

# Gen II Automated Transmissions TRTS0062 EN-US

May 2013

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



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## 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.

Before starting a vehicle:

- Sit in the driver's seat
- Place Shift Lever in neutral
- Set the parking brake

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

- Place Shift Lever in neutral
- Set the parking brake
- Block the wheels

When parking the vehicle or leaving the cab:

- Place Shift Lever in neutral
- 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:

1. Place Shift Lever in neutral
2. Lift the drive wheels off of the ground or disconnect the driveline

Do not operate vehicle if Alternator light is lit or if gauges indicate low voltage.

For parts or service call us  
Pro Gear & Transmission, Inc.



**1 (877) 776-4600**

**(407) 872-1901**

**parts@eprogear.com**

**906 W. Gore St.**

**Orlando, FL 32805**



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## 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

### 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

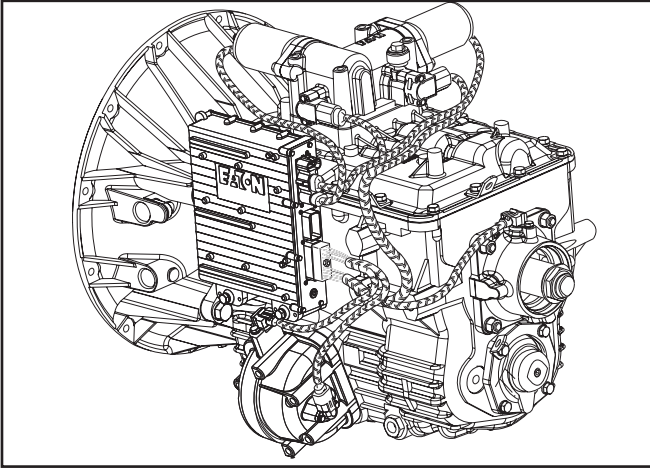
### 6-Pin Deutsch Diagnostic Adapter

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

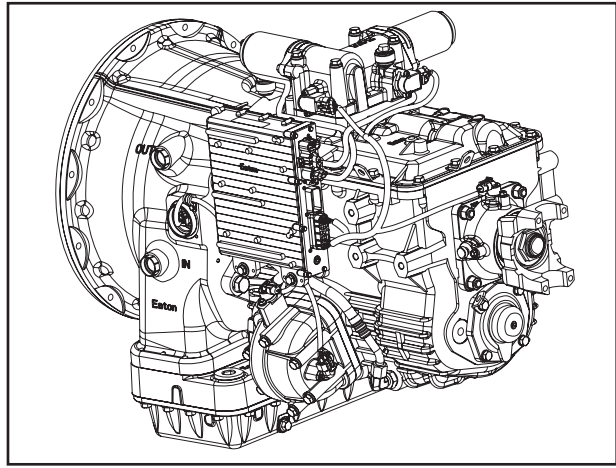
For more information call 1-800-826-HELP (826-4357)

## Transmission Models Included

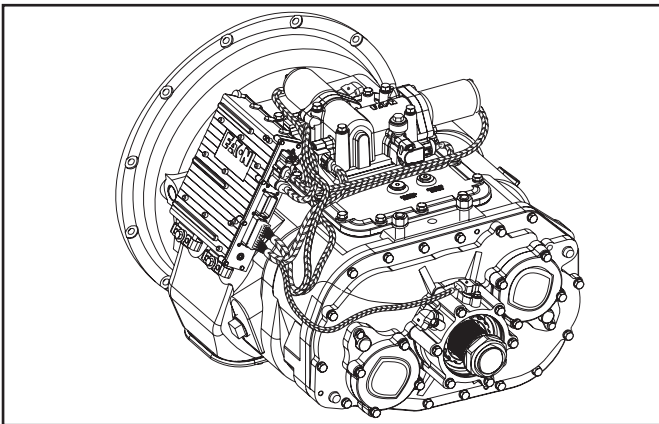
6-Speed



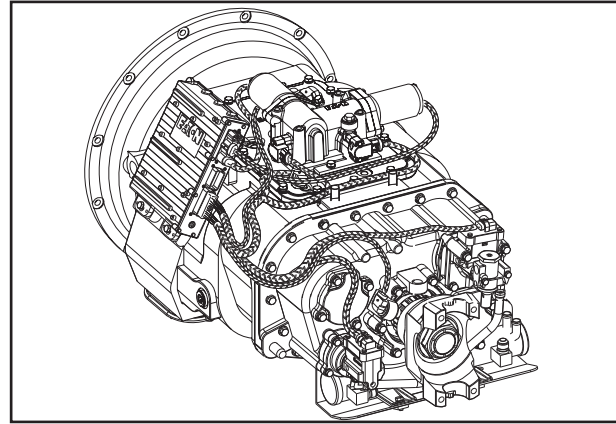
6-Speed ASW



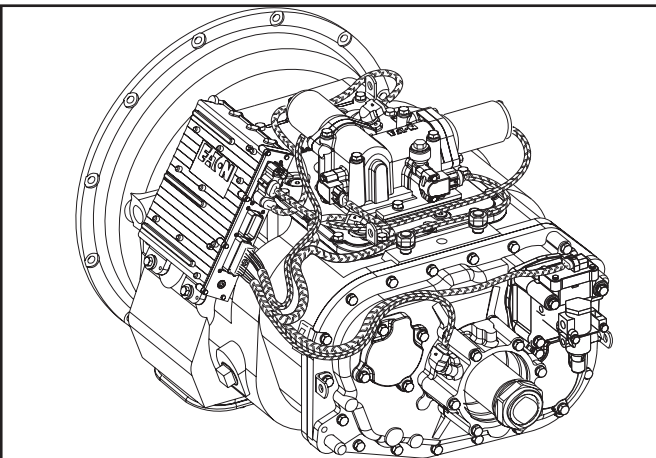
7-Speed



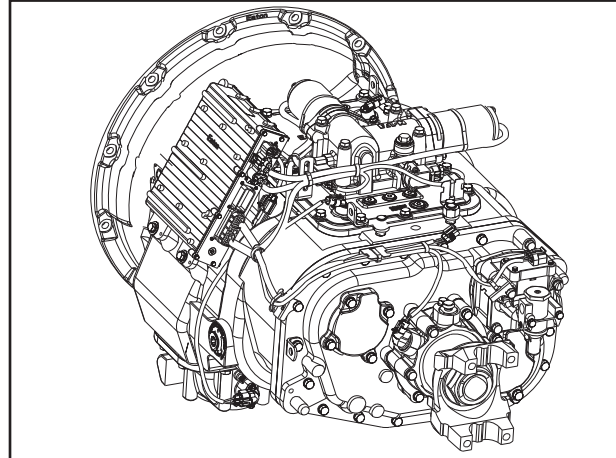
18-Speed



10-Speed

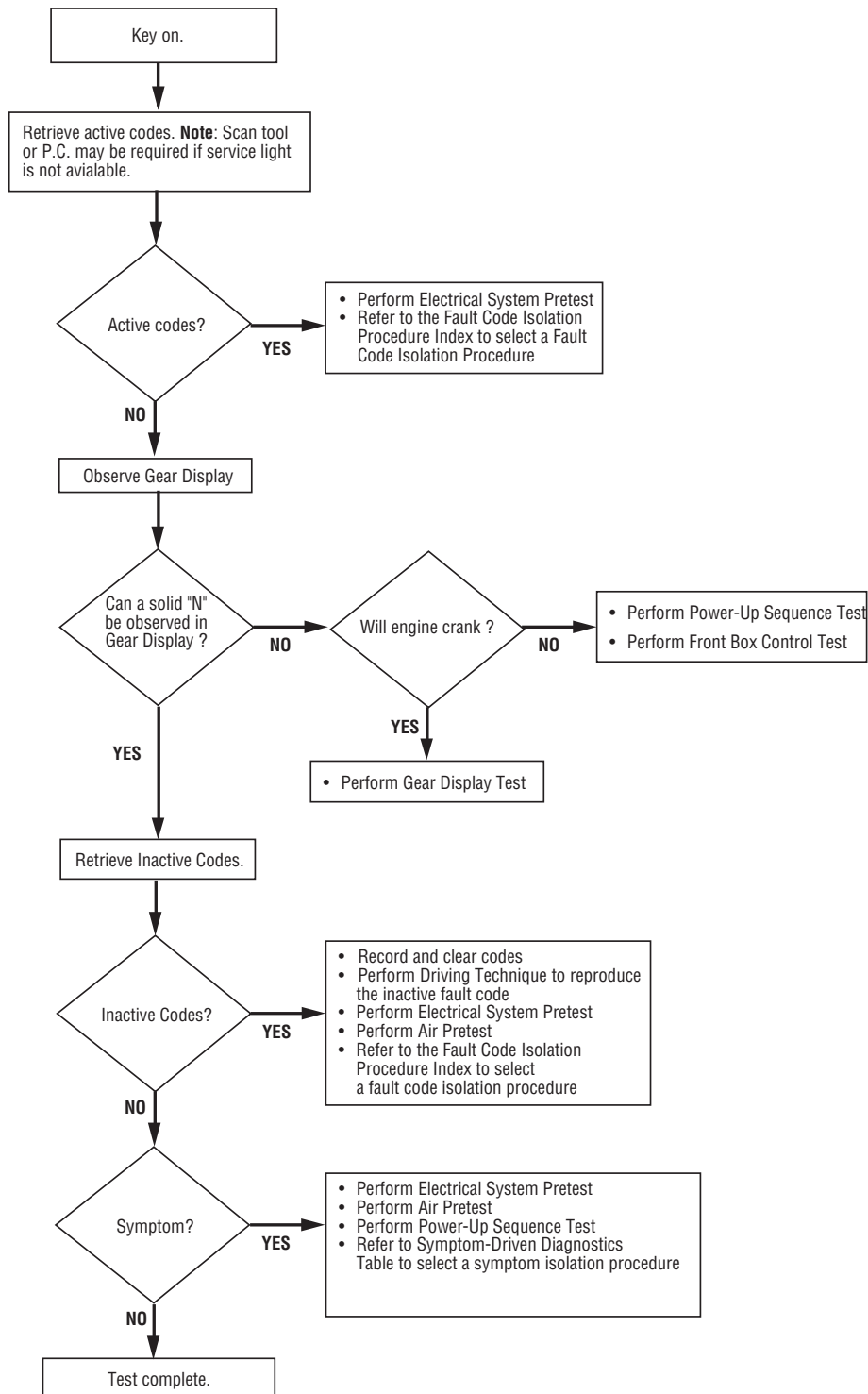


10-Speed DM



# Diagnostic Procedure

Follow the flow chart 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 self-diagnostic mode.

**Note:** Use a PC-based Service Tool, such as the ServiceRanger to retrieve fault codes.

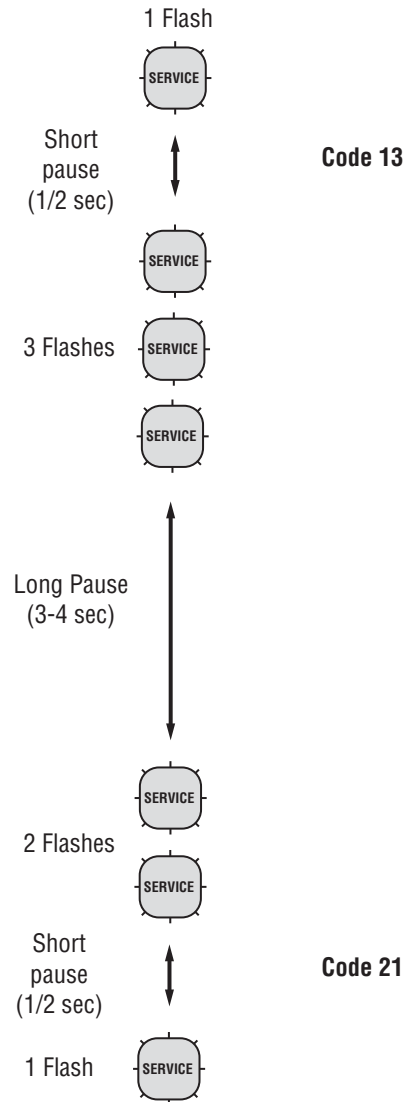
1. Place the Shift Lever in neutral.
2. Set the parking brake.
3. Turn the key on but do not start the engine. If the engine is running, you may still retrieve codes; however, do not engage the Starter if the engine stalls.
4. To Retrieve Active Codes: Turn the key off and on 2 times within 5 seconds ending with the key on. After 5 seconds, the Service light begins flashing 2-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 on. Turn key off and on 4 times within 5 seconds ending with the key on. After 5 seconds, the Service light begins flashing 2-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 light and record the codes. A 1 to 2 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 Transmission Controller memory. Active fault codes will be 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 key on, but do not start the engine.
4. Start with the key on. Turn the key off and on 6 times within 5 seconds ending with the key on.



**Note:** If the codes have been successfully cleared, the Service light will come on and stay on for 5 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 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.
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.



<b>Fault Codes</b>	<b>PID</b>	<b>SID</b>	<b>FMI</b>	<b>Description</b>	<b>Type of Code</b>	<b>Driving Technique</b>
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.
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.

Fault Codes	PID	SID	FMI	Description	Type of Code	Driving Technique
41		56	7	Range Failed to Engage	System	Operate vehicle and perform several range up shifts and down shifts. The failure is detected after 5 consecutive attempts to complete the same type of range shift. Several shifts (10 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 up shifts and down shifts. The failure is detected after 5 consecutive attempts to complete the same type of range shift. Several shifts (10 or more) may be necessary before the controller confirms the failure.
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.

<b>Fault Codes</b>	<b>PID</b>	<b>SID</b>	<b>FMI</b>	<b>Description</b>	<b>Type of Code</b>	<b>Driving Technique</b>
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.
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 (10 or more) may be required before operator confirms the failure.

Fault Codes	PID	SID	FMI	Description	Type of Code	Driving Technique
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 up shifts and down shifts in the top gears. If this does not set the code, then perform the following. With vehicle stopped, select a drive gear and fully press 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.
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
11		254	12	Shift Controller	Component	
12		233	12	Transmission Controller	Component	
14		18	2, 4, 5	Invalid lever Position	Component	
16		248	2	Eaton Proprietary Link (EPL)	Component	
17		237	3, 4	Start Enable Relay Coil	Component	
25				No Codes		
26		55	10	Clutch Slip	Component	
27		55	7	Clutch Disengagement	Component	
28		52	3,4,5,7	Clutch System Fault	Component	
31		218	3,4	Momentary Engine Ignition Interrupt Relay	Component	
32		62	4	Switched System Voltage	Component	
33	168		4	Battery Voltage supply	Component	
35		231	2	J1939 Data Link	System	
41		56	7	Range Failed to Engage	System	
42		61	7	Splitter Failed to Engage	System	
43		35, 36	3, 4, 5	Range Valve	Component	
44	53		3, 4, 5	Inertia Brake Solenoid Coil	Component	
46		37, 38	3, 4, 5	Splitter Valve	Component	
51	60		2, 3, 4, 10	Rail Select Sensor	Component	
52	59		2, 3, 4	Gear Select Sensor	Component	
56	161		2, 5	Input Shaft Speed Sensor	Component	
57	160		2	Main Shaft Speed Sensor	Component	
58	191		2	Output Shaft Speed Sensor	Component	
61		39	5, 6	Rail Select Motor	Component	
63		40	5, 6	Gear Select Motor	Component	

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<b>Fault Codes</b>	<b>PID</b>	<b>SID</b>	<b>FMI</b>	<b>Description</b>	<b>Type of Code</b>	<b>Page Number</b>
65		251	4	Logic Power	Component	
71		60	7	Stuck Engage	System	
72		59	7	Failed to Select Rail	System	
73		58	7	Failed to Engage Gear	System	
74		54	7,10,12	Failed to Synchronize	System	
83		18	14	Shift Lever Missing	System	
91		236	5	Power Connection	System	
92		168	14	Weak System Battery Voltage	System	
93		231	14	Loss of J1939 Communication from the Engine	System	

## Symptom-Driven Diagnostics Index

Symptom	Isolation Procedure	Page Number
Electrical System Test	Electrical System Test	
Gear display shows a dash	Front Box Control Test	
Gear display not working	Gear Display Power Supply Test	
Engine starting system complaint	Start Enable Relay Test	
AutoShift will not engage a gear	AutoShift Will Not Engage A Gear Test	
UltraShift DM will not engage a gear	UltraShift DM Will Not Engage A Gear Test	
UltraShift ASW will not engage a gear	UltraShift ASW Will Not Engage A Gear Test	
No J1587 communications	J1587 Data Link Test	
Unsatisfactory range shift	Range System Test	
Unsatisfactory splitter shift	Splitter System Test	
Unable to shift transmission with up/down buttons	Up-Down Button Test	
UltraShift DM shift complaint	UltraShift DM Shift Complaint Test	
UltraShift ASW shift complaint	UltraShift ASW Shift Complaint Test	
UltraShift ASW clutch engagement complaint	UltraShift ASW Clutch Engagement Test	
Transmission air leak	Transmission Air Leak Test	
No lights on Shift Lever	Shift Lever Back Light Test	

## 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 Electrical 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 operator as some other fault code or symptom.

### Fallback

There is no fallback for the Electrical Pretest; however, it may effect other systems.

### Possible Causes

This pretest can be used for any of the following:

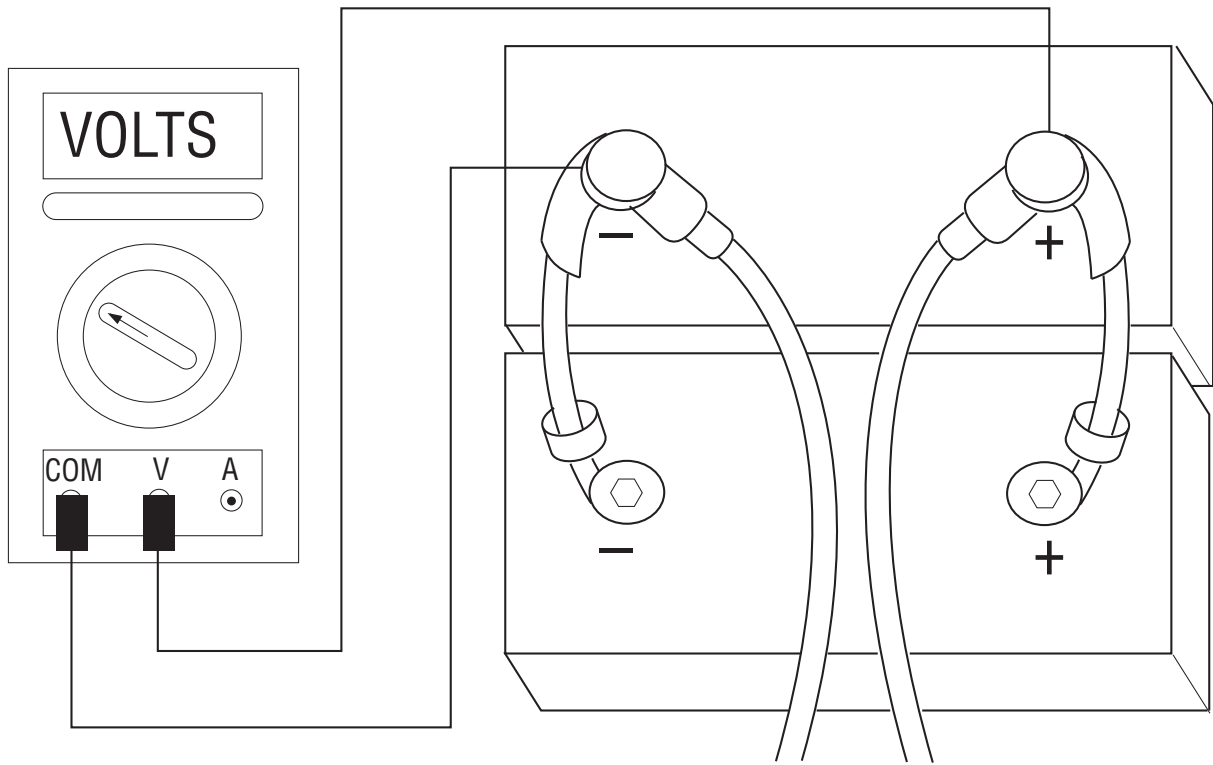
- Low batteries
- Starter-battery connections

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter
- Battery load tester



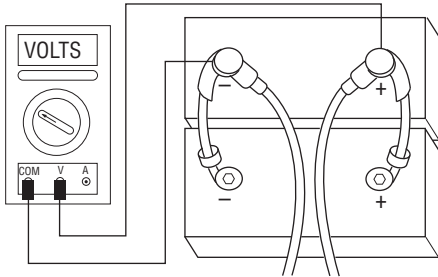
### Component Identification



## Electrical System Pretest

**A** *Purpose: Measure battery voltage, visually inspect batteries.*

1. Key off.
2. Inspect starter, battery and in-line fuse holder connections for integrity.
3. Measure voltage across batteries.



- If voltage is 11–13 volts on a 12-volt system or 22–26 on a 24-volt system, go to **Step B**.
- If voltage is outside of range, repair or replace batteries and charging system as required. Then measure voltage again.

**B** *Purpose: Verify the batteries pass a load test.*

1. Key off.
2. Load test the Batteries.
  - If the batteries maintain the specified load, test complete.
  - If the batteries fail the Load Test, replace the damaged battery(s). Go to **Step A**.

## Power-Up Sequence Pretest

### Overview

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

### Detection

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

### Fallback

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

### Possible Causes

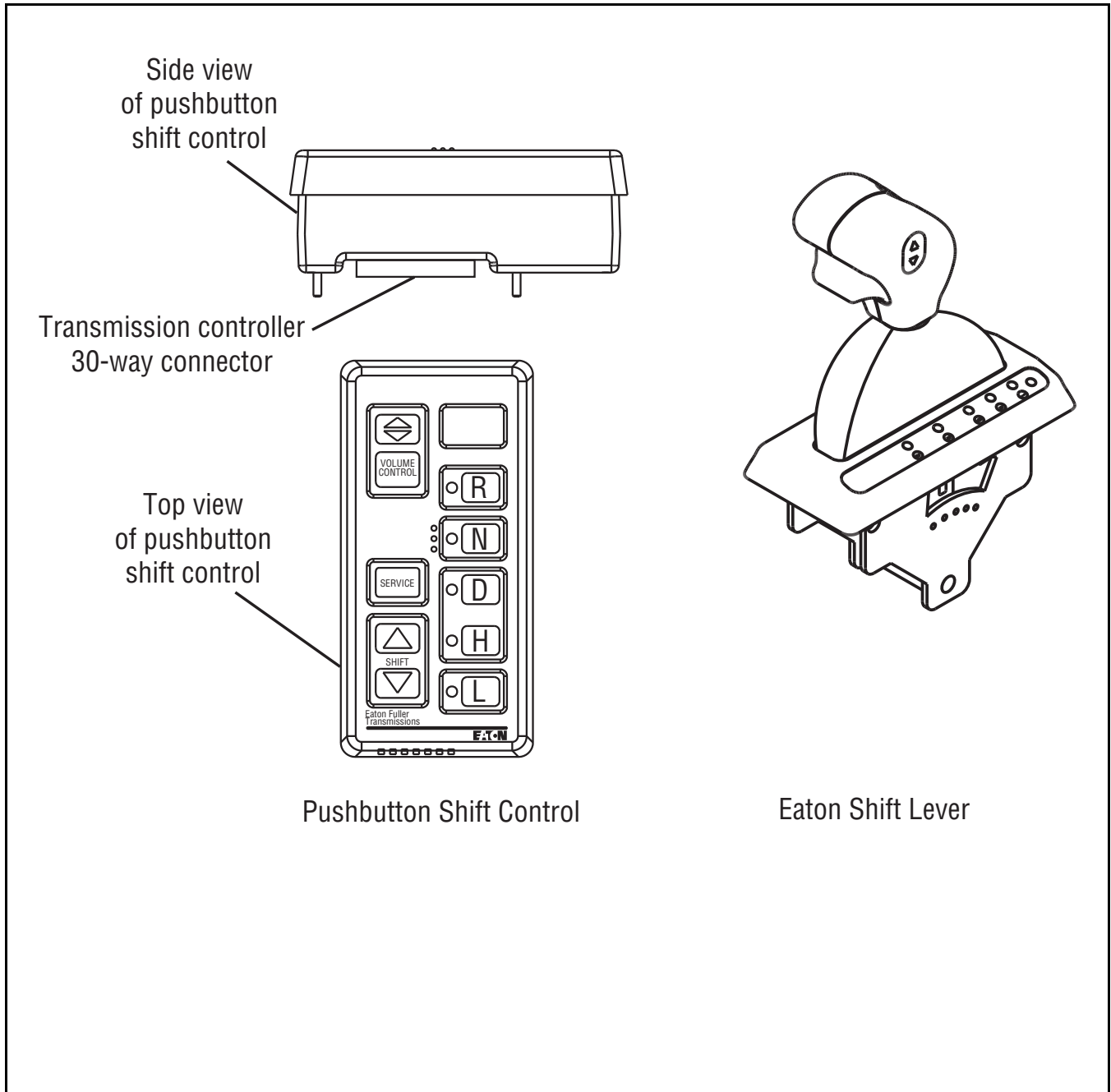
This test can be used for the following:

- Shift Controller
- Vehicle Harness

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

### Component Identification



## Power-Up Sequence Pretest

**A** **Purpose:** Visually identify if the vehicle is equipped with a Shift Lever.

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.**

**B** **Purpose:** Verify proper power up of the transmission shift controller.

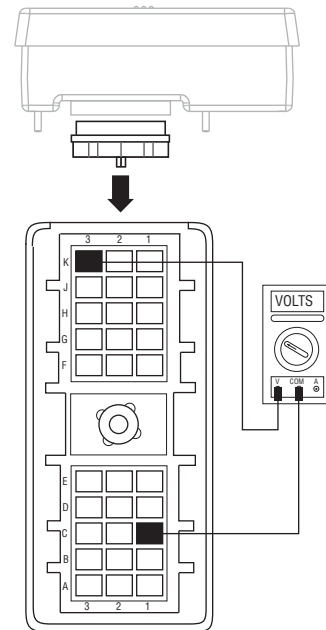
1. Key on.
2. Observe Service light.

**Note:** If Service light is flashing, see “Diagnostic Procedure” on page 4.

- If Service light lights for one second and turns off, Test complete.
- If Service light never comes on, go to **Step C.**
- If Service light is on steady, replace **Shift Control.** Repeat this step.

**C** **Purpose:** Confirm switched ignition voltage to the transmission shift controller.

1. Key off.
2. Disconnect Shift Controller 30-way connector.
3. Key on.
4. Measure voltage across batteries and record finding.
5. Measure voltage between Shift Controller 30-way Pin C1 and Pin 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.**

**D** **Purpose:** Visually identify if the Shift Lever is an Eaton Shift Lever or an OEM Shift Lever.

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.**

**E** **Purpose:** Visually observe the Service light during key-on power up.

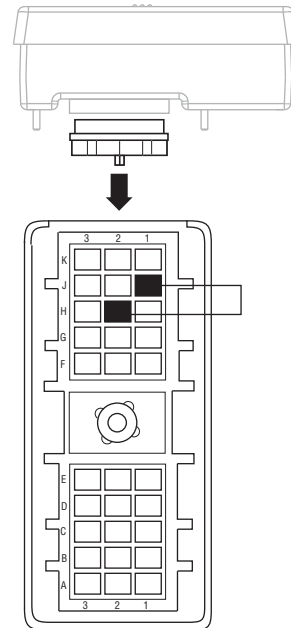
1. Key on.
2. Observe Service light.

**Note:** If Service light is flashing, see “Diagnostic Procedure” on page 4.

- If Service light illuminates for one second and turns off, test complete.
- If Service light never comes on, go to **Step F.**
- If Service light is on steady, go to **Step H.**

**F** **Purpose:** Test operation of the transmission Service light.

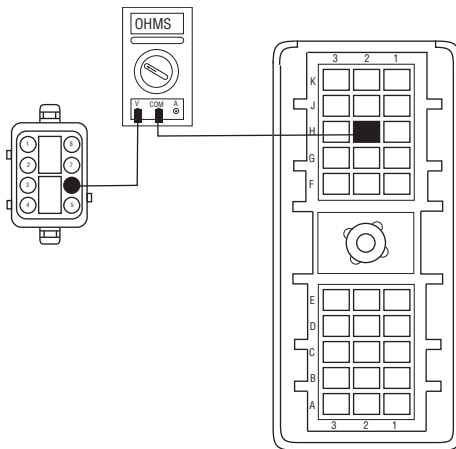
1. Key off.
2. Locate Shift Controller.
3. Disconnect Shift Controller 30-way connector.
4. Place a jumper across Shift Controller 30-way connector Pin J1 and Pin H2.



- If Service light turns on, replace **Shift Control**. Go to **Step E.**
- If Service light never comes on, go to **Step G.**

**G** **Purpose:** Confirm OEM Service light power wire continuity and test for a short to ground.

1. Key off.
2. Disconnect Shift Lever 8-way connector.
3. Measure resistance between:
  - Shift Controller 30-way Pin H2 and Shift Lever 8-way connector Pin 6
  - Shift Controller 30-way connector Pin H2 and ground.



- If resistance between Pin H2 and Pin 6 is 0–0.3 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 Vehicle Harness between Shift Controller and Shift Lever, go to **Step E**.

**H** **Purpose:** Test the transmission Service light.

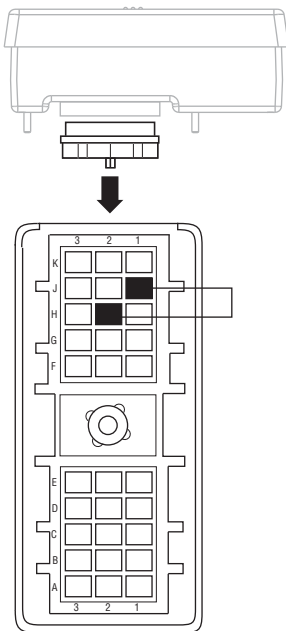
1. Key on.
2. Locate Shift Controller.
3. Disconnect Shift Controller 30-way connector.
  - If Service light turns off, replace **Shift Control**. Go to **Step E**.
  - If Service light remains on, repair OEM harness as required. Go to **Step E**.

**I** **Purpose:** Measure battery voltage to the Service light

1. Key off.
2. Locate Service light connector on Vehicle Harness.
3. Measure voltage across Pin A and Pin B on Service light connector.
4. Key on.
  - If voltage is within 2 volts of total battery voltage for 1 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**.

**J** **Purpose:** Test voltage to the transmission Service light

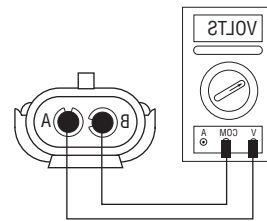
1. Key off.
2. Locate Shift Controller.
3. Disconnect Shift Controller 30-way connector.
4. Place a jumper across Shift Controller 30-way connector Pin J1 and Pin H2.
5. Key on.
6. Measure voltage across Service light connector.



- If voltage is within 2 volts of battery voltage. Replace **Shift Control**. Go to **Step I**.
- If no voltage is measured, repair Vehicle Harness as required. Go to **Step I**.

**K** **Purpose:** Measure voltage drop across the OEM transmission Service light

1. Key on.
2. Locate Shift Controller.
3. Disconnect Shift Controller 30-way connector.
4. Measure voltage across Service Light connector Pin A and Pin B.



- If no voltage is measured, replace **Shift Control**. Go to **Step I**.
- If voltage is within 2 volts of battery voltage, repair Vehicle Harness as required. Go to **Step I**.



## 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 operator as some other type of fault code or symptom.

### Fallback

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

### Possible Causes

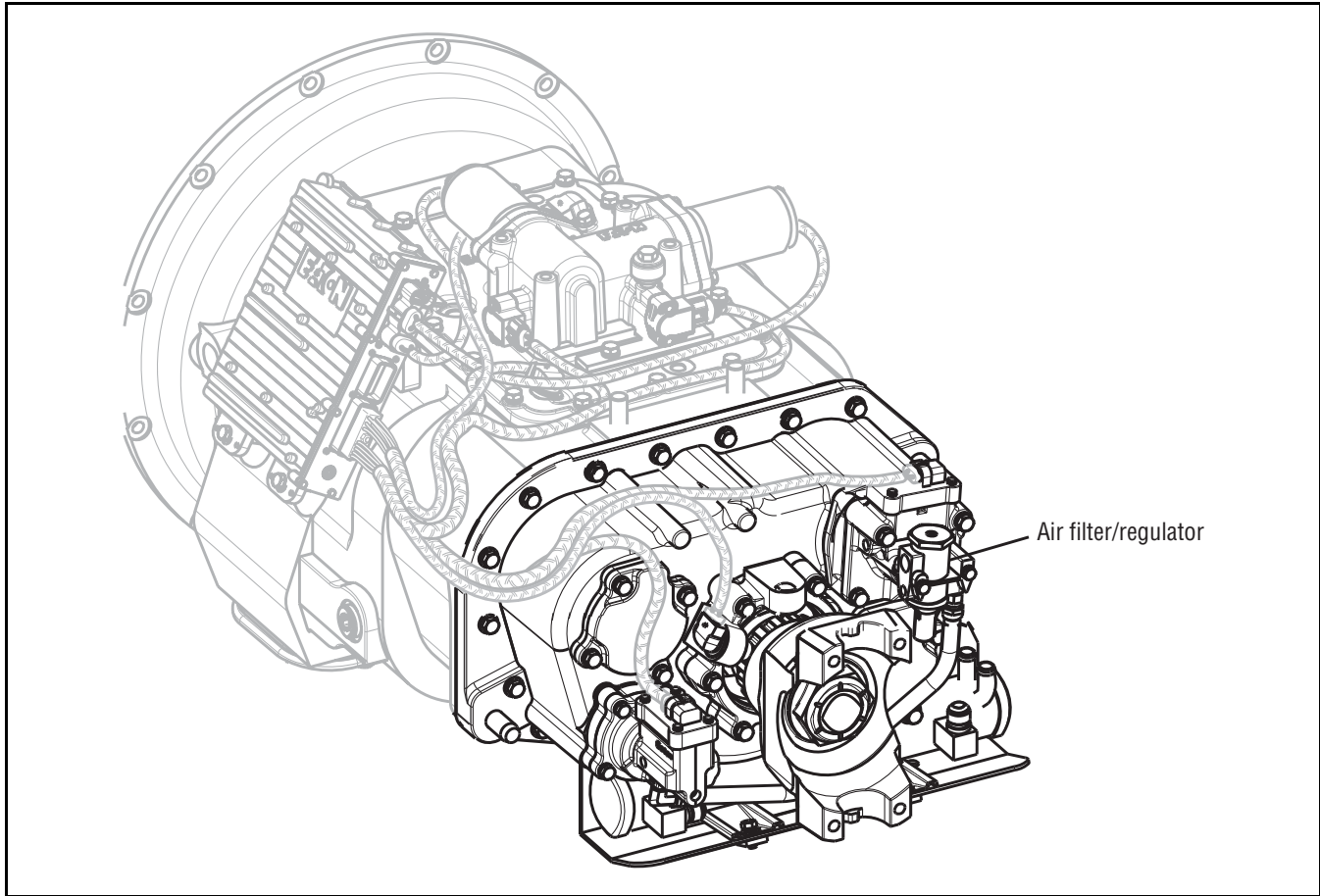
This pretest can be used for any of the following:

- Low air pressure
- Contaminated air
- Air Filter-Regulator

### Additional Tools

- Basic hand tools
- 0-100 PSI Air pressure gauge

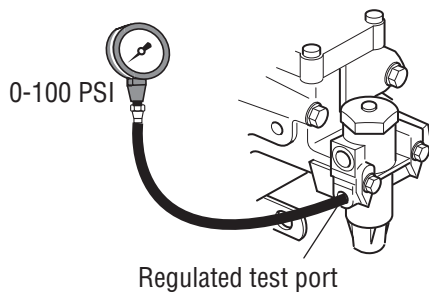
## Component Identification



## Air Pretest

**A** *Purpose: Verify proper truck system air pressure.*

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 90–120 PSI, go to **Step B.**
- If air pressure is outside of range, repair vehicle air system as required. Repeat this step.

**B** *Purpose: Verify system pressure is maintained.*

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.

**C** *Purpose: Confirm air pressure to the Filter Regulator Supply port.*

1. Read air pressure gauge installed at the regulated port.
  - If air pressure is 55–65 PSI, test complete.
  - If air pressure is outside of range, go to **Step D.**

**D** *Purpose: Confirm air flow to the Filter-Regulator.*

1. Remove air supply line to the Air Filter-Regulator and check airflow.
  - If air flows from the supply line, replace **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.**



## Fault Code 11: Shift Controller

**J1587 MID: 130    SID:254    FMI:12**

### Overview

Fault Code 11 indicates an internal failure of the Shift Controller.

### Detection

The Shift Controller checks the program memory every time the key is turned on. If the Shift Controller detects a failure within the program memory, it sets this fault code.

### Conditions to Set Fault Code Active

### Fallback

This fault causes an in-place fallback while operating and a self-check failure if it occurs during power up.

### Possible Causes

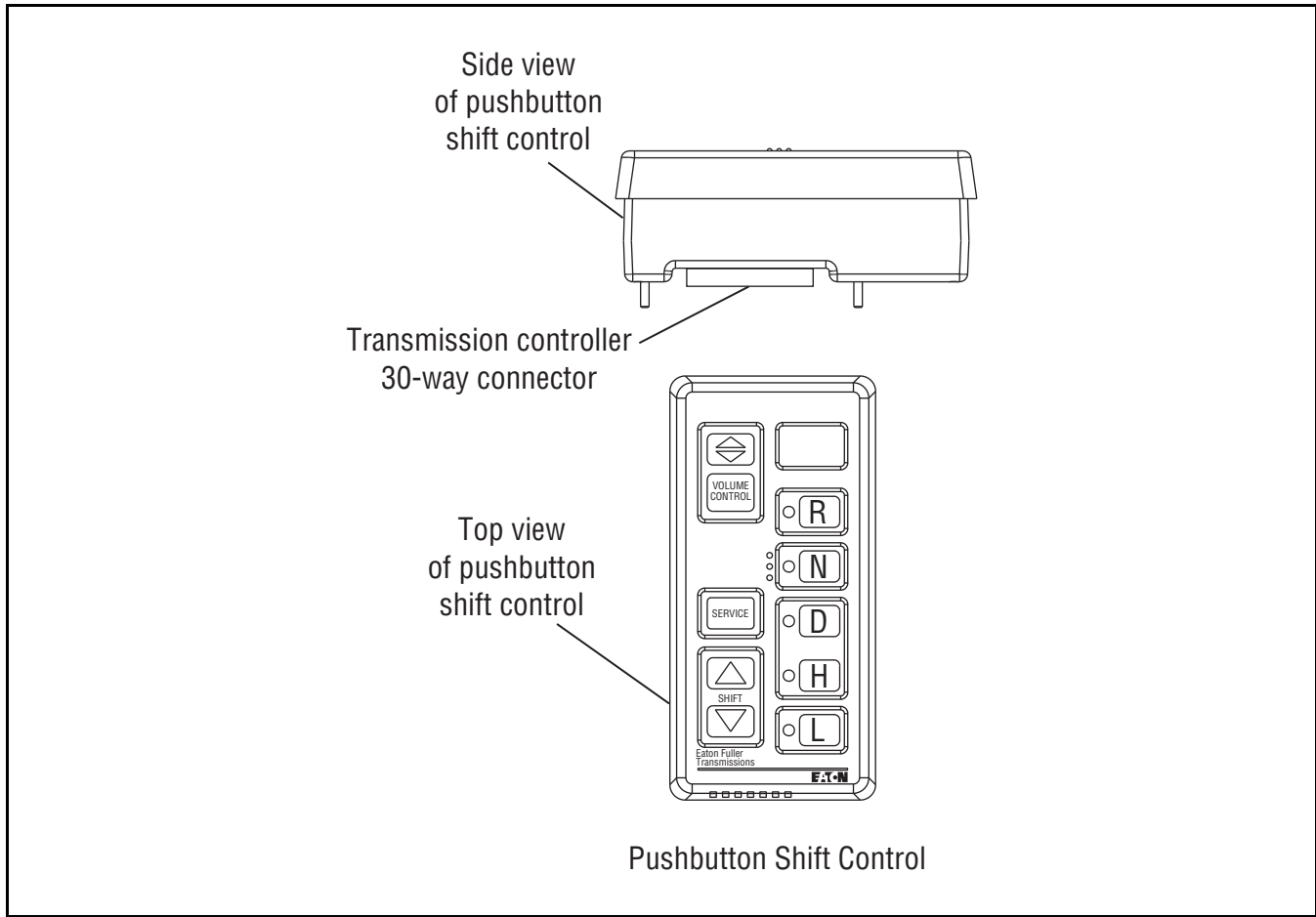
This fault code can be caused by any of the following:

- Improper configuration software
- Shift Controller

### Additional Tools

- Basic hand tools

### Component Identification



---

## Fault Code 11: Shift Controller Test

**A****Purpose:** Check for Active or Inactive fault codes.

1. Key on.
  2. Retrieve Codes, see “Retrieving Fault Codes” on page 5.
    - If Fault Code 11 is Active, replace **Shift Control**.
    - If Fault Code 11 is Inactive, test complete.
-





## Fault Code 12: Transmission Controller

**J1587:MID 130    SID 233    FMI 12**

### Overview

Fault Code 12 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 Controller detects a failure within the program memory, it sets this fault code.

### Conditions to Set Fault Code Active

### Fallback

This fault causes an in-place fallback while moving and a failure during system initialization.

### Possible Causes

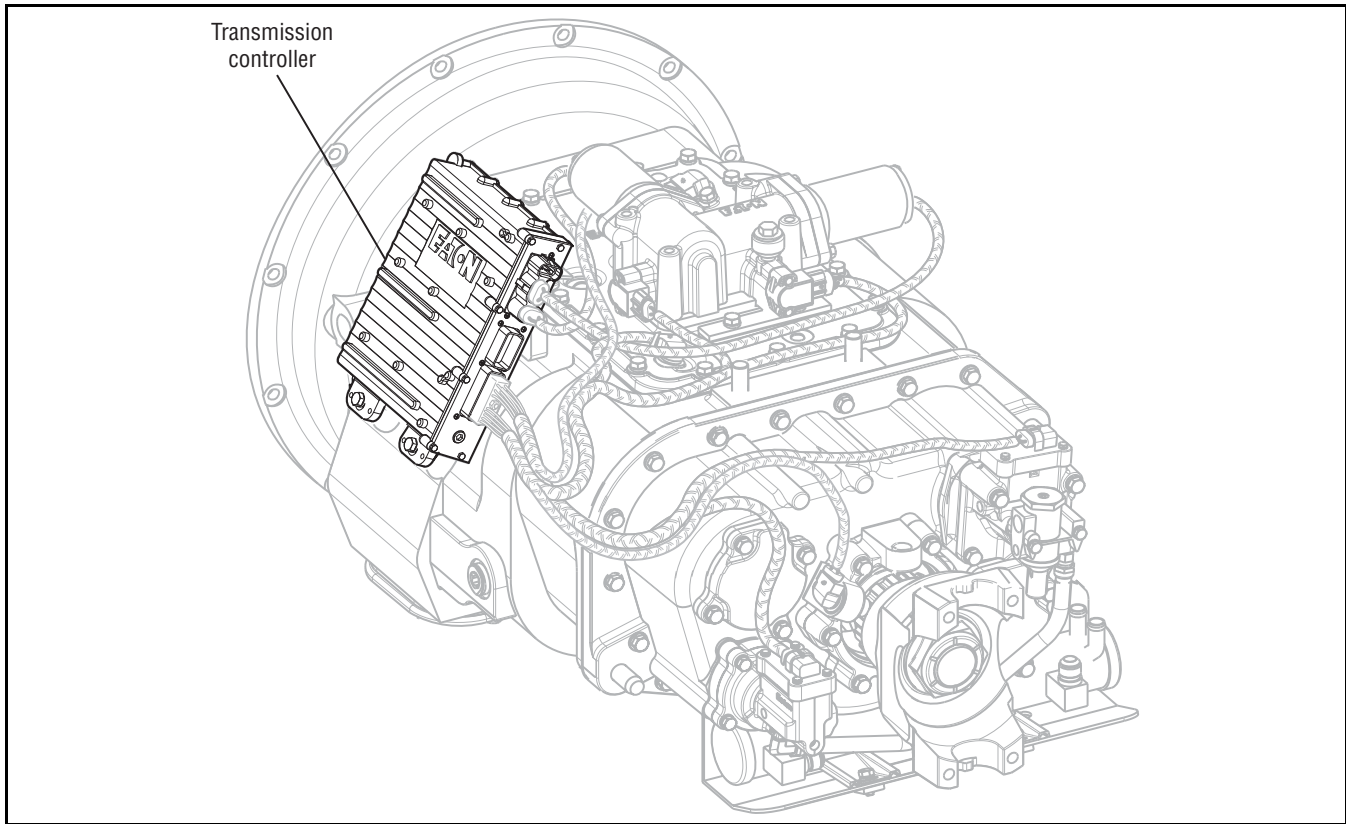
This fault code can be caused by any of the following:

- Improper configuration software
- Transmission controller

### Additional Tools

- Basic hand tools

## Component Identification



---

## Fault Code 12: Transmission Controller Test

**A****Purpose:** Check for Active or Inactive fault codes.

1. Key on.
  2. Retrieve codes, see “Retrieving Fault Codes” on page 5.
    - If Fault Code 12 is Active, replace **Transmission Controller**.
    - If Fault Code 12 is Inactive, test complete.
-



## Fault Code 14: Invalid Lever Position

**J1587:MID 130    SID 18    FMI 2,4,5**

### Overview

Fault Code 14 indicates an electrical failure of the Eaton Shift Lever or OEM Shift Lever.

### Detection

Starting at key on and throughout operation, the Shift Controller constantly measures 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.

### Conditions to Set Fault Code Active

### Fallback

This fault causes a down shift only fallback.

### Possible Causes

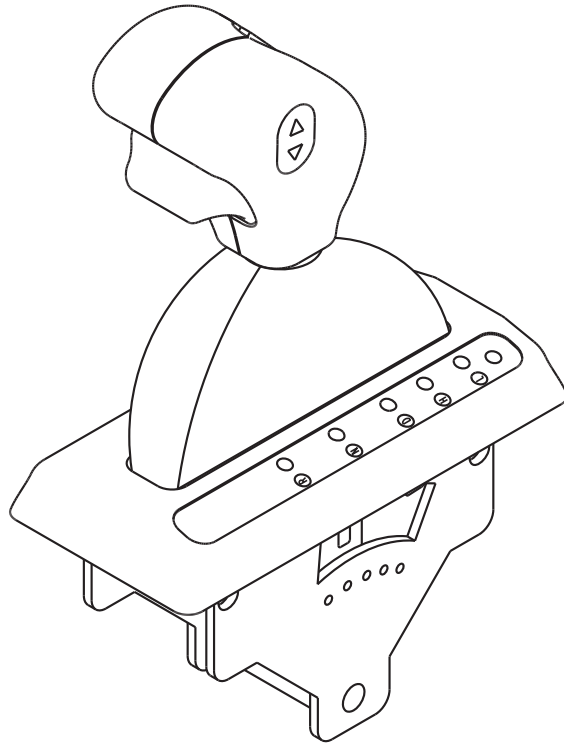
This fault code can be caused by any of the following:

- Eaton Shift Lever or OEM Shift Lever
- Vehicle Harness
- Shift Controller

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Shift Stalk tester
- PC-based Service Tool

**Component Identification**



**Shift Lever**

## Fault Code 14: Invalid Lever Position Test

**A** **Purpose:** Visually identify if the Shift Lever is an Eaton Shift Lever or an OEM Shift Lever.

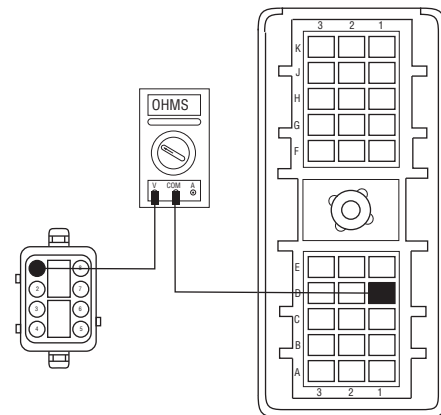
1. Is vehicle equipped with an Eaton-supplied Shift Lever or an OEM-supplied Shift Lever?
  - If Eaton Shift Lever, go to **Step B.**
  - If OEM Shift Lever, go to **Step F.**

**B** **Purpose:** Confirm OEM Shift Lever Harness integrity.

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.**

**C** **Purpose:** Verify continuity of the OEM Shift Lever Harness. Test for a short to ground.

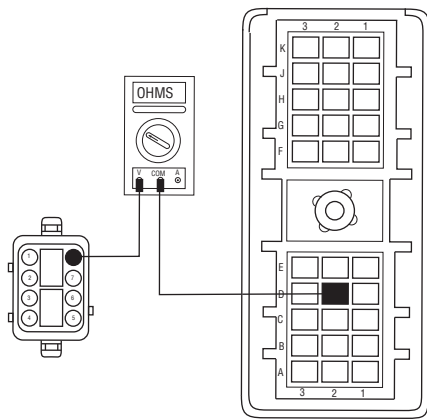
1. Key off.
2. Locate Shift Controller.
3. Disconnect Shift Controller 30-way connector.
4. Measure resistance between:
  - Shift Controller 30-way Pin D1 and Shift Lever 8-way connector Pin 1
  - Shift Controller 30-way connector Pin D1 and ground



- If resistance between Pin D1 and Pin 1 is 0–0.3 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 Shift Lever Harness between Shift Controller and Shift Lever. Go to **Step V.**

**D** **Purpose:** Verify continuity of the OEM Shift Lever Harness, and test for a short to ground.

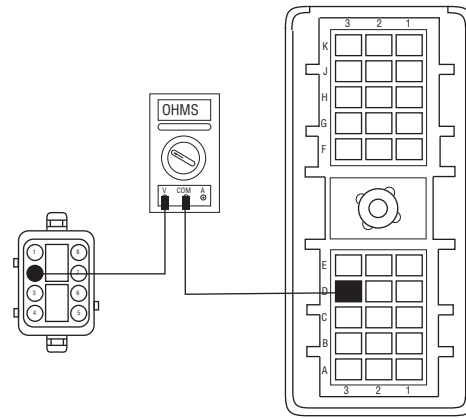
1. Key off.
2. Disconnect Shift Controller 30-way connector.
3. Measure resistance between:
  - Shift Controller 30-way Pin D2 and Shift Lever 8-way connector Pin 8
  - Shift Controller 30-way connector Pin D2 and ground



- If resistance between Pin D2 and Pin 8 is 0–0.3 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 Shift Lever Harness between the Shift Controller and Shift Lever. Go to **Step V**.

**E** **Purpose:** Verify continuity of the OEM Shift Lever Harness, and test for a short to ground.

1. Key off.
2. Disconnect Shift Controller 30-way connector.
3. Measure resistance between:
  - Shift Controller 30-way Pin D3 and Shift Lever 8-way connector Pin 2
  - Shift Controller 30-way connector Pin D3 and ground



- If resistance between Pin D3 and Pin 2 is 0–0.3 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 Shift Lever Harness between Shift Controller and Shift Lever. Go to **Step V**.



**F** **Purpose:** Confirm OEM Shift Lever Harness integrity.

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**.

**V** **Purpose:** Verify repair.

1. Key off.
2. Reconnect all connectors.
3. Key on.
4. Clear codes, see "Clearing Fault Codes" on page 6.
5. Use Driving Techniques to attempt to reset the code, see "Driving Techniques" on page 7.
6. Check for codes, see "Retrieving Fault Codes" on page 5.
  - If no codes, test complete.
  - If Fault Code 14 appears, go to **Step A** to find error in testing.
  - If code other than 14 appears see "Fault Code Isolation Procedure Index" on page 12.

**G** **Purpose:** Confirm OEM Shift Lever Harness integrity

1. Key off.
2. Locate Shift Controller.
3. Disconnect Shift Controller 30-way connector.
4. Refer to OEM wiring diagram and verify that OEM wiring between Shift Lever and Shift Controller is correct.
  - If OEM wiring is correct, replace **Shift Control**. Go to **Step V**.
  - If OEM wiring is incorrect, repair OEM harness between Shift Controller and Shift Lever. Go to **Step V**.



---

## Fault Code 16: Eaton Proprietary Link (EPL)

**J1587:MID 130    SID 248    FMI 2**

### Overview

Fault Code 16 indicates the Shift Controller and the Transmission Controller are unable to communicate.

### Detection

Starting at key on and throughout operation, the Shift Controller constantly communicates with the Transmission Controller. If a communication failure occurs for more than 5 seconds, Fault Code 16 is set.

### Conditions to Set Fault Code Active

### Fallback

This fault causes an in-place fallback while operating and a failure during system initialization.

### Possible Causes

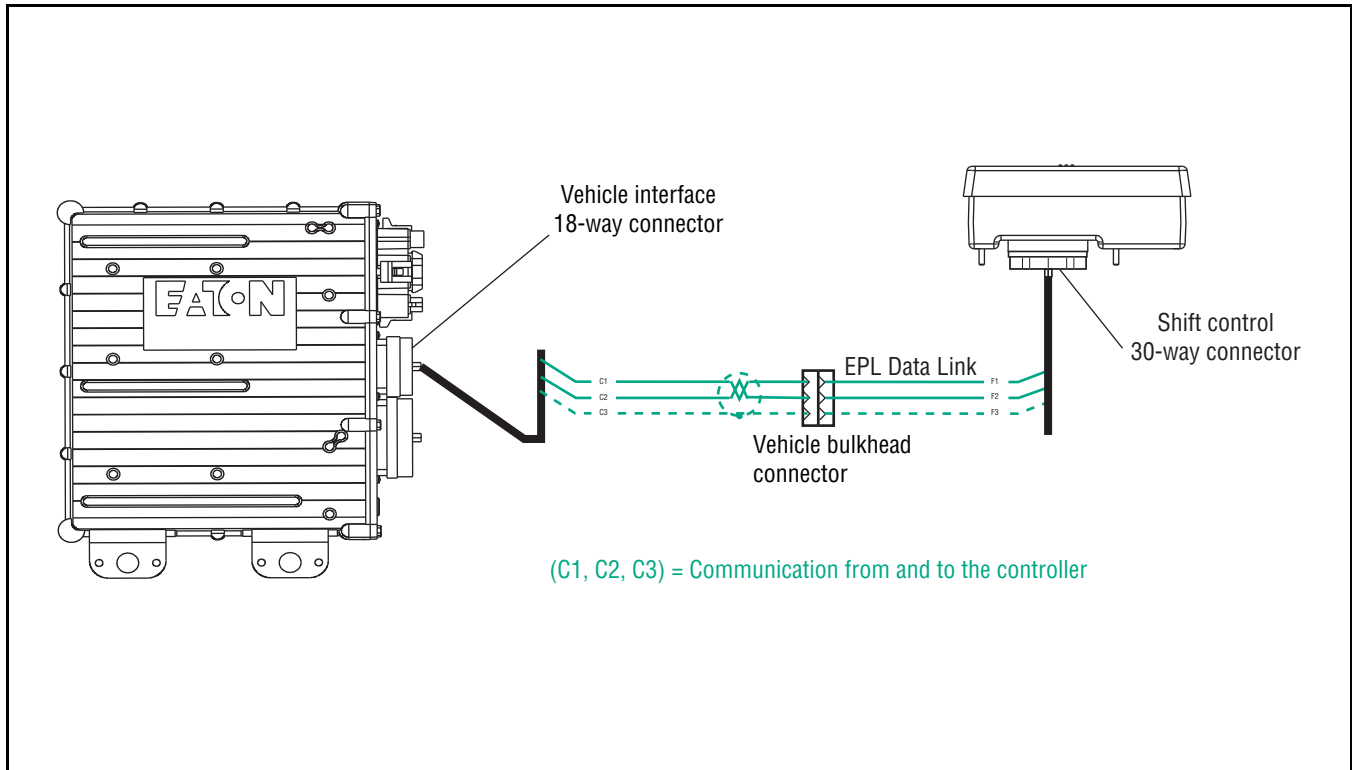
This fault code can be caused by any of the following:

- Vehicle Harness
- Transmission Controller
- Shift Controller

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

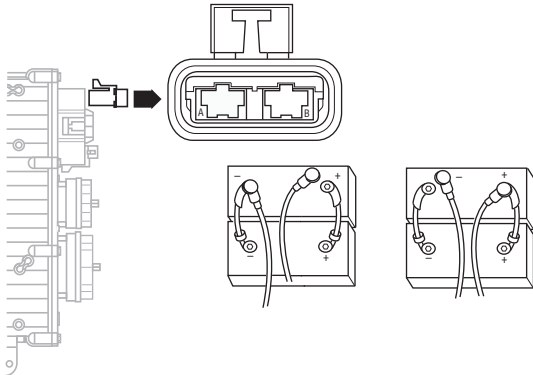
### Component Identification



## Fault Code 16: Eaton Proprietary Link (EPL) Test

**A** **Purpose:** Visually inspect the integrity of the fuse holder and connections.

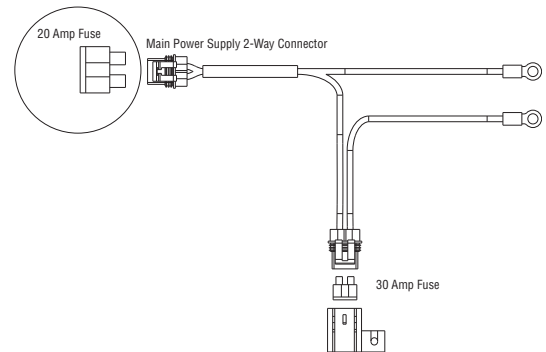
1. Key off.
2. Inspect main power 2-way connector terminals, in-line fuse holder and power supply connections for integrity and corrosion.



