

Shortcuts to GM Solenoid Electrical Diagnosis, Part 1



by Steve Garrett



GM applications have long used sophisticated diagnostic strategies for the solenoids and relays. Several different strategies are used based on the year and type of computer.

Many solenoid and relay problems will set a specific DTC. You can quickly pinpoint the cause of the DTC with a quality scan tool and some basic understanding of the circuits and systems involved.

Solenoid failures can be caused by either hydraulic/mechanical problems or electrical problems. Many technicians have difficulty diagnosing these solenoids electrically, so we're going to look at a few ways to shortcut your diagnostic time and increase your effectiveness when diagnosing these systems.

Most shift solenoids have fault codes available for electrical faults. These faults include:

- Open circuit or solenoid
- Short to ground
- Short to B+
- Shorted solenoid

Shift solenoids are controlled in a specific sequence to provide four forward speeds. Each solenoid is turned on (grounded — computer pin volt-

age low), or turned off (ungrounded — computer pin voltage high) by the computer.

Each solenoid has its own ground and feedback (sense line) circuit in the computer driver circuit. This circuit acts like a built-in digital voltmeter for the computer.

As the solenoid is commanded on, the computer expects to see the feedback (sense line) voltage pulled low (close to zero volts). If the voltage remains high, the computer sets a trouble code. If the code sets while the solenoid is on, it indicates either a shorted solenoid or a short to B+ on the ground side of the circuit (between the solenoid and computer).

When the solenoid is turned off (de-energized), the computer expects to see the solenoid pin voltage rise to system voltage at the feedback circuit (sense line). If the voltage remains low,

the computer will set the same code, but it indicates a different failure. If the code sets when the solenoid is commanded off, look for an open circuit or solenoid, or a short to ground (Figure 1).

NOTE: A short to ground on the feed side (B+) of the solenoid circuit will blow the fuse feeding that circuit. This will usually set multiple solenoid codes because it'll affect all of the solenoids powered by that fuse.

Solenoid code diagnosis will take on one of the following diagnostic strategies and displays:

- QDM feedback — matching commanded/feedback lines.
- Sense line code settings — No scan tool feedback line support.
- ODM feedback — Commanded On/Off — Feedback OK/Fault

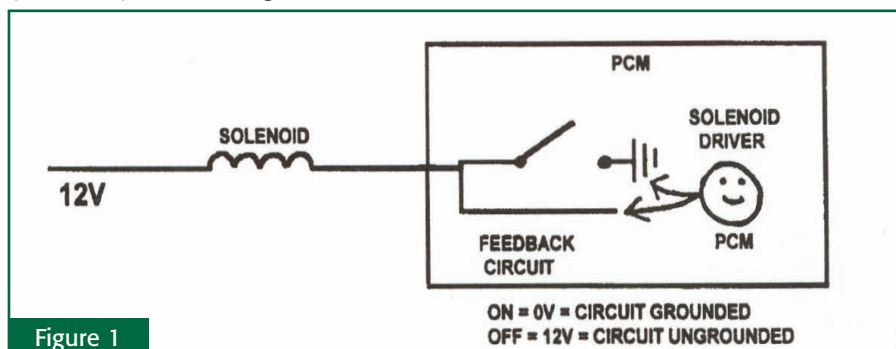


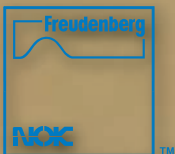
Figure 1

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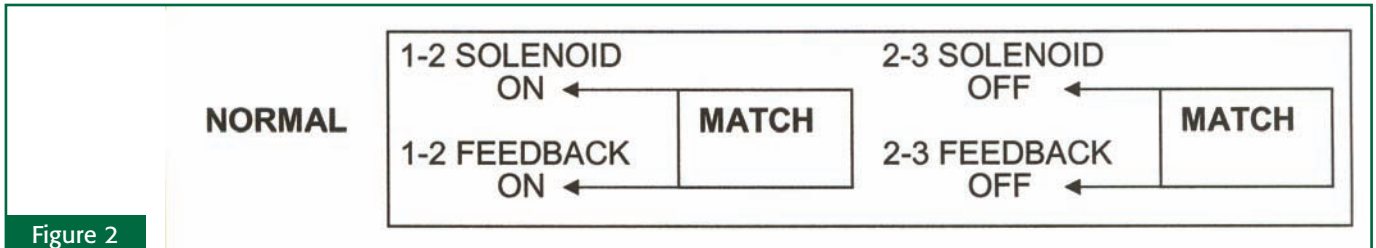


