATION

ABSTRACT

DDEC VI offers engine controls and an extensive range of engine and vehicle options.

The detail provided will facilitate the following:

☐ The selection of features and settings, based on individual applications

☐ The fabrication and installation of a vehicle interface harness, based on individual applications

☐ The communication of messages & data between sensors and various electronic control modules within the installation

☐ The use of industry standard tools to obtain engine data and diagnostic information, as well as to reprogram key parameters

The manual is arranged as follows:

☐ The initial portion covers the installation, beginning with an overview and safety precautions, followed by hardware and wiring requirements, inputs and outputs, and available features.

☐ The second portion covers communication protocol.

☐ The third portion covers the tools capable of obtaining engine data and diagnostic information from the MCM and the CPC, as well as reprogramming of its key parameters.

☐ The final portion, the appendix, summarizes detailed information on codes and kit availability.

This manual does not cover the installation of the engine itself into various applications. For this, the reader should refer to the specific engine application and installation manual.

This manual is intended for those with an electrical background. A simple installation may require a basic understanding of electrical circuits while a more comprehensive electrical/electronics background is required to access all the capability of the DDEC VI.

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1   INTRODUCTION

DDEC VI is a system that monitors and determines all values required for the operation of the engine. A diagnostic interface is provided to connect to an external diagnosis tester.

Besides the engine related sensors and the engine-resident control unit, the Motor Control Module (MCM), this system has a cab-mounted control unit for vehicle engine management, the Common Powertrain Controller (CPC). The connection to the vehicle is made via a CAN interface which digitally transmits the nominal values (e.g. torque, engine speed specification, etc.) and the actual values (e.g. engine speed, oil pressure, etc.).

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2 SAFETY PRECAUTIONS

The following safety measures are essential when installing DDEC VI in a vehicle equipped with a Detroit Diesel engine.

⚠ WARNING:

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

☐ **Always start and operate an engine in a well ventilated area.**

☐ **If operating an engine in an enclosed area, vent the exhaust to the outside.**

☐ **Do not modify or tamper with the exhaust system or emission control system.**

2.1 STANDS

Use safety stands in conjunction with hydraulic jacks or hoists. Do not rely on either the jack or the hoist to carry the load.

2.2 GLASSES

Select appropriate safety glasses for the job. Safety glasses *must* be worn when using tools such as hammers, chisels, pullers and punches.

2.3   WELDING

Consider the consequences of welding.

NOTICE:
When welding, the following must be done to avoid damage to the electronic controls or the engine: □ Both the positive (+) and negative (-) battery leads must be disconnected before welding. □ Ground cable must be in close proximity to welding location - engine must never be used as a grounding point. □ Welding on the engine or engine mounted components is NEVER recommended.

Wear welding goggles and gloves when welding or using an acetylene torch.

⚠ WARNING:
FIRE
To avoid injury from fire, check for fuel or oil leaks before welding or carrying an open flame near the engine.

Insure that a metal shield separates the acetylene and oxygen which must be chained to a cart.

2.4   WORK PLACE

Organize your work area and keep it clean.

⚠ WARNING:
PERSONAL INJURY
To avoid injury from slipping and falling, immediately clean up any spilled liquids.

Eliminate the possibility of a fall by:

□ Wiping up oil spills

□ Keeping tools and parts off the floor

A fall could result in a serious injury.

After installation of the engine is complete:

> ⚠ **WARNING:**
>
> **PERSONAL INJURY**
>
> **To avoid injury from rotating belts and fans, do not remove and discard safety guards.**

☐ Reinstall all safety devices, guards or shields

☐ Check to be sure that all tools and equipment used to install the engine are removed from the engine

2.5 CLOTHING

Wear work clothing that fits and is in good repair. Work shoes must be sturdy and rough-soled. Bare feet, sandals or sneakers are not acceptable foot wear when installing an engine.

> ⚠ **WARNING:**
>
> **PERSONAL INJURY**
>
> **To avoid injury when working near or on an operating engine, remove loose items of clothing and jewelry. Tie back or contain long hair that could be caught in any moving part causing injury.**

2.6 ELECTRIC TOOLS

Improper use of electrical equipment can cause severe injury.

> ⚠ **WARNING:**
>
> **ELECTRICAL SHOCK**
>
> **To avoid injury from electrical shock, follow OEM furnished operating instructions prior to usage.**

Check power tools before using.

2.7   AIR

Use proper shielding to protect everyone in the work area.

⚠ **WARNING:**
EYE INJURY
To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 276 kPa (40 psi) air pressure.

2.8   DIAGNOSTIC TOOLS

For mobile applications, the vehicle operator must maintain control of the vehicle while an assistant performs the diagnostic evaluations using a diagnostic tool.

⚠ **WARNING:**
PERSONAL INJURY
To avoid injury from loss of vehicle/vessel control, the operator of a DDEC equipped engine must not use or read any diagnostic tool while the vehicle/vessel is moving.

2.9   FLUIDS AND PRESSURE

Fluids under pressure can have enough force to penetrate the skin.

⚠ **WARNING:**
PERSONAL INJURY
To avoid injury from penetrating fluids, do not put your hands in front of fluid under pressure. Fluids under pressure can penetrate skin and clothing.

⚠ **WARNING:**
HOT COOLANT
To avoid scalding from the expulsion of hot coolant, never remove the cooling system pressure cap while the engine is at operating temperature. Wear adequate protective clothing (face shield, rubber gloves, apron, and boots). Remove the cap slowly to relieve pressure.

These fluids can infect a minor cut or opening in the skin. See a doctor at once, if injured by escaping fluid. Serious infection or reaction can result without immediate medical treatment.

2.10   BATTERIES

Electrical storage batteries give off highly flammable hydrogen gas when charging and continue to do so for some time after receiving a steady charge.

⚠ **WARNING:**
Battery Explosion and Acid Burn
To avoid injury from battery explosion or contact with battery acid, work in a well ventilated area, wear protective clothing, and avoid sparks or flames near the battery. If you come in contact with battery acid: □ **Flush your skin with water.** □ **Apply baking soda or lime to help neutralize the acid.** □ **Flush your eyes with water.** □ **Get medical attention immediately.**

Always disconnect the battery cable before working on the Detroit Diesel Electronic Controls system.

2.11   FIRE

Keep a charged fire extinguisher within reach. Be sure you have the correct type of extinguisher for the situation. The correct fire extinguisher types for specific working environments are listed in Table 2-1.

Fire Extinguisher	Work Environment
Type A	Wood, Paper, Textile and Rubbish
Type B	Flammable Liquids
Type C	Electrical Equipment

Table 2-1   The Correct Type of Fire Extinguisher

2.12   PAINT

Mask off the MCM prior to applying any paint.

NOTICE:
Do not apply paint to the MCM. The application of paint may affect the performance of the MCM.

2.13   FLUOROELASTOMER

Fluoroelastomer (Viton®) parts such as O-rings and seals are perfectly safe to handle under normal design conditions.

⚠ **WARNING:**
CHEMICAL BURNS
To avoid injury from chemical burns, wear a face shield and neoprene or PVC gloves when handling fluoroelastomer O-rings or seals that have been degraded by excessive heat. Discard gloves after handling degraded fluoroelastomer parts.

A potential hazard may occur if these components are raised to a temperature above 600°F (316°C) (in a fire for example). Fluoroelastomer will decompose (indicated by charring or the appearance of a black, sticky mass) and produce hydrofluoric acid. This acid is extremely corrosive and, if touched by bare skin, may cause severe burns (the symptoms could be delayed for several hours).

3 HARDWARE AND WIRING

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3.1   MOTOR CONTROL MODULE

The engine mounted Motor Control Module (MCM) includes control logic to provide overall engine management. See Figure 3-1.
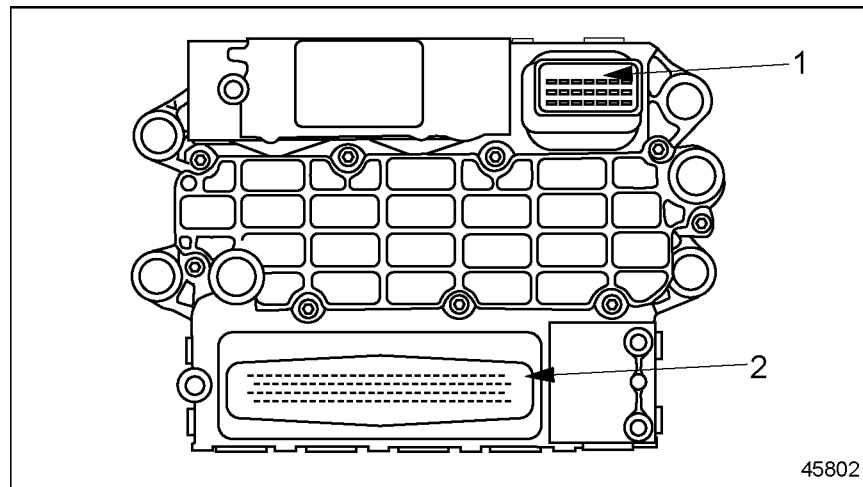
| 1. 21–pin Connector (OEM Responsibility) | 2. 120–pin Connector (Detroit Diesel Responsibility) |

Figure 3-1   Motor Control Module

NOTE:
Do NOT ground the MCM housing. This can result in false codes being logged.

3.1.1   ENGINE HARNESS

The MCM has a 120–pin connector Engine Harness which is factory installed. It also has a 21–pin connector and 31–pin connector which are the responsibility of the OEM.

MCM 120–pin Connector for Series 60 Engines

The pinouts for the 120–pin connector for the Series 60 engine are listed in Table 3-1, Table 3-2, Table 3-3, and Table 3-4.
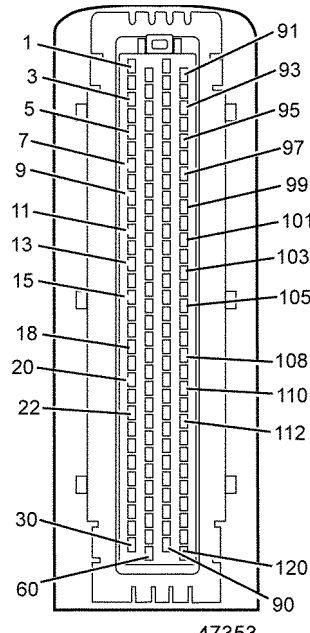
Pin	Signal Type	Function	Connector
1	RPU_H	NC	
2	RPU_L	NC	
3	PV_IM1	NC	
4	MV_B5F	Spill Control Valve (cyl 4) - pin 4	
5	MV_B5	Spill Control Valve Common - pin 3	
6	MV_B5D	Spill Control Valve (cyl 6) - pin 4	
7	MV_B5	Spill Control Valve Common - pin 3	
8	MV_B5B	Spill Control Valve (cyl 5) - pin 4	
9	MV_B5	Spill Control Valve Common - pin 3	
10	MV_B4E	Spill Control Valve (cyl 2) - pin 4	
11	MV_B4	Spill Control Valve Common - pin 3	
12	MV_B4C	Spill Control Valve (cyl 3) - pin 4	
13	MV_B4	NC	
14	MV_B4A	Spill Control Valve (cyl 1) - pin 4	
15	MV_B4	NC	
16	MV_B2F	Needle Control Valve (cyl 4) - pin 2	
17	MV_B2	Needle Control Valve Common - pin 1	
18	MV_B2D	Needle Control Valve (cyl 6) - pin 2	
19	MV_B2	Needle Control Valve Common - pin 1	
20	MV_B2B	Needle Control Valve (cyl 5) - pin 2	
21	MV_B2	Needle Control Valve Common - pin 1	
22	MV_B1E	Needle Control Valve (cyl 2) - pin 2	
23	MV_B1	Needle Control Valve Common (cyl 1,2,3) - pin 1	
24	MV_B1C	Needle Control Valve (cyl 3) - pin 2	
25	MV_B1	NC	
26	MV_B1A	Needle Control Valve (cyl 1) - pin 2	
27	MV_B1	NC	
28	START_B	NC	
29	A16	DOC Outlet Temp Sensor	
30	A01	DPF Outlet Pressure Sensor	

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Table 3-1   MCM Connector – Series 60 (1 of 4)
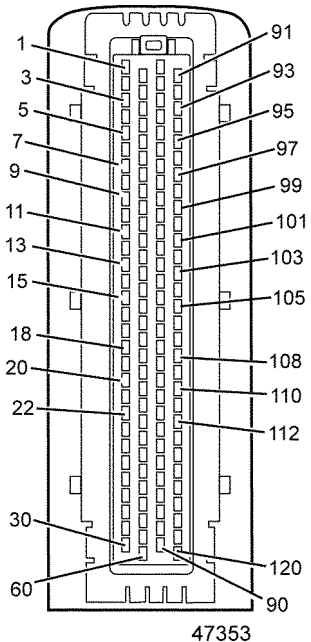
Pin	Signal Type	Function	Connector
31	PWM_5	NC	
32	PWM_7	Jake 1	
33	PWM_6	Two-speed Fan or Variable Speed Fan	
34	PWM_8	NC	
35	PWM_10	NC	
36	PWM_9	NC	
37	PWM_11	NC	
38	PV_M	Ground	
39	HSW2	NC	
40	SW_1	NC	
41	HSW1	NC	
42	DYN3_N	CKP/TRS (-)	
43	DYN3	CKP/TRS (+)	
44	DYN2_N	CMP/SRS (-)	
45	DYN2	CMP/SRS (+)	
46	D3_V	NC	
47	DYN4	Fan Speed	
48	DYM_2M	NC	
49	DYN5_S	NC	
50	SGND_TL	Sensor Ground	
51	DYN1	Turbo Speed Sensor	
52	SGND_P	Sensor Ground	
53	A23	NC	
54	A09	Engine Oil Pressure Sensor	
55	SGND_P	Sensor Ground	
56	A20	NC	
57	A05	NC	
58	SENS1_V	Sensor Power Supply	
59	A17	NC	
60	A02	EGR Valve Position	

Table 3-2   MCM Connector – Series 60 (2 of 4)
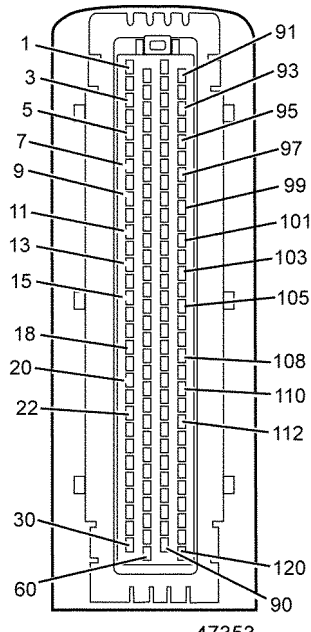
Pin	Signal Type	Function	Connector
61	PWM_1	EGR Valve	
62	PV_B2	Power Supply	
63	PWM_2	NC	
64	PV_B2	Power Supply	
65	PWM_12	Doser	
66	PWM_13	Jake 2	
67	PV_M	Ground	
68	SW_2	NC	
69	SW_8	Fuel Cutoff Valve	
70	SW_6	Ether Start	
71	LIN_V	NC	
72	LIN	NC	
73	DYN_3M	NC	
74	CAN3L	VNT CAN (-)	
75	CAN3H	VNT CAN (+)	
76	D3_S	NC	
77	A29	Supply Fuel Temperature Sensor	
78	A15	NC	
79	D1	NC	
80	A27	NC	
81	A13	NC	
82	SENS2_V	Sensor Supply	
83	A24	EGR Temperature Sensor	
84	A10	Fuel Compensation Pressure Sensor	
85	SENS2_V	Sensor Supply	
86	A21	Turbo Compressor In Temp	
87	A06	Intake Manifold Pressure Sensor	
88	SGND_P	Sensor Ground	
89	A18	DOC Inlet Temp Sensor	
90	A03	Intake Air Throttle Valve	

Table 3-3   MCM Connector – Series 60 (3 of 4)
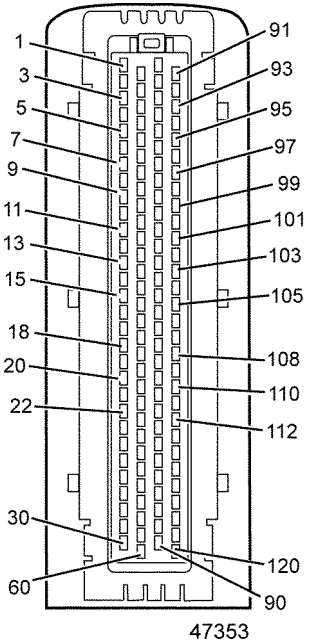
Pin	Signal Type	Function	Connector
91	PV_B1	Power Supply	
92	PWM_3	NC	
93	PV_B1	Power Supply	
94	PWM_4	NC	
95	PV_M	NC	
96	SW_4	NC	
97	SW_5	NC	
98	SW_3	Single-speed Fan or Two-speed Fan	
99	SW_7	NC	
100	H_Out1	Intake Air Throttle (+)	
101	H_Out2	Intake Air Throttle (-)	
102	SGND	Sensor Ground	
103	SGND	Sensor Ground	
104	SGND	Sensor Ground	
105	SGND	Sensor Ground	
106	A30	Intake Air Temperature Sensor	
107	D2	NC	
108	A28	Engine Oil Temperature Sensor	
109	A14	EGR Delta Pressure Sensor	
110	A26	Engine Coolant Temp Sensor	
111	A12	Fuel Line Pressure Sensor	
112	A25	Turbo Compressor Out Temp	
113	A11	NC	
114	SGND_S2	Sensor Ground	
115	A22	DPF Outlet Temp Sensor	
116	A08	NC	
117	SENS1_V	Sensor Power Supply	
118	A07	DPF Inlet Pressure Sensor	
119	A19	NC	
120	A04	NC	

Table 3-4   MCM Connector – Series 60 (4 of 4)

MCM 120–pin Connector for MBE 900 Engines

The pinouts for the 120–pin connector for the MBE 900 engine are listed in Table 3-5, Table 3-6, Table 3-7, and listed in Table 3-8.
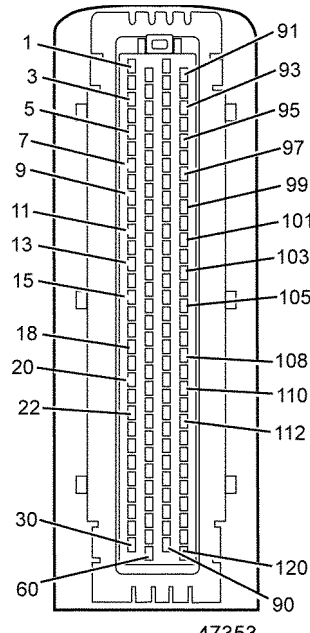
Pin	Signal Type	Function	Connector
1	RPU_H	NC	
2	RPU_L	NC	
3	PV_IM1	NC	
4	MV_B5F	Electronic Unit Pump (cyl 4) – pin 1	
5	MV_B5	Electronic Unit Pump Common (cyl 4) – pin 2	
6	MV_B5D	Electronic Unit Pump(cyl 6) – pin 1	
7	MV_B5	Electronic Unit Pump Common (cyl 6) – pin 2	
8	MV_B5B	Electronic Unit Pump (cyl 5) – pin 1	
9	MV_B5	Electronic Unit Pump Common (cyl 5) – pin 2	
10	MV_B4E	Electronic Unit Pump (cyl 2) – pin 1	
11	MV_B4	Electronic Unit Pump Common (cyl 2) – pin 2	
12	MV_B4C	Electronic Unit Pump (cyl 3) – pin 1	
13	MV_B4	Electronic Unit Pump Common (cyl 3) – pin 2	
14	MV_B4A	Electronic Unit Pump (cyl 1) – pin 1	
15	MV_B4	Electronic Unit Pump Common (cyl 1) – pin 2	
16	MV_B2F	Injector (cyl 4) – pin 1	
17	MV_B2	Injector Common (cyl 4) – pin 2	
18	MV_B2D	Injector (cyl 6) – pin 1	
19	MV_B2	Injector Common (cyl 6) – pin 2	
20	MV_B2B	Injector (cyl 5) – pin 1	
21	MV_B2	Injector Common (cyl 5) – pin 2	
22	MV_B1E	Injector (cyl 2) – pin 1	
23	MV_B1	Injector Common (cyl 2) –– pin 2	
24	MV_B1C	Injector (cyl 3) – pin 1	
25	MV_B1	Injector Common (cyl 3) – pin 2	
26	MV_B1A	Injector (cyl 1) – pin 1	
27	MV_B1	Injector Common (cyl 1) – pin 2	
28	START_B	NC	
29	A16	DOC Outlet Temp Sensor	
30	A01	DPF Outlet Pressure Sensor	

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Table 3-5   MCM Connector – MBE 900 (1 of 4) – C Sample
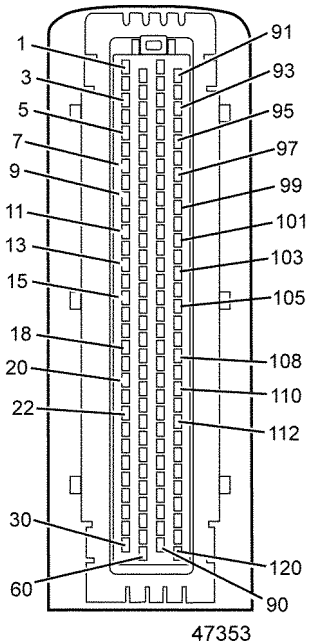
Pin	Signal Type	Function	Connector
31	PWM_5	NC	
32	PWM_7	Constant Throttle Valve	
33	PWM_6	Two-speed Fan or Variable Speed Fan	
34	PWM_8	NC	
35	PWM_10	NC	
36	PWM_9	NC	
37	PWM_11	NC	
38	PV_M	Ground	
39	HSW2	Electrostatic Oil Separator	
40	SW_1	NC	
41	HSW1	Grid Heater	
42	DYN3_N	NC	
43	DYN3	CKP (+)	
44	DYN2_N	NC	
45	DYN2	CMP (+)	
46	D3_V	NC	
47	DYN4	Fan Speed	
48	DYM2_M	CMP (-)	
49	DYN5_S	NC	
50	SGND_TL	Sensor Ground	
51	DYN1	Turbo Speed Sensor	
52	SGND_P	Sensor Ground	
53	A23	NC	
54	A09	Engine Oil Pressure Sensor	
55	SGND_P	Sensor Ground	
56	A20	NC	
57	A05	Water-in- Fuel Sensor	
58	SENS1_V	Sensor Power Supply	
59	A17	NC	
60	A02	EGR Throttle Position	

Table 3-6   MCM Connector – MBE 900 (2 of 4) – C Sample
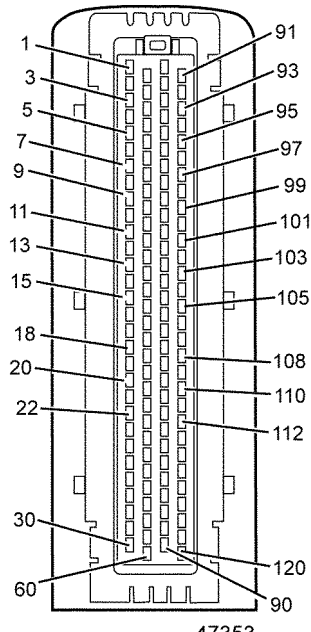
Pin	Signal Type	Function	Connector
61	PWM_1	EGR Valve	
62	PV_B2	Power Supply	
63	PWM_2	NC	
64	PV_B2	Power Supply	
65	PWM_12	Doser	
66	PWM_13	NC	
67	PV_M	Ground	
68	SW_2	NC	
69	SW_8	Fuel Cutoff Valve	
70	SW_6	NC	
71	LIN_V	NC	
72	LIN	NC	
73	DYN3_M	CKP (-)	
74	CAN3L	Wastegate CAN (-)	
75	CAN3H	Wastegate CAN (+)	
76	D3_S	NC	
77	A29	Supply Fuel Temperature Sensor	
78	A15	NC	
79	D1	Grid Heater	
80	A27	NC	
81	A13	NC	
82	SENS2_V	Sensor Power Supply	
83	A24	NC	
84	A10	Fuel Compensation Pressure Sensor	
85	SENS2_V	Sensor Power Supply	
86	A21	Turbo Pressure/Temp Sensor	
87	A06	Intake Manifold Pressure Sensor	
88	SGND_P	Sensor Ground	
89	A18	DOC Inlet Temp Sensor	
90	A03	Intake Air Throttle Position	

Table 3-7   MCM Connector – MBE 900 (3 of 4) – C Sample
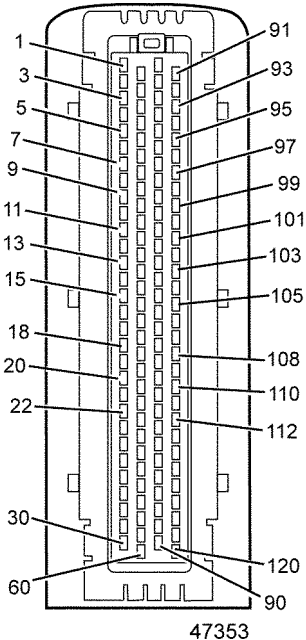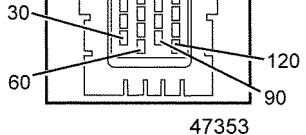
Pin	Signal Type	Function	Connector
91	PV_B1	Power Supply	
92	PWM_3	High Tech Grid Heater	
93	PV_B1	Power Supply	
94	PWM_4	NC	
95	PV_M	Ground	
96	SW_4	Exhaust Brake	
97	SW_5	NC	
98	SW_3	Single-speed or Two-speed Fan	
99	SW_7	NC	
100	H_OUT1	Intake Air Throttle 5kHz (+)	
101	H_OUT2	Intake Air Throttle 5kHz (-)	
102	SGND	NC	
103	SGND	Sensor Ground	
104	SGND	Sensor Ground	
105	SGND	Sensor Ground	
106	A30	Intake Manifold Pressure Sensor	
107	D2	Diagnostic Electrostatic Oil Separator	
108	A28	Engine Oil Temperature Sensor	
109	A14	EGR Delta Pressure Sensor	
110	A26	Engine Coolant Temp Sensor	
111	A12	Fuel Line Pressure Sensor	
112	A25	Intake Air Temperature Sensor	
113	A11	NC	
114	SGND_S2	Sensor Ground	
115	A22	DPF Outlet Temp Sensor	
116	A08	NC	
117	SENS1_V	Sensor Power Supply	
118	A07	DPF Inlet Pressure Sensor	
119	A19	NC	
120	A04	Turbo Compressor Temperature Sensor	

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Table 3-8   MCM Connector – MBE 900 (4 of 4) – C Sample

MCM 120–pin Connector for MBE 4000 Engines

The pinouts for the 120–pin connector for the MBE 4000 engine are listed in Table 3-9, Table 3-10, Table 3-11, and Table 3-12.
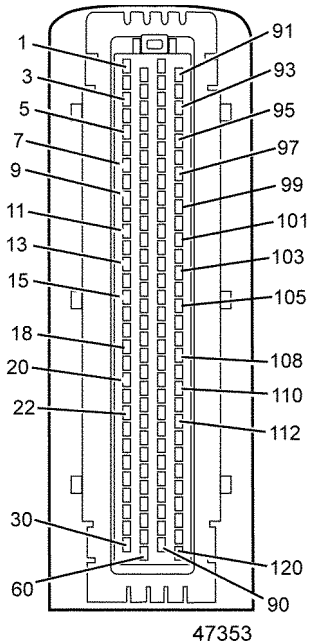
Pin	Signal Type	Function	Connector
1	RPU_H	NC	
2	RPU_L	NC	
3	PV_IM1	NC	
4	MV_B5F	Electronic Unit Pump (cyl 4) – pin 2	
5	MV_B5	Electronic Unit Pump Common (cyl 4) – pin 1	
6	MV_B5D	Electronic Unit Pump (cyl 6) – pin 2	
7	MV_B5	Electronic Unit Pump Common (cyl 6) – pin 1	
8	MV_B5B	Electronic Unit Pump (cyl 5) – pin 2	
9	MV_B5	Electronic Unit Pump Common (cyl 5) – pin 1	
10	MV_B4E	Electronic Unit Pump (cyl 2) – pin 2	
11	MV_B4	Electronic Unit Pump Common (cyl 2) – pin 1	
12	MV_B4C	Electronic Unit Pump (cyl 3) – pin 2	
13	MV_B4	Electronic Unit Pump Common (cyl 3) – pin 1	
14	MV_B4A	Electronic Unit Pump (cyl 1) – pin 2	
15	MV_B4	Electronic Unit Pump Common (cyl 1) – pin 1	
16	MV_B2F	Injector (cyl 4) – pin 2	
17	MV_B2	Injector Common (cyl 4) – pin 1	
18	MV_B2D	Injector (cyl 6) – pin 2	
19	MV_B2	Injector Common (cyl 6) – pin 1	
20	MV_B2B	Injector (cyl 5) – pin 2	
21	MV_B2	Injector Common (cyl 5) – pin 1	
22	MV_B1E	Injector (cyl 2) – pin 2	
23	MV_B1	Injector Common (cyl 2) – pin 1	
24	MV_B1C	Injector (cyl 3) – pin 2	
25	MV_B1	Injector Common (cyl 3) – pin 1	
26	MV_B1A	Injector (cyl 1) – pin 2	
27	MV_B1	Injector Common (cyl 1) – pin 1	
28	START_B	NC	
29	A16	DOC Outlet Temp Sensor	
30	A01	DPF Outlet Pressure Sensor	

Table 3-9   MCM Connector – MBE 4000 (1 of 4) – C Sample
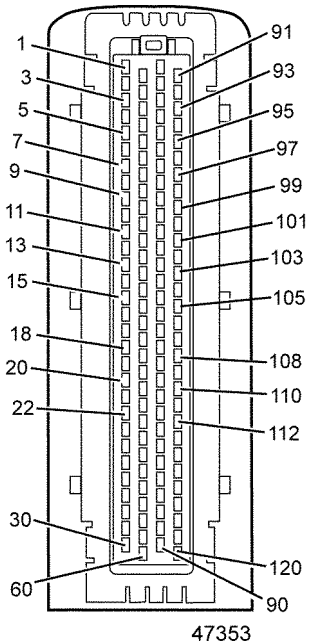
Pin	Signal Type	Function	Connector
31	PWM_5	NC	
32	PWM_7	Constant Throttle Valve	
33	PWM_6	Two-speed Fan or Variable Speed Fan	
34	PWM_8	NC	
35	PWM_10	Wastegate	
36	PWM_9	NC	
37	PWM_11	NC	
38	PV_M	Ground	
39	HSW2	Electrostatic Oil Separator	
40	SW_1	NC	
41	HSW1	Grid Heater	
42	DYN3_N	NC	
43	DYN3	CKP (+)	
44	DYN2_N	NC	
45	DYN2	CMP (+)	
46	D3_V	NC	
47	DYN4	Fan Speed	
48	DYM2_M	CMP (-)	
49	DYN5	NC	
50	SGND_TL	Sensor Ground	
51	DYN1	Turbo Speed Sensor	
52	SGND_P	Sensor Ground	
53	A23	NC	
54	A09	Engine Oil Pressure Sensor	
55	SGND_P	Sensor Ground	
56	A20	NC	
57	A05	NC	
58	SENS1_V	Sensor Power Supply	
59	A17	NC	
60	A02	EGR Throttle Position	

Table 3-10   MCM Connector – MBE 4000 (2 of 4) – C Sample
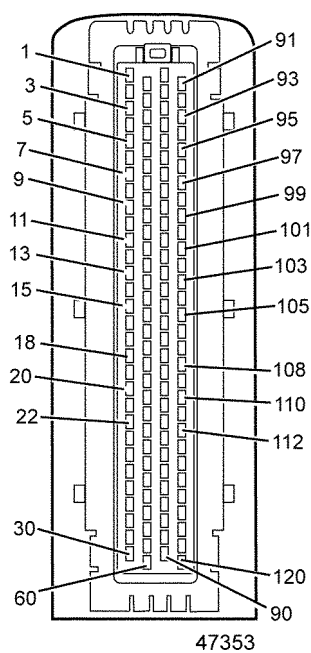
Pin	Signal Type	Function	Connector
61	PWM_1	EGR Valve	
62	PV_B2	Power Supply	
63	PWM_2	NC	
64	PV_B2	Power Supply	
65	PWM_12	Doser	
66	PWM_13	EPV2 (Entry Connecting Flap)	
67	PV_M	Ground	
68	SW_2	NC	
69	SW_8	Fuel Cutoff Valve	
70	SW_6	NC	
71	LIN_V	NC	
72	LIN	NC	
73	DYN3_M	CKP (-)	
74	CAN3L	NC	
75	CAN3H	NC	
76	D3_S	NC	
77	A29	Supply Fuel Temperature Sensor	
78	A15	NC	
79	D1	Grid Heater	
80	A27	NC	
81	A13	NC	
82	SENS2_V	Sensor Power Supply	
83	A24	NC	
84	A10	Fuel Compensation Pressure Sensor	
85	SENS2_V	Sensor Power Supply	
86	A21	Turbo Compressor Temperature Sensor	
87	A06	Intake Manifold Pressure Sensor	
88	SGND_P	Sensor Ground	
89	A18	DOC Inlet Temp Sensor	
90	A03	Intake Air Throttle Position	

Table 3-11   MCM Connector – MBE 4000 (3 of 4) – C Sample
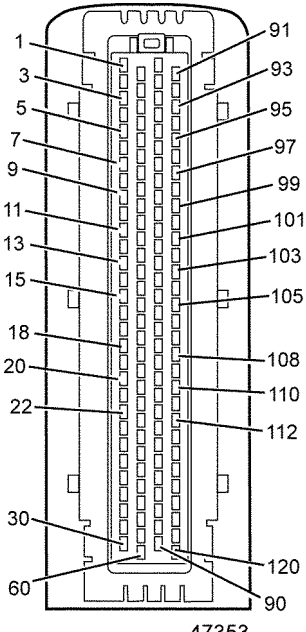
Pin	Signal Type	Function	Connector
91	PV_B1	Power Supply	
92	PWM_3	High Tech Grid Heater	
93	PV_B1	Power Supply	
94	PWM_4	NC	
95	PV_M	Ground	
96	SW_4	EPV1 (Entry Shutoff Flap)	
97	SW_5	NC	
98	SW_3	Single-speed Fan or Two-speed Fan	
99	SW_7	NC	
100	H_OUT1	Intake Throttle Valve 5 kHz (+)	
101	H_OUT2	Intake Air Throttle Valve 5 kHz (-)	
102	SGND	Sensor Ground	
103	SGND	Sensor Ground	
104	SGND	Sensor Ground	
105	SGND	Sensor Ground	
106	A30	Intake Air Temperature Sensor	
107	D2	Electrostatic Oil Separator	
108	A28	Engine Oil Temperature Sensor	
109	A14	Intake Air Delta P Sensor	
110	A26	Engine Coolant Temp Sensor	
111	A12	Fuel Line Pressure Sensor	
112	A25	NC	
113	A11	NC	
114	SGND_S2	Sensor Ground	
115	A22	DPF Outlet Temp Sensor	
116	A08	NC	
117	SENS1_V	Sensor Power Supply	
118	A07	DPF Inlet Pressure Sensor	
119	A19	Intake Manifold Pressure Sensor	
120	A04	Turbo Compressor Pressure Sensor	

Table 3-12   MCM Connector – MBE 4000 (4 of 4) – C Sample

Connector Brackets

The harnesses on MCM must be bracketed and held secure. The bracket design will change for different engines as the routing is different. The 120–pin connector and the 21-pin connector must be tie-wrapped to the brackets as shown in the following drawing for the Series 60 engine (see Figure 3-2).
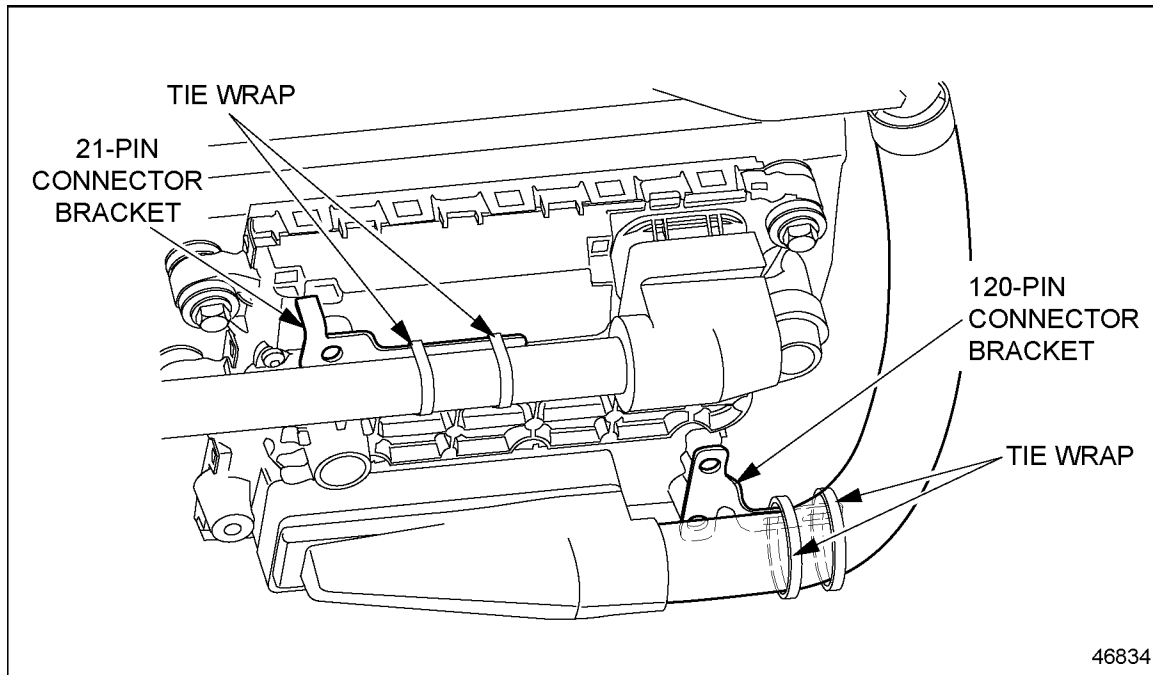
Figure 3-2   **Series 60 Engine 120–pin Connector and 21–pin Connector Tie-wrapped to Brackets**

MCM 21–pin and 31–pin Connectors

The wiring for the VIH 21–pin to the MCM is listed in Table 3-13. The side of the connector shown is looking into the pins.
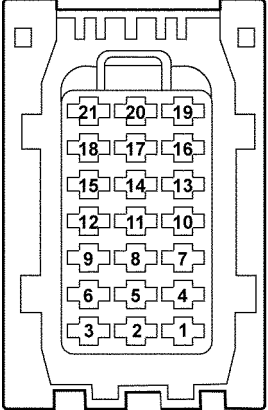
Pin	Signal Type	Function	Connector
21/1	CAN2L	Not Used	
21/2	CAN2GND	Not Used	
21/3	CAN2H	Not Used	
21/4	CAN2GND	Not Used	
21/5	KL31	Battery (-)	
21/6	KL31	Battery (-)	
21/7	KL15	IGN	
21/8	KL31	Battery (-)	
21/9	KL31	Battery (-)	
21/10	CAN1GND	Engine CAN Shield	
21/11	KL30	Battery (+)	
21/12	KL30	Battery (+)	
21/13	CAN1H	Engine CAN +	
21/14	KL30	Battery (+)	
21/15	KL30	Battery (+)	
21/16	CAN1GND	Not Used	
21/17	BOOT	Not Used	
21/18	KDiag_S	Not Used	
21/19	CAN1L	Engine CAN –	
21/20	KL50	Crank Start Input	
21/21	START_B	Crank Activation Output	

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Looking into the Pins on the Harness

Table 3-13   21–Pin Connector to the MCM

Part	DDC Part Number
Connector	024 545 76 26
1.0 – 2.5 mm Contact (single)	014 545 82 26
0.5 – 1.0 mm Contact (single)	014 545 83 26
Seal (2.2 – 3.0 mm^2 insulation diameter)	000 545 29 39
Seal (1.2 – 2.1 mm^2 insulation diameter)	000 545 28 39
Backshell	001 545 79 83
Cavity Plug	000 545 62 80

Table 3-14   21–Pin Connector to the MCM Part Numbers

The part numbers for the 31–pin MCM pigtail connector are listed in Table 3-15.

Part	DDC Part Number
Connector	008 545 31 26
Terminal	006 545 52 26
Seals	000 545 72 80
Cavity Plugs	000 545 62 80
Backshell	000 546 99 35

Table 3-15   31–pin MCM Pigtail Connector Part Numbers

The pinout for the 31–pin pigtail on the Engine Harness is listed in Table 3-16. The OEM is responsible for wiring to this connector.

31–pin	120–pin	Function	Series 60	MBE 900	MBE 4000	HDE
31/1	—	Spare	—	—	—	—
31/2	—	Power Supply (IGN)*	—	—	—	X
31/3	—	Fuel Heater Supply #1†	—	X	-	X
31/4	—	Spare	—	—	—	—
31/5	—	Full Heater Supply #2†	—	X	—	X
31/6	—	Spare	—	—	—	—
31/7	—	Power Supply Ground*	—	—	—	X
31/8	120/70	Ether Start	X	—	—	—
31/9	120/33	Fan Control #2 – High of Two-speed Fan or Variable Speed Fan	X	X	X	X
31/10	120/98	Single Speed Fan or Low for Two-speed Fan	X	X	X	X
31/11	—	Fuel Heater Ground #1†	—	X	—	X
31/12	—	Spare	—	—	—	—
31/13	—	Spare	—	—	—	—
31/14	120/71	Water-in-Fuel Sensor Supply	—	X	—	—
31/15	120/67	Water-in-Fuel Sensor Ground	—	X	—	—
31/16	120/96	Engine Brake Solenoid Control	—	X	—	—
31/17	120/29	DOC Outlet Temp Sensor (Exhaust Gas Temperature in Front of Particulate Trap)	X	X	X	X
31/18	120/89	DOC Inlet Temp Sensor	X	X	X	X
31/19	120/115	DPF Outlet Temp Sensor(Exhaust Gas Temperature After Particulate Trap)	X	X	X	X
31/20	—	Full Heater Ground #2†	—	X	—	X
31/21	—	Spare	—	—	—	—
31/22	120/91	Power Supply (Eng Brk, Fan, Ether)	X	X	X	X
31/23	120/47	Fan Speed	X	X	X	X
31/24	120/88	Sensor Ground	X	X	X	X
31/25	120/59	HDMS Fan Thermal Switch	X	—	X	X
31/26	120/57	Water-in-Fuel Sensor	—	X	—	—
31/27	120/86	TCI Temp	X	—	—	—
31/28	120/114	Sensor Ground	X	X	X	X
31/29	120/85	Sensor Supply	X	X	X	X
31/30	120/30	DPF Outlet Pressure Sensor (Exhaust Gas Pressure After Particulate Filter)	X	X	X	X
31/31	120/118	DPF Inlet Pressure Sensor (Exhaust Gas Pressure Before Particulate Filter)	X	X	X	X

*Fused at 15 amps
† Optional for MBE 900 and HDE. Must use 14 AWG wire and fuse at 20A.

Table 3-16   31–pin MCM Pigtail Connector

3.1.2 DPF HARNESS

The Aftertreatment Device (ATD) configuration includes a Diesel Oxidation Catalyst (DOC) and a Diesel Particulate Filter (DPF). See Figure 3-3.
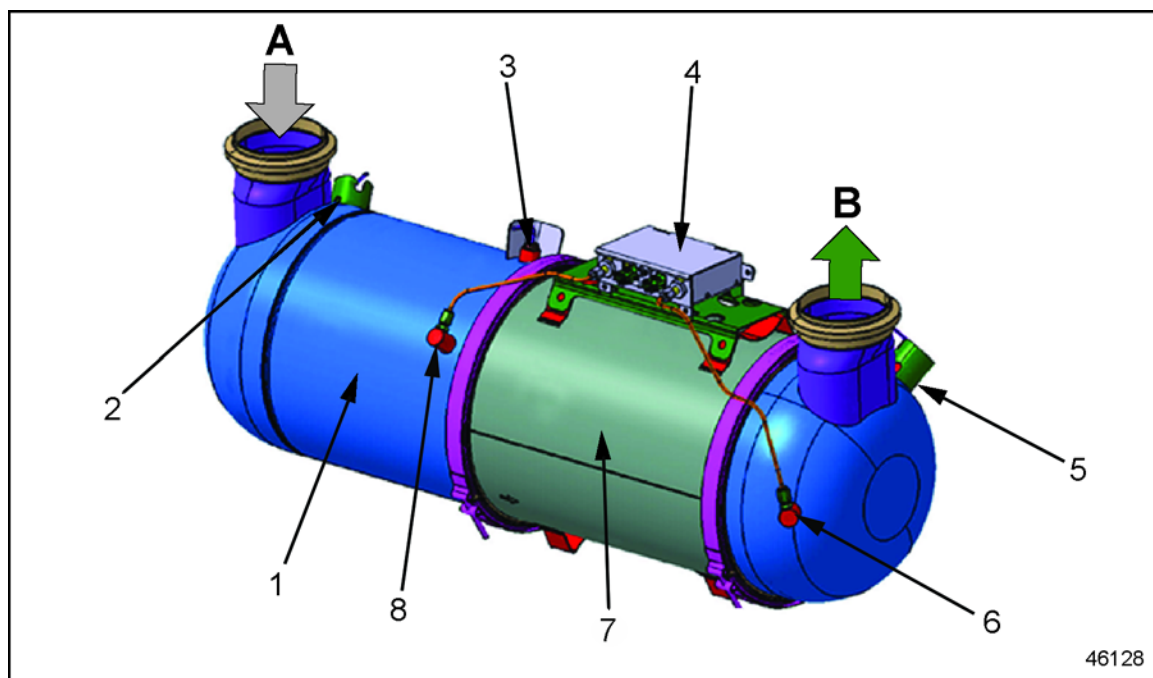
1. Diesel Oxidation Catalyst
2. DOC Inlet Temperature Sensor
3. DOC Outlet Temperature Sensor
4. Sensor Junction Box
5. DPF Outlet Temperature Sensor
6. Diesel Particulate Filter
7. A= Engine Exhaust Inlet
8. B= Exhaust Outlet

Figure 3-3   Aftertreatment Device

The ATD may be horizontally or vertically mounted depending on the vehicle chassis configuration. See Figure 3-4 for a typical mounting view of the ATD.
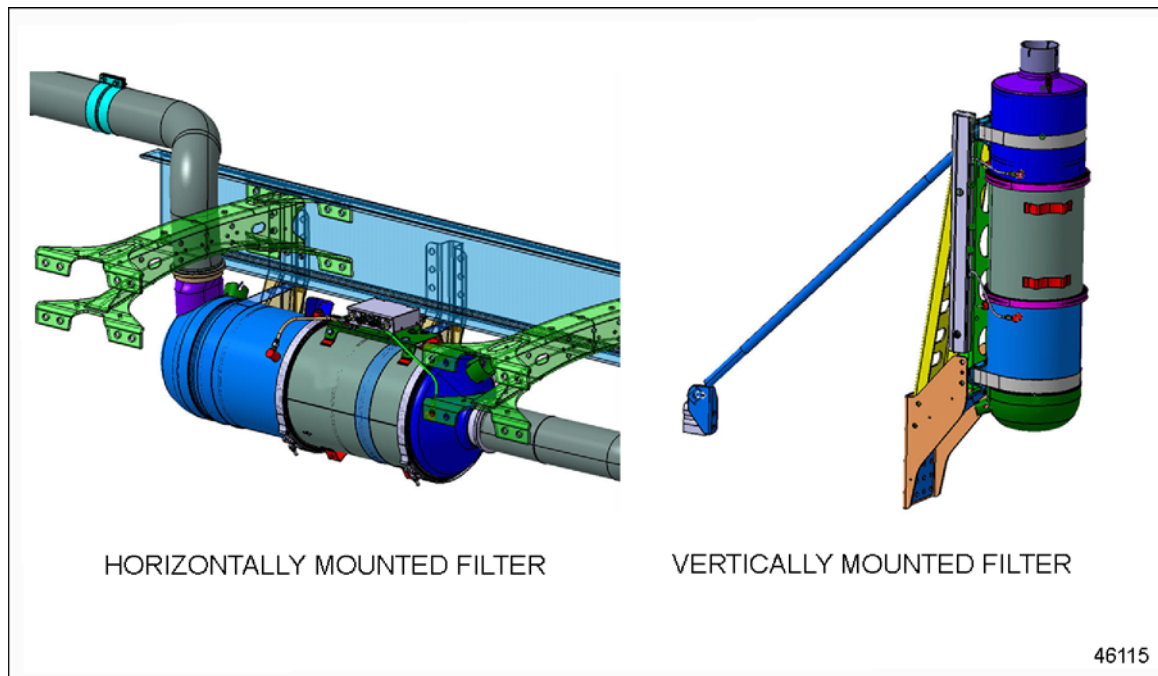
Figure 3-4   Typical Mounting Views of an Aftertreatment Device

The wiring for the DPF Harness is determined by the ATD mount position.

DPF Harness – Vertical Mount ATD (31-pin to 10 pin connector)

See Figure 3-5 for the DPF Harness wiring for vertical mount ATDs.
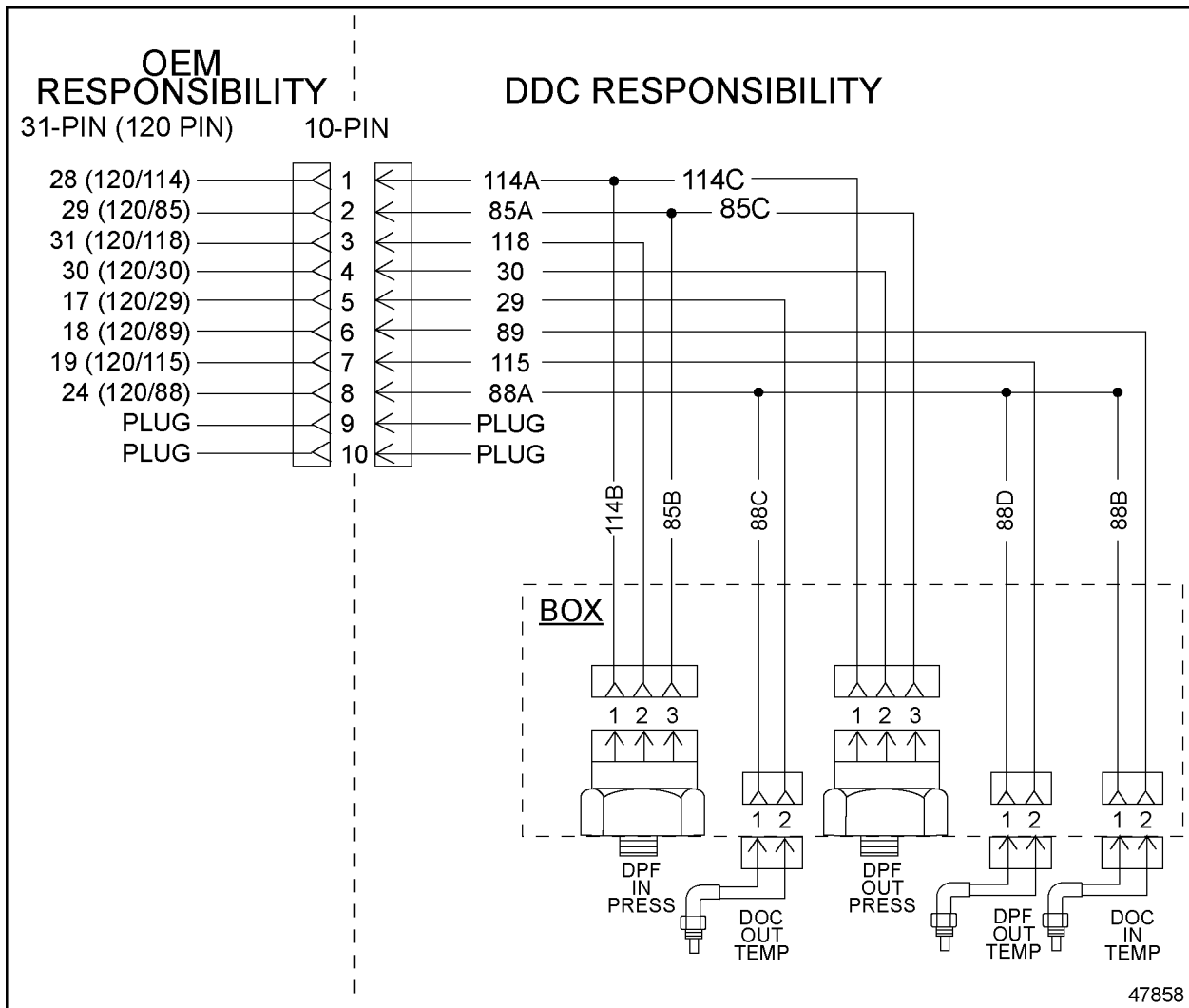
Figure 3-5   Vertical and Under Step Mount ATD Wiring — OEM Responsibility

The wiring for the 10–pin DPF connector is listed in Table 3-17.

The DDC part numbers for the DPF connector arelisted in Table 3-18.
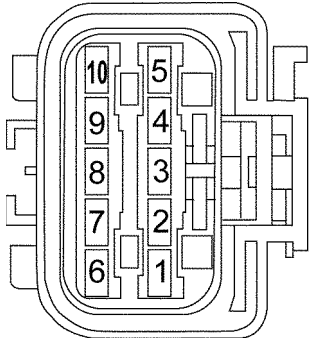
Pin	Function	Connector
1	Sensor Ground	
2	Sensor Supply	
3	DPF Inlet Pressure Sensor (Exhaust Gas Pressure Before Particulate Filter)	
4	DPF Outlet Pressure Sensor (Exhaust Gas Pressure After Particulate Filter)	
5	DOC Outlet Temperature Sensor (Exhaust Gas Temp in Front of Particulate Trap)	
6	DOC Inlet Temperature Sensor	
7	DPF Outlet Temperature Sensor(Exhaust Gas Temp After Particulate Trap)	
8	Sensor Ground	
9	Plug	
10	Plug	45608

Table 3-17   DPF 10–pin Connector

Part	DDC Part Numbers
10–pin Connector	23531613
Terminal (Male)	23531614
Plug	23531615

Table 3-18   DDC Part Numbers for the DPF 10-pin Connector

DPF Harness – Horizontal Mount ATD (31-pin to 10-pin Connector/2-pin Connector)

See Figure 3-6 for the DPF Harness wiring for horizontal mount ATDs.
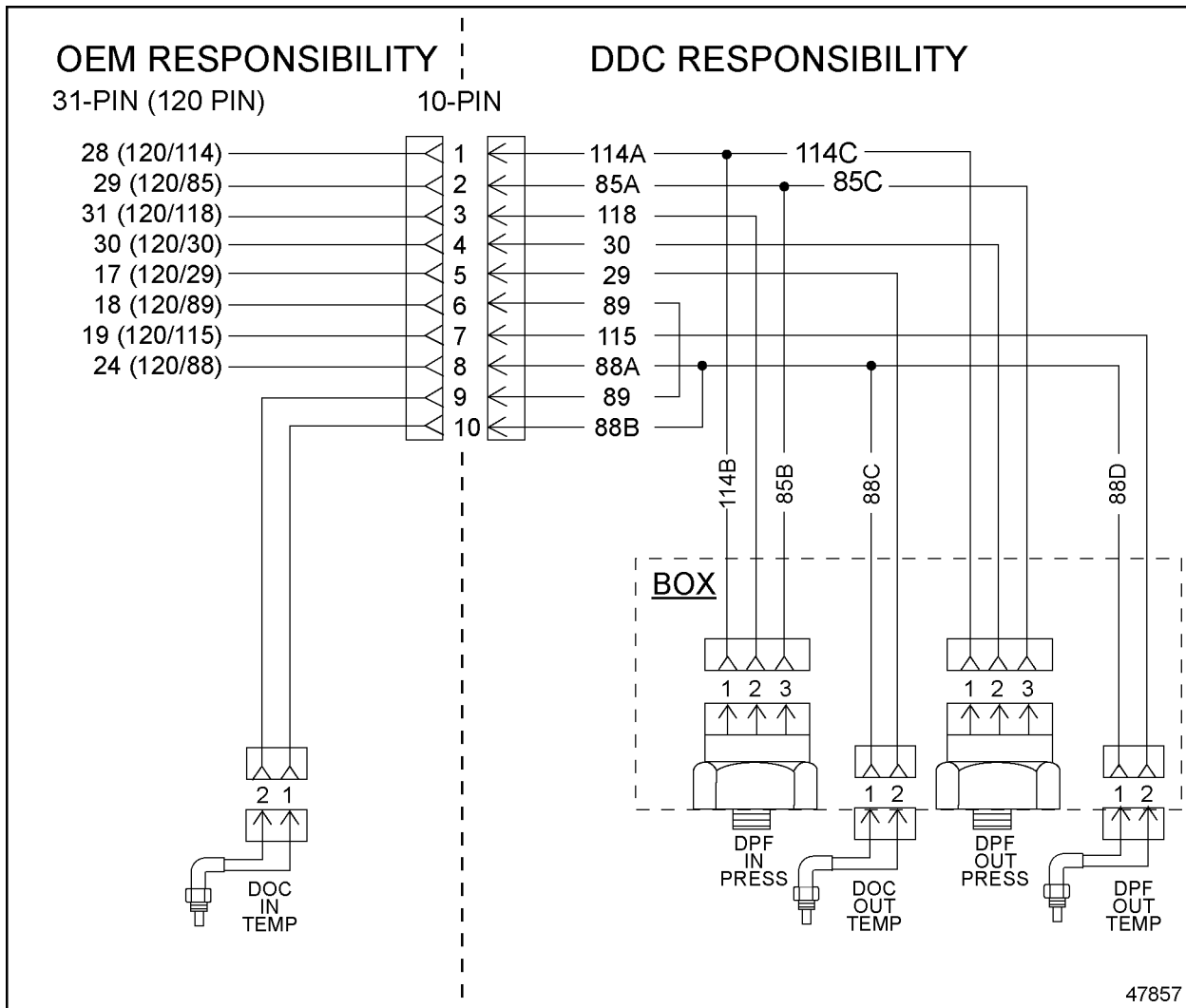
Figure 3-6   Horizontal Mount ATD Wiring — OEM Responsibility

The wiring for the DPF 10–pin connector and 2–pin connector is listed in Table 3-19.

The DDC part numbers for the DPF connector arelisted in Table 3-20.
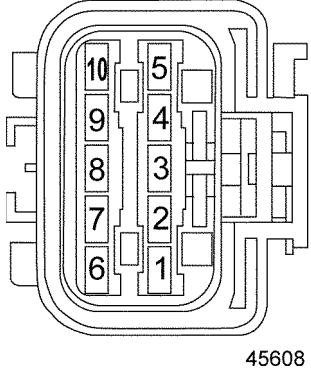
Pin	Function	Connector
1	Sensor Ground	
2	Sensor Supply	
3	DPF Inlet Pressure Sensor (Exhaust Gas Pressure Before Particulate Filter)	
4	DPF Outlet Pressure Sensor (Exhaust Gas Pressure After Particulate Filter)	
5	DOC Outlet Temperature Sensor (Exhaust Gas Temp in Front of Particulate Trap)	
6	DOC Inlet Temperature Sensor	
7	DPF Outlet Temperature Sensor(Exhaust Gas Temp After Particulate Trap)	
8	Sensor Ground	**DPF 2–pin Connector**
9	DOC Inlet Temperature Sensor	2
10	Sensor Ground	1

Table 3-19   DPF 10–pin Connector and 2–pin Connector — Horizontal Mount ATD

Part	DDC Part Numbers
10-Pin Connector	23531613
Terminal (Male)	23531614
Plug	23531615
2-Pin Connector	23537171
Terminal (Female)	23531617

Table 3-20   DDC Part Numbers for the DPF 10-pin and 2–pin Connector — Horizontal Mount ATD

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3.2   COMMON POWERTRAIN CONTROLLER

The Common Powertrain Controller (CPC) has three 18–pin connectors and one 21–pin connector. The following sections contain the connector pin-outs for truck, vocational, transit bus, fire truck, and crane applications.

The CPC is the interface between the MCM and the vehicle/equipment for engine control and manages other vehicle/equipment functions. See Figure 3-7.
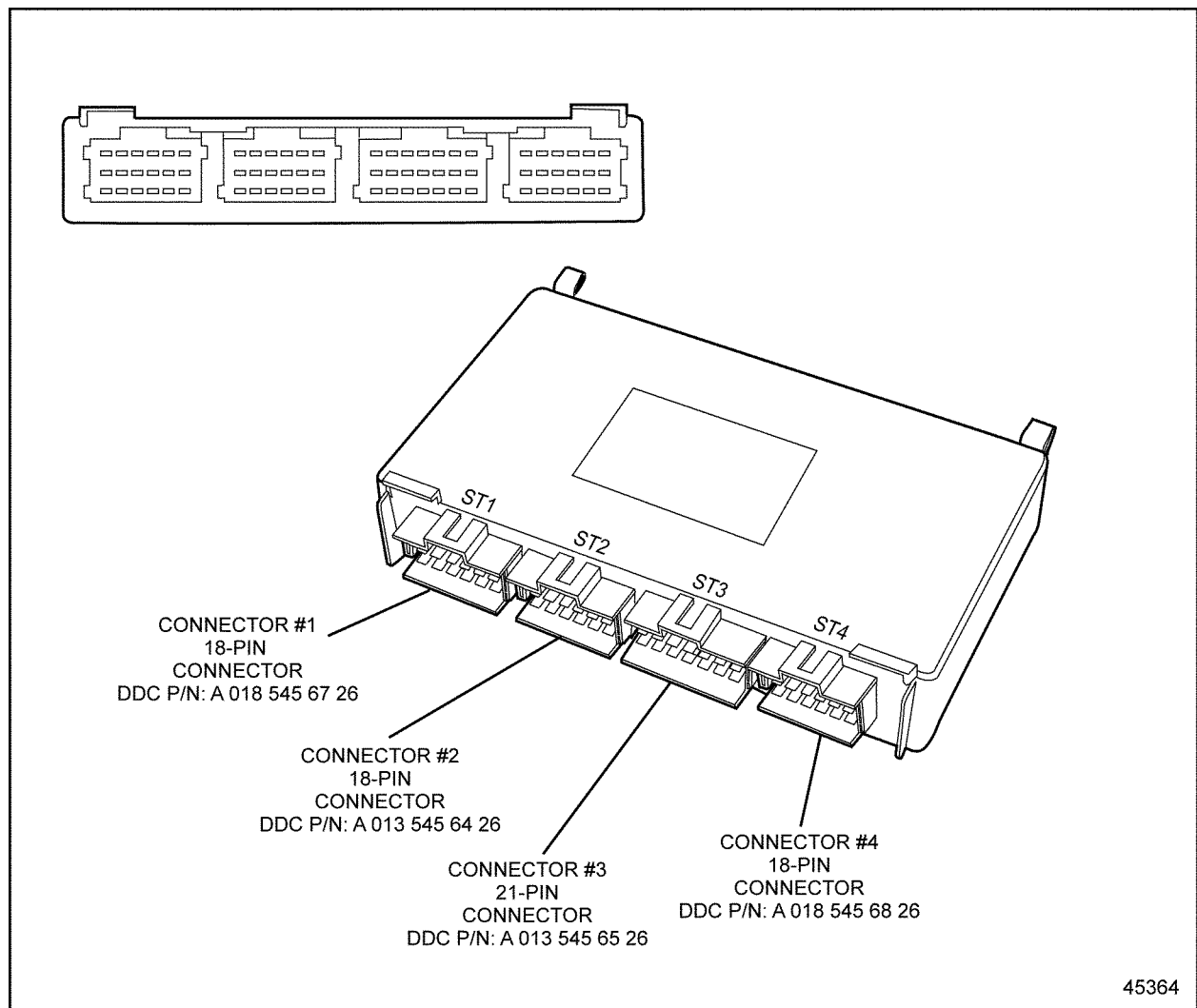
Figure 3-7   The Common Powertrain Controller

The OEM is responsible for mounting this part in an enclosed, protected environment. The mounting bracket is the responsibility of the OEM. There must be maximum physical separation of the VIH from other vehicle/equipment electrical systems. Other electrical system wires should ideally be at least three feet away from the VIH and should not be parallel to the VIH. This will eliminate coupling electromagnetic energy from other systems into the VIH. See Figure 3-8 for the CPC dimensions.
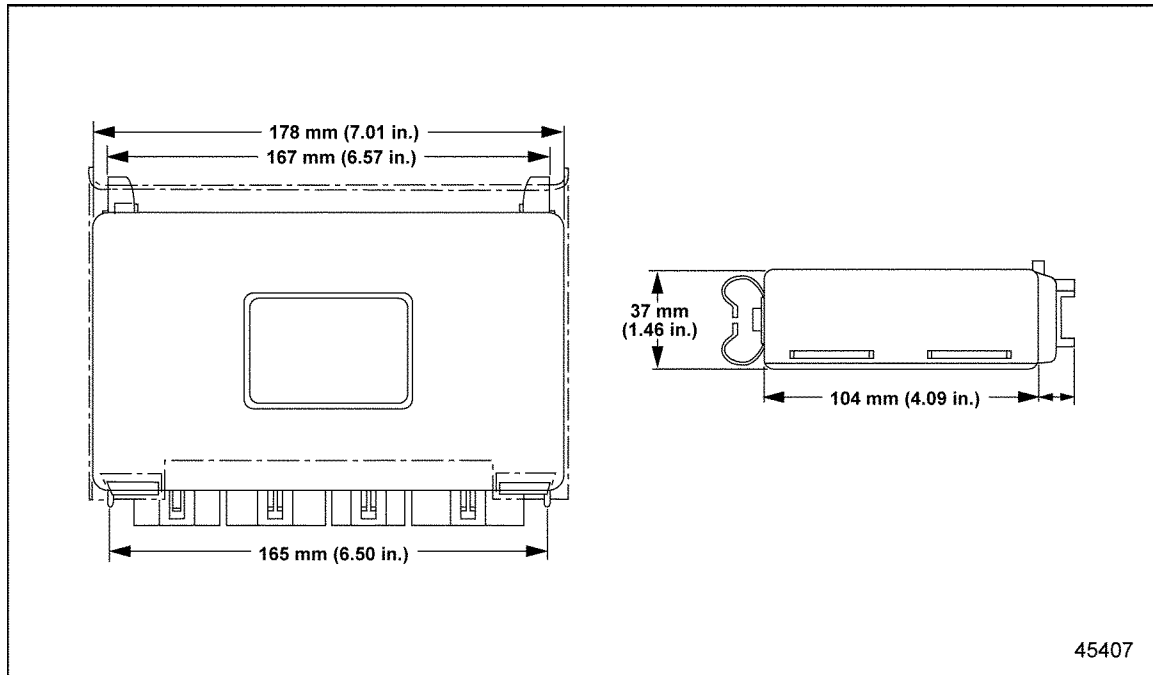
Figure 3-8   CPC Dimensions

NOTE:
The CPC should be mounted with the connectors pointing down.