- If no problem found, go to **Step B**.
- If problem is found, repair power or ground path for the main power supply. Go to **Step V**.

**B** **Purpose:** Verify the Vehicle Harness will carry a proper load.

1. Key off.
2. Insert 20-amp fuse into main power 2-way connector.

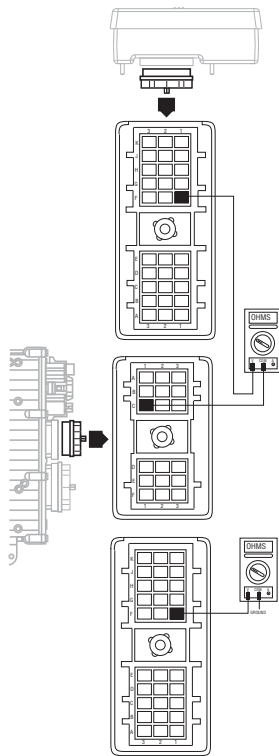


- If fuse blows immediately, go to **Step C**.
- If fuse does not blow immediately, repair wiring from the battery to the Transmission Controller. Go to **Step V**.

**C**

**Purpose:** Verify continuity of the OEM interface harness, and test for a short to ground.

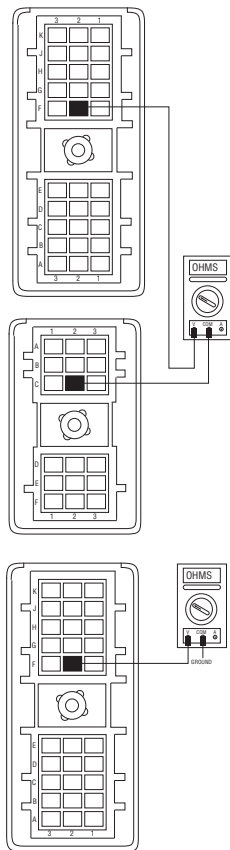
1. Key off.
2. Disconnect Shift Controller 30-way connector.
3. Disconnect Vehicle Interface 18-way connector.
4. Measure resistance between:
  - Shift Controller 30-way connector Pin F1 and vehicle interface 18-way connector Pin C1
  - Shift Controller 30-way connector Pin F1 and ground



- If resistance between Pin F1 and Pin C1 is 0–0.3 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 Vehicle Harness between the Transmission Controller and Shift Controller. Go to **Step V.**

**D** **Purpose:** Verify continuity of the OEM interface harness, and test for a short to ground.

1. Key off.
2. Measure resistance between:
  - Shift Controller 30-way connector Pin F2 and vehicle interface 18-way connector Pin C2
  - Shift Controller 30-way connector Pin F2 and ground

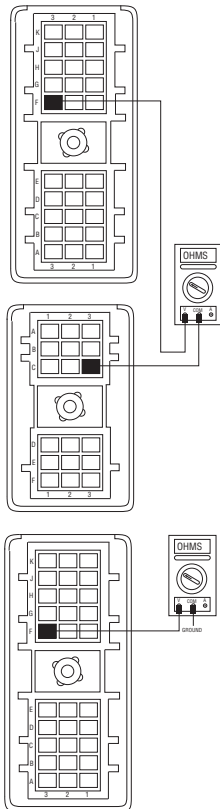


- If resistance between Pin F2 and Pin C2 is 0–0.3 ohms and if resistance between Pin F2 and ground is more than 10K ohms or open circuit [OL], go to **Step E**.
- If any of the above conditions are not met, repair Vehicle Harness between the Transmission Controller and Shift Controller. Go to **Step V**.

**E**

**Purpose:** Verify continuity of the Vehicle Harness, and test for a short to ground.

1. Key off.
2. Measure resistance between:
  - Shift Controller 30-way connector Pin F3 and Vehicle Harness 18-way connector Pin C3
  - Shift Controller 30-way connector Pin F3 and ground



- If resistance between Pin F3 and Pin C3 is 0–0.3 ohms, and if resistance between Pins F2 and ground is more than 10K ohms or open, go to **Step V**.

If the above conditions are not met, repair Vehicle Harness between the Transmission Controller and Shift Controller. Go to **Step V**.

**V**

**Purpose:** Verify repair.

1. Key off.
2. Reconnect all connectors.
3. Key on.
4. Clear codes, see “Clearing Fault Codes” on page 6.
5. Use the “Driving Techniques” section of this book to attempt to reset the code, see “Driving Techniques” on page 7.
6. Check for codes, see “Retrieving Fault Codes” on page 5.
  - If no codes, Test complete.
  - If Fault Code 16 appears, go to **Step A** to find error in testing.
  - If a code other than 16 appears, see “Fault Code Isolation Procedure Index” on page 12.



## Fault Code 17: Start Enable Relay Coil

**J1587:MID 130    SID 237    FMI 3,4**

### Overview

Fault Code 17 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 Controller constantly measures the circuit. If a condition of short to battery, short to ground or open circuit is detected, Fault Code 17 is set.

### Conditions to Set Fault Code Active

### 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.

### Possible Causes

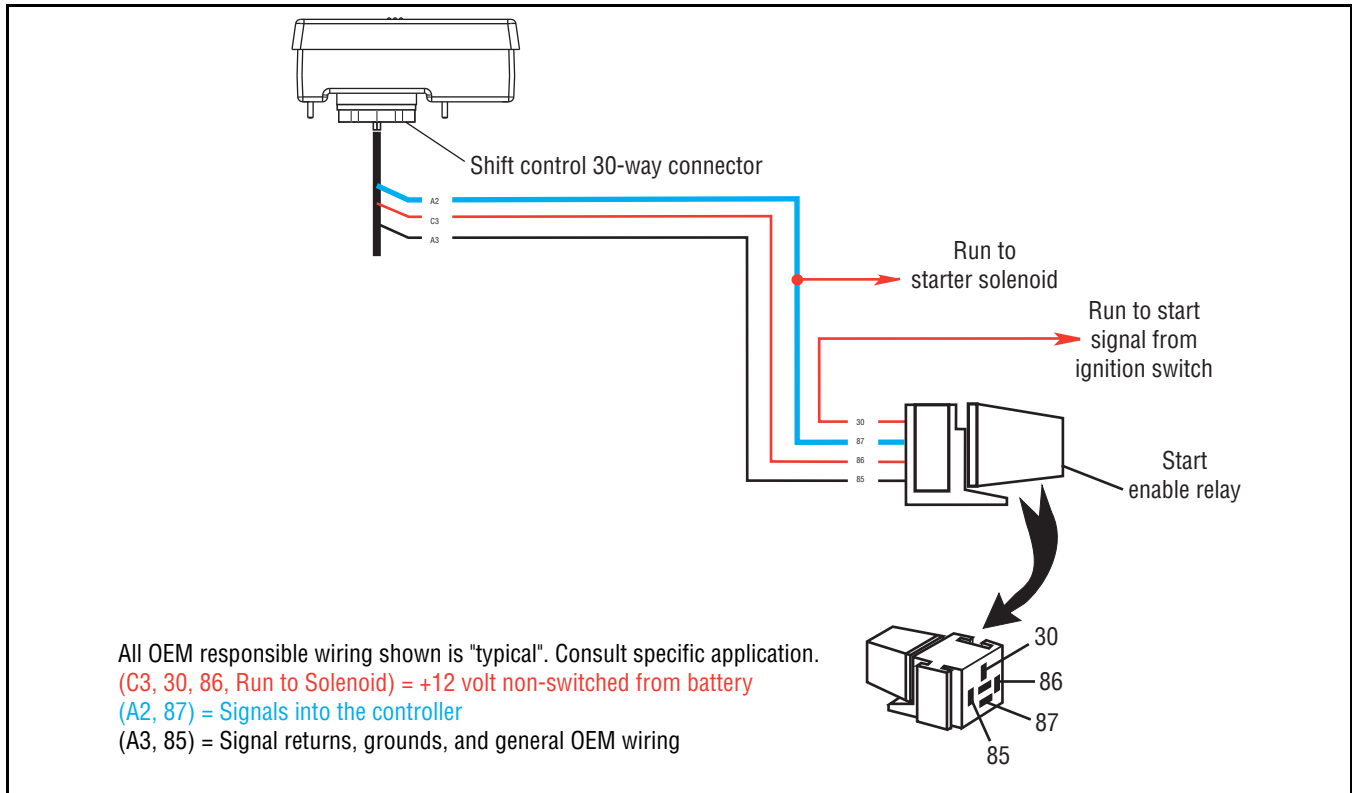
This fault code can be caused by any of the following:

- Relay Coil Open
- Vehicle Harness
- Shift Controller
- Operator too quick on key (not waiting for a “N”)

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

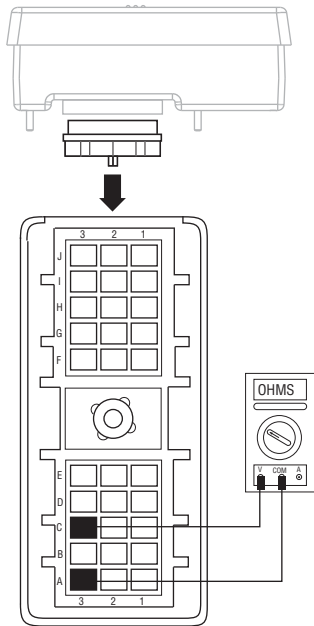
### Component Identification



## Fault Code 17: Start Enable Relay Coil Test

**A** **Purpose:** Measure the resistance of the Start Enable Relay through the Transmission Harness.

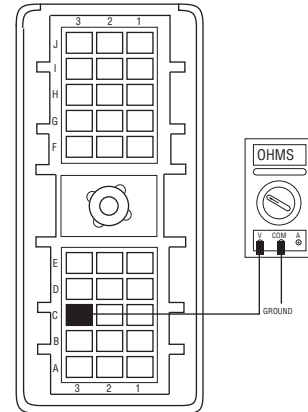
1. Key off.
2. Disconnect Shift Controller 30-way connector.
3. Measure resistance between Shift Controller 30-way connector Pin C3 and Pin A3.



- If resistance is 40–120 ohms, go to **Step B.**
- If resistance is outside of range, go to **Step E.**

**B** **Purpose:** Measure the resistance of the Start Enable Relay through the Transmission Harness 30-way shift controller connector for a short to ground.

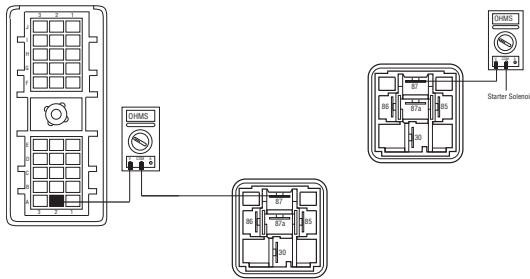
1. Measure resistance between Shift Controller 30-way connector Pin C3 and ground.



- 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.**

**C** **Purpose:** Verify continuity of the Start Enable Relay wire, and check for a short to ground.

1. Disconnect the start enable relay.
2. Measure resistance between Pin 87 of the Start Enable Relay connector and Pin A2 of the Shift Controller 30-way connector, and Pin 87 of the Start Enable Relay connector to the Starter Solenoid.



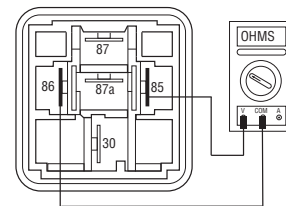
- If resistance is 0–0.3 ohms on both readings, go to **Step D**.
- If resistance is greater than 10K ohms, repair wiring. Go to **Step V**.

**D** **Purpose:** Measure signal voltage at the Start Enable Relay connector.

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 0.6 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**.

**E** **Purpose:** Measure the resistance of the Start Enable Relay at the relay pins.

1. Remove Start Enable Relay from Vehicle Harness.
2. Measure resistance between Start Enable Relay Pin 85 and Pin 86.



- If resistance is 40–120 ohms, repair OEM wiring from Shift Controller to Start Enable Relay. Go to **Step V**.
- If resistance is outside of range, replace Start Enable Relay. Go to **Step V**.

**V****Purpose:** Verify repair.

1. Key off.
  2. Reconnect all connectors.
  3. Key on.
  4. Clear codes, see “Clearing Fault Codes” on page 6.
  5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
  6. Check for codes, see “Retrieving Fault Codes” on page 5.
    - If no codes, test complete.
    - If Fault Code 17 appears, go to **Step A.** to find error in testing.
    - If code other than 17 appears, see “Fault Code Isolation Procedure Index” on page 12.
-



---

## Fault Code 26: Clutch Slip

**J1587:MID 130    SID 55    FMI 10**

### Overview

Fault Code 26 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 1 second, the Fault Code is set.

### Conditions to Set Fault Code Active

### Fallback

This fault causes a down-shift fallback. Once the vehicle is stopped, starting gear and reverse gear can be engaged. The fault will clear at power down and up shifts will be allowed until the fault is detected again.

### Possible Causes

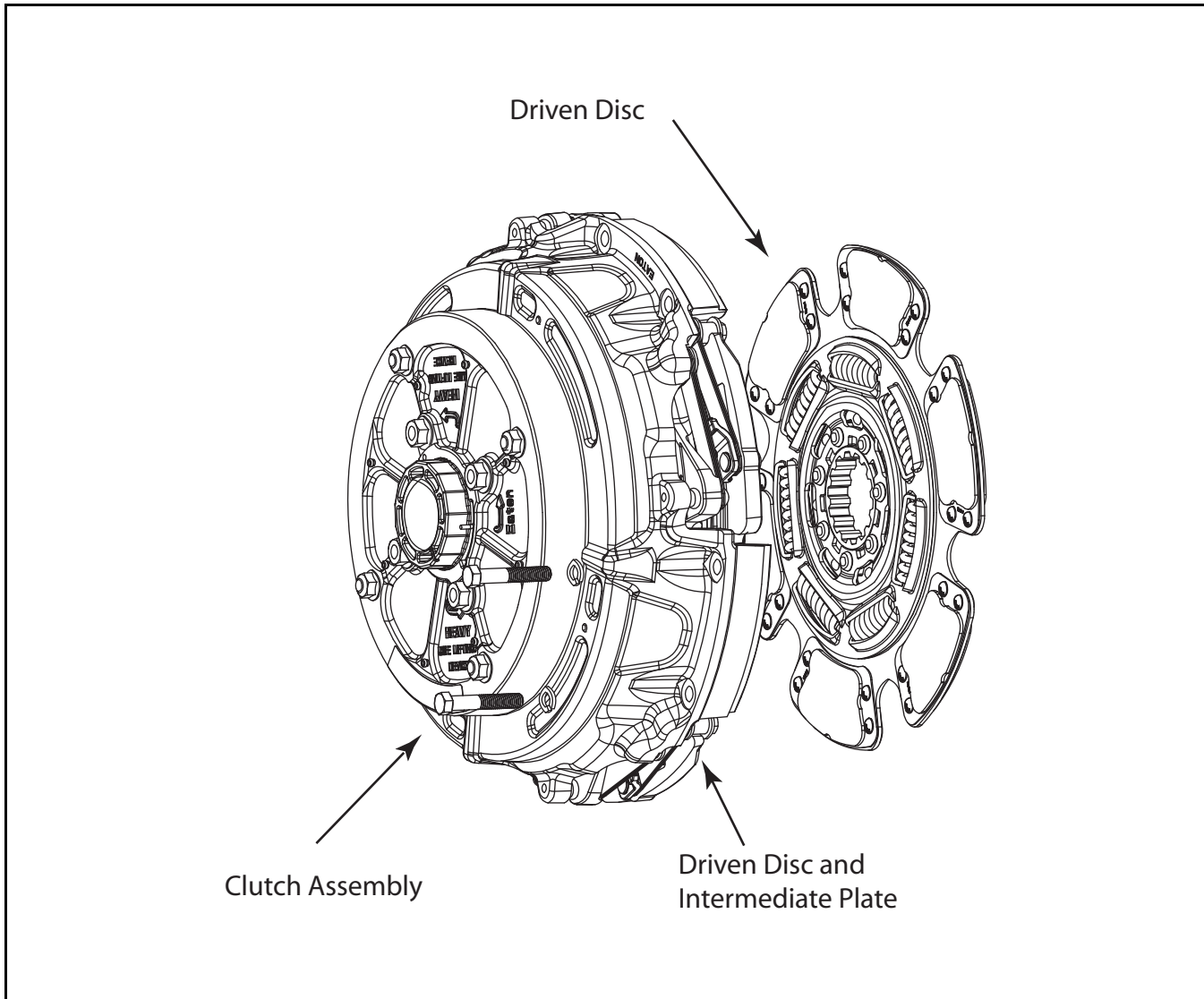
This fault code can be caused by any of the following:

- Worn or broken clutch

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Clutch jack

### Component Identification





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## Fault Code 26: Clutch Slip Test

**A****Purpose:** Check for Active or Inactive fault codes.

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 Fault Code 26 is Active, replace clutch.
    - If Fault Code 26 is not Active, test complete.
-



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## Fault Code 27: Clutch Disengagement

**J1587:MID 130    SID 55    FMI 7**

### Overview

Fault Code 27 indicates the clutch has not disengaged as expected.

### Detection

Starting at key on and throughout operation, the Shift Controller 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.

### Conditions to Set Fault Code Active

### Fallback

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

### Possible Causes

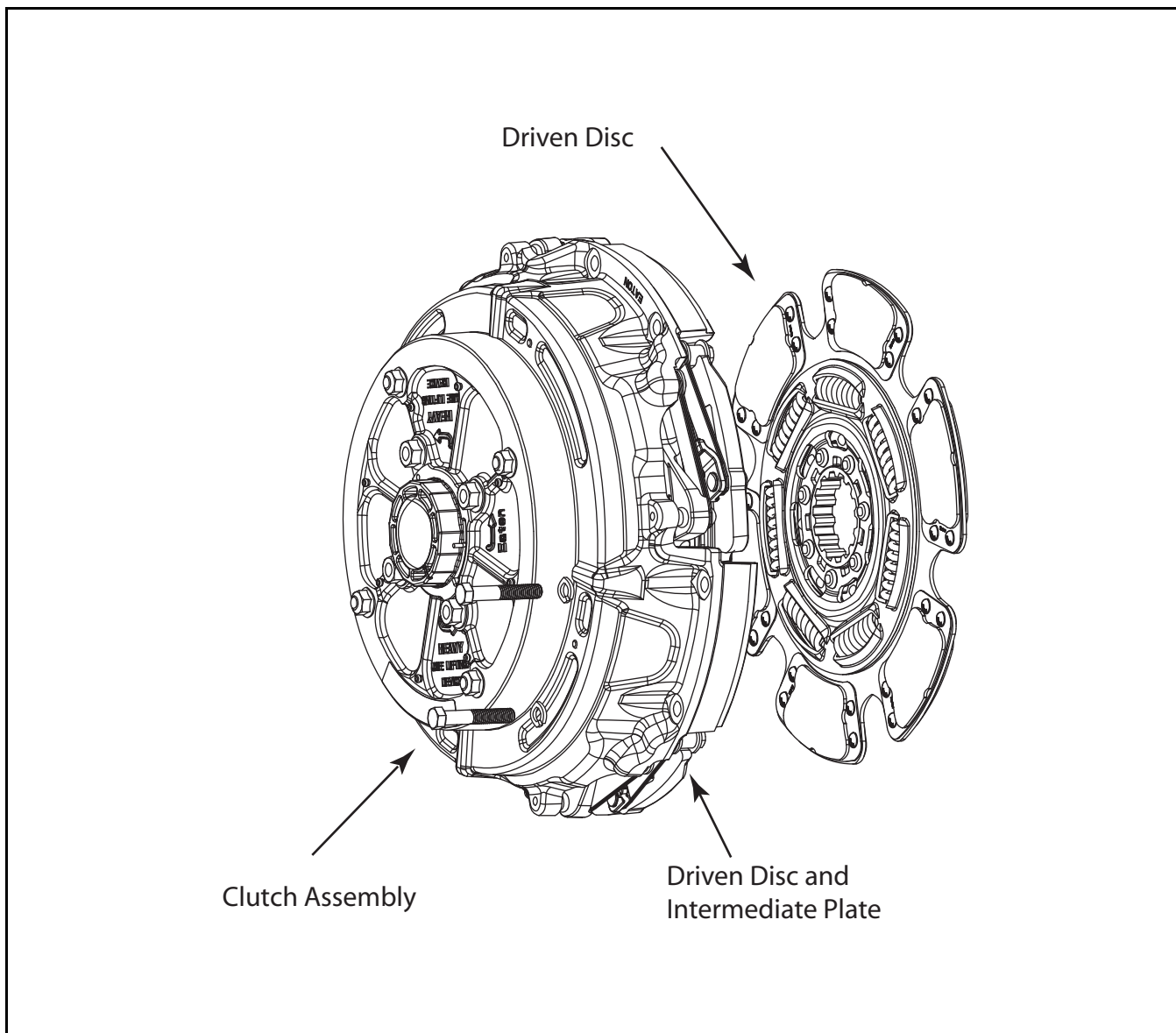
This fault code can be caused by any of the following:

- Worn or broken clutch

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Clutch jack

### Component Identification



---

## Fault Code 27: Clutch Disengagement Test

**A**

**Purpose:** Monitor transmission Input Shaft speed in ServiceRanger.

1. Key on.
2. Start engine.
3. Compare engine RPM to Input Shaft RPM with ServiceRanger.

**Note:** Engine idle RPM must be 700 RPM or lower.

- If the speeds match at idle and Fault Code 27 is Active, replace the clutch.
  - If they do not match, test complete.
-



---

## Fault Code 28: Clutch System Fault

**J1587:MID 130    SID 52    FMI 3, 4, 5, 7**

### Overview

Fault Code 28 indicates either an electrical or mechanical failure in the wet clutch system.

### Detection

Starting at key on and throughout operation, the Transmission Controller constantly monitors this circuit. A failure of short to battery, short to ground or open circuit sets the fault code Active.

When the wet clutch 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 5 seconds, the wet clutch is slipping.

### Conditions to Set Fault Code Active

### Fallback

There is no fallback mode; however, if the failure mode is open circuit, the engine will be disengaged from the Input Shaft.

### Possible Causes

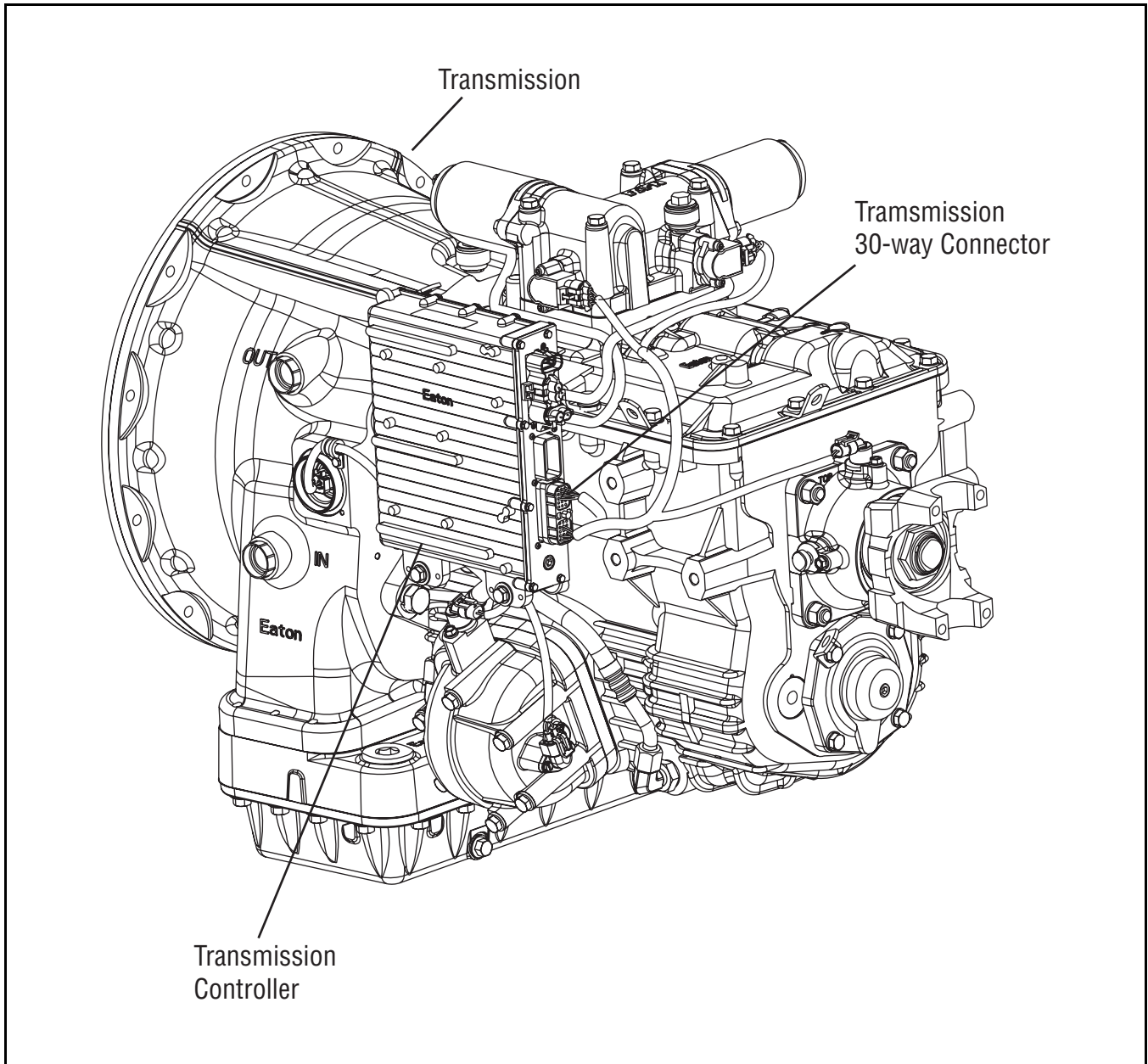
This fault code can be caused by any of the following:

- Transmission Controller
- Transmission Harness
- Low fluid level
- Wet clutch system

### Additional Tools

- Basic hand tools
- Digital volt/ohm meter
- Eaton Test Adapter kit

### Component Identification





## Fault Code 28: Clutch System Fault Test

**A**

**Purpose:** Check wet clutch fluid level.

1. Key on.
2. Place the transmission in neutral.
3. Allow engine to idle at 700–800 RPM for a minimum of 2 minutes.

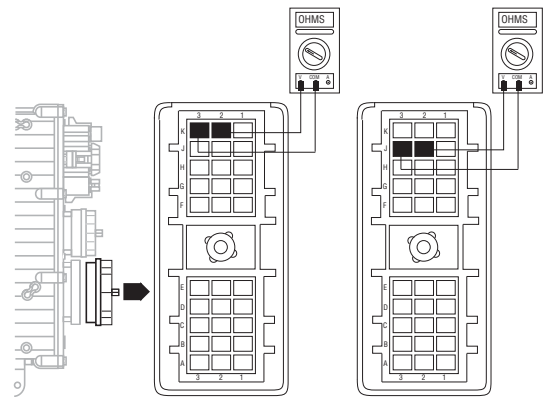
**Note:** Ensure transmission fluid temperature is 60°–120° F (16°–49° C).

4. Check wet clutch 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**.

**B**

**Purpose:** Measure the resistance of the hydraulic manifold through the Transmission Harness.

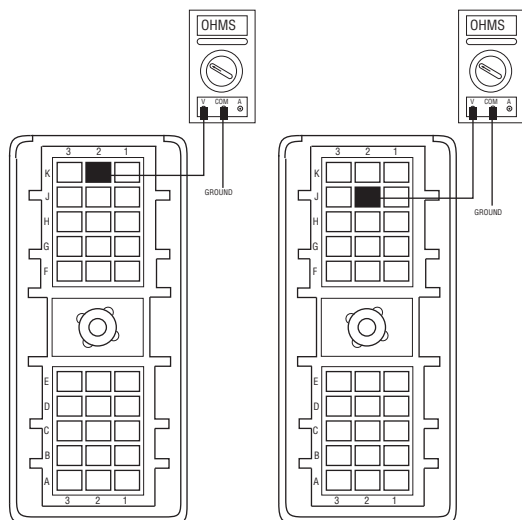
1. Key off.
2. Disconnect the Transmission Controller 30-way connector.
3. Measure resistance between the Transmission Harness 30-way connector:
  - Pin K2 and Pin K3
  - Pin J2 and Pin J3



- If the resistance between Pin K2 and Pin K3 is 6.5–9.5 ohms and the resistance between Pin J2 and Pin J3 is 8.5–12 ohms, go to **Step C**.
- If resistance is outside of range, go to **Step D**.

**C** **Purpose:** Test the Hydraulic Manifold for a short to ground through the Transmission Harness.

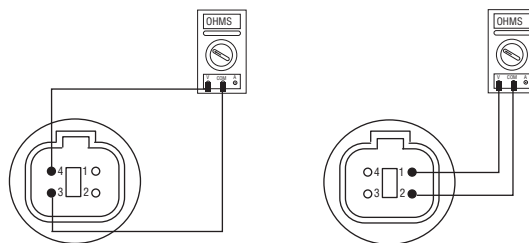
1. Measure resistance between the Transmission Harness 30-way connector:
  - Pin K2 and ground
  - Pin J2 and ground



- 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**.

**D** **Purpose:** Measure the resistance of the hydraulic manifold switch.

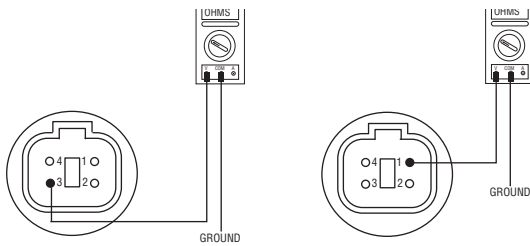
1. Disconnect Transmission Harness located on left side of wet clutch housing.
2. Measure resistance between wet clutch housing connector pins:
  - Pin 3 and Pin 4
  - Pin 1 and Pin 2



- If the resistance between Pin 1 and Pin 2 is 8.5–12 ohms and the resistance between Pin 3 and Pin 4 is 6.5–9.5 ohms, go to **Step E**.
- If resistance is outside of range, replace **Transmission**. Go to **Step V**.

**E** **Purpose:** Test the Hydraulic Manifold Switch for a short to ground.

1. Measure resistance between wet clutch housing connector pins:
  - Pin 3 and ground
  - Pin 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**.

**V** **Purpose:** Verify repair.

1. Key off.
2. Reconnect all connectors.
3. Key on.
4. Clear codes, see “Clearing Fault Codes” on page 6.
5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
6. Check for codes, see “Retrieving Fault Codes” on page 5.
  - If no codes, test complete.
  - If Fault Code 28 appears, go to **Step A** to find error in testing.
  - If code other than 28 appears, see “Fault Code Isolation Procedure Index” on page 12.



---

## Fault Code 31: Momentary Engine Ignition Interrupt Relay (MEIIR)

**J1587:MID 130    SID 218    FMI 3,4**

### Overview

Fault Code 31 indicates an electrical failure of the Momentary Engine Ignition Interrupt Relay (MEIIR) circuit.

### Detection

The fault is detected during power up. The Shift Controller 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.

### Conditions to Set Fault Code Active

### 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.

### Possible Causes

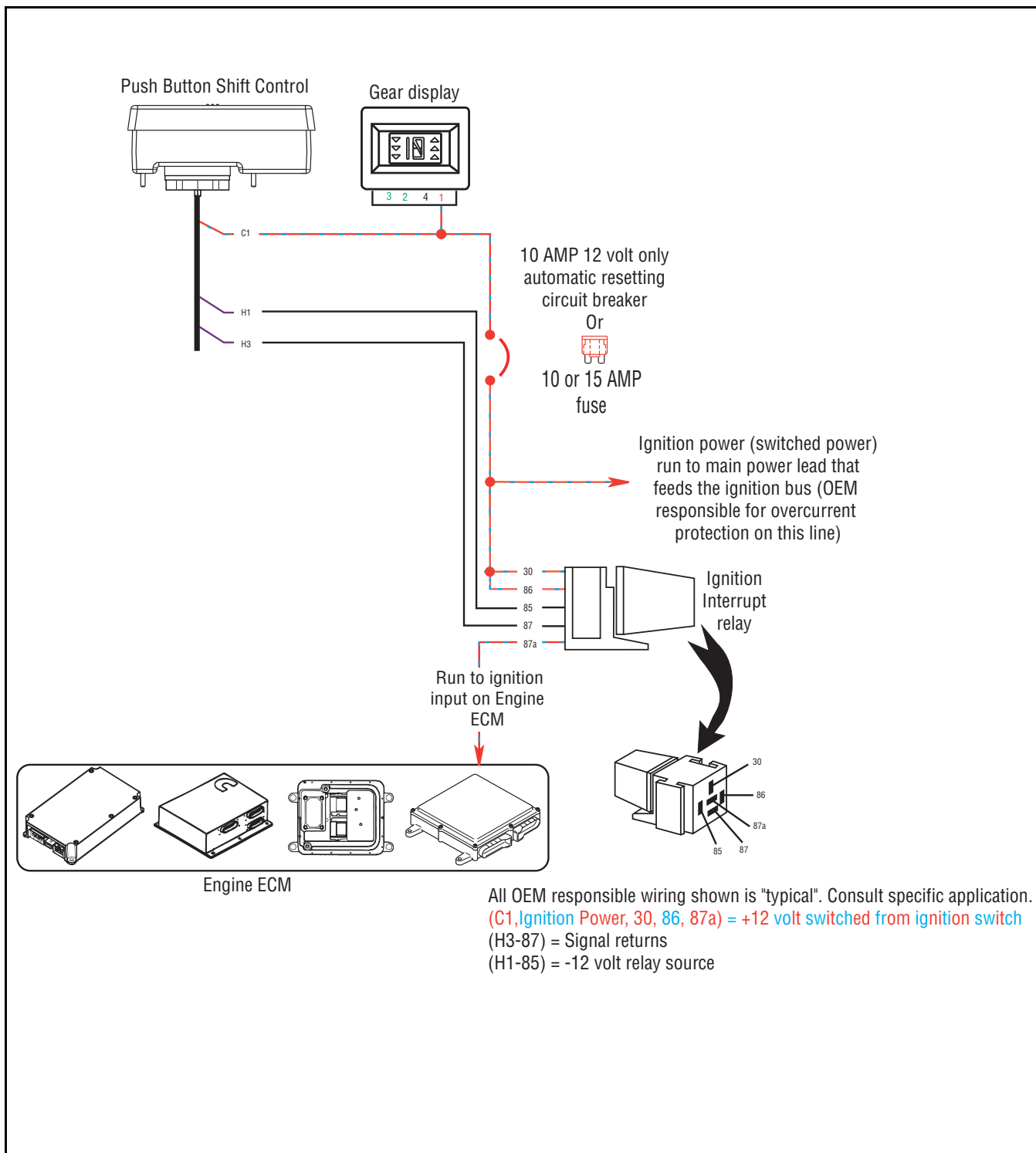
This fault code can be caused by any of the following:

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

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- ServiceRanger

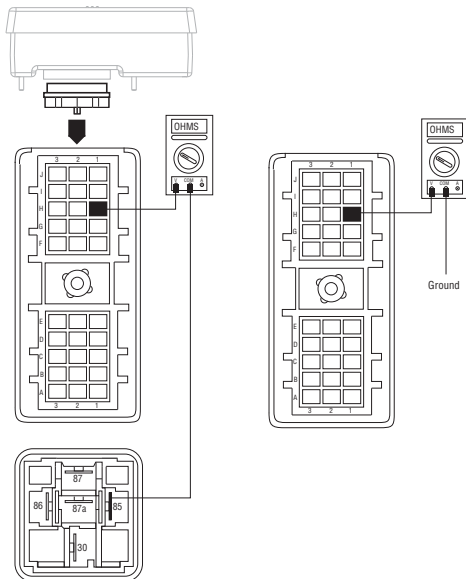
### Component Identification



## Fault Code 31: Momentary Engine Ignition Interrupt Relay (MEIIR) Test

**A** **Purpose:** Verify continuity of the Vehicle Harness and test for a short to ground.

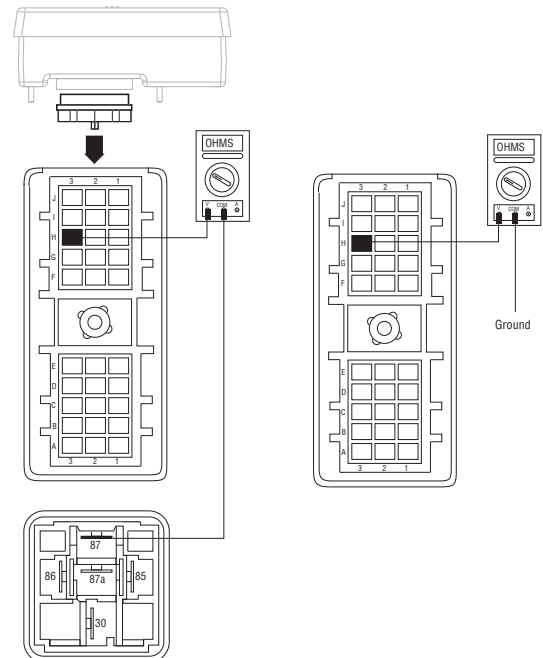
1. Key off.
2. Disconnect Shift Controller 30-way connector.
3. Remove the MEIIR relay from OEM Dash Harness.
4. Measure resistance between:
  - Shift Controller 30-way connector Pin H1 and relay connector Pin 85.
  - Shift Controller 30-way connector Pin H1 and ground.



- If resistance between Pin H1 and Pin 85 is 0–0.3 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 Controller to MEIIR relay. Go to **Step V**.

**B** **Purpose:** Verify continuity of the OEM Vehicle harness and test for a short to ground.

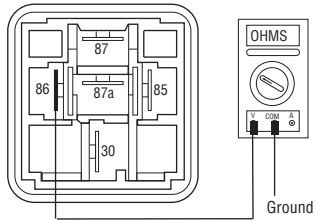
1. Key off.
2. Measure resistance between:
  - Shift Controller 30-way connector Pin H3 and relay connector Pin 87.
  - Shift Controller 30-way connector Pin H3 and ground.



- If resistance between Pin H3 and Pin 87 is 0–0.3 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 Controller to MEIIR relay. Go to **Step V**.

**C** **Purpose:** Measure signal voltage at the MEIIR relay connector.

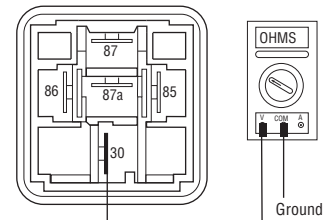
1. Reconnect Shift Controller 30-way connector.
2. Key on.
3. Measure voltage between MEIIR relay connector Pin 86 and ground



- If voltage is within 0.6 of battery voltage, go to **Step D.**
- If voltage is outside of range, repair OEM wiring. Go to **Step V.**

**D** **Purpose:** Measure battery voltage to the MEIIR relay.

1. Key on.
2. Measure voltage between MEIIR relay connector Pin 30 and ground.



- If voltage is within 0.6 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.**



**E** **Purpose:** Check for Active or Inactive fault codes.

1. Key on.
  2. Retrieve codes, see “Retrieving Fault Codes” on page 5.
    - If Fault Code 31 is Inactive, go to **Step V**.
    - If Fault Code 31 is Active, replace **Shift Control**. Go to **Step V**.
- 

**V** **Purpose:** Verify repair.

1. Key off.
  2. Reconnect all connectors.
  3. Key on.
  4. Clear codes, see “Clearing Fault Codes” on page 6.
  5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
  6. Check for codes, see “Retrieving Fault Codes” on page 5.
    - If no codes, test complete.
    - If Fault Code 31 appears, go to **Step A** to find error in testing.
    - If code other than 31 appears, see “Fault Code Isolation Procedure Index” on page 12.
-



## Fault Code 32: Switched System Voltage

**J1587:MID 130    SID 62    FMI 4**

### Overview

Fault Code 32 indicates the switched system voltage from the Shift Controller on Pin J2 and Pin K2 is below 7 volts.

### Detection

The fault is detected immediately after power up.

### Conditions to Set Fault Code Active

### Fallback

This fault causes an in-place fallback.

### Possible Causes

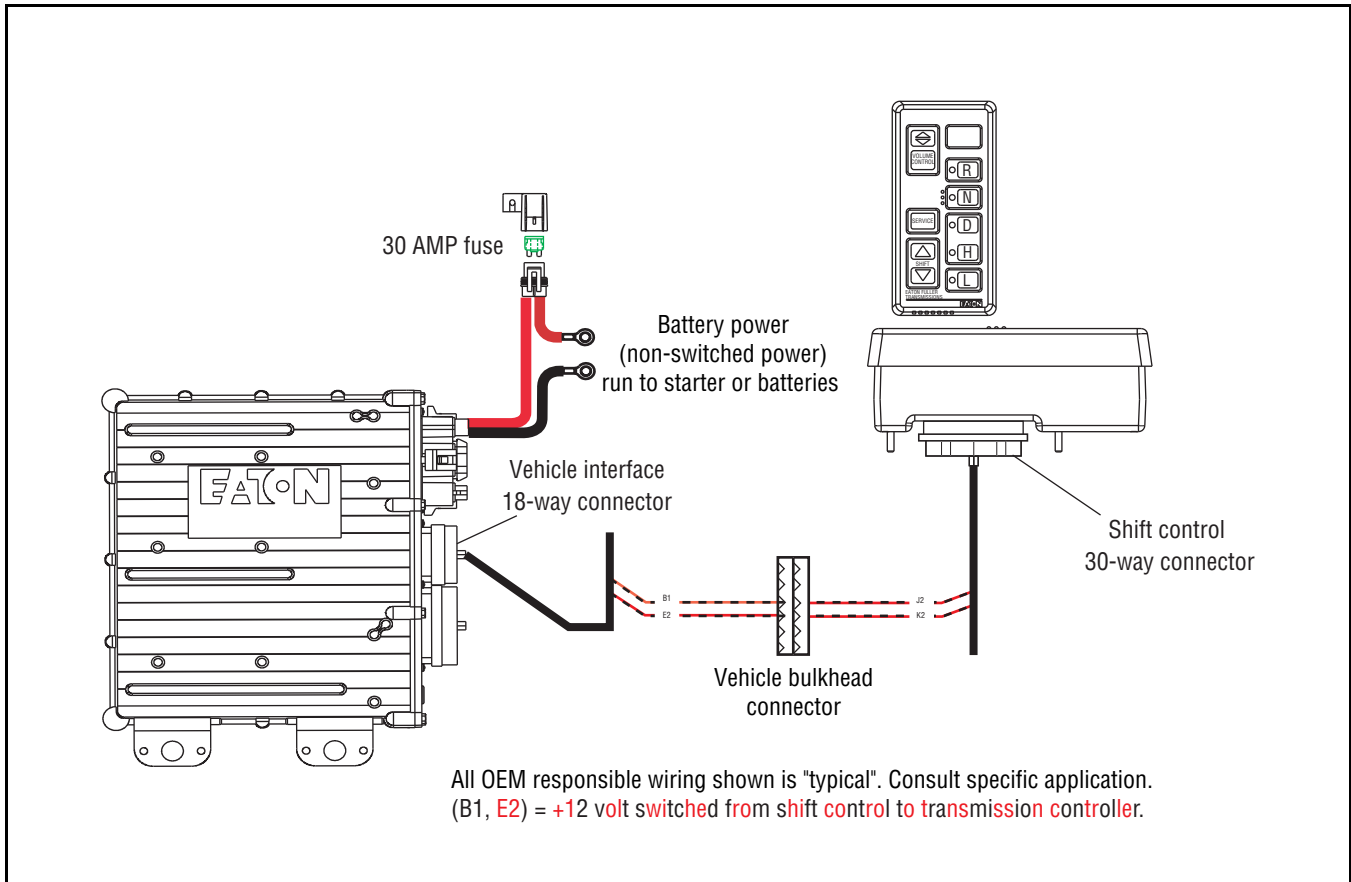
This fault code can be caused by any of the following:

- Low batteries
- OEM Harness
- Shift Controller

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

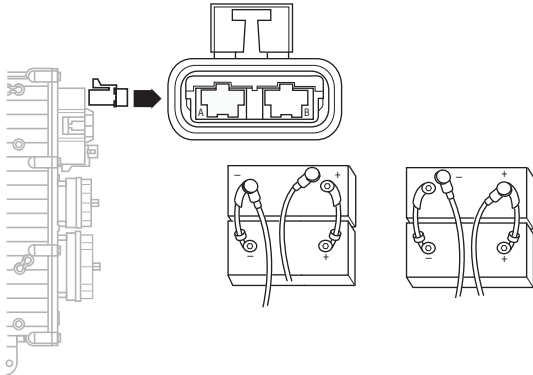
### Component Identification



## Fault Code 32: Switched System Voltage Test

**A** **Purpose:** Inspect the integrity of the fuse holder and connections.

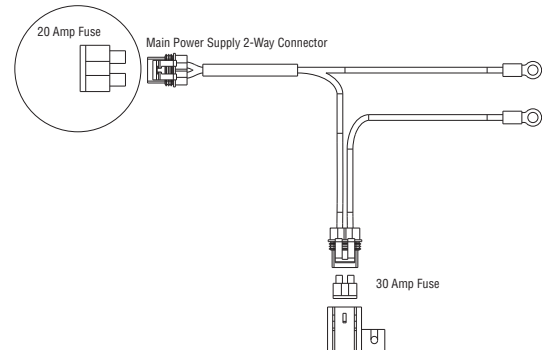
1. Key off.
2. Inspect main power 2-way connector terminals, in-line fuse holder and power supply connections for integrity and corrosion.



- 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**.

**B** **Purpose:** Confirm the Vehicle Harness will carry a proper load.

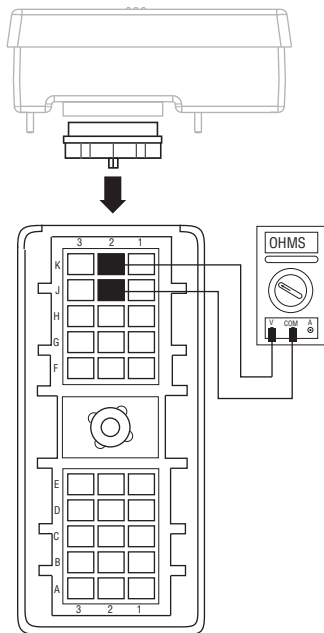
1. Key off.
2. Insert 20-amp fuse into main power supply 2-way connector (at trans controller optional).



- If fuse blows immediately, go to **Step C**.
- If fuse does not blow immediately, repair wiring from the battery to the Transmission Controller. Go to **Step V**.

**C** *Purpose: Verify continuity of the Vehicle Harness.*

1. Key off.
2. Disconnect negative (-) battery cable.
3. Disconnect the main power 2-way connector on the Transmission Controller.
4. Disconnect Shift Controller 30-way connector.
5. Measure resistance between Shift Controller 30-way Pin J2 and Pin K2



- If resistance is 0–0.3 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 Controller. Go to **Step V**.

**V** *Purpose: Verify repair.*

1. Key off.
2. Reconnect all connectors.
3. Key on.
4. Clear codes, see “Clearing Fault Codes” on page 6.
5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
6. Check for codes, see “Fault Code Retrieval/Clearing” on page 5.
  - If no codes, test complete.
  - If Fault Code 32 appears, go to **Step A** to find error in testing.
  - If code other than 32 appears, see “Fault Code Isolation Procedure Index” on page 12.

## Fault Code 33: Battery Voltage Supply

**J1587:MID 130    PID 168    FMI 4**

### Overview

Fault Code 33 indicates the battery power supply to the Shift Controller Pin J1 and Pin K1 is below 7 volts.

### Detection

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

### Conditions to Set Fault Code Active

### Fallback

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

### Possible Causes

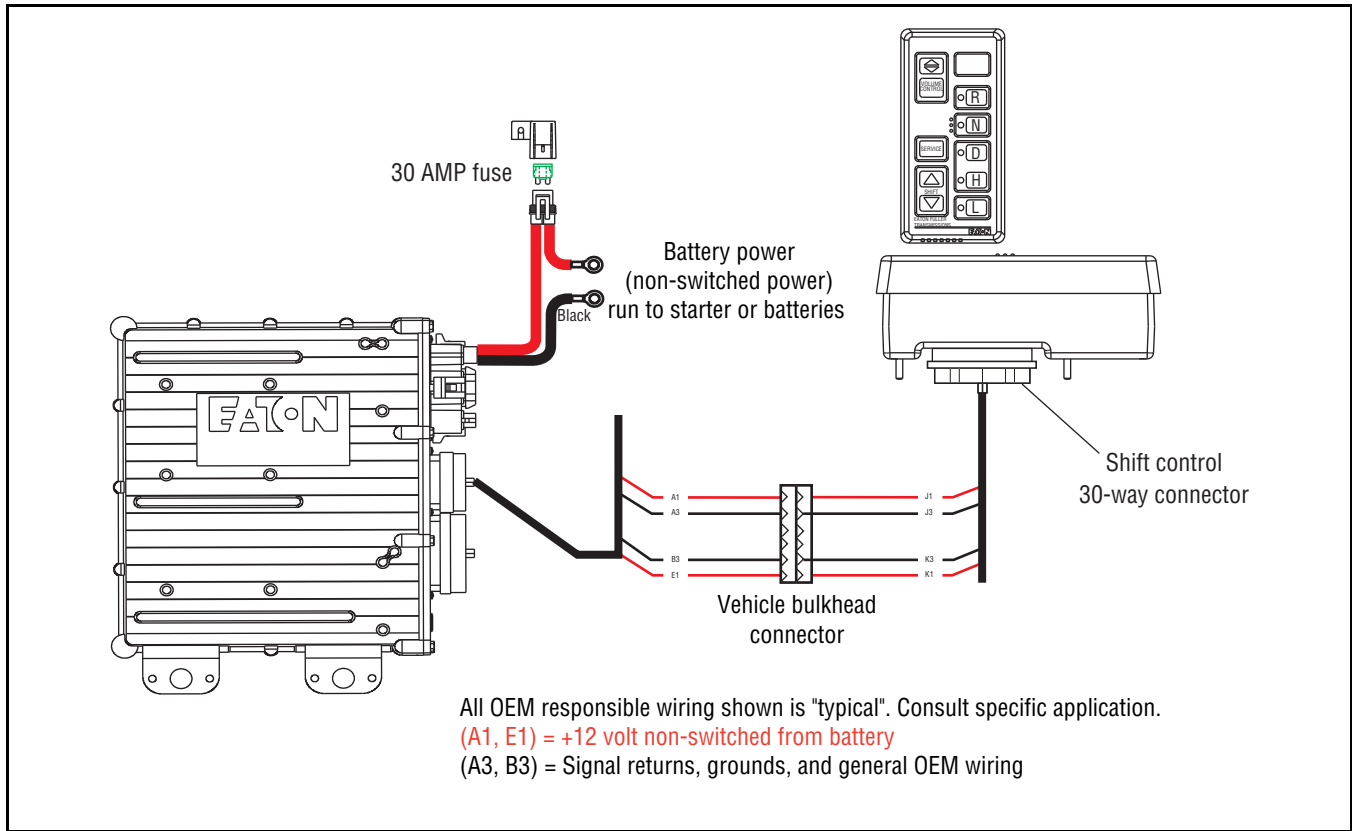
This fault code can be caused by any of the following:

- Battery bus fuse/circuit breaker is open
- Low batteries
- Damaged Vehicle Harness
- Malfunctioning Shift Controller

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

### Component Identification



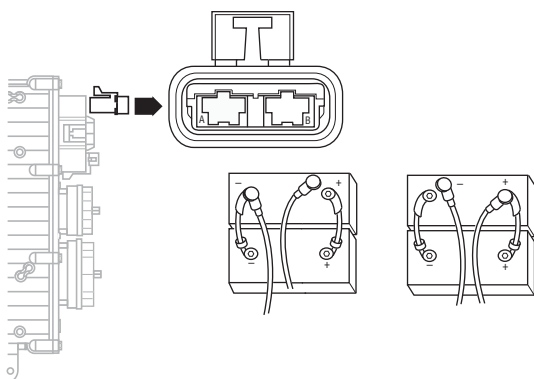


## Fault Code 33: Battery Voltage Supply Test

**A**

**Purpose:** Measure battery voltage. Visually inspect the batteries, inline fuse and power and ground supplies to the ECU.

1. Key off.
2. Inspect main power 2-way connector terminals, in-line fuse holder and power supply connections for integrity and corrosion.

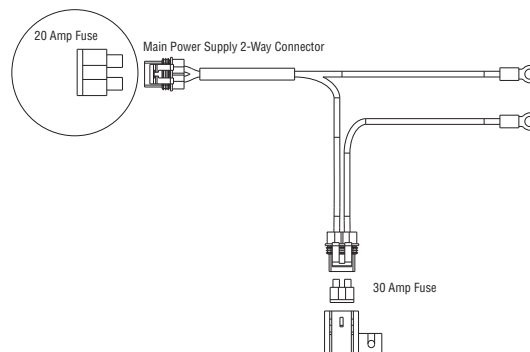


- If no problem found, go to **Step B**.
- If a problem is found, repair power/ground path for the main power supply. Go to **Step V**.

**B**

**Purpose:** Check for proper power supply at main power 2-way connector.

1. Key off.
2. Insert 20-amp fuse into main power 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 Controller. Go to **Step V**.

**V**

**Purpose:** Verify repair.

1. Key on.
2. Retrieve codes, see “Retrieving Fault Codes” on page 5.
  - If Fault Code 33 is Active, see “Electrical System Pretest” on page 15.
  - If Fault Code 33 is Inactive, test complete.



---

## Fault Code 35: J1939 Data Link

**J1587:MID 130    SID 231    FMI 2**

### Overview

Fault Code 35 indicates the transmission failed to communicate with the engine over the J1939 data link.

### Detection

Starting 75 seconds after key on and throughout the operation, the Shift Controller constantly communicates with the engine ECM. If communication fails for more than 5 seconds, Fault Code 35 is set.

### Conditions to Set Fault Code Active

### Fallback

If the fault occurs while moving, it causes a current gear 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.

