

1975-79 COMPUTERIZED ENGINE CONTROLS

Ford Motor Co. Electronic Engine Control II

1a-25

DESCRIPTION

The Electronic Engine Control II (EEC II) system is used on all 1979 Mercury Marquis and California Ford LTD models equipped with the 351" W engine. This system adjusts the engine to the best settings for various conditions of load, speed, temperature and altitude by controlling the following engine functions:

- Ignition Timing
- Carburetor Air/Fuel Ratio
- Engine Speed At Idle
- Exhaust Gas Recirculation (EGR) Flow Rate
- Secondary (Thermactor) Air Flow Rate
- Fuel Evaporation Canister Purging

The EEC II system consists of an Electronic Control Assembly (ECA), several sensors located on the engine or in the various engine systems, special actuators governed by the ECA, and various connecting electrical and vacuum lines.

OPERATION

ELECTRONIC CONTROL ASSEMBLY (ECA)

The ECA is a solid-state, micro-computer consisting of a processor assembly and a calibration assembly. See Fig. 1. This unit is located in the passenger compartment under the instrument panel, to the left of the steering column. The ECA does not include a self-diagnostic function.

Processor Assembly – The processor assembly is housed in an aluminum case and contains circuits designed to continuously sample input signals from the sensors. It calculates the proper spark advance, air/fuel ratio, EGR flow and Thermactor air flow.

It sends out control signals to adjust spark timing, air/fuel ratio, EGR flow, thermactor air mode, evaporation canister purge and idle speed. The processor assembly also provides a continuous reference voltage of 8.0 to 10.0 volts to the BMAP, EVP, ECT and throttle position sensor.

Calibration Assembly – The calibration assembly is contained in a Black plastic housing which is attached to the top of the processor assembly. It contains the "memory" and programming used by the processor assembly and is capable of providing operating information for that particular vehicle, for use by the processor assembly. It also recalls information from its memory when required.

ECA POWER RELAY

This relay is attached to lower right side of ECA mounting bracket. The ECA relay is activated by the ignition switch to supply battery

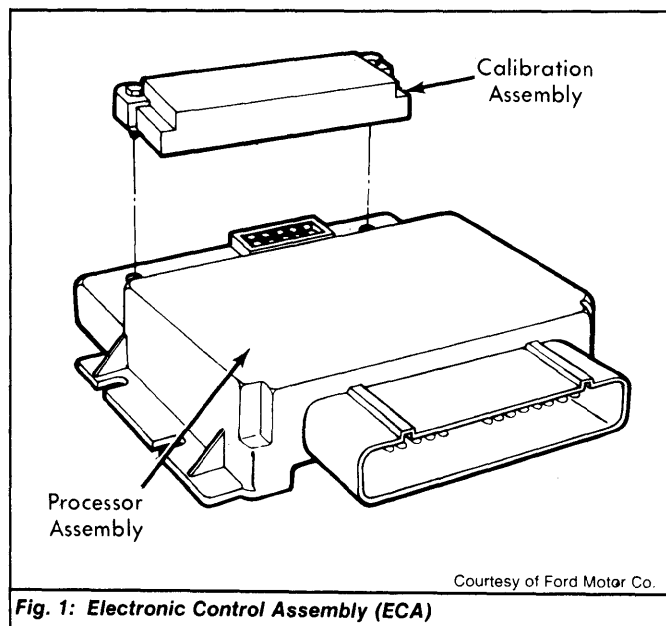


Fig. 1: Electronic Control Assembly (ECA)

voltage to the EEC II system. It also protects the ECA from possible damage due to reversed voltage polarity.

LIMITED OPERATION STRATEGY (LOS) MODE

The LOS mode functions during engine start, or upon failure of the ECA detected by a "safeguard" circuit in the ECA. This mode allows continued vehicle operation (with reduced performance) until repairs can be made. In LOS mode the actuator functions are set as follows:

- Ignition timing set at minimum spark advance (10° BTDC).
- Feedback Carburetor Actuator (FBCA) locked at last controlled position. On startup, the FBCA is driven full rich and then slightly lean.
- No Exhaust Gas Recirculation (EGR).
- Thermactor Air By-Pass (TAB) in dump position.
- Canister Purge (CANP) system is sealed, no purge.
- Throttle Kicker on low RPM idle.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Installed in heater outlet fitting at front of intake manifold near right valve cover, the ECT sensor converts coolant temperature to an electrical signal for the ECA. See Fig. 2. Made of a brass housing which contains a thermistor (a resistor that changes value according to temperature), the ECA is able to tell coolant temperature by changes in sensor resistance.

