



**Getting the
Help You
Need From
the Subaru
New Select
Monitor**

Video Reference Booklet

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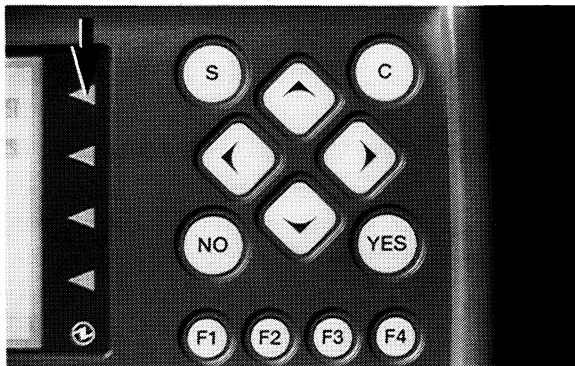
INTRODUCTION

When you're diagnosing a tricky symptom, your best friend is often the Subaru New Select Monitor. This Video Reference Booklet (VRB) will review some key ways to make the most of it.



New Select Monitor (NSM)

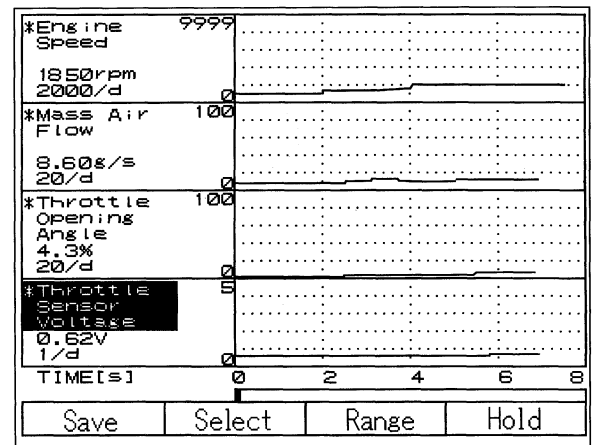
The New Select Monitor, or "NSM," can help diagnose problems quickly, in many ways. It lets you watch what's happening in many sensor and switch circuits, at the same time. Or, to make things easier, it can display only those you consider most important. And, it can display them in a variety of ways.



LED's on NSM

For example, the status of various switches and solenoids can be displayed using LEDs, which make it very easy to see when they are off or on.

Readings from variable items such as engine speed, mass air flow, throttle opening angle, and throttle sensor voltage, can be displayed as plots on a graph.



Graphs Displayed on NSM

The NSM lets you capture this data during a test drive and study it later, back at your workshop.

The NSM can communicate with a computer, allowing you to permanently store data and print out screens. This communication even lets you e-mail saved data.



NSM Communicating with Computer

It can also be used as a multimeter, or as an oscilloscope, and can temporarily record a particular scope wave pattern.

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HOW TO USE THE NEW SELECT MONITOR (A REVIEW OF THE BASICS)

Batteries

The NSM uses four AA disposable alkaline batteries. These batteries provide power for memory retention, and back-up power supply for monitor operation. Don't use rechargeable nicad batteries; they may lose power without warning.



Batteries for NSM

Cartridges

To diagnose any vehicle, you must install the correct cartridge. There are two cartridges for use with the NSM, one for use with the most recent Subarus, and the other for use with earlier models.

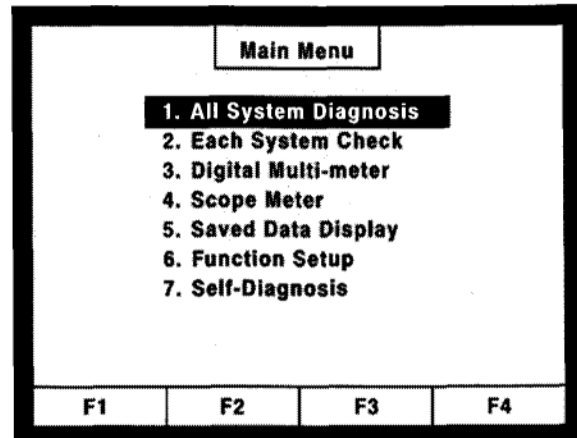


Cartridges for NSM

Connecting the NSM and Using the Keys

With the ignition off, connect the NSM's cable to the vehicle's data link connector. Then turn the ignition on *before* you push the power button on the NSM.

The Main Menu screen appears first. You move the cursor to the item you want, using the up and down arrow keys at the right, then press the "Yes" key to move to the next screen for that function.



Main Menu Screen

Any time you want to back up one screen, press the "C" key, unless the screen directs you with another command.

At the bottom of many screens are blocks marked "F1" through "F4." When these blocks display commands instead of F-numbers, you press the corresponding keys at the right, marked "F1" to "F4," to activate the commands. For example, you can use the "F1" key to save the information on a screen, whenever its F1 block contains the word "Save."

Whenever all four blocks contain commands, even more commands may be available. If so, pressing the "S" key will shift the visible commands so the hidden ones become visible.

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MAIN MENU

Selecting “All System Diagnosis” displays all current Diagnostic Trouble Codes (DTCs), in all systems. (For vehicles equipped with cruise control, the main switch must be on for this communication.)

“Each System Check” lets you specify the system you’re working on, and is your way in to more diagnosis.

The “Digital Multi-Meter” and “Scope Meter” options are also available here.

