4 INPUTS AND OUTPUTS

Section **Page**

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4.1 INPUTS

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

Digital Input Functions	CPC2 Connector / Pin
A/C Status	2/12
ABS Active	3/18
AGS2 PTO Feedback	4/18
Clutch Released / PTO Request for AGS2	4/8
Cruise Control Enable	1/14
DPF Regeneration Switch (allow)	4/13
Engine Brake Low	2/14
Engine Brake Medium	2/15
Fan Control Override	2/13
Idle Validation 1	1/06
Idle Validation 2	1/03
Limiter 0 (LIM0)	1/11
Limiter 1 (LIM1)	2/11
Low Battery Voltage	3/6
Manual Regeneration Request Switch	4/17
Neutral Switch	4/16
Park Brake Interlock	1/2
Remote Throttle Select Switch	2/8
Remote PTO Switch/ Remote VSG Switch	2/9
Resume/Accel Enable	1/16
Service Brake Switch	2/7
Set / Coast Enable	1/12
Stop Engine / Aux Shutdown #1	1/10
Throttle Inhibit	1/17

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.

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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 CPC2 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
3	Adjusted Idle Configuration	—	0 – Disabled 1 – Enabled 2 – Enabled if Neutral 3 – Enabled if Neutral and Park Brake 4 – Enabled if Park Brake	0 – Disabled	VEPS, DRS or DDDL 7.0
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

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4.1.2 ABS ACTIVE

The anti-lock brake system (ABS) input is used with AGS2 transmissions for ABS indication to the CPC2.

Installation

This switch is wired to pin 3/18 of the CPC2.

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

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4.1.3 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 CPC2 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 4-4.

Parameter Group	Parameter	Options	Default	Access
13	Clutch Switch Config	0 – Not Configured 1 – 1 Clutch Switch 2 – 2 Clutch Switch 3 – CCVS1 4 – CCVS2 5 – CCVS3 6 – ETC1	0 – Not Configured	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 4-4 Clutch Switch Programming Options

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4.1.4 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 CPC2 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 4-5.

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 4-5 Cruise Control On/Off Switch Programming Options

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4.1.5 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.

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

Installation

The Resume/Accel Switch is wired to the CPC2 on pin 1/16. The Set/Coast Switch is wired to the CPC2 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.

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Programming Requirements and Flexibility

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

Parameter Group	Parameter	Options	Default	Access
13	CC Set Cst Res Accel Sw Config	0 – Hardwired 1 – CCVS1 2 – CCVS2 3 – CCVS3 4 – CCVS1 or CCVS2 5 – CCVS2 or CCVS3 6 – CCVS1 or CCVS3 7 — CCVS1 or CCVS2 or CCVS3 8 – CCVS1 or hardwired 9 – CCVS2 or hardwired 10 – CCVS3 or hardwired 11 – CCVS1 or CCVS2 or hardwired 12 – CCVS2 or CCVS3 or hardwired 13 – CCVS1 or CCVS3 or hardwired 14 – CCVS1 or CCVS2 or CCVS3 or hardwired	0 – Hardwired	VEPS or DRS

Table 4-6 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.

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4.1.6 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 CPC2 on pin 1/15.

Programming Requirements and Flexibility

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

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

* Not supported in NAFTA

Table 4-7 Diagnostic Request Switch Programming Options

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4.1.7 DPF REGENERATION INHIBIT SWITCH AND REGEN SWITCH

The Regen Switch is used by the operator to initiate a parked regeneration. This switch is REQUIRED. The Regen switch is a momentary normally open switch. Refer to section 5.20 for additional information.

If "DPF J1939 Regen Sw Enable" parameter is enabled (1-Active), the CPC2 will no longer process the hardwired Regen Switch requests. The CPC2 must receive regular periodic switch status messages over J1939.

The DPF Regeneration Inhibit Switch is used to inhibit all DPF regenerations. This switch is OPTIONAL. This is typically used in hazardous environment applications.

If "DPF J1939 Inhibit Sw Enable" parameter is enabled (1-active), the CPC2 will no longer process the hardwired Regen Inhibit switch requests. The CPC2 must receive regular periodic switch status messages over J1939.

A three position switch or two separate switches can be used. The operating state for both switch implementations is listed in Table 4-8.

