INDEX

AUTOMATIC TRANSMISSION SERVICE GROUP

1988
SEMINAR

COMPUTER TRANSMISSION TECHNOLOGY

Space age technology has fully arrived in the automotive industry. Currently most vehicles carry one on board computer. Within the next year some vehicles will have as many as six computers on board. Controlling, engine management, vehicle suspension, Interior air-temperature, Brakes, TRANSMISSION, vehicle location via satellite communication.

The seminars continue on updating computer diagnosing information along with basic transmission diagnosing. We feel it is important to you and the people that work with you in the shop to come up with a common method of diagnosing. We have a chapter in this manual that covers just that.

A thought: It might be helpful to arrange transmission problems as follows:

COMPLAINT .....or problem
CAUSE .....the part or condition creating the problem
CORRECTION ... what is needed to be done to fix the problem

Keep in mind you have the need to be able to diagnose whether the transmission problem is ELECTRICAL — HYDRAULIC — MECHANICAL if it is not the computer . . . again we welcome you.

ROBERT D. CHERRNAY
Technical Director

DALE ENGLAND
Field Service Consultant

AUTOMATIC TRANSMISSION SERVICE GROUP
9200 South Dadeland Blvd.
Suite 114
Miami, Florida 33156

We thank the OTC Division of Sealed Power Corporation, Ford Motor Company, Toyota Motor Car, Chrysler Corporation and General Motors Corporation for some of the information provided and used in this booklet.

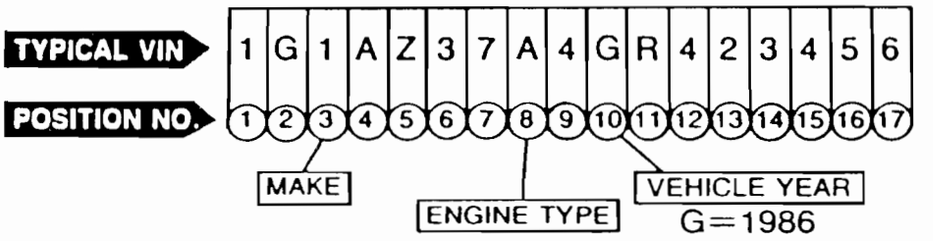
GENERAL MOTORS

C-3 SYSTEM DESCRIPTIONS

The Computer Controlled Command (C-3) system helps control exhaust emissions and improve fuel economy. Because of the many different engine and vehicle combinations used, different variations of the C-3 system are also required. A brief description of each system is listed below.

1. **1981 Systems:** C-3 system used on all applicable vehicles manufactured in 1981.
2. **EFI/TBI System:** C-3 system used on vehicles with throttle body injection.
3. **Full Function System:** C-3 system utilizing carburetion and a full selection of sensors and solenoids.
4. **Olds LC System:** Oldsmobile limited computer system utilizing carburetion and limited sensor functions.
5. **MIN-T System:** Minimum function C-3 system designed for T-body vehicles.
6. **CFI 2BL TBI System:** C-3 system used with one 2 barrel TBI or two single barrel throttle body injectors mounted on a crossfire intake manifold.
7. **Pont 4 PFI System:** C-3 system used on 4 cylinder engines that utilize Port Fuel Injection (PFI) at each cylinder intake port. This system is also known as a Multiport Fuel Injection (MFI) system.
8. **Buick 6 PFI System:** C-3 system used on 6 cylinder engines that utilize Port Fuel Injection (PFI) at each cylinder intake port. This system is also known as Multiport Fuel Injection (MFI) and Sequential Fuel Injection (SFI).
9. **Isuzu System:** C-3 system used on California S-10 and S-15 trucks.
10. **Chev. Trk. System:** C-3 system designed for California trucks using a 4.1L, L-6 engine.
11. **Pontiac L4 EFI Systems:** C-3 system used on the Pontiac L4 engines equipped with Throttle Body Injection.
12. **Olds Full:** C-3 system utilizing a carburetor and a full selection of sensors and solenoids on a 5.0L, V-8 engine.
13. **Chev. PFI System:** C-3 system used on engines that utilize Port Fuel Injection (PFI) at each cylinder intake port.
14. **Pont 6 PFI System:** C-3 system used on 6 cylinder engines that utilize Port Fuel Injection (PFI) at each cylinder intake port.
15. **6.2L Diesel System:** Computerized system used on 6.2L diesel application starting in 1985 for California G.M. light trucks.
16. **86 Buick PFI:** C-3 system used on 6 cylinder engines that utilize Port Fuel Injection (PFI) at each cylinder intake port. This system is also known as Multiport Fuel Injection (MFI) and Sequential Fuel Injection (SFI).
17. **86 PFI V8:** Special Port Fuel Injected (PFI) system used on 1986 5.7L Corvette, 5.0L IROC Camaro, and 5.0L TPI Trans-Am.

1986 PASSENGER CAR VIN SYSTEM



3 MAKE

1-Chevrolet	3-Oldsmobile	6-Cadillac
2-Pontiac	4-Buick	7-GM of Canada

1986 C-3 APPLICATIONS

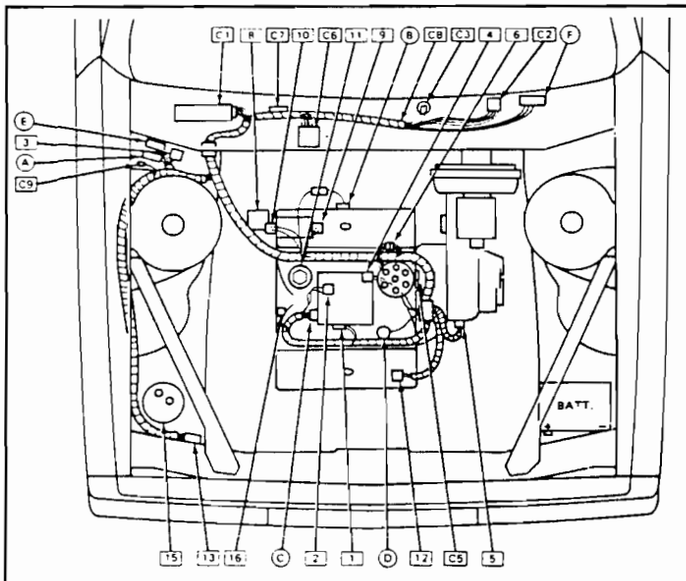
Engine	Type	Vin # (8th Digit)	C-3 System	Monitor Code	Application
1.6L	L4	C	**MIN-T**	5	Chev, Pontiac
1.8L	L4	O	**Pont L4 EFI**	11	Pontiac, Olds, Buick
1.8L	L4	J	**Pont 4 PFI**	7	Pontiac, Olds, Buick
2.0L	L4	P	**EFI**	2	Chev, Pontiac, Olds, Buick, Cadillac
2.0L	L4	I	**EFI**	2	Chevrolet
2.5L	L4	R	**Pont L4 EFI**	11	Chev, Pontiac, Olds, Buick
2.5L	L4	2	**Pont L4 EFI**	11	Chev, Pontiac
2.5L	L4	U	**Pont L4 EFI**	11	Pontiac, Olds, Buick
2.8L	V6	X	**Full**	3	Chev, Pontiac, Olds, Buick
2.8L	V6	W	**Chev PFI**	13	Chev, Pontiac, Olds, Cadillac
2.8L	V6	S	**Chev PFI**	13	Chev, Pontiac
2.8L	V6	9	**Pont 6 PFI**	14	Pontiac
3.0L	V6	L	**86 Bui PFI**	16	Pontiac, Olds, Buick
3.8L	V6	A	**86 Bui PFI**	16	Chev, Pontiac, Olds, Buick
3.8L	V6	B	**86 Bui PFI**	16	Olds, Buick
3.8L	V6	9	**Buick 6 PFI**	8	Buick
3.8L	V6	3	**86 Bui PFI**	16	Olds, Buick
3.8L	V6	7	**86 Bui PFI**	16	Buick
4.1L	V8	8	**DFI**	N/A	Cadillac
4.3L	V6	Z	**CFI 2BL TBI**	6	Chev, Pontiac
5.0L	V8	G	**Full**	3	Chev, Pontiac
5.0L	V8	F	**86 PFI V8**	17	Chev, Pontiac
5.0L	V8	H	**Full**	3	Chev, Pontiac, Olds
5.0L	V8	Y	**Full**	12	Pontiac, Olds, Buick, Cadillac
5.0L	V8	9	**Full**	12	Olds
5.7L	V8	6	**Full**	3	Chevrolet
5.7L	V8	8	**86 PFI V8**	17	Chevrolet

1986 C-3 APPLICATIONS-CALIFORNIA TRUCK ONLY

Engine	Type	Vin # (8th Digit)	C-3 System	Monitor Code	Application
*2.5L	L4	E	**Pont L4 EFI**	11	S-10
2.8L	V6	B	**Full**	3	S-10
*2.8L	V6	R	**CFI 2BL TBI**	6	S-10
4.3L	V6	N	**Full**	3	Chevrolet, GMC
*4.3L	V6	7	**CFI 2BL TBI**	6	Chevrolet, GMC, M-Van
5.0L	V8	H	**Full**	3	Chevrolet, GMC
5.0L	V8	F	**Full**	3	Chevrolet, GMC
5.7L	V8	L	**Full**	3	Chevrolet, GMC
6.2L	V8	C	**6.2L DSL**	15	Chevrolet, GMC
6.2L	V8	J	**6.2L DSL**	15	Chevrolet, GMC

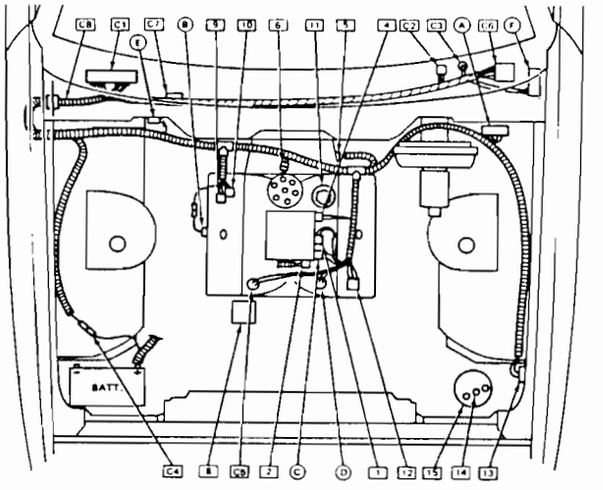
GENERAL MOTORS

1984 COMPUTER COMMAND CONTROL
2.8L, 3.0L, 3.8L, 4.1L, 5.0L & 5.7L FULL FUNCTION

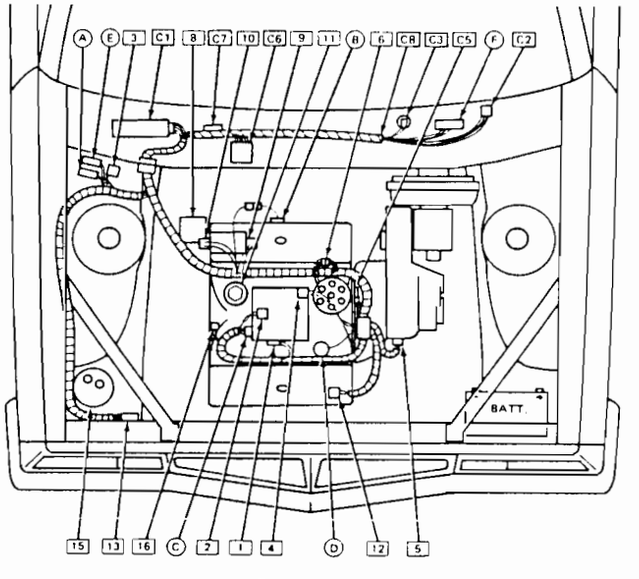


"A" BODY 2.8L (VIN X)

"S" SERIES TRUCK 2.8L (VIN X/1)



"F" BODY 2.8L (VIN 1/L)



"X" BODY 2.8L (VIN X)

COMPUTER HARNESS

C1. Electronic Control Module (ECM)
C2. ALCL Connector
C3. "CHECK ENGINE" Light
C4. System Power Feed
C5. System Harness Ground
C6. Fuse Block
C7. "CHECK ENGINE" Light Driver
C8. Computer Control Harness
C9. Dwell Connector

INFORMATION SENSORS

A. Manifold Pressure Sensor
B. Oxygen Sensor
C. Throttle Position Sensor
D. Coolant Sensor
E. Barometric Pressure Sensor
F. Vehicle Speed Sensor

CONTROLLED DEVICES

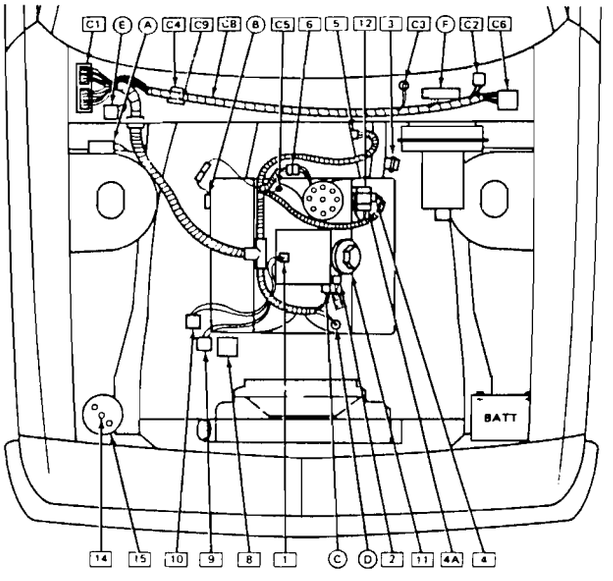
1. M/C Solenoid
2. Idle Speed Control
3. EFE Relay
4. EFE Heated Grid Relay
5. Torque Converter/Clutch Connector
6 Electronic Spark Timing Connector
9 Air Control Solenoid Valve
10. Air Switching Solenoid Valve
11. EGR Valve
12. EGR Solenoid Valve

EMISSION SYSTEMS (Not ECM Controlled)

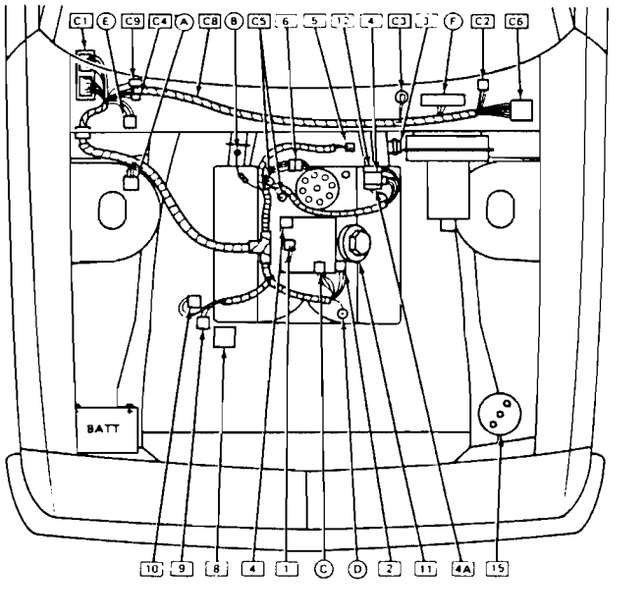
8. Air Injection Pump
13. Canister Purge Solenoid Valve
14. From Fuel Tank
15. Vapor Canister

GENERAL MOTORS

1984 COMPUTER COMMAND CONTROL
2.8L, 3.0L, 3.8L, 4.1L, 5.0L & 5.7L FULL FUNCTION



"B/G" BODIES 5.0L (VIN Y)



"E" BODY 5.0L (VIN Y)

COMPUTER HARNESS

C1. Electronic Control Module (ECM)
C2. ALCL Connector
C3. "CHECK ENGINE" Light
C4. "CHECK ENGINE" Light Driver
C5. System Harness Ground
C6. Fuse Block
C8. Computer Control Harness
C9. Cold Start Module

INFORMATION SENSORS

A. Manifold Pressure Sensor
B. Oxygen Sensor
C. Throttle Position Sensor
D. Coolant Sensor
E. Barometric Pressure Sensor
F. Vehicle Speed Sensor

CONTROLLED DEVICES

1. M/C Solenoid
2. Idle Load Control (ILC)
3. EFE Valve
4. Rear Vacuum Brake Solenoid (RVB)
4A. ILC/RVB Solenoid
5. Torque Converter/Clutch Connector
6. Electronic Spark Timing Connector
9. Air Control Solenoid Valve
10. Air Switching Solenoid Valve
11. EGR Valve
12. EGR Solenoid Valve

EMISSION SYSTEMS (Not ECM Controlled)

8. Air Injection Pump
14. From Fuel Tank
15. Vapor Canister

GENERAL MOTORS — VIN CODE APPLICATION

① – Indicates Nation of Origin.
② – Indicates Manufacturer.
③ – Indicates Make and Type.
④ – Indicates Restraint System.
⑤ – Indicates Carline/Series.
⑥ – Indicates Body Types.
⑦ ⑧ – Indicates Engine Type and Make.
⑨ – Indicates Check Digit.
⑩ – Indicates Model Year.
⑪ – Indicates Assembly Plant.
⑫ ⑬ ⑭ ⑮ ⑯ ⑰ – Indicates Plant Sequential Number.

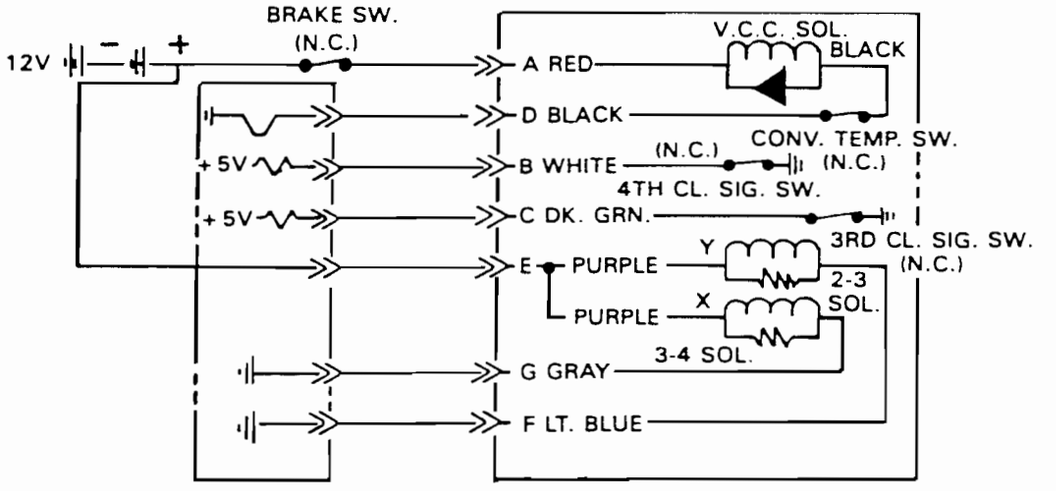
VIN DATE CODES

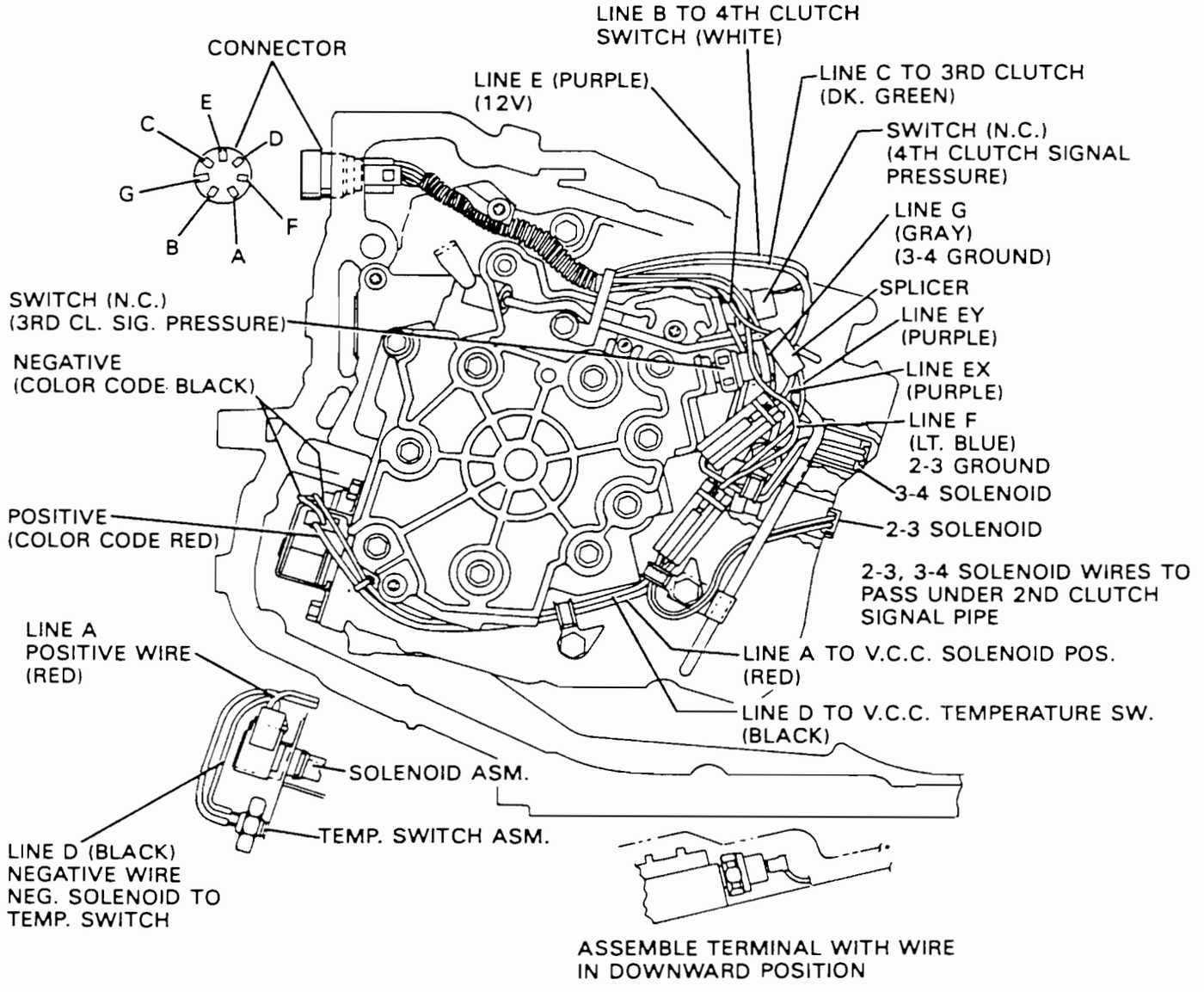
Code	Model Year
A	1980
B	1981
C	1982
D	1983
E	1984
F	1985
G	1986
H	1987

GENERAL MOTORS VIN APPLICATION

VIN Code	Engine Size & Fuel System Type	Electronic Control
1987 Passenger Cars		
4	1.6L 4-Cyl. 2-Bbl.	CCC
C	1.6L 4-Cyl. 2-Bbl.	ECM
K	2.0L 4-Cyl. MFI Turbo	CCC
M	2.0L 4-Cyl. TBI	CCC
1	2.0L 4-Cyl. TBI	CCC
R	2.5L 4-Cyl. TBI	CCC
U	2.5L 4-Cyl. TBI	CCC
R	2.8L V6 TBI	CCC
S	2.8L V6 MFI	CCC
W	2.8L V6 MFI	CCC
9	2.8L V6 MFI	CCC
L	3.0L V6 MFI	CCC
A	3.8L V6 2-Bbl.	CCC
3	3.8L V6 SFI	CCC
7	3.8L V6 SFI Turbo	CCC
8	4.1L V8 DFI	DFI
Z	4.3L V6 TBI	CCC
G	5.0L V8 4-Bbl.	CCC
H	5.0L V8 4-Bbl.	CCC
Y	5.0L V8 4-Bbl.	CCC
9	5.0L V8 4-Bbl.	CCC
F	5.0L V8 TPI	CCC
6	5.7L V8 4-Bbl. Police	CCC
8	5.7L V8 TPI	CCC
1987 Light Trucks		
E	2.5L 4-Cyl. TBI	CCC
R	2.8L V6 TBI	CCC
Z	4.3L V6 TBI	CCC
F	5.0L V8 TBI	CCC
K	5.7L V8 TBI	CCC
W	7.4L V8 TBI	CCC

1988
THM F-7
MODELS: APZ





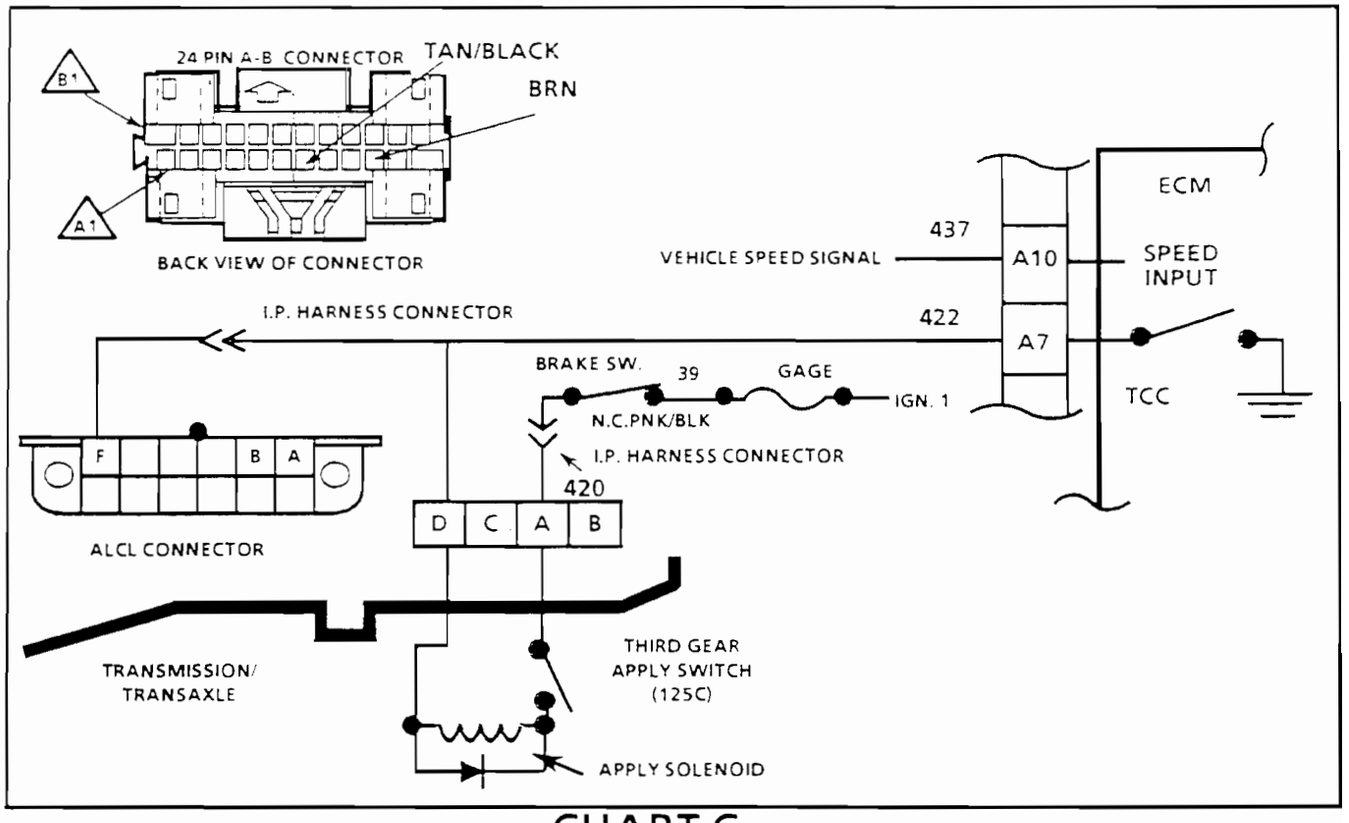


CHART C

TRANSMISSION/TRANSAXLE CONVERTER CLUTCH (TCC)

2.0L "J" SERIES

FUEL INJECTION (TBI)

The purpose of the transmission/transaxle converter clutch feature is to eliminate the power loss of the transmission/transaxle converter stage when the vehicle is in a cruise condition. This allows the convenience of the automatic transmission/transaxle and the fuel economy of a manual transmission/transaxle.

Fused battery ignition is supplied to the TCC solenoid through the brake switch, and transmission/transaxle third gear apply switch. The ECM will engage TCC by grounding CKT 422 to energize the solenoid.

TCC will engage when:

- Engine warmed up
- Vehicle speed above a calibrated value.
- Throttle position sensor output not changing, indicating a steady road speed.
- Transmission/transaxle third gear switch closed
- Brake switch closed

1. Light off confirms transmission/transaxle third gear apply switch is open.
2. At 30 mph the transmission/transaxle third gear switch should close. Test light will come on and confirm battery supply and closed brake switch.
3. Grounding the diagnostic terminal with engine "OFF" should energize the TCC solenoid. This test checks the capability of the ECM to control the solenoid.
4. Solenoids and relay's are turned "ON" or "OFF" by the ECM internal electronic switches called "drivers". Each driver is part of a group of four called "Quad-Drivers". Failure of one can damage any other driver within the set.

Before replacing ECM be sure to check the coil resistance of all solenoids and relays controlled by the ECM. See ECM wiring diagram for the solenoid(s) and relay(s) and the coil terminal identification.

When checking TCC solenoid be sure to raise drive wheels and run about 30 MPH to close third gear apply switch.

CHART C

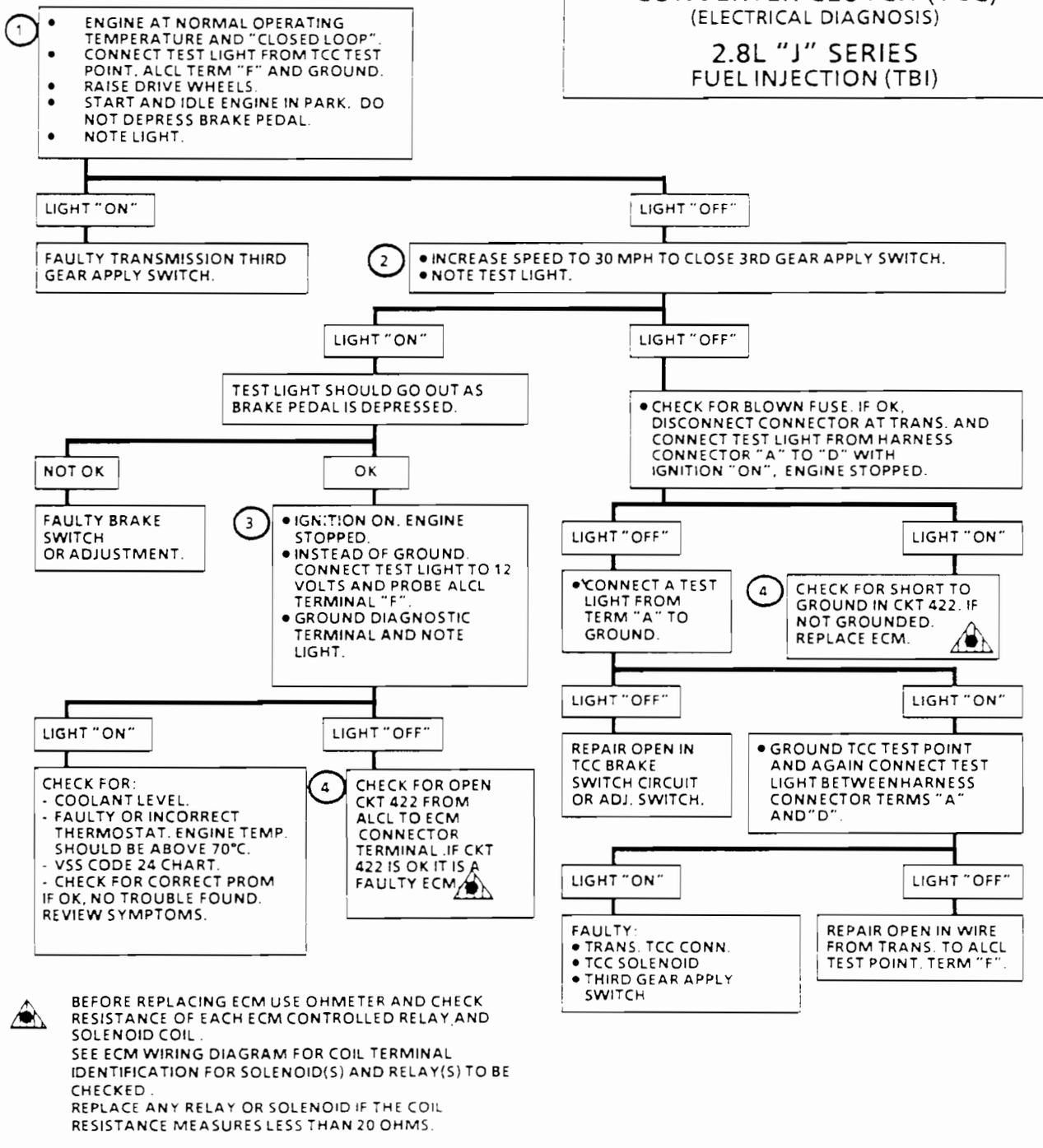
125C TRANSMISSION/TRANSAXLE CONVERTER CLUTCH (TCC)

(ELECTRICAL DIAGNOSIS)

2.8L "J" SERIES

FUEL INJECTION (TBI)

MECHANICAL CHECKS, SUCH AS LINKAGE, OIL LEVEL, ETC. SHOULD BE PERFORMED PRIOR TO USING THIS CHART.



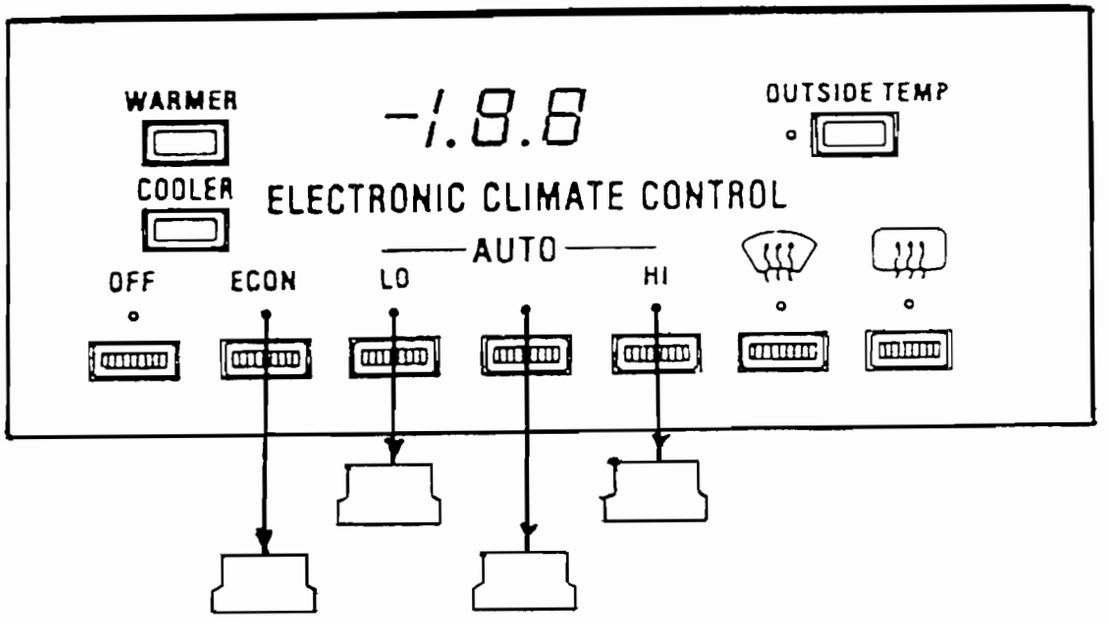
BEFORE REPLACING ECM USE OHMETER AND CHECK RESISTANCE OF EACH ECM CONTROLLED RELAY AND SOLENOID COIL.
SEE ECM WIRING DIAGRAM FOR COIL TERMINAL IDENTIFICATION FOR SOLENOID(S) AND RELAY(S) TO BE CHECKED.
REPLACE ANY RELAY OR SOLENOID IF THE COIL RESISTANCE MEASURES LESS THAN 20 OHMS.

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT

ATSG Technical Service Information

CADILLAC DFI SYSTEMS

1982-85



AUTOMATIC TRANSMISSION SERVICE GROUP

1981-82 DFI CONTROL SYSTEM (CADILLAC V8 ENGINES, EXCEPT DIESEL)

Failure Code Determination — During any diagnostic procedure, "hard failure" codes MUST be distinguished from "intermittent failure" codes. Diagnostic charts CANNOT be used to analyze "intermittent failure" codes, except as noted under Diagnostic Procedure. To determine "hard failure" codes and "intermittent failure" codes, proceed as follows:

6.0L Engine — 1) Enter diagnostics and note stored trouble codes. Clear trouble codes. Exit diagnostics. Turn ignition on, wait 5 seconds and start engine. Accelerate to 2000 RPM for a few seconds and return to idle speed.

2) Shift transmission into drive. Shift transmission into park. If "CHECK ENGINE" light comes on, enter diagnostics, read and record trouble codes. This will reveal "hard failure" codes. Cruise control codes "60-80" never set "CHECK ENGINE" light, treat them as "hard failures". Codes "13", "24", "25", "44" and "45" may require road test to reset "hard failure" after trouble codes were cleared.

3) If "CHECK ENGINE" light does not come on, all stored trouble codes were "intermittent failures", except as noted under Diagnostic Procedure.

4.1L Engine — 1) Enter diagnostics. ECC will display trouble codes beginning with lowest numbered code. Each code will be displayed for 2 seconds until the highest code present has been displayed. Then, "-1.8.8" will appear.

2) Display procedure will repeat twice. On the 3rd pass through the display, "hard failure" codes ONLY, will be displayed. Any codes which appeared during the 1st and 2nd passes but not during the 3rd, are "intermittent failures". If no codes are displayed during the 3rd pass, there are no "hard failures", and the "CHECK ENGINE " light should have been out before entering diagnostics.

3) The 3rd pass ends with "-1.8.8" display. When trouble code sequence is completed, ".7.0" will display. If a code "51" is present, it must be diagnosed before further testing can begin. As long as "51" is displayed, no other diagnostic features are possible.

4) Begin diagnosis with the lowest numbered code, unless code "16" is present. Code "16" should always be diagnosed first (except code "51") since it may have an effect on setting of other codes. If no trouble codes are present, ECC will display "-1.8.8" for 2 seconds and then ".7.0".

***NOTE** — If vehicle exhibits performance problems and no codes are set, refer to performance charts. Components recorded by trouble codes generally do not cause performance problems when no codes are stored.*

Engine Malfunction Test Procedure —1) Enter diagnostics and record stored trouble codes. Begin diagnosis with lowest numbered code which is recorded. If codes "51" or "16" are shown, begin diagnosis with code "51", then proceed to code "16".

2) If "intermittent failures" "13", "44" or "45" (6.0L engine) or "13", "20", "33", "39", "44" or "45" (4.1L engine) appear, use diagnostic chart for corresponding "hard failure" code. If "intermittent failure" code "33" appears on 6.0L engine, refer to diagnostic chart 33A of 1981 Trouble Code charts.

3) On 1981 6.0L engine, code "25" indicates that ECM has detected a malfunction in the MD circuitry. When code "25" is set, ECM will only allow 8 cylinder operation. Refer to 1981 Performance Chart No. 16 for diagnosis of this code.

4) Code "51" (if detectable by ECM) indicates faulty PROM installation. Refer to TROUBLE CODE 51 in this article for diagnosis of this code for 4.1L engine or to PROM removal and installation in this article for 6.0L engine.

1981-82 DFI CONTROL SYSTEM (CADILLAC V8 ENGINES, EXCEPT DIESEL)

Entering Diagnostic Mode — Turn ignition on. Depress "OFF" and "WARMER" buttons on ECC panel simultaneoulsy and hold buttons until ". " appears on digital display panel. Release buttons and code "88" (6.0L engine) or "-1.8.8" (4.1L engine) should appear, indicating beginning of diagnostic readout. Trouble codes will be displayed beginning with lowest numbered code and be repeated a second time. After second time, trouble code "70" (6.0L engine) or ".7.0" (4.1L engine) will appear, indicating ECM is ready for next diagnostic feature. If no codes are stored, "88" (6.0L engine) or "-1.8.8" (4.1L engine) will appear for longer period of time, then code "70" (6.0L engine) or ".7.0" (4.1L engine) will appear. *See Fig. 3 and 4.*

***NOTE** — Trouble code "70" (".7.0") is a decision point. When this code is displayed, either select diagnostic feature e.g., switch test, engine data display, output cycling test, fixed spark mode, exit diagnostic mode or clear codes and then exit diagnostic mode.*

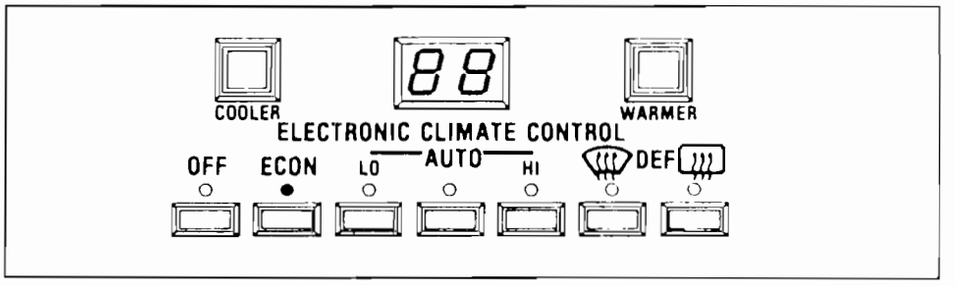


Fig. 3 Trouble Code "88" Displayed on 6.0L Engine Electronic Climate Control (ECC) Panel

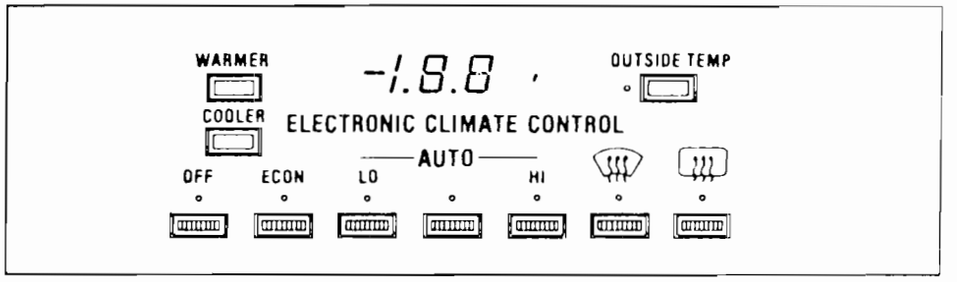


Fig. 4 Trouble Code "-1.8.8" Displayed on 4.1L Engine Electronic Climate Control (ECC) Panel

Clearing Trouble Codes — Trouble codes stored in ECM memory may be cleared (erased) by entering diagnostic mode and then depressing "OFF" and "HI" buttons at the same time. Hold buttons until "00" (6.0L engine) or ".0.0" (4.1L engine) is displayed. Release buttons and code "70" (6.0L engine) or ".7.0" (4.1L engine) should appear.

Exiting Diagnostic Mode — On vehicles equipped with 6.0L engine, depress any ECC function keys except rear window defroster. On vehicles equipped with 4.1L engine, do not depress "LO" or "OUTSIDE TEMP". On all vehicles, exiting may also be completed by turning ignition switch "OFF" for 10 seconds. This will take ECC panel out of diagnostic mode, but will not clear any trouble codes. Original temperature setting should appear on ECC panel.

1981-82 DFI CONTROL SYSTEM (CADILLAC V8 ENGINES, EXCEPT DIESEL)

5) Codes "62" (6.0L engine) and "63" (4.1L engine) indicate that cruise control was engaged and vehicle speed exceeded maximum limit. The ECM allows cruise control operation within a specific speed range. Clear code and road test vehicle.

6) Code "64" (both engines) indicates that cruise control was engaged and vehicle acceleration exceeded preset rate which was programmed into ECM. This could be caused by icy or wet pavement. Clear code and road test vehicle.

7) Code "65" (both engines) indicates that cruise control was engaged and coolant exceeded maximum temperature. Check cooling system, clear codes and road test vehicle.

8) Code "66" (both engines) indicates that cruise control was engaged and engine speed exceeded maximum allowable limit. This code can be caused by removing engine load (transmission in neutral) when cruise control is engaged and operating. Clear codes and road test vehicle.

***NOTE** — After diagnosing trouble codes; switch tests, engine data displays and output cycling tests can be used to isolate "intermittent failures". DO NOT perform any adjustment or repairs on any component until malfunction has been positively located.*

Switch Test Procedure — 1) Enter diagnostics and with code "70" (6.0L engine) or ".7.0" (4.1L engine) displayed, depress and release brake pedal. This will start switch test procedure and code "71" (6.0L engine) or ".7.1" (4.1L engine) will be displayed.

***NOTE** — Each test action must be performed within 10 seconds after codes appear on display panel or ECM will store code as failure and proceed to next code.*

2) With code "71" (".7.1") displayed, depress and release brake pedal again. Code "72" (6.0L engine) or ".7.2" (4.1L engine) should appear. With code "72" (".7.2") displayed, depress throttle to wide open position and release. Code "73" (6.0L engine) or ".7.3" (4.1L engine) should appear.

3) With code "73" (".7.3") displayed, shift transmission into drive then back to netural. Code "74" (6.0L engine) or ".7.4" (4.1L engine) should appear. With code "74" (".7.4") displayed, shift transmission to reverse and back to park. Code "75" (6.0L engine) or ".7.5" (4.1L engine) should appear.

4) With code "75" (".7.5") displayed, switch cruise control on then off. Code "76" (6.0L engine) or ".7.6" (4.1L engine) should appear. With code "76" (".7.6") displayed, switch cruise control on, then depress and release "Set/Coast" button. Code "77" (6.0L engine) or ".7.7" (4.1L engine) should appear. With code "77" (".7.7") displayed, switch cruise control on, then depress and release "Resume/Acceleration" switch. Code "78" (6.0L engine) or ".7.8" (4.1L engine) should appear.

***NOTE** — To pass codes "75" (".7.5"), "76" (".7.6") and "77" (".7.7") on vehicles without cruise control, allow codes to appear for 10 seconds each, then proceed with step 5). Codes will cycle through ECM and be processed as failures.*

5) With code "78" (".7.8") displayed, depress and release "Instant/Average" button on MPG (Fuel Data panel). Code "79" (6.0L engine) or ".7.9" (4.1L engine) should appear. With code "79" (".7.9") displayed, depress and release "Reset" button. Code "80" (6.0L engine) or ".8.0" (4.1L engine) should appear.