Figure 2

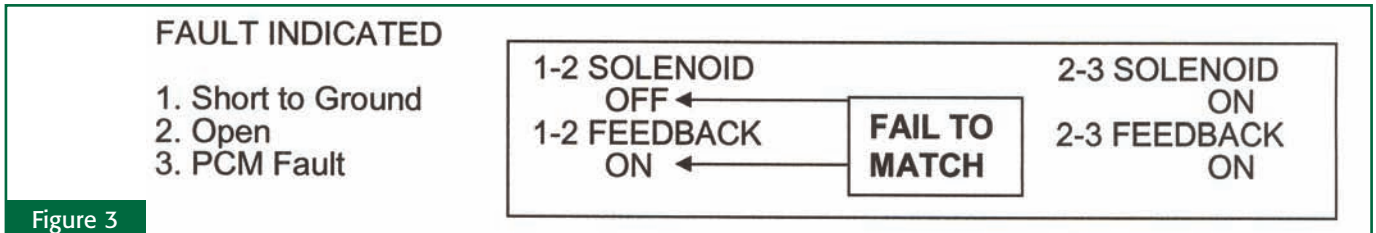


Figure 3

- ODM feedback — Individual display of feedback for all failures.

Feedback Control Operation (QDM Equipped Computers)

Feedback status indicates the actual PCM solenoid driver circuit voltages when solenoid is turned on or off. An ON feedback value indicates the PCM driver circuit voltage is low. An OFF feedback value indicates the PCM driver circuit voltage is high.

Normal Feedback; QDM Applications — To be considered normal, feedback status (On/Off) must match the solenoid command. When the command is on, feedback status should indicate ON. When command is off, feedback status should indicate

OFF (Figure 2).

Faults Indicated — Faults are indicated when feedback status doesn't match solenoid command status. For example:

1. Feedback always indicates ON: The feedback voltage remains low, even when the computer is commanding the solenoids off. This condition indicates one of three possible failures (Figure 3):

- a) Short to Ground
- b) Open Circuit
- c) PCM Fault

2. Feedback always indicates OFF: The feedback voltage remains high, even when the computer is commanding the solenoids on. This condition indicates one of three possible failures (Figure 4):

- a) Short to B+ between the PCM and the solenoid

- b) Shorted Solenoid
- c) PCM Fault

NOTE: Some applications use driver circuits called ODMs rather than QDMs. The term ODM stands for Output Driver Module. ODMs operate the same as QDMs, except their feedback circuits display OK or Fault rather than On or Off.

Feedback Diagnosis (ODM Equipped Computers)

Solenoid diagnosis on computers equipped with Output Driver Modules (ODM) represents the simplest diagnostic routine for finding solenoid faults. Two types of feedback readings may appear on your scan tool, depending on the vehicle software. To make it easier to understand we will refer to them as Type 1 or Type 2 ODM feedback diagnostics.

