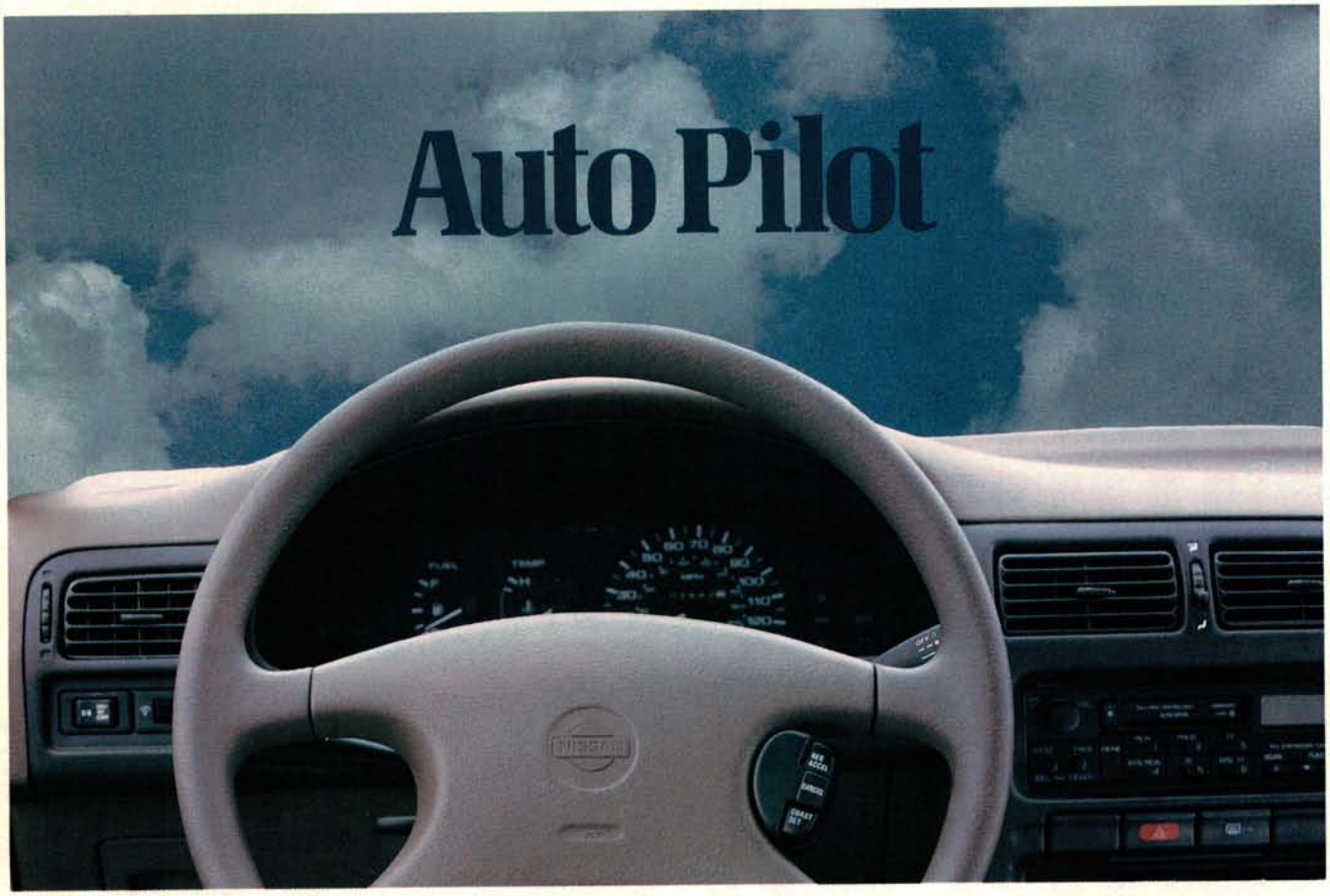
Auto Pilot



How much time do you spend each day commuting to and from work? If any of that time is spent traveling on a boring freeway, there may have been times when you wished there was a way to switch your car over to Auto Pilot. Airplane pilots can do it, why can't we?

Computer controlled vehicle guidance systems may make it to market some day, but for now we'll have to content ourselves with cruise control systems that can maintain vehicle speed. Automotive cruise control systems may be far less sophisticated than their aviation cousins, but they can still be a handful to diagnose and repair when something goes wrong.