1981-82 DFI CONTROL SYSTEM (CADILLAC V8 ENGINES, EXCEPT DIESEL)

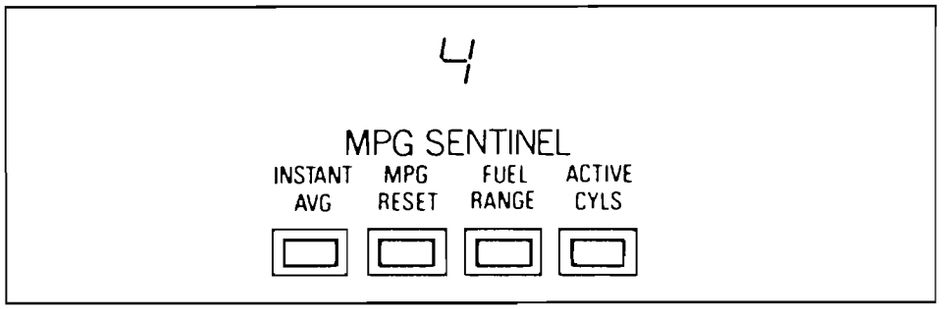


Fig. 5 Diagram of 1981 MPG Panel With 4-Cylinder Mode of Operation Displayed

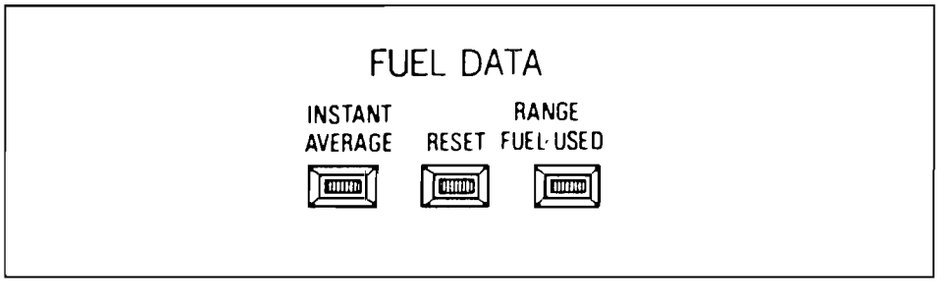


Fig. 6 Diagram of 1982 Fuel Data Panel With Blank Display During Diagnostic Testing

6) With code "80" (".8.0") displayed, depress and release rear window defogger button on 6.0L engine models. On 4.1L engine models, push "Outside Temp" button twice. This test checks ECM's ability to recognize and process air conditioning clutch signal. This test may require engine running with A/C operating in "Auto" mode with temperature selection set at 60°F.

***NOTE** — To pass code "80" (".8.0") on vehicles without rear window defogger, momentarily supply 12 volts to Blue wire in 6-wire connector on ECC power module while code "80" (".8.0") is displayed.*

7) When switch tests are completed, ECM will display codes which did not pass test. Each code will appear beginning with lowest code. Codes will not disappear until affected switch circuit is repaired and retested. After switch tests are complted, ECC will display code "00" (6.0L engine) or ".0.0" (4.1L engine) and return to code "70" (".7.0"). Code "00" (".0.0") indicates all switch circuits are operating properly. Remember that "00" (".0.0") will never be obtained on vehicles without cruise control.

Engine Data Display Procedure — 1) Enter diagnostics and with code "70" displayed on 6.0L engine, slide cruise instrument panel switch off. With code ".7.0" displayed on 4.1L engine, press "Reset" button on Fuel Data panel. Code "90" (6.0L engine) or ".9.0" (4.1L engine) should appear. If code "90" (".9.0") does not appear, refer to 1981 switch test code "75" (6.0L engine) or 1982 switch test code ".7.9" (4.1L engine).

***NOTE** — To advance to code "90" (".9.0") on vehicles without cruise control, momentarily jumper Yellow wire (Pin C, Circuit No. 904) and Lt. Blue/Black wire (Pin D, Circuit No. 903) in 6-wire cruise control instrument panel switch connector. Connector is located on left side of steering column under instrument panel.*

1981-82 DFI CONTROL SYSTEM (CADILLAC V8 ENGINES, EXCEPT DIESEL)

Data Display

2) Engine data display shows values of 11 parameters for 6.0L engine and 13 parameters for 4.1L engine, both monitored by ECM. Parameter numbers 01-11 (6.0L engine) and .0.1-.1.3 (4.1L engine) will be displayed for 1 second on ECC panel, followed by a numerical value. The parameter value will be displayed for 5 seconds on 6.0L engine and 9 seconds on 4.1L engine. Each parameter and value will be repeated until manually advanced to next parameter.

3) To advance display, depress "Instant/Average" button on MPG (Fuel Data) panel. To return to previously displayed parameter, depress "MPG Reset" on 6.0L engine and "Reset" button on 4.1L engine. After last parameter is displayed, code "95" (6.0L engine) or ".9.5" (4.1L engine) should appear. Engine data display may be cleared at anytime, by pressing "Off" and "Hi" ("High") buttons on ECC panel simultaneously. Code "70" (".7.0") should appear.

4) Engine data display information can be used to compare information of engine to that of properly functioning engine for diagnosis of malfunctions. Parameters read and values displayed are as follows:

- 01 (.0.1) — Throttle angle displayed in degrees.
- 02 (.0.2) — On 6.0L engine, MAP value displayed as number between 1 and 99. Reading above 100 will appear as 99. On 4.1L engine, MAP value displayed in kilopascals (kPa).
- 03 (.0.3) — BARO value displayed in same manner as MAP value
- 04 (.0.4) — On 6.0L engine, coolant temperature displayed as number between 0 and 99; see Code and Degrees F chart below. On 4.1L engine, coolant temperature in °C.

6.0L Code	Degrees F	6.0L Code	Degrees F
0	−40	58	160
8	−12	60	167
12	+1	62	174
16	15	64	181
21	32	66	188
25	46	68	195
30	64	70	202
35	81	72	209
40	98	73	212
45	115	75	219
50	133	80	236
52	140	85	254
54	147	90	271
56	153	99	302

- 05 (.0.5) — Manifold air temperature displayed in °F on 6.0L engine and °C for 4.1L engine.
- 06 (.0.6) — Injector Pulse width is displyed in milliseconds. Decimal point will not appear and MUST be assumed between 2 digits (32 means 3.2 milliseconds).
- 07 (.0.7) — Oxygen sensor voltage is displayed in volts. Decimal point will not appear and MUST be assumed before 2 digits (60 means .60 volts).
- 08 (.0.8) — Spark advance value displayed in degrees (2 digits).
- 09 (.0.9) — Ignition cycle value is number of times ignition has been cycled since trouble code was last set.

1981-82 DFI CONTROL SYSTEM (CADILLAC V8 ENGINES, EXCEPT DIESEL)

- 10 (1 0) — On 6.0L engine, Open/Closed loop indicator displays which mode ECM is operating the system. Open loop is indicated by "O" and closed loop is indicated by "1". For 4.1L engine, 1 0 displays battery voltage in volts.

- 11 (1 1) — On 6.0L engine, battery voltage is displayed in volts. Decimal point and 10's will not appear and MUST be assumed (23 means 12.3 volts). On 4.1L engine, .1 1 displays engine RPM divided by 10. Engine speed over 2000 RPM is displayed as "199" since this is the highest number the ECC can display.

- 1 2 — On 4.1L engine only. Vehicle speed in MPH.
- 1.3 — On 4.1L engine only. PROM identification number. To ensure that the correct PROMs are installed.

Output Cycling Tests Procedure — 1) Enter diagnostics and with code "70" (" 7 0") displayed on ECC panel, depress "Instant/Average" button on MPG (Fuel Data) panel. If code "95" (6.0L engine) or ".9 5" (4.1L engine) does not appear, refer to switch test code "78" (".7 8"). Depress "Instant/Average" button of Engine Data Display. Parameter "11" on 6.0L engine and parameter " 1 3" on 4.1L engine should appear.

2) On 6.0L engine, output cycling tests consist of 2 operations: cylinder select test which operates the modulated displacement solenoids and actuator cycling test which turns ECM's outputs on and off. On 4.1L engine, only 1 operation need be performed.

3) On 6.0L engine and 4.1L engine, to enter actuator cycling tests, start engine. Turn engine off and within 5 seconds on 6.0L engine and 2 seconds on 4.1L engine, turn ignition on. Enter diagnostics and display code "95" (" 9 5") on ECC panel. Depress accelerator pedal to wide open throttle position and release pedal. Code "96" (6.0L engine) or " 9 6" (4.1L engine) should appear. If "96"(" 9 6") does not appear, refer to switch test "72" (".7 2").

4) Turn cruise instrument panel switch on. Output cycling tests will cycle Group A outputs on and off for 3 seconds and then cycle Group B outputs on and off for 3 seconds. Group A outputs consist of coolant light, cruise power valve, cruise vacuum valve, air switching valve and ISC extend. Group B outputs consist of cruise "On/Off" switch, canister purge solenoid, EGR valve solenoid, air divert valve and ISC retract.

5) Cycling test will alternate between Group A and Group B outputs and automatically shut off after 2 minutes. Cruise power valve operates continuously. After cycling output is complete, display should switch from code "96" (" 9 6") back to code "95" (" 9 5").

6) To enter cylinder select tests (1981 6.0L engine only), start engine. With engine running, enter diagnostics and display code "95". Depress accelerator pedal to wide open throttle position and release. Code "97" should appear on ECC panel.

7) With code "97" displayed, ECM will control modulated displacement automatically. Depressing "Instant/Average" button on MPG panel will force engine to operate in 8-cylinder mode as long as button is depressed. Depressing "Reset" button on MPG panel will force engine to operate in 6-cylinder mode as long as button is depressed. Depressing "Active Cylinder" button will force engine to operate in 4-cylinder mode as long as button is depressed.

8) Cylinder select test will automatically shut off after 1 minute of operation. To deactivate cylinder select test prior to automatic shut off, depress "Instant/Average" button. Code "95" should appear on display panel.

1981-82 DFI CONTROL SYSTEM (CADILLAC V8 ENGINES, EXCEPT DIESEL)

Fixed Spark Mode Procedure — 1) Used only on 4.1L engine. Purpose of test is to verify proper adjustment of spark timing. Enter diagnostics and with code "7 0" displayed on ECC panel, depress "Instant/Average" button on Fuel Data panel. Code "9.5" should appear.

2) With engine at normal operating temperature, idling at less than 900 RPM and transmission in "P" position, attach a timing light and observe ignition timing. Under these conditions, and with HEI operating properly (codes 23 and 25 not set), ignition timing should be within 20° ± BTDC. If not, the base timing of 10° BTDC should be adjusted accordingly.

MAINTENANCE

The DFI control system does not require periodic maintenance. The ECM signals need for repair or replacement of oxygen sensor. However, if vehicle is raised for other services, check general condition of catalytic converter and exhaust system.

REMOVAL & INSTALLATION

Electronic Control Module (ECM)

Removal & Installation — Remove lower instrument panel cover. Remove 3 nuts securing ECM to instrument panel mounting brackets and ground strap. Remove 3 electrical connectors and remove ECM from vehicle. To install ECM, reverse removal procedure and ensure ground strap is securely attached.

Programmable Read Only Memory (PROM)

Removal — 1) Remove ECM as previously described. Insert tip of small blade screwdriver into keyhole of locking tab on PROM access cover. Carefully bend tab slightly to unlock access cover and slide cover off ECM.

2) Note position of each PROM before removal. Replacement PROM's must be installed in same position as originals. Small reference boss (dimple) on PROM carrier must be aligned with boss (dimple) on PROM socket. Grasp clear PROM between thumb and forefinger. Gently rock PROM back and forth while applying upward force to remove PROM and carrier. Repeat procedure to remove green PROM.

***NOTE** — PROMs are not interchangeable from generation to generation. Be sure part number of replacement PROM matches original PROM.*

Installation — 1) Place PROM in clear carrier upside down on flat surface with pins facing up. Using a narrow blunt tool, press PROM body down on both sides of retainer bar so top of PROM is flush with top of carrier. Repeat procedure for PROM mounted in green carrier. *See Fig. 7.*

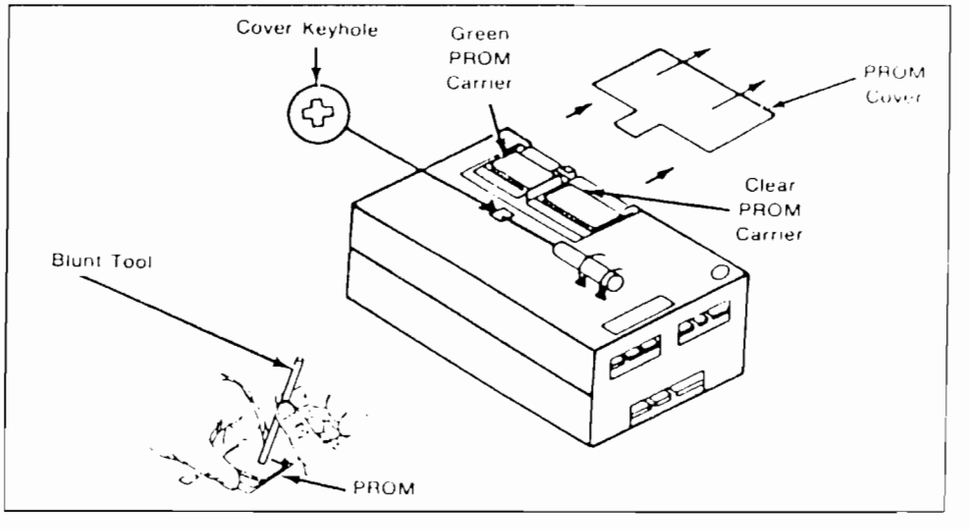
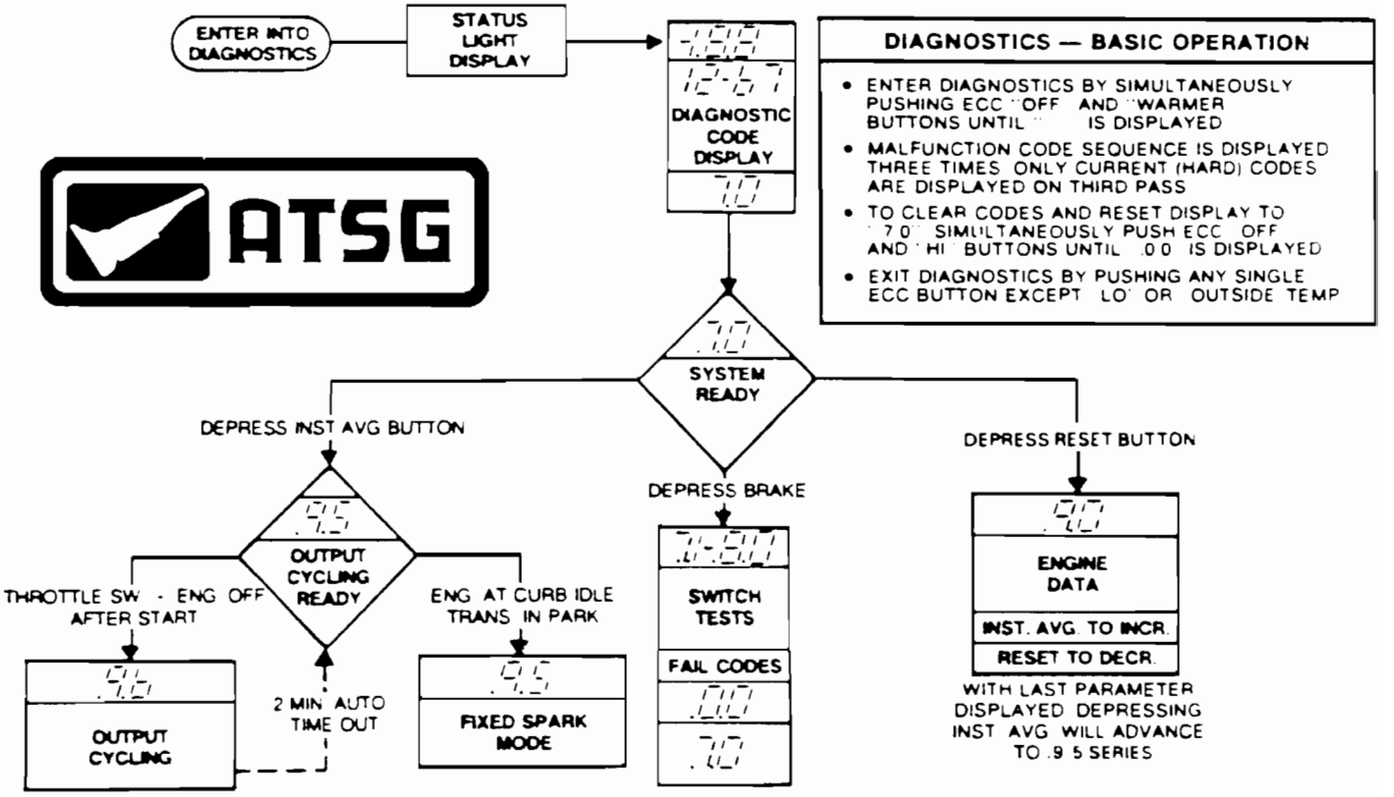


Fig. 7 Installing PROM into Electronic Control Module

1981-85 DFI CONTROL SYSTEM (CADILLAC V8 ENGINES, EXCEPT DIESEL)

1983 DIAGNOSTIC CODES

CODE		MALFUNCTION
■■ 12		No Distributor Signal
⊃ 13		Oxygen Sensor Not Ready [Canister Purge]
⊃ 14	•	Shorted Coolant Sensor Circuit
⊃ 15	•	Open Coolant Sensor Circuit
■■ 16		Generator Voltage Out Of Range [All Solenoids]
⊃ 18		Open Crank Signal Circuit
⊃ 19		Shorted Fuel Pump Circuit
■■ 20		Open Fuel Pump Circuit
⊃ 21	•	Shorted Throttle Position Sensor Circuit [TCC]
⊃ 22	•	Open Throttle Position Sensor Circuit [TCC]
⊃ 23	★	EST Bypass Circuit Problem [AIR]
⊃ 24		Speed Sensor Circuit Problem [TCC]
⊃ 26	•	Shorted Throttle Switch Circuit
⊃ 27	•	Open Throttle Switch Circuit
⊃ 28		Open Fourth Gear Circuit [TCC]
⊃ 29		Shorted Fourth Gear Circuit [TCC]
⊃ 30		ISC Circuit Problem
■■ 31	•	Shorted MAP Sensor Circuit [AIR]
■■ 32	•	Open MAP Sensor Circuit [AIR]
■■ 33	•	MAP/BARO Sensor Correlation Problem [AIR & TCC]
■■ 34	•	MAP Sensor Signal Too High [AIR]
⊃ 35	•	Shorted BARO Sensor Circuit [AIR & TCC]
⊃ 36	•	Open BARO Sensor Circuit [AIR & TCC]
⊃ 37	•	Shorted MAT Sensor Circuit
⊃ 38	•	Open MAT Sensor Circuit
⊃ 39		TCC Engagement Problem
■■ 44		Lean Exhaust Signal [AIR & CL & Canister Purge]
■■ 45		Rich Exhaust Signal [AIR & CL & Canister Purge]
■■ 51		PROM Error
▼ 52		ECM Memory Reset Indicator
▼ 53		Distributor Signal Interrupt



DIAGNOSTICS — BASIC OPERATION

- ENTER DIAGNOSTICS BY SIMULTANEOUSLY PUSHING ECC "OFF" AND "WARMER" BUTTONS UNTIL " " IS DISPLAYED
- MALFUNCTION CODE SEQUENCE IS DISPLAYED THREE TIMES. ONLY CURRENT (HARD) CODES ARE DISPLAYED ON THIRD PASS
- TO CLEAR CODES AND RESET DISPLAY TO " 7.0 " SIMULTANEOUSLY PUSH ECC "OFF" AND "HI" BUTTONS UNTIL ".0 0" IS DISPLAYED
- EXIT DIAGNOSTICS BY PUSHING ANY SINGLE ECC BUTTON EXCEPT "LO" OR "OUTSIDE TEMP"

.9.6 OUTPUTS

Coolant Light
AIR Switch Solenoid
AIR Divert Solenoid
ISC Motor
Cruise Vacuum Solenoid & Engage Light
Cruise Power Solenoid
Canister Purge Solenoid
EGR Solenoid
TCC Solenoid

.7.1 — .8.0 SWITCH TESTS

DIAGNOSTIC DISPLAY	CIRCUIT TEST
7.1	Cruise Control Brake
7.2	Throttle Switch
7.3	Drive
7.4	Reverse
7.5	Cruise "On-Off" — Return Switch To "On" Before Testing 7.6 & 7.7
7.6	Cruise "Set Coast"
7.7	Cruise "Resume/Accel"
7.8	FDP "Instant-Average"
7.9	FDP "Reset"
8.0	A/C Clutch — Push ECC "Outside Temp" Twice To Pass

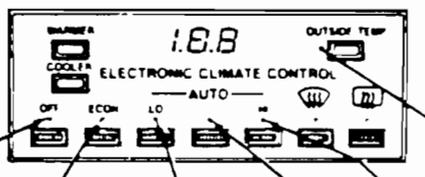
.9.0 ENGINE DATA DISPLAY

PARAMETER NUMBER	PARAMETER	PARAMETER RANGE	DISPLAY UNITS
0 1	Throttle Position	- 10 - 90	Degrees
0.2	MAP	14 - 108	kPa
0 3	BARO	14 - 108	kPa
0 4	Coolant	- 40 - 151	°C
0.5	MAT	- 40 - 151	°C
0 6	Injector Pulse Width	0 - 19 9	ms
0 7	Oxygen Sensor	0 - 1 99	Volts
0.8	Spark Advance	0 - 52	Degrees
0.9	Ignition Cycles	0 - 50	Key Cycles
1.0	Battery Volts	0 - 19 9	Volts
1 1	Engine RPM	0 - 1990	RPM - 10
1.2	Car Speed	0 - 199	MPH
1 3	PROM I D	0 - 199	Code

DISPLAY MODE NUMBERS

DIAGNOSTIC DISPLAY	DESCRIPTION
- 1.8.8	Display Check
.7.0	System Ready For Further Tests
.0.0	Malfunction Codes Cleared Or Switch Tests Complete
.9.0	System Ready To Display Engine Data
.9.5	Engine Off — System Ready For Output Cycling. Engine Running — System In Fixed Spark Mode
.9.6	Output Cycling

STATUS LIGHT DISPLAY



	ECM OPERATING MODE	OXYGEN SENSOR INPUT	THROTTLE SWITCH INPUT	TCC OUTPUT	4TH GEAR INPUT	A/C CLUTCH OUTPUT
LIGHT ON	CLOSED LOOP	RICH	CLOSED THROTTLE	TCC ENABLED	IN 4TH GEAR	CLUTCH ENABLED
LIGHT OFF	OPEN LOOP	LEAN	OPEN THROTTLE	TCC DISABLED	NOT IN 4TH GEAR	CLUTCH DISABLED

1982 DIAGNOSTIC CODES

CODE	MALFUNCTION
▲ 12	No Distributor Signal
▲ 13	Oxygen Sensor Not Ready
▲ 14 •	Shorted Coolant Sensor Circuit
▲ 15 •	Open Coolant Sensor Circuit
▲ 16	Generator Voltage Out Of Range (All Solenoids Except TCC)
▲ 18	Open Crank Signal Circuit
▲ 19	Shorted Fuel Pump Circuit
▲ 20	Open Fuel Pump Circuit
▲ 21 •	Shorted Throttle Position Sensor Circuit (TCC - Elec On)
▲ 22 •	Open Throttle Position Sensor Circuit (TCC - Elec On)
▲ 23	EST Circuit Problem In Run Mode (AIR)
▲ 24	Speed Sensor Circuit Problem (TCC - Elec On)
▲ 25 *	EST Circuit Problem In Bypass Mode (AIR)
▲ 26 •	Shorted Throttle Switch Circuit
△ 27 •	Open Throttle Switch Circuit
▲ 28	Open Fourth Gear Circuit
▲ 29	Shorted Fourth Gear Circuit
▲ 30	ISC Circuit Problem
▲ 31 •	Shorted MAP Sensor Circuit (AIR)
▲ 32 •	Open MAP Sensor Circuit (AIR)
▲ 33 •	MAP BARO Sensor Correlation Problem (AIR)
▲ 34 •	MAP Sensor Signal Too High (AIR)
▲ 35 •	Shorted BARO Sensor Circuit (AIR)
▲ 36 •	Open BARO Sensor Circuit (AIR)
▲ 37 •	Shorted MAT Sensor Circuit
▲ 38 •	Open MAT Sensor Circuit
▲ 39	TCC Engagement Problem
▲ 44	Lean Exhaust Signal (AIR & Closed Loop)
▲ 45	Rich Exhaust Signal (AIR & Closed Loop)
▲ 51	PROM Error
▼ 52	ECM Memory Reset Indicator

1983 DIAGNOSTIC CODES

CODE	MALFUNCTION
■■ 12	No Distributor Signal
□ 13	Oxygen Sensor Not Ready (Canister Purge)
□ 14 •	Shorted Coolant Sensor Circuit
□ 15 •	Open Coolant Sensor Circuit
■■ 16	Generator Voltage Out Of Range (All Solenoids)
□ 18	Open Crank Signal Circuit
□ 19	Shorted Fuel Pump Circuit
■■ 20	Open Fuel Pump Circuit
□ 21 •	Shorted Throttle Position Sensor Circuit (TCC)
□ 22 •	Open Throttle Position Sensor Circuit (TCC)
□ 23 *	EST/Bypass Circuit Problem (AIR)
□ 24	Speed Sensor Circuit Problem (TCC)
□ 26 •	Shorted Throttle Switch Circuit
□ 27 •	Open Throttle Switch Circuit
□ 28	Open Fourth Gear Circuit (TCC)
□ 29	Shorted Fourth Gear Circuit (TCC)
□ 30	ISC Circuit Problem
■■ 31 •	Shorted MAP Sensor Circuit (AIR)
■■ 32 •	Open MAP Sensor Circuit (AIR)
■■ 33 •	MAP/BARO Sensor Correlation Problem (AIR & TCC)
■■ 34 •	MAP Sensor Signal Too High (AIR)
□ 35 •	Shorted BARO Sensor Circuit (AIR & TCC)
□ 36 •	Open BARO Sensor Circuit (AIR & TCC)
□ 37 *	Shorted MAT Sensor Circuit
□ 38 •	Open MAT Sensor Circuit
□ 39	TCC Engagement Problem
■■ 44	Lean Exhaust Signal (AIR & CL & Canister Purge)
■■ 45	Rich Exhaust Signal (AIR & CL & Canister Purge)
■■ 51	PROM Error
▼ 52	ECM Memory Reset Indicator
▼ 53	Distributor Signal Interrupt

1982-83 CRUISE CONTROL DIAGNOSTIC CODES

CODE	MALFUNCTION
▼ 60	Transmission Not In Drive
▼ 63	Car Speed and Set Speed Difference Too High
▼ 64	Car Acceleration Too High
▼ 65	Coolant Temperature Too High
▼ 66	Engine RPM Too High
▼ 67	Cruise Switch Shorted During Enable

COMMENTS:

- ▲ Turns on "Check Engine" light
- ■■ Turns on "Service Now" light
- □ Turns on "Service Soon" light
- ▼ Does not turn on any telltale light
- • Failsoft action
- * Causes system to operate on bypass spark
- [ ] Functions within brackets are disengaged while specified malfunction remains current (hard)

1982 Cruise is disengaged with any diagnostic code

1983 Cruise is disengaged with any "Service Now" light or with code(s) 60-67

1982-83 Cruise is disabled for entire ignition cycle in which code(s) 24 and/or 67 have occurred

1982-83 PROM I.D.

PROM I.D. is Parameter 13 of Engine Data and is displayed as a numerical code as follows:

X X X

AXLE/FINAL DRIVE RATIO

Blank = 3.42:1 "C" Axle Ratio;
3.15:1 "E-K" Final Drive Ratio

1 = 3.73:1 "C" Axle Ratio;
3.36:1 "E-K" Final Drive Ratio

EMISSIONS SYSTEM

1 = "C" Federal
2 = "C" California
3 = "C" Export
4 = "E-K" Federal Mechanical Cluster
5 = "E-K" California Mechanical Cluster
6 = "E-K" Export Mechanical Cluster
7 = "E-K" Federal Digital Cluster
8 = "E-K" California Digital Cluster
9 = "E-K" Export Digital Cluster

PROM CALIBRATION

Numbers 0-9 are assigned by Cadillac Engineering. Check Cadillac Serviceman Bulletins for latest definition.

TEMPERATURE CONVERSION

°C	°F	°C	°F	°C	°F
-40	-40	30	86	85	185
-30	-22	35	95	90	194
-20	-4	40	104	95	203
-10	14	45	113	100	212
-5	23	50	122	105	221
0	32	55	131	110	230
5	41	60	140	120	248
10	50	65	149	130	266
15	59	70	158	140	284
20	68	75	167	150	302
25	77	80	176	160	320

ABBREVIATIONS

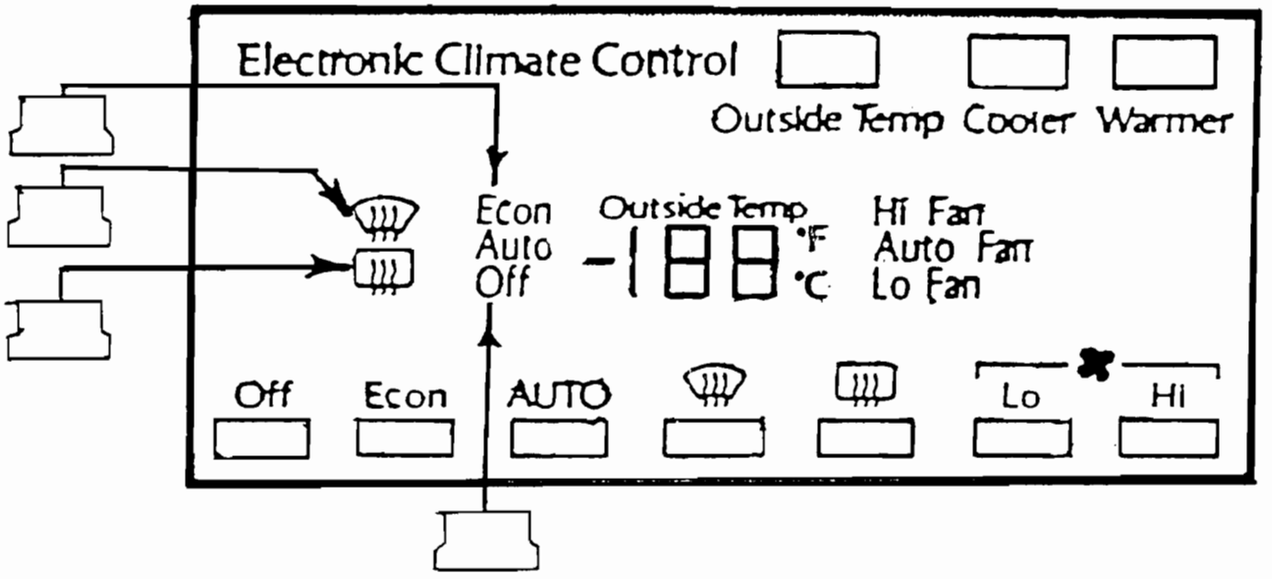
AIR	Air Injection Reaction
BARO	Barometric Pressure
CL	Closed Loop
DFI	Digital Fuel Injection
ECC	Electronic Climate Control
ECM	Electronic Control Module
EGR	Exhaust Gas Recirculation
EST	Electronic Spark Timing
FDP	Fuel Data Panel
ISC	Idle Speed Control
kPa	kilopascals
MAP	Manifold Absolute Pressure
MAT	Manifold Air Temperature
ms	milliseconds
PROM	Programmable Read Only Memory
TCC	Torque Converter Clutch

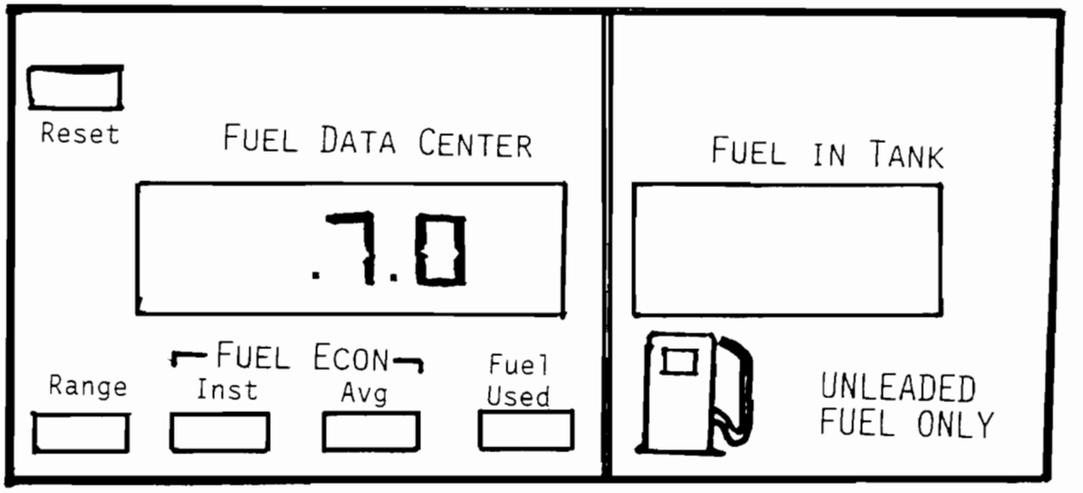
(1) Just as on the original Cadillac system that was introduced in 1980, you enter the self-diagnostic mode by pressing the Off and Warmer buttons on the Electronic Climate Control panel simultaneously. Of course, the newer versions tell you a great deal more.

(2) Trouble codes and all kinds of values are displayed on the Fuel Data Center panel. The 7.0 message means you're at a decision point—the system's ready for whatever test mode you might want to engage.

CADILLAC DFI SYSTEMS

1985-87





AUTOMATIC TRANSMISSION SERVICE GROUP

1985-87 DFI CONTROL SYSTEM (FWD)
(CADILLAC V8 ENGINES, EXCEPT DIESEL)

INTRODUCTION

You know what a C-3 scanner is, right? You plug it into the ALDL (Assembly Line Diagnostic Link, also called the ALCL for Assembly Line Communications Link) under the dash of a GM car and read trouble codes, sensor voltages, loop status, etc. Well, with Cadillac self-diagnostics you get all the same info and more just by sitting in the driver's seat and pushing buttons on the instrument panel.

Yeah, we know. A lot of you out there think self-diagnostics are a joke, a game the engineers are playing to make us believe they care whether or not the car can be fixed when they don't really give a damn. Well, we understand why you have that opinion. After all, we get all the local hopeless cases in our shop for diagnosis, so we know how frustrating it can be these days. But don't stonewall on-board diagnostics. Maybe they haven't always been that helpful in the past, but they've streamlined troubleshooting for us numerous times, and they're getting better. The system we're talking about here is nearly the ultimate, so it's worth learning about.

The DeVille has up to three computers. Yup, three. There's the ECM, of course, but also a BCM (Body Control Module), and an EBCM (Electonic Brake Control Module) tandem microprocessor for the ABS, should you opt for this great safety feature (we won't tackle brake electronics in this article).

The ECM operates in much the same way as any other sophisticated late-model automotive computer. That is, it controls injector pulse width, spark timing, canister purge, converter lockup, etc. on the basis of info it gathers from a network of spies—the oxygen, coolant temperature, vehicle speed, and other sensors, and various switches. What's different about the Cadillac approach is the comprehensive diagnostic feature. Sure, most other makes have some type of self-criticism mode, but nobody else has put as much effort into the idea as Cad. The company's engineers really believe in the concept of a car that tells you what its problems are, and we think they've got the right attitude. We believe this is the way things will have to be in the future on all high-tech cars, but the premier GM division has it now.

1985-87 DFI CONTROL SYSTEM (FWD)
(CADILLAC V8 ENGINES, EXCEPT DIESEL)

And it works—we know because we tried it. It's a little complicated, and tomorrow's versions, Cadillac or otherwise, will probably be more "user friendly," to use computerese.

But the current Caddy systems do a lot more than you'd expect. We'll be concentrating on the '87 DeVille version here because it's more common and simpler than those of the Eldorado and the megadollar Allante.

Okay, here's the scenario: A customer comes in with a driveability or performance complaint, or has become alarmed by a glowing Service Soon or Service Now dash light. Just as with any other car, the first thing you do is lift the hood and look for obvious problems such as a cracked or disconnected vacuum line or other leak on the intake side, bare or loose wires, bad electrical connections, a damaged or missing heated air intake tube, shorting plug cables, cooling system trouble, slipping belts, etc. There's always a high probability that one of these is the culprit.

But suppose it's not. The next step is to simply ease yourself into the driver's seat, switch on the ignition, and hold down the Off and Warmer buttons on the Electronic Climate Control panel simultaneously, which will engage the self-diagnostic mode. Watch the Fuel Data Center. The system will test itself, you'll see 8.8.8., then codes will be displayed for any troubles the computers have recognized. Those in the ECM's memory (called "history codes"—they weren't detected at the last start-up) will be prefixed with "E," such as E52 for the MAT (Manifold Air Temperature) sensor circuit. Current ECM codes are prefixed by E.E. Next, BCM history codes will appear with the prefix "F," then current ones with F.F.

Often, that'll be as far as you have to go. With the code to start you on the right track, check the circuit indicated for wiring problems, then the component itself if possible with a digital VOM. After you make the repair, erase ECM codes by pressing the Off and Hi buttons until you see E.0.0., and BCM codes by holding down Off and Low until F.0.0. appears. You can exit the diagnostics at any time without killing stored codes by pressing Auto.

Of course, it's not always that simple, and here's where the DeVille's capabilities exceed those of other makes. After the codes are displayed, "7.0" will appear automatically. This indicates a decision point—the system is ready to get into more involved investigations. You want engine and sensor parameters? Just start her up, hit Lo and you'll get ECM data (ideally, you'd compare this to a similar car, but that's not practical unless you work at a Cadillac dealership, so you'll have to use specs and your own judgment for deciding whether or not a reading is acceptable). E.9.0. appears, then each time you press Hi you'll advance one by one through the categories (Lo will move you back).

ECM

1985-87 DFI CONTROL SYSTEM (FWD)
(CADILLAC V8 ENGINES, EXCEPT DIESEL)

Data Display

P.0.1.—Throttle angle in degrees.

P.0.2.—Manifold absolute pressure in kilopascals.

P.0.3.—Computed BARO value in kilopascals.

P.0.4.—Coolant temperature in degrees C.

P.0.5.—Manifold air temperature in degrees C.

P.0.6.—Injector pulse width in milliseconds.

P.0.7.—Oxygen sensor voltage.

P.0.8.—Spark advance in degrees.

P.0.9.—Ignition cycle counter (0 to 50, the number of times the key has been turned on and off since a trouble that sets a code was last detected. After 50 cycles without the problem present, the code is cleared. A current or "hard" code will keep the reading at zero).

P.1.0.—Battery voltage (0 to 25.5 volts).

P.1.1.—Engine rpm (0 to 6,270—multiply the display by 10).

P.1.2.—Vehicle speed (0 to a ridiculous 255 mph).

P.1.3.—Oxygen sensor cross counts (0 to 255, indicating sensor activity—how often it switches between lean and rich signals in one second—and a low number means it's sluggish).

P.1.4.—Fuel integrator (0 to 255 counts, used to follow rich/lean trends. A reading of 128 means the integrator isn't altering the amount of fuel supplied to the engine. If the oxygen sensor is rich most of the time, the integrator value will decrease, which will direct the ECM to provide less gas, and vice versa. A reading between 88 and 160 indicates that the ECM can control fuel delivery. A failed MAT sensor will give you a steady 60 and set code E37 or E38).

P.1.5.—Viscous converter clutch voltage (0 to 5.12 volts, indicating the voltage output of the converter clutch temperature sensor, which should be low when the sensor's cold).

P.1.6.—ECM PROM identification number (indicates a particular calibration; sometimes updated PROMs are specified to correct particular problems).

When you get to the end, 7.0 will show again. ECM data is helpful by itself, but you can use it in conjunction with another feature: In the diagnostic mode, the Electronic Climate Control panel becomes a display of status lights (see illustration). For example, to troubleshoot the oxygen sensor you start the engine, go to ECM data parameter P.0.4. (coolant temp), warm it up until you get a reading of 85° C., then move on to category P.0.7. (oxygen sensor voltage). Hold rpm at 1,200-2,000 for two minutes, then note the reading. If voltage is swinging from below .30 to above .60, take a look at the Auto light on the ECC panel. If it's on, the sensor's okay. If it's off, a new part is needed. Also, the Econ light should flash on and off—if it glows constantly, the oxygen sensor signal is always rich, and if it never lights, the signal is always lean.

1985-87 DFI CONTROL SYSTEM (FWD)
(CADILLAC V8 ENGINES, EXCEPT DIESEL)

BCM

Data Display

P.2.0.—Commanded blower voltage (−3.3 to 18.0 volts).

P.2.1.—Coolant temperature (−40 to 151 degrees C.).

P.2.2.—Commanded air mix position (0-100%).

P.2.3.—Actual air mix door position (0-100%).

P.2.4.—Air delivery mode (the number is a code; 0 means max A/C, 1 A/C, 2 intermediate, 3 heater, 4 off, 5 normal purge, 6 cold purge, 7 front defog).

P.2.5.—In car temp (−40 to 102 degrees C.).

P.2.6.—Actual outside temp (−40 to 93 degrees C.).

P.2.7.—High-side temp (condenser out, −40 to 215 degrees C.).

P.2.8.—Low-side temp (evaporator in, −40 to 93 degrees C.).

P.2.9.—Actual fuel level (0 to 19 gallons).

P.3.0.—Ignition cycle counter (0 to 99 key cycles).

P.3.1.—BCM PROM identification.

Again, this info is supplemented by what the ECC panel status lights tell you.

Switch Tests

Then there's the series of tests for various switches. With the engine idling and 7.0 displayed, depress the brake pedal once and E.0.0. will appear, then E.7.1. through E.7.8. You have to cycle each switch within 10 seconds of when its number flashes on or the appropriate trouble code will be set even though the switch may be fine.

When you see E.7.1., hit the brake again and the cruise control/VCC circuit will be tested. At E.7.2., floor the accelerator once to check the throttle switch. With the brake on and E.7.4. showing, shift the trans into reverse, then neutral, which makes sure the park/neutral switch is okay. Turn the cruise control switch off and on when you see E.7.5., press and release the set/coast button at E.7.6., and operate the resume/accel switch with E.7.7. displayed. When E.7.8. appears, turn the wheel from straight ahead to full left or right to check the power steering pressure switch.

With this sequence completed, the ECM will display the trouble codes for any switch that failed its test.

ECM DIAGNOSTIC CODES

CODE	DESCRIPTION	COMMENTS
E10	No Distributor Signal	Ⓐ
E13	Oxygen Sensor Not Ready [AIR, CL & Canister Purge]	Ⓑ
E14	Shorted Coolant Sensor Circuit [AIR]	Ⓑ Ⓖ
E15	Open Coolant Sensor Circuit [AIR]	Ⓑ Ⓖ
E16	Generator Voltage Out Of Range [All Solenoids]	Ⓐ Ⓕ
E18	Open Crank Signal Circuit	Ⓑ
E19	Shorted Fuel Pump Circuit	Ⓑ
E20	Open Fuel Pump Circuit	Ⓐ
E21	Shorted Throttle Position Sensor Circuit	Ⓑ
E22	Open Throttle Position Sensor Circuit	Ⓑ
E23	EST/Bypass Circuit Problem [AIR]	Ⓑ Ⓔ
E24	Speed Sensor Circuit Problem [VCC & Cruise]	Ⓑ Ⓒ Ⓕ
E26	Shorted Throttle Switch Circuit	Ⓑ
E27	Open Throttle Switch Circuit	Ⓑ
E28	Open Third Or Fourth Gear Circuit	Ⓑ
E30	ISC Circuit Problem	Ⓑ
E31	Shorted MAP Sensor Circuit [AIR]	Ⓐ
E32	Open MAP Sensor Circuit [AIR]	Ⓐ
E34	MAP Sensor Signal Too High [AIR]	Ⓐ
E37	Shorted MAT Sensor Circuit [AIR]	Ⓑ
E38	Open MAT Sensor Circuit [AIR]	Ⓑ
E39	VCC Engagement Problem	Ⓑ
E40	Open Power Steering Pressure Switch Circuit	Ⓑ
E44	Lean Exhaust Signal [AIR, CL & Canister Purge]	Ⓐ
E45	Rich Exhaust Signal [AIR, CL & Canister Purge]	Ⓐ
E47	BCM — ECM Data Problem	Ⓑ
E48	EGR System Fault [EGR]	Ⓑ
E51	ECM PROM Error	Ⓐ
E52	ECM Memory Reset Indicator	Ⓒ
E53	Distributor Signal Interrupt	Ⓒ
E55	TPS Misadjusted	Ⓒ
E59	VCC Temperature Sensor Circuit Problem	Ⓒ
E60	Cruise - Transmission Not In Drive [Cruise]	Ⓒ
E63	Cruise - Car Speed And Set Speed Difference Too High [Cruise]	Ⓒ
E64	Cruise - Car Acceleration Too High [Cruise]	Ⓒ
E65	Cruise - Coolant Temperature Too High [Cruise]	Ⓒ
E66	Cruise - Engine RPM Too High [Cruise]	Ⓒ
E67	Cruise - Cruise Switch Shorted During Enable [Cruise]	Ⓒ Ⓓ

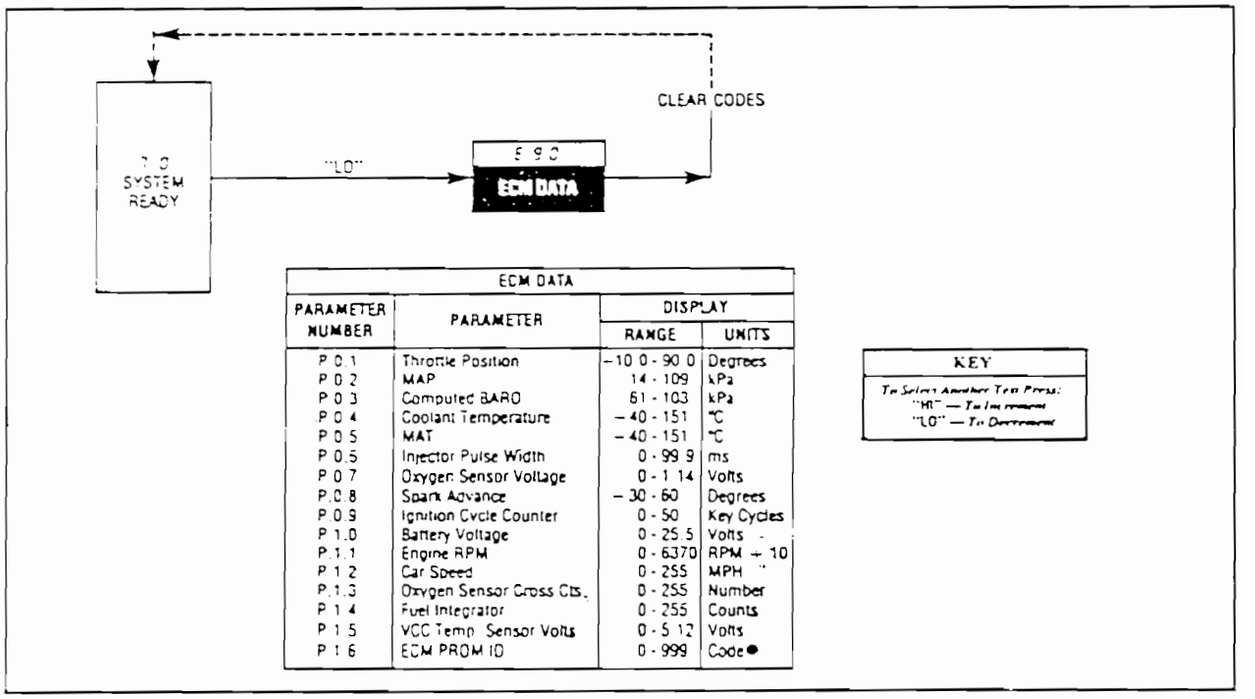
BCM DIAGNOSTIC CODES

CODE	DESCRIPTION	COMMENTS
F10	Outside Air Temperature Circuit Problem	Ⓒ
F11	A/C High Side Temperature Circuit Problem	Ⓒ Ⓗ
F12	A/C Low Side Temperature Circuit Problem [A/C Clutch]	Ⓒ
F13	In-Car Temperature Circuit Problem	Ⓒ
F30	CCP To BCM Data Problem	Ⓒ Ⓘ Ⓙ
F31	FDC To BCM Data Problem	Ⓒ Ⓘ
F32	ECM — BCM Data Problem	Ⓒ Ⓖ
F40	Air Mix Door Problem	Ⓒ
F41	Cooling Fans Problem	Ⓒ Ⓚ
F46	Low A/C Refrigerant Condition Warning	Ⓛ
F47	Very Low A/C Refrigerant Condition Warning [A/C Clutch]	Ⓜ
F48	Very Low A/C Refrigerant Pressure Condition [A/C Clutch]	Ⓜ
F49	High Temperature Clutch Disengage [A/C Clutch]	Ⓒ
F51	BCM PROM Error	Ⓒ Ⓚ

DIAGNOSTIC CODE COMMENTS

Ⓐ	Turns On "SERVICE NOW" Light
Ⓑ	Turns On "SERVICE SOON" Light
Ⓒ	Does Not Turn On Any Telltale Light
Ⓓ	Disables Cruise For Entire Ignition Cycle
Ⓔ	Causes System To Operate On Bypass Spark
Ⓕ	Disengages VCC For Entire Ignition Cycle
Ⓖ	Forces Cooling Fans On Full Speed
Ⓗ	Turns On Cooling Fans Whenever A/C Clutch Is Engaged
Ⓘ	Displays "dI" For Clock Problem Or "dI" For Data Problem
Ⓙ	Turns On Front Defog At 75°F
Ⓚ	Turns On "COOLANT TEMP/FAN" Light Whenever Cooling Fans Should Be Operating
Ⓛ	Turns On "SERVICE AIR COND" Light For A Period Of Time
Ⓜ	Turns On "SERVICE AIR COND" Light For A Period Of Time, & Switches ECC Mode To ECON
Ⓝ	Displays "-151" On CCP And Turns On Front Defog
[ ]	Functions Within Bracket Are Disengaged While Specified Malfunction Remains Current

1985-87 DFI CONTROL SYSTEM (FWD)
(CADILLAC V8 ENGINES, EXCEPT DIESEL)



ECM DATA			
PARAMETER NUMBER	PARAMETER	DISPLAY RANGE	DISPLAY UNITS
P 0.1	Throttle Position	-10.0 - 90.0	Degrees
P 0.2	MAP	14 - 109	kPa
P 0.3	Computed BARO	61 - 103	kPa
P 0.4	Coolant Temperature	-40 - 151	°C
P 0.5	MAT	-40 - 151	°C
P 0.6	Injector Pulse Width	0 - 99.9	ms
P 0.7	Oxygen Sensor Voltage	0 - 1.14	Volts
P 0.8	Spark Advance	-30 - 60	Degrees
P 0.9	Ignition Cycle Counter	0 - 50	Key Cycles
P 1.0	Battery Voltage	0 - 25.5	Volts
P 1.1	Engine RPM	0 - 6370	RPM ÷ 10
P 1.2	Car Speed	0 - 255	MPH
P 1.3	Oxygen Sensor Cross Cts.	0 - 255	Number
P 1.4	Fuel Integrator	0 - 255	Counts
P 1.5	VCC Temp. Sensor Volts	0 - 5.12	Volts
P 1.6	ECM PROM ID	0 - 999	Code●

KEY

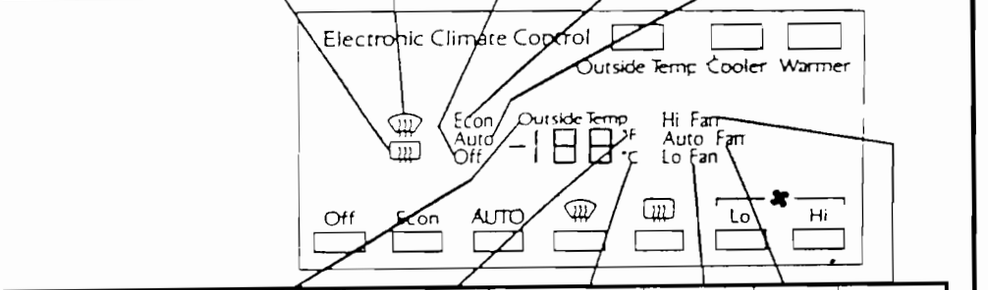
To Select Another Test Press:
"HI" — To Increment
"LO" — To Decrement

There's BCM data, too, which you'll receive by pressing Outside Temp. Note that you can control the cooling fans by pushing Econ.

