508 — PDM Diagram

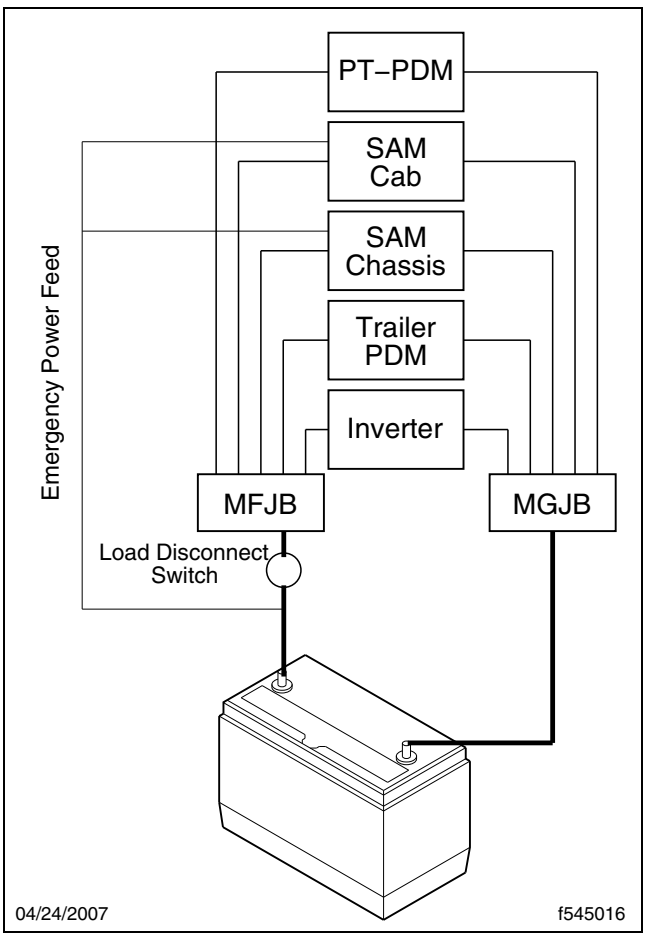


Fig. 1, PDM Diagram

509 — Related Subjects

- **G02.04 — SAM Cab**
- **G02.05 — SAM Chassis**
- **P01.01 — Starting and Charging**

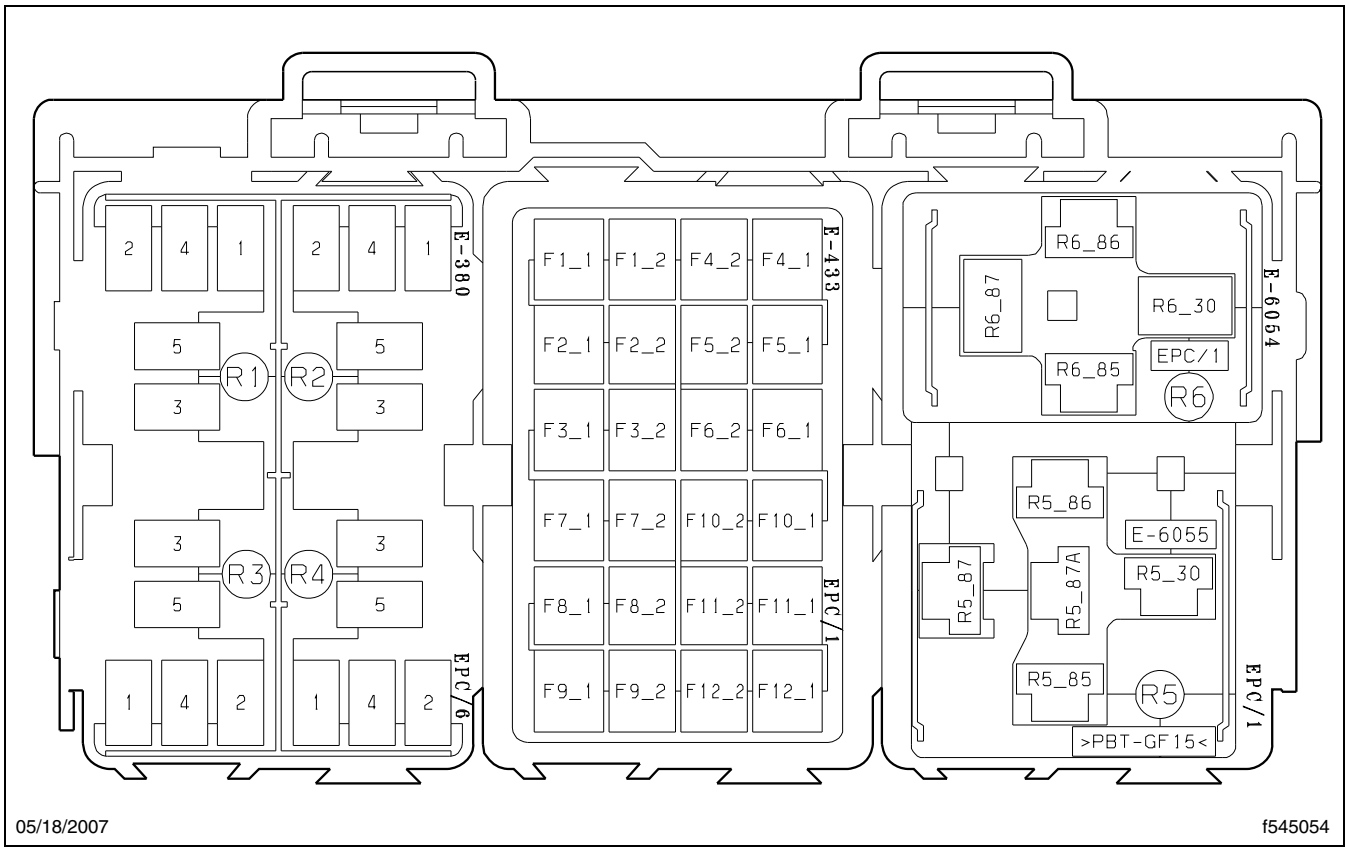


Fig. 6, Powertrain PDM

700 — Possible Causes

- Water Intrusion
- Voltage Spikes
- Short Circuits
- Missing Fuse/Relay
- Incorrect Fuse Rating

