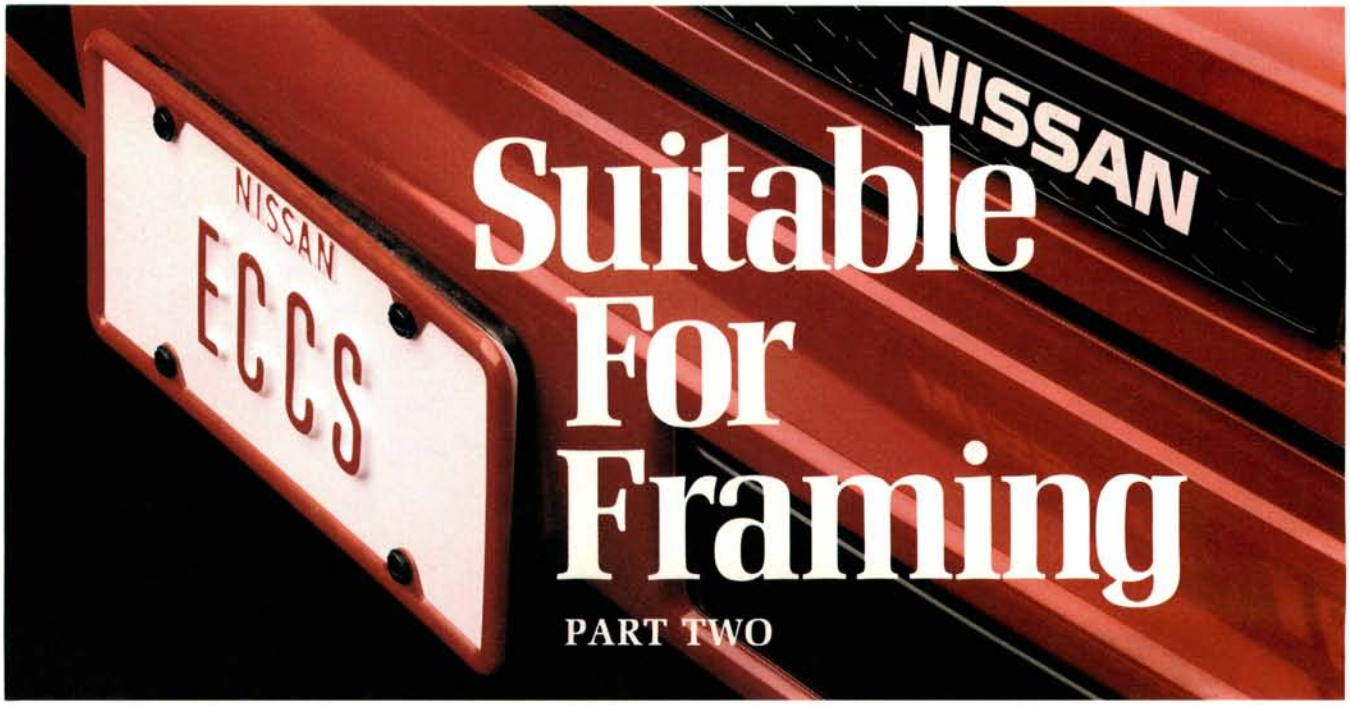


Suitable For Framing

PART TWO

Last month we covered the basic operating principles as well as the component functions and locations of Nissan's ECCS engine management system. This time around we'll look at specific troubleshooting tips on Nissans equipped with Three and Five Mode ECCS systems.

Get With the Program

To get the best troubleshooting results, it's important to follow the proper diagnostic routine. Sloppy diagnostic habits will give you unreliable answers.

Start with a visual inspection. Don't waste time looking for complicated answers when the real problem might be a loose connector or damaged wiring harness. Individual ECCS components are usually reliable. Problems will often be found in the wiring harness or its connectors. Harness corrosion can also cause problems, especially in Snow Belt states.

Check the engine's mechanical condition next. Make sure that all engine adjustments are set to specifications. Simple things like fuel pressure and idle speed are often overlooked. The ECCS system won't work properly if the basics are out of whack. But if everything checks out to this point, you're ready to begin ECCS self-diagnostics.

Trouble Codes

There are too many ECCS trouble codes to list all of them here. Trouble codes don't always have the same meaning in both Three and Five Mode systems. Fortunately, trouble codes are consistent within each system. As you might expect, newer Five Mode models have the most possible codes. Unless you have a photographic memory, you'll need a service manual to sort out the trouble codes, and also for a listing of diagnostic trouble trees.

