



M2 Multiplexing – EMTSP

October 6, 2010
Bryan Howard



Today's Agenda

M2 Multiplexing - The Basics

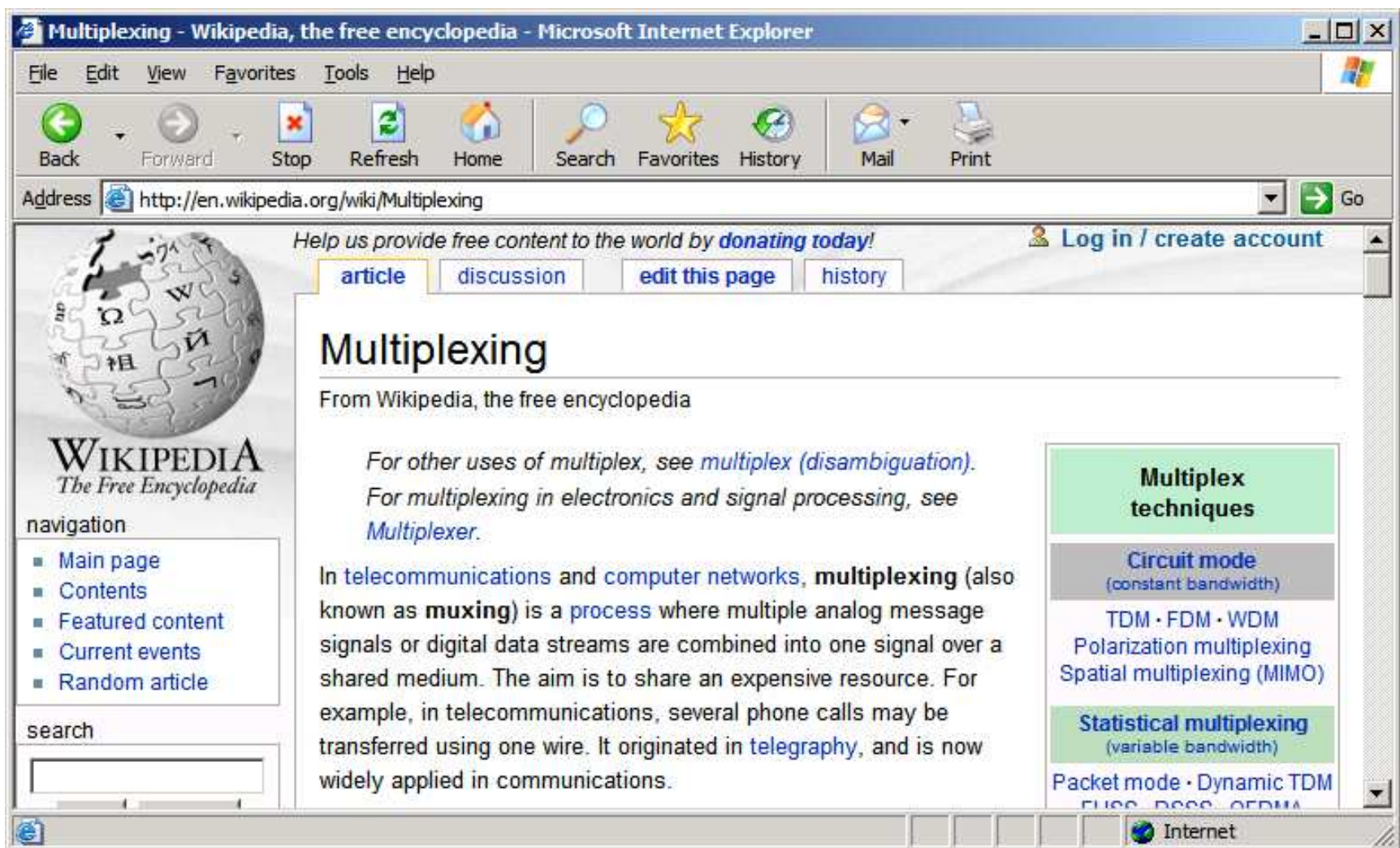
- What is Multiplexing??
- Basic M2 Multiplex Components
- Multiplexing Programming Example
- M2 Resources

Multiplexing – Why is it important?

- Multiplexing is important because it has a Direct Impact on a Users Bottom Line
 - A Vocational truck has no value until a body is installed
 - The ability of a truck to work seamlessly with the body has Value
 - Truck function can complement the Body
 - Facilitation of End customers Business
 - Has the opportunity to enhance Vehicle Safety
- It can significantly simplify Installation for Body Builder if done correctly
 - Can Prevent Cutting up Cabs
 - Reduces Wiring
 - Centralizes Connections
 - Programmable
 - Creates Infinite number of Interlocking options

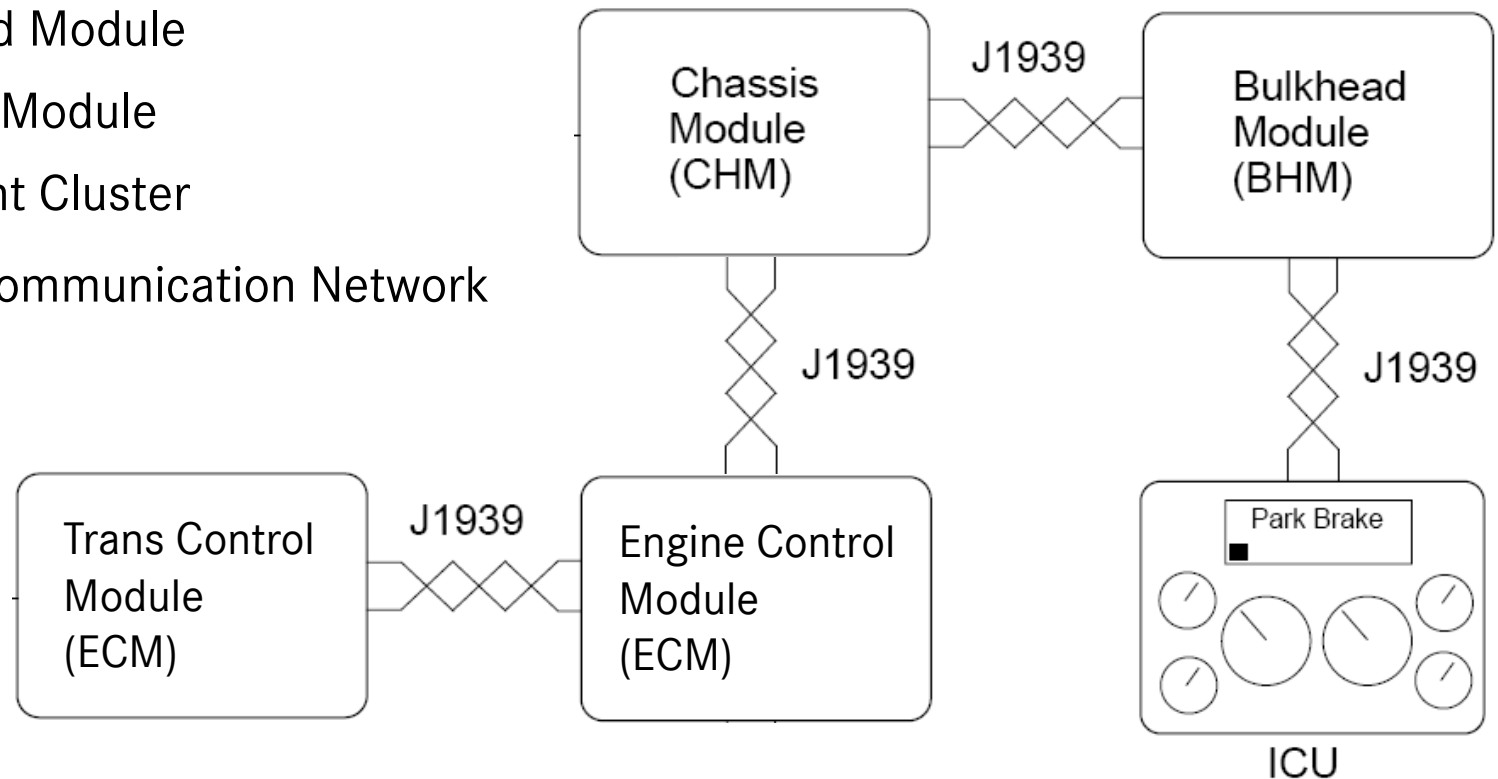
What is Multiplexing?

- Multiplexing – Sending multiple electronic messages through the same signal path at the same time.



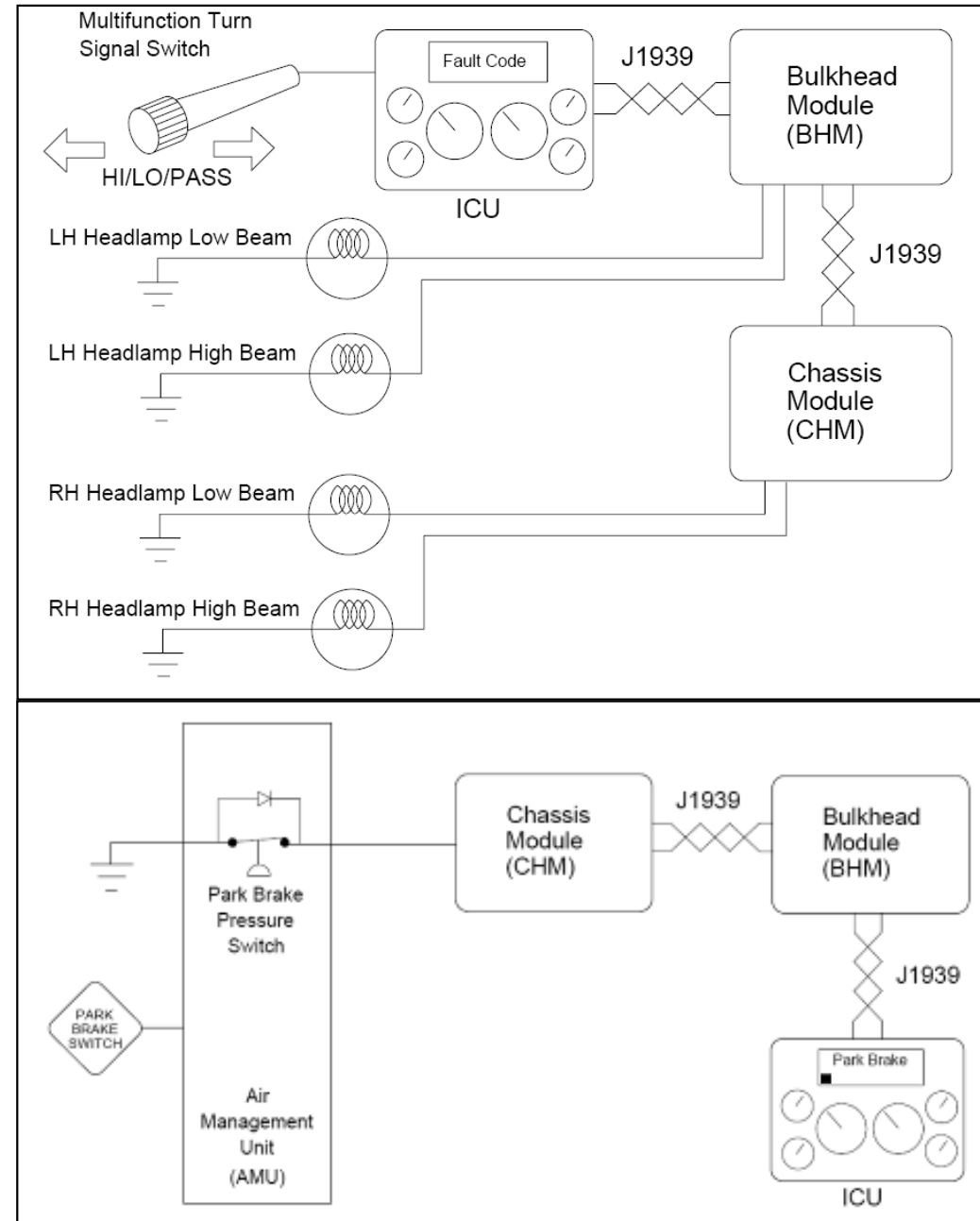
Multiplexing - Computer Network for your Truck

- Multiplexing can be compared to a computer network
- Multiple Control Modules communicate with each other to coordinate truck functions
 - ECM – Engine Control Module
 - TCM – Transmission Control Module
 - BHM – Bulkhead Module
 - CHM – Chassis Module
 - ICU – Instrument Cluster
- J1939 Data link – Communication Network