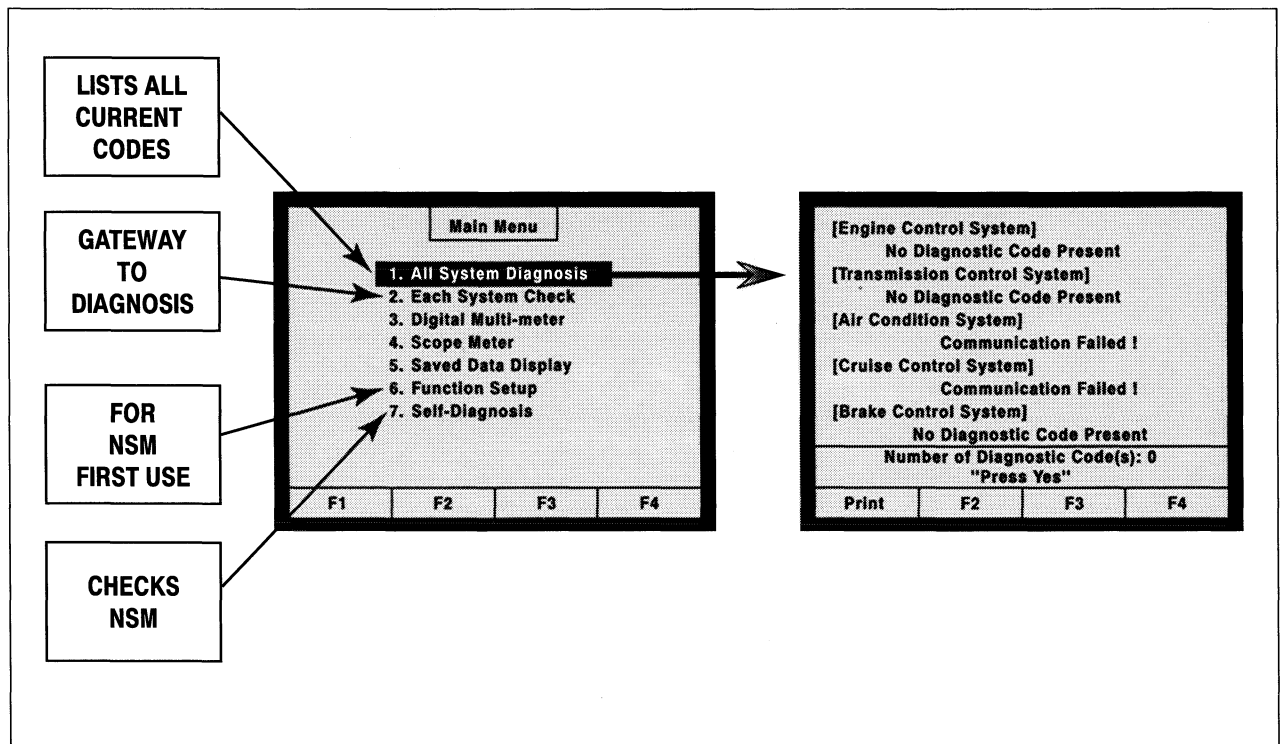
“Saved Data Display” is where to find data you’ve previously saved.

“Function Setup” is used primarily when an NSM is new, but you could use it later, too - to change unit selection, for instance. Another option under “Function Setup” is changing the language used in the display. If you do change the language, you can reset it back to English by performing the following; however, you should be aware that any saved data will be erased.

1. Turn the power Off.
2. Push and hold the “C” key.
3. Turn the power On.

“Self-Diagnosis” allows the NSM to check its own operation, including the condition of the AA batteries.

For diagnosis, “All System Diagnosis,” “Each System Check,” and “Saved Data Display” are used most often.



Main Menu Options

GETTING THE HELP YOU NEED FROM THE SUBARU NEW SELECT MONITOR

“All System Diagnosis”

Always begin with “All Systems Diagnosis,” to check for all current diagnostic codes, not just those in the system you’re focusing on. When the cursor is on this function, and you press “Yes” to activate it, the screen changes to a list of all the systems that communicate with the NSM. After a necessary waiting time for system evaluation, any DTC that is in memory will appear here.

“Communication Failed!” usually means that the car is not equipped with this system, or, in the case of cruise control, that the system is not turned on. Of course, this message can indicate a fault in a control module or the communication circuit.

Pressing “Yes” returns the screen to the “Main Menu,” where you can move on to “Each System Check,” your main gateway to diagnostics.

[Engine Control System]			
P0122 Throttle Position Sensor Circuit			
Low Input			
[Transmission Control System]			
31 Throttle Position Sensor Circuit			
[Air Condition System]			
Communication Failed !			
[Cruise Control System]			
Communication Failed !			
[Brake Control System]			
Number of Diagnostic Code(s): 2			
Press “YES”			
Print	F2	F3	F4

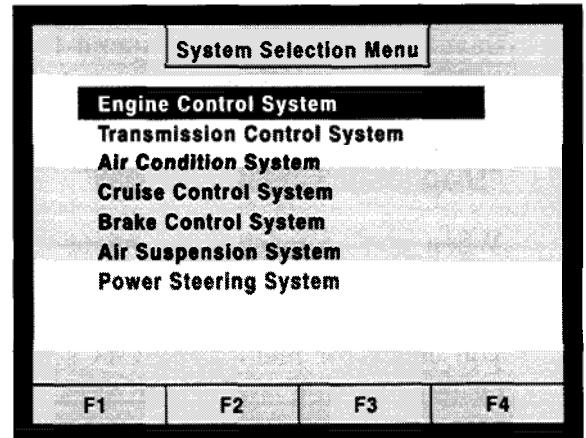
Display Showing Systems Communicating with NSM and DTCs Found (If Any)