Another good reason for using a service manual is what Nissan calls "non-diagnostic items." These are the ECCS components and circuits that aren't covered by a trouble code. Even the most up to date Five Mode ECCS system won't have a trouble code for every ECCS component. The list of ECCS components that aren't covered by a diagnostic trouble code is actually longer than those that are.

Five Mode Clamping

During closed loop idle operation, the ECU searches for the best possible idle air/fuel ratio. This could cause a rough or uneven idle if the ECU were allowed to constantly adjust the injector pulse width between rich and lean. Five Mode ECUs have a "clamping" feature which prevents these problems.

The ECU's clamping program kicks in after the ECU has made several adjustments to the closed loop idle injector pulse duration. This sample period only lasts five to ten seconds, just long enough for the ECU to get close to the perfect injector pulse width. At that point, the ECU clamps on a pulse duration setting that's about halfway between the last lean and rich pulse duration readings.

You can watch the ECU clamp at idle when the ECU is in self-diagnostic modes One or Two. Watch the green LED blink on and off in Mode One. The green LED will go off if the exhaust gas sensor has sent a rich signal to the ECU. If the LED is on, a lean signal has been sent.

When the engine is idling in closed loop, the LED

should blink off and on for about five to ten seconds. As soon as it stops, the ECU has clamped. After clamping, the green LED may be either off or on, depending on whether the mixture was slightly rich or lean when the ECU clamped. The clamped pulse duration setting is never 100 percent perfect, but it sure beats an idle that hunts.

Fail-Safe

Most ECCS systems include fail-safe or back-up systems. The ECU automatically switches into fail-safe mode when a problem is detected in a fail-safe protected component. Depending on the model, the ECU's fail-safe system may monitor the air flow meter, fuel pump, fuel injectors, or cylinder head temperature sensor circuits.

Engine performance in the fail-safe mode varies, depending on which component has failed. A cylinder head temperature sensor failure may cause a barely noticeable change in performance. The fail-safe program for head temperature sensor failure causes the ECU to supply a preset injector pulse width to the injectors, equivalent to a warm engine. The effect on driveability in fail-safe can be mild enough that the driver may not notice any significant change, or the actual cause of his problem may be misinterpreted.

Other component failures will cause more noticeable changes in driveability. The ECU's fail-safe program for air flow meter failure limits engine RPM to between 2000 and 2800 RPM. During a fuel pump circuit malfunction, the ECU energizes the fuel pump relay until the ignition is turned off. These fail-safe functions allow the car to limp through the front door of your shop.

—By Karl Seyfert

Pickup A La Mode Three

Three Mode ECCS systems were used on fuel injected Nissans produced between 1984 and 1986. The Three Mode ECCS system was an early Nissan attempt at an engine management system with limited self-diagnostic ability. The system was able to monitor oxygen sensor and mixture ratio control, store trouble codes, and also do a few switch tests.

The Three Mode ECU has a red and a green LED for trouble code retrieval and other diagnostic information. During code retrieval, the red LED will flash first (for the tens digit), followed by the green LED (for the ones digit). Do you remember new math?

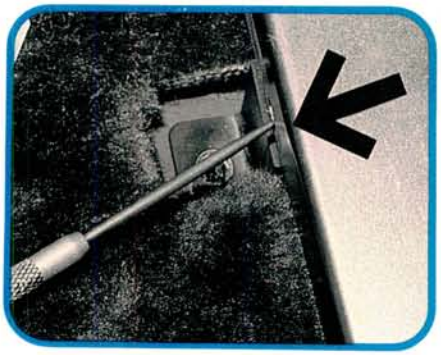
During code retrieval, the Three Mode LEDs will usually flash some "false codes." The service manual will instruct you to operate a certain switch or control to cancel the false codes. This is the ECU's way of testing the operation of these components. If the false codes remain after the switch tests, you've got a real code, not a pretender.

Three Mode systems are also equipped with a diagnostic connector, usually located under the dash, close to the fuse panel. The connector is used to tap into the ECCS wiring harness for remote voltage and resistance testing of several ECCS components.

We picked a late example of the Three Mode system, a 1986.5 Pickup, for several of our photos. To make things more interesting, this particular pickup was suffering from an intermittent ECCS problem. Refer to the chart in last month's article for an outline of the Three Mode system's diagnostic modes. We'll be spending most of our time in Mode Three, looking for trouble codes.