The CPC communicates over the J1587 and J1939 Data Links to the vehicle (see Figure 3-9).
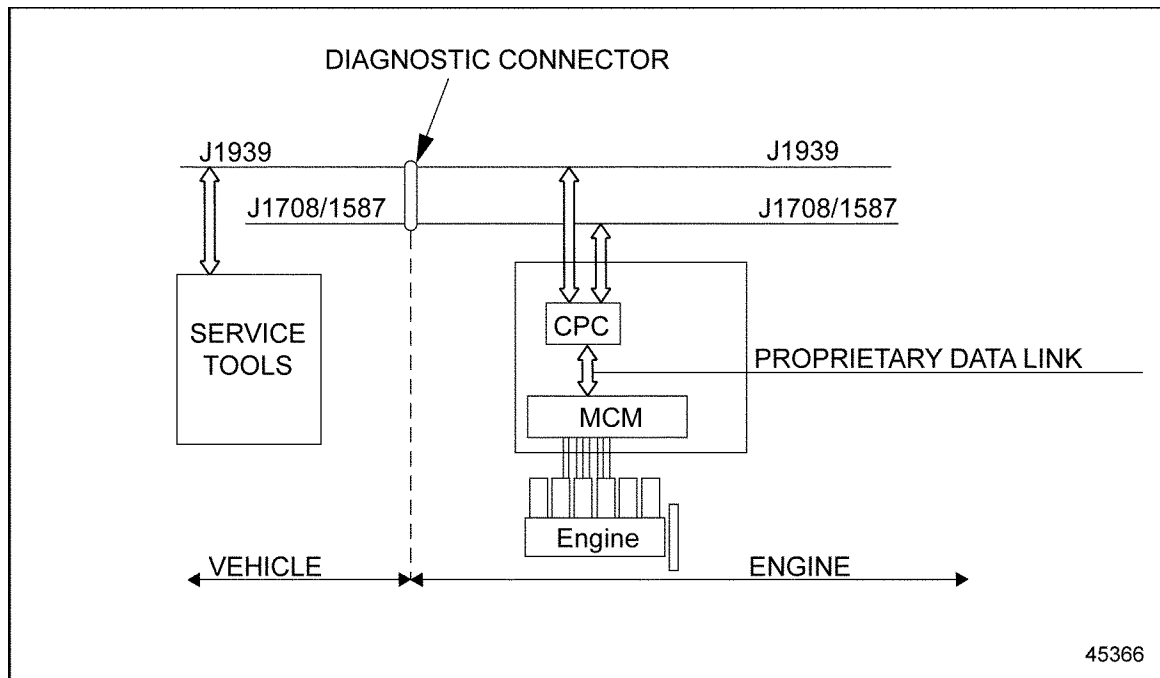
Figure 3-9   NAFTA Architecture On-highway

Within the CPC, sets of data for specific applications are stored. These include idle speed, maximum running speed, and speed limitation. Customer programmable parameters are also stored here.

The CPC receives data from the operator (accelerator pedal position, switches, various sensors) and other electronic control units (for example, synchronization controllers for more than one genset, air compressor controls).

From this data, instructions are computed for controlling the engine and transmitted to the MCM via the proprietary data link.

3.2.1   ENVIRONMENTAL CONDITIONS

Temperature, vibration, and water intrusion must be considered.

Temperature

The ambient operating temperature range is –40°F to 185°F (-40°C to 85°C).

Water Intrusion

The CPC is not water tight and cannot be subject to water spray. It must be mounted in an enclosed, protected environment.

3.2.2   CPC VEHICLE INTERFACE HARNESS

The OEM supplied Vehicle Interface Harness (VIH) connects the CPC to the MCM and other vehicle systems (see Figure 3-10).
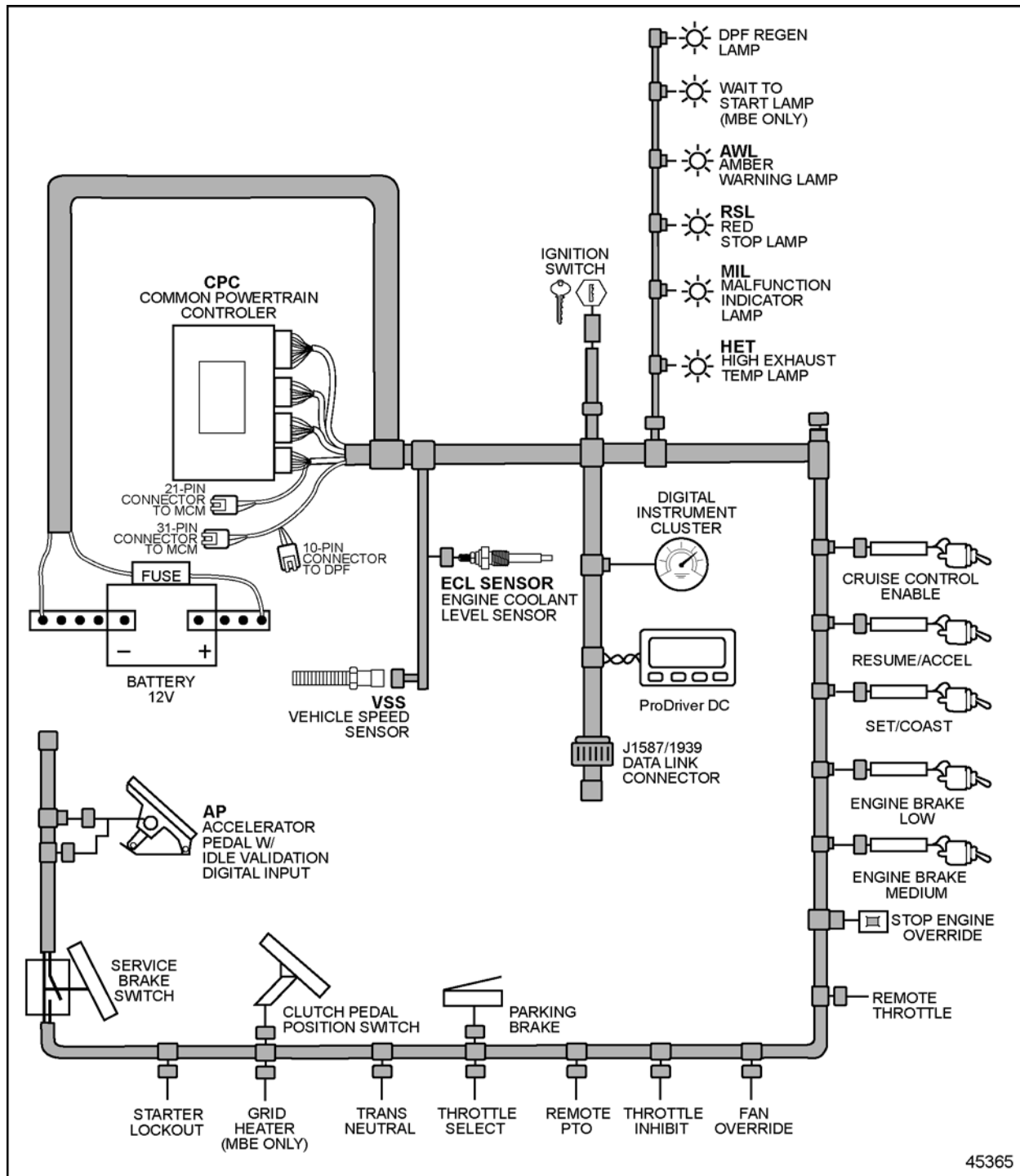
Figure 3-10   Vehicle Interface Harness

The following criteria are to be used when designing the VIH.

➔   **Criteria: VIH Design**

The four vehicle connectors are designed to accept 18 AWG wires for all circuits.

The conductor must be annealed copper, not aluminum, and must comply with the industry standard SAE J1128 document.

Color code the wires as shown in the schematics. If the wires used are the same color, hot stamp the cavity number on the wires.

NOTE:
The Vehicle Speed Sensor (VSS) must be a twisted pair. The twists are a minimum of 12 turns per foot (305 mm) and are required to minimize electromagnetic field coupling.

NOTE:
J1939 cable is required for the J1939 datalink wires. Refer to SAE J1939–11 spec for specific requirements.

The low speed propriety Engine-CAN link between the MCM and the CPC must be a twisted shielded cable with 0.75 mm diameter wire (approximately 20 AWG), bundle shielded with drain wire and 30 twists per meter. The insulation is rated to 105°C. Termination resistors for the Engine-CAN link are located in the CPC and MCM.

Frequency Input

The CPC has one frequency input on the VIH that can accept a variable reluctance sensor. A typical frequency input functions is the Vehicle Speed Sensor (VSS). Requirements for a variable reluctance signal interface are listed in Table 3-21.

Parameter	Range
Input Amplitude Range	V Peak to Peak
Input Frequency Range	0 to 10,000 Hz

Table 3-21   Variable Reluctance Signal Interface

Digital Inputs

These inputs are in low state by providing a connection to battery ground and placed in high state by providing an open circuit.

Digital Input Requirements:

High State: $V_{in} \geq 2/3$ Battery (+)
Low State: $V_{in} \leq 1/3$ Battery (+)
Isink: Capable of sinking 5–20 mA

NOTE:
Use switches that will not oxidize with the passage of time and environmental factors due to the low source current.

Digital Outputs

There are 15 digital outputs located on the CPC.

<u>High</u> <u>Power</u> <u>Outputs</u>

DO_HP_FLEX-01 – 4/9

DO_HP_FLEX_02 – 3/17

DO_HP_HS_01 — 3/7

DO_HP_HS_02 — 3/8

DO_HP_HS_04 — 4/10

DO_HP_LS_01 — 3/9

DO_HP_LS_02 — 4/7

Low-side High Power Output Characteristics:

Resistance: 12 V - vehicle power: R > 8 ohms
Inductivity: ≤ 800 mH (if valve or relay load)
Capacity: ≤ 10 nF
Isink: Capable of sinking less than or equal to 2.0 A

Low Power Outputs

DO_HP_FLEX-1 – 1/13

DO_HP_FLEX_2 – 2/10

DO_HP_FLEX_3 — 3/10

DO_HP_FLEX_4 — 3/12

DO_HP_FLEX_5 — 3/16

DO_HP_FLEX_6 — 4/6

DO_HP_LS_01 — 1/4

DO_HP_LS_02 — 1/5

Low-side Low Power Output Characteristics:

Resistance:	12 V - vehicle power: R > 64 ohms
Inductivity:	< 1.3 H (if relay load)
Capacity:	< 10 nF
Inrush Lamp Current:	< 2.5 A
Isink:	Capable of sinking less than or equal to 0.25 A

3.2.3   VIH WIRING

The OEM is responsible for wiring four connectors to the CPC, one 21–connector to the MCM, one 31–pin connector to the Engine Harness and a 10–pin Diesel Particulate Filter (DPF) connector. The connector and terminal part numbers are listed in the following pages.

Truck Applications

The pin assignments for the Common Powertrain Controller (CPC) #1 connector (18–pins) for truck applications islisted in Table 3-22. The side of the connector shown is looking into the pins.

The part numbers for the #1 connector, Key B and terminals are listed in Table 3-23.

Pin	Signal Type	Function	Connector
1/1	Digital Input_FLEX_01	Dual-speed Axle	
1/2	Digital Input_FLEX_02	Park Brake Interlock	
1/3	Digital Input_SFP_05	Idle Validation Switch 2 (throttle active)	
1/4	Digital Output_LP_LS_02	Throttle Position Sensor Ground	
1/5	Digital Output_LP_LS_01	DPF Regeneration Lamp	
1/6	Digital Input_SFP_06	Idle Validation Switch 1 (idle active)	
1/7	SFP_08	Throttle Position Sensor	
1/8	SFP_07	Throttle Position Sensor Supply	
1/9	PWM_FPO_02	Tachometer	
1/10	Digital Input_FLEX_20	Stop Engine / Aux Shutdown #1	
1/11	Digital Input_FLEX_08	Limiter 0	
1/12	Digital Input_FLEX_03	Set / Coast Enable	
1/13	Digital Output_LP_FLEX_01	MIL Lamp	
1/14	Digital Input_FLEX_04	Cruise Control Enable	
1/15	Digital Input_FLEX_05	Stop Engine Override	
1/16	Digital Input_FLEX_06	Resume / Accel Enable	
1/17	Digital Input_FLEX_07	Not Used	
1/18	SFP_01	Run Start	

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the Harness

Table 3-22   Connector #1 Pin Assignments – Truck Application

Part	DDC Part Number
CPC - 18 Pin Connector - B Key	018 545 67 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-23   Connector #1, 18–pin Connector, B Key

The pin assignments for the Common Powertrain Controller (CPC) #2 connector (18–pins) for truck applications is listed in Table 3-24. The side of the connector shown is looking into the pins.

The part numbers for the #2 connector, Key A and terminals are listed in Table 3-25.
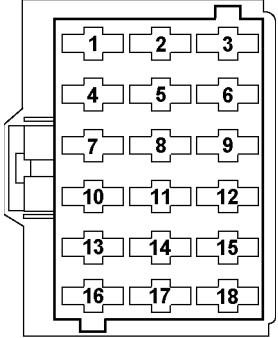
Pin	Signal Type	Function	Connector
2/1	Battery (+) PSU (KL_30)	Main Battery +12 V	
2/2	Battery (-) PSU (KL_31)	Main Battery Ground	
2/3	Battery (+) Switched PSU	Ignition	
2/4	K_DIAG_C	K-line	
2/5	J1708_A_C	J1587(+)	
2/6	J1708_B_C	J1587(–)	
2/7	Digital Input_FLEX_15	Service Brake Released Switch	
2/8	Digital Input_FLEX_16	Remote Throttle Select Switch	
2/9	Digital Input_FLEX_09	Remote PTO Switch	
2/10	Digital Output_LP_FLEX_03	Amber Warning Lamp	
2/11	Digital Input_FLEX_10	Limiter 1	
2/12	Digital Input_FLEX_11	A/C Status	
2/13	Digital Input_FLEX_12	Fan Override	
2/14	Digital Input_FLEX_13	Engine Brake Low	
2/15	Digital Input_FLEX_14	Engine Brake Medium	
2/16	VCAN_L_C	J1939 (-)	
2/17	VCAN_GND_C	J1939 Shield	
2/18	VCAN_H_C	J1939 (+)	

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Looking into the Pins on
the Harness

Table 3-24   Connector #2 Pin Assignments – Truck Application

Part	DDC Part Number
CPC - 18 Pin Connector - A Key	013 545 64 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-25   Connector #2, 18–pin Connector, A Key

The pin assignments for the Common Powertrain Controller (CPC) #3 connector (21–pins) for truck applications islisted in Table 3-26 . The side of the connector shown is looking into the pins.

The part numbers for the #3 connector, Key A and terminals are listed in Table 3-27.
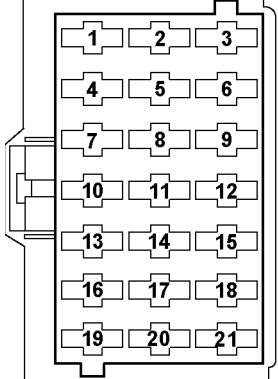
Pin	Signal Type	Function	Connector
3/1	Analog_In_01	OI Thermostat	
3/2	Analog_GND	Sensor Return	
3/3	Analog__SUP_5V	Sensor Supply	
3/4	Analog_In_02	PTO	
3/5	Analog_Out_01	Not Used	
3/6	Analog_Out_02	Not Used	
3/7	Digital Output_HP_HS_01	Top2 Lockout Solenoid/AGS2 PTO Valve	
3/8	Digital Output_HP_HS_02	Top2 Shift Solenoid/AGS2 PTO Lamp	
3/9	Digital Output_HP_LS_01	AGS 2 Backup Lamp	
3/10	Digital Output_LP_FLEX_02	AGS2 Trans Temp Lamp	
3/11	SFP_14	Low Coolant Level Sensor	
3/12	Digital Output_LP_FLEX_04	AGS2 Check Trans Lamp	
3/13	SFP_09	Vehicle Speed (+)	
3/14	SF_VGND	Vehicle Speed (-)	
3/15	Analog_In_SFP_13	Ambient Air Temperature Sensor	
3/16	Digital Output_LP_FLEX_05	Red Stop Lamp	
3/17	Digital Output_HP_FLEX_02	OI Alarm	
3/18	Digital Input_SFP_02	ABS Active (AGS2 Transmission)	
3/19	Not Used	Not Populated	
3/20	Not Used	Not Populated	
3/21	Not Used	Not Populated	

The connector column shows a diagram labeled 42707, with pins 1-21 arranged, captioned:

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Table 3-26   Connector #3 Pin Assignments – Truck Application

Part	DDC Part Number
CPC - 21 Pin Connector - A Key	013 545 65 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-27   Connector #3, 21–pin Connector, Key A

The pin assignments for the Common Powertrain Controller (CPC) #4 connector (18–pins) for truck applications islisted in Table 3-28. The side of the connector shown is looking into the pins.

The part numbers for the #4 connector, Key C and terminals are listed in Table 3-29.
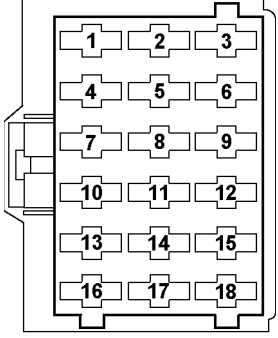
Pin	Signal Type	Function	Connector
4/1	C_ECAN_L	Engine CAN (-)	
4/2	C_ECAN_GND	Engine CAN Shield	
4/3	C_ECAN_H	Engine CAN (+)	
4/4	Digital Input_SFP_11	Not Populated	
4/5	Digital Input_SFP_12	Not Populated	
4/6	Digital Output_LP_FLEX_06	Wait to Start Lamp (Grid Heater)	
4/7	Digital Output_HP_LS_02	High Exhaust System Temperature Lamp	
4/8	Digital Input_FLEX_E1	Clutch Released/PTO Request for AGS2	
4/9	Digital Output_HP_FLEX_01	OI Active Lamp	
4/10	Digital Output_HP_HS_04	Vehicle Power Shutdown	
4/11	Frequency_SFP_10	Not Used	
4/12	PWM_FPO_01	Vehicle Speed Output	
4/13	Digital Input__FLEX_19	—	
4/14	Digital Input_SFP_03	Not Populated	
4/15	Digital Input_SFP_04	Not Populated	
4/16	Digital Input_FLEX_17	Trans Neutral Switch	
4/17	Digital Input_FLEX_21	DPF Regeneration Switch	
4/18	Digital Input_FLEX_18	Hood Tilt Switch/AGS2 PTO Feedback	

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Table 3-28   Connector #4 Pin Assignments – Truck Application

Part	DDC Part Number
CPC - 18 Pin Connector - C Key	018 545 68 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-29   Connector #4, 18–pin Connector, Key C

Vocational Applications

The pin assignments for the Common Powertrain Controller (CPC) #1 connector (18–pin) for vocational applications are listed in Table 3-30. The side of the connector shown is looking into the pins.

The part numbers for the #1 connector, Key B and terminals are listed in Table 3-31.

Pin	Signal Type	Function	Connector
1/1	Digital Input_FLEX_01	Dual-speed Axle	
1/2	Digital Input_FLEX_02	Park Brake Interlock	
1/3	Digital Input_SFP_05	Idle Validation Switch 2 (throttle active)	
1/4	Digital Output_LP_LS_02	Throttle Position Sensor Ground	
1/5	Digital Output_LP_LS_01	DPF Regeneration Lamp	
1/6	Digital Input_SFP_06	Idle Validation Switch 1 (idle active)	
1/7	SFP_08	Throttle Position Sensor	
1/8	SFP_07	Throttle Position Sensor Supply	
1/9	PWM_FPO_02	Tachometer	
1/10	Digital Input_FLEX_20	Stop Engine / Aux Shutdown #1	
1/11	Digital Input_FLEX_08	Limiter 0	
1/12	Digital Input_FLEX_03	Set / Coast Enable	
1/13	Digital Output_LP_FLEX_01	MIL Lamp	
1/14	Digital Input_FLEX_04	Cruise Enable	
1/15	Digital Input_FLEX_05	Stop Engine Override	
1/16	Digital Input_FLEX_06	Resume / Accel Enable	
1/17	Digital Input_FLEX_07	Throttle Inhibit	
1/18	SFP_01	Run Start	

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Table 3-30   Connector #1 Pin Assignments – Vocational Applications

Part	DDC Part Number
CPC - 18 Pin Connector - B Key	018 545 67 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-31   Connector #1, 18–pin Connector, B Key

The pin assignments for the Common Powertrain Controller (CPC) #2 connector (18–pin) for vocational applications are listed in Table 3-32. The side of the connector shown is looking into the pins.

The part numbers for the #2 connector, Key A and terminals are listed in Table 3-33.
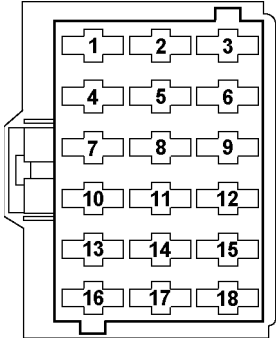
Pin	Signal Type	Function	Connector
2/1	Battery (+) PSU (KL_30)	Main Battery +12 V	
2/2	Battery (-) PSU (KL_31)	Main Battery Ground	
2/3	Battery (+) Switched PSU	Ignition	
2/4	K_DIAG_C	K-line	
2/5	J1708_A_C	J1587 (+)	
2/6	J1708_B_C	J1587 (–)	
2/7	Digital Input_FLEX_15	Service Brake Switch	
2/8	Digital Input_FLEX_16	Remote Throttle Select Switch	
2/9	Digital Input_FLEX_09	Remote PTO Select	
2/10	Digital Output_LP_FLEX_03	Amber Warning Lamp	
2/11	Digital Input_FLEX_10	Limiter 1	
2/12	Digital Input_FLEX_11	A/C Status	
2/13	Digital Input_FLEX_12	Fan Override	
2/14	Digital Input_FLEX_13	Engine Brake Low	
2/15	Digital Input_FLEX_14	Engine Brake Medium	
2/16	VCAN_L_C	J1939-	
2/17	VCAN_GND_C	J1939 Shield	
2/18	VCAN_H_C	J1939+	

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Table 3-32   Connector #2 Pin Assignments – Vocational Applications

Part	DDC Part Number
CPC - 18 Pin Connector - A Key	013 545 64 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-33   Connector #2, 18–pin Connector, A Key

The pin assignments for the Common Powertrain Controller (CPC) #3 connector (21–pin) for vocational applications are listed in Table 3-34. The side of the connector shown is looking into the pins.

The part numbers for the #3 connector, Key A and terminals are listed in Table 3-35.
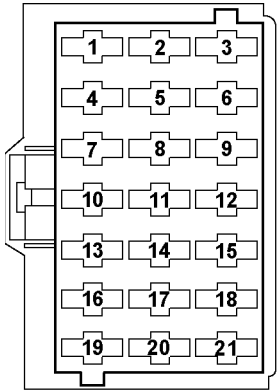
Pin	Signal Type	Function	Connector
3/1	Analog_In_01	Not Used	
3/2	Analog_GND	Sensor Return	
3/3	Analog__SUP_5V	Sensor Supply	
3/4	Analog_In_02	PTO	
3/5	Analog_Out_01	Not Used	
3/6	Analog_Out_02	Not Used	
3/7	Digital Output_HP_HS_01	Not Used	
3/8	Digital Output_HP_HS_02	Not Used	
3/9	Digital Output_HP_LS_01	AGS 2 Backup Lamp/AGS2 PTO Valve	
3/10	Digital Output_LP_FLEX_02	AGS2 Trans Temp Lamp/AGS2 PTO Lamp	
3/11	SFP_14	Low Coolant Level Sensor	
3/12	Digital Output_LP_FLEX_04	AGS2 Check Trans Lamp	
3/13	SFP_09	Vehicle Speed (+)	
3/14	SF_VGND	Vehicle Speed (-)	
3/15	Analog_In_SFP_13	Ambient Air Temperature Sensor	
3/16	Digital Output_LP_FLEX_05	Red Stop Lamp	
3/17	Digital Output_HP_FLEX_02	Starter Lockout/Run Signal	
3/18	Digital Input_SFP_02	ABS Active (AGS2 Transmission)	
3/19	Not Used	Not Populated	
3/20	Not Used	Not Populated	
3/21	Not Used	Not Populated	

Connector illustration (pins 1–21), labeled "42707", "Front Looking into the Pins on the Harness".

Table 3-34   Connector #3 Pin Assignments – Vocational Applications

Part	DDC Part Number
CPC - 21 Pin Connector - A Key	013 545 65 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-35   Connector #3, 21–pin Connector, Key A

The pin assignments for the Common Powertrain Controller (CPC) #4 connector (18–pin) for vocational applications are listed in Table 3-36. The side of the connector shown is looking into the pins.

The part numbers for the #4 connector, Key C and terminals are listed in Table 3-37.

Pin	Signal Type	Function	Connector
4/1	C_ECAN_L	Engine CAN (-)	
4/2	C_ECAN_GND	Engine CAN Shield	
4/3	C_ECAN_H	Engine CAN (+)	
4/4	Digital Input_SFP_11	Not Populated	
4/5	Digital Input_SFP_12	Not Populated	
4/6	Digital Output_LP_FLEX_06	Wait to Start Lamp (Grid Heater)	
4/7	Digital Output_HP_LS_02	High Exhaust System Temperature Lamp	
4/8	Digital Input_FLEX_E1	Clutch Released/PTO Request for AGS2	
4/9	Digital Output_HP_FLEX_01	Deceleration Lamp	
4/10	Digital Output_HP_HS_04	Not Used	
4/11	Frequency_SFP_10	Not Used	
4/12	PWM_FPO_01	Vehicle Speed Output	
4/13	Digital Input__FLEX_19	—	
4/14	Digital Input_SFP_03	Not Populated	
4/15	Digital Input_SFP_04	Not Populated	
4/16	Digital Input_FLEX_17	Trans Neutral Switch	
4/17	Digital Input_FLEX_21	DPF Regeneration Switch	
4/18	Digital Input_FLEX_18	AGS2 PTO Feedback	

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Table 3-36   Connector #4 Pin Assignments – Vocational Applications

Part	DDC Part Number
CPC - 18 Pin Connector - C Key	018 545 68 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-37   Connector #4, 18–pin Connector, Key C

Coach Applications

The pin assignments for the Common Powertrain Controller (CPC) #1 connector (18–pin) for coach applications are listed in Table 3-38.

The part numbers for the #1 connector, Key B and terminals are listed in Table 3-39.

Pin	Signal Type	Function	Connector
1/1	Digital Input_FLEX_01	Transmission Retarder Active	
1/2	Digital Input_FLEX_02	Park Brake Interlock	
1/3	Digital Input_SFP_05	Idle Validation Switch 2 (throttle active)	
1/4	Digital Output_LP_LS_02	Throttle Position Sensor Ground	
1/5	Digital Output_LP_LS_01	DPF Regeneration Lamp	
1/6	Digital Input_SFP_06	Idle Validation Switch 1 (idle active)	
1/7	SFP_08	Throttle Position Sensor	
1/8	SFP_07	Throttle Position Sensor Supply	
1/9	PWM_FPO_02	Not Used	
1/10	Digital Input_FLEX_20	Stop Engine / Aux Shutdown #1	
1/11	Digital Input_FLEX_08	Limiter 0	
1/12	Digital Input_FLEX_03	Set / Coast Enable	
1/13	Digital Output_LP_FLEX_01	MIL Lamp	
1/14	Digital Input_FLEX_04	Cruise Control Enable	
1/15	Digital Input_FLEX_05	Stop Engine Override	
1/16	Digital Input_FLEX_06	Resume / Accel Enable	
1/17	Digital Input_FLEX_07	Throttle Inhibit	
1/18	SFP_01	Run Start	

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Table 3-38   Connector #1 Pin Assignments – Coach Application

Part	DDC Part Number
CPC - 18 Pin Connector - B Key	018 545 67 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-39   Connector #1, 18–pin Connector, B Key

The pin assignments for the Common Powertrain Controller (CPC) #2 connector (18–pin) for coach applications are listed in Table 3-40.

The part numbers for the #2 connector, Key A and terminals are listed in Table 3-41.

Pin	Signal Type	Function	Connector
2/1	Battery (+) PSU (KL_30)	Main Battery +12 V	
2/2	Battery (-) PSU (KL_31)	Main Battery Ground	
2/3	Battery (+) Switched PSU	Ignition	
2/4	K_DIAG_C	K-line	
2/5	J1708_A_C	J1587 (+)	
2/6	J1708_B_C	J1587 (–)	
2/7	Digital Input_FLEX_15	Service Brake Released Switch	
2/8	Digital Input_FLEX_16	Not Used	
2/9	Digital Input_FLEX_09	Not Used	
2/10	Digital Output_LP_FLEX_03	Amber Warning Lamp	
2/11	Digital Input_FLEX_10	Limiter 1	
2/12	Digital Input_FLEX_11	A/C Status	
2/13	Digital Input_FLEX_12	Fan Override	
2/14	Digital Input_FLEX_13	Engine Brake Low	
2/15	Digital Input_FLEX_14	Engine Brake Medium	
2/16	VCAN_L_C	J1939 (-)	
2/17	VCAN_GND_C	J1939 Shield	
2/18	VCAN_H_C	J1939 (+)	

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Table 3-40   Connector #2 Pin Assignments – Coach Application

Part	DDC Part Number
CPC - 18 Pin Connector - A Key	013 545 64 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-41   Connector #2, 18–pin Connector, A Key

The pin assignments for the Common Powertrain Controller (CPC) #3 connector (21–pin) for coach applications are listed in Table 3-42.

The part numbers for the #3 connector, Key A and terminals are listed in Table 3-43.
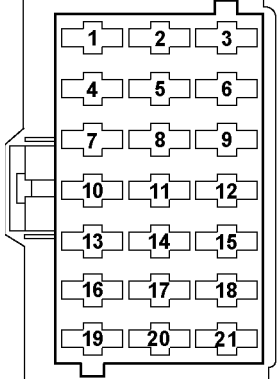
Pin	Signal Type	Function	Connector
3/1	Analog_In_01	Not Used	
3/2	Analog_GND	Sensor Return	
3/3	Analog__SUP_5V	Sensor Supply	
3/4	Analog_In_02	PTO	
3/5	Analog_Out_01	Not Used	
3/6	Analog_Out_02	Not Used	
3/7	Digital Output_HP_HS_01	Not Used	
3/8	Digital Output_HP_HS_02	Not Used	
3/9	Digital Output_HP_LS_01	Not Used	
3/10	Digital Output_LP_FLEX_02	Low Battery Voltage Lamp	
3/11	SFP_14	Low Coolant Level Sensor	
3/12	Digital Output_LP_FLEX_04	Not Used	
3/13	SFP_09	Vehicle Speed (+)	
3/14	SF_VGND	Vehicle Speed (-)	
3/15	Analog_In_SFP_13	Ambient Air Temperature Sensor	
3/16	Digital Output_LP_FLEX_05	Red Stop Lamp	
3/17	Digital Output_HP_FLEX_02	Starter Lockout/Run Signal	
3/18	Digital Input_SFP_02	Not Used	
3/19	Not Used	Not Populated	
3/20	Not Used	Not Populated	
3/21	Not Used	Not Populated	

Connector illustration (pins 1–21), label 42707, Front, Looking into the Pins on the Harness.

Table 3-42   Connector #3 Pin Assignments – Coach Application

Part	DDC Part Number
CPC - 21 Pin Connector - A Key	013 545 65 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-43   Connector #3, 21–pin Connector, Key A

The pin assignments for the Common Powertrain Controller (CPC) #4 connector (18–pin) for coach applications are listed in Table 3-44.

The part numbers for the #4 connector, Key C and terminals are listed in Table 3-45.

Pin	Signal Type	Function	Connector
4/1	C_ECAN_L	Engine CAN (-)	
4/2	C_ECAN_GND	Engine CAN Shield	
4/3	C_ECAN_H	Engine CAN (+)	
4/4	Digital Input_SFP_11	Not Populated	
4/5	Digital Input_SFP_12	Not Populated	
4/6	Digital Output_LP_FLEX_06	Wait to Start Lamp (Grid Heater)	
4/7	Digital Output_HP_LS_02	High Exhaust System Temperature Lamp	
4/8	Digital Input_FLEX_E1	Clutch Released	
4/9	Digital Output_HP_FLEX_01	Deceleration Lamp	
4/10	Digital Output_HP_HS_04	Vehicle Power Shutdown	
4/11	Frequency_SFP_10	Not Used	
4/12	PWM_FPO_01	Not Used	
4/13	Digital Input__FLEX_19	—	
4/14	Digital Input_SFP_03	Not Populated	
4/15	Digital Input_SFP_04	Not Populated	
4/16	Digital Input_FLEX_17	Neutral Switch	
4/17	Digital Input_FLEX_21	DPF Regeneration Switch	
4/18	Digital Input_FLEX_18	Engine Brake Disable	

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Table 3-44   Connector #4 Pin Assignments – Coach Application

Part	DDC Part Number
CPC - 18 Pin Connector - C Key	018 545 68 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-45   Connector #4, 18–pin Connector, Key C

Fire Truck Applications

The pin assignments for the Common Powertrain Controller #1 connector (18–pin) for fire truck applications are listed in Table 3-46.

The part numbers for the #1 connector, Key B and terminals are listed in Table 3-47.
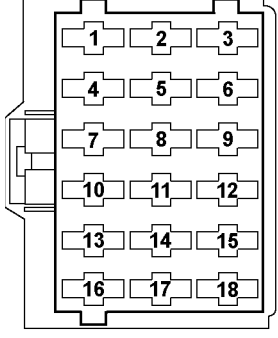
Pin	Signal Type	Function	Connector
1/1	Digital Input_FLEX_01	Transmission Retarder Active	
1/2	Digital Input_FLEX_02	Parking Brake	
1/3	Digital Input_SFP_05	Idle Validation Switch 2 (throttle active)	
1/4	Digital Output_LP_LS_02	Throttle Position Sensor Ground	
1/5	Digital Output_LP_LS_01	DPF Regeneration Lamp	
1/6	Digital Input_SFP_06	Idle Validation Switch 1 (idle active)	
1/7	SFP_08	Throttle Position Sensor	
1/8	SFP_07	Throttle Position Sensor Supply	
1/9	PWM_FPO_02	Not Used	
1/10	Digital Input_FLEX_20	Not Used	
1/11	Digital Input_FLEX_08	Limiter 0	
1/12	Digital Input_FLEX_03	Set / Coast Enable	
1/13	Digital Output_LP_FLEX_01	MIL Lamp	
1/14	Digital Input_FLEX_04	Cruise Enable	
1/15	Digital Input_FLEX_05	Stop Engine Override	
1/16	Digital Input_FLEX_06	Resume / Accel Enable	
1/17	Digital Input_FLEX_07	Throttle Inhibit	
1/18	SFP_01	Run Start	

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Table 3-46   Connector #1 Pin Assignments – Fire Truck Application

Part	DDC Part Number
CPC - 18 Pin Connector - B Key	018 545 67 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-47   Connector #1, 18–pin Connector, B Key

The pin assignments for the Common Powertrain Controller #2 connector (18–pin) for fire truck applications are listed in Table 3-48.

The part numbers for the #2 connector, Key A and terminals are listed in Table 3-49.
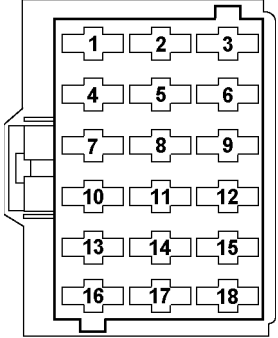
Pin	Signal Type	Function	Connector
2/1	Battery (+) PSU (KL_30)	Main Battery +12 V	
2/2	Battery (-) PSU (KL_31)	Main Battery Ground	
2/3	Battery (+) Switched PSU	Ignition	
2/4	K_DIAG_C	K-line	
2/5	J1708_A_C	J1587 (+)	
2/6	J1708_B_C	J1587 (–)	
2/7	Digital Input_FLEX_15	Not Used	
2/8	Digital Input_FLEX_16	Remote Throttle Select Switch	
2/9	Digital Input_FLEX_09	Remote PTO Select Switch	
2/10	Digital Output_LP_FLEX_03	Amber Warning Lamp	
2/11	Digital Input_FLEX_10	Limiter 1	
2/12	Digital Input_FLEX_11	A/C Status	
2/13	Digital Input_FLEX_12	Fan Override	
2/14	Digital Input_FLEX_13	Engine Brake Low	
2/15	Digital Input_FLEX_14	Engine Brake Medium	
2/16	VCAN_L_C	J1939 (-)	
2/17	VCAN_GND_C	J1939 Shield	
2/18	VCAN_H_C	J1939 (+)	

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Table 3-48   Connector #2 Pin Assignments – Fire Truck Application

Part	DDC Part Number
CPC - 18 Pin Connector - A Key	013 545 64 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-49   Connector #2, 18–pin Connector, A Key

The pin assignments for the Common Powertrain Controller #3 connector (21–pin) for fire truck applications are listed in Table 3-50.

The part numbers for the #3 connector, Key C and terminals are listed in Table 3-51.

Pin	Signal Type	Function	Connector
3/1	Analog_In_01	Not Used	
3/2	Analog_GND	Sensor Return	
3/3	Analog__SUP_5V	Sensor Supply	
3/4	Analog_In_02	PTO	
3/5	Analog_Out_01	Not Used	
3/6	Analog_Out_02	Not Used	
3/7	Digital Output_HP_HS_01	Not Used	
3/8	Digital Output_HP_HS_02	Not Used	
3/9	Digital Output_HP_LS_01	Engine Brake Active	
3/10	Digital Output_LP_FLEX_02	Coolant Level Low Lamp	
3/11	SFP_14	Low Coolant Level Sensor	
3/12	Digital Output_LP_FLEX_04	Low Oil Pressure Lamp	
3/13	SFP_09	Vehicle Speed (+)	
3/14	SF_VGND	Vehicle Speed (-)	
3/15	Analog_In_SFP_13	Ambient Air Temperature Sensor	
3/16	Digital Output_LP_FLEX_05	Red Stop Lamp	
3/17	Digital Output_HP_FLEX_02	Starter Lockout	
3/18	Digital Input_SFP_02	Not Used	
3/19	Not Used	Not Populated	
3/20	Not Used	Not Populated	
3/21	Not Used	Not Populated	

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Table 3-50   Connector #3 Pin Assignments – Fire Truck Application

Part	DDC Part Number
CPC - 21 Pin Connector - A Key	013 545 65 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-51   Connector #3, 21–pin Connector, Key A

The pin assignments for the Common Powertrain Controller #4 connector (18–pin) for fire truck applications are listed in Table 3-52.

The part numbers for the #4 connector, Key C and terminals are listed in Table 3-53.
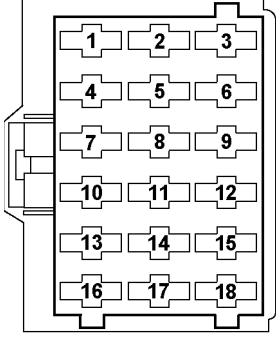
Pin	Signal Type	Function	Connector
4/1	C_ECAN_L	Engine CAN (+)	
4/2	C_ECAN_GND	Engine CAN Shield	
4/3	C_ECAN_H	Engine CAN (+)	
4/4	Digital Input_SFP_11	Not Populated	
4/5	Digital Input_SFP_12	Not Populated	
4/6	Digital Output_LP_FLEX_06	Wait to Start Lamp (Grid Heater)	
4/7	Digital Output_HP_LS_02	High Exhaust System Temperature Lamp	
4/8	Digital Input_FLEX_E1	Not Used	
4/9	Digital Output_HP_FLEX_01	Not Used	
4/10	Digital Output_HP_HS_04	Not Used	
4/11	Frequency_SFP_10	Not Used	
4/12	PWM_FPO_01	Not Used	
4/13	Digital Input__FLEX_19	—	
4/14	Digital Input_SFP_03	Not Populated	
4/15	Digital Input_SFP_04	Not Populated	
4/16	Digital Input_FLEX_17	Neutral Switch	
4/17	Digital Input_FLEX_21	DPF Regeneration Switch	
4/18	Digital Input_FLEX_18	Engine Brake Disable	

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Table 3-52   Connector #4 Pin Assignments – Fire Truck Application

Part	DDC Part Number
CPC - 18 Pin Connector - C Key	018 545 68 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-53   Connector #4, 18–pin Connector, Key C

Crane Applications

The pin assignments for the Common Powertrain Controller #1 connector (18–pin) for crane applications are listed in Table 3-54.

The part numbers for the #1 connector, Key B and terminals are listed in Table 3-55.

Pin	Signal Type	Function	Connector
1/1	Digital Input_FLEX_01	Transmission Retarder Active	
1/2	Digital Input_FLEX_02	Park Brake Interlock	
1/3	Digital Input_SFP_05	Idle Validation Switch 2 (throttle active)	
1/4	Digital Output_LP_LS_02	Throttle Position Sensor Ground	
1/5	Digital Output_LP_LS_01	DPF Regeneration Lamp	
1/6	Digital Input_SFP_06	Idle Validation Switch 1 (idle active)	
1/7	SFP_08	Throttle Position Sensor	
1/8	SFP_07	Throttle Position Sensor Supply	
1/9	PWM_FPO_02	Not Used	
1/10	Digital Input_FLEX_20	Stop Engine / Aux Shutdown #1	
1/11	Digital Input_FLEX_08	Limiter 0	
1/12	Digital Input_FLEX_03	Set / Coast Enable	
1/13	Digital Output_LP_FLEX_01	MIL Lamp	
1/14	Digital Input_FLEX_04	Cruise Control Enable	
1/15	Digital Input_FLEX_05	Stop Engine Override	
1/16	Digital Input_FLEX_06	Resume / Accel Enable	
1/17	Digital Input_FLEX_07	Throttle Inhibit	
1/18	SFP_01	Run Start	

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Table 3-54   Connector #1 Pin Assignments – Crane Application

Part	DDC Part Number
CPC - 18 Pin Connector - B Key	018 545 67 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-55   Connector #1, 18–pin Connector, B Key

The pin assignments for the Common Powertrain Controller #2 connector (18–pin) for crane applications are listed in Table 3-56.

The part numbers for the #2 connector, Key A and terminals are listed in Table 3-57.
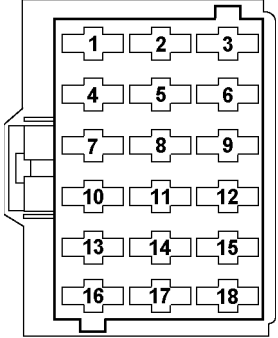
Pin	Signal Type	Function	Connector
2/1	Battery (+) PSU (KL_30)	Main Battery +12 V	
2/2	Battery (-) PSU (KL_31)	Main Battery Ground	
2/3	Battery (+) Switched PSU	Ignition	
2/4	K_DIAG_C	K-line	
2/5	J1708_A_C	J1587 (+)	
2/6	J1708_B_C	J1587 (–)	
2/7	Digital Input_FLEX_15	Service Brake Released Switch	
2/8	Digital Input_FLEX_16	Remote Throttle Select	
2/9	Digital Input_FLEX_09	Remote PTO Enable Switch	
2/10	Digital Output_LP_FLEX_03	Amber Warning Lamp	
2/11	Digital Input_FLEX_10	Limiter 1	
2/12	Digital Input_FLEX_11	A/C Status	
2/13	Digital Input_FLEX_12	Fan Override	
2/14	Digital Input_FLEX_13	Engine Brake Low	
2/15	Digital Input_FLEX_14	Engine Brake Medium	
2/16	VCAN_L_C	J1939 (-)	
2/17	VCAN_GND_C	J1939 Shield	
2/18	VCAN_H_C	J1939 (+)	

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Table 3-56   Connector #2 Pin Assignments – Crane Application

Part	DDC Part Number
CPC - 18 Pin Connector - A Key	013 545 64 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-57   Connector #2, 18–pin Connector, A Key

The pin assignments for the Common Powertrain Controller #3 connector (21–pin) for crane applications are listed in Table 3-58.

The part numbers for the #3 connector, Key A and terminals are listed in Table 3-59.
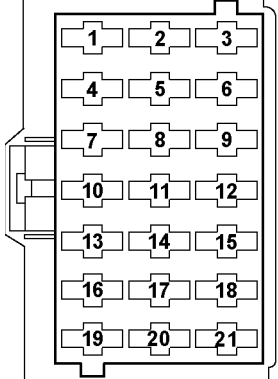
Pin	Signal Type	Function	Connector
3/1	Analog_In_01	—	
3/2	Analog_GND	Sensor Return	
3/3	Analog__SUP_5V	Sensor Supply	
3/4	Analog_In_02	PTO	
3/5	Analog_Out_01	Not Used	
3/6	Analog_Out_02	Not Used	
3/7	Digital Output_HP_HS_01	Not Used	
3/8	Digital Output_HP_HS_02	Not Used	
3/9	Digital Output_HP_LS_01	Engine Brake Active	
3/10	Digital Output_LP_FLEX_02	Low Battery Voltage Lamp	
3/11	SFP_14	Low Coolant Level Sensor	
3/12	Digital Output_LP_FLEX_04	Cruise Active Lamp	
3/13	SFP_09	Vehicle Speed (+)	
3/14	SF_VGND	Vehicle Speed (-)	
3/15	Analog_In_SFP_13	Ambient Air Temperature Sensor	
3/16	Digital Output_LP_FLEX_05	Red Stop Lamp	
3/17	Digital Output_HP_FLEX_02	Not Used	
3/18	Digital Input_SFP_02	Not Used	
3/19	Not Used	Not Populated	
3/20	Not Used	Not Populated	
3/21	Not Used	Not Populated	

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Table 3-58   Connector #3 Pin Assignments – Crane Application

Part	DDC Part Number
CPC - 21 Pin Connector - A Key	013 545 65 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-59   Connector #3, 21–pin Connector, Key A

The pin assignments for the Common Powertrain Controller #4 connector (18–pin) for crane applications are listed in Table 3-60

The part numbers for the #4 connector, Key C and terminals are listed in Table 3-61.

Pin	Signal Type	Function	Connector
4/1	C_ECAN_L	Engine CAN (-)	
4/2	C_ECAN_GND	Engine CAN Shield	
4/3	C_ECAN_H	Engine CAN (+)	
4/4	Digital Input_SFP_11	Not Populated	
4/5	Digital Input_SFP_12	Not Populated	
4/6	Digital Output_LP_FLEX_06	Wait to Start Lamp (Grid Heater)	
4/7	Digital Output_HP_LS_02	High Exhaust System Temperature Lamp	
4/8	Digital Input_FLEX_E1	Clutch Released	
4/9	Digital Output_HP_FLEX_01	Deceleration Lamp	
4/10	Digital Output_HP_HS_04	Vehicle Power Shutdown	
4/11	Frequency_SFP_10	Not Used	
4/12	PWM_FPO_01	Not Used	
4/13	Digital Input__FLEX_19	—	
4/14	Digital Input_SFP_03	Not Populated	
4/15	Digital Input_SFP_04	Not Populated	
4/16	Digital Input_FLEX_17	Trans Neutral Switch	
4/17	Digital Input_FLEX_21	DPF Regeneration Switch	
4/18	Digital Input_FLEX_18	RPM Freeze	

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Table 3-60   Connector #4 Pin Assignments – Crane Application

Part	DDC Part Number
CPC - 18 Pin Connector - C Key	A 018 545 68 26
CPC - socket 0.5-1.0mm wire (single)	A 013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	A 013 545 78 26

Table 3-61   Connector #4, 18–pin Connector, Key C

Transit Bus Applications

The pin assignments for the Common Powertrain Controller (CPC) #1 connector (18–pin) for transit bus applications are listed in Table 3-62.

The part numbers for the #1 connector, Key B and terminals are listed in Table 3-63.
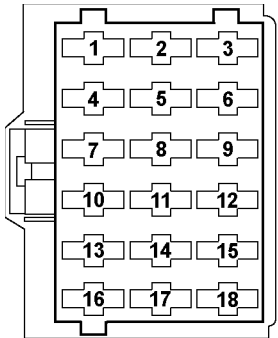
Pin	Signal Type	Function	Connector
1/1	Digital Input_FLEX_01	Transmission Retarder Active	
1/2	Digital Input_FLEX_02	Park Brake Interlock	
1/3	Digital Input_SFP_05	Idle Validation Switch 2 (throttle active)	
1/4	Digital Output_LP_LS_02	Throttle Position Sensor Ground	
1/5	Digital Output_LP_LS_01	DPF Regeneration Lamp	
1/6	Digital Input_SFP_06	Idle Validation Switch 1 (idle active)	
1/7	SFP_08	Throttle Position Sensor	
1/8	SFP_07	Throttle Position Sensor Supply	
1/9	PWM_FPO_02	Not Used	
1/10	Digital Input_FLEX_20	Stop Engine / Aux Shutdown #1	
1/11	Digital Input_FLEX_08	Limiter 0	
1/12	Digital Input_FLEX_03	Not Used	
1/13	Digital Output_LP_FLEX_01	MIL Lamp	
1/14	Digital Input_FLEX_04	Not Used	
1/15	Digital Input_FLEX_05	Stop Engine Override	
1/16	Digital Input_FLEX_06	Not Used	
1/17	Digital Input_FLEX_07	Throttle Inhibit	
1/18	SFP_01	Run Start	

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Table 3-62   Connector #1 Pin Assignments – Transit Bus Application

Part	DDC Part Number
CPC - 18 Pin Connector - B Key	018 545 67 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-63   Connector #1, 18–pin Connector, B Key

The pin assignments for the Common Powertrain Controller (CPC) #2 connector (18–pin) for transit bus applications are listed in Table 3-64.

The part numbers for the #2 connector, Key A and terminals are listed in Table 3-65.
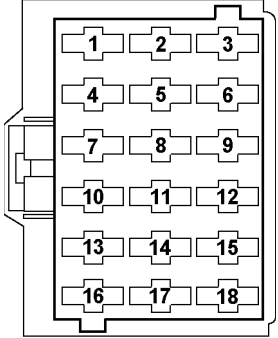
Pin	Signal Type	Function	Connector
2/1	Battery (+) PSU (KL_30)	Main Battery +12 V	
2/2	Battery (-) PSU (KL_31)	Main Battery Ground	
2/3	Battery (+) Switched PSU	Ignition	
2/4	K_DIAG_C	K-line	
2/5	J1708_A_C	J1587 (+)	
2/6	J1708_B_C	J1587 (−)	
2/7	Digital Input_FLEX_15	Not Used	
2/8	Digital Input_FLEX_16	Not Used	
2/9	Digital Input_FLEX_09	Not Used	
2/10	Digital Output_LP_FLEX_03	Amber Warning Lamp	
2/11	Digital Input_FLEX_10	Limiter 1	
2/12	Digital Input_FLEX_11	A/C Status	
2/13	Digital Input_FLEX_12	Not Used	
2/14	Digital Input_FLEX_13	Not Used	
2/15	Digital Input_FLEX_14	Not Used	
2/16	VCAN_L_C	J1939 (-)	
2/17	VCAN_GND_C	J1939 Shield	
2/18	VCAN_H_C	J1939 (+)	

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Table 3-64   Connector #2 Pin Assignments – Transit Bus Application

Part	DDC Part Number
CPC - 18 Pin Connector - A Key	013 545 64 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-65   Connector #2, 18–pin Connector, A Key

The pin assignments for the Common Powertrain Controller (CPC) #3 connector (21–pin) for transit bus applications are listed in Table 3-66.

The part numbers for the #3 connector, Key A and terminals are listed in Table 3-67.

Pin	Signal Type	Function	Connector
3/1	Analog_In_01	Not Used	
3/2	Analog_GND	Sensor Return	
3/3	Analog__SUP_5V	Sensor Supply	
3/4	Analog_In_02	PTO	
3/5	Analog_Out_01	Not Used	
3/6	Analog_Out_02	Not Used	
3/7	Digital Output_HP_HS_01	Not Used	
3/8	Digital Output_HP_HS_02	Not Used	
3/9	Digital Output_HP_LS_01	Not Used	
3/10	Digital Output_LP_FLEX_02	Coolant Level Low Lamp	
3/11	SFP_14	Low Coolant Level Sensor	
3/12	Digital Output_LP_FLEX_04	Low Oil Pressure Lamp	
3/13	SFP_09	Vehicle Speed (+)	
3/14	SF_VGND	Vehicle Speed (-)	
3/15	Analog_In_SFP_13	Ambient Air Temperature Sensor	
3/16	Digital Output_LP_FLEX_05	Red Stop Lamp	
3/17	Digital Output_HP_FLEX_02	Starter Lockout/Run Signal	
3/18	Digital Input_SFP_02	Not Used	
3/19	Not Used	Not Populated	
3/20	Not Used	Not Populated	
3/21	Not Used	Not Populated	

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Table 3-66   Connector #3 Pin Assignments – Transit Bus Application

Part	DDC Part Number
CPC - 21 Pin Connector - A Key	013 545 65 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-67   Connector #3, 21–pin Connector, Key A

The pin assignments for the Common Powertrain Controller (CPC) #4 connector (18–pin) for transit bus applications are Table 3-66, and listed in Table 3-68.

The part numbers for the #4 connector, Key C and terminals are listed in Table 3-69.

Pin	Signal Type	Function	Connector
4/1	C_ECAN_L	Engine CAN (-)	
4/2	C_ECAN_GND	Engine CAN Shield	
4/3	C_ECAN_H	Engine CAN (+)	
4/4	Digital Input_SFP_11	Not Populated	
4/5	Digital Input_SFP_12	Not Populated	
4/6	Digital Output_LP_FLEX_06	Wait to Start Lamp (Grid Heater)	
4/7	Digital Output_HP_LS_02	High Exhaust System Temperature Lamp	
4/8	Digital Input_FLEX_E1	Not Used	
4/9	Digital Output_HP_FLEX_01	Deceleration Lamp	
4/10	Digital Output_HP_HS_04	Vehicle Power Shutdown	
4/11	Frequency_SFP_10	Not Used	
4/12	PWM_FPO_01	Not Used	
4/13	Digital Input__FLEX_19	—	
4/14	Digital Input_SFP_03	Not Populated	
4/15	Digital Input_SFP_04	Not Populated	
4/16	Digital Input_FLEX_17	Neutral Switch	
4/17	Digital Input_FLEX_21	DPF Regeneration Switch	
4/18	Digital Input_FLEX_18	Not Used	

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Table 3-68   Connector #4 Pin Assignments – Transit Bus Application

Part	DDC Part Number
CPC - 18 Pin Connector - C Key	A 018 545 68 26
CPC - socket 0.5-1.0mm wire (single)	A 013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	A 013 545 78 26

Table 3-69   Connector #4, 18–pin Connector, Key C

VIH to MCM Connector Wiring

The wiring for the 21–pin MCM connector is listed in Table 3-70. The side of the connector shown is looking into the pins.
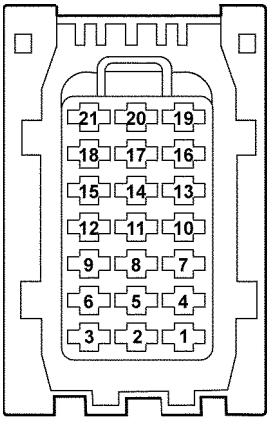
Pin	Signal Type	Function	Connector
21/1	CAN2L	Not Used	
21/2	CAN2GND	Not Used	
21/3	CAN2H	Not Used	
21/4	CAN2GND	Not Used	
21/5	KL31	Battery (-)	
21/6	KL31	Battery (-)	
21/7	KL15	IGN	
21/8	KL31	Battery (-)	
21/9	KL31	Battery (-)	
21/10	CAN1GND	Engine CAN Shield	
21/11	KL30	Battery (+)	
21/12	KL30	Battery (+)	
21/13	CAN1H	Engine CAN +	
21/14	KL30	Battery (+)	
21/15	KL30	Battery (+)	
21/16	CAN1GND	Not Used	
21/17	Not Used	Not Used	
21/18	KDiag_S	Not Used	
21/19	CAN1L	Engine CAN –	
21/20	KL50	Crank Start Input	
21/21	START_B	Crank Activation Output	

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Table 3-70   21–Pin Connector to the MCM

Part	DDC Part Number
Connector	024 545 76 26
1.0 – 2.5 mm Contact (single)	014 545 82 26
0.5 – 1.0 mm Contact (single)	014 545 83 26
Seal (2.2 – 3.0 mm^2 insulation diameter)	000 545 29 39
Seal (1.2 – 2.1 mm^2 insulation diameter)	000 545 28 39
Backshell	001 545 79 83
Cavity Plug	000 545 62 80

Table 3-71   21–Pin Connector to the MCM Part Numbers

The part numbers for the 31–pin MCM pigtail connector are listed in Table 3-72.

Part	DDC Part Number
Connector	008 545 31 26
Terminal	006 545 52 26
Seals	000 545 72 80
Cavity Plugs	000 545 62 80
Backshell	000 546 99 35

Table 3-72   31–pin MCM Pigtail Connector Part Numbers

The pinout for the 31–pin pigtail on the Engine Harness is listed in Table 3-73. The OEM is responsible for wiring to this connector.

31–pin	120–pin	Function	Series 60	MBE 900	MBE 4000	HDE
31/1	—	Spare	—	—	—	—
31/2	—	Power Supply (IGN)*	—	—	—	X
31/3	—	Fuel Heater Supply #1†	—	X	—	X
31/4	—	Spare	—	—	—	—
31/5	—	Fuel Heater Supply #2†	—	X	—	X
31/6	—	Spare	—	-	—	—
31/7	—	Power Supply Ground*	—	—	—	X
31/8	120/70	Ether Start	X	—	—	—
31/9	120/33	Fan Control #2 – High of Two-speed Fan or Variable Speed Fan	X	X	X	X
31/10	120/98	Single Speed Fan or Low for Two-speed Fan	X	X	X	X
31/11	—	Fuel Heater Ground #1†	—	X	—	X
31/12	—	Spare	—	—	—	—
31/13	—	Spare	—	—	—	—
31/14	120/71	Water-in-Fuel Sensor Supply	—	X	—	—
31/15	120/67	Water-in-Fuel Sensor Ground	—	X	—	—
31/16	120/96	Engine Brake Solenoid Control	—	X	—	—
31/17	120/29	DOC Outlet Temp Sensor (Exhaust Gas Temperature in Front of Particulate Trap)	X	X	X	X
31/18	120/89	DOC Inlet Temp Sensor	X	X	X	X
31/19	120/115	DPF Outlet Temp Sensor(Exhaust Gas Temperature After Particulate Trap)	X	X	X	X
31/20	—	Fuel Heater Ground #2†	—	X	—	X
31/21	—	Spare	—	—	—	—
31/22	120/91	Power Supply (Eng Brk, Fan, Ether)	X	X	X	X
31/23	120/47	Fan Speed	X	X	X	X
31/24	120/88	Sensor Ground	X	X	X	X
31/25	120/59	HDMS Fan Thermal Switch	X	—	X	X
31/26	120/57	Water-in-Fuel Sensor	—	X	—	—
31/27	120/86	TCI Temp	X	—	—	—
31/28	120/114	Sensor Ground	X	X	X	X
31/29	120/85	Sensor Supply	X	X	X	X
31/30	120/30	DPF Outlet Pressure Sensor (Exhaust Gas Pressure After Particulate Filter)	X	X	X	X
31/31	120/118	DPF Inlet Pressure Sensor (Exhaust Gas Pressure Before Particulate Filter)	X	X	X	X

*Fused at 15 amps
† Optional for MBE 900 and HDE. Must use 14 AWG wire and fuse at 20A.

Table 3-73   31–pin MCM Pigtail Connector

VIH Power Wiring

The OEM-supplied VIH power wiring (see Figure 3-11) supplies 12 volts to the CPC and MCM. The system must be sourced directly from the battery. The terminals are designed to accept 14 AWG wire with an insulation diameter of 3.2 mm minimum and 5.6 mm maximum.
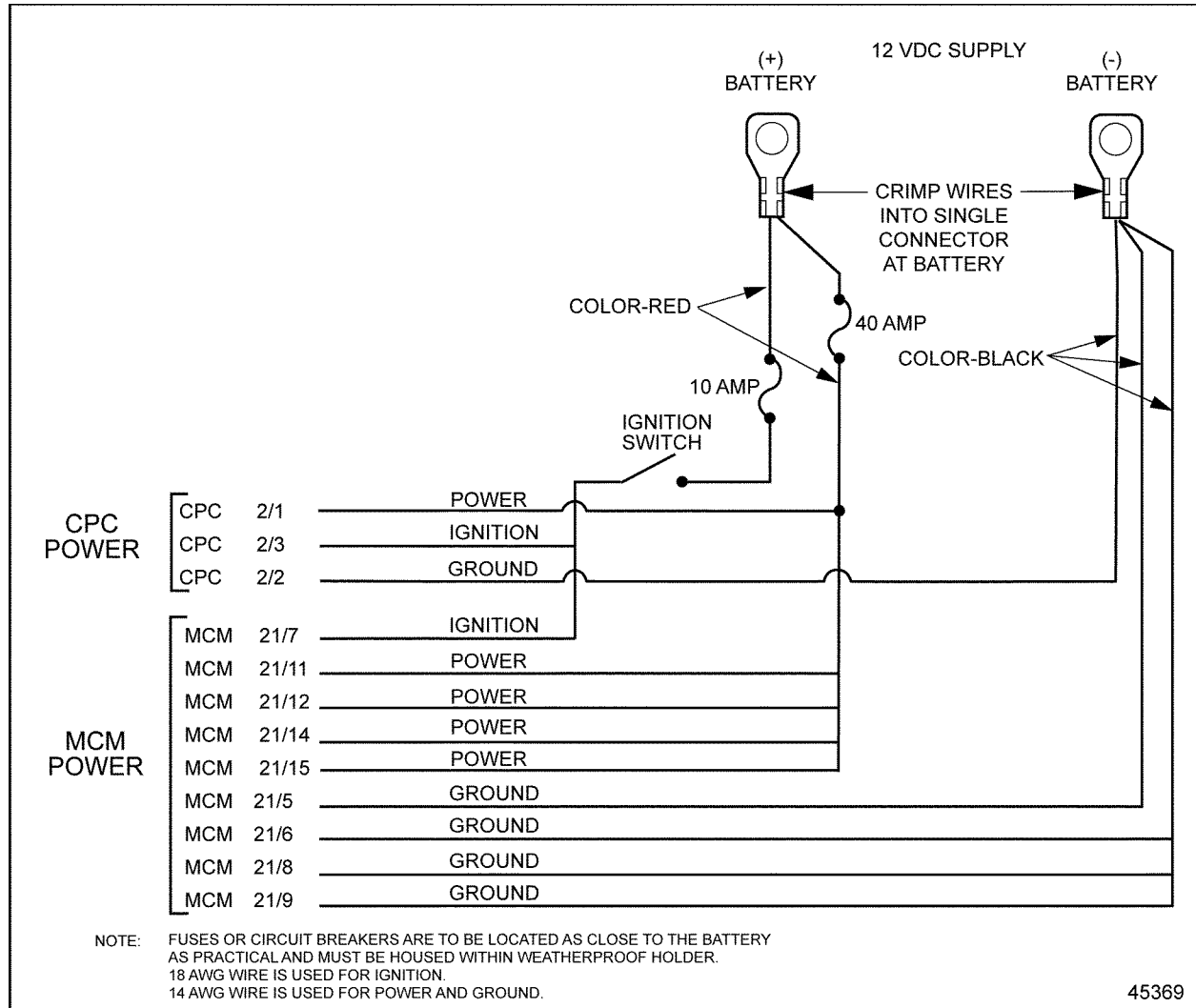
Figure 3-11   Power Wiring

Power and ground must be sourced directly from the battery. An electrically solid connection to the battery or bus bar is required so the battery can filter electrical noise from the power lines. Power for other vehicle systems must not be sourced from the VIH power wires. ***Do not*** use chassis ground.

NOTE:
The ground wire must be electrically separate from chassis ground.

Power and ground bus bars may be used. The bus bar must be connected to the battery posts with 0 AWG or larger wire depending upon the total vehicle current requirement. The connecting wires must be as short as possible to minimize circuit resistance. ***Do not*** connect the ground wire to the chassis ground. The bus bar and all related MCM and CPC ground circuity must **not** be any part of the chassis ground circuit.