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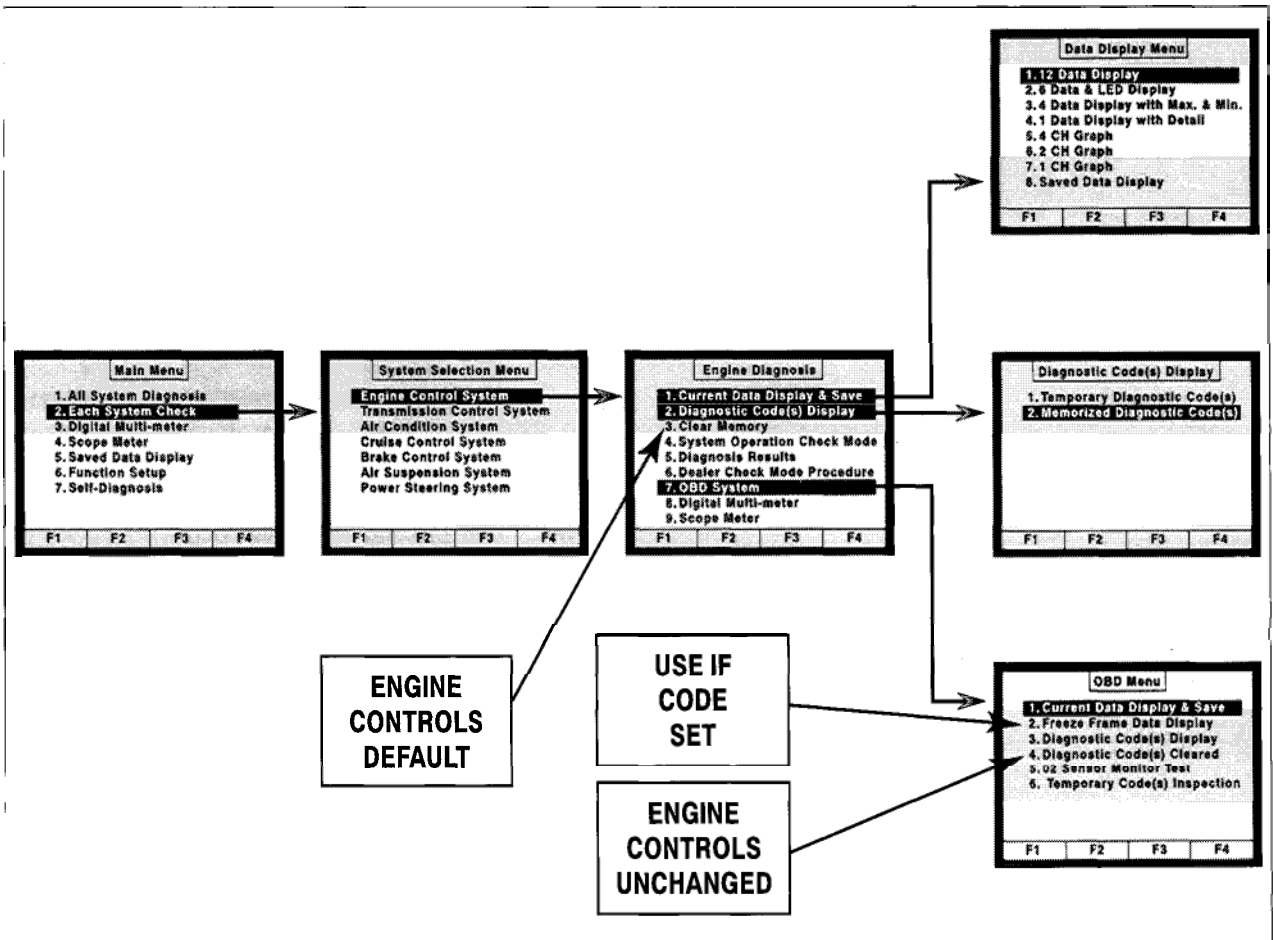
“Each System Check”

Selecting “Each System Check” in the “Main Menu” moves you to the “System Selection Menu,” which lists all the systems that communicate with the NSM. Choosing any one, such as “Engine Control System,” brings up that system’s main diagnostic menu.

For Engine or Transmission Diagnosis, an intermediary screen, not shown here, asks you to confirm that the engine or transmission control module installed matches the vehicle’s engine or transmission.



System Selection Menu (“Each System Check”)



Key Functions Accessed Through “Each System Check”

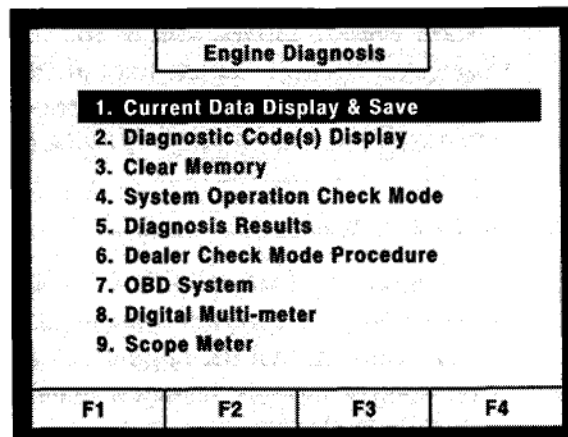
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FUNCTIONS AVAILABLE FROM THE SPECIFIC SYSTEM DIAGNOSTIC MENU (EXAMPLE: 'ENGINE DIAGNOSIS')