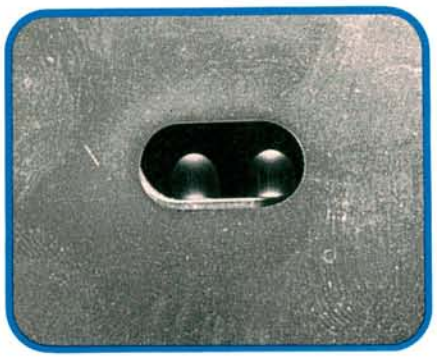
1

Getting to the ECU is the first order of business during Three Mode ECCS diagnosis. We removed the passenger seat on our 1986.5 Pickup guinea pig. This gave us a clear shot at the ECU to check trouble codes and to do our circuit testing. Remove the diagnostic switch's rubber cover.



2

Make sure the diagnostic switch and ignition switch are both turned off. Turn the ignition switch on. Both ECU LEDs light to let you know the ECU is getting power. Turn on the diagnostic switch. If there are any stored trouble codes, the LEDs will begin flashing them now.



3

The LEDs flash each code once, then move on to the next, starting with the lowest trouble code. The codes will repeat after all codes have flashed. This system has two "false codes," a 24 for the Neutral or Clutch/Inhibitor Switch and a 31 for the Load Switch.

4

To clear the false codes, turn the headlights on and off. On automatics, shift the transmission between Park and any other gear. On stick shifts, depress the clutch, shift between neutral and any other gear, then release the clutch. Now depress the clutch, shift back to neutral, then release the clutch.

5

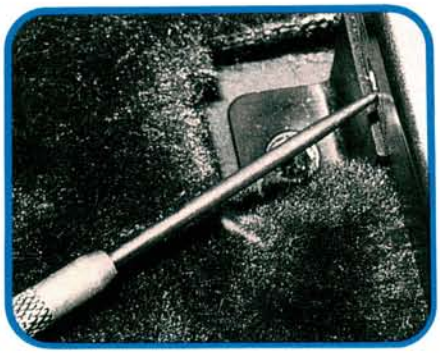
The LEDs should be flashing a friendly Code 44 if there are no other codes. Our truck had an intermittent Code 21 (Ignition Signal), so we didn't get a Code 44 after eliminating 24 and 31. We'll take you through the diagnostic procedure for Code 21.

6

The owner complained that his truck lost power and ran rough intermittently, as though someone were turning the ignition off and on. The tachometer also dropped to zero while this was happening. His description of the symptoms fit nicely with the Code 21 (Ignition Signal) the ECU held in its memory.

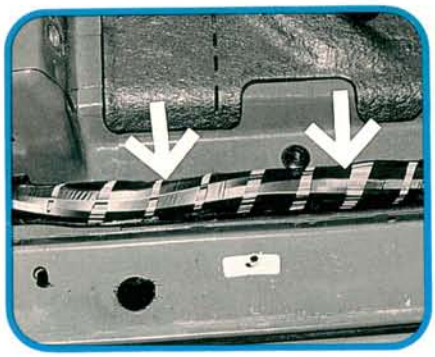
7

We checked for battery voltage at terminal 1 on the main harness side of the power transistor connector, and found no problem there. Next we attached our logic probe to terminal 5, then started the engine to check for a pulse (left photo). The input voltage signal at terminal 3 (right photo) also checked good.



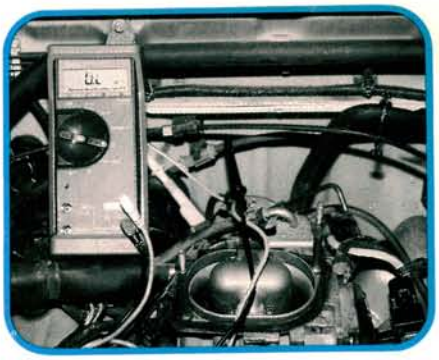
8

The rest of the Code 21 trouble tree checked good. The ECU's memory is cleared by turning the ignition switch on, then turning the diagnostic switch on for two seconds, then back to off. The ECU didn't store any new codes during several road tests and the truck ran great, a perfect example of an intermittent problem.



