4R70W Electronic Controls

APPLICATION & IDENTIFICATION

EEC SYSTEM IDENTIFICATION

Application	System
1995	
Cougar, Thunderbird (3.8L)	EEC-IV
Cougar, Thunderbird (4.6L)	EEC-V
Crown Victoria, Grand Marquis, Town Car	EEC-V
Mark VIII	EEC-IV
"E" & "F" Series	EEC-IV
1996 (All Models)	EEC-V

NOTE: For 4R70W transmission overhaul mechanical testing and repair, see AUTO TRANS OVERHAUL - FORD 4R70W article.

INTRODUCTION

The first step in diagnosing any driveability problem is verifying the customer's complaint with a test drive under the conditions the problem reportedly occurred. Before entering self-diagnostics, perform a careful and complete visual inspection. Most transmission control problems result from mechanical breakdowns or poor electrical connections.

NOTE: Perform all voltage tests with a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance, unless stated otherwise in test procedure.

DESCRIPTION & OPERATION

Input signals from sensors are sent to the Powertrain Control Module (PCM). The PCM can determine when the time and conditions are right for a shift or converter clutch application. The PCM can also determine line pressure needed to optimize shift feel.

The PCM controls transmission operation through 4 electronic solenoids consisting of 3 On/Off solenoids for shifting and torque converter clutch control and one variable force solenoid for line pressure control. The PCM has built-in self-diagnostic capabilities, fail-safe code and warning code display for the main input sensors and solenoid valves.

1995-96 models use Electronic Engine Control systems designated EEC-IV (OBD I) or EEC-V (OBD II). See EEC SYSTEM IDENTIFICATION TABLE. For additional information on the EEC system, refer to appropriate TESTS W/CODES article in ENGINE PERFORMANCE.

NOTE: For engine-related DTCs, see appropriate TESTS W/CODES article in ENGINE PERFORMANCE. These DTCs pertain to engine performance and must be repaired first, as engine performance and related component signals will

affect transmission operation and diagnosis.

INPUT SENSORS

Air Conditioning Clutch (ACC)

On factory installed A/C system, PCM receives signal voltage from ACC switch indication that the air conditioning compressor clutch is engaged. The PCM uses the ACC switch signal to adjust line pressure to compensate for additional engine load. If the ACC switch fails with closed contacts, line pressure will be slightly low with air conditioning off. If the ACC switch fails with open contacts, line pressure will be slightly high with air conditioning on.

Barometric Pressure (BARO) Sensor

The BARO sensor measures barometric pressure to determine altitude at which vehicle is operating. The PCM uses this to adjust shift scheduling. Sensor failure can cause firm shift feel and late shifts at altitude.

Brake On/Off (BOO) Switch

The PCM receives a signal from the BOO switch when the brake switch is operated. Torque converter clutch is disengaged when brakes are applied. Malfunctioning switch will affect torque converter operation.

Electronic Ignition (EI)

The EI system generates a Profile Ignition Pickup (PIP) signal (engine rpm) and sends it to the PCM. Signal received by the PCM affects torque converter clutch operation, WOT shift control and EPC pressure.

Engine Coolant Temperature (ECT) Sensor

Engine temperature signal is sent to PCM. Malfunctioning ECT will affect torque converter clutch operation.

Mass Airflow (MAF) Sensor

The MAF signal is used for Electronic Pressure Control (EPC), shift and TCC scheduling. Sensor malfunction will affect shift and TCC scheduling.

Transmission Range (TR) Sensor

The PCM monitors a series of step down resistors in the TR sensor that act as a voltage divider. The voltage signal corresponds with position of the transmission range selector lever. The TR sensor also contains the neutral/start and backup circuits. Malfunction of the TR sensor may cause high EPC pressure, harsh engagements and firm shift feel. Improper shifting or shift selection and no engine cranking may also result.

Output Shaft Speed (OSS) Sensor

The OSS is a magnetic pickup, located at output shaft ring gear. Sensor sends output shaft speed signal to PCM. Sensor failure may cause no TCC lock-up, harsh shifting and incorrect shift speeds.

Programmable Speedometer/Odometer Module (PSOM)

The PSOM receives input from rear brake anti-lock sensor, which is mounted on rear axle differential

housing. Vehicle speed (MPH) signal is output to PCM and speed control module. PSOM failure may cause harsh engagements, firm shift feel and abnormal shift schedule. Unexpected downshifts may occur at closed throttle and abnormal TCC operation or engages only at WOT. Transmission Control Indicator Light (TCIL) may flash.

Throttle Position (TP) Sensor

The TP sensor is a potentiometer mounted to the engine throttle body. The PCM receives a signal from the TP sensor relaying throttle plate position. TP sensor failure will cause PCM to operate in fail safe mode and raise line pressure to prevent transmission damage. This condition will result in harsh engagements, firm shift feel, abnormal shift schedule and TCC not engaging or cycling.

Transmission Control Switch (TCS)

Switch is mounted on shift lever handle. On/Off operation is displayed by Transmission Control Indicator Light (TCIL). TCIL will flash if EPC circuit is shorted, or monitored sensor or actuator fails. Switch controls operation of 4th gear. Malfunction of switch will cause lack of 4th gear disable function.

Transmission Fluid Temperature (TFT) Sensor

The TFT sensor is located on the valve body in the transmission sump. The PCM monitors voltage across the TFT thermistor to determine transmission temperature. Depending on temperature, the PCM controls line pressure, shift scheduling and TCC operation. Malfunction of sensor will cause incorrect line pressure and possible lack of TCC operation.

OUTPUT DEVICES

Electronic Pressure Control (EPC) Solenoid

The EPC receives signal from the PCM to control line pressure and 2-3 backout valve function. If EPC fails in ON position, transmission is operated in failsafe mode. Minimum line pressure is present. If EPC fails in OFF position, line pressure at maximum pressure. Harsh engagements and shifts will result.

Shift Solenoid Assemblies

1. Two ON/OFF solenoids are used for electronic shift scheduling. Solenoids used are Shift Solenoid No. 1 (SS1) and Shift Solenoid No. 2 (SS2). Solenoids provide gear selection by controlling pressure to 3 shift valves, located in valve body. See SOLENOID OPERATIONS TABLE.

SOLENOID OPERATIONS

Gear Position	SS1	SS2
Overdrive (1)		
"P" (Park)	On	Off
"R" (Reverse)	On	Off
"N" (Neutral)	On	Off
"OD" (Overdrive)		
1st Gear	On	Off
2nd Gear	Off	Off
3rd Gear	Off	On
4th Gear	On	On

"D" (Drive) Or 3rd (2)		
1st Gear	On	Off
2nd Gear	Off	Off
3rd Gear	Off	On
"2" (Manual 2)	Off	Off
"L" (Manual 1) (3)	On	Off
"L" (Manual 1)	Off	Off
(1) "OD" switch released.		
(2) "OD" switch depressed (OD cancelled).		
(3) Transmission is in 2nd gear until vehicle speed drops below calibrated speed.		

2. When shift solenoid is always off, failure could be due to PCM and/or vehicle wiring malfunction, and/or solenoid electrically, hydraulically or mechanically stuck off. For shift symptoms, see **Fig. 1** and **Fig. 2**.
3. When shift solenoid is always on, failure could be due to PCM and/or vehicle wiring malfunction, and/or solenoid electrically, hydraulically or mechanically stuck on. For shift symptoms, see **Fig. 3** and **Fig. 4**.

Torque Converter Clutch (TCC) Solenoid

The TCC receives signal from the PCM. The TCC controls application, modulation and release of torque converter clutch. If solenoid fails in ON position, vehicle engine will run rough (shudder) and engine stalls in Drive at low idle speeds (2nd, 3rd or 4th gear). If solenoid fails in OFF position, torque converter clutch will not engage.

SS-1 ALWAYS OFF:	Transmission Range Selector Lever Position		
	D	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	2	2	2
2	2	2	2
3	3	2 *	2*
4	3	2 *	2*

*No Engine Braking

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Fig. 1: Shift Solenoid No. 1 Always Off - Failed Off
Courtesy of FORD MOTOR CO.

SS-2 ALWAYS OFF:	Transmission Range Selector Lever Position		
	D	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	1	1
2	2	2	2
3	2	2	2
4	1	1	1

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Fig. 2: Shift Solenoid No. 2 Always Off - Failed Off
Courtesy of FORD MOTOR CO.

SS-1 ALWAYS ON:	Transmission Range Selector Lever Position		
	D	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	1	1
2	1	1	1
3	4	2*	2*
4	4	2*	2*

*No Engine Braking

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Fig. 3: Shift Solenoid No. 1 Always On - Failed On
Courtesy of FORD MOTOR CO.

SS-2 ALWAYS ON:	Transmission Range Selector Lever Position		
	D	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	4	2*	2*
2	3	2*	2*
3	3	2*	2*
4	4	2*	2*

* No Engine Braking

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Fig. 4: Shift Solenoid No. 2 Always On - Failed On
Courtesy of FORD MOTOR CO.

TROUBLE SHOOTING

PRELIMINARY INSPECTION

Visually inspect all electrical wiring, looking for chafed, stretched, cut or pinched wiring. Ensure electrical connectors fit tightly and are not corroded. Ensure vacuum hoses are properly routed and are not pinched or cut. Inspect air induction system for possible vacuum leaks. Check PCM, sensors and actuators for physical damage. Check engine coolant level. Check transmission fluid level and condition.

NOTE: For engine-related DTCs, see appropriate TESTS W/CODES article in ENGINE PERFORMANCE. These DTCs pertain to engine performance and must be repaired first, as engine performance and related component signals will affect transmission operation and diagnosis.

EEC-IV SELF-DIAGNOSTIC SYSTEM

DIAGNOSTIC FORMATS

QUICK TESTS, CIRCUIT TESTS and PINPOINT TESTS are diagnostic formats used to test and service EEC-IV system. QUICK TEST allows technician to identify problems and retrieve Diagnostic Trouble Codes (DTCs). CIRCUIT TESTS check engine circuits, sensors and actuators. PINPOINT TESTS check transaxle circuits, sensors and actuators.

Before starting any circuit test, follow all steps under QUICK TEST to find correct circuit or pinpoint test. If vehicle passes QUICK TEST and no driveability symptoms or intermittent faults exist, EEC-IV system is okay.

DIAGNOSTIC TROUBLE CODES (DTC)

During QUICK TEST, 3 types of codes are retrieved: Key On Engine Off (KOEO), Key On Engine Running (KOER) and Continuous Memory Codes. See QUICK TEST for self-test procedures. Codes may be cleared from PCM memory after they have been recorded or repaired. See **CLEARING CODES EEC-IV**.

KOEO & KOER Codes (Hard Faults)

These codes indicate faults are present at time of testing. A hard fault may cause Malfunction Indicator Light (MIL) to glow and remain on until fault is repaired. If KOEO or KOER codes are retrieved during KOEO SELF-TEST or KOER SELF-TEST, use **EEC-IV CODE REFERENCE TABLES** to find correct testing and repair procedures.

Continuous Memory Codes (Soft Faults)

These codes indicate a fault that may or may not be present at time of testing. These codes are used to diagnose intermittent problems. Continuous Memory Codes are retrieved during KOEO SELF-TEST. Some codes may turn on MIL light. Corresponding soft trouble code will be retained in PCM memory. If fault does not reoccur within 40 warm-up cycles (80 cycles on some models), PCM will automatically clear code. Technician may clear codes from memory. See **CLEARING CODES EEC-IV**. Intermittent faults may be caused by a sensor, connector or wiring-related problems.

CAUTION: Continuous Memory Codes should be recorded when retrieved during KOEO SELF-TEST. These codes may be used to identify intermittent problems that exist after all KOEO and KOER codes have been repaired and a Code 111 (pass code) has been obtained. Failure to follow this procedure may result in unnecessary testing. Some Continuous Memory Codes faults may not be valid after KOEO and KOER codes are repaired.

RETRIEVING CODES

DTCs are retrieved from EEC-IV system through Data Link Connector (DLC). DLC is located below instrument panel, to left of steering column. Various methods and test equipment may be used to access these codes:

- Analog Volt-Ohmmeter (VOM)
- Scan Tool
- In-Dash Malfunction Indicator Light (MIL)
- STAR Series Tester

READING CODES

KOEO & KOER SELF-TEST Codes

PCM outputs codes one digit at a time. Record codes in order received. These codes indicate current faults in system and should be serviced in order of appearance. Use **EEC-IV CODE REFERENCE TABLES** to find correct CIRCUIT TEST and/or PINPOINT TEST.

If using analog VOM, pay careful attention to length of pauses in order to read codes correctly. A 1/2-second pause occurs between number of sweeps in a digit. A 2-second pause occurs between digits in a code. A 4-second pause occurs between each code. KOEO codes are separated from Continuous Memory codes by a 6-second delay, a1/2-second sweep (separator) and another 6-second delay. See **Fig. 3**. If using MIL light, DTCs are displayed as flashes.

Scan tool, if used, will count pulses and display them as a digital code. STAR Series Tester will add a zero (0) to single-digit Separator Code (10) and Dynamic Response Code (10). Dynamic Response Code is displayed in KOER SELF-TEST. See **Fig. 3**.

Engine Identification (ID) Codes

Engine ID codes are issued at beginning of KOER SELF-TEST. Codes are one-digit numbers represented by number of pulses displayed. See **Fig. 3**. Engine ID code is equal to one-half the number of engine cylinders. For example, 2 pulses would indicate that engine is a 4 cylinder. ID code is used to verify proper PCM is installed and that SELF-TEST has been entered.

Separator Pulse

Single 1/2-second separator pulse is issued 6-9 seconds after last KOEO code. Continuous Memory Codes (soft faults) are then displayed 6-9 seconds after 1/2-second separator pulse. Some digital test equipment may display separator code as "10" instead of "1".

Pass Codes

A Code 111 indicates no DTCs were recorded in that portion of test; system passes that portion of test. If Code 111 is not retrieved in KOEO SELF-TEST, codes retrieved during KOER SELF-TEST may not be valid. Code 111 (pass code) must be obtained in KOEO SELF-TEST. A Code 111-1-111 output during KOEO SELF-TEST indicates no KOEO code or Continuous Memory Code was recorded.

Continuous Memory Codes

These codes result from information stored by PCM during continuous self-test monitoring. Codes are displayed after separator pulse code in KOEO SELF-TEST. Use these codes for diagnosis only when KOEO SELF-TEST and KOER SELF-TEST result in Code 111 (pass code) and all steps under QUICK TEST are successfully completed. (A few codes are exceptions which may be checked after KOEO codes have been repaired). These codes indicate faults recorded within last 40 engine starts (80 engine starts on some models). Fault may or may not be currently present. See **EEC-IV CODE REFERENCE TABLES**.

Fast Codes

At start of KOEO SELF-TEST and after Wide Open Throttle (WOT) request in KOER SELF-TEST, PCM outputs short bursts of information, known as FAST CODES, which were used by manufacturer during assembly. With most equipment, these code bursts are not visible; an entire code sequence lasts less than 1/2 second.

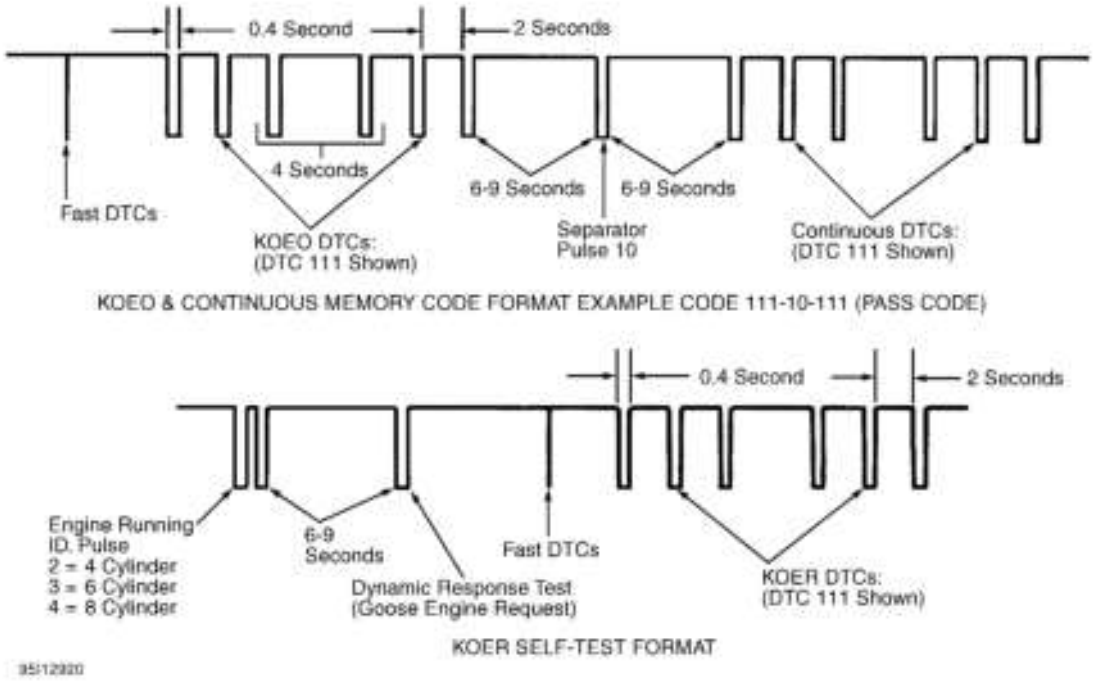

Fig. 5: Reading Diagnostic Trouble Codes (DTCs)
Courtesy of FORD MOTOR CO.

CLEARING CODES EEC-IV

To clear codes from PCM memory, start KOEO SELF-TEST under QUICK TEST. When DTCs appear on test equipment or MIL, disconnect jumper wire from Self-Test Input (STI) connector. If using STAR Series Tester, unlatch center button. This procedure erases Continuous Memory Codes from PCM memory. If problem has not been corrected or fault is still present, hard code will immediately be reset in PCM memory.

