Fuller® Automated Transmissions

Roadranger® More time on the road®

Troubleshooting Guide

Fuller Automated Transmissions

TRTS0062

August 2011

FO-6406A-ASW
FO-6406A-ASX
FO-8406A-ASW
FO-8406A-ASX
RT-14910B-AS2
RTLO-14918A-AS2
RTLO-16918A-AS2
RTLO-18918A-AS2
RTLO-20918A-AS2
RTLO-22918A-AS2
RTO-10710B-AS2
RTO-10910B-AS2
RTO-10910B-DM2
RTO-12710B-AS2
RTO-12910B-AS2
RTO-12910B-DM2
RTO-14710B-AS2
RTO-14710C-AS2
RTO-14910B-AS2
RTO-14910B-DM2
RTO-14910C-AS2
RTO-16710C-AS2
RTO-16910B-AS2
RTO-16910B-DM2
RTO-16910C-AS2
RTO-18910B-AS2

Warnings and Cautions

⚠ WARNING

Follow the specified procedures in the indicated order to avoid personal injury

⚠ CAUTION

Follow the specified procedures in the indicated order to avoid equipment malfunction or damage

Note: Additional relevant information not covered in the service procedure.

⚠ WARNING

Before starting a vehicle:

1. **Sit in the driver's seat**
2. **Place shift lever in neutral**
3. **Set the parking brake**

Before working on a vehicle or leaving the cab with engine running:

4. **Place shift lever in neutral**
5. **Set the parking brake**
6. **Block the wheels**

When parking the vehicle or leaving the cab:

7. **Place shift lever in neutral**
8. **Set the parking brake**

⚠ CAUTION

Do not release the parking brake or attempt to select a gear until the air pressure is at the correct level.

To avoid damage to the transmission during towing:

9. **Place shift lever in neutral**
10. **Lift the drive wheels off of the ground or disconnect the driveling**

Do not operate vehicle if alternator lamp is lit or if gauges indicate low voltage.

Section 1: General Information

Section 2: Fault Isolation Procedures

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Section 3: Symptom Isolation Procedures

Appendix

Suggested Tools

Air Gauges

- 2 (0-100) PSI Air Gauges

Volt/Ohm Meter

- SPX / Kent-Moore 1 (800) 328-6657
- P/N 5505027

PC-based Service Tool “ServiceRanger”

- Contact your OEM

Data Link Tester

- Eaton Service Parts 1 (800) 826-4357
- P/N MF-KIT-04

Shift Lever Tester

- Eaton Service Parts 1 (800) 826-4357
- P/N 691795

Eaton Test Adapter Kit

- SPX / Kent-Moore 1 (800) 328-6657
- P/N J-43318

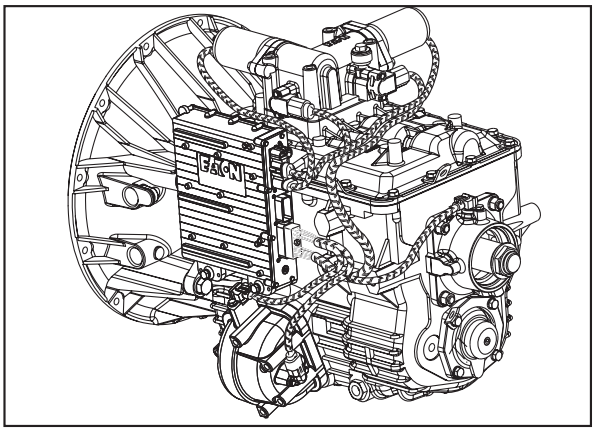
6-Pin Deutsch Diagnostic Adapter

- SPX / Kent-Moore 1 (800) 328-6657
- P/N J-38500-60A

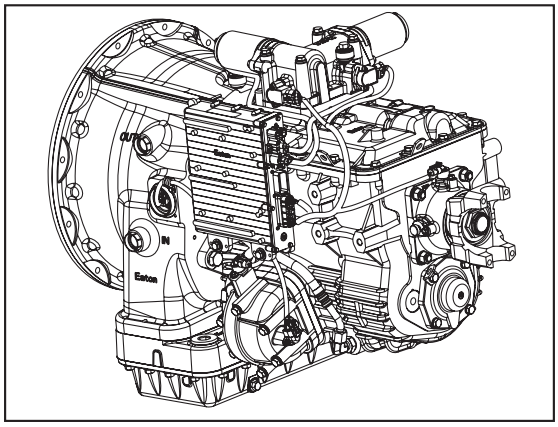
For more information call 1-800-826-HELP (826-4357)

Transmission Models Included

6-Speed



6-Speed ASW



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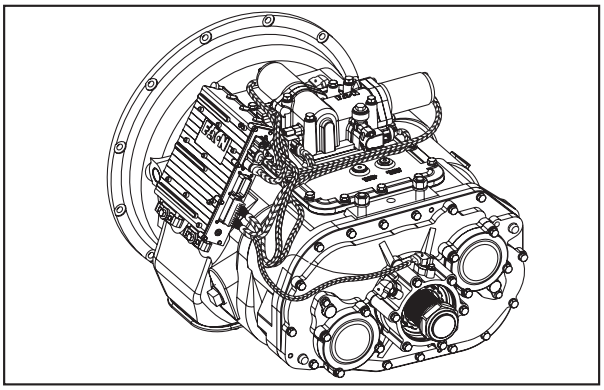
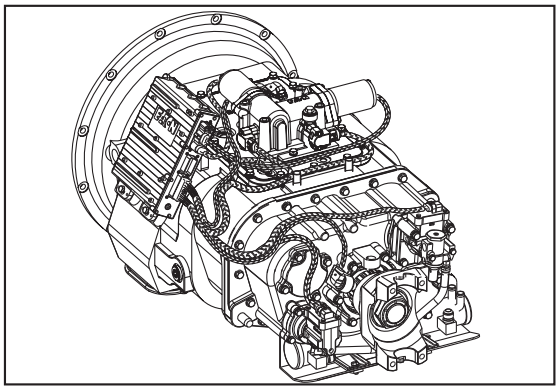
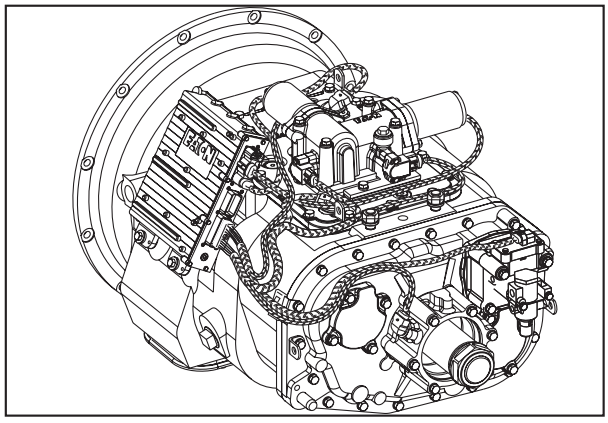


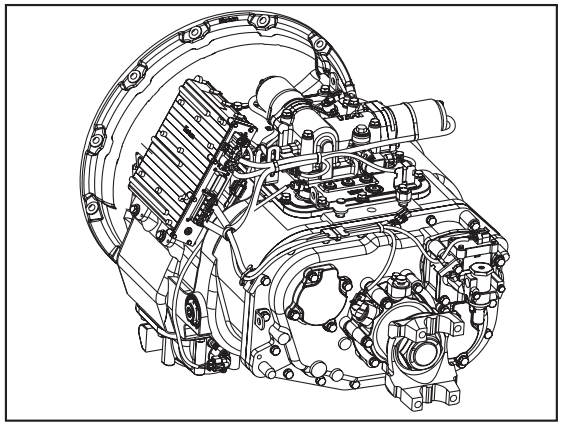
18-Speed



10-Speed

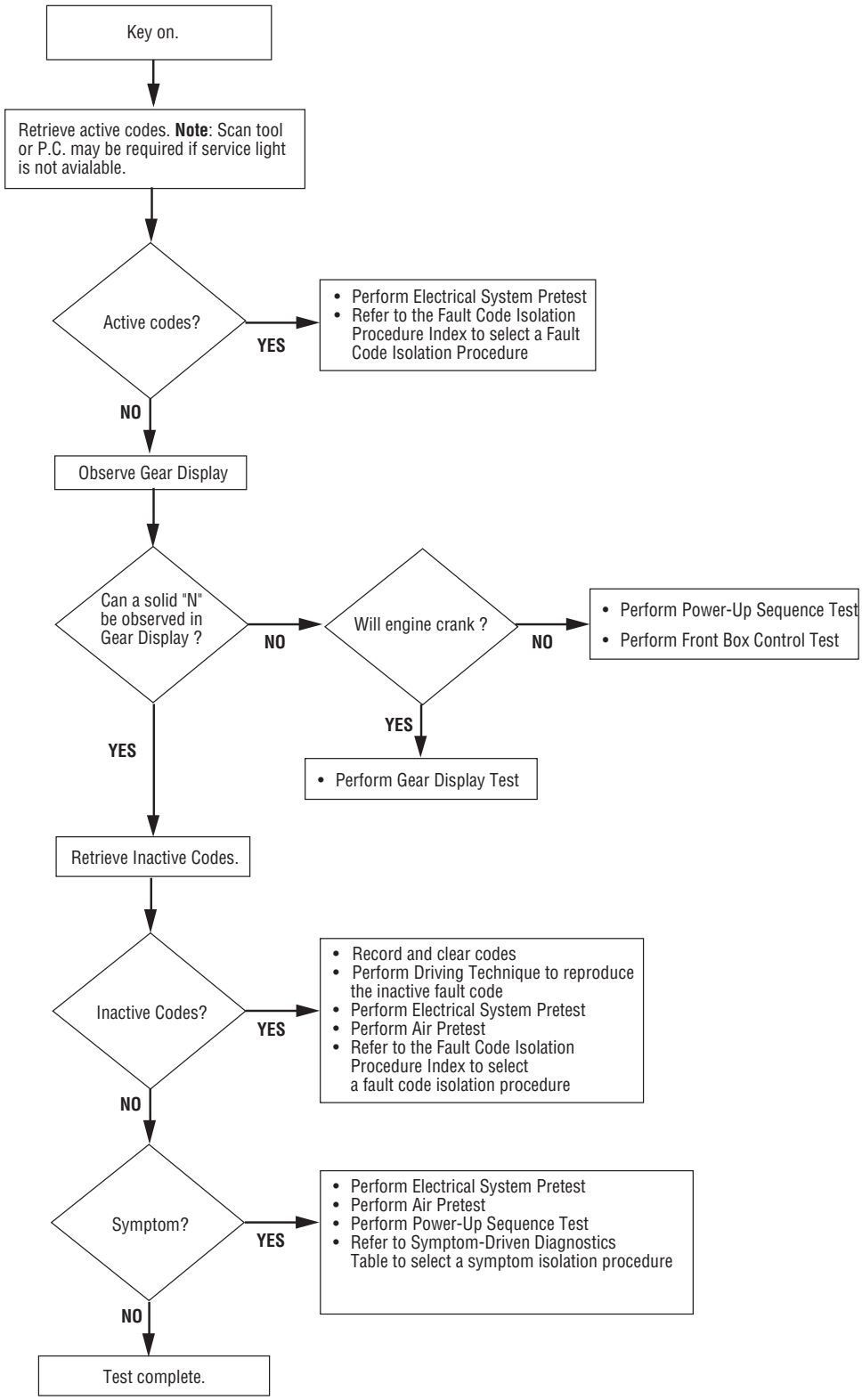


10-Speed DM



Diagnostic Procedure

Follow the flow cart below for all AutoShift failures. Perform tests and procedures as directed by the flowchart.



Fault Code Retrieval/Clearing

Retrieving Fault Codes

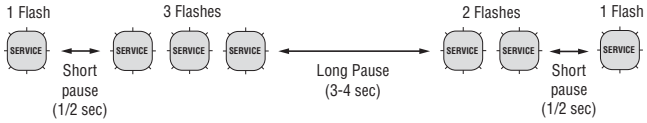
Retrieve fault codes by enabling the system's self-diagnostic mode.

Note: You can also use a PC- based service tool, such as the ServiceRanger to retrieve fault codes.

1. Place the shift lever in neutral.
2. Set the parking brake.
3. Turn the ignition key on but do not start the engine. If the engine already running, you may still retrieve codes, however, do not engage the starter if the engine stalls.
4. To Retrieve Active Codes: Start with the key in the on position. Turn the key off and on two times within five seconds ending with the key in the on position. After five seconds, the service lamp begins flashing two-digit fault codes. If no faults are active, the service light will flash code 25 (no codes).

5. To Retrieve Inactive Codes: Start with the key in the on position. Turn the key off and on four times within five seconds ending with the key in the on position. After five seconds, the service lamp begins flashing two-digit fault codes. If no faults are active, the service light will flash code 25 (no codes).

6. Observe the sequence of flashes on the indicator lamp and record the codes. A one to two second pause separates each stored code, and the sequence automatically repeats after all codes have been flashed.



Clearing Fault Codes

The following procedure clears all inactive fault codes from the ECU's memory. Active fault codes are automatically cleared when the fault has been corrected.

Note: You may use a PC-based Service Tool, such as ServiceRanger, to clear fault codes.

1. Place the shift lever in neutral.
2. Set the parking brake.
3. Turn the ignition key on but do not start the engine.
4. Start with the key in the on position. Turn the key off and on six times within five seconds ending with the key in the on position.

Note: If the codes have been successfully cleared, the service lamp will come on and stay on for five seconds.

5. Turn key off and allow the system to power down.

Driving Techniques

Fault Codes	PID	SID	FMI	Description	Type of Code	Driving Technique
11		254	12	Shift Control	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.
12		233	12	Transmission Controller	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.
14		18	2, 4, 5	Invalid lever Position Test	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.
16		248	2	Eaton Proprietary Link (EPL)	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.
17		237	3, 4	Start Enable Relay Coil	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.
25				NO CODES		
26		55	10	Clutch Slip	Component	Operate the vehicle under load in highest gear possible with engine speed above 1500 rpm. At a steady speed, quickly and fully press the throttle. The failure is detected when clutch slip occurs.
27		55	7	Clutch Disengagement	Component	Operate the vehicle. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration and aggressive stops.

Fault Codes	PID	SID	FMI	Description	Type of Code	Driving Technique
28		52	3,4,5,7	Clutch System Fault	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include low clutch fluid level, heat and vibration.
31		218	3,4	Momentary Ignition Interrupt Relay	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. This fault is only detected during system power-up. If the fault is not present at power-up, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration.
32		62	4	Switched Voltage Supply	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration.
33	168		4	Battery Voltage Supply	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration.
35		231	2	J1939 Data Link	System	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration, and varying levels of throttle demand. It may take up to 75 seconds to set this fault.
41		56	7	Range Failed to Engage	System	Operate vehicle and perform several range upshifts and downshifts. The failure is detected after five consecutive attempts to complete the same type of range shift. Several shifts (ten or more) may be necessary before the controller confirms the failure.
42		61	7	Splitter failed to Engage	System	Operate vehicle and perform several range upshifts and downshifts. The failure is detected after five consecutive attempts to complete the same type of range shift. Several shifts (ten or more) may be necessary before the controller confirms the failure.

Fault Codes	PID	SID	FMI	Description	Type of Code	Driving Technique
43		35, 36	3, 4, 5	Range Valve	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration.
44	53		3, 4, 5	Inertia Brake Solenoid Coil	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration.
46		37, 38	3, 4, 5	Splitter Valve	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration.
51	60		2, 3, 4, 10	Rail Select Sensor	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration.
52	59		2, 3, 4	Gear Select Sensor	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration.
56	161		2, 5	Input Shaft Speed Sensor	Component	Select a forward gear and drive at a steady speed no slower than 10 MPH. It may be necessary to operate the vehicle for a prolonged period of time if the cause of the failure is related to heat and vibration.
57	160		2	Main Shaft Speed Sensor	Component	Select a forward gear and drive at a steady speed no slower than 10 MPH. It may be necessary to operate the vehicle for a prolonged period of time if the cause of the failure is related to heat and vibration.
58	191		2	Output Shaft Speed Sensor	Component	Select a forward gear and drive at a steady speed no slower than 10 MPH. It may be necessary to operate the vehicle for a prolonged period of time if the cause of the failure is related to heat and vibration.

Fault Codes	PID	SID	FMI	Description	Type of Code	Driving Technique
61		39	5, 6	Rail Select Motor	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration.
63		40	5, 6	Gear Select Motor	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration.
65		251	4	Logic Power	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration.
71		60	7	Stuck Engaged	System	Engage Low gear and allow the vehicle to slowly move forward. While the vehicle is in motion, move the shift lever to reverse Low and slowly bring the vehicle to a stop. The vehicle will shift into reverse Low. Several shifts (ten or more) may be required before controller confirms the failure.
72		59	7	Failed to Select Rail	System	Complete several shifts while the vehicle is in motion, including selections from neutral. Also allow the transmission to complete several automatic shifts.
73		58	7	Failed to Engage Gear	System	Complete several shifts while the vehicle is in motion, including selections from neutral. Also allow the transmission to complete several automatic shifts.
74		54	7	Failed to Synchronize	System	Operate vehicle and perform several range upshifts and downshifts in the top gears. If this does not set the code, then perform the following. With vehicle stopped, select a drive gear and fully depress clutch pedal. Return transmission to neutral. Repeat several times.
83		18	14	Shift Lever Missing	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration.

Fault Codes	PID	SID	FMI	Description	Type of Code	Driving Technique
91		236	5	Power Connection	System	Key off. If the fault is present, the system will automatically detect the problem during system calibration and set the code inactive. Possible triggers include corrosion on main battery power and ground.
92		168	14	Weak battery Voltage	System	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include, weak vehicle charging system or battery integrity.
93		231	14	Loss of engine J1939 communication	System	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration.

Fault Code Isolation Procedure Index

Fault Codes	PID	SID	FMI	Description	Type of Code	Page Number
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12		233	12	Transmission Controller	Component	2-19
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16		248	2	Eaton Proprietary Link (EPL)	Component	2-29
17		237	3, 4	Start Enable Relay Coil	Component	2-37
25				No Codes		
26		55	10	Clutch Slip	Component	2-43
27		55	7	Clutch Disengagement	Component	2-45
28		52	3,4,5,7	Clutch System Fault	Component	2-47
31		218	3,4	Momentary Engine Ignition Interrupt Relay	Component	2-53
32		62	4	Switched System Voltage	Component	2-59
33	168		4	Battery Voltage supply	Component	2-65
35		231	2	J1939 Data Link	System	2-69
41		56	7	Range Failed to Engage	System	2-77
42		61	7	Splitter Failed to Engage	System	2-81
43		35, 36	3, 4, 5	Range Valve	Component	2-85
44	53		3, 4, 5	Inertia Brake Solenoid Coil	Component	2-89
46		37, 38	3, 4, 5	Splitter Valve	Component	2-93
51	60		2, 3, 4, 10	Rail Select Sensor	Component	2-97
52	59		2, 3, 4	Gear Select Sensor	Component	2-103
56	161		2, 5	Input Shaft Speed Sensor	Component	2-109
57	160		2	Main Shaft Speed Sensor	Component	2-113
58	191		2	Output Shaft Speed Sensor	Component	2-117
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Fault Codes	PID	SID	FMI	Description	Type of Code	Page Number
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Symptom-Driven Diagnostics Index

Electrical System Pretest

Overview

The test does not relate to any specific fault code, but must be completed before performing Fault Code Isolation Table procedures. The pretest verifies the batteries are fully charged.

Detection

There is no detection process specifically for the basic electrical supply. However, failures of this type are generally detected by the transmission or driver as some other type of fault code or symptom.

Fallback

There is no fallback for the electrical pretest, however, it may effect other systems.

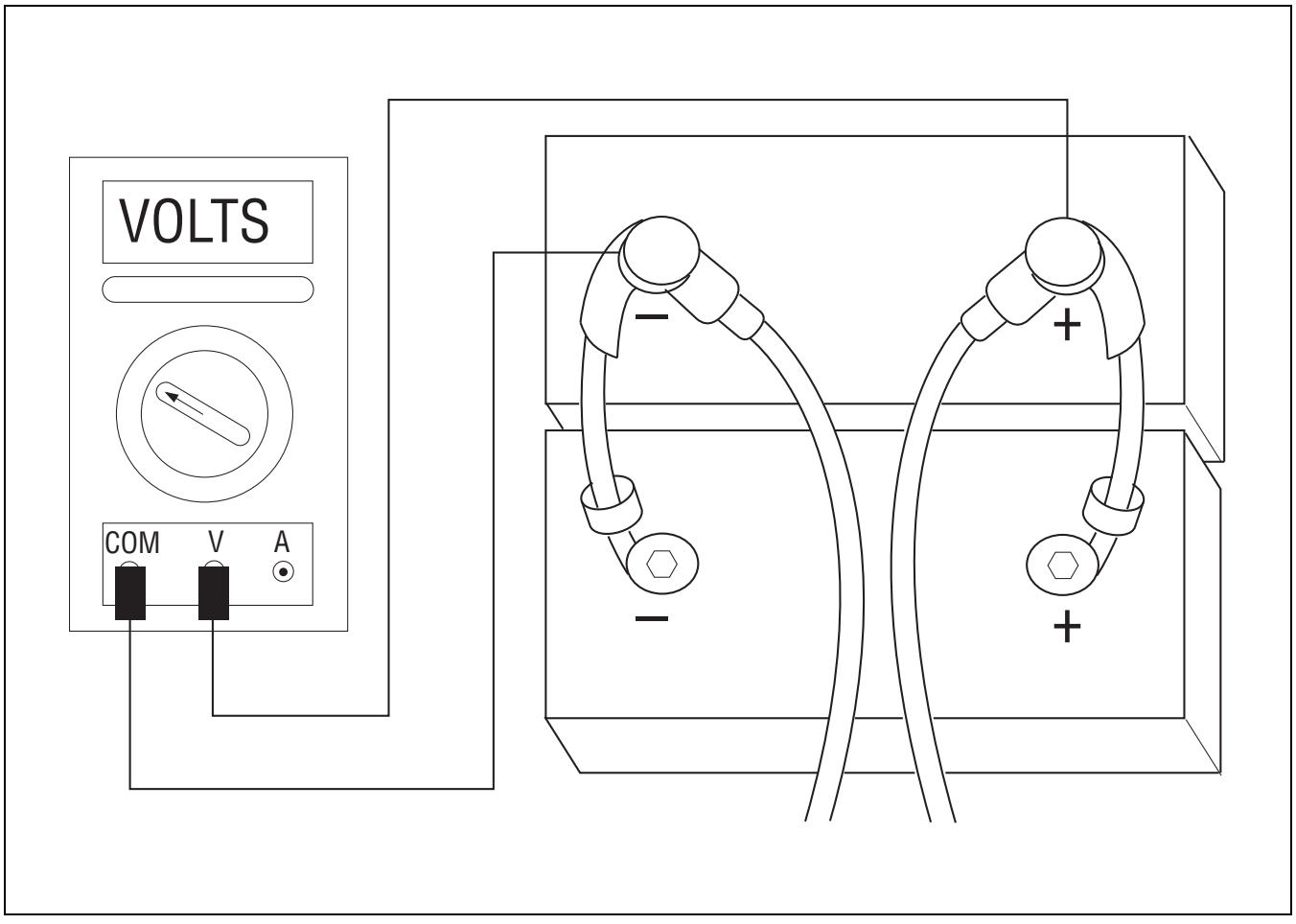
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- Battery Load Tester

Possible Causes

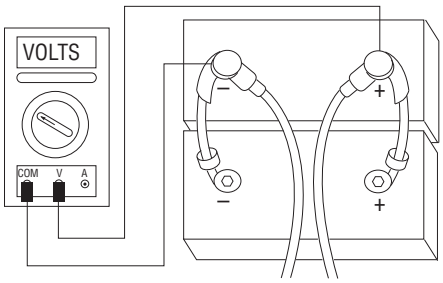
This pretest can be used for any of the following:

- Low Batteries
- Starter/Battery connections



Electrical System Pretest

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Inspect starter/battery and inline fuse holder connections for integrity.		
	3. Measure voltage across batteries. →	If voltage is 11 to 13 volts on a 12 volt system or 22 to 26 on a 24 volt system →	Go to **Step B.**
		If voltage is outside of range →	Repair or replace batteries and charging system as required. Repeat this step.



Step B	Procedure	Condition	Action
	1. Key off.		
	2. Load Test the Batterys. →	If the batteries maintain the specified load →	Test Complete.
		If the batteries fail the load test →	Replace the damaged battery/s and repeat this step.

Power-Up Sequence Pretest

Overview

A failure during the self-check indicates a failure of the Shift Control.

Detection

The power-up self-check is performed automatically each time the key is turned on. Turn the key on and watch the service lamp. If power-up stops with the service lamp constantly on, or it never comes on, self-check has failed.

Fallback

If self-check fails, the product cannot perform any operations.

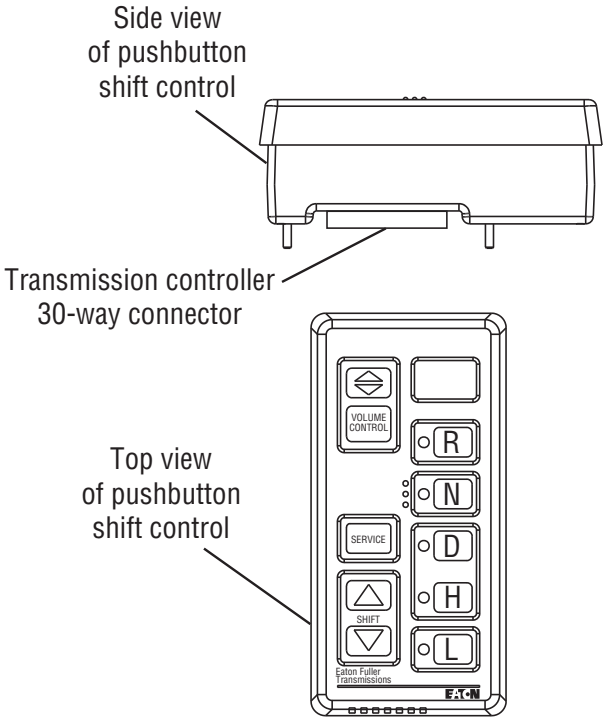
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

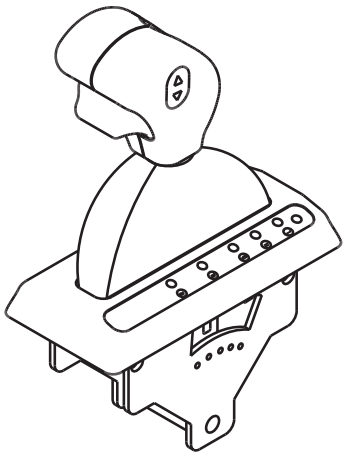
Possible Causes

This test can be used for the following:

- Shift Control
- Vehicle Harness



Pushbutton Shift Control



Eaton Shift Lever

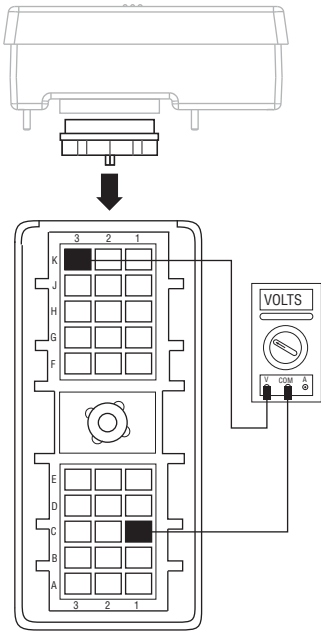
Power-Up Sequence Pretest

Step A	Procedure	Condition	Action
	1. Is vehicle equipped with a Shift Lever?	If vehicle is not equipped with a Shift Lever	Go to **Step B.**
		If vehicle is equipped with a Shift Lever	Go to **Step D.**

Step B	Procedure	Condition	Action
	1. Key on.		
	2. Observe service lamp. **Note:** If service lamp is flashing, go to Diagnostics Procedure (page 1-2).	If service lamp lights for one second and turns off	Test complete.
		If service lamp never comes on	Go to **Step C.**
		If service lamp is on steady	**Replace Shift Control.** Repeat this step.

Power-Up Sequence Pretest, continued

Step C	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect Shift Control 30-way connector.		
	3. Key on.		
	4. Measure voltage between Shift Control 30-way pins C1 and K3.	If voltage is within 1 volt of battery voltage	**Replace Shift Control.** Go to **Step B.**
		If voltage is outside of range	No ignition power. Repair ignition power supply to transmission. Go to **Step B.**



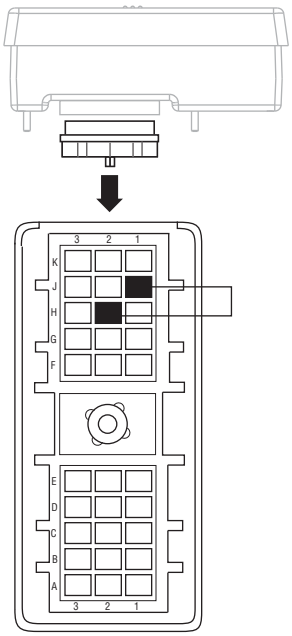
Step D	Procedure	Condition	Action
	1. Is vehicle equipped with an Eaton supplied Shift Lever or an OEM supplied Shift Lever?	If Eaton Shift Lever	Go to **Step E.**
		If OEM Shift Lever	Go to **Step I.**

Power-Up Sequence Pretest, continued

Step E	Procedure	Condition	Action
	1. Key on.		
	2. Observe service lamp. →	If service lamp lights for one second and turns off →	Test complete.
	Note: If service lamp is flashing, go to Diagnostics Procedure (page 1-2).		
		If service lamp never comes on →	Go to **Step F.**
		If service lamp is on steady →	Go to **Step H.**

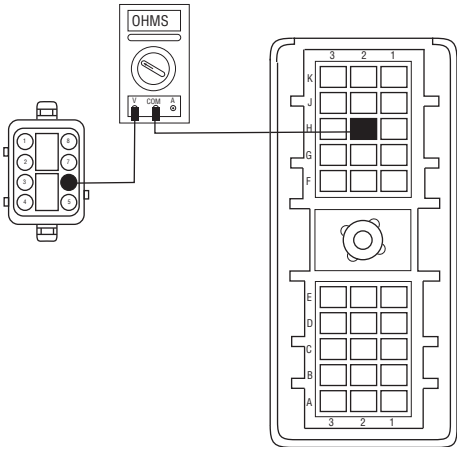
Power-Up Sequence Pretest, continued

Step F	Procedure	Condition	Action
	1. Key off. 2. Locate Shift Control. 3. Disconnect Shift Control 30-way connector. 4. Place a jumper across Shift Control 30-way connector pins J1 and H2.	If service lamp turns on	**Replace Shift Control.** Go to **Step E.**
		If service lamp never comes on	Go to **Step G.**



Power-Up Sequence Pretest, continued

Step G	Procedure	Condition	Action
	1. Key off. 2. Disconnect Shift Lever 8-way connector. 3. Measure resistance between: • Shift Control 30-way pin H2 and Shift Lever 8-way connector pin 6 • Shift Control 30-way connector pin H2 and ground.	If resistance between pins H2 and 6 is 0 to.3 ohms and	
		If resistance between pin H2 and ground is 10K ohms or open circuit [OL]	Replace Shift Lever. Go to **Step E.**
		If any of the above conditions are not met	Repair OEM harness between Shift Control and Shift Lever. Go to **Step E.**



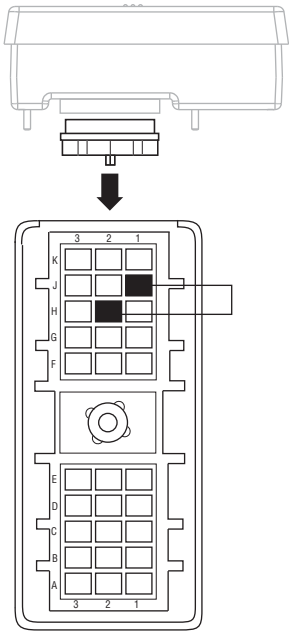
Power-Up Sequence Pretest, continued

Step H	Procedure	Condition	Action
	1. Key on.		
	2. Locate Shift Control.		
	3. Disconnect Shift Control 30-way connector. →	If service lamp turns off →	**Replace Shift Control**. Go to **Step E.**
		If service lamp remains on →	Repair OEM harness as required. Go to **Step E.**

Step I	Procedure	Condition	Action
	1. Key off.		
	2. Locate service lamp connector on OEM harness.		
	3. Measure voltage across pins A & B on service lamp connector.		
	4. Key on. →	If voltage is within 2 volts of battery voltage for one second, then 0 volts →	Test complete.
		If no voltage is measured →	Go to **Step J**.
		If voltage is within 2 volts of battery voltage continuously →	Go to **Step K.**

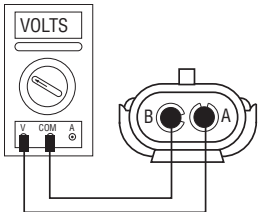
Power-Up Sequence Pretest, continued

Step J	Procedure	Condition	Action
	1. Key off. 2. Locate Shift Control. 3. Disconnect Shift Control 30-way connector. 4. Place a jumper across Shift Control 30-way connector pins J1 and H2. 5. Key on.		
	6. Measure voltage across service lamp connector.	If voltage is within 2 volts of battery voltage	**Replace Shift Control.** Go to **Step I**.
		If no voltage is measured	Repair OEM harness as required. Go to **Step I**.



Power-Up Sequence Pretest, continued

Step K	Procedure	Condition	Action
	1. Key on. 2. Locate Shift Control. 3. Disconnect Shift Control 30-way connector. 4. Measure voltage across service lamp connector pins A and B.	If no voltage is measured	**Replace Shift Control.** Go to **Step I.**
		If voltage is within 2 volts of battery voltage	Repair OEM harness as required. Go to **Step I.**



Power-Up Sequence Pretest, continued

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Air Pretest

Overview

The pretest does not relate to any specific fault code, but must be completed before performing Fault Code Isolation Table procedures. The pretest verifies that the basic air input is OK before testing individual system functions.

Detection

There is no detection process specifically for the basic air supply. However, failures of this type are generally detected by the transmission or driver as some other type of fault code or symptom.

Fallback

There is no fallback mode for air pretest, however, it may effect other systems.

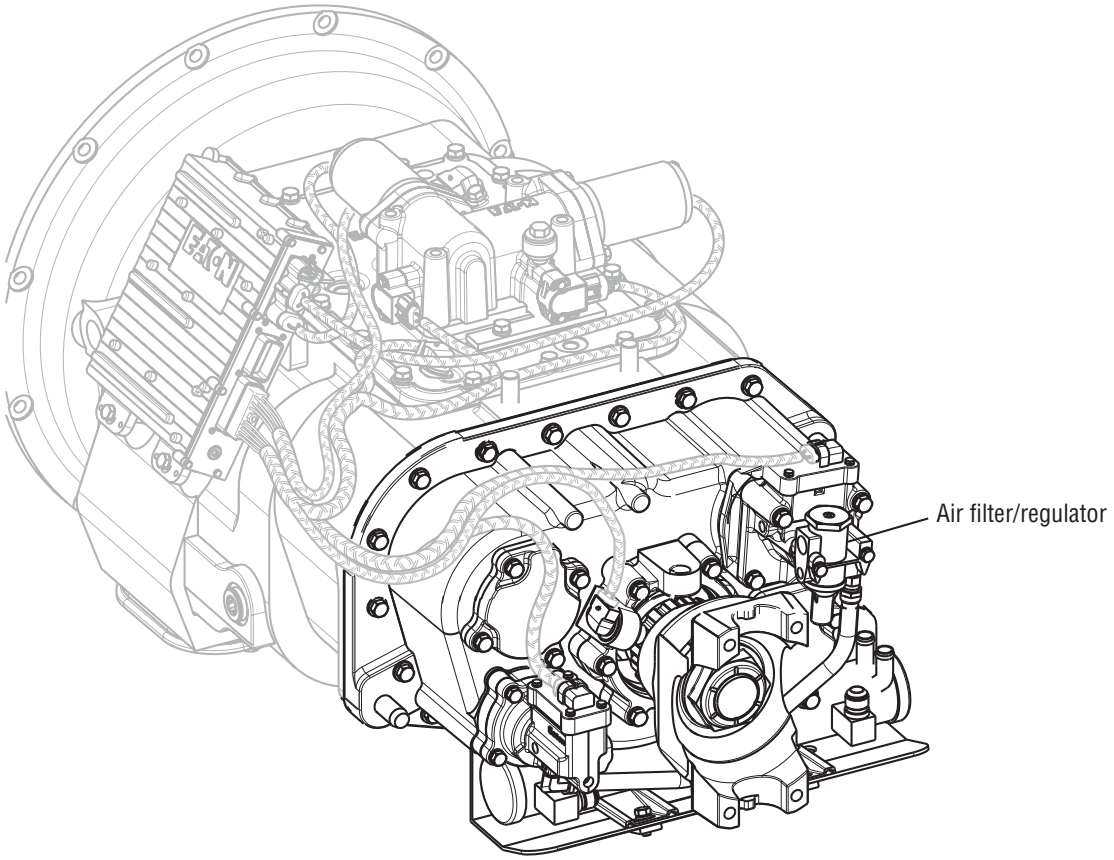
Required Tools

- Basic Hand Tools
- 0-100 PSI Air Pressure Gauge
- Troubleshooting Guide

Possible Causes

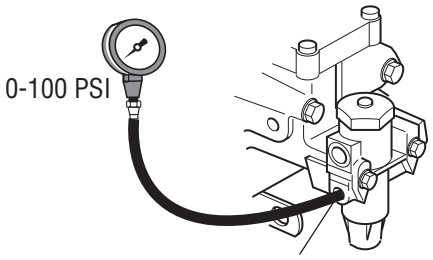
This pretest can be used for any of the following:

- Low Air Pressure
- Contaminated Air
- Air Filter / Regulator



Air Pretest

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Install a 0-100 PSI air pressure gauge in the regulated test port of the air filter / regulator.		
	3. Start engine and allow air pressure to build to governor cut-off.		
	4. Monitor the vehicle air pressure gauge on the dash.	If air pressure cuts off at 90 to 120 PSI	Go to **Step B.**
		If air pressure is outside of range	Repair vehicle air system as required. Repeat this step.



Regulated test port

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Monitor the vehicle air pressure gauge on the dash.	If vehicle maintains air pressure	Go to **Step C.**
		If vehicle loses air pressure	Repair vehicle air system as required. Repeat this step.

Air Pretest , continued

Step C	Procedure	Condition	Action
	1. Read air pressure gauge installed at the regulated port.	If air pressure is 55 to 65 PSI.	Test complete.
		If air pressure is outside of range.	Go to **Step D.**

Step D	Procedure	Condition	Action
	1. Remove air supply line to the air filter /regulator and check airflow.	If air flows from the supply line	**Repair Air Filter / Regulator.** Go to **Step C.**
		If air does not flow from the supply line	Repair vehicle air supply to the regulator. Go to **Step C.**

Air Pretest , continued

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Component Code: 11 (SID 254, FMI 12) Shift Control

Overview

This fault code indicates an internal failure of the Shift Control.

Detection

The Shift Control checks the program memory every time the key is turned on. If the Shift Control is able to detect a failure within its own memory, it sets this fault code.

Fallback

This fault causes an In Place fallback while moving and a self-check failure if it occurs during power-up.

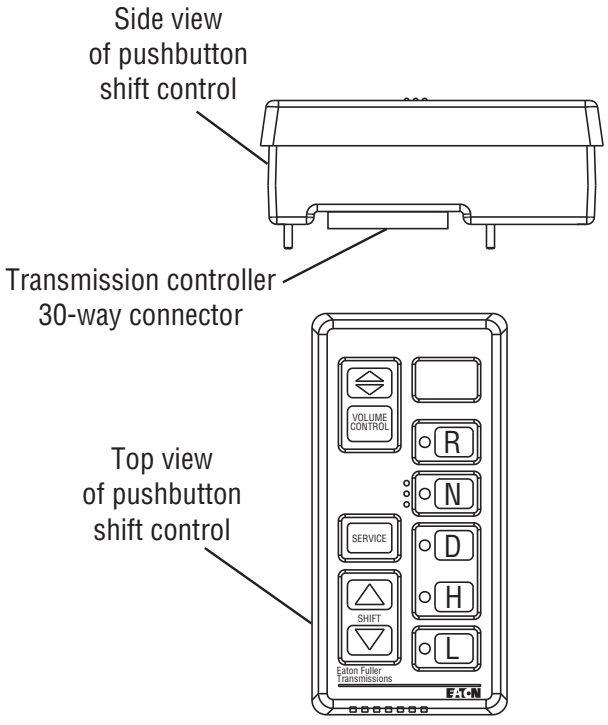
Required Tools

- Basic Hand Tools
- Troubleshooting Guide

Possible Causes

This fault code can be caused by any of the following:

- Improper Configuration Software
- Shift Control



Pushbutton Shift Control

Code 11 (SID 254, FMI 12), Shift Control Test

Step A	Procedure	Condition	Action
	1. Key on.		
	2. Retrieve Codes (see page 1-4) →	If code 11 is active →	**Replace Shift Control**.
		If code 11 is inactive →	Test complete.

Component Code: 12 (SID 233, FMI 12) Transmission Controller

Overview

This fault code indicates an internal failure of the Transmission Controller.

Detection

The Transmission Controller checks the program memory every time the key is turned on. If the transmission is able to detect a failure within its own memory, it sets this fault code.

Fallback

This fault causes an In Place fallback while moving and a failure during system initialization.

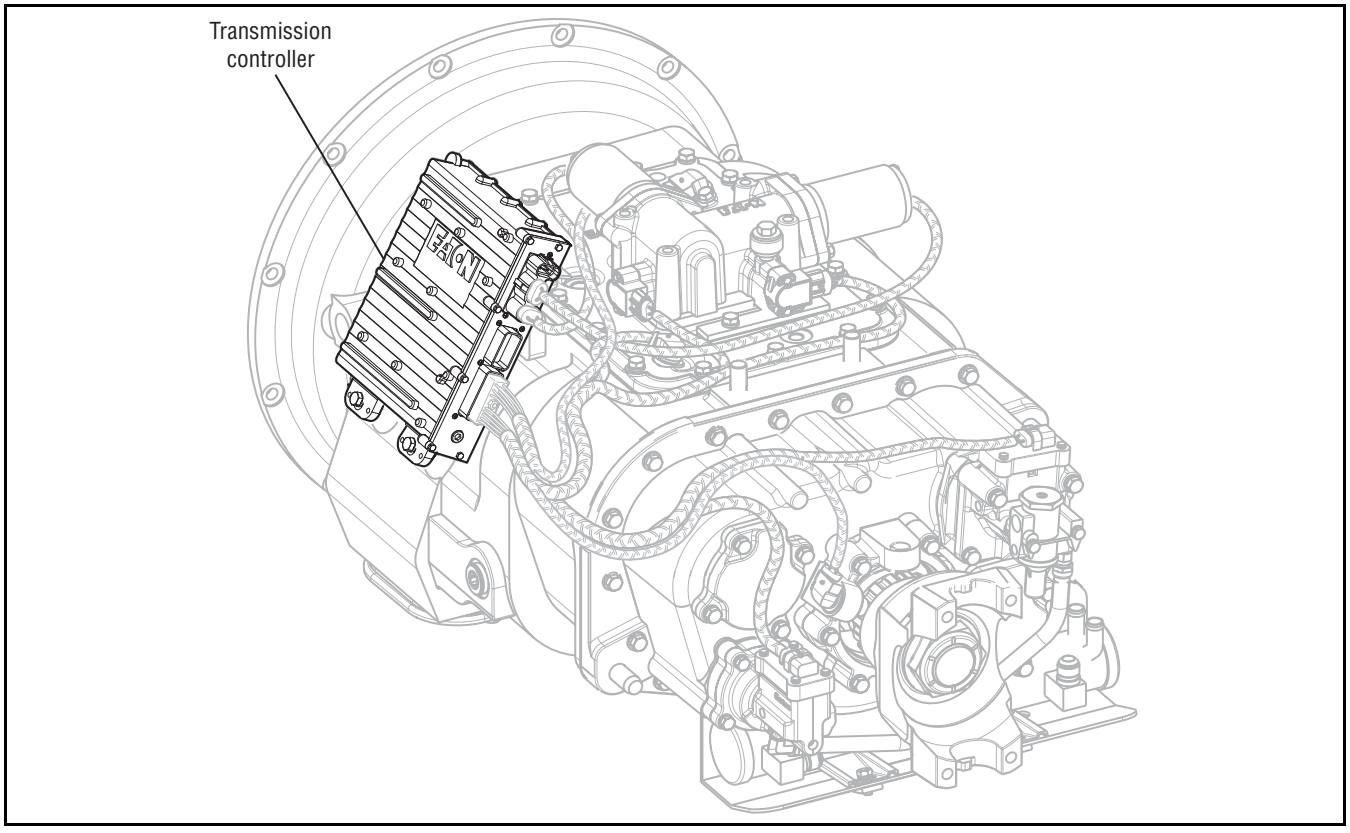
Required Tools

- Basic Hand Tools
- Troubleshooting Guide

Possible Causes

This fault code can be caused by any of the following:

- Improper Configuration Software
- Transmission Controller



Code 12 (SID 233, FMI 12), Transmission Controller Test

Step A	Procedure	Condition	Action
	1. Key on.		
	2. Retrieve codes (see page 1-4) →	If code 12 is active →	**Replace Transmission Controller.**
		If code 12 is inactive →	Test complete.

Component Code: 14 (SID 18, FMI 2,4,5) Invalid Lever Position

Overview

This fault code indicates an electrical failure of the Eaton Shift Lever or OEM Shift Lever.

Detection

Starting at key-on and throughout operation, the Shift Control constantly measures the feedback from the Shift Lever circuit. If the feedback is out of range, the fault is set. This type of failure represents a short to battery, short to ground, or open circuit.

Fallback

This fault causes a downshift only fallback.

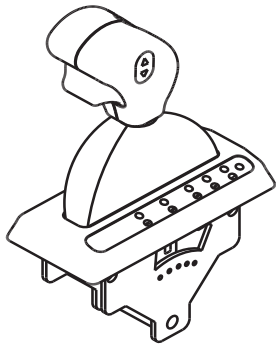
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Shift Stalk Tester
- Troubleshooting Guide
- PC-based Service Tool

Possible Causes

This fault code can be caused by any of the following:

- Eaton Shift Lever or OEM Shift Lever
- OEM Harness
- Shift Control



Shift Lever

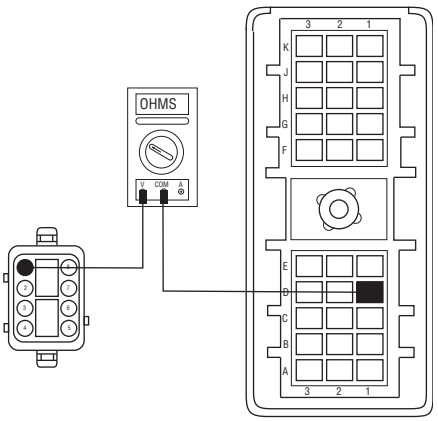
Code 14 (SID 18, FMI 2,4,5), Invalid Lever Position Test

Step A	Procedure	Condition	Action
	1. Is vehicle equipped with an Eaton supplied Shift Lever or an OEM supplied Shift Lever?	If Eaton Shift Lever →	Go to **Step B.**
		If OEM Shift Lever →	Go to **Step F.**

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect Shift Lever 8-way connector.		
	3. Connect Shift Lever tester to the 8-way Shift Lever harness.		
	4. Connect PC-based Service Tool to diagnostic port.		
	5. Key on.		
	6. Select Monitor Data.		
	7. Observe transmission range attained. →	If transmission range attained equals neutral →	**Replace Shift Lever (Only if Fault Code is Active).** Go to **Step V.**
		If transmission range attained does not equal neutral →	Go to **Step C.**

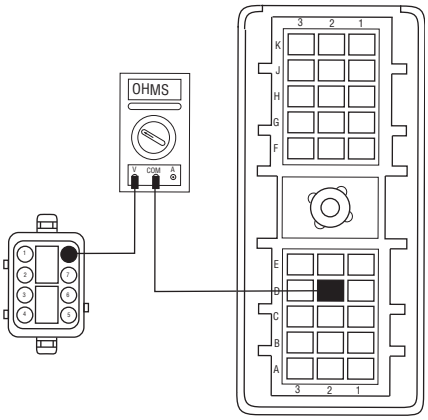
Code 14 (SID 18, FMI 2,4,5), Invalid Lever Position Test, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Locate Shift Control. 3. Disconnect Shift Control 30-way connector. 4. Measure resistance between: • Shift Control 30-way pin D1 and Shift Lever 8-way connector pin 1 • Shift Control 30-way connector pin D1 and ground	If resistance between pins D1 and 1 is 0 to .3 ohms and	
		If resistance between pin D1 and ground is 10K ohms or open circuit [OL]	Go to **Step D.**
		If any of the above conditions are not met	Repair harness between Shift Control and Shift Lever. Go to **Step V.**



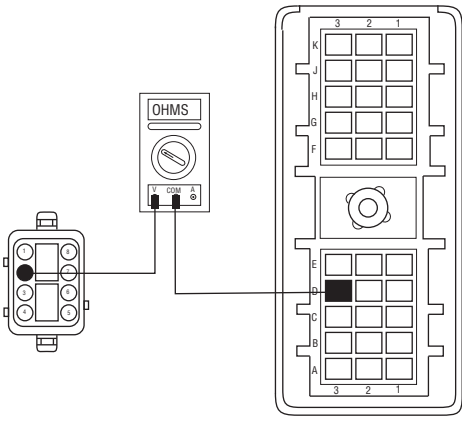
Code 14 (SID 18, FMI 2,4,5), Invalid Lever Position Test, continued

Step D	Procedure	Condition	Action
	1. Key off. 2. Disconnect Shift Control 30-way connector.		
	3. Measure resistance between: • Shift Control 30-way pin D2 and Shift Lever 8-way connector pin 8 • Shift Control 30-way connector pin D2 and ground	If resistance between pins D2 and 8 is 0 to .3 ohms and	
		If resistance between pin D2 and ground is 10K ohms or open circuit [OL]	Go to **Step E.**
		If any of the above conditions are not met	Repair harness between Shift Control and Shift Lever. Go to **Step V.**



Code 14 (SID 18, FMI 2,4,5), Invalid Lever Position Test, continued

Step E	Procedure	Condition	Action
	1. Key off. 2. Disconnect Shift Control 30-way connector.		
	3. Measure resistance between: • Shift Control 30-way pin D3 and Shift Lever 8-way connector pin 2 • Shift Control 30-way connector pin D3 and ground	→ If resistance between pins D3 and 2 is 0 to .3 ohms and	
		→ If resistance between pin D3 and ground is 10K ohms or open circuit [OL]	→ **Replace Shift Control.** Go to **Step V**
		→ If any of the above conditions are not met	→ Repair harness between Shift Control and Shift Lever. Go to **Step V**



Code 14 (SID 18, FMI 2,4,5), Invalid Lever Position Test, continued

Step F	Procedure	Condition	Action
	1. Key off. 2. Disconnect Shift Lever 3-way connector. 3. Connect Shift Lever tester to the 3-way Shift Lever harness. 4. Connect PC-based Service Tool to diagnostic port. 5. Key on. 6. Select monitor data. 7. Observe transmission range attained.	If transmission range attained equals neutral	Contact OEM to replace Shift Lever. Go to **Step V.**
		If transmission range attained does not equal neutral	Go to **Step G.**

Step G	Procedure	Condition	Action
	1. Key off. 2. Locate Shift Control. 3. Disconnect Shift Control 30-way connector. 4. Refer to OEM wiring diagram and verify that OEM wiring between Shift Lever and Shift Control is correct.	If OEM wiring checks out good	**Replace Shift Control** Go to **Step V**
		If OEM wiring does not check out good	Repair OEM harness between Shift Control and Shift Lever. Go to **Step V**

Code 14 (SID 18, FMI 2,4,5), Invalid Lever Position Test, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear codes (see page 1-4) 5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4) →	If no codes →	Test complete.
		If code 14 appears →	Return to **Step A** to find error in testing.
		If code other than 14 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Code 14 (SID 18, FMI 2,4,5), Invalid Lever Position Test, continued

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Component Code: 16 (SID 248, FMI 2) Eaton Proprietary Link (EPL)

Overview

This fault code indicates that the Shift Control and the Transmission Controller are unable to communicate.

Detection

Starting at key-on and throughout operation, the Shift Control constantly monitors the communication with the Transmission Controller. If a communication fault occurs for more than five seconds, fault code 16 is set.

Fallback

This fault causes an In Place fallback while moving and a failure during system initialization.

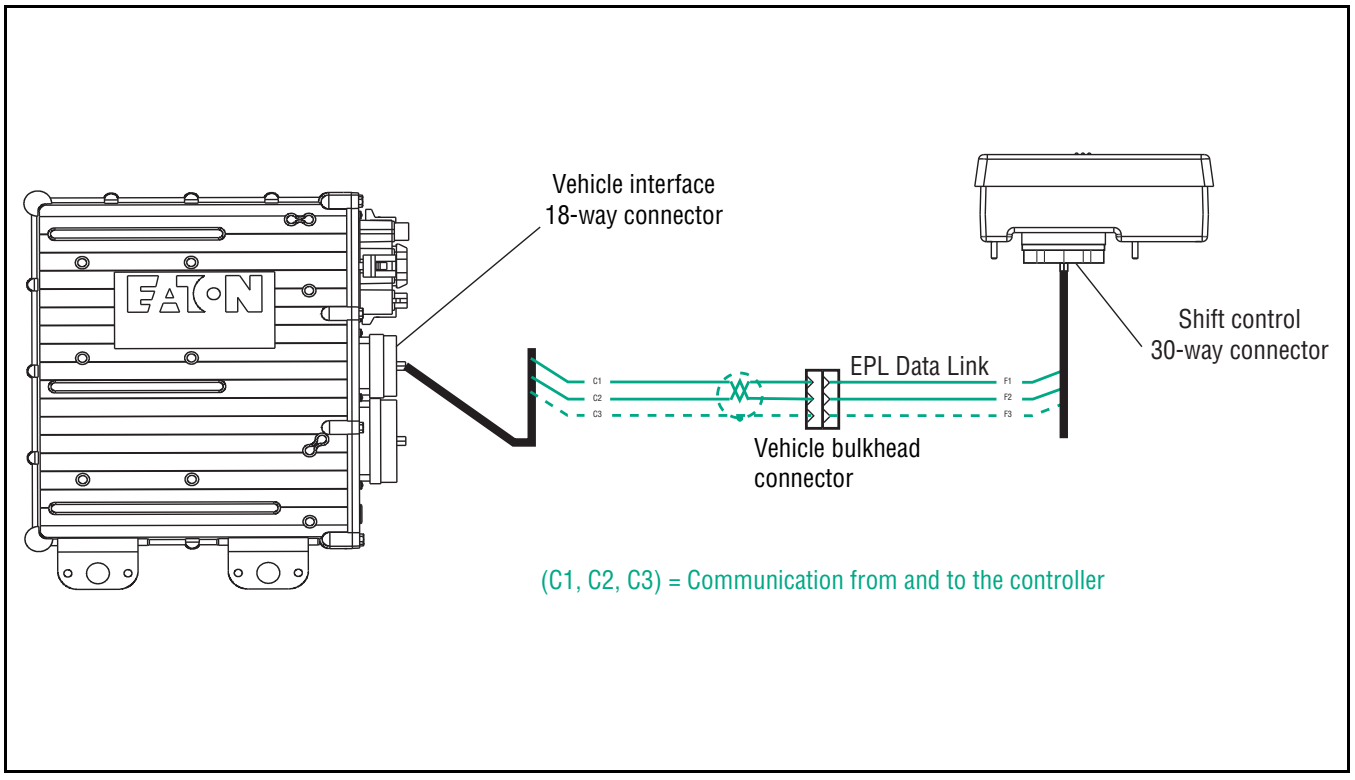
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- Data Link Tester

Possible Causes

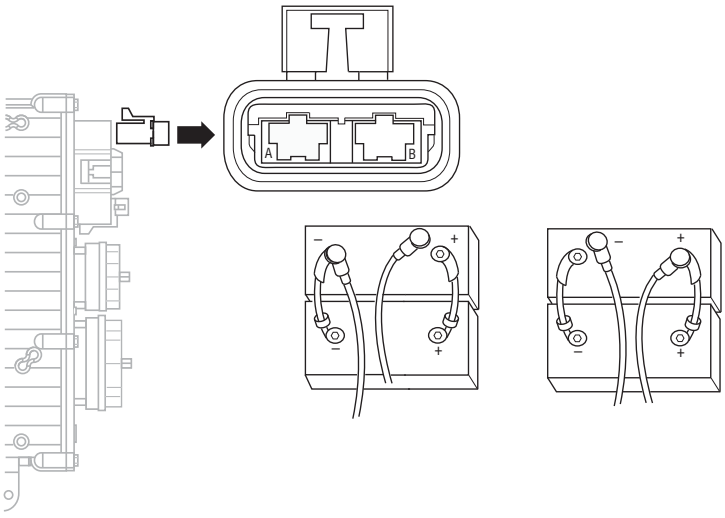
This fault code can be caused by any of the following:

- OEM Harness
- Transmission Controller
- Shift Control



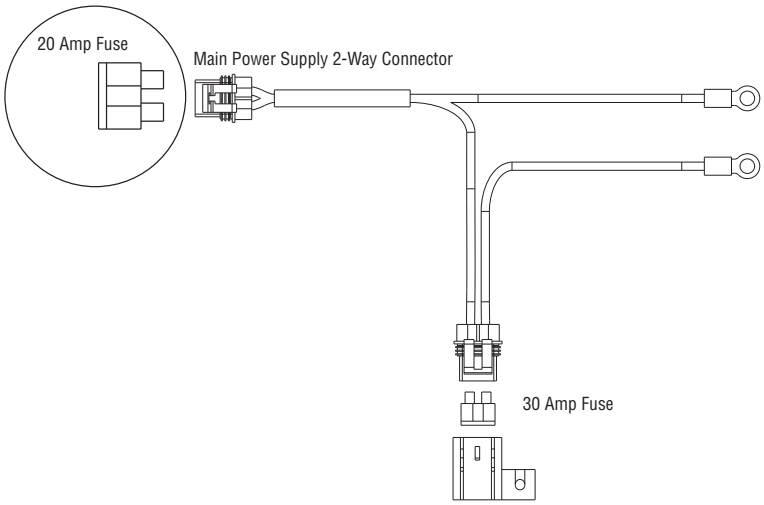
Code 16 (SID 248, FMI 2), Eaton Proprietary Link (EPL) Test

Step A	Procedure	Condition	Action
	1. Key off. 2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion. →	If no problem found →	Go to **Step B.**
		If problem is found →	Repair power/ground path for the main power supply. Go to **Step V.**



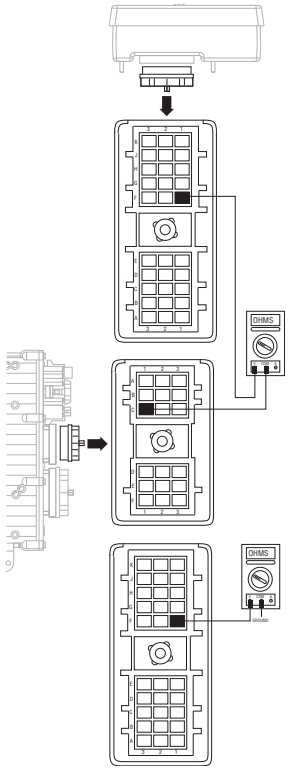
Code 16 (SID 248, FMI 2), Eaton Proprietary Link (EPL) Test, continued

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Insert 20-amp fuse into Main Power Supply 2-way connector. →	If fuse blows immediately →	Go to **Step C.**
		If fuse does not blow immediately →	Repair wiring from the battery to the Transmission ECU. Go to **Step V.**



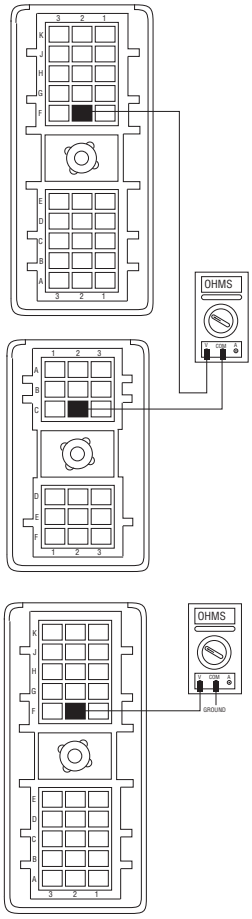
Code 16 (SID 248, FMI 2), Eaton Proprietary Link (EPL) Test, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Disconnect Shift Control 30-way connector. 3. Disconnect vehicle interface 18-way connector. 4. Measure resistance between: • Shift Control 30-way connector pin F1 and vehicle interface 18-way connector pin C1 • Shift Control 30-way connector pin F1 and ground	If resistance between pins F1 and C1 is 0 to.3 ohms and	
		If resistance between pin F1 and ground is 10K ohms or open circuit [OL]	Go to **Step D.**
		If any of the above conditions are not met	Repair harness between the Transmission Controller and Shift Control. Go to **Step V.**



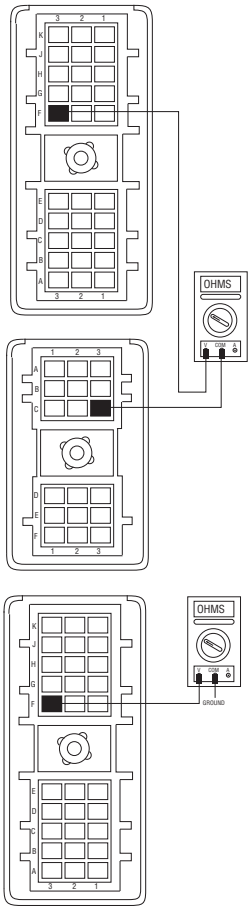
Code 16 (SID 248, FMI 2), Eaton Proprietary Link (EPL) Test, continued

Step D	Procedure	Condition	Action
	1. Key off.		
	2. Measure resistance between: • Shift Control 30-way connector pin F2 and vehicle interface 18-way connector pin C2 • Shift Control 30-way connector pin F2 and ground	If resistance between pins F2 and C2 is 0 to .3 ohms and	
		If resistance between pin F2 and ground is more than 10K ohms or open circuit [OL]	Go to **Step E.**
		If any of the above conditions are not met	Repair harness between the Transmission Controller and Shift Control. Go to **Step V.**



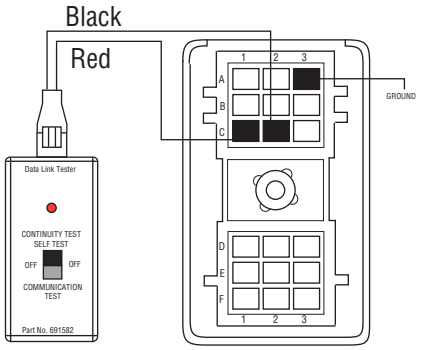
Code 16 (SID 248, FMI 2), Eaton Proprietary Link (EPL) Test, continued

Step E	Procedure	Condition	Action
	1. Key off. 2. Measure resistance between: • Shift Control 30-way connector pin F3 and vehicle interface 18-way connector pin C3 • Shift Control 30-way connector pin F3 and ground	If resistance between pins F3 and C3 is 0 to .3 ohms and	
		If resistance between pin F3 and ground is more than 10K ohms or open circuit [OL]	Go to **Step F.**
		If any of the above conditions are not met	Repair harness between the Transmission Controller and Shift Control. Go to **Step V.**



Code 16 (SID 248, FMI 2), Eaton Proprietary Link (EPL) Test, continued

Step F	Procedure	Condition	Action
	1. Key off. 2. Reconnect Shift Control 30-way connector. 3. Connect jumper wire between vehicle interface 18-way connector pin A3 and ground. 4. Connect the data link tester across vehicle interface 18-way connector pins C1 and C2. 5. Key on.		
	6. Place the data link tester in the Communication Test mode.	If LED is solid or flashing →	**Replace Transmission Controller (Only if Fault Code is Active).** Go to **Step V**.
		If LED is off →	**Replace Shift Control.** Go to **Step V.**



Code 16 (SID 248, FMI 2), Eaton Proprietary Link (EPL) Test, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear codes (see page 1-4) 5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4) →	If no codes →	Test complete.
		If code 16 appears →	Return to **Step A** to find error in testing.
		If code other than 16 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Component Code: 17 (SID 237, FMI 3,4) Start Enable Relay Coil

Overview

This fault code indicates an electrical failure of the relay that allows the engine to start after start-up conditions are met.