Provide maximum physical separation of the VIH power wiring from other vehicle electrical systems. Other electrical system wires should ideally be at least three feet away from the VIH power wiring and should not be parallel to the VIH power wiring. This will eliminate coupling electromagnetic energy from other systems into the VIH power wiring.

NOTICE:
Connection to reverse polarity will damage the system if not properly fused.

A 40 amp fuse must be used and installed as close to the battery as possible.

The conductor must be annealed copper not aluminum and must comply with the industry standard, *SAE J1128 JAN 95 Low Tension Primary Cable*. Contact the Society of Automotive Engineers to obtain documents, refer to Appendix for their address.

Splices must be soldered and sealed with a waterproof insulator. Alpha FIT-300, Raychem TAT-125 or any equivalent heat shrink - dual wall epoxy encapsulating adhesive polyolefin is required.

Detroit Diesel Corporation recommends color coding. Alternatively, wires may be hot stamped with the cavity number.

Wire Resistances

VIH power terminals require 14 AWG wire. The total resistance of the power harness cannot exceed 60 mΩ. The characteristics for Teflon coated and GXL type wire gauges are listed in listed in Table 3-74.

SAE Wire Gauge	Metric Gauge #	Area mm²	Resistance mΩ/m	Resistance mΩ/ft @ 20°C	Resistance mΩ/ft @ 120°C	Diameter mm
16	1	1.129	15.300	4.66	6.50	0.72
14	2	1.859	9.290	2.83	3.94	1.18
12	3	2.929	5.900	1.80	2.50	1.86
10	5	4.663	3.720	1.13	1.58	2.97
8	8	7.277	2.400	0.73	1.02	4.63

Table 3-74   Wire Characteristics

Total power harness resistance is determined by shorting together the eight terminals in the ECU connector, and then measuring the resistance from the battery (+) to battery (-) terminal at the maximum operating temperature (105°C). Disconnect the harness from the batteries before measuring the resistance.

Communications – SAE J1939 Data Link

SAE J1939 Data Link+, SAE J1939 Data Link-, and SAE J1939 Data Link Shield are used as the J1939 communication link. J1939 cable is required for the J1939 data link. Termination resistors are required per the SAE specification. Refer to SAE J1939–11 for specific requirements.

NOTICE:
The communication system operation will degenerate if the wrong cable is used.

The CPC connector pin assignments for SAE J1939 are listed in Table 3-75.

Pin	Signal Type	Function
2/18	Data Link	SAE J1939 (+)
2/17	Data Link	J1939 Shield
2/16	Data Link	SAE J1939 (-)

Table 3-75   J1939 CPC to VIH Connector Pin Assignments

The following SAE documents cover the SAE J1939 Data Link. Contact the Society of Automotive Engineers to obtain documents, refer to Appendix C for their address.

SAE J1939	Top Layer (Overview)
SAE J1939/11	Physical Layer
SAE J1939/21	Data Link Layer
SAE J1939/71	Vehicle Application Layer
SAE J1939/01	Truck and Bus Applications
SAE J1939/73	Application Layer — Diagnostics

J1939 cable is available from the following sources:

Belden Electronics Division

2200 U.S. 27 South

Richmond, IN 47374

Phone: 1–800–235–3361

www.belden.com

Tyco Electronics Corporation

Raychem Wire & Harnessing

300 Constitution Drive

Menlo Park, CA 94025

www.raychem.com

Communications – Proprietary Engine-CAN Data Link

The low speed proprietary Engine-CAN link between the MCM and the CPC must be a twisted shielded cable with 0.75 mm diameter wire (approximately 20 AWG), bundle shielded with drain wire and 30 twists per meter. The insulation is rated to 105°C. Termination resistors for the Engine-CAN link are located in the CPC and MCM. The wiring for the MCM 21–pin connector and the CPC 18–pin #4 connector are listed in Table 3-76.

CPC 18–Pin #4 Connector	Function	MCM 21–Pin Connector
4/3	Engine-CAN Data Link (+)	21/13
4/1	Engine-CAN Data Link (-)	21/19
4/2	Engine-CAN Data Link (Shield)	21/10

Table 3-76   Propriety Engine-CAN Data Link

3.2.4   POWER SUPPLY – 12 VOLT SYSTEM

Normal operating voltage on a 12 V system for the CPC and MCM is 11-16 VDC.

NOTICE:
Operating the CPC or MCM over the voltage limits of 16 volts will cause damage to the CPC or MCM.

Operating the CPC and/or MCM between 8 and 11 volts may result in degraded engine operation. (Transient operation in this range during engine starting is considered normal for 12 volt systems.)

NOTICE:
Reversing polarity will cause damage to the CPC and/or MCM if the Power Harness is not properly fused.

NOTE:
All output loads, ignition and CPC power must be powered from the same battery voltage source.

Average Current Draw

The maximum average current draw is listed in Table 3-77. This information should be used to size the alternator.

System	Maximum Average Current Draw (12 V Nominal Supply)		
	Crank	Idle	Full Load/Rated Speed
MCM – Engine Loads	1.0 A avg	21.0 A avg	25.0 A avg
CPC – Vehicle Loads*	18.0 A peak	55.0 A peak	55.0 A peak

* Vehicle loads are controlled by the OEMs who can best determine the total maximum current draw for their installation.

Table 3-77 Maximum Average Current Draw

The current draw for a CPC configuration is listed in Table 3-78.

Configuration	Condition	Current
CPC	Ignition Off	<1 mA
	Ignition On and Engine Stopped	120 mA

Table 3-78 Current Draw for CPC Configuration

The current draw for a MCM is listed in Table 3-79.

Configuration	Condition	Current
MCM	Ignition Off	<1 mA
	Ignition On and Engine Stopped	400 mA

Table 3-79 Current Draw for MCM Configuration

Battery Isolator

A battery isolator is not required. However, some applications require a battery that is dedicated to the engine and completely isolated from the rest of the vehicle. Commercially available battery isolators can be used.

Main Power Shutdown

The main power supply shutdown schematic shows the DDC approved method for main power switch implementation. See Figure 3-12.
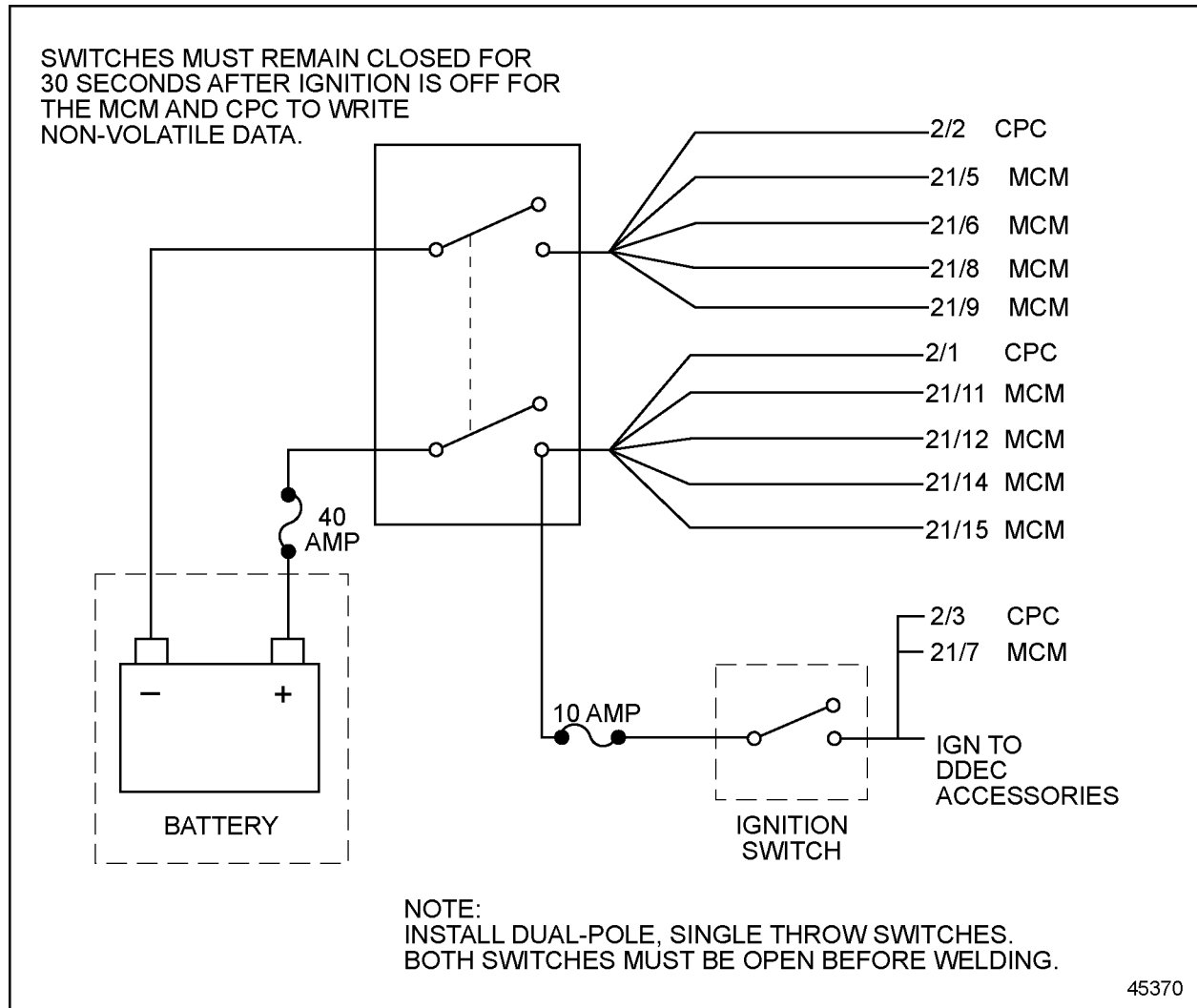
Figure 3-12   Main Power Supply Shutdown

NOTE:
Switches must remain closed for 30 seconds after ignition is off for the MCM and CPC to write non-volatile data.

NOTE:
It is recommended that both the positive (+) and negative (-) battery leads be disconnected.

NOTE:
Disconnecting positive power is not sufficient to isolate the CPC for welding purposes.

NOTICE:
When welding, the following must be done to avoid damage to the electronic controls or the engine:
□ Both the positive (+) and negative (-) battery leads must be disconnected before welding.
□ The welding ground wire must be in close proximity to welding location - the engine must never be used as a grounding point.
□ Welding on the engine or engine mounted components is NEVER recommended.

NOTE:
The alternator should be connected directly to the battery for isolation purposes.

3.2.5   FUSES

A Battery (+) fuse and an ignition circuit fuse must be provided by the vehicle wiring harness. Blade-type automotive fuses are normally utilized; however, manual or automatic reset circuit breakers which meet the following requirements are also acceptable. The fuse voltage rating must be compatible with the CPC – MCM's maximum operating voltage of 16 volts.

⚠ **CAUTION:**
FIRE
To avoid injury from fire, additional loads should not be placed on existing circuits. Additional loads may blow the fuse (or trip the circuit breaker) and cause the circuit to overheat and burn.

```
  ⚠ CAUTION:

         FIRE

To avoid injury from fire, do not replace an existing fuse with
a larger amperage fuse. The increased current may overheat
the wiring, causing the insulation and surrounding materials
to burn.
```

The ignition fuse current rating must be sized for the loads utilized in each application; however, a rating of between 5 and 10 amps is usually sufficient.

The Battery (+) fuse current rating must satisfy two criteria:

☐ Must not open during normal operation

☐ Must open before the MCM or CPC is damaged during a reverse battery condition

Bussmann ATC-30 and Delphi Packard Electric Systems MaxiFuse 30 amp rated fuses or equivalent will satisfy these requirements. Acceptable blow times versus current and temperature derating characteristics are listed in Table 3-80 and Table 3-81.

% of Rated Fuse Current	Minimum Blow Time	Maximum Blow Time
100%	100 hours	-
135%	1 minutes	30 minute
200%	6 seconds	40 seconds

Table 3-80   Fuse Current and Blow Time

Temperature	% of Rated Fuse Current
-40°C	110% max
+25°C	100%
+120°C	80% min

Table 3-81   Fuse Temperature and Current

3.2.6 CONNECTORS

There are three 18–pin connectors and one 21–pin connector to the CPC. The OEM is responsible for the four connectors at the CPC, the 21–pin connector at the MCM, the 31–pin MCM pigtail connector and the 10–pin DPF connector.

NOTE:
The CPC connectors are not water tight and cannot be subject to water spray.

The part numbers for the CPC connectors, the 21–pin connector at the MCM, the 31–pin MCM pigtail connector and the 10–pin DPF connector are listed in the following tables.

Part	DDC Part Number
CPC - 18 Pin Connector - B Key	018 545 67 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-82   Connector #1, 18–pin Connector, B Key

Part	DDC Part Number
CPC - 18 Pin Connector - A Key	013 545 64 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-83   Connector #2, 18–pin Connector, A Key

Part	DDC Part Number
CPC - 21 Pin Connector - A Key	013 545 65 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-84   CPC Connector #3, 21–pin Connector, Key A

Part	DDC Part Number
CPC - 18 Pin Connector - C Key	018 545 68 26
CPC - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 3-85   CPC Connector #4, 18–pin Connector, Key C

Part	DDC Part Number
Connector	024 545 76 26
1.0 – 2.5 mm Contact (single)	014 545 82 26
0.5 – 1.0 mm Contact (single)	014 545 83 26
Seal (2.2 – 3.0 mm^2 insulation diameter)	000 545 29 39
Seal (1.2 – 2.1 mm^2 insulation diameter)	000 545 28 39
Backshell	001 545 79 83
Cavity Plug	000 545 62 80

Table 3-86   21–Pin Connector to the MCM Part Numbers

Part	DDC Part Number
Connector	008 545 31 26
Terminal	006 545 52 26
Seals	000 545 72 80
Cavity Plugs	000 545 62 80
Backshell	000 546 99 35

Table 3-87   31–pin MCM Pigtail Connector Part Numbers

Part	DDC Part Numbers
10-Pin Connector	23531613
Terminal (Male)	23531614
Plug	23531615
2-Pin Connector	23537171
Terminal (Female)	23531617

Table 3-88   DDC Part Numbers for the DPF 10-pin and 2–pin Connector — Horizontal Mount ATD

Part	DDC Part Numbers
Connector	23531613
Terminal	23531614
Plug	23531615

Table 3-89   DDC Part Numbers for the DPF 10-pin Connector — Vertical Mount ATD

Data Link Connector

The SAE J1708/J1587 nine-pin data link connector is required. DDC recommends that the OEM-supplied Data Link Connector be conveniently positioned in a well protected location facilitating subsequent DDDL 7.0 usage (i.e., reprogramming, diagnostics, etc.).

→ REQUIRED: The J1939 data link must be wired to this connector.

The components listed in Table 3-90 are required to incorporate a SAE J1939/J1587 Data Link in a VIH for diagnostic and reprogramming devices.

Component	DDC Part Number	Deutsch Part Number
Nine-pin Deutsch Connector	23529496	HD10-9-1939P
Connector Cover	23529497	HDC 16–9
Two (2) Cavity Plugs	23507136	114017
Seven (7) Terminals	23507132	0460-202-16141

Table 3-90   VIH Components to Incorporate an SAE J1939/J1587 Data Link

The following illustration shows the wiring for the nine-pin connector (see see Figure 3-13).

FRONT VIEW
OF CONNECTOR

CAVITY	LABEL
A	BATTERY GROUND
B	+12V DC
C	J1939 DATA LINK (+)
D	J1939 DATA LINK (-)
E	J1939 SHIELD
F	J1587 DATA LINK (+)
G	J1587 DATA LINK (-)
H	PLUG
J	PLUG

42502
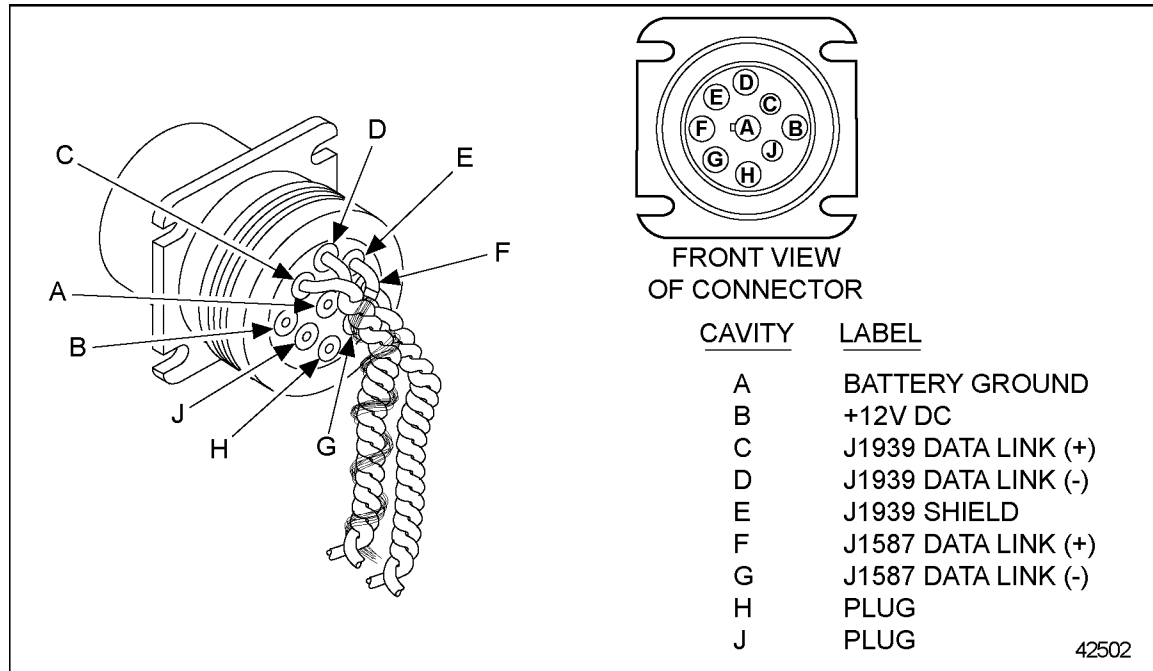
Figure 3-13   Wiring for 9-pin Data Link Connector

The SAE J1587/J1708 Data Link must be twisted pairs. The twists are a minimum of 12 turns per foot (305 mm). The maximum length for the SAE J1587/J1708 Data Link is 130 ft (40 m).

3.3   WIRES AND WIRING

Detroit Diesel Corporation recommends color coding and hot stamping wire numbers in contrasting colors at intervals of four inches or less.

3.3.1   GENERAL REQUIREMENTS

NOTE:
Avoid renumbering DDC circuits since all troubleshooting guides reference the circuit numbers shown in the schematic. DDC suggests including a prefix or suffix with the DDC circuit numbers when conflicts exist.

3.3.2   GENERAL WIRE

All wires used in conjunction with DDEC VI must meet the following criteria:

NOTICE:
DDC does not recommend using any type of terminal lubricant or grease compounds. These products may cause dirt or other harmful substances to be retained in the connector. DDC has not tested these products and cannot stand behind their use.

NOTICE:
Insulation must be free of nicks.

➔   **Criteria: Wires**

Tape, conduit, loom or a combination thereof must be used to protect the wires. Refer to sections 3.4 and 3.5.

All wires must be annealed copper wire (not aluminum).

All wires must comply with SAE J1128.

All wires must be insulated with cross-link polyethylene (XLPE) such as GXL, or any self-extinguishing insulation having a minimum rating of -40°C (-40°F) to 125°C (257°F).

3.3.3 CRIMP TOOLS

The part numbers for the crimp tools for working with the MCM and CPC connectors are listed in Table 3-91.

Description	Part Number
Extraction Tool	726503–1
Hand Crimp Tool	169400–0
Crimp Dies for 0.5 mm – 1.0 mm Terminals	734262–0
Crimp Dies for 1.0 mm – 2.5 mm Terminals	169917–0

Table 3-91   Crimp Tools

3.3.4 DEUTSCH TERMINAL INSTALLATION AND REMOVAL

The method of terminal installation and removal varies. The following sections cover Deutsch terminal installation and removal.

Deutsch Terminal Installation Guidelines

Deutsch connectors have cable seals molded into the connector. These connectors are push-to-seat connectors with cylindrical terminals. The diagnostic connector terminals are gold plated for clarity.

NOTICE:
Improper selection and use of crimp tools have varying adverse effects on crimp geometry and effectiveness. Proper installation of terminals require specialized tools. Do not attempt to use alternative tools.

The crimp tool to use in Deutsch terminal installation is J–34182 (Kent-Moore part number).

NOTICE:
Terminal crimps must be made with the Deutsch crimp tool P/N: HDT-48-00 to assure gas tight connections.

NOTICE:
If a separate seal is required, be sure to install the seal onto the wire before stripping the insulation.

Use the following instructions for installing Deutsch terminals:

1. Strip approximately .25 inch (6 mm) of insulation from the cable.

2. Remove the lock clip, raise the wire gage selector, and rotate the knob to the number matching the gage wire that is being used.

3. Lower the selector and insert the lock clip.

4. Position the contact so that the crimp barrel is 1/32 of an inch above the four indenters. See Figure 3-14. Crimp the cable.
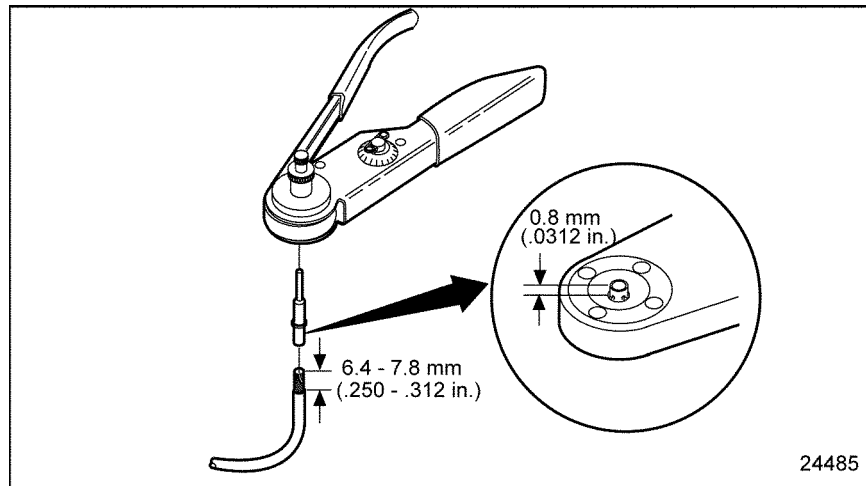
Figure 3-14   Setting Wire Gage Selector and Positioning the Contact

5. Grasp the contact approximately one inch behind the contact crimp barrel. Hold the connector with the rear grommet facing you. See Figure 3-15.
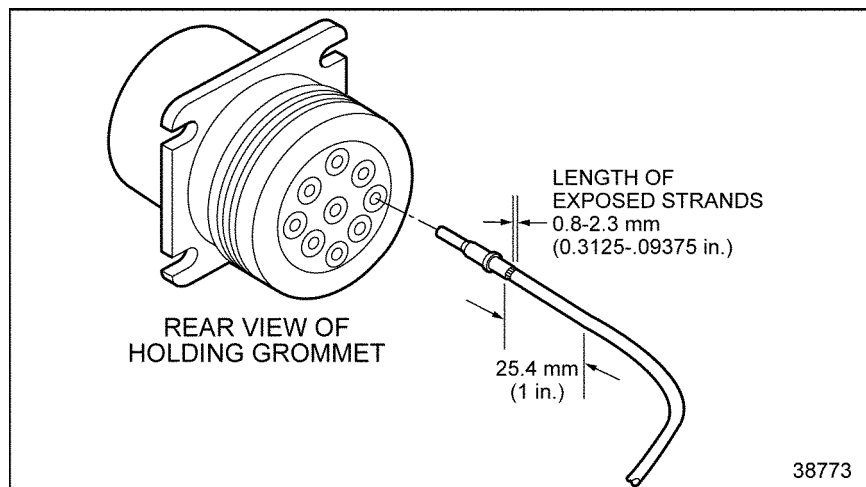
Figure 3-15   Pushing Contact Into Grommet

6. Push the contact into the grommet until a positive stop is felt. See Figure 3-15. A slight tug will confirm that it is properly locked into place. See Figure 3-16.
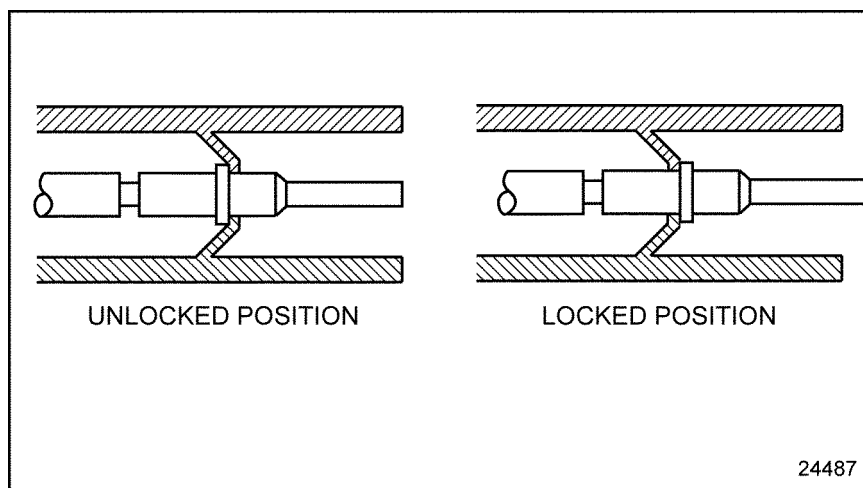
Figure 3-16   Locking Terminal Into Connector

Deutsch Terminal Removal

The appropriate size removal tool should be used when removing cables from connectors. The proper removal tools are listed in Table 3-92.

Tool	Kent-Moore Part Number
Removing (12 AWG)	J–37451
Removing (16-18 AWG)	J–34513-1

Table 3-92   Removal Tools for Deutsch Terminals

Remove Deutsch terminals as follows:

1. With the rear insert toward you, snap the appropriate size remover tool over the cable of contact to be removed. See Figure 3-17.

38774
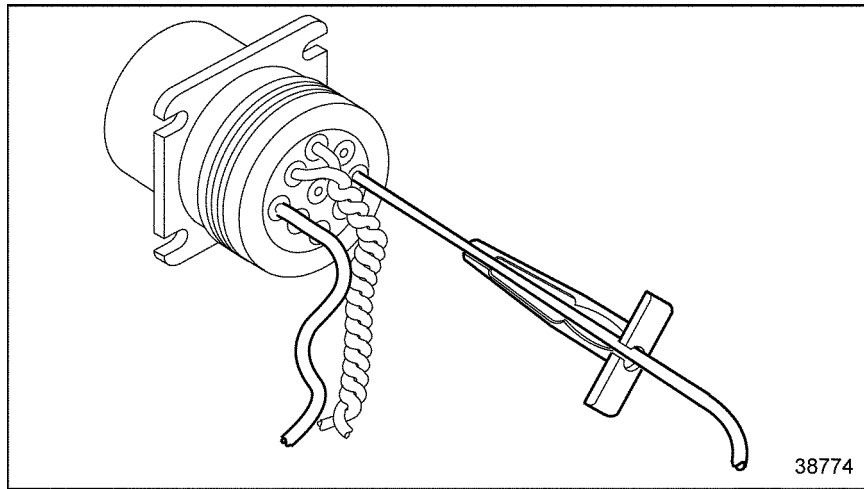
Figure 3-17   Removal Tool Position

2. Slide the tool along the cable into the insert cavity until it engages and resistance is felt. Do not twist or insert tool at an angle. See Figure 3-18.

38775
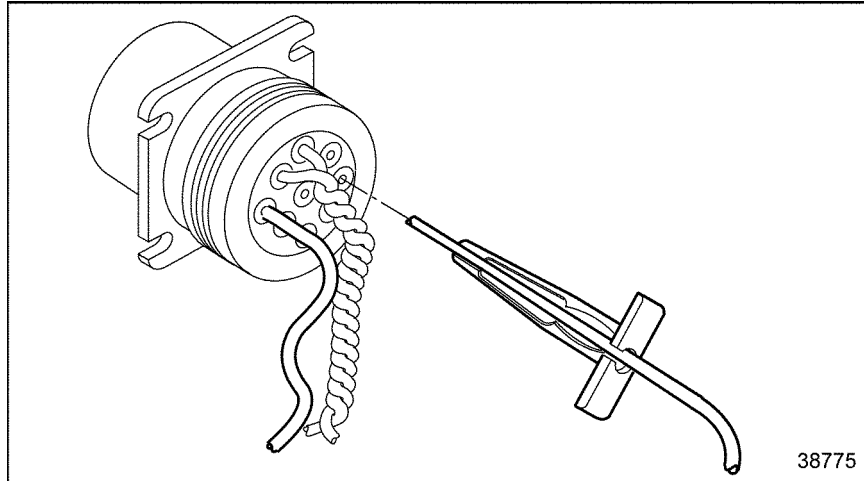
Figure 3-18   Removal Tool Insertion

3. Pull contact cable assembly out of the connector. Keep reverse tension on the cable and forward tension on the tool.

3.3.5 SPLICING GUIDELINES

The following are guidelines which may be used for splices. The selection of crimpers and splice connectors is optional. Select a high quality crimper equivalent to the Kent-Moore tool, J–38706, and commercially available splice clips.

The recommended technique for splicing and repairing circuits (other than power and ignition circuits) is a clipped and soldered splice. Alternatively, any method that produces a high quality, tight (mechanically and electronically sound) splice with durable insulation is considered to be acceptable.

Clipped and Soldered Splicing Method

The tools required are listed in Table 3-93.

Tool	Part Number
Heat Gun	--
Sn 60 solder with rosin core flux	--
Wire Stripper	Kent-Moore J–35615 or equivalent
Splice Clips (commercially available)	Wire size dependent
Heat Shrink Tubing	Raychem HTAT or equivalent

Table 3-93   Recommended Splicing Tools

➔ **Criteria: Splicing Straight Leads**

No more than one strand in a 16 strand wire may be cut or missing.

Use Sn 60 solder with rosin core flux.

The exposed wire must be clean before the splice is soldered.

Soldering splice connectors is optional. To solder splice connectors:

1. Position the leads, so one overlaps the other. See Figure 3-19.
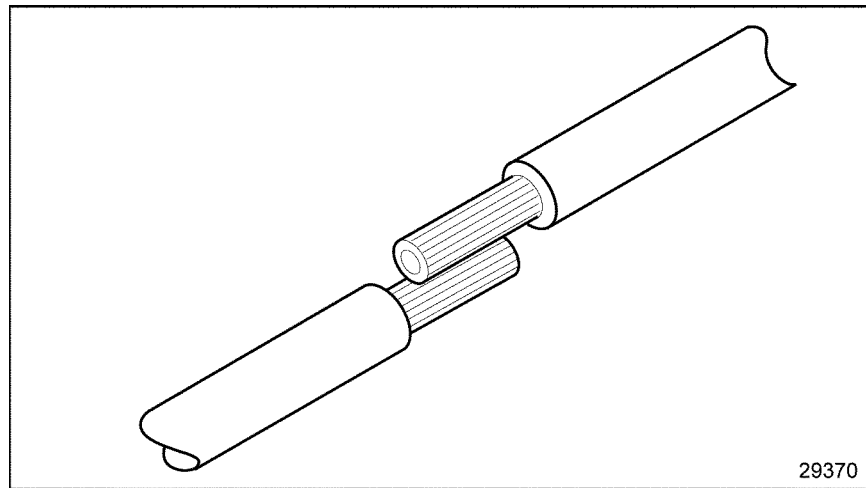
Figure 3-19   Positioning the Leads

2. Secure the leads with a commercially available clip and hand tool. See Figure 3-20.
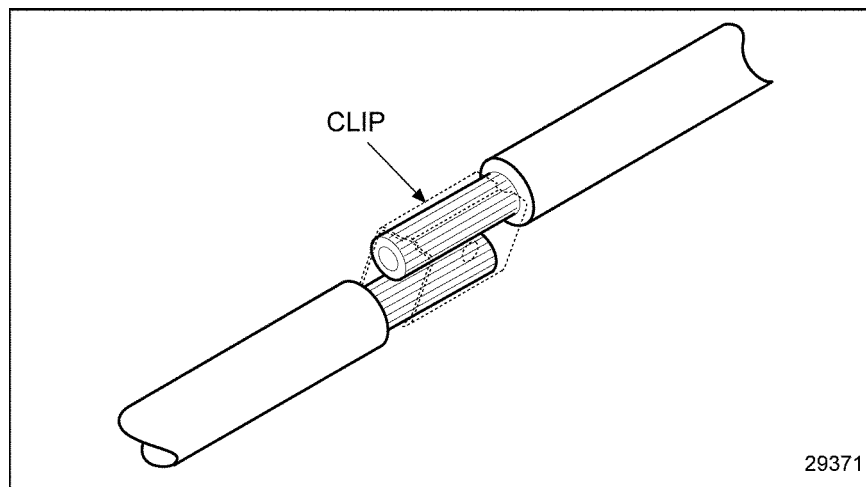
Figure 3-20   Securing the Leads With a Clip

3. Use a suitable electronic soldering iron to heat the wires. Apply the solder to the heated wire and clip (not to the soldering iron) allowing sufficient solder flow into the splice joint.

4. Pull on wire to assure crimping and soldering integrity. The criteria listed in Table 3-94 must be met.

Wire Gage	Must Withstand Applied Load
14 AWG	45 lb (200 N)
16 AWG	27 lb (120 N)
18 AWG	20 lb (90 N)

Table 3-94   Applied Load Criteria for Terminals

5. Loop the lead back over the spliced joint and tape. See Figure 3-21.
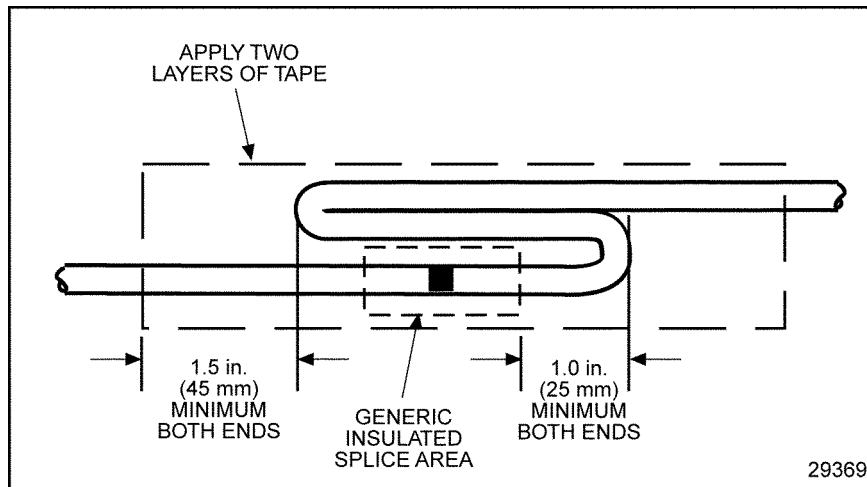
Figure 3-21   Recommended Strain Relief of Spliced Joint

Splicing and Repairing Straight Leads-Alternate Method 1

The tools required are listed in Table 3-95.

Tool	Part Number
Heat Gun	--
Wire Stripper	Kent-Moore J–35615 or equivalent
Splice Clips (commercially available)	Wire size dependent
Heat Shrink Tubing	Raychem HTAT or equivalent
Terminal Crimper for Metri-Pack 280 (12 AWG)	Kent-Moore J–38125-6
Terminal Crimper for Metri-Pack 280 (18 AWG)	Kent-Moore J–39848
Terminal Crimper for Weather Pack	Kent-Moore J–35606
Terminal Crimper for Deutsch	Kent-Moore J–34182
Terminal Crimper for Metri-Pack 150	Kent-Moore J–35123

Table 3-95   Recommended Splicing Tools

➡️ **Criteria: Splicing Straight Leads**

No more than one strand in a 16 strand wire may be cut or missing.

The recommended method to splice straight leads follows:

1. Locate broken wire.

2. Remove insulation as required; be sure exposed wire is clean and not corroded.

3. Insert one wire into the splice clip until it butts against the clip. Stop and crimp (see Figure 3-22, A).

4. Insert the other wire into the splice clip until it butts against the clip stop (see Figure 3-22, B).

NOTICE:
Any terminal that is cracked or ruptured is unacceptable as malfunctions may occur.

5. Visually inspect the splice clip for cracks, rupture, or other crimping damage. Remove and replace damaged clips before proceeding.

6. Pull on wire to ensure the splice integrity. The criteria listed in Table 3-96 must be met.

Wire Gage	**Must Withstand Applied Load**
14 AWG	45 lb (200 N)
16 AWG	27 lb (120 N)
18 AWG	20 lb (90 N)

Table 3-96   Applied Load Criteria for Terminals

7. Shrink the splice clip insulative casing with a heat gun to seal the splice (see Figure 3-22, C).

NOTICE:
Splices may not be closer than 12 in. (.3 m) apart to avoid degradation in circuit performance. Replace wire to avoid having splices closer than 12 in. (.3 m) apart.

8. Loop the lead back over the spliced joint and tape. See Figure 3-21.

CRIMP TO PROVIDE A SOLID CONNECTION.

SPLICE CLIP

(A)

REMOVE ENOUGH INSULATION SO IT CONTACTS THE STOP & CONNECTOR,
BUT DOESN'T EXTEND PAST THE CLIP INSULATOR.

(B)

(C)

SPLICE MUST BE MECHANICALLY AND ELECTRICALLY SOUND.
NO BARE COPPER WIRE MAY BE EXPOSED.

NOTICE
Splices may not be closer than 12 in. (.3 m) apart to avoid degradation in circuit performance. Replace wire to avoid having splices closer than 12 in (.3 m) apart.

37245
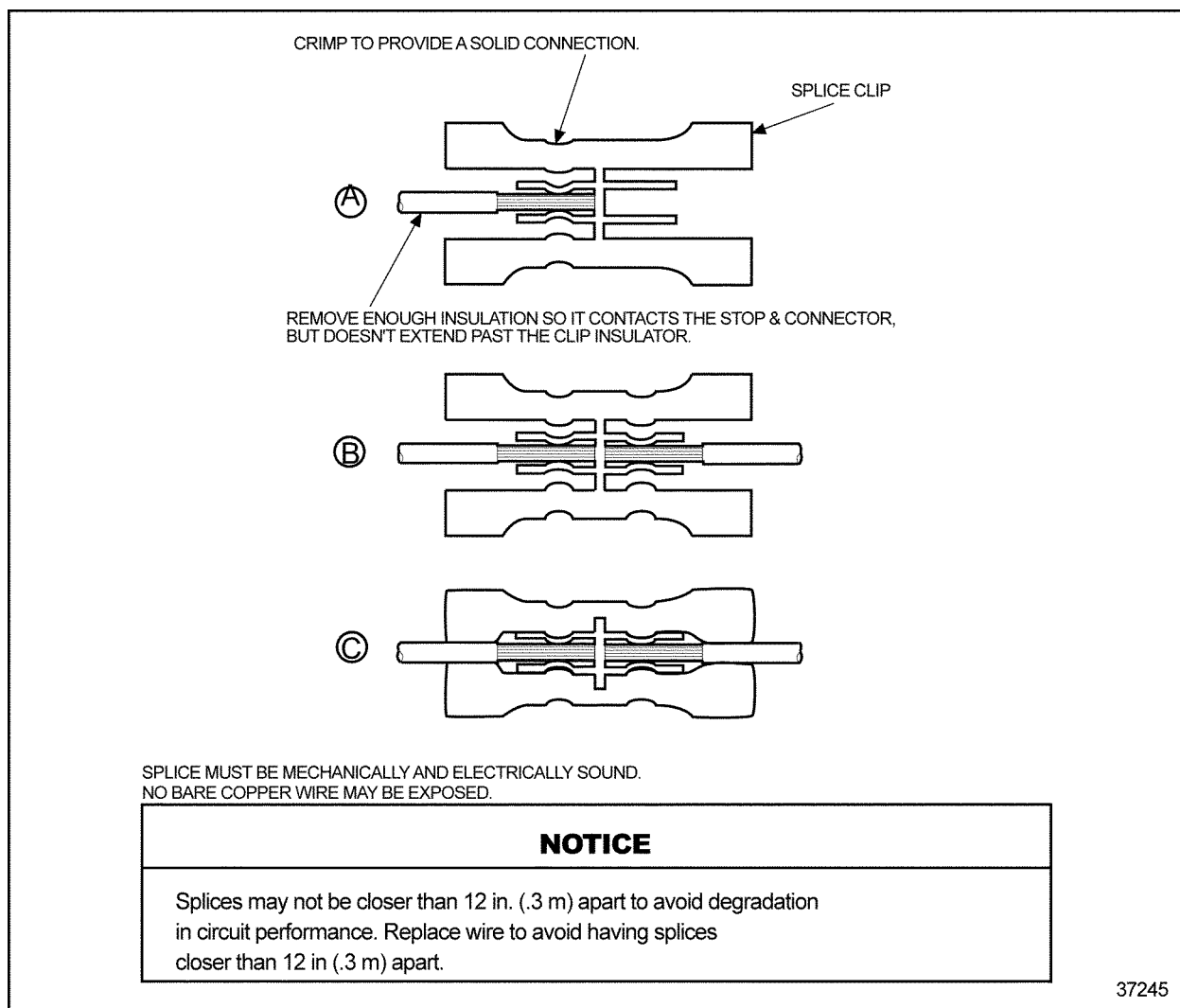
Figure 3-22   Splicing Straight Leads - Alternate Method 1

Splicing and Repairing Straight Leads - Alternate Method 2

This method is not allowed or recommended for power or ignition circuits. The tools required are listed in Table 3-97.

Tool	Part Number
Heat Gun	--
Wire Stripper	Kent-Moore J–35615 or equivalent
Splice Clips (commercially available)	Wire size dependent
Heat Shrink Tubing	Raychem HTAT or equivalent
Terminal Crimper for Metri-Pack 280 (12 AWG)	Kent-Moore J–38125-6
Terminal Crimper for Metri-Pack 280 (18 AWG)	Kent-Moore J–39848
Terminal Crimper for Weather Pack	Kent-Moore J–35606
Terminal Crimper for Deutsch	Kent-Moore J–34182
Terminal Crimper for Metri-Pack 150	Kent-Moore J–35123

Table 3-97   Recommended Splicing Tools

➡ Criteria: Splicing Straight Leads

No more than one strand in a 16 strand wire may be cut or missing.

An acceptable option for splicing straight leads is:

1. Locate broken wire.

2. Remove insulation as required; be sure exposed wire is clean and not corroded.

3. Slide a sleeve of glue lined, shrink tubing (Raychem HTAT or equivalent) long enough to cover the splice clip on the wire and overlap the wire insulation, about .25 in. (6 mm) on both sides (see Figure 3-23, A).

4. Insert one wire into splice clip until it butts against the splice clip. Stop and crimp (see Figure 3-23, B).

5. Insert the remaining wires into the splice clip one at a time until each butts against the splice clip; stop and crimp (see Figure 3-23, B).

NOTICE:
Any terminal that is cracked or ruptured is unacceptable as malfunctions may occur.

6. Visually inspect the terminal for cracks, rupture, or other crimping damage. Remove and replace damaged terminal before proceeding.

7. Slide the shrink tubing over the crimped splice clip (see Figure 3-23, C).

8. Shrink tubing with a heat gun to seal the splice (see Figure 3-23, D).

NOTICE:
A minimum of two layers of heat shrink tubing must be applied to splices that have more than one lead in or out.

9. Loop the lead back over the spliced joint and tape. See Figure 3-21.
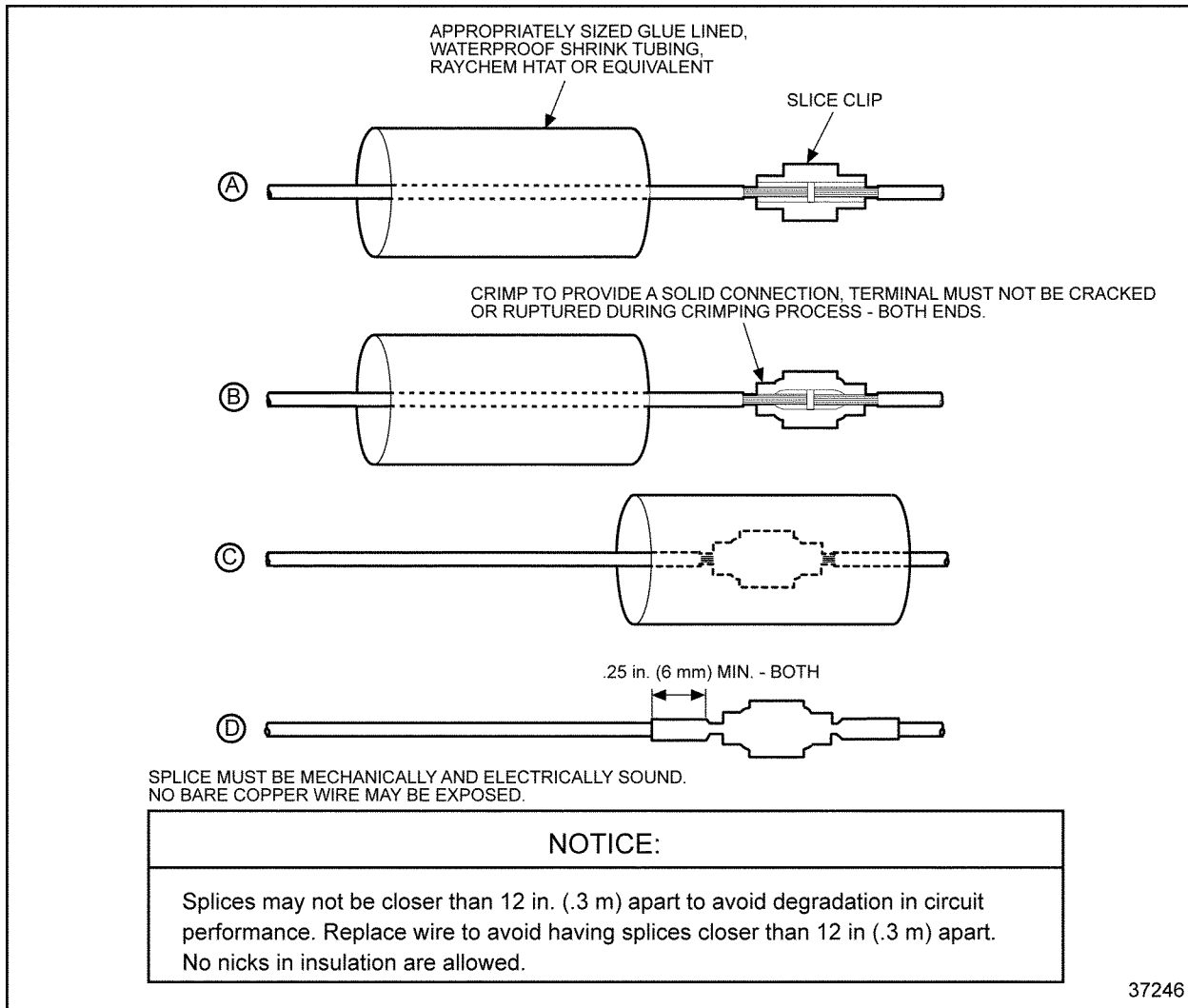
Figure 3-23   Splicing Straight Leads - Alternate Method 2

Shrink Wrap

Shrink wrap is required when splicing non insulated connections. Raychem HTAT or any equivalent heat shrink dual wall epoxy encapsulating adhesive polyolefin is required. Shrink wrap must extend at least .25 in. (6 mm) over wire insulation past splice in both directions.

Alpha Wire Corporation　　　　**Tyco Electronics Corporation**
711 Lidgerwood Ave　　　　　　　Raychem Cable Identification and Protection
P.O. Box 711　　　　　　　　　　300 Constitution Drive
Elizabeth, New Jersey 07207-0711　Menlo Park, CA 94025
1-800-52ALPHA　　　　　　　　　Phone: 1–800–926–2425
www.alphawire.com　　　　　　　www.raychem.com

To heat shrink wrap a splice:

NOTICE:
The heat shrink wrap must overlap the wire insulation about .25 in. (6 mm) on both sides of the splice.

1. Select the correct diameter to allow a tight wrap when heated.

2. Heat the shrink wrap with a heat gun; do not concentrate the heat in one location, but apply the heat over the entire length of shrink wrap until the joint is complete.

3. Repeat step 2 to apply a second layer of protection (if required by splicing guidelines).

Staggering Wire Splices

Position spliced wires properly as follows:

NOTICE:
You must stagger positions to prevent a large bulge in the harness and to prevent the wires from chafing against each other.

1. Stagger the position of each splice (see Figure 3-24) so there is at least a 2.5 in. (65 mm) separation between splices.
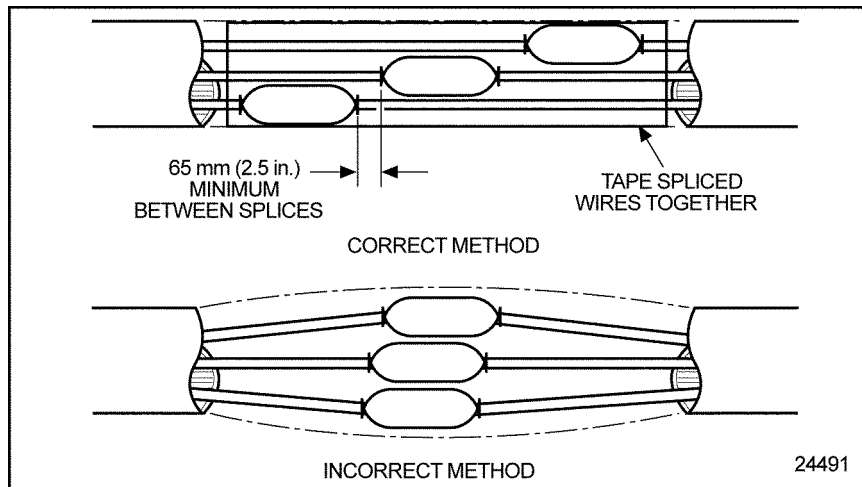
Figure 3-24   The Correct and Incorrect Method of Staggering Multiple Splices

NOTICE:
A minimum of two layers of heat shrink tubing extending .25 in. (6 mm) past the splice must be used to complete the splice.

2. Heat shrink a minimum of two layers of heat shrink tubing.

3. Tape the spliced wires to each other. Refer to section 3.4.

3.4   CONDUIT AND LOOM

Conduit must be used to protect the harness cable and cable splices.

NOTICE:
The conduit must not cover any connectors, switches, relays, fuses, or sensors.

The following guidelines should be used when designing a harness:

NOTICE:
Wires should be sized and cut to near equal length prior to installing conduit.

☐ The distance between the back of the connector or other listed devices to the end of the conduit should not exceed:

  ☐ 1.0 in. (25 mm) for a single connector/device

  ☐ 3 in. (75 mm) for multiple connectors/devices

☐ All cable breakouts and conduit ends must be secured in place with conduit outlet rings or tape.

➔   **Criteria: Conduit and Loom**

Due to the wide variety of operating conditions and environments, it is the responsibility of the OEM to select a conduit that will survive the conditions of the specific applications. Flame retardant convoluted polypropylene conduit or equivalent may be used for most installations. Heat retardant nylon conduit or oil, water, acid, fire, and abrasion resistant non-metallic loom conforming to SAE J562A[*] is also acceptable. The diameter of conduit should be selected based on the number of wires being protected.

* If non-metallic loom is used, secure the ends with tightly wrapped nylon straps to prevent unraveling.

Conduit should cover the wires without binding and without being excessively large.

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3.5   TAPE AND TAPING

Tape must be used when conduit is utilized. Be sure to follow the tape manufacturers' guidelines. The harness manufacturer may use tape under the harness covering (conduit or loom) to facilitate harness building. Tape must be tightly wrapped at all conduit interconnections with a minimum of two layers (refer to section 3.4). Be sure to firmly secure the start and finish ends of tape.

→   **Criteria: Tape**

NOTICE:
Black vinyl electrical tape should not be used in applications where the temperature exceeds 176°F (80°C).

In applications where the temperature doesn't exceed 176°F (80°C), black vinyl electrical tape that is flame retardant and weather resistant may be used.

In applications where temperature exceeds 176°F (80°C), vinyl electrical tape should not be used. For these applications, adhesive cloth backed, flame retardant polyethylene or fiber glass tape (Delphi #PM-2203, Polikan #165 or equivalent) is recommended.

→   **Criteria: Taping**

The tape must extend a minimum of 1 in. (25 mm) past the conduit.

The tape must be crossed over butted conduit ends.

The tape must be extended a minimum of 1 in. (25 mm) in each direction at all branches.

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3.6   SENSORS

DDEC is designed to operate with several types of sensors as listed in Table 3-98.

Sensor Type	Description
Variable Reluctance/Magnetic Pick-up	Used to monitor the crankshaft position, engine speed, turbo speed, and vehicle speed.
Thermistor	Used to monitor temperatures.
Variable Capacitance	Used to monitor manifold, and oil gallery pressures.
Variable Resistance (Potentiometer)	Used to sense throttle position.
Switch	Used to signal coolant level.

Table 3-98   Sensor Types

The sensors integrated into the Engine Harness are factory-installed (refer to section 3.6.1). The sensors integrated into the Vehicle Interface Harness are installed by the OEM (refer to section 3.6.2).

3.6.1   FACTORY-INSTALLED SENSORS

The sensors integrated into the factory-installed Engine Harness are listed in Table 3-99.

Sensor	Function
Camshaft Position Sensor (CMP Sensor)	Indicates a specific cylinder in the firing order.
Crankshaft Position Sensor (CKP Sensor)	Senses crankshaft position and engine speed for functions such as fuel control strategy.
DPF Inlet Pressure Sensor	Sensor measures pressure between the Diesel Oxidation Catalyst (DOC) and the Diesel Particulate Filter (DPF) in the aftertreatment assembly located in the exhaust system of the vehicle.
DPF Outlet Pressure Sensor	Sensor measures pressure on the outlet of the after-treatment device in the exhaust system of the vehicle. Located after the DPF that is within the aftertreatment device.
DPF Outlet Temperature Sensor	Temperature measured at the outlet of the after-treatment system that is installed within the exhaust system of the vehicle. It's located after the DPF that is within the aftertreatment unit.
DOC Inlet Temperature	DOC Temperature In - Temperature measured at the inlet of the after-treatment device in the exhaust system of the vehicle. Located before the DOC that is within the after-treatment device.
DOC Outlet Temperature	Temperature measured between the DOC and the DPF in the aftertreatment assembly located in the exhaust system of the vehicle.
EGR Delta Pressure Sensor EGR Delta P Sensor	Senses EGR pressure for EGR control.
EGR Temperature Sensor	Senses EGR exhaust temperature after EGR cooler. Used for EGR system diagnosis.
Engine Coolant Temperature Sensor (ECT Sensor)	Senses coolant temperature for functions such as engine protection, fan control and engine fueling.
Engine Oil Pressure Sensor (EOP Sensor)	Senses gallery oil pressure for functions such as engine protection.
Engine Oil Temperature Sensor (EOT Sensor)	Senses oil temperature for functions such as reducing variation in fuel injection and fan control.
Fuel Line Pressure Sensor	Senses fuel line pressure
Fuel Compensation Pressure Sensor	Compensates fuel line pressure
Intake Manifold Pressure Sensor (IMP Sensor)	Senses turbo boost for functions such as smoke control and engine protection.
Intake Manifold Temperature Sensor (IMT Sensor)	Senses boost temperature
Supply Fuel Temperature Sensor (SFT Sensor)	Senses fuel temperature for functions such as engine fueling.
Turbo Compressor Temperature Out Sensor	Senses turbo out air temperature.
Turbo Speed Sensor (TSS)	Monitors turbo speed.
Water-in-Fuel Sensor (MBE 900 only)	Detects water in the fuel filter that alerts the owner/driver that the fuel filter needs to be dried out.

Table 3-99   Function of Factory-installed Sensors

See Figure 3-25 for the location of the sensors for the DOC and DPF.
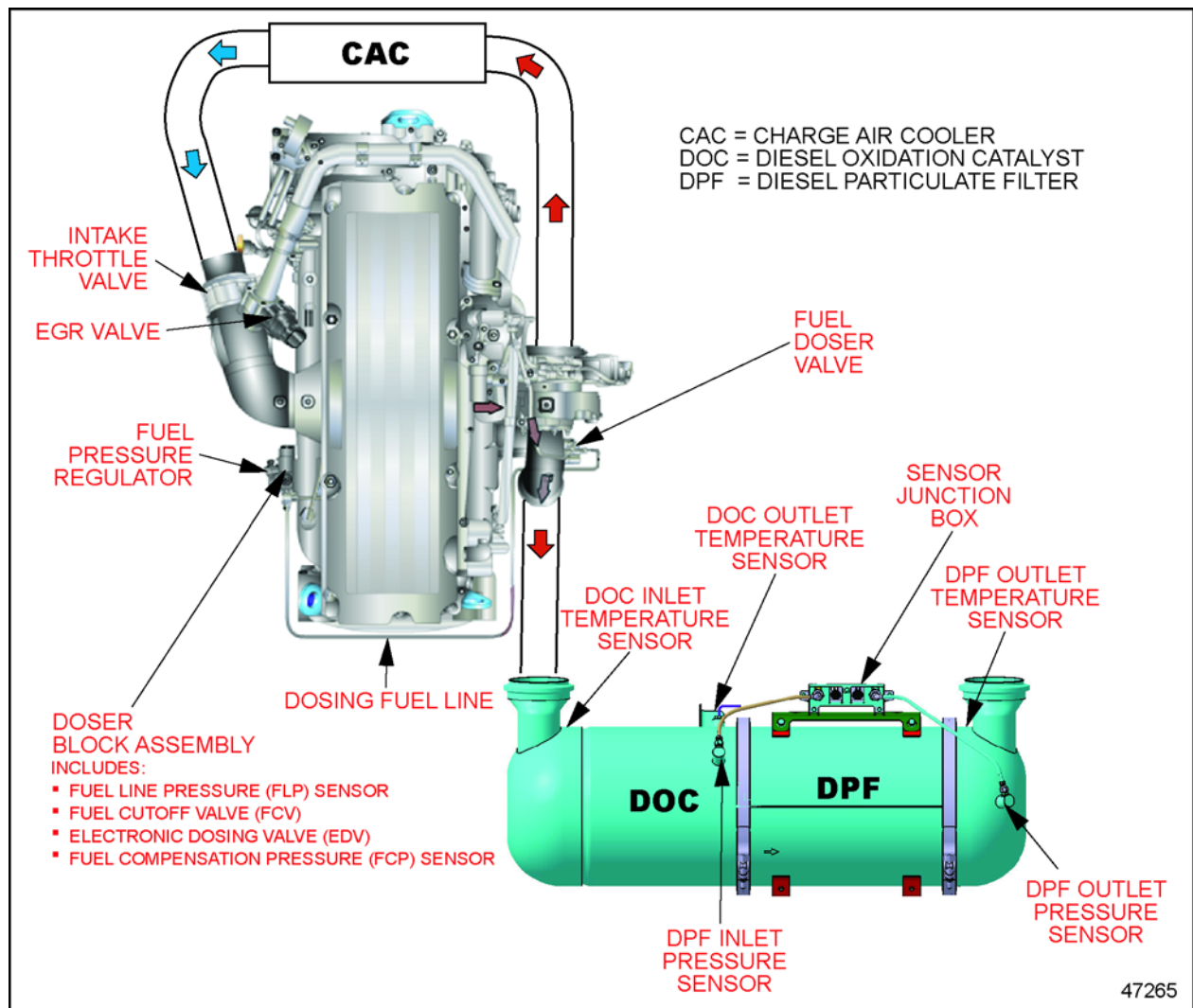
Figure 3-25   Sensor Location for the DOC and DPF

3.6.2 OEM-INSTALLED SENSORS

All sensors must be of the proper type and continuously monitor vehicular and environmental conditions, so the MCM can react to changing situations.

The OEM is responsible for installing the sensors listed in Table 3-100.

Sensor	Part Number	Function
Ambient Air Temperature Sensor (AAT Sensor)	23518328	Senses ambient air temperature specifically for the Ambient Air Temperature Override Disable feature or for OI. Refer to section 3.6.3.
Engine Coolant Level Sensor (ECL Sensor)	23526906 23526905 23526907	Senses coolant level for engine protection. Refer to section 3.6.4.
Turbo Compressor In Temperature Sensor	23527831	Senses the temperature of the turbo compressor inlet. Refer to section 3.6.5.
Vehicle Speed Sensor (VSS)	--	Senses vehicle speed for Cruise Control and Vehicle Speed Limiting. Refer to section 3.6.6.

* Available in some applications

Table 3-100   Function and Guidelines for OEM-installed Sensors

NOTE:
The OEM harness must be securely fastened every six (6) in. It is required that the harness be fastened within six (6) in. of the sensor.

3.6.3   AMBIENT AIR TEMPERATURE SENSOR

The AAT Sensor is a thermistor type sensor with a variable resistance that produces an analog signal between 0 and 5 V, representing the temperature of the ambient air. The AAT Sensor (see Figure 3-26) is used with the Idle Shutdown Timer, specifically for the Ambient Air Temperature Override Disable feature or for Optimized Idle. For additional information on these features refer to Chapter 5.

NOTE:
This sensor is optional.
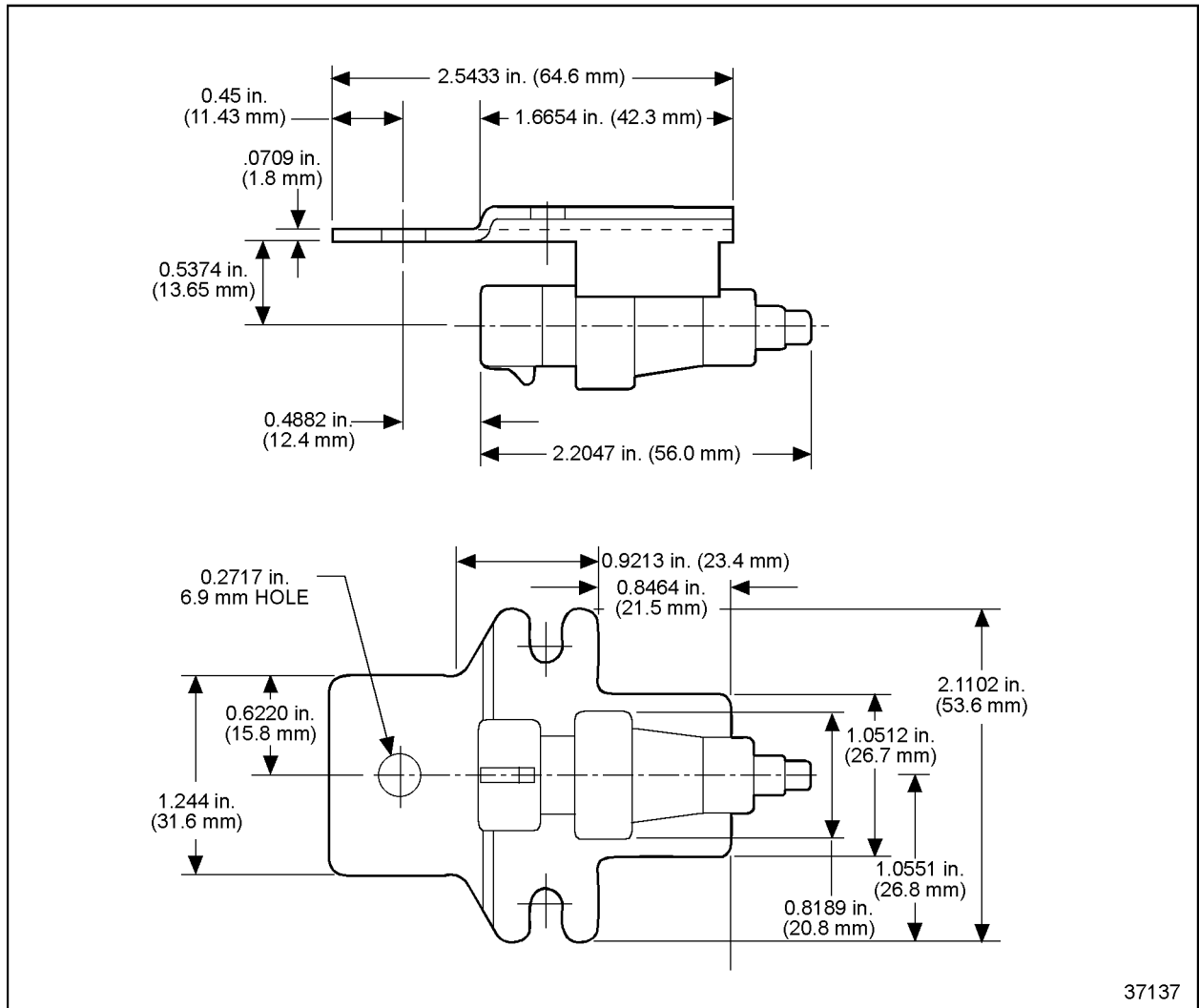
Figure 3-26   Ambient Air Temperatures Sensor Dimensions

Ambient Air Temperature Sensor Installation

Install the AAT Senaor where ambient air temperature can be read. A protected location on the frame rails where it will not be splattered with dirt and grime and is removed from any heat source such as exhaust is preferred. See Figure 3-27 for AAT Sensor installation.