THROTTLE POSITION SENSOR (TPS)

The throttle position sensor is a potentiometer. The resistance of the sensor varies with throttle opening. The ECA applies a reference voltage to the sensor and the resultant sensor output voltage allows the ECA to determine throttle position (closed throttle, part throttle or wide open throttle). This information is used by the ECA in determining the proper amount of spark advance, EGR flow, air/fuel ratio and the proper thermactor air mode.

NOTE: The throttle position sensor mounting holes are slotted to permit rotational adjustment. If sensor is replaced, it must be correctly positioned or erroneous throttle information will be sent to the ECA.

CRANKSHAFT POSITION (CP) SENSOR

To provide the EEC II system with an accurate timing reference (when pistons reach 10°BTDC), the crankshaft vibration damper is fitted with a four-lobe pulse ring.

As the crankshaft rotates, the pulse ring interrupts a magnetic field at the tip of the CP sensor (mounted on right front of engine). See Fig. 2. When the field is interrupted, an output signal is generated and sent to the ECA.

The ECA uses these signals to determine the exact position of the crankshaft. From the frequency of the pulses, the ECA can determine engine RPM. By knowing these 2 factors, the ECA can determine the appropriate ignition timing advance required for best engine operation.

EXHAUST GAS OXYGEN SENSOR

Installed in the exhaust manifold, the exhaust gas oxygen sensor provides the ECA with the oxygen concentration of the exhaust gas. See Fig. 2. The sensor monitors the oxygen concentration of the exhaust gas and generates an output of .6 to 1.1 volts when detecting a rich exhaust gas mixture, and less than .2 volt when detecting a lean mixture. The constantly changing voltage signal is sent to the ECA for analysis.

CAUTION: The EGO sensor resistance CANNOT be measured by connecting an ohmmeter directly to its output lead. Sensor damage will result if this is attempted.

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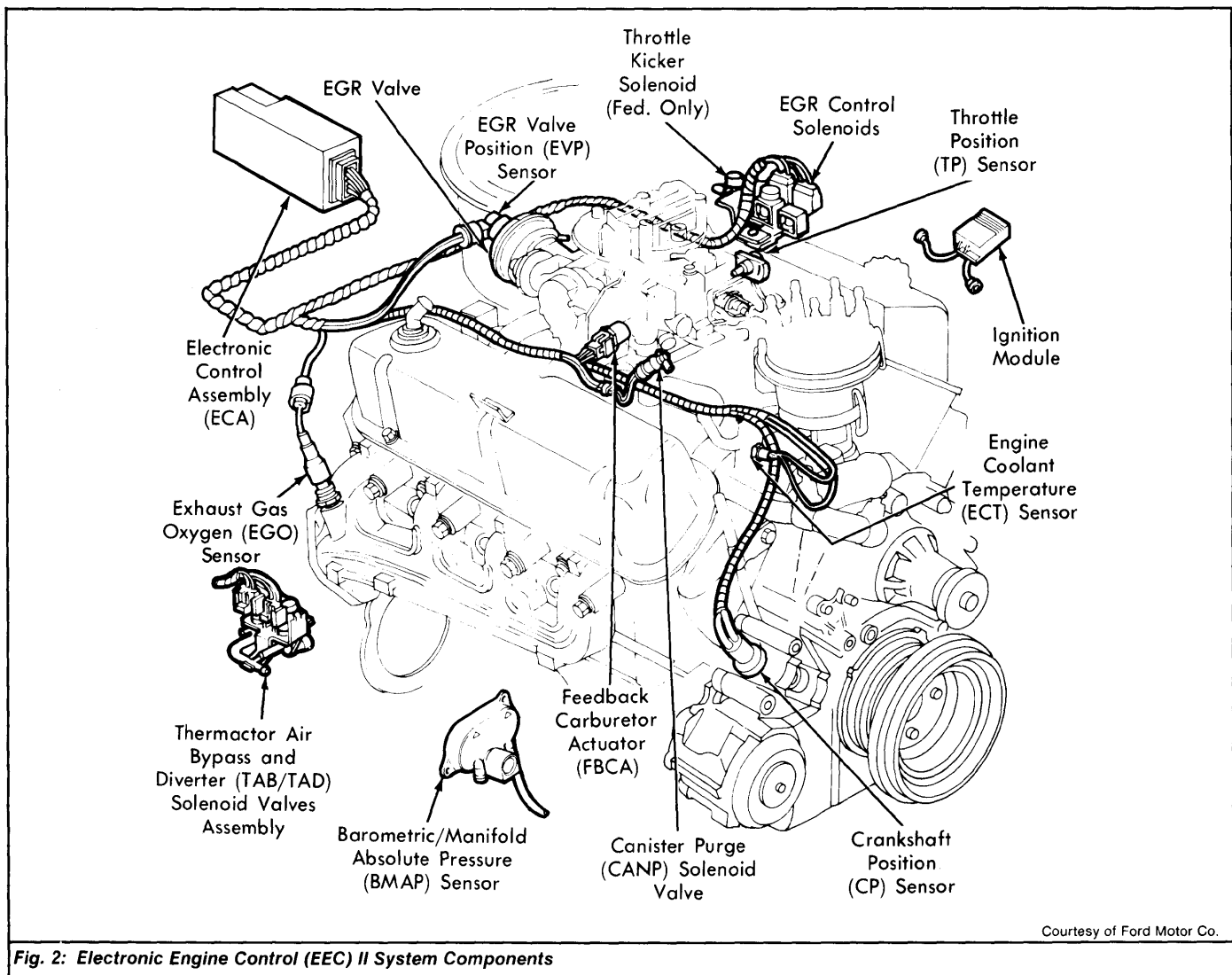


