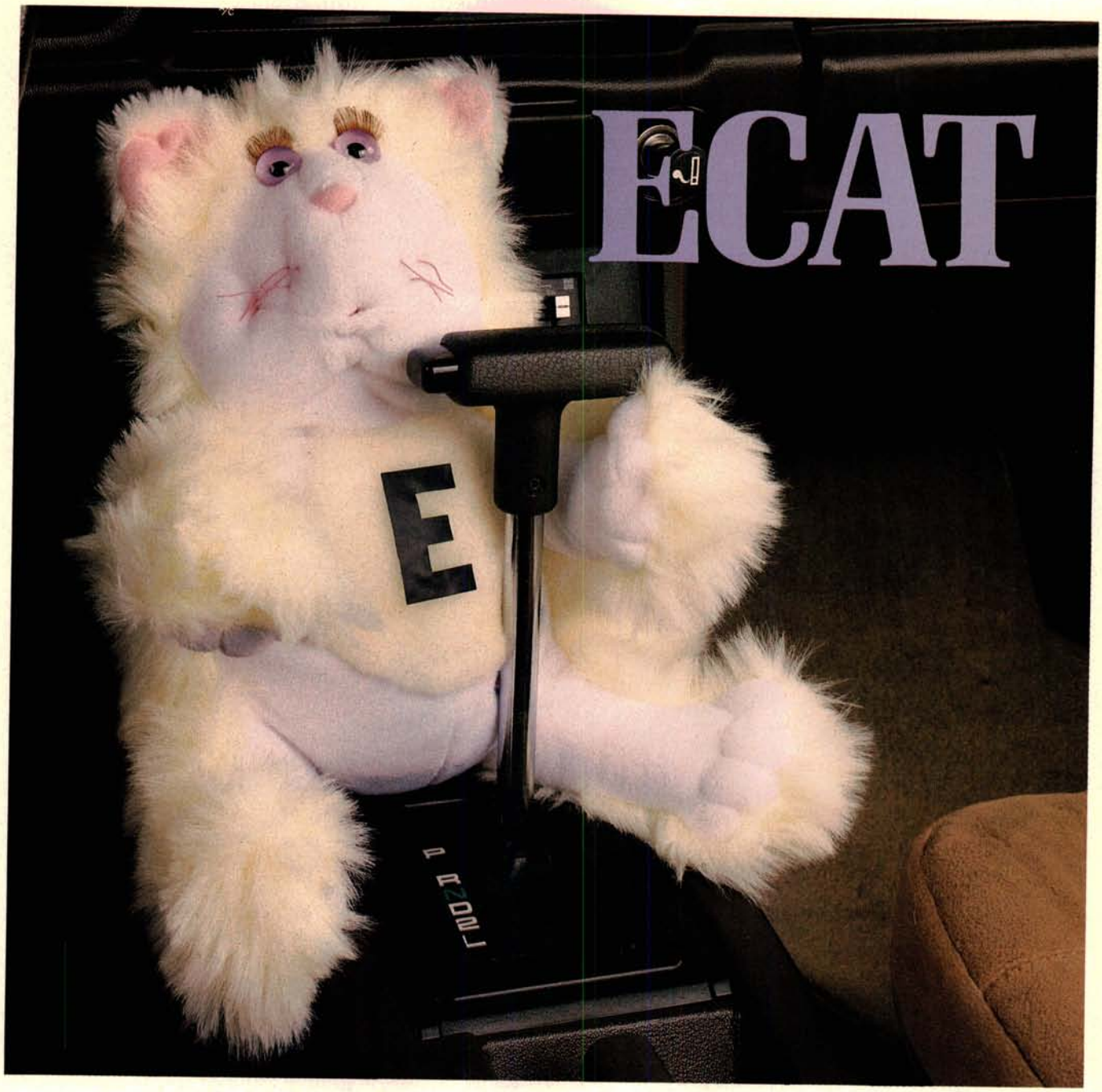
ECAT



So you've been playing cat and mouse games with diagnosis of Electronically Controlled Automatic Transmissions (ECATs). You're never sure if the problem is a transmission hydraulic problem, a transmission computer problem, or an engine performance problem. How do you isolate the cause of a late shift, hard shift, or no shift at all?

This month, we'd like to declaw some diagnosis procedures for Toyota's A43DE rear drive electronically controlled transmissions—and help you get them purring again. These transmissions were bred from the old Toyota A40 bloodlines, and the litter from which our ECAT came included both electronically controlled and old hydraulically controlled transmissions.

