Section 3.2
Common Powertrain Controller 2+

The Common Powertrain Controller2 (CPC2+) has three 18–pin connectors and one 21–pin connector. The following sections contain the connector pin-outs for truck, vocational, and fire truck applications.

The CPC2+ is the interface between the MCM2 and the vehicle/equipment for engine control and manages other vehicle/equipment functions. See Figure "The Common Powertrain Controller" .

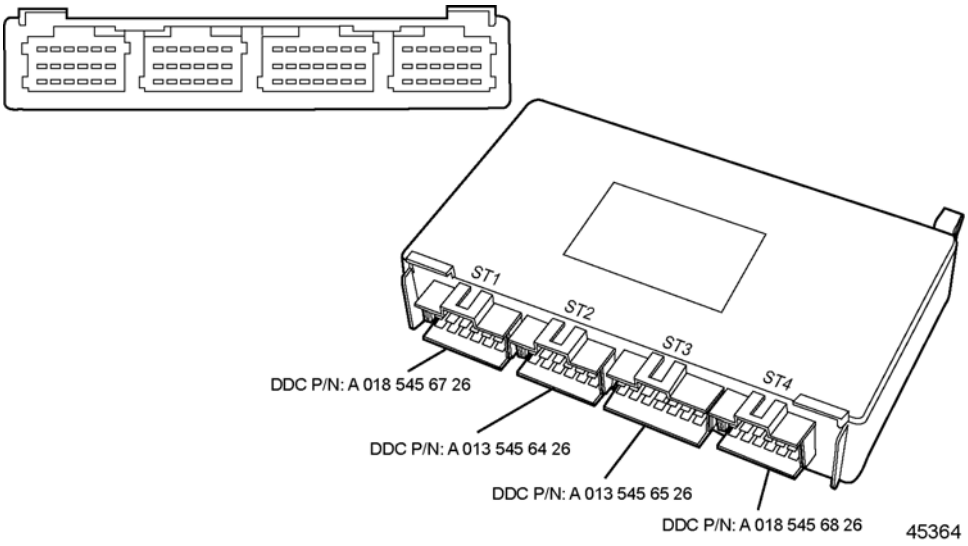


Figure 1. The Common Powertrain Controller

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 "CPC2+ Dimensions" for the CPC2+ dimensions.

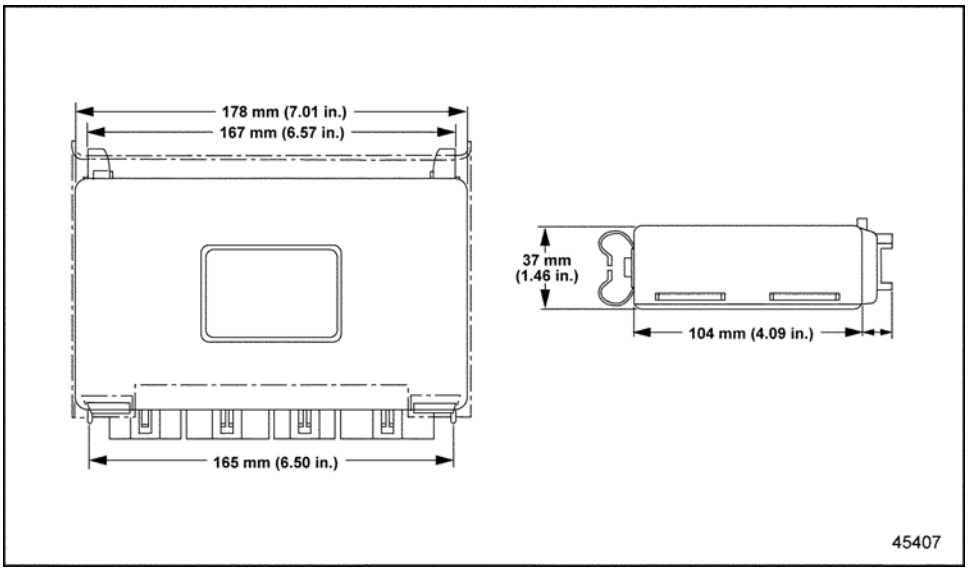


Figure 2. CPC2+ Dimensions

Note: The CPC2+ should be mounted with the connectors pointing down.

Input voltage range BATT+ (U30)	BATT+ Switched (IGN)
Operating Voltage	8 V .. 32 V acc.
Min voltage without RESET	5V
Max. Voltage	36V for 5min.
Jump start	48V for 5min.
Test voltage	24V variant: 28V; 12V variant: 14V
Stand by current at U30	< 1mA; 12...24V
Max allowed current Batt+	8A (2,5 mm² cable needed)
Max allowed current Batt-	10A (2,5 mm² cable needed)
Max allowed current IGN	1A

Table 1. Power Supply

Section 3.2.1
Environmental Conditions

Temperature, vibration, and water intrusion must be considered.

Section 3.2.1.1
Temperature

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

Section 3.2.1.2
Water Intrusion

The CPC2+ is not water tight and cannot be subject to water spray. It must be mounted in an enclosed, protected environment.

Section 3.2.2
CPC2+ 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 39 turns per meter 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 proprietary Powertrain-CAN link between the MCM2, CPC2+, and the ACM2 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 Powertrain-CAN link are located in the CPC2+ and MCM2.

- The ACM2 requires battery power to power down after ignition is OFF.
- ACM2 must not be wired through to disconnect switch.

Section 3.2.2.1
Frequency Input

The CPC2+ 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 "Variable Reluctance Signal Interface" .

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

Table 3. Variable Reluctance Signal Interface

Section 3.2.2.2
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.

Section 3.2.2.3
Digital Outputs

There are 15 digital outputs located on the CPC2+. The high power outputs are listed in Table "High Power Outputs" and the low power outputs are listed in Table "Low Power Outputs" .