### Possible Causes

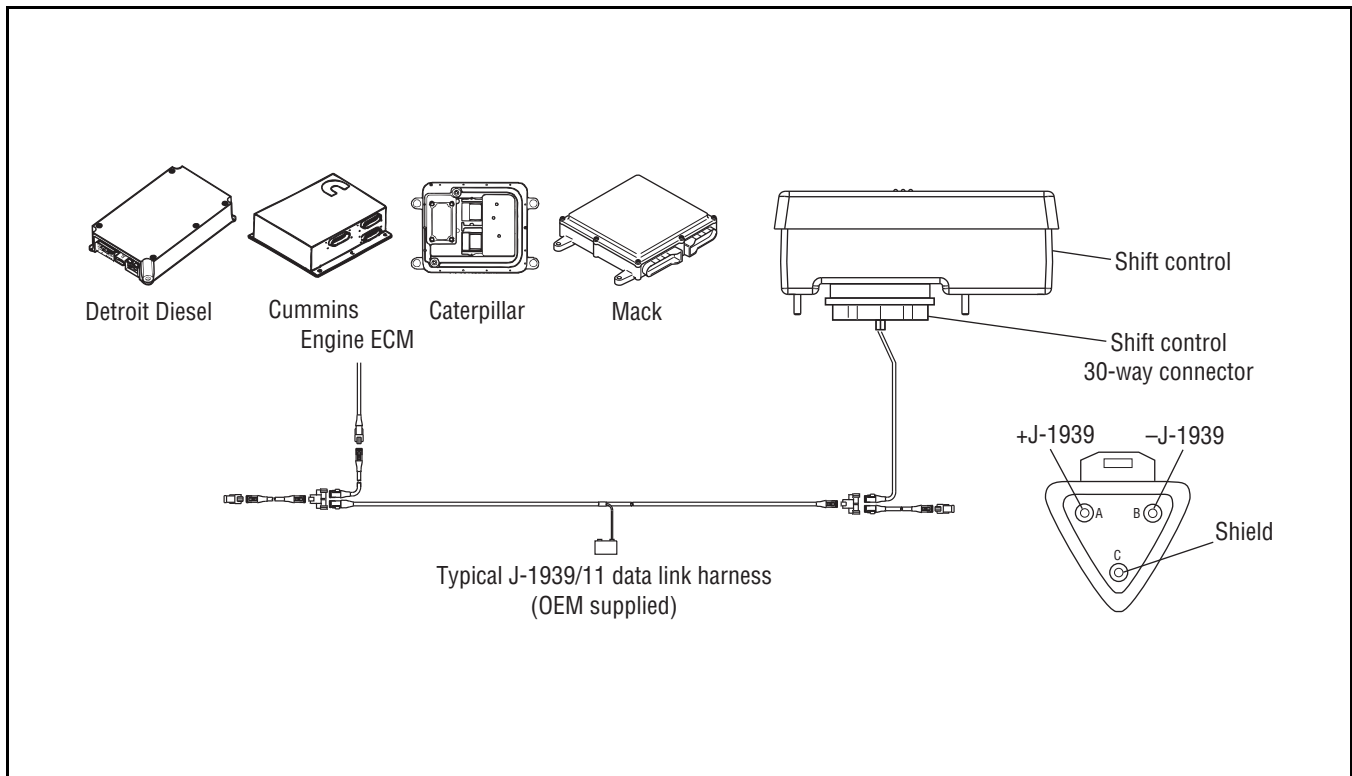
This fault can be caused by any of the following:

- J1939 data link
- Engine ECM
- Vehicle Harness or Connections
- Engine Harness or Connections
- Excessive radio interference
- Shift Controller

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

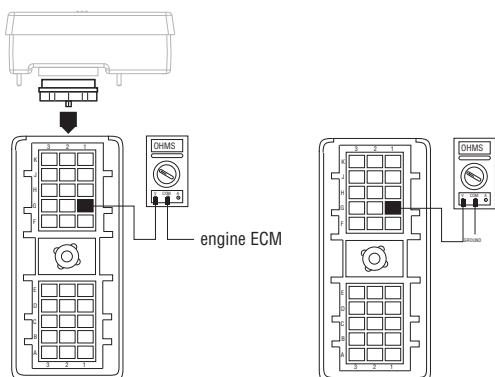
### Component Identification



## Fault Code 35: J1939 Data Link Test

**A** **Purpose:** Verify continuity of the OEM J1939 data high (+) circuit and test for a short to ground.

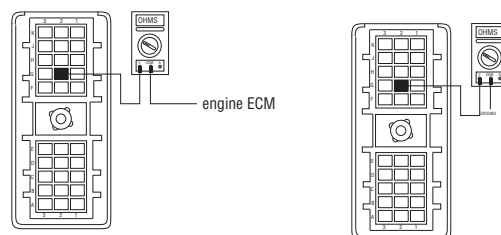
1. Key off.
2. Disconnect Shift Controller 30-way connector.
3. Disconnect engine ECM connector which contains the J1939 Data Link.
4. Measure resistance between:
  - Shift Controller 30-way connector Pin G1 and engine ECM pin (see OEM wiring for positive (+) pin of J1939)
  - Shift Controller 30-way Pin G1 and ground



- If resistance between Pin G1 and engine ECM pin (see OEM wiring for positive (+) J1939 pin) is 0–0.3 ohms, and 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 Controller, go to **Step V**.

**B** **Purpose:** Verify continuity of the OEM J1939 data low (-) circuit and test for a short to ground.

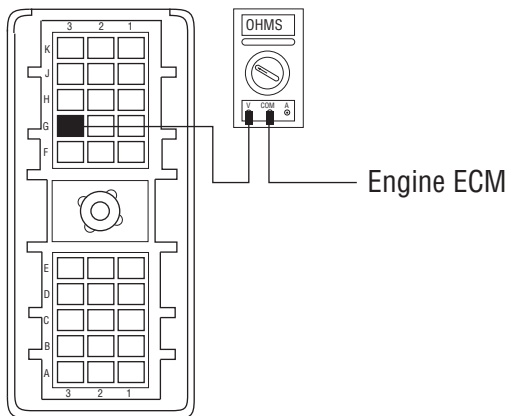
1. Key off.
2. Measure resistance between:
  - Shift Controller 30-way connector Pin G2 and engine ECM pin (see OEM wiring for negative (-) pin of J1939)
  - Shift Controller 30-way Pin G2 and ground



- If resistance between Pin G2 and engine ECM pin (see OEM wiring for negative (-) pin of J1939) is 0–0.3 ohms, and if resistance between Pin G2 and ground is more than 10K ohms or open circuit [OL] and:
  - 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 Controller, go to **Step V**.

**C** **Purpose:** Verify continuity of the OEM J1939 data (shield) circuit and test for a short to ground.

1. Key off.
2. Measure resistance between Shift Controller 30-way connector Pin G3 and engine ECM pin number (see OEM wiring for J1939 shield pin).

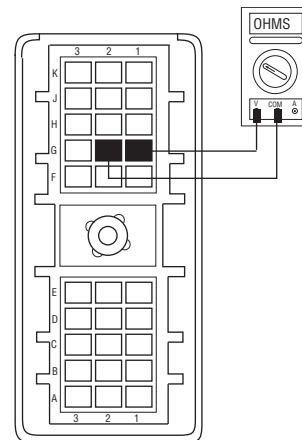


- If resistance between Pin G3 and engine ECM pin (see OEM wiring for J1939 shield pin) is 0–0.3 ohms, go to **Step D**.
- If resistance is outside of range, repair J1939 Data Link Harness between engine ECM and Shift Controller, go to **Step V**.

**D** **Purpose:** Confirm the presence of the terminating resistors on the OEM J1939 data link.

1. Key off.
2. Measure resistance between Shift Controller 30-way connector Pin G1 and Pin G2.

**Note:** Make sure the volt/ohm meter is on the proper scale (around 200 ohm scale).



- If resistance between Pin G1 and Pin G2 is between 50–70 ohms, go to **Step V**.
- If resistance is more than 70 ohms, 1 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 Controller, go to **Step V**.

**V****Purpose:** Verify repair.

1. Key off.
  2. Key on.
  3. Clear codes, see “Clearing Fault Codes” on page 6.
  4. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
  5. Check for codes, see “Retrieving Fault Codes” on page 5.
    - If no codes, test complete.
    - If Fault Code 35 appears, go to **Step A.** to find error in testing.
    - If code other than 35 appears, see “Fault Code Isolation Procedure Index” on page 12.
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## Fault Code 41: Range Failed to Engage

**J1587:MID 130    SID 56    FMI 7**

### Overview

Fault Code 41 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 5 consecutive times and determines the shift cannot be completed based on the speeds across the back box.

### Conditions to Set Fault Code Active

### 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.

### Possible Causes

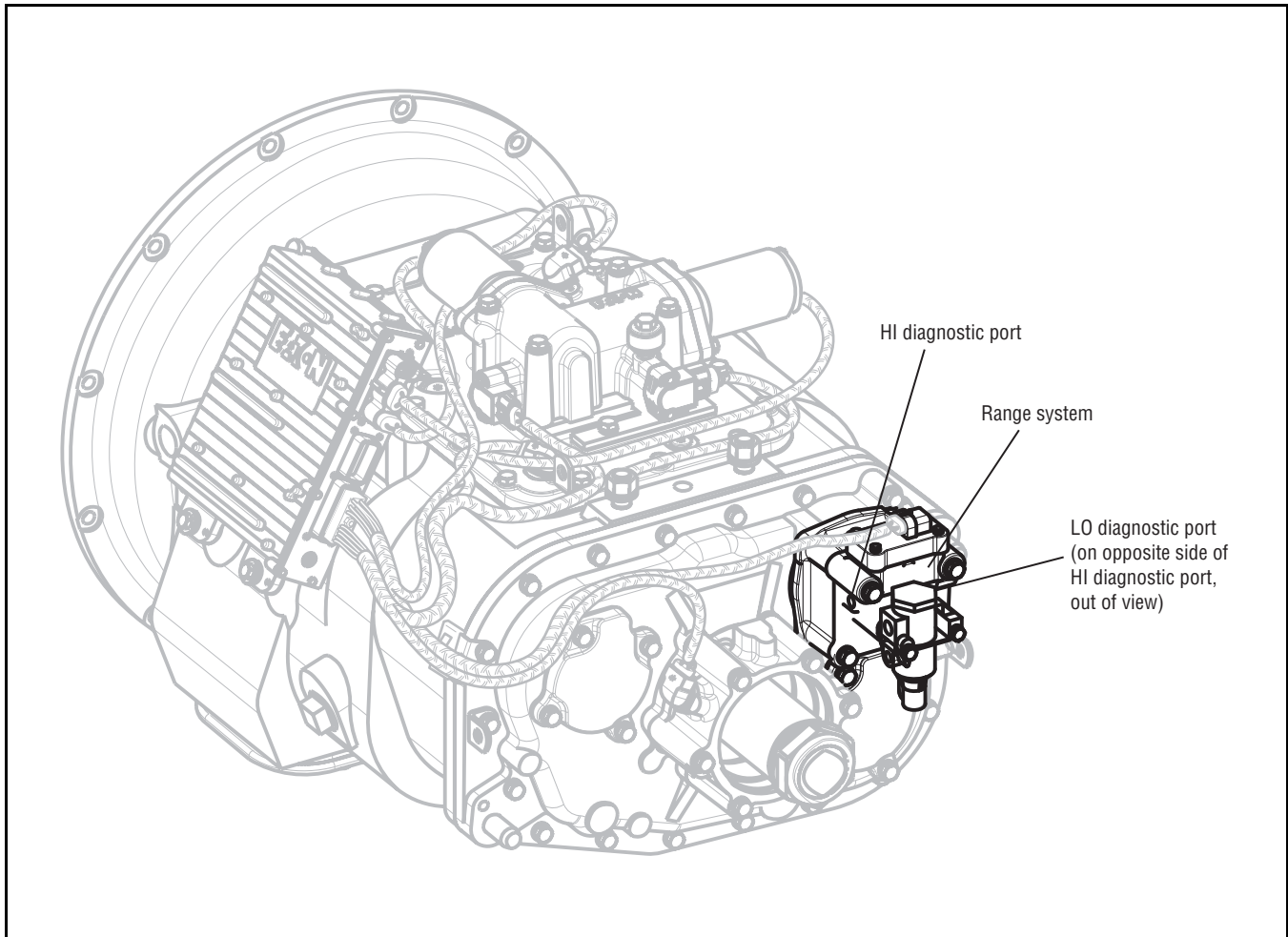
This fault code can be caused by any of the following:

- Low air pressure
- Contaminated air supply
- Air leak
- Range valve
- Range Synchronizer
- Range Actuator, Cylinder, Piston or Yoke

### Additional Tools

- Basic hand tools
- Two 0-100 PSI Air Pressure gauges

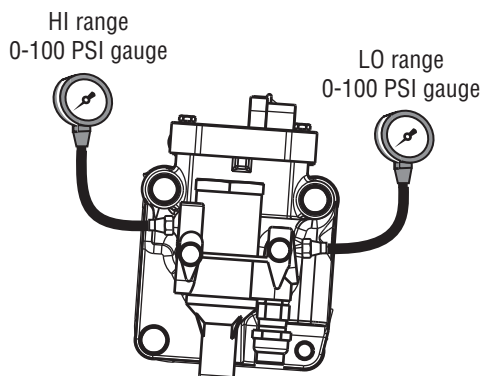
## Component Identification



## Fault Code 41: Range Failed to Engage Test

**A** *Purpose: Measure LO range air pressure.*

1. Key off.
2. Install both 0-100 PSI air pressure gauges into the range cover diagnostic ports.
3. Start engine 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 on.
6. Select reverse with Shift Controller, then select neutral.

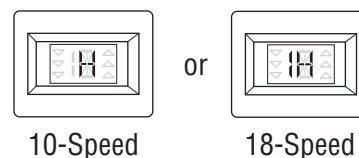
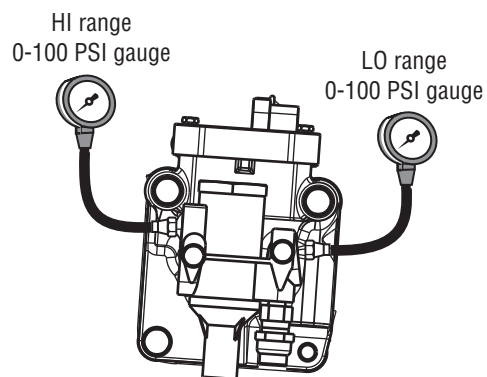


- If LO range air pressure gauge is between 55–65 PSI, and the HI range air pressure gauge is at 0 PSI, go to **Step B**.
- If neither air pressure gauge reads as listed above, replace **Range Valve** and Range Cylinder Cover as required. Go to **Step V**.

**B** *Purpose: Measure HI range air pressure.*

1. Key on.
2. With Shift Controller, select reverse, press the up-shift button, then select neutral.

**Note:** If the Gear Display does not read “H” (10-speed) or “IH” (18-speed), go to the Up-Down Button Test.



- If HI range air pressure gauge is between 55–65 PSI and LO air pressure gauge is at 0 PSI, repair range system as required. Go to **Step V**.
- If neither air pressure gauge reads as listed above, replace **Range Valve** and Range Cylinder Cover as required. Go to **Step V**.

**V****Purpose:** Verify repair.

1. Key off.
  2. Remove all gauges.
  3. Key on.
  4. Clear codes, see “Clearing Fault Codes” on page 6.
  5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
  6. Check for codes, see “Retrieving Fault Codes” on page 5.
    - If no codes, test complete.
    - If Fault Code 41 appears, go to **Step A.** to find error in testing.
    - If a code other than 41 appears, see “Fault Code Isolation Procedure Index” on page 12.
-

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## Fault Code 42: Splitter Failed to Engage

**J1587:MID 130    SID 61    FMI 7**

### Overview

Fault Code 42 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 5 consecutive times and determines the shift cannot be completed based on the speeds across the back box.

### Conditions to Set Fault Code Active

### Fallback

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

### Possible Causes

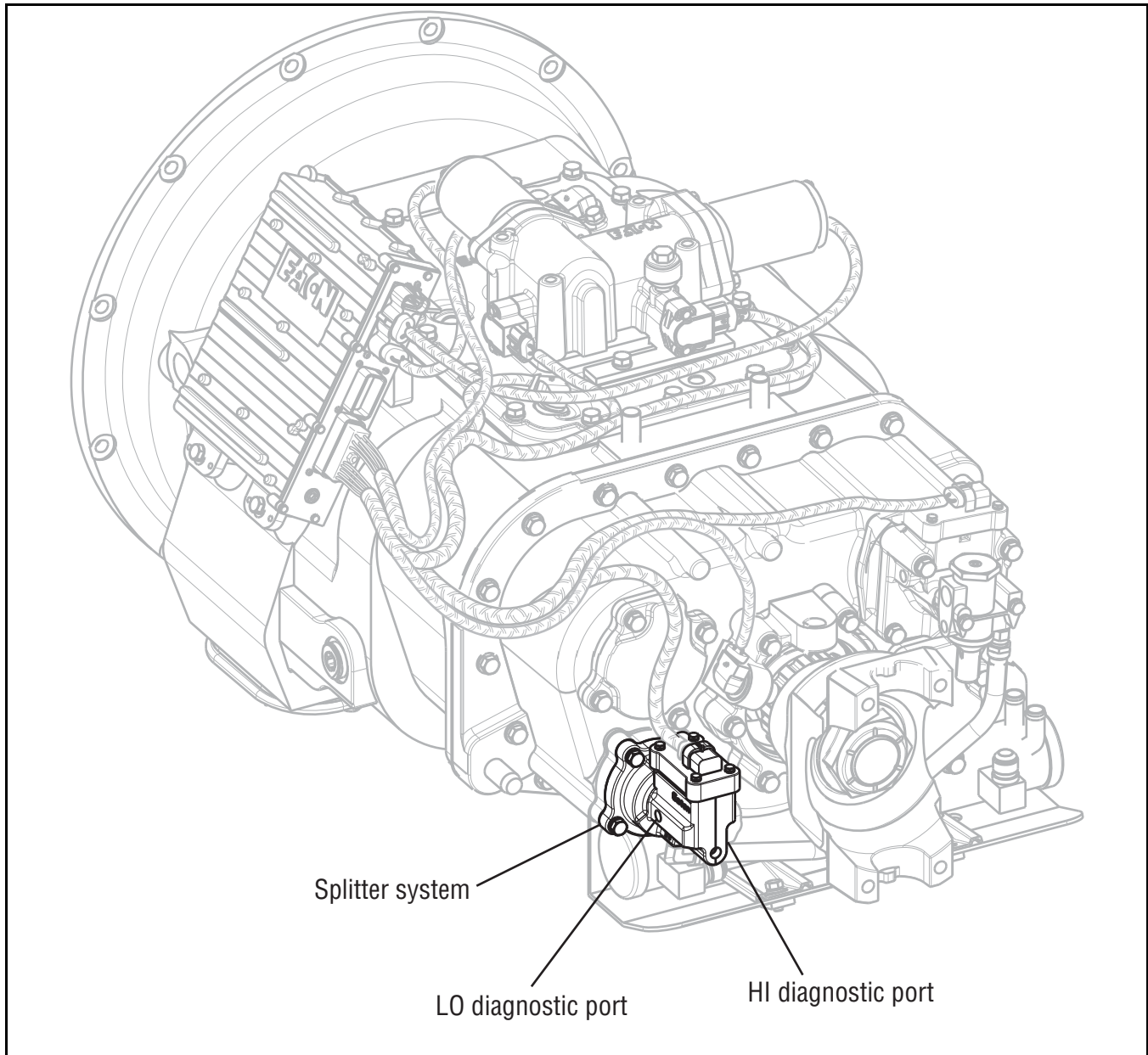
This fault code can be caused by any of the following:

- Low air pressure
- Contaminated air supply
- Air leak
- Splitter valve
- Splitter Actuator, Cylinder, Piston or Yoke

### Additional Tools

- Basic hand tools
- Two 0-100 PSI Air Pressure gauges

## Component Identification

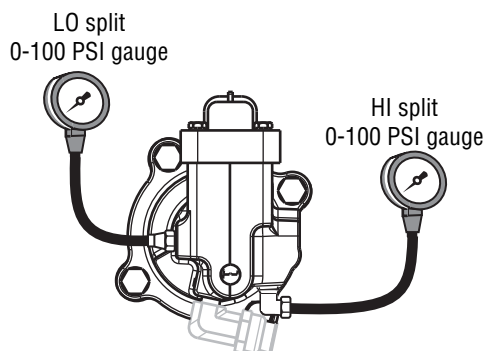


## Fault Code 42: Splitter Failed to Engage Test

**A** *Purpose: Measure LO Splitter air pressure.*

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 on.
5. With Shift Controller, select reverse, then select neutral.

**Note:** Five minutes is allowed for checking the pressure after moving the Shift Lever to neutral.

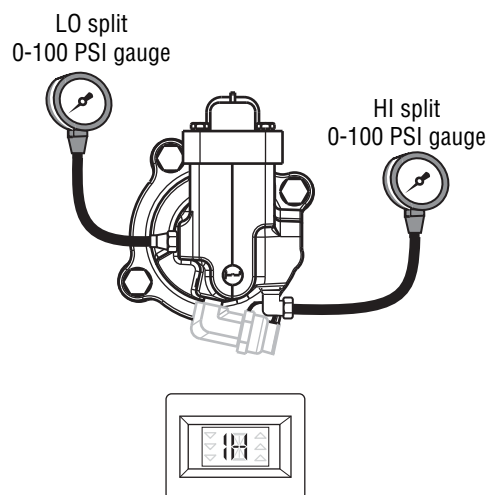


- If HI Splitter gauge measures 55–65 PSI and if LO Splitter gauge measures 0 PSI, go to **Step B.**
- If neither air pressure gauges do not read as listed above, replace **Splitter Valve** and Splitter Cylinder Cover as required. Go to **Step V.**

**B** *Purpose: Measure HI Splitter air pressure.*

1. Key on.
2. With Shift Controller, select reverse, press the up shift button, then select neutral.

**Note:** If the Gear Display does not read “IH” (18-speed), see “Up/Down Button Test” on page 256.



- If LO Splitter gauge measures 55–65 PSI and if HI Splitter gauge measures 0 PSI, repair Mechanical Splitter system as required, go to **Step V.**
- If neither air pressure gauges do not read as listed above, replace **Splitter Valve** and Splitter Cylinder Cover as required. Go to **Step V.**

**V****Purpose:** Verify repair.

1. Key off.
  2. Remove all air pressure gauges.
  3. Key on.
  4. Clear codes, see “Clearing Fault Codes” on page 6.
  5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
  6. Check for codes, see “Retrieving Fault Codes” on page 5.
    - If no codes, test complete.
    - If Fault Code 42 appears, go to **Step A.** to find error in testing.
    - If code other than 42 appears, see “Fault Code Isolation Procedure Index” on page 12.
-



## Fault Code 43: Range Valve

**J1587:MID 130    SID 35, 36    FMI 3, 4, 5**

### Overview

Fault Code 43 indicates an electrical failure of the solenoids that control the range shift.

### Detection

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

### Conditions to Set Fault Code Active

### Fallback

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

### Possible Causes

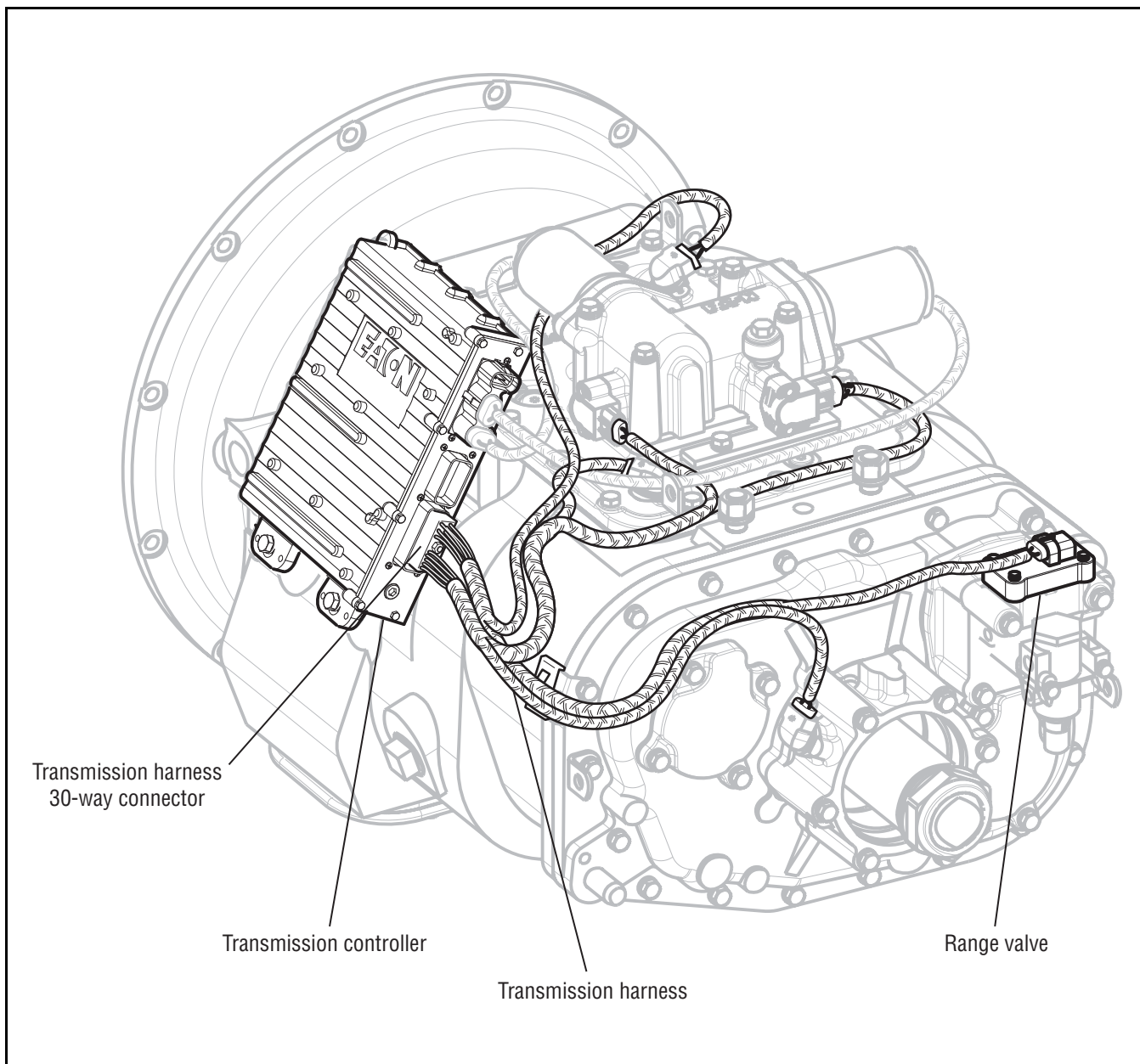
This fault code can be caused by any of the following:

- Range Valve
- Transmission Harness
- Transmission Controller

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

### Component Identification



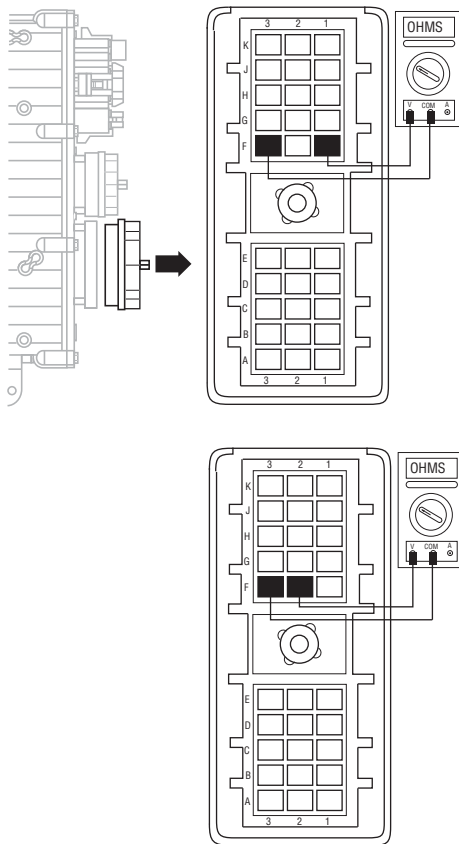
## Fault Code 43: Range Valve Test

**A**

**Purpose:** Measure resistance of high and low Range Solenoid through the Transmission Harness.

1. Key off.
2. Disconnect the Transmission Controller 30-way connector.
3. Measure resistance between the Transmission Harness 30-way connector pins:
  - Pin F1 and Pin F3
  - Pin F3 and Pin F2

**Note:** Observe polarity on volt/ohm meter.

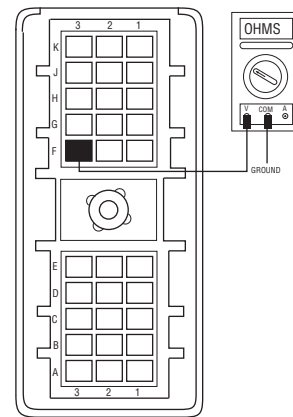


- If resistance is 9–16 ohms, go to **Step B**.
- If resistance is outside of range, go to **Step C**.

**B**

**Purpose:** Test the Range Solenoid Valve common line for shorts to ground through the Transmission Harness.

1. Measure resistance between the Transmission Harness 30-way connector Pin F3 and ground.

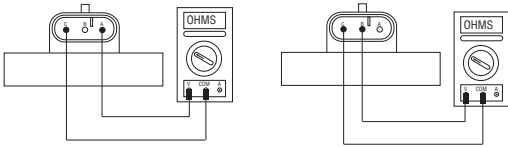


- If resistance is more than 10K ohms or open circuit [OL], replace **Transmission Controller** (only if fault code 43 is Active). Go to **Step V**.
- If resistance is less than 10K ohms, go to **Step C**.

**C**

**Purpose:** Measure resistance of high and low Range Solenoid at the Solenoid Valve.

1. Disconnect the Transmission Harness from Range Valve.
2. Measure resistance between Range Valve pins:
  - Pin A and Pin C
  - Pin B and Pin C

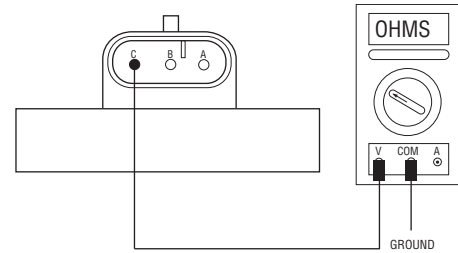


- If resistance is 9–16 ohms, go to **Step D**.
- If resistance is outside of range, replace **Range Valve**. Go to **Step V**.

**D**

**Purpose:** Test the Range Solenoid Valve common line for shorts to ground at the solenoid valve.

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**.

**V****Purpose:** Verify repair.

1. Key off.
2. Reconnect all connectors.
3. Key on.
4. Clear codes, see “Clearing Fault Codes” on page 6.
5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
6. Check for codes, see “Retrieving Fault Codes” on page 5.
  - If no codes, test complete.
  - If Fault Code 43 appears, go to **Step A.** to find error in testing.
  - If code other than 43 appears, see “Fault Code Isolation Procedure Index” on page 12.



---

## Fault Code 44: Inertia Brake Solenoid Coil

**J1587:MID 130    PID 53    FMI 3, 4, 5**

### Overview

Fault Code 44 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.

### Conditions to Set Fault Code Active

### 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.

### Possible Causes

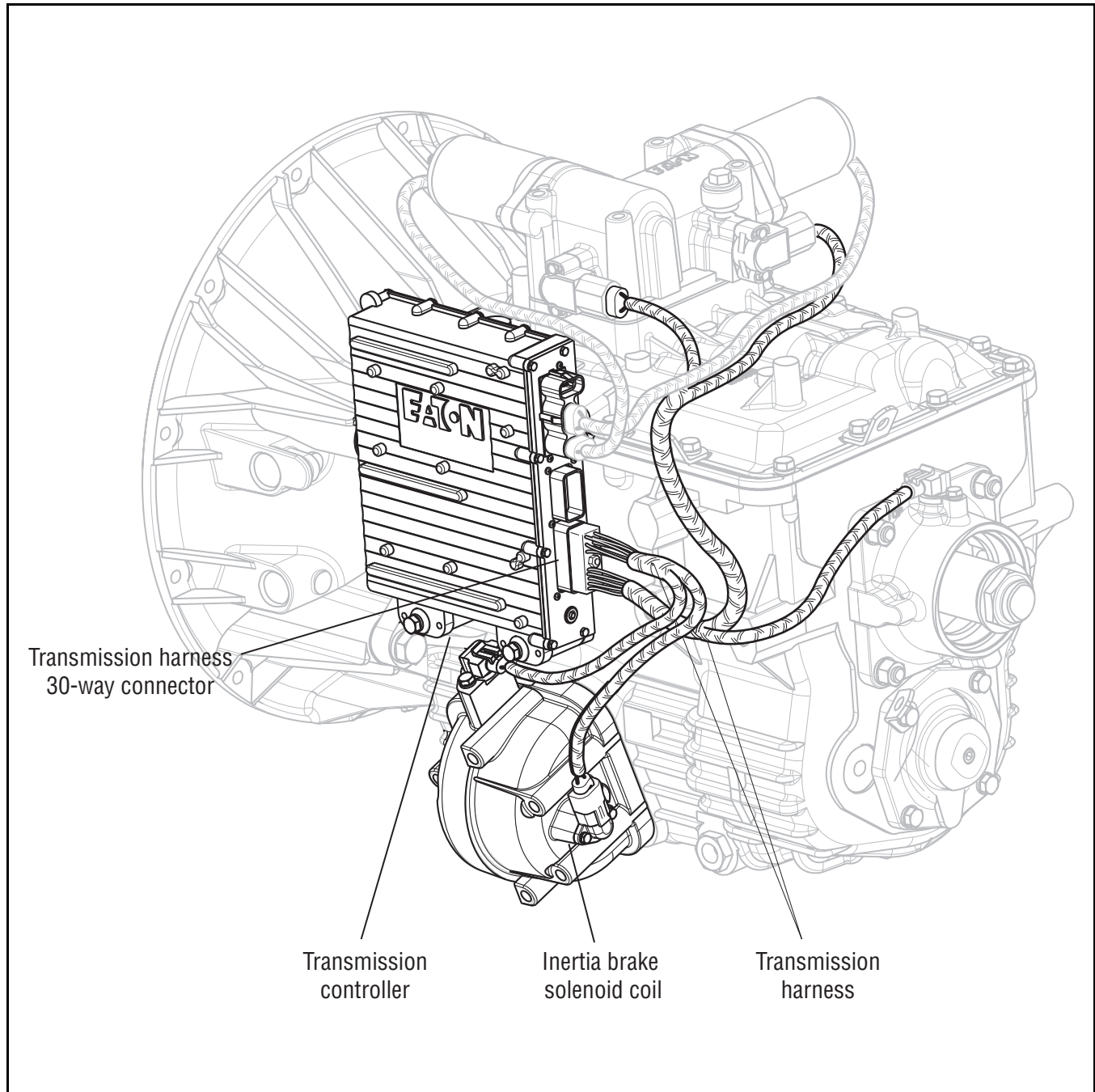
This fault code can be caused by any of the following:

- Inertia Brake Solenoid
- Transmission Harness
- Transmission Controller

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

## Component Identification

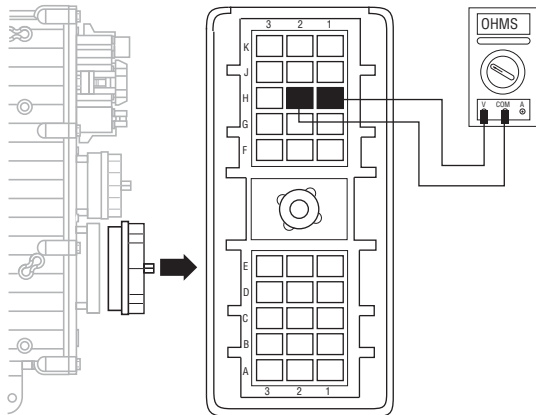




## Fault Code 44: Inertia Brake Solenoid Coil Test

**A** **Purpose:** Measure the resistance of the Inertia Brake Coil through the Transmission Harness.

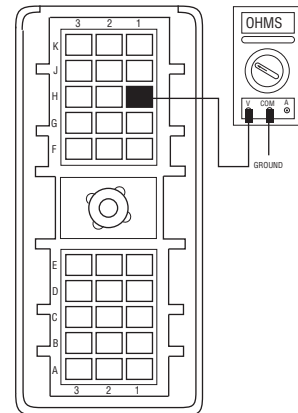
1. Key off.
2. Disconnect the Transmission Controller 30-way connector.
3. Measure resistance between the Transmission Harness 30-way connector Pin H1 and Pin H2.



- If resistance is 2–6 ohms, go to **Step B**.
- If resistance is outside of range, go to **Step C**.

**B** **Purpose:** Test the high-range Solenoid Coil for a short to ground through the Transmission Harness.

1. Measure resistance between the Transmission Harness 30-way connector Pin H1 and ground.

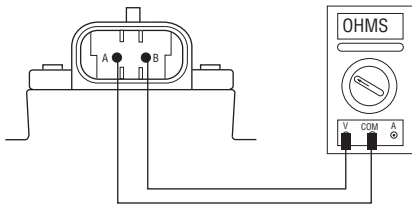


- If resistance is more than 10K ohms or open circuit [OL], replace the **Transmission Controller** (only if fault code is Active). Go to **Step V**.
- If resistance is less than 10K ohms, go to **Step C**.

**C**

**Purpose:** Measure the resistance of the Inertia Brake Coil at the Inertia Brake.

1. Disconnect the Transmission Harness from Inertia Brake coil.
2. Measure resistance between Inertia Brake coil Pin A and Pin B.



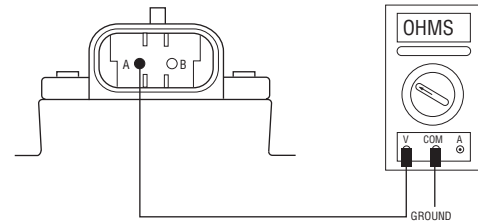
- If resistance is 2–6 ohms, go to **Step D.**
- If resistance is outside of range, replace:
  - **Inertia Brake (6-Speed)**
  - **Inertia Brake (7, 10 and 18-Speed)**

Go to **Step V.**

**D**

**Purpose:** Test the high-side solenoid coil for a short to ground at the inertia brake.

1. Measure resistance between Inertia Brake Coil Pin A and ground.



- If resistance is more than 10K ohms or open circuit [OL], replace the **Adapter Test Kit J43318**. Go to **Step V.**
- If resistance is less than 10K ohms, replace:
  - **Inertia Brake (6-Speed)**
  - **Inertia Brake (7, 10 and 18-Speed)**

Go to **Step V.**

**V****Purpose:** Verify repair.

1. Key off.
  2. Reconnect all connectors.
  3. Key on.
  4. Clear codes, see “Clearing Fault Codes” on page 6.
  5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
  6. Check for codes, see “Retrieving Fault Codes” on page 5.
    - If no codes, test complete.
    - If Fault Code 44 appears, go to **Step A.** to find error in testing.
    - If code other than 44 appears, see “Fault Code Isolation Procedure Index” on page 12.
-



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## Fault Code 46: Splitter Valve

**J1587:MID 130    SID 37, 38    FMI 3, 4, 5**

### Overview

Fault Code 46 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.

### Conditions to Set Fault Code Active

### Fallback

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

### Possible Causes

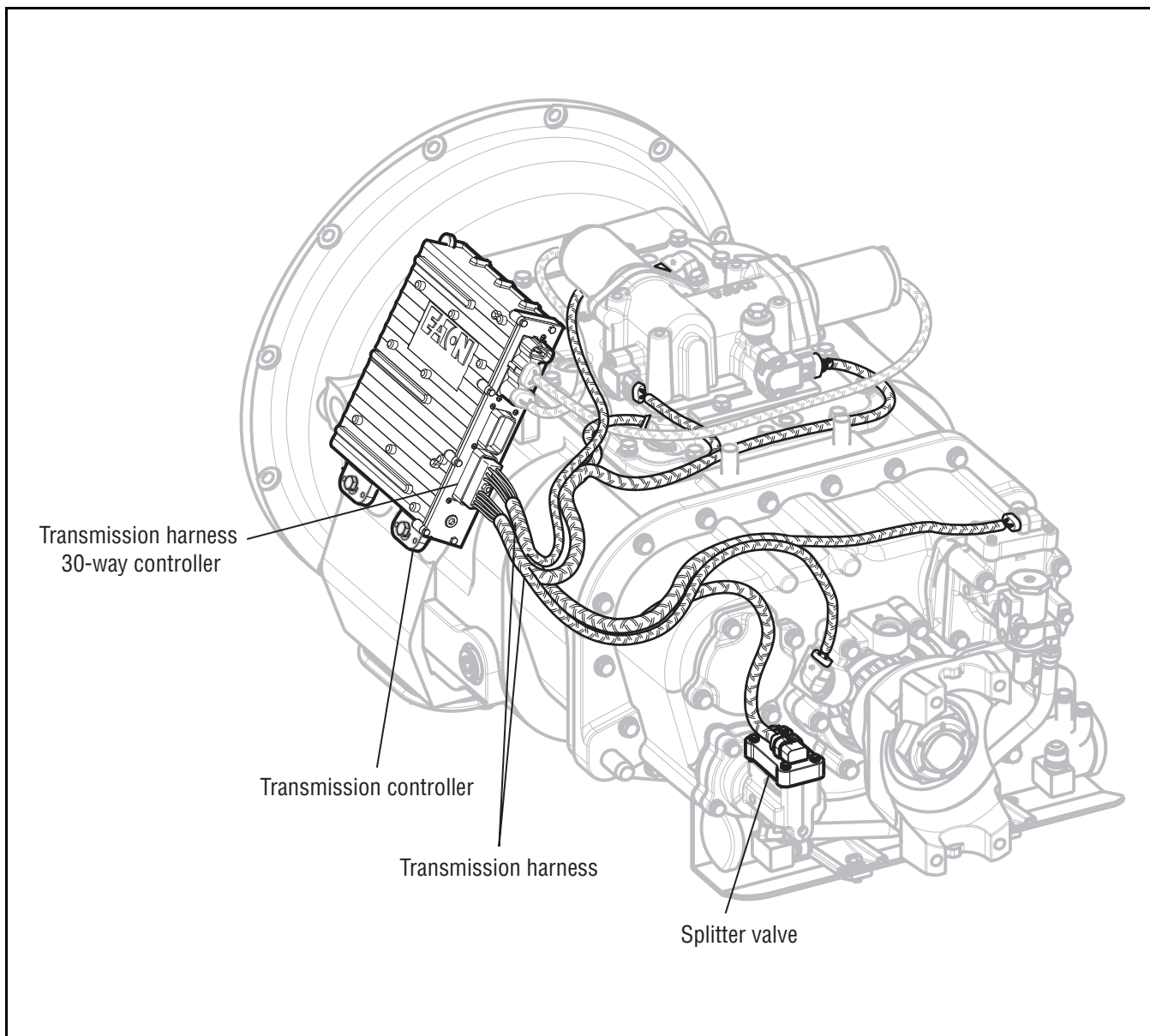
This fault code can be caused by any of the following:

- Splitter Valve
- Transmission Harness
- Transmission Controller

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

### Component Identification

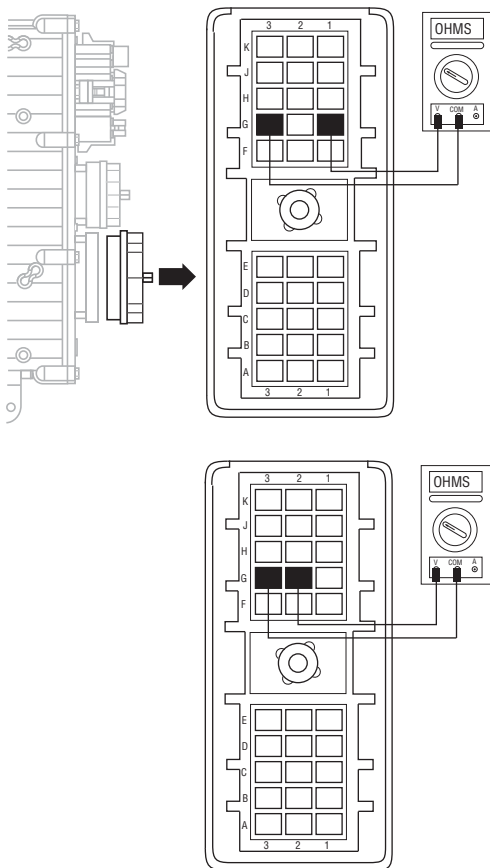


## Fault Code 46: Splitter Valve Test

**A**

**Purpose:** Measure resistance of high and low Splitter Solenoid through the Transmission Harness.

1. Key off.
2. Disconnect the Transmission Controller 30-way connector.
3. Measure resistance between the Transmission Harness 30-way connector:
  - Pin G1 and Pin G3
  - Pin G3 and Pin G2

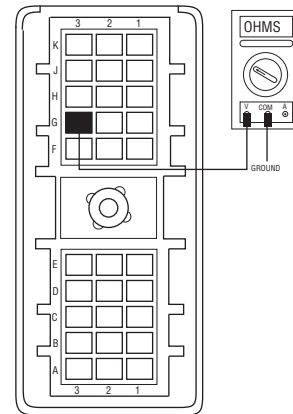


- If resistance is 9–16 ohms, go to **Step B**.
- If resistance is outside of range, go to **Step C**.

**B**

**Purpose:** Test the Splitter Solenoid Valve common line for shorts to ground through the Transmission Harness.

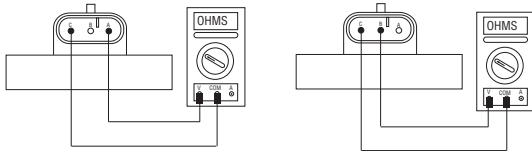
1. Measure resistance between the Transmission Harness 30-way connector Pin G3 and ground.



- If resistance is more than 10K ohms or open circuit [OL], replace the **Transmission Controller** (only if fault code is Active). Go to **Step V**.
- If resistance is less than 10K ohms, go to **Step C**.

**C****Purpose:** Measure resistance of high and low Splitter Solenoid at the Solenoid Valve

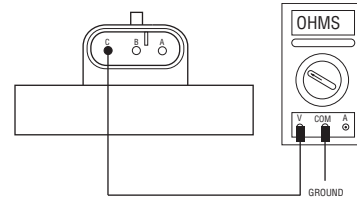
1. Disconnect the Transmission Harness from Splitter Valve.
2. Measure resistance between Splitter Valve:
  - Pin A and Pin C
  - Pin B and Pin C



- If resistance is 9–16 ohms, go to **Step D.**
- If resistance is outside of range, replace the **Splitter Valve.** Go to **Step V.**

**D****Purpose:** Test the Splitter Solenoid Valve common line for shorts to ground at the Solenoid Valve

1. Measure resistance between Splitter Valve Pin C and ground.



- If resistance is more than 10K ohms or open circuit [OL], replace the **Transmission Harness,** go to **Step V.**
- If resistance is less than 10K ohms, replace the **Splitter Valve.** Go to **Step V.**



**V****Purpose:** Verify repair.

1. Key off.
  2. Reconnect all connectors.
  3. Key on.
  4. Clear codes, see “Clearing Fault Codes” on page 6.
  5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
  6. Check for codes, see “Retrieving Fault Codes” on page 5.
    - If no codes, test complete.
    - If Fault Code 46 appears, go to **Step A.** to find error in testing.
    - If code other than 46 appears, see “Fault Code Isolation Procedure Index” on page 12.
-



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## Fault Code 51: Rail Select Sensor

### J1587:MID 130

#### Overview

Fault Code 51 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 full value of the sensor, 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 0 value, indicating an open circuit.

#### Conditions to Set Fault Code Active

#### Fallback

This fault causes an in-place fallback.

#### Possible Causes

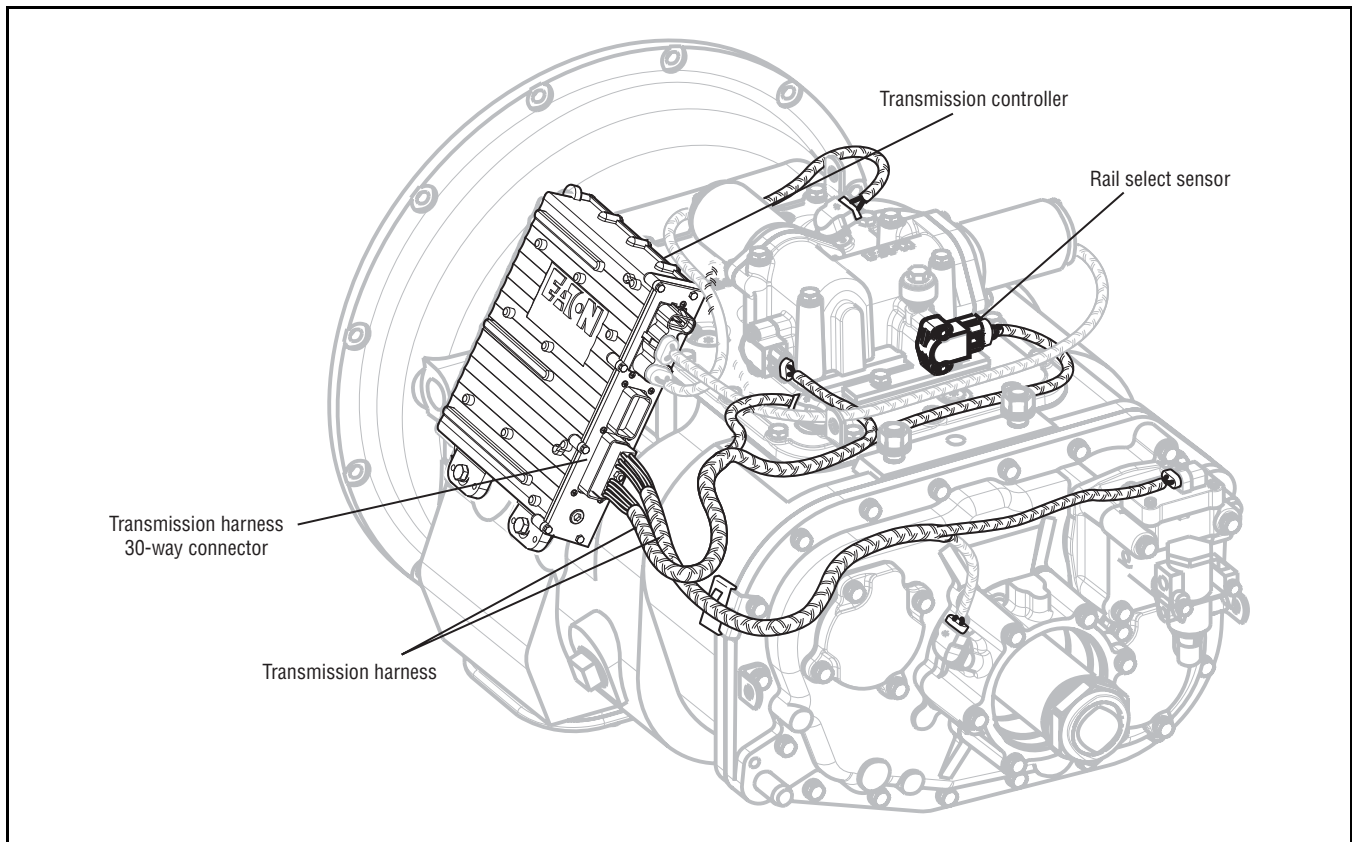
This fault code can be caused by any of the following:

- Transmission Harness
- Rail Select Sensor
- Transmission Controller

#### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

## Component Identification

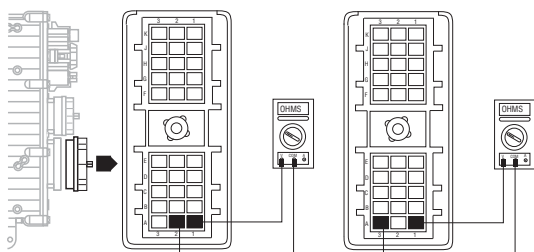


## Fault Code 51: Rail Select Sensor Test

**A** **Purpose:** Measure resistance of the Rail Position Sensor through the Transmission Harness.

1. Key off.
2. Disconnect the Transmission Harness 30-way connector.
3. Measure resistance between the Transmission Harness 30-way connector:
  - Pin A1 and Pin A2
  - Pin A1 and Pin A3

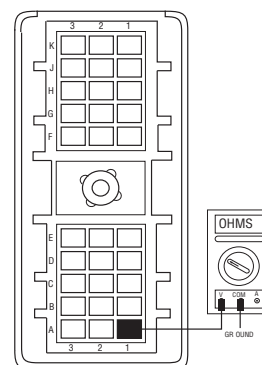
**Note:** An auto-ranging, digital volt/ohm meter must be used.



- (White backed Rail Select Sensor) If resistance between Pin A1 and Pin A2 is 3.5M–6.5M ohms and between Pin A1 and Pin A3 is 13.5K–18.5K ohms, go to **Step B**.
- (Black backed Rail Select Sensor) If resistance between Pin A1 and Pin A2 is 100–200 ohms and between Pin A1 and Pin A3 is 5K–7K ohms, go to **Step B**.
- If any of the above conditions are not met, go to **Step C**.

**B** **Purpose:** Test the Rail Position Sensor voltage supply circuit for shorts to ground through the Transmission Harness.

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 and FMI 10 is Active or Inactive). Reference Service Bulletin TAIB0832 for more information. Go to **Step V**.

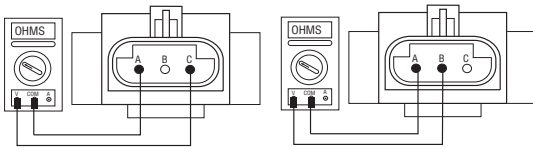
**Note:** FMI 10 only displays with Transmission Controller software version 097 and above. Older versions of software set Fault Code 51 with FMI 3 or Fault Code 72 for the same issue. Replace only the Transmission Harness for these codes as well.

- If resistance is less than 10K ohms, go to **Step C**.

### C **Purpose:** Measure resistance of the Rail Position Sensor at the Rail Position Sensor.

1. Disconnect Transmission Harness from Rail Select Sensor.
2. Measure resistance between rail select sensor pins:
  - Pin A and Pin C
  - Pin A and Pin B

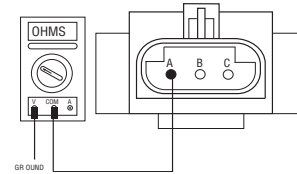
**Note:** An auto-ranging digital volt/ohm meter must be used.



- (White epoxy back sensor) If Pin A and Pin C resistance is 13.5K–18.5K ohms and if Pin A and Pin B resistance is 3.5M–6.5M ohms, go to **Step D**.
- (Black plastic sensor) If Pin A and Pin C resistance is 5K–7K ohms and If Pin A and Pin B resistance is 100–200 ohms, go to **Step D**.
- If any to the above conditions are not met, replace **Electric Shifter**. Go to **Step V**.

### D **Purpose:** Test the Rail Position Sensor Plus line for shorts to ground at the Rail Position Sensor.

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**.

**V****Purpose:** Verify repair.

1. Key off.
  2. Reconnect all connectors.
  3. Key on.
  4. Clear codes, see “Clearing Fault Codes” on page 6.
  5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
  6. Check for codes, see “Retrieving Fault Codes” on page 5.
    - If no codes, test complete.
    - If Fault Code 51 appears, go to **Step A.** to find error in testing.
    - If code other than 51 appears, see “Fault Code Isolation Procedure Index” on page 12.
-





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## Fault Code 52: Gear Select Sensor

**J1587:MID 130    PID 59    FMI 2, 3, 4**

### Overview

Fault Code 52 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 full value of the sensor, the fault code is set. This type of failure represents a short to ground or to battery voltage. The Transmission Controller also monitors the sensor feedback for a 0 value, indicating an open circuit.

### Conditions to Set Fault Code Active

### Fallback

This fault causes an in-place fallback.