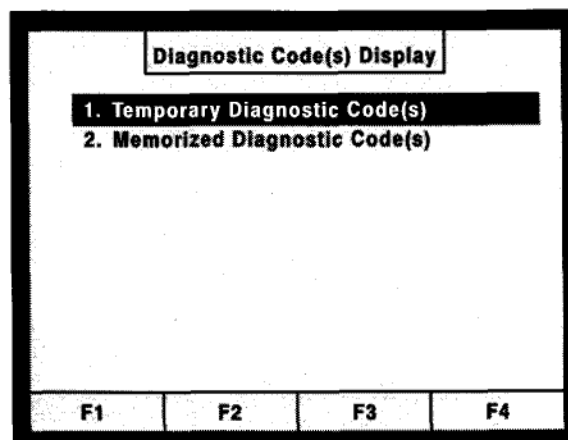
From this menu, "Current Data Display & Save" is where you will spend the most time, but you should always begin by checking for DTCs.

"Diagnostic Code(s) Display"

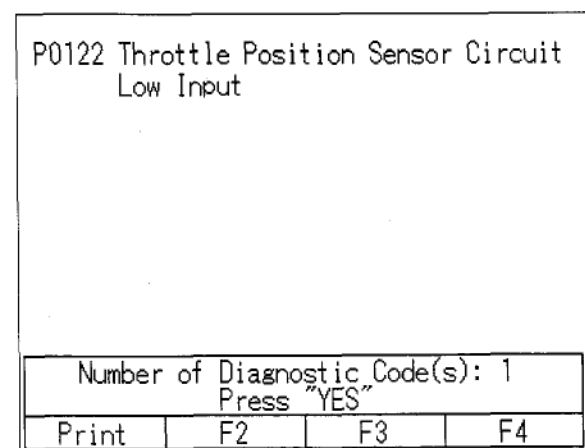
When you've reached the menu for your systems, always start by checking the "Diagnostic Code(s) Display," which lets you check for memorized DTCs for your system, as well as current ones. Under "Memorized Diagnostic Code(s)," you may find a memorized DTC that points right to an intermittent fault.



Engine Diagnosis Menu



"Diagnostic Code(s) Display" Menu



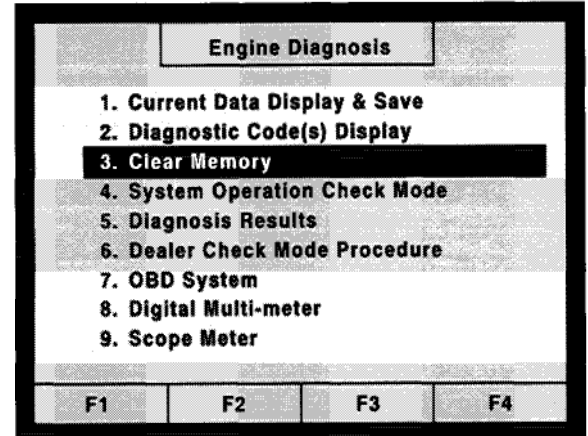
DTC P0122 (Under "Memorized Diagnostic Code(s)")

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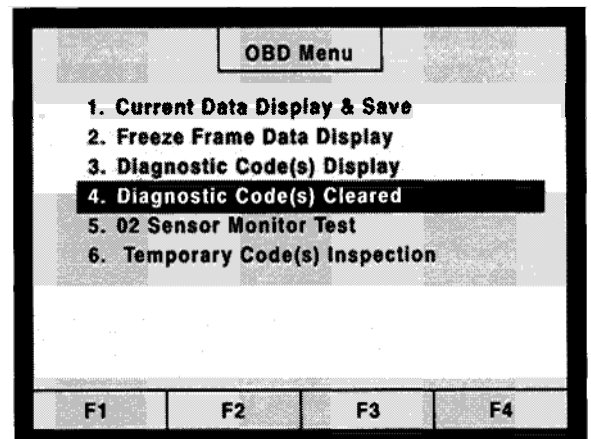
Clearing DTCs

For DTCs in most systems, you select the “Clear Memory” function to clear DTCs when you have completed your repair. But for DTCs in the engine control system, there are two ways. If the problem has existed long enough to teach the Engine Control Module (ECM) “bad habits,” select the “Clear Memory” function, which resets the ECM to its defaults.

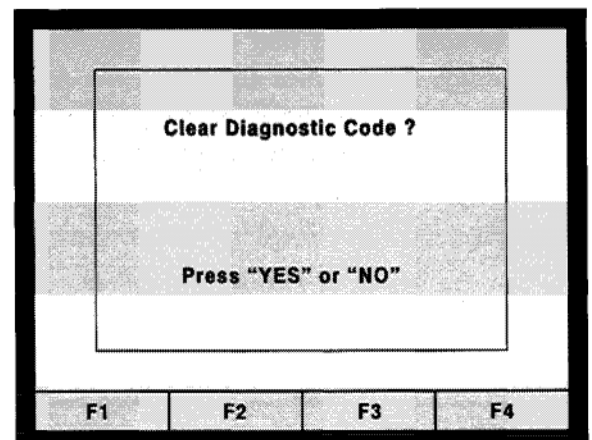
But if faulty control hasn’t been learned, select the “OBD System” and find the “Diagnostic Code(s) Cleared” option on that menu. Clearing DTCs this way retains the ECM’s existing settings.



