

Eaton UltraShift PLUS[®], UltraShift[®] and AutoShift[®] Transmissions TRTS0930

March 2012

F-5405B-DM3	RTLO-18918A-AS3	RTOM-16910B-DM3	FOM-15E310C-VAS	FO-16E309ALL-VMS
F-5505B-DM3	RTLO-20918A-AS3	FO-14E310C-LAS	FOM-16E310C-VAS	FO-17E309ALL-VMS
F-6405B-DM3	RTLO-22918A-AS3	FO-16E310C-LAS	FO-10E308LL-VCS	FO-14E313B-MHP
F-6505B-DM3	RTL0M-16913L-DM3	FO-18E310C-LAS	FO-11E308LL-VCS	FO-16E313B-MHP
FM-14D310B-LST	RTO-10910B-AS3	FOM-14E310C-LAS	FO-12E308LL-VCS	FO-18E313B-MHP
FM-15D310B-LST	RTO-10910B-DM3	FOM-15E310C-LAS	FO-14E308LL-VCS	FO-20E313B-MHP
FO-16D313E-LEP	RTO-12910B-AS3	FOM-16E310C-LAS	FO-16E308LL-VCS	FO-14E318B-MXP
FO-5406B-DM3	RTO-12910B-DM3	FM-14E310B-LAS	FO-17E308LL-VCS	FO-16E318B-MXP
FO-6406A-AW3	RTO-14910B-AS3	FM-15E310B-LAS	FO-16E313A-VHP	FO-18E318B-MXP
FO-6406B-DW3	RTO-14910B-DM3	EO-11E406B-PV	FO-18E313A-VHP	FO-20E318B-MXP
FO-8406A-AW3	RTO-14910C-AS3	FO-10E310C-VAS	FO-20E313A-VHP	FO-22E318B-MXP
FOM-16D313E-LEP	RTO-16910B-AS3	FO-12E310C-VAS	FO-10E309ALL-VMS	FO-14E318B-VXP
RTLO-14918A-AS3	RTO-16910B-DM3	FO-14E310C-VAS	FO-11E309ALL-VMS	FO-16E318B-VXP
RTLO-16913L-DM3	RTO-16910C-AS3	FO-16E310C-VAS	FO-12E309ALL-VMS	FO-18E318B-VXP
RTLO-16918A-AS3	RTO-18910B-AS3	FOM-14E310C-VAS	FO-14E309ALL-VMS	FO-20E318B-VXP
				FO-22E318B-VXP



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SUPPORT

Warnings And Cautions

Warnings and Cautions

WARNING

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

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

WARNING

Before starting a vehicle:

- Ensure adequate fuel level.
- 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:

- Ensure ignition is off while hands are within the clutch housing area.
- 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

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

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:

- Place shift lever in neutral
- Lift the drive wheels off of the ground or disconnect the driveline

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

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Suggested Tools

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 3
- Contact Eaton: 1 (800) 826-4357

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

9-Pin Deutsch Diagnostic Adapter

- SPX / Kent-Moore 1 (800) 328-6657
- P/N J-44012

Vehicle Link Adapters

- RP1210A Compatible USB Adapters recommended for ServiceRanger version 3.

Note: These adapters support both J1708/J1587 and J1939 product communications

- Dearborn: DPA 4+Plus (P/N DG-DPA4PLUS)
- NEXIQ: USB-Link (P/N 125032)
- Noregon: JPRO USB-Data Link Adapter (P/N 12202)

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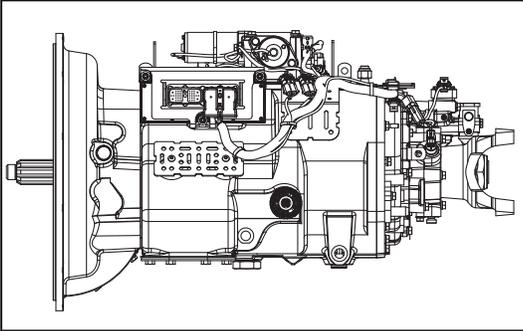
For spec'ing or service assistance, call 1-800-826-HELP (4357) or visit our web site at:
www.roadranger.com. In Mexico, call 001-800-826-4357.



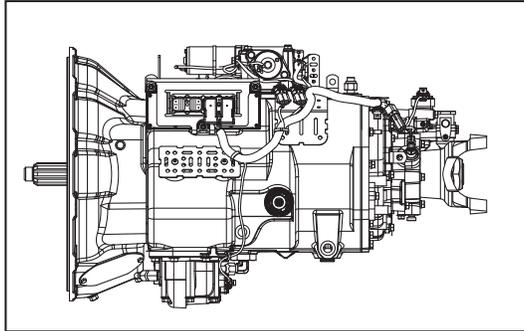
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Transmission Models Included

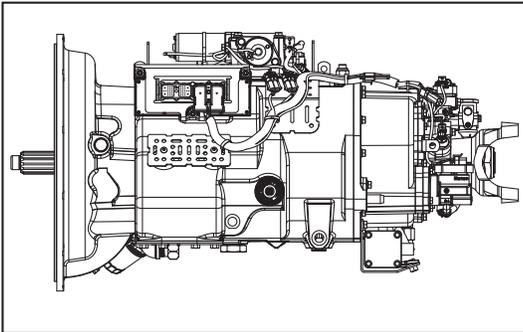
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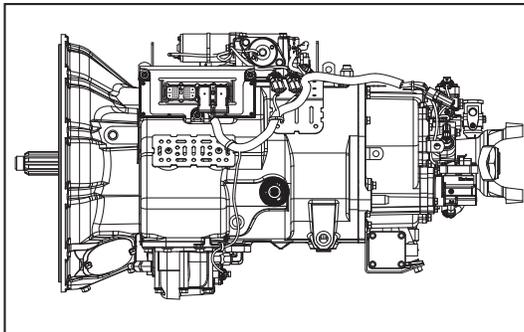
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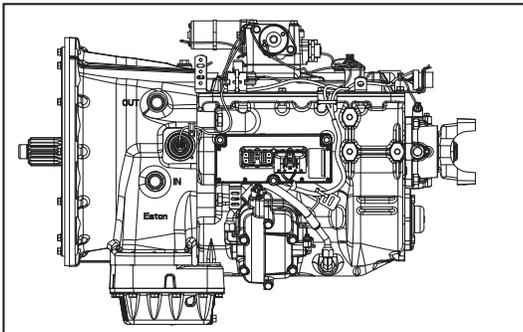
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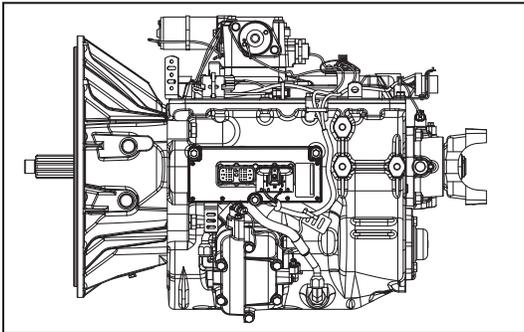
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F(0)-X406X-AW3

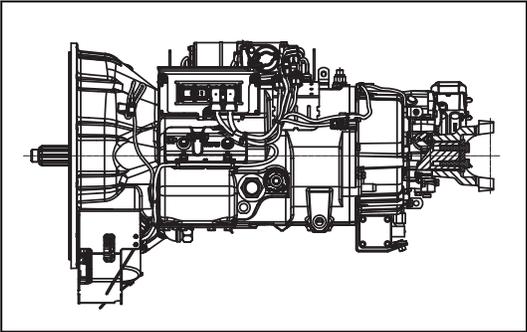


F(0)-X405X-DM3 or F(0)-X406X-DM3

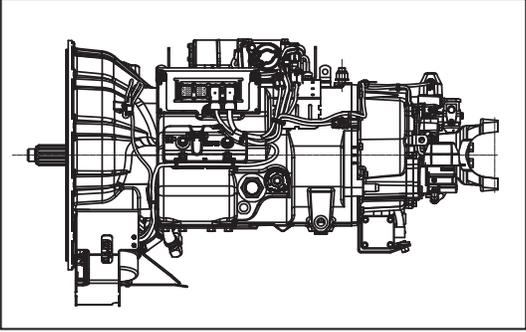


Transmission Models Included

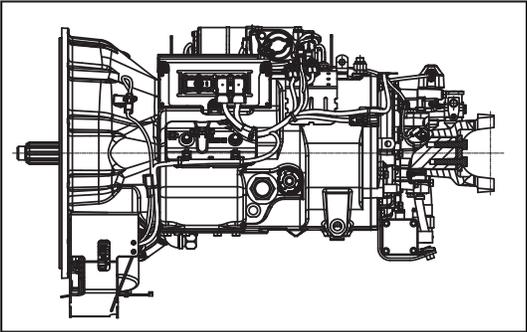
FO-1XE309LL-VMS, FO-1XE308LL-VCS



FO-1XE318-VXP or MXP, FO-1XE313-MHP



F(O)(M)-1XE310-LAS



Diagnostic Procedures

Diagnostic Procedures

STEP A

Procedure	→	Condition	→	Action
1. Key on.				
2. Observe gear display.				
Note: An "88" may show up in the dash at key on. This indicates the Transmission ECU has completed power-up. If the transmission and gear display power-up at the same time, you may not see an "88".		If blank Gear Display		Go to STEP B
		If "-" (One Dash) on Gear Display		Go to STEP D
		If "--" (Two Dashes) or "***" (Two Stars) on Gear Display		Go to STEP D
		"#" (Gear Number) on Gear Display		<ol style="list-style-type: none"> a. Verify Shift Lever or Push Button is in Neutral. b. Turn key off and wait 2 minutes. c. Hold clutch half way to the floor. (If equipped) d. Turn on key. e. If problem continues, call 1-800-826-HELP (4357)
		"F" (Fault Code) on Gear Display		Go to STEP D
		"N" (Neutral) on Gear Display		Go to STEP B

STEP B

Procedure	Condition	Action
1. Attempt to Start Engine	No engine crank, lever is in Neutral and Gear Display is "N" (Neutral)	Perform Start Enable Relay Contact Test.
	No engine crank, lever is in Neutral and Gear Display is blank	Perform Power-Up Sequence Test . If no problems found, refer to OEM for Gear Display problem.
	No engine crank and lever is NOT in Neutral	<ul style="list-style-type: none"> a. Verify Shift Lever or Push Button is in Neutral. b. Turn key off and wait 2 minutes. c. Hold clutch half way to the floor. (If equipped) d. Turn on key. e. If problem continues, call 1-800-826-HELP (4357)
	Engine cranks and Gear Display is blank	Refer to OEM for Gear Display problem.
	Engine cranks and Gear Display is "N" (Neutral)	Go to STEP C

STEP C

Procedure	Condition	Action
1. Engage a gear	Unable to engage gear (ie. flashing gear display with down arrows, or solid "N")	AutoShift Will Not Engage a Gear from Neutral Test UltraShift Will Not Engage a Gear from Neutral Test, UltraShift PLUS Product Will Not Engage a Gear From Neutral Test, or UltraShift AW3 Clutch Engagement Test depending on transmission type.
	Solid "#" (gear number) but no drive	Follow Front Box Control Test on page 371 .
	Gear engaged and drives	Go to STEP E

Diagnostic Procedures

STEP D

Procedure	Condition	Action
1. Check for active codes.	If codes are present	Go to Fault Code Isolation Procedure Index .
	If no codes and Gear Display is "-" (One Dash)	<ol style="list-style-type: none"> Verify Shift Lever or Push Button is in Neutral. Turn key off and wait 2 minutes. Hold clutch half way to the floor. (If equipped) Turn on key. If problem continues, call 1-800-826-HELP (4357) See Front Box control Test.
	If no codes and Gear Display is "--" (Two Dashes) or "***" (Two Stars)	Go to Power Up Sequence Test . If no problem found, refer to OEM for display problem.

STEP E

Procedure	Condition	Action
1. Record and clear inactive fault codes		
2. Drive vehicle and attempt to reset code.	If no codes are present	Test Complete.
	If inactive transmission component or system codes	Record codes and call 1-800-826-HELP (4357).
	If active transmission component or system codes	Go to Fault Code Isolation Procedure Index .

Fault Code Retrieval/Clearing

Retrieving Fault Codes Manually

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

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

- Place the shift lever in neutral.
- Set the parking brake.
- Turn the ignition key on but do not start the engine. If the engine is already running, you may still retrieve codes, however, do not engage the starter if the engine stalls.
- To Retrieve Active Codes: Start with the key in the on position. Turn the key off and on two times within five seconds ending with the key in the on position. After five seconds, the service lamp begins flashing two-digit fault codes. If no faults are active, the service light will flash code 25 (no codes). This is also the procedure to enter, see [Product Diagnostic Mode \(PDM\)](#) on page 19 for details.

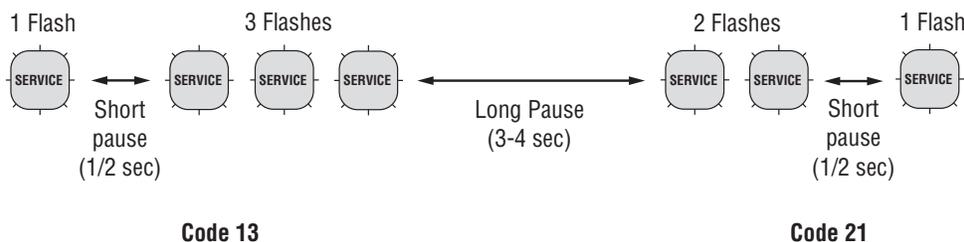
Note: An "88" may show up in the dash at key on, which is a normal power-up test of the display.



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



- Two digit fault codes will be displayed in the Gear Display. Some vehicle may be equipped with a service light. Observe the sequence of flashes on the service light and record the codes. A one to two second pause separates each stored code, and the sequence automatically repeats after all codes have been flashed.



Clearing Fault Codes Manually

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

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

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



Note: If the codes have been successfully cleared, the service lamp will come on and stay on for five seconds. The gear display will show 25 (no codes).

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

Retrieving Fault Codes with ServiceRanger

Overview

This section determines if the transmission ECU is communicating on the vehicle's J1939 data link and if the component has set any fault codes. In order for the system to operate properly, the transmission ECU must be able to communicate with other ECUs on the vehicle's J1939 data link.

Note: This procedure requires ServiceRanger 3.0 or later and an approved RP1210A communications adapter that supports J1939 communications.

Detecting Components

Connect the service PC to the vehicle's 9-pin J1939 diagnostic port connector with an approved RP1210A communications adapter. Start the ServiceRanger program and verify that a connection has been established with the vehicle's J1939 data link.

View the Vehicle Components screen in ServiceRanger and verify that the transmission ECU (source address 3) is being detected.

If the transmission ECU is not being detected by ServiceRanger, proceed to the Electrical Pretest procedure to check for power to the ECU and that all components are properly connected the vehicle's J1939 data link.

Viewing Fault Codes

View the Vehicle Fault Codes screen in ServiceRanger and verify if have set any Active or Inactive codes.

- If an Active code is present, record the vehicle fault information and proceed to Diagnostic Procedure in this manual for the Active code for more information. Do not clear any codes at this time.
- If only Inactive (historic) codes are present, record the vehicle fault information and clear all historic fault codes. Road test the vehicle to verify proper operation.

Clearing Fault Codes with ServiceRanger

After all repairs have been made and the system is functioning normally, clear all vehicle codes before placing the vehicle back into service. To clear codes, connect the service PC to the vehicle and start ServiceRanger. View the Vehicle Fault Codes screen and select Clear All. Refresh the screen to verify all historic codes have been cleared and that no Active codes are present.

Fault Code Isolation Procedure Index

Fault Codes	SPN	PID	SID	FMI	Description
11	629		254	12	No ECU Operation
12	629		254	13, 14	Improper ECU Configuration
13	751		231	8, 11	J1939 Shift Control Device
14 (without Park Pawl)	751		18, 19	2, 3, 4, 5	Invalid Shift Lever Voltage
14 (with Park Pawl)			18, 19	2, 3, 4, 5	Invalid Shift Lever Voltage (will show "F" in display)
15	751		18	9	HIL Shift Device Communication
16	625		248	2	High Integrity Link (HIL)
17	1321		237	3, 4, 14	Start Enable Relay Coil
18	520200	34		9	ECA Communication
19	520273		248	9	CAN ECA Message
21	70	70		14	Auto Neutral Park Brake Switch
22	563	49		9, 14	ABS CAN Message Fault
25					NO CODES
26	522		55	10	Clutch Slip
27	788		55	7, 13	Clutch Disengagement
28	788		52,55	3, 4, 5, 7	Clutch System
29	969	372		4, 5	Remote Throttle Enable
31	1485		218	2, 3, 4, 5, 14	Momentary Engine Ignition Interrupt Relay (MEIIR)
32	158	43		2	Loss of Switch Ignition Power Test

Fault Code Isolation Procedure Index

Fault Codes	SPN	PID	SID	FMI	Description
33	168	168		4	Low Battery Voltage Supply
34	168	168		14	Weak Battery Voltage Supply
35	639		231	2	J1939 Communication Link
36	639		231	14	J1939 Engine Message
37	627		251	5	Power Supply
41	768		35	7	Range Failed to Engage
41	769		36	7	Range Failed to Engage
42	770		37	7	Splitter Failed to Engage
42	771		38	7	Splitter Failed to Engage
43	768		35	3, 4, 5	Range High Solenoid Valve
43	769		36	3, 4, 5	Range Low Solenoid Valve
44	787		54	3, 4, 5	Inertia Brake Solenoid Coil
45	787		54	7	Intertia Brake Performance
46	770		37	3, 4, 5	Splitter Direct Solenoid Valve
46	771		38	3, 4, 5	Splitter Indirect Solenoid Valve
51	60	60		2, 3, 4, 10	Rail Position Sensor
52	59	59		2, 3, 4, 7	Gear Position Sensor
56	161	161		2, 3, 4, 5,10	Input Shaft Speed Sensor
57	160	160		2, 3, 4, 5	Main Shaft Speed Sensor
58	191	191		2, 3, 4, 5, 6, 8	Output Shaft Speed Sensor
61	772		39	1, 5, 6, 12	Rail Select Motor
63	773		40	1, 5, 6, 12	Gear Select Motor
64	788	34		2, 7, 12	ECA Fault
65	5052	192		5, 2	ECA Speed Sensor Fault

Fault Code Isolation Procedure Index

Fault Codes	SPN	PID	SID	FMI	Description
66	520271	34		3, 4	ECA Battery Voltage Fault
67	520274	158		3, 4, 5	ECA Ignition Voltage Fault
68	520274		227	14	Grade Sensor
68	520321		227	13, 14	Grade Sensor
71	560		60	7	Unable to Disengage Gear
72	772		59	7	Failed to Select Rail
73	781		58	7	Failed to Engage Gear
74	518	93		7	Engine Speed Response Fault
74	898	190		7	Engine Torque Response Fault
75*	560		60	14	Power Down In Gear
81	780		47	7	Gear Engagement Detected
83	751		18	14	Shift Lever Missing
83	752		19	7, 12	Shift Lever Missing
84	751		18	13	Shift Control Device Not Configured
84	752		19	13	Park Mechanism Not Calibrated
85	751		18	12	Shift Control Device Incompatible
99	781		58	14	Direction Mismatch

* This code will only be set inactive

- J1939 Source Address (SA) for Eaton transmissions is 3
- J1587 Module Identifier (MID) for Eaton transmissions is 130

Symptom-Driven Diagnostics Index

Symptom	Isolation Procedure
Unable to Shift Transmission with Up/Down Button	Up/Down Button Test
Engine Starting System Complaint	Start Enable Relay Contact Test
No J1587 Communication	J1587 Data Link Test
Gear Display Shows a Dash	Front Box Control Test
AutoShift Will Not Engage a Gear from Neutral	AutoShift Will Not Engage a Gear from Neutral Test
UltraShift DM Will Not Engage a Gear from Neutral	UltraShift DM Will Not Engage a Gear from Neutral Test
UltraShift AW3 Will Not Engage a Gear from Neutral	UltraShift AW3 Clutch Engagement Test
AutoShift AS3 Shift Complaint	AutoShift AS3 Shift Complaint Test
UltraShift DM Shift Complaint	UltraShift DM Shift Complaint Test
UltraShift AW3 Shift Complaint	UltraShift AW3 Shift Complaint Test
Shift Lever Back Light do not work	Shift Lever Back Light Test
UltraShift® PLUS Will Not Engage a Gear from Neutral	UltraShift® PLUS Will Not Engage a Gear from Neutral Test
UltraShift® PLUS Shift Complaint	UltraShift® PLUS Shift Complaint Test

Product Diagnostic Mode (PDM)

Product Diagnostic Mode (PDM)

Product Diagnostic Mode (PDM) is used to help diagnose inactive codes that may have been set during normal driving. This diagnostic mode increases the sensitivity of the fault sensing capability

This procedure tests loose, degraded, and intermittent connections. Use the active fault isolation procedure to guide you to the wiring and connectors that are associated with the inactive fault codes. Flex the wiring harness and connectors and attempt to recreate the fault after activating (PDM).

PDM is only to be used by a trained service technician in an authorized dealer.

This procedure is to be used prior to performing fault isolation procedures for component type codes when there are no active codes present.

To enter PDM mode

Note: Vehicle will not start in Product Diagnostic Mode (PDM). You must turn vehicle key “OFF” and allow the system to power down to exit PDM.

- Vehicle must be stationary, engine must not be running, vehicle parking brake must be set.
- Perform two key clicks of the ignition switch starting in the “ON” position and ending in the “ON” position

Note: An “88” may show up in the dash at key on, which is a normal power-up test of the display.

- The gear display will flash a 25 then a solid “PD” (Product Diagnostic Mode) and the mode will be activated.
- The service light shall flash code 25 once indicating no codes. The service light shall then illuminate solid to indicate PDM until such time that an active code is detected or PDM is exited.
- Refer to PDM section in Fault isolation procedure for the inactive fault to be diagnosed.
- “PD” will remain in gear display until an active fault has been set during the PDM fault isolation procedure.
- If the fault is detected during PDM mode the gear display will display the active fault/s. The warning tone will only sound when the fault is active and the tone will stop when the fault is inactive. The fault will stay in the gear display until the system is powered down.

Active codes set during PDM mode will not be stored as inactive.

- If a fault is detected, exit PDM mode and perform the corresponding “Fault Isolation Procedure”.
- To exit PDM mode, power the system down by turning the key to the “OFF” position.

PDM will only work with the following inactive codes

11, 13, 14, 15, 16, 17, 18, 19, 21, 22, 29, 33, 34, 35, 36, 43, 44, 46, 51, 52, 56, 57, 58, 61, 63, 65, 66, 67, 74, and 99.

Power-Up Sequence Overview

Power-Up Sequence

This test does not relate to any specific fault code, but must be completed if the self check fails at power up.

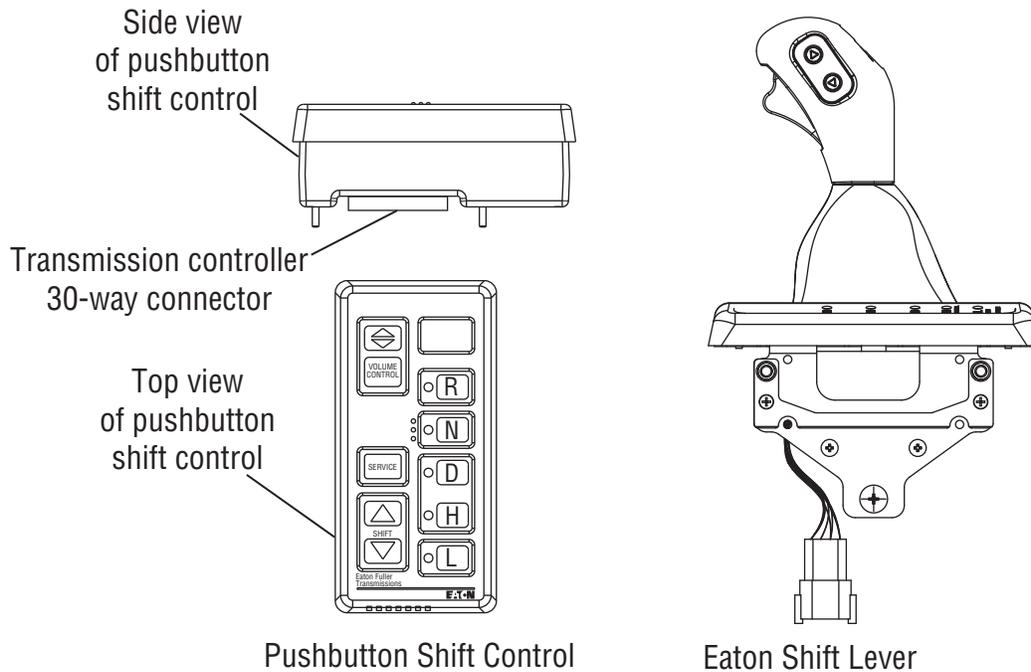
The Transmission ECU checks the program memory every time the key is turned on.

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

- Basic Hand Tools
- Troubleshooting Guide

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

- Vehicle Harness
- Shift Control Device
- Transmission ECU

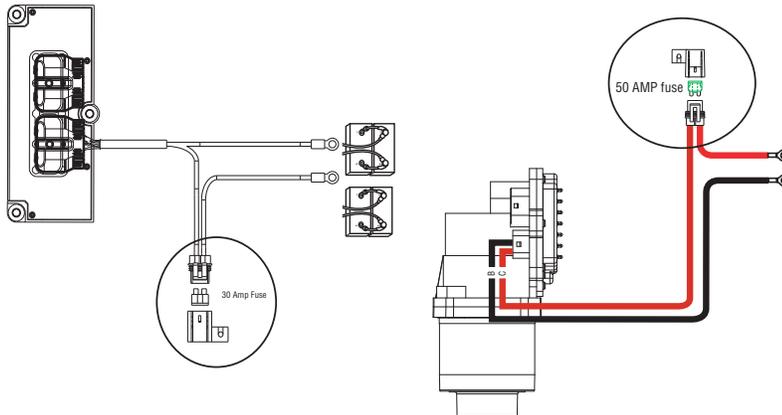


Power Up Sequence Test

Power-Up Sequence Test

STEP A

Procedure	Condition	Action
1. Key off.		
2. Remove and clean all battery and battery to frame connections.		
3. Remove and clean ground supply to engine ECU.		
4. Inspect starter/battery and inline 30 amp fuse holder connections for corrosion or damaged contacts.		



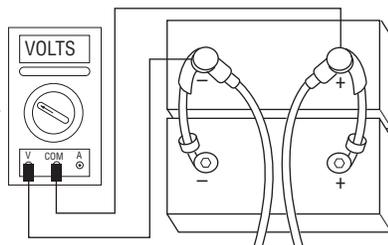
5. Measure voltage across batteries.

If voltage is 11 to 13 volts on a 12 volt system or 22 to 26 on a 24 volt system

Proceed with battery load test. Repair or replace batteries as required. Go To **STEP B**

If voltage is outside of range

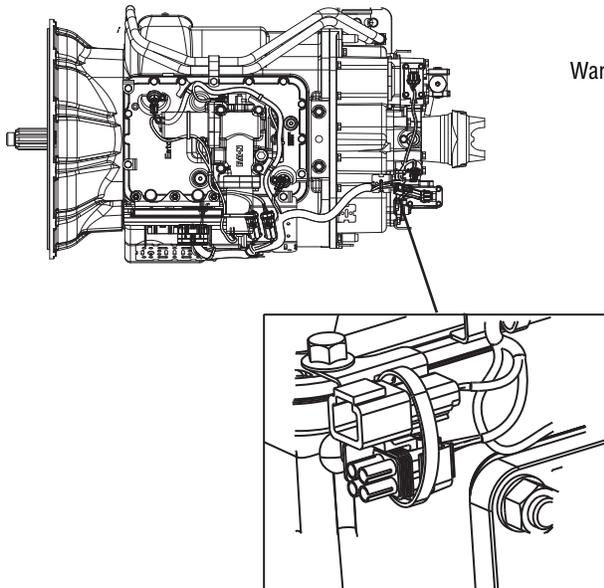
Repair or replace batteries and charging system as required. Repeat this step.



Power-Up Sequence Test Continued

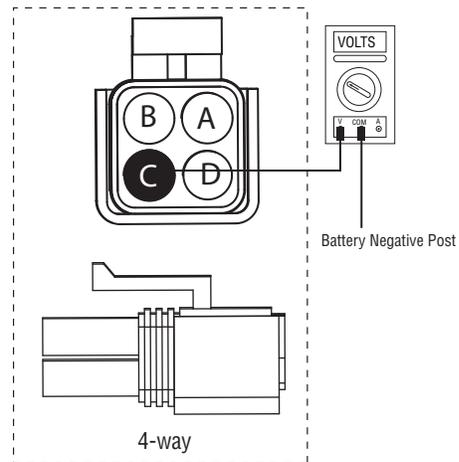
STEP B

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins C and the battery negative post.		If voltage between pin C and the battery negative post is 0.70 volts or less		Go to STEP C
		If voltage is outside of range		Repair battery ground supply to Transmission ECU. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port
4-Pin Diagnostics Port



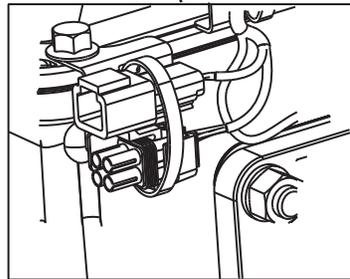
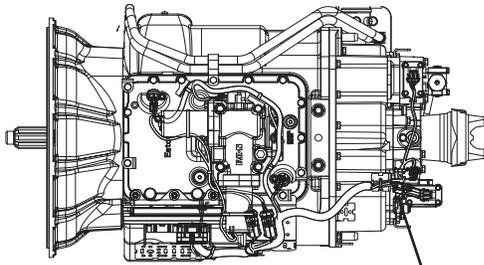
B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

Power Up Sequence Test

Power-Up Sequence Test Continued

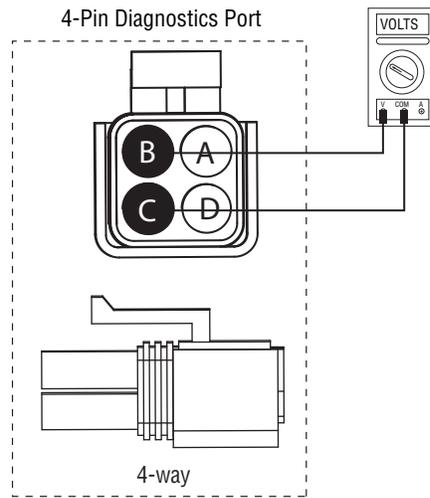
STEP C

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins B and pin C.		If voltage between pins B and C is within 0.6 volts of battery voltage		Go to STEP D
		If voltage is outside of range		Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port

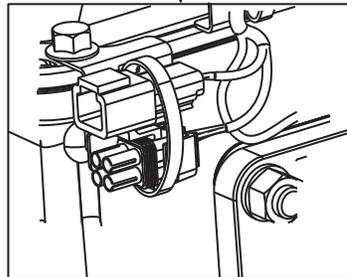
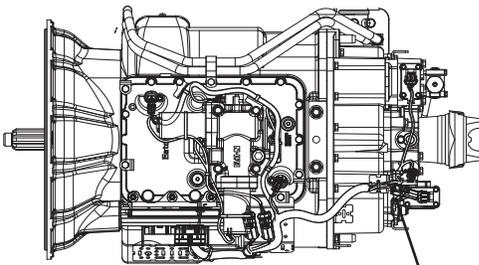


B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

Power-Up Sequence Test Continued

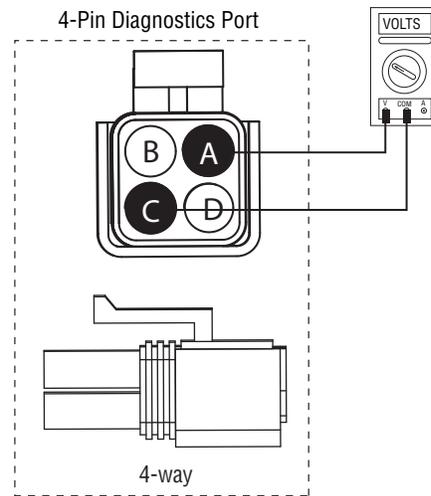
STEP D

Procedure	Condition	Action
1. Key on.		
2. Measure voltage between pin A and pin C.	If voltage between pins A and C is within 0.6 volts of battery voltage	Go to STEP E
	If voltage is outside of range	Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

STEP E

Procedure	Condition	Action
1. Is vehicle equipped with an Shift Lever?	If vehicle is not equipped with a Shift Lever	Go to STEP F
	If vehicle is equipped with a Shift Lever	Go to STEP K

Power Up Sequence Test

Power-Up Sequence Test Continued

STEP F

Procedure	Condition	Action
1. Is it an Eaton Push Button or and OEM J1939 Shift Device?	If an Eaton Push Button Shift Control	Go to STEP G
	If an OEM J1939 Shift Device	Refer to OEM for troubleshooting procedures.

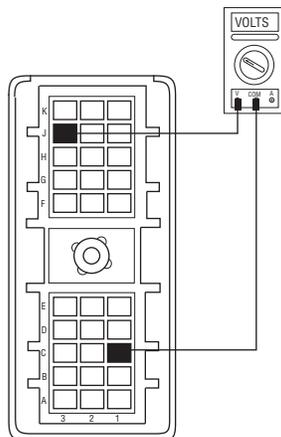
STEP G

Procedure	Condition	Action
1. Key on.		
2. Observe service lamp.		
Note: If service lamp is flashing go to Diagnostics Procedure.	If service lamp lights for one second and turns off	Test complete.
	If service lamp never comes on.	Go to STEP H
	If service lamp is on steady	Replace Shift Control. Go to STEP V

Power-Up Sequence Test Continued

STEP H

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect Shift Control 30-way connector.				
3. Key on.				
4. Measure voltage between Shift Control 30-way pins C1 and J3.		If voltage is within 1 volt of battery voltage		Replace Shift Control. Go to STEP V
		If voltage is outside of range		Go to STEP I



Power Up Sequence Test

Power-Up Sequence Test Continued

STEP I

Procedure	→	Condition	→	Action
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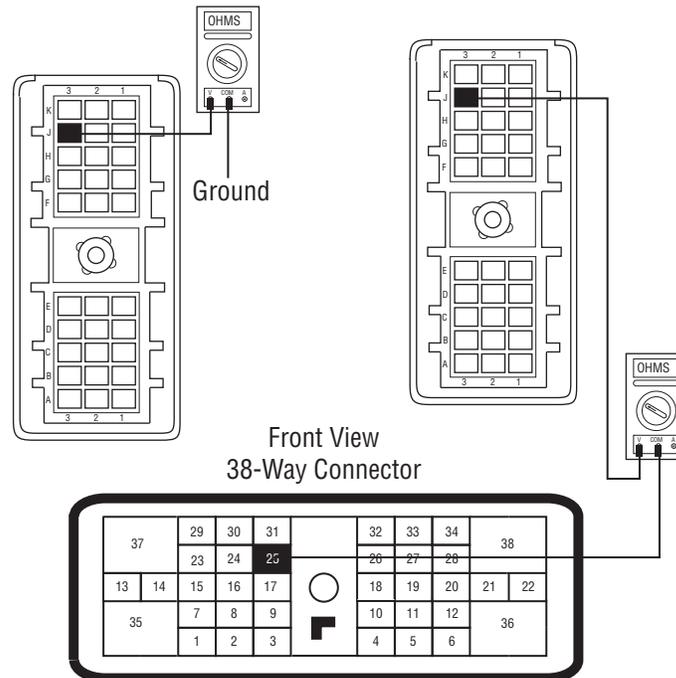
1. Key off.
2. Disconnect negative battery cable.
3. Disconnect 38-way Vehicle Harness from Transmission ECU.
4. Measure resistance between Transmission ECU pin 25 and Shift Control connector pin J3 and from then from pin J3 to ground.

If resistance from pin 25 to J3 is 0 to 0.3 ohms and resistance from J3 to ground is OL / Open

Go to **STEP J**

If resistance is outside of range

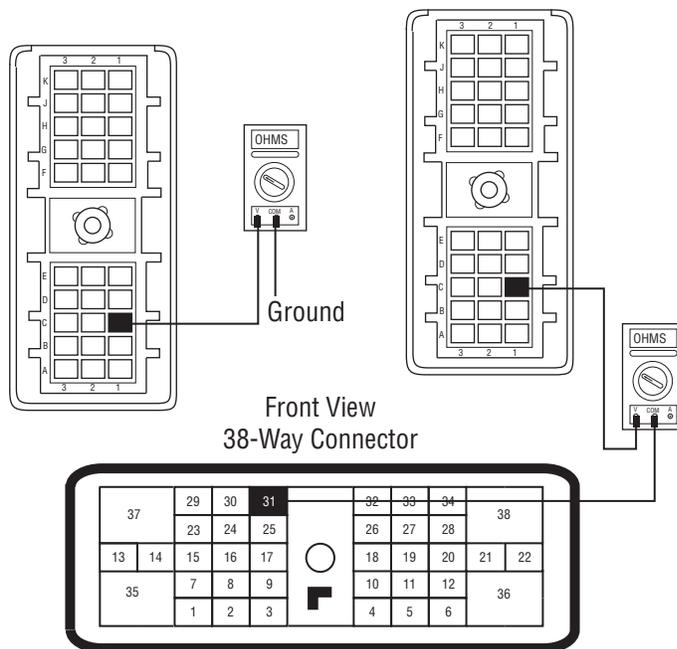
Repair the OEM harness.
Go to **STEP V**



Power-Up Sequence Test Continued

STEP J

Procedure	Condition	Action
1. Measure resistance between Transmission ECU pin 31 and Shift Control connector pin C1 and then from pin C1 to ground.	If resistance from pin 31 to C1 is 0 to 0.3 ohms and resistance from C1 to ground is 10K or OL	Replace the Transmission ECU. Go to STEP V
	If resistance is outside of range	Repair the OEM harness. Go to STEP V



STEP K

Procedure	Condition	Action
1. Is vehicle equipped with an Eaton supplied Shift Lever or an OEM supplied Shift Lever.	If Eaton Shift Lever	Go to STEP M
	If OEM Shift Lever	Go to STEP S

Power Up Sequence Test

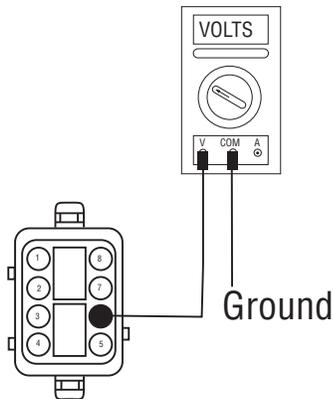
Power-Up Sequence Test Continued

STEP M

Procedure	Condition	Action
1. Key on.		
2. Observe service lamp.	If service lamp lights for one second and turns off	Test complete.
Note: If service lamp is flashing, go to Diagnostic Procedures .	If service lamp never comes on	Go to STEP P
	If service lamp is on steady	Go to STEP N

STEP N

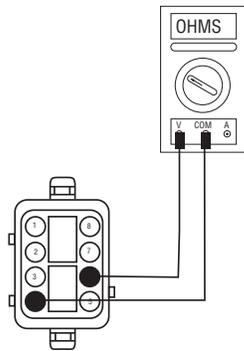
Procedure	Condition	Action
1. Disconnect Shift Lever 8-way connector.		
2. Key on.		
3. Measure voltage at pin 6 and ground.	If voltage is within 2 volts of battery voltage for one second, then 0 volts	Replace the Eaton Shift Lever. Go to STEP V
	If voltage is constant	Go to STEP O



Power-Up Sequence Test Continued

STEP O

Procedure	Condition	Action
1. Key off.		
2. Disconnect negative cable.		
3. Disconnect 38-way Vehicle Harness connector.		
4. Measure resistance between pin 6 and pin 4.	If resistance between pin 6 and 4 is OL / Open	Replace the Transmission ECU. Go to STEP V
	If resistance is less than 10K	Repair the OEM harness. Go to STEP V



STEP P

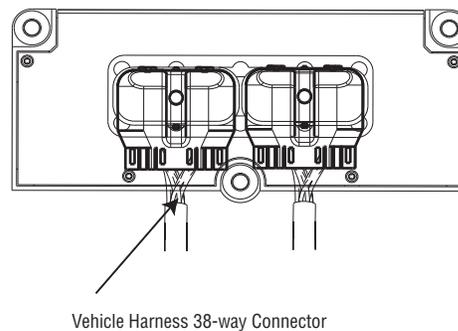
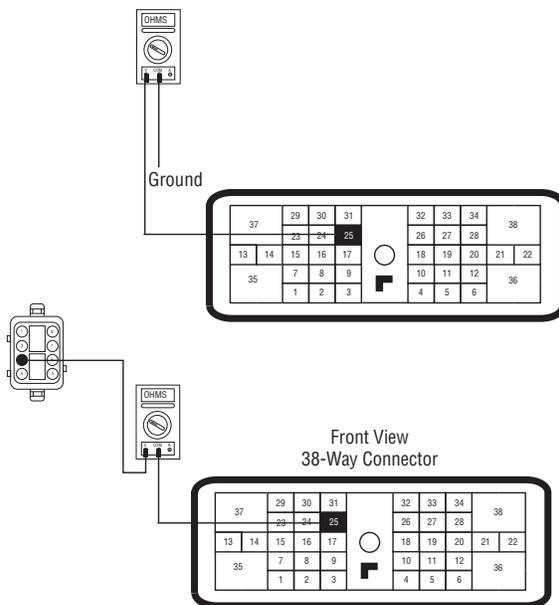
Procedure	Condition	Action
1. Key off.		
2. Disconnect Shift Lever 8-way connector.		
3. Key on.		
4. Measure voltage between pin 3 and pin 6.	If within 1 volt of battery	Replace Eaton Shift Lever. Go to STEP V
	If voltage is outside of range	Go to STEP O

Power Up Sequence Test

Power-Up Sequence Test Continued

STEP Q

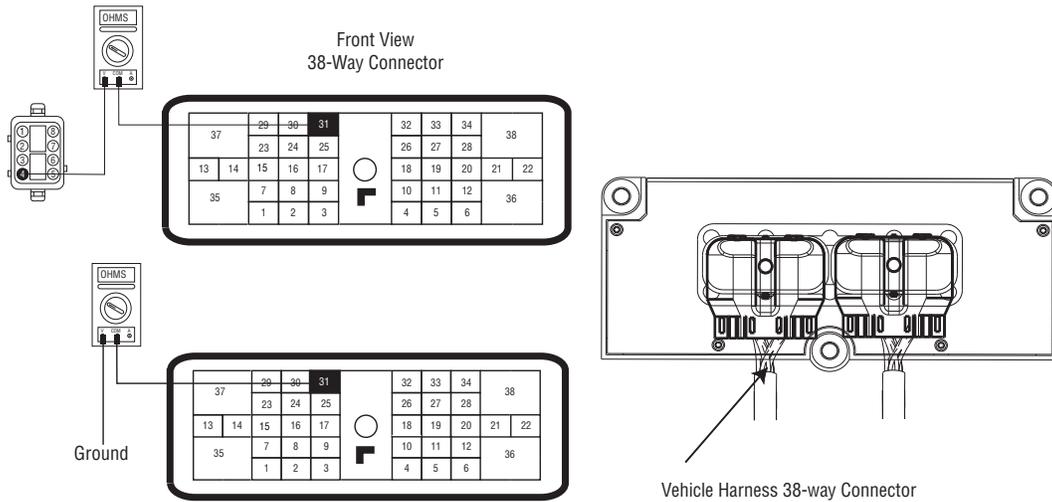
Procedure	→	Condition	→	Action
1. Key off				
2. Disconnect 38-way Vehicle Harness connector on Transmission ECU.				
Note: On Peterbilt disconnect Gear Display				
3. Measure resistance between pin 3 on the 8-way connector and pin 25 on the 38-way connector and from pin 25 to ground.		If resistance between pin 3 and 25 is 0 to 0.3 ohms and resistance from pin 25 to ground is OL.		Go to STEP R
		If resistance is outside of range		Repair harness between Vehicle Harness 38-way connector pin 25 and Vehicle Harness 8-way connector pin 3. Go to STEP V



Power-Up Sequence Test Continued

STEP R

Procedure	→	Condition	→	Action
1. Key off.				
2. Measure resistance between:		If resistance between pins 31 and 4 is 0 to 0.3 ohms and if resistance between pin 31 and ground is OL.		Replace Transmission ECU. Go to STEP V
<ul style="list-style-type: none"> Vehicle Harness 38-way connector pin 31 and Vehicle Harness 8-way connector pin 4 Vehicle Harness 38-way connector pin 31 and ground 		If any of the above conditions are not met		Repair harness between Vehicle Harness 38-way connector pin 31 and Vehicle Harness 8-way connector pin 4. Go to STEP V



Power Up Sequence Test

Power-Up Sequence Test Continued

STEP S

Procedure	Condition	Action
1. Key off.		
2. Locate service lamp connector on OEM harness.		
3. Key on.		
4. Measure voltage across pins A and B on the service lamp connector	If voltage is within 2 volts of battery voltage for one second, then 0 volts	Test complete.
	If no voltage is measured	Go to STEP T
	If voltage is within 2 volts of battery voltage continuously	Go to STEP U

STEP T

Procedure	Condition	Action
1. Key off.		
2. Disconnect negative battery cable.		
3. Disconnect 38-way connector.		
4. Measure resistance from pin A of the OEM connector to pin 23 of the 38-way and from pin 23 to ground.	If resistance from pin A to 23 is 0 to 0.3 ohms and resistance to ground is 10K or greater	Replace the Transmission ECU. Go to STEP V
	If resistance is outside of range	Repair the OEM harness. Go to STEP V

Power-Up Sequence Test Continued

STEP U

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect Transmission ECU 38-way connector.				
4. Measure voltage across service lamp connector pins A and B.		If no voltage is measured		Replace the Transmission ECU. Go to STEP V
		If voltage is within 2 volts of battery voltage		Repair OEM harness as required. Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors and the negative battery cable.				
3. Key on.		If Power-Up Sequence Test completes		Test complete.
		If Power-Up Sequence Test fails		To find error in testing, return to STEP A

Electrical Pretest Overview

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

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.

Theory of Operation

All Generation 3 products require the OEM to supply power to the transmission controller (TECU) and to the optional Electric Clutch Actuator (ECA).

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

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- Battery Load Tester
- ServiceRanger a PC-based Service Tool

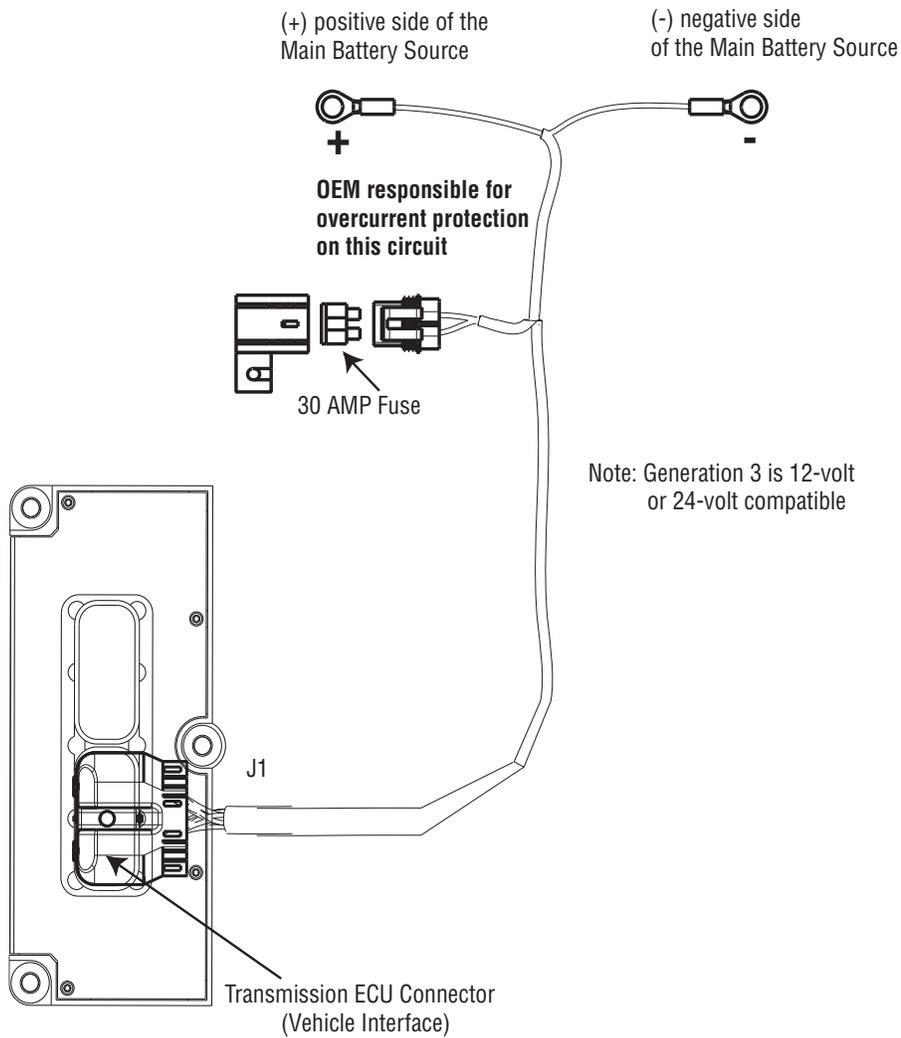
The pretest can be used for any of the following:

- Low Batteries
- Starter / Battery connections
- Main power harness to the Transmission ECU

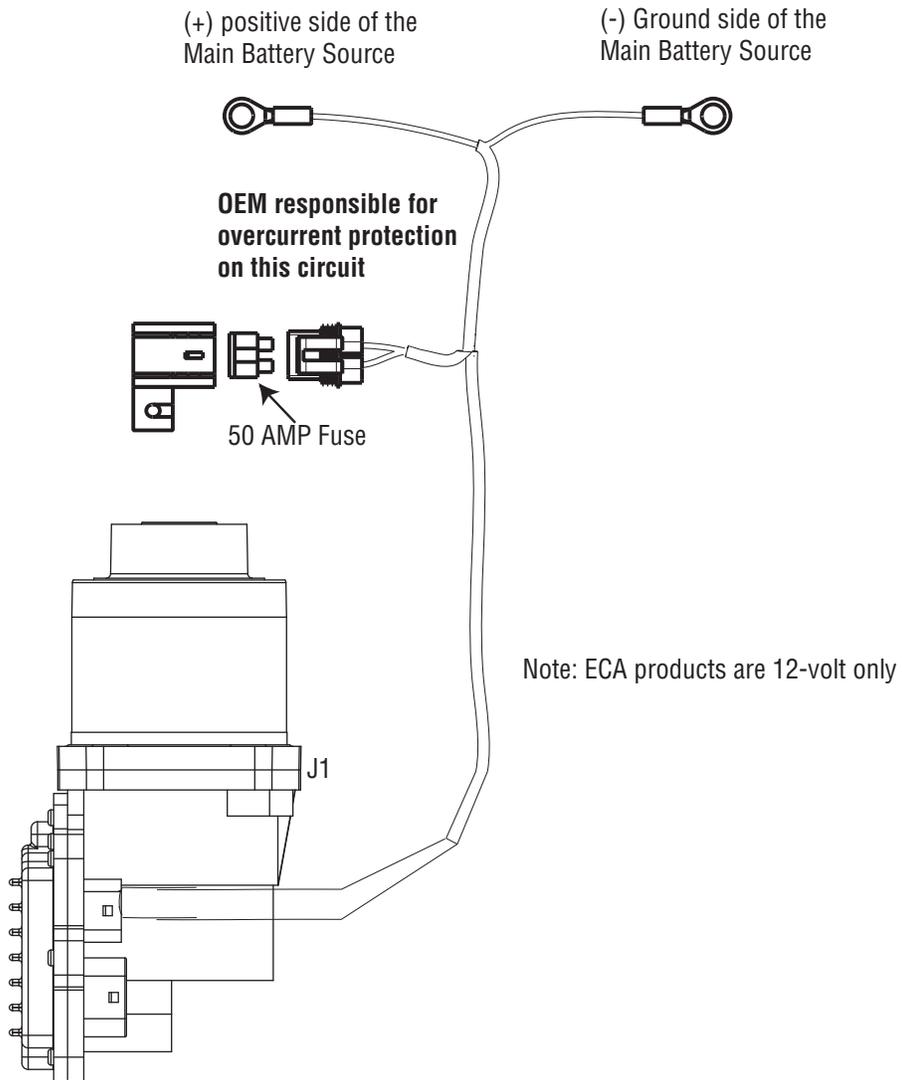
The test does not relate to any specific fault code, but must be completed before perform-

Power Harness

Transmission ECU Power Harness

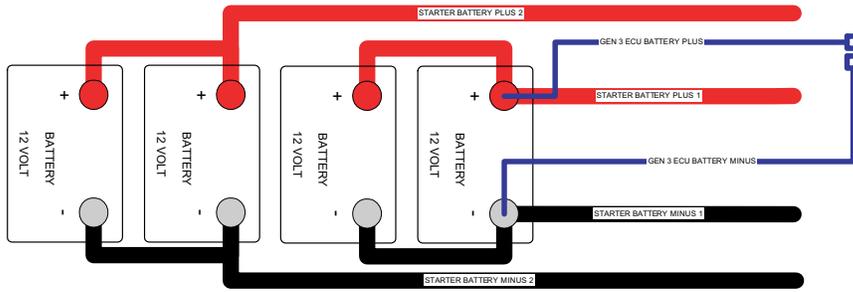


Heavy-Duty Electric Clutch Actuator (ECA) Power Harness

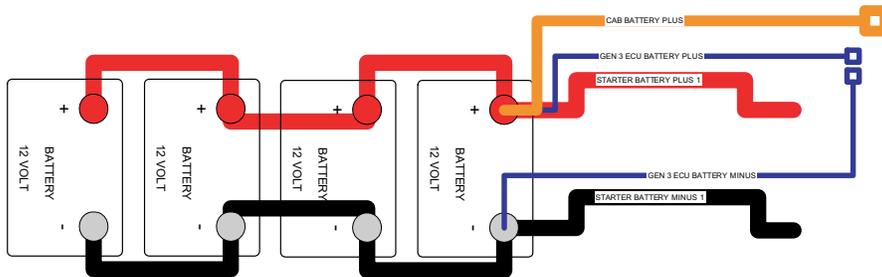


<p>The Transmission ECU and ECA must be wired to a non-switched power source at the battery. IF a disconnect switch is required, the recommended practice is to wait a minimum of three minutes before using the disconnect switch.</p>
<p>It is the OEM responsibility to provide power and ground to the Transmission Controller (TECU) and Electric Clutch Actuator (ECA) from a reliable battery source from the battery which supplies the starter. The power (+) connection must include overload protection per Federal Motor Carrier Safety Regulations, Section 393.31. The TECU Main Power and Ground must be a direct connection from the battery posts to the TECU connector. At 120° C, these conductors must be able to carry 30 amps @ 9 volts with no more than 0.05 ohms per wire (0.1 ohms total) for a total voltage drop from the battery posts to the TECU connector not to exceed 3.0 volts. ECA Main Power and Ground must be able to carry 50 amps @ 9 volts with no more than 0.025 ohms per wire (.05 ohms total) at 120° C. Duration of the 50 amp current draw will not exceed 20 milliseconds.</p>
<p>The Main Power 30 amp fuse connection for the Transmission ECU must be identified with a tag at the battery.</p>
<p>The Main Power 50 amp fuse connection for the Electric Clutch Actuator (ECA) must be identified with a tag at the battery.</p>
<p>Battery Positive and Negative must be disconnected PRIOR to any type of welding on any Fuller Automated transmission-equipped vehicles.</p>
<p>Removal of fuses is not recommended as the method of disconnecting power from the ECU. Making and breaking a circuit through tin plated terminals (e.g. ring terminals, fuses, most connectors) will destroy the plating on the terminal. Opening a switch contact or the main power link is the recommended method of interrupting power.</p>
<p>Application of more than 36 volts to the system (such as jump-starting) will cause system shutdown and possible electrical component damage.</p>
<p>Battery and Ignition power and ground to the TECU must not be switched off during the engine start process.</p>

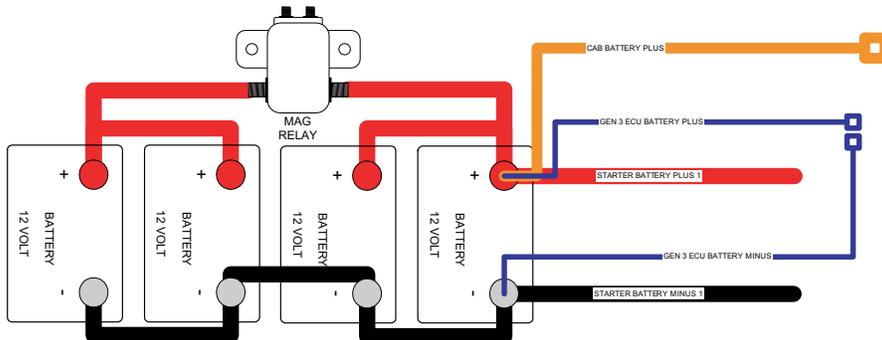
Preferred +12 Volt Connections



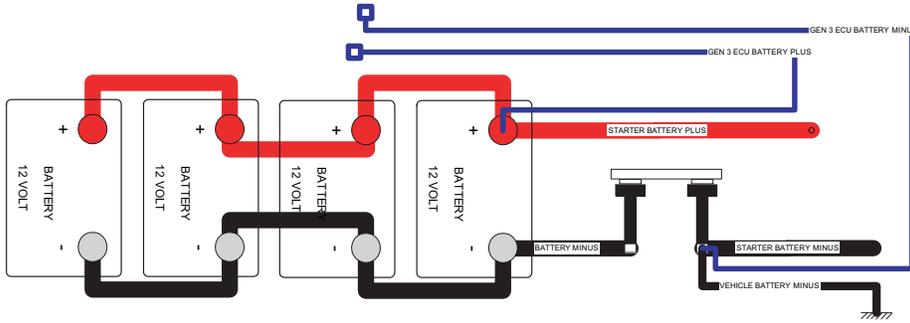
TWO BATTERY BANKS - TWO BATTERIES PER BANK - DUAL JUMPERS TO STARTER
 BATTERIES ARE CONNECTED IN PARALLEL BY PAIRS. GEN 3 POWER SUPPLIED BY BATTERY CLOSEST TO STARTER (BOTH PLUS AND MINUS)



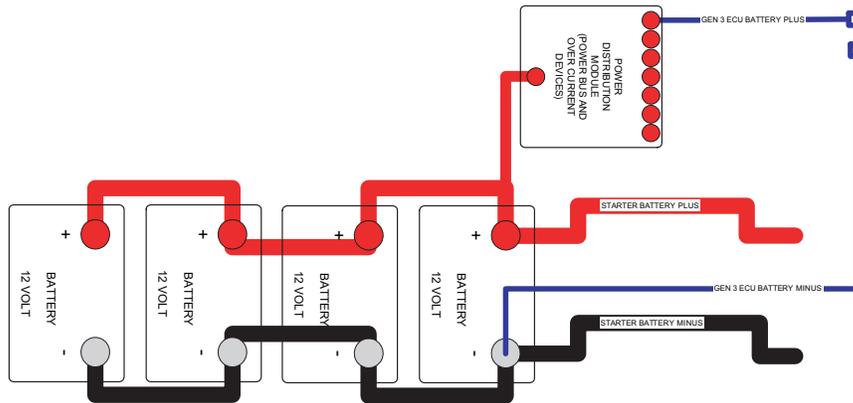
ONE BATTERY BANK - FOUR BATTERIES
 BATTERIES ARE CONNECTED IN PARALLEL. GEN 3 POWER SUPPLIED FROM BATTERY CLOSEST TO STARTER WITH CAB POWER. (BOTH PLUS AND MINUS)



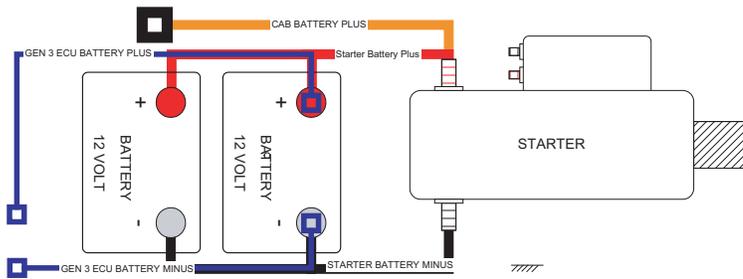
TWO BATTERY BANKS - TWO BATTERIES PER BANK WITH DISCONNECT
 BATTERIES ARE CONNECTED IN PARALLEL BY PAIRS - DISCONNECT FOR CAB AND VEHICLE START - DISCONNECTED PAIR PROVIDES "DEEP DISCHARGE" CAB COMFORT AND ENTERTAINMENT CAPABILITY. GEN 3 POWER SUPPLIED FROM BATTERY SET CLOSEST TO STARTER AND COMMON TO CAB POWER



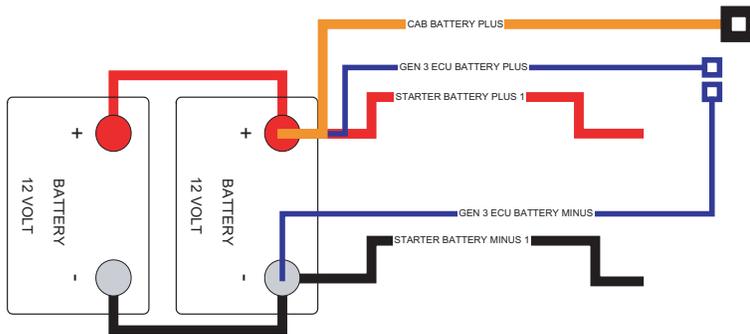
TWO BATTERY BANKS - BATTERY NEGATIVE DISCONNECT SWITCH
 BATTERIES ARE DISCONNECTED AT POWER DOWN WHEN VEHICLE STORED INSIDE. GEN 3 POWER SUPPLIED FROM BATTERY CLOSEST TO THE STARTER. NEGATIVE CONNECTION AT POINT OF VEHICLE CABLE CONNECTION TO DISCONNECT SWITCH



POWER DISTRIBUTION MODULE
 BATTERIES ARE CONNECTED IN PARALLEL, POWER PLUS AND MINUS CONNECTED ON BATTERY CLOSEST TO THE STARTER. CABLES SIZE AND LENGTH OPTIMIZED FOR LOW VOLTAGE DROP

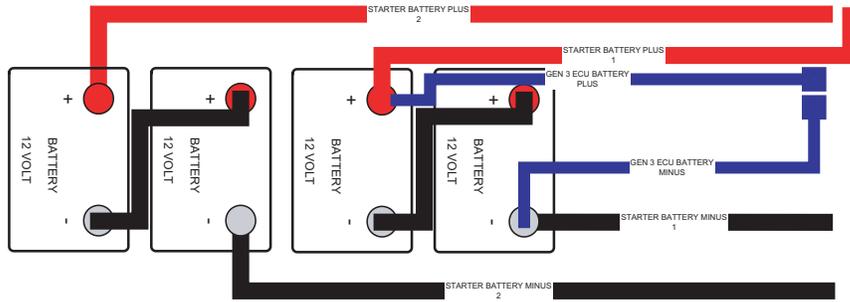


STARTER BATTERY CONNECTION
 GEN 3 POWER PLUS AND MINUS CONNECTED ON BATTERY CLOSEST TO THE STARTER.

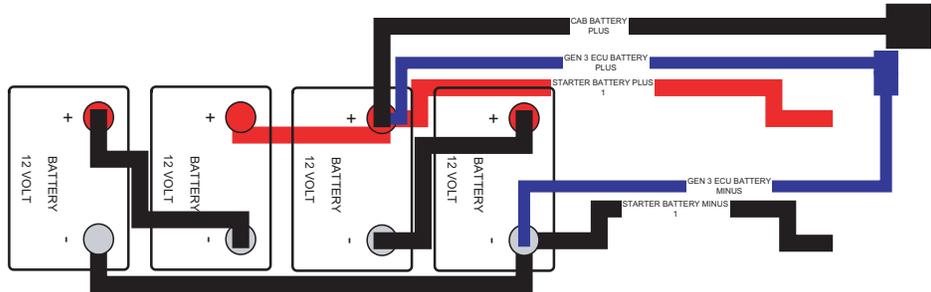


ONE BATTERY BANK - TWO BATTERIES
 BATTERIES ARE CONNECTED IN PARALLEL. GEN 3 POWER SUPPLIED FROM BATTERY CLOSEST TO STARTER WITH CAB POWER. (BOTH PLUS AND MINUS)

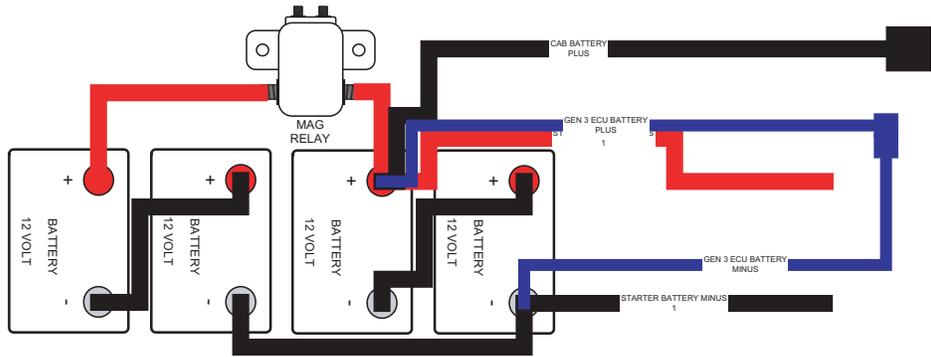
Preferred +24 Volt Connections



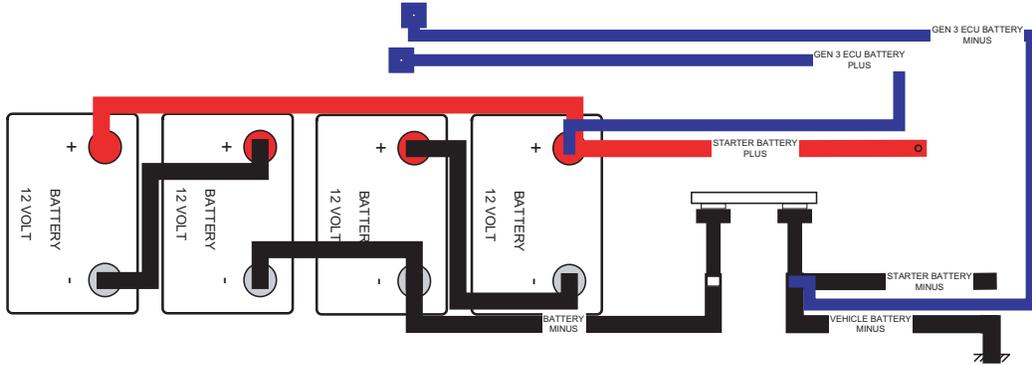
TWO BATTERY BANKS - TWO BATTERIES IN SERIES PER BANK - DUAL JUMPERS TO STARTER
 BATTERIES ARE CONNECTED IN SERIES/PARALLEL BY PAIRS. GEN 3 POWER SUPPLIED BY BATTERY CLOSEST TO STARTER (BOTH PLUS AND MINUS)



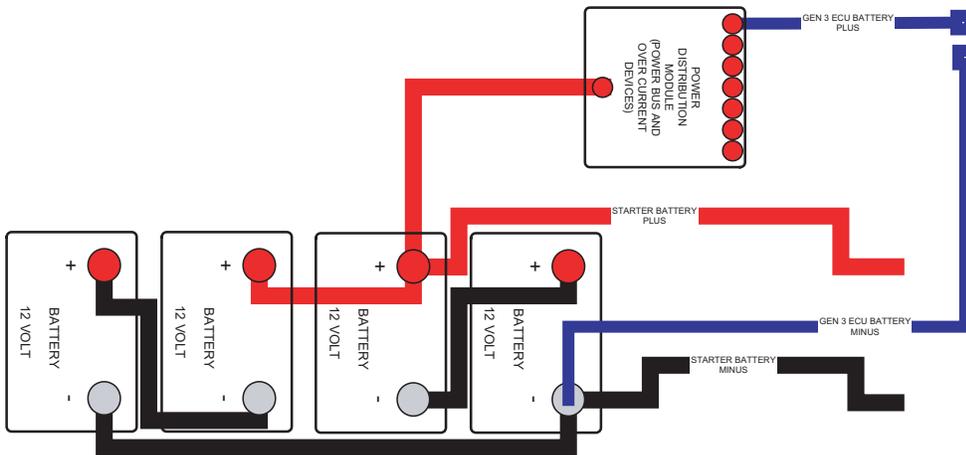
ONE BATTERY BANK - FOUR BATTERIES - ONE CABLE PAIR TO STARTER
 BATTERIES ARE CONNECTED IN SERIES/PARALLEL BY PAIRS. GEN 3 POWER SUPPLIED FROM BATTERY CLOSEST TO STARTER WITH CAB POWER. (BOTH PLUS AND MINUS)



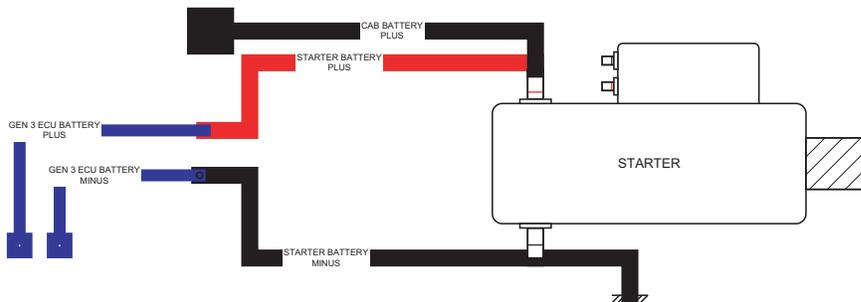
TWO BATTERY BANKS - TWO BATTERIES PER BANK WITH DISCONNECT
 BATTERIES ARE CONNECTED IN SERIES/PARALLEL BY PAIRS - DISCONNECT FOR CAB AND VEHICLE START - DISCONNECTED PAIR PROVIDES "DEEP DISCHARGE" CAB COMFORT AND ENTERTAINMENT CAPABILITY. GEN 3 POWER SUPPLIED FROM BATTERY SET CLOSEST TO STARTER AND COMMON TO CAB POWER



TWO BATTERY BANKS - BATTERY NEGATIVE DISCONNECT SWITCH
 BATTERIES ARE DISCONNECTED AT POWER DOWN WHEN VEHICLE STORED INSIDE. GEN 3 POWER SUPPLIED FROM BATTERY CLOSEST TO THE STARTER. NEGATIVE CONNECTION AT POINT OF VEHICLE CABLE CONNECTION TO DISCONNECT SWITCH



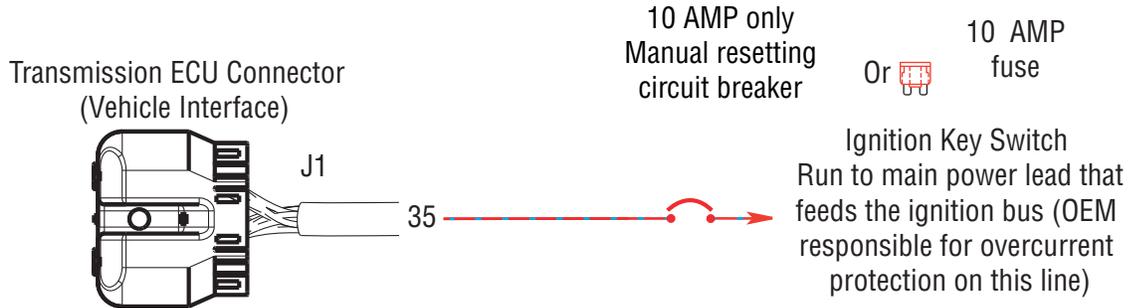
POWER DISTRIBUTION MODULE
 BATTERIES ARE CONNECTED IN SERIES/PARALLEL, POWER PLUS AND MINUS CONNECTED ON BATTERY CLOSEST TO THE STARTER. CABLES SIZE AND LENGTH OPTIMIZED FOR LOW VOLTAGE DROP



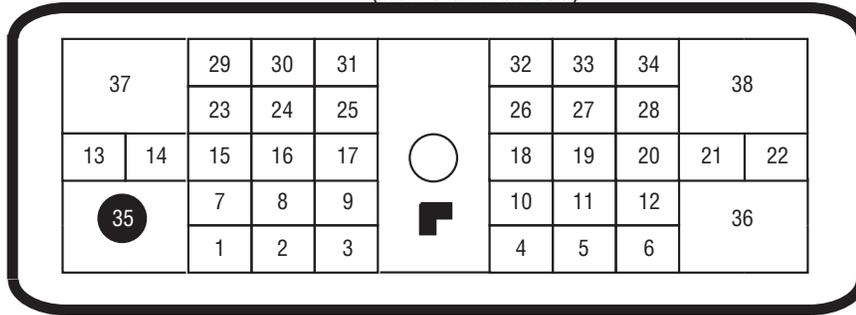
STARTER BATTERY CONNECTION
 GEN 3 POWER PLUS AND MINUS CONNECTED ON BATTERY CLOSEST TO THE STARTER.

Ignition Circuit Detail

Transmission ECU Ignition Circuit



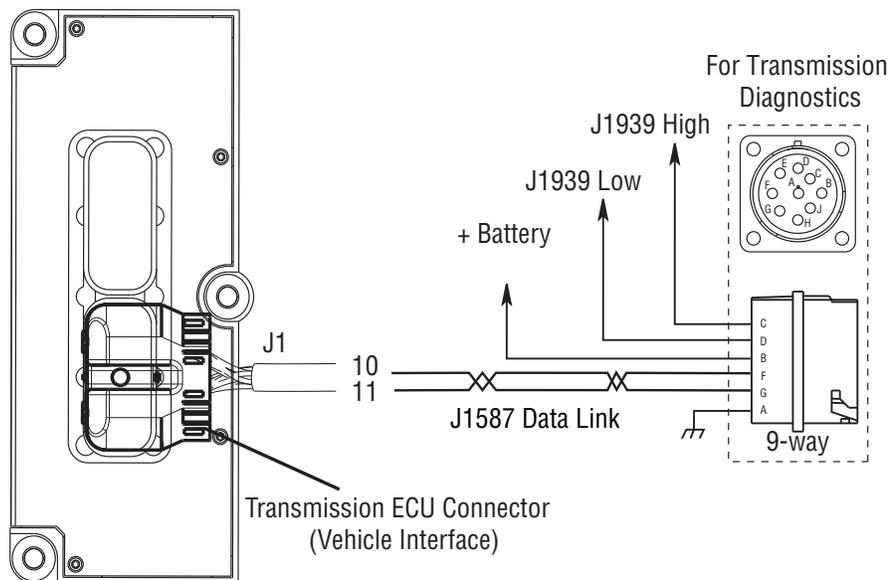
Front View
Transmission ECU Connector
(Vehicle Interface)



FROM	TO
J1-35	VIGN

Battery and Ignition power and ground to the TECU must not be switched off during the engine start process.

J1939 Data Link



J1939 Troubleshooting

- Check the resistance of the J1939 Data Link.
- With the Key-OFF, measure resistance between the 9-pin diagnostic connector pins C and D and record the reading. The reading should be 60 ohms of resistance (between 50 and 70.)
- Check resistance between pins C and A and D and A. These two readings should be 10K ohms or greater (open circuit).

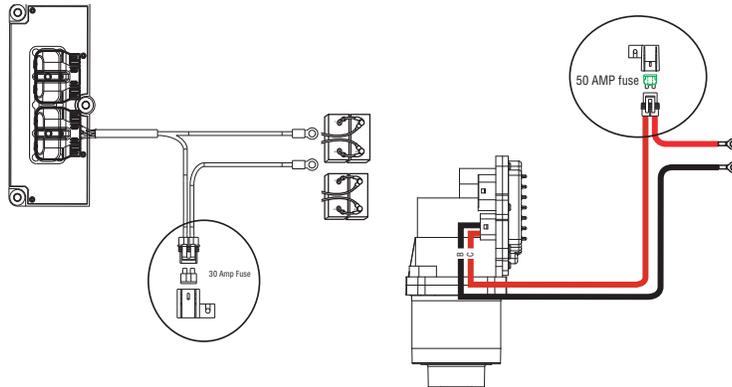
Note: Pin C = J1939+, Pin D = J1939-, Pin A is a chassis ground

- If an inactive data link fault code is being reported by the Transmission ECU, Product Diagnostic Mode (PDM) should be utilized as outlined in this troubleshooting guide before any further steps are taken.

Electrical Pretest

STEP A

Procedure	Condition	Action
1. Key off.		
2. Remove and clean all battery and battery to frame connections.		
3. Remove and clean ground supply to engine ECU.		
4. Inspect starter/battery and inline 30 amp fuse holder connections for corrosion or damaged contacts. Also inspect the 50 amp fuse holder on vehicles equipped with an Electronic Clutch Actuator (ECA).		



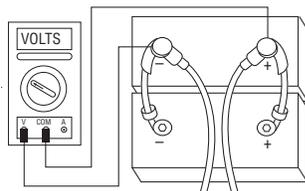
5. Measure voltage across batteries.

If voltage is 11 to 13 volts on a 12 volt system or 22 to 26 on a 24 volt system

Refer to OEM guidelines for battery load test. Repair or replace batteries as required. Go to **STEP B**

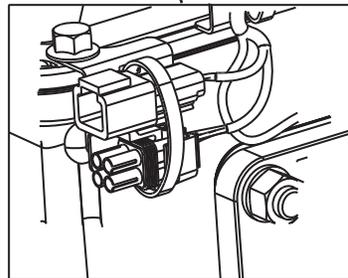
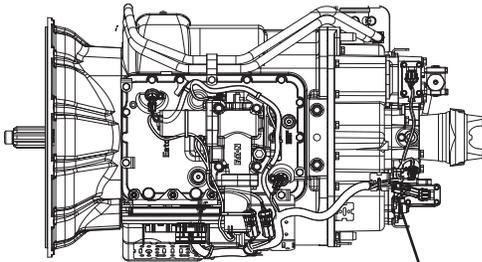
If voltage is outside of range

Repair or replace batteries and charging system as required. Repeat this step.



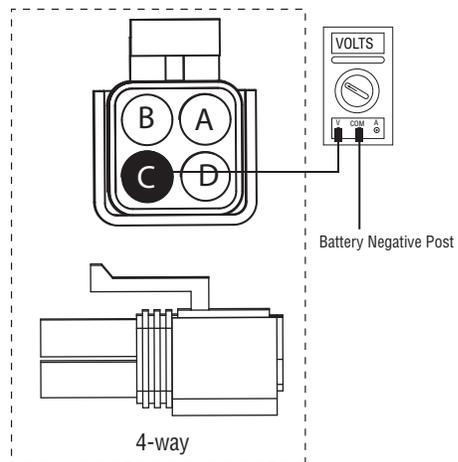
STEP B

Procedure	Condition	Action
1. Locate diagnostic port on Transmission Harness.		
2. Key on.		
3. Measure voltage between pins C and the battery negative post.	If voltage between pin C and the battery negative post is 0.70 volts or less	Go to STEP C
	If voltage is outside of range	Repair battery ground supply to Transmission ECU. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port
4-Pin Diagnostics Port

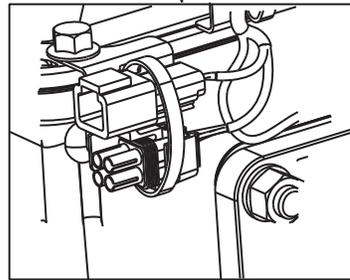
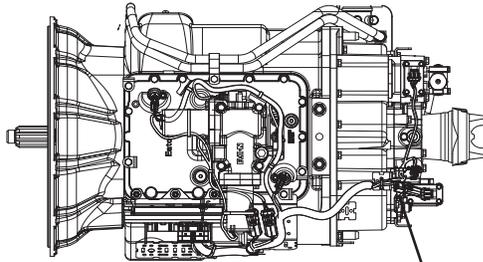


B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

Electrical Pretest

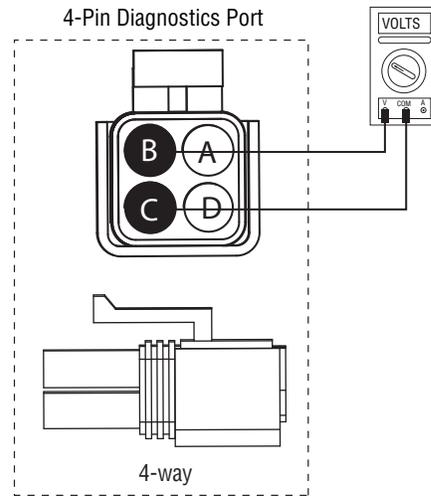
STEP C

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins B and pin C.		If voltage between pins B and C is within 0.6 volts of battery voltage		Go to STEP D
		If voltage is outside of range		Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

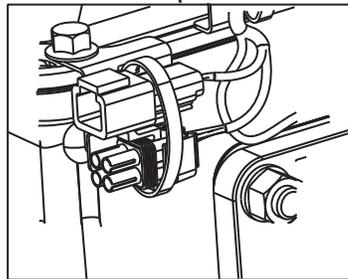
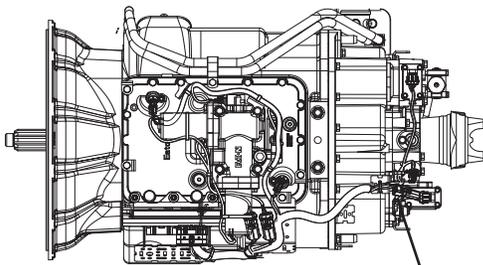
Warning! - Do Not Load Test at Diagnostic Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

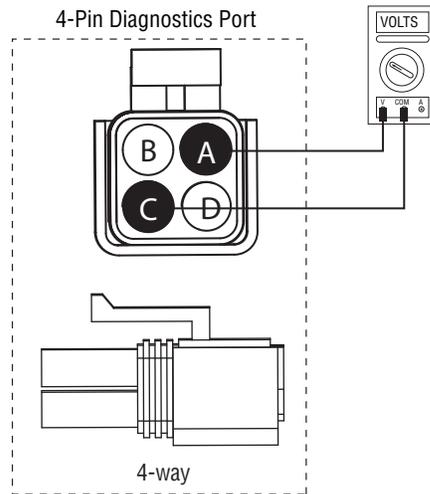
STEP D

Procedure	Condition	Action
1. Key on.		
2. Measure voltage between pin A and pin C.	If voltage between pins A and C is within 0.6 volts of battery voltage	For non-ECA products, test complete. Return to diagnostic procedure. For ECA products, go to STEP E
	If voltage is outside of range	Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port

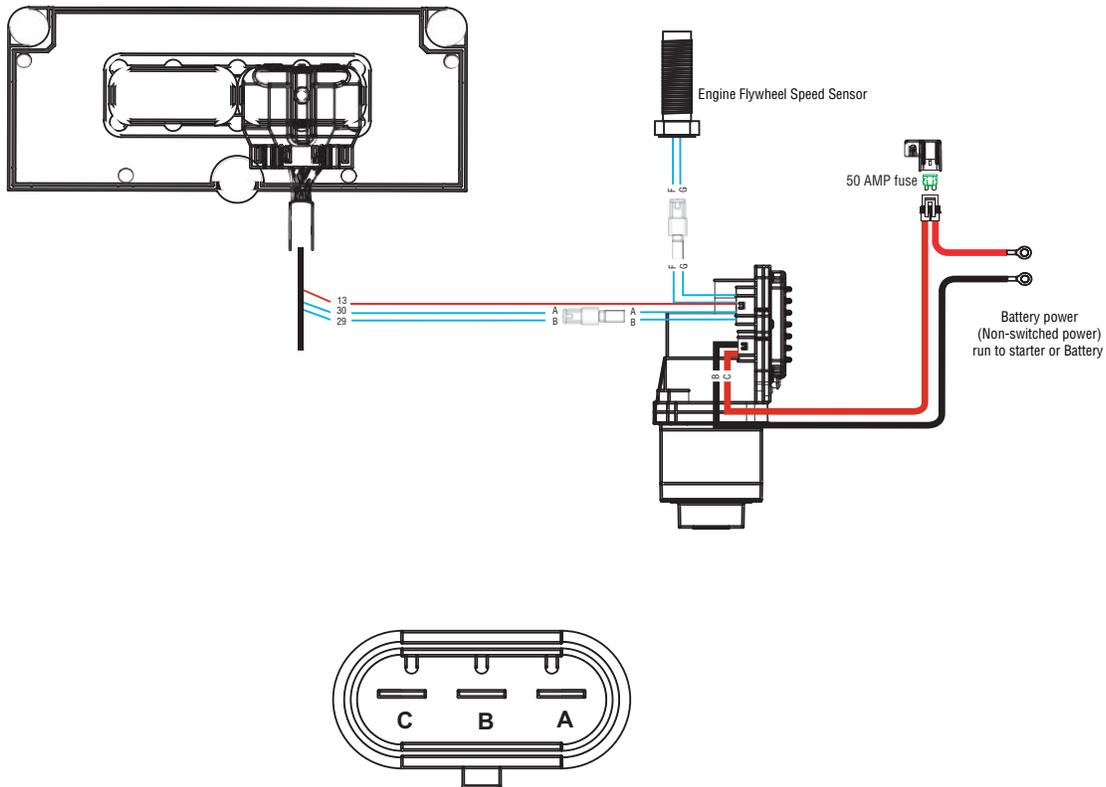


- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

Electrical Pretest

STEP E

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect battery negative.				
3. Disconnect ECA 3-way connector.				
4. Reconnect battery negative.				
5. Measure voltage between pin B and pin C of 3-way connector.		If voltage between pin B and pin C of 3-way connector is within 0.6 volts of battery voltage:		Test complete. Return to diagnostic procedure.
		If voltage is outside of range		Repair battery power supply to ECA. Fuse may be blown. Repeat test.



Component Code 11 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	629		254	12	No ECU Operation

Overview

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

Detection

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

Fallback

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

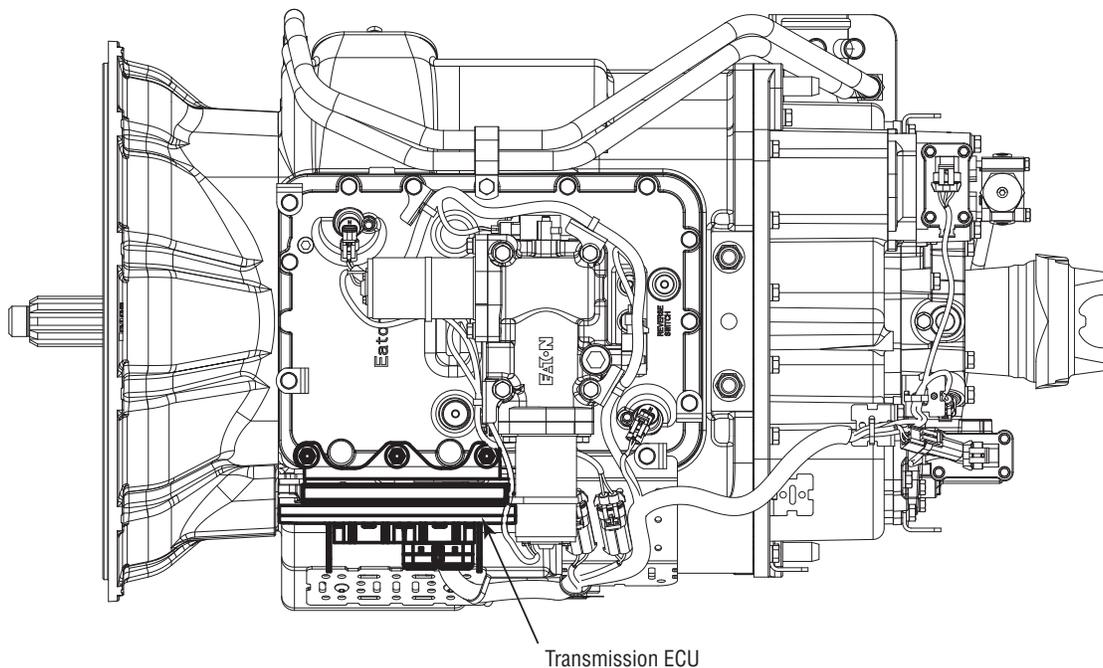
Required Tools

- Troubleshooting Guide
- ServiceRanger a PC-based Service Tool

Possible Causes

This fault code can be caused by the following:

- Transmission ECU



Fault Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
1. Key on.				
2. Retrieve Codes. Go to Fault Code Retrieval/Clearing .		If code 11 is active		Replace Transmission ECU.
		If code 11 is inactive		Test complete.

Component Code 12 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	629		254	13, 14	Improper ECU Configuration

Overview

This fault code indicates the ECU is not reading valid information from memory, including the transmission table and calibration values.

Detection

The Transmission ECU checks the Configuration every time the key is turned on. If the transmission is not able to detect the proper Configuration, it sets this fault code.

Fallback

This fault causes a power up no crank.

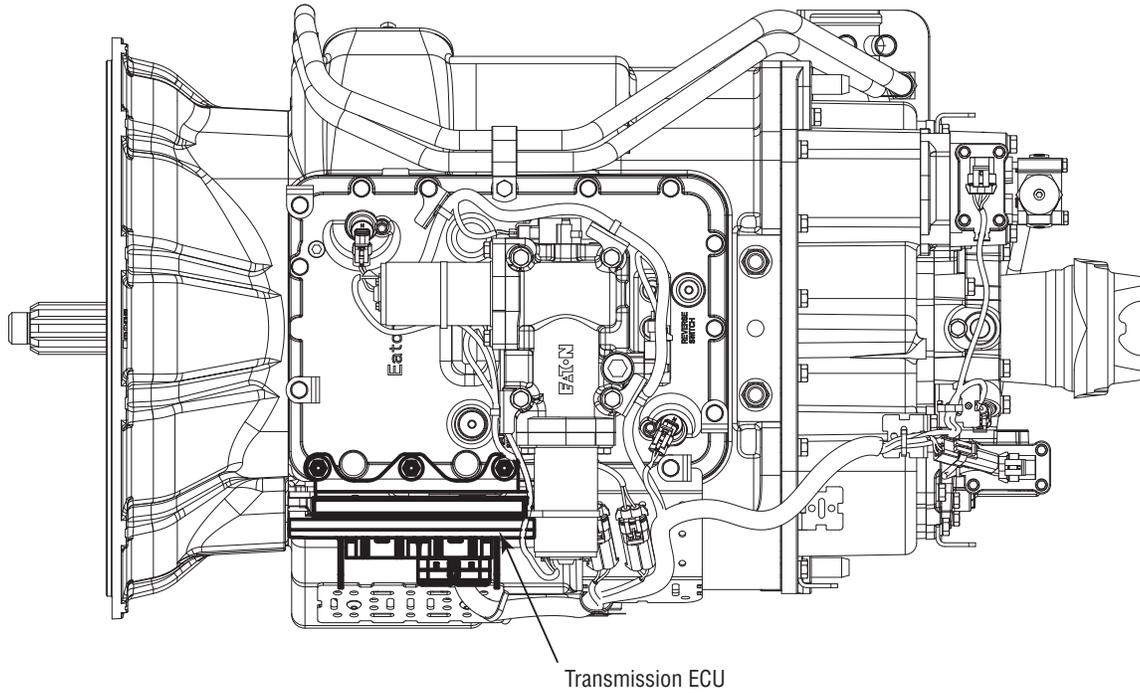
Required Tools

- Troubleshooting Guide
- ServiceRanger a PC-based Service Tool

Possible Causes

This fault code can be caused by the following:

- Improper ECU Configuration Software



Fault Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
1. Key on.				
2. Retrieve codes. Go to Fault Code Retrieval/Clearing .		If code 12 is active		Customer - Call Eaton at 1-800-826-HELP (4357). CSC - Call Technician Service.
		If code 12 is inactive		Test complete.

Component Code 13 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	751		231	8, 11	J1939 Shift Control Device

Overview

This fault indicates communication has been lost, or does not correspond with the neutral request input from the J1939 Shift Device.

When troubleshooting an Inactive code Go to [Product Diagnostic Mode \(PDM\)](#) .

Detection

Starting at key on and throughout operation, the Transmission ECU constantly monitors communication with the J1939 Shift Device. If a neutral request from the J1939 Shift Device does not match the neutral signal or is not received from the J1939 Shift Device, fault code 13 is set.

Fallback

This fault causes a downshift only fallback. Once the transmission re-engages the start gear, there will be no upshifts as long as the code is active.

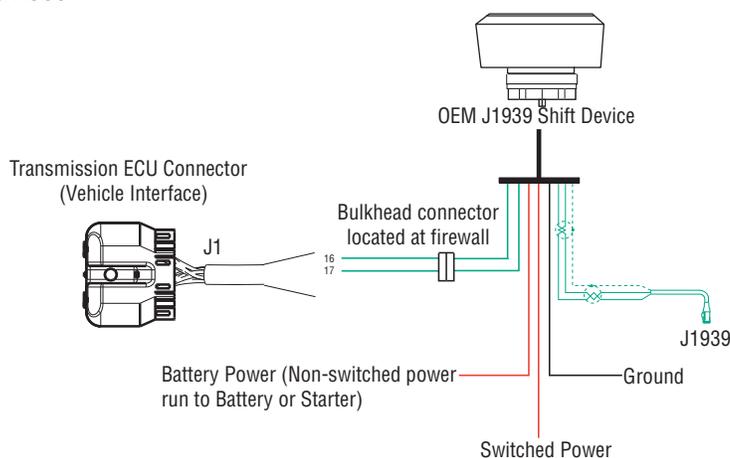
Required Tools

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

Possible Causes

This fault code can be caused by the following:

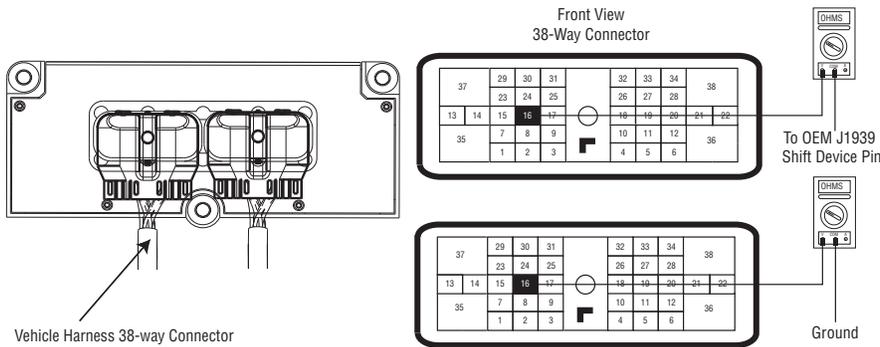
- OEM J1939 Shift Control Device
- Vehicle Harness



Fault Isolation Procedures

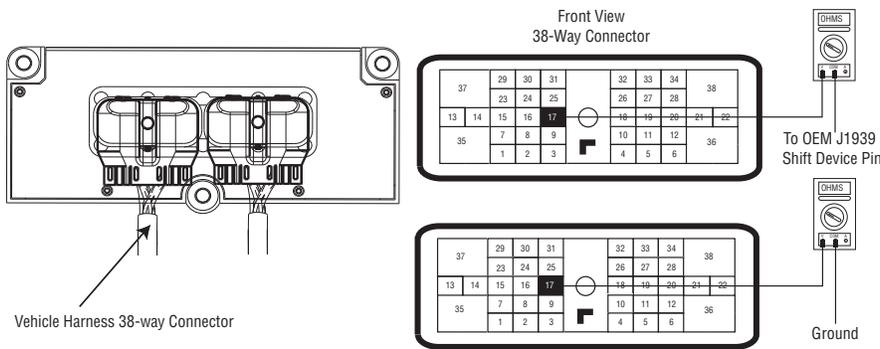
STEP A

Procedure	Condition	Action
1. Key off.		
2. Disconnect negative battery cable.		
3. Disconnect Vehicle Harness 38-way connector.		
4. Measure resistance between 38-way connector pin 16 and corresponding OEM pin at J1939 Shift Device and pin 16 and ground (see OEM wiring for correct pin location)	<p>If resistance is 0 to 0.3 ohms between pin 16 and the corresponding OEM pin and resistance to ground is 10K ohms or greater</p> <p>If resistance is out of range</p>	<p>Go to STEP B</p> <p>Repair wiring between Transmission ECU and J1939 Shift Device. Go to STEP V</p>



STEP B

Procedure	Condition	Action
1. Measure resistance between 38-way connector pin 17 and corresponding OEM pin at J1939 Shift Device and pin 17 and ground (see OEM wiring for correct pin location)	If resistance is 0 to 0.3 ohms between pin 17 and the corresponding OEM pin and resistance to ground is 10K ohms or greater	Problem exists with the J1939 Shift Device, or J1939 Shift Device power, ground or datalink wiring. Contact your OEM for repair strategy. Go to STEP V
	If resistance is out of range	Repair wiring between Transmission ECU and J1939 Shift Device. Go to STEP V



STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors and the negative battery cable.				
3. Key on.				
4. Clear codes. Go to Fault Code Retrieval/Clearing .				
5. Drive vehicle and attempt to reset the code.				
6. Check for codes. Go to Fault Code Retrieval/Clearing .		If no codes		Test complete.
		If code 13 appears		To find error in testing, return to STEP A
		If code other than 13 appears		Go to Fault Code Isolation Procedure Index .

Component Code 14 Isolation Procedures

(without Park Pawl)

MID	SPN	PID	SID	FMI	Description
	751		18, 19	2, 3, 4, 5	Invalid Shift Lever Voltage

Overview

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

When troubleshooting an Inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19.

Detection

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

Fallback

This fault may cause a downshift only fallback mode. The transmission will re-engage the start gear when returned to a stop, but will not upshift as long as the code is active.

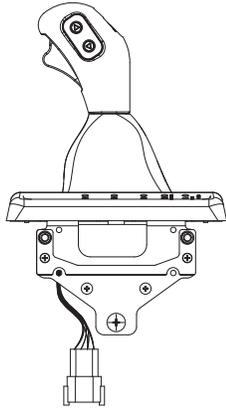
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Shift Stalk Tester
- Troubleshooting Guide
- ServiceRanger a PC-based Service Tool
- Digital Volt/Ohm Meter

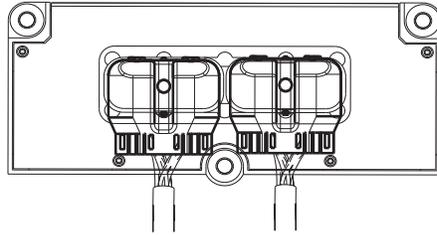
Possible Causes

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

- Eaton Shift Lever or OEM Shift Lever
- OEM Harness
- Transmission ECU



Eaton Shift Lever



Transmission ECU

Component Code 14 Isolation Procedures (without Park Pawl) Fault Isolation Procedures

Fault Isolation Procedures

STEP A

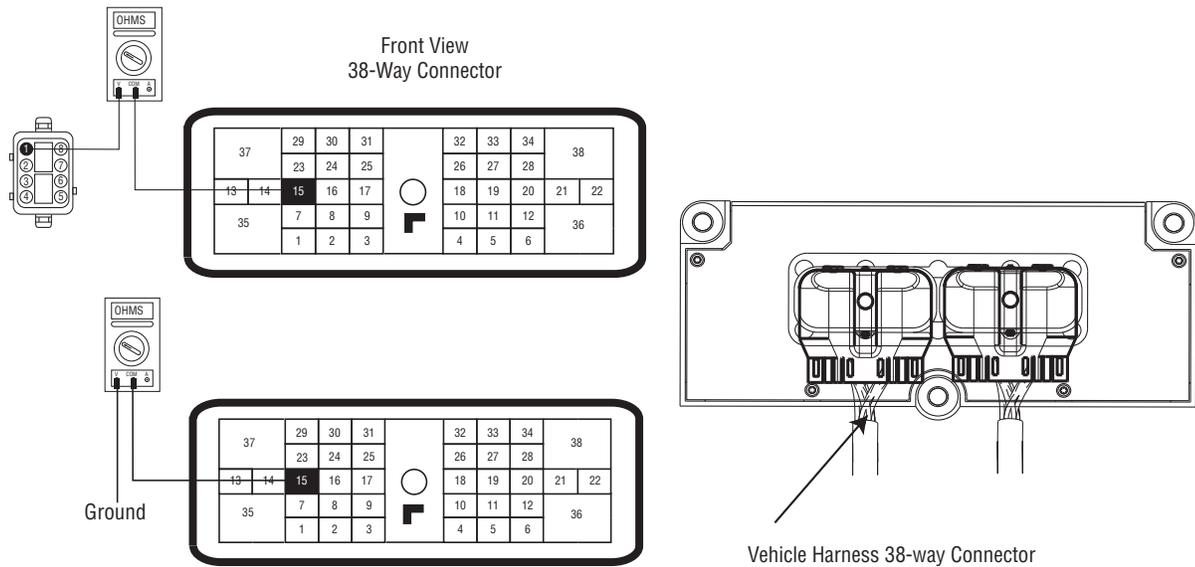
Procedure	→ Condition	→ Action
1. Is vehicle equipped with an Eaton supplied Shift Lever or an OEM supplied Shift Lever?	If Eaton Shift Lever	Go to STEP B
	If OEM Shift Lever	Contact OEM for troubleshooting procedures.