Fig. 2: Electronic Engine Control (EEC) II System Components

BAROMETRIC/MANIFOLD ABSOLUTE PRESSURE (BMAP) SENSOR

The BMAP sensor is actually two sensors combined into one assembly. See Fig. 2. This sensor monitors the absolute value of the intake manifold pressure and atmospheric pressure.

Changes in atmospheric pressure are converted into an electrical signal and sent to the ECA. The ECA uses this signal to compensate spark advance and EGR rate for changes in altitude.

Changes in intake manifold pressure are converted by a pressure-sensing element into electrical signals for the ECA. The signal will vary according to engine load, vehicle speed and atmospheric pressure. This signal is used by the ECA to compensate spark advance and EGR rate to fit engine load.

EGR VALVE POSITION (EVP) SENSOR

The EVP sensor is attached to the EGR valve and provides an electrical signal to the ECA that indicates EGR valve position. Using the input from this and other sensors, the ECA can regulate EGR flow by activating or deactivating a pair of solenoids.

THROTTLE KICKER SYSTEM

Used on Federal vehicles only, the throttle kicker system consists of a Throttle Kicker Solenoid (TKS) and a Throttle Kicker Actuator (TKA). The system is designed to increase engine RPM when the A/C system is on. See Fig. 3.

With A/C system on, the ECA energizes the TKS allowing intake manifold vacuum to reach the TKA. The TKA is positioned on the carburetor against the throttle lever. With vacuum applied, the TKA will increase engine RPM for increased cooling and smoother idle. The TKA is also energized during engine warmup or if an engine overheat condition exists.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

The EGR system used with the EEC II system consists of an EGR valve/sensor assembly, EGR control solenoids, and EGR cooler assembly. Utilizing engine manifold vacuum to operate the EGR valve, the ECA controls EGR gas flow.

When EGR valve is open, exhaust gas from exhaust manifold is directed into the intake manifold and becomes part of the combustion cycle, helping to reduce NOx emissions levels.

EGR Valve/Sensor Assembly - The EGR valve is mounted to the intake manifold under the carburetor. The valve controls EGR flow through a pintle valve and seat. An EGR Valve Position (EVP) sensor is attached to the valve and provides an electrical signal to the ECA indicating EGR valve position. The EGR valve, unlike standard EGR valves, has no opening to observe pintle valve movement. The EGR valve and position sensor are serviced as individual units.

EGR Control Solenoids - The EGR valve flow rate is controlled by 2 solenoids mounted on left valve cover. Proper control of vacuum needed to operate the EGR valve requires 2 types of solenoids:

