1975-79 COMPUTERIZED ENGINE CONTROLS
Ford Motor Co. Electronic Engine Control I

1978-79 Versailles

DESCRIPTION

The Electronic Engine Control I (EEC I) system is used on 1978-79 Versailles 302" engine equipped models. The system is designed to precisely control ignition timing, EGR flow rate, and Thermactor air injection system flow rate.

The EEC I system consists of an Electronic Control Assembly (ECA), 2 pressure sensors, 2 temperature sensors, 3 position sensors, Dura-Spark II ignition system, air pressure-operated EGR system, and Thermactor air by-pass solenoid.

The sensors monitor various engine and ambient conditions and send electrical signals to the ECA for processing. The ECA computes the correct ignition timing, EGR flow rate, and Thermactor air injection flow rate for the best performance and emission control.

OPERATION

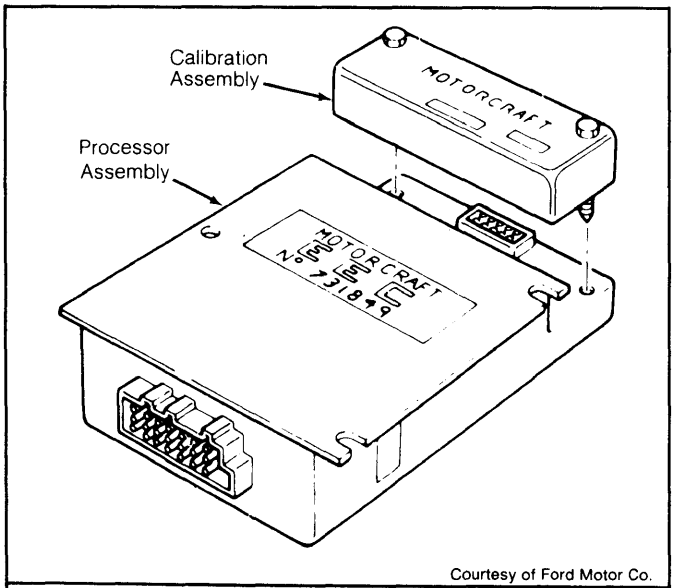
ELECTRONIC CONTROL ASSEMBLY (ECA)

The ECA is a solid-state micro-computer, consisting of a processor assembly and a calibration assembly. The ECA is located under left side of instrument panel, adjacent to brake pedal support. *See Figs. 1 and 4.* The ECA does not include a self-diagnostic function.

Processor Assembly - Housed in an aluminum case, this assembly continuously samples the 7 sensor signals and converts them to a usable signal for the computer. It also performs ignition timing, Thermactor and EGR flow calculations, and sends the proper electrical signal to the ignition module, EGR and Thermactor air control solenoids to adjust the timing and flow rates as required.

Calibration Assembly - This is the "memory" unit of the ECA. It provides calibration information for the ECA, stores the "best mode" information, and sends it out when required.

If the calibration assembly should fail, the engine operates with spark advance held constant at 10°BTDC. The EGR and Thermactor systems are deactivated. This allows operation of the vehicle, with reduced performance, until repairs can be made.



Courtesy of Ford Motor Co.

Fig. 1: Electronic Control Assembly (ECA)

ECA POWER RELAY

The ECA power relay supplies battery voltage to the EEC I system, and protects the ECA from possible damage due to reversed voltage polarity. Power relay is mounted to lower, right side of the ECA bracket. *See Fig. 4.*

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

This sensor monitors all changes in manifold pressure resulting from engine load, speed, and atmospheric pressure variations. The ECA applies a 9-volt reference voltage to sensor and monitors resultant output voltage to determine part throttle spark advance and EGR flow rate. The MAP sensor is mounted on the left rocker arm cover. *See Fig. 4.*

NOTE: A running change was made in the 1978 EEC I system. The Barometric Pressure Sensor and the Manifold Absolute Pressure Sensor were combined in a single housing.

BAROMETRIC PRESSURE (BP) SENSOR

Mounted on engine compartment side of firewall, this unit senses barometric (atmospheric) pressure. *See Fig. 4.* The ECA applies a 9-volt reference voltage to sensor and monitors resultant output voltage. The output voltage produced is proportional to the atmospheric pressure detected by sensor. The ECA adjusts EGR flow requirements according to vehicle altitude.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

The Engine Coolant Temperature (ECT) sensor (thermistor) is installed at rear of intake manifold, near left rocker arm cover. *See Fig. 4.* The coolant temperature sensor resistance is high at low temperatures and decreases as temperature rises. The ECA applies a 9-volt reference voltage to sensor and monitors the resultant voltage drop across sensor.

If coolant temperature is less than 70°F or greater than 230°F, the ECA will cut off all EGR flow. Also, if engine coolant overheats from prolonged idle, the ECA will advance initial engine timing to increase engine speed and improve cooling.

INLET AIR TEMPERATURE (IAT) SENSOR

The inlet air temperatrue sensor is similar in construction to the coolant temperature sensor. Sensor is mounted in the air cleaner body, near inlet duct. *See Fig. 4.* As air temperature rises, the resistance of the sensing thermistor decreases.

The ECA applies a 9-volt reference voltage to sensor and monitors the resultant voltage drop across sensor. By this method, the ECA can determine proper spark advance and Thermactor air injection flow. At high inlet temperatures (above 90°F), the ECA will modify timing advance as necessary to prevent spark knock.

CRANKSHAFT POSITION (CP) SENSOR

To provide EEC system with accurate timing reference, the rear of the crankshaft is fitted with a 4-lobe pulse ring. *See Fig. 2.* The ring is positioned 10 degrees in advance of TDC, to set basic engine timing at 10°BTDC. The crankshaft position sensor is fitted on rear, right side of engine block. *See Fig. 4.*

As crankshaft rotates, the lobes of the pulse ring pass the crankshaft position sensor. The sensor's magnetic field is interrupted and an output voltage pulse is generated and sent to the ECA.

The ECA uses these pulses to determine crankshaft position for ignition timing. Since the crankshaft position sensor tells the ECA when to fire the ignition module, a defective sensor or sensor wiring can prevent the vehicle from starting.

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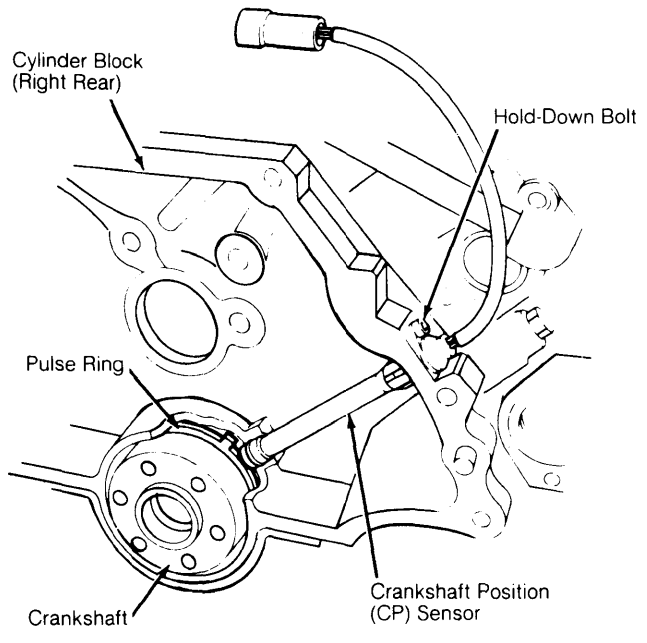


Courtesy of Ford Motor Co.

