Troubleshooting Guide

Eaton Gen III Automated Transmissions TRTS0930 EN-US

August 2013

UltraShift®
AutoShift®
UltraShift® PLUS Linehaul Active Shifting (LAS)
UltraShift® PLUS Linehaul Small Step Efficiency (LSE)
UltraShift® PLUS Multipurpose Extreme Performance (MXP)
UltraShift® PLUS Multipurpose High Performance (MHP)
UltraShift® PLUS Vocational Active Shifting (VAS)
UltraShift® PLUS Vocational Construction Series (VCS)
UltraShift® PLUS Vocational High Performance (VHP)
UltraShift® PLUS Vocational Multipurpose Series (VMS)
UltraShift® PLUS Vocational Extreme Performance (VXP)
UltraShift® PLUS Passenger Vehicle (PV)

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Diagnostic Procedures

Overview
None

Detection
None

Fallback
None

Possible Causes
None

Product Diagnostic (PD) Mode

Product Diagnostic (PD) Mode

PD Mode 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 PD Mode.

PD Mode 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 PD Mode:

Note: Vehicle will not start in PD Mode. You must turn vehicle key off to exit PD Mode.

1. Vehicle must be stationary, engine off, set vehicle parking brake.
2. Turn the key off and on 2 times, starting with key on and ending with key on.

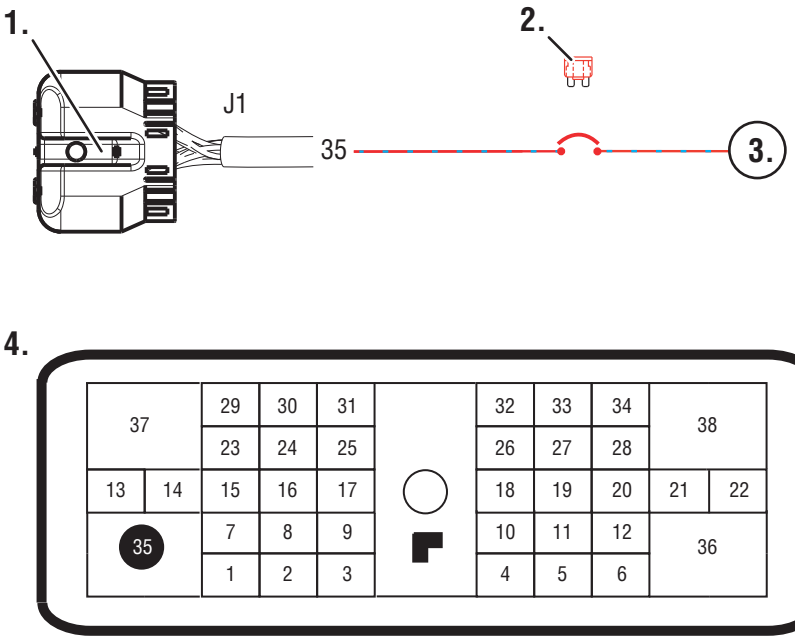
   Note: Dash may display an 88 at key on. This is a normal power-up test of the display.
3. The gear display will flash a 25 then a solid PD (Product Diagnostic Mode) and the mode will be activated.
4. The service light shall flash code 25 once indicating no codes. The service light shall then illuminate solid to indicate PD Mode until such time that an Active code is detected or PD Mode is exited.
5. Refer to PD Mode section in Fault Isolation procedure for the Inactive fault to be diagnosed.
6. PD will remain in gear display until an active fault has been set during the PD Mode fault isolation procedure.
   - If the fault is detected during PD Mode the gear display will display the active fault. 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.

   Note: Active codes set during PD Mode will not be stored as Inactive.
7. If a fault is detected, exit PD Mode and perform the corresponding Fault Isolation Procedure.
8. To exit PD Mode, turn the key off.

PD Mode works 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.

TECU Ignition Circuit



1. TECU connector (vehicle interface)
2. 10 AMP only, manual resetting circuit breaker OR 10 AMP fuse
3. Ignition Key Switch

Note: Run to main power lead that feeds the ignition bus (OEM responsible for overcurrent protection on this line)

4. TECU Connector (vehicle interface) front view

From	To
J1-35	VIGN

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

I

Purpose: *Verify that a proper ground path is being supplied to the Shift Control Device through the Vehicle Harness and test for a short to ground.*

1. Key off.
2. Disconnect negative battery cable.
3. Disconnect 38-way Vehicle Harness from TECU.
4. Measure resistance between TECU 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 Vehicle Harness. Go to **Step V.**

J

Purpose: *Measure the resistance of the ignition voltage supply wire to the Shift Control Device through the Vehicle Harness and test for a short to ground.*

1. Measure resistance between TECU 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 TECU. Go to **Step V.**
   - If resistance is outside of range, repair the Vehicle Harness. Go to **Step V.**

K

Purpose: *Visually identify if the shift lever is an Eaton built shift lever or an OEM built shift lever.*

1. Is vehicle equipped with an Eaton supplied Shift Lever or an OEM supplied Shift Lever.
   - If Eaton Cobra Lever, go to **Step L.**
   - If OEM Shift Lever, go to **Step R.**

L

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

1. Key on.
2. Observe Service light.

   Note: If Service light is flashing, See “Diagnostic Procedures” on page 6.
   - If Service light illuminates for 1 second and turns off, test complete.
   - If Service light never comes on, go to **Step O.**
   - If Service light is on steady, go to **Step M.**

Fault Code 12 - Improper ECU Configuration

A

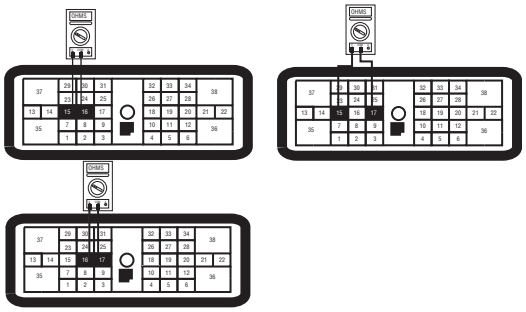
Purpose: *Check for active or Inactive fault codes.*

1. Key on.
2. Retrieve codes. See “Fault Code Retrieval/Clearing” on page 10.
   - If Fault Code 12 is Active, Customer - Call Eaton at 1-800-826-HELP (4357). CSC - Call Technician Service.
   - If Fault Code 12 is Inactive, test complete.

F

Purpose: *Check for short circuits in the shift lever wiring.*

1. Key off.
2. Measure resistance between:
   - Pin 15 and Pin 16 on the TECU 38-way connector.
   - Pin 15 and Pin 17 on the TECU 38-way connector.
   - Pin 16 and Pin 17 on the TECU 38-way connector.



- If resistance on all three is 10K ohm or greater, replace Shift Lever and go to **Step V.**
- If any of the three readings is less than 10K ohm, repair the Vehicle Harness between the Eaton Cobra Lever and TECU. Go to **Step V.**

V

Purpose: *Verify repair.*

1. Key off.
2. Reconnect all connectors and the negative battery cable.
3. Key on.
4. Clear codes, See “Fault Code Retrieval/Clearing” on page 10.
5. Drive vehicle and attempt to reset the code.
6. Check for codes. See “Fault Code Retrieval/Clearing” on page 10.
   - If no codes, test complete.
   - If code 14 appears, go to **Step A.** to find error in testing.
   - If code other than 14 appears, See “Fault Code Isolation Procedure Index” on page 13.