701 — Diagnostic Tools Required

- Digital Multimeter

702 — Diagnosis

Refer to the schematic in modules 280 and 285 for an overview of the vehicle power distribution system for troubleshooting. Use **Table 1**to cross reference the individual modules for each subsystem.

Pinout Mapping				
Connector	Cavity Number	Function		
		Highline	Baseline	Midline
X10	13	Panel Lamps	Panel Lamps	—
X10	14	Inside Temperature Sensor, Ground	Inside Temperature Sensor, Ground	—
X10	15	Belt Buckle Contacts, Ground	Not Connected	—
X10	16	Tire Pressure Monitoring, Battery	Not Connected	—
X10	17	Instrument Cluster, HL Wake Up	Instrument Cluster, HL Wake Up	—
X10	18	Radio, Accessory	Radio, Accessory	—
X11	1	Differential Lock ICU Indicator, RA2	Not Connected	—
X11	2	Washer Level ICU Indicator	Washer Level ICU Indicator	—
X11	3	Electrical Global Fault Indicator (Future Use)	Electrical Global Fault Indicator (Future Use)	—
X11	4	Fuel Water Separator ICU Indicator	Not Connected	—
X11	5	Differential Lock ICU Indicator, RA1	Differential Lock ICU Indicator, RA1	—
X11	6	Low Air Pressure Switch ICU Indicator	Low Air Pressure Switch ICU Indicator	—
X11	7	Lights On Buzzer	Lights On Buzzer	—
X11	8	Air Filter Restriction ICU Indicator	Air Filter Restriction ICU Indicator	—
X11	9	High Beam ICU Indicator	High Beam ICU Indicator	—
X11	10	Rain / Light Sensor, Ground	Not Connected	—
X11	11	Turn Signal Left ICU Indicator	Turn Signal Left ICU Indicator	—
X11	12	Alternator No Charge ICU Indicator	Alternator No Charge ICU Indicator	—
X11	13	Turn Signal Right ICU Indicator	Turn Signal Right ICU Indicator	—
X11	14	Park Brake Switch ICU Indicator	Park Brake Switch ICU Indicator	—
X11	15	Rain / Light Sensor, LIN	Not Connected	—
X11	16	Clutch Switch Return, Ground	Clutch Switch Return, Ground	—
X11	17	Top of Clutch (Cruise Control Disable)	Top of Clutch (Cruise Control Disable)	—
X11	18	Auxiliary Telematic Unit, Ground	Not Connected	—
X11	19	Auxiliary Telematic Unit, Battery	Not Connected	—
X11	20	Bottom of Clutch (Starter Control)	Bottom of Clutch (Starter Control)	—
X11	21	Rain / Light Sensor, Battery	Not Connected	—
X12	1	Rear Baggage Compartment Light Switch Center	Rear Baggage Compartment Light Switch Center	—
X12	2	Rear Baggage Compartment Light Switch Left	Rear Baggage Compartment Light Switch Left	—
X12	3	Footwell Light	Footwell Light	—

Maximum Current Pin List						
Connector	**Pin**	**Function**	**Type**	**Nominal Current (Amps)**	**Maximum Continuous Current (Amps)**	**Maximum Current (Amps)**
X3	11	Radio, Battery	o	10	13.5	15
X3	18	CGW (Central Gateway ECU), Battery	o	0.38	0.513	2
X4	1	Power Feed Spare Output I, Battery	o	15	20.25	30
X4	2	Power Feed Spare Output III, Battery	o	15	20.25	30
X5	1	Power feed Spare Output II, Battery	o	15	20.25	30
X5	2	Power Feed Spare Output IV, Battery	o	15	20.25	30
X6	2	Fleet Management System, Battery	o	5	6.75	25
X6	3	CB Radio, Battery	o	20	27	25
X6	5	Power Feed, Driver Information System, Ignition	o	1.07	1.4445	15
X6	6	Fleet Management System, Ignition	o	5	6.75	15
X6	8	Power Feed, Gauge Pyrometer, Ignition	o	0.5	0.675	15
X6	9	12V Power Receptacle 2 (Dash, Phone), Battery	o	15	20.25	15
X6	10	Power Feed, Gauge Axle Temperature, Ignition	o	0.5	0.675	15
X6	11	Power Feed, Gauge Engine Oil Temp, Ignition	o	0.5	0.675	15
X6	12	Power Feed, Clock Cab, Battery	o	0.1	0.135	15
X6	13	Power Feed, Driver Information System, Battery	o	3	4.05	15
X6	14	Power Feed, Clock Sleeper, Battery	o	0.1	0.135	15
X6	15	12V Power Receptacle 1 (dash, cigar), Battery	o	15	20.25	15
X6	15	12V Power Receptacle 3 (sleeper, cigar), Battery	o	20	27	20
X6	16	Instrument Cluster, Ignition	o	4.6	6.21	10
X6	18	Instrument Cluster, Battery	o	3.78	5.103	5
X7	3	Sleeper HVAC Fan Motor, Battery	o	26	35.1	30
X7	4	Cabin HVAC Fan Motor, Battery	o	26	35.1	30
X8	1	Door Open, Driver side, Pull Down	i	0.04	0.054	—
X8	4	Door Control Driver, Battery	o	20	27	20
X8	5	Door Open Status	o	0.04	0.054	0.5
X8	6	Door Lock, Battery	o	12.4	16.74	20
X8	7	Power Window Driver Side, Accessory	o	10	13.5	15
X8	8	Mirror Heating Driver	o	10	13.5	10
X8	9	Door Sill Lamp Driver	o	0.7	0.945	1.9
X9	1	Body Builder Connector: Revolution	o	0.01	0.0135	1
X9	2	Body Builder Connector, Vehicle Speed	o	0.01	0.0135	1
X9	3	Function pin 1	o	0.2	0.27	2
X9	4	Body Builder Connector, Park Brake	o	0.04	0.054	2
X9	5	Function Pin 2	o	0.2	0.27	2