Connector	Pin	High Power Outputs	Application

4	9	DO_HP_FLEX_01	OI Active Lamp/Water-in-Fuel Indicator
3	17	DO_HP_FLEX_02	OI Alarm
3	7	DO_HP_HS_01	Top2 Lockout Solenoid/Allison Modulation Valve
3	8	DO_HP_HS_02	Top2 Shift Solenoid
4	10	DO_HP_HS_04	Vehicle Power Shutdown/Ignition Relay
3	9	DO_HP_LS_01	Water-in-Fuel Indicator
4	7	DO_HP_LS_02	High Exhaust System Temperature Lamp

Table 5. High Power Outputs

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

Connector	Pin	Low Power Outputs	Application
1	13	DO_LP_FLEX_01	Malfunction Indicator Lamp
3	10	DO_LP_FLEX_02	DEF (DEF) Low lamp
2	10	DO_LP_FLEX_03	Amber Warning Lamp
3	12	DO_LP_FLEX_04	Fuel Filter Restriction Lamp
3	16	DO_LP_FLEX_05	Red Stop Lamp
1	4	DO_LP_LS_02	Throttle Position Sensor Ground
1	5	DO_LP_LS_01	DPF Regeneration Lamp

Table 7. Low Power Outputs

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

Section 3.2.3
VIH WIRING

The OEM is responsible for the following wiring connectors to:

- Four CPC2+ connectors
- One 21–pin connector to the MCM2
- One 10–pin connector to the Engine Harness
- One ACM2 120–pin connector
- One ACM2 21–pin connector

- Two 14–pin connectors to the Diesel Particulate Filter (DPF/SCR)
- Six DEF doser valve connectors
- One DEF pump connector
- One Air Control Unit connector
- One DEF Tank connector

The connectors and terminal part numbers are listed in the following pages.

Section 3.2.3.1
Truck Applications

The pin assignments for the Common Powertrain Controller (CPC2+) #1 connector (18–pins) for truck applications islisted in Table "Connector #1 Pin Assignments – Truck Application" . 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 "Connector #1, 18–pin Connector, B Key" .

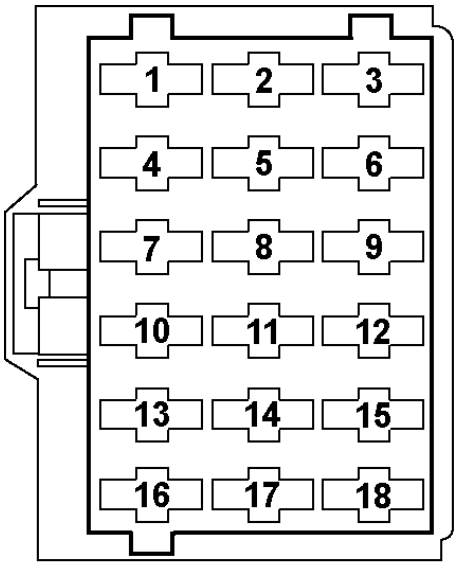
Pin	Signal Type	Function	Connector
1/1	Digital Input_FLEX_01	Dual-speed Axle	 46727 Front Looking into the Pins on the Harness
1/2	Digital Input_FLEX_02	Park Brake Interlock	
1/3	Digital Input_SFP_05	Idle Validation Switch 2 (throttle active)	
1/4	Digital Output_LP_LS_02	Throttle Position Sensor Ground	
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	

Table 9. Connector #1 Pin Assignments – Truck Application

Part	DDC Part Number
CPC2+ - 18 Pin Connector - B Key	018 545 67 26
CPC2+ - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC2+ - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 10. Connector #1, 18–pin Connector, B Key

The pin assignments for the Common Powertrain Controller (CPC2+) #2 connector (18–pins) for truck applications is listed in Table "Connector #2 Pin Assignments – Truck Application" . 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 "Connector #2, 18–pin Connector, A Key" .

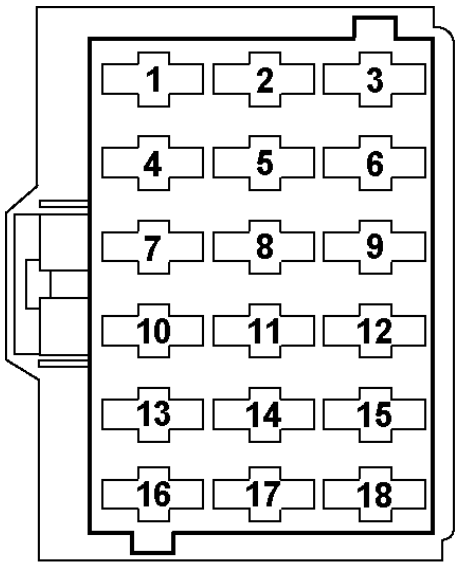
Pin	Signal Type	Function	Connector
2/1	Battery (+) PSU (KL_30)	Main Battery +12 V	
2/2	Battery (-) PSU (KL_31)	Main Battery Ground	
2/3	Battery (+) Switched PSU	Ignition	
2/4	K_DIAG_C	K-line	
2/5	J 1708_A	Not Used	
2/6	J 1708_B	Not Used	
2/7	Digital Input_FLEX_15	Service Brake Released Switch	
2/8	Digital 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 (+)	

Table 11. Connector #2 Pin Assignments – Truck Application

Part	DDC Part Number
CPC2+ - 18 Pin Connector - A Key	013 545 64 26
CPC2+ - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC2+ - socket 1.0-2.5mm wire (single)	013 545 78 26

