

Shortcuts to GM Solenoid Electrical Diagnosis, Part 2



by Steve Garrett

In the last issue of *GEARS*, we looked at the theory behind GM's transmission solenoid control systems. This time, we'll examine the individual systems and see how to diagnose them.

4T60E Solenoid Diagnosis

Unlike most other GM applications, the 4T60E may require a little different approach when it comes to diagnosing solenoid failures. Several different PCM platforms were used through the years with different diagnostic strategies, including:

1. No solenoid DTCs, but feedback line diagnostics are available.
2. Solenoid DTCs and feedback line diagnostics available.
3. QDM feedback, matching commanded/feedback lines as described in the last issue of *GEARS*.
4. ODM feedback - Commanded ON/OFF - Feedback OK/fault as described in the last issue of *GEARS*.
5. ODM feedback - Individual feedback display for all failures as described in the last issue of *GEARS*.

Feedback Line Diagnosis 4T60E (Early Models)

Early model 4T60Es used a slightly different approach to feedback diagnosis than later model 4T60E and other applications. Most early model 4T60E PCM applications used two QDMs:

Unlike some other applications, each QDM feedback circuit is used to indicate the condition of multiple components. This means that a failure of any of the components or their circuits can cause the feedback circuit to indicate a fault.

QDM 1 (A) and QDM 2 (B). Others use up to 8 different QDMs, depending on application.

QDM 1 (A) controlled:

- Canister Purge Solenoid
- Temperature Light
- Low Fan Relay
- Cooling Fan #2
- The TCC Solenoid
- SES Light
- EVAP Solenoid
- Low Oil Light

QDM 2 (B) controlled:

- Shift Solenoid A
- Shift Solenoid B
- The TCC PWM Solenoid
- EGR

QDM 3 (C) controlled:

- Cooling Fan
- A/C Clutch
- Shift Solenoid A
- Shift Solenoid B
- The TCC PWM Solenoid

QDM 4 (D)

- Shift Solenoid A
- Shift Solenoid B
- The TCC PWM solenoid

As you may have noticed, different applications use different QDM assignments. Always refer to the service information to determine which components are assigned to which QDMs for your specific application.

Unlike some other applications, each QDM feedback circuit is used to indicate the condition of multiple components. This means that a failure of any of the components or their circuits can cause the feedback circuit to indicate a fault. In addition, on some applications if a fault occurs in a one of the components or its circuits, not only will that component fail to function properly, but the other components on that circuit may not function either.

You'll need a scan tool to diagnose this type of system on all applications except 1991-95 Cadillacs. On early models the scan tool will display the QDMs as data parameters. The values listed under each QDM display will either be HI or LOW. LOW indicates the circuits are functioning normally; HI indicates a problem.

NOTE: If you apply the brakes, one of the QDMs will display HI; if the A/C compressor is on, the QDM will cycle HI/LOW on some applications.

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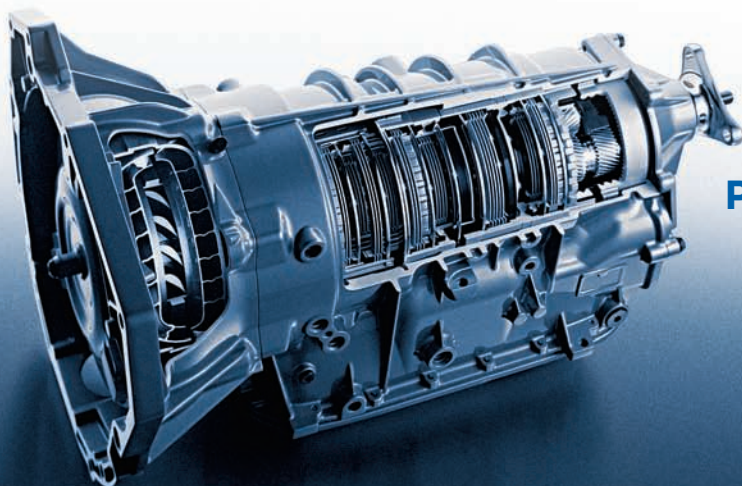


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Feedback Line Diagnosis 4T80E (Northstar Applications)

Northstars are equipped with 8 fault lines: ABCDEFGH. As with other applications, the feedback circuit indicates the condition of the circuits the QDMs are controlling. If you're using onboard diagnostics, access PCM parameter PD16 for QDM ABCD or PD17 for QDM EFGH. QDM A is used for the TCC solenoid and engine temperature lamp; QDM E operates the shift solenoids. The feedback line will be displayed as either a zero or a 1. Zero indicates the circuit is okay; 1 indicates an electrical fault.