Three Position Switch		Truth Table Functionality		
Physical Switch Position	**Position Type**	**Input to Pin 4/17 (DPF Regen Sw)**	**Input to Pin 4/13 (DPF Regen Inhibit Sw)**	**Operating State**
Up	Momentary	Grounded (TRUE)	Grounded (FALSE)	Manual Regen Request
Middle	Maintain	Open (FALSE)	Grounded (FALSE)	Automatic
Down	Maintain	Open (FALSE)	Open (TRUE)	Inhibit/Cancel
N/A	N/A	Grounded (TRUE)	Open (TRUE)	Inhibit/Cancel

NOTE: Above functionality will be realized in the vehicle with one switch (three positions) or with two switches (one for the regen and one for the inhibit).

Table 4-8 Operating State for Both Switch Implementations

The operating state based on J1939 switch status is listed in Table 4-9.

SPN 3696 DPF Regen	SPN 3695 DPF Inhibit	Operating State
ACTIVE (01)	NOT ACTIVE (00)	Manual Regen Request
NOT ACTIVE (00)	NOT ACTIVE (00)	Automatic, No Manual Regen Request
NOT ACTIVE (00)	ACTIVE (01)	Inhibit/Cancel
ACTIVE (01)	ACTIVE (01)	Inhibit/Cancel

NOTE: Above functionality/truth table will be realized in the vehicle with one switch (three positions) or with two switches (one for the regen and one for the inhibit).

Table 4-9 The Operating State Based on J1939 Switch Status

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Installation

The DPF Regeneration Inhibit Switch is wired to pin 4/13 of the CPC2 #4 connector.

The Regen Switch is wired to the CPC2 #4 connector pin 4/17. It can be multiplexed.

Programming Requirements and Flexibility

The options for these digital inputs are listed in Table 4-10.

Parameter Group	Parameter	Options	Default	Access
13	4 13 DI Selection	0 = Disabled 1 = Enable ABS Input* 2 = Enable Transmission Retarder Input* 3 = Enable Grid Heater Detection 4 = Enable Tempo Set* 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 Regeneration Inhibit Switch	0 = Disabled	VEPS or DRS
46	DPF J1939 Inhibit Sw Enable	0 – Not Active 1 – Active	0 = Not Active	VEPS or DRS
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 4-10 Regen Switch and DPF Regeneration Inhibit Switch Programming Options

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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 CPC2 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 4-11.

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	0 – Disable	VEPS or DRS

Table 4-11 Dual-speed Axle Switch Programming Options

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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 CPC2, 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 CPC2.

Programming Requirements and Flexibility

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

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	0 — Disable	VEPS, DRS

* Not supported in NAFTA

Table 4-12 Engine Brake Disable Programming Options

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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 4-13.

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 4-13 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 CPC2 on pin 2/14 and Engine Brake Medium Switch is wired to the CPC2 on pin 2/15.

Programming Requirements and Flexibility

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

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

Table 4-14 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 CPC2 on pin 2/13.

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4.1.12 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 CPC2 on pin 1/6. The Idle Validation 2 Switch is wired to the CPC2 on pin 1/3.

4.1.13 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 CPC2 on pin 1/11, Limiter 1 on pin 2/11.

Programming Requirements and Flexibility

Refer to section 5.17, “Limiters,” for more information.

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4.1.14 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 CPC2 on pin 4/18.

Programming Requirements and Flexibility

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

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 7 — Service Brake Active	0 = Disable	VEPS, DRS

* Not supported in NAFTA

Table 4-15 Hood Tilt Switch Programming Options

4.1.15 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 CPC2 on pin 3/1.

Programming Requirements and Flexibility

The options for this digital input are listed in Table 4-16.

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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 4-16 OI Thermostat Programming Options

4.1.16 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 CPC2 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 4-17.

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 4-17 Configuring the Park Brake Switch Input

4.1.17 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.

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Installation

This input is wired to the CPC2 pin 2/8.

Programming Requirements & Flexibility

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

Parameter Group	Parameter	Options	Default	Access
20	Remote Accelerator Enable	0 – Disable 1 – Enable	0 – Disable	VEPS or DRS

Table 4-18 Configuring the Remote Accelerator Select Input

4.1.18 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 CPC2 pin 2/9.

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4.1.19 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 CPC2.

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 7 — Service Brake Active	0 – Disable	VEPS, DRS

* Not supported in NAFTA

Table 4-19 RPM Freeze Programming Options

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4.1.20 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 CPC2 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

4.1.21 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 CPC2 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 2 – CC Cancel (FUSO)* 3 – Diagnostic Request Switch	1 – Stop Engine Override Switch /Diagnostic Request Switch	VEPS or DRS

* Not supported in NAFTA

Table 4-21 Diagnostic Request Switch Programming Options

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4.1.22 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 CPC2 on pin 1/17.