LABEL	CPC CONNECTOR CAVITY	WIRE COLOR	AMBIENT AIR TEMPERATURE CONNECTOR CAVITY
SENSOR RETURN #1	3/2	YEL/BLK	A
AMBIENT AIR TEMP	3/15	TAN/YEL	B
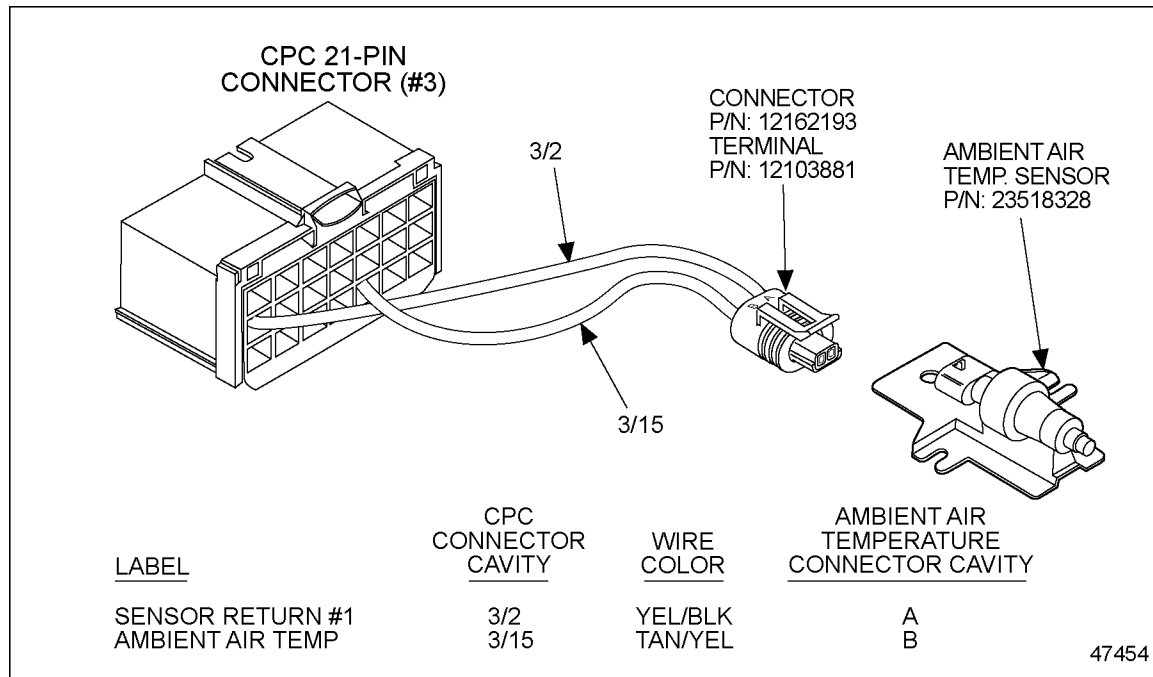
Figure 3-27   Ambient Air Temperature Sensor Installation

The parameter for the AAT Sensor are listed in Table 3-101.

Parameter Group	Parameter	Options	Default	Access
31	Ambient Air Temp Sensor Enable	0 – Not Available 1 – Hardwired 2 – Reserved for J1939 3 – J1587 4 – ECAN	0 – Not Available	VEPS, DRS
31	MID for Ambient Air Temp	0 — 255	0	VEPS, DRS

Table 3-101   Ambient Air Temperature Sensor Parameters

3.6.4   ENGINE COOLANT LEVEL SENSOR

The ECL Sensor provides an input to the engine protection system and warn the operator if a low coolant level has been reached.

NOTE:
This sensor is required.

The main component of the ECL Sensor consists of a conductivity probe, which connects to the CPC (see Figure 3-28).

NOTICE:
The probe has an operational temperature range of -40 to 257°F (-40 to 125°C). Exposure to temperatures beyond this range may result in unacceptable component life, or degraded sensor accuracy.
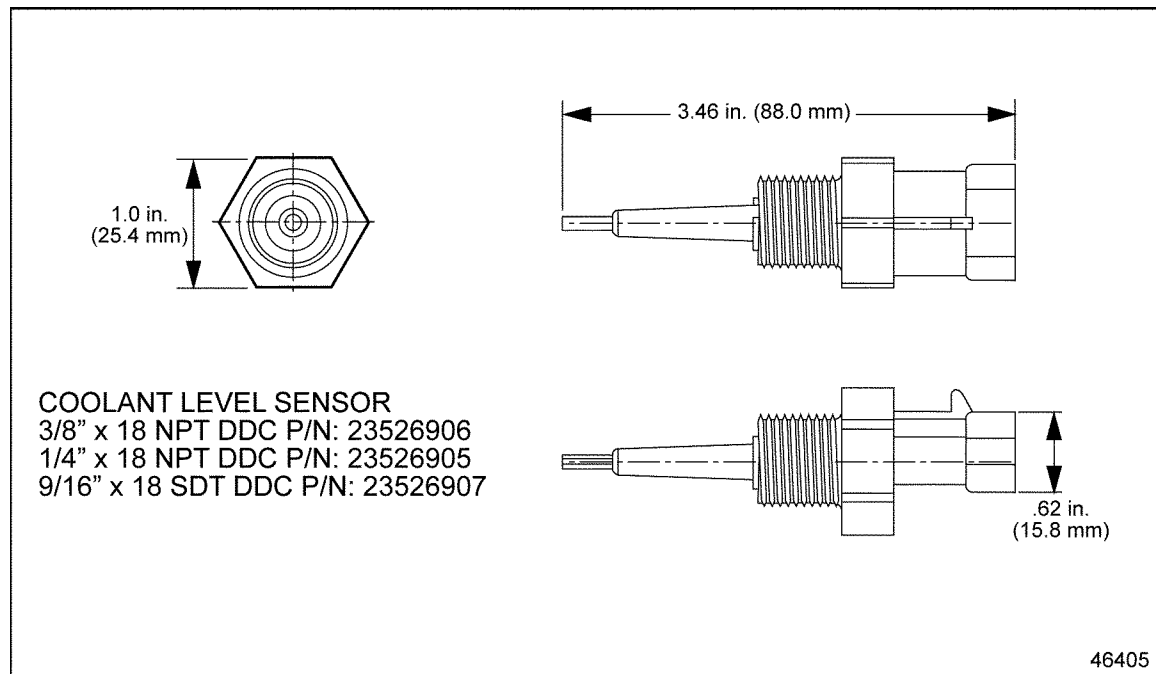
Figure 3-28   Engine Coolant Level Sensor Specifications

The connector listed in Table 3-102 is a Metri-Pack 280 series push-to-seat connector.

Coolant Level Sensor Connector	
Connector	P/N: 15300027
Terminal	P/N: 12077411
Seal	P/N: 12015323
Secondary Lock	P/N: 15300014

Table 3-102   Metri-Pack 280 Connectors and Part Numbers

The OEM must connect the ECL Sensor probe as shown in the next illustration (see Figure 3-29). Polarity of the ground and signal must be correct for proper operation.
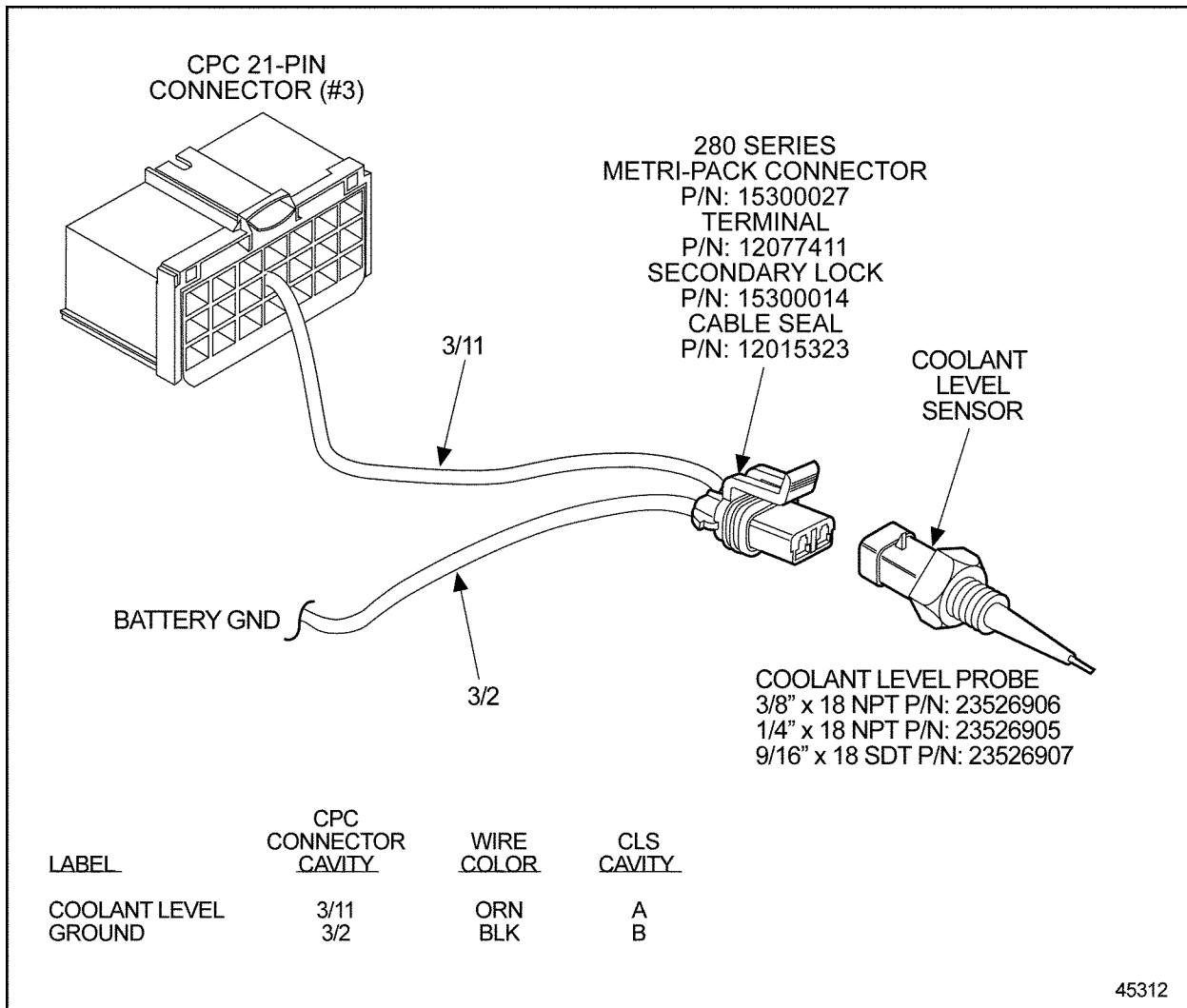
Figure 3-29   Engine Coolant Level Sensor Installation for CPC

The probe should be located in either the radiator top tank or a remote mounted surge tank. It should be mounted horizontally in the center of the tank and must be in a position to signal low coolant before aeration occurs. Typically, this is a height representing 98% of the drawdown quantity. The probe should be located so that it is not splashed by deaeration line, stand pipe or coolant return line flows. The insulated portion of the probe should be inserted into the coolant 1/2 in. or more past the inside wall of the tank. See Figure 3-30.
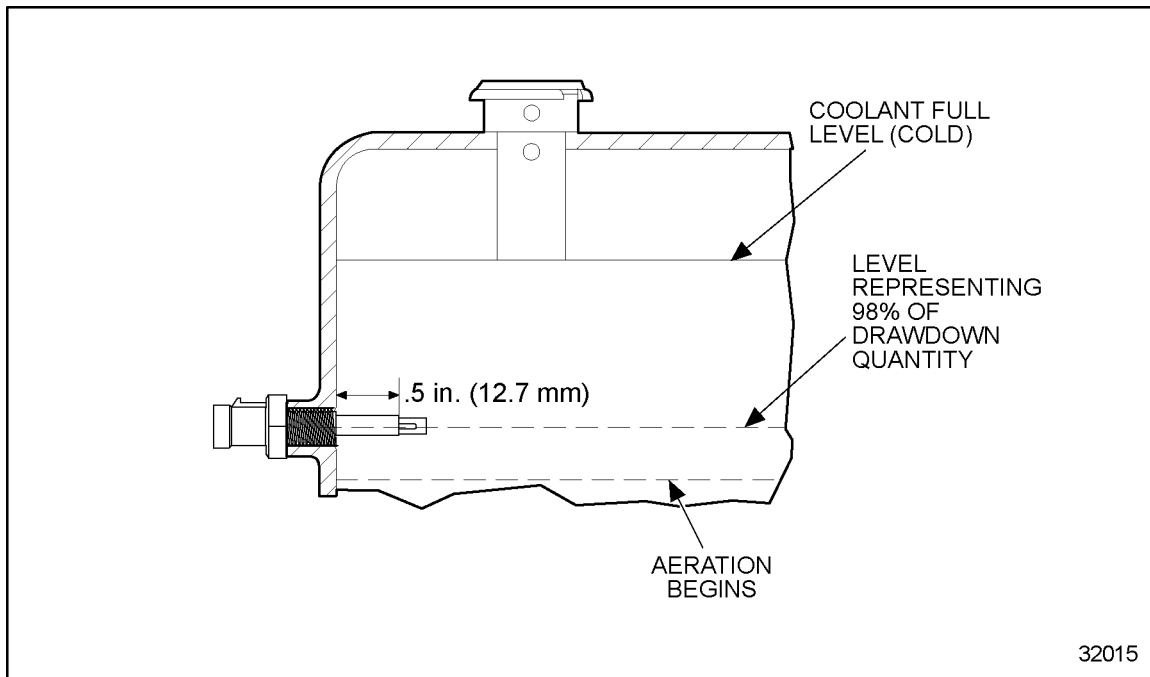
Figure 3-30   Engine Coolant Level Sensor Location - Top of Radiator Tank

Determine proper location for low coolant level sensor while running the drawdown test. It *must* actuate a warning before the satisfactory drawdown level is reached.

The ECL Sensor components are OEM supplied hardware and can be purchased as kits or individual components, depending on OEM requirements.

The following kits listed in Table 3-103 and Table 3-104 provide all the necessary hardware for proper installation of the ECL Sensor. Kits are available through the DDC parts distribution network.

Component	Part Number
ECL Sensor	23526905
Metri-Pack Connector Kit	15300027
Metri-Pack Terminals	12077411
Secondary Lock	15300014
wire Seal	12015323
Terminal	12103881

Table 3-103   ECL Sensor Installation Kit 1/4 in. NPTF P/N: 23515397

Component	Part Number
ECL Sensor	23526906
Metri-Pack Connector Kit	15300027
Metri-Pack Terminals	12077411
Secondary Lock	15300014
Wire Seal	12015323
Terminal	12103881

Table 3-104   ECL Sensor Installation Kit 3/8 in. NPTF P/N: 23515398

The sensor must be enabled with VEPS or the DRS as listed in Table 3-105.

Parameter Group	Parameter	Options	Default
32	Cool Level Sensor Input Enable	0 = Disabled 1 = Dual Level Probe Sensor (IMO), fixed threshold* 2 = Single Level Probe Sensor, temp dependent 3 = Dual Level Float Sensor (FTL), fixed threshold/FTL Gentec 4 = Single Level Probe Sensor, fixed threshold	2

* Not supported in NAFTA

Table 3-105   Enabling the Engine Coolant Level Sensor

3.6.5   TURBO COMPRESSOR IN TEMPERATURE SENSOR

The TCI Sensor produces a signal representing the temperature of the turbo compressor inlet. See Figure 3-31 and Figure 3-32 for installation.

NOTE:
This sensor is required for the Series 60.
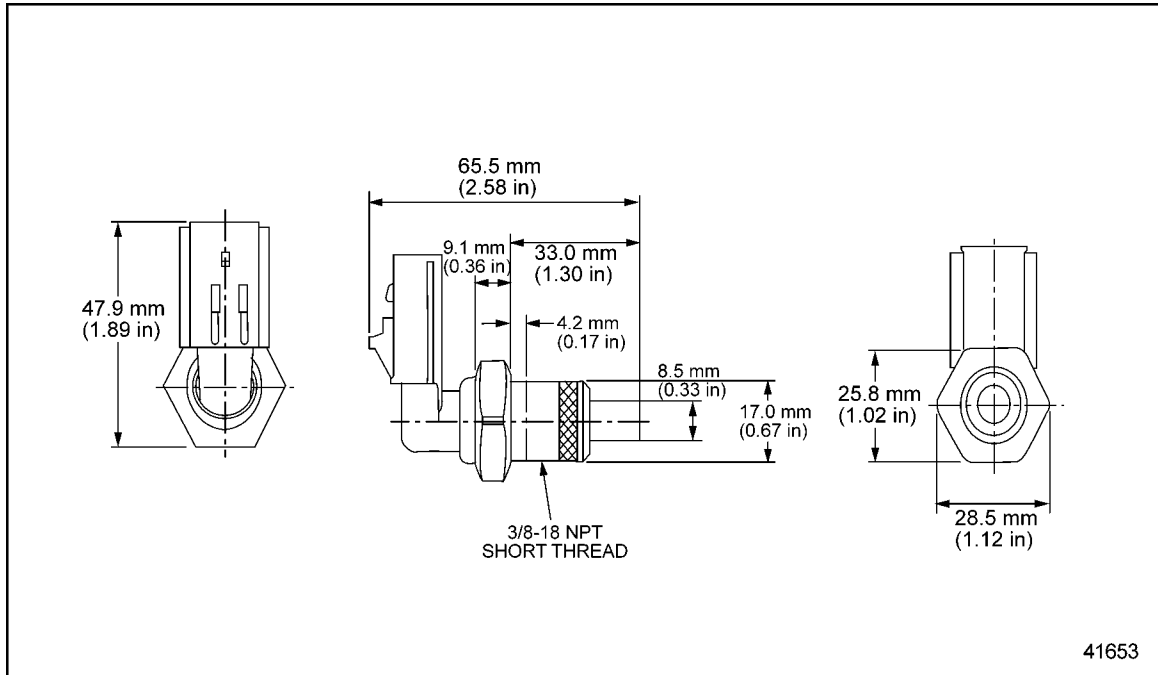
Figure 3-31   Turbo Compressor In Temperature Sensor
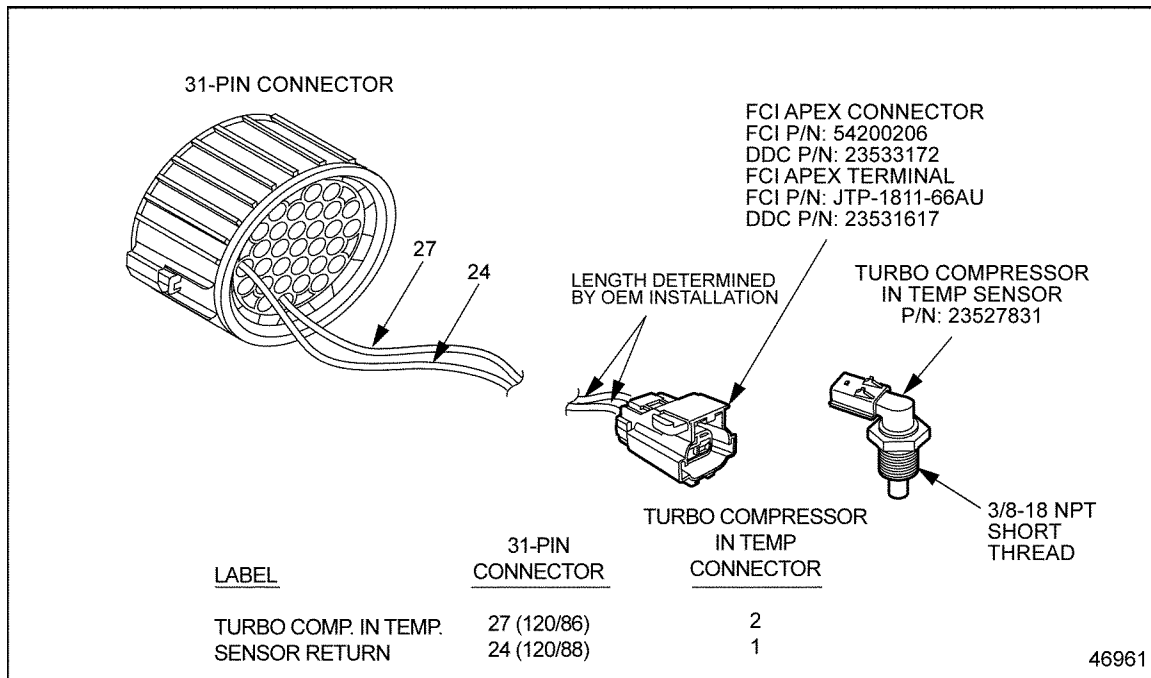
Figure 3-32   Turbo Compressor In Temperature Sensor Installation

3.6.6   VEHICLE SPEED SENSOR

The CPC can calculate vehicle speed providing that it is properly programmed and interfaced with a Vehicle Speed Sensor (VSS) that meets requirements. The VSS (see Figure 3-33) provides a vehicle speed signal for use in Cruise Control and Vehicle Speed Limiting. The VSS signal type can be changed.

NOTE:
DDC does not approve of the use of signal generator sensors.
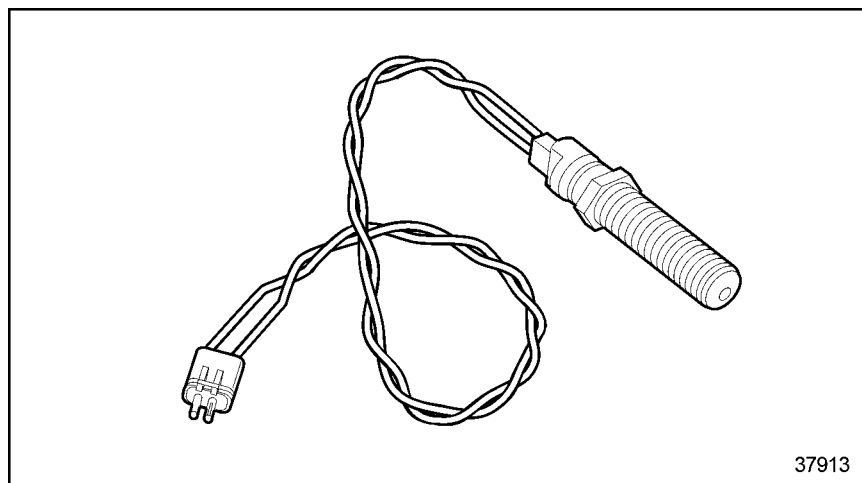
Figure 3-33   Vehicle Speed Sensor

To obtain accurate vehicle mileage, the parameters listed in Table 3-106 must be programmed with VEPS, DRS, or DDDL 7.0.

Parameter Group	Parameter	Range	Default
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) 7 = J1939 (CCVS Source 2) 8 = J1939 (CCVS Source 3)	4 = Magnetic
8	Axle Ratio	1 – 20.0	5.29
8	Number of Output Shaft Teeth	0 – 250	16
8	Tire Revs per Unit Distance	160 – 1599 l/km	312
8	Top Gear Ratio	0.1 – 2.55	1
8	Second Highest Gear Ratio	0.1 – 5.75	2.54
8	Two Spd Axle Second Axle Ratio	1 – 20.0	5.29
8	Anti Tamper	0 = Disable 1 = Enable VSS Anti Tamper Function via ABS 2 = Enable Anti Tamper Function via Gear Ratio	0 = Disable

Table 3-106   Vehicle Speed Sensor Parameters

Magnetic Pickup

The magnetic pickup requirements are listed in Table 3-107. Magnetic Pickup size is determined by installation requirements.

Parameters	Range
Frequency Range	0 - 10 kHz
Low Threshold Voltage	>1.8 Volts Peak to Peak

Table 3-107   Magnetic Pickup Vehicle Speed Sensor Requirements

The Vehicle Speed Sensor is wired to the 21–pin #3 connector of the CPC as listed in Table 3-108.

CPC Connector/Pin	Function
3/13	VSS (+)
3/14	VSS (-)

Table 3-108   Vehicle Speed Sensor Wiring

See Figure 3-34 for the installation of the Magnetic VSS.
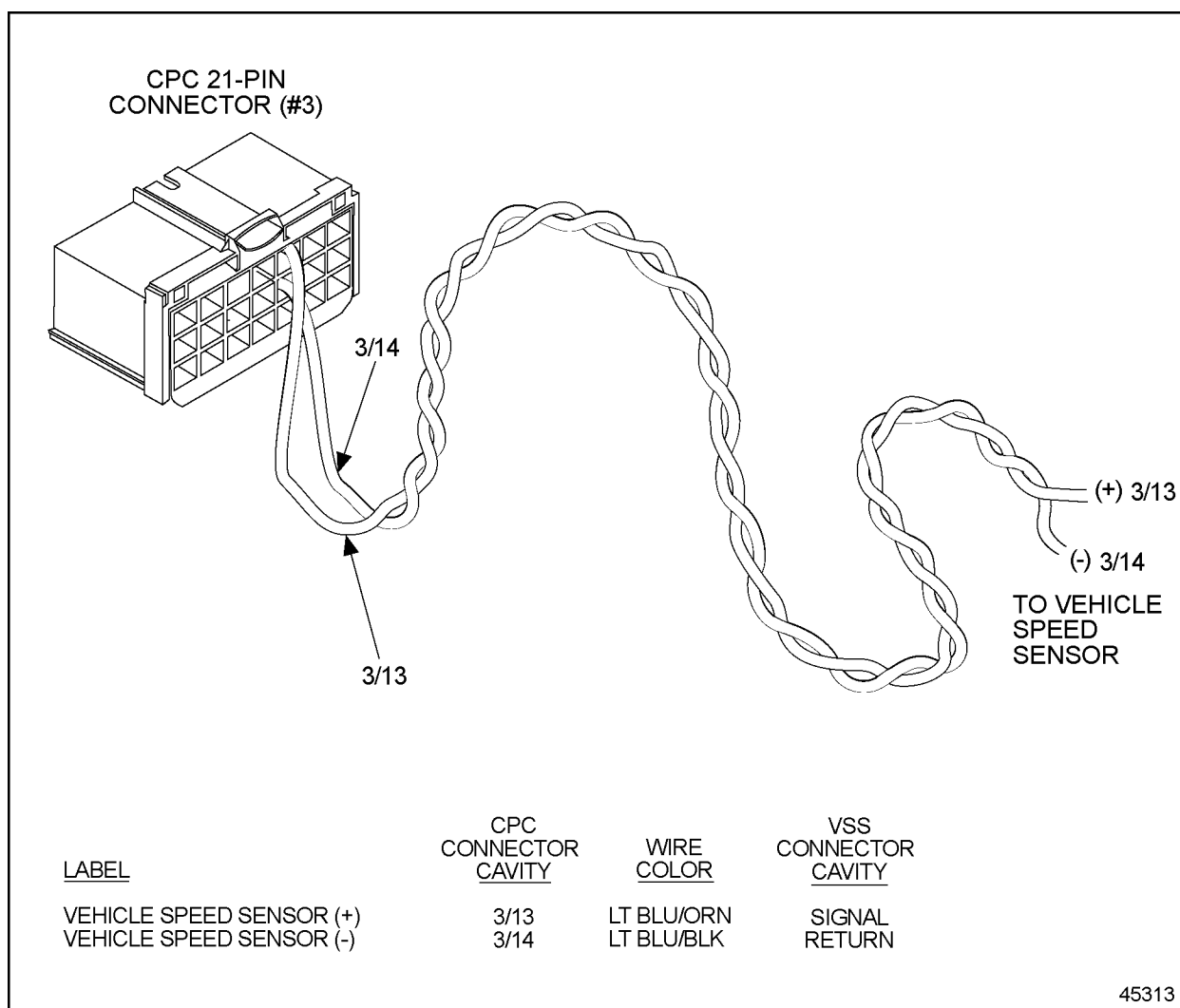
Figure 3-34   Magnetic Vehicle Speed Sensor Installation – CPC

SAE J1939 Data Link

A VSS wired to the CPC is not required if the transmission output shaft speed message is being transmitted over the SAE J1939 Data Link. To obtain accurate vehicle mileage, the parameters listed in Table 3-109 must be programmed with VEPS.

Parameter Group	Parameter	Range	Default
8	Vehicle Speed Sensor	0 = No Sensor 1 = C3 Sensor 2 = Square Wave (Hall Sensor) 3 = J1939 (ECT1) 4 = Magnetic Pickup 5 = J1939 (TCO1) 6 = J1939 (CCVS Source 1) 7 = J1939 (CCVS Source 2) 8 = J1939 (CCVS Source 3)	4 = Magnetic
8	Axle Ratio	1 – 20.0	5.29
8	Tire Revs per Unit Distance	160 – 1599 l/km	312
8	Top Gear Ratio	0.1 – 2.55	1
8	Second Highest Gear Ratio	0 — 5.75	2.54
8	Two Spd Axle Second Axle Ratio	1 – 20.0	5.29
8	Anti Tamper	0 = Disable 1 = Enable VSS ABS Anti Tampering Function 2 = Enable VSS without ABS Anti Tampering Function	0 = Disable

Table 3-109   Vehicle Speed Sensor Parameters for J1939 Option

VSS Anti-tamper

If the sensor appears to be working improperly, but the vehicle speed is not zero, VSS Anti-Tamper will log a VSS fault.

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3.7   LAMPS

The instrument panel warning lamps, the Amber Warning Lamp (AWL) and the Red Stop Lamp (RSL), are supplied by the OEM. The functionality of each lamp along with the wiring requirements are covered separately in the following sections.

3.7.1   AMBER WARNING LAMP

The AWL is controlled by DDEC VI.
The AWL remains ON:

□   For approximately five (5) seconds at the start of every ignition cycle (a bulb check)

□   When an electronic system fault occurs (This indicates the problem should be diagnosed as soon as possible.)

The AWL flashes:

□   When the Diagnostic Request Switch is used to activate the AWL to flash inactive codes

□   During last 90 seconds before Idle Shutdown if programmed for override

□   When Idle Shutdown occurs or the Optimized Idle system shutdown occurs

AWL and PasSmart

AWL is active with PasSmart. When the Passing Speed Duration time expires, the Amber Warning Lamp on the dashboard will begin to flash one minute prior to ramping the Vehicle Limit Speed (VLS) back down to the normal VLS limit. The rampdown event always takes 5 seconds regardless of the Passing Speed Increment programmed into the ECU. The rampdown alert can be distinguished from an engine fault warning in that the AWL flashes for the former and remains on constantly for the latter.

PasSmart still operates when there is an active engine fault. In this situation the Amber Warning Lamp goes from constant illumination to flashing one minute before the VLS limit ramps down. At the end of the passing event when PasSmart is deactivated, the Amber Warning Lamp will return to constant illumination if the engine fault is still active.

Amber Warning Lamp Requirements and Guidelines

The following requirements and guidelines apply to the AWL:

□   The AWL is required.

□   A 12 volt light of less than 0.25 A (DC) is required depending on the ignition source.

□   The AWL must be integrated into the instrument panel or placed in clear view of the equipment operator.

□   The lens color must be amber.

□ The words CHECK ENGINE must appear on or near the AWL lamp.

□ The AWL is connected to pin 2/10 in the CPC.

3.7.2   RED STOP LAMP

The RSL is controlled by DDEC VI.
The RSL remains ON:
   □ For approximately five (5) seconds at the start of every ignition cycle (a bulb check)
   □ When a potential engine damaging fault is detected

The RSL flashes:

□ When Engine Protection Shutdown occurs

□ When the Diagnostic Request Switch is used to activate the RSL to flash active codes

Red Stop Lamp Requirements and Guidelines

The following requirements and guidelines apply to the RSL:

□ The RSL is required.

□ A 12 volt light of less than 0.25 (DC) is required depending on the ignition source. Digital output circuits are designed to sink no more than 0.25 (DC) current.

□ The RSL must be integrated into the instrument panel or placed in clear view of the equipment operator.

□ The lens color must be red.

□ The words STOP ENGINE must appear on or near the RSL lamp.

□ The RSL is connected to pin 3/16 in the CPC.

3.7.3   DPF REGENERATION LAMP

This lamp is controlled by DDEC VI.
The DPF Regeneration Lamp remains ON when
  □ Stationary regeneration is required.
  □ At the start of every ignition cycle, the lamp turns ON for approximately five (5) seconds (a bulb check).

The DPF Regeneration Lamp flashes when a stationary regeneration is required immediately. If the lamp flashing is ignored, derate and/or shutdown could occur.

DPF Regeneration Lamp Requirements and Guidelines

The following requirements and guidelines apply to the DPF Regeneration Lamp:

  □ The DPF Regeneration Lamp is required.

  □ A 12 volt light of less than 0.25 A (DC) is required depending on the ignition source. Digital output circuits are designed to sink no more than 0.25 A (DC) current.

  □ The DPF Regeneration Lamp must be integrated into the instrument panel or placed in clear view of the vehicle operator.

  □ The lens color must be amber.

  □ This output is wired to pin 1/5 of the CPC.

  □ This lamp can be multiplexed on J1939.

  □ The DPF Regeneration symbol shown above is required.

Programming Requirements and Flexibility

The parameters for the DPF Regeneration Lamp are listed in Table 3-110.

Parameter Group	Parameter	Options	Default	Access
35	1 05 Fault Detection	0 = Disabled 1 = Enabled	0 = Disabled	VEPS, DRS
46	DPF Lamp Config	0 = Hardwired 1 = J1939 PTC1	0 = Hardwired	VEPS, DRS

Table 3-110   DPF Regeneration Lamp Options

3.7.4   HIGH EXHAUST SYSTEM TEMPERATURE LAMP

The HEST Lamp is controlled by DDEC VI.
The HEST Lamp remains ON:

- □ For approximately five (5) seconds at the start of every ignition cycle (a bulb check).
- □ When the vehicle speed is less than 5 mph and the DPF outlet temperature is greater than 525°C.

High Exhaust System Temperature Lamp Requirements and Guidelines

The following requirements and guidelines apply to the HEST Lamp:

- □ The HEST Lamp is optional and must be supplied by the OEM.

- □ A 12 volt light of less than 2.0 A (DC) is required depending on the ignition source. Digital output circuits are designed to sink no more than 2.0 A (DC) current.

- □ The HEST Lamp must be integrated into the instrument panel or placed in clear view of the vehicle operator.

- □ The lens color must be amber.

- □ This output is wired to pin 4/7 of the CPC.

- □ This lamp can be multiplexed on J1939.

Programming Requirements and Flexibility

The parameters for the High Exhaust System Temperature Lamp are listed in Table 3-111.

Parameter Group	Parameter	Options	Default	Access
35	4 07 DO Selection	0 = Disabled 1 = Accelerator Pedal Kick Down* 2 = Actual Torque* 3 = Road Speed* 4 = Engine Speed* 5 = Coolant Temperature* 6 = Pedal Torque* 7 = Boost Temperature* 8 = Oil Pressure (MCM threshold)* 9 = Coolant Temperature (MCM threshold)* 10 = Vehicle Power Shutdown/ignition relay 11 = Optimized idle ACC Bus (ignition relay) 12 = Split Valve 1* 13 = High Exhaust System Temperature Lamp	13 = High Exhaust System Temperature Lamp	VEPS, DRS
35	4 07 Fault Detection	0 = Disabled 1 = Enabled	0 = Disabled	VEPS, DRS
46	Hi Exhaust Temp Lamp Config	0 = Hardwired 1 = J1939 PTC1	0 = Hardwired	VEPS, DRS

* Not supported in NAFTA

Table 3-111   High Exhaust System Temperature Lamp Options

3.7.5   MALFUNCTION INDICATOR LAMP

The Malfunction Indicator Lamp (MIL) is controlled by DDEC VI.
The MIL remains ON:
- □ For approximately five (5) seconds at the start of every ignition cycle (a bulb check)
- □ For any emission related fault, the light will go out when the fault is inactive

Malfunction Indicator Lamp Requirements and Guidelines

The following requirements and guidelines apply to the MIL:

- □ The MIL is required.

- □ A 12 volt light of less than 0.25 A (DC) is required depending on the ignition source. Digital output circuits are designed to sink no more than 0.25 A (DC) current.

- □ The MIL must be integrated into the instrument panel or placed in clear view of the vehicle operator.

- □ The lens color must be amber.

- □ This output is wired to pin 1/13 of the CPC.

- □ This lamp can be multiplexed on J1939.

3.7.6   LOW OIL PRESSURE LAMP

The Low Oil Pressure Lamp is controlled by DDEC VI..

The Low Oil Pressure Lamp remains ON:

- □ For approximately five (5) seconds at the start of every ignition cycle (a bulb check)
- □ When a low oil pressure fault is detected

Requirements and Guidelines

The following requirements and guidelines apply to the Low Oil Pressure Lamp:

- □ The Low Oil Pressure Lamp is optional.

- □ A 12 volt light of less than 0.25 A (DC) is required depending on the ignition source. Digital output circuits are designed to sink no more than 0.25 A (DC) current.

- □ The Low Oil Pressure Lamp must be integrated into the instrument panel or placed in clear view of the vehicle operator.

- □ This output is wired to pin 3/12 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 3-112.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 12 DO Selection	3 = Oil Pressure Low Lamp	0 = Disabled 1 = Oil Level Lamp* 2 = AGS2 Check Transmission Indication Lamp 3 = Oil Pressure Low Lamp 4 = Cruise Active Lamp 5 = FUSO Retarder Control 2*	0 = Disabled	VEPS or DRS
35	3 12 DO Fault Detection	–	0 = Disabled 1 = Enabled	0 = Disabled	VEPS or DRS

* Not supported in NAFTA

Table 3-112   Low Oil Pressure Lamp Programming Options

3.7.7   CRUISE ACTIVE LAMP

The Cruise Active Lamp is controlled by DDEC VI..
The Cruise Active Lamp remains ON:
- □ For approximately five (5) seconds at the start of every ignition cycle (a bulb check)
- □ When Cruise Control is active

Cruise Active Lamp Requirements and Guidelines

The following requirements and guidelines apply to the Cruise Active Lamp:

- □ The Cruise Active Lamp is optional.

- □ A 12 volt light of less than 0.25 A (DC) is required depending on the ignition source. Digital output circuits are designed to sink no more than 0.25 A (DC) current.

- □ The Cruise Active Lamp must be integrated into the instrument panel or placed in clear view of the vehicle operator.

- □ This output is wired to pin 3/12 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 3-113.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 12 DO Selection	4 = Cruise Active Lamp	0 = Disabled 1 = Oil Level Lamp* 2 = AGS2 Check Transmission Indication Lamp 3 = Oil Pressure Low Lamp 4 = Cruise Active Lamp 5 = FUSO Retarder Control 2*	0 = Disabled	VEPS or DRS
35	3 12 DO Fault Detection	–	0 = Disabled 1 = Enabled	0 = Disabled	VEPS or DRS

* Not supported in NAFTA

Table 3-113   Cruise Active Lamp Programming Options

3.7.8   DECELERATION LAMP

The Deceleration Lamp is controlled by DDEC VI.

The Deceleration Lamp remains ON:

☐ For approximately five (5) seconds at the start of every ignition cycle (a bulb check)

☐ When percent throttle is zero and Cruise Control is inactive

Deceleration Lamp Requirements and Guidelines

The following requirements and guidelines apply to the Deceleration Lamp:

☐ The Deceleration Lamp is optional.

☐ A 12 volt light of less than 0.25 A (DC) is required depending on the ignition source. Digital output circuits are designed to sink no more than 0.25 A (DC) current.

☐ The Deceleration Lamp must be integrated into the instrument panel or placed in clear view of the vehicle operator.

☐ This output is wired to pin 4/09 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 3-114.

Parameter Group	Parameter	Setting	Options	Default	Access
35	4 09 DO Selection	11 = De-celeration Lamp	0 = Disabled 1 = Accelerator Pedal Idle Position* 2 = Actual Torque* 3 = Road Speed* 4 = Engine Speed* 5 = Coolant Temp* 6 = Pedal Torque* 7 = Boost Temp* 8 = Oil Pressure (MCM Threshold)* 9 = Coolant Temp (MCM Threshold)* 10 = OI Active Lamp 11 = Deceleration Lamp 12 = FUSO Ground Starter Lockout Relay*	0 = Disabled	VEPS or DRS
35	4 09 DO Fault Detection	–	0 = Disabled 1 = Enabled	0 = Disabled	VEPS or DRS

* Not supported in NAFTA

Table 3-114   Deceleration Lamp Programming Options

3.7.9   LOW BATTERY VOLTAGE LAMP

The Low Battery Voltage Lamp is controlled by DDEC VI.

The Low Battery Voltage Lamp remains ON:

□ For approximately five (5) seconds at the start of every ignition cycle (a bulb check)

□ When a low battery voltage is detected

Low Battery Voltage Lamp Requirements and Guidelines

The following requirements and guidelines apply to the Low Battery Voltage Lamp:

□ The Low Battery Voltage Lamp is optional.

□ A 12 volt light of less than 2.0 A (DC) is required depending on the ignition source. Digital output circuits are designed to sink no more than 2.0 A (DC) current.

□ The Low Battery Voltage Lamp must be integrated into the instrument panel or placed in clear view of the vehicle operator.

□ This output is wired to pin 3/10 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 3-115.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 10 DO Selection	3 = Battery Voltage Low Lamp	0 = Disabled 1 = Air Filter Lamp* 2 = AGS2 Transmission Temp Indication Lamp 3 = Battery Voltage Low Lamp 4 = Coolant Level Low Lamp 5 = FUSO Retarder Control 1*	0 = Disabled	VEPS or DRS
35	3 10 DO Fault Detection	–	0 = Disabled 1 = Enabled	0 = Disabled	VEPS or DRS

* Not supported in NAFTA

Table 3-115   Low Battery Voltage Lamp Programming Options

3.7.10   LOW COOLANT LEVEL LAMP
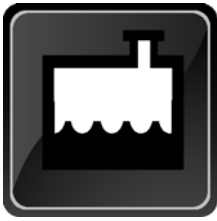
The Low Coolant Level Lamp is controlled by DDEC VI..
The Low Coolant Level Lamp remains ON:
   □   For approximately five (5) seconds at the start of every ignition cycle (a bulb check)
   □   When a low coolant level is detected

Low Coolant Level Lamp Requirements and Guidelines

The following requirements and guidelines apply to the Low Coolant Level Lamp:

   □   The Low Coolant Level Lamp is optional.

   □   A 12 volt light of less than 2.0 A (DC) is required depending on the ignition source. Digital output circuits are designed to sink no more than 2.0 A (DC) current.

   □   The Low Coolant Level Lamp must be integrated into the instrument panel or placed in clear view of the vehicle operator.

   □   This output is wired to pin 3/10 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 3-116.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 10 DO Selection	4 = Coolant Level Low Lamp	0 = Disabled 1 = Oil Level Lamp* 2 = AGS2 Check Transmission Indication Lamp 3 = Oil Pressure Low Lamp 4 = Coolant Level Low Lamp 5 = FUSO Retarder Control 1*	0 = Disabled	VEPS or DRS
35	3 10 DO Fault Detection	–	0 = Disabled 1 = Enabled	0 = Disabled	VEPS or DRS

* Not supported in NAFTA

Table 3-116   Low Coolant Level Lamp Programming Options

3.7.11 OPTIMIZED IDLE ACTIVE LAMP

The Optimized Idle Active Lamp is controlled by DDEC VI..
The Optimized Idle Active Lamp remains ON:
  □ For approximately five (5) seconds at the start of every ignition cycle
    (a bulb check)
  □ When Optimized Idle is active

Optimized Idle Active Lamp Requirements and Guidelines

The following requirements and guidelines apply to the Optimized Idle Active Lamp:

  □ The Optimized Idle Active Lamp is optional.

  □ A 12 volt light of less than 2.0 A (DC) is required depending on the ignition source. Digital
    output circuits are designed to sink no more than 2.0 A (DC) current.

  □ The Optimized Idle Active Lamp must be integrated into the instrument panel or placed in
    clear view of the vehicle operator.

  □ This output is wired to pin 4/09 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 3-117.

Parameter Group	Parameter	Setting	Options	Default	Access
35	4 09 DO Selection	10 = OI Active Lamp	0 = Disabled 1 = Accelerator Pedal Idle Position* 2 = Actual Torque* 3 = Road Speed* 4 = Engine Speed* 5 = Coolant Temp* 6 = Pedal Torque* 7 = Boost Temp* 8 = Oil Pressure (MCM Threshold)* 9 = Coolant Temp (MCM Threshold)* 10 = OI Active Lamp 11 = Deceleration Lamp 12 = FUSO Ground Starter Lockout Relay*	0 = Disabled	VEPS or DRS
35	4 09 DO Fault Detection	–	0 = Disabled 1 = Enabled	0 = Disabled	VEPS or DRS

* Not supported in NAFTA

Table 3-117   Optimized Idle Active Lamp Programming Options

3.7.12   WAIT TO START LAMP

The Wait to Start Lamp is controlled by DDEC VI..
The Wait to Start Lamp remains ON:

- □ For approximately five (5) seconds at the start of every ignition cycle (a bulb check)
- □ When the grid heater system is active; the driver should **not** start the engine when the light is on

Wait to Start Lamp Requirements and Guidelines

The following requirements and guidelines apply to the Wait to Start Lamp:

- □ The Wait to Start Lamp is required for grid heater applications.

- □ A 12 volt light of less than 0.25 A (DC) is required depending on the ignition source. Digital output circuits are designed to sink no more than 0.25 A (DC) current.

- □ The Wait to Start Lamp must be integrated into the instrument panel or placed in clear view of the vehicle operator.

- □ This output is wired to pin 4/06 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 3-116.

Parameter Group	Parameter	Setting	Options	Default	Access
35	4 06 DO Selection	1 = Grid Heater Lamp	0 = Disabled 1 = Grid Heater Lamp 2 = Accelerator Pedal Idle Position* 3 = Run Signal Starter Lockout	1 = Grid Heater Lamp	VEPS or DRS
35	4 06 DO Fault Detection	–	0 = Disabled 1 = Enabled	0 = Disabled	VEPS or DRS

* Not supported in NAFTA

Table 3-118   Wait to Start Lamp Programming Options

3.7.13   AGS2 BACKUP LAMP

The AGS2 Backup Lamp is controlled by DDEC VI.

The AGS2 Backup Lamp remains ON:

☐   For approximately five (5) seconds at the start of every ignition cycle (a bulb check)

☐   When the AGS2 transmission is in reverse

AGS2 Backup Lamp Requirements and Guidelines

The following requirements and guidelines apply to the AGS2 Backup Lamp:

☐   The AGS2 Backup Lamp is optional.

☐   A 12 volt light of less than 0.25 A (DC) is required depending on the ignition source. Digital output circuits are designed to sink no more than 0.25 A (DC) current.

☐   The AGS2 Backup Lamp must be integrated into the instrument panel or placed in clear view of the vehicle operator.

☐   This output is wired to pin 3/09 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 3-119.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 09 DO Selection	2 = AGS2 Backup Lamp	0 = Disabled 1 = Grid Heater Wired* 2 = AGS2 Backup Lamp 3 = Engine Brake Active 4 = Not Used 5 = FUSO Engine Brake Active Lamp*	0 = Disabled	VEPS or DRS
35	3 09 DO Fault Detection	–	0 = Disabled 1 = Enabled	0 = Disabled	VEPS or DRS

* Not supported in NAFTA

Table 3-119   AGS2 Backup Lamp Programming Options

3.7.14   AGS2 CHECK TRANS LAMP

The AGS2 Check Trans Lamp is controlled by DDEC VI..

The AGS2 Check Trans Lamp remains ON:

- □ For approximately five (5) seconds at the start of every ignition cycle (a bulb check)
- □ When the AGS2 transmission ECU sends a diagnostic trouble code with an SPN 2003

AGS2 Check Trans Lamp Requirements and Guidelines

The following requirements and guidelines apply to the AGS2 Check Trans Lamp:

- □ The AGS2 Check Trans Lamp is optional.

- □ A 12 volt light of less than 0.25 A (DC) is required depending on the ignition source. Digital output circuits are designed to sink no more than 0.25 A (DC) current.

- □ The AGS2 Check Trans Lamp must be integrated into the instrument panel or placed in clear view of the vehicle operator.

- □ This output is wired to pin 3/12 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 3-120.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 12 DO Selection	2 = AGS2 Check Transmission Indication Lamp	0 = Disabled 1 = Oil Level Lamp 2 = AGS2 Check Transmission Indication Lamp 3 = Oil Pressure Low Lamp 4 = Cruise Active Lamp 5 = FUSO Retarder Control 2*	0 = Disabled	VEPS or DRS
35	3 12 DO Fault Detection	–	0 = Disabled 1 = Enabled	0 = Disabled	VEPS or DRS

* Not supported in NAFTA

Table 3-120   AGS2 Check Trans Lamp Programming Options

3.7.15   AGS2 TRANS TEMP LAMP

The AGS2 Trans Temp Lamp is controlled by DDEC VI..
The AGS2 Trans Temp Lamp remains ON:
   □   For approximately five (5) seconds at the start of every ignition cycle
        (a bulb check)
   □   When transmission temp is high

AGS2 Trans Temp Lamp Requirements and Guidelines

The following requirements and guidelines apply to the AGS2 Trans Temp Lamp:

   □   The AGS2 Trans Temp Lamp is optional.

   □   A 12 volt light of less than 0.25 A (DC) is required depending on the ignition source.
        Digital output circuits are designed to sink no more than 0.25 A (DC) current.

   □   The AGS2 Trans Temp Lamp must be integrated into the instrument panel or placed in
        clear view of the vehicle operator.

   □   This output is wired to pin 3/10 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 3-121.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 10 DO Selection	2 = AGS2 Check Transmission Indication Lamp	0 = Disabled 1 = Air Filter Lamp* 2 = AGS2 Transmission Temp Indication Lamp 3 = Battery Voltage Low Lamp 4 = Coolant Level Low Lamp 5 = FUSO Retarder Control 1*	0 = Disabled	VEPS or DRS
35	3 10 DO Fault Detection	–	0 = Disabled 1 = Enabled	0 = Disabled	VEPS or DRS

* Not supported in NAFTA

Table 3-121   AGS2 Trans Temp Lamp Programming Options

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4   INPUTS AND OUTPUTS

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4.1 INPUTS

The input functions and their associated pins are listed in Table 4-1.

Digital Input Functions	CPC Connector / Pin
A/C Status	2/12
ABS Active	3/18
Aux Shutdown #1	1/10
Clutch Released Switch	4/8
Cruise Control Enable	1/14
Cruise Control Set/Coast	1/12
Cruise Control Resume/Accel	1/16
Diagnostic Request Switch	1/15
Dual Speed Axle	1/1
Engine Brake Disable	4/18
Engine Brake Low	2/14
Engine Brake Medium	2/15
Fan Control Override	2/13
Fast Engine Heat Up Switch	4/18
Idle Validation 1	1/06
Idle Validation 2	1/03
Limiter 0 (LIM0)	1/11
Limiter 1 (LIM1)	2/11
Optimized Idle Hood Tilt Switch	4/18
Optimized Idle Thermostat	3/1
Park Brake Interlock	1/2
Regen Switch	4/17
Remote Throttle Select Switch	2/8
Remote PTO Switch	2/9
RPM Freeze	4/18
Service Brake Released Switch	2/7
Stop Engine Override/Diagnostic Request Switch	1/15
Throttle Inhibit	1/17
Transmission Neutral Switch	4/16
Transmission Retarder Active	1/1

Table 4-1   DDEC VI Inputs

These inputs can be either a switch or an OEM interlock depending on the function.

The following sections contain a description of the available options.

4.1.1   AIR CONDITION STATUS

This digital input indicates that the air conditioner is inactive. When the digital input is open, then the fan is turned on if configured (Air Condition Enable Auto Fan). There is a 10 second delay when the digital input is grounded before returning to regular idle.

The AC Enable Switch or the AC High Pressure Switch can be used for this input.

Installation

The Air Conditioner Switch is wired to the CPC on pin 2/12.

Programming Requirements and Flexibility

This digital input's parameters are listed in Table 4-2.

Parameter Group	Parameter	Description	Setting	Default	Access
6	Mode of A/C Status Input	Selects Mode for A/C Switch	0 – Disabled 1 – A/C Active Closed 2 – A/C Active Open 3 – LIM Active Closed 4 – LIM Active Open	2 – A/C Active Open	VEPS or DRS
6	Fast Idle Spd Air Cond Input	Fast Idle speed used when A/C is activated	500 – 3000 RPM	600 RPM	VEPS or DRS
19	Air Condition Enable Auto Fan	Enables/disables the fan when the A/C is on	0 – Disable 1 – Enable	1 – Enable	VEPS or DRS

Table 4-2   Air Condition Status Programming Options

4.1.2   ABS ACTIVE

The anti-lock brake system (ABS) input is used with AGS2 transmissions for ABS indication to the CPC.

Installation

This switch is wired to pin 3/18 of the CPC.

Programming Requirements and Flexibility

The options for the ABS digital input are listed in Table 4-3.

Parameter Group	Parameter	Setting	Options	Default	Access
13	3 18 DI Selection	1 — Enable ABS Input	0 — Disable 1 — Enable ABS Input 2 — Enable Transmission Retarder Input 3 — Enable Tempo Set* 4 — Enable Grid Heater Detection* 5 — Switchable Torque Demand* 6 — Drive On Super Structure* 7 — Throttle Inhibit Super Structure* 8 — Split Select* 9 — FUSO Engine Brake Stage 2 Cancel Switch* 10 — DPF Inhibit Switch	0 — Disable	VEPS, DRS

* Not supported in NAFTA

Table 4-3   ABS Programming Options

4.1.3   AUXILIARY SHUTDOWN #1

The auxiliary shutdown input (auxiliary shutdown #1) are used by other vehicle systems when it is desirable to use the CPC's engine protection function. For example, the engine protection function may be used to protect a transmission or pump against failure. When a vehicle system needs the engine to shutdown, an input port configured as auxiliary shutdown is switched to sensor return.

Installation

The Aux Shutdown #1 Switch is wired to the CPC on pin 1/10.

Programming Requirements and Flexibility

The options for the auxiliary shutdown #1 digital input are listed in Table 4-4.

Parameter Group	Parameter	Setting	Options	Default	Access
13	1 10 DI Selection	1 — Enable Aux Shutdown	0 — Disable 1 — Enable Aux Shutdown 2 — FUSO Accelerator Switch*	0 — Disable	VEPS, DRS

* Not supported in NAFTA

Table 4-4   Aux Shutdown #1 Programming Options

4.1.4   CLUTCH SWITCH

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. Cruise Control is suspended if the clutch is pressed once if Auto Resume is enabled. If the clutch is released within three seconds, Cruise Control is automatically resumed.

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

If the transmission type is set to a two pedal system, the engine will know that there is no clutch on the vehicle and will ignore the clutch switch input.

The Clutch Switch is a normally closed switch. It is customer selectable and is normally disabled.

Installation

The Clutch Switch is wired to the CPC on pin 4/8. Alternatively the Clutch switch may be multiplexed on J1939. Refer to section 4.2, "Switch Inputs Received Over J1939 Data Link" for additional information.

Programming Requirements and Flexibility

The options for this digital input are listed in Table 4-5.

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

Table 4-5   Clutch Switch Programming Options

4.1.5   CRUISE CONTROL ON/OFF SWITCH

Cruise Control is enabled but not active when the Cruise Control Master switch digital input is switched to battery ground.

The Cruise Control Master switch is a normally open switch.

Installation

The Cruise Control Master Switch is wired to the CPC on pin 1/14. Alternatively, this input may be multiplexed on J1939. Refer to section 4.2, "Switch Inputs Received Over J1939 Data Link" for additional information on multiplexing this input.

Programming Requirements and Flexibility

The options for this digital input are listed in Table 4-6.

Parameter Group	Parameter	Options	Default	Access
13	CC ON OFF Switch Config	0 – Hardwired 1 – CCVS1 2 – CCVS2 3 – CCVS3	0 – Hardwired	VEPS or DRS

Table 4-6   Cruise Control On/Off Switch Programming Options

4.1.6 CRUISE CONTROL RESUME/ACCEL SWITCH AND SET/COAST SWITCH

RESUME – If Cruise Control has been disabled with the service brake or the clutch switch, momentary contact to the ON position (switching to battery ground) restores the previously set cruise speed.

ACCEL – When Cruise Control is active, the Resume/Accel input can be used to increase the power and speed by toggling the switch. Momentarily toggling and releasing the Resume/Accel switch will increase the set point by 1 MPH increments. Holding the Resume/Accel will increase the set point by 1 MPH per second. When released, the cruise control set point will be at the new speed.

The Resume/Accel Switch is a momentary normally open switch.

SET – Cruise Speed is set by momentarily contact 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 increments. Holding the Set/Coast will decrease the set point by 1 MPH per second. When released the Cruise Control set point will be at the new speed.

The Set/Coast Switch is a momentary normally open switch.

Installation

The Resume/Accel Switch is wired to the CPC on pin 1/16. The Set/Coast Switch is wired to the CPC on pin 1/12. Alternatively, either may be multiplexed on J1939. Refer to section 4.2, "Switch Inputs Received Over J1939 Data Link" for additional information on multiplexing this input.

Programming Requirements and Flexibility

The options for this digital input are listed in Table 4-7.

Parameter Group	Parameter	Options	Default	Access
13	CC Set Cst Res Accel Sw Config	0 – Hardwired 1 – CCVS1 2 – CCVS2 3 – CCVS3	0 – Hardwired	VEPS or DRS

Table 4-7   Cruise Control Resume/Accel Switch Programming Options

Diagnostics

If both the Cruise Control Set/Coast and Resume/Accel switches are grounded for more than a programmed number of consecutive samples, a diagnostic fault is logged. All cruise control switch functions will be disabled.

4.1.7   DIAGNOSTIC REQUEST SWITCH

This digital input allows the flashing of diagnostic codes using the AWL and RSL. This is a momentary normally open switch.

Installation

The Diagnostic Request Switch is wired to #1 connector of the CPC on pin 1/15.

Programming Requirements and Flexibility

The options for this digital input are listed in Table 4-8.

Parameter Group	Parameter	Options	Default	Access
13	1 15 DI Selection	0 – Disabled 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 4-8   Diagnostic Request Switch Programming Options

4.1.8   DUAL-SPEED AXLE SWITCH

This input indicates that the dual-speed axle ratio has been switched when the input is grounded. When the switch is open, the dual speed axle ratio is normal.

The Dual-speed Axle Switch is a normally open switch.

Installation

The Dual-speed Axle Switch is wired to the CPC on pin 1/1. Alternatively, it may be multiplexed on J1939. Refer to section 4.2, "Switch Inputs Received Over J1939 Data Link" for additional information.

Programming Requirements and Flexibility

The options for this digital input are listed in Table 4-9.

Parameter Group	Parameter	Options	Default	Access
13	2nd Axle Speed Switch Config	0 – Hardwired 1 – CCVS1 2 – CCVS2 3 – CCVS3	0 – Hardwired	VEPS or 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 or DRS

* Not Supported in NAFTA

Table 4-9   Dual-speed Axle Switch Programming Options

4.1.9 ENGINE BRAKE DISABLE

Engine Brake Disable is a digital input which is switched to battery ground whenever a vehicle system such as a traction control device does not want engine braking to occur.

The CPC, which controls the Engine Brake directly, will not allow engine braking when the input is switched to battery ground. DDEC VI supports the J1939 message to disable engine brake (TSC1 command to source address 15).

Installation

The Engine Brake Disable Switch is wired to pin 4/18 on the CPC.

Programming Requirements and Flexibility

The options for this digital input are listed in Table 4-10.

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 4-10   Engine Brake Disable Programming Options

4.1.10   ENGINE BRAKE LOW & MEDIUM

The Engine Brake Low and Engine Brake Medium switches select the level of engine braking as listed in Table 4-11.

Engine Brake Low Digital Input	Engine Brake Medium Digital Input	Engine Brake Status
OPEN	OPEN	OFF
GND	OPEN	LOW
OPEN	GND	MEDIUM
GND	GND	HIGH

Table 4-11   Level of Engine Braking

The Engine Brake Low and Engine Brake Medium switches are normally open switches.

Installation

The Engine Brake Low Switch is wired to the CPC on pin 2/14 and Engine Brake Medium Switch is wired to the CPC on pin 2/15.

Programming Requirements and Flexibility

The options for this digital input are listed in Table 4-12.

Parameter Group	Parameter	Options	Default	Access
13	Engine Brake Switch Config	0 – Hardwired 1 — Info from J1939 255 – Not Available	0 – Hardwired	VEPS or DRS

Table 4-12   Engine Brake Switch Programming Options

4.1.11   FAN OVERRIDE

This digital input is used to activate the fan when the input is switched to battery ground.

The fan override switch is a normally open switch.

Installation

The Fan Override Switch is wired to the CPC on pin 2/13.

4.1.12   FAST ENGINE HEAT UP SWITCH

This feature is available for MBE900 engines. The engine goes into thermal management mode to increase heat rejection into the coolant to improve the in-cab heating when the following conditions are met: .

☐ Fast Idle Heat Up Switch is ON (grounded)

☐ Clutch is engaged (grounded if configured)

☐ Transmission in neutral (grounded if configured)

☐ Park Brake is ON (grounded)

☐ PTO is not active

This is a normally open switch.

Installation

The Fast Engine Heat Up Switch is wired to the CPC on pin 4/18.

Programming Requirements and Flexibility

The options for this digital input are listed in Table 4-13.

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 4-13   Fast Engine Heat Up Switch Programming Options

4.1.13   IDLE VALIDATION 1 & IDLE VALIDATION 2

The Idle Validation Switch consists of two contacts. Idle Validation 1 is normally closed and indicates that the accelerator pedal is in the idle position when the input is grounded. Idle Validation 2 is normally open and indicates that the accelerator pedal is not in the idle position when it is grounded.

NOTE:
An Idle Validation Switch is required.

Installation

The Idle Validation 1 Switch is wired to the CPC on pin 1/6. The Idle Validation 2 Switch is wired to the CPC on pin 1/3.

4.1.14   LIMITERS FOR TORQUE, ENGINE SPEED, AND VEHICLE SPEED

These inputs indicate that the engine is being limited to a torque, engine speed or vehicle speed. These limiters are Limiter 0 (LIM0) and Limiter 1 (LIM1).

Installation

Limiter 0 is wired to the CPC on pin 1/11, Limiter 1 on pin 2/11.

Programming Requirements and Flexibility

Refer to section 5.17, "Limiters," for more information.

4.1.15   OPTIMIZED IDLE HOOD TILT SWITCH

The Hood Tilt Switch digital input indicates when the hood is opened or closed for Optimized Idle operation.

The Hood Tilt Switch is a normally open switch and is required for Optimized Idle.

Installation

The Hood Tilt Switch is wired to the CPC on pin 4/18.

Programming Requirements and Flexibility

The options for this digital input are listed in Table 4-14.

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 4-14   Hood Tilt Switch Programming Options

4.1.16   OPTIMIZED IDLE THERMOSTAT

The OI thermostat input indicates when the engine should run to heat/cool the cab when operating in Optimized Idle mode. This input is normally open.

Installation

The OI thermostat is wired to the CPC on pin 3/1.

Programming Requirements and Flexibility

The options for this digital input are listed in Table 4-15.

Parameter Group	Parameter	Options	Default	Access
13	3 01 AI Selection	0 = No Sensor 1 = Air Filter Restriction Sensor* 2 = OI Thermostat 3 = FUSO Clutch Pedal Sensor Input*	0 = No Sensor	VEPS, DRS

* Not supported in NAFTA

Table 4-15   OI Thermostat Programming Options

4.1.17   PARK BRAKE SWITCH

This input indicates that the Park Brake is engaged when switched to battery ground.

The Park Brake Switch is a normally open switch.

Installation

This input is wired to the CPC pin 1/2. Alternatively, this input may be multiplexed on J1939. Refer to section 4.2, "Switch Inputs Received Over J1939 Data Link" for additional information on multiplexing this input.

This input is required.

Programming Requirements & Flexibility

This digital input can be configured as listed in Table 4-16.

Parameter Group	Parameter	Options	Default	Access
13	1 02 DI Selection	0 – Disable 1 – Enable Park Brake Interlock 2 – FUSO Auxiliary Brake Cut Switch*	1 – Enable Park Brake Interlock	VEPS or DRS
13	Park Brake Switch Config	0 – Hardwired 1 – CCVS1 2 – CCVS2 3 – CCVS3	0 – Hardwired	VEPS or DRS

* Not supported in NAFTA

Table 4-16   Configuring the Park Brake Switch Input

4.1.18   REGEN SWITCH

The Regen Switch is used by the operator to initiate a parked regeneration. If "DPF J1939 Regen SW Enable" is active, the CPC will no longer process the hardwired DPF Regen Switch requests. The CPC must receive regular periodic switch status messages over J1939.

The Regen Switch is a momentary normally open switch. Refer to section 5.20 for additional information.

Installation

The Regen Switch is wired to the CPC #4 connector pin 4/17. A switch is required or wiring must be available to connect an external switch.

Programming Requirements and Flexibility

The options for this digital input are listed in Table 4-17.

Parameter Group	Parameter	Options	Default	Access
13	4 17 DI Selection	0 – Disable 1 – 2 Clutch Switch* 2 – DPF Regeneration Switch 3 — FUSO Air Suspension Speed Limit Switch*	2 – DPF Regeneration Switch	VEPS or DRS
46	DPF J1939 Regen Sw Enable	0 – Not Active 1 – Active	0 – Not Active	VEPS or DRS

* Not supported in NAFTA

Table 4-17   Regen Switch Programming Options

4.1.19   REMOTE THROTTLE SELECT SWITCH

This digital input when switched to battery ground indicates that the remote throttle is active. The switch information will only be used if the remote accelerator input is configured.

The remote accelerator enable switch is a normally open switch.

Installation

This input is wired to the CPC pin 2/8.

Programming Requirements & Flexibility

This digital input can be configured as listed in Table 4-18.