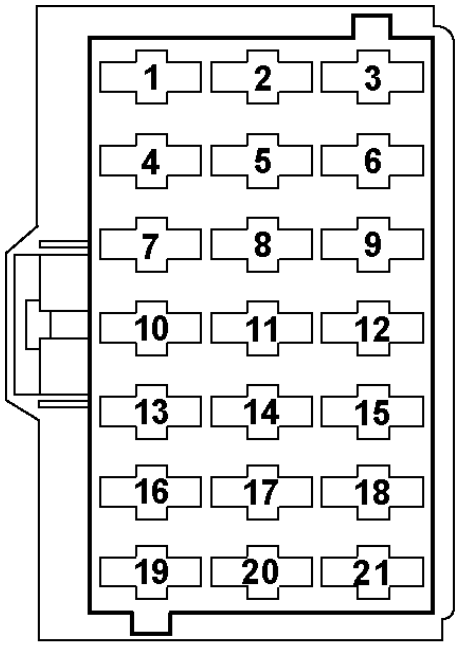
Table 12. Connector #2, 18–pin Connector, A Key

The pin assignments for the Common Powertrain Controller (CPC2+) #3 connector (21–pins) for truck applications islisted in Table "Connector #3 Pin Assignments – Truck Application" . 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 "Connector #3, 21–pin Connector, Key A" .

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
3/8	Digital Output_HP_HS_02	Top2 Shift Solenoid
3/9	Digital Output_HP_LS_01	WIF Lamp
3/10	Digital Output_LP_FLEX_02	DEF Low Lamp
3/11	SFP_14	Low Coolant Level Sensor
3/12	Digital Output_LP_FLEX_04	Fuel Filter Restriction Lamp
3/13	SFP_09	Vehicle Speed (+)
3/14	SF_VGND	Vehicle Speed (-)
3/15	Analog_In_SFP_13	Ambient Air Temp 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
3/19	PTCAN_L 5V	Powertrain CAN (-)
3/20	PTCAN_GND 5V	Powertrain CAN Shield
3/21	PTCAN_H 5V	Powertrain CAN (+)



Looking into the Pins on the Harness

Table 13. Connector #3 Pin Assignments – Truck Application

Part	DDC Part Number
CPC2+ - 21 Pin Connector - A Key	013 545 65 26
CPC2+ - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC2+ - socket 1.0-2.5mm wire (single)	A 013 545 78 26

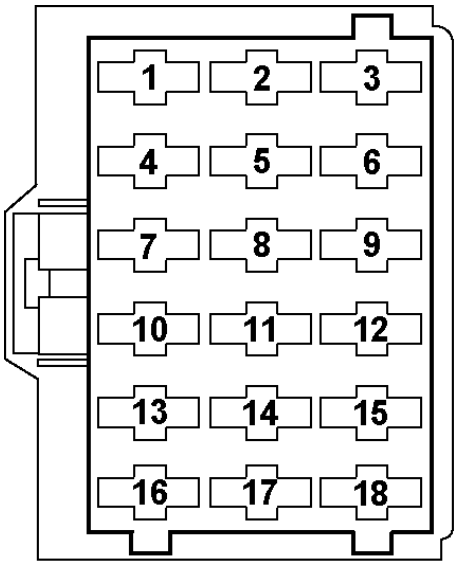
Table 14. Connector #3, 21–pin Connector, Key A

The pin assignments for the Common Powertrain Controller (CPC2+) #4 connector (18–pins) for truck applications is listed in Table "Connector #4 Pin Assignments – Truck Application" . 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 "Connector #4, 18–pin Connector, Key C" .

Pin	Signal Type	Function	Connector
4/1	C_ECAN_L	Not Used	
4/2	C_ECAN_GND	Not Used	

4/3	C_ECAN_H	Not Used
4/4	Digital Input_SFP_11	Not Used
4/5	Digital Input_SFP_12	Not Used
4/7	Digital Output_HP_LS_02	High Exhaust Temperature Lamp
4/8	Digital Input_FLEX_E1	Clutch Released
4/9	Digital Output_HP_FLEX_01	OI Active Lamp / WIF
4/10	Digital Output_HP_HS_04	Vehicle Power Shutdown / IGN Relay
4/11	Frequency_SFP_10	Not Used
4/12	PWM_FPO_01	Vehicle Speed Output
4/13	Digital Input__FLEX_19	DPF Inhibit Switch
4/14	Digital Input_SFP_03	Not Used
4/15	Digital Input_SFP_04	Not Used
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



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Looking into the Pins on the Harness

Table 15. Connector #4 Pin Assignments – Truck Application

Part	DDC Part Number
CPC2+ - 18 Pin Connector - C Key	018 545 68 26
CPC2+ - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC2+ - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 16. Connector #4, 18–pin Connector, Key C

Section 3.2.3.2
Vocational Applications

The pin assignments for the Common Powertrain Controller (CPC2+) #1 connector (18–pin) for vocational applications are listed in Table "Connector #1 Pin Assignments – Vocational Applications" . 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 "Connector #1, 18–pin Connector, B Key" .

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

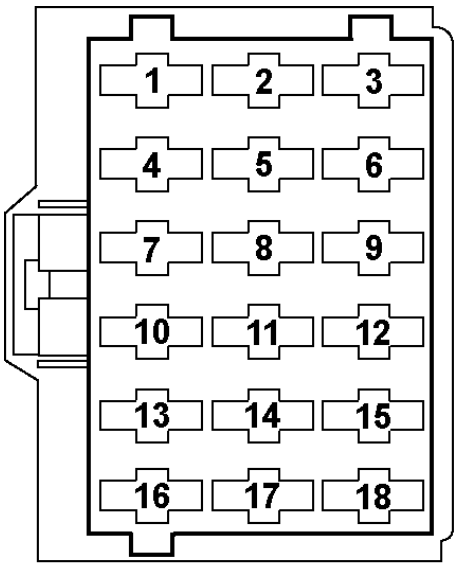

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Table 17. Connector #1 Pin Assignments – Vocational Applications