CAUTION: DO NOT disconnect vehicle battery to clear codes. This will erase stored operating information from Keep-Alive Memory (KAM). To clear KAM, disconnect negative battery terminal for at least 5 minutes.

WARNING: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in the GENERAL INFORMATION before disconnecting battery.

QUICK TEST

Description

Following procedures are functional tests of EEC-IV system. These following 4 basic test steps must be carefully followed in sequence, otherwise misdiagnosis or replacement of non-faulty components may result:

- Visual Check

- Equipment Hookup.
- KOEO (Key On Engine Off) SELF-TEST.
- KOER (Key On Engine Running) SELF-TEST.

Diagnostic Aids

After each service or repair procedure has been completed, repeat QUICK TEST to ensure all EEC-IV systems work properly and DTCs are no longer present.

Visual Check

Complete all steps in **PRELIMINARY INSPECTION** before proceeding to self-diagnostic tests. Ensure vacuum hoses and EEC-IV wiring harnesses are properly connected.

Equipment Hookup

Apply parking brake, and place shift lever in "P" position. Block drive wheels. Turn off all electrical loads. Connect appropriate test equipment to vehicle as follows:

Analog Volt-Ohmmeter (VOM)

1. Turn ignition switch to OFF position. Set VOM at 0-15V DC range. Connect positive lead of VOM to positive battery terminal.
2. Connect negative VOM lead to Self-Test Output (STO) terminal of self-test connector. See **Fig. 4**. Connect timing light, and go to KOEO SELF-TEST. Activate KOEO SELF-TEST by connecting jumper wire from Self-Test Input (STI) pigtail to signal return terminal of self-test connector with ignition on.

Scan Tool

Follow manufacturer's instructions to hook up equipment and record DTCs.

STAR Series Tester

Turn ignition switch to OFF position. Connect color-coded adapter cable leads to diagnostic tester. Connect 2 service connectors of adapter cable to vehicle self-test connector and STI pigtail connector. Connect timing light. Go to KOEO SELF-TEST.

Malfunction Indicator Light (MIL)

Turn ignition on. Connect a jumper wire between Self-Test Input (STI) pigtail and signal return (SIG RTN) terminal of Data Link Connector (DLC). See **Fig. 4**. Go to KOEO SELF-TEST.

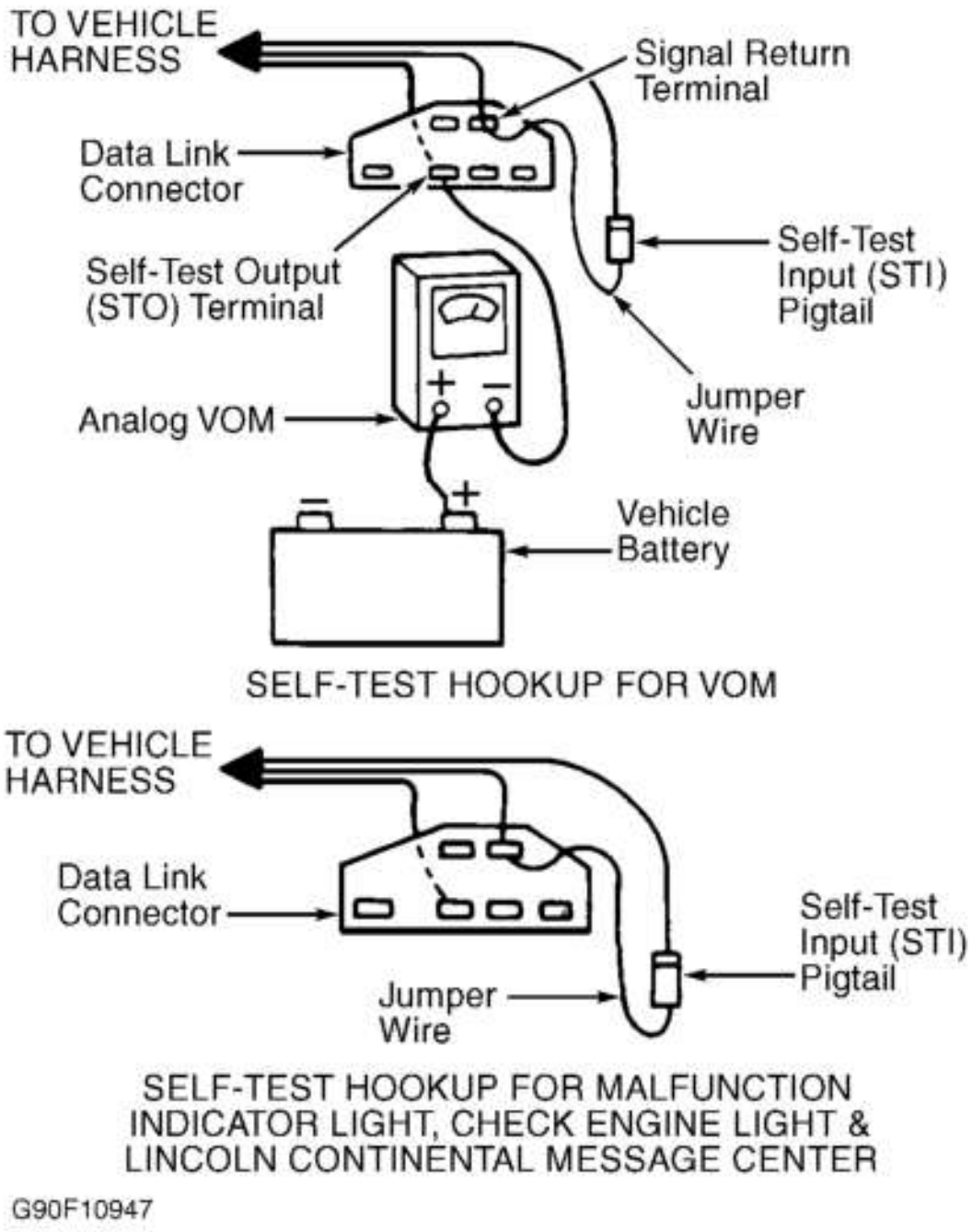

Fig. 6: Connecting Self-Test Diagnostic Equipment
Courtesy of FORD MOTOR CO.

KOEO Self-Test

Ensure engine is at normal operating temperature. If engine does not start (or stalls after starting), continue KOEO SELF-TEST. **DO NOT** depress throttle. Turn ignition off. Wait 10 seconds. Ensure test equipment is properly attached. Turn ignition on (engine off). Record all KOEO and Continuous Memory Codes.

If a Code 111 (pass code) is not retrieved in KOEO portion of test, service KOEO codes at this time. Service

any engine codes recorded before servicing transmission codes. If PCM will not output codes, see appropriate TESTS W/CODES - EEC-IV article in ENGINE PERFORMANCE. If DTCs are retrieved observe the following procedures:

- If Malfunction Indicator Light (MIL) is on, service DTCs in order retrieved.
- If vehicle has a no-start condition, go to CIRCUIT TEST AA, AB or AC in TESTS W/CODES - EEC-IV article in the ENGINE PERFORMANCE.

KOER Self-Test

DO NOT enter this test sequence until a Code 111 (pass code) has been retrieved in KOEO SELF-TEST. If system has not passed KOEO SELF-TEST, codes recorded in KOER SELF-TEST may not be valid.

Deactivate self-test by removing and reconnecting jumper wire or by procedure specified by test equipment in use. Start engine, and run it for 2 minutes at 2000 RPM to warm Heated Exhaust Gas Oxygen (HEGO) sensor. Turn engine off, and wait 10 seconds. Activate KOER SELF-TEST using a jumper wire or appropriate procedure for test equipment used. Start engine. Record all DTCs displayed. Check following items:

- If engine starts and stalls (or stalls during self-test), go to CIRCUIT TESTS in appropriate TESTS W/CODES article in ENGINE PERFORMANCE.
- If vehicle is equipped with a Brake On-Off (BOO) switch, brake pedal must be depressed and released after ID code portion of test.
- If Dynamic Response Code appears, perform a brief Wide Open Throttle (WOT). **DO NOT** perform WOT unless requested.
- If a Code 111 (pass code) is retrieved during KOER SELF-TEST, service Continuous Memory Codes retrieved in KOEO SELF-TEST. See TESTS W/CODES - EEC-IV article in the ENGINE PERFORMANCE section.
- If a Code 111 (pass code) is retrieved during Continuous Memory Code portion of KOEO SELF-TEST (Code 111-1-111) and no driveability problem exists, EEC-IV testing is complete. If driveability problems are still present, go to TROUBLE SHOOTING in **AUTO TRANS OVERHAUL - FORD 4R70W** article.
- If KOER codes are present, see **EEC-IV CODE REFERENCE TABLES**. If system will not output codes, go to CIRCUIT TEST QA. See appropriate TESTS W/CODES article in ENGINE PERFORMANCE.

Continuous Monitor Mode (Wiggle Test)

Continuous Monitor Mode allows technician to attempt to recreate an intermittent fault while monitoring system. This mode, also called "wiggle" test, may be used in both KOEO SELF-TEST and KOER SELF-TEST. CIRCUIT TESTS and PINPOINT TESTS specify use of this procedure to identify intermittent faults in specific circuits or components.

KOEO Wiggle Test Procedure

Connect test equipment. See **Fig. 6**. Turn ignition on, and activate self-test using jumper lead or diagnostic tester. Wait 10 seconds, and then deactivate and reactivate self-test. Wiggle test mode is now activated. Tap, move and wiggle suspect sensor and/or harness area. If a fault is detected, a DTC may be stored in memory and indicated at diagnostic tester or scan tester. Retrieve code, and perform appropriate test. See **EEC-IV CODE REFERENCE TABLES**.

KOER Wiggle Test Procedure

Connect test equipment. See **Fig. 6**. Turn ignition off, and wait 10 seconds. Start engine. Activate self-test using jumper lead or diagnostic tester. Wait 10 seconds, and then deactivate and reactivate self-test. **DO NOT** turn engine off. KOER wiggle test mode is now activated. Tap, move and wiggle suspect sensor and/or harness area. If a fault is detected, a DTC may be stored in memory and indicated at diagnostic tester or scan tester. Retrieve code, and perform appropriate test. See **EEC-IV CODE REFERENCE TABLES**.

ADDITIONAL SYSTEM FUNCTIONS

Additional diagnostic system features are available to help diagnose driveability problems and service EEC-IV systems.

Malfunction Indicator Light (MIL)

MIL is intended to alert driver of certain malfunctions in EEC-IV system.

Light may also be used to retrieve DTCs stored in PCM. When hooked up for KOEO SELF-TEST or KOER SELF-TEST, light will display all codes which turn on light during vehicle operation, not just Continuous Memory Codes.

If light comes on during vehicle operation, vehicle should be inspected as soon as possible. Immediately turning off engine is not necessary; vehicle can be driven with light on.

If light comes on and then goes off during vehicle operation, code causing light to glow will be stored in PCM memory as a Continuous Memory Code.

Light should come on when ignition is turned on and go out when engine is started. If hard fault codes are not present, PCM turns out light when it receives a Profile Ignition Pick-Up (PIP) signal. If light does not come on, see SYMPTOMS in appropriate TESTS W/O CODES article in the ENGINE PERFORMANCE section.

Output State Check

Output State Check is used as an aid in servicing output actuators associated with EEC-IV system. It allows technicians to energize and de-energize most system output actuators on command. This mode is entered from KOEO SELF-TEST after all codes have been retrieved. Leave SELF-TEST activated, and depress throttle to initiate test sequence. Each time throttle is depressed and released, output actuators will change state (from on to off or off to on).

Failure Mode Effects Management (FMEM)

FMEM mode allows system operation when sensors fail or transmit signals that are out of normal operating range. During FMEM mode, PCM substitutes a mid-range signal for defective sensor while continuing to monitor sensor. If faulty sensor's signals return to normal operating range, PCM will use those signals. A KOER Code 998 will be displayed when FMEM mode is in effect.

Hardware Limited Operational Strategy (HLOS)

If a number of system or sensor failures are present and PCM is not receiving enough information to operate, PCM will switch to HLOS mode. PCM will output fixed values to allow operation of vehicle. Driveability concerns will be present. PCM will not output self-test DTCs in this mode.

TRANSMISSION DRIVE CYCLE TEST

NOTE: The transmission drive cycle test must be followed exactly. Malfunctions have to occur 4 times consecutively for codes 645, 646, 647 and 648 to be set and 5 times consecutively for continuous code 628.

1. After repairing any engine performance trouble codes, erase remaining transmission codes. Warm engine to normal operating temperature. Ensure transmission fluid level is correct. Shift transmission to drive "D". Press TCS on shifter handle. O/D OFF light should illuminate.
2. Accelerate from stop to 40 mph. Hold speed for at least 15 seconds (30 seconds above 4000 ft.). Press TCS and accelerate to 50 mph. Hold speed for at least 15 seconds (30 seconds above 4000 ft.). Hold speed and throttle position steady for at least 15 seconds. While maintaining speed with transaxle in 4th gear, lightly depress brake pedal and release (to operate stoplights). Hold speed for at least an additional 5 seconds. Bring vehicle to stop for at least 20 seconds with transmission in drive "D". Repeat steps 1) and 2) at least 5 times. Perform Quick Test and record continuous codes.

TORQUE CONVERTOR ENGAGEMENT TEST

Connect tachometer. Warm engine to normal operating temperature. Ensure transmission fluid level is correct. Maintain approximately 50 mph and tap brake pedal with left foot. Engine RPM should increase when brake pedal is tapped and decrease in about 5 seconds after pedal is released. If torque converter clutch operation is not as specified, see TROUBLE SHOOTING in **AUTO TRANS OVERHAUL - FORD 4R70W** article.

SUMMARY

If no codes (or pass code 111-1-111) is present but driveability problem still exists, return to TROUBLE SHOOTING in FORD 4R70W article.

EEC-IV CODE REFERENCE TABLES

NOTE: In addition to transmission fault codes, engine-related fault codes may be output during QUICK TEST procedure. These fault codes pertain to engine performance and must be repaired first as engine performance will greatly affect transmission operation. For information and testing procedures of engine-related fault codes and components, see appropriate TESTS W/CODES article in ENGINE PERFORMANCE.

EEC-IV CODE REFERENCE

Fault Code (1)	Circuit/Pinpoint Test & Step	Code Definition
No Code/Code Not Listed	(2)	N/A
111	N/A	Pass Code
112	(2)	IAT Indicates 254° F (125° C)
113	(2)	IAT Indicates -40° F (-40° C)
114	(2)	IAT Out Of Range
116	(2)	ECT Out Of Range
117	(2)	ECT Indicates 254° F (125° C)

118	(2)	ECT Indicates -40° F (-40° C)
121	(2)	TPS Voltage High/Low
122	(2)	TPS Malfunction
123	(2)	TPS Malfunction
124	(2)	TPS Malfunction
125	(2)	TPS Malfunction
157	(2)	MAF Sensor Malfunction
158	(2)	MAF Sensor Malfunction
159	(2)	MAF Sensor Malfunction
167	(2)	TPS Malfunction
184	(2)	MAF Sensor Malfunction
185	(2)	MAF Sensor Malfunction
211	(2)	EI System Malfunction
212	(2)	EI System Malfunction
213	(2)	EI System Malfunction
214	(2)	EI System Malfunction
215	(2)	EI System Malfunction
216	(2)	EI System Malfunction
217	(2)	EI System Malfunction
218	(2)	EI System Malfunction
219	(2)	EI System Malfunction
221	(2)	EI System Malfunction
222	(2)	EI System Malfunction
223	(2)	EI System Malfunction
224	(2)	EI System Malfunction
232	(2)	EI System Malfunction
233	(2)	EI System Malfunction
234	(2)	EI System Malfunction
235	(2)	EI System Malfunction
236	(2)	EI System Malfunction
237	(2)	EI System Malfunction
238	(2)	EI System Malfunction
239	(2)	EI System Malfunction
241	(2)	EI System Malfunction
242	(2)	EI System Malfunction
243	(2)	EI System Malfunction
452	(2)	Insufficient VSS Input
519		PSP Circuit Failure

	(2)	
521	(2)	PSP Not Changing State
536	(3) FD1/(4) FD90	BOO Switch Malfunction
539	KM40	A/C Switch Error
617	A1	1-2 Shift Error
618	A1	2-3 Shift Error
619	A1	3-4 Shift Error
621	A1	SS1 Solenoid Circuit Failure
622	A1	SS2 Solenoid Circuit Failure
623	TB3	TCIL Circuit Failure
624	E1	EPC Solenoid Circuit Failure
625	E1	Open PCM Output Driver
628	(4) TG90	TCC Engagement Error
632	TB2	TCS Malfunction
633	(2)	4WD Low Switch Failure
636	B1	TFT Out Of Range
637	B1	TFT Indicates -40° F (-40° C)
638	B1	TFT Indicates 315° F (157° C)
639	F1	Insufficient Input From OSS
645	(4) TG90/A1	No 1st Gear
646	(4) TG90/A1	No 2nd Gear
647	(4) TG90/A1	No 3rd Gear
648	(4) TG90/A1	No 4th Gear
652	C1	TCC Circuit Failure
654	D1	TR Not In Park
656	C1	Excessive Slip
657	B1	Transmission Overtemp
659	D1	TR Always In Park
667	D1	TR Sensor Voltage Low
668	D1	TR Sensor Voltage High
675	D1	TR Voltage Out Of Range
691	(2)	4WD Low Circuit Failure
998	(2)	FMEM Failure

(1) Only engine performance fault codes that may affect transmission operation are listed. For complete list of engine performance fault codes, see appropriate TESTS W/CODES article in ENGINE PERFORMANCE.