Parameter Group	Parameter	Options	Default	Access
13	2 08 DI Selection	0 – Disable 1 – Remote Throttle Enable 2 – Service Brake Active*	1 – Remote Throttle Enable	VEPS or DRS
20	Remote Accelerator Enable	0 – Disable 1 – Enable	0 – Disable	VEPS or DRS

* Not supported in NAFTA

Table 4-18   Configuring the Remote Accelerator Select Input

4.1.20   REMOTE PTO SWITCH

The Remote PTO Switch allows the use of a customer selected high idle speed instead of the hot idle engine speed.

The Remote PTO speed is active when a digital input is switched to battery ground and the parking brake is enabled. The preset speeds are selected by enabling the remote PTO switch once for PTO speed #1, twice for PTO speed #2 or three times for PTO speed #3. These PTO speeds can be set with VEPS. The Remote PTO will override the Cab PTO mode and cab throttle unless "PTO Throttle Override" is disabled.

The Remote PTO Switch is a normally open switch.

Installation

This input is wired to the CPC pin 2/9.

4.1.21   RPM FREEZE

The RPM Freeze input (when grounded) allows the operator to request that PTO maintain the current engine speed. Locking on to a fixed engine speed is desirable in applications where the input is subjected to electrical noise which in turn causes the engine speed to fluctuate. The RPM Freeze Switch is normally open.

Installation

This input is wired to pin 4/18 on the CPC.

Programming Requirements & Flexibility

The options for this digital input are listed in Table 4-19.

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 4-19   RPM Freeze Programming Options

4.1.22   SERVICE BRAKE RELEASED SWITCH

This input indicates that the brake is released when switched to battery ground. If the brake is activated, then the input is open. This input will suspend cruise control when the brake is activated.

The service brake switch is a normally closed switch.

This input is required.

Installation

This input is wired to the CPC pin 2/7. Alternatively, this input may be multiplexed on J1939. Refer to section 4.2, "Switch Inputs Received Over J1939 Data Link" for additional information on multiplexing this input.

Programming Requirements & Flexibility

This digital input can be configured as listed in Table 4-20.

Parameter Group	Parameter	Options	Default	Access
13	Service Brake Switch Config	0 – Hardwired 1 – CCVS1 2 – CCVS2 3 – CCVS3	0 – Hardwired	VEPS or DRS

Table 4-20   Configuring the Service Brake Switch Input

4.1.23   STOP ENGINE OVERRIDE

The Stop Engine Override Switch is a momentary normally open switch. When the input is switched to battery ground, a shutdown override is enabled.

Shutdown Override Switch is a momentary normally open switch.

Installation

This input is wired to the CPC pin 1/15.

This digital input can be configured as listed in Table 4-21.

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 4-21   Diagnostic Request Switch Programming Options

4.1.24   THROTTLE INHIBIT

If the Throttle Inhibit Switch is switched to battery ground, the engine will not respond to the foot pedal or remote throttle.

If the Throttle Inhibit Switch is grounded while the vehicle speed is greater than X mph, the throttle inhibit function will be disabled until the switch is validated again.

The Throttle Inhibit Switch is a normally open switch.

Installation

The Throttle Inhibit Switch is wired to the CPC on pin 1/17.

4.1.25   TRANSMISSION NEUTRAL SWITCH

This digital input when switched to battery ground indicates that the transmission is in neutral. An open circuit indicates in gear.

NOTE:
This input is required for Optimized Idle.

Installation

This input is wired to the CPC pin 4/16.

Programming Requirements & Flexibility

This digital input can be configured as listed in Table 4-22.

Parameter Group	Parameter	Options	Default	Access
13	Trans Neutral Input Config	0 – Hardwired 1 — Info from J1939 255 – Not Available	0 – Hardwired	VEPS or DRS

Table 4-22   Configuring the Transmission Neutral Switch Input

4.1.26   TRANSMISSION RETARDER ACTIVE

This input indicates that the transmission retarder is active. When the input is switched to ground, the fan is turned off. When the input is open, the fan will be turned on. The fan will be on for a minimum of 30 seconds. Refer to the transmission manufacturers documentation to determine when to connect this input.

Installation

The transmission retarder input is wired to pin 1/1.

Programming Requirements & Flexibility

The options for this digital input are listed in Table 4-23.

Parameter Group	Parameter	Options	Default	Access
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 or DRS

* Not supported in NAFTA

Table 4-23   Transmission Retarder Input Options

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4.2   SWITCH INPUTS RECEIVED OVER J1939 DATA LINK

Multiplexing is available for several switch inputs over the SAE J1939 Data Link. The CPC supports this feature for the following switch inputs:

☐ Cruise Control On/Off Switch

☐ Cruise Control Set/Coast

☐ Cruise Control Resume/Accel

☐ Cruise Pause Switch

☐ Service Brake Switch

☐ Park Brake Switch

☐ Clutch Brake Switch

☐ Engine Brake Switches – EBC1 Message

☐ Dual-Speed Axle Switch

To use the multiplexing feature with the CPC, the parameters must be set up correctly. There are three different source addresses (SA) possible for receiving the Cruise Control message. Every switch in this message must be programmed to react on one programmed SA. The SA is programmed by the vehicle OEM.

If an error is detected (wrong data on J1939 CC message or the message is not sent) an error is logged. If the error is caused by wrong data or missing data, the error will be logged and will be held active until the ignition is switched off. Cruise Control will also be disabled.

The options for each source address are listed in Table 4-24. The multiplexing parameters are listed in Table 4-25.

Parameter Group	Parameter	Options	Default	Access
1	EBC1 Source Address J1939	0-255	33	VEPS, DRS
1	CC1 Source Address SAE J1939	0 – 255	23	VEPS, DRS
1	CC2 Source Address SAE J1939	0 – 255	33	VEPS, DRS
1	CC3 Source Address SAE J1939	0 – 255	49	VEPS, DRS
1	TSC1 Source Address SAE J1939	0 – 255	231	VEPS, DRS

Table 4-24   Source Address Options

Parameter Group	Parameter	Options	Default	Access
13	CC On Off Switch Config	0 - Hardwired 1 – CCVS1 2 – CCVS2 3 – CCVS3	0	VEPS, DRS
13	CC Set Cst Res Accel Sw Config	0 - Hardwired 1 – CCVS1 2 – CCVS2 3 – CCVS3	0	VEPS, DRS
13	Service Brake Switch Config	0 - Hardwired 1 – CCVS1 2 – CCVS2 3 – CCVS3	0	VEPS, DRS
13	Park Brake Switch Config	0 - Hardwired 1 – CCVS1 2 – CCVS2 3 – CCVS3	0	VEPS, DRS
13	Clutch Switch Config	0 - Not Configured 1 – 1 Clutch Switch 2 – 2 Clutch Switch* 3 – CCVS1 4 – CCVS2 5 – CCVS3 6 – ETC1	0	VEPS, DRS
13	2nd Axle Speed Switch Config	0 - Hardwired 1 – CCVS1 2 – CCVS2 3 – CCVS3	0	VEPS, DRS
13	Engine Brake Switch Config	0 — Hardwired 1 — Info from J1939 255 — Not Available	0	VEPS, DRS
13	Trans Neutral Input Config	0 — Hardwired 1 — Info from J1939 255 — Not Available	0	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	VEPS, DRS
13	Cab PTO Switch Config	0 - Hardwired 1 – CCVS1 2 – CCVS2 3 – CCVS3 4 – CCVS1 or Hardwired 5 – CCVS2 or Hardwired 6 – CCVS1 or Hardwired	0	VEPS, DRS

* Not supported in NAFTA

Table 4-25   Parameters for Multiplexing

4.3 DIGITAL OUTPUTS – CPC

The CPC has 15 digital output pins, 12 low side and three high side. The CPC digital output functions and their associated pins are listed in Table 4-26.

Digital Output Function	Driver	CPC Connector/Pin
AGS2 Backup Lamp	Low Side	3/09
AGS2 Check Trans Lamp	Low Side	3/12
AGS2 Trans Temp Lamp	Low Side	3/10
Amber Warning Lamp	Low Side	2/10
Cruise Active Lamp	Low Side	3/12
Deceleration Lamp	Low Side	4/09
DPF Regeneration Lamp	Low Side	1/05
Engine Brake Active	Low Side	3/09
Ether Start	Low Side	31/8
High Exhaust System Temperature Lamp	Low Side	4/07
Low Battery Voltage Lamp	Low Side	3/10
Low Coolant Level Lamp	Low Side	3/10
Low Oil Pressure Lamp	Low Side	3/12
Malfunction Indicator Lamp	Low Side	1/13
Optimized Idle Active Lamp	Low Side	4/09
Optimized Idle Alarm	Low Side	3/17
Red Stop Lamp	Low Side	3/16
Starter Lockout/Run Signal	Low Side	3/17
Top2 Shift Solenoid	High Side	3/08
Top2 Lockout Solenoid	High Side	3/07
Vehicle Power Shutdown	High Side	4/10
Wait to Start Lamp	Low Side	4/06

Table 4-26   Digital Outputs – CPC

The digital outputs wired to the MCM are listed in Table 4-27.

Digital Output Function	Driver	MCM Connector/Pin
Ether Start	Low Side	31/8

Table 4-27   Digital Outputs – CPC

4.3.1   AGS2 BACKUP LAMP

This digital output is used for non-multiplexed applications with the AGS2 transmission.

Installation

This digital output circuit is designed to sink no more that 2.0 A (DC) current.

The AGS2 Backup Lamp is wired to pin 3/9 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-28.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 09 DO Selection	2 – AGS2 Backup Lamp	0 – Disabled 1 — Grid Heater Hard Wired* 2 – AGS2 Backup Lamp 3 – Engine Brake Active 4 – Not Used 5 — FUSO Engine Brake Active Lamp*	0 – Disabled	VEPS or DRS
35	3 09 DO Fault Detection	—	0 – Disabled 1 – Enabled	0 – Disabled	VEPS or DRS

* Not supported in NAFTA

Table 4-28   AGS2 Backup Lamp Programming Options

4.3.2   AGS2 CHECK TRANS LAMP

This digital output is used for non-multiplexed applications with the AGS2 transmission.

Installation

This digital output circuit is designed to sink no more that 250 mA (DC) current.

The AGS2 Check Trans Lamp is wired to pin 3/12 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-29.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 12 DO Selection	2 – AGS2 Check Transmission Indication Lamp	0 – Disabled 1 – Oil Level Lamp 2 – AGS2 Check Transmission Indication Lamp 3 – Oil Pressure Low Lamp 4 – Cruise Active Lamp 5 – FUSO Retarder Control 2*	0 – Disabled	VEPS or DRS
35	3 12 DO Fault Detection	—	0 – Disabled 1 – Enabled	0 – Disabled	VEPS or DRS

* Not supported in NAFTA

Table 4-29   AGS2 Check Transmission Indication Lamp Programming Options

4.3.3 AGS2 TRANS TEMP LAMP

This digital output is used for non-multiplexed applications with the AGS2 transmission.

Installation

This digital output circuit is designed to sink no more that 250 mA (DC) current.

The AGS2 Transmission Temp Indication Lamp is wired to pin 3/10 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-30.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 10 DO Selection	2 – AGS2 Transmission Temp Indication Lamp	0 – Disabled 1 – Air Filter Lamp* 2 – AGS2 Transmission Temp Indication Lamp 3 – Battery Voltage Low Lamp 4 – Coolant Level Low Lamp 5 – FUSO Retarder Control 1*	0 – Disabled	VEPS or DRS
35	3 10 DO Fault Detection	—	0 – Disabled 1 – Enable	0 – Disabled	VEPS or DRS

* Not supported in NAFTA

Table 4-30   AGS2 Transmission Temp Indication Lamp Programming Options

4.3.4 AMBER WARNING LAMP

The Amber Warning Lamp is illuminated for all active faults. The AWL will also flash when an engine shutdown occurs.

Installation

This digital output circuit is designed to sink no more than 250 mA (DC) current.

The AWL is wired to pin 2/10 of the CPC.

NOTE:
This digital output is REQUIRED.

4.3.5   CRUISE ACTIVE LAMP

When Cruise Control's Cruise Switch PTO is active, this digital output is switched to ground. This digital output can be used to drive a lamp indicating the active state of Cruise Control.

NOTE:
This function is optional.

Installation

This digital output circuit is designed to sink no more that 250 mA (DC) current. The Cruise Active Lamp is wired to pin 3/12 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-31.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 12 DO Selection	4 — Cruise Active Lamp	0 — Disabled 1 – Oil Level Lamp* 2 — AGS2 Check Trans Lamp 3 — Oil Pressure Low Lamp 4 — Cruise Active Lamp 5 — FUSO Retarder Control 2*	0 — Disabled	VEPS or DRS
35	3 12 DO Fault Detection	—	0 — Disabled 1 — Enabled	0 — Disabled	VEPS or DRS

* Not supported in NAFTA

Table 4-31   Cruise Active Lamp Programming Options

4.3.6   DECELERATION LAMP

The Deceleration Lamp options a lamp in the back of the vehicle to warn that the vehicle is slowing down. This digital output could be used to drive a deceleration lamp or more typically a relay which drives the deceleration lamps. This digital output is switched to ground whenever the percent throttle is zero and Cruise Control is inactive.

NOTE:
This feature is optional.

Installation

This digital output circuit is designed to sink no more than 2.0 mA (DC) current. The Deceleration Lamp is wired to pin 4/9 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-32.

Parameter Group	Parameter	Setting	Options	Default	Access
35	4 09 DO Selection	11 – Deceleration Lamp	0 – Disabled 1 – Accelerator Pedal Idle Position* 2 – Actual Torque* 3 – Road Speed* 4 – Engine Speed* 5 – Coolant Temp* 6 – Pedal Torque* 7 – Boost Temp* 8 – Oil Pressure (MCM Threshold)* 9 – Coolant Temp (MCM Threshold)* 10 – OI Active Lamp 11 – Deceleration Lamp 12 – FUSO Ground Starter Lockout Relay*	0 – Disabled	VEPS or DRS
35	4 09 DO Fault Detection	—	0 — Disabled 1 — Enabled	0 — Disabled	VEPS or DRS

* Not supported in NAFTA

Table 4-32   Deceleration Lamp Programming Options

4.3.7   DPF REGENERATION LAMP (HARDWIRED AND J1939)

The purpose of this lamp is to let the operator know that a parked regeneration is required. This lamp can be hardwired or multiplexed. Solid illumination indicates a manual regeneration is required.

NOTE:
This function is optional.

Installation

This digital output circuit is designed to sink no more than 250 mA (DC) current.

The DPF Lamp is wired to pin 1/5 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-33.

Parameter Group	Parameter	Setting	Options	Default	Access
35	1 05 DO Fault Detection	—	0 – Disabled 1 – Enabled	0 — Disabled	VEPS or DRS
46	DPF Lamp Config	—	0 – Hardwired 1 – J1939 PTC1	0 – Hardwired	VEPS or DRS

Table 4-33   DPF Regeneration Lamp Programming Options

4.3.8   ENGINE BRAKE ACTIVE

This digital output is switched to ground whenever the Engine Brake is active. This digital output could be used to drive an Engine Brake Active Lamp or give an engine brake active indication to another vehicle system

NOTE:
This function is optional.

Installation

This digital output circuit is designed to sink no more than 2.0 A (DC) current.

Engine Brake Active is wired to pin 3/9 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-34.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 09 DO Selection	3 – Engine Brake Active	0 – Disabled 1 – Grid Heater Hard Wired* 2 – AGS2 Backup Lamp 3 – Engine Brake Active 4 – Not Used 5 – FUSO Engine Brake Active Lamp*	0 – Disabled	VEPS or DRS
35	3 09 DO Fault Detection	—	0 — Disabled 1 — Enabled	0 – Disabled	VEPS or DRS

* Not supported in NAFTA

Table 4-34   Engine Brake Active Programming Options

4.3.9   ETHER START

This digital output is switched to ground when ether should be injected into the engine for cold start purposes.

NOTE:
This output is used on a Series 60 engine only.

Installation

This function is wired to pin 31/8 of the 31-pin connector. The power supply for the ether system should be wired to pin 31/22 of the 31-pin connector.

Programming Requirements & Flexibility

The options for this digital input are listed in Table 4-35.

Parameter Group	Parameter	Options	Default	Access
MCM – 1	SW6 Configuration	0 – Disable 24 – Ether Start	0 - Disable	VEPS, DRS
MCM – 8	Cold Start Type	0 – No Function 1 – Grid Heater 3 – Ether Injection	0 – No Function	VEPS, DRS

Table 4-35   Ether Start Options

4.3.10   HIGH EXHAUST SYSTEM TEMPERATURE LAMP (HARDWIRED AND J1939)

The purpose of this lamp is to let the operator know that the exhaust temperature is at an elevated condition with low vehicle speed. It can be hardwired or multiplexed.

NOTE:
This function is optional.

Installation

This digital output circuit is designed to sink no more than 250 mA (DC) current.

The HET Lamp is wired to pin 4/7 of the CPC.

Programming Requirements and Flexibility

The options for this digital input listed in Table 4-36.

Parameter Group	Parameter	Options	Default	Access
35	4 07 DO Selection	0 = Disabled 1 = Accelerator Pedal Kick Down* 2 = Actual Torque* 3 = Road Speed* 4 = Engine Speed* 5 = Coolant Temperature* 6 = Pedal Torque* 7 = Boost Temperature* 8 = Oil Pressure (MCM threshold)* 9 = Coolant Temperature (MCM threshold)* 10 = Vehicle Power Shutdown / Ignition Relay* 11 = Optimized Idle ACC Bus (ignition relay)* 12 = Split Valve 1* 13 = High Exhaust Temp Lamp	13 = High Exhaust Temp Lamp	VEPS, DRS
35	4 07 Fault Detection	0 = Disabled 1 = Enabled	0 = Disabled	VEPS, DRS
46	Hi Exhaust Temp Lamp Config	0 = Hardwired 1 = 1939 PTC1	0 = Hardwired	VEPS, DRS

* Not Available in NAFTA

Table 4-36   High Exhaust System Temperature Lamp Options

4.3.11   LOW BATTERY VOLTAGE LAMP

This digital output is switched to ground when a low battery voltage fault is detected.

NOTE:
This function is optional.

Installation

This digital output circuit is designed to sink no more than 2.0 A (DC) current.

The Low Battery Voltage Lamp is wired to pin 3/10 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-37.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 10 DO Selection	3 – Battery Voltage Low Lamp	0 – Disabled 1 – Air Filter Lamp* 2 – AGS2 Transmission Temp Indication Lamp 3 – Battery Voltage Low Lamp 4 – Coolant Level Low Lamp 5 – FUSO Retarder Control 1*	0 – Disabled	VEPS or DRS
35	3 10 DO Fault Detection	—	0 — Disabled 1 — Enabled	0 – Disabled	VEPS or DRS

* Not supported in NAFTA

Table 4-37   Low Battery Voltage Lamp Programming Options

4.3.12   LOW COOLANT LEVEL LAMP

This digital output is switched to ground when a low coolant level fault is detected.

NOTE:
This function is optional.

Installation

This digital output circuit is designed to sink no more than 250 mA (DC) current.

The Low Coolant Level Lamp is wired to pin 3/10 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-38.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 10 DO Selection	4 – Coolant Level Low Lamp	0 – Disabled 1 – Air Filter Lamp* 2 – AGS2 Transmission Temp Indication Lamp 3 – Battery Voltage Low Lamp 4 – Coolant Level Low Lamp 5 – FUSO Retarder Control 1*	0 – Disabled	VEPS or DRS
35	3 10 DO Fault Detection	—	0 — Disabled 1 — Enabled	0 – Disabled	VEPS or DRS

* Not supported in NAFTA

Table 4-38   Coolant Level Low Lamp Programming Options

4.3.13   LOW OIL PRESSURE LAMP

This digital output is switched to ground when a low oil pressure fault is detected.

NOTE:
This function is optional.

Installation

This digital output circuit is designed to sink no more than 250 mA (DC) current.

The Low Oil Pressure Lamp is wired to pin 3/12 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-39.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 12 DO Selection	3 – Oil Pressure Low Lamp	0 – Disabled 1 – Oil Level Lamp* 2 – AGS2 Check Transmission Indication Lamp 3 – Oil Pressure Low Lamp 4 – Cruise Active Lamp 5 – FUSO Retarder Control 2*	0 – Disabled	VEPS or DRS
35	3 12 DO Fault Detection	—	0 — Disabled 1 — Enabled	0 – Disabled	VEPS or DRS

* Not supported in NAFTA

Table 4-39   Low Oil Pressure Lamp Programming Options

4.3.14   MALFUNCTION INDICATOR LAMP (MIL)

This amber warning lamp is illuminated for all active engine emission related faults including but not limited to after-treatment devices. The MIL may illuminate at the same time as the Amber Warning Lamp.

This is a required lamp. It can be hardwired or multiplexed.

NOTE:
This digital output is REQUIRED.

Installation

This digital output circuit is designed to sink no more than 250 mA (DC) current.

The Malfunction Indicator Lamp is wired to pin 1/13 of the CPC.

4.3.15   OPTIMIZED IDLE ACTIVE LAMP

The Optimized Idle Active lamp digital output will flash at a rate of once every half second while the idle timer is counting down, after the system has initialized. The digital output is switched to sensor return after the idle timer has timed out and Optimized Idle has become active. The output will be activated along with the AWL and the RSL when the ignition is cycled ON for the bulb check. For more information on Optimized Idle, refer to section 5.19, "Optimized Idle."

Installation

This digital output circuit is designed to sink no more than 2.0 A (DC) current. The OI Active Lamp is wired to the CPC on pin 4/09.

NOTE:
This output is required for Optimized Idle.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-40.

Parameter Group	Parameter	Setting	Options	Default	Access
35	4 09 DO Selection	10 – Optimized Idle Active Lamp	0 – Disabled 1 – Accelerator Pedal Position* 2 – Actual Torque* 3 – Road Speed* 4 – Engine Speed* 5 – Coolant Temp* 6 – Pedal Torque* 7 – Boost Temp* 8 – Oil Pressure (MCM Threshold)* 9 – Coolant Temp (MCM Threshold)* 10 – Optimized Idle Active Lamp 11 – Deceleration Lamp 12 – FUSO Ground Starter Lockout Relay*	0 – Disabled	VEPS or DRS
35	4 09 DO Fault Detection	1 — Enabled	0 — Disabled 1 — Enabled	0 – Disabled	VEPS or DRS

* Not supported in NAFTA

Table 4-40   Optimized Idle Active Lamp Programming Options

Diagnostics

A Diagnostic Trouble Code (DTC) will be logged for an open or shorted circuit.

4.3.16   OPTIMIZED IDLE ALARM

The Optimized Idle Alarm digital output is switched to sensor return to turn on the Optimized Idle Alarm. The alarm will sound for five seconds prior to any Optimized Idle engine start. For more information on Optimized Idle, refer to section 5.19, "Optimized Idle."

Installation

This digital output is designed to sink no more than 2.0 A (DC) current. The OI Alarm is wired to the CPC on pin 3/17. The DDC part number for the OI Alarm is 23517899.

NOTE:
This output is required for Optimized Idle.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-41.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 17 DO Selection	4 – Optimized Idle Alarm	0 – Disabled 1 – Enable Starter Lockout 2 – Enable Kickdown Output* 3 – Not Used 4 – Optimized Idle Alarm 5 – Split Valve* 6 – Starter Lockout and AGS2 Run Signal/Starter Lockout 7 – Engine Brake Disabled for Overspeed*	0 – Disabled	VEPS or DRS
35	3 17 DO Fault Detection	—	0 — Disabled 1 — Enabled	0 – Disabled	VEPS or DRS

* Not supported in NAFTA

Table 4-41   Optimized Idle Alarm Programming Options

Diagnostics

A Diagnostic Trouble Code (DTC) will be logged for an open or shorted circuit.

4.3.17 RED STOP LAMP

The Red Stop Lamp (RSL) is illuminated for all active serious faults, which require the engine to be shutdown immediately. The AWL will also flash when an engine shutdown occurs.

Installation

This digital output circuit is designed to sink no more than 250 mA (DC) current.

The RSL is wired to pin 3/16 of the CPC.

NOTE:
This digital output is REQUIRED.

4.3.18 STARTER LOCKOUT

This digital output drives a normally closed relay which interrupts the starting signal when the output has been activated.

Installation

This digital output circuit is designed to sink no more than 2.0 A (DC) current.

The Starter Lockout digital output is wired to pin 3/17 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-42.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 17 DO Selection	1 – Enable Starter Lockout	0 – Disabled 1 – Enable Starter Lockout 2 – Enable Kickdown Output* 3 – Not Used 4 – Optimized Idle Alarm 5 – Split Valve* 6 – Starter Lockout and AGS2 Run Signal/Starter Lockout 7 – Engine Brake Disabled for Overspeed*	0 – Disabled	VEPS or DRS
35	3 17 DO Fault Detection	—	0 — Disabled 1 — Enabled	0 – Disabled	VEPS or DRS

* Not supported in NAFTA

Table 4-42   Starter Lockout Programming Options

4.3.19   TOP2 SHIFT SOLENOID

The shift solenoid is used to command an automatic shift between the top two gears in an Eaton®
Top2 transmission. When the digital output is switched to power, the shift solenoid commands a
shift to the top gear position. When the output is not activated, the shift solenoid commands a
shift to the gear one lower than the top position. The correct transmission type must be selected
when this digital output is programmed. For additional information on Top2, refer to section 5.27,
"Transmission Interface."

Installation

This circuit is a high-side digital output. The Top2 Shift solenoid is wired to pin 3/8 of the CPC.

Programming Requirements and Flexibility

The options for this digital output listed in Table 4-43.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 08 DO Selection	6 — Top2 Shift Solenoid	0 — Disable 1 — Exhaust Brake Only* 2 — Exhaust Brake and Decompression Brake via Single Valve* 3 — Port Extension Turbo Brake* 4 — PTO Stationary for AGS2 5 — PTO Mobile for AGS2 6 — Top2 Shift Solenoid 7 — FUSO Starter Lockout Relay*	0 — Disable	VEPS or DRS
35	3 08 DO Fault Detection	—	0 — Disabled 1 — Enabled	0 — Disable	VEPS or DRS

* Not supported in NAFTA

Table 4-43   Top2 Shift Solenoid Programming Options

Diagnostics

A Diagnostic Trouble Code (DTC) will be logged for an open or shorted circuit.

4.3.20   TOP2 SHIFT LOCKOUT SOLENOID

The shift lockout solenoid is used to disable the driver splitter position switch in an Eaton Top2 transmission. When the digital output is switched to power, the splitter position control is taken away from the driver and controlled by the ECU. The correct transmission type must be selected. For additional information on Top2, refer to section 5.27, "Transmission Interface."

Installation

This circuit is a high-side digital output. The Top2 Shift lockout solenoid is wired to pin 3/7 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-44.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 07 DO Selection	3 — Top2 Lockout Solenoid	0 — Disable 1 — Decompression Valve* 2 — Grid Heater* 3 — Top2 Lockout Solenoid 4 — Modulation Output for Allison Transmission without J1939 Interface (Gear1)* 5 — PTO Valve for AGS2	0 — Disable	VEPS or DRS
35	3 07 DO Fault Detection	—	0 — Disabled 1 — Enabled	0 — Disable	VEPS or DRS

* Not supported in NAFTA

Table 4-44   Top2 Shift Lockout Solenoid Programming Options

Diagnostics

A Diagnostic Trouble Code (DTC) will be logged for an open or shorted circuit.

4.3.21   VEHICLE POWER SHUTDOWN

This digital output actuates a relay that shuts down the rest of the electrical power to the vehicle when an idle shutdown or engine protection shutdown occurs.

Installation

The Vehicle Power Shutdown is wired to pin 4/10 of the CPC. This is a high side digital output.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-45.

Parameter Group	Parameter	Setting	Options	Default	Access
35	4 10 DO Selection	3 — Vehicle Power Shutdown	0 — Disable 3 — Vehicle Power Shutdown/Ignition Relay	0 — Disable	VEPS or DRS
35	4 10 DO Fault Detection	—	0 — Disabled 1 — Enabled	0 — Disable	VEPS or DRS

Table 4-45   Vehicle Power Shutdown Programming Options

4.3.22   WAIT TO START LAMP

This digital output is switched to battery ground when the Wait to Start (Cold Start) system is active. This output is used to drive a light to alert the operator. As long as the lamp is illuminated the engine should not be started.

This output is used for grid heater applications on the MBE 900 and MBE 4000.

NOTE:
The status of this output is also broadcast over J1939 — SPN 1081.

Installation

This digital output circuit is designed to sink no more than 250 mA (DC) current.

The Wait to Start Lamp is wired to pin 4/06 of the CPC.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-46.

Parameter Group	Parameter	Setting	Options	Default	Access
35	4 06 DO Selection	1 – Grid Heater Lamp	0 – Disabled 1 – Grid Heater Lamp 2 – Accelerator Pedal Idle Position* 3 – Run Signal Starter Lockout	1 – Grid Heater Lamp	VEPS or DRS
35	4 06 DO Fault Detection	—	0 — Disabled 1 — Enabled	0 – Disabled	VEPS or DRS

* Not supported in NAFTA

Table 4-46   Wait to Start Lamp Programming Options

4.4   ANALOG OUTPUTS – CPC

The CPC has two analog outputs that can be used for various functions.

4.4.1   PIN 3/05 – ANALOG OUTPUT

This pin can be configured for the functions listed in Table 4-47.

Function	Description	Option
Oil Pressure Lamp	This output will be turned on when MCM detects a pre-warning or warning based on oil pressure.	1
5 Bar Oil Pressure Gauge	The oil pressure will be converted to the proper pulse width for a 5 Bar Oil Pressure Gauge.	2
10 Bar Oil Pressure Gauge	The oil pressure will be converted to the proper pulse width for a 10 Bar Oil Pressure Gauge.	3

Table 4-47   Analog Output Selections for CPC Pin 3/05

4.4.2   PIN 3/06 – ANALOG OUTPUT

This pin can be configured for the functions listed in Table 4-48.

Function	Description	Option
Coolant Temp Lamp	This output will be turned on when MCM detects a pre-warning or warning based on coolant temperature.	1
Coolant Temperature Gauge	The coolant temperature will be converted to the proper pulse width for a coolant temperature gauge.	2
OI Thermostat	Can be used for the input for the OI thermostat.	3

Table 4-48   Analog Output Selections for CPC Pin 3/06

Programming Requirements and Flexibility

The options for the analog outputs are listed in Table 4-49.

Parameter Group	Parameter	Options	Default	Access
9	3 05 AO Selection	0 – Disabled 1 – Oil Pressure Lamp 2 – 5 Bar Oil Pressure Gauge 3 – 10 Bar Oil Pressure Gauge 4 – Fuel Filter Sensor*	0 – Disabled	VEPS, DRS
9	3 06 AO Selection	0 – Disabled 1 – Coolant Temperature Lamp 2 – Coolant Temperature Gauge 3 – OI Thermostat Input*	0 – Disabled	VEPS, DRS

* Not supported in NAFTA

Table 4-49   Analog Output Options

4.5   PWM OUTPUT — CPC

There is one PWM output on the CPC.

4.5.1   PWM OUTPUT — PIN 4/12 PWM SELECTION

This selection is pin 4/12. This pin can be used for a Road Speed PWM output as listed in Table 4-50.

Frequency Hz	Road Speed km/h	Road Speed mph
6.76	1.00	0.622
6.76	3.00	1.865
173.5	78.125	173.50
333.30	150.000	333.30
333.30	156.250	333.30

Table 4-50   Frequency vs. Speed

Programming Requirements and Flexibility

The options for the PWM outputs are listed in Table 4-51.

Parameter Group	Parameter	Options	Default	Access
9	4 12 PWM Output Selection	0 – Disabled 1 – Throttle Torque 10%..90% 2 – Difference Torque 3 – Throttle Torque 90%..10% 4 – Actual Torque 5 – Load Torque (no idle torque for automatic transmission) 6 – Road Speed 7 – Demand Speed 8 – Demand Speed CC+ 9 – AGS2 Transmission Temp Indication Lamp 10 – FUSO Accelerator PWM Output*	0 – Disabled	VEPS, DRS

* Not supported in NAFTA

Table 4-51   PWM Output Options

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5 FEATURES

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.
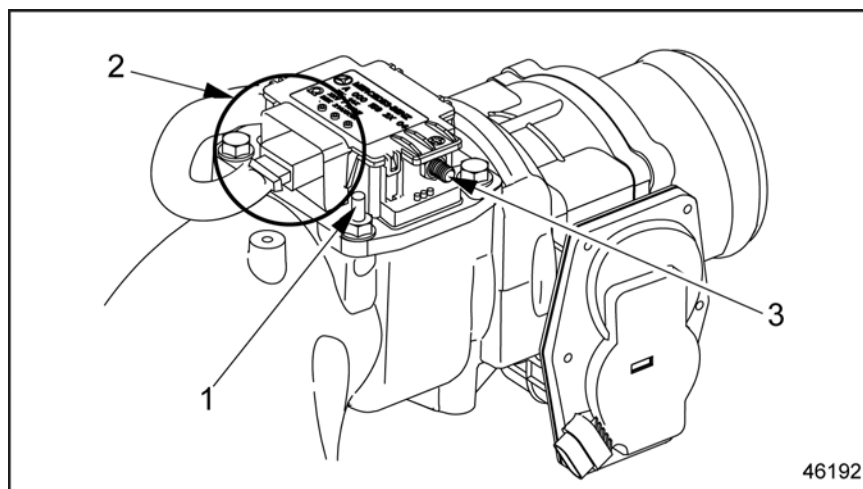
1. Battery Ground   3. Battery Supply (+12 V)

2. Connector to MCM (included in on-engine harness)

Figure 5-1   Grid Heater – MBE 4000
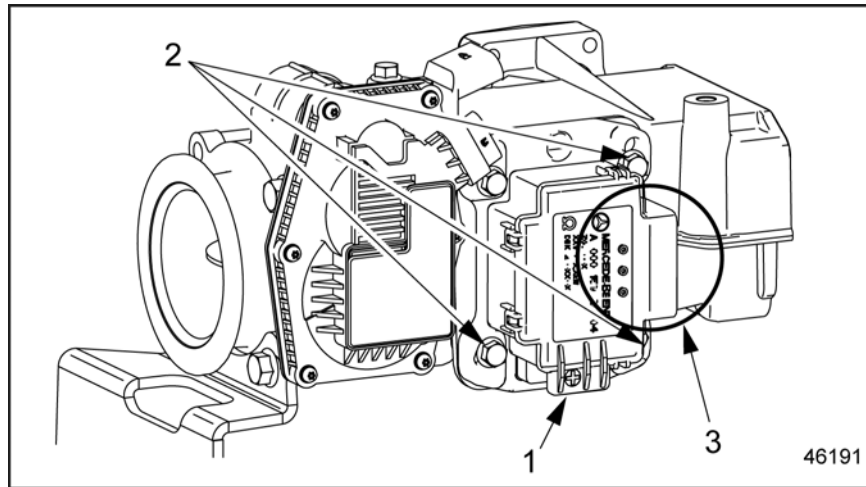
1. Battery Supply (+12 V)   3. Connector to MCM (included in on-engine harness)

2. Possible Battery Ground Connection

Figure 5-2 Grid Heater – MBE 900
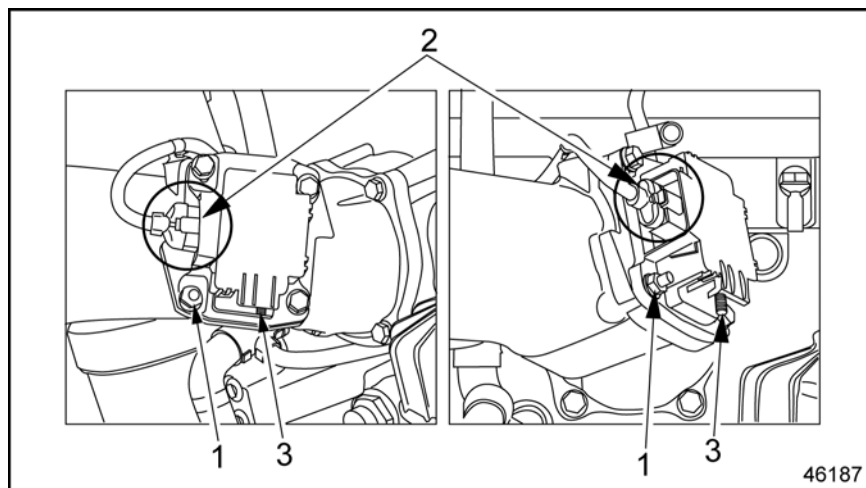
1. Battery Ground   3. Battery Supply (+12 V)

2. Connector to MCM

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.
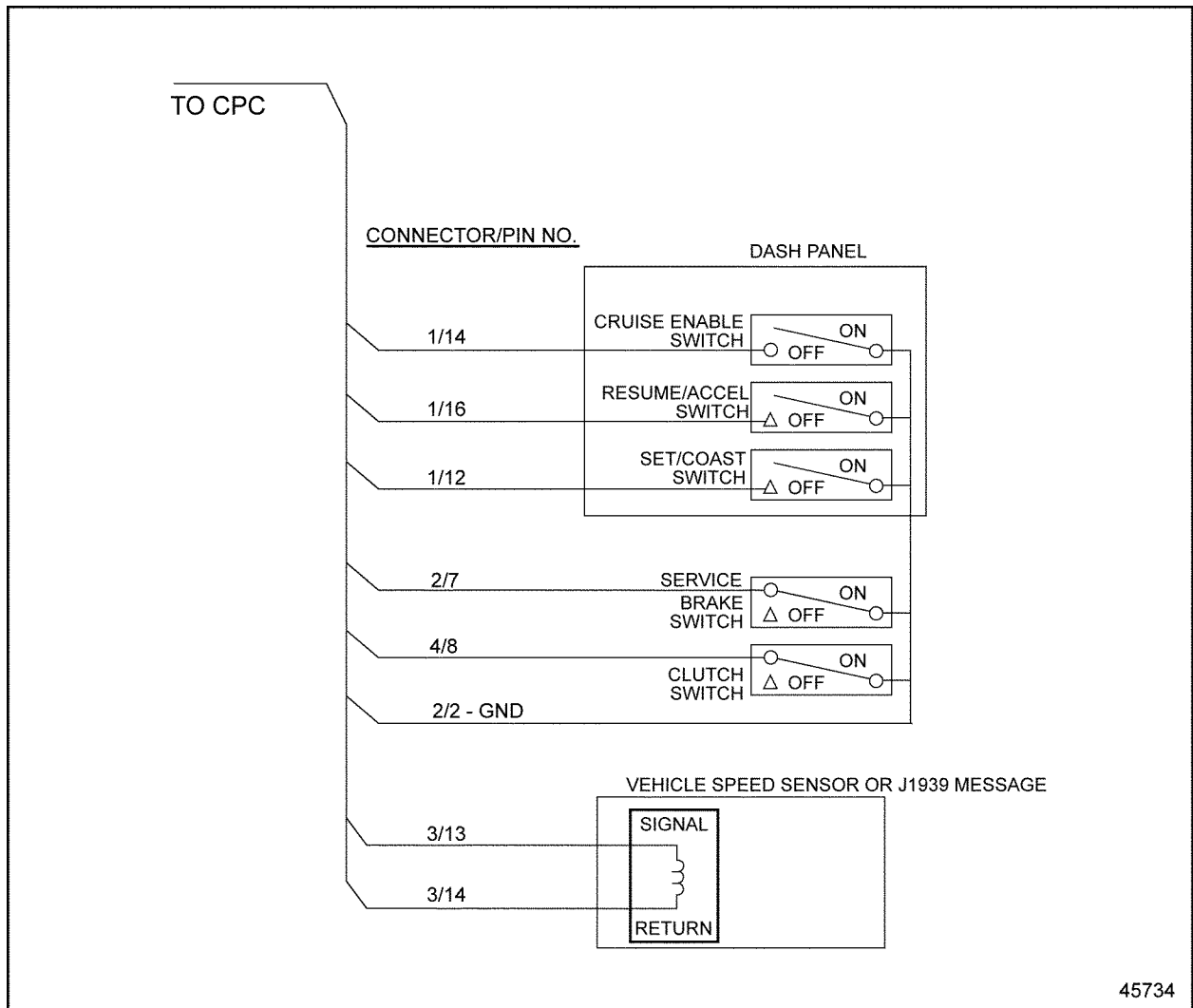
Figure 5-4   Cruise Control Circuit

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
CHECK ENGINE	Amber Warning Lamp (AWL)	Indicates a fault with the engine controls.	Truck can be driven to end of shift. Call for service.
STOP ENGINE	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
(symbol)	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.
(symbol)	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.
(symbol)	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.
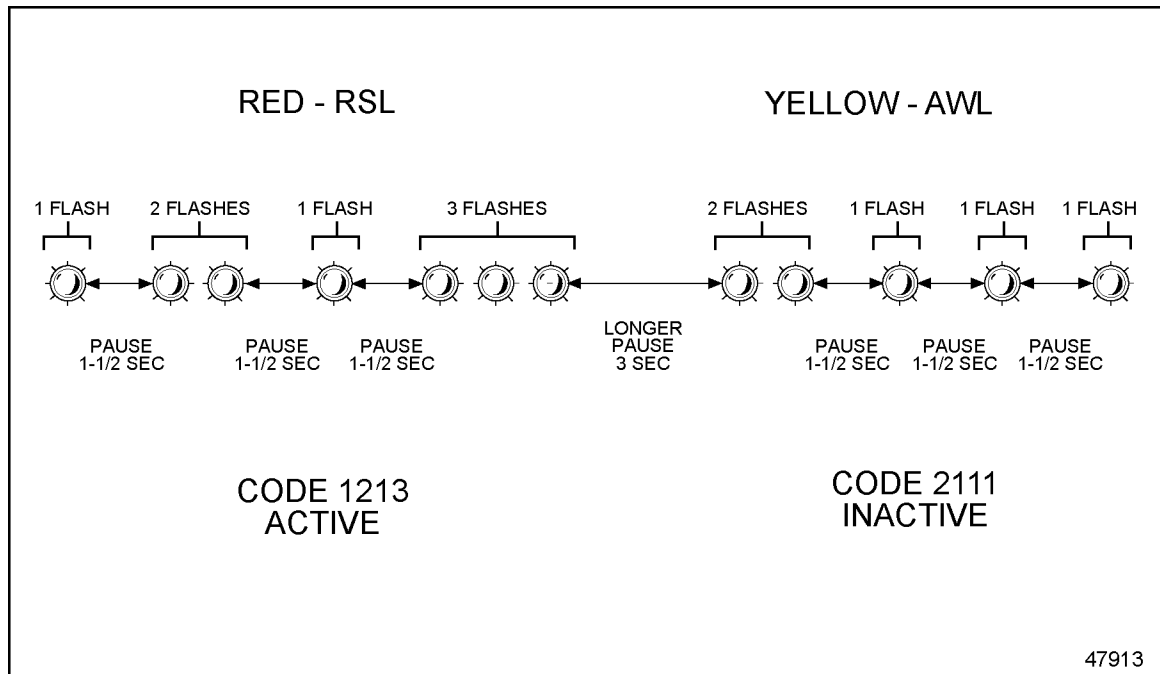
Figure 5-5   Flashing Fault Codes

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.
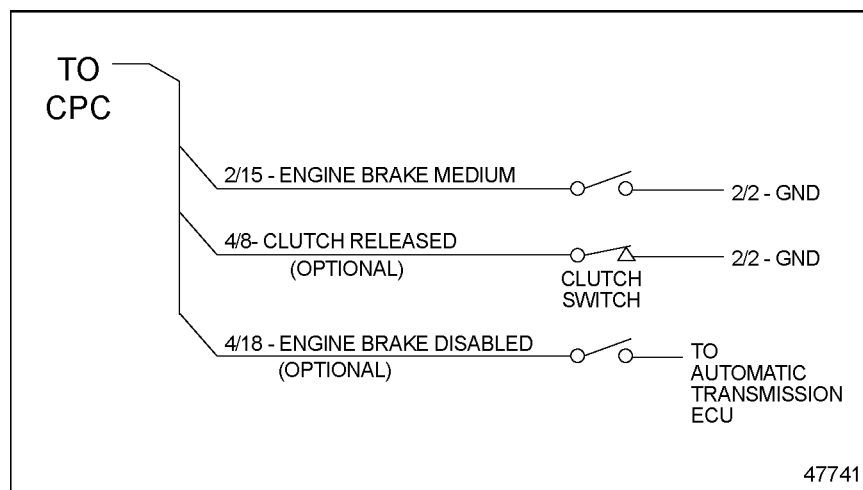
Figure 5-6   Exhaust Flap Only – MBE 900

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.
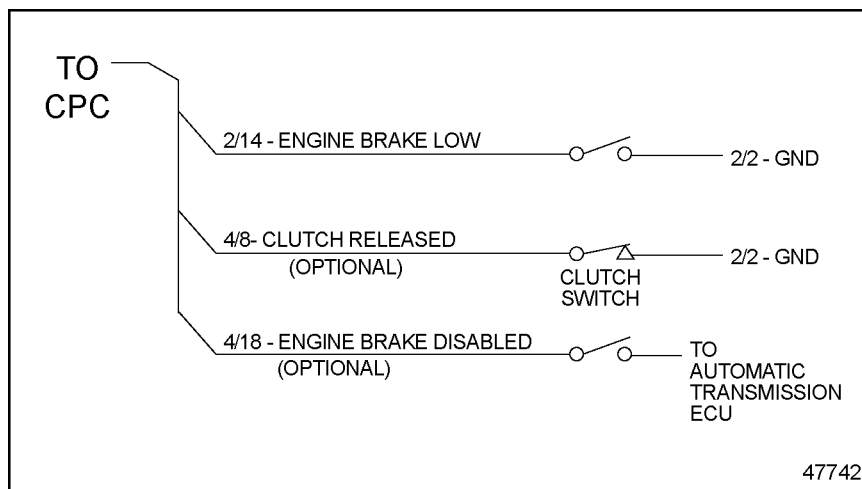
Figure 5-7   Compression Brake Only – MBE 900

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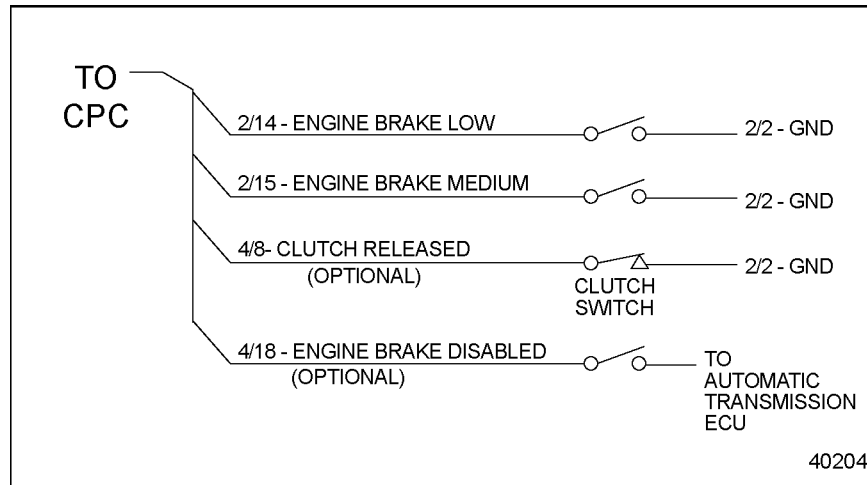
Figure 5-8   Compression Brake and Exhaust Flap – MBE 900

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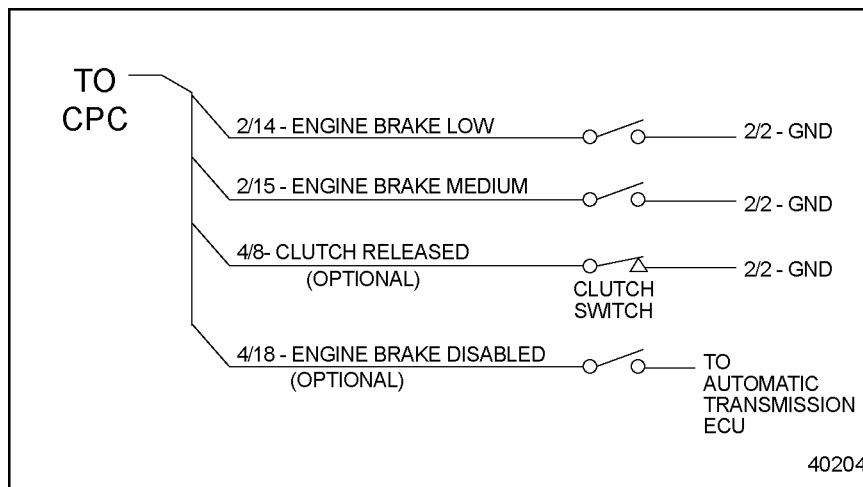
Figure 5-9   Compression Brake and Brake Grate – MBE 4000

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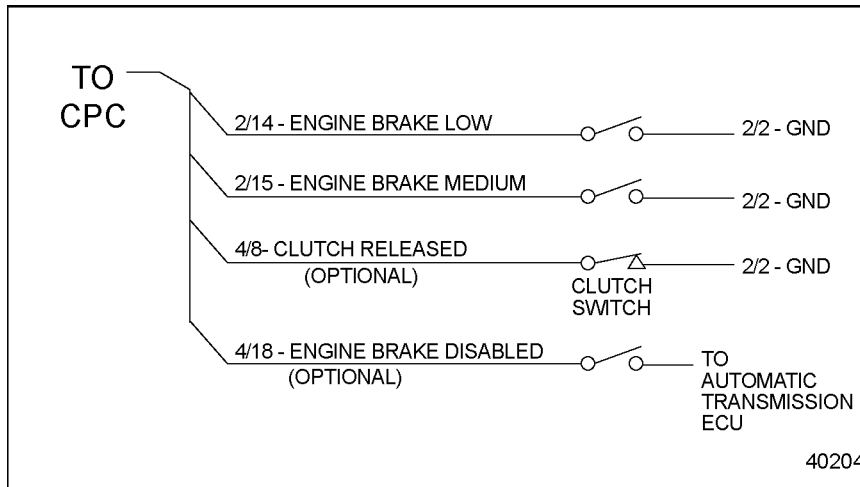
Figure 5-10   Engine Brake for DDEC VI – Series 60

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.

An SEO Switch is required when this engine protection option is selected. Refer to section 5.8.2. The SEO options are available to prevent engine shutdown at the operator's discretion.

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.

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

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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 5-32.

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 5-32   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).
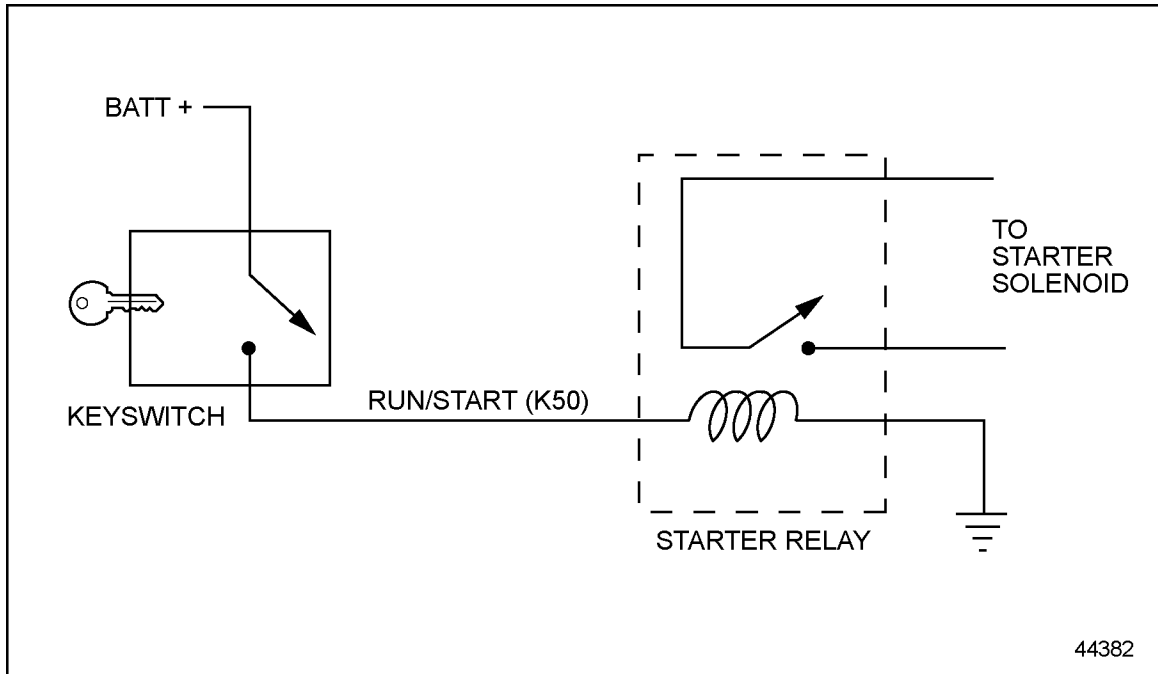
Figure 5-11   Key Switch Starter Control
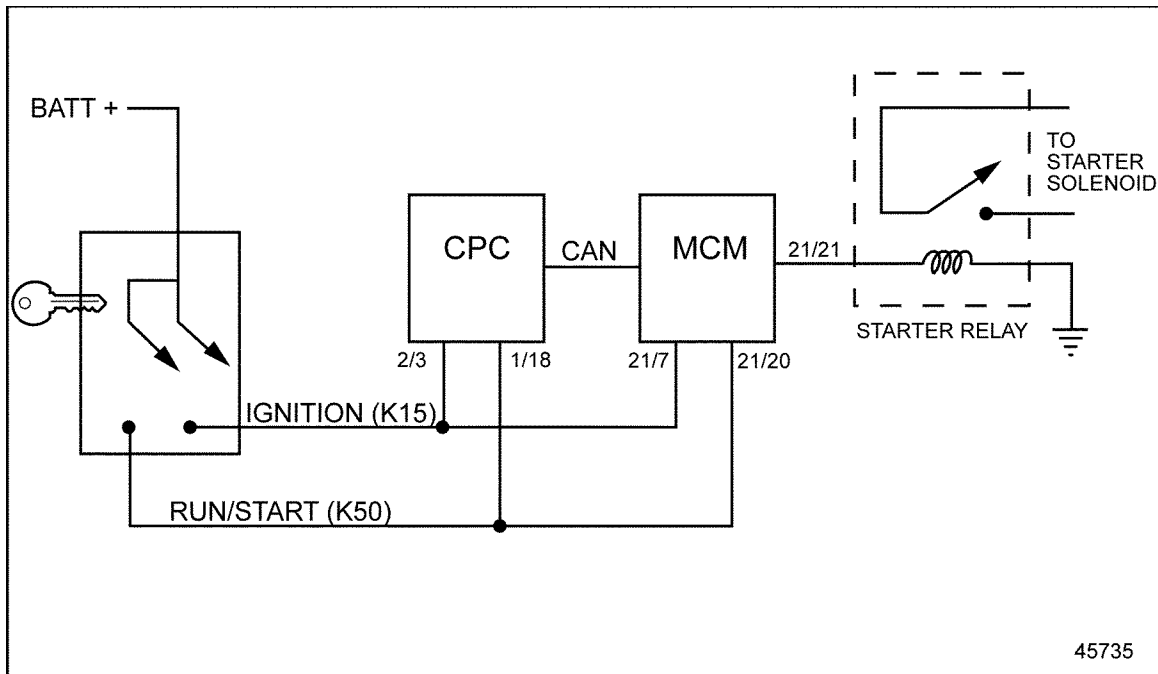
Figure 5-12   MCM Starter Control

5.10.1   PROGRAMMING REQUIREMENTS AND FLEXIBILITY

The Engine Starter Control settings are listed in Table 5-33.

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 5-33   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 5-34.

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

Table 5-34   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.
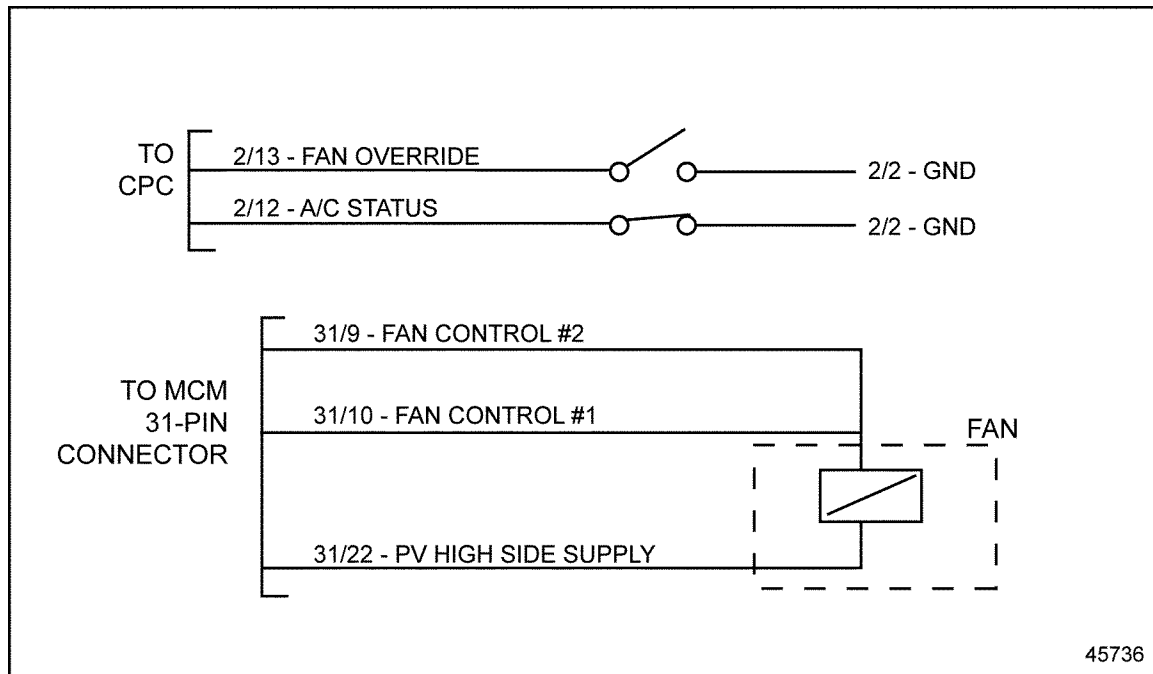
Figure 5-13   Single-speed Fan – Fan Type 4

Programming Requirements and Flexibility

The MCM options for the single-speed fan – Type 4 are listed in Table 5-35.

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 5-35   Single-speed Fan – Type 4 MCM Options

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

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 5-36   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.
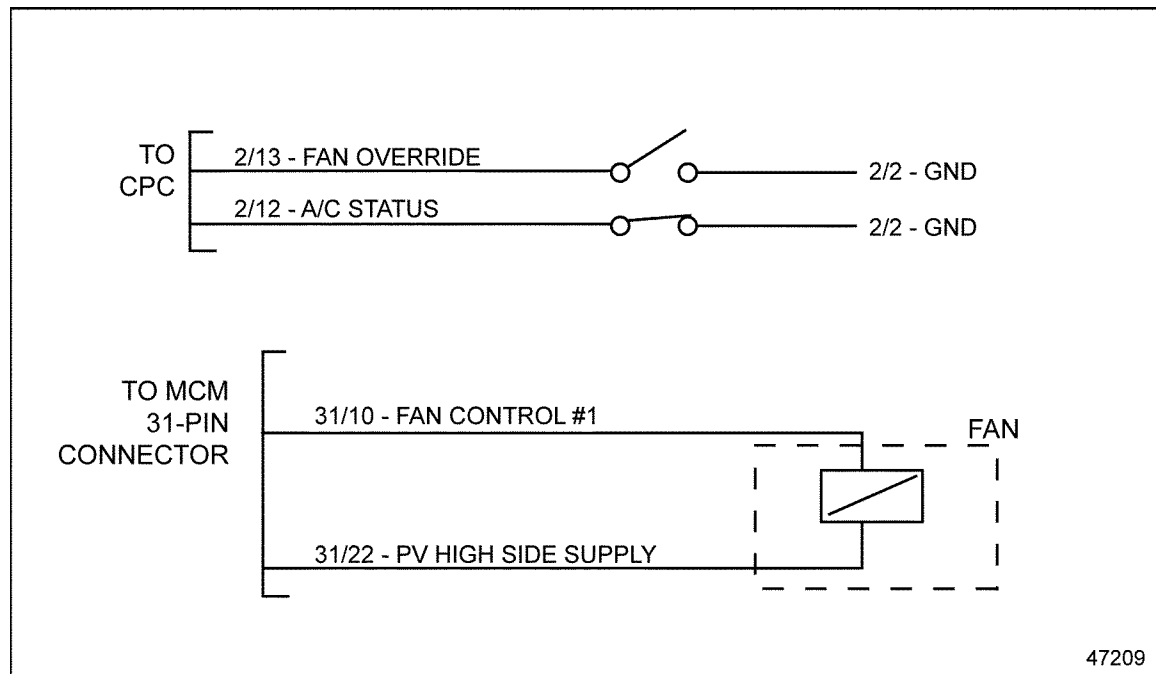
Figure 5-14   Single-speed Fan – Fan Type 7

Programming Requirements and Flexibility

The MCM options for the single-speed fan – Type 7 are listed in Table 5-37.

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 5-37   Single-speed Fan – Type 7 MCM Options

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

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 5-38   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.
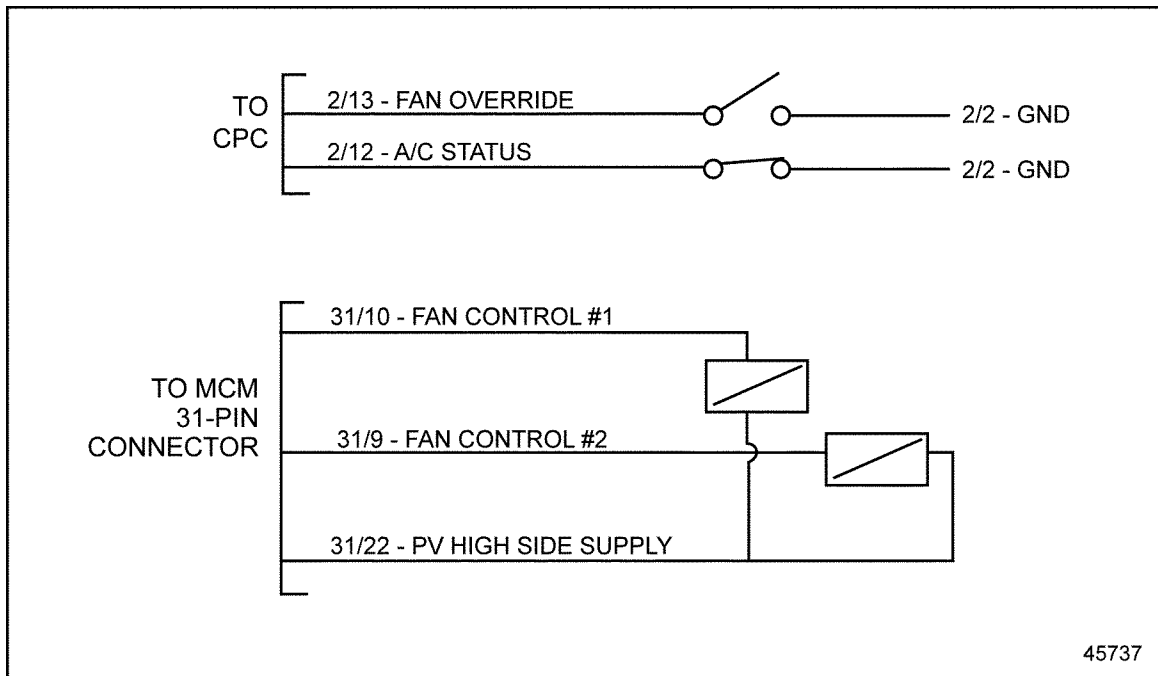
Figure 5-15   Dual Fan (Fan Type 6)

Programming Requirements and Flexibility

The MCM options for dual fans – Type 6 are listed in Table 5-39.

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 5-39   Dual Fan – Type 6 MCM Options

The CPC options for the dual fan – Type 6 are listed in Table 5-40.

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 5-40   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.
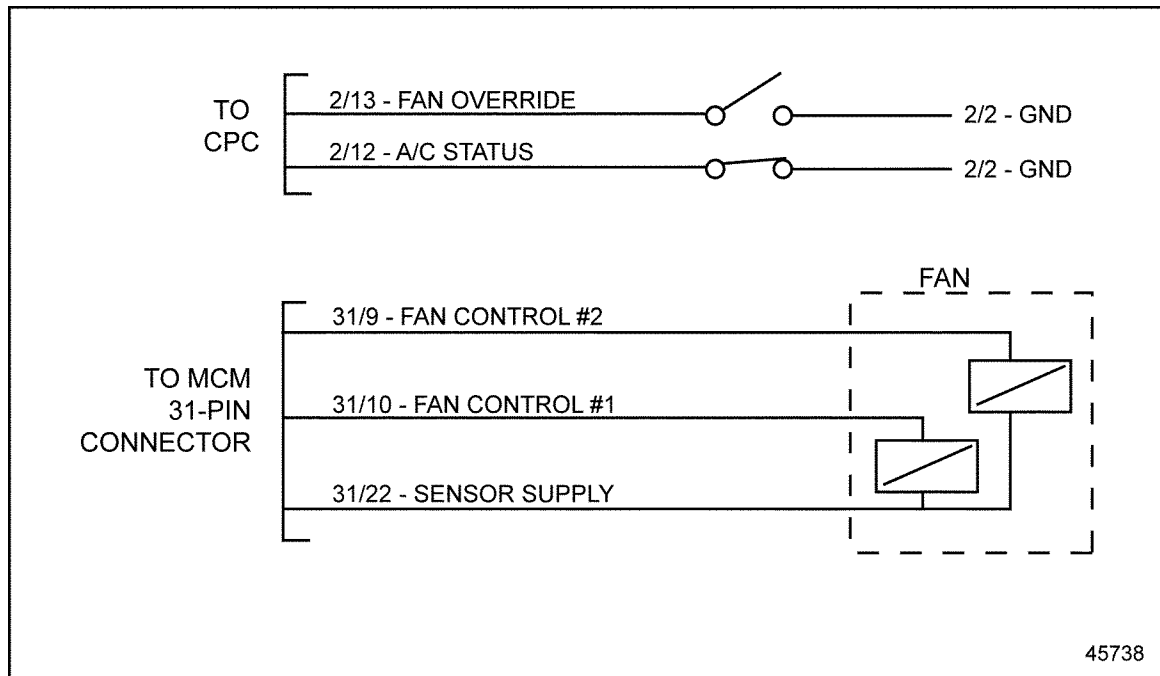
Figure 5-16   Two-speed Fan (Fan type 0 or 1)

Programming Requirements and Flexibility

The MCM options for two-speed fans – Type 1 are listed in Table 5-39.