507 — Datalink Network Topology

The MSF Master is the only component of the switch field that is physically connected to the Cabin CAN datalink. All other components of the switch field are not connected to any of the four datalinks. See **G02.02 — Datalink Communication Structure** for details.

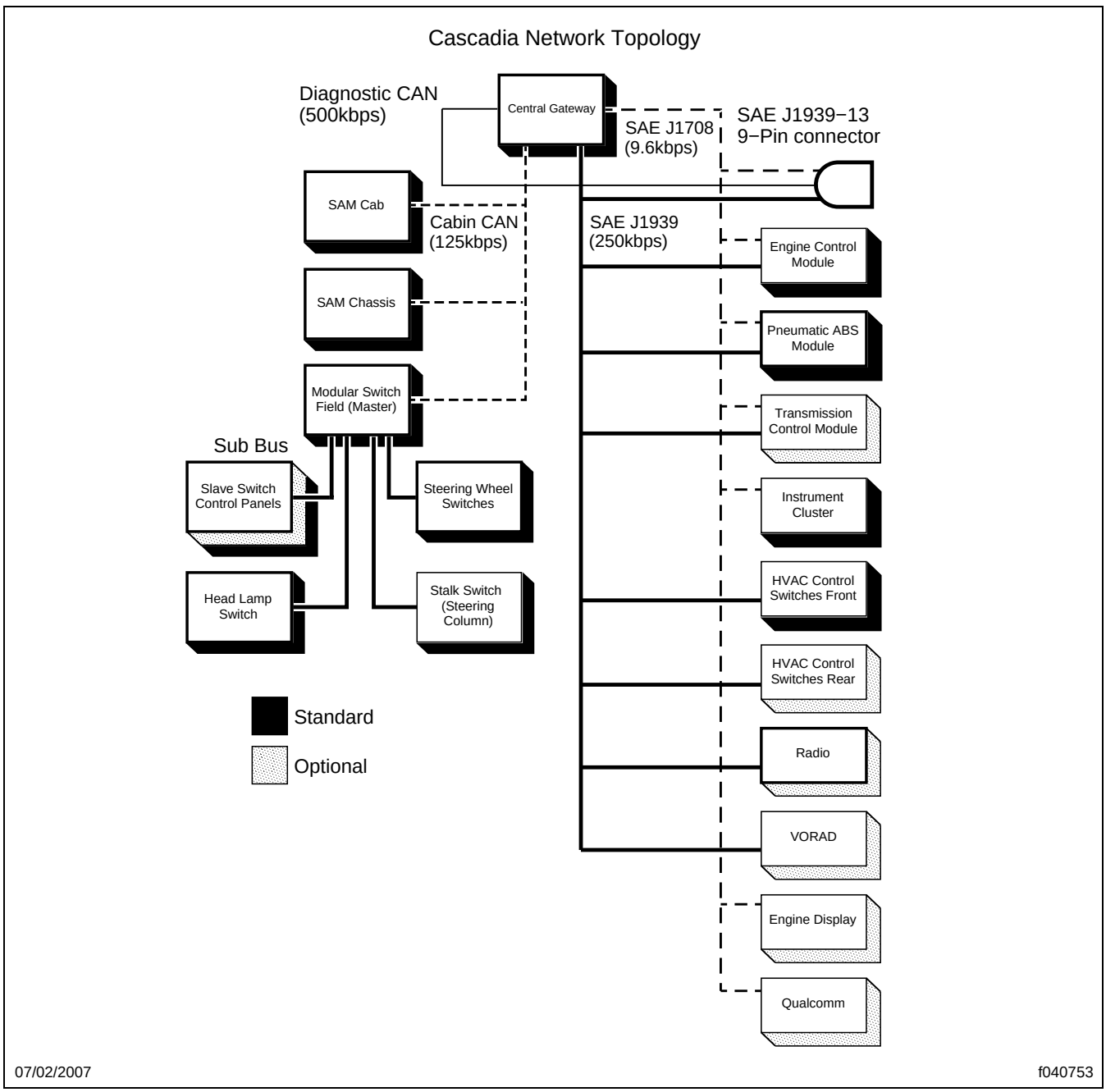


Fig. 3, Datalink Network Topology

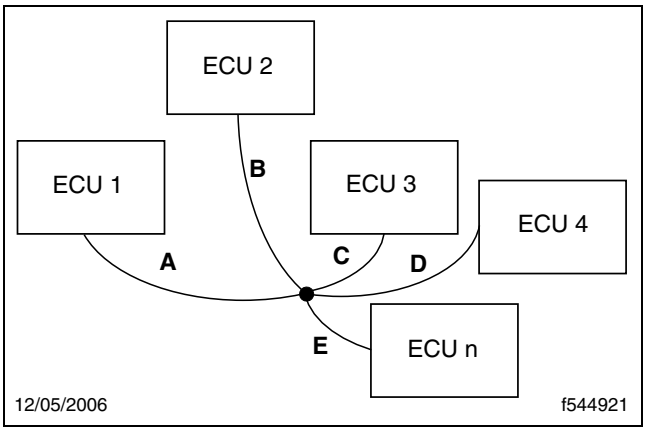


Fig. 2, Generic "Star" Network Topology

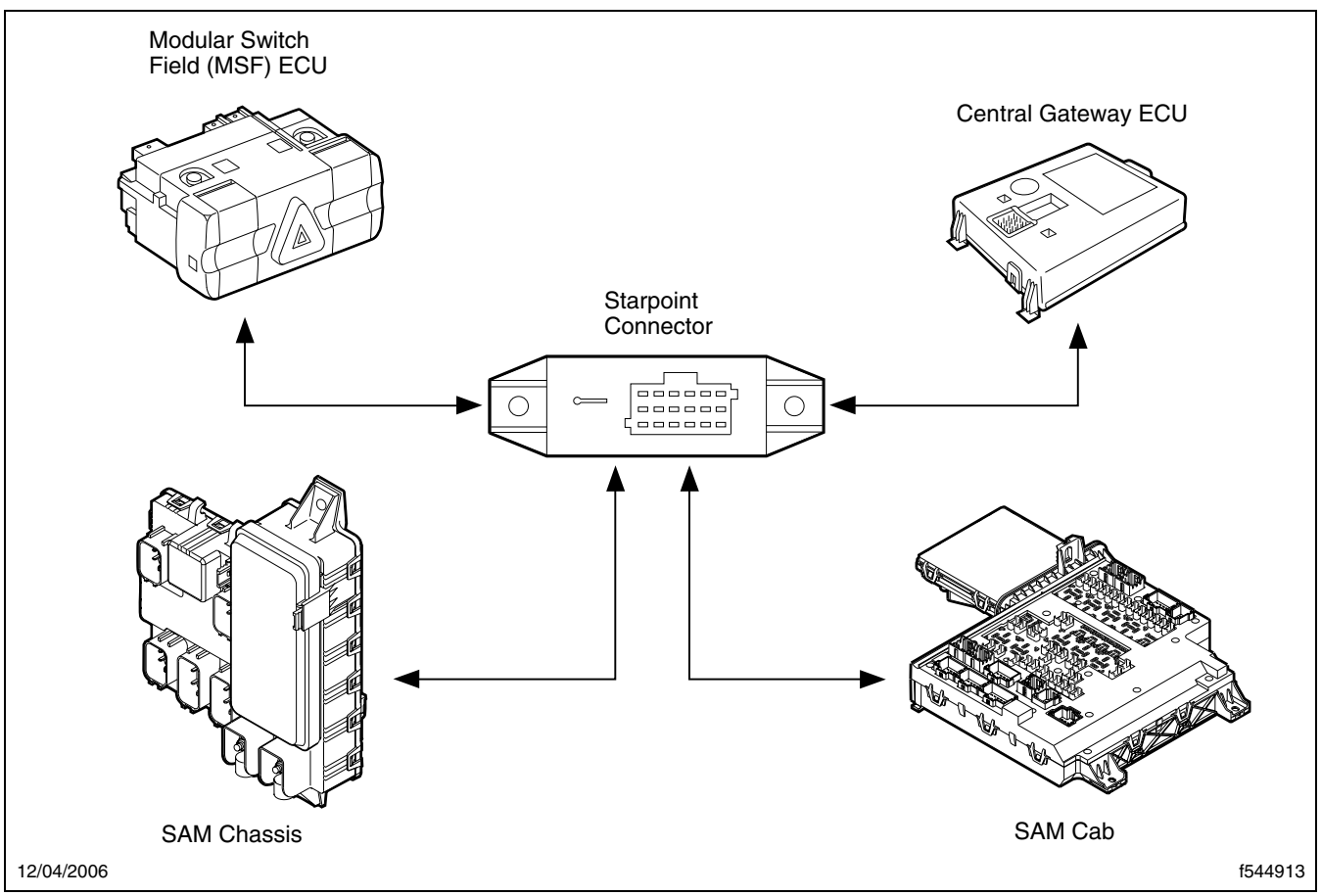


Fig. 3, Cabin CAN Network

For specifications on the starpoint connector, see **800 — Starpoint Connector**.

J1939 Fault Codes			
SA	**SPN**	**FMI**	**Fault Description**
25	523318	07	Blower motor protection mode (speed mismatch or blocked rotor).
25	523329	02	Defrost door actuator data mismatch.
25	523329	03	Vehicle speed – abnormal update rate.
25	523329	04	Defrost door actuator, voltage below normal, open circuit.
25	523330	02	Blend door actuator, data mismatch.
25	523330	03	Blend door actuator, voltage above normal, or shorted to battery.
25	523330	04	Blend door actuator, voltage below normal, open circuit.
25	523331	02	Recirc door actuator, data mismatch.
25	523331	03	Recirc door actuator, voltage above normal, or shorted to battery.
25	523331	04	Recirc door actuator, voltage below normal, open circuit.
25	523332	02	Floor door actuator, data mismatch.
25	523332	03	Floor door actuator, voltage above normal, or shorted to battery.
25	523332	04	Floor door actuator, voltage below normal, open circuit.
42	639	02	One or more required messages missing from datalink.
42	639	09	No messages being received from the datalink.
42	639	13	Device cannot claim source address on datalink.
42	639	19	Messages received with incorrect data or marked as error.
42	886	07	FLR misaligned.
42	886	12	FLR internally defective.
42	886	13	FLR not configured properly
42	886	14	FLR blocked
42	898	13	Engine not configured for SmartCruise operation.
42	898	14	Engine not supported for SmartCruise operation
42	1563	13	VS-400 component detects incompatibility issue with other VS-400 devices.
58	158	03	ACU – voltage above normal.
58	158	04	ACU – voltage below normal.
58	609	12	ACU – bad intelligent device or component.
58	639	02	J1939 Datalink, intermittent or incorrect data.
58	1548	04	COTC sensor, short to ground.
58	1548	05	COTC sensor, short to battery or open circuit