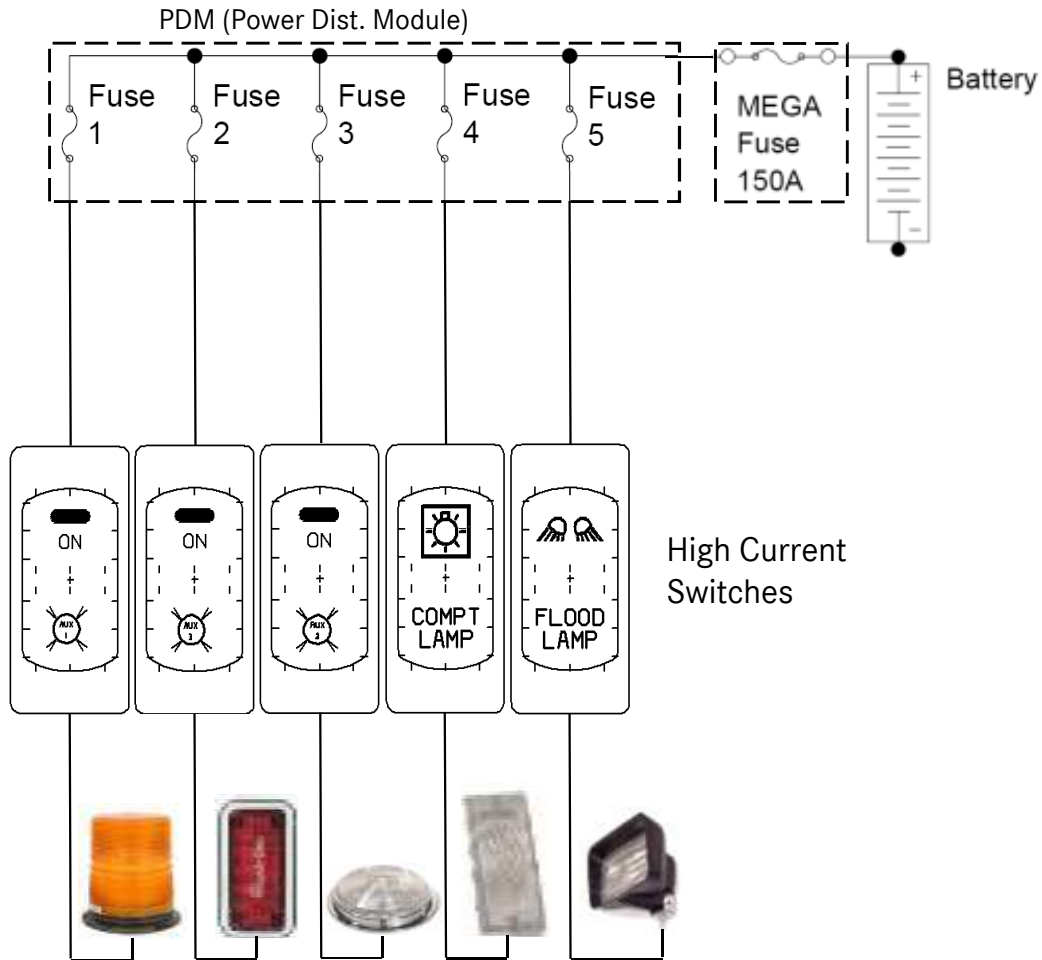
Multiplexing – Common Terms

- Parameter – Computer code (programming) used to customize the configuration of the system.
- Input – A device that feeds a signal into the system, or signal that feeds a message into the system.
- Output – The signal or message that comes out of a system component or device.
- High Current Switch – A switch in which the power to operate a piece of equipment flows through the switch (Hard Wired Switch).
- Low Current Switch – A switch that only signals the system to activate a feature (Smart Switch).

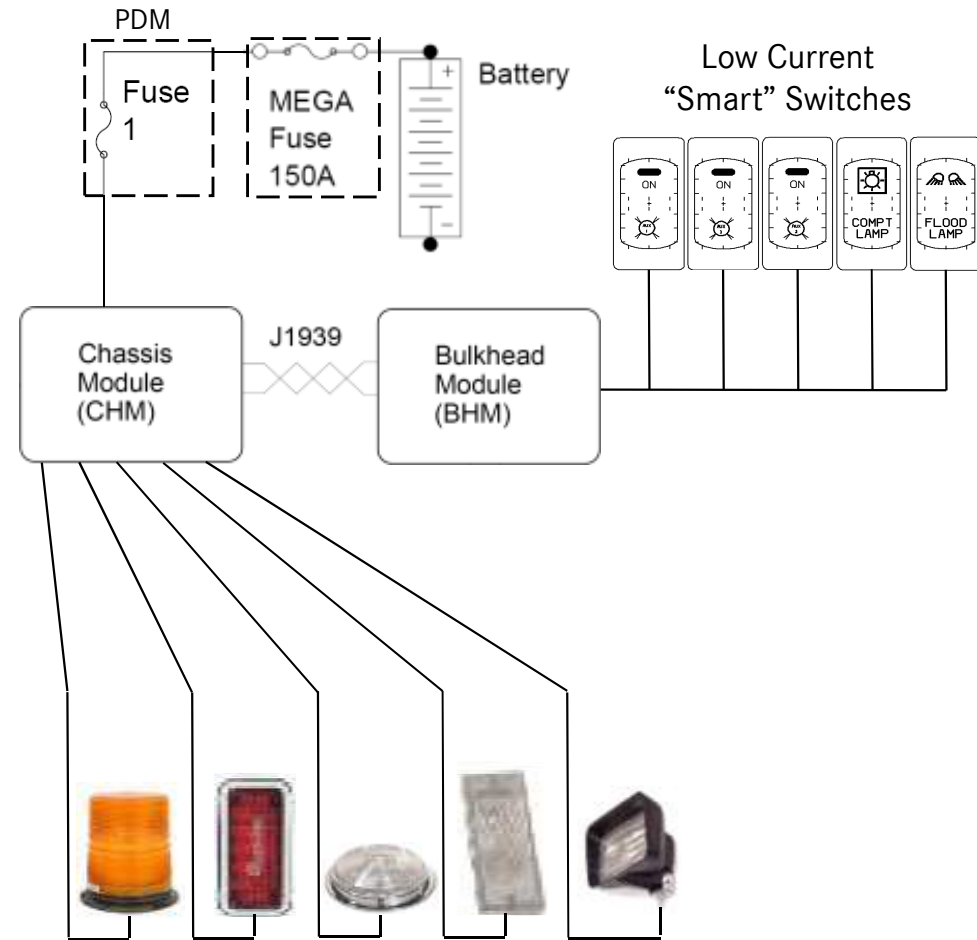


What is Multiplexing?

