SureShift™ Transmission

Maintenance and Diagnostics
Manual No. MM-9970
This publication provides maintenance and service procedures for ZF Meritor’s SureShift™ transmission. The information contained in this publication was current at the time of printing and is subject to revision without notice or liability.

1. You must understand all procedures and instructions before you begin maintenance and service procedures.
2. You must follow your company’s maintenance and service guidelines.
3. You must use special tools, when required, to avoid serious personal injury and damage to components.

Meritor uses the following notations to alert the user of possible safety issues and to provide information that will help to prevent damage to equipment and components.

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**WARNING**

A WARNING indicates a procedure that you must follow exactly to avoid serious personal injury.

**CAUTION**

A CAUTION indicates a procedure that you must follow exactly to avoid damaging equipment or components. Serious personal injury can also occur.

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**Visit Our Web Site**

Visit the Technical Library section of [www.meritorauto.com](http://www.meritorauto.com) for additional product and service information on Meritor’s heavy vehicle systems component lineup.

**Technical Electronic Library on CD**

The CD includes product and service information on Meritor’s heavy vehicle systems component lineup. $20. Order TP-9853.

**Additional SureShift Information**

*SureShift™ Transmission* four-page laminated publication that includes fault code diagnostics and a wiring diagram (TP-98114)

*SureShift Transmission* Video (T-98117)

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**How to Order**

Call Meritor’s Customer Service Center at 800-535-5560.

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**NOTE:**

A NOTE indicates an operation, procedure or instruction that is important for proper service. A NOTE can also supply information that will help to make service quicker and easier.

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This symbol indicates that you must tighten fasteners to a specific torque.
Transmission Model Numbers

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- Designed with a Joystick for Comfortable Shifts
- Minimizes Clutch Use
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<th>M</th>
<th>X</th>
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<th>165</th>
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<td>9-Speed</td>
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<td>155</td>
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</table>

- **R**: Rockwell
- **M**: Manual
- **S**: ESS™
- **X**: Overdrive
- **No Letter**: Direct Drive

### ZF Meritor Model Number

<table>
<thead>
<tr>
<th>M</th>
<th>O</th>
<th>16</th>
<th>G</th>
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<td>16-Speed</td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

- **M**: ZF Meritor
- **O**: Overdrive
- **No Letter**: Direct Drive

- **Torque Rating (lb-ft)**
  - 11 = 1150
  - 12 = 1250
  - 13 = 1350
  - 14 = 1450
  - 15 = 1550
  - 16 = 1650

- **Ratio**
  - **A**: Fully Automated
  - **D**: ESS™ - DDC® ECM
  - **E**: ESS™ - ZF Meritor TCU
  - **M**: Manual
  - **S**: SureShift™

1. Progressive torque is an engine feature that requires a Torq-2™ transmission. In models not featuring progressive torque, this number will be the same as the torque rating.
2. Detroit Diesel Corporation
This manual provides maintenance and diagnostic procedures for SureShift transmission components. For maintenance procedures on ZF Meritor transmissions, refer to Maintenance Manual No. 26A, Nine-, Ten- and Thirteen-Speed Transmissions. Contact Meritor’s Customer Service Center at 800-535-5560 to order this publication.

ZF Meritor’s SureShift™ Transmission and Freightliner Corporation’s SmartShift™ System

SmartShift is a trademark of Freightliner Corporation.

ZF Meritor’s SureShift transmission consists of a seat-mounted joystick shift module, transmission control unit (TCU), dash display, regulating sensors and solenoids, and connecting wiring harnesses that can be used to operate any ZF Meritor SureShift transmission.

Freightliner’s SmartShift System consists of a column-mounted joystick and the wiring harness used to connect the joystick to the TCU.

Freightliner’s SmartShift System can be used to operate either a ZF Meritor transmission or one supplied by another manufacturer. You can identify ZF Meritor’s transmission from the transmission identification plate located on the lower-right side of the transmission. Refer to “Transmission Model Numbers” at the beginning of this manual.

When Freightliner’s SmartShift System is used to operate a ZF Meritor transmission, the TCU, dash display, regulating sensors and solenoids, and connecting wiring harnesses (other than the wiring harness, supplied by Freightliner, which connects the joystick to the TCU) are identical to the components installed with ZF Meritor’s SureShift transmission. The procedures in this manual can be used for diagnostics, and removal and installation of these common components.

Features

Designed with a Joystick for Comfortable Shifts

The SureShift transmission’s shift module enables you to easily shift gears by moving a joystick forward to upshift or backward to downshift.

Minimizes Clutch Use

Only use the clutch to start and stop the vehicle, to shift into REVERSE (R) or when the instrument panel display reads “CL” — a signal from the TCU to use the clutch to break driveline torque.

Automated High and Low Range Shifts

Range shifts are automatic, which means you do not have to preselect high or low ranges.

Shift Module Display and Instrument Panel Display

During operation the SureShift transmission’s shift module display and instrument panel display provide the following operating information.

- The current gear position: FORWARD (F), NEUTRAL (N) or REVERSE (R)
- Shifts in progress
- If a shift is not available (engine below 1000 rpm or above the engine’s rating)
- A system malfunction

A Vehicle Equipped with Engine Brakes

For easier shifting on grades, the SureShift transmission automatically engages the engine brake during upshifs.
Components

Shift Module

The SureShift transmission’s shift module, designed with a joystick, is located next to the driver’s seat. The shift module replaces the standard shift lever, shift tower and shift knob. Figure 1.1.

Figure 1.1

Joystick
Move the joystick forward to upshift and backward to downshift.

NEUTRAL Button
Press and release the NEUTRAL button at any time to shift into NEUTRAL. The NEUTRAL button also enables you to retrieve active and inactive fault codes from the instrument panel display when pressed with the FUNCTION button at the same time.

Manual Override Switch (Emergency Use Only)
Use the manual override switch enables you to manually shift into either the lowest Forward (F) gear or the low Reverse (R) gear to move slowly off the road, into a bay, etc.

1. The vehicle must be stationary.
2. Press the clutch pedal to the end of travel.
3. Select either the lowest forward gear Forward (F) or low Reverse (R).
4. Slowly release the clutch pedal.
5. The display will read “MO” to indicate that the manual override feature is activated.

Shift-n-Cruise™ Function Buttons

The Shift-n-Cruise™ feature integrates cruise control functions into the transmission shift knob, which enable you to re-engage cruise control functions into the transmission shift knob, which enable you to re-engage cruise after a shift without removing your hand from the shift knob.

FUNCTION Button

- Move into the lowest forward gear from a stop
- Move into REVERSE (R) from a stop
- Skip shift
- Enables you to retrieve active and inactive fault codes from the instrument panel display when pressed with the NEUTRAL button at the same time

X-Y Actuator Unit

The X-Y actuator replaces the conventional shift knob, shift tower and shift lever located on top of the transmission. The actuator uses air pressure to shift the main box of the transmission.

Start the Vehicle

WARNING
Always press the clutch prior to starting the engine. Serious personal injury and damage may result should the transmission not be in neutral.

1. Push the clutch pedal to the bottom of the travel to engage the clutch brake.
2. Start the engine.
3. Slowly release the clutch pedal.
4. Allow air pressure in the air system to reach the specified range on the gauge.
How the SureShift Transmission Works

The SureShift transmission is a shift-by-wire system that uses a transmission control unit (TCU) to manage shifts. The system eliminates the conventional “H” shift pattern by using a joystick shift module in place of a conventional shift lever.

When you move the joystick forward or backward to shift, the TCU signals the X-Y actuator to perform the following operations:

- Break driveline torque
- Shift into Neutral (N)
- Complete a range shift, if necessary
- Synchronize road speed to match vehicle speed
- Shift into a selected gear

Second Lowest Starting Gear

1. Move the joystick FORWARD.
2. Release the joystick.
3. Push the clutch pedal to the end of travel to disengage the clutch.
4. Slowly release the clutch pedal.

Third Lowest Starting Gear

1. Move the joystick FORWARD twice and release the joystick.
2. Push the clutch pedal to the end of travel to disengage the clutch.
3. Slowly release the clutch pedal.

Fourth Lowest Starting Gear

1. Move the joystick FORWARD twice. Release the joystick.
2. Push the clutch pedal to the end of travel to disengage the clutch.
3. Move the joystick FORWARD once more. Release the joystick.
4. Slowly release the clutch pedal.

Shift Into Low Reverse (RL)

1. Press and hold the FUNCTION button while you move the joystick BACKWARD.
2. Release the FUNCTION button and the joystick.
3. Push the clutch pedal to the end of travel and slowly release the clutch.

Shift Into High Reverse (RH)

1. Press and hold the FUNCTION button while you move the joystick BACKWARD.
2. Release both the FUNCTION button and the joystick.
3. Push the clutch pedal to the end of travel to disengage the clutch.
4. Press and hold the FUNCTION button while you move the joystick BACKWARD.
5. Release both the FUNCTION button and the joystick.
6. Slowly release the clutch pedal.

How to Shift the Transmission

Shifting Into a Starting Gear

First Lowest Starting Gear

1. Press and hold the FUNCTION button while you move the joystick FORWARD.
2. Release the FUNCTION button and joystick.
3. Push the clutch pedal to the end of travel to disengage the clutch.
4. Slowly release the clutch pedal.
Upshift Into the Rest of the Gears
• Move the joystick FORWARD and release it.

Downshift Into the Rest of the Gears
• Move the joystick BACKWARD and release it.

“Skip Shift” Function
The “skip shift” function enables you to shift up or down more than one gear at a time. To “skip shift,” press and hold the FUNCTION button while shifting.

Reselecting a Starting Gear After Stopping the Vehicle with the Clutch Disengaged
When you bring the vehicle to a complete stop with the clutch disengaged, the transmission remains in the previously-selected gear.

To put the transmission into second gear:
1. Stop the vehicle completely. If the vehicle is not at a complete stop, the transmission will shift into neutral instead of second gear.
2. Move the joystick BACKWARD.

Shift Into Neutral
• Press and release the NEUTRAL button at any time while shifting.

Cab Shift Labels Identify a Transmission

⚠️ CAUTION
Shift patterns vary by vehicle. You must use the correct shift pattern for the vehicle you operate to avoid damage to the transmission.

1. Refer to the shift pattern decal affixed to the sun visor or instrument panel when you shift the transmission. Figure 1.3.
2. If the decal is missing or unreadable, call Meritor’s Worldwide Aftermarket Center at 888-725-9355/Option #5 to order a new decal.
3. Install the new decal in the vehicle.