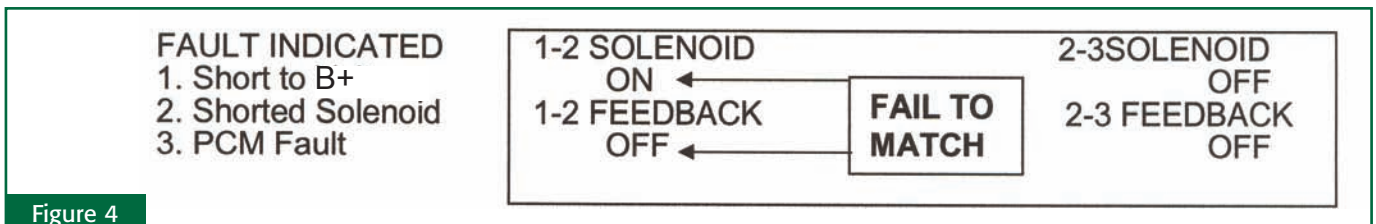


Figure 4

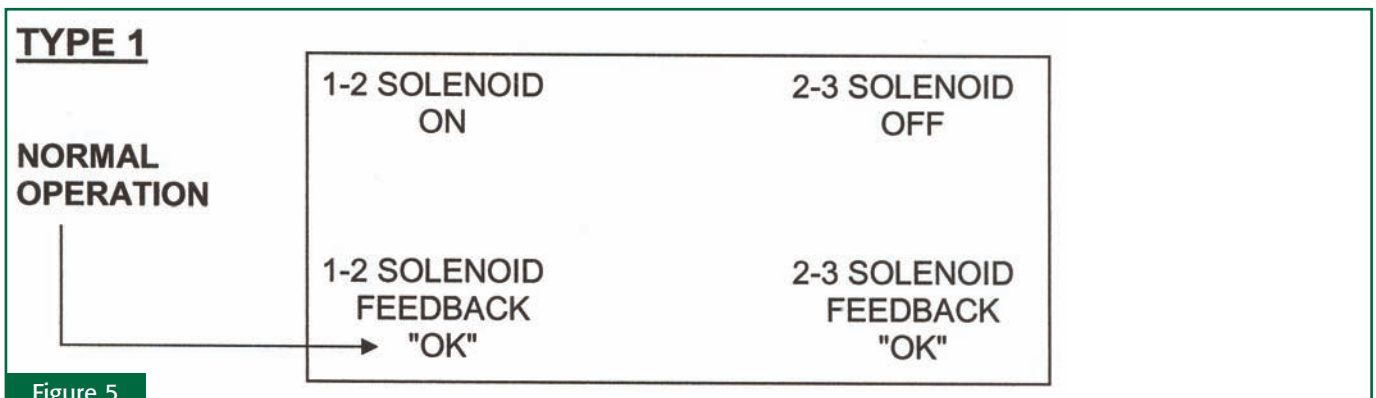
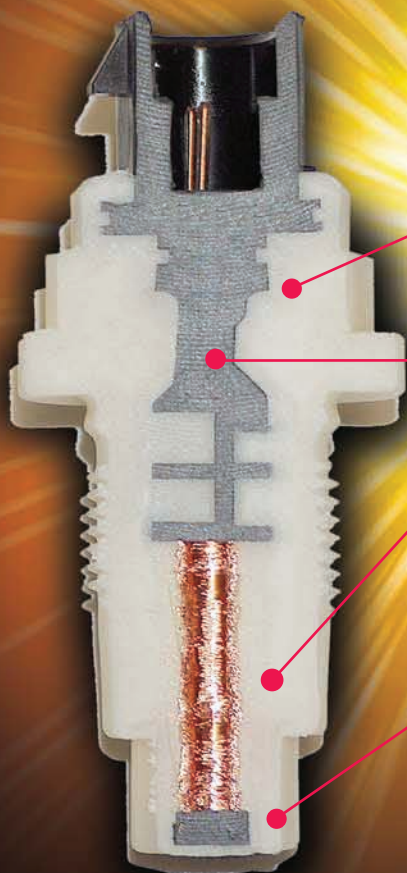


