FAULT CODES

FOR:

ALLISON, CATERPILLAR, CUMMINS,
ICU 3, ICU 3 C2, MERCEDES, WABCO, PCM-FS-65

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FAULT CODES

1000 TRANSMISSIONS

2000 TRANSMISSIONS

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5-5. DIAGNOSTIC TROUBLE CODES (DTCs)

DTC LIST AND DESCRIPTIONS INDEX

DIAGNOSTIC TROUBLE COPDES (DTC)

DTC LIST AND DESCRIPTIONS INDEX (*cont'd*)

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FAULT CODES

3000 MH TRANSMISSIONS

CODES		QUICK CHECKS
MAIN CODE	SUB CODE	
13	12	Check: a. Battery direct ground and power connections are tight and clean. b. Vehicle batteries are charged. c. Vehicle charging system is not over- or under-charging. d. VIM fuse is good. e. VIM connections are tight, clean, and undamaged. f. Vehicle manufacturer supplied wiring is correct. g. ECU connectors are tight, clean, and undamaged.
ECU Input Voltage Low		
13	13	
ECU Input Voltage Medium Low		
13	23	
ECU Input Voltage High		
14	12, 23	Check: a. Is transmission equipped with oil level sensor? b. Engine speed sensor, output speed sensor, temperature sensor, and oil level sensor are working correctly. c. Wiring harness has no opens, shorts to ground, or shorts to battery.
Oil Level Sensor		
21	12, 23	Check: a. TPS connector is properly connected. b. End of TPS cable is pulled out properly. c. Engine fuel lever is in idle position. d. Engine fuel lever provides proper amount of stroke on TPS cable. e. Wiring harness to TPS has no opens, shorts between wires, or shorts to ground. f. TPS for proper operation and resistance readings.
Throttle Position Sensor		

Code Listings And Procedures *(cont'd)*

CODES		QUICK CHECKS
MAIN CODE	**SUB CODE**	
22	14, 15, 16	Check: a. Speed sensors and connectors are tight, clean, and undamaged. b. Wiring harness to sensors has no opens, shorts between wires, or shorts to ground.
Speed Sensors		
23	12, 13, 14, 15, 16	Check: a. ECU connectors are tight, clean, and undamaged. b. Shift selector connector is tight, clean, and undamaged. c. Wiring harness has no opens, shorts between wires, or shorts to ground. d. Shift selector(s) for proper operation.
Shift Selectors		
24	12	Check: a. Air temperature is below –32°C (–25°F) • If yes, this is a correct response for temperature. • If no, check that main transmission connector is tight, clean, and undamaged. b. ECU connectors are tight, clean, and undamaged.
Sump Fluid Temperature Cold		
24	23	Verify the overheat situation. Check: a. Correct dipstick is installed. b. Fluid level is correct. Refer to CARE AND MAINTENANCE section. • If fluid level is incorrect—correct fluid level. • If fluid level is correct—check for cause of overheating. c. Check if ECU and transmission connectors are tight, clean, and undamaged.
Sump Fluid Temperature Hot		

Code Listings And Procedures *(cont'd)*

CODES		QUICK CHECKS
MAIN CODE	**SUB CODE**	
25	00, 11, 22, 33, 44, 55, 66, 77	Check: a. Speed sensor connector is tight, clean, and undamaged. b. ECU connectors are tight, clean, and undamaged. c. Fluid level is correct. Refer to CARE AND MAINTENANCE section. d. Wiring harness to sensor has no opens, shorts between wires, or shorts to ground.
Output Speed Sensor		
26	00, 11	Check: a. TPS for proper operation, related harness for opens and shorts. b. Serial connection to engine is tight, clean, and undamaged. c. SCI wiring harness has no opens or shorts.
Throttle/Engine Coolant Source Not Detected		
32	00, 33, 55, 77	Check: a. Correct dipstick is installed. b. Fluid level is correct. Refer to CARE AND MAINTENANCE section. c. Main transmission connector is tight, clean, and undamaged. d. ECU connectors are tight, clean, and undamaged. e. Wiring harness has no opens, shorts between wires, or shorts to ground.
C3 Pressure Switch Open		
33	12, 23	Check: a. Main transmission connector is tight, clean, and undamaged. b. ECU connectors are tight, clean, and undamaged. c. Wiring harness has no opens, shorts between wires, or shorts to ground.
Sump Oil Temperature Sensor Failure		

Code Listings And Procedures *(cont'd)*

CODES		QUICK CHECKS
MAIN CODE	**SUB CODE**	
34	12, 13, 14, 15, 16, 17	a. Recalibrate ECU, if possible. b. Replace ECU if not possible to recalibrate.
EEPROM		
35	00, 16	Check: a. ECU connectors are tight, clean, and undamaged. b. VIM connectors are tight, clean, and undamaged. c. Vehicle manufacturer supplied wiring has correct power and ground connections. d. Power connections are battery direct. e. Ground connections are battery direct. f. Ignition switch connections are correct.
Power Interruption Real Time Write Interruption		
36	00, 01, 02	a. If able, recalibrate ECU; if not, replace ECU. b. Check that ECU is compatible with TransID level (36 01). c. Troubleshoot TransID wire and circuit for short to battery (36 02).
Hardware/Software Not Compatible		
42	12, 13, 14, 15, 16, 21 22, 23, 24, 26	Check: a. Main transmission connector is tight, clean, and undamaged. b. ECU connectors are tight, clean, and undamaged. c. Wiring harness is not pulled too tight, and there is no damage, chafing, or screws through harness. d. Wiring harness has no opens, shorts between wires, or shorts to ground. e. Unauthorized repairs have not been made. f. Change harness (optional).
Short to Battery in Solenoid Circuit		

Code Listings And Procedures *(cont'd)*

CODES		QUICK CHECKS
MAIN CODE	**SUB CODE**	
44	12, 13, 14, 15, 16, 21, 22, 23, 24, 26	Check: a. Main transmission connector is tight, clean, and undamaged. b. ECU connectors are tight, clean, and undamaged. c. Wiring harness has no opens, shorts between wires, or shorts to ground.
Solenoid Circuit Short to Ground		
45	12, 13, 14, 15, 16, 21, 22, 23, 24, 26	Check: a. b. c. a. Main transmission connector is tight, clean, and undamaged. b. ECU connectors are tight, clean, and undamaged. c. Wiring harness has no opens or shorts.
Solenoid Circuit Open		
46	21, 26, 27	Check: a. Main transmission connector is tight, clean, and undamaged. b. ECU connectors are tight, clean, and undamaged. c. Wiring harness has no opens, shorts between wires, or shorts to ground. d. Replace ECU.
Solenoid Overcurrent		
51	01, 10, 12, 21, 23, 24, 35, 42, 43, 45, 46, 53, 64, 65, XY*	Check: a. Output and turbine speed sensor connectors are tight, clean, and undamaged. b. Speed sensor wiring harness has no opens, shorts between wires, or shorts to ground. c. Correct dipstick is installed. d. Fluid level is correct. Refer to CARE AND MAINTENANCE section.
Offgoing Ratio Test (During Shift)		

Code Listings And Procedures *(cont'd)*

CODES		QUICK CHECKS
MAIN CODE	**SUB CODE**	
52	01, 08, 32, 34, 54, 56, 71, 72, 78, 79, 99, XY*	Check: a. Output and turbine speed sensor connectors are tight, clean, and undamaged. b. Speed sensor wiring harness has no opens, shorts between wires, or shorts to ground. c. Main wiring harness to transmission has no shorts between wires or shorts to ground. d. Correct dipstick is installed. e. Fluid level is correct. Refer to CARE AND MAINTENANCE section.
Offgoing C3 Pressure Switch Test (During Shift)		
53	08, 09, 18, 19, 28, 29, 38, 39, 48, 49, 58, 59, 68, 69, 78, 99, XY*	Check: a. Turbine and engine speed sensor connectors are tight, clean, and undamaged. b. Speed sensor wiring harness has no opens, shorts between wires, or shorts to ground. c. Correct dipstick is installed. d. Fluid level is correct. Refer to CARE AND MAINTENANCE section.
Offgoing Speed Test (During Shift)		
54	01, 07, 10, 12, 17, 21, 23, 24, 27, 32, 34, 35, 42, 43, 45, 46, 53, 54, 56, 64, 65, 70, 71, 72, 80, 81, 82, 83, 85, 86, 87, 92, 93, 95, 96, XY*	Check: a. Turbine and output speed sensor connectors are tight, clean, and undamaged. b. Speed sensor wiring harness has no opens, shorts between wires, or shorts to ground. c. Correct dipstick is installed. d. Fluid level is correct. Refer to CARE AND MAINTENANCE section. e. EEPROM calibration is correct for the transmission.
Oncoming Ratio Test (After Shift)		

Code Listings And Procedures *(cont'd)*

<table>
<tr><th colspan="2">CODES</th><th rowspan="2">QUICK CHECKS</th></tr>
<tr><th>MAIN CODE</th><th>SUB CODE</th></tr>
<tr><td>55</td><td>07, 17, 27, 87, 97, XY*</td><td rowspan="2">Check:
a. Correct dipstick is installed.
b. Fluid level is correct. Refer to CARE AND MAINTENANCE section.
c. Output and turbine speed sensor connectors are tight, clean, and undamaged.
d. Speed sensor wiring harness has no opens, shorts between wires, or shorts to ground.
e. Transmission connector is tight, clean, and undamaged.
f. ECU connectors are tight, clean, and undamaged.
g. C3 pressure switch wiring has no opens, shorts between wires, or shorts to ground.</td></tr>
<tr><td colspan="2">Oncoming C3 Pressure Switch Test (After Shift)</td></tr>
<tr><td>56</td><td>00, 11, 22, 33, 44, 55, 66, 77</td><td rowspan="2">Check:
a. Turbine and output speed sensor connectors are tight, clean, and undamaged.
b. Speed sensor wiring harness has no opens, shorts between wires, or shorts to ground.
c. Transmission connector is tight, clean, and undamaged.
d. ECU connectors are tight, clean, and undamaged.
e. Correct dipstick is installed.
f. Fluid level is correct. Refer to CARE AND MAINTENANCE section.</td></tr>
<tr><td colspan="2">Range Verification Ratio Test</td></tr>
</table>

Code Listings And Procedures *(cont'd)*

<table>
<tr><th colspan="2">CODES</th><th>QUICK CHECKS</th></tr>
<tr><th>MAIN CODE</th><th>SUB CODE</th><th></th></tr>
<tr><td>57</td><td>11, 22, 44, 66, 88, 99</td><td rowspan="2">Check:
a. Correct dipstick is installed.
b. Fluid level is correct. Refer to CARE AND MAINTENANCE section.
c. Output and turbine speed sensor connectors are tight, clean, and undamaged.
d. Speed sensor wiring harness has no opens, shorts between wires, or shorts to ground.
e. Transmission connector is tight, clean, and undamaged.
f. ECU connectors are tight, clean, and undamaged.
g. C3 pressure switch wiring has no opens, shorts between wires, or shorts to ground.</td></tr>
<tr><td colspan="2">Range Verification C3 Pressure Switch Test</td></tr>
<tr><td>61</td><td>00</td><td rowspan="2">Check:
a. Fluid level is correct. Refer to CARE AND MAINTENANCE section.
b. Retarder apply system is not allowing retarder and throttle to be applied at the same time.
c. Fluid cooler is adequately sized for load.</td></tr>
<tr><td colspan="2">Retarder Over Temperature</td></tr>
</table>

CODES		QUICK CHECKS
MAIN CODE	**SUB CODE**	
62	12, 23, 32, 33	Check: a. Retarder temperature measured with diagnostic tool is consistent with code: or determine if code is active using shift selector. b. Sensor connector is tight, clean and undamaged. c. ECU connectors are tight, clean, and undamaged. d. Temperature sensor circuit has no opens, shorts between wires, or shorts to ground. e. Serial connection to engine computer is tight, clean, and undamaged. f. SCI wiring harness has no opens or shorts.
Retarder Temperature Sensor, Engine Coolant Sensor		
63	00, 26, 40, 41, 47	Check input wiring, switches, and connectors to determine why input states are different.
Input Function Fault		
64	12, 23	Use diagnostic tool to read retarder counts and identify problem wires. Check wiring for short to battery, ground wire open, or short to ground.
Retarder Modulation Request Device Fault		
66	00, 11, 22	Check: a. b. c. a. Serial connection to engine computer is tight, clean, and undamaged. b. SCI wiring harness has no opens, shorts, or shorts to ground. c. If diagnostic tool is not available, also be sure that transmission ECU connections are tight, clean, and undamaged. d. Problem with CAN link or engine controls.
Serial Communications Interface Fault		
69	27, 28, 29, 33, 34, 35, 36, 39, 41, 42, 43	a. Clear diagnostic code and retry vehicle start. b. If code recurs, reprogram or replace ECU.
ECU Malfunction		

CODES		QUICK CHECKS
MAIN CODE	**SUB CODE**	
70	12, 13, 14	Reset ECU
Software Problem		
* Additional codes could be logged for other shifts where X indicates range shifted from and Y indicates range shifted to.		

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FAULT CODES
MID, PID, SID

Fault Codes

MESSAGE IDENTIFIERS (MID CODES)	
128 Engine	74 Maximum Road Speed Limit - MAXROADSPEED
130 Electronic Transmission	75 Steering Axle Temperature
136 Anti-Lock Brakes (ABS)	76 Axle Lift Air Pressure
140 Instrumentation Control Unit, Left	77 Forward-Rear Drive Axle Temperature
142 Instrumentation Control Unit, Right #1	78 Rearmost (Rear-Rear) Drive Axle Temperature
(becomes 234 with software ver. 8.4)	79 Road Surface Temperature
164 Bulkhead module	80 Washer Fluid Level
172 ServiceLink	81 Particulate Trap Inlet Pressure
179 Data Logging Unit	82 Air Start Pressure - AIRSTARTPRESS
181 Communications Unit-Satellite	83 Road Speed Limit Status - ROAD SPEED Lim
190 Air Conditioning Protection Unit - ACPU	84 Road Speed
219 Collision Avoidance Radar - VORAD	85 Cruise Control Status - Cruise Status
231 Communications Unit-Cellular	86 Cruise Control Set Speed - CRUISE SET
232 seat belt unit	87 Cruise Control High-Set Limit Speed
234 Instrumentation Control Unit, Right #2	88 Cruise Control Low-Set Limit Speed - CRUISE LO SET
PARAMETER IDENTIFIERS (PID CODES)	89 Power Takeoff Status - PTO STATUS
51 Throttle Position	90 PTO Oil Temperature - PTO OIL TEMP
52 Engine Intercooler Temperature - TEMP	91 Percent Accelerator Pedal Position - ACCEL PDL POS%
53 Transmission Synchronizer Clutch Value - SYNCRO CLUTCH	92 Percent Engine Load - ENG LOAD%
54 Transmission Synchronizer Brake Value - SYNCRO BRAKE	93 Output Torque - OUTPUT TORQUE
55 Shift Finger Positional Status - SHFT FNGR POS	94 Fuel Delivery Pressure - FUEL DLVR PRSS
56 Transmission Range Switch Status - RANGE SWITCH	95 Fuel Filter Differential Pressure - FUEL FILTER
57 Transmission Actuator Status #2 - ACTTRSTATUS#2	96 Fuel Level
58 Shift Finger Actuator Status - SHFT FNGR ACT	97 Water in Fuel Indicator
59 Shift Finger Gear Position - SHFT FNGR GEAR	98 Engine Oil Level
60 Shift Finger Rail Position - SHFT FNGR RAIL	99 Engine Oil Filter Differential Pressure - Oil Fltr Pres
61 Parking Brake Actuator Status	100 Engine Oil Pressure
62 Retarder Inhibit Status - RETARDRINHIBIT	101 Crankcase Pressure
63 Transmission Actuator Status #1 - ACT STATUS #1	102 Boost Pressure
64 Direction Switch Status	103 Turbo Speed
65 Service Brake Switch Status	104 Turbo Oil Pressure
66 Vehicle Enabling Component Status	105 Intake Manifold Temperature - Intake Air TEMP
67 Shift Request Switch Status	106 Air Inlet Pressure
68 Torque Limiting Factor	107 Air Filter Differential Pressure - Air Filter
69 Two-Speed Axle Switch Status	108 Barometric Pressure
70 Parking Brake Switch	109 Coolant Pressure
71 Idle Shutdown Timer Status - IDLESHUTDWNTMR	110 Engine Coolant Temperature
72 Blower Bypass Valve Position - BLOWRBYPASSPOS	111 Coolant Level
73 Auxiliary Water Pump Pressure - Aux PUMP Press	112 Coolant Filter Differential Pressure - CoolFltDiffPrs

Fault Codes (cont.)

PARAMETER IDENTIFIERS (PID CODES) (cont.)	
113 Governor Droop	177 Transmission Oil Temperature - TRAN OIL TEMP
114 Net Battery Current - Battery AMPS	178 Front Axle Weight
115 Alternator Current - Alternator AMPS	179 Rear Axle Weight
116 Brake Application Pressure	180 Trailer Weight
117 Brake Primary Pressure - Primary Press	181 Cargo Weight
118 Brake Secondary Pressure - Sec. Press	182 Trip Fuel
119 Hydraulic Retarder Pressure - Retarder Press	183 Fuel Rate
120 Hydraulic Retarder Oil Temperature - Retdr Oil TEMP	184 Instantaneous Fuel Economy - Inst Fuel Icon
121 Engine Retarder Status - Retardr Status	185 Average Fuel Economy - AVG. Fuel Econ
122 Engine Retarder Percent -% Retarder	186 Power Takeoff Speed
123 Clutch Pressure	187 Power Takeoff Set Speed - PTO SET SPEED
124 Transmission Oil Level - Oil Level	188 Idle Engine Speed
125 Transmission Oil Level High/Low - Oil Level	189 Rated Engine Speed - Rated SPEED
126 Transmission Filter Differential Pressure - FilterDifPress	190 Engine Speed
127 Transmission Oil Pressure - Oil Pressure	191 Transmission Output Shaft Speed - TRAN OUT SPEED
154 Auxiliary Input and Output Status #2	232 DGPS Differential Correction - DGPS Correctn
155 Auxiliary Input and Output Status #1	233 Power Unit Number - POWER UNIT #
156 Injector Timing Rail Pressure	234 Software Identification
157 Injector Metering Rail Pressure	235 Total Idle Hours
158 Battery Potential (voltage)-Switched - Volts (BattSw)	236 Total Idle Fuel Used - Totl Idle Fuel
159 Gas Supply Pressure	237 Vehicle Identification Number
160 Main Shaft Speed	238 Velocity Vector
161 Input Shaft Speed	239 Vehicle Position
162 Transmission Range Selected	240 Change Reference Number
163 Transmission Range Attained	241 Tire Pressure
164 Injection Control Pressure	242 Tire Temperature
165 Compass Bearing - COMPASS Dir.	243 Component Identification
166 Rated Engine Power	244 Trip Distance
167 Alternator Potential (voltage) - Volts (Alt)	245 Total Vehicle Distance
168 Battery Potential (voltage) - Volts (Batt)	246 Total Vehicle Hours
169 Cargo Ambient Temperature - CARGO TEMP	247 Total Engine Hours
170 Cab Interior Temperature - CAB TEMP	248 Total PTO Hours
171 Ambient Air Temperature - Outside TEMP	249 Total Engine Revolutions
172 Air Inlet Temperature	250 Total Fuel Used
173 Exhaust Gas Temperature	251 Clock
174 Fuel Temperature - Fuel TEMP	252 Date
175 Engine Oil Temperature	253 Elapsed Time
176 Turbo Oil Temperature	

Fault Codes (cont.)

SUB-SYSTEM IDENTIFIERS (SID CODES)	
MID 128 - Engine	49 Injector Cylinder #19
1 Injector Cylinder #1	50 Injector Cylinder #20
2 Injector Cylinder #2	51 Auxiliary Output Device Driver #3
3 Injector Cylinder #3	52 Auxiliary Output Device Driver #4
4 Injector Cylinder #4	53 Auxiliary Output Device Driver #5
5 Injector Cylinder #5	54 Auxiliary Output Device Driver #6
6 Injector Cylinder #6	55 Auxiliary Output Device Driver #7
7 Injector Cylinder #7	56 Auxiliary Output Device Driver #8
8 Injector Cylinder #8	57 Auxiliary PWM Driver #1
9 Injector Cylinder #9	58 Auxiliary PWM Driver #2
10 Injector Cylinder #10	59 Auxiliary PWM Driver #3
17 Fuel Shutoff Valve	60 Auxiliary PWM Driver #4
18 Fuel Control Valve	61 Variable Swirl System Valve
19 Throttle Bypass Valve	62 Prestroke Sensor
20 Timing Actuator	63 Prestroke Actuator
21 Engine Position Sensor	64 Engine Speed Sensor #2
22 Timing Sensor	65 Heated Oxygen Sensor
23 Rack Actuator	66 Ignition Control Mode Signal
24 Rack Position Sensor	67 Ignition Control Timing Signal
25 External Engine Protection Input	68 Secondary Turbo Inlet Pressure
26 Auxiliary Output Device Driver #1	69 ACOC (Aftercooler/Oil Cooler) Coolant F
27 Variable Geometry Turbocharger Actuator 1	70 Inlet Air Heater Driver #1
28 Variable Geometry Turbocharger Actuator 2	71 Inlet Air Heater Driver #2
29 External Fuel Command Input	72 Injector Cylinder #21
30 External Speed Command Input	73 Injector Cylinder #22
31 Tachometer Signal Output	74 Injector Cylinder #23
32 Wastegate Output Device Driver	75 Injector Cylinder #24
33 Fan Clutch Output Device Driver	76 Knock Sensor
34 Exhaust Back Pressure Sensor	77 Gas Metering Valve
35 Exhaust Back Pressure Regulator Solenoid	78 Fuel Supply Pump Actuator
36 Glow Plug Lamp	**MID 136 ABS -**
37 Electronic Drive Unit Power Relay	1 Wheel Sensor ABS Axle 1 Left
38 Glow Plug Relay	2 Wheel Sensor ABS Axle 1 Right
39 Engine Starter Motor Relay	3 Wheel Sensor ABS Axle 2 Left
40 Auxiliary Output Device Driver #2	4 Wheel Sensor ABS Axle 2 Right
41 ECM 8 Volts DC Supply	5 Wheel Sensor ABS Axle 3 Left
42 Injection Control Pressure Regulator	6 Wheel Sensor ABS Axle 3 Right
43 Autoshift High Gear Actuator	7 Pressure Mod. Valve ABS Axle 1 Left
44 Autoshift Low Gear Actuator	8 Pressure Mod. Valve ABS Axle 1 Right
45 Autoshift Neutral Gear Actuator	9 Pressure Mod. Valve ABS Axle 2 Left
46 Autoshift Common Low Side (Return)	10 Pressure Mod. Valve ABS Axle 2 Right
47 Injector Cylinder #17	11 Pressure Mod. Valve ABS Axle 3 Left
48 Injector Cylinder #18	

Fault Codes (cont.)

MID 136 ABS - (cont.)	
12 Pressure Mod. Valve ABS Axle 3 Right	230 Idle Validation Switch
13 Retarder Control Relay	231 SAE J1939 Datalink
14 Relay Diagonal 1	232 5-Volt DC Supply
MID 190 ACPU -	233 Controller #2
1 Refrigerant Charge	234 Parking Brake ON Actuator
2 Refrigerant Moisture Level	235 Parking Brake OFF Actuator
3 Non-Condensable Gas in Refrigerant	236 Power Connect Device
4 Refrigerant Flow Control Solenoid	237 Start Enable Device
5 Low Pressure Switch	238 Diagnostic Light-Red
6 Refrigerant Clutch Circuit	239 Diagnostic Light-Amber
7 Evaporator Thermostat Circuit	240 Program Memory
MID 219 VORAD -	242 Cruise Control RESUME Switch
1 Forward Antenna	243 Cruise Control SET Switch
2 Antenna Electronics	244 Cruise Control ENABLE Switch
3 Brake Input Monitor	245 Clutch Pedal Switch #1
4 Speaker Monitor	246 Brake Pedal Switch #1
5 Steering Sensor Monitor	247 Brake Pedal Switch #2
6 Speedometer Monitor	248 Proprietary Datalink
7 Right Turn Signal Monitor	249 SAE J1922 Datalink
8 Left Turn Signal Monitor	250 SAE J1708 (J1587) Datalink
9 Control Display Unit	251 Power Supply
10 Right Side Sensor	252 Calibration Module
11 Left Side Sensor	253 Calibration Memory
12 Rear Sensor	254 Controller #1
GENERIC SIDs -	**FAILURE MODE IDENTIFIERS (FMI CODES)**
151 System Diagnostic Code #1	00 Above normal operating range (temperature, pressure, etc.)
152 System Diagnostic Code #2	01 Below normal operating range (temperature, pressure, etc.)
153 System Diagnostic Code #3	02 Erratic, intermittent, or incorrect data
154 System Diagnostic Code #4	03 Voltage above normal or shorted high
155 System Diagnostic Code #5	04 Voltage below normal or shorted low
219 Start Signal Indicator	05 Current below normal or open circuit
220 Electronic Tractor/Trailer Interface	06 Current above normal or circuit shorted to gnd.
(ISO 11992)	07 Device not responding
221 Internal Sensor Voltage Supply	08 Abnormal frequency
222 Protect Light	09 Abnormal update rate
223 Ambient Light Sensor	10 Abnormal rate of change
224 Audible Alarm	11 Not identifiable
225 Green Light	12 Bad intelligent device or component
226 Transmission Neutral Switch	13 Out of calibration
227 Auxiliary Analog Input #1	14 Special instructions
228 High Pressure Switch	15 Reserved
229 Kickdown Switch	

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FAULT CODES

FOR THE C2

Fault Codes

MESSAGE IDENTIFIERS (MID CODES)	
128 Engine	74 Maximum Road Speed Limit - MAXROADSPEED
130 Electronic Transmission	75 Steering Axle Temperature
136 Anti-Lock Brakes (ABS)	76 Axle Lift Air Pressure
140 Instrumentation Control Unit, Left	77 Forward-Rear Drive Axle Temperature
142 Instrumentation Control Unit, Right #1	78 Rearmost (Rear-Rear) Drive Axle Temperature
(becomes 234 with software ver. 8.4)	79 Road Surface Temperature
164 Bulkhead module	80 Washer Fluid Level
172 ServiceLink	81 Particulate Trap Inlet Pressure
179 Data Logging Unit	82 Air Start Pressure - AIRSTARTPRESS
181 Communications Unit-Satellite	83 Road Speed Limit Status - ROAD SPEED Lim
190 Air Conditioning Protection Unit - ACPU	84 Road Speed
219 Collision Avoidance Radar - VORAD	85 Cruise Control Status - Cruise Status
231 Communications Unit-Cellular	86 Cruise Control Set Speed - CRUISE SET
232 seat belt unit	87 Cruise Control High-Set Limit Speed
234 Instrumentation Control Unit, Right #2	88 Cruise Control Low-Set Limit Speed - CRUISE LO SET
PARAMETER IDENTIFIERS (PID CODES)	89 Power Takeoff Status - PTO STATUS
51 Throttle Position	90 PTO Oil Temperature - PTO OIL TEMP
52 Engine Intercooler Temperature - TEMP	91 Percent Accelerator Pedal Position - ACCEL PDL POS%
53 Transmission Synchronizer Clutch Value - SYNCRO CLUTCH	92 Percent Engine Load - ENG LOAD%
54 Transmission Synchronizer Brake Value - SYNCRO BRAKE	93 Output Torque - OUTPUT TORQUE
55 Shift Finger Positional Status - SHFT FNGR POS	94 Fuel Delivery Pressure - FUEL DLVR PRSS
56 Transmission Range Switch Status - RANGE SWITCH	95 Fuel Filter Differential Pressure - FUEL FILTER
57 Transmission Actuator Status #2 - ACTTRSTATUS#2	96 Fuel Level
58 Shift Finger Actuator Status - SHFT FNGR ACT	97 Water in Fuel Indicator
59 Shift Finger Gear Position - SHFT FNGR GEAR	98 Engine Oil Level
60 Shift Finger Rail Position - SHFT FNGR RAIL	99 Engine Oil Filter Differential Pressure - Oil Fltr Pres
61 Parking Brake Actuator Status	100 Engine Oil Pressure
62 Retarder Inhibit Status - RETARDRINHIBIT	101 Crankcase Pressure
63 Transmission Actuator Status #1 - ACT STATUS #1	102 Boost Pressure
64 Direction Switch Status	103 Turbo Speed
65 Service Brake Switch Status	104 Turbo Oil Pressure
66 Vehicle Enabling Component Status	105 Intake Manifold Temperature - Intake Air TEMP
67 Shift Request Switch Status	106 Air Inlet Pressure
68 Torque Limiting Factor	107 Air Filter Differential Pressure - Air Filter
69 Two-Speed Axle Switch Status	108 Barometric Pressure
70 Parking Brake Switch	109 Coolant Pressure
71 Idle Shutdown Timer Status - IDLESHUTDWNTMR	110 Engine Coolant Temperature
72 Blower Bypass Valve Position - BLOWRBYPASSPOS	111 Coolant Level
73 Auxiliary Water Pump Pressure - Aux PUMP Press	112 Coolant Filter Differential Pressure - CoolFltDiffPrs

Fault Codes (cont.)

PARAMETER IDENTIFIERS (PID CODES) (cont.)	
113 Governor Droop	177 Transmission Oil Temperature - TRAN OIL TEMP
114 Net Battery Current - Battery AMPS	178 Front Axle Weight
115 Alternator Current - Alternator AMPS	179 Rear Axle Weight
116 Brake Application Pressure	180 Trailer Weight
117 Brake Primary Pressure - Primary Press	181 Cargo Weight
118 Brake Secondary Pressure - Sec. Press	182 Trip Fuel
119 Hydraulic Retarder Pressure - Retarder Press	183 Fuel Rate
120 Hydraulic Retarder Oil Temperature - Retdr Oil TEMP	184 Instantaneous Fuel Economy - Inst Fuel Icon
121 Engine Retarder Status - Retardr Status	185 Average Fuel Economy - AVG. Fuel Econ
122 Engine Retarder Percent -% Retarder	186 Power Takeoff Speed
123 Clutch Pressure	187 Power Takeoff Set Speed - PTO SET SPEED
124 Transmission Oil Level - Oil Level	188 Idle Engine Speed
125 Transmission Oil Level High/Low - Oil Level	189 Rated Engine Speed - Rated SPEED
126 Transmission Filter Differential Pressure - FilterDifPress	190 Engine Speed
127 Transmission Oil Pressure - Oil Pressure	191 Transmission Output Shaft Speed - TRAN OUT SPEED
154 Auxiliary Input and Output Status #2	232 DGPS Differential Correction - DGPS Correctn
155 Auxiliary Input and Output Status #1	233 Power Unit Number - POWER UNIT #
156 Injector Timing Rail Pressure	234 Software Identification
157 Injector Metering Rail Pressure	235 Total Idle Hours
158 Battery Potential (voltage)-Switched - Volts (BattSw)	236 Total Idle Fuel Used - Totl Idle Fuel
159 Gas Supply Pressure	237 Vehicle Identification Number
160 Main Shaft Speed	238 Velocity Vector
161 Input Shaft Speed	239 Vehicle Position
162 Transmission Range Selected	240 Change Reference Number
163 Transmission Range Attained	241 Tire Pressure
164 Injection Control Pressure	242 Tire Temperature
165 Compass Bearing - COMPASS Dir.	243 Component Identification
166 Rated Engine Power	244 Trip Distance
167 Alternator Potential (voltage) - Volts (Alt)	245 Total Vehicle Distance
168 Battery Potential (voltage) - Volts (Batt)	246 Total Vehicle Hours
169 Cargo Ambient Temperature - CARGO TEMP	247 Total Engine Hours
170 Cab Interior Temperature - CAB TEMP	248 Total PTO Hours
171 Ambient Air Temperature - Outside TEMP	249 Total Engine Revolutions
172 Air Inlet Temperature	250 Total Fuel Used
173 Exhaust Gas Temperature	251 Clock
174 Fuel Temperature - Fuel TEMP	252 Date
175 Engine Oil Temperature	253 Elapsed Time
176 Turbo Oil Temperature	

Fault Codes (cont.)