![Figure 1.3](image-url)
Fault Codes and Volt-Ohm Meter (VOM) Diagnostics

ZF Meritor’s SureShift transmission control unit (TCU) uses a series of fault codes to identify system malfunctions that the TCU detects and stores into memory.

After you retrieve a fault code from the instrument panel display and identify the fault, use a volt-ohm meter (VOM) to test the area where the fault code indicates that the malfunction has occurred. An authorized ZF Meritor distributor/dealer should repair the fault.

System Faults and Fault Codes

Questions and Answers

What is an active fault?
An active fault is a malfunction that currently exists in the SureShift transmission or system components. The TCU detects the malfunction during operation and stores it into memory as an active fault.

What is an inactive fault?
An inactive fault results when a system malfunction — an active fault — was repaired but not cleared from TCU memory. The fault exists in TCU memory as inactive until it is cleared.

What are fault codes?
The TCU uses a series of alphabetic and numeric characters that enable you to identify, locate and repair malfunctions that have occurred in the system.

Does each fault have its own code?
Yes. For example, Fault Code 23 identifies a fault in the high range solenoid; and Fault Code EE identifies a diagnostic lamp malfunction. Refer to the “Fault Code Diagnostics” table in this section for a complete list of fault codes and fault code descriptions.

How do you retrieve active and inactive faults from TCU memory?
When you press the FUNCTION and NEUTRAL buttons at the same time and then release both buttons, the TCU lists active and inactive faults one at a time on the instrument panel display. Refer to “How to Retrieve Active and Inactive Fault Codes from the Instrument Panel Display” in this section.

Can you view the list of active and inactive faults from the instrument panel display more than once?
Yes. To view the list of faults again, press the FUNCTION and NEUTRAL buttons at the same time and then release both buttons. The TCU will repeat the list of faults again.

In what order does the TCU list faults on the instrument panel display?
Active faults are first, in the order they occurred. Inactive faults are second, in the order they occurred.

What happens if you repair a fault but do not clear it from TCU memory?
The fault remains stored in TCU memory as an inactive fault.

How can you tell if a fault is inactive?
When you retrieve fault codes from the instrument panel display, those codes that are preceded by “:” identify inactive faults.

When should you clear inactive fault codes from TCU memory?
Before you clear inactive fault codes, have a ZF Meritor-authorized technician repair all active faults that currently exist in the system. Next, verify that all faults are repaired. Then clear the fault codes from TCU memory.

When you clear inactive fault codes from TCU memory, are all fault codes cleared at the same time?
Yes.

Who should repair faults in the SureShift transmission?
A ZF Meritor-authorized technician should repair all faults in the system.
**WARNING**

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

When you work on an electrical system, the possibility of electrical shock exists, and sparks can ignite flammable substances. You must always disconnect the battery ground cable before you work on an electrical system to prevent serious personal injury and damage to components.

How to Retrieve Active and Inactive Fault Codes from the Instrument Panel Display

**NOTE:** The vehicle must be stationary to retrieve fault codes.

1. Park the vehicle. Set the parking brake. Turn the engine **OFF**, but leave the ignition **ON**.

2. Prepare to write down the fault codes when the TCU begins to list them on the instrument panel display.

3. Press the NEUTRAL button and the FUNCTION button at the same time and then release both buttons. The TCU lists the fault codes on the instrument panel display one at a time. Refer to Table C in this section for a complete list of fault codes and fault code descriptions.

4. When the TCU has listed all of the fault codes on the instrument panel display, the list will stop.

   - **To view the fault codes again:** Press the NEUTRAL button and the FUNCTION button at the same time and then release both buttons. The TCU will list the codes on the instrument panel display.

5. After you record the flash codes, turn the ignition **OFF**.

How to Read Active and Inactive Fault Codes

1. Each fault code that the TCU lists on the instrument panel display is preceded by either "\^" for an active fault or "." for an inactive fault. The symbols help you to identify what types of faults — active, inactive or both — currently exist in TCU memory.

### Table A: Fault Types and Symbols

<table>
<thead>
<tr>
<th>Type of Fault</th>
<th>TCU Fault Code Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active = Existing (not repaired)</td>
<td>&quot;^&quot;</td>
</tr>
<tr>
<td></td>
<td>^ 23 = Fault currently exists in the high range solenoid.</td>
</tr>
<tr>
<td>Inactive = Repaired but not cleared from TCU memory</td>
<td>&quot;.&quot;</td>
</tr>
<tr>
<td></td>
<td>23 = Fault code for a previously repaired malfunction in the high range solenoid remains in TCU memory.</td>
</tr>
</tbody>
</table>

### Table B: The Shift Module Display and Instrument Panel Display

<table>
<thead>
<tr>
<th>Status</th>
<th>Instrument Panel Display</th>
<th>Shift Module Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gear selector position</td>
<td>L, 1-10, N, RL or RH</td>
<td>R, N or F</td>
</tr>
<tr>
<td>Requested shift not available*</td>
<td>CL (CLutch)</td>
<td>Single beep</td>
</tr>
<tr>
<td>Torque lock**</td>
<td>CL (CLutch)</td>
<td>Fast, repeatable beep</td>
</tr>
<tr>
<td>Upshift or downshift being executed</td>
<td>SH (SHift)</td>
<td>F</td>
</tr>
<tr>
<td>Shifting from a forward gear to neutral</td>
<td>SH (SHift)</td>
<td>F and N</td>
</tr>
<tr>
<td>Shifting from a reverse gear to neutral</td>
<td>SH (SHift)</td>
<td>R and N</td>
</tr>
<tr>
<td>Shifting from neutral to a forward gear</td>
<td>SH (SHift)</td>
<td>N and F</td>
</tr>
<tr>
<td>Shifting from neutral to a reverse gear</td>
<td>SH (SHift)</td>
<td>N and R</td>
</tr>
<tr>
<td>System malfunction</td>
<td>SM (System Malfunction)</td>
<td>F, N, and R; plus a long, repeatable beep</td>
</tr>
</tbody>
</table>

* The SureShift transmission control unit (TCU) will not enable shifts that require the engine to operate below 1000 rpm or above the engine rating.

** Torque lock occurs when the engine is turning faster than its governed speed, and the engine is unable to break torque.
How to Clear Active and Inactive Fault Codes from TCU Memory

NOTE: The vehicle must be stationary to retrieve fault codes.
1. Park the vehicle. Set the parking brake. Turn the engine OFF. Turn the ignition OFF.
2. Press the NEUTRAL button and the FUNCTION button at the same time and hold both buttons.
3. Turn the ignition ON. Do not start the engine.
4. Release both buttons about two seconds after you turn the engine ON. The fault codes will be cleared from TCU memory.

Test and Repair Faults
1. Compare each fault code that you write down to the fault that corresponds. Table C.
2. Use a VOM to test the areas where the fault codes indicate that malfunctions have occurred in the system.
   • **Active Faults:** Have a Meritor-authorized technician repair the fault.
   • **Inactive Faults:** Have a Meritor-authorized technician verify that the fault was previously repaired. Repair faults, if necessary.
3. Clear all fault codes from TCU memory.

Electronic Displays

Table C: Fault Code Diagnostics

<table>
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<th>Instrument Panel Fault Code Display</th>
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<th>Failure Mode Identifier (FMI)</th>
<th>Fault Code Descriptions</th>
<th>Actions Required ②</th>
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</thead>
<tbody>
<tr>
<td>C2</td>
<td>SID 194</td>
<td>No Codes</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>PID 161</td>
<td>5</td>
<td>Main countershaft speed sensor current below normal or open circuit.</td>
<td>Verify the resistance across the speed sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for open circuits.</td>
</tr>
<tr>
<td>A1</td>
<td>PID 161</td>
<td>6</td>
<td>Main countershaft speed sensor current above normal or grounded circuit.</td>
<td>Verify the resistance across the speed sensor. Replace the sensor if the resistance is out of specification. Inspect the wiring harness for damaged wires. Check for grounded circuits.</td>
</tr>
<tr>
<td>A1</td>
<td>PID 161</td>
<td>10</td>
<td>Main countershaft speed sensor rate of change abnormally high.</td>
<td>Verify the resistance across the speed sensor. Replace the sensor if the resistance is out of specification. Inspect the wiring harness for damaged wires. Inspect mechanical components for damage.</td>
</tr>
<tr>
<td>BF</td>
<td>PID 191</td>
<td>5</td>
<td>Transmission output shaft speed sensor current below normal or open circuit.</td>
<td>Verify the resistance across the speed sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for open circuits.</td>
</tr>
<tr>
<td>BF</td>
<td>PID 191</td>
<td>6</td>
<td>Transmission output shaft speed sensor current above normal or grounded circuit.</td>
<td>Verify the resistance across the speed sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for grounded circuits.</td>
</tr>
<tr>
<td>BF</td>
<td>PID 191</td>
<td>10</td>
<td>Transmission output shaft speed sensor rate of change abnormally high.</td>
<td>Verify the resistance across the speed sensor. Replace the sensor if the resistance is out of specification. Inspect the wiring harness for damaged wires. Inspect mechanical components for damage.</td>
</tr>
</tbody>
</table>

① Parameter IDentification (PID) - Subsystem IDentification (SID)
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Table C: Fault Code Diagnostics