Fig. 2: Crankshaft Position Sensor Pulse Ring

THROTTLE POSITION SENSOR (TPS)

This sensor is mounted on side of carburetor, and is coupled to throttle shaft. *See Fig. 4.* The ECA applies a 9-volt reference voltage to throttle position sensor and classifies resultant output voltage into 1 of 3 positions: closed throttle (idle or deceleration), part throttle, or wide open throttle (maximum acceleration). This information is used by ECA to determine proper amount of spark advance, EGR flow, and Thermactor air injection mode.

EGR VALVE POSITION (EVP) SENSOR

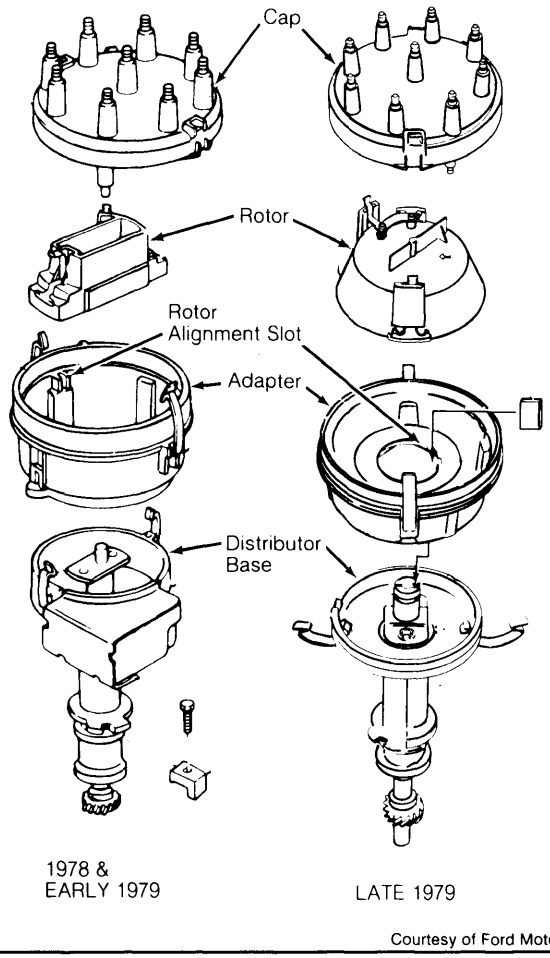
The EGR valve position sensor is part of the EGR valve. The ECA applies a 9-volt reference voltage to sensor and monitors resultant voltage output developed by sensor. The output voltage produced is directly proportional to the EGR valve pintle position, allowing the ECA to determine EGR flow rate.

DURA-SPARK II IGNITION SYSTEM

The Dura-Spark II distributor eliminates conventional mechanical and vacuum advance mechanisms. *See Fig. 3.* All timing is controlled by the ECA, which is capable of firing spark plugs at any point from TDC to 60°BTDC. This flexibility in spark range requires greater separation of adjacent distributor cap electrodes to prevent cross-fire. A bi-level distributor and cap may be used.

In the bi-level design, both the rotor and cap have upper and lower electrodes. As the rotor turns, one of the high-voltage electrode pickup arms aligns with one spoke of the distributor cap center electrode plate, allowing high voltage to pass from the plate, through the rotor to a terminal on the distributor cap and on to the spark plug.

NOTE: Numbers, corresponding to spark plug wires, are molded into the cap for identification. Due to design, however, the wires are NOT arranged in firing order. The actual firing order is 1-5-4-2-6-3-7-8, as noted on the intake manifold. If an aftermarket cap is installed, use original cap as a guide to reference spark plug wire locations



Courtesy of Ford Motor Co.

Fig. 3: EEC I Distributor Assemblies

AIR PRESSURE-OPERATED EGR SYSTEM

The EGR system consists of an EGR cooler assembly, 2 EGR control solenoids, and an EGR valve and sensor assembly. Utilizing air pressure from the air pump, the ECA controls the flow rate of the EGR system. The air pressure signal is drawn from the Thermactor by-pass valve.

EGR Cooler Assembly - An EGR gas cooler is used to reduce EGR gas temperature, thus providing improved engine operation and valve durability. The cooler is mounted over the right valve cover and uses engine coolant to reduce the temperature of the exhaust gases flowing to the EGR valve.

Dual EGR Control Solenoids - The control of EGR operating air pressure requires 2 types of solenoids: a vent type which is normally open to the atmosphere, unless the solenoid is energized, and a pressure type solenoid which is normally closed, blocking air pressure flow to the EGR system, unless the solenoid is energized. When the ECA senses a need for increased EGR flow, it energizes the solenoids and allows air pressure to the system and stops the venting process.

EGR Valve & EGR Valve Position Sensor - The EGR valve with this system looks like standard EGR valves, but is air operated rather than vacuum operated. *See Fig. 5.* Mounted on a spacer plate under the carburetor, the EGR valve has a built-in sensor which tells the ECA what the position of the EGR valve stem is. This valve and sensor assembly has no openings for maintenance or testing. If defective it must be replaced.