(2) See appropriate TESTS W/CODES article in ENGINE PERFORMANCE.

(3) KOER fault code.

(4) Continuous memory code.

EEC-V SELF-DIAGNOSTIC SYSTEM

DIAGNOSTIC FORMATS

QUICK TESTS, CIRCUIT TESTS and PINPOINT TESTS are diagnostic formats used to test and service EEC-V system. QUICK TEST allows technician to identify problems and retrieve diagnostic trouble codes. CIRCUIT TESTS check engine circuits, sensors and actuators. PINPOINT TESTS check transmission circuits, sensors and actuators.

Before starting any CIRCUIT TEST or PINPOINT TEST, follow all steps under QUICK TEST to find correct CIRCUIT TEST or PINPOINT TEST. If vehicle passes QUICK TEST and no driveability symptoms or intermittent faults exist, EEC-V system is okay.

DIAGNOSTIC TROUBLE CODES (DTC)

During QUICK TEST, 3 types of diagnostic trouble codes are retrieved: KOEO, KOER and Continuous Memory codes. See QUICK TEST for self-test procedures. Codes may be cleared from PCM memory after they have been recorded or repaired. See **CLEARING CODES EEC-V**.

KOEO & KOER Codes (Hard Faults)

These codes indicate faults are present at time of testing. A hard fault may cause CHECK ENGINE or Malfunction Indicator Light (MIL) to go on and remain on until fault is repaired. If KOEO or KOER codes are retrieved during KOEO SELF-TEST or KOER SELF-TEST, use EEC-V CODE REFERENCE TABLE to find correct testing and repair procedures.

Continuous Memory Codes (Intermittent Faults)

These codes are used to diagnose intermittent problems. Continuous Memory Codes are retrieved after KOEO SELF-TEST. These codes indicate a fault that may or may not be present at time of testing.

After noting and/or repairing fault, clear codes from memory. See **CLEARING CODES EEC-V**. Intermittent faults may be caused by a sensor, connector or wiring-related problem.

CAUTION: Continuous Memory Codes should be recorded when retrieved. These codes may be used to identify intermittent problems that exist after all KOEO and KOER codes have been repaired. Some Continuous Memory Code faults may not be valid after KOEO and KOER codes are serviced.

RETRIEVING CODES

Fault codes are retrieved from EEC-V system through Data Link Connector (DLC). DLC is located under instrument panel on driver's side. Self-diagnostic test procedures are for use with New Generation Star (NGS) scan tester. If a generic scan tester is used, ensure tool is certified OBD II standard.

READING CODES

KOEO & KOER Self-Test Codes

Record codes in order received. These codes indicate current faults in system and should be serviced in order of appearance. Use **EEC-V CODE REFERENCE TABLE** to identify correct CIRCUIT TEST and/or PINPOINT TEST to perform.

NOTE: If self-test will not activate or TOOL COMMUNICATION ERROR received, see CIRCUIT TEST QA in appropriate TESTS W/CODES article in ENGINE PERFORMANCE.

Pass Codes

SYSTEM PASS indicates no diagnostic trouble codes were recorded in that portion of test. If SYSTEM PASS is not retrieved in KOEO SELF-TEST, codes retrieved during KOER SELF-TEST may not be valid.

Continuous Memory Codes

These codes result from information stored by PCM during continuous self-test monitoring. Use these codes for diagnosis only when KOEO SELF-TEST and KOER SELF-TEST result in SYSTEM PASS and all steps under QUICK TEST are successfully completed. These codes indicate faults previously recorded. Fault may or may not be currently present. See **EEC-V CODE REFERENCE TABLE**.

OBD II Monitor Testing Not Complete

DTC P1000 is set by the PCM with any of the following conditions:

- Vehicle has not been through a complete drive cycle.
- Battery or PCM has been disconnected.
- An OBD II monitor failure occurred before completion of drive cycle.
- PCM DTCs have been erased with a scan tool.

The only way DTC P1000 can be removed from memory is when all OBD II monitors have successfully completed during normal vehicle operation.

CLEARING CODES EEC-V

PCM Reset

After a PCM reset procedure, the following conditions will be met:

- All DTCs cleared from PCM memory
- All freeze frame data cleared from PCM memory
- All oxygen sensor test data cleared from PCM memory
- OBD II system monitor status is reset
- DTC P1000 set in PCM memory

To perform PCM reset using NGS scan tester, ensure connectors are properly connected. Program scan tester using the following steps:

- Select vehicle and engine selection menu (optional). See **Fig. 6**.
- Select year, engine, model and any additional information requested by scan tester (optional).
- Follow operating instructions from scan tester menu.
- Select GENERIC OBD II FUNCTIONS. Press CONT button if monitors are not complete.
- Turn ignition on.

- Select CLEAR DIAGNOSTIC CODES.

All codes should now be cleared from PCM memory. If problem has not been corrected or fault is still present, hard code will immediately be reset in PCM memory.

CAUTION: DO NOT disconnect vehicle battery to clear trouble codes. This will erase operating information from Keep-Alive Memory (KAM). To clear KAM, disconnect negative battery terminal for at least 5 minutes.

CAUTION: When battery is disconnected, vehicle computer may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

QUICK TEST

Description

Following procedures are functional tests of EEC-V system. These basic test steps must be followed in sequence to avoid misdiagnosis:

- Visual Check
- Equipment Hookup
- KOEO (Key On Engine Off) SELF-TEST
- KOER (Key On Engine Running) SELF-TEST
- Computed Timing Check
- Continuous Memory Self-Test

Diagnostic Aids

After each service or repair procedure has been completed, repeat QUICK TEST to ensure all EEC-V systems work properly and diagnostic trouble codes are no longer present.

Equipment Hookup

Connect appropriate test equipment to vehicle as follows:

- **Generic Scan Tester** Ensure scan tester meets or exceeds OBD II standard. Follow manufacturer's instructions to hook up equipment and record diagnostic trouble codes.
- **New Generation STAR (NGS) Tester** Turn ignition switch to OFF position. Connect adapter cable lead to diagnostic tester. See **Fig. 7**. Connect service connectors of adapter cable to vehicle Data Link Connector (DLC). Go to KOEO SELF-TEST.

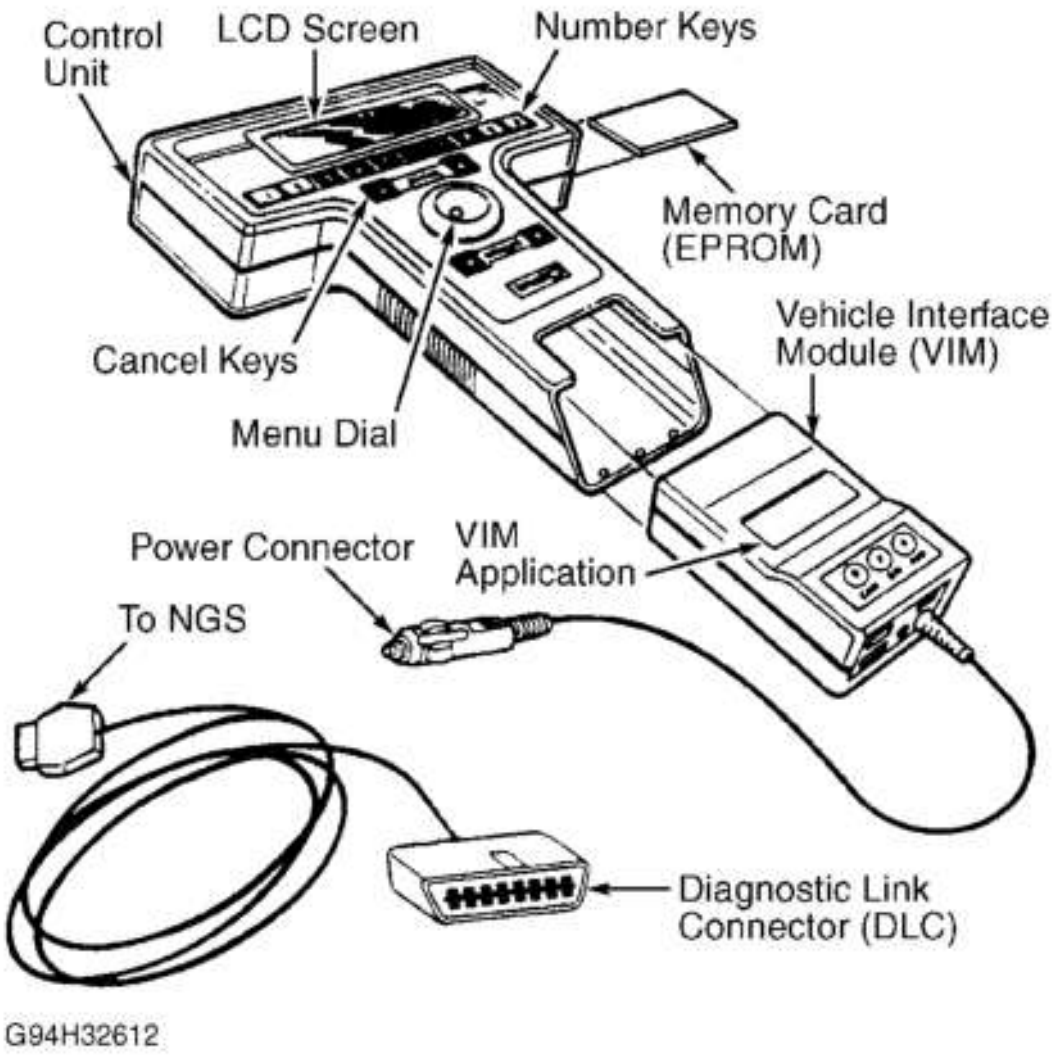

Fig. 7: Identifying New Generation Star (NGS) Scan Tester
Courtesy of FORD MOTOR CO.

KOEO Self-Test

Ensure engine is at normal operating temperature. If engine does not start (or stalls after starting), continue KOEO SELF-TEST. Turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu. See **Fig. 8**.
- Select year, engine, model and any additional information requested by scan tester.
- Select DIAGNOSTIC DATA LINK.
- Select PCM-POWERTRAIN CTRL MODULE.
- Select DIAGNOSTIC TEST MODE.
- Select KOEO ON-DEMAND SELF-TEST.
- Turn ignition on.

- Follow operating instructions from scan tester menu.

KOER Self-Test

Ensure engine is warmed to normal operating temperature. Turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu. See **Fig. 8**.
- Select year, engine, model and any additional information requested by scan tester.
- Select DIAGNOSTIC DATA LINK.
- Select PCM-POWERTRAIN CTRL MODULE.
- Select DIAGNOSTIC TEST MODE.
- Select KOER ON-DEMAND SELF-TEST.
- Start engine and allow to idle.
- Follow operating instructions from scan tester menu.
- Perform BOO and TCS cycling (if equipped).

Continuous Memory Self-Test (Emission Related)

Turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu (optional). See **Fig. 8**.
- Select year, engine, model and any additional information requested by scan tester (optional).
- Select GENERIC OBD II OPTIONS. Press CONT button if monitors are not complete.
- Select DIAGNOSTIC TROUBLE CODES.
- Turn ignition on.
- Follow operating instructions from scan tester menu.

Continuous Memory Self-Test (Enhanced Mode)

Turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu. See **Fig. 8**.
- Select year, engine, model and any additional information requested by scan tester.
- Select DIAGNOSTIC DATA LINK.
- Select PCM-POWERTRAIN CTRL MODULE.
- Select DIAGNOSTIC TEST MODES.
- Select RETRIEVE/CLEAR CONTINUOUS DTCs.
- Turn ignition on.
- Follow operating instructions from scan tester menu.

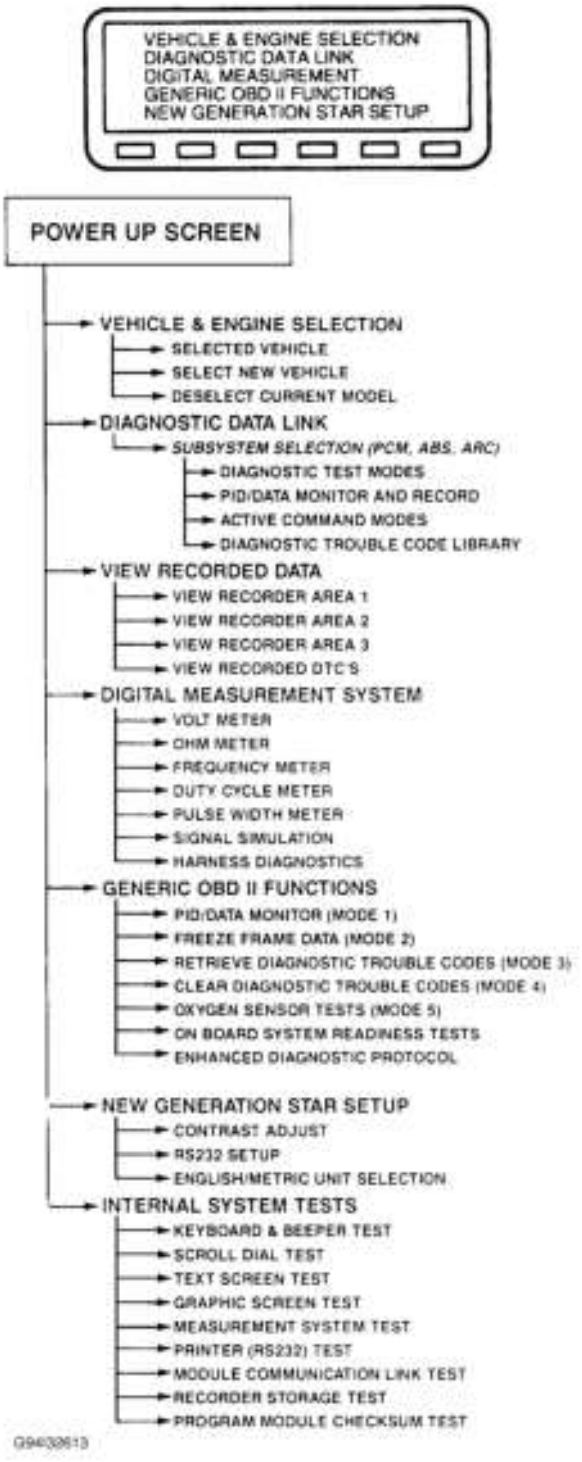

Fig. 8: Identifying New Generation Star (NGS) Main Menu & Mode Paths
Courtesy of FORD MOTOR CO.

ADDITIONAL SYSTEM FUNCTIONS

NOTE: These additional diagnostic system features are available to help diagnose driveability problems and service EEC-V systems.

- **Generic OBD II Parameter Identification (PID)**
- **Non-Generic OBD II Parameter Identification (PID)**
- **On-Board System Readiness (OSR) Test Mode**
- **Freeze Frame Data Mode**
- **Oxygen Sensor Test Mode**
- **Transmission Drive Cycle Test**
- **Failure Mode Effects Management (FMEM)**
- **Hardware Limited Operational Strategy (HLOS)**

Generic OBD II Parameter Identification (PID)

Turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu (optional). See **Fig. 8**.
- Select year, engine, model and any additional information requested by scan tester (optional).
- Select GENERIC OBD II OPTIONS. Press CONT button if monitors are not complete.
- Select PID/DATA MONITOR.
- Turn ignition on or start engine and allow to idle.
- Follow operating instructions from scan tester menu.
- Select PIDs and press START.

Non-Generic OBD II Parameter Identification (PID)

Turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu. See **Fig. 8**.
- Select year, engine, model and any additional information requested by scan tester.
- Select GENERIC OBD II OPTIONS. Press CONT button if monitors are not complete.
- Select DIAGNOSTIC DATA LINK.
- Select PCM-POWERTRAIN CTRL MODULE.
- Select DIAGNOSTIC TEST MODES.
- Select PID DATA MONITOR AND RECORD.
- Turn ignition on or start engine and allow to idle.
- Follow operating instructions from scan tester menu.
- Select PIDs and press START.

On-Board System Readiness (OSR) Test Mode

All OBD II scan testers must display OSR test. The OSR will display monitors on the vehicle and status of all monitors; complete or not complete. If not complete, the scan tester will display which monitor has not completed.

To enter OSR, turn ignition switch to OFF position. Ensure test equipment is properly attached. Program

scan tester using the following steps:

- Select vehicle and engine selection menu (optional). See **Fig. 8**.
- Select year, engine, model and any additional information requested by scan tester.
- Follow operating instructions from scan tester menu.
- Select GENERIC OBD II FUNCTIONS. Press TEST button if monitors are not complete.
- Start engine and allow to idle.
- Select ON-BOARD SYSTEM READINESS

Freeze Frame Data Mode

This mode allows access to emission related data values from specific generic PIDs. These values are immediately stored in continuous memory when an emission related fault occurs. This provides a snapshot of the conditions that were present when the fault occurred. Freeze frame will be stored until PCM memory is erased.

To access FREEZE FRAME DATA MODE, turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu (optional). See **Fig. 8**.
- Select year, engine, model and any additional information requested by scan tester (optional).
- Follow operating instructions from scan tester menu.
- Select GENERIC OBD II FUNCTIONS. Press CONT button if OBD II monitors are not complete.
- Turn ignition on.
- Select FREEZE FRAME PID TESTS.

Oxygen Sensor Test Mode

This mode allows access to on-board sensor fault limits and actual values during test cycle. The test cycle has specific engine operating conditions that must be met for completion. This information is used to determine the efficiency of the catalytic converter.

To access OXYGEN SENSOR TEST mode, turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu (optional). See **Fig. 8**.
- Select year, engine, model and any additional information requested by scan tester (optional).
- Follow operating instructions from scan tester menu.
- Select GENERIC OBD II FUNCTIONS.
- Select OXYGEN SENSOR TESTS.
- Select appropriate oxygen sensor test and follow menu instructions.