<table>
<thead>
<tr>
<th>Instrument Panel Fault Code Display</th>
<th>SAE Codes (PID/ SID) ①</th>
<th>Failure Mode Identifier (FMI)</th>
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<th>Actions Required ②</th>
</tr>
</thead>
<tbody>
<tr>
<td>1F</td>
<td>PID 31</td>
<td>2</td>
<td>Transmission range position sensor data erratic, intermittent or incorrect.</td>
<td>Verify the resistance across the range sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires.</td>
</tr>
<tr>
<td>1F</td>
<td>PID 31</td>
<td>3</td>
<td>Transmission range position sensor voltage above normal or shorted high.</td>
<td>Verify the resistance across the range sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for shorted wires to voltage supply wires.</td>
</tr>
<tr>
<td>1F</td>
<td>PID 31</td>
<td>5</td>
<td>Transmission range position sensor current below normal or open circuit.</td>
<td>Verify the resistance across the range sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for open circuits.</td>
</tr>
<tr>
<td>1F</td>
<td>PID 31</td>
<td>6</td>
<td>Transmission range position sensor current above normal or grounded circuit.</td>
<td>Verify the resistance across the range sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for grounded circuits.</td>
</tr>
<tr>
<td>1F</td>
<td>PID 31</td>
<td>14</td>
<td>Transmission range position sensor. Contact the manufacturer.</td>
<td>Verify the resistance across the range sensor. Replace the sensor if the resistance is not within specification. Contact ZF Meritor. ②</td>
</tr>
<tr>
<td>30</td>
<td>SID 48</td>
<td>2</td>
<td>X-Y gear position sensor data erratic, intermittent or incorrect.</td>
<td>Verify the resistance across the X-Y gear position sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires.</td>
</tr>
<tr>
<td>30</td>
<td>SID 48</td>
<td>3</td>
<td>X-Y gear position sensor voltage above normal or shorted high.</td>
<td>Verify the resistance across the X-Y gear position sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for shorted wires to voltage supply wires.</td>
</tr>
<tr>
<td>30</td>
<td>SID 48</td>
<td>5</td>
<td>X-Y gear position sensor current below normal or open circuit.</td>
<td>Verify the resistance across the X-Y gear position sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for open circuits.</td>
</tr>
<tr>
<td>30</td>
<td>SID 48</td>
<td>6</td>
<td>X-Y gear position sensor current above normal or grounded circuit.</td>
<td>Verify the resistance across the X-Y gear position sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for grounded circuits.</td>
</tr>
<tr>
<td>30</td>
<td>SID 48</td>
<td>14</td>
<td>X-Y gear position sensor. Contact the manufacturer.</td>
<td>Verify the resistance across the X-Y gear position sensor. Replace the sensor if the resistance is not within specification. Contact ZF Meritor. ②</td>
</tr>
<tr>
<td>3C</td>
<td>PID 60</td>
<td>2</td>
<td>X-Y rail position sensor data erratic, intermittent or incorrect.</td>
<td>Verify the resistance across the X-Y rail position sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires.</td>
</tr>
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<tbody>
<tr>
<td>3C</td>
<td>PID 60</td>
<td>3</td>
<td>X-Y rail position sensor voltage above normal or shorted high.</td>
<td>Verify the resistance across the X-Y rail position sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for shorted wires to voltage supply wires.</td>
</tr>
<tr>
<td>3C</td>
<td>PID 60</td>
<td>5</td>
<td>X-Y rail position sensor current below normal or open circuit.</td>
<td>Verify the resistance across the X-Y rail position sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for open circuits.</td>
</tr>
<tr>
<td>3C</td>
<td>PID 60</td>
<td>6</td>
<td>X-Y rail position sensor current above normal or grounded circuit.</td>
<td>Verify the resistance across the X-Y rail position sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for grounded circuits.</td>
</tr>
<tr>
<td>3C</td>
<td>PID 60</td>
<td>14</td>
<td>X-Y rail position sensor. Contact the manufacturer.</td>
<td>Verify the resistance across the X-Y rail position sensor. Replace the sensor if the resistance is not within specification. Contact ZF Meritor. ②</td>
</tr>
<tr>
<td>23</td>
<td>SID 35</td>
<td>3</td>
<td>High range solenoid voltage above normal or shorted high.</td>
<td>Verify the resistance across the high range solenoid. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for shorted wires to voltage supply wires.</td>
</tr>
<tr>
<td>23</td>
<td>SID 35</td>
<td>5</td>
<td>High range solenoid current below normal or open circuit.</td>
<td>Verify the resistance across the high range solenoid. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for open circuits.</td>
</tr>
<tr>
<td>23</td>
<td>SID 35</td>
<td>6</td>
<td>High range solenoid current above normal or grounded circuit.</td>
<td>Verify the resistance across the high range solenoid. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for grounded circuits.</td>
</tr>
<tr>
<td>24</td>
<td>SID 36</td>
<td>3</td>
<td>Low range solenoid voltage above normal or shorted high.</td>
<td>Verify the resistance across the low range solenoid. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for shorted wires to voltage supply wires.</td>
</tr>
<tr>
<td>24</td>
<td>SID 36</td>
<td>5</td>
<td>Low range solenoid current below normal or open circuit.</td>
<td>Verify the resistance across the low range solenoid. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for open circuits.</td>
</tr>
<tr>
<td>24</td>
<td>SID 36</td>
<td>6</td>
<td>Low range solenoid current above normal or grounded circuit.</td>
<td>Verify the resistance across the low range solenoid. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for grounded circuits.</td>
</tr>
<tr>
<td>27</td>
<td>SID 39</td>
<td>3</td>
<td>X-Y rail solenoid #1 voltage above normal or shorted high.</td>
<td>Verify the resistance across the X-Y rail solenoid #1. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for shorted wires to voltage supply wires.</td>
</tr>
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<tr>
<td>27 SID 39 5</td>
<td>X-Y rail solenoid #1 current below normal or open circuit.</td>
<td>Verify the resistance across the X-Y rail solenoid #1. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for open circuits.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27 SID 39 6</td>
<td>X-Y rail solenoid #1 current above normal or grounded circuit.</td>
<td>Verify the resistance across the X-Y rail solenoid #1. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for grounded circuits.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 SID 50 3</td>
<td>X-Y rail solenoid #2 voltage above normal or shorted high.</td>
<td>Verify the resistance across the X-Y rail solenoid #2. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for shorted wires to voltage supply wires.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 SID 50 5</td>
<td>X-Y rail solenoid #2 current below normal or open circuit.</td>
<td>Verify the resistance across the X-Y rail solenoid #2. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for open circuits.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 SID 50 6</td>
<td>X-Y rail solenoid #2 current above normal or grounded circuit.</td>
<td>Verify the resistance across the X-Y rail solenoid #2. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for grounded circuits.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28 SID 40 3</td>
<td>X-Y gear solenoid #1 voltage above normal or shorted high.</td>
<td>Verify the resistance across the X-Y gear solenoid #1. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for shorted wires to voltage supply wires.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28 SID 40 5</td>
<td>X-Y gear solenoid #1 current below normal or open circuit.</td>
<td>Verify the resistance across the X-Y gear solenoid #1. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for open circuits.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28 SID 40 6</td>
<td>X-Y gear solenoid #1 current above normal or grounded circuit.</td>
<td>Verify the resistance across the X-Y gear solenoid #1. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for grounded circuits.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33 SID 51 3</td>
<td>X-Y gear solenoid #2 voltage above normal or shorted high.</td>
<td>Verify the resistance across the X-Y gear solenoid #2. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for shorted wires to voltage supply wires.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33 SID 51 5</td>
<td>X-Y gear solenoid #2 current below normal or open circuit.</td>
<td>Verify the resistance across the X-Y gear solenoid #2. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for open circuits.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33 SID 51 6</td>
<td>X-Y gear solenoid #2 current above normal or grounded circuit.</td>
<td>Verify the resistance across the X-Y gear solenoid #2. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for grounded circuits.</td>
<td></td>
<td></td>
</tr>
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<tbody>
<tr>
<td>38 SID 56</td>
<td>7</td>
<td>Auxiliary section mechanical system not responding correctly.</td>
<td>Inspect the auxiliary section of the transmission for mechanical concerns.</td>
<td></td>
</tr>
<tr>
<td>39 SID 57</td>
<td>2</td>
<td>Shift module assembly communication data erratic, intermittent or incorrect.</td>
<td>Inspect the wiring harness connecting the shift module box to the transmission control unit (TCU) for damaged wires. Replace the wiring harness as needed. If necessary, contact Meritor.</td>
<td></td>
</tr>
<tr>
<td>39 SID 57</td>
<td>14</td>
<td>Shift module assembly communication. Contact the manufacturer.</td>
<td>Replace the shift module assembly. If necessary, contact ZF Meritor.</td>
<td></td>
</tr>
<tr>
<td>3A SID 58</td>
<td>7</td>
<td>Main box shift engagement system not responding correctly.</td>
<td>Inspect the top cover for mechanical concerns.</td>
<td></td>
</tr>
<tr>
<td>3B SID 59</td>
<td>7</td>
<td>Main box rail selection system not responding correctly.</td>
<td>Inspect the top cover for mechanical concerns.</td>
<td></td>
</tr>
<tr>
<td>E3 SID 227</td>
<td>0</td>
<td>Oil temperature sensor data valid but above normal operational range. (Transmission is overheating.)</td>
<td>The transmission is overheating. Check the transmission for correct lube level and oil type.</td>
<td></td>
</tr>
<tr>
<td>E3 SID 227</td>
<td>1</td>
<td>Oil temperature sensor data valid but below normal operational range. (Transmission temperature is too cold.)</td>
<td>The transmission is too cold. Check the transmission for correct lube level and oil type. In colder climates, allow the transmission to warm up prior to operating the vehicle.</td>
<td></td>
</tr>
<tr>
<td>E3 SID 227</td>
<td>2</td>
<td>Oil temperature sensor data erratic, intermittent or incorrect.</td>
<td>Verify the resistance across the oil temperature sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires.</td>
<td></td>
</tr>
<tr>
<td>E3 SID 227</td>
<td>3</td>
<td>Oil temperature sensor voltage above normal or shorted high.</td>
<td>Verify the resistance across the oil temperature sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for shorted wires to voltage supply wires.</td>
<td></td>
</tr>
<tr>
<td>E3 SID 227</td>
<td>4</td>
<td>Oil temperature sensor voltage below normal or grounded circuit.</td>
<td>Verify the resistance across the oil temperature sensor. Replace the sensor if the resistance is not within specification. Inspect the wiring harness for damaged wires. Check for grounded circuits.</td>
<td></td>
</tr>
<tr>
<td>E7 SID 231</td>
<td>11</td>
<td>SAE J-1939 data link failure mode not identifiable.</td>
<td>Verify the J-1939 connections. Inspect the wiring harness for damaged wires.</td>
<td></td>
</tr>
</tbody>
</table>