The ECM switch tests will generate a trouble code for any item that doesn't make/break contact when you operate it.

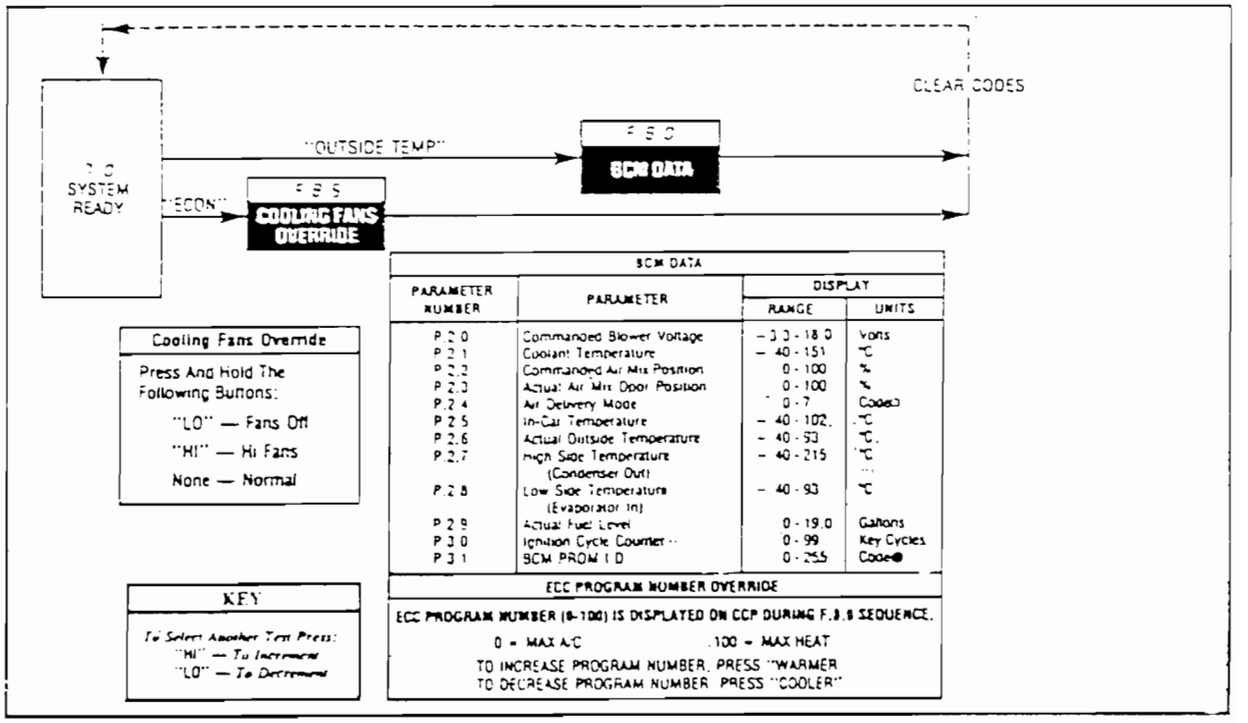
While in the diagnostic mode, the ECC panel lights indicate the status of various components and circuits.

ECM STATUS LIGHT DISPLAY						
	LIGHT ON	IN 4th GEAR	VCC ENABLED	CLOSED THROTTLE	RICH	CLOSED LOOP
	LIGHT OFF	NOT IN 4TH GEAR	VCC DISABLED	OPEN THROTTLE	LEAN	OPEN LOOP
	INDICATOR			Off	Econ	Auto
	FUNCTION	4TH GEAR INPUT	VCC OUTPUT	THROTTLE SWITCH INPUT	OXYGEN SENSOR INPUT	ECM OPERATING MODE



BCM STATUS LIGHT DISPLAY							
	FUNCTION	A/C CLUTCH OUTPUT	COMPRESSOR LOW PRESSURE SWITCH INPUT	HEATER WATER VALVE OUTPUT	A/C-DEF MODE DOOR OUTPUT	COOLING FANS STATUS	UP-DOWN MODE DOOR OUTPUT
	INDICATOR	Outside Temp	°F	°C	Lo Fan	Auto Fan	Hi Fan
	LIGHT ON	ENERGIZED	OPEN (LOW PRESSURE)	CLOSED (NO WATER FLOW)	A/C	FANS RUNNING	UP
	LIGHT OFF	DE-ENERGIZED	CLOSED	OPEN	DEF	FANS OFF	DOWN

1985-87 DFI CONTROL SYSTEM (FWD)
(CADILLAC V8 ENGINES, EXCEPT DIESEL)



ECM DATA

PARAMETER NUMBER	PARAMETER	DISPLAY RANGE	DISPLAY UNITS
P.2.0	Commanded Blower Voltage	- 3.0 - 18.0	Volts
P.2.1	Coolant Temperature	- 40 - 151	°C
P.2.2	Commanded Air Mix Position	0 - 100	%
P.2.3	Actual Air Mix Door Position	0 - 100	%
P.2.4	Air Delivery Mode	0 - 7	Codes
P.2.5	In-Car Temperature	- 40 - 102.	°C
P.2.6	Actual Outside Temperature	- 40 - 93	°C.
P.2.7	High Side Temperature (Condenser Out)	- 40 - 215	°C
P.2.8	Low Side Temperature (Evaporator In)	- 40 - 93	°C
P.2.9	Actual Fuel Level	0 - 19.0	Gallons
P.3.0	Ignition Cycle Counter*	0 - 99	Key Cycles
P.3.1	ECM PROM I.D	0 - 255	Code●

Cooling Fans Override

Press And Hold The Following Buttons:

"LO" — Fans Off

"HI" — Hi Fans

None — Normal

KEY

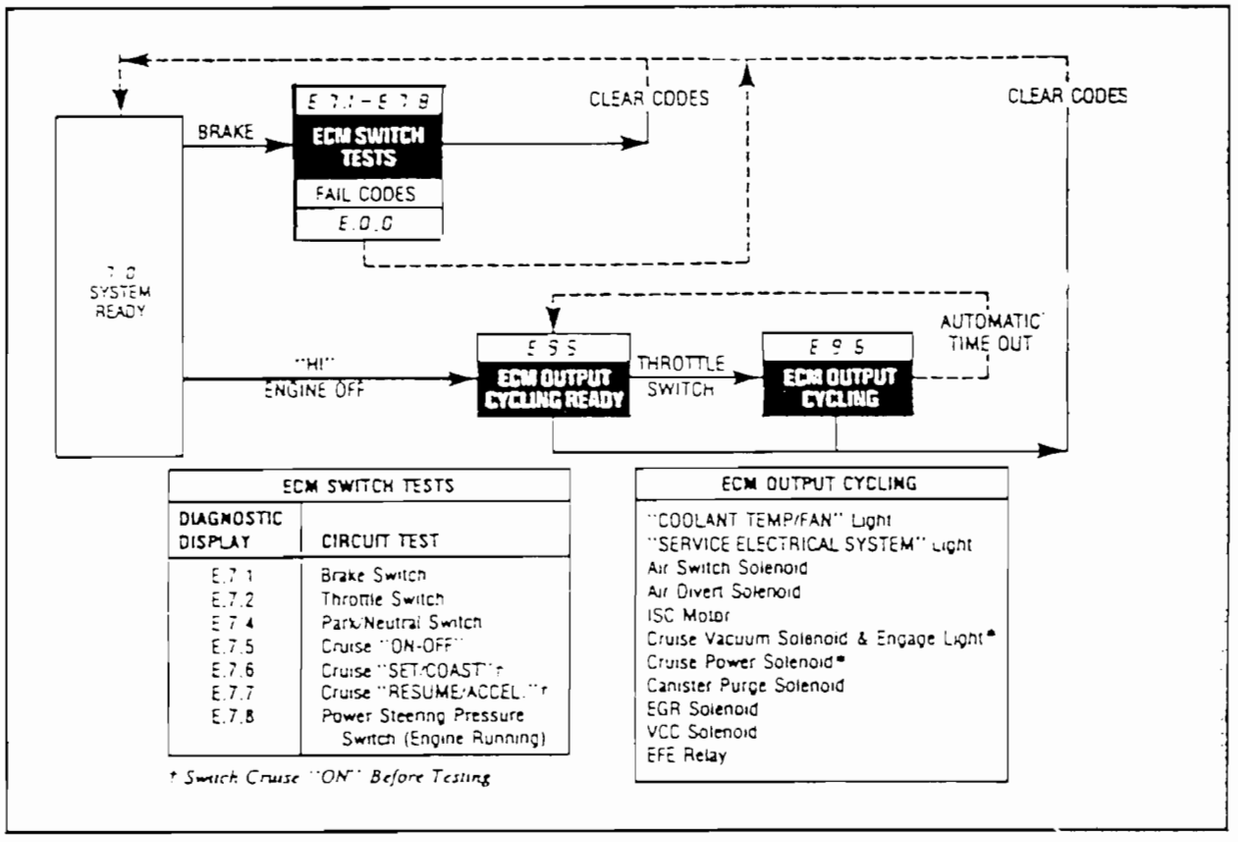
To Select Another Test Press:
"HI" — To Increment
"LO" — To Decrement

ECC PROGRAM NUMBER OVERRIDE

ECC PROGRAM NUMBER (0-100) IS DISPLAYED ON CCP DURING F.8.5 SEQUENCE.

0 = MAX A/C .100 = MAX HEAT

TO INCREASE PROGRAM NUMBER, PRESS "WARMER"
TO DECREASE PROGRAM NUMBER PRESS "COOLER"



ECM SWITCH TESTS

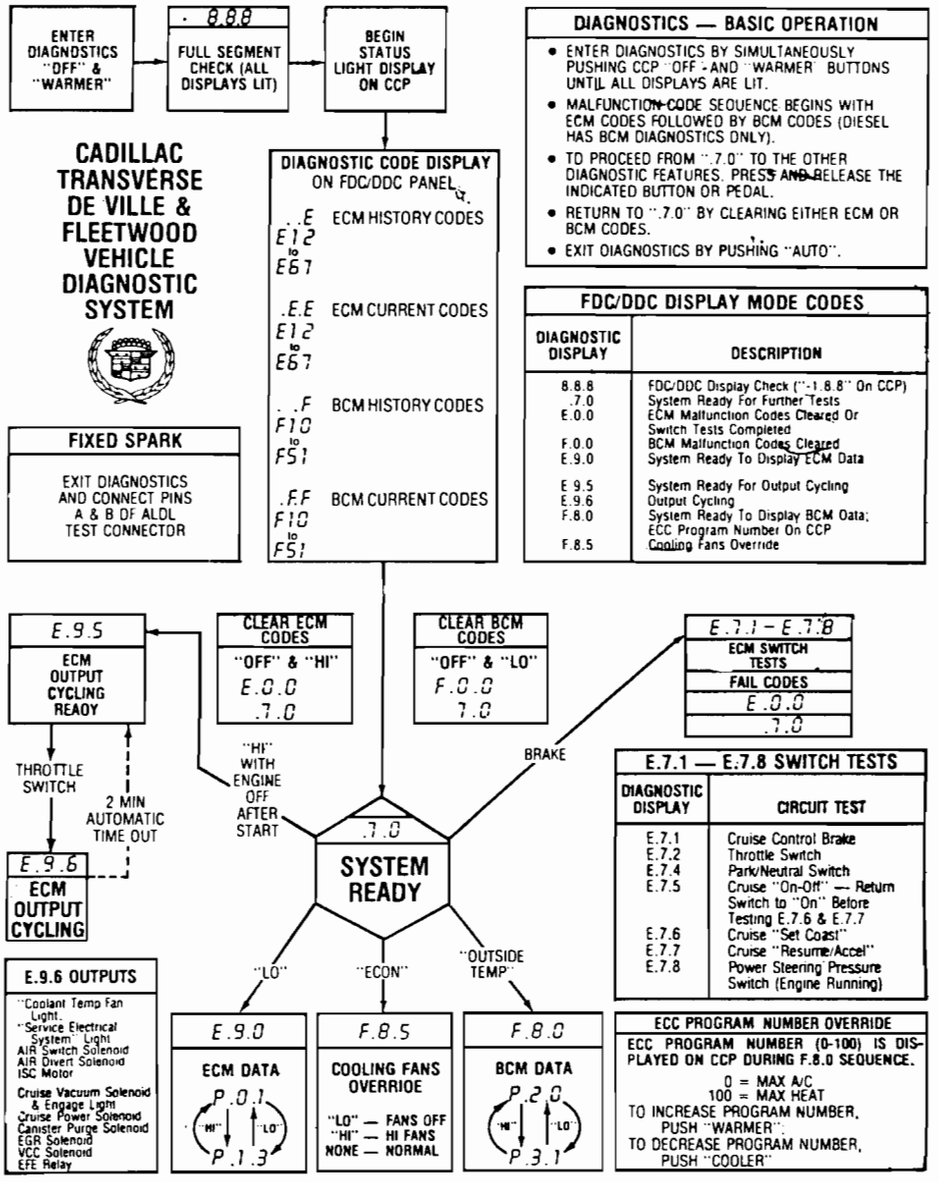
DIAGNOSTIC DISPLAY	CIRCUIT TEST
E.7.1	Brake Switch
E.7.2	Throttle Switch
E.7.4	Park/Neutral Switch
E.7.5	Cruise "ON-OFF"
E.7.6	Cruise "SET/COAST"†
E.7.7	Cruise "RESUME/ACCEL."†
E.7.8	Power Steering Pressure Switch (Engine Running)

† *Switch Cruise "ON" Before Testing*

ECM OUTPUT CYCLING

"COOLANT TEMP/FAN" Light
"SERVICE ELECTRICAL SYSTEM" Light
Air Switch Solenoid
Air Divert Solenoid
ISC Motor
Cruise Vacuum Solenoid & Engage Light●
Cruise Power Solenoid●
Canister Purge Solenoid
EGR Solenoid
VCC Solenoid
EFE Relay

THM 440-T4



DIAGNOSTICS — BASIC OPERATION

- ENTER DIAGNOSTICS BY SIMULTANEOUSLY PUSHING CCP "OFF" AND "WARMER" BUTTONS UNTIL ALL DISPLAYS ARE LIT.
- MALFUNCTION CODE SEQUENCE BEGINS WITH ECM CODES FOLLOWED BY BCM CODES (DIESEL HAS BCM DIAGNOSTICS ONLY).
- TO PROCEED FROM ".7.0" TO THE OTHER DIAGNOSTIC FEATURES, PRESS AND RELEASE THE INDICATED BUTTON OR PEDAL.
- RETURN TO ".7.0" BY CLEARING EITHER ECM OR BCM CODES.
- EXIT DIAGNOSTICS BY PUSHING "AUTO".

FDC/DDC DISPLAY MODE CODES

DIAGNOSTIC DISPLAY	DESCRIPTION
8.8.8	FDC/DDC Display Check ("-1.8.8" On CCP)
.7.0	System Ready For Further Tests
E.0.0	ECM Malfunction Codes Cleared Or Switch Tests Completed
F.0.0	BCM Malfunction Codes Cleared
E.9.0	System Ready To Display ECM Data
E.9.5	System Ready For Output Cycling
E.9.6	Output Cycling
F.8.0	System Ready To Display BCM Data; ECC Program Number On CCP
F.8.5	Cooling Fans Override

E.7.1 — E.7.8 SWITCH TESTS

DIAGNOSTIC DISPLAY	CIRCUIT TEST
E.7.1	Cruise Control Brake
E.7.2	Throttle Switch
E.7.4	Park/Neutral Switch
E.7.5	Cruise "On-Off" — Return Switch to "On" Before Testing E.7.6 & E.7.7
E.7.6	Cruise "Set Coast"
E.7.7	Cruise "Resume/Accel"
E.7.8	Power Steering Pressure Switch (Engine Running)

E.9.6 OUTPUTS

"Coolant Temp Fan Light"
"Service Electrical System" Light
AIR Switch Solenoid
AIR Divert Solenoid
ISC Motor
Cruise Vacuum Solenoid & Engage Light
Cruise Power Solenoid
Canister Purge Solenoid
EGR Solenoid
VCC Solenoid
EFE Relay

ECC PROGRAM NUMBER OVERRIDE

ECC PROGRAM NUMBER (0-100) IS DISPLAYED ON CCP DURING F.8.0 SEQUENCE.

0 = MAX A/C
100 = MAX HEAT

TO INCREASE PROGRAM NUMBER, PUSH "WARMER".
TO DECREASE PROGRAM NUMBER, PUSH "COOLER"

E.9.0 ENGINE DATA DISPLAY

PARAMETER NUMBER	PARAMETER	PARAMETER RANGE	DISPLAY UNITS
P.0.1	Throttle Position	-10 - 90	Degrees
P.0.2	MAP	14 - 109	kPa
P.0.3	Computed BARO	61 - 103	kPa
P.0.4	Coolant Temperature	-40 - 151	°C
P.0.5	MAT	-40 - 151.	°C
P.0.6	Injector Pulse Width	0 - 99.9	ms
P.0.7	Oxygen Sensor Voltage	0 - 1.14	Volts
P.0.8	Spark Advance	0 - 52	Degrees
P.0.9	Ignition Cycle Counter	0 - 50	Key Cycles
P.1.0	Battery Voltage	0 - 25.5	Volts
P.1.1	Engine RPM	0 - 6370	RPM ÷ 10
P.1.2	Car Speed	0 - 255	MPH
P.1.3	ECM PROM I.D.	0 - 255	Code

F.8.0 BCM DATA DISPLAY

PARAMETER NUMBER	PARAMETER	PARAMETER RANGE	DISPLAY UNITS
P.2.0	Commanded Blower Voltage	-3.3 - 18.0	Volts
P.2.1	Coolant Temperature	40 - 215	°C
P.2.2	Commanded Air Mix Door Position	0 - 100	%
P.2.3	Actual Air Mix Door Position	0 - 100	%
P.2.4	Air Delivery Mode 0 = Max A/C 4 = Off 1 = A/C 5 = Normal Purge 2 = Intermediate 6 = Cold Purge 3 = Heater 7 = Front Defog	0 - 7	Code
P.2.5	In-Car Temperature	-40 - 102	°C
P.2.6	Actual Outside Temperature	-40 - 93	°C
P.2.7	High Side Temperature (Condenser Out)	-40 - 215	°C
P.2.8	Low Side Temperature (Evaporator In)	-40 - 93	°C
P.2.9	Actual Fuel Level	0 - 19.0	Gallons
P.3.0	Ignition Cycle Counter	0 - 99	Key Cycles
P.3.1	BCM PROM I.D.	0 - 255	Code

ECM PROM I.D.

ECM PROM I.D. is Parameter .1.3 of Engine Data and is displayed as a numerical code as follows:

X X X

FINAL DRIVE RATIO
2 = 3.33:1 (2.97:1 Effective Ratio)

EMISSIONS SYSTEM
1 = Federal
2 = California
3 = Export
4 = Altitude

ECM PROM CALIBRATION
Number varies with individual calibration.

BCM PROM I.D.

BCM PROM I.D. is Parameter .3.1 of BCM Data and is displayed as a numerical code as follows:

X XX

ENGINE SYSTEM
Blank = Gas
1 = Diesel

BCM PROM CALIBRATION
Numbers vary with individual calibration.

CADILLAC ENGINEERING (4004)

CADILLAC CRAFTSMAN'S LEAGUE

FIRST EDITION

ECM DIAGNOSTIC CODES

CODE		MALFUNCTION
■■	E12	No Distributor Signal
□	E13	Oxygen Sensor Not Ready (AIR & CL & Canister Purge)
□	E14 •	Shorted Coolant Sensor Circuit (AIR)
□	E15 •	Open Coolant Sensor Circuit (AIR)
■■	E16	Generator Voltage Out Of Range (All Solenoids)
□	E18	Open Crank Signal Circuit
□	E19	Shorted Fuel Pump Circuit
■■	E20	Open Fuel Pump Circuit
□	E21 •	Shorted Throttle Position Sensor Circuit
□	E22 •	Open Throttle Position Sensor Circuit
□	E23 ★	EST Bypass Circuit Problem (AIR)
□	E24	Speed Sensor Circuit Problem (VCC)
□	E26 •	Shorted Throttle Switch Circuit
□	E27 •	Open Throttle Switch Circuit
□	E28	Open Third Or Fourth Gear Circuit
□	E30	ISC Circuit Problem
■■	E31 •	Shorted MAP Sensor Circuit (AIR)
■■	E32 •	Open MAP Sensor Circuit (AIR)
■■	E34 •	MAP Sensor Signal Too High (AIR)
□	E37 •	Shorted MAT Sensor Circuit (AIR)
□	E38 •	Open MAT Sensor Circuit (AIR)
□	E39	VCC Engagement Problem
□	E40	Open Power Steering Pressure Switch Circuit
■■	E44	Lean Exhaust Signal (AIR & CL & Canister Purge)
■■	E45	Rich Exhaust Signal (AIR & CL & Canister Purge)
□	E47	BCM — ECM Data Problem
■■	E51	ECM PROM Error
☑	E52	ECM Memory Reset Indicator
▼	E53	Distributor Signal Interrupt
▼	E59 •	VCC Temperature Sensor Circuit Problem

CRUISE CONTROL DIAGNOSTIC CODES

CODE	MALFUNCTION
▼ E60	Transmission Not In Drive
▼ E63	Car Speed and Set Speed Difference Too High
▼ E64	Car Acceleration Too High
▼ E65	Coolant Temperature Too High
▼ E66	Engine RPM Too High
▼ E67	Cruise Switch Shorted During Enable

BCM DIAGNOSTIC CODES

CODE	DESCRIPTION
▼ F10 •	Outside Air Temperature Circuit Problem
▼ F11	A C High Side Temperature Circuit Problem
▼ F12 •	A C Low Side Temperature Circuit Problem (A C Clutch)
▼ F13 •	In-Car Temperature Circuit Problem
▼ F14 •	Diesel Coolant Temperature Circuit Problem
▼ F30	CCP to BCM Data Problem
▼ F31	FDC DDC to BCM Data Problem
▼ F32	ECM — BCM Data Problem
▼ F40	Air Mix Door Problem
▼ F41	Cooling Fans Problem
☑ F46	Low Refrigerant Condition Warning
☑ F47	Very Low Refrigerant Condition (A C Clutch)
☑ F48	Very Low Refrigerant Pressure (A C Clutch)
▼ F49	High Temperature Clutch Disengage (A C Clutch)
▼ F51	BCM PROM Error

SEE DIAGNOSTIC CODE COMMENTS BELOW

DIAGNOSTIC CODE COMMENTS:

■■	Turns on "Service Now" light.
□	Turns on "Service Soon" light.
☑	Turns on "Service Air Cond" light.
▼	Does not turn on any telltale light.
•	Failsoft action.
★	Causes system to operate on bypass spark.
[ ]	Functions within brackets are disengaged while specified malfunction remains current (hard).
E16 & E24	Disengage VCC for entire ignition cycle.
E24 & E67	Disengage Cruise for entire ignition cycle.

Cruise is disengaged with code(s) E16, E51 or E60-E66.

F11	Turns on cooling fans whenever A/C clutch is engaged.
F14	Turns on cooling fans.
F30&F31	Display "c" for clock problem or "d" for data problem on CCP, FDC, or DDC.
F30	Turns on front defog at 75°F.
F41	Turns on "Coolant Temp/Fans" light whenever cooling fans should be operating.
F46	Turns on "Service Air Cond" light for a period of time.
F47 & F48	Turn on "Service Air Cond" light for a period of time, and switch to "ECON".
F51	Displays "–151" on CCP and turns on front defog.

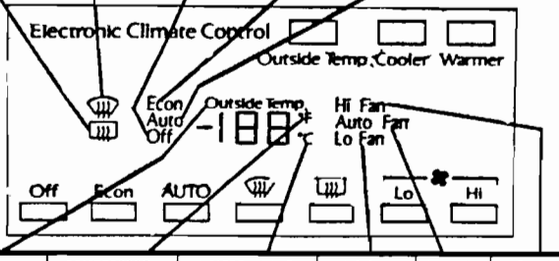
ABBREVIATIONS

AIR	Air Injection Reaction	EST	Electronic Spark Timing
BARO	Barometric Pressure	FDC	Fuel Data Center
BCM	Body Computer Module	ISC	Idle Speed Control
CCP	Climate Control Panel	kPa	kilopascals
CL	Closed Loop	MAP	Manifold Absolute Pressure
DDC	Diesel Data Center	MAT	Manifold Air Temperature
ECC	Electronic Climate Control	ms	milliseconds
ECM	Electronic Control Module	PROM	Programmable Read Only Memory
EFE	Early Fuel Evaporation	VCC	Viscous Converter Clutch
EGR	Exhaust Gas Recirculation		

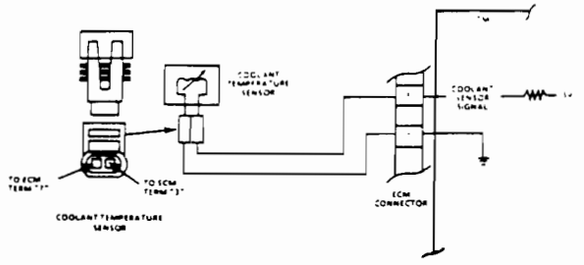
TEMPERATURE CONVERSION

°C	°F	°C	°F	°C	°F
–40	–40	40	104	105	221
–30	–22	45	113	110	230
–20	– 4	50	122	120	248
–10	14	55	131	130	266
– 5	23	60	140	140	284
0	32	65	149	150	302
5	41	70	158	160	320
10	50	75	167	170	338
15	59	80	176	180	356
20	68	85	185	190	374
25	77	90	194	200	392
30	86	95	203	210	410
35	95	100	212	215	419

ECM STATUS LIGHT DISPLAY						
	LIGHT ON	IN 4th GEAR	VCC ENABLED	CLOSED THROTTLE	RICH	CLOSED LOOP
	LIGHT OFF	NOT IN 4TH GEAR	VCC DISABLED	OPEN THROTTLE	LEAN	OPEN LOOP
	INDICATOR			Off	Econ	Auto
	FUNCTION	4TH GEAR INPUT	VCC OUTPUT	THROTTLE SWITCH INPUT	OXYGEN SENSOR INPUT	ECM OPERATING MODE



BCM STATUS LIGHT DISPLAY							
	FUNCTION	A/C CLUTCH OUTPUT	COMPRESSOR LOW PRESSURE SWITCH INPUT	HEATER WATER VALVE OUTPUT	A/C-DEF MODE DOOR OUTPUT	COOLING FANS STATUS	UP/DOWN MODE DOOR OUTPUT
	INDICATOR	Outside Temp	°F	°C	Lo Fan	Auto Fan	Hi Fan
	LIGHT ON	ENERGIZED	OPEN (LOW PRESSURE)	CLOSED (NO WATER FLOW)	A/C	FANS RUNNING	UP
	LIGHT OFF	DE-ENERGIZED	CLOSED	OPEN	DEF	FANS OFF	DOWN



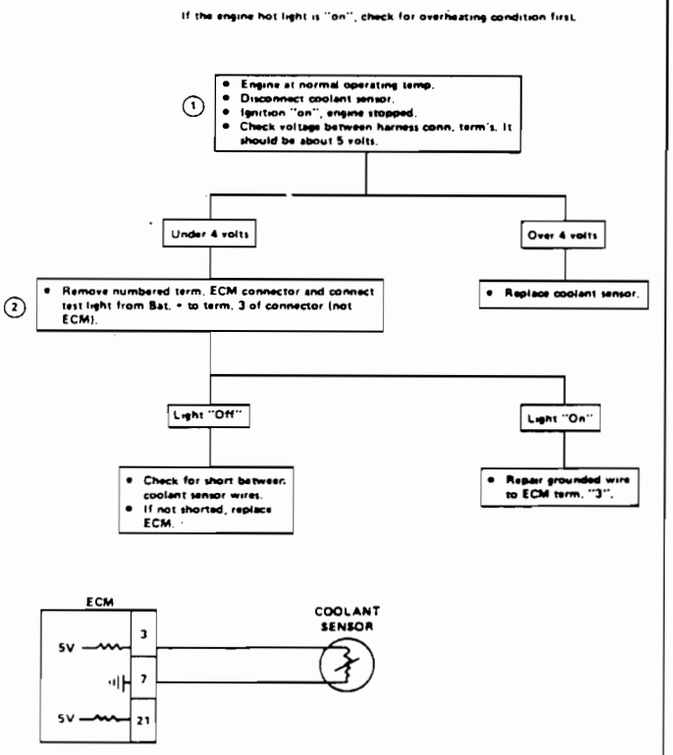
CODE 14, COOLANT SENSOR SHORTED

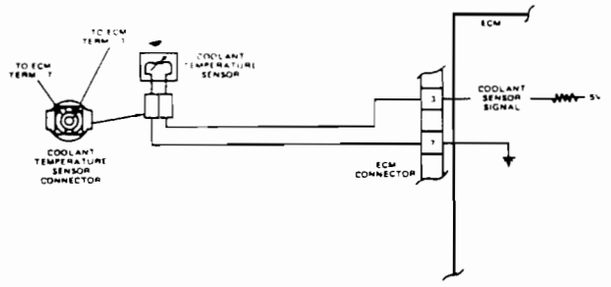
Code 14 means the ECM has seen low resistance of the coolant sensor circuit as high engine temperature, or low voltage at ECM term. "3", for a time longer than specified.

1) This test determines whether fault is in sensor or circuit. Normal circuit voltage is about 5 volts.

NOTE: **Coolant sensor IS NOT connected during this test.**

2) Checks for ground between ECM and coolant sensor. Test light to battery positive will be "OFF" in an ungrounded circuit.





CODE 15, COOLANT SENSOR OPEN

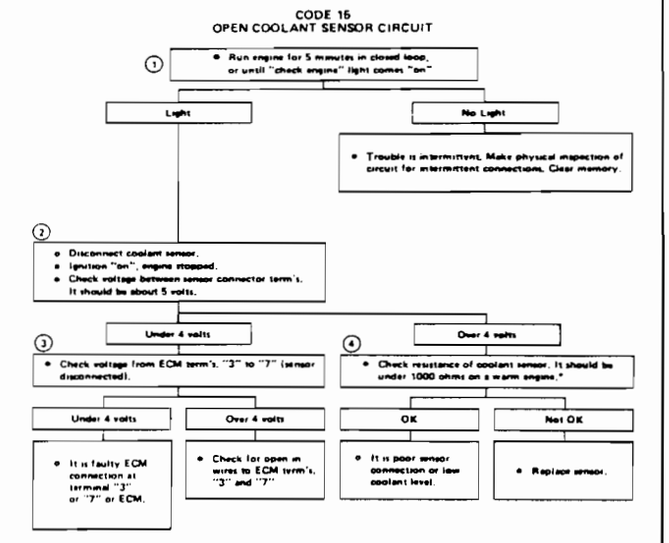
Code 15 means the ECM has seen the resistance of the Coolant Sensor circuit too high. This could be due to high resistance (cold engine temperature) or high voltage at ECM term. "3", for too long a time. This may cause detonation on a warm engine due to excessive spark advance, or poor driveability due to inaccurate fuel control.

1) If problem still exists, "CHECK ENGINE" light will come on and Code 15 will be set.

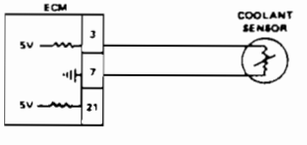
2) This test checks if fault is coolant sensor or lack of voltage to sensor. Normal reading is 5 volts across coolant sensor connector.

3) This test determines whether the low voltage at the sensor connector is due to opens in the coolant sensor wires, or in another part of the 5 volt reference circuit. Normal voltage is about 5 volts from ECM terms. "3" to "7."

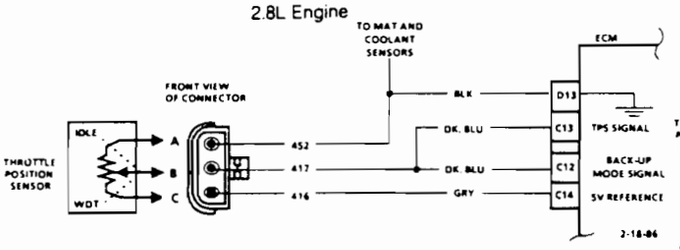
4) This test checks resistance of the coolant sensor. If the resistance is within the chart specifications, coolant sensor is not faulty. Check for corrosion at the connector or low coolant level.



COOLANT SENSOR TEMPERATURE TO RESISTANCE VALUES (APPROXIMATE)		
°F	°C	OHMS
210	100	185
160	70	450
100	38	1,800
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700



2.8L Engine



CODE 21
TPS SIGNAL VOLTAGE HIGH
(ALL ENGINES)

The TPS provides a voltage signal that changes relative to the throttle blade. Signal voltage will vary from about .5 volt at idle to 5 volts at wide open throttle. Code 21 will set if the following conditions occur: TPS signal voltage is greater than 2.5 volts for 3 seconds, airflow less than 12 gm/sec., engine speed less than 1200 RPM or TPS voltage over 4.5 volts with ignition on or engine running.

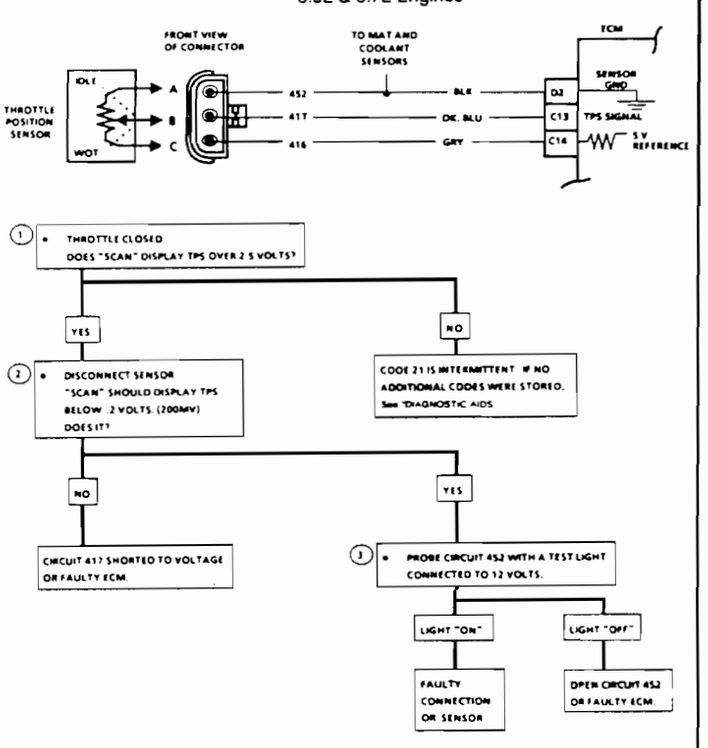
NOTE: Test numbers refer to test numbers on diagnostic chart.

1) Confirms Code 21, and that fault is present.
2) With TPS sensor disconnected, the TPS voltage should go low if the ECM and wiring are okay.
3) Probing circuit No. 452 with a test light checks the 5-volt return circuit, because a faulty 5-volt return will cause a Code 21.

DIAGNOSTIC AIDS

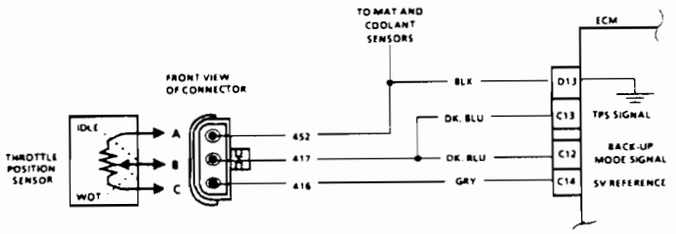
The "SCAN" tester reads throttle position in volts. Reading should be .55-volts with throttle closed and ignition on or at idle. Voltage should increase at a steady rate as throttle is moved toward WOT. An open in circuit No. 452 will result in a Code 21.

5.0L & 5.7L Engines



CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

2.8L Engine



CODE 22
TPS SIGNAL VOLTAGE LOW
(ALL ENGINES)

The TPS provides a voltage signal that changes relative to the throttle blade. Signal voltage will vary from about .5 volt at idle to 4.5 volts at wide open throttle. Code 22 will set if TPS signal voltage is less than about .2 volt for 3 seconds and the engine running.

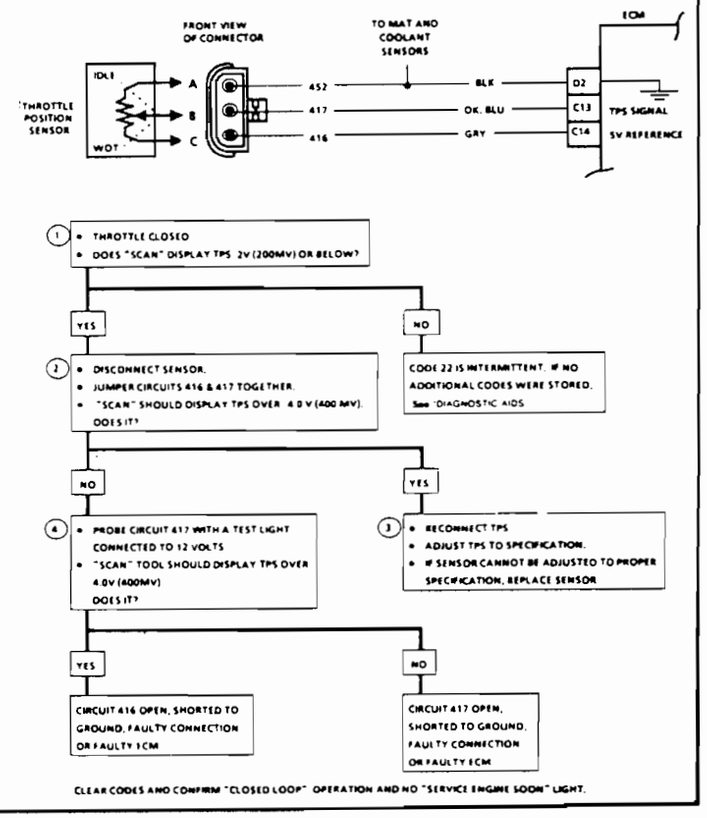
NOTE: Test numbers refer to test numbers on diagnostic chart.

1) Confirms Code 22, and that fault is present.
2) Simulates Code 21, if the ECM recognizes the high signal voltage and sets Code 21, the ECM and wiring are okay.
3) With throttle closed, the TPS adjustment voltage reading should be about .56 volts.
4) This simulates a high signal voltage to check for an open in circuit No. 417.

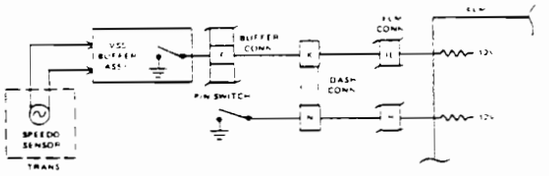
DIAGNOSTIC AIDS

The "SCAN" tester reads throttle position in volts. Reading should be about .56 volts with throttle closed and ignition on or at idle. Voltage should increase at a steady rate as throttle is moved toward WOT. An open or short to ground in circuits No. 416 or 417 will result in a Code 22.

5.0L & 5.7L Engines



CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.



CODE 24, VEHICLE SPEED SENSOR (VSS) (DIGITAL CLUSTER)

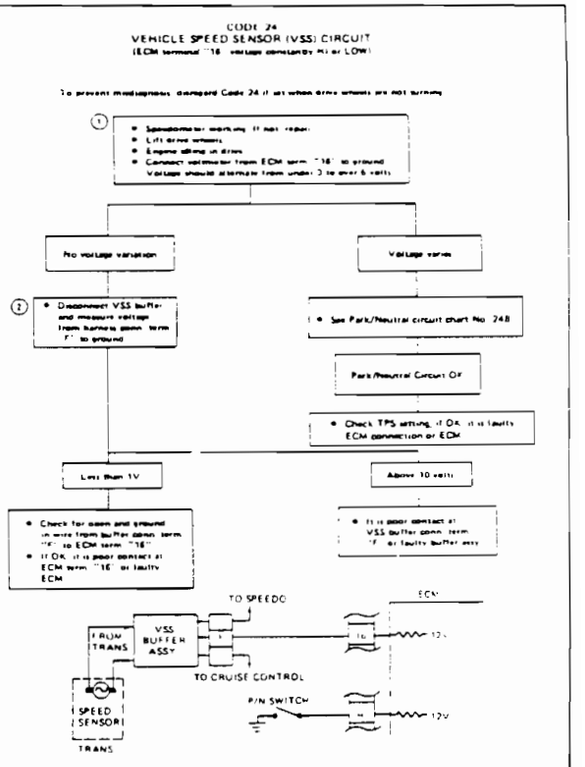
Vehicle speed is sensed by a Vehicle Speed Sensor (VSS). This is comprised of a sensor unit mounted on the transmission, and a VSS Buffer mounted behind the instrument panel (I.P.). The Buffer is supplied 12 volts by the ignition and the ECM. The output from the Buffer to the ECM is a "toggling" of voltage. As the vehicle speed increases the 12 volt signal from the ECM is turned "ON" and "OFF," the faster the speed, the more rapidly the signal toggles. This tells the ECM how fast the vehicle is going. Code 24 says that the ECM has seen the following:

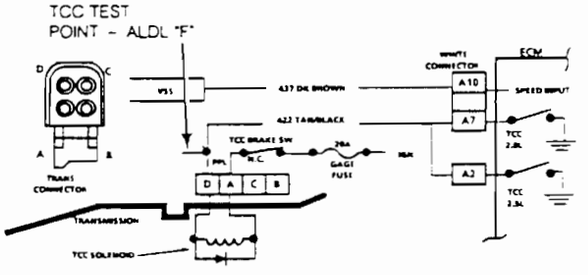
- Vehicle Speed Signal (voltage at term. "16") not rising and falling.
- RPM within an upper and lower limit.
- Engine load (TPS) above a given value.
- Not in Park or Neutral.
- For more than a given time.

This could keep the Torque Clutch Converter from applying and affect idle speed control motor.

1) This test checks if there is a VSS signal to the ECM while the drive wheels are turning. Normal voltage will vary from under 3 volts to more than 6 volts as the wheels turn. If the voltage varies while the wheels are turned, the problem is not in the VSS circuit. Fault could be ECM connector, the ECM or TPS setting.

2) This test checks for proper voltage from ECM to Buffer connector term. "F." If the voltage output from the ECM to the Buffer is in the normal 10-12 volt range the fault is in the buffer connections or the buffer. Low voltage indicates a ground or open to or in the ECM.





TORQUE CONVERTER CLUTCH ELECTRICAL DIAGNOSIS (2.5L & 2.8L ENGINES)

Circuit Description

The purpose of TCC is to eliminate the power loss of torque converter stage when vehicle is in "cruise" condition. This allows the use of an automatic transmission with the fuel economy of a manual transmission.

Fused battery ignition power is supplied to TCC solenoid through the TCC brake switch.

The ECM will engage TCC by grounding circuit No. 422 to energize the TCC solenoid.

Engagement of torque converter clutch will be executed under the following conditions:

- Vehicle speed above 24 MPH.
- Engine temperature above 149°F (65°C).
- Steady TPS reading (not changing-steady road speed).
- Brake switch closed.
- Transmission in 3rd or 4th gear.

Test Description

NOTE: Test numbers refer to test numbers on diagnostic chart.