Output Test Mode

This mode allows a technician to energize and de-energize most of the system output actuators on command. After accessing OUTPUT TEST MODE, outputs and cooling fans can be turned on and off separately.

To access OUTPUT TEST MODE, turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu. See **Fig. 8**.
- Select year, engine, model and any additional information requested by scan tester.
- Follow operating instructions from scan tester menu.
- Select DIAGNOSTIC DATA LINK.
- Select PCM-POWERTRAIN CTRL MODULE.
- Select DIAGNOSTIC TEST MODE.
- Select ACTIVE COMMAND MODE.
- Select OUTPUT TEST MODE.
- Turn ignition on.
- Follow operating instructions from scan tester menu.
- Select either LOW SPEED FAN, HIGH SPEED FAN or ALL ON mode.
- Select START to turn outputs on. This step may cause link up to PIDs.
- Select STOP to turn outputs off.

Failure Mode Effects Management (FMEM)

FMEM mode allows system operation when sensors fail or transmit signals that are out of normal operating range. During FMEM mode, PCM substitutes a mid-range signal for defective sensor while continuing to monitor sensor. If faulty sensor's signals return to normal operating range, PCM will use those signals. Depending on specific failure, a fault code may be set in PCM memory. Hardware Limited Operational Strategy (HLOS)

If a number of system or sensor failures are present and PCM is not receiving enough information to operate, PCM will switch to HLOS mode. PCM will output fixed values to allow operation of vehicle. Driveability concerns will be present. PCM will not output diagnostic trouble codes in this mode.

TRANSMISSION DRIVE CYCLE TEST

NOTE: The transmission drive cycle test must be followed exactly. Malfunctions have to occur 4 times consecutively for DTCs P0781, P0782, P0783, P1731, P1732 and P1733 to be set and 5 times consecutively for continuous DTC P0741.

1. Record and then erase QUICK TEST DTCs. Warm engine to normal operating temperature. Ensure transmission fluid level is correct. Shift transmission to overdrive (OD).
2. Accelerate from stop to 50 mph. Hold speed for at least 15 seconds (30 seconds above 4000 ft.). Press TCS and accelerate to 50 mph. Hold speed for at least 15 seconds (30 seconds above 4000 ft.). Hold speed and throttle position steady for at least 15 seconds. While maintaining speed with transmission in 4th gear, lightly depress brake pedal and release. Maintain speed for additional 5 seconds. Bring vehicle to stop for at least 20 seconds. Repeat steps 1) and 2) at least 5 times. Perform Quick Test and record continuous DTCs.

SUMMARY

If no service codes (or pass code 1111) is present but driveability problem still exists, return to TROUBLE SHOOTING in FORD 4R70W OVERHAUL article.

EEC-V CODE REFERENCE TABLES

NOTE: In addition to transmission fault codes, engine-related fault codes may be output during QUICK TEST procedure. These fault codes pertain to engine performance and must be repaired first as engine performance will greatly affect transmission operation. For information and testing procedures of engine-related fault codes and components, see appropriate TESTS W/CODES , EEC-V article in the ENGINE PERFORMANCE.

EEC-V CODE REFERENCE

Fault Code (1)	Circuit/Pinpoint Test/Step	Code Definition
P1111	N/A	System Pass Code
P0102	(2)	MAF Sensor Malfunction
P0103	(2)	MAF Sensor Malfunction
P0112	(2)	IAT Indicates 254° F (125° C)
P0113	(2)	IAT Indicates -40° F (-40° C)
P0114	(2)	IAT Out Of Range
P0117	(2)	ECT Indicates 254° F (125° C)
P0118	(2)	ECT Indicates -40° F (-40° C)
P0122	(2)	TPS Malfunction
P0123	(2)	TPS Malfunction
P0300	(2)	EI System Malfunction
P0301	(2)	EI System Malfunction
P0302	(2)	EI System Malfunction
P0303	(2)	EI System Malfunction
P0304	(2)	EI System Malfunction
P0305	(2)	EI System Malfunction
P0306	(2)	EI System Malfunction
P0307	(2)	EI System Malfunction
P0308	(2)	EI System Malfunction
P0320	(2)	EI System Malfunction
P0340	(2)	EI System Malfunction
P0500	(2)	Insufficient VSS Input
P0503	(2)	Insufficient VSS Input
P0703	(3) **FD3**	BOO Switch Malfunction
P0707	**D1**	TR Sensor Voltage Low
P0708	**D1**	TR Sensor Voltage High
P0712	**B1**	TFT Indicates 315° F (157° C)

P0713	**B1**	TFT Indicates -40° F (-40° C)
P0720	**F1**	Insufficient Input From OSS
P0721	**F1**	Insufficient Input From OSS
P0741	(4)	TCC Engagement Error
P0743	**C1**	TCC Solenoid Circuit Failure
P0750	**A1**	SS1 Solenoid Circuit Failure
P0751	**A1**	SS1 Solenoid Failure
P0755	**A1**	SS2 Solenoid Circuit Failure
P0756	**A1**	SS2 Solenoid Failure
P0781	**A1**	1-2 Shift Error
P0782	**A1**	2-3 Shift Error
P0783	**A1**	3-4 Shift Error
P1000	(5)	Monitor Testing Incomplete
P1100	(2)	MAF Sensor Malfunction
P1101	(2)	MAF Sensor Malfunction
P1116	(2)	ECT Out Of Range
P1120	(2)	TPS Malfunction
P1121	(2)	TPS Malfunction
P1124	(2)	TP Voltage High/Low
P1125	(2)	TPS Malfunction
P1351	(2)	EI System Malfunction
P1352	(2)	EI System Malfunction
P1353	(2)	EI System Malfunction
P1354	(2)	EI System Malfunction
P1355	(2)	EI System Malfunction
P1359	(2)	EI System Malfunction
P1364	(2)	EI System Malfunction
P1460	(6) **KM1**/(3) **KM30**	A/C Switch Error
P1500	(2)	Intermittent VSS Input
P1501	(2)	Intermittent VSS Input
P1503	(2)	Insufficient VSS Input
P1703	(7) **FD1**/(8) **FD2**	BOO Switch Malfunction
P1705	**D1**	TR Not In Park
P1711	**B1**	TFT Out Of Range
P1729	(2)	4WD Low Switch Failure
P1731	**A1**	1-2 Shift Error
P1732	**A1**	2-3 Shift Error
P1733	**A1**	3-4 Shift Error
P1741	**C1**	TCC Engagement Error
P1742	**C1**	TCC Solenoid Failed On

P1743	**C1**	TCC Solenoid Failed On
P1744	(4)	TCC Engagement Error
P1746	**E1**	EPC Solenoid Circuit Failure
P1747	**E1**	EPC Solenoid Circuit Failure
P1751	**A1**	SS1 Solenoid Failure
P1756	**A1**	SS2 Solenoid Failure
P1780	(7) (2)	TCS Malfunction
P1781	(2)	4WD Low Switch Closed
P1783	**B1**	Transmission Overtemp

(1) Only engine performance fault codes that may affect transmission operation are listed. For complete list of engine performance fault codes, see appropriate TESTS W/CODES article in ENGINE PERFORMANCE.

(2) See appropriate TESTS W/CODES article in ENGINE PERFORMANCE.

(3) Continuous memory code.

(4) See TROUBLESHOOTING in **AUTO TRANS OVERHAUL - FORD 4R70W** article.

(5) During KOEO and KOER self-tests disregard DTC P1000 and continue testing. For Continuous Memory DTC P1000, see READING CODES.

(6) KOER or KOER fault code.

(7) KOER fault code.

(8) KOEO memory code.

EEC-IV & EEC-V CIRCUIT TEST & PINPOINT TESTS PROCEDURES

NOTE: Procedures in CIRCUIT TESTS and PINPOINT TESTS are written for the use of the following Ford Motor Co. test equipment:

- **Super Star II Tester (007-0041B) or New Generation Star (NGS) Tester (007-00500)**
- **60-Pin Breakout Box (007-00033) or 104-Pin Breakout Box (014-00950)**
- **Transmission Tester (007-0085C or 007-0085D)**

Terminal pin references are based on this equipment and appropriate overlays. All references to "test pins", "test terminals" or "jacks" refer to TEST EQUIPMENT.

When aftermarket test equipment is used, always follow test equipment manufacturer's procedures.

HOW TO USE CIRCUIT TESTS & PINPOINT TESTS

1. DO NOT perform any CIRCUIT TEST or PINPOINT TEST unless specifically instructed by a QUICK TEST procedure. Follow each test step in order until fault is found. DO NOT replace any part unless directed to do so. When more than one code is retrieved, start with first code displayed.
2. CIRCUIT TESTS and PINPOINT TESTS ensure electrical circuits are okay before sensors or other components are replaced. Always test circuits for continuity between sensor and PCM. Test all circuits for short to power, opens or short to ground. Voltage Reference (VREF) and Voltage Power

(VPWR) circuits should be tested with ignition on or as specified in CIRCUIT TEST and/or PINPOINT TESTS.

3. DO NOT measure voltage or resistance at PCM. DO NOT connect any test light unless specified in testing procedure. All measurements are made by probing rear of connector (wiring harness side). Isolate both ends of a circuit and turn ignition off when checking for shorts or continuity, unless instructed otherwise.
4. Disconnect solenoids and switches from harness before measuring continuity and resistance or applying voltage. After each repair, check all component connections and repeat QUICK TEST.
5. An open circuit is defined as a resistance reading of greater than 5 ohms. This specification tolerance may be too high for some items in EEC-V system. If resistance approaches 5 ohms, always clean suspect connector and coat it with protective dielectric silicone grease. A short is defined as a resistance reading of less than 10 k/ohms to ground, unless stated otherwise in CIRCUIT TEST and/or PINPOINT TEST.

NOTE: In following tests, circuit diagrams and illustrations are courtesy of Ford Motor Co.

EEC-IV & EEC-V PINPOINT TESTS

NOTE: Procedures in PINPOINT TESTS are written for the use of the following Ford Motor Co. test equipment:

- **Super Star II Tester (007-0041B) or New Generation Star (NGS) Tester (007-00500)**
- **60-Pin Breakout Box (007-00033) or 104-Pin Breakout Box (014-00950)**
- **Transmission Tester (007-0085C or 007-0085D)**

Terminal pin references are based on this equipment and appropriate overlays. All references to "test pins", "test terminals" or "jacks" refer to TEST EQUIPMENT.

When aftermarket test equipment is used, always follow test equipment manufacturer's procedures.

PINPOINT TEST A - SHIFT SOLENOID ELECTRICAL CIRCUIT

1) 4R70W Electronic Diagnostics Ensure transmission harness connector is in acceptable condition. Repair as necessary. Perform KOEO test until Continuous Memory trouble codes have been displayed. See QUICK TEST. Depress throttle to WOT and release. If vehicle enters Output State, go to next step. If vehicle will not enter Output State, see appropriate TESTS W/CODES article in the ENGINE PERFORMANCE section.

2) Check Electrical Signal Operation Disconnect transmission harness connector. Inspect condition of connector and repair as needed. Using DVOM (20-volt scale), connect positive lead to transmission harness connector VPWR terminal. See **Fig. 9**. Connect negative lead to suspect solenoid circuit. Depress and release throttle to cycle solenoid output. If voltage changes at least .5 volt, go to step 5). If voltage is unaffected, go to next step.

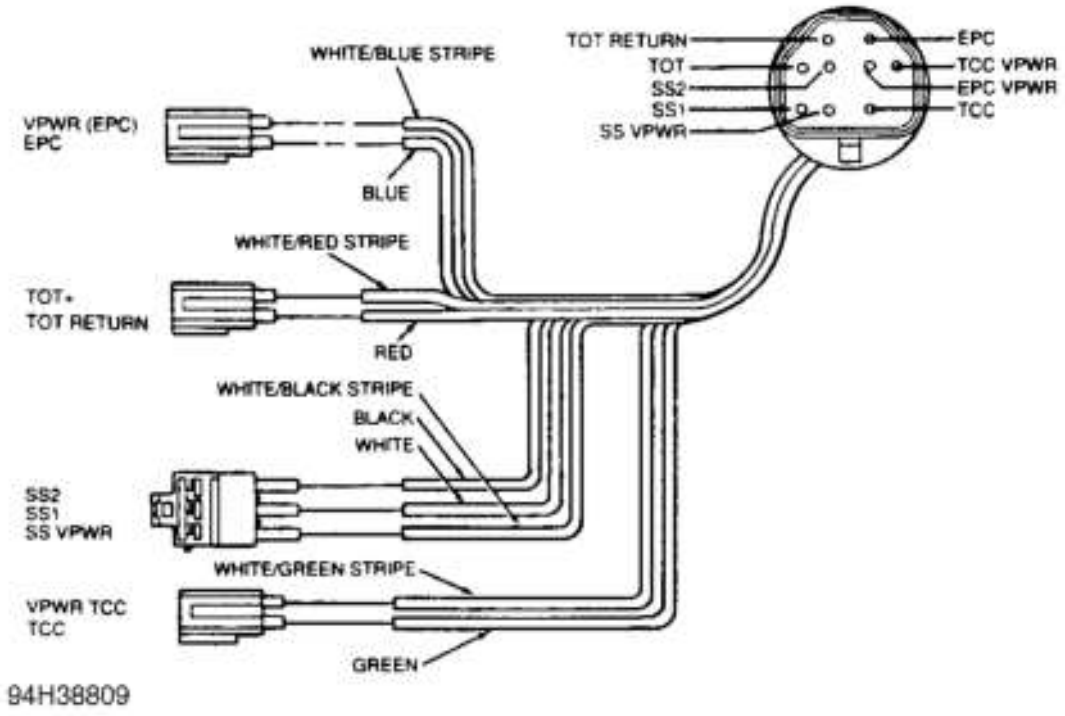

Fig. 9: Identifying Transmission Harness & Connector

BREAKOUT BOX (BOB) TEST PIN IDENTIFICATION

Component Circuit	EEC-IV BOB Test Pin	EEC-V BOB Test Pin
EPC	38	81
EPC VPWR	37/57	71/97
OSS	5	84
SIG RTN	46	91
SS1	51	27
SS2	52	1
SS VPWR	37/57	71/97
TCC	53	82
TCC VPWR	37/57	71/97
TFT	49	37
TR	30	64

3) Check Continuity Of Solenoid Signal & VPWR Harness Circuits Ensure ignition is off. Disconnect PCM connector, and inspect it for damaged pins, corrosion and loose wires. Repair as necessary. Install breakout box, leaving PCM disconnected. Measure and record resistance between applicable breakout box test pin and corresponding shift solenoid terminal at transmission harness connector terminal. See **Fig. 9**. See BREAKOUT BOX (BOB) TEST PIN IDENTIFICATION TABLE. Measure and record resistance between breakout box VPWR test pins and transmission harness connector VPWR terminal. If any resistance is more than 5 ohms, repair open circuit. Connect all components. Disconnect breakout box and repeat QUICK TEST. If each resistance is 5 ohms or less, go to next step.

4) Check Solenoid Harness For Shorts To Power & Ground Measure and record resistance between each shift solenoid test pins and VPWR test pins. Measure and record resistance between each shift solenoid test pin, breakout box ground test pins and chassis ground. If any resistance is less than 10 k/ohms, repair short circuit. Connect all components. Disconnect breakout box and repeat QUICK TEST. If each resistance is 10 k/ohms or more, go to next step.

5) Solenoid Functional Test Connect transmission tester. Perform solenoid function test. See tester instructions. If solenoid activates (LED Green), go to next step. If solenoid does not activate, go to step 7).

6) Transmission Drive Test Perform tester drive test. See tester instructions. If vehicle upshifts when operated with tester, replace PCM. Perform TRANSMISSION DRIVE CYCLE TEST. Repeat QUICK TEST. If DTCs are still present, go to TROUBLE SHOOTING in **AUTO TRANS OVERHAUL - FORD 4R70W** article. If vehicle does not upshift when operated by tester, go to next step.

7) Check Resistance Of Solenoid Set tester Bench/Drive switch to BENCH mode. Set Solenoid Select switch to OHMS CHECK. Connect ohmmeter negative lead to SS1 jack and positive lead to VPWR jack on tester. Measure and record resistance. Connect ohmmeter negative lead to SS2 jack and positive lead to VPWR jack on tester. Measure and record resistance. Resistance for each solenoid should be 20-30 ohms. If resistance is within specification, go to next step. If resistance is not within specification, go to step 9).

8) Check Solenoid For Short To Ground Check continuity between BAT (-) terminal and between SS1 and SS2. Check continuity between BAT (-) terminal and each VPWR terminal. If continuity exists for any circuit, go to next step. If continuity does not exist, go to TROUBLE SHOOTING in **AUTO TRANS OVERHAUL - FORD 4R70W** article.

9) 4R70W Internal Electronic Diagnostics Drain transmission fluid. Remove transmission oil pan. Inspect all internal harness connectors. Ensure all connectors are fully connected and not damaged. Repair as needed. Install all components in reverse order of disassembly. Fill transmission with fluid. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST. If all connectors are okay, go to next step.

10) Check Internal Harness Continuity Disconnect internal harness from solenoid assembly. To test SS1, connect positive lead of ohmmeter to tester SS1 jack and negative lead to solenoid connector White wire. Measure and record resistance. To test SS2, connect positive lead of ohmmeter to tester SS2 jack and negative lead to solenoid connector Black wire. Measure and record resistance. To test SS1 and SS2 VPWR circuits, connect positive lead of ohmmeter to solenoid connector White/Black wire. Connect negative lead to corresponding VPWR tester terminal. Measure and record resistance. If all resistances are .5 ohms or less, go to next step. If any resistance is more than .5 ohms, replace internal harness. Go to step 12).