“Engine Diagnosis” Menu - “Clear Memory” Function Selected



“OBD System” Menu - “Diagnostic Codes Cleared” Function Selected



“Clear Diagnostic Code? (Yes/No)” Prompt

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“Freeze Frame Data Display”

Whenever a DTC has been set, you'll find useful data under “Freeze Frame Data Display.” This function automatically captures certain data at the instant the first DTC was set. It can't capture data for more than one DTC, or for more than that one instant; and you can't choose which items are captured. Still, it's very useful.

For engine DTCs, freeze frame is available in the “OBD Menu,” which appears when you choose the “OBD System.” But for other systems, like transmissions and brakes, you'll find “Freeze Frame” data right under the main diagnosis menu for the system.

“System Operation Check Mode”

This function (using “Actuator ON/OFF Operation”) allows you to command some components on and off, so you can check their mechanical operation. When you run this test, the NSM tells you to turn off the ignition switch and connect the test mode connectors (the 2-pole green connectors with a single wire under the driver's dash panel.) Turn the ignition switch back on. The systems listed cycle on and off until you select an item and push “Yes”; then that system alone is turned on or off. For example, you can check the fuel pump relay, the radiator fan relay, the A/C compressor relay, the EGR solenoid valve, and other devices, using “System Operation Check Mode.”

Freeze frame data	P0122
Fuel system for Bank 1	Op_init.
Calculated load value	1.6 %
Coolant Temp.	147 °F
Short term fuel trim B1	+0.0 %
Long term fuel trim B1	-2.3 %
Mani. Absolute Pressure	248 mmHg
Engine Speed	488 rpm
Vehicle Speed	0 MPH

Print	F2	F3	F4
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Data Displayed Using “Freeze Frame Data Display” Function

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“CURRENT DATA DISPLAY AND SAVE”

When you select this important function, the “Data Display Menu” appears, listing seven possible ways of displaying data. The eighth choice lets you review data that’s already saved.

While you’re looking at this Display Menu, ask yourself two questions:

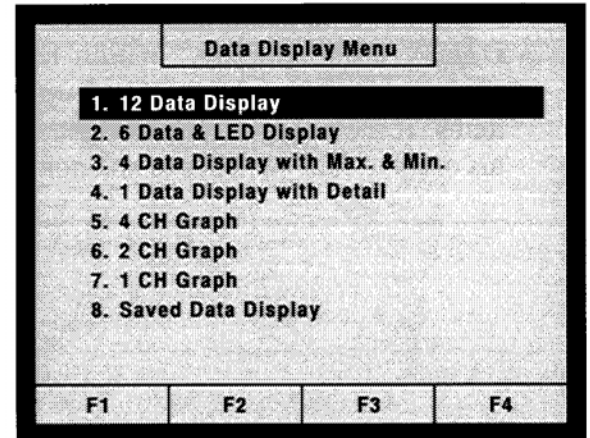
Which data will be most helpful in diagnosis?

What’s the most helpful way to display it?

The answers should determine which function you select from the “Data Display Menu.”

“12 Data Display”

When “12 Data Display” is activated, you’re looking at live data, and can scroll down through all the ECM inputs and outputs. But it would be very hard to catch any intermittent fault that way; so it’s better to select the important ones, and display them in one of the other functions offered.

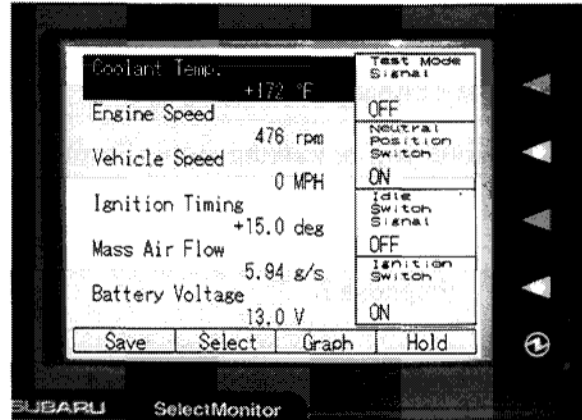


“Data Display Menu”

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"6 Data & LED Display"

If your chief need is to know when switches are going on and off, you can choose "6 Data & LED Display," which lets you observe the changing data of up to six items, at the left, and, on the right, the status of up to four switches or solenoids.



6 Data & LED Display

"4 Data Display with Max. and Min."

If you need to catch maximum and minimum values, you can select "4 Data Display with Max. and Min."

Coolant Temp.	+162 °F	Max. +162	Min. +160
Engine Speed	475 rpm	Max. 477	Min. 467
Vehicle Speed	0 MPH	Max. 0	Min. 0
Battery Voltage	13.0v	Max. 13.0	Min. 12.9
Print Trigger Lock Clear			

"4 Data Display with Max. and Min."

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“4-Channel Graph”

For most diagnosis, it makes sense to choose one of the functions that displays data on a graph. Here's an example.

An owner complains of brief driveability symptoms, but can't relate them to any specific operating conditions. There may be no DTC; or, if you're lucky, a memory DTC - but something makes you suspect an intermittent fault in the throttle sensor circuit.