4.1.23 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 CPC2 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 JCAN 255 – Not Configured	0 – Hardwired	VEPS or DRS

Table 4-22 Configuring the Transmission Neutral Switch Input

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4.1.24 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	0 = Disable	VEPS or DRS

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 CPC2 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
- □ Regen Switch
- □ Regen Inhibit Switch
- □ Remote PTO

To use the multiplexing feature with the CPC2, 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 SAE 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
1	CM1 DPF Source Address SAE J1939	0 – 255	49	VEPS, DRS
1	CM1 Fan Source Addr 1 SAE J1939	0 – 255	25	VEPS, DRS
1	CM1 Fan Source Addr 2 SAE J1939	0 – 255	49	VEPS, DRS
1	PTO Source Address SAE J1939	0 – 255	23	VEPS, DRS

Table 4-24 Source Address Options

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Parameter Group	Parameter	Options	Default	Access
1	PTO Source Address SAE J1939	0–255	23	VEPS, DRS
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 4 – CCVS1 or CCVS2 5 – CCVS2 or CCVS3 6 – CCVS1 or CCVS3 7 — CCVS1 or CCVS2 or CCVS3 8 – CCVS1 or hardwired 9 – CCVS2 or hardwired 10 – CCVS3 or hardwired 11 – CCVS1 or CCVS2 or hardwired 12 – CCVS2 or CCVS3 or hardwired 13 – CCVS1 or CCVS3 or hardwired 14 – CCVS1 or CCVS2 or CCVS3 or hardwired	0	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

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Parameter Group	Parameter	Options	Default	Access
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 8 – CCVS1 or hardwired 9 – CCVS2 or hardwired 10 – CCVS3 or hardwired 11 – CCVS1 or CCVS2 or hardwired 12 – CCVS2 or CCVS3 or hardwired 13 – CCVS1 or CCVS3 or hardwired 14 – CCVS1 or CCVS2 or CCVS3 or hardwired	0	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
13	Stop Engine Override Sw Config (R2 or later)	0 – Hardwired 1 – CCVS1 2 – CCVS2 3 – CCVS3	0	VEPS or DRS
46	DPF J1939 Inhibit Sw Enable	0 – Not Active 1 – Active	0	VEPS or DRS
46	DPF J1939 Regen Sw Enable	0 – Not Active 1 – Active	0	VEPS or DRS

* Not supported in NAFTA

Table 4-25 Parameters for Multiplexing

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4.3 DIGITAL OUTPUTS – CPC2

The CPC2 has 15 digital output pins, 12 low side and three high side. The CPC2 digital output functions and their associated pins are listed in Table 4-26.

Digital Output Function	Driver	CPC2 Connector/Pin
AGS2 Backup Lamp	Low Side	3/09
AGS2 Check Trans Lamp	Low Side	3/12
AGS2 Trans Temp Lamp	Low Side	3/16
Amber Warning Lamp	Low Side	2/10
Cruise Active Lamp	Low Side	3/12
Deceleration Lamp	Low Side	4/09
DEF (Urea) Low Lamp	Low Side	3/10
DPF Regeneration Lamp	Low Side	1/05
Engine Brake Active	Low Side	3/09
High Exhaust System Temperature Lamp	Low Side	4/07
Low Battery Voltage Lamp	Low Side	3/6
Low Coolant Level Lamp	Low Side	3/11
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
Water-in-Fuel Lamp (R2 or later)	Low Side	3/09 or 4/09

Table 4-26 Digital Outputs – CPC2

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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 CPC2.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-27.

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* 6 – WIF 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 4-27 AGS2 Backup Lamp Programming Options

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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 CPC2.

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 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 4-28 AGS2 Check Transmission Indication Lamp Programming Options

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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 CPC2.

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 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 4-29 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 CPC2.

NOTE:
This digital output is REQUIRED.

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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 CPC2.

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 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 4-30 Cruise Active Lamp Programming Options

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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 CPC2.

Programming Requirements and Flexibility

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

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* 13 – WIF Lamp	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 4-31 Deceleration Lamp Programming Options

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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 CPC2.

Programming Requirements and Flexibility

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

Parameter Group	Parameter	Setting	Options	Default	Access
35	1 05 DO Fault Detection	—	0 – Disabled 1 – Enabled	0 — Disabled	VEPS or DRS

Table 4-32 DPF Regeneration Lamp Programming Options

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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 CPC2.

Programming Requirements and Flexibility

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

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* 6 – WIF 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 4-33 Engine Brake Active Programming Options

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4.3.9 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 HEST Lamp is wired to pin 4/7 of the CPC2.

Programming Requirements and Flexibility

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

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

* Not Available in NAFTA

Table 4-34 High Exhaust System Temperature Lamp Options

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4.3.10 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 CPC2.