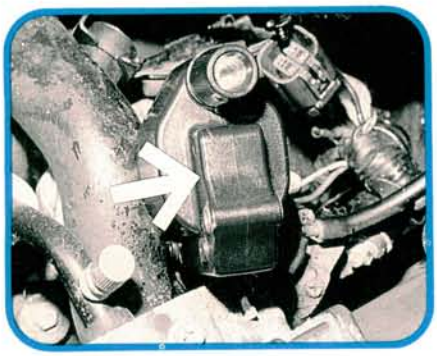
9

We were back to square one. Using the wiring diagram, we traced the circuit between the ECU and the power transistor in hopes of finding our intermittent. We checked for a corroded ECCS harness along the passenger floor pan because of a previous experience on another Nissan pickup. Nothing doing.



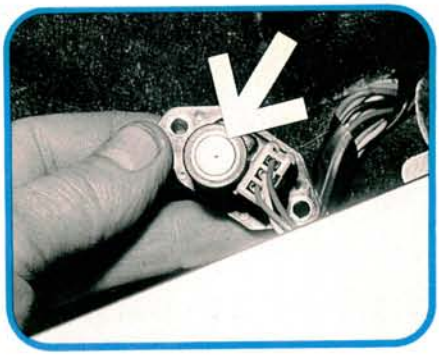
10

Some Nissan models may develop similar symptoms when their throttle sensors fail. Step on the gas several times. Unplug the throttle sensor connector, then connect an ohmmeter between terminal "d" and ground. Resistance should be infinite. Resistance should also be infinite at terminals "e" and "f." It was.



11

Our searching finally turned up something, even though it was in a round about way. The molded ignition coil had cracked along its seam. The coil was leaking its spark to ground under load. The ECU interpreted this as an ignition signal failure.

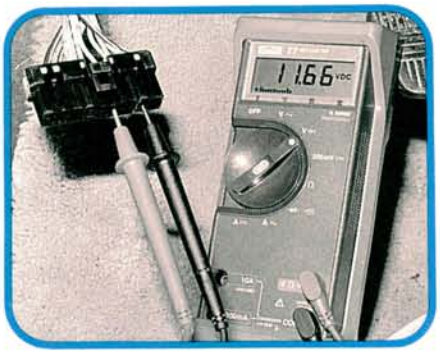


12

Don't look for a CO bypass screw in the air flow meter on throttle body ECCS systems. The screw's been moved from the air flow meter to the side of the ECU. Remove the anti-tamper plug to reach the screw. The ECU's LEDs can be used to set the CO, but a four gas analyzer provides a more precise adjustment.

13

The Three Mode diagnostic connector (usually near the fuse box) is shaped differently than the Five Mode connector. Five Mode scan tools and checker boxes won't fit the Three Mode connector, although its terminals can be used for several ECCS circuit voltage tests.



14

We used the pickup's Three Mode diagnostic connector to check the mixture heater, ignition switch, idle switch, EGR cut solenoid, AIV cut solenoid, load switch, and inhibitor switch circuits. This can be a real time saver when components and connectors are hidden in hard to reach locations.

Five Mode Diagnosis

A few models made the switch to Five Mode ECCS beginning in 1986.5, and by 1987 the changeover was complete. Things get a bit more complicated with the Five Mode ECCS system. Five Mode ECUs play a pretty good game of hide and seek. You might find one under the seat (driver or passenger side), or then again it might turn up in the kick panel (either side), depending on the model and year.

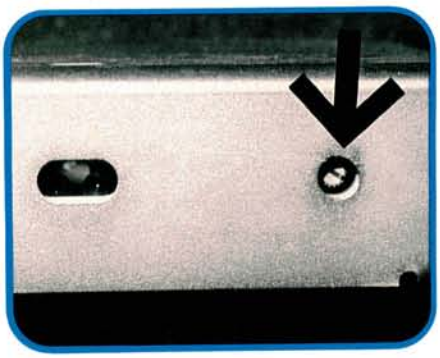
All Five Mode systems have a diagnostic connector that can be used to short cut this game of ECU hide and seek. The diagnostic connector is intended for use with a remote checker box or scan tool. All five of the ECU's diagnostic modes can be accessed using the Five Mode diagnostic connector and the checker box.

Refer to the April 1989 issue of *Import Service* for a complete description of the dedicated Nissan checker box. The checker box is not intended for use with the Three Mode diagnostic connector.

While checker boxes and scan tools are handy, neither is essential for effective Five Mode ECCS diagnosis. All the information these tools provide can be retrieved at the ECU, if less conveniently. Look at it this way, you're probably going to have to dig out the ECU for pin testing anyway. It's either now or later.