SUB-SYSTEM IDENTIFIERS (SID CODES)	
MID 128 - Engine	49 Injector Cylinder #19
1 Injector Cylinder #1	50 Injector Cylinder #20
2 Injector Cylinder #2	51 Auxiliary Output Device Driver #3
3 Injector Cylinder #3	52 Auxiliary Output Device Driver #4
4 Injector Cylinder #4	53 Auxiliary Output Device Driver #5
5 Injector Cylinder #5	54 Auxiliary Output Device Driver #6
6 Injector Cylinder #6	55 Auxiliary Output Device Driver #7
7 Injector Cylinder #7	56 Auxiliary Output Device Driver #8
8 Injector Cylinder #8	57 Auxiliary PWM Driver #1
9 Injector Cylinder #9	58 Auxiliary PWM Driver #2
10 Injector Cylinder #10	59 Auxiliary PWM Driver #3
17 Fuel Shutoff Valve	60 Auxiliary PWM Driver #4
18 Fuel Control Valve	61 Variable Swirl System Valve
19 Throttle Bypass Valve	62 Prestroke Sensor
20 Timing Actuator	63 Prestroke Actuator
21 Engine Position Sensor	64 Engine Speed Sensor #2
22 Timing Sensor	65 Heated Oxygen Sensor
23 Rack Actuator	66 Ignition Control Mode Signal
24 Rack Position Sensor	67 Ignition Control Timing Signal
25 External Engine Protection Input	68 Secondary Turbo Inlet Pressure
26 Auxiliary Output Device Driver #1	69 ACOC (Aftercooler/Oil Cooler) Coolant F
27 Variable Geometry Turbocharger Actuator 1	70 Inlet Air Heater Driver #1
28 Variable Geometry Turbocharger Actuator 2	71 Inlet Air Heater Driver #2
29 External Fuel Command Input	72 Injector Cylinder #21
30 External Speed Command Input	73 Injector Cylinder #22
31 Tachometer Signal Output	74 Injector Cylinder #23
32 Wastegate Output Device Driver	75 Injector Cylinder #24
33 Fan Clutch Output Device Driver	76 Knock Sensor
34 Exhaust Back Pressure Sensor	77 Gas Metering Valve
35 Exhaust Back Pressure Regulator Solenoid	78 Fuel Supply Pump Actuator
36 Glow Plug Lamp	**MID 136 ABS -**
37 Electronic Drive Unit Power Relay	1 Wheel Sensor ABS Axle 1 Left
38 Glow Plug Relay	2 Wheel Sensor ABS Axle 1 Right
39 Engine Starter Motor Relay	3 Wheel Sensor ABS Axle 2 Left
40 Auxiliary Output Device Driver #2	4 Wheel Sensor ABS Axle 2 Right
41 ECM 8 Volts DC Supply	5 Wheel Sensor ABS Axle 3 Left
42 Injection Control Pressure Regulator	6 Wheel Sensor ABS Axle 3 Right
43 Autoshift High Gear Actuator	7 Pressure Mod. Valve ABS Axle 1 Left
44 Autoshift Low Gear Actuator	8 Pressure Mod. Valve ABS Axle 1 Right
45 Autoshift Neutral Gear Actuator	9 Pressure Mod. Valve ABS Axle 2 Left
46 Autoshift Common Low Side (Return)	10 Pressure Mod. Valve ABS Axle 2 Right
47 Injector Cylinder #17	11 Pressure Mod. Valve ABS Axle 3 Left
48 Injector Cylinder #18	

Fault Codes (cont.)

MID 136 ABS - (cont.)	
12 Pressure Mod. Valve ABS Axle 3 Right	230 Idle Validation Switch
13 Retarder Control Relay	231 SAE J1939 Datalink
14 Relay Diagonal 1	232 5-Volt DC Supply
MID 190 ACPU -	233 Controller #2
1 Refrigerant Charge	234 Parking Brake ON Actuator
2 Refrigerant Moisture Level	235 Parking Brake OFF Actuator
3 Non-Condensable Gas in Refrigerant	236 Power Connect Device
4 Refrigerant Flow Control Solenoid	237 Start Enable Device
5 Low Pressure Switch	238 Diagnostic Light-Red
6 Refrigerant Clutch Circuit	239 Diagnostic Light-Amber
7 Evaporator Thermostat Circuit	240 Program Memory
MID 219 VORAD -	242 Cruise Control RESUME Switch
1 Forward Antenna	243 Cruise Control SET Switch
2 Antenna Electronics	244 Cruise Control ENABLE Switch
3 Brake Input Monitor	245 Clutch Pedal Switch #1
4 Speaker Monitor	246 Brake Pedal Switch #1
5 Steering Sensor Monitor	247 Brake Pedal Switch #2
6 Speedometer Monitor	248 Proprietary Datalink
7 Right Turn Signal Monitor	249 SAE J1922 Datalink
8 Left Turn Signal Monitor	250 SAE J1708 (J1587) Datalink
9 Control Display Unit	251 Power Supply
10 Right Side Sensor	252 Calibration Module
11 Left Side Sensor	253 Calibration Memory
12 Rear Sensor	254 Controller #1
GENERIC SIDs -	**FAILURE MODE IDENTIFIERS (FMI CODES)**
151 System Diagnostic Code #1	00 Above normal operating range (temperature, pressure, etc.)
152 System Diagnostic Code #2	01 Below normal operating range (temperature, pressure, etc.)
153 System Diagnostic Code #3	02 Erratic, intermittent, or incorrect data
154 System Diagnostic Code #4	03 Voltage above normal or shorted high
155 System Diagnostic Code #5	04 Voltage below normal or shorted low
219 Start Signal Indicator	05 Current below normal or open circuit
220 Electronic Tractor/Trailer Interface	06 Current above normal or circuit shorted to gnd.
(ISO 11992)	07 Device not responding
221 Internal Sensor Voltage Supply	08 Abnormal frequency
222 Protect Light	09 Abnormal update rate
223 Ambient Light Sensor	10 Abnormal rate of change
224 Audible Alarm	11 Not identifiable
225 Green Light	12 Bad intelligent device or component
226 Transmission Neutral Switch	13 Out of calibration
227 Auxiliary Analog Input #1	14 Special instructions
228 High Pressure Switch	15 Reserved
229 Kickdown Switch	

Fault Code Information

The information below contains all proprietary Bulkhead Module (BHM) fault codes for J1587 and J1939 data bus protocols, how to view these codes, and what they mean. The fault codes can be seen on the instrument cluster. The mode/reset switch is used to scroll through the displays on the message display screen. For more information on the mode/reset switch see
Chapter 3 of the
Saf-T-Liner C2 School Bus Driver's Manual. Each fault code contains three distinct pieces of information, as described below.

J1587 fault codes consist of the following, in this order:

In ServiceLink, J1587 fault codes are shown under J1708. J1587 and J1708 are essentially the same data bus protocol.

- Module Identifier (MID)–Identifies which Electronic Control Unit (ECU) the fault is coming from. The J1587 MID identifying all Bulkhead Information Module faults is 164.
- Subsystem Identifier (SID)–Indicates what function on the ECU has failed. All J1587 SIDs for the BHM are listed in **Table 1**.
- Failure Mode Indicator (FMI)–Indicates in what way the function failed.

References such as BHM B1.A (beginning with SID 050 in **Table 1**) indicate that the fault is sensed to be coming from the Bulkhead Module, connector B1, pin A. Similarly, CHM indicates the Chassis Module, and EXM1-5 indicates the first through fifth Expansion Module on a vehicle.

J1939 faults consist of the following, in this order:

NOTE: As the SAE J1939 subcommittee approves new SPNs for use in J1939 messaging on a continual basis, J1939 SPNs used for diagnostic messages could change when the Bulkhead Module part changes.

- Source Address (SA)–Identifies which ECU the fault is coming from. The J1939 SA identifying all Bulkhead Module faults is 33.
- Suspect Parameter Number (SPN)–Indicates what function on the ECU has failed. All J1939 SPNs for the BHM are listed in **Table 2**.
- Failure Mode Indicator (FMI)–Indicates in what way the function failed.

Also included is a reference table of all FMIs for both data bus protocols. See **Table 3**.

J1587 SIDs for Bulkhead Module (BHM) MID 164		
SID	**Description**	**Possible FMI**
000	Backlighting Dimmer Switch Fault	7
001	Clutch Switch Fault	7
002	Reserved for Future Use	—
003	Headlamp Switch Disagreement—Both Park and On Inputs are CLOSED	7
004	Stalk Switch High Beam Input Fault	2
005	Ignition Switch Fault	7

006	Marker Interrupt Switch Fault	7
007	Stalk Switch Disagreement—Both Wiper High and Wiper Low Inputs are ON	2
008	Stalk Switch Disagreement—Wiper On/Off Input is OFF and Wiper High or Low Input is ON	2
009	Wiper Park Input Fault	7
010	ICU3-M2 Hazard Switch CAN Feedback Error	2
011	Stalk Switch Left Turn Signal Input Fault	2
012	Stalk Switch Right Turn Signal Input Fault	2
013	Stalk Switch Washer Switch Input Fault	2
014	Stalk Switch Wiper On/Off Input Fault	2
015	Stalk Switch Wiper Low Input Fault	2
016	Stalk Switch Wiper High Input Fault	2
017	Wheel Based Vehicle Speed CAN Message Error	2
018	Wake-up Hardware Fault (modules are kept awake)	7
019	Unknown Keep Awake Fault (modules are kept awake)	7
020	Extra Smart Switch	7
021	Duplicate Smart Switch	7
022	Missing Smart Switch	7
025	End of Frame Air Unexpected Pressure Feedback	7
026	End of Frame Air No Pressure Feedback	7
027	Axle Lift Unexpected Pressure Feedback	7
028	Axle Lift No Pressure Feedback	7
031	Suspension Proportioning Unexpected Pressure Feedback	7
032	Suspension Proportioning No Pressure Feedback	7
033	Cigar Lighter Output Fault	7
034	BHM/ICU3-M2 Ignition Mismatch	7
035	BHM/ICU3-M2 Hazard Switch Mismatch	2
036	BHM/ICU3-M2 Wiper Park Mismatch	2
037	Missing Transmission CAN Message	9
038	Missing Chassis Module CAN Message	9
039	Remote Bucket Switch Stuck Fault	7
040	Axle Lift 2 Feedback Fault	7
041	Axle Lift 2 No Feedback Fault	7

042	PTO 1 Feedback Fault	7
043	PTO 1 No Feedback Fault	7
044	PTO 2 Feedback Fault	7
045	PTO 2 No Feedback Fault	7
046-049	Reserved For Future Use	—
050	BHM B1.A	3,4
051	BHM B1.F, B1.P, B2.K, B2.L, B6.A8	5,6
052	BHM B1.J	3,4
053	BHM B1.K, B5.C	5,6
054	BHM B1.L	5,6
055	BHM B1.N	3,4
056	BHM B1.R	5,6
057	BHM B2.M	5,6
058	BHM B3.D	3,4
059	BHM B3.E	3,4,5,6
060	BHM B3.F	5,6
061	BHM B3.G	5,6
062	BHM B3.H	5,6
063	BHM B4.B	5,6
064	BHM B4.E, B4.F	3,4,5,6
065	BHM B4.G	3,4
066	BHM B4.K	3,4
067	BHM B4.M, B5.E	3,4,5,6
068	BHM B5.A, B7.A12	5,6
069	BHM B6.A9, B6.A10	5,6
070	BHM B5.B	5,6
071	BHM B5.D	5,6
072	BHM B5.F	3,4,5,6
073	BHM B5.G	3,4,5,6
074	BHM B5.H, B7.A1	3,4,5,6
075	CHM C1.A, C1.H, C1.J	5,6
076	CHM C1.G, C2.H, C3.N	5,6
077	CHM C1.L	5,6
078	CHM C1.N	5,6

079	CHM C1.P, C2.E, C3.R	5,6
080	CHM C2.A	3,4
081	CHM C2.F, C4.C, C4.D, C4.L, C4.M	3,4,5,6
082	CHM C3.A	3,4,5,6
083	CHM C3.C, C3.D	5,6
084	CHM C3.E	3,4
085	CHM C3.F	3,4
086	CHM C3.J	3,4
087	CHM C3.K	5,6
088	CHM C3.L	5,6
089	CHM C4.F	5,6
090	CHM C4.J	3,4
091	CHM C4.K	5,6
092	CHM C4.P	3,4
093	CHM C5.A	3,4
094	CHM C5.B	3,4
095	CHM C5.F	3,4
096	CHM C5.G	3,4
097	CHM C5.H	3,4
098	CHM C5.J	3,4
099	CHM C5.L	3,4
100	CHM C5.M	3,4
101	EXM1 C1.A, C1.H, C1.C	5,6
101	EXM1 C4.K	5,6
101	EXM1 C3.L	5,6
101	EXM1 C2.F, C4.C, C4.D, C4.L, C4.M	3,4,5,6
101	EXM1 C1.N	5,6
101	EXM1 C1.L	5,6
101	EXM1 C1P, C2.E, C3.R	5,6
101	EXM1 C1.G, C2.H, C3.N	5,6
101	EXM1 C2.A	3,4
101	EXM1 C3.A	3,4,5,6
101	EXM1 C3.C, C3.D	5,6
101	EXM1 C3.K	5,6

101	EXM1 C4.F	5,6
101	EXM1 C5.H	3,4
101	EXM1 C5.C	3,4
101	EXM1 C5.L	3,4
101	EXM1 C5.M	3,4
101	EXM1 C3.E	3,4
101	EXM1 C3.F	3,4
101	EXM1 C3.C	3,4
101	EXM1 C4.C	3,4
101	EXM1 C4.P	3,4
101	EXM1 C5.A	3,4
101	EXM1 C5.B	3,4
101	EXM1 C5.F	3,4
101	EXM1 C5.G	3,4
102	EXM2 C1.A, C1.H, C1.C	5,6
102	EXM2 C4.K	5,6
102	EXM2 C3.L	5,6
102	EXM2 C2.F, C4.C, C4.D, C4.L, C4.M	3,4,5,6
102	EXM2 C1.N	5,6
102	EXM2 C1.L	5,6
102	EXM2 C1P, C2.E, C3.R	5,6
102	EXM2 C1.G, C2.H, C3.N	5,6
102	EXM2 C2.A	3,4
102	EXM2 C3.A	3,4,5,6
102	EXM2 C3.C, C3.D	5,6
102	EXM2 C3.K	5,6
102	EXM2 C4.F	5,6
102	EXM2 C5.H	3,4
102	EXM2 C5.C	3,4
102	EXM2 C5.L	3,4
102	EXM2 C5.M	3,4
102	EXM2 C3.E	3,4
102	EXM2 C3.F	3,4
102	EXM2 C3.C	3,4

102	EXM2 C4.C	3,4
102	EXM2 C4.P	3,4
102	EXM2 C5.A	3,4
102	EXM2 C5.B	3,4
102	EXM2 C5.F	3,4
102	EXM2 C5.G	3,4
103	EXM3 C1.A, C1.H, C1.C	5,6
103	EXM3 C4.K	5,6
103	EXM3 C3.L	5,6
103	EXM3 C2.F, C4.C, C4.D, C4.L, C4.M	3,4,5,6
103	EXM3 C1.N	5,6
103	EXM3 C1.L	5,6
103	EXM3 C1P, C2.E, C3.R	5,6
103	EXM3 C1.G, C2.H, C3.N	5,6
103	EXM3 C2.A	3,4
103	EXM3 C3.A	3,4,5,6
103	EXM3 C3.C, C3.D	5,6
103	EXM3 C3.K	5,6
103	EXM3 C4.F	5,6
103	EXM3 C5.H	3,4
103	EXM3 C5.C	3,4
103	EXM3 C5.L	3,4
103	EXM3 C5.M	3,4
103	EXM3 C3.E	3,4
103	EXM3 C3.F	3,4
103	EXM3 C3.C	3,4
103	EXM3 C4.C	3,4
103	EXM3 C4.P	3,4
103	EXM3 C5.A	3,4
103	EXM3 C5.B	3,4
103	EXM3 C5.F	3,4
103	EXM3 C5.G	3,4
104	EXM4 C1.A, C1.H, C1.C	5,6
104	EXM4 C4.K	5,6

104	EXM4 C3.L	5,6
104	EXM4 C2.F, C4.C, C4.D, C4.L, C4.M	3,4,5,6
104	EXM4 C1.N	5,6
104	EXM4 C1.L	5,6
104	EXM4 C1P, C2.E, C3.R	5,6
104	EXM4 C1.G, C2.H, C3.N	5,6
104	EXM4 C2.A	3,4
104	EXM4 C3.A	3,4,5,6
104	EXM4 C3.C, C3.D	5,6
104	EXM4 C3.K	5,6
104	EXM4 C4.F	5,6
104	EXM4 C5.H	3,4
104	EXM4 C5.C	3,4
104	EXM4 C5.L	3,4
104	EXM4 C5.M	3,4
104	EXM4 C3.E	3,4
104	EXM4 C3.F	3,4
104	EXM4 C3.C	3,4
104	EXM4 C4.C	3,4
104	EXM4 C4.P	3,4
104	EXM4 C5.A	3,4
104	EXM4 C5.B	3,4
104	EXM4 C5.F	3,4
104	EXM4 C5.G	3,4
105	EXM5 C1.A, C1.H, C1.C	5,6
105	EXM5 C4.K	5,6
105	EXM5 C3.L	5,6
105	EXM5 C2.F, C4.C, C4.D, C4.L, C4.M	3,4,5,6
105	EXM5 C1.N	5,6
105	EXM5 C1.L	5,6
105	EXM5 C1P, C2.E, C3.R	5,6
105	EXM5 C1.G, C2.H, C3.N	5,6
105	EXM5 C2.A	3,4
105	EXM5 C3.A	3,4,5,6

105	EXM5 C3.C, C3.D	5,6
105	EXM5 C3.K	5,6
105	EXM5 C4.F	5,6
105	EXM5 C5.H	3,4
105	EXM5 C5.C	3,4
105	EXM5 C5.L	3,4
105	EXM5 C5.M	3,4
105	EXM5 C3.E	3,4
105	EXM5 C3.F	3,4
105	EXM5 C3.C	3,4
105	EXM5 C4.C	3,4
105	EXM5 C4.P	3,4
105	EXM5 C5.A	3,4
105	EXM5 C5.B	3,4
105	EXM5 C5.F	3,4
105	EXM5 C5.G	3,4
106	Reserved For Future Use	—
107	SHM J1.A, J1.E	6
108	SHM J3.G (PWM)	6
109	SHM J3.M(PWM)	6
110	SHM J3.F	5,6
111	SHM J3.K	5,6

Table 1 J1587 SIDs for Bulkhead Module (BHM) MID 164

J1939 SPNs for Bulkhead Module (BHM) SA 33		
SPN	**Description**	**Possible FMI**
70	Parking Brake Switch	2
80	Washer Fluid Level	2
84	Wheel Based Vehicle Speed	19
96	Fuel Level	19
97	Water In Fuel Indicator	19
163	Transmission Current Range	12,19

177	Transmission Oil Temperature Sensor	3,4
523	Transmission Current Gear	12,19
524	Transmission Selected Gear	12,19
597	ABS Service Brake Switch	2
598	Clutch Switch	7
879	Front Left Turn Signals Output Fault	5,6
881	Front Right Turn Signals Output Fault	5,6
882	Park/Marker Lights Output Fault	4,5,6
973	Engine Retarder Selection	19
1487	Backlighting Dimmer Switch Fault	7
1550	A/C Clutch Output Fault	5,6
2003	Missing Transmission CAN Message	9
2071	Missing Chassis Module CAN Message	9
6891	ID/Marker/Clearance Lamps—HW Override Output Fault	5,6
6892	Upper Right Tail Lamp Output Fault	5,6
6893	Upper Left Tail Lamp Output Fault	5,6
6894	Rear Passenger Dome Lamp Output Fault	6
6895	Front Passenger Dome Lamp Output Fault	6
6896	Right Side Air/Electric Entrance Door—Close—Output Fault	6
6897	Right Side Air/Electric Entrance Door—Open—Output Fault	6
6898	Right Side Turn Signal Output Fault	5,6
6900	Left Side Turn Signal Output Fault	5,6
6901	Stepwell Lights Output Fault	5,6
6902	Left Upper Back-up Lamp Output Fault	5,6
6903	Right Upper Back-up Lamp Output Fault	5,6
6904	Rear Right Turn Signal Output Fault	5,6
6905	Rear Left Turn Signal Output Fault	5,6
6906	PTO 2 No Feedback Fault	7
6907	PTO 2 Feedback Fault	7
6908	PTO 1 No Feedback Fault	7
6909	PTO 1 Feedback Fault	7
6910	Axle Lift 2 No Feedback Fault	7

6911	Axle Lift 2 Feedback Fault	7
6912	Remote Bucket Switch Stuck Fault	7
6915	Lamp and Gauge Ignition Output Fault	4,5,6
6916	BHM/ICU3-M2 Wiper Park CAN Message Mismatch	2
6917	BHM/ICU3-M2 Hazard Switch CAN Message Mismatch	2
6918	Missing Smart Switch	7
6919	Duplicate Smart Switch	7
6920	Extra Smart Switch	7
6921	Unknown Keep Awake Fault (modules are kept awake)	7
6922	Wake-up Hardware Fault (modules are kept awake)	7
6923	Wiper Parked Input Fault	7
6924	Stalk Switch Disagreement—Wiper On/Off Input is OFF and Wiper High or Low Input is ON	2
6925	Stalk Switch Disagreement—Both Wiper High and Wiper Low Inputs are ON	2
6926	Marker Interrupt Switch Fault	7
6927	Utility Lamp Output Fault	3,4,5,6
6928	Suspension Proportioning No AMU Pressure Feedback	7
6929	Suspension Proportioning Unexpected AMU Pressure Feedback	7
6930	Suspension Proportioning Solenoid Output Fault	3,4,5,6
6934	Spotlights Output Fault	3,4,5,6
6936	Rear 2 Differential Lock AMU Pressure Feedback Fault	7
6937	Rear 2 Differential Lock Solenoid Output Fault	3,4,5,6
6938	Rear 1 Differential Lock AMU Pressure Feedback Fault	7
6939	Rear 1 Differential Lock Solenoid Output Fault	3,4,5,6
6940	Optional Feature Output Fault	3,4,5,6
6941	Heated Mirrors Output Fault	3,4,5,6
6942	Interaxle AMU Pressure Feedback Fault	7
6943	Interaxle Solenoid Output Fault	3,4,5,6
6944	Fuel Water Separator Heater Output Fault	4,5,6
6945	Front Differential Lock AMU Pressure Feedback Fault	7
6946	Front Differential Lock Solenoid Output Fault	3,4,5,6
6947	Fog Lamp Output Fault	5,6
6954	End of Frame Air No AMU Pressure Feedback	7

6955	End of Frame Air Unexpected AMU Pressure Feedback	7
6956	End of Frame Air Solenoid Output Fault	3,4,5,6
6957	Daytime Running Lights (DRL) Output Fault	5,6
6958	Brake Line Air Dryer Output Fault	3,4,5,6
6959	Axle Shift AMU Pressure Feedback Fault	7
6960	Axle Shift Solenoid Output Fault	3,4,5,6
6961	Axle Lift No AMU Pressure Feedback	7
6962	Axle Lift Unexpected AMU Pressure Feedback	7
6963	Axle Lift Solenoid Output Fault	3,4,5,6
6964	Air Horn Solenoid Output Fault	5,6
6965	BHM VBAT 5 Input Fault	3,4
6966	BHM VBAT 4 Input Fault	3,4
6967	BHM VBAT 3 Input Fault	3,4
6968	BHM VBAT 2 Input Fault	3,4
6969	BHM VBAT 1 Input Fault	3,4
6970	Wiper High Output Fault	5,6
6971	Wiper Low Output Fault	5,6
6972	Stalk Switch Wiper High Input Fault	2
6973	Stalk Switch Wiper Low Input Fault	2
6974	Stalk Switch Wiper On/Off Input Fault	2
6975	ICU3-M2 Wiper Park CAN Feedback Error	2
6976	Washer Pump Output Fault	5,6
6977	Stalk Switch Washer Switch Input Fault	2
6978	Stalk Switch Right Turn Signal Input Fault	2
6979	Stalk Switch Left Turn Signal Input Fault	2
6980	Right Stop Lamp Output Fault	5,6
6981	Left Stop Lamp Output Fault	5,6
6982	Wake-up Hardware Fault	5,6
6983	Starter Relay (Mag Switch) Output Fault	5,6
6984	Ignition System, Accessory Power Outputs Fault	5,6
6985	Ignition System, Ignition Power Outputs Fault	2,5,6
6986	Ignition Switch Fault	7
6987	Tail/Clearance/License Plate Lights Output Fault	5,6
6988	Left Low Beam Output Fault	5,6

6989	Right Low Beam Output Fault	5,6
6990	Left High Beam Output Fault	5,6
6991	Right High Beam Output Fault	5,6
6992	Stalk Switch High Beam Input Fault	2
6993	Headlamp Switch Disagreement—Both Park and On Inputs are CLOSED	7
6994	ICU3-M2 Hazard Switch CAN Feedback Error	19
6995	Horn Output Fault	3,4,5,6
6996	Dome Lamps Switched Power Output Fault	5,6
6997	Cigar Lighter Output Fault	3,4,5,6
6998	Dome Lamps Battery Power Output Fault	5,6
6999	Back-up Lamps/Alarm Output Fault	5,6
7000	Panel Lamp Backlighting PWM Output Fault	3,4,5,6

Table 2 J1939 SPNs for Bulkhead Module (BHM) SA 33

Failure Mode Identifiers		
FMI	**J1939 Description**	**J1587 Description**
00	Data valid but above normal operational range—Most severe level	Data valid but above normal operational range (engine overheating)
01	Data valid but below normal operational range—Most severe level	Data valid but below normal operational range (engine oil pressure too low)
02	Data erratic, intermittent, or incorrect	Data erratic, intermittent, or incorrect
03	Voltage above normal or shorted high	Voltage above normal or shorted high
04	Voltage below normal or shorted low	Voltage below normal or shorted low
05	Current below normal or open circuit	Current below normal or open circuit
06	Current above normal or grounded circuit	Current above normal or grounded circuit
07	Mechanical system not responding or out of adjustment	Mechanical system not responding properly
08	Abnormal frequency, pulse width, or period	Abnormal frequency, pulse width, or period
09	Abnormal update rate	Abnormal update rate
10	Abnormal rate of change	Abnormal rate of change
11	Root cause not known	Failure mode not identifiable
12	Bad intelligent device or component	Bad intelligent device or component
13	Out of Calibration	Out of Calibration

14	Special Instructions	Special Instructions
15	Data valid but above normal operational range—Least severe level	Reserved for future assignment by the SAE Subcommittee
16	Data valid but above normal operational range—Moderately severe level	—
17	Data valid but below normal operational range—Least severe level	—
18	Data valid but below normal operational range—Moderately severe level	—
19	Received network data in error	—
20	Reserved for SAE Assignment	—
21	Reserved for SAE Assignment	—
22	Reserved for SAE Assignment	—
23	Reserved for SAE Assignment	—
24	Reserved for SAE Assignment	—
25	Reserved for SAE Assignment	—
26	Reserved for SAE Assignment	—
27	Reserved for SAE Assignment	—
28	Reserved for SAE Assignment	—
29	Reserved for SAE Assignment	—
30	Reserved for SAE Assignment	—
31	Not available or condition exists	—

C A T E R P I L L A R

C7
FAULT CODES

FLASH CODES	SIS LINKS
0	0071-11 Engine Shutdown Override Switch Occurrence 0084-14 Quick Stop Occurrence 0096-03 Fuel Level voltage high 0096-04 Fuel Level voltage low 0186-04 PTO Engine Shutdown Switch voltage low 0224-11 Theft Deterrent Active (00) 0224-14 Theft Deterrent Active with Engine Cranking (00) 0231-12 J1939 Device Not Responding 0246-11 Brake Pedal Switch #1 Fault 0247-11 Brake Pedal Switch #2 Fault Electrical Connectors - Inspect Fuel Level Sensor Circuit - Test PTO Engine Shutdown Switch Circuit - Test Powertrain Data Link Circuit - Test Service Brake Pedal Position (Switch 1) Circuit - Test Service Brake Pedal Position (Switch 2) Circuit - Test

FLASH CODES	SIS LINKS
1	0071-00 Idle Shutdown Override (01) Idle Shutdown Timer - Test
12	Diagnostic Flash Code Retrieval 0111-02 Coolant Level signal invalid (12) 0111-03 Coolant Level voltage high (12) 0111-04 Coolant Level voltage low (12) Coolant Level Sensor Circuit - Test
15	Diagnostic Flash Code Retrieval 0164-02 Injection Actuation Pressure Signal Erratic (15) 0164-03 Injection Actuation Pressure voltage high (15) 0164-04 Injection Actuation Pressure voltage low (15) Injection Actuation Pressure Sensor - Test Engine Pressure Sensor Open or Short Circuit - Test
16	0173-00 High Exhaust Gas Temperature Derate 0173-11 Very High Exhaust Gas Temperature Derate
17	Diagnostic Flash Code Retrieval 0164-00 Excessive Injection Actuation Pressure (17) Injection Actuation Pressure - Test

FLASH CODES	SIS LINKS
18	Diagnostic Flash Code Retrieval 0042-11 Injection Actuation Pressure output fault Injection Actuation Pressure Control Valve Circuit - Test
21	Diagnostic Flash Code Retrieval 0041-03 8 Volt Supply voltage high (21) 0041-04 8 Volt Supply voltage low (21) 0232-03 5 Volt Supply voltage high (21) 0232-04 5 Volt Supply voltage low (21) Accelerator Pedal (Throttle) Position Sensor Circuit - Test 5 Volt Engine Pressure Sensor Supply Circuit - Test
24	Diagnostic Flash Code Retrieval 0100-03 Oil Pressure voltage high (24) 0100-04 Oil Pressure voltage low (24) Engine Pressure Sensor Open or Short Circuit - Test

FLASH CODES	SIS LINKS
25	Diagnostic Flash Code Retrieval 0102-01 Low Boost Pressure (25) 0102-02 Boost Pressure signal erratic 0102-03 Boost Pressure voltage high (25) 0102-04 Boost Pressure voltage low (25) 0102-07 Boost Pressure not responding Wastegate Solenoid - Test Engine Pressure Sensor Open or Short Circuit - Test
26	Diagnostic Flash Code Retrieval 0108-03 Barometric Pressure voltage high (26) 0108-04 Barometric Pressure voltage low (26) Engine Pressure Sensor Open or Short Circuit - Test
27	Diagnostic Flash Code Retrieval 0110-03 Coolant Temperature voltage high (27) 0110-04 Coolant Temperature voltage low (27) Engine Temperature Sensor Open or Short Circuit - Test
28	Diagnostic Flash Code Retrieval 0091-13 Throttle Position out of calibration (32) Accelerator Pedal (Throttle) Position Sensor Circuit - Test