Detection

Starting at key-on and throughout operation, the Shift Control constantly measures the circuit. A failure mode of short to battery, short to ground, or open circuit is detected.

Fallback

The start enable relay has no fallback, however, if the failure occurred before the engine was started, it is possible the engine will not start.

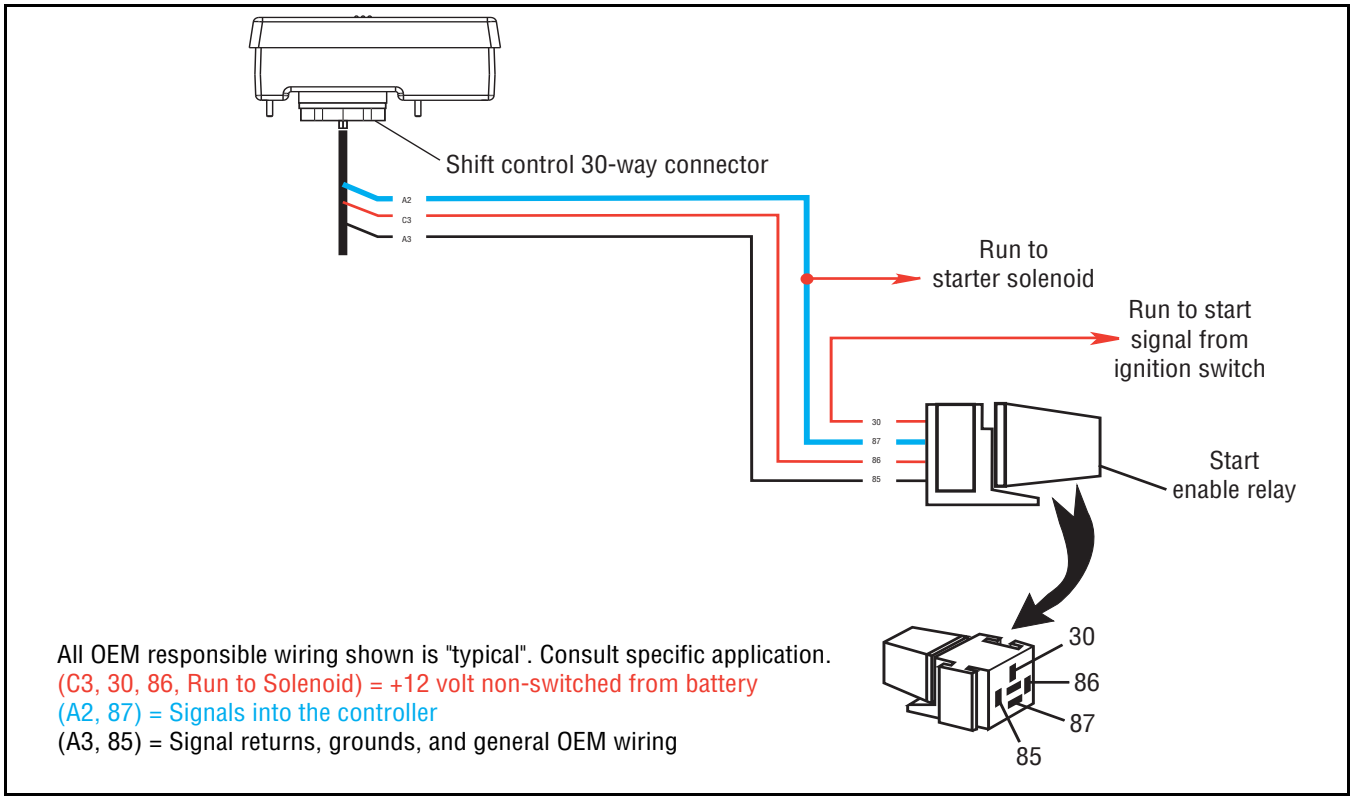
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

This fault code can be caused by any of the following:

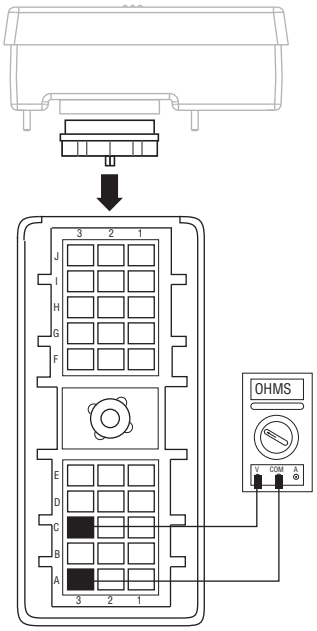
- Relay Coil Open
- OEM Harness
- Shift Control
- Driver too quick on key (not waiting for a “N”)



All OEM responsible wiring shown is "typical". Consult specific application.
(C3, 30, 86, Run to Solenoid) = +12 volt non-switched from battery
(A2, 87) = Signals into the controller
(A3, 85) = Signal returns, grounds, and general OEM wiring

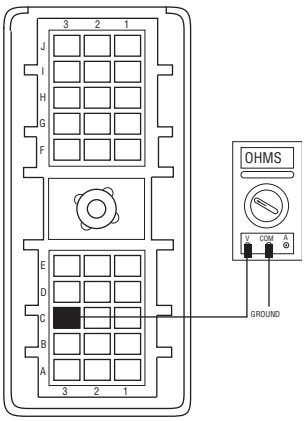
Code 17 (SID 237, FMI 3,4), Start Enable Relay Coil Test

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect Shift Control 30-way connector.		
	3. Measure resistance between Shift Control 30-way connector pins C3 and A3.	If resistance is 40 to 120 ohms	Go to **Step B.**
		If resistance is outside of range	Go to **Step E.**



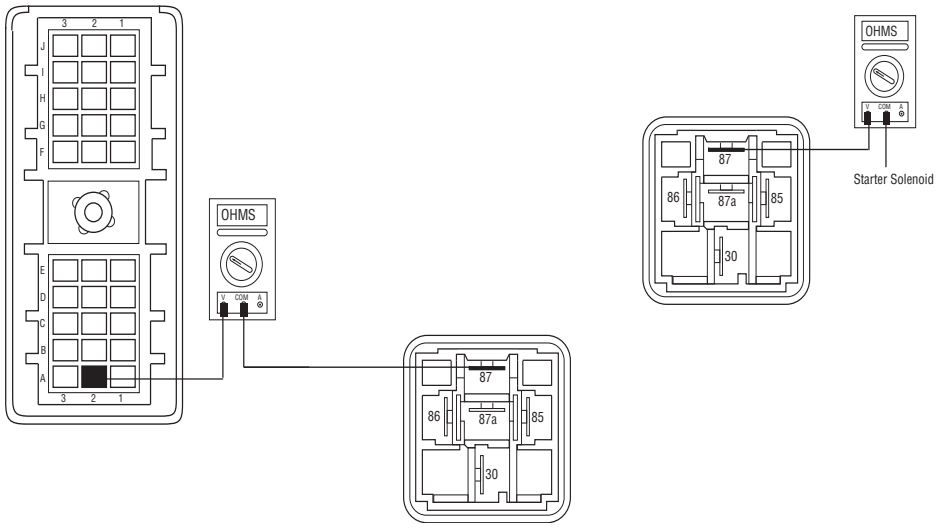
Code 17 (SID 237, FMI 3,4), Start Enable Relay Coil Test, continued

Step B	Procedure	Condition	Action
	1. Measure resistance between Shift Control 30-way connector pin C3 and ground.	If resistance is more than 10K ohms or open circuit [OL]	Go to **Step C.**
		If resistance is less than 10K ohms	Go to **Step E.**



Code 17 (SID 237, FMI 3,4), Start Enable Relay Coil Test, continued

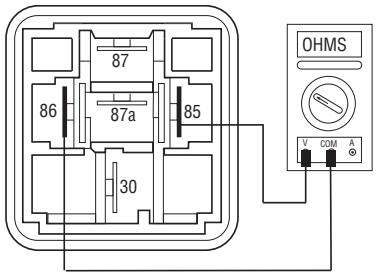
Step C	Procedure	Condition	Action
	1. Disconnect the start enable relay.		
	2. Measure resistance between pin 87 of the start enable relay connector and pin A2 of the Shift Control 30-way connector and from 87 of the start enable relay connector to the starter solenoid.	If resistance is 0-.3 ohms on both readings	Go to **Step D.**
		If resistance is greater than 10K ohms	Repair wiring. Go to Step V.



Code 17 (SID 237, FMI 3,4), Start Enable Relay Coil Test, continued

Step D	Procedure	Condition	Action
	⚠ WARNING 1. Make sure the start enable relay has been disconnected before putting the key in the start position. Place key in start position.		
	2. Measure voltage at pin 30 in the start enable relay connector. →	If voltage is within .6 volts of battery voltage →	**Replace Shift Control (Only if Fault Code is Active)** Go to **Step V.**
		If voltage is outside of range →	Repair wiring. Go to **Step V.**

Step E	Procedure	Condition	Action
	1. Remove start enable relay from OEM harness.		
	2. Measure resistance between start enable relay pins 85 and 86. →	If resistance is 40 to 120 ohms →	Repair OEM wiring from Shift Control to start enable relay. Go to **Step V.**
		If resistance is outside of range →	Replace start enable relay. Go to **Step V.**



Code 17 (SID 237, FMI 3,4), Start Enable Relay Coil Test, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear codes (see page 1-4) 5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4) →	If no codes →	Test complete.
		If code 17 appears →	Return to **Step A** to find error in testing.
		If code other than 17 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Component Code: 26 (SID 55, FMI 10) Clutch Slip

Overview

This fault code indicates the clutch is not performing as expected. The transmission controller detected excessive clutch slip.

Detection

When the transmission is in gear and the clutch is fully engaged, engine speed and input shaft speed are compared. If the engine speed is significantly different from the input shaft speed for a period of one second, the fault code is set.

Fallback

This fault causes a downshift only fallback. Once the vehicle is stopped, starting gear and reverse gear can be engaged. However, the fault will clear at power down and upshifts will be allowed until the fault is detected again.

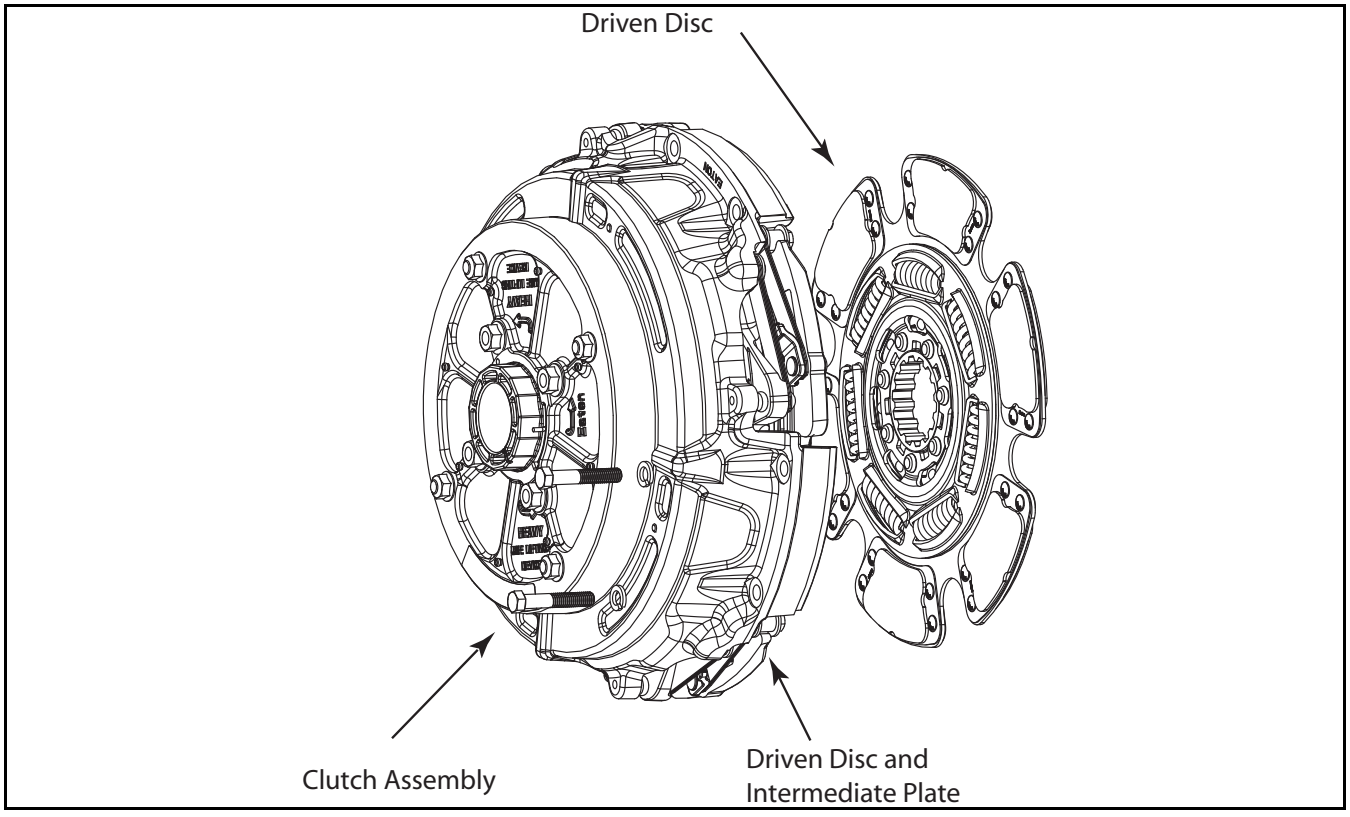
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Troubleshooting Guide
- Clutch Jack

Possible Causes

This fault code can be caused by any of the following:

- Worn or Broken Clutch



Code 26 (SID 55, FMI 10), Clutch Slip Test

Step A	Procedure	Condition	Action
	1. Key on. 2. Start engine 3. Drive vehicle under load in highest gear possible with engine speed above 1500 rpm. At a steady speed, quickly and fully press and hold the throttle. →	If code 26 is active →	**Replace Clutch**
		If code 26 is not active →	Test complete.

Component Code: 27 (SID 55, FMI 7) Clutch Disengagement

Overview

This fault code indicates the clutch has not disengaged as expected.

Detection

Starting at key-on and throughout operation, the Shift Control constantly measures engine rpm and idle torque from the engine.
When engaging a start gear, if the engine speed falls significantly below idle or engine torque rises significantly above idle torque the fault is set.
If in gear and the vehicle is brought to a stop and engine speed falls significantly below idle, the fault is set.

Fallback

There is no fallback associated with this failure, however, it may be difficult to achieve gear engagement or disengagement.

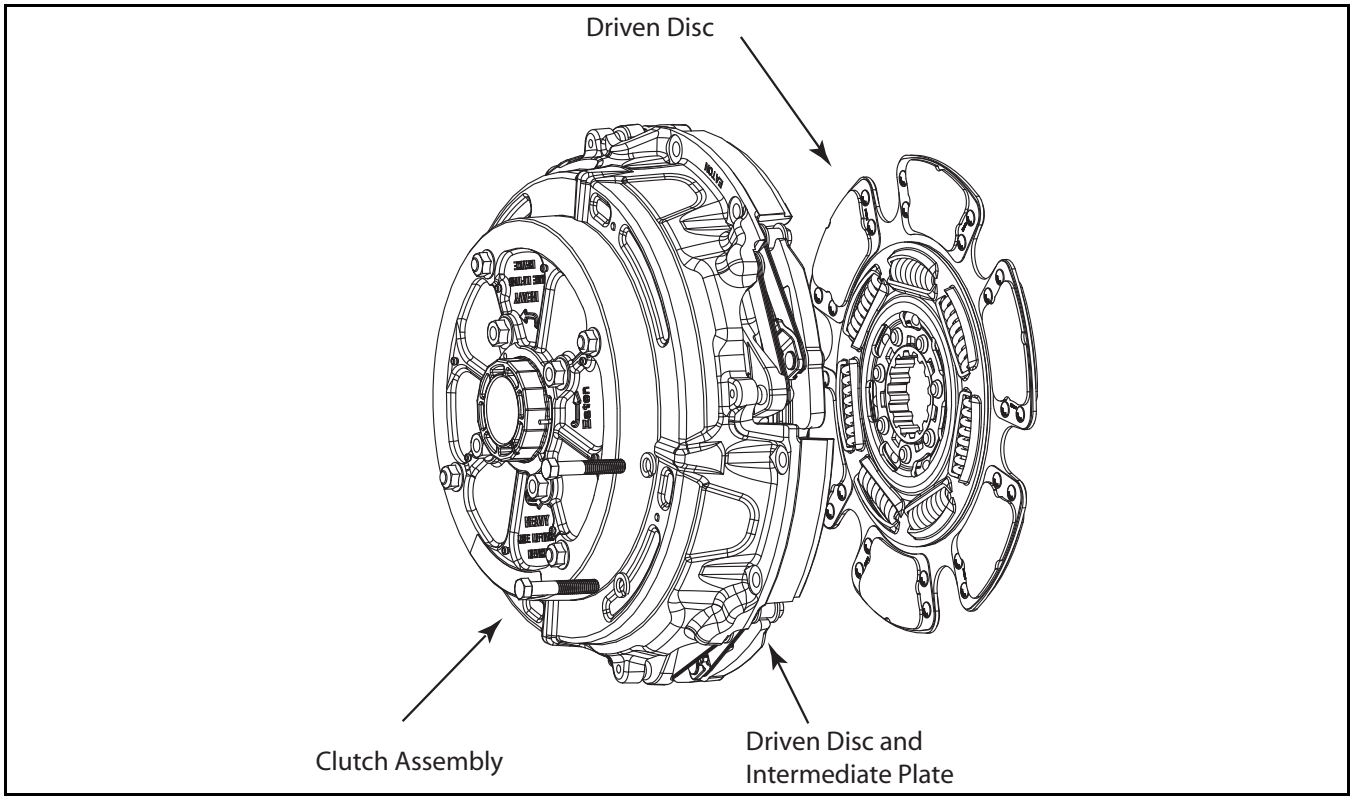
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Clutch Jack
- Troubleshooting Guide

Possible Causes

This fault code can be caused by any of the following:

- Worn or Broken Clutch



Code 27 (SID 55, FMI 7), Clutch Disengagement Test

Step A	Procedure	Condition	Action
	1. Key on.		
	2. Start engine.		
	3. Compare engine rpm to input shaft rpm with ServiceRanger. **Note:** Engine idle rpm must be 700rpm or lower. →	If the speeds match at idle and code is active →	Replace the Clutch.
		If they do not match →	Test complete.

Component Code: 28 (SID 52, FMI 3, 4, 5, 7) Clutch System Fault

Overview

This fault code indicates either an electrical or mechanical failure in the WetClutch system.

Detection

Starting at key-on and throughout operation, the Transmission Controller constantly monitors this circuit. A failure mode of short to battery, short to ground, or open circuit is detected.
When the WetClutch is locked after urge to move, engine speed and Input Shaft speeds are compared. If the engine speed is significantly higher than the Input Shaft speed for a period of five seconds, the WetClutch is slipping.

Fallback

There is no fallback mode. However, if the failure mode is open circuit, the engine will be disengaged from the input shaft.

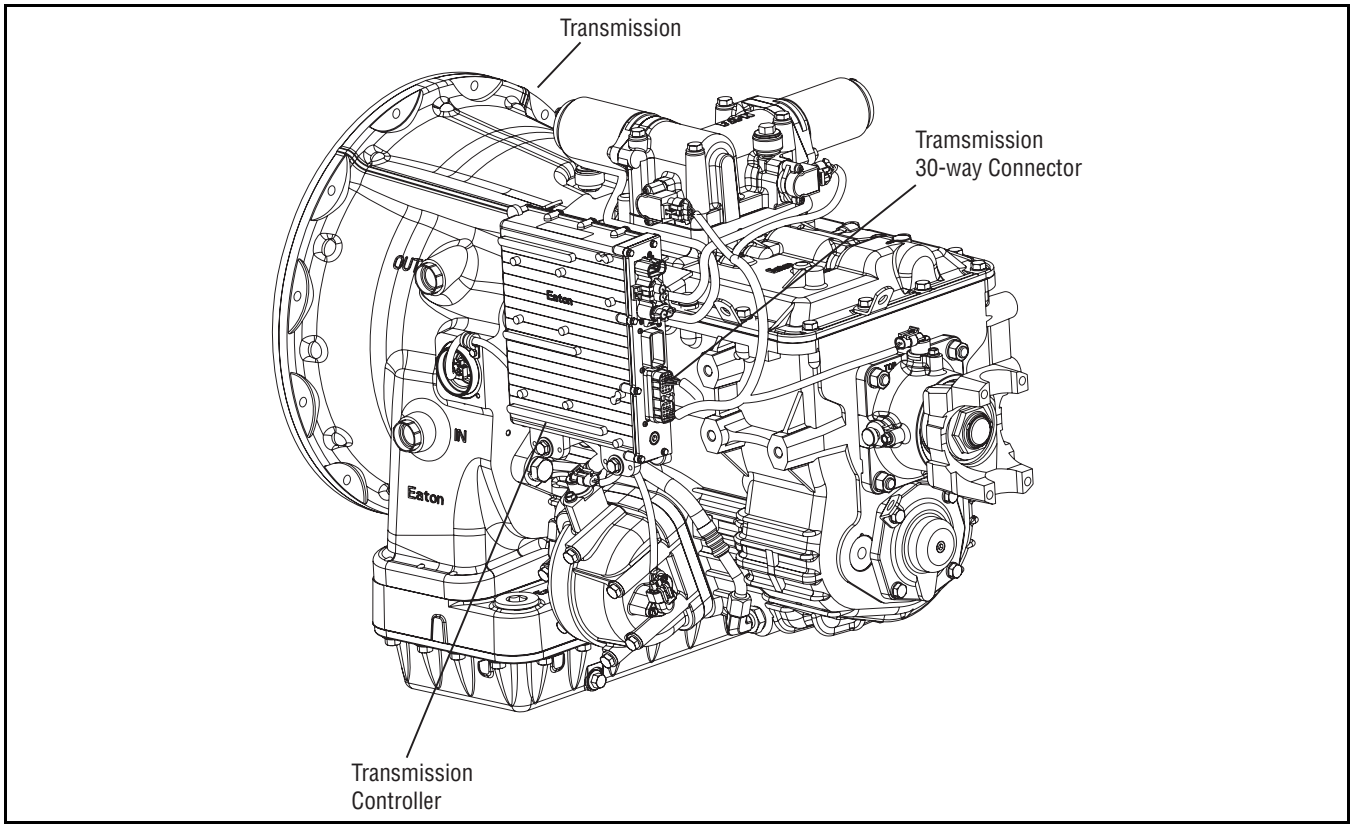
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- Eaton Test Adapter Kit

Possible Causes

This fault code can be caused by any of the following:

- Transmission Controller
- Transmission Harness
- Low Fluid Level
- WetClutch System

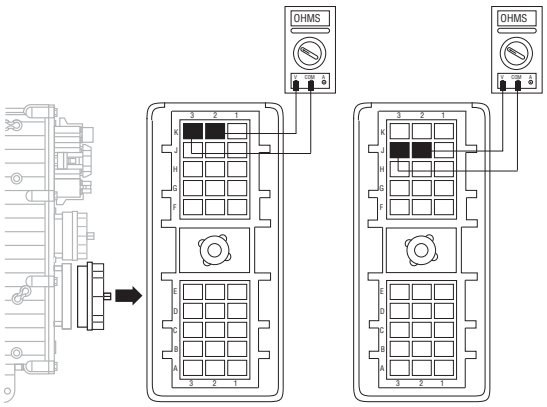


Code 28 (SID 52, FMI 3, 4, 5, 7), Clutch System Fault Test

Step A	Procedure	Condition	Action
	1. Key on. 2. Place the transmission in neutral. 3. Allow engine to idle at 700 to 800 RPM for a minimum of two minutes. **Note:** Ensure transmission fluid temperature is 60 to 120 degrees F (16 to 49 degrees C).		
	4. Check WetClutch fluid level.	If fluid level is at or above the COLD-FULL mark	Go to **Step B.**
		If fluid level is below the COLD-ADD mark	Correct fluid level. Go to **Step V.**

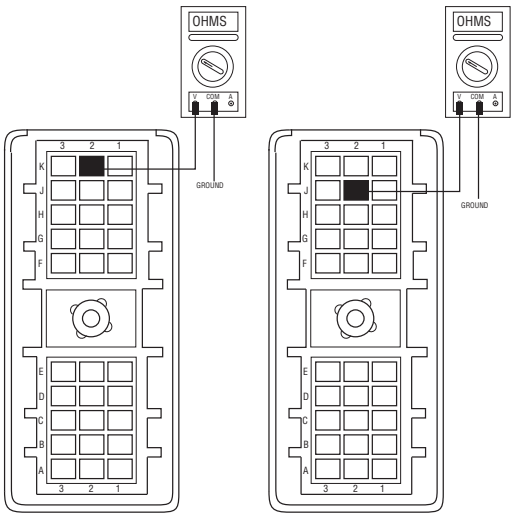
Code 28 (SID 52, FMI 3,4,5,7), Clutch System Fault Test, continued

Step B	Procedure	Condition	Action
	1. Key off. 2. Disconnect the Transmission Controller 30-way connector. 3. Measure resistance between the Transmission Harness 30-way connector pins: • K2 and K3 • J2 and J3	If the resistance between K2 and K3 is 6.5 to 9.5 ohms and the resistance between J2 and J3 is 8.5 to 12 ohms	Go to **Step C.**
		If resistance is outside of range	Go to **Step D.**



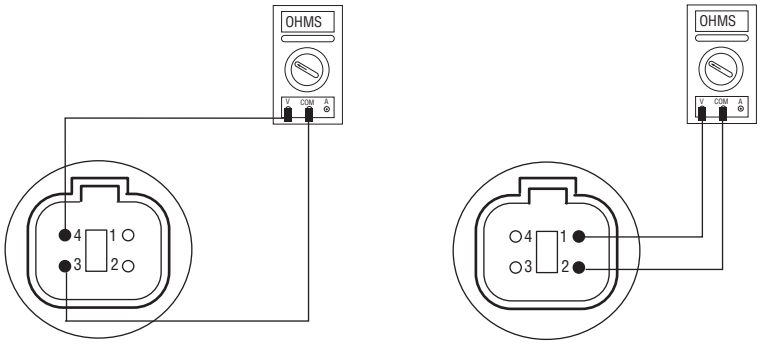
Code 28 (SID 52, FMI 3,4,5,7), Clutch System Fault Test, continued

Step C	Procedure	Condition	Action
	1. Measure resistance between the Transmission Harness 30-way connector pins: • K2 and ground • J2 and ground	If resistance from pin K2 to ground and pin J2 to ground is more than 10K ohms or open circuit [OL]	**Replace Transmission (Only if Fault Code is Active).** Go to **Step V.**
		If resistance is less than 10K ohms	Go to **Step D.**



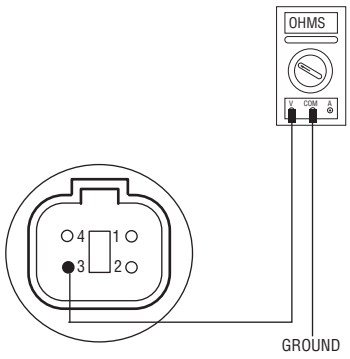
Code 28 (SID 52, FMI 3,4,5,7), Clutch System Fault Test, continued

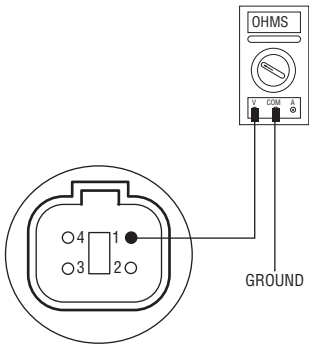
Step D	Procedure	Condition	Action
	1. Disconnect Transmission Harness located on left side of Wet-Clutch housing. 2. Measure resistance between WetClutch housing connector pins: • 3 and 4 • 1 and 2	If the resistance between pins 1 and 2 is 8.5 to 12 ohms and the resistance between 3 and 4 is 6.5 to 9.5 ohms	Go to **Step E.**
		If resistance is outside of range	**Replace Transmission.** Go to **Step V.**



Code 28 (SID 52, FMI 3,4,5,7), Clutch System Fault Test, continued

Step E	Procedure	Condition	Action
	1. Measure resistance between WetClutch housing connector pins: • 3 and ground • 1 and ground	If resistance from pin 3 to ground and pin 1 to ground is more than 10K ohms or open circuit [OL]	**Replace Transmission Harness.** Go to **Step V.**
		If resistance is less than 10K ohms	**Replace Transmission**. Go to **Step V.**





Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear codes (see page 1-4) 5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4)	If no codes	Test complete.
		If code 28 appears	Return to **Step A** to find error in testing.
		If code other than 28 appears	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Component Code: 31
(SID 218, FMI 3,4)
Momentary Engine Ignition Interrupt Relay (MEIIR)

Overview

This fault code indicates an electrical failure of the Momentary engine ignition interrupt relay circuit.

Detection

The fault is detected during power-up. The shift control checks the MEIIR circuit every time the system is powered up. If the electrical characteristics of the circuit are incorrect, the fault code is set.

Fallback

There is no fallback associated with this failure. However, if the engine speed flares uncontrollably while the transmission is in a gear, the transmission may not be able to achieve neutral if it is selected due to a torque lock condition.

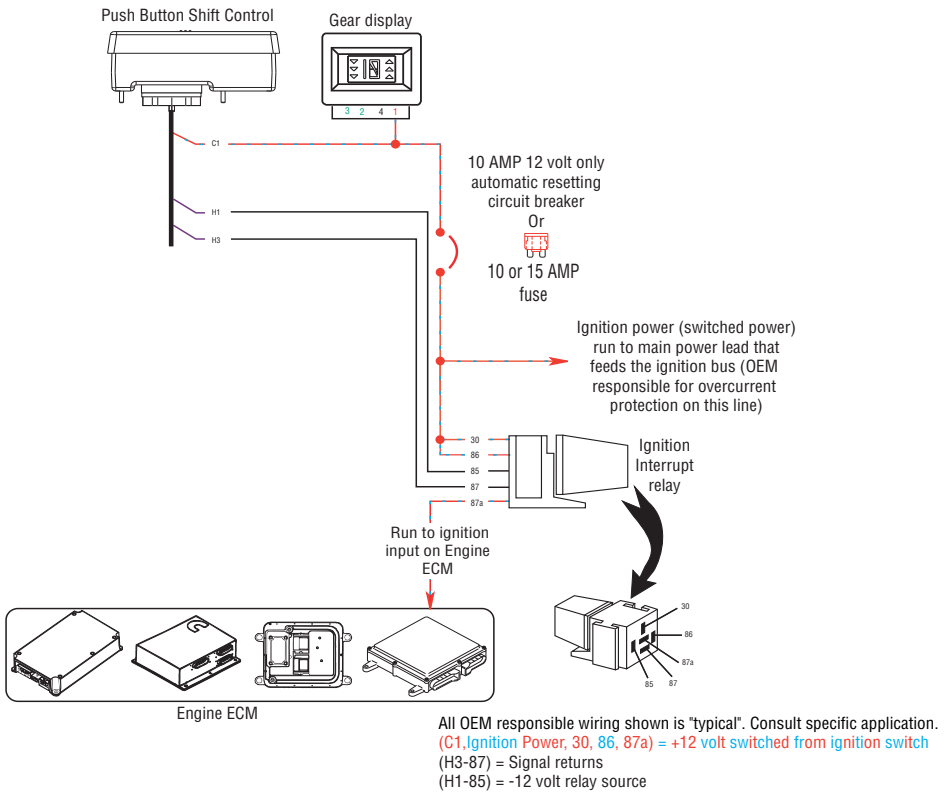
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- ServiceRanger
- Troubleshooting Guide

Possible Causes

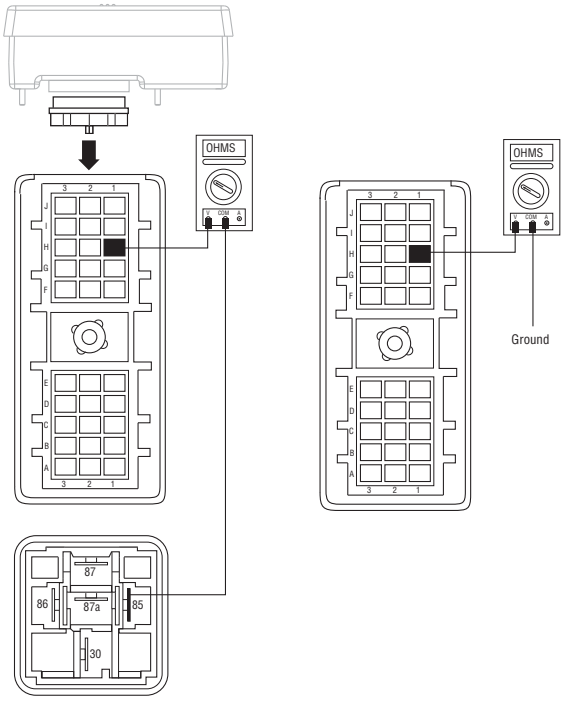
This fault code can be caused by any of the following:

- OEM wiring
- Electrical failure in the MEIIR circuit
- Mechanical failure in the MEIIR relay
- Shift Control



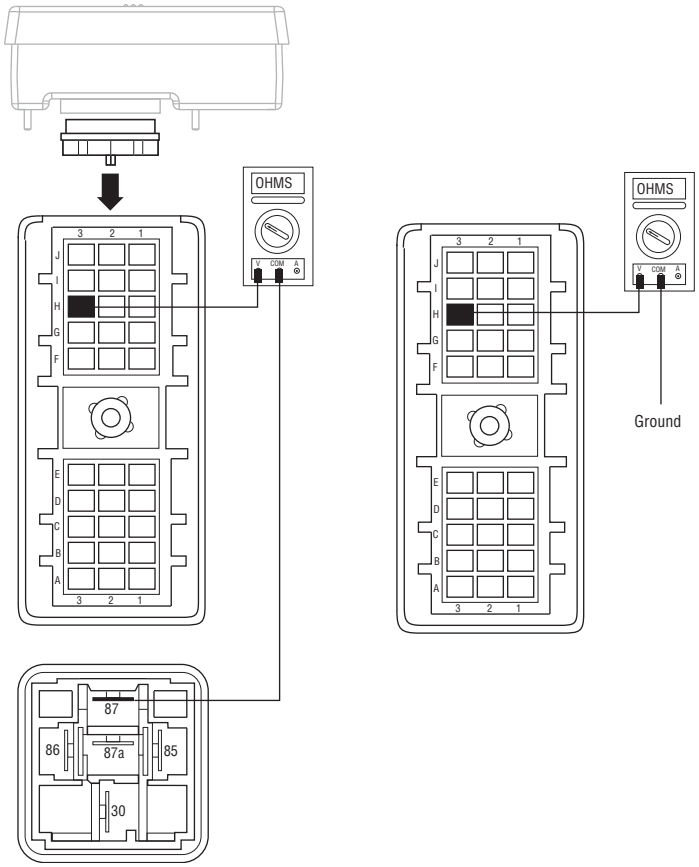
Code 31 (SID 218, FMI 3,4), Momentary Engine Ignition Interrupt Relay (MEIIR) Test

Step A	Procedure	Condition	Action
	1. Key off. 2. Disconnect Shift Control 30-way connector. 3. Remove the MEIIR relay from OEM dash harness. 4. Measure resistance between: • Shift Control 30-way connector pin H1 and relay connector pin 85. • Shift Control 30-way connector pin H1 and ground. →	If resistance between pin H1 and pin 85 is 0 to .3 ohms and if resistance between pin H1 and ground is between 10K ohms and open circuit [OL]. →	Go to **Step B.**
		If resistance is outside of range. →	Repair OEM wiring from Shift Control to MEIIR relay. Go to **Step V.**



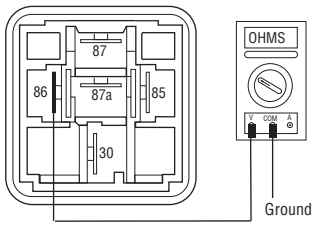
Code 31 (SID 218, FMI 3,4), Momentary Engine Ignition Interrupt Relay (MEIIR) Test, continued

Step B	Procedure	Condition	Action
	1. Key off. 2. Measure resistance between: • Shift Control 30-way connector pin H3 and relay connector pin 87. • Shift Control 30-way connector pin H3 and ground. →	If resistance between pin H3 and pin 87 is 0 to .3 ohms and if resistance between pin H3 and ground is 10K ohms or open circuit [OL] →	Go to **Step C.**
		If resistance is outside of range →	Repair OEM wiring from Shift Control to MEIIR relay. Go to **Step V.**

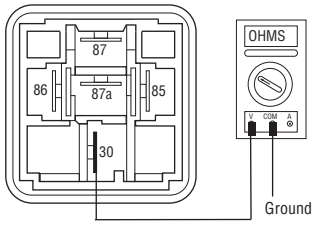


Code 31 (SID 218, FMI 3,4), Momentary Engine Ignition Interrupt Relay (MEIIR) Test, continued

Step C	Procedure	Condition	Action
	1. Reconnect Shift Control 30-way connector.		
	2. Key on.		
	3. Measure voltage between MEIIR relay connector pin 86 and ground	If voltage is within .6 of battery voltage	Go to **Step D.**
		If voltage is outside of range	Repair OEM wiring. Go to **Step V.**



Step D	Procedure	Condition	Action
	1. Key on.		
	2. Measure voltage between MEIIR relay connector pin 30 and ground.	If voltage is within .6 of battery voltage	Replace MEIIR relay (Only if Fault Code is Active). Go to **Step E.**
		If resistance is outside of range	Repair OEM wiring. Go to **Step V.**



Code 31 (SID 218, FMI 3,4), Momentary Engine Ignition Interrupt Relay (MEIIR) Test, continued

Step E	Procedure	Condition	Action
	1. Key on.		
	2. Retrieve codes →	If code 31 is inactive →	Go to **Step V.**
		If code 31 is active →	Replace **Shift control (Only if Fault Code is Active).** Go to **Step V.**

Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Key on.		
	4. Clear codes (see page 1-4)		
	5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4) →	If no codes →	Test complete.
		If code 31 appears →	Return to **Step A** to find error in testing.
		If code other than 31 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Code 31 (SID 218, FMI 3,4), Momentary Engine Ignition Interrupt Relay (MEIIR) Test, continued

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Component Code: 32 (SID 62, FMI 4) Switched System Voltage

Overview

This fault code indicates that the switched system voltage from the Shift Control on pins J2 and K2 is below 7 volts.

Detection

The fault is detected immediately after power-up.

Fallback

This fault causes an In Place fallback.

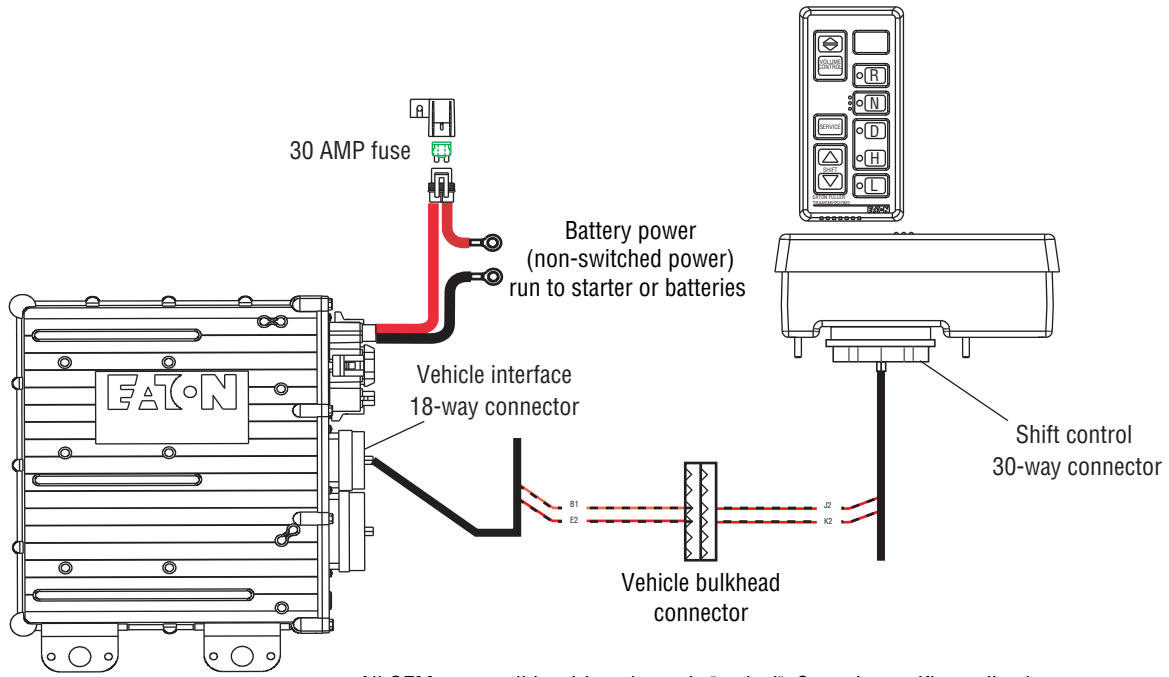
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

This fault code can be caused by any of the following:

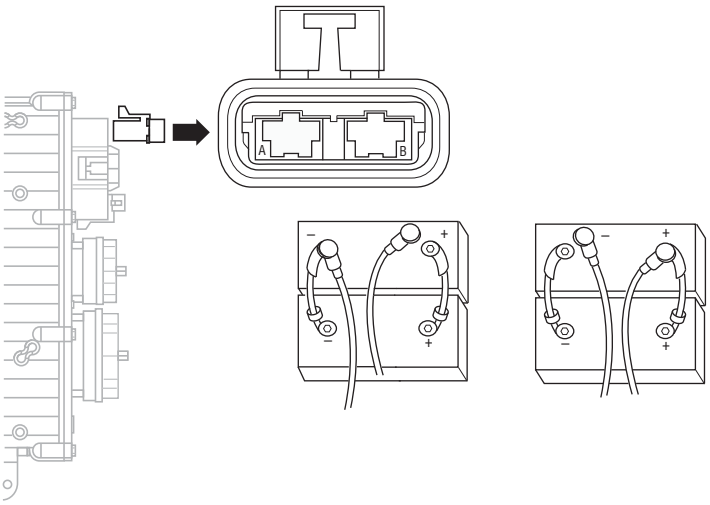
- Low Batteries
- OEM Harness
- Shift Control



All OEM responsible wiring shown is "typical". Consult specific application.
(B1, E2) = +12 volt switched from shift control to transmission controller.

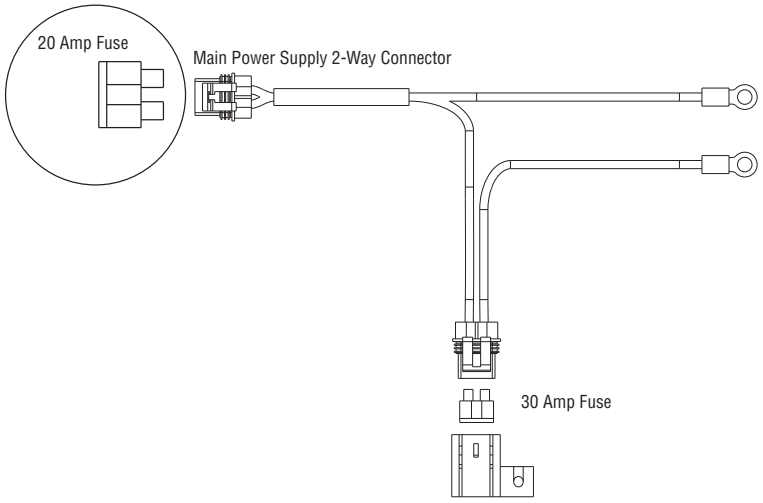
Code 32 (SID 62, FMI 4), Switched System Voltage Test

Step A	Procedure	Condition	Action
	1. Key off. 2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.	→	
		If no problem found →	Go to **Step B.**
		If problem is found →	Repair power/ground path for the main power supply. Go to **Step V.**



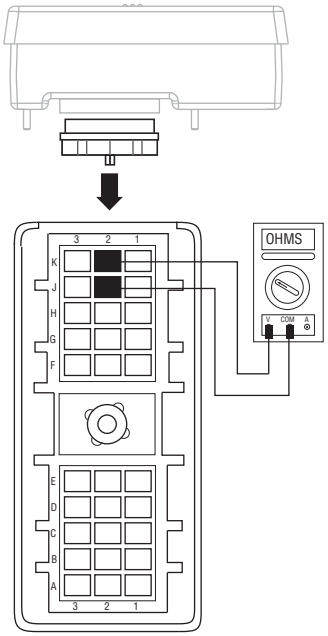
Code 32 (SID 62, FMI 4), Switched System Voltage Test, continued

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Insert 20-amp fuse into Main Power Supply 2-way connector (at trans controller optional).	If fuse blows immediately	Go to **Step C.**
		If fuse does not blow immediately	Repair wiring from the battery to the Transmission ECU. Go to **Step V.**



Code 32 (SID 62, FMI 4), Switched System Voltage Test, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Disconnect negative (-) battery cable. 3. Disconnect the main power 2-way connector on the Transmission Controller. 4. Disconnect Shift Control 30-way connector.		
	5. Measure resistance between Shift Control 30-way pins J2 and K2 →	If resistance is 0 to .3 ohms →	**Replace Shift Control (Only if Fault Code is Active).** Go to **Step V.**
		If resistance is outside of range →	Repair OEM wiring from the Transmission Controller to Shift Control. Go to **Step V.**



Code 32 (SID 62, FMI 4), Switched System Voltage Test, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear codes (see page 1-4) 5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4) →	If no codes →	Test complete.
		If code 32 appears →	Return to **Step A** to find error in testing.
		If code other than 32 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Code 32 (SID 62, FMI 4), Switched System Voltage Test, continued

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Component Code: 33 (PID 168, FMI 4) Battery Voltage Supply

Overview

This fault code indicates that the battery power supply to the Shift Control pins J1 and K1 is below 7 volts.

Detection

The fault is detected immediately after power-up. This fault causes the service lamp to flash, but cannot be retrieved via key clicks (because turning the ignition key off at this point results in an immediate shutdown).

Fallback

If this fault occures while moving, it causes a 1-speed fall-back. Once the vehicle is stopped, the starting gear and reverse can be engaged

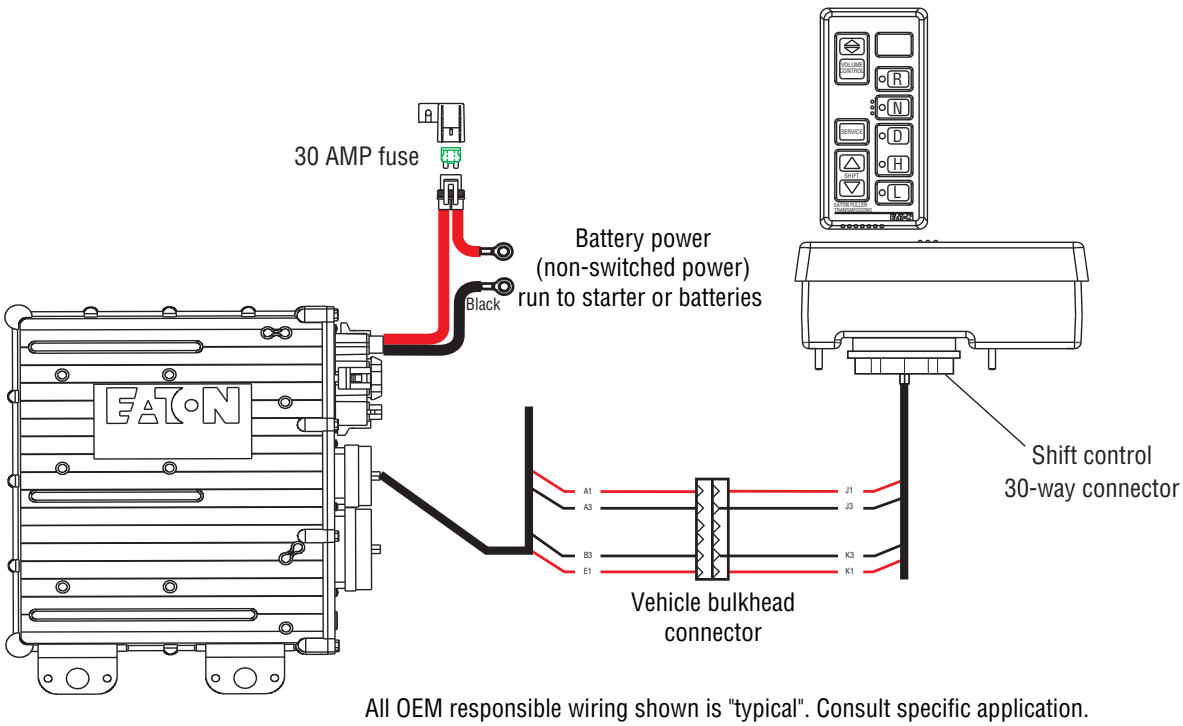
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

This fault code can be caused by any of the following:

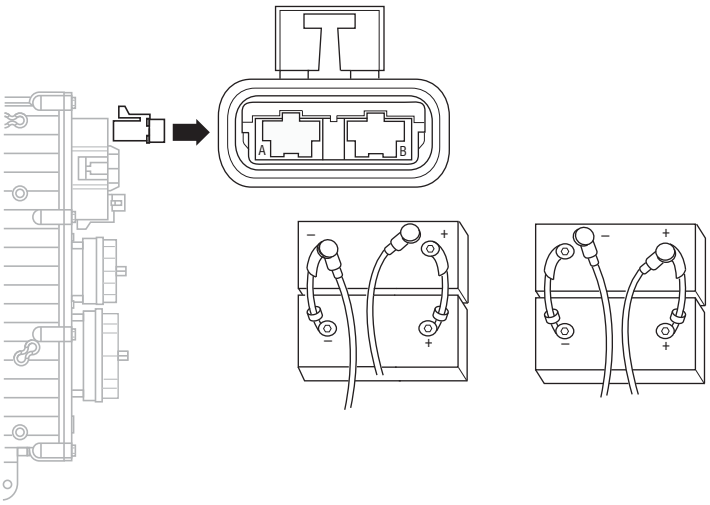
- Battery Bus Fuse / Circuit Breaker is Open
- Low Batteries
- Damaged OEM Harness
- Malfunctioning Shift Control



All OEM responsible wiring shown is "typical". Consult specific application.
(A1, E1) = +12 volt non-switched from battery
(A3, B3) = Signal returns, grounds, and general OEM wiring

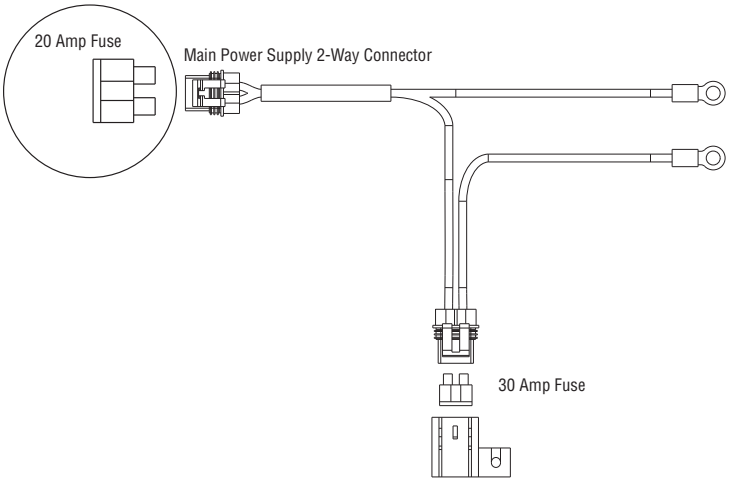
Code 33 (PID 168, FMI 4), Battery Voltage Supply Test

Step A	Procedure	Condition	Action
	1. Key off. 2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.		
		If no problem found →	Go to **Step B.**
		If problem is found →	Repair power/ground path for the main power supply. Go to **Step V.**



Code 33 (PID 168, FMI 4), Battery Voltage Supply Test, continued

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Insert 20-amp fuse into Motor Supply 2-way connector. →	If fuse blows immediately →	Go to **Step V.**
		If fuse does not blow immediately →	Repair wiring from the battery to the Transmission ECU. Go to **Step V.**



Step V	Procedure	Condition	Action
	1. Key on.		
	2. Retrieve codes (see page 1-4) →	If code 33 is active →	**Perform Electrical System Test** (see page 3-1)
		If code 33 is inactive →	Test complete.

Code 33 (PID 168, FMI 4), Battery Voltage Supply Test, continued

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System Code: 35 (SID 231, FMI 2) J1939 Data Link

Overview

This fault code indicates the AutoShift failed to communicate with the engine over the J1939 data link.

Detection

75 seconds after key-on and throughout the operation, the Shift Control constantly monitors the communication with the engine ECM. If a communication fault occurs for more than five seconds, fault code 35 is set.

Fallback

If the fault occurs while moving, it causes a 1-speed fallback. Once vehicle has stopped, the starting gear and reverse can be engaged. If the failure occurs at system initialization, it causes an AutoSelect fallback mode.