The A43DE was used in Cressidas from 8/84 to 8/86 and in Supras from 8/82 to 12/85. Electrical diagnosis procedures for the entire run of these transmissions are not the same. Later style cars used a multipoint diagnostic test connector. Earlier cars, like our '84 Cressida used a single wire diagnostic terminal—the DG terminal. This article will concentrate on diagnosis of the single wire system.

Those of you who don't do trans overhauls shouldn't run off. This is not a rebuild article. A few internal components will be shown, but the real purpose of our efforts is to cut through some of the lengthy and often confusing information found in the shop manual's transmission diagnosis section.

ECAT

General Concepts

- The throttle cable in the A43DE does not control shift points. It controls shift quality (hard or soft shifts).
- Shift points are controlled electronically by solenoids in the valve body.
- A small computer in the left front kick panel on our 1984 Cressida receives inputs from various sensors to determine when to open or close the solenoids.
- Since our ECAT is electronically controlled, two of our old friends from the hydraulic control days are gone: (1) the vacuum modulator has been replaced by the same throttle position sensor used by the fuel system, and (2) vehicle speed is no longer monitored by a hydraulic governor. Instead we have two speed sensors, one at the transmission output shaft, and a second backup sensor in the instrument cluster which measures the speed of the speedometer cable.

Divide and Conquer

In a moment, we'll take you through one logical troubleshooting path for the A43DE. But before we start, please eliminate the obvious. Check the fluid in the trans to make sure it's clean and at the proper level.

And make sure the engine is running properly before condemning the transmission for erratic shifts. Transmission repair specialists tear their hair out when a rebuild comes back because of an engine performance problem.

John Wozniak of Freudenberg NOK not only walked us through a complete teardown of this transmission, he also added a number of great troubleshooting tips not found in the shop manual. Thanks again, John.

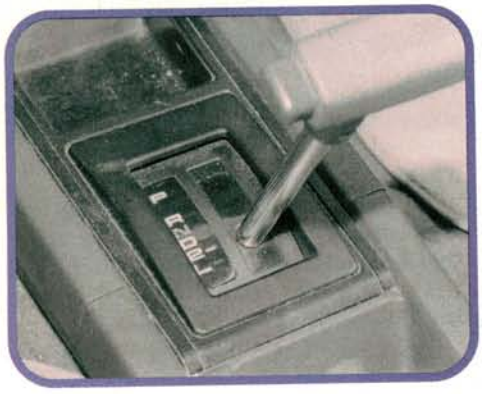
—By Ralph Birnbaum

1

Is your problem in the trans or in the computer? Test drive the car, both cold and hot. If the tranny slips or chatters, suspect a mechanical problem in the transmission. If the transmission is shiftless or shifts at the wrong times, it's time to check the shift solenoids and the ECT circuits which operate them.

2

Still not sure if it's the ECT computer or the trans? Disconnect the computer and drive the car. The ECT computer is located behind the left front kick panel. There are three screws holding the kick panel in place, and one is buried in the carpet trim. Locate the computer and unplug it (key off, please).



3

You can test all but second gear by manually shifting through the gears with the computer disconnected. Start with L (which should give you 1st gear), then shift to 2 (which should give you 3rd gear), and finally, shift to D (which should give you overdrive). Watch for any signs of slippage or chatter.

4

Reconnect the ECT computer. Locate the single wire DG test terminal (used in '83 and '84). This is neither the two wire nor the three wire plug used for checking the engine computer. It is a single, black plastic connector (red wire with a yellow tracer) hanging at the back of the fuse box.)

5

Connect a DVOM between the DG terminal and ground. You can also tap into the DG terminal right at the ECT computer (arrow) if you want to keep your DVOM inside the car. Use the same red and yellow wire at the two wire connector going into the computer. Drive the car again. Have an assistant watch the voltmeter.

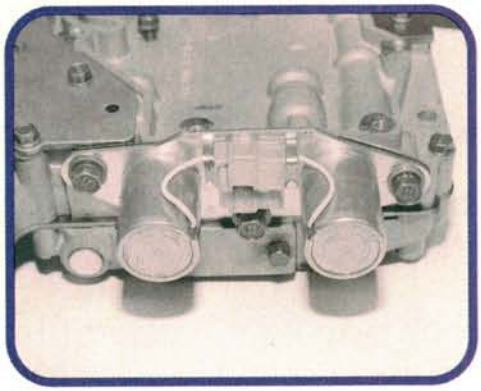
DG Terminal (V)	Gear Position
0	1st
2	2nd
3	2nd Lock-up
4	3rd
5	3rd Lock-up
6	OD
7	OD Lock-up

6

Your voltage readings should rise as shown in this chart. Don't shut the engine off after the test drive or you'll erase any stored information about trouble spots. With the car idling, check the voltage again. If the voltage reading at the DG terminal is zero volts, there are no stored codes.