29	Diagnostic Flash Code Retrieval 0030-08 PTO Throttle signal invalid (29) 0030-13 PTO Throttle out of calibration (29) Remote PTO Accelerator Position Sensor Circuit - Test
31	Diagnostic Flash Code Retrieval 0084-01 Vehicle Speed loss of signal (31) Vehicle Speed and Speedometer Circuit - Test
32	Diagnostic Flash Code Retrieval 0091-08 Throttle Position Invalid (32) Accelerator Pedal (Throttle) Position Sensor Circuit - Test
33	Diagnostic Flash Code Retrieval 0032-05 Turbo Wastegate Solenoid current low 0032-06 Turbo Wastegate Solenoid current high 0032-11 Turbo Wastegate Solenoid current mismatch Wastegate Solenoid - Test

FLASH CODES	SIS LINKS
34	Diagnostic Flash Code Retrieval 0064-02 Secondary Engine Speed loss of signal (34) 0064-11 Secondary Engine Speed no pattern (34) 0190-02 Primary Engine Speed Loss of Signal (34) 0190-11 Primary Engine Speed no pattern (34) Engine Speed/Timing Sensor Circuit - Test
35	Diagnostic Flash Code Retrieval 0190-00 Engine Overspeed Warning (35)
36	Diagnostic Flash Code Retrieval 0084-02 Vehicle Speed signal invalid (36) 0084-08 Vehicle Speed signal out of range (36) 0084-10 Vehicle Speed signal rate of change (36) Vehicle Speed and Speedometer Circuit - Test
37	0094-03 Fuel Pressure voltage high (37) 0094-04 Fuel Pressure voltage low (37) Engine Pressure Sensor Open or Short Circuit - Test

38	Diagnostic Flash Code Retrieval 0105-03 Intake Manifold Air Temperature voltage high (38) 0105-04 Intake Manifold Air Temperature voltage low (38) Engine Temperature Sensor Open or Short Circuit - Test
39	Diagnostic Flash Code Retrieval 0164-11 Injection Actuation Pressure system fault (39) Injection Actuation Pressure - Test
41	Diagnostic Flash Code Retrieval 0084-00 Vehicle Overspeed Warning (41) Vehicle Speed Circuit - Calibrate
42	Diagnostic Flash Code Retrieval 0022-11 Primary to Secondary Engine Speed Signal Calibration (42) 0022-13 Engine Speed Signal Calibration Not Performed (42) Engine Speed/Timing Sensor Circuit - Test Engine Speed/Timing Sensor - Calibrate

FLASH CODES	SIS LINKS
44	Diagnostic Flash Code Retrieval 0128-03 Secondary Fuel Level voltage high 0128-04 Secondary Fuel Level voltage low Fuel Level Sensor Circuit - Test
46	Diagnostic Flash Code Retrieval 0100-01 Low Oil Pressure Warning (46) 0100-11 Very Low Oil Pressure (46) System Overview
47	Diagnostic Flash Code Retrieval 0071-01 Idle Shutdown (47) 0071-14 PTO Shutdown (47) 0186-14 PTO Engine Shutdown Switch Occurrence (47) Idle Shutdown Timer - Test Perform a Basic Search in SIS on the following phrase: PTO Shutdown Timer - Test.
49	Diagnostic Flash Code Retrieval 0070-05 Inlet Air Heater current low 0070-06 Inlet Air Heater current high Air Inlet Heater Circuit - Test

FLASH CODES	SIS LINKS
51	Diagnostic Flash Code Retrieval 0168-00 Excessive ECM Battery Power (17) 0168-01 Low ECM Battery Power (17) 0168-02 ECM Battery Power Intermittent (51) Ignition Key Switch Circuit and Battery Supply Circuit - Test
56	Diagnostic Flash Code Retrieval 0253-02 Check Customer or System Parameters (56) 0253-14 Truck Manufacturer Parameter Not Programed ECM Memory - Test Injector Code - Calibrate
57	Diagnostic Flash Code Retrieval 0231-14 Transmission Data Link Derate Electrical Connectors - Inspect Powertrain Data Link Circuit - Test
58	Diagnostic Flash Code Retrieval 0231-02 J1939 Data Incorrect (58) 0231-11 J1939 Data Link Fault (58) Powertrain Data Link Circuit - Test

FLASH CODES	SIS LINKS
59	Diagnostic Flash Code Retrieval 0252-11 Engine Software Incorrect (59) ECM Memory - Test
61	Diagnostic Flash Code Retrieval 0110-00 High Coolant Temperature Warning (61) 0110-11 Very High Coolant Temperature (61)
62	Diagnostic Flash Code Retrieval 0111-01 Low Coolant Level Warning (62) 0111-11 Very Low Coolant Level (62) 0111-14 Low Coolant Level Warning Electrical Connectors - Inspect Coolant Level Sensor Circuit - Test
63	0094-01 Low Fuel Pressure Warning (63) 0094-11 Low Cranking Fuel Pressure (63)
64	Diagnostic Flash Code Retrieval 0105-00 High Intake Manifold Air Temperature Warning (64) 0105-11 Very High Intake Manifold Air Temperature (64) Electrical Connectors - Inspect

FLASH CODES	SIS LINKS
71	Diagnostic Flash Code Retrieval 0043-02 Key Switch Fault (71) Ignition Key Switch Circuit and Battery Supply Circuit - Test
72	Diagnostic Flash Code Retrieval 0001-11 Cylinder #1 Injector current fault (72) 0002-11 Cylinder #2 Injector current fault (72) Injector Solenoid Circuit - Test
73	Diagnostic Flash Code Retrieval 0003-11 Cylinder #3 Injector current fault (73) 0004-11 Cylinder #4 Injector current fault (73) Injector Solenoid Circuit - Test
74	Diagnostic Flash Code Retrieval 0005-11 Cylinder #5 Injector current fault (74) 0006-11 Cylinder #6 Injector current fault (74) Injector Solenoid Circuit - Test

CID-FMI CODES	SIS LINKS
1-11	0001-11 Cylinder #1 Injector current fault (72) Injector Solenoid Circuit - Test
2-11	0002-11 Cylinder #2 Injector current fault (72) Injector Solenoid Circuit - Test
3-11	0003-11 Cylinder #3 Injector current fault (73) Injector Solenoid Circuit - Test
4-11	0004-11 Cylinder #4 Injector current fault (73) Injector Solenoid Circuit - Test
5-11	0005-11 Cylinder #5 Injector current fault (74) Injector Solenoid Circuit - Test
6-11	0006-11 Cylinder #6 Injector current fault (74) Injector Solenoid Circuit - Test
22-11	0022-11 Primary to Secondary Engine Speed Signal Calibration (42) Engine Speed/Timing Sensor Circuit - Test
22-13	0022-13 Engine Speed Signal Calibration Not Performed (42) Engine Speed/Timing Sensor - Calibrate
30-8	0030-08 PTO Throttle signal invalid (29) Remote PTO Accelerator Position Sensor Circuit - Test

CID-FMI CODES	SIS LINKS
30-13	0030-13 PTO Throttle out of calibration (29) Remote PTO Accelerator Position Sensor Circuit - Test
32-5	0032-05 Turbo Wastegate Solenoid current low Wastegate Solenoid - Test
32-6	0032-06 Turbo Wastegate Solenoid current high Wastegate Solenoid - Test
32-11	0032-11 Turbo Wastegate Solenoid current mismatch Wastegate Solenoid - Test
41-3	0041-03 8 Volt Supply voltage high (21) Accelerator Pedal (Throttle) Position Sensor Circuit - Test
41-4	0041-04 8 Volt Supply voltage low (21) Accelerator Pedal (Throttle) Position Sensor Circuit - Test
42-11	0042-11 Injection Actuation Pressure output fault Injection Actuation Pressure Control Valve Circuit - Test
43-2	0043-02 Key Switch Fault (71) Ignition Key Switch Circuit and Battery Supply Circuit - Test
64-2	0064-02 Secondary Engine Speed loss of signal (34) Engine Speed/Timing Sensor Circuit - Test
64-11	0064-11 Secondary Engine Speed no pattern (34) Engine Speed/Timing Sensor Circuit - Test

CID-FMI CODES	SIS LINKS
70-5	0070-05 Inlet Air Heater current low Air Inlet Heater Circuit - Test
70-6	0070-06 Inlet Air Heater current high Air Inlet Heater Circuit - Test
71-0	0071-00 Idle Shutdown Override (01) Idle Shutdown Timer - Test
71-1	0071-01 Idle Shutdown (47) Perform a Basic Search in SIS on the following phrase: PTO Shutdown Timer - Test.
71-11	0071-11 Engine Shutdown Override Switch Occurrence Electrical Connectors - Inspect
71-14	0071-14 PTO Shutdown (47)
84-0	0084-00 Vehicle Overspeed Warning (41) Vehicle Speed Circuit - Calibrate
84-1	0084-01 Vehicle Speed loss of signal (31) Vehicle Speed and Speedometer Circuit - Test
84-2	0084-02 Vehicle Speed signal invalid (36) Vehicle Speed and Speedometer Circuit - Test
84-8	0084-08 Vehicle Speed signal out of range (36) Vehicle Speed and Speedometer Circuit - Test

CID-FMI CODES	SIS LINKS
84-10	0084-10 Vehicle Speed signal rate of change (36) Vehicle Speed and Speedometer Circuit - Test
84-14	0084-14 Quick Stop Occurrence
91-8	0091-08 Throttle Position Invalid (32) Accelerator Pedal (Throttle) Position Sensor Circuit - Test
91-13	0091-13 Throttle Position out of calibration (32) Accelerator Pedal (Throttle) Position Sensor Circuit - Test
94-1	0094-01 Low Fuel Pressure Warning (63)
94-3	0094-03 Fuel Pressure voltage high (37) Engine Pressure Sensor Open or Short Circuit - Test
94-4	0094-04 Fuel Pressure voltage low (37) Engine Pressure Sensor Open or Short Circuit - Test
94-11	0094-11 Low Cranking Fuel Pressure (63)
96-3	0096-03 Fuel Level voltage high Fuel Level Sensor Circuit - Test
96-4	0096-04 Fuel Level voltage low Fuel Level Sensor Circuit - Test
100-1	0100-01 Low Oil Pressure Warning (46) System Overview

CID-FMI CODES	SIS LINKS
100-3	0100-03 Oil Pressure voltage high (24) Engine Pressure Sensor Open or Short Circuit - Test
100-4	0100-04 Oil Pressure voltage low (24) Engine Pressure Sensor Open or Short Circuit - Test
100-11	0100-11 Very Low Oil Pressure (46)
102-1	0102-01 Low Boost Pressure (25) Wastegate Solenoid - Test
102-2	0102-02 Boost Pressure signal erratic Wastegate Solenoid - Test
102-3	0102-03 Boost Pressure voltage high (25) Engine Pressure Sensor Open or Short Circuit - Test
102-4	0102-04 Boost Pressure voltage low (25) Engine Pressure Sensor Open or Short Circuit - Test
102-7	0102-07 Boost Pressure not responding Wastegate Solenoid - Test
105-0	0105-00 High Intake Manifold Air Temperature Warning (64) Electrical Connectors - Inspect
105-3	0105-03 Intake Manifold Air Temperature voltage high (38) Engine Temperature Sensor Open or Short Circuit - Test

CID-FMI CODES	SIS LINKS
105-4	0105-04 Intake Manifold Air Temperature voltage low (38) Engine Temperature Sensor Open or Short Circuit - Test
105-11	0105-11 Very High Intake Manifold Air Temperature (64) Electrical Connectors - Inspect
108-3	0108-03 Barometric Pressure voltage high (26) Engine Pressure Sensor Open or Short Circuit - Test
108-4	0108-04 Barometric Pressure voltage low (26) Engine Pressure Sensor Open or Short Circuit - Test
110-0	0110-00 High Coolant Temperature Warning (61)
110-3	0110-03 Coolant Temperature voltage high (27) Engine Temperature Sensor Open or Short Circuit - Test
110-4	0110-04 Coolant Temperature voltage low (27) Engine Temperature Sensor Open or Short Circuit - Test
110-11	0110-11 Very High Coolant Temperature (61)
111-1	0111-01 Low Coolant Level Warning (62) Electrical Connectors - Inspect Coolant Level Sensor Circuit - Test
111-2	0111-02 Coolant Level signal invalid (12) Coolant Level Sensor Circuit - Test

CID-FMI CODES	SIS LINKS
111-3	0111-03 Coolant Level voltage high (12) Coolant Level Sensor Circuit - Test
111-4	0111-04 Coolant Level voltage low (12) Coolant Level Sensor Circuit - Test
111-11	0111-11 Very Low Coolant Level (62) Electrical Connectors - Inspect Coolant Level Sensor Circuit - Test
111-14	0111-14 Low Coolant Level Warning
128-3	0128-03 Secondary Fuel Level voltage high Fuel Level Sensor Circuit - Test
128-4	0128-04 Secondary Fuel Level voltage low Fuel Level Sensor Circuit - Test
164-0	0164-00 Excessive Injection Actuation Pressure (17) Injection Actuation Pressure - Test
164-2	0164-02 Injection Actuation Pressure Signal Erratic (15) Injection Actuation Pressure Sensor - Test
164-3	0164-03 Injection Actuation Pressure voltage high (15) Engine Pressure Sensor Open or Short Circuit - Test
164-4	0164-04 Injection Actuation Pressure voltage low (15) Engine Pressure Sensor Open or Short Circuit - Test

CID-FMI CODES	SIS LINKS
164-11	0164-11 Injection Actuation Pressure system fault (39) Injection Actuation Pressure - Test
168-0	0168-00 Excessive ECM Battery Power (17) Ignition Key Switch Circuit and Battery Supply Circuit - Test
168-1	0168-01 Low ECM Battery Power (17) Ignition Key Switch Circuit and Battery Supply Circuit - Test
168-2	0168-02 ECM Battery Power Intermittent (51) Ignition Key Switch Circuit and Battery Supply Circuit - Test
173-0	0173-00 High Exhaust Gas Temperature Derate
173-11	0173-11 Very High Exhaust Gas Temperature Derate
186-4	0186-04 PTO Engine Shutdown Switch voltage low PTO Engine Shutdown Switch Circuit - Test
186-14	0186-14 PTO Engine Shutdown Switch Occurrence (47) PTO Engine Shutdown Switch Circuit - Test
190-0	0190-00 Engine Overspeed Warning (35)
190-2	0190-02 Primary Engine Speed Loss of Signal (34) Engine Speed/Timing Sensor Circuit - Test
190-11	0190-11 Primary Engine Speed no pattern (34) Engine Speed/Timing Sensor Circuit - Test
224-11	0224-11 Theft Deterrent Active (00)

CID-FMI CODES	SIS LINKS
224-14	0224-14 Theft Deterrent Active with Engine Cranking (00)
231-2	0231-02 J1939 Data Incorrect (58) Powertrain Data Link Circuit - Test
231-11	0231-11 J1939 Data Link Fault (58) Powertrain Data Link Circuit - Test
231-12	0231-12 J1939 Device Not Responding Powertrain Data Link Circuit - Test
231-14	0231-14 Transmission Data Link Derate Electrical Connectors - Inspect Powertrain Data Link Circuit - Test
232-3	0232-03 5 Volt Supply voltage high (21) 5 Volt Engine Pressure Sensor Supply Circuit - Test
232-4	0232-04 5 Volt Supply voltage low (21) 5 Volt Engine Pressure Sensor Supply Circuit - Test
246-11	0246-11 Brake Pedal Switch #1 Fault Service Brake Pedal Position (Switch 1) Circuit - Test
247-11	0247-11 Brake Pedal Switch #2 Fault Service Brake Pedal Position (Switch 2) Circuit - Test
252-11	0252-11 Engine Software Incorrect (59) ECM Memory - Test

253-2	0253-02 Check Customer or System Parameters (56) ECM Memory - Test Injector Code - Calibrate
253-14	0253-14 Truck Manufacturer Parameter Not Programed ECM Memory - Test

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ISB02 AND ISL

FAULT CODES

Appendix B. SAE Diagnostic Trouble Codes and Cummins Fault Codes

J1939 SPN / J1939 FMI	J1587 PID /SID / J1587 FMI		Lamp Color	J1939 SPN Description	Fault Code	Cummins Description	Applicable to: Midrange	Heavy Duty
27	2	P27	2	Amber	EGR Position Sensor Circuit	957	EGR Position Sensor Circuit - Data Incorect	Y	
27	2	P27	2	Amber	EGR Position Sensor Circuit Percent Exhaust Gas	1228	EGR Position Sensor Circuit - Data Incorect	Y	Y
27	3	P27	3	Amber	Recirculation Valve Position Percent Exhaust Gas	2271	EGR Valve Position Circuit - shorted high	Y	Y
27	4	P27	4	Amber	Recirculation Valve Position	2272	EGR Valve Position Circuit - shorted low EGR Valve Position Failed Automatic	Y	Y
27	13	P27	13	Amber	System Diagnostic Code #1	2348	Calibration Procedure	Y	Y
84	2	P84	2	Amber	Wheel-based Vehicle Speed	241	Vehicle Speed Sensor Circuit - data incorrect Vehicle Speed Sensor Circuit - tampering has been	Y	Y
84	10	P84	10	Amber	Wheel-based Vehicle Speed	242	detected	Y	Y
91	3	P91	3	Red	Accelerator Pedal Position	131	Accelerator Pedal Position Sensor Circuit - shorted high Accelerator Pedal Position Sensor	Y	Y
91	4	P91	4	Red	Accelerator Pedal Position	132	Circuit - shorted low	Y	Y
91	0	P91	-1	Red	Accelerator Pedal Position 1	148	Accelerator Pedal or Lever Position Sensor 1 Accelerator Pedal or Lever Position Sensor Circuit	Y	
91	1	P91	-1	Red	Accelerator Pedal Position 1	147	Frequency SAE J1939 Multiplexing Accelerator Pedal Sensor System	Y	
91	19	P91	2	Red	Accelerator Pedal Position	287	Error	Y	Y
93	2	P93	2	Amber	Engine Net Brake Torque	528	Auxiliary Alternate Torque Validation Switch	Y	
94	2	P94	2	Amber	Fuel Delivery Pressure	268	Fuel Pressure Sensor Circuit - data incorrect	Y	Y
94	10	P94	10	Amber	Engine Fuel Delivery Pressure	456	Fuel Delivery Pressure	Y	
94	16	P94	0	Amber	Fuel Delivery Pressure	449	Fuel Pressure High - warning	Y	Y
94	18	P94	1	Amber	Fuel Delivery Pressure	482	Fuel Pressure Low - warning		Y
94	3	P94	3	Amber	Fuel Delivery Pressure	546	Fuel Delivery Pressure Sensor Circuit - shorted high		Y
94	4	P94	4	Amber	Fuel Delivery Pressure	547	Fuel Delivery Pressure Sensor Circuit - shorted low Fuel Pump Delivery Pressure - Data Valid but Below		Y
94	18	P94	1	Amber	Fuel Delivery Pressure	2215	Normal Operating Range Moderately Severe Level Fuel Pump Delivery Pressure - Data Valid but Above	Y	
94	16	P94	0	Amber	Fuel Delivery Pressure Fuel Filter Restriction High -	2216	Normal Operating Range Moderately Severe Level Fuel Filter Restriction Moderately High -	Y	
95	16	P95	0	Amber	warning	2372	warning		Y
97	15	P97	0	Maint.	Water in Fuel Indicator	418	Water in Fuel Indicator High - maintenance	Y	Y
97	4	P97	4	Amber	Water in Fuel Indicator	429	Water in Fuel Sensor Circuit - shorted low	Y	Y
100	3	P100	3	Amber	Engine Oil Pressure	135	Engine Oil Pressure Sensor Circuit - shorted high	Y	Y
100	4	P100	4	Amber	Engine Oil Pressure	141	Engine Oil Pressure Sensor Circuit - shorted low	Y	Y
100	18	P100	1	Amber	Engine Oil Pressure	143	Engine Oil Pressure Low - warning	Y	Y
100	1	P100	1	Red	Engine Oil Pressure	415	Engine Oil Pressure Low - critical	Y	Y
100	2	P100	2	Amber	Engine Oil Pressure	435	Engine Oil Pressure Sensor Circuit - data incorrect Intake Manifold Pressure Sensor Circuit #1 [Turbo	Y	Y
102	3	P102	3	Amber	Boost Pressure	122	Compressor Outlet Pressure] - Shorted High Intake Manifold Pressure Sensor Circuit #1 [Turbo	Y	Y
102	4	P102	4	Amber	Boost Pressure	123	Compressor Outlet Pressure] - Shorted Low	Y	Y

SAE Diagnostic Trouble Codes and Cummins Fault Codes (continued)

J1939 SPN	J1939 FMI	J1587 PID /SID	J1587 FMI	Lamp Color	J1939 SPN Description	Fault Code	Cummins Description	Applicable to: Midrange	Heavy Duty
102	16	P102	0	Amber	Engine Turbocharger Boost Pressu	124	Intake Manifold 1 Pressure	Y	
102	2	P102	3	Amber	Boost Pressure	433	Intake Manifold Pressure Sensor Circuit - data incorrect	Y	Y
102	2	P102	2	Amber	Boost Pressure	2973	Intake Manifold Pressure Sensor Circuit - data incorrect	Y	Y
103	16	P103	0	Amber	Turbocharger 1 Speed	595	Turbocharger #1 Speed High - warning	Y	Y
103	18	P103	1	Amber	Turbocharger 1 Speed	687	Turbocharger #1 Speed Low - warning	Y	Y
103	10	P103	10	Amber	Turbocharger 1 Speed	2345	Turbocharger Speed Invalid Rate of Change Detected	Y	
105	3	P105	3	Amber	Intake Manifold #1 Temp	153	IMT Sensor #1 Circuit - shorted high	Y	Y
105	4	P105	4	Amber	Intake Manifold #1 Temp	154	IMT Sensor #1 Circuit - shorted low	Y	Y
105	0	P105	0	Red	Intake Manifold #1 Temp	155	IMT #1 High - critical	Y	Y
105	16	P105	0	Amber	Intake Manifold 1 Temperature	488	Intake Manifold Temp High - warning	Y	
105	15	P105	0	None	Intake Manifold #1 Temp	2964	Intake Manifold Temp High - warning	Y	Y
108	3	P108	3	Amber	Barometric Pressure	221	Ambient Air Pressure Sensor Circuit - shorted high	Y	Y
108	4	P108	4	Amber	Barometric Pressure	222	Ambient Air Pressure Sensor Circuit - shorted low	Y	Y
108	2	P108	2	Amber	Barometric Pressure	295	Ambient Air Pressure Sensor Circuit - data incorrect	Y	Y
110	3	P110	3	Amber	Engine Coolant Temperature	144	Engine Coolant Temperature Sensor Circuit - shorted high	Y	Y
110	4	P110	4	Amber	Engine Coolant Temperature	145	Engine Coolant Temperature Sensor Circuit - shorted low	Y	Y
110	16	P110	0	Amber	Engine Coolant Temperature	146	Engine Coolant Temperature	Y	
110	0	P110	0	Red	Engine Coolant Temperature	151	Engne Coolant Temperature High - critical	Y	Y
110	15	P110	0	None	Engine Coolant Temp	2963	Engine Coolant Temp High - warning	Y	Y
110	16	P110	0	Amber	Engine Coolant Temp	1119	Engine Coolant Temp - moderately severe	Y	Y
111	1	P111	1	Red	Coolant Level	235	Engine Coolant Level - data below normal range	Y	Y
111	3	P111	3	Amber	Coolant Level	195	Engine Coolant Level Sensor Circuit - shorted high	Y	Y
111	4	P111	4	Amber	Coolant Level	196	Engine Coolant Level Sensor Circuit - shorted low	Y	Y
111	18	P111	1	Amber	Coolant Level	197	Engine Coolant Level Low - warning	Y	Y
111	2	P111	2	Amber	Engine Coolant Level	422	Coolant Level	Y	
112	1	P112	1	Red	Water Pump Delta P	1234	Water Pump Differential Pressure - most severe		Y
112	2	P112	2	Amber	Water Pump Delta P	1235	Water Pump Differential Pressure - data erratic, intermittent or incorrect		Y
112	3	P112	3	Amber	Water Pump Delta P	1231	Water Pump Differential Pressure - shorted high		Y
112	4	P112	4	Amber	Water Pump Delta P	1232	Water Pump Differential Pressure - shorted low		Y
112	16	P112	0	Amber	Water Pump Delta P	1236	Water Pump Differential Pressure - in-range		Y
112	18	P112	1	Amber	Water Pump Delta P	1233	Water Pump Differential Pressure - moderately severe		Y
113	2	P113	2	Amber	Engine Governor Droop	524	Auxiliary Alternate Droop Switch Validation	Y	
157	0	P157	0	Red	Engine Injector Metering Rail 1 Pres	449	Injector Metering Rail 1 Pressure	Y	Y
157	3	P157	3	Amber	Injector Metering Rail 1 Pressure	451	Injector Metering Rail #1 Pressure Sensor Circuit - shorted high	Y	
157	4	P157	4	Amber	Injector Metering Rail 1 Pressure	452	Injector Metering Rail #1 Pressure Sensor Circuit - shorted low	Y	
157	18	P157	1	Amber	Injection Metering Rail #1 Pressure	559	Injector Metering Rail #1 Pressure Low - warning level		Y
157	16	P157	0	Red	Injector Metering Rail #1 Pressure	2552	Injector Metering Rail #1 Pressure High - data valid but above normal operating range - moderately severe level.		Y
166	2	P166	2	None	Rated Engine Power	951	Cylinder Power Imbalance between Cylinders	Y	Y
167	16	P167	0	Amber	Alternator Potential (voltage)	596	Electrical Charging System Voltage High - warning level	Y	Y
167	18	P167	1	Amber	Alternator Potential (voltage)	597	Electrical Charging System Voltage Low - warning level	Y	Y

SAE Diagnostic Trouble Codes and Cummins Fault Codes (continued)

								Applicable to:	
J1939 SPN	J1939 FMI	J1587 PID /SID	J1587 FMI	Lamp Color	J1939 SPN Description	Fault Code	Cummins Description	Midrange	Heavy Duty
167	1	P167	1	Red	Alternator Potential (voltage)	598	Electrical Charging System Voltage Low - critical level	Y	Y
168	18	P168	1	Amber	Electrical Potential (Voltage)	441	Battery #1 Voltage Low - warning	Y	
168	16	P168	1	Amber	Electrical Potential (Voltage)	442	Battery #1 Voltage High - warning	Y	
171	3	P171	3	Amber	Ambient Air Temperature	249	Ambient Air Temp Sensor Circuit - shorted high		Y
171	4	P171	4	Amber	Ambient Air Temperature	256	Ambient Air Temp Sensor Circuit - shorted low		Y
174	3	P174	3	Amber	Fuel Temperature	263	Fuel Temp Sensor Circuit - shorted high	Y	Y
174	4	P174	4	Amber	Fuel Temperature	265	Fuel Temp Sensor Circuit - shorted low	Y	Y
175	3	P175	3	Amber	Engine Oil Temp #1	212	Engine Oil Temp Sensor Circuit - shorted high		Y
175	4	P175	4	Amber	Engine Oil Temp #1	213	Engine Oil Temp Sensor Circuit - shorted low		Y
175	0	P175	0	Red	Engine Oil Temp #1	214	Engine Oil Temp High - critical		Y
190	2	P190	2	Red	Engine Speed	115	Engine Speed/Position Sensor Circuit - lost both of two signals	Y	
190	10	P190	10	Amber	Engine Speed	121	Engine Crankshaft Speed/Position	Y	
190	0	P190	0	Red	Engine Speed	234	Engine Speed High - critical	Y	Y
190	2	P190	2	Amber	Engine Speed	689	Primary Engine Speed Sensor Error	Y	Y
190	2	P190	2	None	Engine Speed	2321	Engine Speed / Position Sensor #1 - Data Erratic, Intermittent, or Incorrect	Y	Y
191	18	P191	1	Amber	Transmission Output Shaft Speed	489	Engine Magnetic Crankshaft Speed/Position lost one of two signals	Y	
191	18	P191	0	Amber	Transmission Output Shaft Speed	349	Transmission Output Shaft Speed	Y	
191	16	P191	4	Amber	Actual Engine Percent Torque	243	Engine Brake Actuator Driver Circuit	Y	
251	2	P251	2	Maint.	Time	319	Real Time Clock - power interrupt	Y	Y
411	2	P411	2	Amber	Recirculated Engine Exhaust Gas D	2359	EGR Differential Pressure - data erratic	Y	Y
411	3	P411	3	Amber	Recirculated Engine Exhaust Gas D	2273	EGR Valve Delta P Sensor Circuit - shorted high	Y	Y
411	4	P411	4	Amber	Recirculated Engine Exhaust Gas D	2274	EGR Valve Delta P Sensor Circuit - shorted low	Y	Y
411	16	P411	0	Amber	Recirculated Engine Exhaust Gas D	2359	EGR Differential Pressure - data erratic	Y	
412	3	P412	3	Amber	Recirculated Engine Exhaust Gas T	2375	Exhaust Gas Recirculation Temp Circuit - shorted high	Y	Y
412	4	P412	4	Amber	Recirculated Engine Exhaust Gas T	2376	Exhaust Gas Recirculation Temp Circuit - shorted low	Y	Y
412	15	P412	0	None	Recirculated Engine Exhaust Gas T	2961	EGR Temperature - above normal least severe	Y	Y
412	16	P412	0	Amber	Recirculated Engine Exhaust Gas T	2962	EGR Temperature - above normal moderately severe	Y	Y
441	11	P441	11	None	OEM Temperature	2197	Auxiliary Equipment Sensor Input (OEM Temperature) - warning		Y
558	2	S230	2	Amber	Accelerator Pedal Low Idle Switch	431	Accelerator Pedal Idle Validation Circuit - data incorrect	Y	Y
558	13	S230	13	Red	Accelerator Pedal Low Idle Switch	432	Accelerator Pedal Idle Validation Circuit - out of calibration	Y	Y
558	4	S230	4	Amber	Accelerator Pedal Low Idle Switch	551	Accelerator Pedal Idle Validation Circuit - shorted low	Y	Y
608	2	S250	2	None	SAE J1708 (J1587) Datalink	412	SAE J1587/J1922 Datalink - cannot transmit	Y	Y
611	3	S151	3	Amber	System Diagnostic Code #1	2355	VGT Air Control Shutoff Valve Circuit - shorted high		Y
611	4	S151	4	Amber	System Diagnostic Code #1	2356	VGT Air Control Shutoff Valve Circuit - shorted low		Y
612	2	S152	2	Amber	System Diagnostic Code #2	2554	Exhaust Gas Pressure Sensor Circuit - data erratic, intermittent or incorrect.	Y	Y
615	3	S155	3	Amber	System Diagnostic Code #5	2273	EGR Valve Delta Pressure Sensor Circuit - shorted high	Y	Y
615	4	S155	4	Amber	System Diagnostic Code #5	2274	EGR Valve Delta Pressure Sensor Circuit - shorted low	Y	Y