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<tr>
<td>E7</td>
<td>SID 231</td>
<td>14</td>
<td>SAE J-1939 data link. Contact the manufacturer.</td>
<td>Verify the J-1939 connections. Inspect the wiring harness for damaged wires. If necessary, contact ZF Meritor. ②</td>
</tr>
<tr>
<td>EE</td>
<td>SID 238</td>
<td>3</td>
<td>Diagnostic lamp voltage above normal or shorted high.</td>
<td>Inspect the wiring harness for damaged wires. Check for shorted wires to voltage supply wires.</td>
</tr>
<tr>
<td>EE</td>
<td>SID 238</td>
<td>5</td>
<td>Diagnostic lamp current below normal or open circuit (check the bulb).</td>
<td>The diagnostic bulb requires replacement. However, if necessary inspect the wiring harness for damaged wires. Check for open circuits.</td>
</tr>
<tr>
<td>EE</td>
<td>SID 238</td>
<td>6</td>
<td>Diagnostic lamp current above normal or grounded circuit.</td>
<td>Inspect the wiring harness for damaged wires. Check for grounded circuits.</td>
</tr>
<tr>
<td>FB</td>
<td>SID 251</td>
<td>0</td>
<td>TCU power supply voltage valid but above normal operating range.</td>
<td>Use #3: Check for batteries that are fully charged. Inspect the wiring harness for damaged wires. Check for shorted wires to voltage supply wires.</td>
</tr>
<tr>
<td>FB</td>
<td>SID 251</td>
<td>1</td>
<td>TCU power supply voltage valid but below normal operating range.</td>
<td>The batteries are likely to be low. Verify that they’re charged properly. Inspect the wiring harness for damaged wires. Check for open circuits.</td>
</tr>
<tr>
<td>FB</td>
<td>SID 251</td>
<td>2</td>
<td>TCU power supply data erratic, intermittent or correct.</td>
<td>Verify that the batteries are charged properly. Inspect the wiring harness for damaged wires. Check for open circuits.</td>
</tr>
<tr>
<td>FB</td>
<td>SID 251</td>
<td>3</td>
<td>TCU power supply voltage above normal or shorted high.</td>
<td>Inspect the wiring harness for damaged wires. Check for shorted wires to voltage supply wires.</td>
</tr>
<tr>
<td>FB</td>
<td>SID 251</td>
<td>4</td>
<td>TCU power supply voltage below normal or grounded circuit.</td>
<td>Inspect the wiring harness for damaged wires. Check for grounded circuits.</td>
</tr>
<tr>
<td>FC</td>
<td>SID 252</td>
<td>7</td>
<td>Transmission calibration routine not responding correctly.</td>
<td>Transmission control unit (TCU) fault. Contact the manufacturer.</td>
</tr>
<tr>
<td>FC</td>
<td>SID 252</td>
<td>11</td>
<td>Transmission calibration routine failure mode not identifiable.</td>
<td>Transmission control unit (TCU) fault. Contact the manufacturer.</td>
</tr>
<tr>
<td>FC</td>
<td>SID 252</td>
<td>13</td>
<td>Transmission calibration routine out of calibration.</td>
<td>Transmission control unit (TCU) fault. Contact the manufacturer.</td>
</tr>
<tr>
<td>FD</td>
<td>SID 253</td>
<td>12</td>
<td>Transmission calibration memory device not operational.</td>
<td>Transmission control unit (TCU) fault. Contact the manufacturer.</td>
</tr>
<tr>
<td>FD</td>
<td>SID 253</td>
<td>13</td>
<td>Transmission calibration memory out of calibration.</td>
<td>Transmission control unit (TCU) fault. Contact the manufacturer.</td>
</tr>
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<tr>
<td>FD</td>
<td>SID 253</td>
<td>14</td>
<td>Transmission calibration memory. Contact the manufacturer.</td>
<td>Transmission control unit (TCU) fault. Contact the manufacturer.</td>
</tr>
<tr>
<td>FE</td>
<td>SID 254</td>
<td>12</td>
<td>Transmission control unit not operational.</td>
<td>Transmission control unit (TCU) fault. Contact the manufacturer.</td>
</tr>
<tr>
<td>FE</td>
<td>SID 254</td>
<td>14</td>
<td>Transmission control unit. Contact the manufacturer.</td>
<td>Transmission control unit (TCU) fault. Contact the manufacturer.</td>
</tr>
<tr>
<td>98</td>
<td>SID 152</td>
<td>3</td>
<td>Shift module box supply output voltage above normal or shorted high.</td>
<td>Inspect the wiring harness connecting the shift module box to the transmission control unit (TCU). Check for shorted wires to voltage supply wires. If necessary, contact ZF Meritor.</td>
</tr>
<tr>
<td>98</td>
<td>SID 152</td>
<td>5</td>
<td>Shift module box supply output current below normal or open circuit.</td>
<td>Inspect the wiring harness connecting the shift module box to the transmission control unit (TCU). Check for open circuits. If necessary, contact ZF Meritor.</td>
</tr>
<tr>
<td>98</td>
<td>SID 152</td>
<td>6</td>
<td>Shift module box supply output current above normal or grounded circuit.</td>
<td>Inspect the wiring harness connecting the shift module box to the transmission control unit (TCU). Check for grounded circuits. If necessary, contact ZF Meritor.</td>
</tr>
<tr>
<td>98</td>
<td>SID 152</td>
<td>14</td>
<td>Shift module box supply output. Contact the manufacturer.</td>
<td>Inspect the wiring harness connecting the shift module box to the transmission control unit (TCU). If necessary, contact ZF Meritor.</td>
</tr>
<tr>
<td>99</td>
<td>SID 153</td>
<td>3</td>
<td>Manual override disable output voltage above normal or shorted high.</td>
<td>Inspect the wiring harness connecting the shift module box to the transmission control unit (TCU). Check for shorted wires to voltage supply wires. If necessary, contact ZF Meritor.</td>
</tr>
<tr>
<td>99</td>
<td>SID 153</td>
<td>5</td>
<td>Manual override disable output current below normal or open circuit.</td>
<td>Inspect the wiring harness connecting the shift module box to the transmission control unit (TCU). Check for open circuits. If necessary, contact ZF Meritor.</td>
</tr>
<tr>
<td>99</td>
<td>SID 153</td>
<td>6</td>
<td>Manual override disable output current above normal or grounded circuit.</td>
<td>Inspect the wiring harness connecting the shift module box to the transmission control unit (TCU). Check for grounded circuits. If necessary, contact ZF Meritor.</td>
</tr>
<tr>
<td>97</td>
<td>SID 151</td>
<td>14</td>
<td>Speed sensor plausibility. Contact the manufacturer.</td>
<td>Verify the resistance across both speed sensors. Inspect the wiring harness for damaged wires.</td>
</tr>
</tbody>
</table>

1. Parameter IDentification (PID) - Subsystem IDentification (SID)
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WARNING
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Step 1
The X-Y actuator rail select solenoid is located on the driver's side of the transmission. The eight-pin connector is located on the passenger's side.

Step 2
Disconnect the fifteen-pin transmission wiring harness connector from the cab-mounted transmission control unit (TCU).
• GO TO THE NEXT STEP.

Step 3
Check the resistance between sockets ten and fifteen (rail select solenoid #1 circuit).
Is the resistance 21.15 to 25.85 ohms?
• YES → RAIL SELECT SOLENOID #1 IS OKAY.
• NO → GO TO THE NEXT STEP.

Step 4
Disconnect the eight-pin transmission wiring harness connector from the OEM wiring harness.
• GO TO THE NEXT STEP.
Section 3
VOM Diagnostics
X-Y Actuator Rail Select Solenoid #1

Step 5

Check the resistance between sockets C and H (rail select solenoid #1 circuit).

Is the resistance 21.15 to 25.85 ohms?

- **YES** → **CHECK THE OEM WIRING HARNESS ASSEMBLY. CONSULT THE MANUFACTURER.**
- **NO** → **GO TO THE NEXT STEP.**

Step 6

Disconnect the three-pin rail select solenoid connector from the transmission wiring harness.

- **GO TO THE NEXT STEP.**

Step 7

Check the resistance between sockets two and three of the rail select solenoid assembly connector.

Is the resistance 21.15 to 25.85 ohms?

- **YES** → **REPLACE THE TRANSMISSION WIRING HARNESS.**
- **NO** → **REPLACE THE RAIL SELECT SOLENOID ASSEMBLY.**
The X-Y actuator rail select solenoid is located on the driver's side of the transmission. The eight-pin connector is located on the passenger's side.

Step 1

Disconnect the fifteen-pin transmission wiring harness connector from the cab-mounted transmission control unit (TCU).

Step 2

GO TO THE NEXT STEP.

Step 3

Check the resistance between sockets eleven and fifteen (rail select solenoid #2 circuit).

Is the resistance 21.15 to 25.85 ohms?

• YES → RAIL SELECT SOLENOID #2 IS OKAY.
• NO → GO TO THE NEXT STEP.

Step 4

Disconnect the eight-pin transmission wiring harness connector from the OEM wiring harness.

GO TO THE NEXT STEP.
Section 3
VOM Diagnostics
X-Y Actuator Rail Select Solenoid #2

Step 5

Check the resistance between sockets D and H (rail select solenoid #2 circuit).
Is the resistance 21.15 to 25.85 ohms?
• YES → CHECK THE OEM WIRING HARNESS ASSEMBLY. CONSULT THE MANUFACTURER.
• NO → GO TO THE NEXT STEP.

Step 6

Disconnect the three-pin rail select solenoid connector from the transmission wiring harness.
• GO TO THE NEXT STEP.

Step 7

Check the resistance between sockets one and two of the rail solenoid assembly connector.
Is the resistance 21.15 to 25.85 ohms?
• YES → REPLACE THE TRANSMISSION WIRING HARNESS.
• NO → REPLACE THE RAIL SELECT SOLENOID ASSEMBLY.
The X-Y actuator engage fork solenoid is located on the driver’s side of the transmission. The eight-pin connector is located on the passenger’s side.

Step 1

8 PIN CONNECTOR

ENGAGE FORK SOLENOID # 1 AND #2

Step 2

Disconnect the fifteen-pin transmission wiring harness connector from the cab-mounted transmission control unit (TCU).

- GO TO THE NEXT STEP.

Step 3

Check the resistance between sockets twelve and fifteen (engage fork solenoid #1 circuit).

Is the resistance 9.63 to 11.77 ohms?

- YES → ENGAGE FORK SOLENOID #1 IS OKAY.
- NO → GO TO THE NEXT STEP.

Step 4

Disconnect the eight-pin transmission wiring harness connector from the OEM wiring harness.

- GO TO THE NEXT STEP.
Section 3
VOM Diagnostics
X-Y Actuator Engage Fork Solenoid #1

Step 5

Check the resistance between sockets A and H (engage fork solenoid #1 circuit).

Is the resistance 9.63 to 11.77 ohms?

- **YES** → CHECK THE OEM WIRING HARNESS ASSEMBLY. CONSULT THE MANUFACTURER.
- **NO** → GO TO THE NEXT STEP.