11) Check Internal Harness For Shorts To Ground Using transmission tester, check continuity between each solenoid lead and BAT (-) terminal of tester. If continuity does not exist in any circuit, go to next step. If continuity exists in any circuit, replace internal harness. Go to next step.

12) Check Solenoid Resistance Using ohmmeter, check resistance between terminals of each solenoid. Resistance should be 20-30 ohms. If resistance is within specification, go to next step. If resistance for either solenoid is not within specification, replace solenoid assembly. Install all components in reverse order of disassembly. Fill transmission with fluid. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST.

13) Check Solenoid For Short To Ground Using ohmmeter, check continuity between each solenoid terminal and ground. If continuity exists, replace shift solenoid assembly. If continuity does not exist, go to TROUBLE SHOOTING in FORD 4R70W article. Install all components in reverse order of disassembly. Fill transmission with fluid. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST.

PINPOINT TEST B - TFT ELECTRICAL CIRCUIT

1) Visual Check Check transmission harness connector. Inspect connector for damaged pins, corrosion and loose wires. Repair as necessary. Go to next step.

2) Check Electrical Signal Operation Ensure ignition is off. Disconnect transmission connector. Using DVOM, connect positive lead to transmission harness connector TFT terminal and negative lead to SIG RTN terminal. See **Fig. 9**. Turn ignition on. If voltage is 4.75-5.25 volts, go to step 5). If voltage is not within specification, go to next step.

3) Check Continuity Of TFT & Signal Return (SIG RTN) Circuits Turn ignition off. Disconnect PCM connector, and inspect it for damaged pins, corrosion and loose wires. Repair as necessary. Install breakout box, leaving PCM disconnected. Measure and record resistance between applicable breakout box TFT test pin and transmission harness connector TFT terminal. See **Fig. 9**. Measure and record resistance between applicable SIG RTN test pin and transmission harness connector SIG RTN terminal. If each resistance is less than 5 ohms, go to next step. If any resistance is more than 5 ohms, repair open circuit. Connect all components. Erase trouble codes. See CLEARING CODES. Repeat QUICK TEST.

4) Check TFT Circuit For Short To VPWR & Ground Ensure ignition is off. Disconnect PCM connector, and inspect it for damaged pins, corrosion and loose wires. Repair as necessary. Install breakout box, leaving PCM disconnected. Measure and record resistance between breakout box TFT test pin and VPWR test pins. Measure and record resistance between TFT test pin, breakout box ground test pins and chassis ground. If any resistance is less than 10 k/ohms, repair short circuit. Disconnect breakout box and repeat QUICK TEST. If each resistance is 10 k/ohms or more, go to next step.

NOTE: DTC 637/P0713 is set if resistance exceeds 869 ohms (open circuit). DTC 638/P0712 is set if resistance is below 597 ohms (short circuit).

5) Check Resistance Of TFT Sensor/Harness Install transmission tester. Set tester Bench/Drive switch to BENCH mode. Set Solenoid Select switch to OHMS CHECK. Connect ohmmeter lead to appropriate TFT jacks. Measure and record resistance. Resistance should be within specification. See TFT TEMPERATURE/ RESISTANCE TABLE. If resistance is within specification for specific temperature, either warm up transmission or allow transmission to cool to check resistance at different temperatures. If resistance remains within specification, go to next step. If resistance is not within specification, go to step 7).

TFT TEMPERATURE/RESISTANCE

Temperature °F (°C)	Resistance K/Ohms
32-58 (0-20)	37-100
59-104 (21-40)	16-37
105-158 (41-70)	5-16
159-194 (71-90)	2.7-5
195-230 (91-110)	1.5-2.7
231-266 (111-130)	.8-1.5

6) Check TFT Sensor For Short To Ground Check continuity between BAT (-) tester terminal and each TFT terminal. If continuity exists, go to next step. If continuity does not exist, replace PCM. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST. See **AUTO TRANS OVERHAUL - FORD 4R70W** article for non-electronic symptom diagnostics.

7) 4R70W Internal Electronic Diagnostics Drain transmission fluid. Remove transmission oil pan.

Inspect all internal harness connectors. Ensure all connectors are fully connected and not damaged. Repair as needed. Install all components in reverse order of disassembly. Fill transmission with fluid. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST. If all connectors are okay, go to next step.

8) Check Internal Harness Continuity Disconnect internal harness from TFT sensor. Connect positive lead of ohmmeter to tester TFT (+) jack and negative lead to TFT White/Red wire. Measure and record resistance. Connect positive lead of ohmmeter to tester TFT (-) jack and negative lead to TFT Red wire. If each resistance is .5 ohms or less, go to next step. If either resistance is more than .5 ohms, replace internal harness. Go to step 10).

9) Check Internal Harness For Shorts To Ground Using transmission tester, check continuity between each TFT sensor connector terminal and BAT (-) terminal of tester. If continuity does not exist in any circuit, go to next step. If continuity exists in any circuit, replace internal harness. Go to next step.

10) Check TFT Sensor Resistance Using ohmmeter, check resistance between terminals TFT sensor. See **TFT TEMPERATURE/RESISTANCE TABLE**. If resistance is within specification for specific temperature, go to next step. If resistance is not within specification, replace TFT sensor. Install all components in reverse order of disassembly. Fill transmission with fluid. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST.

11) Check Solenoid For Short To Ground Using ohmmeter, check continuity between each TFT sensor terminal and ground. If continuity exists, replace faulty TFT sensor. If continuity does not exist, install all components in reverse order of disassembly. Fill transmission with fluid. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST, see appropriate TESTS W/CODES article in the ENGINE PERFORMANCE section to diagnose vehicle harness or PCM malfunctions.

PINPOINT TEST C - TCC ELECTRICAL CIRCUIT

NOTE: Transmission tester TCC terminals may be designated MCCC. Refer to TESTER INSTRUCTIONS.

1) 4R70W Electronic Diagnostics Ensure transmission harness connector is in acceptable condition. Repair as necessary. Perform KOEO test until Continuous Memory trouble codes have been displayed. See QUICK TEST. Depress throttle to WOT and release. If vehicle enters Output State, go to next step. If vehicle will not enter Output State, see appropriate TESTS W/CODES article in the ENGINE PERFORMANCE section.

2) Check Electrical Signal Operation Disconnect transmission harness connector. Inspect condition of connector and repair as needed. Using DVOM (20-volt scale), connect positive lead to transmission harness connector VPWR terminal. See **Fig. 9**. Connect negative lead to TCC terminal. Depress and release throttle to cycle solenoid output. If voltage changes at least .5 volts, go to step 5). If voltage is unaffected, go to next step.

3) Check Continuity Of Solenoid Signal & VPWR Harness Circuits Ensure ignition is off. Disconnect PCM connector, and inspect it for damaged pins, corrosion and loose wires. Repair as necessary. Install breakout box, leaving PCM disconnected. Measure and record resistance between applicable breakout box TCC test pin and transmission harness connector TCC terminal. See **Fig. 9**. Measure and record resistance between applicable VPWR test pins and transmission harness connector VPWR terminal. If any resistance is more than 5 ohms, repair open circuit. Connect all components. Disconnect breakout box and repeat QUICK TEST. If resistance is 5 ohms or less, go to next step.

4) Check Solenoid Harness For Shorts To Power & Ground Measure and record resistance between applicable TCC test pin and VPWR test pins. Measure and record resistance between applicable TCC test pin, breakout box ground test pins and chassis ground. If any resistance is less

than 10 k/ohms, repair short circuit. Connect all components. Disconnect breakout box and repeat QUICK TEST. If each resistance is 10 k/ohms or more, go to next step.

5) Solenoid Functional Test Connect transmission tester. Perform TCC solenoid function test. See tester instructions. If solenoid activates (LED Green), go to next step. If solenoid does not activate, go to step 7).

6) Transmission Drive Test Perform tester drive test. See tester instructions. When transmission has shifted into 2nd gear, depress MCCC switch on tester. If engine RPM decreases when operated with tester, replace PCM. Erase trouble codes. See CLEARING CODES. Road test vehicle and repeat QUICK TEST. If symptom or DTC is still present, go to TROUBLE SHOOTING in **AUTO TRANS OVERHAUL - FORD 4R70W** article. If engine RPM does not decrease when operated by tester, go to next step.

7) Check Resistance Of Solenoid Set tester Bench/Drive switch to BENCH mode. Set Solenoid Select switch to OHMS CHECK. Connect ohmmeter negative lead to MCCC TCC jack and positive lead to MCCC VPWR jack on tester. Measure resistance. Resistance should be 1-3 ohms (1995 models) or 10-16 ohms (1996 models). If resistance is within specification, go to next step. If resistance is not within specification, go to step 9).

8) Check Solenoid For Short To Ground Check continuity between BAT (-) tester terminal and each MCCC terminal. If continuity exists, go to next step. If continuity does not exist, Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST. See TROUBLE SHOOTING in **AUTO TRANS OVERHAUL - FORD 4R70W** article for non-electronic symptom diagnostics.

9) 4R70W Internal Electronic Diagnostics Drain transmission fluid. Remove transmission oil pan. Inspect all internal harness connectors. Ensure all connectors are fully connected and not damaged. Repair as needed. Install all components in reverse order of disassembly. Fill transmission with fluid. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST. If all connectors are okay, go to next step.

10) Check Internal Harness Continuity Disconnect internal harness from TCC sensor. Connect positive lead of ohmmeter to tester MCCC TCC jack and negative lead to TCC connector Green wire terminal. Measure and record resistance. Connect positive lead of ohmmeter to tester VPWR jack and negative lead to TCC connector White/Green wire terminal. If each resistance is .5 ohms or less, go to next step. If any resistance is more than .5 ohms, replace internal harness. Go to step 12).

11) Check Internal Harness For Shorts To Ground Using transmission tester, check continuity between each TCC sensor connector terminal and BAT (-) terminal of tester. If continuity does not exist in either circuit, go to next step. If continuity exists in either circuit, replace internal harness. Go to next step.

12) Check TCC Solenoid Resistance Using ohmmeter, check resistance between TCC solenoid terminals. If resistance is 1-3 ohms (1995 models) or 10-16 ohms (1996 models), go to next step. If resistance is not within specification, replace TCC solenoid assembly. Install all components in reverse order of disassembly. Fill transmission with fluid. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST.

13) Check Solenoid For Short To Ground Using ohmmeter, check continuity between each TCC solenoid terminal and ground. If continuity exists, replace faulty TCC solenoid. Install all components in reverse order of disassembly. Fill transmission with fluid. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST. If continuity does not exist, install all components in reverse order of disassembly. Fill transmission with fluid. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST. See TROUBLE SHOOTING in **AUTO TRANS OVERHAUL - FORD 4R70W** article for non-electronic symptom diagnostics.

PINPOINT TEST D - TRANSMISSION RANGE (TR) SENSOR

NOTE: DTC 634/P1705 may be set if transmission is not in park or A/C is on when QUICK TEST is performed.

1) Preliminary Inspection Disconnect TR sensor connector, and inspect it for damaged pins, corrosion and loose wires. Repair as necessary. Reconnect TR sensor connector. Ensure TR sensor is correctly adjusted. See FORD 4R70W article. If sensor requires adjustment, clear trouble codes after adjustment. See CLEARING CODES. Repeat QUICK TEST. If sensor is correctly adjusted, go to next step.

2) Check Electrical Signal Operation Ensure ignition is off. Disconnect TR harness connector. Turn ignition on. Measure voltage at harness connector terminals No. 6 and 7. See **Fig. 10**. If voltage is 4.75-5.25 volts, go to step 5). If voltage is not within specification, go to next step.

3) Check Continuity Of TR Sensor Harness Circuits Turn ignition off. Disconnect PCM connector, and inspect it for damaged pins, corrosion and loose wires. Repair as necessary. Install breakout box, leaving PCM disconnected. Measure and record resistance between applicable breakout box SIG RTN test pin and TR sensor harness connector terminal No. 7. See BREAKOUT BOX (BOB) TEST PIN IDENTIFICATION TABLE. See **Fig. 10**. Measure and record resistance between applicable breakout box TR test pin and TR sensor harness connector terminal No. 6. If each resistance is less than 5 ohms, go to next step. If either resistance is more than 5 ohms, repair open circuit. Remove breakout box and connect all components. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST.

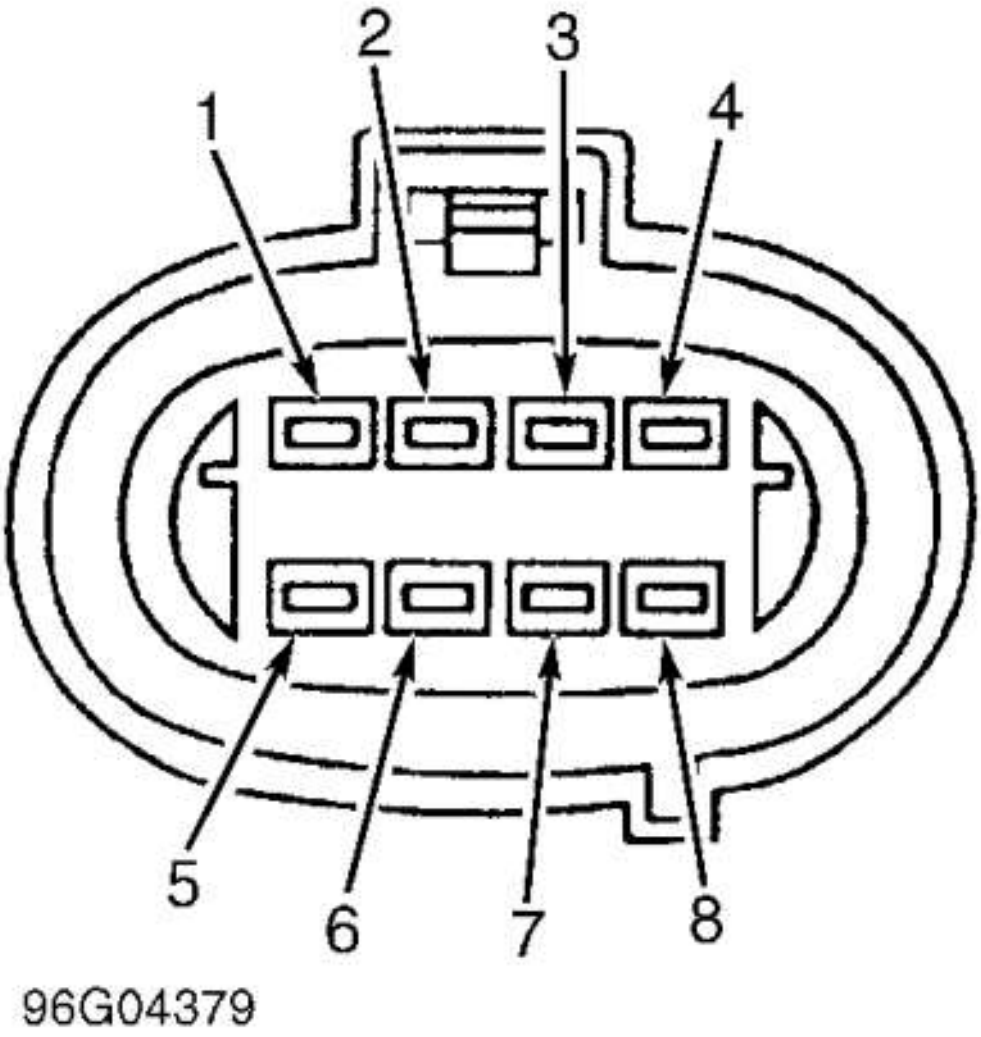

Fig. 10: Identifying Transmission Harness Connector

TR SENSOR WIRE COLOR IDENTIFICATION

Terminal No.	Wire Color	Circuit Identification
1	Red/Light Blue	Starter Control
2	(1) White/Light Blue	Fused Ignition Feed
3	Black/Pink	Backup Lights
4	Pink	Starter Control-To-PCM
5	Black	Ground
6	Light Blue/Yellow	TR Sensor-To-PCM
7	Gray/Red	Signal Return
8	Red/White	4WD Low-Neutral

(1) Purple/Orange on 1996 models.

4) Check TR Circuit For Shorts To Power & Ground Ensure TR sensor harness connector is disconnected. Measure resistance between applicable breakout box TR test pin and VPWR test pins. Measure resistance between applicable breakout box TR test pin, breakout box ground test pins and chassis ground. If each measurement is more than 10 k/ohms, go to next step. If any measurement is less than 10 k/ohms, repair short circuit. Remove breakout box and connect all components. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST.

5) Check TR Sensor Resistance Install TR overlay on transmission tester. Connect tester to TR sensor. Check continuity and resistances in all positions. See **Fig. 11**. If TR sensor does not operate within specification, replace sensor. Connect all components. Erase all trouble codes. Refer to CLEARING CODES. Repeat QUICK TEST. If sensor operates within specification, connect all components. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST. See **AUTO TRANS OVERHAUL - FORD 4R70W** article for non-electronic symptom diagnostics. See appropriate TESTS W/CODES article in the ENGINE PERFORMANCE section to diagnose intermittent faults.

Transmission Range Selector Lever Position	Resistance (ohms)		Voltage Range
	Min	Max	
P	3770	4607	3.97-4.85
R	1304	1593	3.24-3.96
N	660	807	2.55-3.11
D	361	442	1.88-2.30
2	190	232	1.23-1.51
1	78	95	0.61-0.75

G94C38457

Fig. 11: TR Resistance Specification Chart

PINPOINT TEST E - EPC SOLENOID

1) 4R70W Electronic Diagnostics Ensure transmission harness connector is in acceptable condition. Repair as necessary. Perform KOEO test until Continuous Memory trouble code(s) have been displayed. See QUICK TEST. Depress throttle to WOT and release. If vehicle enters Output State, go to next step. If vehicle will not enter Output State, see appropriate TESTS W/CODES article in the ENGINE PERFORMANCE section.

