



November 2006 Premier Issue

Practical uses of Mode \$06

Round out your diagnostic skills

By Phil Fournier





As I worked to get a handle on the presentation of Mode 6 at a technician's level, I was reminded of a slide in one of my PowerPoint presentations that announces "the lab scope allows the technician a look inside the manufacturer's electronic strategy." I'm going to make a similar statement here regarding the use of Mode 6. Mode 6 gives the technician a look inside the manufacturer's strategy. Sometimes it's a blurry look, and sometimes it's a look of limited usefulness, but taking the look is worth the trouble. It will make the technician who takes the trouble a better-rounded diagnostician, even if he/she only uses it for a few selected items.

What It Is

First off we have to cover some basics for those still uncertain of what mode 6 is or isn't. Mode 6 is part of the SAE standards that defined what kind of data would be available to technicians through the OBD2 interface. Simply put, it is the brains behind the operation of the OBD2 monitors of various emission control systems. In theory, it covers what we know as the non-continuous monitors, those usually run by the OBD2 system one per trip if the conditions are right. By now, we all know that those include Fuel Evap, Catalyst, O2 sensor, O2 sensor heater, EGR, and so forth. But the cool thing about the information available in some mode 6 data is that it breaks down the monitor into its various parts, sometimes giving us useful information that cannot be seen as well through looking at live data stream or looking at stored trouble codes.

I'm going to start off by suggesting that if you are serious about learning the benefits of Mode 6, invest a few bucks in a scan tool capable of doing the interpretation for you. If you don't know what I mean by that, it means you are not currently using Mode 6. The first time I stumbled across Mode 6 data was while randomly pushing buttons on my scan tool and looking at stuff. I rapidly backed out of the screen due to what looked to me to be completely useless information, filled with \$ signs, things called TID's and CID's, plus letters and numbers mixed. And so it is unless you have a way to interpret the data. This is because Mode 6 was written in Hexadecimal code (Base 16 instead of Base 10) and not particularly designed with the technician in mind. But never mind, there are plenty of things we have learned to use that fall into this same category.

Hex to Key

Because this article is designed to be useful information, I don't want to get bogged down in a boring discussion of Hexadecimal numbers and Base 16. I will just suggest though that you can use your free Windows calculator to convert the letters and numbers into pure numbers. If you use "Scientific" from the "View" menu, you will get a choice of the "Decimal" calculator or the "Hexadecimal" calculator. Entering the letter and number combination into the Hexadecimal screen and then clicking the button for Decimal will convert the number to a readable number. Unfortunately, that number will still do you

little good unless you know what it means via a conversion key. Part of the reason that this article is based on Ford vehicles is because the Ford information is available for free at www.motorcraftservice.com. Choose "OBD2 Theory and Operation" from the menu on the left of the screen, then scroll down and pick the Adobe Acrobat file to open. Once the file is open you can go to the monitor that you want to look at.

Misfire Counts

But leaving all that behind, there is one area of Mode 6 on a Ford which you can start using immediately, as long as you have some scan tool that will display Mode 6 (and not all of them do; I'll include a list later in the article of assorted scan tools and how to find Mode 6 in them.) I refer to misfire counts, which are not contained in Ford's regular Enhanced data stream on the majority of scan tools. Test ID \$51 in 1996-98 vehicles and Test ID \$53 from 1997 and on in others will display misfire counts WITH THE CORRESPONDING CYLINDER shown as the Component ID (\$01 through \$0A). Note that \$0A is Hex code for the number 10 and indicates cylinder number 10. If you have less than ten cylinders, you can ignore the data in any of the CID's above your number of cylinders because it is bogus. But the beauty of this data is that at last you can identify which cylinder has misfire counts in it, especially when you have NO CODE. The reason for this can be seen in the data. Look at the figure below, captured off a 1999 Merc Marquis with no codes, but a complaint of a misfire under certain load conditions. Note that I am using the AutoEnginuity PC based Scan tool that interprets the data for us but you can most likely use your own scanner in a similar fashion.

