



- Author: Jesse Zacarias
- Subject: Intermittent failure to upshift
- Unit: 722.6
- Vehicle Application: 1998 Mercedes M320

## Essential Reading

- Rebuilder
- Shop Owner
- Center Manager
- Diagnostician
- R & R

## Are We Listening?

I heard a report recently on NPR (National Public Radio) that said, “Doctors are not good listeners; that is why a lot of unnecessary tests are done.”

When I heard that I said to myself, “That is true in our field too.” If we don’t listen well to the patient we may misdiagnose. Let me tell you about something that happened to me just recently that emphasizes this point. We had a customer sent to us by a local general-repair shop. He was a student here for the winter break visiting his family and was about to leave when he started to have transmission problems on his 1998 Mercedes M320.

When we asked what the problem was he simply said, “It won’t upshift at times.”

It was the first week of January and he needed the car to return to school by the following week. In short (no pun intended) he was short on time and cash.

When we talked with the patient (vehicle) this is what he said (see codes in **Figure 1**).

Now we heard “code 014” and thought of bad N2 and N3 speed sensors. We checked the TCM for signs of fluid contamination, since it is a common problem and in the Mercedes M Class the TCM is easily accessible. We found no signs of fluid contamination on the TCM, so we recommended replacement of the speed sensors, which are part of the circuit board; besides, the circuit board should always be replaced on models built before 2003.

After replacing the circuit board, circuit-board case connector, filter and fluid, we cleared the codes and drove the car for a long time. We did not want this

customer to have problems driving out of state. The vehicle performed great, so we released it to the customer. Within a couple of hours he returned. We have all had that awful gut feeling when a car returns that soon. Again we talked with the patient, and this is what he said (see codes in **Figure 2**)

*continues page 6*

**1**

Vehicle History

Back Activate Delete Attachments Print

Odometer/Mileage : 221441      First Name :  
 Technician : Jesse      Last Name : Lopez  
 Vehicle Color : Gray      License :  
 Status : In Progress      PostCode :

Vehicle ID

Year : 1998      Submodel :  
 Make : Mercedes-Benz      Engine :  
 Model : 163.154 (M-SERIES)      Other Vehicle ID

Data Display

Scanner - Codes - 1/4/2013 4:43:56 PM  
 014 - RPM Comparison N2 To N3 Implausible  
 097 - Fault Not Relevant Clear Diagnostic Trouble Code Memory  
 109 - Speed Sensor N3 Y3G11  
 110 - RPM Comparison N2 To N3 Implausible  
 137 - Transfer Case Control CAN Communication Implausible

Attachments

98mz.pids  
 mb2.pids  
 mz3.pids

Scanner - Codes - 1/5/2013 11:12:47 PM  
 - No Codes Present

No Active Vehicle

(Please ignore the time; clock not set correctly)

**2**

Vehicle History

Back Activate Delete Attachments Print

Odometer/Mileage : 0      First Name :  
 Technician :      Last Name :  
 Vehicle Color :      License :  
 Status : In Progress      PostCode :

Vehicle ID

Year : 1998      Submodel :  
 Make : MERCEDES-BENZ      Engine :  
 Model : ML320      Other Vehicle ID

Data Display

Scanner - Codes - 1/9/2013 3:10:38 AM  
 013 - Speed Sensor N3 Y3G11  
 109 - Speed Sensor N3 Y3G11  
 110 - RPM Comparison N2 To N3 Implausible  
 137 - Transfer Case Control CAN Communication Implausible  
 147 - Gear Implausible Or Transmission Slipping

Attachments

Scanner - Codes - 1/10/2013 12:09:43 AM  
 041 - Transfer Case Control CAN Communication Implausible  
 097 - Fault Not Relevant Clear Diagnostic Trouble Code Memory