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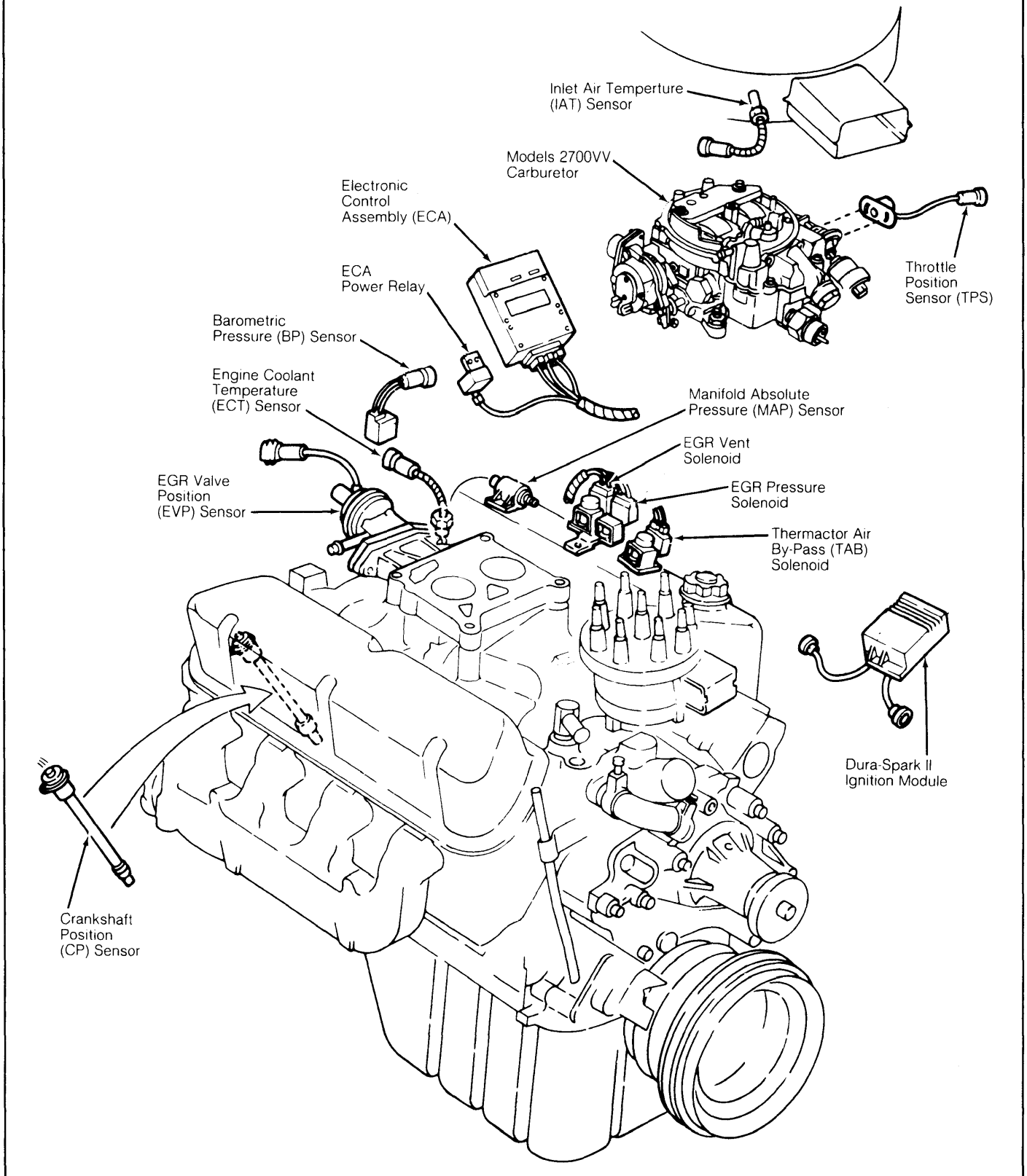

Courtesy of Ford Motor Co.

Fig. 4: Electronic Engine Control (EEC) I System Components

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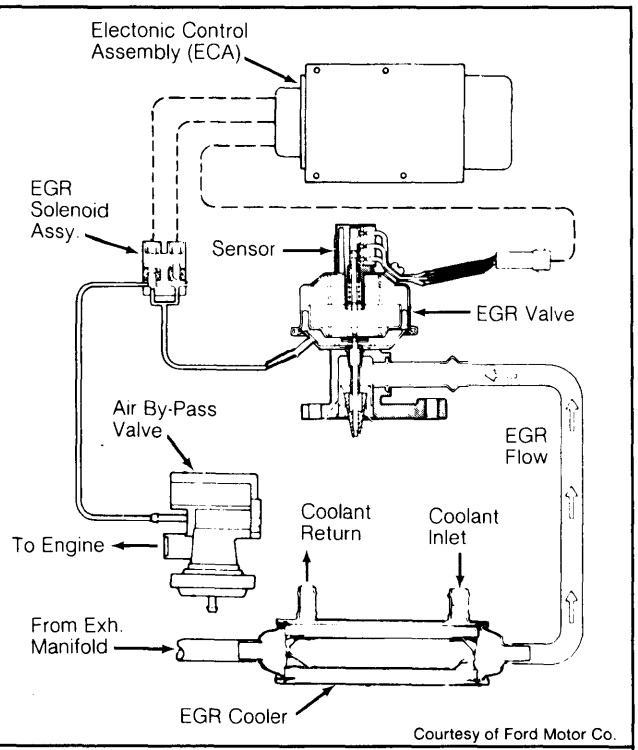

Fig. 5: EEC I Air Pressure Operated EGR System

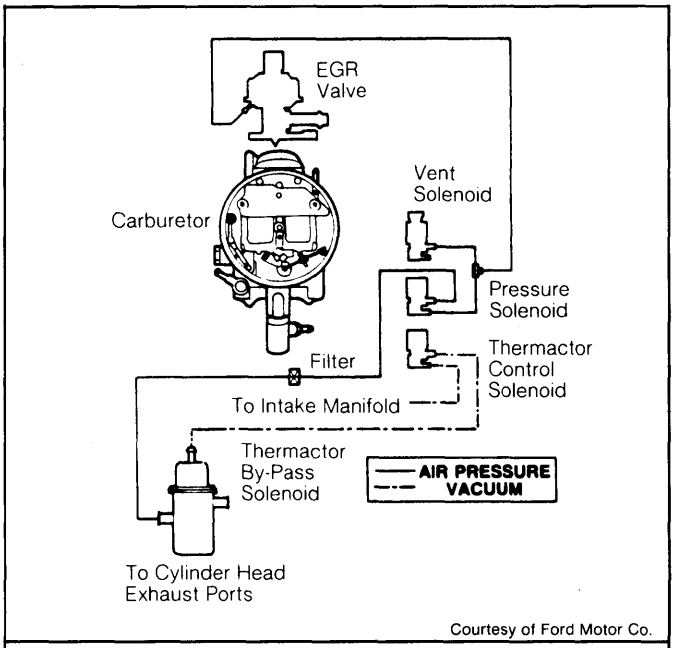

Fig. 7: EEC I Thermactor Air Control System

THERMACTOR AIR CONTROL

Thermactor Air By-Pass (Control) Solenoid - This solenoid reacts the same as the pressure-type EGR solenoid; that is, it is normally closed, blocking air pressure flow until energized. The upper port is connected to the Thermactor by-pass valve top actuator port. The lower port is connected to manifold vacuum. *See Fig. 7.*

When the ECA energizes the solenoid, manifold vacuum is applied to the by-pass valve, allowing air pump air to be injected into the exhaust ports. When de-energized, the by-pass valve "dumps" air pump pressure to the atmosphere. The ECA uses information from the air inlet sensor and throttle position sensor to determine when to inject or dump air pump air.

TESTING & DIAGNOSIS

TEST EQUIPMENT

The following equipment is recommended to properly diagnose and test the Electronic Engine Control I (EEC I) system.

- Digital Volt/Ohmmeter (T78L-50-DVOM).
- EEC I Tester (T78L-50-EEC-1).
- Blue (2-Pin) Test Fixture (203929).
- Brown (2-Pin) Test Fixture (294156).
- Yellow (3-Pin) Test Fixture (203814).
- Ignition Module (Black 4-Pin) Test Fixture (203821).
- Tachometer (0-3000 RPM Range).
- Vacuum/Pressure Gauge (25" Hg/15 psi Range).
- Timing/Advance Light (27-0002).
- Speed Control Tester (Snap-On GA-437).