Fault Code 15 - HIL Shift Device Configuration

A

Purpose: *Check for active or Inactive fault codes. Perform electrical pretest.*

1. Key on.
2. Retrieve active fault codes and FMIs with ServiceRanger using the 9-way diagnostic connector.
3. Perform electrical pretest, see "Electrical Pretest" on page 18.
   - 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.**

B

Purpose: *Confirm the presence of terminating resistors in the HIL.*

1. Key off.
2. Locate and remove the terminating resistor that is wired into the ECA 8-way connector Pin C and Pin E.
3. Measure resistance between the transmission harness connector Pin 1 and Pin 2.

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

   - If resistance between Pin 1 and Pin 2 is between 50-70 ohms, replace **Cobra Lever** or **Shift Control** and go to **Step V.**
   - If resistance is outside of range, replace the:
     - **Medium-Duty Transmission Harness**
     - **Heavy-Duty Transmission Harness**

     Go to **Step V.**

V

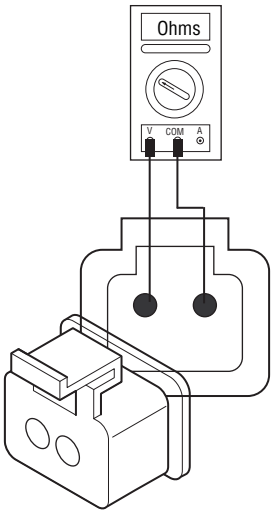
Purpose: *Verify repair.*

1. Key off.
2. Key on.
3. Clear codes. See "Fault Code Retrieval/Clearing" on page 10.
4. Reconnect all connectors and the negative battery cable.
5. Driving Vehicle and attempt to reset the code.
6. Check for codes. See "Fault Code Retrieval/Clearing" on page 10.
   - If no Fault Codes, test complete.
   - If Fault Code 15 appears, go to **Step A.** to find error in testing.
   - If fault code other than 15 appears, See "Fault Code Isolation Procedure Index" on page 13.

M ***Purpose:*** *Confirm the presence of terminating resistors in the HIL.*

1. Key off.
2. Connect 8-way connector.
3. Locate and remove the terminating resistor that is wired into the ECA 8-way connector Pin C and Pin E.
4. Measure resistance between transmission harness connector Pin 1 and Pin 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 Pin 2 is 50-70 ohms, (if fault code is Active) replace the:
  - **Medium-Duty Transmission Electronic Control Unit (TECU)**
  - **Heavy-Duty Transmission Electronic Control Unit (TECU)**

  Go to **Step V.**
- If equipped with a lever or J1939 shift device and resistance between Pin 1 and Pin 2 is 120-130 ohms, go to **Step V.**
- If any of the above conditions are not met, go to **Step N.**

Fault Code 18 - ECA Communication Fault

A

Purpose: *Check for active or Inactive codes, noting FMI.*

1. Key on.
2. Retrieve active fault codes and FMIs with ServiceRanger using the 9-way diagnostic connector.
3. What FMIs are present?
   - If Fault Code 18 (FMI 9) is Active, See "Fault Code 19 - CAN ECA Message Fault" on page 88.
   - If Fault Code 18 (FMI 9) is Inactive, test complete, go to **Step V.**.

V

Purpose: *Verify repair.*

1. Key off.
2. Key on.
3. Clear fault codes, see "Fault Code Retrieval/Clearing" on page 10.
4. Reconnect all connectors and the negative battery cable.
5. Drive vehicle and attempt to reset the code.
6. Check for fault codes, see "Fault Code Retrieval/Clearing" on page 10.
   - If no fault codes, test complete.
   - If Fault Code 18 appears, go to **Step A.** to find error in testing.
   - If fault code other than 18 appears, see "Fault Code Isolation Procedure Index" on page 13.

G

Purpose: *Monitor Park Brake Switch status in ServiceRanger.*

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.**

H

Purpose: *Check for short circuits in the shift lever wiring.*

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 Pin 33 and Pin 19 and measure the resistance between Pin 19 and ground.
   - If resistance between Pin 33 and ground or between Pin 33 and Pin 19 is less than 10K ohm, repair the Vehicle Harness per OEM guidelines. Go to **Step V.**
   - If resistance between Pin 33 and ground and between Pin 33 and Pin 19 are OL, (if fault code is Active) replace the:
     - **Medium-Duty Transmission Electronic Control Unit (TECU)**
     - **Heavy-Duty Transmission Electronic Control Unit (TECU)**

     Go to **Step V.**

V

Purpose: *Verify repair.*

1. Key off.
2. Reconnect all connectors and the negative battery cable.
3. Key on.
4. Clear fault codes, see "Fault Code Retrieval/Clearing" on page 10.
5. Drive vehicle and attempt to reset the fault code.
6. Check for codes, see "Fault Code Retrieval/Clearing" on page 10.
   - If no codes, test complete.
   - If Fault Code 21 appears, go to **Step A.** to find error in testing.
   - If fault code other than 21 appears, See "Fault Code Isolation Procedure Index" on page 13.

Fault Code 27 - Clutch Disengagement

J1587: MID 130 SID 55 FMI 7, 13
J1939: SA 3 SPN 788 FMI 7, 13

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.

Detection

DM Clutch Fault Detection

Starting at key on and throughout operation, the Transmission Electronic Control Unit (TECU) constantly measures engine RPM and idle torque from the engine. If the engine speed falls significantly below idle or engine torque rises significantly above idle torque upon engaging a start gear, the fault is set. If the vehicle is brought to a stop when in gear 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 a speed separation of less than 50 RPMs between engine and input shaft 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.

Note: 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.

Clutch Disengagement Test

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

When troubleshooting a DM Clutch go to **Step A.**. When troubleshooting a heavy-duty ECA Clutch go to **Step B.**. When troubleshooting a medium-duty ECA Clutch go to **Step G.**.

Fallback

No gear engagement from neutral if the truck is stationary; however, if the TECU determines the vehicle is moving, it will allow a gear engagement from neutral.

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

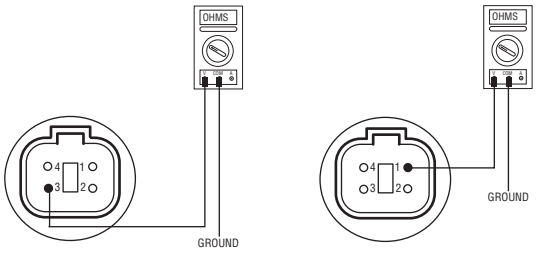
Additional Tools

- Clutch jack

E

Purpose: *Test the hydraulic manifold wiring for short circuits.*

1. Measure resistance between WetClutch housing connector pins:
   - 3 and ground
   - 1 and ground



- If resistance from Pin 3 to ground and Pin 1 to ground is 10K ohm or greater, replace the:
  - **Medium-Duty Transmission Harness**
  - **Heavy-Duty Transmission Harness**

  Go to **Step V.**
- If resistance is less than 10K ohm, Replace Transmission. Go to **Step V.**

V

Purpose: *Verify repair.*

1. Key off.
2. Reconnect all connectors.
3. Key on.
4. Clear codes, see “Fault Code Retrieval/Clearing” on page 10.
5. Drive the vehicle and attempt to reset the code.
6. Check for codes, see “Fault Code Retrieval/Clearing” on page 10.
   - If no codes, test complete.
   - If code 28 appears go to **Step A.** to find error in testing.
   - If code other than 28 appears, See “Fault Code Isolation Procedure Index” on page 13.