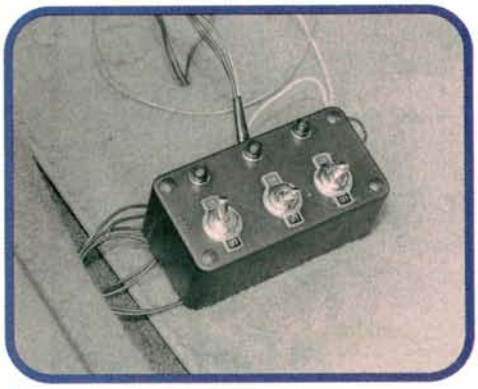
7

A 4 volt signal indicates a problem in the speed sensor or its circuit. An 8 volt reading indicates a solenoid problem. Now check TPS voltage. Turn off the ignition and slowly open the throttle. Voltage should rise smoothly from 0 to 8 volts. Then tap the brake pedal and look for voltage to drop back to zero.



8

If everything has checked out "okay" so far, your problem may not be electrical. Maybe one of these shift solenoids is clogged and sticking. You can bypass the ECT unit and energize the solenoids manually. You are about to send the same signals to the solenoids that the ECT computer is supposed to send.

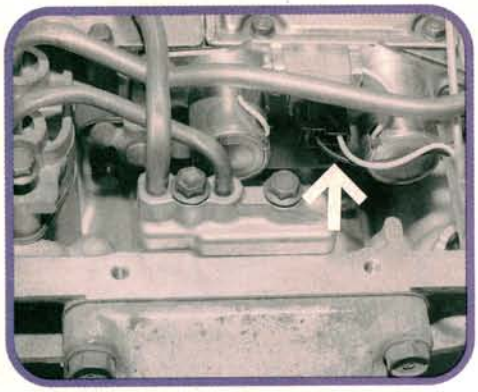


9

With the computer disconnected, substitute a homemade universal ON/OFF switch box like this one. The switches are placed between a 12 volt power source and the S1, S2 solenoid terminals in the ECT wiring harness. Drive the car and shift the transmission through all four gears using the switch box.

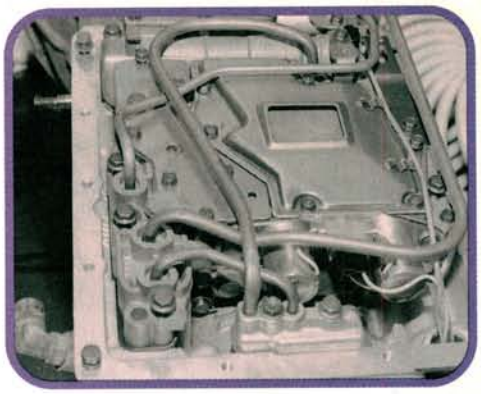
10

This procedure will determine whether or not the shift problem is in the solenoids or their circuits. By working directly from the computer plug, we're checking the entire solenoid electrical circuit–without dropping the pan. Our chart in the accompanying sidebar shows ON/OFF combinations for the four forward gears.



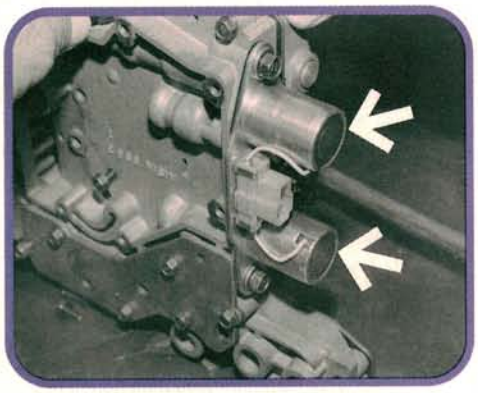
11

If the trans still won't shift, drop the trans oil pan. Check for shorts or opens in the solenoid circuits. Then alternately energize each of the solenoids with 12 volts. Plugged solenoids may have a different sound when energized. Instead of a crisp "click" you may get a slow "clunk" from a sticking piston.



12

Don't let the plumbing in the valve body intimidate you. The steel tubes are pressed into the valve body passages. Just pry them loose and remove them to give you access to the oil filter and solenoids. Be careful not to kink them when you remove them, and make sure they're nice and tight when you reinstall them.