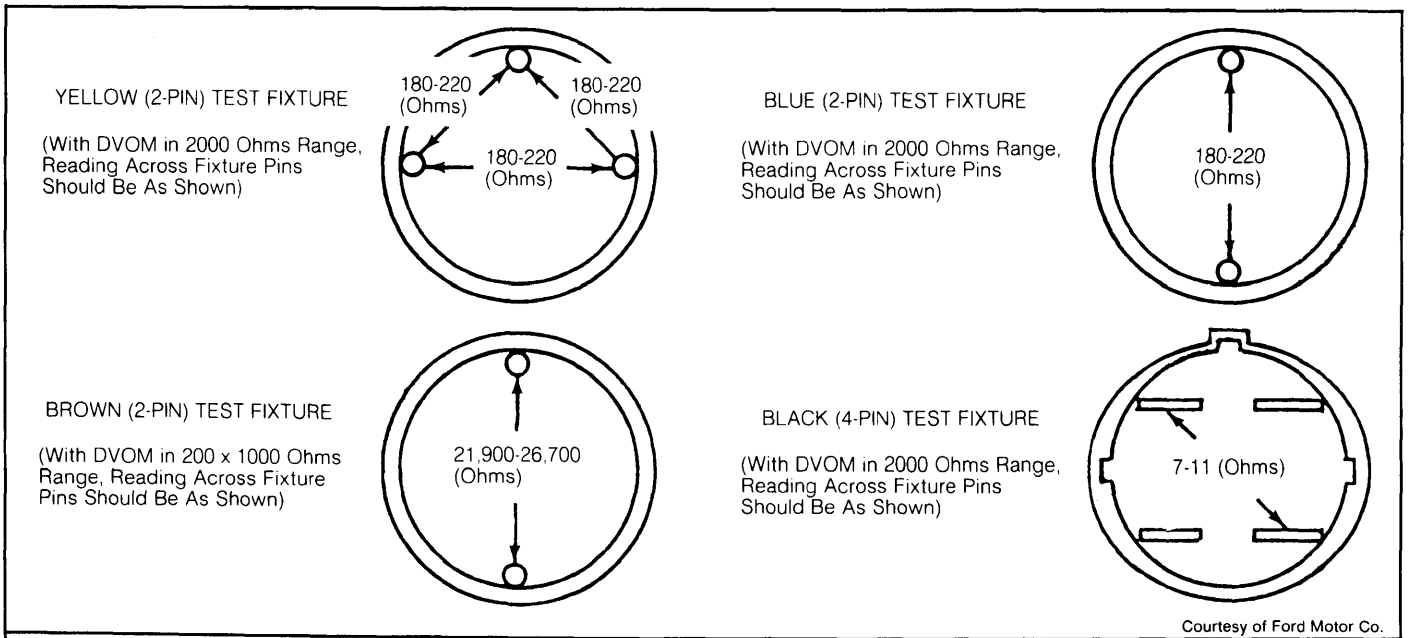

Fig. 6: EEC I System Test Fixtures

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NOTE: Ford Motor Company recommends the use of the EEC I tester and test fixtures to test and diagnose the EEC I system. Test equipment, however, is no longer available. Test fixtures can simulate good sensors. See Fig. 6.
This article, known good sensors, a digital volt/ohmmeter, and test clips (to tap into circuit being tested) should be sufficient to diagnose the EEC I system. Test Clips (JP-13288) are available from J.S. Popper, Inc. 200 Liberty Street Little Ferry, NJ 07643 (201) 641-3252
Read entire test procedure and study the wiring diagram to determine what (how) each sensor/circuit is being tested. After you're familiar with the circuits and test values given in the test steps, test and correct affected circuit. Retest circuit after each repair.

VISUAL (PRE-CHECK) INSPECTION

1) Remove air cleaner. Check routing and condition of all vacuum hoses. Check EEC I system harness for loose, broken, disconnected, or corroded wiring or terminals.
2) Check EGR solenoid Red wire, pressure solenoid Yellow wire, and vent solenoid Green wire. Inspect sensors for damage. Repair items as necessary, and install air cleaner.

TEST EQUIPMENT HOOK-UP

1) Turn ignition off. Disconnect harness from the Electronic Control Assembly (ECA) and connect test equipment. *See Fig. 8.* Set digital volt/ohmmeter (DVOM) switch to "BATTERY TEST" and verify reading is greater than value stated on face plate. If lower, consult tester operators manual.
2) Set DVOM switch to "TESTER" after removing test leads from DVOM test lead jacks. If engine will not start, proceed to ENGINE WILL NOT START procedure. If it starts, proceed to ENGINE STARTS procedure.

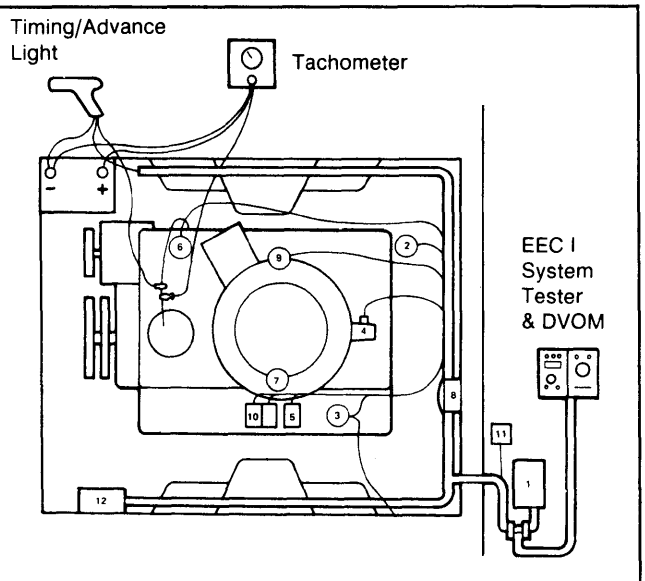

Fig. 8: EEC I System Test Equipment Hook-Up

ENGINE WILL NOT START

1) Depress and hold "NO START" button on tester. Attempt to start engine. If engine starts, release "NO START" button and proceed to step **2)**. If not, release "NO START" button and go to step **5)**.
2) Set test selector switch to position "9" and ignition key to "RUN" position (engine is not running). If reading is 10.5 volts minimum, replace ECA and check that engine starts normally (perform ENGINE STARTS test).
3) If reading is less than 10.5 volts, check for a discharged battery and for and open Black/Yellow dot wire from battery to ECA power relay. Check for open Red/Yellow hash wire from ignition switch to ECA power relay.
4) Also check for an open Red wire from ECA to ECA power relay and for an inoperative ECA power relay. After repairs, retest ECA power relay circuit.
5) Turn ignition key to "OFF" position. Set test selector switch to position "10". Disconnect crankshaft position sensor and attach Blue Test Fixture (203929) to wiring harness.
6) Measure crankshaft position sensor circuit resistance. If reading is between 100-250 ohms, go to next step. If outside this range, check wiring from crankshaft position sensor to ECA and repair as required. Retest crankshaft position sensor circuit.
7) Remove Blue test fixture. Connect crankshaft position sensor and observe DVOM. If reading is now less than 100 ohms or greater than 550 ohms, replace sensor and retest circuit starting at step **5)**. If reading is between 100-550 ohms, go to next step.
8) Set test selector switch to position "11" and connect Ignition Module Test Fixture (203821) to the 4-blade connector at ignition module and observe DVOM. If reading is between 7-13 ohms, check ignition system for proper operation.
9) If reading is less than 7 ohms or greater than 13 ohms, check for short or open circuit in Black wire between ECA and ignition module and between ECA and inlet air temperature sensor (Orange/Yellow hash wire). Repair and retest circuit. Remove ignition module test fixture and reconnect harness.