SAE Diagnostic Trouble Codes and Cummins Fault Codes (continued)

J1939 SPN	J1939 FMI	J1587 PID /SID	J1587 FMI	Lamp Color	J1939 SPN Description	Fault Code	Cummins Description	Applicable to: Midrange	Heavy Duty
615	16	S155	3	Amber	System Diagnostic Code #5	2292	Fuel Inlet Meter Device - flow demand higher than expected	Y	
615	18	S155	4	Amber	System Diagnostic Code #5	2293	Fuel Inlet Meter Device - flow demand lower than expected	Y	
626	11	S237	11	Amber	Engine Start Enable Device 1	381	Intake Air Heater (Relay Enable) 2 Circuit	Y	
626	11	S237	11	Amber	Engine Start Enable Device 1	382	Intake Air Heater (Relay Enable) 2 Circuit	Y	
627	2	S251	2	Amber	Power Supply	434	Power Lost without Ignition Off	Y	Y
627	2	S251	2	None	Power Supply	1117	Power Lost without Ignition Off	Y	Y
629	12	S254	12	Red	Controller #1	111	ECM - critical internal failure	Y	Y
629	12	S254	12	Amber	Controller #1	343	ECM - warning internal hardware failure	Y	Y
629	12	S254	12	Amber	Controller #1	351	Injector Power Supply - bad device	Y	
630	2	S253	2	Amber	Calibration Memory	341	Engine Control Module - data lost	Y	Y
632	4	S17	4	Red	Fuel Shutoff Valve	254	Fuel Shutoff Valve Circuit - shorted low		Y
632	3	S17	3	Amber	Fuel Shutoff Valve	255	Fuel Shutoff Valve Circuit - shorted high		Y
632	7	S17	7	Amber	Fuel Shutoff Valve	259	Fuel Shutoff Valve - stuck open		Y
633	31	S18	11	Amber	Fuel Control Valve #1	2311	EFC Resistance Error	Y	Y
633	3	S18	3	Amber	Engine Fuel Control Valve #1	276	Electronic Fuel Injection Control Valve Circuit	Y	
633	7	S18	7	Amber	Engine Fuel Control Valve #1	277	Electronic Fuel Injection Control Valve	Y	
633	4	S18	4	Amber	Engine Fuel Control Valve #1	279	Electronic Fuel Injection Control Valve Circuit	Y	
633	11	S18	11	Amber	Engine Fuel Control Valve #1	539	Injector Control Valve Electronic Filter (Transorb) Error	Y	
635	31	S20	11	Amber	Timing Actuator #1	2312	Timing Actuator #1 Circuit Error		Y
639	9	S231	9	Amber	SAE J1939 Datalink	285	SAE J1939 Multiplexing PGN Timeout Error	Y	Y
639	13	S231	13	Amber	SAE J1939 Datalink	286	SAE J1939 Multiplexing Configuration Error	Y	Y
639	2	S231	2	None	SAE J1939 Datalink	426	SAE J1939 Datalink - cannot transmit	Y	Y
641	3	S27	3	Amber	Variable Geometry Turbocharger Actuator #1	2277	Variable Geometry Turbo Output Device Driver - shorted high	Y	Y
641	4	S27	4	Amber	Variable Geometry Turbocharger Actuator #1	2278	Variable Geometry Turbo Output Device Driver - shorted low	Y	Y
641	5	S27	5	Amber	Variable Geometry Turbocharger A	2383	VGT Actuator - open circuit	Y	
641	4	S27	4	Amber	Variable Geometry Turbocharger A	2384	VGT Actuator - shorted low	Y	Y
641	3	S27	3	Amber	Variable Geometry Turbocharger A	2385	VGT Actuator - shorted high	Y	Y
641	6	S27	6	Amber	Variable Geometry Turbocharger A	2386	VGT Actuator - current above normal	Y	
641	7	S27	7	Amber	Variable Geometry Turbocharger A	2387	Turbocharger Actuator - mechanical system not responding properly	Y	
641	13	S27	13	Amber	Variable Geometry Turbocharger A	2388	Turbocharger Actuator Position Sensor - out of calibration	Y	
641	15	S27	0	None	Variable Geometry Turbocharger A	9122	Variable Geometry Turbo Actuator Over Temperature (Calculated) - Data Above Normal Range Least Severe Level	Y	
647	4	S33	4	Amber	Fan Clutch Output Device Driver	245	Fan Clutch Circuit - shorted low	Y	Y
647	3	S33	3	Amber	Fan Clutch Output Device Driver	2181	Fan Clutch Circuit - shorted high		
647	3	S33	3	Amber	Fan Clutch Output Device Driver	2377	Fan Control Circuit - shorted high	Y	Y
651	5	S1	5	Amber	Injector Cylinder #01	322	Injector Solenoid Valve Cylinder #1Circuit - open circuit	Y	Y
651	6	S1	6	Amber	Injector Cylinder #01	311	Injector Solenoid Vallve Cylinder #1 Circuit - grounded circuit		Y
651	7	S1	7	Amber	Injector Cylinder #01	1139	Injector Cylinder #1 - Mechanical system not responding	Y	
652	5	S2	5	Amber	Injector Cylinder #02	331	Injector Solenoid Valve Cylinder #2 Circuit - open circuit	Y	Y

SAE Diagnostic Trouble Codes and Cummins Fault Codes (continued)

J1939 SPN	J1939 FMI	J1587 PID /SID	J1587 FMI	Lamp Color	J1939 SPN Description	Fault Code	Cummins Description	Applicable to: Midrange	Heavy Duty
652	6	S2	6	Amber	Injector Cylinder #02	315	Injector Solenoid Valve Cylinder #2 Circuit - grounded circuit		Y
652	7	S2	7	Amber	Injector Cylinder #02	1141	Injector Cylinder #2 - Mechanical system not responding	Y	
653	5	S3	5	Amber	Injector Cylinder #03	324	Injector Solenoid Valve Cylinder #3 Circuit - open circuit	Y	Y
653	6	S3	6	Amber	Injector Cylinder #03	313	Injector Solenoid Valve Cylinder #3 Circuit - grounded circuit		Y
653	7	S3	7	Amber	Injector Cylinder #03	1142	Injector Cylinder #3 - Mechanical system not responding	Y	
654	5	S4	5	Amber	Injector Cylinder #04	332	Injector Solenoid Valve Cylinder #4 Circuit - open circuit	Y	Y
654	6	S4	6	Amber	Injector Cylinder #04	321	Injector Solenoid Valve Cylinder #4 Circuit - grounded circuit		Y
654	7	S4	7	Amber	Injector Cylinder #04	1143	Injector Cylinder #4 - mechanical system not responding	Y	
655	5	S5	5	Amber	Injector Cylinder #05	323	Injector Solenoid Valve Cylinder #5 Circuit - open circuit	Y	Y
655	6	S5	6	Amber	Injector Cylinder #05	312	Injector Solenoid Valve Cylinder #5 Circuit - grounded circuit		Y
655	7	S5	7	Amber	Injector Cylinder #05	1144	Injector Cylinder #5 - Mechanical system not responding	Y	
656	5	S6	5	Amber	Injector Cylinder #06	325	Injector Solenoid Valve Cylinder #6 Circuit - open circuit	Y	Y
656	6	S6	6	Amber	Injector Cylinder #06	314	Injector Solenoid Valve Cylinder #6 Circuit - grounded circuit		Y
656	7	S6	7	Amber	Injector Cylinder #06	1145	Injector Cylinder #6 - Mechanical system not responding	Y	
677	3	S39	3	Amber	Starter Solenoid Lockout Relay Driver Circuit	584	Starter Relay Circuit - shorted high	Y	Y
677	4	S39	4	Amber	Starter Solenoid Lockout Relay Driver Circuit	585	Starter Relay Circuit - shorted low	Y	Y
697	3	S57	3	Amber	Auxiliary PWM Driver #1	2557	Auxiliary PWM Driver #1 - shorted to high source	Y	
697	4	S57	4	Amber	Auxiliary PWM Driver #1	2558	Auxiliary PWM Driver #1 - shorted to low source	Y	
702	3	P154	3	Amber	Auxiliary I/O #2	527	Auxiliary Input/Output Circuit 2	Y	
703	3	S51	3	Amber	Auxiliary I/O #3	529	Auxiliary Input/Output Circuit 3	Y	
703	11	S51	11	Amber	Auxiliary Equipment Sensor Input	779	Auxiliary Equipment Sensor Input (OEM Discrete Input)	Y	
723	7	S64	7	Amber	Engine Speed Sensor #2	731	EPS #2 - Mechanical Misalignment Between Camshaft and Crankshaft Sensors	Y	Y
723	2	S64	2	Amber	Engine Speed Sensor #2	778	Secondary Engine Speed Sensor Error	Y	Y
723	2	S64	2	None	Engine Speed Sensor #2	2322	Engine Speed / Position Sensor #2 - Data Erratic, Intermittent, or Incorrect	Y	
723	31	P190	2	None	Engine Speed	2321	Engine Speed / Position Sensor #1 - Data Erratic, Intermittent, or Incorrect	Y	Y
729	3	S70	3	Amber	Inlet Air Heater Driver #1	2555	Intake Air Heater #1 Circuit - shorted to high source	Y	
729	4	S70	4	Amber	Inlet Air Heater Driver #1	2556	Intake Air Heater #1 Circuit - shorted to low source	Y	
876	11	P50	11	Amber	Compressor Clutch Circuit	191	Air Conditioner Compressor Clutch Control Circuit	Y	
923	11	S9	11	Amber	PWM Output	768	PWM Output Device Driver	Y	
931	11	P73	11	Amber	Engine Fuel Supply Pump Actuator	278	Fuel Supply Pump Driver Circuit	Y	
974	3	P29	3	Red	Remote Accelerator	133	Remote Throttle Pedal Position Sensor Circuit - shorted high	Y	Y
974	4	P29	4	Red	Remote Accelerator	134	Remote Throttle Pedal Position Sensor Circuit - shorted low	Y	Y
974	19	P29	2	Red	Percent Accelerator Position #2	288	SAE J1939 Multiplexing Remote Throttle Data Error	Y	Y
1043	3	S221	3	Amber	Internal Sensor Voltage Supply	283	Engine Speed/Position Sensor (Crankshaft) Supply Voltage Circuit	Y	
1043	4	S221	4	Amber	Internal Sensor Voltage Supply	284	EPS Sensor #1 (Crankshaft) Supply Voltage - shorted low	Y	Y

SAE Diagnostic Trouble Codes and Cummins Fault Codes (continued

Applicable to:

J1939 SPN	J1939 FMI	J1587 PID /SID	J1587 FMI	Lamp Color	J1939 SPN Description	Fault Code	Cummins Description	Midrange	Heavy Duty
1043	3	S221	3	Amber	Internal Sensor Voltage Supply	387	Accelerator Pedal Position Sensor Supply Voltage Circuit - shorted high	Y	Y
1043	4	S221	4	Amber	Internal Sensor Voltage Supply	443	Accelerator Pedal Position Sensor Supply Voltage Circuit - shorted low	Y	Y
1072	4	S28	4	Amber	Engine Compression Brake Output #1	2362	Engine Brake Actuator Circuit #1 - shorted low	Y	Y
1072	3	S28	3	Amber	Engine Compression Brake Output #1	2366	Engine Brake Actuator Circuit #1 - shorted high	Y	Y
1073	4	S29	4	Amber	Engine Compression Brake Output #2	2363	Engine Brake Actuator Circuit #2 - shorted low	Y	Y
1073	3	S29	3	Amber	Engine Compression Brake Output #2	2367	Engine Brake Actuator Circuit #2 - shorted high	Y	Y
1075	3	P73	3	Amber	Electric Lift Pump for Engine Fuel S	2265	Fuel Priming Pump Control Signal Circuit - shorted high	Y	
1075	4	P73	4	Amber	Electric Lift Pump for Engine Fuel S	2266	Fuel Priming Pump Control Signal Circuit - shorted low	Y	
1076	13	S18	13	None	Engine Fuel Injection Pump Fuel Co	493	Fuel Injection Pump Calibration Trim Circuit	Y	
1077	14	S233	14	Amber	Engine Fuel Injection Pump Contro	329	Fuel Pump Control Module Leakage	Y	
1079	4	S232	4	Amber	5 Volts DC Supply	352	Sensor Supply Voltage #1 Circuit - shorted low	Y	Y
1079	3	S232	3	Amber	5 Volts DC Supply	386	Sensor Supply Voltage #1 Circuit - shorted high	Y	Y
1079	3	S212	3	Amber	5 Volts DC Supply	386	Sensor Supply Voltage #1 Circuit - shorted high	Y	Y
1079	4	S212	4	Amber	5 Volts DC Supply	352	Sensor Supply Voltage #1 Circuit - shorted low	Y	Y
1080	4	S232	4	Amber	5 Volts DC Supply	187	Sensor Supply Voltage #2 Circuit - shorted low	Y	Y
1080	3	S232	3	Amber	5 Volts DC Supply	227	Sensor Supply Voltage #2 Circuit - shorted high	Y	Y
1112	4	S82	4	Amber	Engine Compression Brake Output #3	2365	Engine Brake Actuator Circuit #3 - shorted low		Y
1112	3	S82	3	Amber	Engine Compression Brake Output #3	2368	Engine Brake Actuator Circuit #3 - shorted high		Y
1172	3	S151	3	Amber	Turbocharger #1Compressor Inlet Temperature	691	Turbocharger #1 Compressor Inlet Temp Sensor Circuit - shorted high	Y	Y
1172	4	S151	4	Amber	Turbocharger #1Compressor Inlet Temperature	692	Turbocharger #1 Compressor Inlet Temp Sensor Circuit - shorted low	Y	Y
1209	2	P131	2	Amber	Engine Exhaust Gas Pressure	2554	Exhaust Gas Pressure Sensor Circuit - data erratic, intermittent or incorrect	Y	Y
1209	3	P131	3	Amber	Engine Exhaust Gas Pressure	2373	Exhaust Pressure Circuit - shorted high	Y	Y
1209	3	P95	3	Amber	Engine Exhaust Gas Pressure	2373	Exhaust Pressure Circuit - shorted high	Y	Y
1209	4	P95	4	Amber	Engine Exhaust Gas Pressure	2374	Exhaust Pressure Circuit - shorted low	Y	Y
1209	4	P131	4	Amber	Engine Exhaust Gas Pressure	2374	Exhaust Pressure Circuit - shorted low	Y	Y
1244	31	S83	11	Amber	Engine Fuel Control Valve #2	2313	Fueling Actuator #2 Circuit Error		Y
1245	31	S84	11	Amber	Engine Timing Actuator #2	2314	Timing Actuator #2 Circuit Error		Y
1265	4	S85	4	Amber	Engine Oil Burn Valve	223	Centinel Oil Control Valve Circuit - shorted low		Y
1265	3	S85	3	Amber	Engine Oil Burn Valve	224	Centinel Oil Control Valve Circuit - shorted high		Y
1267	3	S87	3	Amber	Idle Shutdown Vehicle Accessories Relay Driver	338	Idle Shutdown Vehicle Accessories Relay Driver Circuit - shorted high		Y
1267	4	S87	4	Amber	Idle Shutdown Vehicle Accessories Relay Driver	339	Idle Shutdown Vehicle Accessories Relay Driver Circuit - shorted low		Y
1321	4	S237	4	Amber	Starter Solenoid Lockout Relay Driver Circuit	584	Starter Relay Circuit - shorted high	Y	
1321	3	S237	3	Amber	Starter Solenoid Lockout Relay Driver Circuit	585	Starter Relay Circuit - shorted low	Y	
1347	4	S126	4	Amber	Fuel Pump Pressurizing Assembly #1	271	High Fuel Pressure Solenoid Valve #1 Circuit - shorted low	Y	

J1939 SPN	J1939 FMI	J1587 PID /SID	J1587 FMI	Lamp Color	J1939 SPN Description	Fault Code	Cummins Description	Applicable to: Midrange	Heavy Duty
1347	3	S126	3	Amber	Fuel Pump Pressurizing Assembly #1	272	High Fuel Pressure Solenoid Valve #1 Circuit - shorted low	Y	
1347	7	S126	7	Amber	Fuel Pump Pressurizing Assembly #1	275	Fuel Pumping Element #1 (Front) - mechanically stuck	Y	
1347	7	S126	7	Amber	Engine Fuel Pump Pressuring Assembly	281	Fuel Pump Pressuring Assembly 1	Y	
1348	4	S127	4	Amber	Engine Fuel Pump Pressuring Assembly	273	Fuel Pump Pressuring Assembly 2 Circuit	Y	
1348	3	S127	3	Amber	Engine Fuel Pump Pressuring Assembly	274	Fuel Pump Pressuring Assembly 2 Circuit	Y	
1348	7	S127	7	Amber	Engine Fuel Pump Pressuring Assembly	282	High Fuel Pressure Solenoid Valve #2	Y	
1348	7	S127	7	Amber	Engine Fuel Pump Pressuring Assembly	328	Fuel Pump Pressuring Assembly 2	Y	
1349	16	P129	0	Red	Injector Metering Rail #2 Pressure	2551	Injector Metering Rail #2 Pressure High - data valid but above normal operating range - moderately severe level.		Y
1349	18	P129	1	Amber	Injector Metering Rail #2 Pressure	486	Injector Metering Rail Pressure Low - warning		Y
1349	6	P129	0	Amber	Injector Metering Rail #2 Pressure	2551	Injector Metering Rail #2 Pressure High - data valid but above normal operating range - moderately severe level.		
1378	31	S153	11	Maint.	Engine Oil Change Interval	649	Change Lubricating Oil & Filter - maintenance	Y	Y
1380	17	P17	1	Maint.	Engine Oil Level Remote Reservoir	219	Engine Oil Level #2 (Remote) Low - maintenance		Y
1388	3	P223	3	Amber	Auxiliary Pressure #2	297	Auxiliary Pressure Sensor Input 1 Circuit	Y	
1388	4	P223	4	Amber	Auxiliary Pressure #2	298	Auxiliary Pressure Sensor Input 1 Circuit	Y	
1590	2	S231	2	None	Adaptive Cruise Control Mode	784	Loss of Communication with Adaptive Cruise Control	Y	Y
1590	2	S86	2	None	Adaptive Cruise Control Mode	784	Loss of Communication with Adaptive Cruise Control		Y
1664	31	S124	11	Amber	Engine Automatic Start Failed (Eng	359	Engine Failed to Start (automatic start)		Y
2629	15	S151	0	None	Engine Turbocharger 1 Compresso	2347	Turbocharger Compressor Outlet Temp - above normal least severe		Y
2789	15	S151	0	None	Engine Turbocharger 1 Calculated T	2346	Turbocharger Turbine Inlet Temp - above normal least severe	Y	Y
2790	15	S309	0	None	Engine Turbocharger 1 Calculated T	2347	Turbocharger Compressor Outlet Temp - above normal least severe	Y	Y
2791	3	S146	3	Amber	Engine Exhaust Gas Recirculation (	2349	EGR Valve Control Circuit - shorted high or open	Y	Y
2791	4	S146	4	Amber	Engine Exhaust Gas Recirculation (	2351	EGR Valve Control Circuit - shorted low	Y	Y
2791	5	S146	5	Amber	Engine Exhaust Gas Recirculation (	2349	EGR Valve Control Circuit - shorted high or open	Y	Y
2791	3	S146	3	Amber	Engine Exhaust Gas Recirculation (	2352	EGR Valve Control Circuit - shorted high or open	Y	Y
2791	6	S146	6	Amber	Engine Exhaust Gas Recirculation (	2353	EGR Valve Control Circuit - excessive current detected	Y	Y
2791	7	S146	7	Amber	Engine Exhaust Gas Recirculation (	2357	EGR Valve Actuator - mechanical system not responding properly	Y	Y
2791	15	S146	0	None	Engine Exhaust Gas Recirculation (	9121	EGR Valve Actuator Over Temperature (Calculated) - Data Above Normal Range Least Severe Level	Y	Y
2795	2	S27	2	Amber	VGT Position Sensor Circuit	958	VGT Position Sensor Circuit - Data Incorrect	Y	
2795	3	S155	3	Amber	VGT 1 Actuator Position	2381	VGT Position Sensor Circuit - Voltage Above Normal or Shorted to High Source	Y	
2795	4	S155	4	Amber	VGT 1 Actuator Position	2382	VGT Position Sensor Circuit - Voltage Below Normal or Shorted to Low Source	Y	
						2372	Fuel Filter Restriction Moderately High - warning		
520195	4	S232	4	Amber	Manufacturer Assignable SPN	187	Sensor Supply 2 Circuit		Y
520195	3	S232	3	Amber	Manufacturer Assignable SPN	227	Sensor Supply 2 Circuit		Y
520198	3	S232	3	Amber	Manufacturer Assignable SPN	385	Sensor Supply 5 Circuit	Y	
520198	18	S232	1	Amber	Manufacturer Assignable SPN	444	Sensor Supply 5	Y	
520199	3	S91	3	Amber	Manufacturer Assignable SPN	515	Sensor Supply 6 Circuit	Y	
520199	4	S91	4	Amber	Manufacturer Assignable SPN	516	Sensor Supply 6 Circuit	Y	

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900

FAULT CODES

5.4.8 BR900 Fault Code Overview

OBD guidelines stipulate that each fault path has important motor variables which apply at the moment the defect is rated.
The environment data (ED) is created from VCU data which is found at the time of the first fault occurrence (VCU) or fault message (PLD).
The ED1 to ED4 are identical for all paths:
ED1: Engine Speed
ED2: Current Engine Torque
ED3: Coolant Temperature
ED4: Boost Pressure

Nr.	PATH OF FAULT	SPN	PID/ SID	MB Path	MB Id	INT FMI	FMI	OBD	VCU PLD	Failure	Fault Reactions
0	Flame Start Gate ED5:battery voltage ED6:torque demand ED7:time/date	54	PID45			--- --- 0	3 4 14		VCU	Open Circuit Shorted to Ground Special Instructions What fault condition triggers this fault?	Discontinue Flame Start or Grid Heater function
1	Vehicle Speed Sensor ED5:battery voltage ED6:torque demand ED7:time/date	84	PID84			--- ---	3 4		VCU	Open Circuit Shorted to Ground	Road speed limiter (if any) shall now use top gear ratio and limit engine speed
2	Accelerator Position Percentage ED5:battery voltage ED6:torque demand ED7:time/date	91	PID91			--- --- ---	3 2 4		VCU	Voltage Above Normal or Shorted to High Source Data Erratic Voltage Below Normal or Shorted to Low Source	IVS limp home function (Low idle speed only if IVS is defect too or in idle position) (see Table Acc. Pedal Operations for details)
3	Fuel Pressure ED5:battery voltage ED6:torque demand ED7:time/date	94	PID94	30 30	15 16	0 1	3 4		PLD	Open Circuit Shorted to Ground	not needed for FTL
4	Engine Oil Level	98	PID98			2 0	14 0		VCU	Data Valid but Very Low Data Valid but Above Normal	not used by FTL

Nr.	PATH OF FAULT	SPN	PID/ SID	MB Path	MB Id	INT FMI	FMI	OBD	VCU PLD	Failure	Fault Reactions
	ED5:battery voltage ED6:torque demand ED7:time/date										
						1	1			Data Valid but Below Normal	
4	Engine Oil Level ED5:battery voltage ED6:torque demand ED7:time/date	98	PID98	25	16	3	3		PLD	Voltage Below Normal	not used by FTL
				25	15	4	4			Voltage Above Normal	
				25	09	5	5			Open Circuit	
				25	17	6	2			Reading Erroneous	
5	Engine Oil Pressure ED5:battery voltage ED6:torque demand ED7:time/date	100	PID100			1	14		VCU	Data Valid but Very Low	Engine speed ramped down to low idle speed, engine shutdown if enabled
						0	1			Data Valid but Below Normal	
5	Engine Oil Pressure ED5:battery voltage ED6:torque demand ED7: time/date	100	PID100	16	15	3	3		PLD	Open Circuit	substitute value
				16	17	2	2			Data Erratic	substitute value
				16	16	4	4			Shorted To Ground	substitute value
6	Boost Pressure ED5:battery voltage ED6:torque demand ED7: time/date	102	PID102	18	20	4	0		PLD	Above Normal	TBD
				18	18	3	1			Below Normal	TBD
				14	17	2	2			Data Erratic	TBD
				14	15	0	3			Open Circuit	substitute value
				14	16	1	4			Shorted to Ground	substitute value
7	Intake Manifold Temperature ED5:battery voltage ED6:torque demand ED7:time/date	105	PID105	12	15	0	3		PLD	Open Circuit	substitute value
				12	16	1	4			Shorted to Ground	substitute value
8	Air Filter Sensor ED5:battery voltage ED6:torque demand ED7:time/date	107	PID107			---	3		VCU	Open Circuit	stop performing air filter warning function
						---	4			Shorted to Ground	
9	Engine Coolant Temperature	110	PID110			1	14		VCU	Data Valid but Very High	engine shutdown if enabled

Nr.	PATH OF FAULT	SPN	PID/ SID	MB Path	MB Id	INT FMI	FMI	OBD	VCU PLD	Failure	Fault Reactions
	ED5:battery voltage ED6:torque demand ED7:time/date					0	0			Data Valid but Above Normal	derate the engine torque
9	Engine Coolant Temperature	110	PID110	15	16	3	4		PLD	Shorted To Ground	substitute value
	ED5:battery voltage ED6:torque demand ED7:time/date			15	15	2	3			Open Circuit	substitute value
10	Coolant Level	111	PID111			---	1		VCU	Data Valid but Below Normal	engine shutdown if enabled
	ED5:battery voltage ED6:torque demand					---	3			Open Circuit	disable shutdown
	ED7:time/date					---	4			Shorted to Ground	disable shutdown
11	Battery Voltage – Switched	158	PID158			0	0		VCU	Data Valid but Above Normal	no fault reaction
	ED5:battery voltage ED6:torque demand ED7:time/date					1	1			Data Valid but Below Normal	
11	Battery Voltage – Switched	158	PID158	22	19	2	2		PLD	No Match of PLD and VCU Signals	TBD
	ED5:battery voltage ED6:torque demand ED7:time/date			23	19						
12	Battery Voltage	168	PID168	75	42	0	3		PLD	Voltage Above Normal	TBD
	ED5:battery voltage ED6:torque demand ED7:time/date			75	43	1	4			Voltage Below Normal	TBD
13	Fuel Temperature	174	PID174	11	15	0	3		PLD	Open Circuit	substitute value
	ED5:battery voltage ED6:torque demand ED7:time/date			11	16	1	4			Shorted to Ground	substitute value
14	Engine Oil Temperature	175	PID175	10	15	0	3		PLD	Open Circuit	substitute value

Nr.	PATH OF FAULT	SPN	PID/ SID	MB Path	MB Id	INT FMI	FMI	OBD	VCU PLD	Failure	Fault Reactions
	ED5:battery voltage ED6:torque demand ED7:time/date			10	16	1	4			Shorted to Ground	substitute value
15	Engine Speed ED5:battery voltage ED6:torque demand ED7:time/date	190	PID190	05	30	1	0		PLD	Above Normal	What is the PLD fault reaction? (we have no docs about that)
16	Cruise Control - VCU internal error ED5:battery voltage ED6:torque demand ED7:time/date	527	SID254			---	TBD		VCU		Temic to provide proposal
17	Idle Validation Switch ED5:battery voltage ED6:torque demand ED7:time/date	558	SID230			5	5		VCU	Open Circuit	Low idle speed
						0	12			Both IVS Contacts Closed	
						0	12			IVS-Not Idle and APS-Idle	
						0	12			IVS-Idle and APS-Not Idle	
18	Cruise Control Switch Contact SET+COAST ED5:battery voltage ED6:torque demand ED7:time/date	599	SID242			0	12		VCU	Both SET and RES contacts closed at the same time	discontinue cruise control and PTO operation
19	Cruise Control Switch Contact RES+ACC ED5:battery voltage ED6:torque demand ED7:time/date	601	SID243			0	12		VCU	Both SET and RES contacts closed at the same time	discontinue cruise control and PTO operation
20	Anti Theft Device ED5:battery voltage ED6:torque demand ED7:time/date	609	SID217	99	65	1	2		PLD	Wrong Key	not used by FTL
				99	61	5	14			Counter Overflow	
				99	64	2	9			No Transponder Code on Hardwire	
				99	63	1	2			No Transponder Code on proprietary Data Link	
				99	62	3	11			Self Locking Active	

Nr.	PATH OF FAULT	SPN	PID/ SID	MB Path	MB Id	INT FMI	FMI	OBD	VCU PLD	Failure	Fault Reactions
				99	60	0	0			No Additional Key Can Be Learned	
20	PLD EEPROM ED5:battery voltage ED6:torque demand ED7:time/date	609	SID233	40	53	5	14		PLD	Checksum Error 3	TBD
				40	52	5	14			Checksum Error 2	TBD
20	PLD Bad Device (used only if starter control by PLD is programmed in PLD EEPROM) ED5:battery voltage ED6:torque demand ED7:time/date	609	SID233	40	38	4	12		PLD	Starter Driver Stage Failed (Non-Conductive)	not used by FTL
				40	39	4	12			Starter Driver Path 1 Failed (Conductive)	
				40	39	4	12			Starter Driver Path 2 Failed (Conductive)	
20	PLD Bad Device (all PWM outputs will be switched off if one HS driver fails) ED5:battery voltage ED6:torque demand ED7:time/date	609	SID233	40	41	4	12		PLD	High Side Driver Failed (Conductive)	No engine brake and fan operation anymore
20	PLD Bad Device ED5:battery voltage ED6:torque demand ED7:time/date	609	SID233	40	54	4	12		PLD	RAM Area for CAN Failed	TBD
20	PLD Programming Wrong ED5:battery voltage ED6:torque demand ED7: time/date	609	SID233	40	37	5	14		PLD	Wrong # Of Cylinders Programmed	TBD
				40	48	5	14			# Of Cylinders Does Not Match Engine Type	TBD
				40	49	5	14			Calibration PWM Outputs Not Valid	TBD
				40	47	5	14			Set of Maps Erroneous	TBD
				40	50	5	14			Wrong Hardware Reference	TBD
20	PLD Bad Device (used	609	SID233	40	38	4	12		PLD	Redundant Starter Driver	not used by FTL

Nr.	PATH OF FAULT	SPN	PID/ SID	MB Path	MB Id	INT FMI	FMI	OBD	VCU PLD	Failure	Fault Reactions
	only if starter control by PLD									Failed	
	is programmed in PLD EEPROM) ED5:battery voltage ED6:torque demand ED7:time/date			40	40	4	12			Starter Driver Voltage Reading Not Plausible	
20	PLD Bad Device ED5:battery voltage ED6:torque demand ED7:time/date	609	SID233	40	24	4	12		PLD	Limp Home Controller Failed	TBD
20	PLD EEPROM ED5:battery voltage ED6:torque demand ED7:time/date	609	SID233	40	51	5	14		PLD	Checksum Error 1	TBD
20	PLD Bad Device Press. Sensor	609	SID233	13	15	4	12		PLD	Open Circuit	substitute value
	ED5:battery voltage ED6:torque demand ED7:time/date			13	16	4	12		PLD	Shorted to ground	substitute value
21	Throttle Pedal Supply ED5:battery voltage	620	SID232				3		VCU	Above Normal	IVS limp home
	ED6:torque demand ED7:time/date						4			Below Normal	
22	Proprietary Data Link	625	SID248			0	14		VCU	CAN High Line Filed	single line operation
						0	14			CAN Low Line Filed	
	ED5:battery voltage ED6:torque demand					1	2			No Communication to PLD	turn on CEL
	ED7:time/date					1	2			PLD Data Erroneous	
22	Proprietary Data Link	625	SID248	01	02	1	2		PLD	VCU Data Erroneous	Low idle
				01	04	1	2			No Communication to VCU	
	ED5:battery voltage ED6:torque demand ED7:time/date			01	01	0	14			CAN_Low Line Failed	single line operation