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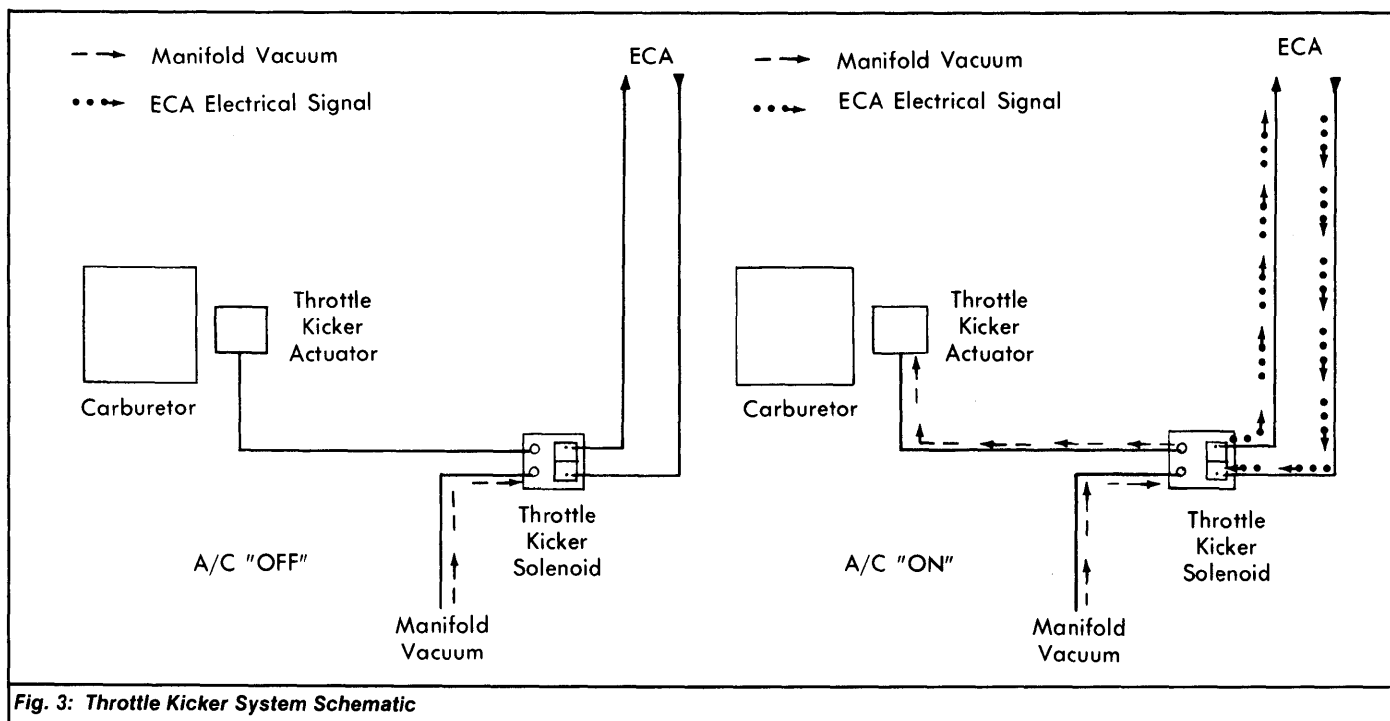


Fig. 3: Throttle Kicker System Schematic

- A vent valve, which is normally open; that is, the outlet port is normally connected to the inlet port when the solenoid is not energized.
- A vacuum valve, which is normally open; that is, the outlet port is normally blocked when solenoid is not energized.

Utilizing input from the various sensors, the ECA directs the vacuum and vent solenoids to increase EGR flow by applying vacuum to the EGR valve, maintain the EGR flow by trapping vacuum in the system, and decrease EGR flow by venting the system to the atmosphere.

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

THREE-WAY CATALYTIC CONVERTER

This is a dual catalytic converter consisting of two converters in one shell, with a mixture chamber between the two. Each converter is composed of a ceramic honeycomb coated with catalyst material.

The Three-Way Catalyst (TWC) converter, acts on exhaust gases as they arrive from the engine. As gases flow from the front TWC converter to the rear, or Conventional Oxidation Catalyst (COC) converter, they mix with air from the thermactor pump injected into the mixing chamber. This air is required for proper oxidation of HC and CO emissions.

Air Supply Pump - This belt driven pump provides the source of air to be controlled by the by-pass/diverter valve as directed by the ECA. The air pump does not have a pressure relief valve, this function being controlled by the by-pass/diverter valve.

By-Pass/Diverter Valve - Air from the air pump has three possible routes through the by-pass/diverter valve: downstream air (air injected into three-way catalyst, upstream air (air injected into exhaust manifold), or by-pass (air vented to atmosphere). See Fig. 4.

The proper routing for thermactor air is determined by the ECA based on engine coolant temperature versus time curve and other sensor data. During normal coolant temperature operation the air is normally directed downstream.

The air is by-passed when the closed throttle time exceeds a set time value, or if the time between the exhaust gas oxygen sensor

exceeds a set time value. The air will also be by-passed during wide open throttle mode or during extended closed throttle operation.

During engine warm-up the thermactor air will be routed upstream. This is to help remove excessive amounts of HC and CO produced during the warm-up period.

Air Control Solenoids - The by-pass/diverter valve is controlled by the Thermactor Air By-Pass (TAB) solenoid, and Thermactor Air Diverter (TAD) solenoid. Solenoids are mounted on top of right fender apron.

The TAB solenoid controls manifold vacuum to the by-pass portion of the by-pass/diverter valve, which in turn controls whether air from Thermactor pump is by-passed to the atmosphere (solenoid de-energized) or routed to control the diverter valve (solenoid energized).