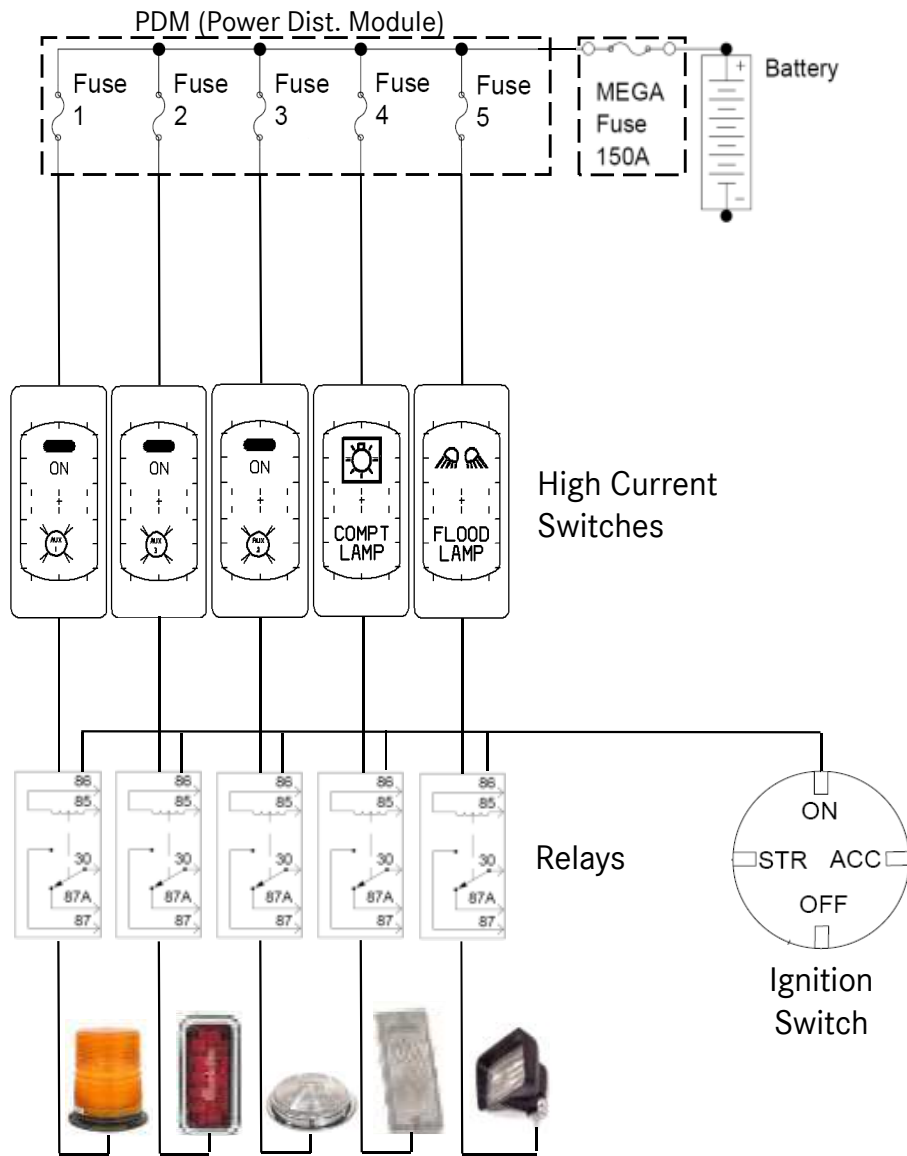
"Hard Wired" – Fused and Relayed



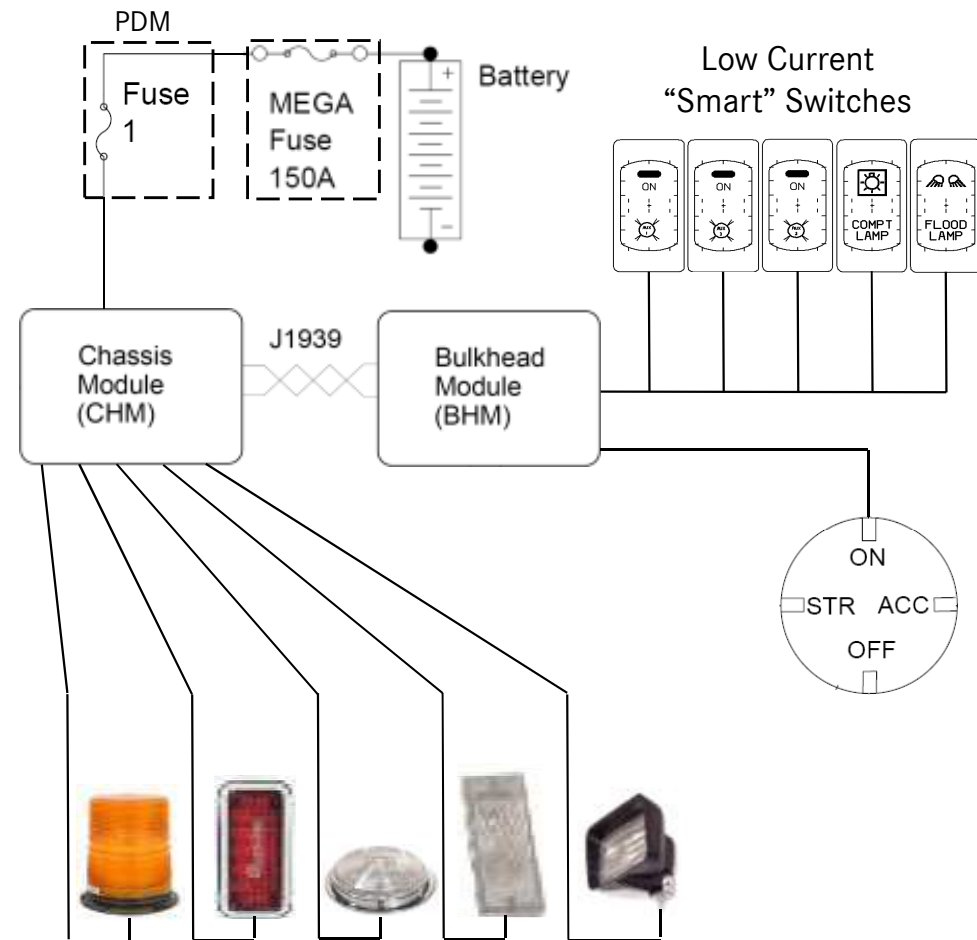
Multiplexed



"Hard Wired" – Fused and Relayed

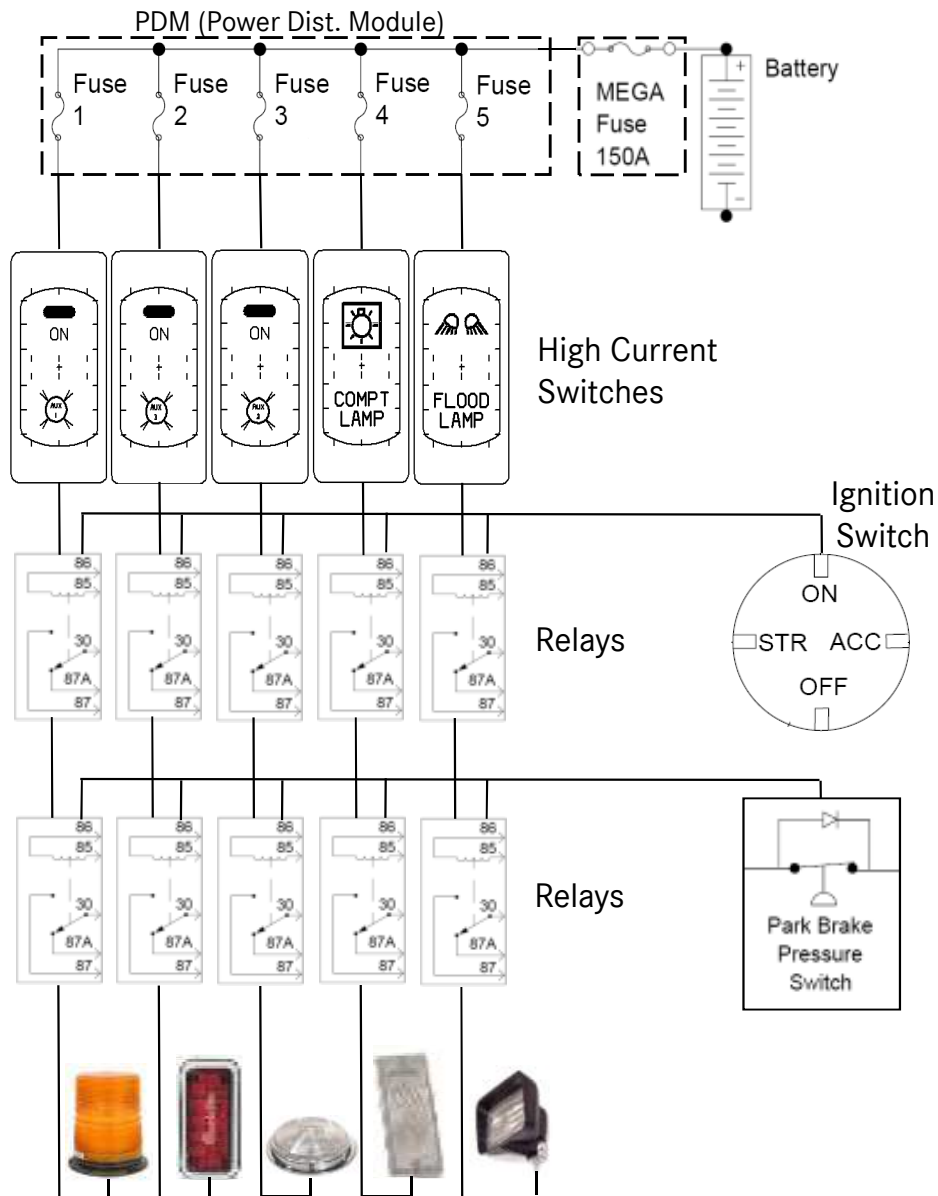


Multiplexed

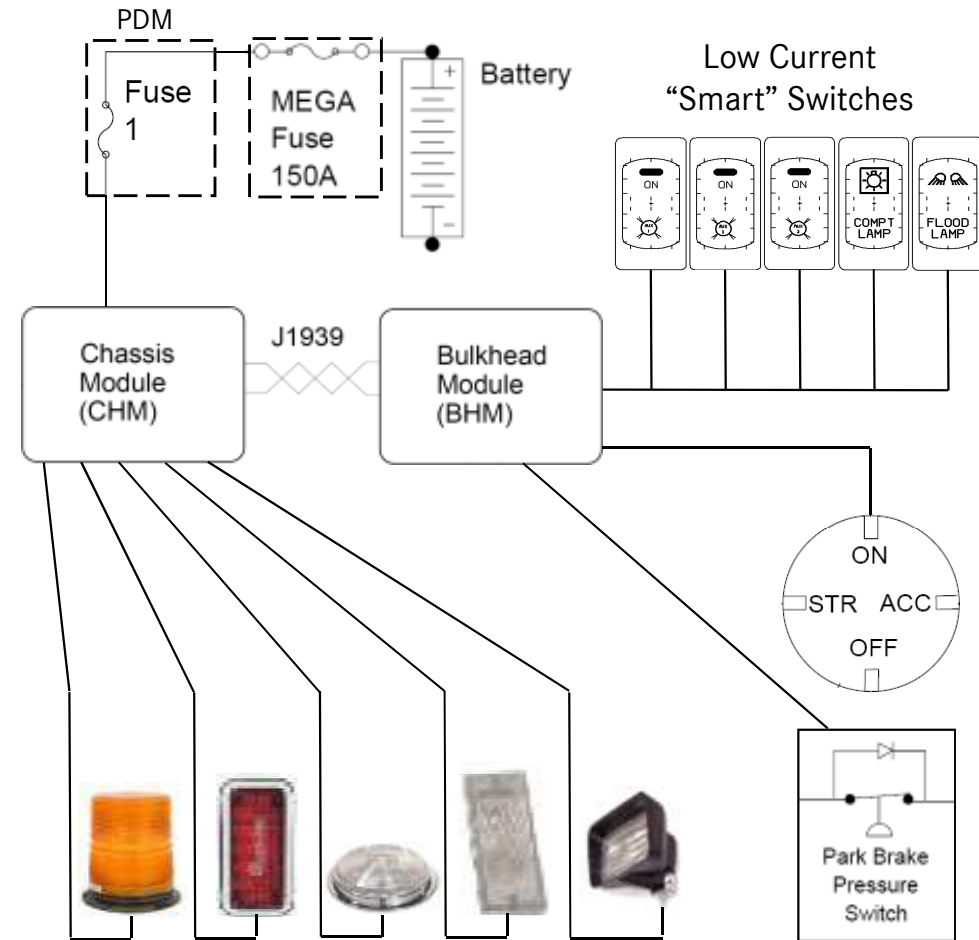


Parameter Change Only!

"Hard Wired" – Fused and Relayed



Multiplexed



Parameter Change Only!

M2 Multiplexing System Components

Stalk Switch



Standard and Vehicle Switches



Smart Switches



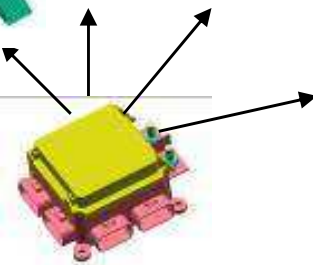
Fuel Level



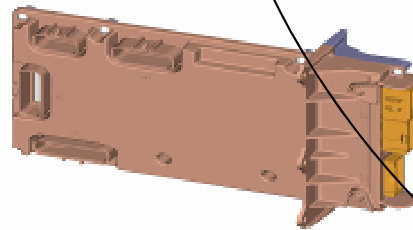
Throttle Pedal



Underhood PDM (Power Distribution Module)