QDM A: If the feedback line indicates a 1 when the TCC or temperature lamp is commanded off, look for an open or short to ground. This means the problem would be in the circuit, the solenoid, or the temperature lamp. If the feedback line indicates a 1 when the TCC or temperature lamp is commanded on, look for a short to voltage in the ground side of the circuit, a shorted solenoid, or a shorted temperature lamp.

NOTE: Early model Northstar applications will indicate 1 on the A, B and D feedback lines. The feedback circuit can't be used for diagnostic purposes for these circuits.

QDM B: Shift solenoid A and B feedback line status is represented by QDM E. A 1 indicates an electrical fault in shift solenoid A or B or their circuits. Check the gear range when the 1 displays to determine which solenoid or circuit is at fault and the type of fault. Here's how to identify the problem when the fault displays a 1:

- 1st and 4th gear command — Solenoid A shorted or solenoid A circuit shorted to voltage on the ground side.
- 3rd and 4th gear command — Solenoid B shorted or solenoid B circuit shorted to voltage on the ground side.
- 2nd and 3rd gear command — Solenoid A open or solenoid A circuit open or shorted to ground.
- 1st and 2nd gear command — Solenoid B open or solenoid B circuit open or shorted to ground.

Late 4T80E Applications

96-on Cadillac and all Aurora applications equipped with the 4T80E require a scan tool for solenoid diagnosis. Unlike earlier applications, ODMs aren't represented as 1's or 0's to indicate the solenoid and its circuit's condition. Instead, the solenoids and circuits are represented by these scan tool parameters:

- Shift Solenoid 1 Driver — This parameter represents ODM 2 output 5 (1-2 solenoid).
- Shift Solenoid 2 Driver — This parameter represents ODM 2 output 6 (2-3 solenoid).
- TCC Solenoid Driver — This parameter represents ODM 2 output 7 (TCC PWM solenoid).

The display will indicate one of 3 states: OK, Open/Short or Over Current:

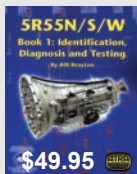
- If the parameter indicates Open/Short, look for an open or short-to-ground in the solenoid or its circuit.
- If the parameter indicates Over Current, look for a short to B+ on



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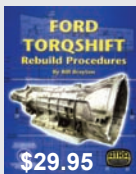
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the ground side of the solenoid or a shorted solenoid.

A defective PCM can also indicate a fault is present even though the solenoid and circuit are okay.

Diagnosis (4L60E/4T60E) (No Scan Feedback Readings Available)

To further aid you in solenoid diagnosis, each solenoid is given a specific code number. 1-2 solenoid faults will set code 82 (P0753); 2-3 solenoid faults will set a code 81 (P0758).

To diagnose solenoid/circuit electrical failures:

1. Key on
2. Record codes stored
3. Start engine
4. Erase codes
5. Set your scan tool for snapshot on any code.
6. Operate the vehicle through all gears manually, pausing at each shift.
7. Check for code 81 (P0753) or 82 (P0758). See which gear was com-

manded when the feedback signal first failed to match the solenoid command, or which gear was commanded when the code first set.

8. The gear commanded at that point, or which gear was commanded when the code first sets (step 7) indicates the failure.

1-2 solenoid will set code 82 (P0753) if:

- Solenoid A is commanded on and feedback voltage remains high for at least 2 seconds.
- Solenoid A commanded off and feedback voltage remains low for at least 2 seconds.

If code 82 (P0753) sets in P-R-N, 1st or 4th gears, it indicates:

1. Shorted solenoid
2. Short to B+ in ground side of solenoid circuit
3. Faulty computer

If a current code 82 (P0753) sets in 2nd or 3rd gears, it indicates:

1. Open-solenoid/circuit
2. Short to ground

3. Faulty computer

2-3 solenoid code 81 (P0758) will set if:

- Solenoid commanded on and feedback voltage remains high for at least 2 seconds.
- Solenoid B is commanded off and feedback voltage remains low for at least 2 seconds.