STEP B

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

STEP C

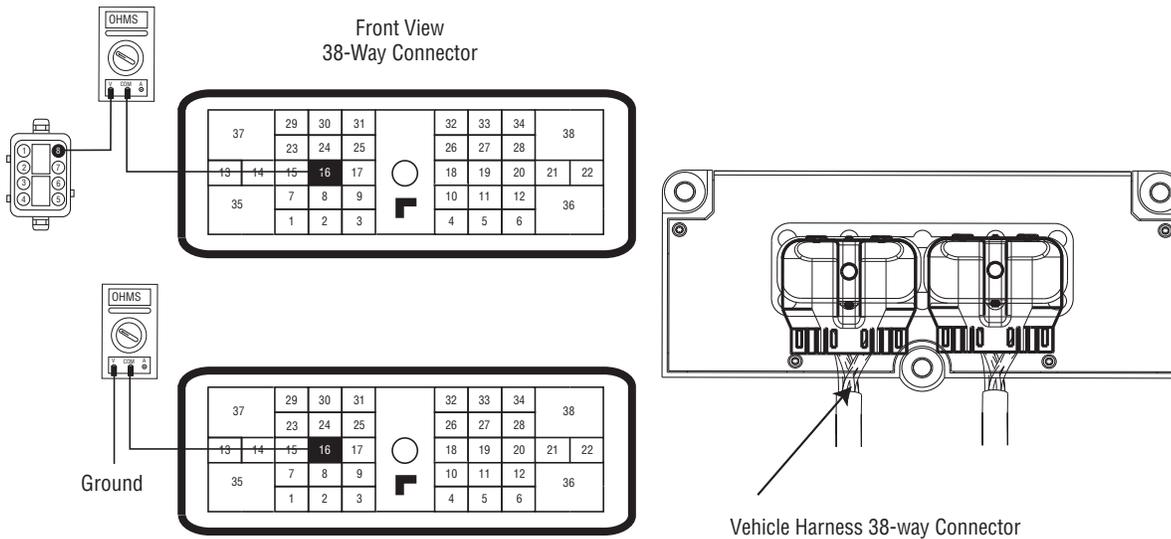
Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect Transmission ECU 38-way connector.				
4. Remove tester from Shift Lever 8-way connector.				
5. Measure resistance between:				
<ul style="list-style-type: none"> ECU 38-way pin 15 and Shift Lever 8-way connector pin 1 ECU 38-way connector pin 15 and ground 		<p>If resistance between pins 15 and 1 is 0 to 0.3 ohms and resistance between pin 15 and ground is 10K ohm or greater</p>		Go to STEP D
		<p>If any of the above conditions are not met</p>		Repair Vehicle Harness between the Transmission ECU and the Shift Lever. Go to STEP V



Component Code 14 Isolation Procedures (without Park Pawl) Fault Isolation Procedures

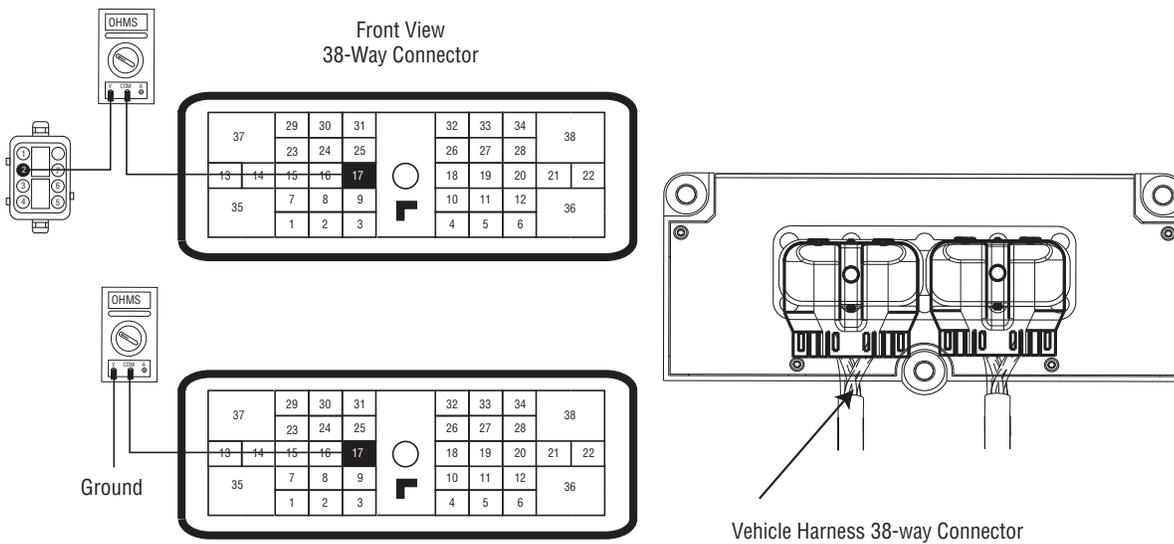
STEP D

Procedure	→ Condition	→ Action
1. Key off.		
2. Measure resistance between:	If resistance between pins 16 and 8 is 0 to 0.3 ohms and resistance between pin 16 and ground is 10K ohm or greater	Go to STEP E
<ul style="list-style-type: none"> ECU 38-way pin 16 and Shift Lever 8-way connector pin 8 ECU 38-way connector pin 16 and ground 	If any of the above conditions are not met	Repair Vehicle Harness between the Shift Lever and Transmission ECU. Go to STEP V



STEP E

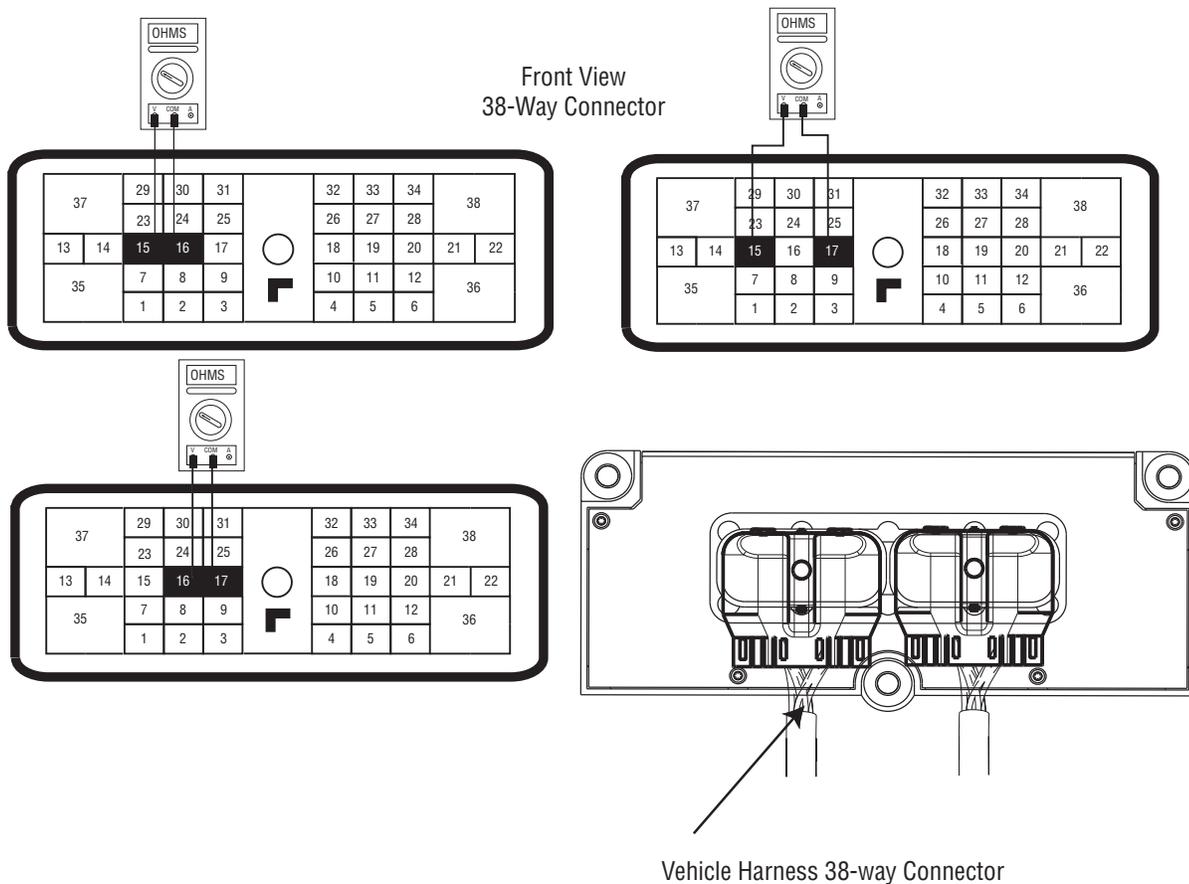
Procedure	→	Condition	→	Action
1. Key off.				
2. Measure resistance between:				
<ul style="list-style-type: none"> ECU 38-way pin 17 and Shift Lever 8-way connector pin 2 ECU 38-way connector pin 17 and ground 		If resistance between pins 17 and 2 is 0 to 0.3 ohms and resistance between pin 17 and ground is 10K ohm or greater		Go to STEP F
		If any of the above conditions are not met		Repair Vehicle Harness between Shift Lever and Transmission ECU. Go to STEP V



Component Code 14 Isolation Procedures (without Park Pawl) Fault Isolation Procedures

STEP F

Procedure	→ Condition	→ Action
1. Key off.		
2. Measure resistance between: <ul style="list-style-type: none"> • Transmission ECU 38-way connector pin 15 and 16 and 15 and 17. Then measure resistance from pin 16 to 17. 	If resistance on all three is 10K ohm or greater	Replace Shift Lever. Go to STEP V
<ul style="list-style-type: none"> • Transmission ECU 38-way connector pin 15 and 16 and 15 and 17. Then measure resistance from pin 16 to 17. 	If any of the three readings is less than 10K ohm	Repair Vehicle Harness between Shift Lever and Transmission ECU. Go to STEP V



STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors and the negative battery cable.				
3. Key on.				
4. Clear codes. Go to Fault Code Retrieval/Clearing .				
5. Drive vehicle and attempt to reset the code.				
6. Check for codes Go to Fault Code Retrieval/Clearing .		If no codes		Test complete.
		If code 14 appears		To find error, return to STEP A
		If code other than 14 appears		Go to Fault Code Isolation Procedure Index .

Component Code 14 Isolation Procedures

(with Park Pawl)

Data Bus	MID	SPN	PID	SID	FMI	Description
J1587	130			18, 19	2, 3, 4, 5	Invalid Shift Lever Voltage (will show "F" in display)
J1939	SA-3				2, 3, 4, 5	Invalid Shift Lever Voltage (will show "F" in display)

Overview

This fault code indicates a possible failure of the Park Pawl Position Sensor or OEM circuit. The sensor is a 4 wire dual hall effect device. When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19.

Detection

Starting at key on and throughout operation the TECU constantly monitors the signal from the Park Pawl Position Sensor. The transmission monitors both sensor signals, if one signal to the TECU is out of range the code will set.

Fallback

This fault code will cause the transmission to be stuck in the last known selected position. If the code comes active while in gear, the transmission will go to a down shift only fallback mode. The transmission will re-engage the start gear when returned to a stop, but will not upshift as long as the code is active.

Required Tools

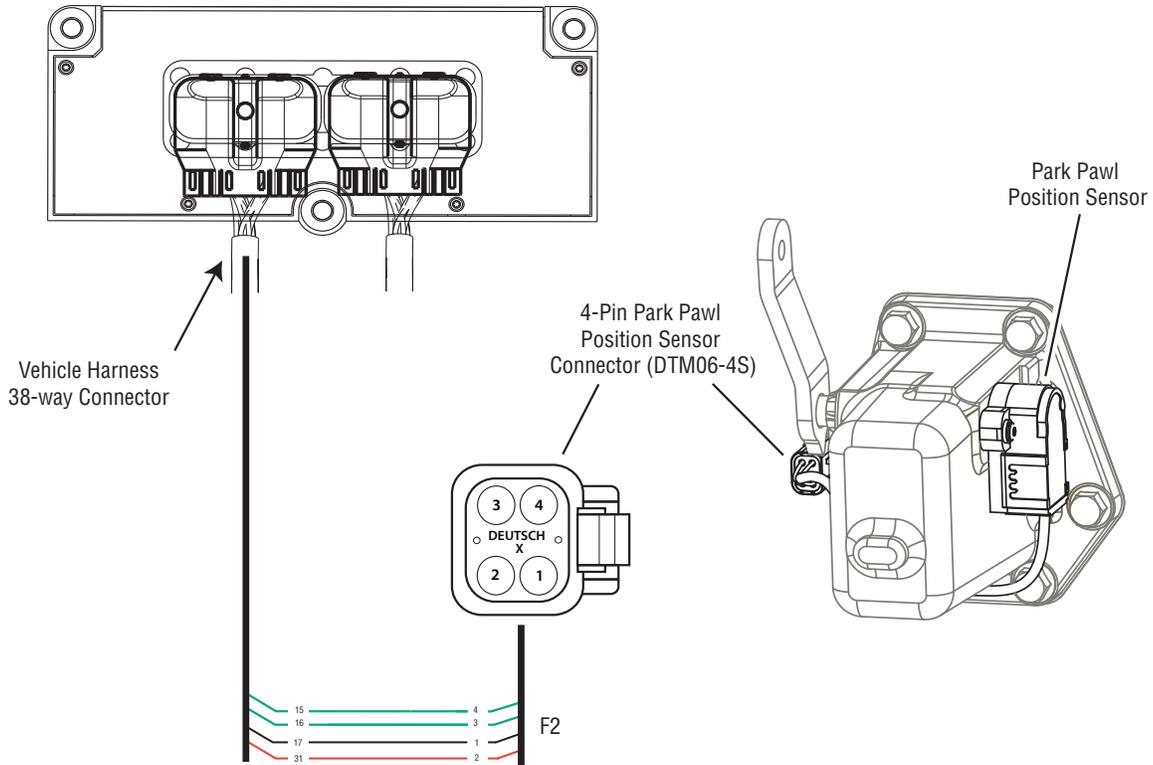
- Basic Hand Tools
- Eaton Test Adapter Kit
- Shift Stalk Tester
- Troubleshooting Guide
- ServiceRanger a PC-based Service Tool
- Digital Volt/Ohm Meter

Possible Causes

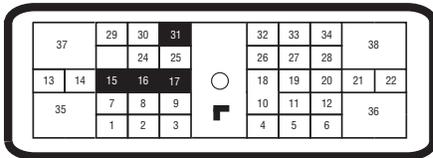
This fault code can be caused by any of the following:

- OEM Harness
- Park Pawl Position Sensor
- Transmission ECU

Component Code 14 Isolation Procedures



Front View
Transmission ECU Connector
(Vehicle Interface)



4-Way PIN#	38-Way PIN#	Type
1	17	Ground
2	31	5 Volt Reference
3	16	Signal 1
4	15	Signal 2

Fault Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
1. Key on.				
2. Retrieve active fault codes and FMIs with ServiceRanger using the 9-pin diagnostic connector.		If Fault Code 14 FMI 2 is active		Proceed to STEP B
		If Fault Code 14 FMI 3, 4 or 5 is active		Proceed to STEP D
		If Fault Code 14 is inactive		Proceed to see Product Diagnostic Mode (PDM) on page 19 .

STEP B

Procedure	→	Condition	→	Action
1. Key off.				
2. Perform shift cable adjustment procedure per OEM guidelines.				
3. Key on.				
4. Retrieve active fault codes and FMIs with ServiceRanger using the 9-pin diagnostic connector.		If Fault Code 14 FMI 2 is Inactive		Proceed to STEP V
		If Fault Code 14 FMI 2 is Active		Proceed to STEP C

STEP C

Procedure	→	Condition	→	Action
1. Perform Park Pawl Position Sensor calibration per TRSM0930.				
2. Key on.				
3. Retrieve active fault codes and FMIs with ServiceRanger using the 9-pin diagnostic connector.		If Fault Code 14 FMI 2 is Inactive		Proceed to STEP V
		If Fault Code 14 FMI 2 is Active		Replace Park Pawl Position Sensor per TRSM0930. Proceed to STEP V

STEP D

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect the Park Pawl Position Sensor 4-way connector.				
3. Key on.				
4. At the Park Pawl Position Sensor 4-way connector, measure voltage between Pin 1 and Pin 2.		If 4.5 to 5.5 volts		Proceed to STEP E
		If less than 4.5 volts		Proceed to STEP G
		If greater than 5.5 volts		Repair or replace OEM harness for short to power per OEM guidelines. Proceed to STEP V

STEP E

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect Park Pawl Position Sensor 4-way connector.				
3. Disconnect TECU 38-way Transmission Harness connector.				
4. Measure resistance between Pin 15 and Pin 4.		If resistance is 0.0 to 0.3 ohms between Pin 15 and Pin 4 and OL (open circuit) between Pin15 and Ground		Proceed to STEP F
5. Measure resistance between Pin 15 and Ground.		If resistance is greater than 0.3 ohms or OL (open circuit) between Pin 15 and Pin 4 or indicates resistance (short to ground) between Pin 15 and Ground		Repair or replace OEM harness for excessive resistance, open or short to ground per OEM guidelines. Proceed to STEP V

STEP F

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect Park Pawl Position Sensor 4-way connector.				
3. Disconnect TECU 38-way Transmission Harness connector.				
4. Measure resistance between Pin 16 and Pin 3.		If resistance is 0.0 to 0.3 ohms between Pin 16 and Pin 3 and OL (open circuit) between Pin 16 and Ground		Replace Park Pawl Position Sensor. Proceed to STEP V
5. Measure resistance between Pin 16 and Ground.		If resistance is greater than 0.3 ohms or OL (open circuit) between Pin 16 and Pin 3 or indicates resistance (short to ground) between Pin 16 and Ground		Repair or replace OEM harness for excessive resistance, open or short to ground per OEM guidelines. Proceed to STEP V

STEP G

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect Park Pawl Position Sensor 4-way connector.				
3. Disconnect TECU 38-way Transmission Harness connector.				
4. Measure resistance between Pin 17 and Pin 1.		If resistance is 0.0 to 0.3 ohms between Pin 17 and Pin 1 and OL (open circuit) between Pin 17 and Ground		Proceed to STEP H
5. Measure resistance between Pin 17 and Ground.		If resistance is greater than 0.3 ohms or OL (open circuit) between Pin 17 and Pin 1 or indicates resistance (short to ground) between Pin 17 and Ground		Repair or replace OEM harness for excessive resistance, open or short to ground per OEM guidelines. Proceed to STEP V

STEP H

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect Park Pawl Position Sensor 4-way connector.				
3. Disconnect TECU 38-way Transmission Harness connector.				
4. Measure resistance between Pin 31 and Pin 2.		If resistance is 0.0 to 0.3 ohms between Pin 31 and Pin 2 and OL (open circuit) between Pin 31 and Ground)		Replace the TECU. Proceed to STEP V
5. Measure resistance between Pin 31 and Ground.		If resistance is greater than 0.3 ohms or OL (open circuit) between Pin 31 and Pin 2 or indicates resistance (short to ground) between Pin 31 and Ground		Repair or replace OEM harness for excessive resistance, open or short to ground per OEM guidelines. Proceed to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors.				
3. Key on.				
4. Clear codes.				
5. Drive vehicle and attempt to reset code.				
6. Check for codes.		If no codes		Test complete
		If Fault Code 14 sets		Proceed to STEP A
		If code other than Fault Code 14 sets		Fault Code Isolation Procedure Index

Component Code 15 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	751		18	9	HIL Shift Device Configuration

Overview

Controller Area Network (CAN) is a high-speed twisted pair 500K proprietary datalink with one 120 ohm resistor at each end of the link. The Transmission ECU is connected to the CAN datalink at the 38-way connector. This link is used to transmit information to the ECU as well as communicate or receive data from the other modules on the network like the HIL Shift Device. See [Product Diagnostic Mode \(PDM\)](#) on page 19 for more information on troubleshooting inactive codes.

Detection

Fault Code 15 is set when the ECU fails to receive Shift Device data for 5 continuous seconds, and it is still communicating with other modules on CAN.

Fallback

This fault causes a downshift only fallback while moving. Once the transmission re-engages the start gear, there will be no upshifts as long as the code is active. If the code is active during power-up a flashing "F" will appear on the gear display and the Transmission ECU will not engage a gear.

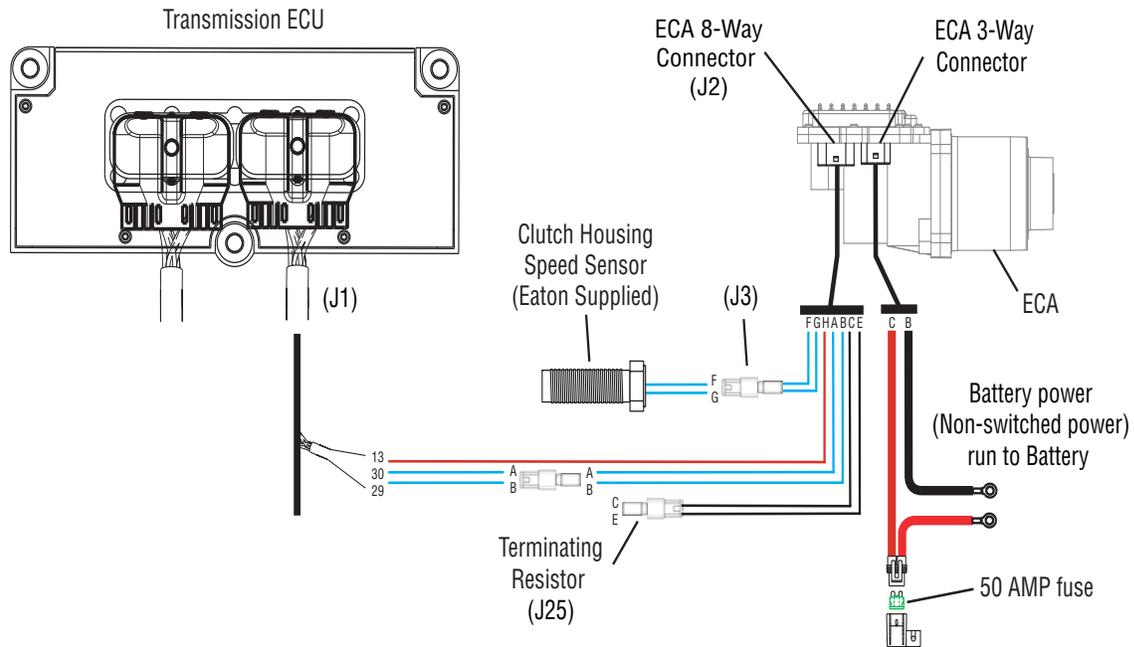
Required Tools

- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- ServiceRanger, PC-based service tool

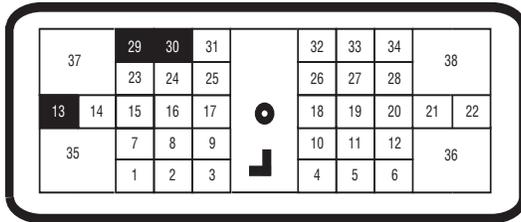
Possible Causes

- CAN data link
- HIL Shift Device

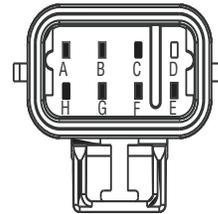
Component Code 15 Isolation Procedures



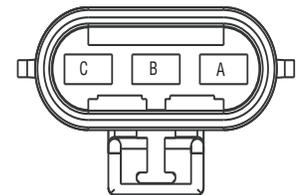
38-Pin Front Harness View
(TECU - Transmission Harness Connector)



ECA 8-Way Connector
Front Harness View



OEM Supplied
ECA 3-Way Connector



TECU 38-Way	ECA 8-Way	Description	Speed Sensor 2-Way	Terminator Resistor 2-Way
J1-30	J2-A	HIL (+) High		
J1-29	J2-B	HIL (-) Low		
	J2-C	Terminator Resistor		J25-2(C)
	J2-D	NOT USED		
	J2-E	Terminator Resistor		J25-1(E)
	J2-F	Speed Sensor (+)	J3-1(F)	
	J2-G	Speed Sensor (-)	J3-2(G)	
J1-13	J2-H	IGN		

▲ IMPORTANT

If Fault Code 16 is active, follow the Fault Code 16 diagnostic procedure.

Component Code 15 Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
1. Key on.				
2. Retrieve active fault codes and FMIs with ServiceRanger using the 9-pin diagnostic connector.				
3. Perform Electrical Pretest.		If no issues are found during the Electrical Pretest and the fault is still active		Go to STEP B
		If issue was repaired during Electrical Pretest		Go to STEP V

STEP B

Procedure	→	Condition	→	Action
1. Key off.				
2. Locate and remove the terminating resistor that is wired into the ECA 8-way connector pins C and E.				
3. Measure resistance between the transmission harness connector pins 1 and 2.				
Note: Make sure the volt/ohm meter is on the proper scale (around 200 ohm scale).		If resistance between pin 1 and 2 is between 50-70 ohms		Replace Shift Device. Go to STEP V
		If resistance is outside of range		Repair Shift Device to ECU CAN Datalink Harness per OEM guidelines. Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Key on.				
3. Clear codes. Go to Fault Code Retrieval/Clearing .				
4. Reconnect all connectors and the negative battery cable.				
5. Driving Vehicle and attempt to reset the code.				
6. Check for codes. Go to Fault Code Retrieval/Clearing .		If no codes		Test complete.
		If code 15 appears		To find error in testing, return to STEP A
		If code other than 15 appears		Go to Fault Code Isolation Procedure Index .

Component Code 16 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	625		248	2	High Integrity Link (HIL)

Overview

This fault code indicates the Transmission ECU is unable to communication with the Push Button Shift Control and / or the Electronic Clutch Actuator.

Detection

Starting at key-on and throughout operation, the Transmission ECU constantly monitors the communication with the Push Button Shift Control and / or Electronic Clutch Actuator. If a communication fault occurs for more than five seconds, fault code 16 is set.

Fallback

This fault causes a downshift only fallback while moving. Once the transmission re-engages the start gear, there will be no upshifts as long as the code is active. If the code is active during power-up a flashing "F" will appear on the gear display and the Transmission ECU will not engage a gear.

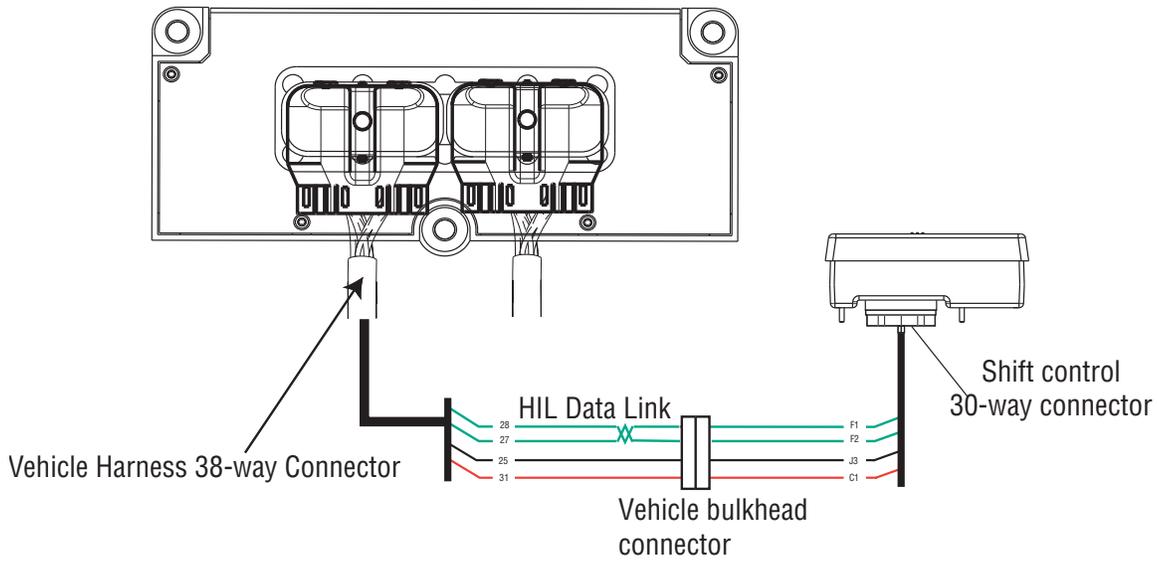
Required Tools

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

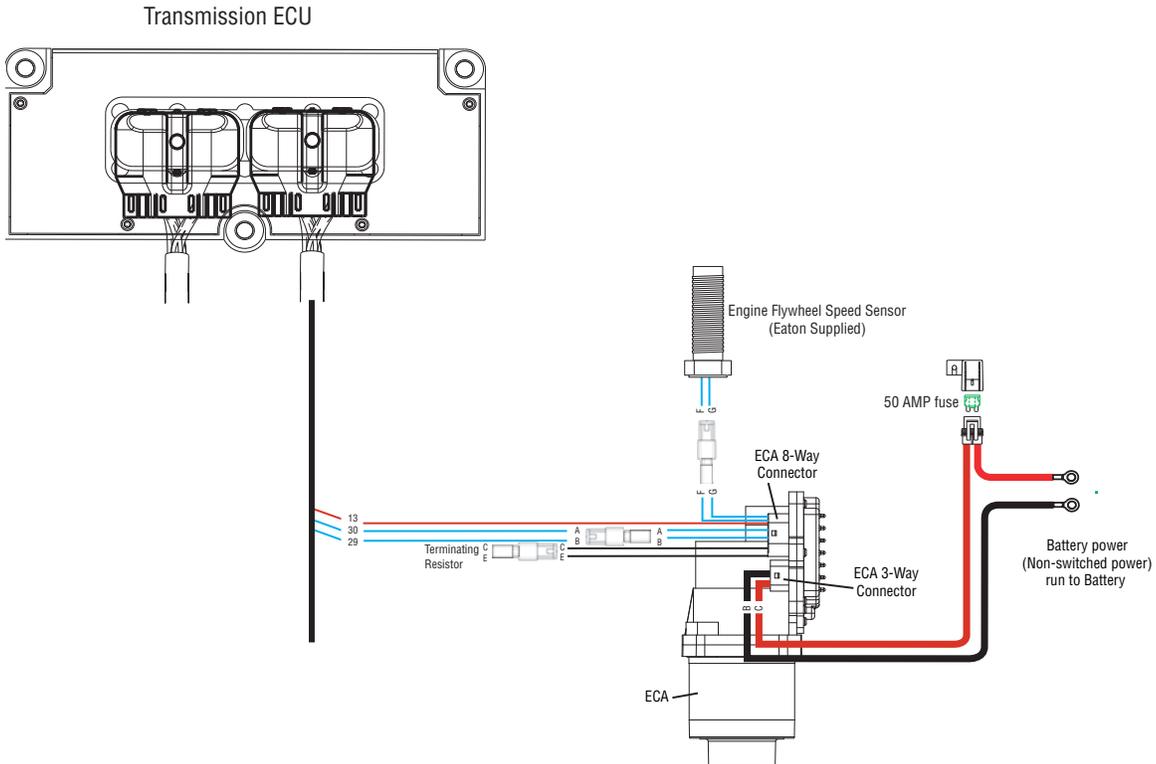
Possible Causes

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

- Vehicle Harness
- Transmission ECU
- Push Button Shift Control
- Charging System
- Transmission Harness
- Electronic Clutch Actuator (ECA)
- Low Batteries
- Corroded or loose power supply to ECU or ECA



Shift Control ECU Legend
 All OEM responsible wiring shown is "typical". Consult specific application.
 (31) = +12 volt switched from TECU
 (28, 27) = Communication from and to the TECU
 (25) = Signal returns, grounds, and general OEM wiring



Fault Isolation Procedures

STEP A

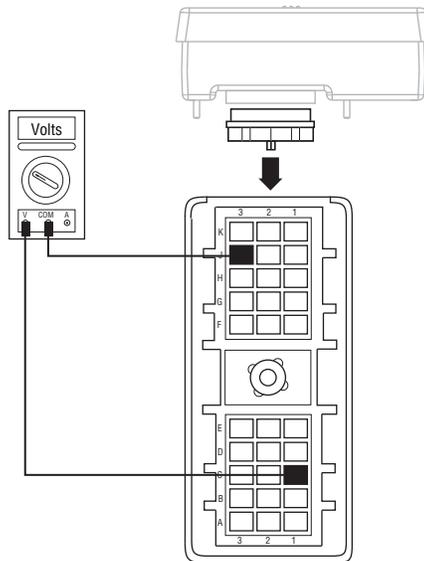
Procedure	→	Condition	→	Action
1. Key on.				
2. Retrieve active fault codes and FMIs with ServiceRanger using the 9-pin diagnostic connector.				
3. Perform Electrical Pretest.		If no issues are found during the Electrical Pretest		If equipped with a Shift Control, go to STEP B If equipped with an OEM Shift Device or Cobra Lever, go to STEP J
		If issue was repaired during Electrical Pretest		Go to STEP V

STEP B

Procedure	→	Condition	→	Action
1. Key off.				
2. Inspect Bulkhead Connector for looseness, corrosion, and contamination.		If Bulkhead Connector is found in serviceable condition.		Go to STEP C
		If looseness, corrosion, or contamination is found at the Bulkhead Connector.		Repair or replace connector per OEM instructions. Go to STEP V

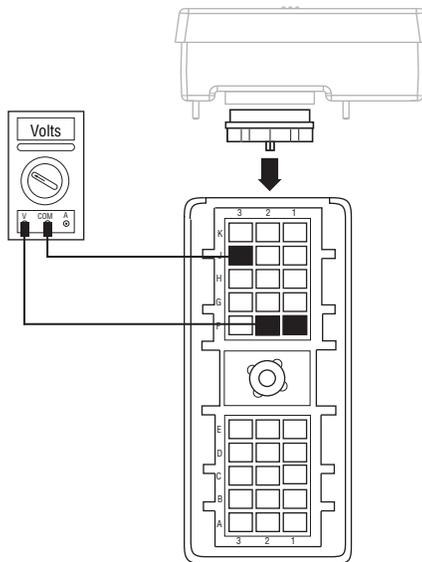
STEP C

Procedure	→	Condition	→	Action
1. Disconnect Shift Control 30-way connector.				
2. Key on.				
3. Measure voltage on 30-way connector pins J3 and C1		If voltage is within 1.2 volts of battery voltage		Go to STEP D
		If out of range		Go to STEP F



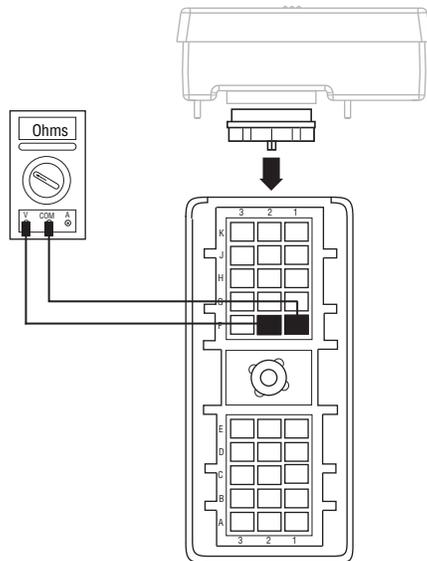
STEP D

Procedure	→	Condition	→	Action
1. Disconnect Shift Control 30-way connector.				
2. Key on.				
3. Measure voltage at Shift Controller 30-way connector pins: - J3 and F1 - J3 and F2		If both readings are between 2-3 volts.		Go to STEP E
		If any of the above requirements are not met.		Go to STEP H



STEP E

Procedure	Condition	Action
<p>1. Key off.</p> <p>Note: Ensure key is off for a minimum of two minutes before proceeding. If unsure, disconnect battery power or remove the 30-amp inline fuse.</p>		
<p>2. Measure resistance at Shift Controller 30-way connector pins F1 and F2.</p>	<p>Transmission is equipped with an ECA and resistance between pins F1 and F2 is between 50-70 ohms.</p> <p>Transmission is not equipped with an ECA and resistance between pins F1 and F2 is between 110-130 ohms.</p>	<p>Replace Push Button Shift Control (Only if Fault Code is Active.) Go to STEP V</p>
	<p>If any of the above requirements are not met.</p>	<p>Go to STEP H</p>



STEP F

Procedure	→	Condition	→	Action
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1. Key off.
2. Disconnect negative battery cable.
3. Disconnect Vehicle Harness 38-way connector.

Note: On Peterbilt, disconnect Gear Display.

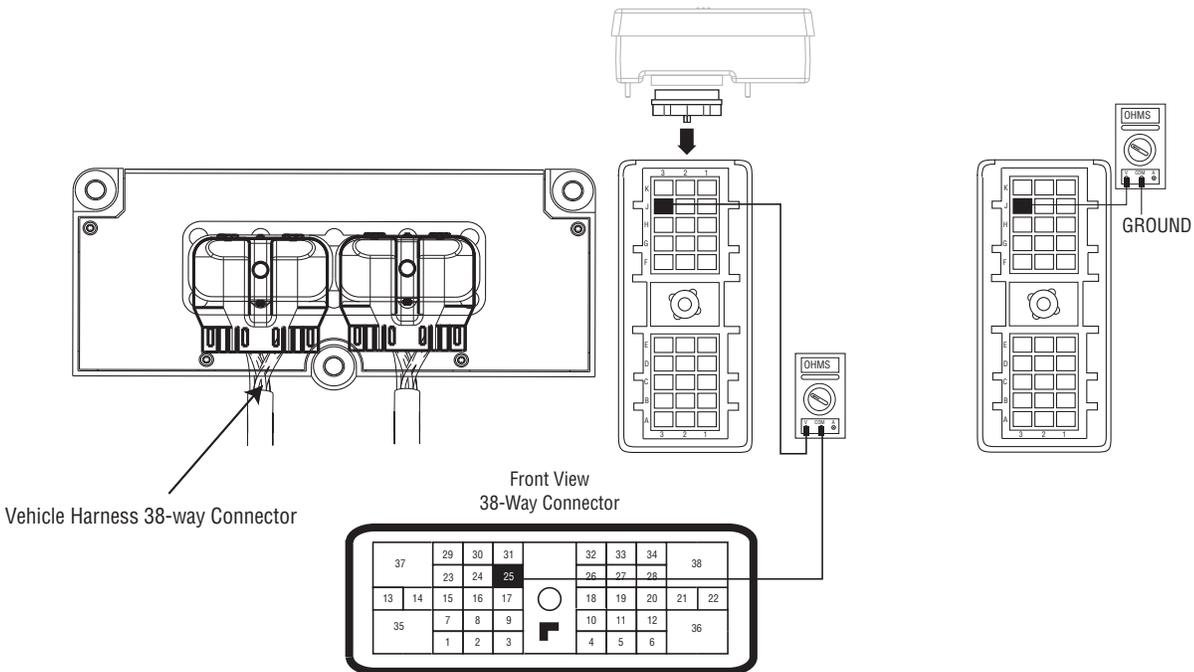
4. Measure resistance between:
 - Shift Control 30-way connector pin J3 and Vehicle Harness 38-way connector pin 25
 - Shift Control 30-way connector pin J3 and ground.

If resistance between pins J3 and 25 is 0 to 0.3 ohms and if resistance between pin J3 and ground is OL

Go to **STEP G**

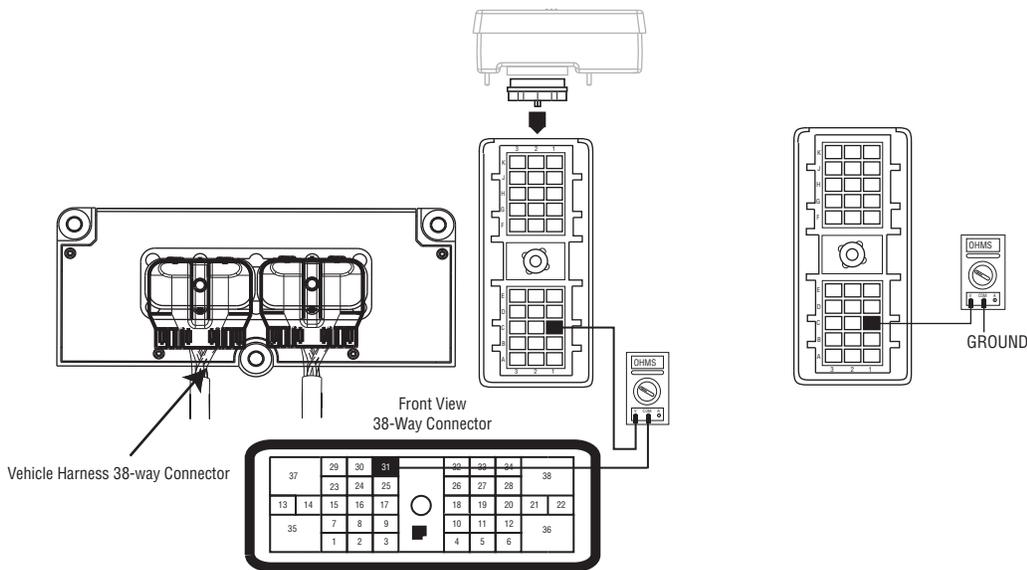
If any of the above conditions are not met

Repair harness between the Shift Control and Transmission ECU.
Go to **STEP V**



STEP G

Procedure	→	Condition	→	Action
1. Key off.				
2. Measure resistance between: <ul style="list-style-type: none"> • Shift Control 30-way connector pin C1 and Vehicle Harness 38-way connector pin 31. • Shift Control 30-way connector pin C1 and ground. 		If resistance between pins C1 and 31 is 0 to 0.3 ohms and resistance between pin C1 and ground is OL		Go to STEP H
		If any of the above conditions are not met		Repair harness between the Transmission ECU and Shift Control. Go to STEP V

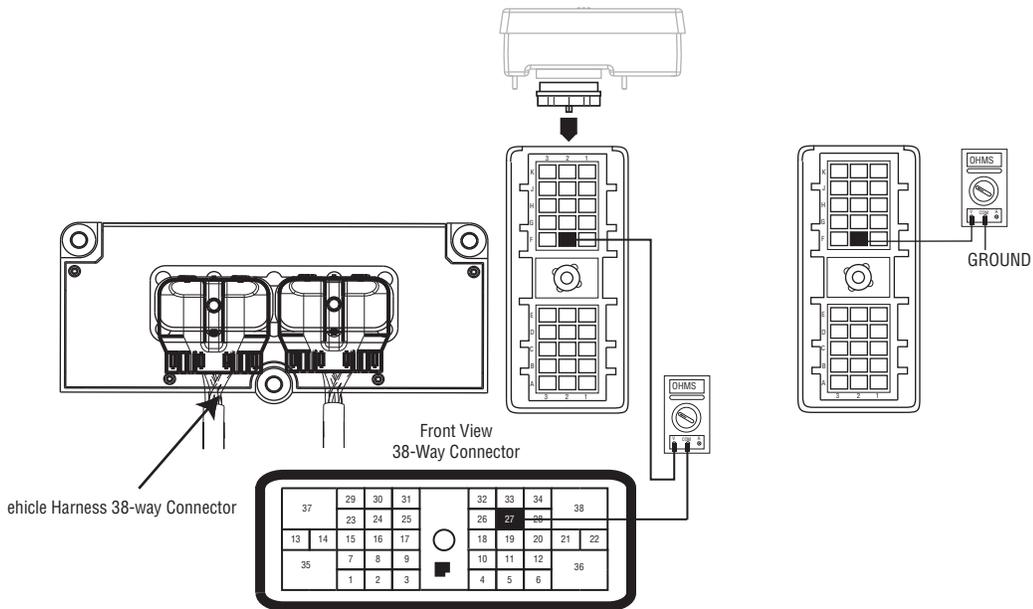


STEP H

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect Vehicle Harness 38-way connector.				
4. Measure resistance between:				
<ul style="list-style-type: none"> • Shift Control 30-way connector pin F1 and Vehicle Harness 38-way connector pin 28. • Shift Control 30-way connector pin F1 and ground. 		<p>If resistance between pins F1 and 28 is 0 to 0.3 ohms and if resistance between pin F1 and ground is OL</p>		Go to STEP I
		<p>If any of the above conditions are not met</p>		<p>Repair harness between the Shift Control and Transmission ECU. Go to STEP V</p>

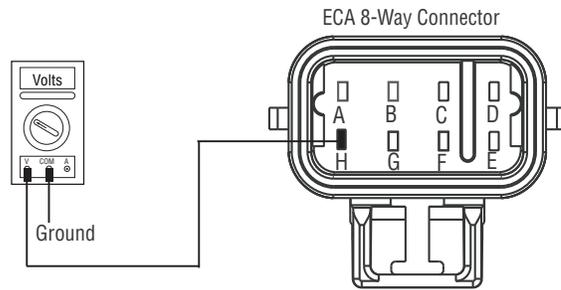
STEP I

Procedure	→	Condition	→	Action
1. Key off.				
2. Measure resistance between:				
<ul style="list-style-type: none"> Shift Control 30-way connector pin F2 and Vehicle Harness 38-way connector pin 27 Shift Control 30-way connector pin F2 and ground 		If resistance between pins F2 and 27 is 0 to 0.3 ohms and resistance between pin F2 and ground is OL		For transmissions without an ECA - Replace Transmission ECU (only if Fault Code is Active). Go to STEP V
				For transmissions equipped with an ECA, go to STEP J
		If any of the above conditions are not met		Repair harness between the Shift Control and Transmission ECU. Go to STEP V



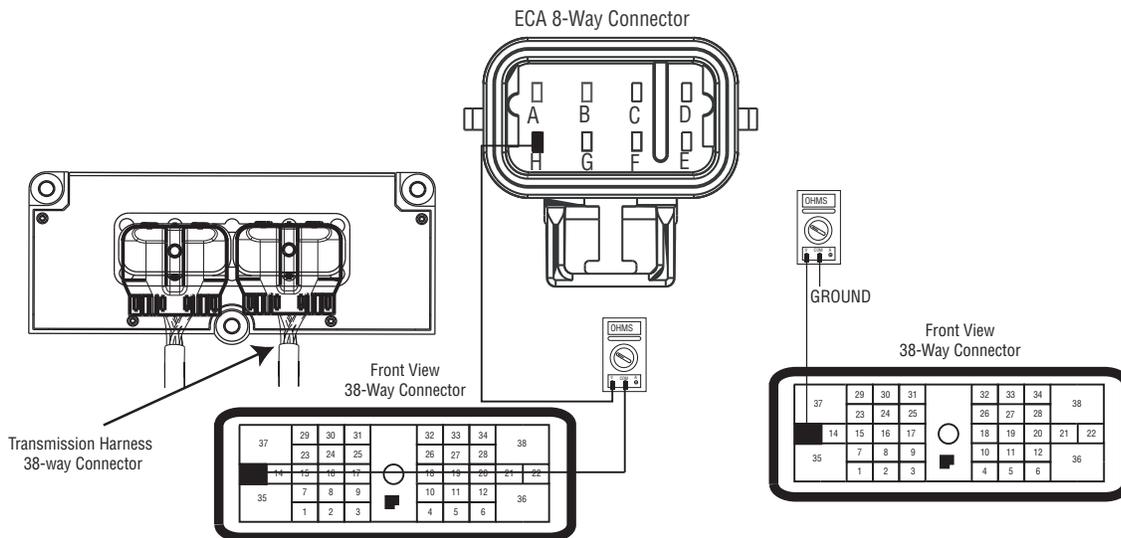
STEP J

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect the ECA 8-way harness connector.				
3. Key on.				
4. Measure voltage at ECA 8-way harness connector from pin H to ground.		Voltage is within 1.2 volts of battery voltage		Go to STEP L
		Voltage is out of range		Go to STEP K



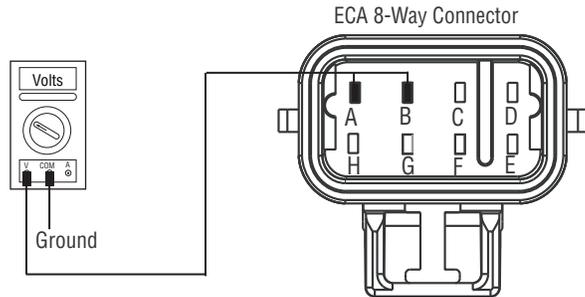
STEP K

Procedure	Condition	Action
1. Key off.		
2. Disconnect the transmission 38-way harness connector at ECU.		
3. Inspect for clean and serviceable 8-way and 38-way connectors, and measure resistance between:		
<ul style="list-style-type: none"> • Transmission 38-way harness connector pin 13 and ECA 8-way harness connector pin H. • Transmission 38-way harness connector pin 13 and ground. 	<p>If connectors are in good repair, and if resistance between pins 13 and H is 0 to 0.3 ohms, and if resistance between pin 13 and ground is OL</p>	<p>Replace ECU (Only if fault code is Active.) Go to STEP V</p>
	<p>If any of the above conditions are not met</p>	<p>Replace Transmission Harness. Go to STEP V</p>



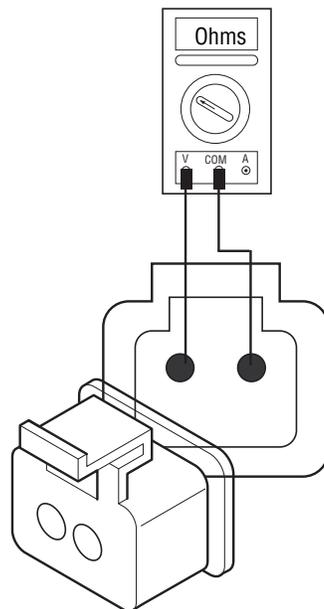
STEP L

Procedure	Condition	Action
1. Key on.		
2. Measure voltage at 8-way connector pins: <ul style="list-style-type: none">• A and ground• B and ground	<p>If voltage between pin A and ground and between pins B and ground are 2-3 volts</p> <p>If any of the above conditions are not met</p>	<p>Go to STEP M</p> <p>Go to STEP N</p>



STEP M

Procedure	→ Condition	→ Action
<ol style="list-style-type: none"> 1. Key off. 2. Connect 8-way connector. 3. Locate and remove the terminating resistor that is wired into the ECA 8-way connector pins C and E. 4. Measure resistance between transmission harness connector pins 1 and 2. <p>Note: Make sure the volt/ohm meter is on the proper scale (around 200 ohm scale).</p>	<p>If equipped with a Push Button Shift Control and resistance between pins 1 and 2 is between 50-70 ohms</p> <p>If equipped with a lever or J1939 shift device and resistance between pins 1 and 2 is between 120-130 ohms</p> <p>If any of the above conditions are not met</p>	<p>Replace ECA (Only if fault code is Active). Go to STEP V</p> <p>Go to STEP N</p>



STEP N

Procedure	→	Condition	→	Action
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1. Key off.
2. Disconnect the transmission 38-way harness connector at ECU.
3. Disconnect the ECA 8-way ECA connector.
4. Inspect for clean and serviceable 8-way and 38-way connectors, and measure resistance between:

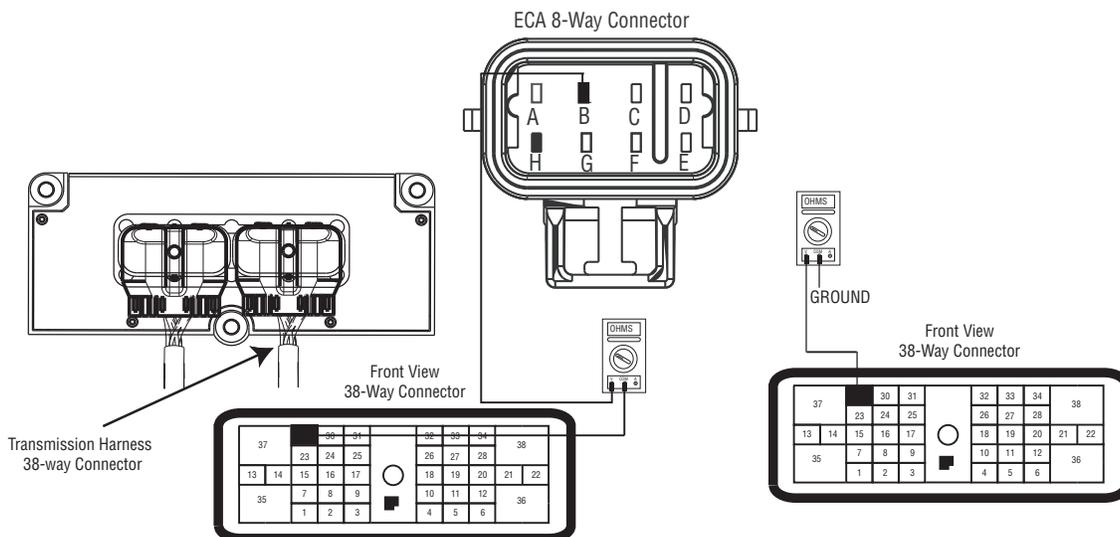
- Transmission 38-way harness connector pin 29 and ECA 8-way harness connector pin B.
- Transmission 38-way harness connector pin 29 and ground.

If connectors are in good repair, and if resistance between pins 29 and B is 0 to 0.3 ohms, and if resistance between pin 29 and ground is OL

Go to **STEP O**

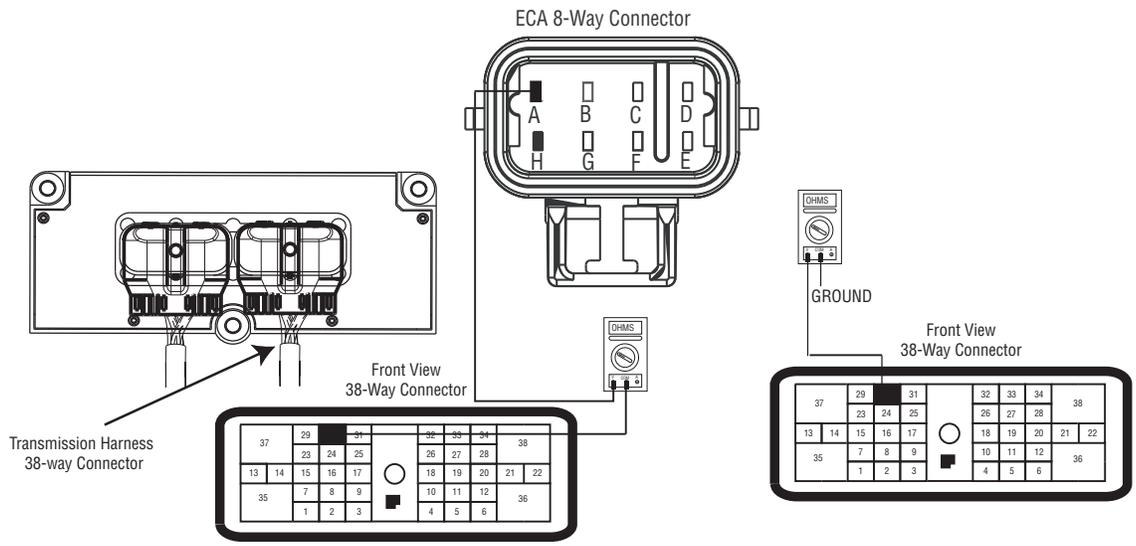
If any of the above conditions are not met

Replace Transmission Harness. Go to **STEP V**



STEP O

Procedure	→	Condition	→	Action
1. Key off.				
2. Measure resistance between:				
<ul style="list-style-type: none"> Transmission 38-way harness connector pin 30 and ECA 8-way harness connector pin A. Transmission 38-way harness connector pin 30 and ground. 		<p>If resistance between pins 30 and A is 0 to 0.3 ohms, and if resistance between pin 30 and ground is OL</p>		<p>Replace ECU (Only if fault code is Active). Go to STEP V</p>
		<p>If any of the above conditions are not met.</p>		<p>Replace Transmission Harness. Go to STEP V</p>



STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors and negative battery cable.				
3. Key on.				
4. Clear codes.				
5. Drive the vehicle and attempt to reset the code.				
6. Check for codes.		If no codes		Test complete.
		If code 16 appears		To find error in testing, return to STEP A
		If code other than 16 appears		Go to Fault Code Isolation Procedure Index .

Component Code 17 Isolation Procedures

Data Bus	MID	SA	SPN	PID	SID	FMI	Description
J1587	130				237	3, 4	Start Enable Relay (SER) circuit
J1939		3	629			3, 4	Start Enable Relay (SER) circuit

Overview

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

When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19.

Detection

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

Fallback

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

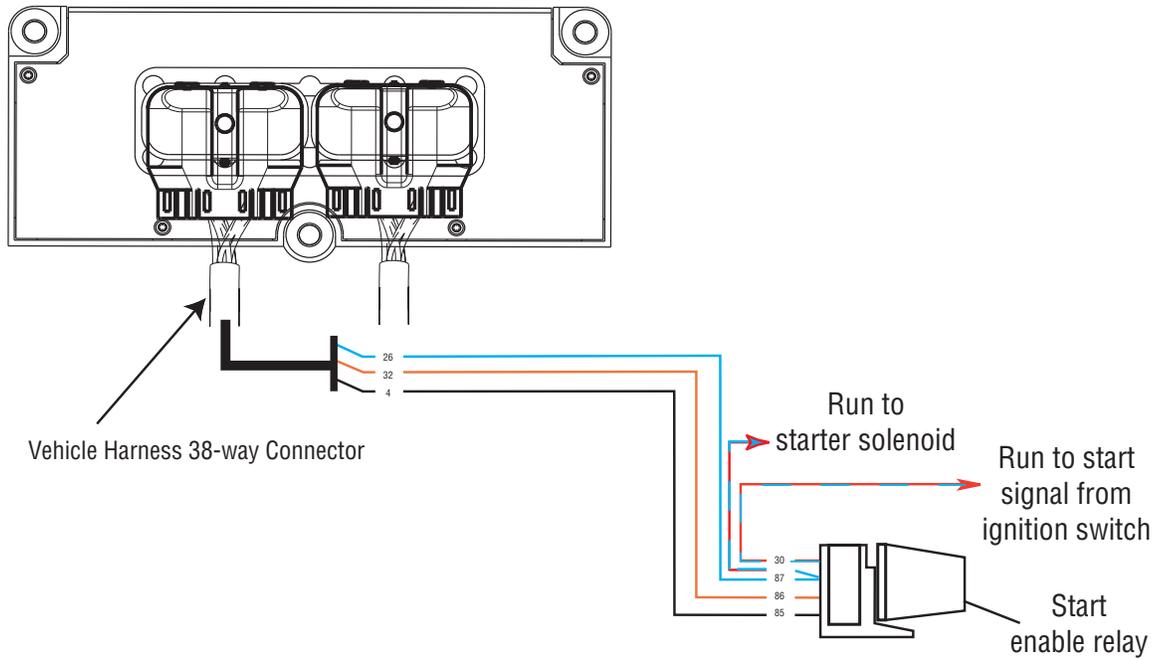
Required Tools

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

Possible Causes

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

- Start Enable Relay
- Vehicle Harness
- Transmission ECU



Trans ECU Legend
 All OEM responsible wiring shown is "typical". Consult specific application.
 (30, 87) = Switched ignition
 (26-87) = Latch into the ECU
 (4-85) = -12 volt relay source
 (32-86) = +12 volt relay source

Fault Isolation Procedures

STEP A

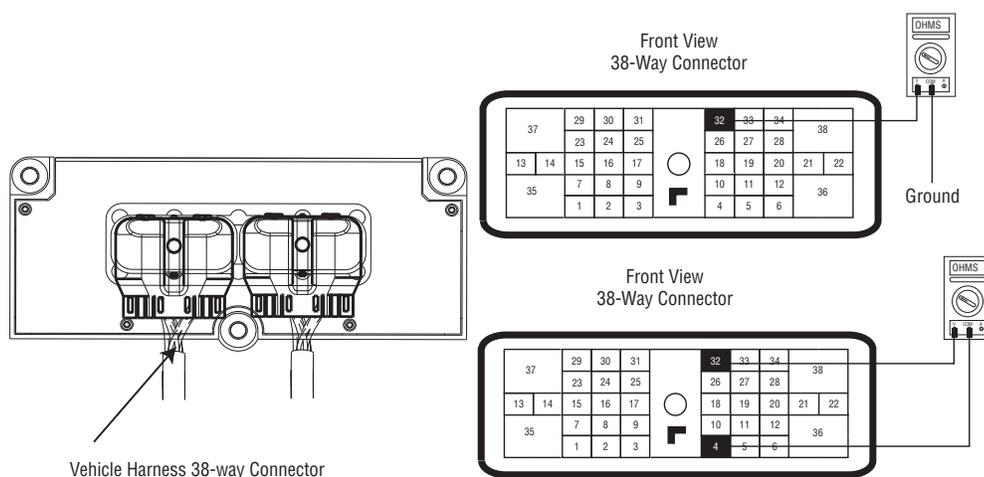
Procedure	Condition	Action
1. Key on.		
Note: The Start Enable Relay must be wired according to Eaton GEN III requirements (shown on previous page) for tests to work properly. If wired differently, consult OEM for correct wiring schematic.		
2. Retrieve active fault codes and FMIs with ServiceRanger using the 9-pin diagnostic connector.		
3. What FMIs are present?	FMI 14 is present	Go to STEP B
	FMI 3 or 4 are present	Go to STEP C

STEP B

Procedure	Condition	Action
1. Inspect OEM Start Enable Relay breakout connector and inspect for mis-routed or defective OEM wiring. Inspect per OEM guidelines.	If SER breakout connector is not connected to SER	Repair / replace SER per OEM guidelines. Go to STEP V
	If circuit has been bypassed	Rewire per OEM guidelines. Go to STEP V
	If harness is defective	Repair harness per OEM guidelines. Go to STEP V

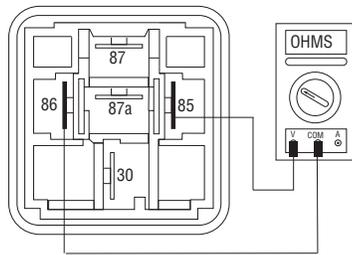
STEP C

Procedure	Condition	Action
1. Key off.		
2. Disconnect negative battery cable.		
3. Disconnect Vehicle Harness 38-way connector.		
4. Measure resistance between Vehicle Harness 38-way connector pins 32 and 4 and measure resistance between Vehicle Harness 38-way connector pin 32 and ground.	If resistance between 32 and 4 is 40 to 120 ohms (12 volt system) or 140 to 480 ohms (24 volt system) and resistance between 32 and ground is OL	Replace Transmission ECU (Only if Fault Code is Active). Go to STEP V
	If resistance is outside of range	Go to STEP B



STEP D

Procedure	Condition	Action
1. Remove Start Enable Relay from vehicle dash harness.		
2. Measure resistance between Start Enable Relay pins 85 and 86.	<p>If resistance is 40 to 120 ohms (12 volt system) or 140 to 480 ohms (24 volt system)</p> <p>If resistance is outside of range</p>	<p>Repair OEM wiring from Transmission ECU to Start Enable Relay. Go to STEP V</p> <p>Replace Start Enable Relay. Go to STEP V</p>



3.

STEP V

Procedure	Condition	Action
1. Key off.		
2. Reconnect all connectors and negative battery cable.		
3. Key on.		
4. Clear codes.		
5. Drive the vehicle and attempt to reset the code.		
6. Check for codes.	<p>If no codes</p> <p>If code 17 appears</p> <p>If code other than 17 appears</p>	<p>Test complete.</p> <p>To find error in testing, return to STEP A</p> <p>Go To Fault Code Isolation Procedure Index.</p>

Component Code 18 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	520200		254	9	ECA Communication Fault

Overview

The Electric Clutch Actuator (ECA) controls the position of the clutch assembly. The ECA communicates with the Transmission ECU over the proprietary Controller Area Network (CAN) datalink to change position, show faults or include other operation information. When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19 for more information on troubleshooting inactive codes.

Detection

Fault Code 18 is set when the ECA loses communication on the CAN datalink for 2 seconds.

Fallback

The ECA will either maintain current clutch position or move to the last position commanded by the ECU. Upon approaching idle the clutch will open and remain in this state. If the fault occurs at power-up, the vehicle will not crank.

Required Tools

- Troubleshooting Guide
- ServiceRanger, PC-based Service Tool

Possible Causes

- CAN datalink from the ECA to the link
- ECA
- Transmission ECU



Fault Isolation Procedure

STEP A

Procedure	→	Condition	→	Action
1. Key on.				
2. Retrieve active fault codes and FMIs with ServiceRanger using the 9-pin diagnostic connector.				
3. What FARM's are present?		If Fault Code 18 (FMI 9) is active		Go to Component Code 19 Isolation Procedures .
		If Fault Code 18 (FMI 9) is not active		Test complete. Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Key on.				
3. Clear codes.				
4. Reconnect all connectors and the negative battery cable.				
5. Driving Vehicle and attempt to reset the code.				
6. Check for codes.		If no codes		Test complete.
		If code 18 appears		To find error in testing, return to STEP A
		If code other than 18 appears		Go to Fault Code Isolation Procedure Index .

Component Code 19 Isolation Procedures

Data Bus	MID	SA	SPN	PID	SID	FMI	Description
J1587	130				248	9	CAN ECA Message Fault
J1939		3	520273		248	9	CAN ECA Message Fault

Overview

The High Integrity Link (HIL) is a Controller Area Network (CAN) high speed proprietary data link to communicated between the Transmission ECU (TECU), Electric Clutch Actuator (ECA), and if equipped, Eaton Push Button Shift Control (PBSC). The TECU is connected to the HIL thru the transmission harness, and to the ECA and the OEM interface vehicle harness to the PBSC.

Detection

Active Fault Code 19 is set when the TECU fails to communicate with the ECA for 2.5 seconds.

Fallback

If the code is active during power-up, the engine will crank/start and the TECU will not engage a gear. If the fault occurs while driving, the ECA will either maintain current clutch position or move to the last position commanded by the TECU. An "F" will appear in the gear display and the service light will blink.

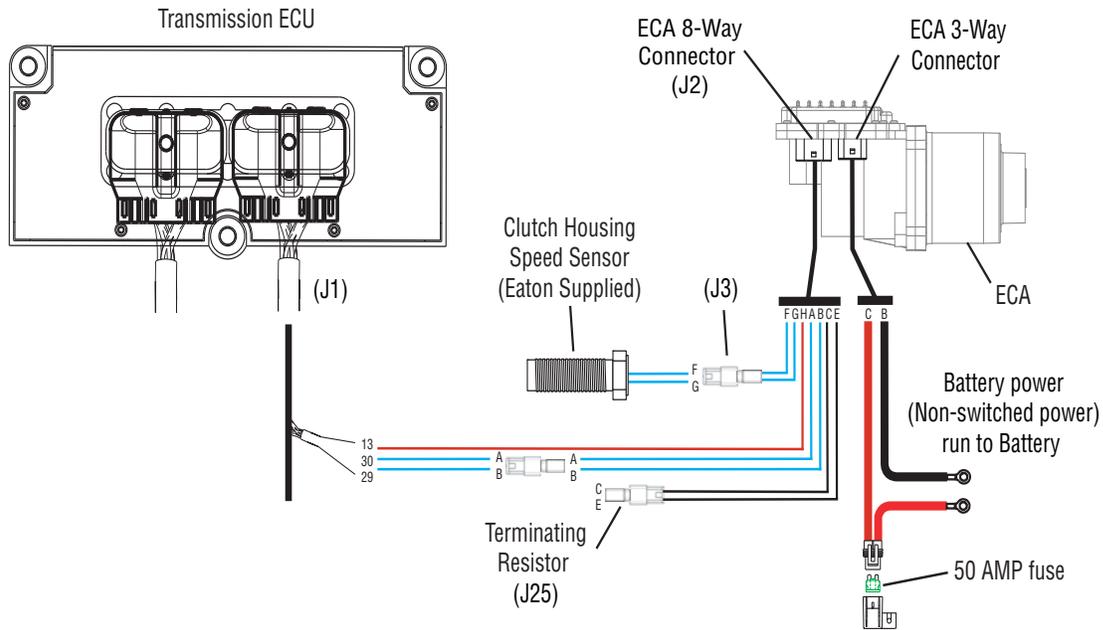
Required Tools

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

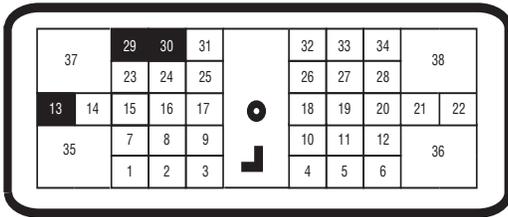
Possible Causes

- OEM ECA power/ground supply
- Transmission harness
- ECA

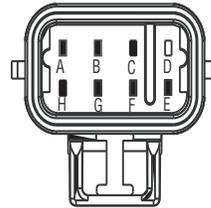
Component Code 19 Isolation Procedures



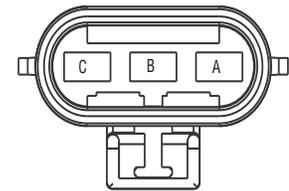
38-Pin Front Harness View
(TECU - Transmission Harness Connector)



ECA 8-Way Connector
Front Harness View



OEM Supplied
ECA 3-Way Connector



TECU 38-Way	ECA 8-Way	Description	Speed Sensor 2-Way	Terminator Resistor 2-Way
J1-30	J2-A	HIL (+) High		
J1-29	J2-B	HIL (-) Low		
	J2-C	Terminator Resistor		J25-2(C)
	J2-D	NOT USED		
	J2-E	Terminator Resistor		J25-1(E)
	J2-F	Speed Sensor (+)	J3-1(F)	
	J2-G	Speed Sensor (-)	J3-2(G)	
J1-13	J2-H	IGN		

Fault Isolation Procedures



If Fault Code 16 is active, follow the Fault Code 16 diagnostic procedure.

STEP A

Procedure	Condition	Action
1. Key on.		
2. Retrieve active fault codes and FMIs with ServiceRanger using the 9-pin diagnostic connector.		
3. Perform Electrical Pretest.	If no issues found during Electrical Pretest and the fault is still active	Go to STEP B
	If issue was repaired during the Electrical Pretest	Go to STEP V

STEP B

Procedure	→	Condition	→	Action
1. Key off.				
2. Locate and remove the terminating resistor that is wired into the ECA 8-way connector pins C and E.				
3. Measure resistance between transmission harness connector pins 1 and 2.				
Note: Make sure the volt/ohm meter is on the proper scale (around 200 ohm scale).		If equipped with a Push Button Shift Control and resistance between pin 1 and 2 is between 50-70 ohms		Replace ECA. Go to STEP V
		If equipped with a Lever or J1939 Shift Device and resistance between pin 1 and 2 is between 110-130 ohms		Replace ECA. Go to STEP V
		If resistance is outside of range.		Replace Transmission Harness. Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors and the negative battery cable.				
3. Key on.				
4. Clear codes.				
5. Drive vehicle and attempt to reset the code.				
6. Check for codes.		If no codes		Test complete.
		If code 19 appears		To find error in testing, return to STEP A
		If code other than 19 appears		Go to Fault Code Isolation Procedure Index .

System Code 21 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	70		254	14	Auto Neutral Park Brake Switch

Overview

An auto neutral feature is provided with this transmission which forces the transmission into neutral in all instances when the parking brake is applied. The OEM installs a normally closed “T” pressure switch into the existing air line to the parking brake valve. The pressure switch output and return wires are connected to the vehicle interface transmission ECU connector. Consult OEM for switch location.

This fault code indicates a failure of the switch that reports engagement of the park brake. When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19 for more information on troubleshooting inactive codes.

Detection

Fault Code 21 is set if the switch indicates the park brake is set while the truck is moving for more than 5 seconds, or if the switch state doesn't match the state broadcast on J1939, or if the switch isn't stable for more than 5 seconds.

Fallback

Remote throttle is disabled, and auto neutral may not work.

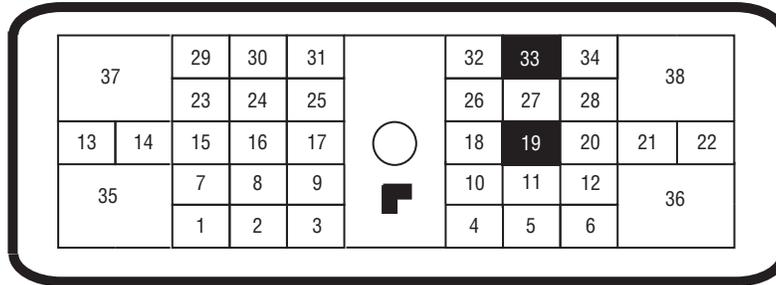
Required Tools

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

Possible Causes

- Park brake switch
- Park brake wiring
- Transmission ECU
- Park brake hardware not installed
- J1939 reporting error

Front View
Transmission ECU Connector
(Vehicle Interface)



Description	From	To
Pressure Switch Signal Wire	Pin 19	Signal Wire
Pressure Switch Return Wire	Pin 33	Return Wire

Fault Isolation Procedures

STEP A

Procedure	→ Condition	→ Action
1. Key on.		
2. Retrieve active fault codes and FMIs with ServiceRanger using the 9-pin diagnostic connector.		
3. Perform Electrical Pretest	If no issues found during Electrical Pretest and the fault is still active	Go to STEP B
	If issue was repaired during the Electrical Pretest	Go to STEP V

STEP B

Procedure	→	Condition	→	Action
1. Ensure vehicle park brake is set and vehicle air system is fully charged.				
2. Using the Data Monitoring function in ServiceRanger, note the status of the Park Brake.		Brake is applied.		Go to STEP C
		Brake is released.		Go to STEP E
		Brake is fluctuating between applied and released.		Go to STEP G

STEP C

Procedure	→	Condition	→	Action
Note: If FC 21 goes inactive when Park Brake is released, a J1939 reporting error is highly probable. Seek OEM assistance before proceeding to Step C.				
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect the switch.				
4. Connect power and key on.		Status changes to Released.		Repair or replace switch per OEM instructions. Go to STEP V
		Status remains Applied.		Go to STEP D

STEP D

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect the Vehicle Harness ECU 38-way connector.				
4. Measure resistance between the Vehicle Harness 38-way connector pin 19 and ground.		If resistance between pin 19 and ground is less than 10K ohm.		Repair harness per OEM guidelines. Go to STEP V
		If resistance between pin 19 and ground is greater than 10K ohm or open.		Replace ECU (only if fault code is active.) Go to STEP V

STEP E

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Bypass the switch by placing a jumper at the switch connections.				
4. Connect power and key on.		Status changed to Applied		Repair or replace switch per OEM instructions. Go to STEP V
		<p>Note: The requirement is for a “normally closed” switch. If the park brake status consistently reports contrary values, a “normally open switch” was possibly installed in error.</p>		
		Status remains Released		Go to STEP F

STEP F

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect the Vehicle Harness ECU 38-way connector.				
4. Measure resistance between the Vehicle Harness 38-way connector pins 33 and 19.		If resistance is greater than 0.3 ohms.		Repair harness per OEM guidelines. Go to STEP V
		If resistance is 0 to 0.3 ohms.		Replace ECU (only if fault code is active.) Go to STEP V

STEP G

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect the switch.				
4. Connect power and key on.		Status changed to Released.		Repair or replace switch per OEM instructions. Go to STEP V
		Status continues changing states.		Go to STEP H

STEP H

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect the Vehicle Harness 38-way connector.				
4. Measure resistance between the Vehicle Harness 38-way connector pins 33 and 19 and measure the resistance between pin 19 and ground.		If resistance between pins 33 and ground or between pins 33 and 19 are less than 10K ohm.		Repair harness per OEM guidelines. Go to STEP V
		If resistance between pins 33 and ground and between pins 33 and 19 are OL		Replace ECU (only if fault code is active.) Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors and the negative battery cable.				
3. Key on.				
4. Clear codes.				
5. Drive vehicle and attempt to reset the code.				
6. Check for codes.		If no codes		Test complete.
		If code 21 appears		To find error in testing, return to STEP A
		If code other than 21 appears		Go to Fault Code Isolation Procedure Index .

System Code 22 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	563		254	9, 14	ABS CAN Message Fault

Overview

J1939 is a high-speed twisted pair 250K baud datalink with one 120 ohm resistor at each end of the link. The transmission ECU is connected to the J1939 datalink at the 38-way vehicle connector. This link is used to transmit information to the ECU as well as communicate or receive data from the other modules on the network like the ABS module. When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19 for more information on troubleshooting inactive codes.

Detection

Fault Code 22 is detected if J1939 communication from the ABS is lost for five seconds and other devices are present on J1939.

Fallback

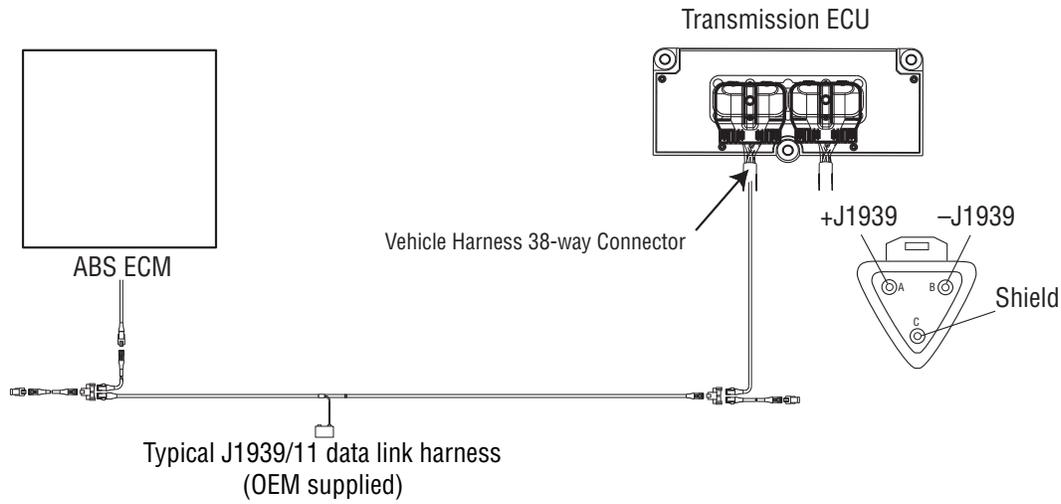
No Fallback mode. However, Hill Start Aid will not function, and the system may attempt a shift during wheel slip events.

Required Tools

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

Possible Causes

- J1939 datalink
- ABS module
- ABS module does not support HSA or is not configured with HSA



Fault Isolation Procedure

STEP A

Procedure	→	Condition	→	Action
1. Key on.				
2. Retrieve active fault codes and FMIs with ServiceRanger using the 9-pin diagnostic connector.		If fault code 22 is active		Repair ABS module or datalink per OEM guidelines.
		If fault code 22 is inactive		Test complete.

Component Code 26 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	522		55	10	Clutch Slip

Overview

This fault code indicates the clutch is not performing as expected. The transmission controller detected excessive clutch slip. This fault can occur with both Datalink Mechanical (DM) and Electronic Clutch Actuator (ECA) clutch models.

Detection

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

Fallback

ECA Clutch Fallback

There is no fallback mode. However, if the clutch is slipping the transmission ECU will request a decrease of engine torque for the duration of the slip event.

DM Clutch Fallback

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

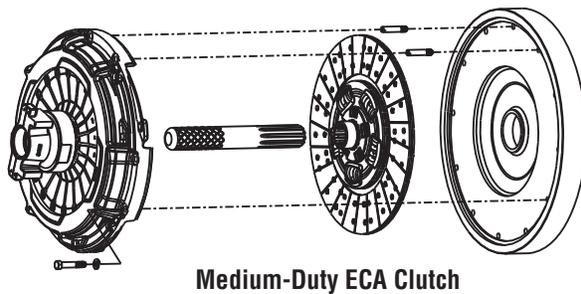
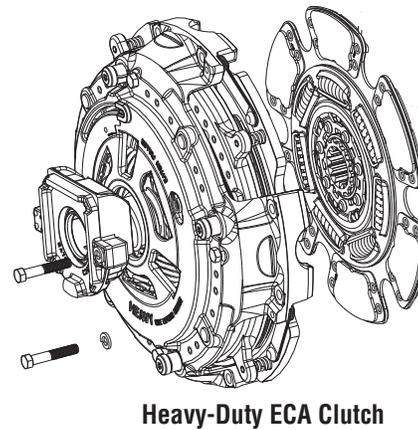
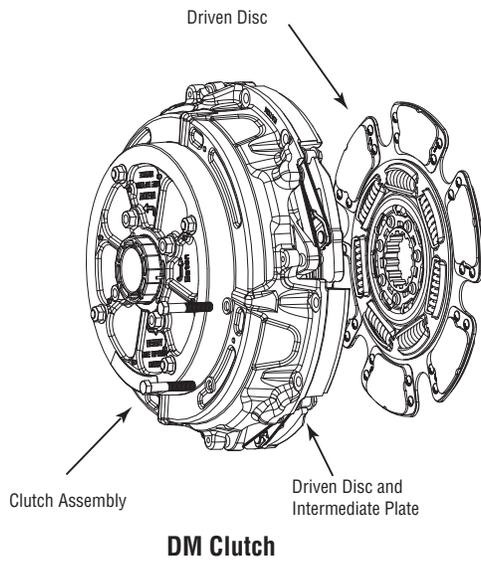
Required Tools

- Basic Hand Tools
- Troubleshooting Guide
- Clutch Jack
- ServiceRanger a PC-based Service Tool

Possible Causes

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

- Worn or Damaged Clutch
- Cams Won't Adjust
- Clutch Abuse
- Low Clutch Torque
- Contaminated Clutch Disks



Clutch Slip Testing

Note: If slip is occurring shortly after clutch greasing, disk contamination is likely. This is a temporary condition and should subside within a few days.

Note: If Fault Code 64 or Fault code 65 is active, follow the associated fault procedure prior to Fault Code 26 procedure.

Note: It is recommended that the pilot bearing and LCIB be replaced whenever the clutch is replaced.

Note: Refer to Installation Guide TRIG1110 for a list of recommended pilot bearings.

Note: Secondary clutch failures resulting from conditions such as pilot bearing failures, excessive torsional vibration, or clutch abuse, are not covered under warranty.

Note: Record Vehicle Performance Analysis every time a clutch is replaced.

If troubleshooting a DM Clutch or medium-duty ECA Clutch, go to [STEP A](#). If troubleshooting a heavy-duty ECA Clutch, go to [STEP B](#).

STEP A

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

STEP B

Procedure	→	Condition	→	Action
1. Key on.				
2. Using ServiceRanger Data Monitor, view Inertia Brake Touch Point Delta.		If the Inertia Brake Touch Point Delta is greater than 27 degrees (0.700")		Go to STEP C
		If less than 27 degrees and a slipping compliant is confirmed		Pull VPA and replace Clutch. Go to STEP V
		If less than 27 degrees and the clutch release bearing and cross shaft were recently lubricated		Pull VPA, clear codes and road test.
				<ul style="list-style-type: none"> • If no slip compliant and no fault code resets, Go to STEP V • If a slip compliant and fault code reset, replace clutch. Go to STEP V

STEP C

Procedure	→	Condition	→	Action
1. Key off.				
2. Check the position wear indicator tab located in clutch cover assembly.		If tab is in the “worn” position		Pull VPA and replace Clutch. (Only if slipping complaint is confirmed.) Go to STEP V
		If tab is not in the “worn” position		Go to STEP D



STEP D

Procedure	→	Condition	→	Action
1. Key off.				
2. Perform the ECA Clutch Reset Procedure. See publication CLSM0200.				
Note: The Open Clutch command can only be performed while the engine is running.				
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> WARNING </div>				
3. Ensure ignition is off before placing hands within the clutch access opening, and ensure hands are removed from the clutch access opening while ignition is cycled on. The clutch will automatically close when the ignition is cycled to “ON”.				
		The reset procedure was successful		Go to STEP V
		The reset procedure was not successful		Pull VPA and Replace Clutch. (Only if slipping complaint is confirmed) Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors and the negative battery cable.				
3. Key on.				
4. Clear codes.				
5. Drive vehicle and attempt to reset the code.				
6. Check for codes.		If no codes		Test complete.
		If code 26 appears		To find error in testing, return to STEP A
		If code other than 26 appears		Go to Fault Code Isolation Procedure Index .

Component Code 27 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	788		55	7, 13	Clutch Disengagement

Overview

The fault code indicates that the clutch has not disengaged as expected. This fault can occur with both Data-link Mechanical (DM) and Electronic Clutch Actuator (ECA) clutch models.

DM Clutch Fault Detection

Starting at key-on and throughout operation, the Transmission ECU 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.

Heavy-Duty ECA Clutch Fault Detection

- Clutch is commanded open and after the Low Capacity Inertia Brake (LCIB) is applied with the speed separation of less than 50 RPM between engine speed and input shaft speed for one second.
- When transmission is in gear and clutch is commanded to open, engine torque is larger than 296 lb-ft (400 N•m) (but engine torque command is less than 0 lb-ft (0 N•m)), and engine speed is below idle speed 100 RPM, and speed separation of less than 50 RPM between engine speed and input shaft speed for one second.
- Release bearing travel is below allowable limit.

IMPORTANT

In UltraShift PLUS transmissions, Fault Code 27 will be active after a new ECU is installed. Press the service brake and start the engine to initiate clutch calibration. The calibration will take approximately 50 seconds and Fault Code 27 will go inactive upon completion.

Fallback

No gear engagement from neutral if the truck is stationary. However, if the ECU determines the vehicle is moving, it will allow a gear engagement from neutral.

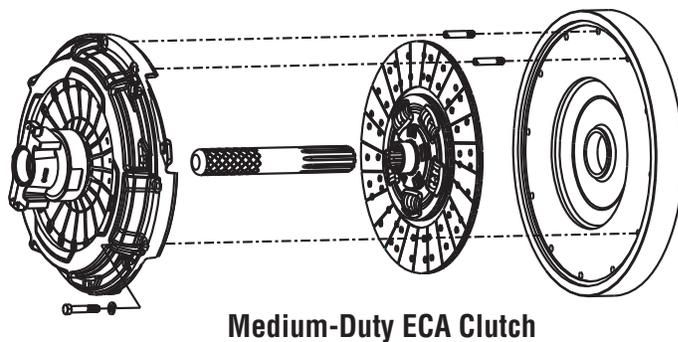
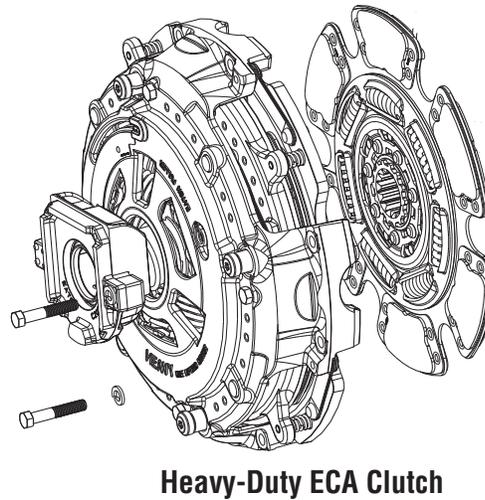
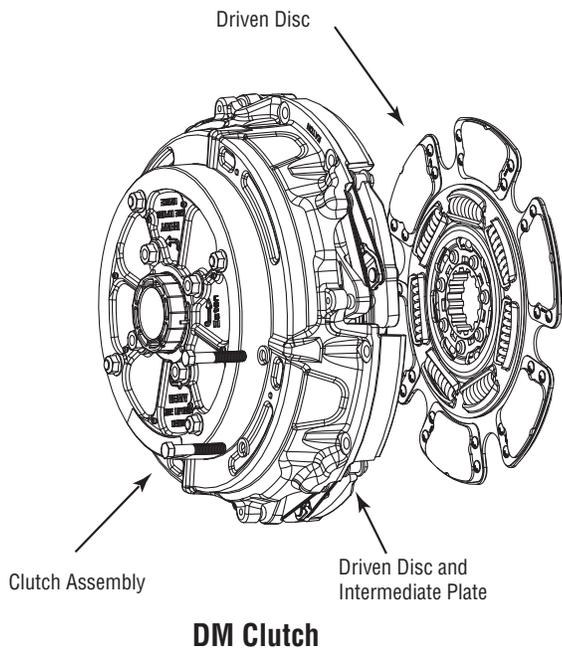
Required Tools

- Basic Hand Tools
- Clutch Jack
- Troubleshooting Guide
- ServiceRanger a PC-based Service Tool

Possible Causes

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

- Failed Clutch
- Clutch Over-Adjusted
- Clutch Thermal Abuse
- Drive Disc Assembly Over-speed
- Pilot Bearing Failure
- Input Shaft Wear
- Lack of Lube in Release Bearing and Bushing



Clutch Disengagement Test

Note: If Fault Code 64 is active, follow Fault Code 64 procedure prior to Fault Code 27 procedure.

Note: It is recommended that the pilot bearing and LCIB be replaced whenever the clutch is replaced.

Note: Refer to Installation Guide TRIG1110 for a list of recommended pilot bearings.

Note: Secondary clutch failures resulting from conditions such as pilot bearing failures, excessive torsional vibration, or clutch abuse, are not covered under warranty.

Note: Record Vehicle Performance Analysis every time a clutch is replaced

Go to Step A when troubleshooting a DM Clutch. Go to Step B when troubleshooting a heavy-duty ECA Clutch. Go to Step G when troubleshooting a medium-duty ECA Clutch.

STEP A

Procedure	→	Condition	→	Action
1. Key on.				
2. Start engine.				
3. Confirm transmission is in neutral.				
4. Raise engine speed above 1500 RPM and allow engine to return to idle.				
5. Compare engine rpm to input shaft rpm with ServiceRanger a PC-based Service Tool.		If the speeds match at idle and code 27 is active		Replace the clutch.
Note: Engine idle rpm must be 700rpm or lower.		If they do not match		Test complete.

STEP B

Procedure	→	Condition	→	Action
1. Key on.				
2. Using ServiceRanger Data Monitor, view Inertia Brake Touch Point Delta.		If the Inertia Brake Touch Point Delta is less than 16 degrees (0.415").		Go to STEP C
		If greater than 16 degrees.		Go to STEP D

⚠ WARNING

The Open Clutch command can only be performed while the engine is running. Ensure ignition is off before placing hands within the clutch access opening, and ensure hands are removed from the clutch access opening while ignition is cycled on. The clutch will automatically close when the ignition is cycled to "ON."

STEP C

Procedure	→	Condition	→	Action
1. Key off.				
2. Perform the Fuller ECA Clutch Reset Procedure. See publication CLSM0200.		The reset was unsuccessful.		Pull VPA data and Replace Clutch. (Only if FC27 is Active). Go to STEP V
		The reset was successful.		Go to STEP V

STEP D

Procedure	→	Condition	→	Action
1. Key off.				
2. Check the position wear indicator tab located in clutch cover assembly.		If the tab is in the “worn” position		Pull VPA and Replace Clutch. (Only if FC27 is active). Go to STEP V
		If the tab is not in the “worn” position		Go to STEP E



STEP E

Procedure	→	Condition	→	Action
1. Key on.				
2. Using ServiceRanger’s Advanced Product Functions, Pull VPA, Record Maximum Input Shaft Speed.		Maximum input shaft speed is 3500 RPM (367 rad/sec) or higher		Pull VPA and Replace Clutch. (Only if FC27 is Active). Go to STEP V
		Maximum input shaft speed is less than 3500 RPM (367 rad/sec)		Go to STEP F

STEP F

Procedure	→	Condition	→	Action
1. Key off.				
2. Visually inspect for signs of damage or failure.		Not sure if release bearing is fully lubed		Grease in accordance with CLSM0200. Go to STEP V
		Physical signs of failed or damaged clutch or release bearing found		Pull VPA and Replace Clutch. (Only if FC27 is Active.) Go to STEP V
		Signs of thermal abuse, such as blued or warped discs, are found		Pull VPA and Replace Clutch. Go to STEP V
		Evidence of a failed or seized pilot bearing found		Replace pilot bearing per OEM instructions and any other damaged parts. Go to STEP V
Note: Refer to Installation Guide, TRIG1110, for a list of recommended pilot bearings.		Found excessive input shaft spline or bushing wear		Replace Input Shaft and any other damaged parts. Go to STEP V

STEP G

Procedure	→	Condition	→	Action
1. Key off.				
2. Remove Electric Clutch Actuator from clutch housing.				
3. Verify release bearing assembly is attached to clutch assembly and functional.		If the release bearing is not attached to the clutch assembly		Replace Clutch. Go to STEP V
		If the release bearing is attached to the clutch assembly and functional		Go to STEP H

STEP H

Procedure	→	Condition	→	Action
1. Key off.				
2. Attempt to rotate the cross-shaft and yoke assembly by hand.		If the cross-shaft assembly rotates by hand from the release bearing to the transmission case		Reinstall ECA. Go to STEP I
		If the cross-shaft assembly does not rotate by hand		Replace the cross-shaft, bushings, and grease. Repeat STEP H

STEP I

Procedure	→	Condition	→	Action
1. Key on.				
2. Start engine.				
3. Launch vehicle and drive until 6th gear is obtained. Then slow down to a stop.				
4. Repeat the launch five times.		If FC 27 is active		Replace the Clutch. Go to STEP V
		If FC 27 is not active		Test is complete. Go to STEP V

STEP V

Procedure	Condition	Action
1. Key off. 2. Reconnect all connectors and the negative battery cable. 3. Key on. 4. Clear codes.	If code 27 appears If code other than 27 appears	To find error in testing, return to STEP A Go to Fault Code Isolation Procedure Index .

Component Code 28 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	788		52, 55	3, 4, 5, 7	Clutch System

Overview

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

Detection

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

Fallback

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

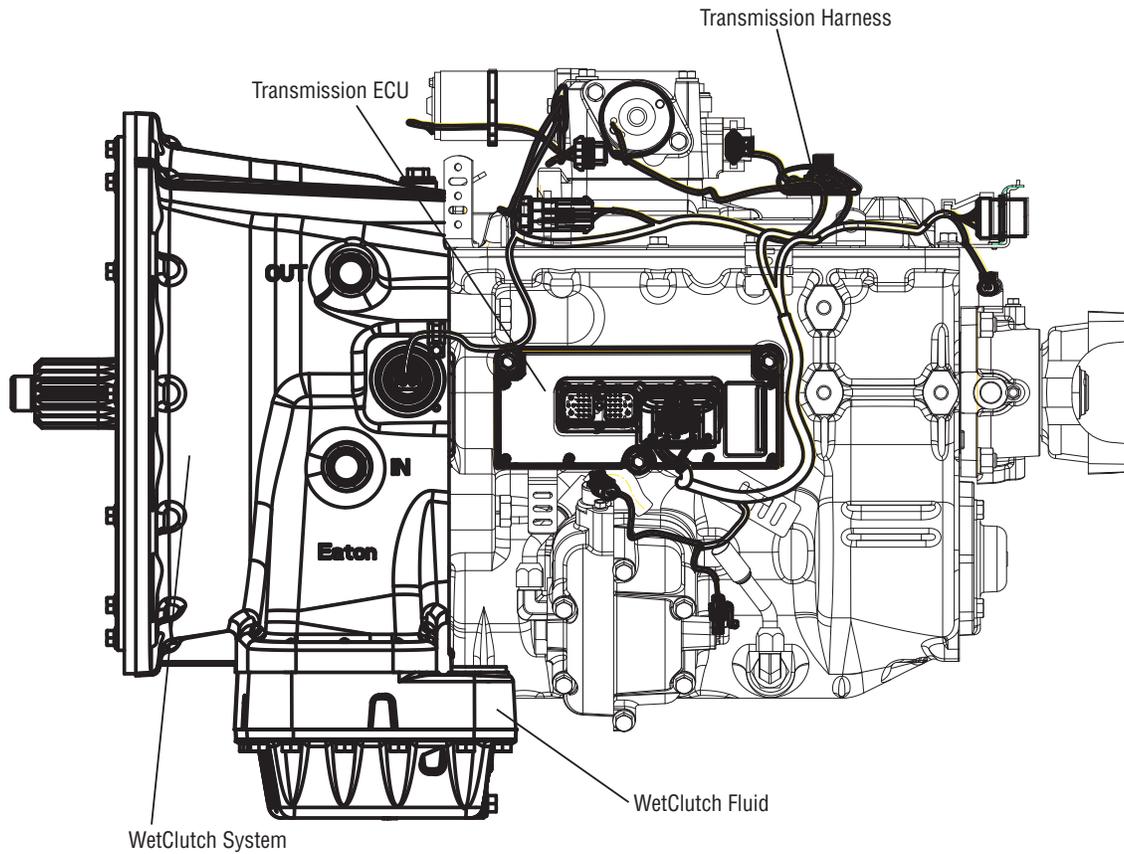
Required Tools

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

Possible Causes

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

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



Fault Isolation Procedures

STEP A

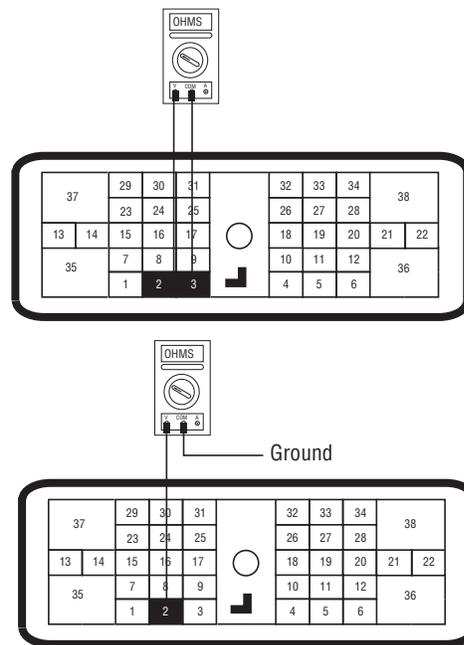
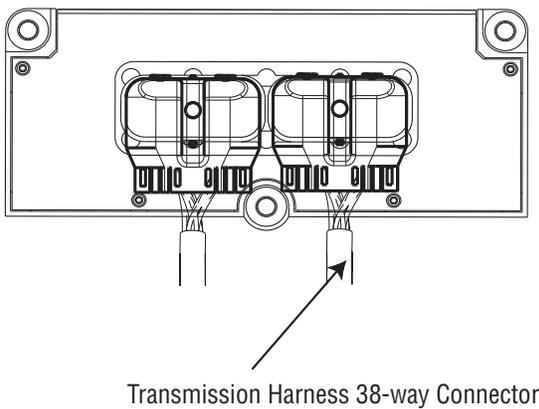
Procedure	→	Condition	→	Action
1. Key on.				
2. Place the transmission in neutral.				
3. Allow engine to idle at 700 to 800 RPM for a minimum of two minutes.				
Note: Ensure transmission fluid temperature is 60 to 120 degrees F (16 to 49 degrees C).				
4. Check WetClutch fluid level.		If fluid level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

STEP B

Procedure	→	Condition	→	Action
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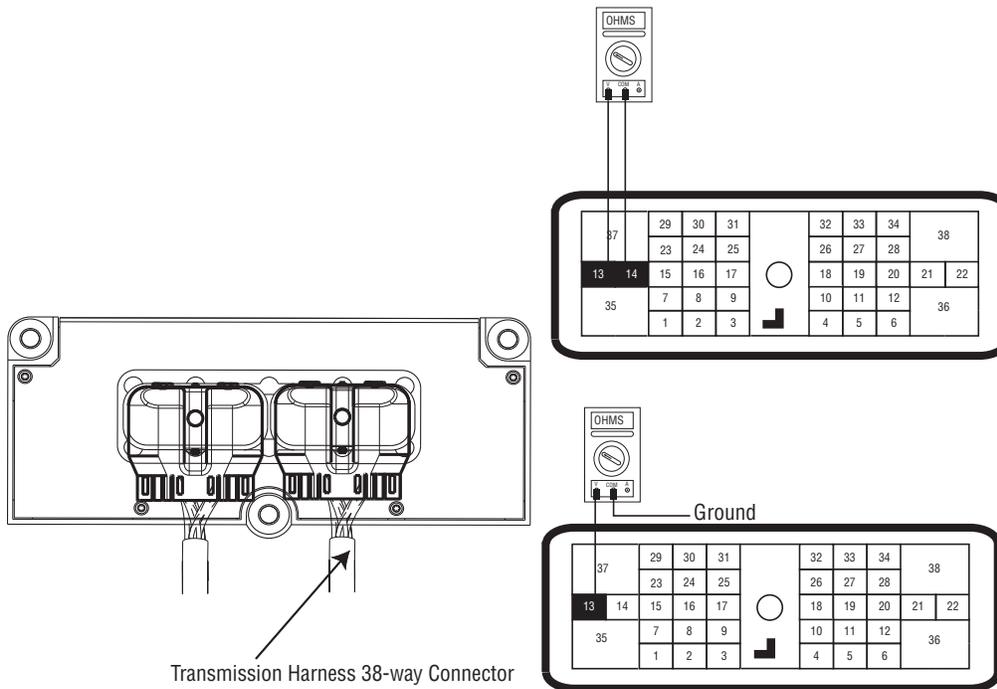
1. Key off.
2. Disconnect the negative battery cable.
3. Disconnect the Transmission ECU 30-way connector.
4. Measure resistance between the Transmission Harness 38-way connector pins 2 and 3 and 2 to ground.

If the resistance between 2 and 3 is 6.5 to 9.5 ohms and is resistance from pin 2 to ground is OL	Go to STEP C
If resistance is outside of range	Go to STEP D



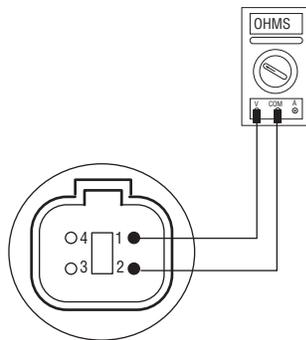
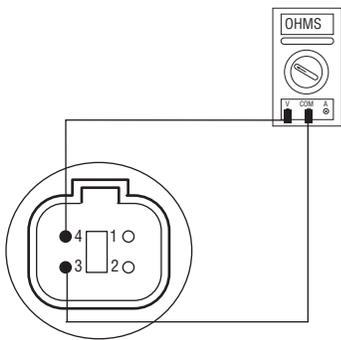
STEP C

Procedure	→ Condition	→ Action
1. Measure resistance between the Transmission Harness 38-way connector pins 13 and 14 and 13 to ground.	If resistance between 13 and 14 is 8.5 to 12 ohms and resistance from pin 13 to ground is OL	Replace Transmission (Only if Fault Code is Active). Go to STEP V
	If resistance is less than 10K ohm	Go to STEP D



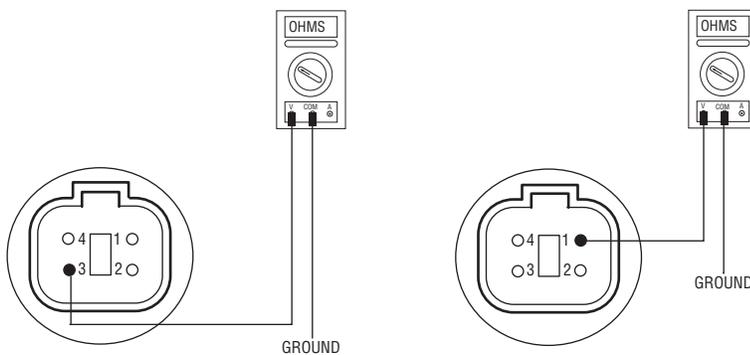
STEP D

Procedure	→	Condition	→	Action
1. Disconnect Transmission Harness located on left side of WetClutch housing.				
2. Measure resistance between WetClutch housing connector pins:				
<ul style="list-style-type: none"> • 3 and 4 • 1 and 2 		<p>If the resistance between pins 1 and 2 is 8.5 to 12 ohms and the resistance between 3 and 4 is 6.5 to 9.5 ohms</p>		Go to STEP E
		<p>If resistance is outside of range</p>		<p>Replace Transmission. Go to STEP V</p>



STEP E

Procedure	→	Condition	→	Action
1. Measure resistance between WetClutch housing connector pins: <ul style="list-style-type: none"> • 3 and ground • 1 and ground 		If resistance from pin 3 to ground and pin 1 to ground is 10K ohm or greater		Replace Transmission Harness. Go to STEP V
		If resistance is less than 10K ohm		Replace Transmission. Go to STEP V



STEP V

Procedure	→	Condition	→	Action
1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear codes. Go to Fault Code Retrieval/Clearing . 5. Drive the vehicle and attempt to reset the code.				
6. Check for codes Go to Fault Code Retrieval/Clearing .		If no codes		Test complete.
		If code 28 appears		To find error in testing, return to STEP A
		If code other than 28 appears		Go to Fault Code Isolation Procedure Index .