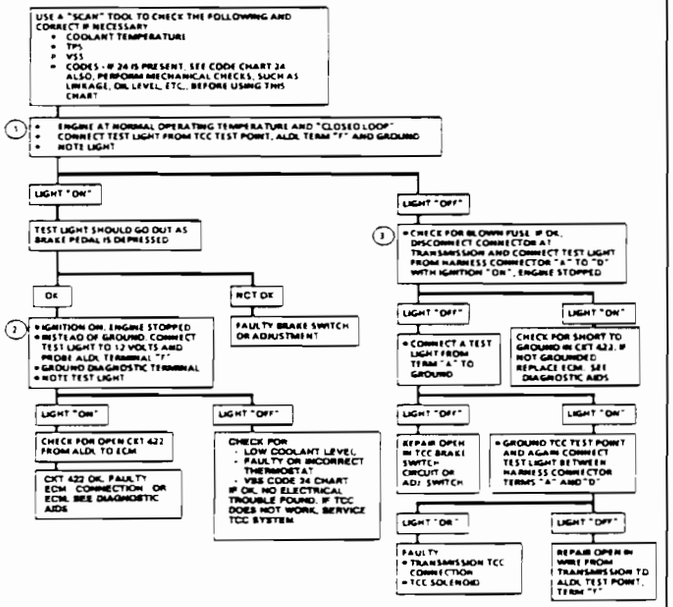
1) Check continuity through the brake switch and TCC solenoid.

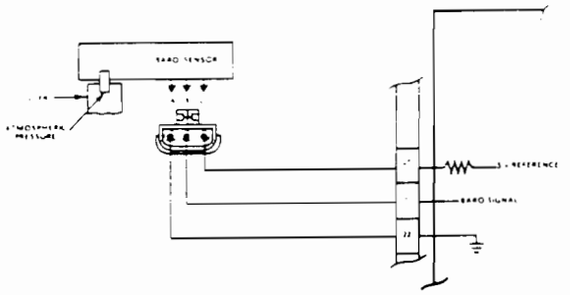
2) Check ability of ECM to energize the TCC solenoid. Grounding the diagnostic connector should energize the relay and cause the light to go out.

3) This test by-passes the TCC solenoid and checks for an open or short in circuit No. 422.

Diagnostic Aids

Solenoid coil resistance must measure more than 20 ohms. Less resistance will cause early failure of the ECM "DRIVER". Using an ohmmeter, check solenoid coil resistance of all ECM-controlled solenoids and relays before replacing ECM. Replace any solenoid or relay that measures less than 20 ohms resistance.





CODE 32, BARO SENSOR

NOTE: **The BARO sensor reacts like a MAP sensor in that it measures highest voltage when barometric pressure is highest.**

Code 32 says that the ECM has seen a BARO pressure (measured in volts) too low at term. "1" of the ECM.

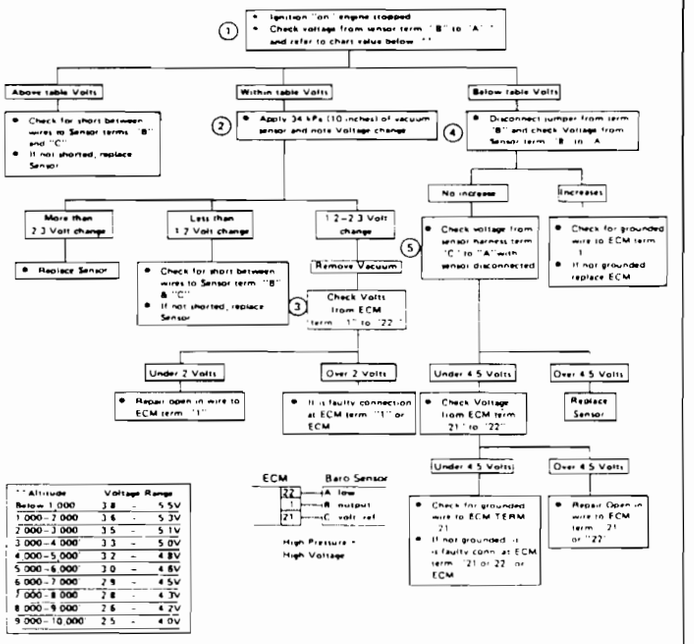
1) This test checks voltage output at the sensor. Voltage normally falls within the middle range on table.

2) This test checks for change in voltage at sensor with reduced barometric pressure (applied vacuum). Normal change should be 1.2-2.3 volts. If change is within specifications, fault is not in sensor, but in wiring or ECM.

3) This test determines if fault is in wiring to sensor, ECM connections or ECM.

4) Measures output of sensor with circuit open to ECM. This is to determine if the fault is in the circuit to ECM term. "1" or the ECM, as would be the case if the voltage increased in this step.

5) Takes the sensor out of the circuit to check for proper 5 volt supply voltage from the ECM. With 5 volt reference voltage, sensor is faulty; if not, the circuit from the ECM, or ECM itself, is at fault.



** Altitude	Voltage Range
Below 1,000	3.8 – 5.5V
1,000–2,000	3.6 – 5.3V
2,000–3,000	3.5 – 5.1V
3,000–4,000	3.3 – 5.0V
4,000–5,000	3.2 – 4.8V
5,000–6,000	3.0 – 4.6V
6,000–7,000	2.9 – 4.5V
7,000–8,000	2.8 – 4.3V
8,000–9,000	2.6 – 4.2V
9,000–10,000	2.5 – 4.0V

CODE 34, MAP SENSOR CIRCUIT

Code 34 says that the ECM has seen the following:

- Pressure outside a specified voltage range (seen by ECM as voltage at term. "20").
- Engine RPM less than a given value.
- Engine at operating temperature.
- All the above for a time greater than specified.

Too high a voltage could cause poor performance because of decreased spark advance and wrong fuel control. Too low a voltage could cause detonation because of too much spark advance and poor performance because of poor fuel control.

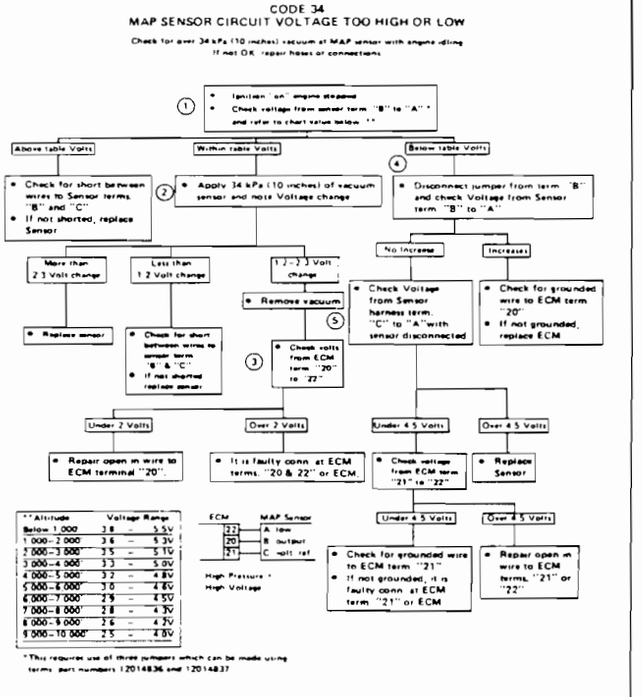
1) This step measures the voltage of the MAP sensor as a means of comparison to its known voltage range. A good sensor will fall about mid-way in the voltage range given in the chart. Measurement must be made with the sensor harness connected and jumpers installed.

2) Applying 10 in. Hg to the sensor should reduce the voltage output of the sensor 1.2-2.3 volts from what was recorded in Step **1).** The sensor has its highest output when manifold pressure (lack of vacuum) is at its highest. The voltage should change as soon as the vacuum is changed. A sluggish sensor could cause detonation and/or poor performance. Rapid voltage changes can only be measured with a DVM.

3) This step checks the voltage at the ECM. Under 2 volts indicates an open in the wire to term. "20." A reading over 2 volts indicates the wiring is okay and fault is in the ECM connections or the ECM.

4) This step checks to determine if the source of low output from the MAP sensor is a ground in the circuit to ECM term. "20" or the ECM. This would be indicated by opening the circuit to term. "20" and noting a voltage increase to normal range when measured at the sensor.

5) This step detemines if the circuit from the 5 volt reference in the ECM and back through term. "22" is complete. Normal reading would be about 5 volts.



** Altitude	Voltage Range
Below 1,000	3.8 – 5.5V
1,000–2,000	3.6 – 5.3V
2,000–3,000	3.5 – 5.1V
3,000–4,000	3.3 – 5.0V
4,000–5,000	3.2 – 4.8V
5,000–6,000	3.0 – 4.6V
6,000–7,000	2.9 – 4.5V
7,000–8,000	2.8 – 4.3V
8,000–9,000	2.6 – 4.2V
9,000–10,000	2.5 – 4.0V

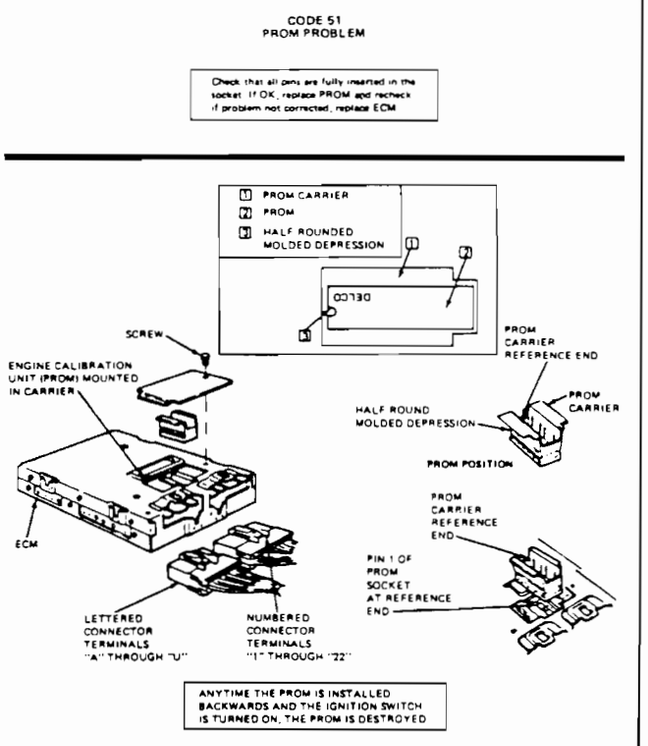
CODE 51, PROM

Code 51 sets if any of the following occur:

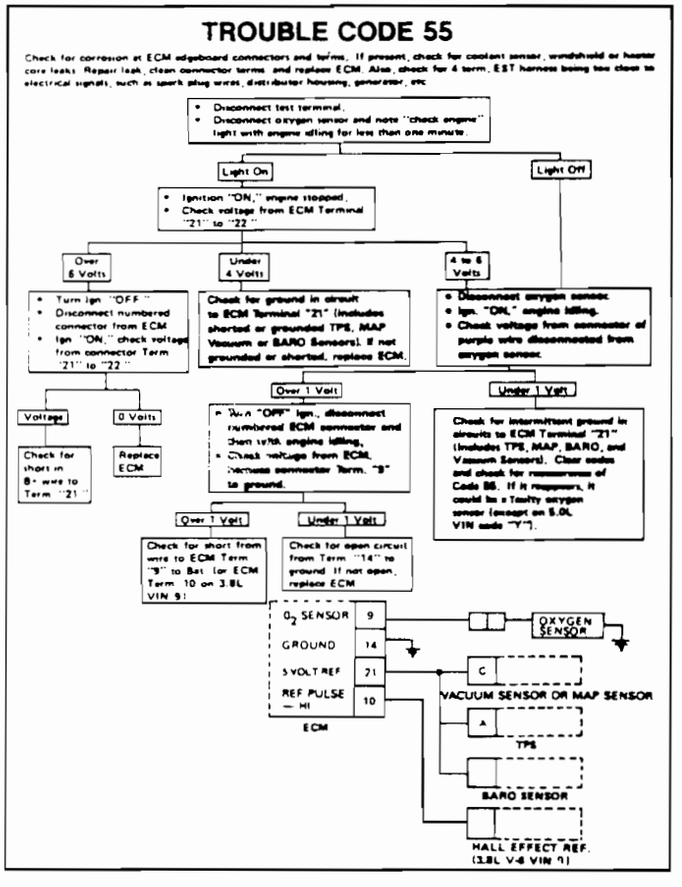
- Faulty PROM unit.
- PROM unit improperly installed (may not set a code if installed backward).
- Some PROM pins not making contact (i.e. bent).

Always check to see that the PROM pins are not bent and inserted properly into ECM.

Make sure the PROM is installed in the proper direction as shown in the chart.



TROUBLE CODE 55



FORD MOTOR CO.

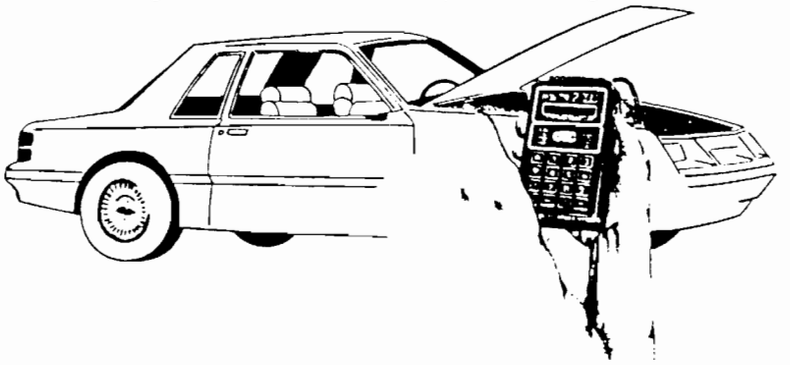
COMPUTERIZED ENGINE CONTROL SYSTEM DESCRIPTIONS

The **Monitor 2000** may be used to diagnose problems in these current Ford computerized engine controlled systems:

Microprocessor Control Unit (MCU)
Electronic Engine Control IV (EEC-IV)
Electronic Engine Control IV- Sequential Fuel Injection (EEC-IV-SFI)

The MCU system was first introduced in 1980 for California vehicles. The computer controls engine air/fuel ratios, and air injection. On some applications the computer will also control canister purge, spark retard, and idle speed.

The EEC-IV system was first introduced in 1983. The computer controls the air/fuel ratio, engine idle speed, EGR valve, fuel pump, air conditioning, coolant fan, and spark timing.



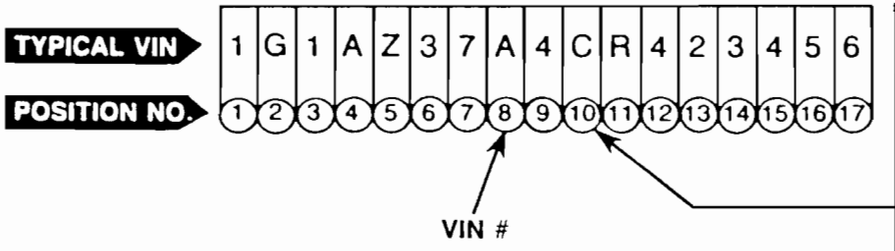
The MCU, EEC-IV and EEC-IV-SFI can be tested quickly by simply plugging the **Monitor 2000** into the Self-Test connector located in the engine compartment. Once connected, several diagnostic procedures are available. The technician can retrieve any service codes held in memory by the Ford computer, check computed timing, request the Ford computer to initiate a Running Self-Test or a sensor Output State Test, ask the computer to clear any service codes, or review service codes stored in the library.

Testing connectors has always been a problem on computer controlled vehicles. The **Monitor 2000** provides a test for evaluating these troublesome connections for the EEC-IV and EEC-IV-SFI systems. This "Wiggle Test" will quickly, and without damage to the connectors, diagnose open or short circuits, or intermittent connections.

A majority of the tests will generate service codes as an end result. These codes, and the appropriate repair procedures found in a vehicle shop manual, must be followed precisely. A vehicle service manual, "Tools & Techniques, Ford MCU and EEC-IV, Computerized Engine Controls through 1985" (Part No. 103072), is available from the Owatonna Tool Company. Refer to the back inside cover of this manual for ordering information.

FORD SYSTEM IDENTIFICATION

The **Monitor 2000** will ask the technician to identify the vehicle engine type by running this message across the display area: "ENTER SYSTEM X 1-MCU 2-EEC-IV 3-EEC-IV-SFI." The following Vehicle Identification Number (VIN) charts may be used to identify engine types and system numbers.



10th Digit	Vehicle Year
A	1980
B	1981
C	1982
D	1983
E	1984
F	1985
G	1986

1980-1981

Engine	Type	Vin #	Computer System	System #
Passenger Cars				
1.3L	4 CYL 2 BL	1	None	N/A
1.6L	4 CYL 2 BL	2	None	N/A
2.3L	4 CYL 2 BL	A	MCU	1
3.3L	6 CYL 1 BL	B	MCU	1
4.2L	V8 2 BL	D	None	N/A
5.0L	V8 2 BL	F	MCU	1
5.0L	V8 EFI	F	EEC-III	N/A
5.8L	V8 2 BL	G	MCU	1
Light Trucks				
4.2L	V8 2 BL	D	None	N/A
4.9L	6 CYL 1 BL	E	None	N/A
5.0L	V8 2 BL	F	MCU	1
5.8L	(M) V8 2 BL	G	None	N/A
5.8L	V8 2 BL	W	MCU	1
6.6L	V8 2 BL	Z	None	1
7.5L	V8 4 BL	L	None	1
California Vehicles				
5.0L	V8 2 BL	F	EEC-III	N/A
5.0L	V8 2 BL	F	EEC-III	N/A
5.8L	V8 2 BL	W	EEC-III	N/A

1982

Engine	Type	Vin #	Computer System	System #
Passenger Cars				
1.6L	4 CYL 2 BL	2	None	N/A
2.3L	4 CYL 2 BL	A	MCU	1
3.3L	6 CYL 1 BL	B	None	N/A
3.8L	V6 2 BL	3	MCU	1
4.2L	V8 2 BL	D	MCU	1
5.0L	V8 2 BL	F	MCU	1
5.0L	V8 EFI	F	EEC-III	N/A
Light Trucks				
3.8L	V6 2 BL	3	None	N/A
4.2L	V8 2 BL	D	None	N/A
4.9L	6 CYL 1 BL	E	MCU	1
5.0L	V8 2 BL	F	EEC-III	N/A
5.8L	V8 2 BL	W	EEC-III	N/A
6.6L	V8 2 BL	Z	None	N/A
7.5L	V8 4 BL	L	None	1

1985

Engine	Type	Vin #	Computer System	System #
Passenger Cars				
1.6L	4 CYL 2 BL	2	None	N/A
1.6L	4 CYL 2 BL HO	4	None	N/A
1.6L	4 CYL EFI	5	EEC-IV	2
1.6L	4 CYL EFI Turbo	6	EEC-IV	2
1.9L	4 CYL 2 BL	9	None	N/A
2.3L	4 CYL 1 BL	A	EEC-IV	2
2.3L	4 CYL EFI Turbo	T	EEC-IV	2
2.3L	4 CYL EFI Turbo	W	EEC-IV	2
2.3L	HSC 4 CYL EFI HO	S	EEC-IV	2
2.3L	HSC 4 CYL EFI	X	EEC-IV	2
3.8L	V6 EFI	3	EEC-IV	2
3.8L	V6 2 BL	C	EEC-IV	2
5.0L	V8 EFI	F	EEC-IV	2
5.0L	V8 4 BL	F	None	N/A
5.0L	V8 EFI	M	EEC-IV	2
5.8L	V8 2 BL	O	MCU	1
Light Trucks				
2.0L	4 CYL 1 BL	C	None	N/A
2.3L	4 CYL 1 BL	A	EEC-IV	2
2.8L	V6 2 BL	S	EEC-IV	2
4.9L	6 CYL 1 BL	Y	EEC-IV	2
5.0L	V8 2 BL	F	EEC-IV	2
5.0L	V8 EFI	N	EEC-IV	2
5.8L	V8 2 BL	G	EEC-IV	2
5.8L	V8 4 BL	H	None	N/A

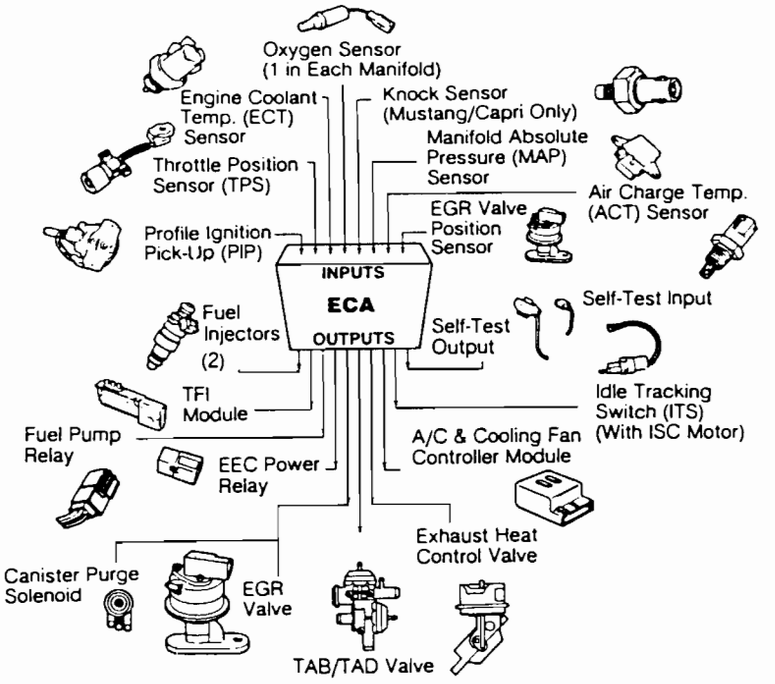
1986

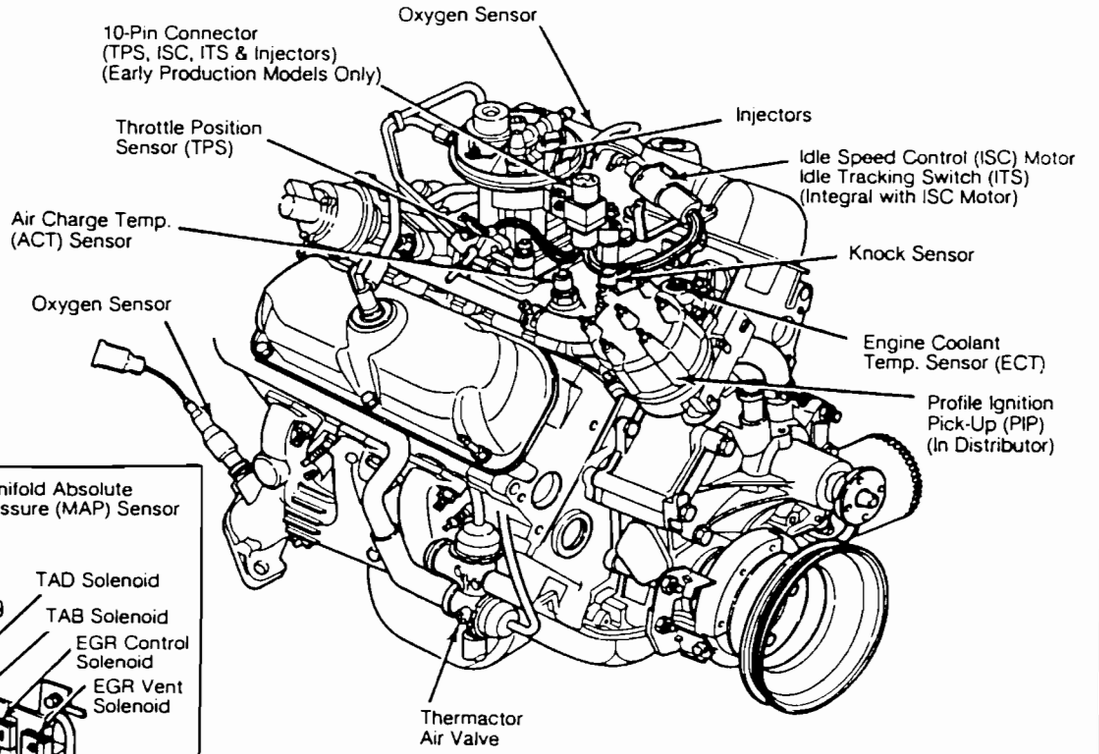
Engine	Type	Vin #	Computer System	System #
Passenger Cars				
1.9L	4 CYL 2 BL	9	None	N/A
1.9L	4 CYL EFI	J	EEC-IV	2
2.0L	4 CYL Diesel	H	None	N/A
2.3L	4 CYL 1 BL OHC	A	EEC-IV	2
2.3L	4 CYL Turbo/INT	T	EEC-IV	2
2.3L	4 CYL EFI OHC	W	EEC-IV	2
2.3L	4 CYL 1 BL HSC	R	None	N/A
2.3L	4 CYL CFI HSC	X	EEC-IV	2
2.3L	4 CYL EFI HSO	S	EEC-IV	2
2.5L	4 CYL CFI HSC	D	EEC-IV	2
3.0L	V6 EFI	U	EEC-IV	2
3.8L	V6 CFI	3	EEC-IV	2
5.0L	V8 EFI	F	EEC-IV	2
5.0L	V8 EFI	M	EEC-IV-SFI	3
5.8L	V8 2 BL HO	G	MCU	1
Light Trucks				
2.0L	4 CYL NFC	C	None	N/A
2.3L	4 CYL EFI	A	EEC-IV	2
2.3L	4 CYL Turbo Diesel	E	None	N/A
2.8L	V6 2 BL	S	EEC-IV	2
2.9L	V6 EFI	T	EEC-IV	2
3.0L	V6 EFI	U	EEC-IV	2
4.9L	6 CYL 1 BL	Y	EEC-IV	2
4.9L	6 CYL 1 BL	9	EEC-IV	2
5.0L	V8 EFI	N	EEC-IV	2
5.8L	V8 4 BL HO	H	None	N/A
6.9L	V8 Diesel	1	None	N/A
7.5L	V8 4 BL HD	L	None	N/A

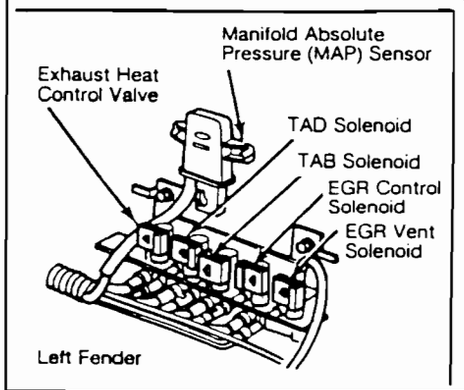
FORD MOTOR CO.

1985 ELECTRONIC ENGINE CONTROL IV THEORY, OPERATION & TESTING - PASSENGER CARS

3.8L CFI EEC-IV Inputs/Outputs & Component Locations







SELF-TEST CONNECTOR LOCATIONS

All models (Thunderbird/Cougar, Mustang/Capri, LTD/Marquis) have the Self-Test connector below starter solenoid between the left strut tower and the battery.

FORD MOTOR CO. VIN CODE APPLICATION

① – Indicates Nation of Origin.
② – Indicates Manufacturer.
③ – Indicates Make and Type.
④ – Indicates Restraint System
⑤ – Indicates Carline/Series.
⑥⑦ – Indicates Body Types
⑧ – Indicates Engine Type and Make
⑨ – Indicates Check Digit.
⑩ – Indicates Model Year.
⑪ – Indicates Assembly Plant.
⑫⑬⑭⑮⑯⑰ – Indicates Plant Sequential Number.

FORD MOTOR CO. VIN APPLICATION

VIN Code	Engine Size & Fuel System Type	Electronic Control
1981 Passenger Cars		
1	1.3L 4-Cyl. 2-Bbl.	[1]
2	1.6L 4-Cyl. 2-Bbl.	[1]
A	2.3L 4-Cyl. 2-Bbl.	MCU
B	3.3L 6-Cyl. 1-Bbl.	MCU
D	4.2L V8 2-Bbl.	[1]
F	5.0L V8 2-Bbl.	[2] EEC III
F	5.0L V8 EFI	EEC III
G	5.8L V8 2-Bbl.	MCU
1981 Light Trucks		
D	4.2L V8 2-Bbl.	[1]
E	4.9L 6-Cyl. 1-Bbl.	[1]
F	5.0L V8 2-Bbl.	[2] EEC III
G	5.8L (M) V8 2-Bbl.	[1]
W	5.8L V8 2-Bbl.	[2] EEC III
Z	6.6L V8 2-Bbl.	[1]
L	7.5L V8 4-Bbl.	[1]
1982 Passenger Cars		
2	1.6L 4-Cyl. 2-Bbl.	[1]
A	2.3L 4-Cyl. 2-Bbl.	[3] MCU
B	3.3L 6-Cyl. 1-Bbl.	[1]
3	3.8L V6 2-Bbl.	MCU
D	4.2L V8 2-Bbl.	[3] MCU
F	5.0L V8 2-BbL.	[3] MCU
F	5.0L V8 EFI	EEC III
1982 Light Trucks		
E	4.9L 6-Cyl. 1-Bbl.	[3] MCU
3	3.8L V6 2-Bbl.	[1]
D	4.2L V8 2-Bbl.	[1]
F	5.0L V8 2-Bbl.	[3] EEC III
W	5.8L V8 2-Bbl.	[3] EEC III
Z	6.6L V8 2-Bbl.	[1]
L	7.5L V8 4-Bbl.	[1]

FORD MOTOR CO. VIN APPLICATION (Cont.)

VIN Code	Engine Size & Fuel System Type	Electronic Control
1983 Passenger Cars		
2	1.6L 4-Cyl. 2-Bbl.	[1]
2	1.6L 4-Cyl. EFI	EEC IV
A	2.3L 4-Cyl. 2-Bbl.	[3] MCU
B	3.3L 6-Cyl. 1-Bbl.	[1]
3	3.8L V6 2-Bbl.	[1]
F	5.0L V8 4-Bbl.	[1]
F	5.0L V8 EFI	EEC III
G	5.8L V8 2-Bbl.	MCU
1983 Light Trucks		
C	2.0L 4-Cyl. 1-Bbl.	MCU
A	2.3L1-Bbl.	MCU
S	2.8L V6 2-Bbl.	EEC IV
3	3.8L V6 2-Bbl.	[1]
E	4.9L 6-Cyl. 1-Bbl.	[3] MCU
F	5.0L V8 2-Bbl.	[3] EEC III
G	5.8L V8 2-Bbl.	[3] EEC III
L	7.5L V8 4-Bbl.	[1]
1984 Passenger Cars		
2	1.6L 4-Cyl. 2-Bbl.	[1]
4	1.6L 4-Cyl. 2-Bbl. H.O.	EEC IV
5	1.6L 4-Cyl. EFI & Turbo	EEC IV
R	2.3L HSC 4-Cyl. 2-Bbl.	EEC IV
A	2.3L 4-Cyl. 1-Bbl.	EEC IV
5	2.3L 4-Cyl. EFI Turbo	EEC IV
3	3.8L V6 2-Bbl.	EEC IV
F	5.0L V8 4-Bbl.	[1] [4]
F	5.0L V8 EFI	EEC IV
M	5.0L V8 EFI	EEC IV
G	5.8L V8 2-Bbl.	MCU

[1] – Engine does not require electronic control.
[2] – California models only. Federal models have MCU.
[3] – California or 50 State models only.
[4] – Capri and Mustang only.
[5] – Under 8500 GVW only.
[6] – Mustang SVO only.

FORD MOTOR CO. VIN CODE APPLICATION

FORD MOTOR CO. VIN APPLICATION (Cont.)

VIN Code	Engine Size & Fuel System Type	Electronic Control
1984 Light Trucks		
C	2.0L 4-Cyl. 1-Bbl.	MCU
A	2.3L 4-Cyl. 1-Bbl.	MCU
S	2.8L V6 2-Bbl.	EEC IV
Y	4.9L 6-Cyl. 1-Bbl.	[5] EEC IV
F	5.0L V8 2-Bbl.	[3]
G	5.8L V8 2-Bbl.	EEC IV
L	7.5L V8 4-Bbl.	[1]
1985 Passenger Cars		
2	1.6L 4-Cyl. 2-Bbl.	[1]
4	1.6L 4-Cyl. 2-Bbl. H.O.	[1]
5	1.6L 4-Cyl. EFI	EEC IV
6	1.6L 4-Cyl. EFI Turbo	EEC IV
9	1.9L 4-Cyl. 2-Bbl.	[1]
A	2.3L 4-Cyl. 1-Bbl.	EEC IV
T	2.3L 4-Cyl. EFI Turbo	[6] EEC IV
W	2.3L 4-Cyl. EFI Turbo	EEC IV
S	2.3L HSC 4-Cyl. EFI H.O.	EEC IV
X	2.3L HSC 4-Cyl. EFI	EEC IV
3	3.8L V6 EFI	EEC IV
C	3.8L V6 2-Bbl.	EEC IV
F	5.0L V8 EFI	EEC IV
F	5.0L V8 4-Bbl.	[1] [4]
M	5.0L V8 EFI	EEC IV
O	5.8L V8 2-Bbl.	MCU
1985 Light Trucks		
C	2.0L 4-Cyl. 1-Bbl.	[1]
A	2.3L 4-Cyl. 1-Bbl.	EEC IV
S	2.8L V6 2-Bbl.	EEC IV
Y	4.9L 6-Cyl. 1-Bbl.	EEC IV
F	5.0L V8 2-Bbl.	EEC IV
N	5.0L V8 EFI	EEC IV
G	5.8L V8 2-Bbl.	EEC IV
H	5.8L V8 4-Bbl.	[1]

[1] – Engine does not require electronic control.
[2] – California models only, Federal models have MCU.
[3] – California or 50 State models only.
[4] – Capri and Mustang only.
[5] – Under 8500 GVW only.
[6] – Mustang SVO only.

AXOD TRANSAXLE

ELECTRICAL SYSTEM DIAGNOSIS

This test should be performed ONLY if a problem has been detected in transaxle. If any of these service codes appeared during SELF-TESTS, the AXOD DRIVE CYCLE TEST should be performed. The following AXOD transaxle related items have malfuctioned or failed as indicated:

- **Code 39 Displayed.** Transaxle converter by-pass clutch is not operating properly.
- **Code 59 Displayed.** THS 4/3 pressure switch circuit has failed open.
- **Code 62 Displayed.** THS 4/3 pressure switch circuit failed closed. If code appears in KEY ON/ENGINE OFF SELF-TEST, THS 3/2 circuit has failed. If code appears in ENGINE RUNNING SELF-TEST, THS 4/3 circuit has failed. If code appears in both SELF-TESTS, both circuits have failed and must be checked.
- **Code 69 Displayed.** THS 3/2 circuit has failed open.
- **Code 89 Displayed.** Transaxle converter by-pass clutch solenoid has stayed always open or closed.

The following service codes are not AXOD transaxle related, but can affect converter clutch by-pass operation. Service these components before servicing AXOD transaxle codes:

- **Code 21 Displayed.** Engine Coolant Temperature (ECT) sensor out of range.
- **Code 22 Displayed.** Manifold Absolute Pressure (MAP) sensor out of range.
- **Code 23 Displayed.** Throttle Position Sensor (TPS) out of range.

AXOD TRANSAXLE (Cont.)

- **Code 24 Displayed.** Air Charge Temperature (ACT) sensor out of range.
- **Code 29 Displayed.** Vehicle Speed Sensor (VSS) not functioning.
- **Code 74 Displayed.** Brake ON/OFF (BOO) switch always open or brake not applied during ENGINE RUNNING SELF-TEST.
- **Code 75 Displayed.** Brake ON/OFF (BOO) switch always closed.

The following service code indicates that a transaxle component may have caused faulty engine idle speed control:

- **Code 57 Displayed.** Neutral Pressure Switch (NPS) failed in Neutral (open). The NPS is normally open and closes with hydraulic pressure. Failure of transaxle to engage in "D" or "R" will cause service code 57 to be displayed. Check for proper hydraulic pressure before testing AXOD transaxle electrical componnents.

NOTE: Ensure that all components are connected before performing test. Perform AXOD DRIVE CYCLE TEST on a slight upgrade or flat terrain. If any other non-AXOD related codes appear, service those codes first as they could affect electrical operation of transaxle.

AXOD Drive Cycle Test. Record and zero service codes. Warm engine to normal operating temperature. With transaxle in "D" range, lightly accelerate from a stop to 40 MPH to allow transaxle to shift into 3rd gear. Hold speed and throttle opening steady for a minimum of 15 seconds (30 seconds above 4000 feet altitude).

Shift transaxle into overdrive and accelerate lightly from 40 to 50 MPH to allow transaxle to shift into 4th gear. Hold speed and throttle opening for a minimum of 15 seconds.

With transaxle in 4th gear, throttle open and a steady speed, lightly apply and release brakes (enough to light brake lamps). Hold speed and throttle opening steady for a minimum of 15 seconds.

Brake to a stop and remain stopped for a minimum of 20 seconds with transaxle in overdrive. Perform QUICK TEST and record service codes.

1) Code 39 Displayed. Check that vehicle harness connector is fully attached to transaxle bulkhead connector and that vehicle harness connector terminals are fully seated in connector. If connector or terminals are not okay, repair as required and repeat QUICK TEST. If connector and terminals are okay, go to next step.

2) Install service jumper harness to transaxle bulkhead connector. Connect VOM positive test lead to Red wire and negative test lead to Black wire. Check resistance. If reading is between 20 and 40 ohms, go to QUICK TEST and service codes as required. If reading is not between 20 and 40 ohms, go to next step.

3) Connect service jumper harness Red wire to battery positive post. With engine running and transaxle in 3rd gear, connect service jumper harness Black wire to ground (to energize by-pass clutch solenoid). DO NOT connect with polarity reversed, otherwise solenoid diode will be damaged.

4) If by-pass clutch is applied (engine RPM drops), there is no electrical component failure. By-pass clutch is operating properly. Error code may be indicating a slipping by-pass clutch. Service transaxle for a no converter clutch apply condition and repeat QUICK TEST.

5) If by-pass clutch is not applied (engine RPM does not drop), check main control by-pass clutch control valve (in valve body) for sticking. If valve is sticking, service valve as required. If valve is okay, go to next step.

6) Remove by-pass solenoid. Check condition of "O" ring. Also check for contamination in/on solenoid or small hole in valve. Shake solenoid vigorously to check for free armature. If solenoid is not okay, replace by-pass clutch solenoid and repeat QUICK TEST. If solenoid is okay, service transaxle for a no converter clutch apply condition and repeat QUICK TEST.

NOTE: The THS 4/3 and 3/2 pressure switches are normally open and close with hydraulic pressure. Failure of transaxle to engage in "D" will cause code 59 to be displayed. Failure of transaxle to shift into 3rd gear will cause code 69 to be displayed. Check for proper hydraulic operation before testing electrical components.

7) Code 59 Displayed. Check that vehicle harness connector is fully attached to transaxle bulkhead connector and that vehicle harness connector terminals are fully seated in connector. If connector or terminals are not okay, repair as required and repeat QUICK TEST. If connector and terminals are okay, go to next step.

AXOD TRANSAXLE (Cont.)

8) Install service jumper harness to transaxle bulkhead connector. Using VOM, check for continuity between engine ground and Blue wire. With engine running and transaxle in Neutral, VOM should indicate no continuity (infinite resistance).

9) Shift transaxle into "D". Switch should close and resistance should be less than 10 ohms. Switch should stay closed in 1st, 2nd and 3rd gears, and then open in 4th gear. If circuit is okay, go to QUICK TEST and service codes as required. If circuit is not okay, go to next step.

10) Remove transaxle side oil pan. Check that internal connector with Blue wire is firmly attached to THS 4/3 pressure switch. Connector should not pull off easily or fit loosely. If connector is not okay, replace bulkhead connector and wiring assembly. Repeat QUICK TEST. If connector is okay, go to next step.

11) Remove connector from pressure switch by pushing on end of connector, and while pulling on connector wire. Check for continuity in bulkhead connector by measuring resistance between Blue wire and terminal inside connector just removed. If reading is more than 2 ohms, replace bulkhead connector and wiring assembly. Repeat QUICK TEST. If reading is less than 2 ohms, go to next step.

12) Remove THS 4/3 pressure switch. Install a 1/8-27 pipe fitting that can be connected to LOW pressure air supply in order to pressure leak and test switch closure. With 50 psi (3.5 kg/cm²) applied, check for ruptured diaphragm by submerging switch in clean transmission fluid. Check for bubbles coming out of small vent hole near switch terminal. If bubbles show, diaphragm has failed. Replace THS 4/3 pressure switch and repeat QUICK TEST. If no bubbles show, go to next step.

13) With 50 psi (3.5 kg/cm²) applied to switch, check resistance between switch terminal and switch case. If reading is less than 8 ohms, hydraulic pressure circuit to switch may have excessive leaks. Service transaxle as required. If reading is more than 8 ohms, replace switch. Repeat step **8)**, and then QUICK TEST. Codes 39, 59, 62, 69 and 89 should no longer be displayed.

NOTE: If code 62 appears in KEY ON/ENGINE OFF SELF-TEST, THS 3/2 circuit has failed. If code 62 appears in ENGINE RUNNING SELF-TEST, THS 4/3 circuit has failed. If code 62 appears in both SELF-TESTS, follow entire test procedure to determine which circuit has failed.

14) Code 62 Displayed. Remove vehicle harness connector from transaxle bulkhead connector and install service jumper harness. Using VOM, measure continuity between engine ground and White wire (THS 3/2 circuit). With engine off, VOM should indicate no continuity (infinite resistance).

15) Measure continuity between engine ground and Blue wire (THS 4/3 circuit). With engine running and transaxle in Neutral, VOM should indicate no continuity (infinite resistance). If all readings show no continuity, go to QUICK TEST and service codes as required. If any reading indicates continuity, go to next step.

16) Remove transaxle side oil pan. Check for pinched, cut, or otherwise grounded wiring. If wiring is damaged, replace bulkhead connector and wiring assembly. After repairs, repeat QUICK TEST. If THS 4/3 pressure switch wiring is okay, go to step **18)**. If THS 3/2 pressure switch wiring is okay, go to next step.

17) Remove wiring from THS 3/2 pressure switch. Using VOM, check pressure switch for continuity to engine ground by connecting one lead to switch terminal and other lead to valve body. If there is no continuity (infinite resistance), go to step **19)**. If there is continuity to ground, replace THS 3/2 pressure switch and repeat QUICK TEST.

18) Remove wiring from THS 4/3 pressure switch. Using VOM, check pressure switch for continuity to engine ground by connecting one lead to switch terminal and other lead to valve body. If there is continuity to ground, replace 4/3 pressure switch and repeat QUICK TEST. If there is no continuity (infinite resistance), go to next step.

19) Using VOM and with wiring removed from both pressure switches, check for continuity to ground. Connect one test lead to White wire and other test lead to ground. Then connect one test lead to Blue wire and other test lead to ground. Make sure that internal terminals are not touching any metallic parts. If there is continuity to ground, replace bulkhead connector and wiring assembly. Repeat QUICK TEST. If

AXOD TRANSAXLE (Cont.)

there is no continuity (infinite resistance), go to QUICK TEST and service codes as required.

NOTE: The THS 4/3 and 3/2 pressure switches are normally open and close with hydraulic pressure. Failure of transaxle to engage in "D" will cause service code 59 to be displayed. Failure of transaxle to shift into 3rd gear will cause code 69 to be displayed. Check for proper hydraulic operation before testing electrical components.

20) Code 69 Displayed. Check that vehicle harness connector is fully attached to transaxle bulkhead connector and that terminals are fully seated in connector. If connector or terminals are not okay, repair as required and repeat QUICK TEST. If connector and terminals are okay, go to next step.

21) Install service jumper harness to transaxle bulkhead connector. Using VOM, check for continuity between engine ground and White wire. With engine running and transaxle in Drive, 1st, or 2nd gear, VOM should indicate no continuity (infinite resistance).

22) When transaxle shifts into 3rd or 4th gear, the switch should close. Resistance should be less than 10 ohms between White wire and engine ground. If circuit is okay, go to QUICK TEST and service codes as required. If circuit is not okay, go to next step.

23) Remove transaxle side oil pan. Check that internal connector with White wire is firmly attached to THS 3/2 pressure switch. Connector should not pull off easily or fit loosely. If connector is not okay, replace bulkhead connector and wiring assembly. Repeat QUICK TEST. If connector is okay, go to next step.

24) Check for continuity in bulkhead connector by measuring resistance between White wire and terminal inside connector just removed. If reading is more than 2 ohms, replace bulkhead connector and wiring assembly. Repeat QUICK TEST. If reading is less than 2 ohms, go to next step.

25) Remove THS 3/2 pressure switch. Install a 1/8-27 pipe fitting that can be connected to LOW pressure air supply in order to pressure leak and test switch closure. With 50 psi (3.5 kg/cm²) applied, check for ruptured diaphragm by submerging switch in clean transmission fluid. Check for bubbles coming out of small vent hole near switch terminal. If bubbles show, diaphragm has failed. Replace THS 3/2 pressure switch and repeat QUICK TEST. If no bubbles show, go to next step.

26) With 50 psi (3.5 kg/cm²) applied to switch, check resistance between switch terminal and switch case. If reading is less than 8 ohms, hydraulic pressure circuit to switch may have excessive leaks. Service transaxle as required. If reading is more than 8 ohms, replace switch. Repeat steps **21)** and **22)**, and then repeat QUICK TEST. Codes 39, 59, 62, 69 and 89 should no longer be displayed.

27) Code 89 Displayed. If code 39 is also displayed, go to step **1)**. Check that vehicle harness connector is fully attached to transaxle bulkhead connector and that vehicle harness terminals are fully seated in connector. If connector or terminals are not okay, repair as required and repeat QUICK TEST. If connector and terminals are okay, go to next step.

28) Install service jumper harness to transaxle bulkhead connector. Connect VOM positive test lead to Red wire and negative test lead to Black wire. Check resistance. If reading is between 20 and 40 ohms, go to QUICK TEST and service codes as required. If reading is not between 20 and 40 ohms, go to next step.

29) Remove transaxle side oil pan. Check that internal connector is fully attached to solenoid. If connector is okay, go to next step. If connector is not okay, fully engage connector and check continuity once more. If resistance is still not between 20 and 40 ohms, go to next step. If resistance is now okay, repeat QUICK TEST.

30) Remove connector from solenoid by pulling on wires at 2-way connector. Check solenoid continuity by connecting VOM positive test lead to solenoid positive terminal and negative test lead to solenoid negative terminal (polarity symbols are stamped on solenoid frame).

31) If circuit is open (infinite resistance), replace solenoid and then repeat QUICK TEST. If solenoid is okay (20 to 40 ohms resistance), replace bulkhead connector and wiring assembly. Connect all internal connectors and repeat step **28)**. If circuit tests okay, install oil pan. Repeat KEY ON/ENGINE OFF SELF-TEST. Code 89 should no longer be displayed.

AXOD TRANSAXLE (Cont.)

NOTE: The NPS is normally open and closes with hydraulic pressure. Failure of transaxle to engage in "D" or "R" will cause service code 57 to be displayed. Check for proper hydraulic pressure before testing electrical components.

32) Code 57 Displayed. Check that vehicle harness connector is fully attached to transaxle connector and that vehicle harness terminals are fully seated in connector. If connector or terminals are not okay, repair as required and repeat QUICK TEST. If connector and terminals are okay, go to next step.

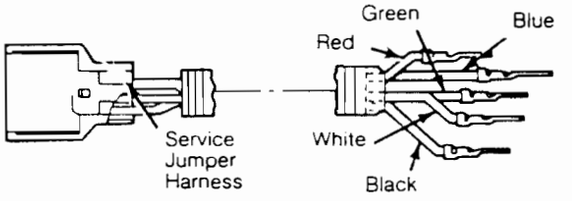
33) Install service jumper harness to transaxle bulkhead connector. Using VOM, check continuity between Green wire and engine ground. With engine running and transaxle in "P" or "N", VOM should indicate no continuity (infinite resistance). Shift transaxle into "R" and "D" ranges, switch should close. Resistance should be less than 10 ohms in both ranges. If circuit is okay, go to QUICK TEST and service codes as required. If circuit is not okay, go to next step.