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

1. Key on.
2. Retrieve codes. See “Fault Code Retrieval/Clearing” on page 10.
   - If Fault Code 31 is Active, replace the:
     - **Medium-Duty Transmission Electronic Control Unit (TECU)**
     - **Heavy-Duty Transmission Electronic Control Unit (TECU)**

     Go to **Step V.**
   - If Fault Code 31 is Inactive, go to **Step V.**

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

1. Key off.
2. Key on.
3. Clear codes. See “Fault Code Retrieval/Clearing” on page 10.
4. Reconnect all connectors and the negative battery cable.
5. Drive vehicle and attempt to reset the code
6. Check for codes. See “Fault Code Retrieval/Clearing” on page 10.
   - If no codes, test complete.
   - If Fault Code 34 appears go to **Step A.** to find error in testing.
   - If code other than 34 appears, See “Fault Code Isolation Procedure Index” on page 13.

E ***Purpose:*** *Check for active and Inactive fault codes.*

1. Key on.
2. Retrieve codes. See “Fault Code Retrieval/Clearing” on page 10.
   - If Fault Code 33 is Active, replace the:
     - **Medium-Duty Transmission Electronic Control Unit (TECU)**
     - **Heavy-Duty Transmission Electronic Control Unit (TECU)**

     Go to **Step V.**
   - If Fault Code 33 is Inactive, clear codes and go to **Step V.**

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

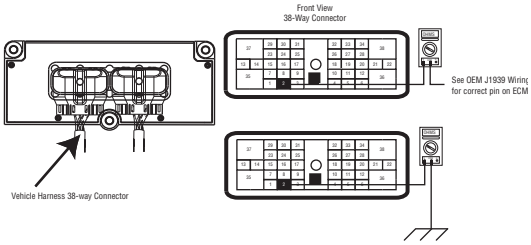
1. Key off.
2. Key on.
3. Clear codes. See “Fault Code Retrieval/Clearing” on page 10.
4. Reconnect all connectors and the negative battery cable.
5. Drive vehicle and attempt to reset the code.
6. Check for codes. See “Fault Code Retrieval/Clearing” on page 10.
   - If no codes, test complete.
   - If Fault Code 33 appears go to **Step A.** to find error in testing.
   - If code other than 33 appears, See “Fault Code Isolation Procedure Index” on page 13.

Fault Code 35 - J1939 Communication Link

A

Purpose: *Verify continuity of J1939 Data Link low (-) circuit and test for short to ground.*

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 number (see OEM wiring for (-) J1939).
   - Vehicle harness 38-way Pin 2 and ground.

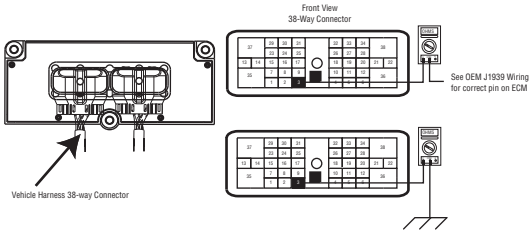


- If resistance between Pin 2 and engine ECM pin is 0 to 0.3 ohms and if resistance between Pin 2 and ground is OL, go to **Step B.**
- If resistance is outside of range, repair J1939 Data Link Harness between engine ECM and TECU. Go to **Step V.**

B

Purpose: *Verify continuity of J1939 Data Link (+) circuit and test for short to ground.*

1. Key off.
2. Measure resistance between:
   - Vehicle Harness 38-way connector Pin 3 and engine ECM pin number (see OEM J1939 wiring for (+) J1939)
   - Vehicle Harness 38-way Pin 3 and ground



- If resistance between Pin 3 and engine ECM pin number is 0 to 0.3 ohms, and if resistance between Pin 3 and ground is OL,
  - If equipped with J1939 Lite, go to **Step D.**
  - If not equipped with J1939 Lite, go to **Step C.**
- If resistance is outside of range, repair J1939 Data Link Harness between engine ECM and TECU. Go to **Step V.**

Fault Code 37 - Power Supply

J1587: MID 130 SID 251 FMI 5
J1939: SA 3 SPN 627 FMI 5

Overview

This fault code indicates excessive resistance has been detected between the power supply source (battery or starter) and the Transmission Electronic Control Unit (TECU).

Detection

The resistance on the TECU 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.

Possible Causes

This fault code can be caused by the following:

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

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

1. Key off.
2. Remove all gauges.
3. Key on.
4. Clear codes. See “Fault Code Retrieval/Clearing” on page 10.
5. Drive vehicle and attempt to reset the code
6. Check for codes. See “Fault Code Retrieval/Clearing” on page 10.
   - If no codes, test complete.
   - If Fault Code 41 appears go to **Step A.** to find error in testing.
   - If fault code other than 41 appears, See “Fault Code Isolation Procedure Index” on page 13.

Fault Code 43 - Range Solenoid Valve

A

Purpose: *Measure resistance of high and low range solenoids through the Transmission Harness.*

1. Key off.
2. Disconnect negative battery cable.
3. Disconnect the TECU 38-way connector.
4. Measure resistance between Pin 28 and Pin 6 and between Pin 34 and Pin 6 on the Transmission Harness 38-way connector.

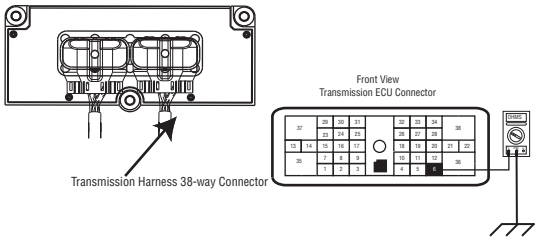
   Note: Observe polarity on Volt\Ohm Meter.

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

B

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

1. Measure resistance between the Transmission Harness 38-way connector Pin 6 and ground.



   - If resistance is OL, (if fault code is Active) replace the:
     - **Medium-Duty Transmission Electronic Control Unit (TECU)**
     - **Heavy-Duty Transmission Electronic Control Unit (TECU)**

     Go to **Step V.**
   - If resistance is less than 10K ohm, go to **Step C.**

Fault Code 45 - High Capacity (HCIB) or Low Capacity (LCIB) Inertia Brake Failure

J1587: MID 130 SID 54 FMI 7
J1939: SA 3 SPN 787 FMI 7

Overview

The fault code indicates that the Low Capacity Inertia Brake (LCIB) or High Capacity Inertia Brake (HCIB) 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 the Inertia Brake system has failed, it may be difficult to engage a gear from a neutral and shifting performance may be reduced.