Figure 5

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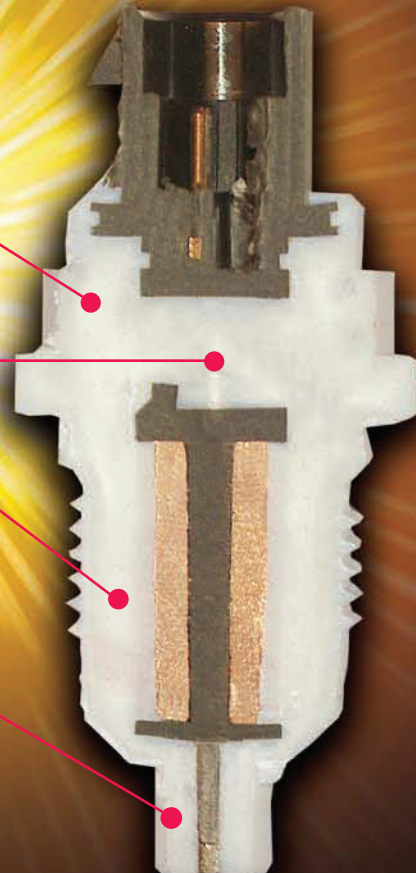
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Type 1 is similar to the diagnostic displays used on QDM equipped vehicles. To be considered normal feedback, the word OK must appear whenever the solenoid is ON or OFF (Figure 5). If the word FAULT appears at any time, a failure is present.

In the example, the computer has commanded the 1-2 solenoid ON and the feedback indicated a fault was present (Figure 6).

The failure present is one of the following:

- A shorted solenoid
- A short to voltage in solenoid circuit between the solenoid and the computer
- A faulty computer

In the example (Figure 7), the computer is commanding the 1-2 solenoid OFF, and the feedback indicates a fault. This indicates one of the following failures:

- An open solenoid
- A short to ground
- An open in the solenoid circuit between the solenoid and the computer
- A faulty computer

In this example (figure 8), the 1-2 solenoid circuit is indicating a fault. This indicates one of these problems:

- A shorted solenoid
- A short to voltage in the solenoid circuit between the solenoid and the computer
- A faulty computer

Here's another example where the 1-2 solenoid circuit is indicating a fault (Figure 9). This time, the problem has to be:

- An open solenoid
- A short to ground
- An open in the solenoid circuit between the solenoid and the computer
- A faulty computer

In the next issue of *GEARS*, we'll look at specific transmissions and vehicle systems, and see how these diagnostic procedures can make it easy to shortcut your diagnosis.