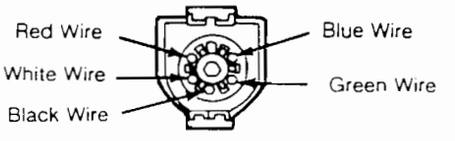
34) Remove transaxle side oil pan. Check that terminal connector with Green wire is firmly attached to NPS. Connector should not pull off easily or fit loosely. If connector is not okay, replace bulkhead connector and wiring assembly. Repeat QUICK TEST. If connector is okay, go to next step.

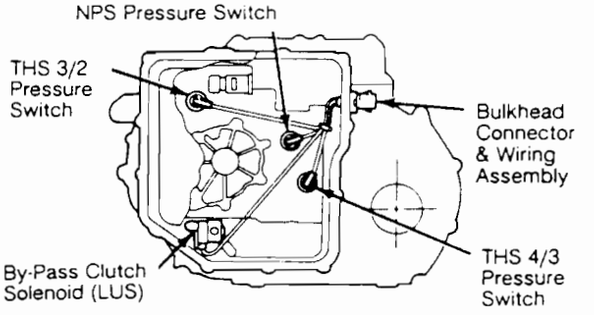
35) Remove connector from NPS by pushing on end of connector while pulling on connector wire. Check for continuity in bulkhead connector by measuring resistance between Green wire and terminal inside connector just removed. If reading is more than 2 ohms, replace bulkhead connector and wiring assembly. Repeat QUICK TEST. If reading is less than 2 ohms, go to next step.

36) Remove NPS. Install a 1/8-27 pipe fitting that can be connected to LOW pressure air supply in order to pressure leak and test switch closure. With 50 psi (3.5 kg/cm²) applied, check for ruptured diaphragm by submerging switch in clean transmission fluid. Check for bubbles coming out of small vent hole near switch terminal. If bubbles show, diaphragm has failed. Replace NPS and repeat QUICK TEST. If no bubbles show, go to next step.

37) With 50 psi (3.5 kg/cm²) applied to switch, check resistance between switch terminal and switch case. If reading is 8 ohms or less, hydraulic pressure circuit to switch may have excessive leaks. Service transaxle as required. If reading is more than 8 ohms, replace switch. Repeat step **33)**, and then repeat QUICK TEST. Codes 39, 59, 62, 69 and 89 should no longer be displayed.







CIRCUIT TEST Q

BRAKE ON/OFF (BOO)

To prevent replacement of good components, be aware that the following non-EEC related areas may be at fault: brake lamp bulb, brake lamp switch, or brake lamp fuse.

1) **Code 74 Displayed.** If brake was NOT depressed during ENGINE RUNNING SELF-TEST, repeat test and depress brake pedal ONLY once during test. Depress and release brake pedal AFTER dynamic response code 1 (10 on Monitor 2000) but before brief WOT. If pedal was depressed, go to next step.

2) Turn key off and wait 10 seconds. Disconnect ECA 60-pin connector. Inspect connector for damaged pins, corrosion, and loose wires. Install breakout box, leaving ECA disconnected. Set DVOM on 20-volt scale. Measure voltage between test pins No. 2 and 40 while applying and releasing brake. If voltage cycles, replace ECA and repeat QUICK TEST. If voltage does not cycle, go to next step.

3) Turn key off. Leave breakout box installed and ECA disconnected. Set DVOM on 200-ohm scale. Disconnect BOO circuit at 12-pin connector. Measure resistance between test pin No. 2 and ground. If reading is less than 5 ohms, repair BOO circuit short to ground. Repeat ENGINE RUNNING SELF-TEST. If reading is greater than 5 ohms, go to step **6**).

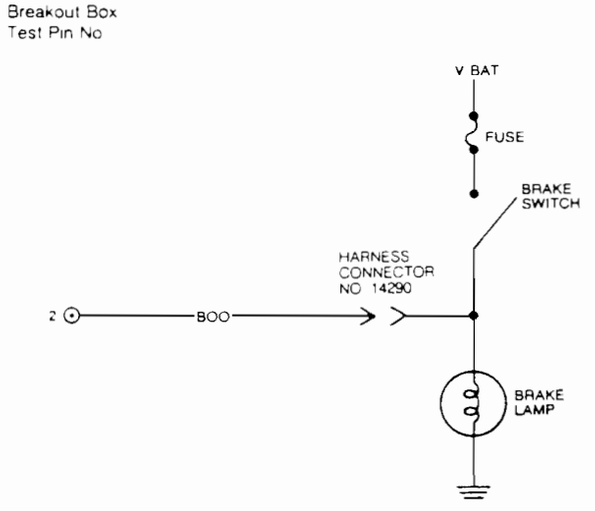
4) **Code 75 Displayed.** Turn key off and wait 10 seconds. Disconnect ECA 60-pin connector. Inspect for and repair any damaged wiring. Install breakout box, leaving ECA disconnected. Set DVOM on 20-volt scale. Measure voltage between test pins No. 2 and 40 while applying and releasing brake. If voltage cycles, replace ECA and repeat QUICK TEST. If voltage does not cycle, go to next step.

5) Turn key off. With breakout box installed and ECA disconnected, set DVOM on 20-volt scale. Disconnect BOO circuit at 12-pin connector. Measure voltage between test pin No. 2 and engine block ground. If reading is greater than 10.5 volts, repair BOO circuit short to power. If reading is less than 10.5 volts, BOO circuit is okay. Check brake lamp circuit.

CIRCUIT TEST Q (Cont.)

6) Turn key off. Install breakout box, leaving ECA disconnected. Set DVOM on 200-ohm scale. Disconnect BOO circuit at 12-pin connector. Measure resistance between test pin No. 2 and 12-pin connector. If reading is greater than 5 ohms, repair open in BOO circuit. Repeat ENGINE RUNNING SELF-TEST. If reading is lower than 5 ohms, BOO circuit is okay. Check brake lamp circuit.

Brake ON/OFF (BOO) Circuit



CIRCUIT TEST II

EXHAUST HEAT CONTROL (EHC)

1) Use only DVOM, not diagnostic tester, for this step. Turn key off and wait 10 seconds. Set DVOM on 20-volt scale. Connect DVOM negative test lead to STO at SELF-TEST connector and positive test lead to positive battery terminal. Install a jumper wire between STI and signal return at SELF-TEST connector. Perform KEY ON/ENGINE OFF SELF-TEST until end of CONTINUOUS SELF-TEST codes (DVOM reads zero volts). Depress and release throttle while watching DVOM reading. If reading did not change to a high voltage, depress throttle to WOT position and release. If STO voltage does not go to high reading, go to CIRCUIT TEST QQ, step **12**). Leave test equipment hooked up. If reading changes to high voltage, remain in OUTPUT STATE CHECK and go to next step.

2) Set DVOM on 20-volt scale. Measure voltage between VPWR and EHC circuits at EHC solenoid. While observing DVOM, depress and release throttle several times to cycle EHC output on and off. If EHC output does not cycle, remove jumper wire and go to step **5**). If EHC output cycles, go to next step.

3) Install vacuum pump to EHC solenoid vacuum supply port and install vacuum gauge to output port. Apply a minimum of 6 in. Hg. With vacuum applied, cycle output on and off by depressing and releasing throttle. If vacuum output does not cycle, replace EHC solenoid and repeat QUICK TEST. If vacuum output cycles, go to next step.

4) Leave vacuum lines disconnected at EHC solenoid. Start engine and check for vacuum. If vacuum is present, EEC system is okay, check EHC solenoid. If no vacuum is present, remove vacuum source blockage or repair vacuum leak. Repeat QUICK TEST.

5) Turn key off and wait 10 seconds. Set DVOM on 200-ohm scale. Disconnect EHC solenoid connector and measure solenoid resistance. If resistance is less than 50 ohms or higher than 100 ohms, replace EHC solenoid and repeat QUICK TEST. If resistance is between 50 and 100 ohms, connect EHC solenoid and go to next step.

6) Turn key on, leaving engine off. With DVOM on 20-volt scale, measure voltage at EHC solenoid harness connector between VPWR circuit and ground. If voltage reading is 10.5 volts or less, repair open circuit in harness and repeat QUICK TEST. If voltage reading is 10.5 volts or higher, go to next step.

7) Turn key off and wait 10 seconds. Disconnect ECA 60-pin connector. Inspect connector for damaged pins, corrosion, or loose wires. Repair if necessary. Install breakout box, leaving ECA disconnected. Set DVOM on 200-ohm scale. Measure resistance between test pin No. 55 and EHC circuit at harness connector. If reading is 5 ohms or higher, repair open circuit and repeat QUICK TEST. If reading is less than 5 ohms, go to next step.

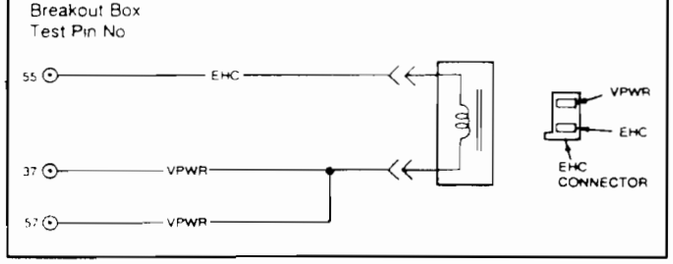
8) Turn key off and wait 10 seconds. Leave breakout box installed and ECA disconnected. Disconnect EHC solenoid. Set DVOM on 200,000-ohm scale. Measure resistance between test pin No. 55 and test pins No. 40, 46, and 60. If any reading is less than 10,000 ohms, repair short to ground and repeat QUICK TEST. If all readings are 10,000 ohms or higher, go to next step.

9) Turn key off and wait 10 seconds. Leave breakout box installed, and ECA and EHC solenoid disconnected. Set DVOM on 200,000-ohm

CIRCUIT TEST II (Cont.)

scale. Measure resistance between test pin No. 55 and test pins No. 37 and 57. If all readings are 10,000 ohms or higher, replace ECA and repeat QUICK TEST. If any reading is less than 10,000 ohms, repair short to power and repeat QUICK TEST. If code is repeated, replace ECA.

Exhaust Heat Control (EHC) Circuit



CIRCUIT TEST JJ

CONVERTER CLUTCH OVERRIDE (CCO)

1) Turn key off and wait 10 seconds. Set DVOM on 200-ohm scale. Disconnect CCO solenoid connector and measure solenoid resistance. If reading is less than 26 ohms or higher than 40 ohms, replace CCO solenoid and repeat QUICK TEST. If reading is between 26 and 40 ohms, connect solenoid and go to next step.

2) Turn key on, leaving engine off. With DVOM on 20-volt scale, measure voltage at CCO solenoid connector between VPWR circuit and ground. If reading is 10.5 volts or less, repair open circuit in harness and repeat QUICK TEST. If reading is 10.5 volts or higher, go to next step.

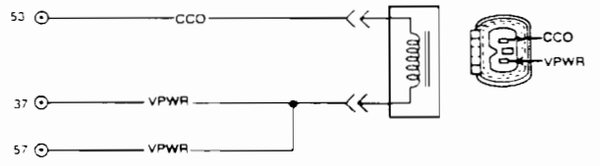
3) Turn key off and wait 10 seconds. Disconnect ECA 60-pin connector. Inspect connector for damaged pins, corrosion, or loose wires. Repair if necessary. Install breakout box, leaving ECA disconnected. Set DVOM on 200-ohm scale. Measure resistance between test pin No. 53 and CCO circuit at solenoid harness connector. If reading is 5 ohms or higher, repair open circuit in harness and repeat QUICK TEST. If reading is less than 5 ohms, go to next step.

4) Turn key off and wait 10 seconds. Leave breakout box installed and ECA disconnected. Disconnect CCO solenoid. Set DVOM on 200,000-ohm scale. Measure resistance between test pin No. 53 and test pins No. 40, 46, and 60. If any reading is less than 10,000 ohms, repair short to ground and repeat QUICK TEST. If all readings are 10,000 ohms or higher, go to next step.

5) Turn key off and wait 10 seconds. Leave breakout box installed, ECA and CCO solenoid disconnected. Set DVOM on 200,000-ohm scale. Measure resistance between test pin No. 53 and test pins No. 37 and 57. If all readings are 10,000 ohms or higher, replace ECA and repeat QUICK TEST. If any reading is less than 10,000 ohms, repair short to power and repeat QUICK TEST. If code is repeated, replace ECA.

CCO Circuit

Breakout Box
Test Pin No.



CIRCUIT TEST RR

AXOD TRANSAXLE

NOTE: Perform this test only when KEY ON/ENGINE OFF SELF-TEST service codes 62, 67, and 89 are present; when ENGINE RUNNING SELF-TEST service code 62 is displayed; or when CONTINUOUS SELF-TEST service codes 29, 39, 57, 59, and 69 are displayed. Ensure that ALL components are connected before performing test.

AXOD Drive Cycle Test. Record and zero continuous memory service codes. Warm engine to operating temperature. With transaxle in "D" range, lightly accelerate from a stop to 40 MPH to allow transaxle to shift into 3rd gear. Hold speed and throttle opening steady for a minimum of 15 seconds (30 seconds above 4000 feet altitude).

CIRCUIT TEST RR (Cont.)

Shift transaxle into overdrive and accelerate lightly from 40 to 50 MPH to allow transaxle to shift into 4th gear. Hold speed and throttle opening steady for a minimum of 15 seconds.

With transaxle in 4th gear, throttle open and speed steady, lightly apply and release brakes (enough to turn on brake lights). Hold speed and throttle opening steady for an additional 15 seconds.

Brake to a stop and remain stopped for a minimum of 20 seconds with transaxle in overdrive. Perform QUICK TEST and record continuous memory service codes.

1) Continuous Code 29 Displayed. Perform AXOD DRIVE CYCLE TEST and return to this step. If continuous code 29 is not displayed, fault cannot be duplicated at this time. If any other codes are present, return to QUICK TEST for instructions. If there are none, test is complete. If continuous code 29 is displayed, go to next step.

2) Turn key off and wait 10 seconds. Disconnect ECA 60-pin connector. Inspect connector for damaged pins, corrosion, or loose wires. Repair if necessary. Install breakout box, leaving ECA and Vehicle Speed Sensor (VSS) disconnected. Set DVOM on 200-ohm scale. Measure resistance between test pin No. 3 and VSS + circuit at harness connector. Measure resistance between test pin No. 6 and VSS - circuit at harness connector. If both readings are 5 ohms or more, repair open(s) in VSS harness, then repeat step **1)**. If both readings are 5 ohms or less, go to next step.

3) With key off, ECA and VSS disconnected, set DVOM on 200,000-ohm scale. Measure resistance between test pin No. 3 and test pins No. 37, 40, and 6. Then measure resistance between test pin No. 6 and test pins No. 37 and 40. If all readings are less than 1000 ohms, repair short(s) in VSS harness, then repeat step **1)**. If all readings are more than 1000 ohms, go to next step.

4) Substitute original VSS with a good known VSS. With ECA and VSS connected, perform AXOD DRIVE CYCLE TEST and return to this step. If continuous code 29 is displayed, replace ECA then repeat step **1)**. If continuous code 29 is not displayed, replace original VSS then repeat QUICK TEST.

5) Continuous Code 69 Displayed. Perform AXOD DRIVE CYCLE TEST and return to this step. If continuous code 69 is not displayed, fault cannot be duplicated at this time. If any other codes are present, return to QUICK TEST for instructions. If none, test is complete. If continuous code 69 is displayed, go to next step.

6) Turn key off and wait 10 seconds. Disconnect ECA 60-pin connector. Inspect connector for damaged pins, corrosion, or loose wires. Repair if necessary. Install breakout box, leaving ECA and AXOD harness disconnected. Set DVOM on 200-ohm scale. Measure resistance between test pin No. 19 and THS 3/2 circuit at AXOD harness connector. If reading is more than 5 ohms, repair open in THS 3/2 circuit then repeat step **5)**. If reading is 5 ohms or less, go to next step.

7) With key off, breakout box installed, and ECA and AXOD harness disconnected, set DVOM on 200,000-ohm scale. Measure resistance between test pin No. 19 and test pin No. 37. If reading is less than 10,000 ohms, repair short to power in THS 3/2 circuit, then repeat step **5)**. If reading is more than 10,000 ohms, go to next step.

8) With key off and breakout box installed, connect ECA and AXOD harness. Install a jumper wire between test pins No. 19 and 40. Perform KEY ON/ENGINE OFF SELF-TEST. If code 62 is displayed, remove jumper wire and go to AXOD TRANSAXLE ELECTRICAL SYSTEM DIAGNOSIS. If code 62 is not displayed, remove jumper wire, replace ECA, and then repeat step **5)**.

9) Continuous Code 59 Displayed. Perform AXOD DRIVE CYCLE TEST and return to this step. If continuous code 59 is not displayed, fault cannot be duplicated at this time. If any other codes are present, return to QUICK TEST for instructions. If none, test is complete. If continuous code 59 is displayed, go to next step.

10) Turn key off and wait 10 seconds. Disconnect ECA 60-pin connector. Inspect connector for damaged pins, corrosion, or loose wires. Repair if necessary. Install breakout box, leaving ECA and AXOD harness disconnected. Set DVOM on 200-ohm scale. Measure resistance between test pin No. 18 and THS 4/3 circuit at AXOD harness connector. If reading is more than 5 ohms, repair open in THS 4/3 harness, then repeat step **9)**. If reading is 5 ohms or less, go to next step.

11) With key off, breakout box installed, and ECA and AXOD harness disconnected, set DVOM on 200,000-ohm scale. Measure resistance

CIRCUIT TEST RR (Cont.)

between pin No. 18 and test pin No. 37. If reading is less than 10,000 ohms, repair short to power in THS 4/3 circuit, then repeat step **9)**. If reading is higher than 10,000 ohms, go to next step.

12) With key off and breakout box installed, connect ECA and AXOD harness. Install a jumper wire between test pins No. 18 and 40. Perform KEY ON/ENGINE OFF SELF-TEST. If code 62 is displayed, remove jumper wire and go to AXOD TRANSAXLE ELECTRICAL SYSTEM DIAGNOSIS. If code 62 is not displayed, remove jumper wire, replace ECA, and then repeat step **9)**.

13) Continuous Code 39 Displayed. Perform AXOD DRIVE CYCLE TEST then return to this step. If continuous code 59 is also present, go directly to step **9)**. If continuous code 39 is displayed, go to AXOD TRANSAXLE ELECTRICAL SYSTEM DIAGNOSIS. If continuous code 39 is not displayed, fault cannot be duplicated at this time. If any other codes are present, return to QUICK TEST for instructions. If none, test is completed.

14) Continous Code 57 Displayed. Perform AXOD DRIVE CYCLE TEST and then return to this step. If continuous code 57 is not displayed, fault cannot be duplicated at this time. If any other codes are present, return to QUICK TEST for instructions. If none, test is completed. If continuous code 57 is displayed, go to next step.

15) Turn key off and wait 10 seconds. Disconnect ECA 60-pin connector. Inspect connector for damaged pins, corrosion, or loose wires. Repair if necessary. Install breakout box, leaving ECA and AXOD harness disconnected. Set DVOM on 200-ohm scale. Measure resistance between test pin No. 30 and NPS circuit at AXOD harness connector. If reading is more than 5 ohms, repair open in NPS circuit, then repeat step **14)**. If reading is 5 ohms or less, go to AXOD TRANSAXLE ELECTRICAL SYSTEM DIAGNOSIS.

16) Code 89 Displayed. Turn key off and wait 10 seconds. Disconnect ECA 60-pin connector. Inspect connector for damaged pins, corrosion, or loose wires. Repair if necessary. Install breakout box, leaving ECA and AXOD harness disconnected. Set DVOM on 200-ohm scale. Measure resistance between test pin No. 37 and VPWR circuit at AXOD harness connector. If reading is more than 5 ohms, repair open in VPWR circuit then repeat QUICK TEST. If reading is 5 ohms or less, go to next step.

17) With key off, breakout box installed, and ECA and AXOD harness disconnected, set DVOM on 200-ohm scale. Measure resistance between test pin No. 53 and LUS circuit at AXOD harness connector. If reading is more than 5 ohms, repair open in LUS circuit and then repeat QUICK TEST. If reading is 5 ohms or less, go to next step.

18) With key off, breakout box installed, and ECA and AXOD harness disconnected, set DVOM on 200,000-ohm scale. Measure resistance between test pin No. 53 and test pins No. 37 and 40. If both readings are less than 10,000 ohms, repair shorts in LUS harness. Repeat QUICK TEST. If code 89 is still displayed, replace ECA and repeat QUICK TEST. If both readings are higher than 10,000 ohms, go to next step.

19) With key off, breakout box installed, and ECA disconnected, connect AXOD harness. Set DVOM on 200,000-ohm scale. Measure resistance between test pin No. 53 and test pin No. 57. If resistance is between 20 and 40 ohms, replace ECA and repeat QUICK TEST. If resistance is not between 20 and 40 ohms, go to AXOD TRANSAXLE ELECTRICAL SYSTEM DIAGNOSIS.

20) Code 62 Displayed. Perform ENGINE RUNNING SELF-TEST and record codes. If code 62 is displayed, fault is in THS 4/3 circuit. Go to next step. If code 62 is not displayed, fault is in THS 3/2 circuit. Go to next step.

21) Turn key off and disconnect AXOD harness. Perform KEY ON/ENGINE OFF SELF-TEST. If code 62 is not displayed, go to AXOD TRANSAXLE ELECTRICAL SYSTEM DIAGNOSIS. If code 62 is displayed, go to next step.

22) Turn key off and install breakout box. Leave ECA and AXOD harnesses disconnected. Set DVOM on 200,000-ohm scale. Measure resistance between test pin No. 18 and test pins No. 40 and 60. Also measure resistance between test pin No. 19 and test pins No. 40 and 60. If all readings are less than 10,000 ohms, repair short(s) to ground. Repeat QUICK TEST. If all readings are higher than 10,000 ohms, replace ECA and repeat QUICK TEST.

23) Verify that code 62 is present in ENGINE RUNNING SELF-TEST. If code 62 is displayed, go to AXOD TRANSAXLE ELECTRICAL SYSTEM DIAGNOSIS. If code is not displayed, fault cannot be

CIRCUIT TEST RR (Cont.)

duplicated at this time. If any other codes are present, return to QUICK TEST for instructions. If none, test is completed.

24) Code 67 Displayed. Turn key on, leaving engine off. Disconnect ECA 60-pin connector. Inspect connector for damaged pins, corrosion, or loose wires. Repair if necessary. Install breakout box and connect ECA to box. Set DVOM on 20-volt scale. Measure voltage between test pins No. 30 and 46. If reading is more than 4.0 volts, go to CIRCUIT TEST O, step **4)**. If reading is less than 4.0 volts, go to next step.

25) With key off, breakout box installed, and ECA and AXOD harness disconnected, set DVOM on 200,000-ohm scale. Measure resistance between test pin No. 30 and test pins No. 40 and 60. If all readings are less than 10,000 ohms, repair short to ground in NPS circuit. Repeat QUICK TEST. If all readings are higher than 10,000 ohms, go to next step.

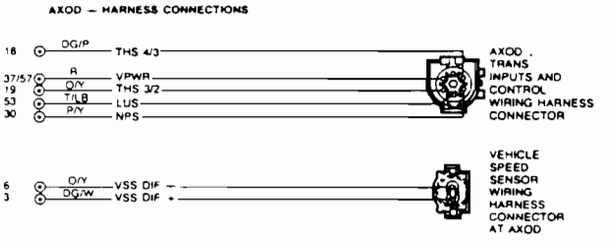
26) With key off and breakout box installed, connect ECA. Leave AXOD harness disconnected. Perform KEY ON/ENGINE OFF SELF-TEST. If code 67 is displayed, replace ECA and repeat QUICK TEST. If code 67 is not displayed, go to AXOD TRANSAXLE ELECTRICAL SYSTEM DIAGNOSIS.

27) Turn key off and wait 10 seconds. Locate and disconnect Vehicle Speed Sensor (VSS). Set DVOM on 2000-ohm scale and measure resistance across vehicle speed sensor. If reading is between 190 and 230 ohms, go to next step. If not, replace vehicle speed sensor and verify that complaint was eliminated.

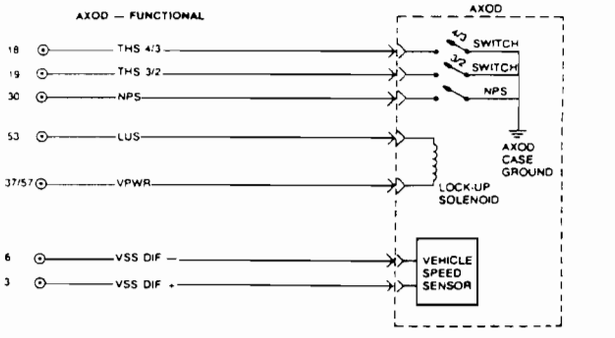
28) Turn key off and wait 10 seconds. Disconnect ECA 60-pin connector. Inspect connector for damaged pins, corrosion, or loose wires. Repair if necessary. Install breakout box, leaving ECA disconnected. Set DVOM on 200-ohm scale. Measure resistance between test pin No. 3 and VSS harness connector. Also measure resistance between test pin No. 6 and VSS harness connector. If both readings are 5 ohms or less, go to next step. If not, repair open circuit in VSS wiring harness.

AXOD Transaxle Circuits

Breakout Box
Test Pin No.



Breakout Box
Test Pin No.

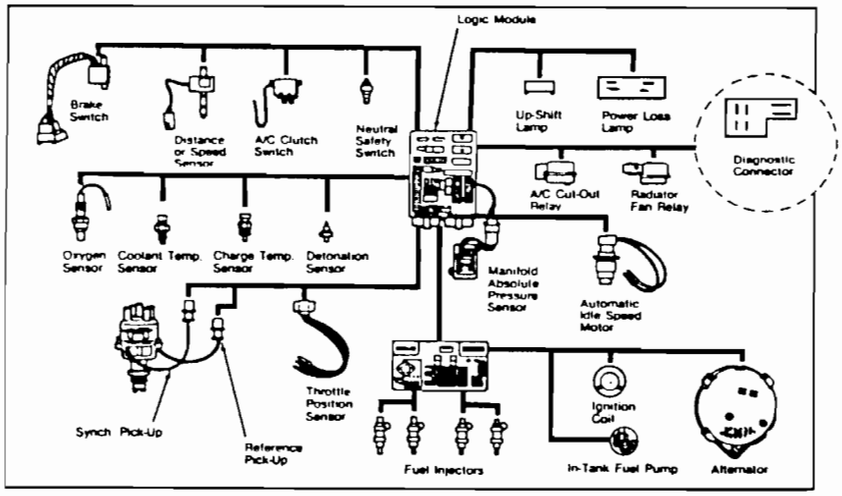


29) Turn key off. With ECA and Vehicle Speed Sensor (VSS) disconnected, set DVOM on 200,000-ohm scale. Measure resistance between test pin No. 3 and test pins No. 37, 40 and 6. Also measure resistance between test pin No. 6 and test pins No. 37, and 40. If all readings are greater than 10,000 ohms, go to next step. If not, repair short(s) in VSS wiring harness.

CHRYSLER
COMPUTERIZED ENGINE CONTROLS

Chrysler first introduced computerized engine controls in late 1983 on the 2.2L TBI engine. The Chrysler system is divided into two separate modules: Logic and Power. The Logic Module, which controls the Power Module, receives all sensor signals, and processes that information to control actuators. The Power Module regulates the injectors, the ignition coil, and the auto shutdown relay.

If the Logic Module determines that a circuit is bad, the "Power Loss" lamp on the vehicle dashboard will light up, informing the driver that something is wrong. The Logic Module may then enter the "Limp In Mode" and attempt to keep the vehicle running by using input from other circuits. A FAULT code for the malfunctioning circuit will be entered into the computer memory, and may be retrieved by using the **Monitor 2000** and the Chrysler memory cartridge.



The Logic Module can be tested quickly by simply plugging the **Monitor 2000** into the diagnostic connector located in the engine compartment. Once connected, several diagnostic procedures are available. The technician may retrieve any fault codes held in memory by the Chrysler computer in two Functions: Deluxe CDR, and Basic CDR.

Deluxe CDR is the Chrysler Diagnostic Reader with help messages giving the technician instruction during a test.

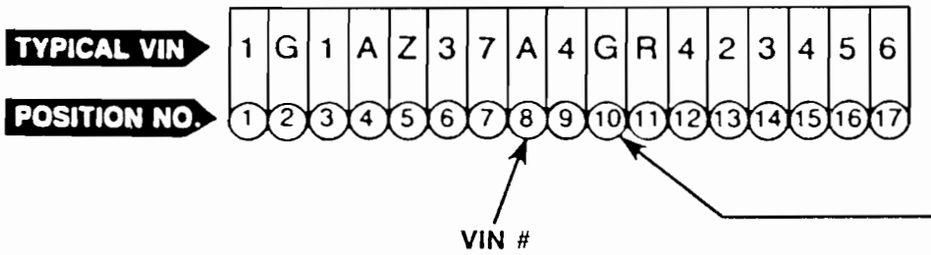
Data Line gives the technician direct access to computer sensors for retrieving data output.

Basic CDR is the Chrysler Diagnostic Reader test without any help messages. It is designed for the technician that is very familiar with Chrysler test procedures.

Fault codes, and the appropriate repair procedures, may be found in a vehicle service manual, "Tools & Techniques, Chrysler Computerized Engine Controls thru 1985" (Part No. 103105) available from the OTC Division of Sealed Power Corporation. Refer to the back inside cover of this manual for ordering information.

CHRYSLER SYSTEM IDENTIFICATION

Before requesting data from the **Monitor 2000,** the system in the vehicle to be tested must be correctly identified. If the wrong system for the vehicle tested is entered into the **Monitor 2000**, the information displayed will NOT be correct. The following Vehicle Identification Number (VIN) charts may be used to identify the vehicle year, engine type, and system number:



10th Digit	Vehicle Year
D	1983
E	1984
F	1985
G	1986

1983-1984

Engine	Type	8th VIN Digit	System	System #
2.2L	4 CYL	D	EFI	1
2.2L	4 CYL	E	Turbo	2
2.2L	4 CYL	C	Mexican	4

1985

Engine	Type	8th VIN Digit	System	System #
1.6L	4 CYL	A	FBC	3
2.2L	4 CYL	D	EFI	1
2.2L	4 CYL	E	Turbo	2
2.2L	4 CYL	C	FBC	3
2.2L	4 CYL	C	Mexican	4
3.7L	V6	H	FBC	3
5.2L	V8	T	FBC	3

1986

Engine	Type	8th VIN Digit	System	System #
*1.6L	4 CYL	A	FBC	3
2.2L	4 CYL	D	EFI	1
2.2L	4 CYL	E	Turbo	2
*2.2L	4 CYL	C	FBC	3
2.2L	4 CYL	C	Mexican	4
2.5L	4 CYL	K	EFI	1
3.7L	V6	H	FBC	3
5.2L	V6	T	FBC	3

*** The 1986 carbureted Omni/Horizon must be programmed as model year 1985.**

CHRYSLER CORP. VIN CODE APPLICATION

1G1AZ37AXE5 100001

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰

1 - Indicates Nation Of Origin
2 - Indicates Manufacturer
3 - Indicates Make and Type
4 - Indicates Restraint System
5 - Indicates Carline/Series
6 & 7 - Indicates Body Types
8 - Indicates Engine Type and Make
9 - Indicates Check Digit
10 - Indicates Model Year: B = 1981, C = 1982, D = 1983, E = 1984, F = 1985, G = 1986
11 - Indicates Assembly Plant
12-17 - Indicates Plant Sequential Numbers

CHRYSLER CORP. VIN APPLICATION

VIN Code	Engine Size & Fuel System Type	Electronic Control
1983 Passenger Cars		
B	1.7L 4-Cyl. 2-Bbl.	SCC
C	2.2L 4-Cyl. 2-Bbl.	SCC
G	2.6L 4-Cyl. 2-Bbl.	SCC
H	3.7L 6-Cyl. 1-Bbl.	SCC
J	3.7L 6-Cyl. 1-Bbl.	SCC
N	5.2L V8 EFI	SCC
P	5.2L V8 2-Bbl.	SCC
R	5.2L V8 4-Bbl.	SCC
S	5.2L V8 4-Bbl.	SCC
1983 Light Trucks		
J	3.7L 6-Cyl. 1-Bbl.	SCC
T	5.2L V8 2-Bbl.	SCC
U	5.2L V8 2-Bbl.	SCC
V	5.9L V8 2-Bbl.	SCC
1984 Passenger Cars		
A	1.6L 4-Cyl. 2-Bbl.	SCC
C	2.2L 4-Cyl. 2-Bbl.	SCC
D	2.2L 4-Cyl. EFI	SCC
E	2.2L 4-Cyl. EFI Turbo	SCC
F	2.2L 4-Cyl. 2-Bbl.	SCC
G	2.6L 4-Cyl. 2-Bbl.	ECU
P	5.2L V8 2-Bbl.	SCC
R	5.2L V8 4-Bbl.	SCC
S	5.2L V8 4-Bbl.	SCC
1984 Light Trucks		
C	2.2L 4-Cyl. 2-Bbl.	SCC
G	2.6L 4-Cyl. 2-Bbl.	ECU
H	3.7L 6-Cyl. 1-Bbl.	SCC
T	5.2L V8 2-Bbl.	SCC
W	5.9L V8 4-Bbl. Fed.	SCC
I	5.9L V8 4-Bbl. Cal.	SCC
1985 Passenger Cars		
A	1.6L 4-Cyl. 2-Bbl.	SCC
C	2.2L 4-Cyl. 2-Bbl.	SCC
D	2.2L 4-Cyl. EFI	SCC
E	2.2L 4-Cyl. EFI Turbo	SCC

CHRYSLER CORP. VIN APPLICATION (Cont.)

VIN Code	Engine Size & Fuel System Type	Electronic Control
1985 Passenger Cars (Cont.)		
G	2.6L 4-Cyl. 2-Bbl.	ECU
P	5.2L V8 2-Bbl.	SCC
R	5.2L V8 4-Bbl.	SCC
S	5.2L V8 4-Bbl.	SCC
1985 Light Trucks		
C	2.2L 4-Cyl. 2-Bbl.	SCC
D	2.0L 4-Cyl. 2-Bbl.	SCC
E	2.6L 4-Cyl. 2-Bbl.	ECU
G	2.6L 4-Cyl. 2-Bbl.	ECU
H	3.7L 6-Cyl. 1-Bbl.	SCC
T	5.2L V8 2-Bbl.	SCC
W	5.9L V8 4-Bbl. Fed.	SCC
I	5.9L V8 4-Bbl. Cal.	SCC
1986 Passenger Cars		
A	1.6L 4-Cyl. 2-Bbl.	SCC
C	2.2L 4-Cyl. 2-Bbl.	SCC
8	2.2l 4-Cyl. 2-Bbl. H.O.	SCC
D	2.2L 4-Cyl. TBI	SCC
E	2.2L 4-Cyl. MFI Turbo	SCC
F	2.2L 4-Cyl. MFI Turbo H.O.	SCC
K	2.5L 4-Cyl. TBI	SCC
P	5.2L V8 2-Bbl. Std.	SCC
4	5.2L V8 2-Bbl. H.D.	SCC
R	5.2L V8 4-Bbl. Std.	SCC
S	5.2L V8 4-Bbl. Police	SCC
1986 Light Trucks		
C	2.2L 2-Bbl.	SCC
G	2.6L 4-Cyl.	ECU
H	3.7L V6 TBI	SCC
T	5.2L V8 2-Bbl.	SCC
V	5.9L V8 2-Bbl.	SCC
I	5.9L V8 4-Bbl. Calif.	SCC
W	5.9L V8 4-Bbl. Fed.	SCC

CHRYSLER MOTORS

1987 ELECTRONIC FUEL CONTROL
RWD LIGHT TRUCKS & VANS EXCEPT DAKOTA 2.2L

TESTING & DIAGNOSIS

A malfunction in the EFC system may result in engine surge, hesitation, rough idle and/or poor fuel economy. Before performing any tests, check all vacuum and electrical wiring for proper routing and connections and check for exhaust and intake manifold leaks. If these are okay, proceed with testing.

The Spark Control Computer controls ignition timing and air/fuel mixture (on models so equipped). When testing requires that either harness connector be disconnected from computer, DO NOT remove grease from either connector or cavities in computer.

The grease is used in order to prevent moisture from corroding the terminals. If there is not at least 1/2" of grease on bottom of computer connector cavities, apply a liberal amount of multipurpose grease (Mopar No. 2932524) over entire end of plug before reinstalling.

ENTERING ON-BOARD DIAGNOSIS

1) Attach the Monitor 2000 to self-test connector. The connector is located in the engine compartment at the left shock tower (pickup models) and center of firewall (van models).

2) Place the read/hold switch in the "READ" position. Open the carburetor switch by placing the fast idle screw on the highest step of the fast idle cam. Turn the ignition switch to the "RUN" position and wait for "00" to display on the read-out box.

3) Move the read/hold switch to the "HOLD" position. Record all codes that appear. The display codes may be stopped by switching the to the "READ" position. Codes will continue when the read-out box is switched back to the "HOLD" position.

FAULT CODES

When a fault code is displayed on the diagnostic read-out box, it indicates the SCC has recognized an abnormal signal in the system. Fault codes indicate the result of a failure, but do not always identify the failed component.

Code 00
This code indicates the diagnostic read-out box is receiving power.

Code 88
This code implies the "start of diagnostic mode." If this code is not displayed first, trouble codes will be inaccurate.

CHRYSLER MOTORS

1987 ELECTRONIC FUEL CONTROL
RWD LIGHT TRUCKS & VANS EXCEPT DAKOTA 2.2L

Code 55
This is the "end of diagnostic mode." This code will always appear as the final code after all other trouble codes have been displayed.

Code 11
Problem with O_2 solenoid control circuit.

Code 12
Problem in the transmission un-lock relay.

NOTE
- *Ignore this code on manual transmission models.*

Code 13
Indicates a problem in the air switching control solenoid system.

Code 14
Indicates the battery has been disconnected within the last 20-40 times the ignition switch has been turned to the "ON" position.

Code 17
Indicates a problem in the electronic throttle control solenoid system.

Code 18
Indicates a problem in the EGR solenoid.

Code 21
Problem with the distributor pick-up system.

Code 22
O_2 system is stuck in the full lean position.

Code 23
O_2 system is stuck in the full rich position.

Code 24
Indicates a problem in the computer.

Code 25
Problem in the radiator fan coolant sensor portion of the engine temperature dual sensor system.

Code 26
Problem in the engine temperature portion of the engine temperature dual sensor system.

Code 28
Problem in the distance sensor system.

Code 31
Indicates the engine has not been cranked since the battery was disconnected.

Code 32
Indicates a problem with the computer.

Code 33
Indicates a problem with the computer.

ACTUATOR TEST CODES

Place the system into Diagnostic Test Mode and wait for Code 55 to appear on the display. Press the ATM button to activate the display. If a specific ATM test is desired, depress ATM button until the desired code is displayed. The computer will turn the selected circuit on and off for up to 5 minutes, until the ATM button is pressed again or the ignition is turned off.

Code 91
Oxygen feedback solenoid activated.

Code 92
Transmission unlock relay activated (A/T).

Code 93
Air switching solenoid activated.

Code 97
Electronic throttle control solenoid activated.

Code 98
EGR solenoid activated.

SENSOR READ TEST CODES

1) The sensor read test checks each circuit for proper operation. If correct code does not appear on the display during the test, the circuit and components must be checked. Place the system in Diagnostic Test Mode and wait for Code 55 to appear on the display.

2) Press the ATM button to activate the display. If a specific sensor read test is desired, hold the ATM button down until the desired code is displayed. Slide the read/hold switch to the "HOLD" position to display the corresponding sensor output level.

NOTE
- *Since the sensor access codes are the same as some ATM test codes, the ATM test circuit will turn on before moving the read/hold button to the "HOLD" position.*

Code 91
With 0-5 in. Hg vacuum applied to the transducer, display should be "01" when the read/hold switch is moved to the "HOLD" position. With 5-15 in. Hg vacuum applied to the transducer, display should be "02" when the read/hold switch is moved to the "HOLD" position. With more than 15 in. Hg vacuum applied to the transducer, display should be "03" when the read/hold switch is moved to the "HOLD" position.

Code 92
This tests the engine coolant sensor circuit. With an engine temperature of less than 50°F (10°C), display should be "01" when the read hold switch is moved to the "HOLD" position. With an engine temperature of 50-100°F (10-38°C), display should be "02" when the read hold switch is moved to the "HOLD" position. With an engine temperature of greater than 100°F (38°C), display should be "03" when the read hold switch is moved to the "HOLD" position.

Code 93
This tests the charge temperature switch circuit. With the engine cold, display should be "01". With the engine at normal operating temperature, display should be "03".

Code 96
This tests the vehicle distance sensor circuit. If the switch is closed, display should be "01". If the switch is open, display should be "02".

SWITCH TEST CODES

1) Place the system in Diagnostic Test Mode and wait for Code 55 to appear on the display. Ensure that both air conditioning and defroster switches are off. Press the ATM button and immediately move the read/hold switch to the "READ" position. Wait for Code 00 to appear on the display.

2) Turn the air conditioning switch to the "ON" position. If the computer is receiving input, the display will change to "88" when the switch is turned on and to "00" when the switch is turned the "OFF" position. Repeat the test for the defroster switch.

Code 00
Air conditioning and defroster are off.

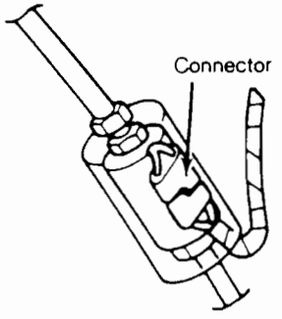
Code 88
Air conditioning or defroster are on.

DRIVEABILITY TEST 10

CODE 28 - SPEED SENSOR CIRCUIT

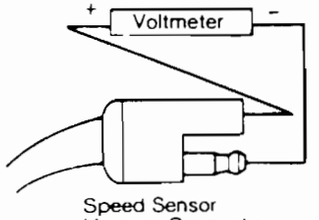
All Models (Except Fed. 3.7L With A/T & Fed. 5.2L)

1) Turn ignition off. Disconnect speed sensor from speedometer cable. Disconnect speed sensor connector. Connect an ohmmeter between the speed sensor connector terminals. Slowly rotate the speed sensor 1 revolution. The ohmmeter should show 8 pulses for every 1 revolution of the speed sensor.



Speed Sensor

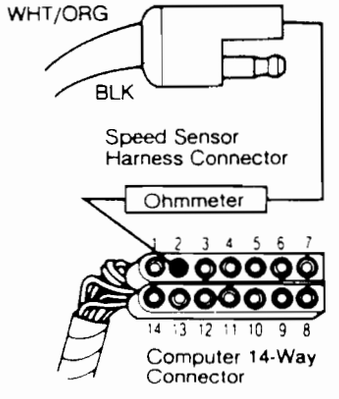
2) If ohmmeter reading is not as specified, replace the speed sensor. If ohmmeter reading is as specified, connect voltmeter positive lead to the White/Orange speed sensor harness connector wire. Connect voltmeter negative lead to the Black/Blue speed sensor harness connector wire.



Speed Sensor Harness Connector

3) Turn the ignition switch to the "RUN" position. Voltmeter reading should be at least 8.5 volts. If voltage is okay, inspect the transaxle drive gear-to-speed sensor drive gear for proper contact. If zero volts, move voltmeter negative lead to a good engine ground. If voltmeter now reads correct voltage, repair speed sensor ground wire.

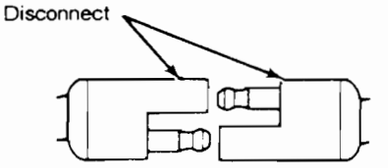
4) If voltmeter still reads zero volts, turn the ignition off. Disconnect the computer 14-way connector. Connect an ohmmeter between 14-way connector cavity "2" and White/Orange speed sensor harness connector wire. Ohmmeter should show continuity.



5) If there is continuity, check terminal in cavity "2" to ensure it is not spread apart causing a poor connection. If connections are okay, replace computer. If there is no continuity, repair open circuit in White/Orange wire.

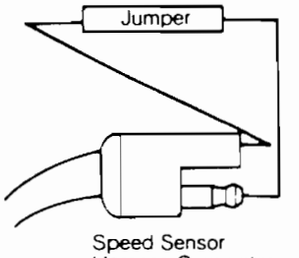
Fed. 3.7L With A/T & Fed. 5.2L

1) Connect diagnostic read-out box to the engine harness connector. Disconnect the speed sensor connector. Place system in Sensor Test Mode 96. Read-out box display should read "02". If the display does not read "02", replace the computer.



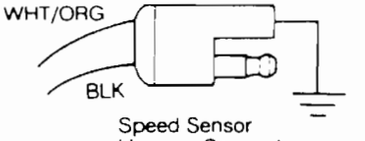
Speed Sensor Connector

2) If the display reads "02", connect a jumper lead between speed sensor connector terminals on the engine harness. Read-out box display should change from "02" to "01".



Speed Sensor Harness Connector

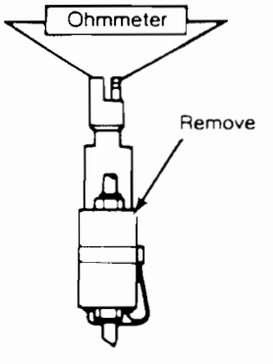
3) If display does not change, connect a jumper lead between speed sensor harness connector White wire and a good engine ground. Read-out box display should change from "02" to "01". If the display changes, repair the Black wire of the speed sensor harness connector for an open circuit.



Speed Sensor Harness Connector

4) If display does not change from "02" to "01", repair the White wire of the speed sensor harness connector for an open circuit. If the display changed from "02" to "01" in step **2)** turn the ignition off. Remove the speed sensor from the transmission.

5) Connect an ohmmeter between the speed sensor harness connector terminals. Slowly rotate the speed sensor 1 revolution. The ohmmeter should show 8 pulses for every 1 revolution of the speed sensor. If ohmmeter reading is okay, inspect transmission drive gear and speedometer cable. If ohmmeter reading is not okay, replace the speed sensor.



Speed Sensor

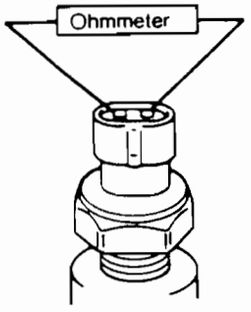
DRIVEABILITY TEST 9

CODE 26 - ENGINE TEMPERATURE SENSOR CIRCUIT

All Models Except Federal 3.7L With A/T

1) Disconnect the engine temperature sensor connector. Connect an ohmmeter between the terminals of the sensor. Ohmmeter reading should show resistance.

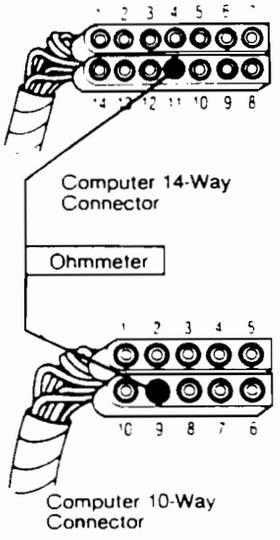
NOTE: The amount of resistance is not important. Just as long as there is resistance.



Engine Temperature Sensor

2) If there is zero resistance or an open circuit, replace the sensor. If there is resistance, reconnect the engine temperature sensor connectors. Connect an ohmmeter between 10-way connector cavity "9" and 14-way connector cavity "11". Ohmmeter should show resistance.

NOTE: The amount of resistance is not important. Just as long as there is resistance.



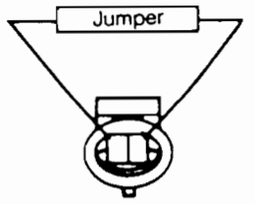
3) If there is resistance, check terminal in 14-way connector cavity "11" to ensure it is not spread apart causing a poor connection. If connections are okay, replace computer. If there is an open circuit, repair wire to 14-way connector cavity "11".