Programming Requirements and Flexibility

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

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 4-35 Low Battery Voltage Lamp Programming Options

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4.3.11 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 CPC2.

Programming Requirements and Flexibility

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

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 4-36 Coolant Level Low Lamp Programming Options

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4.3.12 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 CPC2.

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 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 4-37 Low Oil Pressure Lamp Programming Options

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4.3.13 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 CPC2.

On-Board Diagnostic Requirements and Guidelines

On-Board Diagnostic (OBD) regulations require circuit continuity detection of the MIL circuit. The following requirements apply to the OEM:

- Multiplexed MIL must default to ON if communication is lost between modules for any reason or if sending device indicates the data is unavailable or data is in error.
- If multiplexed (OEM device is controlling lamps), the device shall be capable of detecting any circuit continuity malfunctions. The OEM must broadcast circuit malfunction information (continuity checks) on the powertrain J1939 data link per J1939–73 requirements.
- For applications in which the CPC2 controls the lamp, the bulb must be of sufficient resistance to allow for detection of a circuit continuity error.

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4.3.14 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 CPC2 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 4-38.

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* 13 – WIF Lamp	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 4-38 Optimized Idle Active Lamp Programming Options

Diagnostics

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

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4.3.15 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 CPC2 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 4-39.

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 4-39 Optimized Idle Alarm Programming Options

Diagnostics

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

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4.3.16 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 CPC2.

NOTE:
This digital output is REQUIRED.

4.3.17 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 CPC2.

Programming Requirements and Flexibility

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

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 4-40 Starter Lockout Programming Options

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4.3.18 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 CPC2.

Programming Requirements and Flexibility

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

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 4-41 Top2 Shift Solenoid Programming Options

Diagnostics

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

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4.3.19 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 CPC2.

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 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 4-42 Top2 Shift Lockout Solenoid Programming Options

Diagnostics

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

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4.3.20 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 CPC2. This is a high side digital output.

Programming Requirements and Flexibility

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

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 4-43 Vehicle Power Shutdown Programming Options

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4.3.21 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.

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 CPC2.

On-Board Diagnostic Requirements

On-Board Diagnostic (OBD) regulations require circuit continuity detection of the WTS Lamp circuit. Therefore the following requirements apply to the OEM:

- If multiplexed (OEM device is controlling lamps), the device shall be capable of detection any circuit continuity malfunctions.
- The OEM must broadcast circuit malfunction information (continuity checks) on the powertrain J1939 data link per J1939–73 requirements.

Programming Requirements and Flexibility

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

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	0 – Disabled	VEPS or DRS
35	4 06 DO Fault Detection	—	0 — Disabled 1 — Enabled	0 – Disabled	VEPS or DRS

* Not supported in NAFTA

Table 4-44 Wait to Start Lamp Programming Options

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4.3.22 WATER-IN-FUEL LAMP

This output is turned on when a signal from the MCM is received indicating that he water separator tank is full and requires draining.

Installation

This lamp is required for MBE 900 and the HDE.

The CPC2 pins used are 4/9 for the MBE 900 and 3/9 for the HDE. A 12 volt light of less than 0.25 A (DC) is required. This digital output is designed to sink no more than 0.25 A (DC) current.

Programming Requirements and Flexibility

The options for this digital output are listed in Table 4-45.

Parameter Group	Parameter	Setting	Options	Default	Access
35	3 09 DO Selection	6 = WIF Lamp	0 = Disabled 1 = Grid Heater Hardware* 2 = AGS2 Backup Lamp 3 = Engine Brake Active 4 = Not Used 5 = FUSO Engine Brake Active Lamp* 6 = WIF Lamp	0 = Disabled	VEPS, DRS
35	4 09 DO Selection	13 = WIF Lamp	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 (threshold)* 9 = Coolant Temperature (engine controller threshold) 10 = Optimized Idle Active Lamp 11 = Deceleration Lamp 12 = FUSO Ground Starter Lockout Relay* 13 = WIF Lamp	0 = Disabled	VEPS, DRS

* Not supported in NAFTA

Table 4-45 WIF Lamp Programming Options

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4.4 ANALOG OUTPUTS – CPC2

The CPC2 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 4-46.

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 4-46 Analog Output Selections for CPC2 Pin 3/05

4.4.2 PIN 3/06 – ANALOG OUTPUT

This pin can be configured for the functions listed in Table 4-47.