Step 6

Disconnect the three-pin engage fork solenoid connector from the transmission wiring harness.

- **GO TO THE NEXT STEP.**

Step 7

Check the resistance between sockets two and three of the rail solenoid assembly connector.

Is the resistance 9.63 to 11.77 ohms?

- **YES** → REPLACE THE TRANSMISSION WIRING HARNESS.
- **NO** → REPLACE THE ENGAGE FORK SOLENOID ASSEMBLY.
The X-Y actuator engage fork solenoid is located on the driver’s side of the transmission. The eight-pin connector is located on the passenger’s side.

Disconnect the fifteen-pin transmission wiring harness connector from the cab-mounted transmission control unit (TCU).

- **GO TO THE NEXT STEP.**

Check the resistance between sockets nine and fifteen (engage fork solenoid #2 circuit).

- **YES → ENGAGE FORK SOLENOID #2 IS OKAY.**
- **NO → GO TO THE NEXT STEP.**

Disconnect the eight-pin transmission wiring harness connector from the OEM wiring harness.

- **GO TO THE NEXT STEP.**
Section 3
VOM Diagnostics
X-Y Actuator Engage Fork Solenoid #2

Step 5

Check the resistance between sockets B and H (engage fork solenoid #2 circuit).

Is the resistance 9.63 to 11.77 ohms?

- YES → CHECK THE OEM WIRING HARNESS ASSEMBLY, CONSULT THE MANUFACTURER.
- NO → GO TO THE NEXT STEP.

Step 6

Disconnect the three-pin engage fork solenoid connector from the transmission wiring harness.

- GO TO THE NEXT STEP.

Step 7

Check the resistance between sockets one and two of the rail solenoid assembly connector.

Is the resistance 9.63 to 11.77 ohms?

- YES → REPLACE THE TRANSMISSION WIRING HARNESS.
- NO → REPLACE THE ENGAGE FORK SOLENOID ASSEMBLY.
The X-Y actuator rail select position sensor is located on the driver’s side of the transmission. The ten-pin connector is located on the passenger’s side.

Disconnect the eighteen-pin transmission wiring harness connector from the cab-mounted transmission control unit (TCU).

- GO TO THE NEXT STEP.

Check the resistance between sockets 13 and 18 (rail select position sensor circuit).

Is the resistance 64.8 to 79.2 ohms?

- YES → THE RAIL POSITION SENSOR IS OKAY.
- NO → GO TO THE NEXT STEP.

Disconnect the ten-pin transmission wiring harness connector from the OEM wiring harness.

- GO TO THE NEXT STEP.
Section 3  
VOM Diagnostics  
X-Y Actuator Rail Select Position Sensor

Step 5

Check the resistance between sockets D and K (rail select position sensor circuit).
Is the resistance 64.8 to 79.2 ohms?

- YES → CHECK THE OEM WIRING HARNESS ASSEMBLY. CONSULT THE MANUFACTURER.
- NO → GO TO THE NEXT STEP.

Step 6

Disconnect the two-pin rail select position sensor connector from the transmission wiring harness.
- GO TO THE NEXT STEP.

Step 7

Check the resistance between sockets A and B of the rail select position sensor connector.
Is the resistance 64.8 to 79.2 ohms?

- YES → REPLACE THE TRANSMISSION WIRING HARNESS.
- NO → REPLACE THE RAIL POSITION SENSOR.
The X-Y actuator engage fork position sensor faces the front of the transmission. The ten-pin connector is located on the passenger’s side.

Disconnect the eighteen-pin transmission wiring harness connector from the cab-mounted transmission control unit (TCU).

Step 1

Step 2

Connect the ten-pin transmission wiring harness connector from the OEM wiring harness.

Step 3

Step 4

Check the resistance between sockets 17 and 18 (engage fork position sensor circuit).

Is the resistance 64.8 to 79.2 ohms?

- YES → THE ENGAGE FORK POSITION SENSOR IS OKAY.
- NO → GO TO THE NEXT STEP.
Section 3
VOM Diagnostics
X-Y Actuator Engage Fork Position Sensor

**Step 5**

Check the resistance between sockets C and K (engage fork position sensor circuit).

Is the resistance 64.8 to 79.2 ohms?

- **YES** → CHECK THE OEM WIRING HARNESS ASSEMBLY. CONSULT THE MANUFACTURER.
- **NO** → GO TO THE NEXT STEP.

**Step 6**

Disconnect the two-pin fork position sensor connector from the transmission wiring harness.

- **GO TO THE NEXT STEP.**

**Step 7**

Check the resistance between sockets A and B of the fork position sensor connector.

Is the resistance 64.8 to 79.2 ohms?

- **YES** → REPLACE THE TRANSMISSION WIRING HARNESS.
- **NO** → REPLACE THE FORK POSITION SENSOR.
The main countershaft speed sensor and ten-pin connector are located on the passenger's side of the transmission.

Disconnect the eighteen-pin transmission wiring harness connector from the cab-mounted transmission control unit (TCU).
- **GO TO THE NEXT STEP.**

Check the resistance between sockets 12 and 15 (main countershaft speed sensor circuit). Is the resistance 2.7k to 3.3k ohms?

- **YES → THE MAIN COUNTERSHAFT SPEED SENSOR IS OKAY.**
- **NO → GO TO THE NEXT STEP.**

Disconnect the 10-pin transmission wiring harness connector from the OEM wiring harness.
- **GO TO THE NEXT STEP.**
Section 3
VOM Diagnostics
Main Countershaft Speed Sensor

Step 5

Check the resistance between sockets A and B (main countershaft speed sensor circuit).
Is the resistance 2.7k to 3.3k ohms?
• **YES → CHECK THE OEM WIRING HARNESS ASSEMBLY. CONSULT THE MANUFACTURER.**
• **NO → GO TO THE NEXT STEP.**

Step 6

Disconnect the two-pin main countershaft speed sensor connector from the transmission wiring harness.
• **GO TO THE NEXT STEP.**

Step 7

Check the resistance between sockets A and B of the main countershaft speed sensor connector.
Is the resistance 2.7k to 3.3k ohms?
• **YES → REPLACE THE TRANSMISSION WIRING HARNESS.**
• **NO → REPLACE THE MAIN COUNTERSHAFT SPEED SENSOR.**
The output shaft speed sensor is located at the rear of the transmission. The ten-pin connector is located on the passenger side of the transmission.

Step 2
Disconnect the eighteen-pin transmission wiring harness connector from the cab-mounted transmission control unit (TCU).

Step 3
Check the resistance between sockets six and nine (output shaft speed sensor circuit).
Is the resistance 2.7k to 3.3k ohms?
- **YES** → THE OUTPUT SHAFT SPEED SENSOR IS OKAY.
- **NO** → GO TO THE NEXT STEP.

Step 4
Disconnect the ten-pin transmission wiring harness connector from the OEM wiring harness.

- **GO TO THE NEXT STEP.**
Section 3
VOM Diagnostics
Output Shaft Speed Sensor

**Step 5**

Check the resistance between sockets G and H (output shaft speed sensor circuit).
Is the resistance 2.7k to 3.3k ohms?
- **YES** → CHECK THE OEM WIRING HARNESS ASSEMBLY. CONSULT THE MANUFACTURER.
- **NO** → GO TO THE NEXT STEP.

**Step 6**

Disconnect the two-pin output shaft speed sensor connector from the transmission wiring harness.
- **GO TO THE NEXT STEP.**

**Step 7**

Check the resistance between sockets A and B of the output shaft speed sensor connector.
Is the resistance 2.7k to 3.3k ohms?
- **YES** → REPLACE THE TRANSMISSION WIRING HARNESS.
- **NO** → REPLACE THE OUTPUT SHAFT SPEED SENSOR.
The ten-pin connector and the range position sensor are located on the passenger’s side of the transmission.

**Step 1**

Disconnect the eighteen-pin transmission wiring harness connector from the cab-mounted transmission control unit (TCU).

**Step 2**

Check the resistance between sockets 14 and 18 (range position sensor circuit).

Is the resistance 64.8 to 79.2 ohms?

- **YES** → RANGE POSITION SENSOR IS OKAY.
- **NO** → GO TO THE NEXT STEP.

**Step 3**

Disconnect the ten-pin transmission wiring harness connector from the OEM wiring harness.

**Step 4**

- **GO TO THE NEXT STEP.**
Section 3
VOM Diagnostics
Range Position Sensor

Step 5
Check the resistance between sockets E and K (range position sensor circuit).
Is the resistance 64.8 to 79.2 ohms?

- YES → CHECK THE OEM WIRING HARNESS ASSEMBLY. CONSULT THE MANUFACTURER.
- NO → GO TO THE NEXT STEP.

Step 6
Disconnect the three-pin range position sensor connector from the transmission wiring harness.
- GO TO THE NEXT STEP.

Step 7
Check the resistance between sockets one and two of the range position sensor connector.
Is the resistance 64.8 to 79.2 ohms?

- YES → REPLACE THE TRANSMISSION WIRING HARNESS.
- NO → REPLACE THE RANGE POSITION SENSOR.
Section 3
VOM Diagnostics
High Range Solenoid

Step 1
The high range solenoid is located at the rear of the transmission. The eight-pin connector is located on the passenger’s side of the transmission.

Step 2
Disconnect the fifteen-pin transmission wiring harness connector from the cab-mounted transmission control unit (TCU).
• GO TO THE NEXT STEP.

Step 3
Check the resistance between sockets eight and fifteen (high range solenoid circuit).
Is the resistance 11.0 to 21.0 ohms?
• YES → HIGH RANGE SOLENOID IS OKAY.
• NO → GO TO THE NEXT STEP.

Step 4
Disconnect the eight-pin transmission wiring harness connector from the OEM wiring harness.
• GO TO THE NEXT STEP.
Section 3
VOM Diagnostics
High Range Solenoid

Step 5

Check the resistance between sockets F and H (high range solenoid circuit).

Is the resistance 11.0 to 21.0 ohms?

- YES → CHECK THE OEM WIRING HARNESS ASSEMBLY. CONSULT THE MANUFACTURER.

- NO → GO TO THE NEXT STEP.

Step 6

Disconnect the two-pin high range solenoid connector from the transmission wiring harness.

- GO TO THE NEXT STEP.

Step 7

Check the resistance between sockets A and B of the high range solenoid connector.

Is the resistance 11.0 to 21.0 ohms?

- YES → REPLACE THE TRANSMISSION WIRING HARNESS.