Federal 3.7L Models With A/T

1) Connect diagnostic read-out box to the engine harness connector. Disconnect the coolant sensor harness connector. Read-out box display should read "01". If display does not read "01", replace the computer.

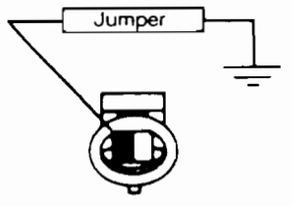
Engine Temperature Sensor Connector

2) If display reads "01", place system in Sensor Test Mode 92. Connect a jumper lead between coolant sensor harness connector terminals. Read-out box display should change from "01" to "03" when jumper lead is connected. If display changes from "01" to "03", replace the coolant sensor.



Engine Temperature Sensor Connector

3) If the display does not change, connect a jumper lead between the Black/Red wire and ground. Read-out box display should change from "01" to "03". If display changes from "01" to "03", repair the Black/Lt. Blue wire for an open circuit. If display does not change, repair Black/Red wire for an open circuit.

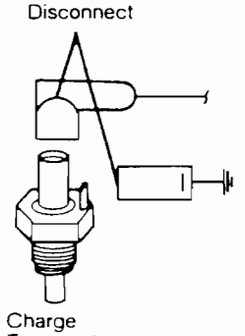


Engine Temperature Sensor Connector

DRIVEABILITY TEST 8

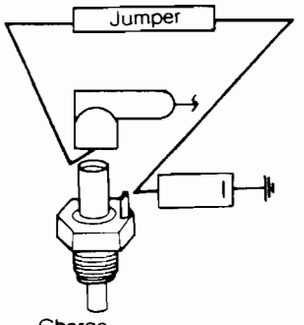
CODE 25 - CHARGE TEMPERATURE SWITCH CIRCUIT (ALL OTHER MODELS)

1) Connect diagnostic read-out box to engine harness connector. Disconnect both connectors from charge temperature switch. Place system in Sensor Test Mode 93. Display on read-out box should be "03". If "03" is not displayed on read-out box, check terminal in 14-way connector cavity No. "9" to ensure it is not spread apart causing a poor connection. If connections are okay, replace computer.



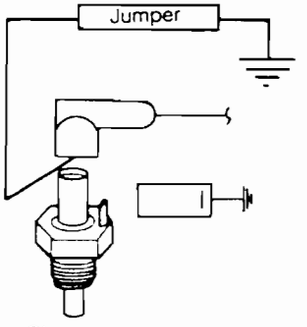
Charge Temperature Switch

2) If "03" is displayed, connect Tan wire to Black wire with a jumper lead. Read-out box display should change from "03" to "01" after jumper lead is connected. If display changes from 03 to 01, replace charge temperature switch.



Charge Temperature Switch

3) If display does not change, connect Tan wire to ground using a jumper lead. Read-out box display should change from "03" to "01" after jumper lead is connected. If display changes from "03" to "01", repair Black wire for an open circuit. If display does not change, repair Tan wire for an open circuit.



Charge Temperature Switch

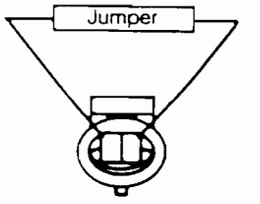
DRIVEABILITY TEST 9

CODE 26 - ENGINE TEMPERATURE SENSOR CIRCUIT

1) Connect diagnostic read-out box to engine harness connector. Disconnect coolant sensor harness connector. Read-out box display should read "01". If display does not read "01", replace computer.

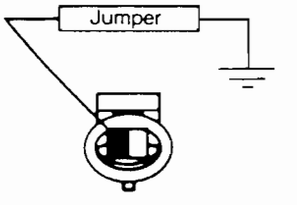
Engine Temperature Sensor Connector

2) If display reads "01", place system in Sensor Test Mode 92. Connect a jumper lead between coolant sensor harness connector terminals. Read-out box display should change from "01" to "03" when jumper lead is connected. If display changes from "01" to "03", replace coolant sensor.



Engine Temperature Sensor Connector

3) If display does not change, connect a jumper lead between Black/Red wire and ground. Read-out box display should change from "01" to "03". If display changes from "01" to "03", repair Black/Lt. Blue wire for an open circuit. If display does not change, repair Black/Red wire for an open circuit.

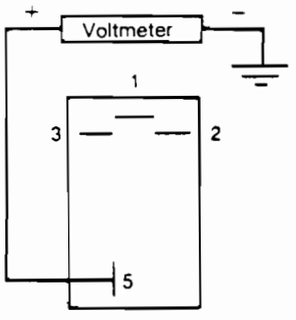


Engine Temperature Sensor Connector

DRIVEABILITY TEST 3

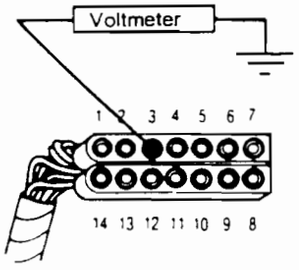
CODE 12 - TRANSMISSION UNLOCK RELAY CIRCUIT

1) Connect diagnostic read-out box to the engine harness connector. Connect a voltmeter to the Orange wire in terminal "5" of the transmission unlock relay and ground. Place system in ATM Test Mode 92. Voltmeter reading should be pulsating between 2-10 volts.



Transmission Unlock Relay

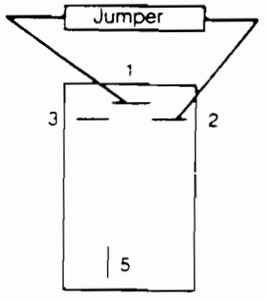
2) If voltmeter reading is not pulsating, but reads within 1 volt of battery voltage, turn ignition off. Disconnect the computer 14-way connector. Connect a voltmeter to the connector cavity "3" and ground. Turn the ignition switch to the "RUN" position. Voltmeter reading should be within 1 volt of battery voltage.



Computer 14-Way Connector

3) If voltage is okay, check terminal in cavity "3" to ensure it is not spread apart causing a poor connection. If connections are okay, replace computer. If voltage is not okay, repair wire in cavity "3" for an open circuit to the transmission unlock relay.

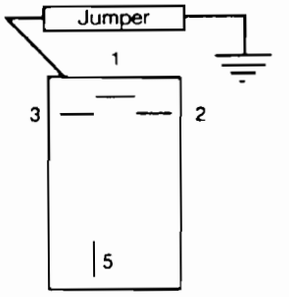
4) If voltmeter reading in step **1)** is pulstaing between 0 and 2 volts, connect a jumper wire between terminals "1" and "2" of the transmission unlock relay. The relay should cycle on and off.



Transmission Unlock Relay

5) If the relay does not cycle on and off, replace the relay. If the relay cycles on and off, repair wire from terminal "2" of the transmission unlock relay to the wiring harness splice for an open circuit.

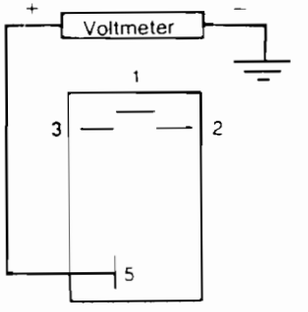
6) If the voltmeter reading in step **1)** pulsates once between 2-10 volts, then stays within 1 volt of battery voltage and relay clicks once, turn ignition off. Connect a jumper wire from the relay mounting bracket to ground. Place system in ATM Test Mode 92. Voltmeter reading should be pulsating between 2-10 volts and the relay should be clicking.



Transmission Unlock Relay

7) If voltmeter pulsates once between 2-10 volts, and then stays within 1 volt of battery voltage and the relay clicks once, replace the relay. If voltmeter reading pulsates between 2-10 volts and the relay is clicking, repair the relay ground.

8) If voltmeter reading in step **1)** is not pulsating, but reads 0-1 volt, disconnect computer 14-way connector. Connect voltmeter to terminal "5" (Orange wire) of the transmission unlock relay and ground. Voltmeter reading should be within 1 volt of battery voltage.



Transmission Unlock Relay

9) If voltage is within 1 volt of battery voltage, replace the computer. If voltage is not within 1 volt of battery voltage, repair Orange wire to connector terminal "5" or the relay for a short to ground.

TOYOTA

ELECTRONICALLY-CONTROLLED TRANSMISSION
●GENERAL DESCRIPTION ●FEATURES OF ECT

GENERAL DESCRIPTION

The conventional automatic transmission operates by mechanically converting vehicle speed into governor pressure, and throttle position (the angle to which the throttle is open) into throttle pressure, and using these hydraulic pressures to control the operation of the clutches and brakes in the planetary gear unit, thus controlling the timing of the shift points. This is called the "hydraulic control method."
In the case of the electronically-controlled transmission (hereafter abbreviated as ECT), on the other hand, sensors electronically sense the speed of the vehicle and the throttle position and send this information to the electronic control unit (hereafter abbreviated as ECU) in the form of electrical signals. The ECU then controls the operation of the clutches and brakes based on this data, thus controlling the timing of the shift points.

FEATURES OF ECT

The ECT has the following advantages over the standard hydraulically-controlled automatic transmission:

1. DRIVER CAN SELECT DRIVING PATTERN HE DESIRES

   In conventional automatic transmissions, the driving pattern (i.e., the shift point timing) is designed into the transmission and cannot be altered.
   However, in the ECT, the driver is able to select the driving pattern (Normal, Econo, or Power) that best suits the existing driving conditions by simply pushing one of the two driving pattern selector buttons.

2. SHIFTING SHOCK IS REDUCED

   Since the shift timing is controlled electronically rather than hydraulically, shifting shock is reduced.

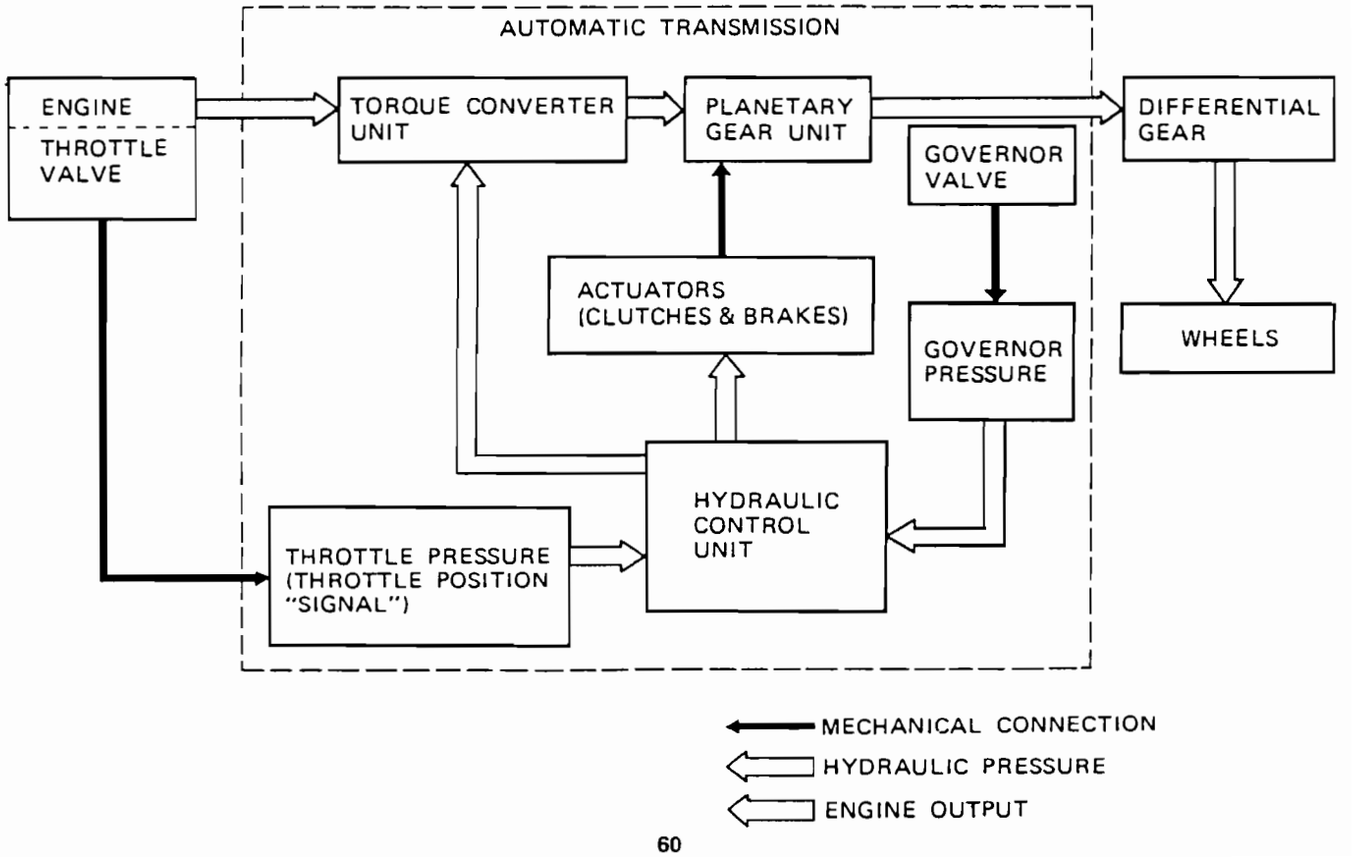
ELECTRONICALLY-CONTROLLED TRANSMISSION
●DIFFERENCES BETWEEN ECT AND HYDRAULICALLY-CONTROLLED AUTOMATIC TRANSMISSION

DIFFERENCES BETWEEN ECT AND HYDRAULICALLY-CONTROLLED AUTOMATIC TRANSMISSION

1. HYDRAULICALLY-CONTROLLED TRANSMISSION

The conventional hydraulically-controlled transmission is composed of three major parts: a torque converter unit, a planetary gear unit, and a hydraulic control unit. Shifting is carried out by the hydraulic control unit in the following way:

(1) The governor valve generates hydraulic pressure in proportion to the speed of the vehicle; this pressure acts as a vehicle speed "signal" to the hydraulic control unit.
(2) The throttle valve in the hydraulic control unit generates hydraulic pressure in proportion to the amount that the accelerator pedal is depressed; this pressure acts as a throttle position "signal" to the hydraulic control unit.
(3) These two pressures cause the shift valves in the hydraulic control unit to operate; the strengths of these pressures control the movements of these valves, and these valves in turn control the hydraulic pressure to the actuators (the clutches and brakes) in the planetary gear unit, which control the shifting of the transmission.

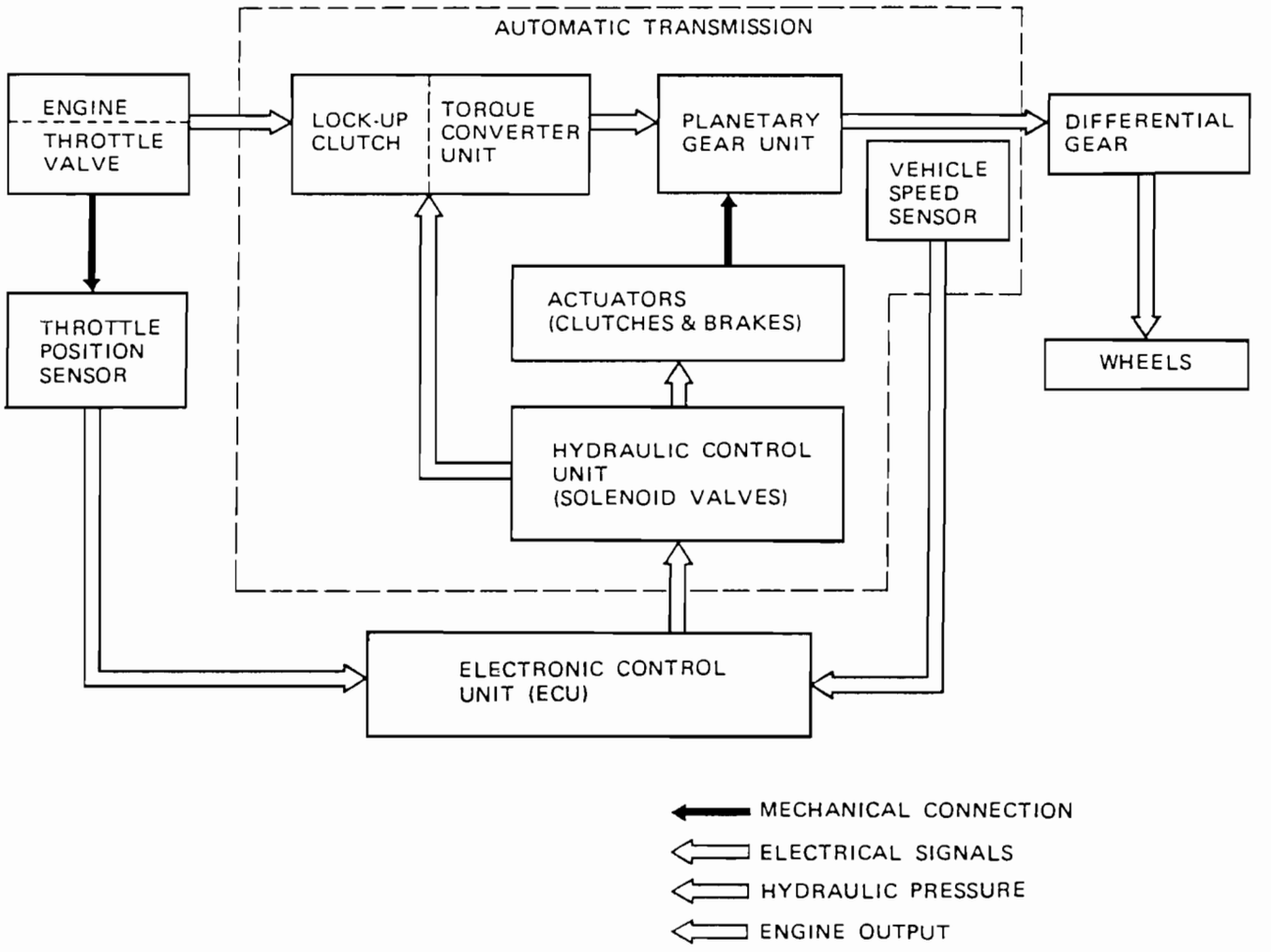


ELECTRONICALLY-CONTROLLED TRANSMISSION
●DIFFERENCES BETWEEN ECT AND HYDRAULICALLY-CONTROLLED AUTOMATIC TRANSMISSION

2. ECT

Aside from having an ECU which controls shifting based upon electrical signals (speed and throttle position signals), the ECT is basically the same as a standard hydraulically-controlled automatic transmission. The ECT controls shifting in the following manner:

(1) The vehicle speed is sensed by the vehicle speed sensor, which sends this data to the ECU in the form of electrical signals.
(2) The angle to which the throttle is open is sensed by the throttle position sensor, which sends this data to the ECU in the form of electrical signals.
(3) The ECU determines the shift timing on the basis of these two signals and operates the solenoid valves in the hydraulic control unit, thus shifting the transmission.



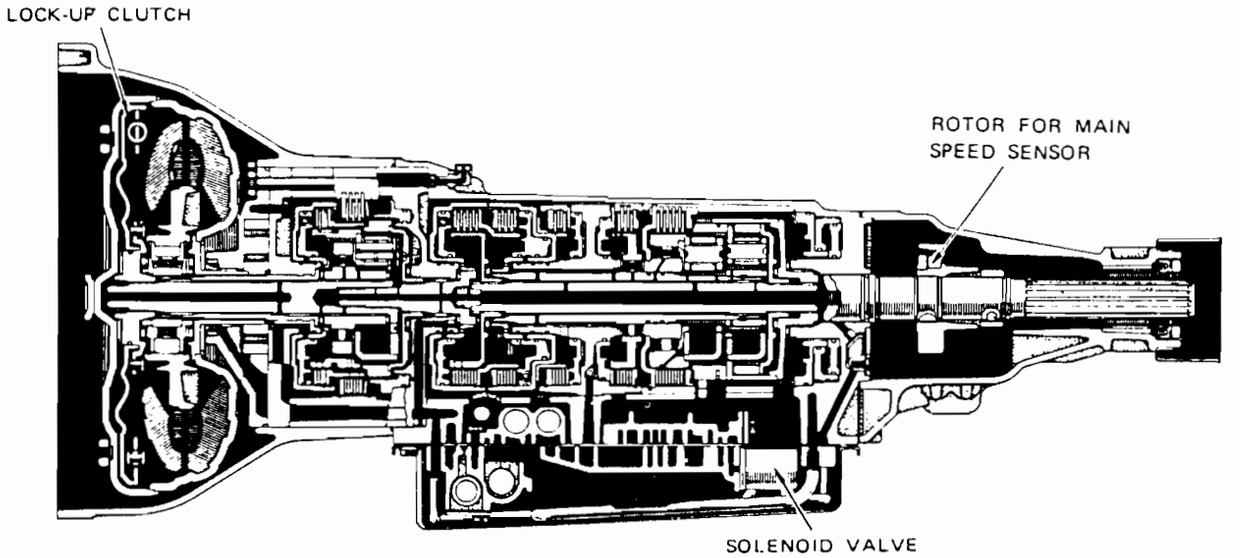
MODEL A43DE (FOR CROWN)
●DESCRIPTION

GENERAL DESCRIPTION

The A43DE is based upon the A43D automatic transmission, but differs from it in the following points:

(1) A lock-up clutch has been added to the torque converter.
(2) An electronic control unit (ECU) is used to control the timing of the shift points and the operation of the lock-up clutch.
(3) A vehicle speed sensor is used instead of a governor valve to electronically sense the speed of the vehicle.
(4) A throttle position sensor is used to electronically sense how far the throttle is open.
(5) Solenoid valves have been added to the valve body to divert hydraulic pressure from one circuit to another. (There are two solenoid valves for controlling the timing of the shift points, and one for controlling lock-up clutch.)
(6) A driving pattern selector is employed to allow the driver to select the driving pattern——NORMAL, ECONO or POWER——that best suits the existing driving conditions.
(7) The "2" range of the transmission has been replaced by the "S" range.
(8) A self-diagnostic system has been provided to allow troubleshooting of the electronic control system to be performed.
(9) The A43DE is provided with a fail-safe function, allowing the transmission, to be operated like a manual transmission so that the vehicle can be safely driven even if the electronic control system should fail.

– NOTE –
This STI will describe only those aspects of the A43DE that are used in the Crown.



MODEL A43DE: CUTAWAY VIEW

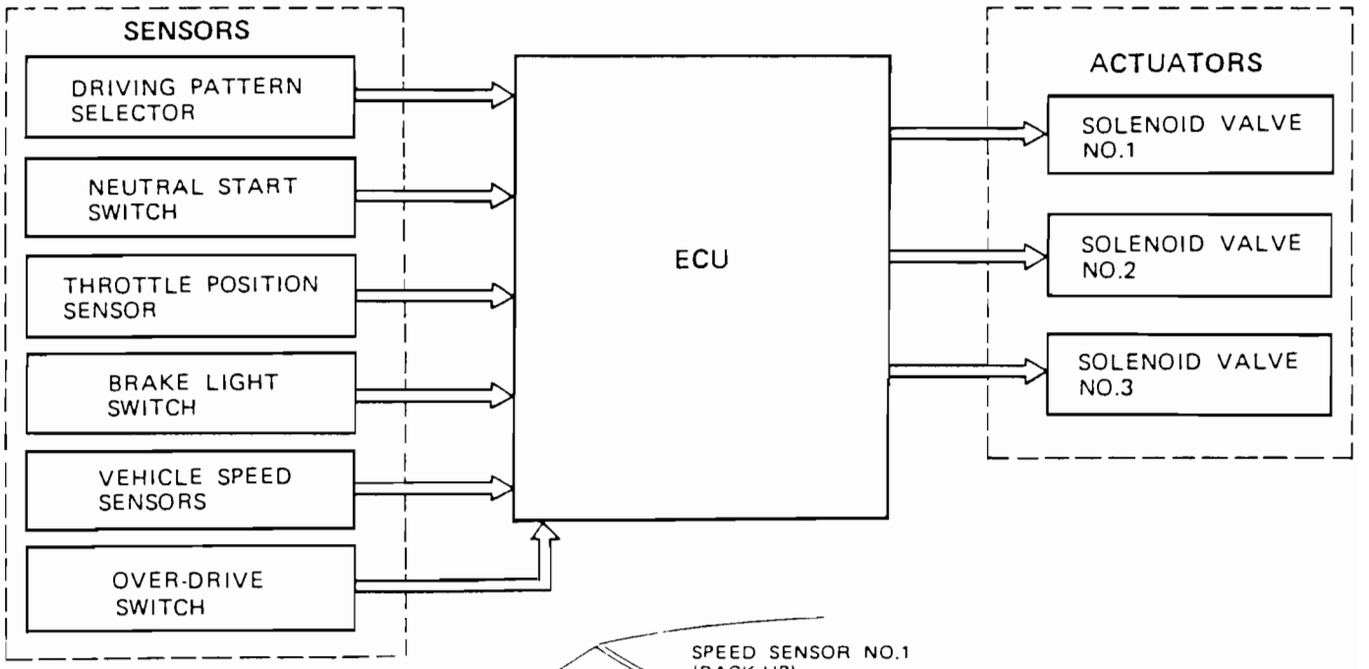
ELECTRONIC CONTROL SYSTEM (A43DE)
●GENERAL OUTLINE

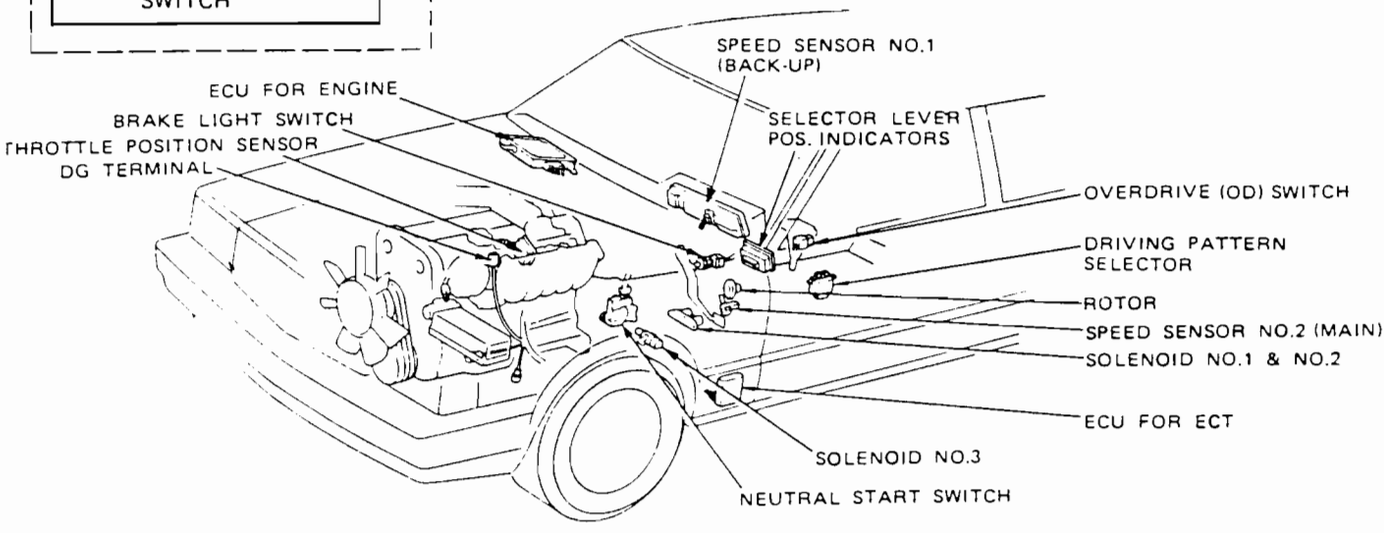
GENERAL OUTLINE

The electronic control system for controlling the shift points and the operation of the lock-up clutch is composed of the following three parts:

(1) Sensors: these sense the vehicle speed and throttle position and send this data to the ECU in the form of electronic signals.
(2) ECU: this determines the shift and lock-up timing based upon the signals from the sensors.
(3) Actuators: solenoid valves divert hydraulic pressure from one circuit of the hydraulic control unit to another, thus controlling shifting and lock-up timing.

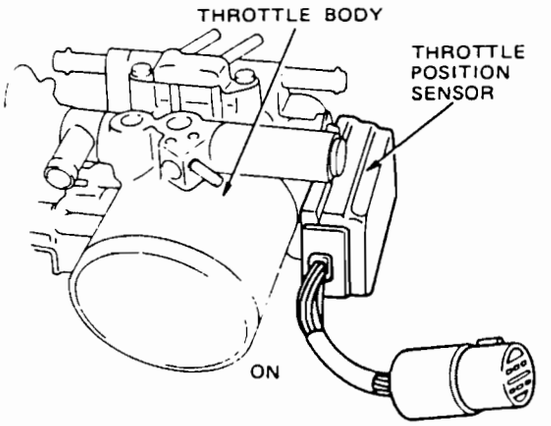
The ECU determines the shift timing and the operation of the lock-up clutch based upon the signals from the sensors, and controls the solenoids of the hydraulic control unit accordingly.





ELECTRONIC CONTROL SYSTEM (A43DE)
●CONSTRUCTION AND OPERATION

CONSTRUCTION AND OPERATION



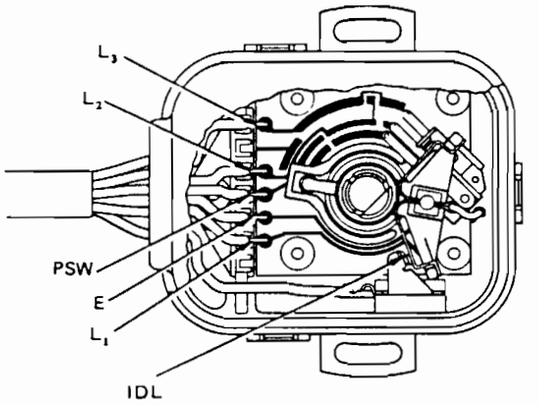
1. THROTTLE POSITION SENSOR

(1) CONSTRUCTION

This sensor is mounted on the throttle body and electronically senses how far the throttle is open. It then sends this data to the ECU (in the form of electrical signals) to control shifting and lock-up in the transmission.

– NOTE –

These signals correspond to the throttle pressure used in hydraulically-controlled transmissions, but since they are used in the ECT to control shifting and lock-up, throttle pressure is not needed in the ECT for this. The throttle pressure generated by the ECT throttle valve (located in the valve body) is therefore used instead for controlling the line pressure.



INTERNAL CONSTRUCTION OF SENSOR

(2) OPERATION

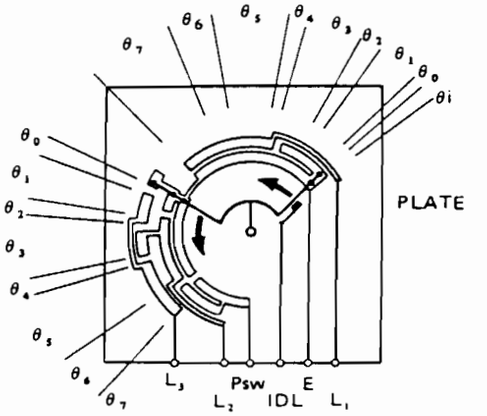
As shown in the schematic diagram, the plate rotates counterclockwise together with the throttle valve, causing contacts L_1, L_2, L_3 and IDL to make and break contact with contact E (ground).

If, for example, the throttle opens to angle θ_4, contacts L_1 and L_2 make contact with contact E.

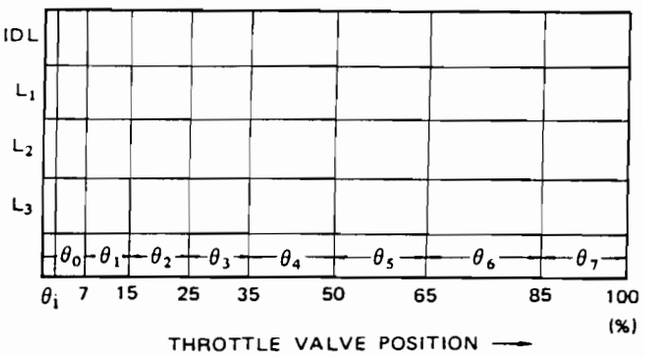
If the engine is idling, IDL makes contact with E.

There are eight throttle positions that can be sensed by the throttle position sensor, and the throttle position signal that is sent to the ECU depends upon whether it is L_1, L_2, L_3 and/or IDL that is making or breaking contact with E.

The make/break status of each contact is tabulated to the right; the filled-in rectangles indicate the throttle positions at which each contact makes contact with E.



SCHEMATIC DIAGRAM OF SENSOR



ELECTRONIC CONTROL SYSTEM (A43DE)
●CONSTRUCTION AND OPERATION

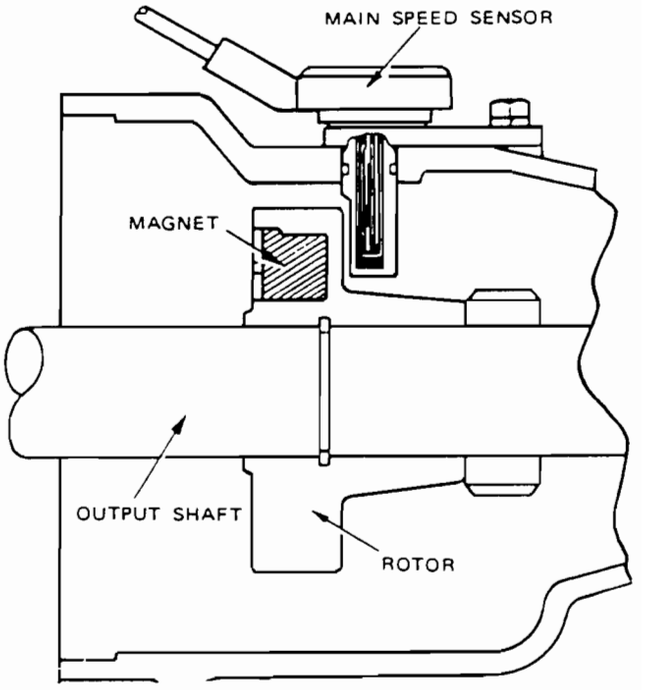
2. SPEED SENSORS

(1) MAIN SPEED SENSOR (SPEED SENSOR NO. 2)

A rotor with built-in magnet is mounted on the transmission output shaft. Every time the output shaft (and thus the rotor) makes one complete revolution, the magnet activated the reed switch, which is built into the extension housing, causing it to generate a signal. This signal, which corresponds to the governor pressure in a conventional automatic transmission, is sent to the ECU, which uses it in controlling the shift points and the operation of the lock-up clutch. (The ECT does not need a governor valve.)

(2) BACK-UP SPEED SENSOR (SPEED SENSOR NO. 1)

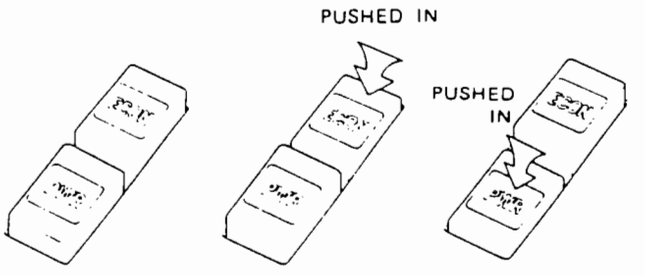
This sensor is built into the speedometer and operates in place of the main speed sensor if this sensor should happen to malfunction. It outputs four pulses for every one revolution of the speedometer cable.



MAIN SPEED SENSOR CUTAWAY VIEW

3. DRIVING PATTERN SELECTOR

The driving pattern selector allows the driver to select the driving pattern – Normal, Economy, or Power – that best suits the existing driving conditions by pushing in one of two buttons, ECON or PWR. Depending upon which of these is pushed in, the transmission goes into either the Economy mode or the Power mode. If neither is pused in, the transmission remains in the Normal mode.



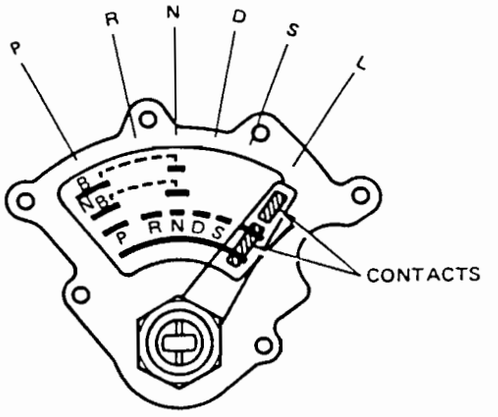
NORMAL MODE ECONO MODE POWER MODE

ELECTRONIC CONTROL SYSTEM (A43DE)
●CONSTRUCTION AND OPERATION

4. NEUTRAL START SWITCH

In the ECT, the neutral start switch is provided with contacts for all ranges and is used to send signals to the ECU to informe it of the current position of the selector lever. These signals are also used to turn on the electrical selector lever position indicators.

The make/break status of each contact is tabulated to the right.

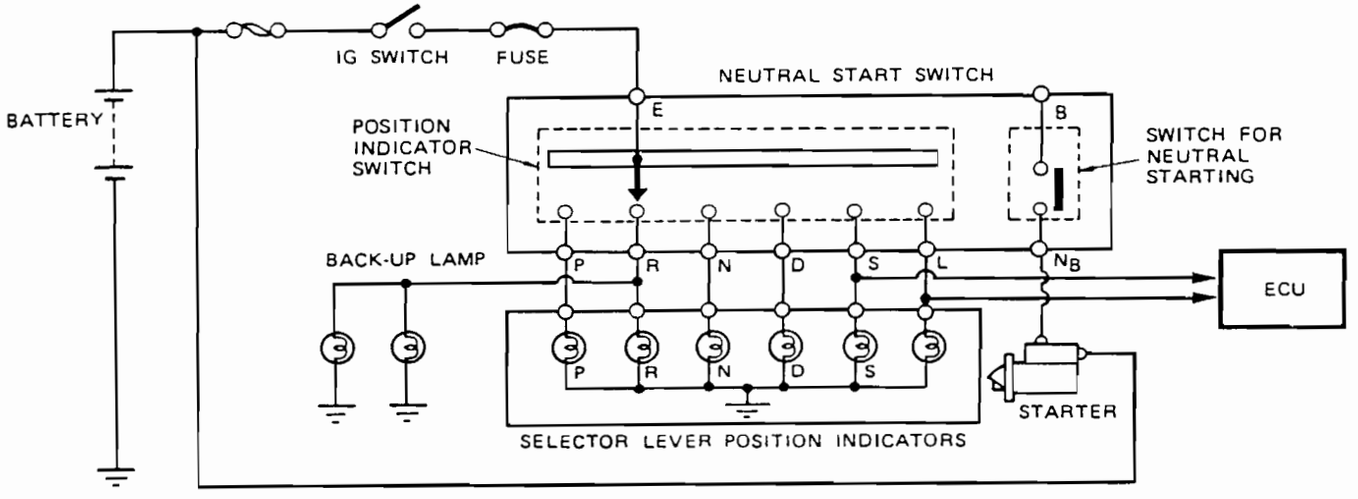


– NOTES –

1. *If terminal S or terminal L is electrically connected to terminal E, the ECU determines that the transmission is in either the S or the L range, respectively. If neither the S nor the L terminal is grounded, then the ECU determines that the transmission is in the D range.*
2. *In the P, N and R ranges, the neutral start switch does not send signals showing the shift selector position to the ECU.*

TERMINAL / SHIFT POSITION	FOR NEUTRAL STARTING		FOR SELECTOR LEVER POSITION INDICATORS						
	B	NB	E	P	R	N	D	S	L
P	○—○		○—○						
R			○		○				
N	○—○		○			○			
D			○				○		
S			○					○	
L			○						○

○—○ : INDICATES THAT TERMINALS ARE ELECTRICALLY CONNECTED.



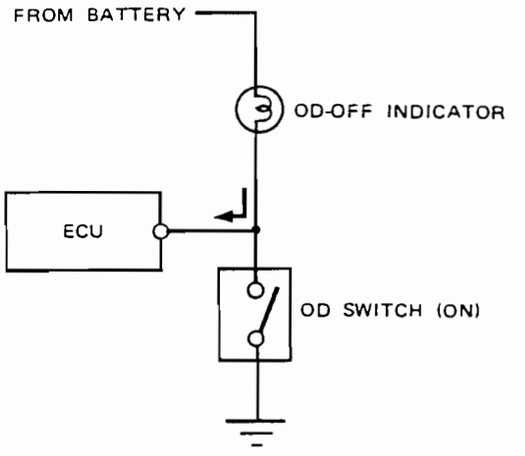
ELECTRONIC CONTROL SYSTEM (A43DE)
●CONSTRUCTION AND OPERATION

5. OVERDRIVE SWITCH

This switch causes the transmission to shift into and out of overdrive.

(1) OD SWITCH "ON"

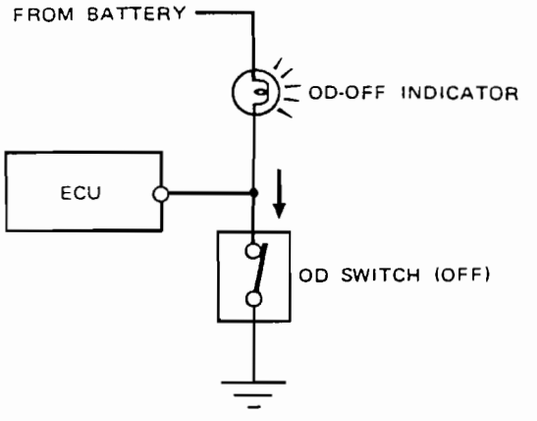
When the OD switch is turned on, the current from the battery flows to the ECU, causing the transmission to be OD-enabled, as shown in the wiring diagram.



(2) OD SWITCH "OFF"

When the OD switch is turned off, the current from the battery flows to ground as shown in the wiring diagram. Therefore, OD is disabled, i.e., the transmission is not permitted by the ECU to shift into overdrive.

At the same time, the OD-OFF indicator comes on.



OD switch operation is shown in the following table:

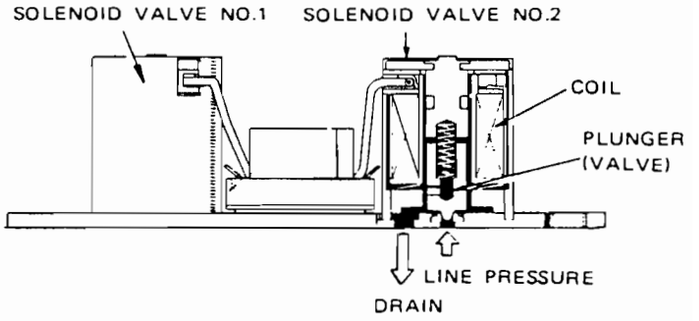
	OD SWITCH	
	ON	OFF
CONTACTS OF OD SWITCH	Open	Closed
OD GEAR	Enabled	Disabled
OD-OFF INDICATOR	Off	On

6. BRAKE LIGHT SWITCH

This switch is mounted on the brake pedal bracket. Its purpose is to prevent the engine from stalling if the rear wheels lock up when brakes are suddenly applied. When the brake pedal is operated, this switch sends a signal to the ECU, informing it that the brakes have been applied. The ECU therefore cancels operation of the lock-up clutch while braking is in progress.

ELECTRONIC CONTROL SYSTEM (A43DE)
●CONSTRUCTION AND OPERATION

7. SOLENOID VALVES NO. 1 AND 2



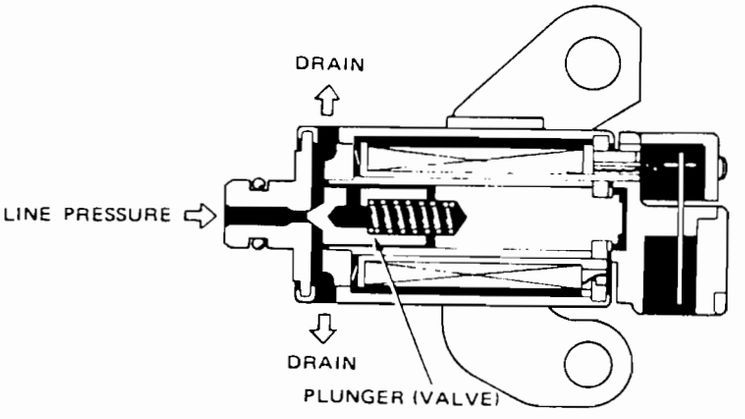
These solenoid valves are mounted on the automatic transmission valve body and are turned on and off by electrical signals from the ECU; this is the actual physical means by which the transmission is shifted from one gear to another. ("On" here means "open" — the plunger of the solenoid valve is attracted upward by the coil, thus opening the valve and allowing line pressure fluid to drain.)

The relationship between the operation of these valves and each gear is shown in the table below:

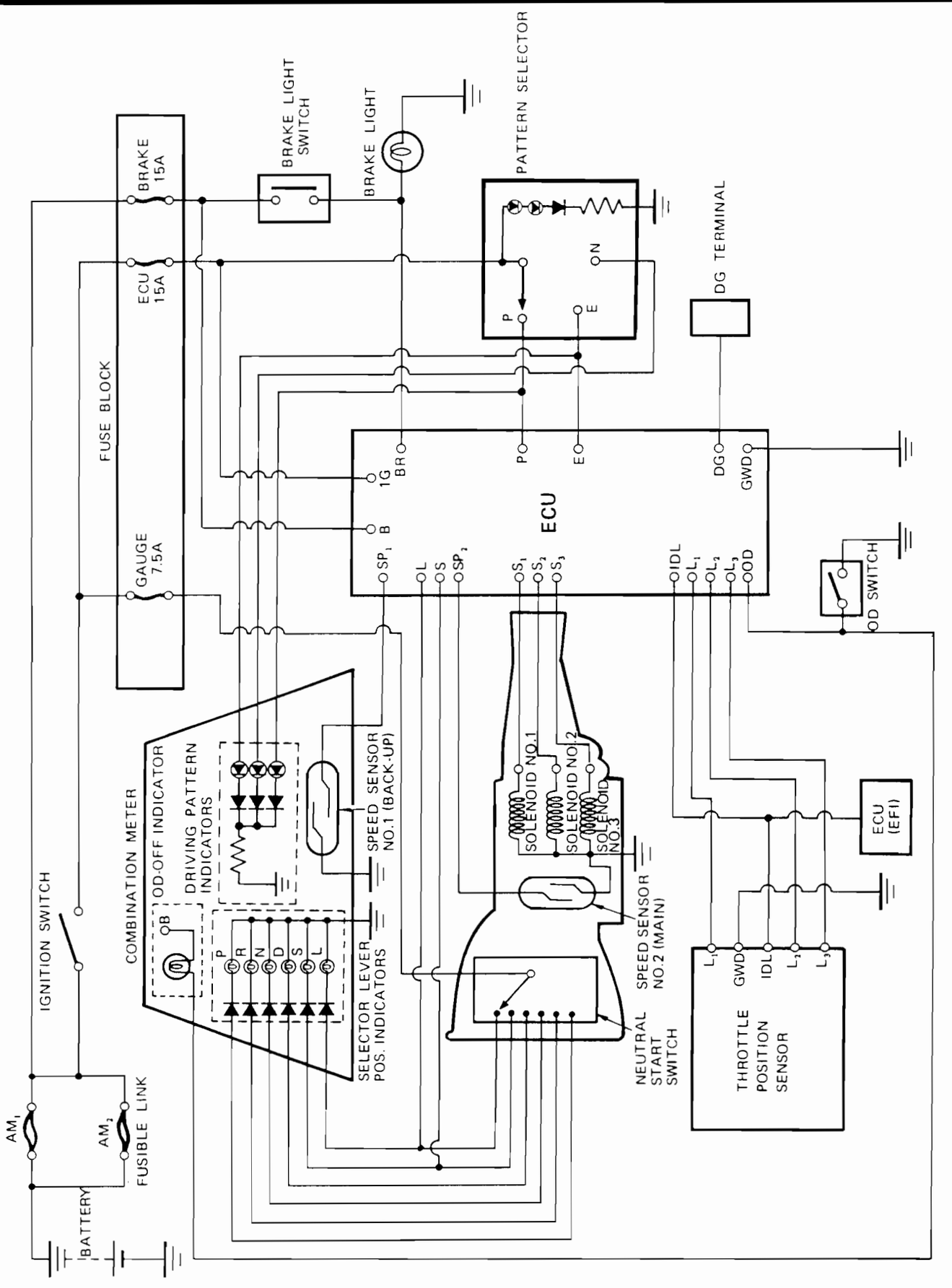
SOLENOID VALVE \ GEAR	1ST	2ND	3RD	OD
NO. 1	On	On	Off	Off
NO. 2	Off	On	On	Off

8. SOLENOID VALVE NO. 3

This is also mounted on the valve body and is turned on and off by signals from the ECU, thus operating the lock-up clutch.
In the case of this valve also, "on" means "open"— the valve opens, causing line pressure to drain, thus operating the lock-up system.