TEST FIXTURE/SENSOR SUBSTITUTION

Fixture Color	Sensor Substitution
Yellow	Manifold Absolute Pressure, Throttle Position, Barometric Pressure, EGR Valve Position
Blue	Engine Coolant Temp., Crankshaft Position
Brown	Inlet Air Temperature
Black	Ignition Module
Orange	[1] Barometric/Manifold Absolute Pressure

[1] - A running change was made in the 1978 EEC I system. The Barometric Pressure Sensor and the Manifold Absolute Pressure Sensor were combined in a single housing.

ENGINE STARTS

Vehicle Preparation - 1) Block both front wheels. Apply parking brake and place transmission level in Park position. Turn off all electrical equipment.
2) Perform crank signal check as follows: Disconnect wire from starter relay "S" terminal. Set test selector switch to position "22". Turn ignition key to "START" position. If reading is less than 5 volts, check battery voltage. Replace battery or repair circuit as necessary.
3) If reading is more than 5 volts, reconnect wire to starter relay "S" terminal. Start and run engine until normal operating temperature is reached. Check that throttle is off fast idle and on curb idle. Turn engine off and place ignition key to "RUN" position (engine off).

Data Collection - Set test selector switch to position "1" and DVOM selector switch to "TESTER". Using test selector switch, set switch positions and perform TEST SEQUENCE I and TEST SEQUENCE II tests.

Test Sequence I - 1) With vehicle prepared as specified, place switch in "Vref" (reference voltage) position. Note voltage reading.

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Reading should be 8.5-9.5 volts. If not, perform REFERENCE VOLTAGE (VREF) NOT WITHIN LIMITS procedure. See COMPONENT DIAGNOSIS in this article.

NOTE: If reference voltage limits are incorrect, the REFERENCE VOLTAGE (VREF) NOT WITHIN LIMITS procedure must be performed and limits corrected before proceeding with remainder of TEST SEQUENCE I.

2) Set switch to "MAP" position. Note voltage reading. Reading should be within limits shown in VOLTAGE LIMIT/ALTITUDE VARIATION table. If not, complete test sequence before performing COMPONENT DIAGNOSIS testing and repairs.
3) Set switch to "TP". Note voltage reading. Reading should be 1.65-2.14 volts. If not, complete test sequence before performing COMPONENT DIAGNOSIS testing and repairs.
4) Set switch to "BP". Note voltage reading. Reading should be within limits shown in VOLTAGE LIMIT/ALTITUDE VARIATION table. If not, complete test sequence before performing COMPONENT DIAGNOSIS testing and repairs.

VOLTAGE LIMIT/ALTITUDE VARIATION

Elevation (Feet)	MAP & BP Limits (Volts)
0-1000	6.7-7.8
1000-2000	6.5-7.4
2000-3000	6.2-7.3
3000-4000	6.0-7.0
4000-5000	5.8-6.8
5000-6000	5.5-6.6
6000-7000	5.3-6.4

5) Set switch to "ECT". Note voltage reading. Reading should be 1.9-3.7 volts. If not, complete test sequence before performing COMPONENT DIAGNOSIS testing and repairs.
6) Set switch to "IAT". Note voltage reading. Reading should be 4.1-6.3 volts. If not, complete test sequence before performing COMPONENT DIAGNOSIS testing and repairs.
7) Set switch to "TAB". Note voltage reading. Reading should be greater than 10.5 volts. If not, complete test sequence before performing COMPONENT DIAGNOSIS testing and repairs.
8) Set switch to "EVP". Note voltage reading. Reading should be 1.09-1.61 volts. If not, complete test sequence (I and II) before performing COMPONENT DIAGNOSIS testing and repairs.

NOTE: After completing "Test Sequence I", go to "Test Sequence II" and complete sequence before attempting repairs on sensors/circuit which did not meet specifications (except as noted).

TEST SEQUENCE I & II SENSOR SPECIFICATIONS

Sensor/Circuit Being Checked	Test Fixture Being Used	System Operating Volt/Ohms Specs.
Crankshaft Position	Blue	100-250 Ohms
Ignition Module	Black	7-13 Ohms
Reference Voltage (Vref)		8.5-9.5 Volts
Crank Signal		5 Volts
Manifold Absolute Pressure		
Test Sequence I		[1]
Test Sequence II	Yellow	3.5-5.5 Volts
Throttle Position		1.65-2.14 Volts
Barometric Pressure		
Test Sequence I		[1]
Engine Coolant Temp.		1.9-3.7 Volts
Inlet Air Temperature		
Test Sequence I		4.1-6.3 Volts
Test Sequence II	Brown	5.2-7.2 Volts
TAB Solenoid		At Least 10.5 Volts
EGR Valve Position		1.09-1.61 Volts

[1] - See VOLTAGE LIMIT/ALTITUDE VARIATION table for specifications.

Test Sequence II - 1) Turn ignition "OFF". Apply parking brake and place transmission lever in Park position. Disconnect Manifold Absolute Pressure (MAP) and Inlet Air Temperature (IAT) sensors from wiring harness. Install Yellow Test Fixture (203814) to MAP sensor connector.
2) Install Brown Test Fixture (294156) to IAT sensor connector. Start and run engine until normal operating temperature is reached. Ensure engine is at curb idle.
3) Set test selector switch to "MAP" and note voltage reading. Reading should be 3.5-5.5 volts. If not, perform MANIFOLD ABSOLUTE PRESSURE SENSOR NOT WITHIN LIMITS procedure. See COMPONENT DIAGNOSIS in this article. Perform testing and repairs as indicated before proceeding with test sequence.
4) Set switch to "IAT". Note voltage reading. Reading should be 5.2-7.2 volts. If not, perform INLET AIR TEMPERATURE SENSOR NOT WITHIN LIMITS procedure under COMPONENT DIAGNOSIS before proceeding with test sequence.
5) Set switch to "TAB". Raise engine speed briefly to 1600-1800 RPM, release throttle, and measure voltage and time span. Voltage should go from 1.6 volts to more than 10.5 volts within 55-65 seconds. If not, complete test sequence before performing COMPONENT DIAGNOSIS testing and repairs.
6) Set switch to "EVP". Install Speed Control Tester (Snap-On GA-437) and set engine speed to 1550-1650 RPM. Note voltage and spark advance data. See Ford's Vehicle Emission Control Information Label on valve cover. If voltage and spark are incorrect, complete test sequence COMPONENT DIAGNOSIS testing and repairs.
7) Remove speed control tester and turn ignition off. Remove MAP and IAT sensor test fixtures. Reconnect sensors to harness, go to DATA ANALYSIS.