Nr.	PATH OF FAULT	SPN	PID/ SID	MB Path	MB Id	INT FMI	FMI	OBD	VCU PLD	Failure	Fault Reactions
				01	00	0	14			CAN_High Line Failed	
				01	49	0	14			Calibration not valid What is behind this fault?	TBD
23	VCU Internal Error ED5:battery voltage ED6:torque demand ED7:time/date	629	SID254			0	12		VCU	Checksum Fault Flash	Temic to provide proposal
						0	12			Checksum Fault EEPROM	
						0	12			DLU Status	
						0	12			FMS Status	
						0	12			FSS Status	
24	Crankshaft Position Sensor ED5:battery voltage ED6:torque demand ED7:time/date	636	SID21	03	10	2	1		PLD	Signal Voltage to Low	emergency run on camshaft
				03	11	3	7			No Match of Camshaft and Crankshaft Signals	
				03	12	4	8			Time Out	emergency run on camshaft
				03	13	5	14			Pin's Swapped	no fault reaction
				03	08	1	4			Shorted to Ground	emergency run on camshaft
				03	09	0	3			Open Circuit	emergency run on camshaft
25	Injector Cylinder #1 ED5:battery voltage ED6:torque demand ED7:time/date	651	SID1	50	28	0	6		PLD	Shorted Circuit	turn off valve
				50	26	2	7			No Plunger	set last valid impact time
				50	27	1	5			Current Below Normal or Open Circuit	turn off valve
				90	44	3	12			Idle Smoothness Governor at Limit	TBD
				90	45	4	14			Single Cylinder Correction at Limit	TBD
26	Injector Cylinder #2 ED5:battery voltage ED6:torque demand ED7:time/date	652	SID2	51	28	0	6		PLD	Shorted Circuit	turn off valve
				51	26	2	7			No Plunger	set last valid impact time
				51	27	1	5			Current Below Normal or Open Circuit	turn off valve
				91	44	3	12			Idle Smoothness Governor at	TBD

Nr.	PATH OF FAULT	SPN	PID/ SID	MB Path	MB Id	INT FMI	FMI	OBD	VCU PLD	Failure	Fault Reactions
										Limit	
				91	45	4	14			Single Cylinder Correction at Limit	TBD
27	Injector Cylinder #3 ED5:battery voltage ED6:torque demand ED7:time/date	653	SID3	52	28	0	6		PLD	Shorted Circuit	turn off valve
				52	26	2	7			No Plunger	set last valid impact time
				52	27	1	5			Current Below Normal or Open Circuit	turn off valve
				92	44	3	12			Idle Smoothness Governor at Limit	TBD
				92	45	4	14			Single Cylinder Correction at Limit	TBD
28	Injector Cylinder #4 ED5:battery voltage ED6:torque demand ED7:time/date	654	SID4	53	28	0	6		PLD	Shorted Circuit	turn off valve
				53	26	2	7			No Plunger	set last valid impact time
				53	27	1	5			Current Below Normal or Open Circuit	turn off valve
				93	44	3	12			Idle Smoothness Governor at Limit	TBD
				93	45	4	14			Single Cylinder Correction at Limit	TBD
29	Injector Cylinder #5 ED5:battery voltage ED6:torque demand ED7:time/date	655	SID5	54	28	0	6		PLD	Shorted Circuit	turn off valve
				54	26	2	7			No Plunger	set last valid impact time
				54	27	1	5			Current Below Normal or Open Circuit	turn off valve
				94	44	3	12			Idle Smoothness Governor at Limit	TBD
				94	45	4	14			Single Cylinder Correction at Limit	TBD
30	Injector Cylinder #6 ED5:battery voltage ED6:torque demand ED7:time/date	656	SID6	55	28	0	6		PLD	Shorted Circuit	turn off valve
				55	26	2	7			No Plunger	set last valid impact time
				55	27	1	5			Current Below Normal or Open Circuit	turn off valve

Nr.	PATH OF FAULT	SPN	PID/ SID	MB Path	MB Id	INT FMI	FMI	OBD	VCU PLD	Failure	Fault Reactions
				95	44	3	12			Idle Smoothness Governor at Limit	TBD
				95	45	4	14			Single Cylinder Correction at Limit	TBD
31	Injector Cylinder #7 ED5:battery voltage ED6:torque demand ED7:time/date	657	SID7	56	28	0	6		PLD	Shorted Circuit	turn off valve
				56	26	2	7			No Plunger	set last valid impact time
				56	27	1	5			Current Below Normal or 3Open Circuit	turn off valve
				96	44	3	12			Idle Smoothness Governor at Limit	TBD
				96	45	4	14			Single Cylinder Correction at Limit	TBD
32	Injector Cylinder #8 ED5:battery voltage ED6:torque demand ED7:time/date	658	SID8	57	28	0	6		PLD	Shorted Circuit	turn off valve
				57	26	2	7			No Plunger	set last valid impact time
				57	27	1	5			Current Below Normal or Open Circuit	turn off valve
				97	44	3	12			Idle Smoothness Governor at Limit	TBD
				97	45	4	14			Single Cylinder Correction at Limit	TBD
33	Engine Starter Motor Relay (used only if starter control by PLD is programmed in PLD EEPROM) ED5:battery voltage ED6:torque demand ED7:time/date	677	SID39	80	86	4	7		PLD	Starter Does Not Engage	not used by FTL
				80	33	3	14			Relay Jammed	
				80	05	2	3			Shorted to High Source (Extern Current)	
				80	08	0	6			Shorted to Ground	
				80	09	1	5			Open Circuit	
33	Engine Starter Motor Relay (Starter Lockout) ED5:battery voltage	677	SID39			6	6		VCU	Shorted to Ground	discontinue lockout function
						5	5			Open Circuit	

Nr.	PATH OF FAULT	SPN	PID/ SID	MB Path	MB Id	INT FMI	FMI	OBD	VCU PLD	Failure	Fault Reactions
	ED6:torque demand ED7:time/date										
34	Auxiliary PWM Driver #1 (Exhaust Flap or Variable Geometry Turbocharger) ED5:battery voltage ED6:torque demand ED7:time/date	697	SID57	70	06	0	6		PLD	High Side Line Shorted to Ground	turn off output
				70	09	1	5			Open Circuit	turn off output
35	Auxiliary PWM Driver #2 (Switched or Continuous Decompression Engine Retarded) ED5:battery voltage ED6:torque demand ED7:time/date	698	SID58	73	06	0	6		PLD	High Side Line Shorted to Ground	turn off output
				73	05	2	3			High Side Line Shorted to High Source	turn off output
				73	17	1	5			Low Side Line Shorted to Ground or Open Circuit	turn off output
36	Auxiliary PWM Driver #3 (Dual Sp. Fan Low Stage or Single Sp. Fan) ED5:battery voltage ED6:torque demand ED7:time/date	699	SID59	71	06	0	6		PLD	High Side Line Shorted to Ground	turn off output
				71	09	1	5			Open Circuit	turn off output
37	Auxiliary PWM Driver #4 (Dual Speed Fan High Stage or Single Sp. Fan) ED5:battery voltage ED6:torque demand ED7:time/date	700	SID60	72	06	0	6		PLD	High Side Line Shorted to Ground	turn off output
				72	09	1	5			Open Circuit	turn off output
38	Camshaft Position Sensor ED5:battery voltage	723	SID64	04	12	2	8		PLD	Time Out	emergency run on crankshaft
				04	13	3	14			Pin's Swapped	no fault reaction
				04	08	1	4			Shorted to Ground	emergency run on

Nr.	PATH OF FAULT	SPN	PID/ SID	MB Path	MB Id	INT FMI	FMI	OBD	VCU PLD	Failure	Fault Reactions
	ED6:torque demand ED7:time/date										crankshaft
				04	09	0	3			Open Circuit	emergency run on crankshaft
39	Throttle Select ED5:battery voltage ED6:torque demand ED7: time/date	969	SID 29				TBD			Can currently not be detected	
40	Throttle Inhibit ED5:battery voltage ED6:torque demand ED7:time/date	972	SID 29				TBD			Can currently not be detected	
41	Remote Throttle Pedal Supply ED5:battery voltage ED6:torque demand ED7:time/date	974	SID29				3		VCU	Open Load	low idle (if remote throttle is selected only)
							4			Shorted To Ground	
							2			Out of Range	
42	Fan Speed ED5:battery voltage ED6:torque demand ED7:time/date	986	158 TBD	71	12	0	8		PLD	Time out	not needed for FTL
43	Accessory bus shutdown ED5:battery voltage ED6:torque demand ED7:time/date	1004 TBD	SID56				3		VCU	Open Circuit	discontinue accessory bus shutdown function
							4			Shorted to Ground	
44	Gear output 1 ED5:battery voltage ED6:torque demand ED7:time/date	1005 TBD	SID43				3		VCU	Open Circuit	discontinue Top 2 function
							4			Shorted to Ground	
45	Gear output 2 ED5:battery voltage ED6:torque demand ED7:time/date	1006 TBD	SID44				3		VCU	Open Circuit	discontinue Top 2 function
							4			Shorted to Ground	

Nr.	PATH OF FAULT	SPN	PID/ SID	MB Path	MB Id	INT FMI	FMI	OBD	VCU PLD	Failure	Fault Reactions
46	Analogue Output Oil Pressure (Imo) ED5:battery voltage ED6:torque demand ED7:time/date	1012 TBD	TBD 156				3		VCU	TBD	not needed for FTL
							4			TBD	
							5			TBD	
							6			TBD	
47	Analogue Output Coolant Temperature (Imo) ED5:battery voltage ED6:torque demand ED7:time/date	1013 TBD	TBD 157				3		VCU	TBD	not needed for FTL
							4			TBD	
							5			TBD	
							6			TBD	

W

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ABS

FAULT CODES

SID	FMI	Blink Code	FAULT	Universal pin/plug	BASIC, pin/plug	FRAME pin/plug	Fault-indication	E-FRAME, E-Universal COMMENT (REACTION)	Cause	Action
Wheel Sensor left front										
0	1	3 + 2	air gap	12;15/18	12;15/18	7..8/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	air gap too large, sensor output voltage too low but just exceeds trigger level	Check bearing play, polewheel run out, push sensor to polewheel.
1	2	5 + 2	incorrect tyre	12;15/18	12;15/18	7..8/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	such proportion of tyre diameter/ pole wheel teeth number that wheel speed difference within front axle > 10 % or difference within wheels of different axles > 19 % . Pneus or number of polewheel teeth are different.	Check wheel circumference and number of polewheel teeth
1	3	4 + 2	shorted to UBATT	12;15/18	12;15/18	7..8/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	DC voltage detected. Short circuit or impedance to battery voltage.	Check sensor wiring..
1	4	4 + 2	shorted to ground	12;15/18	12;15/18	7..8/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	Short circuit to ground is detected.	Check Sensor wiring, replace Sensor if necessary.
1	5	4 + 2	open circuit	12;15/18	12;15/18	7..8/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	Open circuit is detected	Check Sensor wiring, replace Sensor if necessary.
1	6	4 + 2	short circuit	12;15/18	12;15/18	7..8/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	Short circuit between sensorwires IG/IGM is detected	Check Sensor wiring, replace Sensor if necessary.
1	7	6 + 2	incorrect pole wheel	12;15/18	12;15/18	7..8/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	Cyclic drop out detected at speed higher than 10 km/h. Several wheel revolution necessary.	Check polewheel for damages / missing teeth. Use WABCO sensor probe. Replace polewheel if not checked o.k. If additional airgap faults are stored, adjust airgap.
1	8	3 + 2	slip	12;15/18	12;15/18	7..8/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	16 sec. slip duration detected.	Adjust airgap. Other possible reasons: gear engaged at slippery conditions or modulator valve does not work correctly.
1	9	5 + 2	wires mismatched	12;15/18	12;15/18	7..8/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	Wire IG or IGM of another sensor is detected.	Check for mismatch-fault of another sensor. Correct harness.
1	10	3 + 2	speed drop-out	12;15/18	12;15/18	7..8/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	Temporarily loss of wheel speed signal. Air gap too large, sensor voltage exceeds trigger level at too late.	Adjust airgap. Check sensor wiring and connectors for intermittent contact. Turn the wheel and read out amplitudes of sensor signals and compare with required values.
1	11	5 + 2	abnormal speed (chatter)	12;15/18	12;15/18	7..8/x2	WL	ABS: partial disabled ASR, RSC, RSA: disabled with standard parameterset not as fault interpreted. FMI 11 not stored.	Brake squeezes or chatters.	NO repair instruction. Check sensor wiring and connectors for intermittent contact. Check toothed wheel for damages. Read out amplitudes of sensor signals and compare with required values.
1	12	5 + 2	frequency too high	12;15/18	12;15/18	7..8/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	non plausible sensor frequency measured.	Check sensor wiring and connectors for intermittent contact. Check whether brake squeezes. Change ELECTRONIC if fault occurence repeats without brake squeezing.

SID	FMI	Blink Code	FAULT	Universal pin/plug	BASIC, pin/plug	FRAME pin/plug	Fault-indication	E-FRAME, E-Universal COMMENT (REACTION)	Cause	Action
Wheel Sensor right front										
2	1	3 + 1	air gap	10;13/18	10;13/18	5..6/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	air gap too large, sensor output voltage too low but just exceeds trigger level	Check bearing play, polewheel run out, push sensor to polewheel.
2	2	5 + 1	incorrect tyre	10;13/18	10;13/18	5..6/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	such proportion of tyre diameter/ pole wheel teeth number that wheel speed difference within front axle > 10 % or difference within wheels of different axles > 19 % . Pneus or number of polewheel teeth are different.	Check wheel circumference and number of polewheel teeth
2	3	4 + 1	shorted to UBATT	10;13/18	10;13/18	5..6/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	DC voltage detected. Short circuit or impedance to battery voltage.	Check sensor wiring..
2	4	4 + 1	shorted to ground	10;13/18	10;13/18	5..6/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	Short circuit to ground is detected.	Check Sensor wiring, replace Sensor if necessary.
2	5	4 + 1	open circuit	10;13/18	10;13/18	5..6/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	Open circuit is detected	Check Sensor wiring, replace Sensor if necessary.
2	6	4 + 1	short circuit	10;13/18	10;13/18	5..6/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	Short circuit between sensorwires IG/IGM is detected	Check Sensor wiring, replace Sensor if necessary.
2	7	6 + 1	incorrect pole wheel	10;13/18	10;13/18	5..6/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	Cyclic drop out detected at speed higher than 10 km/h. Several wheel revolution necessary.	Check polewheel for damages / missing teeth. Use WABCO sensor probe. Replace polewheel if not checked o.k. If additional airgap faults are stored, adjust airgap.
2	8	3 + 1	slip	10;13/18	10;13/18	5..6/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	16 sec. slip duration detected.	Adjust airgap. Other possible reasons: gear engaged at slippery conditions or modulator valve does not work correctly.
2	9	5 + 1	wires mismatched	10;13/18	10;13/18	5..6/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	Wire IG or IGM of another sensor is detected.	Check for mismatch-fault of another sensor. Correct harness.
2	10	3 + 1	speed drop-out	10;13/18	10;13/18	5..6/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	Temporarily loss of wheel speed signal. Air gap too large, sensor voltage exceeds trigger level at too late.	Adjust airgap. Check sensor wiring and connectors for intermittent contact. Turn the wheel and read out amplitudes of sensor signals and compare with required values.
2	11	5 + 1	abnormal speed	10;13/18	10;13/18	5..6/x2	WL	ABS: partial disabled ASR, RSC, RSA: disabled with standard parameterset not as fault interpreted. FMI 11 not stored.	Brake squeezes or chatters.	NO repair instruction. Check sensor wiring and connectors for intermittent contact. Check toothed wheel for damages. Read out amplitudes of sensor signals and compare with required values.
2	12	5 + 1	frequency too high	10;13/18	10;13/18	5..6/x2	WL	ABS: wheel disabled ASR, RSC, RSA: disabled	non plausible sensor frequency measured.	Check sensor wiring and connectors for intermittent contact. Change ELECTRONIC if fault occurence repeats.

SID	FMI	Blink Code	FAULT	Universal pin/plug	BASIC, pin/plug	FRAME pin/plug	Fault-indication	E-FRAME, E-Universal COMMENT (REACTION)	Cause	Action
Wheel Sensor left rear										
3	1	3 + 4	air gap	11;14/18	11;14/18	1..2/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	air gap too large, sensor output voltage too low but just exceeds trigger level	Check bearing play, polewheel run out, push sensor to polewheel.
3	2	5 + 4	incorrect tyre	11;14/18	11;14/18	1..2/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	such proportion of tyre diameter/ pole wheel teeth number that wheel speed difference within front axle > 10 % or difference within wheels of different axles > 19 % . Pneus or number of polewheel teeth are different.	Check wheel circumference and number of polewheel teeth
3	3	4 + 4	shorted to UBATT	11;14/18	11;14/18	1..2/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	DC voltage detected. Short circuit or impedance to battery voltage.	Check sensor wiring..
3	4	4 + 4	shorted to ground	11;14/18	11;14/18	1..2/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	Short circuit to ground is detected.	Check Sensor wiring, replace Sensor if necessary.
3	5	4 + 4	open circuit	11;14/18	11;14/18	1..2/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	Open circuit is detected	Check Sensor wiring, replace Sensor if necessary.
3	6	4 + 4	short circuit	11;14/18	11;14/18	1..2/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	Short circuit between sensorwires IG/IGM is detected	Check Sensor wiring, replace Sensor if necessary.
3	7	6 + 4	incorrect pole wheel	11;14/18	11;14/18	1..2/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	Cyclic drop out detected at speed higher than 10 km/h. Several wheel revolution necessary.	Check polewheel for damages / missing teeth. Use WABCO sensor probe. Replace polewheel if not checked o.k. If additional airgap faults are stored, adjust airgap.
3	8	3 + 4	slip	11;14/18	11;14/18	1..2/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	16 sec. slip duration detected.	Adjust airgap. Other possible reasons: gear engaged at slippery conditions or modulator valve does not work correctly.
3	9	5 + 4	wires mismatched	11;14/18	11;14/18	1..2/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	Wire IG or IGM of another sensor is detected.	Check for mismatch-fault of another sensor. Correct harness.
3	10	3 + 4	speed drop-out	11;14/18	11;14/18	1..2/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	Temporarily loss of wheel speed signal. Air gap too large, sensor voltage exceeds trigger level at too late.	Adjust airgap. Check sensor wiring and connectors for intermittent contact. Turn the wheel and read out amplitudes of sensor signals and compare with required values.
3	11	5 + 4	abnormal speed	11;14/18	11;14/18	1..2/x3	WL	ABS: partial disabled ASR, RSC, RSA: disabled SMR: disabled with standard parameterset not as fault interpreted. FMI 11 not stored.	Brake squeezes or chatters.	NO repair instruction. Check sensor wiring and connectors for intermittent contact. Check toothed wheel for damages. Read out amplitudes of sensor signals and compare with required values.
3	12	5 + 4	frequency too high	11;14/18	11;14/18	1..2/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	non plausible sensor frequency measured.	Check sensor wiring and connectors for intermittent contact. Change ELECTRONIC if fault occurence repeats.

SID	FMI	Blink Code	FAULT	Universal pin/plug	BASIC, pin/plug	FRAME pin/plug	Fault-indication	E-FRAME, E-Universal COMMENT (REACTION)	Cause	Action
Wheel Sensor right rear										
4	1	3 + 3	air gap	17;18/18	17;18/18	3..4/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	air gap too large, sensor output voltage too low but just exceeds trigger level	Check bearing play, polewheel run out, push sensor to polewheel.
4	2	5 + 3	incorrect tyre	17;18/18	17;18/18	3..4/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	such proportion of tyre diameter/ pole wheel teeth number that wheel speed difference within front axle > 10 % or difference within wheels of different axles > 19 % . Pneus or number of polewheel teeth are different.	Check wheel circumference and number of polewheel teeth
4	3	4 + 3	shorted to UBATT	17;18/18	17;18/18	3..4/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	DC voltage detected. Short circuit or impedance to battery voltage.	Check sensor wiring..
4	4	4 + 3	shorted to ground	17;18/18	17;18/18	3..4/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	Short circuit to ground is detected.	Check Sensor wiring, replace Sensor if necessary.
4	5	4 + 3	open circuit	17;18/18	17;18/18	3..4/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	Open circuit is detected	Check Sensor wiring, replace Sensor if necessary.
4	6	4 + 3	short circuit	17;18/18	17;18/18	3..4/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	Short circuit between sensorwires IG/IGM is detected	Check Sensor wiring, replace Sensor if necessary.
4	7	6 + 3	incorrect pole wheel	17;18/18	17;18/18	3..4/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	Cyclic drop out detected at speed higher than 10 km/h. Several wheel revolution necessary.	Check polewheel for damages / missing teeth. Use WABCO sensor probe. Replace polewheel if not checked o.k. If additional airgap faults are stored, adjust airgap.
4	8	3 + 3	slip	17;18/18	17;18/18	3..4/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	16 sec. slip duration detected.	Adjust airgap. Other possible reasons: gear engaged at slippery conditions or modulator valve does not work correctly.
4	9	5 + 3	wires mismatched	17;18/18	17;18/18	3..4/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	Wire IG or IGM of another sensor is detected.	Check for mismatch-fault of another sensor. Correct harness.
4	10	3 + 3	speed drop-out	17;18/18	17;18/18	3..4/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	Temporarily loss of wheel speed signal. Air gap too large, sensor voltage exceeds trigger level at too late.	Adjust airgap. Check sensor wiring and connectors for intermittent contact. Turn the wheel and read out amplitudes of sensor signals and compare with required values.
4	11	5 + 3	abnormal speed	17;18/18	17;18/18	3..4/x3	WL	ABS: partial disabled ASR, RSC, RSA: disabled SMR: disabled with standard parameterset not as fault interpreted. FMI 11 not stored.	Brake squeezes or chatters.	NO repair instruction. Check sensor wiring and connectors for intermittent contact. Check toothed wheel for damages. Read out amplitudes of sensor signals and compare with required values.
4	12	5 + 3	frequency too high	17;18/18	17;18/18	3..4/x3	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled	non plausible sensor frequency measured.	Check sensor wiring and connectors for intermittent contact. Change ELECTRONIC if fault occurence repeats.

SID	FMI	Blink Code	FAULT	Universal pin/plug	BASIC, pin/plug	FRAME pin/plug	Fault-indication	E-FRAME, E-Universal COMMENT (REACTION)	Cause	Action
Wheel Sensor left third (6S-nM)										
5	1	3 + 6	air gap	2;5/15		3..4/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	air gap too large, sensor output voltage too low but just exceeds trigger level	Check bearing play, polewheel run out, push sensor to polewheel.
5	2	5 + 6	incorrect tyre	2;5/15		3..4/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	such proportion of tyre diameter/ pole wheel teeth number that wheel speed difference within front axle > 10 % or difference within wheels of different axles > 19 % . Pneus or number of polewheel teeth are different.	Check wheel circumference and number of polewheel teeth
5	3	4 + 6	shorted to UBATT	2;5/15		3..4/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	DC voltage detected. Short circuit or impedance to battery voltage.	Check sensor wiring..
5	4	4 + 6	shorted to ground	2;5/15		3..4/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	Short circuit to ground is detected.	Check Sensor wiring, replace Sensor if necessary.
5	5	4 + 6	open circuit	2;5/15		3..4/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	Open circuit is detected	Check Sensor wiring, replace Sensor if necessary.
5	6	4 + 6	short circuit	2;5/15		3..4/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	Short circuit between sensorwires IG/IGM is detected	Check Sensor wiring, replace Sensor if necessary.
5	7	6 + 6	incorrect pole wheel	2;5/15		3..4/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	Cyclic drop out detected at speed higher than 10 km/h. Several wheel revolution necessary.	Check polewheel for damages / missing teeth. Use WABCO sensor probe. Replace polewheel if not checked o.k. If additional airgap faults are stored, adjust airgap.
5	8	3 + 6	slip	2;5/15		3..4/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	16 sec. slip duration detected.	Adjust airgap. Other possible reasons: gear engaged at slippery conditions or modulator valve does not work correctly.
5	9	5 + 6	wires mismatched	2;5/15		3..4/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	Wire IG or IGM of another sensor is detected.	Check for mismatch-fault of another sensor. Correct harness.
5	10	3 + 6	speed drop-out	2;5/15		3..4/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	Temporarily loss of wheel speed signal. Air gap too large, sensor voltage exceeds trigger level at too late.	Adjust airgap. Check sensor wiring and connectors for intermittent contact. Turn the wheel and read out amplitudes of sensor signals and compare with required values.
5	11	5 + 6	abnormal speed	2;5/15		3..4/x4	WL	ABS: partial disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel with standard parameterset not as fault interpreted. FMI 11 not stored.	Brake squeezes or chatters.	NO repair instruction. Check sensor wiring and connectors for intermittent contact. Check toothed wheel for damages. Read out amplitudes of sensor signals and compare with required values.
5	12	5 + 6	frequency too high	2;5/15		3..4/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	non plausible sensor frequency measured.	Check sensor wiring and connectors for intermittent contact. Change ELECTRONIC if fault occurence repeats.

SID	FMI	Blink Code	FAULT	Universal pin/plug	BASIC, pin/plug	FRAME pin/plug	Fault-indication	E-FRAME, E-Universal COMMENT (REACTION)	Cause	Action
Wheel Sensor right third (6S-nM)										
6	1	3 + 5	air gap	14;11/15		5..6/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	air gap too large, sensor output voltage too low but just exceeds trigger level	Check bearing play, polewheel run out, push sensor to polewheel.
6	2	5 + 5	incorrect tyre	14;11/15		5..6/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	such proportion of tyre diameter/ pole wheel teeth number that wheel speed difference within front axle > 10 % or difference within wheels of different axles > 19 % . Pneus or number of polewheel teeth are different.	Check wheel circumference and number of polewheel teeth
6	3	4 + 5	shorted to UBATT	14;11/15		5..6/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	DC voltage detected. Short circuit or impedance to battery voltage.	Check sensor wiring..
6	4	4 + 5	shorted to ground	14;11/15		5..6/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	Short circuit to ground is detected.	Check Sensor wiring, replace Sensor if necessary.
6	5	4 + 5	open circuit	14;11/15		5..6/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	Open circuit is detected	Check Sensor wiring, replace Sensor if necessary.
6	6	4 + 5	short circuit	14;11/15		5..6/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	Short circuit between sensorwires IG/IGM is detected	Check Sensor wiring, replace Sensor if necessary.
6	7	6 + 5	incorrect pole wheel	14;11/15		5..6/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	Cyclic drop out detected at speed higher than 10 km/h. Several wheel revolution necessary.	Check polewheel for damages / missing teeth. Use WABCO sensor probe. Replace polewheel if not checked o.k. If additional airgap faults are stored, adjust airgap.
6	8	3 + 5	slip	14;11/15		5..6/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	16 sec. slip duration detected.	Adjust airgap. Other possible reasons: gear engaged at slippery conditions or modulator valve does not work correctly.
6	9	5 + 5	wires mismatched	14;11/15		5..6/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	Wire IG or IGM of another sensor is detected.	Check for mismatch-fault of another sensor. Correct harness.
6	10	3 + 5	speed drop-out	14;11/15		5..6/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	Temporarily loss of wheel speed signal. Air gap too large, sensor voltage exceeds trigger level at too late.	Adjust airgap. Check sensor wiring and connectors for intermittent contact. Turn the wheel and read out amplitudes of sensor signals and compare with required values.
6	11	5 + 5	abnormal speed	14;11/15		5..6/x4	WL	ABS: partial disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel with standard parameterset not as fault interpreted. FMI 11 not stored.	Brake squeezes or chatters.	NO repair instruction. Check sensor wiring and connectors for intermittent contact. Check toothed wheel for damages. Read out amplitudes of sensor signals and compare with required values.
6	12	5 + 5	frequency too high	14;11/15		5..6/x4	WL	ABS: wheel disabled ASR, RSC, RSA: disabled SMR: disabled if driven wheel	non plausible sensor frequency measured.	Check sensor wiring and connectors for intermittent contact. Change ELECTRONIC if fault occurence repeats.

SID	FMI	Blink Code	FAULT	Universal pin/plug	BASIC, pin/plug	FRAME pin/plug	Fault-indication	E-FRAME, E-Universal COMMENT (REACTION)	Cause	Action
Modulator left front										
7	3	2 + 2	shorted to UBATT	3;6/18	3;6/18	2..10/x2	WL	ABS: disabled SMR: disabled ASR, RSC, RSA: disabled EBL: disabled	Inlet (EV) or outlet (AV) are short-circuited to battery supply or to another modulator wire.	Check modulator wires.
7	5	2 + 2	open circuit	3;6/18	3;6/18	2..10/x2	WL	ABS: wheel disabled RSC, RSA: disabled	Inlet (EV) or outlet (AV) wire is broken.	Check modulator wires.
7	6	2 + 2	shorted to ground	3;6/18	3;6/18	2..10/x2	WL	ABS: wheel disabled RSC, RSA: disabled	Inlet (EV) or outlet (AV) is shorted to ground.	Check modulator wires.
Modulator right front										
8	3	2 + 1	shorted to UBATT	1;4/18	1;4/18	3..4/x2	WL	ABS: disabled SMR: disabled ASR, RSC, RSA: disabled EBL: disabled	Inlet (EV) or outlet (AV) are short-circuited to battery supply or to another modulator wire.	Check modulator wires.
8	5	2 + 1	open circuit	1;4/18	1;4/18	3..4/x2	WL	ABS: wheel disabled RSC, RSA: disabled	Inlet (EV) or outlet (AV) wire is broken.	Check modulator wires.
8	6	2 + 1	shorted to ground	1;4/18	1;4/18	3..4/x2	WL	ABS: wheel disabled RSC, RSA: disabled	Inlet (EV) or outlet (AV) is shorted to ground.	Check modulator wires.
Modulator left rear										
9	3	2 + 4	shorted to UBATT	2;5/18	2;5/18	10..12/x3	WL	ABS: disabled ASR, RSC, RSA: disabled SMR: disabled EBL: disabled	Inlet (EV) or outlet (AV) are short-circuited to battery supply or to another modulator wire.	Check modulator wires.
9	5	2 + 4	open circuit	2;5/18	2;5/18	10..12/x3	WL	ABS: wheel disabled SMR: disabled ASR: Diff. Brake disabled RSC, RSA: disabled EBL: wheel disabled	Inlet (EV) or outlet (AV) wire is broken.	Check modulator wires.
9	6	2 + 4	shorted to ground	2;5/18	2;5/18	10..12/x3	WL	ABS: wheel disabled SMR: disabled ASR: Diff. Brake disabled RSC, RSA: disabled EBL: wheel disabled	Inlet (EV) or outlet (AV) is shorted to ground.	Check modulator wires.
Modulator right rear										
10	3	2 + 3	shorted to UBATT	8;9/18	8;9/18	7..9/x3	WL	ABS: disabled ASR, RSC, RSA: disabled SMR: disabled EBL: disabled	Inlet (EV) or outlet (AV) are short-circuited to battery supply or to another modulator wire.	Check modulator wires.
10	5	2 + 3	open circuit	8;9/18	8;9/18	7..9/x3	WL	ABS: wheel disabled SMR: disabled ASR: Diff. Brake disabled RSC: disabled EBL: wheel disabled	Inlet (EV) or outlet (AV) wire is broken.	Check modulator wires.
10	6	2 + 3	shorted to ground	8;9/18	8;9/18	7..9/x3	WL	ABS: wheel disabled SMR: disabled ASR: Diff. Brake disabled RSC: disabled EBL: wheel disabled	Inlet (EV) or outlet (AV) is shorted to ground.	Check modulator wires.