### Possible Causes

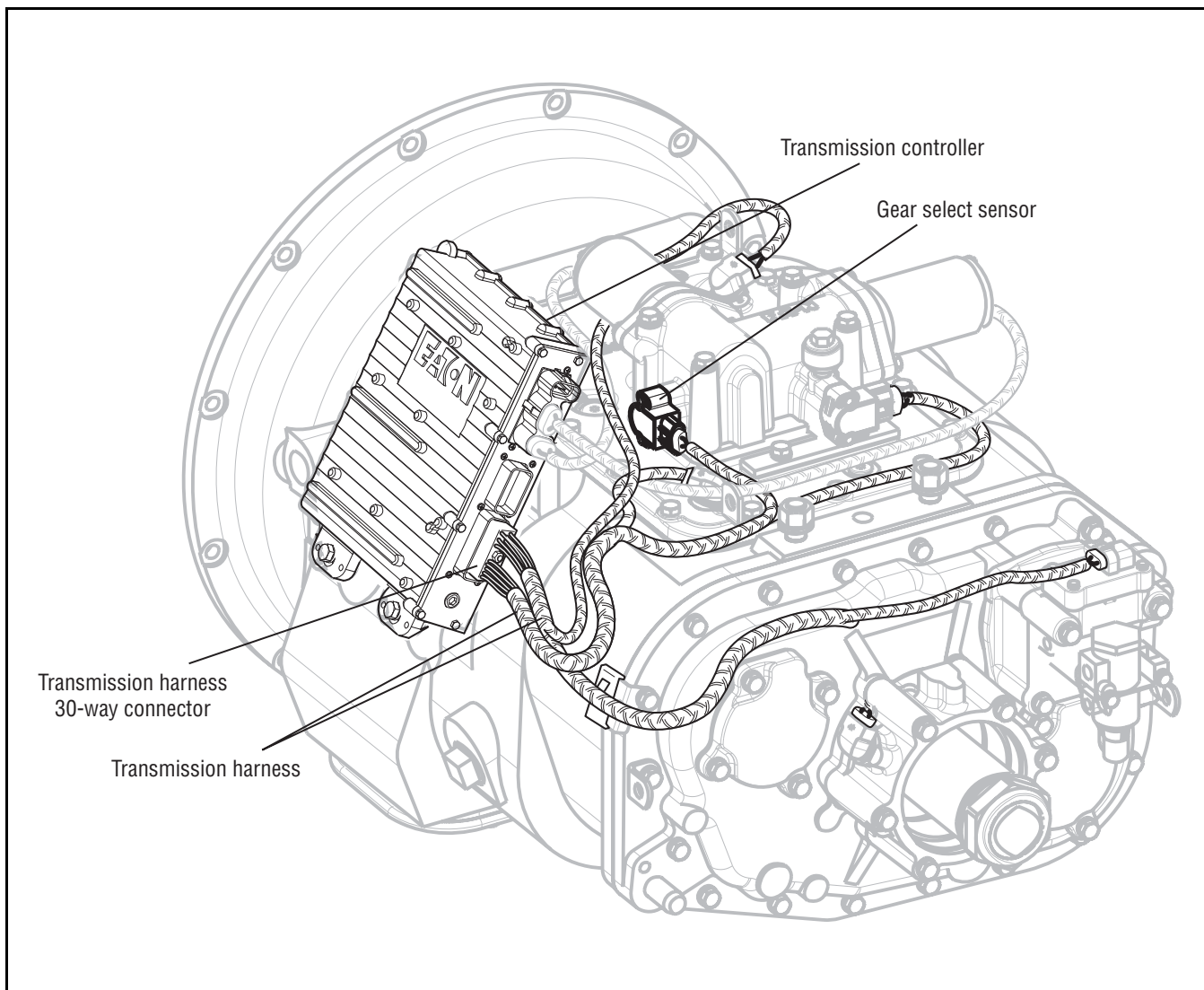
This fault code can be caused by any of the following:

- Transmission Harness
- Gear Select Sensor
- Transmission Controller

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

### Component Identification

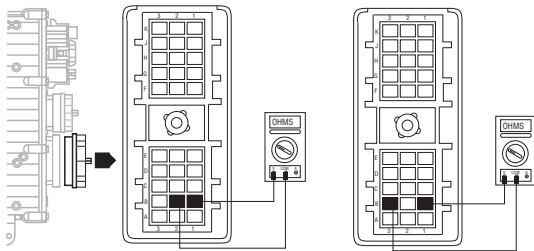


## Fault Code 52: Gear Select Sensor Test

**A** **Purpose:** Measure resistance of the Gear Position Sensor through the Transmission Harness.

1. Key off.
2. Disconnect the Transmission controller 30-way connector.
3. Measure resistance between the Transmission Harness 30-way connector pins:
  - Pin B1 and Pin B2
  - Pin B1 and Pin B3

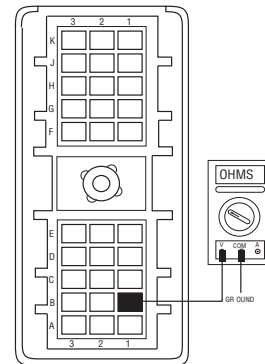
**Note:** An auto ranging digital volt/ohm meter must be used.



- (White epoxy back sensor) If Pin B1 and Pin B2 resistance is 3.5M–6.5M ohms and if Pin B1 and Pin B3 resistance is 13.5K–18.5K ohms, go to **Step B**.
- (Black plastic back sensor) If Pin B1 and Pin B2 resistance is 100–200 ohms and if Pin B1 and Pin B3 resistance is 5K–7K ohms, go to **Step B**.
- If any of the above conditions are not met, go to **Step C**.

**B** **Purpose:** Test the Gear Position Sensor Plus line for shorts to ground through the Transmission Harness.

1. Measure resistance between transmission harness 30-way connector Pin B1 to ground.

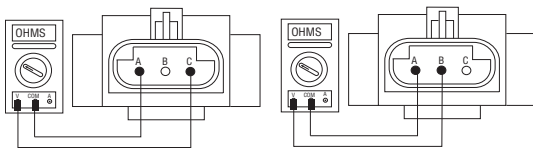


- If resistance is more than 10K ohms or open circuit [OL], replace **Transmission Controller** (only if fault code is Active). Go to **Step V**.
- If resistance is less than 10K ohms, go to **Step C**.

### C **Purpose:** Measure resistance of the Gear Position Sensor at the Rail Position Sensor.

1. Disconnect transmission harness from Gear Select Sensor.
2. Measure resistance between gear select sensor pins:
  - Pin A and Pin C
  - Pin A and Pin B

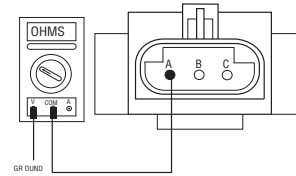
**Note:** An auto ranging digital volt/ohm meter must be used.



- (White epoxy back sensor) If Pin A and Pin C resistance is 13.5K–18.5K ohms and if Pin A and Pin B resistance is 3.5M–6.5M ohms, go to **Step D**.
- (Black plastic back sensor) If Pin A and Pin C resistance is 5K–7K and if Pin A and Pin B resistance is 100–200 ohms, go to **Step D**.
- If any to the above conditions are not met, replace the **Electric Shifter**. Go to **Step V**.

### D **Purpose:** Test the Gear Position Sensor Plus line for shorts to ground at the Gear Position Sensor.

1. Measure resistance between gear select sensor Pin A and ground.



- If resistance is more than 10K ohms or open circuit [OL], replace the **Transmission Harness**. Go to **Step V**.
- If resistance is less than 10K ohms, replace the **Electric Shifter**. Go to **Step V**.

### V **Purpose:** Verify repair.

1. Key off.
2. Reconnect all connectors.
3. Key on.
4. Clear codes, see “Clearing Fault Codes” on page 6.
5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
6. Check for codes, see “Retrieving Fault Codes” on page 5.
  - If no codes, test complete.
  - If Fault Code 52 appears, go to **Step A** to find error in testing.
  - If code other than 52 appears, see “Fault Code Isolation Procedure Index” on page 12.

---

## Fault Code 56: Input Shaft Speed Sensor

**J1587:MID 130    PID 161    FMI 2, 5**

### Overview

Fault Code 56 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 at least one sensor is inconsistent.

### Conditions to Set Fault Code Active

### 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.

### Possible Causes

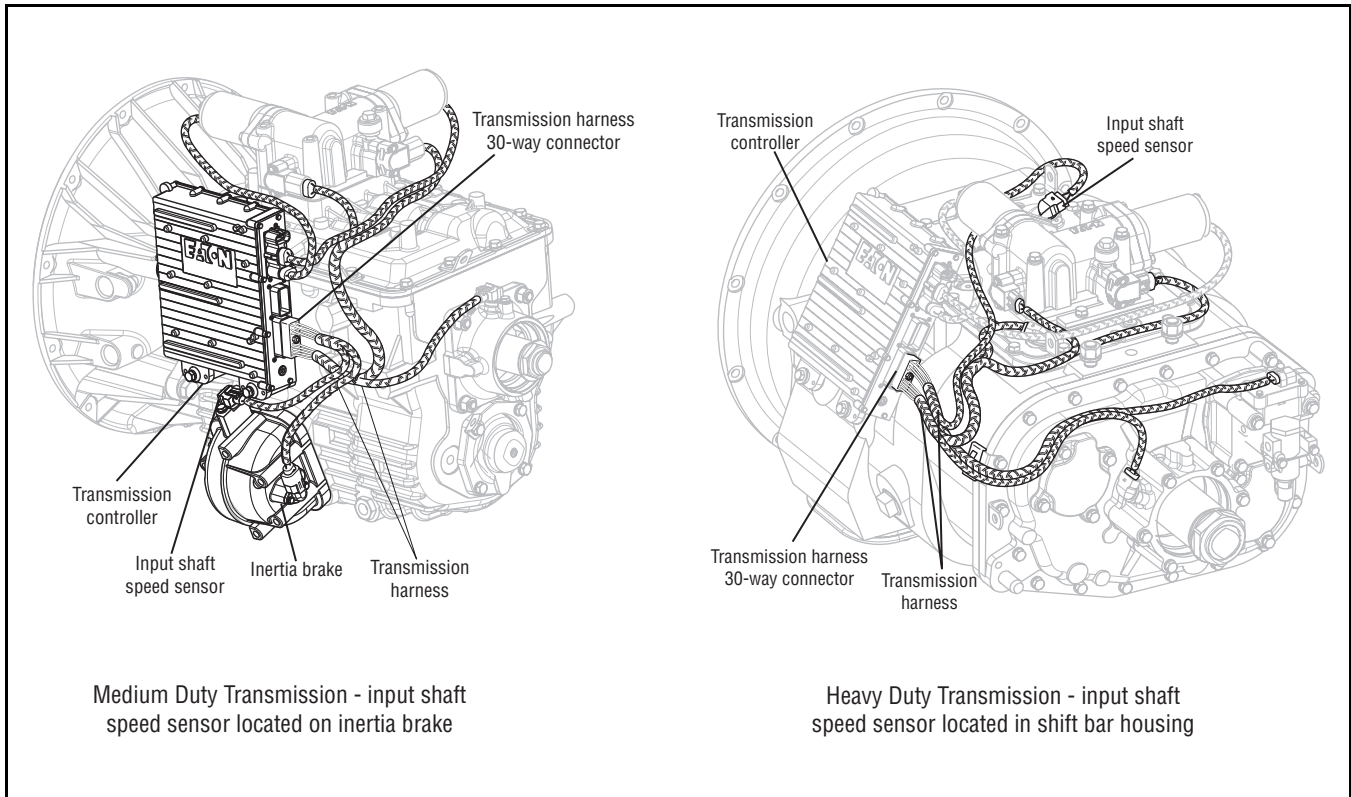
This fault code can be caused by any of the following:

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

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

### Component Identification



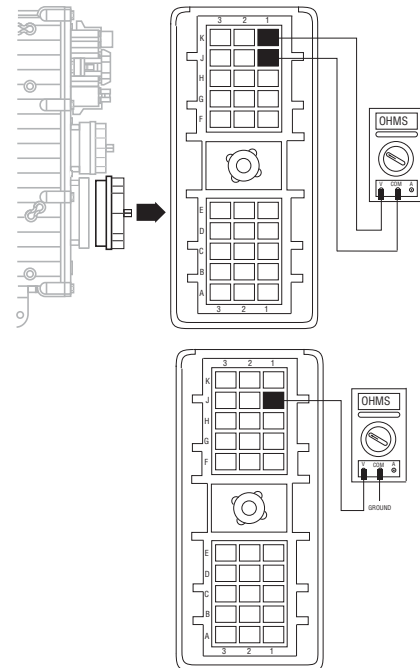
## Fault Code 56: Input Shaft Speed Sensor Test

**A** *Purpose:* Drive the vehicle and monitor engine speed and Input Shaft speed in ServiceRanger.

1. Drive vehicle and monitor engine RPM and Input Shaft RPM with ServiceRanger
  - 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**.

**B** *Purpose:* Measure Input Shaft Speed Sensor through the Transmission Harness and test for a short to ground.

1. Key off.
2. Disconnect the Transmission Controller 30-way connector.
3. Measure resistance between the Transmission Controller 30-way connector Pin J1 and Pin K1 and between Pin J1 and ground.



- If Pin J1 and Pin K1 resistance is 2K–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**.

**C**

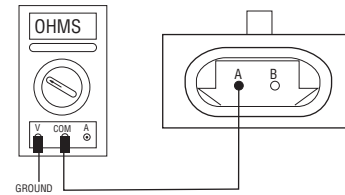
**Purpose:** Visually inspect Input Shaft Speed Sensor and upper countershaft PTO gear for contamination or damage.

- Inspect Input Shaft Speed Sensor and upper countershaft PTO gear 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 if sent here from Step D or E, replace the:
      - **Input Shaft Speed Sensor (6-Speed)**
      - **Input Shaft Speed Sensor (7, 10 and 18-Speed)**
- Go to **Step V.**

**E**

**Purpose:** Test for a short to ground at the Input Shaft Speed Sensor.

- Measure resistance between Input Shaft Speed Sensor Pin A and ground.

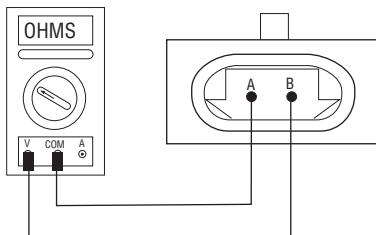


- If resistance is more than 10K ohms or open circuit [OL], replace the **Transmission Harness**. Go to **Step V.**
- If resistance is less than 10K ohms, go to **Step C.**

**D**

**Purpose:** Measure Input Shaft Speed Sensor resistance.

- Disconnect the Transmission Harness from Input Shaft Speed Sensor.
- Measure resistance between Input Shaft Speed Sensor Pin A and Pin B.



- If resistance is 2K–4.5K ohms, go to **Step E.**
- If resistance is outside of range, go to **Step C.**



**V****Purpose:** Verify repair.

1. Key off.
  2. Reconnect all connectors.
  3. Verify proper installation of Speed Sensor.
  4. Key on.
  5. Clear codes, see “Clearing Fault Codes” on page 6.
  6. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
  7. Check for codes, see “Retrieving Fault Codes” on page 5.
    - If no codes, test complete.
    - If Fault Code 56 appears, go to **Step A.** to find error in testing.
    - If code other than 56 appears, see “Fault Code Isolation Procedure Index” on page 12.
-



---

## Fault Code 57: Main Shaft Speed Sensor

**J1587:MID 130    PID 160    FMI 2**

### Overview

Fault Code 57 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.

### Conditions to Set Fault Code Active

### Fallback

There fault causes an in-place fallback mode.

### Possible Causes

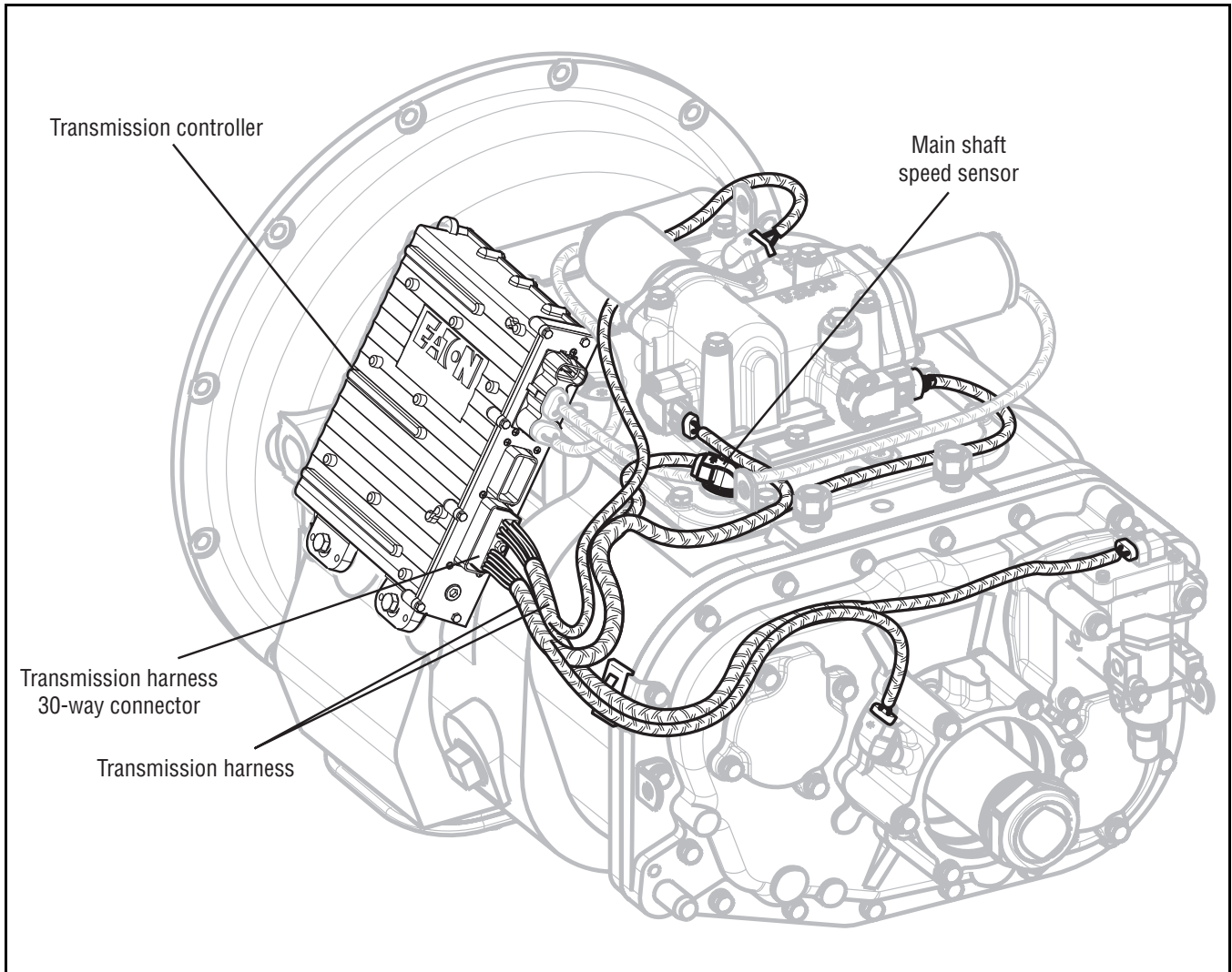
This fault code can be caused by any of the following:

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

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

### Component Identification

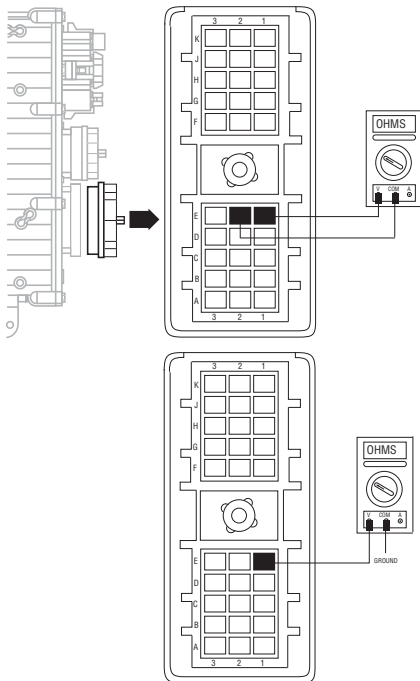


## Fault Code 57: Main Shaft Speed Sensor Test

**A**

**Purpose:** Measure Main Shaft Speed Sensor through the Transmission Harness and test for a short to ground.

1. Key off.
2. Disconnect the Transmission Controller 30-way connector.
3. Measure resistance between the Transmission Controller 30-way connector Pin E1 and Pin E2 and between E1 and ground.



- If Pin E1 and Pin E2 resistance is 2K–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**.

**B**

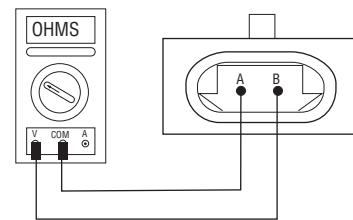
**Purpose:** Visually inspect Main Shaft Speed Sensor for contamination or damage.

1. Inspect Main 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 if sent here from Step C or Step D, replace the **Main Shaft Speed Sensor** and inspect the Upper Reverse Idler gear for damage. Go to **Step V**.

**C**

**Purpose:** Measure Main Shaft Speed Sensor resistance.

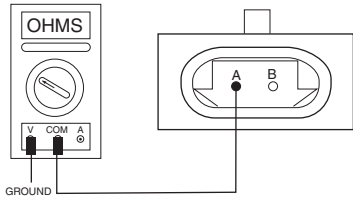
1. Disconnect the Transmission Harness from the Main Shaft Speed Sensor.
2. Measure resistance between the Main Shaft Speed Sensor Pin A and Pin B.



- If resistance is 2K–4.5K ohms, go to **Step D**.
- If resistance is outside of range, go to **Step B**.

**D** **Purpose:** Test for a short to ground at the Main Shaft Speed Sensor.

1. Measure resistance between Main Shaft Speed Sensor Pin A and ground.



- If resistance is more than 10K ohms or open circuit [OL], replace the **Transmission Harness**. Go to **Step V**.
- If resistance is less than 10K ohms, go to **Step B**.

**V** **Purpose:** Verify repair.

1. Key off.
2. Reconnect all connectors.
3. Verify proper installation of Speed Sensor.
4. Key on.
5. Clear codes, see “Clearing Fault Codes” on page 6.
6. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
7. Check for codes, see “Clearing Fault Codes” on page 6.
  - If no codes, test complete.
  - If Fault Code 57 appears, go to **Step A** to find error in testing.
  - If code other than 57 appears, see “Fault Code Isolation Procedure Index” on page 12.

---

## Fault Code 58: Output Shaft Speed Sensor

**J1587:MID 130    PID 191    FMI 2**

### Overview

Fault Code 58 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.

### Conditions to Set Fault Code Active

### Fallback

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

### Possible Causes

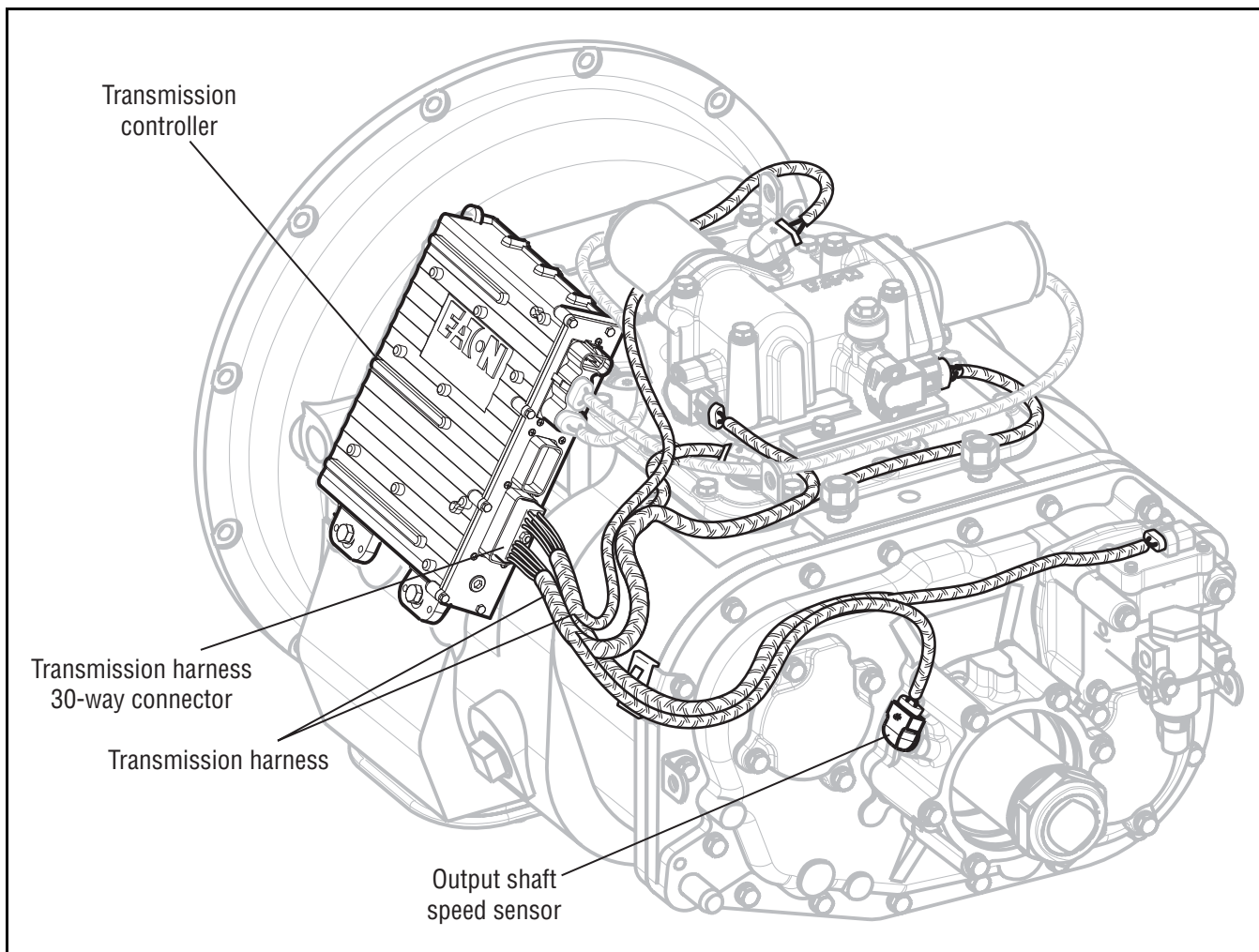
This fault code can be caused by any of the following:

- Transmission Harness
- Output Shaft Speed Sensor
- Various transmission components
- Transmission Controller
- Failed or loose Tone Wheel

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

### Component Identification



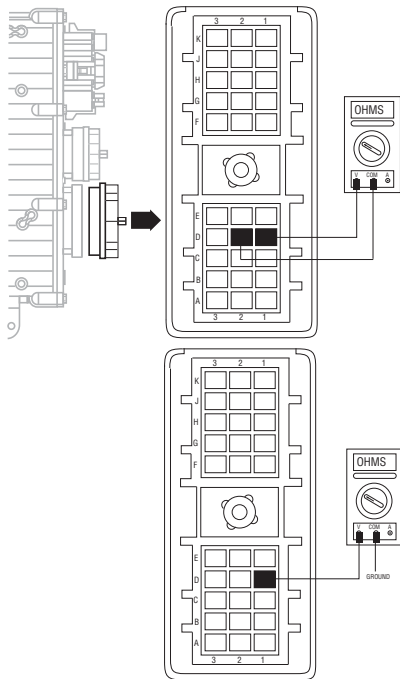


## Fault Code 58: Output Shaft Speed Sensor Test

**A**

**Purpose:** Measure Output Shaft Speed Sensor through the Transmission Harness and test for a short to ground.

1. Key off.
2. Disconnect the Transmission Controller 30-way connector.
3. Measure resistance between the Transmission Controller 30-way connector Pin D1 and Pin D2 and between Pin 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**.

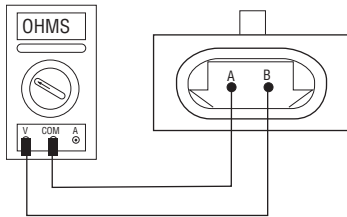
**B**

**Purpose:** Visually inspect Output Shaft Speed Sensor and Tone Wheel for contamination or damage.

1. Inspect Output Shaft Speed Sensor and Tone Wheel for contamination, looseness, damage or corrosion.
    - If no problem found, replace the **Transmission Controller** (only if fault code is Active). Go to **Step V**.
    - If problem is found or if sent here from Step C or Step D, replace the:
      - **Output Shaft Speed Sensor (6 and 7-Speed)**
      - **Output Shaft Speed Sensor (10 and 18-Speed)**
- Inspect the Tone Wheel for damage, looseness or corrosion. Go to **Step V**.

**C****Purpose:** Measure Output Shaft Speed Sensor resistance.

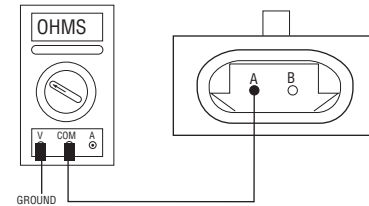
1. Disconnect the Transmission Harness from the Output Shaft Speed Sensor.
2. Measure resistance between Output Shaft Speed Sensor Pin A and Pin B.



- If resistance is 2K–4.5K ohms, go to **Step D**.
- If resistance is outside of range, go to **Step B**.

**D****Purpose:** Test for a short to ground at the Output Shaft Speed Sensor.

1. Measure resistance between Output Shaft Speed Sensor Pin A and ground.



- If resistance is more than 10K ohms or open circuit [OL], replace the **Transmission Harness**. Go to **Step V**.
- If resistance is less than 10K ohms, go to **Step B**.

**V****Purpose:** Verify repair.

1. Key off.
  2. Reconnect all connectors.
  3. Verify proper installation of Speed Sensor.
  4. Key on.
  5. Clear codes, see “Clearing Fault Codes” on page 6.
  6. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
  7. Check for codes, see “Retrieving Fault Codes” on page 5.
    - If no codes, test complete.
    - If Fault Code 58 appears, go to **Step A.** to find error in testing.
    - If code other than 58 appears, see “Fault Code Isolation Procedure Index” on page 12.
-



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## Fault Code 61: Rail Select Motor

**J1587:MID 130    SID 39    FMI 5, 6**

### Overview

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. If a failure mode of short to battery, short to ground, or open circuit is detected, the fault code is set. 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.

### Conditions to Set Fault Code Active

### Fallback

This fault causes an in-place fallback.

### Possible Causes

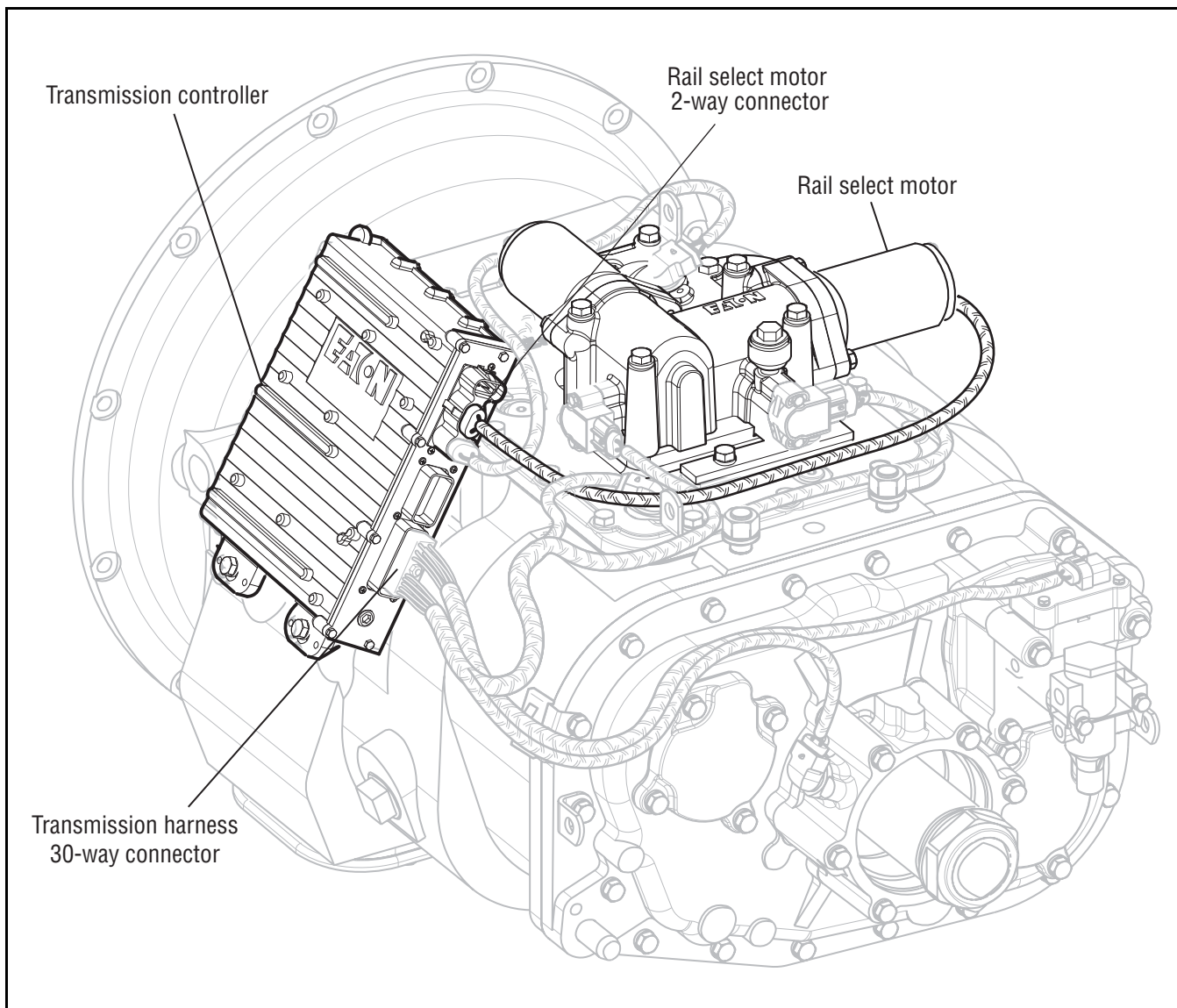
This fault code can be caused by any of the following:

- Rail Select Motor
- Transmission Controller

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

### Component Identification

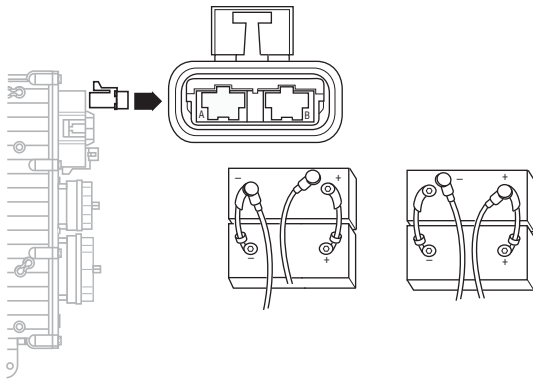


## Fault Code 61: Rail Select Motor Test

**A**

**Purpose:** Visually inspect the main power 2-way connector, in-line Fuse Holder and vehicle power supply connections.

1. Key off.
2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.

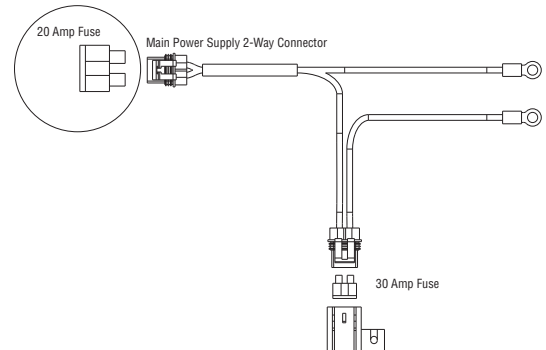


- If no problem found, go to **Step B.**
- If problem is found, repair power/ground path for the main power supply. Go to **Step V.**

**B**

**Purpose:** Check for proper power supply at Main Power Harness 2-way connector.

1. Key off.
2. Insert 20-amp fuse into main power 2-way connector.

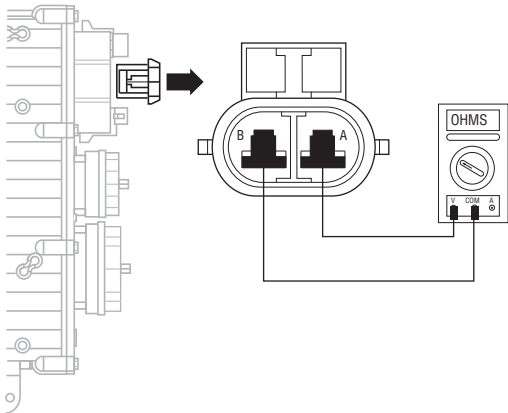


- If fuse blows immediately, go to **Step C.**
- If fuse does not blow immediately, repair wiring from the battery to the Transmission Controller. Go to **Step V.**

**C**

**Purpose:** Measure the resistance of the Electric Shifter through the Rail Select Motor Harness.

1. Disconnect Rail Select Motor 2-way (black) connector from the Transmission Controller.
2. Measure resistance between Rail Select 2-way connector Pin A and Pin B.

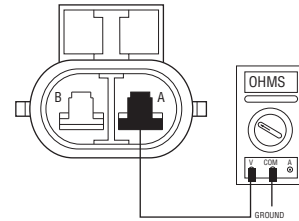


- If resistance is 0.3–150 ohms, go to **Step D.**
- If resistance is outside of range, replace the **Electric Shifter**. Go to **Step V.**

**D**

**Purpose:** Test the Rail Select Motor for a short to ground at the 2-way Rail Select Motor Connector.

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 the **Transmission Controller** (only if fault code is Active). Go to **Step V.**
- If resistance is outside of range, replace the **Electric Shifter**. Go to **Step V.**



**V****Purpose:** Verify repair.

1. Key off.
  2. Reconnect all connectors.
  3. Key on.
  4. Clear codes, see “Clearing Fault Codes” on page 6.
  5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
  6. Check for codes, see “Retrieving Fault Codes” on page 5.
    - If no codes, Test complete.
    - If Fault Code 61 appears, go to **Step A.** to find error in testing.
    - If code other than 61 appears, see “Fault Code Isolation Procedure Index” on page 12.
-



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## Fault Code 63: Gear Select Motor

**J1587:MID 130    SID 40    FMI 5, 6**

### Overview

Fault Code 63 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. If failure mode of short to battery, short to ground, or open circuit is detected, this fault code sets. The Transmission Controller also monitors the electrical current required to drive the motors. If the upper current limit is exceeded, the fault code is also set.

### Conditions to Set Fault Code Active

### Fallback

This fault causes an in-place fallback.

### Possible Causes

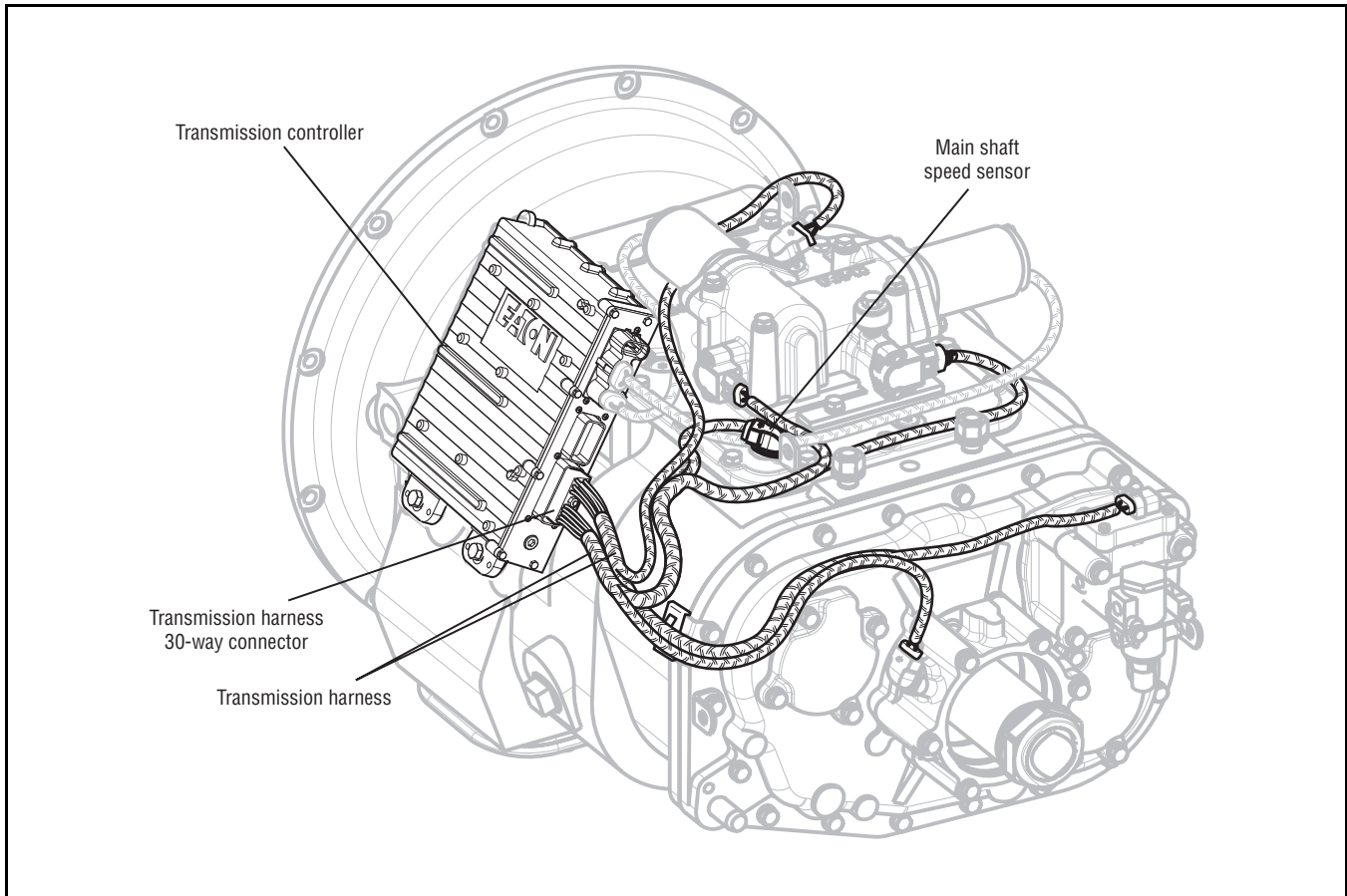
This fault code can be caused by any of the following:

- Gear Select Motor
- Transmission Controller

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

## Component Identification

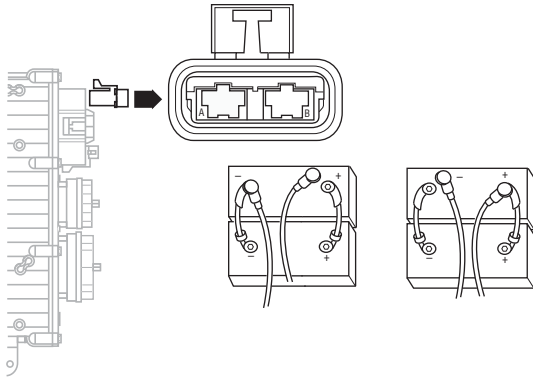


## Fault Code 63: Gear Select Motor Test

**A**

**Purpose:** Visually inspect the main power 2-way connector, in-line fuse holder and vehicle power supply connections for signs of damage.

1. Key off.
2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.

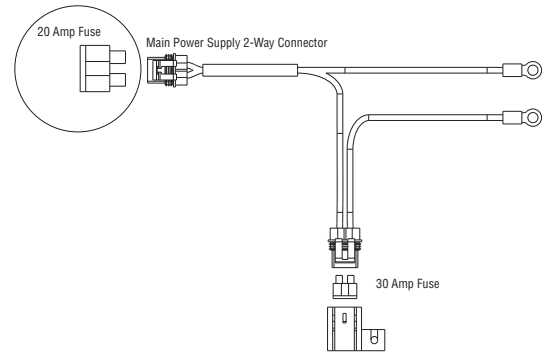


- If no problem found, go to **Step B.**
- If problem is found, repair power/ground path for the main power supply. go to **Step V.**

**B**

**Purpose:** Check for proper power supply at Main Power Harness 2-way connector.

1. Key off.
2. Insert 20-amp fuse into main power 2-way connector.

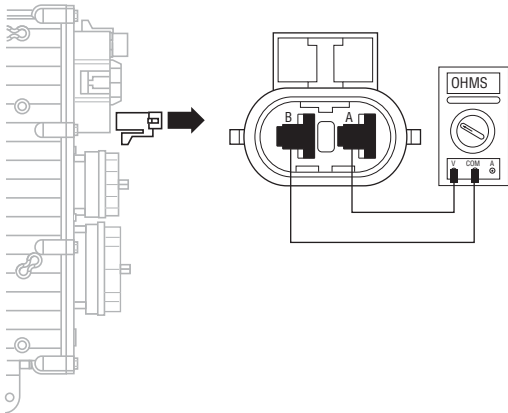


- If fuse blows immediately, go to **Step C.**
- If fuse does not blow immediately, repair wiring from the battery to the Transmission Controller. go to **Step V.**

**C**

**Purpose:** Measure the resistance of the Electric Shifter through the Gear Select Motor Harness.

1. Disconnect Gear Select Motor 2-way (blue) connector from the Transmission Controller.
2. Measure resistance between Gear Select 2-way connector Pin A and Pin B.

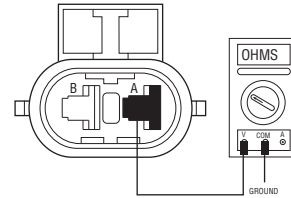


- If resistance is 0.3–150 ohms, go to **Step D**.
- If resistance is outside of range, replace the **Electric Shifter**. Go to **Step V**.

**D**

**Purpose:** Test the Gear Select Motor for a short to ground at the 2-way Gear Select Motor Connector.

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 the **Transmission Controller** (only if fault code is Active). Go to **Step V**.
- If resistance is outside of range, replace the **Electric Shifter**. Go to **Step V**.

**V****Purpose:** Verify repair.

1. Key off.
  2. Reconnect all connectors.
  3. Key on.
  4. Clear codes, see “Clearing Fault Codes” on page 6.
  5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
  6. Check for codes, see “Retrieving Fault Codes” on page 5.
    - If no codes, Test complete.
    - If Fault Code 63 appears, go to **Step A.** to find error in testing.
    - If code other than 63 appears, see “Fault Code Isolation Procedure Index” on page 12.
-





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## Fault Code 65: Logic Power

**J1587:MID 130    SID 251    FMI 4**

### Overview

Fault Code 65 indicates the Transmission Controller has detected low transmission logic power to the Transmission Controller on vehicle interface 18-way connector Pin B1 and Pin 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.

### Conditions to Set Fault Code Active

### Fallback

This fault causes an in-place fallback.

### Possible Causes

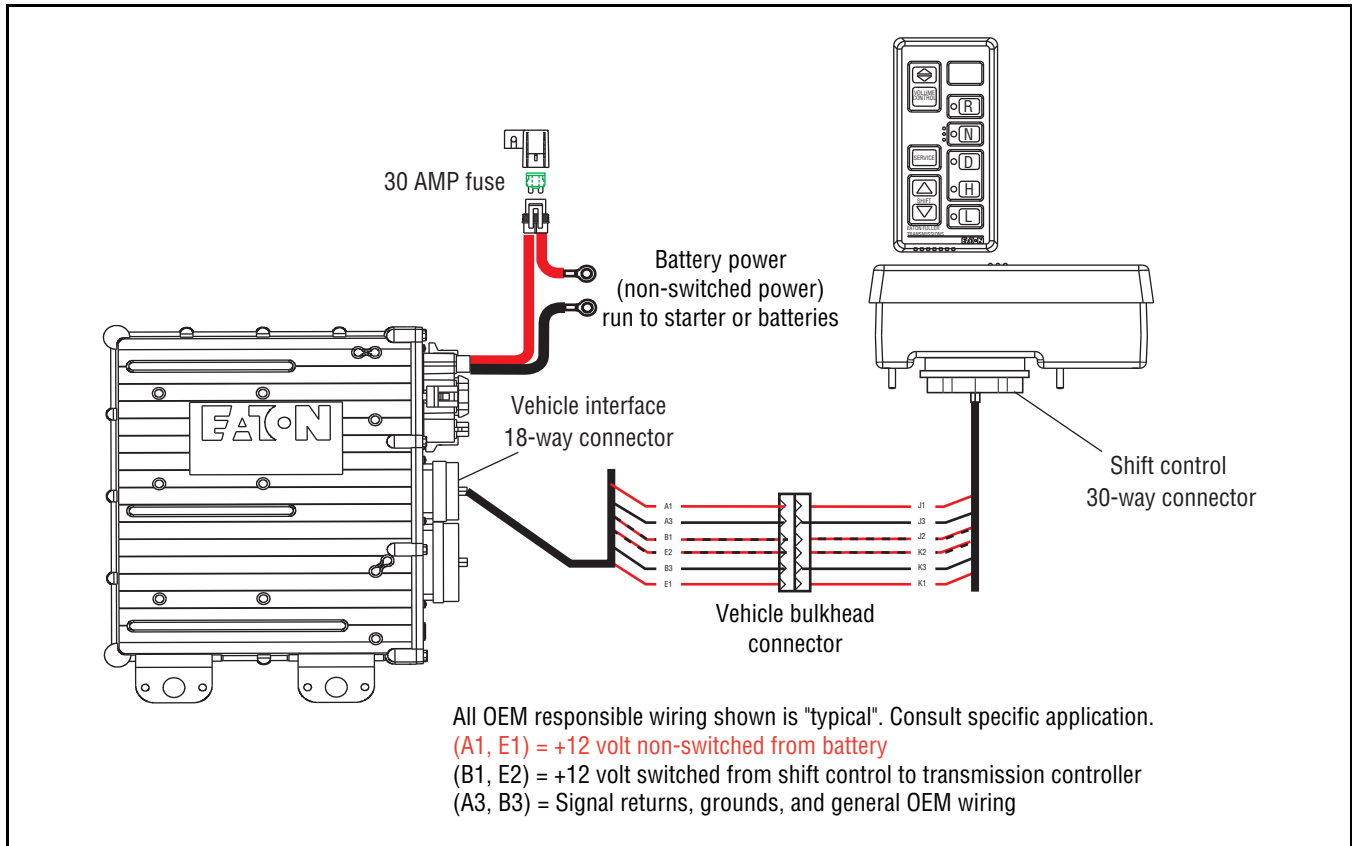
This fault code can be caused by any of the following:

- Battery Bus Fuse / Circuit Breaker is Open
- Low batteries
- Corroded or loose contacts
- Transmission Controller
- Shift Controller

### Additional Tools

- Basic hand tools
- Eaton Test Adapter Kit
- Digital volt/ohm meter
- Troubleshooting Guide

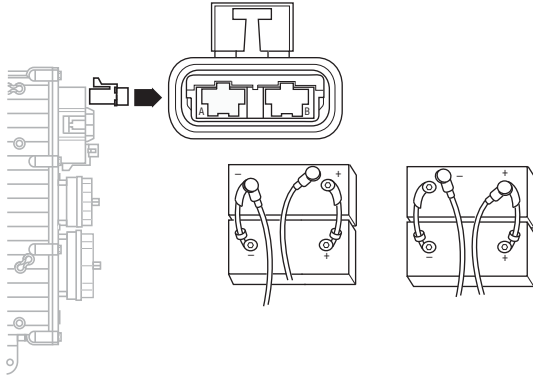
### Component Identification



## Fault Code 65: Logic Power Test

**A** **Purpose:** Visually inspect the integrity of the fuse holder and connections.

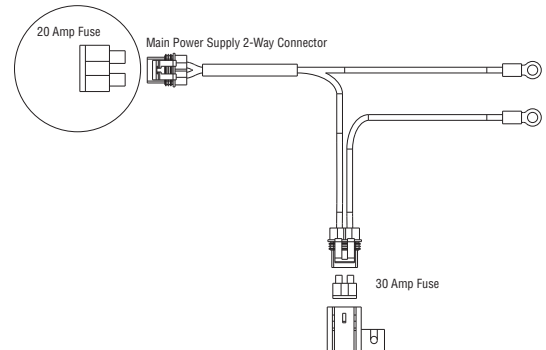
1. Key off.
2. Inspect main power 2-way connector terminals, in-line fuse holder and power supply connections for integrity and corrosion.



- 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**.

**B** **Purpose:** Confirm Vehicle Harness will carry a proper load.

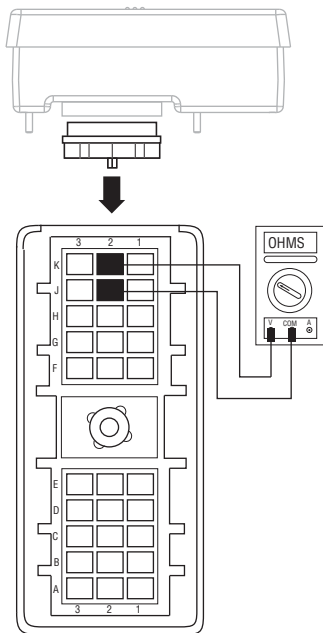
1. Key off.
2. Insert 20-amp fuse into main power 2-way connector.



- If fuse blows immediately, go to **Step C**.
- If fuse does not blow immediately, repair wiring from the battery to the Transmission Controller. Go to **Step V**.

### C Purpose: Verify continuity of the Vehicle Harness.

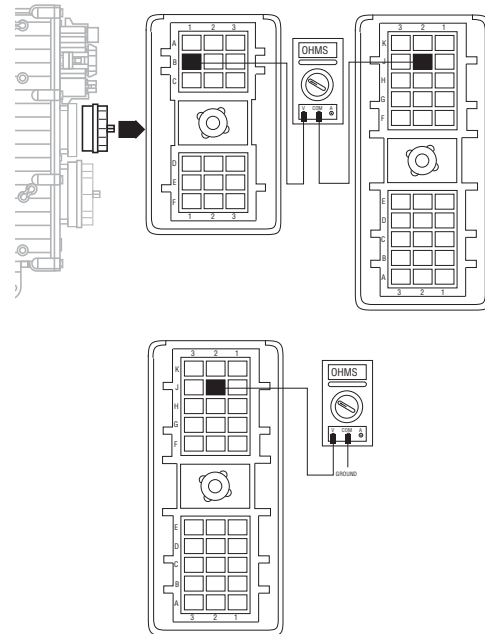
1. Key off.
2. Disconnect negative (-) battery cable.
3. Disconnect the main power 2-way connector on the Transmission Controller.
4. Disconnect Shift Controller 30-way connector.
5. Measure resistance between Shift Controller 30-way Pin J2 and Pin K2.



- If Pin J2 and Pin K2 resistance is 0–0.3 ohms, go to **Step F**.
- If any of the above conditions are not met, go to **Step D**.

### D Purpose: Verify continuity of the Vehicle Harness and test for a short to ground

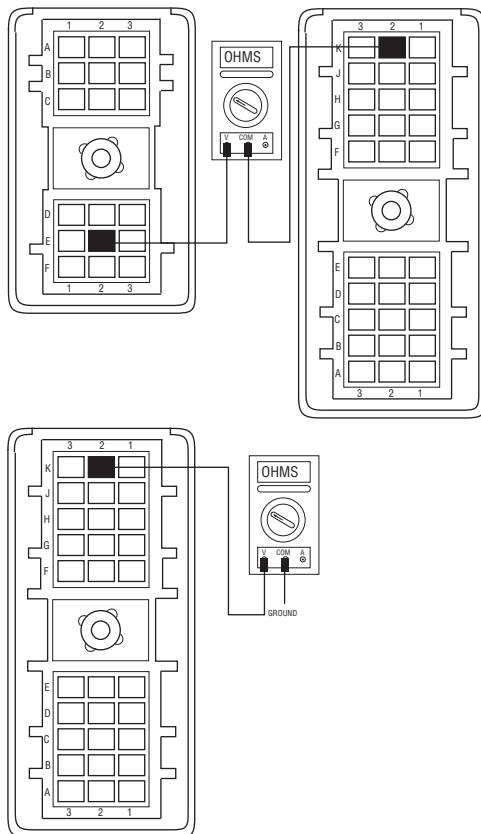
1. Key off.
2. Disconnect vehicle interface 18-way connector.
3. Measure resistance from:
  - Vehicle interface 18-way connector Pin B1 and Shift Controller 30-way connector Pin J2
  - Shift Controller 30-way connector J2 and ground



- If resistance between Pin B1 and Pin J2 is 0–0.3 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 the Shift Controller. Go to **Step V**.

**E Purpose:** Verify continuity of the Vehicle Harness and test for a short to ground.

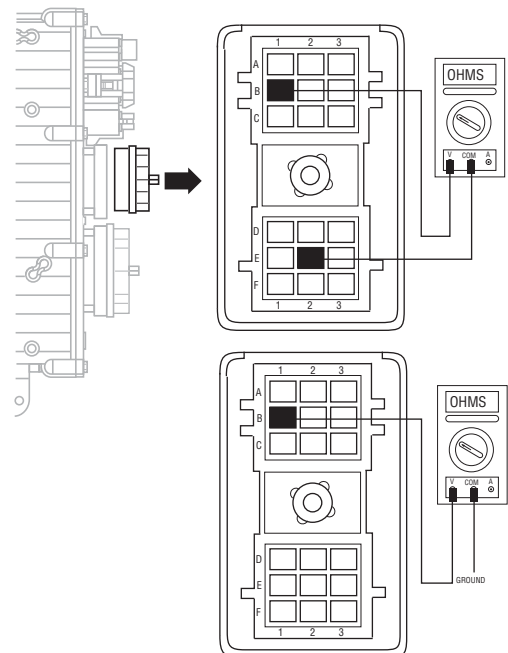
1. Key off.
2. Measure resistance from:
  - Vehicle Harness 18-way connector Pin E2 and Shift Controller 30-way connector Pin K2
  - Shift Controller 30-way connector Pin K2 and ground



- If resistance between Pin E2 and Pin K2 is 0–0.3 ohms and if Pin K2 and ground resistance is 10K ohms or open circuit [OL], replace the **Transmission Controller**. Go to **Step V**.
- If any of the above conditions are not met, repair OEM wiring from the Transmission Controller to Shift Controller. Go to **Step V**.