System Code 29 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	969		254	4, 5	Remote Throttle Enable

Overview

This fault indicates an electrical failure of the relay that allows the remote throttle to operate. The relay and wiring are installed by the OEM. When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19 for more information on troubleshooting inactive codes.

Detection

Starting at key-on and throughout operation, the Transmission ECU constantly measures the circuit. The fault is set if the ECU detects a bad (open/short) connection for 2 seconds in the wiring from the ECU to the Relay.

Fallback

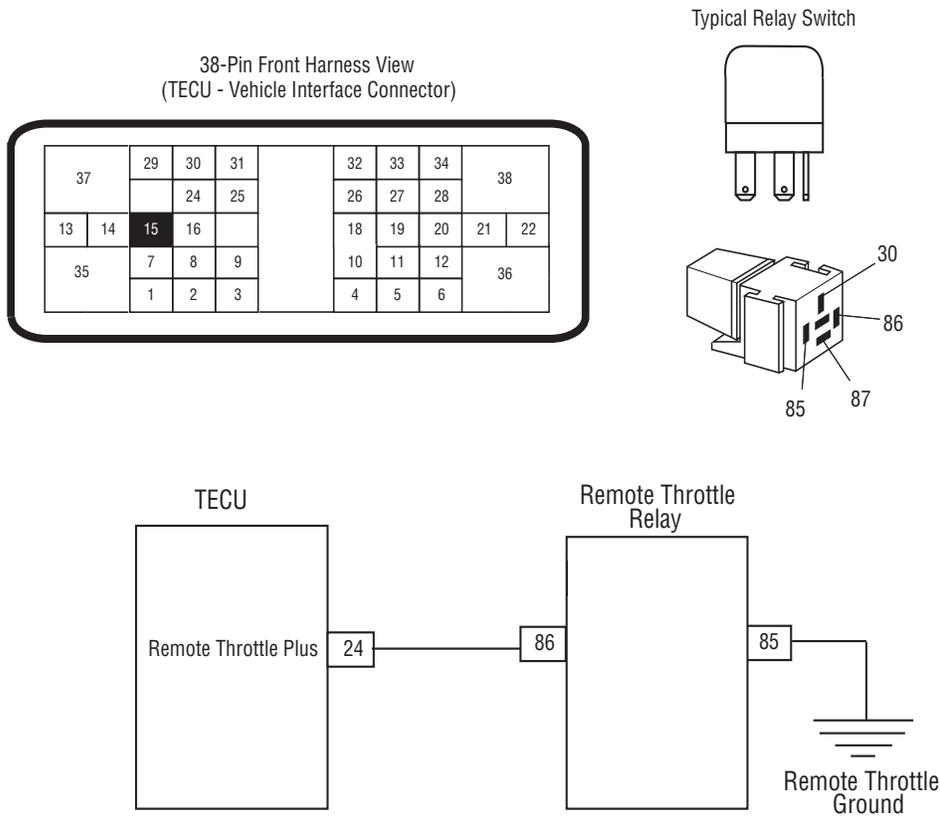
There is no fallback mode associated with this fault, but the remote throttle will either not work or always work when this fault is active.

Required Tools

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

Possible Causes

- Remote Throttle Relay
- Harness
- Transmission ECU
- Software Misconfiguration



Fault Isolation Procedures

STEP A

Procedure	Condition	Action
1. Follow OEM troubleshooting guidelines to ensure the Remote Throttle Enable Relay has not failed.	If relay is functional	Go to STEP B
	If relay is faulted	Test complete.

STEP B

Procedure	→	Condition	→	Action
1. Key on.				
Note: The Remote Throttle Enable Relay must be wired according to Eaton Gen 3 requirements (shown on previous page) for tests to work properly. If wired differently, consult OEM for correct wiring schematic.				
2. Retrieve active fault codes and FMIs with ServiceRanger using the 9-pin diagnostic connector.				
3. What FMIs are present?		FMI 4 is present		Go to STEP C
		FMI 5 is present		Go to STEP D

STEP C

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect battery cable.				
3. Disconnect the vehicle harness 38-way connector.				
4. Measure the resistance between vehicle harness 38-way connector pins 24 and ground.		If the resistance between 24 and ground is OL		Replace the TECU (if fault code active). Go to STEP V
		If resistance is out of range.		Repair the vehicle harness. Go to STEP V

STEP D

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect battery cable.				
3. Disconnect the vehicle harness 38-way connector.				
4. Disconnect the OEM harness from the Throttle Enable Relay.				
5. Measure resistance between vehicle harness 38-way connector pin 24 and pin 86 of the Throttle Enable Relay connector.		If resistance between pins 24 and 86 is 0 to 0.3 ohms.		Replace the TECU (if fault code is active). Go to STEP V
		If resistance is out of range.		Repair the vehicle harness. Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors.				
3. Key on.				
4. Clear codes.				
5. Drive the vehicle and attempt to reset the code.				
6. Check for codes.		If no codes		Test complete.
		If code 29 appears		To find error in testing, return to STEP A
		If code other than 29 appears		Go to Fault Code Isolation Procedure Index .

Component Code 31 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	1485		218	2, 3, 4, 5, 14	Momentary Engine Interruption Relay (MEIR)

Overview

This fault code indicates an electrical failure of the MEIR circuit.

Detection

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

Fallback

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

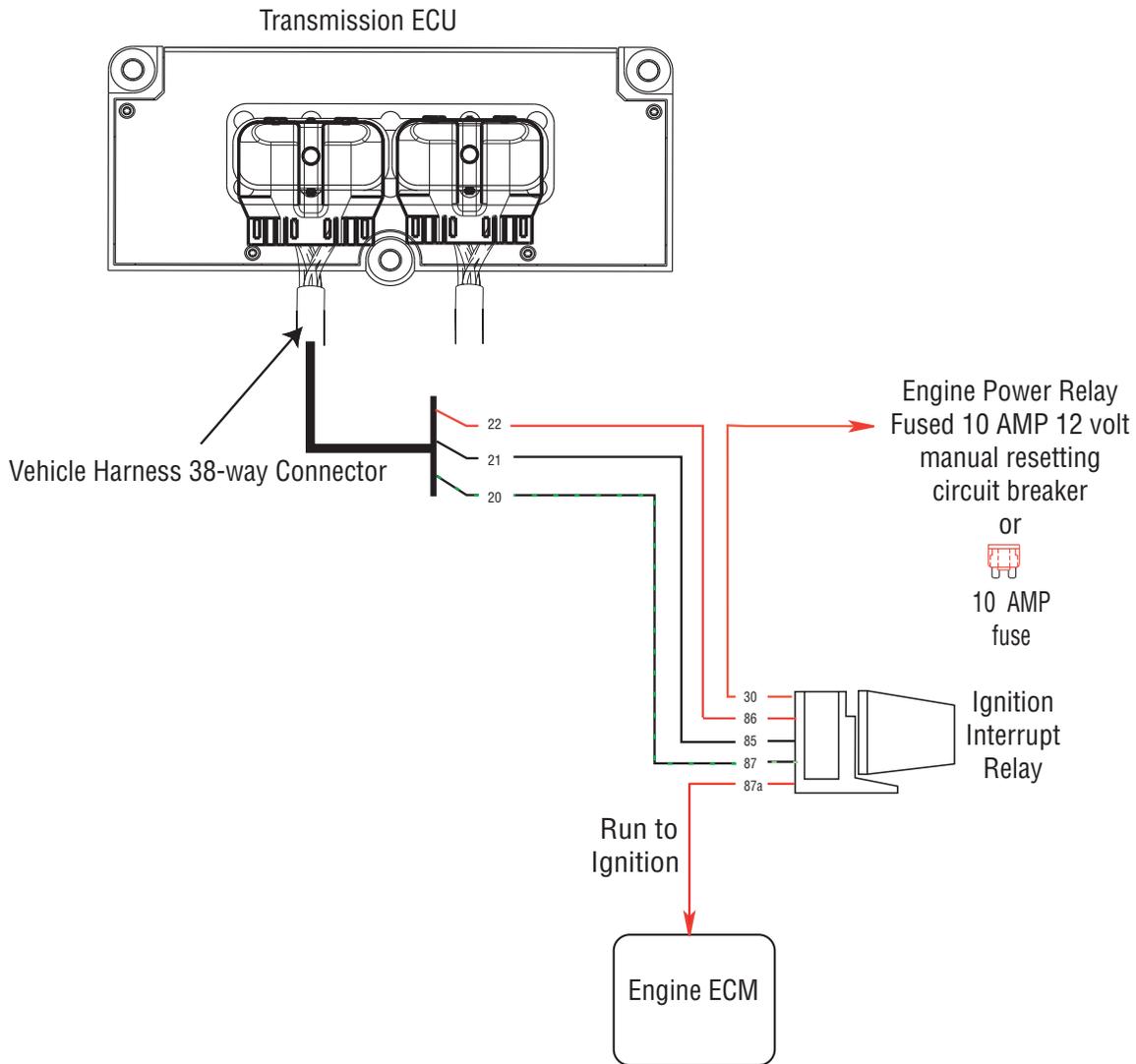
Required Tools

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

Possible Causes

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

- OEM wiring
- Mechanical failure in the MEIR relay
- Transmission ECU

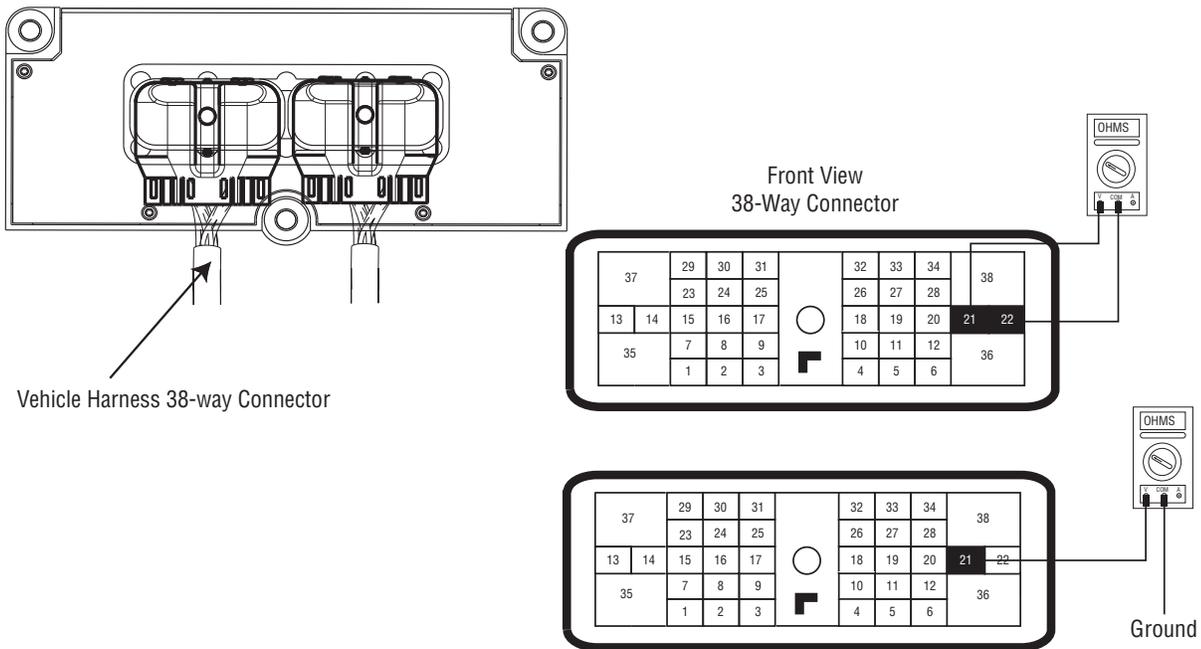


Ignition Interrupt Legend
 All OEM responsible wiring shown is "typical". Consult specific application.
 (30, 87a) = +12 volt switched
 (20-87) = Signal
 (21-85) = -12 volt relay source
 (22-86) = +12 volt relay source

Fault Isolation Procedures

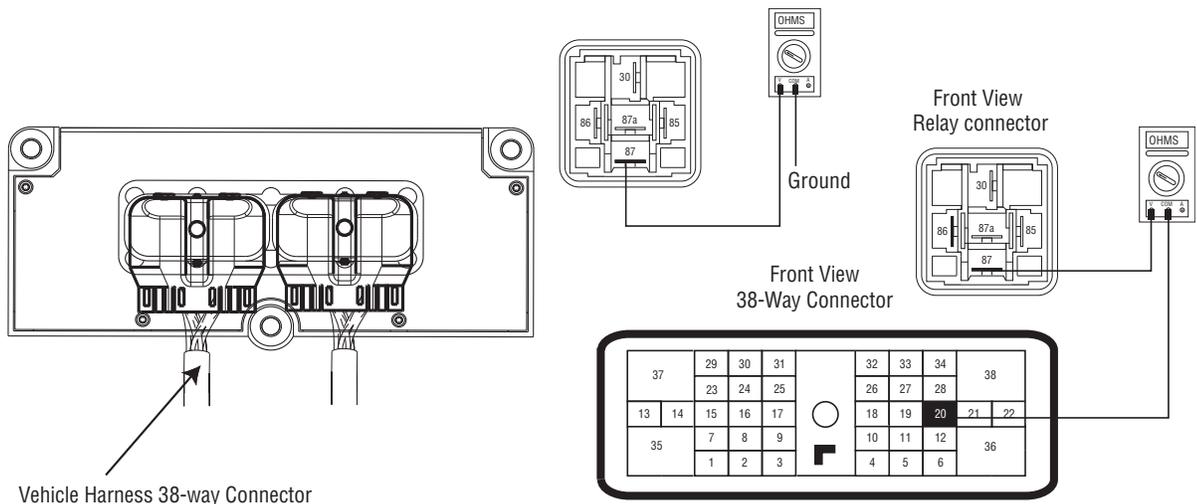
STEP A

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect Transmission ECU Vehicle Harness 38-way connector.				
4. Measure resistance between Vehicle Harness 38-way connector pins 21 and 22 and from pin 21 to ground.		If resistance between pins 21 and 22 is 40 to 120 ohms (12 volt system) or 140 to 480 ohms (24 volt system) and resistance from pin 21 to ground is OL		Go to STEP B
		If resistance is outside of range		Go to STEP D



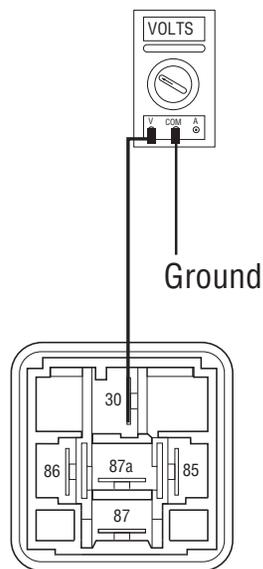
STEP B

Procedure	Condition	Action
1. Measure resistance between Transmission Vehicle Harness 38-way connector pin 20 and MEIIR relay connector pin 87 and from MEIIR relay connector pin 87 to ground.	If resistance between pin 20 and 87 is 0 to 0.3 ohms and if resistance between pin 87 and ground is OL	Go to STEP C
	If resistance is outside of the range	Repair OEM harness between the Transmission ECU and the MEIIR relay connector. Go to STEP V



STEP C

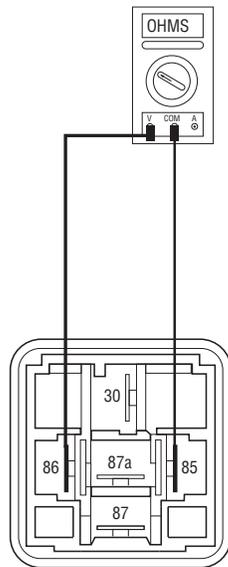
Procedure	Condition	Action
1. Disconnect MEIIR relay from connector.		
2. Key on.		
3. Measure voltage from pin 30 of the MEIIR relay connector to ground.	<p>If voltage is within 0.6 volts of battery voltage</p> <p>If voltage is outside of range</p>	<p>Replace MEIIR relay. Go to STEP E</p> <p>Repair OEM harness. Go to STEP V</p>



Front View
Relay connector

STEP D

Procedure	→	Condition	→	Action
1. Remove MEIIR relay from OEM dash harness.				
2. Measure resistance between MEIIR relay pins 85 and 86.		If resistance is 40 to 120 ohms (12 volt system) or 140 to 480 ohms (24 volt system)		Repair OEM wiring from the Transmission ECU to the MEIIR relay. Go to STEP V
		If resistance is outside of range		Replace MEIIR relay. Go to STEP V



Front View
Relay connector

STEP E

Procedure	→	Condition	→	Action
1. Key on.				
2. Retrieve codes.		If code 31 is inactive		Go to STEP V
		If code 31 is active		Replace Transmission ECU. Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors and negative battery cable if removed.				
3. Key on.				
4. Clear codes. Go to Fault Code Retrieval/Clearing .				
5. Drive the vehicle and attempt to reset the code.				
6. Check for codes. Go to Fault Code Retrieval/Clearing .		If no codes		Test complete.
		If code 31 appears		To find error in testing, return to STEP A
		If code other than 31 appears		Go to Fault Code Isolation Procedure Index .

Component Code 32 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	158	43		2	Loss of Switch Ignition Power Test

Overview

This fault code indicates a loss of Switched Ignition Power to the Transmission ECU.

When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19.

Detection

The Transmission ECU monitors Ignition Power during normal operation. If Ignition power is lost to the Transmission ECU during operation a fault is logged.

Fallback

This fault causes an In Place fallback while moving.

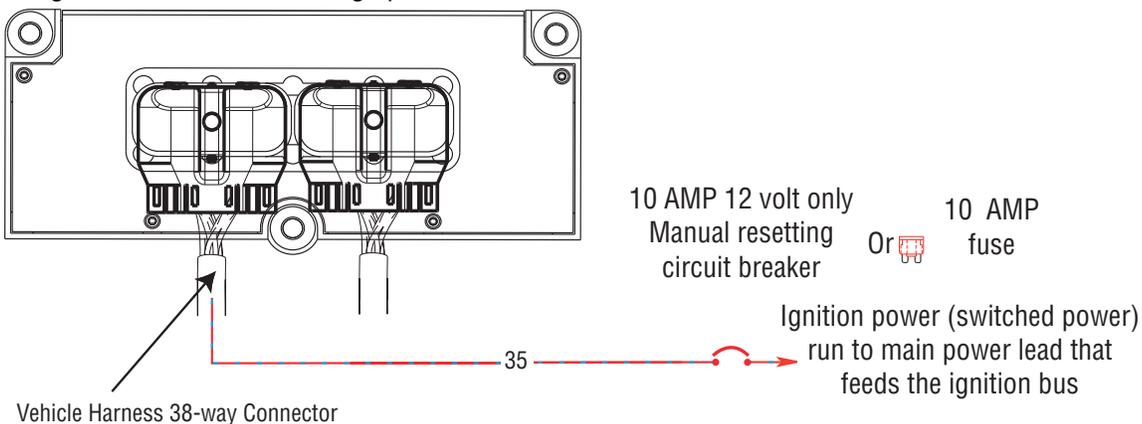
Required Tools

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

Possible Causes

This fault code can be caused by the following:

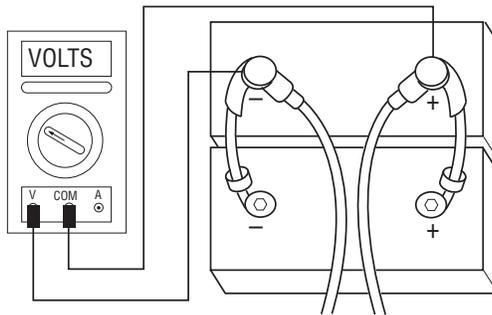
- Ignition Switch is turned off during operation
- Ignition Power is lost during operation



Fault Isolation Procedures

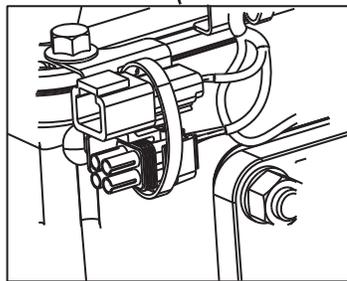
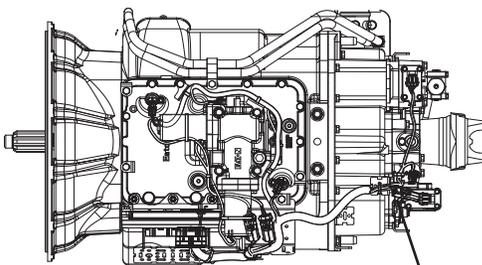
STEP A

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



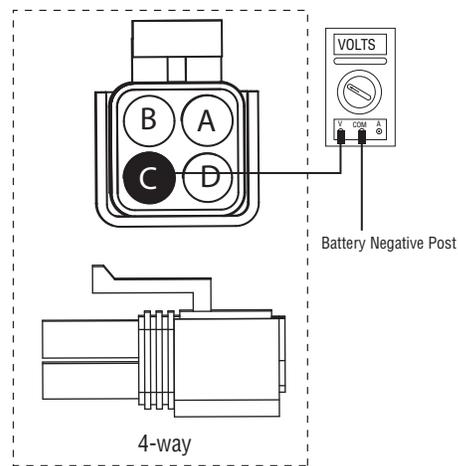
STEP B

Procedure	Condition	Action
1. Locate diagnostic port on Transmission Harness.		
2. Key on.		
3. Measure voltage between pins C and the battery negative post.	If voltage between pin C and the battery negative post is 0.70 volts or less	Go to STEP C
	If voltage is outside of range	Repair battery ground supply to Transmission ECU. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

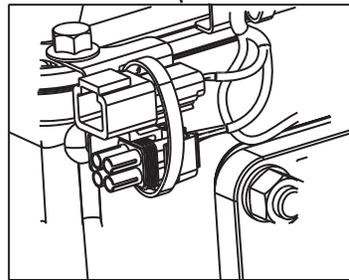
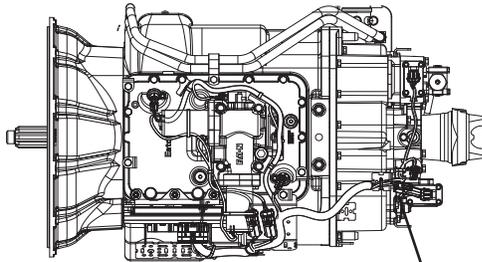
Warning! - Do Not Load Test at Diagnostic Port
4-Pin Diagnostics Port



- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

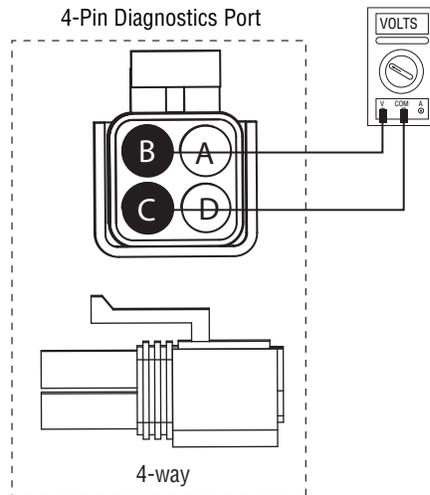
STEP C

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins B and pin C.		If voltage between pins B and C is within 0.6 volts of battery voltage		Go to STEP D
		If voltage is outside of range		Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

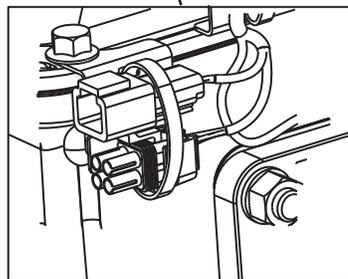
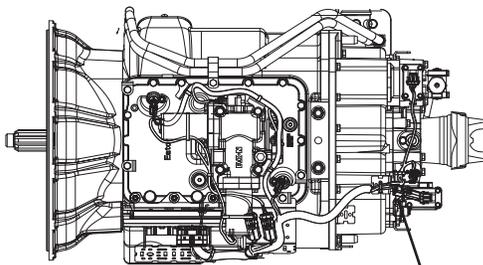
Warning! - Do Not Load Test at Diagnostic Port



- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

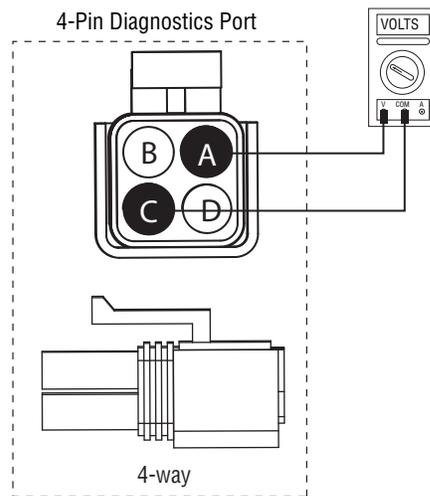
STEP D

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin A and pin C.		If voltage between pins A and C is within 0.6 volts of battery voltage		Go to STEP V
		If voltage is outside of range		Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

STEP V

Procedure	→	Condition	→	Action
1. Drive vehicle and attempt to reset codes.				
2. Retrieve Codes. Go to Fault Code Retrieval/Clearing .		If code 32 is inactive		This code indicates a loss of ignition switched power to the Transmission ECU during operation. Verify the key was not turned off during operation. Inspect ignition circuit for intermittent open.

Component Code 33 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	168	168		4	Low Battery Voltage Supply

Overview

This fault code indicates that the vehicle battery power supply to the Transmission ECU is below 7 volts.

When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19.

Detection

Starting at key-on and throughout operation, the Transmission ECU constantly measures vehicle voltage. If voltage is below 7 volts for more than one second, fault code 33 will be set, and the service light will flash.

Fallback

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

Required Tools

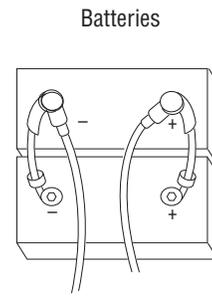
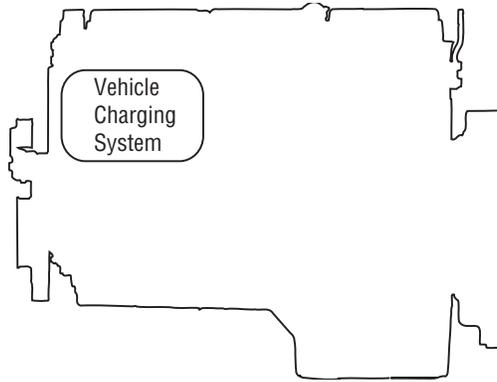
- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- ServiceRanger a PC-based Service Tool

Possible Causes

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

- Corroded or loose power supply to Transmission ECU
- Low Batteries
- Damaged OEM Harness
- Transmission ECU

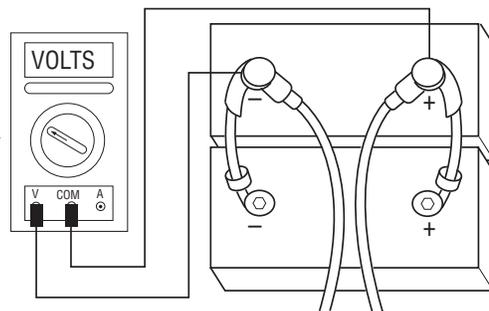
- Charging system



Fault Isolation Procedures

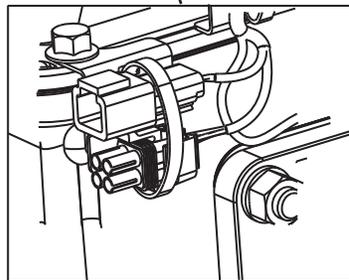
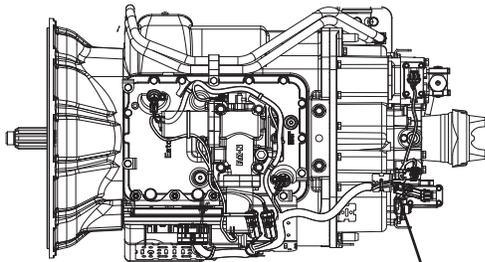
STEP A

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



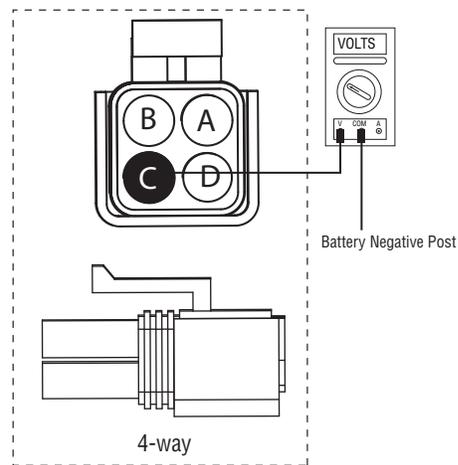
STEP B

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins C and the battery negative post.		If voltage between pin C and battery negative post is 0.70 volts or less		Go to STEP C
		If voltage is outside of range		Repair battery ground supply to Transmission ECU. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

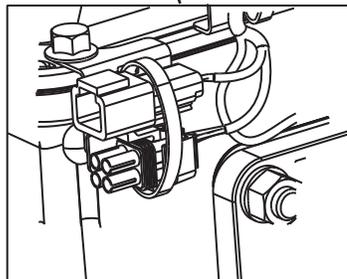
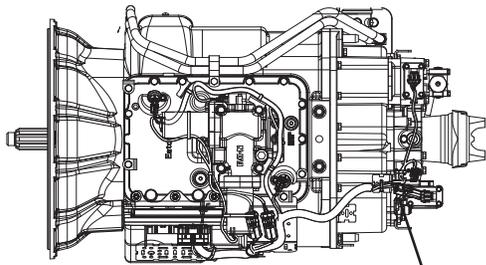
Warning! - Do Not Load Test at Diagnostic Port
4-Pin Diagnostics Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

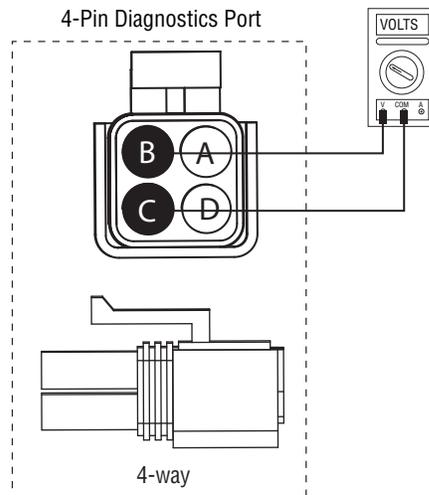
STEP C

Procedure	→ Condition	→ Action
1. Locate diagnostic port on Transmission Harness.		
2. Key on.		
3. Measure voltage between pins B and pin C.	If voltage between pins B and C is within 0.6 volts of battery voltage	Go to STEP D
	If voltage is outside of range	Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

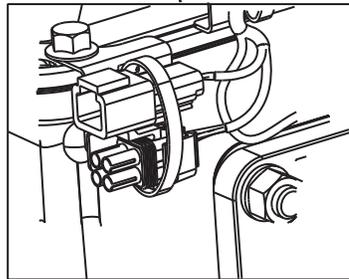
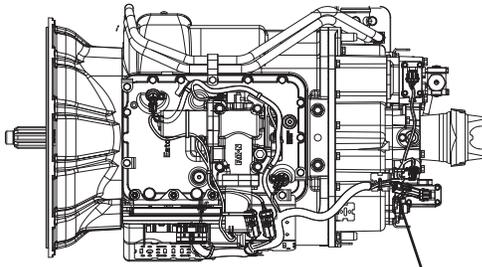
Warning! - Do Not Load Test at Diagnostic Port



- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

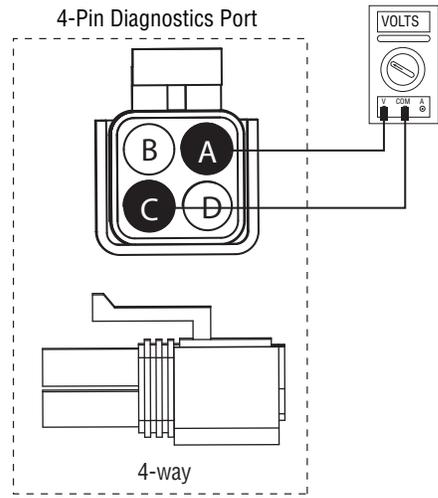
STEP D

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin A and pin C.		If voltage between pins A and C is within 0.6 volts of battery voltage		Go to STEP E
		If voltage is outside of range		Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

STEP E

Procedure	→	Condition	→	Action
1. Key on.				
2. Retrieve codes. Go to Fault Code Retrieval/Clearing .		If code 33 is active		Replace Transmission ECU (only if Fault Code is active). Go to STEP V
		If code 33 is inactive		Clear codes. Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Key on.				
3. Clear codes. Go to Fault Code Retrieval/Clearing .				
4. Reconnect all connectors and the negative battery cable.				
5. Driving Vehicle and attempt to reset the code.				
6. Check for codes. Go to Fault Code Retrieval/Clearing .		If no codes		Test complete.
		If code 33 appears		To find error in testing, return to STEP A
		If code other than 33 appears		Go to Fault Code Isolation Procedure Index .

Component Code 34 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	168	168		14	Weak Battery Voltage Supply

Overview

This fault indicates the vehicle is supplying weak battery voltage to the transmission for ten seconds.

When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19.

Detection

Starting at key-on and throughout operation, the Transmission ECU constantly measures vehicle voltage. If voltage is below 9 volts for more than ten seconds, fault code 34 will be set. The service light will not flash.

Fallback

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

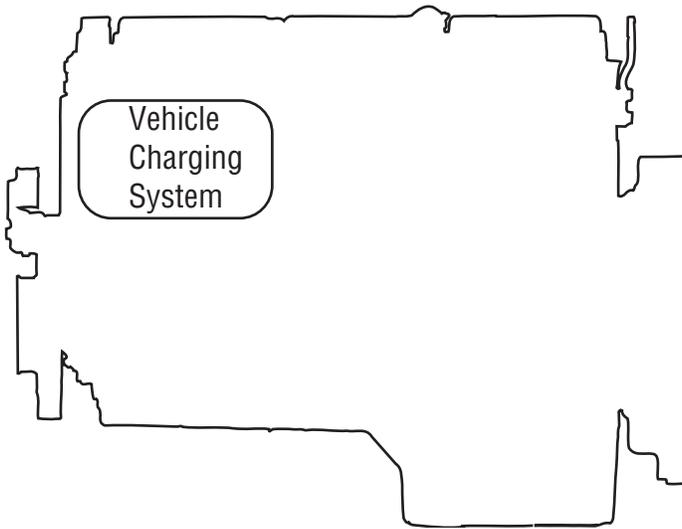
Required Tools

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

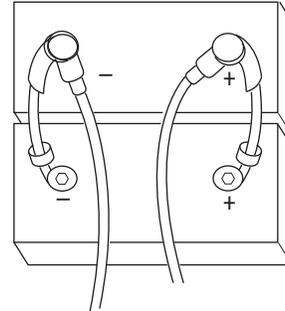
Possible Causes

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

- Corroded or loose power supply to Transmission ECU
- Low Batteries
- Damaged OEM Harness
- Transmission ECU
- Charging system



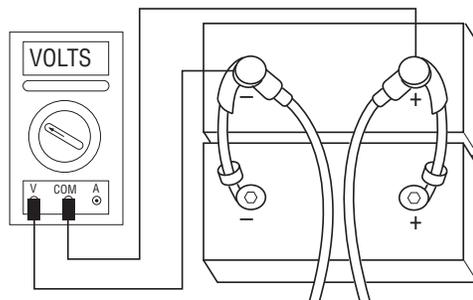
Batteries



Fault Isolation Procedures

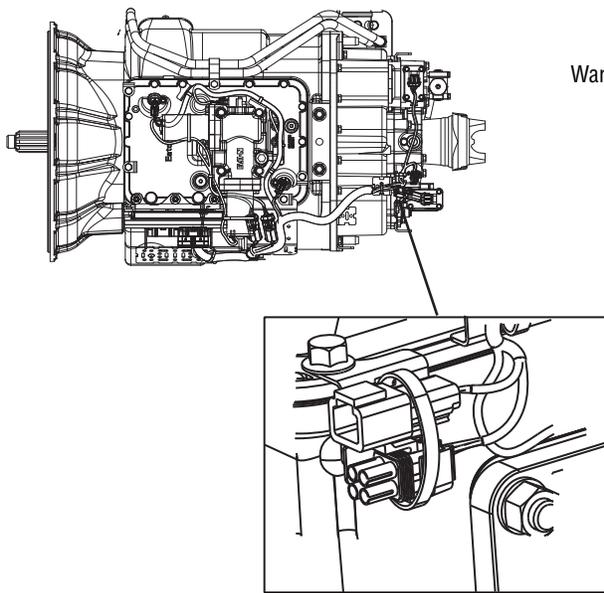
STEP A

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



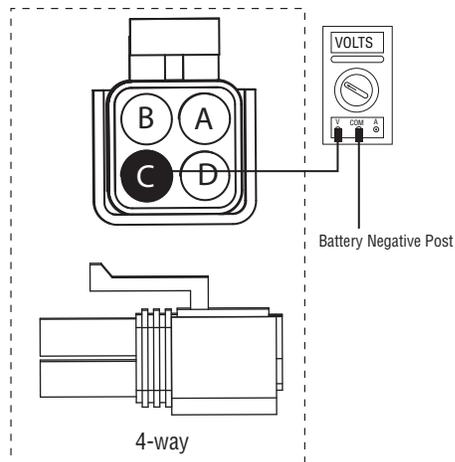
STEP B

Procedure	Condition	Action
1. Locate diagnostic port on Transmission Harness.		
2. Key on.		
3. Measure voltage between pins C and the battery negative post.	If voltage between pin C and battery negative post is 0.70 volts or less If voltage is outside of range	Go to STEP C Repair battery ground supply to Transmission ECU. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

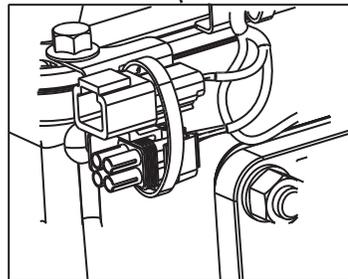
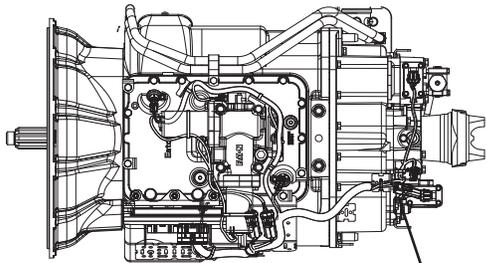
Warning! - Do Not Load Test at Diagnostic Port
4-Pin Diagnostics Port



- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

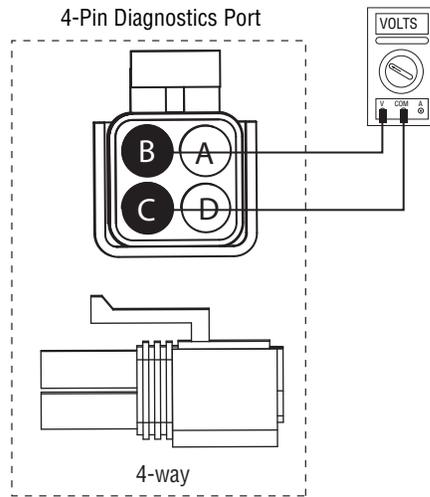
STEP C

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins B and pin C.		If voltage between pins B and C is within 0.6 volts of battery voltage		Go to STEP D
		If voltage is outside of range		Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

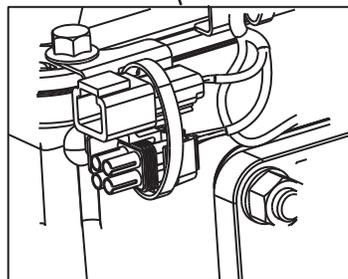
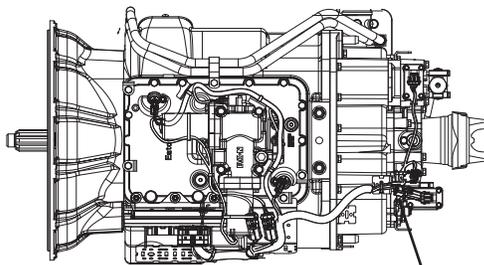
Warning! - Do Not Load Test at Diagnostic Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

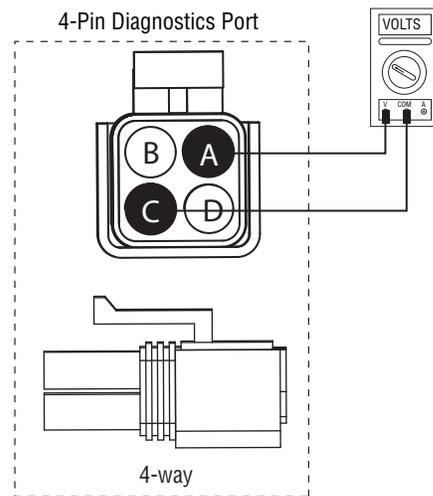
STEP D

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin A and pin C.		If voltage between pins A and C is within 0.6 volts of battery voltage		Go to STEP E
		If voltage is outside of range		Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

STEP E

Procedure	→	Condition	→	Action
1. Key on.				
2. Retrieve codes. Go to Fault Code Retrieval/Clearing .		If code 34 is active		Replace Transmission ECU (only if Fault Code is active). Go to STEP V
		If code 34 is inactive		Clear codes. Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Key on.				
3. Clear codes. Go to Fault Code Retrieval/Clearing .				
4. Reconnect all connectors and the negative battery cable.				
5. Driving Vehicle and attempt to reset the code				
6. Check for codes. Go to Fault Code Retrieval/Clearing .		If no codes		Test complete.
		If code 34 appears		To find error in testing, return to STEP A
		If code other than 34 appears		Go to Fault Code Isolation Procedure Index .

System Code 35 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	639		231	2	J1939 Communication Link

Overview

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

If you have an active fault code 35 with an UltraShift DM transmission and the engine will crank but not start, please check the OEM supplied MEIIR (Momentary Engine Ignition Interrupt Relay) circuit and see that the engine has proper ignition voltage.

When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19.

Detection

75 seconds after key-on and throughout the operation, the Transmission ECU constantly monitors the communication with the engine ECM. If a communication fault occurs for more than five seconds, and no other devices are present, fault code 35 is set.

Fallback

If the fault occurs during power up the transmission will go into AutoSelect mode. If the fault occurs while moving, it causes an in place fallback and the transmission will remain in whatever gear the failure occurred. Once the vehicle stops, start and reverse gears can be selected and the transmission will operate in AutoSelect mode.

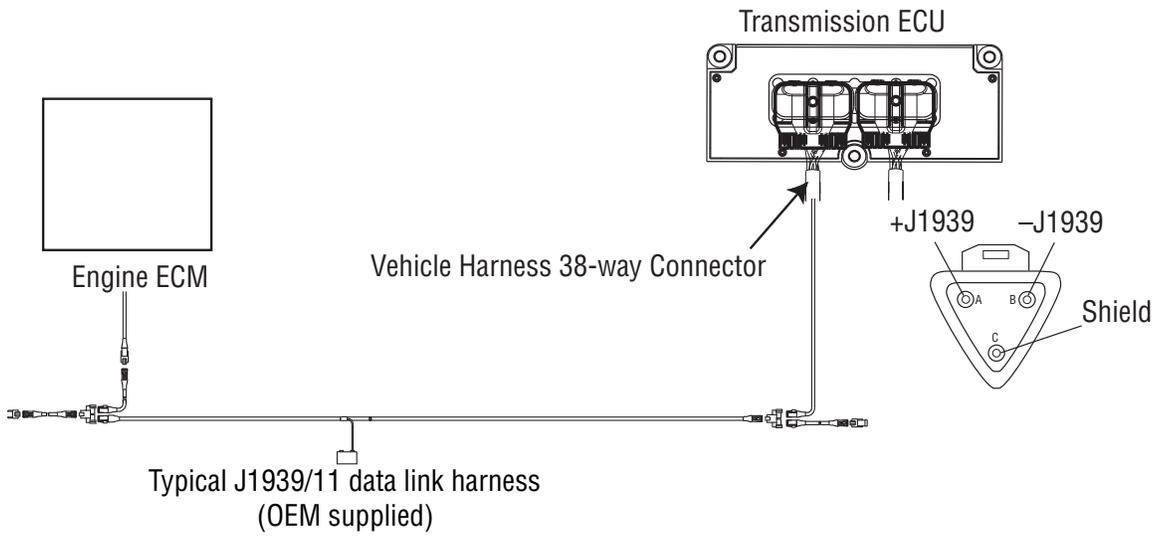
Required Tools

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

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
- Transmission ECU



Fault Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
-----------	---	-----------	---	--------

1. Key off.
2. Disconnect negative battery cable.
3. Disconnect Vehicle Harness 38-way connector.
4. Disconnect engine ECM connector which contains the J1939 Data Link.
5. Measure resistance between:

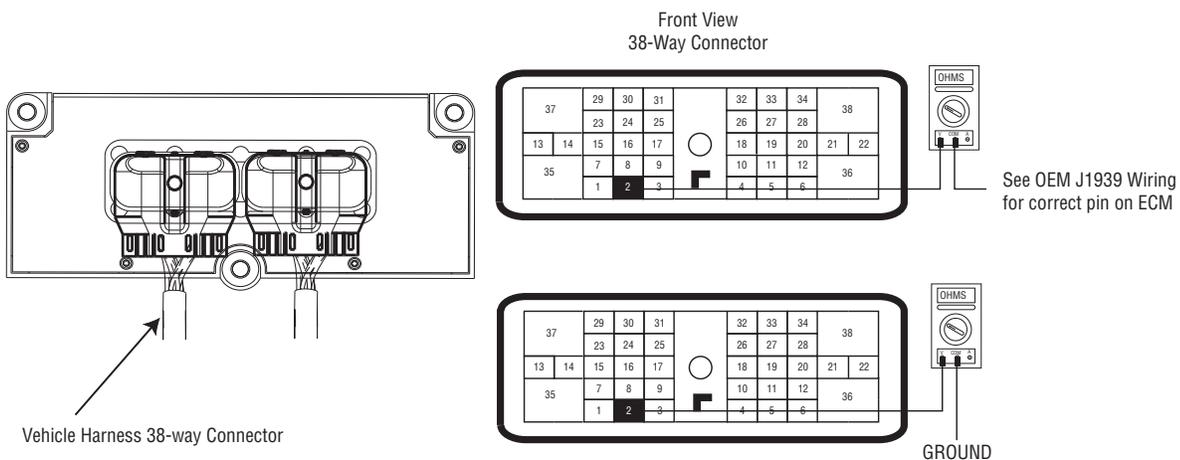
- Vehicle Harness 38-way connector pin 2 and engine ECM pin # (see OEM wiring for (-) J1939).
- Vehicle harness 38-way pin 2 and ground.

If resistance between pin 2 and engine ECM pin # (see OEM wiring for (-)J1939) is 0 to 0.3 ohms and if resistance between pin 2 and ground is OL

Go to **STEP B**

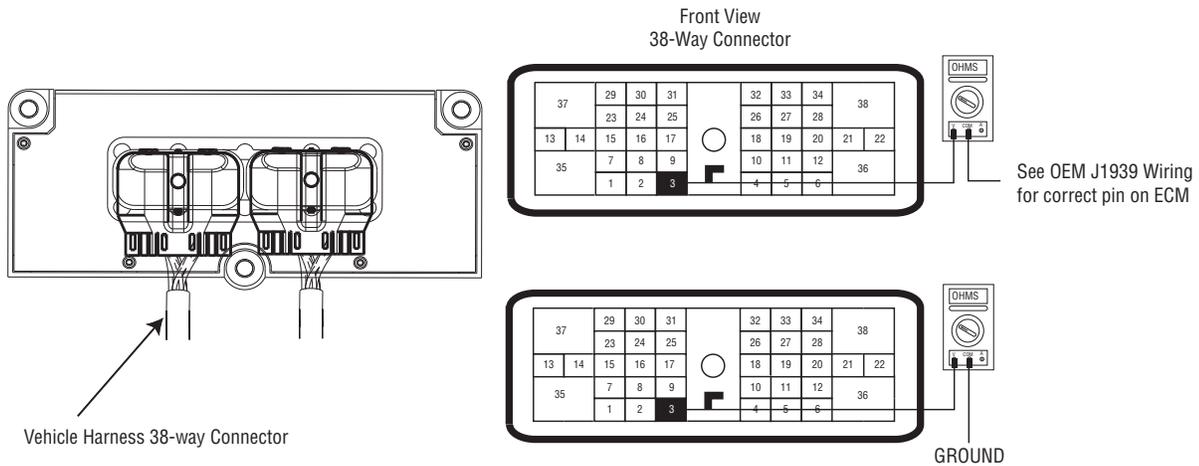
If resistance is outside of range

Repair J1939 Data Link Harness between engine ECM and Transmission ECU.
Go to **STEP V**



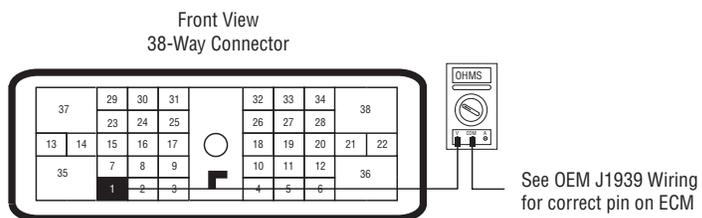
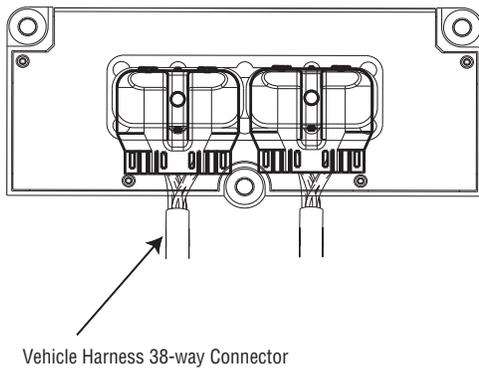
STEP B

Procedure	→ Condition	→ Action
1. Key off.		
2. Measure resistance between:		
<ul style="list-style-type: none"> Vehicle Harness 38-way connector pin 3 and engine ECM pin # (see OEM J1939 wiring for (+) J1939) Vehicle Harness 38-way pin 3 and ground 	<p>If resistance between pin 3 and engine ECM pin # (see OEM J1939 wiring for (+)J1939) is 0 to 0.3 ohms and if resistance between pin 3 and ground is OL</p> <p>If resistance is outside of range</p>	<p>If equipped with J1939 Lite, go to STEP D</p> <p>If not equipped with J1939 Lite, go to STEP C</p> <p>Repair J1939 Data Link Harness between engine ECM and Transmission ECU. Go to STEP V</p>



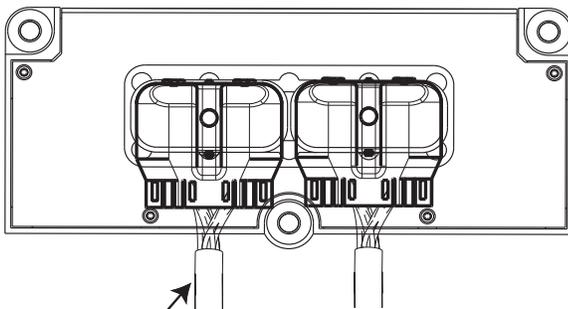
STEP C

Procedure	→	Condition	→	Action
1. Key off.				
2. Measure resistance between:				
<ul style="list-style-type: none"> Vehicle Harness 38-way connector pin 1 and engine ECM pin # (see OEM J1939 wiring for J1939 shield). 		If resistance between pin 1 and engine ECM pin # (see OEM J1939 wiring for J1939 shield) is 0 to 0.3 ohms		Go to STEP D
		If resistance is outside of range		Repair J1939 Data Link Harness between engine ECM and Transmission ECU. Go to STEP V

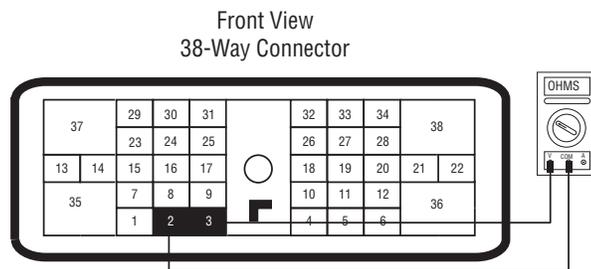


STEP D

Procedure	→	Condition	→	Action
1. Key off.				
2. Measure resistance between <ul style="list-style-type: none"> • Vehicle Harness 38-way connector pin 2 and 3. 				
Note: Make sure the volt/ohm meter is on the proper scale (around 200 ohm scale)		If resistance between pin 2 and 3 is between 50 to 70 ohms		Go to STEP V
		If resistance is more than 70 ohms		One or more of the terminating resistors on the J1939 data link harness is either missing or out of range. Repair OEM 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 Transmission ECU. Go to STEP V



Vehicle Harness 38-way Connector



STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Key on.				
3. Clear codes. Go to Fault Code Retrieval/Clearing .				
4. Reconnect all connectors and the negative battery cable.				
5. Driving Vehicle and attempt to reset the code				
6. Check for codes. Go to Fault Code Retrieval/Clearing .		If no codes		Test complete.
		If code 35 appears		To find error in testing, return to STEP A
		If code other than 35 appears		Go to Fault Code Isolation Procedure Index .

System Code 36 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	639		231	14	J1939 Engine Message

Overview

This fault code indicates the Transmission ECU has communicated with another ECU, but is unable to communicate with the engine ECU over the J1939 data link.

If you have an active fault code 36 with an UltraShift DM transmission and the engine will crank but not start, please check the OEM supplied MEIR (Momentary Engine Ignition Interrupt Relay) circuit and see that the engine has proper ignition voltage.

When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19.

Detection

The fault is detected if J1939 communication from the engine is lost for 5 seconds and other devices are present on J1939.

Fallback

If the fault occurs during power up the transmission will go into AutoSelect mode. If the fault occurs while moving, it causes an in place fallback and the transmission will remain in whatever gear the failure occurred. Once the vehicle stops, start and reverse gears can be selected and the transmission will operate in AutoSelect mode.

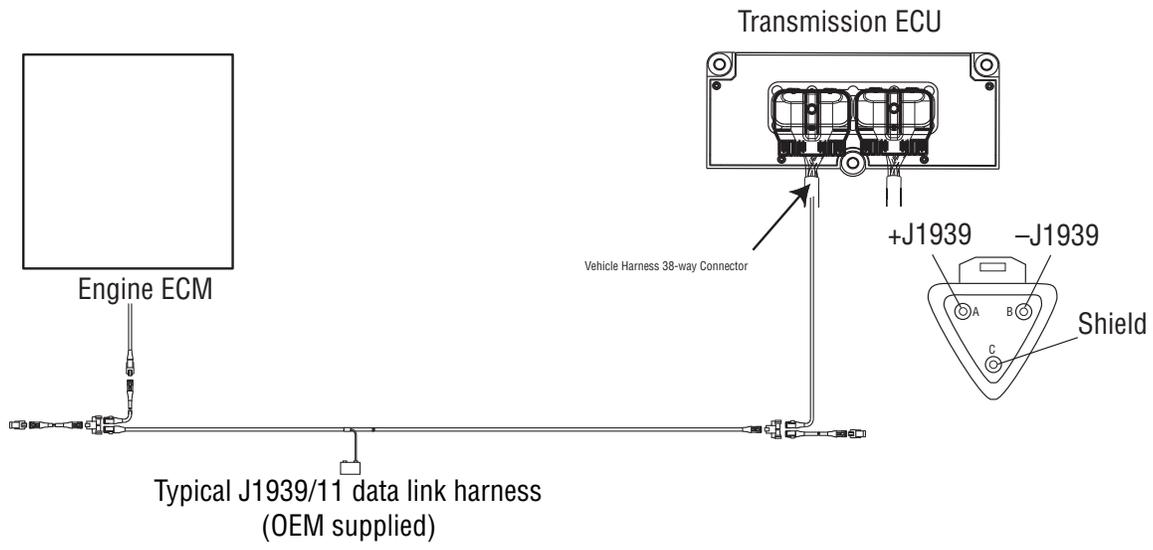
Required Tools

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

Possible Causes

This fault can be caused by any of the following:

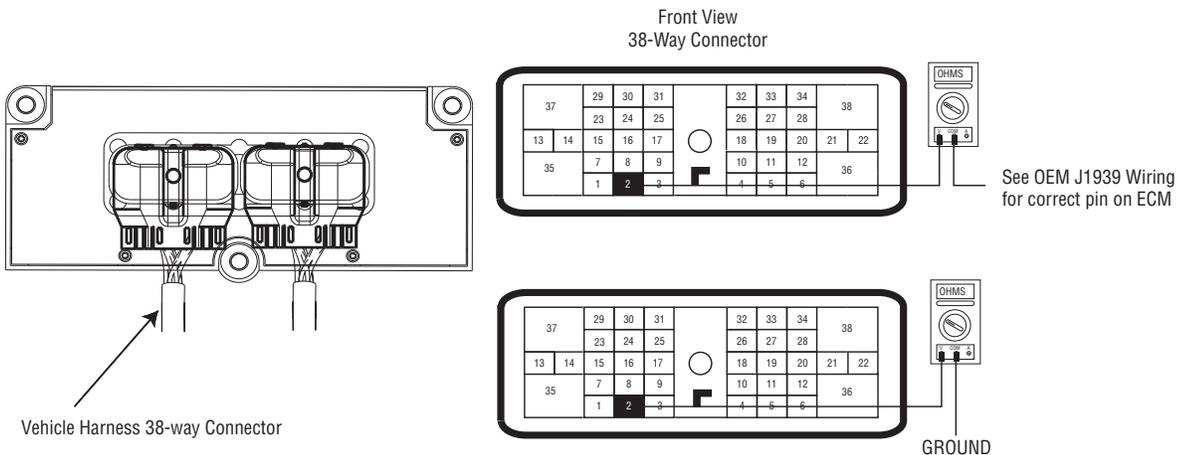
- J1939 Data Link
- Engine ECM
- Vehicle Harness or Connections
- Engine Harness or Connections
- Excessive Radio Interference
- Transmission ECU



Fault Isolation Procedures

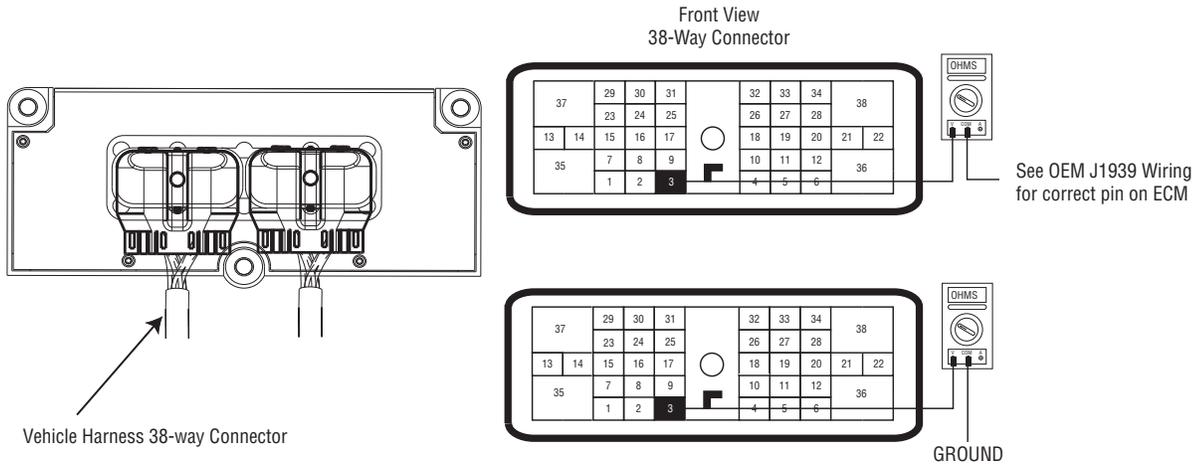
STEP A

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect Vehicle Harness 38-way connector.				
4. Disconnect engine ECM connector which contains the J1939 Data Link.				
5. Measure resistance between:				
<ul style="list-style-type: none"> Vehicle Harness 38-way connector pin 2 and engine ECM pin # (see OEM wiring for (-)J1939). Vehicle Harness 38-way connector pin 2 and ground. 		<p>If resistance between pin 2 and engine ECM pin # (see OEM wiring for (-)J1939) is 0 to 0.3 ohms and if resistance between pin 2 and ground is OL</p>		Go to STEP B
		<p>If resistance is outside of range</p>		<p>Repair J1939 Data Link Harness between engine ECM and Transmission ECU. Go to STEP V</p>



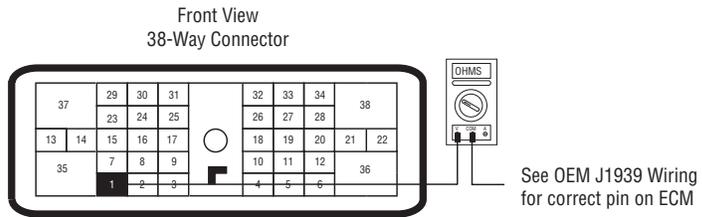
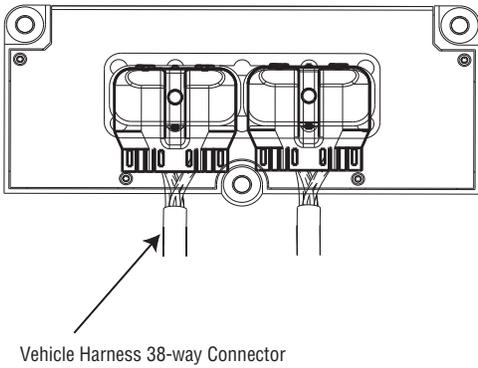
STEP B

Procedure	→	Condition	→	Action
1. Key off.				
2. Measure resistance between:				
<ul style="list-style-type: none"> Vehicle Harness 38-way connector pin 3 and engine ECM pin # (see OEM wiring for (+)J1939) Vehicle Harness 38-way connector pin 3 and ground 		<p>If resistance between pin 3 and engine ECM pin # (see OEM wiring for (+)J1939) is 0 to 0.3 ohms and if resistance between pin 3 and ground is OL</p>		<p>If equipped with J1939 Lite, go to STEP D.</p> <p>If not equipped with J1939 Lite, go to STEP C</p>
		<p>If resistance is outside of range</p>		<p>Repair J1939 Data Link Harness between Engine ECM and Transmission ECU. Go to STEP V</p>



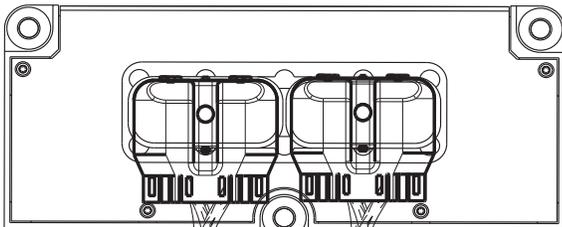
STEP C

Procedure	Condition	Action
1. Key off.		
2. Measure resistance between Vehicle Harness 38-way connector pin 1 and engine ECM pin # (see OEM wiring for J1939 shield).	<p>If resistance between pin 1 and engine ECM pin # (see OEM wiring for J1939 shield) is 0 to 0.3 ohms</p> <p>If resistance is outside of range</p>	<p>Go to STEP D</p> <p>Repair J1939 Data Link Harness between engine ECM and Transmission ECU. Go to STEP V</p>

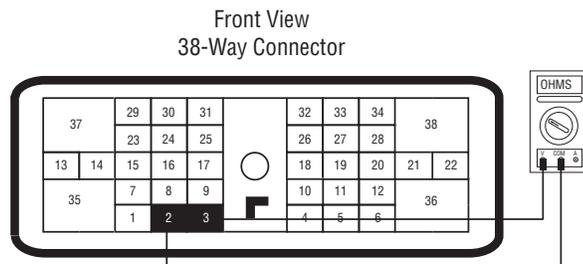


STEP D

Procedure	→	Condition	→	Action
1. Key off.				
2. Measure resistance between Vehicle Harness 38-way connector pin 2 and 3.				
Note: Make sure the volt/ohm meter is on the proper scale (around 200 ohm scale).				
		If resistance between pin 2 and 3 is between 50 to 70 ohms		Go to STEP V
		If resistance is more than 70 ohms		One or more of the terminating resistors on the J1939 data link harness is either missing or out of range. Repair J1939 Data Link Harness. Go to STEP V
		If resistance is less than 50 ohms		Repair the J1939 Data Link between the Engine ECM and the Transmission ECU. Go to STEP V



Vehicle Harness 38-way Connector



STEP V

Procedure	Condition	Action
1. Key off. 2. Reconnect all connectors and the negative battery cable. 3. Key on. 4. Clear codes. Go to Fault Code Retrieval/Clearing . 5. Driving Vehicle and attempt to reset the code.	If no codes If code 36 appears If code other than 36 appears	Test complete. To find error in testing, return to STEP A Go to Fault Code Isolation Procedure Index .

Component Code 37 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	627		251	5	Power Supply

Overview

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

Detection

The resistance on the Transmission ECU power supply circuit is measured during each shift. If the resistance is greater than 0.4 ohms this fault will set.

Fallback

No fallback mode.

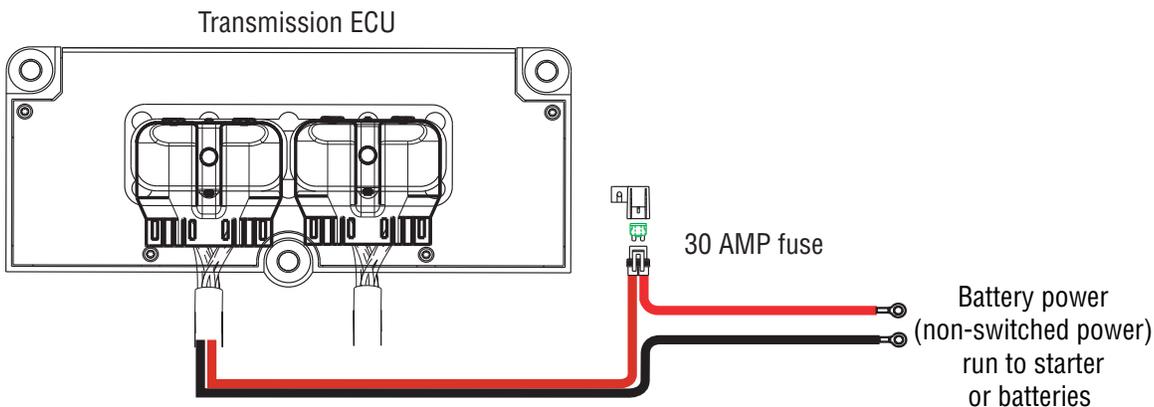
Required Tools

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

Possible Causes

This fault code can be caused by the following:

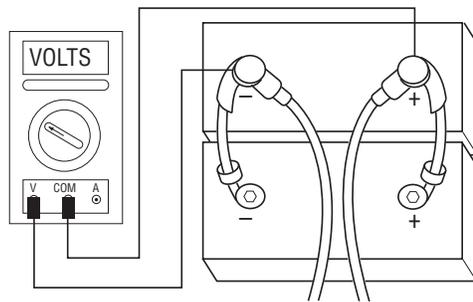
- Corrosion on power or ground supply connections/wires to the Transmission ECU
- Corrosion in fuse holder for Transmission ECU power supply.



Fault Isolation Procedures

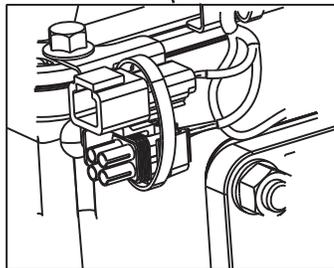
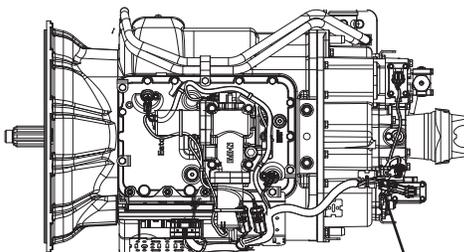
STEP A

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



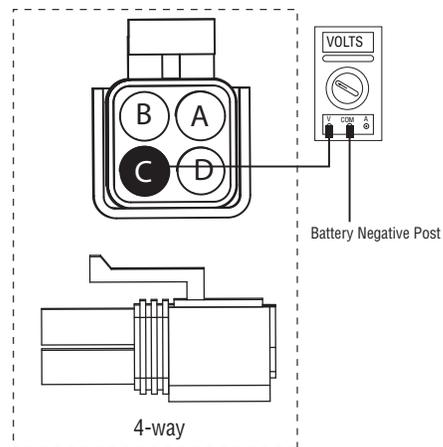
STEP B

Procedure	→ Condition	→ Action
1. Locate diagnostic port on Transmission Harness.		
2. Key on.		
3. Measure voltage between pins C and the battery negative post.	If voltage between pin C and battery negative post is 0.70 volts or less	Go to STEP C
	If voltage is outside of range	Repair battery ground supply to Transmission ECU. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

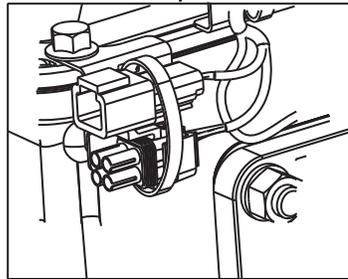
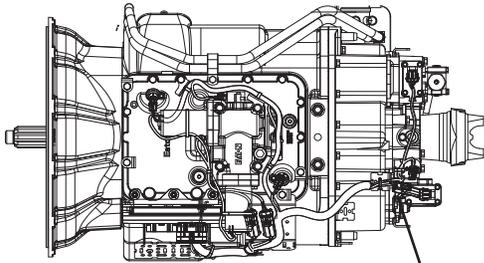
Warning! - Do Not Load Test at Diagnostic Port
4-Pin Diagnostics Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

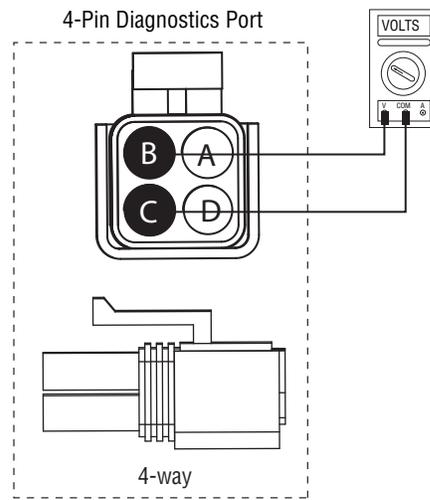
STEP C

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins B and pin C.		If voltage between pins B and C is within 0.6 volts of battery voltage		Go to STEP D
		If voltage is outside of range		Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

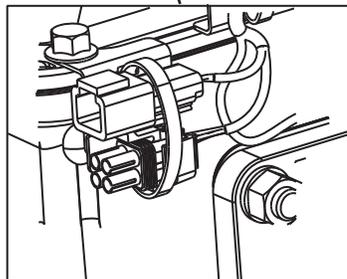
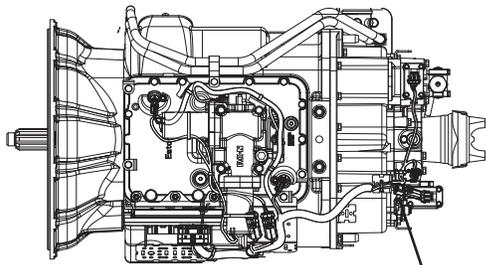
Warning! - Do Not Load Test at Diagnostic Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

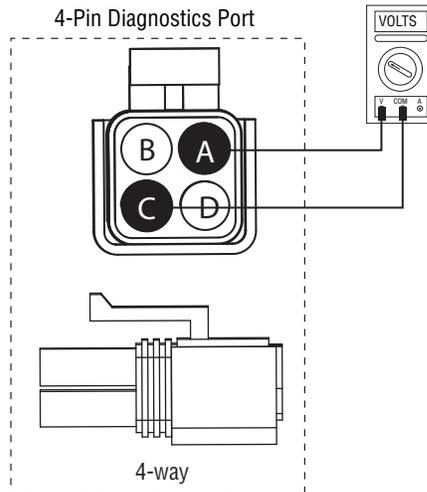
STEP D

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin A and pin C.		If voltage between pins A and C is within 0.6 volts of battery voltage		Go to STEP E
		If voltage is outside of range		Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

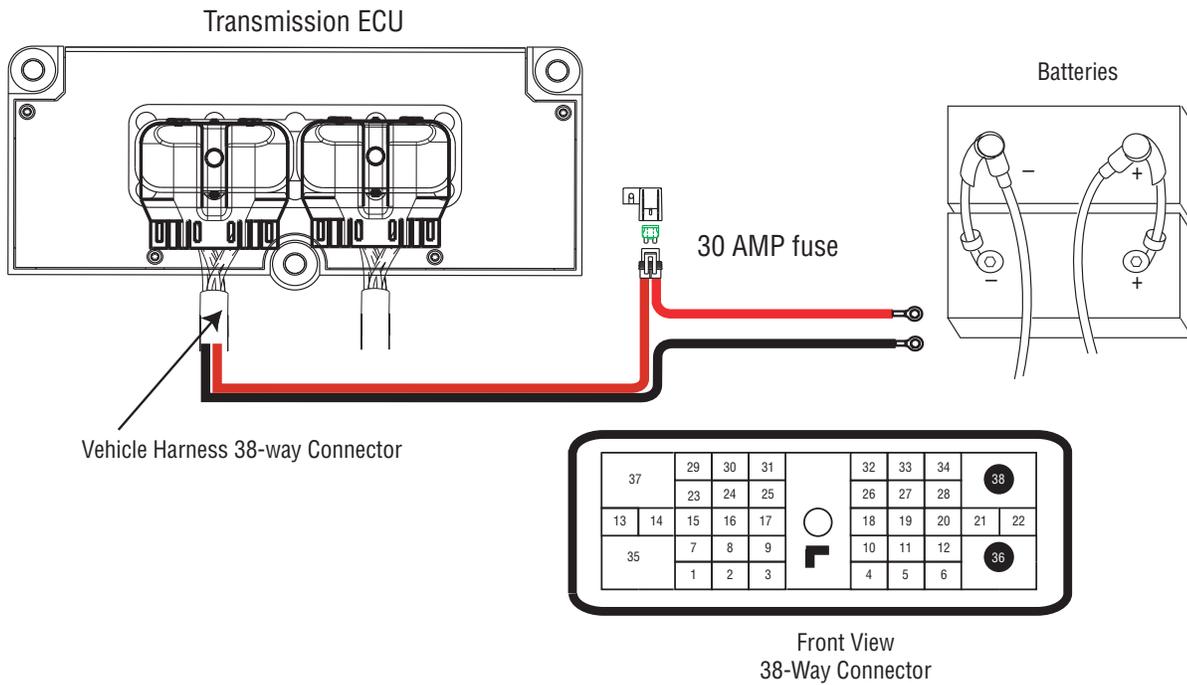
Warning! - Do Not Load Test at Diagnostic Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

STEP E

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect the Vehicle Harness 38-way.				
4. Inspect main power 38-way connector terminals pin 36 and 38, in-line fuse holder, and power supply connections for integrity and corrosion.		If no problem found		Go to STEP V
		If problem is found		Repair power/ground path for the main power supply. Go to STEP V



STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Clean and reconnect all connectors.				
3. Key on.				
4. Clear codes. Go to Fault Code Retrieval/Clearing .				
5. Drive vehicle and attempt to reset the code				
6. Check for codes Go to Fault Code Retrieval/Clearing .		If no codes		Test complete.
		If code 37 appears		To find error in testing, return to STEP A
		If code other than 37 appears		Go to Fault Code Isolation Procedure Index .

System Code 41 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	768		35	7	Range Failed to Engage
	769		36	7	Range Failed to Engage

Overview

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

Detection

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

Fallback

This fault causes a current range 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.

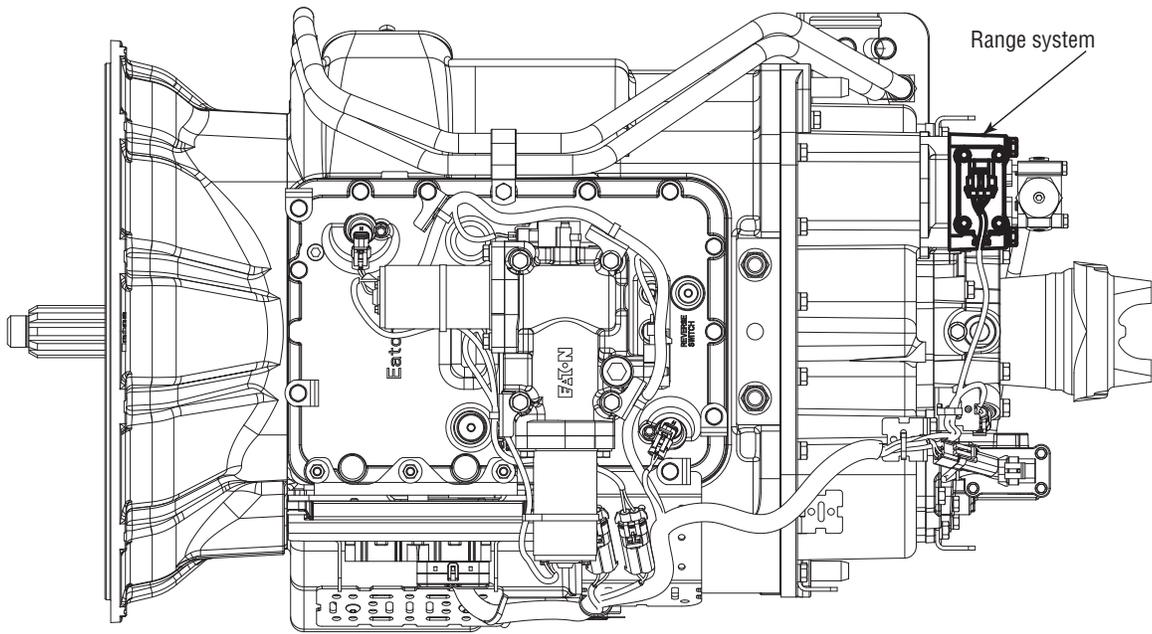
Required Tools

- Basic Hand Tools
- (2) 0-100 PSI Air Pressure Gauges
- Troubleshooting Guide
- ServiceRanger a PC-based Service Tool

Possible Causes

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

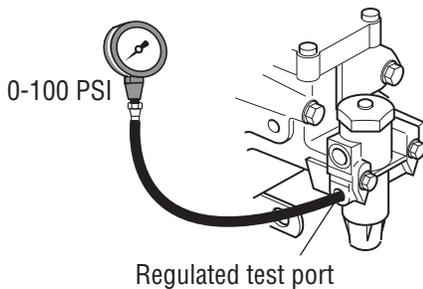
- Low Air Pressure
- Contaminated Air Supply
- Air Leak
- Range Solenoid Valve
- Range Synchronizer
- Range Actuator / Cylinder / Piston / Yoke
- Range Cover



Fault Isolation Procedures

STEP A

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



STEP B

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

STEP C

Procedure	→	Condition	→	Action
1. Read air pressure gauge installed at the regulated port.		If air pressure is in range: <ul style="list-style-type: none"> • 55 to 65 PSI • 75 to 80 PSI for UltraShift PLUS LAS Models 		Go to STEP E
		If air pressure is outside of range		Go to STEP D

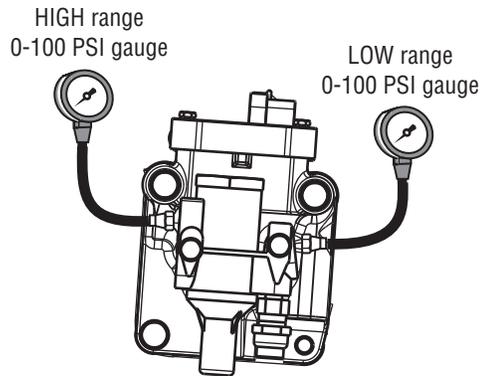
STEP D

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

STEP F

Procedure	→ Condition	→ Action
1. Key on.		
2. With Shift Control, select the highest reverse gear available by pressing the upshift button/arrow, then select neutral.	<p>If HIGH range gauge =</p> <ul style="list-style-type: none"> • 55 to 65 PSI for Non-LAS Models • 75 to 80 PSI for UltraShift PLUS LAS Models <p>And if LOW range gauge = 0 PSI</p> <p>If air pressure gauges do not read as shown above</p>	<p>Repair mechanical range system as required. Go to STEP V</p> <p>Replace Range Solenoid Valve and Range Cylinder Cover as required. Go to STEP V</p>

Important: Monitor gear display after selecting the highest reverse gear available and confirm gear position has changed in the display. A gear change is required to energize the range solenoid.



3.

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Remove all gauges.				
3. Key on.				
4. Clear codes. Go to Fault Code Retrieval/Clearing .				
5. Drive Vehicle and attempt to reset the code				
6. Check for codes. Go to Fault Code Retrieval/Clearing .		If no codes		Test complete.
		If code 41 appears		To find error in testing, return to STEP A
		If code other than 41 appears		Go to Fault Code Isolation Procedure Index .

System Code 42 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	770		37	7	Splitter Failed to Engage
	771		38	7	Splitter Failed to Engage

Overview

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

Detection

The transmission attempts the same splitter shift 3 consecutive times and determines the shift cannot be completed based on the speeds across the back box.

Fallback

This fault causes a current splitter fallback and the transmission stays in either LOW split or HIGH split.

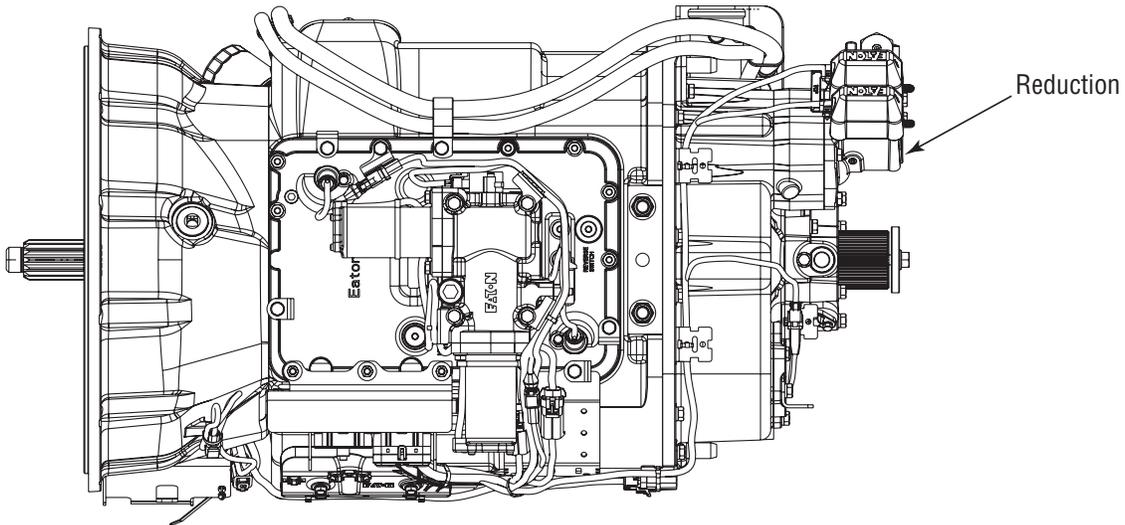
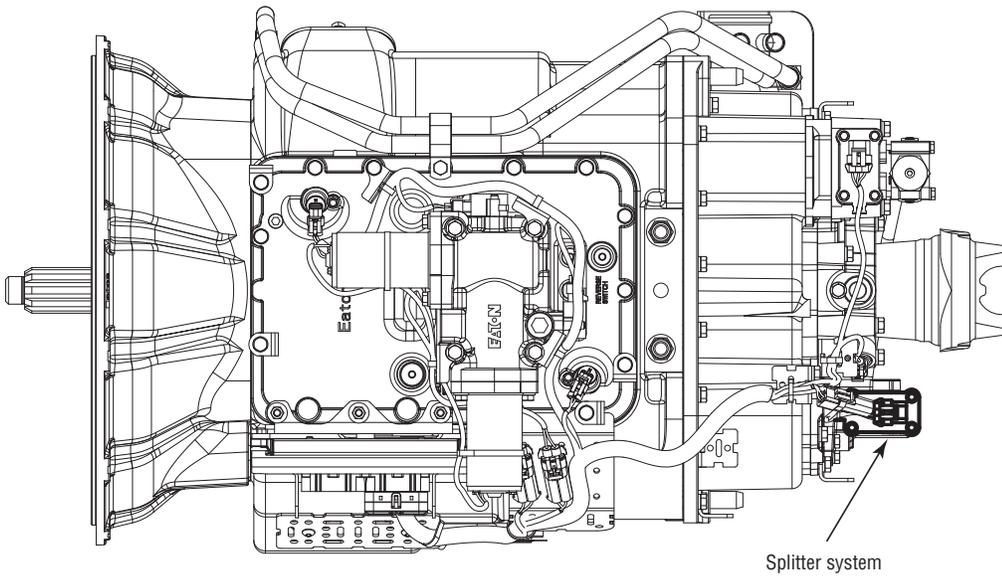
Required Tools

- Basic Hand Tools
- (2) 0-100 PSI Air Pressure Gauges
- Troubleshooting Guide
- ServiceRanger a PC-based Service Tool

Possible Causes

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

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

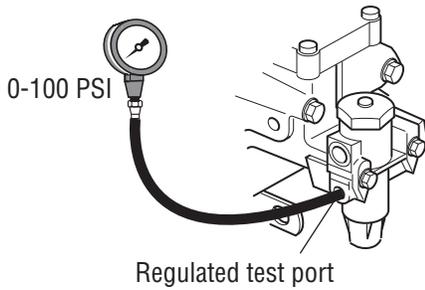


Alternate View - Combination
Cylinder Models

Fault Isolation Procedures

STEP A

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



STEP B

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

STEP C

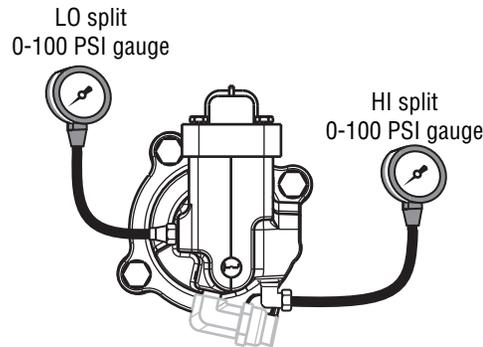
Procedure	→	Condition	→	Action
1. Read air pressure gauge installed at the regulated port.		If air pressure is 55 to 65 PSI		Go to STEP E
		If air pressure is outside of range		Go to STEP D

STEP D

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

STEP F

Procedure	→ Condition	→ Action
1. Key on.		
2. With Shift Control, select reverse (R2 in the gear display 13/18-speed). Note: If R2 isn't displayed the up arrow button needs to be pressed.	If HIGH Splitter gauge = 55 to 65 PSI and if LOW Splitter gauge = 0 PSI If air pressure gauges do not read as shown above	Repair Mechanical Splitter system as required. Go to STEP V Replace Splitter Solenoid Valve and Splitter Cylinder Cover as required. Go to STEP V



STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Remove all pressure gauges.				
3. Key on.				
4. Clear codes. Go to Fault Code Retrieval/Clearing .				
5. Drive Vehicle and attempt to reset the code				
6. Check for codes. Go to Fault Code Retrieval/Clearing .		If no codes		Test complete.
		If code 42 appears		To find error in testing, return to STEP A
		If code other than 42 appears		Go to Fault Code Isolation Procedure Index .

Component Code 43 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	768		35	3, 4, 5	Range High Solenoid Valve
	769		36	3, 4, 5	Range Low Solenoid Valve

Overview

This fault code indicates an electrical failure of the solenoids that control the Range Solenoid Valve.

When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19.

Detection

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

Fallback

This fault causes a current range 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.

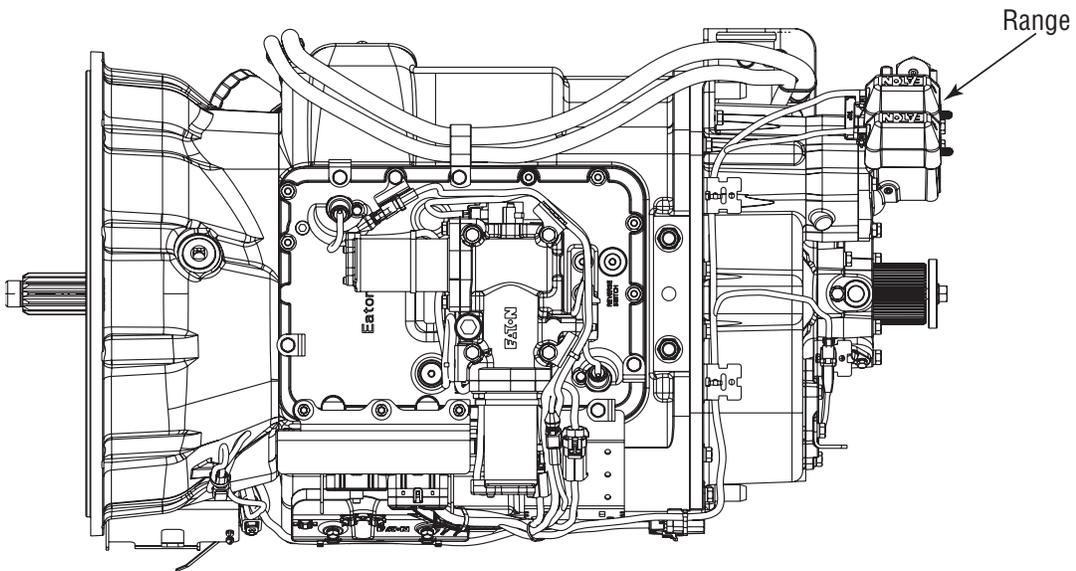
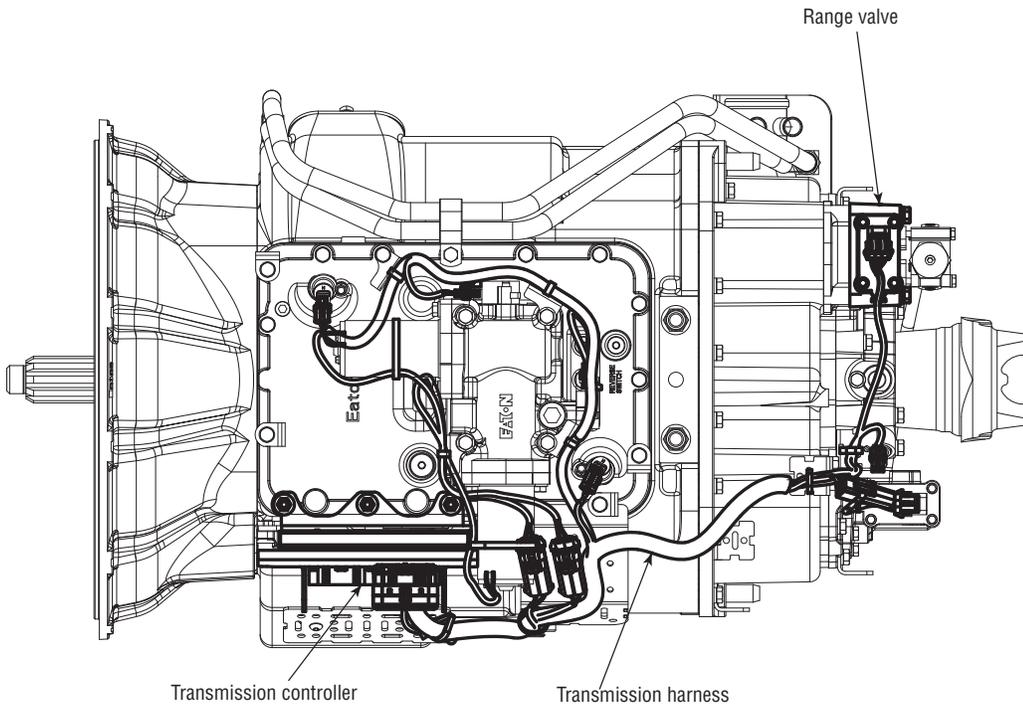
Required Tools

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

Possible Causes

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

- Range Solenoid Valve
- Transmission Harness
- Transmission ECU

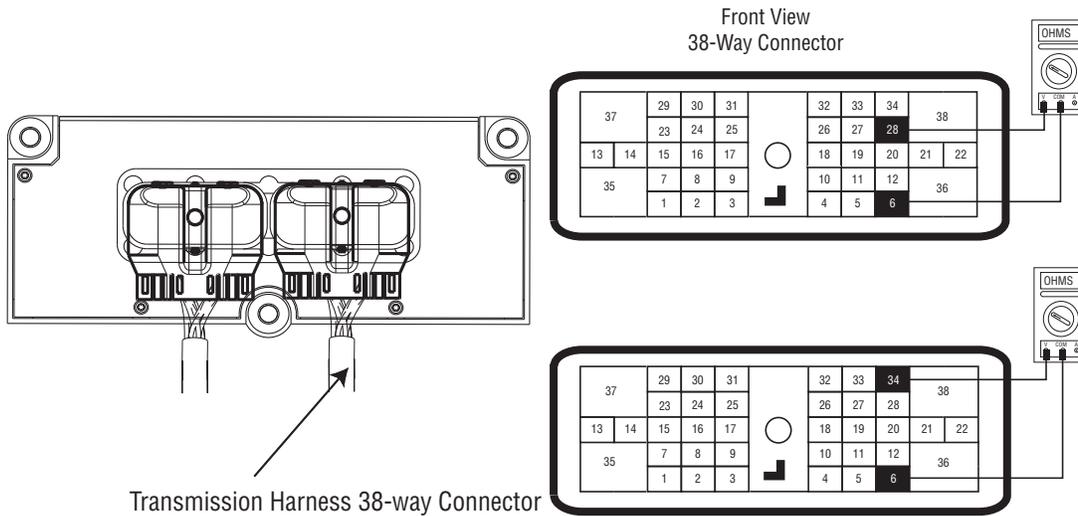


Alternate View - Combination
Cylinder Models

Fault Isolation Procedures

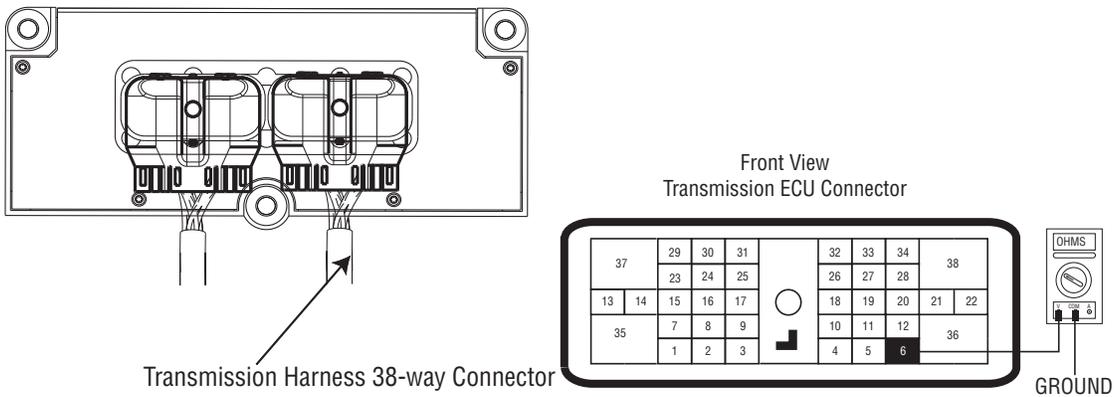
STEP A

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect the Transmission ECU 38-way connector.				
4. Measure resistance between the Transmission Harness 38-way connector pins:				
<ul style="list-style-type: none"> • 28 and 6 • 34 and 6 • Observe polarity on Volt\Ohm Meter. 		If resistance is 9 to 16 ohms		Go to STEP B
		If resistance is outside of range		Go to STEP C



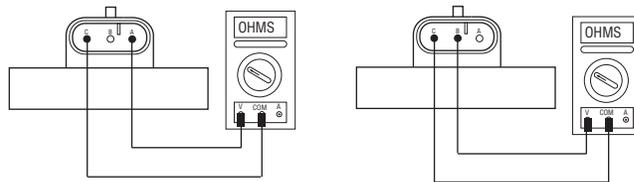
STEP B

Procedure	→ Condition	→ Action
1. Measure resistance between the Transmission Harness 38-way connector pin 6 and ground.	If resistance is OL	Replace Transmission ECU (Only if Fault Code is Active). Go to STEP V
	If resistance is less than 10K ohm	Go to STEP C



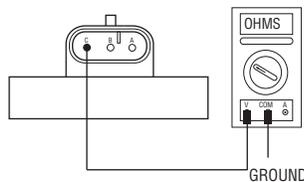
STEP C

Procedure	Condition	Action
1. Disconnect the Transmission Harness from Range Solenoid Valve.		
2. Measure resistance between Range Solenoid Valve pins: <ul style="list-style-type: none"> • A and C • B and C 	If resistance is 9 to 16 ohms If resistance is outside of range	Go to STEP D Replace Range Solenoid Valve. Go to STEP V



STEP D

Procedure	Condition	Action
1. Measure resistance between Range Solenoid Valve pin C and ground.	If resistance is OL If resistance is less than 10K ohm	Replace Transmission Harness. Go to STEP V Replace Range Solenoid Valve. Go to STEP V



STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors and the negative battery cable.				
3. Key on.				
4. Clear codes. Go to Fault Code Retrieval/Clearing .				
5. Drive vehicle and attempt to reset the code.				
6. Check for codes. Go to Fault Code Retrieval/Clearing .		If no codes		Test complete.
		If code 43 appears		To find error in testing, return to STEP A
		If code other than 43 appears		Go to Fault Code Isolation Procedure Index .

Component Code 44 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	787		54	3, 4, 5	Inertia Brake Solenoid Coil

Overview

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

When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19.

Detection

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

Fallback

No Fallback Mode. However, if it is the Inertia Brake system that failed, it may be difficult to engage a gear from a stop if the Inertia Brake was providing assistance (due to a dragging clutch). Also, hill shifting performance may be reduced.

