Shift By Wire (SBW & SBW II) Actuator

Re-Calibration Procedure

For Allison 1000 - 2000 Series Transmissions

AES-204

Horizontally Mounted Actuator

Vertically Mounted Actuator

<table>
<thead>
<tr>
<th>ECN</th>
<th>REV</th>
<th>REVISION RECORD</th>
<th>DATE</th>
<th>ENGINEER</th>
</tr>
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<tbody>
<tr>
<td>14553</td>
<td>B</td>
<td>Added Page 2</td>
<td>4/26/2013</td>
<td>John Maher</td>
</tr>
<tr>
<td>14355</td>
<td>A</td>
<td>Released</td>
<td>5/1/2012</td>
<td>Don Krueger</td>
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</table>
## Hardware used during this Re-Calibration Procedure.

<table>
<thead>
<tr>
<th>Fastener Name &amp; Number</th>
<th>Fastener Type</th>
<th>Torque</th>
<th>Tolerance</th>
<th>Required Tools</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Bolt SC508</td>
<td>M8 x 55mm Hex Bolt</td>
<td>Per Allison Specification</td>
<td>13mm Socket Wrench</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rear Cover Bolts</td>
<td>Allison Rear Cover Bolts</td>
<td>Per Allison Specification</td>
<td>15mm Socket Wrench</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top Mounting Bracket Bolt (Vertical Mount installation only)</td>
<td>M8 x 60mm Flange Head Hex Bolt</td>
<td>24 lbs-ft</td>
<td>± 4 lbs-ft</td>
<td>15mm Socket Wrench</td>
<td></td>
</tr>
<tr>
<td>Shift Shaft Adapter Screws (Qty 4)</td>
<td>#10-32 x ½” Torx Screws</td>
<td>20 lbs-in</td>
<td>± 4 lbs-in</td>
<td>T27 Torx Bit</td>
<td></td>
</tr>
<tr>
<td>Shift Shaft Adapter</td>
<td>To Remove stuck Shift Shaft Adapters</td>
<td>N/A</td>
<td>N/A</td>
<td>#10-32 x 1 3/4” to 2-1/2” Screws</td>
<td></td>
</tr>
<tr>
<td>Cap Nut Locking Screw SC511</td>
<td>1/4 - 28 x 2” Hex Head Screw</td>
<td>18 lbs-in</td>
<td>± 4 lbs-in</td>
<td>3/16” Hex Wrench (Allen Wrench)</td>
<td></td>
</tr>
<tr>
<td>Cap Nut Specialty Fastener</td>
<td>5 lbs-ft</td>
<td>± 1 lbs-ft</td>
<td>16mm Socket and Open End Wrench, or 5/8” wrenches will work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cover Screws (Qty 3)</td>
<td>#10-32 x Torx Button Head Screws</td>
<td>20 lbs-in</td>
<td>± 4 lbs-in</td>
<td>T25 Torx Bit</td>
<td></td>
</tr>
</tbody>
</table>

### Hardware

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Marking</th>
<th>Number</th>
<th>When Used?</th>
<th>Images</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver Round Spacer</td>
<td>With 1 Groove</td>
<td>MT1246</td>
<td>On NSBU Equipped Transmission</td>
<td></td>
</tr>
<tr>
<td>Blue Round Spacer</td>
<td>With 2 Grooves</td>
<td>MT1317</td>
<td>On IMS Equipped Transmission</td>
<td></td>
</tr>
<tr>
<td>Silver Hex Spacer</td>
<td>No Grooves</td>
<td>MT1269</td>
<td>On Vertical Mount with 3mm thick OEM Brackets</td>
<td></td>
</tr>
<tr>
<td>Red Hex Spacer</td>
<td>With 1 Groove</td>
<td>MT1291</td>
<td>On Vertical Mount without OEM Brackets</td>
<td></td>
</tr>
<tr>
<td>Alignment Tool</td>
<td>None</td>
<td></td>
<td>On all Installations</td>
<td></td>
</tr>
</tbody>
</table>
**Bench Testing the Actuator:**

**CAUTION:**

Do not connect the Actuator to a power supply unless it is **completely installed** on the transmission. If power is connected to an Actuator that is not completely installed on the transmission, the sensor will not function properly and the motor may be damaged.