Possible Causes

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

- LCIB material worn
- Failed LCIB
- Failed HCIB

Fault Code 51 - Rail Position Sensor

J1587: MID 130 SID 60 FMI 2, 3, 4, 10
J1939: SA 3 SPN 60 FMI 2, 3, 4, 10

Overview

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

The transmission controller supplies sensor power to the Electric Shifter position sensors and uses the reported sensor position to determine gear finger location. There are 4 fault conditions defined by the reported FMI via ServiceRanger software.

This fault will not be set if a System Battery Voltage Low fault (Fault Code 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 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

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. An equal sign will appear 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, downshift nor shift into neutral.

Conditions to Set Fault Code 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.

Possible Causes

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

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.
- Electric Shifter - The rail sensor may have been damaged or malfunctioned.

FMI 3:

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

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

1. Key off.
2. Reconnect all connectors.
3. Key on.
4. Clear fault codes, see “Fault Code Retrieval/Clearing” on page 10.
5. Drive the vehicle and attempt to reset the fault code.
6. Check for fault codes, see “Fault Code Retrieval/Clearing” on page 10.
   - If no fault codes, test complete.
   - If Fault Code 52 appears, go to **Step A.** to find error in testing.
   - If code other than 52 appears, See “Fault Code Isolation Procedure Index” on page 13.

Fault Code 57 - Main Shaft Speed Sensor

A

Purpose: *Measure Main Shaft Speed Sensor resistance, test for short to ground through the Transmission Harness*

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
   - 15 and ground
   - If resistance between Pin 15 and Pin 16 is 2k to 4.5K ohm and between Pin 15 to ground is OL, go to **Step B.**
   - If resistance is outside of the range, go to **Step C.**

B

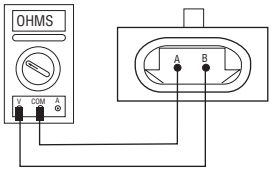
Purpose: *Visually inspect the Main Shaft Speed Sensor for contamination and damage.*

1. Inspect Main Shaft Speed Sensor for contamination or damage.
   - If no problem found, replace TECU (only if fault code is Active) and 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 and go to **Step V.**

C

Purpose: *Measure Main Shaft Speed Sensor resistance.*

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



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

Fault Code 61 - Rail Select Motor

A

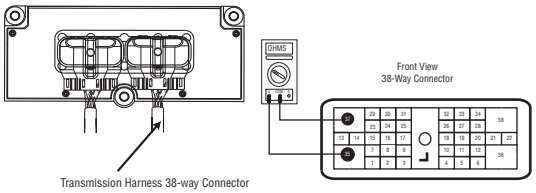
Purpose: *Check for active or Inactive fault codes (noting FMI) and perform electrical pretest.*

1. Use ServiceRanger to retrieve and record fault code 61 FMI information.
2. Perform the "Electrical Pretest" on page 18, inspect TECU power supply harness and fuse holder.
   - Issue found with TECU power supply harness or vehicle batteries, repair or replace items found during electrical pretest, go to **Step V.**
   - Electrical pretest passed, no issues found, go to **Step B.**

B

Purpose: *Measure the resistance of Electric Shifter Rail motor through the Transmission Harness.*

1. Key off.
2. Disconnect the negative battery cable.
3. Disconnect the Transmission Harness 38-way connector from the TECU.
4. Measure resistance between Pin 35 and Pin 37.



   - Measured resistance is 2 ohms or less, go to **Step C.**
   - Measured resistance is greater than 2 ohms, go to **Step D.**

Fault Code 64 - ECA Fault

J1587: MID 130 PID 34 FMI 2, 7, 12
J1939: SA 3 SPN 788 FMI 2, 7, 12

Overview

The UltraShift PLUS transmission receives torque input through the clutch. The amount of torque being transferred through the clutch is controlled by the Electronic Clutch Actuator (ECA), which moves the clutch yoke, thereby opening and closing the clutch. The ECA power and ground is an OEM-supplied 3-way connector that is directly connected to the vehicle batteries. The ECA is connected to the Transmission Electronic Control Unit (TECU) by an 8-way connector that is part of the Transmission Harness. The ECA communicates with the TECU over the High Integrity Link (HIL) to actuate the clutch yoke, communicate fault codes, or communicate other system information.

Detection

The TECU 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 malfunctions.

Conditions to Set Fault Code Active

FMI 2 - Data Erratic: ECA detects a loss of battery and/or ground for 1 second or longer.

FMI 7 - Mechanical System Not Responding: ECA detects excessive motor current or incorrect clutch position during a clutch position change for 1 second or longer.

FMI 12 - Bad Intelligent Device: ECA detects an internal failure for 1 second or longer.

Fallback

All FMIs:

- "F" flashes in the gear display.
- Service light flashes (if equipped)
- Transmission will not engage a gear from neutral.
- ECA may maintain the current clutch position using the clutch holding device.
- ECA may move the clutch to the closed position (clutch engaged against the engine flywheel).
- Transmission may continue to shift until the vehicle comes to a stop.
- Engine cranks and starts.

Conditions to Set Fault Code Inactive

FMI 2: Proper ECA Battery and Ground supply are detected for 2 seconds.

FMI 7: Normal ECA motor current is detected and ECA position is correct for 2 seconds.

FMI 12: No internal ECA failures are detected for 2 seconds.

Possible Causes

FMI 2, 12:

- **Vehicle Harness**
  - Wires are shorted to ground, shorted to power or open.
  - Terminals are bent, spread, corroded or loose.
- **ECA**
  - Internal failure occurred.
  - Terminals are bent, spread, corroded or loose.

FMI 7:

- **Vehicle Harness**
  - Wires are shorted to ground, shorted to power or open.
  - Terminals are bent, spread, corroded or loose.
- **Clutch**
  - Release Bearing failure occurred.
  - Lack of lubricant in Release Bearing or Cross-Shaft Assembly.
  - Internal failure occurred.
- **ECA**
  - Internal failure occurred.
  - Terminals are bent, spread, corroded or loose

J ***Purpose:*** *Inspect Clutch Cover lugs.*

1. Key off.
2. Remove Clutch Housing Inspection Cover.
3. Inspect Clutch Cover for damaged or missing lugs.
   - If damage is found or lugs are missing, replace the HD ECA Clutch. Go to **Step V.**
   - If the Clutch Cover is not damaged and all lugs are present, replace **Thread-In ECA Speed Sensor**. Go to **Step V.**.

K ***Purpose:*** *Inspect Flywheel Housing (thread-in) ECA Speed Sensor installation and adjustment.*

1. Key off.
2. Verify ECA Speed Sensor is properly threaded and adjusted in the Engine Flywheel Housing, and properly connected to the ECA.