- NO → REPLACE THE HIGH RANGE SOLENOID ASSEMBLY.
The low range solenoid is located at the rear of the transmission. The eight-pin connector is located on the passenger’s side.

Disconnect the fifteen-pin transmission wiring harness connector from the cab-mounted transmission control unit (TCU).

- GO TO THE NEXT STEP.

Check the resistance between sockets seven and fifteen (low range solenoid circuit).

Is the resistance 11.0 to 21.0 ohms?

- YES → LOW RANGE SOLENOID IS OKAY.
- NO → GO TO THE NEXT STEP.

Disconnect the eight-pin transmission wiring harness connector from the OEM wiring harness.

- GO TO THE NEXT STEP.
Section 3
VOM Diagnostics
Low Range Solenoid

Step 5

Check the resistance between sockets E and H (low range solenoid circuit).

Is the resistance 11.0 to 21.0 ohms?

- **YES** → CHECK THE OEM WIRING HARNESS ASSEMBLY. CONSULT THE MANUFACTURER.
- **NO** → GO TO THE NEXT STEP.

Step 6

Disconnect the two-pin low range solenoid connector from the transmission wiring harness.

- **GO TO THE NEXT STEP.**

Step 7

Check the resistance between sockets A and B of the low range solenoid connector.

Is the resistance 11.0 to 21.0 ohms?

- **YES** → REPLACE THE TRANSMISSION WIRING HARNESS.
- **NO** → REPLACE THE LOW RANGE SOLENOID ASSEMBLY.
Step 1

Disconnect the six-pin Shift-n-Cruise connector from the shift module.

- **GO TO THE NEXT STEP.**

Step 2

Without pressing any of the Shift-n-Cruise pads, check the resistance between sockets one and two (“set” circuit).

Is the circuit open?

- **YES  ➔ GO TO THE NEXT STEP.**
- **NO  ➔ REPLACE THE SHIFT-N-CRUISE SWITCH ASSEMBLY.**

Step 3

Press and hold **SET** on the Shift-n-Cruise pad. Check the resistance between sockets one and two (“set” circuit).

Is the resistance 0.0 to 0.5 ohms?

- **YES  ➔ GO TO THE NEXT STEP.**
- **NO  ➔ REPLACE THE SHIFT-N-CRUISE SWITCH ASSEMBLY.**

Step 4

Without pressing any of the Shift-n-Cruise pads, check the resistance between sockets one and three (“resume” circuit).

Is the circuit open?

- **YES  ➔ GO TO THE NEXT STEP.**
- **NO  ➔ REPLACE THE SHIFT-N-CRUISE SWITCH ASSEMBLY.**
Section 3
VOM Diagnostics
Shift-n-Cruise Assembly

Step 5
Press and hold **RESUME** on the Shift-n-Cruise pad. Check the resistance between sockets one and three ("resume" circuit).

Is the resistance 0.0 to 0.5 ohms?
- **YES** → GO TO THE NEXT STEP.
- **NO** → REPLACE THE SHIFT-N-CRUISE SWITCH ASSEMBLY.

Step 6
Without pressing any of the Shift-n-Cruise pads, check the resistance between sockets four and five ("pause" circuit).

Is the resistance 0.0 to 0.5 ohms?
- **YES** → GO TO THE NEXT STEP.
- **NO** → REPLACE THE SHIFT-N-CRUISE SWITCH ASSEMBLY.

Step 7
Press and hold **PAUSE** on the Shift-n-Cruise pad. Check the resistance between sockets four and five ("pause" circuit).

Is the circuit open?
- **YES** → THE SHIFT-N-CRUISE FUNCTIONS CORRECTLY.
- **NO** → REPLACE THE SHIFT-N-CRUISE SWITCH ASSEMBLY.
Disconnect the transmission wiring harness from the OEM wiring harness, the solenoids and the sensors. Disconnect the following connectors:

- Ten-pin transmission wiring harness connector, View F-F.
- Eight-pin transmission wiring harness connector, View E-E.
- Two-pin high range solenoid connector, View C-C (left).
- Two-pin low range solenoid connector, View C-C (right).
- Four-pin range position sensor connector, View A-A (right).
- Four-pin engage fork position sensor connector, View B-B (right).
- Two-pin main countershaft speed sensor connector, View D-D (right).
- Four-pin engage fork solenoid connector, View A-A (middle).
- Four-pin rail select position sensor connector, View B-B (left).
- Four-pin rail select solenoid connector, View A-A (left).
- Two-pin output shaft speed sensor connector, View D-D (left).
Section 3
VOM Diagnostics
Transmission Wiring Harness

Step 2

Remove the transmission wiring harness from the vehicle and place it on a bench.

- GO TO THE NEXT STEP.

Step 3

Check continuity between socket A of the eight-pin transmission wiring harness connector and socket three of the engage fork solenoid connector.

Is there continuity?

- YES → GO TO THE NEXT STEP.
- NO → REPLACE THE TRANSMISSION WIRING HARNESS.

Step 4

Check continuity between socket B of the eight-pin transmission wiring harness connector and socket one of the engage fork solenoid connector.

Is there continuity?

- YES → GO TO THE NEXT STEP.
- NO → REPLACE THE TRANSMISSION WIRING HARNESS.

Step 5

Check continuity between socket C of the eight-pin transmission wiring harness connector and socket three of the rail select solenoid connector.

Is there continuity?

- YES → GO TO THE NEXT STEP.
- NO → REPLACE THE TRANSMISSION WIRING HARNESS.
Step 6

Check continuity between socket D of the eight-pin transmission wiring harness connector and socket one of the rail select solenoid connector. Is there continuity?

- YES → GO TO THE NEXT STEP.
- NO → REPLACE THE TRANSMISSION WIRING HARNESS.

Step 7

Check continuity between socket E of the eight-pin transmission wiring harness connector and socket A of the low range solenoid connector. Is there continuity?

- YES → GO TO THE NEXT STEP.
- NO → REPLACE THE TRANSMISSION WIRING HARNESS.

Step 8

Check continuity between socket F of the eight-pin transmission wiring harness connector and socket A of the high range solenoid connector. Is there continuity?

- YES → GO TO THE NEXT STEP.
- NO → REPLACE THE TRANSMISSION WIRING HARNESS.

Step 9

Check continuity between socket H of the eight-pin transmission wiring harness connector and
- Socket two of the engage fork solenoid connector.
- Socket two of the rail select solenoid connector.
- Socket B of the high range solenoid connector.
- Socket B of the low range solenoid connector. Is there continuity to all sockets?

- YES → GO TO THE NEXT STEP.
- NO → REPLACE THE TRANSMISSION WIRING HARNESS.
Check continuity between socket A of the ten-pin transmission wiring harness connector and socket A of the main countershaft speed sensor.

Is there continuity?

- YES → GO TO THE NEXT STEP.
- NO → REPLACE THE TRANSMISSION WIRING HARNESS.

Check continuity between socket B of the ten-pin transmission wiring harness connector and socket B of the main countershaft speed sensor.

Is there continuity?

- YES → GO TO THE NEXT STEP.
- NO → REPLACE THE TRANSMISSION WIRING HARNESS.

Check continuity between socket C of the ten-pin transmission wiring harness connector and socket A of the engage fork position sensor.

Is there continuity?

- YES → GO TO THE NEXT STEP.
- NO → REPLACE THE TRANSMISSION WIRING HARNESS.

Check continuity between socket D of the ten-pin transmission wiring harness connector and socket A of the rail select position sensor.

Is there continuity?

- YES → GO TO THE NEXT STEP.
- NO → REPLACE THE TRANSMISSION WIRING HARNESS.
Step 14

Check continuity between socket E of the ten-pin transmission wiring harness connector and socket one of the range position sensor.

Is there continuity?

- YES → GO TO THE NEXT STEP.
- NO → REPLACE THE TRANSMISSION WIRING HARNESS.

Step 15

Check continuity between socket G of the ten-pin transmission wiring harness connector and socket A of the output shaft speed sensor.

Is there continuity?

- YES → GO TO THE NEXT STEP.
- NO → REPLACE THE TRANSMISSION WIRING HARNESS.

Step 16

Check continuity between socket H of the ten-pin transmission wiring harness connector and socket B of the output shaft speed sensor.

Is there continuity?

- YES → GO TO THE NEXT STEP.
- NO → REPLACE THE TRANSMISSION WIRING HARNESS.

Step 17

Check continuity between socket K of the ten-pin transmission wiring harness connector and
- Socket B of the engage fork position sensor.
- Socket B of the rail select position sensor.
- Socket two of the range position sensor.

Is there continuity?

- YES → THE WIRING HARNESS IS OKAY.
- NO → REPLACE THE TRANSMISSION WIRING HARNESS.
Transmission Control Unit (TCU)

The transmission control unit (TCU) is not serviceable.

1. Refer to Section 2 for instructions on how to retrieve and identify fault codes.

2. If the instrument panel display identifies active Fault Code FE, a fault exists in the TCU. Replace the TCU. Contact Meritor’s Customer Service Center at 800-535-5560 for assistance.

Shift Module

The transmission’s shift module is not serviceable.

1. Refer to Section 2 for instructions on how to retrieve and identify fault codes.

2. If the instrument panel display identifies active Fault Codes 39 and 98, check the wiring harness for damage. Replace a damaged wiring harness.

   - If the wiring harness is not damaged:
     Contact Meritor’s Customer Service Center at 800-535-5560 for assistance.

Instrument Panel Display

The transmission’s instrument panel display is not serviceable.

1. Refer to Section 2 for instructions on how to retrieve and identify fault codes.

2. Check the OEM wiring harness for damage. Replace a damaged wiring harness.

   - If the OEM wiring harness is not damaged:
     Contact Meritor’s Customer Service Center at 800-535-5560 for assistance.
Section 5  
Troubleshooting Air Leaks  
Air Filter Regulator

**WARNING**
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Verify that the vehicle’s air tanks are full (approximately 120 psi).
Are the air tanks full?
- **YES** → GO TO THE NEXT STEP.
- **NO** → START THE ENGINE TO BUILD AIR PRESSURE IN THE TANKS TO 120 PSI. GO TO NEXT STEP.

Air leaks can occur in the transmission from parts other than the air filter/regulator (for example, pin holes in the air line, fittings, breather, etc.).
Listen for audible air leaks. Can you hear air leaking from the transmission?
- **YES** → FIX THE LEAK. GO TO THE NEXT STEP.
- **NO** → GO TO THE NEXT STEP.