MODEL A43DE
●ELECTRIC CIRCUIT



SHIFT POINT CONTROL

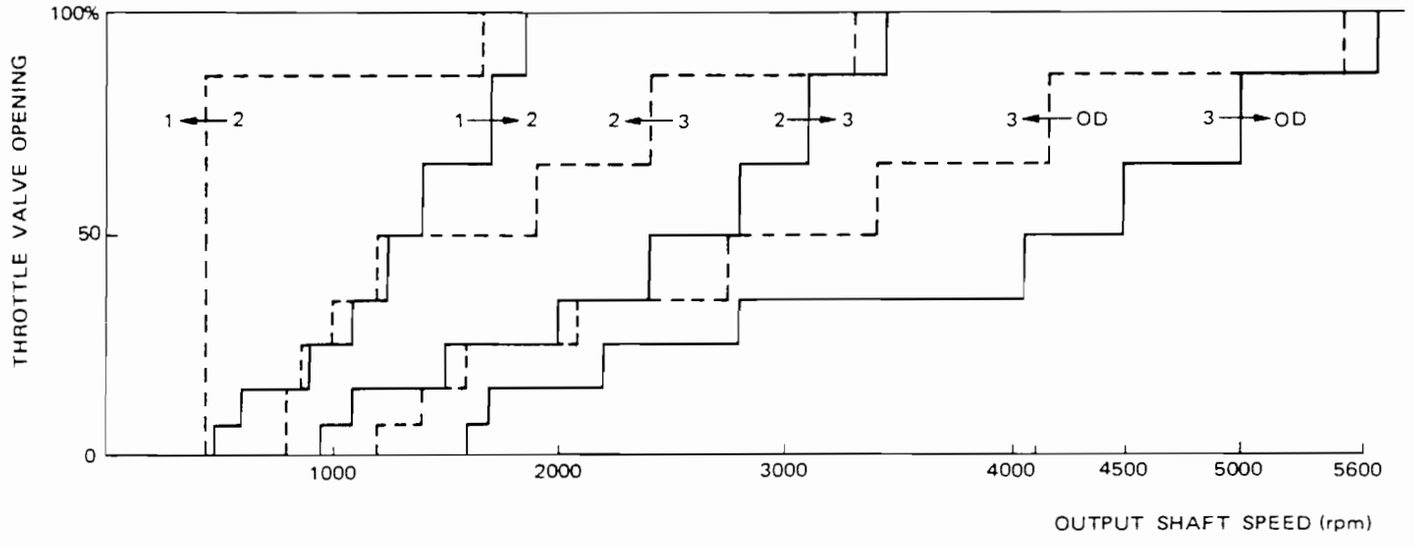
The ECU's memory can store all of the driving patterns (each of which differs depending upon the shift points) shown in the table below.

RANGE / DRIVING PATTERN / GEAR	D	S	L
	1ST, 2ND, 3RD, OD	1ST, 2ND, 3RD	1ST, 2ND
NORMAL	S–1	S–4	S–6
ECONO	S–2	↑	↑
POWER	S–3	S–5	↑

The characteristics of each driving pattern are explained below, and a shifing diagram is shown for each.

1. D RANGE, NORMAL MODE (S-1)

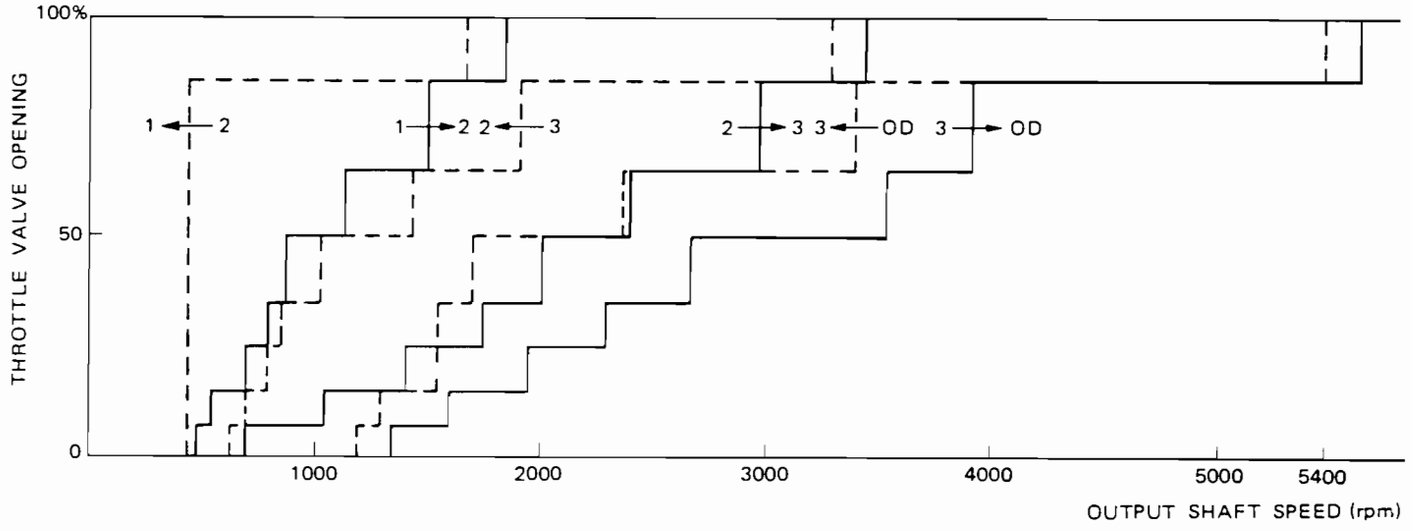
This pattern is the most suitable for normal city, suburban, and highway driving. If neither driving pattern selector button is pushed in, this is the pattern that is automatically set.



FUNCTIONING OF ECU (A43DE)
●SHIFT POINT CONTROL

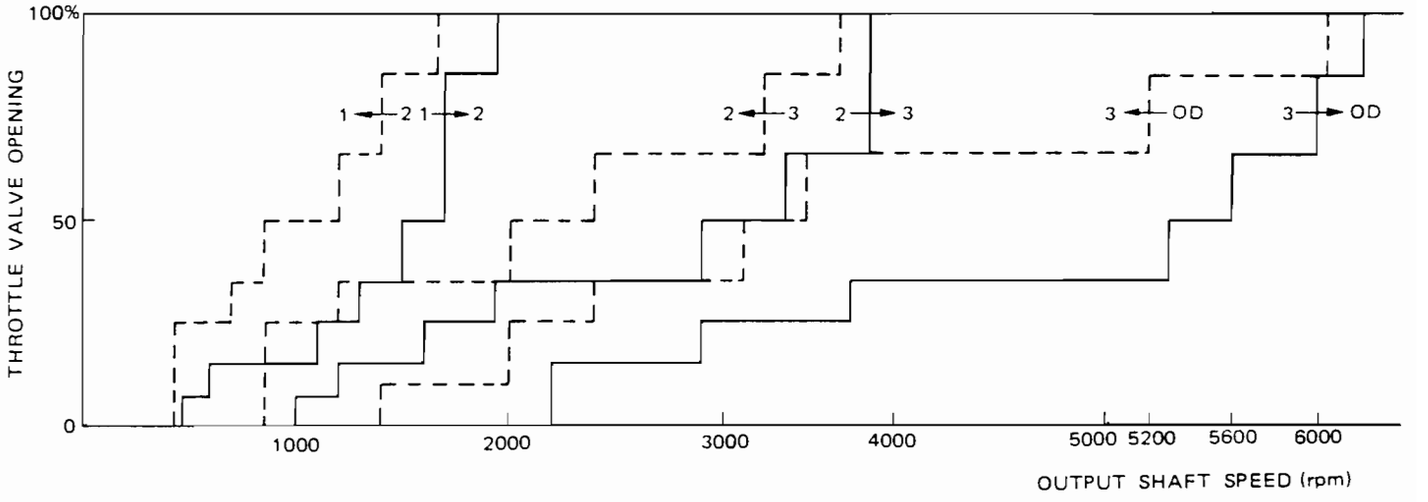
2. D RANGE, ECONOMY MODE (S-2)

This is the most fuel-efficient driving pattern. For this reason, the speeds at which the transmission up-shifts and down-shifts are set lower than in the other patterns.



3. D RANGE, POWER MODE (S-3)

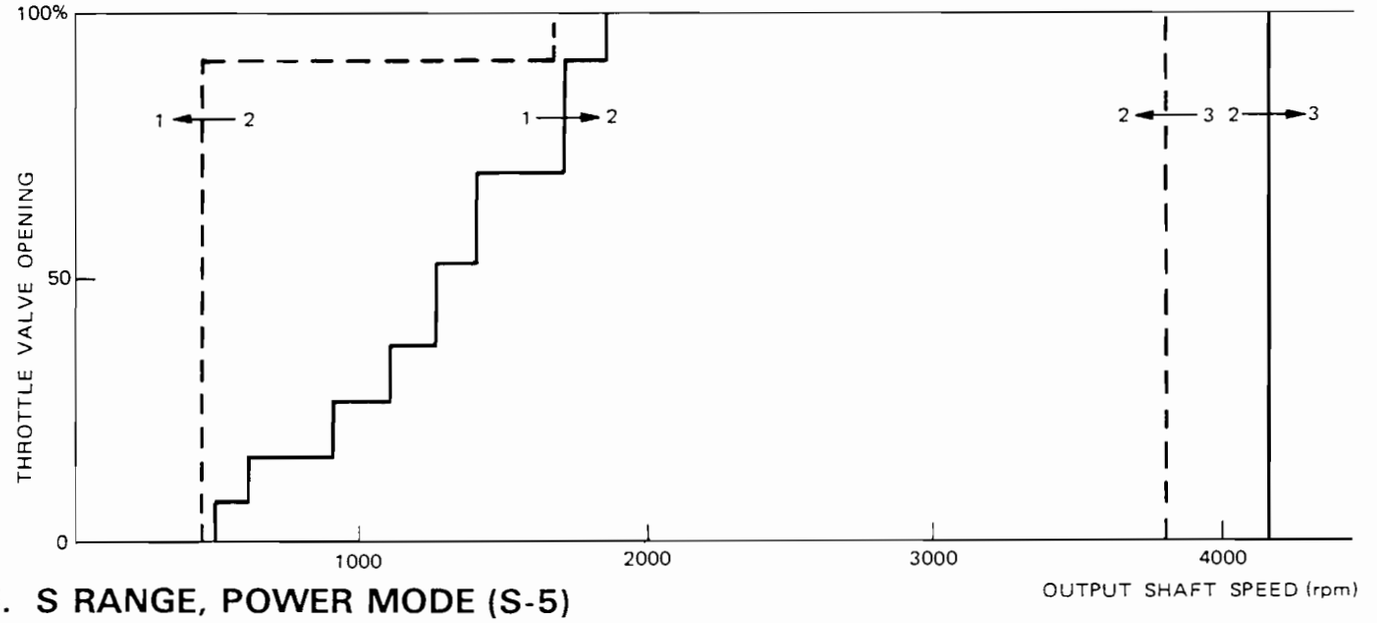
This is the best for accelerating. For this reason, the speed at which the transmission up-shifts and down-shifts is set higher.



FUNCTIONING OF ECU (A43DE)
●SHIFT POINT CONTROL

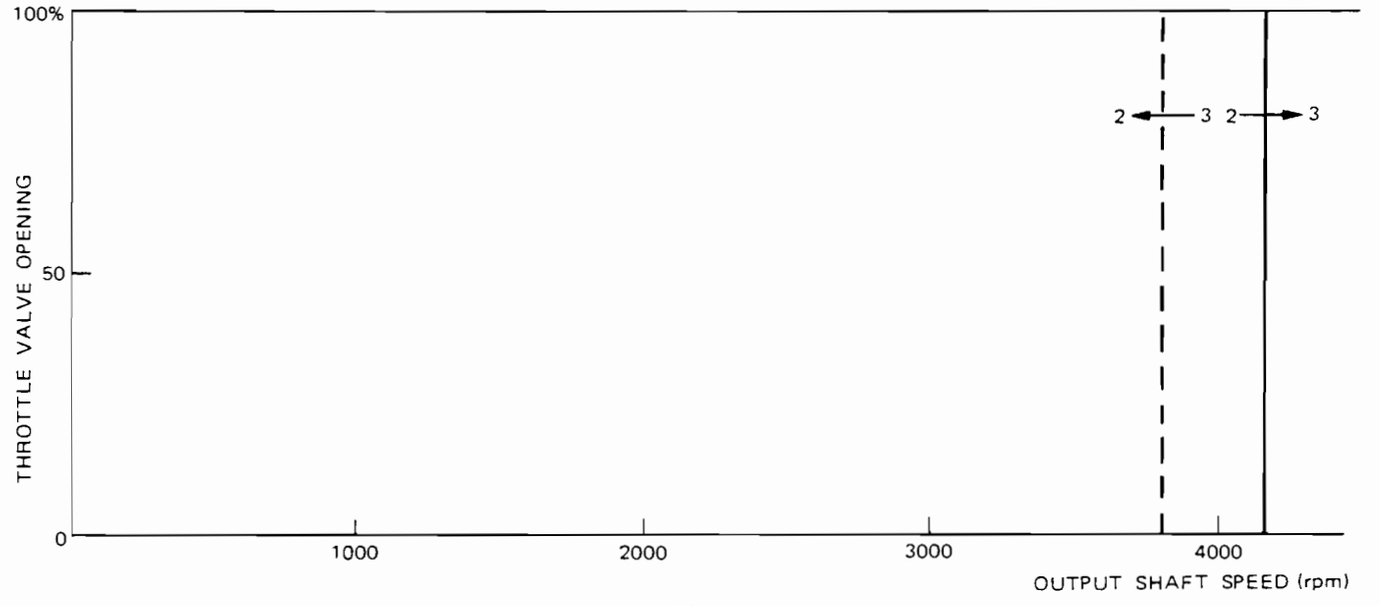
4. S RANGE, NORMAL MODE (S-4) AND ECONOMY MODE (S-4)

These are equivalent to the 2 range in a conventional automatic transmission.
The speed range that this covers is very wide, and this pattern has the added advantage of allowing engine braking to be performed when the vehicle is being driven on mountain roads.
However, to prevent the engine from over-running, the transmission automatically shifts into 3rd gear if the speed of the output shaft rises above 4,150 RPM.



5. S RANGE, POWER MODE (S-5)

When the transmission is in the S range (Power mode), it normally operates only in 2nd gear and does not down-shift into 1st gear. This is to prevent the vehicle from slipping on slippery roads.
This also allows the vehicle operate more smoothly on mountain roads by preventing the transmission from constantly up-shifting and down-shifting. Up-shifting is performed, however, to prevent engine over-run.

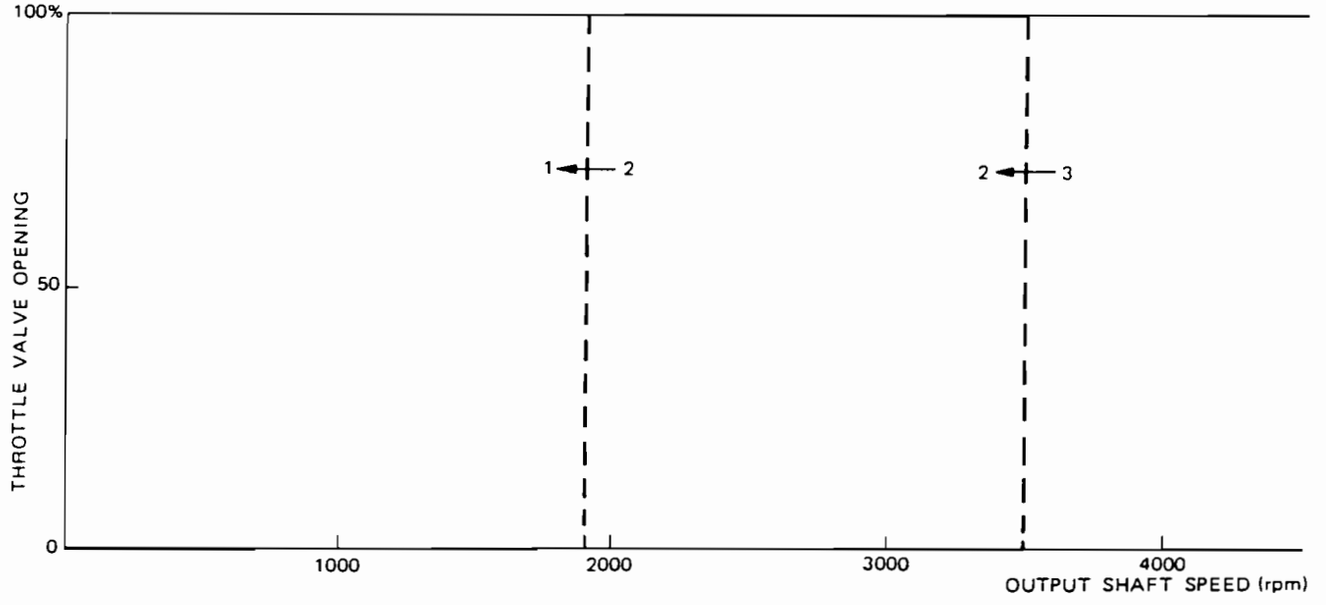


FUNCTIONING OF ECU (A43DE)
●SHIFT POINT CONTROL

6. L RANGE, ALL MODES (S-6)

This is basically the same as the L range in the A43D transmission.

However, to prevent the engine from over-running, the transmission performs down-shifting as shown in the diagram. It does not perform up-shifting.



FUNCTIONING OF ECU (A43DE)
●CONTROL OF LOCK-UP SYSTEM

CONTROL OF LOCK-UP SYSTEM

The ECU controls the lock-up system by causing it to engage at a lower speed when the Econo mode is selected than when the Normal or Power mode is selected. This helps to improve fuel economy.
As an example, lock-up speeds for when the vehicle is running in OD with the transmission in the D range are shown in the table below:

RANGE	GEAR	DRIVING PATTERN	LOCK-UP CLUTCH	
			ENGAGED (km/h)	DISENGAGED (km/h)
D	OD	ECONO	50 – 55	47 – 52
		NORMAL & POWER	83 – 90	79 – 85

(throttle valve 5% open)

– NOTES –

1. *The lock-up system operates in the 2nd, 3rd and OD gears of the D range.*
2. *The lock-up system goes off under the following conditions:*

CONDITION	PURPOSE
Brake light switch on (during braking)	To prevent engine from stalling if rear wheels lock-up when brakes are suddenly applied.
Idle contact of throttle position sensor closes (sensor goes on)	↑
Vehicle speed lower than set speed by 10 kph or more when vehicle is running on cruise control	To cause the torque converter to operate in order to increase the driving torque.

The ECU also controls lock-up timing in order to reduce shock during shifting. If the transmission up-shifts or down-shifts while the lock-up system is in operation, the ECU deactivates the lock-up system. This helps to reduce shifting shock. After up-shifting or down-shifting is completed, the ECU reactivates the lock-up system.

FUNCTIONING OF ECU (A43DE)
● SELF-DIAGNOSTIC FUNCTIONS

SELF-DIAGNOSTIC FUNCTIONS

The ECU is equipped with a built-in self-diagnostic system, which allows the technician to easily and quickly locate malfunctioning part or circuit during troubleshooting of the ECT. This is done by measuring the voltage that is output from the DG (diagnostic) terminal, which is provided in the ECU.
The self-diagnostic function is summarized in the table below:

LOCATION OF MALFUNCTION	WARNING INDICATOR	OUTPUT FROM DG TERMINAL	MEMORY
SPEED SENSORS & CIRCUITRY	Provided	Trouble code	Provided
SOLENOID VALVES & CIRCUITRY			
THROTTLE POSITION SENSORS & CIRCUITRY	Not provided	Steady voltage	Not provided
BRAKE LIGHT SWITCH & CIRCUITRY			
SHIFT SIGNAL FROM ECU TO SOLENOID VALVES			

1. DIAGNOSABLE ITEMS

This system can diagnose the following five different types of problems:

(1) Malfunctions of the speed sensors or their circuitry

(2) Malfunctions of the solenoids or their circuitry

(3) Malfunctions of the throttle position sensor or its circuitry

(4) Malfunctions of the brake light switch or its circuitry

(5) Incorrect transmission of signals from the ECU to the solenoid valves.

FUNCTIONING OF ECU (A43DE)
●SELF-DIAGNOSTIC FUNCTIONS

2. WARNING INDICATOR

In addition to this diagnostic function, which is used during troubleshooting, there is also an OD–OFF indicator (warning light) that blinks to warn the driver of trouble whenever a malfunction occurs in the speed sensors (SP_1 or SP_2) or the solenoid valves (Nos. 1, 2 or 3), or in the circuitry of either. This indicator is not used for the other three problems mentioned above in items (3) to (5).

– NOTE –
The OD–OFF indicator blinks when the OD switch is on (that is, while the transmission is OD-enabled).

3. DG TERMINAL OUTPUT

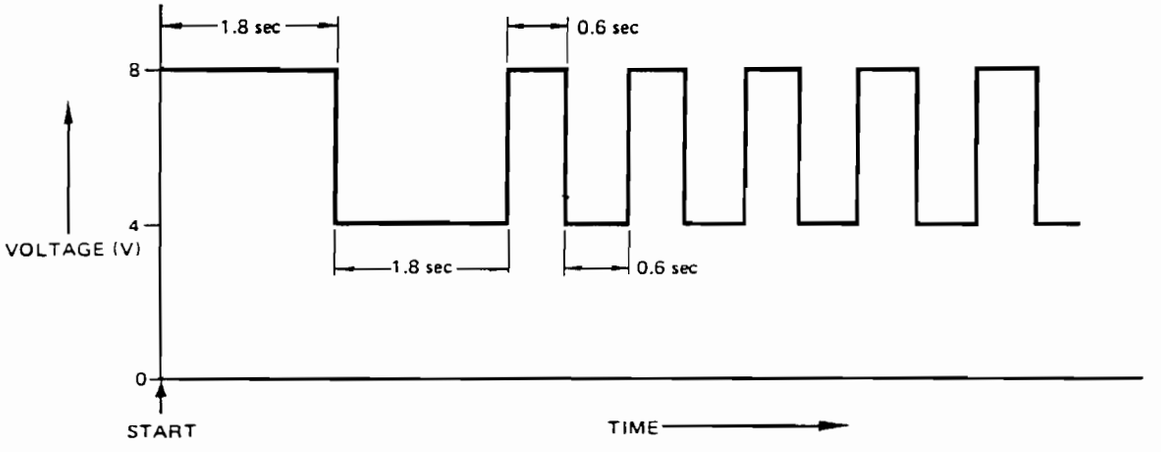
The ECU outputs two different types of voltage to the DG terminal, depending upon the location of the malfunction. One type is a steady voltage (to be explained later), while the other is a so-called "trouble code."

(1) TROUBLE CODES

Trouble codes are output only when the OD–OFF indicator blinks. If a voltmeter is hooked up to the DG terminal at this time, a variable voltage will be seen to be output. This variable voltage (trouble code) can be interpreted in the following way:

NORMAL

As long as the ECT is normal (not malfunctioning), a signal alternating between 4V and 8V (0.6 sec each) is output from the DG terminal, as shown in the diagram below:



FUNCTIONING OF ECU (A43DE)
●SELF-DIAGNOSTIC FUNCTIONS

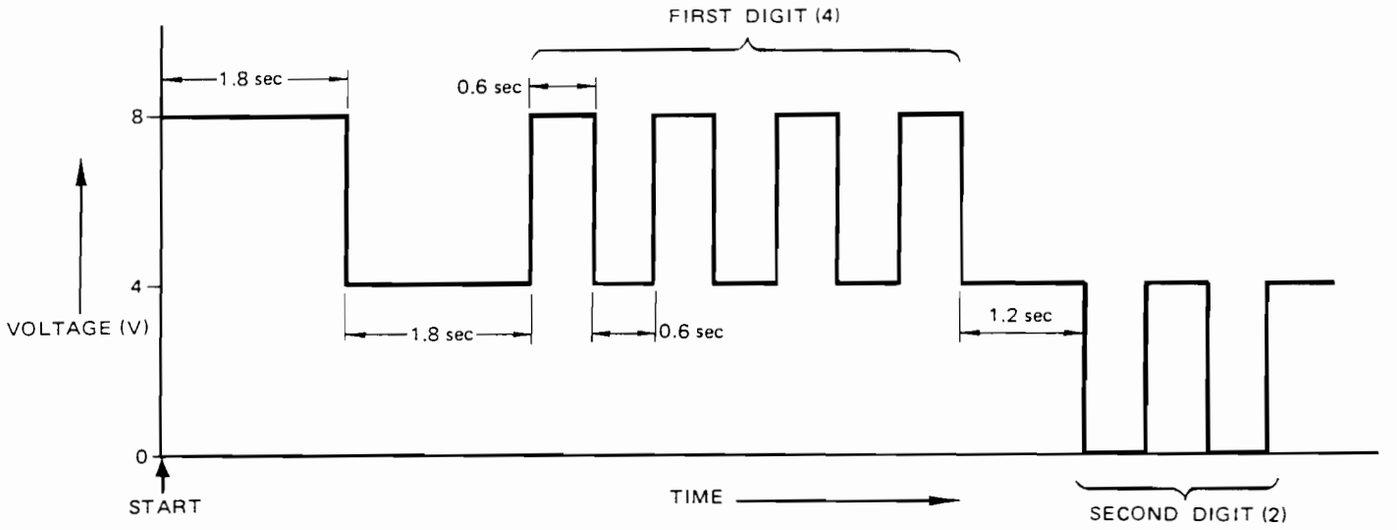
MALFUNCTION

If the ECT malfunctions, this will be indicated by an output of 8V for 1.8 sec, followed by an output of 4V for 1.8 sec. Thereafter, the actual trouble code itself will be output as follows:

The needle of the voltage tester will deflect several times (for 0.6 sec each time) between 4V and 8V and between 4V and 0V (also for 0.6 sec each time).

First it will deflect between 4V and 8V. The number of times that it does this indicates the first digit of a two-digit code number. Next, 4V will be output for 1.2 sec, then the needle will deflect between 4V and 0V. The number of times that it does this indicates the second digit of the code.

Often there will be more than one trouble code. If this is the case, the lowest code number will be output first, followed by the next highest code number or numbers. In between each code number, 4V will be output for 1.8 sec. (In the illustration below, trouble code of 42 is indicated.)



(2) STEADY VOLTAGE

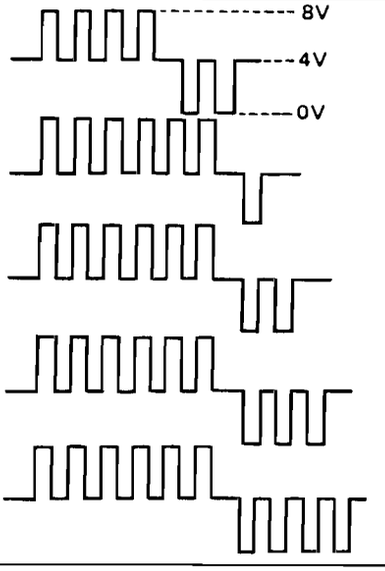
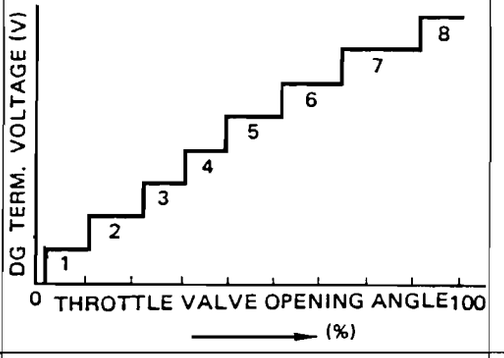
If a malfunction occurs in the throttle position sensor or the brake light switch (used for releasing the lock-up system during braking), or in the circuitry of either, a steady voltage (not a trouble code) will be output from the DG terminal.

– NOTE –

The OD–OFF light will not blink if such a malfunction occurs.

FUNCTIONING OF ECU (A43DE)
●SELF-DIAGNOSTIC FUNCTIONS

4. SUMMARY OF RELATIONSHIP BETWEEN DG TERM. OUTPUT AND DIAGNOSIS

ITEM	CONDITIONS	DG TERM OUTPUT	DIAGNOSIS
Speed sensors (Nos.1 & 2)	Engine stopped, ignition switch on		Back-up speed sensor bad, or wire harness cut or shorted out
			Main speed sensor bad, or wire harness cut or shorted out
Solenoid valves (Nos. 1,2 & 3)			Wiring of solenoid valve No.1 cut or shorted out, or wire harness cut or shorted out
			Wiring of solenoid valve No.2 cut or shorted out, or wire harness cut or shorted out
			Wiring of solenoid valve No.3 cut or shorted out, or wire harness cut or shorted out
Throttle position sensor	Engine stopped, ignition switch on; throttle gradually opened all the way		Normal
Brake light switch (for deactivating lock-up system)	Engine stopped, ignition switch on, throttle valve fully open, DG term outputting 8V	Brake pedal depressed .... 0V Brake pedal released 8V	Normal
Shift signal from ECU (to solenoid)	Vehicle travelling at 10 km/h or faster, OD switch on	DGTerm.voltage (V) / Gear: 0 1st 2 2nd 3 2nd(Lock-up) 4 3rd 5 3rd(Lock-up) 6 OD 7 OD(Lock-up)	Normal

FUNCTIONING OF ECU (A43DE)
●SELF-DIAGNOSTIC FUNCTIONS

5. MEMORY FUNCTION

If a malfunction occurs in one of the speed sensors or solenoid valves, or in the circuitry of either, this fact will be communicated to the ECU and stored in its memory. This information will then be output from the DG terminal as a trouble code, to be used as explained above to find the location of the malfunction.

–NOTES–

1. *This data will remain in memory, and will be output whenever a tester is hooked up to the DG terminal, as long as the ECU connector is connected and the battery connector remains connected to the battery. If either of these are disconnected, however, the data will be erased.*
2. *Data concerning malfunctions in the throttle position sensor or brake light switch, or in their circuitry, are not recorded in the ECU memory.*

6. FAIL-SAFE FUNCTIONS

The ECU is provided with two fail-safe functions:

(1) SOLENOID VALVE BACK-UP FUNCTION

If either solenoid valve No.1 or No.2 malfuctions, the ECU can still control the transmission by operating the remaining solenoid to put the transmission in a gear that will allow the vehicle to be operated safely and without the danger of shifting shock such as would occur if the transmission were suddenly shifted from a low to a high gear, or vice versa.

For example, if solenoid valve No.1 malfunctions while the vehicle is running in 1st gear with the transmission in the D range, the fail-safe function causes the transmission to shift into 3rd gear instead of into OD as it would if no fail-safe function were provided.

Furthermore, if both solenoid valves malfunction, the driver can still safely drive the vehicle by operating the shift selector manually.

Range	NORMAL			SOLENOID NO.1 MALFUNCTIONING			SOLENOID NO.2 MALFUNCTIONING			BOTH SOLENOIDS MALFUNCTIONING
	Solenoid valve		Gear	Solenoid valve		Gear	Solenoid valve		Gear	Gear when shift selector is manually operated
	NO.1	NO.2		NO.1	NO.2		NO.1	NO.2		
D	ON	OFF	1st	x	ON (OFF)	3rd (OD)	ON	x	1st	OD
	ON	ON	2nd	x	ON	3rd	OFF (ON)	x	OD (1st)	OD
	OFF	ON	3rd	x	ON	3rd	OFF	x	OD	OD
	OFF	OFF	OD	x	OFF	OD	OFF	x	OD	OD
S	ON	OFF	1st	x	ON (OFF)	3rd (OD)	ON	x	1st	3rd
	ON	ON	2nd	x	ON	3rd	OFF (ON)	x	3rd (1st)	3rd
	OFF	ON	3rd	x	ON	3rd	OFF	x	3rd	3rd
L	ON	OFF	1st	x	OFF	1st	ON	x	1st	1st
	ON	ON	2nd	x	ON	2nd	ON	x	1st	1st

( ) : No fail-safe function x : Malfunctions

TORQUE CONVERTER UNIT
●LOCK-UP SYSTEM

(2) BACK-UP SPEED SENSING FUNCTION

There are two vehicle speed sensors: a main sensor (No.2), located on the transmission output shaft; and a back-up sensor (no.1), located in the speedometer. Due to this, even if the main sensor for some reason malfunctions, the ECU can continue to operate normally by keeping itself informed of the speed of the vehicle by the use of the signals from the back-up sensor.

TORQUE CONVERTER UNIT

The torque converter unit of the A43DE is provided with a lock-up system.

LOCK-UP SYSTEM

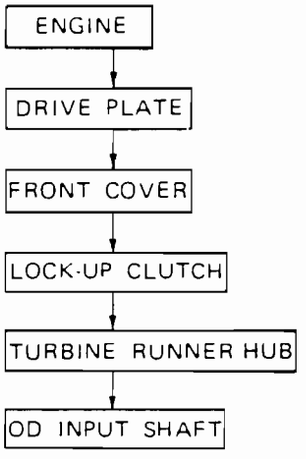
(1) FUNCTION

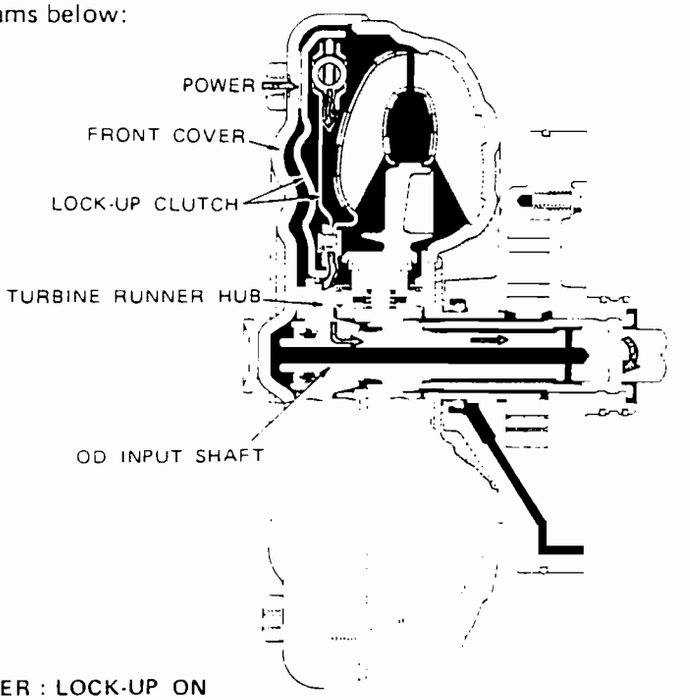
This system transmits the output of the engine directly to the planetary gear unit in order to reduce torque converter loss and thus improve fuel efficiency.

(2) CONSTRUCTION

The lock-up clutch is mounted on the turbine runner hub of the torque converter. When the lock-up clutch is forced against the front cover of the torque converter by converter pressure, the turbine runner and the pump impeller rotate together as one unit.

Power is transmitted along the paths shown in the diagrams below:





TORQUE CONVERTER : LOCK-UP ON

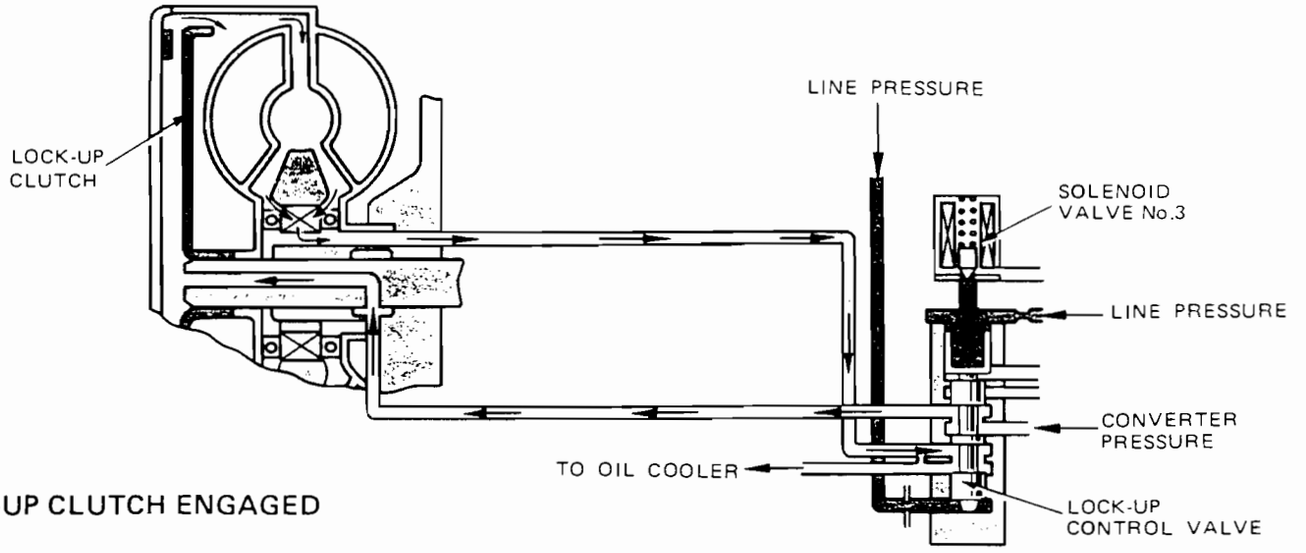
TORQUE CONVERTER UNIT
●LOCK-UP SYSTEM

(3) OPERATION

The lock-up clutch is engaged and disengaged by the lock-up clutch being forced either to the left or to the right by converter pressure.

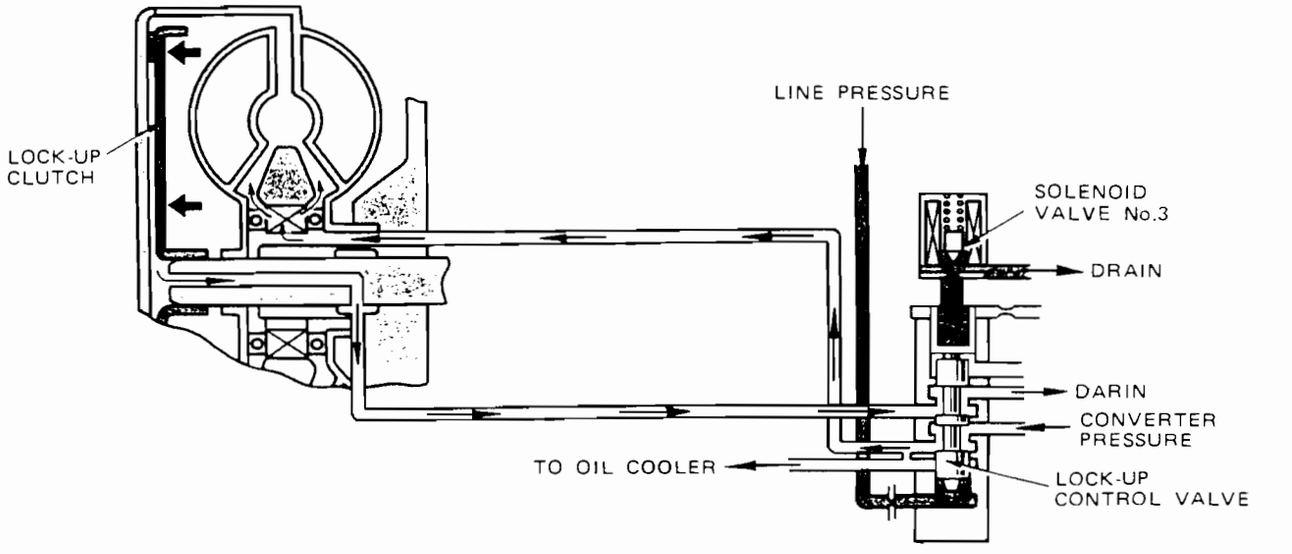
LOCK-UP CLUTCH DISENGAGED

If it receives no signals from the ECU, solenoid valve No.3 remains closed, causing line pressure to act upon both the upper and lower parts of the lock-up control valve.
The lock-up control valve is therefore held down by the spring, and since the fluid flows as shown in the diagram, the lock-up clutch does not operate.



LOCK-UP CLUTCH ENGAGED

When solenoid valve No.3 is turned on by a signal from the ECU, the hydraulic fluid acting on the upper part of the control valve is drained. The hydraulic pressure therefore falls, so the control valve is pushed up. The fluid thus flows as shown in the diagram, pushing the lock-up clutch against the front cover, and causing the torque converter to lock up.



PLANETARY GEAR UNIT

The construction and operation of the planetary gear unit is basically the same as that of the planetary gear unit in the A43D transmission in that its various clutches, one-way clutches, and brakes are used to effect the shifting of gears.

The conditions under which the clutches, one-way clutches, and brakes operate are shown in the table below:

SELECTOR POSITION \ OPERATING ELEMENT / GEAR		SOLENOID VALVE NO. 1	SOLENOID VALVE NO. 2	C_0	C_1	C_2		B_0	B_1	B_2	B_3		F_0	F_1	F_2	GEAR RATIO
						I.P.	O.P.				I.P.	O.P.				
P	Park	OFF	OFF	○												–
R	Rev	OFF	OFF	○			○	○				○	○	○			2.212
N	Neu	OFF	OFF	○												–
D	1st	ON	OFF	○	○								○		○	2.452
	2nd	ON	ON	○	○					○			○	○		1.452
	3rd	OFF	ON	○	○		○			○			○			1.000
	OD	OFF	OFF				○	○		○						0.688
S	1st	ON	OFF	○	○								○		○	2.452
	2nd	ON	ON	○	○				○	○			○	○		1.452
	3rd	OFF	ON	○	○					○			○			1.000
L	1st	ON	OFF	○	○						○	○	○		○	2.452
	2nd*	ON	ON	○	○				○	○			○	○		1.452

I.P. = Inner piston

O.P. = Outer piston

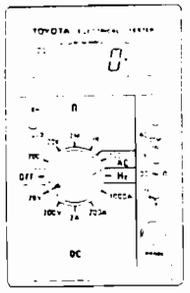
○ = Operates

* When the transmission is shifted from the D range (3rd or OD) to the L range, it goes briefly into 2nd gear before shifting into first. This is to prevent engine over-run.

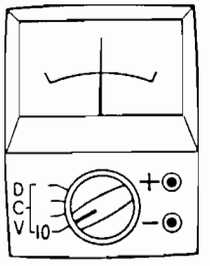
NECESSARY TOOLS & EQUIPMENT

CIRCUIT TESTERS

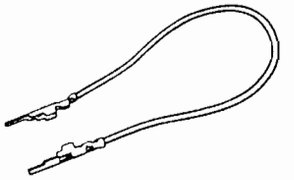
Dititat Type



Analog type



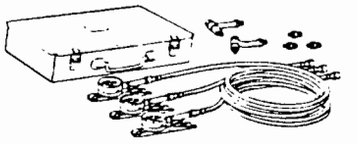
SERVICE WIRE



Short-circuiting wire

OIL PRESSURE GAUGE

(SST 09992-00093)



AT1109 AT1110

NOTE:
Use a circuit tester with a high-impedance (40KΩ/V minimum).

GENERAL PRECAUTIONS

ELECTRONIC CONTROL SYSTEM

1. Before removing ECT wiring connectors, terminals, etc., first disconnect the power by either turning the ignition switch off or disconnecting the battery cables from the battery terminals.

   NOTE: Any diagnosis code retained by the ECU will be cleared when the battery cable is removed.
   Therefore, if necessary, read the diagnostic code(s) before removing the battery cable.

2. When installing a battery, be especially careful not to incorrectly connect the positive and negative cables.

3. Do not permit parts to receive a severe impact during removal or installation. Handle all ECT parts carefully, particularly the ECU.

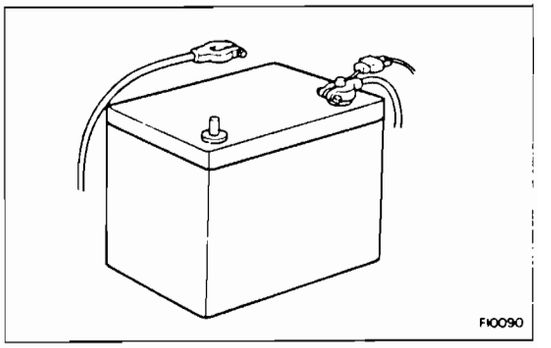
4. Do not be careless during troubleshooting as there are numerous electronic circuits and even slight terminal contact can cause further troubles.

5. Do not open the ECU cover.

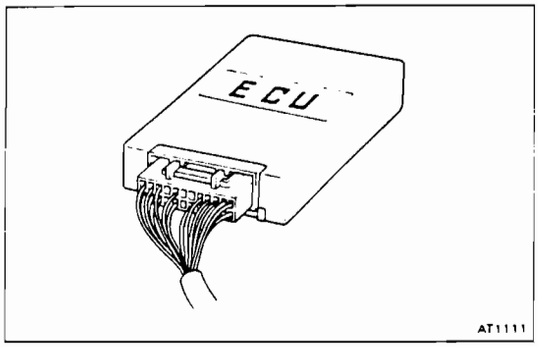
6. When inspecting during rainy weather, take care to prevent entry of water. Also, when washing the engine compartment, prevent water from getting on the ECT parts and wiring connectors.

7. Parts should be replaced as an assembly.

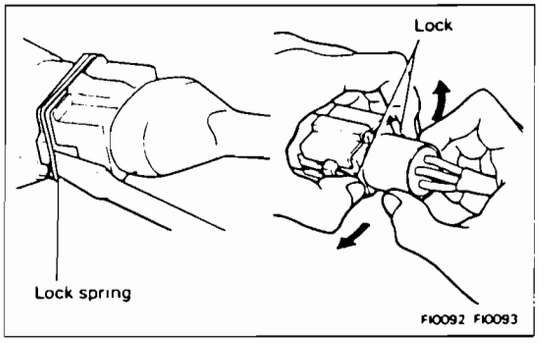
8. Care is required when pulling out wiring connectors and when inserting them.
   (a) Release the lock and pull out the connector, pulling on the connectors (not the cord).