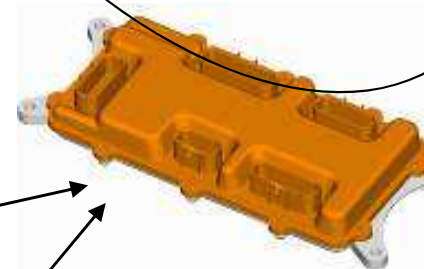
Instrument Cluster



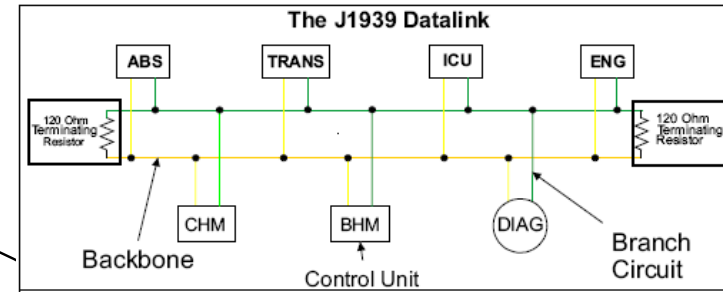
Bulkhead Module

Park Brake Switch

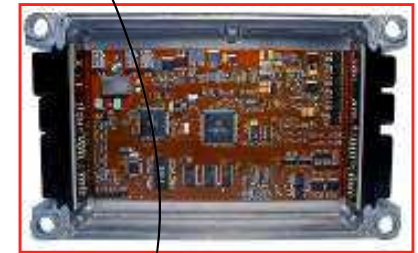
Service Brake Switch



Chassis Module



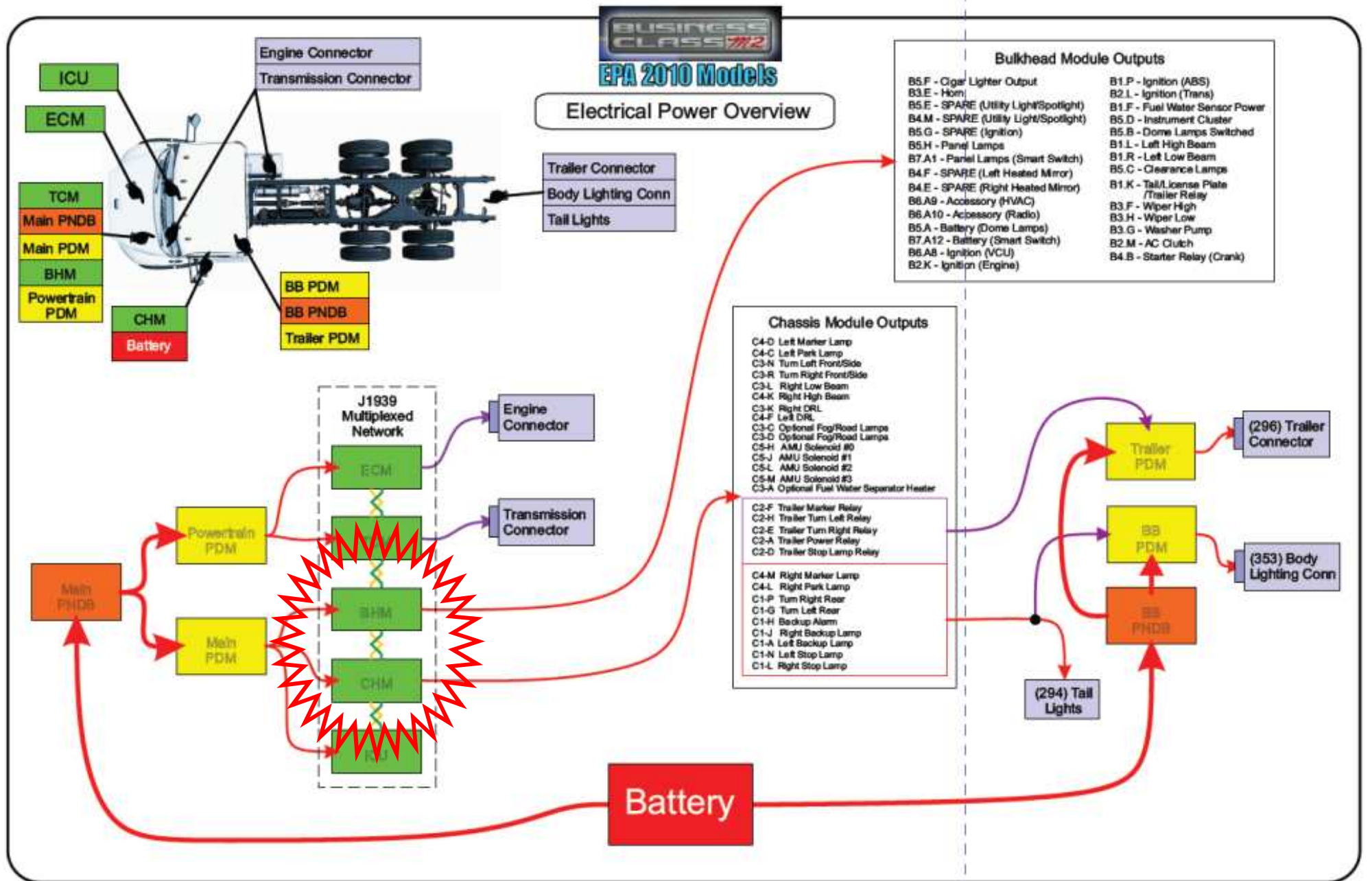
ABS ECU



Engine ECU

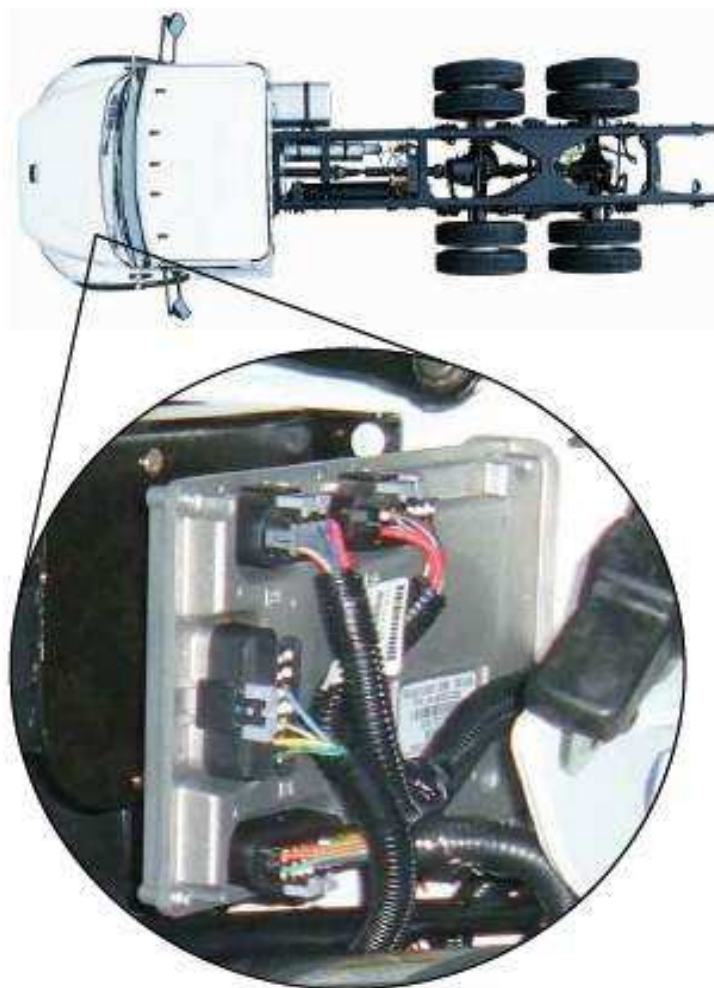
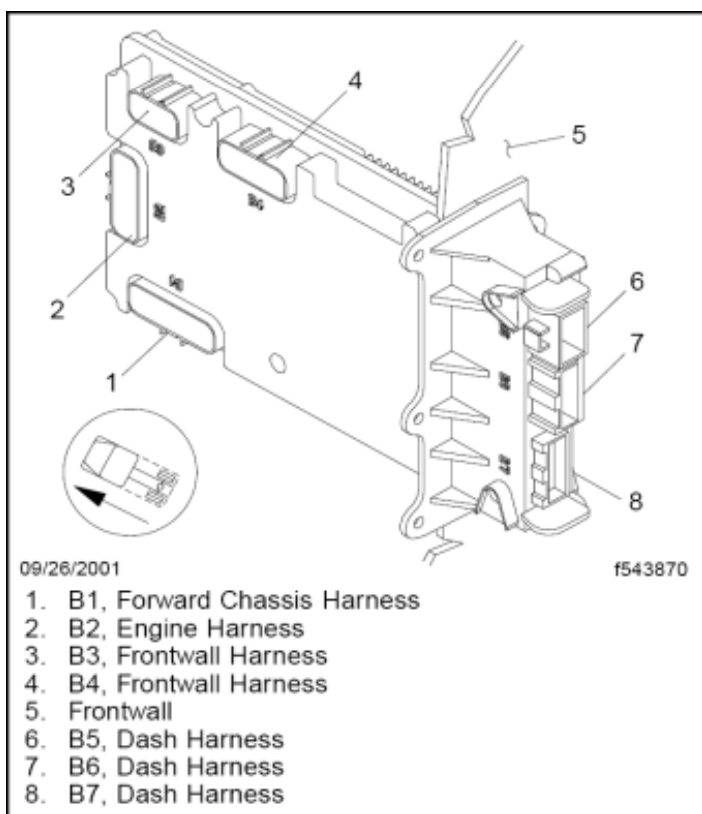


Unit
Low Air Pressure Switch



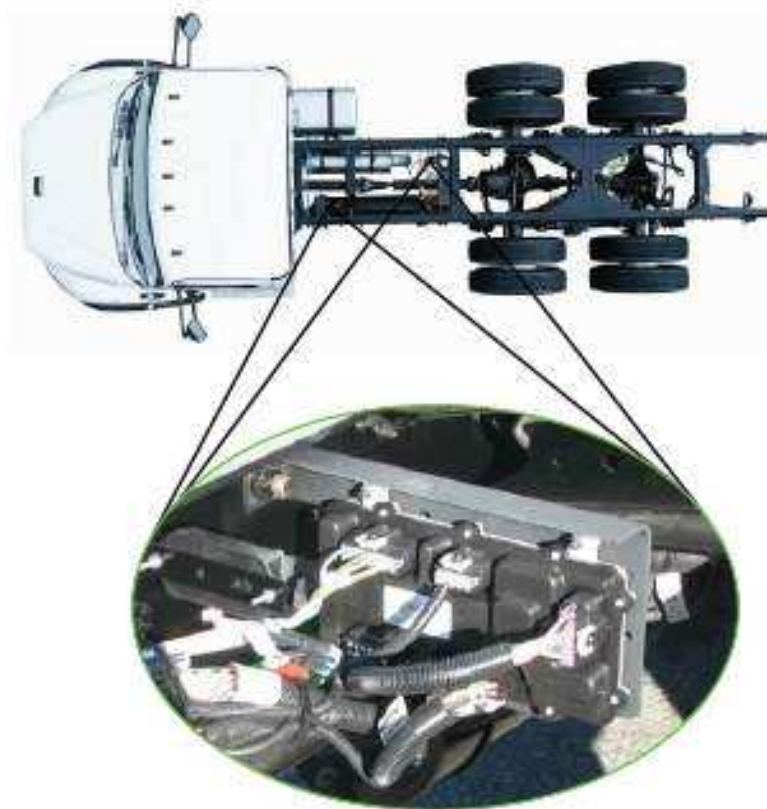
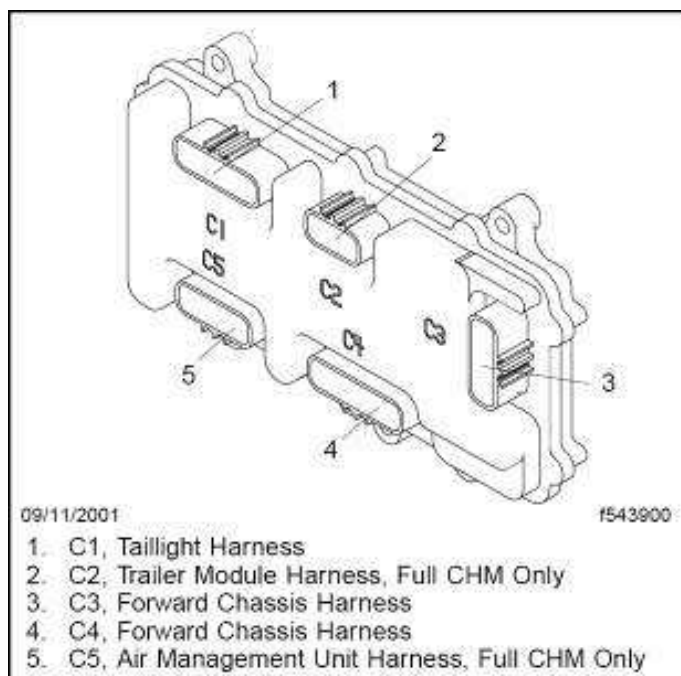
- Primary Function

- “Brains” of the operation
- Makes all system decisions, commands all other modules
- Contains all system Parameters
- Controls power flow & circuit protection to the various components of the M2 electrical system
- Supports up to 5 Smart Switches directly
- Is reprogrammable
- Every M2 vehicle is equipped with BHM

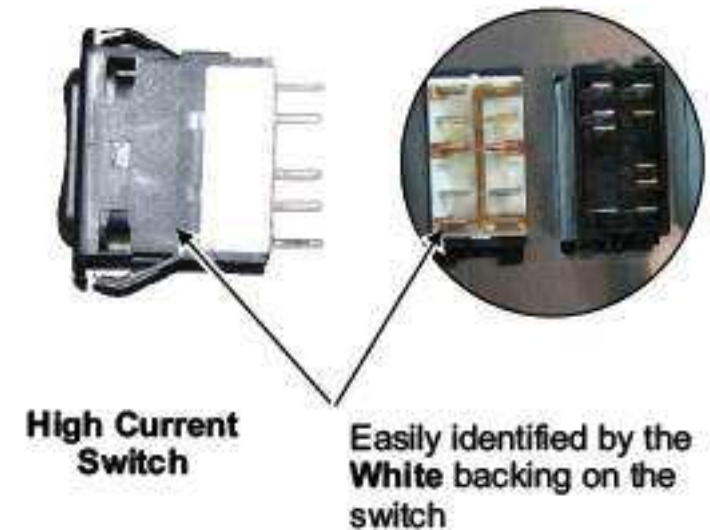
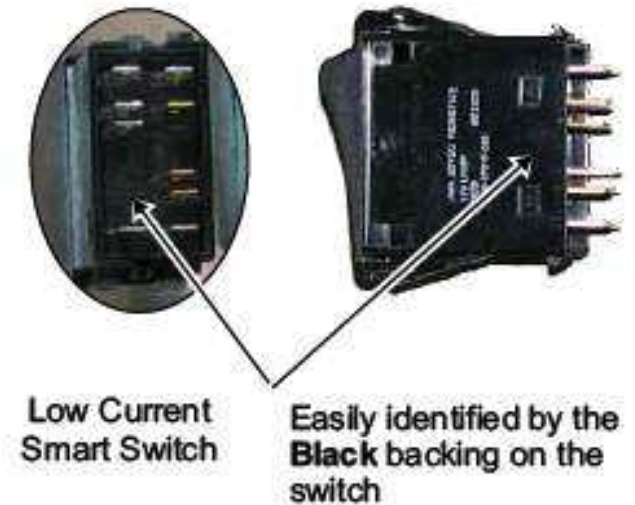


- Primary Function

- “Good kid” – Does what it’s told
- Reports it’s input and output states to BHM
- Provides power flow & circuit protection to the various components of the M2 electrical system
- Every M2 vehicle is equipped with CHM
- Not reprogrammable



- Smart switches are optional low-current switches that are connected to the Bulkhead Module (BHM) or to an optional Switch Expansion Module (SEM) on a Business Class® M2 vehicle. A smart switch is used to activate an optional feature on the vehicle.
- A smart switch is significantly different from a high current switch. Unlike a high-current switch, the smart switch is designed to control very low currents, and will be damaged if it is connected to a high-current circuit. A smart switch has an internal printed circuit board which contains:
 - A light-emitting diode (LED) for backlighting the switch when the headlights are turned on;
 - A light-emitting diode (LED) that, when on solid, indicates the feature is activated and, when blinking, indicates an error condition.
 - Two precision resistors that are used to create a unique switch identifier that allows the BHM to identify each switch that is connected;
 - Three precision resistors that are used to indicate the position of the switch.
- Reference Parameters are linked to resistive value of a Switch by the BHM



Convenience Feature: Headlights - Automatic Headlights when Wipers Engaged



Data Codes:

Headlights with Wipers:

- 311-019: w/Daytime running lights
- 311-020: w/Daytime running lights, w/Rocker/Toggle momentary interrupter switch
- 311-021: no Daytime running lights

Models:

- M2 Platform

What

- Automatically engages headlights when driver turns on the windshield wipers

Why it's important

- Safety feature
- Increases driver visibility
- Makes the truck more visible to oncoming traffic

Convenience Feature: Headlights - Alternating Flashing Headlights (Wig Wag)



What

- NFPA complaint headlight warning system for emergency vehicles
- Dash Switch actuation or Customer supplied ground input

Why it's important

- No 3rd party switches needed for the dash
- Eases truck equipment manufacturer body integration, provides OEM finish.

Data Codes:

Alternating flashing headlamp system

- 27D-004: w/Body Builder Controlled Engagement
- 27D-012: w/Dash Switch
- 27D-013: w/Dash Switch and no park brake interlock (Railroad service truck only)

Models:

- M2 Platform

Convenience Feature: Wipers – Automatic Slowest Wiper Speed w/Park Brake



Data Codes:

- 660-025: Single Electric Windshield wiper motor with delay – Programmed to slowest speed with park brake set

Models:

- M2 Platform

Availability:

- October 2010

What

- Reduces wiper speed to Slowest Intermittent Speed setting when park brake is set regardless of Wiper Switch position

Why it's important

- Reduces wear and tear on wiper motor
- Decreases frequency of wiper blade replacement

Safety Features: Audible Warnings – Door Open without Park Brake set



Data Codes:

Electric Horn Warning System for Park Brake not Set

- 275-060: With Door Open and Ignition Key off or Accessory Position
- 275-061 With Door Open and all ignition key positions

Models:

- M2 Platform

What

- Horn warning when driver door opened with park brake not set

Why it's important

- Safety feature
- Warns drivers not to leave cab without park brake set

Safety Features: Audible Warnings – Exterior Regen Notification

	Interior Dash Light Warning	Exterior Warning
First Stage		10 Sec Horn Blast
Second Stage		10 Sec Horn Blast & Hazard Lamps

Data Codes:

- 275-063 2-STAGE ELECTRIC HORN AND HAZARD LAMP ALERT CONTROLLED BY PARTICULATE FILTER REGENERATION REQUIRED STATUS
- 275-064 ELECTRIC HORN WARNING SYS FOR PARK BRK NOT SET W/DOOR OPEN & ALL IGN KEY POSITIONS; 2-STAGE ELEC HORN & HAZARD LAMP ALERT CTRL BY PART FILTER REGEN REQ'D STATUS

Models:

- M2 Platform

What

- Combination horn and hazard lamp exterior warning for Stage 1 and 2 Regen notifications
- 275-064 includes driver door open/prk brk not set warning.