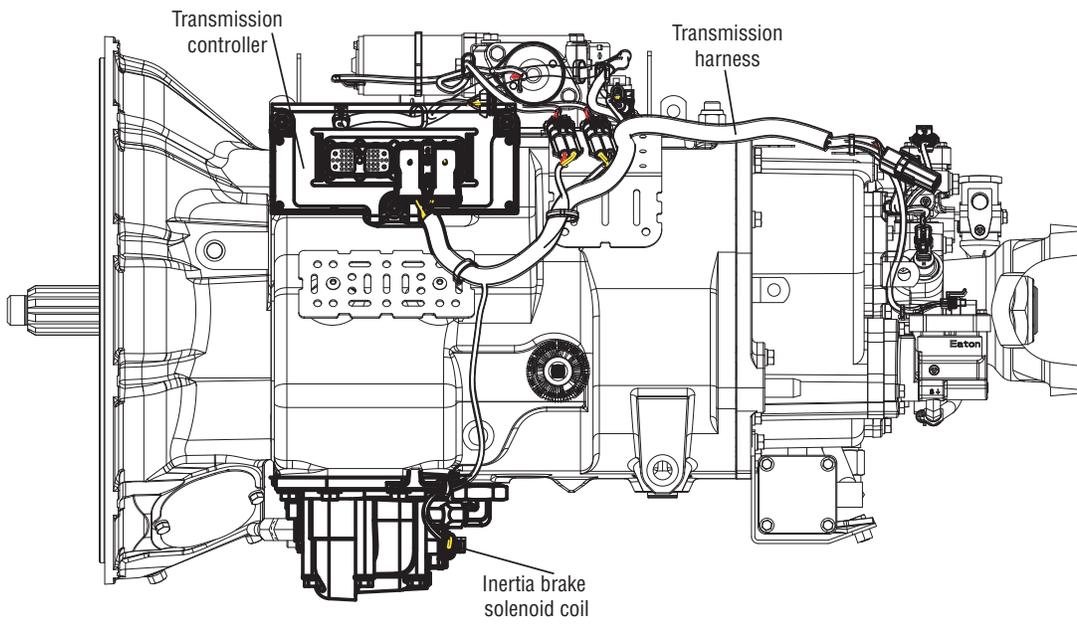
Required Tools

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

Possible Causes

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

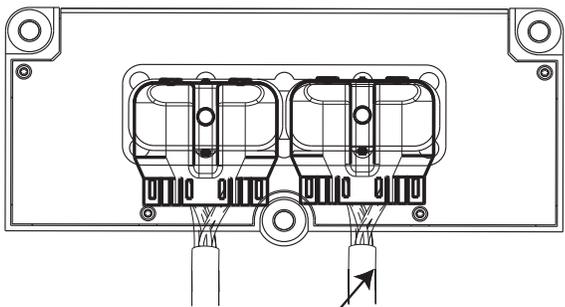
- Inertia Brake Solenoid
- Transmission Harness
- Transmission ECU



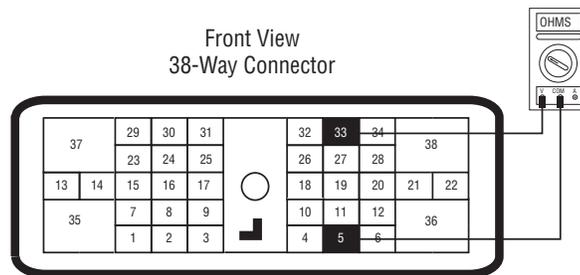
Fault Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect the Transmission Harness 38-way connector.				
4. Measure resistance between the Transmission Harness 38-way connector pins 33 and 5.		If resistance is 2 to 6 ohms		Go to STEP B
		If resistance is outside of range		Go to STEP C

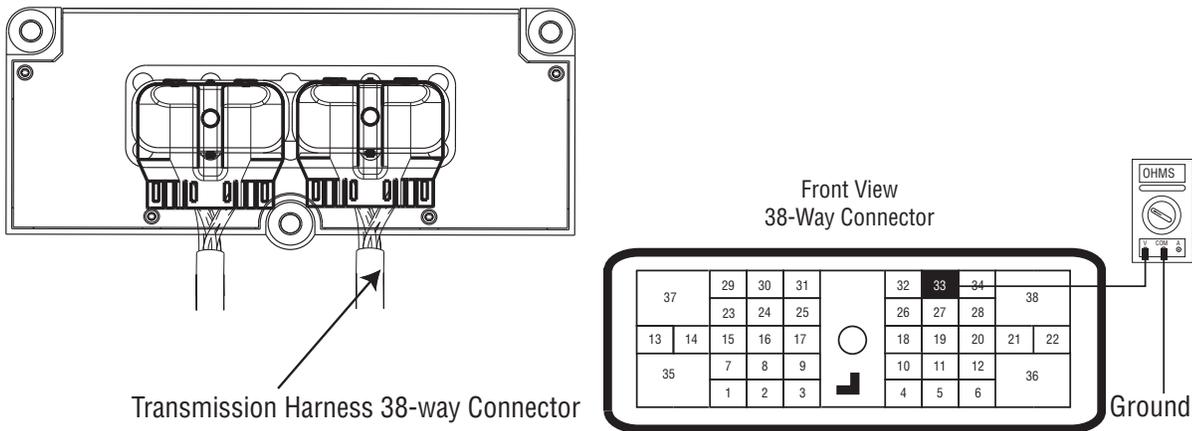


Transmission Harness 38-way Connector



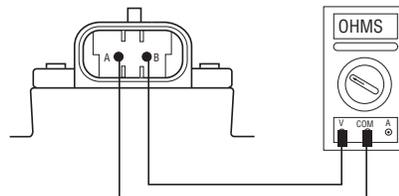
STEP B

Procedure	Condition	Action
1. Measure resistance between the Transmission Harness 38-way connector pin 33 and ground.	If resistance is OL	Replace Transmission ECU (only if Fault Code is Active). Go to STEP V
	If resistance is less than 10K ohm	Go to STEP C



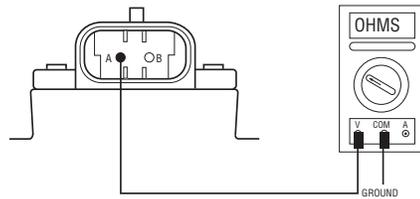
STEP C

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



STEP D

Procedure	→ Condition	→ Action
1. Measure resistance between Inertia Brake coil pin A and ground.	If resistance is OL	Replace Transmission Harness. Go to STEP V
	If resistance is less than 10K ohm	Replace Inertia Brake. Go to STEP V



STEP V

Procedure	→ Condition	→ Action
1. Key off.		
2. Reconnect all connectors and the negative battery cable.		
3. Key on.		
4. Clear codes. Go to Fault Code Retrieval/Clearing .		
5. Drive the vehicle and attempt to reset the code.		
6. Check for codes. Go to Fault Code Retrieval/Clearing .	If no codes	Test complete.
	If code 44 appears	To find error in testing, return to STEP A
	If code other than 44 appears	Go to Fault Code Isolation Procedure Index .

System Code 45 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	787		54	7	High Capacity (HCIB) or Low Capacity (LCIB) Inertia Brake Failure

Overview

The fault code indicates that the Low or High Capacity Inertia Brake is not performing as expected. A transmission will have either an LCIB or HCIB, it will not have both. The LCIB is used only on heavy-duty products with an Electronic Clutch Actuator (ECA).

Detection

The HCIB fault sets if the Inertia Brake is unable to synchronize the transmission during an upshift.

The LCIB fault sets if the LCIB is applied and the transmission input shaft deceleration is less than 1000 rpm/sec for 15 cumulative times in 1 power cycle with greater than 32 amps applied to the ECA with a non-neutral mode selected.

Fallback

No Fallback Mode. However, if it is the Inertia Brake system has failed, it may be difficult to engage a gear from a neutral and shifting performance may be reduced.

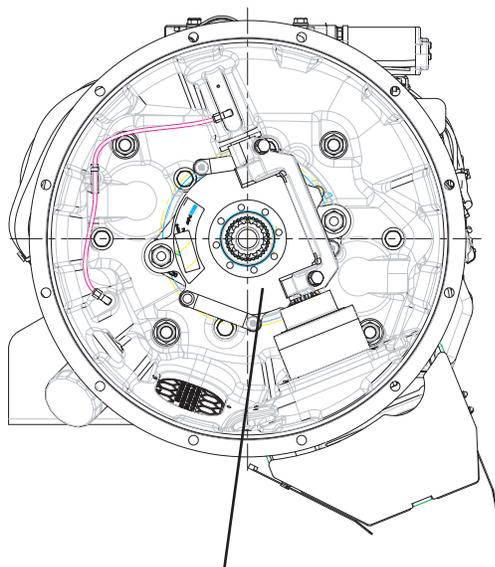
Required Tools

- Basic Hand Tools
- ServiceRanger a PC based service tool.
- Troubleshooting Guide

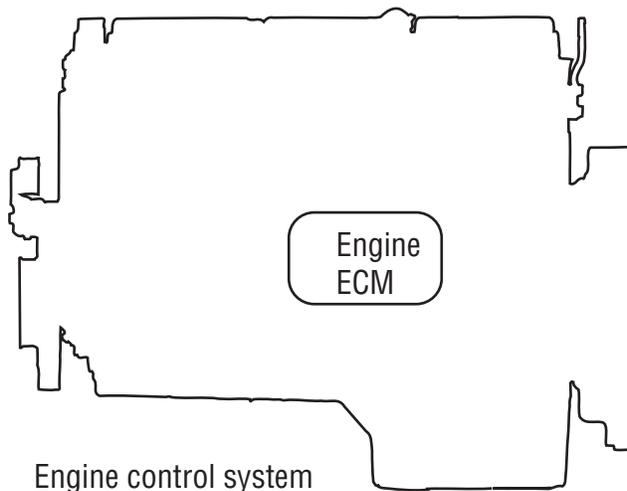
Possible Causes

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

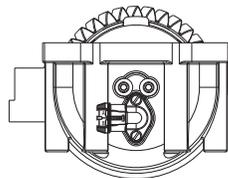
- LCIB material worn
- Failed LCIB
- Failed HCIB



Low Capacity Inertia Brake



Engine control system



High Capacity Inertia brake

Fault Isolation Procedures

Inertia Brake Performance Test

Note: Go to Step A for HCIB troubleshooting. Go to Step B for LCIB troubleshooting.

STEP A

Procedure	→	Condition	→	Action
1. Key on.				
2. Connect ServiceRanger, select “Advanced Product Functions”.				
3. Start Engine, PTO must be disengaged.				
4. Select “Inertia Brake Test”.				
5. Run test and follow instructions.		Test passes		Go to STEP V
		Test Fails		Replace Inertia Brake. Go to STEP V
		Test Aborts		Correct displayed test failure condition and retest.

STEP B

Procedure	→	Condition	→	Action
Note: If fault code 27 or fault code 64 is active, follow these procedures first.				
1. Key off.				
2. Open clutch housing hand-hole cover and inspect LCIB for worn material. Refer to LCIB Inspection Procedure in CLSM0200.		If wear is excessive.		Replace LCIB. Go to STEP V
		If wear is not excessive.		Go to STEP C

STEP C

Procedure	→	Condition	→	Action
1. Key on.				
2. Connect ServiceRanger and select "Advanced Product Functions".				
3. Start engine. PTO must be disengaged.				
4. Select "Inertia Brake Test" and run test five consecutive times.		If all five tests pass (above 1000 RPM/sec)		Go to STEP V
		If all five tests fail (below 1000 RPM/sec)		Replace LCIB. Perform ECA Clutch Reset Procedure. See publication CLMT1310. Go to STEP V

Note: Always perform ECA Clutch Reset Procedure CLMT1310 after replacing an LCIB.

STEP V

Procedure	→	Condition	→	Action
1. Key on.				
2. Clear codes.				
3. Drive the vehicle and attempt to reset the code.				
4. Check for codes.		If no codes		Test complete.
		If code 45 appears		To find error in testing, return to STEP A
		If code other than 45 appears		Go to Fault Code Isolation Procedure Index .

Component Code 46 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	770		37	3, 4, 5	Splitter Direct Solenoid Valve
	771		38	3, 4, 5	Splitter Indirect Solenoid Valve

Overview

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

When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19.

Detection

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

Fallback

This fault causes a current splitter fallback and the transmission stays in either LOW split or HIGH split.

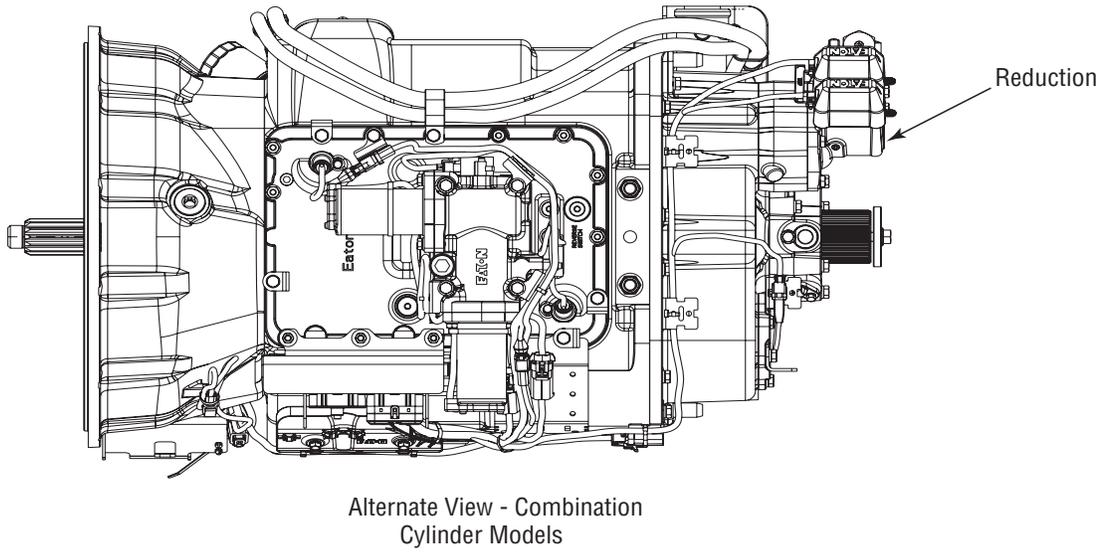
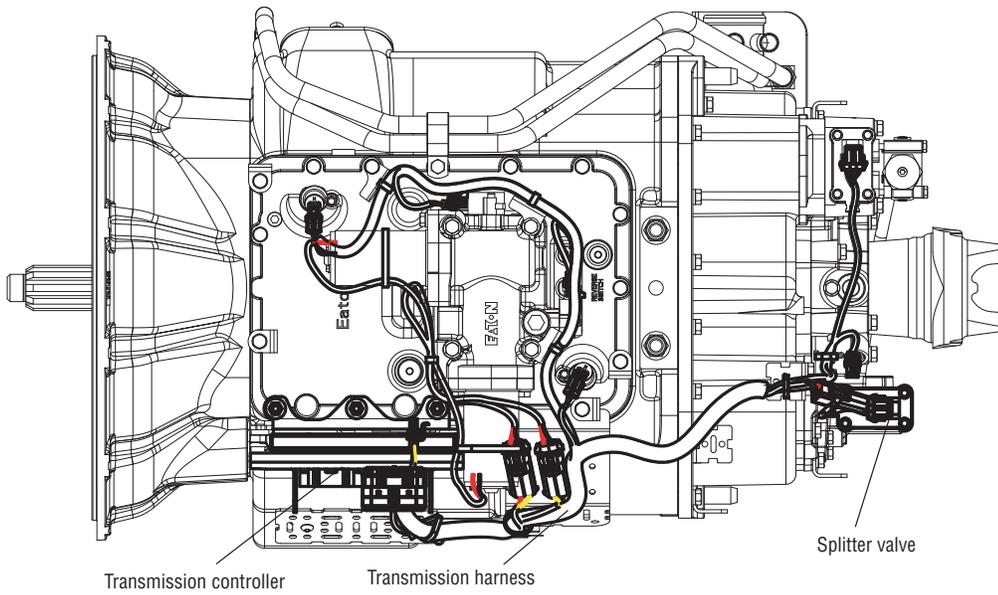
Required Tools

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

Possible Causes

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

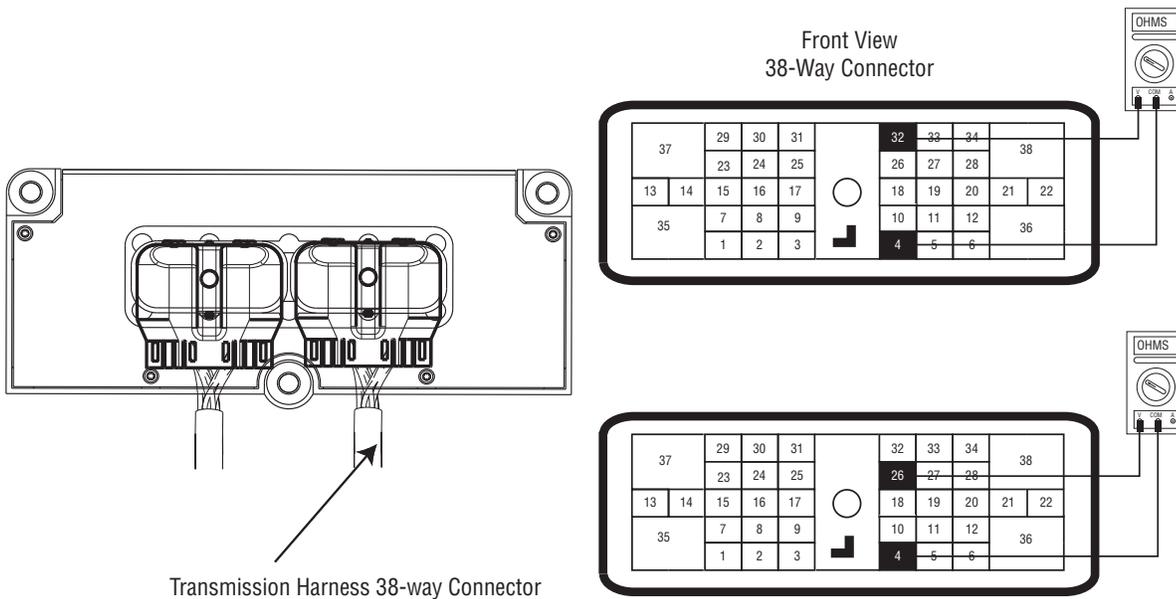
- Splitter Solenoid Valve
- Transmission Harness
- Transmission ECU



Fault Isolation Procedures

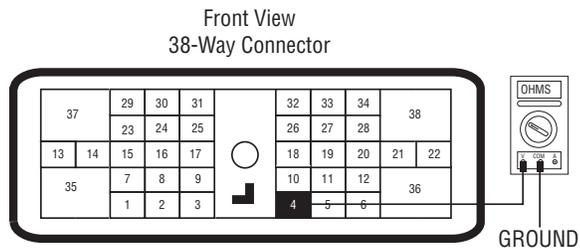
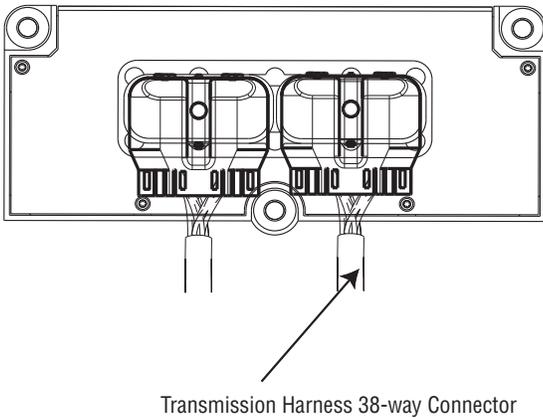
STEP A

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect the Transmission Harness 38-way connector.				
4. Measure resistance between the Transmission Harness 38-way connector pins:				
• 32 and 4		If resistance is 9 to 16 ohms		Go to STEP B
• 26 and 4		If resistance is outside of range		Go to STEP C



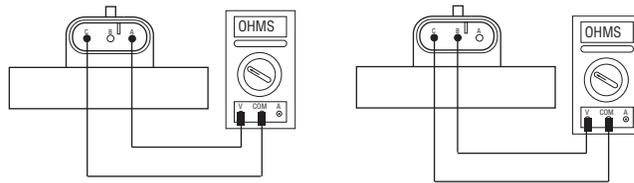
STEP B

Procedure	→ Condition	→ Action
1. Measure resistance between the Transmission Harness 38-way connector pin 4 and ground.	If resistance is OL	Replace Transmission ECU (Only if Fault Code is Active). Go to STEP V
	If resistance is less than 10K ohm	Go to STEP C



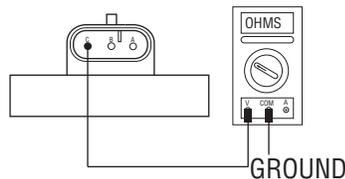
STEP C

Procedure	Condition	Action
1. Disconnect the Transmission Harness from Splitter Solenoid Valve.		
2. Measure resistance between Splitter Solenoid Valve pins:		
<ul style="list-style-type: none"> • A and C • B and C 	If resistance is 9 to 16 ohms	Go to STEP D
	If resistance is outside of range	Replace Splitter Solenoid Valve. Go to STEP V



STEP D

Procedure	Condition	Action
1. Measure resistance between Splitter Solenoid Valve pin C and ground.	If resistance is OL	Replace Transmission Harness. Go to STEP V
	If resistance is less than 10K ohm	Replace Splitter Solenoid Valve. Go to STEP V



STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors and the negative battery cable.				
3. Key on.				
4. Clear codes. Go to Fault Code Retrieval/Clearing .				
5. Drive the vehicle and attempt to reset the code.				
6. Check for codes. Go to Fault Code Retrieval/Clearing .		If no codes		Test complete.
		If code 46 appears		To find error in testing, return to STEP A
		If code other than 46 appears		Go to Fault Code Isolation Procedure Index .

Component Code 51 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
130	60	60		2, 3, 4, 10	Rail Position Sensor

Overview

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

Theory of Operation

The transmission controller supplies sensor power to the XY shifter position sensors and uses the reported sensor position to determine gear finger location. There are four fault conditions defined by the reported FMI via ServiceRanger software.

This fault will not be set if a System Battery Voltage Low fault (FC 33) is active.

Detection

Starting at key-on and throughout operation, the transmission controller constantly monitors the position of the sensor. If a failure condition is detected, the fault code is set.

Conditions to Set the Fault Code Active

- FMI 2 - The transmission controller detects the rail sensor voltage is outside the 10-90% range for 1 second or longer.
- FMI 3 - The transmission controller detects the rail sensor supply voltage is 5% above the expected supply voltage for 1 second or longer.
- FMI 4 - The transmission controller detects the rail sensor supply voltage is 5% below the expected supply voltage for 1 second or longer.
- FMI 10 - The transmission controller detects the rail sensor signal moving more than ± 0.093 " (2%) when the rail motor is turned off in gear.

Fallback mode During Power-Up

- The transmission will power-up and may not be able to confirm neutral, no start gears can be selected.
- Unit may not crank "=" in the display.

Fallback Mode During Operation

- The transmission remains in its current gear. An "F" may appear in the gear display.
- The service light will blink.
- Until the fault is cleared, driver may have to shut off engine in gear.
- Will not upshift. Will not downshift. Will not shift to neutral.

Conditions to Set the Fault Inactive

- FMI 2 - The fault becomes inactive when the transmission controller detects the rail sensor output voltage is within 10% - 90% for 1 second or longer.

- FMI 3, 4 - The fault becomes inactive when the transmission controller detects the rail sensor supply is within + / - 5% of the expected voltage.
- FMI 10 - The rail position is within + / - 0.093" (2%) of when the shift state went idle.

Required Tools

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

Possible Causes for Fault

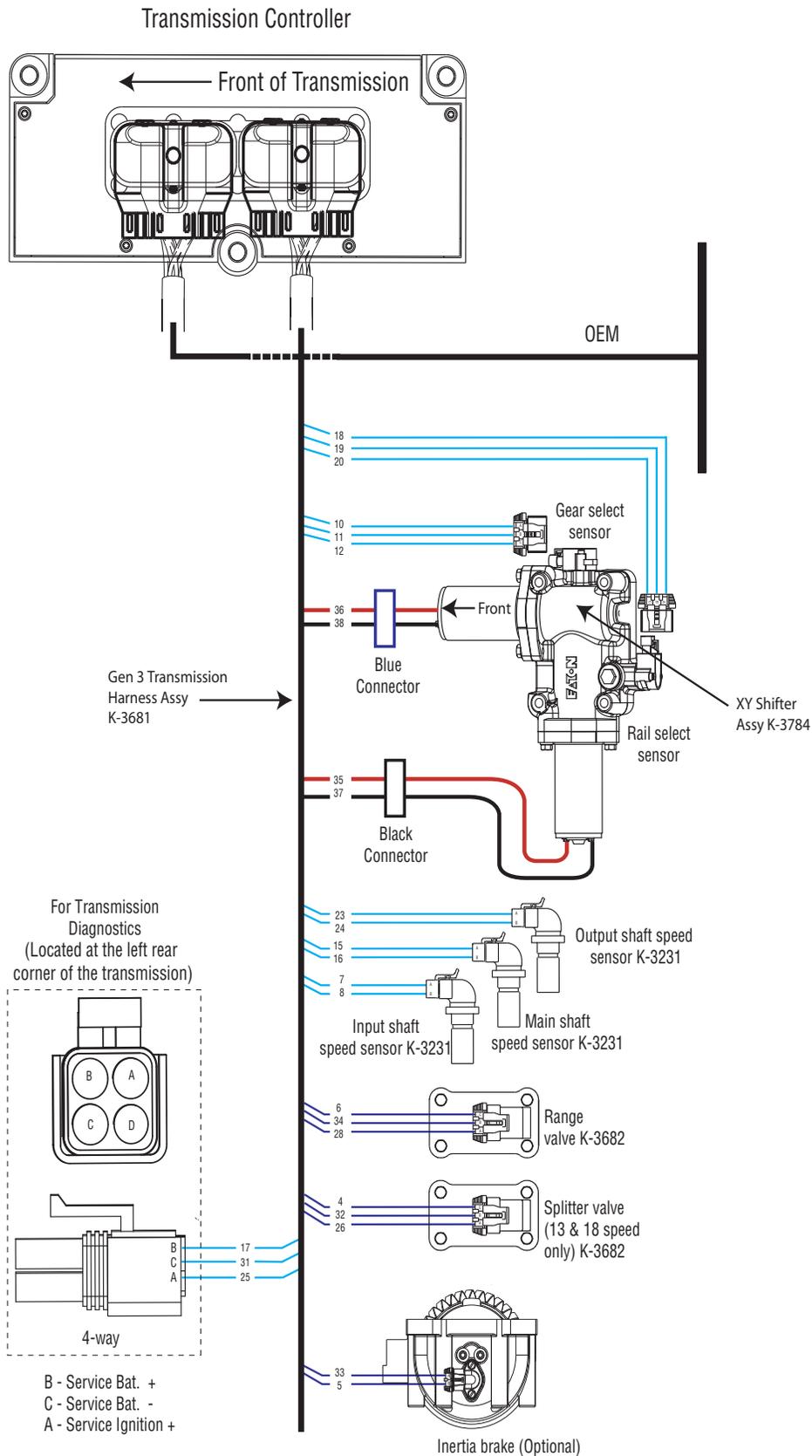
FMI 2, 4, 10:

- Transmission Harness - Connections and wires between the transmission controller and the rail sensor may be loose or damaged, terminals and wires may be bent, burnt or wires may be grounded, open, or shorted.
- XY Shifter - The rail sensor may have been damaged or malfunctioned.

FMI 3:

- Transmission Controller - The transmission controller may have been damaged or malfunctioned.

Component Code 51 Isolation Procedures



Fault Isolation Procedure

STEP A

Procedure	→	Condition	→	Action
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1. If the fault code is inactive put unit in PDM mode and perform the wire wiggle test. Check the overall harness connections to sensor. If a tone is heard and/or a fault code appears in the gear display, go to the Fault Code Isolation Procedure Index.
2. Key off.
3. Disconnect negative battery cable.
4. Disconnect the Transmission Harness 38-way connector.
5. Measure resistance between the Transmission Harness 38-way connector pins:
 - 18
 - 19

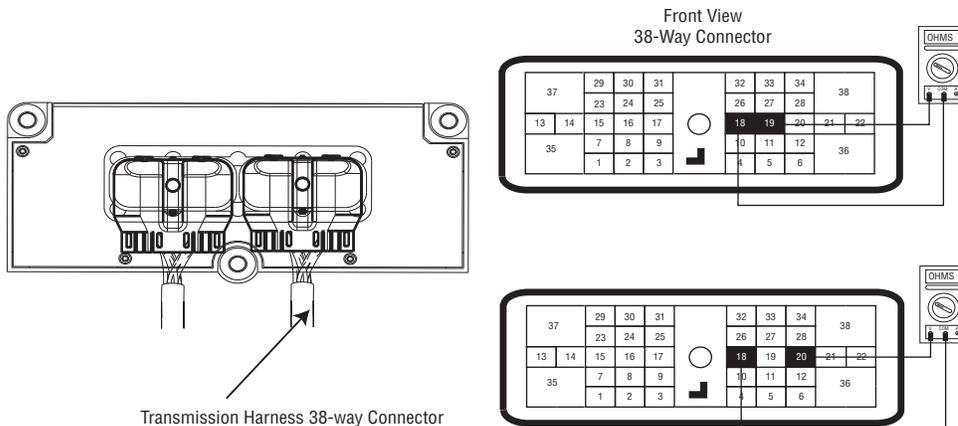
Note: An Auto Ranging Digital Volt/Ohm Meter must be used.

If pin 18 and 19 resistance is 100 to 200 ohms and if pin 18 and 20 resistance is 5K to 7K ohm

Go to **STEP B**

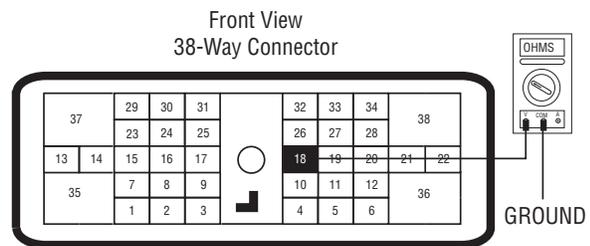
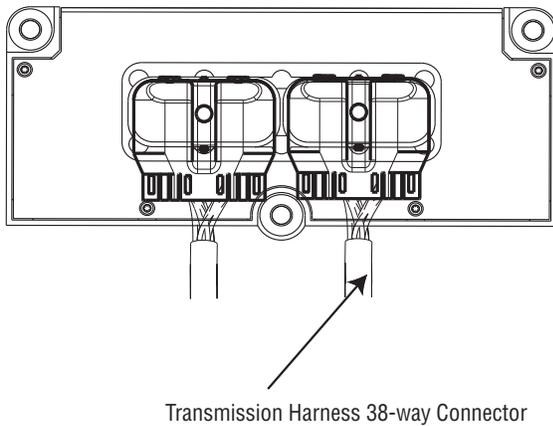
If any of the above conditions are not met

Go to **STEP C**



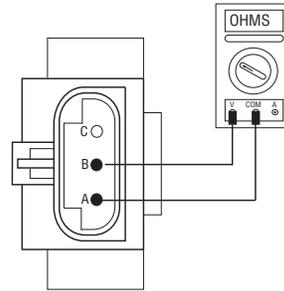
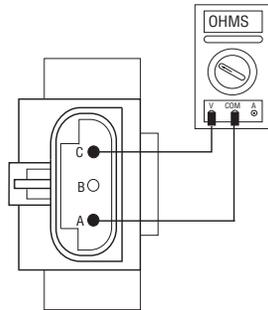
STEP B

Procedure	→	Condition	→	Action
1. Measure resistance between Transmission Harness 38-way connector pin 18 to ground.		If resistance is OL		Reconnect 38-way connector, replace Transmission Controller (only if fault code is active.)
		If FMI 2, 3, 4, or 10 is present with an inactive code		Replace the XY shifter and Transmission Harness.
		If resistance is less than 10K ohm		Go to STEP C



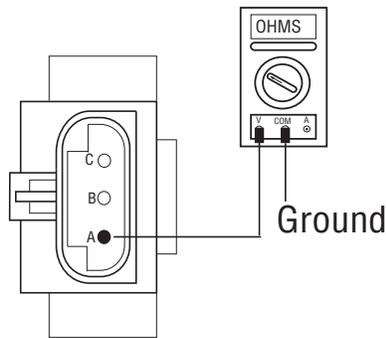
STEP C

Procedure	Condition	Action
1. Disconnect Transmission Harness from Rail Select Sensor.		
2. Measure resistance between Rail Select Sensor pins: - A and C - A and B		
Note: An Auto Ranging Digital Volt/Ohm Meter must be used.	If pin A and C resistance is 5K to 7K and if pin A and B resistance is 100 to 200 ohms	Go to STEP D
	If any of the above conditions are not met	Replace XY Shifter. Go to STEP V



STEP D

Procedure	→ Condition	→ Action
1. Measure resistance between Rail Select Sensor pin A and ground.	If resistance is OL	Replace Transmission Harness. Go to STEP V
	If resistance is less than 10K ohm	Replace XY Shifter. Go to STEP V



STEP V

Procedure	→ Condition	→ Action
1. Key off.		
2. Reconnect all connectors.		
3. Key on.		
4. Clear codes.		
5. Drive the vehicle and attempt to reset the code.		
6. Check for codes.	If no codes	Test complete.
	If code 51 appears	To find error in testing, return to STEP A
	If code other than 51 appears	Go to Fault Code Isolation Procedure Index .

Component Code 52 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
130	59	59		2, 3, 4, 7	Gear Position Sensor

Overview

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

Theory of Operation

The transmission controller supplies sensor power to the XY shifter position sensors and uses the reported sensor position to determine gear finger location. There are four fault conditions defined by the reported FMI via ServiceRanger software.

This fault will not be set if a System Battery Voltage Low fault (FC 33) is active.

Detection

Starting at key-on and throughout operation, the transmission controller constantly monitors the position of the sensor. If a failure condition is detected, the fault code is set.

Conditions to Set the Fault Code Active

- FMI 2 - The transmission controller detects the gear sensor voltage is outside the 10-90% range for 1 second or longer.
- FMI 3 - The transmission controller detects the gear sensor supply voltage is 5% above the expected supply voltage for 1 second or longer.
- FMI 4 - The transmission controller detects the gear sensor supply voltage is 5% below the expected supply voltage for 1 second or longer.

Fallback mode During Power-Up

- The transmission will power-up and may not be able to confirm neutral, no start gears can be selected.
- Unit may not crank “=” in the display.

Fallback Mode During Operation

- The transmission remains in its current gear. An “F” may appear in the gear display.
- The service light will blink.
- Until the fault is cleared, driver may have to shut off engine in gear.
- Will not upshift. Will not downshift. Will not shift to neutral.

Conditions to Set the Fault Inactive

- FMI 2 - The fault becomes inactive when the transmission controller detects the gear sensor output voltage is within 10% - 90% for 1 second or longer.
- FMI 3, 4 - The fault becomes inactive when the transmission controller detects the gear sensor supply is within + / - 5% of the expected voltage.
- FMI 7 - Shift finger is beyond maximum engagement.

Required Tools

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

Possible Causes for Fault

FMI 2, 4:

- Transmission Harness - Connections and wires between the transmission controller and the rail sensor may be loose or damaged, terminals and wires may be bent, burnt or wires may be grounded, open, or shorted.
- XY Shifter - The rail sensor may have been damaged or malfunctioned.

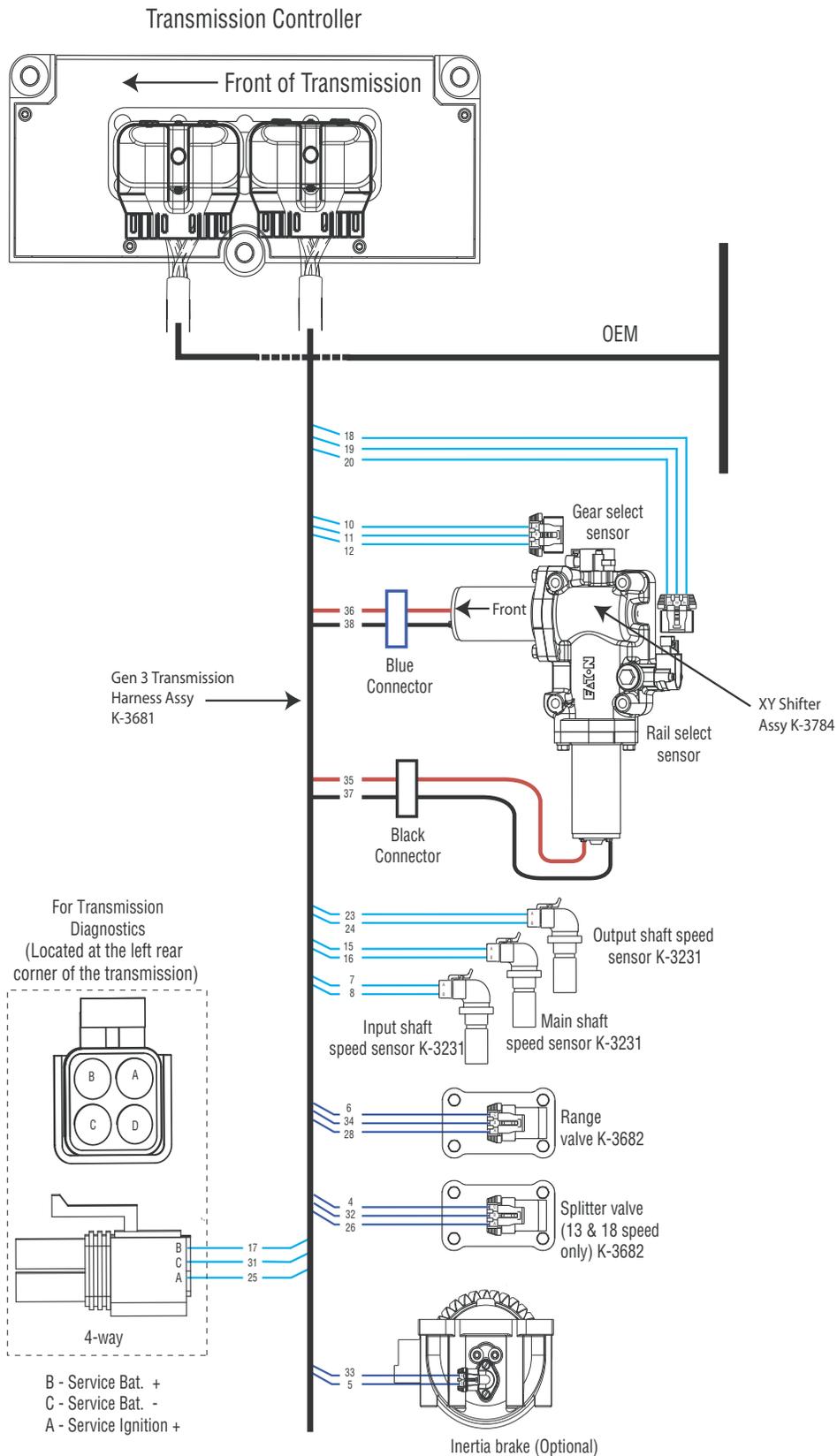
FMI 3:

- Transmission Controller - The transmission controller may have been damaged or malfunctioned.

FMI 7:

- XY Shifter - Possible broken shift finger.

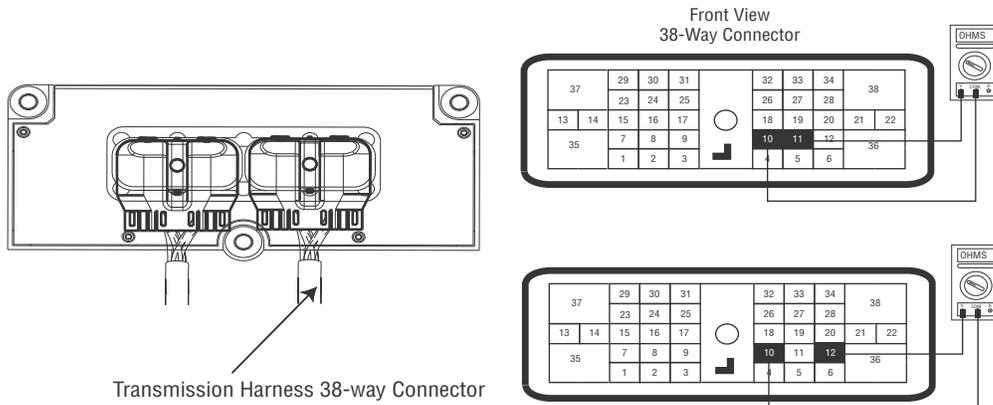
Component Code 52 Isolation Procedures



Fault Isolation Procedures

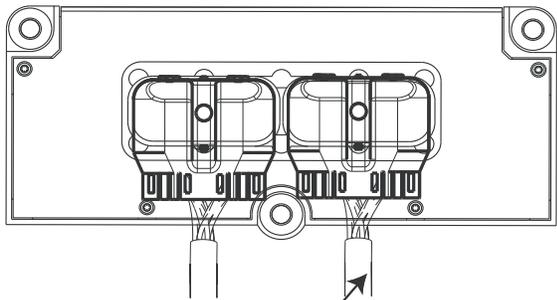
STEP A

Procedure	→	Condition	→	Action
1. If the fault code is inactive put unit in PDM mode and perform the wire wiggle test. Check the overall harness connections to sensor. If a tone is heard and/or a fault code appears in the gear display, go to the Fault Code Isolation Procedure Index.				
2. Key off.				
3. Disconnect negative battery cable.				
4. Disconnect the Transmission Harness 38-way connector.				
5. Measure resistance between the Transmission Harness 38-way connector pins:				
- 10 and 11				
- 10 and 12				
Note: An Auto Ranging Digital Volt/Ohm Meter must be used.		If pin 10 and 11 resistance is 100 to 200 ohms and if pin 10 and 12 resistance is 5K to 7K ohm		Go to STEP B
		If any of the above conditions are not met		Go to STEP C

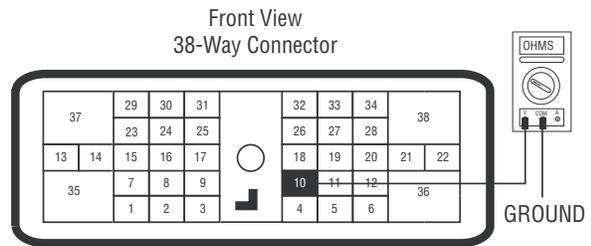


STEP B

Procedure	→ Condition	→ Action
1. Measure resistance between Transmission Harness 38-way connector pin 10 to ground.	If resistance is OL	Reconnect 38-way connector, replace Transmission Controller (only if fault code is active.)
	If FMI 2, 3, or 4 is present with an inactive code	Replace the XY Shifter and Transmission Harness.
	If FMI 7 is present, remove XY Shifter to inspect for a broken shift finger. If the shift finger is broken	Replace the XY Shifter.
	If resistance is less than 10K ohm	Go to STEP C

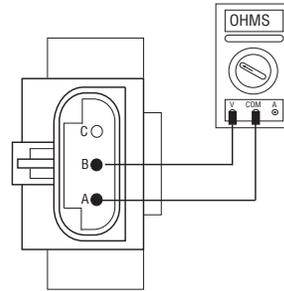
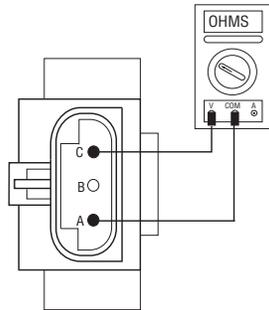


Transmission Harness 38-way Connector



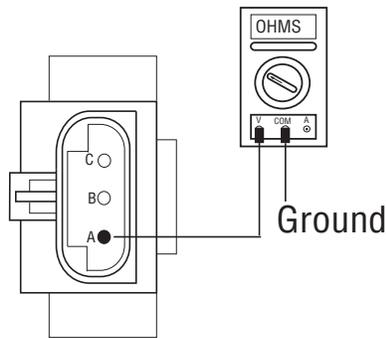
STEP C

Procedure	→	Condition	→	Action
1. Disconnect Transmission Harness from Gear Select Sensor.				
2. Measure resistance between Gear Select Sensor pins: - A and C - A and B				
Note: An Auto Ranging Digital Volt/Ohm Meter must be used.		If pin A and C resistance is 5K to 7K ohm and if pin A and B resistance is 100 to 200 ohms		Go to STEP D
		If any of the above conditions are not met		Replace XY Shifter. Go to STEP V



STEP D

Procedure	→ Condition	→ Action
1. Measure resistance between Gear Select Sensor pin A and ground.	If resistance is OL	Replace Transmission Harness. Go to STEP V
	If resistance is less than 10K ohm	Replace XY Shifter. Go to STEP V



STEP V

Procedure	→ Condition	→ Action
1. Key off.		
2. Reconnect all connectors.		
3. Key on.		
4. Clear codes.		
5. Drive the vehicle and attempt to reset the code.		
6. Check for codes.	If no codes	Test complete.
	If code 52 appears	To find error in testing, return to STEP A
	If code other than 52 appears	Go to Fault Code Isolation Procedure Index .

Component Code 56 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	161	161		2, 3, 4, 5, 10	Input Shaft Speed Sensor

Overview

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

When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19.

Detection

A speed sensor is determined faulty when all the speed sensor readings are compared and one sensor is inconsistent, or the sensor is shorted to power or ground.

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.

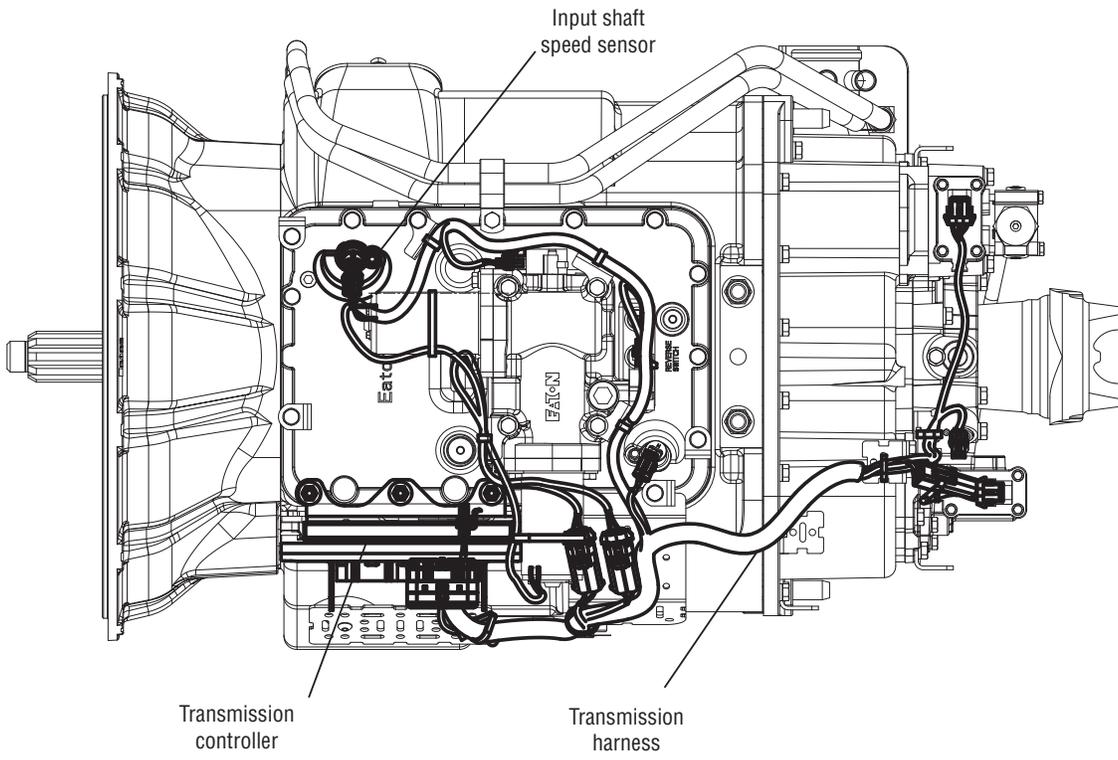
Required Tools

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

Possible Causes

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

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



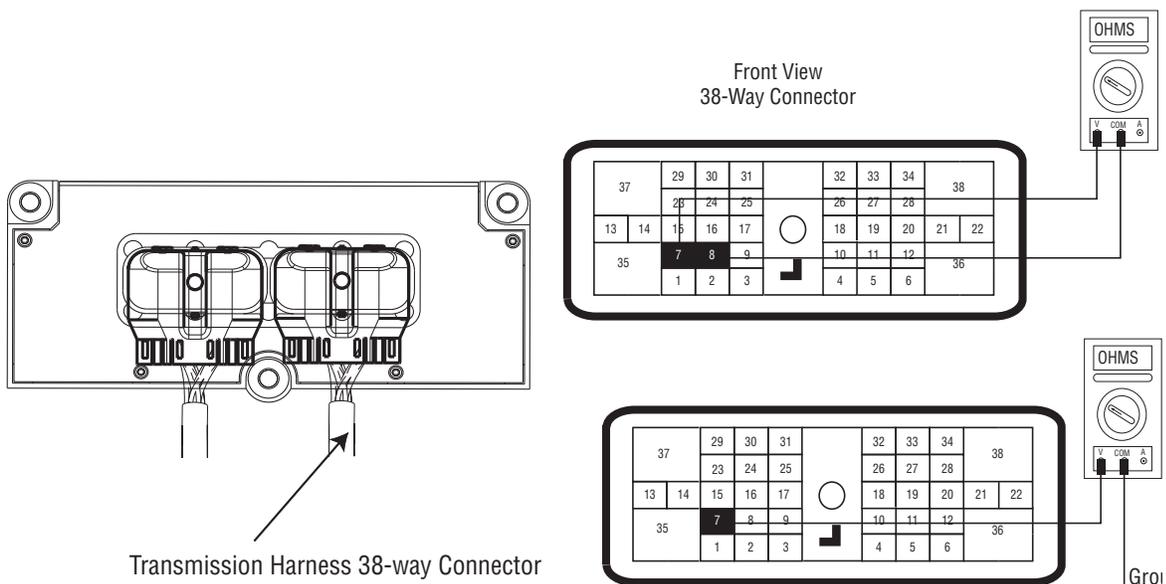
Fault Isolation Procedures

STEP A

Procedure	Condition	Action
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

STEP B

Procedure	Condition	Action
1. Key off.		
2. Disconnect negative battery cable.		
3. Disconnect the Transmission Harness 38-way connector.		
4. Measure resistance between the Transmission Harness 38-way connector pins 7 and 8 and pin 7 and ground.	If resistance is 2K to 4.5K ohm and pin 7 to ground is OL	Go to STEP C
	If resistance is outside of the range	Go to STEP D

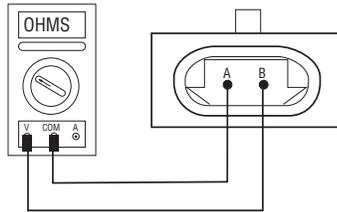


STEP C

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

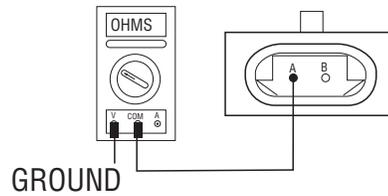
STEP D

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



STEP E

Procedure	→ Condition	→ Action
1. Measure resistance between Input Shaft Speed Sensor pin A and ground.	If resistance is OL	Replace Transmission Harness. Go to STEP V
	If resistance is less than 10K ohm	Go to STEP C



STEP V

Procedure	→ Condition	→ Action
1. Key off.		
2. Reconnect all connectors and the negative battery cable.		
3. Verify proper installation of speed sensor.		
4. Key on.		
5. Clear codes. Go to Fault Code Retrieval/Clearing .		
6. Drive the vehicle and attempt to reset the code.		
7. Check for codes. Go to Fault Code Retrieval/Clearing .	If no codes	Test complete.
	If code 56 appears	To find error in testing, return to STEP A
	If code other than 56 appears	Go to Fault Code Isolation Procedure Index .

Component Code 57 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	160	160		2, 3, 4, 5	Main Shaft Speed Sensor

Overview

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

When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19.

Detection

A speed sensor is determined faulty when all the speed sensor readings are compared and one sensor is inconsistent, or the sensor is shorted to power or ground.

Fallback

This fault causes an In Place fallback mode.

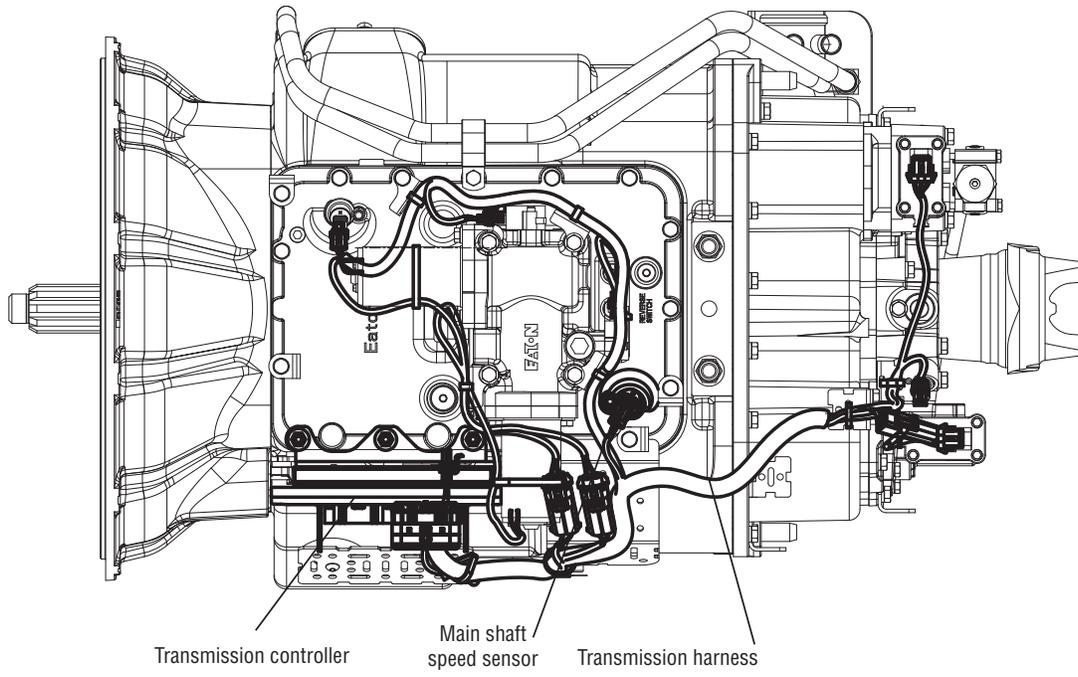
Required Tools

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

Possible Causes

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

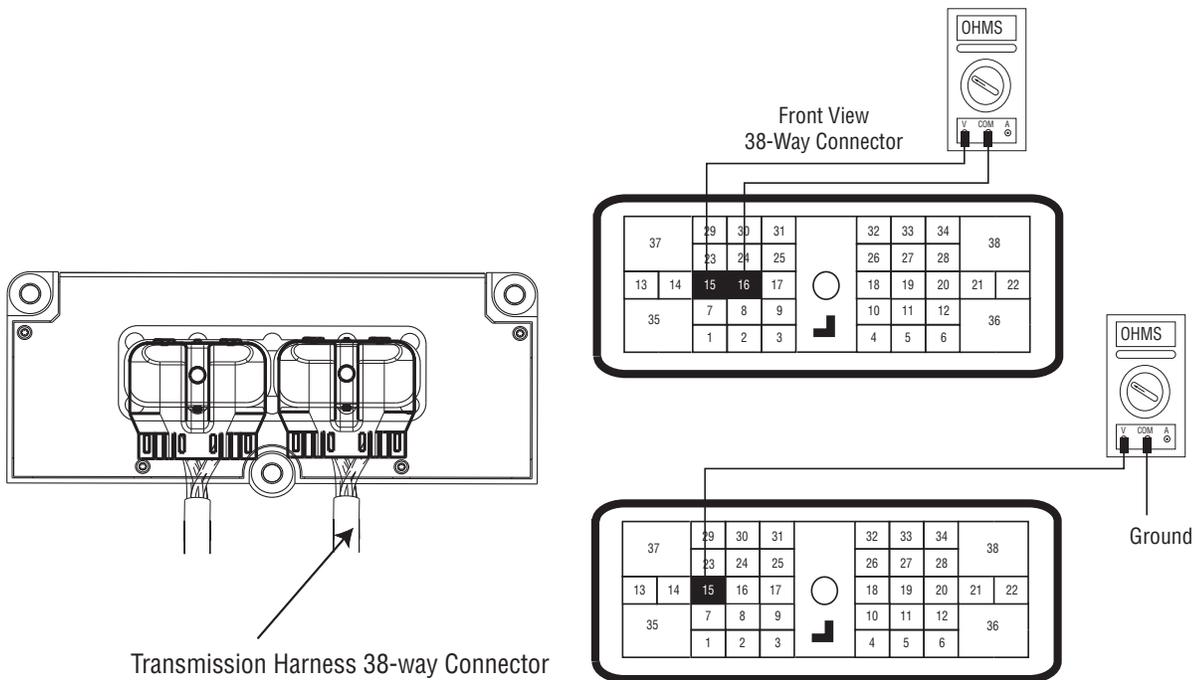
- Transmission Harness
- Main Shaft Speed Sensor
- Various Transmission Components
- Transmission ECU



Fault Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect the Transmission Harness 38-way connector.				
4. Measure resistance between the Transmission Harness 38-way connector pins 15 and 16 and 15 and ground.		If resistance is 2k to 4.5K ohm and pin 15 to ground is OL		Go to STEP B
		If resistance is outside of the range		Go to STEP C

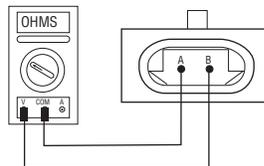


STEP B

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

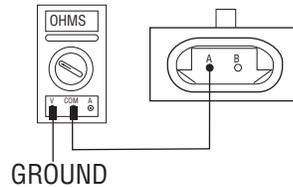
STEP C

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



STEP D

Procedure	→ Condition	→ Action
1. Measure resistance between Main Shaft Speed Sensor pin A and ground.	If resistance is OL	Replace Transmission Harness. Go to STEP V
	If resistance is less than 10K ohm	Go to STEP B



STEP V

Procedure	→ Condition	→ Action
1. Key off.		
2. Reconnect all connectors and the negative battery cable.		
3. Verify proper installation of speed sensor.		
4. Key on.		
5. Clear codes. Go to Fault Code Retrieval/Clearing .		
6. Drive the vehicle and attempt to reset the code.		
7. Check for codes. Go to Fault Code Retrieval/Clearing .	If no codes	Test complete.
	If code 57 appears	To find error in testing, return to STEP A
	If code other than 57 appears	Go to Fault Code Isolation Procedure Index .

Component Code 58 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	191	191		2, 3, 4, 5, 6, 8	Output Shaft Speed Sensor

Overview

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

When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19.

Detection

A speed sensor is determined faulty when all the speed sensor readings are compared and one sensor is inconsistent, the sensor is shorted to power or ground, a grounded circuit is detected, or if an abnormal frequency is detected.

Fallback

This fault causes an In Place fallback.

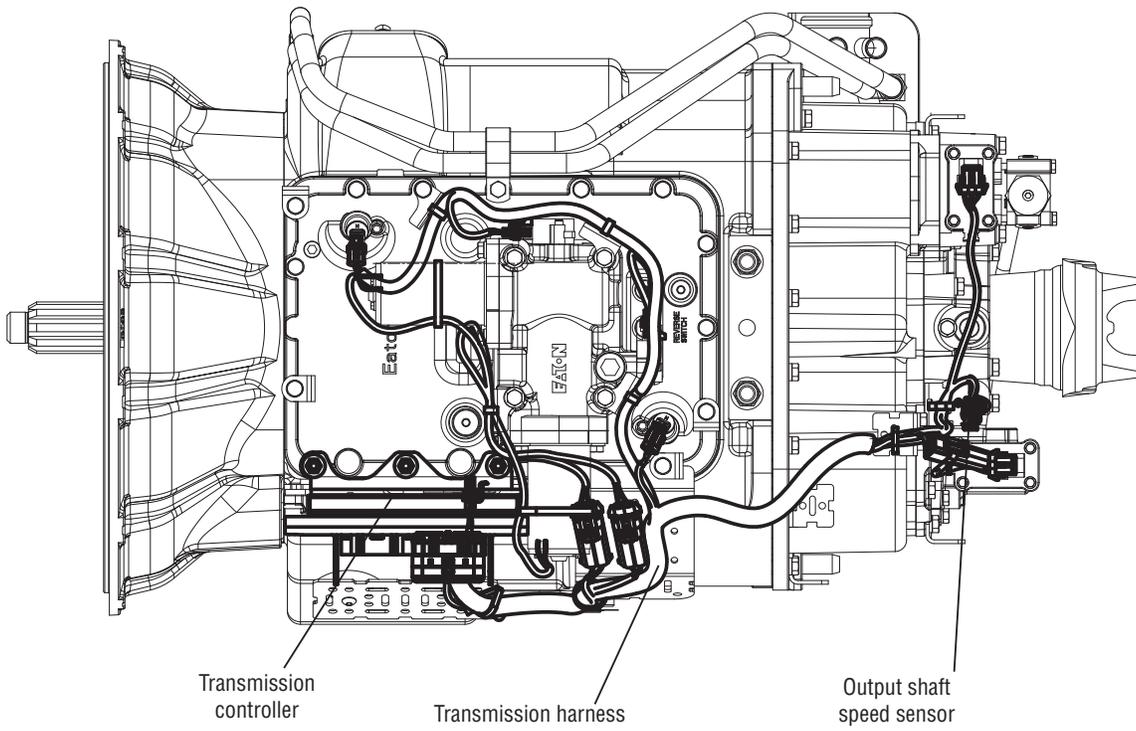
Required Tools

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

Possible Causes

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

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

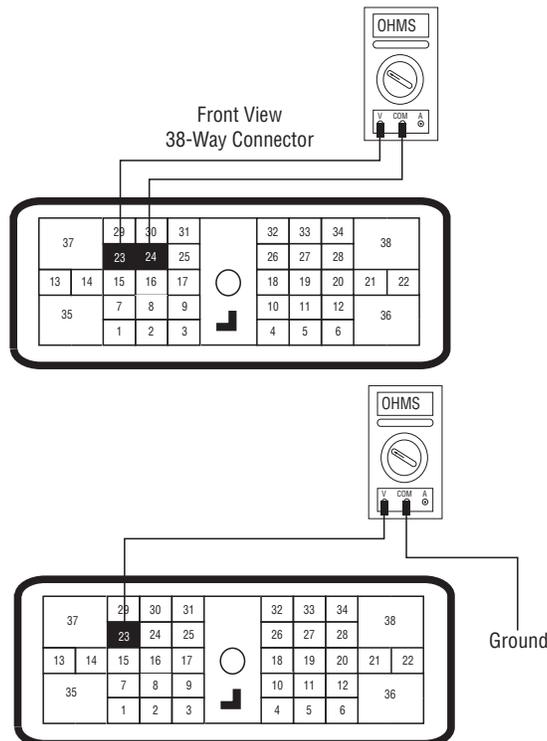
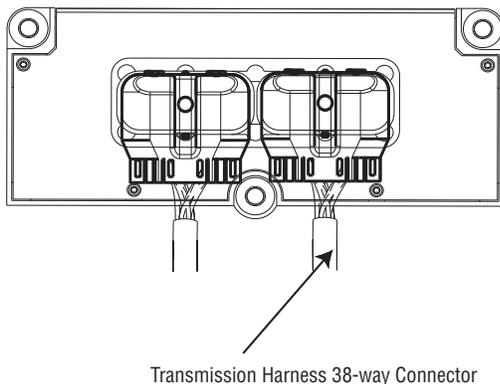


Fault Isolation Procedures

Note: If troubleshooting an UltraShift® PLUS model transmission’s output shaft speed sensor, which is a directional sensor, go to Step E. Otherwise start at Step A.

STEP A

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect the Transmission Harness 38-way connector.				
4. Measure resistance between the Transmission Harness 38-way connector pins 23 and 24 and 23 and ground.		If resistance is 2K to 4.5K ohm and pin 23 to ground is OL		Go to STEP B
		If resistance is outside of the range		Go to STEP C

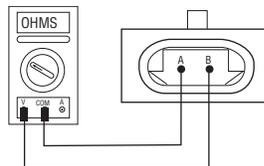


STEP B

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

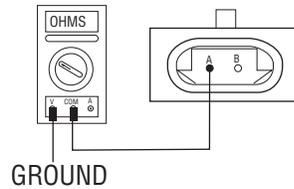
STEP C

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



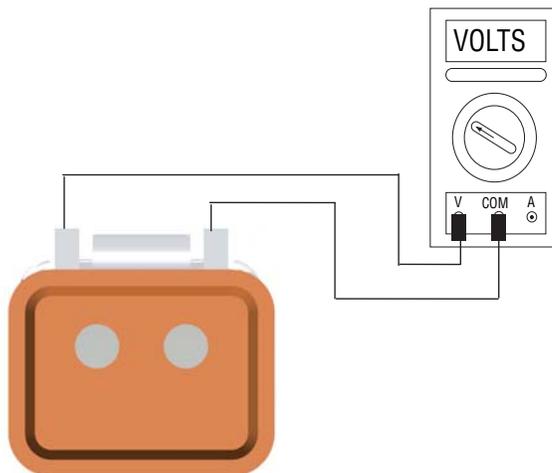
STEP D

Procedure	Condition	Action
1. Measure resistance between Output Shaft Speed Sensor pin A and ground.	If resistance is OL	Replace Transmission Harness. Go to STEP V
	If resistance is less than 10K ohm	Go to STEP B



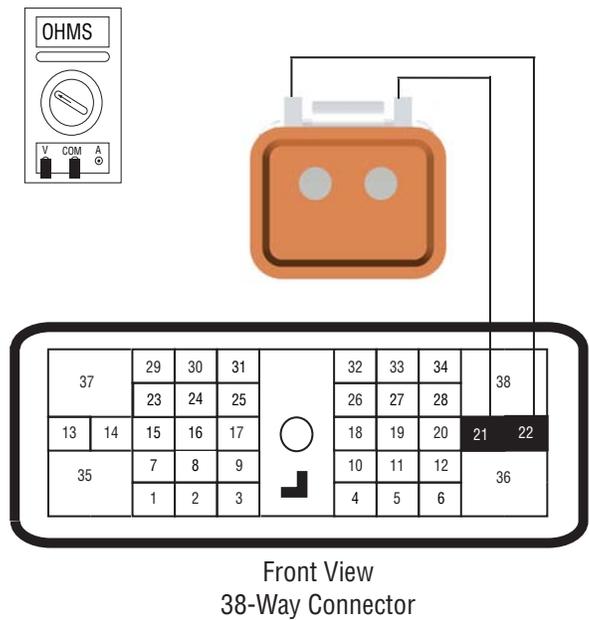
STEP E

Procedure	Condition	Action
1. Key off.		
2. Disconnect the Transmission Harness from the Output Shaft Speed Sensor.		
3. With key on, measure voltage from Transmission Harness connector 1 and 2.	If voltage is within 4.9 - 5.1 volts	Replace the Output Shaft Sensor. Go to STEP V
	If voltage is out of range	Go to STEP F



STEP F

Procedure	→ Condition	→ Action
1. Key off.		
2. Disconnect negative battery cable.		
3. Disconnect the Transmission Harness 38-way connector.		
4. Check for connector damage and measure resistance between: - Transmission Harness 38-way connector pins 22 and Transmission Harness connector 1. - Transmission Harness 38-way connector pins 21 and Transmission Harness connector 2.	If harness connections are in good condition and resistance of both circuits measure between 0 to 0.3 ohms	Replace the ECU (Only if Fault Code is Active.) Go to STEP V
	If damaged or failed harness connectors are found, or if either or both circuits are out of range	Replace the Transmission Harness. Go to STEP V



STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors and the negative battery cable.				
3. Verify proper installation of speed sensor.				
4. Key on.				
5. Clear codes.				
6. Drive the vehicle and attempt to reset the code.				
7. Check for codes.		If no codes		Test complete.
		If code 58 appears		To find error in testing, return to STEP A
		If code other than 58 appears		Go to Fault Code Isolation Procedure Index .

Component Code 61 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
130	772		39	1, 5, 6, 12	Rail Select Motor

Overview

This fault indicates the XY shifter Rail Motor system is not working properly.

Theory of Operation

The TECU checks the rail motor for open or shorted connections. There are four fault conditions defined by the reported FMI via ServiceRanger software.

Detection

Starting at key-on and throughout operation, the TECU constantly monitors the motor circuit. If a failure mode of short to battery, short to ground, open circuit, or low current is detected the fault is set.

Conditions to Set the Fault Code Active

- FMI 1 - The TECU detects a high resistance in the motor circuit (5 ohms or greater) resulting in slow or no movement of the XY shift finger. This fault will set when the XY shifter fails to select the proper rail.
- FMI 5, 6 - This fault is set when the condition is detected for at least 0.5 seconds and the TECU attempts to move the XY shift finger. FMI 5 is open or shorted to ground, FMI 6 is shorted to power.
- FMI 12 - The TECU detects a fault condition within the TECU XY control circuit, resulting in slow or no movement of the XY shift finger. This fault is set when the XY shifter fails to select the proper rail.

Fallback Mode During Power-Up

- The transmission will power-up and may not be able to confirm neutral, no start gear can be selected.
- The Engine will not crank and a dash “-” will be shown in the gear display.

Fallback Mode During Operation

- The transmission remains in its current gear. An “F” may appear in the gear display.
- The service light will blink.
- Until the fault is cleared, driver may have to shut off engine in gear.

Conditions to Set the Fault Inactive

- FMI 1, 12 - The fault becomes inactive when the shift is completed.
- FMI 5, 6 - The fault becomes inactive when the open or short circuit conditions are not detected for 0.5 seconds.

Required Tools

- Basic Hand Tools

- Eaton Test Adapter Kit
- Digital Volt / Ohm Meter
- Troubleshooting Guide
- ServiceRanger, a PC-based Service Tool

Possible Causes for Fault

FMI 1, 5:

- The XY shifter rail motor may be damaged, failed, or has developed a low resistance to ground.
- Connections and wires between the rail motor and the TECU may be loose or damaged, terminals and wires may be bent, or terminals may be burnt.
- TECU may have an internal short to ground or open circuit and has failed.

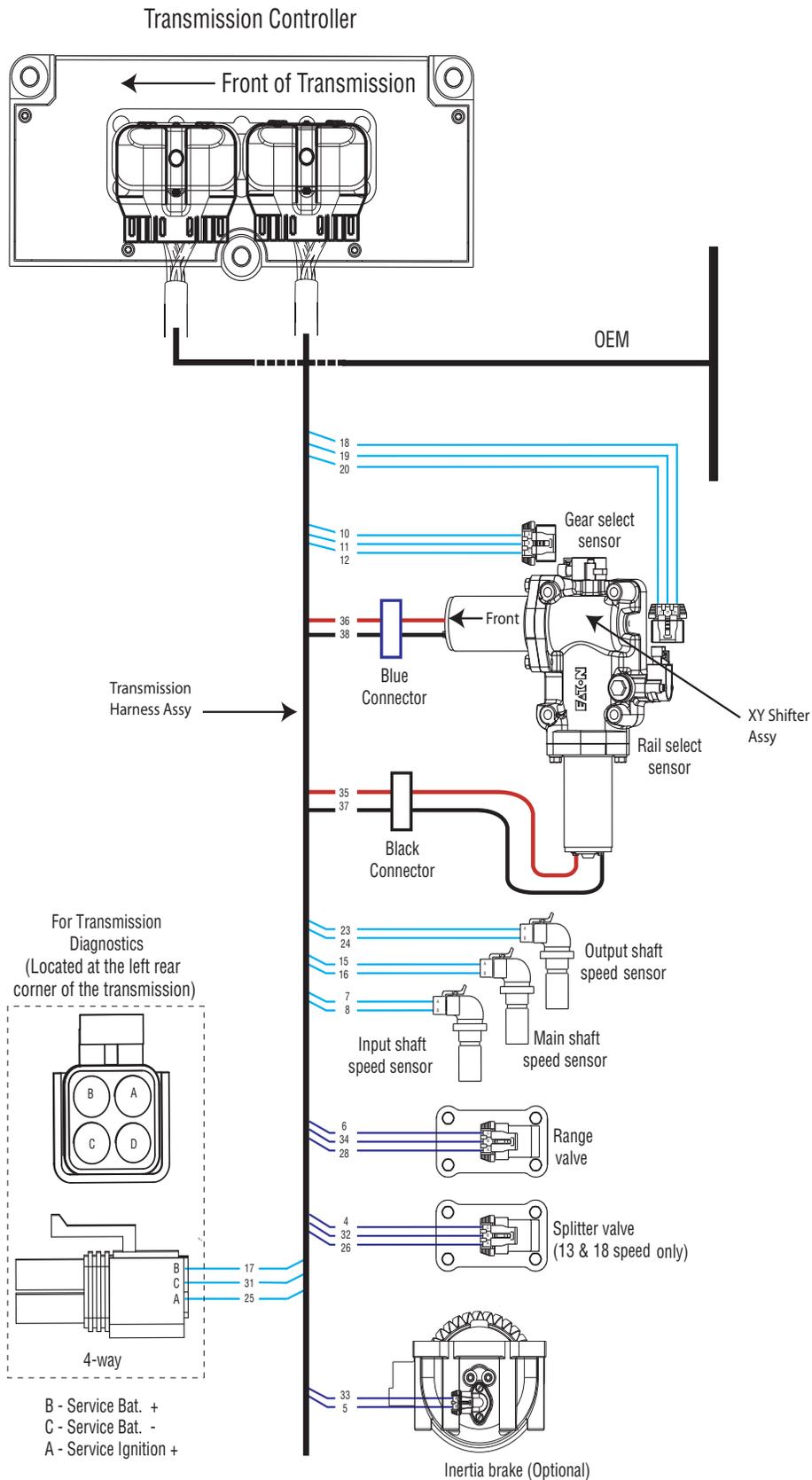
FMI 6:

- The wires between the rail motor and the TECU may be grounded or shorted.
- TECU may have internal short to power and has failed.

FMI 12:

- Poor chassis power or ground.
- The wires between the rail motor and the TECU may be grounded or shorted.
- TECU internal failure.

Component Code 61 Isolation Procedures



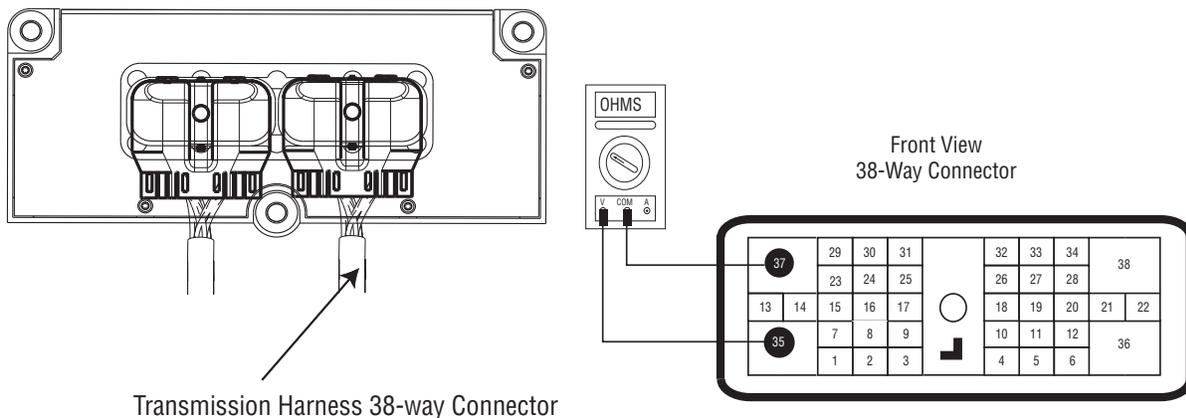
Fault Isolation Procedures

STEP A

Procedure	Condition	Action
1. Use ServiceRanger to retrieve and record fault code 61 FMI information.	Issue found with TECU power supply harness or vehicle batteries	Repair or replace items found during Electrical Pretest. Go to STEP V
2. Perform Electrical Pretest, inspect TECU power supply harness and fuse holder.	Electrical Pretest passed, no issues found	Go to STEP B

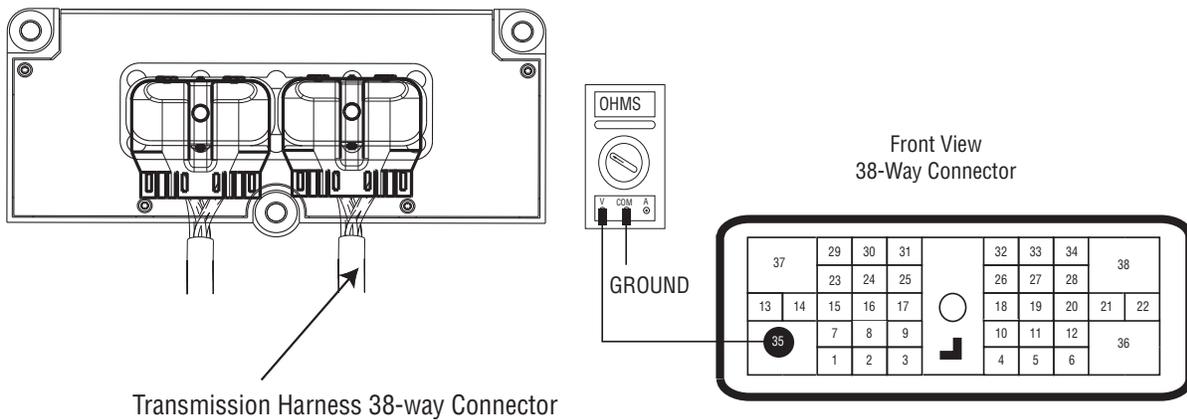
STEP B

Procedure	Condition	Action
1. Key off.	Measured resistance is 2 ohms or less	Go to STEP C
2. Disconnect the negative battery cable.	Measured resistance is greater than 2 ohms	Go to STEP D
3. Disconnect the Transmission Harness 38-way connector from the TECU.		
4. Measure resistance between pins 35 and 37.		



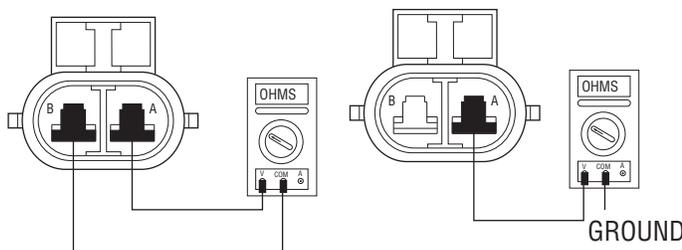
STEP C

Procedure	Condition	Action
1. Measure the resistance between pin 35 and ground.	Measured resistance is 1M ohm or greater	Go to STEP E
	Measured resistance is less than 1M ohm	Go to STEP D



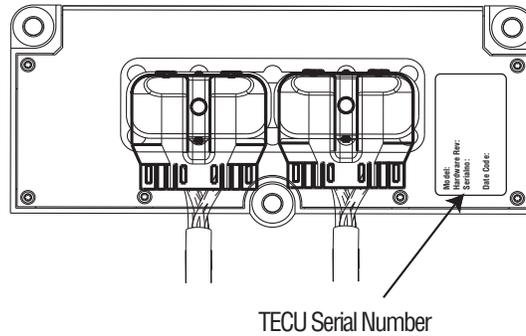
STEP D

Procedure	Condition	Action
1. Disconnect the black 2-way rail motor connector from the transmission harness.	Measured resistance is: <ul style="list-style-type: none"> • Pin A to B – 2 ohms or less • Pin A to Ground – 1M ohm or greater 	Replace the Transmission Harness. Go to STEP V
2. Measure the resistance of the Rail Motor at the 2-way connector.	Measured resistance is out of range	Replace the XY shifter. Go to STEP V



STEP E

Procedure	→ Condition	→ Action
1. FMI information recorded from Step A.	FMI 1 or 5 is active	Replace the TECU and transmission harness. Go to STEP V
	FMI 1 or 5 is inactive and the TECU serial number is between ETC2000000 and ETC2029918	Replace the TECU and transmission harness. Go to STEP V
	FMI 1 or 5 is inactive and the TECU serial number is above ETC2029918	Replace the XY shifter and transmission harness. Go to STEP V
	FMI 6 or 12 is active or inactive	Replace the TECU. Go to STEP V



STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors and the negative battery cable.				
3. Key on.				
4. Clear codes.				
5. Drive the vehicle and attempt to reset the code.				
6. Check for codes.		If no codes		Test complete.
		If code 61 appears		To find error in testing, return to STEP A

Component Code 63 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
130	773		40	1, 5, 6, 12	Gear Select Motor

Overview

This fault indicates the XY shifter Gear Motor system is not working properly.

Theory of Operation

The TECU checks the gear motor and controller for open or shorted connections. There are four fault conditions defined by the reported FMI via ServiceRanger software.

Detection

Starting at key-on and throughout operation, the TECU constantly monitors the motor circuit. If a failure mode of short to battery, short to ground, open circuit, or low current is detected the fault is set.

Conditions to Set the Fault Code Active

- FMI 1 - The TECU detects a high resistance in the motor circuit (5 ohms or greater) resulting in slow or no movement of the XY shift finger. This fault will set when the XY shifter fails to engage or disengage a gear.
- FMI 5, 6 - This fault is set when the condition is detected for at least 0.5 seconds and the TECU attempts to move the XY shift finger. FMI 5 is open or shorted to ground, FMI 6 is shorted to power.
- FMI 12 - The TECU detects a fault condition within the TECU XY control circuit, resulting in slow or no movement of the XY shift finger. This fault is set when the XY shifter fails to engage or disengage a gear.

Fallback Mode During Power-Up

- The transmission will power-up and may not be able to confirm neutral, no start gear can be selected.
- The Engine will not crank and a dash “-” will be shown in the gear display.

Fallback Mode During Operation

- The transmission remains in its current gear. An “F” may appear in the gear display.
- The service light will blink.
- Until the fault is cleared, driver may have to shut off engine in gear.

Conditions to Set the Fault Inactive

- FMI 1, 12 - The fault becomes inactive when the shift is completed.
- FMI 5, 6 - The fault becomes inactive when the open or short circuit conditions are not detected for 0.5 seconds.

Required Tools

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

Possible Causes for Fault

FMI 1, 5:

- The XY shifter gear motor may be damaged, failed, or has developed a low resistance to ground.
- Connections and wires between the gear motor and the TECU may be loose or damaged, terminals and wires may be bent, or terminals may be burnt.
- TECU may have an internal short to ground or open circuit and has failed.

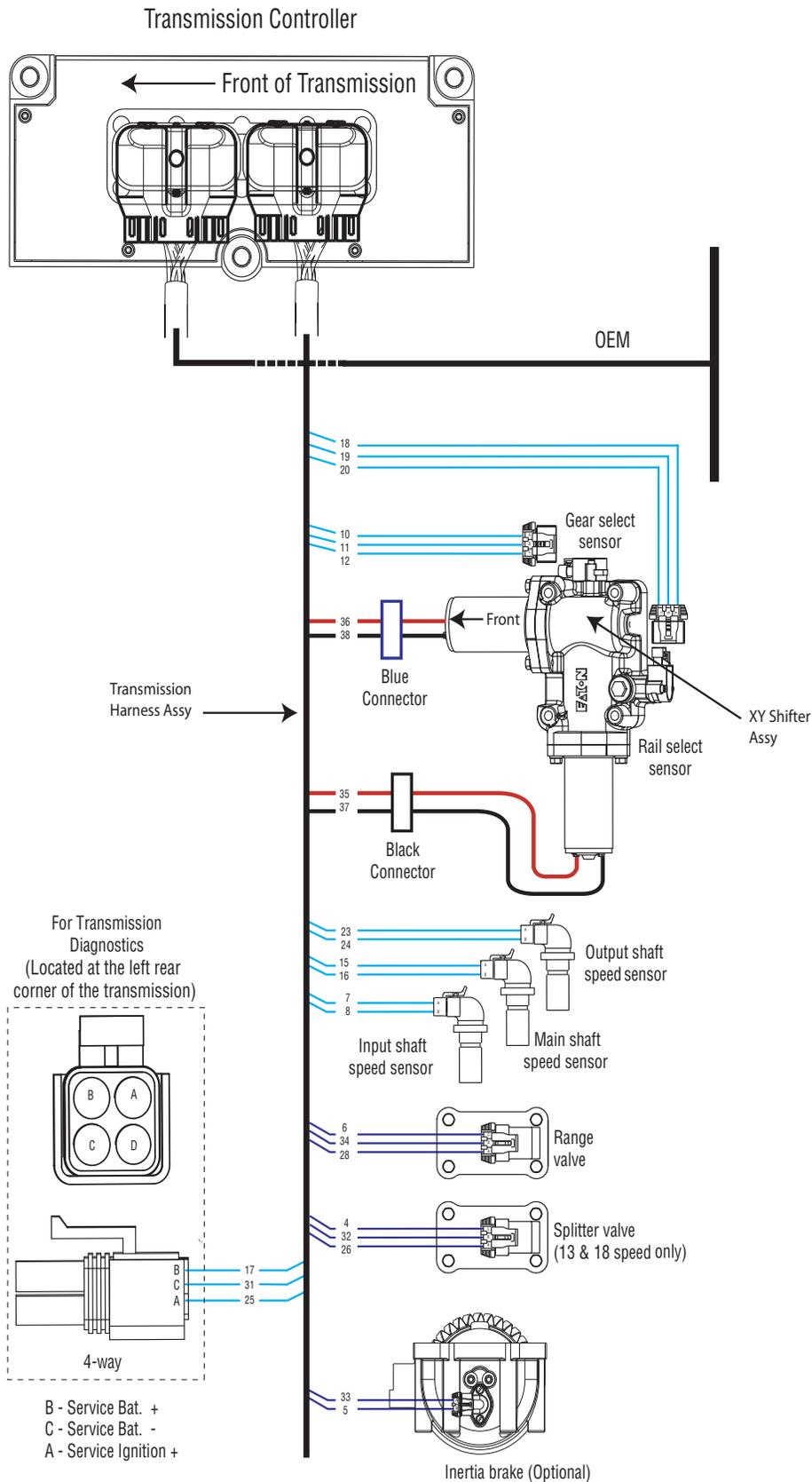
FMI 6:

- The wires between the gear motor and TECU may be shorted to power.
- TECU may have internal short to power and has failed.

FMI 12:

- Poor chassis power or ground.
- The wires between the gear motor and TECU may be shorted to ground.
- TECU internal failure.

Component Code 63 Isolation Procedures



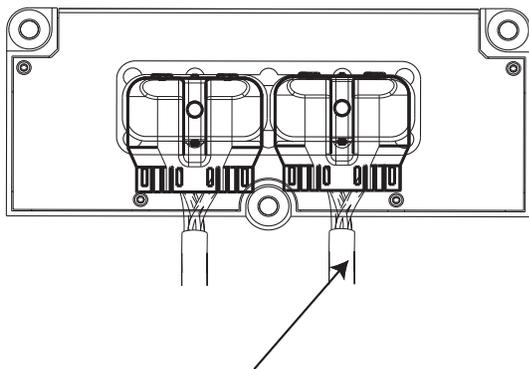
Fault Isolation Procedures

STEP A

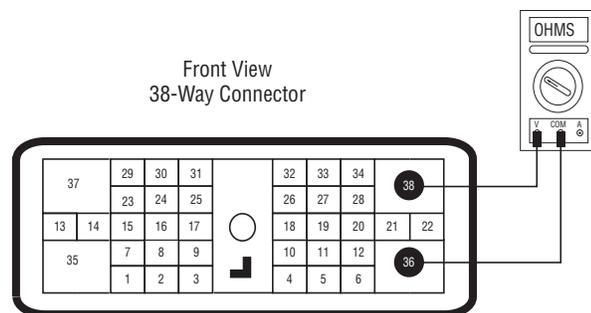
Procedure	Condition	Action
1. Use ServiceRanger to retrieve and record fault code 63 FMI information.	Issue found with TECU power supply harness or vehicle batteries	Repair or replace items found during Electrical Pretest. Go to STEP V
2. Perform Electrical Pretest, inspect TECU power supply harness and fuse holder.	Electrical Pretest passed, no issues found	Go to STEP B

STEP B

Procedure	Condition	Action
1. Key off.	Measured resistance is 2 ohms or less	Go to STEP C
2. Disconnect the negative battery cable.	Measured resistance is greater than 2 ohms	Go to STEP D
3. Disconnect the Transmission Harness 38-way connector from the TECU.		
4. Measure resistance between pins 36 and 38.		

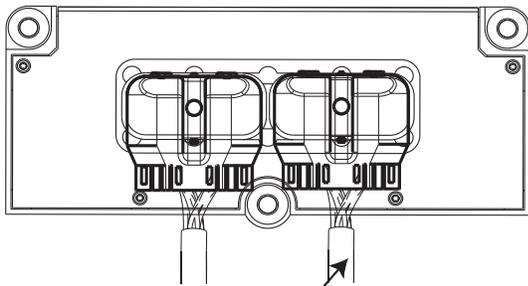


Transmission Harness 38-way Connector

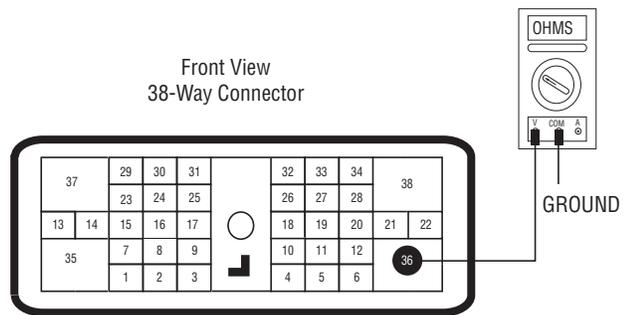


STEP C

Procedure	Condition	Action
1. Measure the resistance between pin 36 and ground.	Measured resistance is 1M ohm or greater	Go to STEP E
	Measured resistance is less than 1M ohm	Go to STEP D

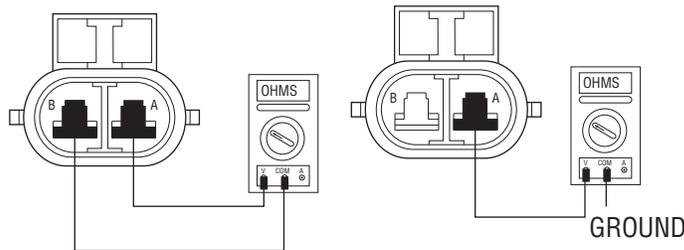


Transmission Harness 38-way Connector



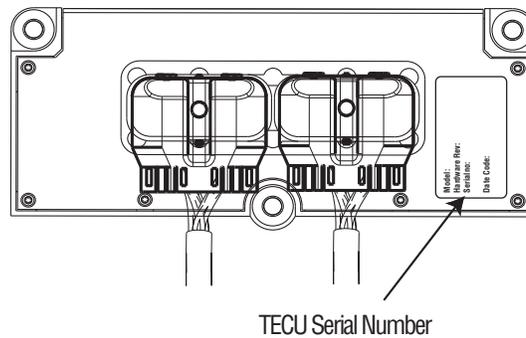
STEP D

Procedure	Condition	Action
1. Disconnect the blue 2-way gear motor connector from the transmission harness.	Measured resistance is: <ul style="list-style-type: none"> Pin A to B – 2 ohms or less Pin A to Ground – 1M ohm or greater 	Replace the Transmission Harness. Go to STEP V
2. Measure the resistance of the gear motor at the 2-way connector.	Measured resistance is out of range	Replace the XY shifter. Go to STEP V



STEP E

Procedure	→ Condition	→ Action
1. FMI information recorded from Step A.	FMI 1 or 5 is active	Replace the TECU and transmission harness. Go to STEP V
	FMI 1 or 5 is inactive and the TECU serial number is between ETC2000000 and ETC2029918	Replace the TECU and transmission Harness. Go to STEP V
	FMI 1 or 5 is inactive and the TECU serial number is above ETC2029918	Replace the XY shifter and transmission harness. Go to STEP V
	FMI 6 or 12 is active or inactive	Replace the TECU. Go to STEP V



STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors and the negative battery cable.				
3. Key on.				
4. Clear codes.				
5. Drive the vehicle and attempt to reset the code.				
6. Check for codes.		If no codes		Test complete.
		If code 63 appears		To find error in testing, return to STEP A
		If code other than 63 appears		Go to Fault Code Isolation Procedure Index .

System Code 64 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	788	34		2, 7, 12	ECA Fault

Overview

The Electric Clutch Actuator (ECA) controls the position of the clutch assembly. The ECA has a main power 3-way connector that is directly connected to the 12-volt battery and an 8-way connector that is connected to the Transmission ECU and the Engine Speed Sensor. The ECA communicates with the ECU over the proprietary Controller Area Network (CAN) datalink to change position, show faults, or include other operation information.

Detection

Starting at key-on and throughout operation, the Transmission ECU constantly monitors the ECA for excessive motor current, excessive motor temperature, incorrect motor position, improper battery or ignition voltage to the ECA, or various internal ECA failures.

Fallback

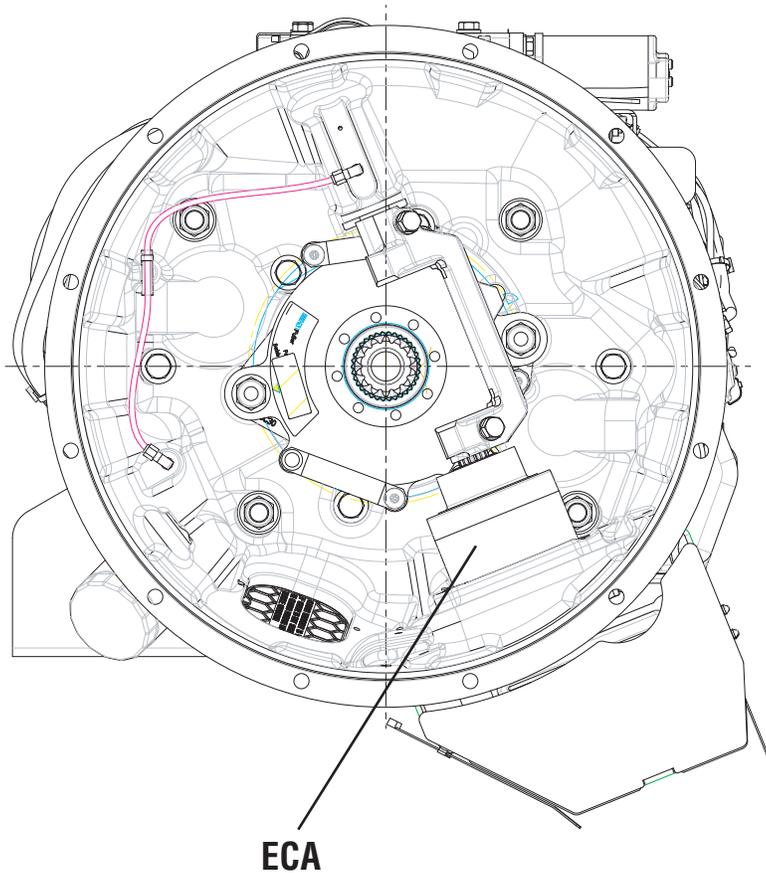
If the fault occurs while driving, the ECA will either maintain current clutch position or move to the last position commanded by the ECU. If the fault occurs at power-up, the vehicle will not crank.

Required Tools

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

Possible Causes

- ECA
- Cross-shaft
- Exhaust
- Release yoke
- Lack of Lube in Release Bearing
- ECA Power Supply Harness, Connections, and Fuse Holder
- Charging System
- Transmission Harness
- Transmission ECU
- Low Batteries or Bad Main Power Connection



Fault Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
1. Retrieve active fault codes and FMIs with ServiceRanger using the 9-pin diagnostic connector.				
2. Key off.				
3. Disconnect negative battery cable.				
4. What FMIs are present?		FMI 2 is present		Follow Fault Code 66 diagnostic procedure. If no fault found, proceed to Fault Code 67 diagnostic procedure.
		FMI 12 is present		Replace the ECA. Go to STEP V
		FMI 7 is present		Go to STEP B

STEP B

Procedure	→ Condition	→ Action
1. Check for signs of a failed release bearing or bushing failure.	There is no evidence of a failed release bearing or bushing	Grease bearing in accordance with CLSM0200. Go to STEP C
	Release bearing or bushing shows signs of damage due to low lube	Replace the Clutch. Go to STEP V

STEP C

Procedure	→ Condition	→ Action
1. Check the ECA for any debris build-up, damaged exhaust, or missing exhaust heat shields near the ECA.	ECA has no debris build-up or exhaust damage next to the unit	Go to STEP D
	ECA has debris build-up or exhaust damage next to the unit	Remove the debris build-up, or repair the exhaust damage. Go to STEP V

STEP D

Procedure	→ Condition	→ Action
1. Disconnect the ECA 8-way and 3-way connectors.		
2. Remove the ECA.		
Note: For additional information on ECA or Cross-Shaft removal, see publication TRSM0930, Fuller Automated Transmission Service Manual.		
3. Rotate the cross-shafts by grabbing the exposed lower cross-shafts and rotating it.	If the cross-shafts rotate without any binding	Replace the ECA. Go to STEP V
	If the cross-shafts bind when rotated.	Replace the cross-shafts and bushings. Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors.				
3. Key on.				
4. Clear codes.				
5. Drive the vehicle and attempt to reset the code.				
6. Check for codes.		If no codes		Test complete.
		If code 64 appears		To find error in testing, return to STEP A
		If code other than 64 appears		Go to Fault Code Isolation Procedure Index .

Component Code 65 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	5052	192		5, 2	ECA Speed Sensor Fault

Overview

The Electric Clutch Actuator (ECA) controls the position of the clutch assembly. The ECA has a main power 3-way connector that is directly connected to the 12-volt battery and an 8-way connector that is connected to the transmission ECU and the Engine Speed Sensor. The Engine Speed Sensor is installed in Transmission Clutch Housing. (Early models had the sensor installed in the Engine Flywheel Housing.) Location may vary, contact OEM for exact location. The ECA communicates with the ECU over the proprietary Controller Area Network (CAN) datalink to change position, show faults, or include other operation information. When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19 for more information on troubleshooting inactive codes.

Detection

The speed sensor is determined to be faulty when the ECU detects J1939 engine speed at idle, but does not detect ECA engine speed, or when the ECA detects an open on the ECA speed sensor signal circuit at key on.

Fallback

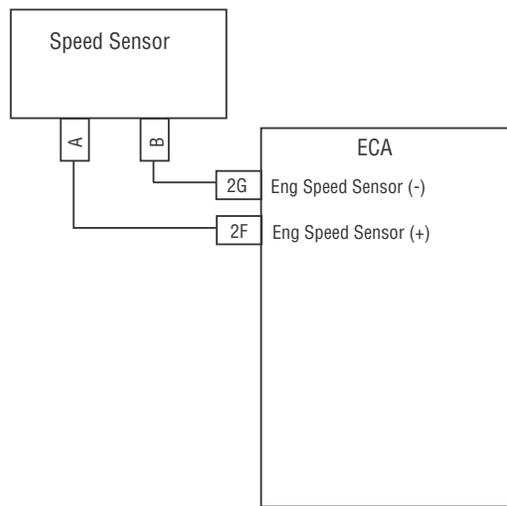
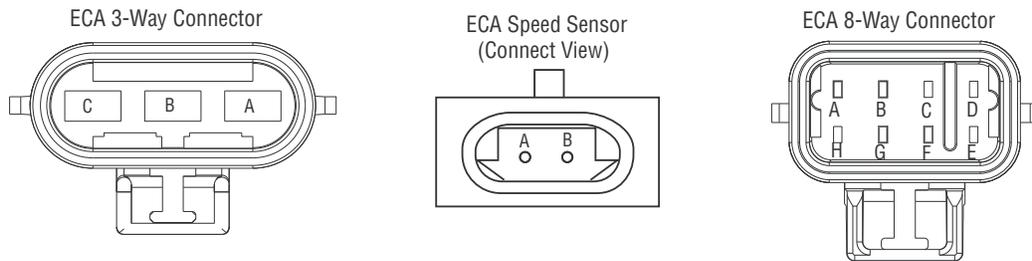
There is no fallback mode associated with this fault. The Transmission ECU also detects engine speed over the J1939 datalink. Given engine speed detection is redundant; this fault will not likely affect transmission operation.

Required Tools

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

Possible Causes

- ECA Speed Sensor
- ECA Speed Sensor Harness
- ECA
- Flywheel
- Improper Installation
- Damaged Clutch Speed Lug



Fault Isolation Procedures

Important: On early models, the sensor is installed in the engine flywheel housing, and the speed is picked up from the flywheel. On later models, the sensor is installed in the clutch housing, and the speed is picked up from (4) lugs cast into the clutch cover. The sensor resistance value differs per location.

STEP A

Procedure	→ Condition	→ Action
1. Retrieve active fault codes and FMIs with ServiceRanger using the 9-pin diagnostic connector.		
2. What FMIs are present?	FMI 5 is present	Go to STEP B
	FMI 2 is present	Go to STEP G

STEP B

Procedure	→	Condition	→	Action
1. Key off.				
2. Check resistance between ECA 8-way harness connector pins F and G.		If resistance is 140 - 180 ohms in flywheel housing mounted sensor, or 2K to 4.5K ohm in clutch housing mounted sensor		Go to STEP D
		If resistance is out of range		Go to STEP C

STEP C

Procedure	→	Condition	→	Action
1. Key off.				
2. Check resistance between ECA Speed Sensor connector pins A and B.		If resistance is 140 - 180 ohms in flywheel housing mounted sensor, or 2K to 4.5K ohm in clutch housing mounted sensor		Replace Transmission Harness. Go to STEP V
		If resistance is out of range		Replace the ECA Speed Sensor. Go to STEP V

STEP D

Procedure	→	Condition	→	Action
1. Key off.				
2. Check resistance between ECA 8-way connector pins F and ground.		If resistance is 10K or greater.		Go to STEP F
		If resistance is out of range.		Go to STEP E

STEP E

Procedure	→	Condition	→	Action
1. Key off.				
2. Check resistance between ECA Speed Sensor connector pins A and ground.		If resistance is 10K ohm or greater		Replace Transmission Harness. Go to STEP V
		If resistance is out of range		Replace the ECA Speed Sensor. Go to STEP V

STEP F

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage from the ECA 8-way harness connector pin G and ground.		If voltage is 0 volts at key on and FMI 5 is active		Replace the ECA (only if fault code is active). Go to STEP V
		If voltage is greater than 0 volts at key on		Indicates short to power. Replace the Transmission Harness. Go to STEP V

STEP G

Procedure	→	Condition	→	Action
1. Key off.				
Note: Reference publication TRSM0930, Fuller Automated Transmission Service Manual, for ECA Speed Sensor removal and installation.				
2. Remove the ECA speed sensor and examine the sensor end for signs of damage or debris buildup.		If the sensor shows no signs of cracks, misaligned connections, or metallic debris buildup		Go to STEP H
		If the sensor is damaged or has debris buildup		Replace or clean the ECA Speed Sensor as needed. Go to STEP V

STEP H

Procedure	→	Condition	→	Action
1. Key off.				
2. Depending on where the sensor is mounted, inspect the engine flywheel to ensure there are no missing or damaged teeth, or inspect the clutch cover to ensure there are no missing or damaged speed lugs.		If flywheel teeth or clutch cover speed lugs are all intact and in good condition		Reinstall ECA Speed Sensor and drive vehicle. If fault returns replace the sensor. Go to STEP V
		If flywheel teeth or clutch cover speed lugs are damaged or missing		Replace or repair the flywheel per OEM instructions.

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors.				
3. Key on.				
4. Clear codes.				
5. Drive the vehicle and attempt to reset the code.				
6. Check for codes.		If no codes		Test complete.
		If code 65 appears		To find error in testing, return to STEP A
		If code other than 65 appears		Go to Fault Code Isolation Procedure Index .

Component Code 66 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	520271	34		3, 4	ECA Battery Voltage Fault

Overview

The Electric Clutch Actuator (ECA) controls the position of the clutch assembly. The ECA has a main power 3-way connector that is directly connected to the 12-volt battery positive and negative terminals. When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19 for more information on troubleshooting inactive codes.