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 5-41   Two-speed Fan – Type 1 MCM Options

The CPC options for the two-speed fan – Type 1 are listed in Table 5-42.

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 5-42   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.
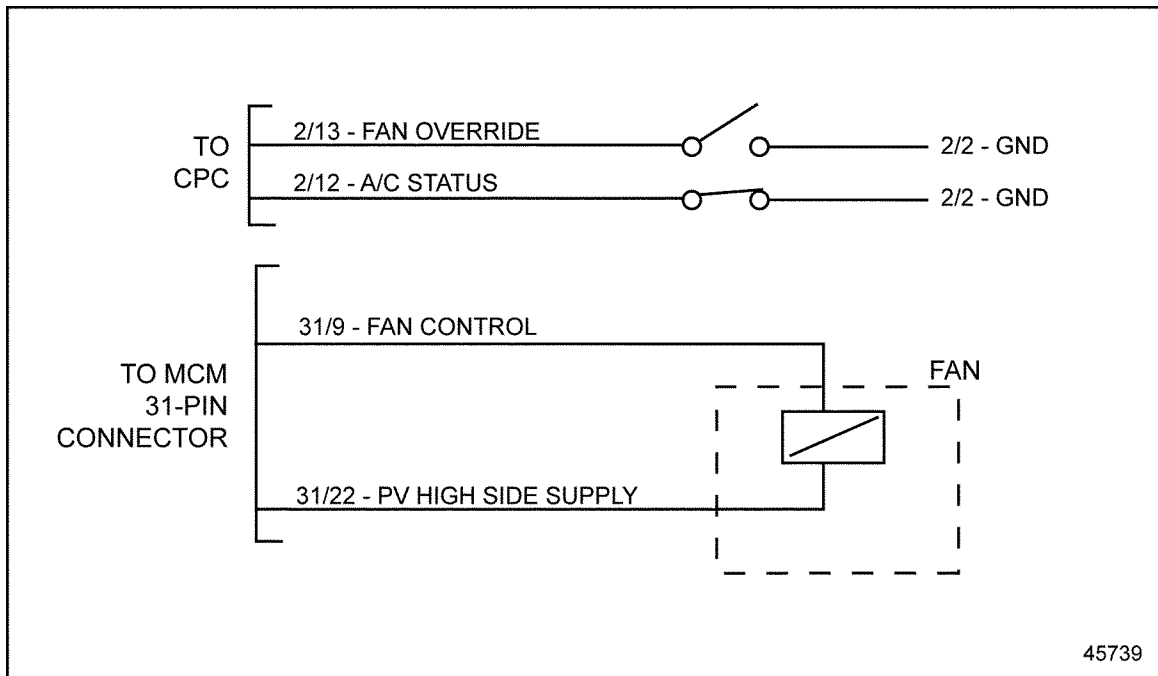
Figure 5-17   Variable Speed Fan without Fan Speed Feedback (Fan Type 3)

Programming Requirements and Flexibility

The MCM options for variable speed fans without fan speed feedback – Type 3 are listed in Table 5-43.

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 5-43   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 5-44.

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 5-44   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.
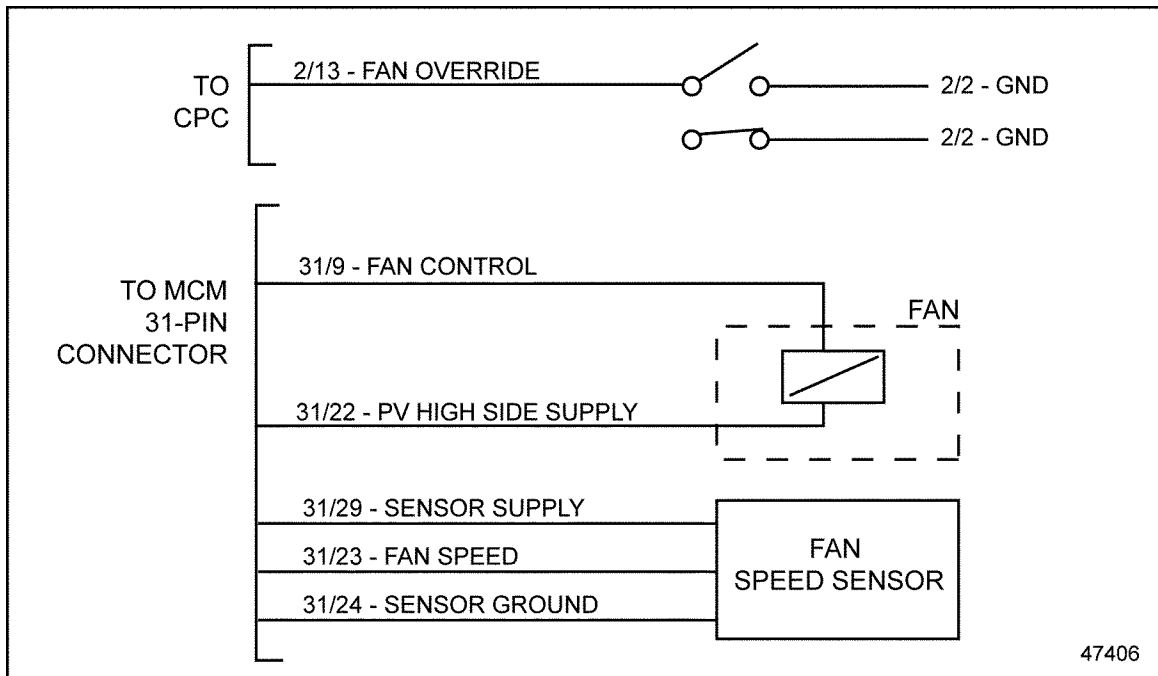
Figure 5-18   Variable Speed Fan with Fan Speed Feedback (Fan Type 2)

Programming Requirements and Flexibility

The options for variable speed fans without fan speed feedback – Type 2 are listed in Table 5-45.

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 5-45   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 5-46.

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 5-46   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 5-47.

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 5-47   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 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

Driving Time	7:23:38		VSG(PTO) Time	0:00:00
Driving Percent	89.74 %		VSG(PTO) Percent	0.00 %
Driving Fuel	70.54 gal		VSG(PTO) Fuel	0.00 gal
Driving Economy	6.55 mpg			
			Stop Idle Time	0:42:31
Vehicle Speed Limiting			Stop Idle Percent	8.60 %
Time	0:00:00		Stop Idle Fuel	0.25 gal
Percent	0.00 %			
Distance	0.0 mi		Over Rev Limit	1800 rpm
Fuel	0.00 gal		Count	0
			Time	0:00:08
Top Gear			Percent	0.03 %
Time	7:00:04			
Percent	94.69 %		Highest RPM	1987 rpm
Distance	452.1 mi		Occurred	02/01/07 13:17:23 (EST)
Fuel	67.75 gal			
			Diag. Records	3
Top Gear - 1			Hard Brake Count	0
Time	0:04:33		Brake Count	27
Percent	1.03 %		Eng. Brake Time	0:08:05
Distance	3.7 mi			
Fuel	0.88 gal		Optimized Idle Time	
			Active	0:00:00
Cruise			Run	0:00:00
Time	6:05:32		Battery	0:00:00
Percent	82.40 %		Engine Temp.	0:00:00
Distance	397.0 mi		Thermostat	0:00:00
Fuel	60.88 gal		Extended Idle	0:00:00
			Continuous	0:00:00
Top Gear Cruise				
Time	6:04:54		Optimized Idle Battery Charging Starts	
Percent	82.25 %		Normal Count	0
Distance	396.3 mi		Alternate Count	0
Fuel	60.63 gal		Continuous Run	0
Speeding A(>=70 mph and <75 mph)			Fan On Time	
Count	5		Total Time	0:00:00
Time	0:01:08		Engine System	0:00:00
Percent	0.26 %		Manual	0:00:00
Speeding B(>=75 mph)			A/C	0:00:00
Count	0			
Time	0:00:00			
Percent	0.00 %		Pump On Time	
			Time	0:00:00
Highest Speed	73.5 mph		Distance	0.0 mi
Occurred	02/01/07 14:17:51 (EST)		Fuel	0.00 gal
Coasting Time	0:00:00		Engine Utilization	98.74 %
Coasting Percent	0.00 %		Vehicle Utilization	88.61 %
DPF Regeneration				
Parked Regen Count	0			
Driving Regen Count	2			
Parked Regen Fuel	0.00 gal			
Driving Regen Fuel	4.08 gal			

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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
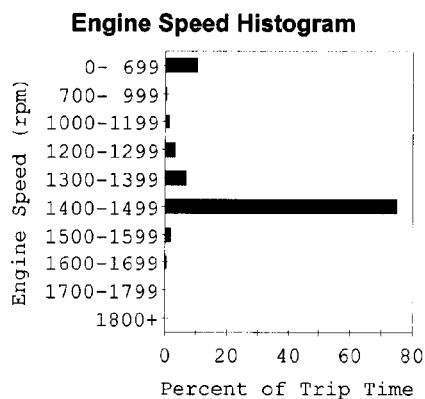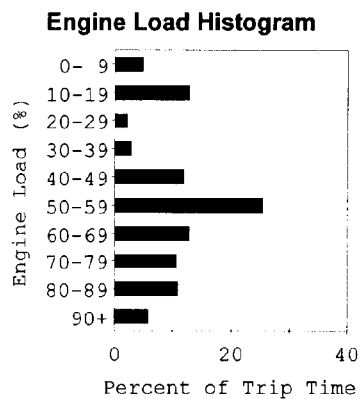
Percent of Trip Time in Load and RPM Table

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
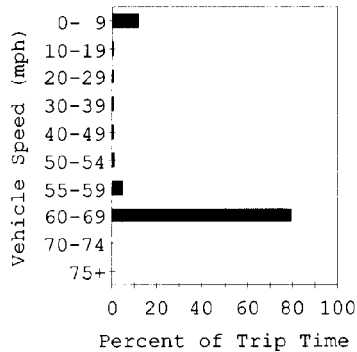
Engine Speed Histogram
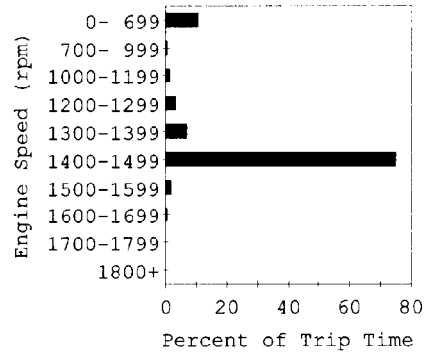
Percent of Trip Time in Speed and RPM Table
Vehicle Speed (mph)

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 5-48.

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 5-48   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 5-49.

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 5-49   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 5-50.

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 5-50   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).
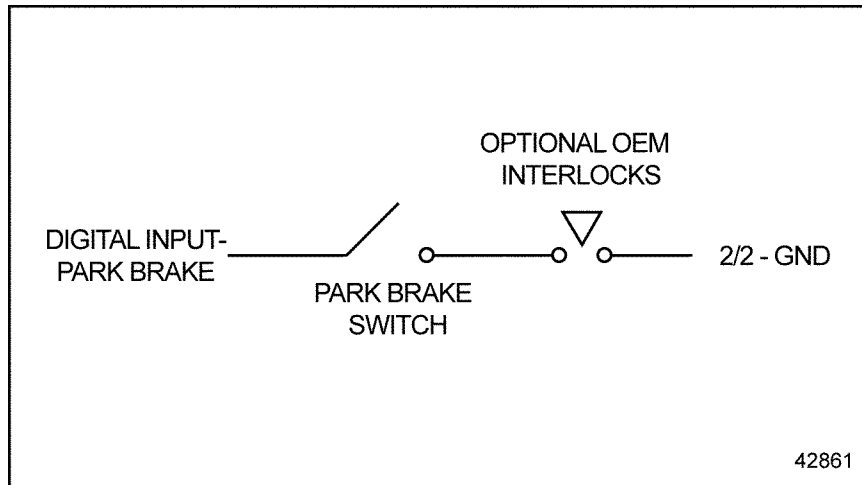
Figure 5-23   Park Brake Digital Input

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).
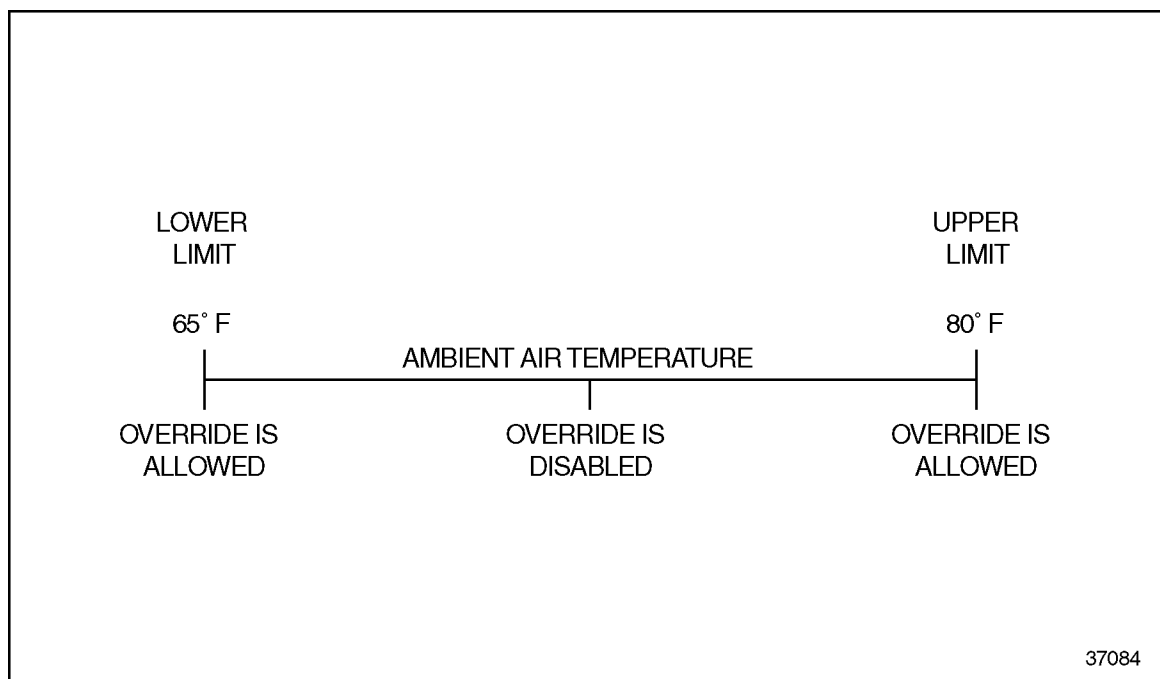
Figure 5-24   Ambient Air Temperature Override

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).
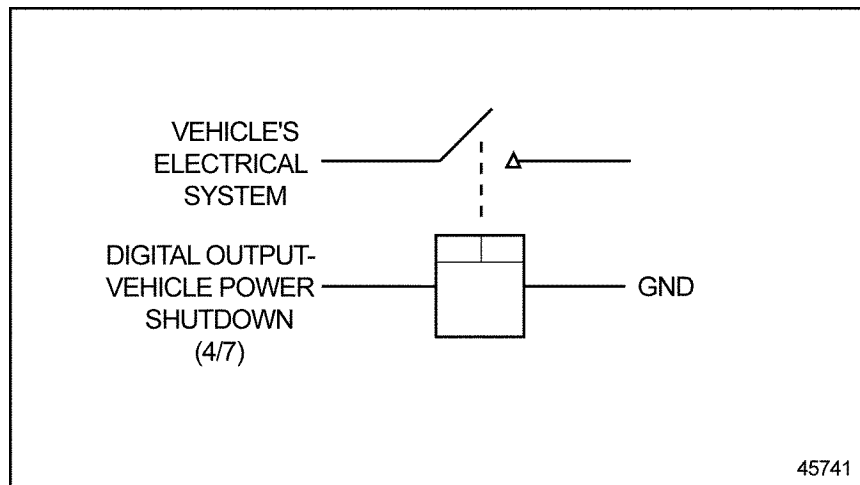
Figure 5-25   Vehicle Power Shutdown Relay

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 5-51.

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 5-51   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 5-52.

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

Table 5-52   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 5-53.

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	$-15.625 - 15.625 m/s^2$	$10 m/s^2$	DDDL 7.0, DRS, VEPS
5	Limiter1 Max Vehicle Accel	$-15.625 - 15.625 m/s^2$	$10 m/s^2$	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 5-53 Limiter 0 and Limiter 1 Parameters

The parameters for min and max engine speed are listed in Table 5-54.

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 5-54 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 5-55.

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 <u>Gear</u> <u>Down</u> <u>Protect</u> Ratio	<u>Gear</u> <u>Down</u> <u>Protect</u> 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 5-55 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 5-56.

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 5-56   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 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 5-57.

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 5-57   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 5-58.

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 5-58   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 5-59.

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

Table 5-59   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 5-60.

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 5-60   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 5-61. 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 5-61   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.

<u>Continuous</u> <u>Run</u> <u>Mode</u> - 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.

<u>Extended</u> <u>Idle</u> <u>Mode</u> - 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.
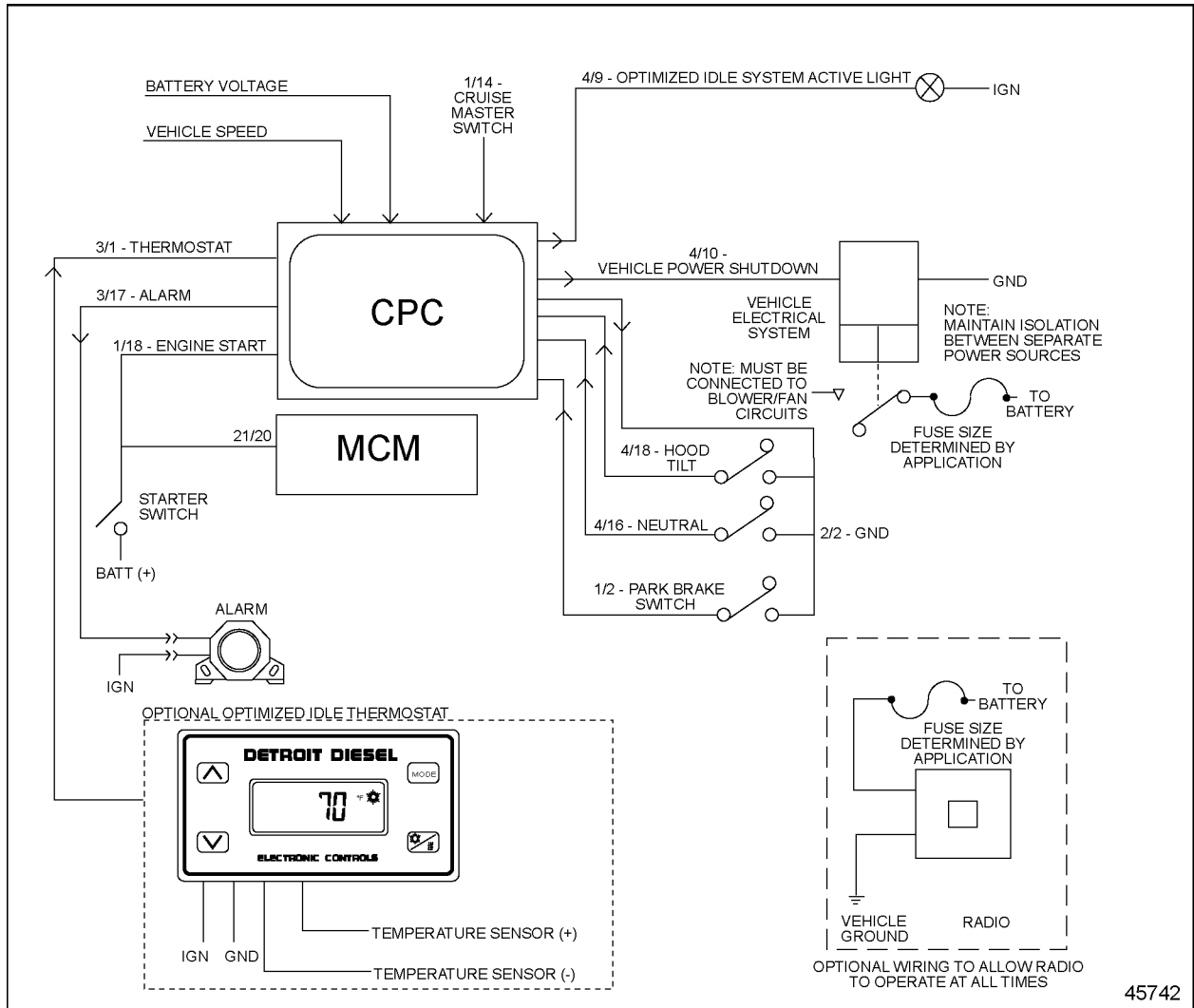
Figure 5-26   Optimized Idle System

5.19.3   PROGRAMMING REQUIREMENTS AND FLEXIBILITY

The digital inputs and outputs listed in Table 5-62 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 5-62   Optimized Idle Digital Inputs and Digital Outputs

Optimized Idle options for battery charging and continuous run are listed in Table 5-63.

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 5-63   Optimized Idle Options

Optimized Idle installations should have the parameters listed in Table 5-64 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 5-64   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 5-65.

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 5-65   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.
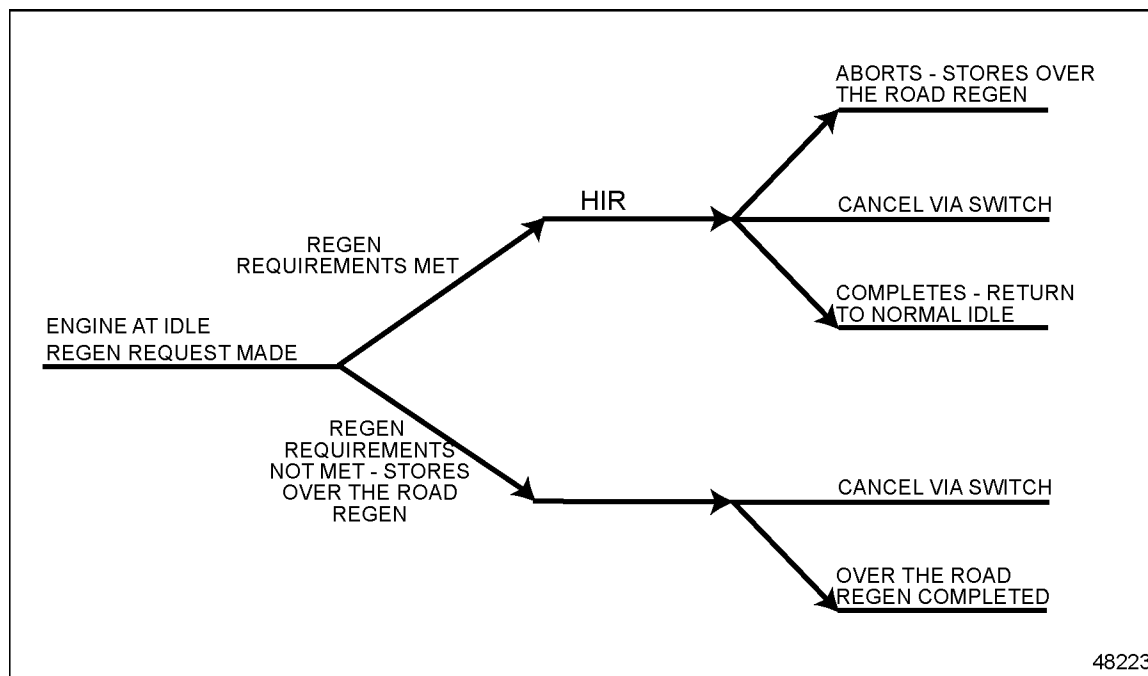
Figure 5-27   Parked Regeneration

Programming Requirements and Flexibility

The parameters listed in Table 5-66 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 5-66   Parameter Settings for Manual Transmissions

The parameters listed in Table 5-67 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 5-67   Parameter Settings for J1939 Transmissions (Allison, Eaton UltraShift, Eaton AutoShift)

The parameter listed in Table 5-68 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 5-68   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 5-69.

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

Table 5-69   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 5-70.

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 5-70   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 5-71.

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 5-71   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.
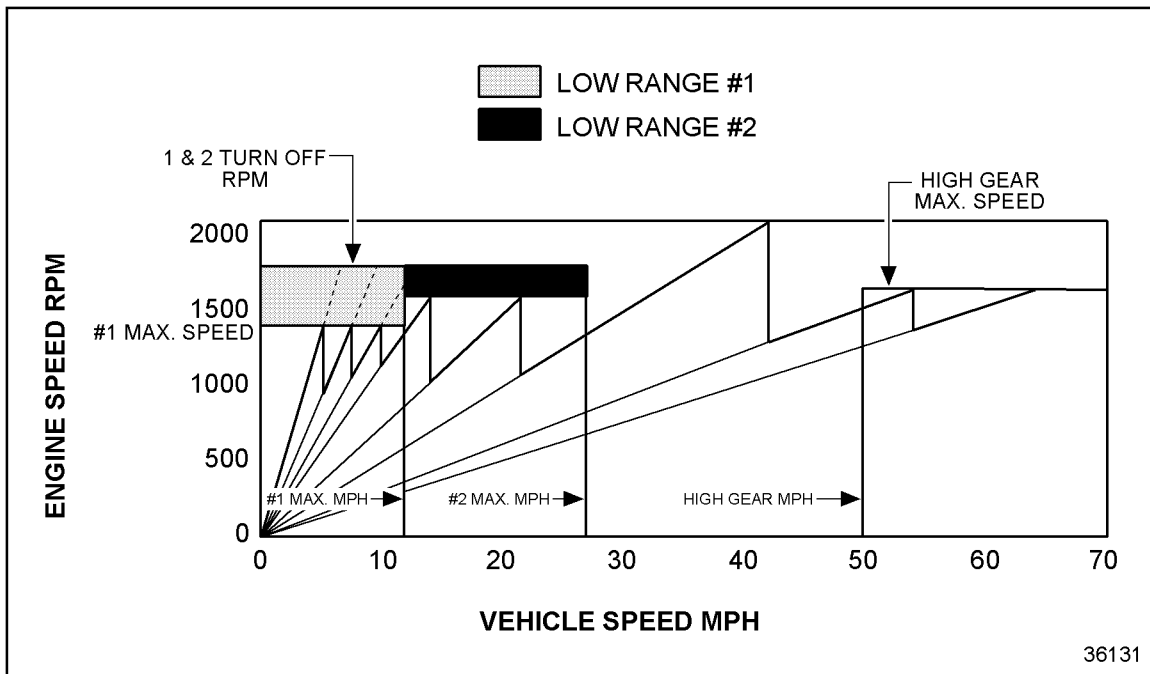
Figure 5-28   Progressive Shift Chart - Represents Default

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.

70MPH CAN BE ACHIEVED IN DIRECT GEAR AT 2000 RPM.

VSL 70

ENGINE SPEED, RPM

2400
2000
1600
1200
800
400
0

PEAK TORQUE RPM

CRUISE SPEED 70

0   10   20   30   40   50   60   70   80   90   100

VEHICLE SPEED, MPH

SHIFT SCHEDULE
STANDARD

PROGRESSIVE SHIFT FORCES 70 MPH INTO OVERDRIVE AT A LOWER ENGINE SPEED.

VSL 70

ENGINE SPEED, RPM

2400
2000
1600
1200
800
400
0

PEAK TORQUE RPM

CRUISE SPEED 70

0   10   20   30   40   50   60   70   80

VEHICLE SPEED, MPH

SHIFT SCHEDULE	DDEC IV PROGRESSIVE
LOW RANGE 1	12.0 MPH, 2100 RPM
LOW RANGE 2	27.0 MPH, 2100 RPM
HIGH RANGE	67.0 MPH, 1700 RPM

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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 5-72.

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 5-72   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.
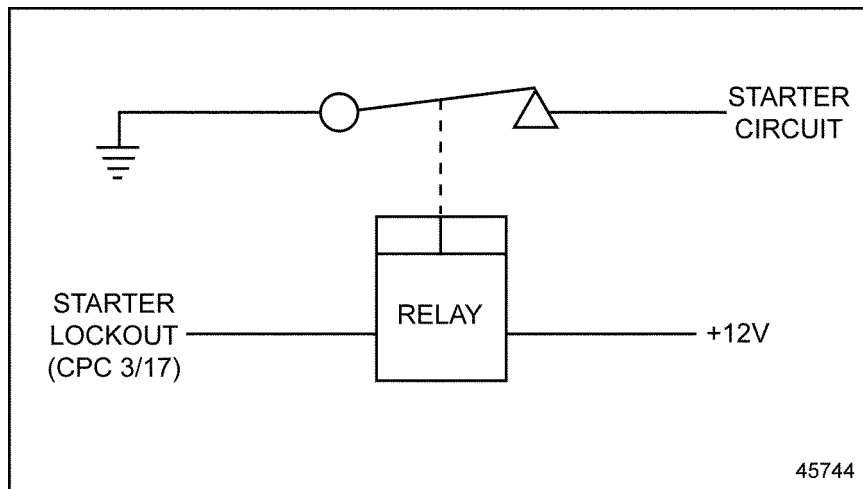
Figure 5-30   Starter Lockout

5.24.3   PROGRAMMING REQUIREMENTS AND FLEXIBILITY

Starter Lockout may be enabled or disabled as listed in Table 5-73 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 5-73   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.
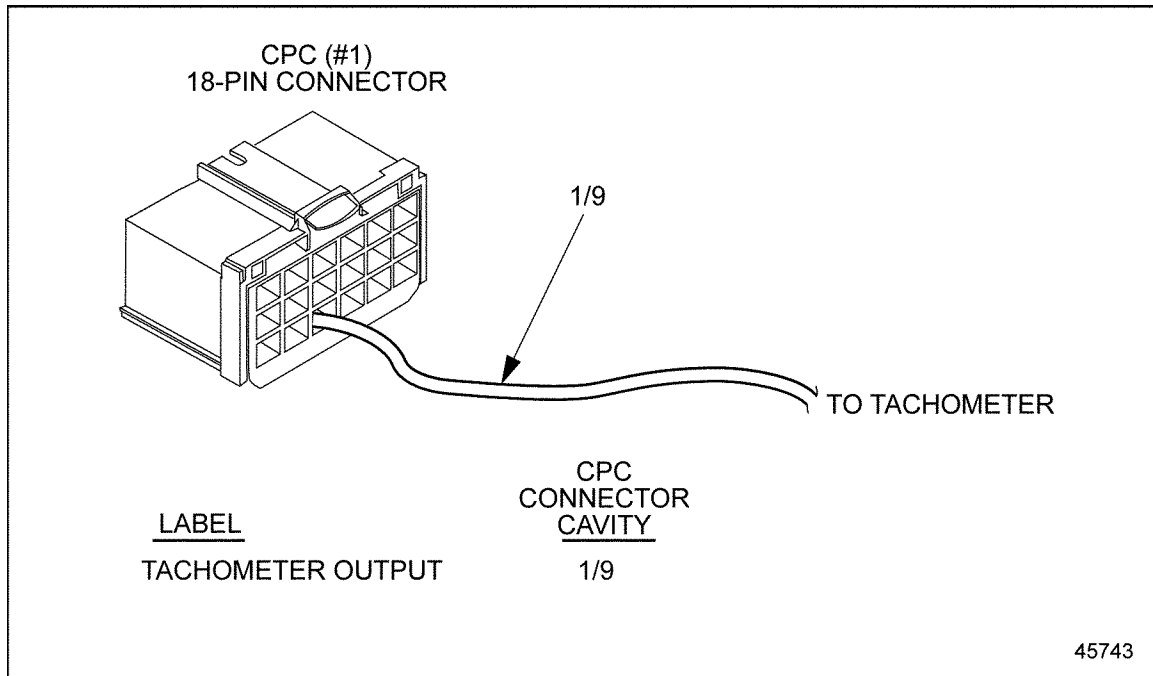
Figure 5-31   Tachometer Drive Installation

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.
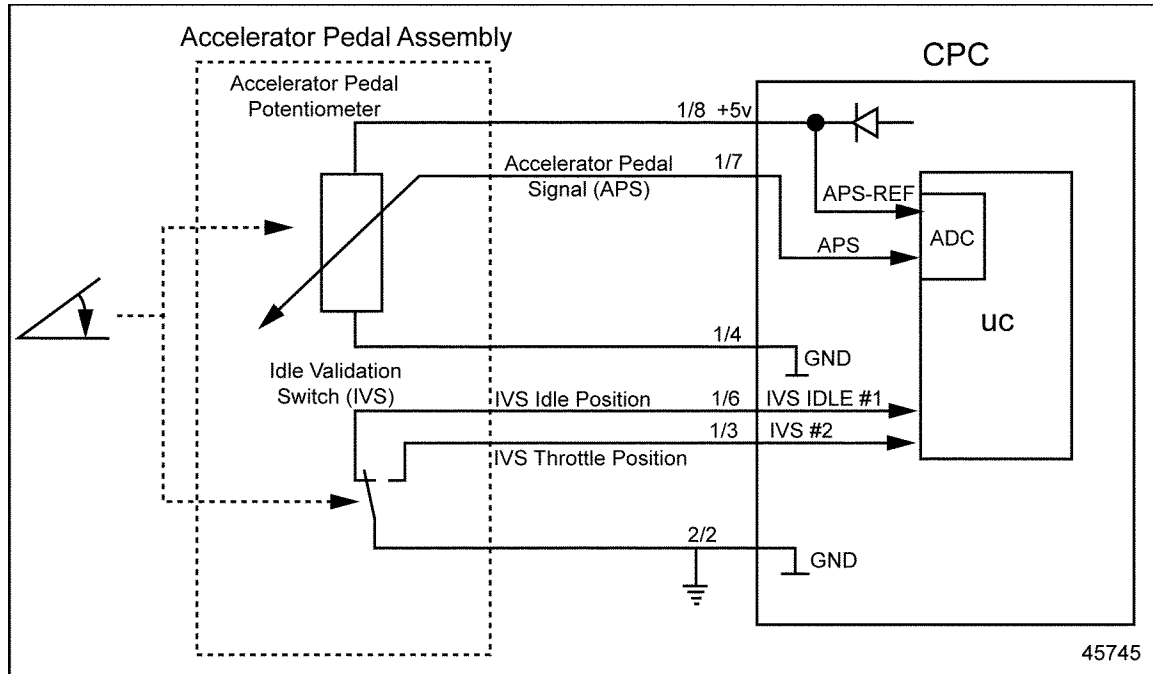
Figure 5-32   Accelerator Pedal Installation

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.
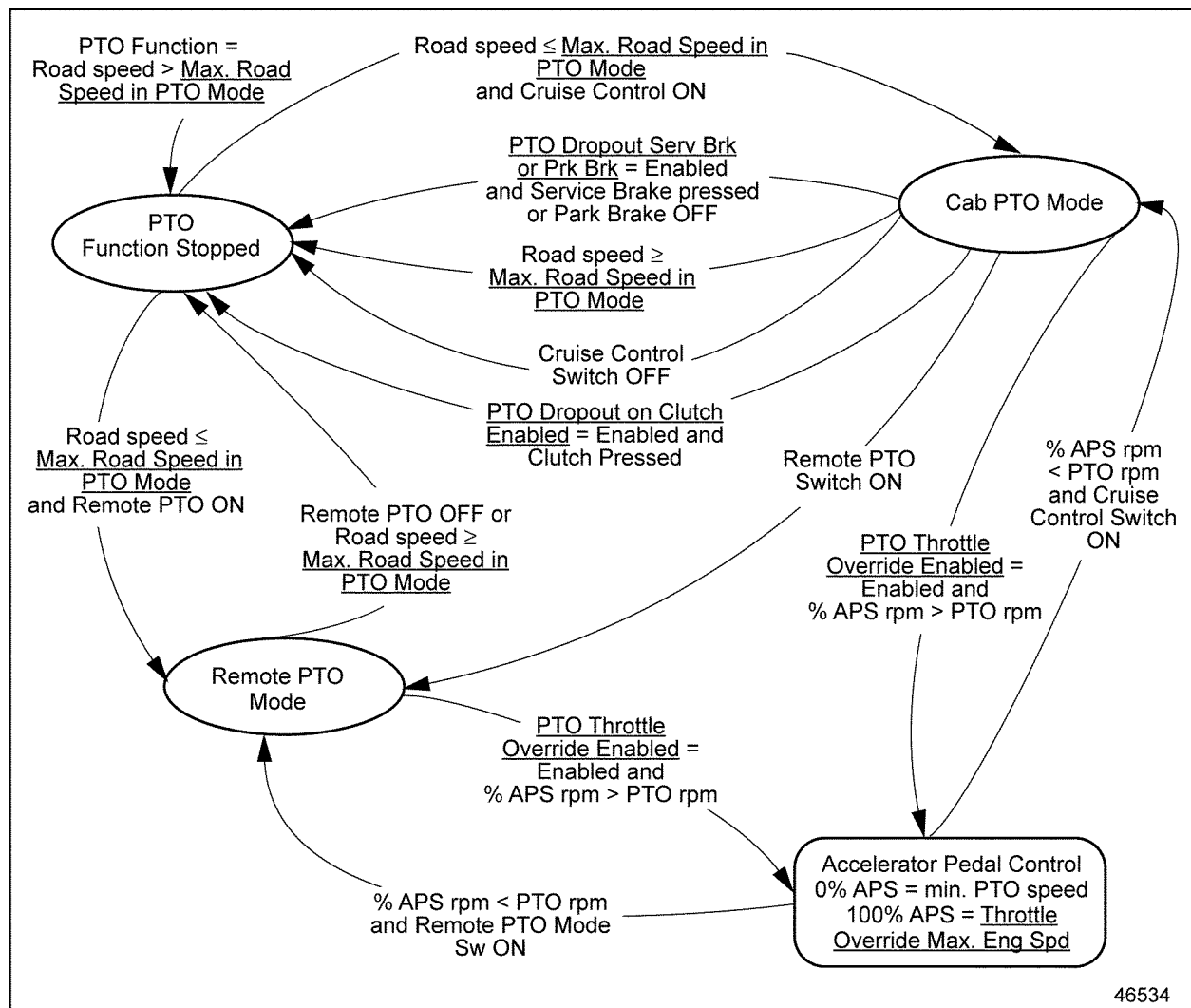
Figure 5-33   PTO Logic

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.
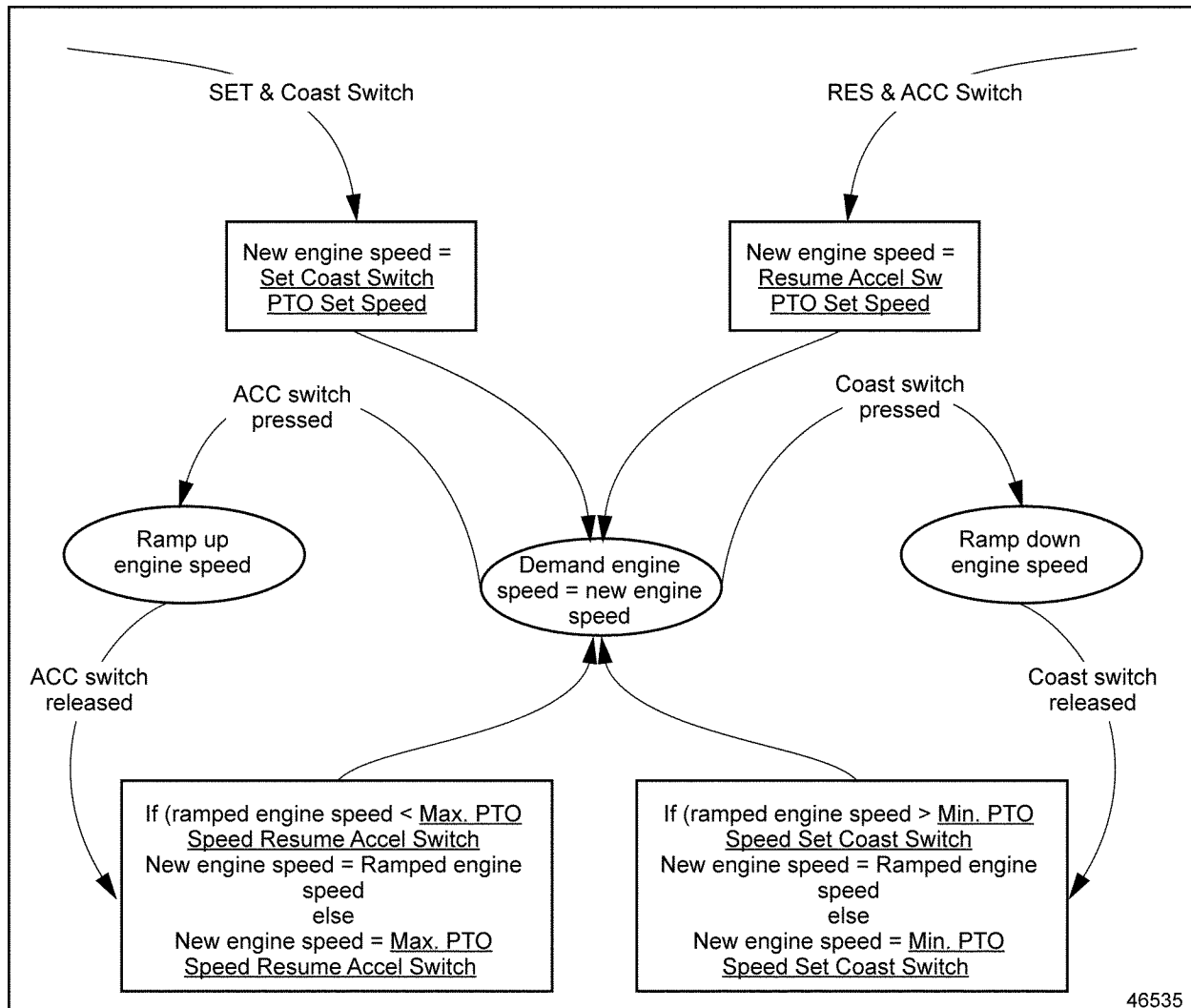
Figure 5-34   Cab PTO Mode

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 5-74 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 5-74   Cruise Switch PTO Digital Inputs

The Cruise Switch PTO parameters are listed in Table 5-75 and Table 5-76.

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 5-75   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 5-76   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.
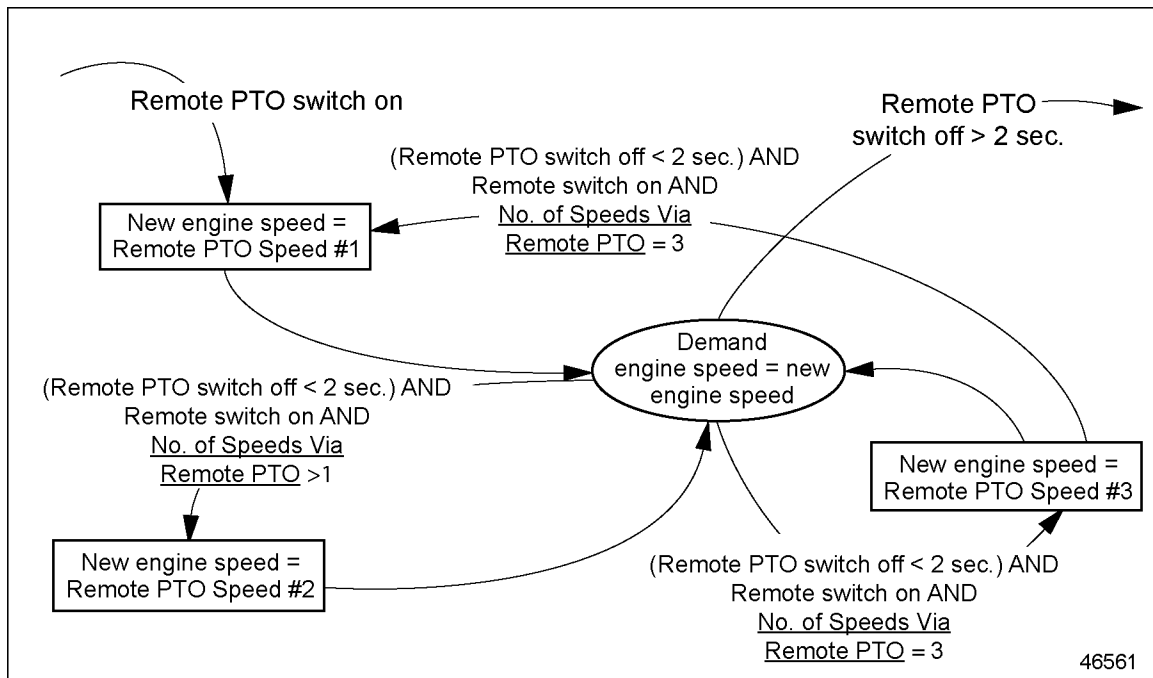
Figure 5-35   Remote PTO Mode – Pulsed Input Using Pin 2/9

Installation

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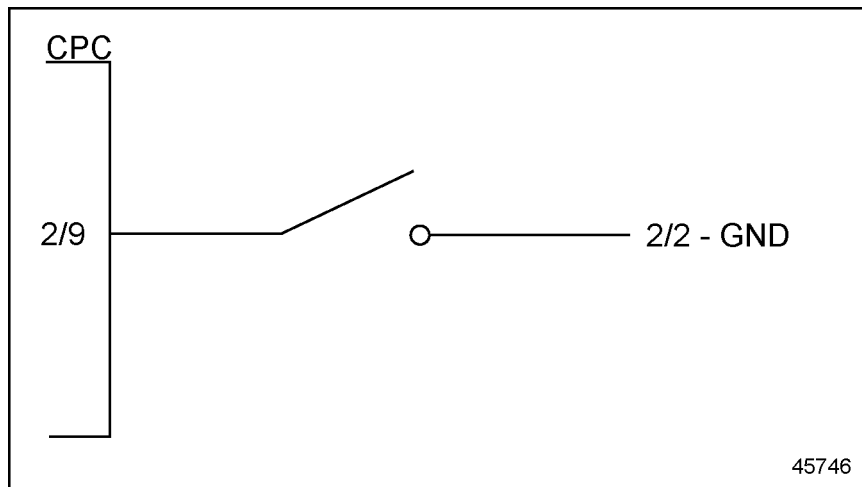
Figure 5-36   Remote PTO Switch

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 5-77.

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 5-77   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 5-78.

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)	OFF (Open)	ON (Ground)	Remote PTO Speed 2
ON (Ground)	Ground	ON (Ground)	Remote PTO Speed 3

Table 5-78   Binary Inputs

Installation for Gray Coded or Binary Input

See Figure 5-37 for the wiring of gray coded or binary input.
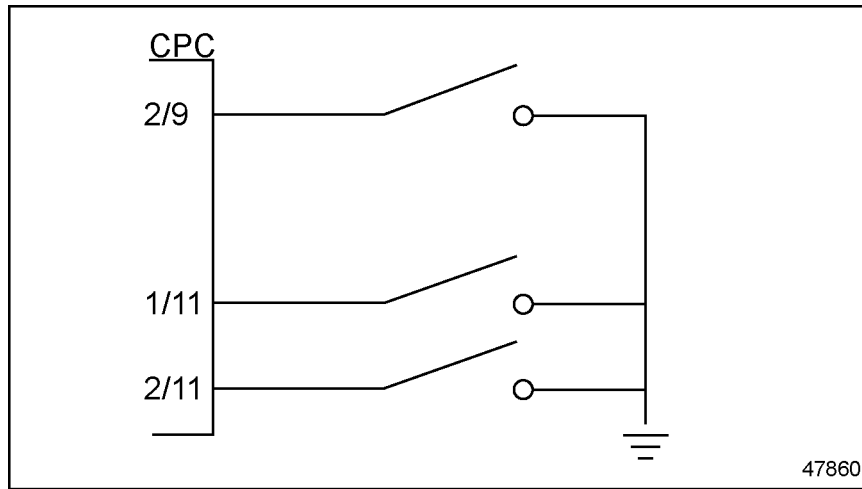
Figure 5-37   Remote PTO Gray Coded or Binary Input

Remote PTO Programming Requirement and Flexibility

The Remote PTO parameters are listed in Table 5-79 and Table 5-80.

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 5-79   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 5-80   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 5-81 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 5-81   Remote Accelerator Control Parameter Settings

Installation

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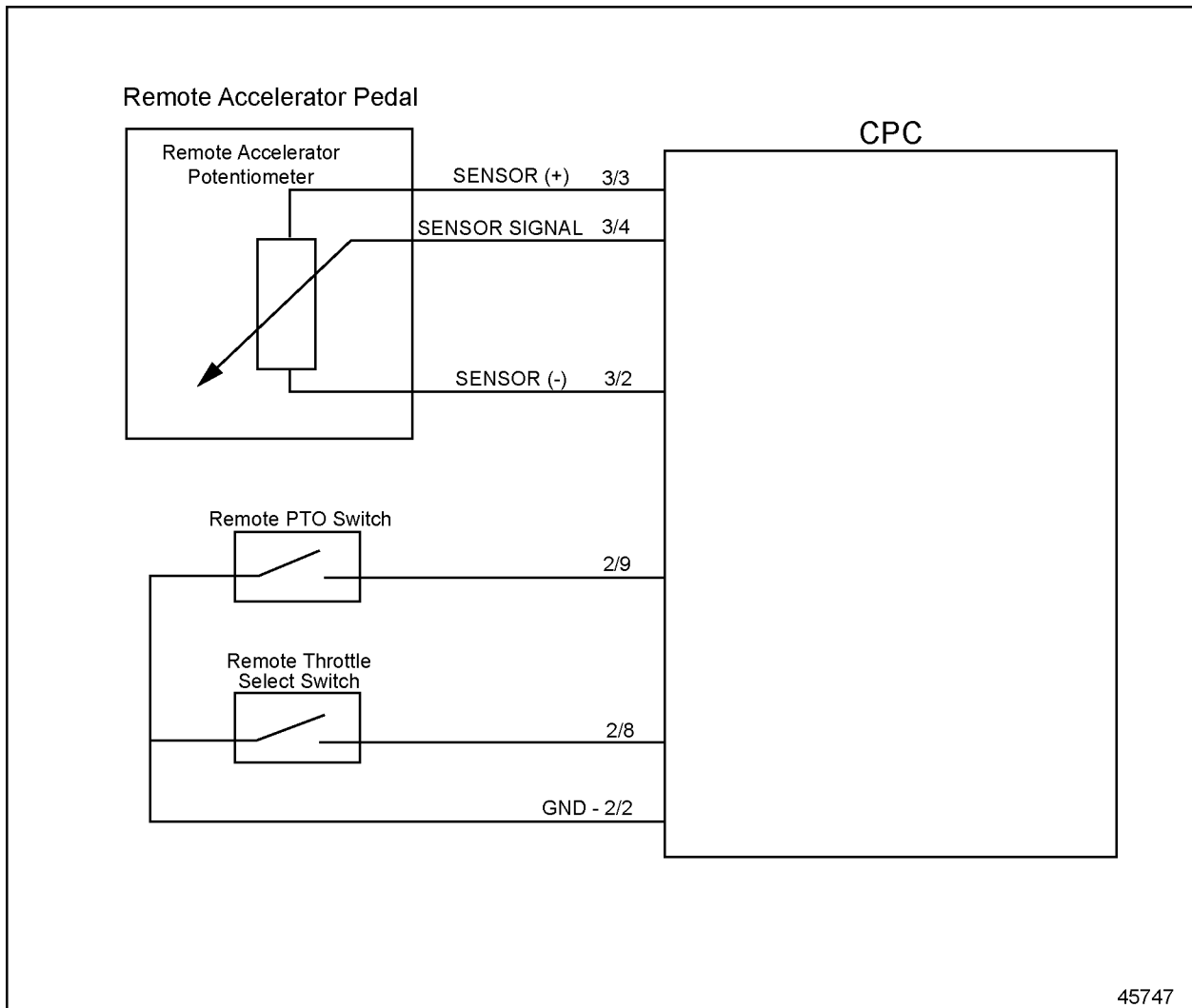
Figure 5-38   Remote Accelerator Control for PTO or ALSG

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 5-82.

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 5-82   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 5-83.

Parameter Group	Parameter	Setting
2	Transmission Type	<u>DIRECT</u> <u>ENGINE</u> <u>START</u> 0 – Manual Transmission without Neutral Switch <u>MCM</u> <u>ENGINE</u> <u>START</u> 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	<u>Optional</u> 0 – Hardwired 255 – Not Configured

Table 5-83   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.
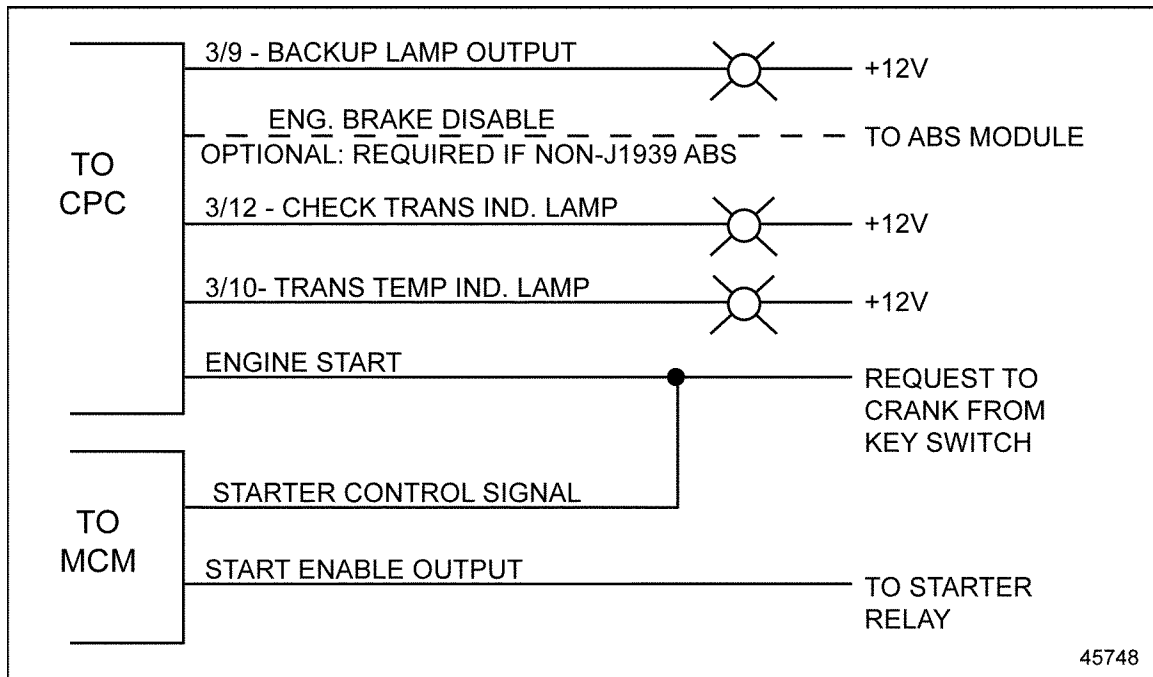
Figure 5-39   AGS2 Transmission Interface to CPC/MCM – Non-multiplexed
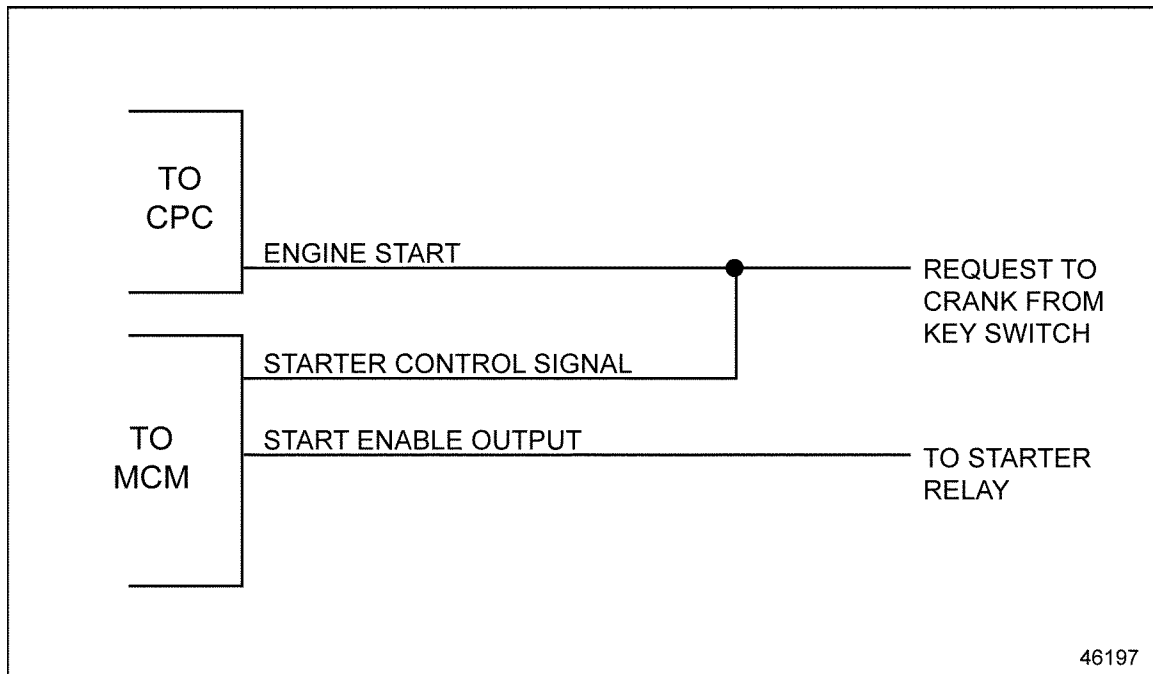
Figure 5-40   AGS2 Transmission Interface to CPC/MCM – Multiplexed

The AGS2 connector pinout is listed in Table 5-84.

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 5-84   AGS2 Connector

Programming Requirements and Flexibility

AGS2 transmissions have additional programming requirements on non-multiplexed vehicles as listed in Table 5-85.

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 5-85   AGS2 Transmission Programming Requirements for Non-Multiplexed Vehicles

AGS2 transmissions have additional programming requirements on 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 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 5-86   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.
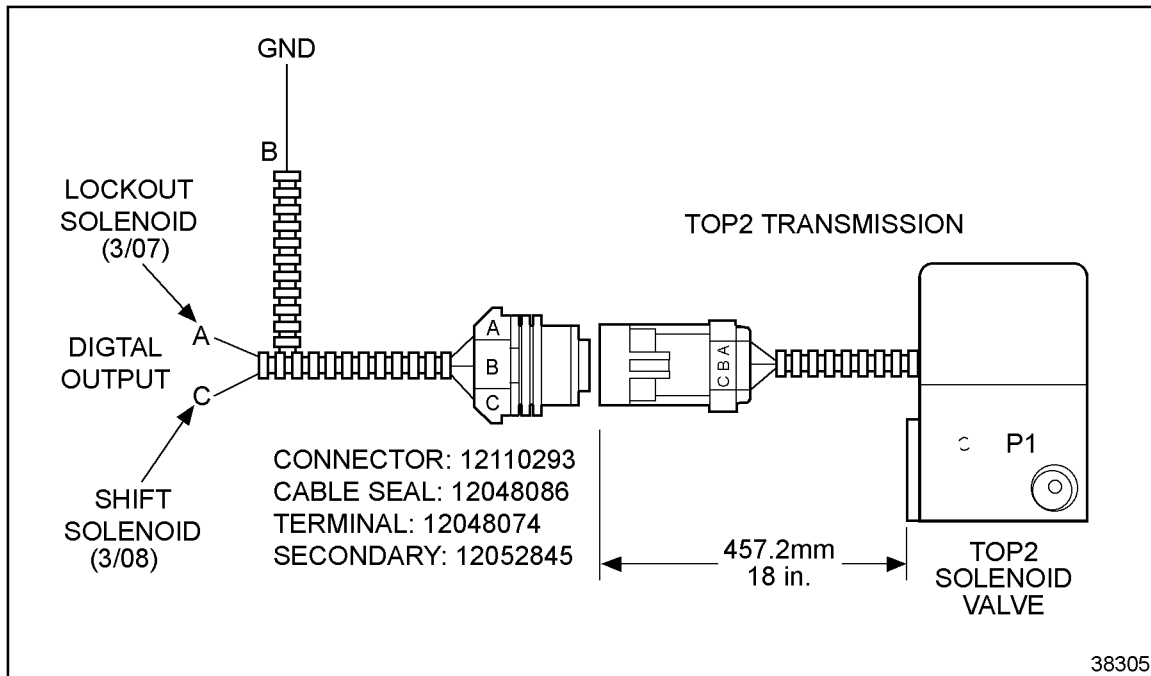
Figure 5-41   Top2 Transmission

Programming Requirements and Flexibility

The Top2 feature is enabled when the Top2 Shift Solenoid and the Top2 Lockout Solenoid digital outputs, listed in Table , 5-87 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 5-87   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 5-88 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 5-88   Eaton UltraShift Transmission Parameters

5.27.5 EATON ULTRASHIFT ASW TRANSMISSION

Programming Requirements and Flexibility

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

Parameter Group	Parameter	Setting
2	Transmission Type	<u>DIRECT</u> <u>ENGINE</u> <u>START</u> 2 – Eaton UltraShift Direct Start <u>MCM</u> <u>ENGINE</u> <u>START</u> 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 5-89   Eaton UltraShift ASW Transmission Parameters

5.27.6   EATON AUTOSHIFT TRANSMISSION

Programming Requirements and Flexibility

The parameters listed in Table 5-90 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 5-90   Eaton AutoShift Transmission Parameters

5.27.7 ZF ASTRONIC TRANSMISSION

Programming Requirements and Flexibility

The parameters listed in Table 5-91 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 5-91   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 5-92 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 5-92   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 5-93.

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 5-93   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 5-94.

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 5-94   VSS Anti-tampering Parameters

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6 COMMUNICATION PROTOCOLS

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6.1   OVERVIEW

Key components of the CPC system are the serial communication links SAE J1587 and SAE J1939. Using these communication links allows CPC to offer the following functionality:

- □ Transmitting sensor information from the MCM via the data link at regular intervals and/or upon request to obtain data and to monitor for failures

- □ Sharing information between stand-alone modules used in the system via the data link

- □ Sharing engine data with electronic dashboard displays and vehicle management information systems via the data link

- □ Transmitting and performing diagnostic procedures from external instrumentation such as the hand-held diagnostic data readers or DDDL via the data link

- □ Transmitting customer requested changes to the CPC from external instrumentation via the data link

- □ Transmitting to the powertrain the messages assigned to both the engine and the transmission retarder.

The following industry standard Society of Automotive Engineers (SAE) documents can be used as a reference:

- □ SAE J1587, *Electronic Data Interchange Between Microcomputer Systems In Heavy Duty Vehicle Applications*

- □ SAE J1708, *Serial Data Communications Between Microcomputer Systems In Heavy Duty Vehicle Applications*

- □ SAE J1939/71, *Vehicle Application Layer*

- □ SAE J1939, *Top Layer (Overview)*

- □ SAE J1939/01, *Truck and Bus Applications*

- □ SAE J1939/11, *Physical Layer*

- □ SAE J1939/21, *Data Link Layer*

- □ SAE J1939/73, *Application Layer Diagnostics*

To obtain a copy of the above documents contact the Society of Automotive Engineers (SAE).

SAE International
400 Commonwealth Drive
Warrendale, PA 15096
Attention: Publications
Phone: (412) 776-4970
www.sae.org

6.2 SAE J1587 DATA LINK

SAE RP J1587 defines the recommended format of messages and data being communicated between microprocessors used in heavy-duty vehicle applications. SAE J1587 Data Link + and SAE J1587 Data Link - as shown on the Vehicle Interface Harness schematic are used as the J1587 communication link. These circuits also exist in the nine-pin Diagnostic Connector, Cab for use with the diagnostic tools.

NOTE:
The maximum length for the SAE J1587 Data Link is 40 m (130 ft).

6.2.1 MESSAGE FORMAT

A complete description of the CPC parameters is provided within this section of the manual. CPC transmits parametric data at SAE J1587 recommended rates in packed message form. The first byte or character of each message is the Message Identification character (MID). The MID identifies which microcomputer on the serial communication link originated the information. Each device in the system originating messages must have a unique MID. The assignment of MIDs should be based on those listed in SAE RP J1587. The primary MID is 128.

The ProDriver display uses MID 171. Off-board diagnostic tools like hand-held readers should be identified by MID 172. Off-board programming stations like Vehicle Engine Programming Station (VEPS) should be identified by MID 182. Messages using MIDs as recommended by SAE RP J1587 will be responded to by the CPC.