(550) Misfire Monitoring	(\$00) Total Engine Misfire and Emission Threshold Misfire Rate (Updated every 10	0.000	0.300	2.949	%
(553) Misfire Monitoring	(\$01) Cylinder #1 Misfire and Catalyst Damage Threshold Misfire Rate per 200 Re	0.000	0.300	54.144	%
(553) Misfire Monitoring	(\$02) Cylinder #2 Misfire and Catalyst Damage Threshold Misfire Rate per 200 Re	0.000	0.300	54.144	%
(553) Misfire Monitoring	(\$03) Cylinder #3 Misfire and Catalyst Damage Threshold Misfire Rate per 200 Re	0.244	0.300	54.144	%
(553) Misfire Monitoring	(\$04) Cylinder #4 Misfire and Catalyst Damage Threshold Misfire Rate per 200 Re	0.000	0.300	54.144	%
(553) Misfire Monitoring	(\$05) Cylinder #5 Misfire and Catalyst Damage Threshold Misfire Rate per 200 Re	0.000	0.300	54.144	%
(553) Misfire Monitoring	(\$06) Cylinder #6 Misfire and Catalyst Damage Threshold Misfire Rate per 200 Re	0.000	0.300	54.144	%
(553) Misfire Monitoring	(\$07) Cylinder #7 Misfire and Catalyst Damage Threshold Misfire Rate per 200 Re	0.000	0.300	54.144	%
(553) Misfire Monitoring	(\$08) Cylinder #8 Misfire and Catalyst Damage Threshold Misfire Rate per 200 Re	0.000	0.300	54.144	%
(553) Misfire Monitoring	(\$09) Cylinder #9 Misfire and Catalyst Damage Threshold Misfire Rate per 200 Re	0.000	0.300	54.144	%
(553) Misfire Monitoring	(\$0A) Cylinder #10 Misfire and Catalyst Damage Threshold Misfire Rate per 200 Re	0.000	0.300	54.144	%

Notice that all cylinders have zeros in the misfire counts column except cylinder #3. The counts are low, nowhere near the threshold required to set a code. But this information was invaluable on a coil-on-plug engine that I had no way to connect to in looking for a misfire under load condition. After inspecting the plug boot and spark plug for any sign of arching, and finding none, all I had to do to verify the coil was failing was to swap it with another cylinder and take the car for a second road test, after clearing codes. (Note: Though there were no codes, a code clear procedure removes the data from Mode 6 misfire monitors; this is not necessarily true of all data in Mode 6 though.) Finding the misfire has followed the coil to a different cylinder, the coil can be replaced with perfect confidence in a proper repair.

It is a bit ironic that Mode 6 data on a Ford contains misfire counts, since SAE J1979 defined Mode 6 as non-continuous monitor information and Mode 7 as continuous. Never mind, we'll take the data for its usefulness, even if it is in the wrong place. But this little snafu is symptomatic of Mode 6 data in general. Not all things are as they might be expected to be, which makes some technicians throw up their hands and conclude that the moving target is not worth the trouble. But let's carry on and see what other use we might get out of it.

Cat Stats

I know many technicians who sweat over the replacement of a catalyst because of a code P0420/P0430. When factory cats cost in excess of \$800 each, it is small wonder that they worry about a misdiagnosis. But how about if we could record the Mode 6 data, clear the code, and then drive the car to see what resets in the Mode 6 monitor? Let's see what our 1999 Grand Marquis with 108k miles on it shows for Mode 6 data on its catalyst monitor.