   Note: For adjustment procedures, see the *Eaton Gen III Service Manual* (TRSM0930).
3. Remove ECA Speed Sensor. Visually inspect for damage or debris build up.
   - If sensor is properly adjusted and no damage or debris build up is found, go to **Step L.**
   - If sensor is out of adjustment, perform Thread-In ECA Speed Sensor adjustment specified in TRSM0930. Go to **Step V.**
   - If sensor is damaged or debris build-up is found, inspect for cause of damage or debris build-up, replace **Thread-In ECA Speed Sensor**. Go to **Step V.**

Fault Code 67 - ECA Ignition Voltage Fault

A

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

1. Key on, engine off.
2. Connect ServiceRanger.
3. Retrieve Snapshot and VPA data by creating a *Service Activity Report* within ServiceRanger
4. Update transmission software to latest available level.

Caution: To avoid damaging the TECU, use an Eaton-approved communications adapter and ensure all satellite systems are disabled before updating software.

5. Retrieve and record the transmission fault codes, FMIs, occurrences and timestamps.
   - If Fault Code 67 is Active, go to **Step C.**
   - If Fault Code 67 is Inactive, go to **Step B.**

B

Purpose: *Use Product Diagnostic (PD) Mode to locate intermittent failures.*

1. Set parking brakes and chock wheels.
2. Key on, engine off.
3. Place transmission in Product Diagnostic (PD) Mode. See more about PD mode in the *PD Mode* section of this book.

   Note: Transmission cannot enter PD Mode when there are Active fault codes

4. Wiggle wiring and connections. Be sure to include the Transmission Harness from the 8-Way ECA Connector to the TECU.
   - If any fault became Active while wiggling the Transmission Harness, replace
     - **Medium-Duty Transmission Harness**
     - **Heavy-Duty Transmission Harness**

     Go to **Step V.**
   - If no fault codes became Active, go to **Step D.**

Fault Code 71 - Unable to Disengage Gear

A

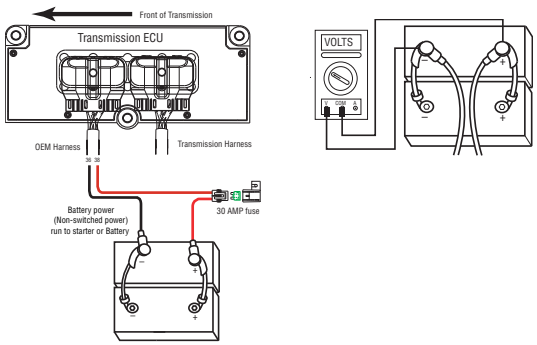
Purpose: *Determine if an Electric Shifter was installed without recalibrating the transmission.*

1. Key off.
2. Was a new Electric Shifter or TECU just installed without recalibrating the transmission?
   - Yes, perform transmission calibration. Turn key on, and allow the transmission to power up. Turn key off, wait 2 minutes and go to **Step V.**.
   - No, go to **Step B.**

B

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

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 and go to **Step C.**
   - If voltage is outside of range, repair or replace batteries and charge system as required. Repeat test.

Fault Code 73 - Failed to Engage Gear

J1587: MID 130 SID 58 FMI 7
J1939: SA 3 SPN 781 FMI 7

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.

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 5 times with no battery voltage faults.

Conditions to Set Fault Code Active

Conditions to Set Fault Code Active

- FMI 7 - The system is unable to engage a gear 5 times with no battery voltage faults.

Fallback

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 Fault Code Inactive

Conditions to Set Fault Code Active

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

Possible Causes

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

FMI 7:

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

Electric Shifter

- New Electric Shifter installed and not recalibrated per the L-Letter (L-2003-30)
- Mechanical issue with the Electric Shifter
- Badly contaminated / gummed up / soiled Electric 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 Electronic Control Unit (TECU)

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

Engine

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

Fault Code 75 - Power Down In Gear

J1587: MID 130 SID 60 FMI 14
J1939: SA 3 SPN 560 FMI 14

Overview

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

Note: This code will only be set Inactive

Detection

The Transmission Electronic Control Unit (TECU) 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 to appear in the gear display during power-up if the transmission is torque locked after shutting down in gear.

Possible Causes

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

- Improper shut down procedure

Fault Code 83 - Shift Lever Missing

A

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

1. Key on.
2. Retrieve codes. See “Fault Code Retrieval/Clearing” on page 10.
   - If Fault Code 83 is Active, replace Eaton **Cobra Lever** or OEM Shift Lever.
   - If Fault Code 83 is Inactive, test complete.

Fault Code 99 - Direction Mismatch

J1587: MID 130 SID 58 FMI 14
J1939: SA 3 SPN 781 FMI 14

Overview

The transmission controller is monitoring the Gear Position sensor and has determined the Electric Shifter is moving in the opposite intended direction.

Detection

- The fault can be detected any time after the Transmission Electronic Control Unit (TECU) powers up and a non-neutral mode is selected.
- FMI 14 - The transmission controller detected an incorrect Electric Shifter position.

Conditions to Set Fault Code Active

Conditions to Recreate Fault

- None

Fallback

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

Conditions to Set Fault Code Inactive

Conditions to Clear Fault

- The fault becomes Inactive after power down.

Possible Causes

This fault code can be caused by the following:

- Internal transmission controller fault.
- Transmission wire harness shorted.
- Electric Shifter failure.

Start Enable Relay Contact Test

A

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

1. Key off.
2. Inspect starter/battery and in-line fuse holder connections for integrity.
3. Measure voltage across batteries.
   - If voltage is 11–13 volts on a 12-volt system or 22 to 26 on a 24 volt system, proceed with battery load test. Repair or replace batteries as required and go to **Step B.**
   - If voltage is outside of range, repair or replace batteries and charging system as required. Repeat test.

B

Purpose: *Verify proper ground path between the batteries and the transmission harness 4-way diagnostic connector.*

1. Locate diagnostic port on Transmission Harness.
2. Key on.
3. Measure voltage between Pin C and the battery negative post.
   - If voltage is 0.70 volts or less, go to **Step C.**
   - If voltage is outside of range, repair battery ground supply to TECU. Repeat test.

C

Purpose: *Measure proper battery voltage at the transmission harness 4-way diagnostic connector.*

1. Locate diagnostic port on Transmission Harness.
2. Key on.
3. Measure voltage between Pin B and Pin C.
   - If voltage is within 0.6 volts of battery voltage, go to **Step D.**
   - If voltage is outside of range, repair battery power supply to TECU. Fuse may be blown. Repeat test.

D

Purpose: *Measure proper ignition voltage at the transmission harness 4-way diagnostic connector.*

1. Key on.
2. Measure voltage between Pin A and Pin C.
   - If voltage is within 0.6 volts of battery voltage, go to **Step E.**
   - If voltage is outside of range, repair ignition power supply to TECU. Fuse may be blown. Repeat test.

Front Box Control Test

Overview
This symptom-driven test is performed if a dash is displayed on the gear display, and there are no active or Inactive codes.

Detection
Turn the key on and watch the Gear Display. If the Gear Display shows "-" constantly, the Transmission Electronic Control Unit (TECU) was not able to confirm front box control.

Any time the service light 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 dash will appear on the Gear Display.

Possible Causes
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

E

Purpose: *Visually observe the gear display when placing the transmission into Drive.*

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, See “Front Box Control Test” on page 326.
   - 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).