NOTE: The Vehicle Emission Control Information label on some 1978 models is difficult to read. The TEST SEQUENCE II limits from label are given below. For California models (Calibration 8-11L-R11), spark advance is 27-34 degrees BTDC. EGR valve position sensor voltage is 3.50-4.50 volts. On all other models (Calibration 8-11D-RO), spark advance is 48-54 degrees BTDC. EGR valve position sensor voltage is 4.20-5.00 volts.

Data Analysis - 1) If one or more sensor/circuit test is out of limits, perform appropriate COMPONENT DIAGNOSIS procedure. If initial system check or COMPONENT DIAGNOSIS procedure is completed and cause of trouble is not found, go to next step
2) Verify that initial complaint still exists. If so, repeat initial system check and/or appropriate procedure under COMPONENT DIAGNOSIS. If initial complaint does not exist, road test vehicle and try to recreate problem. If still not solved, repeat appropriate test procedure.

COMPONENT DIAGNOSIS

NOTE: If component repair/replacement and/or retest is required in the following procedures, retest vehicle starting at VEHICLE PREPARATION procedure.

Reference Voltage (Vref) Not Within Limits - 1) Turn test selector switch to position "9", ignition to "RUN", and DVOM switch to "TESTER". If battery voltage is greater than 10.5 volts, go to step **4)**.
2) If battery voltage is less than 10.5 volts, check for a discharged battery. Check for open Black/Yellow hash wire from battery to ECA power relay. *See Fig. 9.*
3) Also check for open Red/Yellow hash wire from ignition switch to ECA power relay. Check for open Red wire from ECA to ECA power relay. Inoperative ECA power relay. Repair or replace circuit as required.
4) Disconnect engine coolant temperature sensor and set test selector switch in position "1". Detach each sensor, in the following order, and note reference voltage. If reference voltage is 8.5-9.5

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volts, replace defective sensor(s) and retest. If sensors are okay, go to next step.

- Engine Coolant Temperature Sensor
- Inlet Air Temperature Sensor
- EGR Valve Position Sensor
- Throttle Position Sensor
- Manifold Absolute Pressure Sensor
- Barometric Pressure Sensor

5) Disconnect Blue (10-pin) harness connector from tester. If reference voltage is 8.5-9.5 volts, check Orange/White (BP) wire, Light Green/Yellow (ECT) wire, and Light Green/Purple (IAT) wire circuits for a short.
7) Also check Black/White wire for an open. *See Fig. 9.* Repair wire(s) as necessary. If voltage is still incorrect, replace ECA and retest.
8) Reconnect all sensors and harness to tester. Continue with TESTING SEQUENCE I and II" if necessary.

Manifold Absolute Pressure (MAP) Sensor Not Within Limits - 1) If MAP sensor reading was not within limits of TEST SEQUENCE I, go to next step. If MAP reading is not within limits of TEST SEQUENCE II, go to step **8)**.
2) Compare MAP sensor reading with the BP sensor reading of that test. If within 0.75 volts, do not change sensors, they are okay. Variance is due to local air pressure.
3) If above comparison is not within 0.75 volt of BP reading, check that ignition switch is off and disconnect MAP sensor. Connect Yellow Test Fixture (203814) to wiring harness. Set test selector switch to position "13" and DVOM to "TESTER".
4) If reading is between 100-250 ohms, go to step **5)**. If outside this range, check Light Green/Black wire from MAP sensor to ECA for a short or open. Also check Black/White wire for a short or open. *See Fig. 9.* Repair wire(s) and retest.
5) Set test selector switch to position "12". If reading is between 100-250 ohms, inspect manifold absolute pressure sensor connector. If damaged, repair as necessary. If good, replace MAP sensor and retest. If voltage is still out of limits, replace ECA and retest.
6) If reading is in step **5)** is less than 100 ohms or more than 250 ohms, check Orange/White wire from throttle position sensor to ECA for short or open. Also check Black/White wire for a short or open. *See Fig. 9.* Repair wire(s) and retest.
7) Turn test selector switch off and disconnect test equipment. Remove Yellow test fixture.

NOTE: Steps 8) and 9) are to be used only if MAP reading is not within limits during TEST SEQUENCE II".

8) If MAP reading is not within limits of TEST SEQUENCE II", turn ignition off. Remove Yellow test fixture from harness. Set DVOM to "2000-OHM" range and check Yellow test fixture resistance.
9) If resistance is less than 170 ohms or greater than 230 ohms, replace test fixture and repeat TEST SEQUENCE II. If resistance is within 170-230 ohms, carefully align pins of Yellow test fixture with harness and reconnect. Repeat TEST SEQUENCE II.

Throttle Position Sensor (TPS) Not Within Limits - 1) Verify that ignition switch is in "OFF" position. Set test selector switch to position "12" and DVOM switch to "TESTER". Disconnect TPS and attach Yellow Test Fixture (203814) to harness. If reading is between 100 and 250 ohms, go to step **3)**.
2) If not, check Orange/White wire from throttle position sensor to ECA for a short or open. Also check Black/White wire for a short or open. *See Fig. 9.* Repair wire(s) and retest.
3) Set test selector switch to position "14". If reading is between 100-250 ohms, go to next step. If not, check Dark Green/Light Green wire from TPS to ECA for a short or open. Also check Black/White wire for a short or open. Repair wire(s) and retest.
4) Connect DVOM between Orange/White wire and Black/White wire of TPS connector. Set DVOM to "200x1000 OHMS" range. If reading is between 3000-5000 ohms, go to next step. If reading is incorrect, replace TPS and retest.
5) Connect DVOM between Dark Green/Light Green wire and Black/White wire of connector. *See Fig. 9.* Set DVOM switch to "2000 OHMS" range. Verify throttle is in closed position (off high cam).
6) If reading is less than 580 ohms and greater than 1100 ohms, adjust TPS until reading is correct and retest. If unable to bring TPS into range, replace TPS and retest.
7) If reading is between 580-1100 ohms, reconnect TPS to harness. Set test selector switch to position "3". Turn ignition key to "RUN" and DVOM to "TESTER".
8) Adjust TPS until voltmeter reading is 1.82-1.93 volts and retest. If TPS cannot be adjusted to obtain proper voltage, replace ECA and retest. Turn DVOM off and disconnect test equipment. Remove Yellow test fixture.