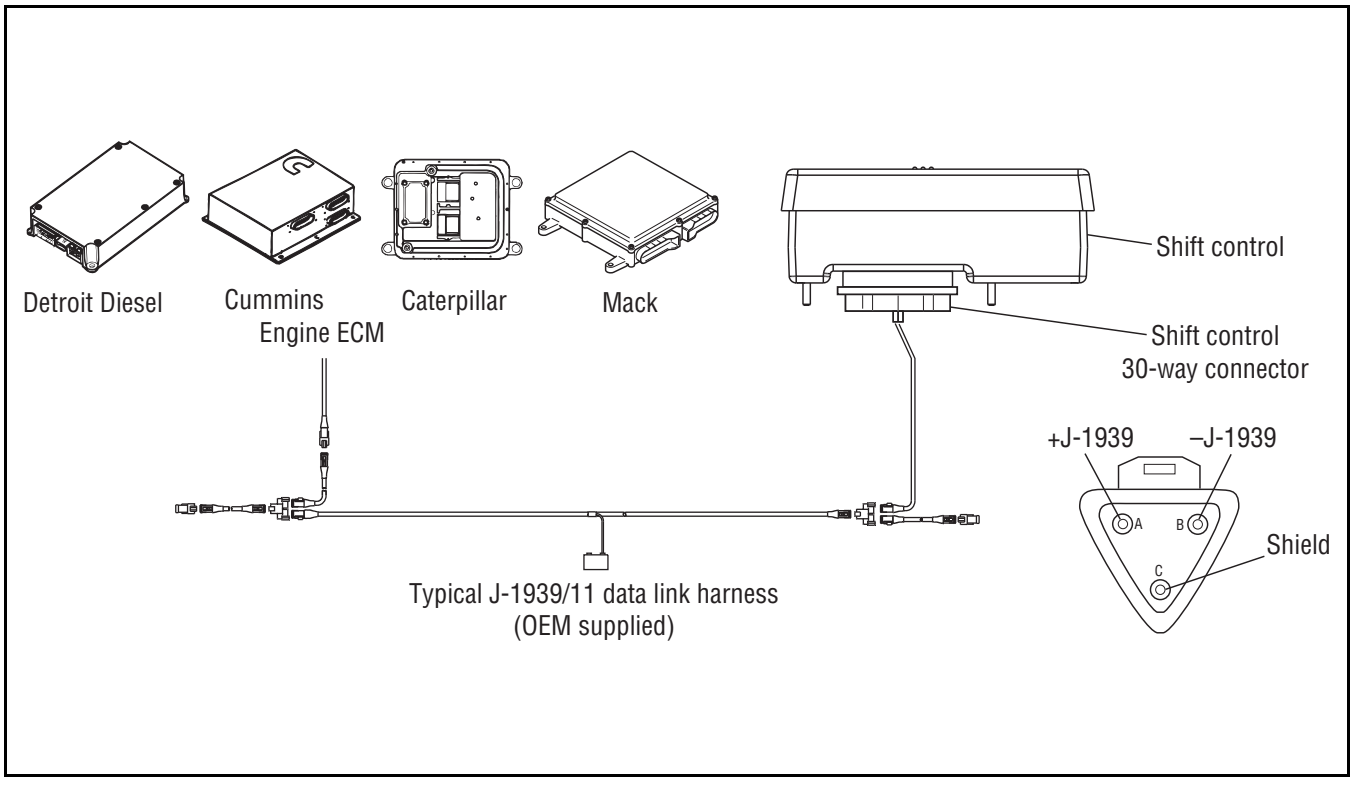
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- Data Link Tester

Possible Causes

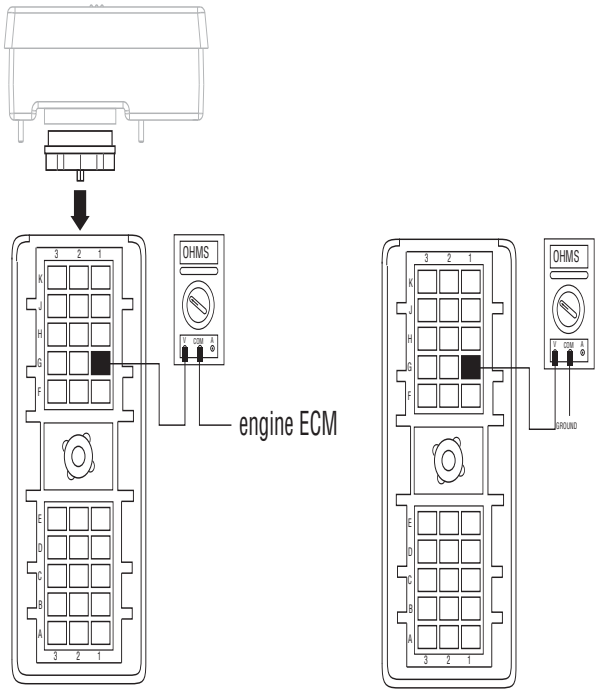
This fault can be caused by any of the following:

- J1939 Data Link
- Engine ECM
- Vehicle Interface Harness or Connections
- Engine Harness or Connections
- Excessive Radio Interference
- Shift Control



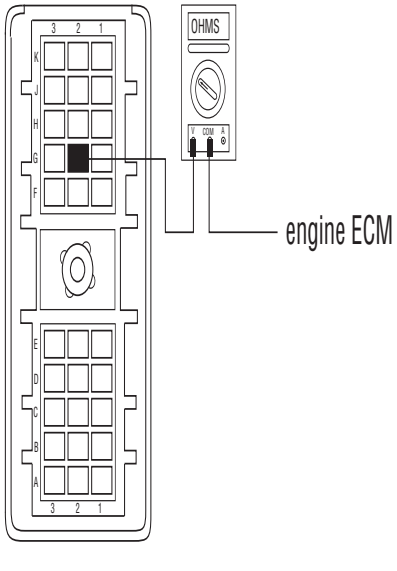
Code 35 (SID 231, FMI 2), J1939 Data Link Test

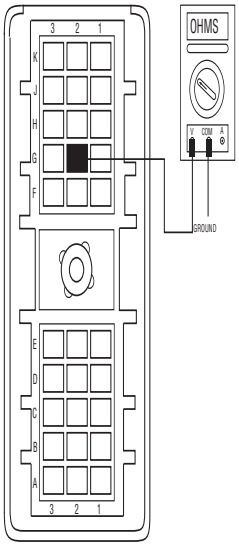
Step A	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect Shift Control 30-way connector.		
	3. Disconnect engine ECM connector which contains the J1939 Data Link.		
	4. Measure resistance between:	If resistance between pin G1 and engine ECM pin # (see OEM wiring for (+) J1939) is 0 to .3 ohms and	
	• Shift Control 30-way connector pin G1 and engine ECM pin # (see OEM wiring for (+) J1939) • Shift Control 30-way pin G1 and ground	If resistance between pin G1 and ground is more than 10K ohms or open circuit [OL]	Go to **Step B.**
		If resistance is outside of range	Repair J1939 Data Link Harness between engine ECM and Shift Control. Go to **Step V.**



Code 35 (SID 231, FMI 2), J-1939 Data Link Test, continued

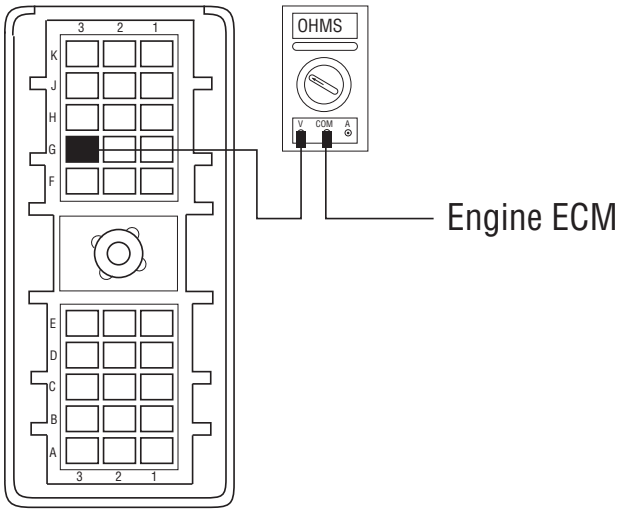
Step B	Procedure	Condition	Action
	1. Key off. 2. Measure resistance between: • Shift Control 30-way connector pin G2 and engine ECM pin # (see OEM wiring for (-) J1939) • Shift Control 30-way pin G2 and ground	If resistance between pin G2 and engine ECM pin # (see OEM wiring for (-) J1939) is 0 to .3 ohms and	
		If resistance between pin G2 and ground is more than 10K ohms or open circuit [OL]	If equipped with J1939 Lite, go to **Step D.** If not equipped with J1939 Lite, go to **Step C.**
		If resistance is outside of range	Repair J1939 Data Link Harness between engine ECM and Shift Control. Go to **Step V.**





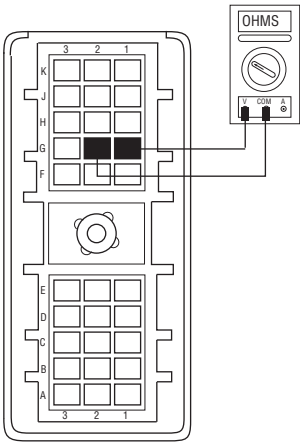
Code 35 (SID 231, FMI 2), J-1939 Data Link Test, continued

Step C	Procedure	Condition	Action
	1. Key off.		
	2. Measure resistance between Shift Control 30-way connector pin G3 and engine ECM pin # (see OEM wiring for J1939 shield)	If resistance between pin G3 and engine ECM pin # (see OEM wiring for J1939 shield) is 0 to .3 ohms	Go to **Step D**. (if working on a Mack engine, go to **Step E.**)
		If resistance is outside of range	Repair J1939 Data Link Harness between engine ECM and Shift Control. Go to **Step V.**



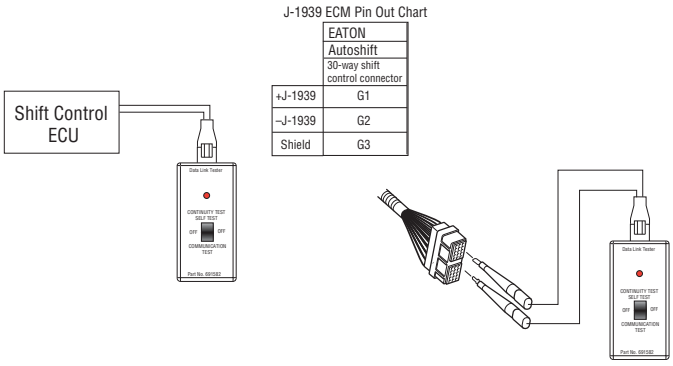
Code 35 (SID 231, FMI 2), J-1939 Data Link Test, continued

Step D	Procedure	Condition	Action
	1. Key off.		
	2. Measure resistance between Shift Control 30-way connector pin G1 and G2.	If resistance between pin G1 and G2 is between 50 to 70 ohms	Go to **Step E.**
	Note: Make sure the volt/ohm meter is on the proper scale (around 200 ohm scale)	If resistance is more than 70 ohms	One or more of the terminating resistors on the J1939 data link harness is either missing or out of range. Repair J1939 Data Link Harness. Go to **Step V.**
		If resistance is less than 50 ohms	Repair the J1939 Data Link between the engine ECM and the Shift Control. Go to **Step V.**



Code 35 (SID 231, FMI 2), J-1939 Data Link Test, continued

Step E	Procedure	Condition	Action
	1. Key off. **Note:** Data link test is designed to test a signal from an individual ECU. The ECU must be isolated from the rest of the Data link. 2. Reconnect engine ECM connector and Shift Control 30-way connector. 3. Disconnect the 3-way stub connector, which connects the transmission into the J1939 Data Link. 4. Connect the Data Link Tester to the 3-way stub connector, which connects the transmission into the J1939 Data Link. • Red lead from Data Link Tester connects to the + J1939. • Black lead from Data Link Tester connects to the - J1939. 5. Place the Data Link Tester in communication test mode.	**Note:** If vehicle does not use 3-way stub connectors, then do not reconnect the engine ECM connector and connect the Data Link Tester across the +/- J1939 terminals (see chart).	
	6. Key on. →	If LED is solid or flashing →	Problem exists with the engine ECM. Repair according to manufacturer's recommendations. Go to **Step V.**
		If LED if off →	**Replace Shift Control.** Go to **Step V.**



Code 35 (SID 231, FMI 2), J-1939 Data Link Test, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Key on. 3. Clear codes (see page 1-4) 4. Use Driving Techniques to attempt to reset the code (see page 1-6) 5. Check for codes (see page 1-4)	If no codes	Test complete.
		If code 35 appears	Return to **Step A** to find error in testing.
		If code other than 35 appears	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Code 35 (SID 231, FMI 2), J-1939 Data Link Test, continued

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System Code: 41
(SID 56, FMI 7)
Range Failed to Engage

Overview

This fault code indicates the transmission is unable to complete a shift across the range. The range is either stuck in HI or LO, or cannot complete engagement into HI or LO.

Detection

The transmission attempts the same range shift five consecutive times and determines the shift cannot be completed based on the speeds across the back box.

Fallback

This fault causes a 5-speed fallback and the transmission stays in either LO range or HI range. When the vehicle comes to a stop, an attempt to shift into LO range is made.

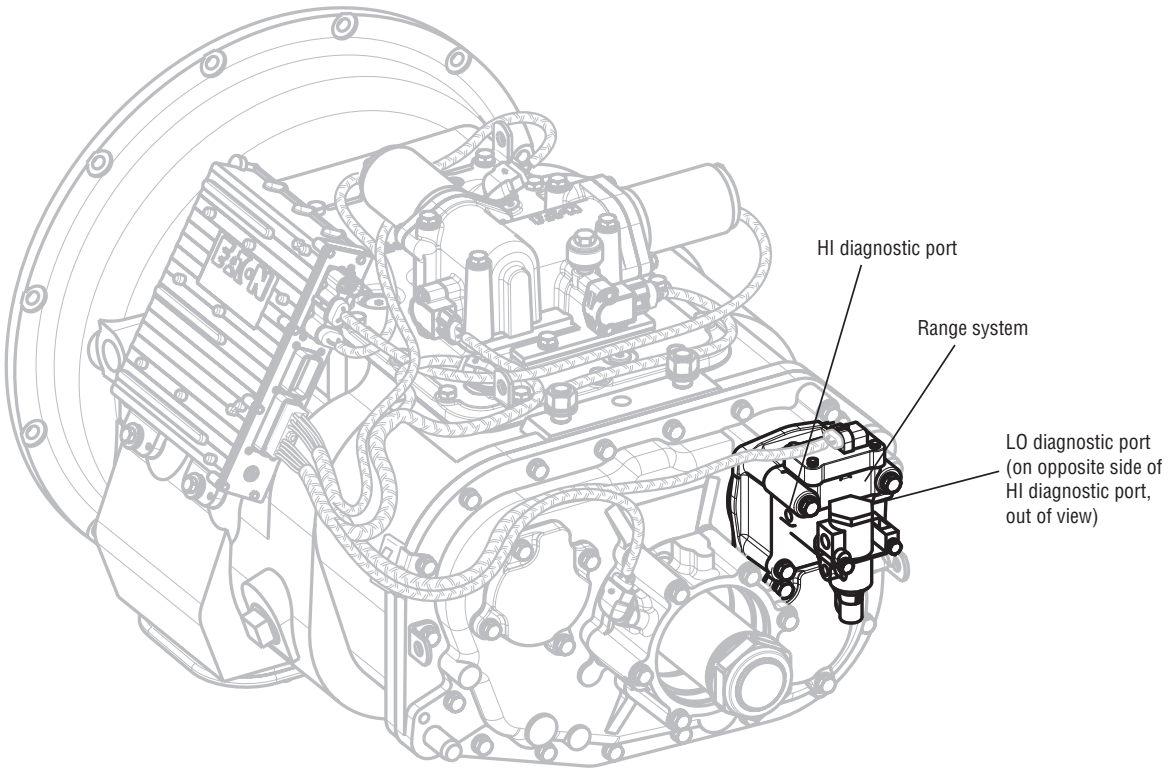
Required Tools

- Basic Hand Tools
- (2) 0-100 PSI Air Pressure Gauges
- Troubleshooting Guide

Possible Causes

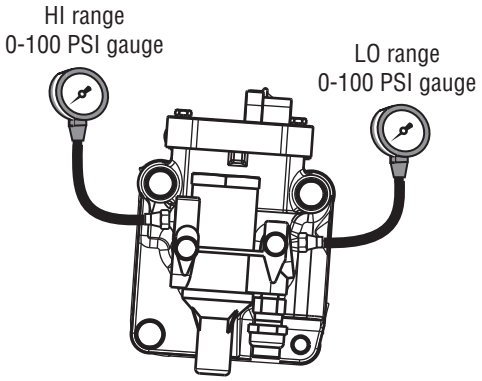
This fault code can be caused by any of the following:

- Low Air Pressure
- Contaminated Air Supply
- Air Leak
- Range Valve
- Range Synchronizer
- Range Actuator / Cylinder / Piston / Yoke



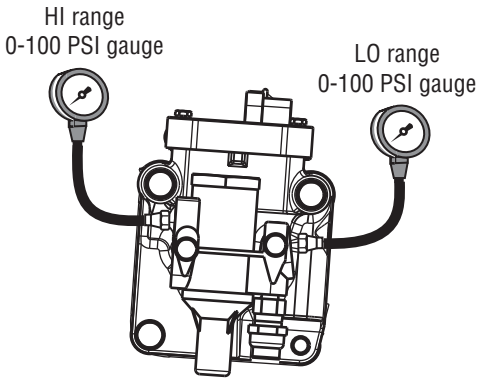
Code 41 (SID 56, FMI 7), Range Failed to Engage Test

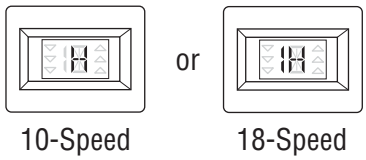
Step A	Procedure	Condition	Action
	1. Key off.		
	2. Install both 0-100 PSI air pressure gauges into the range cover diagnostic ports.		
	3. Start vehicle and allow air pressure to build to governor cut-off.		
	4. Release clutch to register Input Shaft speed in the transmission.		
	5. Turn off engine, but leave key in "ON" position.		
	6. With Shift Control, select reverse, then select neutral. →	If LO range gauge = 55 to 65 PSI and	
		If Hi range gauge = 0 PSI →	Go to **Step B.**
		Note: Five minutes is allowed for checking the air pressure after shifting the transmission to neutral.	
		If both air pressure gauges do not read as listed above →	**Replace Range Valve and Range Cylinder Cover as required.** Go to **Step V.**



Code 41 (SID 56, FMI 7), Range Failed to Engage Test, continued

Step B	Procedure	Condition	Action
	1. Key on.		
	2. With Shift Control, select reverse, press the upshift button, then select neutral.	If HI range gauge = 55 to 65 PSI and	
	Note: If the Gear Display does not read "H" (10-speed) or "IH" (18-speed), go to the Up/Down Button Test.	If LO range gauge = 0 PSI	Repair mechanical range system as required. Go to **Step V.**
		If both air pressure gauges do not read as listed above	**Replace Range Valve and Range Cylinder Cover as required.** Go to **Step V.**





Code 41 (SID 56, FMI 7), Range Failed to Engage Test, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Remove all gauges. 3. Key on. 4. Clear codes (see page 1-4) 5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4) →	If no codes →	Test complete.
		If code 41 appears →	Return to **Step A** to find error in testing.
		If code other than 41 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

System Code: 42
(SID 61, FMI 7)
Splitter Failed to Engage

Overview

This fault code indicates the transmission is unable to complete a shift across the Splitter. The Splitter is either stuck in HI or LO, or cannot complete engagement into HI or LO.

Detection

The transmission attempts the same splitter shift five consecutive times and determines the shift cannot be completed based on the speeds across the back box.

Fallback

This fault causes a 9-speed fallback and the transmission stays in either LO split or HI split.

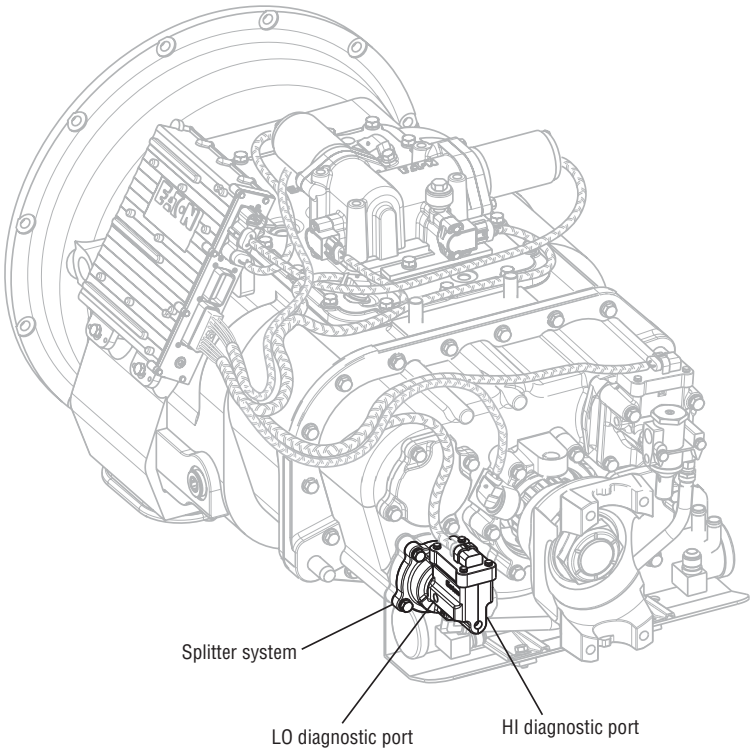
Required Tools

- Basic Hand Tools
- (2) 0-100 PSI Air Pressure Gauges
- Troubleshooting Guide

Possible Causes

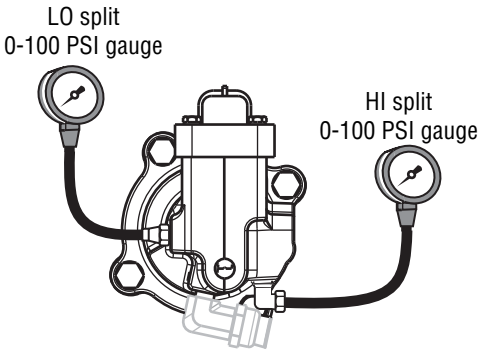
This fault code can be caused by any of the following:

- Low Air Pressure
- Contaminated Air Supply
- Air Leak
- Splitter Valve
- Splitter Actuator / Cylinder / Piston / Yoke



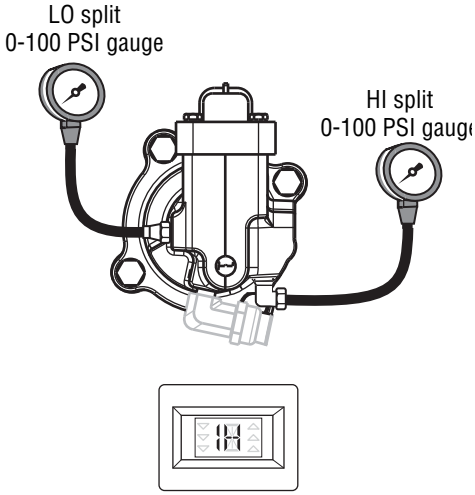
Code 42 (SID 61, FMI 7), Splitter Failed to Engage Test

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Install both 0-100 PSI air pressure gauges into the Splitter cover diagnostic ports.		
	3. Start vehicle and allow air pressure to build to governor cut-off.		
	4. Turn off engine, but leave key in "ON" position.		
	5. With Shift Control, select reverse, then select neutral.	If HI Splitter gauge = 55 to 65 PSI and	
		If LO Splitter gauge = 0 PSI	Go to **Step B.**
		Note: Five minutes is allowed for checking the pressure after moving the Shift Lever to neutral.	
		If both air pressure gauges do not read as listed above	**Replace Splitter Valve and Splitter Cylinder Cover as required.** Go to **Step V.**



Code 42 (SID 61, FMI 7), Splitter Failed to Engage Test, continued

Step B	Procedure	Condition	Action
	1. Key on.		
	2. With Shift Control, select reverse, press the upshift button, then select neutral.	If LO Splitter gauge =55 to 65 PSI and	
	Note: If the Gear Display does not read "IH" (18-speed), go to the Up/Down Button Test.	If HI Splitter gauge = 0 PSI	Repair Mechanical Splitter system as required. Go to **Step V.**
		If both air pressure gauges do not read as listed above	**Replace Splitter Valve and Splitter Cylinder Cover as required.** Go to **Step V.**



Code 42 (SID 61, FMI 7), Splitter Failed to Engage Test, continued

Step V	Procedure	Condition	Action
	1. Key off.		
	2. Remove all pressure gauges.		
	3. Key on.		
	4. Clear codes (see page 1-4)		
	5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4) →	If no codes →	Test complete.
		If code 42 appears →	Return to **Step A** to find error in testing.
		If code other than 42 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Component Code: 43 (SID 35, 36, FMI 3, 4, 5) Range Valve

Overview

This fault code indicates an electrical failure of the solenoids that control the range.

Detection

Starting at key-on and throughout operation, the Transmission Controller constantly measures this circuit. A failure mode of short to battery, short to ground, or open circuit is detected.

Fallback

This fault causes a 5-speed fallback and the transmission stays in either LO range or HI range. When the vehicle comes to a stop, an attempt to shift into LO range is made.

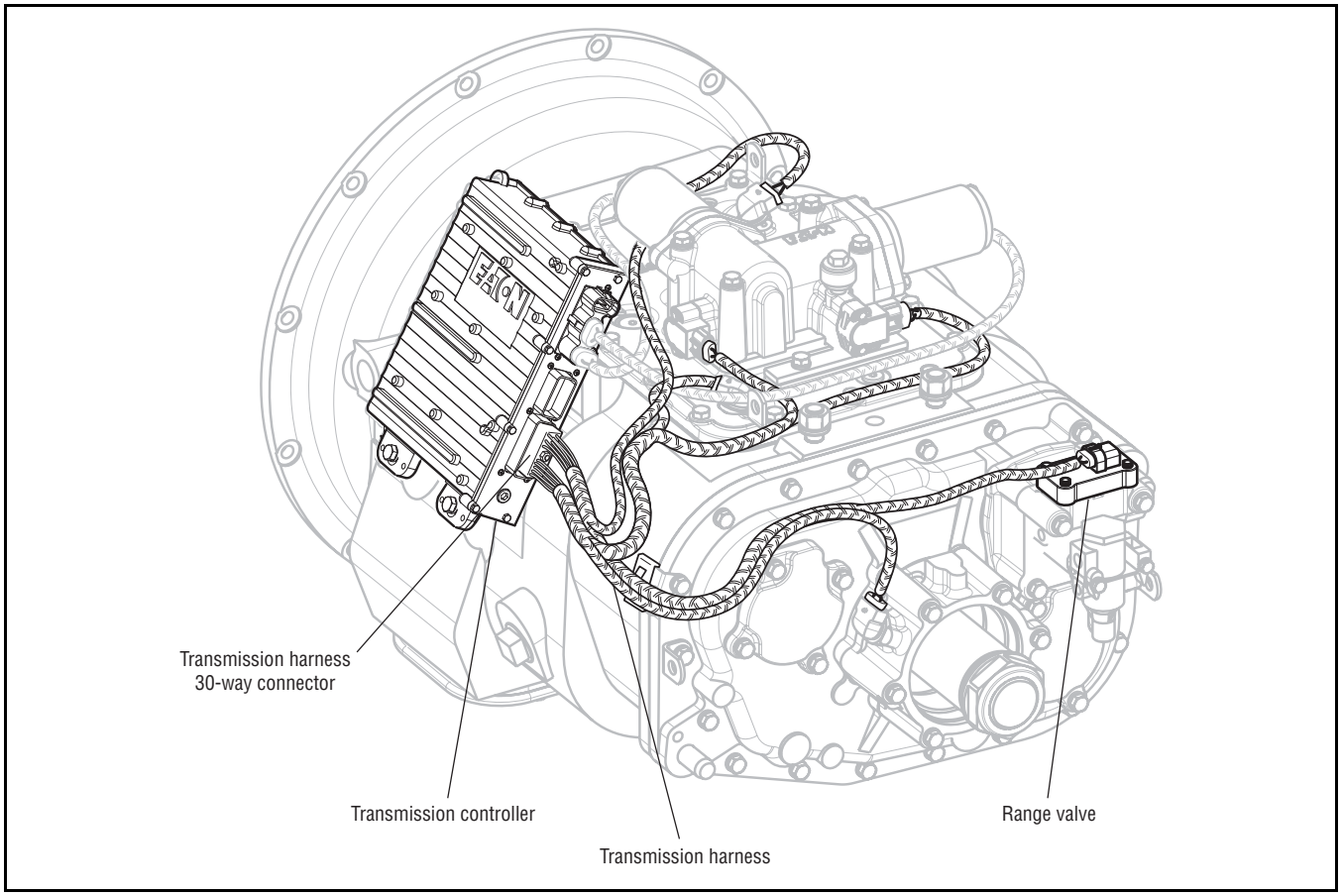
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

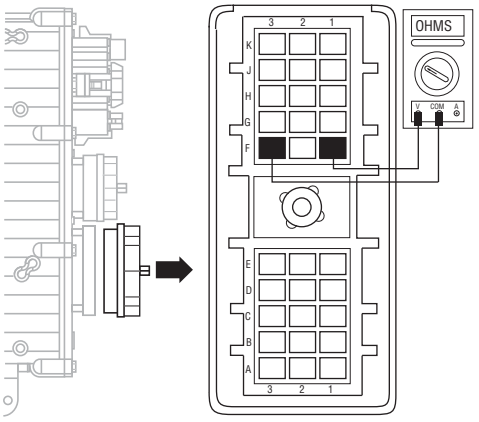
This fault code can be caused by any of the following:

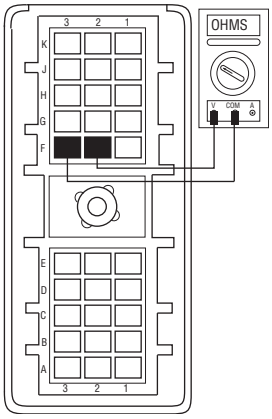
- Range Valve
- Transmission Harness
- Transmission Controller



Code 43 (SID 35, 36, FMI 3, 4, 5), Range Valve Test

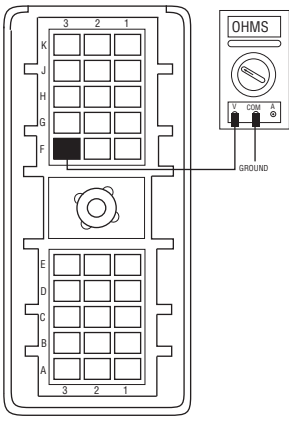
Step A	Procedure	Condition	Action
	1. Key off. 2. Disconnect the Transmission Controller 30-way connector. 3. Measure resistance between the Transmission Harness 30-way connector pins: • F1 and F3 • F3 and F2 **Note:** Observe polarity on Volt\Ohm Meter.	If resistance is 9 to 16 ohms →	Go to **Step B.**
		If resistance is outside of range →	Go to **Step C.**



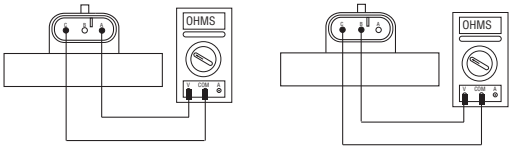


Code 43 (SID 35,36, FMI 3,4,5), Range Valve Test, continued

Step B	Procedure	Condition	Action
	1. Measure resistance between the Transmission Harness 30-way connector pin F3 and ground.	If resistance is more than 10K ohms or open circuit [OL]	**Replace Transmission Controller (Only if Fault Code is Active).** Go to **Step V.**
		If resistance is less than 10K ohms	Go to **Step C.**

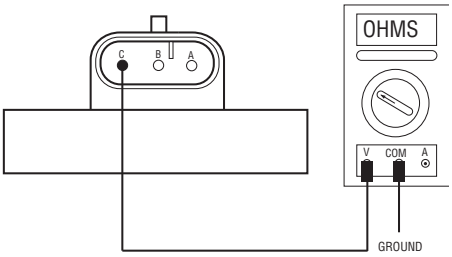


Step C	Procedure	Condition	Action
	1. Disconnect the Transmission Harness from Range Valve.		
	2. Measure resistance between Range Valve pins: • A and C • B and C	If resistance is 9 to 16 ohms	Go to **Step D.**
		If resistance is outside of range	**Replace Range Valve**. Go to **Step V.**



Code 43 (SID 35,36, FMI 3,4,5), Range Valve Test, continued

Step D	Procedure	Condition	Action
	1. Measure resistance between Range Valve pin C and ground.	If resistance is more than 10K ohms or open circuit [OL]	**Replace Transmission Harness.** Go to **Step V.**
		If resistance is less than 10K ohms	**Replace Range Valve.** Go to **Step V.**



Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Key on.		
	4. Clear codes (see page 1-4)		
	5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4)	If no codes	Test complete.
		If code 43 appears	Return to **Step A** to find error in testing.
		If code other than 43 appears	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Component Code: 44 (PID 53, FMI 3, 4, 5) Inertia Brake Solenoid Coil

Overview

This fault code indicates an electrical failure of the solenoid that controls the pneumatic Inertia Brake.

Detection

Starting at key-on and throughout operation, the Transmission Controller constantly measures this circuit. A failure mode of a short to battery, short to ground, or open circuit is detected.

Fallback

There is no fallback associated with this failure. However, it may be difficult to perform an initial engagement due to a poorly adjusted clutch. Also, hill shifting performance may be reduced.

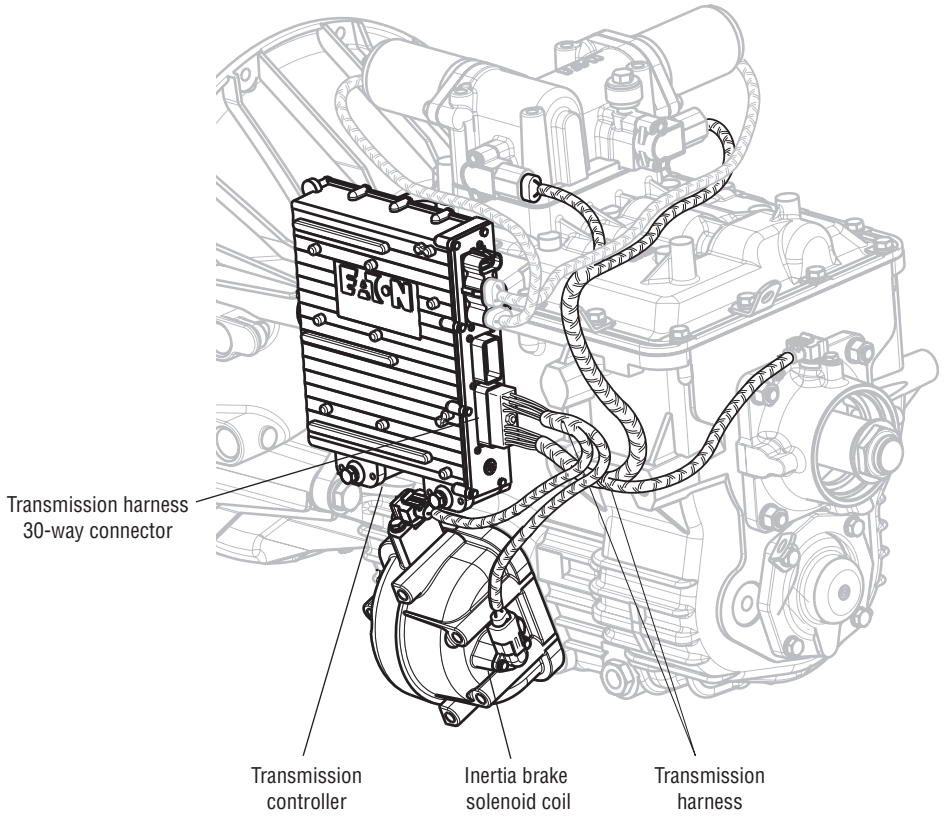
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

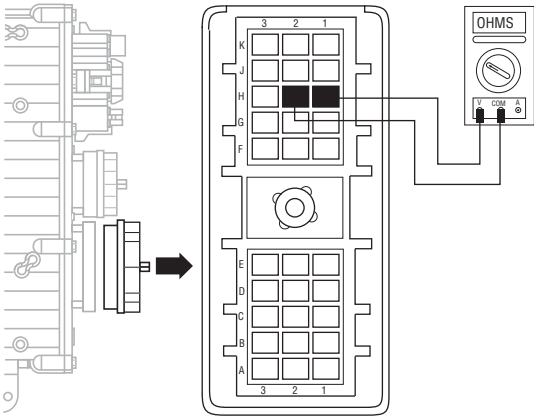
This fault code can be caused by any of the following:

- Inertia Brake Solenoid
- Transmission Harness
- Transmission Controller



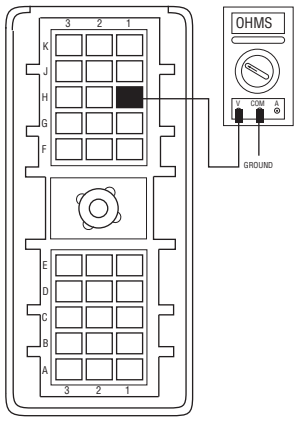
Code 44 (PID 53, FMI 3, 4, 5), Inertia Brake Solenoid Coil Test

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect the Transmission Controller 30-way connector.		
	3. Measure resistance between the Transmission Harness 30-way connector pins H1 and H2.	If resistance is 2 to 6 ohms	Go to **Step B.**
		If resistance is outside of range	Go to **Step C.**

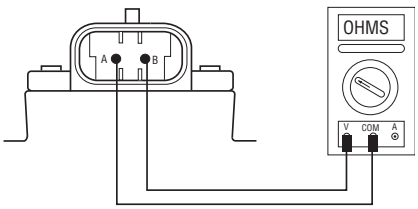


Code 44 (PID 53, FMI 3,4,5), Inertia Brake Solenoid Coil Test, continued

Step B	Procedure	Condition	Action
	1. Measure resistance between the Transmission Harness 30-way connector pin H1 and ground.	If resistance is more than 10K ohms or open circuit [OL]	**Replace Transmission Controller (Only if Fault Code is Active).** Go to **Step V.**
		If resistance is less than 10K ohms	Go to **Step C.**

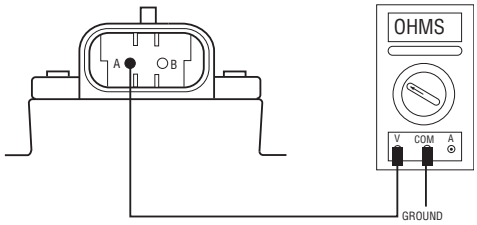


Step C	Procedure	Condition	Action
	1. Disconnect the Transmission Harness from Inertia Brake coil.		
	2. Measure resistance between Inertia Brake coil pins A and B.	If resistance is 2 to 6 ohms	Go to **Step D.**
		If resistance is outside of range	**Replace Inertia Brake.** Go to **Step V.**



Code 44 (PID 53, FMI 3,4,5), Inertia Brake Solenoid Coil Test, continued

Step D	Procedure	Condition	Action
	1. Measure resistance between Inertia Brake coil pin A and ground.	If resistance is more than 10K ohms or open circuit [OL]	**Replace Transmission Harness.** Go to **Step V.**
		If resistance is less than 10K ohms	**Replace Inertia Brake.** Go to **Step V.**



Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Key on.		
	4. Clear codes (see page 1-4)		
	5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes(see page 1-4)	If no codes	Test complete.
		If code 44 appears	Return to **Step A** to find error in testing.
		If code other than 44 appears	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Component Code: 46 (SID 37, 38, FMI 3, 4, 5) Splitter Valve

Overview

This fault code indicates an electrical failure of the solenoids that control the Splitter.

Detection

Starting at key-on and throughout operation, the Transmission Controller constantly measures this circuit. Depending on the reading, a failure mode of short to battery, short to ground, or open circuit is detected.

Fallback

This fault causes a 9-speed fallback and the transmission stays in either LO split or HI split.

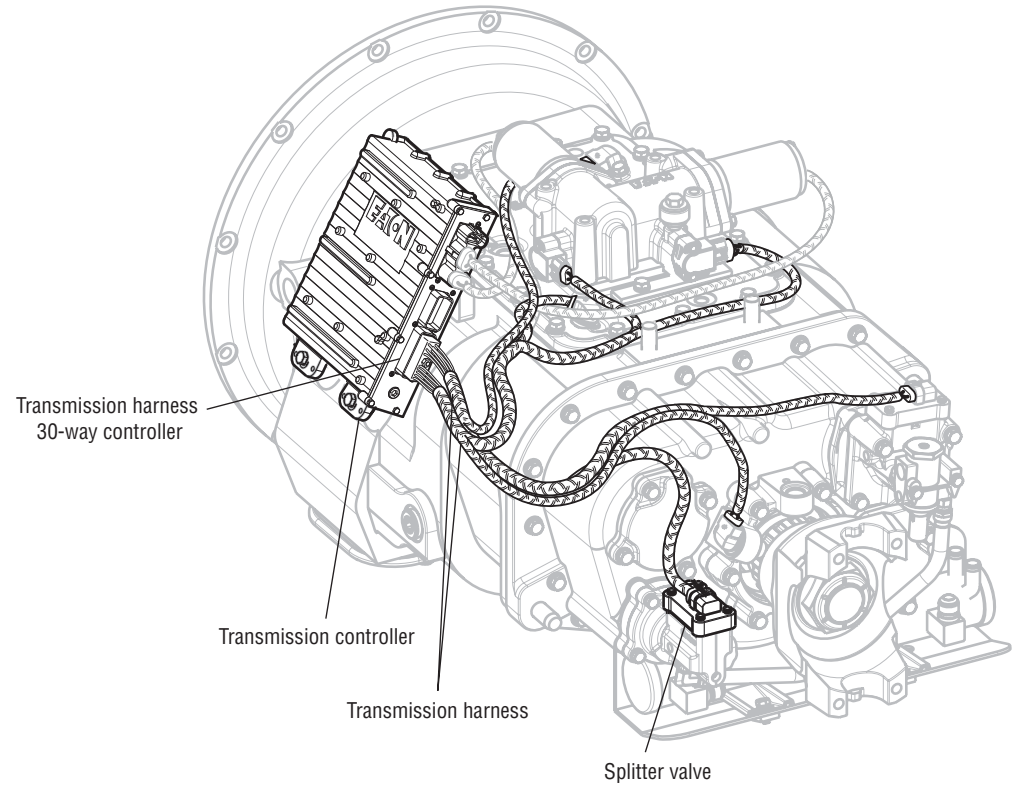
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

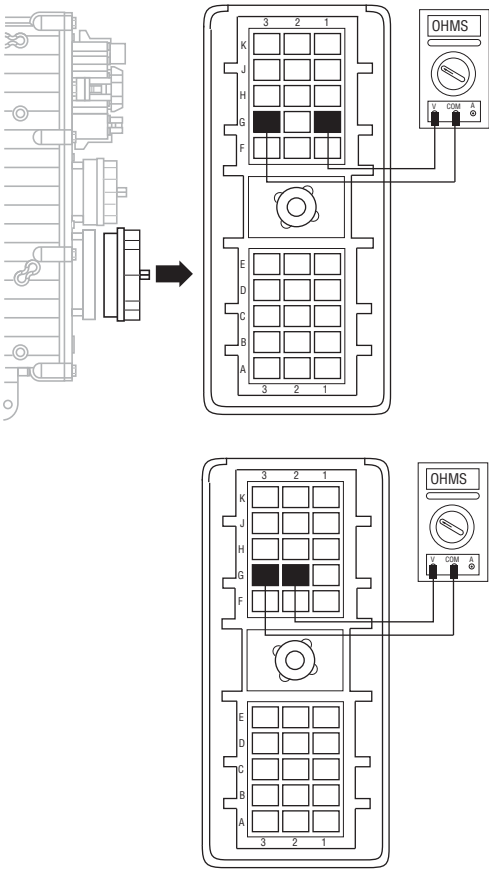
This fault code can be caused by any of the following:

- Splitter Valve
- Transmission Harness
- Transmission Controller



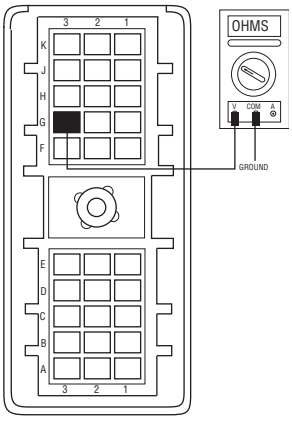
Code 46 (SID 37, 38, FMI 3, 4, 5), Splitter Valve Test

Step A	Procedure	Condition	Action
	1. Key off. 2. Disconnect the Transmission Controller 30-way connector. 3. Measure resistance between the Transmission Harness 30-way connector pins: • G1 and G3 • G3 and G2	If resistance is 9 to 16 ohms	Go to **Step B.**
		If resistance is outside of range	Go to **Step C.**

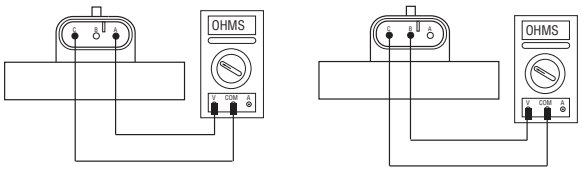


Code 46 (SID 37,38, FMI 3,4,5), Splitter Valve Test, continued

Step B	Procedure	Condition	Action
	1. Measure resistance between the Transmission Harness 30-way connector pin G3 and ground.	If resistance is more than 10K ohms or open circuit [OL]	**Replace Transmission Controller (Only if Fault Code is Active).** Go to **Step V.**
		If resistance is less than 10K ohms	Go to **Step C.**

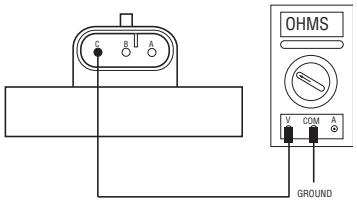


Step C	Procedure	Condition	Action
	1. Disconnect the Transmission Harness from Splitter Valve. 2. Measure resistance between Splitter Valve pins: • A and C • B and C	If resistance is 9 to 16 ohms	Go to **Step D.**
		If resistance is outside of range	**Replace Splitter Valve.** Go to **Step V.**



Code 46 (SID 37,38, FMI 3,4,5), Splitter Valve Test, continued

Step D	Procedure	Condition	Action
	1. Measure resistance between Splitter Valve pin C and ground.	If resistance is more than 10K ohms or open circuit [OL]	**Replace Transmission Harness.** Go to **Step V.**
		If resistance is less than 10K ohms	**Replace Splitter Valve.** Go to **Step V.**



Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Key on.		
	4. Clear codes (see page 1-4)		
	5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4)	If no codes	Test complete.
		If code 46 appears	Return to **Step A** to find error in testing.
		If code other than 46 appears	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Component Code: 51 (PID 60, FMI 2, 3, 4, 10) Rail Select Sensor

Overview

This fault code indicates an electrical failure of the Rail Select Sensor on the Electric Shifter.

Detection

Starting at key-on and throughout operation, the Transmission Controller constantly monitors the feedback from the sensor. If the feedback is below 10% or above 90% of the sensor's full value, the fault code is set. This type of failure represents a short to ground or battery. The Transmission Controller also monitors the sensor feedback for a zero value, indicating an open circuit.

Fallback

This fault causes an In Place fallback.

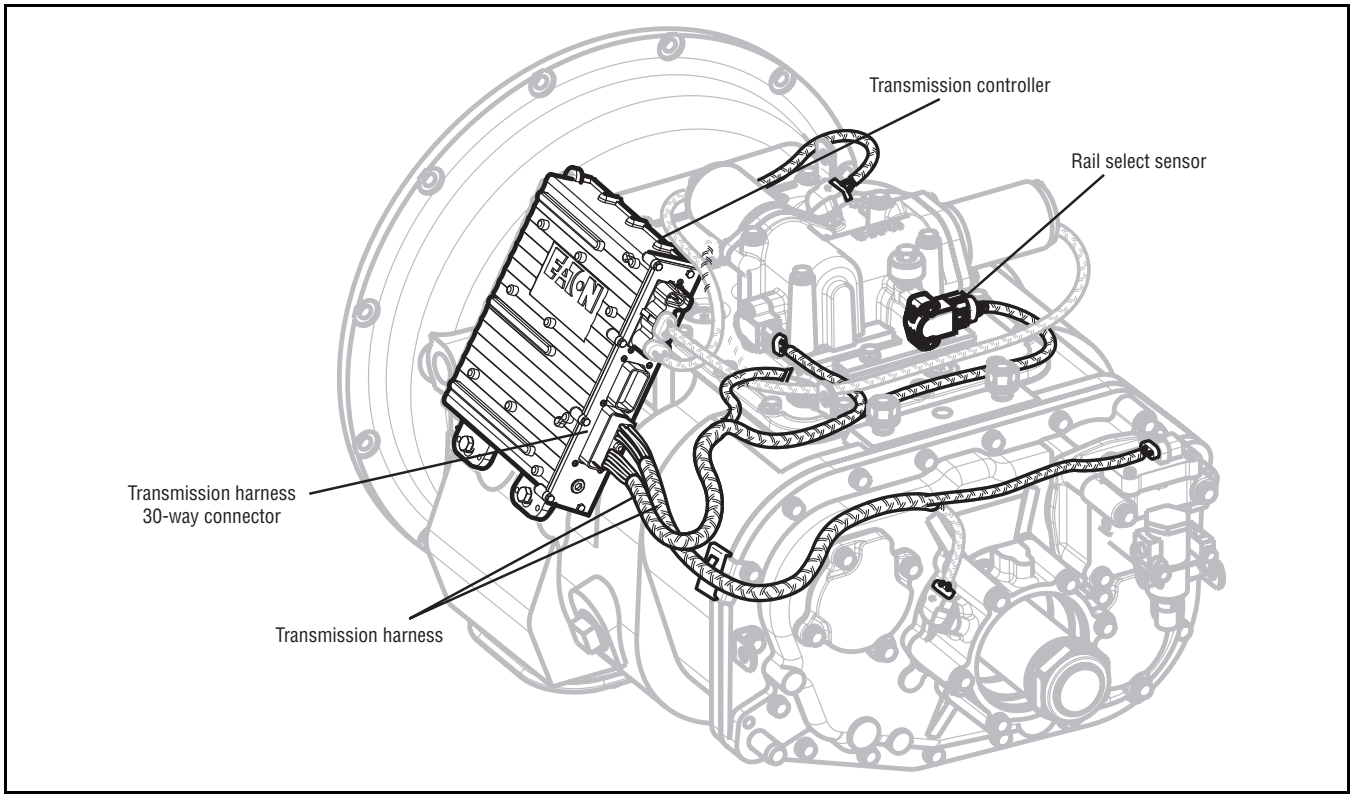
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

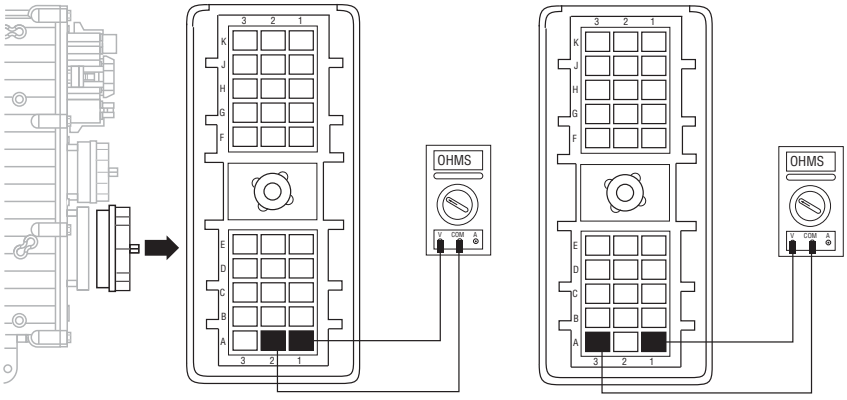
This fault code can be caused by any of the following:

- Transmission Harness
- Rail Select Sensor
- Transmission Controller



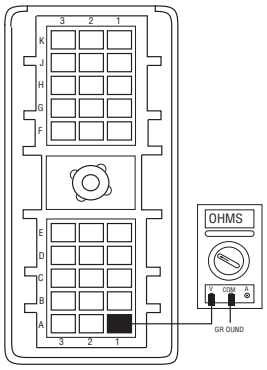
Code 51 (PID 60, FMI 2, 3, 4, 10) Rail Select Sensor Test

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect the Transmission Harness 30-way connector.		
	3. Measure resistance between the Transmission Harness 30-way connector pins: • A1 and A2 • A1 and A3 **Note:** An Auto Ranging Digital Volt/Ohm Meter must be used.	(White epoxy back sensor) If pin A1 and A2 resistance is 3.5M to 6.5M ohms and if pin A1 and A3 resistance is 13.5K to 18.5K ohms.	Go to **Step B.**
		(Black plastic back sensor) If pin A1 and A2 resistance is 100 to 200 ohms and if pin A1 and A3 resistance is 5K to 7K ohms	Go to **Step B.**
		If any of the above conditions are not met	Go to **Step C.**



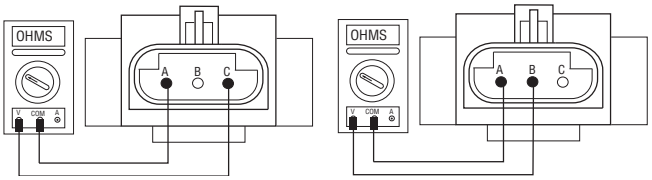
Code 51 (PID 60, FMI 2, 3, 4, 10) Rail Select Sensor Test, continued

Step B	Procedure	Condition	Action
	1. Measure resistance between transmission harness 30-way connector pin A1 to ground. →		
		If resistance is more than 10K ohms or open circuit [OL] →	Replace transmission controller if Fault Code 51 is active. Replace transmission harness if Fault Code 51 / FMI 10 is active or inactive. Reference Service Bulletin TAIB-0832 for more information. **Note:** FMI 10 will only display with transmission controller software version 097 and above. Older versions of software will set FC 51 / FMI 3 or FC 72 for the same issue; replace only the transmission harness for these codes as well. Go to **Step V.**
		If resistance is less than 10K ohms →	Go to **Step C.**



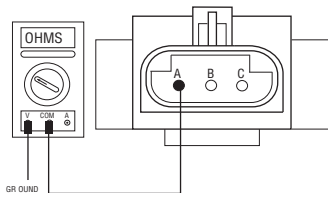
Code 51 (PID 60, FMI 2, 3, 4, 10) Rail Select Sensor Test, continued

Step C	Procedure	Condition	Action
	1. Disconnect transmission harness form rail select sensor.		
	2. Measure resistance between rail select sensor pins: • A and C • A and B **Note:** An Auto Ranging Digital Volt/ Ohm Meter must be used.	(White epoxy back sensor) If pin A and C resistance is 13.5K to 18.5K ohms and If pin A and B resistance is 3.5M to 6.5M ohms	Go to **Step D.**
		(Black plastic sensor) If pin A and C resistance is 5K to 7K ohms and If pin A and B resistance is 100 to 200 ohms	Go to **Step D.**
		If any to the above conditions are not met	**Replace Electric Shifter.** Go to **Step V.**



Code 51 (PID 60, FMI 2, 3, 4, 10) Rail Select Sensor Test, continued

Step D	Procedure	Condition	Action
	1. Measure resistance between rail select sensor pin A and ground. →		
		If resistance is more than 10K ohms or open circuit [OL] →	Replace transmission harness. Go to **Step V.**
		If resistance is less than 10K ohms →	**Replace Electric Shifter.** Go to **Step V.**



Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Key on.		
	4. Clear codes (see page 1-4)		
	5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4) →	If no codes →	Test complete.
		If code 51 appears →	Return to **Step A** to find error in testing.
		If code other than 51 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Code 51 (PID 60, FMI 2, 3, 4, 10) Rail Select Sensor Test, continued

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Component Code: 52 (PID 59, FMI 2, 3, 4) Gear Select Sensor

Overview

This fault code indicates an electrical failure of the Gear Select Sensor on the Electric Shifter.

Detection

Starting at key-on and throughout operation, the Transmission Controller constantly monitors the feedback from the sensor. If the feedback is below 10% or above 90% of the sensor's full value, the fault code is set. This type of failure represents a short to ground or battery. The Transmission Controller also monitors the sensor feedback for a zero value, indicating an open circuit.

Fallback

This fault causes an In Place fallback.

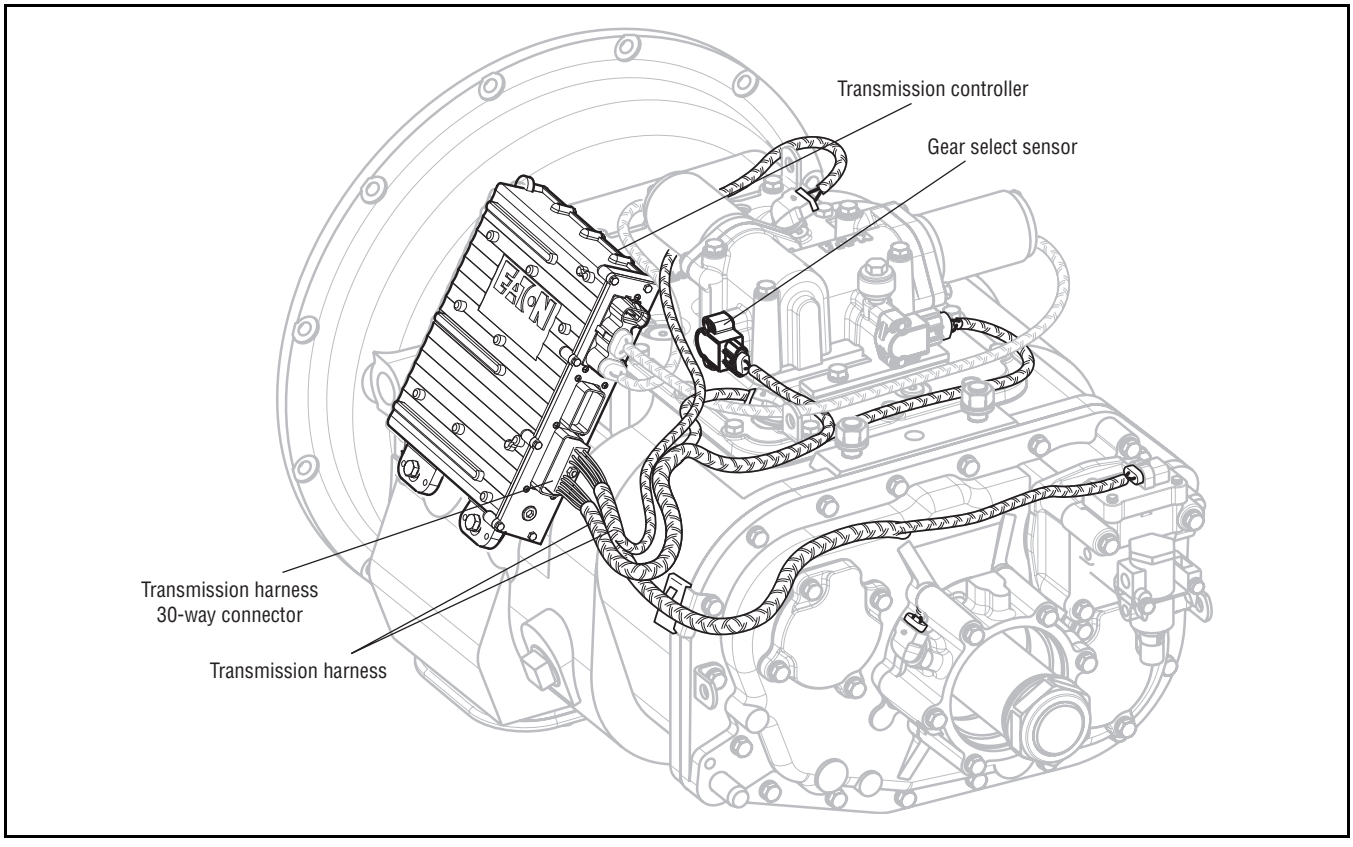
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

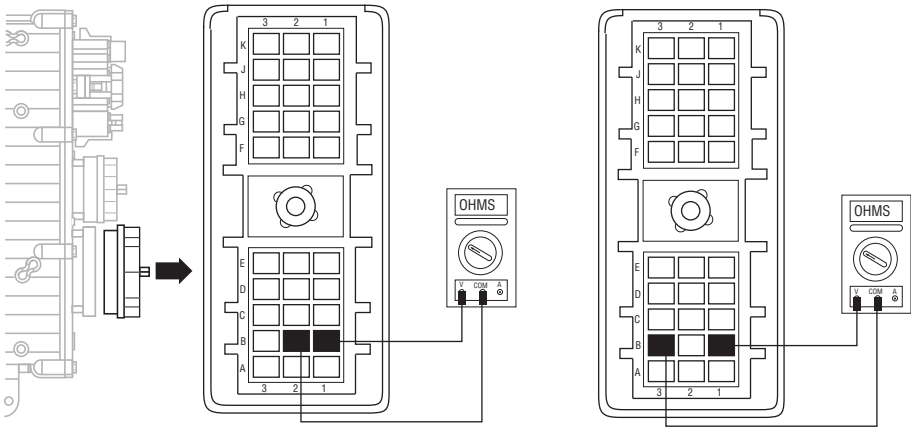
This fault code can be caused by any of the following:

- Transmission Harness
- Gear Select Sensor
- Transmission Controller



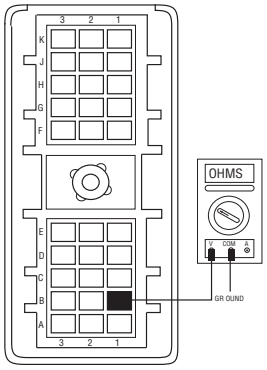
Code 52 (PID 59, FMI 2, 3, 4), Gear Select Sensor Test

Step A	Procedure	Condition	Action
	1. Key off. 2. Disconnect the Transmission controller 30-way connector.		
	3. Measure resistance between the Transmission Harness 30-way connector pins: • B1 and B2 • B1 and B3 **Note:** An Auto Ranging Digital Volt/Ohm Meter must be used.	(White epoxy back sensor) If pin B1 and B2 resistance is 3.5M to 6.5M ohms and if pin B1 and B3 resistance is 13.5K to 18.5K ohms.	Go to **Step B.**
		(Black plastic back sensor) If pin B1 and B2 resistance is 100 to 200 ohms and if pin B1 and B3 resistance is 5K to 7K ohms	Go to **Step B.**
		If any of the above conditions are not met	Go to **Step C.**



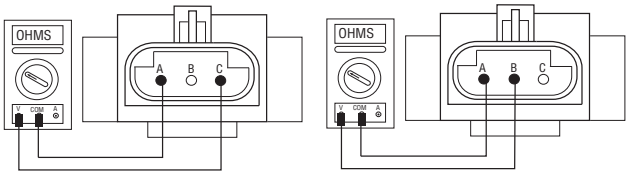
Code 52 (PID 59, FMI 2, 3, 4), Gear Select Sensor Test, continued

Step B	Procedure	Condition	Action
	1. Measure resistance between transmission harness 30-way connector pin B1 to ground. →		
		If resistance is more than 10K ohms or open circuit [OL] →	Replace **Transmission Controller** (Only if Fault Code is Active). Go to **Step V.**
		If resistance is less than 10K ohms →	Go to **Step C.**

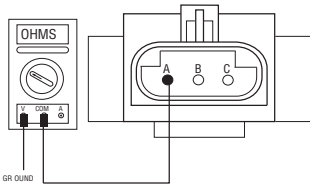


Code 52 (PID 59, FMI 2, 3, 4), Gear Select Sensor Test, continued

Step C	Procedure	Condition	Action
	1. Disconnect transmission harness form gear select sensor.		
	2. Measure resistance between gear select sensor pins: • A and C • A and B **Note:** An Auto Ranging Digital Volt/ Ohm Meter must be used.	(White epoxy back sensor) If pin A and C resistance is 13.5K to 18.5K ohms and If pin A and B resistance is 3.5M to 6.5M ohms	Go to **Step D.**
		(Black plastic back sensor) If pin A and C resistance is 5K to 7K and If pin A and B resistance is 100 to 200 ohms	Go to **Step D.**
		If any to the above conditions are not met	**Replace Electric Shifter.** Go to **Step V.**



Step D	Procedure	Condition	Action
	1. Measure resistance between gear select sensor pin A and ground.		
		If resistance is more than 10K ohms or open circuit [OL]	Replace transmission harness. Go to **Step V.**
		If resistance is less than 10K ohms	**Replace Electric Shifter.** Go to **Step V.**



Code 52 (PID 59, FMI 2, 3, 4), Gear Select Sensor Test, continued

Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Key on.		
	4. Clear codes (see page 1-4)		
	5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4). →	If no codes →	Test complete.
		If code 52 appears →	Return to **Step A** to find error in testing.
		If code other than 52 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Code 52 (PID 59, FMI 2, 3, 4), Gear Select Sensor Test, continued

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Component Code: 56 (PID 161, FMI 2, 5) Input Shaft Speed Sensor

Overview

This fault code indicates an electrical problem in the Input Shaft Speed Sensor circuit. The signal from the sensor did not match the current operating conditions.