The TAD solenoid controls manifold vacuum to the diverter portion of the by-pass/diverter valve, which in turn controls which direction (upstream or downstream) Thermactor air is routed. In the de-energized position, air is routed downstream. In the energized position, air is routed upstream.

Exhaust Check Valves - Two exhaust check valves are used in the EEC II Thermactor system to prevent reverse flow of exhaust gases in the event of system malfunction. One check valve is located between the by-pass/diverter valve and the exhaust ports, and the other valve between the catalytic converter and the by-pass/diverter valve.

THERMACTOR AIR SYSTEM

The EEC II thermactor air system consists of an, air supply pump, by-pass/diverter valve, air control solenoids, exhaust check valves, and a three-way catalytic converter. See Fig. 4.

The efficiency of the catalytic converter is dependent upon temperature and the chemical makeup of the exhaust gases. Air must be provided to the COC catalyst for the oxidation of HC and CO byproducts of the TWC catalyst.

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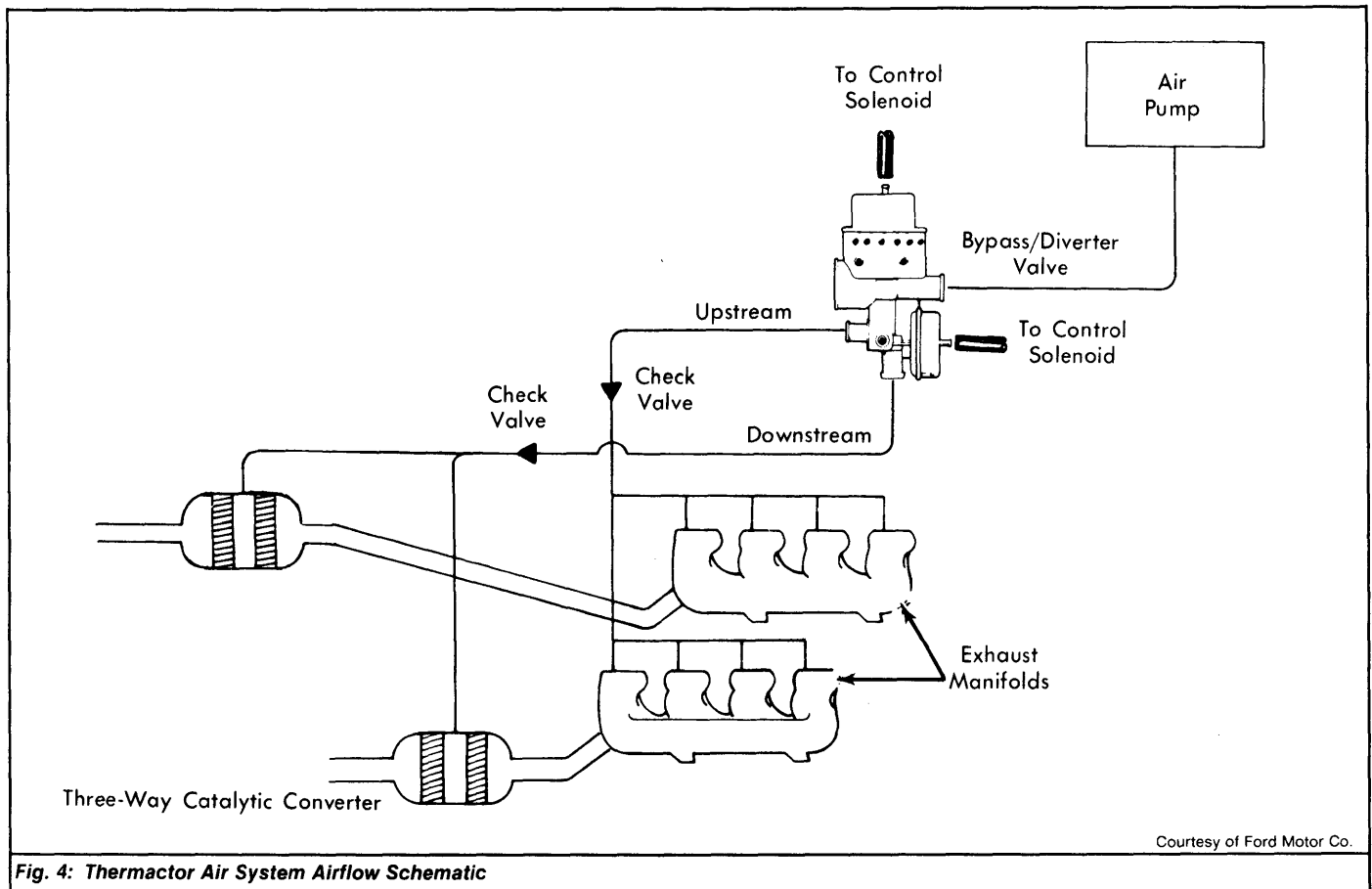


Fig. 4: Thermactor Air System Airflow Schematic

Courtesy of Ford Motor Co.

