Foreign Service



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The A/C button's insistently blinking LED may catch your Toyota customer's eye. This month, Dan explains the purpose of the LED and the system behind it.

ush the A/C button on an Asian vehicle and you expect two things to happen: The system should produce cold air and the button's LED should turn on and stay on. Suppose you push the A/C button on a Toyota and the compressor doesn't run? What's more, what if the LED on the button blinks steadily? This column explains what that blinking LED means.



Toyota began equipping its a/c compressors with speed sensors in the 1980s. This sensor, which measures compressor rpm, was initially a simple reed switch. By the early '90s, it became an AC signal generator. The oscilloscope pattern below shows a typical compressor speed signal, captured at idle on a 1997 Avalon. Hands down, the scope is the most accurate way to test this sensor.

Whenever the air conditioner is running, a small computer called an *air conditioning amplifier* constantly monitors compressor rpm and compares it to engine speed. The air conditioning amplifier, which is made of a black plastic material and is a little larger than a pack of cigarettes, is usually located on or near the evaporator case.

Before we proceed, let's avoid confusion by clarifying three details our Toyota buddies emphasize. First, although many technicians know the compressor speed sensor as a speed or rpm sensor, many shop manuals call it a *lock sensor*. That's *lock*, as in "the compressor may lock up!" Second, manuals often identify Toyota's engine rpm signal as Ne. Third, the electrical schematics sometimes show a reed switch when, in fact, the vehicle has the AC signal generator-style lock sensor.

The amplifier shuts off the compressor clutch and blinks the A/C button's LED whenever it senses a major difference between compressor speed and engine speed. Your job, should you choose to accept it, is to diagnose what's causing this difference in speed. The root cause could be as simple as a slipping drive belt or overcharged air conditioner. Or it may be as severe as a seized compressor.

The compressor clutch itself could be failing (slipping). For that matter, the clutch could be slipping due to an overcharge or a major voltage drop across its power supply circuit (badly worn clutch continued on page 14

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relay contacts). The root cause could also be an intermittent open occurring in the clutch circuit (a tired, temperamental clutch relay popping open).

Whatever you do, don't expect the LED on the A/C button to blink for just any a/c failure. For example, say you open up a Toyota system to replace leaking expansion-valve Orings. Then, when you put everything back together, you forget to reconnect the thermistor that monitors evaporator temperature. The air conditioning amplifier interprets the disconnected thermistor as being an extremely cold evaporator-too cold to turn on the compressor. Therefore, the amplifier won't turn on the clutch, and it won't blink the LED for this condition, either.

Once again, the amplifier blinks the LED only when it senses that difference in rpm we discussed earlier.

If the lock sensor itself fails, the air conditioning amplifier shuts off the compressor clutch and blinks the LED. One quick way to simplify diagnosis is to carefully hot-wire the clutch with a fused jumper lead and run the compressor just long enough to see if its lock sensor generates a decent AC signal on the scope. If it doesn't, replace the sensor and retest.

Often, all it takes to temporarily power up the compressor is to remove the air conditioning relay and jumper across the correct pair of terminals in its socket or connector. If you mistakenly jumper across the two control-side terminals, you may let all the smoke out of the air conditioning amplifier!

Unless the Toyota you're working on has automatic temperature control (ATC), you won't have any trouble codes to assist you. Beginning in the early '90s, amplifiers on ATCequipped Toyotas *do* store trouble codes. However, you'll have to refer to the appropriate shop manual because the procedure for pulling a/c codes varies from vehicle to vehicle. Note also that within the last few years, the ECM has begun handling some of the amplifier's duties.

Lock Sensor R&R Tips

A lock sensor R&R amounts to major a/c service because you have to discharge the system before removing the old sensor. Price the job accordingly and don't forget details such as a new receiver-dryer. If the lock sensor has a snap ring, Toyota specialists urge you to look at it very closely before you remove it. Note which side of this snap ring is beveled and reinstall it the same way you found it. If you put this snap ring on backward, refrigerant pressure will eventually blow the lock sensor out of the compressor!

Finally, remember that Previa minivans produced from 1991-97 don't have a lock sensor. If you see a blinking LED on a Previa's A/C button, you can bet that a diode inside the button assembly has failed. In that case, just replace the entire A/C button assembly.



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