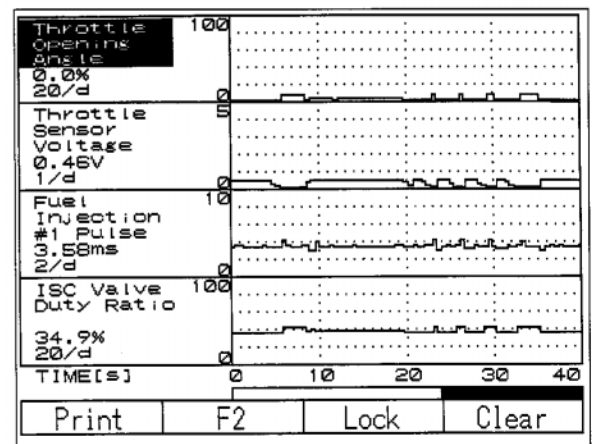
There are four readings related to the throttle sensor signal that you want to observe; so you select the 4-channel graph and are given four graph blocks to set up.

The first items in the engine data list already appear in these blocks - and you scroll down to find the four you want. “Throttle Opening Angle” is the first desired reading to appear; and now it must be marked for actual graphing.

Marking and Selecting Items

To mark an item for display in any of these functions, use the arrow keys to move the cursor to it, and then press “Yes.” An asterisk will appear next to it. (Pressing “Yes” again would remove the asterisk.) When you have placed all asterisks next to all the items you want to observe, press the F2 key, to “select” them. If you have not already selected the way you want them displayed, now press “C” to return to the “Data Display Menu” and select the desired function.

Your finished graph includes throttle opening angle, throttle sensor voltage, fuel injection #1 pulse, and idle speed control valve duty ratio; it's already live.



4-Channel Graph (Shown in Replay)

AN INTRODUCTION TO KEYLESS ENTRY AND THEFT DETERRENT SYSTEMS

CAPTURING AND SAVING DATA

At the bottom of the 4-Channel Graph screen, all the "F"-blocks are filled with available commands, and pressing the "S" key would reveal additional options. Knowing which key you'll want to use requires answering another question: How do you want to capture the data?

If you know any particular operating conditions under which the symptoms occur - if, say, they always occur at about 60 miles per hour, or if a DTC is always set when they occur - you can set up the recording to be automatically triggered when that vehicle speed is reached, or that DTC is set (see "Trigger Function").

Manual Capture

If you don't know the related operating conditions, you can capture the data manually, while you wiggle the throttle sensor harness, trying to induce the fault. (You could also capture data on a test drive, with a helper driving.)

The four graphs are running, as you start the engine, then begin to manipulate the wires. By wiggling the throttle sensor harness in ways that could occur on the road, you might make the intermittent show up. When you're finished with the trial, you press F4, "Hold," to stop the recording.

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Saving Data

Notice this: whenever you want to save a recording, you should also press the "Save" key, soon, to avoid losing it. The NSM assigns it an event number, listed with the date and time. You should write down this information, so that later, when you look up your "event" through "Saved Data Display," you'll be able to recognize it.

Replaying Data

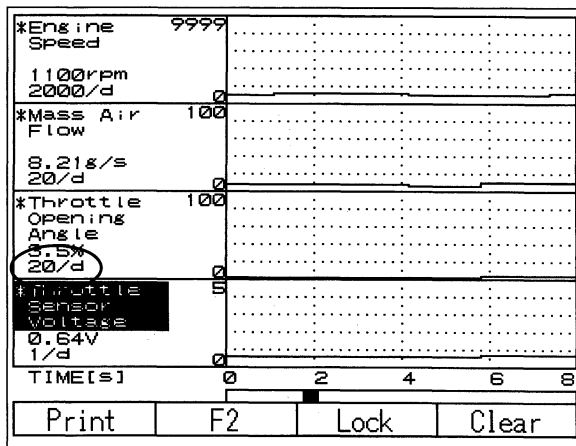
Of course, you want to study it right now. To move forward and back through a recorded graph, you use the right and left arrow keys, which move the vertical "memory bar" that emerges from the left side. The changing value displayed at the left of each graph is that item's value at the point where the memory bar intersects its trace. So, to learn the exact value of any point on any trace, you can simply move the memory bar to that point and read the value that will be displayed at the left.

Save Data			
24.Engine	07/24/1998	09:39	
25.Engine	07/24/1998	09:42	
26.Engine	07/24/1998	09:52	
27.Engine	07/30/1998	10:50	
28.Engine	07/31/1998	11:22	
29.Engine	07/31/1998	11:26	
30.Engine	08/01/1998	10:21	
31.Engine	10/02/1998	05:34	
32.Engine	10/02/1998	05:36	
33.Engine	10/02/1998	05:37	↓
Print	Delete	F3	F4

Event Log

GETTING THE HELP YOU NEED FROM THE SUBARU NEW SELECT MONITOR

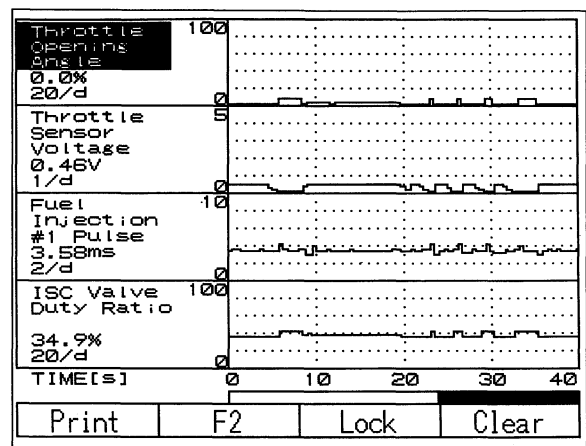
If the movement is too slow, you can change the range of the time display. Press F3, for "Range." The cursor will jump to a note interpreting the vertical range that's currently being displayed. (For example "20/d" means that the throttle opening angle is being displayed at 20% per vertical division.) Pressing the right and left arrows now would let you change that range.