(S03) Oxygen Sensor Monitoring	(S02) Downstream O2 Sensor Switch-Point Voltage	0.452	0.300	0.000	V
(S10) Catalyst Monitoring	(S21) Bank 2 Switch Ratio and Max. Limit	0.281	0.000	0.842	Unitless
(S10) Catalyst Monitoring	(S11) Bank 1 Switch Ratio and Max. Limit	0.254	0.300	0.842	Unitless

This cat monitor was run after the coil was replaced, and we can safely conclude by looking at the data that this catalyst is still in good condition. The switch ratio of the bank 1 cat (the side of the misfiring coil) is actually a bit better than that of bank 2. And both cats are well under the limit described here as .842, which according to the Ford website reflects a limit of the percentage of switching of the rear O2 sensor as opposed to the front one. Notice what happens to the data when we clear codes:

(S03) Oxygen Sensor Monitoring	(S02) Downstream O2 Sensor Switch-Point Voltage	0.452	0.300	0.000	V
(S10) Catalyst Monitoring	(S21) Bank 2 Switch Ratio and Max. Limit	0.749	0.000	0.842	Unitless
(S10) Catalyst Monitoring	(S11) Bank 1 Switch Ratio and Max. Limit	0.749	0.300	0.842	Unitless

It didn't go to zero, did it? Instead, some random number got put in the box, a number that looks like a near-failure of .749. But what's the likelihood that both cats would measure the exact same switch ratio? Just about zero, but this illustrates the need to not be careless in your treatment of Mode 6 information. The graphic below (captured from a 1998 Ford Winstar) show what the data would like uninterpreted:

See Chart on following page!



November 2006 Premier Issue

Non-Cont. Monitoring Test Result

TID/CID	Result	Min.	Max.	Test
01/11	Pass	21F	N/A	330
01/21	Pass	21F	N/A	313
03/01	Pass	0	N/A	1CD
03/02	Pass	0	N/A	1CD
10/21	Pass	N/A	20	3
10/11	Pass	N/A	20	1
22/00	Pass	N/A	300	14D
25/00	Pass	400	N/A	8000
41/11	Fail	F900	N/A	1B
Print	F2	F3	Page Dn	

You could do the math, converting the numbers from Hex to Decimal, and then multiplying by the conversion factor listed on the website of .0156. But why bother? It is easy to see that the two catalysts on this vehicle are well within the maximum limit. But what if you had a code P0420, cleared it, then drove the vehicle and saw the 10/11 test number at 19? You could be pretty comfortable at recommending the catalyst, and depending on where you saw the 10/21 parameter, you might be recommending a pair.

On the following pages... Restricted EGR and scan tool tips

Choked off?

Restricted EGR is one other place where Mode 6 on a Ford can come in handy. Here is data from a normal system (1999 Ford Crown Vic 4.6L with no problems):

(\$41) EGR System Monitoring	(\$11) Delta Pressure for Upstream Hose Test and Threshold	-1.388	-6.981	0.000	inh20
(\$41) EGR System Monitoring	(\$12) Delta Pressure for Downstream Hose Test and Threshold	-1.388	0.000	6.989	inh20
(\$45) EGR System Monitoring	(\$20) Delta Pressure for Stuck Open Valve Test and Threshold	1.011	0.000	1.607	V
(\$4A) EGR System Monitoring	(\$30) Delta Pressure for Flow Test and Threshold	41.590	5.990	0.000	inh20
(\$4B) EGR System Monitoring	(\$30) EVR Duty Cycle for Flow Test and Threshold	51.17%	0.000	90.000	%

Notice that the TID \$45/\$20 is the same as the DPFE voltage as long as the EGR valve is not stuck open. This can help a technician that may not have enhanced Ford data, as the generic data stream (Mode 1) does not list DPFE voltage as a parameter.

Listed below is the data (same vehicle) where I disconnected the intake side hose on the inconveniently located DPFE (see photo ?):

(\$41) EGR System Monitoring	(\$11) Delta Pressure for Upstream Hose Test and Threshold	-1.373	0.000	0.000	inh20
(\$41) EGR System Monitoring	(\$12) Delta Pressure for Downstream Hose Test and Threshold	-1.373	0.000	0.000	inh20
(\$45) EGR System Monitoring	(\$20) Delta Pressure for Stuck Open Valve Test and Threshold	1.005	0.000	1.592	V
(\$4A) EGR System Monitoring	(\$30) Delta Pressure for Flow Test and Threshold	6.887	5.990	0.000	inh20
(\$4B) EGR System Monitoring	(\$30) EVR Duty Cycle for Flow Test and Threshold	89.938	0.000	80.000	%