Use the supply port to measure the regulated transmission air pressure.
Is the pressure 60 to 70 psi?
- **YES** → THE FILTER/REGULATOR WORKS CORRECTLY.
- **NO** → REPLACE THE FILTER REGULATOR. REFER TO SECTION 6.
Section 5  
Troubleshooting Air Leaks  
High and Low Range Solenoids

Step 1

Verify that the air filter/regulator functions correctly. Refer to page 47.

Does the air filter/regulator function correctly?

- **YES** → GO TO THE NEXT STEP.
- **NO** → REPLACE THE AIR FILTER/REGULATOR. REFER TO SECTION 6.

Step 2

Does either the high range or low range solenoid continually vent air?

- **YES** → REPLACE THE SOLENOID.
- **NO** → THE SOLENOIDS DO NOT LEAK. REFER TO SECTION 3 FOR FURTHER TROUBLESHOOTING OPTIONS.
The X-Y actuator operates pneumatically and receives air through the air filter/regulator.

**Step 1**
Verify the air filter/regulator functions correctly. Refer to page 47.
Does the air filter/regulator function correctly?
- **YES** → GO TO THE NEXT STEP.
- **NO** → REPLACE THE AIR FILTER/REGULATOR.

**Step 2**
Check the air lines for leaks.
Do the X-Y actuator air lines leak?
- **YES** → REPLACE THE X-Y ACTUATOR AIR LINES. REFER TO SECTION 7.
- **NO** → GO TO THE NEXT STEP.
SureShift Transmission Components

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</table>
**WARNING**

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

## Shift Module Removal

**Step 1**

Unplug the twelve-pin connector from the **BOTTOM** of the shift module.
- **GO TO THE NEXT STEP.**

**Step 2**

Unplug the six-pin connector from the bottom side of the shift module.
- **GO TO THE NEXT STEP.**

**Step 3**

Use a 6 mm Allen wrench to remove the two fasteners from the front of the shift module.
- **GO TO THE NEXT STEP.**

**Step 4**

Lift the shift module **UP** and **OUT** of the base.
Shift Module Installation

Step 1
Place the shift module on the base. Engage the clip on the back of the shift module with the clip on the base. Lower the front of the shift module onto the base.
- GO TO THE NEXT STEP.

Step 2
Tighten the two fasteners to 10 lb-ft (13.6 N•m).
- GO TO THE NEXT STEP.

Step 3
Connect the twelve-pin connector to the BOTTOM of the shift module.
- GO TO THE NEXT STEP.

Step 4
Connect the six-pin connector to the BOTTOM of the shift module.
Shift-n-Cruise Assembly Information

The Shift-n-Cruise assembly is a separate component from the shift module assembly.

- **If the Shift-n-Cruise feature does not work correctly:** Follow the procedures in this section to replace the Shift-n-Cruise assembly only. Do not replace the entire shift module assembly.

Shift-n-Cruise Assembly Removal

**Step 1**

Using a small screwdriver or a pick, carefully pry the top of the Shift-n-Cruise pad out of the shift module.

- **GO TO THE NEXT STEP.**

**Step 2**

Using a pick, carefully disconnect the Shift-n-Cruise pad from the wiring harness.
Shift-n-Cruise Assembly Installation

Connect the Shift-n-Cruise pad to the shift module wiring harness.
- GO TO THE NEXT STEP.

SureShift Display Removal

Unfasten the vehicle’s dash such that the back side of the display is exposed. Refer to the OEM maintenance manual for instructions.
- GO TO THE NEXT STEP.

Install the Shift-n-Cruise system buttons pad. Position the BOTTOM of the pad in the shift module. Carefully press the TOP of the pad until it is securely in place.

Unplug the sensor.
- GO TO THE NEXT STEP.
Use a 7 mm socket and driver to remove the two fasteners.

- **GO TO THE NEXT STEP.**

Remove the clamp.

- **GO TO THE NEXT STEP.**

Remove the display from the dash panel.
Section 7
Removal and Installation

Instrument Panel Display Installation

Step 1
Insert the instrument panel display into the dash.
• GO TO THE NEXT STEP.

Step 2
Place the clamp over the threaded posts.
• GO TO THE NEXT STEP.

Step 3
Use a 7 mm socket and driver to fasten the instrument panel display to the dash.
• GO TO THE NEXT STEP.

Step 4
Plug in the instrument panel display.
• GO TO THE NEXT STEP.
Replace any parts you removed when you installed the instrument panel display. Refer to the OEM maintenance manual for instructions.
TCU Removal

**Step 1**
Unplug the 18-pin connector from the TCU.

- GO TO THE NEXT STEP.

**Step 2**
Unplug the 15-pin connector from the TCU.

- GO TO THE NEXT STEP.

**Step 3**
Remove the four fasteners that secure the TCU to the cab.

- GO TO THE NEXT STEP.

**Step 4**
Remove the TCU.

- GO TO THE NEXT STEP.
TCU Installation

Step 1
Install the four fasteners that secure the TCU to the cab.
- GO TO THE NEXT STEP.

Step 2
Plug the 18-pin connector into the TCU.
- GO TO THE NEXT STEP.

Step 3
Plug the 15-pin connector into the TCU.
X-Y Actuator Rail Select Solenoid Removal

**Step 1**

The X-Y actuator rail select solenoid assembly is located on the driver's side of the transmission.
- GO TO THE NEXT STEP.

**Step 2**

Disconnect the transmission wiring harness from the rail select solenoid assembly.
- GO TO THE NEXT STEP.

**Step 3**

Use a Phillips screwdriver to remove the three fasteners securing the solenoid assembly to the X-Y actuator.
- GO TO THE NEXT STEP.

**Step 4**

The solenoid assembly cover will be loose. Hold the cover in place, so that it does not fall off and expose the O-rings.
- GO TO THE NEXT STEP.
Carefully remove the solenoid assembly from the X-Y actuator.
X-Y Actuator Rail Select Solenoid Assembly Installation

Step 1

The X-Y actuator rail select solenoid assembly is located on the driver's side of the transmission.

- GO TO THE NEXT STEP.

Step 2

Insert the solenoid assembly into the X-Y actuator. Apply light pressure to the cover to keep it from separating from the solenoids.

- GO TO THE NEXT STEP.

Step 3

Use a Phillips screwdriver to fasten the solenoid assembly to the X-Y actuator.

- GO TO THE NEXT STEP.

Step 4

Connect the transmission wiring harness to the rail select solenoid assembly.
X-Y Actuator Fork Engage Solenoid Removal

Step 1

The X-Y actuator fork engage solenoid assembly is located on the driver's side of the transmission.

- GO TO THE NEXT STEP.

Step 2

Disconnect the wiring harness from the fork engage solenoid assembly.

- GO TO THE NEXT STEP.

Step 3

Use a Phillips screwdriver to remove the three fasteners that secure the solenoid assembly to the X-Y actuator.

- GO TO THE NEXT STEP.

Step 4

The solenoid assembly cover will be loose. Hold the cover in place, so that it does not fall off and expose the O-rings.

- GO TO THE NEXT STEP.
Carefully remove the solenoid assembly from the X-Y actuator.
X-Y Actuator Fork Engage Solenoid Assembly Installation

Step 1

The X-Y actuator fork engage solenoid assembly is located on the driver's side of the transmission.

- GO TO THE NEXT STEP.

Step 2

Insert the solenoid assembly into the X-Y actuator. Apply light pressure to the cover to keep it from separating from the solenoids.

- GO TO THE NEXT STEP.

Step 3

Use a Phillips screwdriver to fasten the solenoid assembly to the X-Y actuator.

- GO TO THE NEXT STEP.

Step 4

Connect the transmission wiring harness to the fork engage solenoid assembly.
X-Y Actuator Rail Select Position Sensor Removal

Step 1

The X-Y actuator rail select solenoid assembly is located on the driver's side of the transmission.

- **GO TO THE NEXT STEP.**

Step 2

Disconnect the transmission wiring harness from the rail select position sensor.

- **GO TO THE NEXT STEP.**

Step 3

Use a Phillips screwdriver to remove the three fasteners that secure the rail select position sensor to the X-Y actuator.

- **GO TO THE NEXT STEP.**

Step 4

Remove the clamp.

- **GO TO THE NEXT STEP.**
Remove the position sensor from the X-Y actuator.
X-Y Actuator Rail Select Position Sensor Installation

**Step 1**

The X-Y actuator rail select position sensor is located on the driver's side of the transmission.

- GO TO THE NEXT STEP.

**Step 2**

Insert the position sensor into the X-Y actuator.

- GO TO THE NEXT STEP.

**Step 3**

Install the clamp.

- GO TO THE NEXT STEP.

**Step 4**

Use a Phillips screwdriver to tighten the three fasteners that secure the position sensor to the X-Y actuator.

- GO TO THE NEXT STEP.
Connect the transmission wiring harness to the rail select position sensor.
X-Y Actuator Fork Engage Position Sensor Removal

Step 1

The X-Y actuator fork engage position sensor is located on the driver's side of the transmission.

- GO TO THE NEXT STEP.

Step 2

Disconnect the transmission wiring harness from the fork engage position sensor.

- GO TO THE NEXT STEP.

Step 3

Use a Phillips screwdriver to remove the three fasteners that secure the position sensor to the X-Y actuator.

- GO TO THE NEXT STEP.

Step 4

Remove the clamp.

- GO TO THE NEXT STEP.
Remove the position sensor from the X-Y actuator.
X-Y Actuator Fork Engage Position Sensor Installation

Step 1
The X-Y actuator fork engage position sensor is located on the driver's side of the transmission.
• GO TO THE NEXT STEP.

Step 2
Install the position sensor into the X-Y actuator.
• GO TO THE NEXT STEP.

Step 3
Install the clamp.
• GO TO THE NEXT STEP.

Step 4
Use a Phillips screwdriver to tighten the three fasteners that secure the position sensor to the X-Y actuator.
• GO TO THE NEXT STEP.
Step 5

Connect the transmission wiring harness to the fork engage position sensor.
Main Countershaft Speed Sensor Removal

Use a one-inch wrench to disconnect the main countershaft speed sensor. Remove the sensor.

Main Countershaft Speed Sensor Installation

Install the O-ring onto the main countershaft speed sensor. 
- GO TO THE NEXT STEP.