Why it's important

- Notifies driver of manual regen required
- Warns drivers not to leave cab without park brake set
- Avoids potential plugging of DPF filter

Safety Features: Distraction Reduction - Radio off in Reverse



Data Codes:

Radio Wiring with Power Cutoff

- 74D-001: For Reverse or PTO Engaged
- 74D-002: When Vehicle in Reverse Gear

Models:

- M2 Platform

Radio turned off automatically when truck is in reverse

What

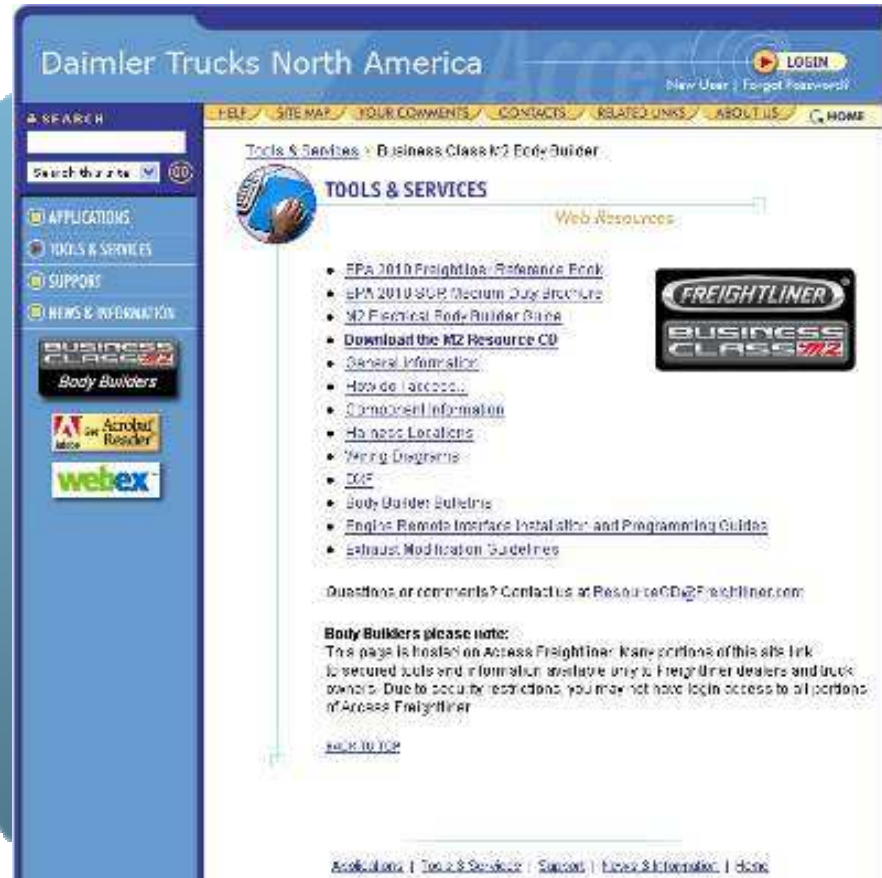
- Cuts power to radio when truck is in reverse or PTO engaged

Why it's important

- Removes driver distraction while backing up
- Lowers noise level so driver can hear warnings

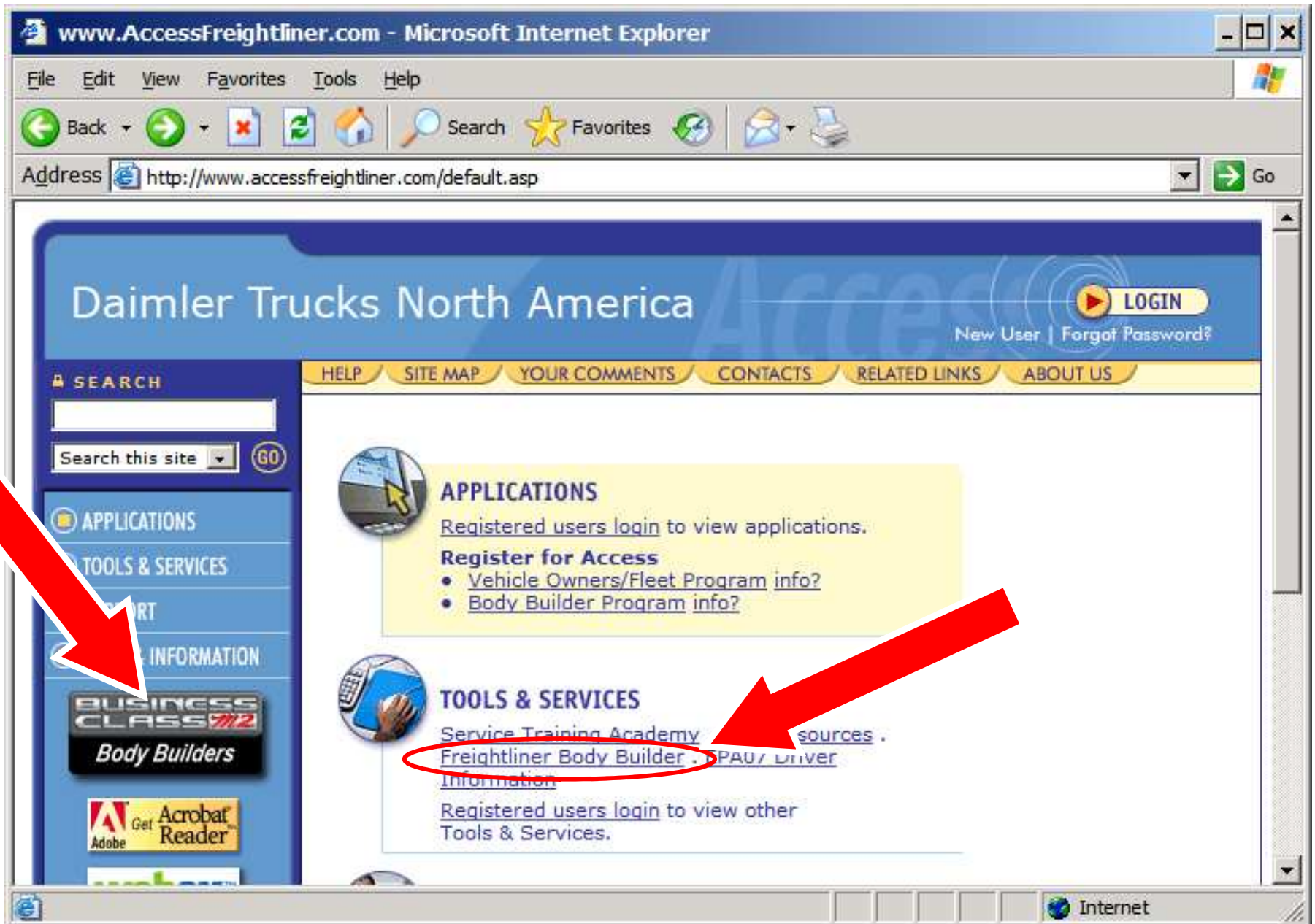
Access Freightliner provides “one stop shopping” to locate all the new 2010 body builder information

- New systems and information has been designed to help customers understand the changes and advantages coming in 2010 engines and components.
- New documents will be easier to access and easier to use with relevant information where and when you need it.

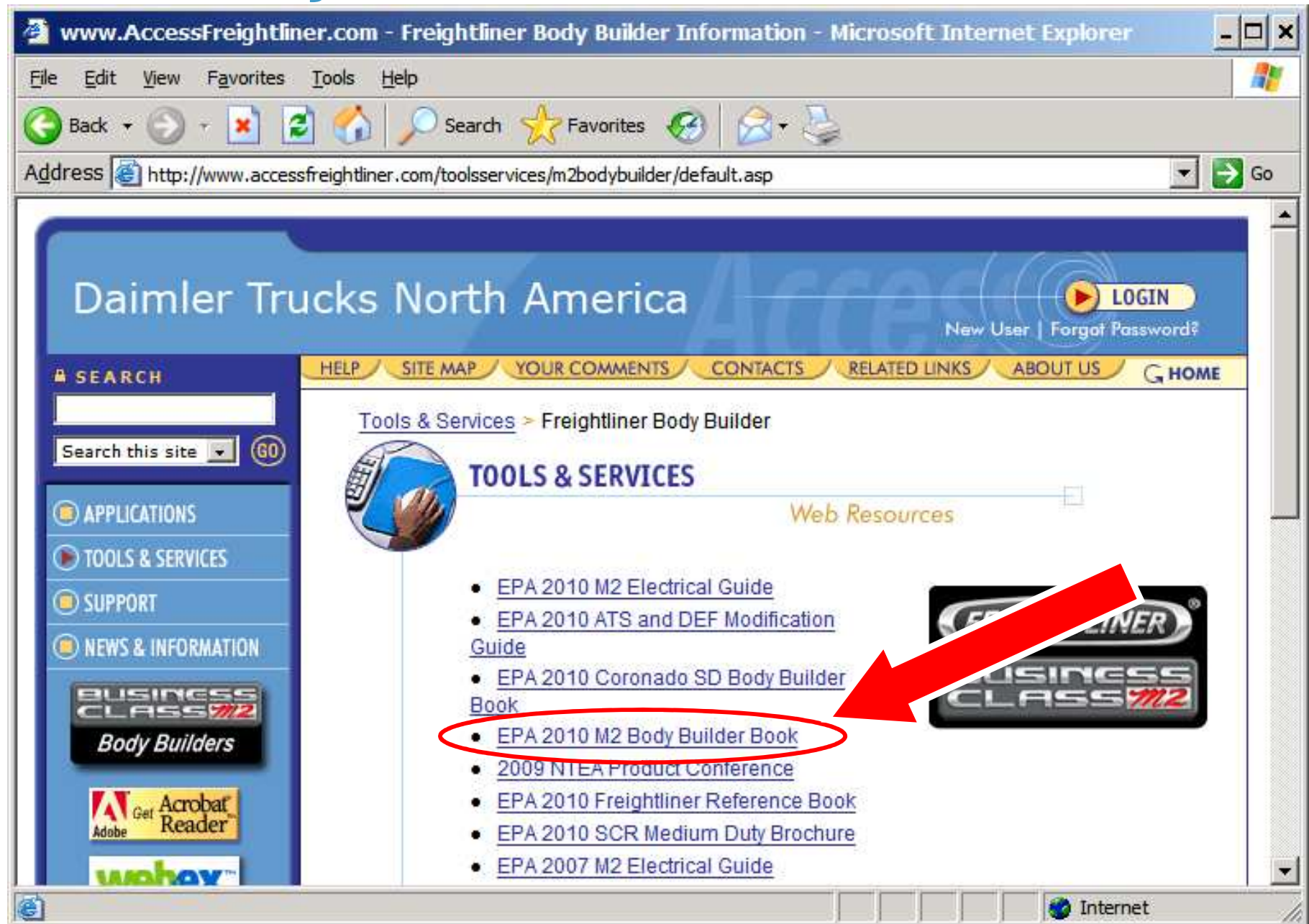


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M2 2010 Body Builder Book



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Web Resources

- [EPA 2010 M2 Electrical Guide](#)
- [EPA 2010 ATS and DEF Modification Guide](#)
- [EPA 2010 Coronado SD Body Builder Book](#)
- [EPA 2010 M2 Body Builder Book](#)
- [2009 NTEA Product Conference](#)
- [EPA 2010 Freightliner Reference Book](#)
- [EPA 2010 SCR Medium Duty Brochure](#)
- [EPA 2007 M2 Electrical Guide](#)

BUSINESS CLASS M2
Body Builders

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webtv



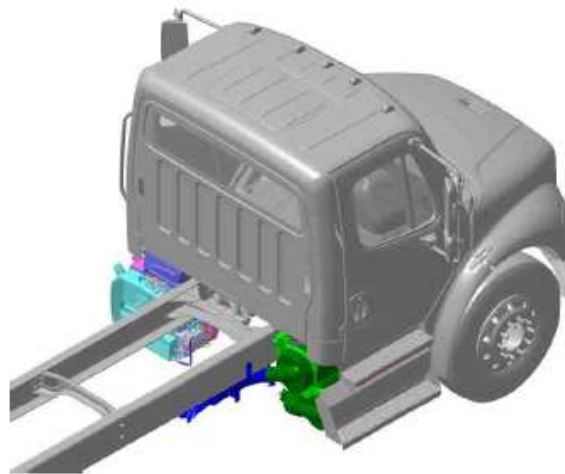
EPA 2010 Electrical Body Builder Book – May 2010 Release