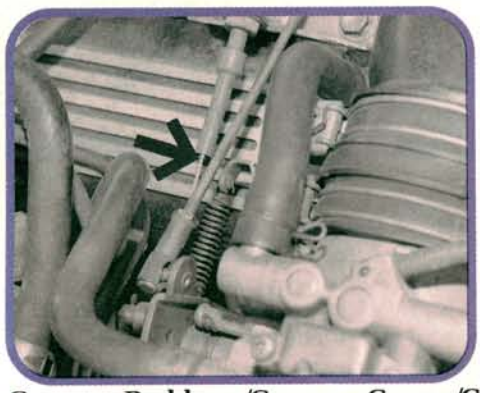


13

Solenoids are also electromagnets, and they will attract metal particles. This can cause them to stick mechanically, even if the holding coils are okay. Some rebuilders fix sticking solenoids by peeling back the lips on the solenoid cans, cleaning, and reassembling them. They are expensive to replace.

14

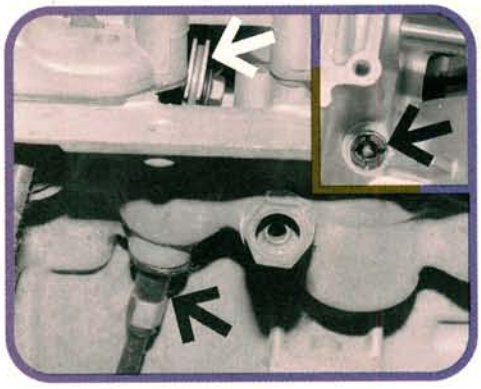
The lockup solenoid sits all alone at the opposite end of the valve body. Unlike the shift solenoids, it is normally open, venting hydraulic pressure until the solenoid closes it. If you're familiar with GM lockups, you'll understand how this system works. Lockup solenoids can also get plugged.



15

Common Problems/Common Causes/Common Fixes

If shifts are too harsh or too soft, check the throttle cable adjustment. Open the throttle all the way. There's a metal barrel pressed onto the cable. If the cable's adjusted properly, 1 mm of the barrel will extend beyond the rubber sleeve on the cable housing at WOT (arrow).

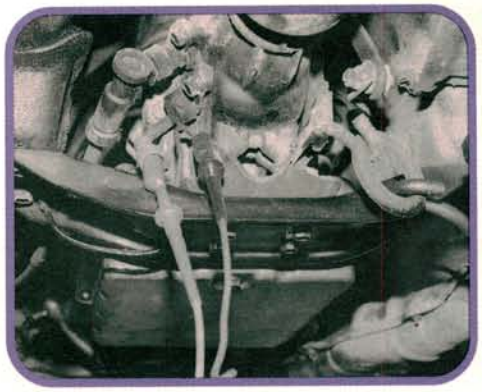


16

Throttle valve cable replacements are not a two minute job. The cable housing snaps into the tranny above the valve body. So you'll need to drop the valve body, not only to unsnap the housing, but also to hook the new cable end to the valve body pivot lever. And once again, cables ain't cheap.

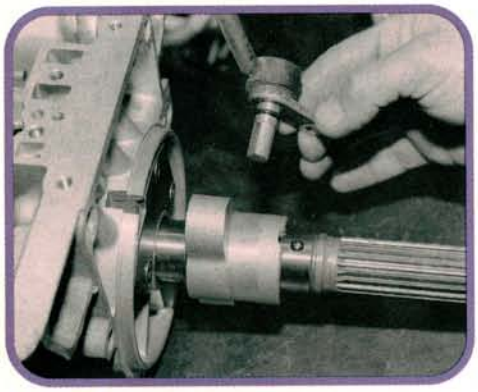
17

If the plastic locking tabs which hold the cable in the trans break, you can repair the old cable instead of replacing it. Teckpak/Fitzall (**Circle No.215**) has a repair kit which allows you to install a new end on the cable. The kit fits all Aisin Warner cables used by Toyota, Volvo, Jaguar, BMW and Jeep.