Most early cruise control systems used regulated engine manifold vacuum to control the throttle opening. Automotive engineers started looking for other methods when engines started sprouting more vacuum hoses than a plate full of linguini. By the time all of those hoses took their share of the manifold vacuum, there just wasn't enough vacuum left over to operate the cruise control system.

If there's not enough engine vacuum, what can be used instead? We've chosen two cruise control systems for this article, one from Nissan and the other from Volkswagen and Audi. Beside being from opposite ends of the world, these systems also offer two decidedly different answers to the low engine vacuum problem.

If there's not enough vacuum to run the cruise, why not make your own? That's the approach the Volkswagen system uses. The system may remind you of a conventional cruise control system with the only difference being the addition of a vacuum pump. The vacuum pump kicks in to give the system the vacuum it needs to open the throttle.

Unlike the Volkswagen system and most other cruise control systems, the 1984 Nissan Stanza's Automatic Speed Control Device (ASCD) uses pressure rather than vacuum to control the amount of throttle opening. A small compressor capable of producing about 14 PSI is built into the ASCD actuator. The actuator is a one piece unit that is connected to the vehicle throttle linkage to control vehicle speed.

Both systems use small electronic control units to manage system operation. The Nissan system is all electronic, so we won't be checking any vacuum hoses for leaks during our diagnosis. We'll do lots of harness terminal tests instead.

The Volkswagen system is more of a hybrid. Think of it as a vacuum system with electronic control. The electronics decide what needs to be done, then adjust the vacuum supply to do it.

You can draw your own conclusions about which system was more successful. The Volkswagen system is still in use on current Volkswagen and Audi models with minor modifications. Nissan now also uses vacuum pump cruise control systems on several of their cars and abandoned the compressor system a few years ago.

— By Karl Seyfert

VOLKSWAGEN/AUDI SYSTEM

1

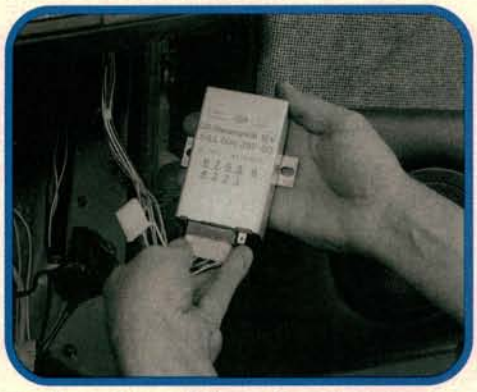
First Things First

Let's eliminate the obvious first. The cruise control will not operate with blown fuses or brake light bulbs. This system is used on a wide variety of Volkswagen and Audi models. Consult a service manual to find the number of the fuse or fuses that power the system you are working on.

2

Vacuum Hose Test

Check for vacuum leaks next. Disconnect the supply vacuum line at the vacuum pump. Press the vacuum servo diaphragm, then close off the disconnected vacuum line. If the servo leaks down and returns to its original position, look for leaks in the clutch and brake vent valves, vacuum servo, or vacuum lines.



3

Backprobing Etiquette

Remove the trim panels and locate the control unit. Disconnect the control unit's multipin harness connector. The connector terminal numbers are marked on the control unit. To avoid terminal damage, conduct all wiring tests by backprobing the rear (harness) side of the connector.

4

System Ground and Power Supply

Resistance between a good chassis ground and terminal 8 should be 0 ohms. Turn the ignition and cruise control switches on. Check for battery voltage between terminals 1 and 8. If the voltage is low or 0 volts, check the column switch and wiring for damage. Also recheck the cruise control fuse.

5

Brake Light Circuit

Move the negative voltmeter lead to terminal 3 and check for battery voltage. If the reading is low or 0 volts, check the brake light switch for proper adjustment. Then check the cruise control column switch and wiring. Finally, check for a good ground through the brake light circuit.

6

Cut Off Circuit Checks

Leave the voltmeter leads connected to terminals 1 and 3. Depressing the brake pedal, clutch pedal, or turning off the cruise control switch should drop the voltmeter reading to 0 volts. Inspect the vent valves, cruise switch, and related wiring if the voltmeter reads battery voltage during any of these tests.

7

Set and Resume Operation

Move the positive lead to terminal 6 and the negative lead to terminal 8. Check for battery voltage when the RESUME switch is pressed. Move the positive lead to terminal 2 to check for battery voltage when the SET switch is pressed. Inspect the cruise control column switch and wiring if either reading is incorrect.