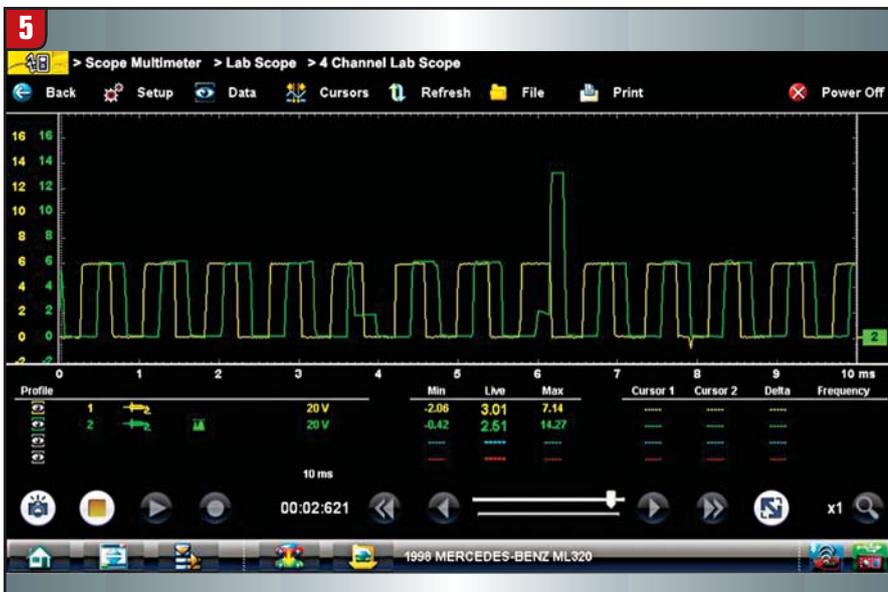
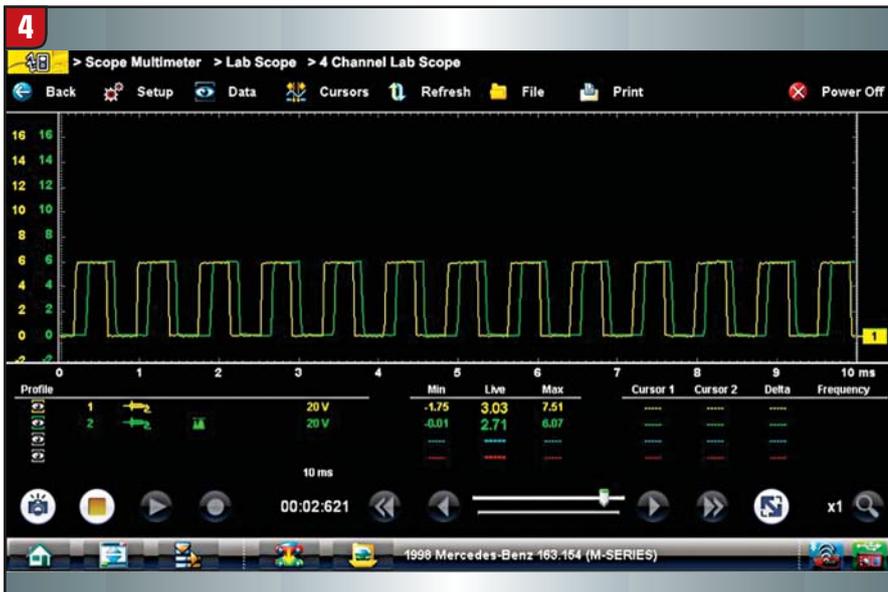
No Active Vehicle



Testing N2 and N3 speed sensors in reference to battery ground

Since the codes were directing us to the N2 and N3 speed sensors again (notice no code 014), we decided to go straight to the horse's mouth, so to speak; we back-probed the N2 and N3 speed sensors at the TCM (Figure 3).

Channel 1 (yellow) is N2 speed-sensor signal and Channel 2 (green) is N3 speed-sensor signal in reference to battery ground. The problem was intermittent so we had to drive it for a while, but we finally got to see the problem. Figure 4 shows a good signal from both N2 and N3 speed sensors. Remember that both speed sensors share a common 6 volts and ground provided by the TCM. Each speed sensor has its own signal return wire to the TCM. Grounding the scope to battery ground (reference to battery ground) allows us to see the voltage and ground integrity of the circuit in one test. Here we can see good voltage source (6 volts) and a good ground (0 volt), and the frequency (Hz) changed with increase in road speed.



However, every now and then we saw a short to voltage on the N3 speed-sensor return signal (Figure 5).

Now the most-likely short in the circuit to battery voltage would be the voltage that the TCM provides to the transmission through pin 6 for the shift solenoids, and since this was an intermittent problem we had to make an educated guess. We know how problematic the transmission-harness connector can be, so we decided to start there. Our hunch paid off (Figure 6).



It appears that the connector did leak transmission fluid into the harness, but it did not get to the TCM. The fluid had caused the insulation to flake off at the bot-

*continues page 8*

tom of the “U” portion of the bend in the harness. This harness is part of the main vehicle harness and the cost would be more than this student could pay, so we decided to cut each wire individually and then install heat-shrink tubing on the damaged part of the wire before reconnecting the wire halves and then shrink the tubing to ensure good seal and insulation.