F

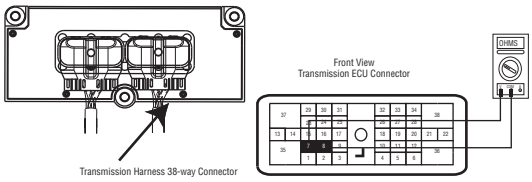
Purpose: *Monitor Input Shaft Speed in ServiceRanger.*

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.**

G

Purpose: *Measure the resistance of the Input Shaft Speed Sensor through the Transmission Harness.*

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 Pin 7 and Pin 8.



   - If resistance is 2K to 4.5K ohm, go to **Step H.**
   - If resistance is outside of range, go to **Step J.**

V

Purpose: *Verify repair.*

1. Key off.
2. Reconnect all connectors.
3. Key on.
4. Drive the vehicle to determine whether the complaint has been repaired.
   - If the transmission engages a gear, test complete.
   - If the transmission does not engage a gear, go to **Step A.** to find error in testing.

UltraShift AW3 Clutch Engagement Test

A

Purpose: *Inspect the transmission fluid level.*

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 this step.

B

Purpose: *Visually inspect the torsional coupler.*

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.**

C

Purpose: *Bring engine up to operating temperature and test the clutch engagement operation.*

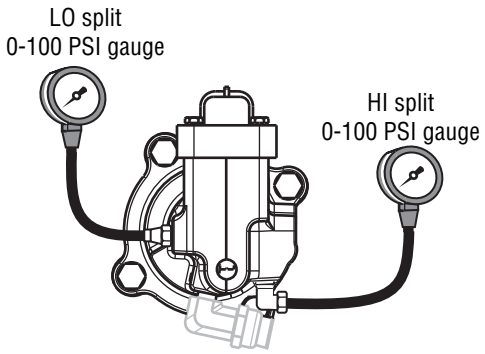
1. Key on.
2. Engine running, allow engine to reach operating temperature.
3. Key off.
4. Start vehicle.
5. Allow vehicle to idle in neutral for a minimum of 2 minutes.
6. Drive vehicle.
   - If clutch engagement complaint does not change, go to **Step D.**
   - If clutch engagement complaint is corrected, test complete.

R

Purpose: *Measure high splitter air pressures.*

1. Key off.
2. Start vehicle and allow air pressure to build to governor cut-off.
3. Turn off engine, but leave key on.
4. With Shift Control, select reverse (R1 in gear display for 13/18-speed), then select neutral

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



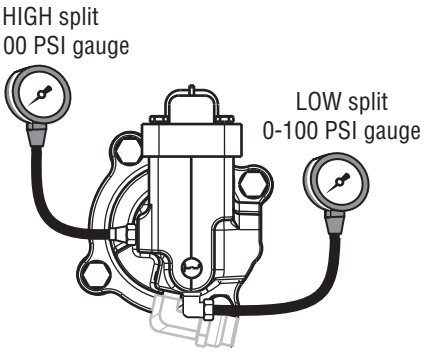
- If high splitter gauge is between 55 to 65 PSI and if low splitter gauge is 0 PSI, go to **Step S.**
- If air pressure gauges do not read as shown above, replace **Splitter Valve**. Go to **Step V.**

S

Purpose: *Measure low splitter air pressures.*

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.



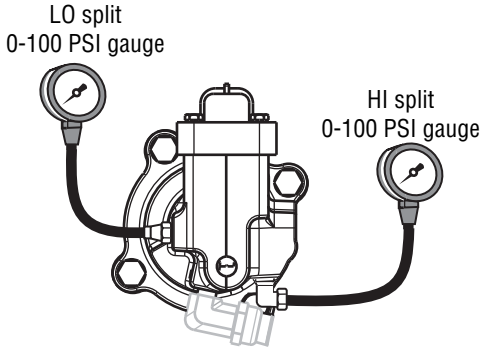
- If low splitter gauge is between 55 to 65 PSI and if high splitter gauge is 0 PSI, go to **Step V.**
- If air pressure gauges do not read as shown above, replace **Splitter Valve**. Go to **Step V.**

T

Purpose: *Measure high splitter air pressures.*

1. Key off.
2. Start vehicle and allow air pressure to build to governor cut-off.
3. Turn off engine, but leave key on.
4. With Shift Control, select reverse (R1 in gear display for 13/18-speed), then select neutral

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



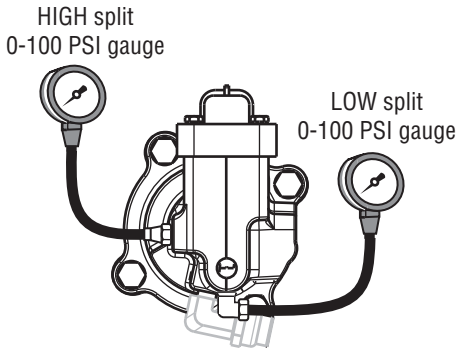
- If high splitter gauge is 55 to 65 PSI and if low splitter gauge is 0 PSI, go to **Step U.**
- If neither air pressure gauge reads as listed above, replace **Splitter Valve**. Go to **Step V.**

U

Purpose: *Measure low splitter air pressures.*

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.



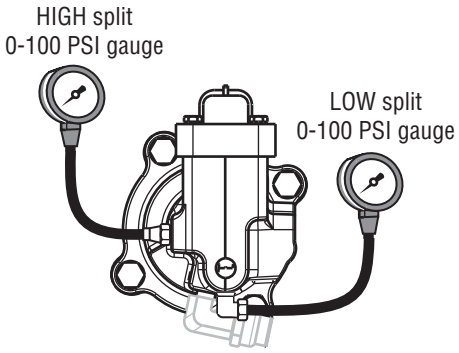
- If low splitter gauge is 55 to 65 PSI and if high splitter gauge is 0 PSI, go to **Step V.**
- If neither air pressure gauge reads as listed above, replace the **Splitter Valve**. Go to **Step V.**

S

Purpose: *Measure low splitter air pressures.*

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 reads 55 to 65 PSI and if high splitter gauge is 0 PSI, go to **Step V.**
- If neither gauge reads as shown above, replace the **Splitter Valve**. Go to **Step V.**

V

Purpose: *Verify repair.*

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

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.