Detection

Starting at key-on and throughout operation, the Transmission ECU constantly measures ECA voltage. Fault Code 66 will set if the ECA battery voltage is above 17 volts for 10 ms or greater, or if the ECA battery voltage is below 8.5 volts for 10 ms or greater.

Fallback

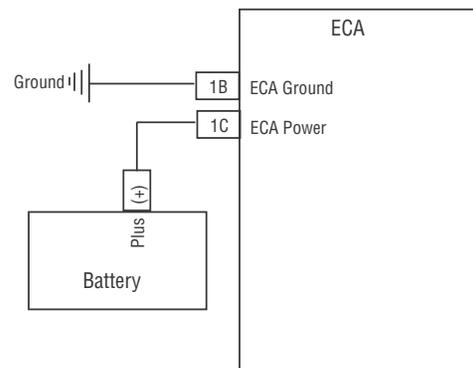
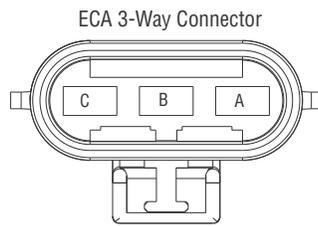
If the fault occurs while driving, the ECA will either maintain current clutch position or move to the last position commanded by the ECU, then the ECA holding device will engage. If the fault occurs at power-up, the vehicle will not crank.

Required Tools

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

Possible Causes

- ECA power supply harness, connections, and fuse holder
- Low batteries or bad main power connection
- Charging system
- ECA



Fault Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
1. Key on.				
2. Retrieve active fault codes and FMIs with ServiceRanger using the 9-pin diagnostic connector.				
3. Perform Electrical Pretest.		If FC 66 / FMI 3 is active after performing the Electrical Pretest		Replace the ECA (only if Fault Code is Active). Go to STEP V
		If FC 66 / FMI 4 or FC 64 / FMI 2 is active after performing the Electrical Pretest		Go to STEP B

STEP B

Procedure	→	Condition	→	Action
1. Check ECA power harness for excessive resistance or poor/loose connections, per OEM guidelines.		If connection or wiring problem found		Repair power harness per OEM guidelines. Go to STEP V
		If no problem found with harness or connections, and FC 66 / FMI 4 is still active		Replace the ECA. Go to STEP V
		If no problem found with harness or connections, and FC 64 / FMI 2 is still active		Proceed to STEP B of Fault Code 67 Diagnostic Procedure.

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors.				
3. Key on.				
4. Clear codes.				
5. Drive the vehicle and attempt to reset the code.				
6. Check for codes.		If no codes		Test complete.
		If FC 66 or FC 64 / FMI 2 appears		To find error in testing, return to STEP A
		If code other than FC 66 or FC 64 / FMI 2 appears		Go to Fault Code Isolation Procedure Index .

Component Code 67 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	520274	158		3, 4, 5	ECA Ignition Voltage Fault

Overview

The Electric Clutch Actuator (ECA) controls the position of the clutch assembly. The ECA has an 8-way connector that supplies ignition power to the ECA from the transmission ECU. When troubleshooting an inactive code see [Product Diagnostic Mode \(PDM\)](#) on page 19 for more information on troubleshooting inactive codes.

Detection

The Transmission ECU monitors ECA ignition voltage during normal operation. Fault Code 67 is set if the ECA ignition voltage is shorted to the 12-volt system prior to powering the ignition supply for the ECA, or when the ECA ignition voltage is shorted to ground during key on operation.

Fallback

If the fault occurs while driving, the ECA will either maintain current clutch position or move to the last position commanded by the ECU, then the ECA holding device will engage. If the fault occurs at power-up, the vehicle will not crank.

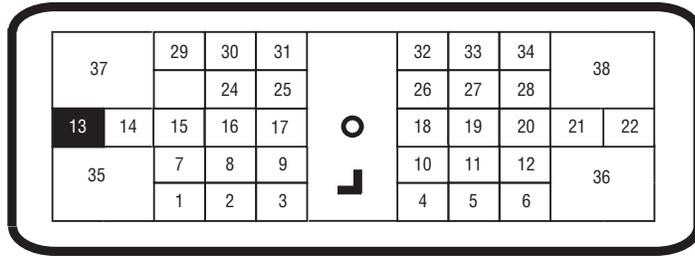
Required Tools

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

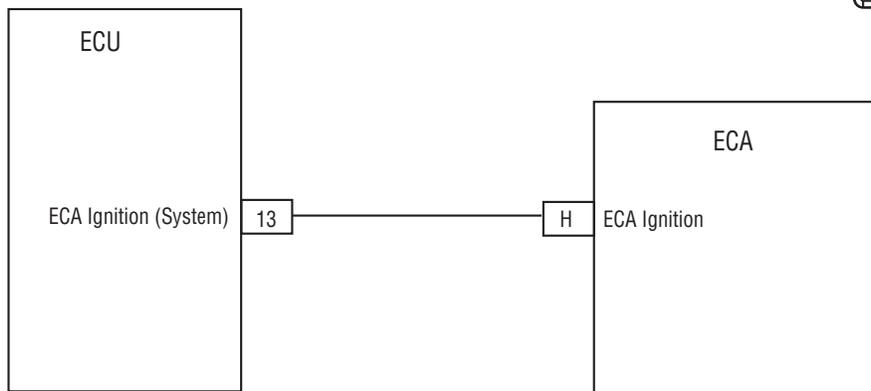
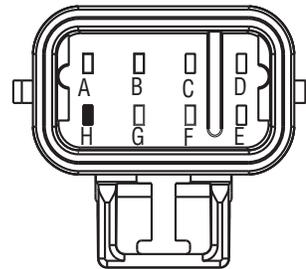
Possible Causes

- Transmission Harness
- Transmission ECU
- ECA

38-Pin Front Harness View
(ECU - Transmission Interface Connector)



ECA 8-Way Connector



Fault Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
1. Key on.				
2. Retrieve active fault codes and FMIs with ServiceRanger using the 9-pin diagnostic connector.				
3. Perform Electrical Pretest.		If FC 67 is active after performing the Electrical Pretest.		Go to STEP B

STEP B

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect the ECA 8-way harness connector.				
3. Measure voltage at ECA 8-way harness connector from pin H to ground: - With key on. - With key off.		Voltage is within 11-13 volts at key-on and 0 volts at key-off		Go to STEP C
		If any of the above conditions are not met		Go to STEP D

STEP C

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect the Transmission 38-way harness connector at ECU.				
3. Inspect the ECU 38-way and ECA 8-way harness connectors for signs of damage or misaligned connections.		No signs of damaged or misaligned harness connections		Replace ECA (only if fault code 67 or fault code 64 / FMI 2 is active). Go to STEP V
		If evidence is found of damaged or misaligned harness connections		Replace the Transmission Harness. Go to STEP V

STEP D

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect the transmission 38-way harness connector at ECU.				
3. Measure resistance between: - Transmission 38-way harness connector pin 13 and ECA 8-way connector pin 2H. - Transmission 38-way harness connector pin 13 and ground.		If resistance between pins 13 and 2H is 0 to 0.3 ohms and if resistance between pin 13 and ground is OL		Go to STEP E
		If any of the above conditions are not met		Replace the transmission harness. Go to STEP V

STEP E

Procedure	→	Condition	→	Action
1. Key off.				
2. Inspect the ECU 38-way and ECA 8-way harness connectors for signs of damage or misaligned connections.		No signs of damaged or misaligned harness connections		Replace ECU (only if fault code 67 or fault code 64 / FMI 2 is active). Go to STEP V
		If evidence is found of damaged or misaligned harness connections		Replace the transmission harness. Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors.				
3. Key on.				
4. Clear codes.				
5. Drive the vehicle and attempt to reset the code.				
6. Check for codes.		If no codes		Test complete.
		If fault code 67 or fault code 64 / FMI 2 appears		To find error in testing, return to STEP A
		If code other than fault code 67 or fault code 64 / FMI 2 appears		Go to Fault Code Isolation Procedure Index .

Component Code 68 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	520274		227	14	Grade Sensor
	520321		227	13, 14	Grade Sensor

Overview

The Grade Sensor is mounted inside the transmission ECU and is essential for Hill-Start-Aid. The Grade Sensor also provides information to the ECU to assist in smooth vehicle launch and shifting.

Detection

A fault will be set if the grade sensor reports an illogical grade to the ECU.

Fallback

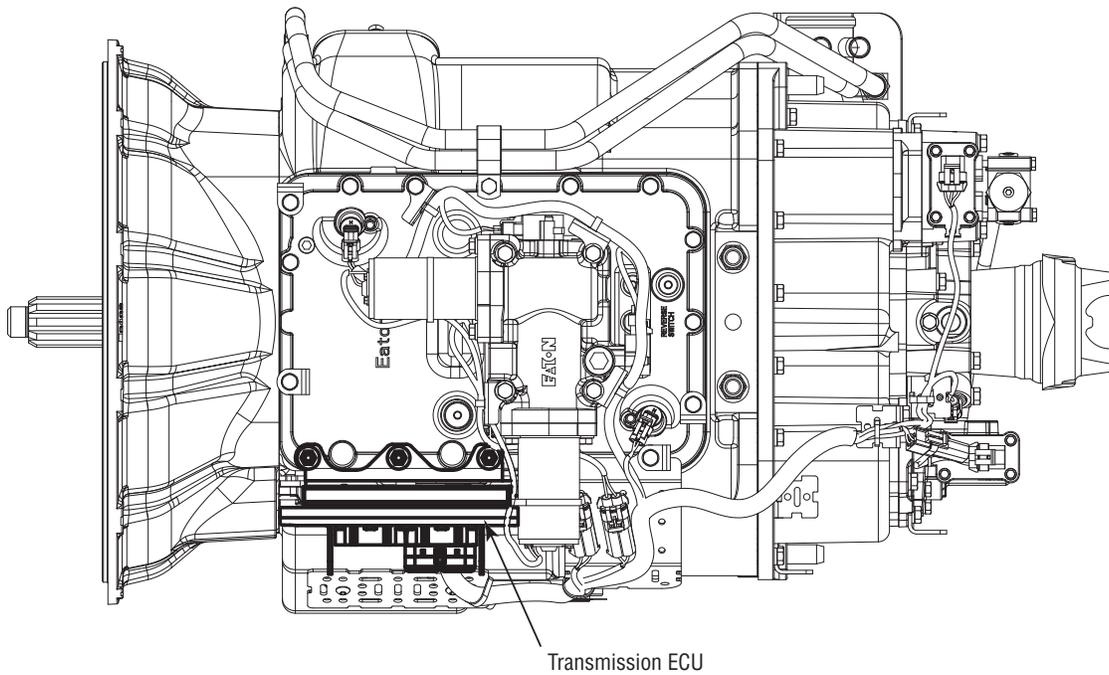
Hill-Start-Aid is enabled all the time.

Required Tools

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

Possible Causes

- Improperly mounted ECU
- Uncalibrated ECU
- ECU failure



Fault Isolation Procedures

STEP A

Procedure	Condition	Action
1. Key on.		
2. Retrieve active fault codes and FMIs with ServiceRanger using the 9-pin diagnostic connector.		
3. Perform Electrical Pretest.	If FMI 13 is active after performing the Electrical Pretest	Go to STEP B
	If FMI 14 is active after performing the Electrical Pretest	Go to STEP C
	If issue was repair during the Electrical Pretest	Go to STEP V

STEP B

Procedure	→	Condition	→	Action
1. Key on.				
2. Calibrate the ECU using ServiceRanger. (Steps below)				
Before Grade Sensor Calibration, verify the vehicle is on level ground, the suspension is fully aired and the vehicle is at the appropriate ride height.				
3. Open the Advanced Product Functions menu and click on the transmission model.				
4. Open the Grade Sensor Calibration and follow the instructions.				
5. Click on Calibrate Grade Sensor.				
6. Verify Fault Code 68 has gone inactive.		If FMI 13 is not active		Close ServiceRanger and turn off ignition switch to save calibration. Go to STEP V
		If FMI 13 is still active		Call Roadranger Tech Support at 1-800-826-4357 for assistance.

The Grade Sensor can be calibrated via ServiceRanger or Operator Triggered Special Function. Detailed instructions on both methods can be found in Service Manual TRSM0930.

STEP C

Procedure	→	Condition	→	Action
1. Key on.				
2. Ensure that the transmission ECU is properly mounted and secured.		If ECU found insecure or not properly mounted		Properly secure the ECU. Go to STEP V
		If ECU was found properly mounted and secure		Replace the TECU (if fault code is active.) Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors.				
3. Key on.				
4. Clear codes.				
5. Drive the vehicle and attempt to reset the code.				
6. Check for codes.		If no codes		Test complete.
		If code 68 appears		To find error in testing, return to STEP A
		If code other than 68 appears		Go to Fault Code Isolation Procedure Index .

Component Code 71 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
130	560		60	7	Unable to Disengage Gear

Overview

This fault indicates the system cannot disengage from the current gear. The system will continue attempting to disengage the current gear after the fault is set.

Theory of Operation

Vehicle must be moving and attempting to change gear position and no electrical faults are active.

Detection

The system is unable to select the neutral position after 3 consecutive attempts.

Conditions to Set the Fault Code Active

- FMI 7 - The system is unable to select the neutral position after 3 consecutive attempts.

Fallback mode During Power-Up

- None, this fault can not be set at power-up.

Fallback Mode During Operation

- When this fault is active, the transmission will continue to attempt to select neutral.
- The system will alternate the engine speed up and down in an attempt to achieve disengagement.
- The gear display may blink the destination gear.
- The service light will not flash, nor will an "F" be displayed on the dash.
- The diagnostic code will not be transmitted on the J1587 bus until fault codes have been requested by a service tool.

Conditions to Set the Fault Inactive

- FMI 7 - The fault becomes inactive when neutral is achieved.

Required Tools

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

Possible Causes for Fault

FMI 7:

Shift Bar Housing

- Mechanical issue with the shift bar housing.
- Damaged shift bar housing interlock parts.

XY Shifter

- New XY shifter installed and not recalibrated per the L-Letter (L-2003-30)
- Mechanical issue with the XY shifter.
- Badly contaminated / gummed up / soiled XY shifter ball screw due to oil cooler leak.
- Worn center shaft bushing (TAIB-0814.)

Base Transmission

- Main box mechanical failure.
- Sliding clutch / shift yoke wear.

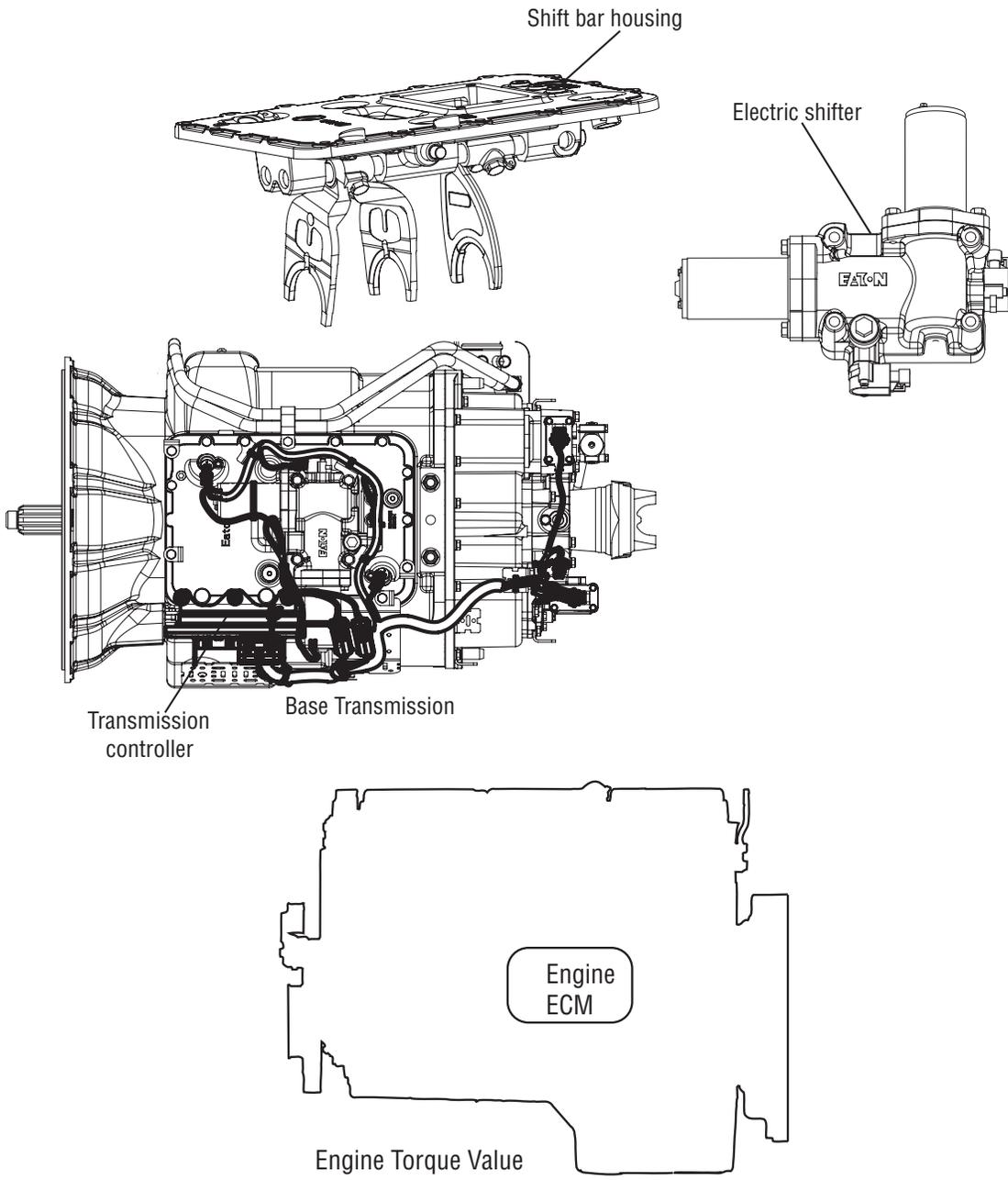
Transmission ECU

- New ECU installed and not recalibrated per the L-Letter (L-2005-04.)

Engine

- Inaccurately reporting engine torque value.

Component Code 71 Isolation Procedures



Fault Isolation Procedures

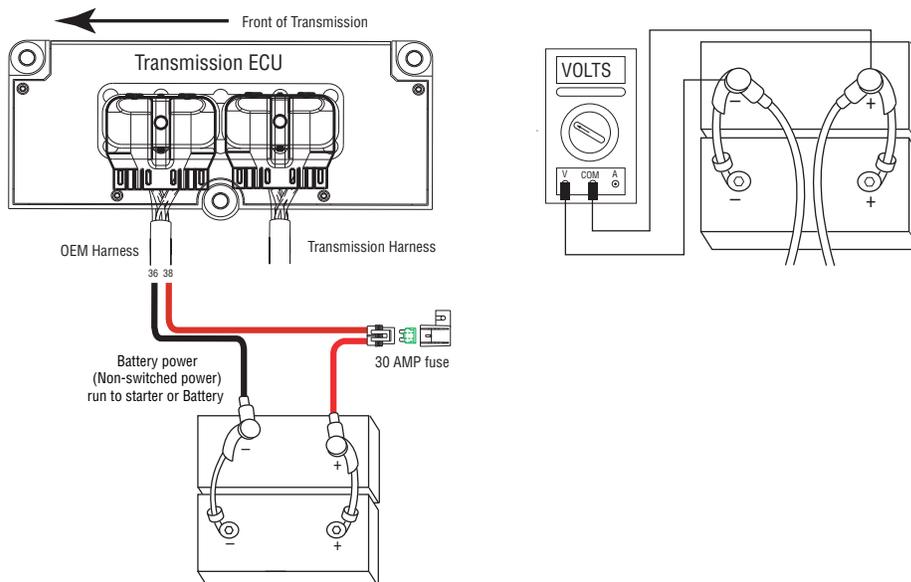
Active or Inactive Fault Code 71 - Go to Step A.

STEP A

Procedure	→	Condition	→	Action
1. Key off.				
2. Was a new XY Shifter or Transmission ECU just installed without recalibrating the transmission?		Yes		Perform transmission calibration. Turn the ignition switch to ON and allow the transmission to power up. Turn the ignition to OFF and wait two minutes. Go to STEP V
		No		Go to STEP B

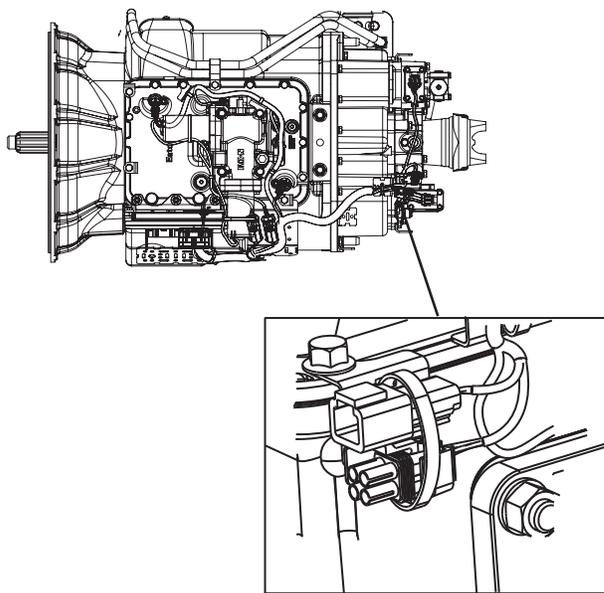
STEP B

Procedure	→	Condition	→	Action
3. Key off.				
4. Inspect starter / battery and in-line fuse holder connections for integrity.				
5. Measure voltage across batteries.		If voltage is 11 to 13 volts on a 12-volt system or 22 to 26 on a 24-volt system		Proceed with battery load test. Repair or replace batteries as required. Go to STEP C
		If voltage is outside of range		Repair or replace batteries and charge system as required. Repeat test.

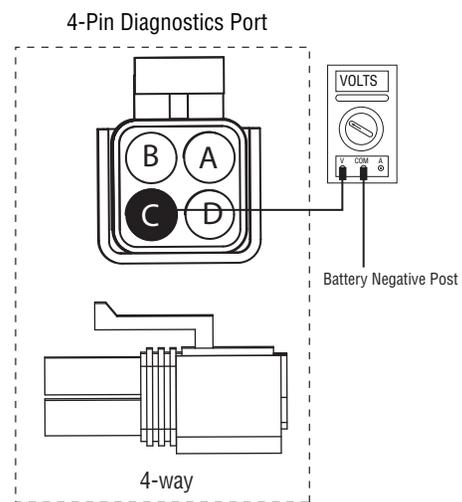


STEP C

Procedure	→	Condition	→	Action
1. Locate the diagnostic port on the Transmission Harness - located at the left rear corner of the transmission.				
2. Key on.				
3. Measure voltage between pins C and the battery negative post.		If voltage between pin C and battery negative post is 0.70 volts or less		Go to STEP D
		If voltage is outside of range		Repair battery ground supply to Transmission ECU. Repeat test.



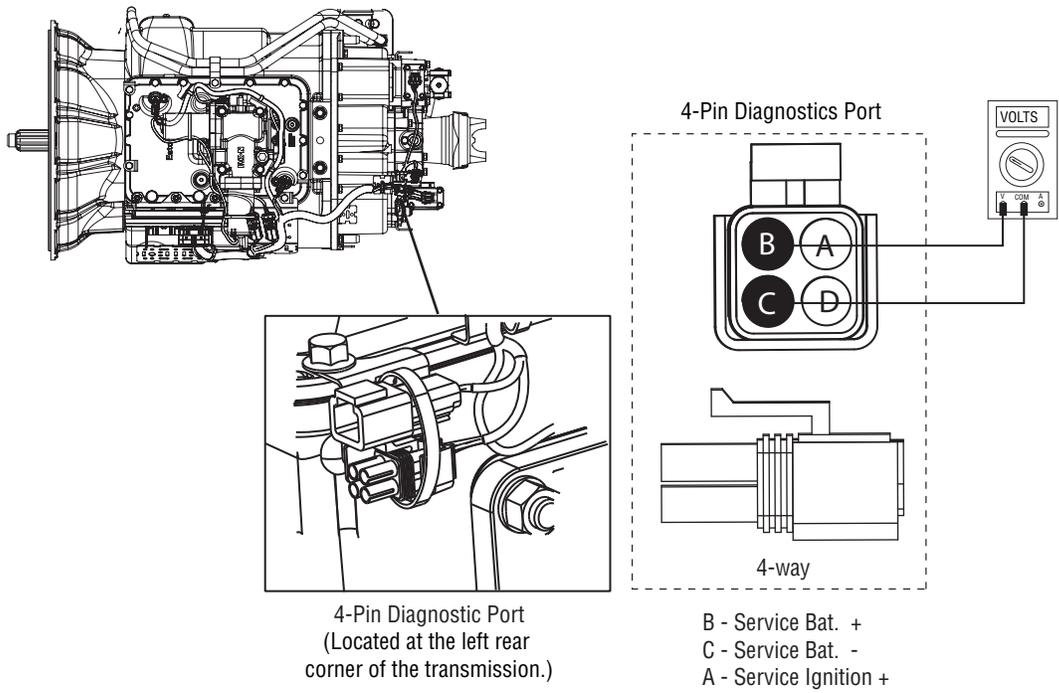
4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

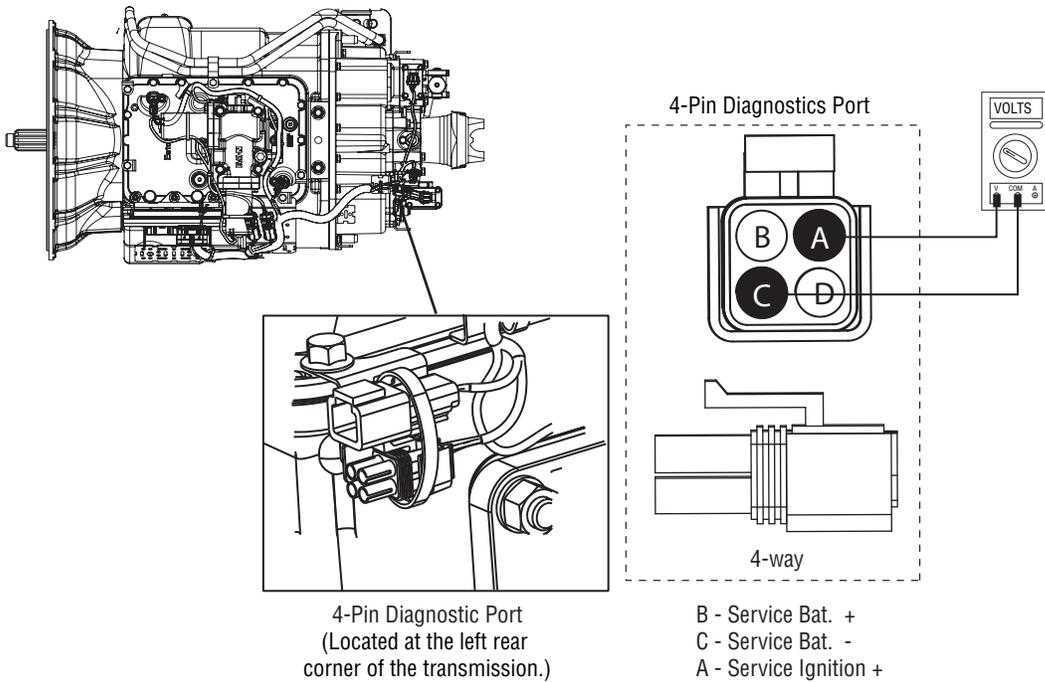
STEP D

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin B and pin C.		If voltage between pins B and C is within 0.6 volts of battery voltage		Go to STEP E
		If voltage is outside of range		Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



STEP E

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin A and pin C.		If voltage between pin A and C is within 0.6 volts of battery voltage		Go to STEP F
		If voltage is outside of range		Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.

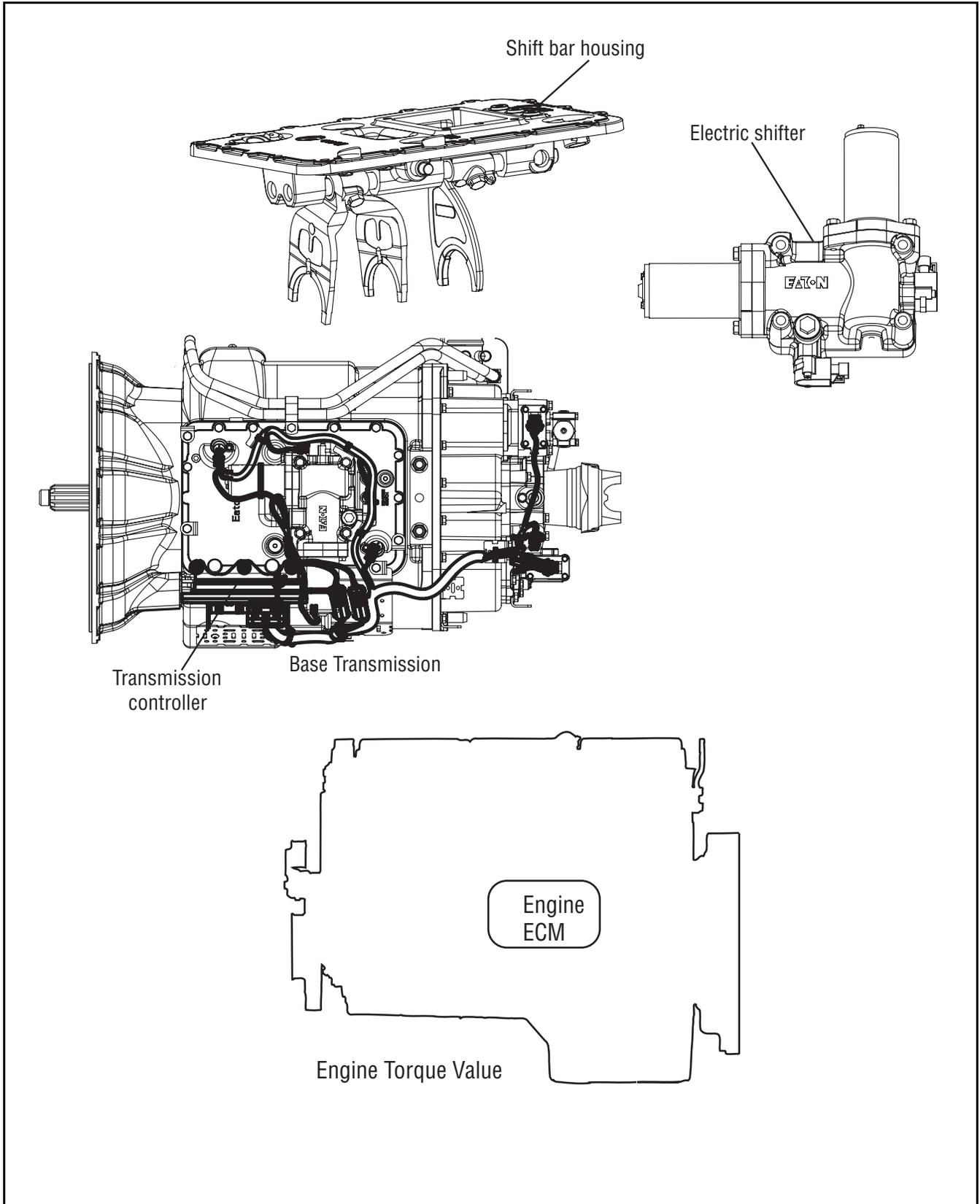


STEP F

Procedure	→	Condition	→	Action
1. Key off.				
2. Remove Electric Shifter from Shift Bar Housing.				
3. Inspect the Shift Bar Housing: - Visually inspect shift rails and blocks. - Verify shift bar housing operation by confirming shift rails can physically engage each gear individually. - Confirm the shift bar housing can not engage two gears at the same time.				
4. Inspect XY Shifter: - Check for mechanical issues with the XY Shifter. - Visually inspect for badly contaminated / gummed up / soiled XY shifter ball screw due to oil cooler leaks. - Check for a worn center shaft bushing (see TAIB-0814).				
5. Inspect Base Transmission: - Drain and inspect oil for debris. - Remove I-brake or PTO cover and inspect for main box mechanical failure. - Inspect sliding clutches and shift yokes for wear.		If no problem found		Replace Electric Shifter and Transmission Harness. Go to STEP V
		If problem found		Repair as required. Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors and the negative battery cable.				
3. Key on.				
4. Clear codes.				
5. Drive the vehicle and attempt to reset the code.				
6. Check for codes.		If no codes		Test complete.
		If code 71 appears		To find error in testing, return to STEP A
		If code other than 71 appears		Go to Fault Code Isolation Procedure Index .



Component Code 72 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
130	772		59	7	Failed to Select Rail

Overview

This fault indicates the system is unable to position the XY shift finger on the desired shift rail. The system will continue attempting to select the desired rail position after the fault is set.

Theory of Operation

Vehicle must be moving and attempting to select a rail and no electrical faults are active.

Detection

The system is unable to select the desired rail position after five consecutive attempts.

Conditions to Set the Fault Code Active

- FMI 7 - The system is unable to select the desired rail position after five consecutive attempts.

Fallback mode During Power-Up

- Vehicle may not crank (-) in the gear display.

Fallback Mode During Operation

- When this fault is active, the transmission will continue to attempt to select the desired rail position.
- The system will alternate the engine speed up and down during a shift.
- The gear display may blink the destination gear.
- The service light will not flash, nor will an "F" be displayed on the dash.
- The diagnostic code will not be transmitted on the J1587 bus until fault codes have been requested by a service tool.

Conditions to Set the Fault Inactive

- FMI 7 - The fault becomes inactive when the desired rail position is achieved.

Required Tools

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

Possible Causes for Fault

FMI 7:

Shift Bar Housing

- Mechanical issue with the shift bar housing.
- Damaged shift bar housing interlock parts.

XY Shifter

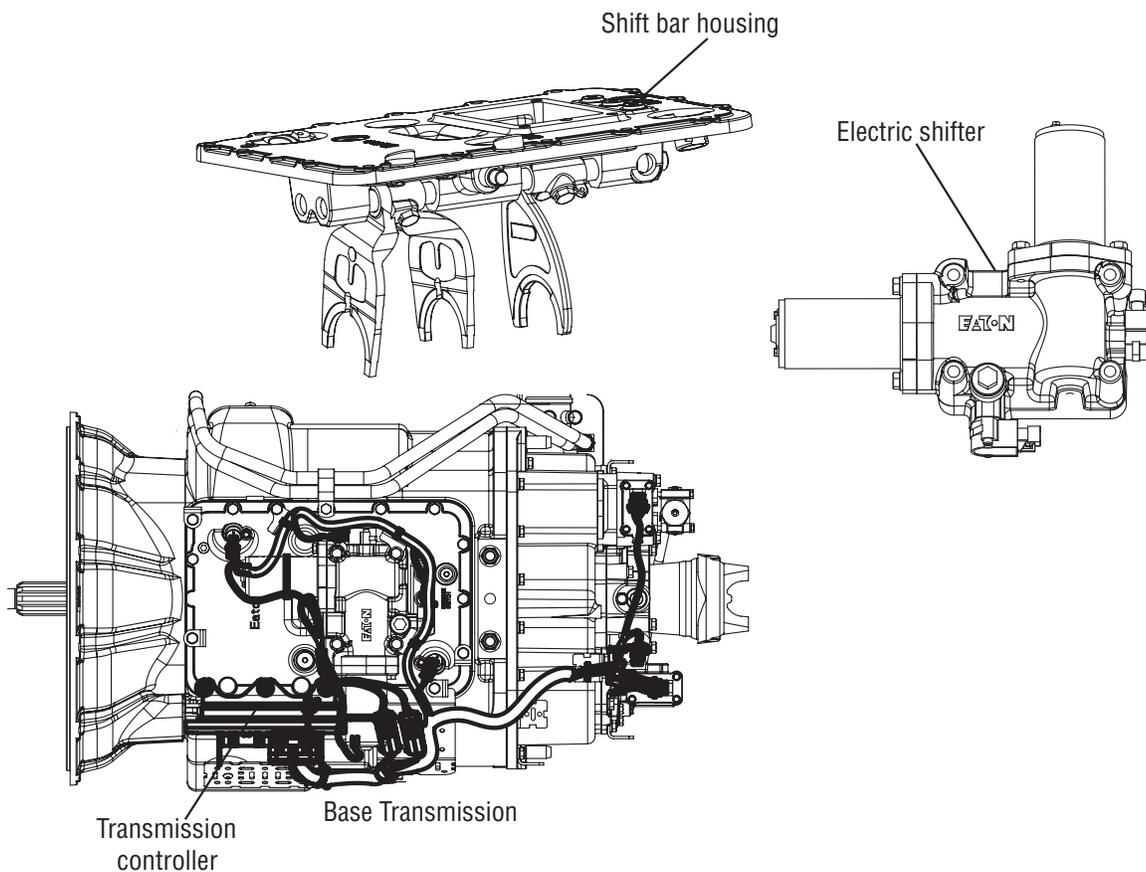
- New XY shifter installed and not recalibrated per the L-Letter (L-2003-30)
- Mechanical issue with the XY shifter.
- Badly contaminated / gummed up / soiled XY shifter ball screw due to oil cooler leak.
- Worn center shaft bushing (TAIB-0814.)

Base Transmission

- Main box mechanical failure.
- Sliding clutch / shift yoke wear.

Transmission ECU

- New ECU installed and not recalibrated per the L-Letter (L-2005-04.)



Fault Isolation Procedures

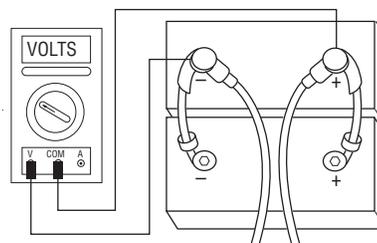
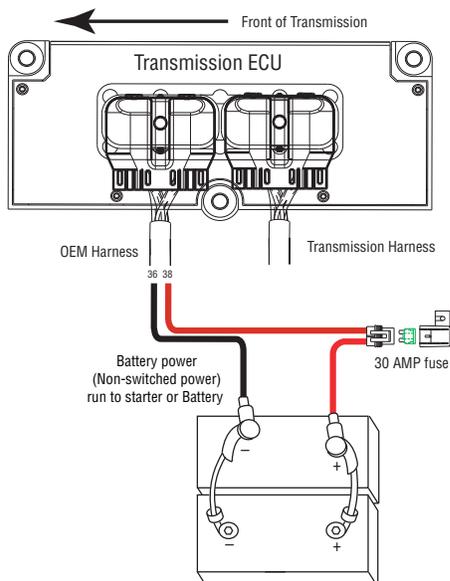
Active or Inactive Fault Code 72 - Go to Step A.

STEP A

Procedure	→	Condition	→	Action
1. Key off.				
2. Was a new XY Shifter or Transmission ECU just installed without recalibrating the transmission?		Yes		Perform transmission calibration. Turn the ignition switch to ON and allow the transmission to power up. Turn the ignition to OFF and wait two minutes. Go to STEP V
		No		Go to STEP B

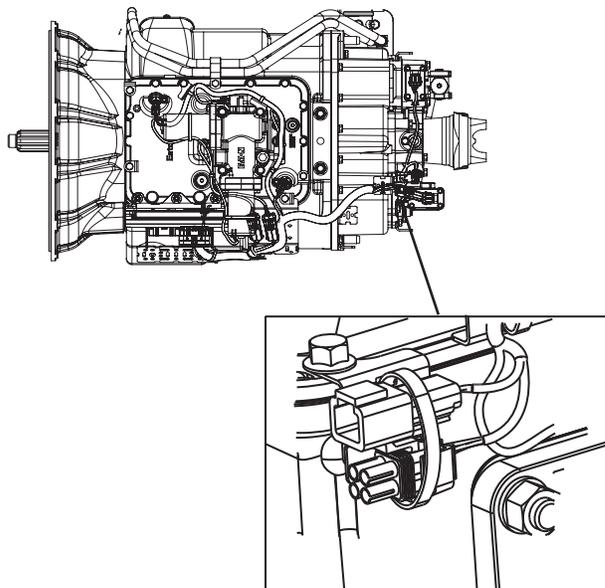
STEP B

Procedure	→	Condition	→	Action
3. Key off.				
4. Inspect starter / battery and inline fuse holder connections for integrity.				
5. Measure voltage across batteries.		If voltage is 11 to 13 volts on a 12-volt system or 22 to 26 on a 24-volt system		Proceed with battery load test. Repair or replace batteries as required. Go to STEP C
		If voltage is outside of range		Repair or replace batteries and charge system as required. Repeat test.

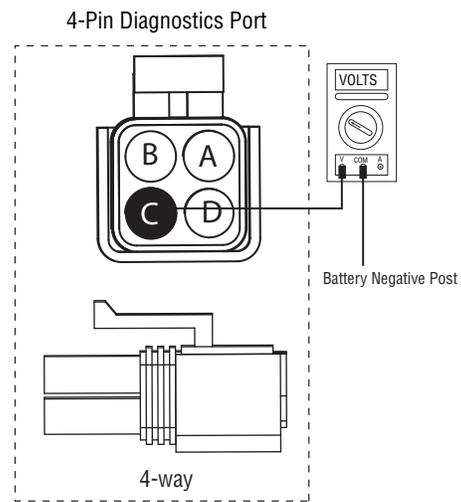


STEP C

Procedure	→	Condition	→	Action
1. Locate the diagnostic port on the Transmission Harness - located at the left rear corner of the transmission.				
2. Key on.				
3. Measure voltage between pins C and the battery negative post.		If voltage between pin C and battery negative post is 0.70 volts or less.		Go to STEP D
		If voltage is outside of range		Repair battery ground supply to Transmission ECU. Repeat test.



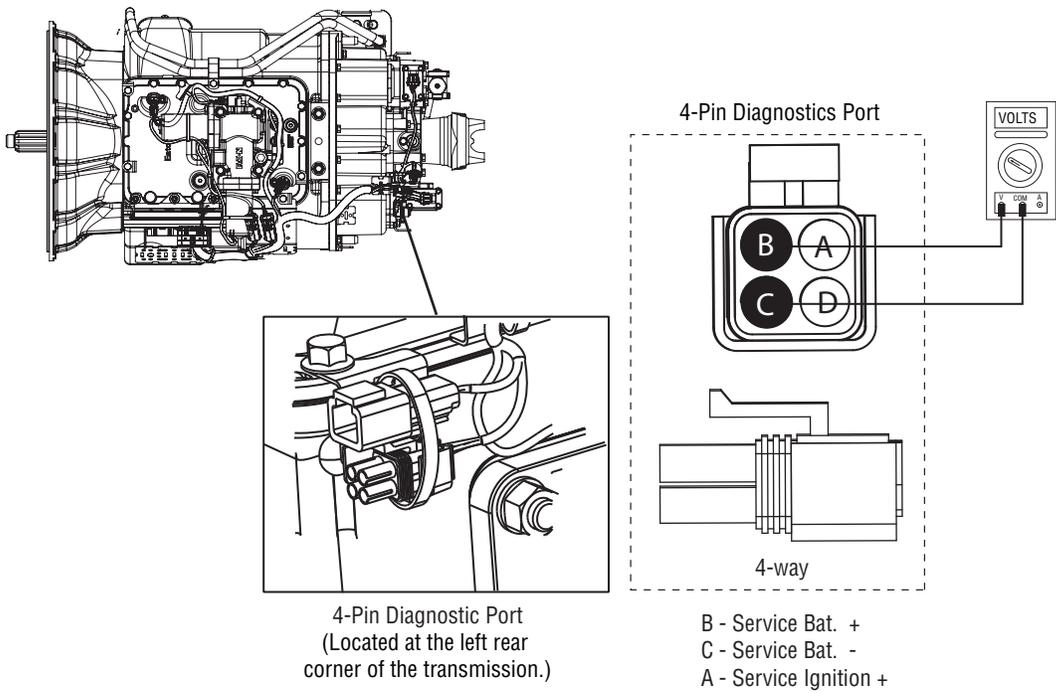
4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

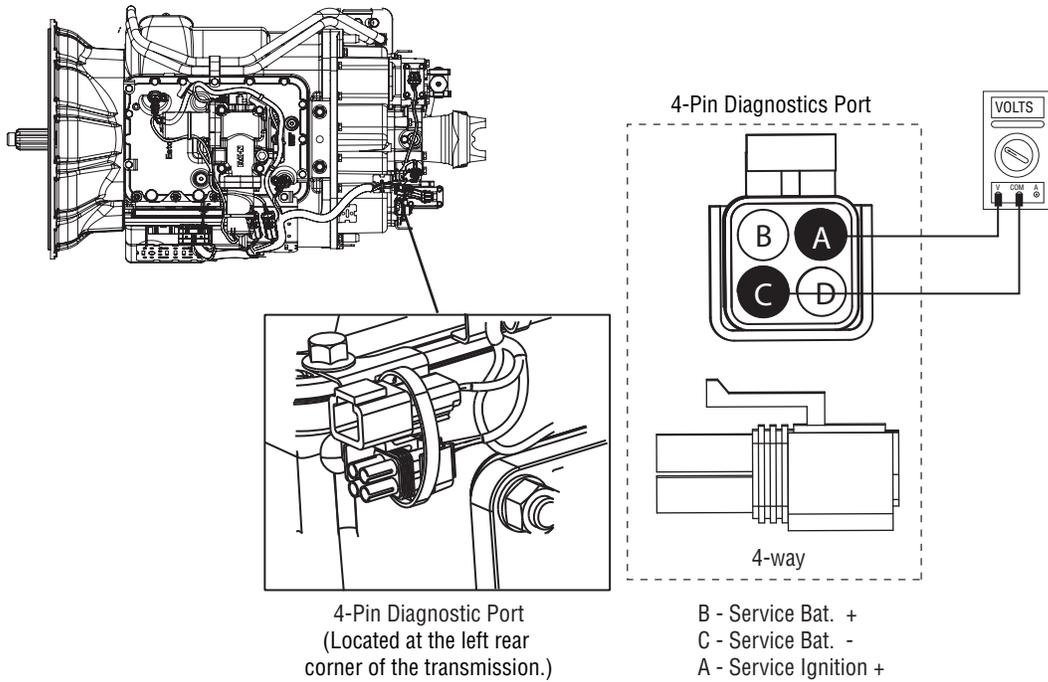
STEP D

Procedure	→ Condition	→ Action
1. Key on.		
2. Measure voltage between pin B and pin C.	<p>If voltage between pins B and C is within 0.6 volts of battery voltage</p> <p>If voltage is outside of range</p>	<p>Go to STEP E</p> <p>Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.</p>



STEP E

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin A and pin C.		If voltage between pin A and C is within 0.6 volts of battery voltage		Go to STEP F
		If voltage is outside of range		Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.



STEP F

Procedure	→	Condition	→	Action
1. Key off.				
2. Remove Electric Shifter from Shift Bar Housing.				
3. Inspect the Shift Bar Housing: - Visually inspect shift rails and blocks. - Verify shift bar housing operation by confirming shift rails can physically engage each gear individually. - Confirm the shift bar housing can not engage two gears at the same time.				
4. Inspect XY Shifter: - Check for mechanical issues with the XY Shifter. - Visually inspect for badly contaminated / gummed up / soiled XY shifter ball screw due to oil cooler leaks. - Check for a worn center shaft bushing (see TAIB-0814).				
5. Inspect Base Transmission: - Drain and inspect oil for debris. - Remove I-brake or PTO cover and inspect for main box mechanical failure. - Inspect sliding clutches and shift yokes for wear.		If no problem found		Replace Electric Shifter and Transmission Harness. Go to STEP V
		If problem found		Repair as required. Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors and the negative battery cable.				
3. Key on.				
4. Clear codes.				
5. Drive the vehicle and attempt to reset the code.				
6. Check for codes.		If no codes		Test complete.
		If code 72 appears		To find error in testing, return to STEP A
		If code other than 72 appears		Go to Fault Code Isolation Procedure Index .

Component Code 73 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
130	781		58	7	Failed to Engage Gear

Overview

This fault indicates the system cannot engage the desired gear. The system will continue attempting to engaged the desired gear after the fault is set.

Theory of Operation

Vehicle must be moving and attempting to engage a gear and no electrical faults can be active.

Detection

The system unsuccessfully attempts to engage a gear five times with no battery voltage faults.

Conditions to Set the Fault Code Active

- FMI 7 - The system is unable to engage a gear five times with no battery voltage faults.

Fallback mode During Power-Up

- None. This fault can not be set at power-up.

Fallback Mode During Operation

- When this fault is active, the transmission will continue to attempt to engage the gear.
- The system will alternate the engine speed up and down in an attempt to achieve engagement.
- The gear display may blink the destination gear.
- The service light will not flash, nor will an “F” be displayed on the dash.
- The diagnostic code will not be transmitted on the J1587 bus until fault codes have been requested by a service tool.

Conditions to Set the Fault Inactive

- FMI 7 - The fault becomes inactive when neutral is achieved.

Required Tools

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

Possible Causes for Fault

FMI 7:

Shift Bar Housing

- Mechanical issue with the shift bar housing.
- Damaged shift bar housing interlock parts.

XY Shifter

- New XY shifter installed and not recalibrated per the L-Letter (L-2003-30)
- Mechanical issue with the XY shifter.
- Badly contaminated / gummed up / soiled XY shifter ball screw due to oil cooler leak.
- Worn center shaft bushing (TAIB-0814.)

Base Transmission

- Main box mechanical failure.
- Sliding clutch / shift yoke wear.

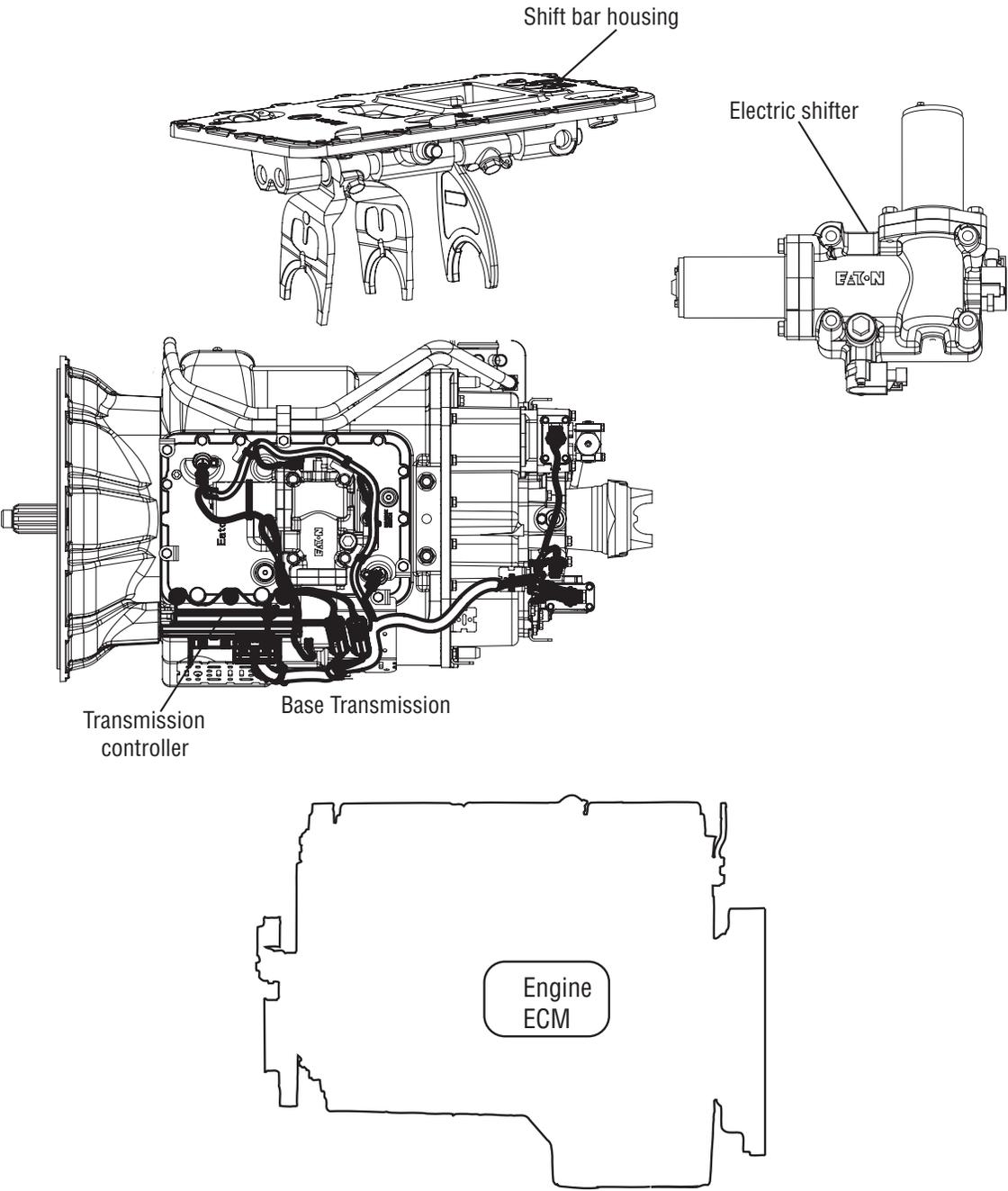
Transmission ECU

- New ECU installed and not recalibrated per the L-Letter (L-2005-04.)

Engine

- Inaccurately or not responding to the transmission speed control command.

Component Code 73 Isolation Procedures



Fault Isolation Procedures

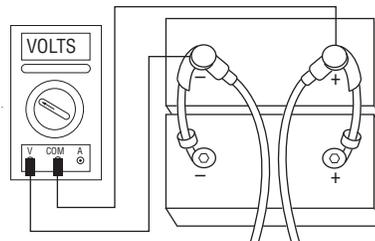
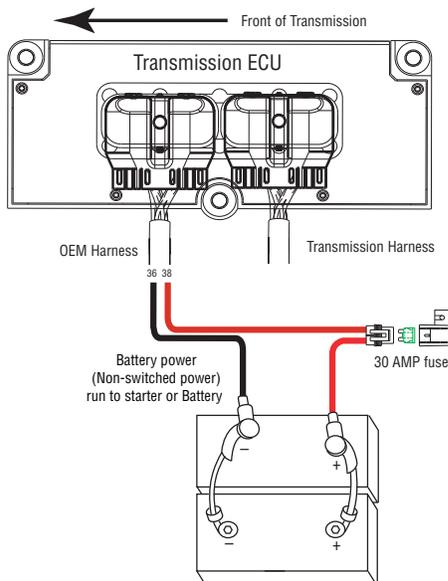
Active or Inactive Fault Code 73 - Go to Step A.

STEP A

Procedure	→	Condition	→	Action
1. Key off.				
2. Was a new XY Shifter or Transmission ECU just installed without recalibrating the transmission?		Yes		Perform transmission calibration. Turn the ignition switch to ON and allow the transmission to power up. Turn the ignition to OFF and wait two minutes. Go to STEP V
		No		Go to STEP B

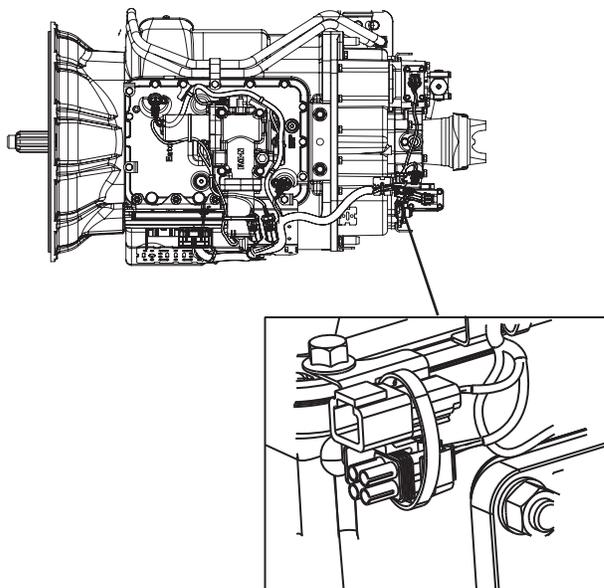
STEP B

Procedure	→	Condition	→	Action
3. Key off.				
4. Inspect starter / battery and inline fuse holder connections for integrity.				
5. Measure voltage across batteries.		If voltage is 11 to 13 volts on a 12-volt system or 22 to 26 on a 24-volt system		Proceed with battery load test. Repair or replace batteries as required. Go to STEP C
		If voltage is outside of range		Repair or replace batteries and charge system as required. Repeat test.

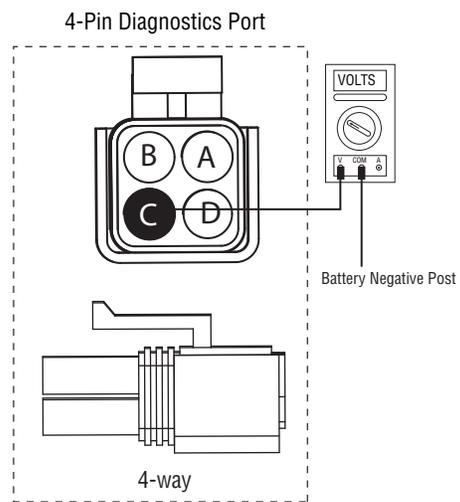


STEP C

Procedure	→	Condition	→	Action
1. Locate the diagnostic port on the Transmission Harness - located at the left rear corner of the transmission.				
2. Key on.				
3. Measure voltage between pins C and the battery negative post.		If voltage between pin C and battery negative post is 0.70 volts or less		Go to STEP D
		If voltage is outside of range		Repair battery ground supply to Transmission ECU. Repeat test.



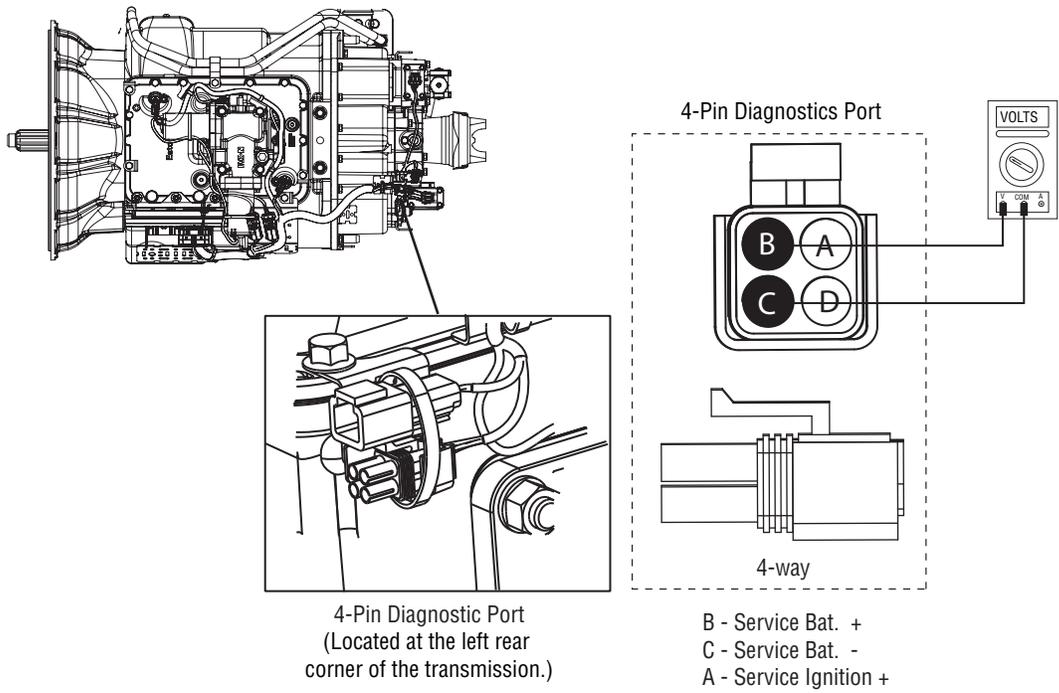
4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

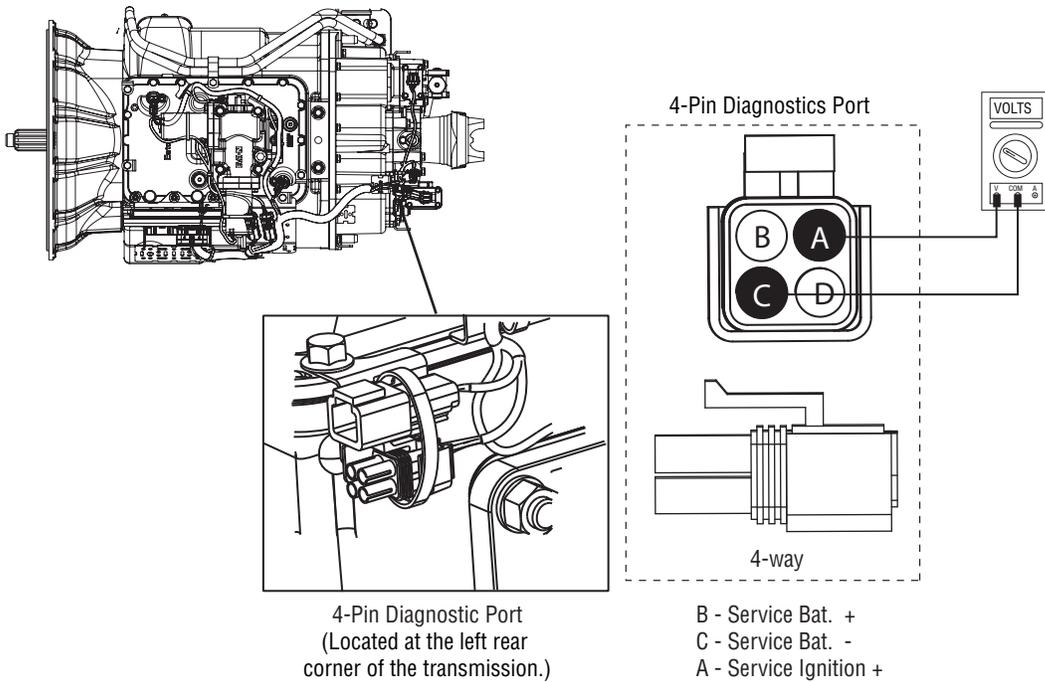
STEP D

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin B and pin C.		If voltage between pins B and C is within 0.6 volts of battery voltage		Go to STEP E
		If voltage is outside of range		Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



STEP E

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin A and pin C.		If voltage between pin A and C is within 0.6 volts of battery voltage		Go to STEP F
		If voltage is outside of range		Repair Ignition power supply to ECU. Fuse may be blown Repeat test.



STEP F

Procedure	→	Condition	→	Action
1. Key off.				
2. Remove Electric Shifter from Shift Bar Housing.				
3. Inspect the Shift Bar Housing: - Visually inspect shift rails and blocks. - Verify shift bar housing operation by confirming shift rails can physically engage each gear individually. - Confirm the shift bar housing can not engage two gears at the same time.				
4. Inspect XY Shifter: - Check for mechanical issues with the XY Shifter. - Visually inspect for badly contaminated / gummed up / soiled XY shifter ball screw due to oil cooler leaks. - Check for a worn center shaft bushing (see TAIB-0814).				
5. Inspect Base Transmission: - Drain and inspect oil for debris. - Remove I-brake or PTO cover and inspect for main box mechanical failure. - Inspect sliding clutches and shift yokes for wear.		If no problem found		Replace Electric Shifter and Transmission Harness. Go to STEP V
		If problem found		Repair as required. Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors and the negative battery cable.				
3. Key on.				
4. Clear codes.				
5. Drive the vehicle and attempt to reset the code.				
6. Check for codes.		If no codes		Test complete.
		If code 73 appears		To find error in testing, return to STEP A
		If code other than 73 appears		Go to Fault Code Isolation Procedure Index .

System Code 74 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	518	93		7	Engine Speed Response Fault
	898	190		7	Engine Torque Response Fault

Overview

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

Detection

If there is engine communication on the J1939 Link and the engine does not respond to transmission speed and torque commands, the code will set.

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.

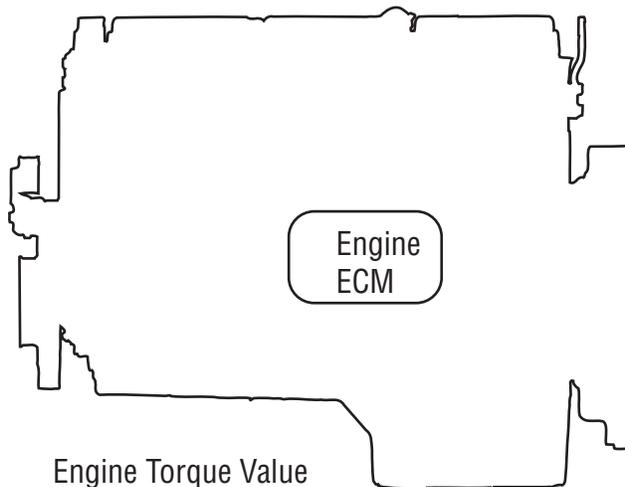
Required Tools

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

Possible Causes

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

- Engine Control System



Fault Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
1. Key on.				
2. Retrieve codes. Go to Fault Code Retrieval/Clearing .		If code 74 is active		Contact the OEM because the engine is failing to respond to the transmissions command during a shift.
		If code is not active		Test complete.

System Code 75 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	560		60	14	Power Down In Gear

Note: This code will only be set inactive

Overview

This fault is detected when the vehicle is powered down in any gear position other than neutral.

Detection

The Transmission ECU monitors shift device position and electric shifter position during vehicle shut down. If a non-neutral shift device position and in gear position are detected during vehicle shut down, this code will be set.

Fallback

No Fallback Mode. This is a non driving power down fault, it may cause a “-” dash during power up if the transmission is torque locked after shutting down in gear.

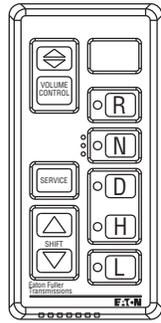
Required Tools

- ServiceRanger a PC-based Service Tool
- Troubleshooting Guide
- Driver Instruction Book

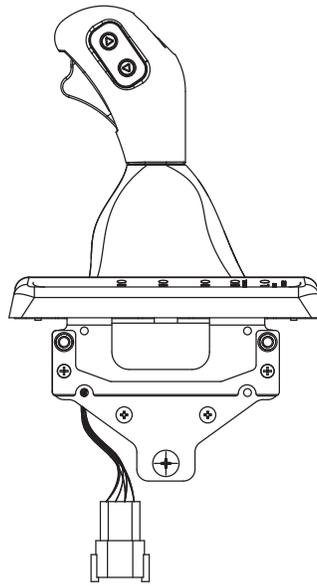
Possible Causes

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

- Improper Shut Down Procedure



Pushbutton Shift Control



Eaton Shift Lever

STEP A

Procedure	Condition	Action
1. Key on.		
2. Retrieve Codes. Go to Fault Code Retrieval/Clearing .	If code 75 is inactive	<p>No action necessary, this code indicates the driver powered down the system prior to selecting neutral.</p> <p>Explain to driver, shift selector must be in neutral before powering down to prevent a stuck in gear situation and or a power up no crank situation.</p>

Component Code 81 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	780		47	7	Gear Engagement Detected

Overview

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

Detection

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

Fallback

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

Required Tools

- Basic Hand Tools
- ServiceRanger version 2.5 or newer

Possible Causes

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

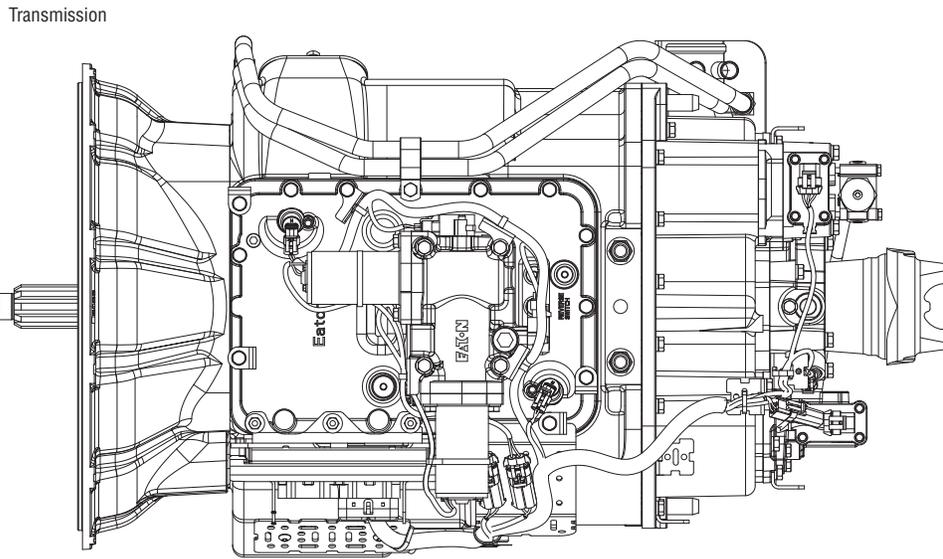
- Worn internal transmission components.

Conditions to Recreate Fault

- Only set during a shift.

Conditions to Clear Fault

- The fault becomes inactive after power down.



Fault Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
1. Key on.				
2. Retrieve codes. Go to Fault Code Retrieval/Clearing .		If code 81 is active or inactive		Customer - Call Eaton at 1-800-826-HELP (4357). CSC - Call Technician Service.

System Code 83 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	751		18	14	Shift Lever Missing
	752		19	7, 12	Shift Lever Missing

Overview

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

Detection

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

Fallback

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

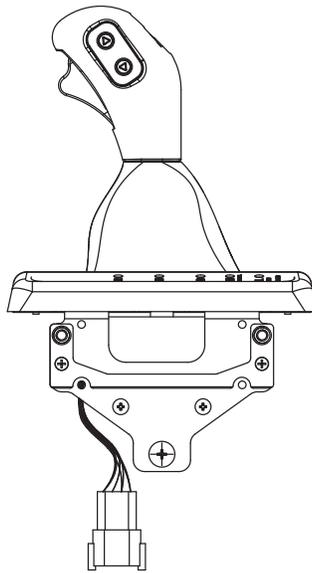
Required Tools

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

Possible Causes

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

- Eaton Shift Lever or OEM Shift Lever



Eaton Shift Lever

Fault Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
1. Key on.				
2. Retrieve Codes. Go to Fault Code Retrieval/Clearing .		If code 83 is active		Replace Eaton Shift Lever or OEM Shift Lever.
		If 83 is inactive		Test complete.

System Code 84 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	751		18	13	Shift Control Device Not Configured
	752		19	13	Park Mechanism Not Calibrated

Overview

This fault indicates a new Transmission ECU has not detected a shift control device.

Detection

The fault is detected the first time the system is powered up. The Transmission ECU looks for a shift control device if none are detected the system will set this code.

Note: The fault will only be set active.

Fallback

Power up no crank.

Required Tools

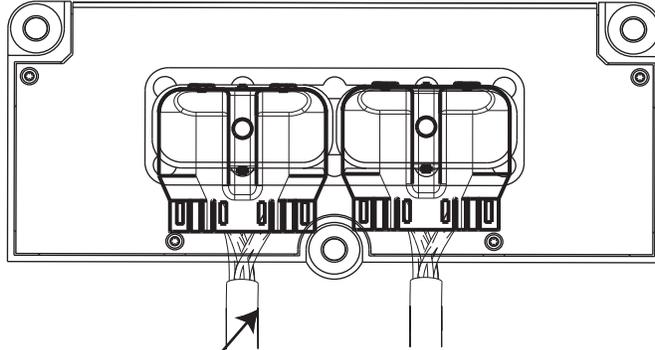
- Basic Hand Tools
- ServiceRanger a PC-based Service Tool
- Troubleshooting Guide

Possible Causes

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

- Damaged OEM Wiring Harness between Transmission ECU and shift control device after new ECU is installed.

- Disconnected shift control device after new ECU is installed.



Vehicle Harness 38-way Connector

Fault Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
1. Verify shift control device is connected to the OEM wiring.				
2. Key on.				
3. Retrieve codes. Go to Fault Code Retrieval/Clearing .		If code 84 is active		Repair OEM wiring between Transmission ECU and shift control device.

Component Code 85 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	751		18	12	Shift Control Device Incompatible

Overview

This fault indicates the Transmission ECU has detected a non compatible shift control device.

Detection

The Transmission ECU looks for a shift control device every time the system is powered up. If a non compatible shift control device is detected the system will set this code.

Fallback

This fault causes an In Place Fallback

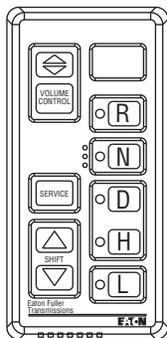
Required Tools

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

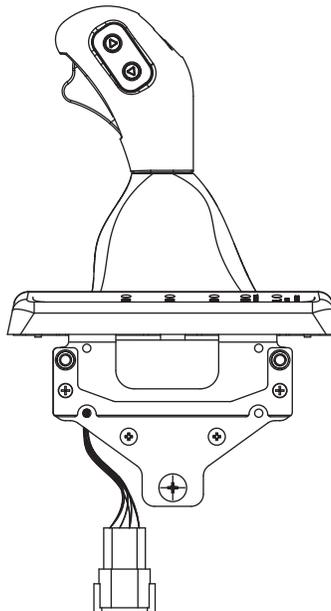
Possible Causes

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

- Non compatible shift control device



Pushbutton Shift Control



Eaton Shift Lever

Fault Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
1. Verify shift control device is connected to the OEM wiring.				
2. Key on.				
3. Retrieve codes. Go to Fault Code Retrieval/Clearing .		If code 85 is active		Verify correct shift control device is installed on vehicle.

Component Code 99 Isolation Procedures

MID	SPN	PID	SID	FMI	Description
	781		58	14	Direction Mismatch

Overview

The transmission controller is monitoring the gear position sensor and has determined the XY shifter is moving in the opposite intended direction.

Detection

- The fault can be detected any time after the transmission ECU powers up and a non-neutral mode is selected.
- FMI 14 - The transmission controller detected an incorrect XY shifter position.

Fallback

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

Required Tools

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

Possible Causes

This fault code can be caused by the following:

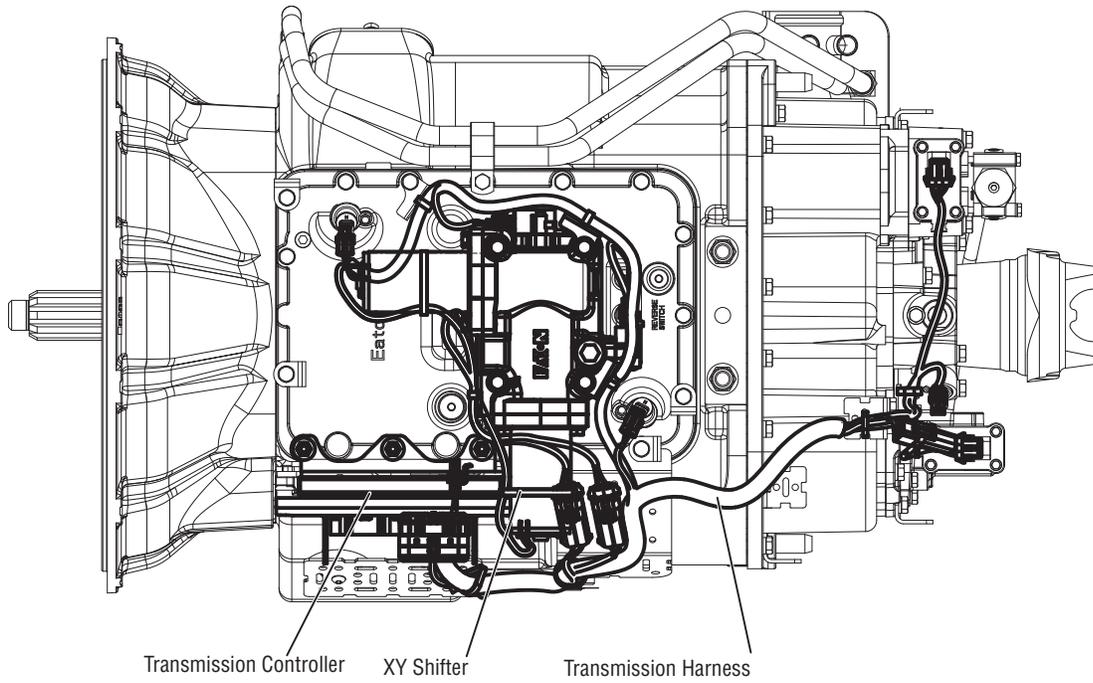
- Internal transmission controller fault.
- Transmission wire harness shorted.
- XY shifter failure.

Conditions to Recreate Fault

- None

Conditions to Clear Fault

- The fault becomes inactive after power down.



Fault Isolation Procedures

STEP A

Procedure	Condition	Action
1. Key on.		
2. Retrieve codes. Go to Fault Code Retrieval/Clearing .	If code 99 is active or inactive.	Customer - Call Eaton at 1-800-826-HELP (4357). CSC - Call Technician Service.

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

Fallback

There is no fallback for this symptom.

Required Tools

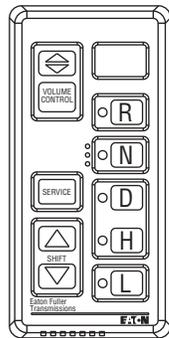
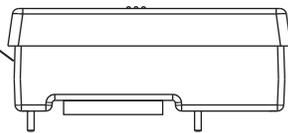
- Basic Hand Tools
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

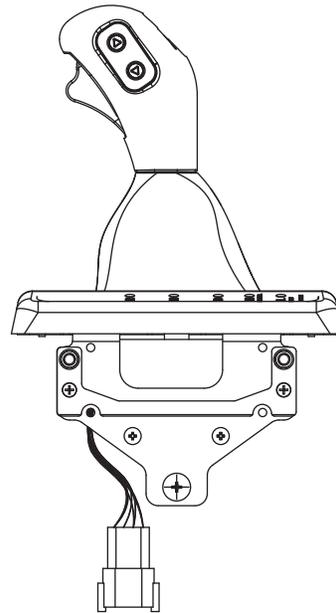
This symptom can be caused by any of the following:

- Pushbutton Shift Control
- Shift Lever

Side view
of pushbutton
shift control



Pushbutton Shift Control



Eaton Shift Lever

System Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
1. Start engine.				
2. Place Shift Device in "Manual".				
3. Drive the vehicle and use the buttons to initiate upshifts and downshifts, when shift conditions permit.		If the up and down buttons are working properly, the transmission will make upshifts and downshifts		Test complete.
		If the transmission does not make upshifts and/or downshifts		Replace Shift Control. Repeat test.

Start Enable Relay Contact Test

Overview

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

Detection

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

Fallback

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

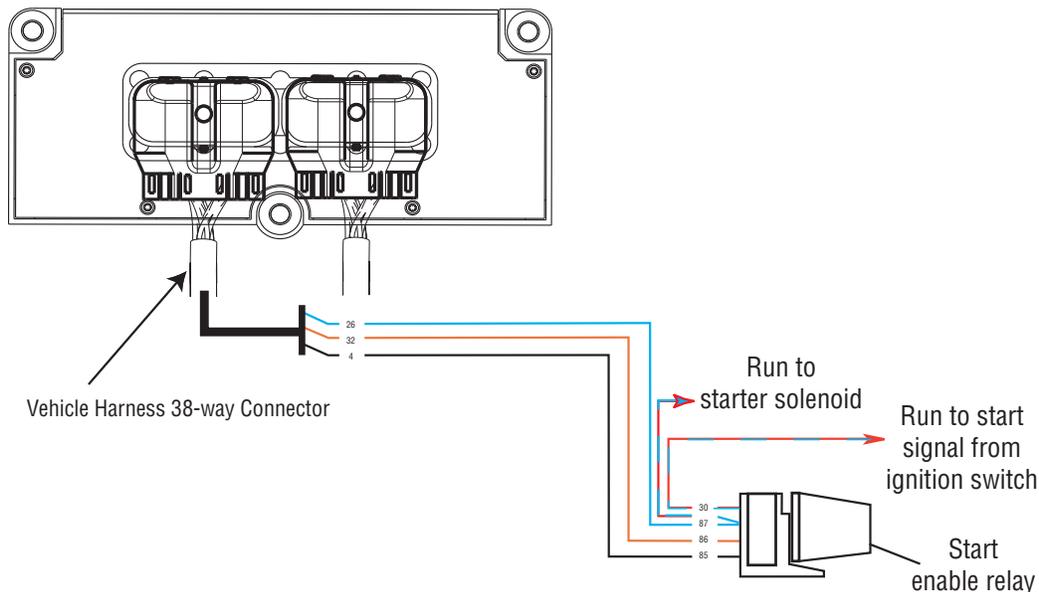
Required Tools

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

Possible Causes

This symptom can be caused by any of the following:

- Start Enable Relay
- Starter Solenoid Wiring
- Vehicle Harness



Trans ECU Legend

All OEM responsible wiring shown is "typical". Consult specific application.

(30, 87) = Switched ignition

(26-87) = Latch into the ECU

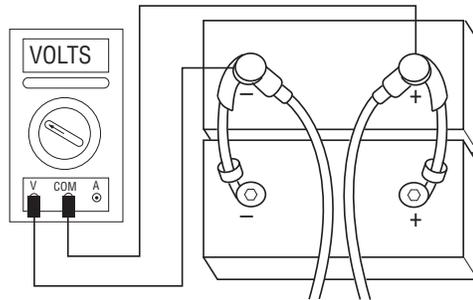
(4-85) = -12 volt relay source

(32-86) = +12 volt relay source

System Isolation Procedures

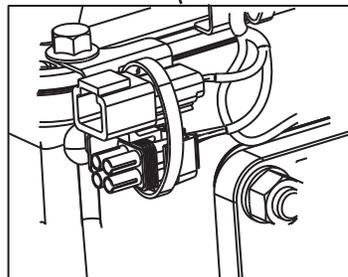
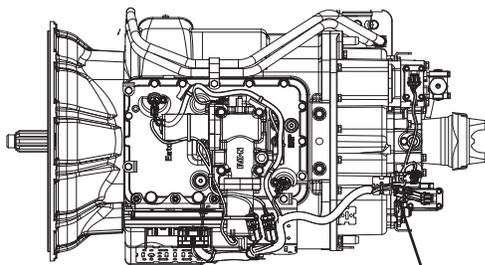
STEP A

Procedure	Condition	Action
1. Key off.		
2. Inspect starter/battery and in-line fuse holder connections for integrity.		
3. Measure voltage across batteries.	If voltage is 11 to 13 volts on a 12 volt system or 22 to 26 on a 24 volt system	Proceed with battery load test. Repair or replace batteries as required. Go to STEP B
	If voltage is outside of range	Repair or replace batteries and charging system as required. Repeat test.



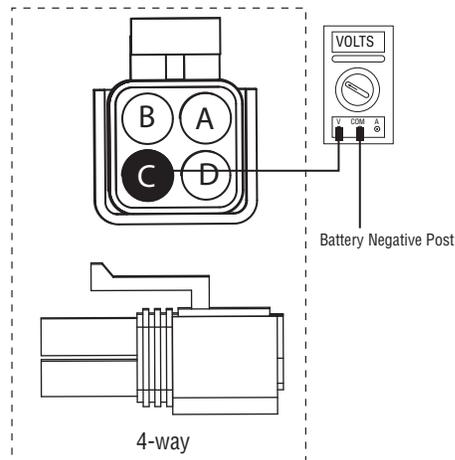
STEP B

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins C and the battery negative post.		If voltage between pin C and battery negative post is 0.70 volts or less		Go to STEP C
		If voltage is outside of range		Repair battery ground supply to Transmission ECU. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear

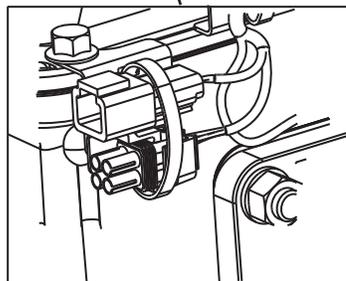
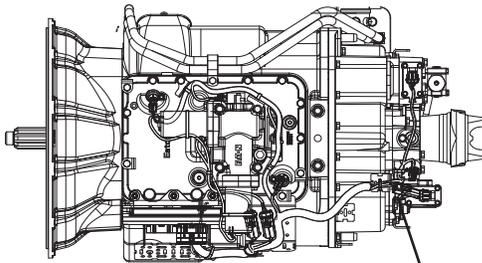
Warning! - Do Not Load Test at Diagnostic Port
4-Pin Diagnostics Port



B - Service Bat. +
C - Service Bat. -

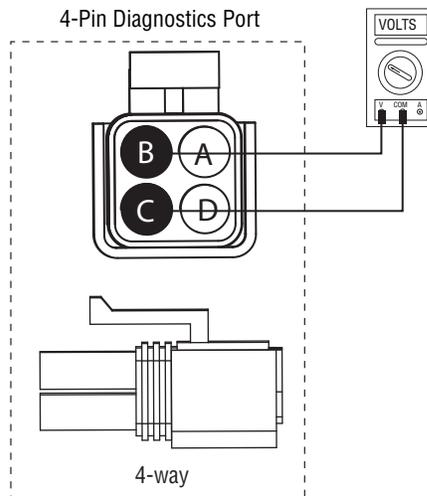
STEP C

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins B and pin C.		If voltage between pins B and C is within 0.6 volts of battery voltage		Go to STEP D
		If voltage is outside of range		Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

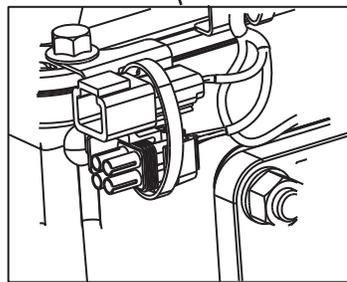
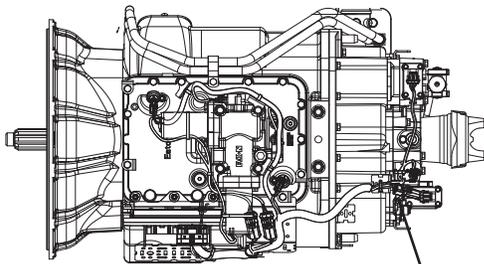
Warning! - Do Not Load Test at Diagnostic Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

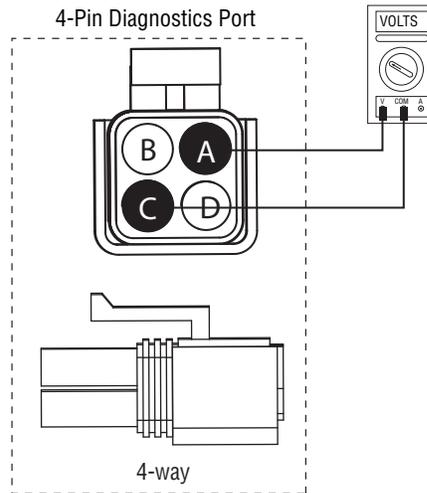
STEP D

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin A and pin C.		If voltage between pins A and C is within 0.6 volts of battery voltage		Go to STEP E
		If voltage is outside of range		Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port



- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

STEP E

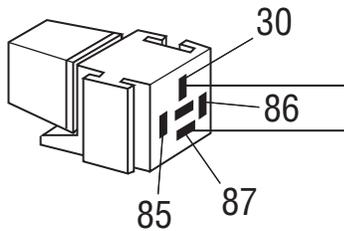
Procedure	→	Condition	→	Action
1. Key off.				
Note: The Start Enable Relay must be wired according to Eaton GEN III requirements (shown on previous page) for this test to work properly. If wired differently, consult OEM for correct wiring schematic.				
2. Disconnect negative battery cable.				
3. Disconnect Vehicle Harness 38-way connector.				
4. Reconnect negative battery cable.				
5. Key on.				
6. Engage Starter.		If engine cranks		Go to STEP F
		If engine does not crank		Go to STEP G

STEP F

Procedure	→	Condition	→	Action
1. Key off.				
2. Remove the Start Enable Relay.				
3. Key on.				
4. Engage starter.		If vehicle cranks		Repair short to power on Vehicle Harness. Go to STEP V
		If vehicle does not crank		Replace Start Enable Relay. Go to STEP V

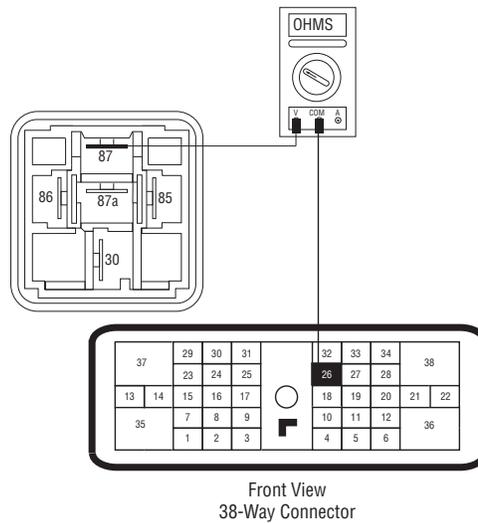
STEP G

Procedure	→	Condition	→	Action
1. Key on.				
2. Disconnect negative battery cable.				
3. Reconnect Vehicle Harness 38-way connector.				
4. Reconnect negative battery cable.				
5. Place a jumper wire across connector contacts 30 and 87.				
<div style="border: 1px solid black; padding: 5px; display: inline-block;">  WARNING </div>				
6. Make sure the parking brake is set before jumping the Start Enable Relay.				
7. Key on. Verify neutral on Gear Display.				
8. Engage starter.		If engine cranks		Replace the Start Enable Relay. Go to STEP H
		If engine does not crank		Refer to OEM for repair of harness or starter.



STEP H

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect Vehicle Harness 38-way connector.				
4. Disconnect the Start Enable Relay.				
5. Measure resistance between pin 87 of the start enable relay connector and pin 26 of the Vehicle Harness 38-Way connector.		If resistance is 0 to 0.3 ohms		Go to STEP V
		If resistance is greater than 10K ohm		Repair wiring. Go to STEP V



STEP V

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

J1587 Data Link Test

Overview

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

Symptom Isolation Procedures

Detection

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

Fallback

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

Required Tools

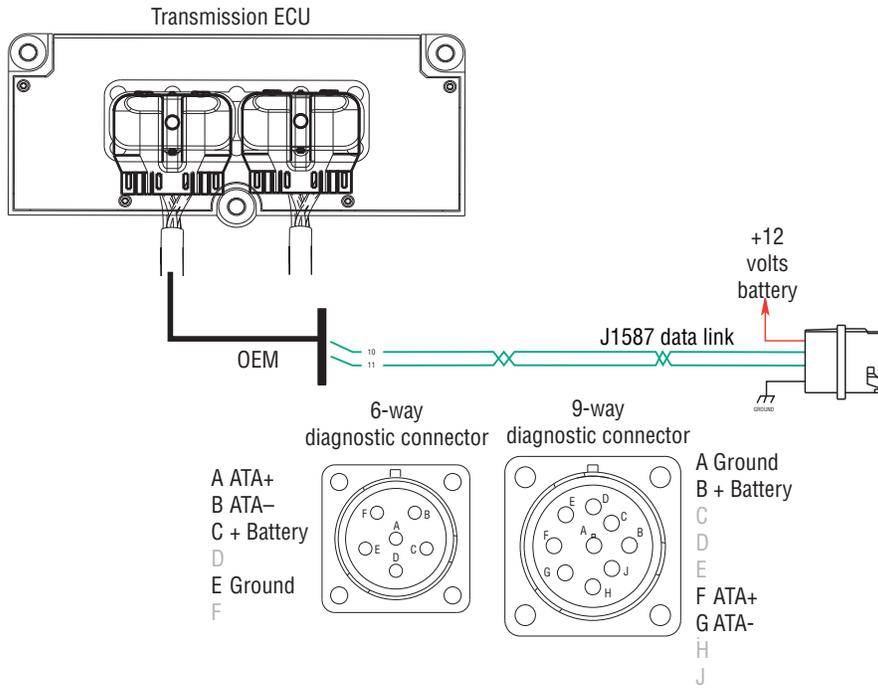
- Basic Hand Tools
- Eaton Test Adapter Kit
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- ServiceRanger a PC-based Service Tool

Possible Causes

This symptom can be caused by any of the following:

- J1587 Data Link Harness
- ServiceRanger a PC-based Service Tool

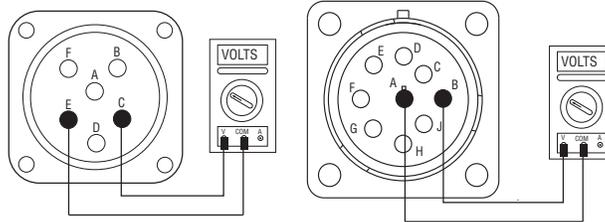
- Transmission ECU



System Isolation Procedures

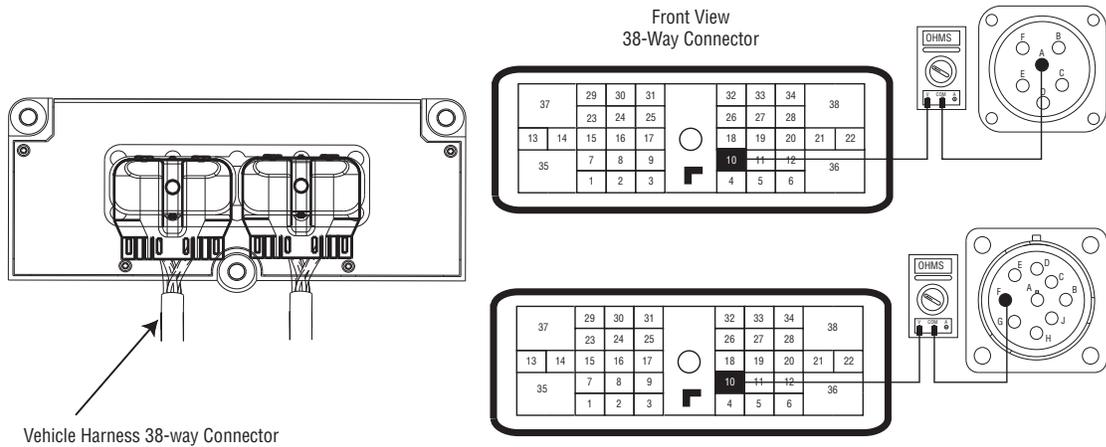
STEP A

Procedure	→ Condition	→ Action
1. Key off.		
2. Measure voltage either between 6-way diagnostic connector pins C and E or 9-way diagnostic connector pins B and A.	<p>If voltage is within 0.6 volts of battery voltage</p> <p>If voltage is outside of range</p>	<p>Go to STEP B</p> <p>Repair battery or ground wire to vehicle diagnostic connector. Go to STEP V</p>



STEP B

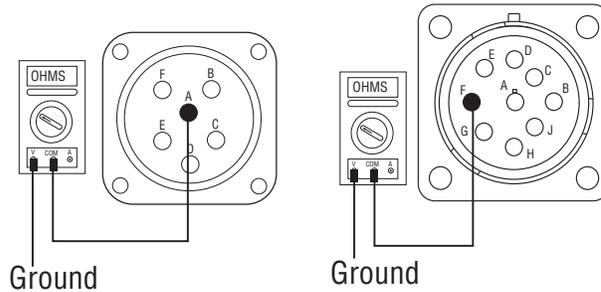
Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect Vehicle Harness 38-way connector.				
4. Measure resistance from Vehicle Harness 38-way connector pin 10 and either 6-way diagnostic connector pin A or 9-way diagnostic connector pin F.		If resistance is 0 to 0.3 ohms		Go to STEP C
		If resistance is outside of range		Repair vehicle interface harness. Repeat this step.



STEP C

Procedure	→ Condition	→ Action
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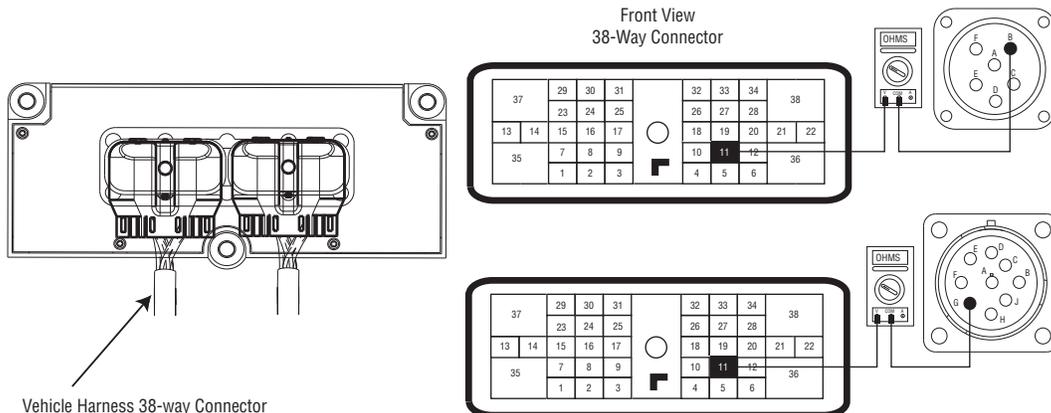
- | | | |
|---|------------------------------------|--|
| 1. Measure resistance between either 6-way diagnostic connector pin A or 9-way diagnostic connector pin F and ground. | If resistance is OL | Go to STEP D |
| | If resistance is less than 10K ohm | Repair vehicle interface harness.
Go to STEP V |



STEP D

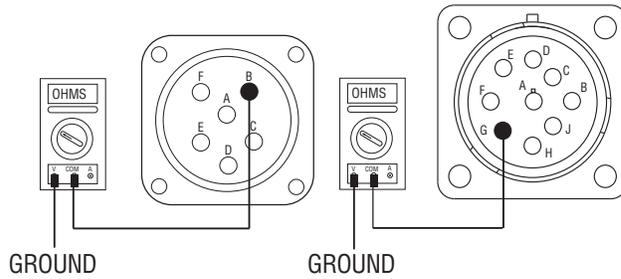
Procedure	→ Condition	→ Action
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- | | | |
|--|-----------------------------------|--|
| 1. Measure resistance between Vehicle Harness 38-way connector pin 11 and either 6-way diagnostic connector pin B or 9-way diagnostic connector pin G. | If resistance is 0 to 0.3 ohms | Go to STEP E |
| | If resistance is outside of range | Repair vehicle interface harness.
Go to STEP V |



STEP E

Procedure	→ Condition	→ Action
1. Measure resistance between either 6-way diagnostic connector pin B or 9-way diagnostic connector pin G and ground.	If resistance is OL	Go to STEP V
	If resistance is less than 10K ohm	Repair vehicle interface harness. Go to STEP V



STEP V

Procedure	→ Condition	→ Action
1. Key on.		
2. Connect ServiceRanger a PC-based Service Tool.	If ServiceRanger a PC-based Service Tool functions correctly	Test complete.
	If ServiceRanger a PC-based Service Tool does not function correctly	To find error in testing, return to STEP A

Front Box Control Test

Overview

This symptom-driven test is performed if a “-” is displayed on the Gear Display, and there are no active or inactive codes.

Detection

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

Any time the service lamp is flashing, go to Diagnostics Procedure.

Fallback

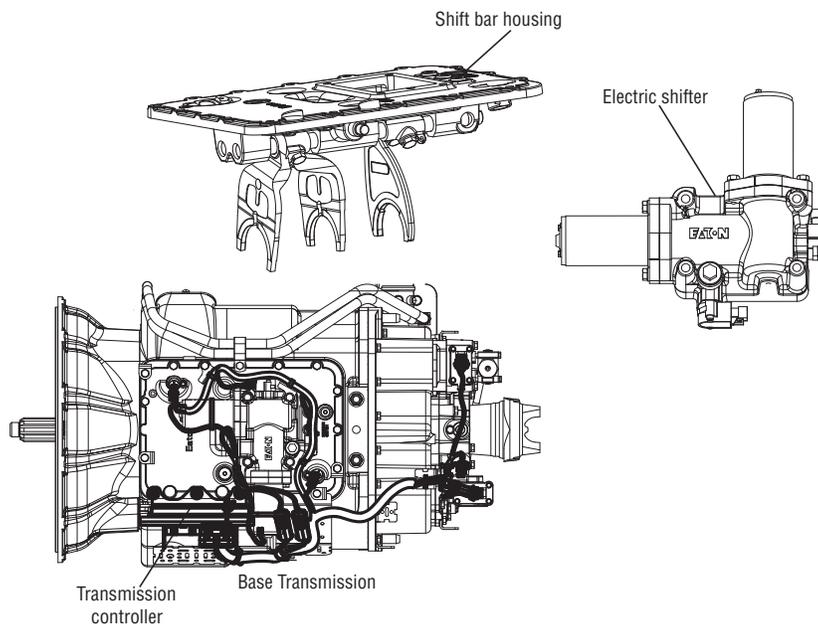
This fault causes an In Place fallback while moving, and it causes a failure during system initialization. A “-” will appear on the Gear Display.

Required Tools

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

This symptom can be caused by any of the following:

- Low Power to Gear Select Motor
- Electric Shifter
- Gear Select Sensor
- Yoke / Clutch / Main Shaft
- Shift Bar Housing
- Dragging Clutch
- Torque Locked in Gear



STEP A

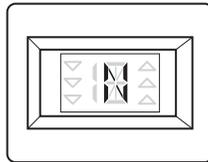
Procedure	→	Condition	→	Action
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1. Key on.
2. Depress clutch pedal (if equipped) half way to the floor.
3. Place Shift Device in Neutral.

4. Observe Gear Display.

If Gear Display shows: "N"

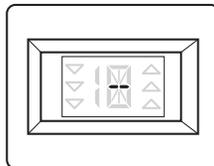
Go to **STEP B**



Note: If service lamp is flashing, go to Diagnostics Procedure (page 1-2).