Barometric Pressure (BP) Sensor Not Within Limits - 1) Review test readings of BP and MAP sensors as obtained during TEST SEQUENCE I. If BP reading is within 0.75 volt of MAP sensor reading, both sensors are okay and should not be changed. Variance is due to local air pressure.
2) If BP reading differs from MAP reading by 0.75 volts or more, Check that ignition switch is off. Disconnect BP sensor. Connect Yellow Test Fixture (203814) to wiring harness.
3) Set test selector switch to position "12" and DVOM to "TESTER". If reading is between 100-250 ohms, go to step **4)**. If reading is less than 100 ohms or more than 250 ohms, check Orange/White wire from BP sensor to ECA for a short or open. Also check Black/White wire for a short or open. Repair wire(s) and retest.
4) Set test selector switch to position "15". If reading is less than 100 ohms or more than 250 ohms, check Dark Blue/Light Green wire from BP sensor to ECA for a short or open. Also check Black/White wire for a short or open. *See Fig. 9.* Repair wire(s) and retest.
5) If reading is between 100-250 ohms, inspect sensor leads and connector. If damaged, repair as necessary. If okay, replace BP sensor and retest. If reading is still out of limits, replace ECA and retest. Turn DVOM off and disconnect test equipment. Remove Yellow test fixture.

Engine Coolant Temperature (ECT) Sensor Not Within Limits - 1) Verify that ignition is off. Set test selector switch to position "10". Set DVOM switch to "TESTER". Disconnect ECT connector and connect Blue Test Fixture (203929) to wiring harness. If reading is between 100-250 ohms, go to step **3)**.
2) If reading is less than 100 ohms or more than 250 ohms, check Light Green/Yellow wire from ECT sensor to ECA for a short or open. Also check Black/White wire for a short or open. *See Fig. 9.* Repair wire(s) and retest.
3) Connect DVOM between pins of ECT sensor connector. Set DVOM switch to "200x1000 OHMS" scale. If reading is more than 6000 ohms, check engine coolant temperature with a thermometer.
4) If coolant temperature is below 160°F, verify that cooling system is operating in proper temperature range and retest. If coolant temperature is more than 160°F, replace ECT sensor and retest.
5) If ECT sensor reading in step **3)** is less than 1500 ohms, check condition of cooling system, make necessary corrections, and check system operating temperature. If coolant temperature is above 220°F, retest system. If coolant temperature is below 220°F, replace ECT sensor and retest.
6) If ECT reading in step **3)** is between 1500-6000 ohms, replace ECA and retest. After tests, turn test selector switch off and disconnect test equipment. Remove Blue test fixture.

Inlet Air Temperature (IAT) Not within Limits - 1) If IAT reading is not in limits during TEST SEQUENCE I, go to next step. If IAT reading is not within limits of TEST SEQUENCE II, go to step **7)**.
2) Turn ignition is off. Set test selector switch to position "17". Disconnect IAT sensor connector and attach Blue Test Fixture (203929) to wiring harness. If reading is between 100-250 ohms, go to step **4)**.

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3) If reading is less than 100 ohms or more than 250 ohms, check Light Green/Purple wire from IAT sensor to ECA for a short or open. Also check Black/White wire for a short or open. Repair wire(s) and retest.
4) Connect DVOM between Light Green/Purple and Black/White wires of IAT sensor connector. Set DVOM switch to "200x1000 OHMS" scale. If reading is less than 6500 ohms or greater than 45,000 ohms, go to next step. If reading is between 6500-45,000 ohms, replace ECA and retest.
5) Check air cleaner assembly for proper operation of vacuum temperature control. See VACUUM CONTROL TEMPERATURE SENSOR in 1975-79 THERMOSTATIC AIR CLEANERS - ALL MODELS in EXHAUST EMISSION CONTROLS section.
6) If air cleaner assembly vacuum temperature control is okay, replace IAT sensor and retest. Turn "Tester Function" switch to "OFF" and disconnect test equipment.

NOTE: Steps 7) and 8) are to be used only if IAT reading is not within limits during TEST SEQUENCE II.

7) If IAT reading is not within limits of TEST SEQUENCE II, turn ignition off. Remove Brown test fixture from harness. Set DVOM to "200x1000 OHMS" range and check Brown test fixture resistance.
8) If resistance is less than 23,300 ohms or greater than 25,300 ohms, replace test fixture and repeat TEST SEQUENCE II. If resistance is within 23,300-25,300 ohms, carefully align pins of Brown test fixture with harness and reconnect. Repeat TEST SEQUENCE II.

Thermactor Air By-Pass (TAB) Solenoid Not Within Limits - 1) Turn test selector switch to position "7". Set DVOM to "TESTER" position and ignition key to "RUN" position. If reading is less than 10.5 volts, go to next step. If reading is greater than 10.5 volts, go to step **3)**.
2) Check Red wire from TAB solenoid to engine block with DVOM. If reading is now less than 10.5 volts, repair open in Red wire and retest. *See Fig. 9.* If reading is now more than 10.5 volts, repair open in White/Red dot wire and retest.
3) Install vacuum gauge between TAB solenoid and air by-pass valve. Operate engine at 1600 RPM until vacuum stabilizes. Return engine to idle and observe vacuum drop.
4) Vacuum should go from 15-20 in. Hg to less than 1 in. Hg in less than 60 seconds after release of throttle. If not, check Thermactor air by-pass valve for proper operation. If complaint is not solved, replace ECA and retest.

EGR Valve Position (EVP) Sensor Not Within Limits - 1) Turn engine off and disconnect EVP sensor. Connect Yellow Test Fixture (203814) to wiring harness. Set test selector switch to position "12" and DVOM switch to "TESTER". If reading is between 100-250 ohms, go to step **3)**
2) If reading is less than 100 ohms or more than 250 ohms, check Brown/Light Green wire from EVP sensor to ECA for short or open. Also check Black/White wire for short or open. *See Fig. 9.* Repair wire(s) and retest.
3) Set test selector switch to position "18". If reading is between 100-250 ohms, go next step. If reading is less than 100 ohms or more than 250 ohms, check Brown/Light Green wire from EVP sensor to ECA for short or open. Also check Black/White wire for short or open. Repair wire(s) and retest.
4) Connect DVOM between Orange/White and Black/White wires at EVP sensor connector. Set DVOM to "200x1000 OHMS" scale. If reading is between 2800-5300 ohms, go to next step. If reading is less than 2800 ohms or more than 5300 ohms, replace EGR valve assembly and retest.
5) Connect ohmmeter between Brown/Light Green wires Black/White wires of EVP sensor connector. If reading is between 350-940 ohms, reconnect EVP sensor to wiring harness and go to next step. If reading is outside this range, replace the EGR valve assembly and retest.
6) Disconnect EGR air hose from air by-pass valve (small hose on side of valve). Connect pressure gauge to this fitting, leaving EGR hose disconnected. With transmission in Park, run engine at 1600 RPM.
7) If pressure gauge reading is greater than 1.5 psi, go to next step. If pressure is less than 1.5 psi, check operation of air by-pass valve. Replace valve if necessary and retest.
8) Connect a known good test hose between small port at side of air by-pass valve and EGR valve assembly. Set test selector switch in position "8". With transmission in Park, run engine at 1600 RPM.
9) If voltage is 6.4 volts or less, replace EGR valve assembly and retest. If voltage is greater than 6.4 volts, install original hoses and proceed to "EGR Solenoid Valve Check". Reconnect all pressure and vacuum hoses to their proper fittings.