Part	DDC Part Number
CPC2+ - 18 Pin Connector - B Key	018 545 67 26
CPC2+ - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC2+ - socket 1.0-2.5mm wire (single)	013 545 78 26

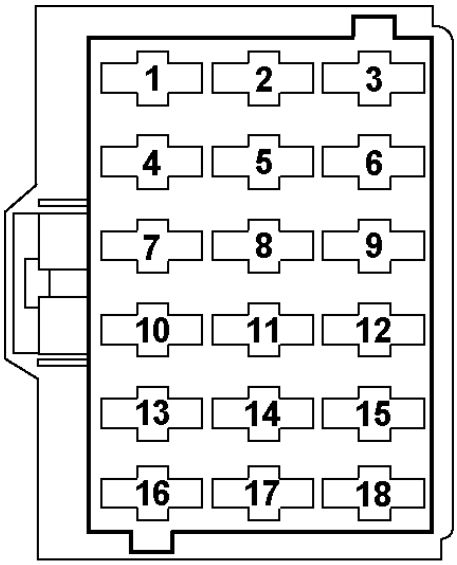
Table 18. Connector #1, 18–pin Connector, B Key

The pin assignments for the Common Powertrain Controller (CPC2+) #2 connector (18–pin) for vocational applications are listed in Table "Connector #2 Pin Assignments – Vocational Applications" . 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 "Connector #2, 18–pin Connector, A Key" .

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	J 1708_A	Not Used	
2/6	J 1708_B	Not Used	
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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Looking into the Pins on the Harness

Table 19. Connector #2 Pin Assignments – Vocational Applications

Part	DDC Part Number
CPC2+ - 18 Pin Connector - A Key	013 545 64 26
CPC2+ - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC2+ - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 20. Connector #2, 18–pin Connector, A Key

The pin assignments for the Common Powertrain Controller (CPC2+) #3 connector (21–pin) for vocational applications are listed in Table "Connector #3 Pin Assignments – Vocational Applications" . 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 "Connector #3, 21–pin Connector, Key A" .

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	DEF Low 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 Temp 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
3/19	PTCAN_L 5V	Powertrain CAN (-)
3/20	PTCAN_GND 5V	Powertrain CAN Shield
3/21	PTCAN_H 5V	Powertrain CAN (+)

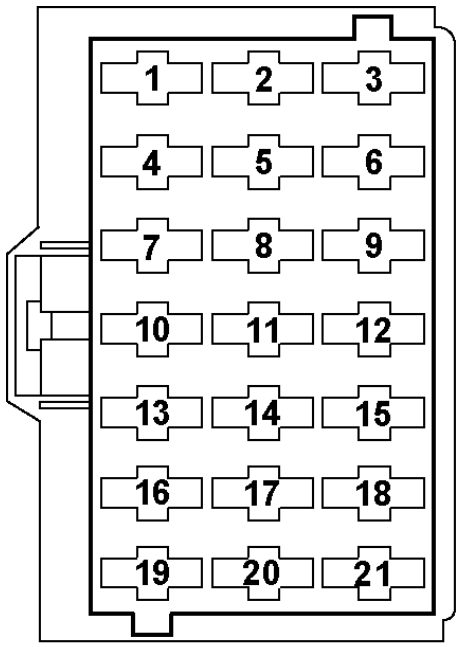


Table 21. Connector #3 Pin Assignments – Vocational Applications

Part	DDC Part Number
CPC2+ - 21 Pin Connector - A Key	013 545 65 26
CPC2+ - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC2+ - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 22. Connector #3, 21–pin Connector, Key A

The pin assignments for the Common Powertrain Controller (CPC2+) #4 connector (18–pin) for vocational applications are listed in Table "Connector #4 Pin Assignments – Vocational Applications" . 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 "Connector #4, 18–pin Connector, Key C" .

Pin	Signal Type	Function	Connector
4/1	C_ECAN_L	Not Used	
4/2	C_ECAN_GND	Not Used	
4/3	C_ECAN_H	Not Used	

4/4	Digital Input_SFP_11	Not Used
4/5	Digital Input_SFP_12	Not Used
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	Not Used
4/11	Frequency_SFP_10	Not Used
4/12	PWM_FPO_01	Vehicle Speed Output
4/13	Digital Input__FLEX_19	DPF Inhibit Switch
4/14	Digital Input_SFP_03	Not Used
4/15	Digital Input_SFP_04	Not Used
4/16	Digital Input_FLEX_17	Trans Neutral Switch
4/17	Digital Input_FLEX_21	DPF Regeneration Switch
4/18	Digital Input_FLEX_18	Not Used

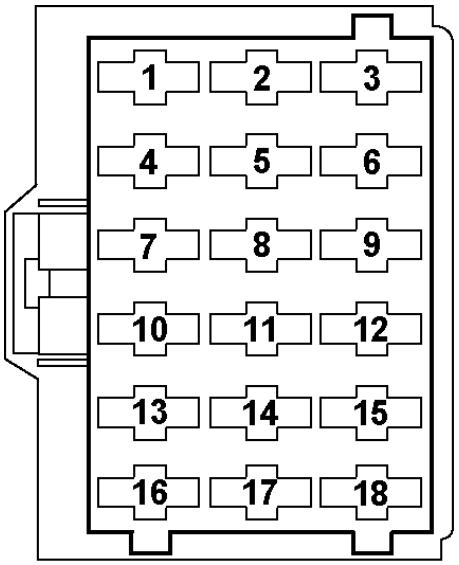


Table 23. Connector #4 Pin Assignments – Vocational Applications

Part	DDC Part Number
CPC2+ - 18 Pin Connector - C Key	018 545 68 26
CPC2+ - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC2+ - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 24. Connector #4, 18–pin Connector, Key C