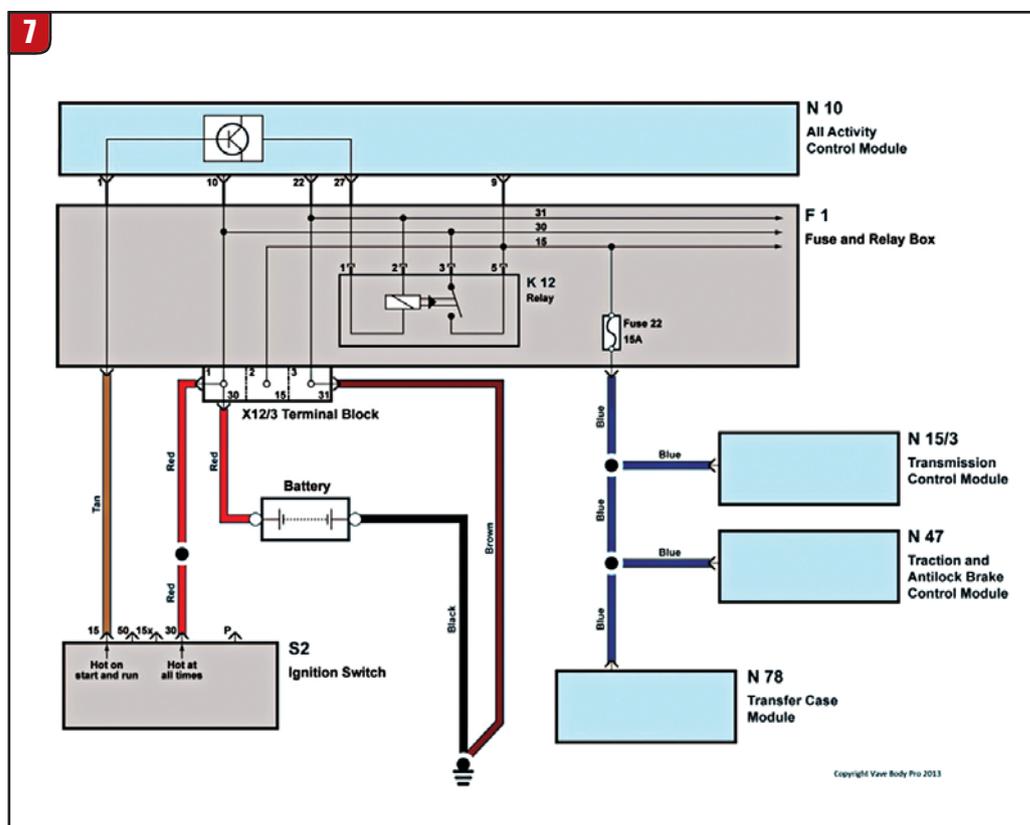
After fixing the harness we cleared the codes and road-tested the vehicle, and all worked well until we turned off the ignition and restarted the vehicle. The transmission refused to shift, and when we checked for

codes on the transmission module, we saw 041 (“no CAN communication with transfer-case module”) and on the transfer-case module we got code P1831 (“Fault with voltage supply to transfer case range motor”).

A close look at the wiring diagram (Figure 7) led us to suspect the K12 relay, and after more voltage-drop checks we found relay K12 to be defective. The relay would fail at times to turn on and supply voltage to circuit 15, which feeds fuse F22, which in turn provides voltage to the transmission control module (N15/3), transfer-case module (N78) and ABS module (N47). With these modules not turned on, no speed-sensor information was provided to the TCM, so the transmission would not shift.

The vehicle was finally finished after we corrected its three problems. It had: bad speed sensors, shorted harness and bad K12 relay. But was not the patient (vehicle) trying to tell us this?

Well, let’s go back to the beginning. The vehicle’s original codes were 014 (“rpm comparison: rpm N2 to rpm N3 implausible”), 109 (“rpm sensor N3”), 110 (“rpm N2 to rpm N3 implausible”) and 137 (“CAN communication with transfer-case control module faulty”). Upon researching the codes (see ATSG 722.6 Tech Trans manual, page 29), we discovered a very important fact about Mercedes codes for this unit: They run from 002 to 065, and codes higher than 098 are INTERMITTENT codes. To find the root DTC in an intermittent code, one needs to subtract 96 from the value.



For example, code 110 is really telling you “rpm N2 to rpm N3 implausible intermittent.” To find the root DTC we subtract 96 and get DTC 14, which is described as “rpm N2 to rpm N3 implausible,” but it is not intermittent. Did we not find that because of the shorted wire the N3 sensor was causing an intermittent short to voltage and thus the 110 code? In a way, the patient was telling us this from the beginning, because code 109 means “rpm sensor N3 intermittent.” The root code obtained by subtracting 96 is code 013, “rpm sensor N3.”

Code 137 means “CAN communications with transfer-case control module faulty intermittent,” and the root code found by subtracting 96 is 041 “CAN communication with transfer-case control module faulty.” So in essence, was not the patient telling us all along, “Hey, I have an intermittent problem with my N3 speed sensor and an intermittent problem communicating between my transfer-case module and my transmission module, and Doc, I need for you to find out why?”

Unlike our doctors, who don’t want to hear more than one problem at a time, we need to listen to all the problems to see whether they are related to one another. If we “listen” well we can save not only time but also money. In our field the customer pays only once when it comes to diagnosing. Are we listening? **TD**

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