EPA 2010 Models

Electrical System Overview

EPA 2010 M2 Electrical

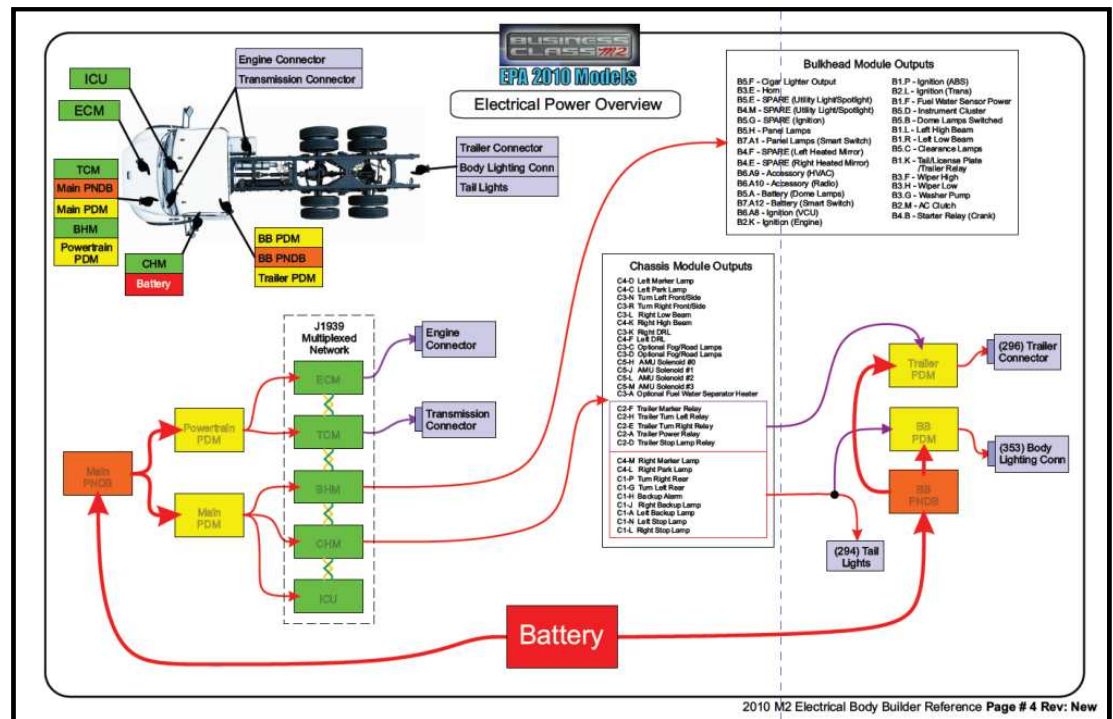


Body Builder Reference Guide

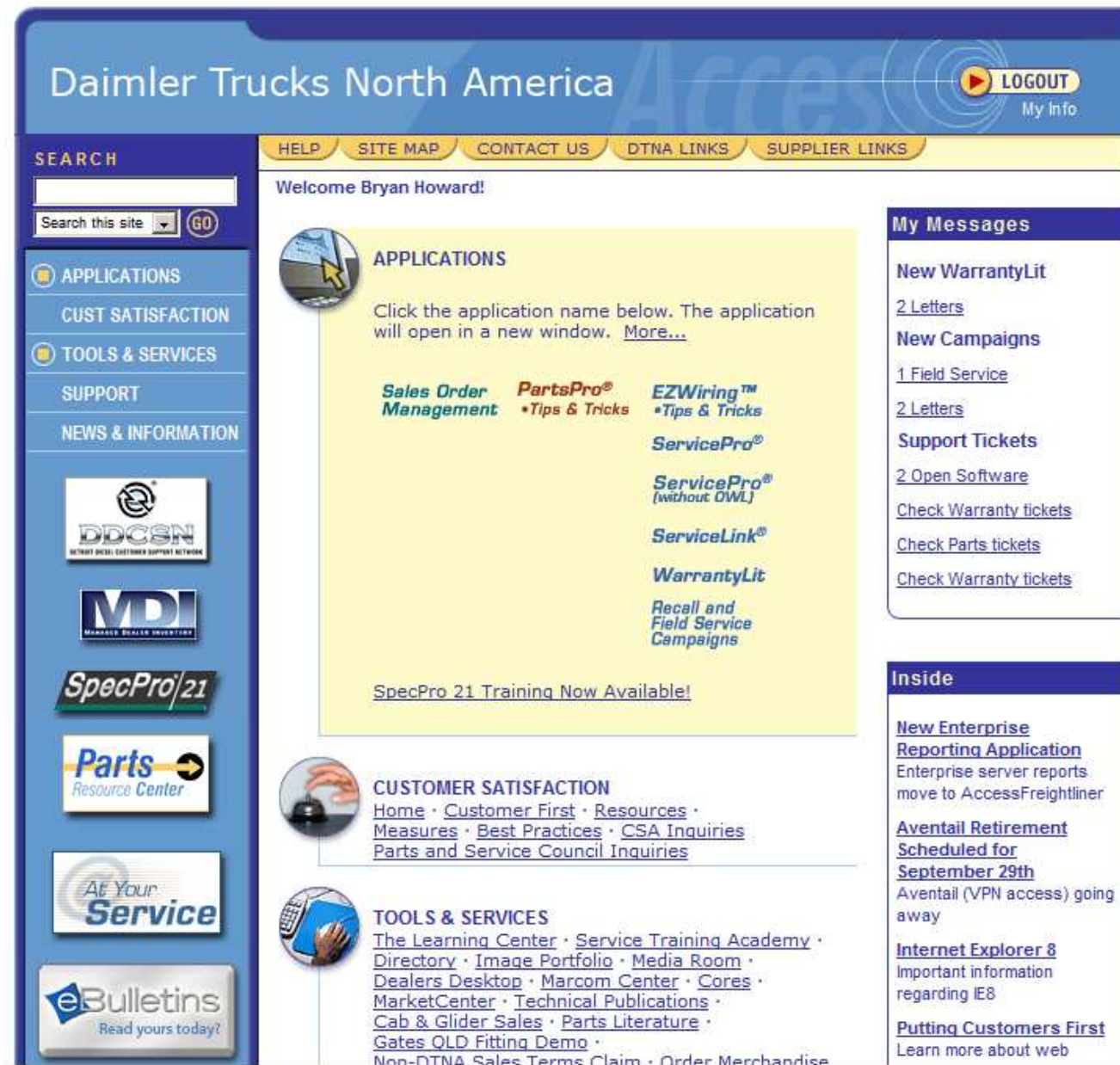
2010 M2 Electrical Body Builder Reference Title Page Rev New

EPA 2010 Electrical Body Builder Book – March 2010 Release

- New Pages
 - Power Distribution Road Map
 - Power Net Distribution Box – Positive Battery Disconnect
 - High Current Switch Packages
 - High Current Switch Label Options
 - Bulkhead Connector Details
 - PTO Controls
 - PTO Control Schematics
 - Hybrid ePTO Connections
 - Remote Start Stop Controls
 - VDR Prep Information



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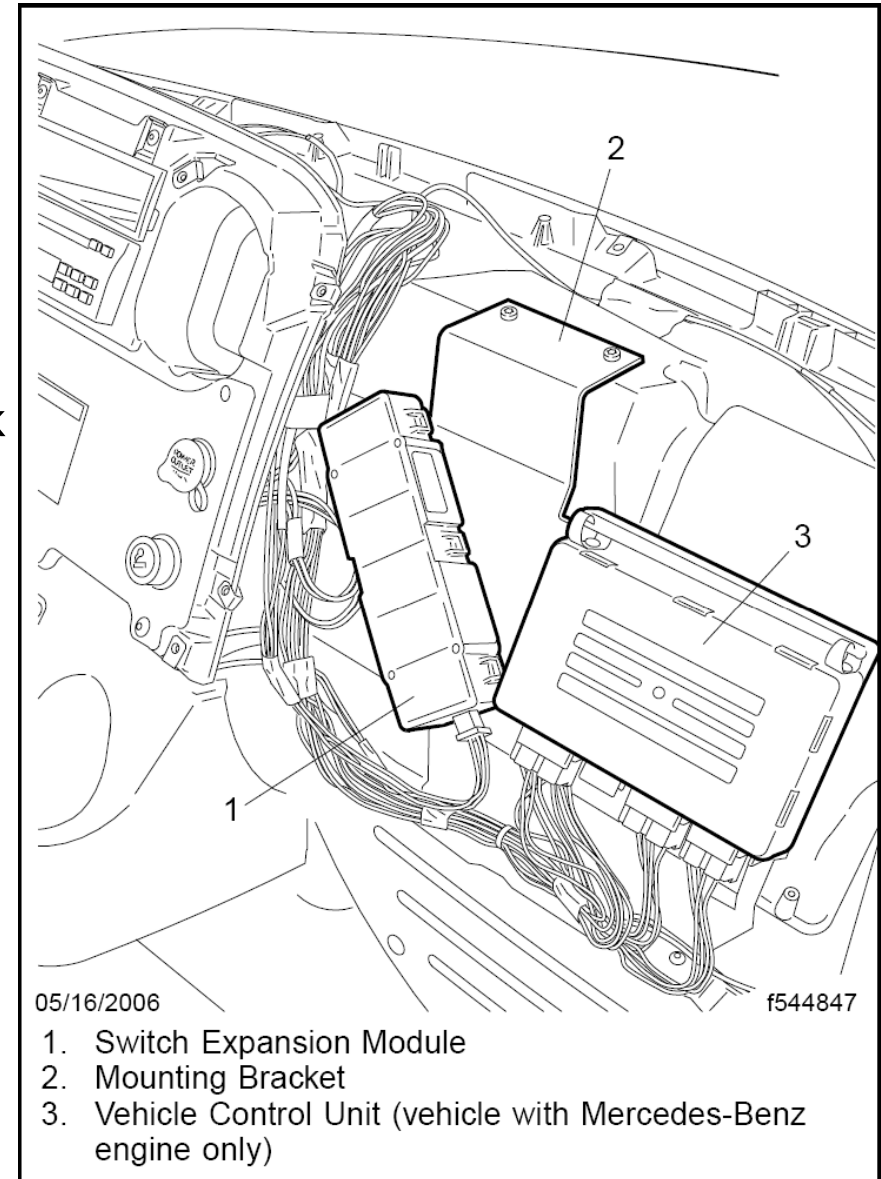
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Back Up

- A Switch Expansion Module (SEM) is used on a Business Class® M2 vehicle when more than five smart switches are installed on the vehicle.
- Each adds up to 6 Smart Switches (beyond 5 supported directly by BHM)
- System can handle up to 4 SEMs on CAN network (Currently only one released)
- The function of the SEM is to:
 - Read all smart switch IDs and positions;
 - Transmit the smart switch IDs and position data on the J1939 data link;
 - Turn on the smart switch indicator lights when commanded to do so by the Bulkhead Module (BHM).
- Ordered with Data Code:
 - 860-004 SMART SWITCH EXPANSION MODULE





Lighting Interfaces – Taillight Converting

Converting Combination to Separate Stop/Turn Signal Lights

1. Shut down the engine, apply the parking brakes, and chock the tires.
 2. Gather the necessary parts:
 - 2 Packard GT280 female terminals (15304717, 15304720, or equivalent for 16/14 AWG)
 - 2 Packard GT280 cable seals (15366067 or equivalent)
 - Appropriate wiring for connecting additional lighting
 3. Disconnect the negative leads from the batteries or, if the vehicle is equipped with a battery disconnect switch, turn the switch to the off position.
 4. Cut new wires to the required length to reach the left- and right-rear turn signal lights. Be sure to have enough length for routing the wires and installing cable terminals.
 5. Crimp a terminal and terminal seal to one end of each of the wires.
 6. Locate and disconnect connector C1 of the CHM. See **Fig. 1**.
 7. Remove the seals from cavities G and P of CHM connector C1.
 8. Install the wire for the left turn signal light into cavity G. Make sure the terminal is fully seated.
 9. Install the wire for the right turn signal light into cavity P. Make sure the terminal is fully seated.
 10. Route the new turn signal light wires to the rear of the truck. Use a split loom to protect the wires and tie-strap the loom to the existing harness where appropriate.
 11. Connect wires to the rear turn signal lights.
 12. Connect the negative leads to the batteries or, if the vehicle is equipped with a battery disconnect switch, turn the switch to the on position.
- IMPORTANT:** When converting a vehicle from combination stop/turn signal lights to separate stop/turn signal lights, you must follow the conversion information in **Table 1** exactly. Using a different reference parameter may result in incorrect operation of either the rear lights or daytime running lights (DRL) and may have legal consequences for the vehicle owner, which may include fines and having vehicles placed out of service. The regulations in the Federal Motor Vehicle Safety Standards (FMVSS) and Canadian Motor Vehicle Safety Standards (CMVSS) control rear lighting and DRL functionality. Some jurisdictions enforce these regulations during vehicle inspections.
13. Using ServiceLink, apply the appropriate reference parameter to the vehicle. See **Table 1**.
 14. Verify the proper operation of the lights.
 15. Remove the chocks from the tires.

Reference Parameters for a Conversion from Combination to Separate Stop/Turn Signal Lights	
Existing Parameter	New Parameter
26-01020-000 or 26-01020-010	26-01020-004 or 26-01020-009
26-01020-001	26-01020-003
26-01020-006	26-01020-007
26-01020-012	26-01020-013

Table 1, Reference Parameters for a Conversion from Combination to Separate Stop/Turn Signal Lights



Lighting Interfaces – Taillight Converting

Converting Separate to Combination Stop/Turn Signal Lights

1. Shut down the engine, apply the parking brakes, and chock the tires.
2. Locate the existing turn signal wires where they terminate at the rear turn signal lights.
 - 2.1 Cut the wires.
 - 2.2 Apply heat shrink to the chassis side of the wires to seal the wire.
 - 2.3 Tuck the wires in to the harness loom.
3. Locate the existing stop light wires where they terminate at the stop lights.
 - 3.1 Route the wires as needed to the new combination stop/turn signal lights.
 - 3.2 Use convoluted tubing to protect the wires, and use tie-straps to secure the wires to the existing harness.