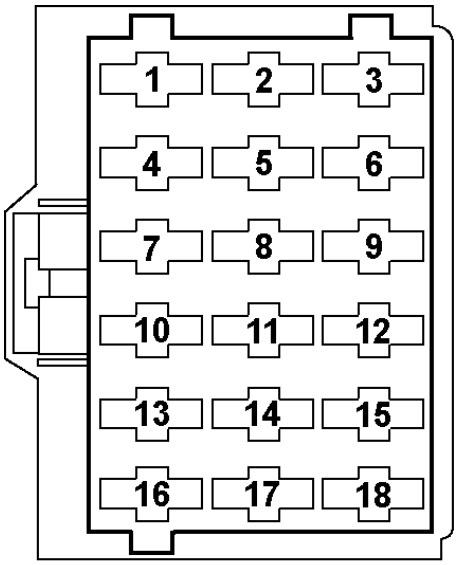
Section 3.2.3.3
Coach Applications

The pin assignments for the Common Powertrain Controller (CPC2+) #1 connector (18–pin) for coach applications are listed in Table "Connector #1 Pin Assignments – Coach Application" .

The part numbers for the #1 connector, Key B and terminals are listed in Table "Connector #1, 18–pin Connector, B Key" .

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	Tachometer
1/10	Digital Input_FLEX_20	Retarder Level Stage 0
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	Retarder Level Stage 4
1/18	SFP_01	Run Start



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Looking into the Pins on the Harness

Table 25. Connector #1 Pin Assignments – Coach Application

Part	DDC Part Number
CPC2+ - 18 Pin Connector - B Key	018 545 67 26
CPC2+ - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC2+ - socket 1.0-2.5mm wire (single)	013 545 78 26

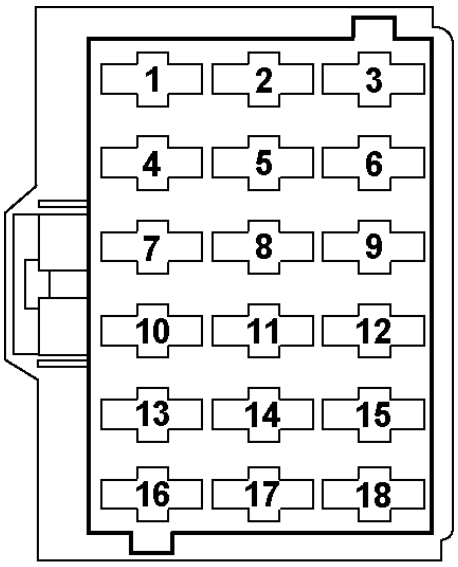
Table 26. Connector #1, 18–pin Connector, B Key

The pin assignments for the Common Powertrain Controller (CPC2+) #2 connector (18–pin) for coach applications are listed in Table "Connector #2 Pin Assignments – Coach Application" .

The part numbers for the #2 connector, Key A and terminals are listed in Table "Connector #2, 18–pin Connector, A Key" .

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	J 1708_A	Not Used	
2/6	J 1708_B	Not Used	
2/7	Digital Input_FLEX_15	Service Brake Released Switch	
2/8	Digital Input_FLEX_16	Retarder Level Stage 3	
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	Retarder Level Stage 5
2/14	Digital Input_FLEX_13	Retarder Level Stage 1
2/15	Digital Input_FLEX_14	Retarder Level Stage 2
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 27. Connector #2 Pin Assignments – Coach Application

Part	DDC Part Number
CPC2+ - 18 Pin Connector - A Key	013 545 64 26
CPC2+ - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC2+ - socket 1.0-2.5mm wire (single)	013 545 78 26

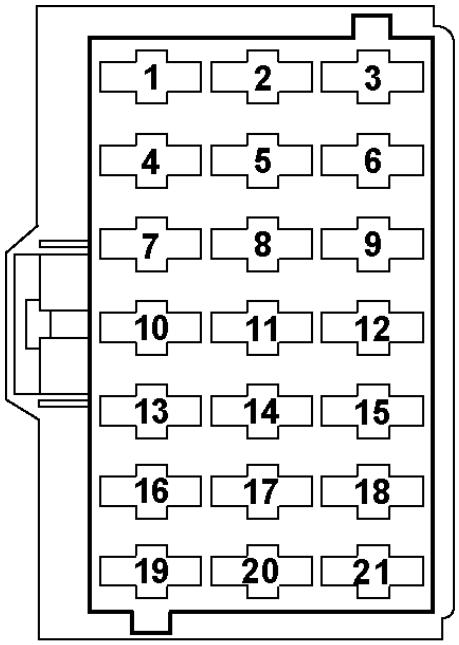
Table 28. Connector #2, 18–pin Connector, A Key

The pin assignments for the Common Powertrain Controller (CPC2+) #3 connector (21–pin) for coach applications are listed in Table "Connector #3 Pin Assignments – Coach Application" .

The part numbers for the #3 connector, Key A and terminals are listed in Table "Connector #3, 21–pin Connector, Key A" .

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	DEF Low Lamp
3/11	SFP_14	Low Coolant Level Sensor
3/12	Digital Output_LP_FLEX_04	Low Battery Voltage 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	PTCAN_L 5V	Powertrain CAN (-)
3/20	PTCAN_GND 5V	Powertrain CAN Shield
3/21	PTCAN_H 5V	Powertrain CAN (+)



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Looking into the Pins on the Harness

Table 29. Connector #3 Pin Assignments – Coach Application

Part	DDC Part Number
CPC2+ - 21 Pin Connector - A Key	013 545 65 26
CPC2+ - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC2+ - socket 1.0-2.5mm wire (single)	013 545 78 26
CPC2+ - socket 1.0-2.5mm wire (strip)	—

Table 30. Connector #3, 21–pin Connector, Key A

The pin assignments for the Common Powertrain Controller (CPC2+) #4 connector (18–pin) for coach applications are listed in Table "Connector #4 Pin Assignments – Coach Application" .