2) Check Electrical Signal Operation Disconnect transmission harness connector. Inspect condition of connector and repair as needed. Using DVOM (20-volt scale), connect positive lead to transmission

harness connector VPWR terminal. See **Fig. 9**. Connect negative lead to EPC terminal. Depress and release throttle to cycle solenoid output. If voltage changes at least .5 volt, go to step 5). If voltage is unaffected, go to next step.

3) Check Continuity Of Solenoid Signal & VPWR Harness Circuit Turn ignition off. Disconnect PCM connector, and inspect it for damaged pins, corrosion and loose wires. Repair as necessary. Install breakout box, leaving PCM disconnected. Measure and record resistance between transmission harness connector EPC VPWR terminal and applicable breakout box VPWR test pins. See **Fig. 9**. Measure and record resistance between transmission harness connector EPC terminal and breakout box EPC test pin. If each resistance is 5 ohms or less, go to next step. If any resistance is more than 5 ohms, repair open circuit. Connect all components. Erase all trouble codes. Refer to CLEARING CODES. Repeat QUICK TEST.

4) Check Harness For Short To Power Or Ground Measure and record resistance between applicable breakout box EPC test pin and VPWR test pins. Measure and record resistance between EPC test pin, breakout box ground test pins and chassis ground. If any resistance is less than 10 k/ohms, repair short circuit. Disconnect breakout box and repeat QUICK TEST. If each resistance is 10 k/ohms or more, go to next step.

5) EPC Functional Test Disconnect transmission harness connector. Connect transmission tester. Connect line pressure gauge. See **AUTO TRANS OVERHAUL - FORD 4R70W** article. Set Bench/Drive switch to DRIVE mode. Set Gear Select switch to 1st gear position. Perform EPC function test. See tester instructions. Observe line pressure on gauge while depressing EPC switch (KOER). EPC solenoid should activate (LED Green) and line pressure should drop when EPC switch is depressed. If solenoid operates correctly, replace PCM. Connect all components. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST. If solenoid is not operating, go to next step.

6) Check Resistance Of Solenoid Ensure tester power is off. Set Bench/Drive switch to BENCH mode. Connect ohmmeter negative lead to EPC jack. Connect positive lead to VPWR jack. If resistance is 2.48-5.66 ohms, go to next step. If resistance is not within specifications, go to step 8).

7) Check Solenoid For Short To Ground Check continuity between BAT (-) terminal of transmission tester and each EPC jack. If continuity exists, go to next step. If continuity does not exist, see TROUBLE SHOOTING in **AUTO TRANS OVERHAUL - FORD 4R70W** article.

8) 4R70W Internal Electronic Diagnostics Drain transmission fluid. Remove transmission oil pan. Inspect all internal harness connectors. Ensure all connectors are fully connected and not damaged. Repair as needed. Install all components in reverse order of disassembly. Fill transmission with fluid. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST. If all connectors are okay, go to next step.

9) Check Internal Harness Continuity Disconnect internal harness from EPC solenoid assembly. Connect positive lead of ohmmeter to tester EPC jack and negative lead to EPC connector Blue wire terminal. Measure and record resistance. Connect positive lead of ohmmeter to tester VPWR jack and negative lead to EPC connector White/Blue wire terminal. If each resistance is .5 ohms or less, go to next step. If any resistance is more than .5 ohms, replace internal harness. Go to step 11).

10) Check Internal Harness For Shorts To Ground Using transmission tester, check continuity between each EPC sensor connector terminal and BAT (-) terminal of tester. If continuity does not exist in either circuit, go to next step. If continuity exists in either circuit, replace internal harness. Go to next step.

11) Check EPC Solenoid Resistance Using ohmmeter, check resistance between EPC solenoid terminals. Resistance should be 2.48-5.66 ohms. If resistance is within specification, go to next step. If resistance is not within specification, replace EPC solenoid. Install all components in reverse order of disassembly. Fill transmission with fluid. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST.

12) Check Solenoid For Short To Ground Using ohmmeter, check continuity between each EPC

solenoid terminal and ground. If continuity exists, replace faulty EPC solenoid. Install all components in reverse order of disassembly. Fill transmission with fluid. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST. If continuity does not exist, install all components in reverse order of disassembly. Fill transmission with fluid. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST. See TROUBLE SHOOTING in **AUTO TRANS OVERHAUL - FORD 4R70W** article for non-electronic symptom diagnostics.

PINPOINT TEST F - OUTPUT SHAFT SPEED (OSS) SENSOR

1) Visual Check Inspect condition of OSS harness and component connector. Repair as needed. Go to next step.

2) Check Continuity Of OSS Harness Circuit Turn ignition off. Disconnect PCM connector, and inspect it for damaged pins, corrosion and loose wires. Repair as necessary. Install breakout box, leaving PCM disconnected. Disconnect OSS harness connector. Measure and record resistance between applicable breakout box OSS test pin and OSS harness connector positive terminal. See **Fig. 12**. Measure and record resistance between applicable breakout box SIG RTN test pin and OSS harness connector negative terminal. If each resistance is 5 ohms or less, go to next step. If any resistance is more than 5 ohms, repair open circuit. Connect all components. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST.

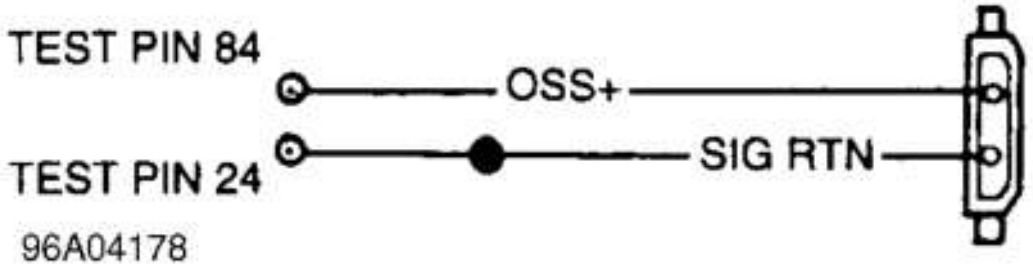

Fig. 12: Identifying OSS Harness Connector

3) Check OSS Circuit For Short To Power & Ground Measure and record resistance between applicable breakout box OSS and SIG RTN test pins, and VPWR test pins. Measure and record resistance between OSS and SIG RTN test pins, breakout box ground test pins and chassis ground. If any resistance is less than 10 k/ohms, repair short circuit. Connect all components. Disconnect breakout box and repeat QUICK TEST. If each resistance is 10 k/ohms or more, go to next step.

4) OSS Functional Test Ensure OSS harness connector is disconnected. Connect transmission tester to OSS component connector. Connect voltmeter leads to appropriate tester OSS jacks. Set voltmeter to 20 volt A/C scale. Perform drive cycle test. See TRANSMISSION DRIVE CYCLE TEST. If voltage increases with vehicle speed, replace PCM. Connect all components. Erase all trouble codes. See CLEARING CODES. Repeat QUICK TEST. If voltage does not increase with speed, go to next step.

5) Check Resistance Of OSS Connect ohmmeter leads to appropriate transmission tester OSS jacks. If resistance is 450-750 ohms, go to next step. If resistance is not within specification, replace OSS. Connect all components. Erase all trouble codes. See CLEARING CODES. Perform drive cycle test. See TRANSMISSION DRIVE CYCLE TEST. Repeat QUICK TEST.

6) Check OSS For Short To Ground Check for continuity between each OSS jack and tester BAT (-) jack. If continuity does not exist, go to next step. If continuity exists, replace OSS. Connect all components. Erase all trouble codes. See CLEARING CODES. Perform drive cycle test. See TRANSMISSION DRIVE CYCLE TEST. Repeat QUICK TEST.

7) Check OSS Magnetism Remove OSS from transmission. See **AUTO TRANS OVERHAUL - FORD 4R70W** article. Determine if OSS magnetically attracted to ferrous metal. If OSS acts like a magnet, go to next step. If OSS does not stick to ferrous metal surface, replace OSS. Connect all components. Erase all trouble codes. See CLEARING CODES. Perform drive cycle test. See TRANSMISSION DRIVE CYCLE TEST. Repeat QUICK TEST.

8) Check Output Shaft Ring Gear With OSS removed, inspect condition of ring gear. Rotate driveshaft and ensure all 6 holes or indentations of ring gear are not damaged. Replace ring gear if damaged. See **AUTO TRANS OVERHAUL - FORD 4R70W** article. If ring gear is not damaged, replace OSS. Connect all components. Erase all trouble codes. See CLEARING CODES. Perform drive cycle test. See TRANSMISSION DRIVE CYCLE TEST. Repeat QUICK TEST.

EEC-IV CIRCUIT TESTS

NOTE: Procedures in CIRCUIT TESTS are written for the use of the following Ford Motor Co. test equipment:

- **Super Star II Tester (007-0041B)**
- **60-Pin Breakout Box (007-00033)**
- **Transmission Tester (007-0085C)**

Terminal pin references are based on this equipment and appropriate overlays. All references to "test pins", "test terminals" or "jacks" refer to test equipment. When aftermarket test equipment is used, always follow test equipment manufacturer's procedures.

CIRCUIT TEST FD - BRAKE ON-OFF (BOO) SWITCH

Diagnostic Aids

Perform this test when directed by QUICK TEST. This test is intended to diagnose a faulty BOO switch circuit or PCM. To prevent replacement of good components, be aware following non-EEC related areas may be at fault:

- Brake light bulb.
- Brake light switch or brake light fuse.

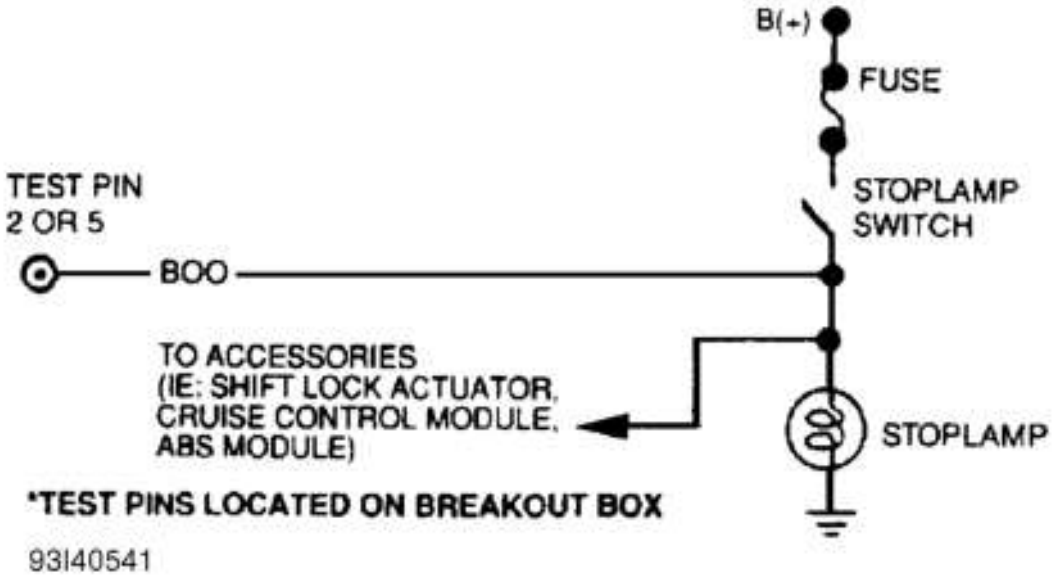

Fig. 13: BOO Switch Circuit

TEST PIN WIRE COLOR IDENTIFICATION

Application	Wire Color
No. 2 (BOO)	Light Green

1) DTC 536: Verify Brake Pedal Was Depressed DTC 536 indicates that when brake pedal is applied during KOER SELF-TEST, BOO signal did not cycle high and low. Possible causes for this fault are:

- Brake pedal not applied during self-test.
- Brake pedal applied during entire self-test.
- Open brake light circuit.
- Short to ground or power.
- Faulty brake light switch.
- Faulty Powertrain Control Module (PCM).

If brake was not applied during KOER SELF-TEST, repeat test. Depress and release brake pedal only once during test. If pedal was depressed, go to next step.

2) Check Operation Of Brake Lights With ignition on, check operation of brake lights. If brake lights operate normally, go to next step. If brake lights do not operate, go to step 4). If brake lights are always on,go to step 5).

3) Check For BOO Switch Circuit Cycling Turn ignition off. Disconnect PCM connector. Inspect terminals, and repair if damaged. Install breakout box, leaving PCM disconnected. Measure voltage between BOO test pin No. 2 and test pin No. 40 while applying and releasing brake. If voltage cycles, replace PCM. Remove breakout box and repeat QUICK TEST. If voltage does not cycle, repair open circuit in BOO switch circuit between PCM and BOO switch connection to brake light circuit. Repeat QUICK TEST.

4) Check For Power To BOO Switch Ensure related fuses and brake light bulbs are in good condition. Turn ignition off. Disconnect BOO switch (located on brake pedal). Measure voltage between BAT (+) input to BOO switch and ground. If voltage is greater than 10 volts, check condition of BOO switch. If BOO switch is okay, repair open circuit between BOO switch and brake light ground. Repeat QUICK TEST. If voltage is less than 10 volts, repair open BAT (+) circuit to brake light switch and repeat QUICK TEST.

5) Verify BOO Switch Is Not Always Closed Turn ignition off. Disconnect BOO switch (located on brake pedal). Turn ignition on. If brake lights are still on, go to next step. If brake lights are not on, verify correct installation of BOO switch. If installation is okay, replace BOO switch and repeat QUICK TEST.

6) Check For Short To Power In PCM Turn ignition off. Disconnect PCM. Turn ignition on. Check brake lights. If brake lights are on, go to next step. If brake lights are not on, replace PCM and repeat QUICK TEST.

7) Check For Short To Power In Shift Lock Actuator Turn ignition off. Ensure PCM and brake light switch are disconnected. Disconnect shift lock actuator, cruise control module and ABS module (if equipped). Turn ignition on. If brake lights are still on, repair short to power in BOO or stoplight circuit and repeat QUICK TEST. If brake lights are not on, repair short circuit in shift lock actuator circuit, cruise control system circuit or ABS circuit. Repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 7) to step 90). No test procedures have been omitted.

90) DTC 536: Check For Proper Brake Light Switch Installation Continuous memory DTC 536 indicates a BOO circuit failure. If BOO input does not cycle after a predetermined number of transitions from 0 mph to a specific speed, the BOO input is assumed to be damaged and continuous memory DTC 536 is set. Possible causes of failure are:

- Incorrect brake light switch installation.
- Open brake light/BOO circuit.
- Brake Light/BOO circuit short.
- Damaged switch or ground circuit.

If switch is correctly installed and in good condition, go to next step. If switch or harness is damaged, service as needed, clear continuous memory repeat QUICK TEST.

91) Inspect Brake Light Ground Inspect brake light ground connection and harness connector. Repair as needed, clear continuous memory and repeat QUICK TEST. If connections are okay, go to next step.

92) Inspect Brake Light/BOO Circuits For Shorts With KOEO and brake pedal released, perform wiggle test of brakelight/BOO circuit harness and connectors while observing brake lights. If brake lights illuminate, inspect and repair circuits as needed, clear continuous memory and repeat QUICK TEST. If brake lights do not illuminate, go to next step.

93) Inspect Brake Light Circuit Continuity With ignition off, depress brake pedal and hold. Perform wiggle test of brake light circuits while observing brake lights. Lightly tap brake light switch while observing brake lights. If brake lights intermittently go out, inspect and repair circuits as needed, clear continuous memory and repeat QUICK TEST. If brake lights remain illuminated, go to next step.

94) Inspect BOO Circuit Continuity With ignition off, ensure brake pedal is released. Disconnect PCM connector. Inspect terminals, and repair if damaged. Install breakout box, leaving PCM

disconnected. Measure resistance between BOO test pin No. 2 and brake light circuit at switch while performing wiggle test on harness and connector. If resistance intermittently increases above 5 ohms, inspect and repair open circuit. Repeat QUICK TEST. If resistance is within specification, go to next step for further diagnosis.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 94) to step 99). No test procedures have been omitted.

99) Road Test Vehicle Purpose of this test is to identify faults by monitoring certain controlled parameters while trying to recreate a drive-ability or MIL symptom. To prepare for road test, complete the following:

- Install fuel pressure gauge and if available, a MAP/BARO tester.
- Disconnect PCM connector, install breakout box and reconnect PCM to breakout box.
- Connect "T" vacuum gauge into manifold vacuum line.
- Have DVOM, writing materials and appropriate schematics and pin voltage charts available.

With ignition on and negative lead of DVOM connected to negative battery terminal, ensure following signals are correct:

- POWER: KAPWR (pin No. 1) is greater than 10.5 volts, VPWR (pins No. 37 and 57) is greater than 10.5 volts and VREF (pin No. 26) is 4-6 volts.
- GROUNDS: PWR GND (pins No. 40 and 60), SIG RTN (pin No. 46) and IGN GND (pin No. 16) are 0.0-0.5 volt.
- OPTIONAL GROUNDS: HO2S GND (pin No. 49), CSE GND (pin No. 20) and MAF RTN (pin No. 9 or 15) are 0.0-0.5 volt.

Diagnostic Aids

Test lights and DVOM are useful during diagnosis. For example: a test light could be connected at brake light switch between battery and ground and another test light between switch bulb circuit and ground. Test light to battery circuit should always be illuminated and other test light should only illuminate when brake light is depressed.

With DVOM connected between test pins No. 2 and 40 at breakout box, check voltage. If voltage is 6-7 volts with brake pedal released, possible open circuit between PCM and brake light ground could exist.