If Gear Display shows: "-" or a flashing gear with no arrows

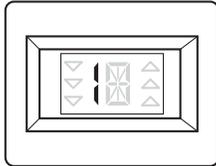
Go to **STEP C**



Front Box Control Test

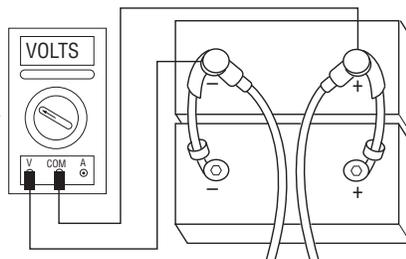
STEP B

Procedure	Condition	Action
<p>1. Key on.</p> <p>2. Place Shift Device in Neutral.</p> <p>3. Depress clutch pedal (if equipped) half way to the floor. If it's a two pedal design apply the service brake.</p> <p>4. Select Drive</p>	<p>If Gear Display shows a solid gear</p>	<p>Test complete.</p>
<p>Note: If service lamp is flashing, go to Diagnostics Procedure (page 1-2).</p>	<p>If Gear Display shows a flashing gear with no arrows</p>	<p>Go to STEP C</p>



STEP C

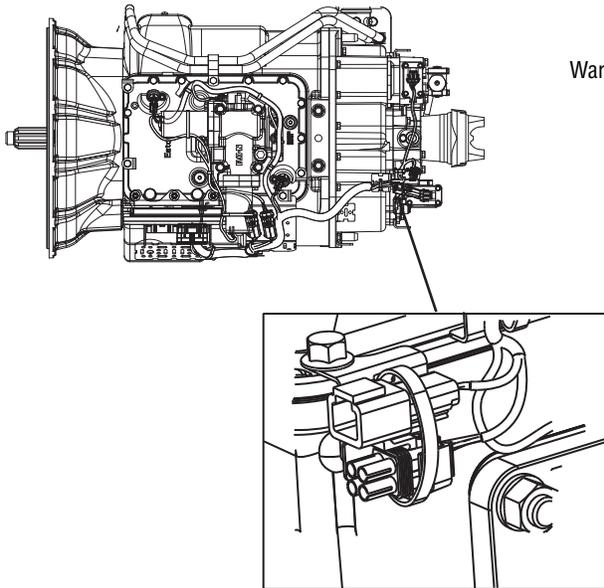
Procedure	→	Condition	→	Action
1. Key off.				
2. Inspect starter/battery and inline fuse holder connections for integrity.				
3. Measure voltage across batteries.		<p>If voltage is 11 to 13 volts on a 12 volt system or 22 to 26 on a 24 volt system</p> <p>If voltage is outside of range</p>		<p>Proceed with battery load test. Repair or replace batteries as required. Go to STEP D</p> <p>Repair or replace batteries and charging system as required. Repeat test.</p>



Front Box Control Test

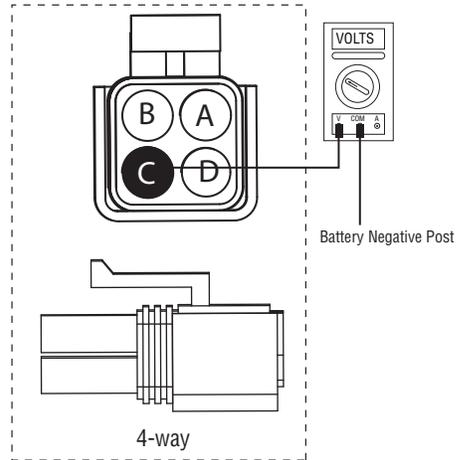
STEP D

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins C and the battery negative post.		If voltage between pin C and battery negative post is 0.70 volts or less		Go to STEP E
		If voltage is outside of range		Repair battery ground supply to Transmission ECU. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

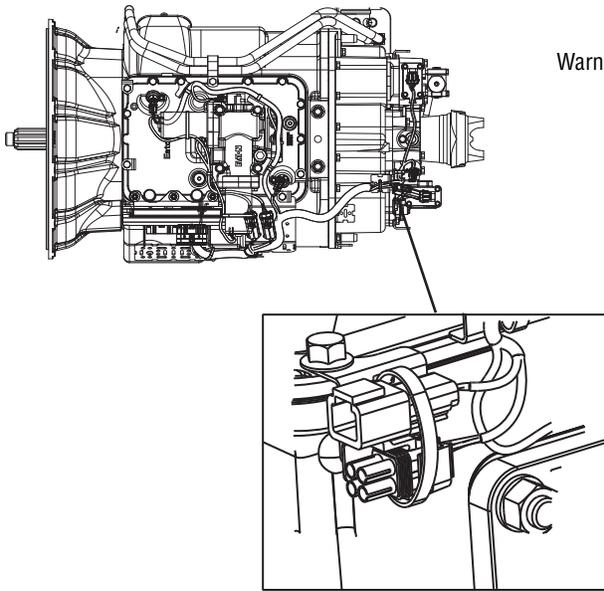
Warning! - Do Not Load Test at Diagnostic Port
4-Pin Diagnostics Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

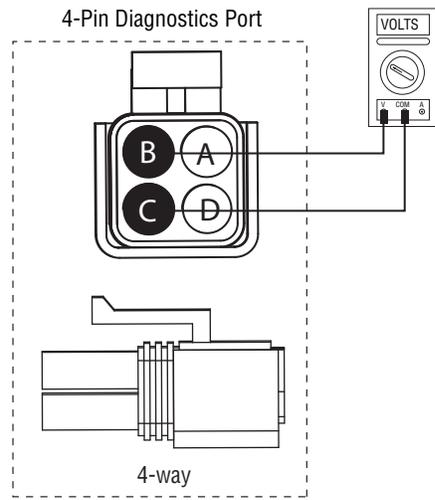
STEP E

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins B and pin C.		If voltage between pins B and C is within 0.6 volts of battery voltage		Go to STEP F
		If voltage is outside of range		Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port

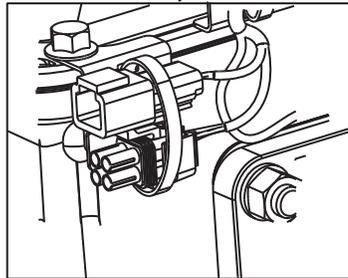
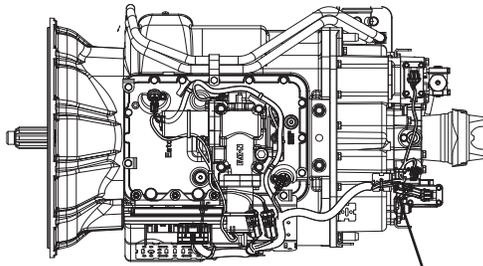


- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

Front Box Control Test

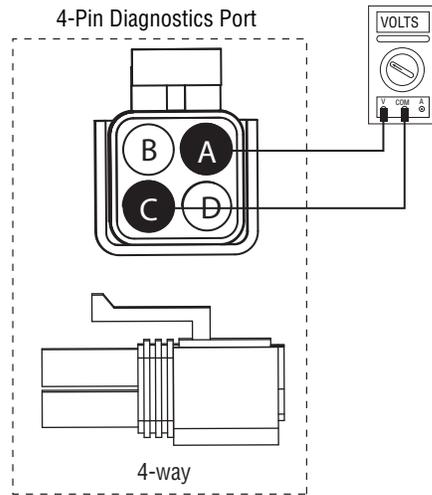
STEP F

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin A and pin C.		<p>If voltage between pins A and C is within 0.6 volts of battery voltage</p> <p>If voltage is outside of range</p>		<p>Go to STEP G</p> <p>Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.</p>



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

STEP G

Procedure	→	Condition	→	Action
1. Key off.				
2. Remove Electric Shifter from Shift Bar Housing.				
3. Inspect the Shift Bar Housing:				
<ul style="list-style-type: none"> • Shift Blocks • Shift Rails • Inspect electric shifter for evidence of lube contamination. 				
Note: See if the Shift Bar Housing can engage two gears at the same time to verify interlock operation.		If no problem found		Replace Electric Shifter. Go to STEP V
		If problem found		Repair as required. Go to STEP V

STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Reconnect all connectors.				
3. Place Shift Control into neutral.				
4. Key on.		If Gear Display displays a solid "N"		Test complete.
		If Gear Display does not display a solid "N"		To find error in testing, return to STEP A

AutoShift Will Not Engage a Gear from

Neutral Test

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

Fallback

There is no fallback mode for this symptom.

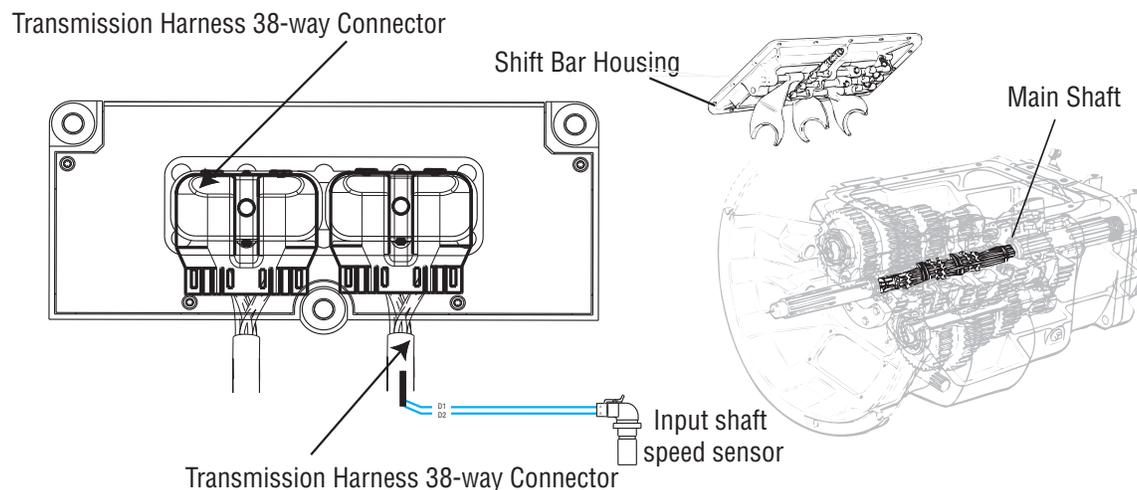
Required Tools

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

Possible Causes

This symptom can be caused by any of the following:

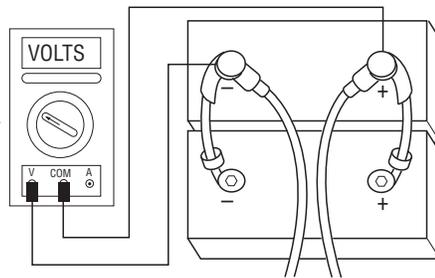
- Input Shaft Speed Sensor
- Transmission
- Clutch Brake/Clutch
- Transmission Harness
- Transmission ECU



System Isolation Procedure

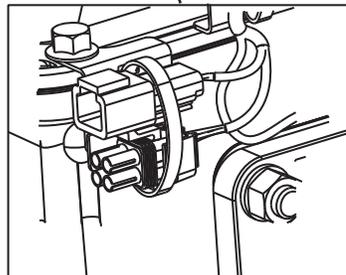
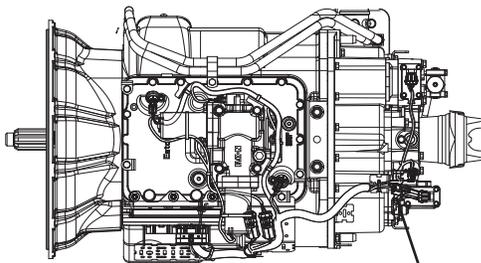
STEP A

Procedure	Condition	Action
1. Key off.		
2. Inspect starter/battery and in-line fuse holder connections for integrity.		
3. Measure voltage across batteries.	If voltage is 11 to 13 volts on a 12 volt system or 22 to 26 on a 24 volt system	Proceed with battery load test. Repair or replace batteries as required. Go to STEP B
	If voltage is outside of range	Repair or replace batteries and charging system as required. Repeat test.



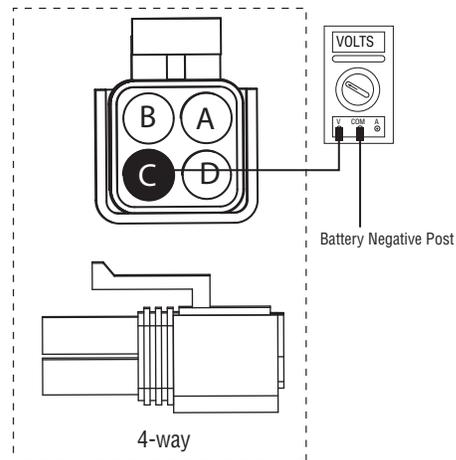
STEP B

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins C and the battery negative post.		If voltage between pin C and battery negative post is 0.70 volts or less		Go to STEP C
		If voltage is outside of range		Repair battery ground supply to Transmission ECU. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

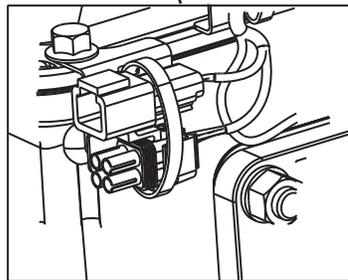
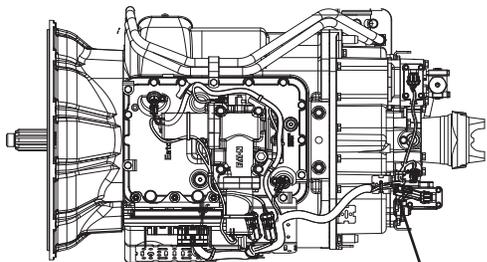
Warning! - Do Not Load Test at Diagnostic Port
4-Pin Diagnostics Port



- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

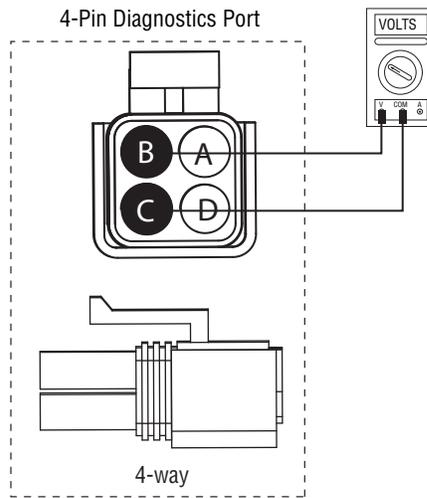
STEP C

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins B and pin C.		If voltage between pins B and C is within 0.6 volts of battery voltage		Go to STEP D
		If voltage is outside of range		Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

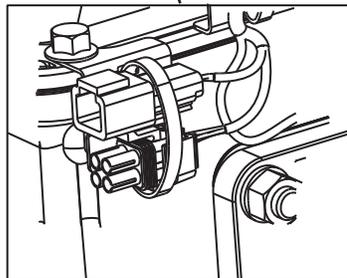
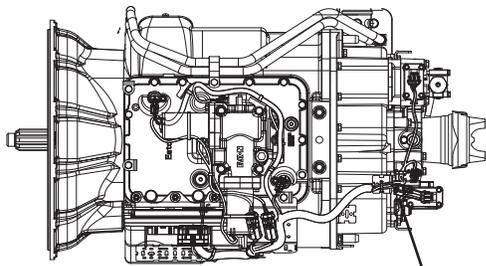
Warning! - Do Not Load Test at Diagnostic Port



- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

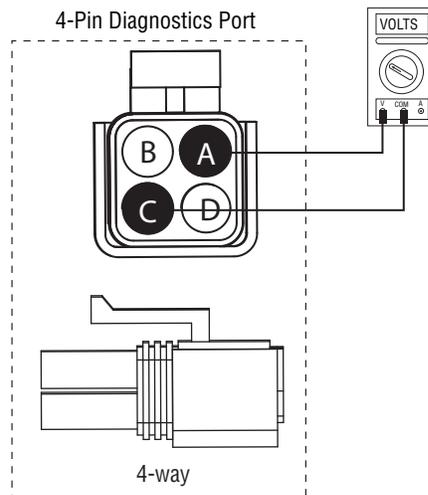
STEP D

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin A and pin C.		If voltage between pins A and C is within 0.6 volts of battery voltage If voltage is outside of range		Go to STEP E Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port



B - Service Bat. +
 C - Service Bat. -
 A - Service Ignition +

STEP E

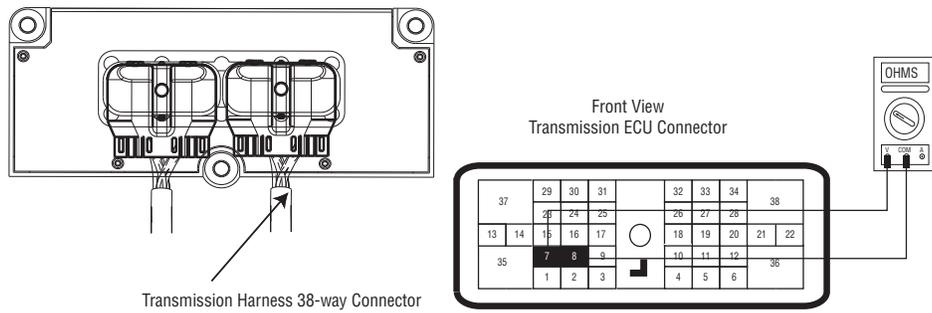
Procedure	→	Condition	→	Action
1. Key on.				
2. Depress clutch pedal.				
3. Start engine.				
4. Release clutch pedal to verify Input Shaft speed.				
5. Depress clutch pedal.				
6. Place Shift Lever in "D".				
7. Observe Gear Display.		If Gear Display shows a solid "N" and the warning tone sounds		Go to STEP F
		If Gear Display shows a flashing gear with arrows		Go to STEP M
		If Gear Display shows a flashing gear with no arrows		Go to Front Box Control Test.
		If Gear Display shows a solid gear but the vehicle will not move		Contact your local Eaton Representative or call 1-800-826-HELP (4357).

STEP F

Procedure	→	Condition	→	Action
1. Key off.				
2. Connect ServiceRanger a PC-based Service Tool.				
3. Start engine. Release clutch pedal.				
4. View Input Shaft speed.		If Input Shaft speed exists		Contact your local Eaton Representative or call 1-800-826-HELP (4357).
		If Input Shaft speed does not exist		Go to STEP G

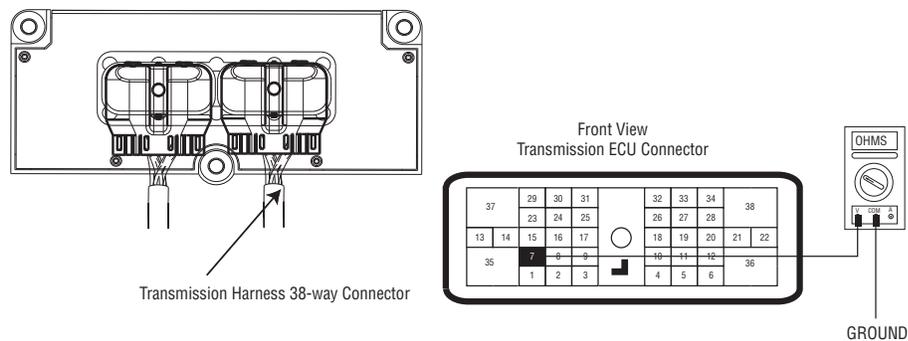
STEP G

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect the Transmission Harness 38-way connector.				
4. Measure the resistance between the Transmission Harness 38-way connector pins 7 and 8.		If resistance is 2K to 4.5K ohm		Go to STEP H
		If resistance is outside of range		Go to STEP J



STEP H

Procedure	→	Condition	→	Action
1. Measure resistance between the Transmission Harness 38-way connector pin 7 and ground.		If resistance is OL		Go to STEP I
		If resistance is less than 10K ohm		Go to STEP J

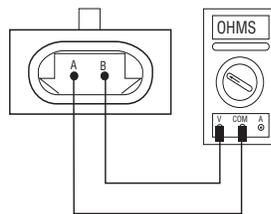


STEP I

Procedure	→ Condition	→ Action
1. Inspect Input Shaft Speed Sensor for contamination or damage.	If no problem found	Go to STEP L
	If problem found or you were sent here from Step J or K	Replace Input Shaft Speed Sensor and inspect the upper countershaft PTO gear for damage. Go to STEP V

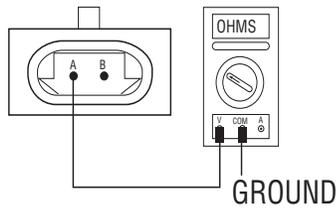
STEP J

Procedure	→ Condition	→ Action
1. Disconnect the Transmission Harness from the Input Shaft Speed Sensor.		
2. Measure resistance between Input Shaft Speed Sensor pins A and B.	If resistance is 2K to 4.5K ohm	Go to STEP K
	If resistance is outside of range	Go to STEP I



STEP K

Procedure	Condition	Action
1. Measure resistance between Input Shaft Speed Sensor pin A and ground.	If resistance is OL	Replace Transmission Harness. Go to STEP V
	If resistance is less than 10K ohm	Go to STEP I



STEP L

Procedure	Condition	Action
1. Key off.		
2. Verify the Upper Countershaft is turning.		
3. Turn the Input Shaft and verify the Upper Countershaft is rotating.	If Upper Countershaft is turning	Replace Transmission ECU. Go to STEP V
	If Upper Countershaft is not turning	Contact your Eaton Representative or call Eaton at 1-800-826-HELP (4357).

STEP M

Procedure	→	Condition	→	Action
1. Connect PC-based service tool.				
2. Start engine.				
3. Depress clutch pedal.				
4. View input shaft speed.		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 input shaft speed drops below 150		Test complete. Go to STEP V

STEP V

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

Heavy-Duty UltraShift PLUS Will Not

Engage a Gear from Neutral Test

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

Fallback

There is no fallback mode for this symptom.

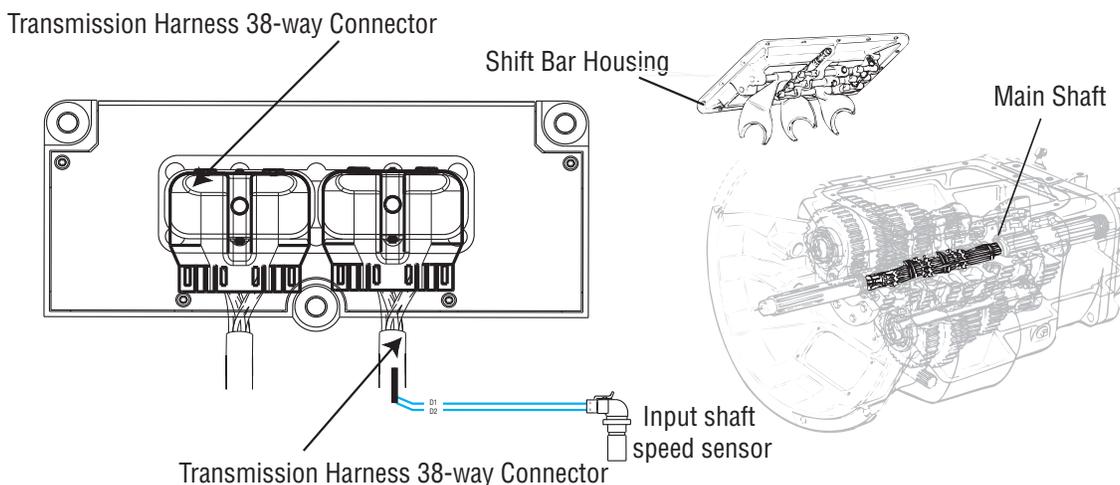
Required Tools

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

Possible Causes

This symptom can be caused by any of the following:

- Input Shaft Speed Sensor
- Transmission
- LCIB / Clutch
- Transmission Harness
- Transmission ECU

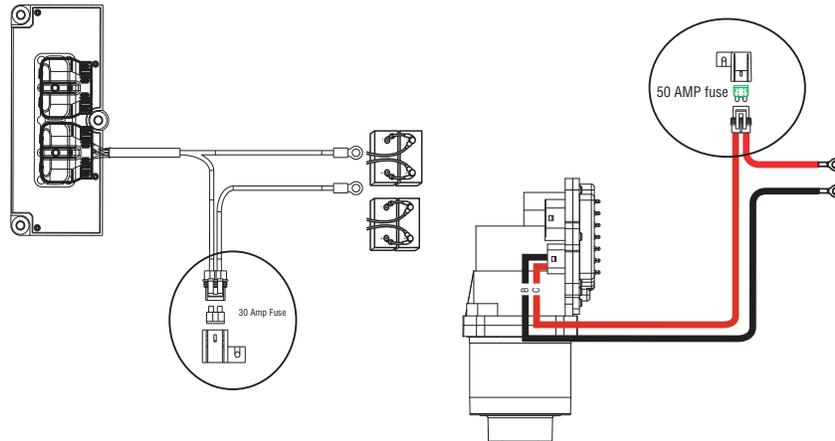


System Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
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1. Key off.
2. Remove and clean all battery and battery to frame connections.
3. Remove and clean ground supply to engine ECU.
4. Inspect starter/battery and inline 30 amp fuse holder connections for corrosion or damaged contacts. Also inspect 50 amp fuse holder on vehicles equipped with an Electronic Clutch Actuator (ECA.)



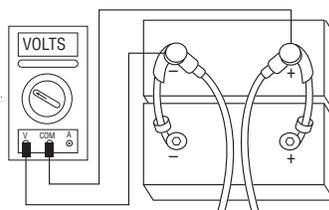
5. Measure voltage across batteries.

If voltage is 11 to 13 volts on a 12 volt system or 22 to 26 on a 24 volt system

Refer to OEM guidelines for battery load test. Repair or replace batteries as required. Go to **STEP B**

If voltage is outside of range

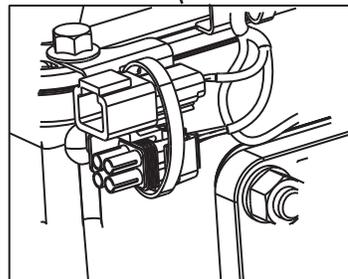
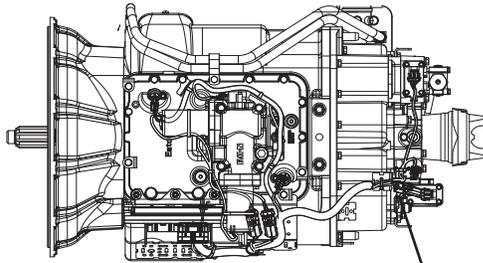
Repair or replace batteries and charging system as required. Repeat this step.



Heavy-Duty UltraShift PLUS Will Not Engage a Gear from Neutral Test System Isolation

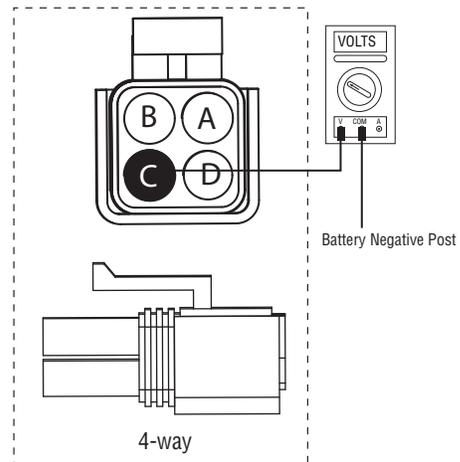
STEP B

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins C and the battery negative post.		If voltage between pin C and battery negative post is 0.70 volts or less		Go to STEP C
		If voltage is outside of range		Repair battery ground supply to Transmission ECU. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

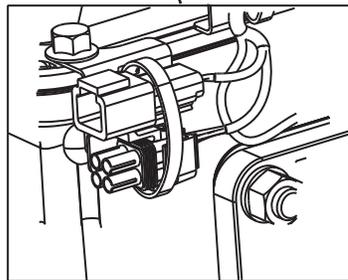
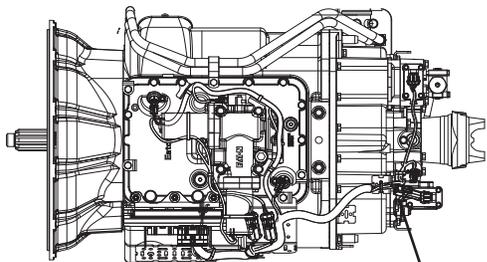
Warning! - Do Not Load Test at Diagnostic Port
4-Pin Diagnostics Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

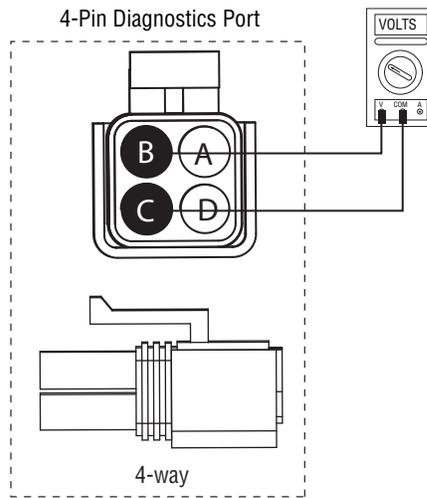
STEP C

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins B and pin C.		If voltage between pins B and C is within 0.6 volts of battery voltage		Go to STEP D
		If voltage is outside of range		Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port

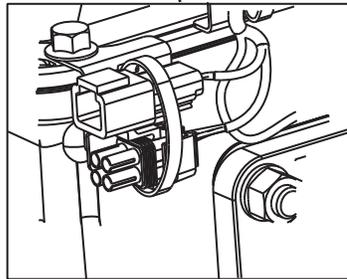
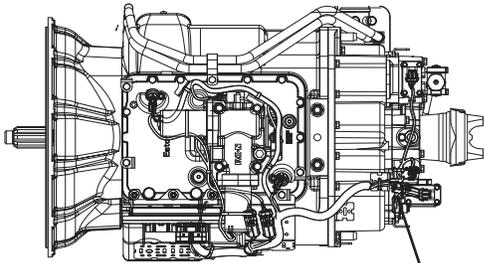


- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

Heavy-Duty UltraShift PLUS Will Not Engage a Gear from Neutral Test System Isolation

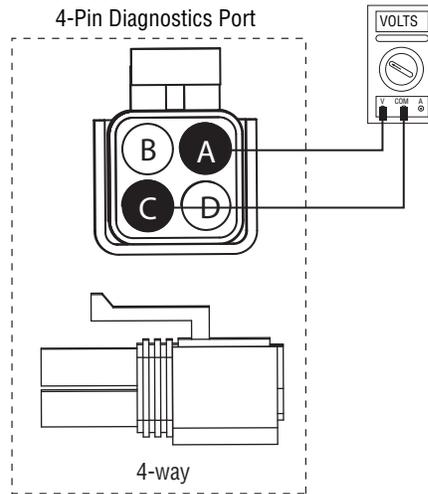
STEP D

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin A and pin C.		If voltage between pins A and C is within 0.6 volts of battery voltage		Go to STEP E
		If voltage is outside of range		Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

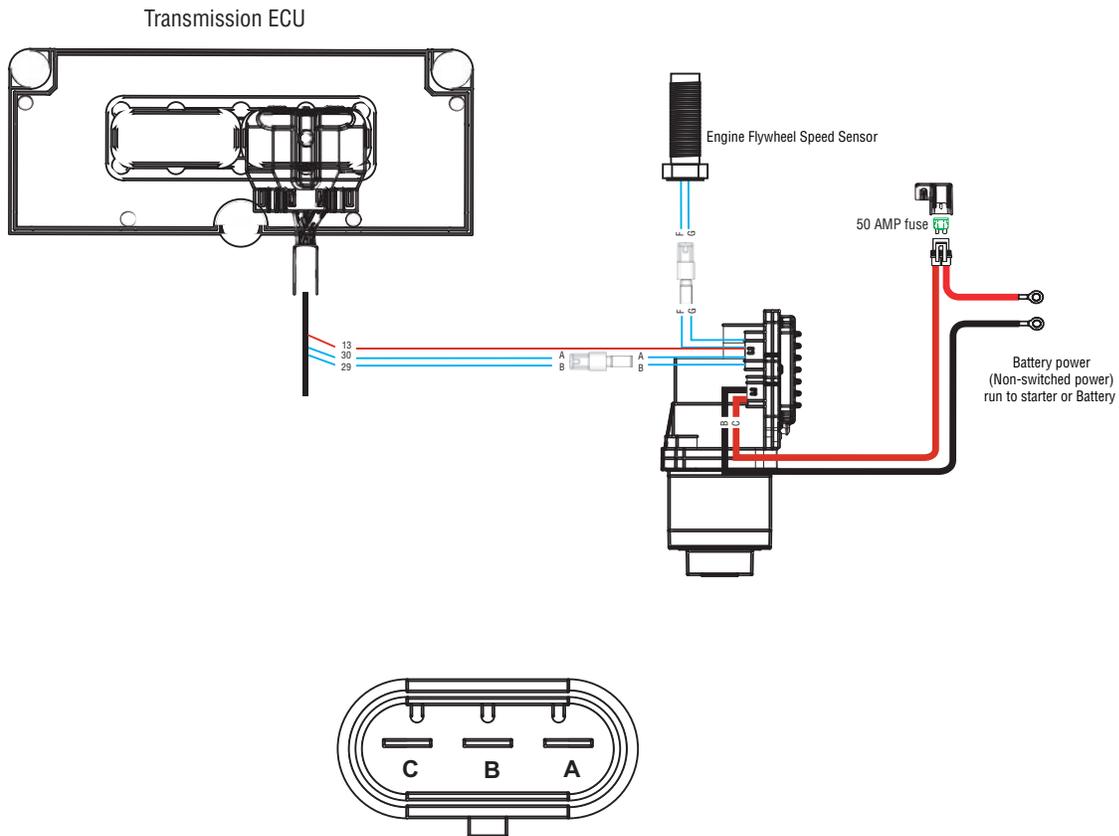
Warning! - Do Not Load Test at Diagnostic Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

STEP E

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect battery negative.				
3. Disconnect ECA 3-way connector.				
4. Reconnect battery negative.				
5. Measure voltage between pin B and pin C of 3-way connector.		If voltage between pin B and pin C of 3-way connector is within 0.6 volts of battery voltage		Go to STEP F
		If voltage is outside of range		Repair battery power supply to ECA. Fuse may be blown. Repeat test.



Heavy-Duty UltraShift PLUS Will Not Engage a Gear from Neutral Test System Isolation

STEP F

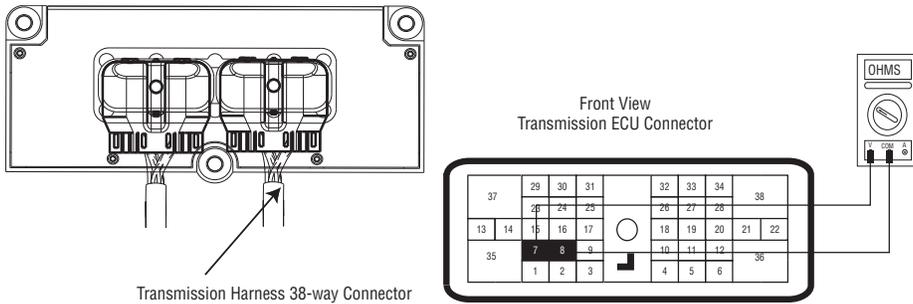
Procedure	Condition	Action
1. Key on.		
2. Depress service brake.		
3. Start engine.		
4. Place Shift Lever in "D."		
5. Observe Gear Display.	If Gear Display shows a solid "N" and the warning tone sounds.	Go to STEP G
	If Gear Display shows a flashing gear.	Go to STEP N
	If Gear Display shows a solid gear but the vehicle will not move.	Contact your local Eaton Representative or call 1-800-826-HELP (4357).

STEP G

Procedure	Condition	Action
1. Key off.		
2. Connect ServiceRanger a PC-based Service Tool.		
3. Start engine. Let idle with foot off brake for more than three seconds.		
4. View Input Shaft speed.	If Input Shaft speed exists	Contact your local Eaton Representative or call 1-800-826-HELP (4357).
	If Input Shaft speed does not exist	Go to STEP H

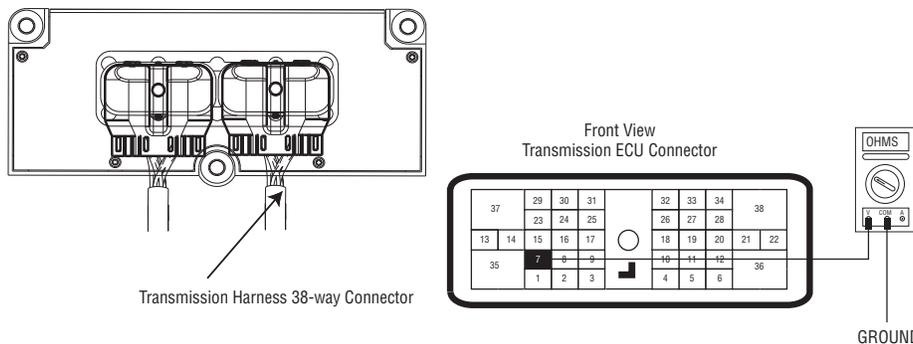
STEP H

Procedure	Condition	Action
1. Key off.		
2. Disconnect negative battery cable.		
3. Disconnect the Transmission Harness 38-way connector.		
4. Measure the resistance between the Transmission Harness 38-way connector pins 7 and 8.	If resistance is 2K to 4.5K ohm	Go to STEP I
	If resistance is outside of range	Go to STEP K



STEP I

Procedure	Condition	Action
1. Measure resistance between the Transmission Harness 38-way connector pin 7 and ground.	If resistance is OL	Go to STEP J
	If resistance is less than 10K ohm	Go to STEP K



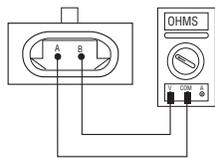
Heavy-Duty UltraShift PLUS Will Not Engage a Gear from Neutral Test System Isolation

STEP J

Procedure	Condition	Action
1. Inspect Input Shaft Speed Sensor for contamination or damage.	If no problem found	Go to STEP M
	If problem found or you were sent here from Step L or K	Replace Input Shaft Speed Sensor and inspect the upper countershaft PTO gear for damage. Go to STEP V

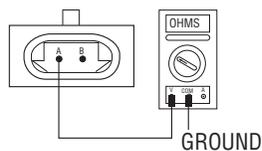
STEP K

Procedure	Condition	Action
1. Disconnect the Transmission Harness from the Input Shaft Speed Sensor.		
2. Measure resistance between Input Shaft Speed Sensor pins A and B.	If resistance is 2K to 4.5K ohm	Go to STEP L
	If resistance is outside of range	Go to STEP J



STEP L

Procedure	Condition	Action
1. Measure resistance between Input Shaft Speed Sensor pin A and ground.	If resistance is OL	Replace Transmission Harness. Go to STEP V
	If resistance is less than 10K ohm	Go to STEP J



STEP M

Procedure	→	Condition	→	Action
1. Key off.				
2. Verify the Upper Countershaft is turning.				
3. Turn the Input Shaft and verify the Upper Countershaft is rotating.		If Upper Countershaft is turning		Replace Transmission ECU. Go to STEP V
		If Upper Countershaft is not turning		Contact your Eaton Representative or call Eaton at 1-800-826-HELP (4357).

STEP N

Procedure	→	Condition	→	Action
1. Connect PC-based service tool.				
2. Start engine				
3. Depress service brake.				
4. Place shift lever in "D."				
5. View input shaft speed.		If input shaft speed does not drop below 150 rpm		ECA Clutch is out of adjustment or Low Capacity Inertia Brake (LCIB) is malfunctioning. Troubleshoot per ECA Product Fault Code 27 and ECA Product Fault Code 45 diagnostic procedures in this manual. Go to STEP V
		If input shaft speed drops below 150 rpm		Go to Front Box Control Test .

STEP V

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

UltraShift DM3 Will Not Engage a Gear from

Neutral Test

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

Fallback

There is no fallback mode for this symptom.

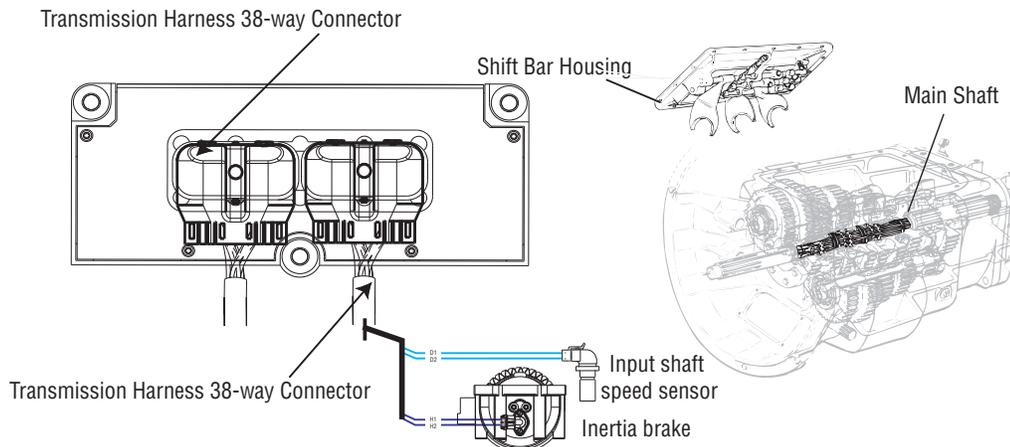
Required Tools

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

Possible Causes

This symptom can be caused by any of the following:

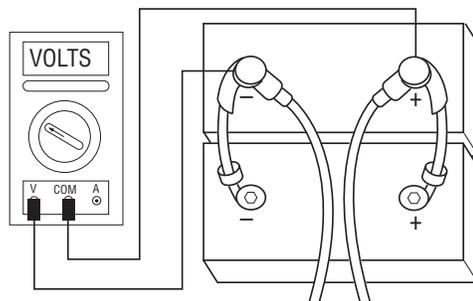
- Input Shaft Speed Sensor
- Transmission
- Inertia Brake
- Clutch/Clutch Brake
- OEM Service Brake Switch Operation
- Transmission ECU
- Transmission Harness



Symptom Isolation Procedures

STEP A

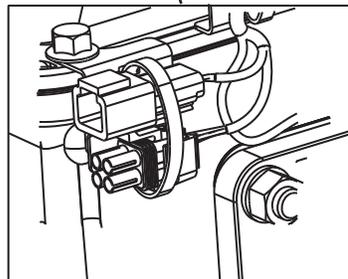
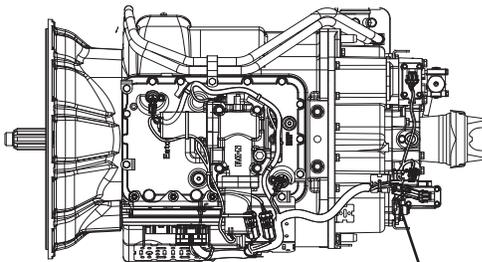
Procedure	Condition	Action
1. Key off.		
2. Inspect starter/battery and inline fuse holder connections for integrity.		
3. Measure voltage across batteries.	If voltage is 11 to 13 volts on a 12 volt system or 22 to 26 on a 24 volt system	Proceed with battery load test. Repair or replace batteries as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



UltraShift DM3 Will Not Engage a Gear from Neutral Test Symptom Isolation Procedures

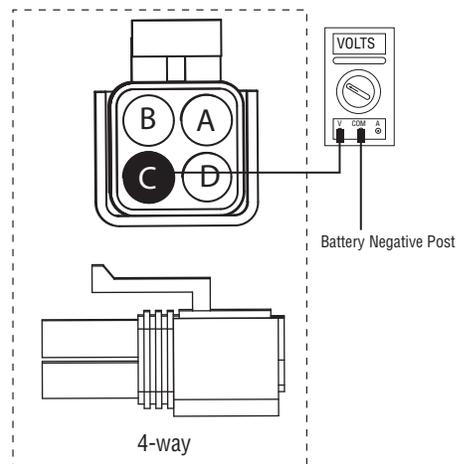
STEP B

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins C and the battery negative post.		If voltage between pin C and battery negative post is 0.70 volts or less		Go to STEP C
		If voltage is outside of range		Repair battery ground supply to Transmission ECU. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

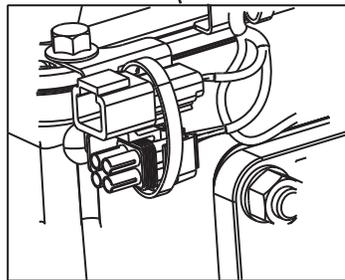
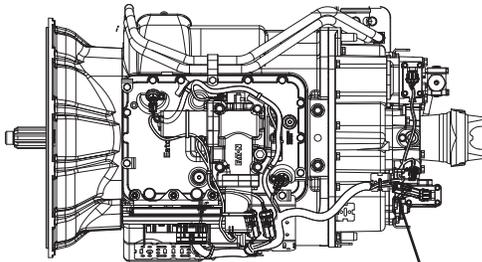
Warning! - Do Not Load Test at Diagnostic Port
4-Pin Diagnostics Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

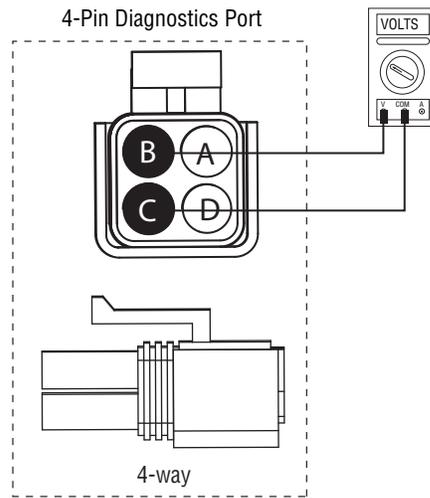
STEP C

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins B and pin C.		If voltage between pins B and C is within 0.6 volts of battery voltage		Go to STEP D
		If voltage is outside of range		Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port

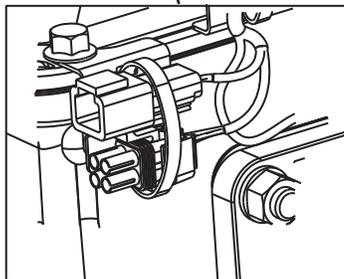
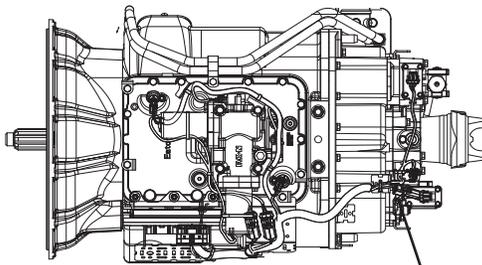


- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

UltraShift DM3 Will Not Engage a Gear from Neutral Test Symptom Isolation Procedures

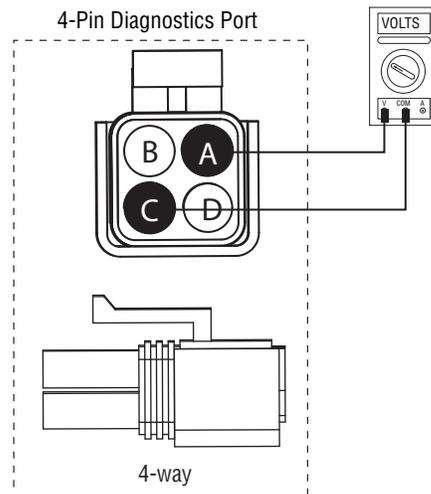
STEP D

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin A and pin C.		If voltage between pins A and C is within 0.6 volts of battery voltage		Go to STEP E
		If voltage is outside of range		Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

STEP E

Procedure	Condition	Action
1. Key on.		
2. Start engine.		
3. Apply service brake while selecting "D".		
Note: Using a ServiceRanger a PC-based Service Tool verify OEM service brake operation.		
4. Observe Gear Display.	If Gear Display shows a solid "N" and the warning tone sounds	Go to STEP F
	If Gear Display shows a flashing gear with arrows	Go to STEP M
	If Gear Display shows a flashing gear with no arrows	Go to Front Box Control Test.
	If Gear Display shows a solid gear but the vehicle will not move	Contact your Eaton Representative or call Eaton at 1-800-826-HELP (4357).

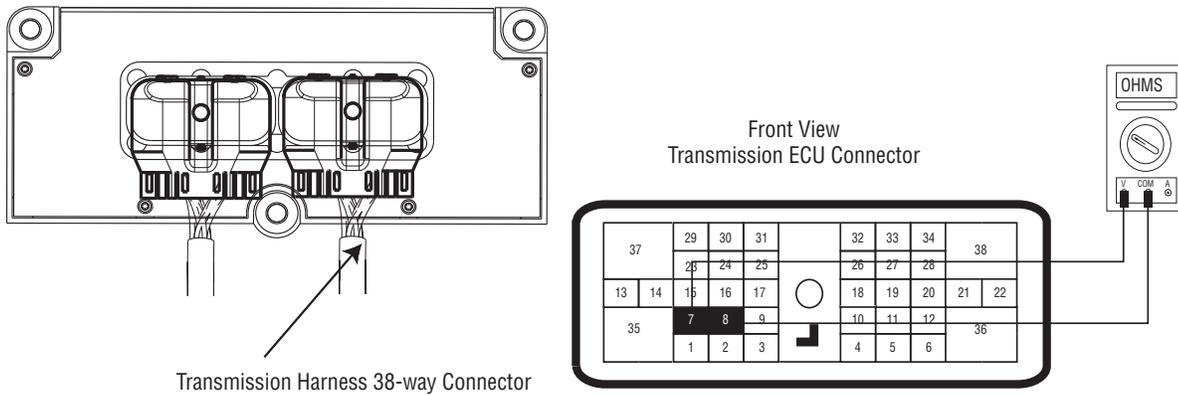
STEP F

Procedure	Condition	Action
1. Key off.		
2. Connect PC-based Service Tool.		
3. Start engine. Increase rpm and hold above 1000 rpm.		
4. View Input Shaft speed.	If Input Shaft speed exists	Contact your Eaton Representative or call Eaton at 1-800-826-HELP (4357).
	If Input Shaft speed does not exist	Go to STEP G

UltraShift DM3 Will Not Engage a Gear from Neutral Test Symptom Isolation Procedures

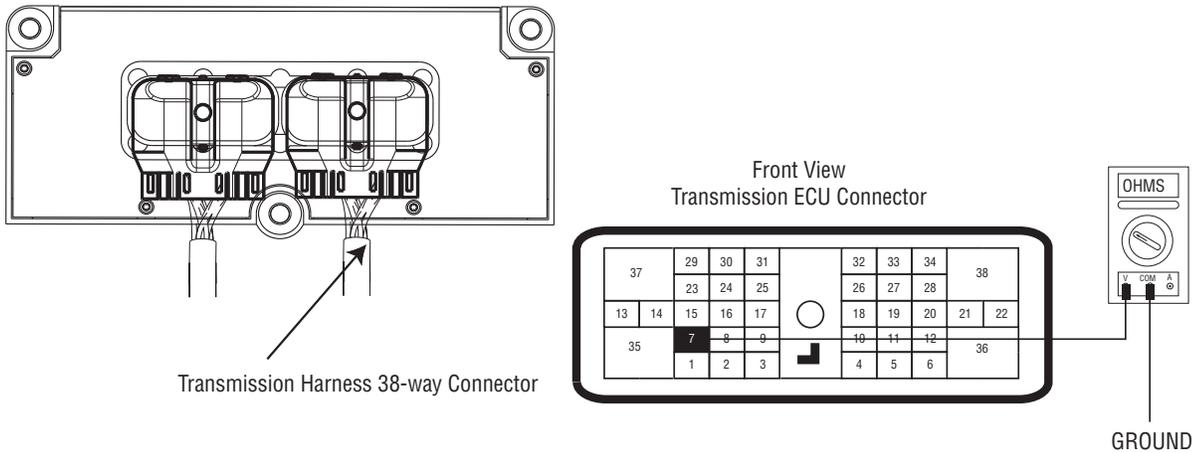
STEP G

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect the Transmission Harness 38-way connector.				
4. Measure the resistance between the Transmission Harness 38-way connector pins 7 and 8.		If resistance is 2K to 4.5K ohm		Go to STEP H
		If resistance is outside of range		Go to STEP J



STEP H

Procedure	Condition	Action
1. Measure resistance between the Transmission Harness 38-way connector pin 7 and ground.	If resistance is OL	Go to STEP I
	If resistance is less than 10K ohm	Go to STEP J



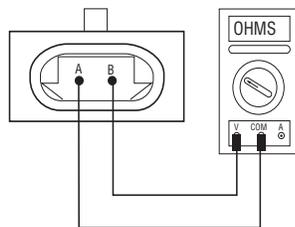
STEP I

Procedure	Condition	Action
1. Inspect Input Shaft Speed Sensor for contamination or damage.	If no problem found	Go to STEP L
	If problem found	Replace Input Shaft Speed Sensor and inspect the upper countershaft PTO gear for damage. Go to STEP V

UltraShift DM3 Will Not Engage a Gear from Neutral Test Symptom Isolation Procedures

STEP J

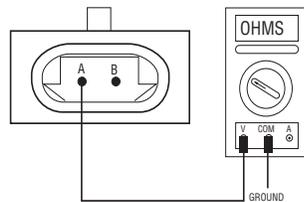
Procedure	Condition	Action
1. Disconnect the Transmission Harness from the Input Shaft Speed Sensor.		
2. Measure resistance between Input Shaft Speed Sensor pins A and B.	If resistance is 2K to 4.5K ohm	Go to STEP K
	If resistance is outside of range	Replace Input Shaft Speed Sensor. Go to STEP V



3.

STEP K

Procedure	Condition	Action
1. Measure resistance between Input Shaft Speed Sensor pin A and ground.	If resistance is OL	Replace Transmission Harness. Go to STEP V
	If resistance is less than 10K ohm	Replace Input Shaft Speed Sensor. Go to STEP V



STEP L

Procedure	→	Condition	→	Action
1. Key off.				
2. Turn the Input Shaft and verify the Upper Countershaft is rotating.		If Upper Countershaft is turning		Replace transmission ECU. Go to STEP V
		If Upper Countershaft is not turning		Contact your Eaton Representative or call Eaton at 1-800-826-HELP (4357) for a repair strategy.

STEP M

Procedure	→	Condition	→	Action
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 N
		If input shaft speed drops below 150		Test complete. Go to STEP V

UltraShift DM3 Will Not Engage a Gear from Neutral Test Symptom Isolation Procedures

STEP N

Procedure	→	Condition	→	Action
1. Key on.				
2. Make sure the PTO is off.				
3. Connect ServiceRanger a PC-based Service Tool and select "Advanced Product Functions".				
4. Start engine.				
5. Select "Inertia Brake Test".				
6. Run test and follow instructions.		Test passes		replace Clutch. Go to STEP V
		Test fails		Replace Inertia brake. Go to STEP V
		Test aborts		Correct displayed test failure condition and retest.

STEP V

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

UltraShift AW3 Clutch Engagement Test

Overview

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

Detection

There is no detection other than a driver complaint.

Fallback

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

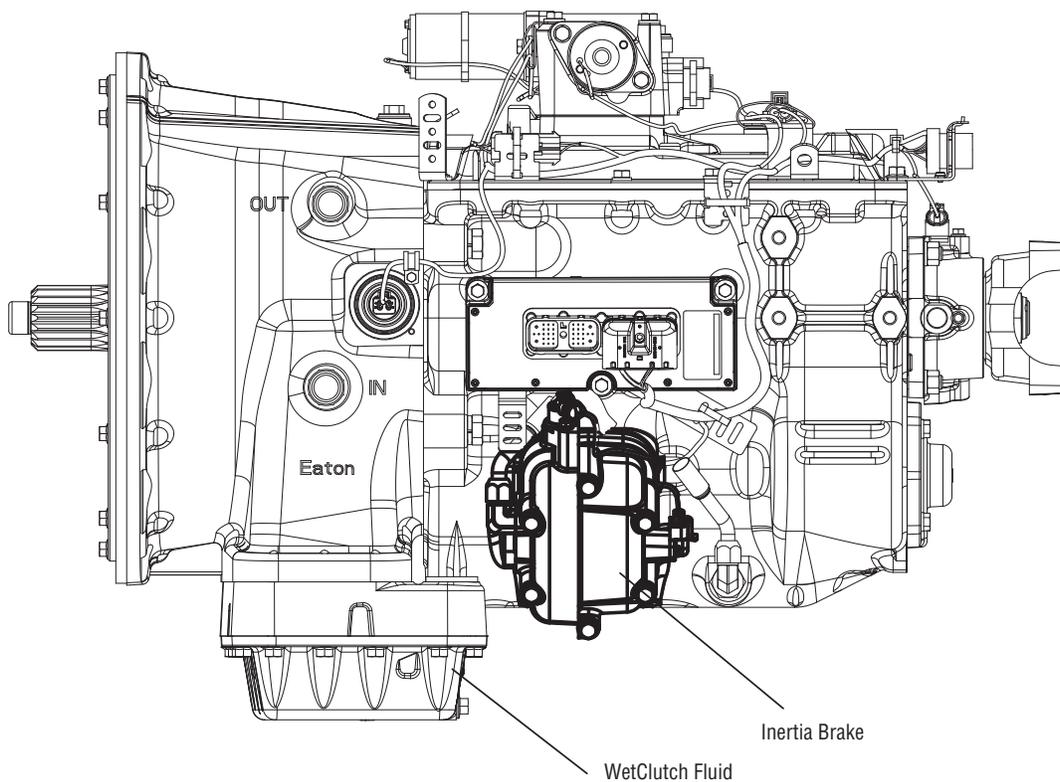
Required Tools

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

Possible Causes

This symptom can be caused by any of the following:

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



Symptom Isolation Procedures

STEP A

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

STEP B

Procedure	→	Condition	→	Action
1. Remove the flywheel inspection cover and inspect the rubber coupler for damage or shear.		If no damage is observed		Go to STEP C
		If damage is observed		Replace the Torsional Coupler. Go to STEP V

STEP C

Procedure	→	Condition	→	Action
1. Key on.				
2. Engine running, allow engine to reach operating temperature.				
3. Key off.				
4. Start vehicle.				
5. Allow vehicle to Idle in Neutral for a minimum of 2 (two) minutes.				
6. Drive vehicle.		If Clutch Engagement Complaint does not change		Go to STEP D
		If Clutch Engagement Complaint is corrected		Test complete.

STEP D

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect Transmission Harness from the I-Brake.				
3. Key on.				
4. Drive vehicle (Flashing Service Light will exist).		If Clutch Engagement Complaint does not change		Contact your Eaton Representative or call Eaton at 1-800-826-HELP (4357).
		If Clutch Engagement Complaint is corrected		Replace Inertia Brake. Go to STEP V

STEP V

Procedure	Condition	Action
1. Key Off.		
2. Reconnect Transmission Harness to I-Brake.		
3. Key on.		
4. Drive the vehicle to determine whether the complaint has been repaired.	If shift complaint has not been repaired	Contact your Eaton Representative or call Eaton at 1-800-826-HELP (4357).
	If the shift complaint has been repaired	Test complete.

AutoShift AS3 Shift Complaint Test

Overview

This symptom driven test is performed if a shift complaint exists, and there are no active or inactive codes.

Detection

There is no detection other than a driver complaint.

Fallback

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

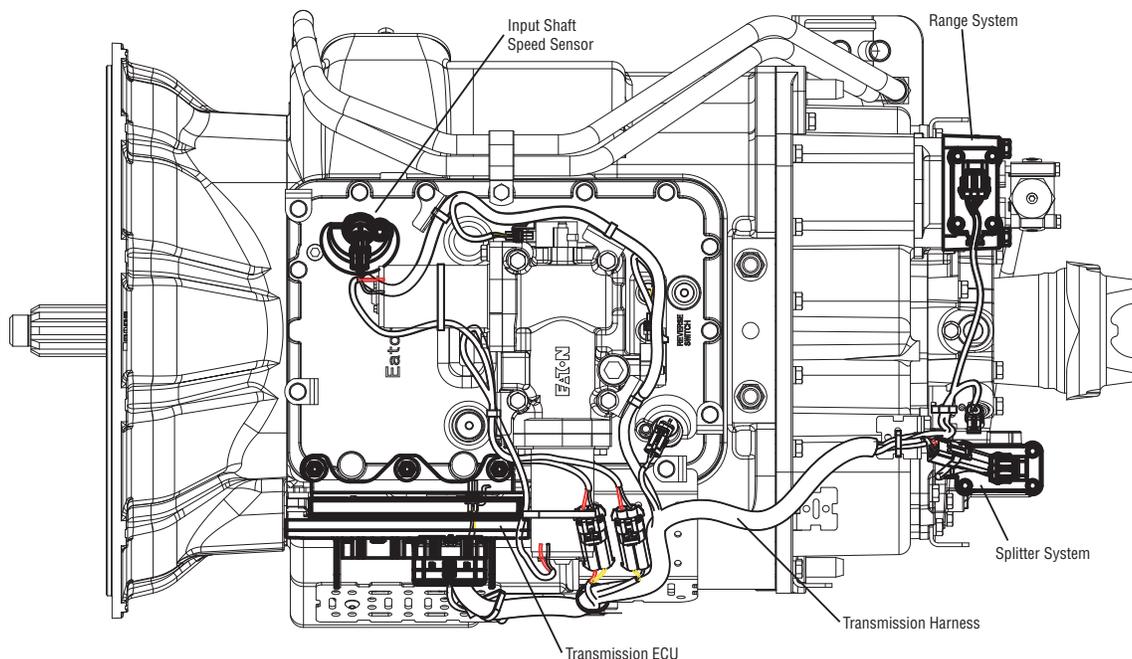
Required Tools

- Basic Hand Tools
- Troubleshooting Guide
- 0-100 PSI Air Pressure Gauge (2)
- Eaton Test Adapter Kit

Possible Causes

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

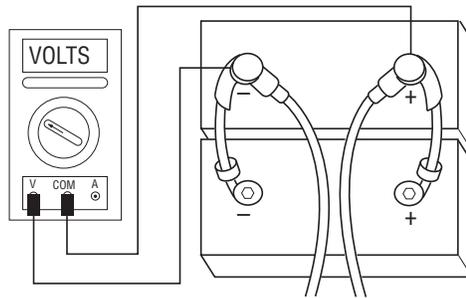
- Electric Shifter
- Range system
- Splitter system
- Input Shaft Speed Sensor
- Transmission Harness
- Shift Bar Housing
- Transmission ECU



Symptom Isolation Procedure

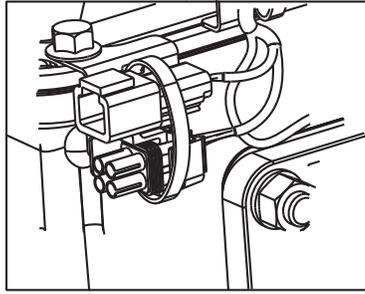
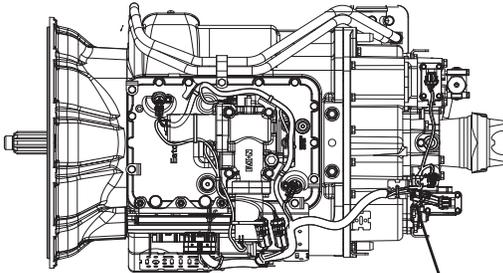
STEP A

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



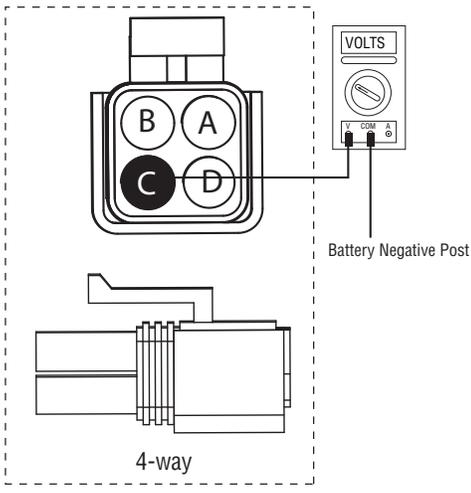
STEP B

Procedure	Condition	Action
1. Locate diagnostic port on Transmission Harness.		
2. Key on.		
3. Measure voltage between pins C and the battery negative post.	If voltage between pin C and battery negative post is 0.70 volts or less	Go to STEP C
	If voltage is outside of range	Repair battery ground supply to Transmission ECU. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

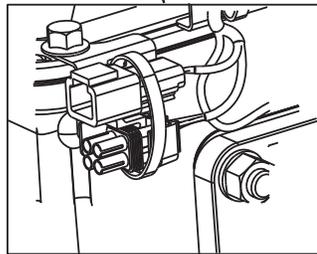
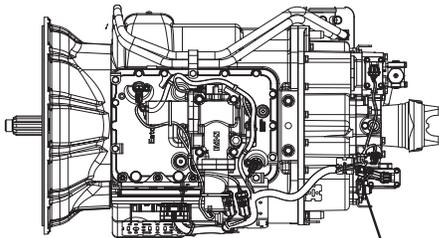
Warning! - Do Not Load Test at Diagnostic Port
4-Pin Diagnostics Port



- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

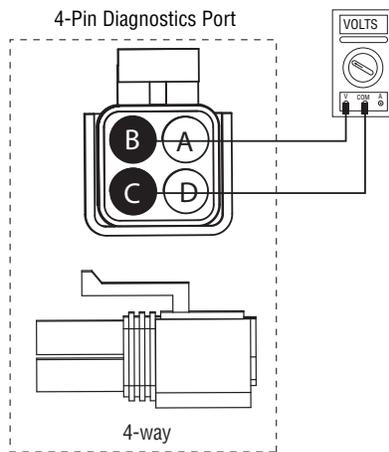
STEP C

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins B and pin C.		If voltage between pins B and C is within 0.6 volts of battery voltage If voltage is outside of range		Go to STEP D Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

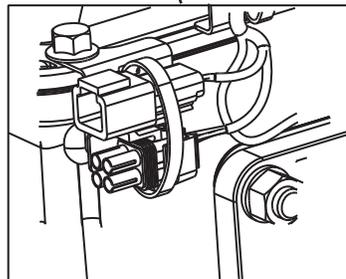
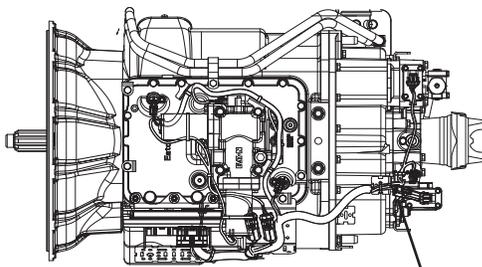
Warning! - Do Not Load Test at Diagnostic Port



- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

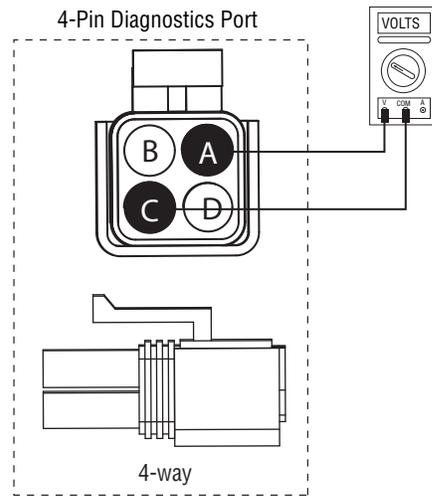
STEP D

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin A and pin C.		If voltage between pins A and C is within 0.6 volts of battery voltage		Go to STEP E
		If voltage is outside of range		Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port



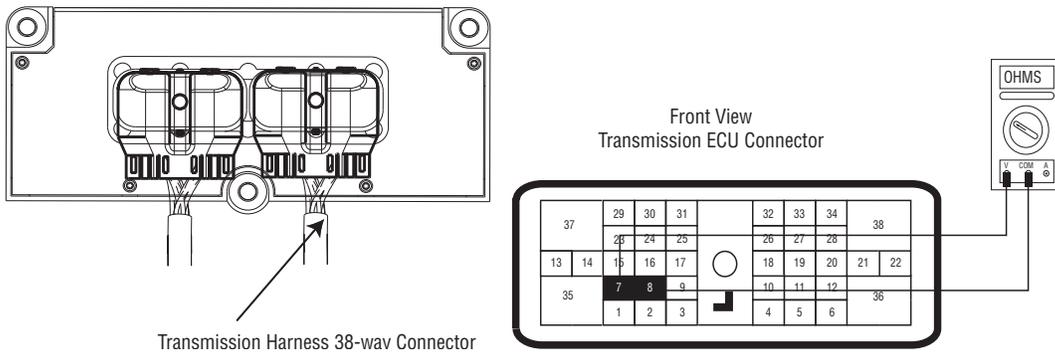
B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

STEP E

Procedure	→	Condition	→	Action
1. Connect PC based service tool and monitor input shaft speed with clutch pedal released.		If input shaft speed matches engine rpm		Go to STEP K
		If Input shaft speed reads 0		Go to STEP F

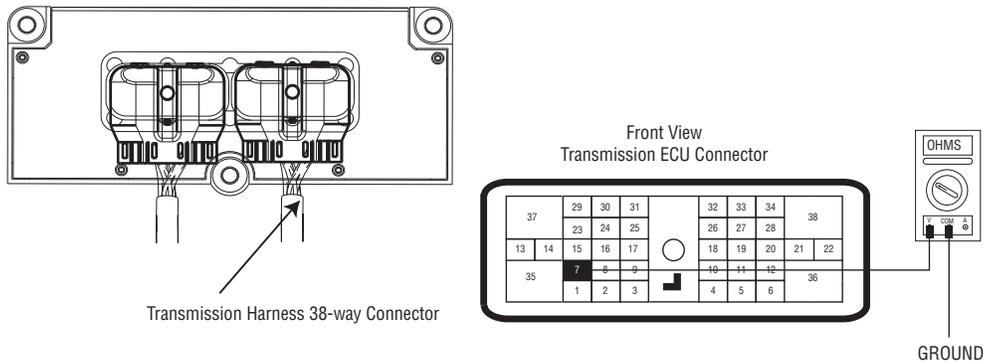
STEP F

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect the Transmission Harness 38-way connector.				
4. Measure the resistance between the Transmission Harness 38-way connector pins 7 and 8.		If resistance is 2K to 4.5K ohm		Go to STEP G
		If resistance is outside of range		Go to STEP I



STEP G

Procedure	Condition	Action
1. Measure resistance between the Transmission Harness 38-way connector pin 7 and ground.	If resistance is OL	Go to STEP H
	If resistance is less than 10K ohm	Go to STEP I

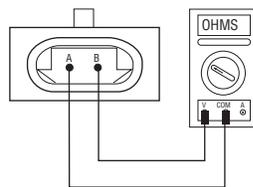


STEP H

Procedure	Condition	Action
1. Inspect Input Shaft Speed Sensor for contamination or damage.	If no problem found	Replace Transmission ECU. Go to STEP V
	If problem found or you were sent here from Step H or I	Replace Input Shaft Speed Sensor and inspect the upper countershaft PTO gear for damage. Go to STEP V

STEP I

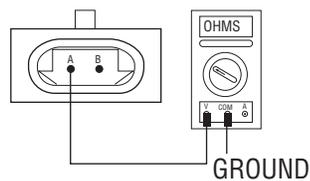
Procedure	Condition	Action
1. Disconnect the Transmission Harness from the Input Shaft Speed Sensor.		
2. Measure resistance between Input Shaft Speed Sensor pins A and B.	If resistance is 2K to 4.5K ohm	Go to STEP J
	If resistance is outside of range	Go to STEP H



3.

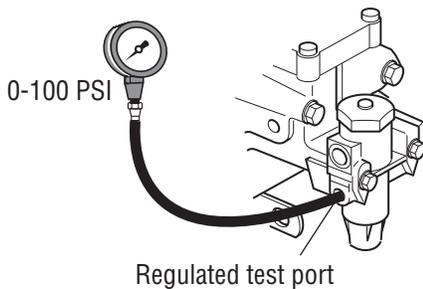
STEP J

Procedure	Condition	Action
1. Measure resistance between Input Shaft Speed Sensor pin A and ground.	If resistance is OL	Replace Transmission Harness. Go to STEP V
	If resistance is less than 10K ohm	Go to STEP H



STEP K

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



STEP L

Procedure	→	Condition	→	Action
1. Key off.				
2. Monitor the vehicle air pressure gauge on the dash.		If vehicle maintains air pressure		Go to STEP M
		If vehicle loses air pressure		Repair vehicle air system as required. Repeat test.

STEP M

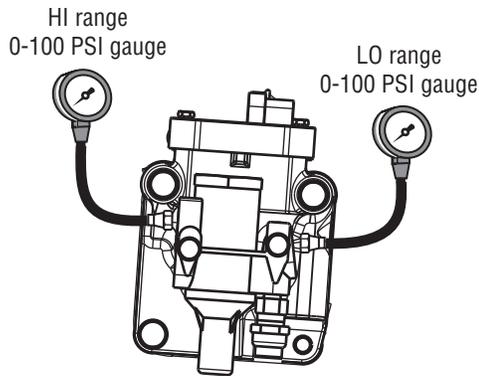
Procedure	Condition	Action
1. Read air pressure gauge installed at the regulated port.	If air pressure is 55 to 65 PSI	Go to STEP O
	If air pressure is outside of range	Go to STEP N

STEP N

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

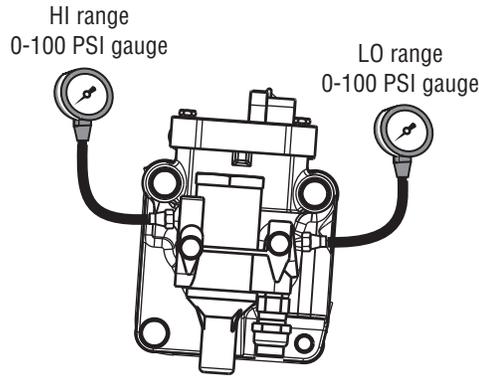
STEP O

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



STEP P

Procedure	→	Condition	→	Action
1. Key on.				
2. With the Shift Control, select the highest reverse gear available by pressing the upshift button/arrow, then select neutral.		If HIGH range gauge = 55 to 65 PSI and If LOW range gauge = 0 PSI		Go to STEP Q
		If both air pressure gauges do not read as listed above		Replace Range SOlenoid Valve and Range CYlinder Cover as required. Go to STEP V



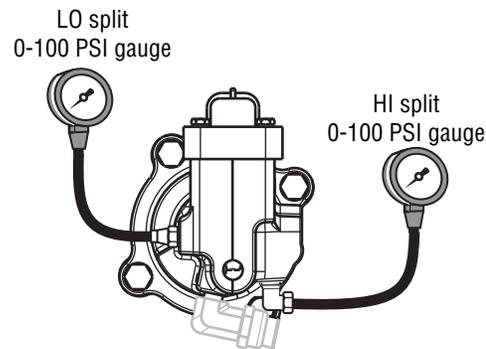
3.

STEP Q

Procedure	→	Condition	→	Action
1. Is the transmission equipped with a splitter system? (i.e. 18-Speed)		If the transmission is equipped with a splitter system If the transmission is not equipped with a splitter system		Go to STEP R Go to STEP V

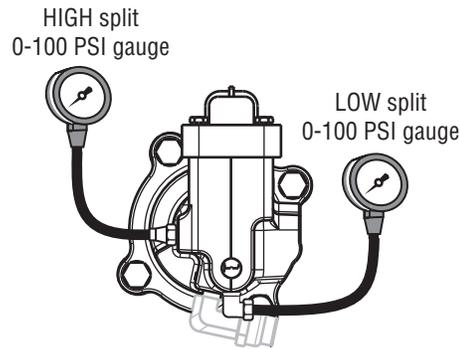
STEP R

Procedure	→	Condition	→	Action
1. Key off.				
2. Start vehicle and allow air pressure to build to governor cut-off.				
3. Turn off engine, but leave key in "ON" position.				
4. With Shift Control, select reverse (R1 in gear display for 13/18-speed), then select neutral		If HIGH Splitter gauge = 55 to 65 PSI and if LOW Splitter gauge = 0 PSI Note: Five minutes is allowed for checking the pressure after moving the Shift Lever to neutral.		Go to STEP S
		If air pressure gauges do not read as shown above		Replace SPlitter Solenoid Valve and Splitter Cylinder Cover as required. Go to STEP V



STEP S

Procedure	→	Condition	→	Action
1. Key on.				
2. With Shift Control, select reverse (R2 in the gear display 13/18-speed). Note: If R2 isn't displayed the up arrow button needs to be pressed.		If LOW Splitter gauge =55 to 65 PSI and if HIGH Splitter gauge = 0 PSI If air pressure gauges do not read as shown above		Go to STEP V Replace Splitter Solenoid Valve and Splitter Cylinder Cover as required. Go to STEP V



STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Remove all pressure gauges.				
3. Reconnect all connectors.				
4. Key on.				
5. Drive the vehicle to determine whether the complaint has been repaired.		If the transmission shifts normal If the transmission still has a shifting complaint		Test complete. To find error in testing, return to STEP A

Heavy-Duty UltraShift Plus Shift Complaint

Test

Overview

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

Detection

There is no detection other than a driver complaint.

Fallback

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

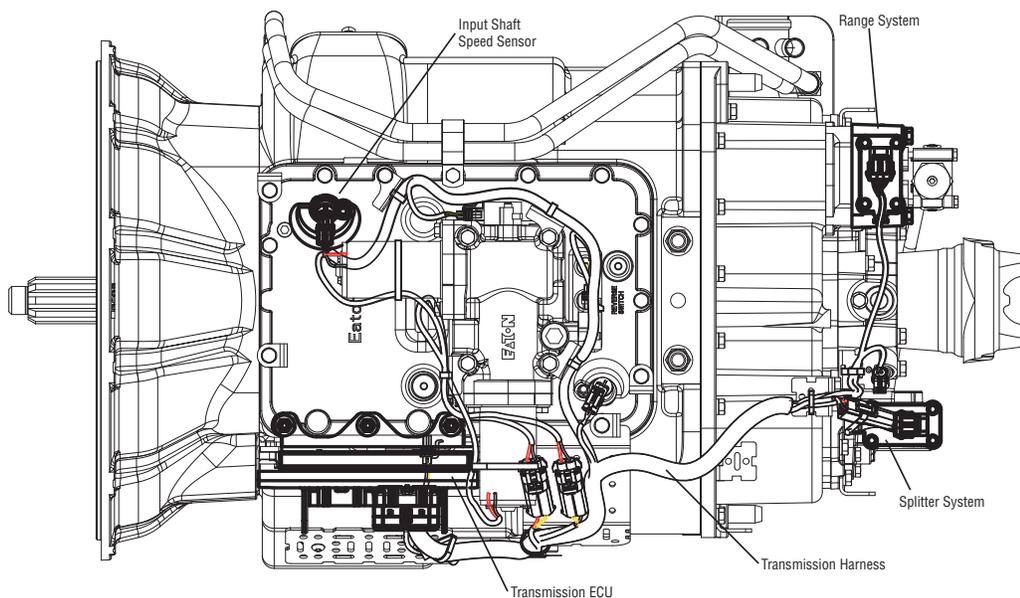
Required Tools

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

Possible Causes

This symptom can be caused by any of the following:

- Inertia Brake
- Input Shaft Speed Sensor
- Transmission ECU
- Transmission Harness
- Range System
- Splitter System

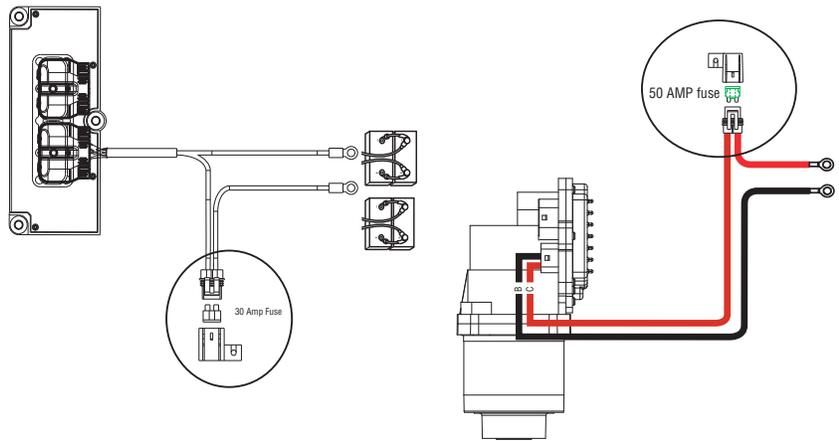


System Isolation Procedure

STEP A

Procedure	→	Condition	→	Action
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1. Key off.
2. Remove and clean all battery and battery to frame connections.
3. Remove and clean ground supply to engine ECU.
4. Inspect starter/battery and in-line 30 amp fuse holder connections for corrosion or damaged contacts. Also inspect the 50 amp fuse holder on vehicles equipped with an Electronic Clutch Actuator (ECA.)



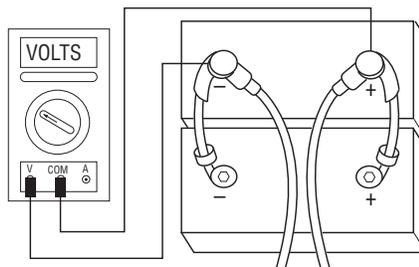
5. Measure voltage across batteries.

If voltage is 11 to 13 volts on a 12 volt system or 22 to 26 on a 24 volt system

Proceed with battery load test. Repair or replace batteries as required. Go to **STEP B**

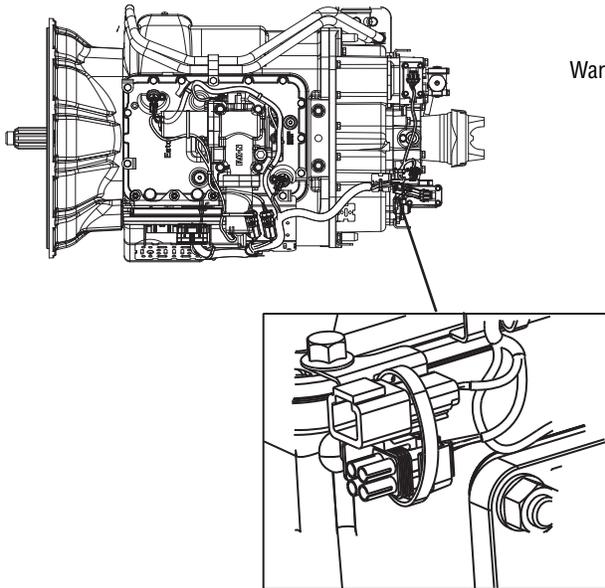
If voltage is outside of range

Repair or replace batteries and charging system as required. Repeat this step.



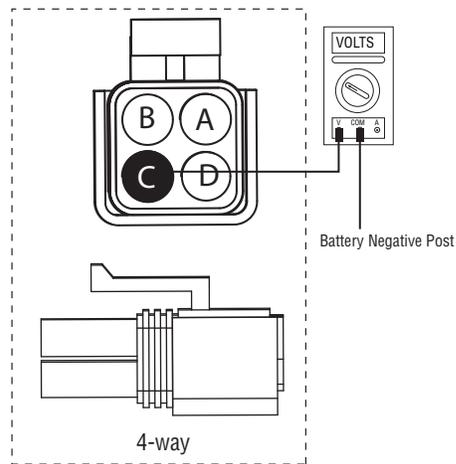
STEP B

Procedure	Condition	Action
1. Locate diagnostic port on Transmission Harness.		
2. Key on.		
3. Measure voltage between pins C and the battery negative post.	If voltage between pin C and battery negative post is 0.70 volts or less	Go to STEP C
	If voltage is outside of range	Repair battery ground supply to Transmission ECU. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

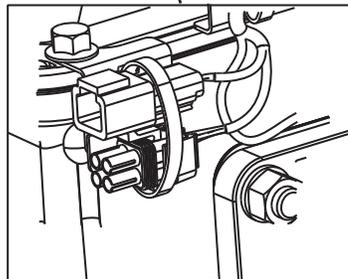
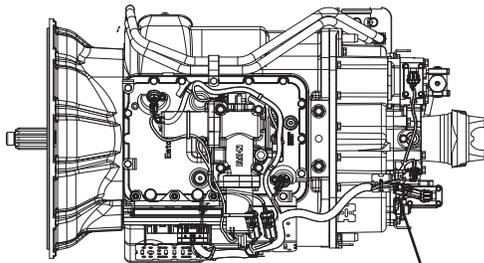
Warning! - Do Not Load Test at Diagnostic Port
4-Pin Diagnostics Port



- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

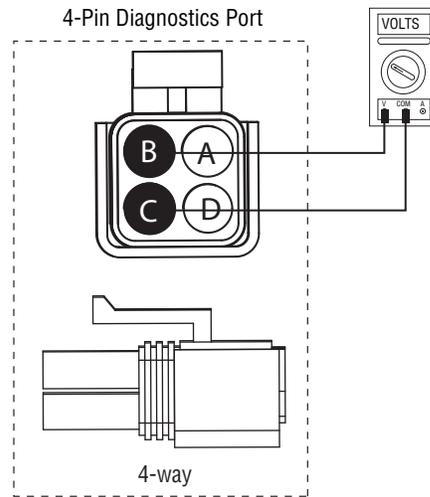
STEP C

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins B and pin C.		If voltage between pins B and C is within 0.6 volts of battery voltage If voltage is outside of range		Go to STEP D Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

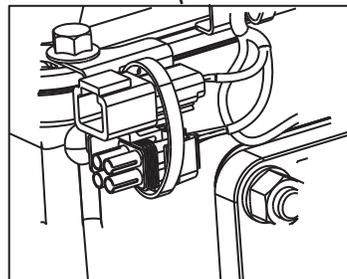
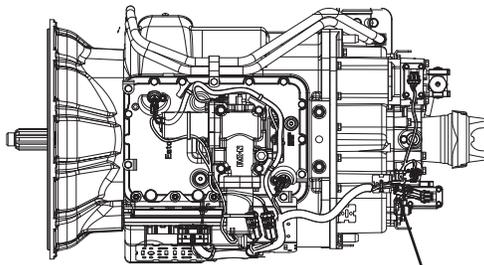
Warning! - Do Not Load Test at Diagnostic Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

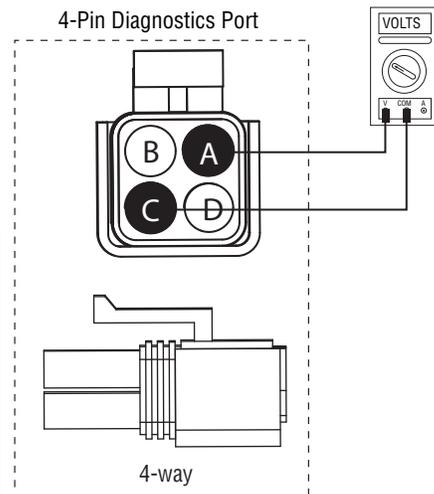
STEP D

Procedure	Condition	Action
1. Key on.		
2. Measure voltage between pin A and pin C.	If voltage between pins A and C is within 0.6 volts of battery voltage	Go to STEP E
	If voltage is outside of range	Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

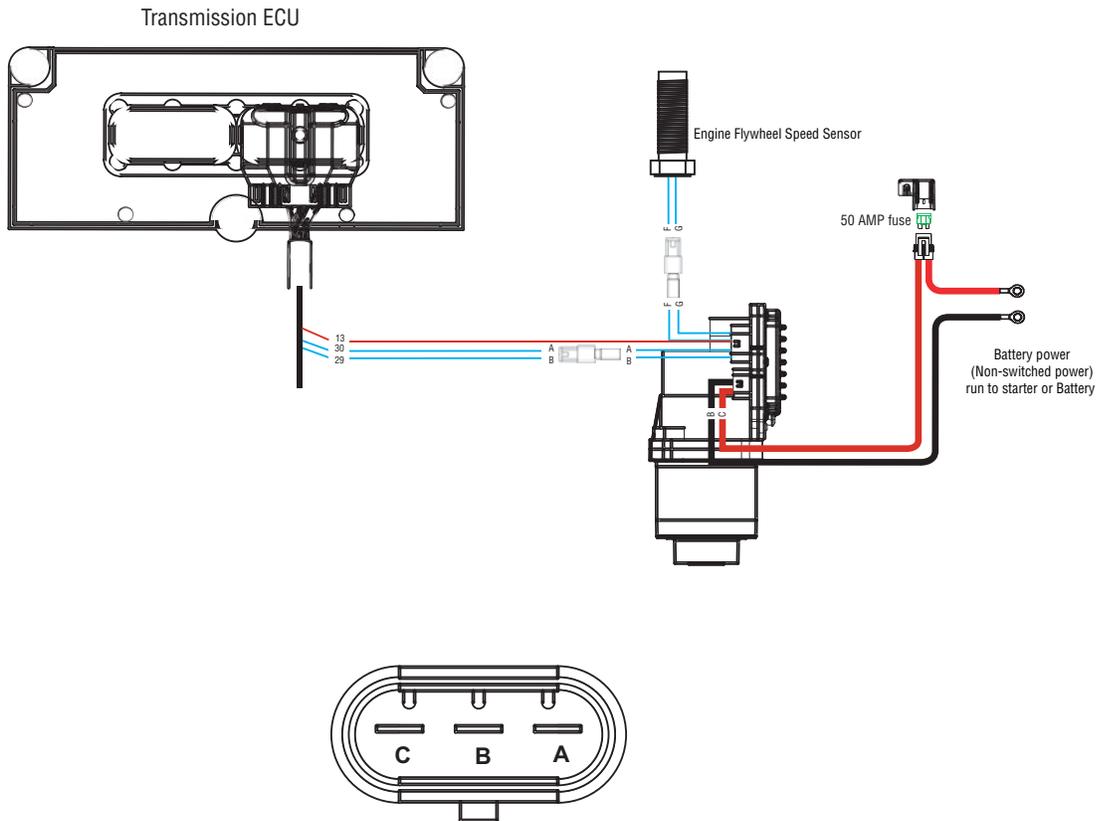
Warning! - Do Not Load Test at Diagnostic Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

STEP E

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect battery negative.				
3. Disconnect ECA 3-way connector.				
4. Reconnect battery negative.				
5. Measure voltage between pin B and pin C of 3-way connector.		If voltage between pin B and pin C of 3-way connector is within 0.6 volts of battery voltage		Go to STEP F
		If voltage is outside of range		Repair battery power supply to ECA. Fuse may be blown. Repeat test.



STEP F

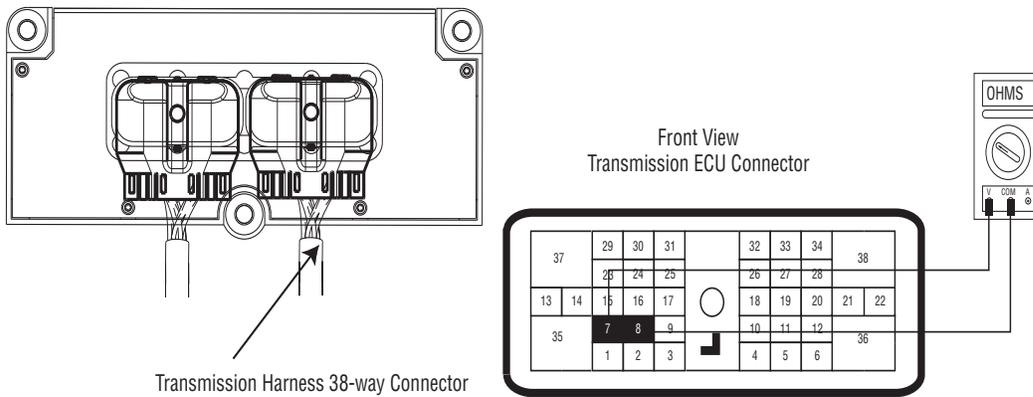
Procedure	→	Condition	→	Action
1. Key on.				
2. Connect ServiceRanger, select "Advanced Product Function".				
3. Start Engine.				
4. Select "LCIB Deceleration Test".				
5. Run test and follow instructions.		Test passes (5 consecutive tests pass)		Go to STEP G
		Test Fails (5 consecutive tests fail)		Follow the System Code 45 Isolation Procedures

STEP G

Procedure	→	Condition	→	Action
1. At idle, compare engine rpm to input shaft rpm with ServiceRanger.		If input shaft speed matches engine rpm		Go to STEP M
		If Input shaft speed reads 0		Go to STEP H

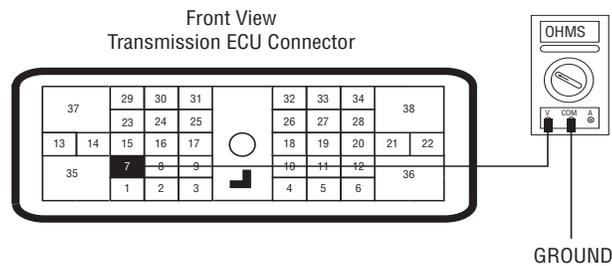
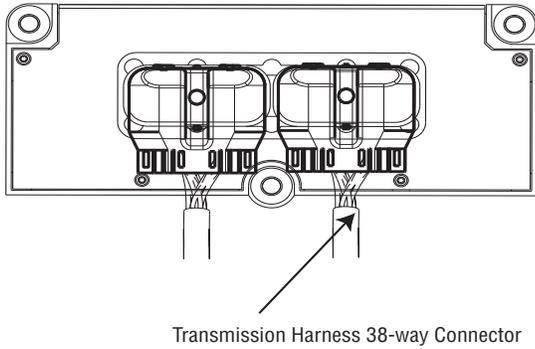
STEP H

Procedure	Condition	Action
1. Key off.		
2. Disconnect negative battery cable.		
3. Disconnect the Transmission Harness 38-way connector.		
4. Measure the resistance between the Transmission Harness 38-way connector pins 7 and 8.	If resistance is 2K to 4.5K ohm	Go to STEP I
	If resistance is outside of range	Go to STEP K



STEP I

Procedure	Condition	Action
Measure resistance between the Transmission Harness 38-way connector pin 7 and ground.	If resistance is OL	Go to STEP J
	If resistance is less than 10K ohm	Go to STEP K

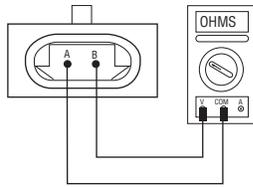


STEP J

Procedure	Condition	Action
1. Inspect Input Shaft Speed Sensor for contamination or damage.	If no problem found	Go to STEP M
	If problem found or you were sent here from Step K or L	Replace Input Shaft Speed Sensor and inspect the upper countershaft PTO gear for damage. Go to STEP V

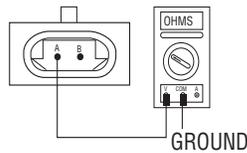
STEP K

Procedure	→	Condition	→	Action
1. Disconnect the Transmission Harness from the Input Shaft Speed Sensor.				
2. Measure resistance between Input Shaft Speed Sensor pins A and B.		If resistance is 2K to 4.5K ohm		Go to STEP L
		If resistance is outside of range		Go to STEP J



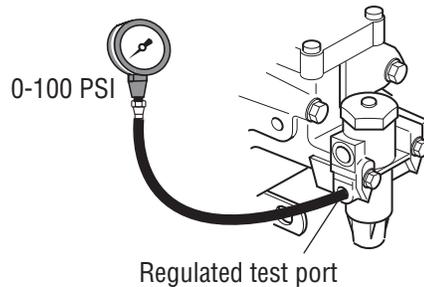
STEP L

Procedure	→	Condition	→	Action
1. Measure resistance between Input Shaft Speed Sensor pin A and ground.		If resistance is OL		Replace Transmission Harness. Go to STEP V
		If resistance is less than 10K ohm		Go to STEP J



STEP M

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



STEP N

Procedure	→	Condition	→	Action
1. Key off.				
2. Monitor the vehicle air pressure gauge on the dash.		If vehicle maintains air pressure		Go to STEP O
		If vehicle loses air pressure		Repair vehicle air system as required. Repeat test.

STEP O

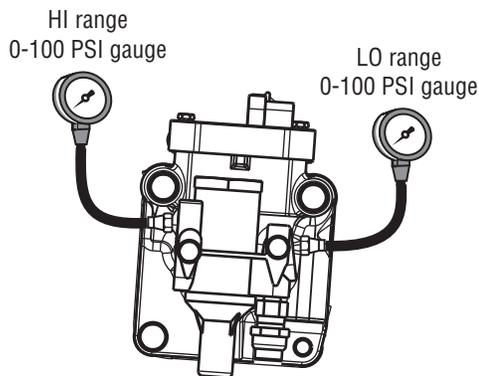
Procedure	→	Condition	→	Action
1. Read air pressure gauge installed at the regulated port.		If air pressure is 55 to 65 PSI		Go to STEP Q
		If air pressure is outside of range		Go to STEP P

STEP P

Procedure	→	Condition	→	Action
1. Remove air supply line to the air filter /regulator and check airflow.		If air flows from the supply line		Repair Filter/Regulator. Go to STEP L
		If air does not flow from the supply line		Repair vehicle air supply to the regulator. Go to STEP L

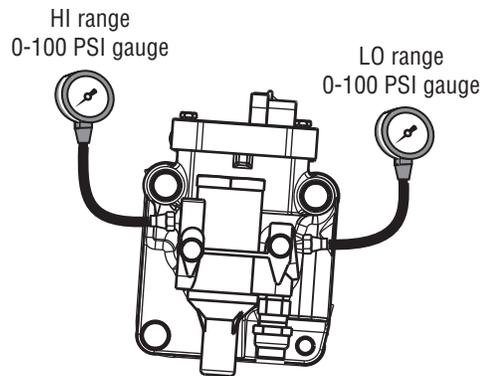
STEP Q

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



STEP R

Procedure	→ Condition	→ Action
1. Key on.		
2. With the Shift Control, select the highest reverse gear available by pressing the upshift button/arrow, then select neutral.	If HIGH range gauge = 55 to 65 PSI and If LOW range gauge = 0 PSI If both air pressure gauges do not read as listed above	Go to STEP S Replace Range Solenoid Valve and Range Cylinder Cover as required. Go to STEP V

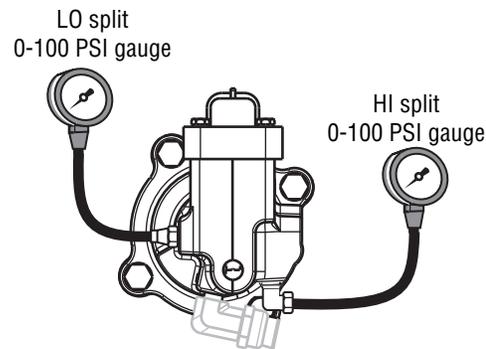


STEP S

Procedure	→ Condition	→ Action
1. Is the transmission equipped with a splitter system? (i.e. 13-Speed)	If the transmission is equipped with a splitter system If the transmission is not equipped with a splitter system	Go to STEP T Go to STEP V

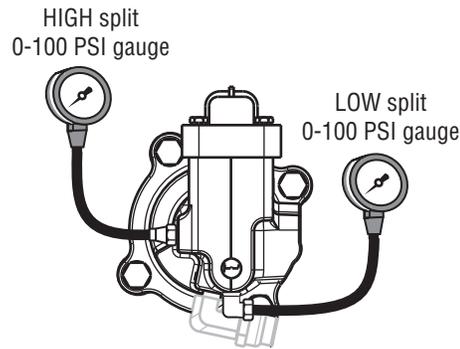
STEP T

Procedure	→	Condition	→	Action
1. Key off.				
2. Start vehicle and allow air pressure to build to governor cut-off.				
3. Turn off engine, but leave key in "ON" position.				
4. With Shift Control, select reverse (R1 in gear display for 13/18-speed), then select neutral		If HIGH Splitter gauge = 55 to 65 PSI and if LOW Splitter gauge = 0 PSI Note: Five minutes is allowed for checking the pressure after moving the Shift Lever to neutral.		Go to STEP U
		If air pressure gauges do not read as shown above		Replace Splitter Solenoid Valve and Splitter Cylinder Cover as required. Go to STEP V



STEP U

Procedure	→	Condition	→	Action
1. Key on.				
2. With Shift Control, select reverse (R2 in the gear display 13/18-speed).		If LOW Splitter gauge =55 to 65 PSI and if HIGH Splitter gauge = 0 PSI		Go to STEP V
Note: If R2 isn't displayed the up arrow button needs to be pressed.		If air pressure gauges do not read as shown above		Replace Splitter Solenoid Valve and Splitter Cylinder Cover as required. Go to STEP V



STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Remove all pressure gauges.				
3. Reconnect all connectors.				
4. Key on.				
5. Drive the vehicle to determine whether the complaint has been repaired.		If the transmission shifts normal		Test complete.
		If the transmission still has a shifting complaint		To find error in testing, return to STEP A

UltraShift DM3 Shift Complaint Test

Overview

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

Detection

There is no detection other than a driver complaint.