Cummins DEF Level Sensor Resistance	
Sensor Resistance (ohms)	**Float Distance (mm) From Top Plate**
68	<80
112	80
157	97.6
207	115.2
261	132.8
320	150.4
385	168
485	185.6
539	203.2
629	220.8
731	238.4
847	256
981	273.6
1135	291.2
1316	308.8
1532	326.4
1793	344
2114	361.6
2521	379.2
3052	396.8
3744	414.4
4812	433

Table 22, Cummins DEF Level Sensor Resistance

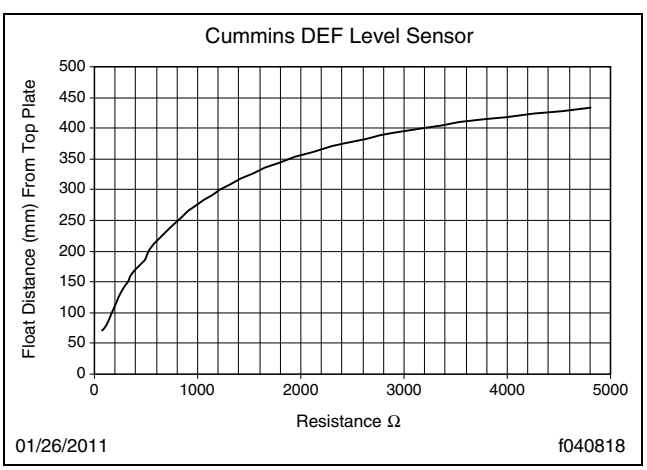


Fig. 11, Cummins DEF Level Sensor Resistance

500 — Terms and Abbreviations

Cabin CAN—A proprietary datalink connecting certain ECUs on the vehicle, specifically the CGW, MSF, SAM Cab and SAM Chassis.

CAN—Controller Area Network

CAN ID—The identifier for a specific message, which also contains the source address of the sending ECU communicating on the J1939 datalink.

CGW—Central Gateway

Datalink—A collection of wires, connecting system components, through which data is transmitted.

Datalink Topology—The arrangement in which the nodes (ECUs) of a datalink are connected to each other.

Diagnostic CAN—Datalink that runs from the diagnostic connector to the CGW.

Diagnostic Connector—A 9-pin diagnostic connector is used for troubleshooting the electrical system.

ECU—Electronic Control Unit, typically connected to a datalink.

FMI—Failure Mode Indicator. The part of a J1587, J1939, and CAN fault code that identifies how part of a device, or item on a device, failed.

MSF—Modular Switch Field

Multiplexing—Sending multiple electronic messages through the same signal path at the same time—in this case, through the CAN buses.

SA—Source Address; indicates numeric assignment for a device that communicates on J1939.

SAM—Signal Detect and Actuation Module

SAM Cab—Signal Detect and Actuation Module Cab ("SAM Cabin"); this ECU controls mainly cab-related functionality. See **G02.04 — SAM Cab** for more information.

SAM Chassis—Signal Detect and Actuation Module Chassis; this ECU controls mainly chassis-related functionality. See **G02.05 — SAM Chassis** for more information.

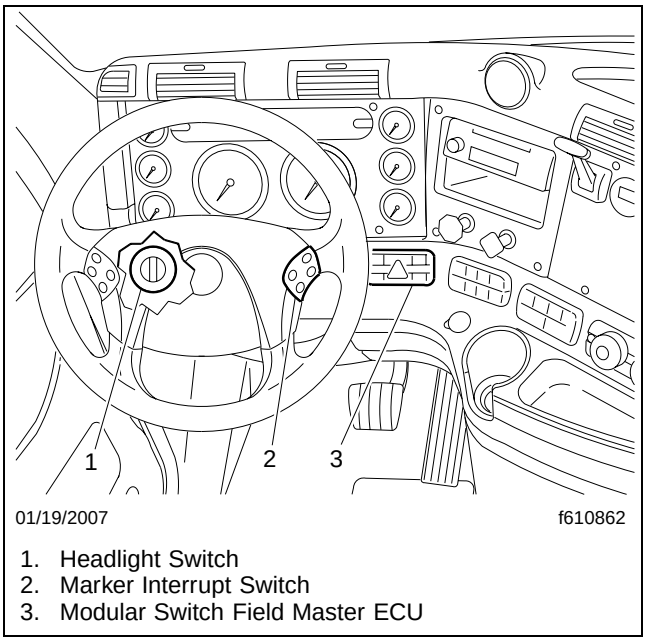
SPN—Suspect Parameter Number. The part of a J1939 or CAN fault code that identifies how part of a device, or item on a device, failed.

501 — General Information

This subject provides an overview of the exterior lighting system. Each lighting component is detailed individually in **C04 — Exterior Lighting**.