*Failure to do so may result in injury or death.*

- The Actuator should not be removed from the vehicle and “bench tested”.
- If the Actuator is removed from the vehicle and power is applied the sensor will not function properly and the motor may be damaged.
- All tests relating to the Actuator require it to be completely installed on the vehicle, and all connections securely made to the Controller.
There are two important points to note before re-calibrating:

1) Does the Horizontal or Vertical orientation matter?

Horizontal Mounting

The Procedure is the same for the Horizontal and Vertical Mounted Actuators. When there is a variation or modification in the procedure, the steps are clearly identified as ‘Horizontal Mount’ or ‘Vertical Mount’.

Vertical Mounting

2) Some Allison Transmissions, known as Pre-Gen 4 Models, have an external Neutral-Start-Backup (NSBU) Assembly. Will this impact the Re-Calibration Procedure?

No, you will not need to adjust the NSBU Assembly found on the Pre-Gen 4 versions of the Allison Transmission.

NSBU Connector shown with Horizontal Mounting.

NSBU Connector shown with Vertical Mounting.
Re-Calibration Procedure
This is the SBW Re-Calibration Procedure for actuators that are already installed onto vehicles. Note: If this is a “first time” installation or a replacement of a new actuator, please refer to Arens Controls AES-203 Installation Procedure.

**WARNING**

If the transmission is installed in a chassis, do the following:

a) Park the vehicle on level ground.
b) Set the emergency brake.
c) Chock/block the tires to prevent the vehicle from moving unexpectedly.
d) Turn off the engine.

Failure to follow these steps could result in serious injury or death.

1. Remove these three screws holding the cover plate on the actuator, shown in Figure #1. Set aside the cover, screws, and O-Ring.

2. Loosen the socket head cap screw, located in the center of the cap nut, one or two turns but do not remove it.
3. Loosen and remove the cap nut, as shown in Figure #3, and set aside.

4. Remove these four socket head cap screws that hold the Shift Shaft Adapter in place, as shown in Figure #4.

If the Shift Shaft Adapter is stuck on the Transmission Selector Shaft, use two long #10-32 screws (not supplied) to help with removal. Insert the two long #10-32 screws into these holes on the Shift Shaft Adapter (see Illustration #1). The screws will act as a “puller”, and help remove the Shift Shaft Adapter from the Transmission Selector Shaft. Remove these two screws after the Shift Shaft Adapter has been removed.
WARNING

Before moving on to the next part of the Re-Calibration Procedure, be sure that you have:

a) Parked the vehicle on level ground.

b) Set the emergency brake.

c) Chocked/block the tires to prevent the vehicle from moving unexpectedly.

d) Turned off the engine.

Failure to follow these steps could result in serious injury or death.

5. Move up into the cab of the vehicle and turn the ignition ON, but do not engage the starter, leaving the engine OFF. Select NEUTRAL, then REVERSE, then NEUTRAL again. This will ensure that the Actuator is in the Neutral position.

6. Check that the Transmission is in NEUTRAL by "bumping" the starter with the ignition switch. If the transmission is in NEUTRAL the starter will engage. If the Transmission is not in NEUTRAL the starter will not engage.

7. If the transmission is not in NEUTRAL, perform the following steps:

   A. IMPORTANT – The following steps are to confirm that the transmission is truly in NEUTRAL. Performing these steps incorrectly will result in calibrating the transmission in a position other than NEUTRAL.