Subsystems also require identifiers. The subsystem identifier character (SID) is a single byte character used to identify field-repairable or replaceable subsystems for which failures can be detected or isolated. SIDs are used in conjunction with SAE standard Diagnostic Trouble Codes defined in J1587 within PID 194.

The identifiers used by CPC are defined and listed in Table 6-1.

Identifier	Description
Failure Mode Identifier (FMI)	The FMI describes the type of failure detected in the subsystem and identified by the PID or SID.
Message Identification Character (MID)	The MID is the first byte or character of each message that identifies which microcomputer on CPC SAE J1587 DL serial communication link originated the information.
Parameter Identification Character (PID)	A PID is a single byte character used in CPC SAE J1587 DL messages to identify the data byte(s) that follow. PIDs identify the parameters transmitted.
Subsystem Identification Character (SID)	A SID is a single byte character used to identify field-repairable or replaceable subsystems for which failures can be detected or isolated.

Table 6-1   Identifiers Used by CPC

6.2.2   SAE J1708/J1587 MESSAGE PRIORITY

Each messagesent by CPC is assigned a priority on a scale of 1 to 8, in compliance with the
message priority assignment specified in SAE RP J1708. The most critical message has a priority
of one. The message assignments are listed in Table 6-2. All devices transmitting messages across
DDEC's SAE J1708/J1587 Data Link must be prioritized and transmitted in this manner.

Priority	Description
1 and 2	Reserved for messages that require immediate access to the bus.
3 and 4	Reserved for messages that require prompt access to the bus in order to prevent severe mechanical damage.
5 and 6	Reserved for messages that directly affect the economical or efficient operation of the vehicle.
7 and 8	All other messages not fitting into the previous priority categories.

Table 6-2   Message Priority Assignments

6.2.3   SAE J1587 PIDS REQUIRING ACTION

CPC will respond to data requests per the J1587 PID requests shown in the next sections.

Data Request

The format for a data request is shown below.

PID   **Data**
0   a
                      a - Parameter number of the requested parameter

Component Specific Request

The format for a component specific request is shown below.

PID   **Data**
128   a b
                      a - Parameter number of the requested parameter
                      b - MID of the component from which the parameter data is requested

NOTE:
CPC responds with the appropriate data provided the MID in byte (b) matches the MID
stored in calibration. The primary MID for CPC is 128.

J1587 Outputs - Single Byte Parameters

PID 33 - Clutch Cylinder Position
update rate: On Request
format:

PID	Data
33	a
	a – Clutch Cylinder Position

PID 40 - Engine Retarder Switches Status
update rate: 0.2 s or on state change
format:

PID	Data
40	a

a – Engine Retarder Switches Status
Bits 8–7:   Reserved – all bits set to 1
Bits 6–3::   Engine Retarder Level Switch
        0 - 0 Cylinders
        1 - 2 Cylinders
        3 - 3 Cylinders
        4 - 4 Cylinders
        5 - 5 Cylinders
        6 - 6 Cylinders
        7 - 7 Cylinders
        8 - 8 Cylinders
        9 - 13 – Reserved
        14 – Error
        15 – Not Available
Bits 2–1:   Engine Retarder Switch
        00 - Off
        01 - On
        10 - Error
        11 - Not Available

PID 41 - Cruise Control Switches Status
update rate: 1.0 s or on state change
format:

	PID	Data
	41	a

a – Cruise Control Switches Status

Bits 8–7:	Reserved - all bits set to 1
Bits 6–5:	Cruise Control On/Off Switch Status
	00 - Off
	01 - On
	10 - Error
	11 - Not Available
Bits 4–3:	Cruise Control Set Switch Status
	00 - Off
	01 - On
	10 - Error
	11 - Not Available
Bits 2–1:	Cruise Control Resume Switch Status
	00 - Off
	01 - On
	10 - Error
	11 - Not Available

PID 43 - Ignition Switch Status
update rate: 1.0 s or on state change
format:

	PID	Data
	43	a

a – Ignition Switch Status

Bits 8–7:	Start Aid Contacts Status – N/A
Bits 6–5:	Crank Contacts Status – N/A
Bits 4–3:	Run Contacts Status
	00 - Off
	01 - On
	10 - Error
	11 - Not Available
Bits 2–1:	Accessory Contacts Status – N/A

PID 44 - Attention/Warning Indicator Lamps Status

update rate: 1 time/s or 10 time/s when changing

format:

Bit: 1,2	Red Stop Lamp Status
	00 - off
	01 - on
	10 - error
	11 - Not Available
Bit: 3,4	Amber Warning Lamp Status
	00 - off
	01 - on
	10 - error
	11 - Not Available
Bit: 5-8	Reserved, All Bits set to 1

PID 62 - Retarder Inhibit Status

update rate: On request

format:

Bits: 1, 2	Retarder Inhibit Status
	00 - Off (not Inhibited)
	01 - On (Inhibited)
Bits: 3-8	Uncommitted, all Bits set to 1

source: Digital output for Engine Brake Enable

comments: Used with the Engine Brake outputs.

PID 64 - Direction Switch Status

update rate: On request

format:

PID	Data
64	a

a – Direction Switch Status

Bits 8–7:	Reserved; Both Set to 1
Bits 6–5:	Forward Switch Status — N/A
Bits 4–3:	Neutral Switch Status
	00 - Off
	01 - On
	10 - Error
	11 - Not Available
Bits 2–1:	Reverse Switch Status — N/A

PID 65 - Service Brake Status

update rate:	1 time/s
format:	

	Bits: 1, 2	Service Brake Status
		00 - off
		01 - on
	Bits: 3-8	Uncommitted, all Bits set to 1
		Bits 3-8 = 1
source:	Service Brake Switch	

PID 68 - Torque Limiting Factor

update rate:	1 time/s
resolution:	0.5%/Bit (Uns/SI)
source:	ECU calculated.
comments:	This parameter indicates the amount of engine protection torque reduction that is in effect.

PID 69- Two-Speed Axle Switch Status

update rate:	1 time/s
format:	

	Bits: 8	Two-Speed Axle Switch
		0 - off
		1 - on
	Bits: 1-7	All Bits set to 0

PID 70 - Parking Brake Switch Status

update rate:	1 time/s
format:	

	Bits: 8	Parking Brake Switch Status
		0 - off
		1 - on
	Bits: 1-7	Uncommitted, all Bits set to 0
source:	Parking Brake Switch	

PID 71 - Idle Shutdown Timer Status

update rate:	1 time/s
format:	

Bit: 1	Idle Shutdown Override ("Driver Alert") 1 - Active
Bit: 2	Engine Has Shutdown by Idle Timer to 1 - Yes
Bit: 3	Idle Timer Shutdown Override 1 - Active (Idle Shutdown has been overridden)
Bit: 4	Idle shutdown timer function 1 - Enabled in calibration 0 - Disabled in calibration
Bit: 8	Idle Shutdown Timer Status 1 - Active
Bits: 5-7	All Bits set to 0

PID 74 - Vehicle Speed Set Limit (Road Speed Limiting)

update rate:	On request only
resolution:	0.5 mph/Bit (Uns/SI)
source:	Calibration value (customer defined)
comments:	Vehicle Speed Limiting is a customer option.

PID 83 - Vehicle Speed Limit Status

update rate:	1 time/s
format:	

Bit: 8	Vehicle Speed Status 1 - Active
Bits: 1-7	All Bits set to 0

source:	ECU calculated
comments:	Vehicle Speed Limiting is a customer option.

PID 84 - Speed

update rate:	10 times/s
resolution:	0.5 mph/Bit (Uns/SI)
source:	Vehicle Speed Sensor input
comments:	Transmitted only if the Vehicle Speed Sensor is configured.

PID 85 - Cruise Control Switch Status

update rate: 10 times/s

format:

		On/Off Switch
	Bit: 1	1-On
		0-Off
		Set Switch
	Bit: 2	1-Off
		0-On
		Coast Switch
	Bit: 3	1-Off
		0-On
		Resume Switch
	Bit: 4	1-Off
		0-On
		Accel Switch
	Bit: 5	1-Off
		0-On
		Brake Switch
	Bit: 6	1-Off
		0-On
		Clutch Switch
	Bit: 7	1-Off
		0-On
		Cruise Active
	Bit: 8	1-On
		0-Off

source: Cruise Control switch inputs

PID 86 - Cruise Control Set Speed

update rate: 0.1 times/s, 5 times/s when the set speed is changing

resolution: 0.5 mph/Bit (Uns/SI)

source: Cruise Control switch inputs

comments: Transmitted if Vehicle Speed Cruise control is enabled.

PID 89 - VSG Switch Status

update rate: 1 time/s

format:

Bit: 1	On/off switch
	0-Off
	1-On
Bit: 2	Set switch
	0-Off
	1-On
Bit: 3	Coast switch
	0-Off
	1-On
Bit: 4	Resume switch
	0-Off
	1-On
Bit: 5	Accel switch
	0-Off
	1-On
Bit: 6	Brake
	0-Off
	1-On
Bit: 7	Clutch
	0-Off
	1-On
Bit: 8	VSG
	0-Off
	1-On

comments: Transmitted when either Cruise-Switch VSG or analog VSG is configured.

PID 91 - Percent Throttle

update rate: 10 times/s

resolution: 0.4%/Bit (Uns/SI)

source: Throttle Sensor input

PID 92 - Percent Engine Load

update rate: 10 times/s

resolution: 0.5%/Bit (Uns/SI)

source: ECU calculated

comments: Percent engine load is the ratio of actual torque and the minimum of the requested torque and digital torque limit.

PID 93 - Output Torque

update rate: 1 time/s

resolution: 20 ft-lb/Bit (S/SI)

PID 94 - Fuel Delivery Pressure
update rate: 1 time/s
resolution: 0.5 psi/Bit (Uns/SI)
source: Fuel Pressure Sensor

PID 98 - Engine Oil Level
update rate: 0.1 time/s
resolution: 0.5%/Bit (Uns/SI)
source: Oil Level Sensor

PID 100 - Engine Oil Pressure
update rate: 1 time/s
resolution: 0.5 psi/Bit (Uns/SI)
source: Oil pressure sensor
sensor range: 0 to 65 psi

PID 102 - Turbo Boost Pressure (Gage)
update rate: 1 times/s
resolution: 0.125 psi/Bit (Uns/SI)
source: Turbo Boost Pressure Sensor

PID 105 - Intake Manifold Temperature
update rate: 1 time/s
resolution: 1°F/Bit (Uns/SI)
source: Intake Manifold Temperature Sensor

PID 106 - Air Inlet Pressure
update rate: 1 time/s
resolution: 0.25 psi/bit (Uns/SI)

PID 107 - Air Filter Differential Pressure
update rate: 0.1 time/s
resolution: 0.2 in.H_2O/Bit (Uns/SI)
source: Air Filter Differential Pressure Sensor

PID 108 - Barometric Pressure
update rate: 1 time/s
resolution: 0.0625 psi/Bit (Uns/SI)

PID 110 - Coolant Temperature
update rate: 1 time/s
resolution: 1°F/Bit (Uns/SI)
source: Engine Coolant Temperature Sensor
sensor range: 0 to 300°F

PID 111 - Coolant Level
update rate: 0.1 times/s
resolution: 0.5%/Bit (Uns/SI) (or full = 100%, low = 0%)
source: Engine Coolant Level Sensor
comments: If the Add Coolant Level Sensor (ACL Sensor) is installed with the Engine
                Protection Coolant Level Sensor (ECL Sensor), the coolant level will be:
                        100%   When both sensors are in coolant
                         50%   When the ACL Sensor is out of the coolant
                          0%   When both sensors are out of the coolant
                If only the ECL Sensor is configured:
                        100%   Full
                          0%   Low

PID 121 - Engine Retarder Status
update rate: 5 times/s
format:

                        Bit: 1   1 – 2 cylinders active
                        Bit: 2   1 – 3 cylinders active
                        Bit: 3   1 – 4 cylinders active
                        Bit: 4   1 – 6 cylinders active
                        Bit: 5   1 – 8 cylinders active
                        Bit: 8   1 - Retarder active
comments: Transmitted only if engine brakes are configured.

PID 122 - Engine Retarder Percent
update rate: 1 time/s
resolution: 0.5%Bit (Uns/SI)

Double Byte Parameters

PID 168 - Battery Voltage
update rate: 1 time/s
resolution: 0.05 volts/Bit (Uns/I)
source: Battery voltage measured at input to CPC

PID 171 - Ambient Air Temperature
update rate: 0.1 time/s
resolution: 0.25°F/Bit (S/I)

PID 173 - Exhaust Gas Temperature (DOC Inlet Temperature)
update rate: 1.0 time/s
resolution: 0.25°F/Bit (S/I)

PID 174 - Fuel Temperature
update rate: 1 time/s
resolution: 0.25°F/Bit (S/I)
source: Supply Fuel Temperature Sensor
sensor range: -40 to 175°F

PID 175 - Engine Oil Temperature
update rate: 1 time/s
resolution: 0.25°F/Bit (S/I)
source: Engine Oil Temperature Sensor
sensor range: -40 to 300°F

PID 182 - Trip Fuel
update rate: 0.1 times/s
resolution: 0.125 gal/Bit (Uns/I)

PID 183 - Instantaneous Fuel Economy (MPG)
update rate: 5 times/s
resolution: 1/256 mpg/Bit (Uns/I)

PID 184 - Instantaneous Fuel Economy (MPG)
update rate: 5 times/s
resolution: 1/256 mpg/Bit (Uns/I)

PID 185 - Average Fuel Economy (MPG)
update rate: 0.1 times/s
resolution: 1/256 mpg/Bit (Uns/I)

PID 187 - VSG Set Speed

update rate:	0.1 times/s, 5 times per s when the set speed is changing
resolution:	0.25 rpm/Bit (Uns/I)
source:	VSG switch input
comments:	Used to indicate the current set speed from:

- □ Analog VSG
- □ Cruise Switch VSG

PID 188 - Idle Set Speed

update rate:	On request only
resolution:	0.25 rpm/Bit (Uns/I)
source:	Calibration value

PID 189 - Rated Engine Speed

update rate:	On request only
resolution:	0.25 rpm/Bit (Uns/I)
source:	Calibration value

PID 190 - Engine Speed

update rate:	10 times/s
resolution:	0.25 rpm/Bit (Uns/I)

PID 203 - DPF Outlet Temperature

update rate:	1 times/s
resolution:	0.25°F/Bit (S/I)

PID 366- Engine Oil Level High/Low

update rate:	0.1 times/s
resolution:	0.473 L/Bit

PID 439 (255 183)- Extended Range boost Pressure

update rate:	1 times/s
resolution:	0.125 kPa/Bit (Uns/I)

Variable Length Parameters

PID 192 - Multi-Section Parameter

update rate: Used to transmit messages that are greater than 21 bytes in length.

format:

PID	Data
192	n a b c/d c c c c c

   n - Byte count of data that follows this character. This excludes characters MID, PID 192 and n but it includes a, b, c, or d type character.

   a = PID specifying the parameter that has been sectioned.

   b = The last section number (total number of sections minus ONE) and the current section number. The upper nibble contains the current section number (1 to 15). The lower nibble contains the current section number and is limited to the range 0 to 15. Section numbers are assigned in ascending order.

   c = Data portion of the sectioned parameter. May be 1 to 14 characters in the first packet. May be 1 to 15 characters in the middle and ending packets.

   d = Byte count of the total data portion. This character is sent only in the first packet. The values are limited to 239 or less but must be greater than 17.

comment: PID 192 is used to section any CPC message that exceeds 21 bytes while the engine is running, in particular PID 194, PID 196, and PID 243. If the engine is stopped, CPC may transmit messages up to 40 bytes in length.

PID 194 - Transmitter System Diagnostic Code / Occurrence Count Table

update rate: On Request only

format:

PID	Data
194	n a b c a b c a b c a b c a b c...

n -   Byte count of data that follows this character. This excludes characters MID, PID 194 and n but includes a, b, c type characters.

a -   SID or PID of a standard diagnostic code.

b -   Diagnostic code character

Bits: 1-4	FMI of a standard diagnostic code	
Bit: 5	Byte (a) Identifier	
	1 -	Byte (a) is a SID
	0 -	Byte (a) is a PID
Bit: 6	Type of Diagnostic Code	
	1 -	standard diagnostic code
	0 -	expansion diagnostic codes (PID/SID from page 2)
Bit: 7	Current Status of Fault	
	1 -	fault is inactive
	0 -	fault is active
Bit: 8	Occurrence count	
	1 -	count is included
	0 -	count is not included

c -   Occurrence count for the diagnostic code defined by the preceding 2 characters. The maximum occurrence count is 255. Bit 8 of byte (b) of the diagnostic code is used to determine if it is included.

comment: Diagnostic codes are transmitted periodically while active. When the active code becomes inactive, the code is transmitted once to indicate that the fault became inactive. Inactive diagnostic codes are available by request of PID 194. If more than 6 codes are active at any point, PID 194 is sectioned as described in PID 192.

PID 195 – Transmitter Data Request / Clear Count

format:

PID	Data
195	n a b c

n - Number of parameter data characters = 3

a - MID of the device to which the request is directed

b - SID or PID of a standard diagnostic code

c - Diagnostic code number

Bits:1 - 4		Failure mode identifier (FMI) of a standard diagnostic code
Bit:5		Byte (b) identifier
	1 -	Byte (b) is a Subsystem Identifier (SID)
	0 -	Byte (b) is a Parameter Identifier (PID)
Bit:6		Type of diagnostic code
	1 -	Standard diagnostic code
	0 -	Reserved for expansion diagnostic codes
Bit:7, 8	00--	Request an ASCII descriptive message for the given diagnostic code.
	01 -	Request count be cleared for the given diagnostic code on the device with the given MID.
	10 -	Request counts be cleared for all diagnostic codes on the device with the given MID. The diagnostic code given in this transmission is ignored.
	11 -	Request additional diagnostic information for the given diagnostic code, the content of which is defined under PID 196.

PID 196 - Diagnostic Data/count clear response

update rate: On Request only

format:

PID	Data
196	n a b c c c c c

n =   Byte count of data that follows this character. This excludes characters MID, PID 194 and n but includes a, b, and c type characters.

a =   SID or PID of a standard diagnostic code

b =   Diagnostic Code Character

Bits 1-4 -   FMI of a standard diagnostic code

Bit 5 -   Byte (a) identifier

1 -   Byte (a) is a SID

0 -   Byte (a) is a PID

Bit 6 -   Type of diagnostic code

1 -   standard diagnostic code

0 -   expansion diagnostic codes (PID/SID from page 2)

Bit 7-8 -   Action

- Message is an ASCII descriptive message for the given diagnostic code.

01 -   The count has been cleared for the given diagnostic code.

10 -   All clearable diagnostic counts have been cleared for this device.

- Message is additional diagnostic information for the given diagnostic code, as defined below.

c =   Additional information (if applicable)

c1-c5 -   ATA/VMRS (DTDSC)

c6, c7 -   Engine hours the code was first logged (LSB first) format: 1 h/Bit. range - 0-65535 hours.

c8, c9 -   Calendar date (Month, Day) the code was first logged, if available.

c10, c11 -   Clock time the code was first logged (hours, minutes), if available.

c12, c13 -   Engine hours the code last became active (LSB first).

c14, c15 -   Calendar date (Month, Day) the code last became active, if available.

c16, c17 -   Clock time the code last became active (hours, minutes), if available.

PID 196 - Diagnostic Data/count clear response

update rate: On Request only

format:

PID	Data

c18, c19 - Number of ss the code has been active (LSB first).
format: ss = 1 s/Bit
range = 0-65535 (18.2 hours)
Value remains at 65535 ss once it has been reached.

c20 - Number of Stop Engine Override Switch restarts while the code was active. The value remains at 255 once it has been reached.

c21+ = Optional associated parameter value (scaled as defined in J1587)
For temperatures, pressures, and voltages with FMI 0 - Highest value achieved
For temperatures, pressures, and voltages with FMI 1 - Lowest value achieved
For engine speed with FMI 0 - Highest speed achieved
For vehicle speed with FMI 0 or 11 - Highest speed achieved

Last byte = checksum

comment: The date and time that the code last became inactive (bytes c14-c17) will be transmitted as zero if the code is currently active. This data may be sectioned using PID 192.

PID 233- Unit Number (Power Unit)

update rate: On Request only

format:

PID	Data
231	n a a a . . .

n = number of bytes: 10
a = unit number in alphanumeric ASCII characters

PID 234- Software Identification

update rate: On Request only

format:

PID	Data		
234	n		
	Byte: 1	Number of SW ID fields	
	Byte: 2	1st digit of major_num (ASCII)	
	Byte: 3	2nd digit of major_num (ASCII)	
	Byte: 4	3rd digit of major_num (ASCII)	
	Byte: 5	* delimiter (ASCII)	
	Byte: 6	1st digit of minor_num (ASCII)	
	Byte: 7	2nd digit of minor_num (ASCII)	
	Byte: 8	3rd digit of minor_num (ASCII)	
	Byte: 9	* delimiter (ASCII)	
	Byte: 10	1st digit of edit_ver (ASCII)	
	Byte: 11	2nd digit of edit_ver (ASCII)	
	Byte: 12	3rd digit of edit_ver (ASCII)	
	Byte: 13	* delimiter (ASCII)	
	Byte: 14	1st digit of config_id (ASCII)	
	Byte: 15	2nd digit of config_id (ASCII)	
	Byte: 16	3rd digit of config_id (ASCII)	
	Byte: 17	* delimiter (ASCII)	
	Byte: 18	rel_type (ASCII)	
	Byte: 19	* delimiter (ASCII)	
	Byte: 20	hw_ver	
	Byte: 21	* delimiter (ASCII)	
	Byte: 22	edit_let (ASCII)	
	Byte: 23	* delimiter (ASCII)	
	Byte: 24	1st digit of diag_ver(ASCII)	
	Byte: 25	2nd digit of diag_ver(ASCII)	
	Byte: 26	3rd digit of diag_ver(ASCII)	
	Byte: 27	* delimiter (ASCII)	
	Byte: 28	1st digit of diag_variant(ASCII)	
	Byte: 29	2nd digit of diag_variant(ASCII)	
	Byte: 30	3rd digit of diag_variant(ASCII)	
	Byte: 31	* delimiter (ASCII)	
	Byte: 32	1st digit sw_year (ASCII)	
	Byte: 33	2nd digit sw_year (ASCII)	
	Byte: 34	* delimiter (ASCII)	
	Byte: 35	1st digit sw_month (ASCII)	
	Byte: 36	2nd digit sw_month (ASCII)	
	Byte: 37	* delimiter (ASCII)	
	Byte: 38	1st digit sw_day (ASCII)	

PID 234- Software Identification

Byte: 39	2nd digit sw_day (ASCII)
Byte: 40	* delimiter (ASCII)
Byte: 41	1st digit sw_hour (ASCII)
Byte: 42	2nd digit sw_hour (ASCII)
Byte: 43	* delimiter (ASCII)
Byte: 44	1st digit sw_minute (ASCII)
Byte: 45	2nd digit sw_minute (ASCII)
Byte: 46	* delimiter (ASCII)
Byte: 47	ECU Serial Number (ASCII)
Byte: 48	ECU Serial Number (ASCII)
Byte: 49	ECU Serial Number (ASCII)
Byte: 50	ECU Serial Number (ASCII)
Byte: 51	ECU Serial Number (ASCII)
Byte: 52	ECU Serial Number (ASCII)
Byte: 53	ECU Serial Number (ASCII)
Byte: 54	ECU Serial Number (ASCII)
Byte: 55	ECU Serial Number (ASCII)
Byte: 56	ECU Serial Number (ASCII)
Byte: 57	ECU Serial Number (ASCII)
Byte: 58	ECU Serial Number (ASCII)
Byte: 59	ECU Serial Number (ASCII)
Byte: 60	* delimiter (ASCII)

PID 235- Total Idle Hours
update rate: On Request only
format:

PID	Data
235	n a a a a

n = number of bytes: 4
a = Total idle hours; scaled 0.05 hours/Bit (Uns/LI)
comment: Accumulates time while the engine is operating at idle.

PID 236- Total Idle Fuel Used
update rate: On Request only
format:

PID	Data
236	n a a a a

n = number of bytes: 4
a = Idle fuel used; scaled 1/8 hours/Bit (Uns/LI)
comment: Accumulates while the engine is operating at idle.

PID 237- Vehicle Identification Number (VIN)

update rate:	On Request only
format:	

PID	Data
237	n a a a ...

       n =   number of bytes: up to 17

       a =   VIN in ASCII characters

source:	Calibration value

PID 243- Device Identification

update rate:	On Request only
format:	

PID	Data
243	n a b b b b b c d d d d d d d d e f f f f f f f f f f g h h h h h h h h h h i

       n =   number of bytes: 38

       a =   component ID = MID

       b =   ATA/VMRS manufacturer ID (5 bytes)

       c =   delimiter: ASCII '*'

       d =   engine model number (8 bytes)

       e =   delimiter: ASCII '*'

       f =   engine serial number (10 bytes)

       g =   delimiter : ASCII '*'

       h =   unit number (10 bytes)

source:	Calibration value
comment:	This parameter may be sectioned using PID 192.

PID 244- Trip Miles

update rate:	0.1 times/s
format:	

PID	Data
244	n a a a a

       n =   number of bytes: 4

       a =   trip miles 0.1 mile/Bit (Uns/LI)

comment:	Transmitted only if the vehicle speed sensor is configured.

PID 245- Total Miles

update rate: 0.1 times/s

format:

PID	Data
245	n a a a a

      n =   number of bytes: 4

      a =   total miles, 0.1 mile/Bit (Uns/LI)

comment: Transmitted only if the vehicle speed sensor is configured.

PID 247- Total Engine Hours

update rate: On request only

format:

PID	Data
247	n a a a a

      n =   number of bytes: 4

      a =   total engine hours 0.05 hour/Bit (Uns/LI)

comment: Used to identify the total hours that the engine is operating. Time accumulated while the engine speed is above 60 rpm.

PID 248- Total VSG Hours

update rate: On request only

format:

PID	Data
248	n a a a a

      n =   number of bytes: 4

      b =   total VSG hours 0.05 hour/Bit (Uns/LI)

comment: Used to identify total engine hours the engine is operating in the following modes:

           -Hand throttle VSG

           -High idle using cruise switches

PID 249- Total Engine Revolutions

update rate: On request only

format:

PID	Data
249	n a a a a

      n =   number of bytes: 4

      a =   total engine revolutions 1000 revolutions/Bit (Uns/SI)

PID 250- Total Fuel Used

update rate:	On request only
format:	

PID	Data
250	n a a a a

        n =   number of bytes: 4

        a =   total fuel used 0.125 gal/Bit (Uns/LI)

PID 251- Clock

update rate:	On request only
format:	

PID	Data
251	n a b c

        n =   number of bytes: 3

        a =   Seconds 0.25 sec/Bit, range 0 to 59.75 seconds

        b =   Minutes 1.0 min/Bit, range 0 to 59 minutes

        c =   Hours 1.00 hour/Bit, range 0 to 23 hours

comment: Transmitted if clock data is considered valid. The time is broadcast in Greenwich Mean Time.

PID 252- Date

update rate:	On request only
format:	

PID	Data
252	n a b c

        n =   number of bytes: 3

        a =   Day 0.25 day/Bit, range 1 to 31.75 days

        b =   Month 1.0 month/Bit, range 1 to 12 months

        c =   Year - 1985 1.00 year/Bit, range 0 to 99

comment: Day of the month is scaled such that 0 is a null value, values 1, 2, 3, and 4 are the first day of the month, 5, 6, 7, 8,are the second day of the month, etc. Transmitted if clock data is considered valid.

PID 384 - Component-Specific Request Parameter

update rate: On request only

format:

PID	Data
384	a b

a =   Parameter number of the requested parameter from page 2 (transmitted module 256)

b =   MID of the component from which the parameter data is requested. Only the specified component should transmit the specified parameter. If the specified component is in the MID range 0 to 127, its response is not defined in this document.

PID 448- Page 2 Multi-Section Parameter

update rate: Defined by specified sectioned parameter

format:

PID	Data
448	n,a,b,c/d,c,c,c,c,c,c,c

n =   Byte count of data that follows this character. This excludes characters MID, PID 448, and n, but it includes a, b, c, or d type characters.

a =   PID from page 2 (PIDs 256 to 510) specifying the parameter that has been selected.

b =

The last section number (total number of sections minus ONE) and the current section number. The upper nibble contains the last section number (1 to 15). The lower nibble contains the current section number and is limited to the range 0 to 15. Section numbers are assigned in ascending order.

c =   Data portion of sectioned parameters. May be 1 to 13 characters in the firstpacket as byte d is transmitted only in the first packet. May be 1 to 14 characters in the middle and ending packets.

d =   Total byte count of the original data. It is the same value as the byte count of the parameter being sectioned. This character is broadcast only in the first packet. The value must be greater than 16 but is limited to 224.

6.3   SAE J1939 MESSAGES AND MESSAGE FORMAT

J1939 (+), J1939 (-), and J1939 Shield are used as the J1939 communication link.

The message format uses the parameter group number as the label for a group of parameters. Each of the parameters within the group can be expressed in ASCII, as scaled data, or as function states consisting of one or more Bits. Alphanumeric data will be transmitted with the most significant byte first. Other parameters consisting of two or more data bytes shall be transmitted least significant byte first. The type of data is also identified for each parameter.

The following sections identify the parameters that are supported by DDEC.

The J1939 source address can be set for various components as listed in Table 6-3.

Parameter Group	Parameter	Options	Default	Access
1	EBC1 Source Address SAE J1939	0–255	33	VEPS, DRS
1	TSC1 Source Address SAE J1939	0–255	231	VEPS, DRS
1	CC1 Source Address SAE J1939	0–255	23	VEPS, DRS
1	CC2 Source Address SAE J1939	0–255	33	VEPS, DRS
1	CC3Source Address SAE J1939	0–255	49	VEPS, DRS
1	CM1 DPF Source Address SAE J1939	0–255	49	VEPS, DRS
1	CM1 Fan Source Addr1 SAE J1939	0–255	49	VEPS, DRS
1	CM1 Fan Source Addr2 SAE J1939	0–255	49	VEPS, DRS

Table 6-3   J1939 Source Address

6.3.1   SAE J1939 SUPPORTED MESSAGES

The format of SAE J1939 supported messages may be seen in the following sections.

ACC1 – Adaptive Cruise Control

Reception rate:	100 ms	
Transmission rate:	1 second	
Data length:	8 bytes	
Data Page:	0	
PDU format:	254	
PDU specific:	111	
PGN:	65135 (0x00FE6F)	
Byte : 1	Speed of Forward Vehicle - N/A	
Byte : 2	Distance to Forward Vehicle - N/A	
Byte : 3	Adaptive Cruise Control Set Speed - N/A	
Byte : 4	ACC Status 1	
	Bits: 8,7	Not Defined
	Bits: 6-4	Adaptive Cruise Control Set Distance Mode - N/A
	Bits: 3-1	Adaptive Cruise Control Mode (SPN 1590)
		110: Error
		111: Not Available
Byte : 5–6	Road Curvature - N/A	
Byte : 7	Bits: 8,7	Not Defined
	Bits: 5,6	ACC Distance Alert Signal–N/A
	Bits: 3,4	ACC System Shutoff Warning–N/A
	Bits: 1,2	ACC Target Detected–N/A
Byte : 8	Not Defined	

ACK/NACK – Acknowledge / Negative Acknowledge

Transmission Rate:	As Needed
Data Length:	8 bytes
Data Page:	0
PDU format:	232
PDU specific:	Destination Address
Default priority:	6
PGN:	59,392 (0x00E800)

Byte: 1   Control Byte

     0:   Positive Acknowledgment (ACK)

     1:   Negative Acknowledgment (NACK)

     2:   Access Denied (PGN supported but access denied)

Byte: 2   Group Function Value (if applicable)- N/A

Bytes: 3–5   Reserved for assignment by SAE, send each of these bytes as "FF"

Byte: 6–8   Parameter Group Number of requested information

AMB – Ambient Conditions

Transmission Rate:	1 sec
Data Length:	8 bytes
Data Page:	0
PDU format:	254
PDU specific:	245
Default priority:	6
PGN:	65,269 (0x00FEF5)

Byte: 1   Barometric Pressure (SPN 108)

     Resolution: 0.5 kPa / Bit, 0 kPa offset

Byte: 2   Cab Interior Temperature - N/A

Bytes: 4,5   Ambient Air Temperature (SPN 171)

     Resolution: 0.03125°C / Bit, -273°C offset

Byte: 6   Air Inlet Temperature (SPN 172)

     Resolution: 1°C / Bit, -40°C offset

Bytes: 7,8   Road Surface Temperature - N/A

ATI2 - Aftertreatment Intake Gas 2

Transmission Repetition Rate: 500 ms
Data Length: 8 bytes
Extended Data Page: 0
Data Page: 0

PDU format: 253

PDU specific: 180
Default priority: 6
PGN: 64948 (0xFDB4)
Bytes: 1–2   Exhaust Gas Temperature 1 (SPN 3241) – N/A
Bytes: 3–4   Particulate Trap Intake Gas Temperature (SPN 3242) (CPC Rel 2 or later)
    Resolution: 0.03125°C / Bit, -273°C offset
Byte: 5   Exhaust Gas Temperature 1 Preliminary FMI (SPN 3243) – N/A
Byte: 6   Particulate Trap Intake Exhaust Gas Temperature Preliminary FMI – N/A

ATO2 - Aftertreatment Outlet Gas 2

Transmission Repetition Rate: 500 ms
Data Length: 8 bytes
Extended Data Page: 0
Data Page: 0

PDU format: 253

PDU specific: 179
Default priority: 6
PGN: 64947 (0xFDB3)
Bytes: 1–2   Exhaust Gas Temperature 3 (SPN 3245) – N/A
Bytes: 3–4   Particulate Trap Outlet Gas Temperature (SPN 3246) (CPC Rel 2 or later)
    Resolution: 0.03125°C / Bit, -273°C offset
Byte: 5   Exhaust Gas Temperature 3 Preliminary FMI (SPN 3247) – N/A
Byte: 6   Particulate Trap Outlet Exhaust Gas Temperature Preliminary FMI – N/A

CCSS – Cruise Control / Vehicle Speed Setup

Transmission Rate :   On Request

Data Length: 8 bytes

Data Page: 0
PDU format: 254
PDU specific: 237
Default priority: 6
PGN: 65,261 (0x00FEED)
Byte: 1   Maximum Vehicle Speed Limit (SPN 74)
        Resolution: 1 km/h / Bit, 0 km/h offset
Byte: 2   Cruise Control High Set Limit Speed. (SPN 87)
        Resolution: 1 km/h / Bit, 0 km/h offset
Byte: 3   Cruise Control Low Set Limit Speed (SPN 88)
        Resolution: 1 km/h / Bit, 0 km/h offset
Bytes: 4-8   Not Defined

CCVS – Cruise Control / Vehicle Speed

Transmission/Reception Rate:		100 ms
Data Length:		8 bytes
Data Page:		0
PDU format:		254
PDU specific:		241
Default priority:		6
PGN:		65,265 (0x00FEF1)

Byte: 1   Measured_SW1

        Bits: 8,7   Not Defined

        Bits: 6,5   Cruise Control Pause Switch (SPN 1633)
                00:   Off
                01:   On
                10:   Error
                11:   Take No Action

        Bits: 4,3   Parking Brake Switch (SPN 70)
                00:   Park Brake Not Set
                01:   Park Brake Set
                10:   Error
                11:   Not Configured

        Bits: 2,1   Two Speed Axle Switch (SPN 69)
                00:   Low Speed Range
                01:   High Speed Range
                10:   Error
                11:   Not Configured

Byte: 2,3   Wheel Based Vehicle Speed (SPN 84)
        Resolution: 1/256 km/h, 0 km/h Offset

Byte: 4   Measured_CC_SW1

        Bits: 8,7   Clutch Switch (SPN 598)
                00:   Clutch Pedal Released
                01:   Clutch Pedal Depressed
                10:   Error
                11:   Not Configured

        Bits: 6,5   Service Brake Switch (SPN 597)
                00:   Brake Pedal Released
                01:   Brake Pedal Depressed
                10:   Error
                11:   Not Configured

        Bits: 4,3   Cruise Control Enable Switch (SPN 596)
                00:   Cruise Control Disabled
                01:   Cruise Control Enabled
                10:   Error
                11:   Not Configured

	Bits: 2,1	Cruise Control Active (SPN 595)
		00: Cruise Control Off
		01: Cruise Control On
		10: Error
		11: Not Configured
Byte: 5	Measured _CC_SW2	
	Bits: 8,7	Cruise Control Accelerate Switch (SPN 602)
		00: Accelerate Switch Off
		01: Accelerate Switch On
		10: Error
		11: Not Configured
	Bits: 6,5	Cruise Control Resume Switch (SPN 601)
		00: Resume Switch Off
		01: Resume Switch On
		10: Error
		11: Not Configured
	Bits: 4,3	Cruise Control Coast Switch (SPN 600)
		00: Coast Switch Off
		01: Coast Switch On
		10: Error
		11: Not Configured
	Bits: 2,1	Cruise Control Set Switch (SPN 599)
		00: Set Switch Off
		01: Set Switch On
		10: Error
		11: Not Configured
Byte: 6	Cruise Control Set Speed (SPN 86)	
	Resolution:	1 km/h/Bit, 0 km/h Offset
Byte: 7	State_CC	
	Bits: 8–6	Cruise Control State (SPN 527)
		000: Off/Disabled
		001: Hold
		010: Accelerate
		011: Decel/Coast
		100: Resume
		101: Set
		110: Accelerator Override
		111: Not Available
	Bits: 5-1	PTO State - (SPN 976)
		00000: Disabled/Off
		00001: Hold
		00010: Remote Hold
		00100: Remote Standby

00101:	Set
00110:	Decelerate/Coast
00111:	Resume
01000:	Accelerate
01001:	Accelerator Override
01010:	Programmed Speed 1
01011:	Programmed Speed 2
01100:	Programmed Speed 3
11111:	Not Available

Byte: 8   Measured_Idle_SW1

     Bits: 8,7   Engine Shutdown Override Switch (SPN 1237)

         00:    Switch Off

         01:    Switch On

         11:    Not Configured

     Bits: 6,5   Engine Test Mode Switch – N/A

     Bits: 4,3   Idle Decrement Switch (SPN 967)

         00:    Off

         01:    On

     Bits: 2,1   Idle Increment Switch (SPN 968)

         00:    Off

         01:    On

CI – Component Identification

Transmission Rate :	On Request
Data Length:	37 bytes
Data Page:	0
PDU format:	254
PDU specific:	235
Default priority:	6
PGN:	65,259 (0x00FEEB)
Bytes: 1-5	Make (SPN 586) – ASCII
Byte: 6	* - Delimiter
Bytes 7–14:	Engine Model Number (SPN 587) – ASCII
Byte: 15	* - Delimiter
Byte: 16–25	Engine Serial Number (SPN 588) – ASCII
Byte: 26	* - Delimiter
Byte: 27–36	Unit Number (Power Unit) (SPN 233) - ASCII
Byte: 37	* - Delimiter
Note:	DDEC VI also supports an alternate format of the component identification data to satisfy an AGS2 transmission.
Example:	Series 60 – DTDSC*606HG6E*00R01234567**
	MBE900 – MRCBN*926N07*123456**
	MBE4000 – MRCBN*460N07*123456**

CM1 – Cab Message1

Transmission Rate:	1 sec
Data Length:	8 bytes
Data Page:	0
PDU Format:	224
PDU Specific:	218
Default Priority:	6
PGN:	57, 344(0x00E00016)
Byte: 1	Requested Percent Fan Speed (SPN 986)
	Resolution: 0.4%/Bit, 0 offset
Bytes: 2 – 3	Cab Interior Temperature Command – N/A
Byte: 4	
	Bits: 2–1 Auxiliary Heater Coolant Pump Request – N/A
	Bits: 4–3 Battery Main Switch Hold Request – N/A
	Bits: 6–5 Operator Seat Direction Switch – N/A
	Bits: 8–7 Seat Belt Switch – N/A
Byte: 5	

Bits: 8–7   Vehicle Speed Governor Enable Switch — N/A

Bits: 6–5   Vehicle Limiting Speed Governor Increment Switch – N/A

Bits: 4–3   Vehicle Limiting Speed Governor Decrement Switch – N/A

Bits: 2–1   Not Defined

Byte: 6

Bits: 4–3   Particulate Trap Regeneration Force Switch (SPN 3696)
        00:   Not Active
        01:   Active
        10:   Error
        11:   Not Available

Bits: 2–1   Particulate Trap Regeneration Inhibit Switch (SPN 3695)
        00:   Not Active
        01:   Active
        10:   Error
        11:   Not Available

Byte: 7

Bits: 8–7   Request Cab Zone Heating— N/A

Bits: 6–5   Request Engine Zone Heating – N/A

Bits: 4–1   Auxiliary Heater Mode Request– N/A

Byte: 8   Selected Maximum Vehicle Speed Limit – N/A

DM1 – Active Diagnostic Trouble Codes

Transmission / Reception Rate:	Whenever a DTC becomes an active fault and at a normal update rate of one second or longer, and then becomes inactive, a DM1 message will be transmitted to reflect this state change. If a different DTC changes state within one second update period, a new DM1 message is transmitted to reflect this new DTC.
Data Length:	Variable
Data Page:	0
PDU Format:	254
PDU Specific:	202
Default Priority:	6
PGN:	65226 (0x00FECA)

Byte: 1	Bits: 8–7	Malfunction Indicator Lamp Status (SPN 1213)
		00: Lamp Off
		01: Lamp On
		10: Error
		11: Not Available
	Bits: 6–5	Red Stop Lamp Status (SPN 623)
		00: Lamp Off
		01: Lamp On
		10: Error
		11: Not Available
	Bits: 4–3	Amber Warning Lamp Status (SPN 624)
		00: Lamp Off
		01: Lamp On
		10: Error
		11: Not Available
	Bits: 2–1	Protect Lamp Status (SPN 987) – N/A
Byte: 2	Bits: 8–1	Reserved for SAE assignment Lamp Status
Byte: 3	Bits: 8–1	SPN, 8 least significant bits of SPN (SPN 1214) (most significant at bit 8)
Byte: 4	Bits: 8–1	SPN, second byte of SPN (most significant at bit 8)
Byte: 5	Bits: 8–6	SPN, 3 most significant bits (most significant at bit 8)
	Bits: 5–1	FMI (SPN 1215) (most significant at bit 5)
Byte: 6	Bit: 8	SPN Conversion Method (SPN 1706)
	Bits: 7–1	Occurrence Count (SPN 1216)

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Byte: 7   Bits: 8–1 Not Defined

Byte: 8   Bits: 8–1 Not Defined

DM2 – Previously Active Diagnostic Trouble Codes

Transmission Rate:	On Request	
Data Length:	Variable	
Data Page:	0	
PDU Format:	254	
PDU Specific:	203	
Default Priority:	6	
PGN:	65227 (0x00FECB)	

Byte: 1	Bits: 8–7	Malfunction Indicator Lamp Status (SPN 1213)
		00: Lamp Off
		01: Lamp On
		10: Error
		11: Not Available
	Bits: 6–5	Red Stop Lamp Status (SPN 623)
		00: Lamp Off
		01: Lamp On
		10: Error
		11: Not Available
	Bits: 4–3	Amber Warning Lamp Status (SPN 624)
		00: Lamp Off
		01: Lamp On
		10: Error
		11: Not Available
	Bits: 2–1	Protect Lamp Status (SPN 987) – N/A
Byte: 2	Bits: 8–1	Reserved for SAE Assignment Lamp Status
Byte: 3	Bits: 8–1	SPN, 8 least significant bits of SPN (most significant at bit 8) (SPN 1214)
Byte: 4	Bits: 8–1	SPN, second byte of SPN (most significant at bit 8) (SPN 1214)
Byte: 5	Bits: 8–6	SPN, 3 most significant bits (most significant at bit 8) (SPN 1214)
	Bits: 5–1	FMI (most significant at bit 5) (SPN 1215)
Byte: 6	Bit: 8	SPN conversion Method (SPN 1706)
	Bits: 7–1	Occurrence count (SPN 1216)
Byte: 7	Bits: 8–1	Not Defined
Byte: 8	Bits: 8–1	Not Defined

DM3 - Diagnostic Data Clear/Reset of Previously Active DTCs

Reception Rate:	On Request using PGN 59904
Data Length:	0
Data Page:	0
PDU Format:	254
PDU Specific:	204
Default Priority:	6
PGN:	65,228 (0x00FECC)

Note: All of the non-permanent diagnostic information pertaining to previously active (inactive) visible diagnostic trouble codes will be erased when this PG is requested. The diagnostic data associated with active trouble codes will not be affected. Upon reception of this PG request, DDEC will respond with a Positive Acknowledgement (ACK). This message clears both CPC and MCM previously active DTCs.

DM11 — Diagnostic Data Clear/Reset for Active DTCs

Reception Rate:	On Request Using PGN 59904
Data Length:	0
Data Page:	0
PDU Format:	254
PDU Specific:	211
Default Priority:	6
PGN:	65,235 (0x00FED3)

Note: All of the non-permanent diagnostic information pertaining to active visible diagnostic trouble codes will be erased when this PG is requested. The diagnostic data associated with previously active (inactive) trouble codes will not be affected. Upon reception of this PG request, DDEC will respond with a Positive Acknowledgement (ACK). This message clears both CPC and MCM previously active DTCs.

DM13 — Stop Start Broadcast

Reception Rate :   As Received
Data Length: 8 bytes
Data Page: 0
PDU format: 223
PDU specific: Destination Address
Default priority: 3
PGN: 57,008 (0x00DF00)

Byte: 1	SAE Primary Links	
	Bits: 8, 7	Current Data Link (SPN 1230)
		00: Stop Broadcast
		01: Start Broadcast
		11: Don't Care
	Bits: 6, 5	J1587 * (SPN 608)
		00: Stop Broadcast
		01: Start Broadcast
		11: Don't Care
	Bits: 4, 3	J1922 (SPN 622) – N/A
	Bits: 2, 1	J1939 Network #1, Primary Vehicle Network (SPN 639)
		00: Stop Broadcast
		01: Start Broadcast
		11: Don't Care
Byte: 2	Other Networks #1	
	Bits: 8, 7	J1939 Network #2 - N/A
	Bits: 6, 5	ISO 9141 - N/A
	Bits: 4, 3	J1850 - N/A
	Bits: 2, 1	Other, Manufacture Specified Port - N/A
Byte: 3	Other Networks #2	
	Bits: 8, 7	J1939 Network #3 - N/A
	Bits: 6–1	Not Defined
Byte: 4	Control Flags	
	Bits: 8–5	Hold Signal (SPN 1236)
		0000: All Devices
		0001: Devices whose broadcast state has been modified
		0010–1110: Not Defined
		1111: N/A
	Bits: 4–1	Suspended Signal – N/A
Byte: 5–6	Suspended Duration – N/A	
Byte: 7–8	SAE Reserved	

EBC1 – Electronic Brake Controller #1

Transmission/Reception Rate:	100 ms	
Data Length:	8 bytes	
Data Page:	0	
PDU format:	240	
PDU specific:	1	
Default priority:	6	
PGN:	61,441 (0x00F001)	
Byte : 1	Status EBC1	
	Bits: 1-2	ASR Brake Control Active – N/A
	Bits: 3-4	Anti-Lock Braking (ABS) Active (SPN 563)
		00: ABS Passive but installed
	Bits: 5-6	01: ABS Active
		10: Reserved
		11: Not Available
	Bits: 7-8	EBS Brake Switch – N/A
Byte: 2	Brake Pedal Position – N/A	
Byte: 3	Status EBC2	
	Bits: 1-2	ABS Off-Road Switch – N/A
	Bits: 3-4	ASR Off-Road Switch – N/A
	Bits: 5-6	ASR "Hill Holder" Switch – N/A
	Bits: 7-8	Traction Control Override Switch – N/A
Byte: 4	Measured Aux.1	
	Bits: 1-2	Accelerator Interlock Switch – N/A
	Bits: 3-4	Engine Derate Switch – N/A
	Bits: 5-6	Auxiliary Engine Shutdown Switch – N/A
	Bits: 7-8	Remote Accelerator Enable Switch (SPN 969)
		00: Off
		01: On
Byte: 5	Engine Retarder Selection (SPN 973)	
	Resolution: 0.4% / Bit, 0% Offset	
Byte: 6	EBC Lamp Status – N/A	
Byte: 7	Source Address of Controlling Device for Brake Control – N/A	
Byte: 8	Not Defined	

EBC2 – Wheel Speed Information

Reception Rate :	100 ms
Data Length:	8 bytes
Data Page:	0
PDU format:	254
PDU specific:	191
Default priority:	6
PGN:	65,215

Bytes : 1, 2   Front Axle Speed (SPN 904)

                    Resolution: 1/256 km/h per bit, 0 offset

Byte: 3   Relative Speed, Front Axle, Left Wheel – N/A

Byte: 4   Relative Speed, Front Axle, Right Wheel – N/A

Byte: 5   Relative Speed, Front Axle #1, Left Wheel – N/A

Byte: 6   Relative Speed, Front Axle #1, Right Wheel – N/A

Byte: 7   Relative Speed, Front Axle #2, Left Wheel – N/A

Byte: 8   Relative Speed, Front Axle #2, Right Wheel – N/A

EC – Engine Configuration

Transmission Rate :	5 sec.
Data Length:	34 bytes
Data Page:	0
PDU format:	254
PDU specific:	227
Default priority:	6
PGN:	65,251 (0x00FEE3)

Bytes: 1,2   Engine Speed At Idle, Point 1 (SPN 188)
            Resolution: 0.125 rpm / Bit, 0 rpm offset

Byte: 3   Percent Torque At Idle, Point 1 (SPN 539)
            Resolution: 1% / Bit, -125% offset

Bytes: 4, 5   Engine Speed At Point 2 (SPN 528)
            Resolution: 0.125 rpm / Bit, 0 rpm offset

Byte: 6   Percent Torque At Point 2 (SPN 540)
            Resolution: 1% / Bit, -125% offset

Bytes: 7,8   Engine Speed At Point 3 (SPN 529)
            Resolution: 0.125 rpm / Bit, 0 rpm offset

Byte: 9   Percent Torque At Point 3 (SPN 541)
            Resolution: 1% / Bit, -125% offset

Bytes: 10, 11   Engine Speed At Point 4 (SPN 530)
            Resolution: 0.125 rpm / Bit, 0 rpm offset

Byte: 12   Percent Torque At Point 4 (SPN 542)
            Resolution: 1% / Bit, -125% offset

Bytes: 13, 14   Engine Speed At Point 5 (SPN 531)
            Resolution: 0.125 rpm / Bit, 0 rpm offset

Byte: 15   Percent Torque At Point 5 (SPN 543)
            Resolution: 1% / Bit, -125% offset

Bytes: 16, 17   Engine Speed At High Idle, Point 6 (SPN 532)
            Resolution: 0.125 rpm / Bit, 0 rpm offset

Bytes: 18, 19   Engine Gain (KP) Of Endspeed Governor - N/A

Bytes: 20, 21   Reference Engine Torque (SPN 544)
            Resolution: 1 Nm / Bit, 0 Nm offset

Byte: 22, 23   Maximum Momentary Engine Override Speed, Point 7 (SPN 533)
            Resolution: 0.125 rpm / Bit, 0 rpm offset

Byte: 24   Maximum Momentary Engine Override Time Limit (SPN 534)
            Resolution: 0.1 s / Bit, 0 s offset

Byte: 25   Requested Speed Control Range Lower Limit - 300 RPM – N/A

Byte: 26   Requested Speed Control Range Upper Limit – N/A

Byte: 27   Requested Torque Control Range Lower Limit – N/A

Byte: 28   Requested Torque Control Range Upper Limit – N/A

Byte 29,30   Extended Range Requested Speed Control Range Upper Limit — N/A

Byte 31,32   Engine Moment of Inertia (SPN 1794)

Resolution: 0.004 kgm^2/Bit, 0 kgm^2/Bit Offset

Byte 33,34   Default Engine Torque Limit — N/A

EEC1 – Electronic Engine Controller #1

Transmission Rate:	10 ms	
Data Length:	8 bytes	
Data Page:	0	
PDU format:	240	
PDU specific:	4	
Default priority:	3	
PGN:	61,444 (0x00F004)	

Byte : 1   Status_EEC1

        Bits: 8-5   Not Defined

        Bits: 4-1   Engine / Retarder Torque Mode (SPN 899)

                0000:   Low Idle Governor

                0001:   Accelerator Pedal

                0010:   Cruise Control

                0011:   PTO Governor

                0100:   Road Speed Governor

                  0101:   ASR Control

                0110:   Transmission Control

                0111:   ABS Control

                1000:   Torque Limiting

                1001:   High Speed Governor

                1010:   Braking System

                1011:   Remote Accelerator - N/A

                1100:   Not Defined

                1101:   Not Defined

                1110:   Other

                1111:   Not Available

Byte: 2   Drivers Demand Engine - Pct Torque (SPN 512)

        Resolution: 1% / Bit, -125% offset

Byte: 3   Actual Engine - Percent Torque (SPN 513)

        Resolution: 1% / Bit, -125% offset

Bytes: 4,5   Engine Speed (SPN 190)

        Resolution: 0.125 rpm / Bit, 0 rpm offset

Byte: 6   Source address of controlling device for engine control (SPN 1483)

Byte: 7   Bits: 8–5   Not Defined

        Bits: 1–4   Engine Starter Mode (SPN 1675)

                0000:   Start Not Requested

                0001:   Starter Active, Gear Not Engaged

                0010:   Starter Active, Gear Engaged

                0011:   Start Finished; Starter Not Active After Having Been Actively Engaged

                0100:   Starter Inhibited Due To Engine Already Running

0101:   Starter Inhibited Due To Engine Not Ready For Start (preheating)

0110:   Starter Inhibited Due To Driveline Engaged Or Other Transmission Inhibit

0111:   Starter Inhibited Due To Active Immobilizer

1000:   Starter Inhibited Due To Starter Over-Temp

1001-1011: Reserved

1100:   Starter Inhibited - Reason Unknown

1101:   Error

1110:   Error

1111:   Not Available

Byte: 8   Engine Demand–Percent Torque (SPN 2432)

Resolution: 1% / Bit, -125% offset

EEC2 – Electronic Engine Controller #2

Transmission/Reception Rate :	50 ms	
Data Length:	8 bytes	
Data Page:	0	
PDU format:	240	
PDU specific:	3	
Default priority:	3	
PGN:	61,443 (0x00F003)	
Byte: 1	Status_EEC2	
	Bits: 8-7	Accelerator Pedal 2 Low Idle Switch — N/A
	Bits: 6-5	Road Speed Limit Status (SPN 1437)
		00: Active
		01: Not Active
	Bits: 4-3	AP Kickdown Switch (SPN 559)
		00: Kickdown Passive
		01: Kickdown Active
		11: Not Configured
	Bits: 2,1	AP Low Idle Switch (SPN 558)
		00: Not In Low Idle Condition
		01: In Low Idle Condition
		10: Error Detected
		11: Not Configured
Byte: 2	Accelerator Pedal Position (TPS) (SPN 91)	
	Resolution:	0.4% / Bit, 0% offset
Byte: 3	Percent Load At Current Speed (SPN 92)	
	Resolution:	1% / Bit, 0% offset
Byte: 4	Remote Accelerator (SPN 974)	
	Resolution:	0.4% / Bit, 0% offset
Byte: 5	Accelerator Pedal Position 2 (SPN 29) — N/A	
Byte: 6	Vehicle Acceleration Rate Limit Status	
	Bits: 8–3	Not Defined
	Bits: 2–1	Vehicle Acceleration Limit Status (SPN 2979)
		00: Limit Not Active
		01: Limit Active
		10: Reserved
		11: Not Defined
Byte: 7	Actual Maximum Available Engine percent Torque – N/A	
Byte: 8	Not Defined	

EEC3 – Electronic Engine Controller #3

Transmission Rate :	250 ms
Data Length:	8 bytes
Data Page:	0
PDU format:	254
PDU specific:	223
Default priority:	6
PGN:	65,247 (0x00FEDF)

Byte: 1   Nominal Friction - Percent Torque (SPN 514)
              Resolution: 1%/Bit, -125% Offset

Bytes: 2,3   Engine's Desired Operating Speed (SPN 515)
              Resolution: 0.125 rpm/Bit, 0 rpm Offset

Byte 4:   Engine's Desired Operating Speed Asymmetry Adjustment (SPN 519)
              Ratio: 0 to 250

Byte 5:   Engine Controlled Cooling Fan Losses – Percent Torque (SPN 2978)
              Resolution: 1%/Bit, -125% Offset

Byte: 6–7   Exhaust Gas Mass (SPN 3236) — N/A

Byte: 8   After-Treatment

              Bits: 7-8   After-Treatment Intake Dew Point Message – N/A
              Bits: 5-6   After-Treatment Exhaust Dew Point Message – N/A
              Bits: 3-4   After-Treatment Intake Dew Point Message – N/A
              Bits: 1-2   After-Treatment Exhaust Dew Point Message – N/A

EEC4 – Electronic Engine Controller #4

Transmission Rate :	On Request
Data Length:	8 bytes
Data Page:	0
PDU format:	254
PDU specific:	190
Default priority:	7
PGN:	65,214 (0x00FEBE)

Bytes: 1,2   Rated Engine Power (SPN 166)
              Resolution: 0.5 kW / Bit, 0 kW offset (0.67 hp / Bit, 0 hp offset)

Bytes: 3,4   Rated Engine Speed (SPN 189)
              Resolution: 0.125 rpm / Bit, 0 rpm offset

Bytes: 5-8   Not Defined

EFL/P1 – Engine Fluid Level/Pressure1

Transmission Rate :	500 ms	
Data Length:	8 bytes	
Data Page:	0	
PDU format:	254	
PDU specific:	239	
Default priority:	6	
PGN:	65,263 (0x00FEEF)	
Byte: 1	Fuel Delivery Pressure (SPN 94)	
	Resolution:	4 kPa / Bit, 0 kPa Offset
Byte: 2	Extended Crankcase Blowby Pressure – N/A	
Byte: 3	Engine Oil Level (SPN 98)	
	Resolution:	Resolution: 0.4%/Bit, 0% Offset
Byte: 4	Engine Oil Pressure (SPN 100)	
	Resolution:	4 kPa / Bit, 0 kPa Offset
Byte: 5,6	Crankcase Pressure (SPN 101)	
	Resolution:	1/128 kPa / Bit, –250 kPa Offset
Byte: 7	Coolant Pressure (SPN 109)	
	Resolution:	2 kPa / Bit, 0 kPa Offset
Byte: 8	Coolant Level – (SPN 111)	
	Resolution: 0.4%/Bit, 0% Offset	

EFL/P2 – Engine Fluid Level/Pressure #2

Transmission Rate :	500 ms	
Data Length:	8 bytes	
Data Page:	0	
PDU format:	254	
PDU specific:	219	
Default priority:	6	
PGN:	65,243 (0x00FEDB)	
Bytes: 1,2	Injection Control Pressure - N/A	
Bytes: 3,4	Injector Metering Rail Pressure (SPN 157)	
	Resolution:	1/256 MPa / Bit, 0 MPa offset
Bytes: 5,6	Injector Timing Rail 1 Pressure–N/A	
Bytes: 7,8	Injector Metering Rail 2 Pressure–N/A	

ERC1 - Electronic Retarder Controller #1

Transmission/Reception Rate:	100 ms	
Data Length:	8 bytes	
Data Page:	0	
PDU format:	240	
PDU specific:	0	
Default priority:	6	
PGN:	61,440 (0x00F000)	

Byte : 1   Status_ERC1

    Bits: 8,7   Retarder Enable - Shift Assist Switch (SPN 572)
- 00: Retarder Brake Assist Disabled
- 01: Retarder Brake Assist Enabled
- 10: Error
- 11: Not Available

    Bits: 6,5   Retarder Enable - Brake Assist Switch (SPN 571)
- 00: Retarder Brake Assist Disabled
- 01: Retarder Brake Assist Enabled
- 10: Error
- 11: Not Available

    Bits: 4-1   Engine/Retarder Torque Mode (SPN 900)
- 0000: No Request (default)
- 0001: Operator Selection
- 0011: Cruise Control
- 0011: PTO Governor
- 0100: Road Seed Governor – N/A
- 0101: ASR Control
- 0110: Transmission Control
- 0111: ABS Control
- 1000: Torque Limiting – N/A
- 1001: High Speed Governor – N/A
- 1010: Braking System
- 1011: Remote Accelerator – N/A
- 1100: Not Defined
- 1101: Not Defined
- 1110: Other
- 1111: Not Defined

Byte: 2   Actual Retarder - Percent Torque (SPN 520)
    Resolution: 1%/Bit, –125% Offset

Byte: 3   Intended Retarder Percent Torque - N/A

Byte: 4

    Bits: 8–5   Not Defined
    Bits: 3,4   Retarder Requesting Brake Light – N/A
    Bits: 1,2   Engine Coolant Load Increase – N/A

Byte: 5   Source address of controlling device for retarder control (SPN 1480)

Resolution: 1 Source Address/Bit, 0 Offset

Byte: 6   Drivers Demand Retarder–Percent Torque–N/A
Byte: 7   Retarder Selection, non-engine (SPN 1716)
            Resolution: 0.4%/Bit, 0 Offset
Byte: 8   Actual Maximum Available Retarder–Percent Torque–N/A

ET1 – Engine Temperature #1

Transmission Rate :   1 sec
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 238
Default priority: 6
PGN: 65,262 (0x00FEEE)
Byte: 1   Engine Coolant Temperature (SPN 110)
            Resolution: 1°C / Bit, -40°C offset
Byte: 2   Fuel Temperature (SPN 174)
            Resolution: 1°C / Bit, -40°C offset
Bytes: 3,4   Engine Oil Temperature (SPN 175)
            Resolution: 0.03125°C / Bit, -273°C offset
Bytes: 5,6   Turbo Oil Temperature -N/A
Byte: 7   Engine Intercooler Temperature (SPN 52)
            Resolution: 1°C / Bit, -40°C offset
Byte 8:   Engine Intercooler Thermostat Opening–N/A

ET2 – Engine Temperature #2

Transmission Rate: 1 sec
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 164
Default priority: 6
PGN: 65,188 (00FEA416)
Bytes: 1–2   Engine Oil Temperature 2 – N/A
Bytes: 3–4   Engine ECU Temperature (SPN 1136)
            Resolution: 0.01325°C/Bit, –273°C offset
Bytes: 5–6   Exhaust Gas Recirculation Differential Pressure (SPN 411)
            Resolution: 1/128 kPa/Bit, –250 kPa offset
Bytes: 7–8   Exhaust Gas Recirculation Temperature (SPN 412)
            Resolution: 0.03125°C / Bit, -273°C offset

ETC1 – Electronic Transmission Controller #1

Reception Rate :	10 ms	
Data Length:	8 bytes	
Data Page:	0	
PDU format:	240	
PDU specific:	2	
Default priority:	3	
PGN:	61,442 (0x00F002)	
Byte : 1	Status_ETC1	
	Bits: 8,7	Not Defined
	Bits: 6,5	Shift in Progress (SPN 574)
		00: Shift is not in process
		01: Shift in process
		11: Not Available
	Bits: 4,3	Torque Converter Lockup Engaged (SPN 573)
		00: Torque Converter Lockup Disengaged
		01: Torque Converter Lockup Engaged
		11: Not Available
	Bits: 2,1	Driveline Engaged (SPN 560)
		00: Driveline Disengaged
		01: Driveline Engaged
		11: Not Available
Byte: 2,3	Output Shaft Speed (SPN 191)	
	Resolution: 0.125 rpm / Bit, 0 rpm offset	
Byte: 4	Percent Clutch Slip (SPN 522)	
	Resolution: 0.4%/Bit, 0% Offset	
Byte: 5	Command_ETC1	
	Bits: 8-5	Not Defined
	Bits: 4-3	Progressive Shift Disabled (SPN 607)
		00: Progressive Shift is Not Disabled
		01: Progressive Shift Is Disabled
		11: Take No Action
	Bits: 2,1	Momentary Engine Overspeed Enable (SPN 606)
		00: Momentary Engine Overspeed Is Disabled
		01: Momentary Engine Overspeed Is Enabled
		11: Not Available
Bytes: 6,7	Input Shaft Speed (SPN 161)	
	Resolution: 0.125 rpm/Bit, 0 Offset	
Byte: 8	Source Address of Controlling Device for Transmission Control–N/A	

ETC2 – Electronic Transmission Controller #2

Reception Rate :   100 ms
Data Length: 8 bytes
Data Page: 0
PDU format: 240
PDU specific: 5
Default priority: 6
PGN: 61,445 (0x00F005)
Byte : 1   Transmission Selected Gear (SPN 524)
                Resolution: 1 Gear Value / Bit, –125 Offset
Byte: 2,3   Transmission Actual Gear Ratio – N/A
Byte: 4   Transmission Current Gear (SPN 523)
                Resolution: 1 Gear Value/Bit, – 125 Offset
Byte: 5-6   Transmission Requested Range – N/A
Byte: 7-8   Transmission Current Range – N/A

ETC7 – Electronic Transmission Controller 7

Reception Rate :	100 ms
Data Length:	8
Data Page:	0
PDU format:	254
PDU specific:	74
Default priority:	6
PGN:	65,098