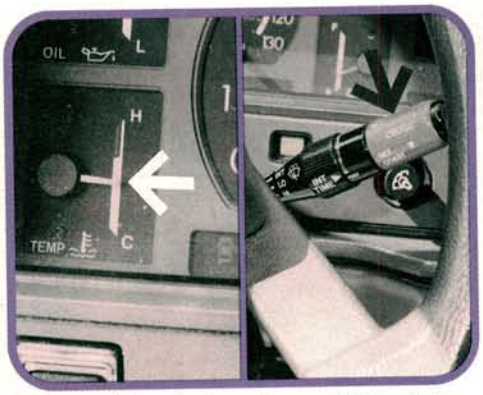
18

The governor used on hydraulically controlled trannys has been replaced by a speed sensor in the A43DE. Testing it is easy. Unplug the sensor. Connect an analog ohmmeter between the sensor lead and ground. As you turn the driveshaft, the meter needle should bounce back and forth between zero and infinity.



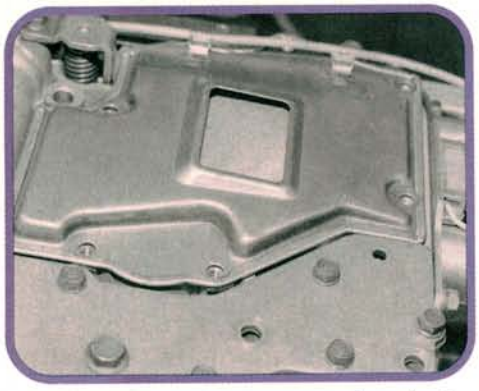
19

The speed sensor in the trans (shown here) is the number one sensor. The sensor at the speedometer cable on the back of the instrument cluster is supposed to provide a fail safe. But a whacky speedo sensor can cause a number of strange shift problems even if the tranny sensor is doing its job correctly.



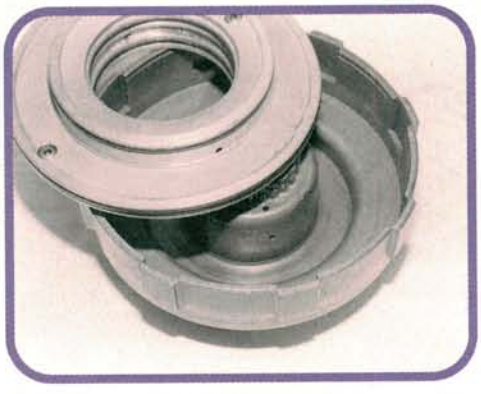
20

No overdrive in fourth gear? Check for an open engine thermostat or faulty coolant sensor. If the ECT doesn't get a signal that the engine is fully warmed up, it won't select fourth/overdrive. Another possible cause of no 4th/OD is a bad cruise control. Disconnect the cruise module and repeat the test drive.



21

Regular transmission service is important. The "screen door" filter might keep flies and mosquitoes out of your kitchen, but it won't stop tiny metal particles. As mentioned earlier, these particles love to end up in the shift solenoids, causing them to stick.



22

Reverse gear chatter may be caused by a bad seal in the direct/reverse clutch. Only the inner piston is applied in third gear. In reverse, both pistons apply for greater clamping at the clutch pack. If one seal fails, the other isn't strong enough to hold the clutch pack in reverse, causing slippage or chatter.

Miscellanea

We hope the previous steps will help you isolate some of the more common problems you'll see on these trannys. However, there will be times when you'll need to dig deeper. Here are a few more things to check when a faulty input to the ECT causes a shift timing problem.

1) Check for proper battery voltage. This may sound ridiculously simple, but a problem in the battery or charging system should always be eliminated before proceeding with any electrical diagnosis.

2) It may be a good idea to run the throttle position and brake signal tests several times. An intermittent electrical problem in the TPS, or a brake switch which sticks occasionally can lead to an on-again, off-again problem. TPS and brake signal failures aren't stored in memory, so you'll need to catch them in the act.

3) If you get a 4 volt code at the DG terminal indicating a bad speed sensor, but the trans works properly, check the primary sensor in the trans. The ECT may be using the backup signal from the dash speed sensor. And don't forget that a faulty signal from the dash sensor can result in a strange assortment of shift problems.

Later models got a lot smarter. Cars from 1985 on will store a code 42 when a speed sensor fails.

Solenoid ON/OFF Combinations

	Solenoid #1	Solenoid #2
First gear	ON	OFF
Second gear	ON	ON
Third gear	OFF	ON
Fourth gear (O/D)	OFF	OFF

If both solenoids have failed or aren't receiving power for whatever reason, you'll get the following gears when the trans is shifted manually.

D will give you O/D

2 will give you 3rd gear

1 will give you 1st gear

You'll notice that these are the same combinations we got when we disconnected the ECT computer and shifted the trans manually. That's because with the computer disconnected, neither solenoid operates.