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
Transmission Temperature Indicator Lamp	This output will be turned on when the MCM2 detects a pre-warning or warning based on transmission temperature.	3
Battery Voltage Low lamp	This output will be turned on when the MCM2 detects a low battery voltage input.	4
Coolant Level Low Lamp	This output will be turned on when the MCM2 detects a pre-warning or warning based on coolant level.	5

Table 4-47 Analog Output Selections for CPC2 Pin 3/06

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Programming Requirements and Flexibility

The options for the analog outputs are listed in Table 4-48.

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 – AGS2 Transmission Temp Indication Lamp 4 – Battery Voltage Low Lamp 5 – Coolant Level Low Lamp	0 – Disabled	VEPS, DRS

* Not supported in NAFTA

Table 4-48 Analog Output Options

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4.5 PWM OUTPUT — CPC2

There is one PWM output on the CPC2.

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 4-49.

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 4-49 Frequency vs. Speed

Programming Requirements and Flexibility

The options for the PWM outputs are

Parameter Group	Parameter	Options	Default	Access
9	4 12 PWM Output Selection	0 – Disabled 1 – Throttle Torque 10%..90% 2 – Different 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 4-50 PWM Output Options

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4.6 ACM INPUT SENSORS AND OUTPUT ACTUATORS

The ACM input sensors are listed in Table 4-51.

Sensor	Function
Air Pressure Sensor	Senses system air pressure to maintain 3 Bar > Urea pressure for proper dosing. Sensor is also used for air pressure system leak testing.
Ambient Air Temperature Sensor	Analog ambient temperature reference input. Used for heater control to prevent DEF freezing.
DEF Level Sensor	DEF (urea) level tank sensor used for on-board diagnostics (OBD) and driver warning indicators.
DPF Inlet Pressure Sensor	Used for regen calculation. The catalyzed DPF function is to convert HC and CO emissions during active regeneration as well as to convert NO to NO2 to support the NOx conversion in the SCR.
DPF Outlet Pressure Sensor	Used for regen calculation. The catalyzed DPF function is to convert HC and CO emissions during active regeneration as well as to convert NO to NO2 to support the NOx conversion in the SCR.
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 after-treatment unit.
DOC Inlet Temperature	Monitors exhaust temperature coming into the DOC. Used for regen calculation and to support soot oxidation and convert HC injected during active regeneration.
DOC Outlet Temperature	Temperature measured between the DOC and the DPF in the after-treatment assembly located in the exhaust system of the vehicle.
DOC Outlet Temperature Inboard	Monitors exhaust temperature exiting out of the DOC. Used for regen calculation and to support soot oxidation and convert HC injected during active regeneration.
DOC Outlet Temperature Outboard	Monitors secondary exhaust flow temperature exiting out of the DOC. Used for regen calculation and to support soot oxidation and convert HC injected during active regeneration.
SCR Inlet Temperature	Used for NOx calculation
Smart NOx Sensor (DPF Outlet)	Measures the NOx concentration, air/fuel ration and equilibrium oxygen partial pressure in the exhaust gas.
Smart NOx Sensor (SCR Outlet)	Measures the NOx concentration, air/fuel ration and equilibrium oxygen partial pressure in the exhaust gas.
Urea Pressure Sensor	Provides a dosing unit pressure signal so the DEF is kept in a required pressure range.
Urea Temperature Sensor	Proper DEF flow is a function of the temperature sensor input and balanced operation of the electronic controls.

Table 4-51 ACM Input Sensors

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The ACM output actuators are listed in Table 4-52.

Actuator	Description
Air Pressure Limiting Solenoid Valve	Master control solenoid allows vehicle compressed air supply to activate urea control. The ACM controlled solenoid facilitates DEF urea dosing or system purging to prevent freezing.
Pressure Limiting Valve	Operates as a pressure regulator. Air pressure is regulated to approximately 5.5 Bar through the valve for proper system operation.
Overflow Valve	Operates as a system check valve. When a calibrated minimum air pressure is reached the valve opens allowing pressure to the downstream devices.
Air Control Unit Set (12V)	Supplies air to dosing valve to atomize DEF for dosing. Air pressure purges system to prevent freezing.
Dosing Unit (12V)	Provides control flow for DEF dosing for SCR function. Atomizes DEF for SCR injection.
Supply Unit (12V)	Provides a filtered DEF flow and stores a small DEF volume to maintain pressure. A permanent magnet brush motor is used to pump DEF.
Cooling Water Valve	Provides engine coolant upon command to flow through the supply unit and DEF tank to prevent freezing.
Dosing Unit Diffuser Heater	Prevents freezing by providing heat for air pressure upon command, for DEF atomizing and SCR function.
Dosing Unit Heater	Prevents freezing of DEF between the dosing valve and nozzle

Table 4-52 ACM Output Actuators

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