The part numbers for the #4 connector, Key C and terminals are listed in Table "Connector #4, 18–pin Connector, Key C" .

Pin	Signal Type	Function	Connector
4/1	C_ECAN_L	Not Used	
4/2	C_ECAN_GND	Not Used	
4/3	C_ECAN_H	Not Used	

4/4	Digital Input_SFP_11	Not Used
4/5	Digital Input_SFP_12	Not Used
4/7	Digital Output_HP_LS_02	High Exhaust 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 / IGN Relay
4/11	Frequency_SFP_10	Not Used
4/12	PWM_FPO_01	Not Used
4/13	Digital Input__FLEX_19	DPF Inhibit Switch
4/14	Digital Input_SFP_03	Not Used
4/15	Digital Input_SFP_04	Not Used
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

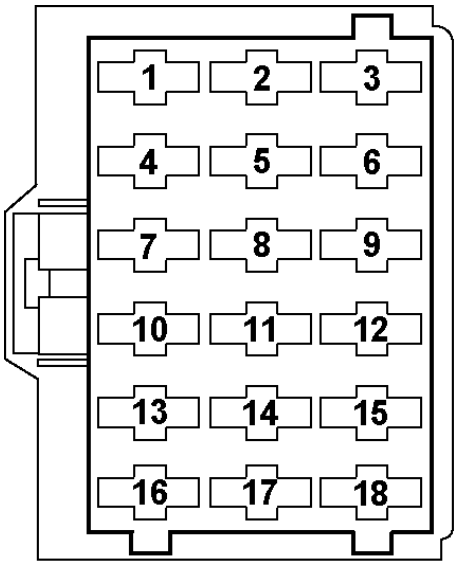

Table 31. Connector #4 Pin Assignments – Coach Application

Part	DDC Part Number
CPC2+ - 18 Pin Connector - C Key	018 545 68 26
CPC2+ - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC2+ - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 32. Connector #4, 18–pin Connector, Key C

Section 3.2.3.4
Fire Truck Applications

The pin assignments for the Common Powertrain Controller #1 connector (18–pin) for fire truck applications are listed in Table "Connector #1 Pin Assignments – Fire Truck Application" .

The part numbers for the #1 connector, Key B and terminals are listed in Table "Connector #1, 18–pin Connector, B Key" .

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	Tachometer
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

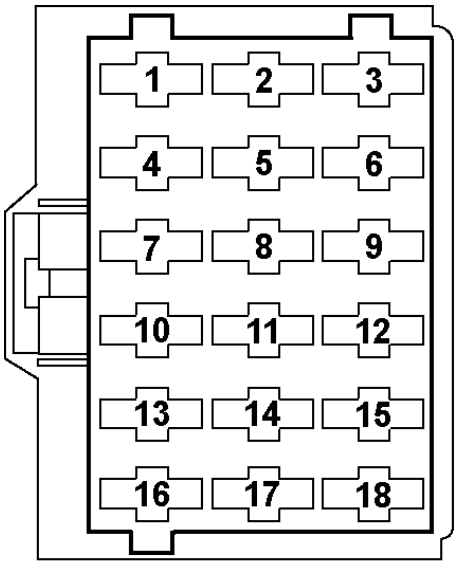

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Table 33. Connector #1 Pin Assignments – Fire Truck Application

Part	DDC Part Number
CPC2+ - 18 Pin Connector - B Key	018 545 67 26
CPC2+ - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC2+ - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 34. 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 "Connector #2 Pin Assignments – Fire Truck Application" .

The part numbers for the #2 connector, Key A and terminals are listed in Table "Connector #2, 18–pin Connector, A Key" .

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	J 1708_A	Not Used	
2/6	J 1708_B	Not Used	
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 (+)

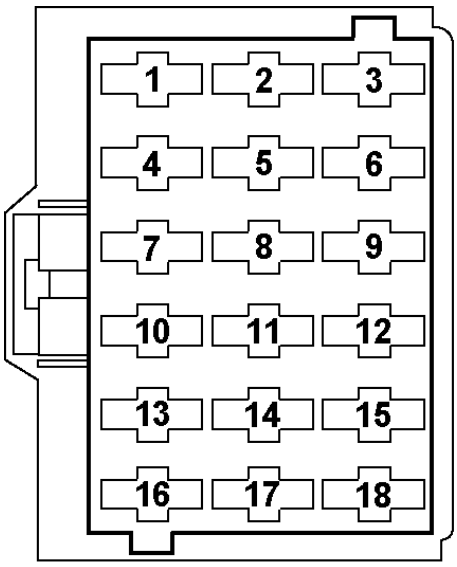

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Table 35. Connector #2 Pin Assignments – Fire Truck Application

Part	DDC Part Number
CPC2+ - 18 Pin Connector - A Key	013 545 64 26
CPC2+ - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC2+ - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 36. 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 "Connector #3 Pin Assignments – Fire Truck Application" .

The part numbers for the #3 connector, Key C and terminals are listed in Table "Connector #3, 21–pin Connector, Key A" .