The external lighting system is multiplexed using a combination of wiring, CAN messages, and the following electronic components:

- Modular Switch Field (MSF)
  - MSF Master ECU
  - MSF Slaves Switch Housing
  - Sub-bus Switches
  - Rotary (Headlight) Switch
  - Steering Wheel Switches



1. Headlight Switch
2. Marker Interrupt Switch
3. Modular Switch Field Master ECU

Fig. 4, Light Switches

601 — Component Details

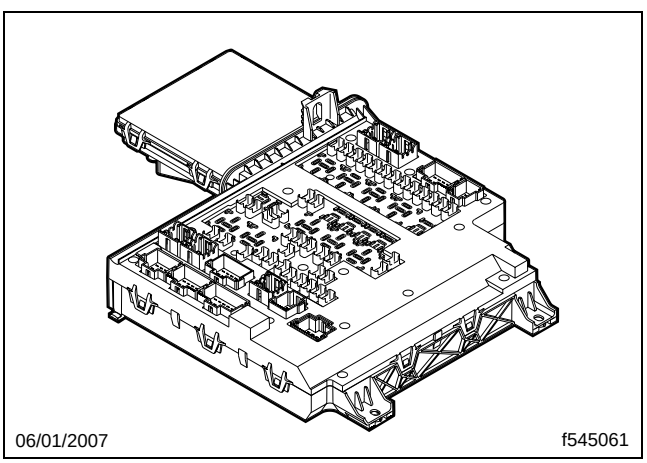
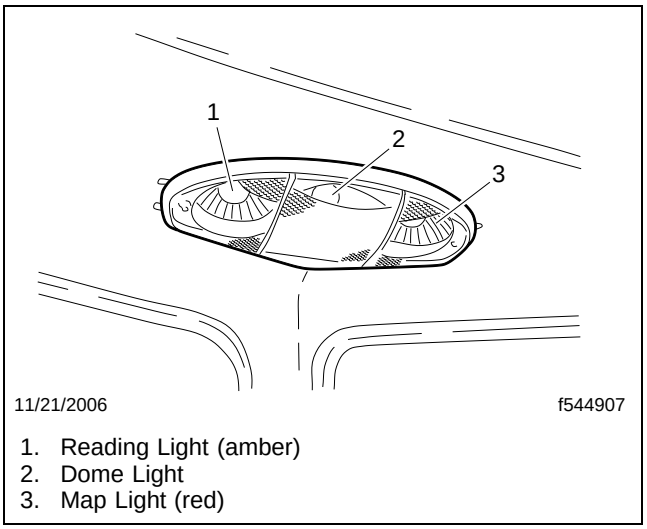


Fig. 5, SAM Cab

601 — Component Details

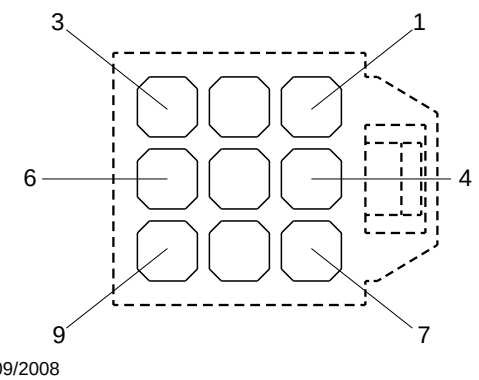


1. Reading Light (amber)
2. Dome Light
3. Map Light (red)

Fig. 2, Dome Light (driver-side)

NOTE: The reading light and the map light are reversed on the passenger-side of the vehicle.