Detection

A Speed Sensor is determined faulty when all the Speed Sensor readings are compared and one sensor is inconsistent.

Fallback

This fault causes an In Place fallback. If the Input Shaft Speed Sensor fails before power-up, the transmission is unable to engage a gear and the fault code cannot be reproduced.

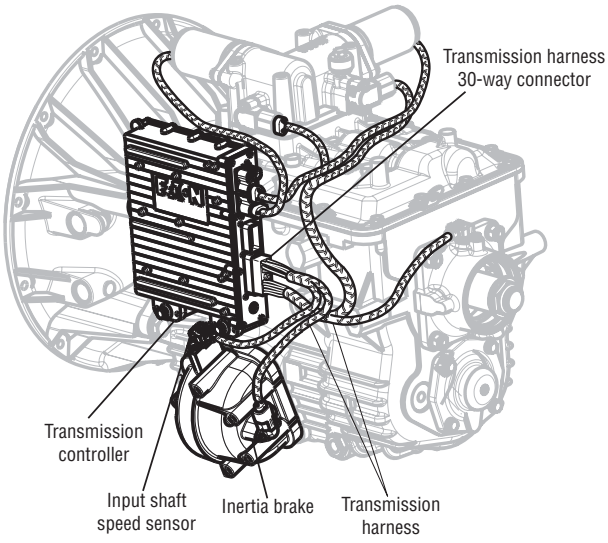
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

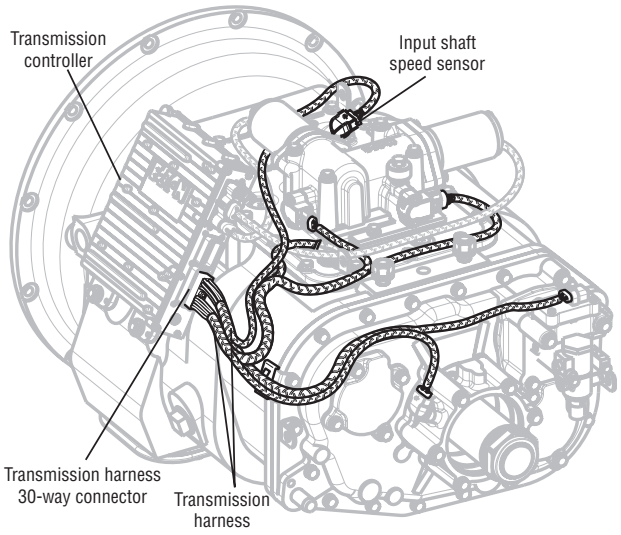
Possible Causes

This fault code can be caused by any of the following:

- Transmission Harness
- Input Shaft Speed Sensor
- Various Transmission Components
- Transmission Controller



Medium Duty Transmission - input shaft speed sensor located on inertia brake

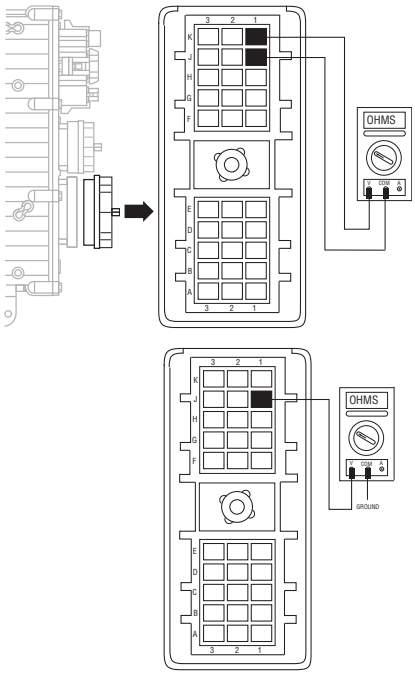


Heavy Duty Transmission - input shaft speed sensor located in shift bar housing

Code 56 (PID 161, FMI 2, 5), Input Shaft Speed Sensor Test

Step A	Procedure	Condition	Action
	1. Drive vehicle and monitor engine rpm and input shaft rpm with Service-Ranger	If engine rpm and input shaft rpm match and code is not active during test drive	Test complete.
		If input shaft rpm is erratic or varies from engine rpm	Go to **Step B.**

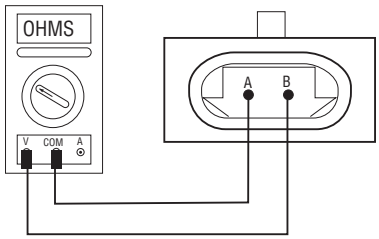
Step B	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect the Transmission Controller 30-way connector.		
	3. Measure resistance between the Transmission Controller 30-way connector pins J1 and K1 and between J1 and ground.	If pin J1 and K1 resistance is 2K to 4.5K ohms and pin J1 to ground resistance is 10K ohms or greater	Go to **Step C.**
		If any of the above conditions are not met	Go to **Step D.**



Code 56 (PID 161, FMI 2,5), Input Shaft Speed Sensor Test, continued

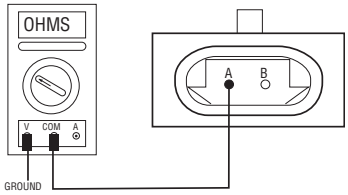
Step C	Procedure	Condition	Action
	1. Inspect Input Shaft Speed Sensor for contamination or damage. →	If no problem found →	**Replace Transmission Controller (Only if Fault Code is Active).** Go to **Step V.**
		If problem is found or you were sent here from Step D or E →	**Replace Input Shaft Speed Sensor** and inspect the upper countershaft PTO gear for damage. Go to **Step V.**

Step D	Procedure	Condition	Action
	1. Disconnect the Transmission Harness from Input Shaft Speed Sensor.		
	2. Measure resistance between Input Shaft Speed Sensor pins A and B. →	If resistance is 2K to 4.5K ohms →	Go to **Step E.**
		If resistance is outside of range →	Go to **Step C.**



Code 56 (PID 161, FMI 2,5), Input Shaft Speed Sensor Test, continued

Step E	Procedure	Condition	Action
	1. Measure resistance between Input Shaft Speed Sensor pin A and ground.	If resistance is more than 10K ohms or open circuit [OL]	**Replace Transmission Harness.** Go to **Step V.**
		If resistance is less than 10K ohms	Go to **Step C.**



Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Verify proper installation of Speed Sensor.		
	4. Key on.		
	5. Clear codes (see page 1-4)		
	6. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	7. Check for codes (see page 1-4)	If no codes	Test complete.
		If code 56 appears	Return to **Step A** to find error in testing.
		If code other than 56 appears	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Component Code: 57 (PID 160, FMI 2) Main Shaft Speed Sensor

Overview

This fault code indicates an electrical problem in the Main Shaft Speed Sensor circuit. The signal from the sensor did not match the current operating conditions

Detection

A Speed Sensor is determined faulty when all the Speed Sensor readings are compared and one sensor is inconsistent.

Fallback

There fault causes an in place Fallback mode.

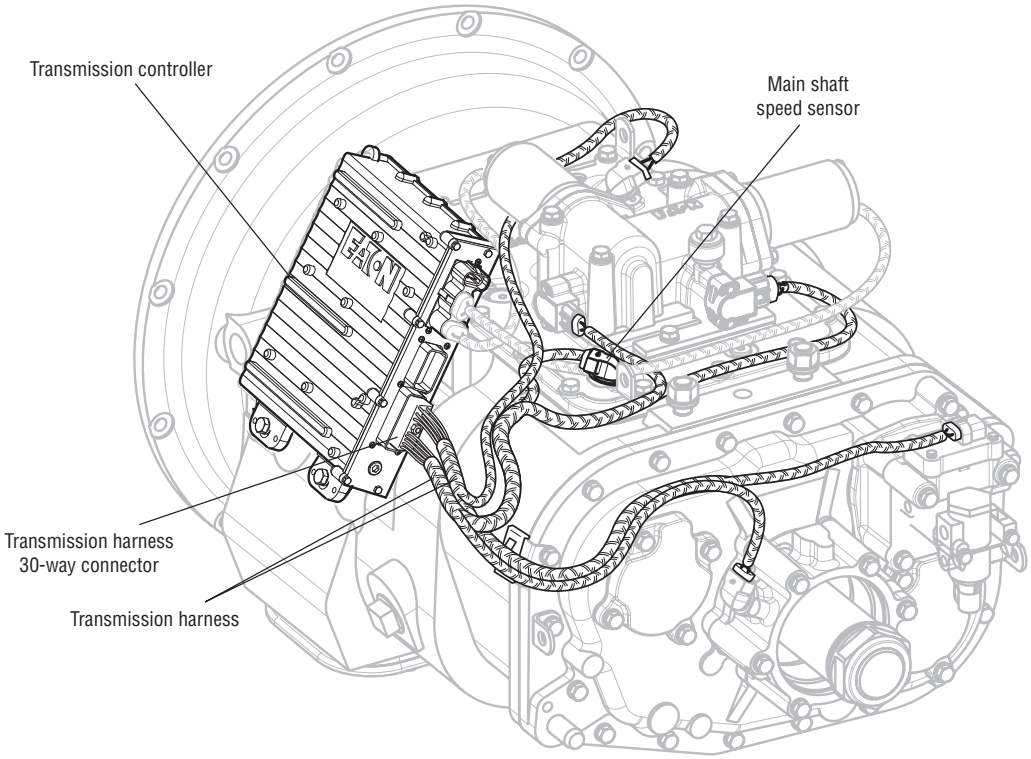
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

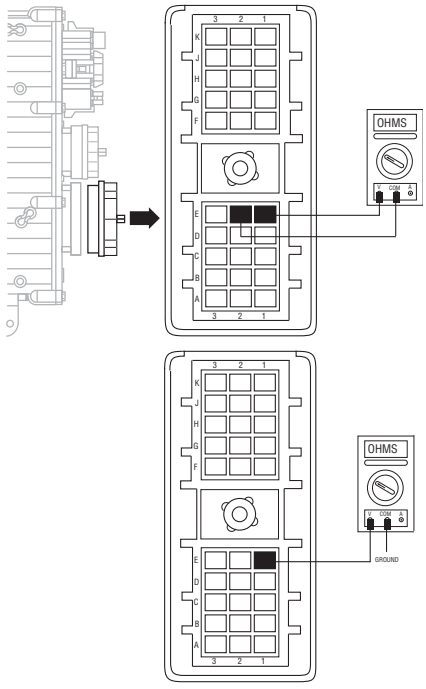
This fault code can be caused by any of the following:

- Transmission Harness
- Main Shaft Speed Sensor
- Various Transmission Components
- Transmission Controller



Code 57 (PID 160, FMI 2), Main Shaft Speed Sensor Test

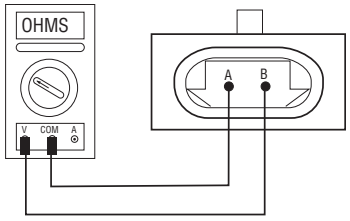
Step A	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect the Transmission Controller 30-way connector.		
	3. Measure resistance between the Transmission Controller 30-way connector pins E1 and E2 and between E1 and ground.	If pin E1 to E2 resistance is 2K to 4.5K ohms and pin E1 to ground resistance is 10K ohms or greater	Go to **Step B.**
		If resistance is outside of the range	Go to **Step C.**



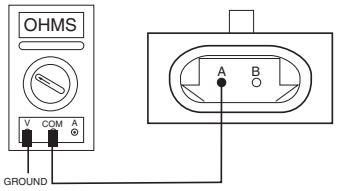
Step B	Procedure	Condition	Action
	1. Inspect Mainshaft Speed Sensor for contamination or damage.	If no problem found	**Replace Transmission Controller (Only if Fault Code is Active).** Go to **Step V.**
		If problem is found or you were sent here from Step C or D	**Replace MainShaft Speed Sensor** and inspect the upper reverse idler gear for damage. Go to **Step V.**

Code 57 (PID 160, FMI 2), Main Shaft Speed Sensor Test, continued

Step C	Procedure	Condition	Action
	1. Disconnect the Transmission Harness from the Main Shaft Speed Sensor.		
	2. Measure resistance between the Main Shaft Speed Sensor pins A and B.	If resistance is 2K to 4.5K ohms	Go to **Step D.**
		If resistance is outside of range	Go to **Step B.**



Step D	Procedure	Condition	Action
	1. Measure resistance between Main Shaft Speed Sensor pin A and ground.	If resistance is more than 10K ohms or open circuit [OL]	**Replace Transmission Harness.** Go to **Step V**.
		If resistance is less than 10K ohms	Go to **Step B.**



Code 57 (PID 160, FMI 2), Main Shaft Speed Sensor Test, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Verify proper installation of Speed Sensor. 4. Key on. 5. Clear codes (see page 1-4) 6. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	7. Check for codes (see page 1-4) →	If no codes →	Test complete.
		If code 57 appears →	Return to **Step A** to find error in testing.
		If code other than 57 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Component Code: 58 (PID 191, FMI 2) Output Shaft Speed Sensor

Overview

This fault code indicates an electrical problem in the Output Shaft Speed Sensor circuit. The signal from the sensor did not match the current operating conditions

Detection

A Speed Sensor is determined faulty when all Speed Sensor readings are compared and one sensor is inconsistent.

Fallback

This fault causes a 5-speed fallback and the transmission stays in either LO range or HI range. When the vehicle comes to a stop, an attempt to shift into LO range is made. The fallback causes a 1-speed fallback on transmissions with no auxiliary section.

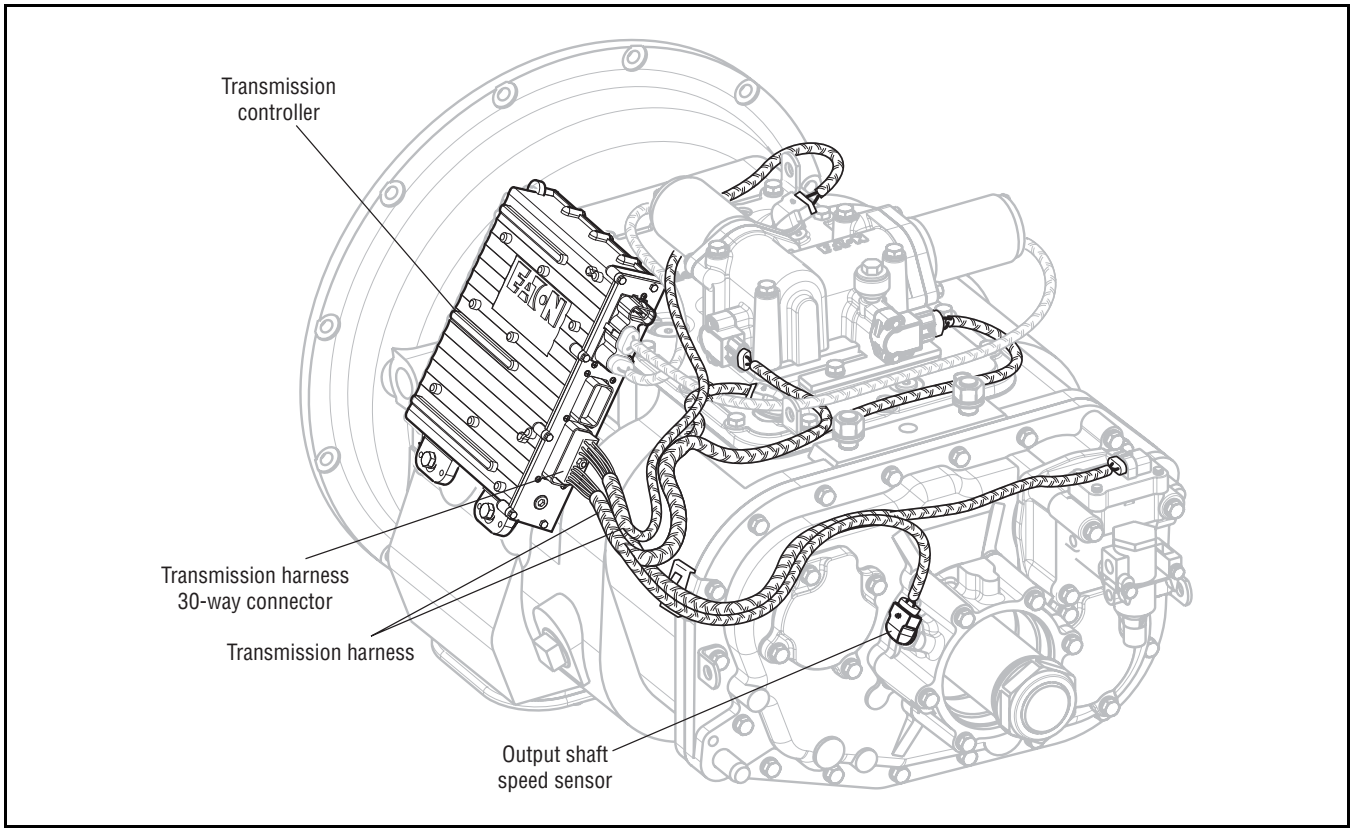
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

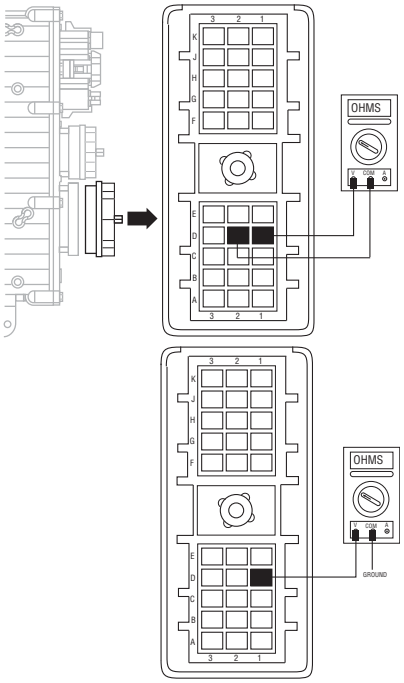
This fault code can be caused by any of the following:

- Transmission Harness
- Output Shaft Speed Sensor
- Various Transmission Components
- Transmission Controller
- Failed or Loose Tone Wheel



Code 58 (PID 191, FMI 2), Output Shaft Speed Sensor Test

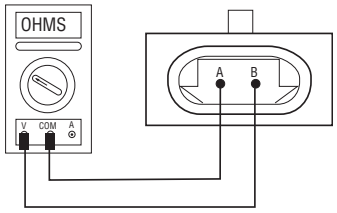
Step A	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect the Transmission Controller 30-way connector.		
	3. Measure resistance between the Transmission Controller 30-way connector pins D1 and D2 and between D1 and ground.	If pin D1 to D2 resistance is 2K to 4.5K ohms and pin D1 to ground resistance is 10K ohms or greater	Go to **Step B.**
		If resistance is outside of the range	Go to **Step C.**



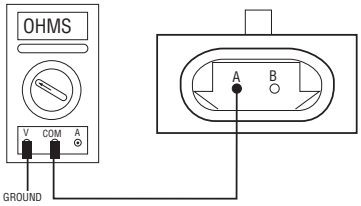
Step B	Procedure	Condition	Action
	1. Inspect Output Shaft Speed Sensor for contamination or damage.	If no problem found	**Replace Transmission Controller (Only if Fault Code is Active).** Go to **Step V.**
		If problem is found or you were sent here from Step C or D	**Replace Output Shaft Speed Sensor** and inspect the tone wheel for damage, looseness or corrosion. Go to **Step V.**

Code 58 (SID 191, FMI 2), Output Shaft Speed Sensor Test, continued

Step C	Procedure	Condition	Action
	1. Disconnect the Transmission Harness from the Output Shaft Speed Sensor.		
	2. Measure resistance between Output Shaft Speed Sensor pins A and B.	If resistance is 2K to 4.5K ohms	Go to **Step D.**
		If resistance is outside of range	Go to **Step B.**



Step D	Procedure	Condition	Action
	1. Measure resistance between Output Shaft Speed Sensor pin A and ground.	If resistance is more than 10K ohms or open circuit [OL]	**Replace Transmission Harness.** Go to **Step V.**
		If resistance is less than 10K ohms	Go to **Step B.**



Code 58 (SID 191, FMI 2), Output Shaft Speed Sensor Test, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Verify proper installation of Speed Sensor. 4. Key on. 5. Clear codes(see page 1-4) 6. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	7. Check for codes (see page 1-4) →	If no codes →	Test complete.
		If code 58 appears →	Return to **Step A** to find error in testing.
		If code other than 58 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Component Code: 61 (SID 39, FMI 5, 6) Rail Select Motor

Overview

This fault code indicates an electrical failure of the Rail Select Motor.

Detection

Starting at key-on and throughout operation, the Transmission Controller constantly measures the motor circuit. Failure mode of short to battery, short to ground, or open circuit is detected. The Transmission Controller also monitors the amount of current required to drive the motors. If the over current limit is exceeded, the fault code is also set.

Fallback

This fault causes an In Place fallback.

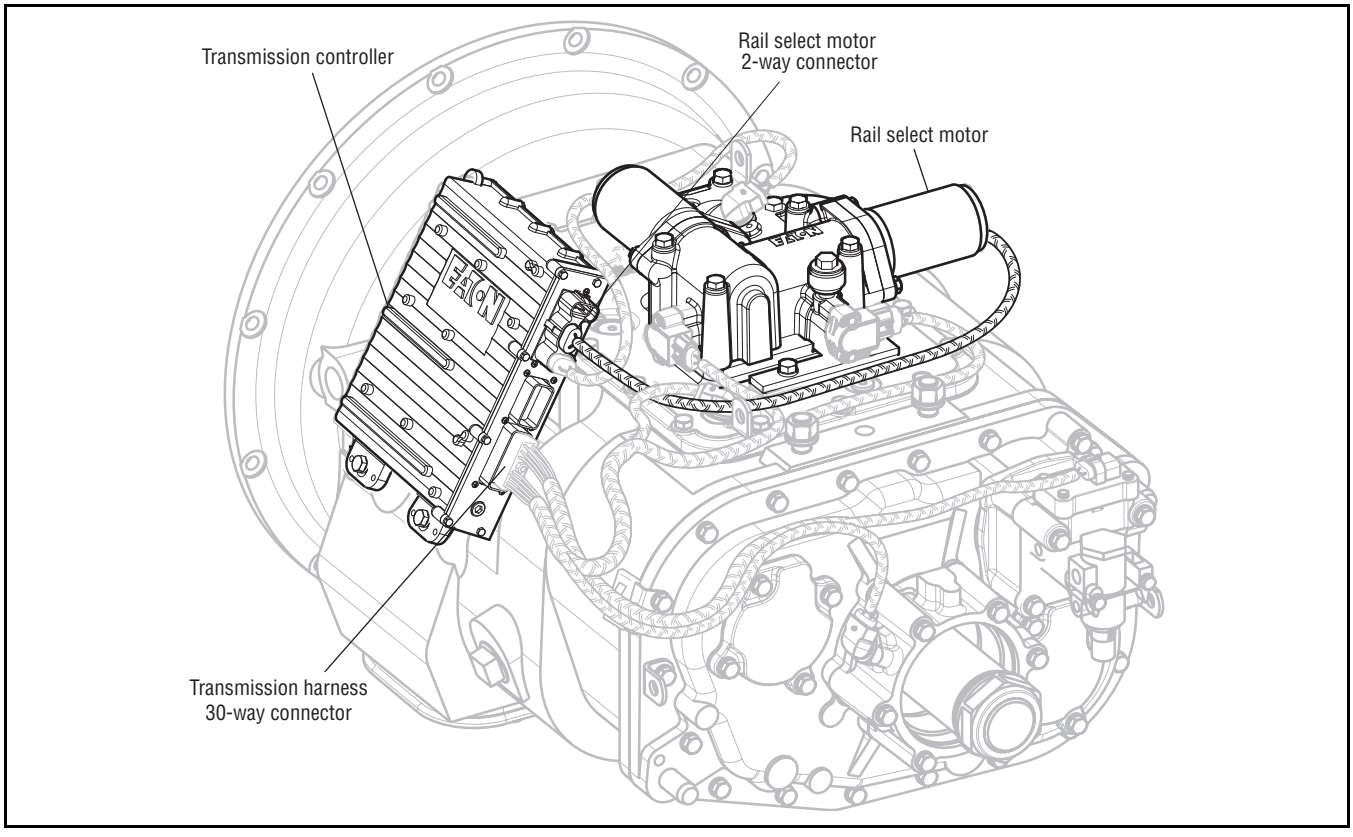
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

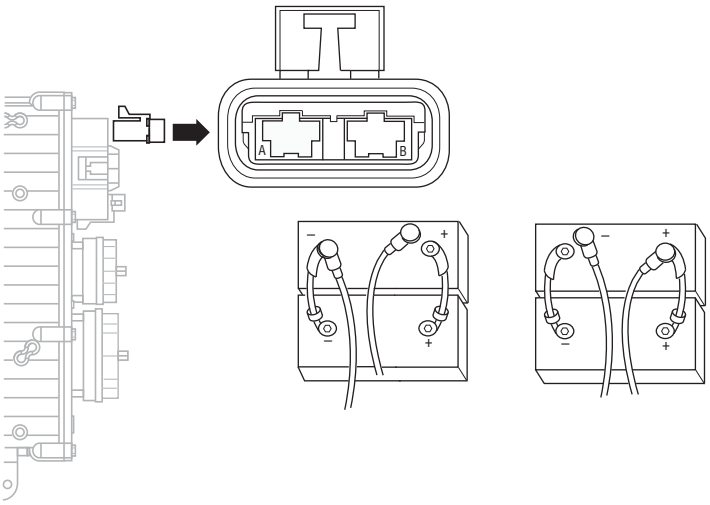
This fault code can be caused by any of the following:

- Rail Select Motor
- Transmission Controller



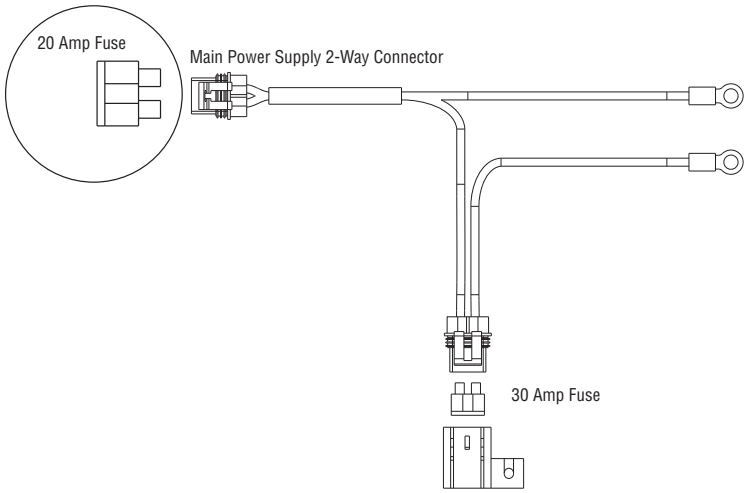
Code 61 (SID 39, FMI 5, 6), Rail Select Motor Test

Step A	Procedure	Condition	Action
	1. Key off. 2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.	→	
		If no problem found →	Go to **Step B.**
		If problem is found →	Repair power/ground path for the main power supply. Go to **Step V.**



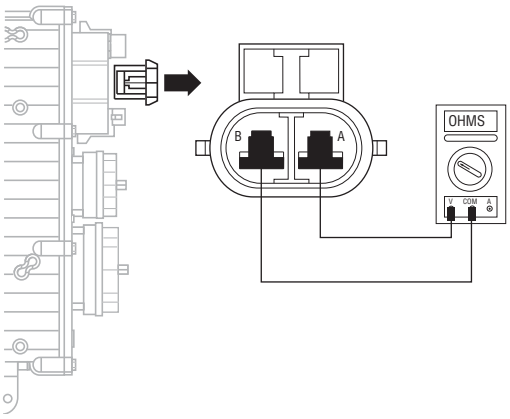
Code 61 (SID 39, FMI 5,6), Rail Select Motor Test, continued

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Insert 20-amp fuse into Motor Supply 2-way connector. →	If fuse blows immediately →	Go to **Step C.**
		If fuse does not blow immediately →	Repair wiring from the battery to the Transmission ECU. Go to **Step V.**

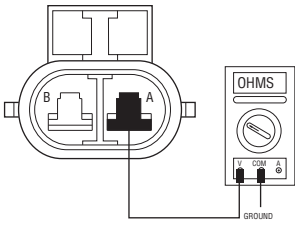


Code 61 (SID 39, FMI 5,6), Rail Select Motor Test, continued

Step C	Procedure	Condition	Action
	1. Disconnect Rail Select Motor 2-way (black) connector from the Transmission Controller.		
	2. Measure resistance between Rail Select 2-way connector pins A and B.	If resistance is .3 to 150 ohms	Go to **Step D.**
		If resistance is outside of range	**Replace Electric Shifter.** Go to **Step V.**



Step D	Procedure	Condition	Action
	1. Measure resistance between Rail Select Motor 2-way connector pin A and ground.	If resistance is more than 10K ohms or open circuit [OL]	**Replace Transmission Controller (Only if Fault Code is Active).** Go to **Step V.**
		If resistance is outside of range	**Replace Electric Shifter.** Go to **Step V.**



Code 61 (SID 39, FMI 5,6), Rail Select Motor Test, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear codes (see page 1-4) 5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4) →	If no codes →	Test complete.
		If code 61 appears →	Return to **Step A** to find error in testing.
		If code other than 61 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Code 61 (SID 39, FMI 5,6), Rail Select Motor Test, continued

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Component Code: 63 (SID 40, FMI 5, 6) Gear Select Motor

Overview

This fault code indicates an electrical failure of the Gear Select Motor.

Detection

Starting at key-on and throughout operation, the Transmission Controller constantly measures the motor circuit. Failure mode of short to battery, short to ground, or open circuit is detected. The Transmission Controller also monitors the amount of current required to drive the motors. If the over current limit is exceeded, the fault code is also set.

Fallback

This fault causes an In Place fallback.

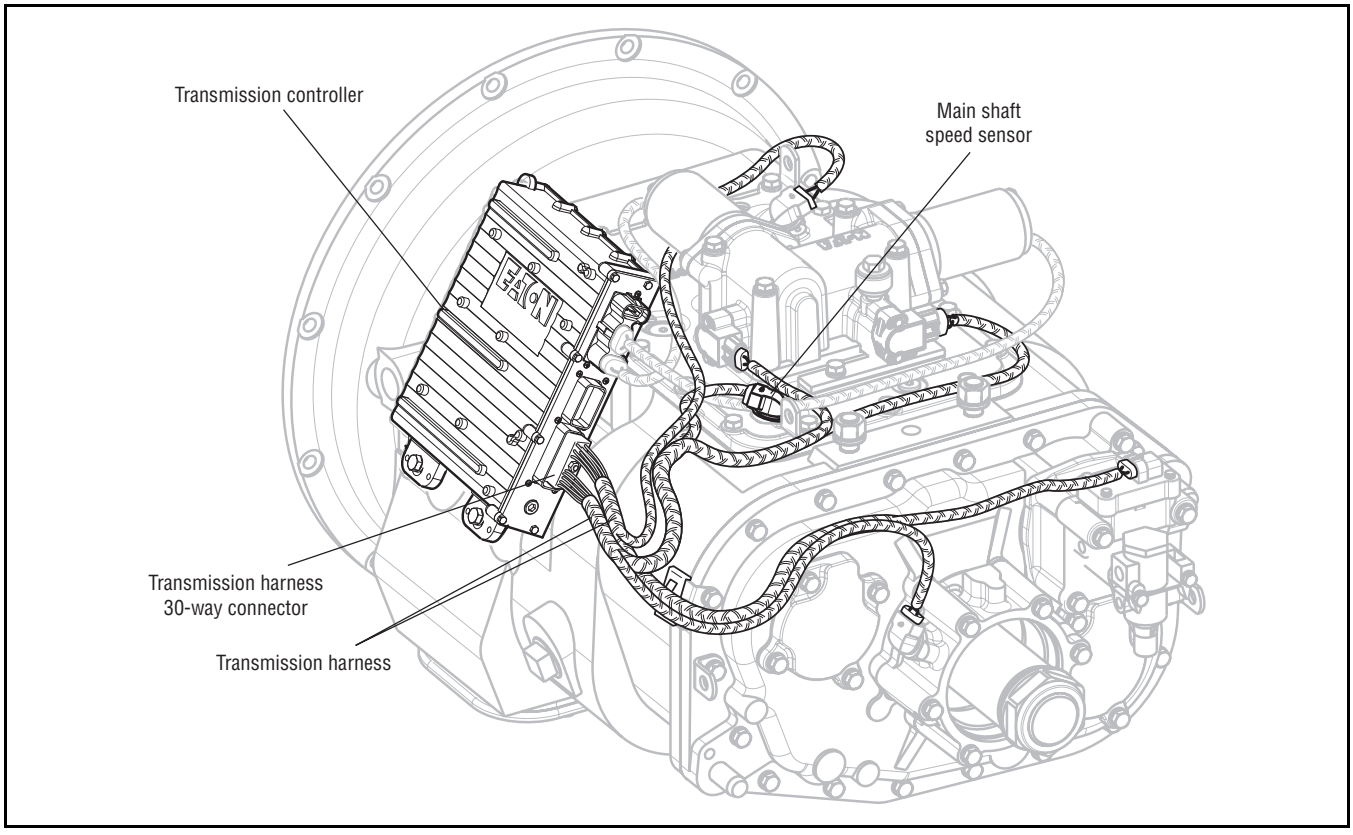
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

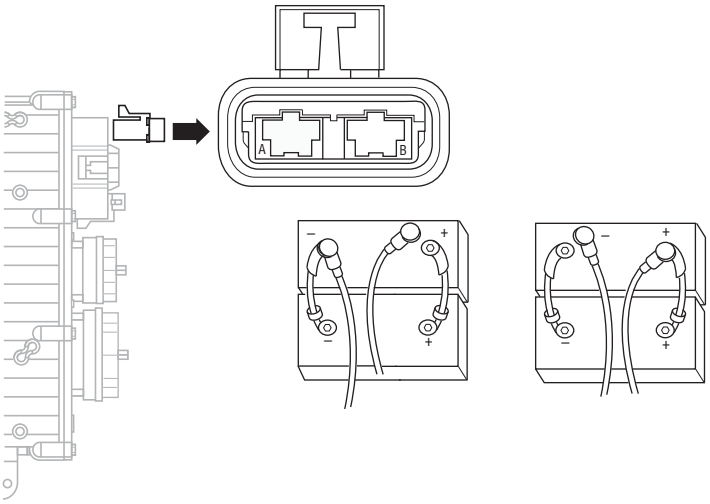
This fault code can be caused by any of the following:

- Gear Select Motor
- Transmission Controller



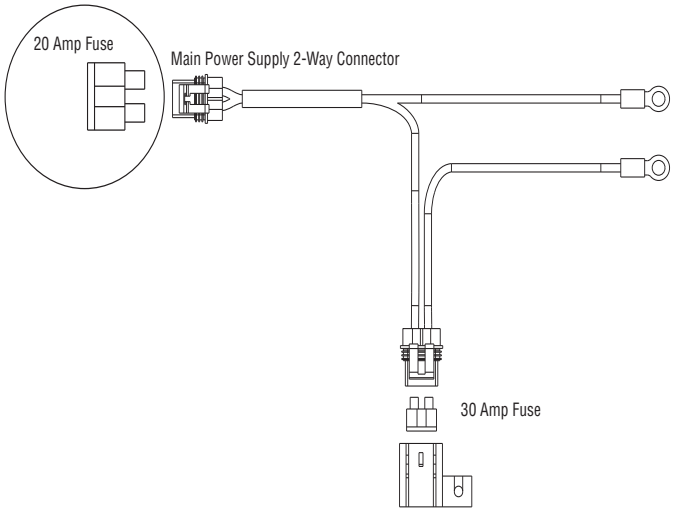
Code 63 (SID 40, FMI 5, 6), Gear Select Motor Test

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.	If no problem found →	Go to **Step B.**
		If problem is found →	Repair power/ground path for the main power supply. Go to **Step V.**



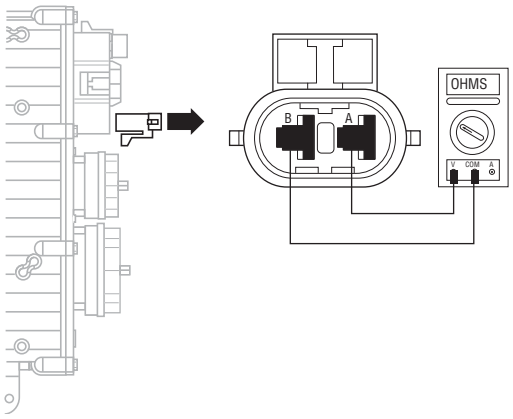
Code 63 (SID 40, FMI 5,6), Gear Select Motor Test, continued

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Insert 20-amp fuse into Motor Supply 2-way connector. →	If fuse blows immediately →	Go to **Step C.**
		If fuse does not blow immediately →	Repair wiring from the battery to the Transmission ECU. Go to **Step V.**

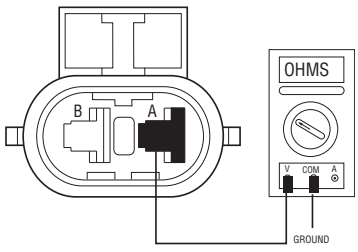


Code 63 (SID 40, FMI 5,6), Gear Select Motor Test, continued

Step C	Procedure	Condition	Action
	1. Disconnect Gear Select Motor 2-way (blue) connector from the Transmission Controller.		
	2. Measure resistance between Gear Select 2-way connector pins A and B.	If resistance is .3 to 150 ohms	Go to **Step D.**
		If resistance is outside of range	**Replace Electric Shifter.** Go to **Step V.**



Step D	Procedure	Condition	Action
	1. Measure resistance between Gear Select Motor 2-way connector pin A and ground.	If resistance is more than 10K ohms or open circuit [OL]	**Replace Transmission Controller (Only if Fault Code is Active).** Go to **Step V.**
		If resistance is outside of range	**Replace Electric Shifter.** Go to **Step V.**



Code 63 (SID 40, FMI 5,6), Gear Select Motor Test, continued

Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Key on.		
	4. Clear codes (see page 1-4)		
	5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4). →	If no codes →	Test complete.
		If code 63 appears →	Return to **Step A** to find error in testing.
		If code other than 63 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Code 63 (SID 40, FMI 5,6), Gear Select Motor Test, continued

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Component Code: 65 (SID 251 FMI 4) Logic Power

Overview

This fault code indicates the Transmission Controller has detected low transmission logic power to the Transmission Controller on vehicle interface 18-way connector pins B1 and E2.

Detection

Starting at key-on and throughout operation, the Transmission Controller constantly measures the motor voltage. If the reading is low, the fault code is set.

Fallback

This fault causes an In Place fallback.

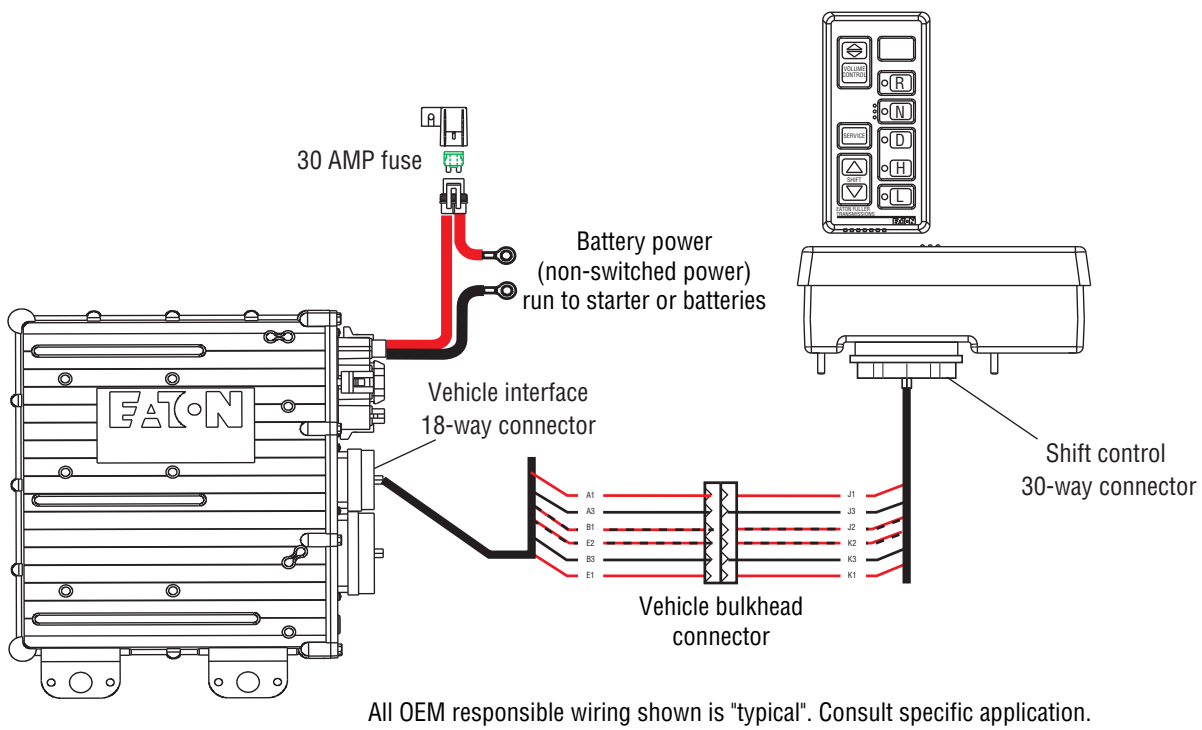
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

This fault code can be caused by any of the following:

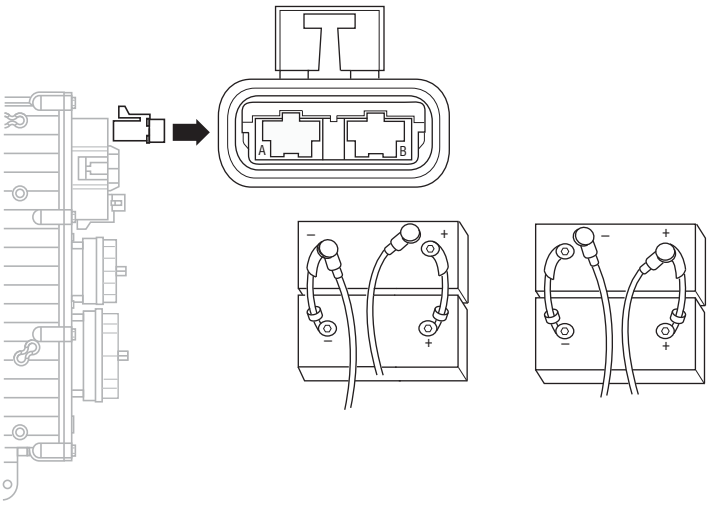
- Battery Bus Fuse / Circuit Breaker is Open
- Low Batteries
- Corroded or Loose Contacts
- Transmission Controller
- Shift Control



All OEM responsible wiring shown is "typical". Consult specific application.
(A1, E1) = +12 volt non-switched from battery
(B1, E2) = +12 volt switched from shift control to transmission controller
(A3, B3) = Signal returns, grounds, and general OEM wiring

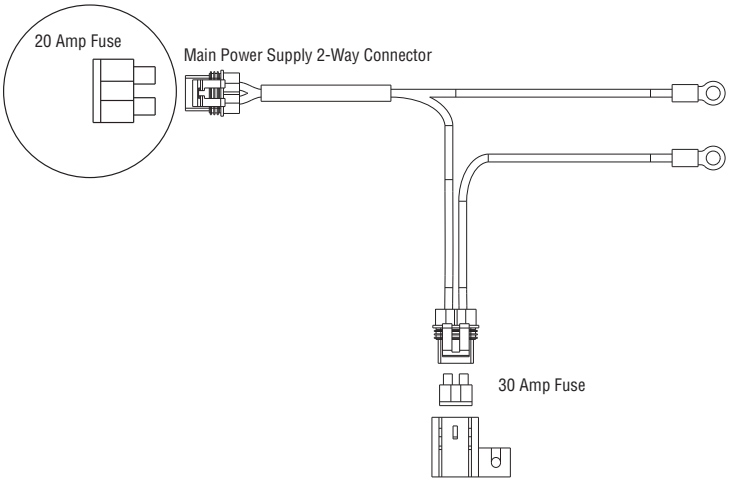
Code 65 (SID 251 FMI 4), Logic Power Test

Step A	Procedure	Condition	Action
	1. Key off. 2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.	→	
		If no problem found →	Go to **Step B.**
		If problem is found →	Repair power/ground path for the main power supply. Go to **Step V.**



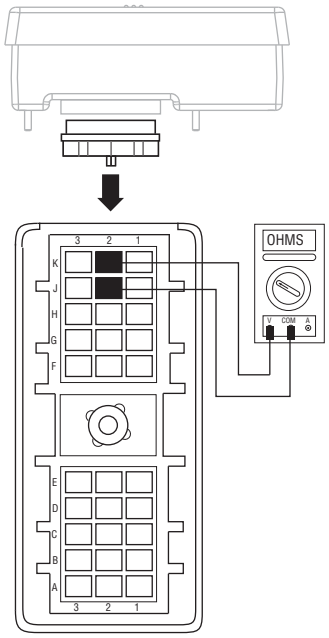
Code 65 (SID 251, FMI 4), Logic Power Test, continued

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Insert 20-amp fuse into Motor Supply 2-way connector. →	If fuse blows immediately →	Go to **Step C.**
		If fuse does not blow immediately →	Repair wiring from the battery to the Transmission ECU. Go to **Step V.**



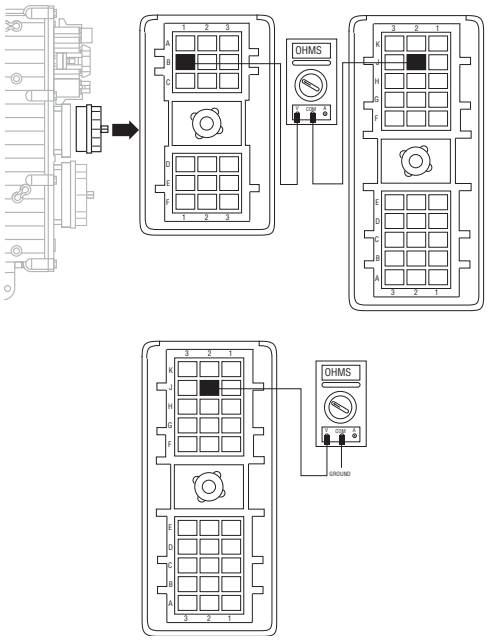
Code 65 (SID 251, FMI 4), Logic Power Test, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Disconnect negative (-) battery cable. 3. Disconnect the main power 2-way connector on the Transmission Controller. 4. Disconnect Shift Control 30-way connector.		
	5. Measure resistance between Shift Control 30-way pins J2 and K2.	If pins J2 and K2 resistance is 0 to .3 ohms	Go to **Step F.**
		If any of the above conditions are not met	Go to **Step D.**



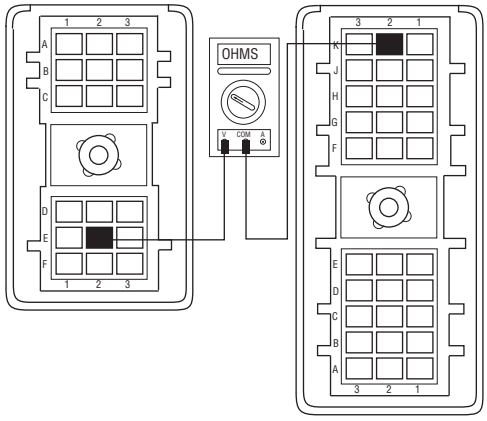
Code 65 (SID 251, FMI 4), Logic Power Test, continued

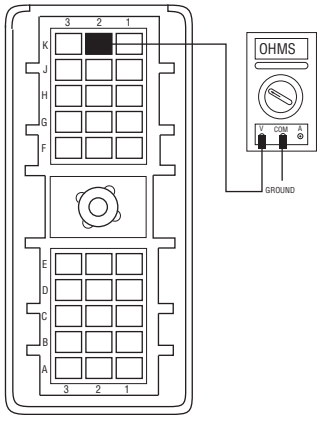
Step D	Procedure	Condition	Action
	1. Key off. 2. Disconnect vehicle interface 18-way connector. 3. Measure resistance from: • Vehicle interface 18-way connector pin B1 and Shift Control 30-way connector pin J2 • Shift Control 30-way connector J2 and ground	If resistance between pins B1 and J2 is 0 to .3 ohms and	
		If pin J2 and ground resistance is 10K ohms or open circuit [OL]	Go to **Step E.**
		If any of the above conditions are not met	Replace OEM wiring from the Transmission Controller to Shift Control. Go to **Step V.**



Code 65 (SID 251, FMI 4), Logic Power Test, continued

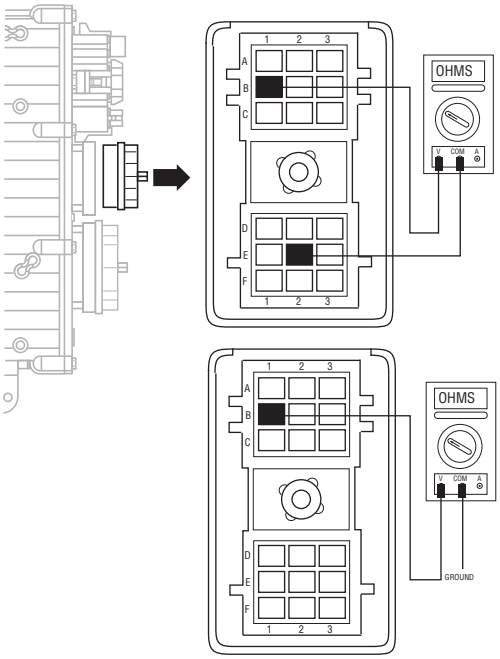
Step E	Procedure	Condition	Action
	1. Key off. 2. Measure resistance from: • Vehicle interface 18-way connector pin E2 and Shift Control 30-way connector pin K2 • Shift Control 30-way connector pin K2 and ground	If resistance between pins E2 and K2 is 0 to .3 ohms and	
		If pin K2 and ground resistance is 10K ohms or open circuit [OL]	**Replace Transmission Controller.** Go to **Step V.**
		If any of the above conditions are not met	Repair OEM wiring from the Transmission Controller to Shift Control. Go to **Step V.**





Code 65 (SID 251, FMI 4), Logic Power Test, continued

Step F	Procedure	Condition	Action
	1. Key off. 2. Reconnect Shift Control 30-way connector. 3. Disconnect vehicle interface 18-way connector. 4. Measure resistance between vehicle interface 18-way connector pins: • B1 and E2 • B1 and ground	→ If resistance between pins B1 and E2 is 0 to.3 ohms and	
		If pin B1 and ground resistance is 10K ohms or open circuit [OL] →	**Replace Transmission Controller (Only if Fault Code is Active).** Go to **Step V.**
		If any of the above conditions are not met →	**Replace Shift Control.** Go to **Step V.**



Code 65 (SID 251, FMI 4), Logic Power Test, continued

Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Key on.		
	4. Clear codes (see page 1-4)		
	5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4) →	If no codes →	Test complete.
		If code 65 appears →	Return to **Step A** to find error in testing.
		If code other than 65 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11).

System Code: 71 (SID 60, FMI 7) Stuck Engaged

Overview

This fault code indicates the transmission was unable to move the front box to neutral during a shift request.

Detection

The transmission detects this by attempting the same shifter actions five times and not sensing the desired position.

Fallback

This fault causes an In Place fallback.

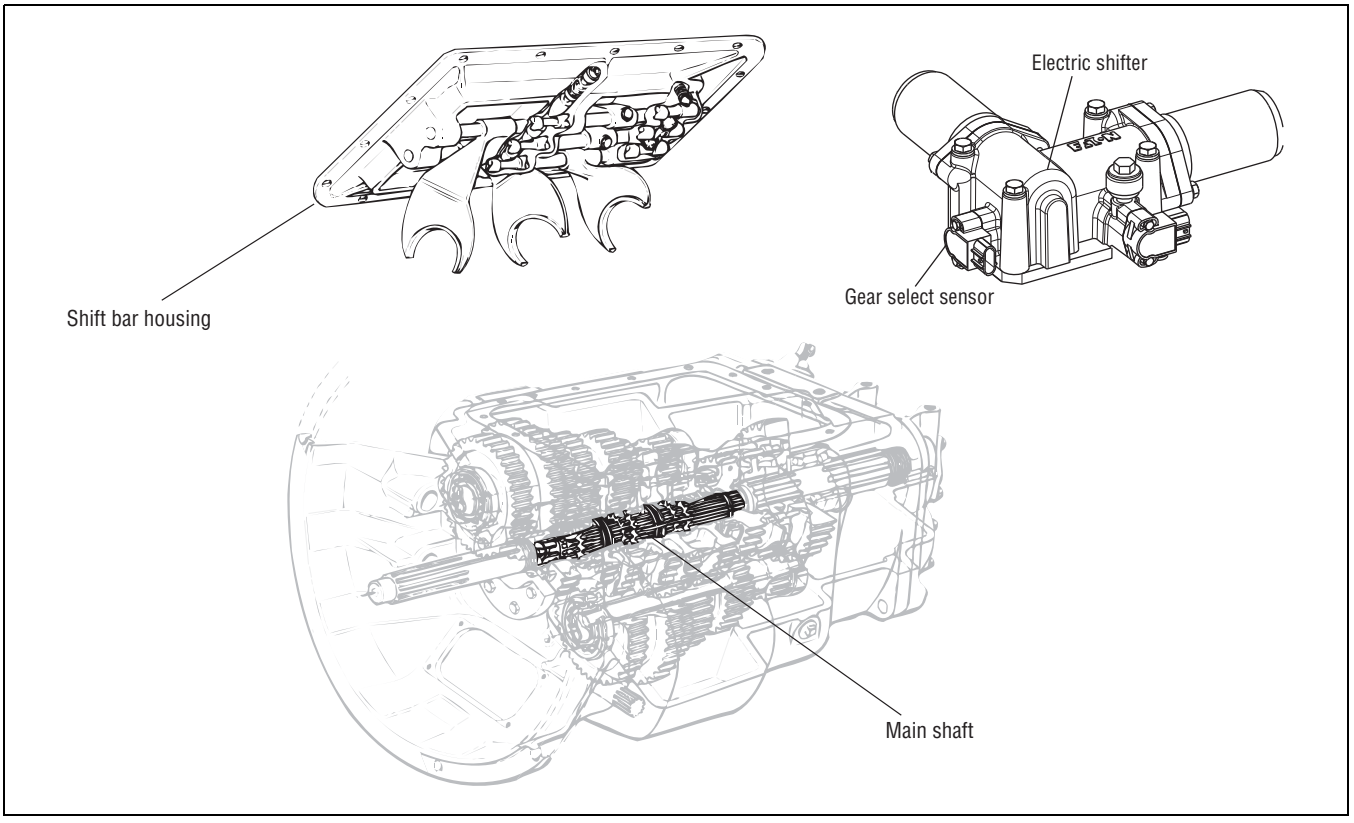
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

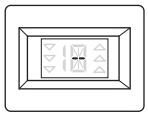
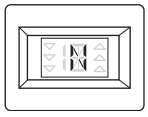
Possible Causes

This fault code can be caused by any of the following:

- Low Power to Gear Select Motor
- Gear Select Sensor
- Electric Shifter
- Yoke / Clutch / Main Shaft
- Shift Block
- Failed or Misaligned Shift Block
- Dragging Clutch
- Torque Locked in Gear

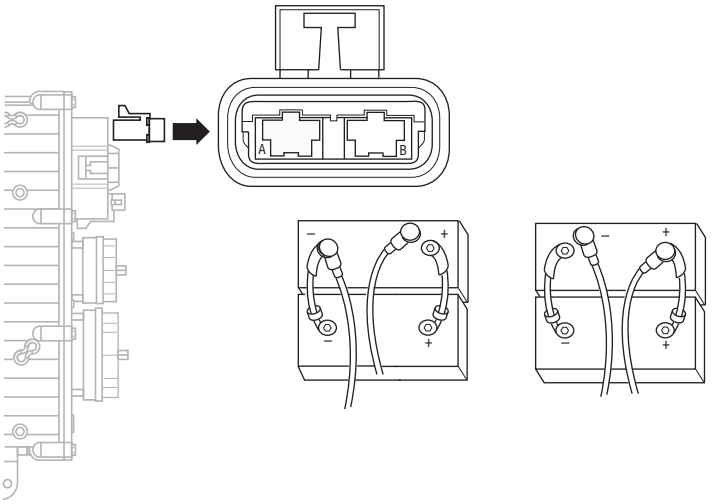


Code 71 (SID 60, FMI 7), Stuck Engaged Test

Step A	Procedure	Condition	Action
	1. Place Shift Lever in neutral. 2. Depress clutch pedal. 3. Key on. 4. Observe service lamp.	If you have an active code 71 or Gear Display shows:	Go to **Step B.**
			
		If no lights or tones turn on	**Perform Electrical Pretest** (see page 3-1)
		If "N" is highlighted on Shift Lever and Gear Display shows:	Go to **Step V.**
			

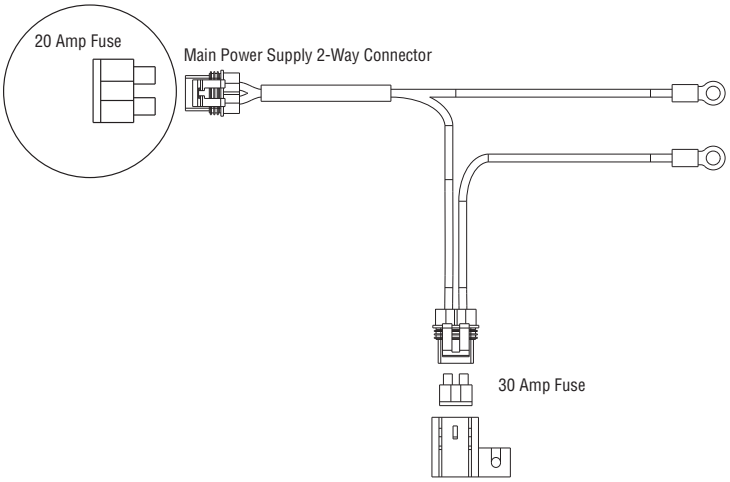
Code 71 (SID 60, FMI 7), Stuck Engaged Test, continued

Step B	Procedure	Condition	Action
	1. Key off. 2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.	If no problem found →	Go to **Step C.**
		If problem is found →	Repair power/ground path for the main power supply. Go to **Step V.**



Code 71 (SID 60, FMI 7), Stuck Engaged Test, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Insert 20-amp fuse into Motor Supply 2-way connector.	If fuse blows immediately	Go to **Step D.**
		If fuse does not blow immediately	Repair wiring from the battery to the Transmission ECU. Go to **Step V.**



Step D	Procedure	Condition	Action
	1. Key off. 2. Remove Electric Shifter from Shift Bar Housing. 3. Inspect the Shift Bar Housing: • Shift Blocks • Shift Rails • Inspect electric shifter for evidence of lube contamination	If no problem found	**Replace Electric Shifter (Only if Fault Code is Active).** Go to **Step V.**
		If problem found	Repair as required. Go to **Step V.**

Code 71 (SID 60, FMI 7), Stuck Engaged Test, continued

Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Key on.:		
	4. Clear codes (see page 1-4)		
	5. Use Driving Techniques to attempt to reset the code(see page 1-6)		
	6. Check for codes(see page 1-4) →	If no codes →	Test complete.
		If code 71 appears →	Return to **Step A** to find error in testing.
		If code other than 71 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Code 71 (SID 60, FMI 7), Stuck Engaged Test, continued

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System Code: 72
(SID 59, FMI 7)
Failed to Select Rail

Overview

This fault code indicates the transmission is unable to select the required rail during a shift.