SID	FMI	Blink Code	FAULT	Universal pin/plug	BASIC, pin/plug	FRAME pin/plug	Fault-indication	E-FRAME, E-Universal COMMENT (REACTION)	Cause	Action
DBR, Retarder										
13	3	7 + 3	shorted to UBATT	14/14	14/14	5/x1	WL	DBR control disabled	Output is shorted to battery supply.	Check wire.
13	5	7 + 3	open circuit	14/14	14/14	5/x1	WL	DBR control disabled	DBR-output is not connected to a load.	Check wire. If load is not permanently supervisable (direct connection to another ECU with an internal high-impedance pull up resister) check parametersetting.
13	6	7 + 3	shorted to ground	14/14	14/14	5/x1	WL	DBR control disabled	Output is shorted to ground.	Check wire.
other										
14	4	8 + 1	Voltage supply axles 1+2+Dif, low voltage/open circuit	8/14	8/14	1/x1	WL	ABS: disabled ASR, RSC, RSA: disabled SMR: disabled EBL: disabled	Supply voltage is temporarily too low. WL on as long as voltage is too low.	Check supply wire and fuse.
14	4	8 + 1								
14	5	8 + 5	GND 2 open circuit	9/14	9/14	11/x1	WL	ABS: disabled ASR, RSC, RSA: disabled SMR: disabled EBL: disabled	Connection to central Ground interrupted or with too high resistance.	Check wire
14	7	8 + 3	Voltage supply axles 1+2+Dif, internal relay does not open	internal	internal	2/x1 internal	WL	ABS: disabled ASR, RSC, RSA: disabled SMR: disabled EBL: disabled	Internal relay does not open power line.	Change ELECTRONIC if fault detection repeats.
15	3	8 + 5	Dif-OV (LD) shorted to Ubatt	7/18 8/15	16/18	12/x2 6/x3	WL	ASR: Diff. Brake disabled RSC: disabled	output is shorted to battery supply.	Check wire
15	4	8 + 1	Voltage supply axle 3 + Aux. Low voltage/open circuit	7/14		2/x1	WL	ABS: disabled ASR, RSC, RSA: disabled SMR: disabled EBL: disabled	Supply voltage is temporarily too low. WL on, as long as voltage is too low.	Check supply wire and fuse.
15	5	8 + 5	Dif-OV (LD) high impedance	7/18 8/15	7/18	12/x2 6/x3 internal	WL	ASR: Diff. Brake disabled RSC: disabled	lowside driver does not work	Change ELECTRONIC if fault detection repeats.
15	6	8 + 5	Dif-OV (LD) shorted to ground	7/18 8/15	7/18	12/x2 6/x3	WL		output is shorted to ground.	Check wire
15	7	8 + 3	Voltage supply 3rd axle+Aux. internal relay does not open	7/14		1/x1 internal	WL	ABS: disabled ASR, RSC, RSA: disabled SMR: disabled EBL: disabled	Internal relay does not open power line.	Change ELECTRONIC if fault detection repeats.

SID	FMI	Blink Code	FAULT	Universal pin/plug	BASIC, pin/plug	FRAME pin/plug	Fault-indication	E-FRAME, E-Universal COMMENT (REACTION)	Cause	Action
18	3	7 + 2	Diff. Brake Valve, shorted to UBATT	7;16/18	16/18	5/x3	WL	ASR: Diff. Brake disabled RSC: disabled	Output is shorted to battery supply.	Check wire.
18	5	7 + 2	Diff. Brake Valve, open circuit	7;16/18	16/18	5/x3	WL	ASR: Diff. Brake disabled RSC: disabled	Output wire is interrupted.	Check wire.
18	6	7 + 2	Diff. Brake Valve, shorted to ground	7;16/18	16/18	5/x3	WL	ASR: Diff. Brake disabled RSC: disabled	Output is shorted to ground.	Check wire.
19	3	7 + 6	Trailer Brake Valve, shorted to UBATT	13/15		1/x2	WL	ASR: Diff. Brake disabled RSC: disabled	Output is shorted to battery supply.	Check wire.
19	5	7 + 6	Trailer Brake Valve, open circuit	13/15		1/x2	WL	RSC disabled	Output wire is interrupted.	Check wire.
19	6	7 + 6	Trailer Brake Valve, shorted to ground	13/15		1/x2	WL	RSC disabled	Output is shorted to ground.	Check wire.
22	8	7 + 1								
23	5	7 + 4								
23	5	7 + 4	Warning Light WL-Relay (E-Frame)	15/14	15/14	10/x1	WL if grounded. off if burned out	Blinkcode activation via warning lamp switch longer than 16 sec. causes fault detection	Output detects no load to plus or is grounded.	Check wire and bulb.
231	2	7 + 1	SAE J1939 VSC1 speed bad plausibility	1 ..3/14	1 ..3/14	6 ..7/x1	WL	supervision normally not activated	unplausibility between received vehicle speed and ABS vehicle speed. Supervision normally not activated	check tire size and set parameter correctly
231	5	7 + 1	SAE J1939 open or short circuit	1 ..3/14	1 ..3/14	6 ..7/x1	WL	ASR, RSC, RSA: disabled SMR: disabled SAE J1939 switched to inactive because communication is disturbed.	SAE J1939 communication impossible. SAE J1939 high open or short circuit to plus or ground or SAE J1939 low or low/high are mismatched.	Check wire.
231	6	7 + 1	SAE J1939 no access	1;3/14	1;3/14	6 ..7/x1	WL	ASR, RSC, RSA: disabled SMR: disabled ABS ECU tries multiple to restart communication. Within 10 sec. it is not possible. SAE J1939 remains inactive. FMI 5 might be additionally stored.	SAE J1939 communication impossible. SAE J1939 high open or short circuit to plus or ground or SAE J1939 low or low/high are mismatched.	Check wire.
231	7	7 + 1	SAE J1939 ERC_DR time-out	1;3/14	1;3/14	6 ..7/x1	WL	Driveline Retarder may cause instability.	Driveline integrated retarder sends message incorrectly. Time out supervision detects faults if activated.	Check Driveline-Retarder ECU or it's wires
231	8	7 + 1	SAE J1939 ERC_ER time-out	1;3/14	1;3/14	6 ..7/x1	WL	Engine Retarder may cause instability.	Engine integrated retarder sends message incorrectly. Time out supervision detects fault if activated. Standard is no timeout supervision.	Check engine ECU or it's wires
231	9	7 + 1	SAE J1939 ETC time-out	1;3/14	1;3/14	6 ..7/x1	WL	dragtorque control influenced	Gearbox sends message incorrectly. Time out supervision detects fault if activated. Standard is no timeout supervision.	
231	9	7 + 1	SAE J1939 time-out EEC1	1;3/14	1;3/14	6 ..7/x1	WL	ASR, RSC, RSA: disabled SMR: disabled dragtorque may cause instability	engine electronic sends torque message incorrectly. Time out supervision detects fault.	Check engine ECU or it's wires
231	10	7 + 1	SAE J1939 ERC_EXR time-out	1;3/14	1;3/14	6 ..7/x1	WL	Exaust Retarder may cause instability.	Exhaust integrated retarder sends message incorrectly. Time out supervision detects fault if activated. Standard is no timeout supervision.	Check engine ECU or it's wires

SID	FMI	Blink Code	FAULT	Universal pin/plug	BASIC, pin/plug	FRAME pin/plug	Fault-indication	E-FRAME, E-Universal COMMENT (REACTION)	Cause	Action
231	12	8 + 3	SAE J1939, internal error	internal	internal	6 ..7/x1	WL	ABS: disabled SMR: disabled ASR, RSC, RSA: disabled EBL: disabled	internal fault	Replace ELECTRONIC if fault detection repeats.
251	3	8 + 2	Overvoltage	8/14	8/14	1..2/x1	WL	all valves disabled; no ABS, SMR, Diff. Brake, EBL	Supply voltage too high for more than 5 sec.	Check alternator and battery.
253	2	8 + 2	EBL-Systemuntersch	2/14	2/14		WL	rear axle may be overbraked	EBL wrongly disabled	Check parametersetting.
253	2	8 + 4	EEPROM, Wheel Parameter incorrect				WL	Wheel parameters are out of tolerance. No ABS, SMR, ASR, RSC, RSC, EBL	wrong parameter	Replace ELECTRONIC if fault detection repeats.
253	12	8 + 4	EEPROM, checksum				WL	Was diagnostic device disconnected during active diagnosis? No ABS, SMR, ASR, RSC, RSA, EBL, no blinkcode	Checksum of parameter or analog adjustment is wrong	Check parametersetting.
254	5		ELECTRONIC w/o loads	x/18	x/18	x/X2 +x/X3 +x/X4	WL	Normal for EOL testing of single cabin. Fault not memorized. No ABS, SMR, ASR, RSC, RSA, EBL	No modulators connected.	Check harness for sensors and modulators
254	8	7 + 1	excessive slip / dynotester	all sensors	all sensors	all sensors	WL	On rolling roads resp. dynotesters slip supervision time can be exceeded when faultdetection is not disabled by diagnostic tools or blinkcode (3sec.) . ABS, SMR, ASR disabled	One axle was much faster than other.	Check airgaps respectively vehicle use.
254	9	2 + 1	Modulator-Valve activation-time	all modu-lators	all modu-lators	all modu-lators	temporarily WL	75 % of 5 minutes modulator was avtivated. no ASR during fault activness.	Control via modulator was to long. After a delay time function is normal.	
254	12	8 + 3	Internal Error				WL	no ABS, ASR, SMR, RSC, RSA, EBL no blinkcode	multiple possibilities	Replace ELECTRONIC if fault detection repeats
254	13	8 + 6	Accelerometer out of range (0V)	internal		internal	WL	RSC, RSA disabled	measured acceleration out of range	Replace ELECTRONIC if fault detection repeats
254	13	8 + 6	Accelerometer out of range (5V)	internal		internal	WL	RSC, RSA disabled	measured acceleration out of range	Replace ELECTRONIC if fault detection repeats
254	14	8 + 6	ECU mounting	internal		internal	WL	RSC, RSA disabled	mounted with a slope. measured acceleration offset not plausible	Check ECU mounting. Replace ELECTRONIC if fault detection repeats
254	14	8 + 6	Accelerometer plausibility	internal		internal	WL	RSC, RSA disabled	linearity fault. measured acceleration offset/amplitude not plausible	Check ECU mounting. Replace ELECTRONIC if fault detection repeats
254	14	8 + 6	extreme banked road	internal		internal	WL	RSC, RSA disabled	extreme banked road. measured acceleration offset not plausible	

PROGRAM CONTROL MODULE
LIGHTING & INTLK

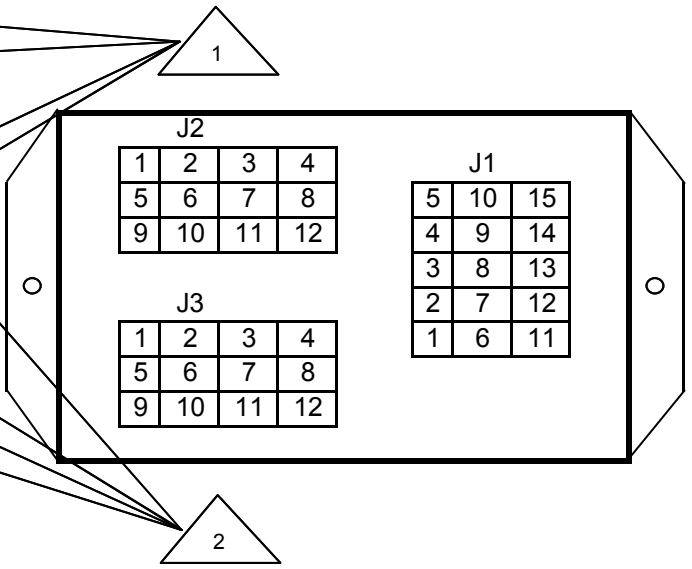
DIAGNOSTIC FOR THE PCM LIGHT

PCM

PROGRAM CONTROL MODULE - LIGHTING & INTLK

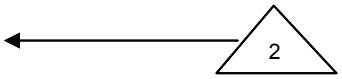
15 Pin Connector JI

pin 1	Circ # 21L	RH Low Beam	12V N.O.
pin 2	Circ # 20L	LH Low Beam	12V N.O.
pin 3	Circ # 14	Battery/Low beam	
pin 4	Circ # 29A	Panel Lamps	PWM 12V N.O.
pin 5	Circ # 21H	RH High Beam	12V N.O.
pin 6	Circ # 20H	LH High Beam	12V N.O.
pin 7	Circ # 125C	PK BK SOL Lock	12V N.O.
pin 8	Circ# 222	High Beam Input	GND N.O.
pin 9	Circ # 306	Ign Input/High beam	12V N.O.
pin 10	Circ # GND	Ground	
pin 11	Circ # 223L	Shift Lock Sol	GND N.O.
pin 12	Circ # 236D	ADA Permission	GND N.O.
pin 13	Circ # open	Programmable Out	PROGRAMMABLE
pin 14	Circ # 36B	Service Brake	12V N.O
pin 15	Circ # 14	Batt/svc-brk-sup	



12 Pin Connector J2

pin 1	Circ # 20A	HL on Input	12V N.O.
pin2	Circ # 440B	Srvc BK Input	OPEN N.O
pin 3	Circ # 81 D	Diag LP output	GND N.O.
pin 4	Circ # 376R1	ABS Event Input	CLOSES TO J2-6
pin 5	Circ # 236	Neutral Input	GND N.O.
pin 6	Circ # 376R	ABS Event Input	CLOSES TO J2-4
pin 7	Circ # 379B	PB/LP Input	GND-N.O.
pin 8	Circ # 223P	Park position input	GND-N.O.
pin 9	Circ # 224A	ABS OPTO output	CLOSES TO J2-12
pin 10	Circ # 439U	PTO OPTO output	CLOSES TO J2-11
pin 11	Circ # 440	PTO OPTO input	CLOSES TO J2-10
pin 12	Circ # 224G	ABS OPTO input	CLOSES TO J2-09



12 Pin Connector J3

pin 1	Cir # 236E	ADA Lift request	12V-N.O.
pin 2	Cir # 29C	Panel LP adj input	GND;DOWN/12V;UP-N.O.
pin 3	OPEN	EXH/Brk Input	BI-N.O.
pin 4	Cir # 23	MRK/Prk LP Input	12V-N.O.
pin 5	OPEN	Programmable input	PROGRAMMABLE
pin 6	Cir # 472X	Cummins/Mercedes	
pin 7	Cir # 475G	High Idle Input	GND-N.O.
pin 8	Cir # 453S	3mph/Retrd act in	OPEN-N.C.
pin 9	OPEN	Aux OPTO Trigger	BI-N.O.
pin 10	OPEN	Aux OPTO Output	CLOSES TO J3-11
pin 11	OPEN	AUX OPTO Input	CLOSES TO J3-10
pin 12	Cir # 472X	Eng Run Input	BI-N.O.

1 DRL IS A PROGRAMMABLE PWM SIGNAL USING LOW OR HIGH HEADLIGHTS BASED ON PROGRAMMING OF "IPOPCMxxxx" PART. SEE NEXT SHEETS FOR DIFFERENCES

2 INPUTS AND OUTPUTS FUNCTIONALITY IS PROGRAMMABLE AND MAY DIFFER FROM ONE"IPOPCMXXXX" PART NUMBER TO THE NEXT. DESCRIPTIONS SEPERATEDBY A"/" INDICATE PROGRAMMING FOR FB65/FS65 RESPECTIVELY.

Electrical Lay out for PCM

15 Pin Connector JI

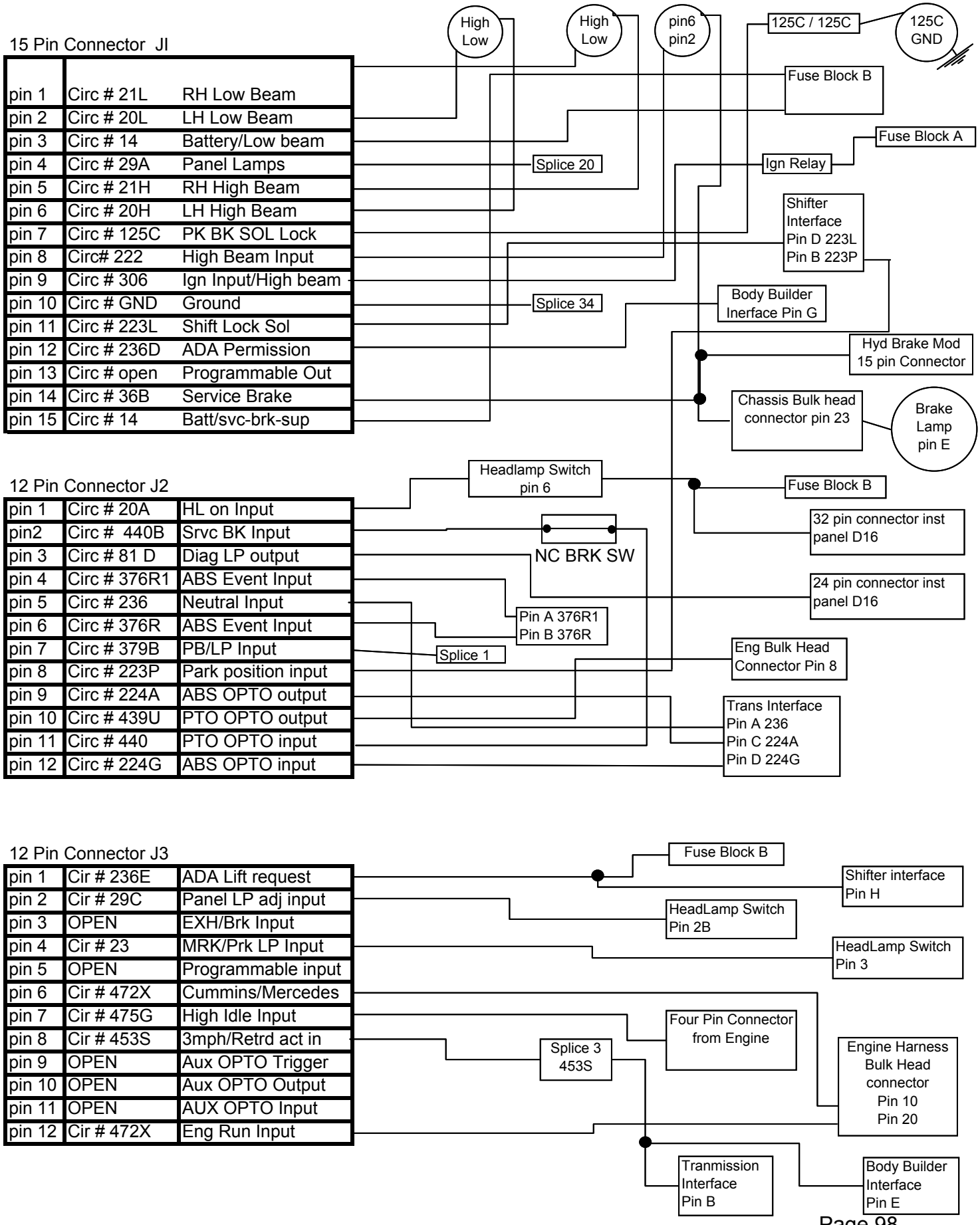
pin 1	Circ # 21L	RH Low Beam
pin 2	Circ # 20L	LH Low Beam
pin 3	Circ # 14	Battery/Low beam
pin 4	Circ # 29A	Panel Lamps
pin 5	Circ # 21H	RH High Beam
pin 6	Circ # 20H	LH High Beam
pin 7	Circ # 125C	PK BK SOL Lock
pin 8	Circ# 222	High Beam Input
pin 9	Circ # 306	Ign Input/High beam
pin 10	Circ # GND	Ground
pin 11	Circ # 223L	Shift Lock Sol
pin 12	Circ # 236D	ADA Permission
pin 13	Circ # open	Programmable Out
pin 14	Circ # 36B	Service Brake
pin 15	Circ # 14	Batt/svc-brk-sup

12 Pin Connector J2

pin 1	Circ # 20A	HL on Input
pin2	Circ # 440B	Srvc BK Input
pin 3	Circ # 81 D	Diag LP output
pin 4	Circ # 376R1	ABS Event Input
pin 5	Circ # 236	Neutral Input
pin 6	Circ # 376R	ABS Event Input
pin 7	Circ # 379B	PB/LP Input
pin 8	Circ # 223P	Park position input
pin 9	Circ # 224A	ABS OPTO output
pin 10	Circ # 439U	PTO OPTO output
pin 11	Circ # 440	PTO OPTO input
pin 12	Circ # 224G	ABS OPTO input

12 Pin Connector J3

pin 1	Cir # 236E	ADA Lift request
pin 2	Cir # 29C	Panel LP adj input
pin 3	OPEN	EXH/Brk Input
pin 4	Cir # 23	MRK/Prk LP Input
pin 5	OPEN	Programmable input
pin 6	Cir # 472X	Cummins/Mercedes
pin 7	Cir # 475G	High Idle Input
pin 8	Cir # 453S	3mph/Retrd act in
pin 9	OPEN	Aux OPTO Trigger
pin 10	OPEN	Aux OPTO Output
pin 11	OPEN	AUX OPTO Input
pin 12	Cir # 472X	Eng Run Input



Logic For Program Control Modules

	IPOPCM8001	IPOPCM8002
Daytime Running Lights	N=NONE	Y=80% J1-1,J1-2 IF J3-12 AND NOT J3-4
Park Brake Solenoid Locking	Y=J1-7 IF (J1-9 & J1-12 & J3-1) OR (J1-9 & J2-7 & J2-2 & J3-8) OR (J1-9 & TMR2MIN) 6	Y=J1-7 IF (J1-9 & J1-12 & J3-1) OR (J1-9 & J2-7 & J2-2 & J3-8) OR (J1-9 & TMR2MIN) 6
Shifter Park Position Monitring	Y=J2-8	Y=J2-8
Shifter Park Position Solenoid Locking	Y=J1-11 IF (J1-9 & J1-12 & J3-1) OR (J1-9 & J2-7 & J2-2 & J3-8) OR (J1-9 & TMR2MIN) 8	Y=J1-11 IF (J1-9 & J1-12 & J3-1) OR (J1-9 & J2-7 & J2-2 & J3-8) OR (J1-9 & TMR2MIN) 8
ADA Intrlock Output	Y=J1-12 IF (J1-9, J2-5, J3-8, J2-7, J2-8, & J3-12)	Y=J1-12 IF (J1-9, J2-5, J3-8, J2-7, J2-8, & J3-12)
PTO Output Logic	Y=PTO OPTO IF J1-9,J2-5,J2-8,J2-7 J3-12, J2-1, J2-2, J3-8 & (J3-7) OR (J1-12 & J3-1) OR (12.75v FOR 10 SECONDS AFTER SERVICE BRAKE IS RELEASED)	Y=PTO OPTO IF J1-9,J2-5,J2-8,J2-7 J3-12, J2-1, J2-2, J3-8 & (J3-7) OR (J1-12 & J3-1) OR (12.75v FOR 10 SECONDS AFTER SERVICE BRAKE IS RELEASED)
J1-7	PK BRAKE SOLENOID LOCK OUTPUT	PK BRAKE SOLENOID LOCK OUTPUT
J1-11	SHIFTER LOCK OUTPUT	SHIFTER LOCK OUTPUT
J1-12	ADA ENABLE OUTPUT	ADA ENABLE OUTPUT
J1-13	Y IF J3-5	Y IF J3-5
J2-8	PARK POSITION INPUT	PARK POSITION INPUT
J3-1	ADA LIFT ACTIVE INPUT	ADA LIFT ACTIVE INPUT
J3-5	Y = J1-13	Y = J1-13
J3-7	HIGH IDLE INPUT	HIGH IDLE INPUT
J3-8	3 MPH SIGNAL INPUT	3 MPH SIGNAL INPUT

6 PARK BEAKE ACTIVATION IS NOT AUTOMATIC.
IF THE PARK BRAKE IS RELEASED DURING AN ADA EVENT, THE SYSTEM WILL RE-APPLY IT
IF THE DRIVER ATTEMPTS TO RELEASE A SET PARK BRAKE WITHOUT THE SERVICE BRAKE DEPRESSED
IT WILL RE-APPLY AUTOMATICALLY.

7 PARK BRAKE IS AUTOMATICLY APPLIED UPON SHIFTER MOVING TO THE "PB" POSITION.
IF SHIFTER IS NOTIN THE "PB" POSITION AND THE SERVICE BRAKE IS NOT APPLIED,
PARK BRAKE WILL RE-APPLY AUTOMATICLY IF ALREADY SET.

8 TMR2MIN WILL MONITOR RELEASE OF PARK BRAKE OR REMOVAL OF SHIFTER FROM "P" OR "PB" (ONLY WHERE APPLICABLE) WITH THE IGNTION OFF. IF EITHER OF THESE EVENTS OCCURS THE PARK BRAKE WILL LOCK AND THE SHIFTER WILL LOCK UPON ENTERING"P" OR "PB" POSTION (IF APPLICABLE). THESE WILL REMAIN LOCKED UNTIL 2 MINUTES AFTER THE SERVICE BRAKE IS RELEASED. IPOPMC8007 & 8008 DO NOT MONITOR "P" WITH IGNTION OFF DUE TO IT BEING USED WITH ARENS SHIFTERS.

Logic For Program Control Modules

	IPOPCM8003	IPOPCM8004
Daytime Running Lights	N=NONE	Y=80% J1-1,J1-2 IF J3-12 AND NOT J3-4
Park Brake Solenoid Locking	Y=J1-7 IF J2-8, J3-8 7	Y=J1-7 IF J2-8, J3-8 7
Shifter Park Position Monitring	Y=J2-8	Y=J2-8
Shifter Park Position Solenoid Locking	Y=J1-11 IF J2-8, J2-5 AND NOT J2-2	Y=J1-11 IF J2-8, J2-5 AND NOT J2-2
ADA Intrlock Output	Y=J1-12 IF (J1-9, J2-5, J3-8, J2-7, J2-8, & J3-12)	Y=J1-12 IF (J1-9, J2-5, J3-8, J2-7, J2-8, & J3-12)
PTO Output Logic	Y=PTO OPTO IF J1-9,J2-5,J2-8,J2-7 J3-12, J2-1, J2-2, J3-8 & (J3-7) OR (J1-12 & J3-1) OR (12.75v FOR 10 SECONDS AFTER SERVICE BRAKE IS RELEASED)	Y=PTO OPTO IF J1-9,J2-5,J2-8,J2-7 J3-12, J2-1, J2-2, J3-8 & (J3-7) OR (J1-12 & J3-1) OR (12.75v FOR 10 SECONDS AFTER SERVICE BRAKE IS RELEASED)
J1-7	PK BRAKE SOLENOID LOCK OUTPUT	PK BRAKE SOLENOID LOCK OUTPUT
J1-11	SHIFTER LOCK OUTPUT	SHIFTER LOCK OUTPUT
J1-12	ADA ENABLE OUTPUT	ADA ENABLE OUTPUT
J1-13	Y IF J3-5	Y IF J3-5
J2-8	PARK POSITION INPUT	PARK POSITION INPUT
J3-1	ADA LIFT ACTIVE INPUT	ADA LIFT ACTIVE INPUT
J3-5	Y = J1-13	Y = J1-13
J3-7	HIGH IDLE INPUT	HIGH IDLE INPUT
J3-8	3 MPH SIGNAL INPUT	3 MPH SIGNAL INPUT

6 PARK BEAKE ACTIVATION IS NOT AUTOMATIC.
IF THE PARK BRAKE IS RELEASED DURING AN ADA EVENT, THE SYSTEM WILL RE-APPLY IT
IF THE DRIVER ATTEMPTS TO RELEASE A SET PARK BRAKE WITHOUT THE SERVICE BRAKE DEPRESSED
IT WILL RE-APPLY AUTOMATICALLY.

7 PARK BRAKE IS AUTOMATICLY APPLIED UPON SHIFTER MOVING TO THE "PB" POSITION.
IF SHIFTER IS NOTIN THE "PB" POSITION AND THE SERVICE BRAKE IS NOT APPLIED,
PARK BRAKE WILL RE-APPLY AUTOMATICLY IF ALREADY SET.

8 TMR2MIN WILL MONITOR RELEASE OF PARK BRAKE OR REMOVAL OF SHIFTER FROM "P" OR "PB" (ONLY WHERE APPLICABLE) WITH THE IGNTION OFF. IF EITHER OF THESE EVENTS OCCURS THE PARK BRAKE WILL LOCK AND THE SHIFTER WILL LOCK UPON ENTERING"P" OR "PB" POSTION (IF APPLICABLE). THESE WILL REMAIN LOCKED UNTIL 2 MINUTES AFTER THE SERVICE BRAKE IS RELEASED. IPOPMC8007 & 8008 DO NOT MONITOR "P" WITH IGNTION OFF DUE TO IT BEING USED WITH ARENS SHIFTERS.

Logic For Program Control Modules

	IPOPCM8005	IPOPCM8006
Daytime Running Lights	N=NONE	Y=80% J1-1,J1-2 IF J3-12 AND NOT J3-4
Park Brake Solenoid Locking	Y=J1-7 IF (J1-9 & J1-12 & J3-1) OR (J1-9 & J2-7 & J2-2 & J3-8) OR (J1-9 & TMR2MIN)	Y=J1-7 IF (J1-9 & J1-12 & J3-1) OR (J1-9 & J2-7 & J2-2 & J3-8) OR (J1-9 & TMR2MIN)
Shifter Park Position Monitring	NOT PROGRAMED	NOT PROGRAMED
Shifter Park Position Solenoid Locking	NOT PROGRAMED	NOT PROGRAMED
ADA Intrlock Output	Y=J1-12 IF (J1-9, J2-5, J3-8, J2-7, J2-8, & J3-12)	Y=J1-12 IF (J1-9, J2-5, J3-8, J2-7, J2-8, & J3-12)
PTO Output Logic	Y=PTO OPTO IF J1-9,J2-5,J2-8,J2-7 J3-12, J2-1, J2-2, J3-8 & (J3-7) OR (J1-12 & J3-1) OR (12.75v FOR 10 SECONDS AFTER SERVICE BRAKE IS RELEASED)	Y=PTO OPTO IF J1-9,J2-5,J2-8,J2-7 J3-12, J2-1, J2-2, J3-8 & (J3-7) OR (J1-12 & J3-1) OR (12.75v FOR 10 SECONDS AFTER SERVICE BRAKE IS RELEASED)
J1-7	PK BRAKE SOLENOID LOCK OUTPUT	PK BRAKE SOLENOID LOCK OUTPUT
J1-11	SHIFTER LOCK OUTPUT	SHIFTER LOCK OUTPUT
J1-12	ADA ENABLE OUTPUT	ADA ENABLE OUTPUT
J1-13	Y IF J3-5	Y IF J3-5
J2-8	PARK POSITION INPUT	PARK POSITION INPUT
J3-1	ADA LIFT ACTIVE INPUT	ADA LIFT ACTIVE INPUT
J3-5	Y = J1-13	Y = J1-13
J3-7	HIGH IDLE INPUT	HIGH IDLE INPUT
J3-8	3 MPH SIGNAL INPUT	3 MPH SIGNAL INPUT

6

PARK BEAKE ACTIVATION IS NOT AUTOMATIC.
IF THE PARK BRAKE IS RELEASED DURING AN ADA EVENT, THE SYSTEM WILL RE-APPLY IT
IF THE DRIVER ATTEMPTS TO RELEASE A SET PARK BRAKE WITHOUT THE SERVICE BRAKE DEPRESSED
IT WILL RE-APPLY AUTOMATICALLY.