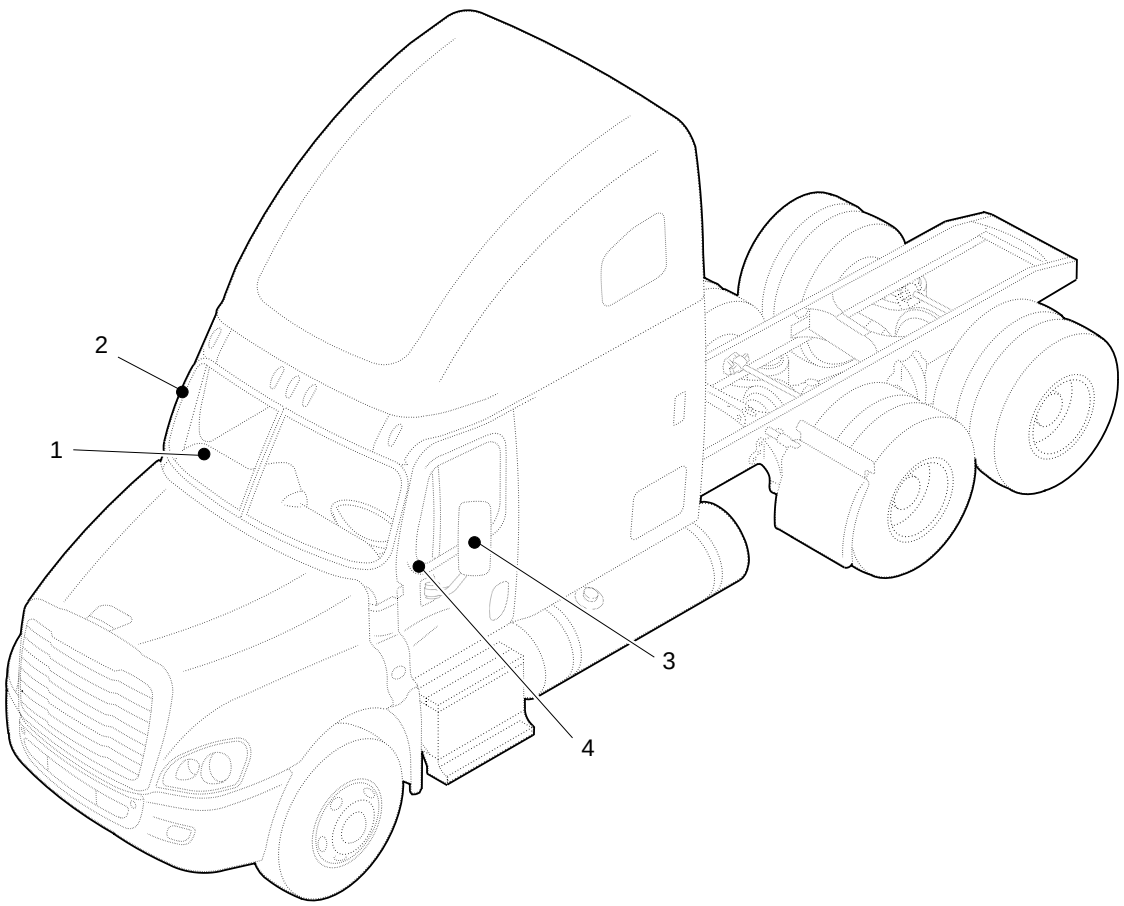
SAM Cab Connector 8



Pin	Circuit	Description
1	108T	Door Open Driver Side
6	443	Door Lock, BAT

Table 1, SAM Cab Connector 8

600 — Component Locations



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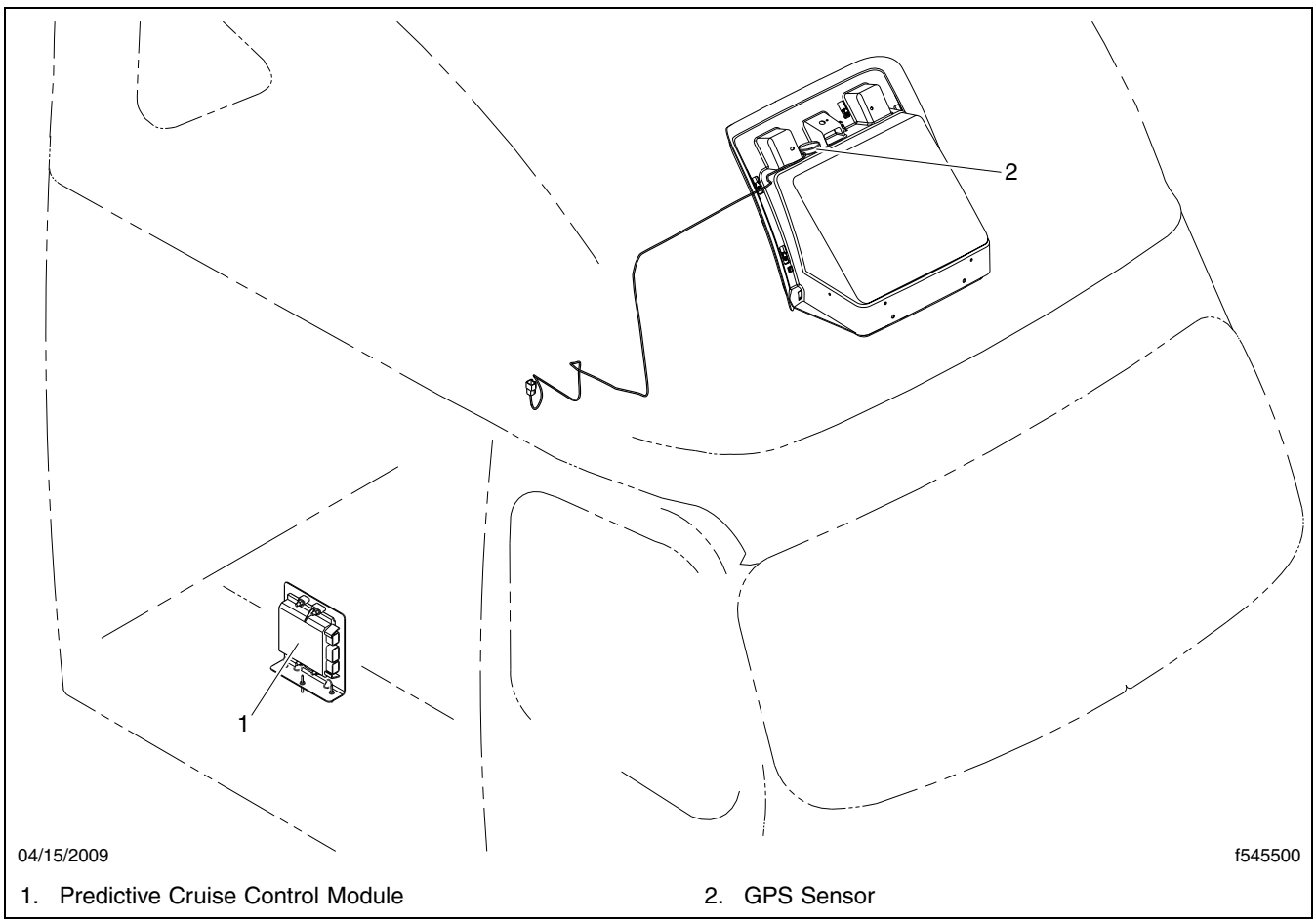
1. SAM Cab
2. Passenger Side Mirror
3. Driver Side Mirror
4. Door-Mounted Switch (inside vehicle)