Detection

The transmission detects this by attempting the same shifter actions five times and not sensing the desired position.

Fallback

This fault causes an In Place fallback.

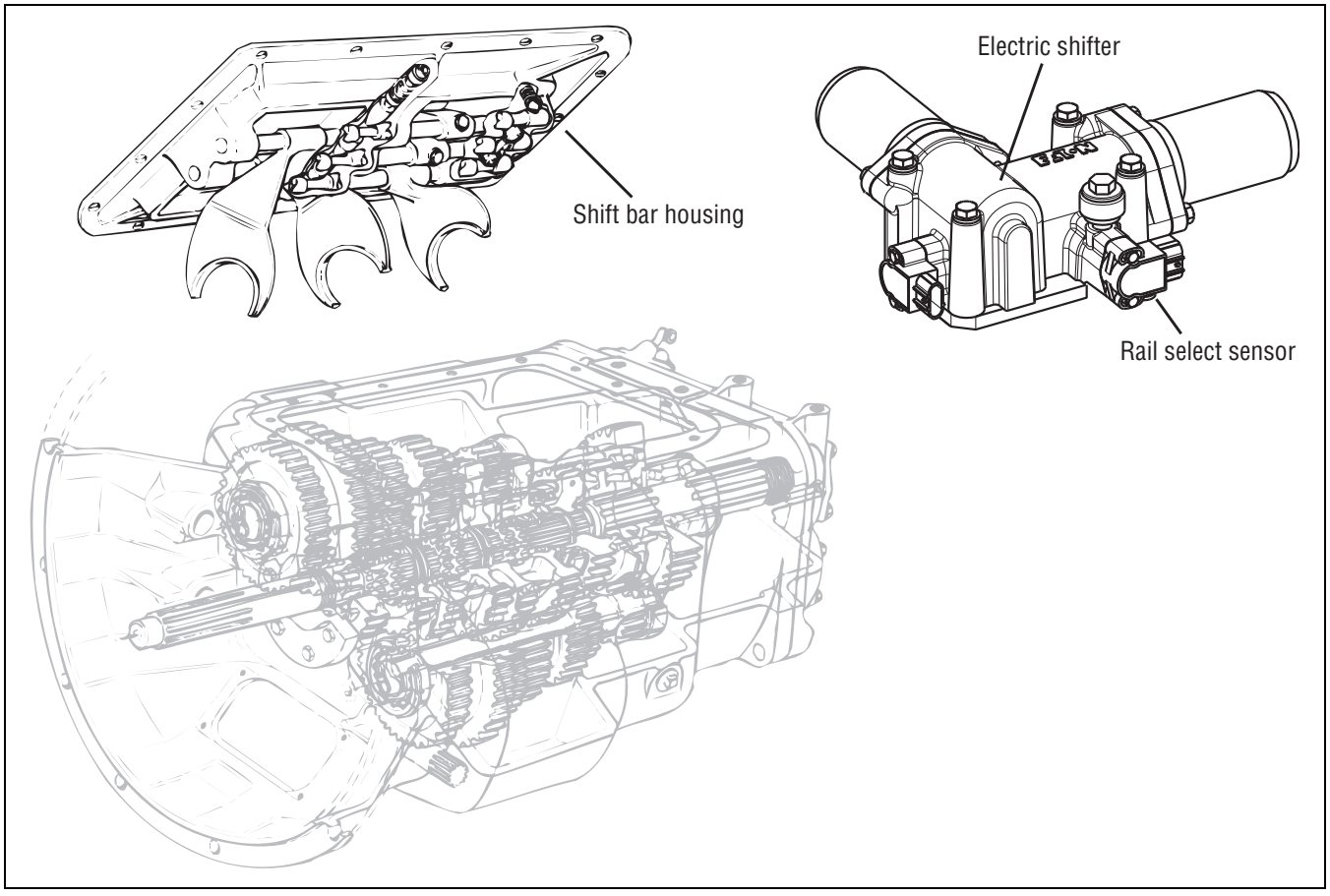
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

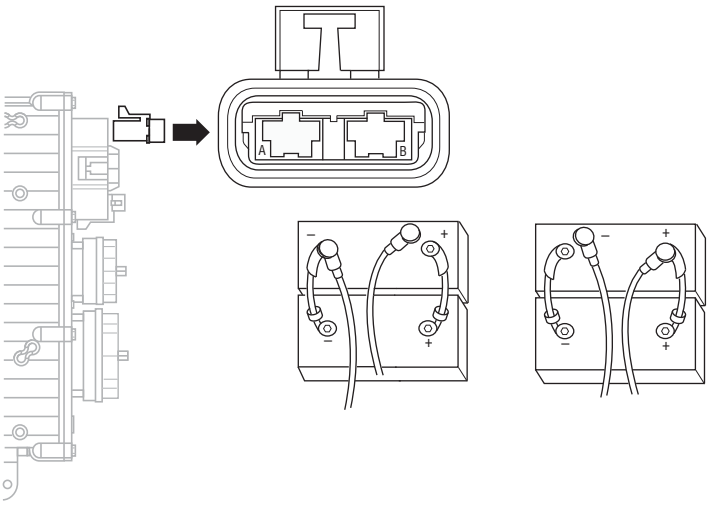
This fault code can be caused by any of the following:

- Low Power to Rail Motor
- Rail Select Motor
- Rail Select Sensor
- Shift Block
- Transmission Controller
- Rail slips into gear during vehicle transportation (this occurs during piggy-backing)



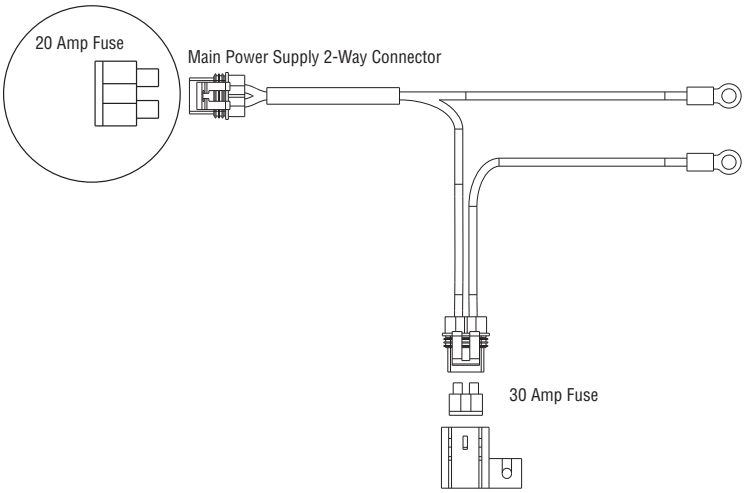
Code 72 (SID 59, FMI 7), Failed to Select Rail Test

Step A	Procedure	Condition	Action
	1. Key off. 2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.	→	
		If no problem found →	Go to **Step B.**
		If problem is found →	Repair power/ground path for the main power supply. Go to **Step V.**



Code 72 (SID 59, FMI 7), Failed to Select Rail Test, continued

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Insert 20-amp fuse into Motor Supply 2-way connector. →	If fuse blows immediately →	Go to **Step C.**
		If fuse does not blow immediately →	Repair wiring from the battery to the Transmission ECU. Go to **Step V.**



Step C	Procedure	Condition	Action
	1. Key off.		
	2. Remove Electric Shifter from Shift Bar Housing.		
	3. Inspect the Shift Bar Housing: →	If no problem found →	**Replace Electric Shifter** (Only if Fault Code is Active). Go to **Step V.**
	• Shift Blocks • Shift Rails • Inspect electric shifter for evidence of lube contamination	If problem found →	Repair as required. Go to **Step V.**

Code 72 (SID 59, FMI 7), Failed to Select Rail Test, continued

Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Key on.		
	4. Clear codes (see page 1-4)		
	5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4) →	If no codes →	Test complete.
		If code 72 appears →	Return to **Step A** to find error in testing.
		If code other than 72 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

System Code: 73 (SID 58, FMI 7) Failed to Engage Gear

Overview

This fault code indicates the transmission is unable to engage the desired gear in the front box during a shift.

Detection

The transmission detects this by attempting the same shifter actions five times and not sensing the desired position.

Fallback

This fault causes an In Place fallback.

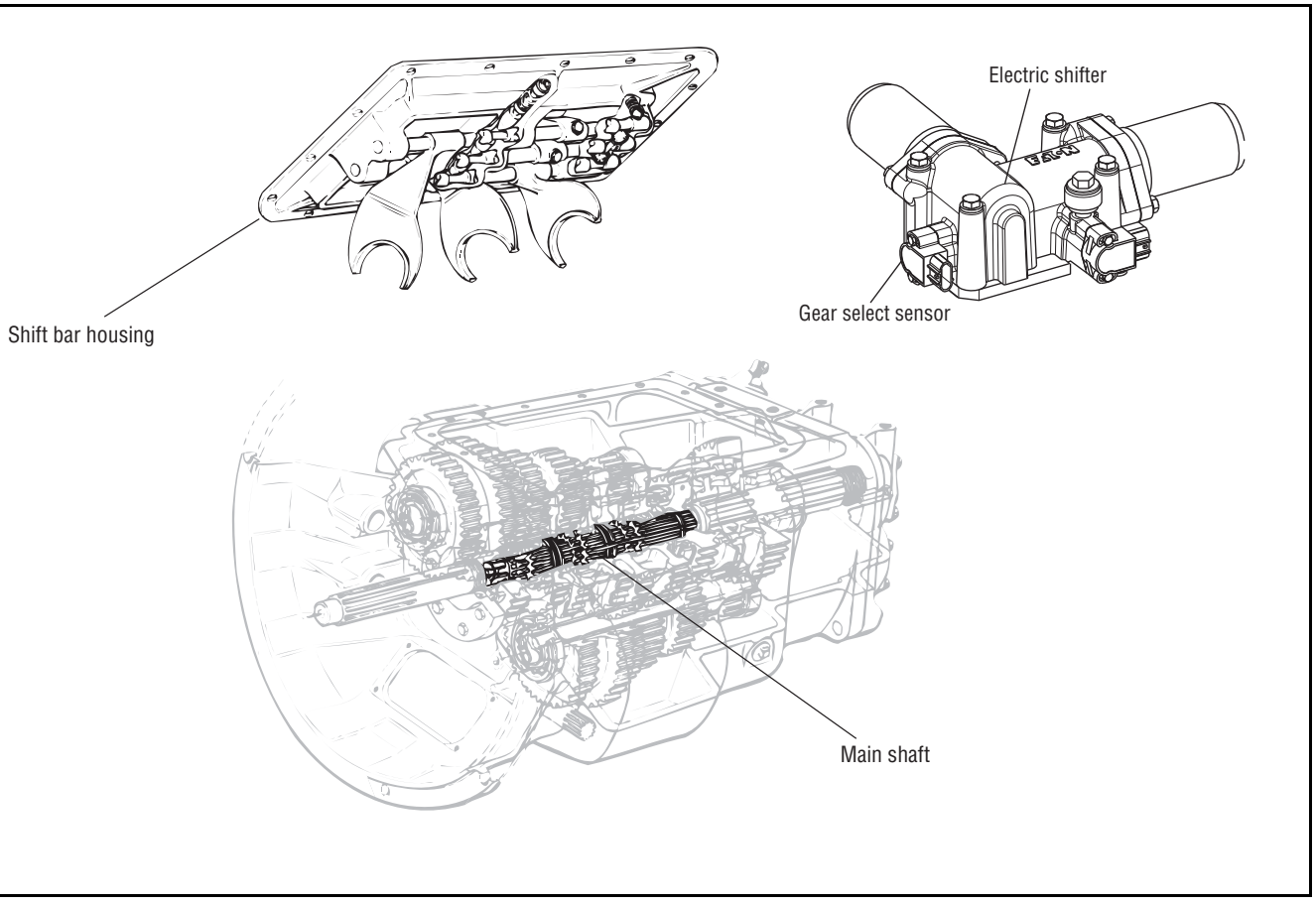
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

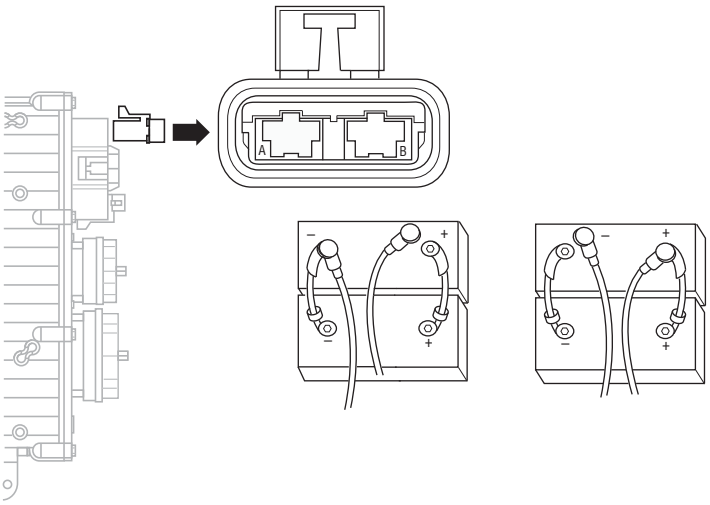
This fault code can be caused by any of the following:

- Electric Shifter
- Yoke / Clutch / Main Shaft
- Gear Select Sensor
- Shift Block



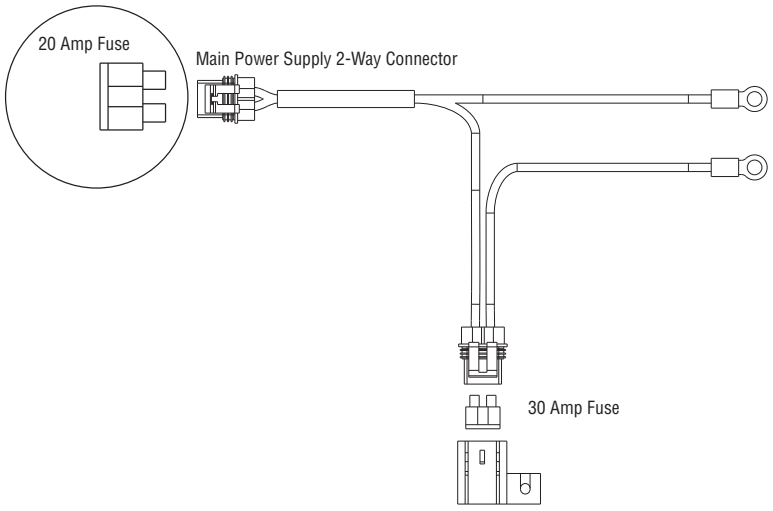
Code 73 (SID 58, FMI 7), Failed to Engage Gear Test

Step A	Procedure	Condition	Action
	1. Key off. 2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.	→	
		If no problem found →	Go to **Step B.**
		If problem is found →	Repair power/ground path for the main power supply. Go to **Step V.**



Code 73 (SID 58, FMI 7), Failed to Engage Gear Test, continued

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Insert 20-amp fuse into Motor Supply 2-way connector. →	If fuse blows immediately →	Go to **Step C.**
		If fuse does not blow immediately →	Repair wiring from the battery to the Transmission ECU. Go to **Step V.**



Step C	Procedure	Condition	Action
	1. Key off.		
	2. Remove Electric Shifter from Shift Bar Housing.		
	3. Inspect the Shift Bar Housing: • Shift Blocks → • Shift Rails • Inspect electric shifter for evidence of lube contamination	If no problem found →	**Replace Electric Shifter (Only if Fault Code is Active).** Go to **Step V.**
		If problem found →	Repair as required. Go to **Step V.**

Code 73 (SID 58, FMI 7), Failed to Engage Gear Test, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear codes (see page 1-4) 5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4)	If no codes →	Test complete.
		If code 73 appears →	Return to **Step A** to find error in testing.
		If code other than 73 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

System Code: 74 (SID 54, FMI 7, 10, 12) Failed to Synchronize

Overview

This fault code indicates the transmission is unable to use system controls to synchronize during a shift.

Detection

If there is engine communication on the J1939 Link and the engine does not respond to transmission speed and torque commands, the code will set. Failure of the Inertia Brake system to slow the Input Shaft will also set the code.

Fallback

If the failure occurs while moving, it could cause a 1-speed fallback. Once the vehicle is stopped, starting gear and reverse gear can be engaged. However, if it is the Inertia Brake system that failed, it may be difficult to engage a gear from a stop if the Inertia Brake was providing assistance (due to a poorly adjusted clutch).

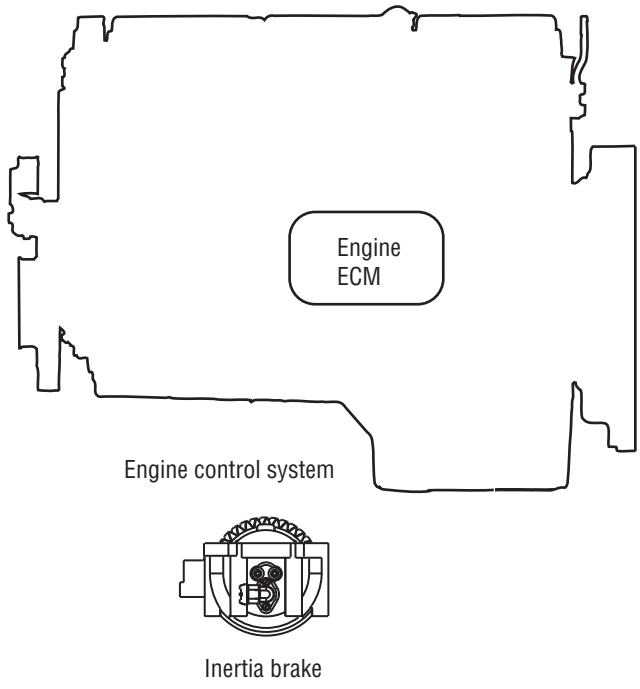
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- PC-based Service Tool
- Troubleshooting Guide

Possible Causes

This fault code can be caused by any of the following:

- Clutch Out of Adjustment
- Damaged Input Shaft Brake
- Inertia Brake
- Engine Control System



Code 74 (SID 54, FMI 7, 10, 12), Failed to Synchronize Test

Step A	Procedure	Condition	Action
	1. Is transmission equipped with an Inertia Brake?	If the transmission is equipped with Inertia Brake	Go to **Step B.**
		If the transmission is not equipped with Inertia Brake	Go to **Step C.**

Step B	Procedure	Condition	Action
	1. Key on.		
	2. Connect ServiceRanger, select “Advanced Product Functions”.		
	3. Start engine, PTO must be disengaged.		
	4. Select “Inertia Brake Test”.		
	5. Run test and follow instructions.	Test passes	Go to **Step V.**
		Test fails	**Replace Inertia Brake. G**o to **Step V.**
		Test aborts	Correct displayed test failure condition and retest.

Step C	Procedure	Condition	Action
	1. Key on.		
	2. Retrieve codes (see page 1-4).	If code 74 is active	Contact the OEM because the engine is failing to respond to the transmissions command during a shift.
		If code is not active	Test complete.

Code 74 (SID 54, FMI 7, 10, 12), Failed to Synchronize Test

Step V	Procedure	Condition	Action
	1. Key on.		
	2. Clear codes (see page 1-5).		
	3. Drive the vehicle and attempt to reset the code.		
	4. Check for codes (see page 1-4).	If no codes →	Test complete.
		If code 74 appears →	Return to **Step A** to find error in testing.
		If code other than 74 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11).

Code 74 (SID 54, FMI 7, 10, 12), Failed to Synchronize Test

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Code 74 (SID 54, FMI 7, 10, 12), Failed to Synchronize Test

Code 74 (SID 54, FMI 7, 10, 12), Failed to Synchronize Test

Component Code: 81 (SID 47, FMI 7) Gear Engagement Detected

Overview

The transmission controller has detected that the shift finger position indicates neutral and a comparison of input and main shaft speeds indicate the transmission is in gear. The comparison of shaft speeds is only performed when the vehicle is moving and a shift is in process.

Detection

- The fault is detected after the transmission ECU powers up and a non-neutral condition is detected during a shift.
- FMI 7 - The transmission controller detected an inaccurate finger position.

Fallback

This fault causes an in-place fallback. The transmission will remain in current gear.

Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- ServiceRanger version 2.5 or newer

Possible Causes

This fault code can be caused by any of the following:

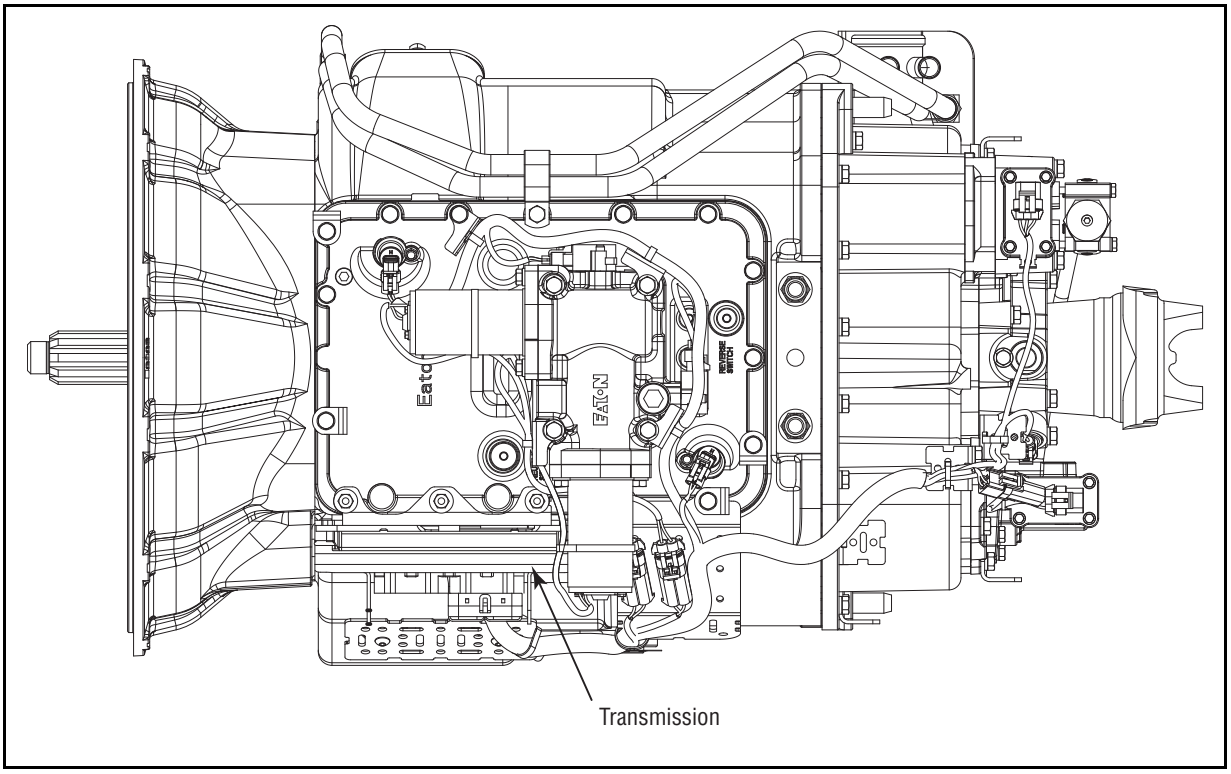
- Worn internal transmission components.

Conditions to Recreate Fault

- Only set during a shift.

Conditions to Clear Fault

- The fault becomes inactive after power down.



Code 81 (SID 47, FMI 7), Gear Engagement Detected

Step A	Procedure	Condition	Action
	1. Key on.		
	2. Retrieve codes (see page 1-4). →	If code 81 is active or inactive →	Customer - Call Eaton at 1-800-826-HELP (4357). CSC - Call Technician Service.

System Code: 83 (SID 18, FMI 14) Missing Lever

Overview

This fault code indicates the Eaton Shift Lever or the OEM Shift Lever is not sensing any lever positions.

Detection

Starting at key-on and throughout operation, the Shift Control constantly measures the feedback from the Shift Lever circuit. If the Shift Lever reports no lever positions are sensed, the fault code is set. To allow the Shift Control to detect this fault, it is necessary to turn the key-on since it constantly monitors for failure mode.

Fallback

This fault causes a downshift only fallback and shifts to neutral when the vehicle stops.

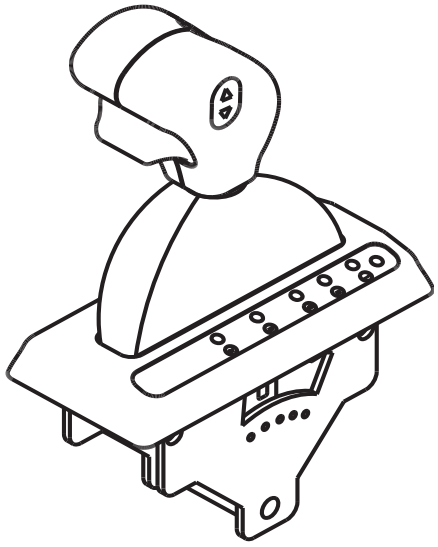
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Troubleshooting Guide

Possible Causes

This fault code can be caused by any of the following:

- Eaton Shift Lever or OEM Shift Lever



Shift Lever

Code 83 (SID 18, FMI 14), Missing Lever Test

Step A	Procedure	Condition	Action
	1. Key on.		
	2. Retrieve Codes (see page 1-4) →	If code 83 is active →	Replace Eaton Shift Lever or OEM Shift Lever.
		If 83 is inactive →	Test complete.

System Code: 91
(SID 236, FMI 5)
Power Connection

Overview

This fault code indicates an excessive resistance has been detected between the power supply source (battery or starter) and the transmission controller.

Detection

The fault is detected during power down.

Fallback

None

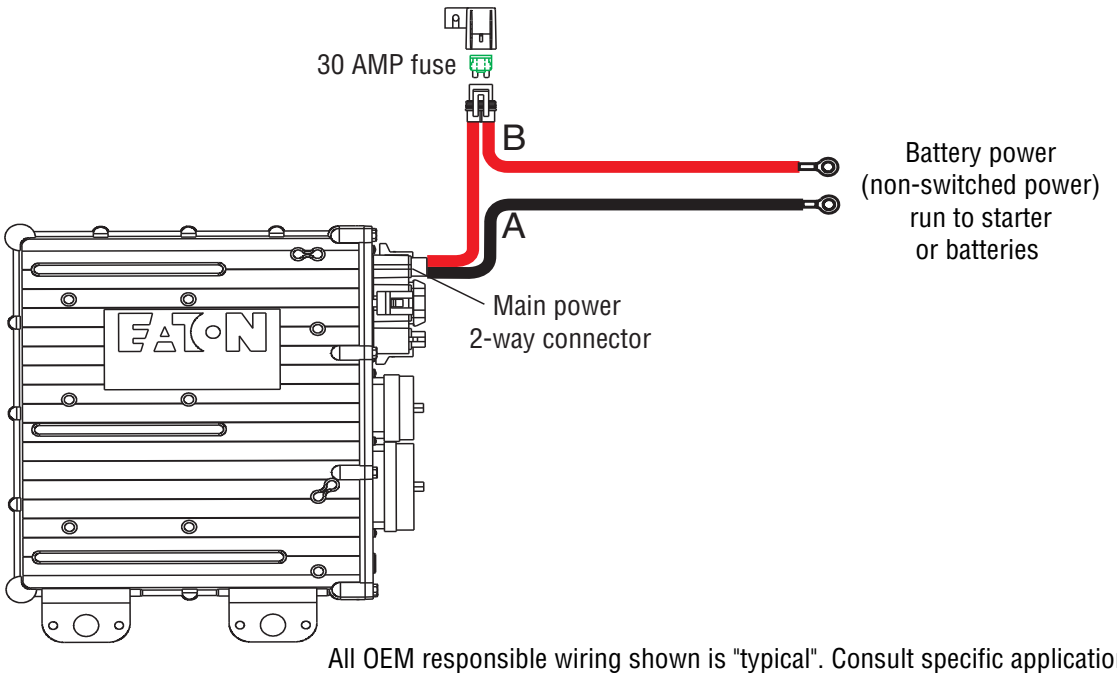
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Troubleshooting Guide

Possible Causes

This fault code can be caused by any of the following:

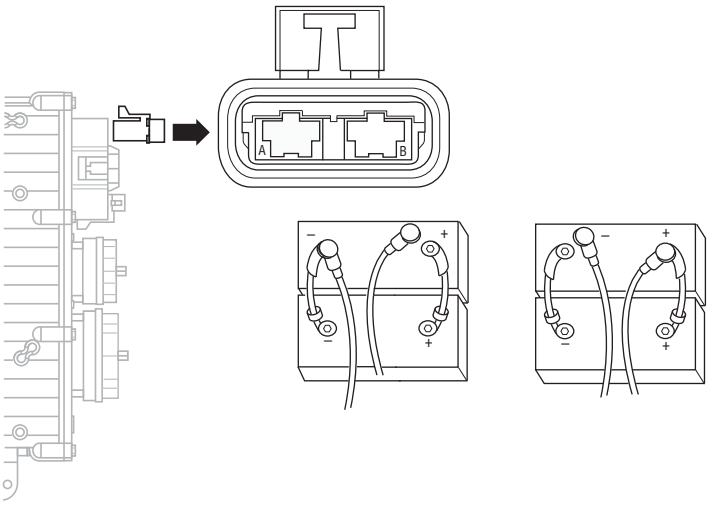
- OEM Wiring Harness between battery or starter and transmission controller.



All OEM responsible wiring shown is "typical". Consult specific application.
(B) = +12 volt non-switched from battery
(A) = Signal returns, grounds, and general OEM wiring

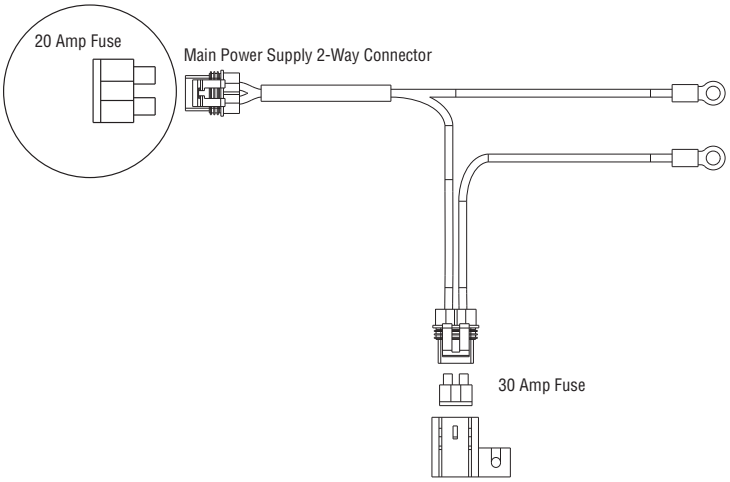
Code 91 (SID 236, FMI 5), Power Connection Test

Step A	Procedure	Condition	Action
	1. Key off. 2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.	→	
		If no problem found →	Go to **Step B**
		If problem is found →	Repair power/ground path for the main power supply. Go to **Step V.**



Code 91 (SID 236, FMI 5), Power Connection Test, continued

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Insert 20-amp fuse into Main Power Supply 2-way connector. →	If fuse blows immediately →	Go to **Step V.**
		If fuse does not blow immediately →	Repair wiring from the battery to the Transmission ECU. Go to **Step V.**



Step V	Procedure	Condition	Action
	1. Key off.		
	2. Clean and reconnect all connectors.		
	3. Key on.		
	4. Clear codes (see page 1-4)		
	5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4) →	If no codes →	Test complete.
		If code 91 appears →	Return to **Step A** to find error in testing.
		If code other than 91 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Code 91 (SID 236, FMI 5), Power Connection Test, continued

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System Code: 92
(SID 168, FMI 14)
Weak System Battery Voltage

Overview

This fault code indicates that the vehicle is supplying weak battery voltage to the transmission.

Detection

The fault is detected when vehicle battery voltage is below 9 volts for a period of at least 10 seconds.

Fallback

If this fault occurs while moving, it causes an inplace fallback. Once the vehicle is stopped, the starting gear and reverse can be engaged.

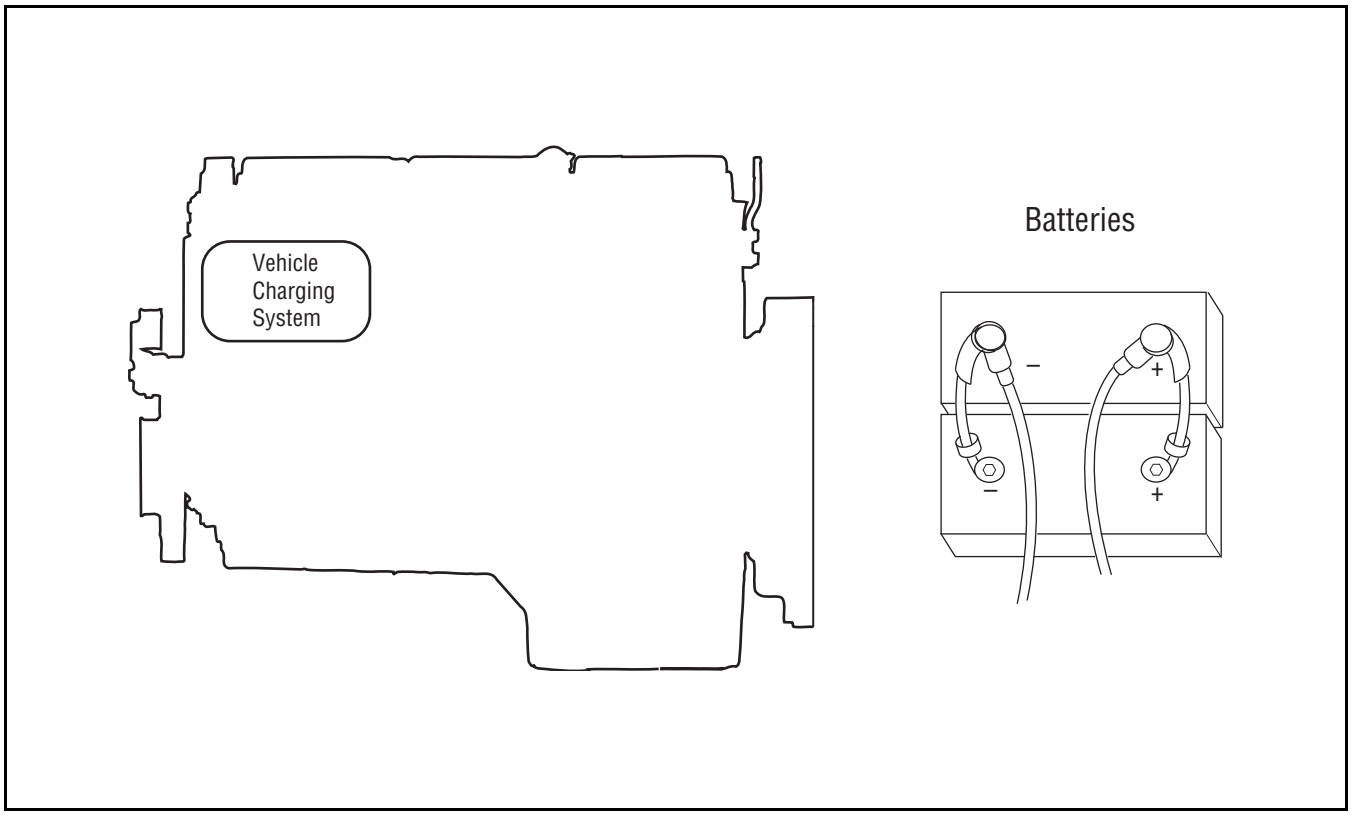
Required Tools

- Basic Hand Tools
- Troubleshooting Guide

Possible Causes

This fault code can be caused by any of the following:

- Vehicle charging system or battery integrity



Code 92 (SID 168, FMI 14), Weak System Battery Voltage Test

Step A	Procedure	Condition	Action
	1. Key off. 2. If fault code 92 is present, inactive or active. 3. Inspect vehicle charging system and battery integrity to ensure battery voltage does not drop below 9 volts during normal operation. →	If no problem found →	Go to **Step V.**
		If problem is found →	Repair vehicle changing system and or battery integrity. Go to **Step V.**

Step V	Procedure	Condition	Action
	1. Key on. 2. Clear codes (see page 1-4) 3. Use Driving Techniques to attempt to reset the code (see page 1-6) 4. Check for codes (see page 1-4) →	If no codes →	Test complete.
		If code 92 appears →	Return to **Step A** to find error in testing.
		If code other than 92 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

System Code: 93
(SID 231, FMI 14)
Loss of J1939 Communication from the Engine

Overview

This fault code indicates the System Controller is broadcasting J1939 messages and receiving J1939 messages, but has not received J1939 messages from the engine.

Detection

The fault is detected if J1939 communication from the engine is lost for 5 seconds.

Fallback

If the fault occurs while moving, it causes a 1-speed fallback. Once vehicle has stopped, the starting gear and reverse can be engaged. If the failure occurs at system initialization, it causes an AutoSelect fallback mode.

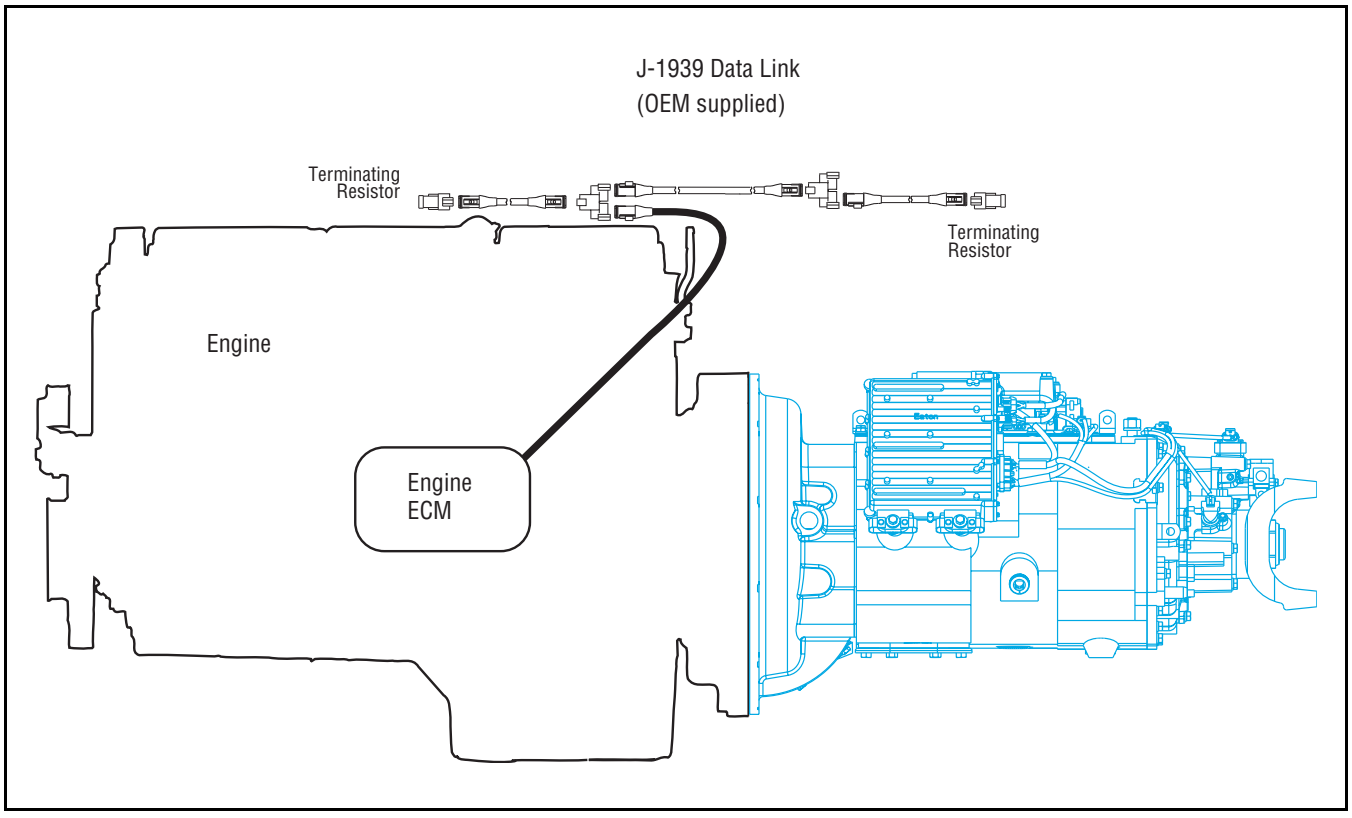
Required Tools

- Basic Hand Tools
- Troubleshooting Guide

Possible Causes

This fault code can be caused by any of the following:

- OEM supplied J1939 harness
- Engine ECM



Code 93 (SID 231, FMI 14), Loss of J1939 Communication from the Engine Test

Step A	Procedure	Condition	Action
	1. Key on. 2. If fault code 93 is present, inactive or active. 3. Inspect OEM J1939 harness. →	If problem found with harness →	Repair OEM J1939 harness. Go to **Step V.**
		If no problem is found with harness →	Problem exists with engine ECM. Repair according to vehicle manufacturer's recommendations. Go to **Step V.**

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear codes (see page 1-4) 5. Use Driving Techniques to attempt to reset the code (see page 1-6)		
	6. Check for codes (see page 1-4) →	If no codes →	Test complete.
		If code 93 appears →	Return to **Step A** to find error in testing.
		If code other than 93 appears →	Go to **Fault Code Isolation Procedure Index** (see page 1-11)

Electrical System

Overview

The test does not relate to any specific fault code, but must be completed before performing Fault Code Isolation Table procedures. The pretest verifies the basic electrical inputs before testing individual circuits.

Detection

There is no detection process specifically for the basic electrical supply. However, failures of this type are generally detected by the transmission or driver as some other type of fault code or symptom.

Fallback

There is no fallback for the electrical pretest, however, it may effect other systems.

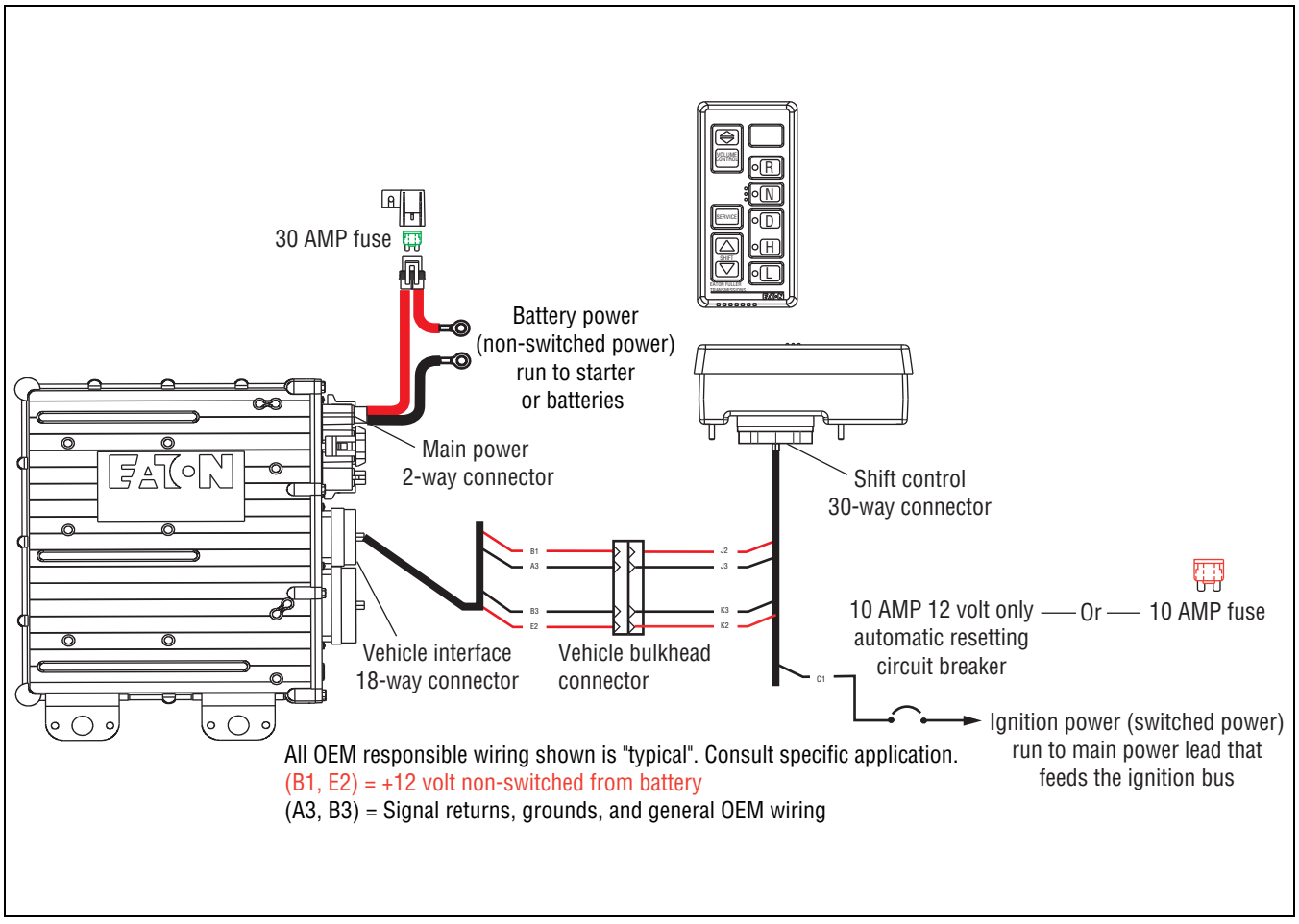
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

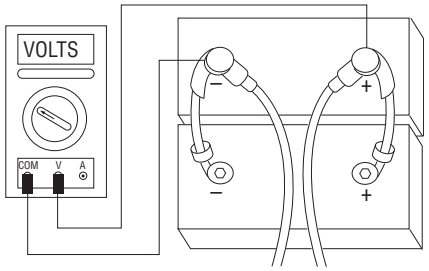
This pretest can be used for any of the following:

- Corroded Power Contacts
- Blown Fuse
- Wiring Harness
- Low Batteries
- Transmission Controller



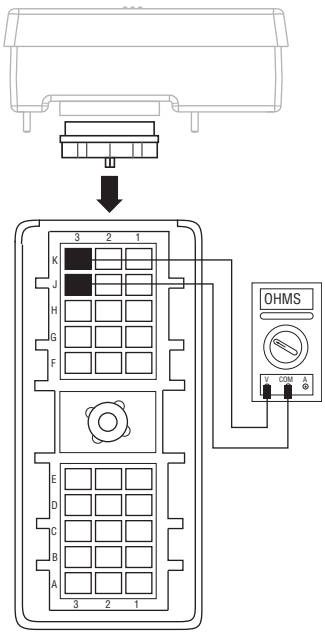
Electrical System Test

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Inspect starter/battery connections for integrity.		
	3. Measure voltage across batteries and load test the batteries.	If voltage is 11 to 13 volts on a 12 volt system or	
		22 to 26 on a 24 volt system and the batteries pass the load test	Go to **Step B.**
		If voltage is outside of range or batteries fail the load test	Repair or replace batteries and charging system as required. Repeat this step.



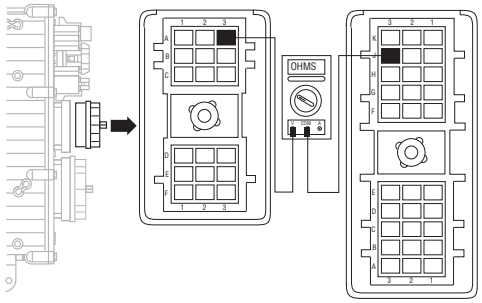
Electrical System Test, continued

Step B	Procedure	Condition	Action
	1. Key off. 2. Disconnect negative (-) battery cable. 3. Disconnect Shift Control 30-way connector. 4. Measure resistance between Shift Control 30-way pins J3 and K3.	If resistance is 0 to 1 ohms	Go to **Step E.**
		If resistance is outside of range	Go to **Step C.**



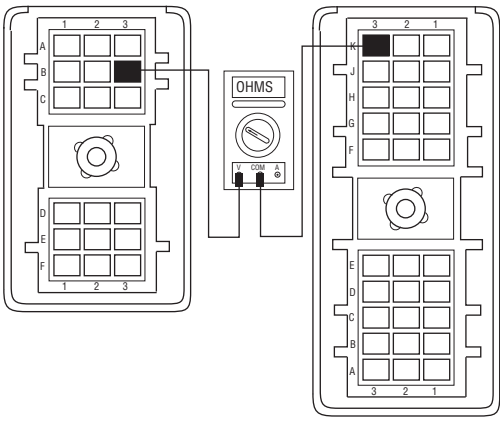
Electrical System Test, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Disconnect vehicle interface harness 18-way connector from the Transmission Controller.		
	3. Measure resistance from vehicle interface 18-way connector pin A3 and Shift Control 30-way connector pin J3.	If resistance is 0 to .3 ohms	Go to **Step D.**
		If resistance is outside of range	Repair OEM wiring from the Transmission Controller to Shift Control. Reconnect all connectors. Go to **Step A.**



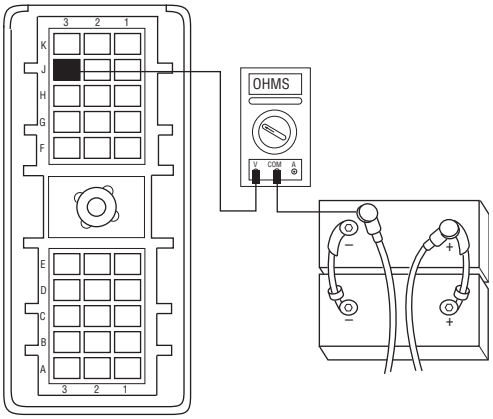
Electrical System Test, continued

Step D	Procedure	Condition	Action
	1. Key off.		
	2. Measure resistance from vehicle interface 18-way connector pin B3 and Shift Control 30-way connector pin K3.	If resistance is 0 to .3 ohms	**Replace Transmission Controller.** Reconnect all connectors. Go to **Step A.**
		If resistance is outside of range	Repair OEM wiring from the Transmission Controller to Shift Controller. Reconnect all connectors. Go to **Step A.**



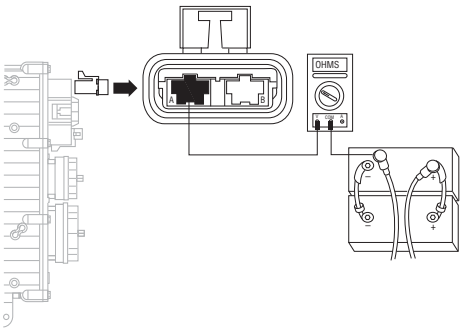
Electrical System Test, continued

Step E	Procedure	Condition	Action
	1. Key off.		
	2. Measure resistance from Shift Control 30-way connector pin J3 and negative (-) battery cable	If resistance is 0 to .3 ohms	Go to **Step G.**
		If resistance is outside of range	Go to **Step F.**



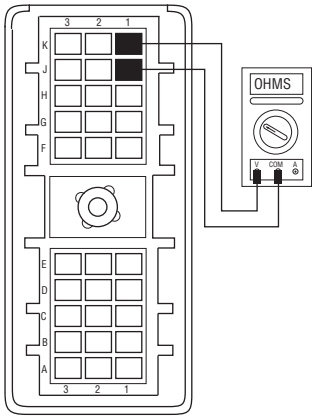
Electrical System Test, continued

Step F	Procedure	Condition	Action
	1. Key off. 2. Disconnect the main power 2-way connector on the Transmission Controller.		
	3. Measure resistance between the main power 2-way connector pin A and the negative (-) battery cable.	If resistance is 0 to .3 ohms →	**Replace Transmission Controller.** Reconnect all connectors. Go to **Step A.**
		If resistance is outside of range →	Repair ground path for the transmission. Reconnect all connectors. Go to **Step A.**



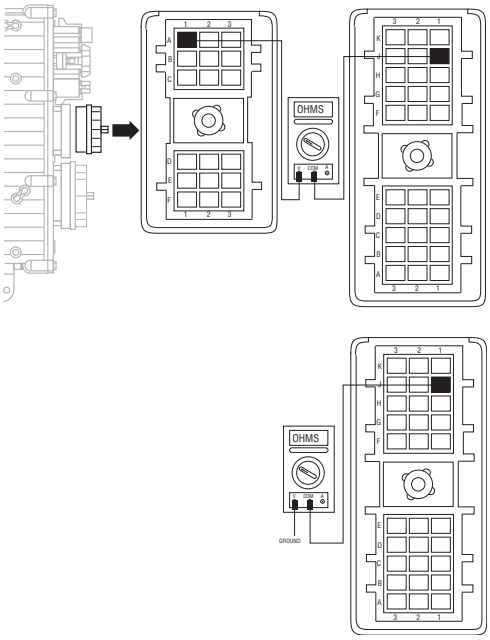
Electrical System Test, continued

Step G	Procedure	Condition	Action
	1. Key off.		
	2. Measure resistance from Shift Control 30-way connector pins J1 and K1	If pin J1 and K1 resistance is 0 to 1 ohms	Go to **Step J.**
		If the above conditions are not met	Go to **Step H.**



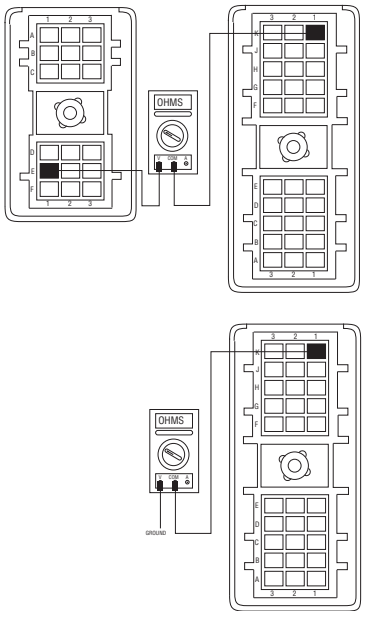
Electrical System Test, continued

Step H	Procedure	Condition	Action
	1. Key off. 2. Disconnect the Transmission Controller 18-way connector. 3. Measure resistance from: • Vehicle interface 18-way connector pin A1 and Shift Control 30-way connector pin J1. • Shift Control 30-way connector J1 and ground.	If pin A1 and J1 resistance is 0 to .3 ohms and	
		If pin J1 and ground resistance is more than 10K ohms or open circuit [OL]	Go to **Step I.**
		If any of the above conditions are not met	Repair OEM wiring from the Transmission Controller to Shift Controller. Reconnect all connectors. Go to **Step A.**



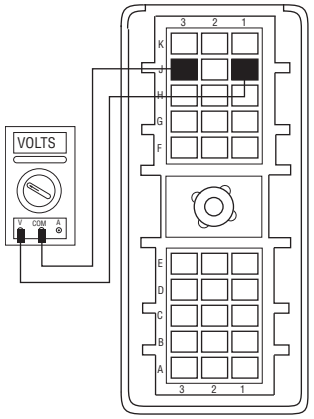
Electrical System Test, continued

Step I	Procedure	Condition	Action
	1. Key off.		
	2. Measure resistance from: • Vehicle interface 18-way connector pin E1 and Shift Control 30-way connector pin K1 • Shift Control 30-way connector K1 and ground	If pin E1 and K1 resistance is 0 to .3 ohms and	
		If pin K1 and ground resistance is more than 10K ohms or open circuit [OL]	**Replace Transmission Controller.** Reconnect all connectors. Go to **Step A.**
		If any of the above conditions are not met	Repair OEM wiring from the Transmission Controller to Shift Controller. Reconnect all connectors. Go to **Step A.**



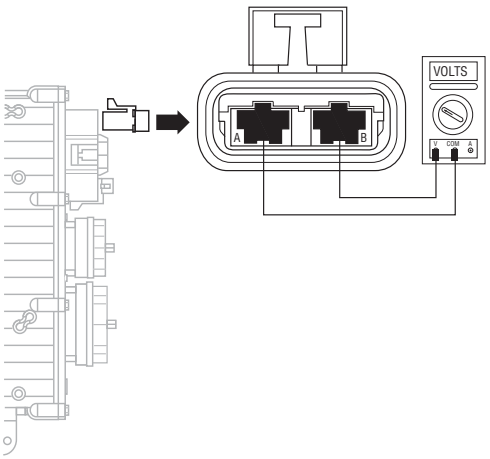
Electrical System Test, continued

Step J	Procedure	Condition	Action
	1. Key off. 2. Reconnect negative (-) battery cable.		
	3. Measure voltage between Shift Control 30-way connector pin J1 and J3.	If voltage between pins J1 and J3 is within .6 volts of battery voltage	Go to **Step L.**
		If voltage is outside of range	Go to **Step K.**



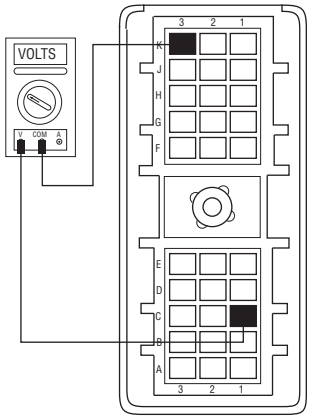
Electrical System Test, continued

Step K	Procedure	Condition	Action
	1. Key off. 2. Disconnect the main power 2-way connector on the Transmission Controller.		
	3. Measure voltage between the main power 2-way connector pins A and B.	If voltage is within .6 volts of battery voltage	**Replace Transmission Controller.** Reconnect all connectors. Go to **Step A.**
		If voltage is outside of range	Repair battery power supply to the transmission. Fuse may be blown. Reconnect all connectors. Go to **Step A.**



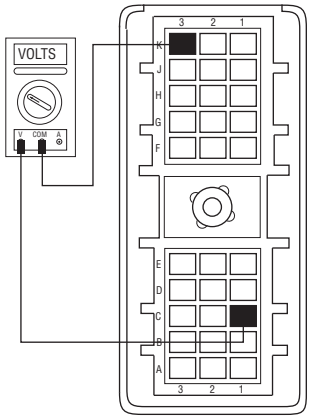
Electrical System Test, continued

Step L	Procedure	Condition	Action
	1. Key off.		
	2. Measure voltage between Shift Control 30-way connector pins C1 and K3.	If voltage is less than .6 volts	Go to **Step M.**
		If voltage is outside of range	Constant ignition power. Repair ignition supply to the transmission. Repeat this step.