NOTE: If the total current draw for the combination stop/turn signal light circuit on either side will exceed 6.7 amps, install relays.

IMPORTANT: When converting a vehicle from separate stop/turn signal lights to combination stop/turn signal lights, you must follow the conversion information in **Table 2** exactly. Using a different reference parameter may result in incorrect operation of either the rear lights or daytime running lights (DRL) and may have legal consequences for the vehicle owner, which may include fines and having vehicles placed out of service. The regulations in the Federal Motor Vehicle Safety Standards (FMVSS) and Canadian Motor Vehicle Safety Standards (CMVSS) control rear lighting and DRL functionality. Some jurisdictions enforce these regulations during vehicle inspections.

4. Using ServiceLink, apply the appropriate reference parameter to the vehicle. See **Table 2**.
5. Verify the correct operation of the lighting.
6. Remove the chocks from the tires.

Reference Parameters for a Conversion from Separate to Combination Stop/Turn Signal Lights	
Existing Parameter	New Parameter
26-01020-004 or 26-01020-009	26-01020-000 or 26-01020-010
26-01020-003	26-01020-001
26-01020-007	26-01020-006
26-01020-013	26-01020-012
26-01020-015	26-01020-014

Table 2, Reference Parameters for a Conversion from Separate to Combination Stop/Turn Signal Lights

Stop/Turn Signal Light Reference Parameters	
Parameter	Description
26-01020-000	Combination stop/turn signal
26-01020-001	Combination stop/turn signal with DRL
26-01020-002	Combination stop/turn signal
26-01020-003	Separate stop/turn signal with DRL
26-01020-004	Separate stop/turn signal
26-01020-006	Combination stop/turn signal with DRL
26-01020-007	Separate stop/turn signal with DRL
26-01020-009	Separate stop/turn signal
26-01020-010	Combination stop/turn signal
26-01020-011	Combination stop/turn signal
26-01020-012	Combination stop/turn signal with DRL
26-01020-013	Separate stop/turn signal with DRL
26-01020-014	Combination stop
26-01020-015	Separate stop
26-01020-018	Combination stop/turn signal with DRL, front side marker and taillight on with DRL

Table 1, Stop/Turn Signal Light Reference Parameters

Body Builder and Trailer PDM's

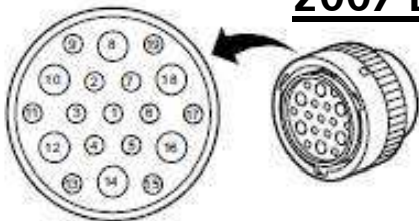
- Body Builder and Trailer PDM's relocated from Chassis Frame to Cab
- Avoids the harsh rail environment.
- New location is back wall behind Driver's seat.
- Factory Pass through provided for Power outputs to chassis.
- Body Builder Connectors on Frame at BOC or EOF



Body Builder Lighting – Module 353

- Vehicle Interface Lighting Connector Change (High Amperage option only)
 - 353-026 VEHICLE INTERFACE WIRING AND PDM WITH BODY BUILDER CONNECTOR, BACK OF CAB
 - 353-027 VEHICLE INTERFACE WIRING AND PDM WITH BODY BUILDER CONNECTOR AT END OF FRAME

2007 EPA Trucks

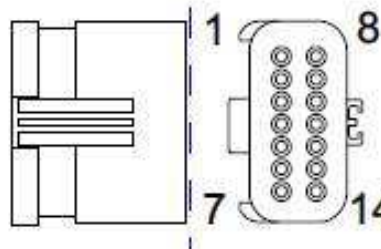


TERM-MALE 12/14 AWG DUF 046020412141

TERM-MALE 16/18 AWG DUF 046020216141



2010 EPA Trucks



Mating connector supplied with Chassis
Apex Connector part Num **FCI54201415**

FTL Part # **23-13153-010**

TERM-MALE, APEX2.8

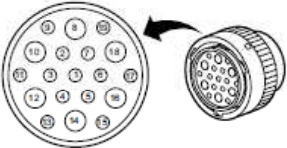
FTL Part # **23-13211-010** FCI54001801, **-011** FCI54001401
-012 FCI54001001, **-013** FCI54001818, **-014** FCI54001441

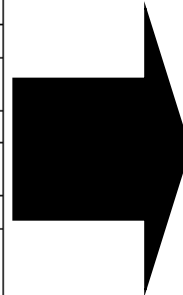


Body Builder Lighting – Module 353

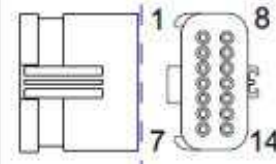
- High Amperage Vehicle Interface Lighting Output Change – Data Codes 353-026 & 353-027
- Additional Outputs for 2010
 - 2 - 20 Amp Battery Outputs 1 - 20 Amp Ignition Output

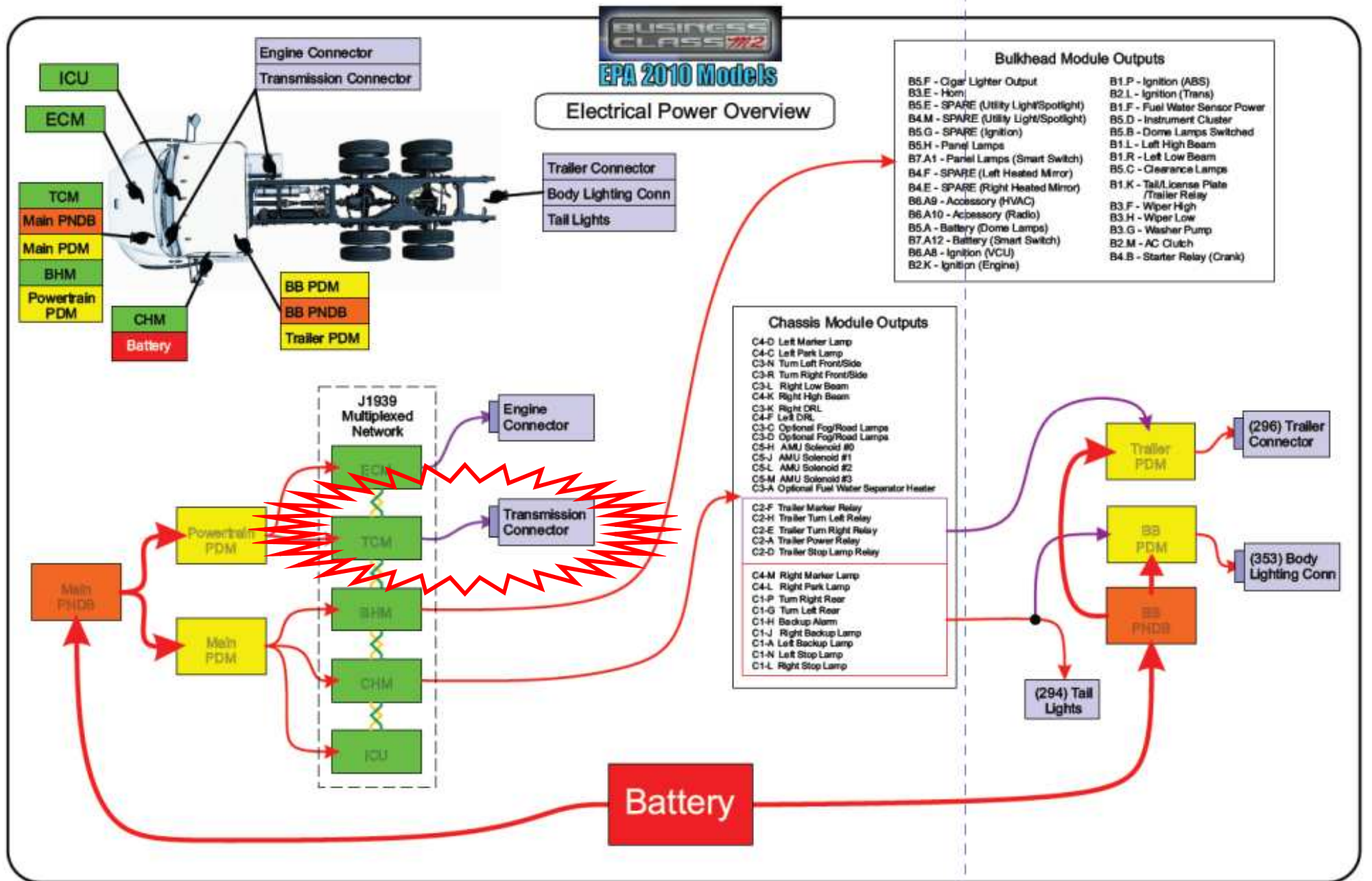
2007 EPA Trucks

High-current Lighting Interface Harness A06-48218					
Connector Pin	Signal Name	Signal Type	Circuit Color	Circuit Number	Current Capacity
 TERM-MALE 12/14 AWG DUF 046020412141 TERM-MALE 16/18 AWG DUF 046020216141					
1-5					
6	Ground	Ground	BK	GND 2	
7					
8*	Backup Light	+12V via PDM Fuse 2 (20A) With relay 1 (backup light) active.	DKBL	120B	20A
9					
10	Right Stop Light	+12V via PDM Fuse 4 (20A) With relay 2 (right stop light) Active.	R-W	36	20A
11	Ground	Ground	BK	GND 1	
12	Right Stop Light or Right Stop/Turn Light	+12V via PDM Fuse 6 (20A) With relay 3 (right turn light) Active.	DKG	38R	20A
13					
14	Left Taillight	+12V via PDM Fuse 1 (20A) With relay 4 (left taillight) active.	BR	23A	20A
15	Ground	Ground	BK	GND 2	
16	Left Stop Light or Left Stop/Turn Light	+12V via PDM Fuse 5 (20A) with relay 6 (left turn light) active.	Y	38L	20A
17					
18	Left Stop Light	+12V via PDM Fuse 3 (20A) With relay 5 (left stop light) active.	R-W	36	20A
19	Ground	Ground	BK	GND 1	



2010 EPA Trucks

High-current Lighting Interface Harness Mod 353					
 Mating connector supplied with Chassis Apex Connector part Num FCI54201415 FTL Part # 23-13153-010 TERM-MALE, APEX2.8 FTL Part # 23-13211-010 FCI54001801, -011 FCI54001401 -012 FCI54001001, -013 FCI54001818, -014 FCI54001441					
Connector Pin	Signal Name	Signal Type	Circuit Color	Circuit Number	Current Capacity
1	Tail Lamp	+12V via PDM Fuse 7 With Relay 1 Active	BR	23	20 A
2	Back Up Lamp	+12V via PDM Fuse 12 With Relay 2 Active	DKBL	120B	20 A
3	Right Turn Lamp	+12V via PDM Fuse 1 With Relay 3 Active	DKG	38R	20 A
4	Right Stop Lamp	+12V via PDM Fuse 6 With Relay 4 Active	R-W	36P	20 A
5	Left Stop Lamp	+12V via PDM Fuse 2 With Relay 5 Active	R-W	36N	20 A
6	Left Turn Lamp	+12V via PDM Fuse 5 With Relay 6 Active	Y	38L	20 A
7	Marker Lamp	+12V via PDM Fuse 3 With Relay 7 Active	BR	46B	20 A
8	Ignition Power	+12V via PDM Fuse 4 With Relay 8 Active	PK	52F	20 A
9	Battery Power	+12V via PDM Fuse 11	R	14U	20 A
10	Battery Power	+12V via PDM Fuse 8	R	14U	20 A
11	Ground	Ground	BK	GND	-
12	Ground	Ground	BK	GND	-
13	Ground	Ground	BK	GND	-
14	Ground	Ground	BK	GND	-





Transmission Interface - Module 34C

- Transmission Interface is a Convenience Package
- Allows Body Builders to access Features of the Allison transmission at a convenient location
- The option provides a harness that connects circuits from the Inputs and Outputs of the Allison Transmission Control Module to a Connector the Body Builder can access
- Connector can be located in 3 different places:
 - Firewall Mounting
 - Back of Cab (Left Hand Frame Rail)
 - End of Frame
- Data Codes

Data Book Codes for the EPA 2007 Transmission Interface Harnesses	
Data Book Code	Description
34C-001	Transmission Interface Harness at the Frontwall
34C-002	Transmission Interface Harness at Back of Cab
34C-003	Transmission Interface at End of Frame