Sample 4-Channel Graph

However, in this case, it's the horizontal range that's a problem. To change the horizontal range, move the cursor down to "Time (in seconds)." At default, the time range is 2 seconds per horizontal division, meaning that 8 seconds' worth of the recording can be seen at once. If you press the right arrow once, the total timespan will change to 20 seconds; if you press the right arrow again, the timespan becomes 40 seconds. To restart, press "YES." Replay will resume, and you will be able to move through the recording more quickly.

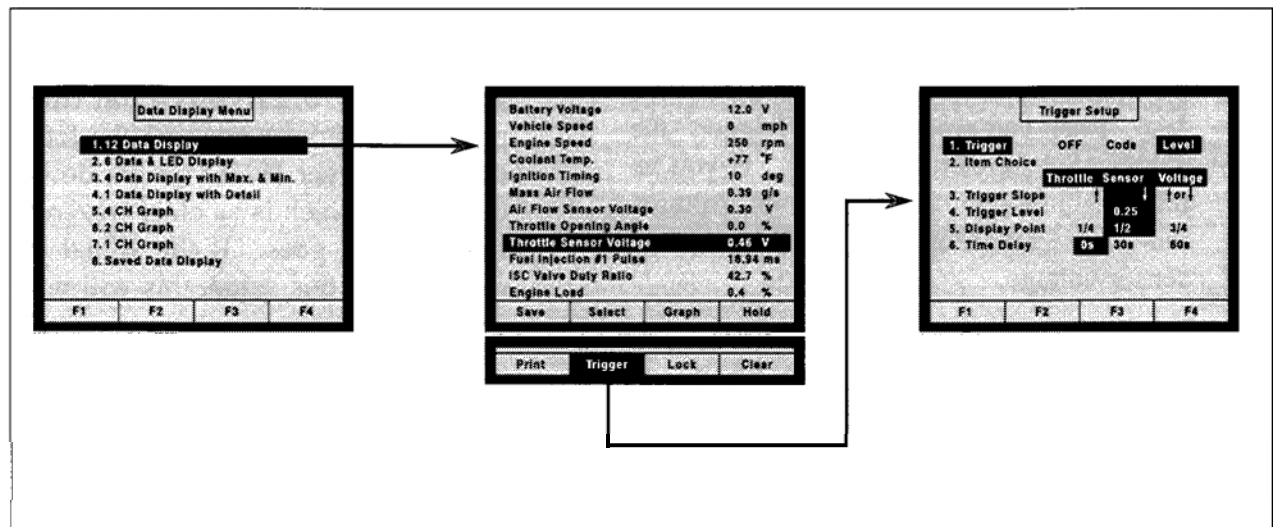
By examining the recording, you will be able to see whether there is evidence of an intermittent open in the throttle sensor signal to the engine control module. (If you move the memory bar to the fault in your recording and watch the voltage reading, you can see how low the voltage actually falls.) You can also see how the other values change in response.



4-Channel Graph Recording Showing Intermittent Open in Throttle Sensor Voltage

During any replay of a graph, a horizontal "time bar" beneath the graph will move along more slowly than the traces themselves, showing you where the displayed seconds of data occur, in relation to the beginning and end of the recording as a whole. In the above graph, the time bar shows that the displayed segment is toward the end of the recording.

GETTING THE HELP YOU NEED FROM THE SUBARU NEW SELECT MONITOR



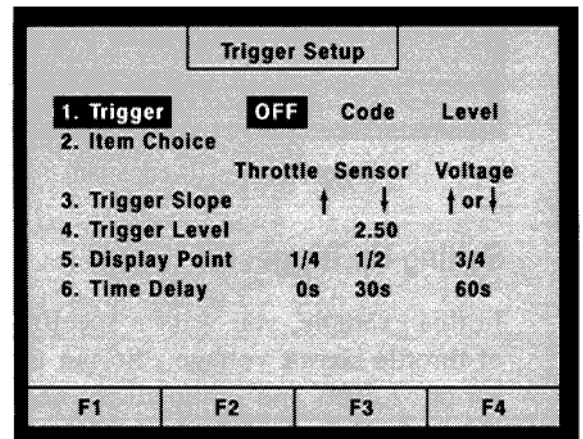
Trigger Set Up Process (Completed Screen Shown at Right)

Trigger Function

If you find evidence that the signal through the throttle sensor circuit is being interrupted during vehicle operation, you may be able to use the NSM to find the location of the intermittent open. The NSM's trigger, or automatic recording function, includes an audible beep. You can set up the trigger so that, while you wiggle the harness, the beep will sound as soon as the open occurs. That will tell you which section of the harness is the trouble spot.

Trigger can be used whenever the symptom is known to occur under one or more particular operating conditions. A drop-off of a signal voltage to zero volts is such a condition.

To set-up the trigger function, first select a type of data display, from the Data Display Menu. In our example, setting up a 1-channel graph makes sense, since you're interested now in just one item. When you have set up your graph, be sure to leave the cursor on the item that should be the trigger. In the example we've discussed, it's the throttle sensor voltage.