   B. Make sure that the four Socket Head Cap Screws that hold the Shift Shaft Adapter in place have been removed as described in step 6. Again, place the two long (1-3/4” to 2-1/2”) #10-32 screws (not supplied) in the two threaded holes (not the slot) of the Shift Shaft Adapter. And place the shift shaft Adapter back into the actuator engaging the Transmission’s Selector Shaft.

   C. Using a long substantial screwdriver wedged between the 2 long screws, rotate the shift shaft adapter clockwise. Do not force the selector shaft when it reaches the end of its travel. This could damage the transmission. The transmission is now in *PARK detent position

   D. Next, slowly and carefully rotate the selector shaft back counterclockwise two detents. The transmission is now in NEUTRAL. Once NEUTRAL has been obtained on the transmission, Remove the two #10-32 screws for the Shift Shaft Adapter and remove the Shift Shaft Adapter from the Actuator.

   *NOTE – All Allison 1000 and 2000 series transmission have a PARK detent position regardless if they have a PARK pawl or not.

   IMPORTANT - When moving the selector shaft in the counterclockwise direction from PARK, the tendency is to move it too fast. This may result in moving past the NEUTRAL (the 2 detents) position. The transmission MUST be in NEUTRAL for proper calibration

8. Double check that the transmission is in NEUTRAL by repeating step #6.

9. Turn the Ignition OFF. The Push Button Shift Selector will react in different ways, depending on which Push Button Shift Selector is installed. Check the next page for more details.
The engine should turn off when the ignition is turned off, though the Push Button Shift Selector will remain on. The Push Button Shift Selector will stay ON supplying power to the Actuator, holding it in NEUTRAL. This is the desired condition with this Push Button Shift Selector.

The Re-Calibration Procedure continues on the next page.

Both the engine and the Push Button Shift Selector should turn off when the key is turned off. This is the desired condition for this shift selector.

The Re-Calibration Procedure continues on the next page.
Horizontal Mount – Loosen Mounting Bolts

10. Loosen the 3 bolts that hold the actuator to the transmission 1 to 3 turns. These bolts include the 2 rear cover bolts and the single front bolt.
11. Wiggle the actuator to make sure that it is loose.
12. Press the SBW Actuator Alignment Tool into the Actuator until it is flush with the actuator face.

Vertical Mount – Loosen Mounting Bolts

10. Loosen the 4 bolts that hold the actuator to the transmission 1 to 3 turns. These bolts include the 2 rear-cover bolts and the 2 front bolts.
11. Wiggle the actuator to make sure that it is loose.
12. Press the SBW Actuator Alignment Tool into the Actuator until it is flush with the actuator face.

13. Next, while holding Actuator, re-tighten bolt #1 first (shown in Figure #5a above), then tighten the two rear bolts. It is important that the front bolt #1 be tightened first.
14. The actuator should now be in the correct position over the transmission selector shaft.
These steps apply to both Horizontal and Vertical Mount Systems

15. Remove the SBW Actuator Alignment Tool and set aside. When removing the Alignment Tool make sure that the Actuator does not move. Lube the O-Ring on the outer face of the Actuator

16. Place a long #10-32 screw into one of the slotted holes in the lost motion wheel, shown in Figure #7a. Grasp the head of the socket head cap screw with a pair of pliers and pull the lost motion wheel outward; it should move outward above 1/8” to 3/16”. This places the actuator into the “calibration” position. See Figures #7b and #7c for correct positing.

Figure #7a

Calibration Position, pulled outward  
Figure #7b

Operating Position, pushed inward  
Figure #7c
17. Lube the O-ring on the Shift Shaft Adapter. Align the witness marks on the Shift Shaft Adapter with the witness marks on the actuator housing. **Use the single groove witness mark** on the Shift Shaft Adapter as shown in Figure #8a. Place the shift shaft adapter into the center of the actuator, shown in Figure #8b. Be sure that the Shift Shaft Adapter properly engages the end of Selector Shaft of the transmission.