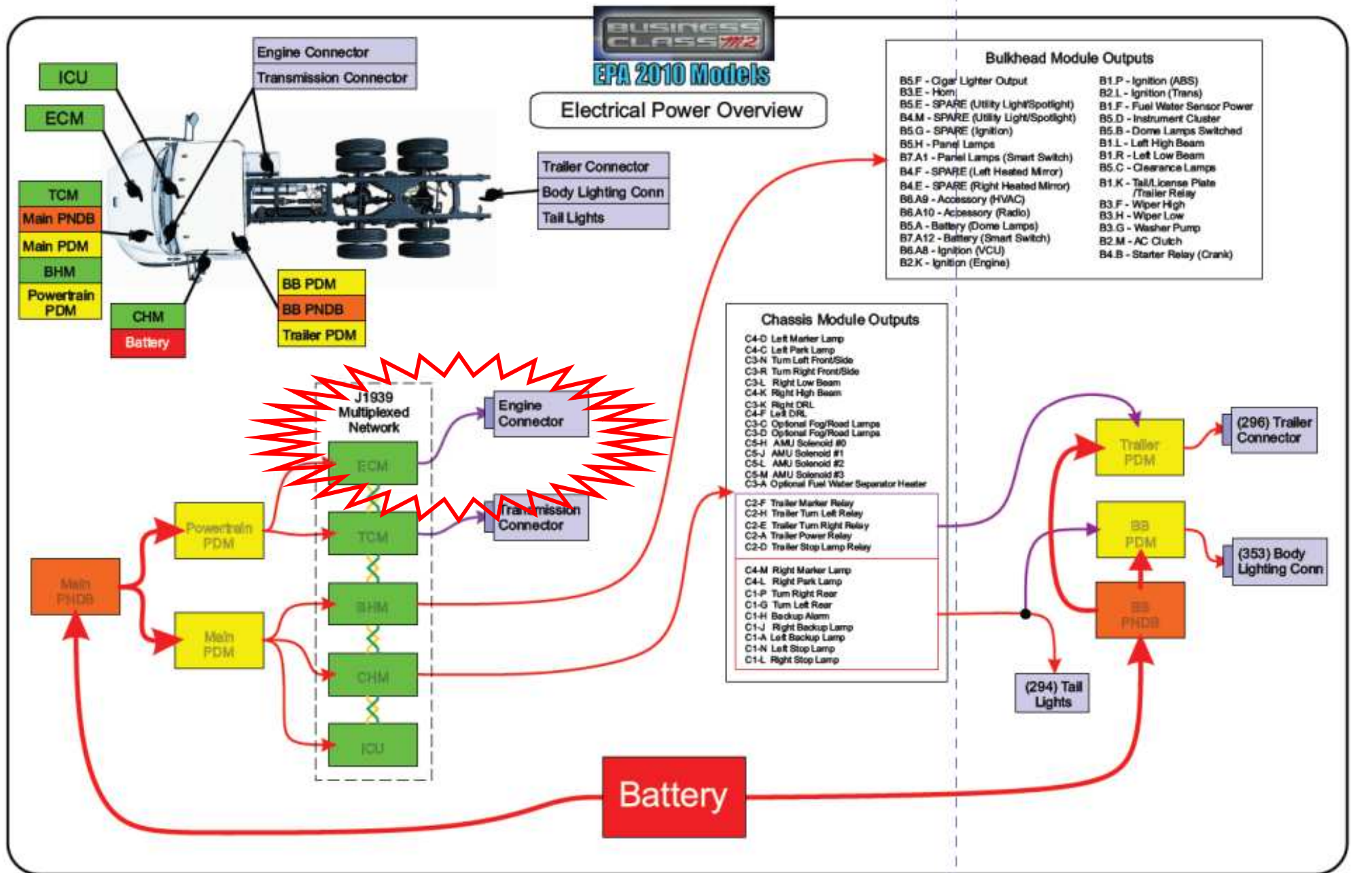
Transmission Interface - Module 34C

- The transmission interface harness changes depending on whether the Truck Spec has a 1000/2000 Series or a 3000/4000 Series transmission.
- The transmission interface harness provides most of the optional I/O circuits, and the speedometer signal



Transmission Interface Connector Pinout Assignments on Sterling and M2 Vehicles				
Pin No.	Freightliner Circuit No.	Allison Transmission® Circuit No.	Allison Transmission Function ¹	
			1000/2000 Series	3000/4000 Series
1	232E	163	Ignition Signal	Ignition Signal
2	497C7 (O ²)	150	PTO Enable	—
3	497C8 (O)	113	—	Secondary Mode Indicator Range Indicator Engine Overspeed Indicator
4	497Y	103	Digital Ground	Digital Ground
5	497K (O)	125	Vehicle Speed Sensor	Vehicle Speed Sensor
6	497C4 (O)	105	Output Speed Indicator A	Output Speed Indicator A
7	497C3 (O)	145	Neutral Indicator for PTO Two-Speed Axle Enable	Neutral Indicator for PTO Two-Speed Axle Enable
8	497D3 (I ³)	143	PTO Enable	Direction Change Enable PTO Enable Reverse Enable
9	497C1 (O)	130	—	Engine Overspeed Indicator PTO Enable Secondary Mode Indicator
10	497D5 (I)	142	Secondary Mode Input	Auxiliary Hold Secondary Mode Input Two-Speed Axle Enable Automatic Neutral-Dual Input With Park Brake Auto Neutral-Dual Input With Service Brake Status Auxiliary Function Range Inhibit (special) Auto Neutral-Dual Input With Service Brake Status
11	497D6 (I)	101	Auxiliary Function Range Inhibit (standard)	Auxiliary Function Range Inhibit (standard) Automatic Neutral-Dual Input With Park Brake Shift Selector Transition Two-Speed Axle Enable Shift Selector Transition/Secondary Shift Schedule Auxiliary Function Range Inhibit (special)
12	497D10 (I)	117	—	Automatic Neutral-Single Input Direction Change Enable Reverse Enable Automatic Neutral-Dual Input With Park Brake Auto Neutral-Dual Input With Service Brake Status
13	497C6 (O)	164	Sump Retarder Temperature Indicator	Sump Retarder Temperature Indicator
14	497D1 (I)	123	3rd Lockup Pump Mode	4th Lockup Pump Mode Kickdown Direction Change Enable
15	497D4 (I)	122	3rd Lockup Pump Mode Transfer Case Low	4th Lockup Pump Mode Refuse Packer Step Switch Reduced Engine Load at Stop
16	497C3 (O)	145	Neutral Indicator for PTO Two-Speed Axle Enable	Neutral Indicator for PTO Two-Speed Axle Enable

Table 2, Transmission Interface Connector Pinout Assignments on Sterling and M2 Vehicles





Remote Engine Interface & PTO Controls

- The Remote Engine Interface Controls and PTO Controls work in conjunction with each other
 - Remote Engine Interface – Controls the RPM of the engine.
 - PTO Controls – Controls the engagement of the PTO.
- Both Remote Engine Interface and PTO Controls can have independent functional interlocks.
- Interlocks are conditions that have to be met prior to a function engaging
 - Neutral Interlock
 - Park Brake Interlock
 - Customer Supplied signal



Remote Engine Interface - Module 148, 163, 87L

- Remote Engine Interface is a Convenience Package
- Allows Body Builders to access Electronic Features of either a Cummins, MBE or DD Engine at a convenient location
- The option provides a harness that connects circuits from the Inputs and Outputs of the Engine Control Module to a Connector the Body Builder can access
- The optional features provided by this harness include:
 - Fast Idle
 - Increment/Decrement
 - Multiple Fixed Set Speeds
 - Variable RPM Throttle

Engine Remote Interface Connector Pinout Assignments			
Cavity	Circuit	Circuit Description	Engine
1	483Z	Sensor Common Ground With Interlock	All engines
2	439U	Remote PTO	All engines
3	492U	Cruise Control PTO Remote On/Off	All engines except CAT
4	483A	PTO Set	All engines
5	483B	PTO Resume	All engines
6	439V1	PTO Set Speed A Signal	Detroit Diesel, Mercedes, CAT (M2 only)
	483R	Maximum Operating Speed/Governor	Cummins only
7	439V2	PTO Set Speed B Signal	Detroit Diesel, Mercedes, CAT (M2 only)
8	483E	Tachometer + Signal, Engine rpm	All engines
9	483F	Tachometer – Signal, Engine rpm	Caterpillar only
	492Z	Throttle Inhibit	Detroit Diesel and Mercedes-Benz only
10	483N	Remote Throttle On/Off	All engines except CAT
11	483C	Remote Throttle Signal	All engines
12	483D	Remote Throttle Power	All engines
13	492Y	Remote Signal Ground	All engines
14	492W	PTO Active	Caterpillar only
15	Optional	Optional Circuit	All engines
16	Optional	Optional Circuit	All engines



Remote Engine Interface - Module 148, 163, 87L

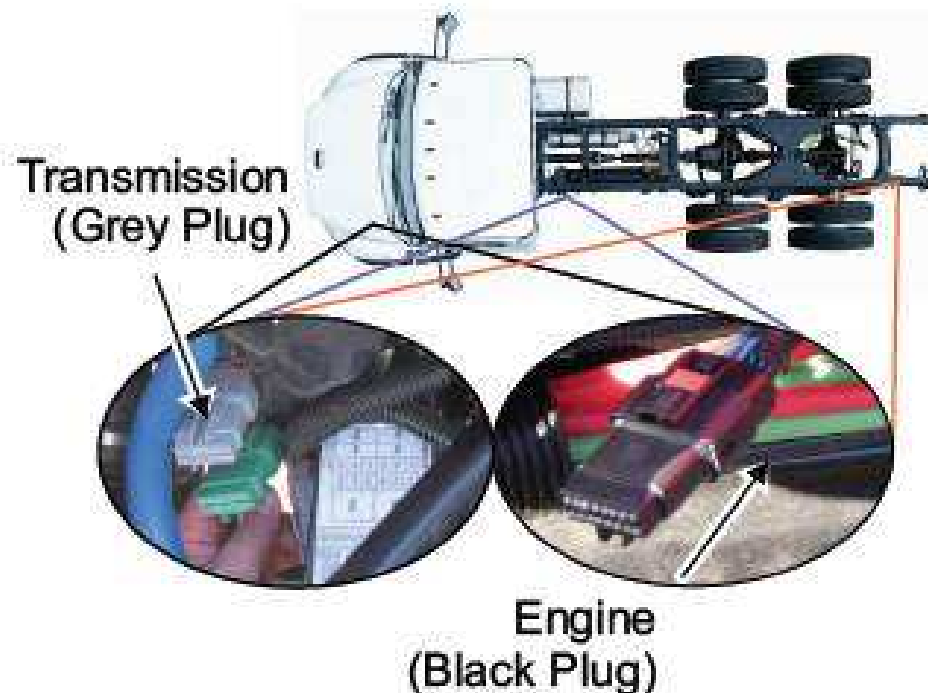
- The option is spec'd by using a combination of 3 different data codes
 - Module 148 – Determines the type of Remote Throttle
 - Module 163 – Determines the location of Interface Connector
 - Module 87L – Determines the Interlock requirements

Data Book Codes for Engine Remote Interface Harnesses (ERIH)	
Data Book Code	Description
148-070	ERIH With Fixed Single Speed
148-071	ERIH With Increment/Decrement
148-072	ERIH With Multiple Set Speeds
148-073	ERIH for Remote Throttle
163-001	ERIH at Back of Cab
163-002	ERIH at End of Frame
163-003	ERIH at End of Frame w/6-ft Harness
163-004	ERIHs in Engine Compartment
163-005	ERIH Behind Front Bumper
163-006	ERIH Inside the Cab Under the Dash
87L-001	ERIH With Park Brake Interlock
87L-003	ERIH With Park Brake and Neutral Interlocks
87L-005	ERIH Without Interlocks

Remote Engine Interface - Module 148, 163, 87L

- Feature Descriptions

- Remote PTO – This feature is useful when set programmed engine speeds are required. (Cummins – 5 Set Speeds, DD/MBE – 3 Set Speeds)
- Remote Throttle – This feature provides ability for the installation of a Remote Variable throttle.
- Throttle Inhibit – This feature prevents the engine from responding to the foot pedal or remote throttle.





PTO Controls – Module 372

- PTO Controls – Provide the combination of wiring and pneumatic plumbing to engage the PTO.
- Data Code Descriptions can be misleading
 - “Electric/Air” does not necessarily mean Electric over air
 - We can accommodate
 - Electric over air
 - Electric over hydraulic
 - Dual PTO Controls
 - Double Shift
- PTO Wiring and Plumbing are Driven by 4 Modules
 - 372 Module – Control and Interlock Scheme
 - 362 Module – PTO to be installed
 - Factory
 - Customer Supplied
 - 363 Module – PTO Mounting Location
 - 342 Module – Transmission Type



Remote Start/Stop – Module 157

- Data Codes
 - 157-004 - MANUAL REMOTE ENGINE START/STOP
 - 157-007 - MANUAL REMOTE ENGINE START/STOP WITH PTO RE-ENGAGE
- Functionality
 - 157-004 - The functionality includes a dash mounted "Machine Mode" switch that when engaged in the on position allows the driver to exit the cab and remotely stop the engine and subsequently later remotely restart the engine without having to re-enter the cab.
 - 157-007 - Same as -004 with additional functionality added that allows for the PTO to also be re-engaged automatically after re-start is completed.
- Feature is Interlocked with Park Brake and Transmission Neutral.
- Interface point for the Body Builder is the Remote Engine Interface connector
- Not available with Manual transmission