Fallback

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

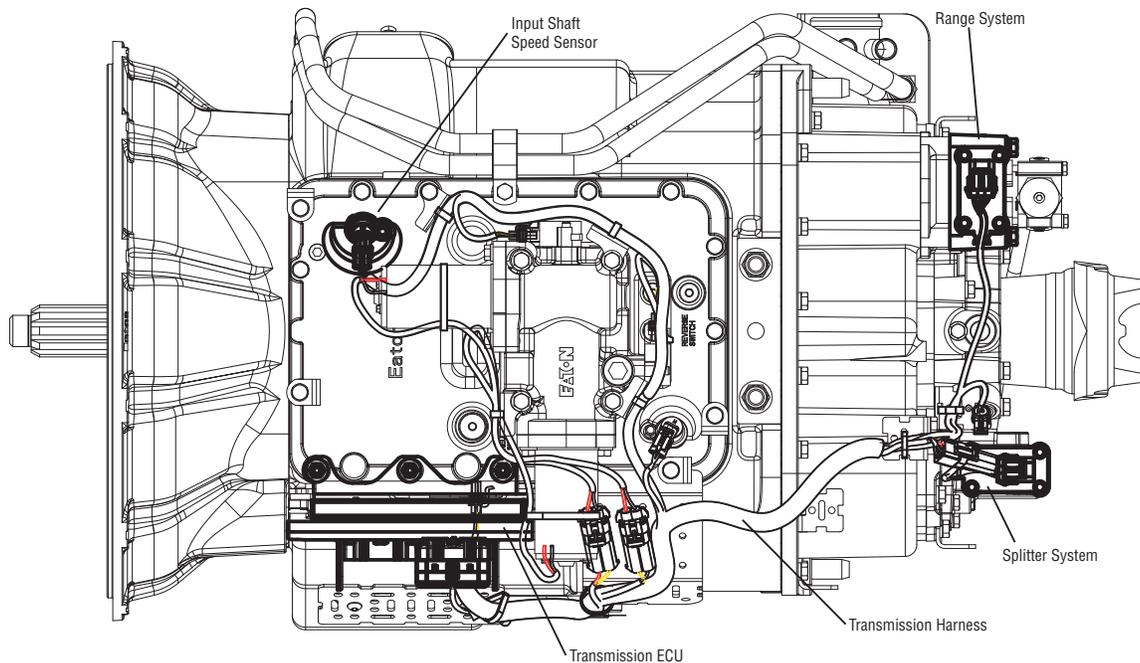
Required Tools

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

Possible Causes

This symptom can be caused by any of the following:

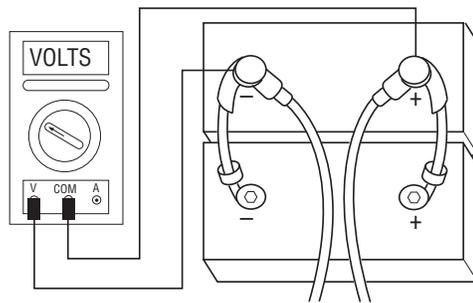
- Inertia Brake
- Input Shaft Speed Sensor
- Transmission ECU
- Transmission Harness
- Range System
- Splitter System



Symptom Isolation Procedure

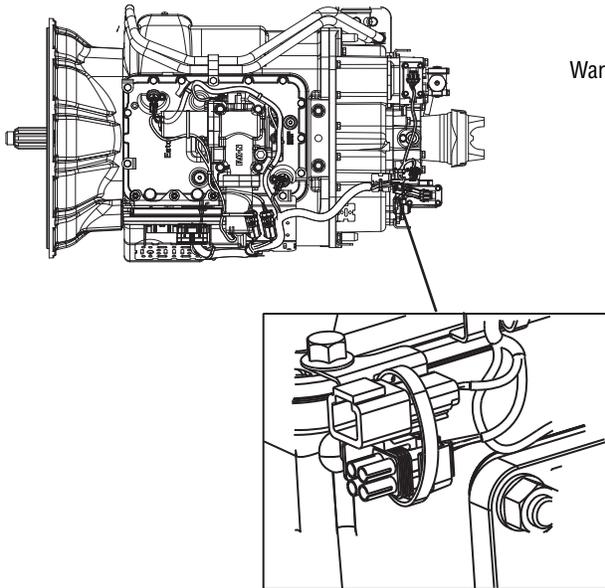
STEP A

Procedure	Condition	Action
1. Key off.		
2. Inspect starter/battery and in-line fuse holder connections for integrity.		
3. Measure voltage across batteries.	If voltage is 11 to 13 volts on a 12 volt system or 22 to 26 on a 24 volt system	Proceed with battery load test. Repair or replace batteries as required. Go to STEP B
	If voltage is outside of range	Repair or replace batteries and charging system as required. Repeat test.



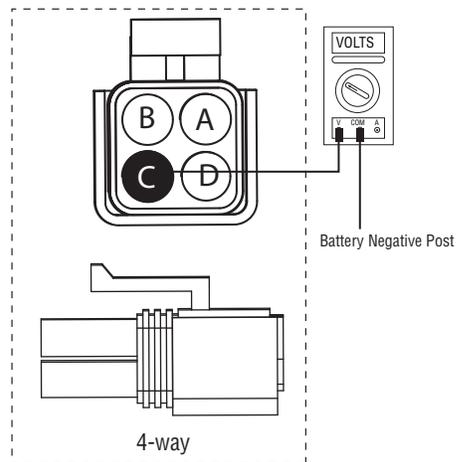
STEP B

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins C and the battery negative post.		If voltage between pin C and battery negative post is 0.70 volts or less		Go to STEP C
		If voltage is outside of range		Repair battery ground supply to Transmission ECU. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

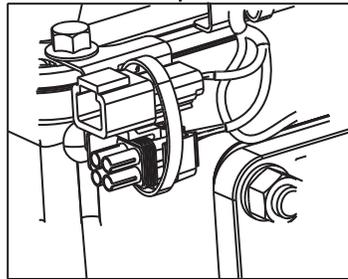
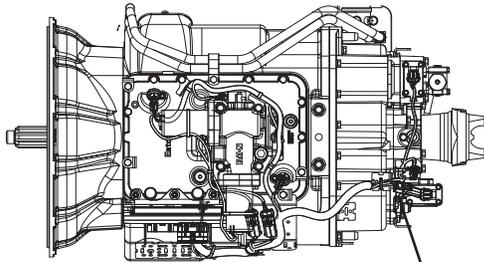
Warning! - Do Not Load Test at Diagnostic Port
4-Pin Diagnostics Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

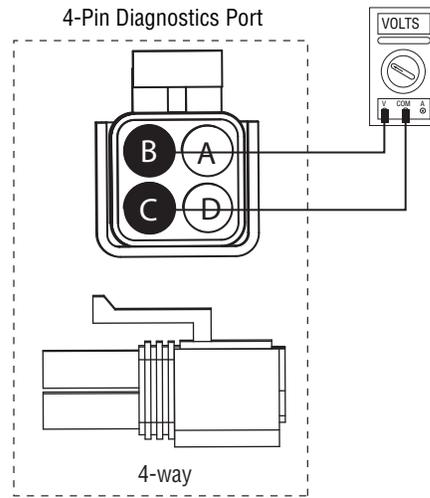
STEP C

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins B and pin C.		If voltage between pins B and C is within 0.6 volts of battery voltage		Go to STEP D
		If voltage is outside of range		Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

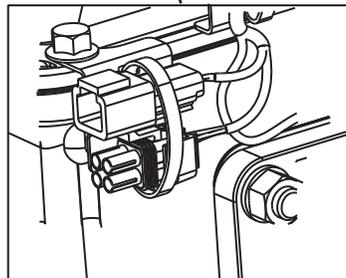
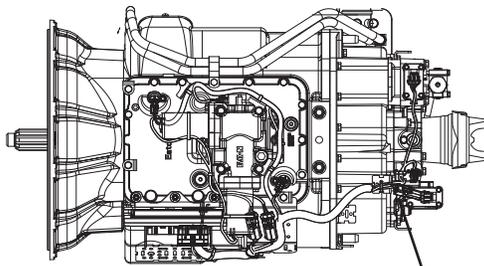
Warning! - Do Not Load Test at Diagnostic Port



- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

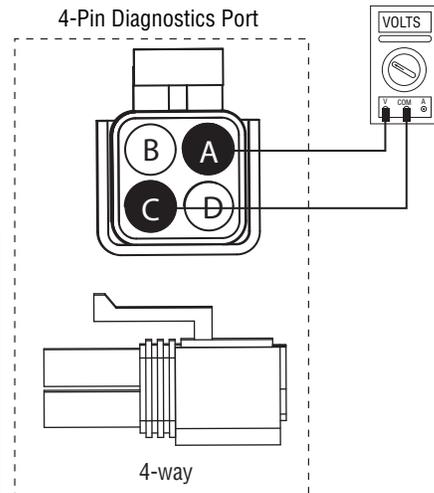
STEP D

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin A and pin C.		If voltage between pins A and C is within 0.6 volts of battery voltage If voltage is outside of range		Go to STEP E Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port



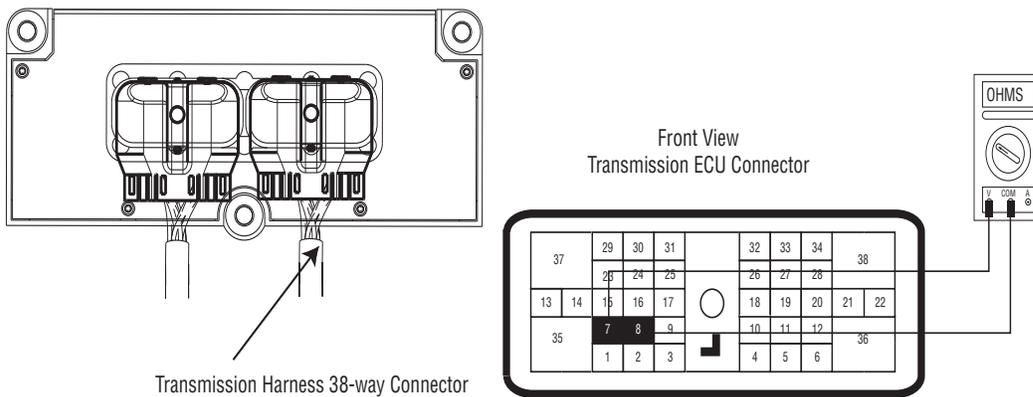
- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

STEP E

Procedure	→	Condition	→	Action
Note: Engine rpm must remain above 1000 rpm during the following test.				
1. Compare engine rpm to input shaft rpm with ServiceRanger.		If input shaft speed matches engine rpm		Go to STEP K
		If Input shaft speed reads 0		Go to STEP F

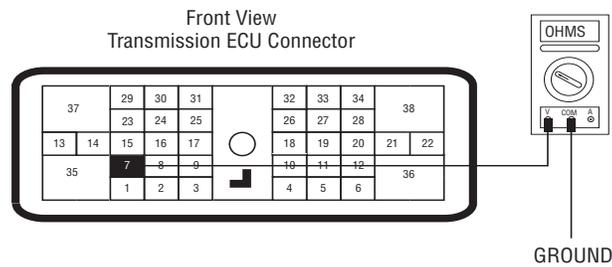
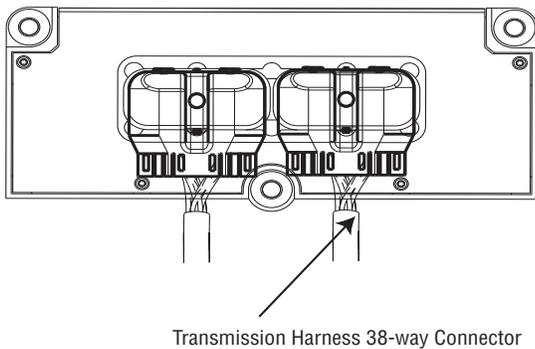
STEP F

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect negative battery cable.				
3. Disconnect the Transmission Harness 38-way connector.				
4. Measure the resistance between the Transmission Harness 38-way connector pins 7 and 8.		If resistance is 2K to 4.5K ohm		Go to STEP G
		If resistance is outside of range		Go to STEP I



STEP G

Procedure	Condition	Action
1. Measure resistance between the Transmission Harness 38-way connector pin 7 and ground.	If resistance is OL	Go to STEP H
	If resistance is less than 10K ohm	Go to STEP I

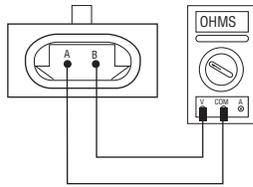


STEP H

Procedure	Condition	Action
1. Inspect Input Shaft Speed Sensor for contamination or damage.	If no problem found	Replace Transmission ECU Go to STEP V
	If problem found or you were sent here from STEP I or STEP J	Replace Input Shaft Speed Sensor and inspect the upper countershaft PTO gear for damage. Go to STEP V

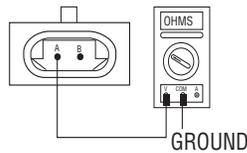
STEP I

Procedure	→	Condition	→	Action
1. Disconnect the Transmission Harness from the Input Shaft Speed Sensor.				
2. Measure resistance between Input Shaft Speed Sensor pins A and B.		If resistance is 2K to 4.5K ohm		Go to STEP J
		If resistance is outside of range		Go to STEP H



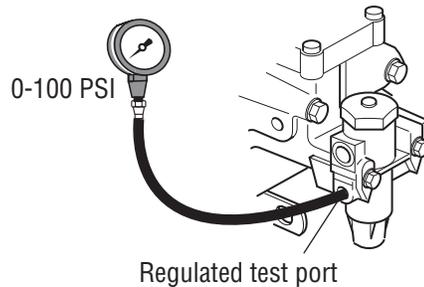
STEP J

Procedure	→	Condition	→	Action
1. Measure resistance between Input Shaft Speed Sensor pin A and ground.		If resistance is OL		Replace Transmission Harness Go to STEP V
		If resistance is less than 10K ohm		Go to STEP H



STEP K

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



STEP L

Procedure	→	Condition	→	Action
1. Key off.				
2. Monitor the vehicle air pressure gauge on the dash.		If vehicle maintains air pressure		Go to STEP M
		If vehicle loses air pressure		Repair vehicle air system as required. Repeat test.

STEP M

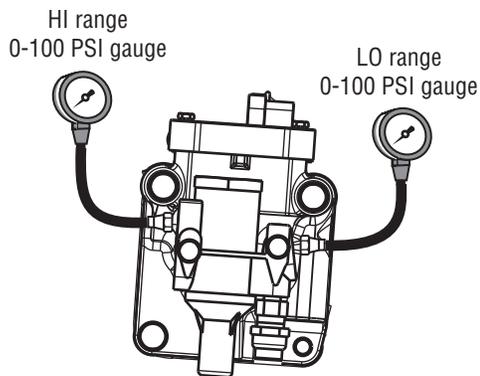
Procedure	Condition	Action
1. Read air pressure gauge installed at the regulated port.	If air pressure is 55 to 65 PSI	Go to STEP O
	If air pressure is outside of range	Go to STEP N

STEP N

Procedure	Condition	Action
1. Remove air supply line to the air filter /regulator and check airflow.	If air flows from the supply line	Repair Air Filer / Regulator
	If air does not flow from the supply line	Repair vehicle air supply to the regulator. Go to STEP J

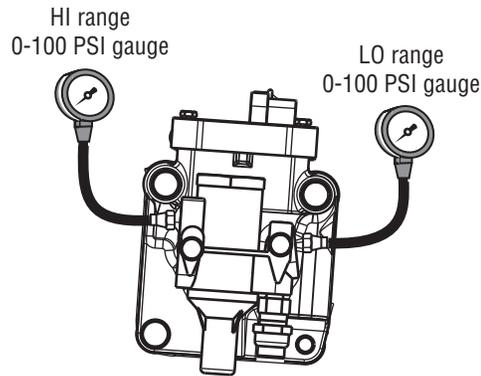
STEP O

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



STEP P

Procedure	→	Condition	→	Action
1. Key on.				
2. With the Shift Control, select the highest reverse gear available by pressing the upshift button/arrow, then select neutral.		If HIGH range gauge = 55 to 65 PSI and If LOW range gauge = 0 PSI		Go to STEP Q
		If both air pressure gauges do not read as listed above		Replace Range Solenoid Valve and Range Cylinder cover as required. Go to STEP V



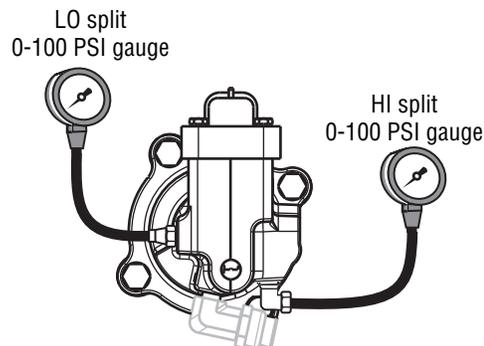
3.

STEP Q

Procedure	→	Condition	→	Action
1. Is the transmission equipped with a splitter system? (i.e. 13-Speed)		If the transmission is equipped with a splitter system		Go to STEP R
		If the transmission is not equipped with a splitter system		Go to STEP V

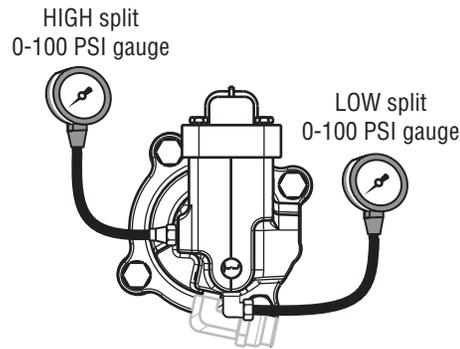
STEP R

Procedure	→	Condition	→	Action
<ol style="list-style-type: none"> 1. Key off. 2. Start vehicle and allow air pressure to build to governor cut-off. 3. Turn off engine, but leave key in "ON" position. 4. With Shift Control, select reverse (R1 in gear display for 13/18-speed), then select neutral. 		<p>If HIGH Splitter gauge = 55 to 65 PSI and if LOW Splitter gauge = 0 PSI</p> <p>Note: Five minutes is allowed for checking the pressure after moving the Shift Lever to neutral.</p> <p>If air pressure gauges do not read as shown above</p>		<p>Go to STEP S</p> <p>Replace Splitter Solenoid Valve and Splitter Cylinder Cover as required. Go to STEP V</p>



STEP S

Procedure	→	Condition	→	Action
1. Key on.				
2. With Shift Control, select reverse (R2 in the gear display 13/18-speed). Note: If R2 isn't displayed the up arrow button needs to be pressed.		If LOW Splitter gauge =55 to 65 PSI and if HIGH Splitter gauge = 0 PSI If air pressure gauges do not read as shown above		Go to STEP V Replace Splitter Solenoid Valve and Splitter Cylinder Cover as required. Go to STEP V



STEP V

Procedure	→	Condition	→	Action
1. Key off.				
2. Remove all pressure gauges.				
3. Reconnect all connectors.				
4. Key on.				
5. Drive the vehicle to determine whether the complaint has been repaired.		If the transmission shifts normal If the transmission still has a shifting complaint		Test complete. To find error in testing, return to STEP A

UltraShift AW3 Shift Complaint Test

Overview

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

Detection

There is no detection other than a driver complaint.

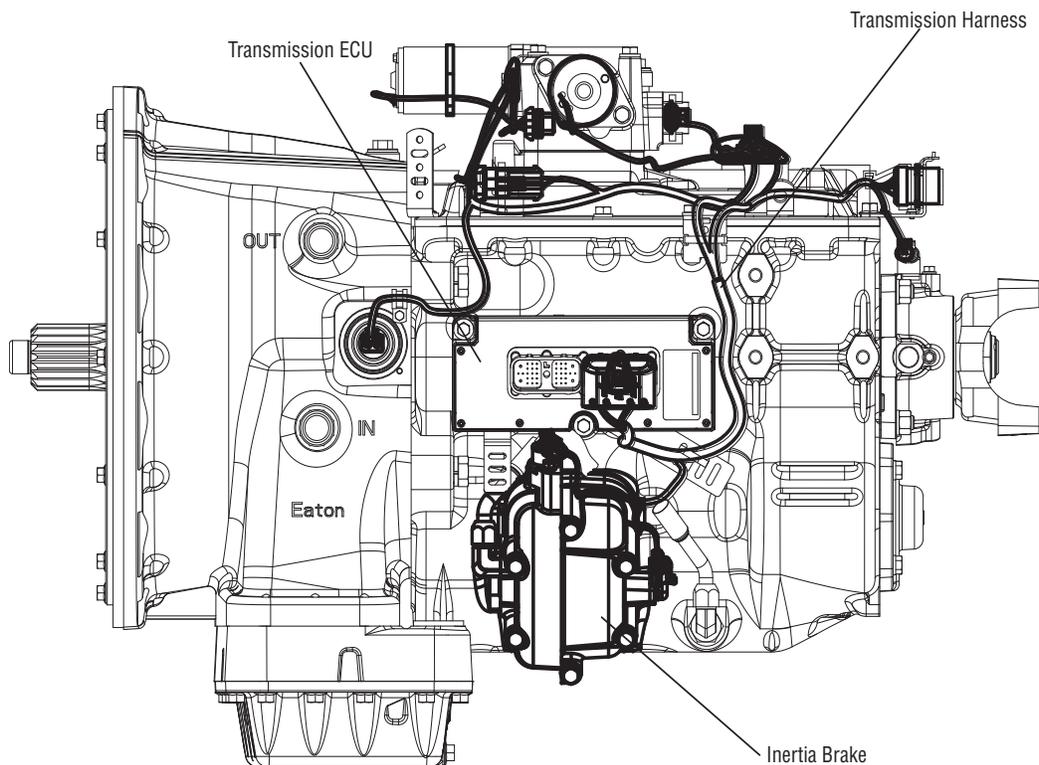
Fallback

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

Possible Causes

This symptom can be caused by any of the following:

- Basic Hand Tools
- Eaton Test Adapter Kit
- ServiceRanger a PC-based Service Tool
- Troubleshooting Guide
- Low Fluid Level
- Inertia Brake
- Input Shaft Speed Sensor
- Transmission ECU
- Transmission Harness



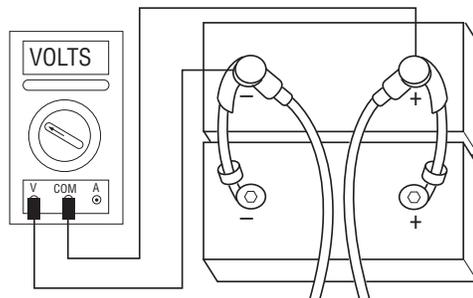
Symptom Isolation Procedures

STEP A

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

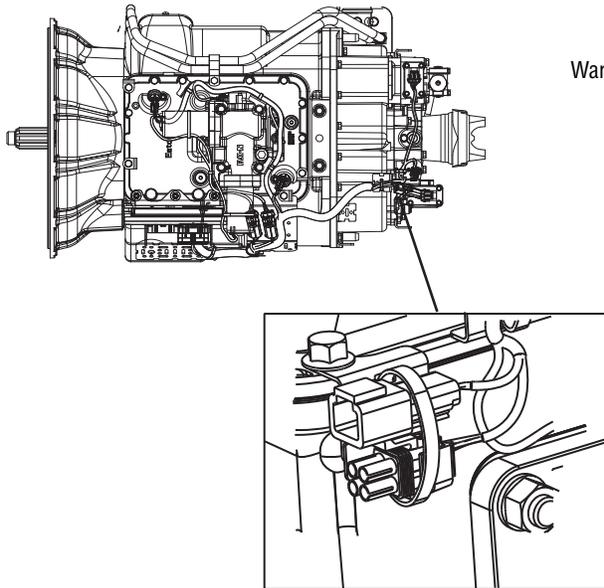
STEP B

Procedure	Condition	Action
1. Key off.		
2. Inspect starter/battery and inline fuse holder connections for integrity.		
3. Measure voltage across batteries.	If voltage is 11 to 13 volts on a 12 volt system or 22 to 26 on a 24 volt system	Proceed with battery load test. Repair or replace batteries as required. Go to STEP C
	If voltage is outside of range	Repair or replace batteries and charging system as required. Repeat test.



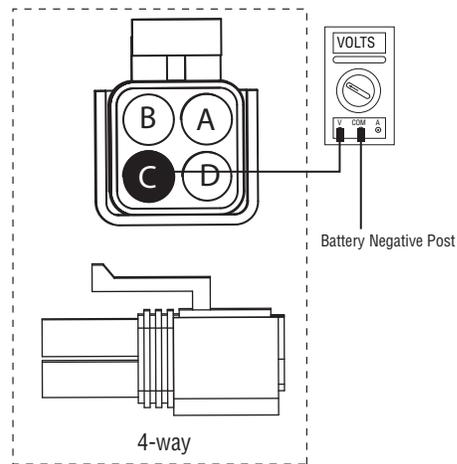
STEP C

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins C and the battery negative post.		If voltage between pin C and battery negative post is 0.70 volts or less		Go to STEP D
		If voltage is outside of range		Repair battery ground supply to Transmission ECU. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

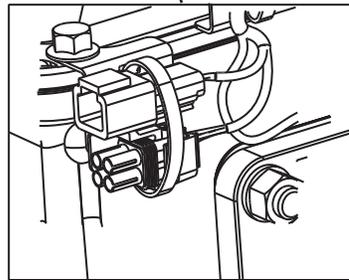
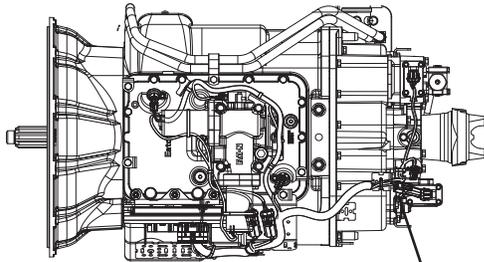
Warning! - Do Not Load Test at Diagnostic Port
4-Pin Diagnostics Port



- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

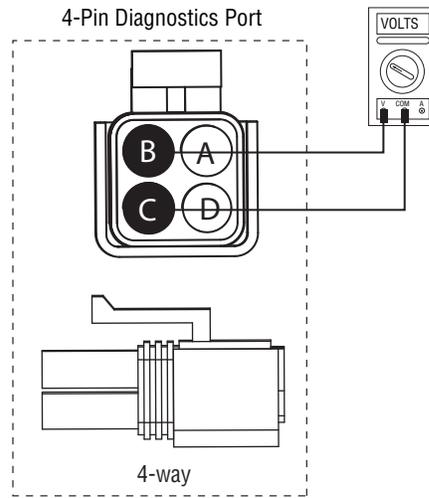
STEP D

Procedure	→	Condition	→	Action
1. Locate diagnostic port on Transmission Harness.				
2. Key on.				
3. Measure voltage between pins B and pin C.		If voltage between pins B and C is within 0.6 volts of battery voltage		Go to STEP E
		If voltage is outside of range		Repair battery power supply to Transmission ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

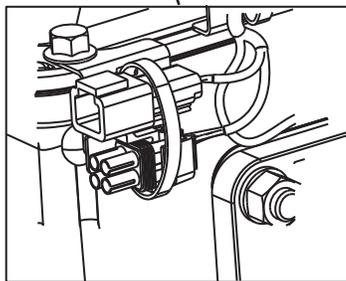
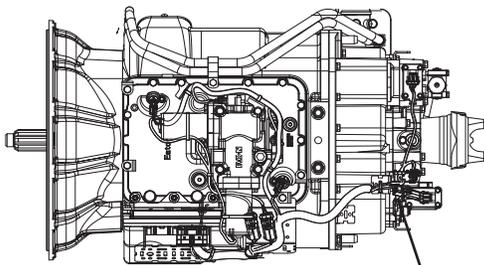
Warning! - Do Not Load Test at Diagnostic Port



- B - Service Bat. +
- C - Service Bat. -
- A - Service Ignition +

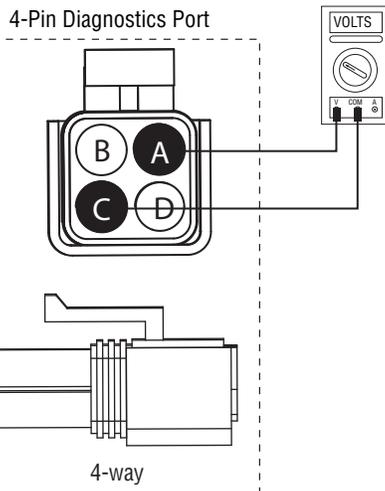
STEP E

Procedure	→	Condition	→	Action
1. Key on.				
2. Measure voltage between pin A and pin C.		If voltage between pins A and C is within 0.6 volts of battery voltage		Go to STEP F
		If voltage is outside of range		Repair Ignition power supply to ECU. Fuse may be blown. Repeat test.



4-Pin Diagnostic Port
(Located at the left rear corner of the transmission.)

Warning! - Do Not Load Test at Diagnostic Port



B - Service Bat. +
C - Service Bat. -
A - Service Ignition +

STEP F

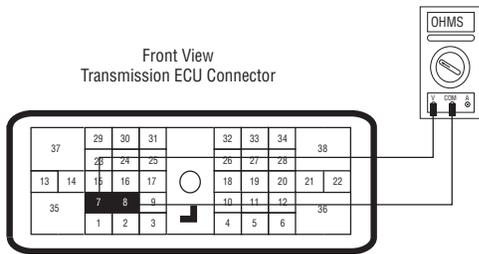
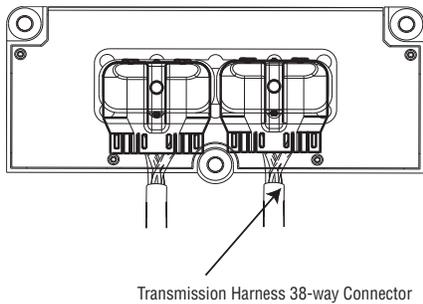
Procedure	→	Condition	→	Action
1. Key on.				
2. Connect ServiceRanger, select "Advanced Product Function".				
3. Start Engine, PTO must be disengaged.				
4. Select "Inertia Brake Test".				
5. Run test and follow instructions.		Test Passes		Go to STEP G
		Test Fails		Replace Inertia Brake Go to STEP V
		Test Aborts		Correct displayed test failure condition and retest.

STEP G

Procedure	→	Condition	→	Action
1. Drive vehicle and monitor engine rpm and input shaft rpm with ServiceRanger		If engine rpm and input shaft rpm match during the test drive		Test complete.
		If input shaft rpm is erratic or reads zero		Go to STEP H

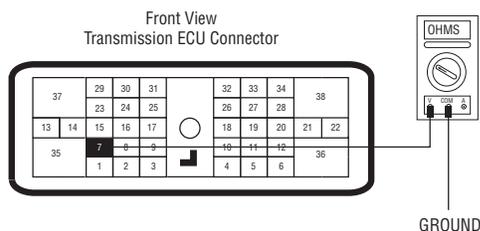
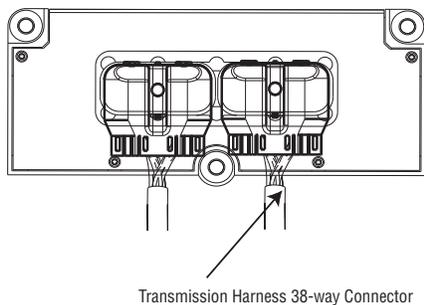
STEP H

Procedure	Condition	Action
1. Key off.		
2. Disconnect negative battery cable.		
3. Disconnect the Transmission Harness 38-way connector.		
4. Measure the resistance between the Transmission Harness 38-way connector pins 7 and 8.	If resistance is 2K to 4.5K ohm	Go to STEP I
	If resistance is outside of range	Go to STEP J



STEP I

Procedure	Condition	Action
1. Measure resistance between the Transmission Harness 38-way connector pin 7 and ground.	If resistance is OL	Go to STEP J
	If resistance is less than 10K ohm	Go to STEP K

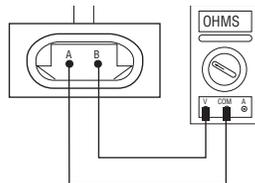


STEP J

Procedure	→ Condition	→ Action
1. Inspect Input Shaft Speed Sensor for contamination or damage.	If no problem found	Replace Transmission ECU Go to STEP V
	If problem found or you were sent here from Step J or K	Replace Input Shaft Speed Sensor and inspect the upper countershaft PTO gear for damage. Go to STEP V

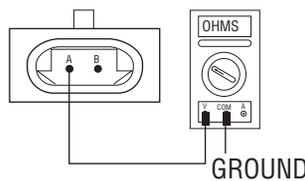
STEP K

Procedure	→ Condition	→ Action
1. Disconnect the Transmission Harness from the Input Shaft Speed Sensor.		
2. Measure resistance between Input Shaft Speed Sensor pins A and B.	If resistance is 2K to 4.5K ohm	Go to STEP L
	If resistance is outside of range	Go to STEP J



STEP L

Procedure	→ Condition	→ Action
1. Measure resistance between Input Shaft Speed Sensor pin A and ground.	If resistance is OL	Replace Transmission harness Go to STEP V
	If resistance is less than 10K ohm	Go to STEP J



STEP V

Procedure	Condition	Action
1. Key off.		
2. Remove all pressure gauges.		
3. Reconnect all connectors.		
4. Key on.		
5. Drive the vehicle to determine whether the complaint has been repaired.	If the transmission shifts normal	Test complete.
	If the transmission still has a shifting complaint	To Find error in testing, return to STEP A

Shift Lever Back Light Test

Overview

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

Detection

There is no detection other than a driver complaint.

Fallback

There is no fallback mode for this symptom.

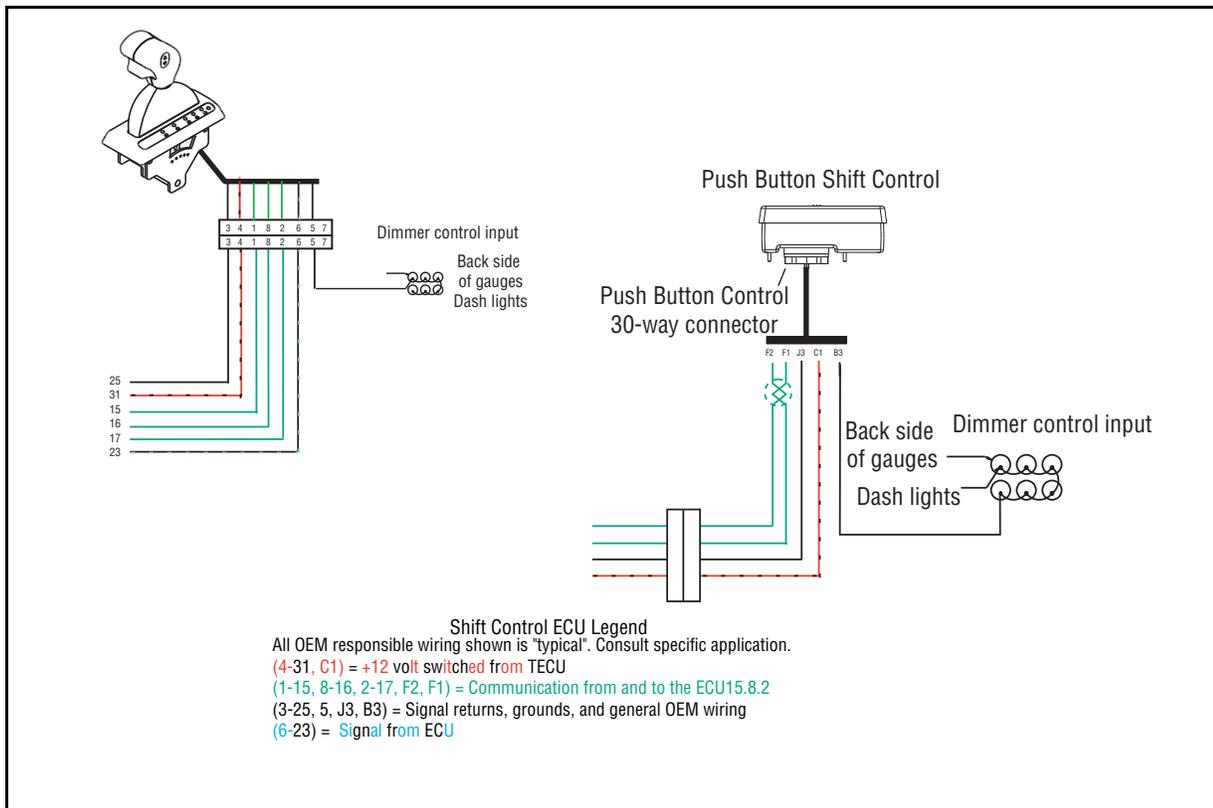
Required Tools

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

Possible Causes

This symptom can be caused by any of the following:

- OEM Wiring
- Shift Control
- Shift Lever



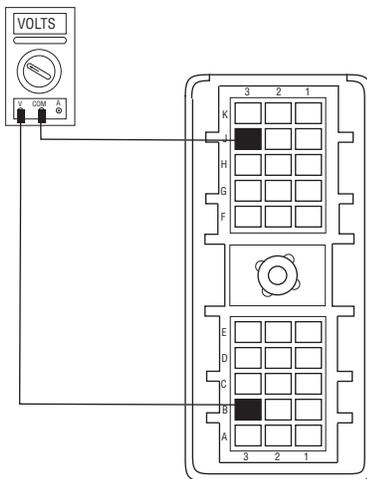
Symptom Isolation Procedures

STEP A

Procedure	→	Condition	→	Action
1. Verify Shift Lever.		If vehicle is equipped with an OEM Shift Lever		Refer to OEM for repair strategy.
		If vehicle is equipped with a Push Button Shift Control		Go to STEP B
		If vehicle is equipped with Cobra Lever		Go to STEP C

STEP B

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect Shift Control 30-way connector.				
3. Key on.				
4. Turn dimmer switch to max.				
5. Measure voltage between pin B3 and J3.		If voltage is within 0.6 volts of battery voltage		Replace Shift Control. Go to STEP V
		If voltage is outside of range		Repair OEM wire between pin B3 and the dash lights. Go to STEP V

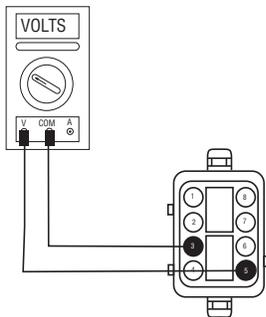


STEP C

Procedure	→	Condition	→	Action
1. Key on.				
2. Turn vehicle lights on.				
3. Turn dimmer switch to max.		Cobra Lever lights on, but do not dim when vehicle lights are on		Go to STEP D
		Cobra Lever lights do not come on		Go to STEP E

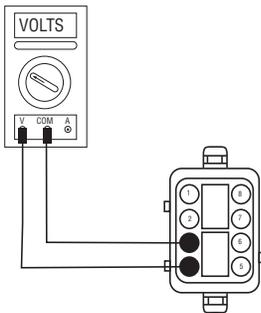
STEP D

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect Cobra Lever 8-way connector.				
3. Key on.				
4. Turn dimmer switch to max.				
5. Measure voltage between pin 5 and pin 3 on the 8-way OEM harness.		If voltage is within 2 volts of battery voltage		Replace Cobra Lever. Go to STEP V
		If voltage is outside of range		Repair OEM wire between pin 5 and dash lights. Go to STEP V



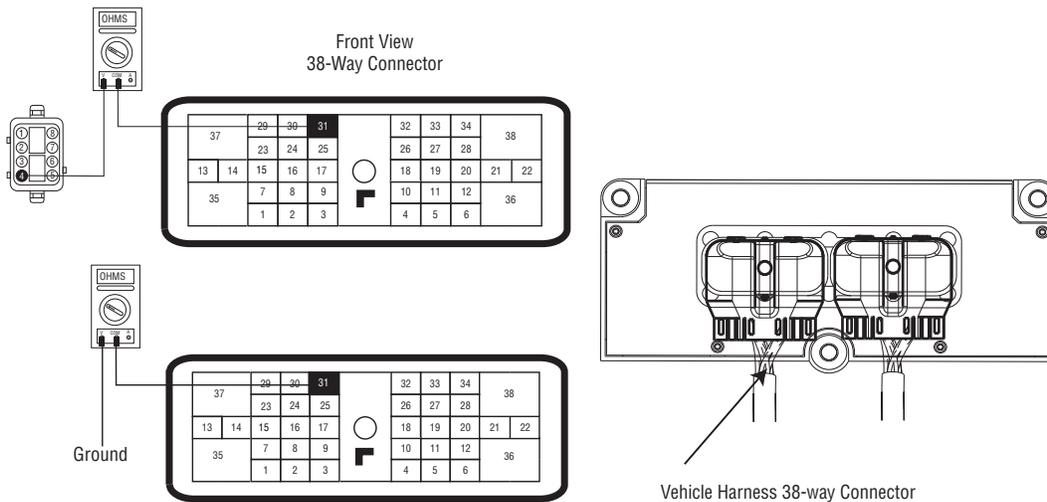
STEP E

Procedure	Condition	Action
1. Key off.		
2. Disconnect Cobra Lever 8-way connector.		
3. Key on.		
4. Measure voltage between pin 3 and pin 4 on the 8-way vehicle harness connector.	If voltage is within 0.6 volts of battery voltage	Replace Cobra Lever. Go to STEP V
	If voltage is out of range	Go to STEP F



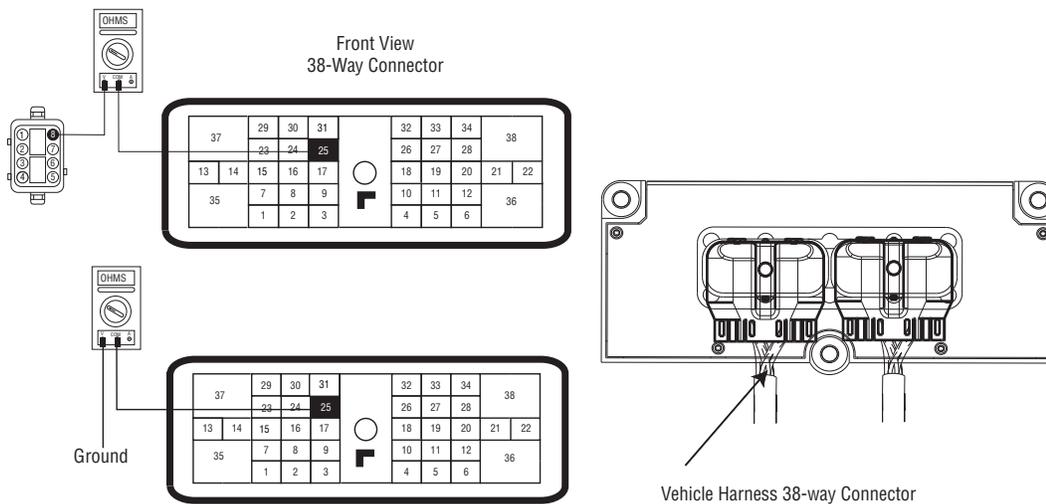
STEP F

Procedure	→	Condition	→	Action
1. Key off.				
2. Disconnect Negative battery cable.				
3. Disconnect Vehicle Harness 38-way connector.				
4. Measure resistance between: <ul style="list-style-type: none"> • Vehicle Harness 38-way connector pin 31 and Vehicle Harness 8-way connector pin 4. • Vehicle Harness 38-way connector pin 31 and ground. 		If resistance between pins 31 and 4 is 0 to 0.3 ohms and if resistance between pin 31 and ground is OL		Go to STEP G
		If any of the above conditions are not met		Repair harness between Vehicle Harness 38-way connector pin 31 and Vehicle Harness 8-way connector pin 4. Go to STEP V



STEP G

Procedure	→	Condition	→	Action
1. Key off.				
2. Measure resistance between:		If resistance between pins 25 and 3 is 0 to 0.3 ohms and if resistance between 25 and ground is OL		Perform Electrical Pre-test. If test passes replace transmission ECU. Go to STEP V
<ul style="list-style-type: none"> • Vehicle Harness 38-way connector pin 25 and Vehicle Harness 8-way connector pin 3 • Vehicle Harness 38-way connector pin 25 and ground 				



STEP V

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

Appendix

Connector Pin Descriptions

(Non-ECA Products) Transmission Controller 38-Way (Vehicle Interface Connector)

38-Way	Description	Wire	38-Way	Description	Wire
1	J1939 Shield (CAN)	18 TXL	20	MEIIR Contact	18 TXL
2	J1939 Low (CAN)	18 TXL	21	MEIIR Minus	18 TXL
3	J1939 High (CAN)	18 TXL	22	MEIIR Plus	18 TXL
4	Start Enable Relay Minus	18 TXL	23	Service Light Output	18 TXL
5	Not Used	Plug	24	Not Used	18 TXL
6	Not Used	Plug	25	Shift Control Power Minus	18 TXL
7	Not Used	Plug	26	Start Enable Latch	18 TXL
8	Not Used	Plug	27	HIL Low (Proprietary CAN)	18 TXL
9	Not Used	Plug	28	HIL High (Proprietary CAN)	18 TXL
10	J1587 Plus	18 TXL	29	Not Used	Plug
11	J1587 Minus	18 TXL	30	Not Used	Plug
12	ISO9141-K Communications	18 TXL	31	Shift Control Power Plus	18 TXL
13	Not Used	Plug	32	Start Enable Relay Plus	18 TXL
14	Not Used	Plug	33	Not Used	Plug
15	Shift Control Input (Mode Auto)	18 TXL	34	Not Used	Plug
16	Shift Control Input (Mode Manual/ Neutral Signal)	18 TXL	35	Ignition	12 GXL or 14SXL
17	Shift Control Input (Mode Common/ Neutral Return)	18 TXL	36	Battery Minus	12 GXL
18	PTO	18 TXL	37	Not Used	Plug
19	Auto Neutral AW3	18 TXL	38	Battery Plus	12 GXL

Push button Shift Control 30-Way Connector

30-Way	DESCRIPTION	Wire
C1	Shift Control Power Plus	16 TXL
B3	V dash	16 TXL
F1	HIL(+) HI	16 TXL
F2	HIL(-) LO	16 TXL
J3	Shift Control Power Minus	16 TXL

Cobra Lever 8-Way Connector

8-Way	DESCRIPTION	Wire
1	Shift Control Input (Mode Auto)	16 TXL
2	Shift Control Input (Mode Common)	16 TXL
3	Shift Control Power Minus	16 TXL
4	Shift Control Lever Power Plus	16 TXL
5	Dash Lights	16 TXL
6	Service Light Output	16 TXL
8	Shift Control Input (Mode Manual)	16 TXL
7	No Connection	16 TXL

(Non-ECA Products) Transmission Controller 38-Way
(Eaton Supplied Assembly)

38-Way	DESCRIPTION	Wire	38-Way	Description	Wire
1	Not Used	Plug	20	Rail Position Sensor Minus	18 TXL
2	Clutch Lube Solenoid Plus	18 TXL	21	Not Used	Plug
3	Clutch Lube Solenoid Minus	18 TXL	22	Not Used	Plug
4	Splitter Solenoid Common Minus	18 TXL	23	Output Shaft Speed Sensor High	18 TXL
5	Inertia Brake Solenoid Minus	18 TXL	24	Output Shaft Speed Sensor Low	18 TXL
6	Range Solenoid Common Minus	18 TXL	25	Service Ignition	18 TXL
7	Input Shaft Speed Sensor High	18 TXL	26	Splitter Indirect Solenoid Plus	18 TXL
8	Input Shaft Speed Sensor Low	18 TXL	27	Not Used	Plug
9	Not Used	Plug	28	Range High Solenoid Plus	18 TXL
10	Gear Position Sensor Plus	18 TXL	29	Not Used	18 TXL
11	Gear Position Sensor Signal	18 TXL	30	Not Used	18 TXL
12	Gear Position Sensor Minus	18 TXL	31	Service Battery Minus	18 TXL
13	Clutch Solenoid Plus	18 TXL	32	Splitter Direct Solenoid Plus	18 TXL
14	Clutch Solenoid Minus	18 TXL	33	Inertia Brake Solenoid Plus	18 TXL
15	Main Shaft Speed Sensor High	18 TXL	34	Range Low Solenoid Plus	18 TXL
16	Main Shaft Speed Sensor Low	18 TXL	35	Rail Motor Plus	14SXL
17	Service Battery Plus	18 TXL	36	Gear Motor Plus	14SXL
18	Rail Position Sensor Plus	18 TXL	37	Rail Motor Minus	14SXL
19	Rail Position Sensor Signal	18 TXL	38	Gear Motor Minus	14SXL

**(Heavy-Duty & Medium-Duty UltraShift Plus) Transmission Controller
38-Way (Vehicle Interface Connector)**

38-Way	DESCRIPTION	Wire	38-Way	Description	Wire
1	Comm CAN Shield - J1939_S	18 TXL	20	Analog Switch Input 3 (MEIIR Contact)	18 TXL
2	Comm CAN Low - J1939_L	18 TXL	21	Driver Out Negative - MEIIR (CLUTCH1)	18 TXL
3	Comm CAN High - J1939_H	18 TXL	22	Driver Out Positive - MEIIR (CLUTCH1)	18 TXL
4	Driver Out Negative - Start Enable Relay	18 TXL	23	Driver Out Positive - Service Light	18 TXL
5	Not Used	Plug	24	Driver Out Positive - Body Option	18 TXL
6	Analog Return		25	Service - Ignition Positive	18 TXL
7	Comm CAN Shield - J1939_S (Pass Through)	18 TXL	26	Driver Out Positive - Splitter Indirect	18 TXL
8	Comm CAN Low - J1939_L (Pass Through)	18 TXL	27	Not Used	Plug
9	Comm CAN High - J1939_H (Pass Through)	Plug	28	Driver Out Positive - Range High	18 TXL
10	Comm Serial A - J1587_A	18 TXL	29	COMM CAN Low - PNL_L (Proprietary CAN)	
11	Comm Serial B - J1587_B	18 TXL	30	COMM CAN High - PNL_H (Proprietary CAN)	
12	Comm Serial K - ISO9141-K Line	18 TXL	31	Driver Out Positive - Console Power	18 TXL
13	Not Used	Plug	32	Driver Out Positive - Splitter Direct	18 TXL
14	Analog Switch Return (Gen 3.7)	18 TXL	33	Driver Out Positive - Inertia Brake	18 TXL
15	Analog In - Resistive Ladder 1 (Mode Auto)	18 TXL	34	Driver Out Positive - Range Low	18 TXL
16	Analog In - Resistive Ladder 2 (Mode Manual)	18 TXL	35	Motor Positive - X (Rail)	14 SXL
17	Analog Return - Resistive Ladder (Common)	18 TXL	36	Motor Positive - Y (Gear)	12 GXL
18	Analog / Switch Input 1	18 TXL	37	Motor Negative - X (Rail)	14 SXL
19	Analog / Switch Input 2	18 TXL	38	Motor Negative - Y (Gear)	12 GXL

**(Heavy-Duty UltraShift Plus) Transmission Controller 38-Way
(Eaton Supplied Assembly)**

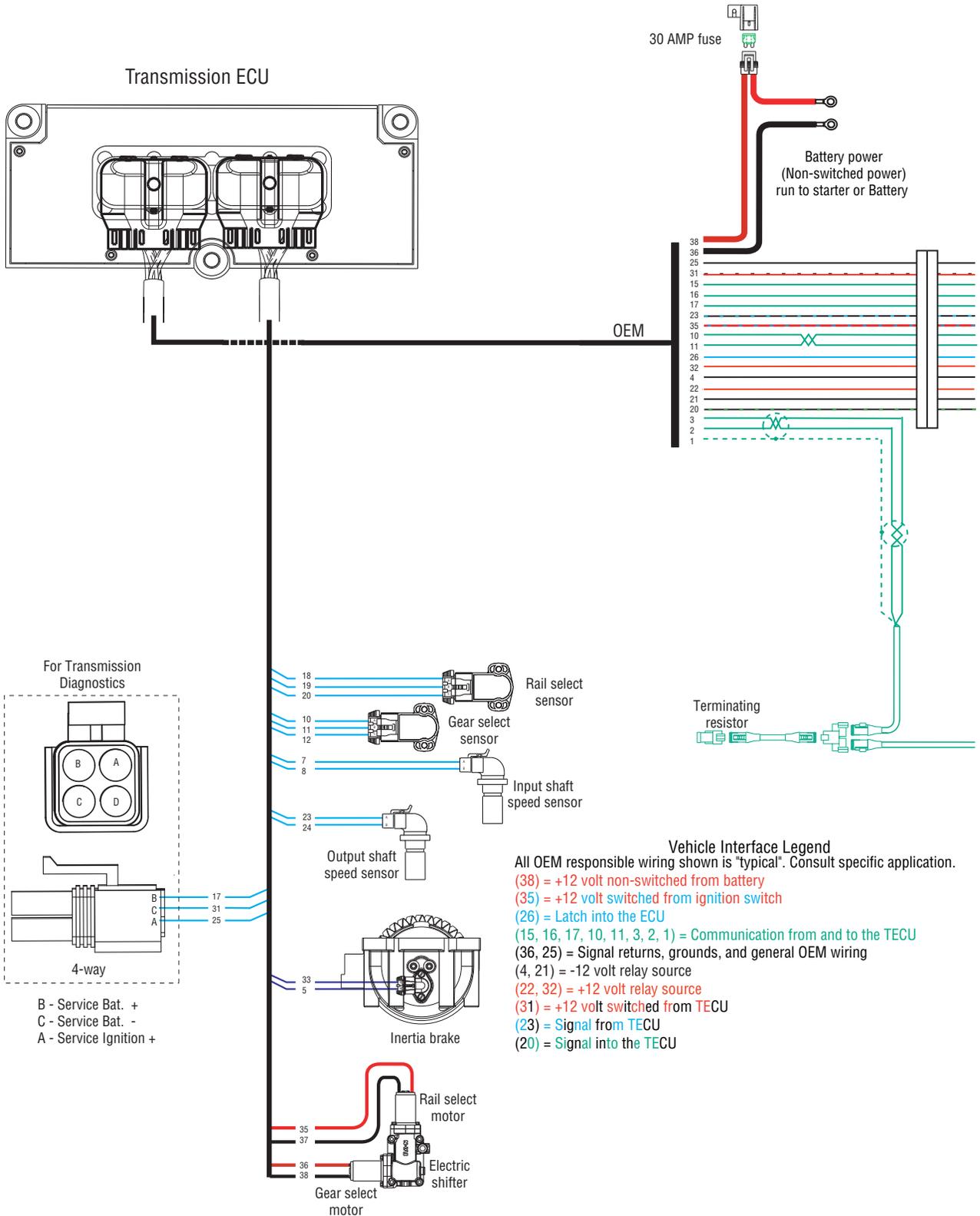
38-Way	DESCRIPTION	Wire	38-Way	Description	Wire
1	Analog Switch Signal Return (Gen 3.7)	18 TXL	20	Sensor Supply, Hall - Negative [X (Rail)]	18 TXL
2	Driver Out Positive - Clutch2	18 TXL	21	Sensor Hall Speed Negative (Gen 3.7)	18 TXL
3	Driver Out Negative - Clutch2	18 TXL	22	Sensor Hall Speed Positive 5V (Gen 3.7)	18 TXL
4	Driver Out Negative - Splitter Common	18 TXL	23	Sensor VR Speed High - Output Shaft	18 TXL
5	Not Used	Plug	24	Sensor VR Speed Low - Output Shaft	18 TXL
6	Driver Out Negative - Range Common		25	Service - Ignition Positive	18 TXL
7	Sensor VR Speed High - Input Shaft	18 TXL	26	Driver Out Positive - Splitter Indirect	18 TXL
8	Sensor VR Speed Low - Input Shaft	18 TXL	27	Not Used	Plug
9	Analog Switch Input 0.5 VDC (Gen 3.7)	Plug	28	Driver Out Positive - Range High	18 TXL
10	Sensor Supply, Hall - Positive [Y (Gear)]	18 TXL	29	COMM CAN Low - PNL_L (Proprietary CAN)	
11	Sensor Signal, Hall Position [Y (Gear)]	18 TXL	30	COMM CAN High - PNL_H (Proprietary CAN)	
12	Sensor Supply, Hall - Negative [Y (Gear)]	18 TXL	31	Service - Battery Negative	18 TXL
13	Driver Out Positive - CLUTCH1 (MEIIR)		32	Driver Out Positive - Splitter Direct	18 TXL
14	Driver Out Negative - CLUTCH1 (MEIIR)	18 TXL	33	Not Used	Plug
15	Sensor VR Speed High - Main Shaft	18 TXL	34	Driver Out Positive - Range Low	18 TXL
16	Sensor VR Speed Low - Main Shaft	18 TXL	35	Motor Positive - X (Rail)	14 SXL
17	Service - Battery Positive	18 TXL	36	Motor Positive - Y (Gear)	12 GXL
18	Sensor Supply, Hall - Positive [X (Rail)]	18 TXL	37	Motor Negative - X (Rail)	14 SXL
19	Sensor Signal, Hall Position [X (Rail)]	18 TXL	38	Motor Negative - Y (Gear)	12 GXL

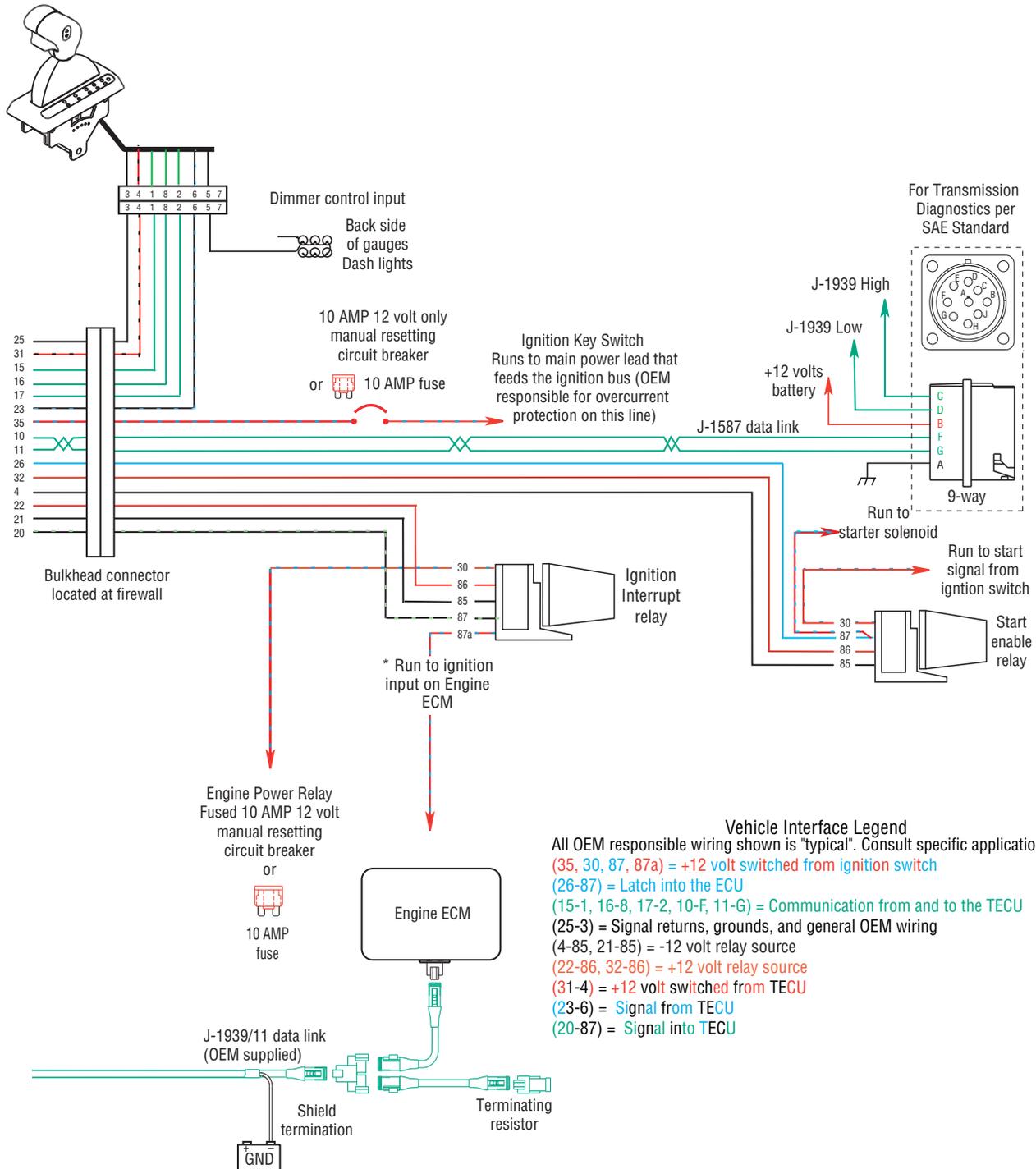
Appendix

(Medium-Duty UltraShift Plus) Transmission Controller 38-Way (Eaton Supplied Assembly)

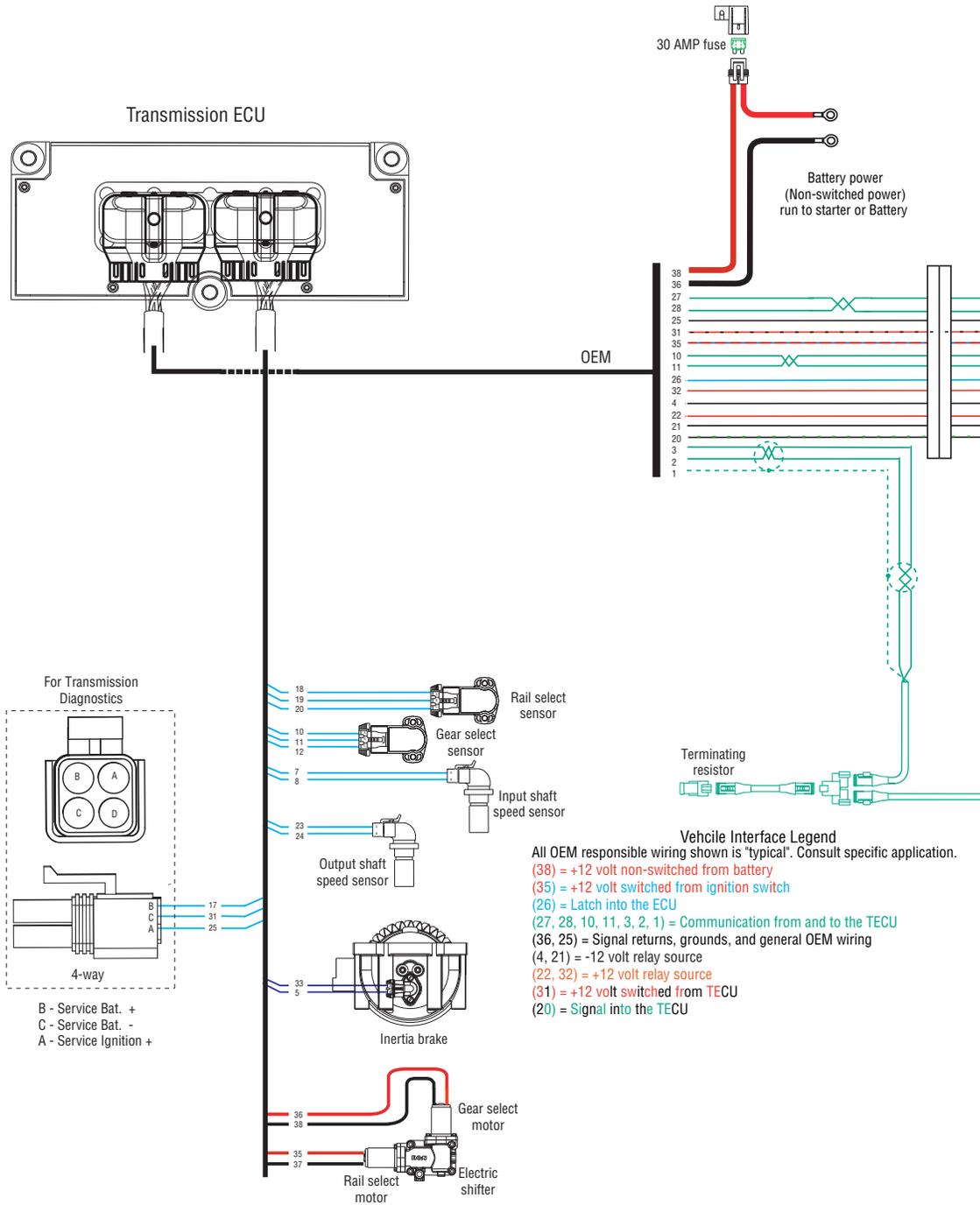
38-Way	DESCRIPTION	Wire	38-Way	Description	Wire
1	Analog Switch Signal Return (Gen 3.7)	18 TXL	20	Sensor Supply, Hall - Negative [X (Rail)]	18 TXL
2	Driver Out Positive - Clutch2	18 TXL	21	Sensor Hall Speed Negative (Gen 3.7)	18 TXL
3	Driver Out Negative - Clutch2	18 TXL	22	Sensor Hall Speed Positive 5V (Gen 3.7)	18 TXL
4	Driver Out Negative - Splitter Common	18 TXL	23	Sensor VR Speed High - Output Shaft	18 TXL
5	Driver Out Negative - Inertia Brake		24	Sensor VR Speed Low - Output Shaft	18 TXL
6	Driver Out Negative - Range Common		25	Service - Ignition Positive	18 TXL
7	Sensor VR Speed High - Input Shaft	18 TXL	26	Driver Out Positive - Splitter Indirect	18 TXL
8	Sensor VR Speed Low - Input Shaft	18 TXL	27	DO NOT CONNECT WIRE	18 TXL
9	Analog Switch Input 0.5 VDC (Gen 3.7)	Plug	28	Driver Out Positive - Range High	18 TXL
10	Sensor Supply, Hall - Positive [Y (Gear)]	18 TXL	29	COMM CAN Low - PNL_L (Proprietary CAN)	
11	Sensor Signal, Hall Position [Y (Gear)]	18 TXL	30	COMM CAN High - PNL_H (Proprietary CAN)	
12	Sensor Supply, Hall - Negative [Y (Gear)]	18 TXL	31	Service - Battery Negative	18 TXL
13	Driver Out Positive - CLUTCH1 (MEIIR)		32	Driver Out Positive - Splitter Direct	18 TXL
14	Driver Out Negative - CLUTCH1 (MEIIR)	18 TXL	33	Driver Out Positive - Inertia Brake	18 TXL
15	Not Used	Plug	34	Driver Out Positive - Range Low	18 TXL
16	Not Used	Plug	35	Motor Positive - X (Rail)	14 SXL
17	Service - Battery Positive	18 TXL	36	Motor Positive - Y (Gear)	12 GXL
18	Sensor Supply, Hall - Positive [X (Rail)]	18 TXL	37	Motor Negative - X (Rail)	14 SXL
19	Sensor Signal, Hall Position [X (Rail)]	18 TXL	38	Motor Negative - Y (Gear)	12 GXL

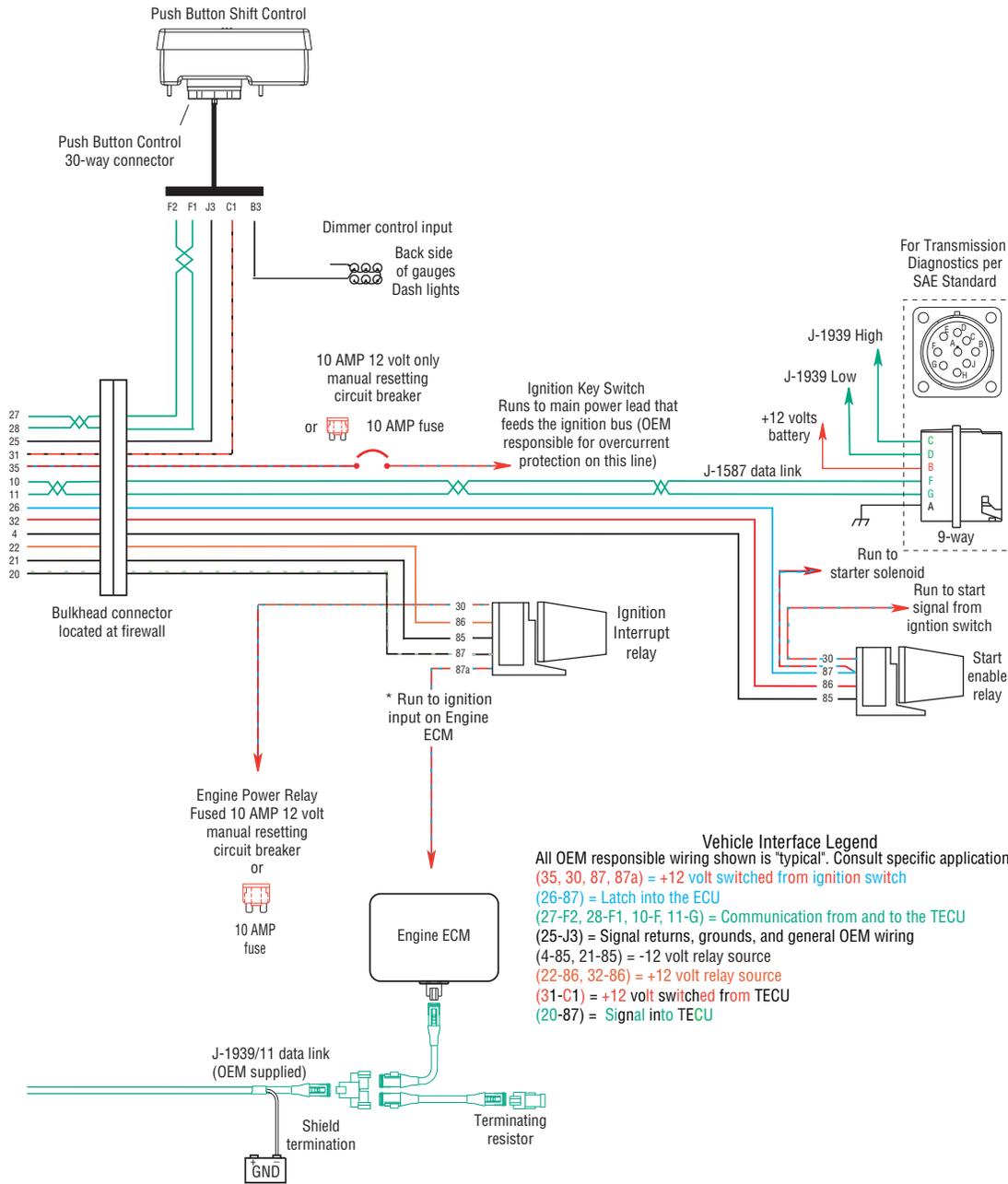
UltraShift DM3 6-Speed Wiring Diagram with Analog Shifter



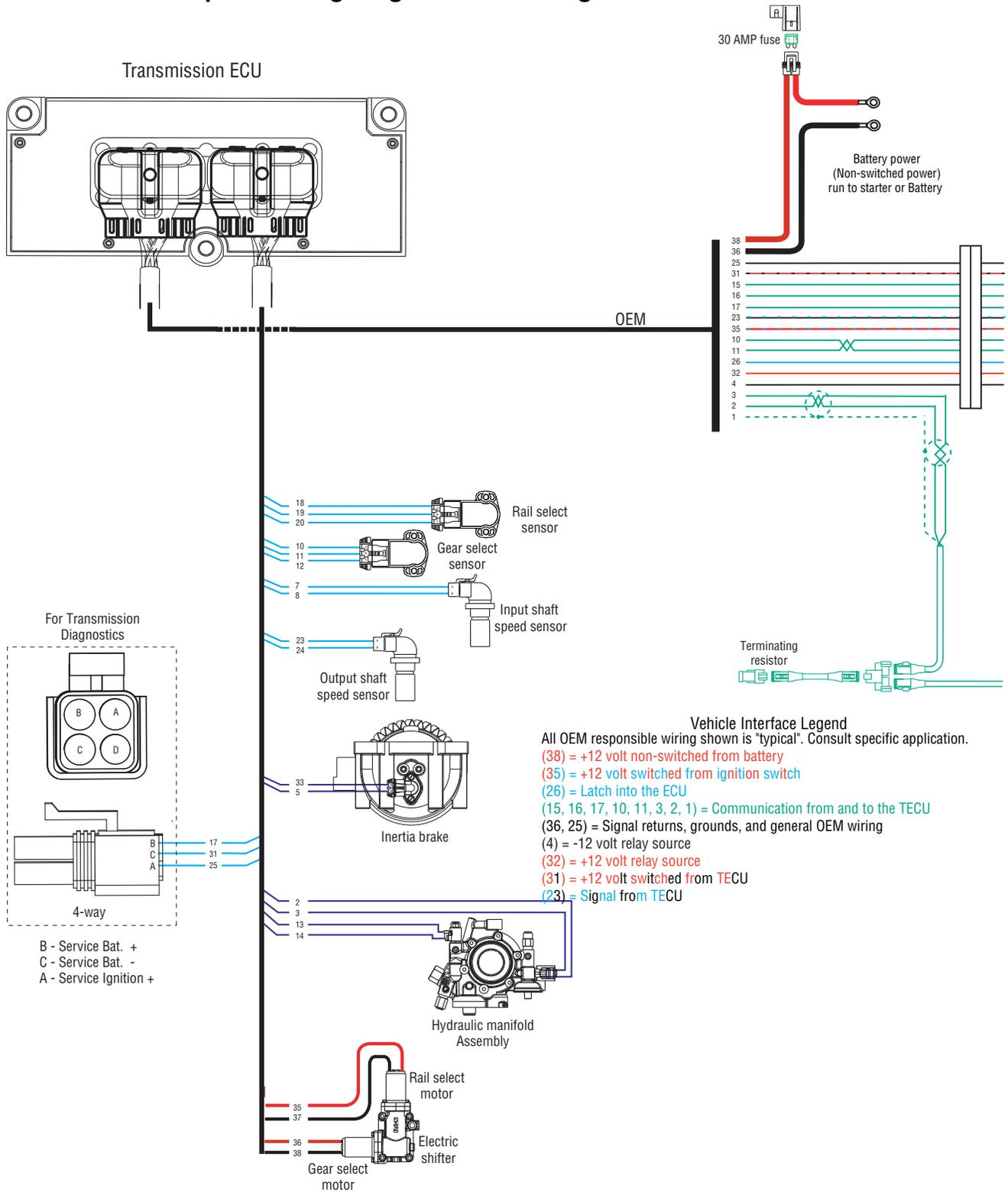


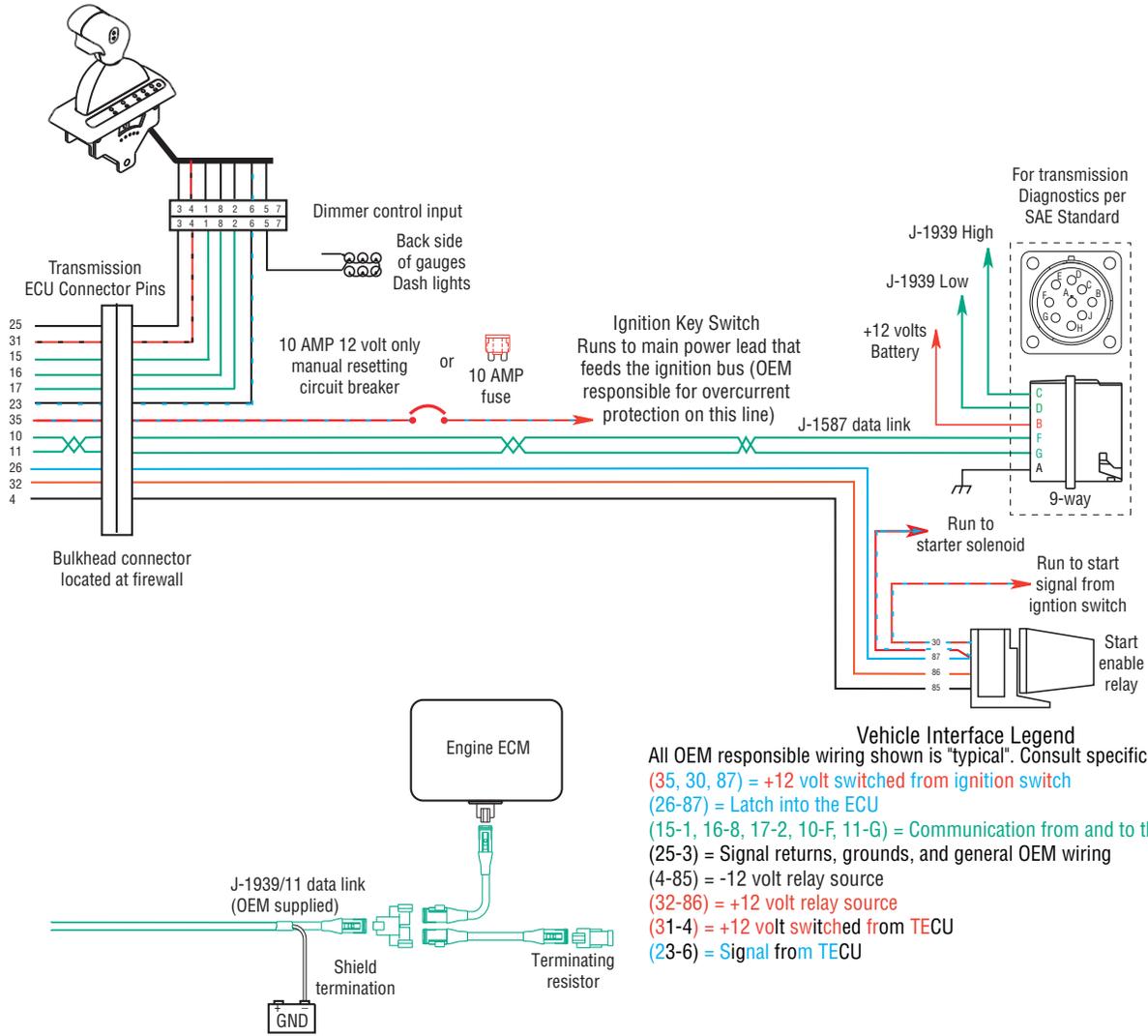
UltraShift DM3 6-Speed Wiring Diagram with Push Button Shifter



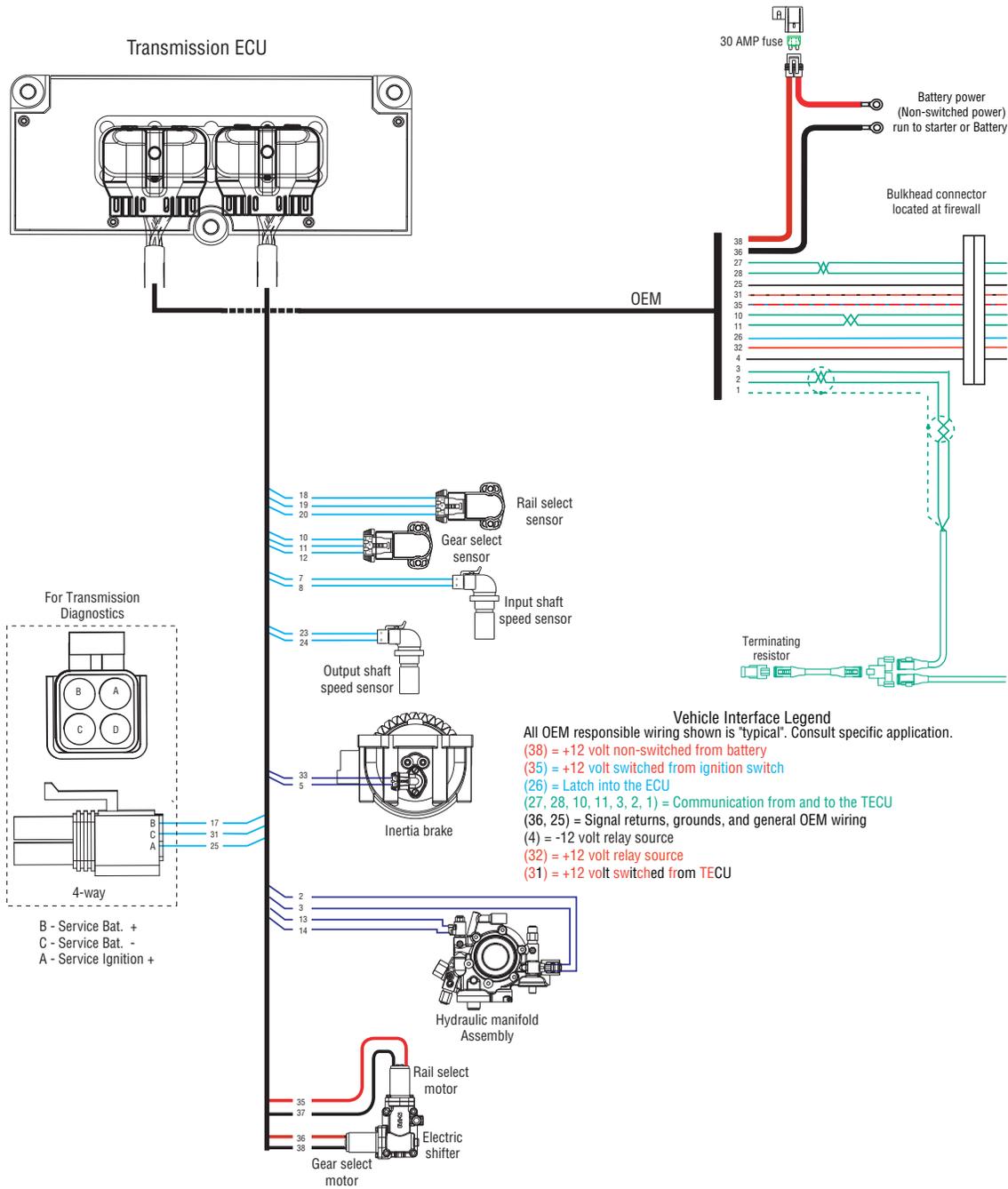


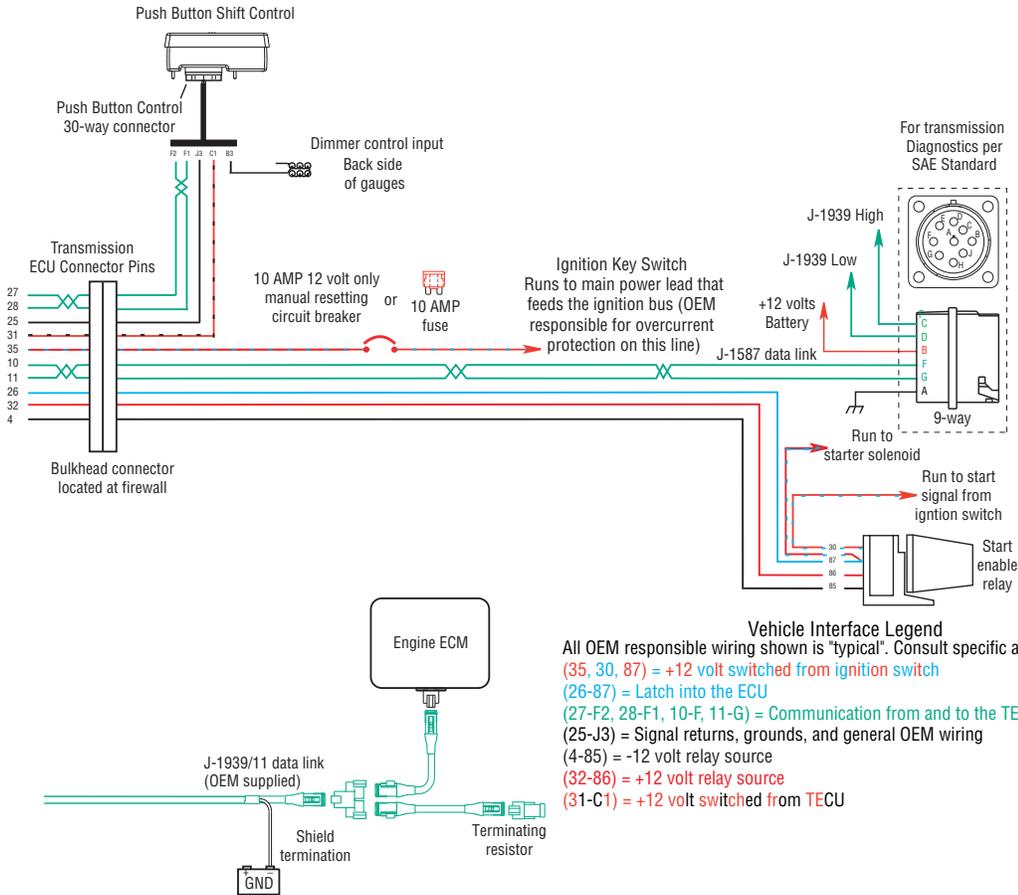
UltraShift AW3 6-Speed Wiring Diagram with Analog Shifter



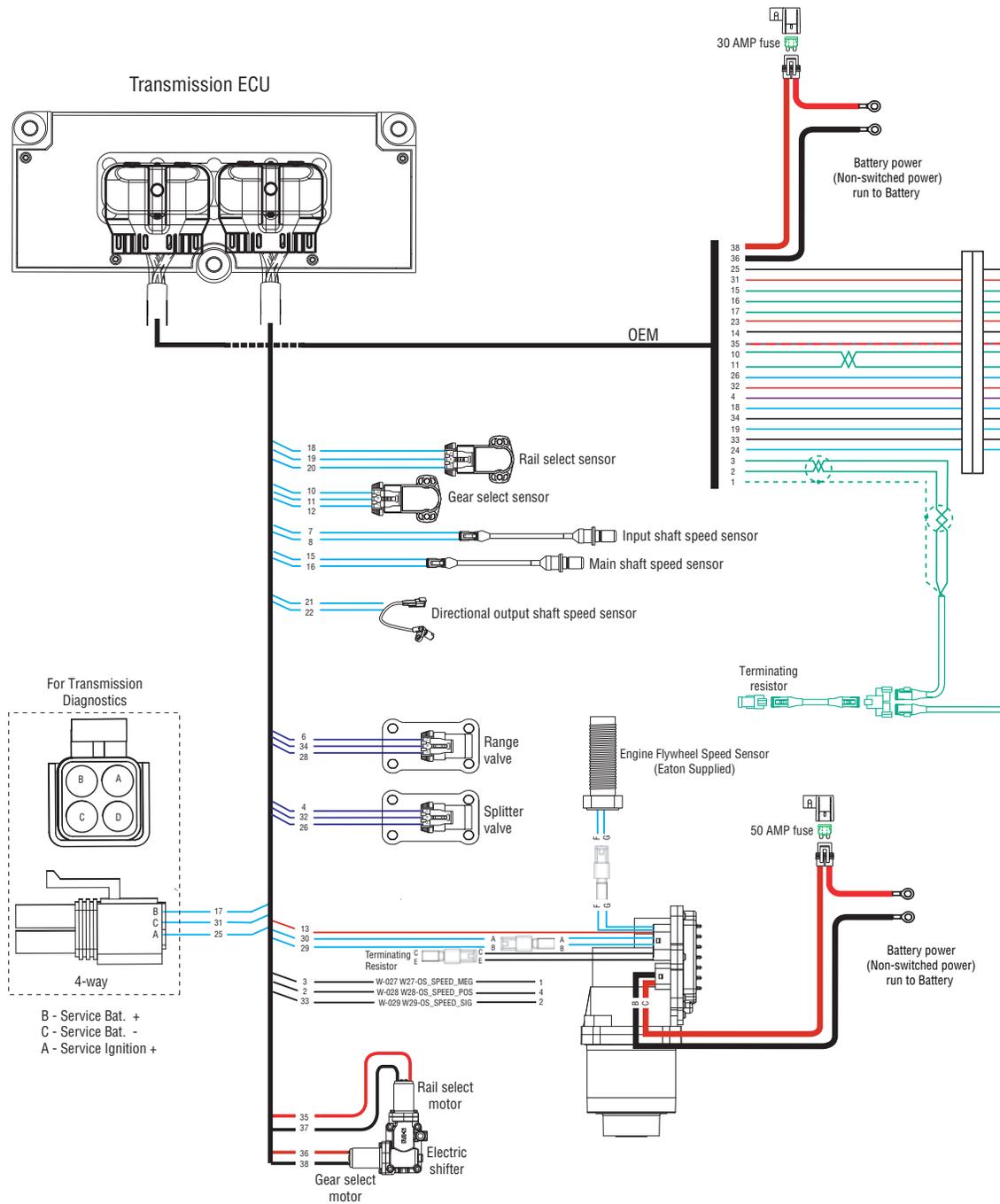


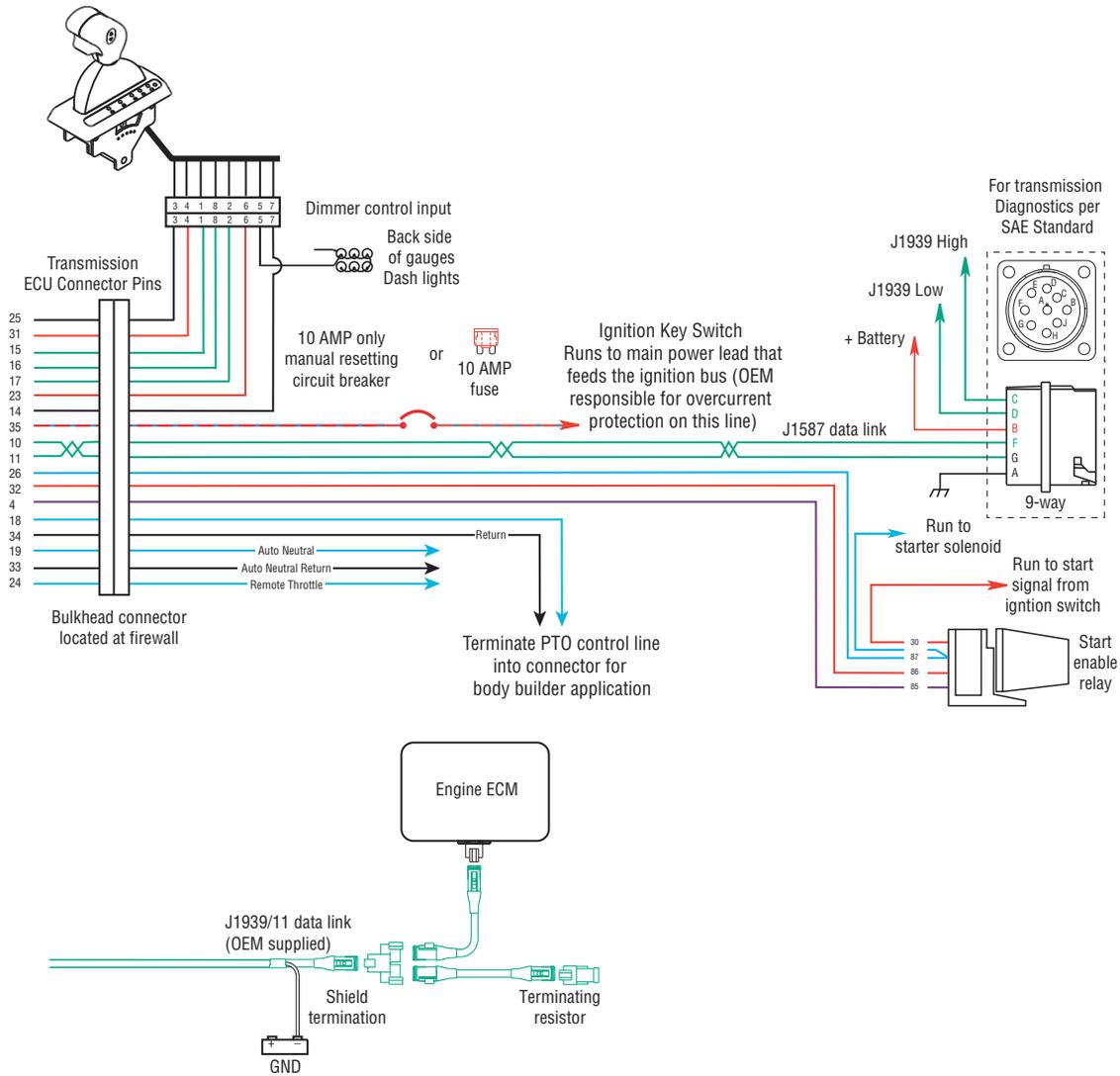
UltraShift AW3 6-Speed Wiring Diagram with Push Button Shifter





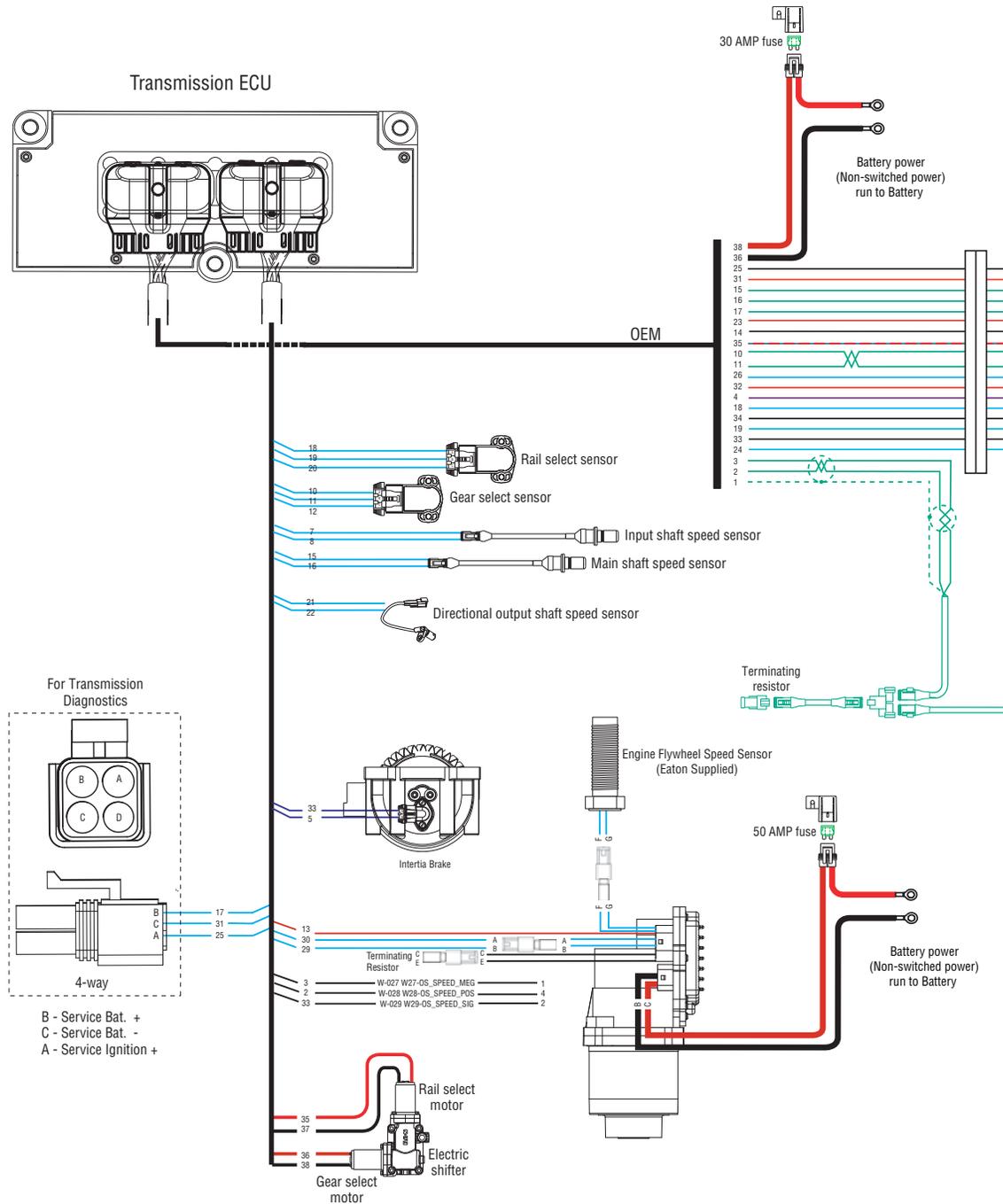
Medium-Duty UltraShift PLUS Models Wiring Diagram with Analog Shifter

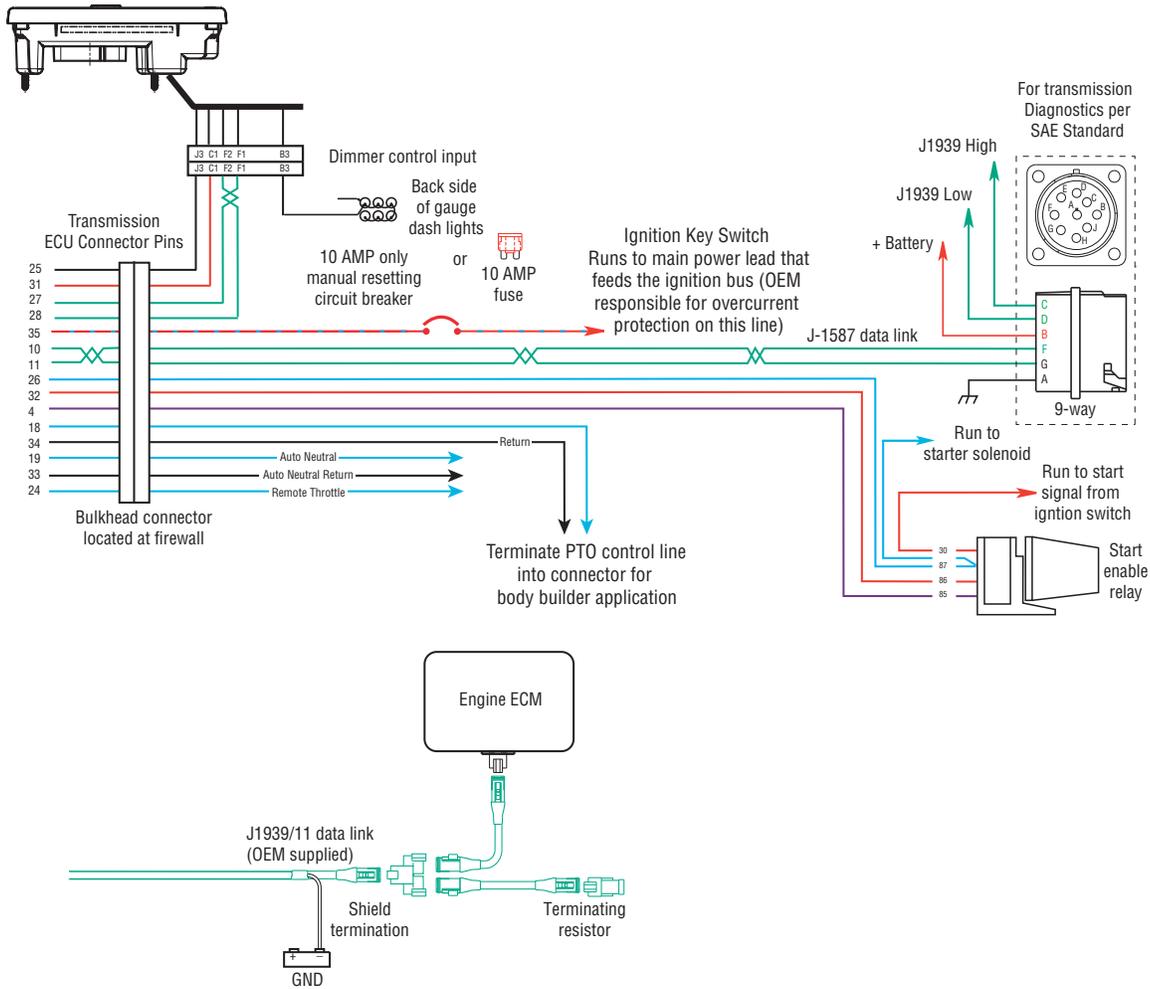




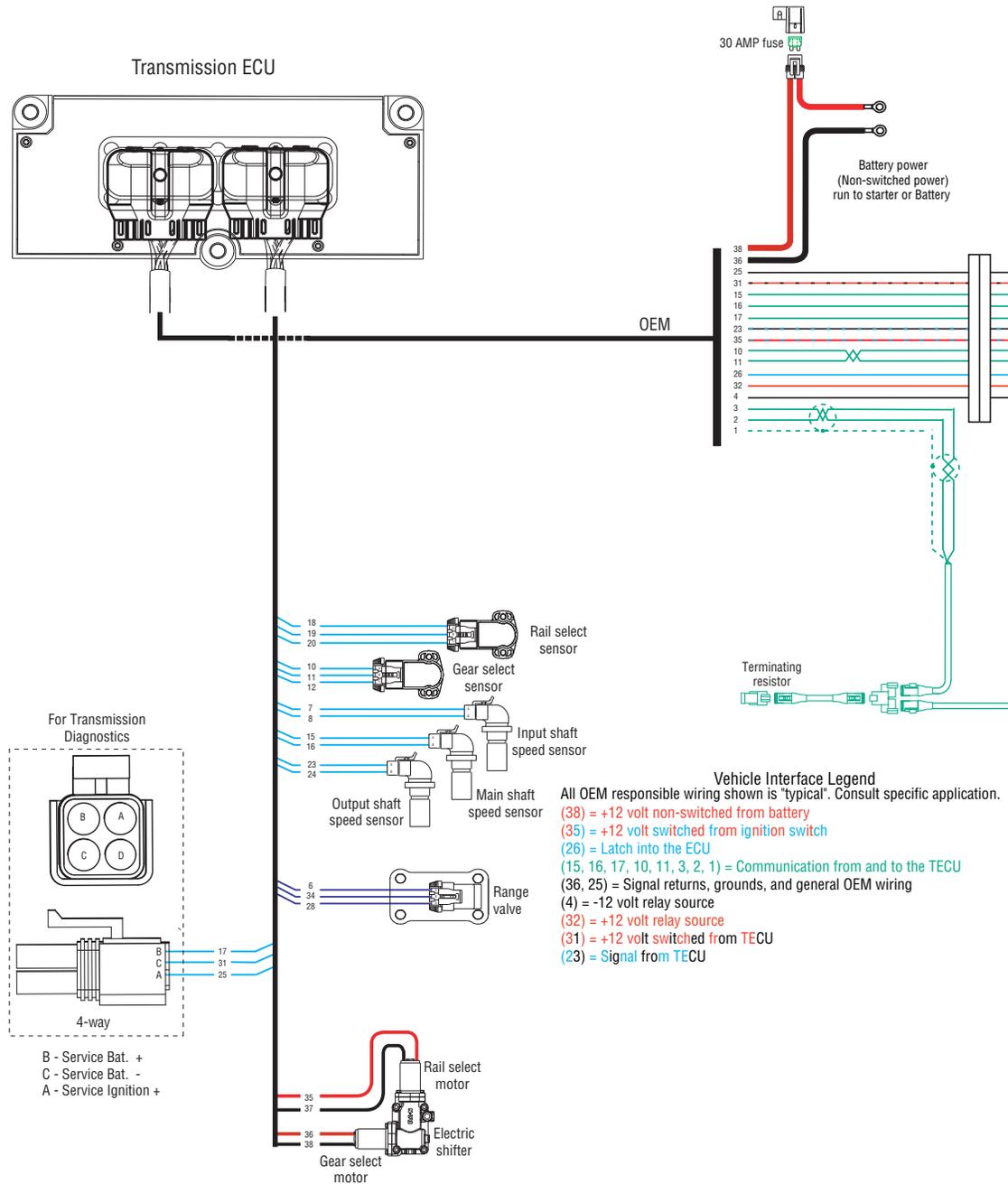
Medium-Duty UltraShift PLUS Models Wiring Diagram with Push Button Shifter Appendix