Possible Causes
This symptom can be caused by any of the following:

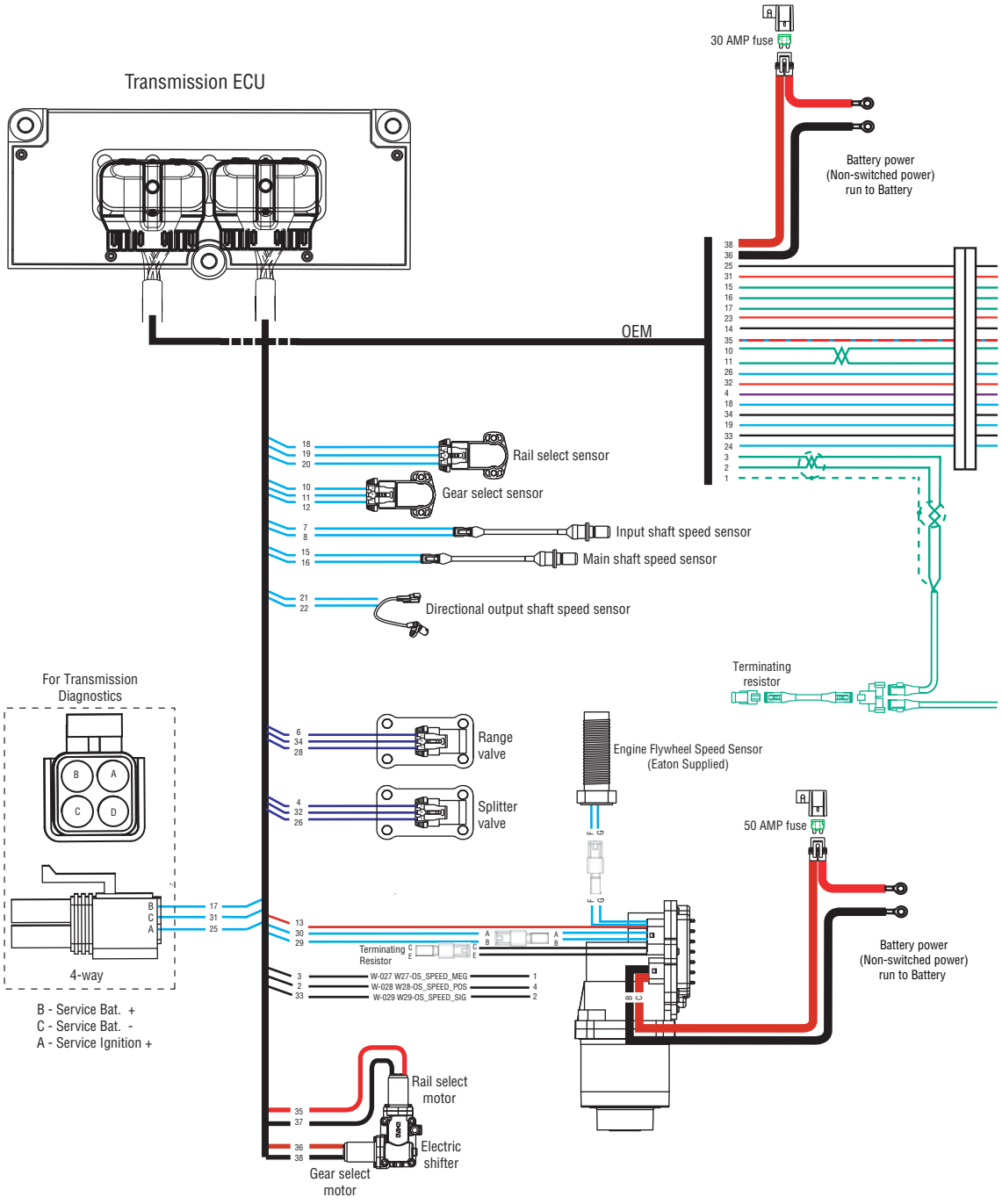
- OEM Wiring
- Shift Control
- Shift Lever

Heavy-Duty UltraShift *PLUS* Transmission Controller 38-Way (Eaton Supplied Assembly)

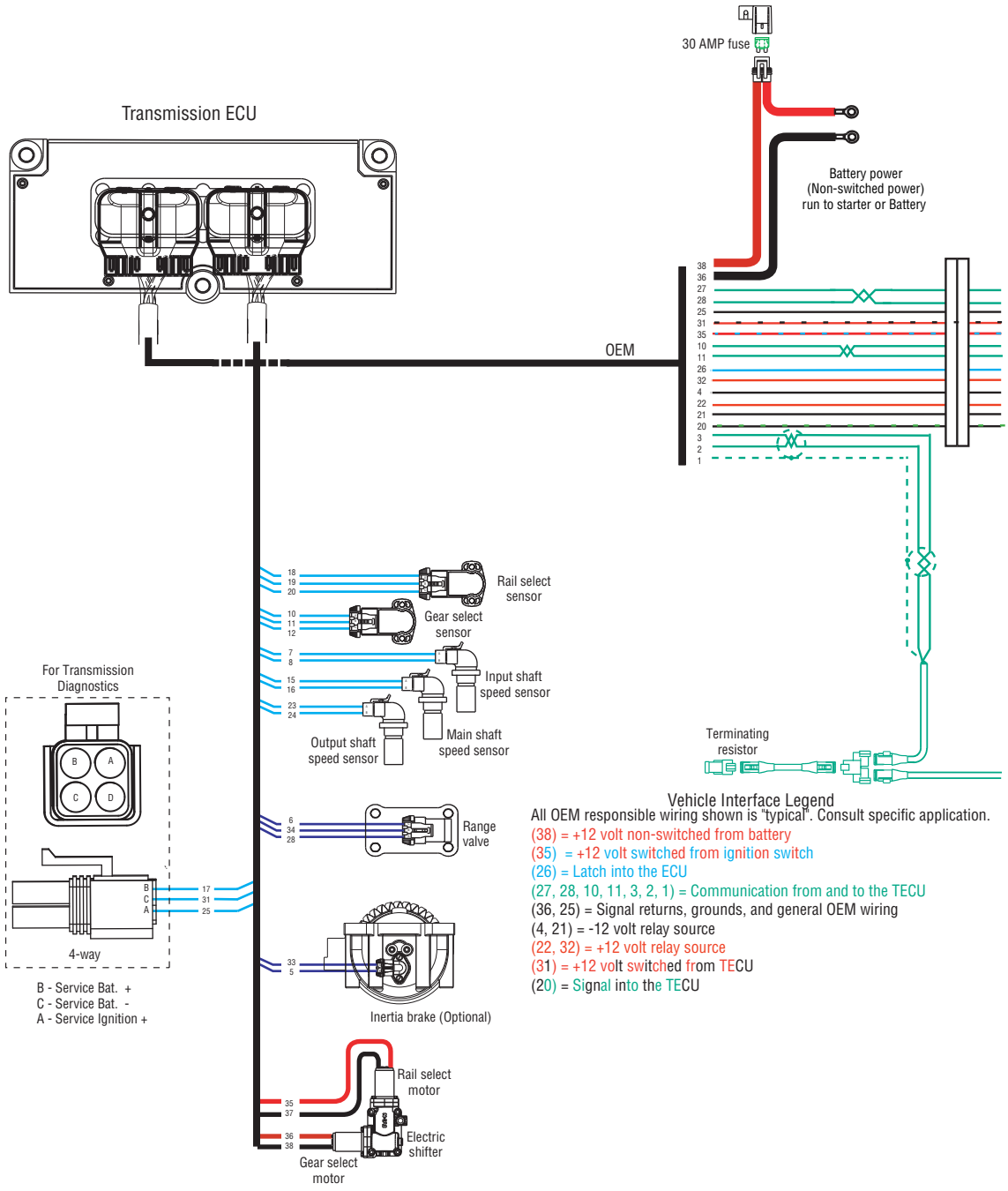
38-Way	Description	Wire
1	Analog Switch Signal Return (Gen 3.7)	18 TXL
2	Driver Out Positive - Clutch2	18 TXL
3	Driver Out Negative - Clutch2	18 TXL
4	Driver Out Negative - Splitter Common	18 TXL
5	Not Used	Plug
6	Driver Out Negative - Range Common	
7	Sensor VR Speed High - Input Shaft	18 TXL
8	Sensor VR Speed Low - Input Shaft	18 TXL
9	Analog Switch Input 0 5 VDC (Gen 3.7)	Plug
10	Sensor Supply, Hall - Positive [Y (Gear)]	18 TXL
11	Sensor Signal, Hall Position [Y (Gear)]	18 TXL
12	Sensor Supply, Hall - Negative [Y (Gear)]	18 TXL
13	Driver Out Positive - CLUTCH1 (MEIIR)	
14	Driver Out Negative - CLUTCH1 (MEIIR)	18 TXL
15	Sensor VR Speed High - Main Shaft	18 TXL
16	Sensor VR Speed Low - Main Shaft	18 TXL
17	Service - Battery Positive	18 TXL
18	Sensor Supply, Hall - Positive [X (Rail)]	18 TXL
19	Sensor Signal, Hall Position [X (Rail)]	18 TXL