Electrical System Test, continued

Step M	Procedure	Condition	Action
	1. Key on.		
	2. Measure voltage between Shift Control 30-way connector pins C1 and K3.	If voltage is within .6 volts of battery voltage	Test complete.
		If voltage is outside of range	No ignition power. Repair ignition supply to the transmission. Repeat this step.



Front Box Control

Overview

This symptom-driven test is performed if the service lamp is on constantly and/or "-" is displayed on the Gear Display, and there are no active or inactive codes

Detection

Turn the key on and watch the Gear Display. If the Gear Display shows "-" constantly, the Transmission Controller was not able to confirm front box control.

Any time the service lamp is flashing, go to Diagnostics Procedure (page1-2).

Fallback

This fault causes an In Place fallback while moving, and it causes a failure during system initialization. A "-" will appear on the Gear Display.

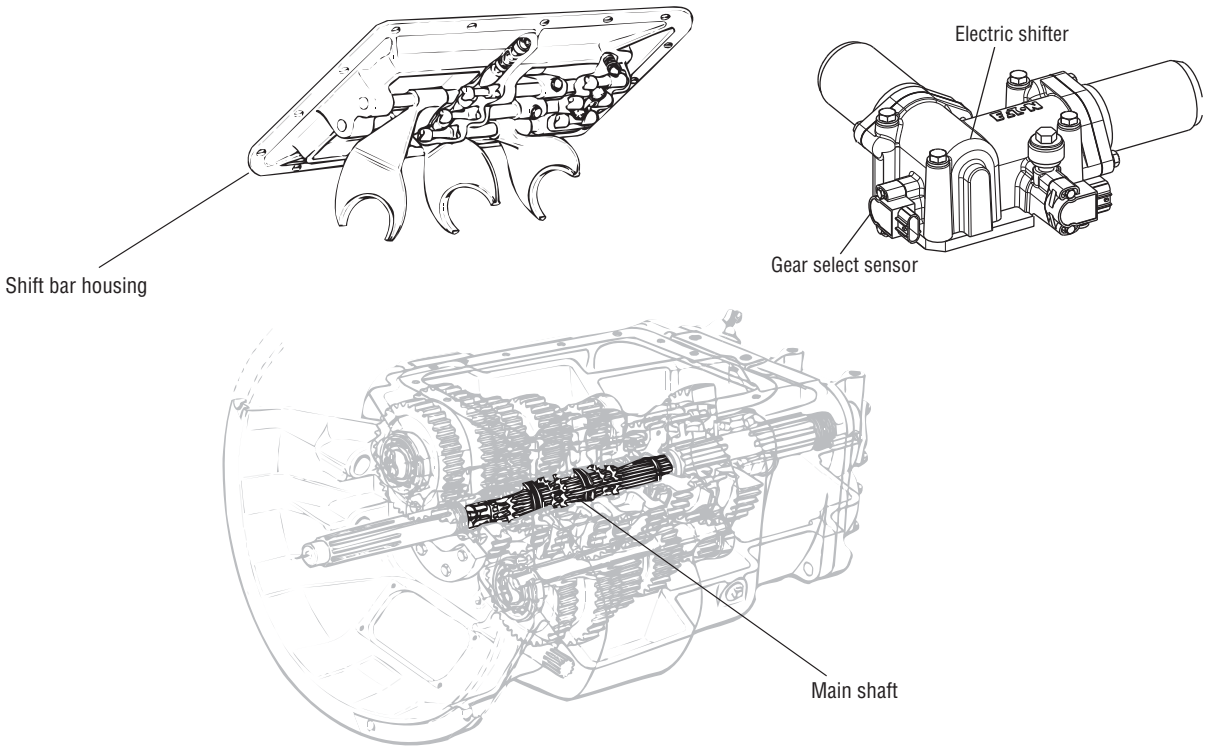
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

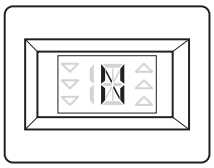
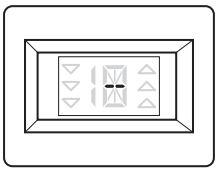
Possible Causes

This symptom can be caused by any of the following:

- Electric Shifter
- Yoke / Clutch / Main Shift
- Shift Block
- Gear Select Sensor

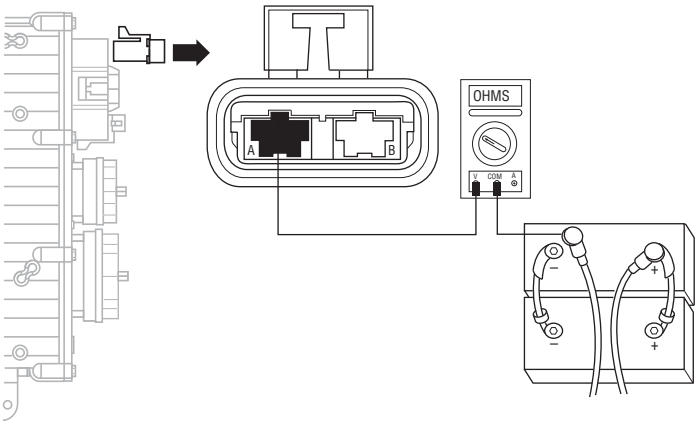


Front Box Control Test

Step A	Procedure	Condition	Action
	1. Key on.		
	2. Place shift control in neutral.		
	3. Depress clutch pedal, however, do not engage the input shaft brake (clutch brake).		
	4. Observe Gear Display. **Note:** If service lamp is flashing, go to Diagnostics Procedure (page 1-2).	If Gear Display shows: "N" 	→ Test complete.
		If Gear Display shows: "-" 	→ Go to **Step B.**

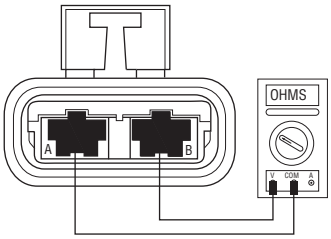
Front Box Control Test, continued

Step B	Procedure	Condition	Action
	1. Key off. 2. Disconnect negative (-) battery cable. 3. Disconnect main power 2-way connector from the Transmission Controller.		
	4. Measure resistance between main power 2-way connector pin A and negative (-) battery cable.	If resistance is 0 to .3 ohms	Go to **Step C.**
		If resistance is outside of range	Check battery and ground supply to the Transmission Controller. Repeat this step. If problem continues, repair main power harness to the Transmission Controller. Go to **Step V.**



Front Box Control Test, continued

Step C	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect negative (-) battery cable.		
	3. Measure voltage across main power 2-way connector pins A and B. →	If voltage is within .6 volts of battery voltage →	Go to **Step D.**
		If voltage is outside of range →	Check battery and ground supply to the Transmission Controller. Repeat this step. If problem continues, repair main power harness to the Transmission. Go to **Step V.**



Step D	Procedure	Condition	Action
	1. Key off.		
	2. Remove Electric Shifter from Shift Bar Housing.		
	3. Inspect the Shift Bar housing: • Shift Blocks • Shift Rails → • Inspect electric shifter for evidence of lube contamination	If no problem found →	**Replace Electric Shifter.** Go to **Step V.**
		If problem found →	Repair as required. Go to **Step V.**

Front Box Control Test, continued

Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Place Shift Control into neutral.		
	4. Key on. →	If Gear Display displays a solid “N” →	Test complete.
		If Gear Display does not display a solid “N” →	Return to **Step A** to find error in testing.

Front Box Control Test, continued

Gear Display Power Supply

Overview

This symptom-driven test is performed if Gear Display is not working, and there are no active or inactive codes.

Detection

The Shift Control has no fault detection capability for this failure. The failure is observed by the driver when operating the vehicle. To observe this failure, operate the vehicle and monitor the Gear Display.

Fallback

This symptom has no effect on vehicle operation, however, the Gear Display may not function.

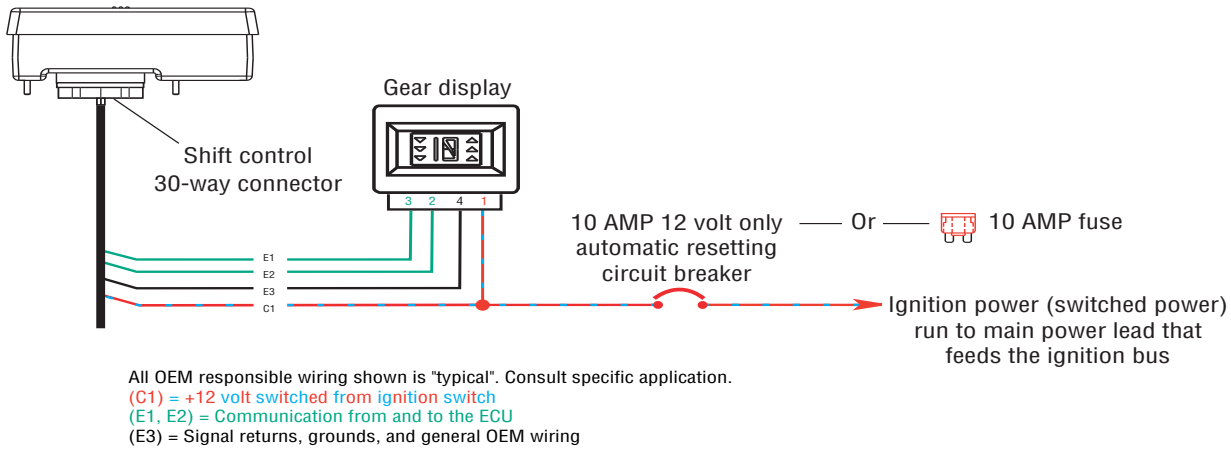
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- Data Link Tester

Possible Causes

This symptom can be caused by any of the following:

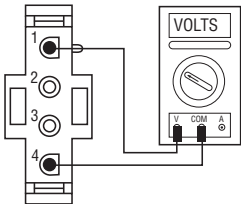
- Gear Display
- Vehicle Harness
- Ignition Power Supply
- Shift Control



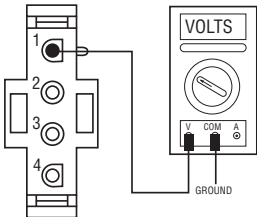
All OEM responsible wiring shown is "typical". Consult specific application.
(C1) = +12 volt switched from ignition switch
(E1, E2) = Communication from and to the ECU
(E3) = Signal returns, grounds, and general OEM wiring

Gear Display Power Supply Test

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Remove the dash panel and unplug the Gear Display 4-way connector from the Dash Harness.		
	3. Key on.		
	4. Measure voltage between Gear Display 4-way connector pins 1 and 4.	If voltage is within .6 volts of battery voltage	Go to **Step D.**
		If voltage is outside of range	Go to **Step B.**

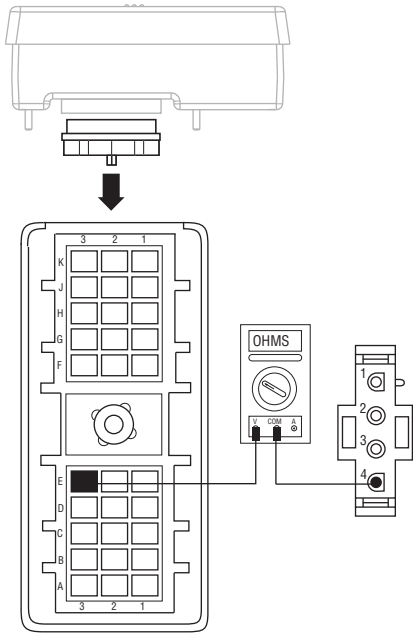


Step B	Procedure	Condition	Action
	1. Key on.		
	2. Measure voltage between Gear Display 4-way connector pin 1 and ground.	If voltage is within .6 volts of battery voltage	Go to **Step C.**
		If voltage is outside of range	Repair ignition supply to Gear Display. Go to **Step V.**



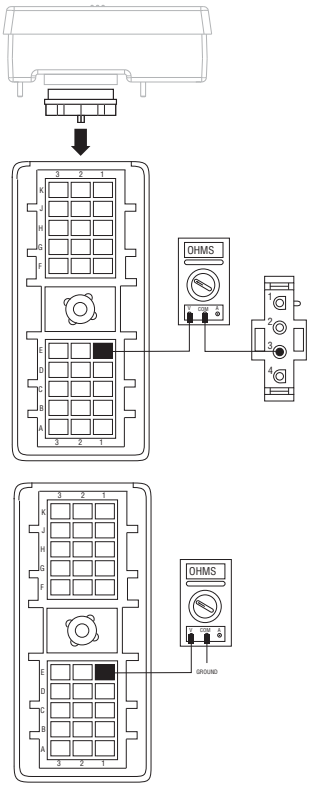
Gear Display Power Supply Test, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Disconnect Shift Control 30-way connector. 3. Measure resistance between Shift Control 30-way connector pin E3 and Gear Display 4-way connector pin 4.	If resistance is within 0 to .3 ohms	Go to **Step D.**
		If resistance is outside of range	Repair harness between Gear Display and Shift Control. Go to **Step V.**



Gear Display Power Supply Test, continued

Step D	Procedure	Condition	Action
	1. Key on. 2. Disconnect Shift Control 30-way connector. 3. Measure resistance between: • Shift Control 30-way connector pin E1 and Gear Display 4-way connector pin 3 • Shift Control 30-way connector pin E1 and ground	If resistance between pins E1 and 3 is 0 to .3 ohms and	
		If resistance between pin E1 and ground is 10K ohms or open circuit [OL]	Go to **Step E.**
		If any of the above conditions are not met	Repair harness between Gear Display and Shift Control. Go to **Step V.**



Gear Display Power Supply Test, continued

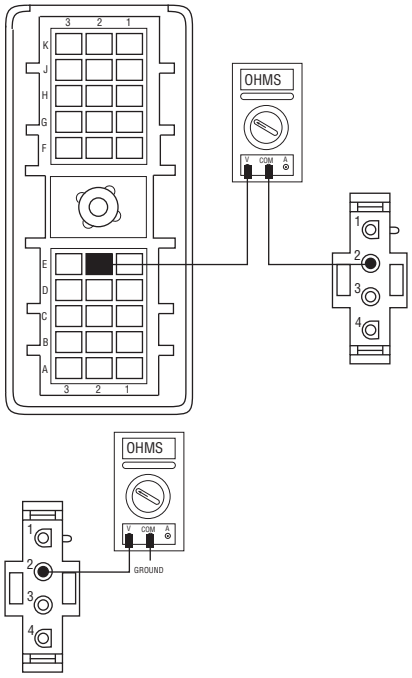
Step E	Procedure	Condition	Action

1. Key off.
2. Measure resistance between:
   - Shift Control 30-way connector pin E2 and Gear Display 4-way connector pin 2
   - Gear Display 4-way connector pin 2 and ground

→ If resistance between pins E2 and 2 is 0 to .3 ohms and

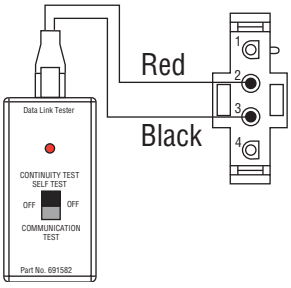
→ If resistance between pin 2 and ground is 10K ohms or open circuit [OL] → Go to **Step F.**

→ If any of the above conditions are not met → Repair harness between Gear Display and Shift Control. Go to **Step V.**



Gear Display Power Supply Test, continued

Step F	Procedure	Condition	Action
	1. Key off. 2. Reconnect Shift Control 30-way connector. 3. Connect the Data Link Tester across the Gear Display 4-way connector pins 2 and 3. 4. Key on. 5. Place the Data Link Tester in the communication test mode.	If test passed	**Replace Gear Display.** Go to **Step V.**
		If test failed	**Replace Shift Control.** Go to **Step V.**



Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Drive the vehicle to determine whether the complaint has been repaired.	If complaint was repaired	Test complete.
		If complaint was not repaired	Return to **Step A** to find error in testing.

Start Enable Relay Contact

Overview

This symptom-driven test is performed if the engine does not start with the Shift Lever in neutral, and there are no active or inactive codes.

Detection

The Shift Control has no fault detection capability for this failure. The failure is observed by the driver when operating the vehicle. To observe this failure, attempt to start the vehicle.

Fallback

This symptom has no effect on vehicle operation, however, if the failure occurred before the engine was started, it is possible the engine will not start.

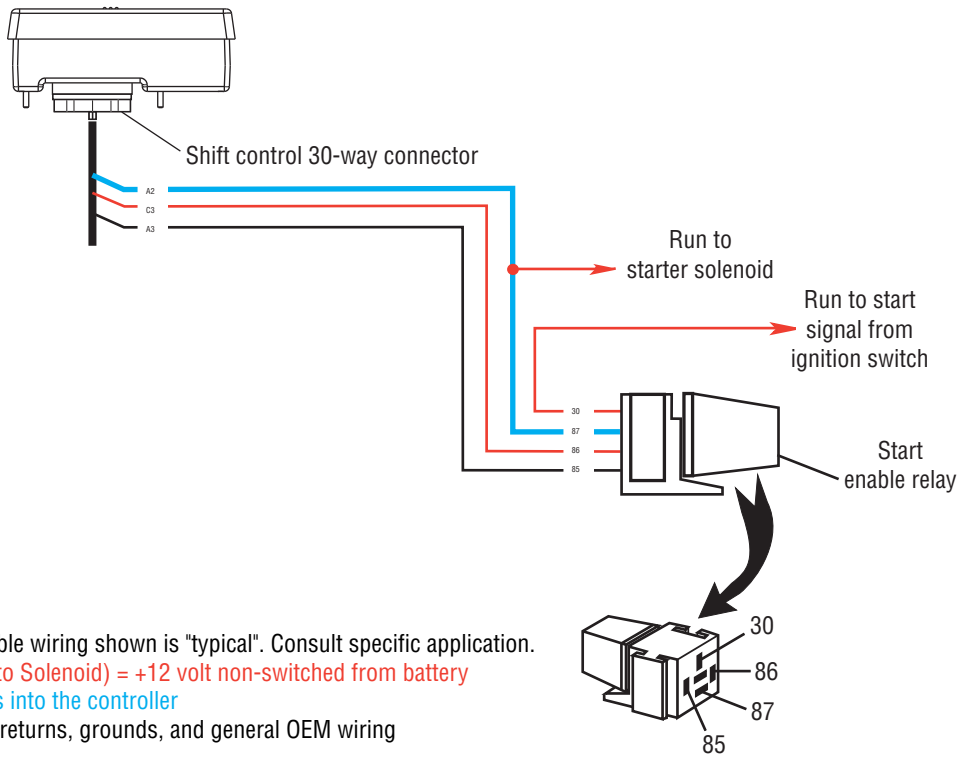
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

This symptom can be caused by any of the following:

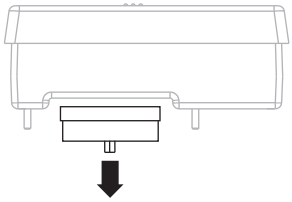
- Start Enable Relay
- Starter Solenoid Wiring



All OEM responsible wiring shown is "typical". Consult specific application.
(C3, 30, 86, Run to Solenoid) = +12 volt non-switched from battery
(A2, 87) = Signals into the controller
(A3, 85) = Signal returns, grounds, and general OEM wiring

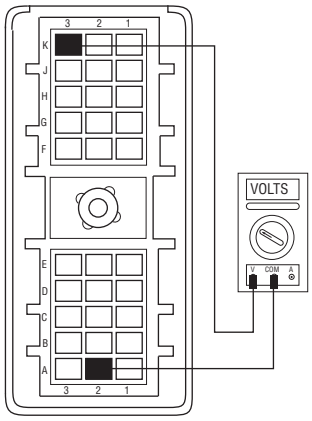
Start Enable Relay Contact Test

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect Shift Control 30-way connector.		
	3. Key on.		
	4. Engage Starter. →	If engine cranks →	Go to **Step B.**
		If engine does not crank →	Go to **Step C.**



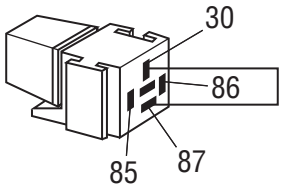
Start Enable Relay Contact Test, continued

Step B	Procedure	Condition	Action
	1. Key off. 2. Remove positive (+) battery cable.		
	3. Measure resistance between Shift Control 30-way connector pins A2 and K3.	If resistance is more than 10K ohms or open circuit [OL]	Replace Start Enable Relay. Go to **Step V.**
		If resistance is less than 10K ohms	Starter solenoid circuit is short to ground. Repair as required. Go to **Step V.**



Start Enable Relay Contact Test, continued

Step C	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect Shift Control 30-way connector.		
	3. Place a jumper across the Start Enable Relay contacts 30 and 87.		
	4. Engage starter. →	If engine cranks →	Go to **Step D.**
		If engine does not crank →	Go to **Step E.**

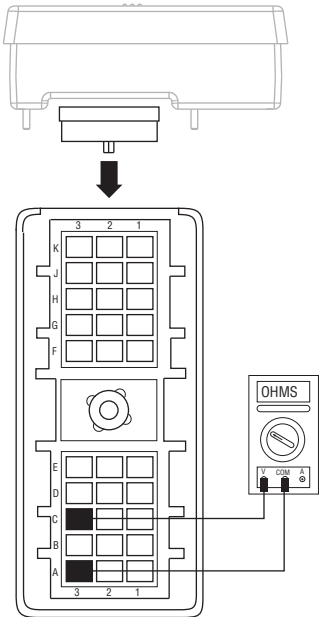


Step D	Procedure	Condition	Action
	1. While engaging starter → remove jumper wire.	If engine continues to crank →	Test complete.
		If engine stops cranking when jumper is removed →	Latching circuit in Shift Control is malfunctioning. **Replace Shift Control** and repeat this step.

Step E	Procedure	Condition	Action
	1. Replace Start Enable Relay.		
	2. Engage starter. →	If engine cranks →	Test complete.
		If engine does not crank →	Go to **Step F.**

Start Enable Relay Contact Test, continued

Step F	Procedure	Condition	Action
	1. Measure resistance between Shift Control 30-way connector pins A3 and C3.	If resistance is 40 to 90 ohms	Check vehicle starting system. If no problem found, replace **Shift Control**. Go to **Step V.**
		If resistance is outside of range	Repair harness between Start Enable Relay and Shift Control. Go to **Step V.**



Start Enable Relay Contact Test, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Start the engine to determine whether the Start Enable Relay contact complaint has been repaired.	If engine starts	Test complete.
		If engine does not start	Return to **Step A** to find error in testing.

AutoShift Will Not Engage a Gear

Overview

This symptom-driven test is performed if the transmission does not engage a gear, and there are no active or inactive codes.

Detection

If the Shift Control is unable to provide a fault code, the driver may observe this failure as the transmission not initiating or completing a shift. The driver may observe this failure as the transmission neutralizes.

Fallback

There is no fallback mode for this symptom.

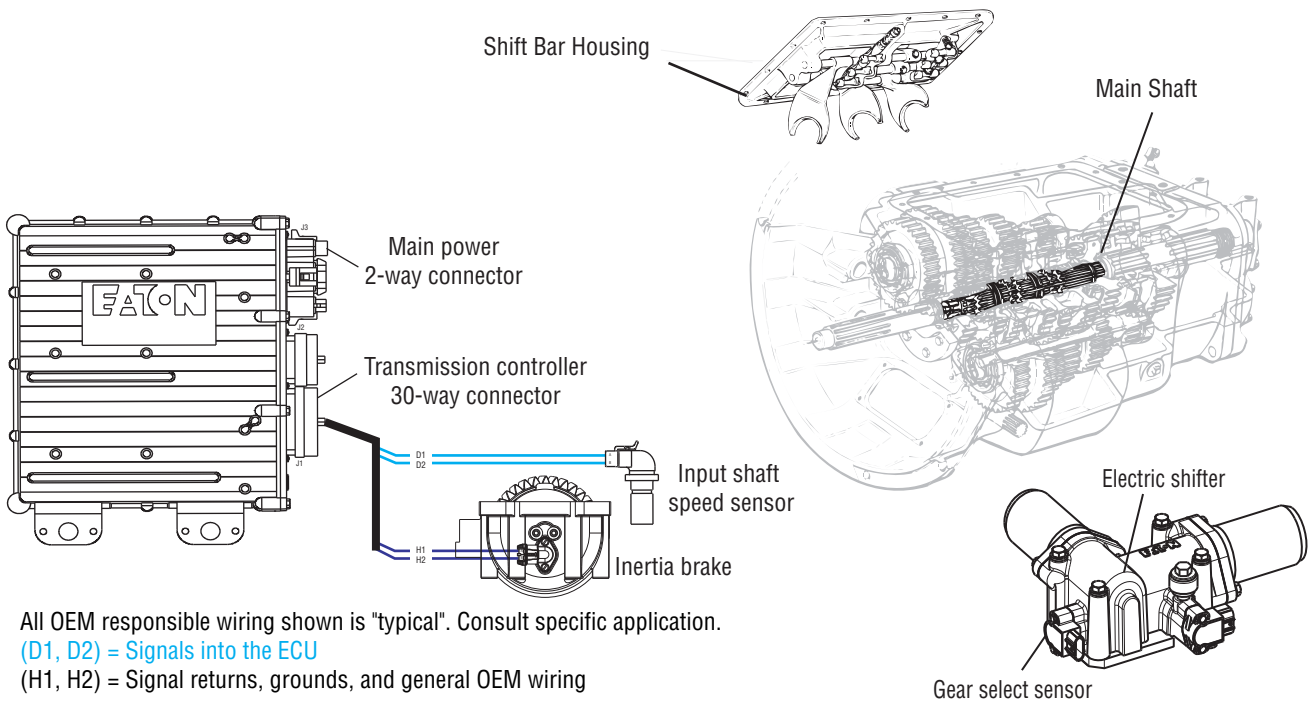
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- PC-based Service Tool

Possible Causes

This symptom can be caused by any of the following:

- Input Shaft Speed Sensor
- Electric Shifter
- Transmission
- Gear Select Sensor
- Inertia Brake
- Clutch Brake



All OEM responsible wiring shown is "typical". Consult specific application.
(D1, D2) = Signals into the ECU
(H1, H2) = Signal returns, grounds, and general OEM wiring

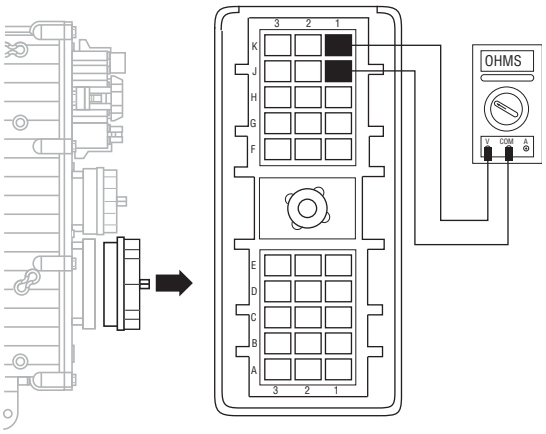
AutoShift Will Not Engage a Gear Test

Step A	Procedure	Condition	Action
	1. Key on.		
	2. Depress clutch pedal.		
	3. Start engine.		
	4. Release clutch pedal to verify Input Shaft speed.		
	5. Depress clutch pedal.		
	6. Place Shift Lever in “D”.		
	7. Observe Gear Display. →	If Gear Display shows a solid “N” →	Go to **Step B.**
		If Gear Display shows a flashing gear with arrows →	Go to **Step H.**
		If Gear Display shows a flashing gear with no arrows →	Go to **Step J.**
		If Gear Display shows a solid gear but vehicle will not move →	Contact Eaton at 1-800-826-4357 for repair strategy.

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Connect PC-based Service Tool.		
	3. Start engine. Release clutch pedal.		
	4. View Input Shaft speed. →	If Input Shaft speed exists →	Go to **Step V.**
		If Input Shaft speed does not exist →	Go to **Step C.**

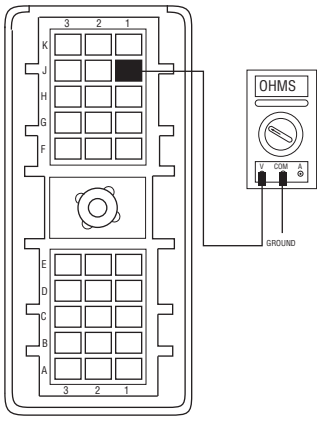
AutoShift Will Not Engage a Gear Test, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Disconnect the Transmission Controller 30-way connector. 3. Measure the resistance between the Transmission Controller 30-way connector pins J1 and K1.	If resistance is 2K to 4.5K ohms	Go to **Step D.**
		If resistance is outside of range	Go to **Step E.**

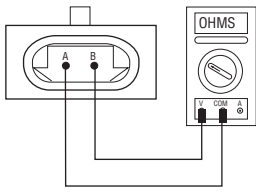


AutoShift Will Not Engage a Gear Test, continued

Step D	Procedure	Condition	Action
	1. Measure resistance between the Transmission Harness 30-way connector pin J1 and ground.	If resistance is more than 10K ohms or open circuit [OL]	Go to **Step G.**
		If resistance is less than 10K ohms	Go to **Step E.**

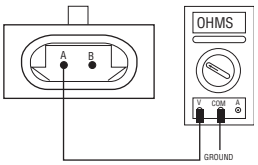


Step E	Procedure	Condition	Action
	1. Disconnect the Transmission Harness from the Input Shaft Speed Sensor.		
	2. Measure resistance between Input Shaft Speed Sensor pins A and B.	If resistance is 2K to 4.5K ohms	Go to **Step F.**
		If resistance is outside of range	**Replace Input Shaft Speed Sensor.** Go to **Step V.**



AutoShift Will Not Engage a Gear Test, continued

Step F	Procedure	Condition	Action
	1. Measure resistance between Input Shaft Speed Sensor pin A and ground.	If resistance is 10K ohms or open circuit [OL]	**Replace Transmission Harness.** Go to **Step V.**
		If resistance is less than 10K ohms	**Replace Input Shaft Speed Sensor.** Go to **Step V.**



Step G	Procedure	Condition	Action
	1. Key off.		
	2. Verify the Upper Countershaft is turning.		
	3. Turn the Input Shaft and verify the Upper Countershaft is rotating.	If Upper Countershaft is turning	**Replace Transmission Controller.** Go to **Step V.**
		If Upper Countershaft is not turning	Contact Eaton at 1-800-826-4357 for repair strategy.

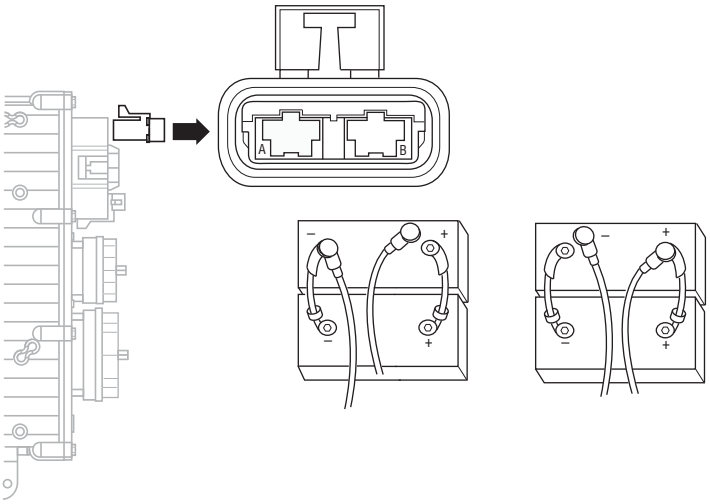
AutoShift Will Not Engage a Gear Test, continued

Step H	Procedure	Condition	Action
	1. Connect P.C. based service tool.		
	2. Start engine		
	3. View input shaft speed.		
	4. Depress clutch pedal. →	If input shaft speed does not drop below 150 rpm →	Clutch is out of adjustment and/or Input Shaft Brake (Clutch Brake) is malfunctioning. Adjust clutch per manufacturer's specifications. Go to **Step V.** If vehicle is equipped with an Inertia Brake. Go to **Step I.**
		If input shaft speed drops below 150 →	Test complete.Go to **Step V.**

Step I	Procedure	Condition	Action
	1. Key on.		
	2. Make sure the PTO is off.		
	3. Connect PC-based service tool and select "Advanced Product Function".		
	4. Start engine.		
	5. Select "Inertia Brake Test".		
	6. Run test and follow instructions. →	Test passes →	Test complete. Go to **Step V.**
		Test fails →	**Replace Inertia Brake.** Go to **Step V.**
		Test aborts	Correct displayed test failure condition and retest.

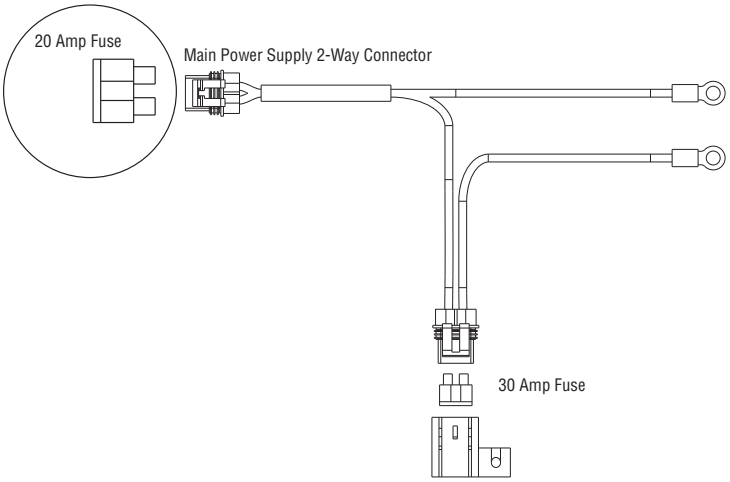
AutoShift Will Not Engage a Gear Test, continued

Step J	Procedure	Condition	Action
	1. Key off. 2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.	If no problem found	Go to **Step K.**
		If problem is found	Repair power/ground path for the main power supply. Go to **Step V.**



AutoShift Will Not Engage a Gear Test, continued

Step K	Procedure	Condition	Action
	1. Key off.		
	2. Insert 20-amp fuse into Motor Supply 2-way connector. →	If fuse blows immediately →	Go to **Step L.**
		If fuse does not blow immediately →	Repair wiring from the battery to the Transmission ECU. Go to **Step V.**



Step L	Procedure	Condition	Action
	1. Key off.		
	2. Remove Electric Shifter from Shift Bar Housing.		
	3. Inspect the Shift Bar Housing: • Shift Blocks → • Shift Rails • Inspect electric shifter for evidence of lube contamination	If problem is found →	Repair as required. Go to **Step V.**
		If no problem is found →	**Replace Electric Shifter.** Go to **Step V.**

AutoShift Will Not Engage a Gear Test, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Drive the vehicle to determine whether the complaint has been repaired.	If the transmission engages a gear	Test complete.
		If the transmission does not engage a gear	Return to **Step A** to find error in testing.

AutoShift Will Not Engage a Gear Test, continued

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UltraShift DM Will Not Engage a Gear

Overview

This symptom-driven test is performed if the transmission does not engage a gear, and there are no active or inactive codes.

Detection

If the Shift Control is unable to provide a fault code, the driver may observe this failure as the transmission not initiating or completing a shift. The driver may observe this failure as the transmission neutralizes.

Fallback

There is no fallback mode for this symptom.

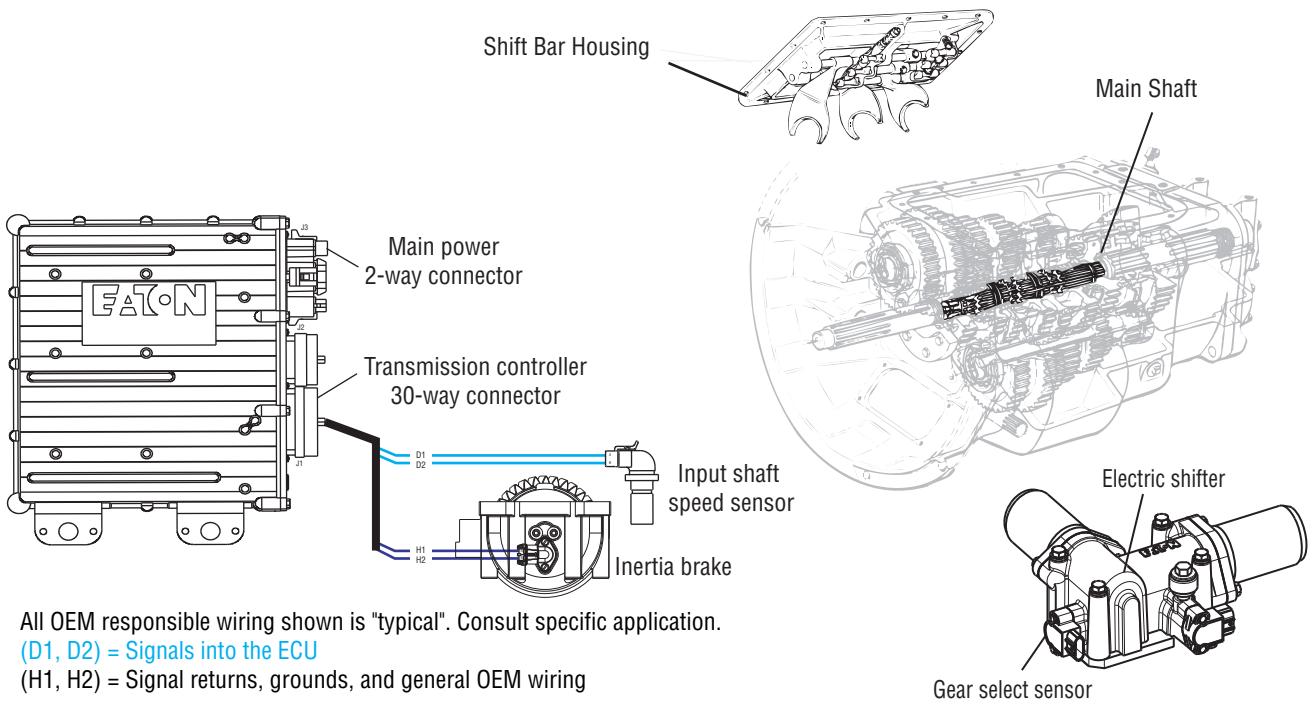
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- PC-based Service Tool

Possible Causes

This symptom can be caused by any of the following:

- Input Shaft Speed Sensor
- Electric Shifter
- Transmission
- Gear Select Sensor
- Inertia Brake
- Clutch



All OEM responsible wiring shown is "typical". Consult specific application.
(D1, D2) = Signals into the ECU
(H1, H2) = Signal returns, grounds, and general OEM wiring

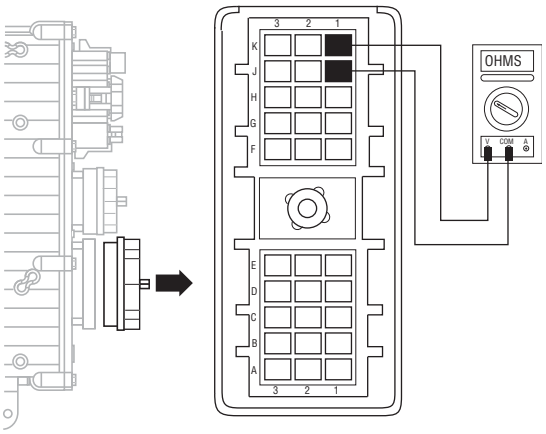
UltraShift DM Will Not Engage a Gear Test

Step A	Procedure	Condition	Action
	1. Key on. 2. Start engine. 3. Place Shift Lever in “D”. 4. Observe Gear Display. →	If Gear Display shows a solid “N” →	Go to **Step B.**
		If Gear Display shows a flashing gear with arrows →	Go to **Step H.**
		If Gear Display shows a flashing gear with no arrows →	Go to **Step J.**
		If Gear Display shows a solid gear but vehicle will not move →	Contact Eaton at 1-800-826-4357 for repair strategy.

Step B	Procedure	Condition	Action
	1. Key off. 2. Connect PC-based Service Tool. 3. Start engine. Increase rpm and hold above 800 rpm. 4. View Input Shaft speed. →	If Input Shaft speed exists →	Contact Eaton at 1-800-826-4357 for repair strategy.
		If Input Shaft speed does not exist →	Go to **Step C.**

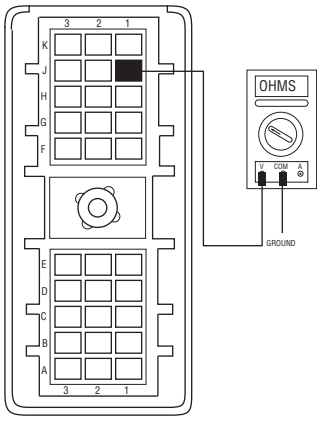
UltraShift DM Will Not Engage a Gear Test, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Disconnect the Transmission Controller 30-way connector.		
	3. Measure the resistance between the Transmission Controller 30-way connector pins J1 and K1.	If resistance is 2K to 4.5K ohms	Go to **Step D.**
		If resistance is outside of range	Go to **Step E.**

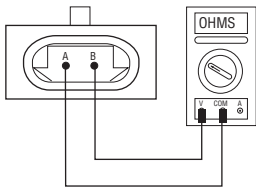


UltraShift DM Will Not Engage a Gear Test, continued

Step D	Procedure	Condition	Action
	1. Measure resistance between the Transmission Harness 30-way connector pin J1 and ground.	If resistance is more than 10K ohms or open circuit [OL]	Go to **Step G.**
		If resistance is less than 10K ohms	Go to **Step E.**

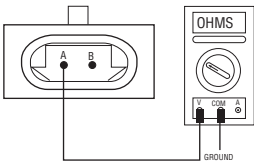


Step E	Procedure	Condition	Action
	1. Disconnect the Transmission Harness from the Input Shaft Speed Sensor.		
	2. Measure resistance between Input Shaft Speed Sensor pins A and B.	If resistance is 2K to 4.5K ohms	Go to **Step F.**
		If resistance is outside of range	**Replace Input Shaft Speed Sensor.** Go to **Step V.**



UltraShift DM Will Not Engage a Gear Test, continued

Step F	Procedure	Condition	Action
	1. Measure resistance between Input Shaft Speed Sensor pin A and ground.	If resistance is 10K ohms or open circuit [OL]	**Replace Transmission Harness.** Go to **Step V.**
		If resistance is less than 10K ohms	**Replace Input Shaft Speed Sensor.** Go to **Step V.**



Step G	Procedure	Condition	Action
	1. Key off.		
	2. Turn the Input Shaft and verify the Upper Countershaft is rotating.	If Upper Countershaft is turning	**Replace Transmission Controller.** Go to **Step V.**
		If Upper Countershaft is not turning	Contact Eaton at 1-800-826-4357 for repair strategy.

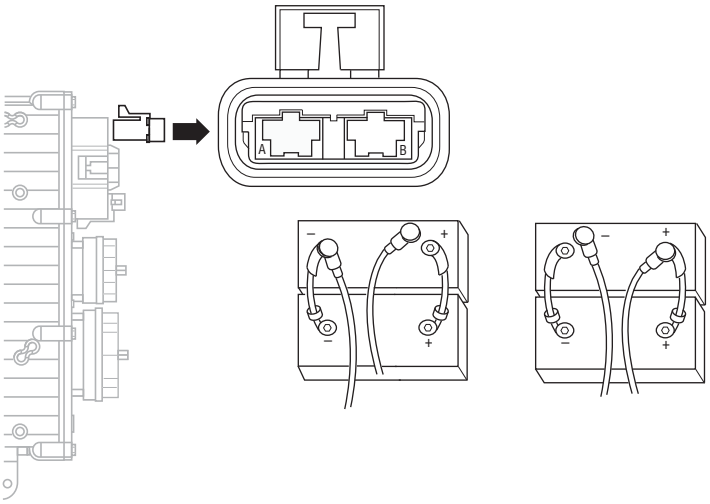
Step H	Procedure	Condition	Action
	1. Connect P.C. based service tool.		
	2. Start engine		
	3. View input shaft speed.	If input shaft speed does not drop below 150 rpm	Clutch is dragging. Go to **Step I.**
		If input shaft speed drops below 150	Test complete.Go to**Step V.**

UltraShift DM Will Not Engage a Gear Test, continued

Step I	Procedure	Condition	Action
	1. Key on. 2. Make sure the PTO is off. 3. Connect PC-based service tool and select "Advanced Product Function". 4. Start engine. 5. Select "Inertia Brake Test". 6. Run test and follow instructions. →	Test passes →	**Replace Clutch.** Go to **Step V.**
		Test fails →	**Replace Inertia Brake.** Go to **Step V.**
		Test aborts	Correct displayed test failure condition and retest.

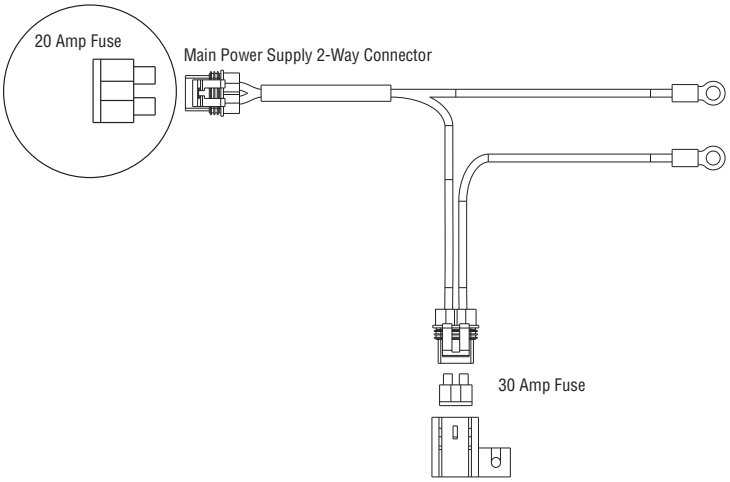
UltraShift DM Will Not Engage a Gear Test, continued

Step J	Procedure	Condition	Action
	1. Key off. 2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion. →	If no problem found →	Go to **Step K.**
		If problem is found →	Repair power/ground path for the main power supply. Go to **Step V.**



UltraShift DM Will Not Engage a Gear Test, continued

Step K	Procedure	Condition	Action
	1. Key off. 2. Insert 20-amp fuse into Motor Supply 2-way connector.	If fuse blows immediately	Go to **Step L.**
		If fuse does not blow immediately	Repair wiring from the battery to the Transmission ECU. Go to **Step V.**



Step L	Procedure	Condition	Action
	1. Key off. 2. Remove Electric Shifter from Shift Bar Housing. 3. Inspect the Shift Bar Housing: • Shift Blocks • Shift Rails • Inspect electric shifter for evidence of lube contamination	If problem is found	Repair as required. Go to **Step V.**
		If no problem is found	**Replace Electric Shifter.** Go to **Step V.**

UltraShift DM Will Not Engage a Gear Test, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Drive the vehicle to determine whether the complaint has been repaired.	If the transmission engages a gear	Test complete.
		If the transmission does not engage a gear	Return to **Step A** to find error in testing.

UltraShift DM Will Not Engage a Gear Test, continued

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UltraShift ASW Will Not Engage a Gear

Overview

This symptom-driven test is performed if the transmission does not engage a gear, and there are no active or inactive codes.

Detection

If the Shift Control is unable to provide a fault code, the driver may observe this failure as the transmission not initiating or completing a shift. The driver may observe this failure as the transmission neutralizes.

Fallback

There is no fallback mode for this symptom.

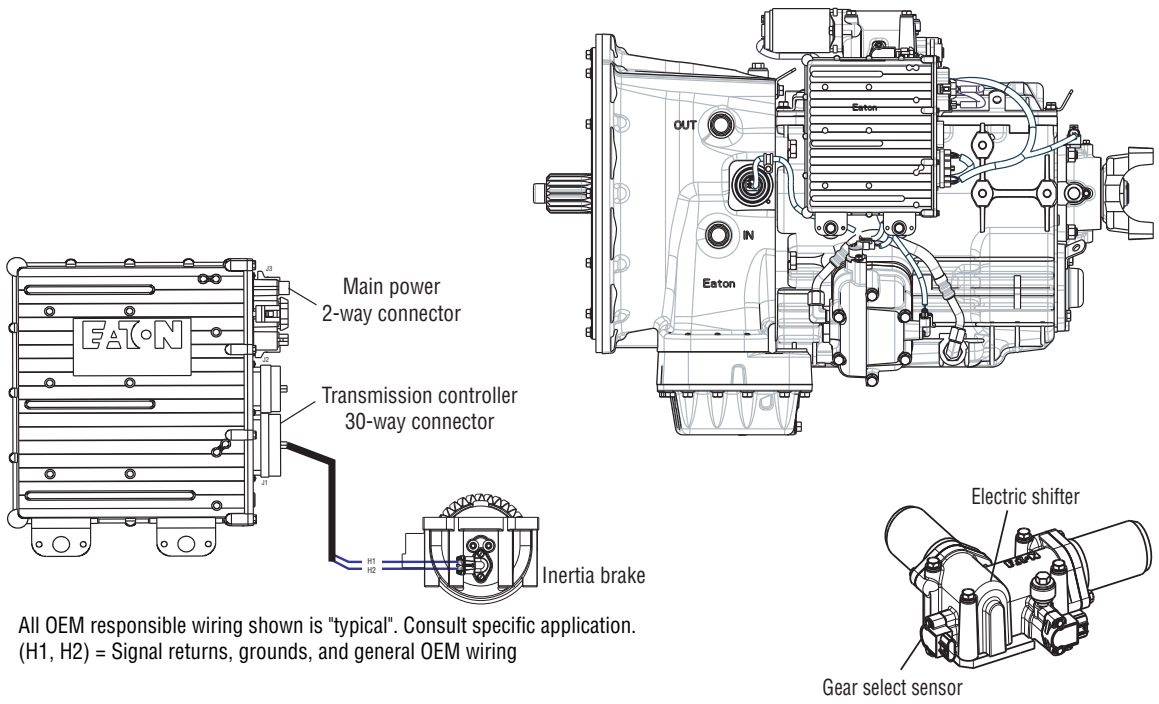
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- PC-based Service Tool

Possible Causes

This symptom can be caused by any of the following:

- Fluid Level
- Inertia Brake
- Electric Shifter
- PTO circuit
- Transmission



All OEM responsible wiring shown is "typical". Consult specific application.
(H1, H2) = Signal returns, grounds, and general OEM wiring

UltraShift ASW Will Not Engage a Gear Test

Step A	Procedure	Condition	Action
	1. Key on. 2. Start engine. 3. Place Shift Lever in “D”. 4. Observe Gear Display. →	If Gear Display shows a solid start gear but vehicle will not move →	Go to **Step B.**
		If Gear Display shows a flashing gear with arrows →	Go to **Step C.**
		If Gear Display shows a flashing gear with no arrows →	Go to **Step D.**
		If Gear Display shows a Direct Drive Gear →	Go to **Step G.**

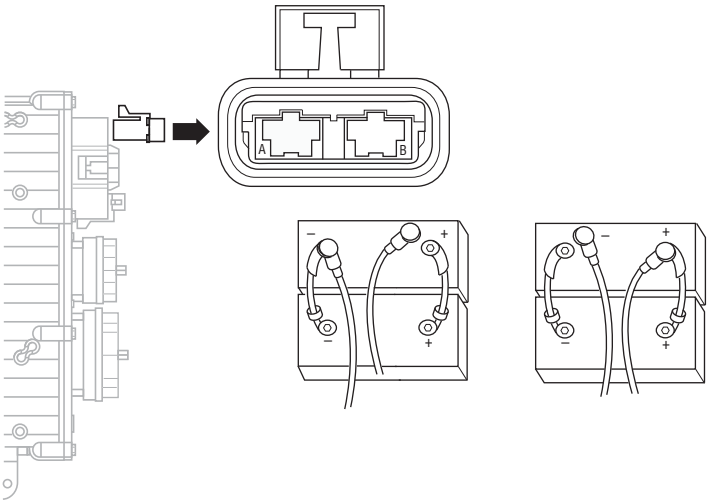
Step B	Procedure	Condition	Action
	1. Place transmission in neutral. 2. Allow engine to idle at 600 to 700 RPM for a minimum of 2 minutes. Ensure transmission fluid temperature is 60 to 120 degrees F (16 to 49 degrees C). 3. Check WetClutch fluid level. →	If fluid level is at COLD/FULL mark →	Remove flywheel inspection cover and inspect rubber coupler for damage or shear. If no damage observed go to **Step C.** If damaged observed, service torsional coupler.
		If fluid level is below the COLD/ADD mark →	Correct fluid level, check for leaks. Go to **Step V.**

UltraShift ASW Will Not Engage a Gear Test, continued

Step C	Procedure	Condition	Action
	1. Key on. 2. Make sure PTO is off. 3. Connect PC-based service tool and select “Advanced Product Function”. 4. Start engine. 5. Select “Inertia Brake Test”. 6. Run test and follow instructions.	Test passes	Test complete. Go to **Step V.**
		Test fails	**Replace Inertia Brake.** Go to **Step V.**
		Test aborts	Correct displayed test failure condition and retest.

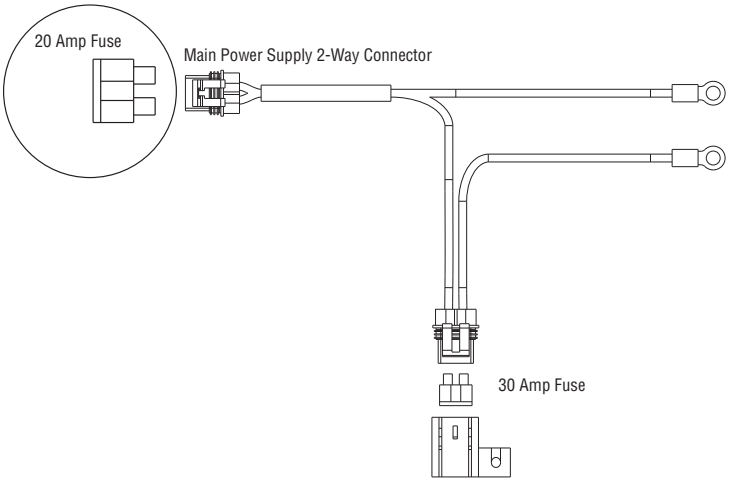
UltraShift ASW Will Not Engage a Gear Test, continued

Step D	Procedure	Condition	Action
	1. Key off. 2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion. →	If no problem found →	Go to **Step E.**
		If problem is found →	Repair power/ground path for the main power supply. Go to **Step V.**



UltraShift ASW Will Not Engage a Gear Test, continued

Step E	Procedure	Condition	Action
	1. Key off.		
	2. Insert 20-amp fuse into Motor Supply 2-way connector. →	If fuse blows immediately →	Go to **Step F.**
		If fuse does not blow immediately →	Repair wiring from the battery to the Transmission ECU. Go to **Step V.**



Step F	Procedure	Condition	Action
	1. Key off.		
	2. Remove Electric Shifter from Shift Bar Housing.		
	3. Inspect the Shift Bar Housing: • Shift Blocks → • Shift Rails • Inspect electric shifter for evidence of lube contamination	If problem is found →	Repair as required. Go to **Step V.**
		If no problem is found →	Contact your Eaton Representative or call 1-800-826-HELP.

UltraShift ASW Will Not Engage a Gear Test, continued

Step G	Procedure	Condition	Action
	1. Key on. Make sure PTO switch is off. 2. Start engine. 3. Select “D”. →	If Gear Display shows Direct Drive Gear. →	Repair PTO circuit. Go to **Step V.**
		If Gear Display shows correct start gear. →	Go to **Step V.**

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Drive the vehicle to determine whether the complaint has been repaired. →	If the transmission engages a gear →	Test complete.
		If the transmission does not engage a gear →	Contact your Eaton Representative or call 1-800-826-HELP.

J1587 Data Link

Overview

This symptom-driven test is performed if the PC-based Service Tool does not work.

Detection

The service technician observes the failure when operating the PC-based Service Tool. To observe this failure, simply connect the PC-based Service Tool to the transmission via the J1587 diagnostic connector located in the cab.

Fallback

There is no fallback mode for J1587 Data Link. The PC-Base Service Tool will not work correctly.