CIRCUIT TEST KM - A/C DEMAND SWITCH

Diagnostic Aids

Perform this test when diagnosing a symptom. To prevent replacing good components, check the following non-EEC components and systems

- Refrigerant charge.
- Low ambient temperature (less than 45°F/7°C).

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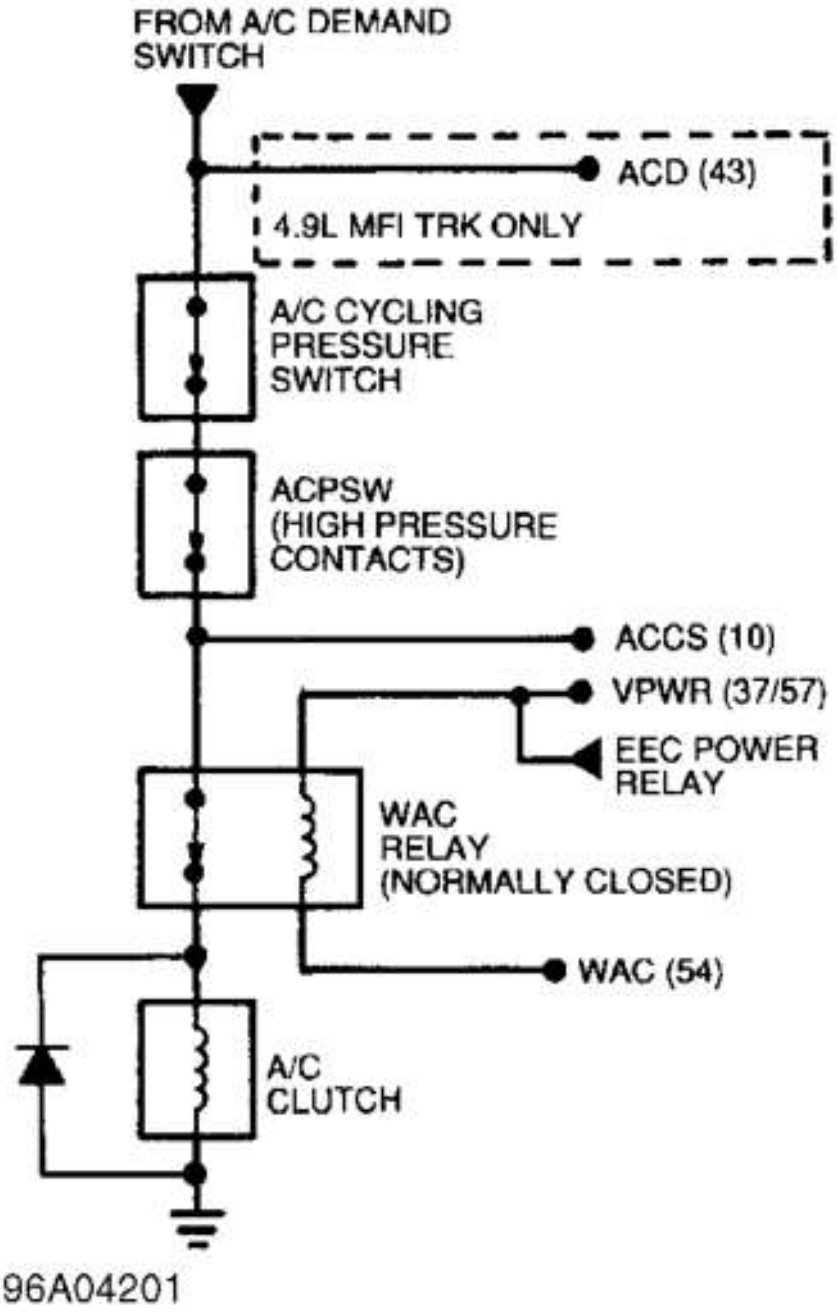

Fig. 14: WOT A/C Cut-Out Circuit

NOTE: This procedure starts with step 40). No test procedures have been omitted. Before performing this test, ensure A/C switch is off. If A/C switch was on, turn A/C off and repeat QUICK TEST.

40) DTC 539: Check A/C Input DTC 539 indicates ACCS input to PCM was high during KOEO/KOER SELF-TEST. Turn ignition off. Disconnect PCM connector. Inspect terminals, and

repair if damaged. Install breakout box, leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 10 at breakout box and chassis ground. If voltage is 1.0 volt or more, verify operation of A/C demand switch. If A/C demand switch is okay, repair short to power in A/C circuit and repeat QUICK TEST. If voltage is less than 1.0 volt, replace PCM. Remove breakout box and repeat QUICK TEST.

CIRCUIT TEST TB - TRANSMISSION CONTROL SWITCH (TCS)/INDICATOR LAMP (TCIL)

Diagnostic Aids

Perform this test when directed by QUICK TEST. This test is intended to diagnose a faulty Transmission Control Switch (TCS), Transmission Control Indicator Light, TCS/TCIL circuit or PCM. To prevent replacement of good components, ensure the following non-EEC related areas are not at fault:

- Engine condition (compression, cam timing, valves, etc.).
- Charging system or battery.
- Transmission fluid level and condition.

NOTE: This procedure begins with step 2). No test procedures have been omitted.

2) DTC 653: Verify TCS Was Cycled DTC 653 indicates that when TCS was cycled during KOER SELF-TEST, TCS signal did not cycle high and low. Possible causes for this fault are:

- TCS not cycled during self-test.
- Faulty TCS.
- Open TCS/TCIL circuit.
- Short to ground or power.
- Faulty Powertrain Control Module (PCM).

If TCS was not cycled during KOER SELF-TEST, repeat test. If switch was cycled, go to next step.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 2) to step 4). No test procedures have been omitted.

4) Check For TCS Circuit Cycling Turn ignition off. Disconnect PCM connector. Inspect terminals, and repair if damaged. Install breakout box, leaving PCM disconnected. Turn ignition on. Measure voltage between TCS test pin No. 41 and test pins No. 40 and 60 while cycling TCS. If voltage cycles, replace PCM and repeat QUICK TEST. If voltage does not cycle, go to next step.

5) Check TCS Circuit For Short To Ground Disconnect TCS connector. Inspect terminals, and repair if damaged. Measure resistance between test pin No. 41 and test pins No. 40 and 60. Measure resistance between test pin No. 32 ("E" and "F" Series) or No. 55 (Except "E" and "F" Series) and test pins No. 40 and 60. If each resistance is more than 10 k/ohms, go to step 8). If any resistance is less than 10 k/ohms, inspect and repair short circuit. Repeat QUICK TEST.

6) Check For Power Through TCIL Circuit Turn ignition on. Measure voltage between test pin No. 32 ("E" and "F" Series) or No. 55 (Except "E" and "F" Series) and test pins No. 40 and 60. If voltage is less than 10.5 volts, go to next step. If voltage is more than 10.5 volts, replace PCM and repeat QUICK TEST.

7) Check Output Driver Signal Turn ignition on. Measure voltage between test pin No. 32 ("E" and

"F" Series) or No. 55 (Except "E" and "F" Series) and ground jack on breakout box. If voltage is more than 2 volts, go to next step. If voltage is less than 2 volts, check fuse and TCIL bulb. If fuse and bulb are okay, inspect and repair open circuit. Repeat QUICK TEST.

8) Check Continuity Of TCS Harness Turn ignition off. Measure resistance between ignition power at fuse panel and power side of TCS connector. Measure resistance between test pin No. 41 and signal side of TCS connector. If each resistance is less than 5 ohms, go to next step. If either resistance is more than 5 ohms, inspect and repair open circuit. Repeat QUICK TEST.

9) Check Harness For Short To Power Turn ignition off. Ensure PCM and TCS are disconnected. Measure resistance between test pin No. 41 and test pins No. 37 and 57. Measure resistance between test pin No. 32 ("E" and "F" Series) or No. 55 (Except "E" and "F" Series) and test pins No. 37 and 57. If each resistance is more than 10 k/ohms, replace transmission control switch. Repeat QUICK TEST. If any resistance is less than 10 k/ohms, inspect and repair short circuit. Repeat QUICK TEST.

CIRCUIT TEST TG - TORQUE CONVERTOR CLUTCH (TCC) EXCESSIVE

SLIP INDICATED

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Wiring harness circuits (TCC).
- Faulty Powertrain Control Module (PCM).

NOTE: This procedure starts with step 90). No test procedures have been omitted.

90) Perform Drive Cycle Test Warm engine to normal operating temperature. Ensure transmission fluid level is correct. Shift transmission to drive "D". Press TCS on shifter handle. O/D OFF light should illuminate. Accelerate from stop to 40 mph. Hold speed for at least 15 seconds (30 seconds above 4000 ft.). Press TCS and accelerate to 50 mph. Hold speed for at least 15 seconds (30 seconds above 4000 ft.). Hold speed and throttle position steady for at least 15 seconds. While maintaining speed with transmission in 4th gear, lightly depress brake pedal and release (to operate stoplights). Hold speed for at least an additional 5 seconds. Bring vehicle to stop for at least 20 seconds with transmission in drive "D". Repeat drive cycle test at least 5 times. Perform QUICK TEST and record Continuous Memory Codes. If continuous memory DTC 628 is present, go to next step. If no codes are present and driveability symptoms still exist, see **PINPOINT TEST C** for further diagnosis of TCC solenoid.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 90) to step 92). No test procedures have been omitted.

92) Check Harness Circuits Connect scan tool to DLC. Access KOEO continuous monitor mode. Perform wiggle test of PCM and TCC circuit harness and connectors. If no faults are indicated, go to TROUBLE SHOOTING in FORD 4R70W article. If fault is indicated, inspect and repair circuits or replace components as needed. Clear continuous memory and repeat QUICK TEST.

EEC-V CIRCUIT TESTS

NOTE: **Procedures in CIRCUIT TESTS are written for the use of the following Ford Motor Co. test equipment:**

- **New Generation Star (NGS) Tester (007-00500)**
- **104-Pin Breakout Box (014-00950)**
- **Transmission Tester (007-0085D)**

Terminal pin references are based on this equipment and appropriate overlays. All references to "test pins", "test terminals" or "jacks" refer to test equipment. When aftermarket test equipment is used, always follow test equipment manufacturer's procedures.

CIRCUIT TEST FD - BRAKE ON-OFF (BOO) SWITCH

Diagnostic Aids

Perform this test when directed by QUICK TEST. This test is intended to diagnose a faulty BOO switch circuit or PCM. To prevent replacement of good components, be aware following non-EEC related areas may be at fault:

- Brake light bulb.
- Brake light switch or brake light fuse.

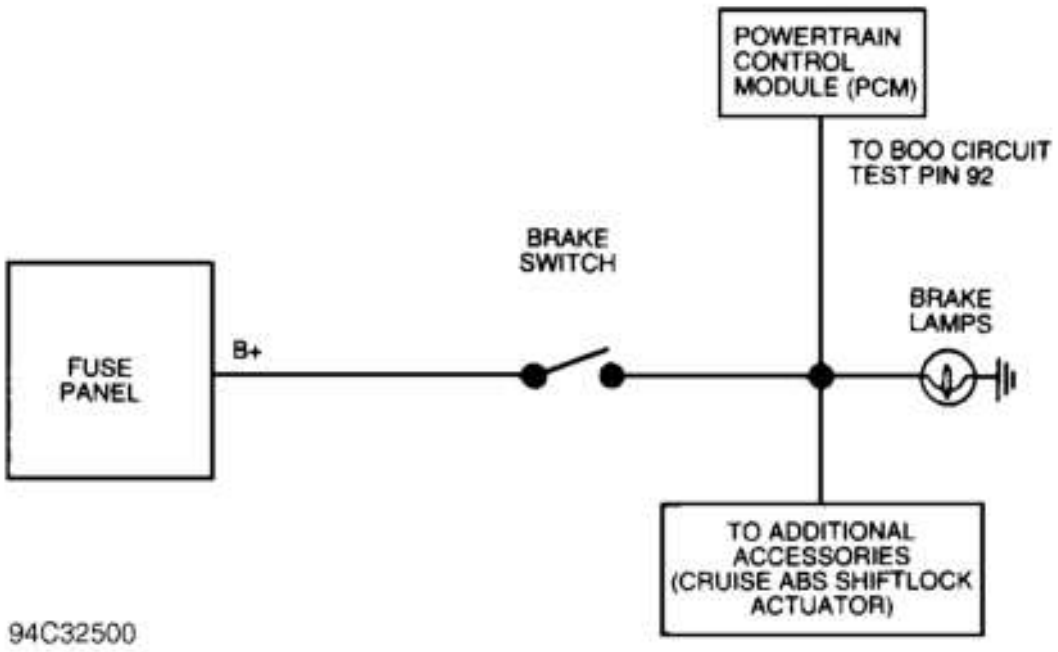

Fig. 15: BOO Switch Circuit

1) DTC P0703/P1703: Verify Brake Pedal Was Depressed This DTC indicates that when brake pedal is applied during KOER SELF-TEST, BOO signal did not cycle high and low. Possible causes for this fault are as follows:

- Brake pedal not applied during self-test.
- Brake pedal applied during entire self-test.
- Open brake light circuit.
- Short to ground or power.
- Faulty BOO switch.
- Faulty Powertrain Control Module (PCM).

If brake was not applied during KOER SELF-TEST, repeat test. Depress and release brake pedal only once during test. If pedal was depressed, go to step 3).

2) DTC P1703 This DTC indicates that voltage was present at BOO circuit during KOEO SELF-TEST. Possible causes for this fault are as follows:

- Brake pedal applied during KOEO self-test.
- BOO circuit short to or power.
- Faulty BOO switch.
- Faulty Powertrain Control Module (PCM).

If brake was applied during KOEO SELF-TEST, repeat test. If pedal was not depressed, go to next step.

3) Check Operation Of Brake Lights With ignition on, check operation of brake lights. If brake lights operate normally, go to next step. If brake lights do not operate, go to step 5). If brake lights are always on,go to step 6).

4) Check For PCM BOO PID Cycling If scan tool is not available or BOO PID is not accessible, go to step 10). Turn ignition on, engine off (KOEO). Access BOO PID using scan tool. Observe scan tool while applying and releasing brake. If BOO PID cycles, perform wiggle test of BOO switch and circuit and brake light harness and connectors while observing scan tool. If BOO PID changes abruptly, inspect and repair circuits or replace components as needed. Clear continuous memory and repeat QUICK TEST.

5) Check For Power To BOO Switch Ensure related fuses and brake light bulbs are in good condition. Turn ignition off. Disconnect BOO switch (located on brake pedal). Measure voltage between B (+) input to BOO switch and ground. If voltage is more than 10 volts, go to next step. If voltage is less than 10 volts, repair open in B (+) circuit to BOO switch and repeat QUICK TEST.

6) Verify Integrity Of BOO Switch Disconnect BOO switch connector. Measure resistance between BOO switch terminals while depressing brake pedal. If resistance is less than 5 ohms, repair open circuit between BOO switch and brake light ground. Repeat QUICK TEST. If resistance is more than 5 ohms, replace BOO switch and repeat QUICK TEST.

7) Verify BOO Switch Is Not Always Closed Turn ignition off. Disconnect BOO switch (located on brake pedal). Turn ignition on. If brake lights are still on, go to next step. If brake lights are not on, verify correct installation of BOO switch. If installation is okay, replace BOO switch and repeat QUICK TEST.

8) Check For Short To Power In PCM Turn ignition off. Disconnect PCM. Turn ignition on. Check brake lights. If brake lights are on, go to next step. If brake lights are off, replace PCM and repeat QUICK TEST.

9) Check For Short To Power In Shift Lock Actuator Turn ignition off. Ensure PCM and BOO switch are disconnected. Disconnect shift lock actuator, cruise control module, ABS module and Generic Electronic Module (if equipped). Turn ignition on. If brake lights are still on, repair short to

power in BOO circuit and repeat QUICK TEST. If brake lights are off, repair short circuit in shift lock actuator circuit, cruise control system circuit, ABS circuit or Generic Electronic Module circuit. Reconnect all components and repeat QUICK TEST.

10) Check For BOO Circuit Cycling Turn ignition off. Wait 10 seconds. Disconnect PCM pin connector. Inspect terminals, and repair if damaged. Install breakout box, leaving PCM disconnected. Measure voltage between BOO test pin No. 92 and test pins No. 51, 76 and 77 while applying and releasing brake. If voltage cycles, replace PCM and repeat QUICK TEST. If voltage does not cycle, repair open circuit in BOO switch circuit between PCM and BOO switch connection to brake light circuit. Repeat QUICK TEST.

CIRCUIT TEST KM - WOT A/C CUT-OFF (WAC)

NOTE: If vehicle is not equipped with A/C, DTC P1460 can be ignored.

Diagnostic Aids

Perform this test when directed by QUICK TEST. To prevent replacing good components, check the following non-EEC components and systems:

- Refrigerant charge.
- Low ambient temperature (less than 45°F).

1) DTC P1460: (KOEO/KOER) Check ACCS PID Is Off DTC P1460 indicates A/C was on during SELF-TEST or a WAC fault. Possible causes for this fault are:

- A/C on during self-test.
- Open or shorted circuit.
- Faulty WAC relay.
- Faulty PCM.
-

If A/C or defrost was on during KOER/KOER SELF-TEST, turn A/C off and repeat test. If A/C was not on, start engine. Using scan tool access ACCS PID. If ACCS PID is off, go to next step. If ACCS PID is on, go to step 20).