**F Purpose:** Verify continuity of the Vehicle Harness and test for a short to ground

1. Key off.
2. Reconnect Shift Controller 30-way connector.
3. Disconnect Vehicle Harness 18-way connector.
4. Measure resistance between vehicle interface 18-way connector pins:
  - B1 and E2
  - B1 and ground



- If resistance between Pin B1 and Pin E2 is 0–0.3 ohms and if Pin B1 and ground resistance is 10K ohms or open circuit [OL], replace the **Transmission Controller** (only if fault code is Active). Go to **Step V**.
- If any of the above conditions are not met, replace the **Shift Control**. Go to **Step V**.

**V** **Purpose:** Verify repair.

1. Key off.
  2. Reconnect all connectors.
  3. Key on.
  4. Clear codes, see “Clearing Fault Codes” on page 6.
  5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
  6. Check for codes, see “Retrieving Fault Codes” on page 5.
    - If no codes, test complete.
    - If Fault Code 65 appears, go to **Step A.** to find error in testing.
    - If code other than 65 appears, see “Fault Code Isolation Procedure Index” on page 12..
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## Fault Code 71: Stuck Engaged

**J1587:MID 130    SID 60    FMI 7**

### Overview

Fault Code 71 indicates the transmission was unable to move the front box to neutral during a shift request.

### Detection

The transmission detects this fault by attempting the same shifter actions 5 times and not sensing the desired position.

### Conditions to Set Fault Code Active

### Fallback

This fault causes an in-place fallback.

### Possible Causes

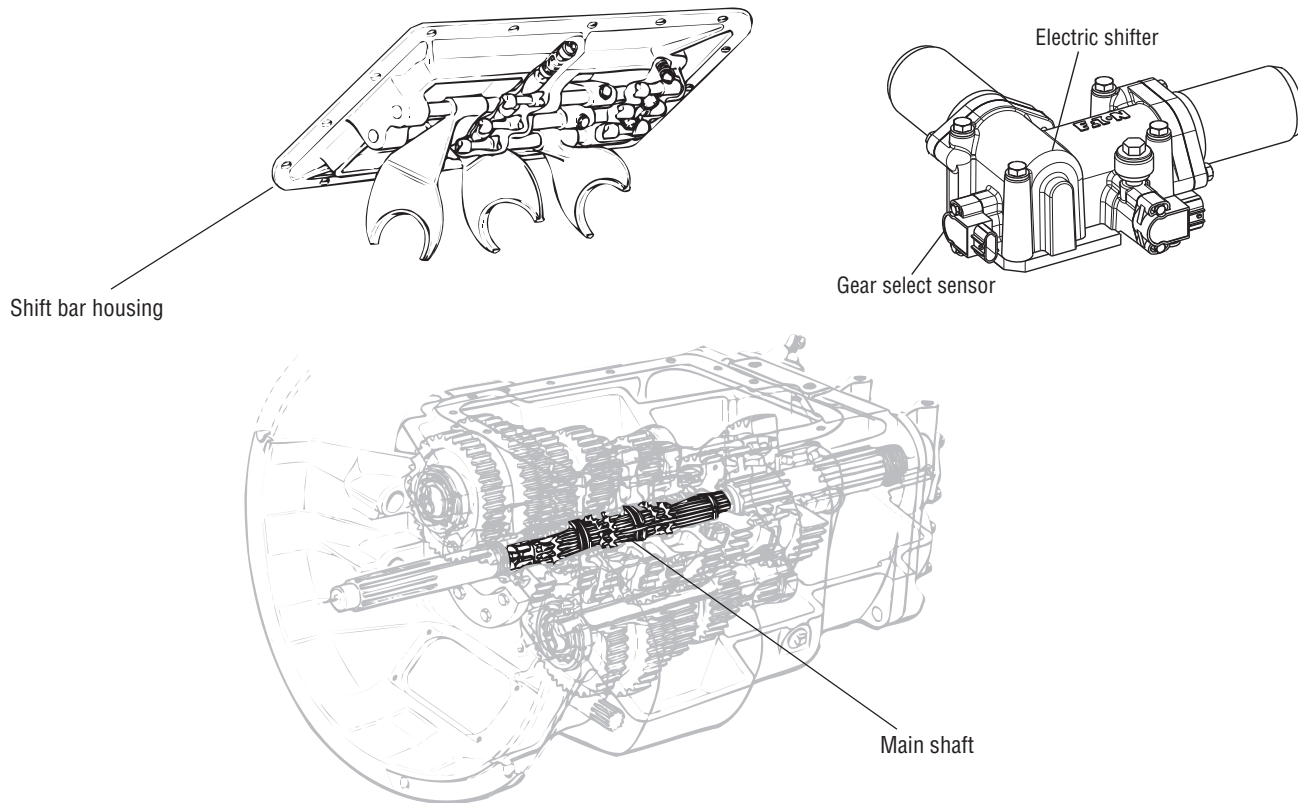
This fault code can be caused by any of the following:

- 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

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

## Component Identification

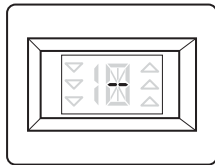




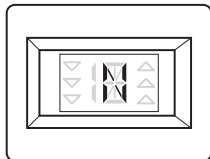
## Fault Code 71: Stuck Engaged Test

**A** *Purpose: Check for Active or Inactive fault codes.*

1. Place Shift Lever in neutral.
2. Press clutch pedal.
3. Key on.
4. Observe Service light.
  - If you have an Active Fault Code 71 or Gear Display shows a dash, go to **Step B.**

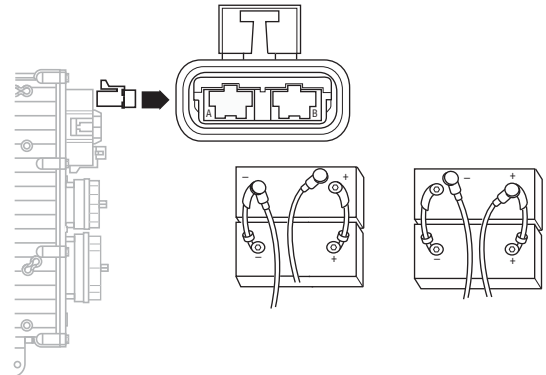


- If no lights or tones turn on, perform the “Electrical System Pretest” on page 15
- If “N” is highlighted on Shift Lever and Gear Display shows N, go to **Step V.**



**B** *Purpose: Inspecting the integrity of the fuse holder and connections.*

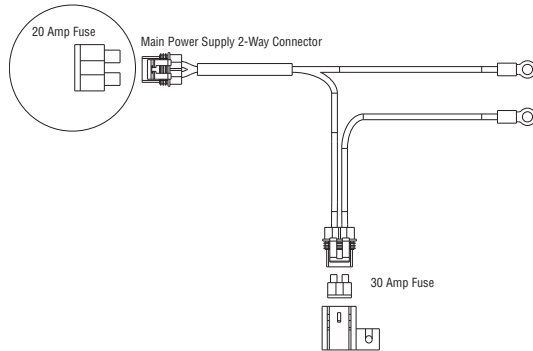
1. Key off.
2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.



- 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.**

**C** **Purpose:** Confirm the Vehicle Harness will carry a proper load.

1. Key off.
2. Insert 20-amp fuse into main power 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 Controller. Go to **Step V**.

**D** **Purpose:** Visually inspect the Shift Bar Housing, Electric Shifter and base transmission for signs of mechanical damage

1. Key off.
2. Remove Electric Shifter from Shift Bar Housing.
3. Inspect the Shift Bar Housing Shift Blocks and Shift Rails. Inspect the Electric Shifter for evidence of contamination in the lubricant.
  - If no problem found, replace the **Electric Shifter** (only if fault code is Active). Go to **Step V**.
  - If problem found, repair as required. Go to **Step V**.

**V** **Purpose:** Verify repair.

1. Key off.
2. Reconnect all connectors.
3. Key on.
4. Clear codes, see “Clearing Fault Codes” on page 6.
5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
6. Check for codes, see “Retrieving Fault Codes” on page 5.
  - If no codes, Test complete.
  - If Fault Code 71 appears, go to **Step A** to find error in testing.
  - If code other than 71 appears, see “Fault Code Isolation Procedure Index” on page 12.

## Fault Code 72: Failed to Select Rail

**J1587:MID 130    SID 59    FMI 7**

### Overview

Fault Code 72 indicates the transmission is unable to select the required rail during a shift.

### Detection

The transmission detects this by attempting the same shifter actions 5 times and not sensing the desired position.

### Conditions to Set Fault Code Active

### Fallback

This fault causes an in-place fallback.

### Possible Causes

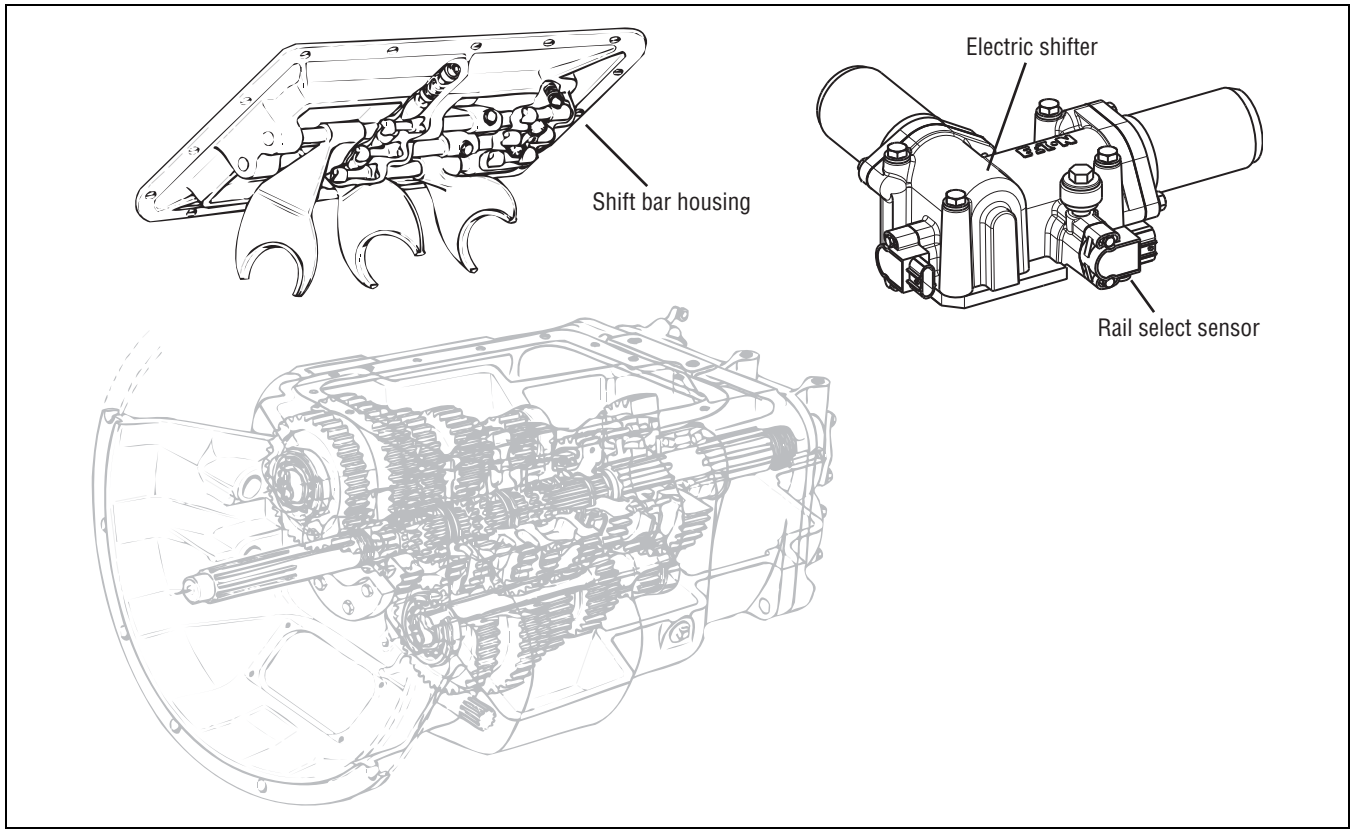
This fault code can be caused by any of the following:

- Low power to Rail Motor
- Rail Select Motor
- Rail Select Sensor
- Shift Block
- Transmission Controller
- Rail slips into gear during vehicle transportation

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

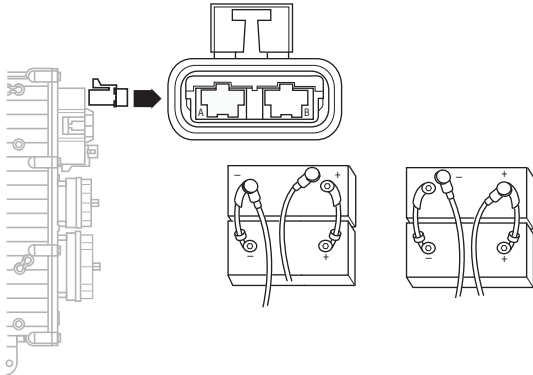
### Component Identification



## Fault Code 72: Failed to Select Rail Test

**A** **Purpose:** *Inspect the integrity of the Fuse Holder and connections.*

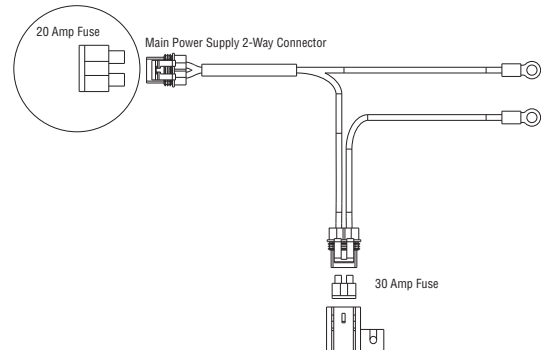
1. Key off.
2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.



- 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**.

**B** **Purpose:** *Confirm the Vehicle Harness will carry a proper load.*

1. Key off.
2. Insert 20-amp fuse into main power 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 Controller. Go to **Step V**.

**C**

**Purpose:** Visually inspect the Shift Bar Housing Electric Shifter and base transmission for signs of mechanical damage.

1. Key off.
2. Remove Electric Shifter from Shift Bar Housing.
3. Inspect the Shift Bar Housing Shift Blocks and Shift Rails. Inspect the Electric Shifter for evidence of lube contamination
  - If no problem found, replace the **Electric Shifter** (only if fault code is Active). Go to **Step V.**
  - If problem found, repair as required. Go to **Step V.**

**V**

**Purpose:** Verify repair.

1. Key off.
2. Reconnect all connectors.
3. Key on.
4. Clear codes, see “Clearing Fault Codes” on page 6.
5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
6. Check for codes, see “Retrieving Fault Codes” on page 5.
  - If no codes, test complete.
  - If Fault Code 72 appears, go to **Step A.** to find error in testing.
  - If code other than 72 appears, see “Fault Code Isolation Procedure Index” on page 12.

## Fault Code 73: Failed to Engage Gear

**J1587:MID 130    SID 58    FMI 7**

### Overview

Fault Code 73 indicates the transmission is unable to engage the desired gear in the front box during a shift.

### Detection

The transmission detects this fault by attempting the same shifter action 5 times and not sensing the desired position.

### Conditions to Set Fault Code Active

### Fallback

This fault causes an in-place fallback.

### Possible Causes

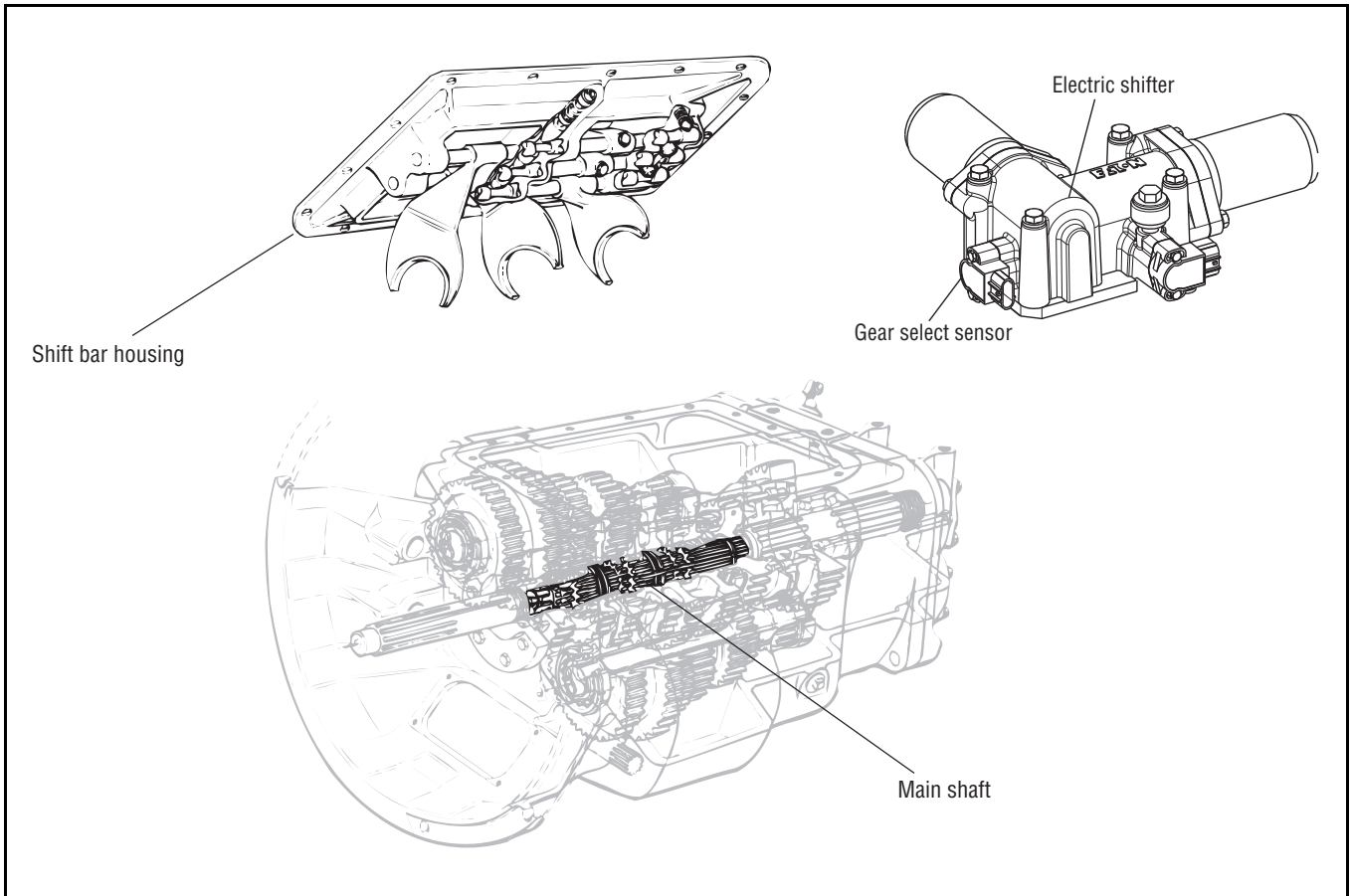
This fault code can be caused by any of the following:

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

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

### Component Identification

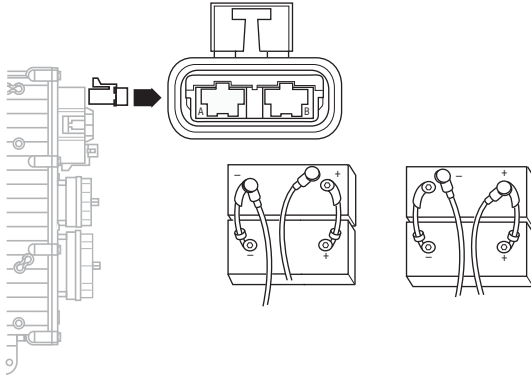




## Fault Code 73: Failed to Engage Gear Test

**A** **Purpose:** Inspect the integrity of the Fuse Holder and connections.

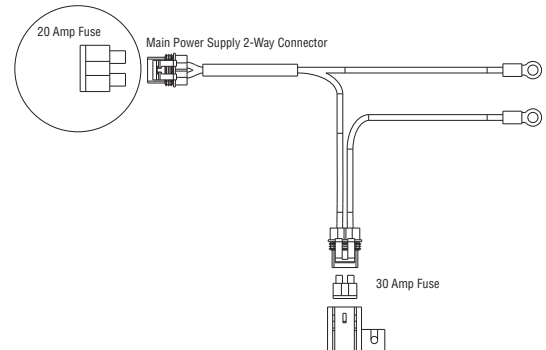
1. Key off.
2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.



- 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**.

**B** **Purpose:** Confirm the Vehicle Harness will carry a proper load.

1. Key off.
2. Insert 20-amp fuse into main power 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 Controller. go to **Step V**.

**C**

**Purpose:** Visually inspect the Shift Bar Housing Electric Shifter and base transmission for signs of mechanical damage.

1. Key off.
2. Remove Electric Shifter from Shift Bar Housing.
3. Inspect the Shift Bar Housing Shift Blocks and Shift Rails. Inspect the Electric Shifter for evidence of contamination in the lubricant.
  - If no problem found, replace the **Electric Shifter** (only if fault code is Active). Go to **Step V.**
  - If problem found, repair as required. Go to **Step V.**

**V**

**Purpose:** Verify repair.

1. Key off.
2. Reconnect all connectors.
3. Key on.
4. Clear codes, see “Clearing Fault Codes” on page 6.
5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
6. Check for codes, see “Retrieving Fault Codes” on page 5.
  - If no codes, Test complete.
  - If Fault Code 73 appears, go to **Step A.** to find error in testing.
  - If code other than 73 appears, see “Fault Code Isolation Procedure Index” on page 12.

---

## Fault Code 74: Failed to Synchronize

**J1587: MID 130    SID 54            FMI 7, 10, 12**

### Overview

Fault Code 74 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, sets the code. Failure of the Inertia Brake system to slow the Input Shaft also sets the code.

### Conditions to Set Fault Code Active

### 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. If the Inertia Brake system 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).

### Possible Causes

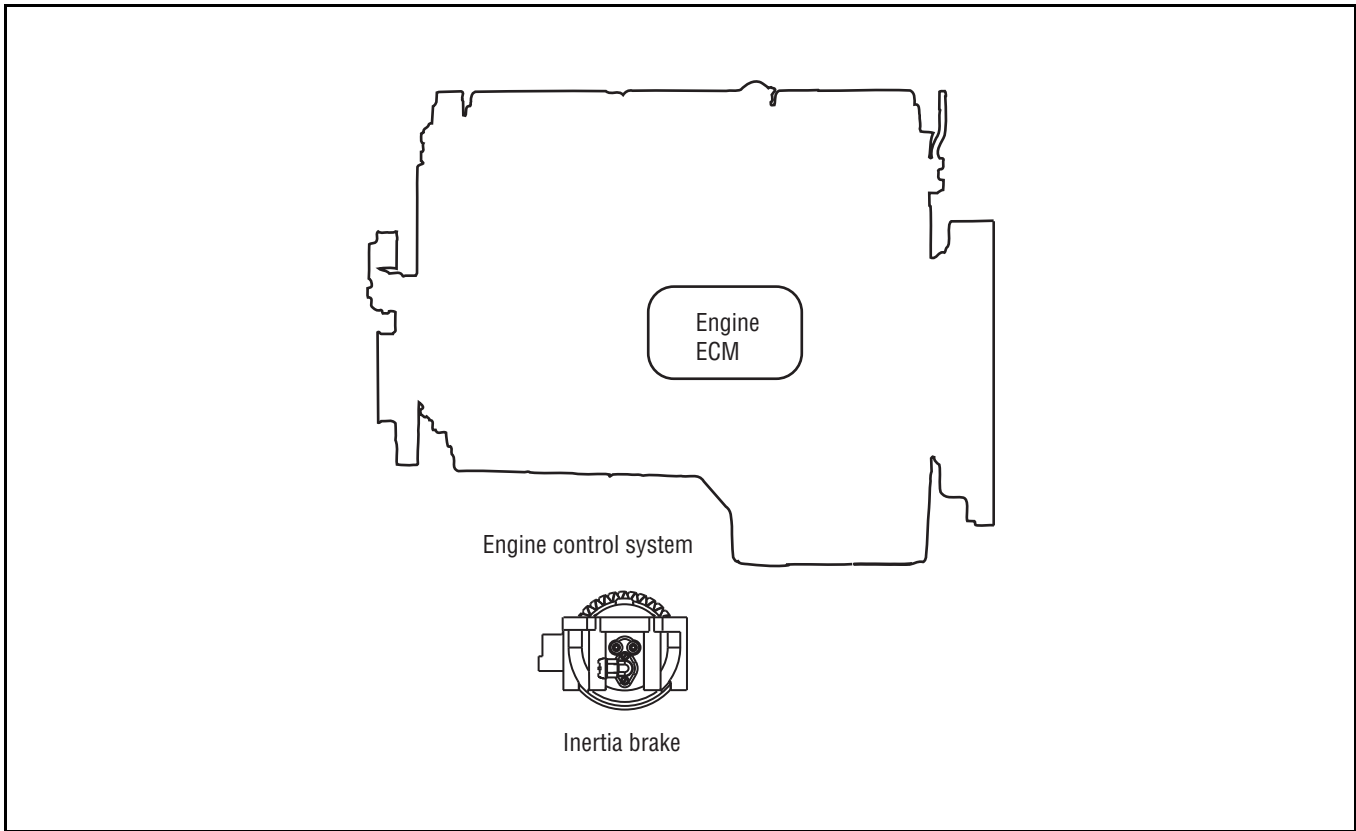
This fault code can be caused by any of the following:

- Clutch out of adjustment
- Damaged Input Shaft Brake
- Inertia Brake
- Engine Control System

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- PC-based Service Tool

### Component Identification



## Fault Code 74: Failed to Synchronize Test

**A** *Purpose: Determine if truck has Inertia Brake installed.*

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.**

**B** *Purpose: Verify proper operation of the Inertia Brake.*

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 the:
    - **Inertia Brake (6-Speed)**
    - **Inertia Brake (7, 10 and 18-Speed)**Go to **Step V.**
  - Test aborts, correct displayed test failure condition and retest.

**C** *Purpose: Check for Active or Inactive fault codes.*

1. Key on.
2. Retrieve codes, see “Retrieving Fault Codes” on page 5.
  - If Fault Code 74 is Active, contact the OEM. Engine is failing to respond to the transmissions command during a shift.
  - If Fault Code 74 is not Active, test complete.

**V** *Purpose: Verify repair.*

1. Key on.
2. Clear codes, see “Clearing Fault Codes” on page 6.
3. Drive the vehicle and attempt to reset the code.
4. Check for codes, see “Retrieving Fault Codes” on page 5.
  - If no codes, test complete.
  - If Fault Code 74 appears, go to **Step A.** to find error in testing.
  - If code other than 74 appears, see “Fault Code Isolation Procedure Index” on page 12.



---

## Fault Code 81: Gear Engagement Detected

**J1587:MID 130    SID 47    FMI 7**

### Overview

The Transmission Controller 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. This fault can only be set during a shift, and becomes inactive after power down.

### Detection

The fault is detected after the Transmission Controller powers up and a non-neutral condition is detected during a shift.

FMI 7 - The Transmission Controller detected an inaccurate finger position.

### Conditions to Set Fault Code Active

### Fallback

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

### Possible Causes

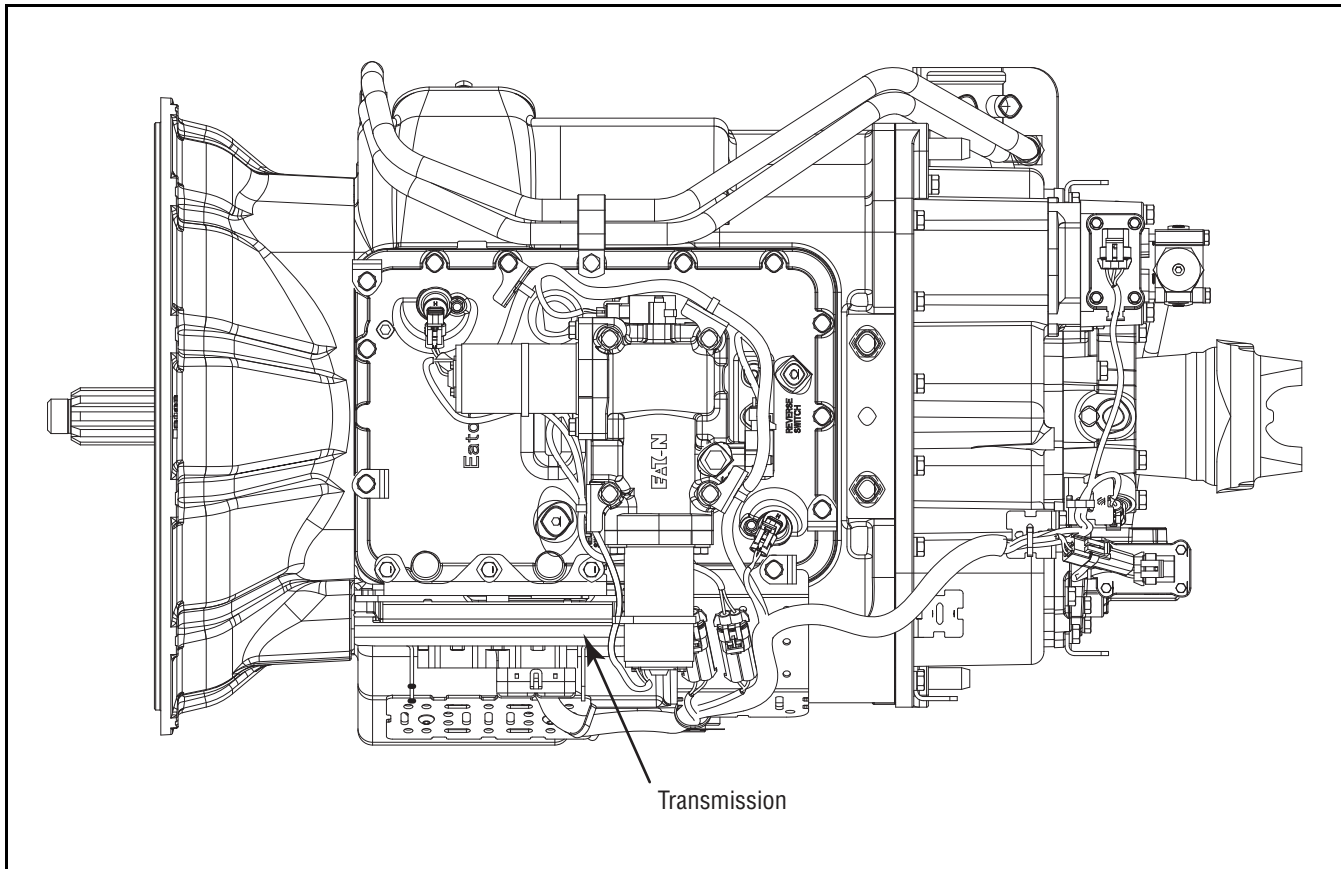
This fault code can be caused by any of the following:

- Worn internal transmission components

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- PC-based Service Tool

## Component Identification





---

## Fault Code 81: Gear Engagement Detected Test

**A**

**Purpose:** Check for Active or Inactive fault codes.

1. Key on.
  2. Retrieve codes, see “Retrieving Fault Codes” on page 5.
    - If Fault Code 81 is Active or Inactive:
      - Customer - Call Eaton at 1-800-826-HELP (4357)
      - CSC - Call Technician Service.
-



## Fault Code 83: Missing Lever

**J1587:MID 130    SID 18    FMI 14**

### Overview

Fault Code 83 indicates the Shift Lever is not sensing any lever positions.

### Detection

Starting at key on and throughout operation, the Shift Controller constantly measures the feedback from the Shift Lever circuit. If the Shift Lever reports no lever positions are sensed, the fault code is set.

### Conditions to Set Fault Code Active

### Fallback

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

### Possible Causes

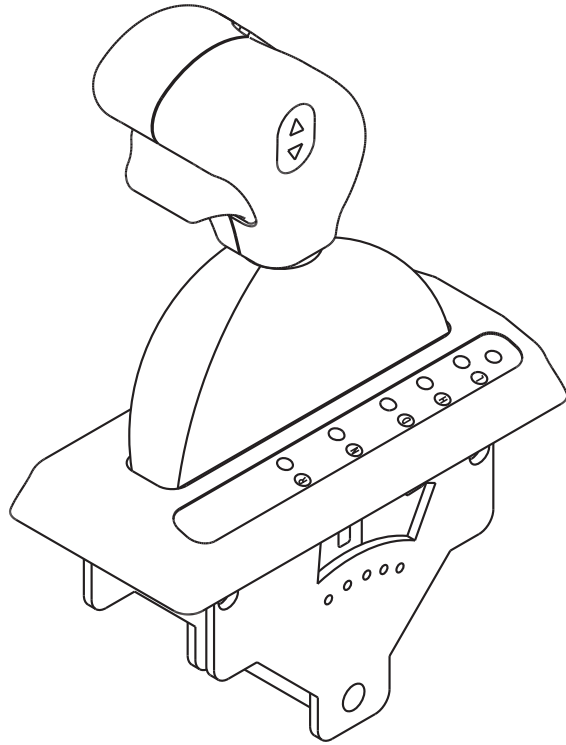
This fault code can be caused by any of the following:

- Shift Lever

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit

## Component Identification



Shift Lever

---

## Fault Code 83: Missing Lever Test

**A**

*Purpose: Check for Active or Inactive fault codes.*

1. Key on.
  2. Retrieve Codes, see “Retrieving Fault Codes” on page 5.
    - If Fault Code 83 is Active, replace the Shift Lever.
    - If Fault Code 83 is Inactive, test complete.
-



## Fault Code 91: Power Connection

**J1587:MID 130    SID 236    FMI 5**

### Overview

Fault Code 91 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.

### Conditions to Set Fault Code Active

### Fallback

None

### Possible Causes

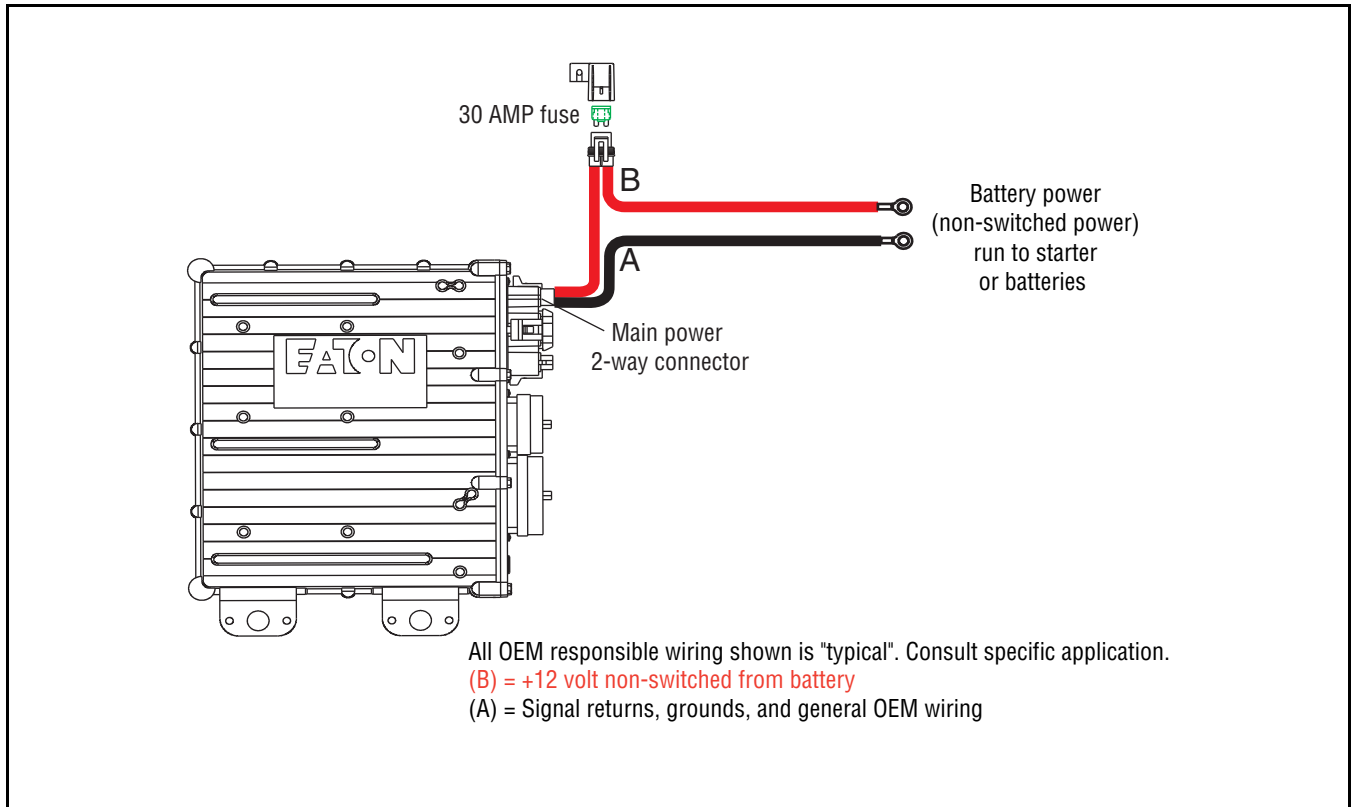
This fault code can be caused by any of the following:

- Vehicle Harness between battery or starter and Transmission Controller.

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit

### Component Identification

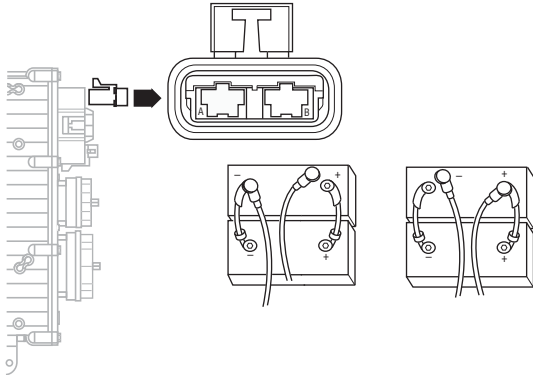




## Fault Code 91: Power Connection Test

**A** **Purpose:** Inspect the integrity of the Fuse Holder and connections.

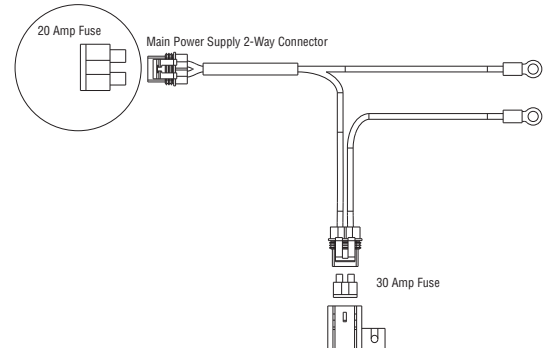
1. Key off.
2. Inspect main power 2-way connector terminals, in-line Fuse Holder, and power supply connections for integrity and corrosion.



- If no problem found, go to **Step B**.
- If problem found, repair power/ground path for the main power supply. Go to **Step V**.

**B** **Purpose:** Confirm the Vehicle Harness will carry a proper load.

1. Key off.
2. Insert 20-amp fuse into main power 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 Controller. Go to **Step V**.

**V****Purpose:** Verify repair.

1. Key off.
  2. Clean and reconnect all connectors.
  3. Key on.
  4. Clear codes, see “Clearing Fault Codes” on page 6.
  5. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
  6. Check for codes, see “Retrieving Fault Codes” on page 5.
    - If no codes, test complete.
    - If Fault Code 91 appears, go to **Step A.** to find error in testing.
    - If code other than 91 appears, see “Fault Code Isolation Procedure Index” on page 12.
-

## Fault Code 92: Weak System Battery Voltage

**J1587:MID 130    SID 168    FMI 14**

### Overview

Fault Code 92 indicates 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.

### Conditions to Set Fault Code Active

### Fallback

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

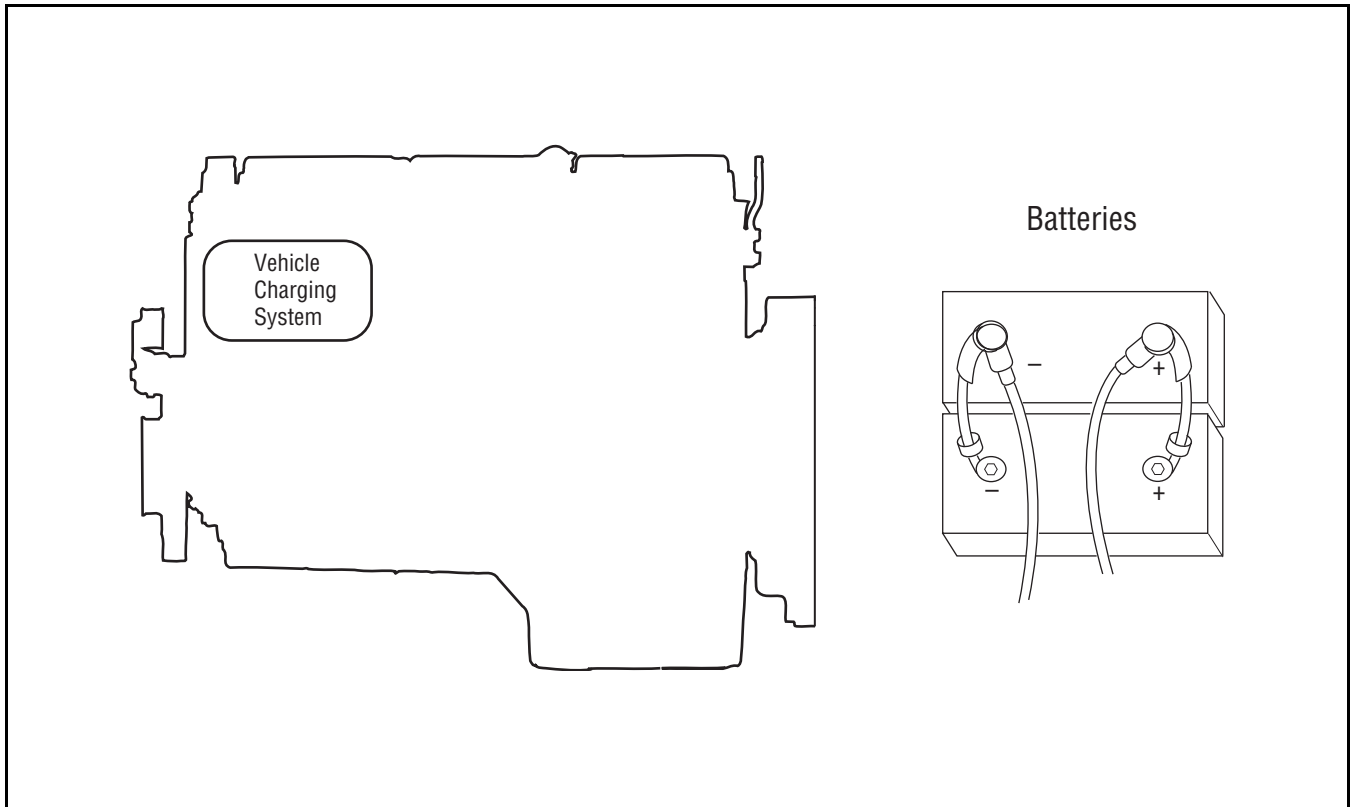
### Possible Causes

This fault code can be caused by the vehicle charging system or battery integrity.

### Additional Tools

- Basic hand tools

### Component Identification



## Fault Code 92: Weak System Battery Voltage Test

**A****Purpose:** Check for Active or Inactive fault codes.

1. Key off.
2. Determine 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 charging system and or battery integrity. go to **Step V.**

**V****Purpose:** Verify repair.

1. Key on.
2. Clear codes, see “Clearing Fault Codes” on page 6.
3. Use Driving Techniques to attempt to reset the code, see “Driving Techniques” on page 7.
4. Check for codes, see “Retrieving Fault Codes” on page 5.
  - If no codes, Test complete.
  - If Fault Code 92 appears, go to **Step A.** to find error in testing.
  - If code other than 92 appears, see “Fault Code Isolation Procedure Index” on page 12.



---

## Fault Code 93: Loss of J1939 Communication from the Engine

**J1587:MID 130    SID 231    FMI 14**

### Overview

Fault Code 93 indicates the Transmission Controller is not receiving J1939 messages from the engine.

### Detection

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

### Conditions to Set Fault Code Active

### 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.

### Possible Causes

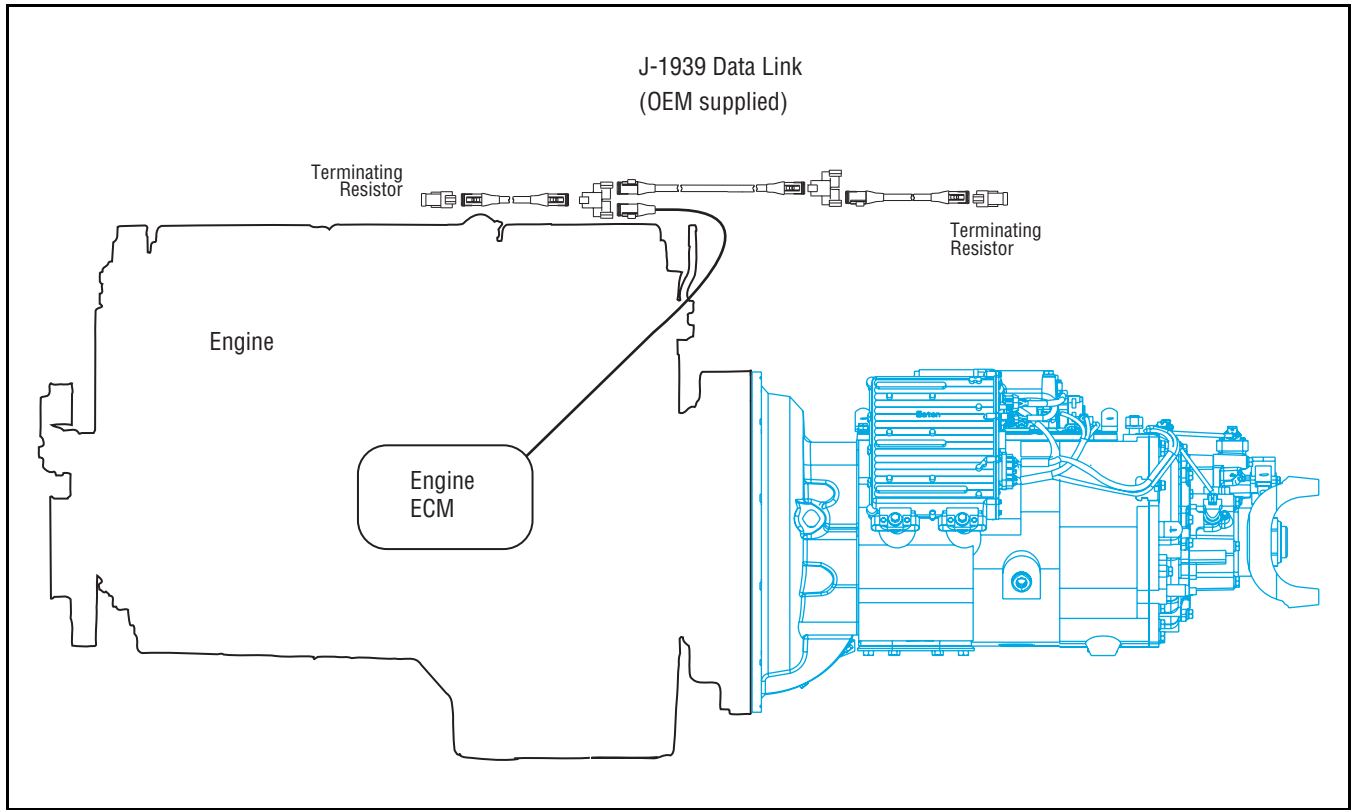
This fault code can be caused by any of the following:

- OEM supplied J1939 harness
- Engine ECM

### Additional Tools

- Basic hand tools

### Component Identification





## Fault Code 93: Loss of J1939 Communication from the Engine Test

**A****Purpose:** Check for Active or Inactive fault codes.

1. Key on.
  2. Determine if Fault Code 93 is present (either 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**.
- 

**V****Purpose:** Verify repair.

1. Key off.
  2. Reconnect all connectors.
  3. Key on.
  4. Clear codes, see "Clearing Fault Codes" on page 6.
  5. Use Driving Techniques to attempt to reset the code, see "Driving Techniques" on page 7.
  6. Check for codes, see "Retrieving Fault Codes" on page 5.
    - If no codes, test complete.
    - If Fault Code 93 appears, go to **Step A** to find error in testing.
    - If code other than 93 appears, see "Fault Code Isolation Procedure Index" on page 12.
-



## 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 test 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.

### Conditions to Set Fault Code Active

### Fallback

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

### Possible Causes

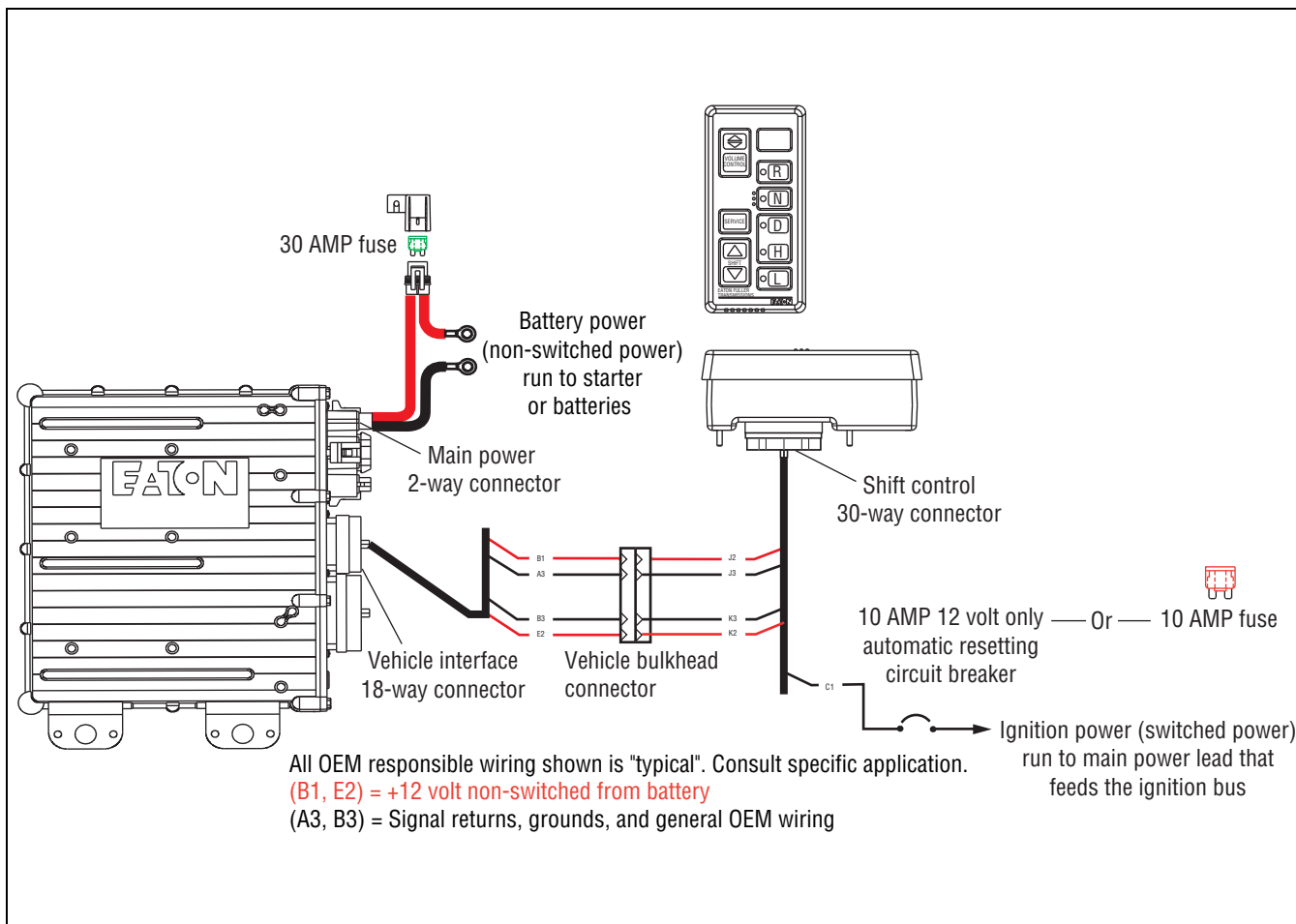
This pretest can be used for any of the following:

- Corroded power contacts
- Blown fuse
- Wiring Harness
- Low batteries
- Transmission Controller

### Additional Tools

- Basic hand tools
- Eaton Test Adapter Kit
- Digital volt/ohm meter

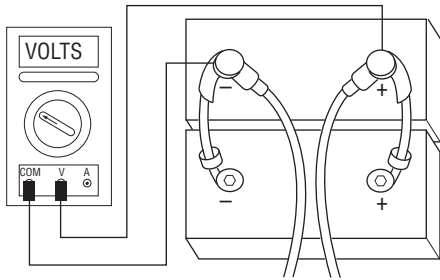
### Component Identification



## Electrical System Test

**A** **Purpose:** *Inspect the integrity of the battery connections and fuse.*

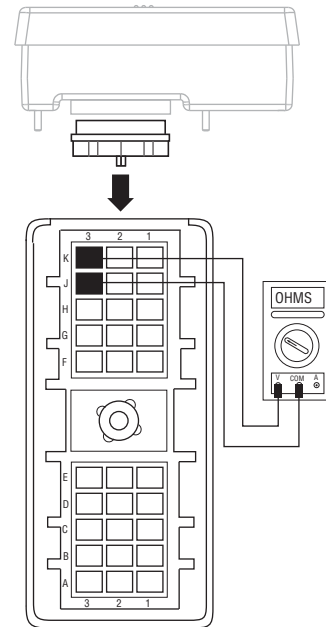
1. Key off.
2. Inspect starter and battery connections for integrity.
3. Measure voltage across batteries and load test the batteries.



- If voltage is 11–13 volts on a 12-volt system or 22–26 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.

**B** **Purpose:** *Verify continuity of the Vehicle Harness.*

1. Key off.
2. Disconnect negative (-) battery cable.
3. Disconnect Shift Controller 30-way connector.
4. Measure resistance between Shift Controller 30-way Pin J3 and Pin K3.

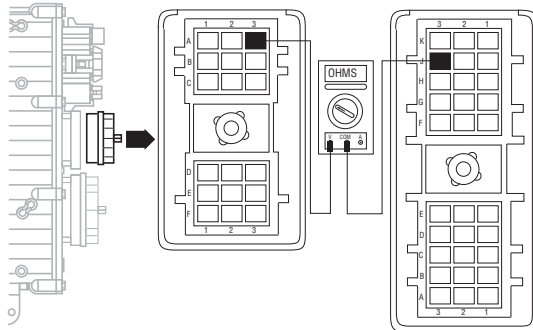


- If resistance is 0–1 ohms, go to **Step E**.
- If resistance is outside of range, go to **Step C**.

**C**

**Purpose:** Verify continuity of the transmission Shift Controller ground wire.

1. Key off.
2. Disconnect Vehicle Harness 18-way connector from the Transmission Controller.
3. Measure resistance from Vehicle Harness 18-way connector Pin A3 and Shift Controller 30-way connector Pin J3.

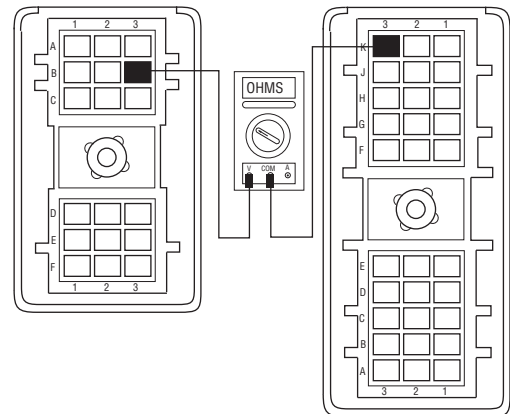


- If resistance is 0–0.3 ohms, go to **Step D**.
- If resistance is outside of range, repair OEM wiring from the Transmission Controller to Shift Controller. Reconnect all connectors. Go to **Step A**.