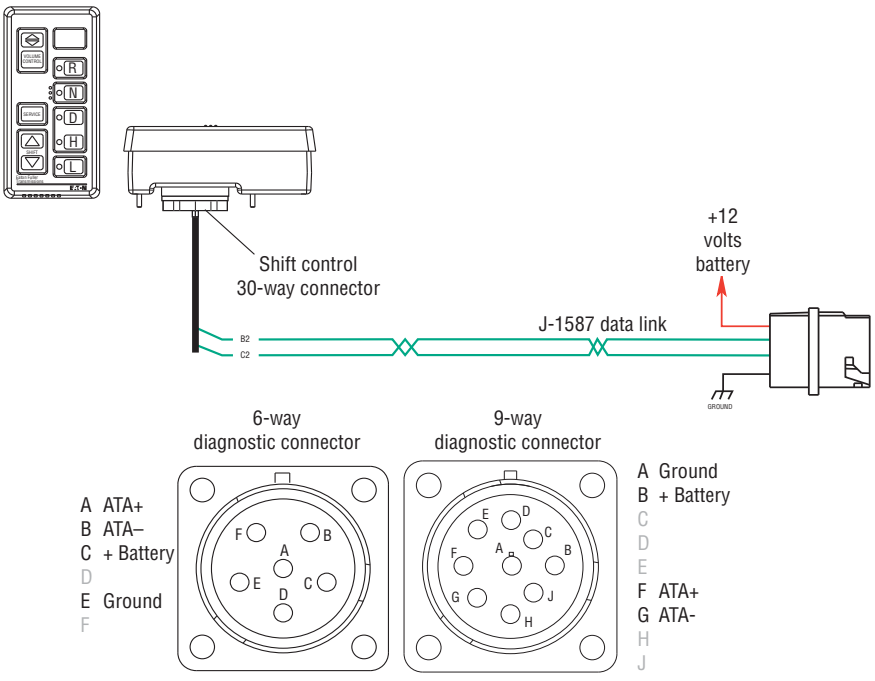
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Data Link Tester
- Troubleshooting Guide
- PC-based Service Tool

Possible Causes

This symptom can be caused by any of the following:

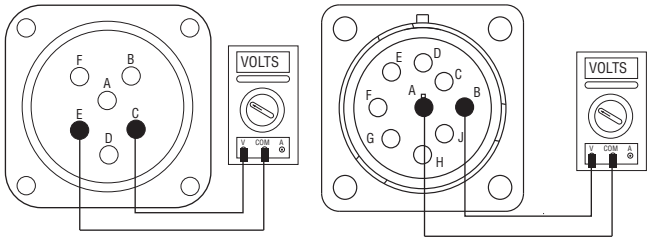
- J1587 Data Link Harness
- Shift Control
- PC-based Service Tool



All OEM responsible wiring shown is "typical". Consult specific application.
(B2, C2) = Communication from and to the ECU
+12 volt non-switched from battery

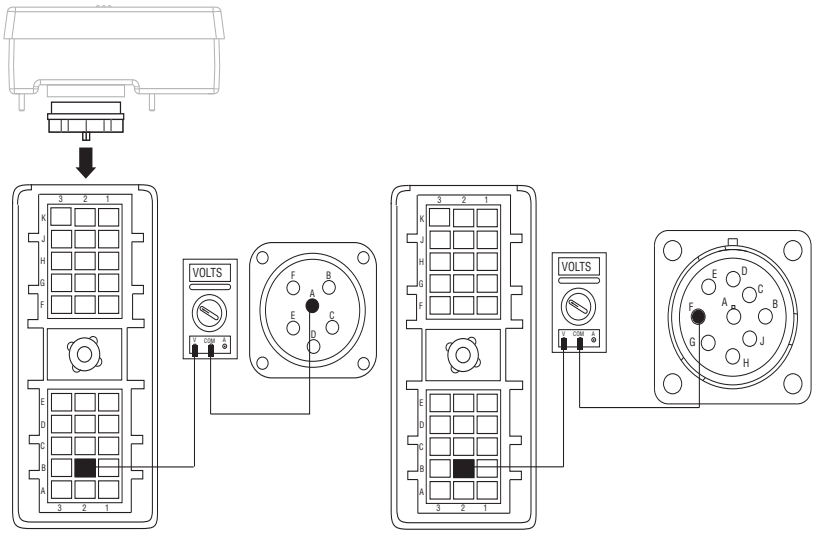
J1587 Data Link Test

Step A	Procedure	Condition	Action
	1. Key on.		
	2. Measure voltage either between 6-way diagnostic connector pins C and E or 9-way diagnostic connector pins B and A.	If voltage is within .6 volts of battery voltage	Go to **Step B.**
		If voltage is outside of range	Repair battery or ground line to vehicle diagnostic connector. Go to **Step V.**



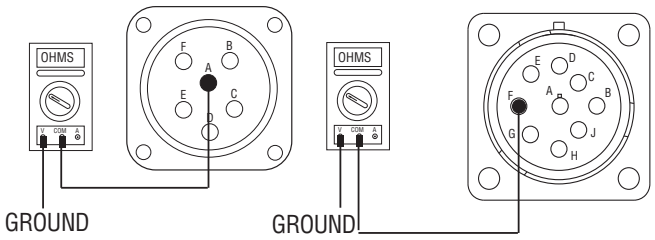
J-1587 Data Link Test, continued

Step B	Procedure	Condition	Action
	1. Key off. 2. Disconnect negative battery cable. 3. Disconnect Vehicle Harness 30-way connector. 4. Measure resistance from Vehicle Harness 30-way connector pin B2 and either 6-way diagnostic connector pin A or 9-way diagnostic connector pin F.	If resistance is 0 to .3 ohms	Go to **Step C.**
		If resistance is outside of range	Repair vehicle interface harness. Repeat this step.

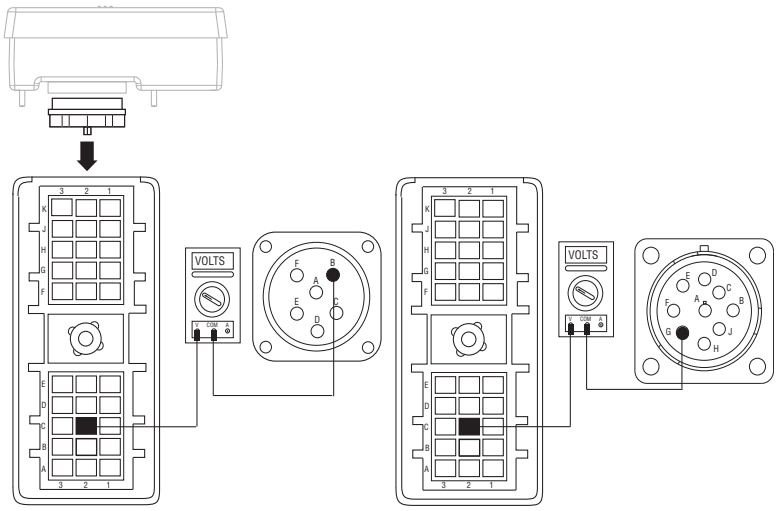


J-1587 Data Link Test, continued

Step C	Procedure	Condition	Action
	1. Measure resistance between either 6-way diagnostic connector pin A or 9-way diagnostic connector pin F and ground.	If resistance is more than 10K ohms or open circuit [OL]	Go to **Step D.**
		If resistance is less than 10K ohms	Repair vehicle interface harness. Go to **Step V.**

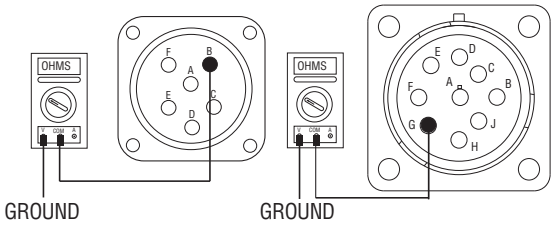


Step D	Procedure	Condition	Action
	1. Measure resistance between Vehicle Harness 30-way connector pin C2 and either 6-way diagnostic connector pin B or 9-way diagnostic connector pin G.	If resistance is 0 to .3 ohms	Go to **Step E.**
		If resistance is outside of range	Repair vehicle interface harness. Go to **Step V.**



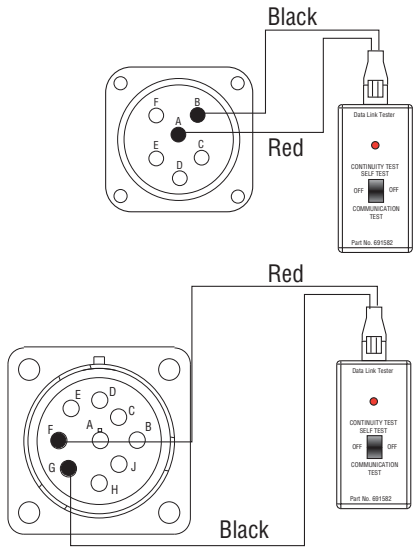
J-1587 Data Link Test, continued

Step E	Procedure	Condition	Action
	1. Measure resistance between either 6-way diagnostic connector pin B or 9-way diagnostic connector pin G and ground.	If resistance is more than 10K ohms or open circuit [OL]	Go to **Step F.**
		If resistance is less than 10K ohms	Repair vehicle interface harness. Go to **Step V.**



J-1587 Data Link Test, continued

Step F	Procedure	Condition	Action
	1. Key off. 2. Reconnect Vehicle Harness 30-way connector. 3. Disconnect all data links to the vehicle diagnostic connector, leaving only the transmission connected. 4. Connect the Data Link Tester across the 6-way diagnostic connector pins A and B or the 9-way diagnostic connector F and G. 5. Key on. 6. Place the Data Link Tester in the Communication Test mode.	If test passed	Problem exists with service tool in one of the following areas: • Communication box • Cables • PC Repair as required. Go to **Step V.**
		If test failed	**Replace Shift Controller.** Go to **Step V**.



J-1587 Data Link Test, continued

Step V	Procedure	Condition	Action
	1. Key on.		
	2. Connect PC-based Service Tool. →	If PC-based Service Tool functions correctly →	Test complete.
		If PC-based Service Tool does not function correctly →	Return to **Step A** to find error in testing.

J-1587 Data Link Test, continued

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Range System

Overview

This symptom-driven test is completed if the transmission does not perform range shifts, and there are no active or inactive fault codes.

Detection

The failure is observed by the driver when operating the vehicle. To observe this failure, operate the vehicle and make several shifts up and down across the range.

Fallback

There is no fallback for this symptom.

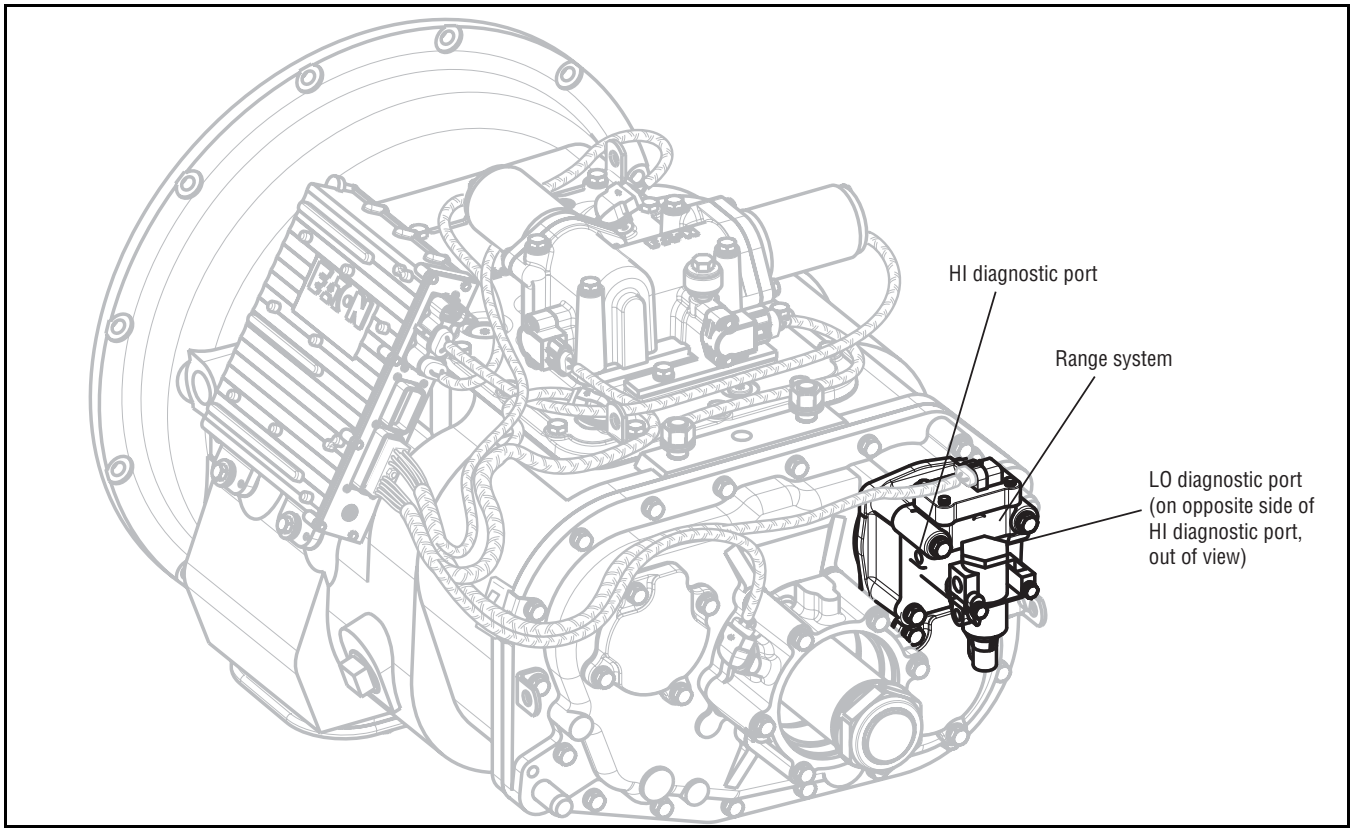
Required Tools

- Basic Hand Tools
- (2) 0-100 PSI Air Pressure Gauges
- Troubleshooting Guide

Possible Causes

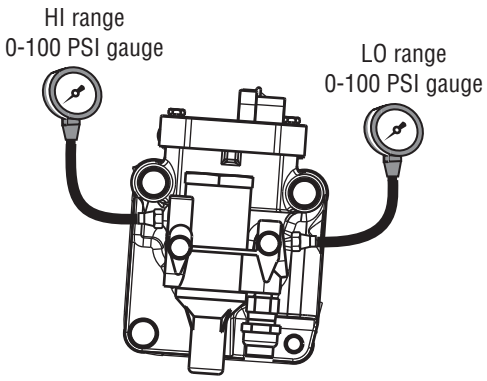
This symptom can be caused by any of the following:

- Low Air Pressure
- Contaminated Air Supply
- Air Leak
- Range Valve
- Range Synchronizer
- Range Actuator / Cylinder / Piston / Yoke



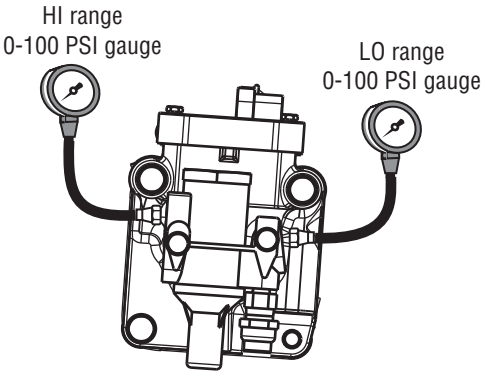
Range System Test

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Install both 0-100 PSI Air Pressure Gauges into the Range Valve diagnostic ports.		
	3. Start vehicle and allow air pressure to build to governor cut-off.		
	4. Release clutch to register Input Shaft Speed in the transmission.		
	5. Turn off engine, but leave key in the "ON" position.		
	6. With the Shift Control, select reverse, then select neutral. →	If LO range gauge = 55 to 65 PSI and	
		If HI range gauge = 0 PSI →	Go to **Step B.**
		Note: Five minutes is allowed for checking the pressure after moving the Shift Control to neutral.	
		If both pressure gauges do not read as listed above →	**Replace Range Valve and Range Cylinder Cover as required.** Repeat this step.

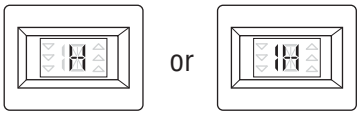


Range System Test, continued

Step B	Procedure	Condition	Action
	1. Key on.		
	2. With Shift Control, select reverse, press the Up-shift Button, then select neutral. →	If HI range gauge = 55 to 65 PSI and	
		If LO range gauge = 0 PSI →	Repair mechanical Range System as required. Go to **Step V.**
		If both pressure gauges do not read as listed above →	**Replace Range Valve and Range Cylinder Cover** as required. Go to **Step V.**



Note: If the gear display does not read "H" (10-Speed) or "IH" (18-Speed), go to the Up/Down Button Test.



10-Speed or 18-Speed

Range System Test, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Remove gauges. 3. Key on. 4. Drive the vehicle to determine whether the complaint has been repaired.	If complaint was repaired	Test complete.
		If the complaint was not repaired	Return to **Step A** to find error in testing.

Splitter System

Overview

This symptom-driven test is completed if the transmission does not perform Splitter Shifts, and there are no active or inactive fault codes.

Detection

The failure is observed by the driver when operating the vehicle. To observe this failure, operate the vehicle and make several shifts up and down across the Splitter.

Fallback

There is no fallback for this symptom.

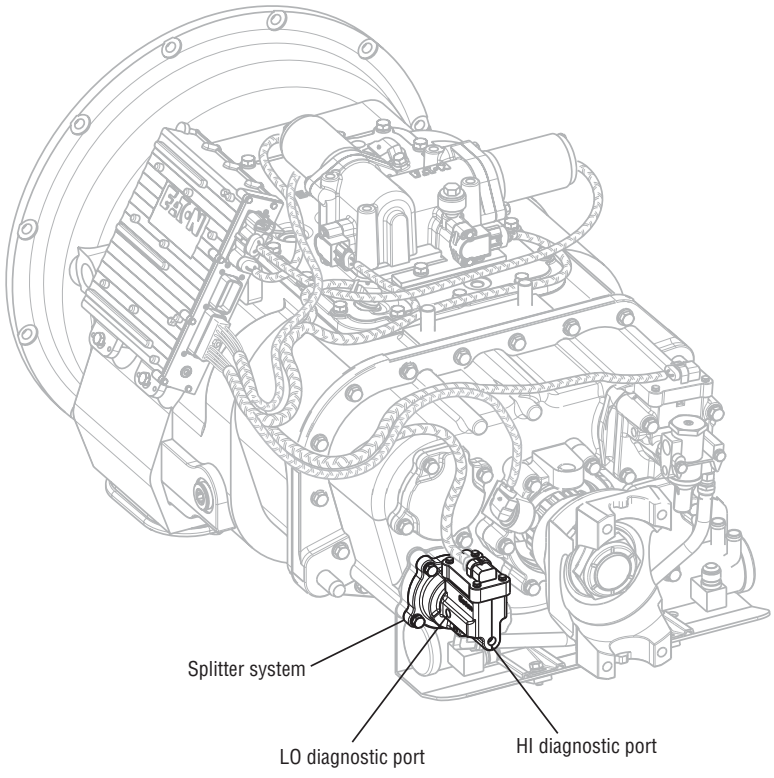
Required Tools

- Basic Hand Tools
- (2) 0-100 PSI Air Pressure Gauges
- Troubleshooting Guide

Possible Causes

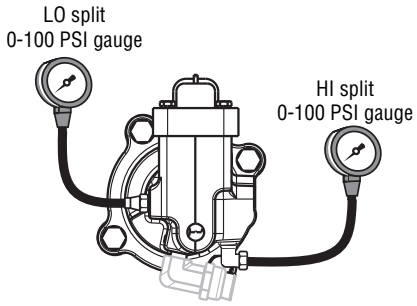
This symptom can be caused by any of the following:

- Low Air Pressure
- Contaminated Air Supply
- Air Leak
- Splitter Valve
- Splitter Actuator / Cylinder / Piston / Yoke



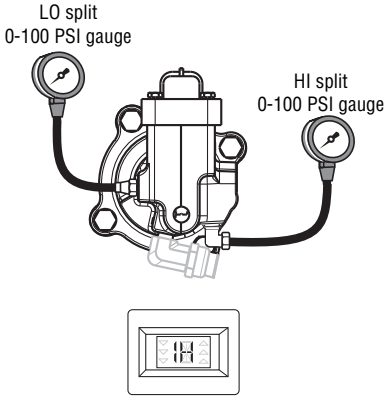
Splitter System Test

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Install both 0-100 PSI air pressure gauges into the Splitter Valve diagnostic ports.		
	3. Start vehicle and allow air pressure to build to governor cut-off.		
	4. Release clutch to register Input Shaft speed in the transmission.		
	5. Turn off engine, but leave key in the "ON" position.		
	6. With the Shift Control, select reverse, then select neutral.	If Hi split gauge = 55 to 65 PSI and	
		If LO split gauge = 0 PSI →	Go to **Step B.**
		Note: Five minutes is allowed for checking the pressure after moving the Shift Control to neutral.	
		If both pressure gauges do not read as listed above →	**Replace Splitter Valve and Splitter Cylinder Cover** as required. Repeat this step.



Splitter System Test, continued

Step B	Procedure	Condition	Action
	1. Key on.		
	2. With Shift Control, select reverse, press the Upshift Button, then select neutral. →	If LO split gauge = 55 to 65 PSI and →	
		If HI split gauge = 0 PSI →	Repair mechanical Splitter system as required. Go to **Step V.**
	Note: If the Gear Display does not read "IH" (18 speed), go to the Up/Down Button Test.	If both pressure gauges do not read as listed above →	**Replace Splitter Valve and Splitter Cylinder Cover** as required. Go to **Step V.**



Step V	Procedure	Condition	Action
	1. Key off.		
	2. Remove all gauges.		
	3. Key on.		
	4. Drive the vehicle to determine whether the complaint has been repaired. →	If the complaint was repaired →	Test complete.
		If the complaint was not repaired →	Return to **Step A** to find error in testing.

Splitter System Test, continued

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Up/Down Button

Overview

This symptom-driven test is performed if unable to shift the transmission with the Up/Down Buttons, and there are no Active or Inactive codes.

Detection

The Shift Control has no fault detection capability for this failure. The failure is observed by the driver when operating the vehicle.

Fallback

There is no fallback for this symptom.

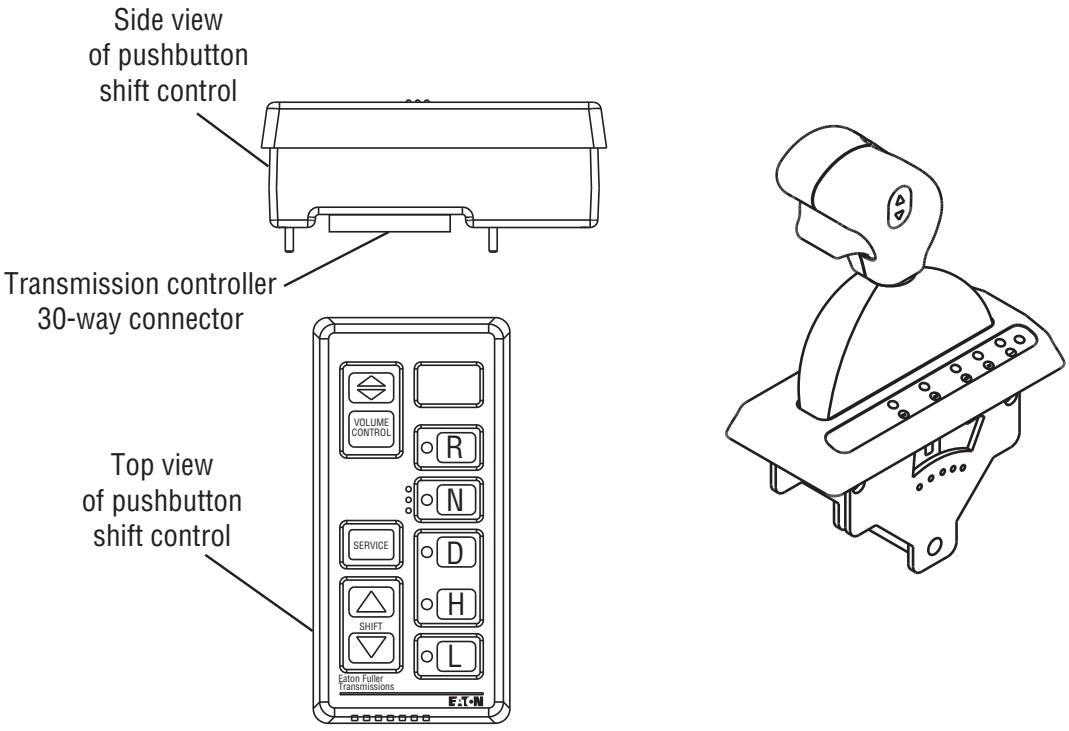
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

This symptom can be caused by any of the following:

- Shift Control



Pushbutton Shift Control

Eaton Shift Lever

Up/Down Button Test

Step A	Procedure	Condition	Action
	1. Start engine.		
	2. Place Shift Lever in “Manual”.		
	3. Drive the vehicle and use the buttons to initiate upshifts and downshifts. →	If the up and down buttons are working properly, the transmission will make upshifts and downshifts. →	Test complete.
		If the transmission does not make upshifts and/or downshifts. →	**Replace Shift Control.** Repeat this step.

UltraShift DM Shift Complaint

Overview

This symptom-driven test is performed if a shift complaint exists, and there are no Active or Inactive codes.

Detection

There is no detection other than a driver complaint.

Fallback

There is no fallback mode for shift complaint, however, it may effect vehicle performance.

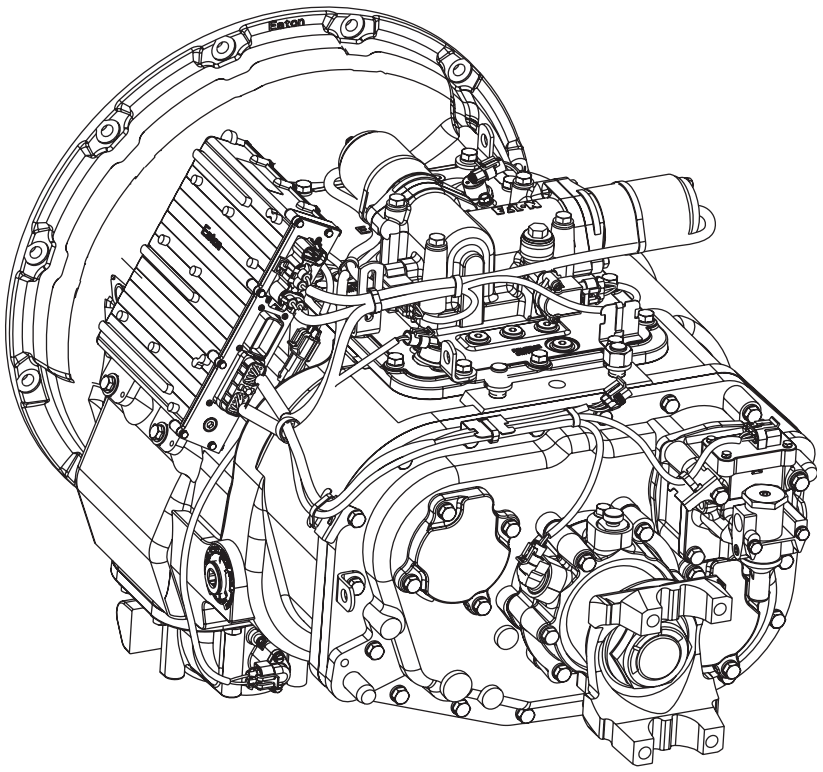
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- PC-based Service Tool
- Troubleshooting Guide

Possible Causes

This symptom can be caused by any of the following:

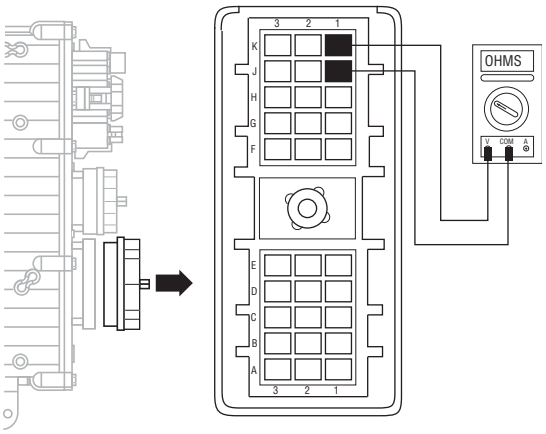
- Inertia Brake
- Input Shaft Speed Sensor
- Electric Shifter
- Shift Bar Housing
- Transmission



UltraShift DM Shift Complaint Test

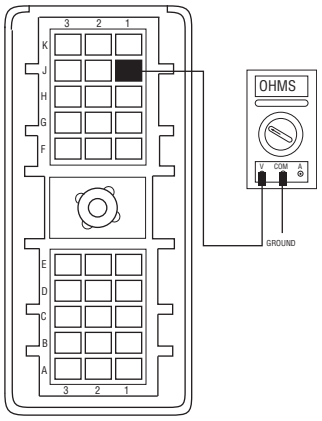
Step A	Procedure	Condition	Action
	1. Key on. 2. Make sure PTO is off. 3. Connect PC-based service tool and select "Advanced Product Function". 4. Start engine. 5. Select "Inertia Brake Test" →		
	6. Run test and follow instructions.	Test Passes →	Go to **Step B.**
		Test Fails →	**Replace Inertia Brake.** Go to **Step V.**
		Test Aborts →	Correct displayed test failure condition and retest.

Step B	Procedure	Condition	Action
	1. Key off. 2. Disconnect the Transmission Controller 30-way connector.		
	3. Measure the resistance between the Transmission Controller 30-way connector pins J1 and K1. →	If resistance is 2K to 4.5K ohms →	Go to **Step C.**
		If resistance is outside of range →	Go to **Step D.**

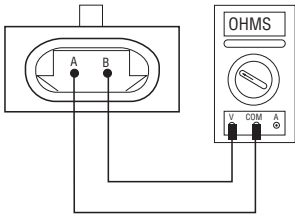


UltraShift DM Shift Complaint Test, continued

Step C	Procedure	Condition	Action
	1. Measure resistance between the Transmission Harness 30-way connector pin J1 and ground.	If resistance is more than 10K ohms or open circuit [OL]	Go to **Step F.**
		If resistance is less than 10K ohms	Go to **Step D.**

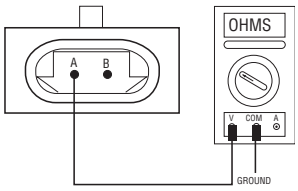


Step D	Procedure	Condition	Action
	1. Disconnect the Transmission Harness from the Input Shaft Speed Sensor.		
	2. Measure resistance between Input Shaft Speed Sensor pins A and B.	If resistance is 2K to 4.5K ohms	Go to **Step E.**
		If resistance is outside of range	**Replace Input Shaft Speed Sensor.** Go to **Step V.**



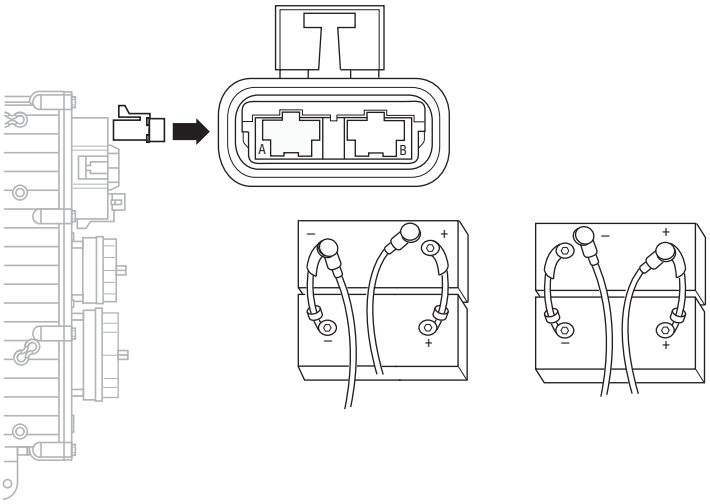
UltraShift DM Shift Complaint Test, continued

Step E	Procedure	Condition	Action
	1. Measure resistance between Input Shaft Speed Sensor pin A and ground.	If resistance is 10K ohms or open circuit [OL]	**Replace Transmission Harness.** Go to **Step V.**
		If resistance is less than 10K ohms	**Replace Input Shaft Speed Sensor.** Go to **Step V.**



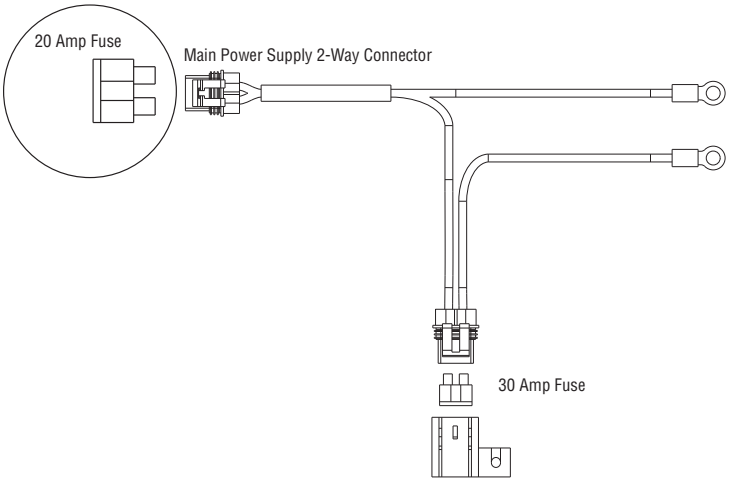
UltraShift DM Shift Complaint Test, continued

Step F	Procedure	Condition	Action
	1. Key off. 2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion. →	If no problem found →	Go to **Step G.**
		If problem is found →	Repair power/ground path for the main power supply. Go to **Step V.**



UltraShift DM Shift Complaint Test, continued

Step G	Procedure	Condition	Action
	1. Key off. 2. Insert 20-amp fuse into Motor Supply 2-way connector.	If fuse blows immediately	Go to **Step H.**
		If fuse does not blow immediately	Repair wiring from the battery to the Transmission ECU. Go to **Step V.**



Step H	Procedure	Condition	Action
	1. Key off. 2. Remove Electric Shifter from Shift Bar Housing. 3. Inspect the Shift Bar Housing: • Shift Blocks • Shift Rails • Inspect electric shifter for evidence of lube contamination	If no problem found	Contact your Eaton Representative. Or call 1-800-826-HELP
		If problem found	Repair as required. Go to **Step V.**

UltraShift DM Shift Complaint Test, continued

Step V	Procedure	Condition	Action
	1. Key on.		
	2. Drive the vehicle to determine whether the complaint has been repaired. →	If shift complaint has been repaired →	Test complete.
		If the shift complaint has not been repaired →	Contact your Eaton Representative. Or call 1-800-826-HELP

UltraShift DM Shift Complaint Test, continued

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UltraShift ASW Shift Complaint

Overview

This symptom-driven test is performed if a shift complaint exists, and there are no Active or Inactive codes.

Detection

There is no detection other than a driver complaint.

Fallback

There is no fallback mode for shift complaint, however, it may effect vehicle performance.

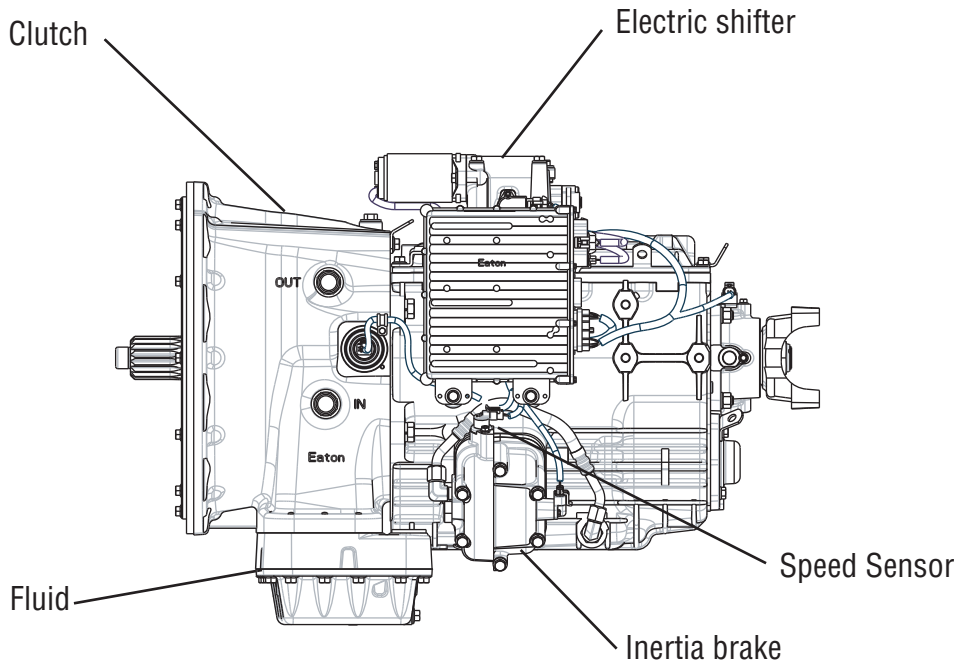
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- PC-based Service Tool
- Troubleshooting Guide

Possible Causes

This symptom can be caused by any of the following:

- Low Fluid Level
- Inertia Brake
- Input Shaft Speed Sensor
- Electric Shifter
- Transmission
- Shift Bar Housing



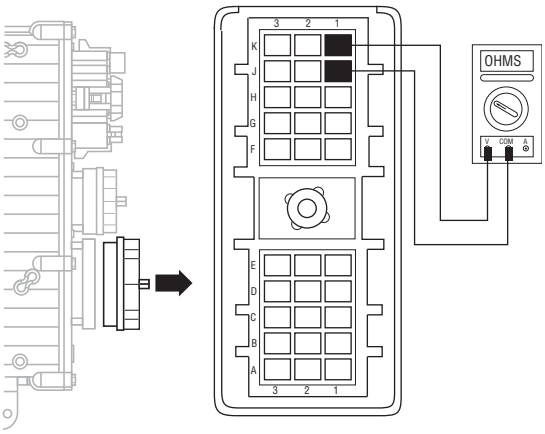
UltraShift ASW Shift Complaint Test

Step A	Procedure	Condition	Action
	1. Place transmission in neutral.		
	2. Allow engine to idle at 600 to 700 RPM for a minimum of 2 minutes. Ensure transmission fluid temperature is 60 to 120 degrees F (16 to 49 degrees C)		
	3. Check transmission fluid level. →	If fluid level is at COLD-FULL mark →	Go to **Step B.**
		If fluid level is below the COLD-ADD mark →	Correct fluid level, check for leaks. Go to **Step V.**

Step B	Procedure	Condition	Action
	1. Key on.		
	2. Make sure PTO is off.		
	3. Connect PC-based service tool and select “Advanced Product Function”.		
	4. Start engine.		
	5. Select “Inertia Brake Test” →		
	6. Run test and follow instructions.	Test Passes →	Go to **Step C.**
		Test Fails →	**Replace Inertia Brake.** Go to **Step V.**
		Test Aborts →	Correct displayed test failure condition and retest.

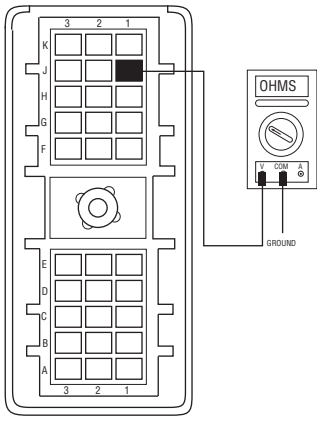
UltraShift ASW Shift Complaint Test, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Disconnect the Transmission Controller 30-way connector.		
	3. Measure the resistance between the Transmission Controller 30-way connector pins J1 and K1.	If resistance is 2K to 4.5K ohms	Go to **Step D.**
		If resistance is outside of range	Go to **Step E.**

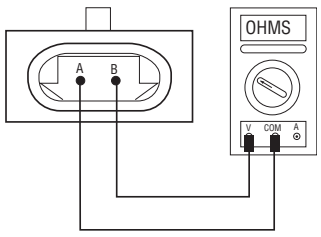


UltraShift ASW Shift Complaint Test, continued

Step D	Procedure	Condition	Action
	1. Measure resistance between the Transmission Harness 30-way connector pin J1 and ground.	If resistance is more than 10K ohms or open circuit [OL]	Go to **Step G.**
		If resistance is less than 10K ohms	Go to **Step E.**

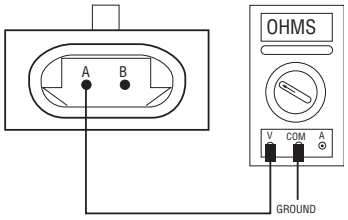


Step E	Procedure	Condition	Action
	1. Disconnect the Transmission Harness from the Input Shaft Speed Sensor.		
	2. Measure resistance between Input Shaft Speed Sensor pins A and B.	If resistance is 2K to 4.5K ohms	Go to **Step F.**
		If resistance is outside of range	**Replace Input Shaft Speed Sensor.** Go to **Step V.**

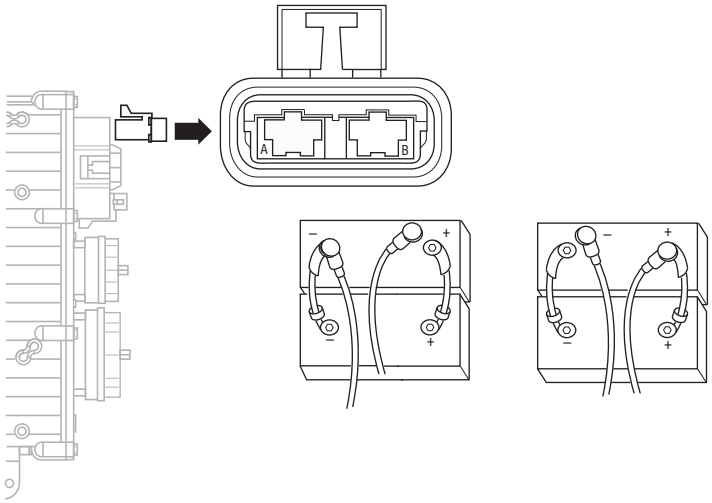


UltraShift ASW Shift Complaint Test, continued

Step F	Procedure	Condition	Action
	1. Measure resistance between Input Shaft Speed Sensor pin A and ground.	If resistance is 10K ohms or open circuit [OL]	**Replace Transmission Harness.** Go to **Step V.**
		If resistance is less than 10K ohms	**Replace Input Shaft Speed Sensor.** Go to **Step V.**

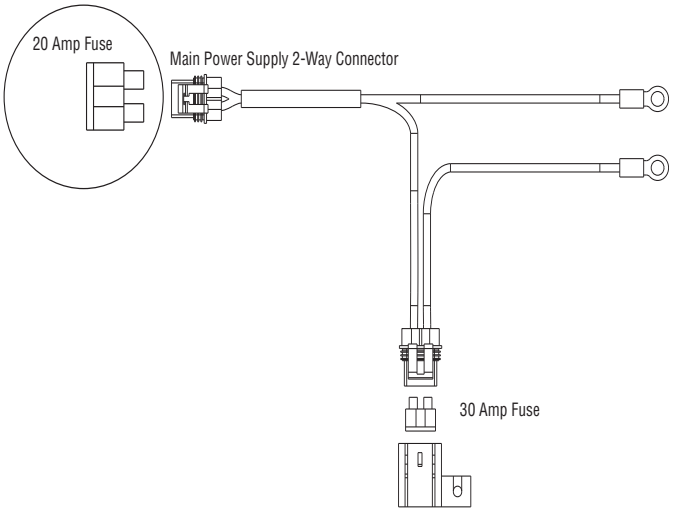


Step G	Procedure	Condition	Action
	1. Key off. 2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.	If no problem found	Go to **Step H.**
		If problem is found	Repair power/ground path for the main power supply. Go to **Step V.**



UltraShift ASW Shift Complaint Test, continued

Step H	Procedure	Condition	Action
	1. Key off.		
	2. Insert 20-amp fuse into Motor Supply 2-way connector. →	If fuse blows immediately →	Go to **Step I.**
		If fuse does not blow immediately →	Repair wiring from the battery to the Transmission ECU. Go to **Step V.**



Step I	Procedure	Condition	Action
	1. Key off.		
	2. Remove Electric Shifter from Shift Bar Housing.		
	3. Inspect the Shift Bar Housing: • Shift Blocks → • Shift Rails • Inspect electric shifter for evidence of lube contamination	If no problem found →	Contact your Eaton Representative, or call 1-800-826-HELP.
		If problem found →	Repair as required. Go to **Step V.**

UltraShift ASW Shift Complaint Test, continued

Step V	Procedure	Condition	Action
	1. Key on.		
	2. Drive the vehicle to determine whether the complaint has been repaired. →	If shift complaint has been repaired →	Test complete.
		If the shift complaint has not been repaired →	Contact your Eaton Representative, or call 1-800-826-HELP.

UltraShift ASW Shift Complaint Test, continued

UltraShift ASW Clutch Engagement

Overview

This symptom-driven test is performed if a clutch engagement complaint exists, and there are no Active or Inactive codes.

Detection

There is no detection other than a driver complaint.

Fallback

There is no fallback mode for clutch engagement complaint, however, it may effect vehicle performance.

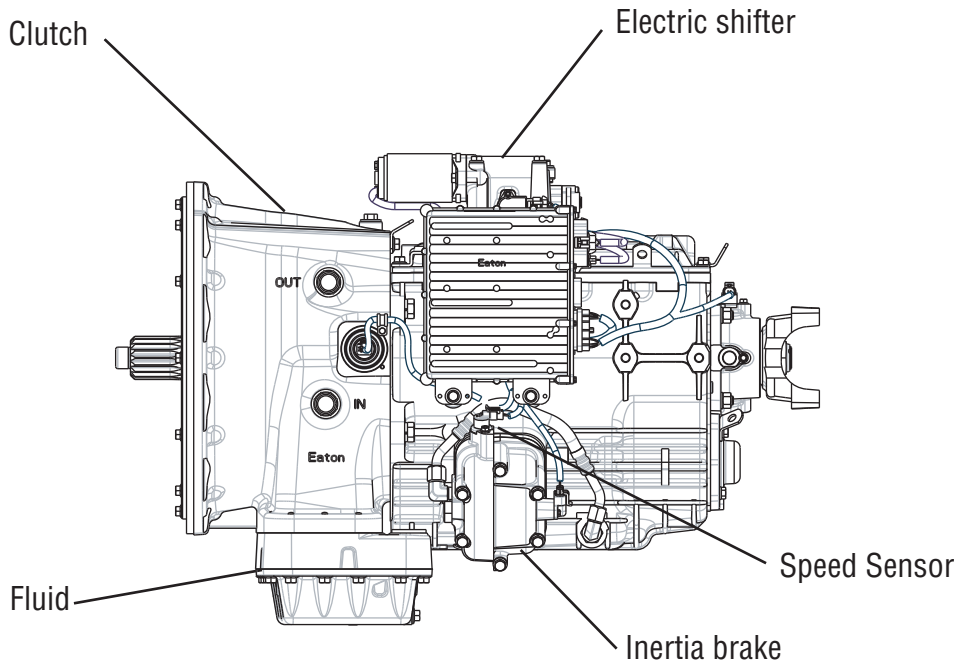
Required Tools

- Basic Hand Tools
- PC-based Service Tool
- Troubleshooting Guide

Possible Causes

This symptom can be caused by any of the following:

- Low Fluid Level
- Inertia Brake
- Clutch Calibration
- Transmission



UltraShift ASW Clutch Engagement Test

Step A	Procedure	Condition	Action
	1. Place transmission in neutral.		
	2. Allow engine to idle at 600 to 700 RPM for a minimum of 2 minutes. Ensure transmission fluid temperature is 60 to 120 degrees F (16 to 49 degrees C)		
	3. Check transmission fluid level. →	If fluid level is at COLD-FULL mark →	Go to **Step B.**
		If fluid level is below the COLD-ADD mark →	Correct fluid level, check for leaks. Drive Vehicle, if Clutch Engagement Complaint exist repeat. **Step A.**

Step B	Procedure	Condition	Action
	1. Key on.		
	2. Engine running, allow engine to reach operating temperature		
	3. Key off.		
	4. Start vehicle.		
	5. Allow vehicle to Idle in Neutral for a minimum of 2 (two) minutes.		
	6. Drive vehicle. →	If Clutch Engagement Complaint does not change →	Remove flywheel inspection cover and inspect rubber coupler for damage or shear. If no damage observed go to **Step C.** If damaged observed, service torsional coupler.
		If Clutch Engagement Complaint is corrected →	Test complete.

UltraShift ASW Clutch Engagement Test, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Disconnect Transmission Harness from the I-Brake. 3. Key on. 4. Drive vehicle (Flashing Service Light will exist).	If Clutch Engagement Complaint does not change →	Contact your Eaton Representative. Or call 1-800-826-HELP
		If Clutch Engagement Complaint is corrected →	**Replace Inertia Brake.** Go to **Step V.**

Step V	Procedure	Condition	Action
	1. Key Off. 2. Reconnect Transmission Harness to I-Brake. 3. Key on. 4. Drive the vehicle to determine whether the complaint has been repaired. →	If shift complaint has not been repaired →	Contact your Eaton Representative. Or call 1-800-826-HELP
		If the shift complaint has been repaired →	Test complete.

UltraShift ASW Clutch Engagement Test, continued

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Transmission Air Leak

Overview

This symptom-driven test is performed if the transmission has an air leak and there are no Active or Inactive fault codes.

Detection

There is no detection process specifically for a transmission Air Leak. However, failures of this type are generally detected by the transmission or driver as some other type of fault code or symptom.

Fallback

There is no fallback mode for a transmission air leak, however, it may effect other vehicle systems.

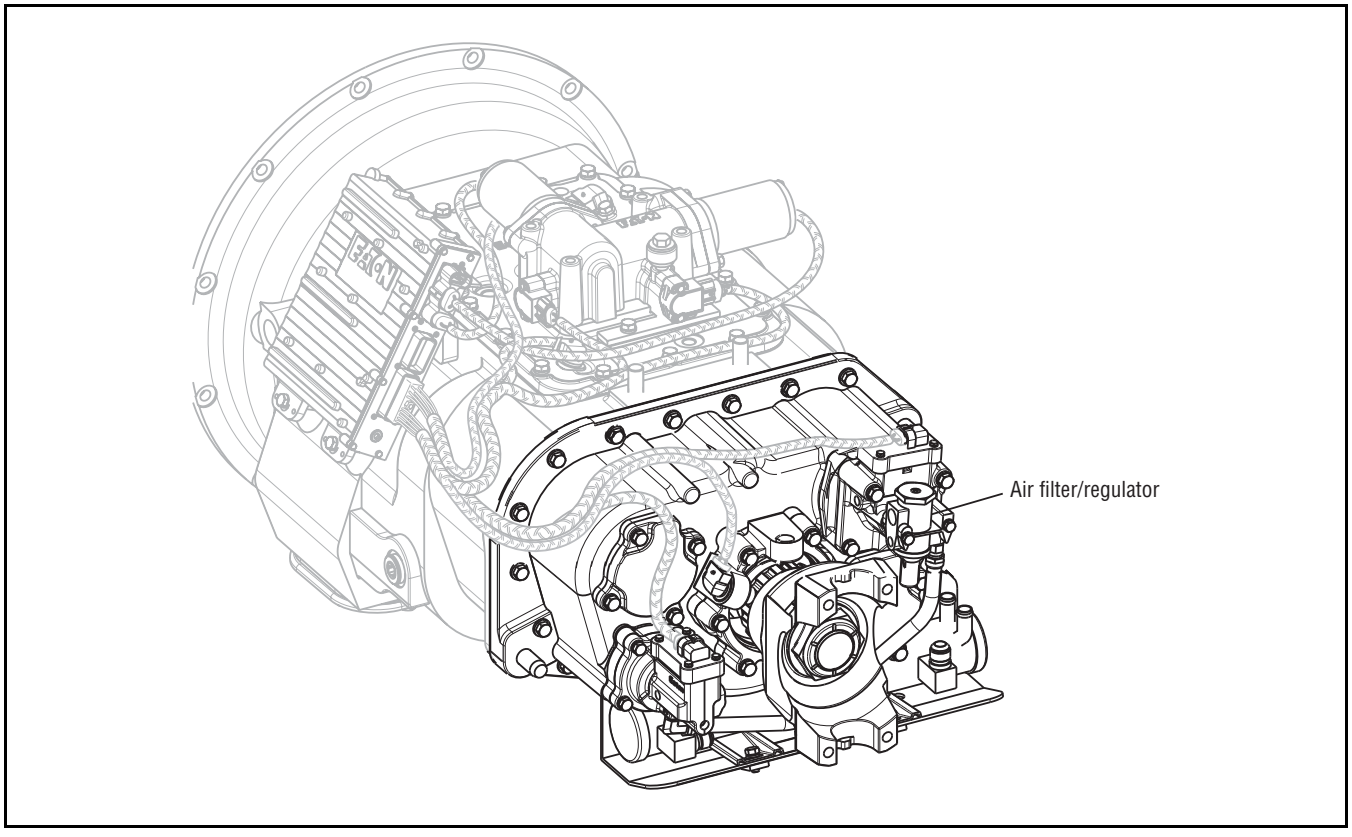
Required Tools

- Basic Hand Tools
- Troubleshooting Guide

Possible Causes

This symptom can be caused by any of the following:

- Contaminated Air
- Range Valve
- Splitter Valve
- Air Filter/Regulator
- Range Piston / O-ring
- Splitter Piston / O-ring



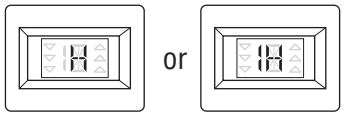
Transmission Air Leak Test

Step A	Procedure	Condition	Action
	1. Start engine.		
	2. Allow air pressure to build to governor cut-off.		
	3. Leave transmission in neutral.		
	4. Key off.		
	5. Listen for constant air leaks. →	If there are no constant air leaks →	Go to **Step B.**
		If air leaks from fittings or air lines at: →	Repair fittings or lines as required. Repeat this step.
		• Air filter/regulator	
		• Splitter Cylinder supply line (18-speed only)	
		If air leaks at the Range Valve exhaust port →	**Replace Range Valve.** Go to **Step V.**
		If air leaks at Splitter Valve exhaust port (18-speed only) →	**Replace Splitter Valve.** Go to **Step V.**

Step B	Procedure	Condition	Action
	1. Start engine.		
	2. Turn off engine, but leave key in "ON" position.		
	3. With the Shift Control, select reverse, then select neutral. →	If there are no constant air leaks →	Go to **Step C.**
		If air leaks at the Range Valve exhaust port →	Go to **Step D.**
		If air leaks at the Splitter Valve exhaust port (18-speed only) →	Go to **Step F.**
		If air leaks at the transmission breather →	Go to **Step G.**

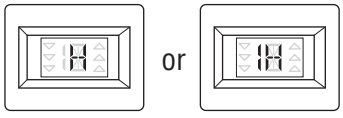
Transmission Air Leak Test, continued

Step C	Procedure	Condition	Action
	1. Key on.		
	2. With Shift Control, select reverse, press the Upshift Button, and then select neutral.	If there are no constant air leaks	Go to **Step E.**
	Note: If Gear Display does not read "H" (10-speed) or "IH" (18-speed), go to the Up/Down Button Test.		
		If air leaks at the Range Exhaust Port	**Replace Range Valve.** Go to **Step V.**



10-Speed or 18-Speed

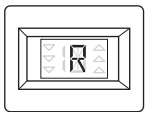
Step D	Procedure	Condition	Action
	1. Key on.		
	2. With Shift Control, select reverse, press the upshift button, and then select neutral.	If there are no constant air leaks	**Replace Range Valve.** Go to **Step V.**
	Note: If Gear Display does not read "H" (10-speed) or "IH" (18-speed), go to the Up/Down Button Test.	If air leaks at the Range Exhaust Port	Replace Range Piston and O-rings. Go to **Step V.**



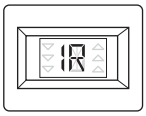
10-Speed or 18-Speed

Transmission Air Leak Test, continued

Step E	Procedure	Condition	Action
	1. Key on.		
	2. With Shift Control, select reverse, press the downshift button, and then select neutral.		
	3. Listen for constant air leaks.	If there are no constant air leaks	Test complete.
		If air leaks at the Splitter exhaust port	Repair Splitter Piston and O-rings. Go to **Step V.**
	Note: If Gear Display does not read "R" (10-speed), go to Up/Down Button Test.		

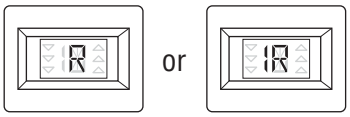


Step F	Procedure	Condition	Action
	1. Key on.		
	2. With Shift Control, select reverse, press the downshift button, and then select neutral.		
	3. Listen for constant air leaks.	If there are no constant air leaks	**Replace Splitter Valve** (18-speed only). Go to **Step V.**
	Note: If Gear Display does not read "IR" (18-speed), go to Up/Down Button Test.	If air leaks at the Splitter Valve exhaust port	Repair Splitter Piston and O-rings (18-speed only). Go to **Step V.**



Transmission Air Leak Test, continued

Step G	Procedure	Condition	Action
	1. Key on. 2. With Shift Control, select reverse, press the downshift button, and then select neutral.		
	3. Listen for constant air leak.	If the leak continues →	Repair the Range Yoke Bar O-rings as required (18-speed only). Go to **Step V.**
	Note: If Gear Display does not read "H" (10-speed) or "IH" (18-speed), go to the Up/Down Button Test.	If the air leak stops →	Replace the Splitter Yoke Bar O-ring as required (18-speed only. Go to **Step V.**



10-Speed 18-Speed

Step V	Procedure	Condition	Action
	1. Start engine 2. Release clutch to register Input Shaft speed in the transmission. 3. Turn off engine, but leave key in the "ON" position. 4. Listen for constant air leaks under the following conditions: • With Shift Control, select reverse, then select neutral • With Shift Control, select reverse, press Upshift Button, then select neutral	If there are no constant leaks →	Test complete.
		If there are constant air leaks →	Return to **Step A** to find error in testing.

Transmission Air Leak Test, continued

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Shift Lever Back Light

Overview

This symptom-driven test is performed if the Shift Lever or Shift Control back lighting is not functioning.

Detection

There is no detection other than a driver complaint.

Fallback

There is no fallback mode for this symptom.

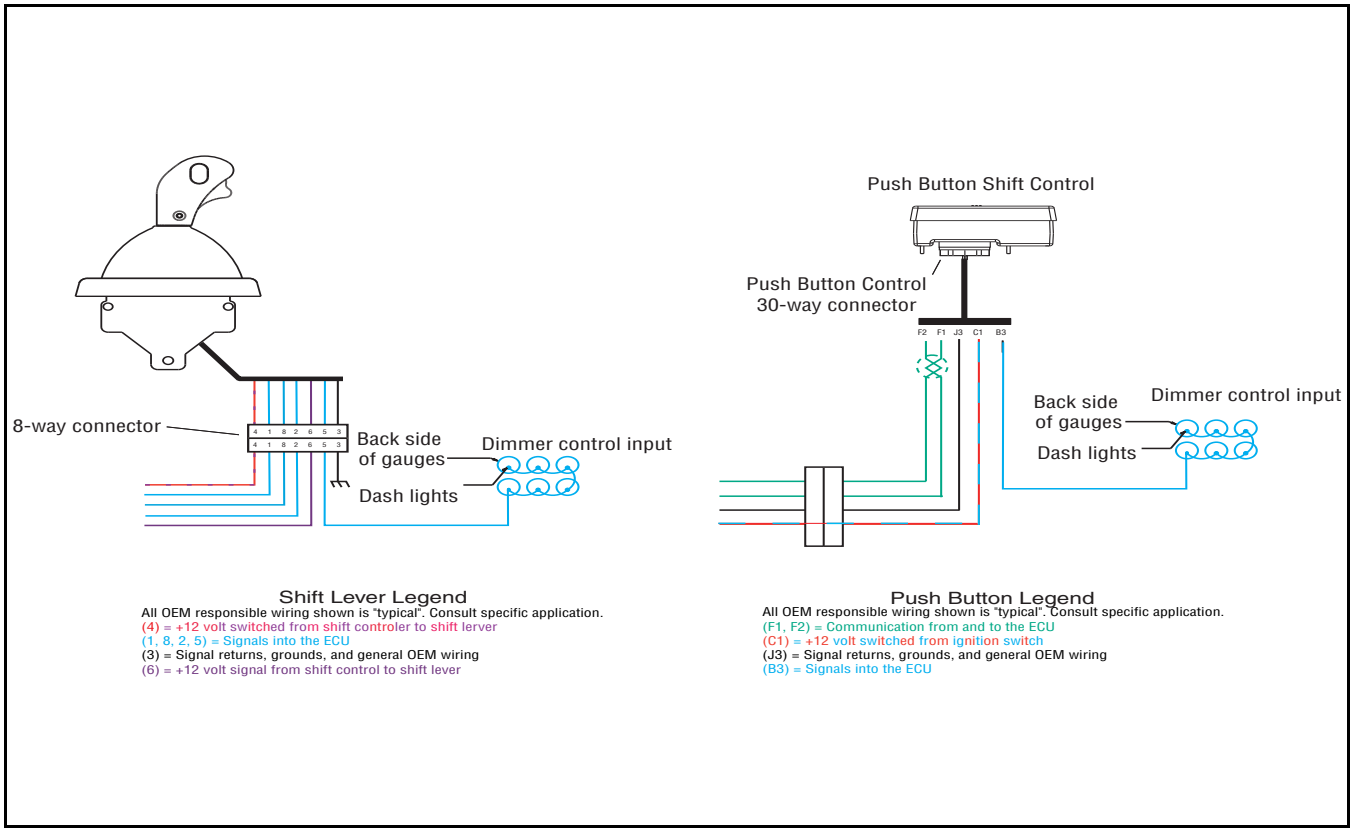
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

This symptom can be caused by any of the following:

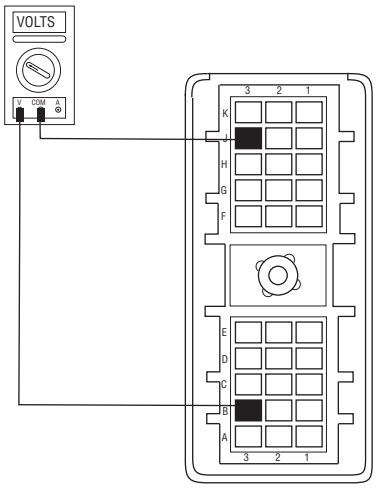
- OEM Wiring
- Shift Control
- Shift Lever



Shift Lever Back Light Test

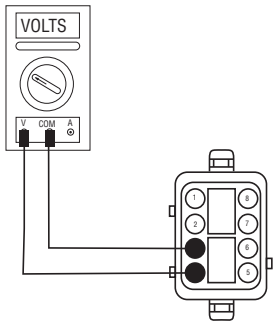
Step A	Procedure	Condition	Action
	1. Is vehicle equipped with a Shift Lever?	If vehicle is not equipped with a Shift Lever	Go to **Step B.**
		If vehicle is equipped with a Shift Lever	Go to **Step C.**

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect Shift Control 30-way connector.		
	3. Key on.		
	4. Measure voltage between Shift Control pins B3 and J3 with the dash lights fully on.	If voltage is within 2 volts of battery voltage	Replace **Shift Control**. Go to **Step V.**
		If voltage is outside of range	Repair OEM harness. Go to **Step V.**



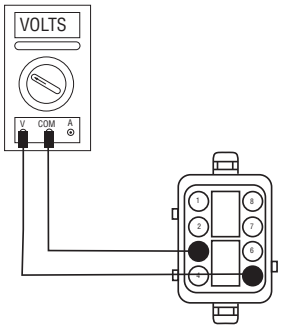
Shift Lever Back Light Test, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Disconnect Shift Lever 8-way connector. 3. Key on. 4. Measure voltage between Shift Lever 8-way pins 4 and 3.	If voltage is within 1 volt of battery voltage	Go to **Step D.**
		If voltage is outside of range	Repair ignition supply to Shift Lever. Go to **Step V.**



Shift Lever Back Light Test, continued

Step D	Procedure	Condition	Action
	1. Key on.		
	2. Measure voltage between Shift Lever 8-way connector pins 5 and 3 with the dash lights fully on.	If voltage is within 2 volts of battery voltage	Replace Shift Lever. Go to **Step V.**
		If voltage is outside of range	Repair OEM harness to Shift Lever. Go to **Step V.**



Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Key on.		
	4. Turn on the dash lights fully.	If back light works correctly	Test complete.
		If back lights do not work correctly	Return to **Step A** to find error in testing.