FEEDBACK CARBURETOR ACTUATOR (FBCA)

The FBCA controls air/fuel ratio on signal from the ECA by adjusting the position of a vacuum bleed metering rod in the carburetor. See Fig. 5. This actuator is not a solenoid but a combination motor and leadscrew. The leadscrew changes the rotary motion of the motor to a linear (in and out) motion of the actuator shaft.

The FBCA actuator shaft can be set by ECA signal to any position between fully retracted and fully extended. When the actuator shaft is fully extended, the vacuum bleed metering rod is seated, permitting the slightly rich mixture to enter the engine unchanged.

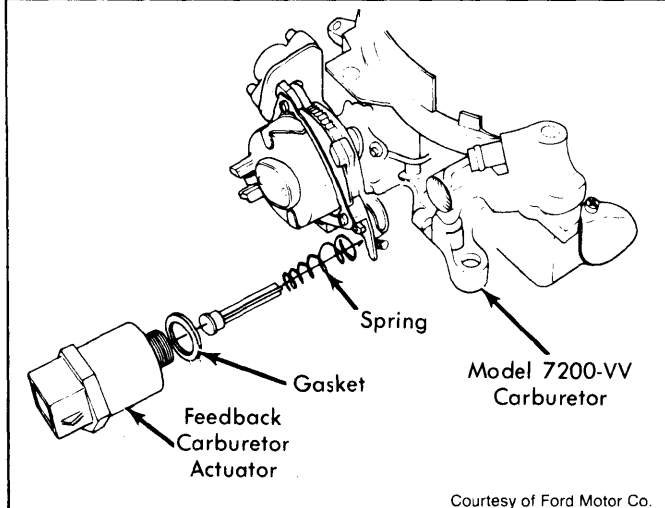


Fig. 5: Feedback Carburetor Actuator

Courtesy of Ford Motor Co.

When the actuator shaft is retracted, the metering rod bleeds vacuum from the control vacuum chamber into the fuel bowl. This lowers the air pressure in the fuel bowl, which leans out the air/fuel mixture.

CANISTER PURGE SYSTEM

Canister Purge (CANP) Solenoid - This solenoid is a combination solenoid and valve. Located in the line between the intake manifold purge fitting and the carbon canister, the CANP solenoid controls the flow of vapors from the canister to the intake manifold during various engine operating modes. The valve is opened and closed by a signal from the ECA.

DURA-SPARK III IGNITION SYSTEM

The EEC II system uses a Dura-Spark III ignition module and ignition coil to generate the required high voltage spark. An all new distributor, designed specifically for the EEC II system, is also used. See Fig. 6.

Distributor - The distributor eliminates conventional mechanical and vacuum advance mechanisms. All timing is controlled by the ECA, which is capable of firing the spark plug at any point within a 50 degree range depending on calibration. This increased spark capability requires greater separation of adjacent distributor cap electrodes to prevent cross-fire.

Bi-Level Rotor & Distributor Cap - Both the rotor and cap have upper and lower electrode levels. 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 the terminal on the cap and on to the spark plug.

The numbers molded into the top of the distributor cap are wire identification numbers. Due to the unique design of the cap and rotor, the wires ARE NOT arranged in the cap in firing order.

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The outer ring of numbers is for use with the EEC II system. The actual firing order is 1-3-7-2-6-5-4-8, is stamped on intake manifold. If an aftermarket cap is installed, use original cap as a guide to reference spark plug wire locations.

NOTE: Do not attempt to remove any silicone coating from the rotor lower electrode blades or from the distributor cap electrodes (including the center plate electrodes). With age, this silicone compound has the appearance of being a contaminant of the cap and electrodes. This condition is normal and will not affect the performance. For additional information, see MOTORCRAFT EEC IGNITION SYSTEM article in DISTRIBUTORS & IGNITION SYSTEMS section.