38-Way	Description	Wire
20	Sensor Supply, Hall - Negative [X (Rail)]	18 TXL
21	Sensor Hall Speed Negative (Gen 3.7)	18 TXL
22	Sensor Hall Speed Positive 5V (Gen 3.7)	18 TXL
23	Sensor VR Speed High - Output Shaft	18 TXL
24	Sensor VR Speed Low - Output Shaft	18 TXL
25	Service - Ignition Positive	18 TXL
26	Driver Out Positive - Splitter Indirect	18 TXL
27	Not Used	Plug
28	Driver Out Positive - Range High	18 TXL
29	COMM CAN Low - PNL_L (Proprietary CAN)	
30	COMM CAN High - PNL_H (Proprietary CAN)	
31	Service - Battery Negative	18 TXL
32	Driver Out Positive - Splitter Direct	18 TXL
33	Not Used	Plug
34	Driver Out Positive - Range Low	18 TXL
35	Motor Positive - X (Rail)	14 SXL
36	Motor Positive - Y (Gear)	12 GXL
37	Motor Negative - X (Rail)	14 SXL
38	Motor Negative - Y (Gear)	12 GXL

Medium-Duty UltraShift PLUS Models
Wiring Diagram with Analog Shifter



UltraShift 10-Speed Wiring Diagram with Push Button Shifter

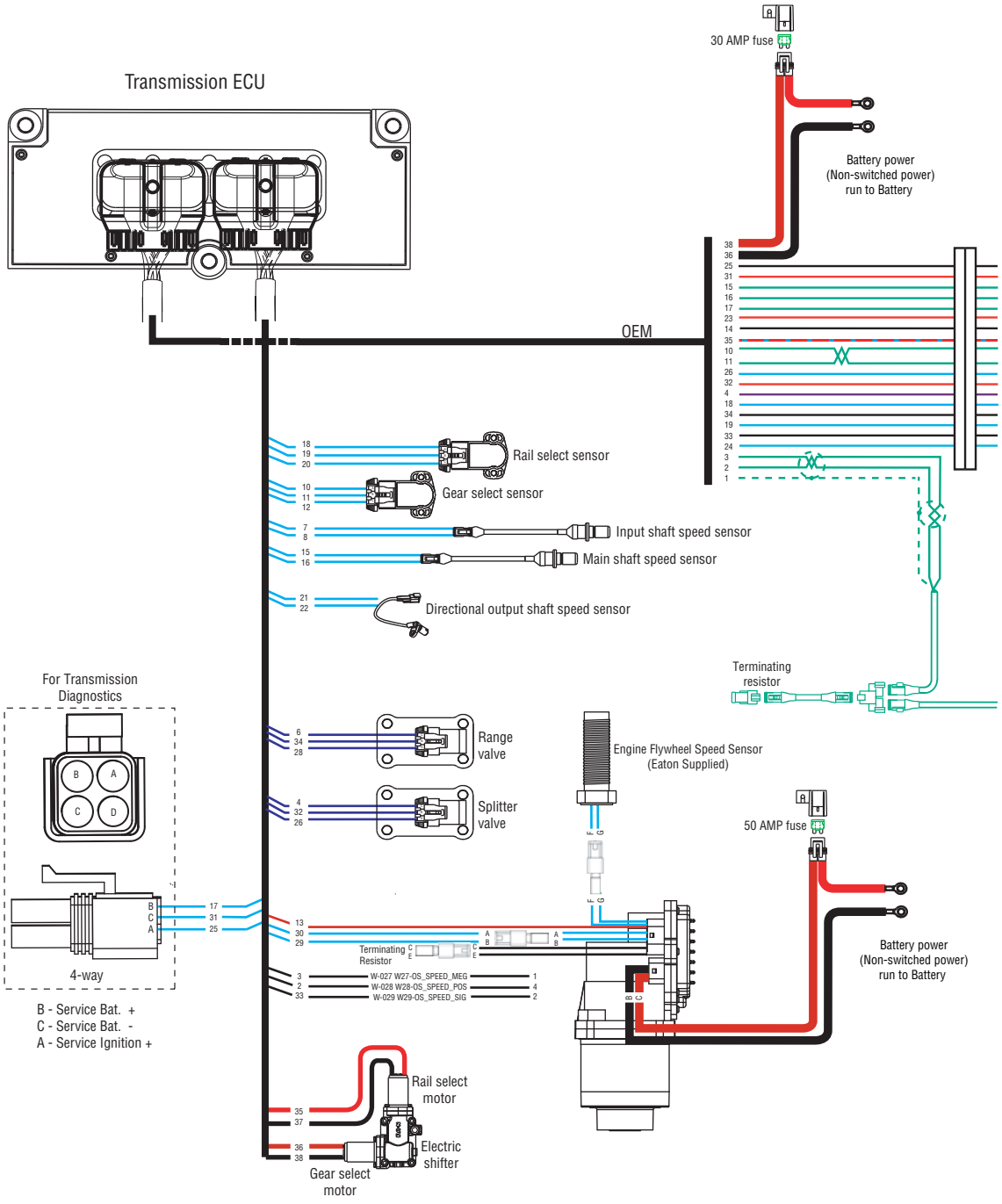


Vehicle Interface Legend

All OEM responsible wiring shown is "typical". Consult specific application.

(38) = +12 volt non-switched from battery
(35) = +12 volt switched from ignition switch
(26) = Latch into the ECU
(27, 28, 10, 11, 3, 2, 1) = Communication from and to the TECU
(36, 25) = Signal returns, grounds, and general OEM wiring
(4, 21) = -12 volt relay source
(22, 32) = +12 volt relay source
(31) = +12 volt switched from TECU
(20) = Signal into the TECU

Heavy-Duty UltraShift PLUS Models
Wiring Diagram with Analog Shifter



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 Electronic Control Unit (TECU) 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

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

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

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

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

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

Without ServiceRanger a PC-based Service Tool

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