Connector Pin Descriptions

Transmission Controller 18-Way (Vehicle Interface Connector)

18-Way	Description	Notes
A1	Batt 1	
A2	ATA +	
A3	GND 1	
B1	Trans Batt 1	
B2	ATA -	
B3	GND 2	
C1	EPL +	
C2	EPL -	
C3	EPL shield	
D1	Aux speed 1 +	
D2	Aux speed 1 -	
D3	Aux input 2	Input, LO side
E1	Batt 2	
E2	Trans Batt 2	
E3	Aux input 2	(Return)
F1	Aux input 1	Input, LO side
F2	Aux input 1	(Return)
F3	Aux output 1	Output, LO side driver

Transmission Controller 30-Way Connector

30-Way	Description	Notes
A1	Rail position +	
A2	Rail position	(Signal)
A3	Rail position -	
B1	Gear position +	
B2	Gear position	(Signal)
B3	Gear position -	
C1	Aux Input 7	(Return)
C2	Aux Input 7	Input, LO side
C3	Aux analog Input 8	Input, Analog
D1	Output Shaft Speed +	
D2	Output Shaft Speed -	
D3	Aux Analog Input 9	Input, Analog
E1	Main Shaft Speed +	
E2	Main Shaft Speed -	
E3	Aux Analog Power	(+5 volts)
F1	Range Valve High	
F2	Range Valve Low	
F3	Range Valve common	
G1	Splitter Valve DIR	
G2	Splitter Valve IND	Output, High side driver
G3	Splitter Valve common	Output, LO side driver
H1	Inertia Brake +	
H2	Inertia Brake -	
H3	Aux Analog	(Return)
J1	Input Shaft Speed +	
J2	Lock-up Clutch +	
J3	Lock-up Clutch -	
K1	Input Shaft Speed -	
K2	Interrupt Clutch +	
K3	Interrupt Clutch -	

Shift Control 30-Way Connector

30-Way	Description	Notes
A1	Aux input/output 3	Input/output, LO side driver
A2	Start enable latch	
A3	Start enable relay -	
B1	Aux input 5	(Return)
B2	1587 +	
B3	Vdash	
C1	Ignition	
C2	1587 -	
C3	Start enable relay +	
D1	Aux input 5	Input, LO side
D2	Aux input 6	Input, LO side
D3	Aux output 3	Output, LO side driver
E1	Gear display clock	
E2	Gear display data	
E3	Gear display	(Return)
F1	EPL +	
F2	EPL -	
F3	EPL shield	
G1	1939 +	
G2	1939 -	
G3	1939 shield	
H1	Aux input 6	(Return)
H2	Aux output 2	Output, HI/LO side driver
H3	Aux input/output 4	Input/output, LO side driver
J1	Batt 1	
J2	Trans Batt 1	
J3	GND 1	
K1	Batt 2	
K2	Trans Batt 2	
K3	GND 2	

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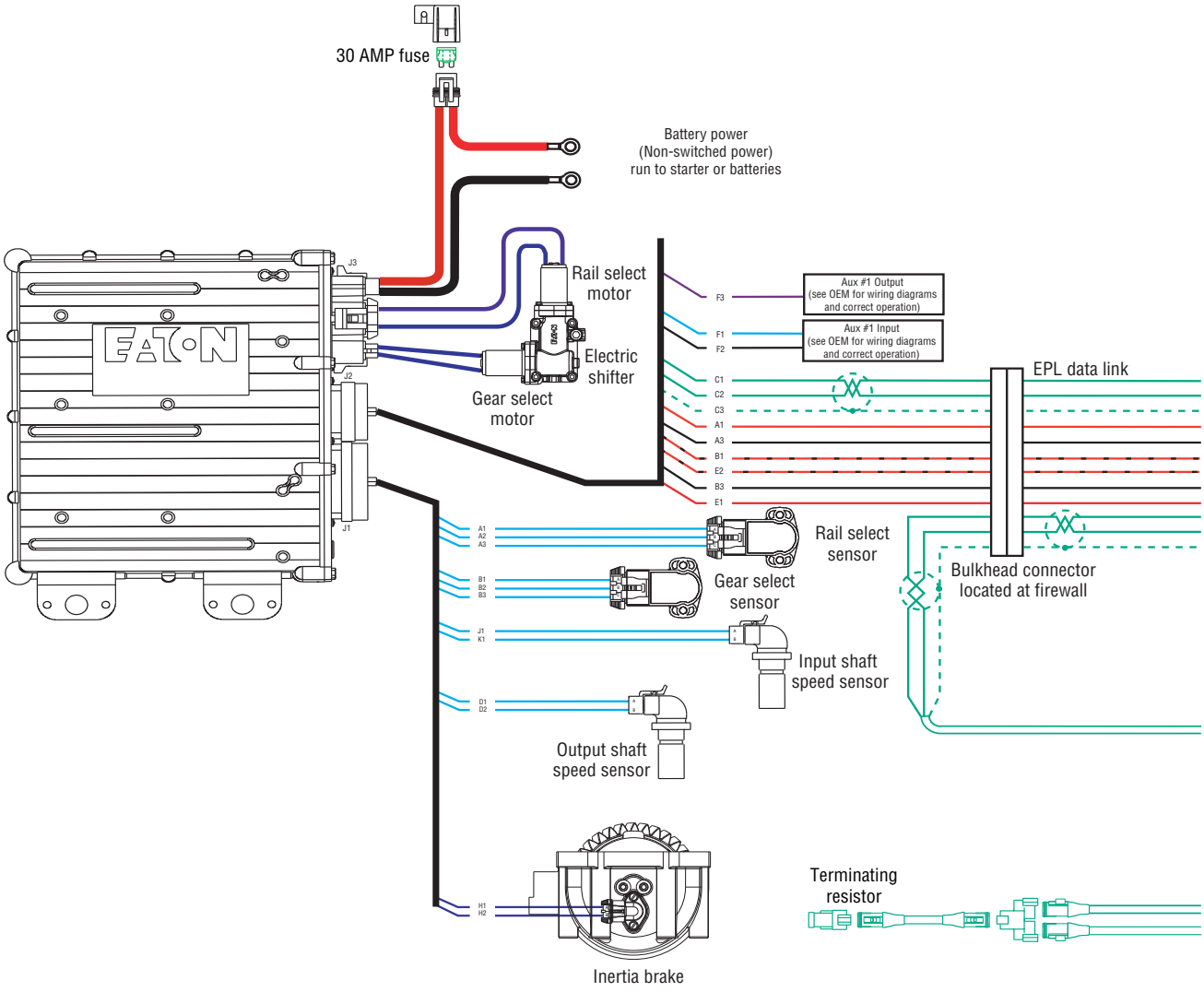
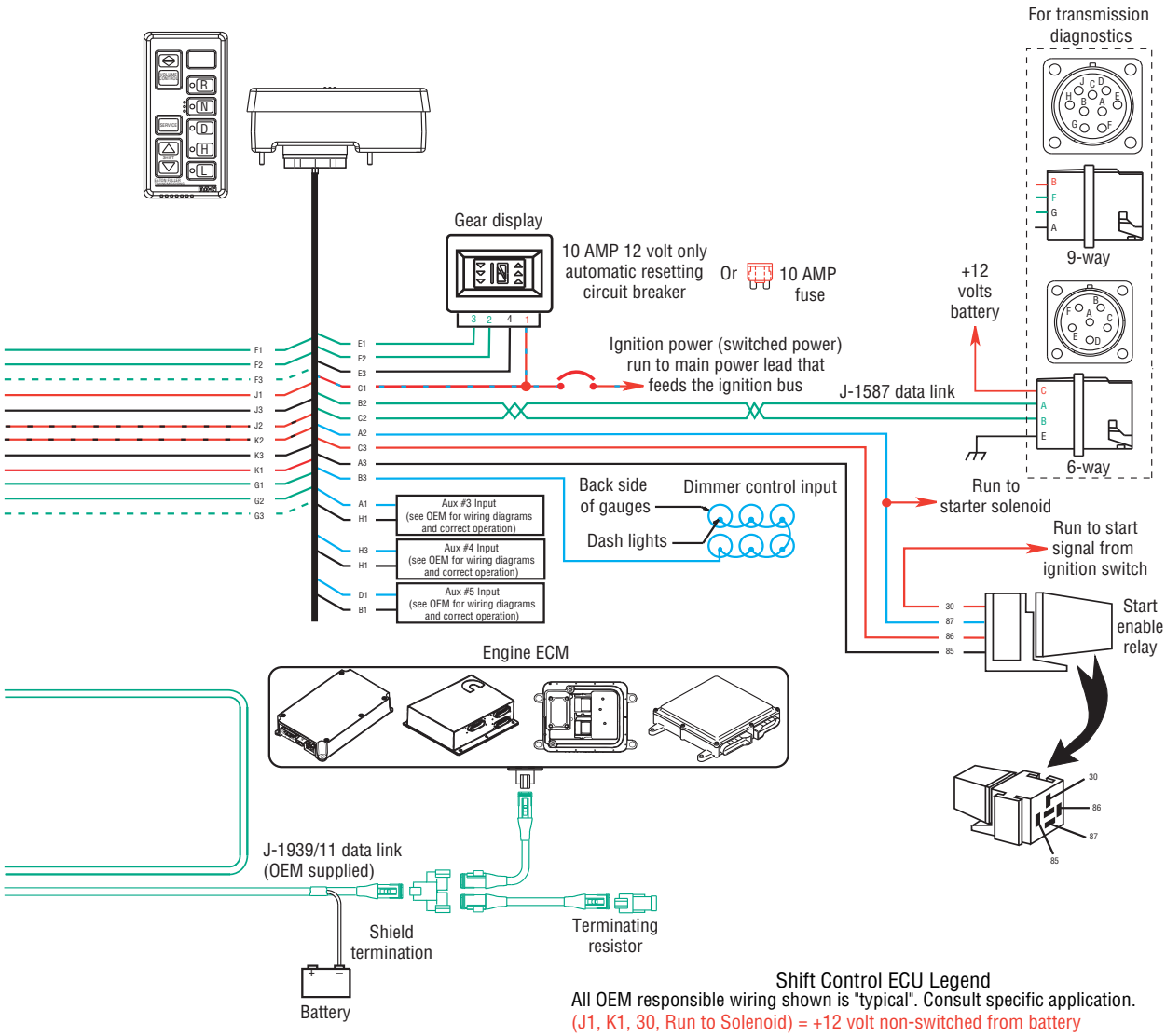
6-Speed and 7-Speed AutoShift Wiring Diagram



Trans ECU Legend

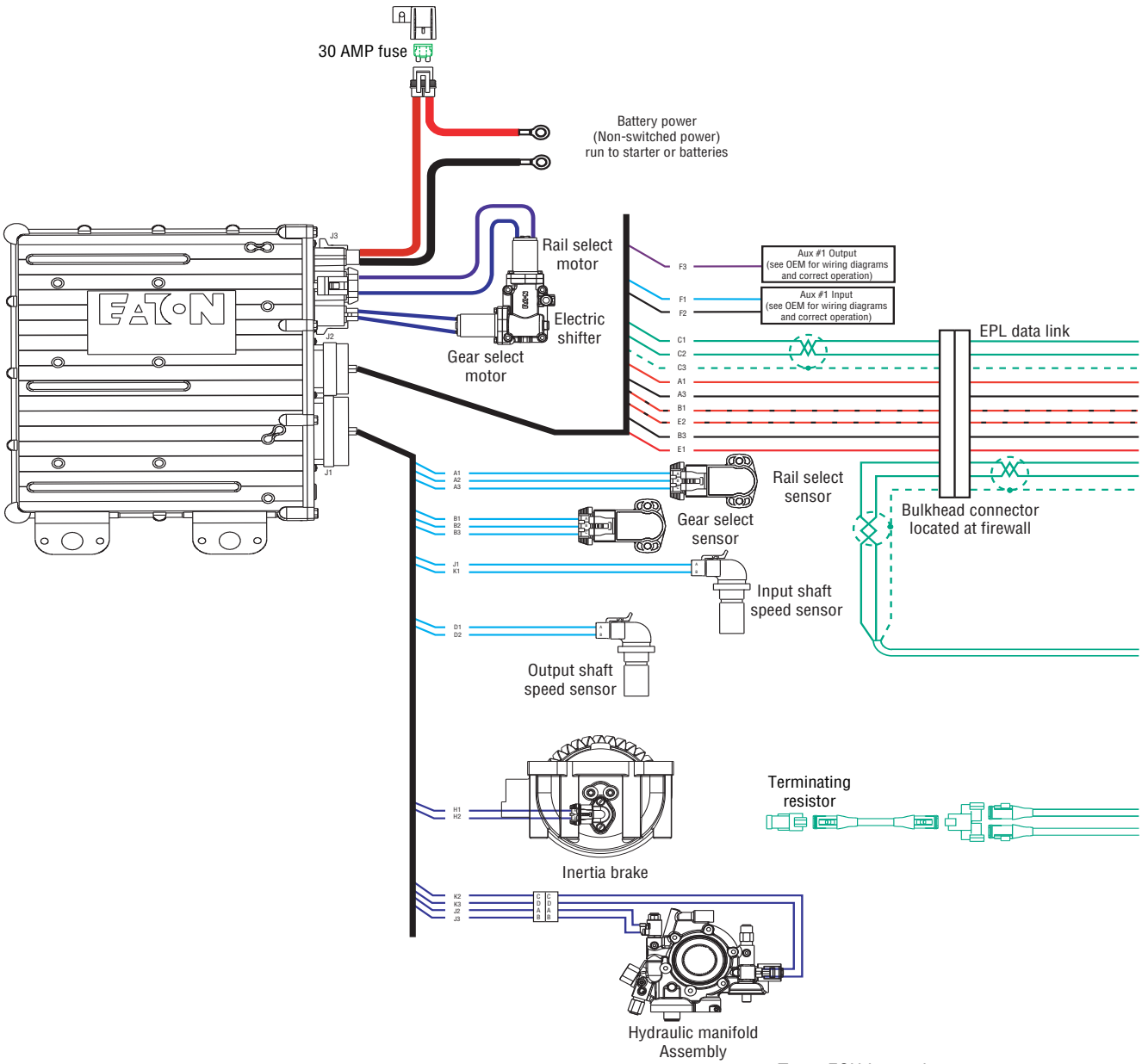
All OEM responsible wiring shown is "typical". Consult specific application.
(A1, E1) = +12 volt non-switched from battery
(B1, E2) = +12 volt switched from shift control to transmission controller
(F1) = Signals into the ECU
(C1, C2, C3, J-1939) = Communication from and to the ECU
(F2, A3, B3) = Signal returns, grounds, and general OEM wiring
(F3) = Aux output 1



Shift Control ECU Legend

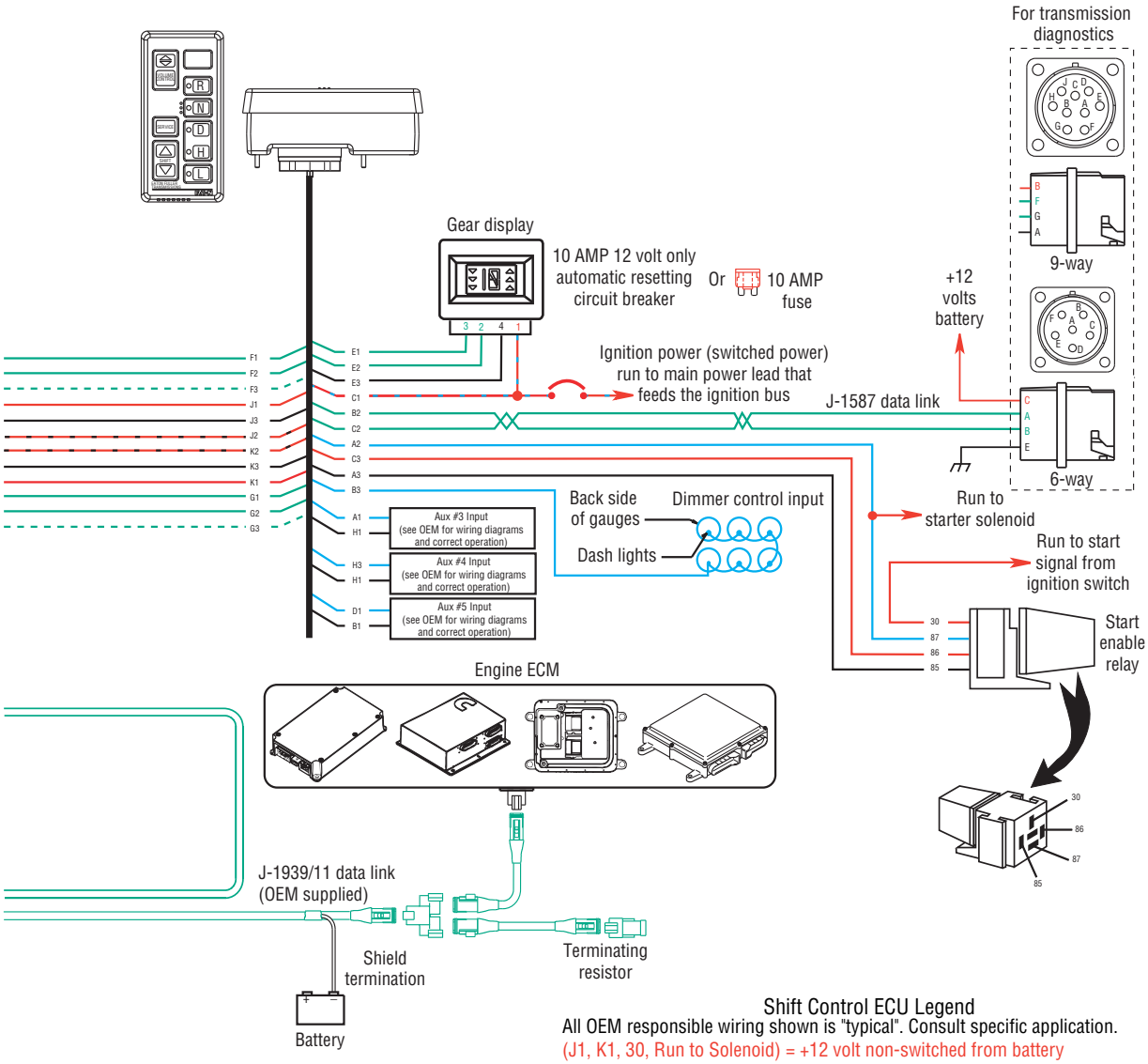
All OEM responsible wiring shown is "typical". Consult specific application.
(J1, K1, 30, Run to Solenoid) = +12 volt non-switched from battery
(J2, K2) = +12 volt switched from shift control to transmission controller
(C1) = +12 volt switched from ignition switch
(A2-87, B3, A1, H3, D1) = Signals into the ECU
(F1, F2, F3, G1, G2, G3, E1, E2, B2, C2, J-1939) = Communication from and to the ECU
(J3, K3, E3, H1, B1) = Signal returns, grounds, and general OEM wiring
(A3-85) = -12 volt relay source
(C3-86) = +12 volt relay source

6-Speed UltraShift ASW Wiring Diagram



Trans ECU Legend

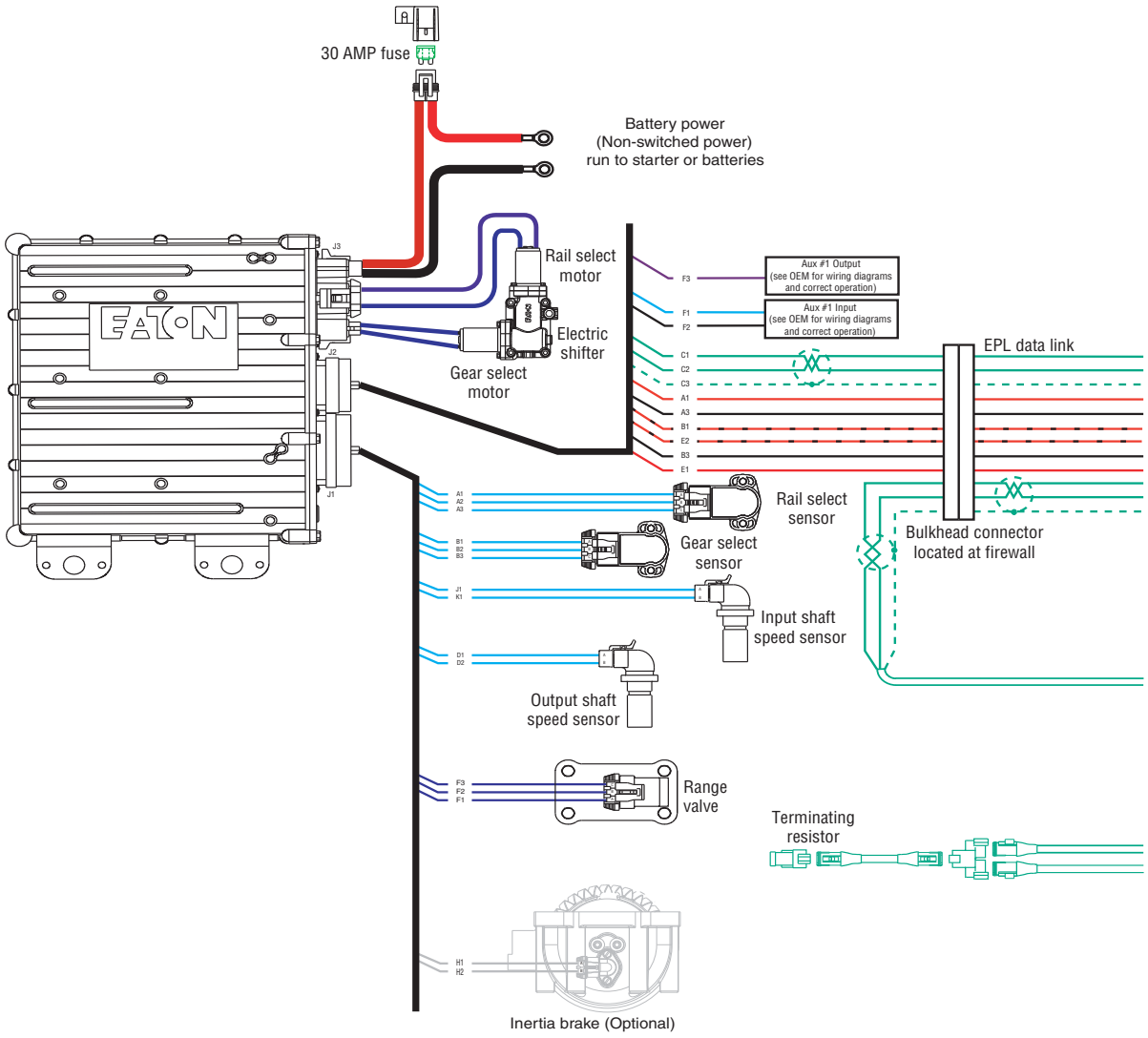
All OEM responsible wiring shown is "typical". Consult specific application.
(A1, E1) = +12 volt non-switched from battery
(B1, E2) = +12 volt switched from shift control to transmission controller
(F1) = Signals into the ECU
(C1, C2, C3, J-1939) = Communication from and to the ECU
(F2, A3, B3) = Signal returns, grounds, and general OEM wiring
(F3) = Aux output 1



Shift Control ECU Legend

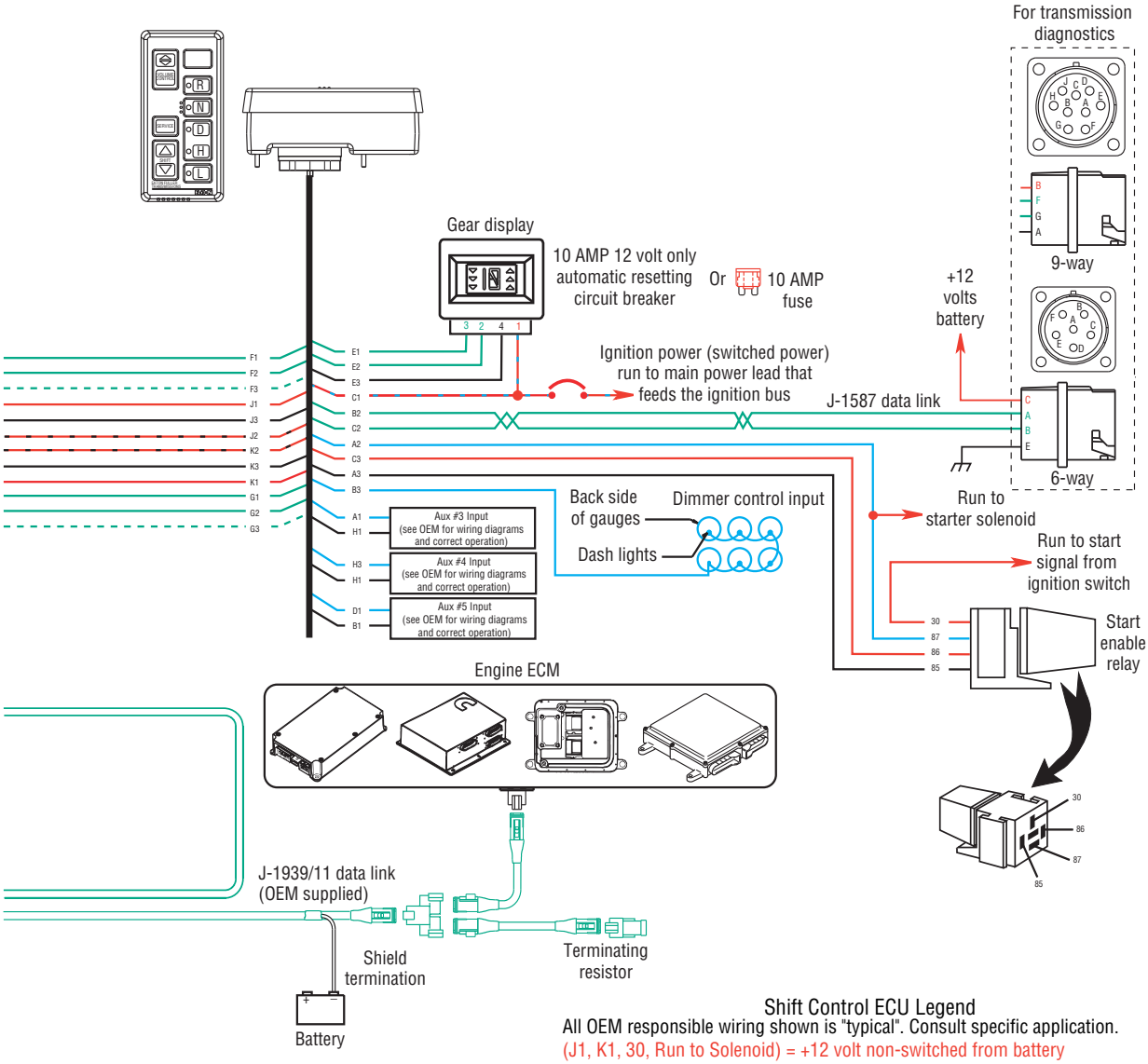
All OEM responsible wiring shown is "typical". Consult specific application.
(J1, K1, 30, Run to Solenoid) = +12 volt non-switched from battery
(J2, K2) = +12 volt switched from shift control to transmission controller
(C1) = +12 volt switched from ignition switch
(A2-87, B3, A1, H3, D1) = Signals into the ECU
(F1, F2, F3, G1, G2, G3, E1, E2, B2, C2, J-1939) = Communication from and to the ECU
(J3, K3, E3, H1, B1) = Signal returns, grounds, and general OEM wiring
(A3-85) = -12 volt relay source
(C3-86) = +12 volt relay source

10-Speed AutoShift Wiring Diagram



Trans ECU Legend

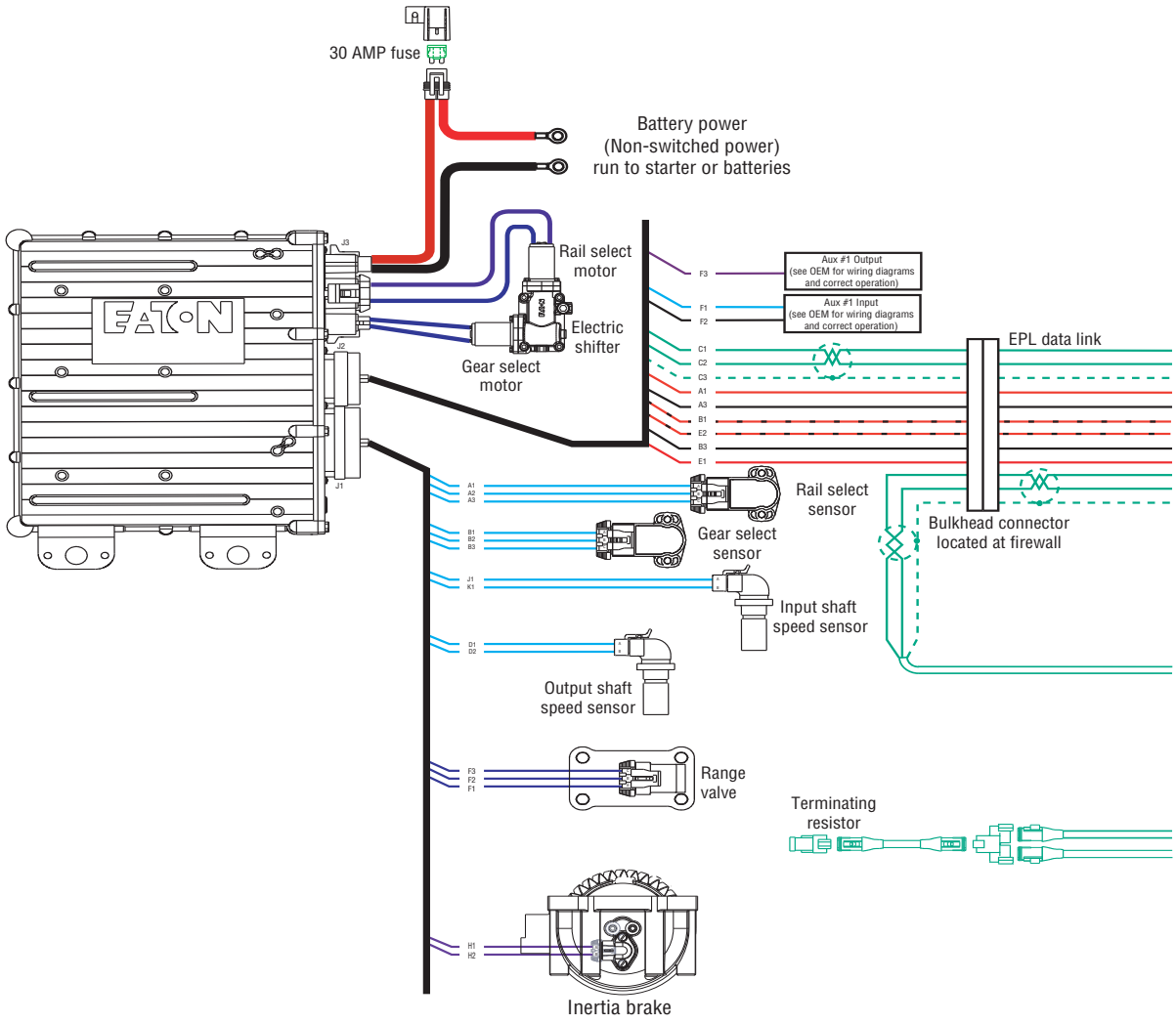
All OEM responsible wiring shown is "typical". Consult specific application.
(A1, E1) = +12 volt non-switched from battery
(B1, E2) = +12 volt switched from shift control to transmission controller
(F1) = Signals into the ECU
(C1, C2, C3, J-1939) = Communication from and to the ECU
(F2, A3, B3) = Signal returns, grounds, and general OEM wiring
(F3) = Aux output 1



Shift Control ECU Legend

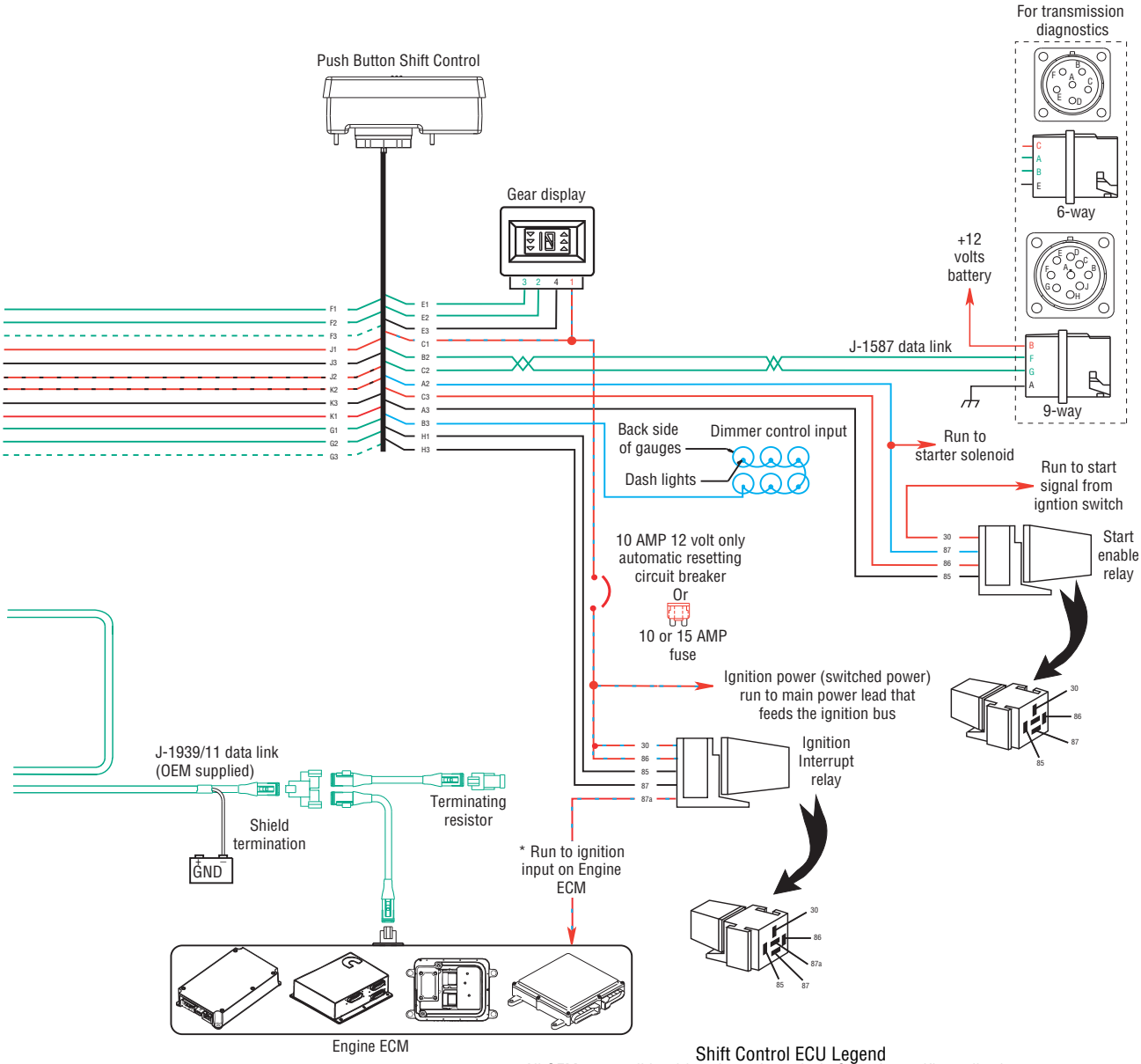
All OEM responsible wiring shown is "typical". Consult specific application.
(J1, K1, 30, Run to Solenoid) = +12 volt non-switched from battery
(J2, K2) = +12 volt switched from shift control to transmission controller
(C1) = +12 volt switched from ignition switch
(A2-87, B3, A1, H3, D1) = Signals into the ECU
(F1, F2, F3, G1, G2, G3, E1, E2, B2, C2, J-1939) = Communication from and to the ECU
(J3, K3, E3, H1, B1) = Signal returns, grounds, and general OEM wiring
(A3-85) = -12 volt relay source
(C3-86) = +12 volt relay source

10-Speed UltraShift DM Wiring Diagram



Trans ECU Legend

All OEM responsible wiring shown is "typical". Consult specific application.
(A1, E1) = +12 volt non-switched from battery
(B1, E2) = +12 volt switched from shift control to transmission controller
(F1) = Signals into the ECU
(C1, C2, C3, J-1939) = Communication from and to the ECU
(F2, A3, B3) = Signal returns, grounds, and general OEM wiring
(F3) = Aux output 1

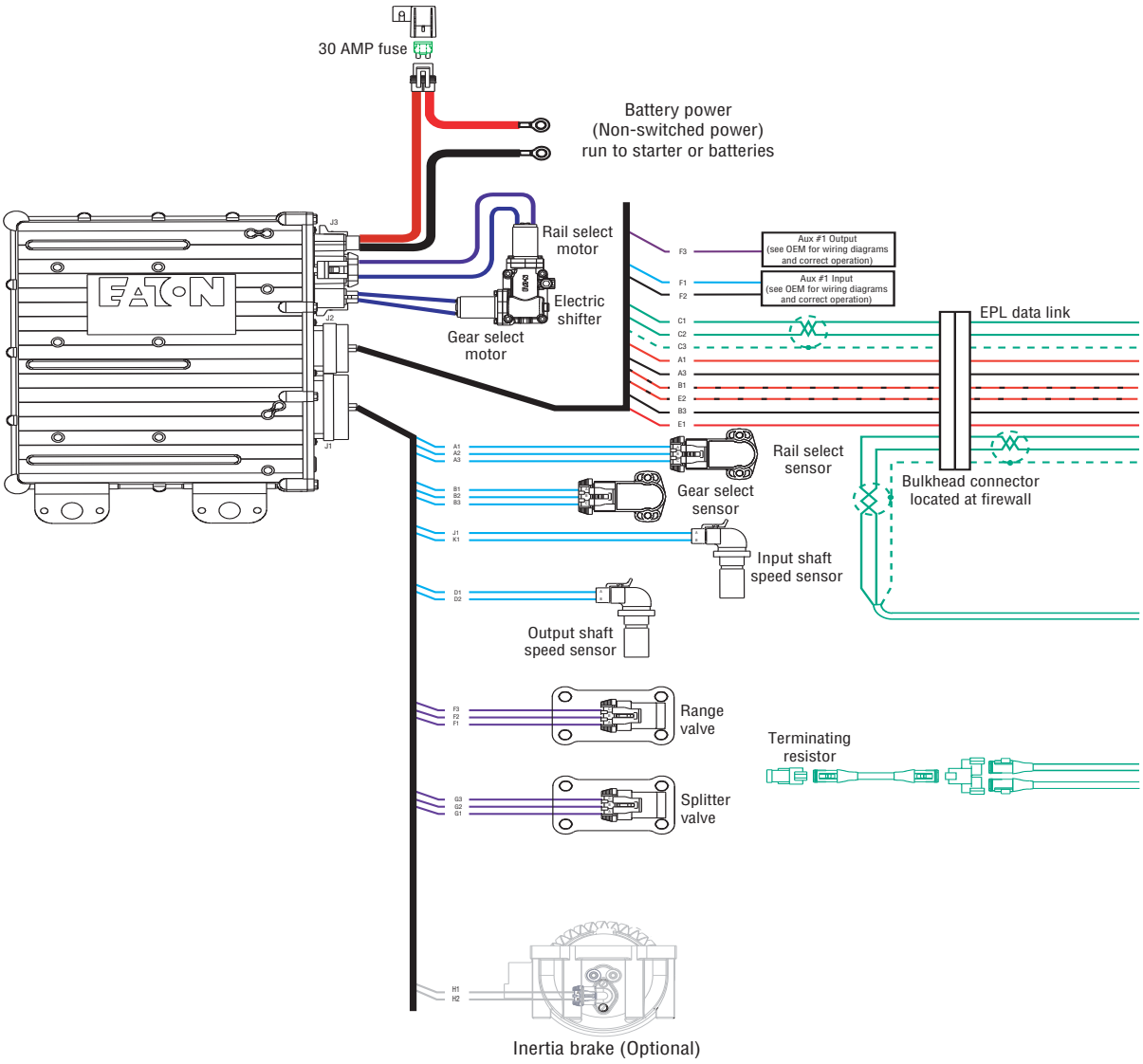


* For vehicle/engine systems which use a vehicle system ECU, contact the Eaton OEM liaison for installation schematics

Shift Control ECU Legend

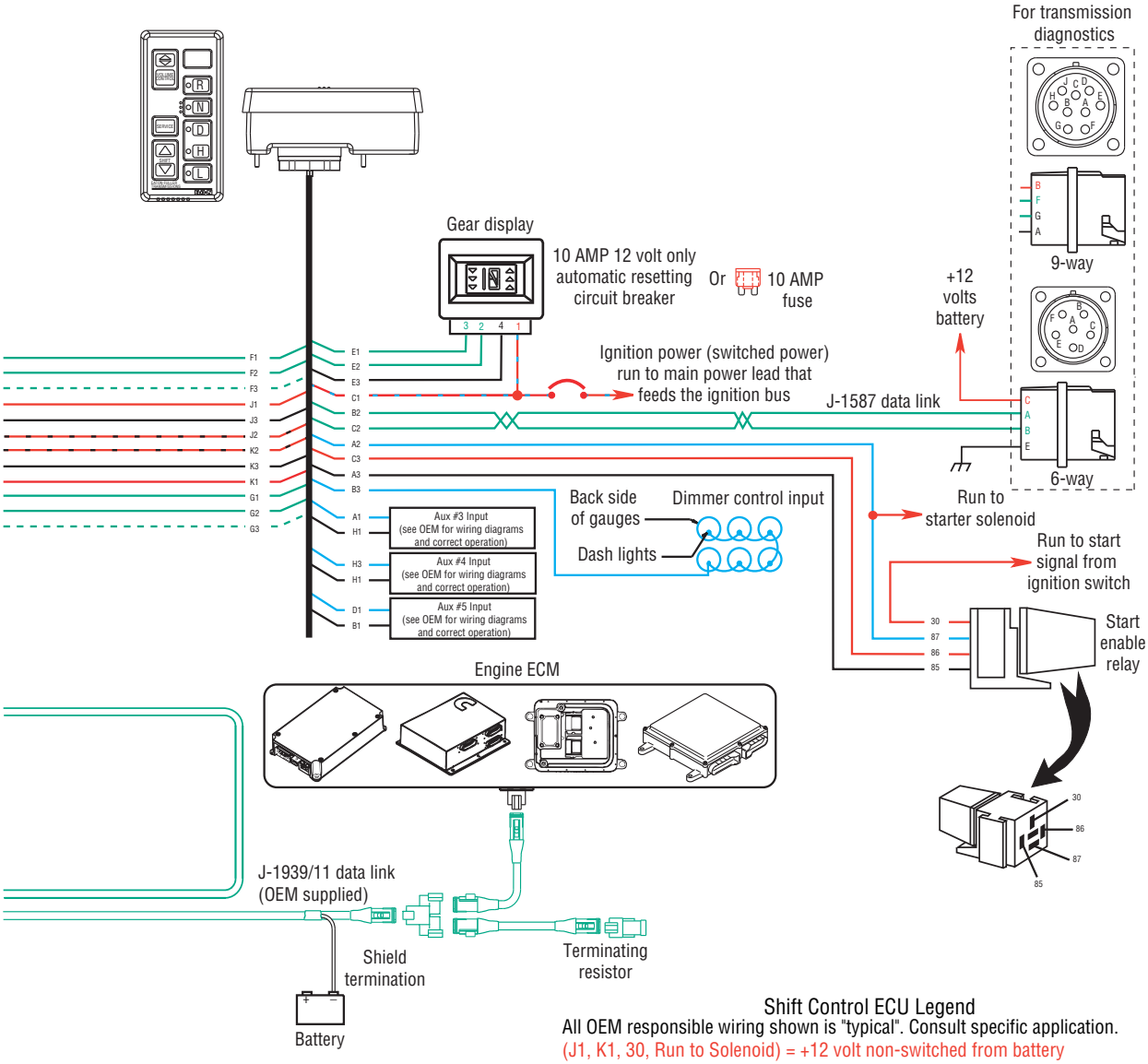
All OEM responsible wiring shown is "typical". Consult specific application.
(J1, K1, Run to Solenoid, Start: 30) = +12 volt non-switched from battery
(J2, K2) = +12 volt switched from shift control to transmission controller
(C1,Ignition Power, Ignition: 30, 86, 87a) = +12 volt switched from ignition switch
(A2-87) = Signals into the ECU
(F1, F2, F3, G1, G2, G3, E1, E2, B2, C2, J-1939) = Communication from and to the ECU
(J3, K3, E3, H3-87) = Signal returns, grounds, and general OEM wiring
(A3-85, H1-85) = -12 volt relay source
(C3-86) = +12 volt relay source

18-Speed AutoShift Wiring Diagram



Trans ECU Legend

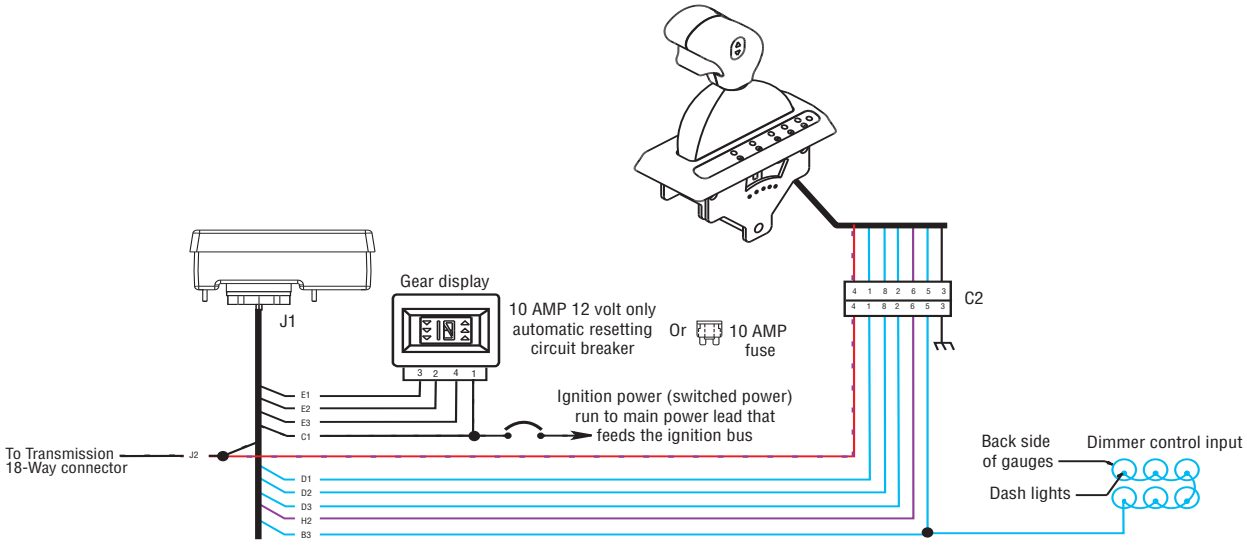
All OEM responsible wiring shown is "typical". Consult specific application.
(A1, E1) = +12 volt non-switched from battery
(B1, E2) = +12 volt switched from shift control to transmission controller
(F1) = Signals into the ECU
(C1, C2, C3, J-1939) = Communication from and to the ECU
(F2, A3, B3) = Signal returns, grounds, and general OEM wiring
(F3) = Aux output 1



Shift Control ECU Legend

All OEM responsible wiring shown is "typical". Consult specific application.
(J1, K1, 30, Run to Solenoid) = +12 volt non-switched from battery
(J2, K2) = +12 volt switched from shift control to transmission controller
(C1) = +12 volt switched from ignition switch
(A2-87, B3, A1, H3, D1) = Signals into the ECU
(F1, F2, F3, G1, G2, G3, E1, E2, B2, C2, J-1939) = Communication from and to the ECU
(J3, K3, E3, H1, B1) = Signal returns, grounds, and general OEM wiring
(A3-85) = -12 volt relay source
(C3-86) = +12 volt relay source

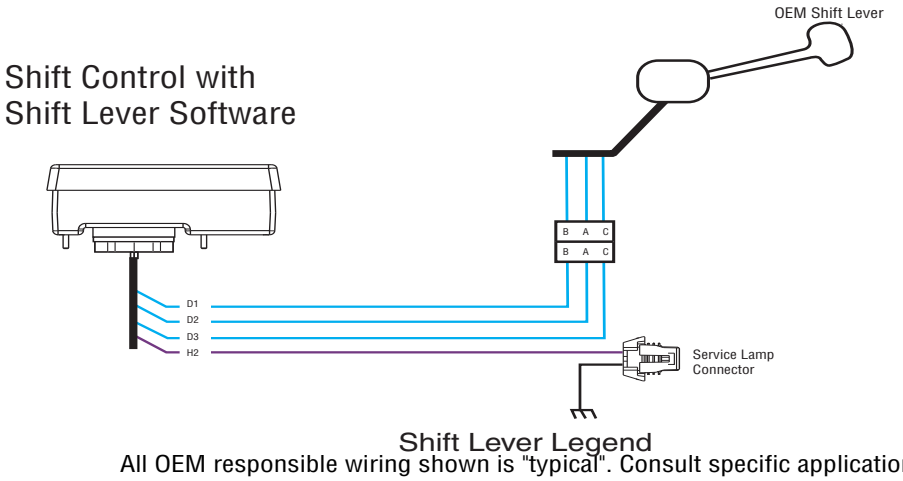
Eaton Shift Lever Wiring Diagram



Shift Lever Legend

All OEM responsible wiring shown is "typical". Consult specific application.
(J2-4) = +12 volt switched from shift controler to shift lerver
(D1-1, D2-8, D3-2, B3-5) = Signals into the ECU
(3) = Signal returns, grounds, and general OEM wiring
(H2-6) = +12 volt signal from shift control to shift lever

OEM Shift Lever Wiring Diagram



Shift Lever Legend

All OEM responsible wiring shown is "typical". Consult specific application.
(D1-B, D2-A, D3-C) = Signals into the ECU
(H2) = +12 volt signal from shift control to shift lever

Proper Clutch Operation

When performing the test for Proper Clutch Operation, the vehicle should be in the same condition as when the problem occurred. For instance, if the problem only occurs when the vehicle is hot, drive the vehicle to warm it up before conducting the test.

When the operator depresses the clutch pedal and shifts from neutral to drive or reverse, the transmission controller waits for the transmission input shaft speed to decrease to less than 150 RPM before shifting the transmission into gear. If the clutch is not disengaging completely or the clutch brake is not functioning properly, the input shift will not slow down and the transmission will not shift into gear.

Check For Proper Clutch Operation

With PC-Base Service Tool

1. Connect PC-Based Service Tool.
2. Make sure the transmission is in neutral
3. Start Engine.
4. Set PC-Based Service Tool to monitor input shaft speed.
5. With Clutch pedal up (clutch engaged), compare input shaft speed and engine speed (RPM). They should be the same.

Note: If engine speed and input shaft speeds are not the same, then perform input shaft speed sensor test and confirm proper clutch adjustment.

6. Check clutch for slippage, and repair or replace as needed.
7. Depress clutch pedal to active clutch brake. Within 2 seconds, input shaft speed should be less than 25 RPM (0 RPM is desired). If input shaft does not stop turning, the clutch is not disengaging completely or the clutch brake is not functioning properly.
8. Check for proper clutch adjustment, adjust as necessary.
9. Inspect clutch brake for excessive friction material wear or internal damage. Replace as necessary.

Note: The clutch brake may have to be removed to inspect properly.

10. If clutch adjustment is correct and clutch brake appears satisfactory, the problem may be a defective clutch. The clutch may require repair or replacement. Refer to the clutch manufacturer's service information to verify a dragging clutch.

Without PC-Based Service Tool

1. Place transmission in neutral.
2. Start Engine.
3. Let up on the clutch pedal (clutch engaged).
4. Depress clutch pedal fully to activate clutch brake and hold for 2 seconds.
5. Place transmission in starting gear.
6. If starting gear display shows a solid gear (engaged), the procedure is complete. If the gear display shows a flashing gear (not yet engaged) continue on to number 7.
7. If flashing gear is displayed, slowly release the clutch pedal.
8. If flashing gear does not become solid or gear does not engage, check clutch brake for proper function and check clutch adjustment.
9. If gear does not engage and clutch is adjusted properly, troubleshooting for a dragging clutch according to clutch manufacturer.

Confirm Proper Clutch Adjustment and Clutch Brake Contact

Confirm Release Bearing Travel Gap

Use a 1/2” gauge to verify the release bearing travel gap. This gap (distance between the rear of the release bearing and the clutch brake) must be between 1/2” and 9/16”.

If this dimension is incorrect, adjust the clutch per the clutch manufacturer’s instructions.

Confirm the Free-Play gap (For mechanical clutch release systems with free-play)

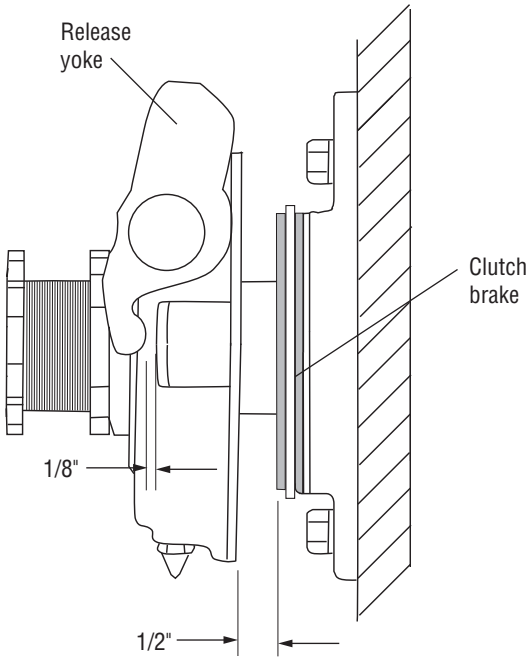
Use a 1/8” or 1/16” gauge to verify proper free-play gap. This gap should be 1/8” Easy Pedal and 1/16” Solo.

If this dimension is incorrect, adjust the clutch per the clutch manufacturer’s instructions.

Confirm Proper Clutch Brake Contact

Insert a .010” feeler gauge between the release bearing and the clutch brake. have an assistant fully depress the clutch pedal. The .010” feeler gauge should be squeezed between the rear of the release bearing and the clutch brake. Have the assistant slowly let up the clutch pedal. The .010” feeler gauge should slide out when the clutch pedal is 1/2” to 1” above the cab floor or lower pedal stop.

If the .010” feeler gauge is not adequately squeezed to prevent removal, or can be removed with the pedal less than1/2” or greater than 1”, Check and adjust the clutch pedal height and travel per the chassis manufacturer’s instructions. In addition, check the external clutch linkage for excessive wear or obstruction preventing complete travel.



Adapter Test Kit #J-43318

Gray Adapters

Gray adapter are to only used for the following connectors:

- Vehicle interface 18-way
- Transmission Controller 30-way connector
- Shift Control 30-way connector
- Speed Sensors
- Position Sensors
- Range Valve
- Splitter Valve

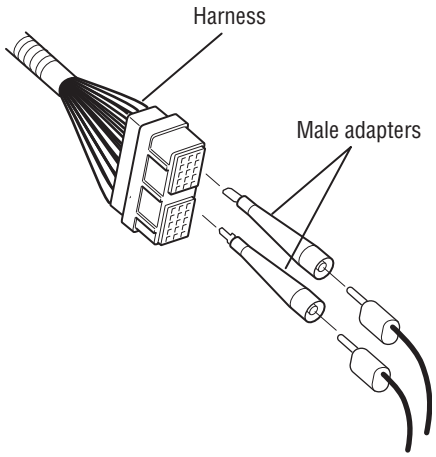
Purple Adapters

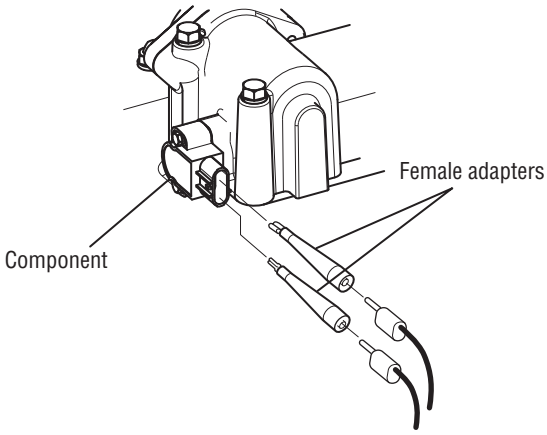
Purple adapter are to only used for the following connectors:

- Motors
- Main Power
- Inertia Brake

Adapter Pins

Use the male adapter to test the harness pins.Use the female adapter to test the component pins.





Troubleshooting Worksheet

1. Have you been able to verify the concern.

2. Do you have any **active** codes from the service light on the console? If so, list them.

3. Detailed description of the complaint. How often does it occur? (Please try to avoid, “transmission won’t shift”).

    a. When you notice the symptom/s, does the service light flash or does the driver notice an “F” in the gear display? In addition, does the driver notice any “ABS” or “Check Engine” lights on?

    b. When you notice the symptom/s, what does the gear display indicate? (flashing number, solid number, flashing arrows, blank display, etc.).

    c. When the symptom/s occur, do you have control of the throttle? If so, what RPM will the engine achieve?

    d. When you stop the truck, will the transmission return to neutral, or are you forced to shut the engine off with the transmission still in gear. If forced to shut down in gear, will the engine re-crank and what does the gear display indicate?

    e. Will the engine crank? If not, is the service light flashing, and what does the gear display indicate?

    f. Will the transmission engage a start gear from neutral? If not, is the service light flashing, and what does the gear display indicate? If a Push Button Shift Controller, will the indicator lights follow the buttons?

4. What diagnosis or repairs have been made to this point?

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