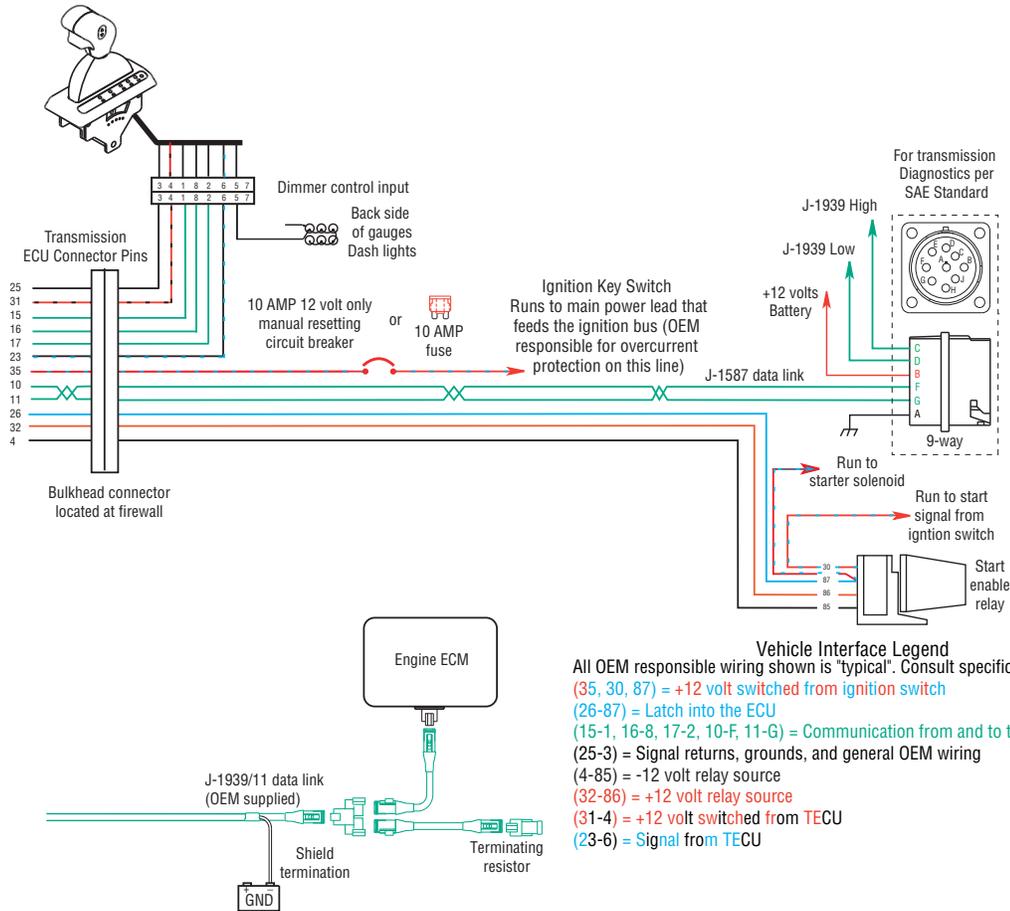
Medium-Duty UltraShift PLUS Models Wiring Diagram with Push Button Shifter



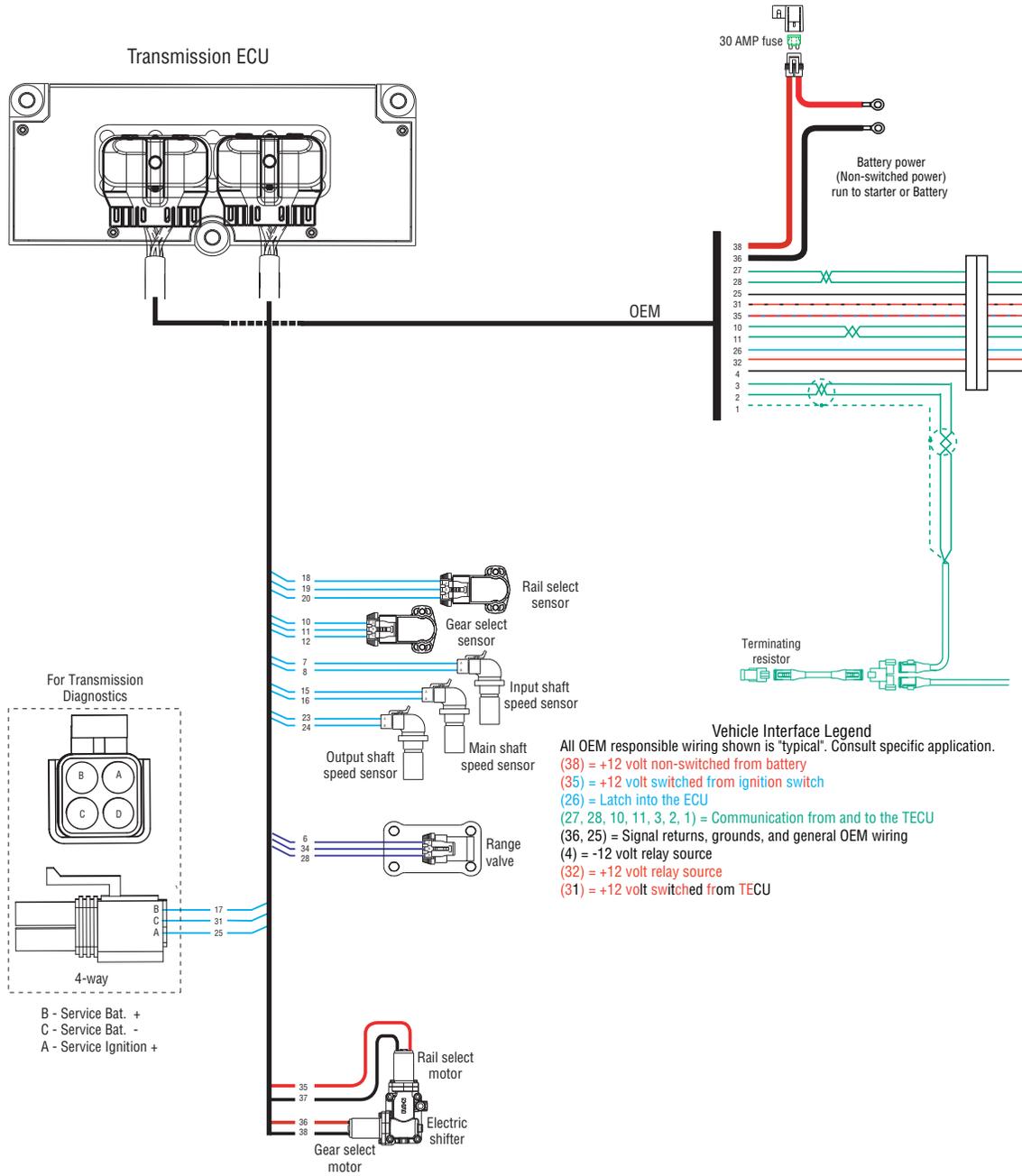


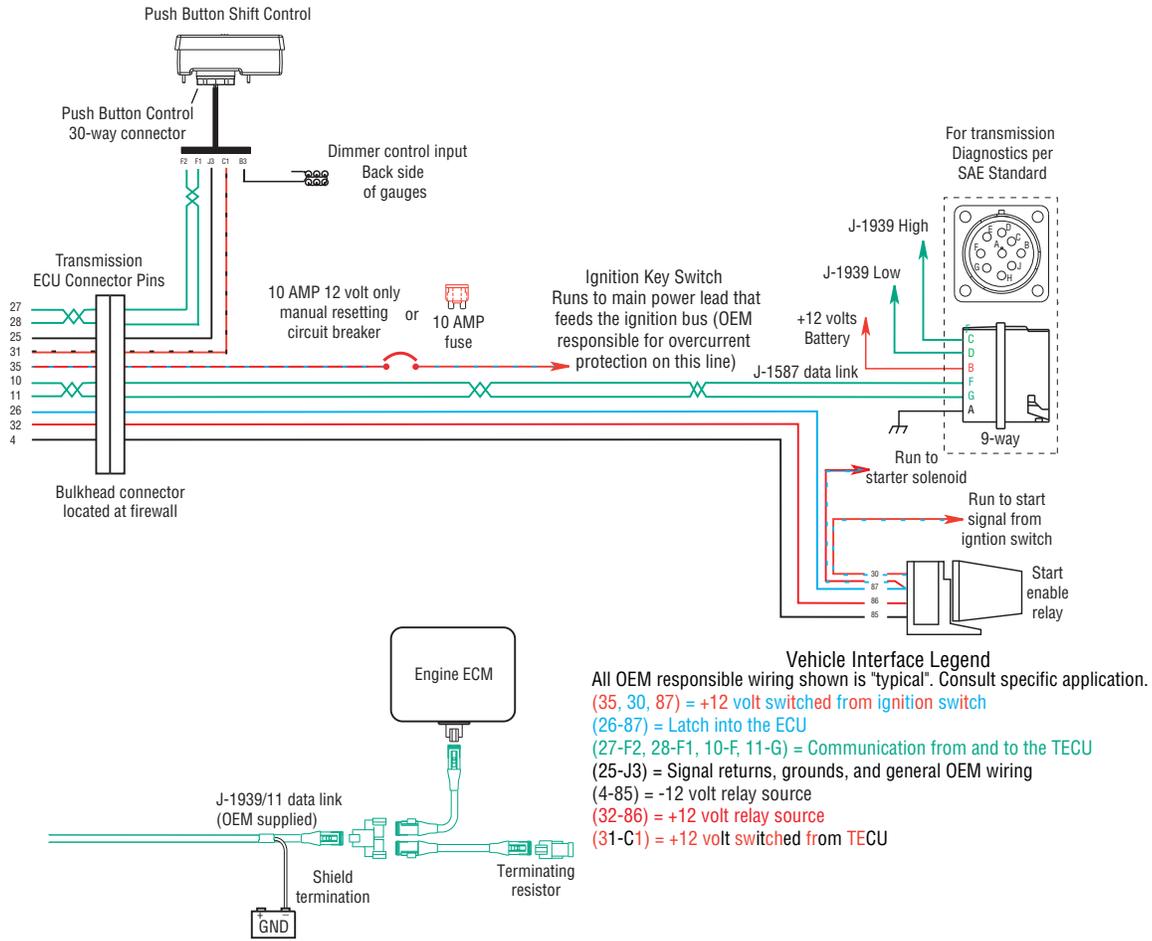
AutoShift 10-Speed Wiring Diagram with Analog Shifter



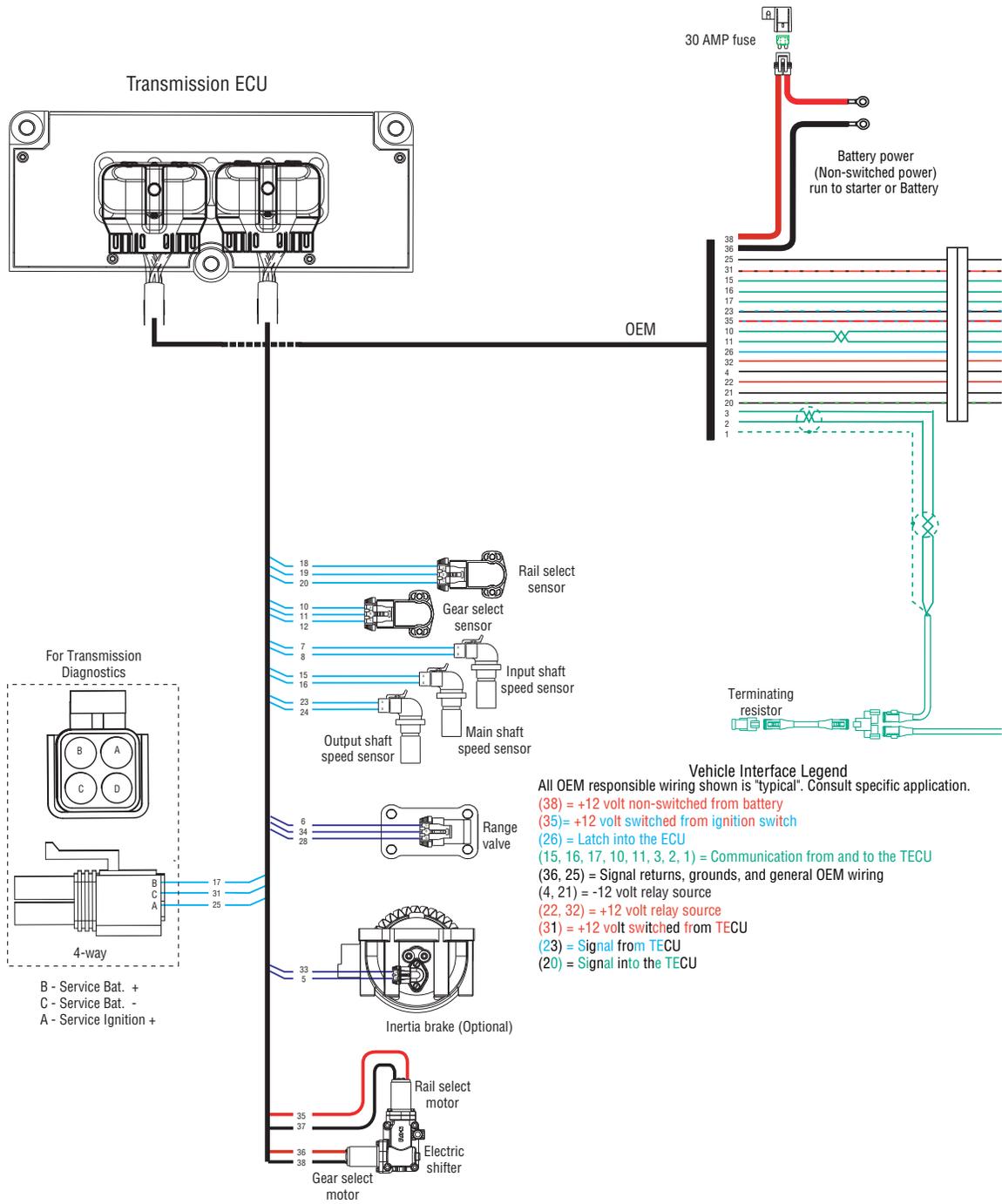


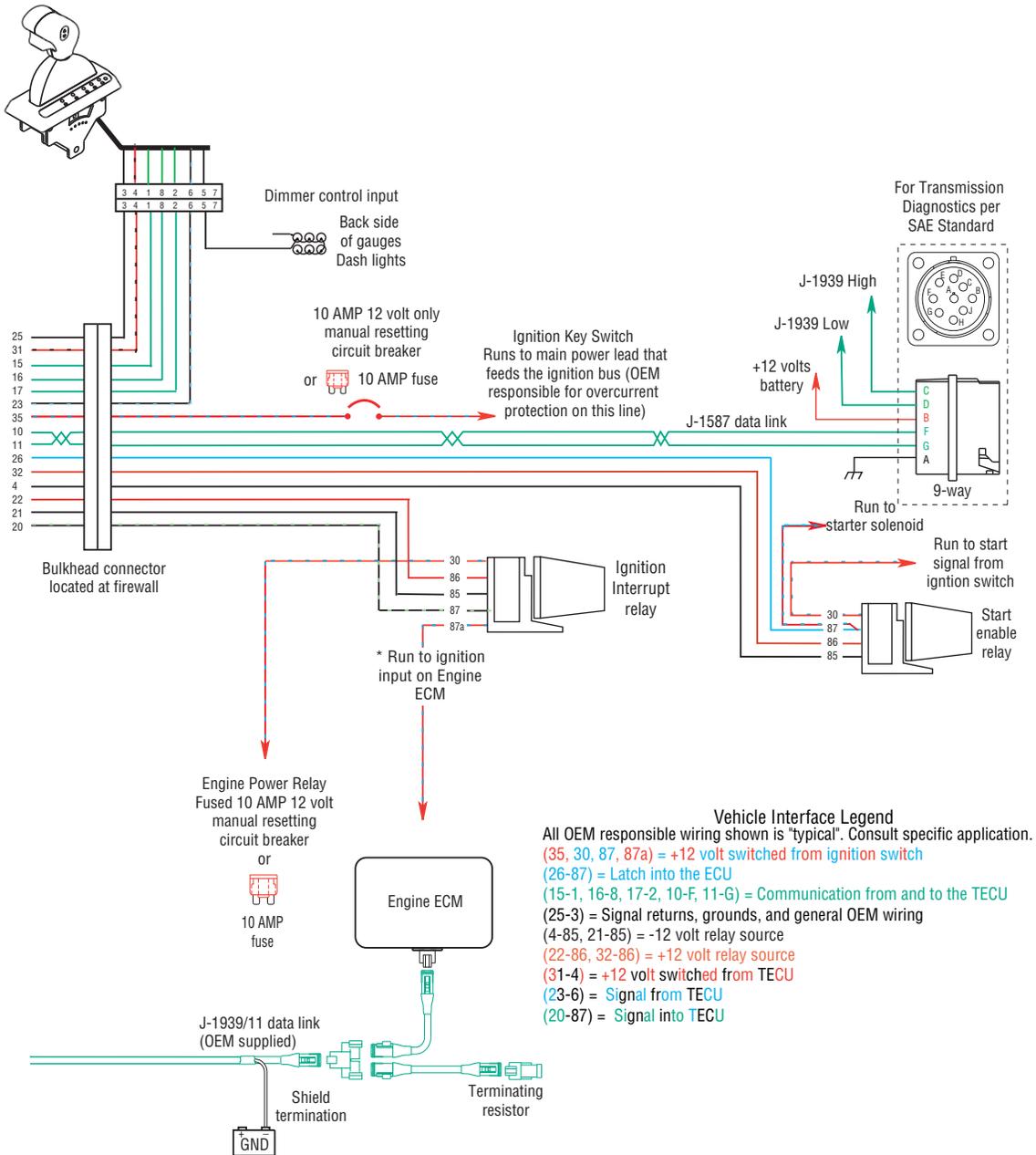
AutoShift 10-Speed Wiring Diagram with Push Button Shifter



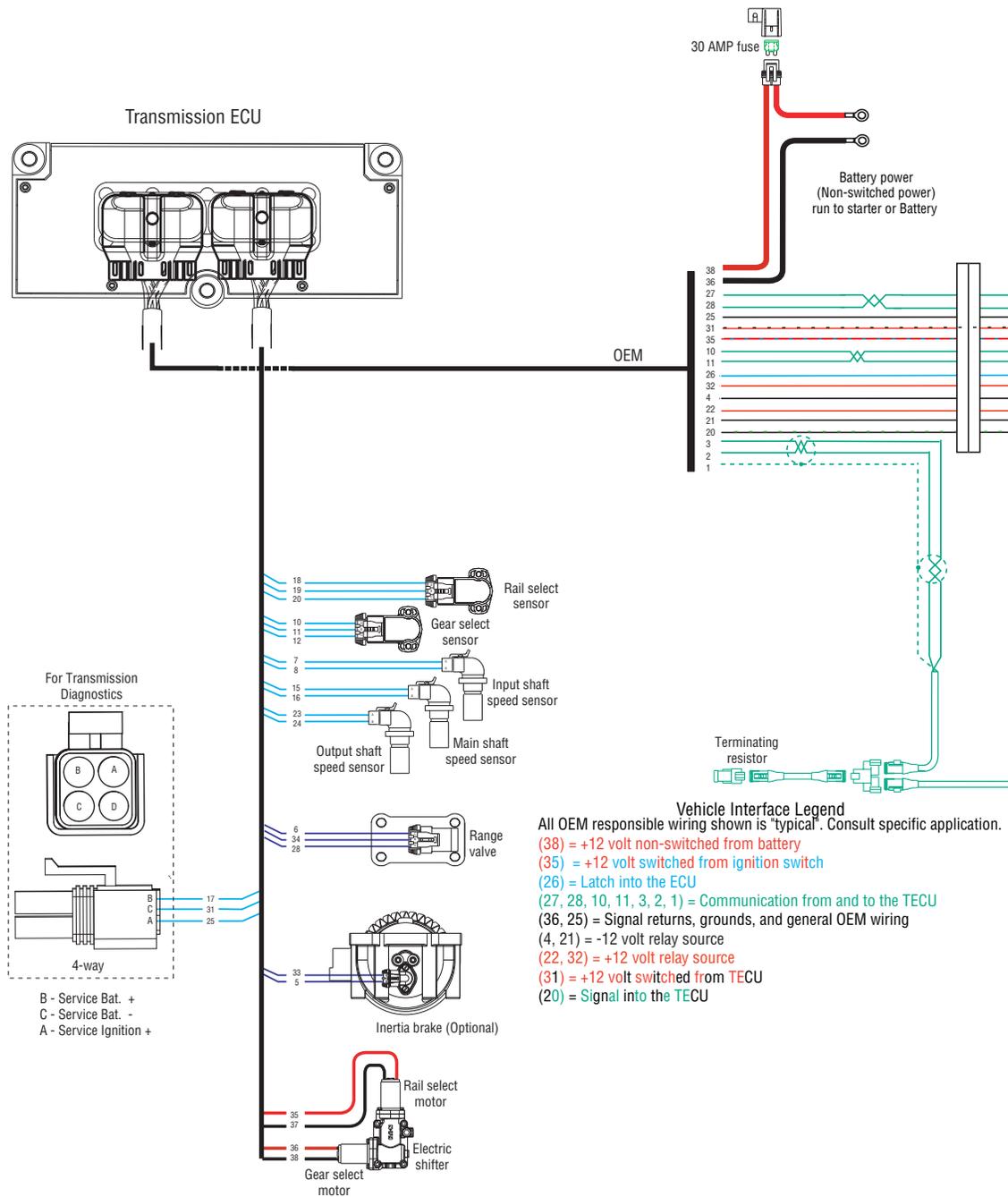


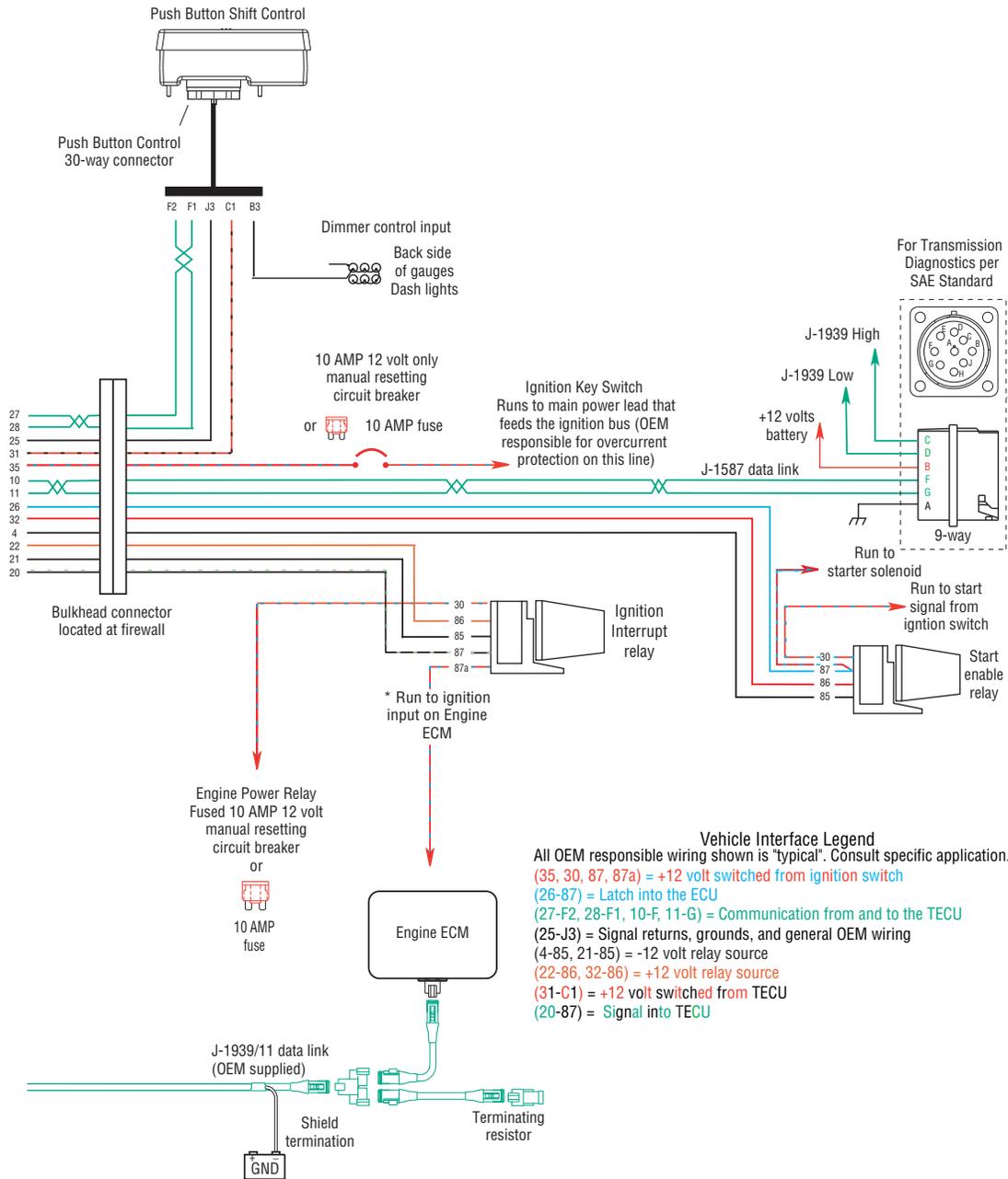
UltraShift 10-Speed Wiring Diagram with Analog Shifter



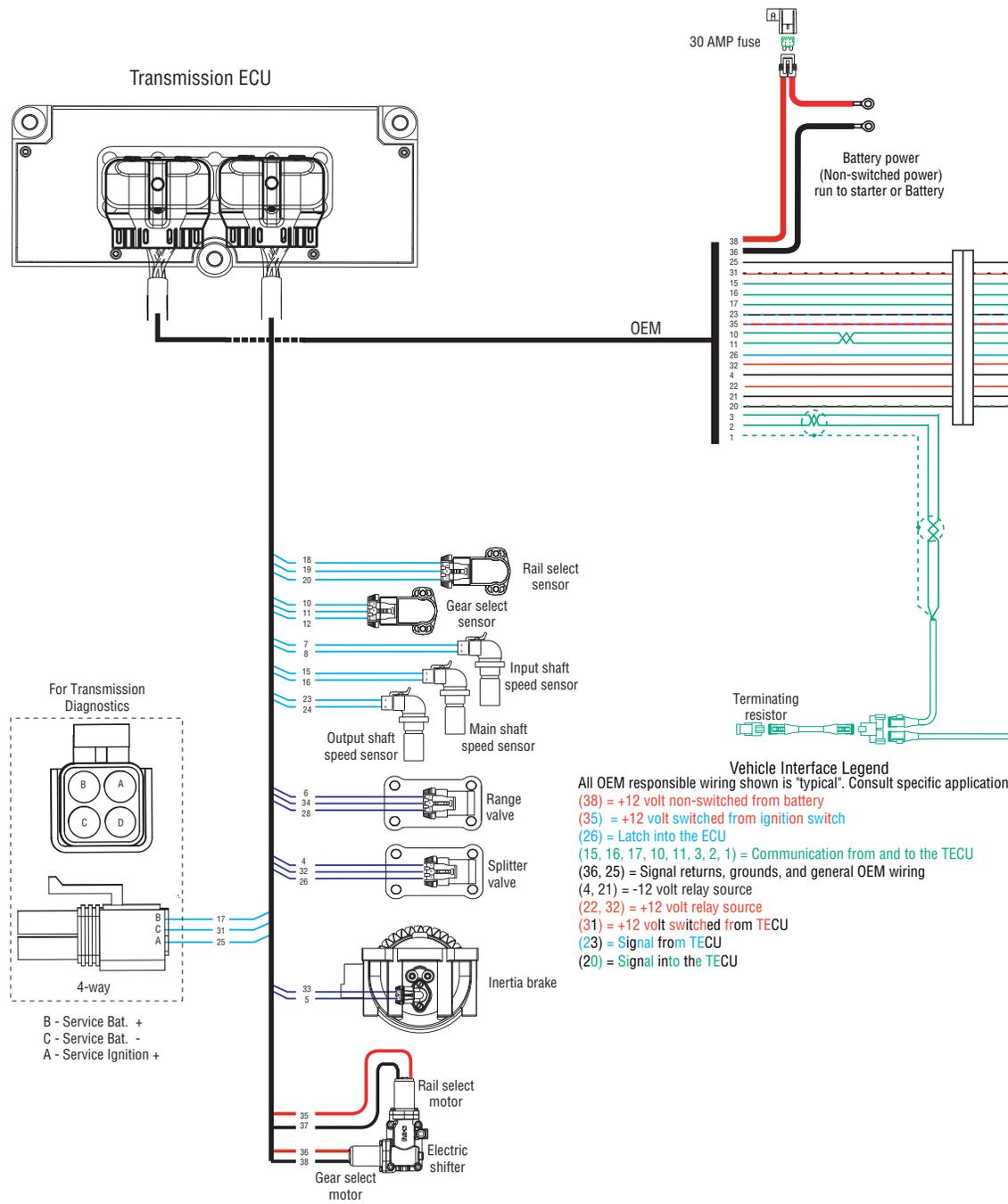


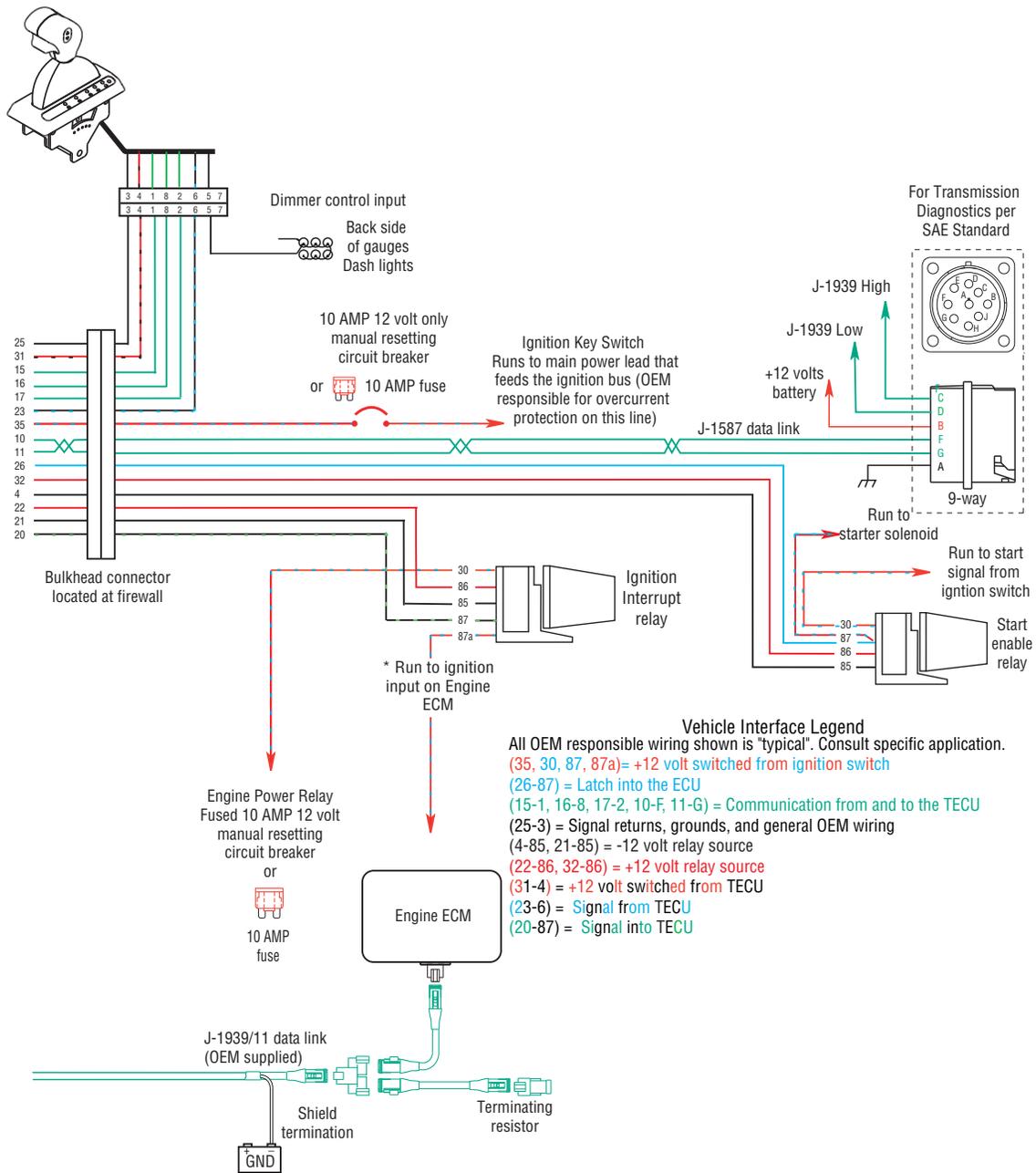
UltraShift 10-Speed Wiring Diagram with Push Button Shifter



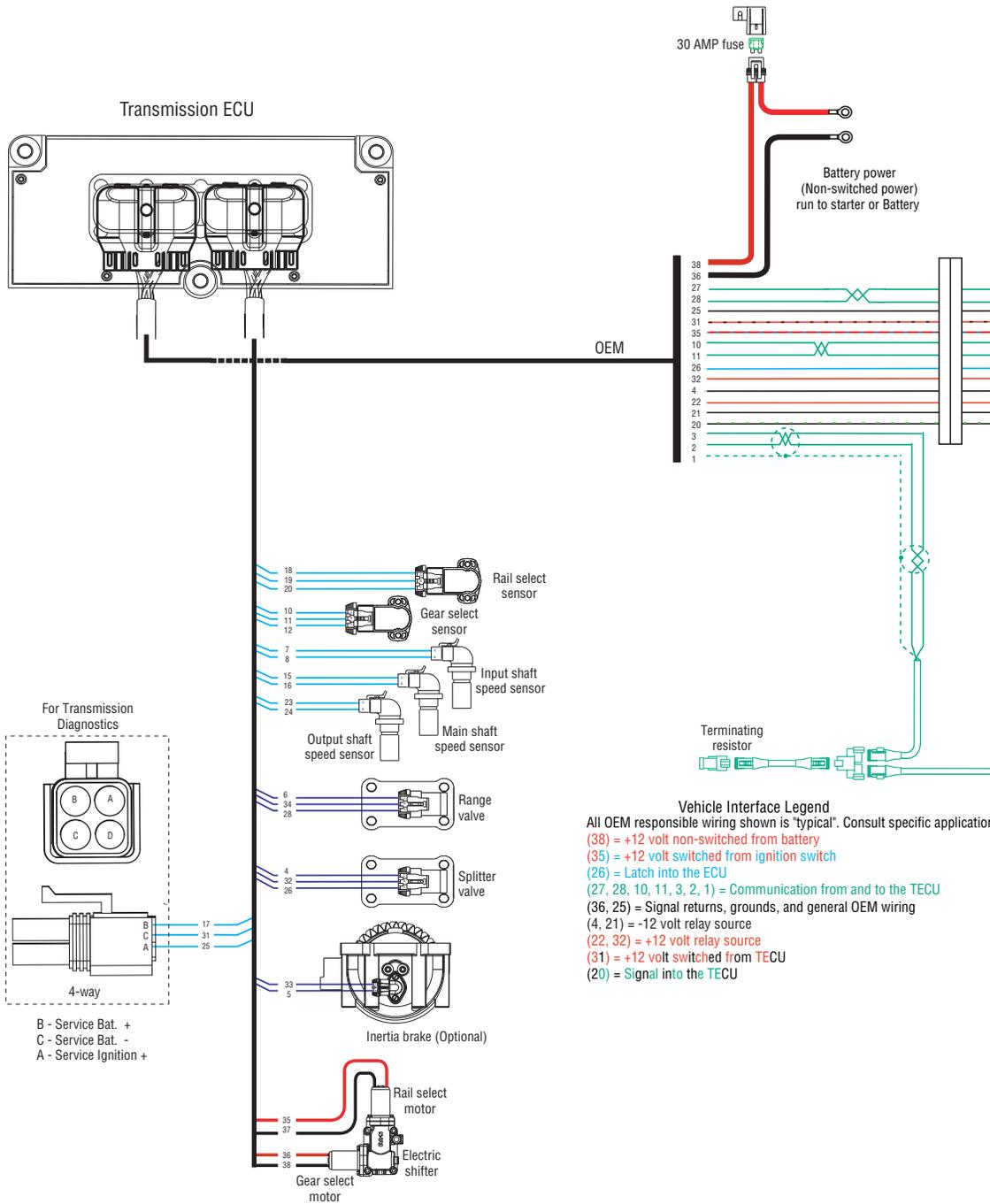


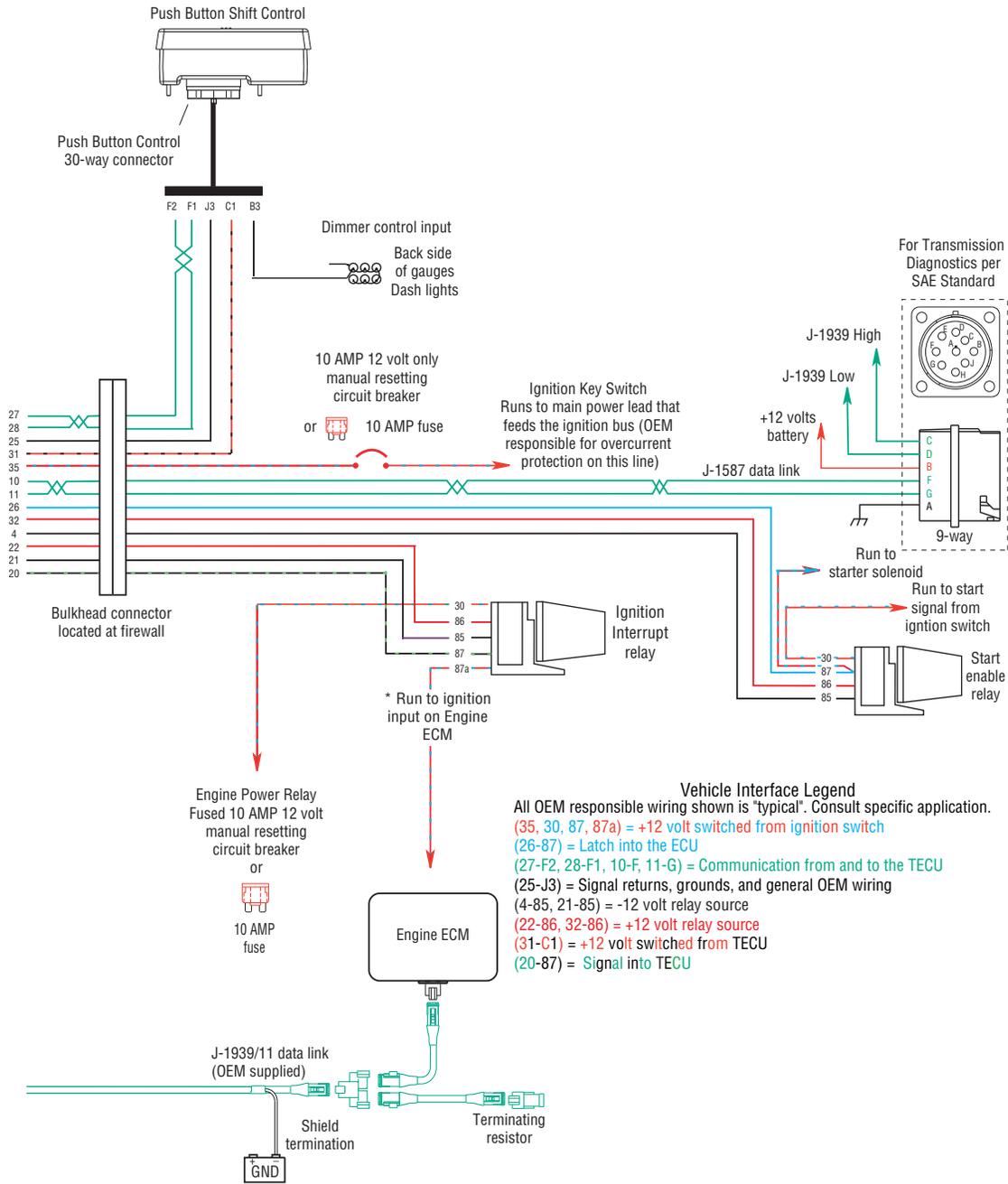
UltraShift 13-Speed Wiring Diagram with Analog Shifter



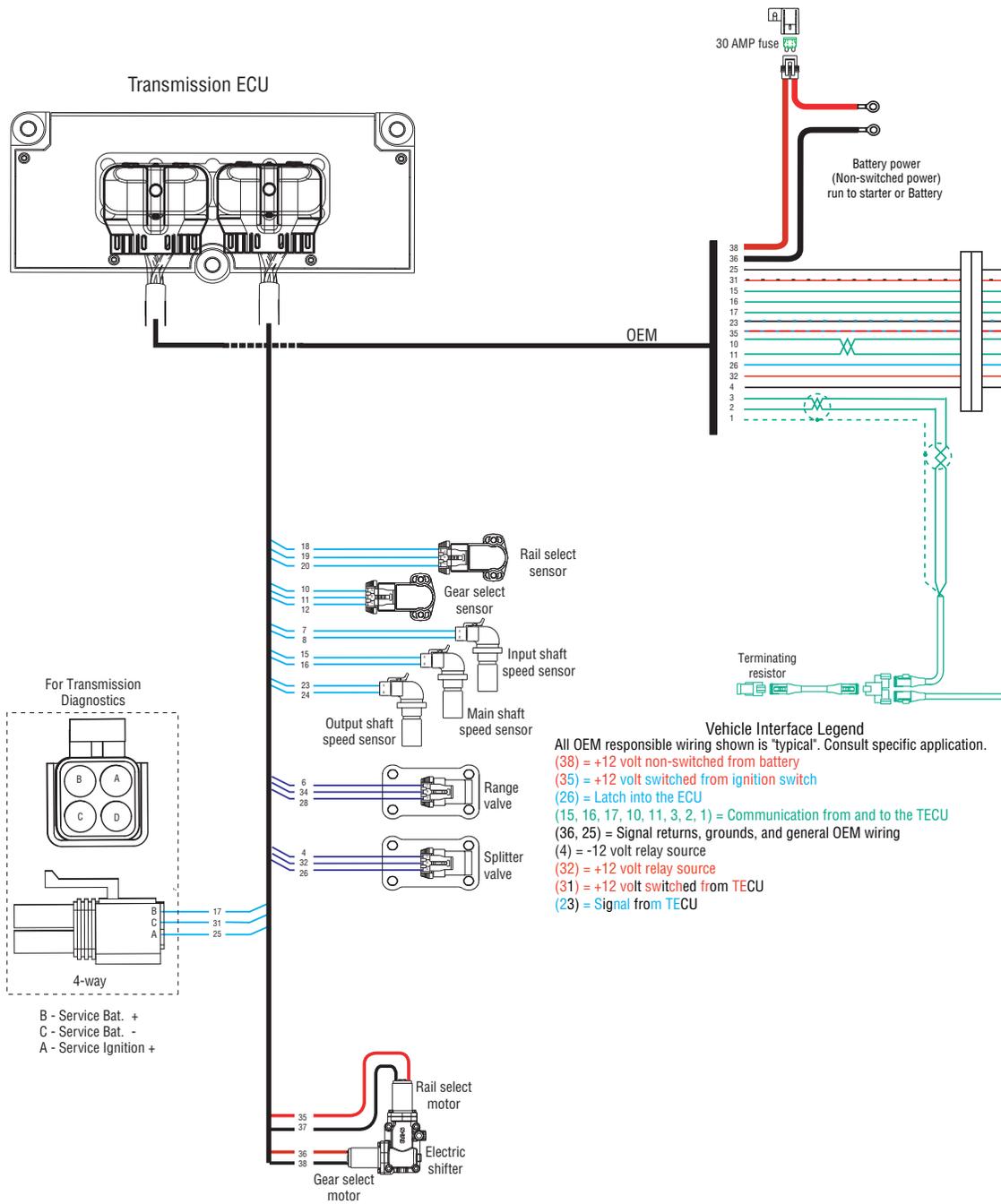


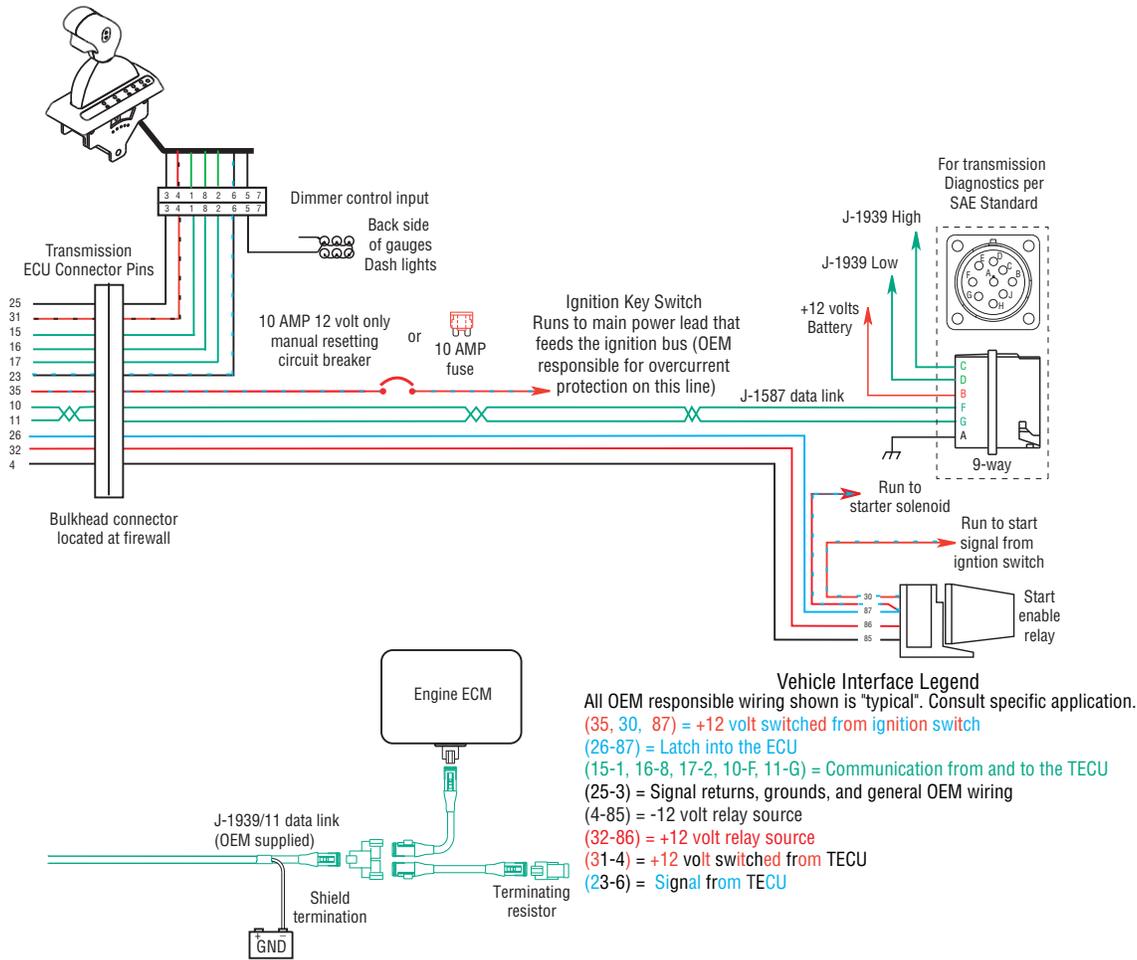
UltraShift 13-Speed Wiring Diagram with Push Button Shifter



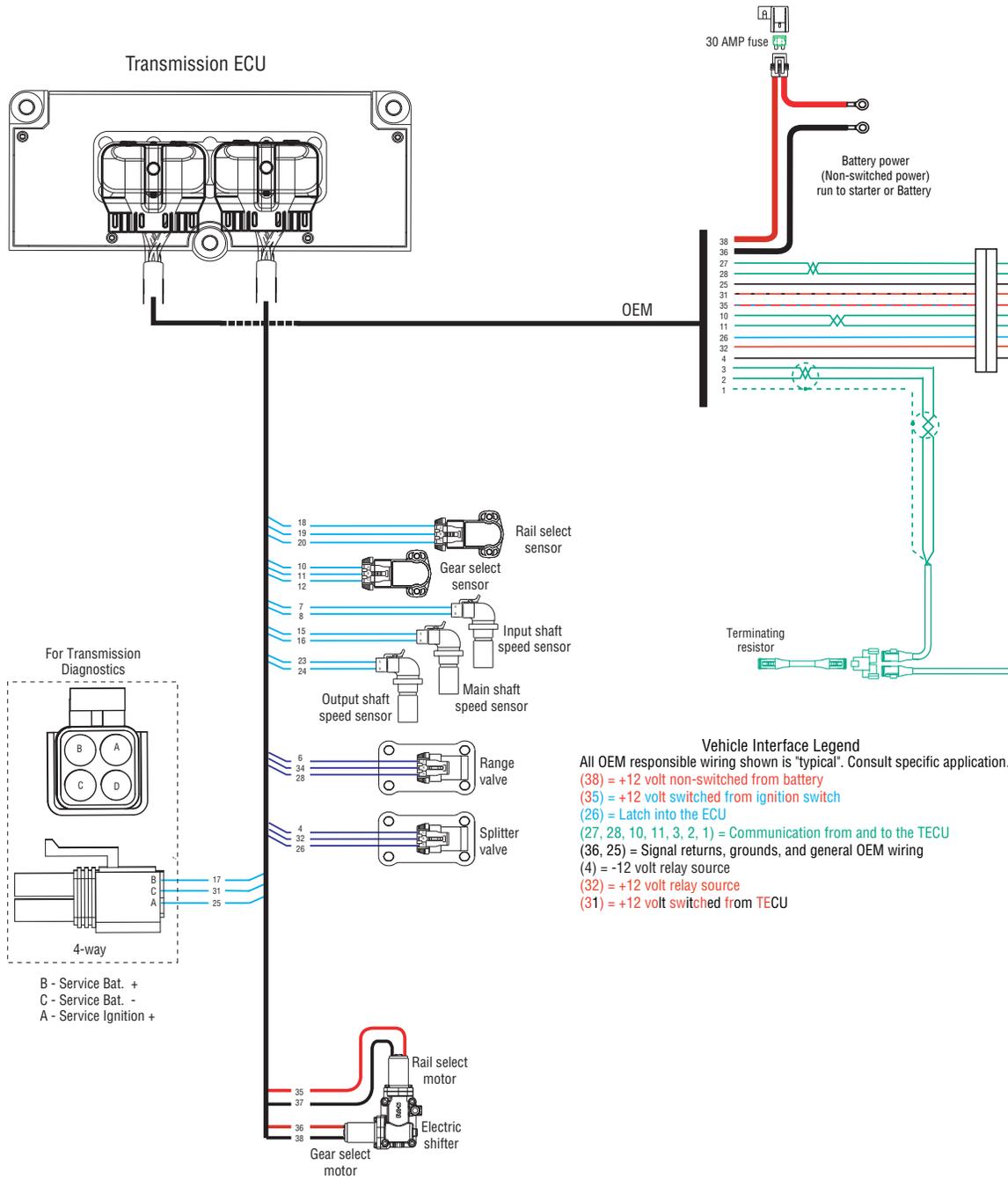


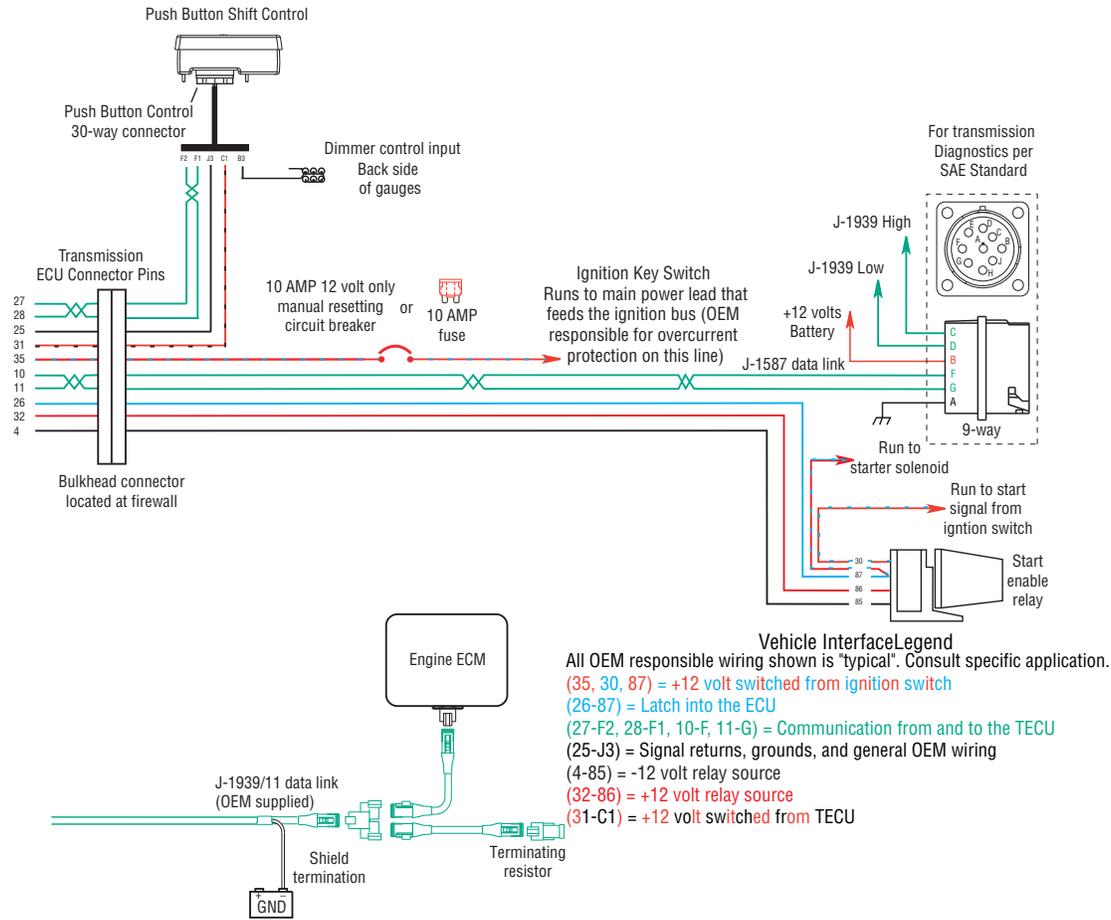
AutoShift 18-Speed Wiring Diagram with Analog Shifter



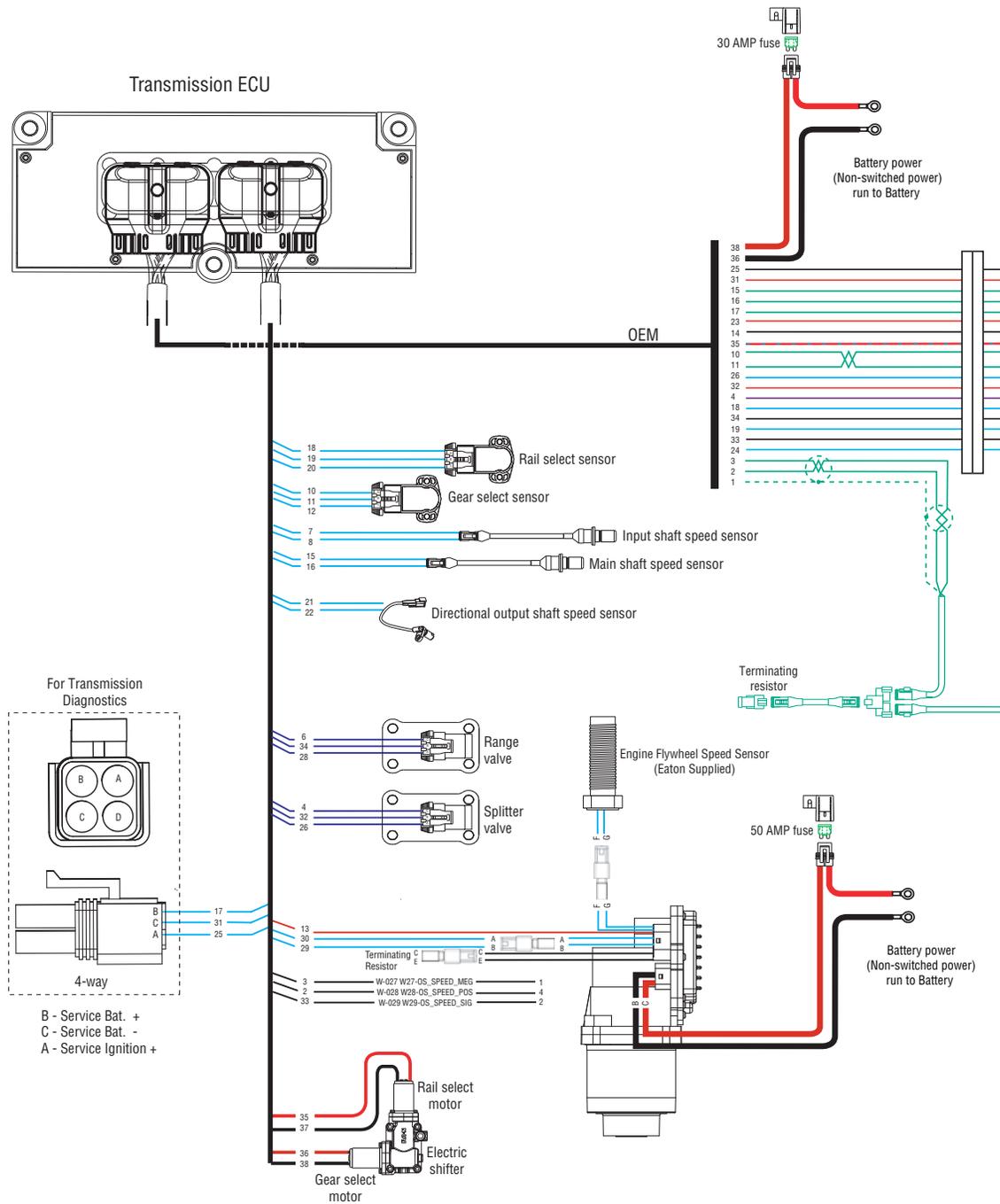


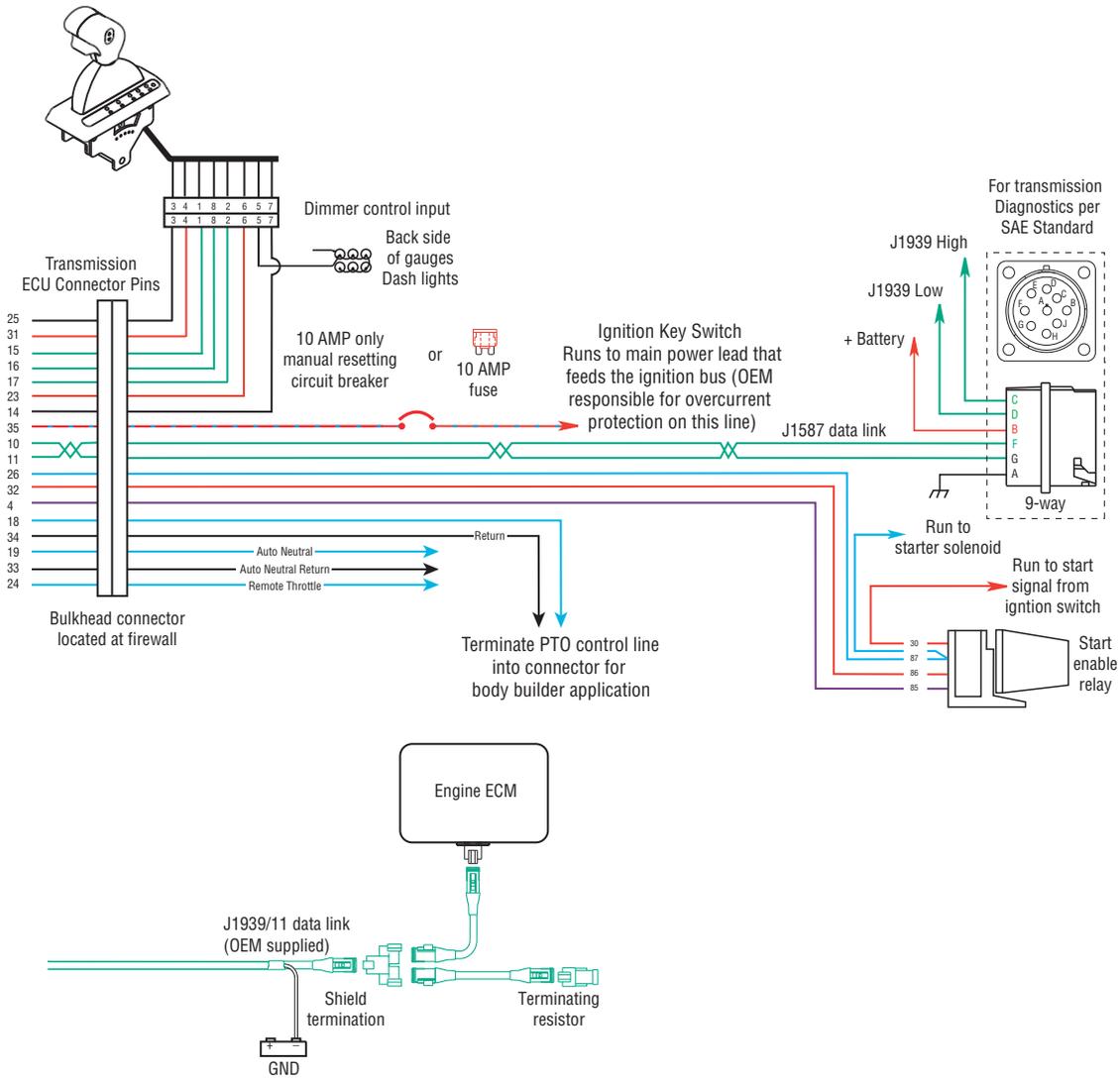
AutoShift 18-Speed Wiring Diagram with Push Button Shifter



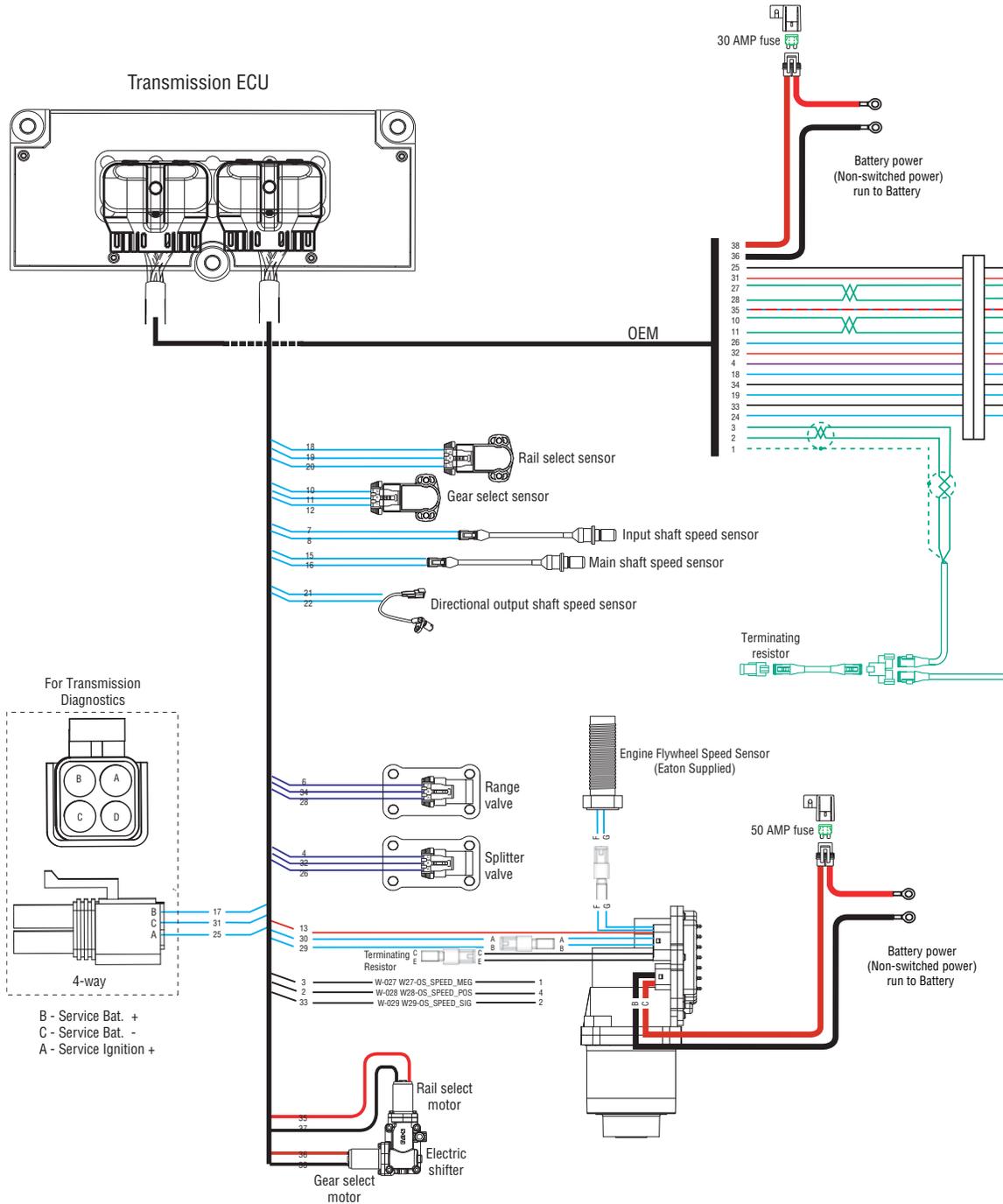


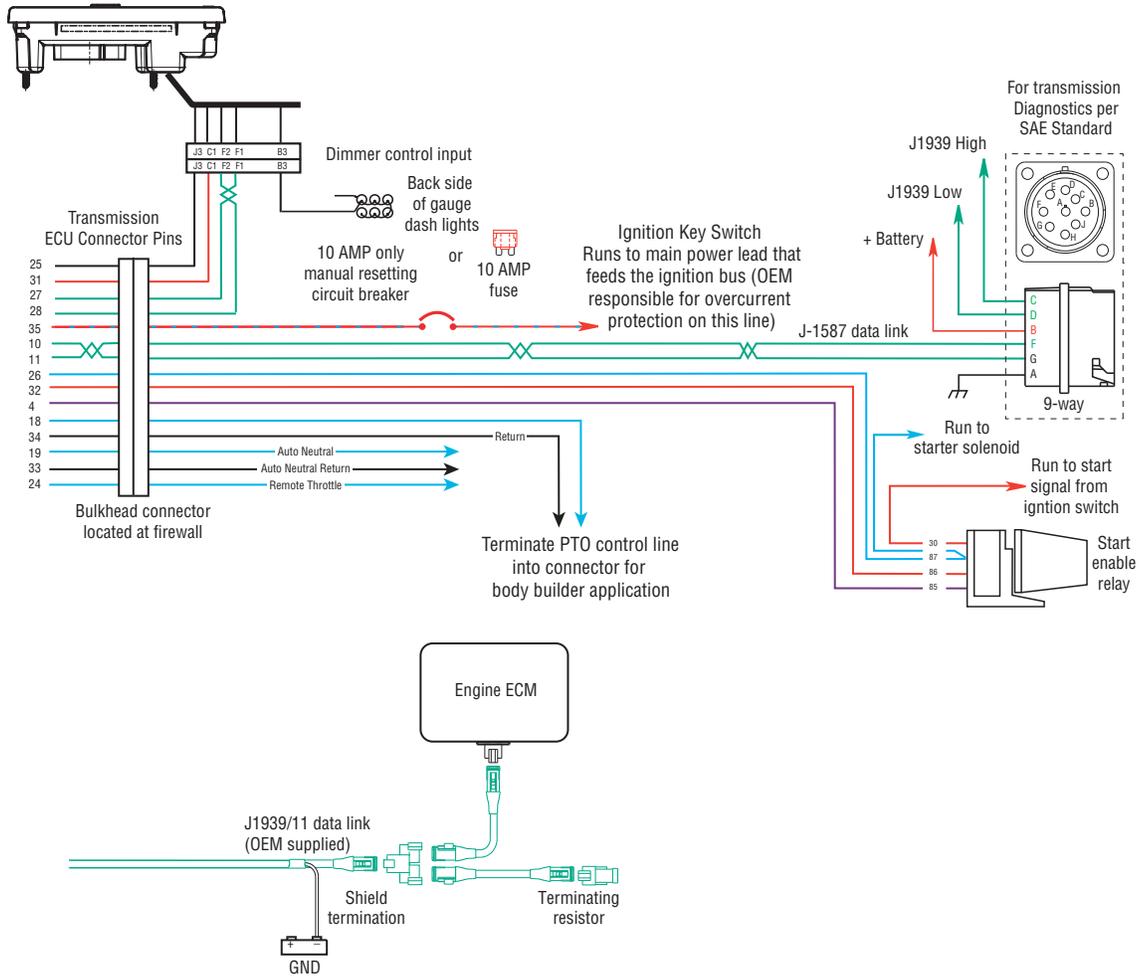
Heavy-Duty UltraShift PLUS Models Wiring Diagram with Analog Shifter



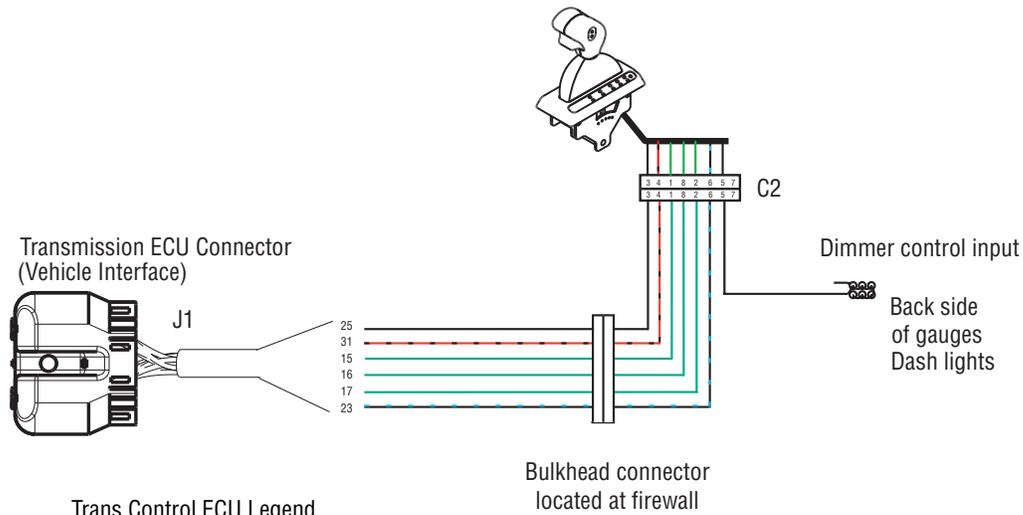


Heavy-Duty UltraShift PLUS Models Wiring Diagram with Push Button Shifter





Eaton Shift Lever Wiring Diagram



Trans Control ECU Legend

All OEM responsible wiring shown is "typical". Consult specific application.

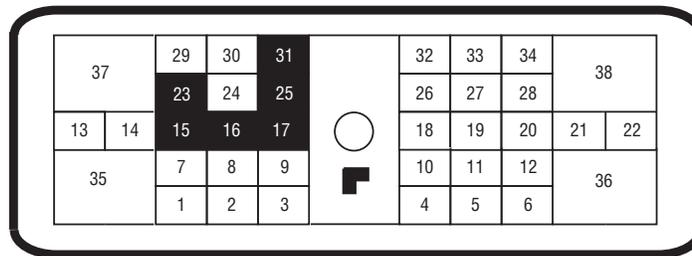
(31-4) = +12 volt switched from TECU

(15-1, 16-8, 17-2) = Communication from and to the TECU

(25-3, 5) = Signal returns, grounds, and general OEM wiring

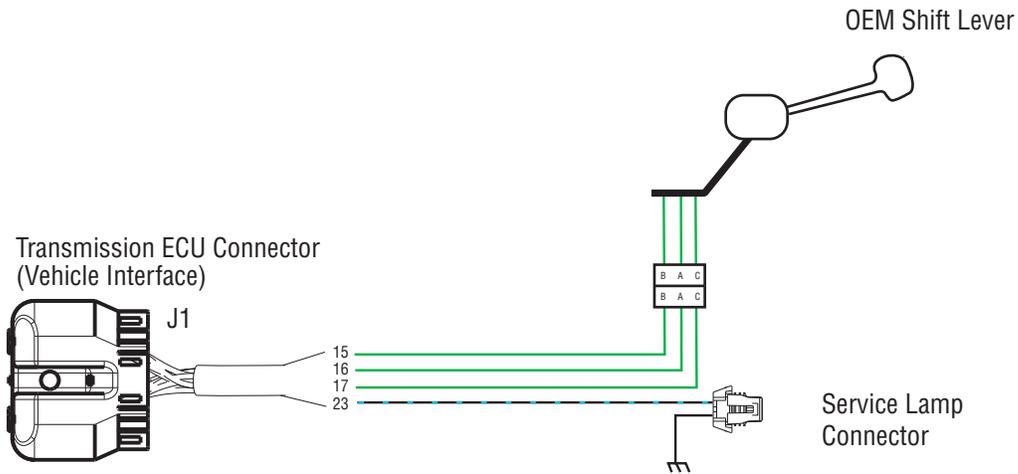
(23-6) = Signal from TECU

Front View
Transmission ECU Connector



FROM	TO	DESCRIPTION
J1-15	C2-1	Shift Control Input (Mode Auto)
J1-17	C2-2	Shift Control Input (Mode Common)
J1-25	C2-3	Shift Control Power Minus
J1-31	C2-4	Shift Control Power Plus
	C2-5	Dash Lights
J1-23	C2-6	Service Light Output
J1-16	C2-8	Shift Control Input (Mode Manual)
	C2-7	No Connection

OEM Shift Lever Wiring Diagram



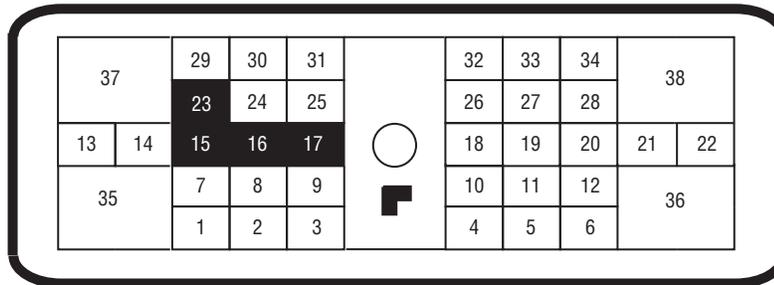
Vehicle Interface Legend

All OEM responsible wiring shown is "typical". Consult specific application.

(15-B, 16-A, 17-C) = Communication to and from the TECU

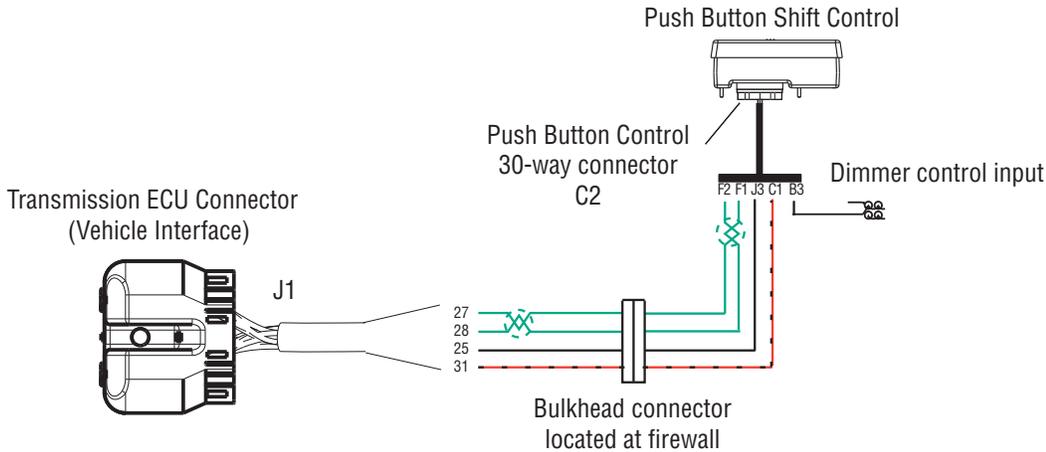
(23) = Signal from TECU

Front View
Transmission ECU Connector

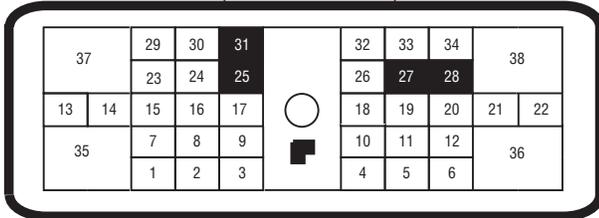


FROM	TO	DESCRIPTION
J1-15	F2-B	Shift Control Input (Mode Auto)
J1-16	F2-A	Shift Control Input (Mode Manual)
J1-17	F2-C	Shift Control Input (Mode Common)
J1-23	F3-A	Service Lamp Output
F3-B		Ground

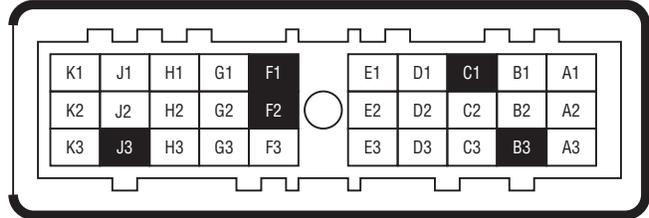
Eaton Push Button Wiring Diagram



Front View
Transmission ECU Connector
(Vehicle Interface)



Front View
Shift Control (30-Way Connector)



Vehicle Interface Legend

All OEM responsible wiring shown is "typical". Consult specific application.

(31-C1) = +12 volt switched from TECU

(27-F2, 28-F1) = Communication from and to the TECU

(25-J3) = Signal returns, grounds, and general OEM wiring

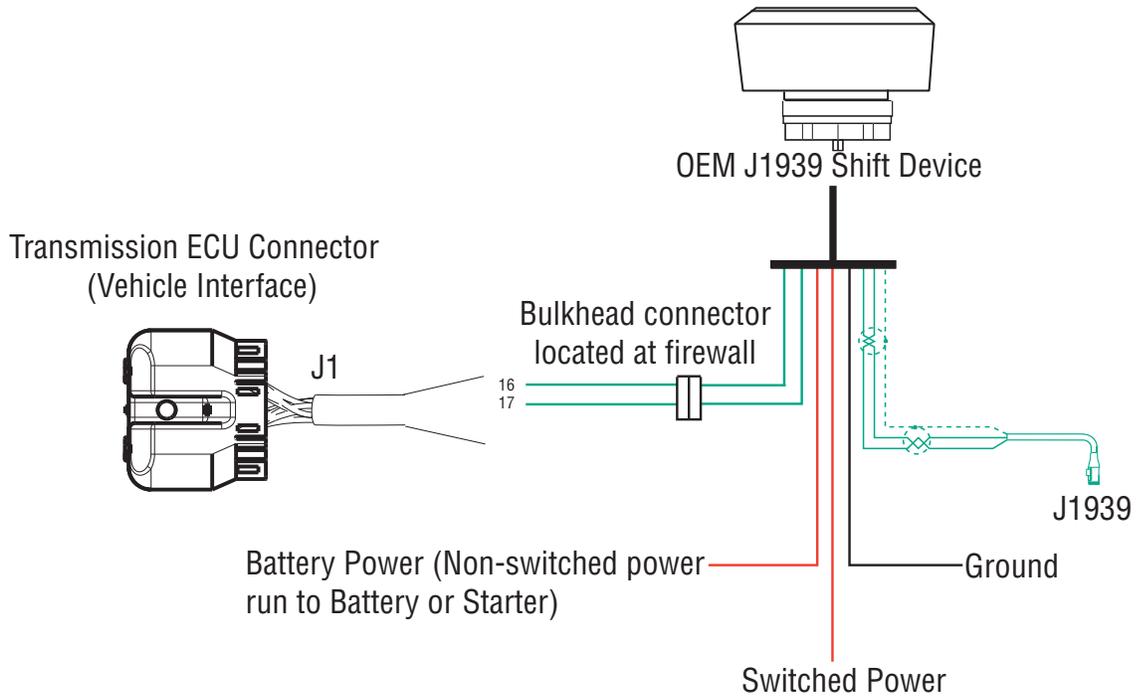
FROM	TO	DESCRIPTION
J1-27	C2-F2	HIL(-) LO
J1-28	C2-F1	HIL(+) HI
J1-25	C2-J3	Shift Control Power Minus
J1-31	C2-C1	Shift Control Power Plus
C2-B3		Dimmer Control Input

FROM	TO	DESCRIPTION
J1-D1	C2-1	RNDHL
J1-D3	C2-2	COMMON
-----	C2-3	GROUND
J1-J2	C2-4	SPLICE into TRANS BATT 1
J1-B3	C2-5	DIMMER CONTROL

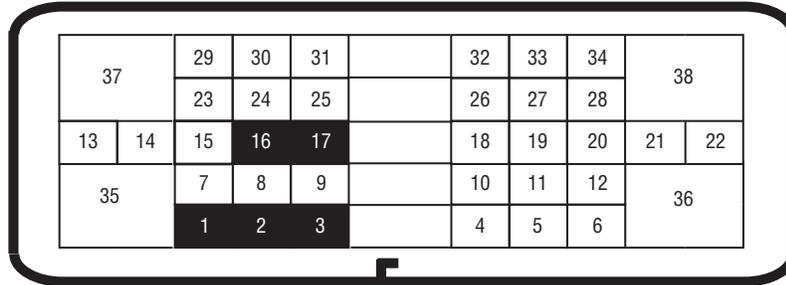
FROM	TO	DESCRIPTION
J1-H2	C2-6	SERVICE LAMP
J1-D2	C2-8	MANUAL MODE

FROM	TO	DESCRIPTION
J1-27	C2-F2	EPL- LO
J1-28	C2-F1	EPL+ HI
J1-25	C2-J3	Ground 1
J1-31	C2-C1	Ignition
C2-B3		Dimmer Control Input

OEM J1939 Shift Input Device Wiring Diagram

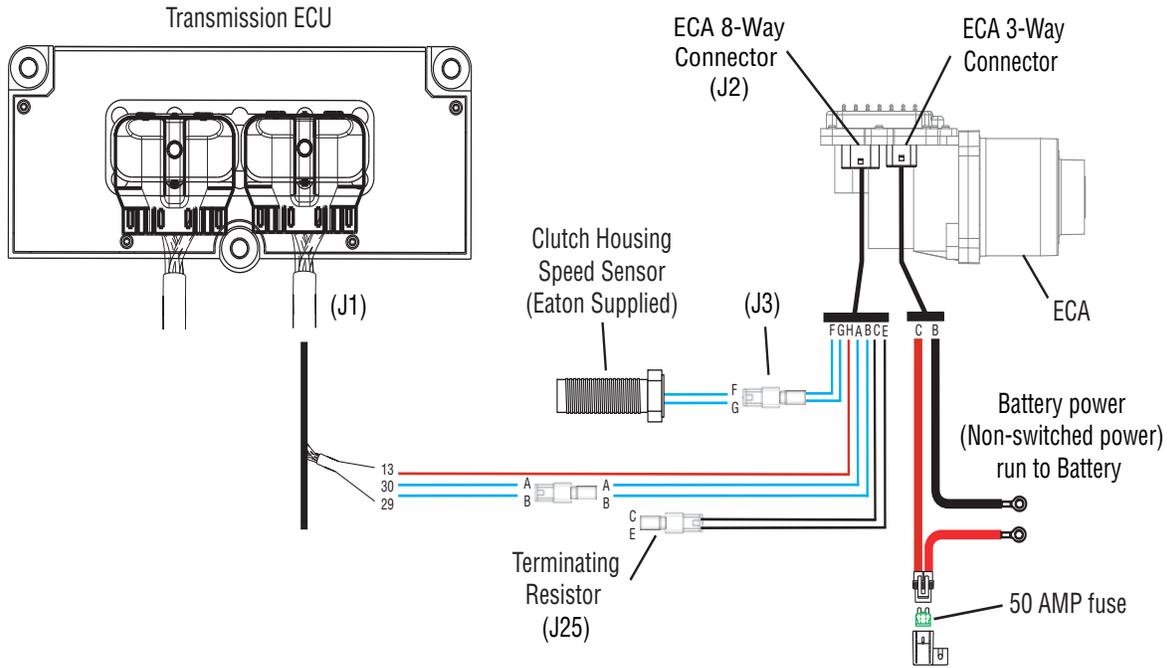


Front View
Transmission ECU Connector
(Vehicle Interface)

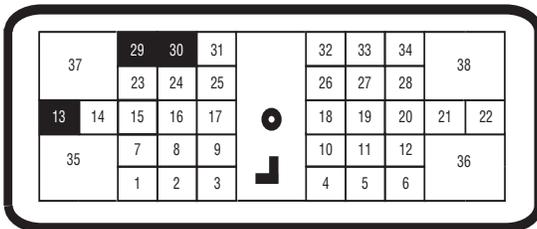


FROM	TO	DESCRIPTION
J1-16	Connector C2	Shift Control Input (Neutral Request Signal)
J1-17	Connector C2	Shift Control Input (Neutral Request Return)
OEM	Connector C2	Shift Control Power Minus (Ground)
OEM	Connector C2	Shift Control Power Plus (Ignition)
OEM	Connector C2	Shift Control Power Plus (Battery)
Connector C2	OEM	J1939 High
OEM	Connector C2	J1939 Low
OEM	Connector C2	J1939 Shield

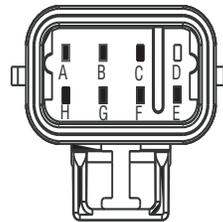
Heavy Duty UltraShift Plus Models ECA Wiring Diagram



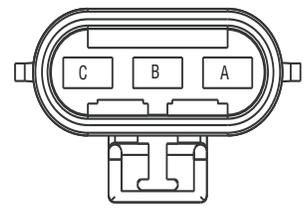
38-Pin Front Harness View
(TECU - Transmission Harness Connector)



ECA 8-Way Connector
Front Harness View



OEM Supplied
ECA 3-Way Connector



TECU 38-Way	ECA 8-Way	Description	Speed Sensor 2-Way	Terminator Resistor 2-Way
J1-30	J2-A	HIL (+) High		
J1-29	J2-B	HIL (-) Low		
	J2-C	Terminator Resistor		J25-2(C)
	J2-D	NOT USED		
	J2-E	Terminator Resistor		J25-1(E)
	J2-F	Speed Sensor (+)	J3-1(F)	
	J2-G	Speed Sensor (-)	J3-2(G)	
J1-13	J2-H	IGN		

Proper Clutch Operation

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

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

Check For Proper Clutch Operation

Note: Please refer to publication CLSM0200 for installation, adjustment, and general service guidelines for the ECA clutch.

With PC-Base Service Tool

- Connect ServiceRanger a PC-based Service Tool.
- Make sure the transmission is in neutral
- Start Engine.
- Set ServiceRanger a PC-based Service Tool to monitor input shaft speed.
- 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.

- Check clutch for slippage, and repair or replace as needed.
- Depress clutch pedal to active clutch brake. Within 2 seconds, input shaft speed should be less than 25 RPM (0 RPM is desired). If input shaft does not stop turning, the clutch is not disengaging completely or the clutch brake is not functioning properly.
- Check for proper clutch adjustment, adjust as necessary.
- 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.

- 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 ServiceRanger a PC-based Service Tool

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

Confirm Proper Clutch Adjustment and Clutch Brake Contact

Confirm Release Bearing Travel Gap

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

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

Confirm the Free-Play gap*

*For mechanical clutch release systems with free-play.

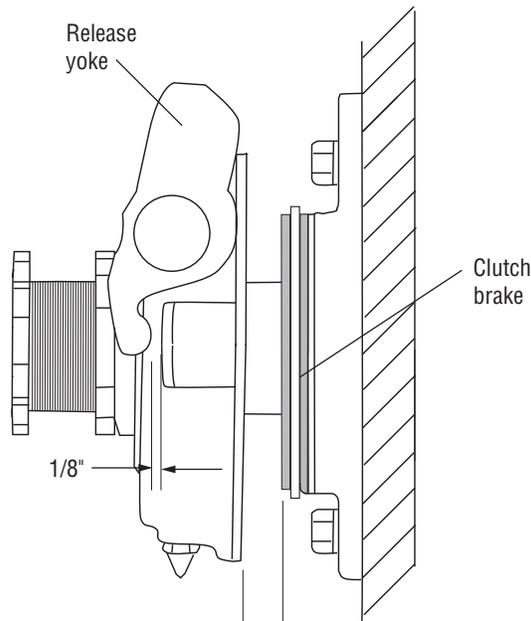
Use a 1/8" gauge to verify proper free-play gap on Easy Pedal.

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

Confirm Proper Clutch Brake Contact

Insert a 0.010" feeler gauge between the release bearing and the clutch brake. have an assistant fully depress 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's instructions. In addition, check the external clutch linkage for excessive wear or obstruction preventing complete travel.



Clutch Grease Interval Service Procedure

Clutch Greasing Guidelines

▲ IMPORTANT

It is highly important to follow proper clutch lube intervals as specified in Lubrication Manual, TCMT0021. Failure to do so may result in clutch failure and unnecessary repairs.

The heavy-duty ECA clutch housing has two grease fittings on the lower right side. The upper port is marked “CS” for the upper cross-shaft assembly, while the lower port is marked “RB” for the release bearing.



For more detailed cross-shaft greasing information refer to the “Release Yoke and Cross-shaft(s) Installation” section of this manual. Refer to Clutch Service Manual, CLSM0200, for release bearing greasing information.

Grease Interval Count Reset

The Heavy-Duty UltraShift PLUS has an optional prognostic feature that notifies the operator when the Clutch Release Bearing needs greasing. This feature can be enabled or disabled via ServiceRanger.

At the appropriate grease interval and shortly after each engine start, “GI” will momentarily appear in the gear display, along with an audible tone. This will continue to occur at each engine start until clutch service has been completed.

Note: “GI” stands for grease interval and may be misread as “G1” on gear display.

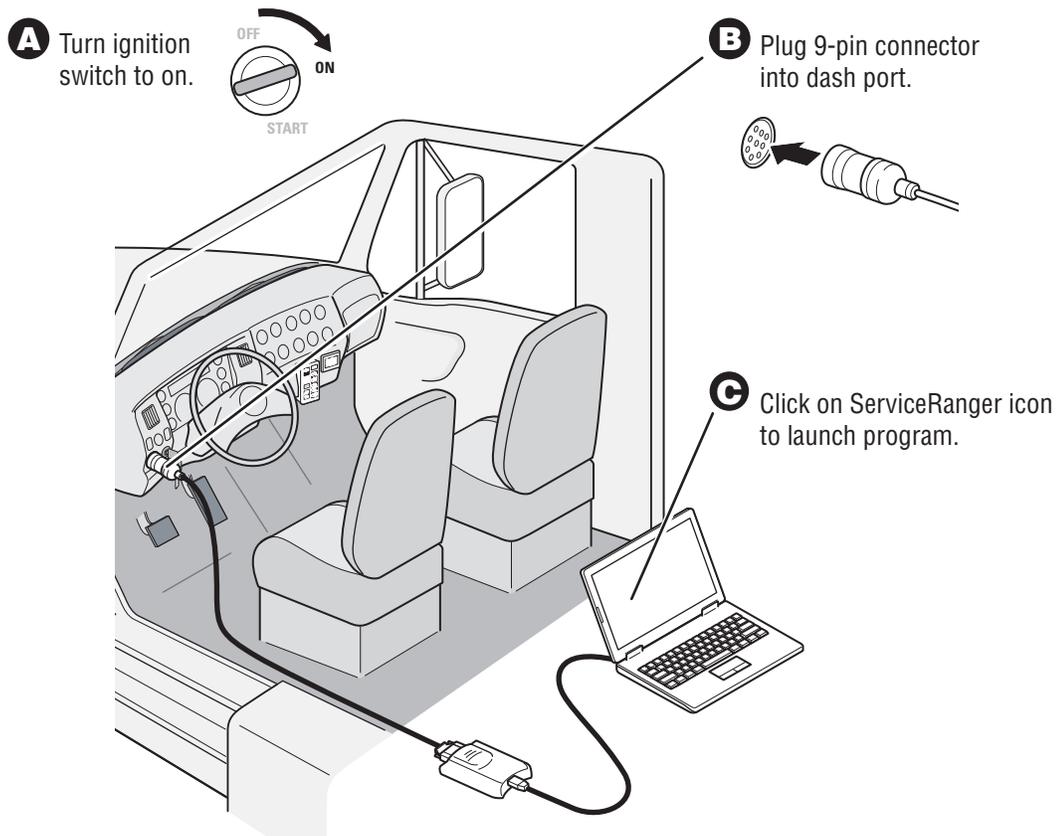
The operator can choose to follow this Automated Lube Schedule or the published lube guidelines in the Lubrication Manual TCMT0021. When enabled, it is highly important to reset the Grease Interval Count every time the release bearing is greased.

The Grease Interval Count can be reset via ServiceRanger or Operator Triggered Special Function.

ServiceRanger Procedure

CAUTION

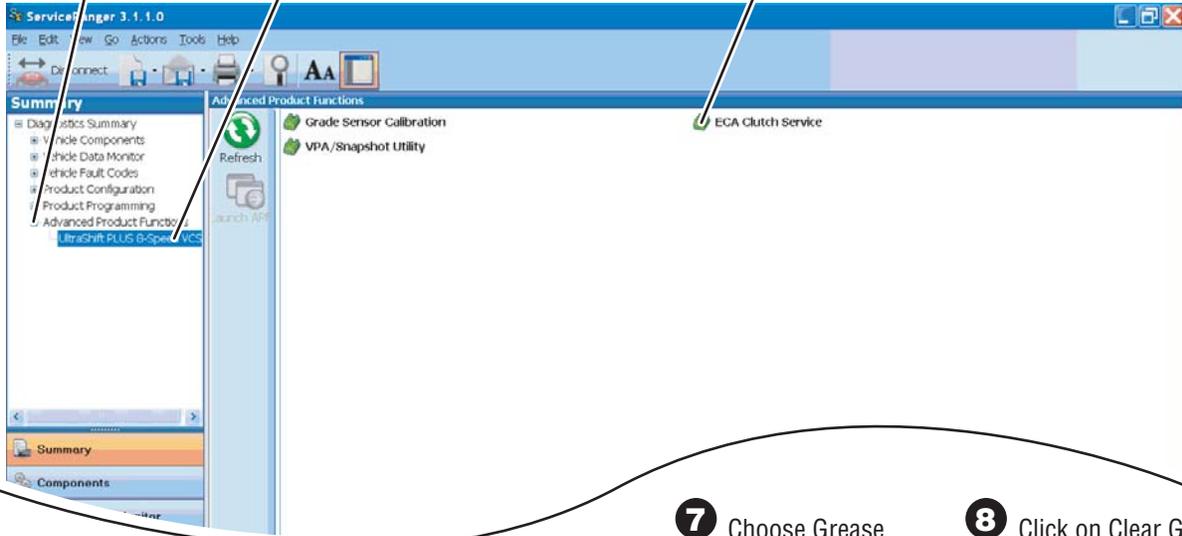
Ensure that hands are not inside the clutch housing while opening or closing the clutch.



4 Open and expand the Advanced Product Functions tree.

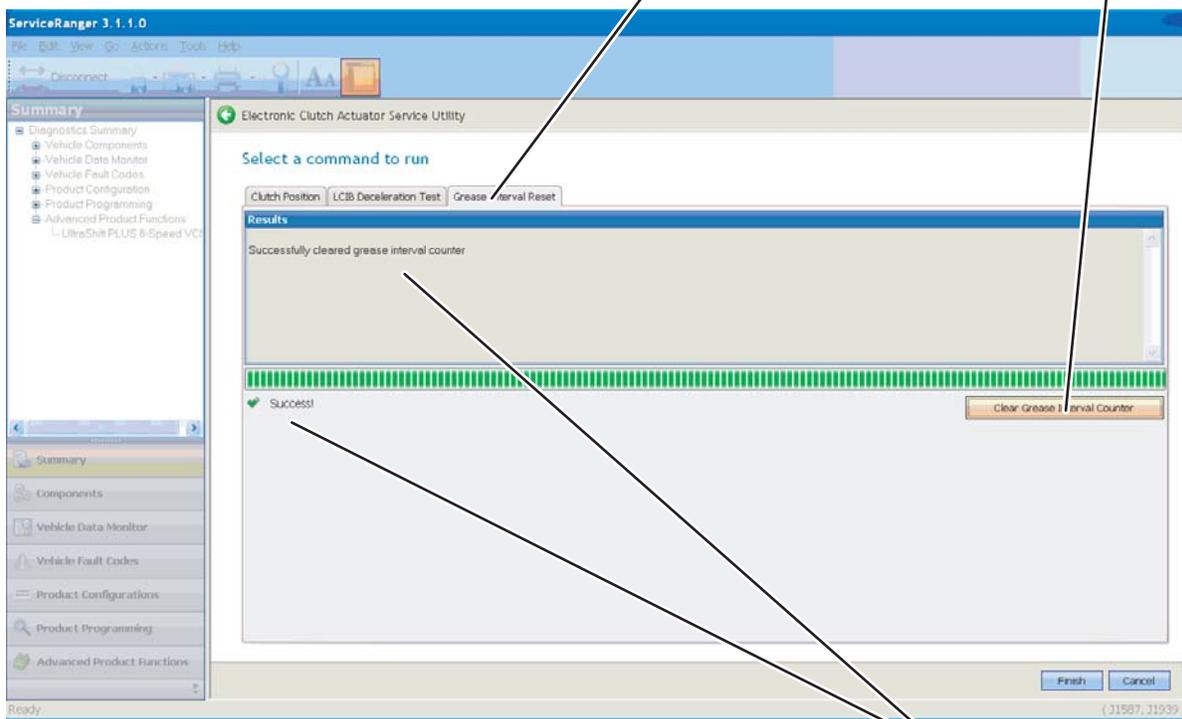
5 Click on transmission.
Note: Advanced Product Functions appear.

6 Click on ECA Clutch Service.



7 Choose Grease Interval Reset tab.

8 Click on Clear Grease Interval Counter.



9 Confirm Positive results.

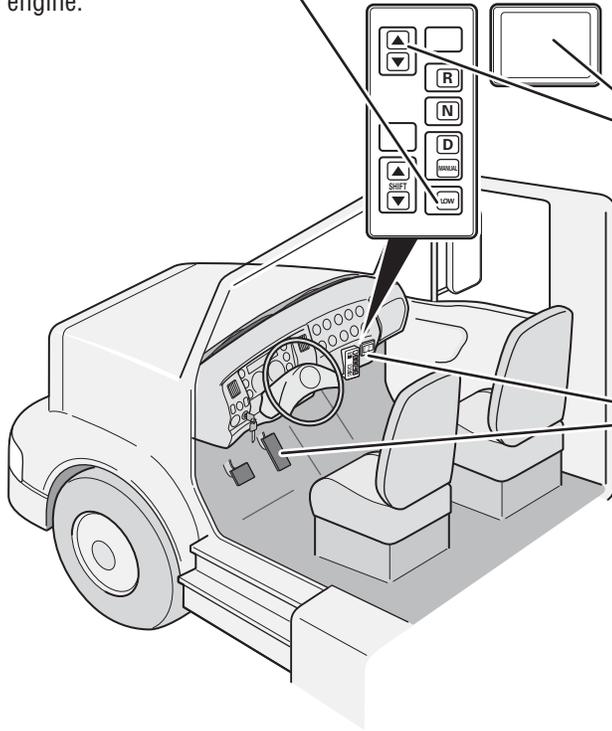
10 Turn ignition switch

Operator Triggered Procedure

- 1** From the off position, turn ignition to on without cranking the engine.



- 2** Select low mode on the shift device.



- 3** Press the manual up-shift button until the gear display shows "3".



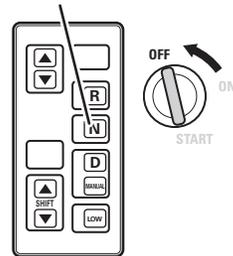
- 4** Press Accelerator to the floor. Gear display will show a down arrow.



- 5** Release the accelerator. Gear display will show a "0".



- 6** Select neutral and turn ignition to off in order to save the reset.



Adapter Test Kit # J-43318

Note: Use extreme caution when inserting adapters into the connectors to avoid spreading or distorting of the terminals.

Gray Adapters

Gray adapter are to only be used for the following connectors:

- Shift Control 30-way connector
- Speed Sensors
- Position Sensors
- Range Solenoid Valve
- Splitter Solenoid Valve

Green and Brown Adapters

Green and brown adapters are to only be used for the following connectors:

- Vehicle interface 38-way connector
- Transmission ECU 38-way connector

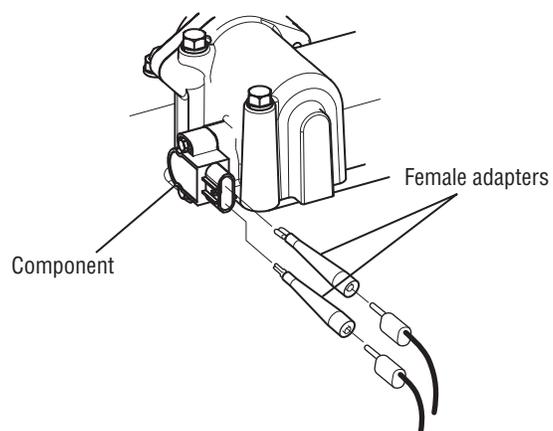
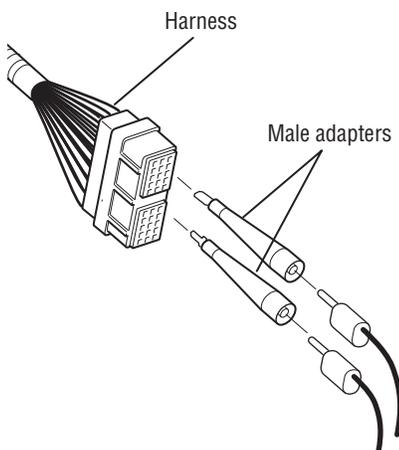
Purple Adapters

Purple adapter are to only be 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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In Mexico, call 001-800-826-4357.