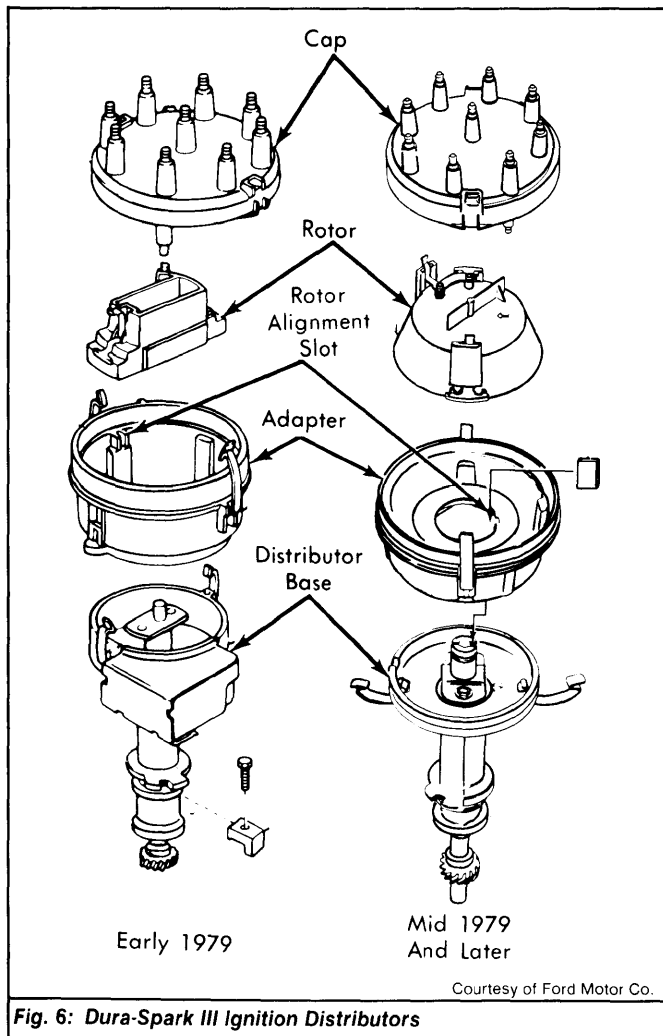


Fig. 6: Dura-Spark III Ignition Distributors

TESTING & DIAGNOSIS

TEST EQUIPMENT

The following equipment is recommended to properly diagnose and test the Electronic Engine Control II system:

- Digital Volt/Ohmmeter (T78L-50-DVOM).
- EEC II Tester (T79L-50-EEC-II).
- Vacuum/Pressure Gauge (5" Hg/25 psi Range).
- Vacuum Gauge (0-25" Hg Range).
- Tachometer (0-5000 RPM Range).
- Speed Control Tester (Snap-On GA-437).

NOTE: The EEC II tester plugs in between the ECA and the vehicle wiring harness to monitor EEC II system signals. See EEC II operator's manual for test procedures and test specifications. Although Ford Motor Co. has not recommended testing this system without the use of the EEC II tester, a series of test procedures have been developed and are included in this article. These test procedures have been field tested and have worked satisfactorily. 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 II system. Test Clips (JP-13288) are available from J.S. Popper, Inc. 200 Liberty Street Little Ferry, NJ 07643 (201) 641-3252

VISUAL (PRE-CHECK) INSPECTION

- 1) Perform basic fuel system and ignition system checks, to ensure there is gas and spark. Remove air cleaner assembly and inspect all vacuum and pressure hoses for proper connection to fittings, or any broken, cracked or pinched conditions.
- 2) Inspect EEC II sub-system harness for proper connections to the EGR solenoids. Red wire to both, Yellow wire to EGR control solenoid and Dark Green wire to EGR vent solenoid.
- 3) Check for any loose or detached connectors or broken or detached wires. Ensure all terminals are completely seated. Check for partially broken or frayed wires at connectors or any shorting between wires.
- 4) Also check for and clean corrosion at all electrical connections. Inspect sensors for evidence of physical damage. Repair items as required. Replace air cleaner.
- 5) Check vehicle charging system. Check for full battery charge and check battery cable connections for tightness. Inside passenger compartment, check to make sure the ECA power relay is securely attached and making a good ground connection.

ECA POWER RELAY

- 1) Check battery operating cranking voltage at battery. A minimum of 10.5 volts is required. Black ground wire (circuit No. 57) and Black/Light Green Dot (circuit No. 60) are connected to battery and chassis ground. Red/Light Green wire (circuit No. 16) supplies ignition voltage to the relay. See Fig. 7.
- 2) Red wire (circuit No. 361) provides the ECA with current when the relay is energized. Test these circuits with a 12-volt test light (where applicable) and a 10 megohm hi-impedance voltmeter where necessary. The ECA power relay can be the cause of a no-start condition.