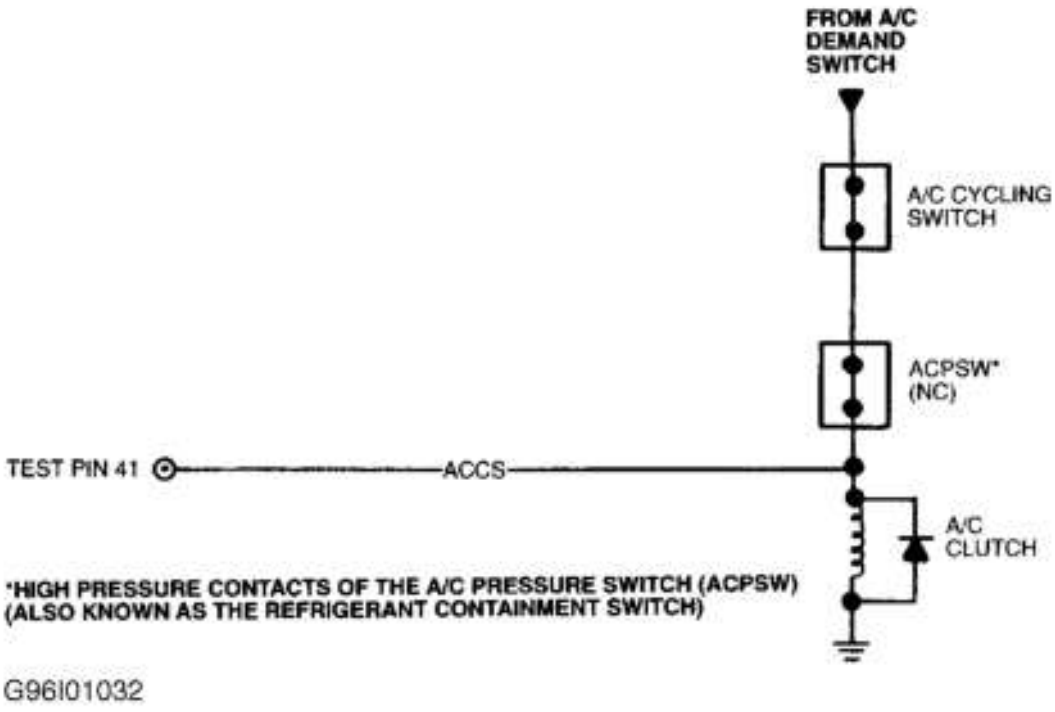

Fig. 16: WOT A/C Cut-Out Circuit ("E" & "F" Series)

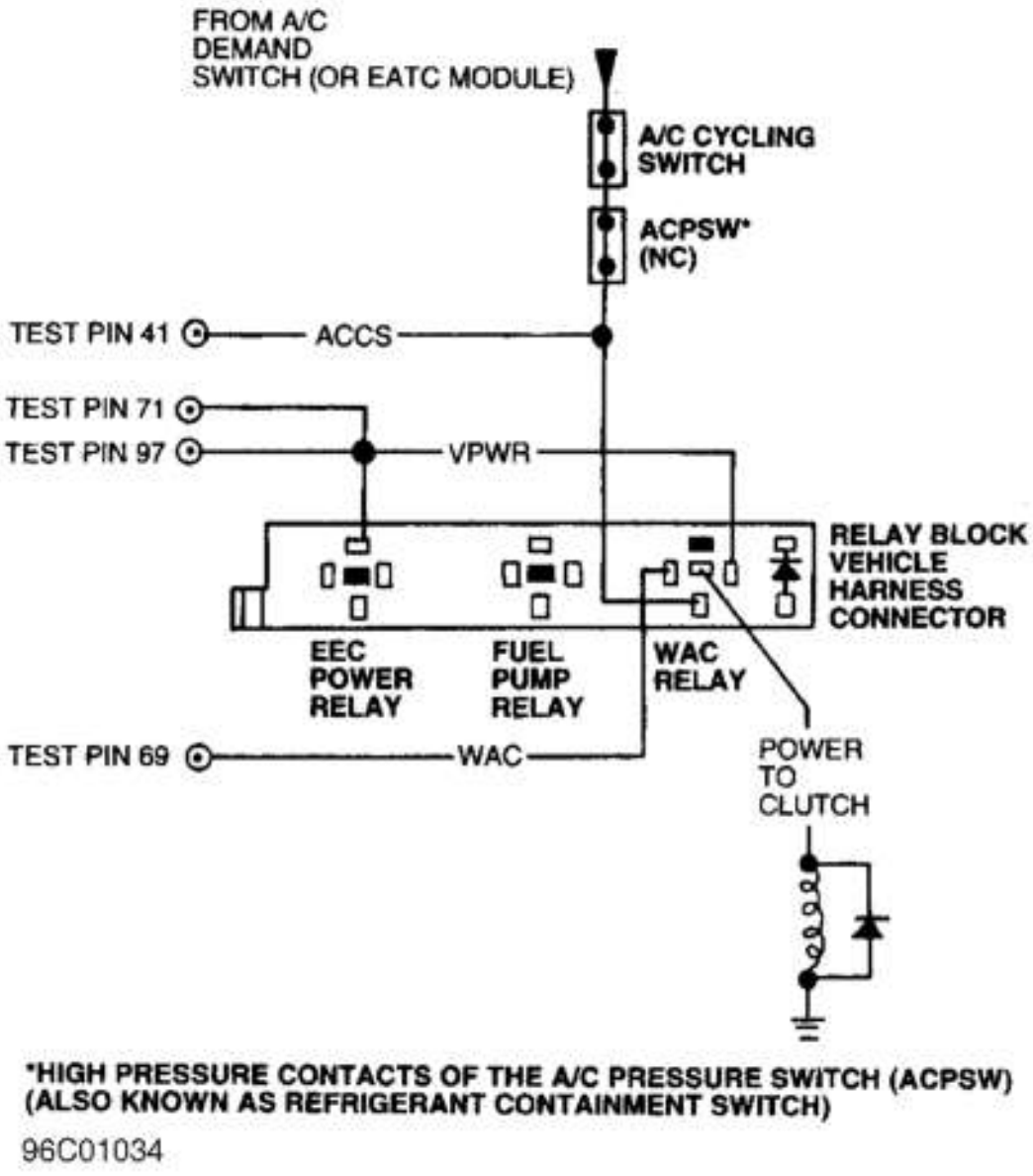

Fig. 17: WOT A/C Cut-Out Circuit (Except "E" & "F" Series)

2) Check For VPWR To WAC Relay Turn ignition off. Remove WAC relay. Turn ignition on. Measure voltage between relay connector terminal No. 86 (VPWR) and chassis ground. If voltage is more than 10.5 volts, go to next step. If voltage is less than 10.5 volts, repair open VPWR circuit. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat QUICK TEST.

3) Check WAC Relay Turn ignition off. Remove WAC relay. Measure resistance between relay terminal No. 85 and 86. Resistance should be 40-120 ohms. Measure resistance between terminal No. 85 and terminals No. 30, 87 and 87A. Resistance should be 10 k/ohms or more. If resistance is as specified, go to next step. If resistance is not as specified, replace WAC relay. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat QUICK TEST.

4) Check WAC Circuit For Short To Power Ensure ignition is off and WAC relay is removed.

Disconnect PCM connector. Inspect terminals, and repair if damaged. Install breakout box, leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 69 and chassis ground. If voltage is less than one volt, go to next step. If voltage is more than one volt, repair short to power in WAC circuit. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat QUICK TEST.

5) Check WAC Circuit For Short To Ground Ensure ignition is off. Disconnect scan tool from DLC. Measure resistance between test pin No. 69 and test pins No. 51, 91, and 103. If each resistance is 10 k/ohms or more, go to next step. If any resistance is less than 10 k/ohms, repair short to ground in WAC circuit. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat QUICK TEST.

6) Check WAC Circuit Continuity Ensure ignition is off. Measure resistance between relay connector terminal No. 85 (WAC) and test pin No. 69. If resistance is more than 5 ohms, repair open circuit. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat QUICK TEST. If resistance is less than 5 ohms, replace PCM. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 6) to step 20). No test procedures have been omitted.

20) ACCS PID On: Disconnect ACPSW & Check ACCS PID Is Off Turn ignition off. Disconnect A/C pressure switch. Turn ignition on. Using scan tool access ACCS PID. On all except "E" and "F" Series if ACCS PID is on, go to next step. On "E" and "F" Series if ACCS PID is on, go to step 22). If ACCS PID is off, turn ignition off. Check operation of A/C demand switch or EATC module. If switch is okay, repair short to power in A/C demand circuit to A/C pressure switch.

21) Check A/C Clutch Circuit For Short To Power Turn ignition off. Remove WAC relay. Turn ignition on. Measure voltage between power-to-clutch terminal of relay harness connector and chassis ground. If voltage is less than one volt, go to next step. If voltage is more than one volt, repair short to power. Connect all components and repeat QUICK TEST.

22) Check ACCS Circuit For Short To Power Ensure ignition is off and WAC relay is removed. Disconnect A/C pressure switch. Disconnect PCM connector. Inspect terminals, and repair if damaged. Install breakout box, leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 41 (ACCS) and test pins No. 51 and 103. On all except "E" and "F" Series, if voltage is less than one volt, go to next step. On "E" and "F" Series, if voltage is less than one volt, replace PCM. Connect all components and repeat QUICK TEST. If voltage is more than one volt, repair short to power in ACCS circuit. Remove breakout box, connect all components and repeat QUICK TEST.

23) Check ACCS Circuit Voltage To PCM Turn ignition off. Install WAC relay. Turn ignition on. Measure voltage between test pin No. 41 (ACCS) and test pins No. 51 and 103. If voltage is less than one volt, replace PCM. Remove breakout box, connect all components and repeat QUICK TEST. If voltage is more than one volt, replace WAC relay. Remove breakout box, connect all components and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 23) to step 30). No test procedures have been omitted.

30) DTC P1460: (Continuous Memory) Check WAC Circuit DTC P1460 indicates WAC circuit failure. Possible causes for this fault are:

- Open or shorted WAC circuit.
- Open VPWR to WAC relay.

Turn ignition off. Disconnect A/C cycling switch or low pressure switch connector. Connect jumper wire between harness terminals. Turn ignition and A/C switch on. Connect scan tool. Check for indication of fault while wiggling and bending WAC circuit between relay and PCM. Fault will be indicated by A/C clutch clicking on. Wiggle and bend WAC circuit between PCM (terminal No. 69) and relay. Lightly tap on WAC relay to simulate road shock. Check connectors for clean tight connection. If any faults are found, isolate and repair as necessary. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat QUICK TEST. If no faults are found, go to next step.

31) Check WAC Circuit For Intermittents Turn ignition off. Turn ignition and A/C on (engine off). Using scan tool, access Output Test Mode. Turn outputs off. Check for indication of fault while wiggling and bending WAC circuit between PCM (terminal No. 69) and WAC relay. Lightly tap on WAC relay to simulate road shock. Fault will be indicated by A/C clutch clicking off. Check connectors for clean tight connection. If any faults are found, isolate and repair as necessary. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat QUICK TEST. If no faults are found, fault cannot be duplicated at this time. Go to CIRCUIT TEST Z in appropriate TESTS W/CODES EEC-V article in the ENGINE PERFORMANCE section.

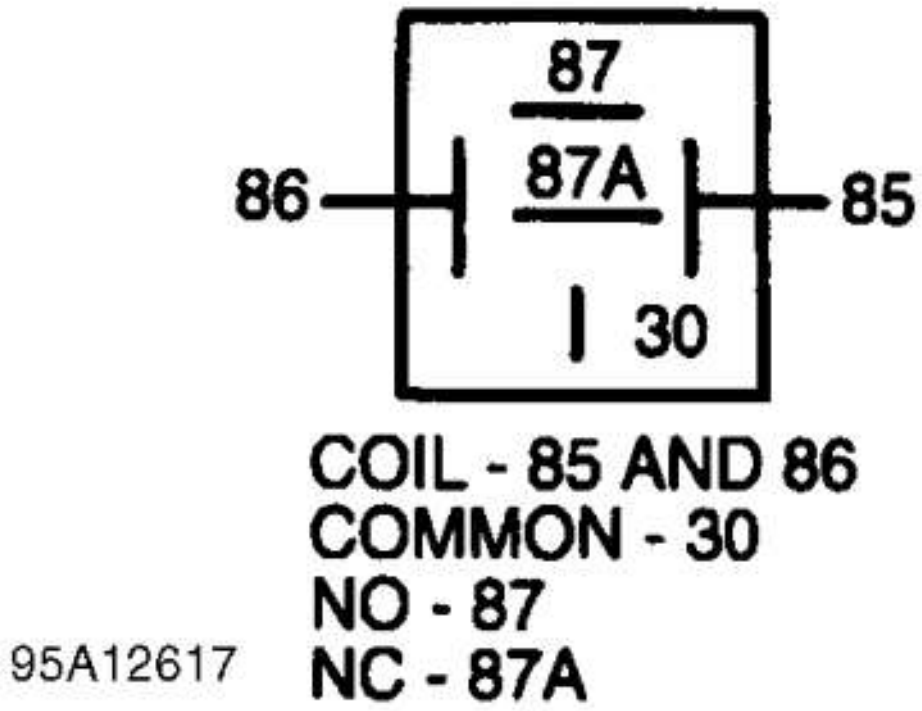

Fig. 18: A/C Relay Connector Terminals

CIRCUIT TEST TB - TRANSMISSION CONTROL SWITCH (TCS)/INDICATOR LAMP (TCIL)

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following

- Wiring harness circuits (TCIL & TCS).
- Faulty PCM.

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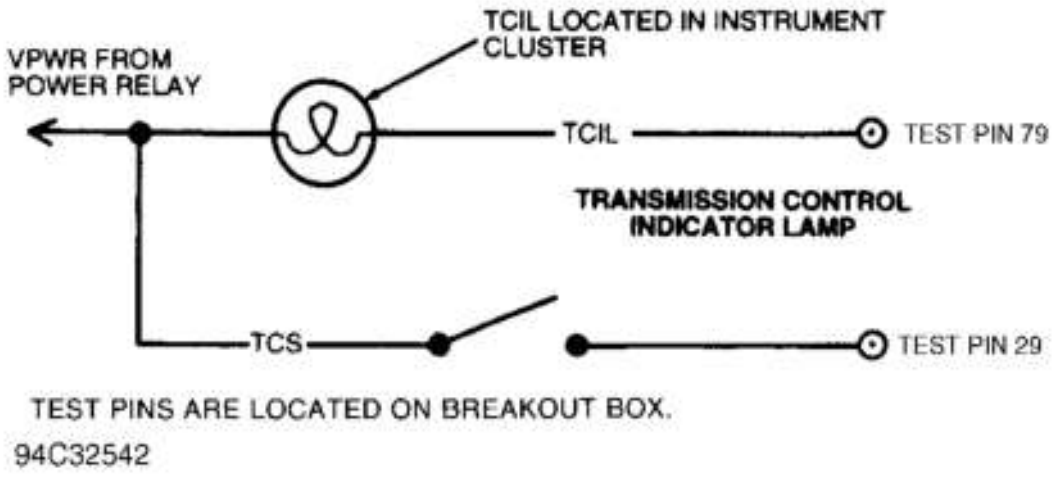

Fig. 19: TCIL & TCS Circuit Schematic

1) DTC P1780: Check Test Validity This DTC indicates that TCS was not cycled during KOER self-test. Possible causes are as follows:

- TCS not cycled during KOER self-test.
- TCS circuit damage.
- Faulty TCS.
- Faulty PCM.
- Repeat KOER self-test if TCS was not cycled in original test. If TCS was cycled during KOER self-test, go to next step.

2) Check TCS Circuit Voltage Turn ignition off. Disconnect PCM connector. Inspect pins for damage. Install breakout box, leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 29 (TCS) and test pins No. 24 and 77 (PWR GND) at breakout box while cycling TCS. If voltmeter reading does not cycle when TCS is cycled, go to next step. If voltmeter reading cycles when TCS is cycled, replace PCM and repeat QUICK TEST.

3) Check Circuit For Short To Ground Turn ignition off. Disconnect TCS. Inspect pins for damage and repair if necessary. Measure resistance between breakout box test pin No. 29 (TCS) and test pins No. 24 and 77 (PWR GND). If resistance is 10 k/ohms or more, go to next step. If resistance is less than 10 k/ohms, repair short circuit and repeat QUICK TEST.

4) Check Continuity Of TCS Circuits Leave ignition off. Connect ohmmeter positive lead to TCS

keypower at the fuse panel. Connect negative lead to power terminal of TCS harness connector. Measure resistance between test pin No. 29 and signal terminal of TCS harness connector. If each resistance is less than 5 ohms, go to next step. If either resistance is more than 5 ohms, repair open circuit and repeat QUICK TEST.

5) Check Circuit For Short To Power Leave ignition off. Measure resistance between breakout box test pin No. 29 (TCS) and test pins No. 71 and 97 (VPWR). If resistance is 10 k/ohms or more, replace TCS switch and repeat QUICK TEST. If resistance is less than 10 k/ohms, repair short circuit and repeat QUICK TEST.

6) TCIL Always On Turn ignition on. Cycle TCS. If TCIL does not cycle on and off, go to next step. If TCIL cycles on and off, fault is intermittent. Go to CIRCUIT TEST Z in appropriate TESTS W/CODES - EEC-V article in the ENGINE PERFORMANCE section.

7) Check Output Driver Signal Turn ignition off. Disconnect PCM connector. Inspect pins for damage and repair if necessary. Turn ignition on. If TCIL goes off, replace PCM. If TCIL remains on, repair TCIL circuit short to ground.

8) TCIL Will Not Turn On Perform KOER self-test. If DTC 1780 is not present, go to next step. If DTC 1780 is present, go to step 1).

9) Check Harness Circuits For Shorts Turn ignition off. Disconnect PCM connector. Inspect pins for damage and repair if necessary. Install breakout box, leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 79 (TCIL) and test pins No. 24 and 76 (PWR GND) at breakout box. If voltage is 2 volts or more, replace PCM. If voltage is less than 2 volts, check indicator bulb and fuse. If bulb and fuse are okay, repair open circuit between test pin No. 79 and ignition switch.