If code 81 (P0758) sets in P-R-N, 1st or 2nd, it indicates:

1. Shorted solenoid
2. Short to B+ in ground side of solenoid circuit
3. Faulty computer

If code 81 (P0758) sets in 3rd or 4th, it indicates:

1. Open solenoid/circuit
2. Short to ground
3. Faulty computer

4L80E Diagnosis (No Scan Data Available)

1. Key on
2. Record codes
3. Start engine

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4. Erase codes
5. Set the scan tool for snapshot on any code.
6. Operate vehicle through all gears manually, pausing at each shift.
7. Check for code 81 (P0753) or 82 (P0758). See which gear was commanded when the feedback signal failed to match the solenoid command, or which gear was commanded when the code first set.
8. The gear commanded at that point, or which gear was commanded when the code first sets (step 7) indicates the failure condition.

If code 82 (P0753) sets in P-R-N, 1st or 4th gears, it indicates:

- A short to B+ in the ground side of the solenoid circuit (in the wiring between the computer and the solenoid).
- A shorted solenoid (low resistance/high current flow).
- A faulty computer.

If code 82 (P0753) sets in 2nd or 3rd gears, it indicates:

- An open in the ground side of the solenoid circuit (in the wiring between the computer and the solenoid).
- An open in the solenoid or internal transmission wiring (high resistance).
- A short-to-ground in the ground side of the solenoid circuit (in the wiring between the computer and the solenoid).
- A faulty computer.

If code 81 (P0758) sets in 3rd or 4th gears, it indicates:

- A short to B+ in the ground side of the solenoid circuit (in the wiring between the computer and the solenoid).
- A shorted solenoid (low resistance/high current flow).
- A faulty computer.

If code 81 (P0758) sets in P-R-N, 1st or 2nd gears, it indicates:

- An open in the ground side of the solenoid circuit (in the wiring between the computer and the solenoid).
- An open in the solenoid or internal transmission wiring (high resis-

tance).

- A short-to-ground in the ground side of the solenoid circuit (in the wiring between the computer and the solenoid).
- A faulty computer.

4L60E/4L65E/4T65E Code 81 (P0758) Diagnosis (2-3 Shift Solenoid Electrical Fault)

If code 81 (P0758) sets in P-R-N, 1st or 2nd gears, it indicates:

- A short to B+ in the ground side of the solenoid circuit (in the wiring between the computer and the solenoid).
- A shorted solenoid (low resistance/high current).
- A faulty computer.

NOTE: Shift solenoids should measure at least 20Ω when measured at the passthrough connector terminals at 20°C (68°F).

If code 81 (P0758) sets in 3rd or 4th gears, it indicates:

- An open in the ground side of the solenoid circuit (in the wiring between the computer and the solenoid).
- An open in the solenoid or internal transmission wiring (high resistance).
- A short-to-ground in the ground side of the solenoid circuit (in the wiring between the computer and the solenoid).
- A faulty computer.

NOTE: Shift solenoids should measure at least 20Ω when measured at the passthrough connector terminals at 20°C (68°F). Shift solenoid current flow shouldn't exceed 0.75 amps. The shift solenoid should energize at 7.5 volts or more (measured across the terminals). The shift solenoid should de-energize when voltage is one volt or less.

NOTE: QDM/ODM circuits are overcurrent protected, so a shorted sole-

noid or circuit shouldn't damage the computer.

4T60E CODE 26/27/29 or 56 (QDM Circuit Fault)

Several DTCs have been used with the 4T60E. Depending on the vehicle software, you may not get a DTC to indicate a solenoid or circuit fault; others will use the same DTC for any solenoid failure. Some applications will set a specific DTC for each solenoid.

If the vehicle uses DTCs P1650, 26 or 29 to indicate a fault in either solenoid A or B, and on some applications, the TCC PWM solenoids or their circuits, code P1650, 26 or 29 will set if:

1. The solenoid is commanded on, and...
2. The voltage remains high for longer than 2 seconds.

These conditions indicate a shorted solenoid or a short to battery voltage in the ground side of the solenoid circuit.

- A solenoid A fault is indicated if the DTC P1650, 26 or 29 sets while in 1st and 4th gears.
- A solenoid B fault is indicated if the DTC P1650, 26 or 29 sets while in 1st and 2nd gears.
- A TCC PWM solenoid fault is indicated if the DTC P1650, 26 or 29 sets while the TCC PWM solenoid is commanded on (high duty cycle).
- An EGR solenoid fault is indicated if the DTC P1650, 26 or 29 sets while one of the EGR valves is commanded on.

Code P1650, 26 or 29 will set if:

1. The solenoid is commanded off, and...
2. The voltage remains low for longer than 2 seconds.

These conditions indicate a short-to-ground or an open circuit.