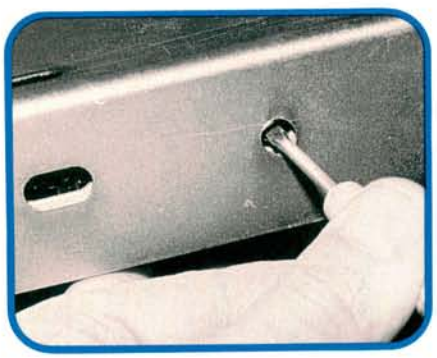
1

Position the ECU so that you can see the LEDs and diagnostic switch. Turn the ignition on. Both LEDs should light and stay lit. Shut the ignition off while watching the LEDs. The LEDs and the ECU take several seconds to shut off. That's why it's important to disconnect the ECU with the power off.



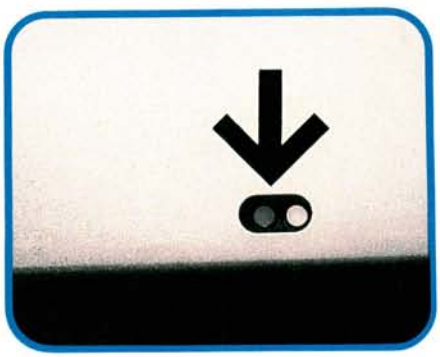
2

Turn the ignition back on. To put the ECU into self-diagnostics, turn the selector fully clockwise. Both LEDs will begin flashing together, once for mode one, twice for mode two, etc. If the selector switch is left in the "on" position, the mode selections will continue to scroll by on the LEDs.



3

To select a mode, carefully turn the selector switch counterclockwise to the "off" position immediately after the LEDs flash the diagnostic mode you want to enter. The chart in last month's article will give you a description of each diagnostic mode's function.



4

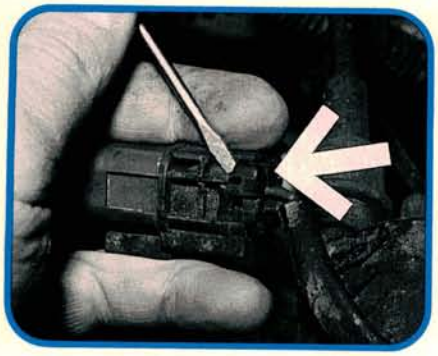
We'll make our first stop at Mode Three to check for stored trouble codes. Trouble codes are played back from lowest to highest, then repeated—just like a Three Mode system. The trouble code memory will be erased if you stop the ECU at Mode Three, then move forward and stop at Mode Four.

5

Up to now, we've looked at stationary tests. Sometimes the problem won't show up unless the car is driven. Mode Five handles "Real Time" diagnosis. The ECU monitors several ECCS circuits in Mode Five and will flash a trouble code as soon as an intermittent problem is detected.

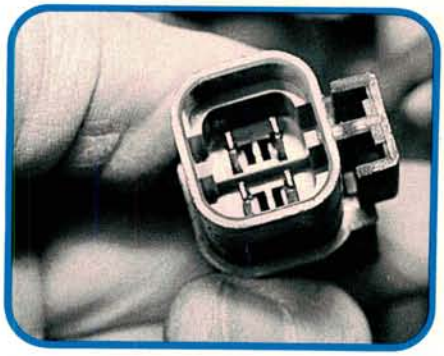
6

Unless you've got a riding partner, it's pretty tough to watch the LEDs and drive at the same time in Mode Five. Nissan's dedicated checker box plugs into the diagnostic connector, making real time diagnosis much easier and safer. Scan tools are also available from aftermarket suppliers for this purpose.



7

There are several choices when taking DVOM readings at harness connectors. Measurements may be taken on the harness or terminal side of the connector, and with or without the wiring harness and component connectors plugged together. Remove plastic covers (arrow) for harness side (H.S.) measurements.



8

Read the diagnostic instructions carefully. Make sure where the measurement is to be taken. This test at the ignition coil connector called for a reading on the terminal side (T.S.) of the main harness with the coil wiring disconnected. Avoid touching test leads to each other during terminal side DVOM tests.

9

A new diagnostic tool called "Consult" was introduced for use on selected 1990 models. By 1992, all Nissans will use this new system. The Consult unit uses the diagnostic connector to make active component tests, simulate operating conditions, override preset values, record, and play back ECCS data.

10

In addition to ECCS, the 300 ZX's automatic transmission, climate control, and Super HICAS (rear steering) systems can also be diagnosed using Consult. Automatic Climate Control trouble codes can be retrieved directly through the dash controls. One car may have as many as five separate ECUs talking to each other.