8

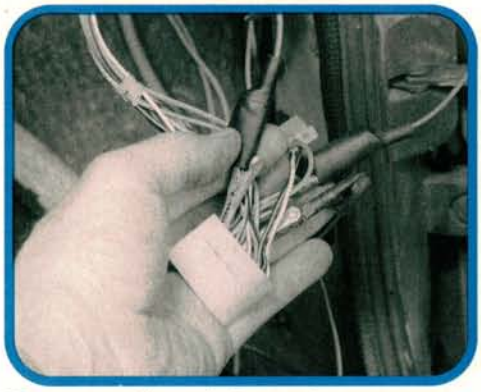
Vacuum Pump Tests

Put your DVOM aside. To test vacuum pump operation, run jumper wires from terminals 7 and 4 to terminal 8. Turn the ignition and cruise switches on. The vacuum motor should run and fully open the throttle. Check for vacuum leaks or faulty vacuum vents if the pump runs but the throttle doesn't open.

9

Vacuum Pump Cancel Circuit

Depressing the brake or clutch pedal must vent the servo vacuum and close the throttle. If the servo doesn't vent and the throttle stays open, check for an incorrectly adjusted or sticking vacuum vent valve. If both are working properly, check for obstructions in the vacuum lines to the servo.



10

Vacuum Circuit Integrity

Disconnect the jumper lead between terminals 4 and 8, but leave the jumper between 7 and 8 connected. The vacuum pump should stop running, but the vacuum servo must hold vacuum to keep the throttle open. If not, check for vacuum leaks. The throttle must close when the jumper between terminals 7 and 8 is removed.

11

Speed Sensor Static Test

The control unit should prevent cruise control engagement below about 30 MPH. To test the vehicle speed sensor, attach your ohmmeter leads to terminals 5 and 8. Resistance should be 1000 to 1300 ohms. Inspect the speed sensor and related wiring if the resistance is out of range.

12

Speed Sensor Dynamic Test

A dynamic speed sensor test is specified for some later cruise systems. Turn the ignition and cruise control switches on. Raise one front wheel and block the other. Slowly rotate the wheel forward while watching the voltmeter. The voltage at terminals 5 and 8 should vary between 0 and 10.5 volts.

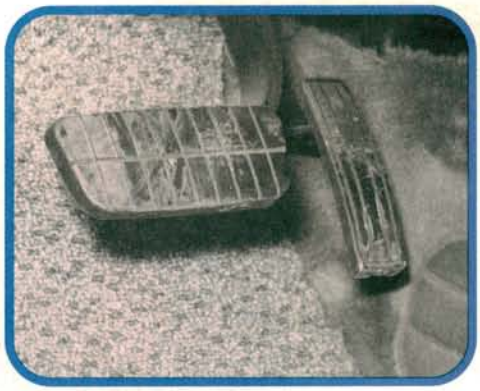
Auto Pilot

NISSAN SYSTEM

1

Power Supply Circuit Check

The Nissan control unit is located behind the right kick panel. Remove the control unit harness connector, then turn on the ignition and ASCD main switches. Check for battery voltage between terminals 5 and 14. The terminals numbers are on the connector. Backprobe from the harness side of the connector.



2

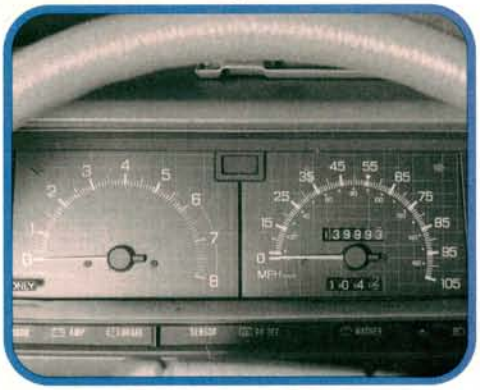
Cut Off Circuit Check

If the cruise control won't engage, the cut off circuit may be open. With the transmission in Drive and the ignition and cruise switches on, check for battery voltage between terminals 5 and 13. The stop light switch, clutch switch, inhibitor relay, and inhibitor switch can interrupt this circuit.

3

Set Switch Circuit Check

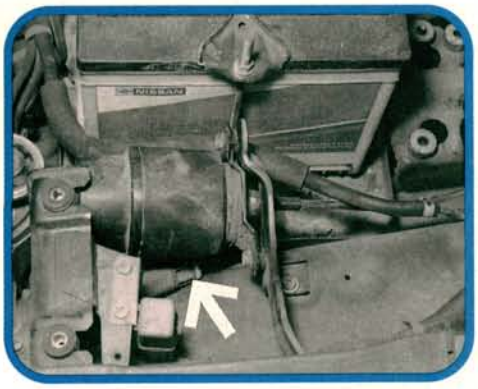
To check the set switch circuit, turn the ignition switch off. Connect ohmmeter leads between terminals 1 and 14, then push the ASCD set switch. The ohmmeter should read 0 ohms. If not, check the set switch contacts and the wiring between the set switch and the control unit for damage.