Fig. 1, Component Locations

600 — Component Locations



1. Predictive Cruise Control Module
2. GPS Sensor

Fig. 1, Component Locations

600 — Component Locations

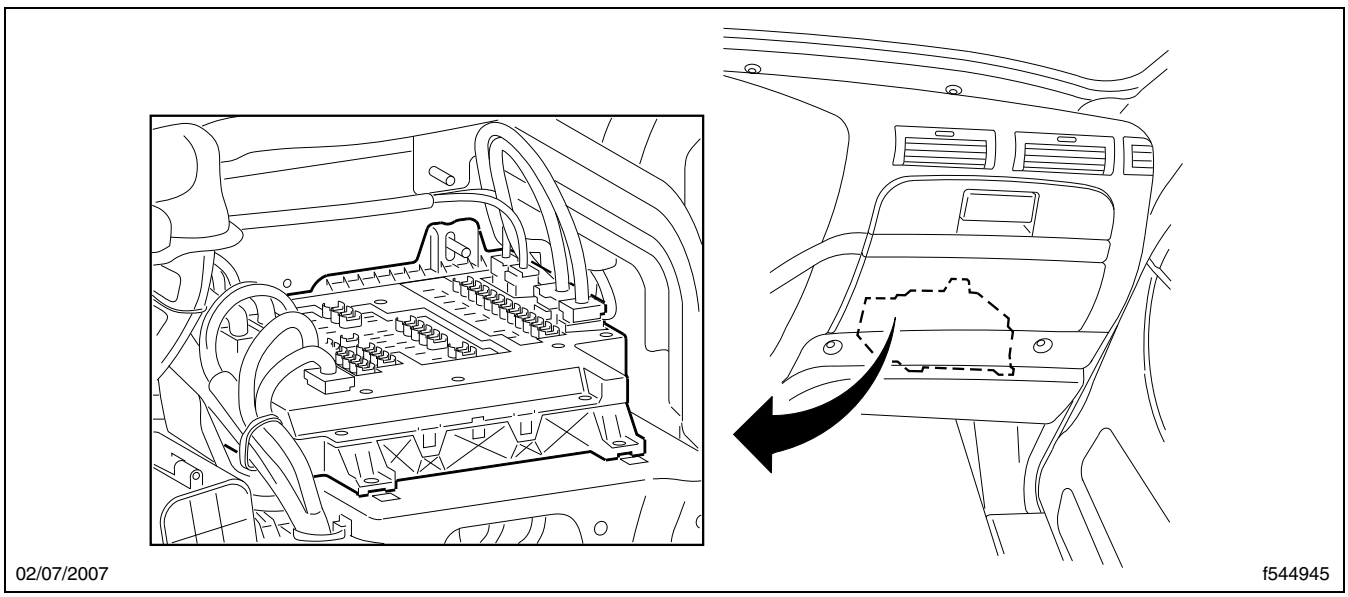
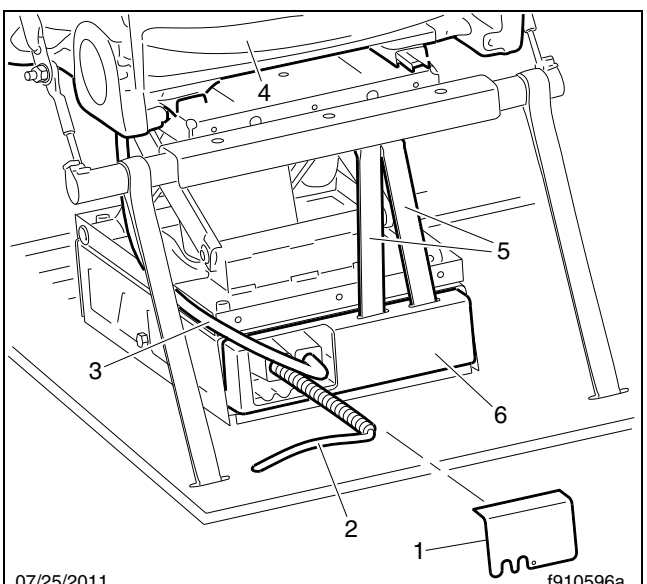


Fig. 1, SAM Cab



1. Access Panel
2. Cab Harness
3. Side-Roll Air Bag Harness
4. Seat Back
5. Pull-Down Straps
6. RollTek Module

Fig. 2, RollTek Module

Is there between 4 and 8 Ohms?

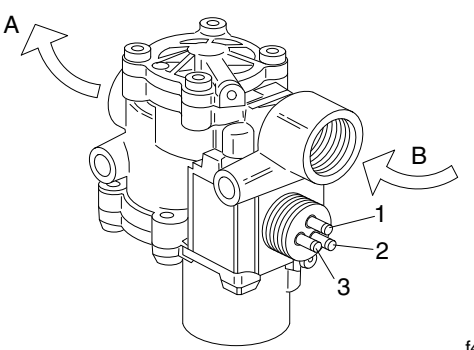
YES →The modulator is good. Check the modulator valve circuit wiring.

NO →Clean the terminals on the modulator valve and check the resistance again. If the resistance is still not correct, replace the valve.

706 — Retarder Relay Faults (SID 013)

J1587 Retarder Relay Fault Codes (SID 013)—Troubleshooting					
MID	**SID**	**FMI**	**Fault Description**	**Fault Trigger**	**Action**
136	013	03	Retarder relay circuit—short to power	This vehicle does not use the retarder relay circuit.	Check if a circuit has been connected to pin X1/14 by mistake. Re-configure the ECU.
		05	Retarder relay circuit—open circuit		
		06	Retarder relay circuit—short to ground		

Table 16, J1587 Retarder Relay Fault Codes (SID 013)



A. Delivery Port B. Supply Port

1. Ground (Common)
2. Exhaust Solenoid (Out)
3. Supply Solenoid (In)

Fig. 28, Modulator Valve Terminals