Note that this set a pending code P0401(EGR flow insufficient) on a single road test. However, because we have no specs for TID 41/CID11 & 12, they do not help us like they are supposed to and the vehicle does not set the code P1405 like it is supposed to. But obviously something is detected. Next I reconnected the DPFE hose and installed a restriction in the EGR valve (see figure ?) to simulate a restricted EGR passage. I captured the following data:

(\$41) EGR System Monitoring	(\$11) Delta Pressure for Upstream Hose Test and Threshold	-1.373	0.000	0.000	inh20
(\$41) EGR System Monitoring	(\$12) Delta Pressure for Downstream Hose Test and Threshold	-1.373	0.000	0.000	inh20
(\$45) EGR System Monitoring	(\$20) Delta Pressure for Stuck Open Valve Test and Threshold	1.005	0.000	1.592	V
(\$4A) EGR System Monitoring	(\$30) Delta Pressure for Flow Test and Threshold	6.887	5.990	0.000	inh20
(\$4B) EGR System Monitoring	(\$30) EVR Duty Cycle for Flow Test and Threshold	89.938	0.000	80.000	%

I find it very interesting that TID \$4A/\$30 has barely passing numbers, but in order to achieve that much flow, the computer had to ratchet up the EVR duty cycle to 89%. However, in spite of repeated road tests and completed EGR monitors, this condition would not set even a pending code. Below is another capture with the EGR blocked completely:

(\$41) EGR System Monitoring	(\$11) Delta Pressure for Upstream Hose Test and Threshold	-0.975	-6.981	0.000	inh20
(\$41) EGR System Monitoring	(\$12) Delta Pressure for Downstream Hose Test and Threshold	-0.975	0.000	6.989	inh20
(\$45) EGR System Monitoring	(\$20) Delta Pressure for Stuck Open Valve Test and Threshold	1.002	0.000	1.628	V
(\$4A) EGR System Monitoring	(\$30) Delta Pressure for Flow Test and Threshold	-1.474	5.990	0.000	inh20
(\$4B) EGR System Monitoring	(\$30) EVR Duty Cycle for Flow Test and Threshold	89.948	0.000	80.000	%



Taken all together, we can see that Mode 6 stored data can help us nail down a restricted EGR passage that does not set a code, now that we know to look at TIDs \$4A/\$30 and \$4B/30. You can probably do that on your scan tool without an interpreter, but you are going to have to do the Hex plus conversion math and use the Ford website.

Conclusion

In conclusion, Mode 6 is a barrel of data, some of it bogus and meaningless, and much of it powerful. I'm told that Honda recommends the use of Mode 6 data in the diagnosis of fuel evaporative problems. I'd recommend you dive into your scan tool and pick some TID's and CID's to figure out so you can get started on learning what to expect, particularly if you have the good fortune to work on a single car line. If you are a multicar line guy like me, try it out on Ford misfires to start with and see if you don't find it to be a real time saver.

How to access Mode \$06 in assorted scan tools

(found under Generic or Global OBD II in every case):

MasterTech: Select "F5 System Test" then "F2 Other Results" (Note that results are displayed as "Pass/Fail". To get the actual readings press "*", Help")

Snap On: (later than 2001 cartridge, earlier versions don't have Mode 6): After communicating with vehicle select "Display Test Parameters/Results" then select "Non-Continuous Monitored systems (Mode \$6). (MT2500; Solus, Modis similar)

BDM: Select "Non-Continuous Monitor Test Results"

NGS: Select Diag Monitoring Test Results

AutoEnginuity: Select On Board Test Results tab

OTC Genesis: Select "Special Tests" then "Component Parameters"

Click here to apply for a free subscription to
Master Technician Magazine:

http://mastertechmag.com/magazine/main.php?smPID=PHP::eu_subscribe.php