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	Water in Fuel
3/10	Digital Output_LP_FLEX_02	DEF 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 Temp Sensor
3/16	Digital Output_LP_FLEX_05	Red Stop Lamp
3/17	Digital Output_HP_FLEX_02	Low Coolant Lamp
3/18	Digital Input_SFP_02	Not Used
3/19	PTCAN_L 5V	Powertrain CAN (-)
3/20	PTCAN_GND 5V	Powertrain CAN Shield
3/21	PTCAN_H 5V	Powertrain CAN (+)

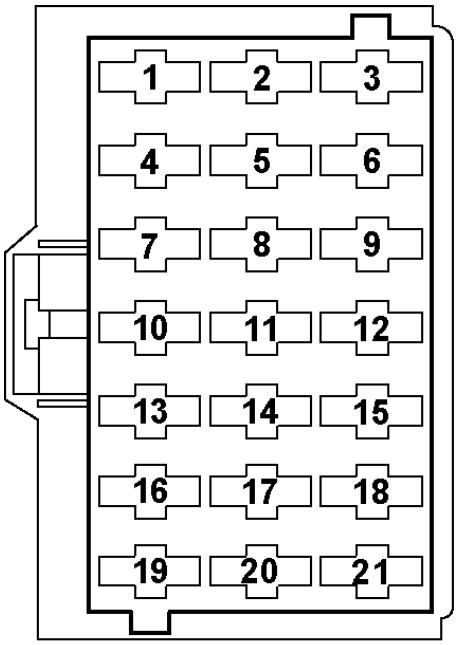


Table 37. Connector #3 Pin Assignments – Fire Truck Application

Part	DDC Part Number
CPC2+ - 21 Pin Connector - A Key	013 545 65 26
CPC2+ - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC2+ - socket 1.0-2.5mm wire (single)	A 013 545 78 26

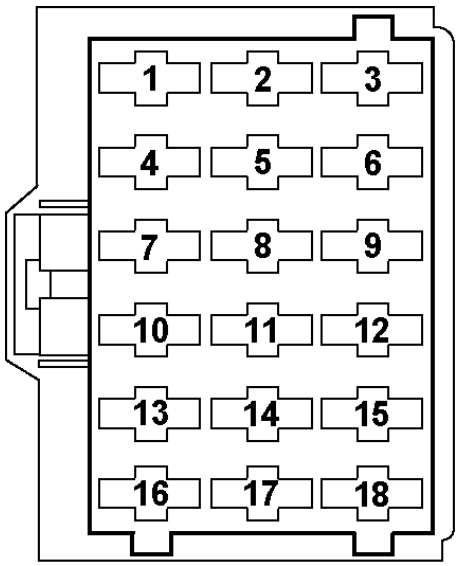
Table 38. Connector #3, 21–pin Connector, Key A

The pin assignments for the Common Powertrain Controller #4 connector (18–pin) for fire truck applications are listed in Table "Connector #4 Pin Assignments – Fire Truck Application" .

The part numbers for the #4 connector, Key C and terminals are listed in Table "Connector #4, 18–pin Connector, Key C" .

Pin	Signal Type	Function	Connector
4/1	C_ECAN_L	Not Used	
4/2	C_ECAN_GND	Not Used	
4/3	C_ECAN_H	Not Used	
4/4	Digital Input_SFP_11	Not Used	

4/5	Digital Input_SFP_12	Not Used
4/7	Digital Output_HP_LS_02	High Exhaust Temperature Lamp
4/8	Digital Input_FLEX_E1	Not Used
4/9	Digital Output_HP_FLEX_01	Cruise Active Lamp
4/10	Digital Output_HP_HS_04	Engine Brake Active
4/11	Frequency_SFP_10	Not Used
4/12	PWM_FPO_01	Not Used
4/13	Digital Input__FLEX_19	DPF Inhibit Switch
4/14	Digital Input_SFP_03	Not Used
4/15	Digital Input_SFP_04	Not Used
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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Looking into the Pins on the Harness

Table 39. Connector #4 Pin Assignments – Fire Truck Application

Part	DDC Part Number
CPC2+ - 18 Pin Connector - C Key	018 545 68 26
CPC2+ - socket 0.5-1.0mm wire (single)	013 545 76 26
CPC2+ - socket 1.0-2.5mm wire (single)	013 545 78 26

Table 40. Connector #4, 18–pin Connector, Key C

Section 3.2.3.5
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 "Wire Characteristics" .

SAE Wire Gauge	Metric Gauge #	Area mm^2	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 41. 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.

Section 3.2.3.6
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.

Communications to a Scan Tool: All OBD control modules (e.g., engine, auxiliary emission control module) on a single vehicle shall use the same protocol for communication of required emission-related messages from on-board to off-board network communications to a scan tool meeting SAE J1978 specifications or designed to communicate with an SAE J1939 network.

The OBD system shall use the following standardized protocol: SAE J1939. This protocol may only be used on vehicles with diesel engines.

Vehicle Identification Number: All vehicles shall have the vehicle identification number (VIN) available in a standardized format through the standardized data link connector in accordance with SAE J1979/J1939 specifications. Only one electronic control unit per vehicle shall report the VIN to an SAE J1978/J1939 scan tool.

If the VIN is reprogrammed, all emission-related diagnostic information identified shall be erased in conjunction with reprogramming of the VIN.

NOTICE:

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

The CPC2+ connector pin assignments for SAE J1939 are listed in Table "J1939 CPC2+ to VIH Connector Pin Assignments" .

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

Table 43. J1939 CPC2+ 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	Tyco Electronics Corporation
2200 U.S. 27 South	Raychem Wire & Harnessing
Richmond, IN 47374	300 Constitution Drive
Phone: 1–650–361–3333	Menlo Park, CA 94025
www.belden.com	www.raychem.com

Section 3.2.3.7
Communications – Proprietary Powertrian-CAN Data Link

The proprietary Powertrain-CAN link between the MCM2, CPC2+, and the ACM2 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 Powertrain-CAN link are located in the CPC2+ and ACM2. The wiring for the MCM2 21–pin connector and the CPC2+ 18–pin #4 connector are listed in Table "Proprietary Engine-CAN Data Link" .