4

Speed Sensor Circuit Check

If the cruise control still won't engage, check the speed sensor circuit. Disconnect the speedometer cable at the transmission. With the ignition off, connect an ohmmeter between terminals 5 and 10. Slowly turn the speedometer cable. The ohmmeter should deflect twice per cable revolution.



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Actuator Check I

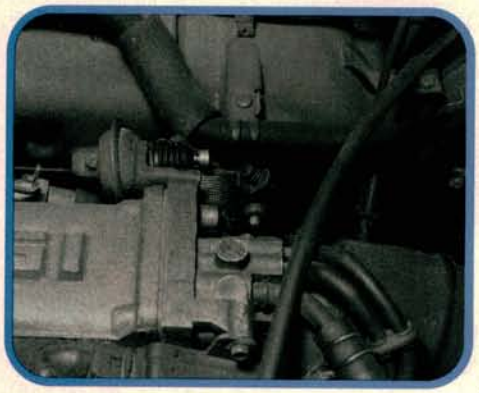
Check the actuator next. The actuator must be replaced if it flunks any test. Probe at the front of the actuator's six terminal male connector. Top left is terminal 1, bottom right is terminal 6. The motor should run after connecting battery voltage to terminal 6 and grounding terminal 4.

6

Actuator Check II

The resistance between terminals 4 and 5 should be 0 ohms. Now apply battery voltage to terminal 1 and ground terminal 2. The ohmmeter should now show an open circuit between terminals 4 and 5. Run the motor for 30 seconds using terminals 6 and 4. Resistance between terminals 4 and 5 should return to 0 ohms.

Circle No. 108 on Reader Service Card



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Actuator Check III

Dig out your jumper wires. Ground terminals 3 and 4. Apply battery voltage to terminal 1, then ground terminal 2. The motor should run, and pull the throttle open. The throttle should close within a minute after removing the ground from terminal 2, and close immediately after ungrounding terminal 3.

8

Cut Off Circuit Check

If the set speed won't cancel, check the cut off circuit. Turn the ignition and ASCD main switches on. Connect a voltmeter between the control unit harness connector terminals 5 and 13. Stepping on the brake or clutch pedals, or shifting into neutral on automatics should drop the voltage to 0.

9

Stop Light Circuit Check

If the cut off circuit checked out, move on to the stop light circuit. Leave the ignition and ASCD main switches on. Connect a voltmeter between terminals 5 and 9, then step on the brake pedal. If the voltmeter indicates battery voltage and you've already tested the actuator, replace the control unit.

10

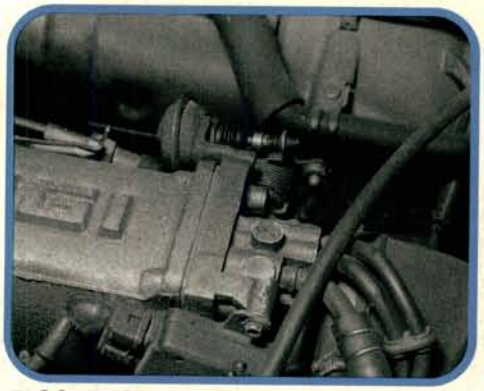
Resume Switch Circuit Check

If the cruise won't resume after it's cancelled, turn the ignition switch off. Connect an ohmmeter between terminals 2 and 14 at the harness connector. Push the RESUME switch. If the ohmmeter reading doesn't drop to 0 ohms, check for wiring breaks or a defective resume switch.

11

Accelerate Switch Circuit Check

If the cruise won't accelerate above the set speed, turn the ignition off. Connect an ohmmeter between terminals 3 and 14, then push the ACCELERATE switch. If the ohmmeter reading doesn't drop to 0 ohms, check for wiring breaks or a defective switch. If the ohmmeter reading checks good, replace the control unit.



12

Cable Adjustment

If the cruise control drops below or overshoots the set speed, the actuator cable may be incorrectly adjusted. Without depressing the accelerator, turn the actuator cable adjusting nuts until there is no cable free play. Overtightening the cable may keep the throttle from closing at idle.