**D**

**Purpose:** Verify continuity of the transmission Shift Controller ground wire.

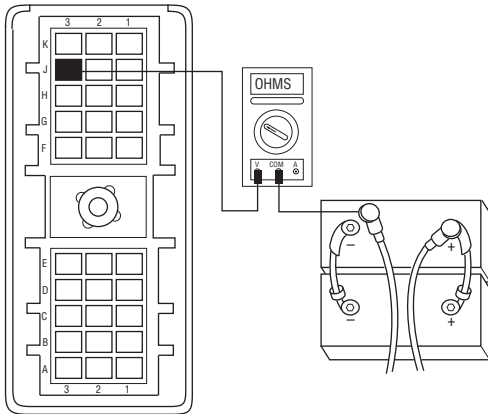
1. Key off.
2. Measure resistance from Vehicle Harness 18-way connector Pin B3 and Shift Controller 30-way connector Pin K3.



- If resistance is 0–0.3 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**.

**E** **Purpose:** Measure resistance of the transmission Shift Controller ground.

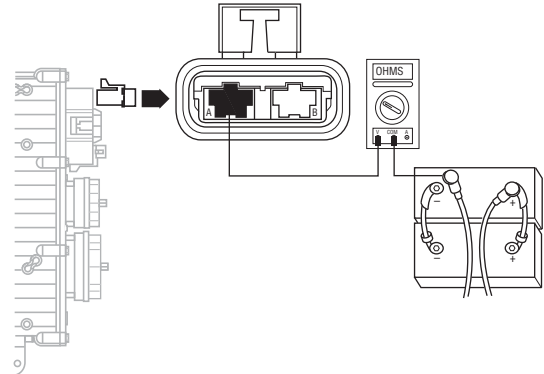
1. Key off.
2. Measure resistance from Shift Control 30-way connector Pin J3 and negative (-) battery cable



- If resistance is 0–0.3 ohms, go to **Step G**.
- If resistance is outside of range, go to **Step F**.

**F** **Purpose:** Measure resistance of the Transmission Controller ground.

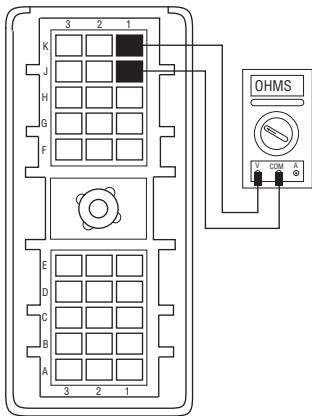
1. Key off.
2. Disconnect the main power 2-way connector on the Transmission Controller.
3. Measure resistance between the main power 2-way connector Pin A and the negative (-) battery cable.



- If resistance is 0–0.3 ohms, replace the **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**.

## G Purpose: Verify continuity of the Vehicle Harness.

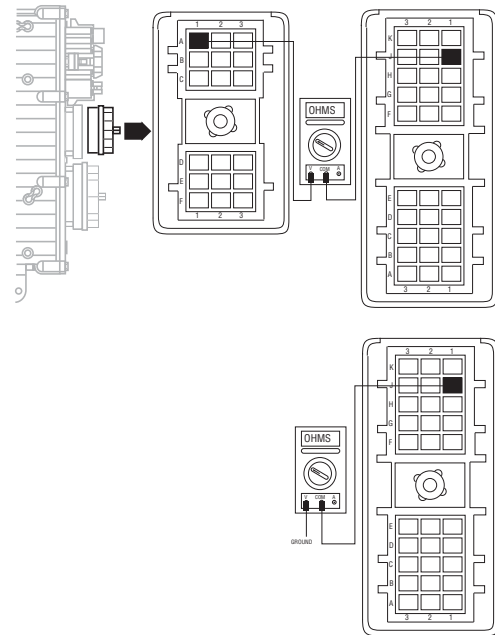
1. Key off.
2. Measure resistance from Shift Controller 30-way connector Pin J1 and Pin K1



- If Pin J1 and Pin K1 resistance is 0–1 ohms, go to **Step J**.
- If the above conditions are not, go to **Step H**.

## H Purpose: Verify continuity of the Shift Controller power wire and test for a short to ground.

1. Key off.
2. Disconnect the Shift Controller 18-way connector.
3. Measure resistance from:
  - Vehicle Harness 18-way connector Pin A1 and Shift Controller 30-way connector Pin J1.
  - Shift Controller 30-way connector J1 and ground.

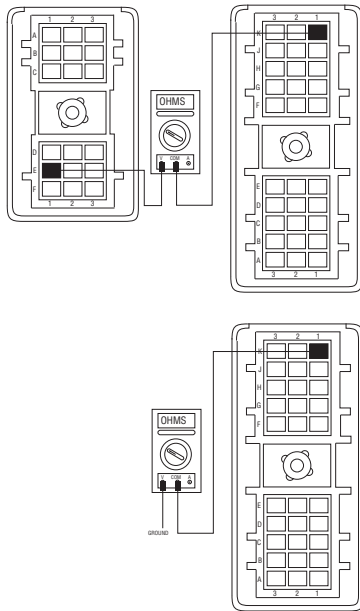


- If Pin A1 and Pin J1 resistance is 0–0.3 ohms and if Pin J1 and ground resistance is more than 10K ohms or open circuit [OL], go to **Step I**.
- If any of the above conditions are not met, Repair OEM wiring from the Transmission Controller to Shift Controller. Reconnect all connectors. Go to **Step A**.



**I** **Purpose:** Verify continuity of the Shift Controller power wire and test for a short to ground.

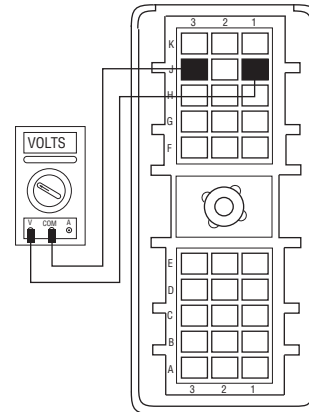
1. Key off.
2. Measure resistance from:
  - Vehicle Harness 18-way connector Pin E1 and Shift Controller 30-way connector Pin K1
  - Shift Controller 30-way connector K1 and ground



- If Pin E1 and Pin K1 resistance is 0–0.3 ohms and if Pin K1 and ground resistance is more than 10K ohms or open circuit [OL], replace the **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**.

**J** **Purpose:** Measure battery voltage to the Shift Controller.

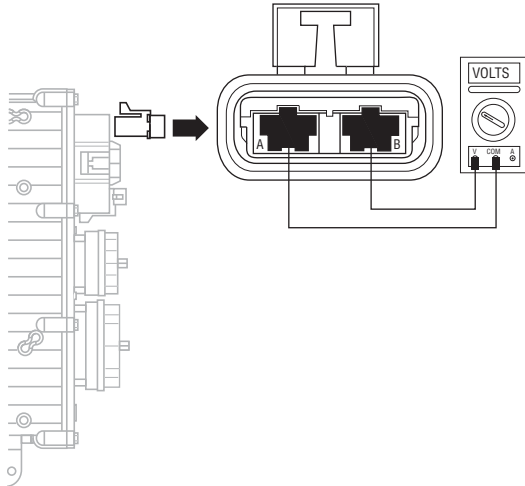
1. Key off.
2. Reconnect negative (-) battery cable.
3. Measure voltage between Shift Controller 30-way connector Pin J1 and Pin J3.



- If voltage between Pin J1 and Pin J3 is within 0.6 volts of battery voltage, go to **Step L**.
- If voltage is outside of range, go to **Step K**.

**K****Purpose:** Measure battery voltage to the Transmission Controller.

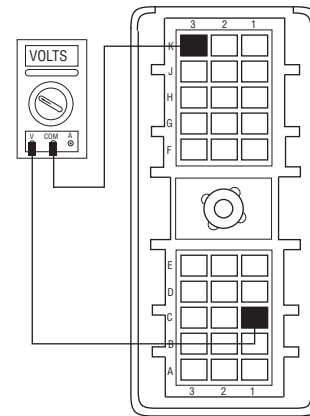
1. Key off.
2. Disconnect the main power 2-way connector on the Transmission Controller.
3. Measure voltage between the main power 2-way connector Pin A and Pin B.



- If voltage is within 0.6 volts of battery voltage, replace the **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**.

**L****Purpose:** Measure battery voltage to the Shift Controller.

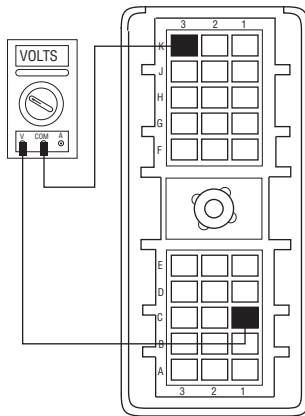
1. Key off.
2. Measure voltage between Shift Controller 30-way connector Pin C1 and Pin K3.



- If voltage is less than 0.6 volts, go to **Step M**.
- If voltage is outside of range and ignition has constant power, repair ignition supply to the transmission. Repeat this step.

**M****Purpose:** Measure battery voltage to the Shift Controller.

1. Key on.
2. Measure voltage between Shift Controller 30-way connector Pin C1 and Pin K3.



- If voltage is within 0.6 volts of battery voltage, test complete.
- If voltage is outside of range and the ignition has no power, repair ignition supply to the transmission. Repeat this step.



## Front Box Control

### Overview

This symptom-driven test is performed if the Service light is on constantly or a dash (-) 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 a dash (-) constantly, the Transmission Controller was not able to confirm front box control.

Any time the Service light is flashing, see the Diagnostic Procedure on page 4

### Conditions to Set Fault Code Active

### Fallback

This fault causes an in-place fallback while moving, and it causes a failure during system initialization. A dash (-) will appear on the Gear Display.

### Possible Causes

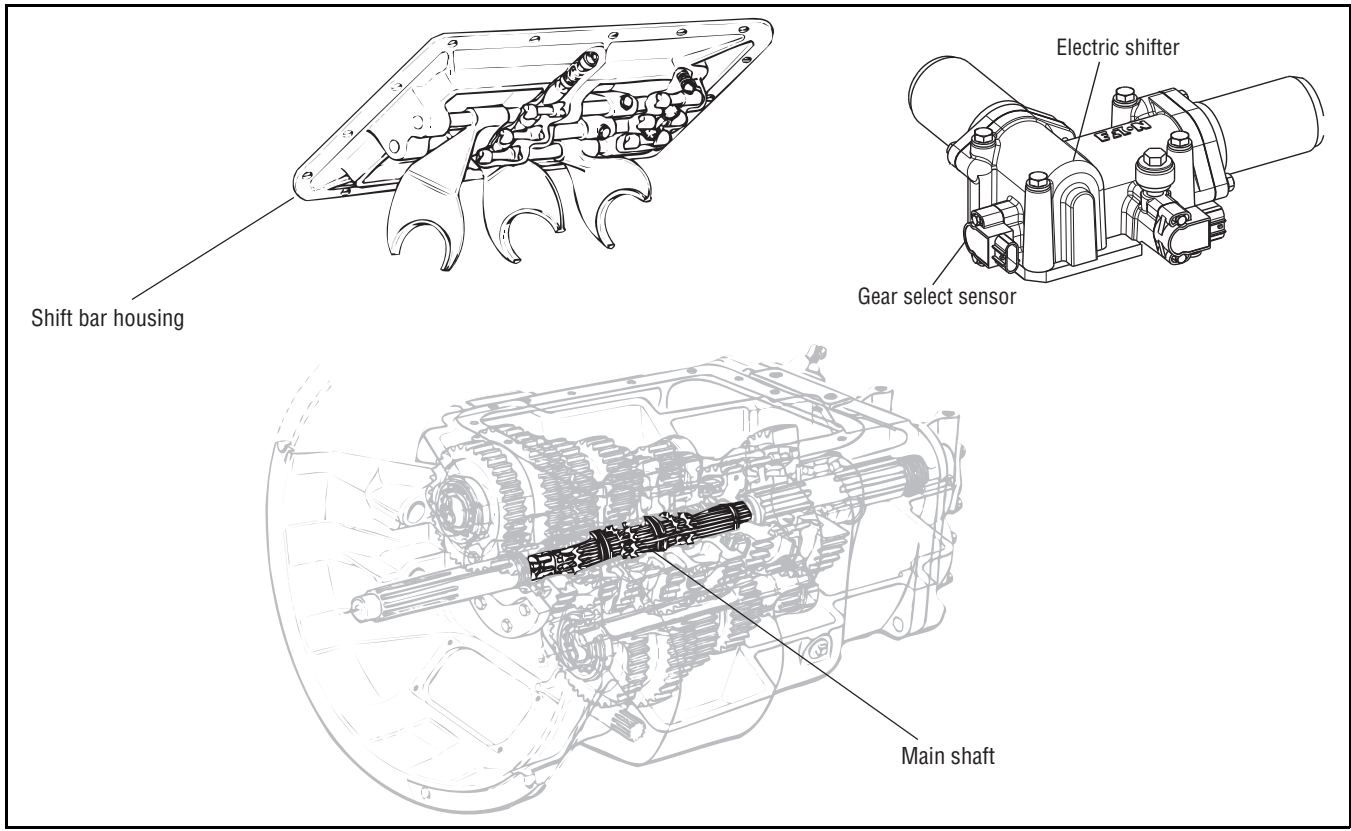
This symptom can be caused by any of the following:

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

### Additional Tools

- Basic hand tools
- Eaton Test Adapter Kit
- Digital volt/ohm meter

### Component Identification



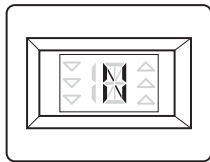
## Front Box Control Test

**A** **Purpose:** Confirm the system is able to obtain neutral.

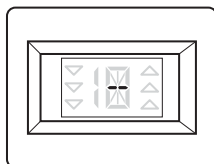
1. Key on.
2. Place Shift Controller in neutral.
3. Press Clutch Pedal. Do not engage the Input Shaft brake (clutch brake).
4. Observe Gear Display.

**Note:** If Service light is flashing, go to Diagnostic Procedure on page 4

- If Gear Display shows “N,” test complete.



- If Gear Display shows dash (-), go to **Step B.**



**B** **Purpose:** Verify continuity of the ground wire for the Transmission Controller.

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 0–0.3 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.**

**C** **Purpose:** Measure battery voltage to the Transmission Controller.

1. Key off.
2. Reconnect negative (-) battery cable.
3. Measure voltage across main power 2-way connector Pin A and Pin B.
  - If voltage is within 0.6 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.**

**D** **Purpose:** Visually inspect the Shift Bar Housing Electric Shifter and base transmission.

1. Key off.
2. Remove Electric Shifter from Shift Bar Housing.
3. Inspect the Shift Bar housing including shift blocks and shift rails
4. Inspect the Electric Shifter for evidence of lube contamination
  - If no problem found, replace the **Electric Shifter**. Go to **Step V**.
  - If problem found, repair as required. Go to **Step V**.

**V** **Purpose:** Verify repair.

1. Key off.
2. Reconnect all connectors.
3. Place Shift Controller into neutral.
4. Key on.
  - If Gear Display displays a solid “N”, test complete.
  - If Gear Display does not display a solid “N” find error in testing. Go to **Step A**.



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

### Conditions to Set Fault Code Active

### Fallback

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

### Possible Causes

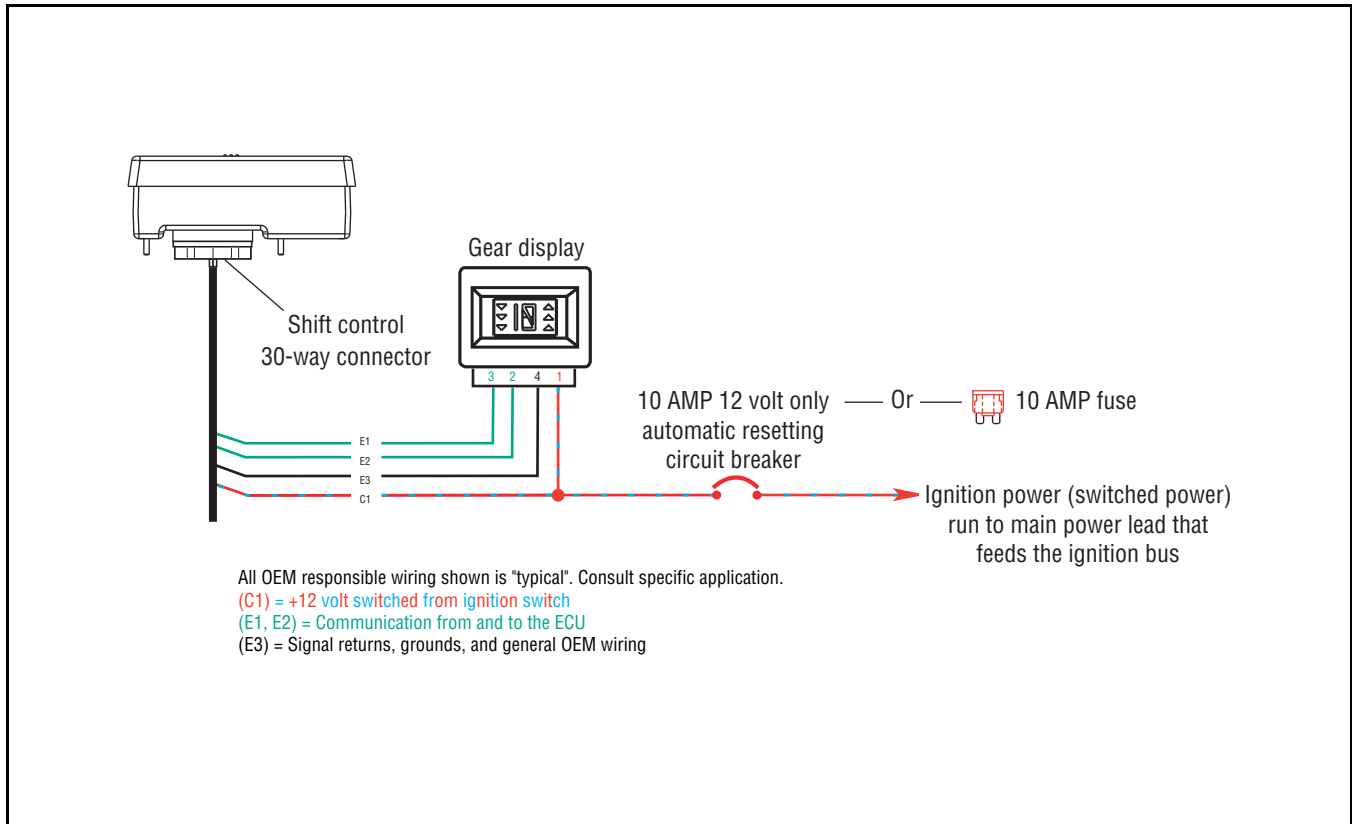
This symptom can be caused by any of the following:

- Gear display
- Vehicle Harness
- Ignition power supply
- Shift Controller

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

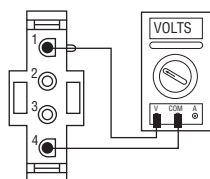
### Component Identification



## Gear Display Power Supply Test

**A** **Purpose:** Measure battery voltage to the Gear Display.

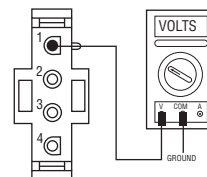
1. Key off.
2. Remove the dash panel and unplug the Gear Display 4-way connector from the Dash Harness.
3. Key on.
4. Measure voltage between Gear Display 4-way connector Pin 1 and Pin 4.



- If voltage is within 0.6 volts of battery voltage, go to **Step D**.
- If voltage is outside of range, go to **Step B**.

**B** **Purpose:** Measure battery voltage to the Gear Display utilizing a chassis ground.

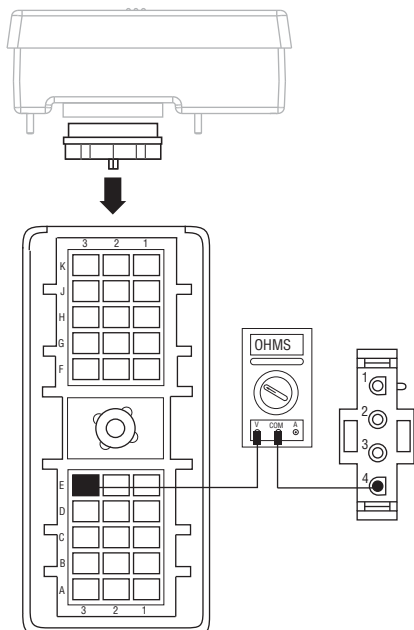
1. Key on.
2. Measure voltage between Gear Display 4-way connector Pin 1 and ground.



- If voltage is within 0.6 volts of battery voltage, go to **Step C**.
- If voltage is outside of range, repair ignition supply to Gear Display. Go to **Step V**.

**C****Purpose:** Verify continuity of the Gear Display ground wire.

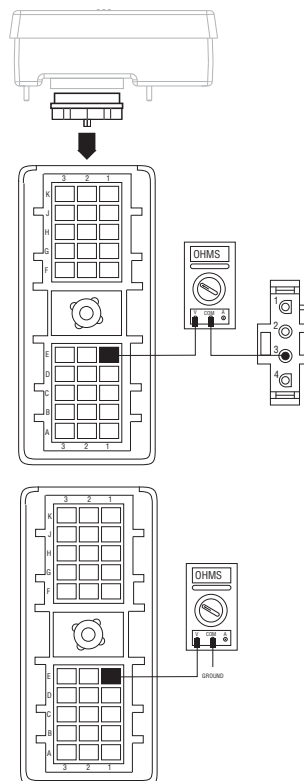
1. Key off.
2. Disconnect Shift Controller 30-way connector.
3. Measure resistance between Shift Controller 30-way connector Pin E3 and Gear Display 4-way connector Pin 4.



- If resistance is within 0–0.3 ohms, go to **Step D.**
- If resistance is outside of range, repair Vehicle Harness between Gear Display and Shift Controller. Go to **Step V.**

**D****Purpose:** Verify continuity of the OEM data link to the OEM gear display and test for a short to ground.

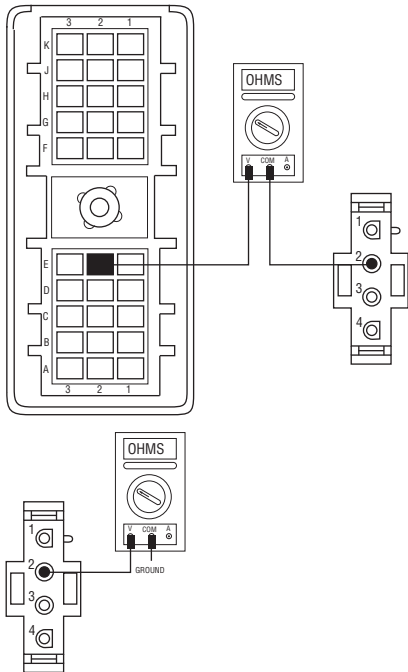
1. Key on.
2. Disconnect Shift Controller 30-way connector.
3. Measure resistance between:
  - Shift Controller 30-way connector Pin E1 and Gear Display 4-way connector Pin 3
  - Shift Controller 30-way connector Pin E1 and ground



- If resistance between Pin E1 and Pin 3 is 0–0.3ohms and if resistance between Pin E1 and ground is 10K ohms or open circuit, go to **Step E.**
- If the above conditions are not met, repair Vehicle Harness between Gear Display and Shift Controller. Go to **Step V.**

**E** **Purpose:** Verify continuity of the data link to the Gear Display and test for a short to ground.

1. Key off.
2. Measure resistance between:
  - Shift Controller 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 Pin E2 and Pin 2 is 0–0.3 ohms and if resistance between Pin 2 and ground is 10K ohms or open circuit, go to **Step V**.
- If the above conditions are not met, repair Vehicle Harness between Gear Display and Shift Controller. Go to **Step V**.

**V** **Purpose:** Verify repair.

1. Key off.
2. Reconnect all connectors.
3. Key on.
4. Drive the vehicle to determine whether the complaint has been repaired.
  - If concern was repaired, test complete.
  - If concern was not repaired, go 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 Controller has no fault detection capability for this failure. The failure is observed by the operator when driving the vehicle. To observe this failure, attempt to start the vehicle.

### Conditions to Set Fault Code Active

### 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.

### Possible Causes

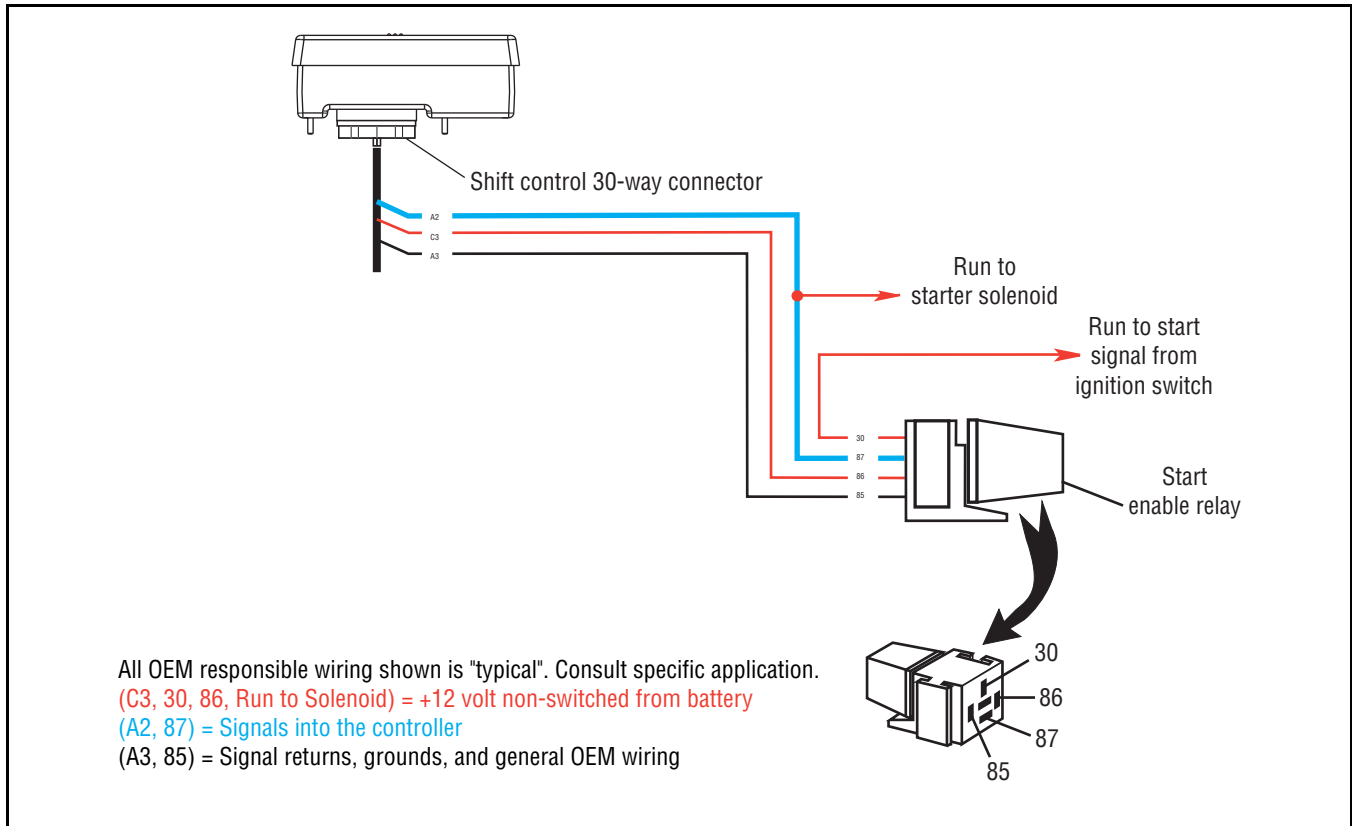
This symptom can be caused by any of the following:

- Start Enable Relay
- Starter Solenoid Wiring

### Additional Tools

- Basic hand tools
- Eaton Test Adapter Kit
- Digital volt/ohm meter

### Component Identification

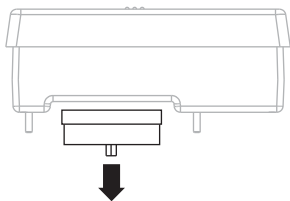




## Start Enable Relay Contact Test

**A** *Purpose:* Verify start enable circuit operation.

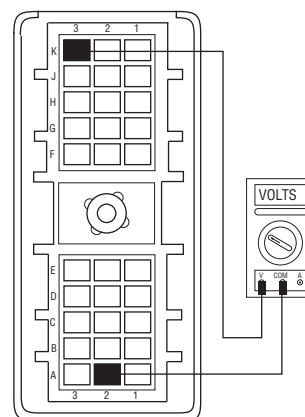
1. Key off.
2. Disconnect Shift Controller 30-way connector.
3. Key on.
4. Engage Starter.



- If engine cranks, go to **Step B.**
- If engine does not crank, go to **Step C.**

**B** *Purpose:* Verify Start Enable Latch wire is not shorted.

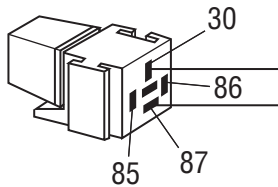
1. Key off.
2. Remove positive (+) battery cable.
3. Measure resistance between Shift Controller 30-way connector Pin A2 and Pin K3.



- If resistance is more than 10K ohms or open circuit [OL], replace the 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.**

**C** *Purpose: Verify the OEM Starter Circuit is operating properly.*

1. Key off.
2. Reconnect Shift Controller 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.**

**D** *Purpose: Verify operation of the Starter Enable Relay Latch circuit*

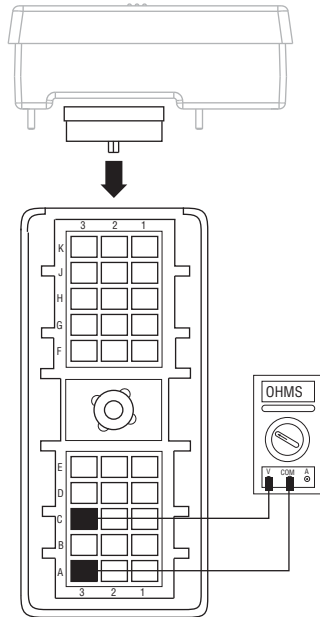
1. While engaging starter remove jumper wire.
  - If engine continues to crank, test complete.
  - If engine stops cranking when jumper is removed and latching circuit in Shift Controller is malfunctioning, replace the **Shift Control**. Repeat this step.

**E** *Purpose: Confirm Start Enable Relay operation.*

1. Replace Start Enable Relay.
2. Engage starter.
  - If engine cranks, test complete.
  - If engine does not crank, go to **Step F.**

**F** **Purpose:** Verify resistance of the Start Enable Relay circuit.

1. Measure resistance between Shift Controller 30-way connector Pin A3 and Pin C3.



- If resistance is 40–90 ohms, check vehicle starting system. If no problem found, replace the **Shift Control**. Go to **Step V**.
- If resistance is outside of range, repair Vehicle Harness between Start Enable Relay and Shift Controller. Go to **Step V**.

**V** **Purpose:** Verify repair.

1. Key off.
2. Reconnect all connectors.
3. Key on.
4. Start the engine to determine whether the Start Enable Relay contact has been repaired.
  - If engine starts, test complete.
  - If engine does not start, go 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 Controller is unable to provide a fault code, the operator may observe this failure as the transmission not initiating or completing a shift. The operator may observe this failure as the transmission neutralizes.

## Conditions to Set Fault Code Active

## Fallback

There is no fallback mode for this symptom.

## Possible Causes

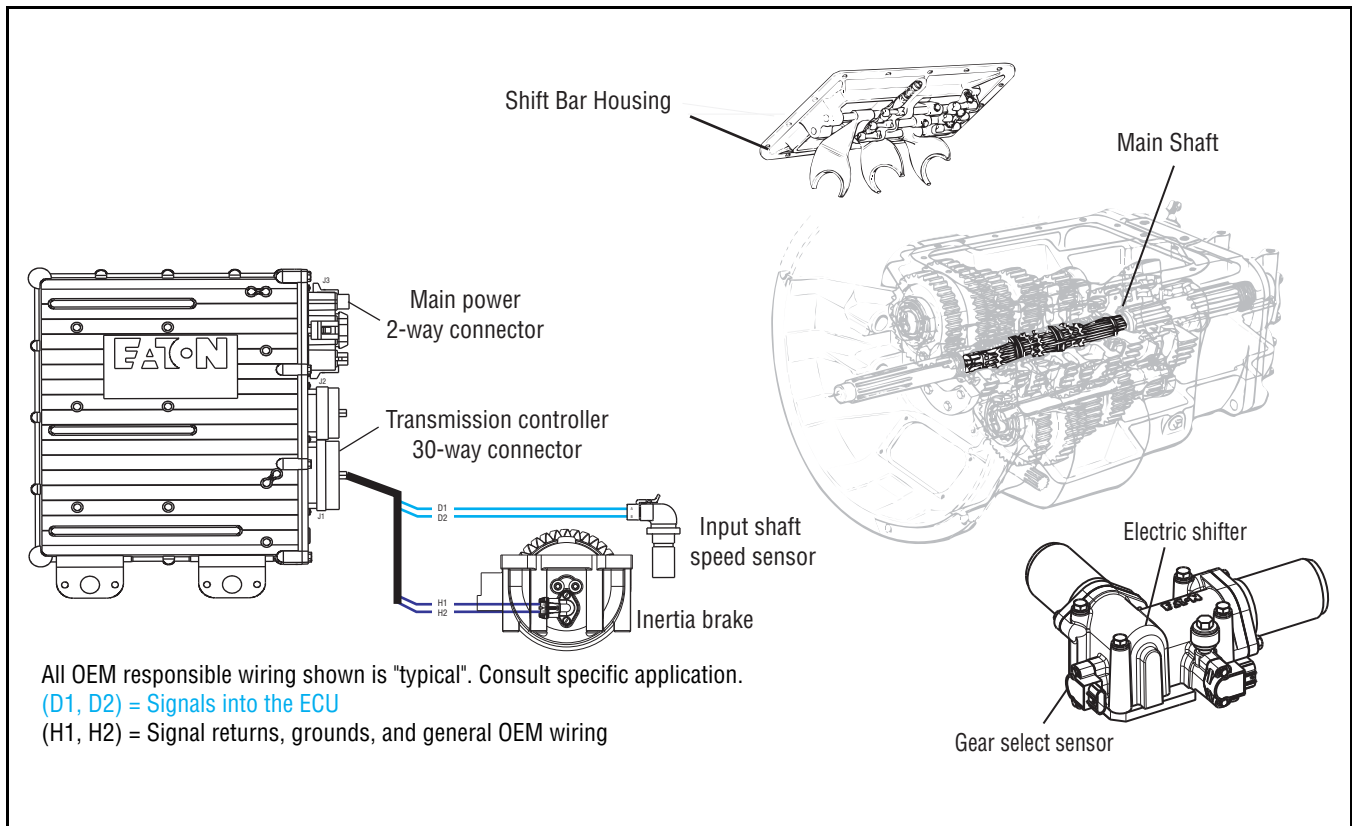
This symptom can be caused by any of the following:

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

## Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter
- PC-based Service Tool

### Component Identification



## AutoShift Will Not Engage a Gear Test

**A** *Purpose:* Confirm system operation and complaint.

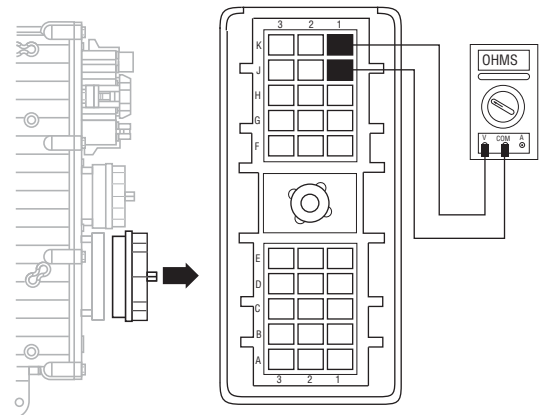
1. Key on.
2. Press Clutch Pedal.
3. Start engine.
4. Release Clutch Pedal to verify Input Shaft speed.
5. Press Clutch Pedal.
6. Place Shift Lever in "D."
7. Observe Gear Display.
  - If Gear Display shows a solid "N", go to **Step B.**
  - If Gear Display shows a flashing gear with arrows, go to **Step 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.

**B** *Purpose:* Monitor input shaft speed in ServiceRanger.

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.**

**C** *Purpose:* Verify resistance of the Input Shaft Speed Sensor circuit.

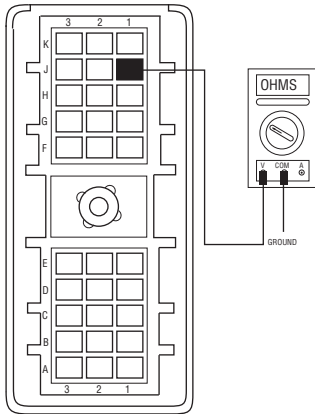
1. Key off.
2. Disconnect the Transmission Controller 30-way connector.
3. Measure the resistance between the Transmission Controller 30-way connector Pin J1 and Pin K1.



- If resistance is 2K–4.5K ohms, go to **Step D.**
- If resistance is outside of range, go to **Step E.**

**D** **Purpose:** Test for a short to ground on the Input Shaft Speed Sensor circuit.

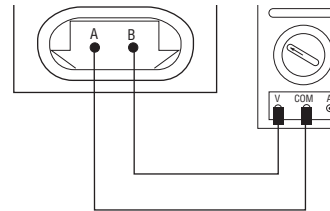
1. Measure resistance between the Transmission Harness 30-way connector Pin J1 and ground.



- 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.**

**E** **Purpose:** Measure resistance of the Input Shaft Speed Sensor.

1. Disconnect the Transmission Harness from the Input Shaft Speed Sensor.
2. Measure resistance between Input Shaft Speed Sensor Pin A and Pin B.

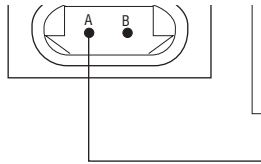


- If resistance is 2K–4.5K ohms, go to **Step F.**
- If resistance is outside of range, replace the:
  - **Input Shaft Speed Sensor (6-Speed)**
  - **Input Shaft Speed Sensor (7, 10 and 18-Speed)**
 Go to **Step V.**



**F** **Purpose:** Test for a short to ground on the Input Shaft Speed Sensor.

1. Measure resistance between Input Shaft Speed Sensor Pin A and ground.



- If resistance is 10K ohms or open circuit [OL], replace the **Adapter Test Kit J43318**. Go to **Step V**.
- If resistance is less than 10K ohms, replace the:
  - **Input Shaft Speed Sensor (6-Speed)**
  - **Input Shaft Speed Sensor (7, 10 and 18-Speed)**

Go to **Step V**.

**H** **Purpose:** Monitor Input Shaft speed in ServiceRanger.

1. Connect PC-based service tool.
2. Start engine.
3. View Input Shaft speed.
4. Press 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 RPM, test complete. Go to **Step V**.

**G** **Purpose:** Verify the Countershaft is turning.

1. Key off.
2. Turn the Input Shaft and verify the Upper Countershaft is rotating.
  - If Upper Countershaft is turning, replace the **Transmission Controller**. Go to **Step V**.
  - If Upper Countershaft is not turning, contact Eaton at 1-800-826- 4357 for repair strategy.

**I**

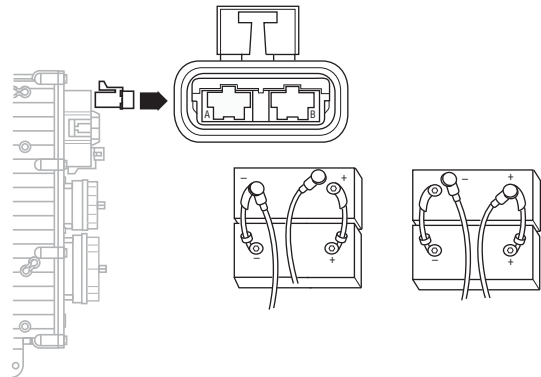
**Purpose:** Perform Inertia Brake Test using ServiceRanger.

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.
  - If test passes, test complete. Go to **Step V.**
  - If test fails, replace the
    - **Inertia Brake (6-Speed)**
    - **Inertia Brake (7, 10 and 18-Speed)**
  - After replacing the Inertia Brake, Go to **Step V.**
  - If test aborts, correct displayed test failure condition and retest.

**J**

**Purpose:** Inspect the integrity of the Fuse Holder and connections.

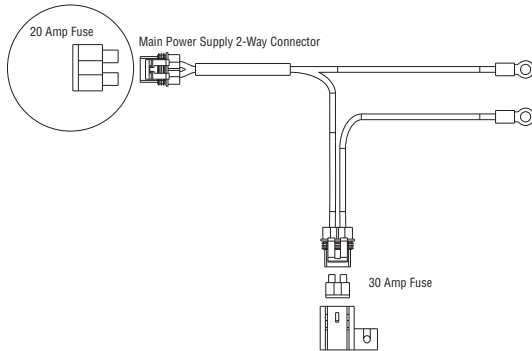
1. Key off.
2. Inspect main power 2-way connector terminals, in-line fuse holder and power supply connections for integrity and corrosion.



- 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.**

**K** **Purpose:** Verify the Vehicle Harness will carry a proper load.

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 Controller. Go to **Step V**.

**L** **Purpose:** Visually inspect the Shift Bar Housing, Electric Shifter and base transmission for signs of mechanical damage.

1. Key off.
2. Remove Electric Shifter from Shift Bar Housing.
3. Inspect the Shift Bar Housing Shift Blocks, Shift Rails and Electric Shifter for evidence of lube contamination
  - If problem is found, repair as required. Go to **Step V**.
  - If no problem is found, replace the **Electric Shifter**. Go to **Step V**.

**V** **Purpose:** Verify repair.

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, go to **Step A** to find error in testing.



# 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 Controller is unable to provide a fault code, the operator may observe this failure as the transmission not initiating or completing a shift. The operator may observe this failure as the transmission neutralizes.

## Conditions to Set Fault Code Active

## Fallback

There is no fallback mode for this symptom.

## Possible Causes

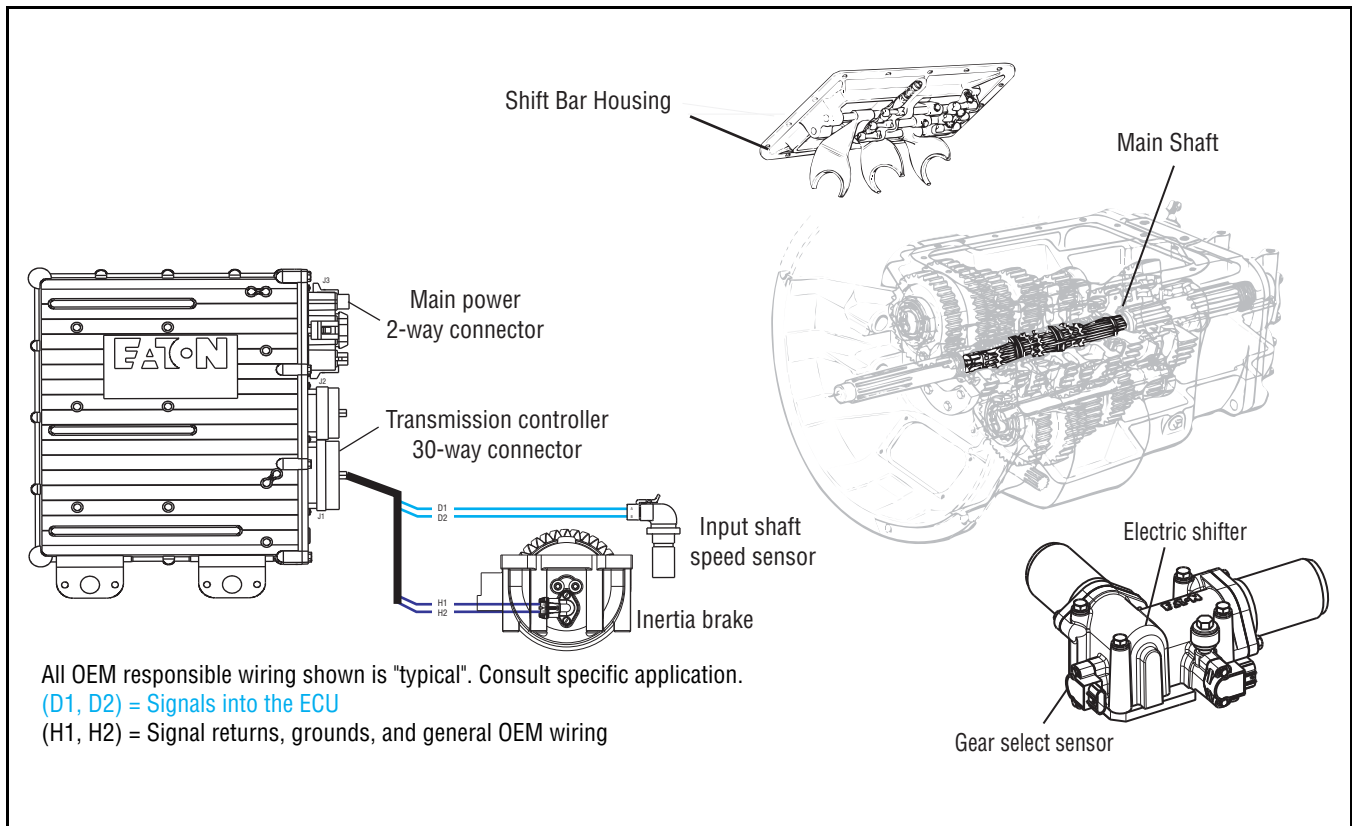
This symptom can be caused by any of the following:

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

## Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter
- PC-based Service Tool

### Component Identification



## UltraShift DM Will Not Engage a Gear Test

**A** *Purpose:* Confirm system operation and complaint.

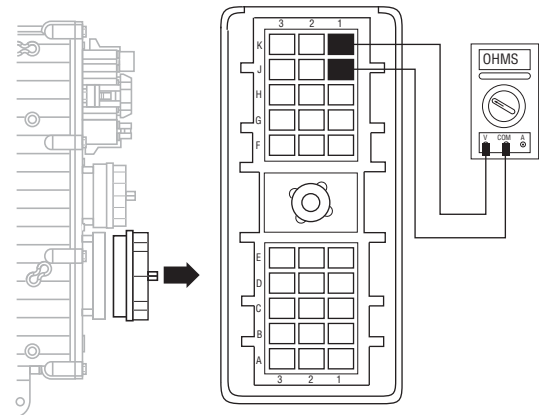
1. Key on.
2. Start engine.
3. Place Shift Lever in "D."
4. Observe Gear Display.
  - If Gear Display shows a solid "N", go to **Step B.**
  - If Gear Display shows a flashing gear with arrows, go to **Step H.**
  - If Gear Display shows a flashing gear with no arrows, go to **Step J.**
  - If Gear Display shows a solid gear but vehicle will not move, contact Eaton at 1-800-826-4357 for repair strategy.

**B** *Purpose:* Monitor Input Shaft speed in ServiceRanger.

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.**

**C** *Purpose:* Verify resistance of the Input Shaft Speed Sensor circuit.

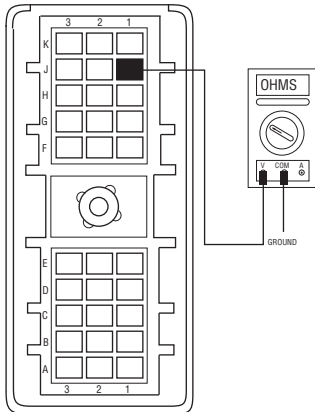
1. Key off.
2. Disconnect the Transmission Controller 30-way connector.
3. Measure the resistance between the Transmission Controller 30-way connector Pin J1 and Pin K1.



- If resistance is 2K–4.5K ohms, go to **Step D.**
- If resistance is outside of range, go to **Step E.**

**D** **Purpose:** Test for a short to ground on the Input Shaft Speed Sensor circuit.

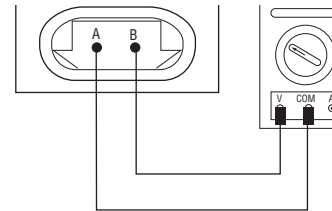
1. Measure resistance between the Transmission Harness 30-way connector Pin J1 and ground.



- 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.**

**E** **Purpose:** Measure resistance of the Input Shaft Speed Sensor.

1. Disconnect the Transmission Harness from the Input Shaft Speed Sensor.
2. Measure resistance between Input Shaft Speed Sensor Pin A and Pin B.

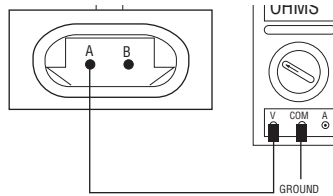


- If resistance is 2K–4.5K ohms, go to **Step F.**
- If resistance is outside of range, replace the:
  - **Input Shaft Speed Sensor (6-Speed)**
  - **Input Shaft Speed Sensor (7, 10 and 18-Speed)**
 Go to **Step V.**



**F** **Purpose:** Test for a short to ground on the Input Shaft Speed Sensor.

1. Measure resistance between Input Shaft Speed Sensor Pin A and ground.



- If resistance is 10K ohms or open circuit [OL], replace the **Adapter Test Kit J43318**. Go to **Step V**.
- If resistance is less than 10K ohms, replace the:
  - **Input Shaft Speed Sensor (6-Speed)**
  - **Input Shaft Speed Sensor (7, 10 and 18-Speed)**

Go to **Step V**.

**G** **Purpose:** Verify the Countershaft is turning.

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.

**H** **Purpose:** Monitor Input Shaft speed in ServiceRanger.

1. Connect PC-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 RPM, test complete. Go to **Step V**.

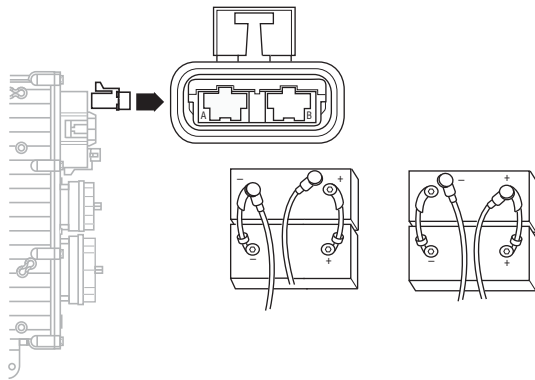
**I** **Purpose:** Perform Inertia Brake Test using ServiceRanger.

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 the:
      - **Inertia Brake (6-Speed)**
      - **Inertia Brake (7, 10 and 18-Speed)**
- Go to **Step V**.
- Test aborts, correct displayed test failure condition and retest.

**J**

**Purpose:** Inspecting the integrity of the Fuse Holder and connections.

1. Key off.
2. Inspect main power 2-way connector terminals, in-line fuse holder and power supply connections for integrity and corrosion.

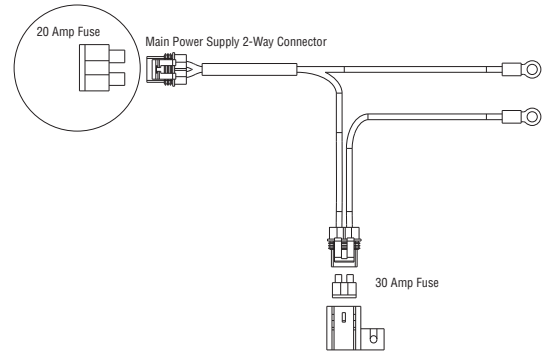


- If no problem found, go to **Step K**.
- If problem is found, repair power/ground path for the main power supply. Go to **Step V**.

**K**

**Purpose:** Confirming the Vehicle Harness will carry a proper load.

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 Controller. Go to **Step V**.

**L****Purpose:** Visually inspect the shift bar housing Electric Shifter and base transmission.

1. Key off.
2. Remove Electric Shifter from Shift Bar Housing.
3. Inspect the Shift Bar Housing Shift Blocks, Shift Rails and Electric Shifter for evidence of lube contamination
  - If problem is found, repair as required. Go to **Step V.**
  - If no problem is found, replace the **Electric Shifter.** Go to **Step V.**

**V****Purpose:** Verify repair.

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, go to **Step A.** to find error in testing.



# 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 Controller is unable to provide a fault code, the operator may observe this failure as the transmission not initiating or completing a shift. The operator may observe this failure as the transmission neutralizes.

## Conditions to Set Fault Code Active

## Fallback

There is no fallback mode for this symptom.

## Possible Causes

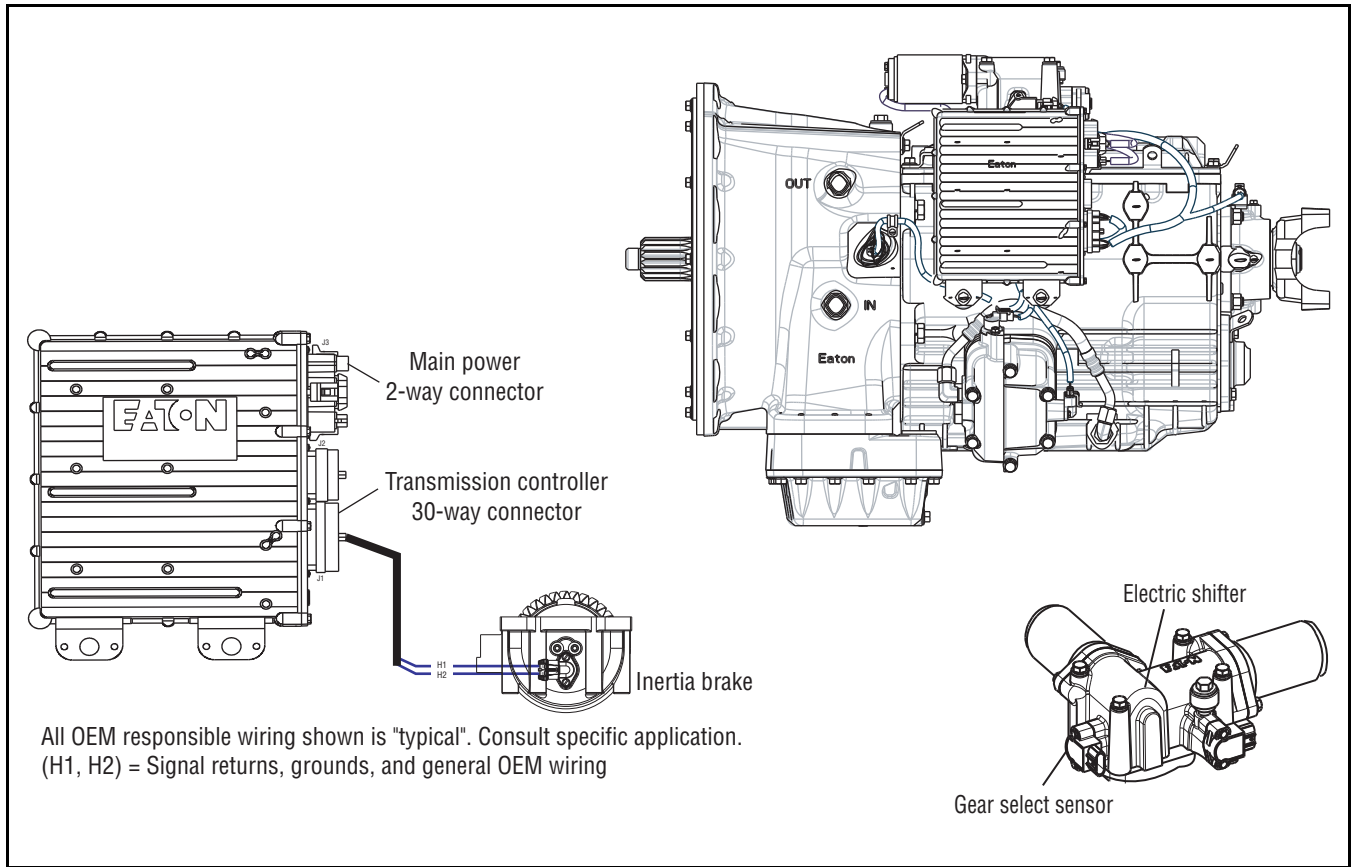
This symptom can be caused by any of the following:

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

## Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter
- PC-based Service Tool

### Component Identification



## UltraShift ASW Will Not Engage a Gear Test

**A** *Purpose: Confirm system operation and complaint.*

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.**

**C** *Purpose: Perform Inertia Brake Test using ServiceRanger.*

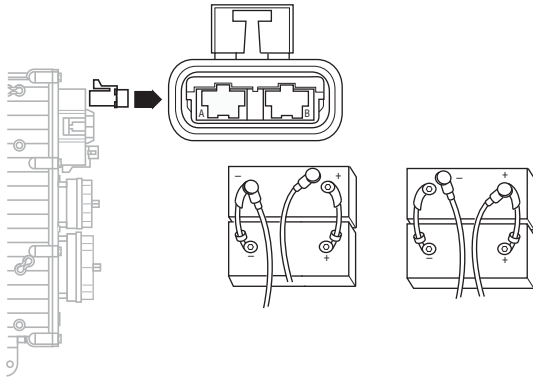
1. Key on.
2. Make sure PTO is off.
3. Connect PC-based service tool and select “Advanced Product Function.”
4. Start engine.
5. Select “Inertia Brake Test.”
6. Run test and follow instructions.
  - Test passes, test complete. Go to **Step C.**
  - Test fails, replace the:
    - **Inertia Brake (6-Speed)**
    - **Inertia Brake (7, 10 and 18-Speed)**Go to **Step V.**
  - Test aborts, correct displayed test failure condition and retest.