EGR Solenoid Valve Check - 1) Turn ignition key to "RUN" position (engine off). Set test selector switch to position "19". Depress and hold "EGR PRESSURE" button on tester while reading DVOM. If reading is between 1-5 volts, go to step **3)**.
2) If reading is less than 1.0 volt, check for open circuit in Red wire and/or Yellow wire. *See Fig. 9.* If no open is found, replace EGR solenoid assembly and retest. If reading is greater than 5.0 volts, replace EGR solenoid valve assembly and retest.
3) Set test selector switch to position "20". Depress and hold the "EGR VENT" button on tester. If reading is between 1-5 volts, go to next step. If reading is less than 1.0 volt, repair open circuit in Red wire and/or Dark Green wire. If no open is found, replace EGR solenoid assembly and retest. If reading is greater than 5.0 volts, replace EGR solenoid assembly and retest.
4) Disconnect pressure hose from output side of EGR pressure solenoid (lower fitting). Connect pressure gauge to this fitting, leaving pressure hose disconnected.
5) With transmission in Neutral, run engine at 1100 RPM. If pressure gauge reading is greater than 0.5 psi after 5 seconds, replace EGR solenoid valve assembly and retest. If pressure is less than 0.5 psi, go to next step.
6) Reconnect pressure hose to output side of EGR pressure solenoid. Disconnect EGR valve pressure hose at hose "T" and connect pressure gauge to "T". Leave EGR valve hose disconnected.
7) With transmission in Neutral, run engine at 1100 RPM. Depress and hold "EGR PRESSURE" and "EGR VENT" buttons on tester until pressure stabilizes, then release "EGR PRESSURE" button.
8) If maximum pressure reading is less than 0.5 psi or decreases more than 0.5 psi in 5 seconds, replace EGR solenoid assembly, hoses or fittings, and retest. If maximum pressure reading is more than 0.5 psi and decreases less than 0.5 psi in 5 seconds, go to next step.
9) With engine at 1100 RPM and EGR valve hose still disconnected, press and hold "EGR PRESSURE" and "EGR VENT" buttons on tester until pressure stabilizes. Release "EGR PRESSURE" button, then release "EGR VENT" button. Pressure should drop immediately.
10) If pressure remains within 0.5 psi of maximum reading for 5 seconds, replace EGR solenoid assembly and retest. If pressure drops immediately, to less than 1/2 of maximum reading, replace EGR valve assembly and retest. If, after retest, EVP data is still out of limits, replace ECA and retest.

Spark Advance Not Within Limits - With engine fully warm, run engine at idle in Park. Depress and hold "No Start" switch and check spark advance. If spark advance is within 8-12 degrees BTDC, replace ECA and retest.

Crank Signal Not Within Limits - 1) Using DVOM, test battery voltage (10.5 volts minimum). Recharge, repair or replace battery as required and retest.
2) Disconnect harness wire from "S" terminal on starter relay and set test selector switch to position "22". With ignition switch in "START" position, verify that reading is 5.0 volts or more.
3) If reading is less than 5.0 volts, check for open or short circuits in Black Wire and/or Red/Light Blue wire. *See Fig. 9.* Repair wire(s) and retest. Reconnect harness wire to "S" terminal of starter relay.

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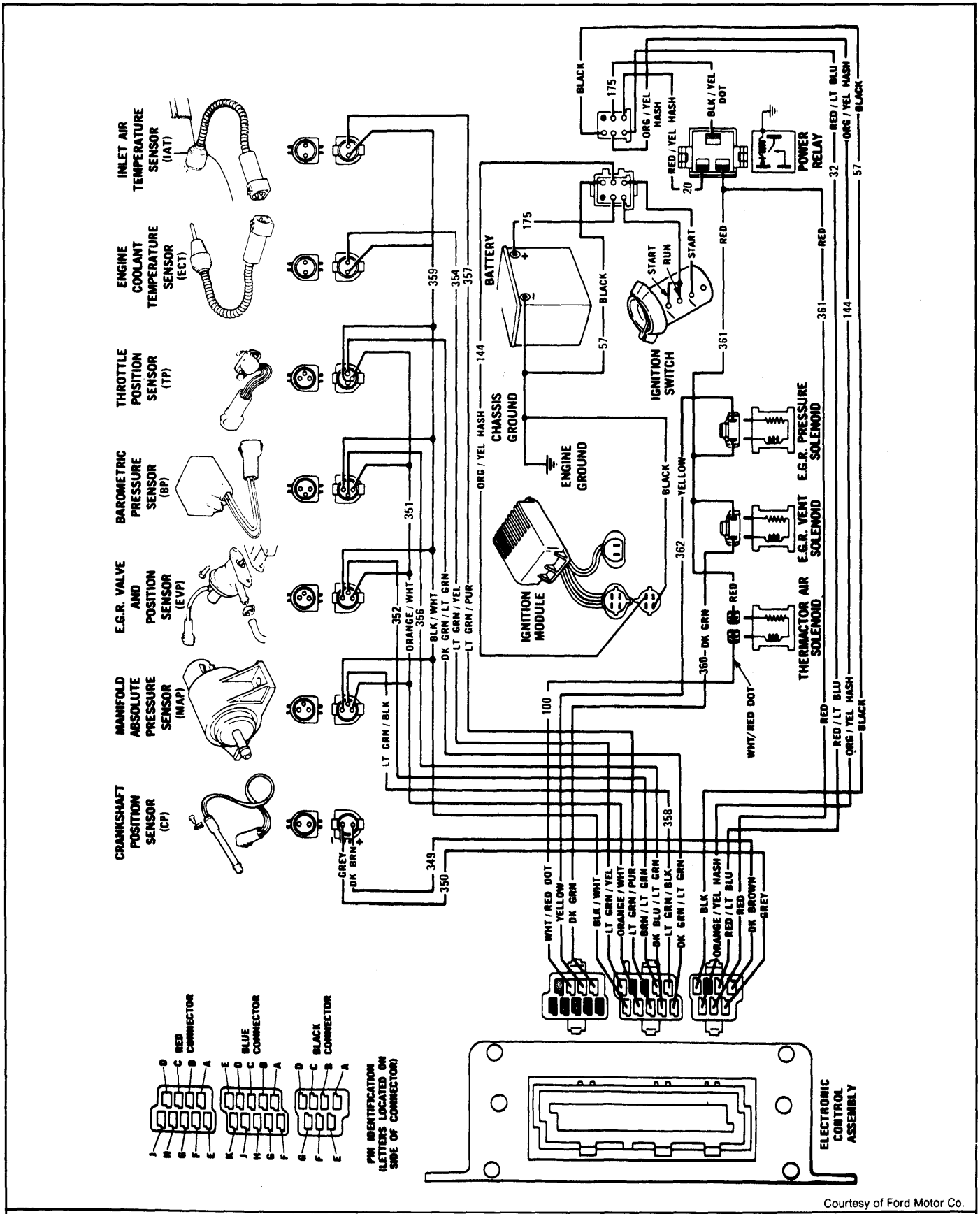
WIRING DIAGRAMS



Courtesy of Ford Motor Co.

Fig. 9: Electronic Engine Control I System Wiring Schematic