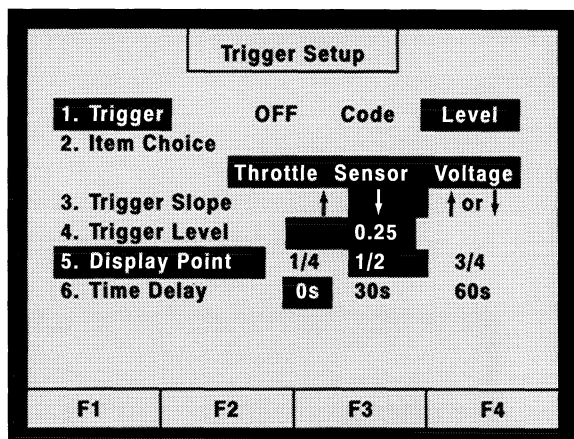
Trigger Set Up Screen

GETTING THE HELP YOU NEED FROM THE SUBARU NEW SELECT MONITOR

Trigger Set Up Screen

Next, to find the Trigger command, press "S." When you press F2, for "Trigger," the Trigger Set Up screen appears. If you've left the cursor on throttle sensor voltage, the "Item Choice" indicated will be throttle sensor voltage.

You can set up an automatic recording to be triggered in one of two ways, which you indicated by leaving the cursor in the right place. The trigger can be either the first DTC that's set ("Code") or a specific level of the trigger item ("Level").



Trigger Screen (Completed)

Setting Up Trigger for "Level"

In this example, you want a specific level of throttle sensor voltage. So put the cursor on "Level" and set up all the necessary details, as follows. Using the down arrow, move the cursor to "Trigger slope"; then use the right arrow to move the cursor to the downward pointing arrow on the display, since you want the trigger to occur when the voltage first *falls* to a particular level. To set that level, next use the downward arrow to move the cursor to "Trigger Level." (Pressing the right arrow would now raise the trigger level from 2.50 volts,

which is the default value, to 2.75 volts.) Pressing the left arrow will lower the trigger level by 0.25 volts each time it is pressed. Continue pressing the left arrow until the trigger level you get down to is 0.25 volts, which is as close to zero as the trigger level goes. If the signal voltage drops below this value, this will now trigger the recording.

The "Display Point" could be set at 1/4, 1/2, or 3/4. Ordinarily, you would probably want the display point to be 1/2 - that is, you'd like to have the trigger event displayed at the mid-point of the graph, left to right.

For "Time Delay," selecting 0 seconds means the NSM will beep at the same time as the recording is triggered.

When all of the details are set, press "Yes." The trigger function is now ready. Now you can start the engine and again begin methodically wiggling the harness that contains the suspect wire and connectors. When you hear the beep, you'll know the voltage in the circuit has dropped to nearly zero, and that your last movement is what caused it. That tells you where to begin inspecting the circuit.

Conclusion

The more you use the New Select Monitor, the more familiar you'll become with all these screens, and the more you'll realize the many ways this versatile tool can help you solve your daily diagnostic problems.

GETTING THE HELP YOU NEED FROM THE SUBARU NEW SELECT MONITOR

Mark your answers to the following questions and mail the quiz to Subaru Video Training Program Headquarters.

Name _____

Dealer _____ Dealer Code _____

1. Using the New Select Monitor (NSM), you can display the status of various switches and solenoids, using LEDs.
 - a. True
 - b. False
2. When all four "F"-blocks at the bottom of a screen contain commands, and more commands are available, you can display those additional commands by pressing:
 - a. "C"
 - b. "S"
 - c. "YES"
 - d. "NO"
3. To display all current Diagnostic Trouble Codes (DTCs) in all systems, you would select...
 - a. Each System Check.
 - b. Saved Data Display.
 - c. All System Diagnosis.
 - d. Self-Diagnosis.
4. When you select "All System Diagnosis," the message "Communication Failed!" can mean...
 - a. The car is not equipped with the system (or the system is not turned on).
 - b. There is a fault in a control module.
 - c. There is a fault in the communication circuit.
 - d. Any of the above.
5. To clear a Diagnostic Trouble Code (DTC) for an Engine Control Module (ECM) system, if the problem has not existed long enough to teach the ECM "bad habits," select...
 - a. Clear Memory.
 - b. Diagnostic Codes Cleared (under "OBD System")
 - c. Self Diagnosis.
 - d. System Operation Check Mode.
6. You can command some components to turn off, using...
 - a. Each System Check.
 - b. Self Diagnosis.
 - c. System Operation Check Mode.
 - d. All System Diagnosis.
7. When choosing items you want to graph, you use...
 - a. The "YES" key and the arrow keys.
 - b. The "C" key and the "S" key.
 - c. The "YES" key and the "NO" key.
 - d. The "C" key and the arrow keys.
8. To end a recording that you're capturing manually, press...
 - a. F1 Save.
 - b. F2 Select.
 - c. F3 Range.
 - d. F4 Hold.
9. The NSM can be set up to record...
 - a. With manually operated start and stop points.
 - b. When a DTC is set.
 - c. When a known specific vehicle condition occurs (for example 60 mph).
 - d. Any one of the above.
10. When you set "Time Delay" at ..., the NSM will beep at the same time as the recording is triggered.
 - a. 0 s
 - b. 30 s
 - c. 60 s
 - d. None of the above.

Tear out answer sheet, fold, tape, and mail back. Prizes will be sent to the first 1,000 technicians who return this quiz and earn a passing grade.