**B** *Purpose: Check wet clutch fluid level.*

1. Place transmission in neutral.
2. Allow engine to idle at 600–700 RPM for a minimum of 2 minutes. Ensure transmission fluid temperature is 60–120° F (16–49° C).
3. Check wet clutch fluid level.
  - If fluid level is at “Cold” or “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” or “Full” mark, correct fluid level, check for leaks. Go to **Step V.**

**D** **Purpose:** Inspect the integrity of the Fuse Holder and connections.

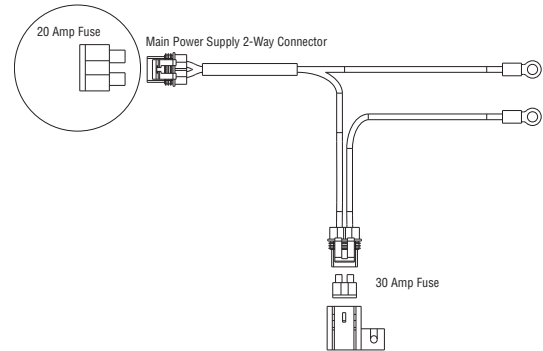
1. Key off.
2. Inspect main power 2-way connector terminals, in-line fuse holder and power supply connections for integrity and corrosion.



- 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**.

**E** **Purpose:** Verify the Vehicle Harness will carry a proper load.

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 Controller. Go to **Step V**.

**F** **Purpose:** Visually inspect the Shift Bar Housing, Electric Shifter and base transmission.

1. Key off.
2. Remove Electric Shifter from Shift Bar Housing.
3. Inspect the Shift Bar Housing Shift Blocks, Shift Rails and 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.



**G****Purpose:** Confirm operation.

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.**
- 

**V****Purpose:** Verify repair.

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.

### Conditions to Set Fault Code Active

### Fallback

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

### Possible Causes

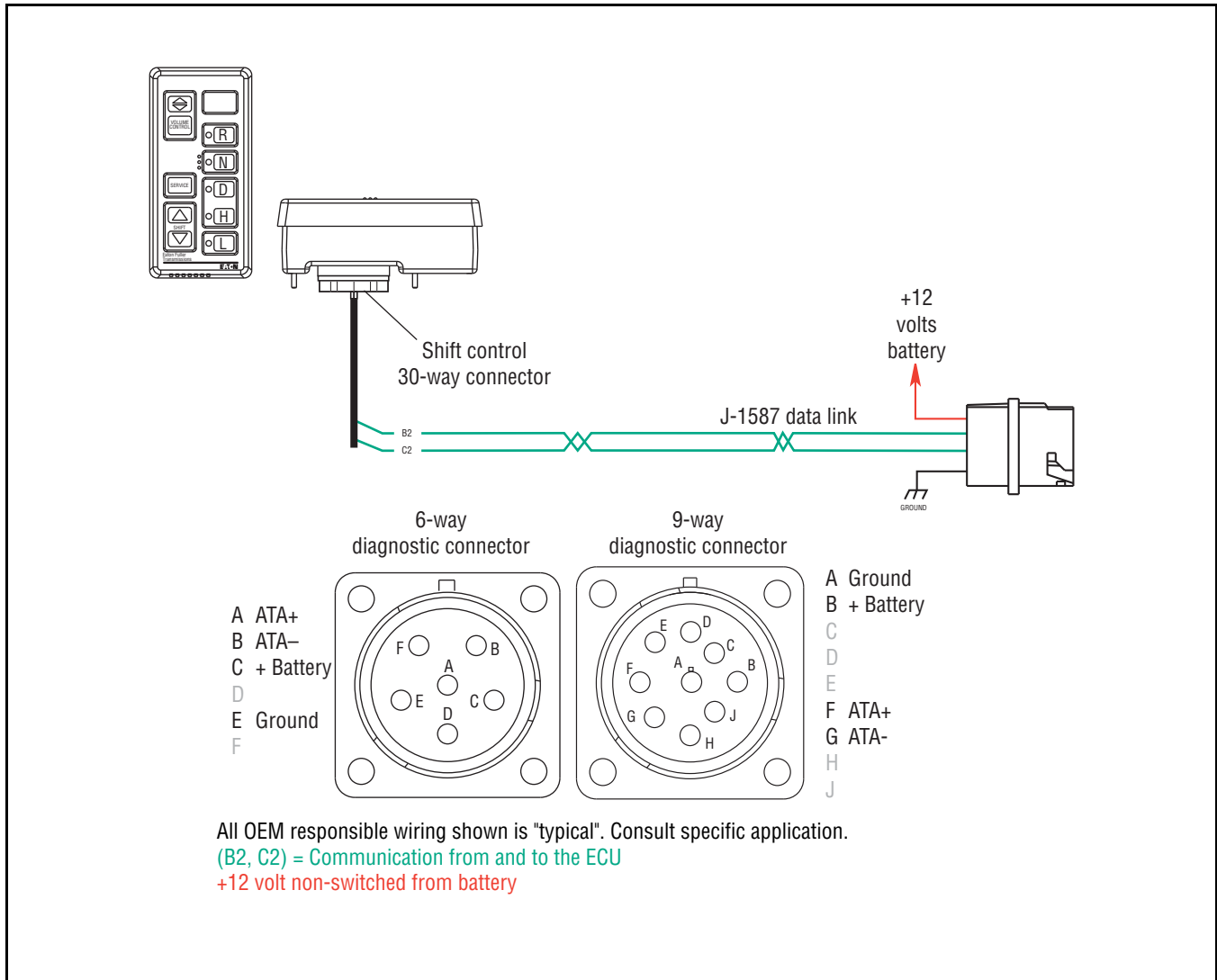
This symptom can be caused by any of the following:

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

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter
- PC-based Service Tool

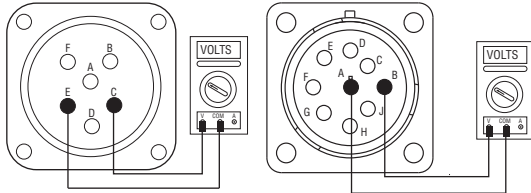
### Component Identification



## J1587 Data Link Test

**A** *Purpose: Measure battery voltage at the diagnostics connector.*

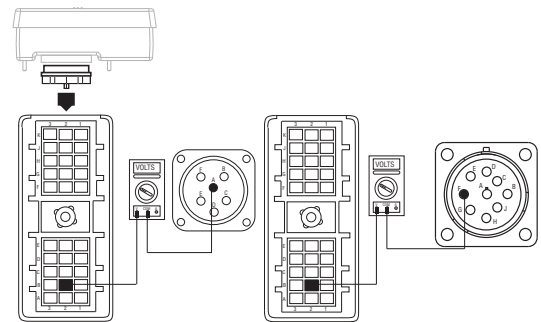
1. Key off.
2. Measure voltage either between 6-way diagnostic connector Pin C and Pin E or 9-way diagnostic connector Pin B and Pin A.



- If voltage is within 0.6 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**.

**B** *Purpose: Confirm continuity of the OEM J1587 Data link.*

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.

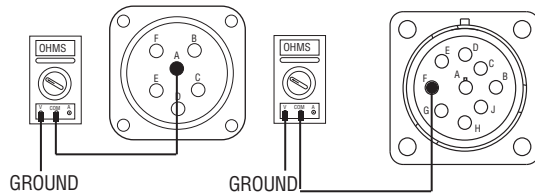


- If resistance is 0–0.3 ohms, go to **Step C**.
- If resistance is outside of range, repair Vehicle Harness. Repeat this step.

**C**

**Purpose:** Test for a short to ground on the J1587 Data Link.

1. Measure resistance between either 6-way diagnostic connector Pin A or 9-way diagnostic connector Pin F and ground.

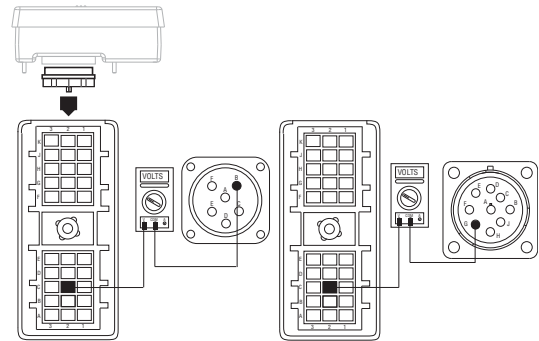


- If resistance is more than 10K ohms or open circuit [OL], go to **Step D**.
- If resistance is less than 10K ohms, repair OEM harness. Go to **Step V**.

**D**

**Purpose:** Confirm continuity of the J1587 Data Link.

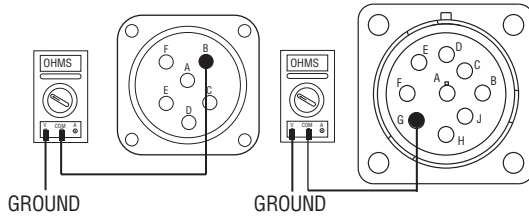
1. Measure resistance between Vehicle Harness 30-way connector Pin C2 and either 6-way diagnostic connector Pin B or 9-way diagnostic connector Pin G.



- If resistance is 0–0.3 ohms, go to **Step E**.
- If resistance is outside of range, repair Vehicle Harness. Go to **Step V**.

**E** **Purpose:** Test for a short to ground on the J1587 Data Link.

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 V**.
- If resistance is less than 10K ohms, repair OEM harness. Go to **Step V**.

**V** **Purpose:** Verify repair.

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, go to **Step A** to find error in testing.





## Range System Test

### 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.

### Conditions to Set Fault Code Active

### Fallback

There is no fallback for this symptom.

### Possible Causes

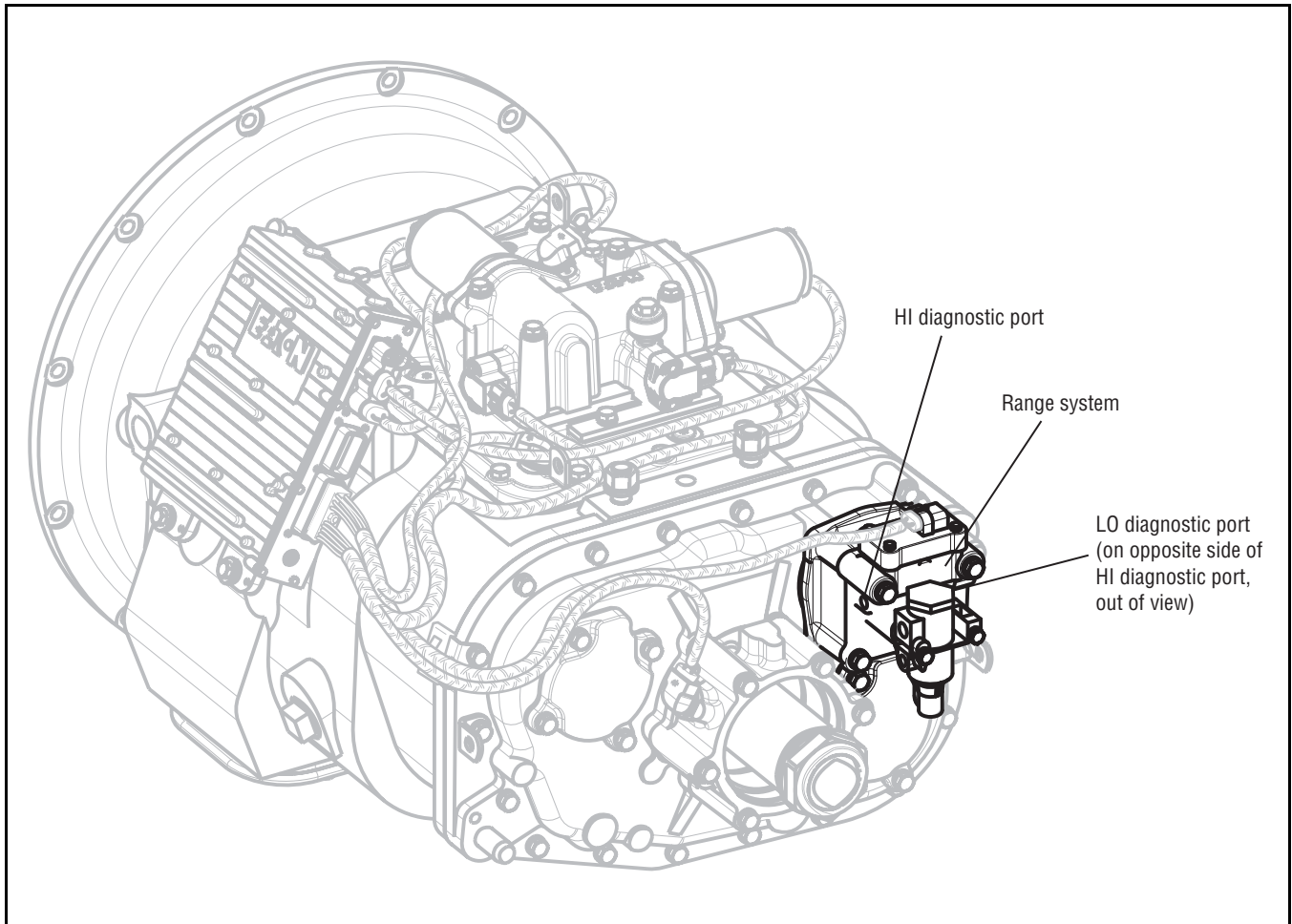
This symptom can be caused by any of the following:

- Low air pressure
- Contaminated air supply
- Air leak
- Range Valve
- Range Synchronizer
- Range Actuator, Cylinder, Piston, Yoke

### Additional Tools

- Basic hand tools
- Two 0-100 PSI Air Pressure gauges

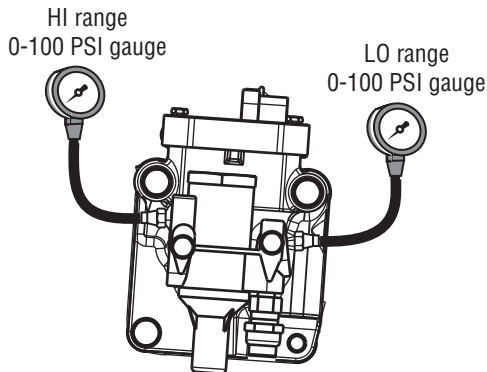
## Component Identification



## Range System Test

**A** *Purpose: Measure LO range air pressure.*

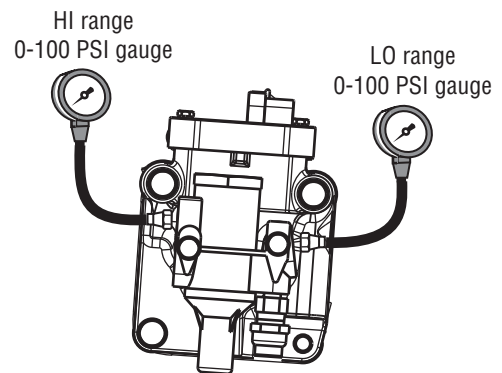
1. Key off.
2. Install both 0-100 PSI air pressure gauges into the Range Valve diagnostic ports.
3. Start engine and allow air pressure to build to governor cut off.
4. Release clutch to register Input Shaft Speed in the transmission.
5. Turn off engine, but leave key on.
6. With the Shift Controller, select reverse, then select neutral.



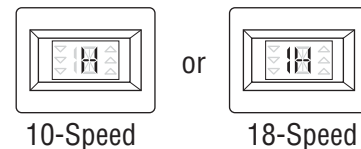
- If LO range air pressure gauge is between 55–65 PSI and the HI range air pressure gauge is 0 PSI, go to **Step B**.
- If neither air pressure gauge reads as listed above, replace the **Range Valve** and Range Cylinder Cover as required. Repeat this step.

**B** *Purpose: Measure HI range air pressure.*

1. Key on.
2. With Shift Controller, select reverse, press the Upshift Button, then select neutral.



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



- If HI range air pressure gauge is between 55–65 PSI and the LO range air pressure gauge is at 0 PSI, repair range system as required. Go to **Step V**.
- If neither air pressure gauge reads as listed above, replace the **Range Valve** and Range Cylinder Cover as required. Go to **Step V**.

**V****Purpose:** Verify repair.

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, go 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 Operator when driving the vehicle. To observe this failure, drive the vehicle and make several shifts up and down across the Splitter.

## Conditions to Set Fault Code Active

## Fallback

There is no fallback for this symptom.

## Possible Causes

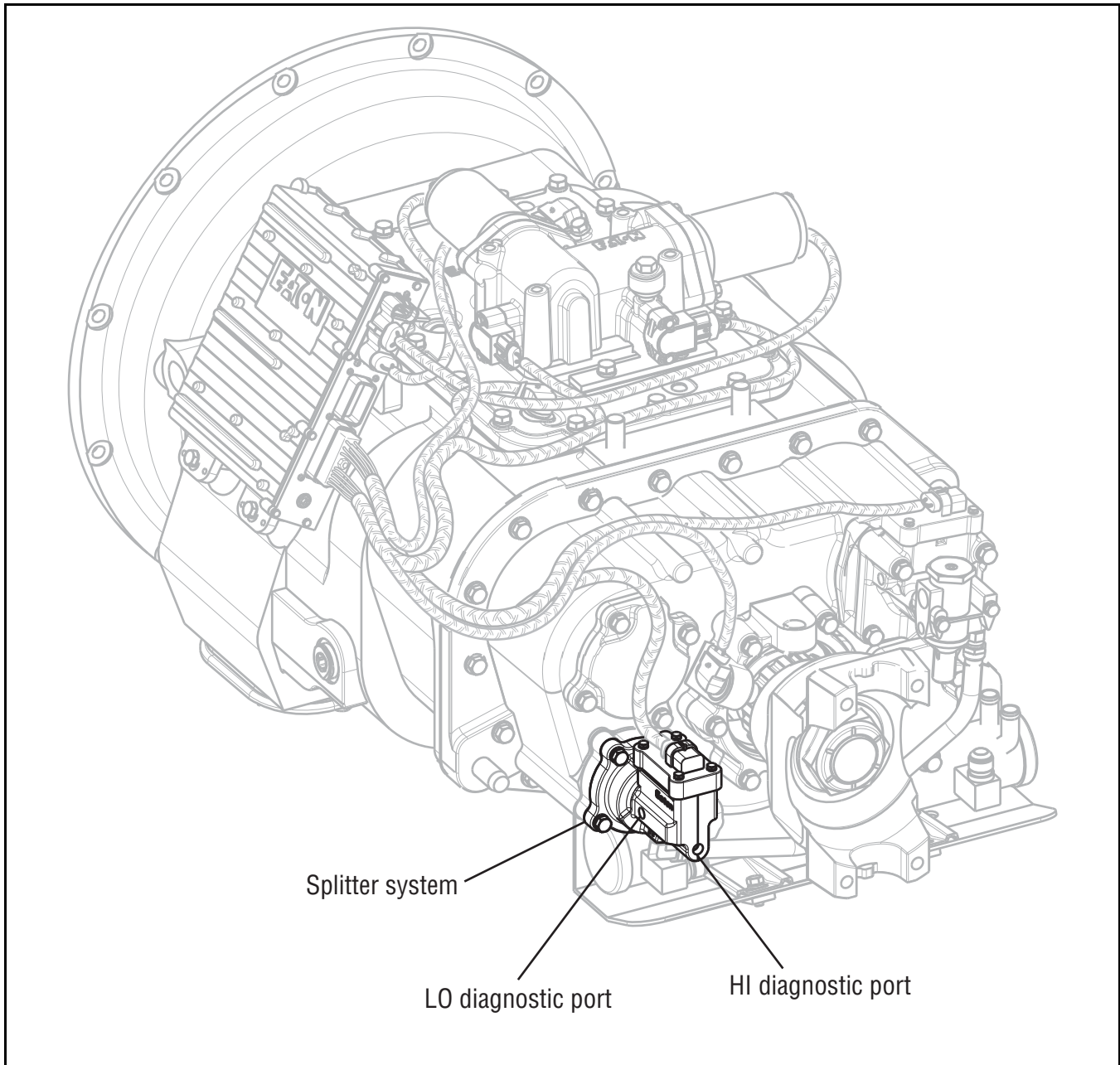
This symptom can be caused by any of the following:

- Low air pressure
- Contaminated air supply
- Air leak
- Splitter Valve
- Splitter Actuator, Cylinder, Piston, Yoke

## Additional Tools

- Basic hand tools
- Two 0–100 PSI Air Pressure gauges

### Component Identification

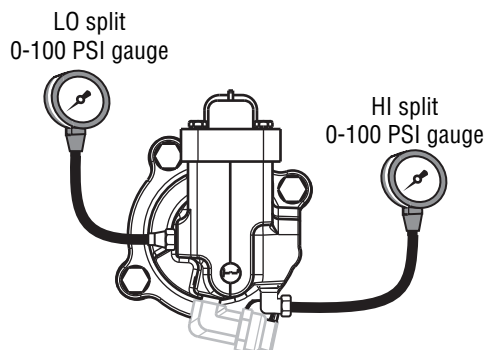


## Splitter System Test

**A** *Purpose: Measure LO Splitter air pressure.*

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 on.
6. With the Shift Controller, select reverse, then select neutral.

**Note:** Five minutes is allowed for checking the pressure after moving the Shift Controller to neutral.

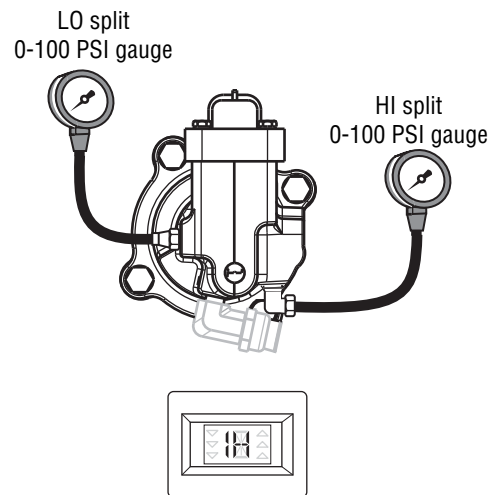


- If Hi split gauge is between 55–65 PSI and if LO split gauge is 0 PSI, go to **Step B**.
- If both pressure gauges do not read as listed above, replace the **Splitter Valve** and Splitter Cylinder Cover as required. Repeat this step.

**B** *Purpose: Measure HI splitter air pressure.*

1. Key on.
2. With Shift Controller, select reverse, press the Upshift Button, then select neutral.

**Note:** If the Gear Display does not read “IH” (18 speed), see “Up/Down Button Test” on page 256.



- If LO split gauge is between 55–65 PSI and If HI split gauge is 0 PSI, repair mechanical Splitter system as required. Go to **Step V**.
- If both pressure gauges do not read as listed above, replace the **Splitter Valve** and Splitter Cylinder Cover as required. Go to **Step V**.

**V****Purpose:** Verify repair.

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, go to **Step A.** to find error in testing.
-



## Up/Down Button Test

### 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 Controller has no fault detection capability for this failure. The failure is observed by the Operator when driving the vehicle.

### Conditions to Set Fault Code Active

### Fallback

There is no fallback for this symptom.

### Possible Causes

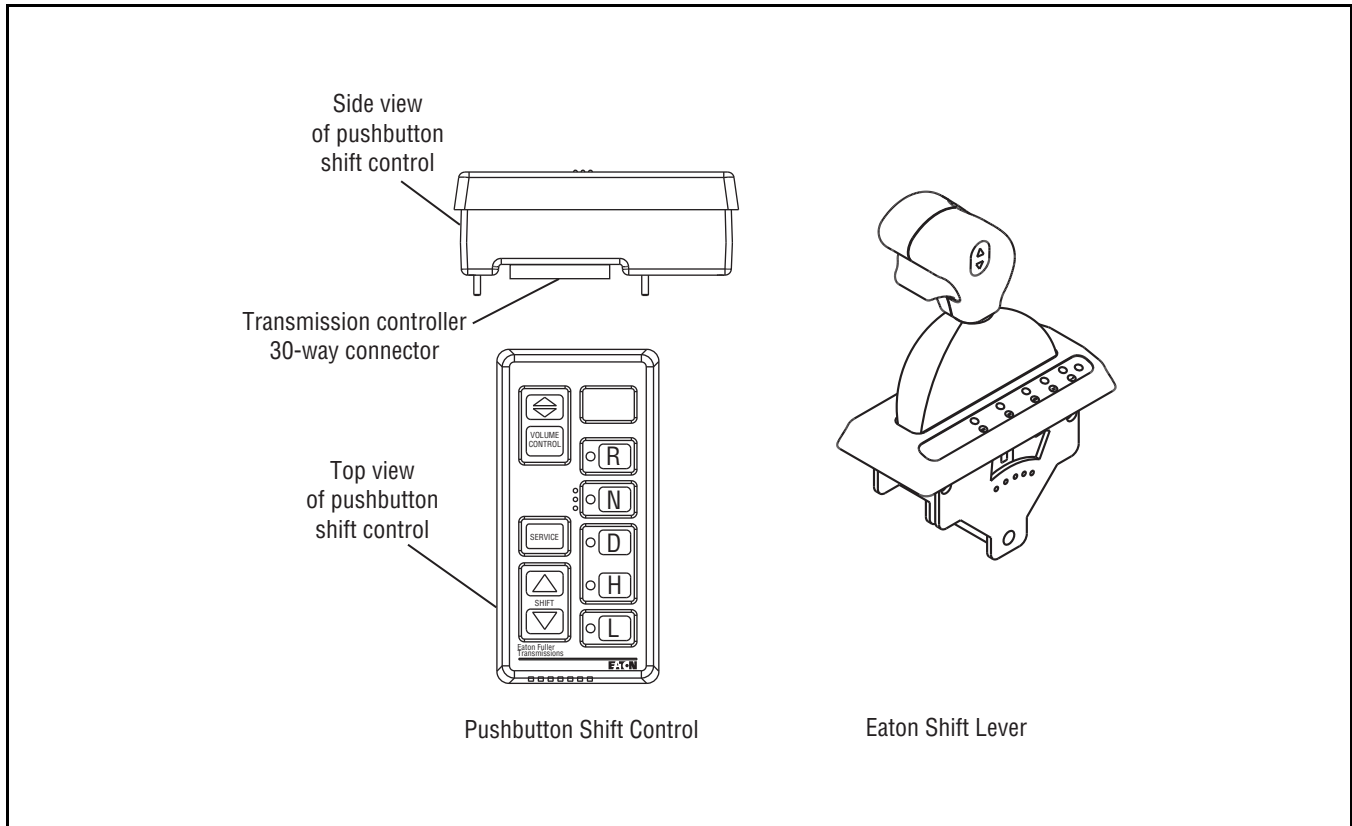
This symptom can be caused by any of the following:

- Shift Controller

### Additional Tools

- Basic hand tools
- Digital volt/ohm meter

### Component Identification



---

## Up/Down Button Test

**A**

**Purpose:** Confirm operation of the Shift Controller up and down buttons.

1. Start engine.
  2. Place Shift Lever in manual.
  3. Drive the vehicle and use the buttons to initiate up shifts and down shifts.
    - If the up and down buttons are working properly, the transmission will make up shifts and down shifts, test complete.
    - If the transmission does not make up shifts or down shifts, 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 operator complaint.

## Conditions to Set Fault Code Active

## Fallback

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

## Possible Causes

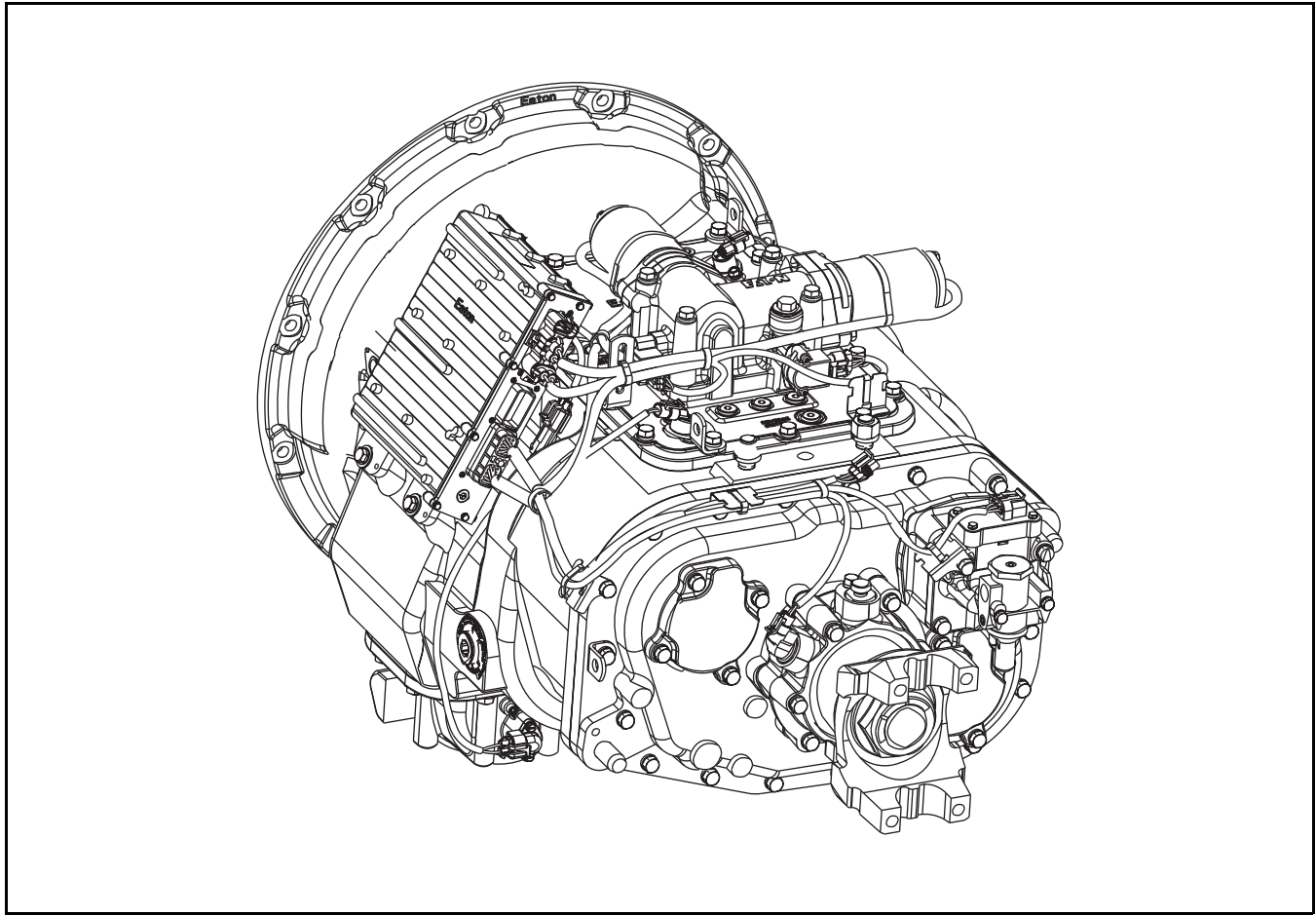
This symptom can be caused by any of the following:

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

## Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- PC-based Service Tool

## Component Identification



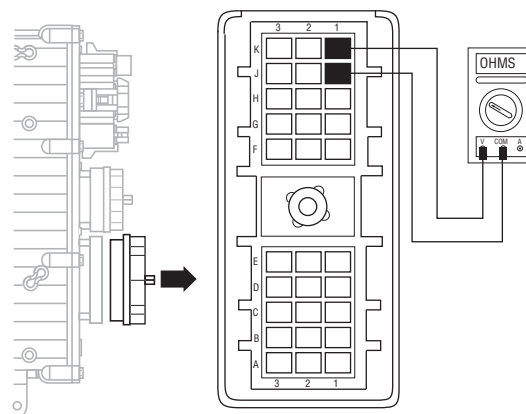
## UltraShift DM Shift Complaint Test

**A** **Purpose:** Perform Inertia Brake Test using ServiceRanger.

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.
  - If test passes, go to **Step B.**
  - If test fails, replace the:
    - **Inertia Brake (6-Speed)**
    - **Inertia Brake (7, 10 and 18-Speed)**
  - After replacing the Inertia Brake, go to **Step V.**
  - If test aborts, correct displayed test failure condition and retest.

**B** **Purpose:** Verify resistance of the Input Shaft Speed Sensor circuit.

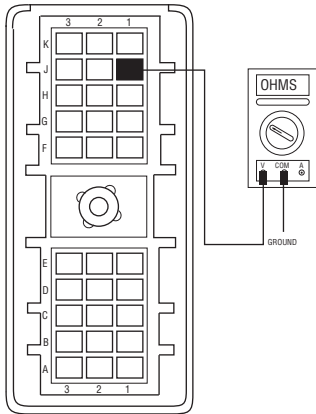
1. Key off.
2. Disconnect the Transmission Controller 30-way connector.
3. Measure the resistance between the Transmission Controller 30-way connector Pin J1 and Pin K1.



- If resistance is 2K–4.5K ohms, go to **Step C.**
- If resistance is outside of range, go to **Step D.**

**C** **Purpose:** Test for a short to ground on the Input Shaft Speed Sensor circuit.

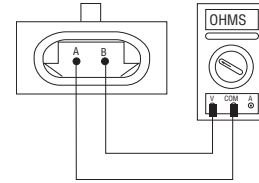
1. Measure resistance between the Transmission Harness 30-way connector Pin J1 and ground.



- 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.**

**D** **Purpose:** Measure resistance of the Input Shaft Speed Sensor.

1. Disconnect the Transmission Harness from the Input Shaft Speed Sensor.
2. Measure resistance between Input Shaft Speed Sensor Pin A and Pin B.

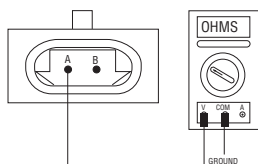


- If resistance is 2K–4.5K ohms, go to **Step E.**
- If resistance is outside of range, replace the:
  - **Input Shaft Speed Sensor (6-Speed)**
  - **Input Shaft Speed Sensor (7, 10 and 18-Speed)**
- After replacing Input Shaft Speed Sensor, go to **Step V.**



**E** **Purpose:** Test for a short to ground on the Input Shaft Speed Sensor.

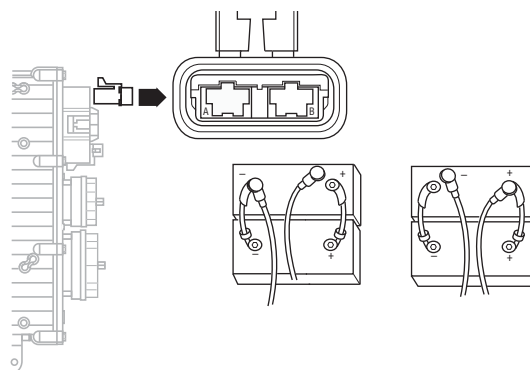
1. Measure resistance between Input Shaft Speed Sensor Pin A and ground.



- If resistance is 10K ohms or open circuit [OL], Replace the **Adapter Test Kit J43318**. Go to **Step V**.
- If resistance is less than 10K ohms, replace the:
  - **Input Shaft Speed Sensor (6-Speed)**
  - **Input Shaft Speed Sensor (7, 10 and 18-Speed)**
- After replacing the Input Shaft Speed Sensor, go to **Step V**.

**F** **Purpose:** Inspect the integrity of the Fuse Holder and connections.

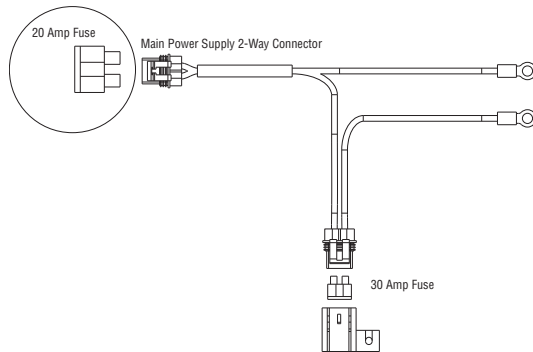
1. Key off.
2. Inspect main power 2-way connector terminals, in-line fuse holder and power supply connections for integrity and corrosion.



- 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**.

**G****Purpose:** Confirm the Vehicle Harness will carry a proper load.

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 Controller. Go to **Step V**.

**V****Purpose:** Verify repair.

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

**H****Purpose:** Visually inspect the Shift Bar Housing, Electric Shifter and base transmission.

1. Key off.
2. Remove Electric Shifter from Shift Bar Housing.
3. Inspect the Shift Bar Housing Shift Blocks, Shift Rails and 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

### 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 Operator complaint.

### Conditions to Set Fault Code Active

### Fallback

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

### Possible Causes

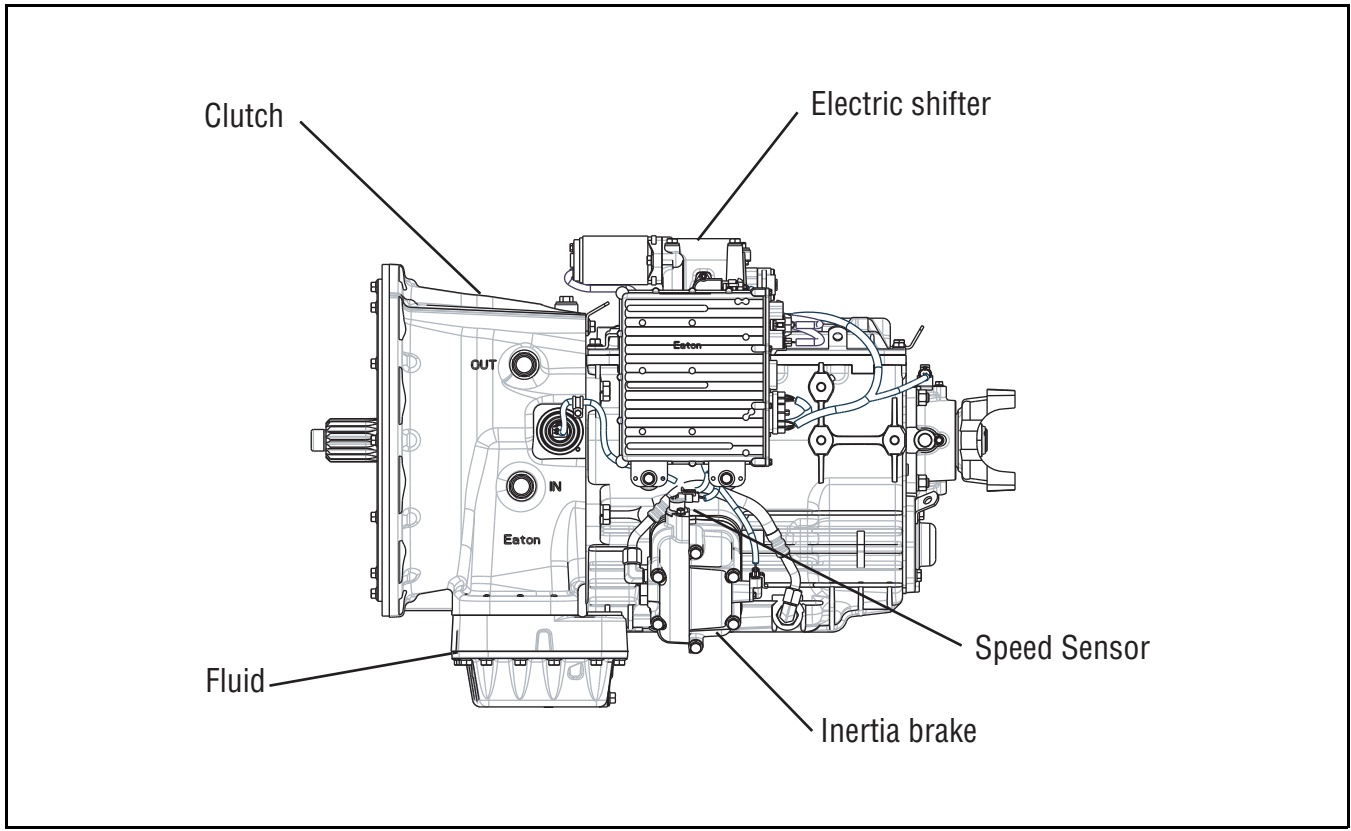
This symptom can be caused by any of the following:

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

### Additional Tools

- Basic hand tools
- Eaton Test Adapter Kit
- PC-based Service Tool

### Component Identification



## UltraShift ASW Shift Complaint Test

**A** *Purpose: Check wet clutch fluid level.*

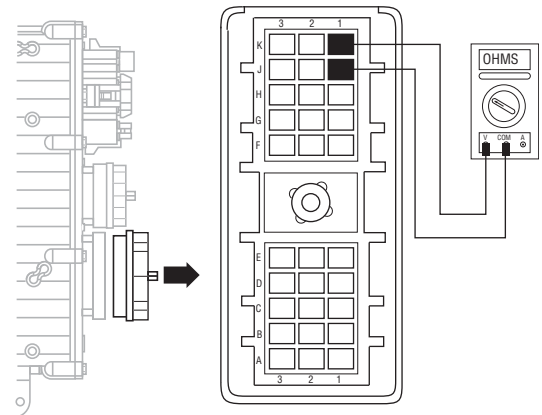
1. Place transmission in neutral.
2. Allow engine to idle at 600–700 RPM for a minimum of 2 minutes. Ensure transmission fluid temperature is 60–120° F (16 to 49° C)
3. Check transmission fluid level.
  - If fluid level is at Cold-Full mark, go to Step B.
  - If fluid level is below the Cold-Add mark, correct fluid level, check for leaks. Go to **Step V**.

**B** *Purpose: Perform Inertia Brake Test using ServiceRanger.*

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.
  - If test passes, go to **Step C**.
  - If test fails, replace the:
    - **Inertia Brake (6-Speed)**
    - **Inertia Brake (7, 10 and 18-Speed)**
  - After replacing the Inertia Brake, go to **Step V**.
  - If test aborts, correct displayed test failure condition and retest.

**C** *Purpose: Verify resistance of the Input Shaft Speed Sensor circuit.*

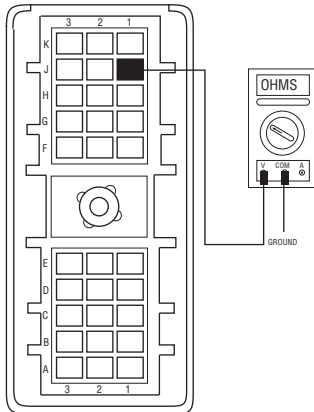
1. Key off.
2. Disconnect the Transmission Controller 30-way connector.
3. Measure the resistance between the Transmission Controller 30-way connector Pin J1 and Pin K1.



- If resistance is 2K–4.5K ohms, go to **Step D**.
- If resistance is outside of range, go to **Step E**.

**D** **Purpose:** Test for a short to ground on the Input Shaft Speed Sensor circuit.

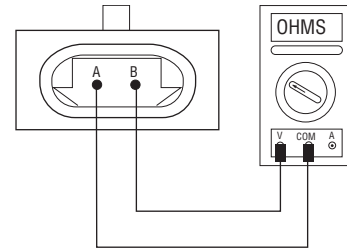
1. Measure resistance between the Transmission Harness 30-way connector Pin J1 and ground.



- 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.**

**E** **Purpose:** Measure resistance of the Input Shaft Speed Sensor.

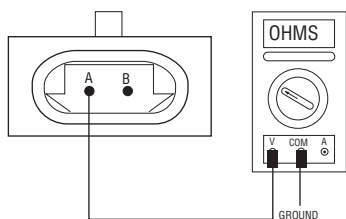
1. Disconnect the Transmission Harness from the Input Shaft Speed Sensor.
2. Measure resistance between Input Shaft Speed Sensor Pin A and Pin B.



- If resistance is 2K–4.5K ohms, go to **Step F.**
- If resistance is outside of range, replace the:
  - **Input Shaft Speed Sensor (6-Speed)**
  - **Input Shaft Speed Sensor (7, 10 and 18-Speed)**
- After replacing the Input Shaft Speed Sensor, go to **Step V.**

**F** **Purpose:** Test for a short to ground on the Input Shaft Speed Sensor.

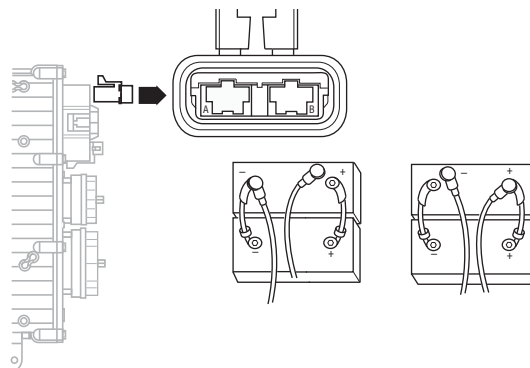
1. Measure resistance between Input Shaft Speed Sensor Pin A and ground.



- If resistance is 10K ohms or open circuit [OL], replace the **Transmission Harness**. Go to **Step V**.
- If resistance is less than 10K ohms, replace the:
  - **Input Shaft Speed Sensor (6-Speed)**
  - **Input Shaft Speed Sensor (7, 10 and 18-Speed)**
- After replacing the Input Shaft Speed Sensor, go to **Step V**.

**G** **Purpose:** Inspect the integrity of the Fuse Holder.

1. Key off.
2. Inspect main power 2-way connector terminals, in-line fuse holder, and power supply connections for integrity and corrosion.

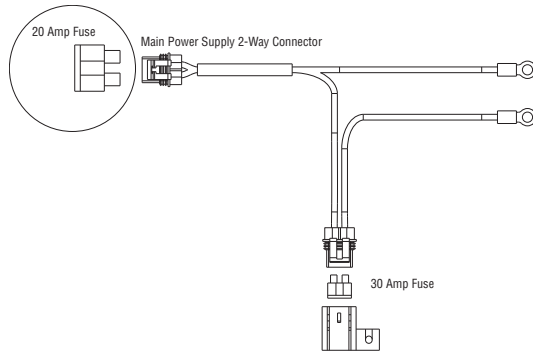


- If no problem found, go to **Step H**.
- If problem is found, repair power/ground path for the main power supply. Go to **Step V**.

**H**

**Purpose:** Confirm the Vehicle Harness will carry a proper load.

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 Controller. Go to **Step V**.

**I**

**Purpose:** Visually inspect the Shift Bar Housing, Electric Shifter and base transmission

1. Key off.
2. Remove Electric Shifter from Shift Bar Housing.
3. Inspect the Shift Bar Housing Shift Blocks, Shift Rails and 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**.



**V****Purpose:** Verify repair.

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 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 Operator complaint.

## Conditions to Set Fault Code Active

## Fallback

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

## Possible Causes

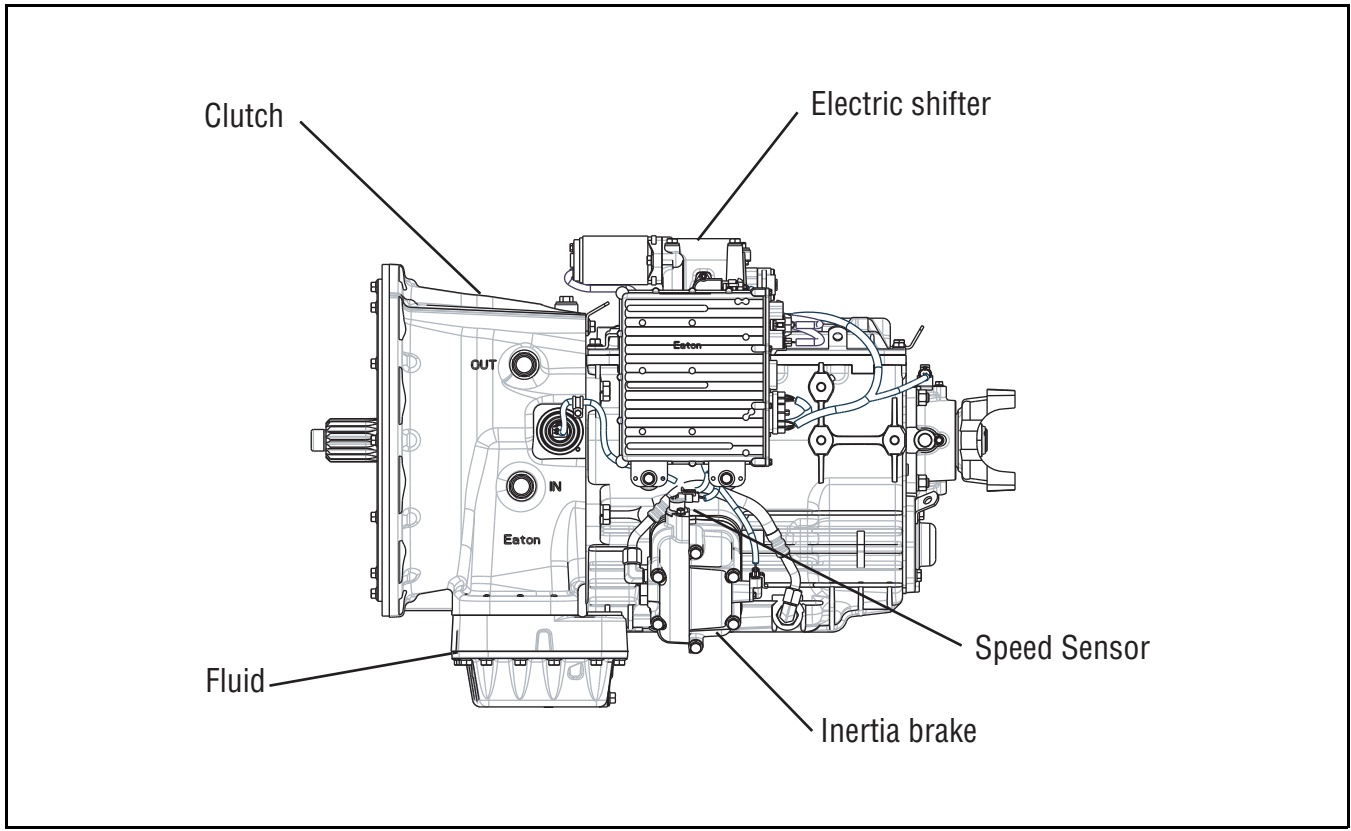
This symptom can be caused by any of the following:

- Low fluid level
- Inertia Brake
- Clutch calibration
- Transmission

## Additional Tools

- Basic hand tools
- PC-based Service Tool

### Component Identification



## UltraShift ASW Clutch Engagement Test

**A** *Purpose: Check wet clutch fluid level.*

1. Place transmission in neutral.
2. Allow engine to idle at 600–700 RPM for a minimum of 2 minutes. Ensure transmission fluid temperature is 60–120° F (16–49° 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.

**B** *Purpose: Complete a clutch calibration.*

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 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.

**C** *Purpose: Confirm operation.*

1. Key off.
2. Disconnect Transmission Harness from the Inertia 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 the:
    - **Inertia Brake (6-Speed)**
    - **Inertia Brake (7, 10 and 18-Speed)**
  - After replacing the Inertia Brake, go to **Step V.**

**V****Purpose:** Verify repair.

1. Key off.
  2. Reconnect Transmission Harness to Inertia 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.
-

## 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 Operator as some other type of fault code or symptom.

### Conditions to Set Fault Code Active

### Fallback

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

### Possible Causes

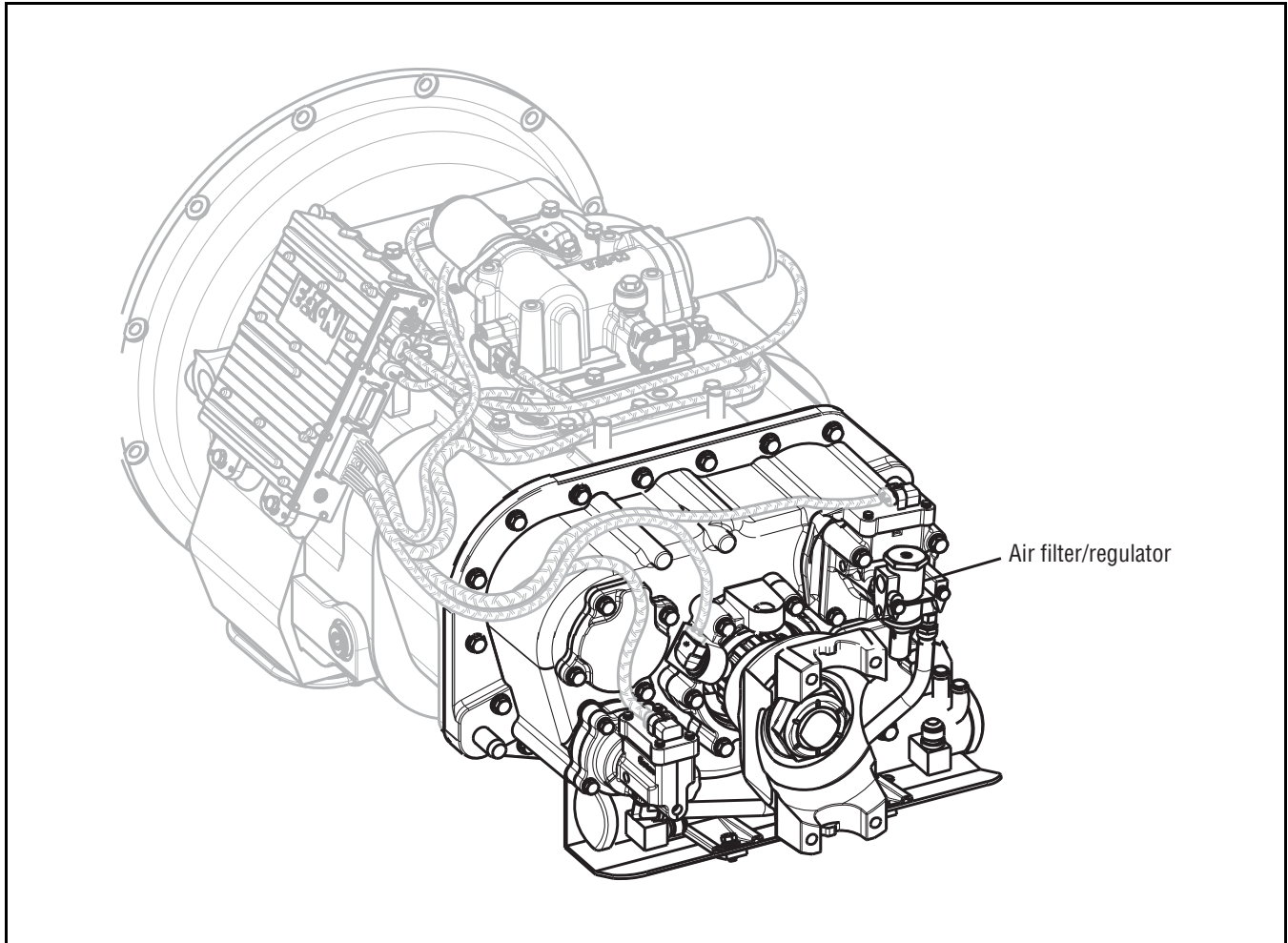
This symptom can be caused by any of the following:

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

### Additional Tools

- Basic hand tools

## Component Identification





## Transmission Air Leak Test

### **A** *Purpose: Confirm air leak*

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:
    - Air filter/regulator
    - Splitter Cylinder supply line (18-speed only)Repair fittings or lines as required. After making repairs, repeat this step.
  - If air leaks at the Range Valve exhaust port, replace the **Range Valve**. Go to **Step V.**
  - If air leaks at Splitter Valve exhaust port (18-speed only), replace the **Splitter Valve**. Go to **Step V.**

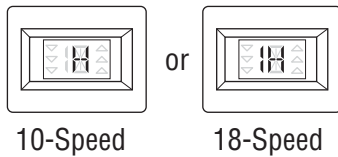
### **B** *Purpose: Confirm location of air leak.*

1. Start engine.
2. Turn off engine, but leave key in "ON" position.
3. With the Shift Controller, 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.**

**C****Purpose:** Confirm location of air leak.

1. Key on.
2. With Shift Controller, select reverse, press the Up-shift Button, and select neutral.

**Note:** If Gear Display does not read “H” (10-speed) or “IH” (18-speed), see “Up/Down Button Test” on page 256.

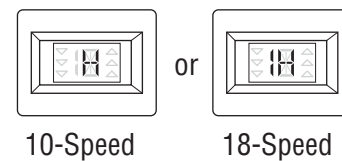


- If there are no constant air leaks, go to **Step E.**
- If air leaks at the Range Exhaust Port, replace the **Range Valve.** Go to **Step E.**

**D****Purpose:** Confirm location of air leak.

1. Key on.
2. With Shift Controller, select reverse, press the Up-shift button, and select neutral.

**Note:** If Gear Display does not read “H” (10-speed) or “IH” (18-speed), see “Up/Down Button Test” on page 256.

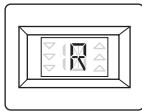


- If there are no constant air leaks, replace **Range Valve.** Go to **Step E.**
- If air leaks at the Range Exhaust Port, replace the Range Piston and O-rings. Go to **Step E.**

**E** **Purpose:** Confirm location of air leak.

1. Key on.
2. With Shift Controller, select reverse, press the Down-shift button, and select neutral.
3. Listen for constant air leaks.