FI0090

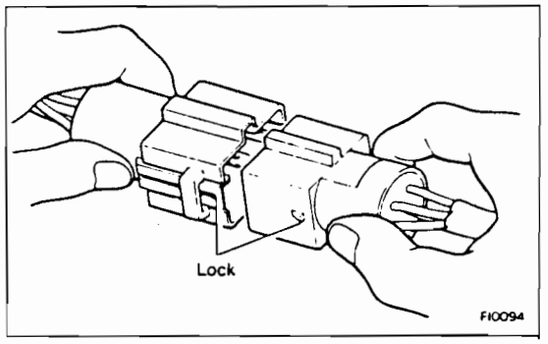


AT1111

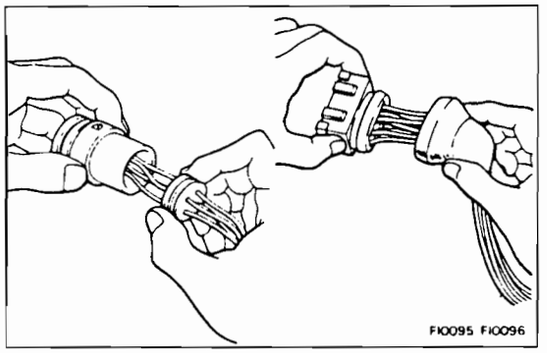


FI0092 FI0093

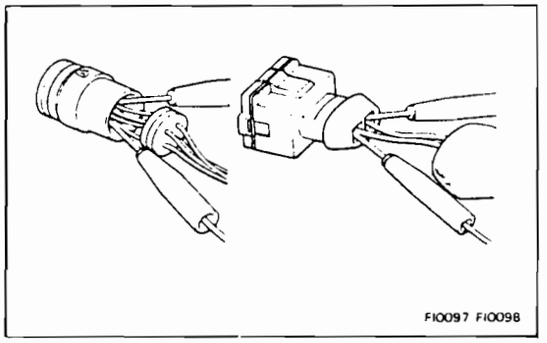
(b) Fully insert the connector and insure that it is locked.



9. When inspecting a connector with a circuit tester:
   (a) Carefully remove the water-proofing rubber if it is a water-proof type connector.



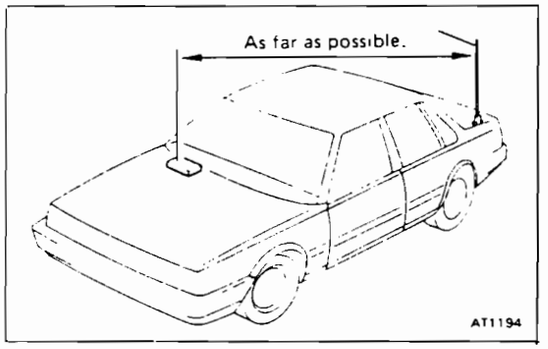
   (b) Insert the tester probe into the connector from the wiring side when checking the continuity, amperage or voltage.
   (c) Do not apply unnecessary force to the terminal.
   (d) After checking, securely reinstall the water-proofing rubber on the connector.

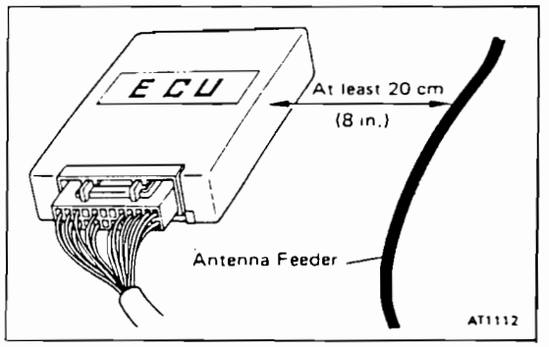


IF CAR IS EQUPPED WITH MOBILE RADIO SYSTEM (HAM, CB, ETC.)

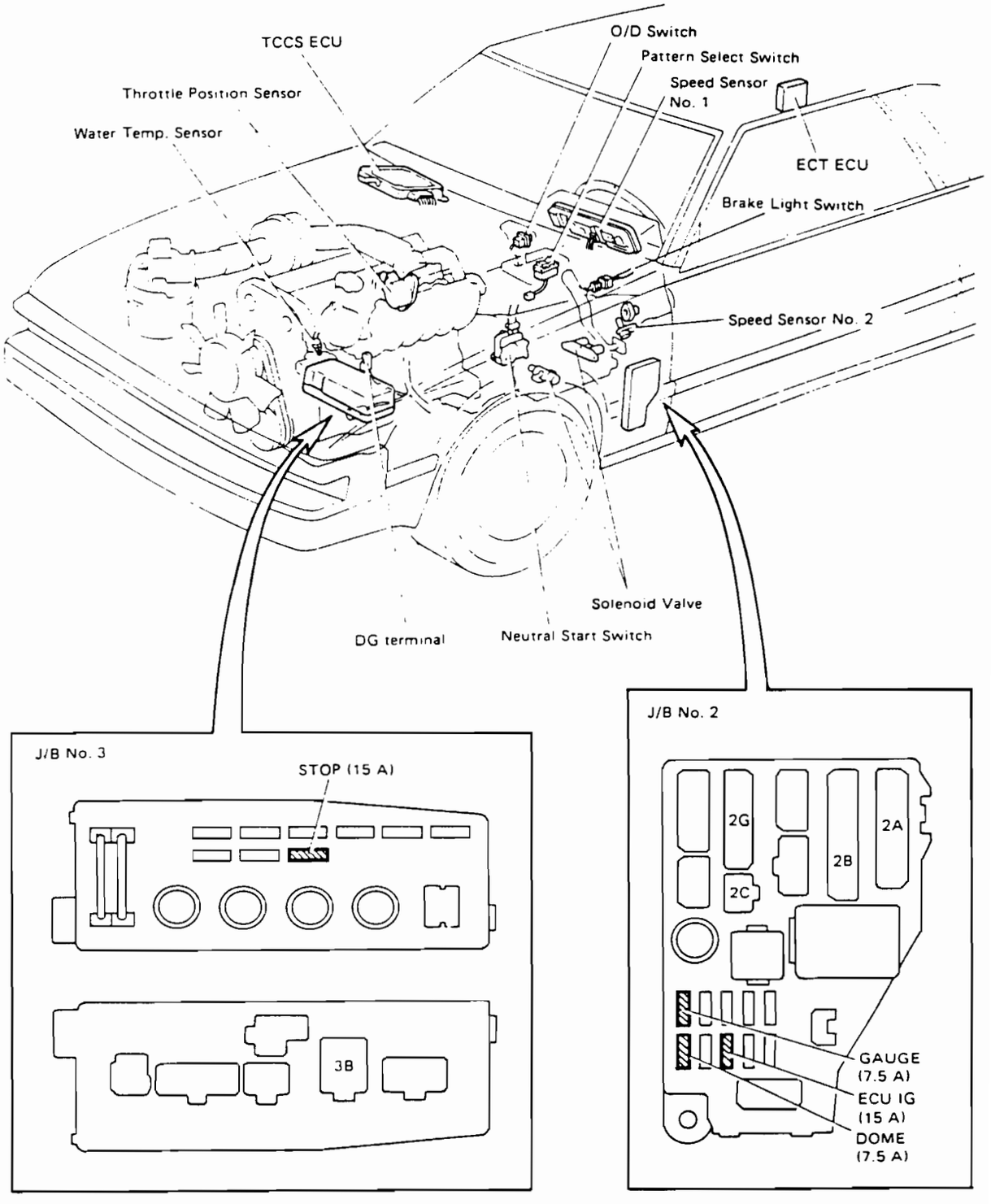
The ECU has been designed so that it will not be affected by outside interference.
However, if your vehicle is equipped with an CB radio transceiver, etc. (even one with about 10 W output), it may, at times, have an affect upon ECU operation, especially if the antenna and feeder are installed nearby.
Therefore, observe the following precautions.

   (a) Install the antenna as far as possible from the ECU.
   (b) Keep the antenna feeder as far away as possible from the ECU wires — at least 20 cm (8 in.) and, especially, do not wind them together.
   (c) Insure that the feeder and antenna are properly adjusted.
   (d) Do not equip your vehicle with a powerful mobil radio system.

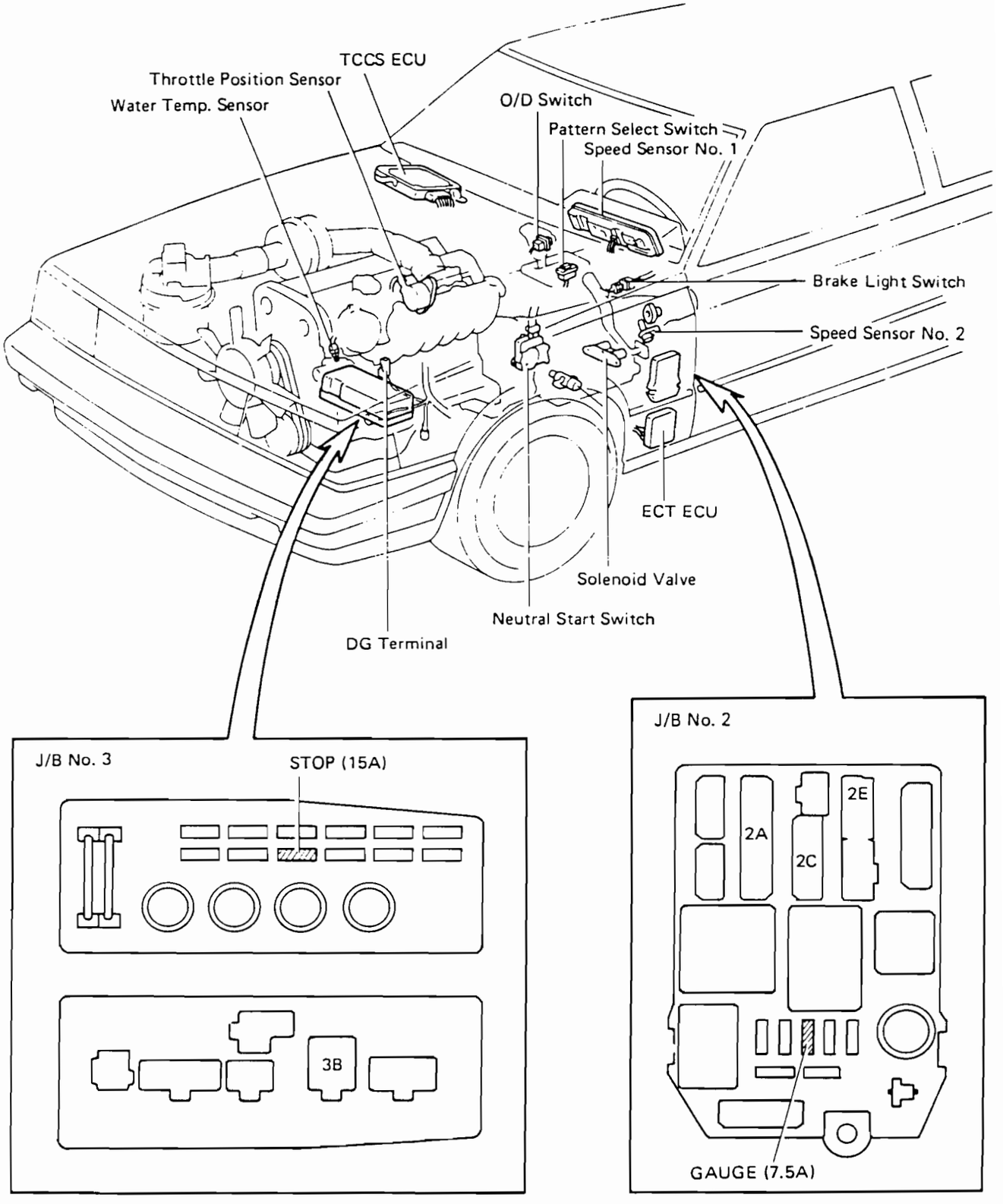




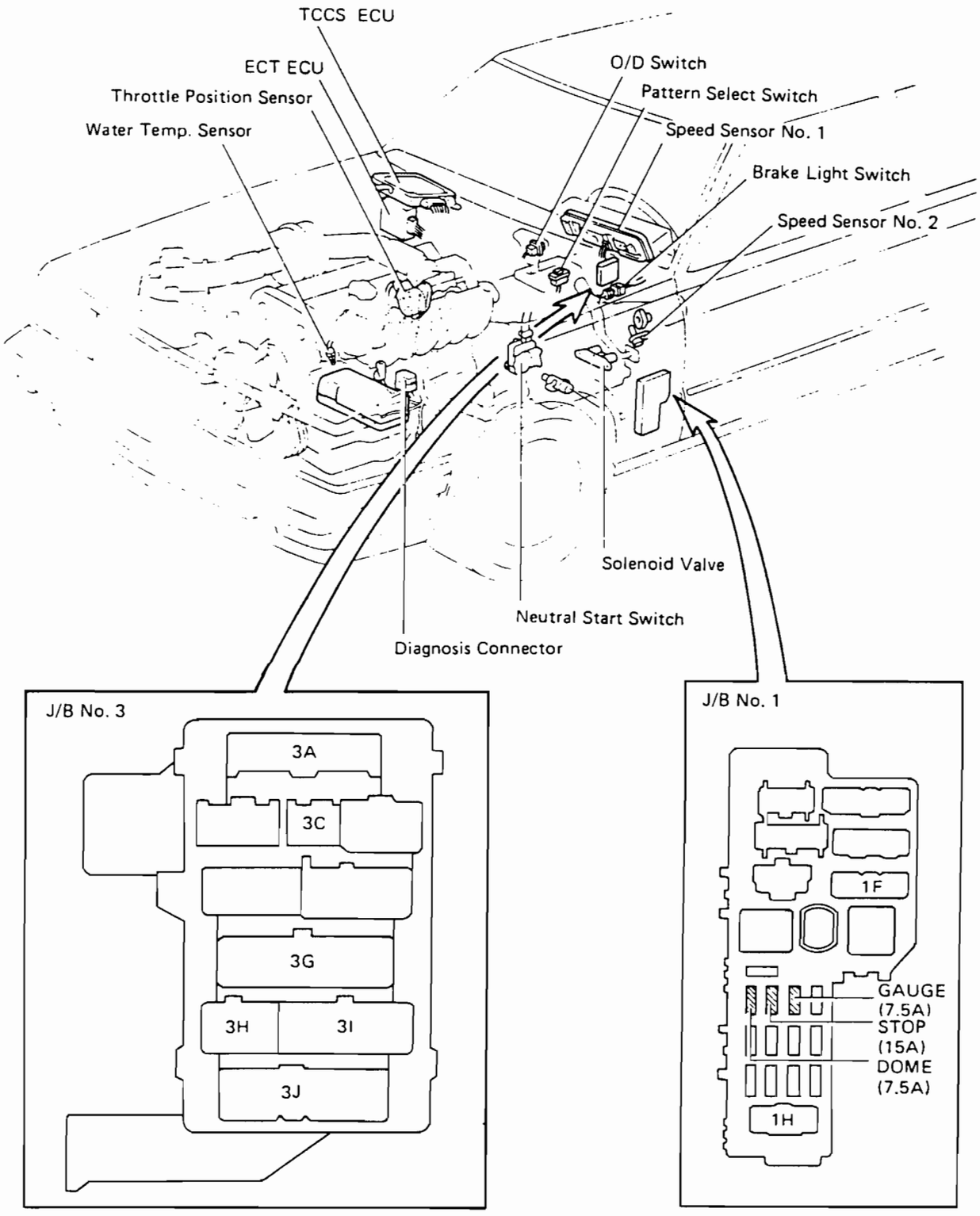
SYSTEM LAYOUT — Supra



SYSTEM LAYOUT — '83 and '84 Cressida



SYSTEM LAYOUT — '85 Cressida



SELF-DIAGNOSTIC FUNCTIONS

SELF-DIAGNOSTIC SYSTEM

FOR THE '85 CRESSIDA AND SUPRA

When the ECU detects an open or short circuit in the vehicle speed sensors or solenoid valves circuitry, it flashes the "O/D OFF" lamp to alert the driver. (Note: When the O/D switch is OFF, the "O/D OFF" lamp merely lights; it does not blink.) At the same time, ECU stores the location of the fault in its memory. The memory contents remain intact even if the ignition switch is turned OFF because the memory stored is protected by a back-up power supply.

The memory contents will be displayed through the "O/D OFF" lamp by turning the ignition switch ON and short-circuiting the ECT and E_1 terminals of the diagnostics connector (Cressida) or grounding DG terminal (Supra).

Six diagnostic codes, including Normal, are provided. They are displayed as flashing patterns on the "O/D-OFF" lamp.

Normal code indication

The lamp will blink once every 0.25 seconds.

Malfunction code indication

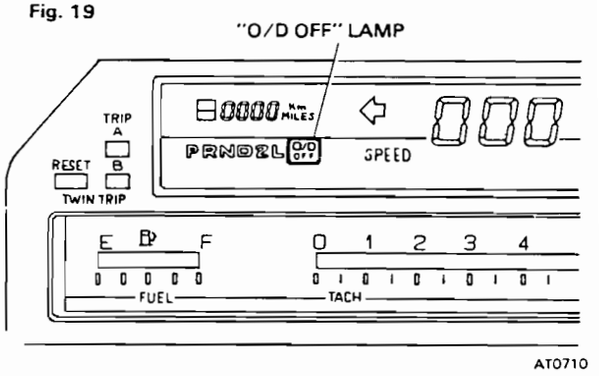
First, the lamp will pause for 4 seconds. Thereafter, the number of times the lamp blinks every 0.5 seconds is the first figure of a code. Next, the number of times the lamp blinks every 0.5 second is the second figure of the code.

If there is more than one malfunction code, the code with the smallest number will appear first. Followed by a pause for 2.5 seconds, then the next code will appear in the same manner as described above.

Finally, the entire procedure will be repeated.

In the illustration, malfunction code 62 is indicated.

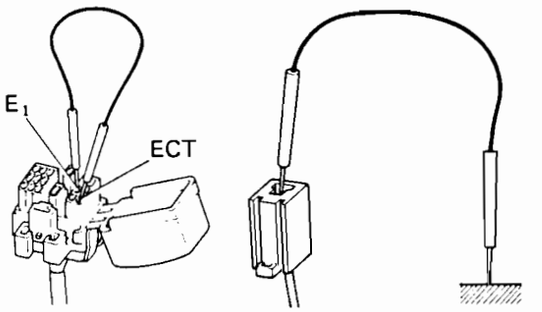
Fig. 19



AT0710

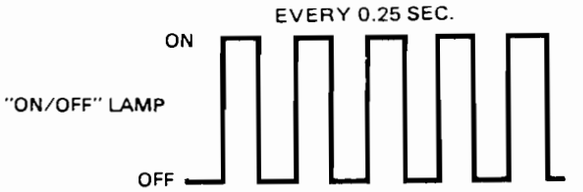
Fig. 20 ECT CONNECTOR (Cressida)

Fig. 21 DG CONNECTOR (Supra)



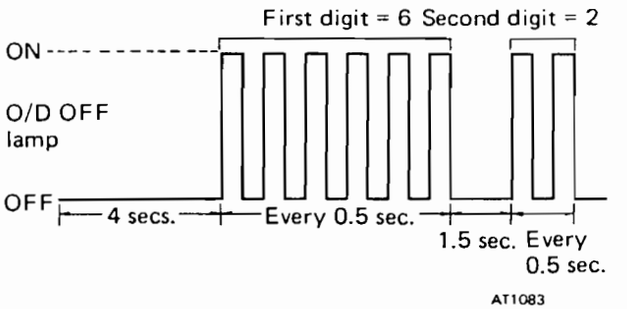
AT1123 AT1124

Fig. 22 NORMAL CODE



AT0716

Fig. 23 MALFUNCTION CODE 62



AT1083

DIAGNOSTIC CODE

Code No.	Light Pattern	Diagnosis System
42		Defective No. 1 speed sensor (in combintion meter) Severed wire harness or short circuit
61		Defective No. 2 speed sensor (in ATM) Severed wire harness or short circuit
62		Severed No. 1 solenoid or short circuit Severed wire harness or short circuit
63		Severed No. 2 solenoid or short circuit Severed wire harness or short circuit
64		Severed No. 3 solenoid or short circuit Severed wire harness or short circuit

— NOTES —

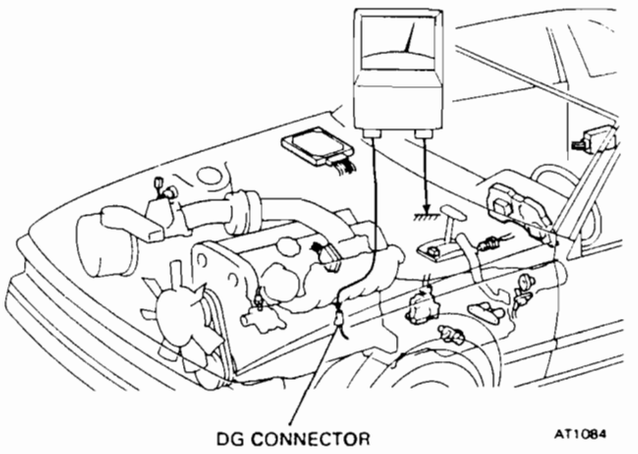
1. If the diagnosis system yields a code other than NORMAL even though the "O/D OFF" lamp was not blinking, there is intermittent trouble. Check all the connections in the circuits corresponding to that code.
2. Should the speed sensors No. 1 and No. 2 happen to fail simultaneously, the ECU will neither alert the driver by flashing the "O/D OFF" lamp nor record any diagnostic code except NORMAL. It will, however, decide that the driver allow to use only 1st and none of the other gears; shifting upward will then be disabled.
3. Codes 62, 63, and 64 are limited to short or open circuits in the electrical system comprised of the solenoids, wire harness, and connectors. The ECU is unable to detect mechanical trouble (sticking, for example) in the solenoid valves.
4. Should solenoid valve No. 3 (for lock-up clutch control) fail, the ECU will not flash the "O/D OFF" lamp to alert the driver. It will, however, record the failure in the form of code 64, which may be displayed during troubleshooting.

MODELS OTHER THAN THE '85 CRESSIDA AND SUPRA

The self-diagnostic systems in all other models do not display the diagnosis code by flashing the "OD-OFF" lamp but by the voltage value read from the DG or ECT terminal:

Voltage reading	Implication
0 V	Normal
4 V	Speed sensor defective
8 V	Solenoid valves defective

Fig. 24



— NOTES —

1. The voltage is only available when the ignition switch is turned ON and the vehicle speed is 9 kmph (6 mph) or less.
2. The ECU is incapable of detecting trouble with a speed sensor if the vehicle is stopped. The vehicle must undergo running test first. Then, if there is trouble with a speed sensor, a voltage of 4 V will be output from the DG terminal. Turning the ignition switch OFF, however, will erase this error indication.
3. When the voltage is 8 V, one of the three solenoid (or the associated wire harness and connectors) has a fault.
4. If the voltage is other than 0 V, 4 V, or 8 V is displayed, the first suspect is the throttle position sensor. If the sensor is in good condition, the fault lies in the ECU.
5. A circuit tester with a low impedance will yield a reading lower than the actual value. A circuit tester with an internal impedance of 40 kΩ/V or more is recommended

OPERATION CHECK FUNCTION (Common to All Models)

Connecting a voltmeter to the ECT or DG terminal and measuring the voltage enables you to check:

1. Throttle position sensor
2. Brake signal
3. Shift timing

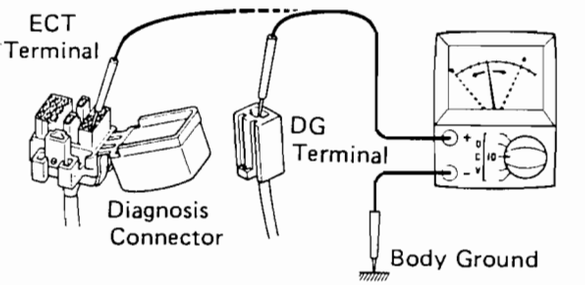
CHECKING THE THROTTLE POSITION SENSOR

With the ignition switch ON and the vehicle parked, gradually depress the accelerator pedal from the fully closed position to full open positions. If the voltage at the DG or ECT terminal rises in 1 volt increments from 0 V to 8 V, the throttle position sensor is working normally.

— NOTES —

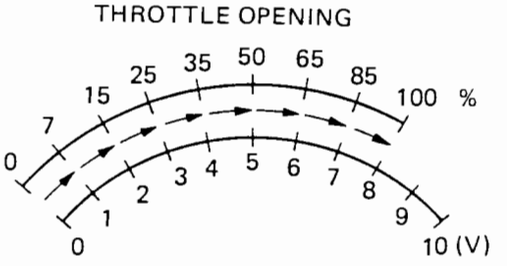
1. Do not touch the brake pedal during this check. Pressing the brake pedal will yield a zero reading for all accelerator positions.
2. If reading remains at 0 V as the accelerator is depressed, possible causes are:
   a. A brake signal remains ON.
   b. An IDL signal remains ON.
   c. Trouble in the ECU power supply circuit.
   d. Trouble in the ECU itself.

Fig. 25



AT1167

Fig. 26

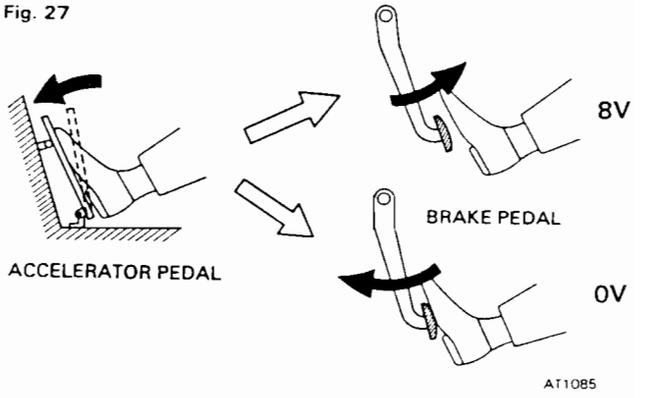


AT1125

CHECKING THE BRAKE SIGNAL

Before checking the brake signal, make sure that the throttle position sensor is operating normally. With the ignition switch ON and the vehicle parked, depress the accelerator pedal to the fully open throttle position so that the voltage reads 8 V at the ECT or DG terminal. Depress the brake pedal. If the voltage drops from 8 V to 0 V, the brake signal is operating normally.

Fig. 27

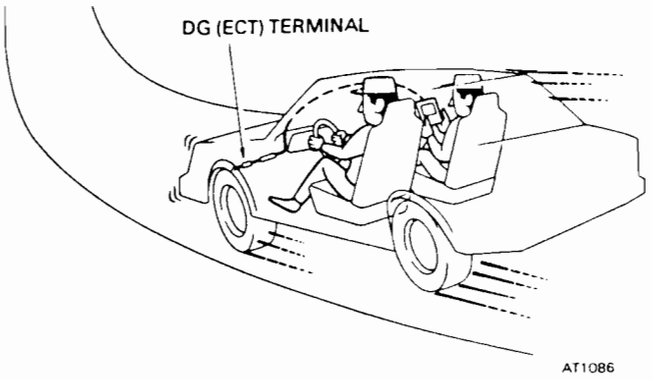


CHECKING SHIFT TIMING

Perform a road test with a voltmeter connected to the ECT or DG terminal. The output voltages for each gear range should be as shown in the table below.

Gear	1st	2nd		3rd		OD	
lock-up	—	OFF	ON	OFF	ON	OFF	ON
DG term. voltage	0	2	3	4	5	6	7

Fig. 28



— NOTES —

1. The voltages shown are only output when the vehicle speed exceeds 10 kmph (6 mph). At lower speeds, the voltage will lie between 0 V and 8 V and depend on the degree to which the accelerator is depressed—that is, it will switch to the throttle position sensor output.
2. The lock-up clutch will turn ON only infrequently during normal 2nd and 3rd gear operation. To trigger this action, press the accelerator pedal to 50% or more of its stroke. At less than 50%, the voltage may change in the sequence 2 V—4 V—6 V— 7 V.
3. If the gears fail to shift in response to the changes in the voltage readings, the possible cause of trouble is solenoid sticking or a malfunction in the automatic transmission body.

FAIL-SAFE FUNCTIONS

SOLENOID VALVE BACK-UP FUNCTION

If either solenoid valve No. 1 or No. 2 malfunctions, the ECU can still control the transmission by operating the remaining solenoid to put the transmission in a gear that will allow the vehicle to be operated smoothly.

For example, if solenoid valve No. 1 malfunctions while the vehicle is running in 1st gear with the transmission in the D range, the fail-safe function causes the transmission to shift into 3rd gear instead of into OD as it would if no fail-safe function were provided.

Furthermore, if both solenoid valves malfunction, the driver can still safely drive the vehicle by operating the shift selector lever manually.

Range	NORMAL			SOLENOID NO. 1 MALFUNCTIONING			SOLENOID NO. 2 MALFUNCTIONING			BOTH SOLENOIDS MALFUNCTIONING
	Solenoid valve		Gear	Solenoid valve		Gear	Solenoid valve		Gear	Gear when shift selector is manually operated
	NO. 1	NO. 2		NO. 1	NO. 2		NO. 1	NO. 2		
D	ON	OFF	1st				ON	×	1st	OD
	ON	ON	2nd	×	ON	3rd				OD
	OFF	ON	3rd	×	ON	3rd	OFF	×	OD	OD
	OFF	OFF	OD	×	OFF	OD	OFF	×	OD	OD
2 (S)	ON	OFF	1st				ON	×	1st	3rd
	ON	ON	2nd	×	ON	3rd				3rd
	OFF	ON	3rd	×	ON	3rd	OFF	×	3rd	3rd
L	ON	OFF	1st	×	OFF	1st	ON	×	1st	1st
	ON	ON	2nd	×	ON	2nd	ON	×	1st	1st

( ) : No fail-safe function × : Malfunctions

BACK-UP SPEED SENSING FUNCTION

There are two vehicle speed sensors: a main sensor (No. 2), located on the transmission extension housing, and a back-up sensor (No. 1), located in the speedometer. Due to this, even if the main sensor for some reason malfunctions, the ECU can continue to operate normally by keeping itself informed of the speed of the vehicle by the use of the signals from the back-up sensor.

MANUAL RUNNING FUNCTION

When the electronically-controlled system is totally deactivated, the ECT mechanically shifts the gears to the positions shown in fig. 29 in response to the shift lever position.

If the electronic control system fails, disconnecting the ECU connector or the ECT solenoid connector in engine compartment provide the same manual gear shifting.

Fig. 29

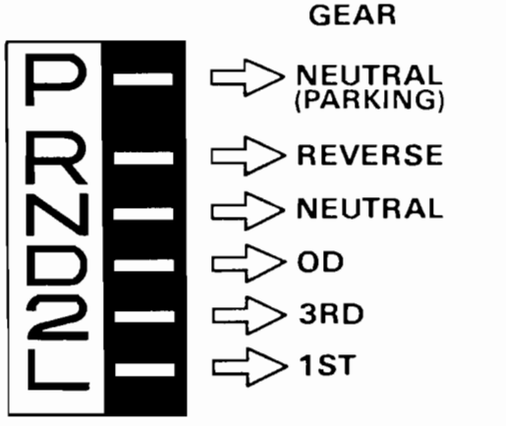


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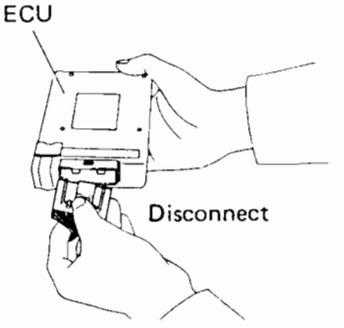
Fig. 30 MANUAL RUNNING FUNCTION



DIAGNOSING ELECTRONIC PROBLEMS
TOYOTA TRANSMISSIONS
A43DE OR A140E

A voltage test must be made at the D.G. (DIAGNOSTIC TERMINAL) located either under the hood, in the left kick panel or the left door arm rest depending on car and model.

An Analog Volt Meter must be used. The following voltages must be obtained:

VOLTAGE AT D.G. TERMINAL	GEAR POSITION
0	1st gear
2	2nd gear
3	2nd lockup
4	3rd
5	3rd lockup
6	O/D
7	O/D lockup

(1) If voltage rises from 0 to 7 in above sequence the control system is o.k.
(2) If there is a constant 8 volt indication, the solenoid is defective.
(3) If there is a constant 4 volt indication, the speed sensor is faulty.
(4) Stop the vehicle, but do not stop the engine, stopping the engine will cancel all codes from the ECU memory.

CHECK THE FOLLOWING VOLTAGES

0 VOLTS Volt system normal or defective brake signal

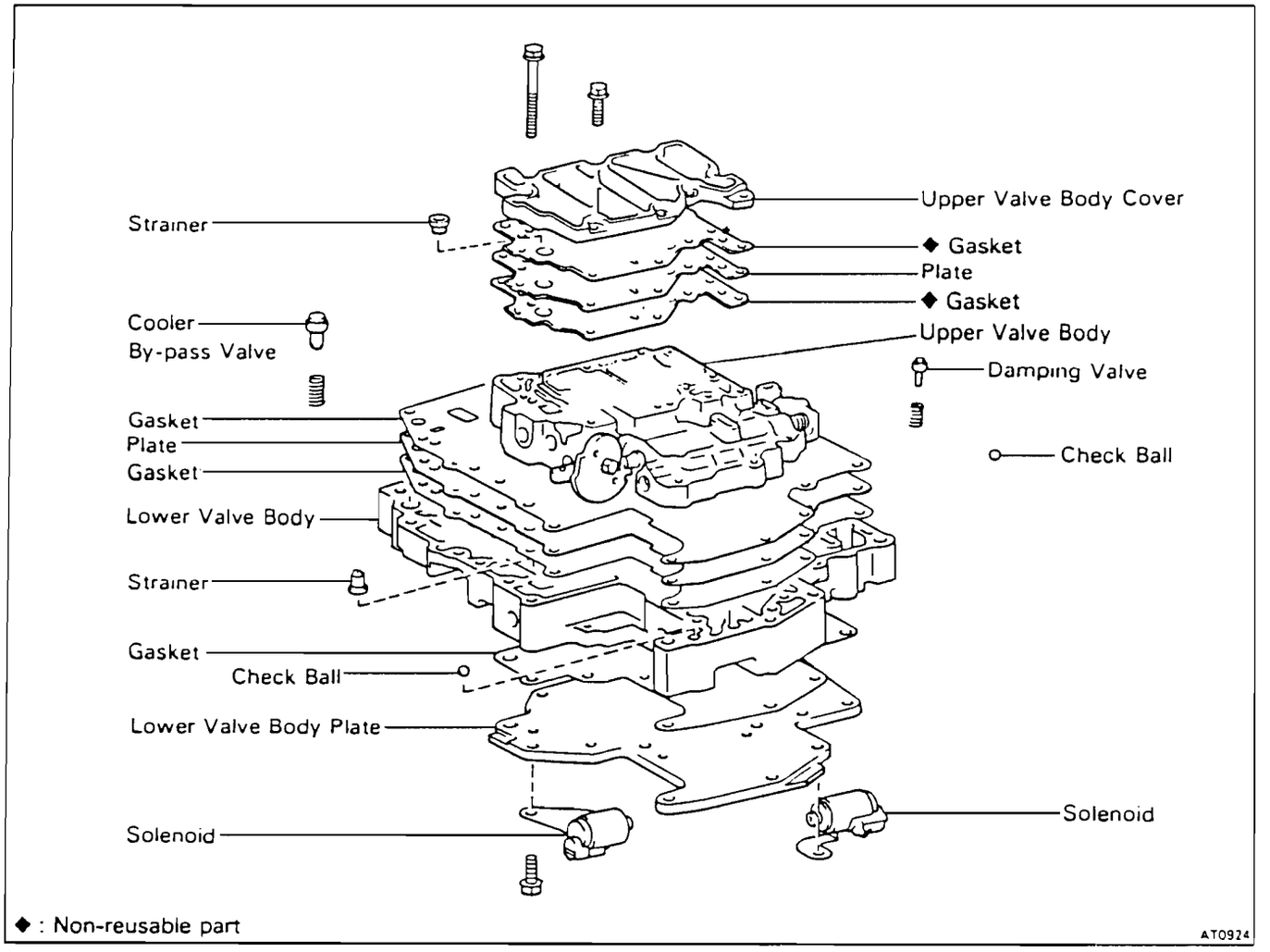
4 VOLTS Faulty speed sensor #2

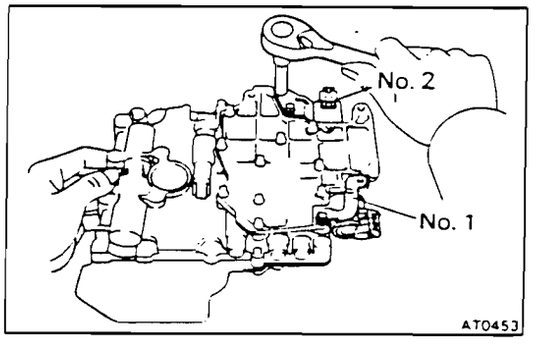
8 VOLTS Faulty Solenoid

(5) Inspect throttle position sensor. Turn off the engine, and while slowly depressing the gas pedal, check that the terminal D.G. Voltage rises in sequence.
(6) Inspect the brake signal:
   (a) depress the gas pedal to where 8 volts is indicated for the D.G. Terminal
   (b) depress the brake pedal and check the voltage reading for the D.G. Terminal

Brake pedal depressed	0 volts
Brake pedal released	8 volts

Valve Body (A140E/2S-E)

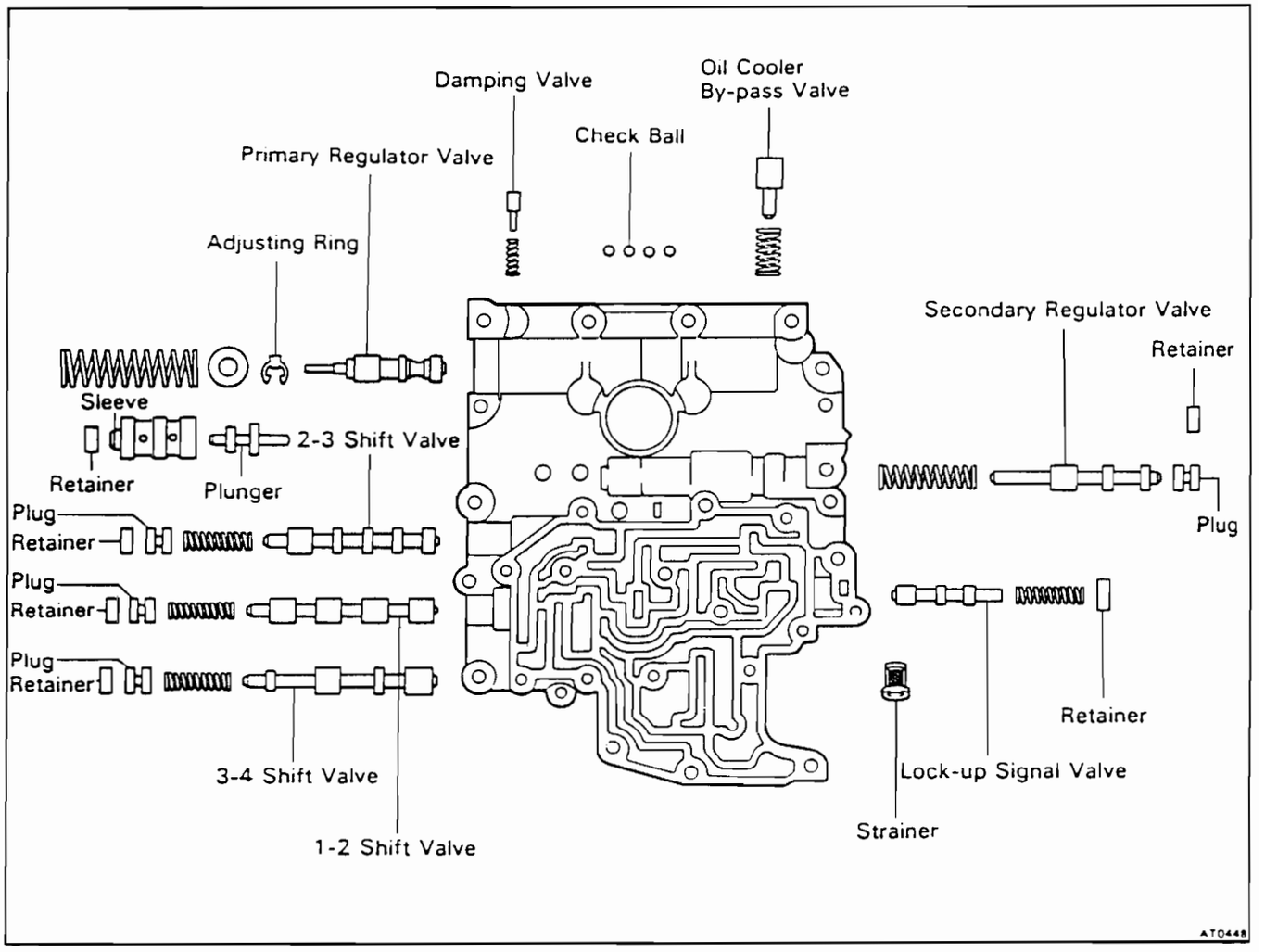


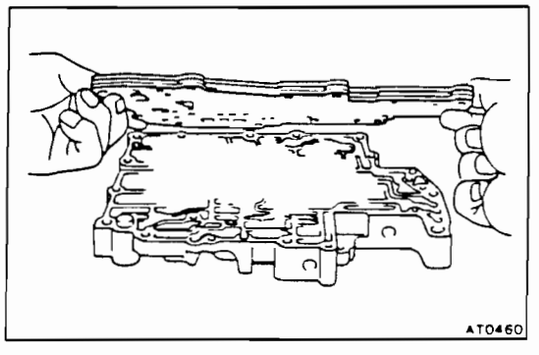


(Disassembly of Valve Body)

1. **REMOVE NO.1 SOLENOID**
   Remove the one bolt and the solenoid.
2. **REMOVE NO.2 SOLENOID**
   Remove the two bolts and the solenoid.

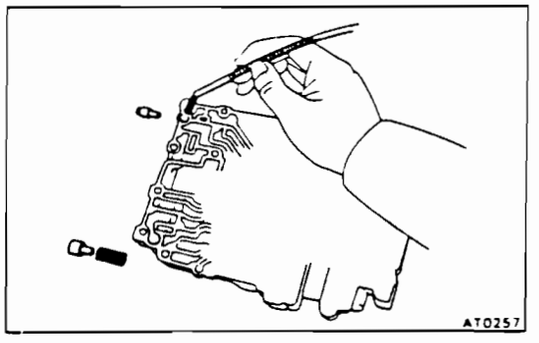
(Lower Valve Body)





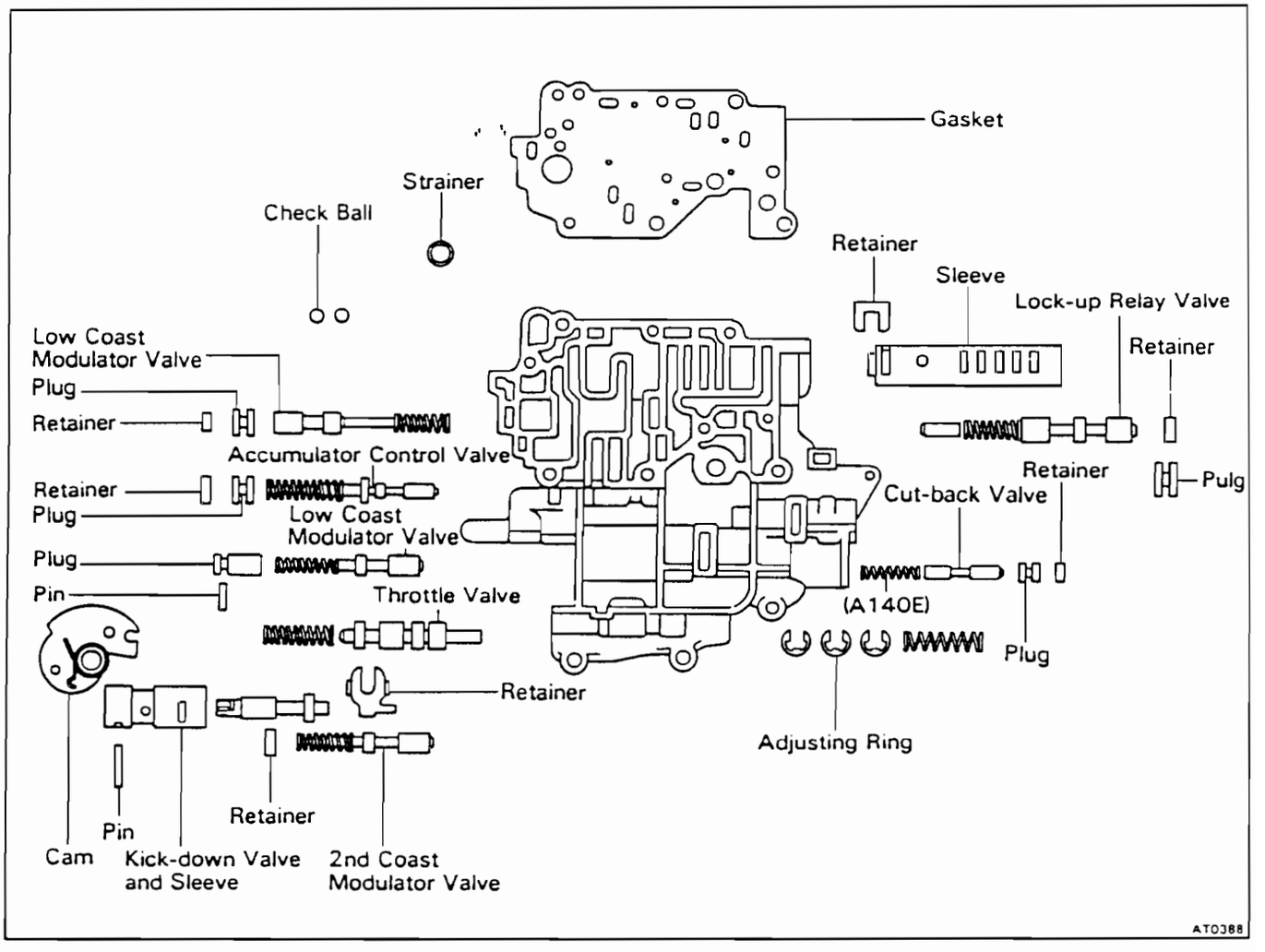
DISASSEMBLY OF LOWER VALVE BODY

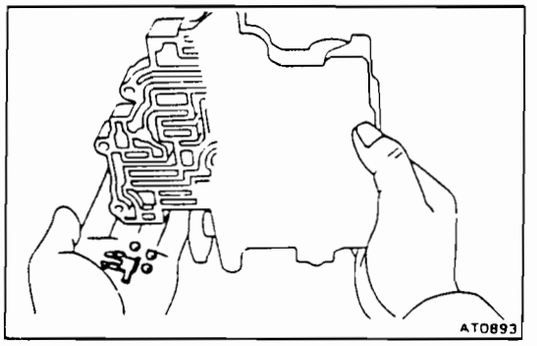
1. REMOVE LOWER VALVE BODY PLATE AND GASKETS



2. REMOVE COOLER BY-PASS VALVE AND SPRING
3. REMOVE DAMPING VALVE AND SPRING

(Upper Valve Body)

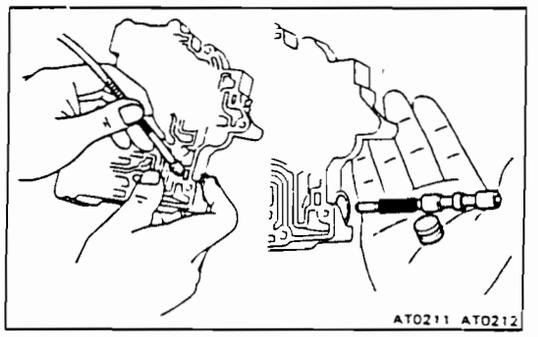




DISASSEMBLY OF UPPER VALVE BODY

1. **REMOVE THROTTLE VALVE RETAINER AND CHECK BALLS**

   NOTE: A140E Two check balls
   A140L Three check balls



2. **REMOVE LOCK-UP RELAY VALVE**

   (a) Remove the retainer for the plug with a magnetic finger and remove the plug.

   (b) Remove the lock-up relay valve, control valve and spring.