**Horizontal Mount, Shift Shaft Adapter with or without the NSBU Assembly**

**Vertical Mount, Shift Shaft Adapter with or without the NSBU Assembly**

17. Lube the O-Ring on the Shift Shaft Adapter. Align the witness marks on the Shift Shaft Adapter with the witness marks on the actuator housing. **Use the double witness mark** on the Shift Shaft Adapter as shown in Figure #8c. Place the shift shaft adapter into the center of the actuator, shown in Figure #8d. Be sure that the Shift Shaft Adapter properly engages the end of Selector Shaft of the transmission.
These steps apply to both Horizontal and Vertical Mount Systems

18. Insert the (Qty 4) #10-32 x ½” long Socket Head Cap Screws into the Shift Shaft Adapter.

19. Place your thumb over the center of the Shift Shaft Adapter. Press the Shift Shaft Adapter inward while tightening all 4 screws that secure the shift shaft adapter to 20 lbs.-in, as shown in Figure #9.

20. **IMPORTANT** – First, lube the O-Ring on the Cap Nut. Place the Cap Nut through the Shift Shaft Adapter and thread on to the end of the Transmission Selector Shaft. Tighten to 18 lbs.-in, **and then loosen the Cap Nut 1/2 to 1 full turn.** Holding the cap nut with a wrench, tighten the socket head cap screw that goes through the center of the cap nut to 5 lbs.-ft, shown in Figure #11. The Actuator will not work if you do not loosen the Cap Nut as described above.

21. Install the O-Ring, shown in Figure #11, then attach the Cover Plate with the 3 Cover Plate Screws, shown in Figure #12. Tighten the 3 screws to 20 lbs.-in.
System Checks:

**CAUTION:**

When performing the following system checks, make sure that the vehicle’s emergency brake is set, the wheels are chocked, and foot pressure is maintained on the service brake pedal. *Failure to do so may result in injury or death.*

i. The recalibration of the SBW system was done with the transmission in NEUTRAL; as such, the transmission should still be in NEUTRAL. To confirm this, power-up the system with the ignition switch without starting the engine. The “Monitor” side (right hand side) of the display should indicate “N” for NEUTRAL. If it does not, select NEUTRAL by depressing the “N” button on the PBSS (Push Button Shift Selector). The display should now show “NN” for NEUTRAL. Attempt to start the engine. If the recalibration was done correctly the engine should start. Turn OFF the engine and proceed to the next system check.

ii. If chassis/vehicle is equipped with PARK, power-up the system with the ignition switch without starting the engine. Select “P” for PARK. The “Monitor” side (right hand side) of the display should indicate “P” for PARK. Attempt to start the engine. If the recalibration was done correctly the engine should start. Turn OFF the engine and proceed to the next system check.

iii. Power-up the system with the ignition switch without starting the engine. Select DRIVE, the SBW (Shift By Wire) system will place the transmission in the DRIVE position. The display should indicate “DN” for CAN equipped vehicles or “DD” for non-CAN equipped vehicles for DRIVE position.

   i. **NOTE:** With the ignition ON, and the engine not running, the CAN message from the Allison TCM (Transmission Control Module) to the Arens Controls PBSS (Push Button Shift Selector) will result in an “N” indication on the “Monitor” side of the display for any gear (e.g.: DRIVE, REVERSE, etc.). This is normal. Once the engine is running the Display for DRIVE will indicate “D1” through “D5”, depending on the vehicles speed, or “DD” if CAN is not utilized; for REVERSE the display will indicate “RR”.

   b. Attempt to start the engine. If the recalibration was done correctly the engine should not start.

If any of these system checks fail to function as described above, see Arens Controls Trouble Shooting Guide AES-125.

This completes the Installation of the Arens Controls SBW Actuator.

For help with Troubleshooting, be sure to download the AES-125-C, the SBW II Troubleshooting Guide.