7

PARK BRAKE IS AUTOMATICLY APPLIED UPON SHIFTER MOVING TO THE "PB" POSITION.
IF SHIFTER IS NOTIN THE "PB" POSITION AND THE SERVICE BRAKE IS NOT APPLIED,
PARK BRAKE WILL RE-APPLY AUTOMATICLY IF ALREADY SET.

8

TMR2MIN WILL MONITOR RELEASE OF PARK BRAKE OR REMOVAL OF SHIFTER FROM "P" OR "PB" (ONLY WHERE APPLICABLE) WITH THE IGNTION OFF. IF EITHER OF THESE EVENTS OCCURS THE PARK BRAKE WILL LOCK AND THE SHIFTER WILL LOCK UPON ENTERING"P" OR "PB" POSTION (IF APPLICABLE). THESE WILL REMAIN LOCKED UNTIL 2 MINUTES AFTER THE SERVICE BRAKE IS RELEASED. IPOPMC8007 & 8008 DO NOT MONITOR "P" WITH IGNTION OFF DUE TO IT BEING USED WITH ARENS SHIFTERS.

Logic For Program Control Modules

	IPOPCM8007	IPOPCM8008
Daytime Running Lights	N=NONE	Y=80% J1-1,J1-2 IF J3-12 AND NOT J3-4
Park Brake Solenoid Locking	Y=J1-7 IF J2-8, J2-7 AND (J3-1 OR NOT J2-2) 6	Y=J1-7 IF J2-8, J2-7 AND (J3-1 OR NOT J2-2) 6
Shifter Park Position Monitring	Y=J2-8	Y=J2-8
Shifter Park Position Solenoid Locking	Y=J1-11 IF (J1-9 & J1-12 & J3-1) OR (J1-9 & J2-7 & J2-2 & J3-8) OR (J1-9 & TMR2MIN) 8	Y=J1-11 IF (J1-9 & J1-12 & J3-1) OR (J1-9 & J2-7 & J2-2 & J3-8) OR (J1-9 & TMR2MIN) 8
ADA Intrlock Output	Y=J1-12 IF (J1-9, J2-5, J3-8, J2-7, J2-8, & J3-12)	Y=J1-12 IF (J1-9, J2-5, J3-8, J2-7, J2-8, & J3-12)
PTO Output Logic	Y=PTO OPTO IF J1-9,J2-5,J2-8,J2-7 J3-12, J2-1, J2-2, J3-8 & (J3-7) OR (J1-12 & J3-1) OR (12.75v FOR 10 SECONDS AFTER SERVICE BRAKE IS RELEASED)	Y=PTO OPTO IF J1-9,J2-5,J2-8,J2-7 J3-12, J2-1, J2-2, J3-8 & (J3-7) OR (J1-12 & J3-1) OR (12.75v FOR 10 SECONDS AFTER SERVICE BRAKE IS RELEASED)
J1-7	PK BRAKE SOLENOID LOCK OUTPUT	PK BRAKE SOLENOID LOCK OUTPUT
J1-11	SHIFTER LOCK OUTPUT	SHIFTER LOCK OUTPUT
J1-12	ADA ENABLE OUTPUT	ADA ENABLE OUTPUT
J1-13	Y IF J3-5	Y IF J3-5
J2-8	PARK POSITION INPUT	PARK POSITION INPUT
J3-1	ADA LIFT ACTIVE INPUT	ADA LIFT ACTIVE INPUT
J3-5	Y = J1-13	Y = J1-13
J3-7	HIGH IDLE INPUT	HIGH IDLE INPUT
J3-8	3 MPH SIGNAL INPUT	3 MPH SIGNAL INPUT

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PARK BEAKE ACTIVATION IS NOT AUTOMATIC.
IF THE PARK BRAKE IS RELEASED DURING AN ADA EVENT, THE SYSTEM WILL RE-APPLY IT
IF THE DRIVER ATTEMPTS TO RELEASE A SET PARK BRAKE WITHOUT THE SERVICE BRAKE DEPRESSED
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PARK BRAKE IS AUTOMATICLY APPLIED UPON SHIFTER MOVING TO THE "PB" POSITION.
IF SHIFTER IS NOTIN THE "PB" POSITION AND THE SERVICE BRAKE IS NOT APPLIED,
PARK BRAKE WILL RE-APPLY AUTOMATICLY IF ALREADY SET.

8

TMR2MIN WILL MONITOR RELEASE OF PARK BRAKE OR REMOVAL OF SHIFTER FROM "P" OR "PB" (ONLY WHERE APPLICABLE) WITH THE IGNTION OFF. IF EITHER OF THESE EVENTS OCCURS THE PARK BRAKE WILL LOCK AND THE SHIFTER WILL LOCK UPON ENTERING"P" OR "PB" POSTION (IF APPLICABLE). THESE WILL REMAIN LOCKED UNTIL 2 MINUTES AFTER THE SERVICE BRAKE IS RELEASED. IPOPMC8007 & 8008 DO NOT MONITOR "P" WITH IGNTION OFF DUE TO IT BEING USED WITH ARENS SHIFTERS.

The Diagnostics for the PCN is as follows:

DIAG OUT	Flashes diagnostic codes at 0.5 sec on 0.5 sec off and 4 sec between codes if IGN is on. A second codes of 1 flash is added if open load and 2 flashes if overload.

OVERVA	12 Volt in Channel A Overvoltage 3 Flashes
UNDRVA	12 Volt in Channel A Undervoltage 4 Flashes
OVSHTDWN	Overvoltage Shut Down ON Continuous
UNSHTDWN	Undervoltage Shut Down ON Continuous
OVERVB	12 Volt in Channel B Overvoltage 5 Flashes
UNDRVB	12 Volt in Channel B Undervoltage 6 Flashes
EXTRA_ER	Extra Output Error 7 Flashes
PANEL_OC	Panel Output Overcurrent 8 Flashes
RHLB_ER	Right Headlamp Low Beam Error 9 Flashes
LHLB_ER	Left Headlamp Low Beam Error 10 Flashes
HB_ER	High Beam Error 11 Flashes
SBRAKE_ER	Service Brake Error 12 Flashes
OPEN_LOAD	Second code of 1 Flash
OVER_LOAD	Second code of 2 Flashes

With the above chart as reference the following codes are your potential codes to have.

12 volts in Channel A Overvoltage----------3-2
12 volts in Channel A & B Overvoltage----------3-5
12 volts in Channel A Undervoltage----------4-1
12 volts in Channel A & B undervoltage----------4-6
12 volts in Channel B Overvoltage----------5-2
12 volts in Channel B Undervoltage----------6-1
Extra output Error----------7-1
Extra output Error----------7-2
Panel Output Undercurrent----------8-1
Panel Output Overcurrent----------8-2
Right Headlamp Low Beam Error----------9-1
Right Headlamp Low Beam Error----------9-2
Left Headlamp Low Beam Error----------10-1
Left Headlamp Low Beam Error----------10-2
High Beam Error----------11-1
High Beam Error----------11-2
Service Brake Error----------12-1
Service Brake Error----------12-1

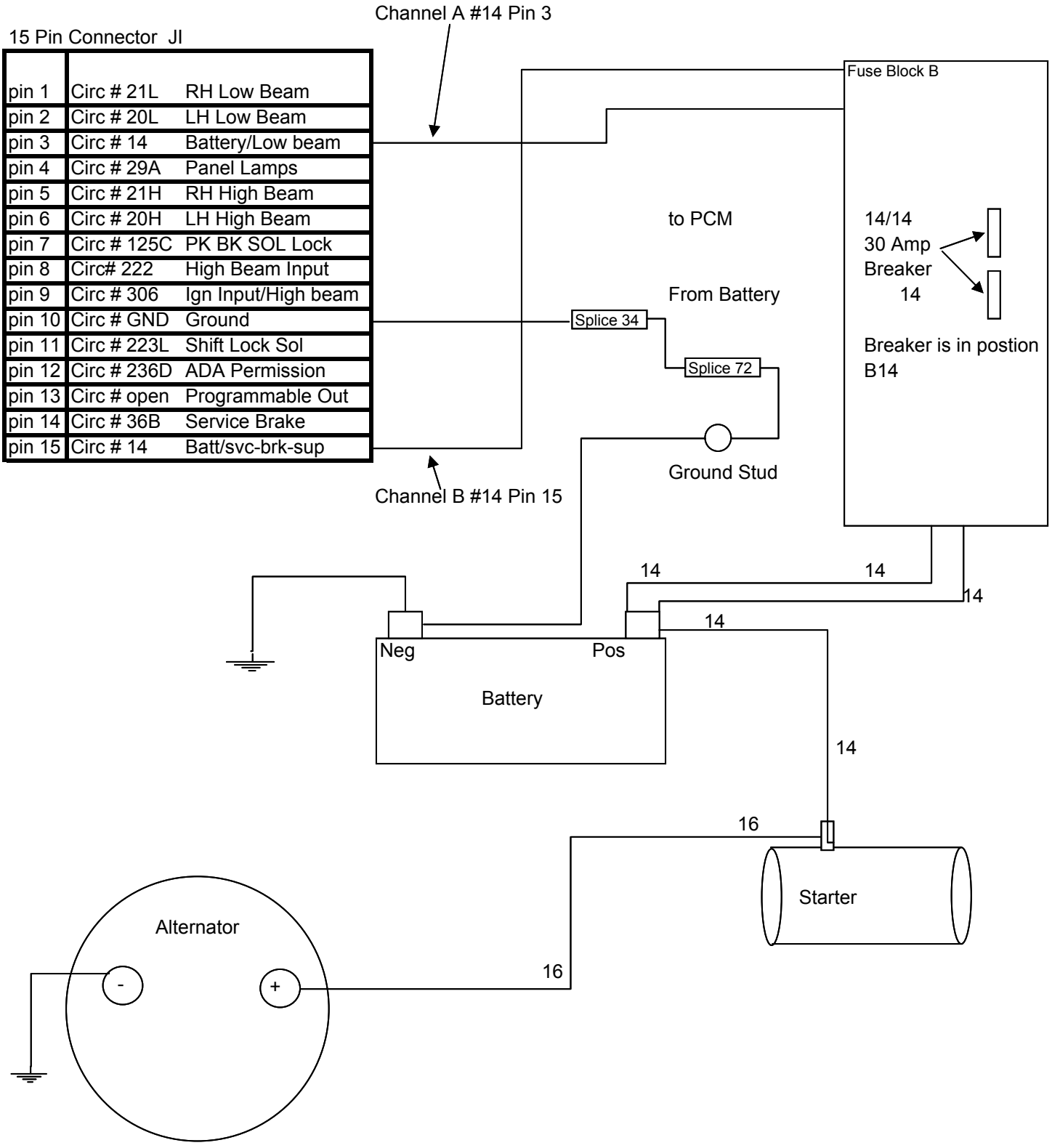
PCM VOLTAGE SPECIFICATIONS

VARIABLE	***VOLTAGE + OR - 10%***
Under Voltage Warning On	11.94V
Under Voltage Warning Off	12.37V
Under Voltage Shutdown	
Under Voltage Restart	9.0V
Over Voltage Warning On	16.0V
Over Voltage Warning Off	15.5V
Over Voltage Shutdown	19.3V
Over Voltage Restart	16.2V
Under Voltage High Idle On	12.7V
Idle Current	27MA

Code 3-2 and 3-5 and 5-2

15 Pin Connector JI

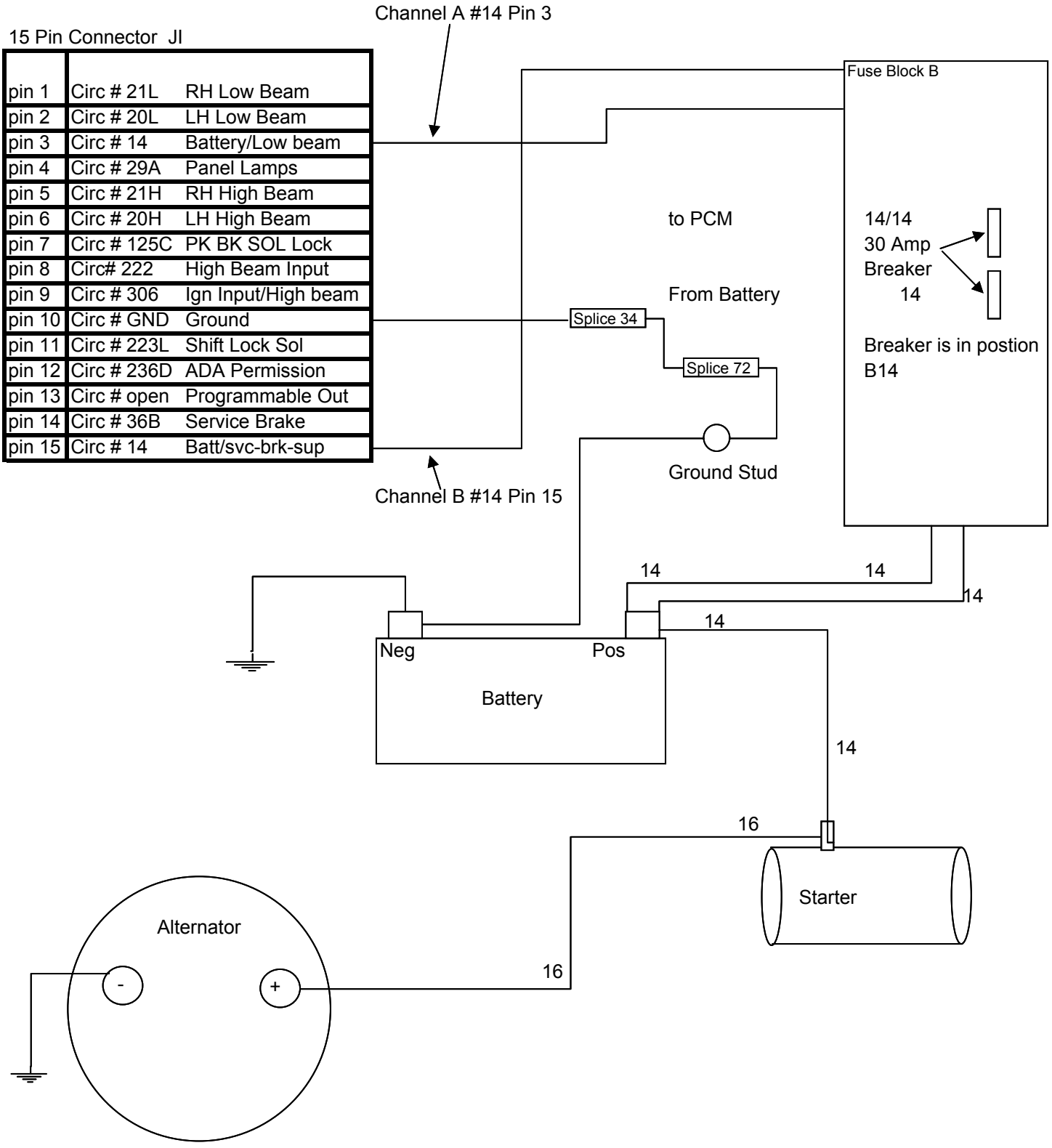
pin 1	Circ # 21L	RH Low Beam
pin 2	Circ # 20L	LH Low Beam
pin 3	Circ # 14	Battery/Low beam
pin 4	Circ # 29A	Panel Lamps
pin 5	Circ # 21H	RH High Beam
pin 6	Circ # 20H	LH High Beam
pin 7	Circ # 125C	PK BK SOL Lock
pin 8	Circ# 222	High Beam Input
pin 9	Circ # 306	Ign Input/High beam
pin 10	Circ # GND	Ground
pin 11	Circ # 223L	Shift Lock Sol
pin 12	Circ # 236D	ADA Permission
pin 13	Circ # open	Programmable Out
pin 14	Circ # 36B	Service Brake
pin 15	Circ # 14	Batt/svc-brk-sup



Code 4-1 and 4-6 and 6-1

15 Pin Connector JI

pin 1	Circ # 21L	RH Low Beam
pin 2	Circ # 20L	LH Low Beam
pin 3	Circ # 14	Battery/Low beam
pin 4	Circ # 29A	Panel Lamps
pin 5	Circ # 21H	RH High Beam
pin 6	Circ # 20H	LH High Beam
pin 7	Circ # 125C	PK BK SOL Lock
pin 8	Circ# 222	High Beam Input
pin 9	Circ # 306	Ign Input/High beam
pin 10	Circ # GND	Ground
pin 11	Circ # 223L	Shift Lock Sol
pin 12	Circ # 236D	ADA Permission
pin 13	Circ # open	Programmable Out
pin 14	Circ # 36B	Service Brake
pin 15	Circ # 14	Batt/svc-brk-sup



Code 7-1 and 7-2

15 Pin Connector JI

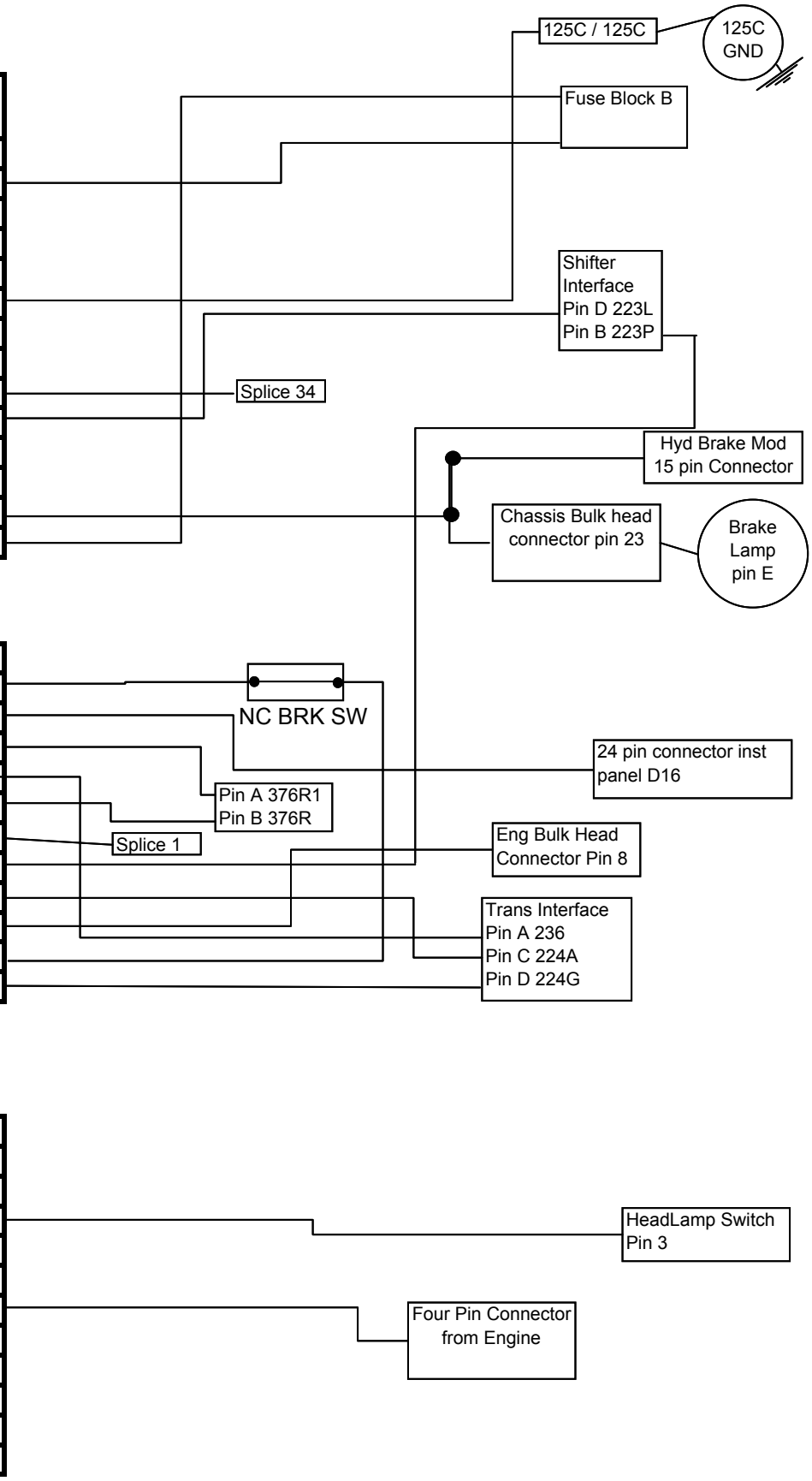
pin 1	Circ # 21L	RH Low Beam
pin 2	Circ # 20L	LH Low Beam
pin 3	Circ # 14	Battery/Low beam
pin 4	Circ # 29A	Panel Lamps
pin 5	Circ # 21H	RH High Beam
pin 6	Circ # 20H	LH High Beam
pin 7	Circ # 125C	PK BK SOL Lock
pin 8	Circ# 222	High Beam Input
pin 9	Circ # 306	Ign Input/High beam
pin 10	Circ # GND	Ground
pin 11	Circ # 223L	Shift Lock Sol
pin 12	Circ # 236D	ADA Permission
pin 13	Circ # open	Programmable Out
pin 14	Circ # 36B	Service Brake
pin 15	Circ # 14	Batt/svc-brk-sup

12 Pin Connector J2

pin 1	Circ # 20A	HL on Input
pin2	Circ # 440B	Srvc BK Input
pin 3	Circ # 81 D	Diag LP output
pin 4	Circ # 376R1	ABS Event Input
pin 5	Circ # 236	Neutral Input
pin 6	Circ # 376R	ABS Event Input
pin 7	Circ # 379B	PB/LP Input
pin 8	Circ # 223P	Park position input
pin 9	Circ # 224A	ABS OPTO output
pin 10	Circ # 439U	PTO OPTO output
pin 11	Circ # 440	PTO OPTO input
pin 12	Circ # 224G	ABS OPTO input

12 Pin Connector J3

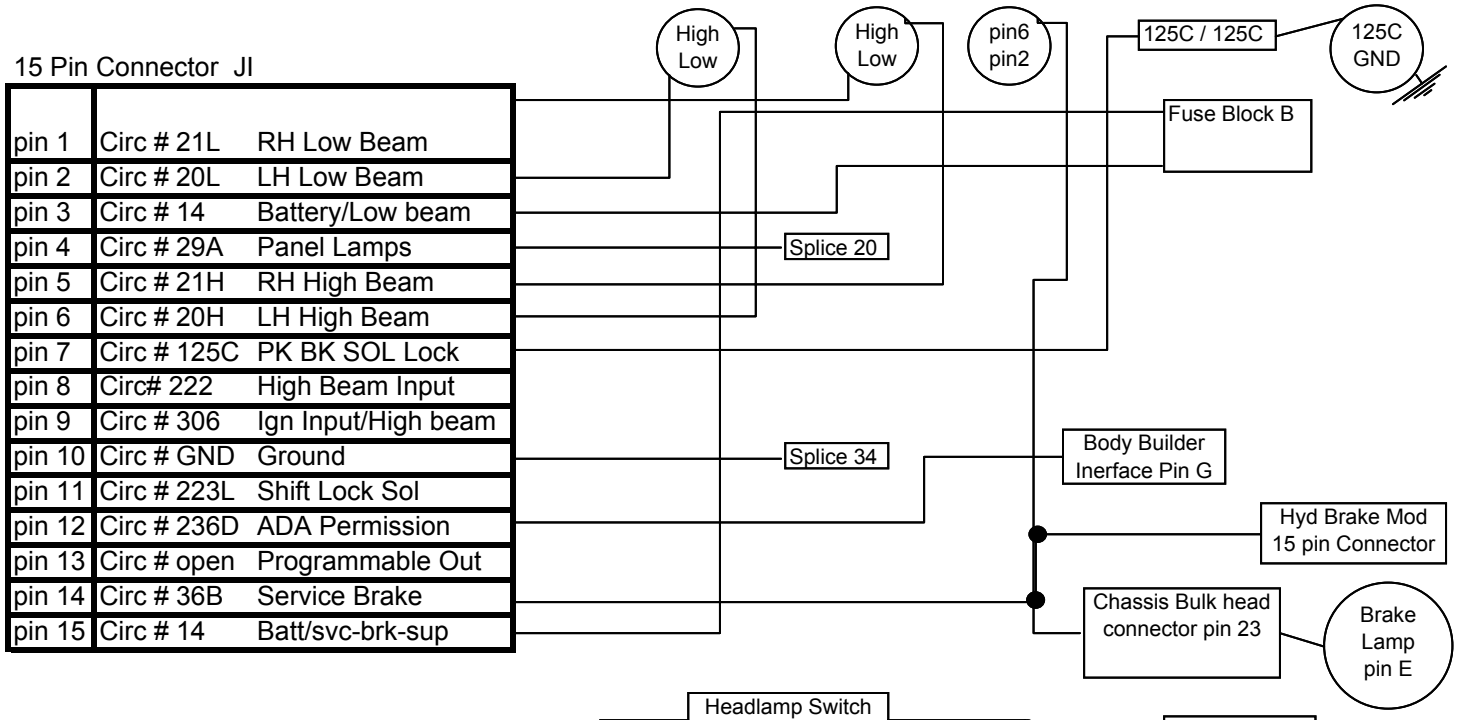
pin 1	Cir # 236E	ADA Lift request
pin 2	Cir # 29C	Panel LP adj input
pin 3	OPEN	EXH/Brk Input
pin 4	Cir # 23	MRK/Prk LP Input
pin 5	OPEN	Programmable input
pin 6	Cir # 472X	Cummins/Mercedes
pin 7	Cir # 475G	High Idle Input
pin 8	Cir # 453S	3mph/Retrd act in
pin 9	OPEN	Aux OPTO Trigger
pin 10	OPEN	Aux OPTO Output
pin 11	OPEN	AUX OPTO Input
pin 12	Cir # 472X	Eng Run Input



Code 8-1 and 8-2

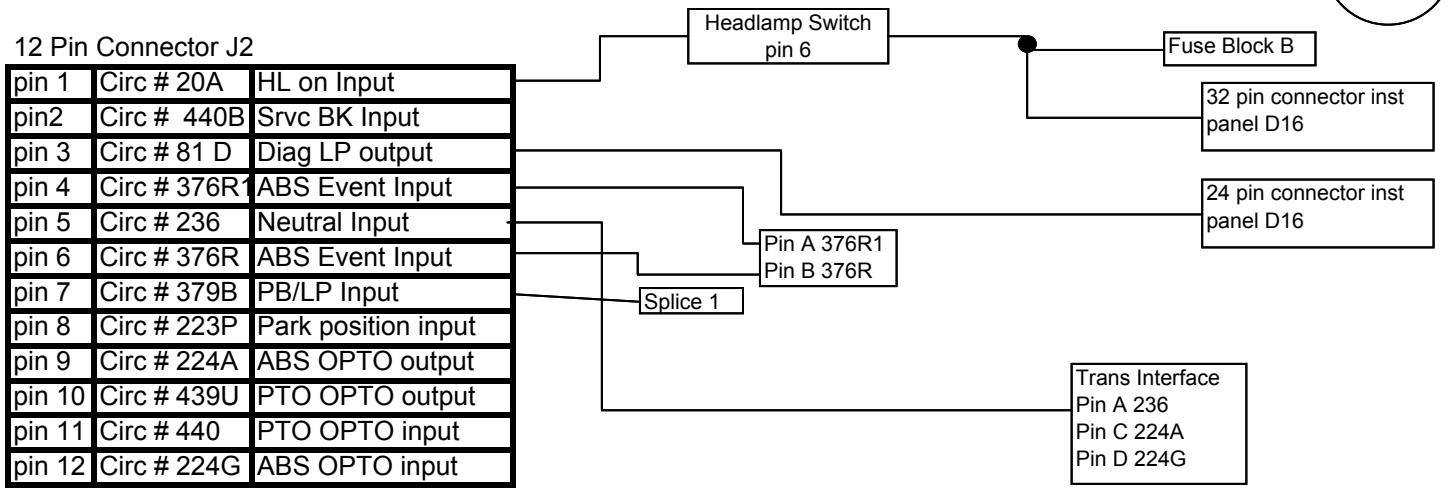
15 Pin Connector JI

pin 1	Circ # 21L	RH Low Beam
pin 2	Circ # 20L	LH Low Beam
pin 3	Circ # 14	Battery/Low beam
pin 4	Circ # 29A	Panel Lamps
pin 5	Circ # 21H	RH High Beam
pin 6	Circ # 20H	LH High Beam
pin 7	Circ # 125C	PK BK SOL Lock
pin 8	Circ# 222	High Beam Input
pin 9	Circ # 306	Ign Input/High beam
pin 10	Circ # GND	Ground
pin 11	Circ # 223L	Shift Lock Sol
pin 12	Circ # 236D	ADA Permission
pin 13	Circ # open	Programmable Out
pin 14	Circ # 36B	Service Brake
pin 15	Circ # 14	Batt/svc-brk-sup



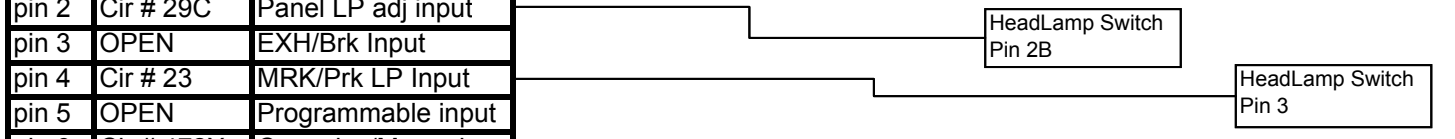
12 Pin Connector J2

pin 1	Circ # 20A	HL on Input
pin2	Circ # 440B	Srvc BK Input
pin 3	Circ # 81 D	Diag LP output
pin 4	Circ # 376R1	ABS Event Input
pin 5	Circ # 236	Neutral Input
pin 6	Circ # 376R	ABS Event Input
pin 7	Circ # 379B	PB/LP Input
pin 8	Circ # 223P	Park position input
pin 9	Circ # 224A	ABS OPTO output
pin 10	Circ # 439U	PTO OPTO output
pin 11	Circ # 440	PTO OPTO input
pin 12	Circ # 224G	ABS OPTO input