- A solenoid A fault is indicated if the DTC 26 or 29 sets while in 2nd and 3rd gears.
- A solenoid B fault is indicated if the DTC 26 or 29 sets while in 3rd and 4th gears.
- A TCC PWM solenoid fault is indicated if the DTC P1650, 26 or 29 sets while the TCC PWM solenoid is commanded off (0% duty

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cycle).

- An EGR solenoid fault is indicated if the DTC P1650, 26 or 29 sets while one of the EGR valves is commanded off.

If the vehicle uses DTC 26 to indicate a fault in only solenoid A, code 26 will set if:

- The solenoid is commanded on, and...
- The voltage remains high for longer than 2 seconds.

A solenoid A fault is indicated if the DTC 26 sets while in 1st and 4th gears. This indicates a shorted solenoid or a short to battery voltage in the ground side of the solenoid circuit.

Code 26 will set if:

- If the solenoid is commanded off, and...
- The voltage remains low for longer than 2 seconds.

A solenoid A fault is indicated if the DTC 26 sets while in 2nd and 3rd gears.

If your vehicle uses DTC 27 to indicate a fault in the TCC and the EVAP solenoids/circuits, code 27 will set if:

- The solenoid is commanded on, and...
- The voltage remains high for longer than 2 seconds.

A TCC solenoid/circuit fault is indicated if the DTC 27 sets while the TCC is commanded on. If the DTC only sets when the EVAP solenoid is commanded on, the problem is in the EVAP solenoid or its circuit. This indicates a shorted solenoid or a short to battery voltage in the ground side of the solenoid circuit.

Code 26 will set if:

- The solenoid is commanded off, and...
- The voltage remains low for longer than 2 seconds.

A solenoid A fault is indicated if the DTC 26 sets while in 2nd and 3rd gears.

If your vehicle uses DTC 56 to

indicate a fault in either solenoid A or solenoid B, and the TCC PWM solenoids or their circuits on some applications, code 56 is also used on some applications to indicate a problem with the digital EGR valve or its circuits. Code 56 will set if:

- The solenoid is commanded on, and...
- The voltage remains high for longer than 2 seconds.

This indicates a shorted solenoid or a short to battery voltage in the ground side of the solenoid circuit.

- A solenoid A fault is indicated if the DTC 56 sets while in 1st and 4th gears.
- A solenoid B fault is indicated if the DTC 56 sets while in 1st and 2nd gears.
- A TCC PWM solenoid fault is indicated if the DTC 56 sets while the TCC PWM solenoid is being commanded on (high duty cycle).
- An EGR solenoid fault is indicated if the DTC 56 sets while one of the EGR solenoids is being

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commanded on.

Code 56 will set if:

- The solenoid is commanded off, and...
- The voltage remains low for longer than 2 seconds.

This indicates a short-to-ground or an open circuit.

- A solenoid A fault is indicated if the DTC 26 or 29 sets while in 2nd and 3rd gears.
- A solenoid B fault is indicated if the DTC 26 or 29 sets while in 3rd and 4th gears.
- A TCC PWM solenoid fault is indicated if the DTC 56 sets while the TCC PWM solenoid is being commanded off (0 duty cycle).
- An EGR solenoid fault is indicated if the DTC 56 sets while one of the EGR solenoids is being commanded off.

Code P1640 will set if:

- The solenoid is commanded on, and...

- The voltage remains high for longer than 2 seconds.

This indicates a shorted solenoid or a short to battery voltage on the ground side of the solenoid circuit.

- A TCC solenoid fault is present if the DTC sets when the TCC apply solenoid is commanded on.
- An EVAP solenoid fault is present if the DTC sets when the EVAP solenoid is commanded on.
- A cooling fan relay fault is present if the DTC sets when the cooling fan is commanded on.
- A low oil indicator fault is present if the DTC sets when the low oil lamp is commanded on.

Code P1640 will set if:

- If the solenoid is commanded off, and...
- The voltage remains low for longer than 2 seconds.

This indicates a shorted solenoid or a short to battery voltage in the ground side of the solenoid circuit.

- A TCC solenoid fault is present if the DTC sets when the TCC apply solenoid is commanded off.
- An EVAP solenoid fault is present if the DTC sets when the EVAP solenoid is commanded off.
- A cooling fan relay fault is present if the DTC sets when the cooling fan is commanded off.
- A low oil indicator fault is present if the DTC sets when the low oil lamp is commanded off.

On most applications, once you get the hang of what you should or shouldn't see on your scan tool, you can diagnose a solenoid electrical problem in less than a minute by simply clearing the DTC and operating the transmission through the gears, while monitoring the command and feedback status with your scan tool. And as we all know, time means money in this business!



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