Use a one-inch wrench to install the main countershaft speed sensor. Use a torque wrench to tighten the sensor to 15 lb-ft (20 N•m). Connect the sensor to the transmission wiring harness.
Output Shaft Speed Sensor Removal

**Step 1**

Use a one-inch wrench to disconnect the output shaft speed sensor. Remove the sensor.

Output Shaft Speed Sensor Installation

**Step 1**

Install the O-ring onto the speedometer pickup sensor.

- **GO TO THE NEXT STEP.**

**Step 2**

Use a one-inch wrench to install the main output shaft speed sensor. Use a torque wrench to tighten the sensor to 15 lb-ft (20 N•m). Connect the sensor to the transmission wiring harness.
Range Position Sensor Removal

Step 1

Unplug the range position sensor. Use a 1-1/16-inch wrench to remove the sensor.

Range Position Sensor Installation

Step 1

Install the O-ring on the range position sensor.

- GO TO THE NEXT STEP.

Step 2

Use a 1-1/16-inch wrench to install the range position sensor. Use a torque wrench to tighten the sensor to 15 lb-ft (20 N•m). Connect the sensor to the transmission wiring harness.
Range Cylinder Solenoid Removal

**Step 1**
Disconnect the two range solenoid connectors.
- GO TO THE NEXT STEP.

**Step 2**
Use a 5/32-inch Allen wrench to remove the two Allen-head bolts that secure either the high or low range cylinder solenoid, depending on which solenoid you are replacing.
- GO TO THE NEXT STEP.

**Step 3**
Remove either the high or low range cylinder solenoid from the range housing. (The low side of the range housing is illustrated.)
Lubricate the new range cylinder solenoid O-rings with Dow Corning® No. 111 Silicone Grease or equivalent. Install the O-rings onto the replacement range cylinder solenoid.

- GO TO THE NEXT STEP.

Use a 5/32-inch Allen wrench to install the range cylinder solenoid into the range housing. Install the two Allen-head bolts that secure the range cylinder solenoid. Tighten the bolts to 45-55 lb-in (5-6 N•m).

Engage the range cylinder solenoid connector.

- GO TO THE NEXT STEP.

Reconnect the two solenoid connectors.
Transmission Wiring Harness Removal

**Step 1**
Disconnect the ten-pin transmission wiring harness connector (sensor circuits).
- GO TO THE NEXT STEP.

**Step 2**
Disconnect the eight-pin transmission wiring harness connector (solenoid circuits).
- GO TO THE NEXT STEP.

**Step 3**
Disconnect the two-pin high and low solenoid connectors.
- GO TO THE NEXT STEP.

**Step 4**
Disconnect the four-pin range position sensor.
- GO TO THE NEXT STEP.
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Step 5
Disconnect the four-pin engage fork and rail select solenoids.
- GO TO THE NEXT STEP.

Step 6
Disconnect the four-pin engage fork position and rail select position sensors.
- GO TO THE NEXT STEP.

Step 7
Disconnect the two-pin main countershaft speed and output shaft speed sensors.
- GO TO THE NEXT STEP.

Step 8
Carefully remove the transmission wiring harness from the “J” clips.
Transmission Wiring Harness Installation

**Step 1**
Connect the ten-pin transmission wiring harness connector (sensor circuits).

**Step 2**
Connect the eight-pin transmission wiring harness connector (solenoid circuits).
- **GO TO THE NEXT STEP.**

**Step 3**
Connect the two-pin high and low solenoid connectors.
- **GO TO THE NEXT STEP.**

**Step 4**
Connect the four-pin range position sensor.
- **GO TO THE NEXT STEP.**
Connect the four-pin engage fork and rail select solenoids.
- **GO TO THE NEXT STEP.**

Connect the four-pin engage fork position and rail select position sensors.
- **GO TO THE NEXT STEP.**

Connect the two-pin main counter shaft speed and output shaft speed sensors.
- **GO TO THE NEXT STEP.**

Carefully install the transmission wiring harness into the “J” clips.
Range Cylinder Removal

**Step 1**
Use a 5/32-inch Allen wrench to remove the four Allen-head bolts that secure the two range cylinder solenoids.

- **GO TO THE NEXT STEP.**

**Step 2**
Remove the range cylinder solenoids.

- **GO TO THE NEXT STEP.**
Section 7
Removal and Installation

Step 3
Use a 9/16-inch wrench to remove the four 3/8-16 range cylinder cover bolts.
• GO TO THE NEXT STEP.

Step 4
Remove the range cylinder cover.
• GO TO THE NEXT STEP.

Step 5
Remove the large O-ring from the range cylinder cover.
• GO TO THE NEXT STEP.

Step 6
Use an 11/16-inch socket to remove the 11/16-inch range cylinder piston nut.
• GO TO THE NEXT STEP.
Step 7

Remove the piston from the housing.
- GO TO THE NEXT STEP.

Range Cylinder Installation

**WARNING**
Take care when using Loctite® to avoid serious personal injury. Follow the manufacturer’s instructions to prevent irritation to the eyes and skin. If Loctite gets into your eyes, flush them with water for 15 minutes. Have your eyes checked by a doctor as soon as possible.

Step 1

Lubricate the range cylinder piston O-ring with Dow Corning® #111 Silicone Grease or equivalent. Install the O-ring onto the range piston.
- GO TO THE NEXT STEP.

Step 2

Lubricate the bore of the range cylinder housing with Dow Corning® #111 Silicone Grease or equivalent. Install piston into the bore of the range housing.
- GO TO THE NEXT STEP.
Install the range shift shaft nut with an 11/16-inch socket. Use an 11/16-inch socket to tighten the nut to 35-50 lb-ft (47-68 N•m).

- GO TO THE NEXT STEP.

Lubricate the large and small O-rings with Dow Corning® #111 Silicone Grease or equivalent. Install the range cylinder cover O-ring and the small O-ring.

- GO TO THE NEXT STEP.

Install the range cylinder cover. Clean the capscrew threads. Apply Loctite® #242 (Meritor part No. 2297-B-6112) to threads of the capscrews. Use a torque wrench to tighten the four 3/8-16 capscrews to 35-45 lb-ft (47-61 N•m).

- GO TO THE NEXT STEP.

Lubricate the range cylinder solenoid O-rings with Dow Corning® #111 Silicone Grease or equivalent. Install the O-rings onto the range cylinder solenoids.

- GO TO THE NEXT STEP.
Lubricate the range cylinder solenoid O-rings with Dow Corning® #111 Silicone Grease or equivalent. Install the O-rings onto the range cylinder solenoids.

Install the range cylinder solenoids onto the range housing.

• **GO TO THE NEXT STEP.**

Use a 5/32-inch Allen wrench to install the four range cylinder solenoid bolts. Tighten the bolts to a torque of 50 lb-in (6 N·m).
Shift Module Bracket Removal

Step 1
The bracket supports the shift module and folds down to allow the driver to access the sleeper.
• GO TO THE NEXT STEP.

Step 2
Use a 6 mm Allen wrench to remove the two fasteners that secure the shift module to the bracket.
• GO TO THE NEXT STEP.

Step 3
Carefully tilt the shift module up exposing the two wiring harness connectors.
• GO TO THE NEXT STEP.

Step 4
Remove the six-pin connector from the shift module assembly.
• GO TO THE NEXT STEP.
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Step 5
Remove the 12-pin connector from the shift module assembly.

• GO TO THE NEXT STEP.

Step 6
Remove the shift module from the bracket.

• GO TO THE NEXT STEP.

Step 7
Remove the knob from the bracket.

• GO TO THE NEXT STEP.

Step 8
Gently remove the upper half of the shift module bracket such that the wire harness is pulled through the cover.

• GO TO THE NEXT STEP.
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Step 9
Remove the two fasteners that secure the lower half of the bracket to the seat. Consult the OEM maintenance manual for instructions to remove the seat cushion.
• GO TO THE NEXT STEP.

Step 10
Carefully remove the lower half of the bracket, pulling the wire harness through the cover.
• GO TO THE NEXT STEP.

Step 11
Disconnect the shift module bracket wiring harness from the OEM wiring harness.
Shift Module Bracket Installation

**Step 1**

The bracket supports the shift module and folds down to allow the driver to access the sleeper.

- **GO TO THE NEXT STEP.**

**Step 2**

Connect the shift module bracket wiring harness to the OEM harness.

- **GO TO THE NEXT STEP.**

**Step 3**

Insert the shift module bracket wiring harness through the lower section of the shift module bracket.

- **GO TO THE NEXT STEP.**

**Step 4**

Use a 6 mm Allen wrench to tighten the two fasteners that secure the lower section of the shift module bracket to the seat. Consult the OEM maintenance manual for instructions to remove the seat cushion.

- **GO TO THE NEXT STEP.**
Section 7
Removal and Installation

Step 5
Insert the shift module bracket wiring harness through the upper section of the bracket.
• GO TO THE NEXT STEP.

Step 6
Install the upper section of the shift module bracket onto the lower section. Hand-tighten the knob on the back of the bracket to secure the upper section of the shift module bracket to the lower section.
• GO TO THE NEXT STEP.

Step 7
Connect the 12-pin connector of the shift module bracket wiring harness to the shift module.
• GO TO THE NEXT STEP.

Step 8
Connect the 6-pin connector of the shift module bracket wiring harness to the shift module.
• GO TO THE NEXT STEP.
Carefully place the shift module onto the shift module bracket.

- **GO TO THE NEXT STEP.**

Use a 6 mm Allen wrench to secure the shift module to the bracket by tightening the two fasteners in the front of the shift module.
Wire Splicing Procedure

1. Remove 0.5-inch (12 mm) of insulation from each end of the wires that are to be connected. Figure 7.1.

2. Insert each end of the wire(s) into a self-sealing “butt splice” connector tube. Use the correct crimping tool to crimp each end of the tube. Figure 7.2.

3. Use a heat gun to heat the connector until the ends of the connector seal the wire. Carefully follow the manufacturer’s instructions when you use the heat gun. Figure 7.3.

4. Pull the connector to verify that it is crimped correctly.

5. Position wire splices at least one inch (25 mm) apart. Figure 7.4.

**CAUTION**
Splices that are not sealed correctly can damage components. Always use the correct crimping tool required for the application to ensure that the splice connector tube will completely seal the wires.

**WARNING**
If used incorrectly, a heat gun can cause serious personal injury and damage to components. Always carefully follow the manufacturer’s instructions when you use a heat gun.

**WARNING**
Wire splices that are placed too close together can “short circuit” and cause serious personal injury and damage to components. Always position wire splices at least one inch (25 mm) apart.