12 Pin Connector J3

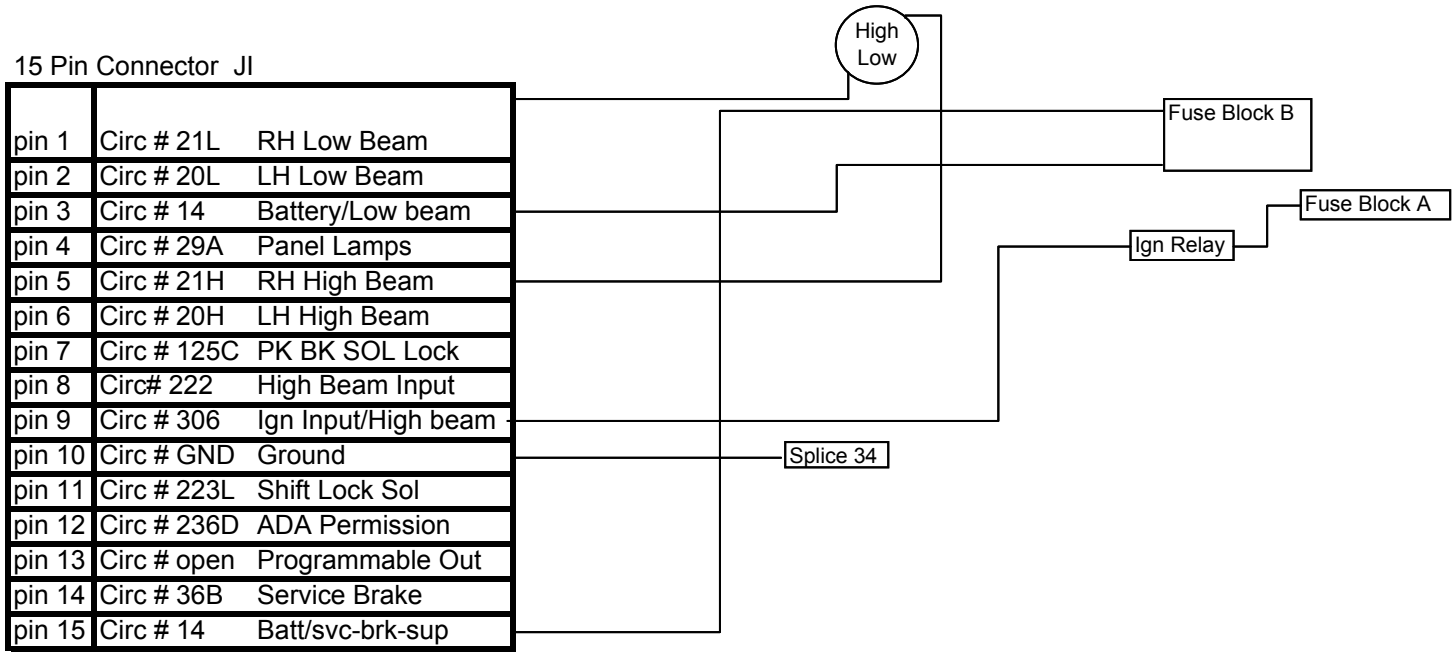
pin 1	Cir # 236E	ADA Lift request
pin 2	Cir # 29C	Panel LP adj input
pin 3	OPEN	EXH/Brk Input
pin 4	Cir # 23	MRK/Prk LP Input
pin 5	OPEN	Programmable input
pin 6	Cir # 472X	Cummins/Mercedes
pin 7	Cir # 475G	High Idle Input
pin 8	Cir # 453S	3mph/Retrd act in
pin 9	OPEN	Aux OPTO Trigger
pin 10	OPEN	Aux OPTO Output
pin 11	OPEN	AUX OPTO Input
pin 12	Cir # 472X	Eng Run Input



Code 9-1 and 9-2

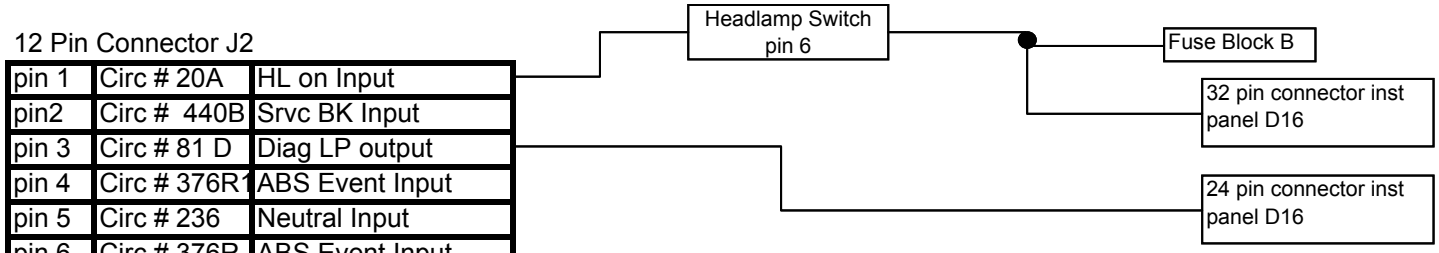
15 Pin Connector JI

pin 1	Circ # 21L	RH Low Beam
pin 2	Circ # 20L	LH Low Beam
pin 3	Circ # 14	Battery/Low beam
pin 4	Circ # 29A	Panel Lamps
pin 5	Circ # 21H	RH High Beam
pin 6	Circ # 20H	LH High Beam
pin 7	Circ # 125C	PK BK SOL Lock
pin 8	Circ# 222	High Beam Input
pin 9	Circ # 306	Ign Input/High beam
pin 10	Circ # GND	Ground
pin 11	Circ # 223L	Shift Lock Sol
pin 12	Circ # 236D	ADA Permission
pin 13	Circ # open	Programmable Out
pin 14	Circ # 36B	Service Brake
pin 15	Circ # 14	Batt/svc-brk-sup



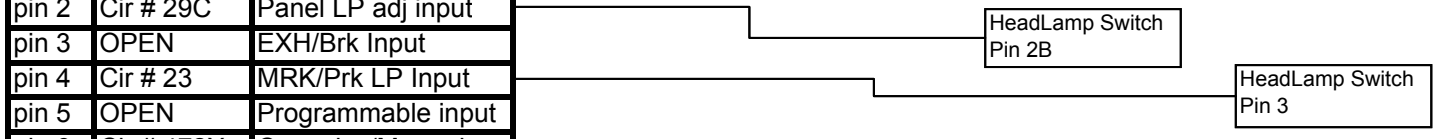
12 Pin Connector J2

pin 1	Circ # 20A	HL on Input
pin2	Circ # 440B	Srvc BK Input
pin 3	Circ # 81 D	Diag LP output
pin 4	Circ # 376R1	ABS Event Input
pin 5	Circ # 236	Neutral Input
pin 6	Circ # 376R	ABS Event Input
pin 7	Circ # 379B	PB/LP Input
pin 8	Circ # 223P	Park position input
pin 9	Circ # 224A	ABS OPTO output
pin 10	Circ # 439U	PTO OPTO output
pin 11	Circ # 440	PTO OPTO input
pin 12	Circ # 224G	ABS OPTO input



12 Pin Connector J3

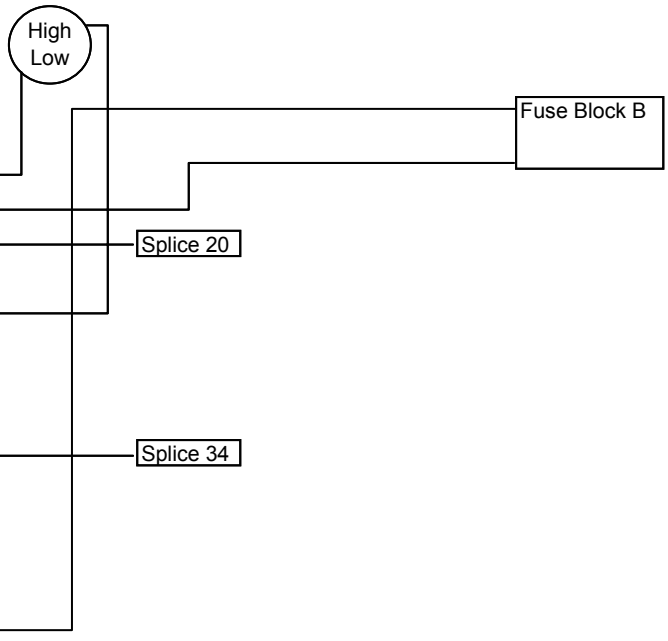
pin 1	Cir # 236E	ADA Lift request
pin 2	Cir # 29C	Panel LP adj input
pin 3	OPEN	EXH/Brk Input
pin 4	Cir # 23	MRK/Prk LP Input
pin 5	OPEN	Programmable input
pin 6	Cir # 472X	Cummins/Mercedes
pin 7	Cir # 475G	High Idle Input
pin 8	Cir # 453S	3mph/Retrd act in
pin 9	OPEN	Aux OPTO Trigger
pin 10	OPEN	Aux OPTO Output
pin 11	OPEN	AUX OPTO Input
pin 12	Cir # 472X	Eng Run Input



Code 10-1 and 10-2

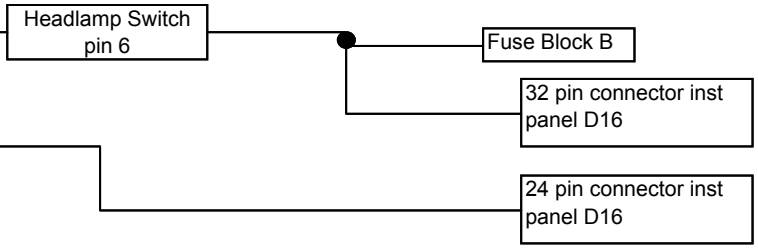
15 Pin Connector JI

pin 1	Circ # 21L	RH Low Beam
pin 2	Circ # 20L	LH Low Beam
pin 3	Circ # 14	Battery/Low beam
pin 4	Circ # 29A	Panel Lamps
pin 5	Circ # 21H	RH High Beam
pin 6	Circ # 20H	LH High Beam
pin 7	Circ # 125C	PK BK SOL Lock
pin 8	Circ# 222	High Beam Input
pin 9	Circ # 306	Ign Input/High beam
pin 10	Circ # GND	Ground
pin 11	Circ # 223L	Shift Lock Sol
pin 12	Circ # 236D	ADA Permission
pin 13	Circ # open	Programmable Out
pin 14	Circ # 36B	Service Brake
pin 15	Circ # 14	Batt/svc-brk-sup



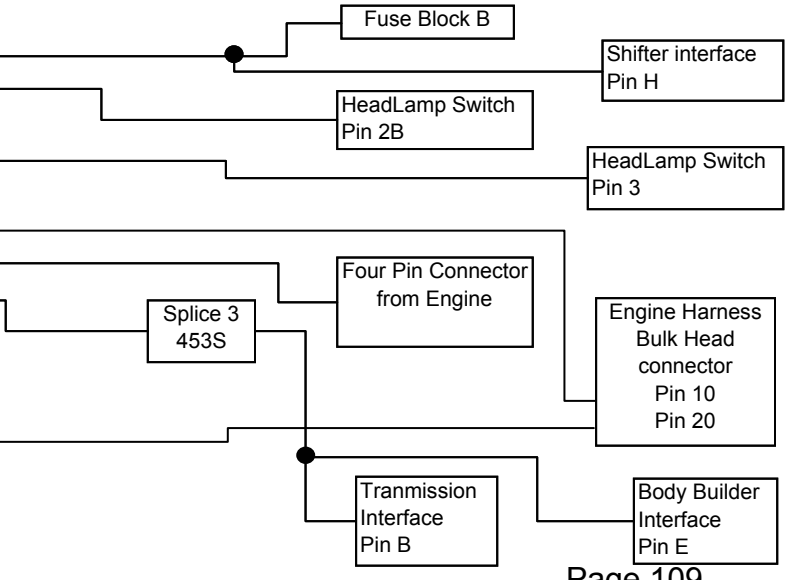
12 Pin Connector J2

pin 1	Circ # 20A	HL on Input
pin2	Circ # 440B	Srvc BK Input
pin 3	Circ # 81 D	Diag LP output
pin 4	Circ # 376R1	ABS Event Input
pin 5	Circ # 236	Neutral Input
pin 6	Circ # 376R	ABS Event Input
pin 7	Circ # 379B	PB/LP Input
pin 8	Circ # 223P	Park position input
pin 9	Circ # 224A	ABS OPTO output
pin 10	Circ # 439U	PTO OPTO output
pin 11	Circ # 440	PTO OPTO input
pin 12	Circ # 224G	ABS OPTO input



12 Pin Connector J3

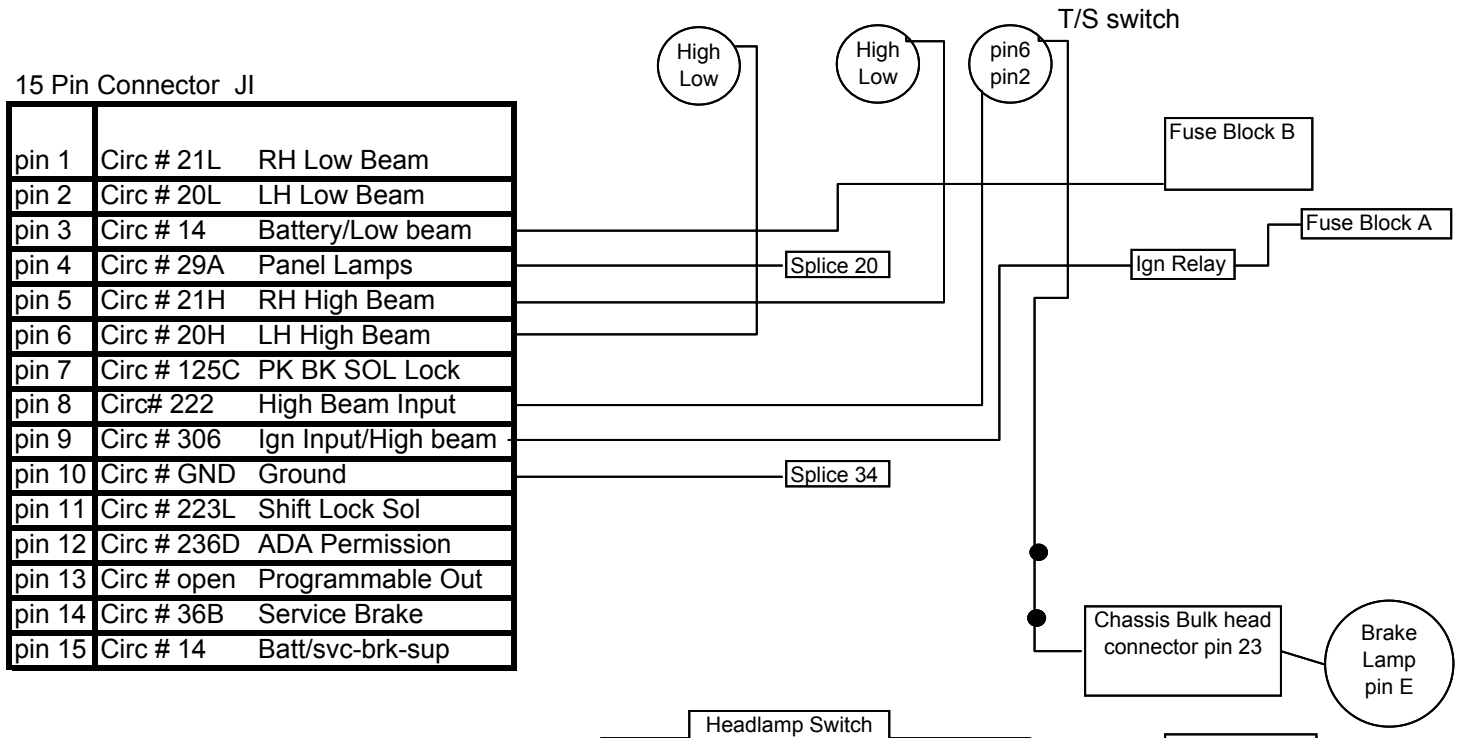
pin 1	Cir # 236E	ADA Lift request
pin 2	Cir # 29C	Panel LP adj input
pin 3	OPEN	EXH/Brk Input
pin 4	Cir # 23	MRK/Prk LP Input
pin 5	OPEN	Programmable input
pin 6	Cir # 472X	Cummins/Mercedes
pin 7	Cir # 475G	High Idle Input
pin 8	Cir # 453S	3mph/Retrd act in
pin 9	OPEN	Aux OPTO Trigger
pin 10	OPEN	Aux OPTO Output
pin 11	OPEN	AUX OPTO Input
pin 12	Cir # 472X	Eng Run Input



Code 11-1 and 11-2

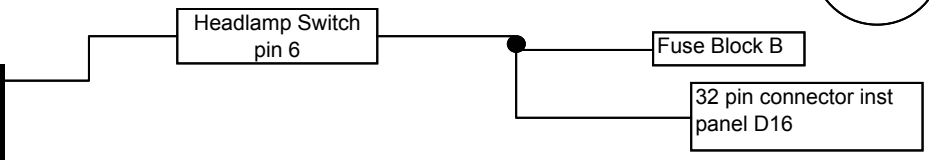
15 Pin Connector JI

pin 1	Circ # 21L	RH Low Beam
pin 2	Circ # 20L	LH Low Beam
pin 3	Circ # 14	Battery/Low beam
pin 4	Circ # 29A	Panel Lamps
pin 5	Circ # 21H	RH High Beam
pin 6	Circ # 20H	LH High Beam
pin 7	Circ # 125C	PK BK SOL Lock
pin 8	Circ# 222	High Beam Input
pin 9	Circ # 306	Ign Input/High beam
pin 10	Circ # GND	Ground
pin 11	Circ # 223L	Shift Lock Sol
pin 12	Circ # 236D	ADA Permission
pin 13	Circ # open	Programmable Out
pin 14	Circ # 36B	Service Brake
pin 15	Circ # 14	Batt/svc-brk-sup



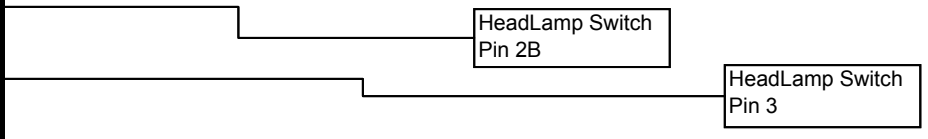
12 Pin Connector J2

pin 1	Circ # 20A	HL on Input
pin2	Circ # 440B	Srvc BK Input
pin 3	Circ # 81 D	Diag LP output
pin 4	Circ # 376R1	ABS Event Input
pin 5	Circ # 236	Neutral Input
pin 6	Circ # 376R	ABS Event Input
pin 7	Circ # 379B	PB/LP Input
pin 8	Circ # 223P	Park position input
pin 9	Circ # 224A	ABS OPTO output
pin 10	Circ # 439U	PTO OPTO output
pin 11	Circ # 440	PTO OPTO input
pin 12	Circ # 224G	ABS OPTO input



12 Pin Connector J3

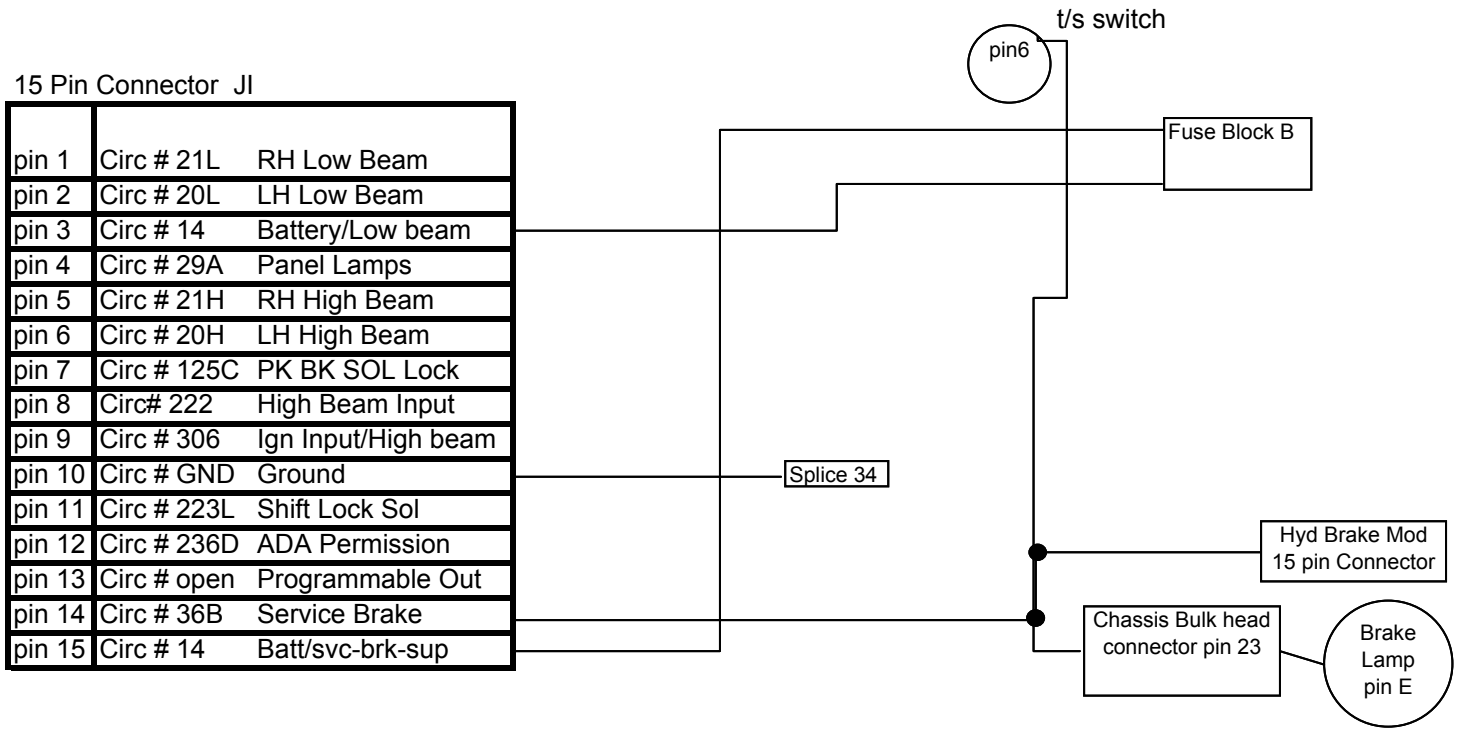
pin 1	Cir # 236E	ADA Lift request
pin 2	Cir # 29C	Panel LP adj input
pin 3	OPEN	EXH/Brk Input
pin 4	Cir # 23	MRK/Prk LP Input
pin 5	OPEN	Programmable input
pin 6	Cir # 472X	Cummins/Mercedes
pin 7	Cir # 475G	High Idle Input
pin 8	Cir # 453S	3mph/Retrd act in
pin 9	OPEN	Aux OPTO Trigger
pin 10	OPEN	Aux OPTO Output
pin 11	OPEN	AUX OPTO Input
pin 12	Cir # 472X	Eng Run Input



Code 12-1 and 12-2

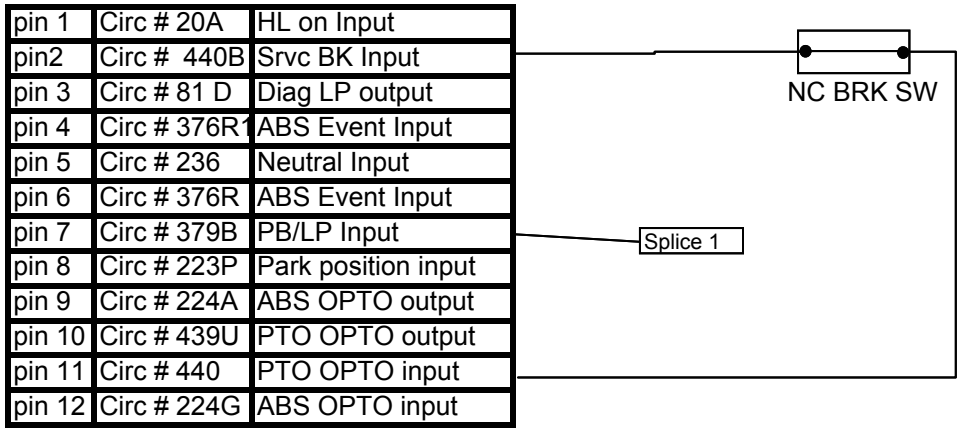
15 Pin Connector JI

pin 1	Circ # 21L	RH Low Beam
pin 2	Circ # 20L	LH Low Beam
pin 3	Circ # 14	Battery/Low beam
pin 4	Circ # 29A	Panel Lamps
pin 5	Circ # 21H	RH High Beam
pin 6	Circ # 20H	LH High Beam
pin 7	Circ # 125C	PK BK SOL Lock
pin 8	Circ# 222	High Beam Input
pin 9	Circ # 306	Ign Input/High beam
pin 10	Circ # GND	Ground
pin 11	Circ # 223L	Shift Lock Sol
pin 12	Circ # 236D	ADA Permission
pin 13	Circ # open	Programmable Out
pin 14	Circ # 36B	Service Brake
pin 15	Circ # 14	Batt/svc-brk-sup



12 Pin Connector J2

pin 1	Circ # 20A	HL on Input
pin2	Circ # 440B	Srvc BK Input
pin 3	Circ # 81 D	Diag LP output
pin 4	Circ # 376R1	ABS Event Input
pin 5	Circ # 236	Neutral Input
pin 6	Circ # 376R	ABS Event Input
pin 7	Circ # 379B	PB/LP Input
pin 8	Circ # 223P	Park position input
pin 9	Circ # 224A	ABS OPTO output
pin 10	Circ # 439U	PTO OPTO output
pin 11	Circ # 440	PTO OPTO input
pin 12	Circ # 224G	ABS OPTO input



Information provided by General Instrument

HYDRAULIC BRAKE MODULE TEST SPECIFICATIONS

HYDRAULIC BRAKE MODULE TEST SPECFICATIONS

1.0 GENERAL DESCRIPTION

The Hydraulic Brake System Monitor Module (or Brake Module for short) is an electronic module that monitors several signals from the hydraulic brake system in the vehicle, and alerts the driver when the system has a fault. This module has three outputs and 9 inputs. The outputs are used for two warning lamps and a buzzer. The inputs are connected to sensor switches that detect different types of faults in the system.

1.0.1. Reference Documents

53-268482-1 Schematics

32012 Final Assembly Drawing

1.1 Electrical Requirements

1.1.1. Operating Voltage Range

The module must meet all requirements with a battery voltage that ranges from 9V to 16V. Any reference to “battery voltage“ refers to this voltage range.

1.1.2. Operating Temperature Range

All units must meet all requirements with an ambient temperature that varies from -40C to +85C.

1.1.3. Operational requirements

1.1.3.1 Module Active

The Module will be active 9powered) in the following conditions:
A. Anytime that battery voltage is applied to the ignition input.
B. Or anytime that battery voltage is applied to the brake pedal input.
C. Or anytime that ignition is off and there is battery voltage applied to the door open input.

1.1.3.2 Power-On Self Test

The module will activate the Self Test mode any time that battery voltage is applied to the ignition on input, after a short period of no power conditions, and regardless of all the other inputs.

When the module is in the self test mode, it will activate the “R“ and “P“ outputs, and also the Buzzer output. These three outputs will be activated for 0.5 seconds minimum, and 3 seconds maximum.

After the self test time period has elapsed, the module will change into the normal operating mode, in which all the other functions are active.

1.1.3.3 Light “R” Output Function.

The “R” output must become activated if anyone of the following input conditions becomes true:

1.1.3.3.1. Flow Switch is activated (input tied to ground). Input voltage Hydraulic fluid should be 0.0v + or – 0.6v. This input will indirectly cause the Pump Motor input to change to battery voltage. See paragraph 1.1.3.3.3.

1.1.3.3.2. Differential Pressure Switch is activated (input tied to ground. Input voltage should be 0.0V + or – 0.6V.

1.1.3.3.3. Flow Switch is activated (input tied to ground) and there is no voltage present at the Pump Motor Input. That is, if conditions indicate that pump should be ON, but there is no power applied to the pump motor.

1.1.3.3.4. Fluid Level Switch is activated (input tied to ground). Input Voltage is 0.0V + or – 0.6V.

1.1.3.3.5. Pump Motor Continuity fails, that is, if the motor winding resistance increases significantly so that the voltage at the Pump Motor input goes higher than 0.6V. The Pump Motor input is actively pulled towards the battery voltage through the circuitry of the module. Under Normal operating conditions, the Pump Motor is OFF, and its winding resistance is very low, forcing the input voltage to ground (0.6V MAX). If the motor winding is open or fails, its DC resistance will increase significantly, and the module should be able to detect this condition.

1.1.3.4. Light “P” Output Function

The “P” output must become activated if any of the following input conditions becomes true:

1.1.3.4.1. Park Brake switch is activated (input tied to ground), WITH Battery voltage applied to the Ignition input. That is, 0.0V + or – 0.6V at the Park Brake Input, while having battery voltage at Ignition input.

1.1.3.4.2. Park Brake Switch inactive (open circuit input), AND battery voltage applied to the Door Open input, AND 0.0V applied to the Ignition input. These conditions must also activate the Buzzer output.

1.1.4 Input/Output Signal Requirements.

1.1.4.1. Light “R” or Light “P” or “BUZZER” Outputs

When the corresponding output is inactive, the terminal will present a high circuit impedance (open circuit).

When the corresponding output is active, the terminal will present a low impedance to ground. That is, the output will be connected to ground trough a bipolar transistor. Both “P” and “BUZZER” outputs have a maximum current capacity of 300mA. The “R” output has a maximum capacity of 600mA.

All three outputs should be able to withstand continuous short circuit conditions. SEE schematic.

1.1.4.2. Park Brake

This input is normally open when the parking brake is OFF. It is connected to ground when the parking brake is activated.

1.1.4.3. Differential Pressure Switch Input

This input is normally open when hydraulic pressures in the vehicle system are equal. This input is connected to ground when the differential pressure in the system gets between 70-225 psi, and resets to the normal open conditions when the pressures return to normal.

1.1.4.4. Hydraulic Fluid flow Switch Input

When the vehicle engine is powered, this input is normally open. When the fluid flow is inhibited, the switch closes, connecting the input to ground. The flow switch is closed anytime the engine is not running (not pumping hydraulic fluid into the system). In this case the auxiliary pump motor is turned on, to supply the system with hydraulic pressure.

1.1.4.5. Door Open

The door switch is normally open when the driver's door is closed. When the door opens, the switch closes, providing battery voltage for this signal input.

1.1.4.6. Ignition

The ignition input in to the module will be floating when the ignition switch is open in the vehicle. When Ignition is ON, battery voltage is applied to this input of the module.

1.1.4.7. Brake Pedal

When the brake pedal is depressed, the switch closes, supplying battery voltage to the signal input of the module.

1.1.4.8. Hydraulic Fluid Level

The fluid level switch in the tank is normally open. When the fluid level is below 25%, the switch closes, connecting the signal input to ground.

1.1.4.9. Winding of Pump Motor

The impedance of the armature of this motor is 0.104 ohms to ground, and the inductance is from 0.35mH to 0.46mH. The motor is connected to ground through the armature.

1.1.4.10 Relay

This output is connected directly to the input signals for the Ignition and Brake Pedal. The signal is active based on these inputs as defined in paragraphs 1.1.4.6 and 1.1.4.7 above.

Notes