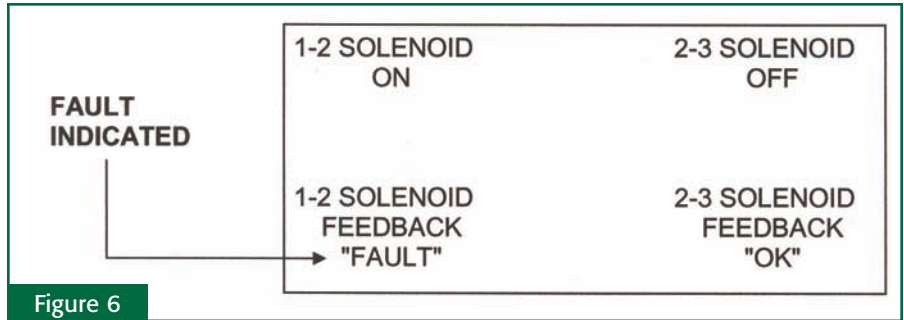


Figure 6

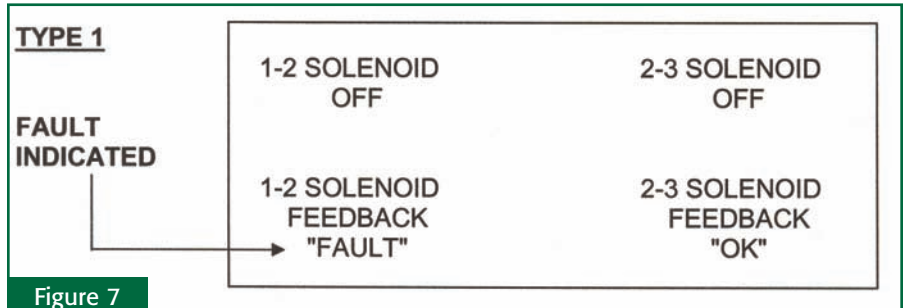


Figure 7

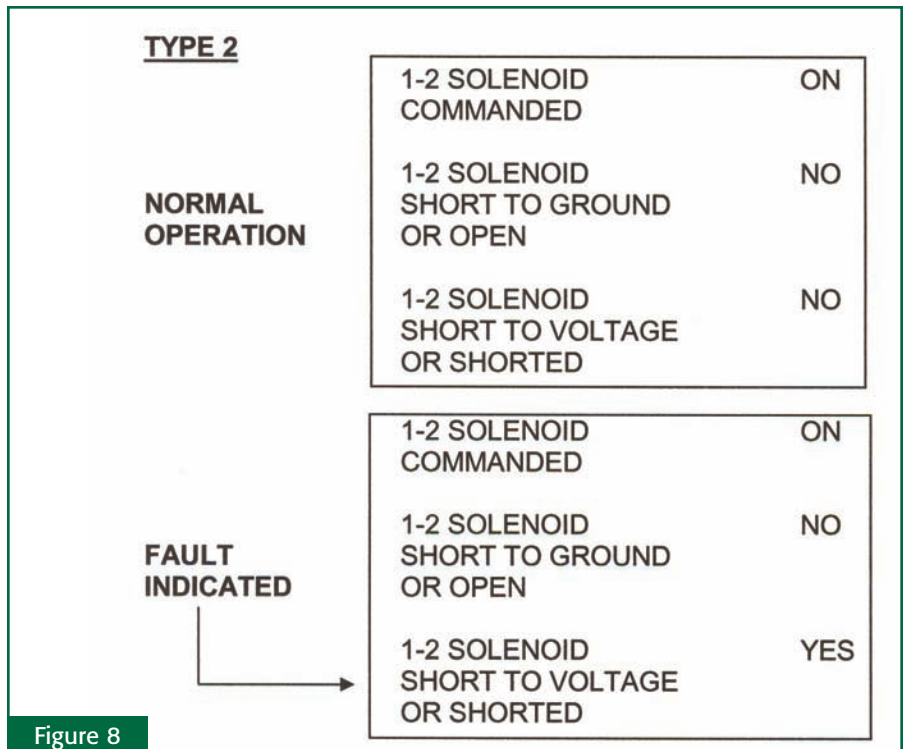


Figure 8

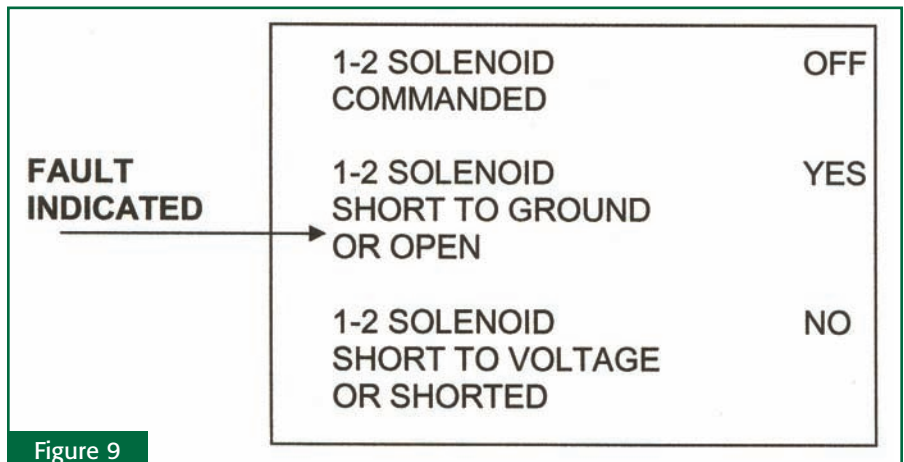


Figure 9

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