**Note:** If Gear Display does not read “R” (10-speed), see “Up/Down Button Test” on page 256.

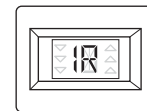


- If there are no constant air leaks, test complete.
- If air leaks at the Splitter exhaust port, repair Splitter Piston and O-rings. Go to **Step V.**

**F** **Purpose:** Confirm location of air leak.

1. Key on.
2. With Shift Controller, select reverse, press the Down-shift button, and select neutral.
3. Listen for constant air leaks.

**Note:** If Gear Display does not read “IR” (18-speed), see “Up/Down Button Test” on page 256.

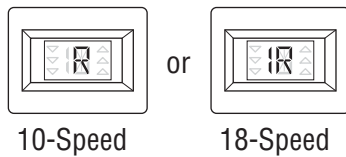


- If there are no constant air leaks (18-speed only), replace the **Splitter Valve** Go to **Step V.**
- If air leaks at the Splitter Valve exhaust port, repair Splitter Piston and O-rings (18-speed only). Go to **Step V.**

**G****Purpose:** Confirm location of air leak.

1. Key on.
2. With Shift Controller, select reverse, press the Down-shift button, and select neutral.
3. Listen for constant air leak.

**Note:** If Gear Display does not read “H” (10-speed) or “IH” (18-speed), see “Up/Down Button Test” on page 256.



- If the leak continues, repair the Range Yoke Bar O-rings as required (18-speed only). Go to **Step V.**
- If the air leak stops, replace the Splitter Yoke Bar O-ring as required (18-speed only). Go to **Step V.**

**V****Purpose:** Verify repair.

1. Start engine
  2. Release clutch to register Input Shaft speed in the transmission.
  3. Turn off engine, but leave key on.
  4. Listen for constant air leaks under the following conditions:
    - With Shift Controller, select reverse, then select neutral
    - With Shift Controller, select reverse, press Upshift Button, then select neutral
- If there are no constant leaks, test complete.
  - If there are constant air leaks, go to **Step A.** to find error in testing.

## Shift Lever Back Light

### Overview

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

### Detection

There is no detection other than an Operator complaint.

### Conditions to Set Fault Code Active

### Fallback

There is no fallback mode for this symptom.

### Possible Causes

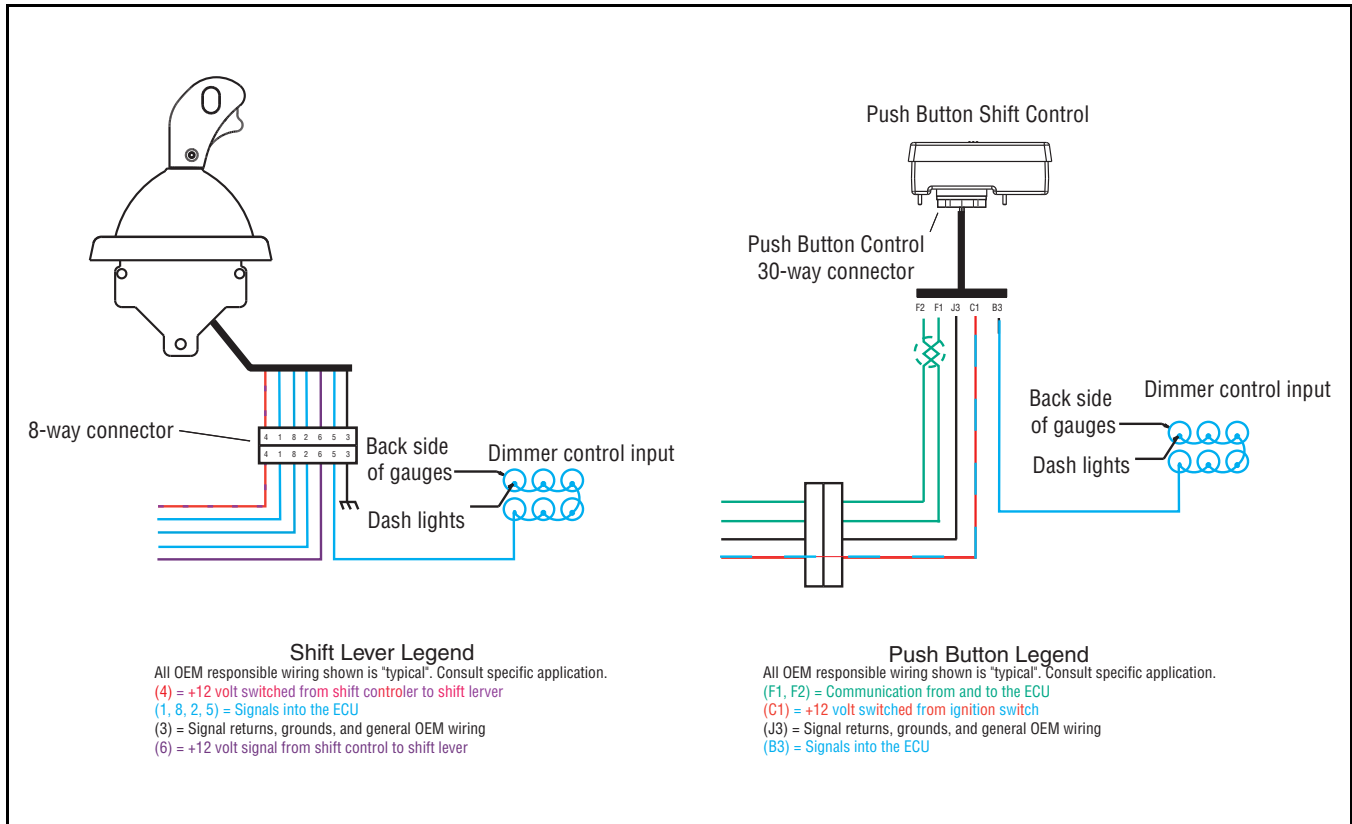
This symptom can be caused by any of the following:

- OEM Wiring
- Shift Controller
- Shift Lever

### Additional Tools

- Basic hand tools
- Eaton Test Adapter kit
- Digital volt/ohm meter

### Component Identification



## Shift Lever Back Light Test

**A** *Purpose: Visually identify if the vehicle is equipped with an Eaton Cobra Lever.*

1. Is vehicle equipped with an Eaton Cobra Lever?
  - If vehicle is not equipped with a Eaton Cobra Lever, go to **Step B.**
  - If vehicle is equipped with a Eaton Cobra Lever, go to **Step C.**

**B** *Purpose: Measure battery voltage of the OEM Dash Light circuit.*

1. Key off.
2. Disconnect Shift Controller 30-way connector.
3. Key on.
4. Measure voltage between Shift Controller Pin B3 and Pin J3 with the Dash lights fully on.
  - If voltage is within 2 volts of battery voltage, replace the **Shift Control** Go to **Step V.**
  - If voltage is outside of range, repair Vehicle Harness. Go to **Step V.**

**C** *Purpose: Measure battery voltage of the OEM Dash Light circuit.*

1. Key off.
2. Disconnect Shift Lever 8-way connector.
3. Key on.
4. Measure voltage between Shift Lever 8-way Pin 4 and Pin 3.
  - If voltage is within 1 volt of battery voltage, go to **Step D.**
  - If voltage is outside of range, repair the ignition supply to the Eaton Cobra Lever. Go to **Step V.**

**D** *Purpose: Measure battery voltage of the OEM Dash Light circuit.*

1. Key on.
2. Measure voltage between Shift Lever 8-way connector Pin 5 and Pin 3 with the Dash lights fully on.
  - If voltage is within 2 volts of battery voltage, replace Eaton Cobra Lever. Go to **Step V.**
  - If voltage is outside of range, repair Vehicle Harness to Eaton Cobra Lever. Go to **Step V.**

**V****Purpose:** Verify repair.

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, go 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 -	

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<b>30-Way</b>	<b>Description</b>	<b>Notes</b>
K2	Interrupt Clutch +	
K3	Interrupt Clutch -	

## Shift Controller 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	

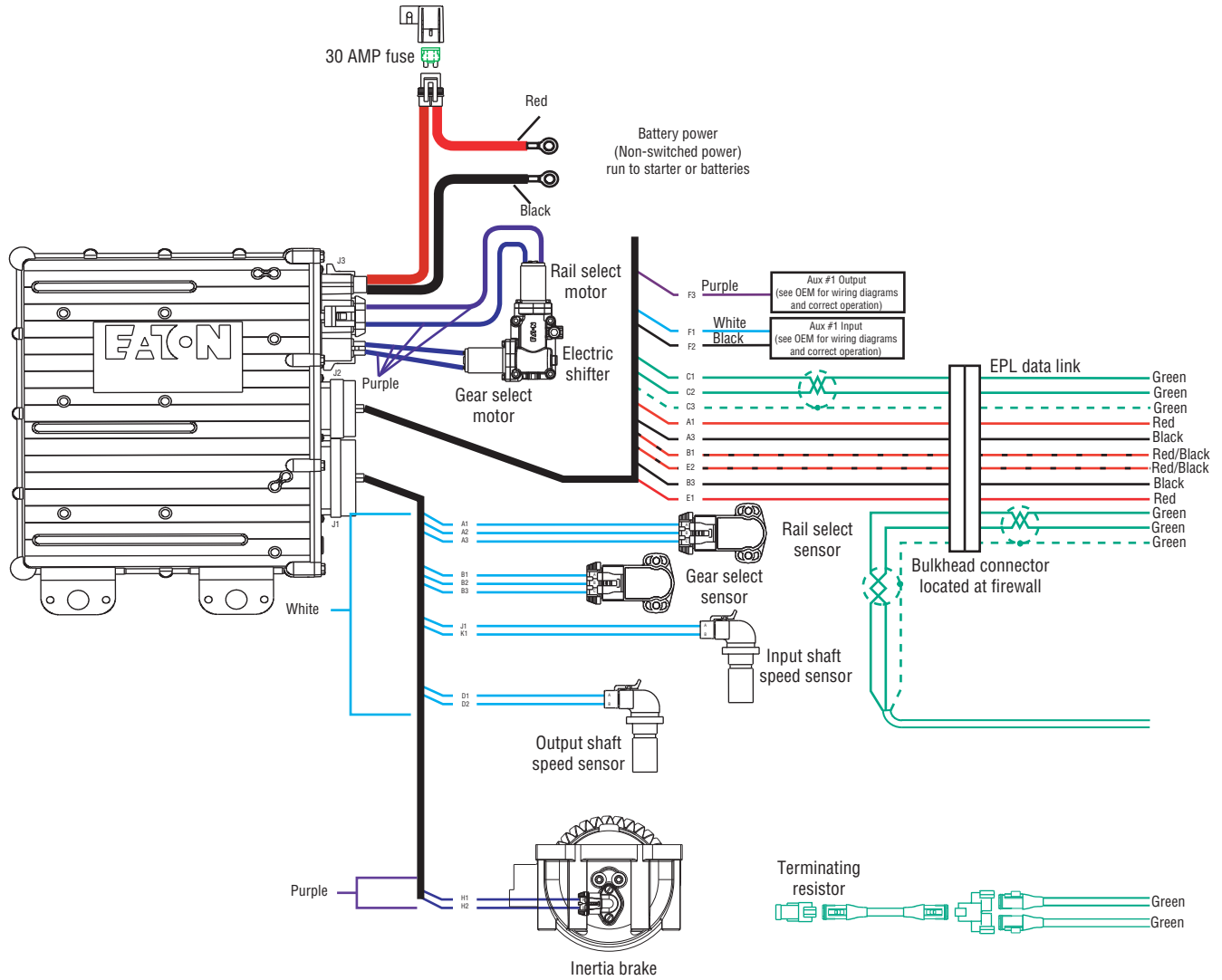
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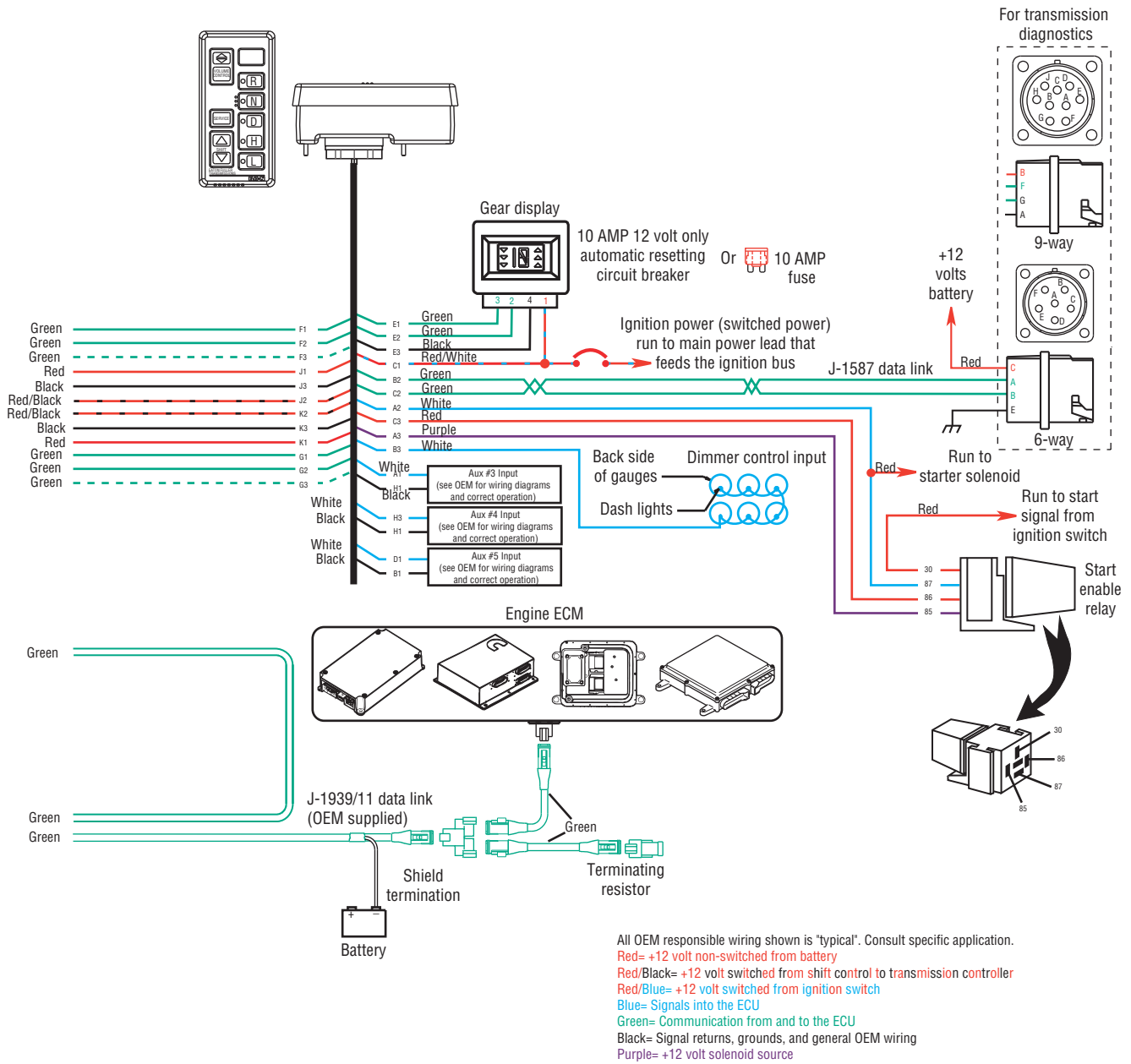
30-Way	Description	Notes
K3	GND 2	



# Wiring Diagrams

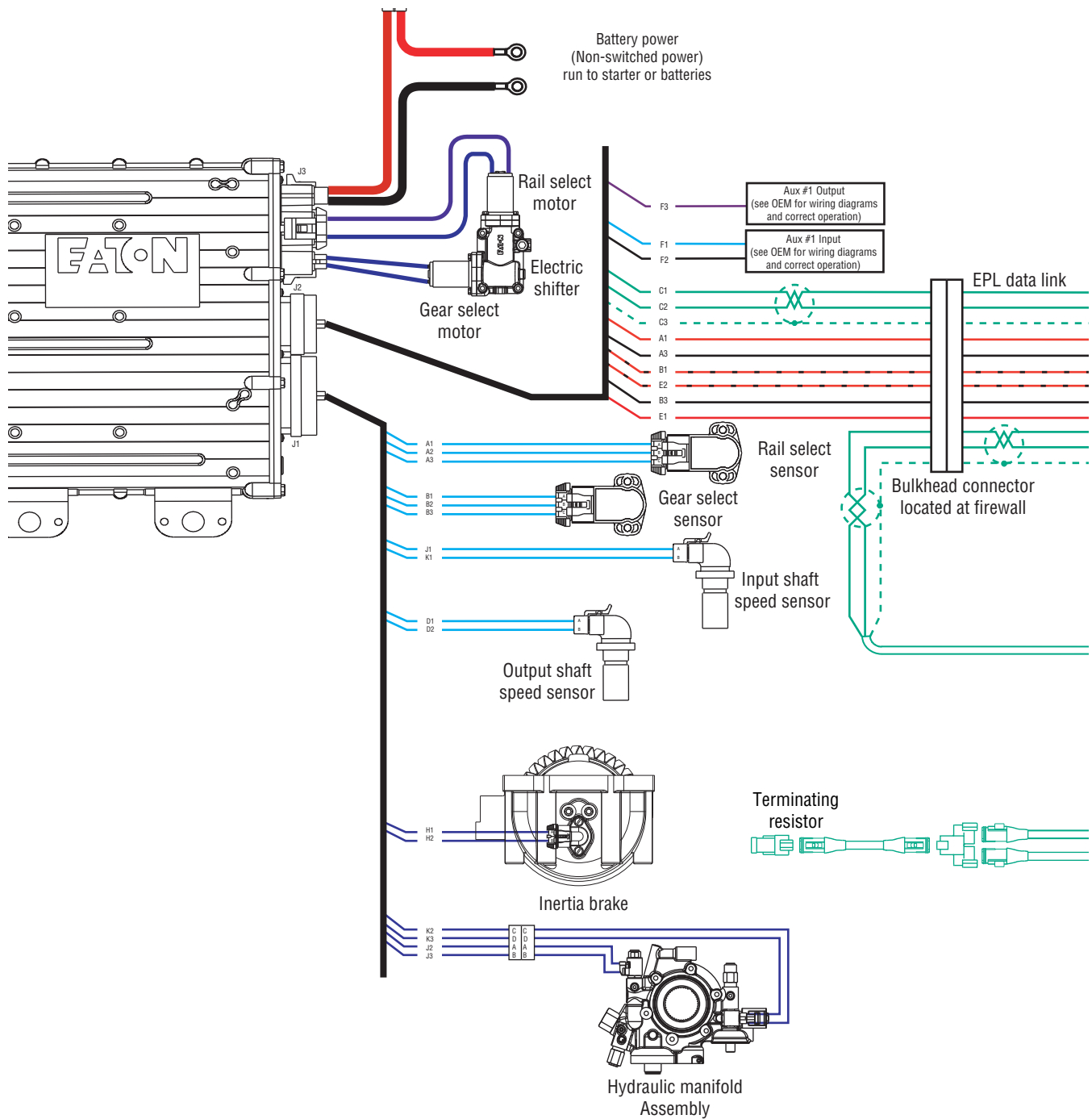
## 6-Speed and 7-Speed AutoShift







## 6-Speed UltraShift ASW



All OEM responsible wiring shown is "typical". Consult specific applica

(A1, E1) = +12 volt non-switched from battery

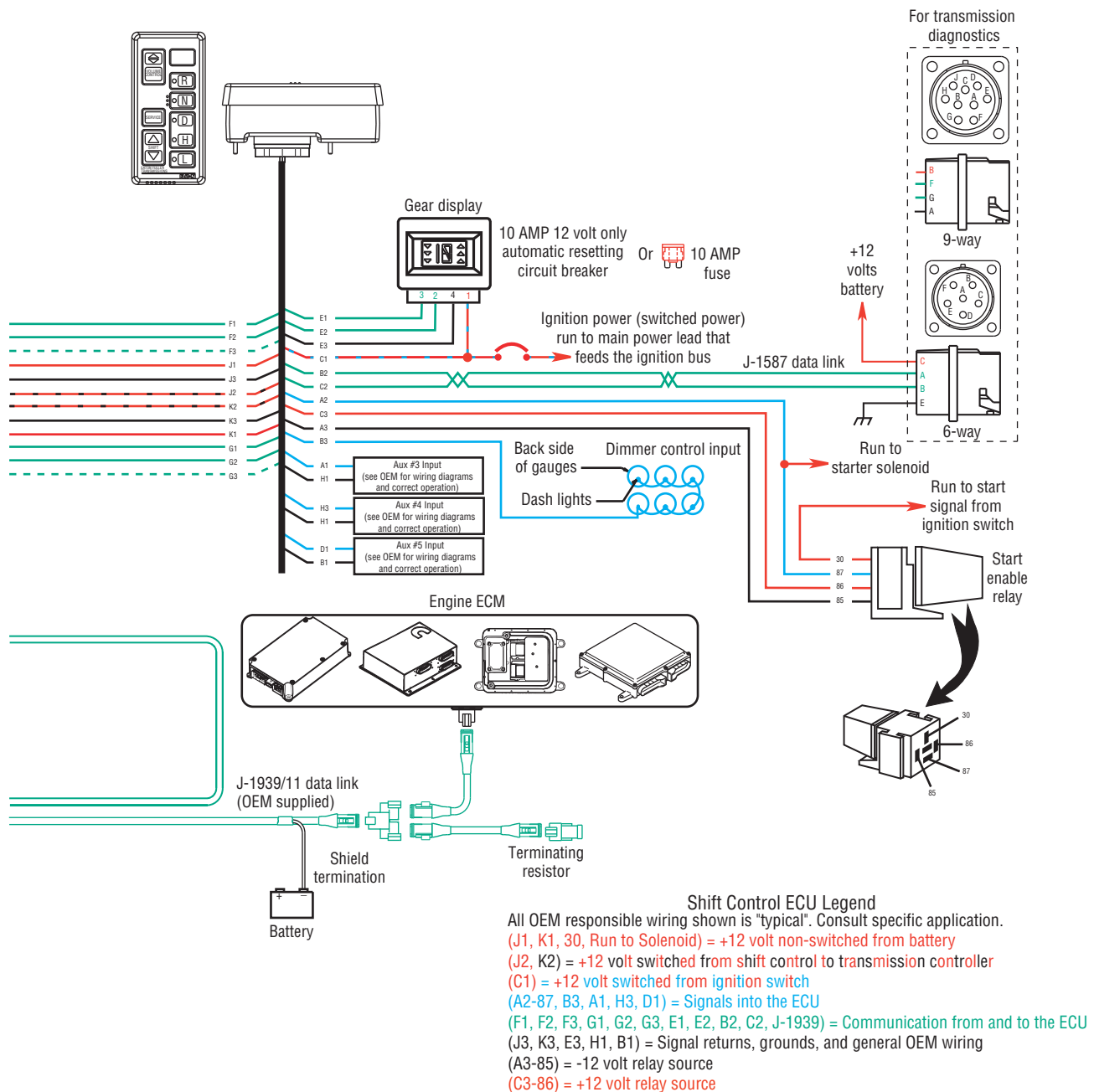
(B1, E2) = +12 volt switched from shift control to transmission contro

(F1) = Signals into the ECU

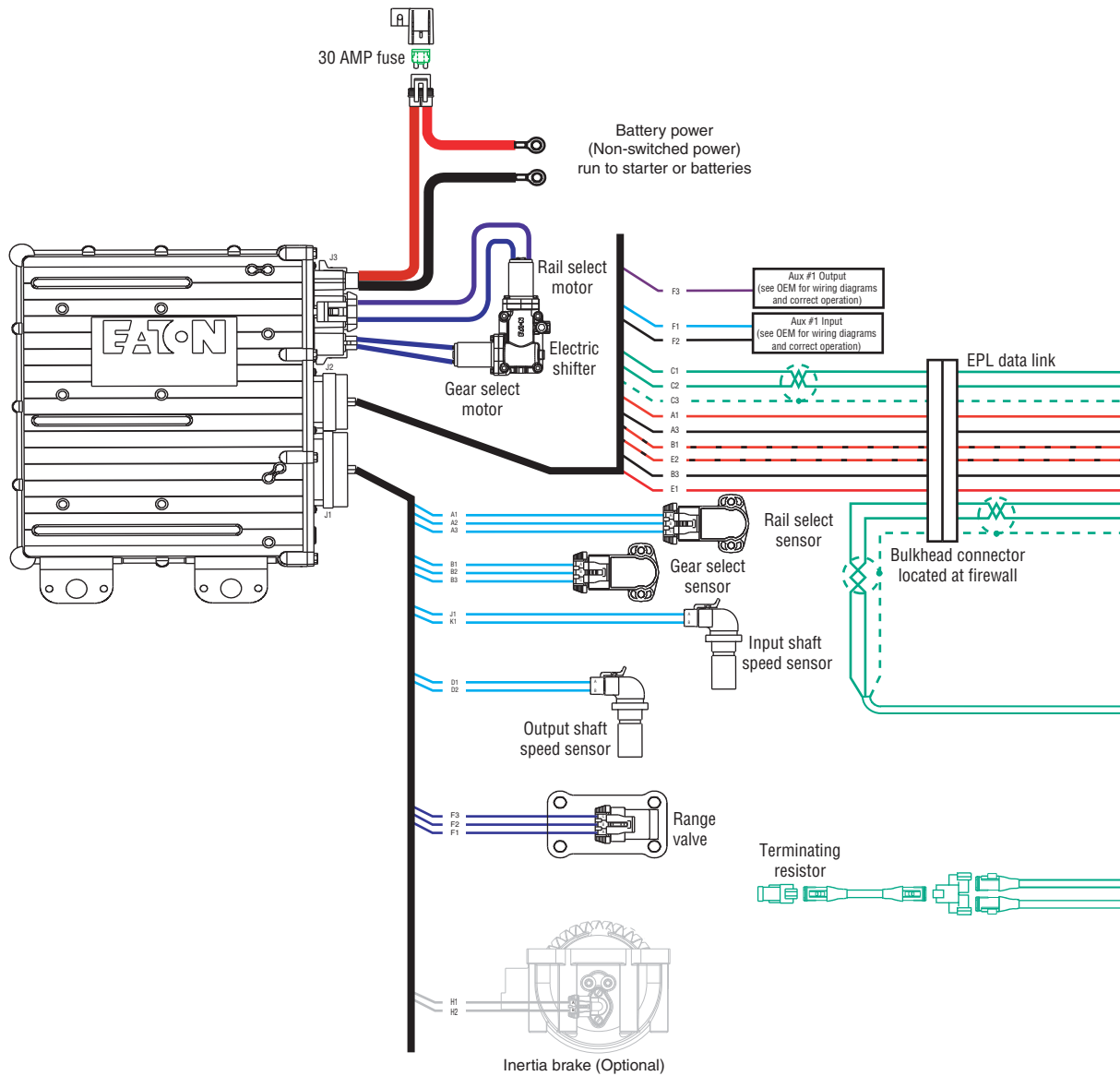
(C1, C2, C3, J-1939) = Communication from and to the ECU

(F2, A3, B3) = Signal returns, grounds, and general OEM wiring

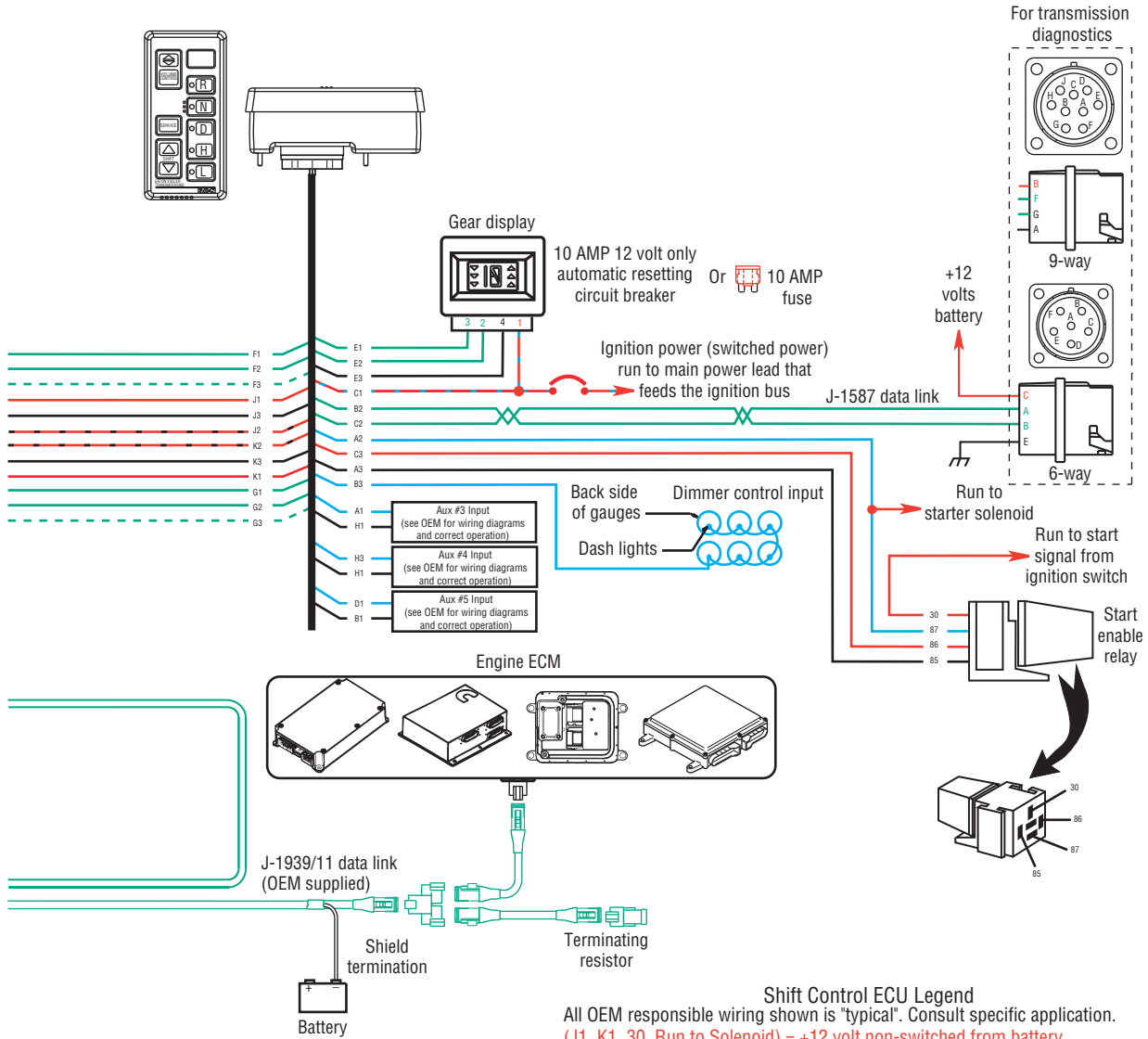
(F3) = Aux output 1



# 10-Speed AutoShift



**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

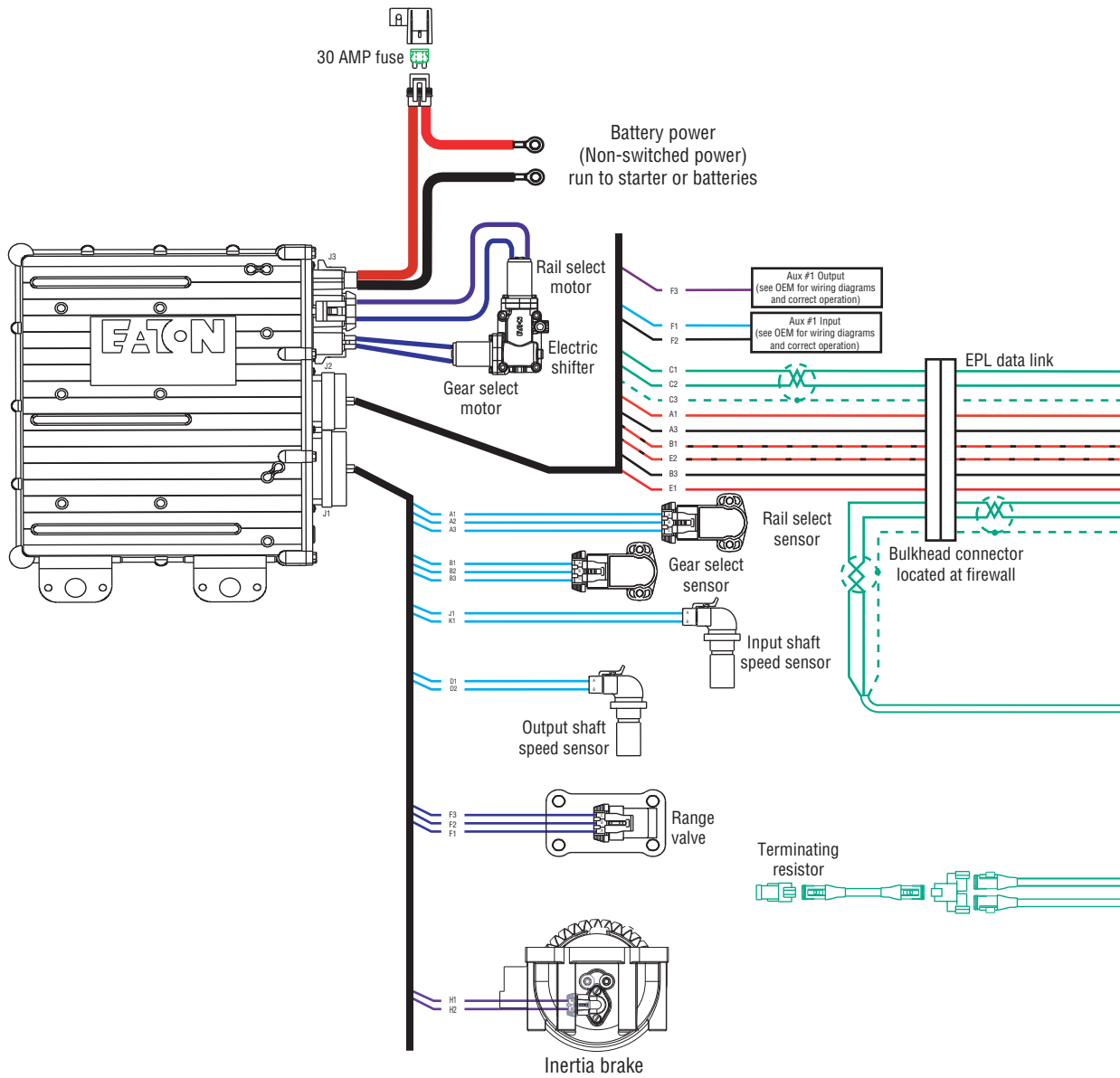
(F1, F2, F3, G1, G2, G3, E1, E2, B2, C2, J-1939) = Communication from and to the ECU

(J3, K3, E3, H1, B1) = Signal returns, grounds, and general OEM wiring

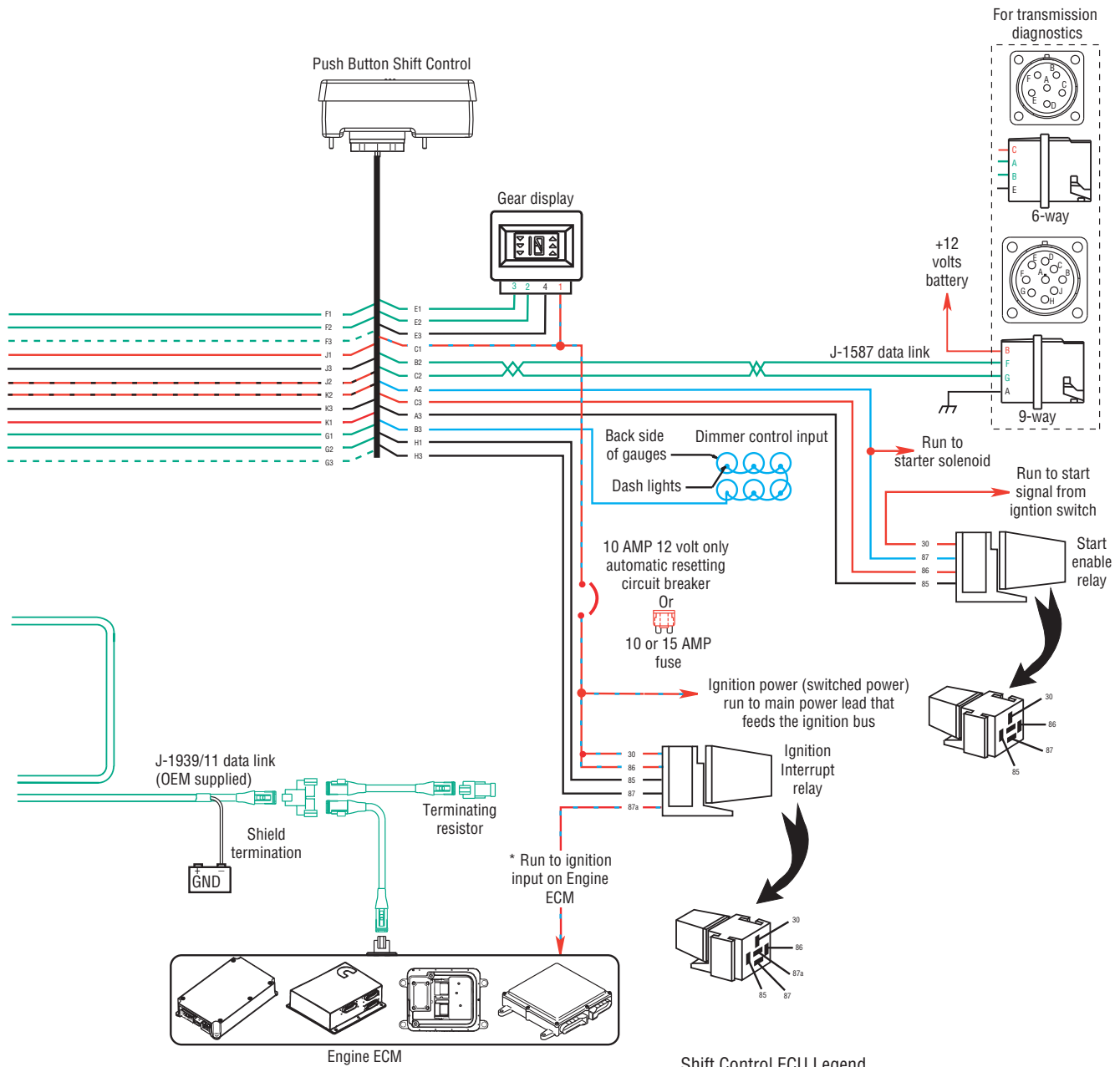
(A3-85) = -12 volt relay source

(C3-86) = +12 volt relay source

# 10-Speed UltraShift DM



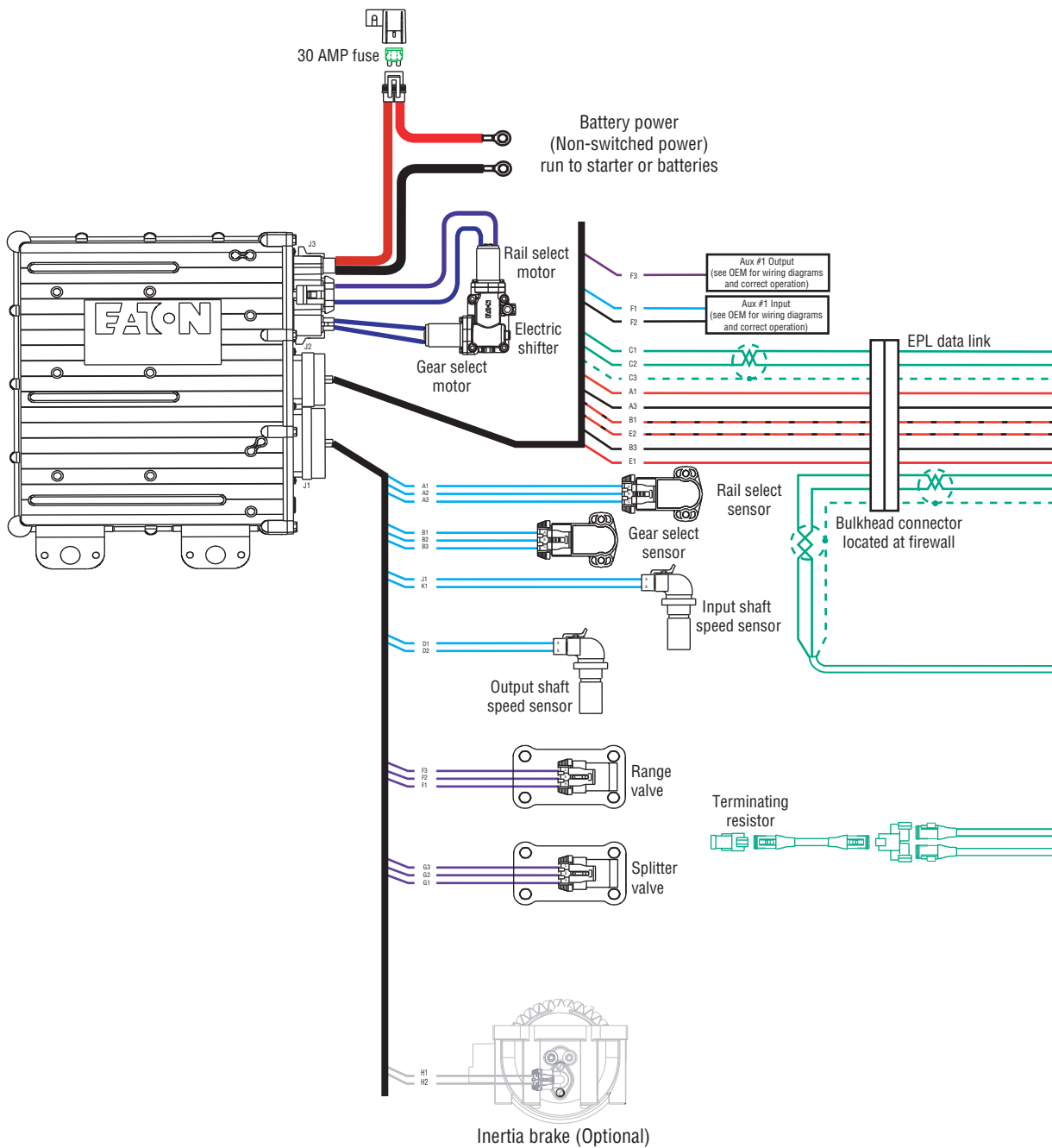
**Trans ECU Legend**  
 All OEM responsible wiring shown is "typical". Consult specific application.  
 (A1, E1) = +12 volt non-switched from battery  
 (B1, E2) = +12 volt switched from shift control to transmission controller  
 (F1) = Signals into the ECU  
 (C1, C2, C3, J-1939) = Communication from 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

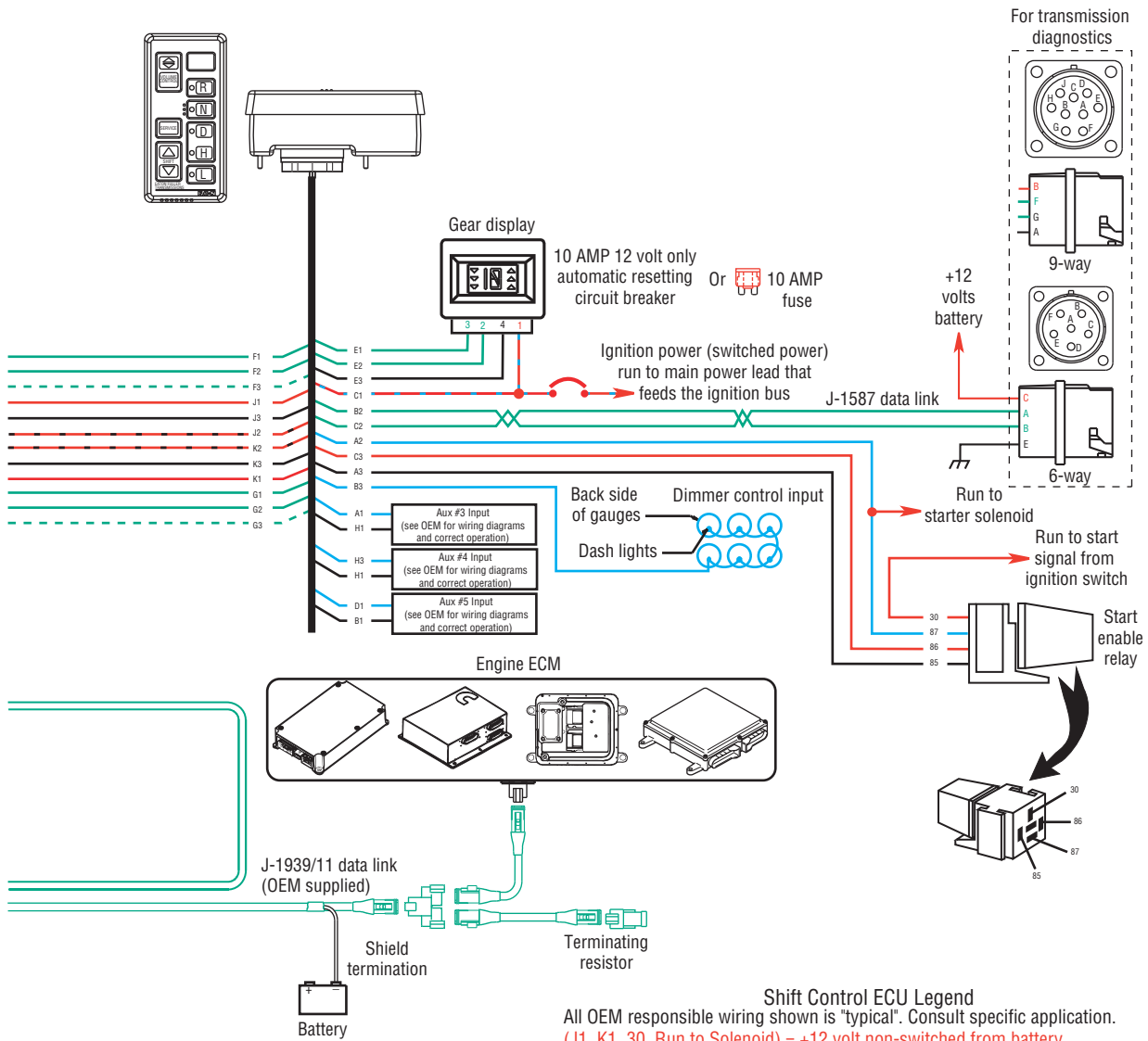
**Shift Control ECU Legend**  
 All OEM responsible wiring shown is "typical". Consult specific application.  
 (J1, K1, Run to Solenoid, Start: 30) = +12 volt non-switched from battery  
 (J2, K2) = +12 volt switched from shift control to transmission controller  
 (C1, Ignition Power, Ignition: 30, 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



### Trans ECU Legend

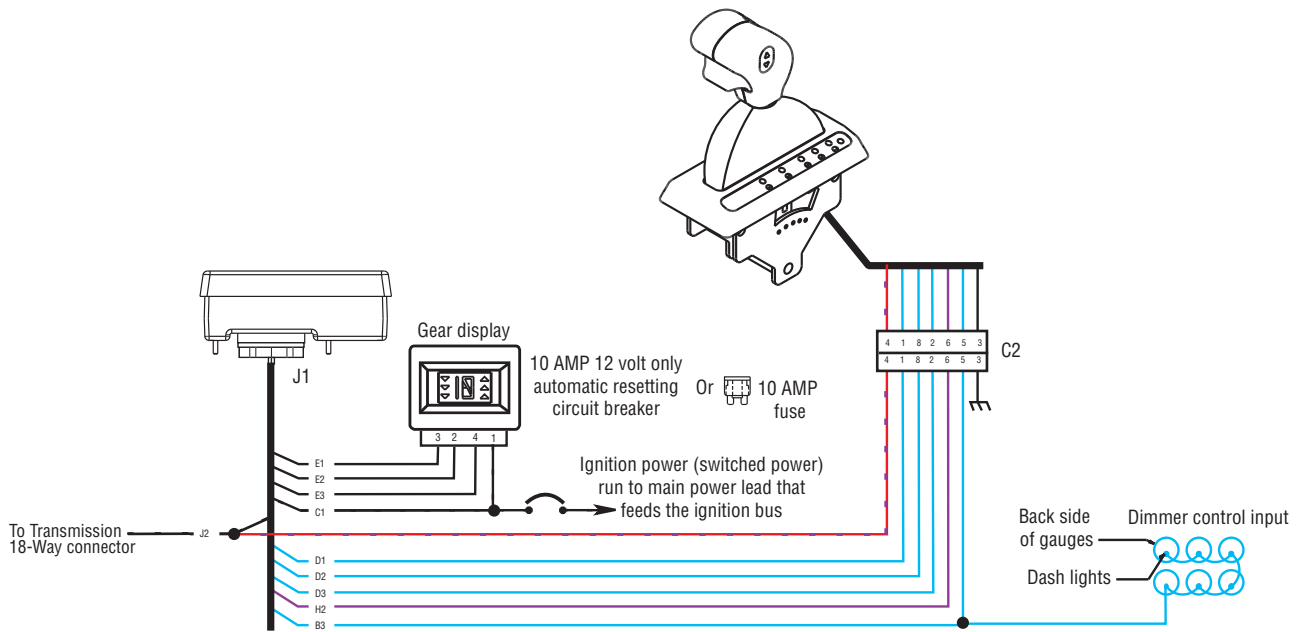
- All OEM responsible wiring shown is "typical". Consult specific application.
- (A1, E1) = +12 volt non-switched from battery
- (B1, E2) = +12 volt switched from shift control to transmission controller
- (F1) = Signals into the ECU
- (C1, C2, C3, J-1939) = Communication from and to the ECU
- (F2, A3,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



### Shift Lever Legend

All OEM responsible wiring shown is "typical". Consult specific application.

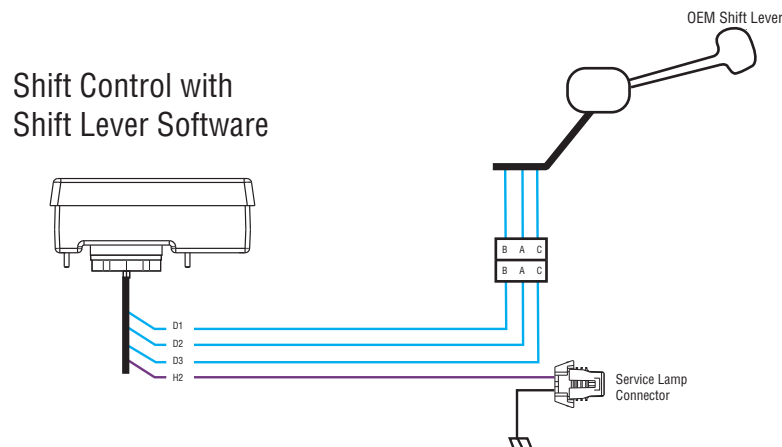
(J2-4) = +12 volt switched from shift controller to shift lever

(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



### 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 presses 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 Shaft will not slow down and the transmission will not shift into gear.

### Check For Proper Clutch Operation

#### With PC-Based Service Tool

1. Connect PC-Based Service Tool.
2. Make sure the transmission is in neutral
3. Start engine.
4. Select "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. Repair or replace as needed.
7. Press 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. Press Clutch Pedal fully to activate Clutch Brake and hold for 2 seconds.
5. Place transmission in starting gear.
6. If 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 Step 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, troubleshoot 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 instructions.

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

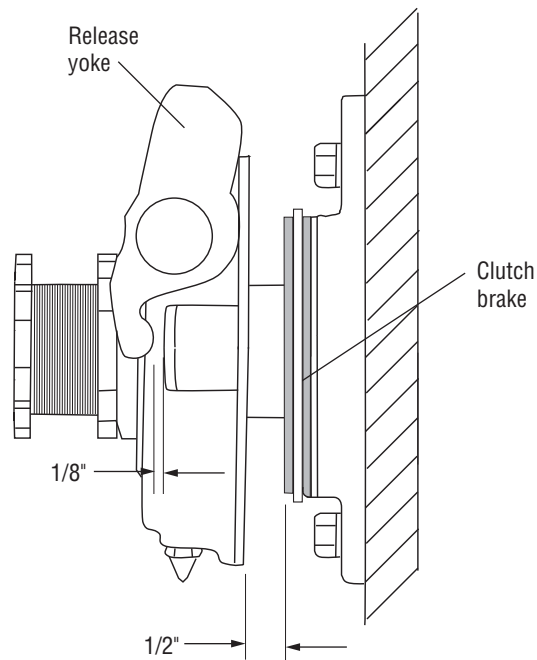
Use a 1/8" or 1/16" gauge to verify proper free-play gap. This gap should be 1/8" Easy Pedal and 1/16" Solo.

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

### Confirm Proper Clutch Brake Contact

Insert a 0.010" Feeler gauge between the Release Bearing and the Clutch Brake. Have an assistant fully press the Clutch Pedal. The 0.010" 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 0.010" Feeler gauge should slide out when the clutch pedal is 1/2" to 1" above the cab floor or lower Pedal Stop.

If the 0.010" Feeler gauge is not adequately squeezed to prevent removal, or can be removed with the pedal less than 1/2" or greater than 1", check and adjust the Clutch Pedal height and travel per the chassis manufacturer instructions. In addition, check the external Clutch Linkage for excessive wear or obstruction preventing complete travel.

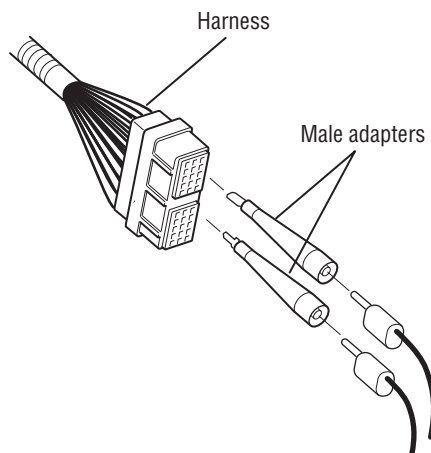


## Adapter Test Kit J43318

### Gray Adapters

Gray adapter are only used for the following connectors:

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



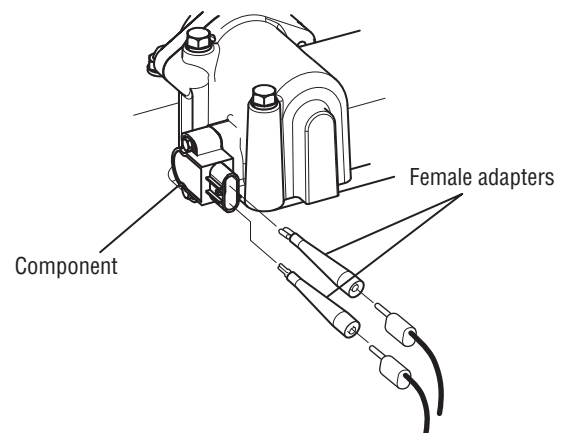
### Purple Adapters

Purple adapter are 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.



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## 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 Operator notice an “F” in the Gear Display? In addition, does the Operator 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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Pro Gear & Transmission, Inc.



**1 (877) 776-4600**

**(407) 872-1901**

**parts@eprogear.com**

**906 W. Gore St.**

**Orlando, FL 32805**