Byte : 1	Transmission Request State	
	Bits: 8,7	Transmission Requested Range Display Flash State (SPN 1849) – N/A
	Bits: 6,5	Transmission Requested Range Display Blank State (SPN 1850) – N/A
Byte: 2	Transmission Switches	
	Bits: 7,8	Transmission Shift Inhibit Indicator (SPN 1851) – N/A
	Bits: 5,6	Transmission Engine Crank Enable (SPN 2900)
		00: Cranking disabled; engine cranking is prohibited by the transmission type
		01: Cranking enabled; engine cranking is allowed by transmission
		10: Error
		11: Not Available
	Bits: 3,4	Active Shift Console Indicator (SPN 2945) – N/A
	Bits: 1,2	Transmission ready for Brake Release (SPN 3086) – N/A
Byte: 3	Transmission Mode Indicators	
	Bits: 7,8	Bits: 7,8 Transmission Mode 1 Indicator (SPN 2536) – N/A
	Bits: 5,6	Bits: 5,6 Transmission Mode 2 Indicator (SPN 2537) – N/A
	Bits: 3,4	Transmission Mode 3 Indicator (SPN 2538) – N/A
	Bits: 1,2	Transmission Mode 4 Indicator (SPN 2539) – N/A
Byte: 4	Transmission Requested Gear Feedback (SPN 3289) – N/A	
Bytes: 5,6	Not Defined	

FD – Fan Drive

Transmission Rate: 1 sec

Data Length: 8 bytes

Data Page: 0

PDU Format: 254

PDU Specific: 189

Default Priority: 6

PGN: 65, 213 (Ox00FEBD)

Byte: 1   Estimated Percent Fan Torque (SPN 975)

   Resolution: 0.4%/bit, 0% offset

Byte: 2   Fan Drive State (SPN 977)

0000:	Fan Off
0001:	Engine System General
0010:	Excessive Engine Air Temperature
0011:	Excessive Engine Oil Temperature
0100:	Excessive Engine Coolant Temperature
0101:	Excessive Transmission Oil Temperature
0110:	Excessive Hydraulic Oil Temperature
0111:	Default Operation
1000:	Not Defined
1001:	Manual Control
1010:	Transmission Retarder
1011:	A/C System
1100:	Timer
1101:	Engine Brake
1110:	Other
1111:	Not Available

Bytes: 3–4   Fan Speed (SPN 1639)

   Resolution: 0.125 rpm/bit, 0 rpm offset

Bytes: 5–8   Not Defined

Hours – Engine Hours, Revolutions

Transmission Rate:	On Request
Data Length:	8 Bytes
Data Page:	0
PDU Format:	254
PDU Specific:	229
Default Priority:	6
PGN:	65,253 (0x00FEE5)

Bytes: 1–4   Total Engine Hours (SPN 247)

        Resolution: 0.05 hr/bit, 0 hr/bit offset

Bytes: 5–8   Total Engine Revolutions (SPN 249)

        Resolution: 1000 rev/bit, 0 rev/bit offset

IC1 – Inlet/Exhaust Conditions #1

Transmission Rate:	500 ms
Data Length:	8 Bytes
Data Page:	0
PDU Format:	254
PDU Specific:	246
Default Priority:	6
PGN:	65,270 (0x00FEF6)

Byte: 1   Particulate Trap Inlet Pressure — N/A

Byte: 2   Boost Pressure (SPN 102)

        Resolution: 2 kPa / Bit, 0 kPa / Bit Offset

Byte: 3   Intake Manifold Temperature (SPN 105)

        Resolution: 1°C / Bit, -40°C / Bit Offset

Byte: 4   Air Inlet Pressure (SPN 106)

        Resolution: 2 kPa / Bit, 0kPa / Bit Offset

Byte: 5   Air Filter Differential Pressure (SPN 107)

        Resolution: 0.05 kPa / Bit, 0 kPa Offset

Byte: 6   Exhaust Gas Temperature (SPN 173)

        Resolution: 0.03125°C / Bit, –273°C Offset

Byte: 8   Coolant Filter Differential Pressure — N/A

IO — Idle Operation

Transmission Rate :   On Request
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 220
Default priority: 6
PGN: 65,244 (0x00FEDC)
Bytes: 1-4   Total Idle Fuel Used (SPN 236)
                Resolution: 0.5 L / Bit, 0 L offset
Bytes: 5-8   Total Idle Hours (SPN 235)
                Resolution: 0.05 hr / Bit, 0 hr offset

LFC – Fuel Consumption (Liquid)

Transmission Rate: On Request
Data Length: 8 Bytes
Data Page: 0
PDU Format: 254
PDU Specific: 233
Default Priority: 6
PGN: 65,257 (0x00FEE9)
Bytes: 1–4   Trip Fuel (SPN 182)
                       Resolution: 0.05 L/bit, 0 L/bit offset
Bytes: 5–8   Total Fuel Used (SPN 250)
                       Resolution: 0.05 L/bit, 0 L/bit offset

LFE – Fuel Economy (Liquid)

Transmission Rate:	100 ms
Data Length:	8 Bytes
Data Page:	0
PDU Format:	254
PDU Specific:	242
Default Priority:	6
PGN:	65,266 (0x00FEF2)

Bytes: 1,2   Fuel Rate (SPN 183)

     Resolution: 0.05 L/h/bit, 0 km/L offset

Bytes: 3,4   Instantaneous Fuel Economy (SPN 184)

     Resolution: 1/512 km/ l/bit, o km/ l offset

Bytes: 5–6   Average Fuel Economy (SPN 185)

     Resolution: 1/512 km/ l/bit, o km/ l offset

Byte: 7   Throttle Position (SPN 51)

     Resolution: 0.4%/Bit, 0% offset

Byte: 8   Not Defined

PTC1 – Particulate Trap Control 1

Transmission Reception Rate:	1 second or on change
Data Length:	8 bytes
Extended Data Page:	0
Data Page:	0
PDU Format:	253
PDU Specific:	124
Default Priority:	6
PGN:	64, 892 (OxFD7C)

Byte: 1

	Bits: 8–4	Reserved
	Bits: 3–1	Particulate Trap Lamp Command (SPN 3697)
		000: Off
		001: On – solid
		010: Reserved for SAE assignment
		011: Reserved for SAE assignment
		100: On – fast blink (1 HZ)
		101: Reserved for SAE assignment
		110: Reserved for SAE assignment
		111: Not Available

Byte: 2

	Bit: 8	Reserved
	Bits: 7–5	Particulate Trap Status (SPN 3701) – N/A
	Bits: 4–3	Particulate Trap Active Regeneration Status (SPN 3700)
		00: Not Active
		01: Active
		10: Regeneration needed – automatically initiated active regeneration imminent
		11: Not Available
	Bits: 2–1	Particulate Trap Passive Regeneration Status (SPN 3699) — N/A

Byte: 3

	Bits: 8–7	Particulate Trap Active Regeneration Inhibited Due to Service Brake Active (SPN 3705) – N/A

Bits: 6–5 Particulate Trap Active Regeneration Inhibited Due to Clutch (SPN 3704)
00: Not Inhibited
01: Inhibited
10: Reserved for SAE assignment
11: Not Available

Bits: 4–3 Particulate Trap Active Regeneration Inhibited Due to Inhibit Switch (SPN 3703)
00: Not Inhibited
01: Inhibited
10: Reserved for SAE assignment
11: Not Available

Bits: 2–1 Particulate Trap Active Regeneration Inhibited Status (SPN 3702)
00: Not Inhibited
01: Inhibited
10: Reserved for SAE assignment
11: Not Available

Byte 4

Bits: 8–7 Particulate Trap Active Regeneration Inhibited Due to Vehicle Speed Above Allowed Speed (SPN 3709)
00: Not Inhibited
01: Inhibited
10: Reserved for SAE assignment
11: Not Available

Bits: 6–5 Particulate Trap Active Regeneration Inhibited Due to Out of Neutral (SPN 3708) – N/A

Bits: 4–3 Particulate Trap Active Regeneration Inhibited Due to Accelerator Pedal Off Idle (SPN 3707)
00: Not Inhibited
01: Inhibited
10: Reserved for SAE assignment
11: Not Available

Bits: 2–1 Particulate Trap Active Regeneration Inhibited Due to PTO Active (SPN 3706)
00: Not Inhibited
01: Inhibited
10: Reserved for SAE assignment
11: Not Available

Byte: 5

Bits: 8–7 Particulate Trap Active Regeneration Inhibited Due to System Timeout (SPN 3713) – N/A

	Bits: 6–5	Particulate Trap Active Regeneration Inhibited Due to System Fault Active (SPN 3712) – N/A

Bits: 6–5   Particulate Trap Active Regeneration Inhibited Due to System Fault Active (SPN 3712) – N/A

Bits: 4–3   Particulate Trap Active Regeneration Inhibited Due to Low Exhaust Gas Temperature (SPN 3711) – N/A

Bits: 2–1   Particulate Trap Active Regeneration Inhibited Due to Parking Brake Not Set (SPN 3710)
00:   Not Inhibited
01:   Inhibited
10:   Reserved for SAE assignment
11:   Not Available

Byte: 6

Bits: 8–7   Particulate Trap Active Regeneration Inhibited Due to Vehicle Speed Below Allowed Speed (SPN 3717) – N/A

Bits: 6–5   Particulate Trap Active Regeneration Inhibited Due to Engine Not Warmed Up (SPN 3716) – N/A

Bits: 4–3   Particulate Trap Active Regeneration Inhibited Due to Permanent System Lockout (SPN 3715) – N/A

Bits: 2–1   Particulate Trap Active Regeneration Inhibited Due to Temporary System Lockout (SPN 3714) – N/A

Byte: 7

Bits: 8–6   Reserved

Bits: 5–3   Exhaust System High Temperature Lamp Command (SPN 3698)
000:   Off
001:   On – solid
010:   Reserved for SAE assignment
011:   Reserved for SAE assignment
100:   On – fast blink (1 HZ)
101:   Reserved for SAE assignment
110:   Reserved for SAE assignment
111:   Not Available

Bits: 2–1   Particulate Trap Automatic Active Regeneration Initiation Configuration (SPN 3718) — N/A

Byte: 8   Not Defined

PTO – Power Takeoff Information

Transmission Rate :		100 ms
Data Length:		8 bytes
Data Page:		0
PDU format:		254
PDU specific:		240
Default priority:		6
PGN:		65,264 (0x00FEF0)
Byte: 1	Power Takeoff Oil Temperature - N/A	
Byte: 2,3	Power Takeoff Speed - N/A	
Byte: 4,5	Power Takeoff Set Speed (SPN 187)	
	Resolution:	0.125 rpm / Bit, 0 rpm offset
Byte: 6	Measured_PTO_1	
	Bits: 8,7	Not Defined
	Bits: 6,5	Remote PTO Variable Speed Control Switch - N/A
	Bits: 4,3	Remote PTO Preprogrammed Speed Control Switch (SPN 979)
		00: Switch Off
		01: Switch On
		11: Not Configured
	Bits: 2,1	PTO Enable Switch (SPN 980)
		00: Switch Off
		01: Switch On
		11: Not Configured
Byte: 7	Measured_PTO_2	
	Bits: 8,7	PTO Accelerate Switch (SPN 981)
		00: Switch Off
		01: Switch On
		11: Not Configured
	Bits: 6,5	PTO Resume Switch (SPN 982)
		00: Switch Off
		01: Switch On
		11: Not Configured
	Bits: 4,3	PTO Coast/Decelerate Switch (SPN 983)
		00: Switch Off
		01: Switch On
		11: Not Configured
	Bits: 2,1	PTO Set Switch (SPN 984)
		00: Switch Off
		01: Switch On
		11: Not Configured
Byte: 8	Not Defined	

RC – Retarder Configuration

Transmission Rate: 5 sec or upon receipt of a destination specific request

Data Length: 19 bytes

Data Page: 0

PDU Format: 254

PDU Specific: 225

Default Priority: 6

PGN: 65, 249 (OxOOFEE1)

Byte: 1   Type and Location

                  Bits: 8–5   Retarder Location (SPN 902)

0000:	Engine Compression Release Brake
0001:	Engine Exhaust Brake
0010:	Transmission Input
0011:	Transmission Output
0100:	Driveline
0101:	Trailer
0110:	Not Defined
0111:	Not Defined
1000:	Not Defined
1001:	Not Defined
1010:	Not Defined
1011:	Not Defined
1100:	Not Defined
1101:	Not Defined
1110:	Other
1111:	Not Available

                  Bits: 4–1   Retarder Type (SPN 901)

0000:	Electric/Magnetic
0001:	Hydraulic
0011:	Cooled Friction
0011:	Compression Release (Engine Retarder)
0100:	Exhaust
0101:	Not Defined
0110:	Not Defined
0111:	Not Defined
1000:	Not Defined
1001:	Not Defined
1010:	Not Defined
1011:	Not Defined

	1100:	Not Defined
	1101:	Not Defined
	1110:	Other
	1111:	Not Available

Byte: 2	Retarder Control Method (SPN 557)

0 – DVB
1 – Konstandrossel
2 – Low/High Compression
3 – Low/Med/High Compression
255 — Not Configured

Bytes: 3–4	Retarder Speed at Idle, Point 1 (SPN 546)
	Resolution: 0.125 rpm/bit, 0 rpm offset
Byte: 5	Percent Torque at Idle, Point 1 (SPN 551)
	Resolution: 1%/Bit, −125% offset
Bytes: 6,7	Maximum Retarder Speed, Point 2 (SPN 548)
	Resolution: 0.125 rpm/Bit, 0 rpm offset
Byte: 8	Percent Torque at Maximum Speed, Point 2 (SPN 552)
	Resolution: 1%/Bit, −125% offset
Bytes: 9,10	Retarder Speed, Point 3 (SPN 549)
	Resolution: 0.125 rpm/bit, 0 rpm offset
Byte: 11	Percent Torque, Point 3 (SPN 553)
	Resolution: 1%/Bit, −125% offset
Bytes: 12, 13	Retarder Speed, Point 4 (SPN 550)
	Resolution: 0.125 rpm/bit, 0 rpm offset
Byte: 14	Percent Torque, Point 4 (SPN 554)
	Resolution: 1%/Bit, −125% offset
Bytes: 15,16	Retarder Speed at Peak Torque, Point 5 (SPN 547)
	Resolution: 0.125 rpm/bit, 0 rpm offset
Bytes: 17,18	Reference Retarder Torque (SPN 556)
	Resolution: 1 Nm/Bit, 0 Nm offset
Byte: 19	Percent Torque at Peak Torque, Point 5 (SPN 555)
	Resolution: 1%/Bit, −125% offset

Requests

Reception Rate: As Needed
Data Length: 3 bytes
Data Page: 0
PDU format: 234
PDU specific: Destination Address
Default priority: 6
PGN: 59,904 (0x00EA00)
Bytes : 1 — 3   Requested PGN

NOTE:
It is recommended that requests occur no more than 2 or 3 times per second.

Shutdown — Idle Shutdown

Transmission Rate :   1 sec
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 228
Default priority: 6
PGN: 65,252 (0x00FEE4)

Byte: 1	Idle Shutdown_1	
	Bits: 8,7	Idle Shutdown Timer State (SPN 590)
		00: Inactive
		01: Active
	Bits: 6,5	Idle Shutdown Timer Override (SPN 592)
		00: Inactive
		01: Active
	Bits: 4,3	Driver Alert Mode (SPN 594)
		00: Inactive
		01: Active
	Bits: 2,1	Engine Has Shutdown by Idle Shutdown (SPN 593)
		00: Engine has not shutdown by idle shutdown
		01: Engine has shutdown by idle shutdown
Byte: 2	Idle Shutdown_2	
	Bits: 8,7	Idle Shutdown Timer Function (SPN 591)
		00: Disabled in Calibration
		01: Enabled in Calibration
	Bits: 6-1	Not Defined
Byte: 3	Bits: 8,7	Not Defined
	Bits: 6,5	Refrigerant High Pressure Switch- N/A
	Bits: 4,3	Refrigerant Low Pressure Switch- N/A
	Bits: 2,1	A/C High Pressure Fan Switch (SPN 985)
		00: Pressure Normal
		01: Pressure High Fan May be Engaged
Byte: 4	Lamp_commands	
	Bits: 2, 1	Wait to Start Lamp (SPN 1081)
		00: Inactive
		01: Active
Byte: 5	Engine Shutdown_1	
	Bits: 8,7	Engine Protection System Timer State (SPN 1107)
		00: Timer not Active
		01: Timer Active
	Bits: 6,5	Engine Protection System Timer Override (SPN 1108)

		00: Override Off
		01: Override On
	Bits: 4,3	Engine Shutdown Approaching (SPN 1109)
		00: Not Approaching
		01: Approaching
	Bits: 2,1	Engine Has Shutdown By Engine Protection System (SPN 1110)
		00: Not Shutdown
		01: Has Shutdown
Byte: 6	Engine Shutdown_2	
	Bits: 8,7	Engine Protection System Configuration (SPN 1111)
		00: Not Enabled In Calibration
		01: Enabled In Calibration
	Bits: 6-1	Not Defined
Bytes: 7-8	Not Defined	

SOFT – Software Identification

Transmission Rate :	On Request
Data Length:	60 bytes
Data Page:	0
PDU format:	254
PDU specific:	218
Default priority:	6
PGN:	65,242 (0x00FEDA)
Byte: 1	Number of Software Identification Fields - 15 (SPN 965)
Byte: 2	1st digit of Major Version Level - ASCII
Byte: 3	2nd digit of Major Version Level - ASCII
Byte: 4	3rd digit of Major Version Level - ASCII
Byte: 5	* - Delimiter
Byte: 6	1st digit of Minor Version Level - ASCII
Byte: 7	2nd digit of Minor Version Level - ASCII
Byte: 8	3rd digit of Minor Version Level - ASCII
Byte: 9	* - Delimiter
Byte: 10	1st Digit of Edit Build Version - ASCII
Byte: 11	2nd Digit of Edit Build Version - ASCII
Byte: 12	3rd Digit of Edit Build Version - ASCII
Byte: 13	* - Delimiter
Byte: 14	1st Digit of Config ID - ASCII
Byte: 15	2nd Digit of Config ID - ASCII
Byte: 16	3rd Digit of Config ID - ASCII
Byte: 17	* - Delimiter
Byte: 18	Software Release Type - ASCII
	X - Experimental
	T - Pre-production
	R - Production
Byte: 19	* - Delimiter
Byte: 20	CPC Hardware Major Version - ASCII
Byte: 21	* - Delimiter
Byte: 22	Edit Letter - ASCII
Byte: 23	* - Delimiter
Byte: 24	1st Digit of Diagnostic Version - ASCII
Byte: 25	2nd Digit of Diagnostic Version - ASCII
Byte: 26	3rd Digit of Diagnostic Version - ASCII
Byte: 27	* - Delimiter
Byte: 28	1st Digit of Diagnostic Variant - ASCII
Byte: 29	2nd Digit of Diagnostic Variant - ASCII
Byte: 30	3rd Digit of Diagnostic Variant - ASCII
Byte: 31	* - Delimiter
Bytes: 32,33	Software Year – ASCII

Byte: 34   * - Delimiter
Bytes: 35, 36   Software Month – ASCII
Byte: 37   * - Delimiter
Bytes: 38, 39   Software Day - ASCII
Byte: 40   * - Delimiter
Bytes: 41,42   Software Hour – ASCII
Byte: 43   * - Delimiter
Bytes: 44,45   Software Minute – ASCII
Byte: 46   * - Delimiter
Bytes: 47,48   ECU Serial Number – Production Year – ASCII
Byte: 49   * - Delimiter
Bytes: 50–53   Production Day
Byte: 54   * - Delimiter
Bytes: 55–59   Production Unit
Byte: 60   * - Delimiter

TC — Turbocharger

Transmission Rate :   1 sec
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 221
Default priority: 6
PGN: 65, 245 (0x00FEDD)
Byte: 1   Turbo Oil Pressure - N/A
Bytes: 2,3   Turbocharger 1 Speed (SPN 103)
                 Resolution: 4 rpm / Bit, 0 rpm offset
Byte: 4   Bits: 8–7   Turbo Oil Level Switch–N/A
                 Bits: 6–1   Not Defined
Bytes: 5-8   Not Defined

TCFG2 — Transmission Configuration

Transmission Reception Rate :	On request or sender may transmit every 5 seconds until acknowledged by reception of the engine configuration message PGN 65251 SPN 1846
Data Length:	Variable
Data Page:	0
PDU format:	254
PDU specific:	75
Default priority:	6
PGN:	65, 099 (0xFE4B)

Bytes: 1–2   Transmission Torque Limit (SPN 1845)

           Resolution: 1 Nm/Bit, 0 offset

Bytes: 3–8   Not Defined

TCO1 — Tachograph

Reception Rate :		50 ms
Data Length:		8
Data Page:		0
PDU format:		254
PDU specific:		108
Default priority:		3
PGN:		65,132 (0x00FE6C)
Byte : 1	Driver Status	
	Bits: 7,8	Drive Recognize (SPN 1611) – N/A
	Bits: 4–6	Driver 2 Working State (SPN 1613) – N/A
	Bits: 1–3	Driver 1 Working State (SPN 1612) – N/A
Byte: 2	Driver 1	
	Bits: 7,8	Overspeed (SPN 1614) – N/A
	Bits: 4–6	Driver card, Driver 1 (SPN 1615) – N/A
	Bits: 1–3	Driver 1 Time Related States (SPN 1617) – N/A
Byte: 3	Driver 2	
	Bits: 7,8	Not Defined
	Bits: 5,6	Driver card, driver 2 (SPN 1616) – N/A
	Bits: 1–4	Driver 2 Time Related States (SPN 1618) – N/A
Byte: 4	TCO1 Information	
	Bits: 7,8	Direction Indicator (SPN 1619) – N/A
	Bits: 5,6	Tachograph Performance (SPN 1620) – N/A
	Bits: 3,4	Handling Information (SPN 1621) – N/A
	Bits: 1,2	System Event (SPN 1622) – N/A
Bytes: 5,6	Tachograph Output Shaft Speed (SPN 1623)	
	Resolution:	0.125 rpm/bit, 0 offset
Bytes: 7,8	Tachograph Vehicle Speed (SPN 1624)	
	Resolution:	1/256 km/h per bit, 0 offset

TD — Time/Date

Transmission Rate :   On Request
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 230
Default priority: 6
PGN: 65,254 (0x00FEE6)

Byte: 1   Seconds (SPN 959)
     Resolution: 0.25 sec / Bit, 0 sec offset
Byte: 2   Minutes (SPN 960)
     Resolution: 1 min / Bit, 0 min offset
Byte: 3   Hours (SPN 961)
     Resolution: 1 hour / Bit, 0 h offset
Byte: 4   Month (SPN 963)
     Resolution: 1 month / Bit, 0 month offset
Byte: 5   Day (see Note) (SPN 962)
     Resolution: 0.25 day / Bit, 0 day offset
Byte: 6   Year (SPN 964)
     Resolution: 1 year / Bit, 1985 year offset
Byte: 7   Local Minute Offset – N/A
Byte: 8   Local Hour Offset – N/A
Note: The Day field represents days elapsed (e.g. 1/1/98 at 12:00 am would be 0 for byte 5 (Day) and 1/1/98 at 1:00 pm would be 2 for byte 5 and 1/15/98 at 1:00 pm would be 62 for byte 5).

TSC1 — Torque Speed Control

Reception Rate :   10 ms when active to the engine, 50 ms when active to the retarder
Data Length: 8 bytes
Data Page: 0
PDU format: 0
PDU specific: Destination Address
Default priority: 3
PGN: 0 (0x000000)

Byte : 1   Control Bits
     Bits: 8,7   Not Defined
     Bits: 6,5   Override Control Mode Priority (SPN 897)
         00: Highest
         01: High
         10: Medium
         11: Low

Reception Rate :		10 ms when active to the engine, 50 ms when active to the retarder
	Bits: 4,3	Engine Requested Speed Control Conditions (SPN 696)
		00: Transient optimized for driveline disengaged and non-lockup conditions
		01: Stability optimized for driveline disengaged and non-lockup conditions
		10: Stability optimized for driveline engaged and/or in lockup condition 1 (e.g. vehicle driveline)
		11: Stability optimized for driveline engaged and/or in lockup condition 2 (e.g. PTO driveline)
	Bits: 2,1	Override Control Modes (SPN 695)
		00: Override Disabled
		01: Speed Control
		10: Torque Control
		11: Speed/Torque Limit Control
Byte: 2,3		Requested Speed / Speed Limit (SPN 898)
		Resolution: 0.125 rpm / Bit, 0 rpm offset
Byte: 4		Requested Torque / Torque Limit (SPN 518)
		Resolution: 1% / Bit, -125% offset
		0-125% for engine torque requests
		-125-0% for retarder torque requests
Bytes: 5-8		Not Defined
Note:		The CPC will honor TSC1 messages from the following source addresses:

- □ TSC1 Source Address J1939 — Customer Selectable
- □ Transmission (Source Address 3)
- □ ABS (Source Address 11)
- □ Adaptive Cruise Control (Source Address 42)

VD — Vehicle Distance

Transmission Rate :	100 ms
Data Length:	8 bytes
Data Page:	0
PDU format:	254
PDU specific:	224
Default priority:	6
PGN:	65,248 (0x00FEE0)

Bytes: 1-4   Trip Distance (SPN 244)
            Resolution: 0.125 km / Bit, 0 km offset
Bytes: 5-8   Total Vehicle Distance (SPN 245)
            Resolution: 0.125 km / Bit, 0 km offset

VDHR – High Resolution Vehicle Distance

Transmission Rate :	1 sec
Data Length:	8 bytes
Data Page:	0
PDU format:	254
PDU specific:	193
Default priority:	6
PGN:	65,217 (0x00FEC1)

Bytes: 1-4   High Resolution Total Vehicle Distance (SPN 917)
            Resolution: 5 m / Bit, 0 m offset (16.4 ft/Bit, 0 ft offset)
Bytes: 5-8   High Resolution Trip Distance (SPN 918)
            Resolution: 5 m / Bit, 0 m offset (16.4 ft/Bit, 0 ft offset)

VEP – Vehicle Electrical Power

Transmission Rate :	1 sec
Data Length:	8 bytes
Data Page:	0
PDU format:	254
PDU specific:	247
Default priority:	6
PGN:	65,271 (0x00FEF7)

Byte: 1   Net Battery Current - N/A
Byte: 2   Alternator Current - N/A
Bytes: 3,4   Alternator Potential (voltage) - N/A
Bytes: 5,6   Electrical Potential (voltage) (SPN 168)
            Resolution: 0.05 V / Bit, 0 V offset
Bytes: 7,8   Battery Potential (Voltage), Switched (SPN 158)
            Resolution: 0.05 V / Bit, 0 V offset

VH — Vehicle Hours

Transmission Rate :	On Request
Data Length:	8 bytes
Data Page:	0
PDU format:	254
PDU specific:	231
Default priority:	6
PGN:	65,255 (0x00FEE7)

Bytes: 1-4   Total Vehicle Hours -N/A
Bytes: 5-8   Total Power Takeoff Hours (SPN 248)
             Resolution: 0.05 h / Bit, 0 h offset

VI – Vehicle Identification

Transmission Rate :	On Request
Data Length:	Variable
Data Page:	0
PDU format:	254
PDU specific:	236
Default priority:	6
PGN:	65, 260 (0x00FEEC)

Bytes: Vehicle Identification Number (SPN 237)
1–XX   Up to 200 characters ('X' delimited)

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APPENDIX A: HARNESS WIRING DIAGRAMS

The MCM Engine Harness schematic for the Series 60 and MBE engines and the CPC Vehicle Interface Harness schematics are available on the DDC extranet.

APPENDIX B: ACRONYMS

AAT Sensor	Ambient Air Temperature Sensor
ABS	Anti-lock Braking System
AECL Sensor	Add Engine Coolant Level Sensor
ACP Sensor	Air Compressor Pressure Sensor
ACS	Application Code System
AFR Sensor	Air Filter Restriction Sensor
AIM	Auxiliary Interface Module
ALSG	Automotive Limiting Speed Governor
AP	Acelator Pedal
AP Sensor	Accelerator Pedal Sensor
ATI	Aux Timed Input
A/T	Automatic Transmission
AWL	Amber Warning Lamp
BPP	Brake Pedal Position
CC	Cruise Control
CKP	Crankshaft Position Sensor
CMP	Camshaft Position Sensor
CPC	Common Powertrain Controller
CPP Switch	Clutch Pedal Position Switch
DCC	Diagnostic Connector, Cab
DDC	Detroit Diesel Corporation
DDEC	Detroit Diesel Electronic Controls

DDDL	Detroit Diesel Diagnostic Link
DLC	Data Link Connector
DRS	DDEC Reprogramming System
DTC	Diagnostic Trouble Code
ECL Sensor	Engine Coolant Level Sensor
ECT Sensor	Engine Coolant Temperature Sensor
EDM	Electronic Display Module
EEPROM	Electronically Erasable Programmable Read Only Memory
EFC	Electronic Fire Commander
EH	Engine Harness
EOL Sensor	Engine Oil Level Sensor
EOP	Engine Over Temperature Protection
EOP Sensor	Engine Oil Pressure Sensor
EOT Sensor	Engine Oil Temperature Sensor
ESS	Engine Synchro Shift
ET Sensor	Exhaust Temperature Sensor
FEI	Fuel Economy Incentive
FMI	Failure Mode Identifier
FRS	Fuel Restriction Sensor
HEI	Half Engine Idle
IAT Sensor	Intake Air Temperature Sensor
IMP Sensor	Intake Manifold Pressure Sensor
ISD	Idle Shutdown

MCM	Motor Control Module
MPG	Miles Per Gallon
MPH	Miles Per Hour
MID	Message IDentification Character
OECL Sensor	Optical Engine Coolant Level Sensor
OEM	Original Equipment Manufacturer
OI	Optimized Idle
PGN	Parameter Group Number
PID	Parameter IDentification Character
PSG	Pressure Sensor Governor
PTO	Power Take-off
PVM	Pulse to Voltage Module
PW	Pulse Width
PWM	Pulse Width Modulated
RSL	Red Stop Lamp
SEO	Stop Engine Override
SID	Subsystem IDentification Character
SFT Sensor	Supply Fuel Temperature Sensor
TCI Sensor	Turbo Compressor In Temperature Sensor
TCO Sensor	Turbo Compressor Out Temperature Sensor
TDC	Top Dead Center
VEPS	Vehicle Electronic Programming System
VIH	Vehicle Interface Harness
VIN	Vehicle Identification Number

VLS   Vehicle Limiting Speed

VSS   Vehicle Speed Sensor

APPENDIX C: PARAMETER LIST

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
0 Speed Gov TSC1 Condition	22	0	16	0	DRS, VEPS	0 - Series 60; 16 - MBE
1 Speed Gov TSC1 Condition	22	0	16	0	DRS, VEPS	0 - Series 60; 16 - MBE
2 Speed Gov TSC1 Condition	22	0	16	0	DRS, VEPS	0 - Series 60; 16 - MBE
3 Speed Gov TSC1 Condition	22	0	16	0	DRS, VEPS	0 - Series 60; 16 - MBE
1 01 DI Selection	13	0	3	0	DRS, VEPS	0=disable, 1=enable Dual Speed Axle, 2=enable transmission retarder input, 3=FUSO Auxiliary brake cut switch
1 021 DI Selection	13	0	2	1	DRS, VEPS	0=disable, 1=enable park brake interlock, 2=FUSO Park brake switch
1 05 DO Fault Detection	35	0	1	0	DRS, VEPS	0=disabled, 1=enabled
1 10 DI Selection	13	0	2	0	DRS, VEPS	0=disable, 1=enable aux shutdown, 2=FUSO Accelerator switch
1 15 DI Selection	13	0	3	1	DRS, VEPS	0=disable, 1=Shutdown override / Diagnostic Request (Fault Code Flashing), 2=CC-Cancel, 3=Diagnostic Request (Fault Code Flashing)
2 08 DI Selection	13	0	2	1	DRS, VEPS	0=disable, 1=Remote-Throttle enable, 2=Service-Brace active
2nd Axle Speed Switch Config	13	0	3	0	DRS, VEPS	0=hardwired, 1=Ccvs1, 2=Ccvs2, 3=Ccvs3
3 01 AI Selection	13	0	3	0	DRS, VEPS	0=no sensor, 1=air filter restriction sensor, 2=OI Thermostat input, 3=FUSO Clutch pedal sensor input
3 05 AO Selection	9	0	4	0	DRS, VEPS	0=disabled, 1=oil pressure lamp, 2=5 bar oil pressure gauge, 3=10 bar oil pressure gauge, 4=fuel filter sensor
3 06 AO Selection	9	0	3	0	DRS, VEPS	0=disabled, 1=coolant temperature lamp, 2=coolant temperature gauge, 3=OI Thermostat input
3 07 DO Fault Detection	35	0	1	0	DRS, VEPS	0=disabled, 1=enabled

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
3 07 DO Selection	35	0	5	0	DRS, VEPS	0=disabled, 1=decompression valve, 2=grid heater, 3=TOP2 lockout solenoid, 4=modulation output for Allison Transmission without J1939 Interface (Gear1), 5=PTO valve for AGS2
3 08 DO Fault Detection	35	0	1	0	DRS, VEPS	0=disabled, 1=enabled
3 08 DO Selection	35	0	7	0	DRS, VEPS	0=disabled, 1=exhaust brake only, 2=exhaust and decompression brake via single valve, 3=port extension turbo brake, 4=PTO stationary for AGS2, 5=PTO mobile for AGS2, 6=TOP2 shift solenoid, 7=Fuso starter lockout relay
3 09 DO Fault Detection	35	0	1	0	DRS, VEPS	0=disabled, 1=enabled
3 09 DO Selection	35	0	5	0	DRS, VEPS	0=disabled, 1=grid heater hardwired, 2=AGS2 backup lamp, 3=engine brake active, 4=not used, 5=FUSO engine brake active lamp
3 10 DO Fault Detection	35	0	1	0	DRS, VEPS	0=disabled, 1=enabled
3 10 DO Selection	35	0	5	0	DRS, VEPS	0=disabled, 1=air filter lamp, 2=AGS2 transmiss. temp indication lamp, 3=battery voltage low lamp, 4=coolant level low lamp, 5=Fuso retarder control 1
3 12 DO Fault Detection	35	0	1	0	DRS, VEPS	0=disabled, 1=enabled
3 12 DO Selection	35	0	5	0	DRS, VEPS	0=disabled, 1=oil level lamp, 2=AGS2 check transmiss. indication lamp OI: Optimized Idle, 3=oil pressure low lamp, 4=cruise / Pressure Governor System active lamp, 5=Fuso retarder control 2
3 17 DO Fault Detection	35	0	1	0	DRS, VEPS	0=disabled, 1=enabled
3 17 DO Selection	35	0	7	0	DRS, VEPS	0=disabled, 1=enable starter lockout, 2=enable kick down output, 3=not used, 4=optimized idle alarm, 5=split valve 2, 6=starter lockout and AGS2 run signal / starter lockout, 7=engine brake disabled for over speed
3 18 DI Selection	13	0	10	0	DRS, VEPS	0=disable, 1=enable ABS input, 2=enable transmission retarder input, 3=enable tempo set, 4=enable grid heater detection, 5=switchable torque demand, 6=drive on super structure, 7=throttle inhibit super structure, 8=split select, 9=FUSO Engine brake stage 2 cancel switch, 10=DPF inhibit switch

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
4 06 DO Fault Detection	35	0	1	0	DRS, VEPS	0=disabled, 1=enabled
4 06 DO Selection	35	0	3	1	DRS, VEPS	0=disabled, 1=grid heater lamp, 2=accelerator pedal idle position, 3=run signal / starter lockout
4 07 DO Fault Detection	35	0	1	0	DRS, VEPS	0=disabled, 1=enabled
4 07 DO Selection	35	0	13	13	DRS, VEPS	0=disabled, 1=accelerator pedal kick down, 2=actual torque, 3=road speed, 4=engine speed, 5=coolant temperature, 6=pedal torque, 7=boost temperature, 8=oil pressure (PLD threshold), 9=coolant temperature (PLD threshold), 10=vehicle power shutdown / ignition relay, 11=optimized idle ACC bus (ignition relay), 12=split valve 1, 13=High Exhaust Temperature Lamp
4 08 DI Selection	13	0	2	1	DRS, VEPS	0=disable, 1=clutch switch, 2=PTO request for AGS2
4 09 DO Fault Detection	35	0	1	0	DRS, VEPS	0=disabled, 1=enabled
4 09 DO Selection	35	0	12	0	DRS, VEPS	0=disabled, 1=accelerator pedal idle position, 2=actual torque, 3=road speed, 4=engine speed, 5=coolant temperature, 6=pedal torque, 7=boost temperature, 8=oil pressure (PLD threshold), 9=coolant temperature (PLD threshold), 10=optimized idle active lamp, 11=deceleration lamp, 12=Fuso ground starter lockout relay
4 10 DO Fault Detection	35	0	1	0	DRS, VEPS	0=disabled, 1=enabled
4 10 DO Selection	35	0	3	0	DRS, VEPS	0=disabled, 1=not used, 2=not used, 3=vehicle power shutdown / ignition relay
4 12 PWM Output Selection	9	0	10	0	DRS, VEPS	0=disabled, 1=throttle torque 10%..90%, 2=difference torque, 3=throttle torque 90%..10%, 4=actual torque, 5=load torque (no idle torque for automatic transmission), 6=road speed, 7=demand speed, 8=demand speed CC+, 9=AGS2 transmiss. temp indication lamp, 10=FUSO Accelerator PWM output

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
4 13 DI Selection	13	0	10	0	DRS, VEPS	0=disable, 1=enable ABS input, 2=enable transmission retarder input, 3=enable tempo set, 4=enable grid heater detection, 5=switchable torque demand, 6=drive on super structure, 7=throttle inhibit super structure, 8=split select, 9=FUSO Engine brake stage 2 cancel switch, 10=DPF inhibit switch
4 17 DI Selection	13	0	3	2	DRS, VEPS	0=disable, 1=2 Clutch Switch, 2=DPF regeneration switch, 3=FUSO Air suspension speed limit switch
4 18 DI Selection	13	0	6	0	DRS, VEPS	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
AC Fan Vehicle Speed Enable	19	0	1	0	DRS, VEPS	0=disable, 1=enable
AC Fan Vehicle Speed Thresh	19	0	250 km/h	32.1875 km/h	DRS, VEPS	—
Adaptive Cruise Control Enable	43	0	1	0	DRS, VEPS	0=disable, 1=enable
Adaptive Cruise Engine Brake Mask	10	0	81	64	DRS, VEPS	0=no engine brake activation, 16=exhaust flap only, 17=Jake Brake 2nd stage, 64=decompression valve only or Jake Brake 1st stage, 80=decompression valve and exhaust flap, 81=decompression valve and turbo brake or Jake Brake 3rd stage
Adjusted Idle Configuration	3	0	4	0	DRS, VEPS	0=disabled, 1=enabled, 2=enabled if neutral, 3=enabled if neutral and park brake, 4=enabled if park brake
Air Condition Enable Auto Fan	19	0	1	1	DRS, VEPS, DDDL 7.0	0=disable, 1=enable
AL Conditions	23	0	4	0	DRS, VEPS	0=AL permanently active, 1=No AL during shift, 2=extended AL with torque curve#3 thresh., 3=combination 1+2, 4=No AL during shift torque freeze + release
AL Min Engine Torque	23	0	100%	100%	DRS, VEPS	—
AL Ramp up Rate	23	0	8191.875 (1/min)/s	0	DRS, VEPS	0..65535=signal

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
Ambient Air Temp Sensor Enable	31	0	4	0	DRS, VEPS	0=not available, 1=hardwired, 2=reserved for J1939, 3=J1587, 4=ECAN
Anti Tamper	8	0	2	0	DRS, VEPS, DDDL 7.0	0=disabled, 1=enable anti-tampering function via ABS, 2=enable anti-tampering function via Gear Ratio
Axle Ratio	8	1	20	5.29	DRS, VEPS, DDDL 7.0	—
Cab PTO Switch Config	13	0	6	0	DRS, VEPS	0=hardwired, 1=Ccvs1, 2=Ccvs2, 3=Ccvs3, 4=Ccvs1 or hardwired, 5=Ccvs2 or hardwired, 6=Ccvs3 or hardwired
CC ON OFF Switch Config	13	0	3	0	DRS, VEPS	CC ON OFF Switch Config
CC Pause Switch Config	13	0	7	0	DRS, VEPS	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
CC Set Cst Res Accel Sw Config	13	0	3	0	DRS, VEPS	0=hardwired, 1=Ccvs1, 2=Ccvs2, 3=Ccvs3
CC1 Source Address SAE J1939	1	0	255	23	DRS, VEPS	—
CC2 Source Address SAE J1939	1	0	255	33	DRS, VEPS	—
CC3 Source Address SAE J1939	1	0	255	49	DRS, VEPS	—
Clutch Switch Config	13	0	6	9	DRS, VEPS	0=no clutch switch, 1=1 Clutch Switch, 2=2 Clutch Switch, 3=Ccvs1, 4=Ccvs2, 5=Ccvs3, 6=ETC1
CM1 DPF Source Addr SAE J1939	1	0	255	49	DRS, VEPS	—
CM1 Fan Source Addr1 SAE J1939	1	0	255	25	DRS, VEPS	—
CM1 Fan Source Addr2 SAE J1939	1	0	255	49	DRS, VEPS	—
Config PTO Speed Control	7	0	5	0	DRS, VEPS, DDDL 7.0	d, 2=enabled if neutral, 3=enabled if neutral and park brake, 4=enabled if park brake, 5=PTO while driving

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
Cool Level Eng Protect Shtdn	18	0	1	1	DRS, VEPS, DDDL 7.0	0=warning, 1=engine shutdown
Cool Level Sensor Input Enable	32	0	4	2	DRS, VEPS	0=disable, 1=dual level probe sensor (IMO), fix threshold evaluation, 2=single level probe sensor (Rusty Nail), temperature dependent evaluation, 3=dual level float sensor (FTL), fix threshold evaluation, 4=single level probe sensor (Rusty Nail), fix threshold evaluation
Coolant Temp Eng Protect Shtdn	18	0	1	1	DRS, VEPS, DDDL 7.0	0=disable, 1=enable
Cruise Control Enable Eng Brk	10	0	1	0	DRS, VEPS, DDDL 7.0	0=disable, 1=enable automatic engine brake operation with cruise control
Cruise Power	15	0	2	0	DRS, VEPS, DDDL 7.0	0=high power only, 1=low power only, 2=Cruise power enabled
Cruise RSL Eng Brk Mode Select	10	0	1	0	DRS, VEPS, DDDL 7.0	0=vehicle overspeed based, 1=torque interface based
Decrement Cruise Set Speed	15	0 km/h	10 km/h	1.61 km/h	DRS, VEPS, DDDL 7.0	—
DPF J1939 Inhibit Sw Enable	46	0	1	0	DRS, VEPS	0=not active, 1=active
DPF J1939 Regen Sw Enable	46	0	1	0	DRS, VEPS	0=not active, 1=active
DPF Lamp Config	46	0	1	0	DRS, VEPS	0=hardwired, 1=J1939 PTC1
DPF Stationary Regen Only	46	0	1	1	DRS, VEPS	0=disabled, 1=enabled
EBC1 Source Address SAE J1939	1	0	255	33	DRS, VEPS	—
Enable Cruise Auto Resume	15	0	2	0	DRS, VEPS, DDDL 7.0	0=disable, 1=enable automatic cruise resume function after clutch has been released once, 2=release clutch twice
Enable Idle PTO Shtdn Override	17	0	2	1	DRS, VEPS, DDDL 7.0	0=disabled, 1=enabled, allows Stop Engine Override / Diagnostic Request switch (pin 1/15) to override engine idle/PTO shutdown, 2=enable without clutch and service brake

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
Enable Idle Shutdown	17	0	3	0	DRS, VEPS, DDDL 7.0	0=disable, 1=enable idle shutdown with Park Brake status, 2=enable idle shutdown without Park Brake status, 3=enable idle shutdown with edge triggered accelerator pedal
Enable Noise Control	23	0	1	1	DRS, VEPS	0=VCU style, 1=DDEC style
Enable PTO Shutdown	17	0	3	0	DRS, VEPS, DDDL 7.0	0=disable, 1=enable PTO shutdown with Park Brake status, 2=enable PTO shutdown without Park Brake status, 3=enable PTO shutdown with edge triggered accelerator pedal
Eng Brake Enable Auto Fan	19	0	1	0	DRS, VEPS, DDDL 7.0	0=disable, 1=enable
Eng Brk Stage 1 Off Delay Time	10	0	1280000	240 ms	DRS, VEPS	0..64000=signal
Eng Brk Stage 2 Off Delay Time	10	0	1280000	240 ms	DRS, VEPS	0..64000=signal
Eng Brk Stage 3 Off Delay Time	10	0	1280000	240 ms	DRS, VEPS	0..64000=signal
Eng Speed Limit While Veh Stop	3	0 1/min	4000 1/min	3000 1/min	DRS, VEPS, DDDL 7.0	—
Engine Brake Configuration	10	0	3	0	DRS, VEPS	0=no engine brake, 1=Decompression Valve Only or Exhaust Flap Only, 2=decompression valve + exhaust flap, 3=jake compression brake or turbo brake
Engine Brake Switch Config	13	0	255	0	DRS, VEPS	0=hardwired, 1=info from J1939 (muxed), 255=not available
Engine Hour Sync Fault Enable	37	0	1	1	DRS, VEPS	0=disabled, 1=enabled
Fan AC Hold Time	19	0 s	600 s	180 s	DRS, VEPS	—
Fan Vehicle Speed Enable	19	0	1	0	DRS, VEPS	0=disable, 1=enable
Fan Vehicle Speed Threshold	19	0	250	0 km/h	DRS, VEPS	0..32000=signal
Fast Idle Spd Air Cond Input	6	500 1/min	3000 1/min	600 1/min	DRS, VEPS, DDDL 7.0	—

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
Fault Code Flashing Enable	37	0	1	1	DRS, VEPS	0=disabled, 1=enabled
FEI Conversion Factor	23	0 mph /mpg	20 mph /mpg	2 mph /mpg	DRS, VEPS, DDDL 7.0	—
FEI Max Vehicle Speed Reward	23	0 km/h	20 km/h	0 km/h	DRS, VEPS, DDDL 7.0	—
FEI Minimum Fuel Economy	23	4 mpg	20 mpg	7 mpg	DRS, VEPS, DDDL 7.0	—
FEI Use Trip Mileage	23	0	1	0	DRS, VEPS, DDDL 7.0	0=based on filtered fuel economy, 1=based on trip fuel economy
Fleet Management Enable	27	0	1	1	DRS, VEPS, DDDL 7.0	0=disabled, 1=enabled
FM Alert Update Enable	27	0	1	1	DRS, VEPS, DDDL 7.0	0=disabled, 1=enabled
FM Daily Usage Enable	27	0	1	1	DRS, VEPS, DDDL 7.0	0=disabled, 1=enabled
FM Fuel Density	27	0 kg/l	65.535 kg/l	0.835 kg/l	DRS, VEPS	—
FM Incident Update Enable	27	0	1	1	DRS, VEPS, DDDL 7.0	0=disabled, 1=enabled
FM Monthly Trip Enable	27	0	1	1	DRS, VEPS, DDDL 7.0	0=disabled, 1=enabled
FM Serv Interval Update Enable	27	0	1	1	DRS, VEPS, DDDL 7.0	0=disabled, 1=enabled
Fuel Economy Incentive Enable	23	0	1	0	DRS, VEPS, DDDL 7.0	0=disabled, 1=enabled
Gear Ratio for High Gear Power	23	0	2	0.02	DRS, VEPS	—
Gear Ratio Gear Down Protect	23	0	2	0.01	DRS, VEPS	—

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
Hi Amb Air Override Temp	17	–40°C	75°C	32°C	DRS, VEPS, DDDL 7.0	—
Hi Eng Brk Max Cruise RSL Spd	10	0 km/h	48 km/h	10 km/h	DRS, VEPS, DDDL 7.0	—
Hi Eng Brk Min Cruise RSL Spd	10	0 km/h	48 km/h	6 km/h	DRS, VEPS, DDDL 7.0	—
Hi Exhaust Temp Lamp Config	46	0	1	0	DRS, VEPS	0=hardwired, 1=J1939 PTC1
Hold Time Fan	19	0 s	600 s	10 s	DRS, VEPS, DDDL 7.0	—
Idle Shutdown Auto Override	17	0	1	0	DRS, VEPS, DDDL 7.0	0=no automatic override performed, 1=automatic override performed
Idle Shutdown Time	17	1 s	5000 s	60 s	DRS, VEPS, DDDL 7.0	—
Increment Cruise Set Speed	15	0 km/h	10 km/h	1.6 km/h	DRS, VEPS, DDDL 7.0	—
J1587 Page2 SID Convert Enable	37	0	1	0	DRS, VEPS	0=disabled, 1=enabled
J1939 Engine Retarder Config	10	3	255	255	DRS, VEPS	0=variable controlled brake, 1=1 step, 2=low/high steps, 3=Jake or Constant Throttle Brake, 4= Exhaust Flap, 255=not configured
J1939 Fan Request Enable	19	0	1	0	DRS, VEPS	0=disabled, 1=enabled
J1939 Steps Engine Brake	10	0	255	255	DRS, VEPS	0=variable controlled brake, 1=1 step, 2=low/high steps, 3=low/medium/high steps, 255=not configured
Limiter0 Max Eng Speed Enabled	5	0 1/min	4000 1/min	4000 1/min	DRS, VEPS, DDDL 7.0	—
Limiter0 Max Eng Trq Enabled	5	0 Nm	5000 Nm	5000 Nm	DRS, VEPS, DDDL 7.0	—
Limiter0 Max Road Spd Enabled	5	0	152 km/h	152 km/h	DRS, VEPS, DDDL 7.0	—

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
Limiter0 Max Trq Curve Select	4	0	3	0	DRS, VEPS	0=PLD torque curve (max. torque), 1=Power Rating Curve #1, 2=Power Rating Curve #2, 3=Power Rating Curve #3
Limiter0 Max Vehicle Accel	5	−15.625 m/ss	15.625 m/ss	10 m/ss	DRS, VEPS, DDDL 7.0	—
Limiter0 Min Eng Speed Enabled	5	0 1/min	4000 1/min	500 1/min	DRS, VEPS, DDDL 7.0	—
Limiter1 Max Eng Speed Enabled	5	0 1/min	4000 1/min	4000 1/min	DRS, VEPS, DDDL 7.0	—
Limiter1 Max Eng Trq Enabled	5	0	5000 Nm	5000 Nm	DRS, VEPS, DDDL 7.0	—
Limiter1 Max Road Spd Enabled	5	0 km/h	152 km/h	152 km/h	DRS, VEPS, DDDL 7.0	—
Limiter1 Max Vehicle Accel	5	−15.625 m/ss	15.625 m/ss	10 m/ss	DRS, VEPS, DDDL 7.0	—
Limiter1 Min Eng Speed Enabled	5	0 1/min	4000 1/min	500 1/min	DRS, VEPS, DDDL 7.0	—
Lo Amb Air Override Temp	17	−40°C	75°C	−4°C	DRS, VEPS, DDDL 7.0	—
Low Eng Brk Max Cruise RSL Spd	10	0 km/h	48 km/h	5 km/h	DRS, VEPS, DDDL 7.0	—
Low Eng Brk Min Cruise RSL Spd	10	0 km/h	48 km/h	2 km/h	DRS, VEPS, DDDL 7.0	—
Max Adjusted Idle Speed	3	0 1/min	4000 1/min	850 1/min	DRS, VEPS, DDDL 7.0	—
Max Cruise Set Speed	15	48 km/h	152 km/h	152 km/h	DRS, VEPS, DDDL 7.0	—
Max Engine Load PTO Shutdown	17	0 Nm	5000 Nm	100 Nm	DRS, VEPS	—
Max Engine Speed	3	0 1/min	4000 1/min	3000 1/min	DRS, VEPS	—
Max PTO Spd Resume Accel Sw	7	500 1/min	3000 1/min	3000 1/min	DRS, VEPS, DDDL 7.0	—

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
Max Road Speed	3	102 km/h	152 km/h	152 km/h	DRS, VEPS, DDDL 7.0	—
Max Road Speed in PTO Mode	6	0 km/h	128 km/h	10 km/h	DRS, VEPS	—
Med Eng Brk Max Cruise RSL Spd	10	0 km/h	48 km/h	7 km/h	DRS, VEPS, DDDL 7.0	—
Med Eng Brk Min Cruise RSL Spd	10	0 km/h	48 km/h	5 km/h	DRS, VEPS, DDDL 7.0	—
MID for Ambient Air Temp	31	0 km/h	255 km/h	0 km/h	DRS, VEPS	—
Min Coolant Temp	17	–40°C	200°C	10°C	DRS, VEPS	—
Min Cruise Set Speed	15	16 km/h	152 km/h	32 km/h	DRS, VEPS, DDDL 7.0	—
Min Eng Spd for Engine Brakes	10	0 1/min	4000 1/min	1100 1/min	DRS, VEPS	—
Min Engine Speed	3	0 1/min	4000 1/min	592 1/min	DRS, VEPS	—
Min PTO Spd Set Coast Sw	7	500 1/min	3000 1/min	500 1/min	DRS, VEPS, DDDL 7.0	—
Min Road Spd Eng Brk Operation	10	0 km/h	200 km/h	0 km/h	DRS, VEPS, DDDL 7.0	—
Mode of AC Status Input	5	0	4	2	DRS, VEPS	0=disabled, 1=AC active closed, 2=AC active open, 3=LIM active closed, 4=LIM active open
No of Speeds via Remote PTO	7	1	3	1	DRS, VEPS, DDDL 7.0	—
Noise Max Engine Speed	23	0 1/min	4000 1/min	1450 1/min	DRS, VEPS	—
Noise Min Engine Speed	23	0 1/min	4000 1/min	1100 1/min	DRS, VEPS	—
Number of Output Shaft Teeth	8	0	250	16	DRS, VEPS, DDDL 7.0	—

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
OI Alternate Battery Run Time	12	0 s	30600 s	0 s	DRS, VEPS, DDDL 7.0	—
OI Continuous Batt Time Enable	12	0	1	0	DRS, VEPS, DDDL 7.0	0=disabled, 1=enabled
OI Extended Mode Disable	12	0	1	0	DRS, VEPS, DDDL 7.0	0=enable, 1=disable
OI Lower Limit Continuous Run	12	–40°C	100°C	–4°C	DRS, VEPS, DDDL 7.0	—
OI Target Engine RPM ae 0	12	800 1/min	1000 1/min	1000 1/min	DRS, VEPS, DDDL 7.0	—
OI Target Engine RPM ae 1	12	800 1/min	1000 1/min	1000 1/min	DRS, VEPS, DDDL 7.0	—
OI Target Engine RPM ae 2	12	800 1/min	1000 1/min	1000 1/min	DRS, VEPS, DDDL 7.0	—
OI Target Engine RPM ae 3	12	800 1/min	1000 1/min	1000 1/min	DRS, VEPS, DDDL 7.0	—
OI Target Engine RPM ae 4	12	800 1/min	1000 1/min	1000 1/min	DRS, VEPS, DDDL 7.0	—
OI Thermostat Max Time	12	0 s	459000 s	0 s	DRS, VEPS, DDDL 7.0	—
OI Upper Limit Continuous Run	12	–40°C	100°C	32°C	DRS, VEPS, DDDL 7.0	—
OI Variable Volt Thresh Enable	12	0	1	0	DRS, VEPS, DDDL 7.0	0=disabled, 1=enabled
Oil Level Eng Protect Shtdn	18	0	1	1	DRS, VEPS, DDDL 7.0	0=warning, 1=engine shutdown
Oil Press Eng Protect Shtdn	18	0	1	1	DRS, VEPS, DDDL 7.0	0=disable, 1=enable
Optimized Idle Enable	12	0	1	0	DRS, VEPS	0=disable, 1=enable

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
Park Brake Switch Config	13	0	3	0	DRS, VEPS	0=hardwired, 1=Ccvs1, 2=Ccvs2, 3=Ccvs3
PasSmart Enable	23	0	1	0	DRS, VEPS, DDDL 7.0	0=disable, 1=enable
Progressive Shift Enable	23	0	1	0	DRS, VEPS, DDDL 7.0	0=disable, 1=enable
PS High Gear On Vehicle Spd	23	0 km/h	250 km/h	80.5 km/h	DRS, VEPS, DDDL 7.0	—
PS High Gear RPM Limit	23	0 1/min	4000 1/min	1650 1/min	DRS, VEPS, DDDL 7.0	—
PS Low Gear 1 Max RPM Limit	23	0 1/min	4000 1/min	1800 1/min	DRS, VEPS, DDDL 7.0	—
PS Low Gear 1 Max Vehicle Spd	23	0 km/h	250 km/h	19.3 km/h	DRS, VEPS, DDDL 7.0	—
PS Low Gear 1 RPM Limit	23	0 1/min	4000 1/min	1400 1/min	DRS, VEPS, DDDL 7.0	—
PS Low Gear 2 Max RPM Limit	23	0 1/min	4000 1/min	1800 1/min	DRS, VEPS, DDDL 7.0	—
PS Low Gear 2 Max Vehicle Spd	23	0 km/h	250 km/h	43.5 km/h	DRS, VEPS, DDDL 7.0	—
PS Low Gear 2 RPM Limit	23	0 1/min	4000 1/min	1800 1/min	DRS, VEPS, DDDL 7.0	—
PS Pass Speed Duration	23	0 min	255 min	0 min	DRS, VEPS, DDDL 7.0	—
PS Pass Speed Increment	23	0 km/h	250 km/h	0 km/h	DRS, VEPS, DDDL 7.0	—
PS Pass Speed Interval	23	1 h	24 h	8 h	DRS, VEPS, DDDL 7.0	—
PTO Dropout on Clutch Enabled	7	0	1	0	DRS, VEPS, DDDL 7.0	0=No PTO drop out with clutch pedal, 1=Causes PTO to drop out if the Clutch is being depressed

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
PTO Dropout Serv Brk Prk Brk	7	0	3	0	DRS, VEPS, DDDL 7.0	0=No PTO drop out on service brake or park brake activation, 1=Causes PTO to drop out on Service Brake or Park Brake activation, 2=Drop out on Service Brake activation, 3=Drop out on Park Brake activation
PTO Enable Auto Fan Activation	19	0	1	0	DRS, VEPS, DDDL 7.0	0=disable, 1=enable
PTO Ramp Rate	7	25 (1/min) /s	2500 (1/min) /s	200 (1/min)/s	DRS, VEPS, DDDL 7.0	—
PTO Shutdown Time	17	1 s	5000 s	60 s	DRS, VEPS, DDDL 7.0	—
PTO Throttle Override Enable	7	0	1	1	DRS, VEPS, DDDL 7.0	0=disable, 1=Enable engine speed in PTO mode to be increased with throttle input
Ramp Fan	19	1 %/s	100 %/s	25 %/s	DRS, VEPS	—
Ramp Rate Adjusted Idle Spd	3	0 (1/min) /s	8191 .875 (1/min) /s	100 (1/min)/s	DRS, VEPS, DDDL 7.0	—
Remote Accelerator Enable	20	0	1	0	DRS, VEPS	0=disable, 1=enable
Remote PTO Spd Selection Mode	6	0	2	0	DRS, VEPS	0=1 pulsed input(VCU style), 1=2 gray coded inputs, 2=2 binary coded inputs
Resume Accel Max PTO Torque	7	0 Nm	5000 Nm	5000 Nm	DRS, VEPS, DDDL 7.0	—
Resume Accel Sw PTO Set Spd	7	0 1/min	3000 1/min	500 1/min	DRS, VEPS, DDDL 7.0	—
Road Spd Limit Max Stage Num	10	0	3	0	DRS, VEPS	0=off, 1=low, 2=medium, 3=high
Second Highest Gear Ratio	8	0	5.75	2.55	DRS, VEPS, DDDL 7.0	—
Service Brake Switch Config	13	0	3	3	DRS, VEPS	0=hardwired, 1=Ccvs1, 2=Ccvs2, 3=Ccvs3

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
Service Brk Enable Eng Brakes	10	0	2	0	DRS, VEPS, DDDL 7.0	0=disable, 1=enable automatic engine brake when applied service brake, 2=operator selection and service brake for engine brake activation
Set Coast Max PTO Torque	7	0 Nm	5000 Nm	5000 Nm	DRS, VEPS, DDDL 7.0	—
Set Coast Switch PTO Set Speed	7	0 1/min	3000 1/min	500 1/min	DRS, VEPS, DDDL 7.0	—
Single Step Adjusted Idle Spd	3	0 1/min	100 1/min	16 1/min	DRS, VEPS, DDDL 7.0	—
Spd 1 Max Eng Trq Remote PTO	7	0 Nm	5000 Nm	5000 Nm	DRS, VEPS, DDDL 7.0	—
Spd 1 via Remote PTO	7	500 1/min	3000 1/min	950 1/min	DRS, VEPS, DDDL 7.0	—
Spd 2 Max Eng Trq Remote PTO	7	0 Nm	5000 Nm	5000 Nm	DRS, VEPS, DDDL 7.0	—
Spd 2 via Remote PTO	7	500 1/min	3000 1/min	1250 1/min	DRS, VEPS, DDDL 7.0	—
Spd 3 Max Eng Trq Remote PTO	7	0 Nm	5000 Nm	5000 Nm	DRS, VEPS, DDDL 7.0	—
Spd 3 via Remote PTO	7	500 1/min	3000 1/min	1850 1/min	DRS, VEPS, DDDL 7.0	—
Stage 1 Eng Brk Off Delta Spd	10	0 1/min	8000 1/min	100 1/min	DRS, VEPS	—
Stage 1 Factor Engine Brake	10	0%	100%	100%	DRS, VEPS	—
Stage 1 Mask Engine Brake	10	0	81	64	DRS, VEPS	0=no engine brake activation, 16=exhaust flap only, 17=Jake Brake 2nd stage, 64=decompression valve only or Jake Brake 1st stage, 80=decompression valve and exhaust flap, 81=decompression valve and turbo brake or Jake Brake 3rd stage
Stage 2 Eng Brk Off Delta Spd	10	0 1/min	800 1/min	100 1/min	DRS, VEPS	—

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
Stage 2 Factor Engine Brake	10	0%	100%	100%	DRS, VEPS	—
Stage 2 Mask Engine Brake	10	0	81	80	DRS, VEPS	0=no engine brake activation, 16=exhaust flap only, 17=Jake Brake 2nd stage, 64=decompression valve only or Jake Brake 1st stage, 80=decompression valve and exhaust flap, 81=decompression valve and turbo brake or Jake Brake 3rd stage
Stage 3 Eng Brk Off Delta Spd	10	0	800 1/min	50 1/min	DRS, VEPS	—
Stage 3 Factor Engine Brake	10	0	100%	100%	DRS, VEPS	—
Stage 3 Mask Engine Brake	10	0	81	80	DRS, VEPS	0=no engine brake activation, 16=exhaust flap only, 17=Jake Brake 2nd stage, 64=decompression valve only or Jake Brake 1st stage, 80=decompression valve and exhaust flap, 81=decompression valve and turbo brake or Jake Brake 3rd stage
Throttle Override Max Eng Spd	7	0	3000 1/min	3000 1/min	DRS, VEPS, DDDL 7.0	—
Tire Revs per Unit Distance	8	160 1/km	1599 1/km	312 1/km	DRS, VEPS, DDDL 7.0	—
Top Gear Ratio	8	0.099 609375	2.5498 046875	1	DRS, VEPS, DDDL 7.0	—
Top2 Cruise Control Sw Enable	42	0	1	0	DRS, VEPS, DDDL 7.0	0=disable, 1=using cruise control master switch
Torque Factor Gear Dwn Protect	23	0	1	0	DRS, VEPS	—
Torque Factor High Gear Power	23	0	1	0	DRS, VEPS	—
Trans Factor Engine Brake	10	0%	100%	100%	DRS, VEPS	—
Trans Mask Engine Brake	10	0	81	64	DRS, VEPS	0=no engine brake activation, 16=exhaust flap only, 17=Jake Brake 2nd stage, 64=decompression valve only or Jake Brake 1st stage, 80=decompression valve and exhaust flap, 81=decompression valve and turbo brake or Jake Brake 3rd stage

Diagnostic Name	Parameter Group	Min	Max	Default	Access	Range
Trans Neutral Input Config	13	0	255	0	DRS, VEPS	0=hardwired, 1=info from J1939 (muxed), 255=not available
Trans Retarder Fan Percent	19	0%	100%	0	DRS, VEPS	—
Trans Torque Limit Enable	3	0	1	0	DRS, VEPS	0=disabled, 1=enable
Transmission Type	2	0	7	0	DRS, VEPS	0 – Manual, without neutral switch, 1 – Not Used in NAFTA, 2 – Allison, Eaton UltraShift, AutoShift, ZF ASTronic: direct start, 3 – Manual, with neutral switch, 4 – Not Used in NAFTA, 5 – Eaton AutoShift, UltraShift, ZF ASTronic, AGS2: MCM Start, 6 – Allison, Eaton UltraShift ASW: MCM Start, 7 – Eaton Top2
Transmit EBC1 for AGS2	1	0	3	0	DRS, VEPS	0=no EBC1, standard PTO message, 1=transmit EBC1 and standard PTO message, 2=no EBC1, AGS2 specific PTO message, 3=transmit EBC1 and AGS2 specific PTO message
TSC1 Source Address SAE J1939	1	0	255	231	DRS, VEPS	—
Two Spd Axle Second Axle Ratio	8	1	20	5.29	DRS, VEPS, DDDL 7.0	—
Vehicle Speed Sensor	8	0	8	4	DRS, VEPS, DDDL 7.0	0=no sensor, 1=C3 sensor, 2=square wave (hall sensor), 3=J1939 ETC1, 4=magnetic pickup vehicle speed sensor, 5=J1939 TCO, 6=J1939 CCVS Source1, 7=J1939 CCVS Source2, 8=J1939 CCVS Source3

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