CPC2+ 18–Pin #4 Connector	Function	MCM2 21–Pin Connector
3/21	Powertrain-CAN Data Link (+)	21/13
3/19	Powertrain-CAN Data Link (-)	21/19
3/20	Powertrain-CAN Data Link (Shield)	21/10
3/20	Powertrain-CAN Data Link (Shield)	21/19

Table 46. Proprietary Engine-CAN Data Link

Section 3.2.4
Power Supply – 12 Volt System

Normal operating voltage on a 12 V system for the CPC2+ and MCM2 is 11-16 VDC.

NOTICE:

Operating the CPC2+ or MCM2 over the voltage limits of 16 volts will cause damage to the CPC2+ or MCM2.

Operating the CPC2+ and/or MCM2 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 CPC2+ and/or MCM2 if the Power Harness is not properly fused.

Note: All output loads, ignition and CPC2+ power must be powered from the same battery voltage source.

Section 3.2.4.1
Average Current Draw

The maximum average current draw is listed in Table "Maximum Average Current Draw" . This information should be used to size the alternator.

System	Maximum Average Current Draw (12 V Nominal Supply)		
	Crank	Idle	Full Load/Rated Speed
MCM2 – Engine Loads	4.0 A avg	21.0 A avg	25.0 A avg
CPC2+ – Vehicle Loads*	18.0 A peak	55.0 A peak	55.0 A peak

Table 49. Maximum Average Current Draw

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

The current draw for a CPC2+ configuration is listed in Table "Current Draw for CPC2+ Configuration" .

Configuration	Condition	Current
CPC2+	Ignition Off	<1 mA
	Ignition On and Engine Stopped	120 mA

Table 50. Current Draw for CPC2+ Configuration

The current draw for a MCM2 is listed in Table "Current Draw for MCM2 Configuration" .

Configuration	Condition	Current
MCM2	Ignition Off	<1 mA
	Ignition On and Engine Stopped	400 mA

Table 51. Current Draw for MCM2 Configuration

Overall maximum ACM2 current capability is 50.0 amps.

Loads	Current — amps	
	Actual Load	ACM2 Capability

	Imax (avg)	Imax (pk)	Imax (avg)	Imax (pk)
ACM2 Quiescent Draw	0.5	0.5	0.5	0.5
Sensors	0.2	0.2	0.3	0.3
NOx1 — engine out	1.0	12.0	8.0	16.0
NOx2 — tailpipe out	1.0	12.0	8.0	16.0
Pump	0.5	1.0	2.0	2.0
Injector	2.0	2.0	2.0	2.0
Diffuser Heater	2.0	2.0	2.0	2.0
Compressed Air Solenoid	1.5	1.5	1.5	1.5
Engine Coolant Solenoid	1.5	1.5	1.5	1.5
Electric Line Heaters	9.0	9.0	9.0	9.0
Total	19.2	41.7	34.8	50.8

Table 52. ACM2 Current

Section 3.2.4.2
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.

Section 3.2.4.3
Main Power Shutdown

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

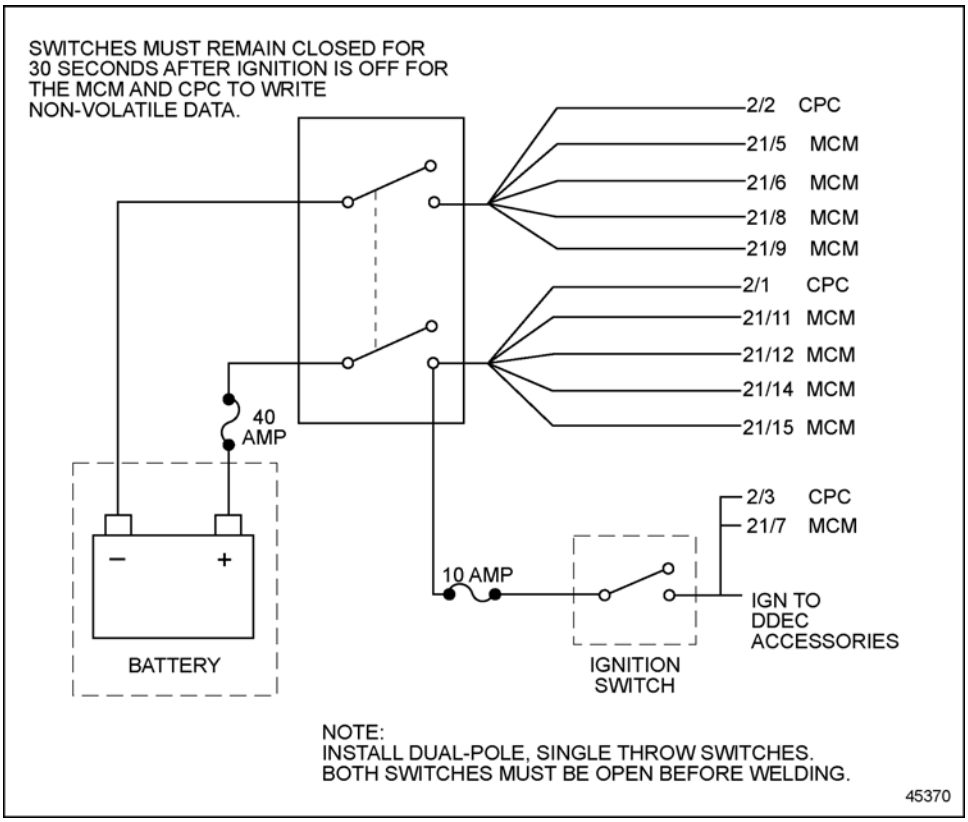

Figure 3. Main Power Supply Shutdown

Note: Switches must remain closed for 30 seconds after ignition is off for the MCM2 and CPC2+ 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 CPC2+ 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.

Section 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 CPC2+ – MCM2'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 MCM2 or CPC2+ 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 "Fuse Current and Blow Time" and Table "Fuse Temperature and Current" .

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

Table 56. Fuse Current and Blow Time

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

Table 57. Fuse Temperature and Current

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