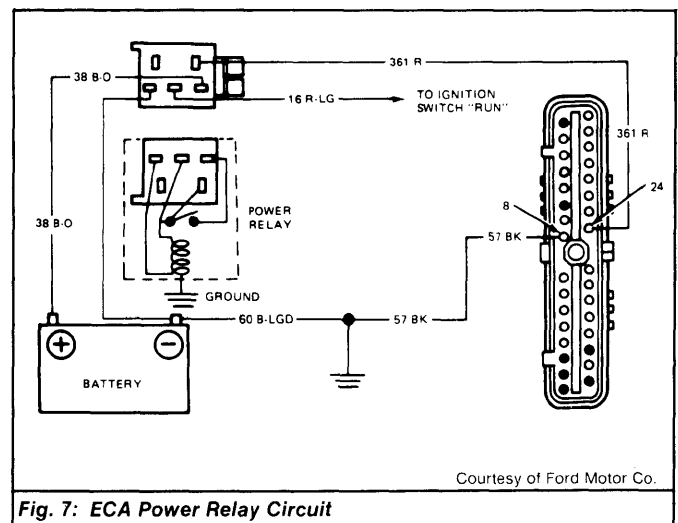


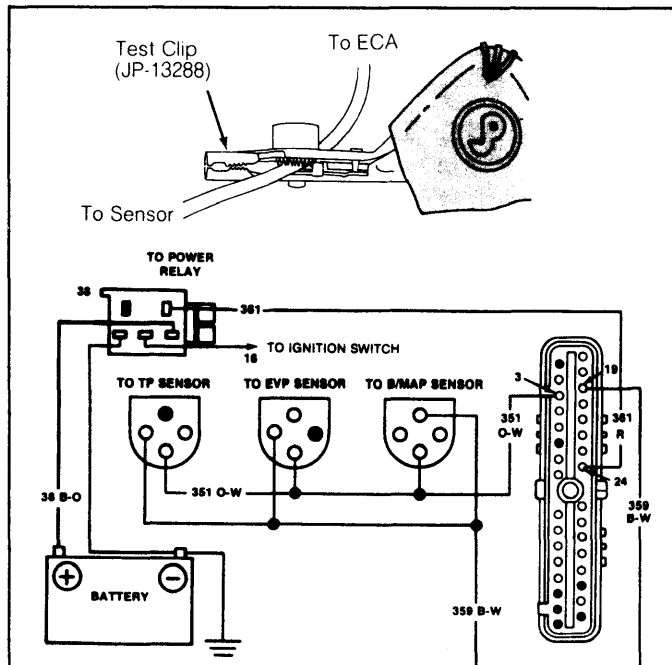
Fig. 7: ECA Power Relay Circuit

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SENSOR REFERENCE VOLTAGE

1) Use a 10 megohm hi-impedance voltmeter to check the 9-volt Reference Voltage (Vref) output at all of the sensors. If the Vref is not present, work back through the circuits and the ECA power relay to find your problem.

2) If the ECA has battery power to it and its ground circuit is okay, the sensors should receive the 9-volt reference signal over Orange/White wire (circuit No. 351). See Fig. 8. Otherwise, replace the ECA and recheck for 9-volt Vref signal.

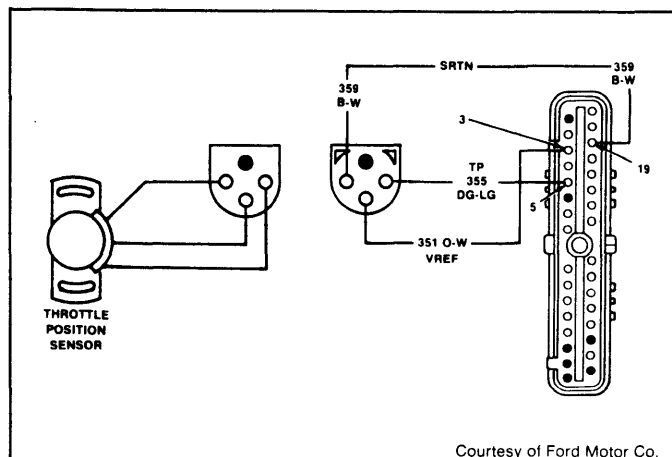


Courtesy of Ford Motor Co.

Fig. 8: Sensor Reference Voltage Circuit

THROTTLE POSITION SENSOR

The throttle position sensor signal on Light Green/Dark Green wire (circuit No. 355) should be 1.8-2.5 volts at closed throttle position. See Fig. 9. At Wide Open Throttle (WOT) position, the throttle position sensor signal should go to over 6 volts (minimum). If necessary, adjust throttle position sensor signal to 2.1 volts with throttle closed.

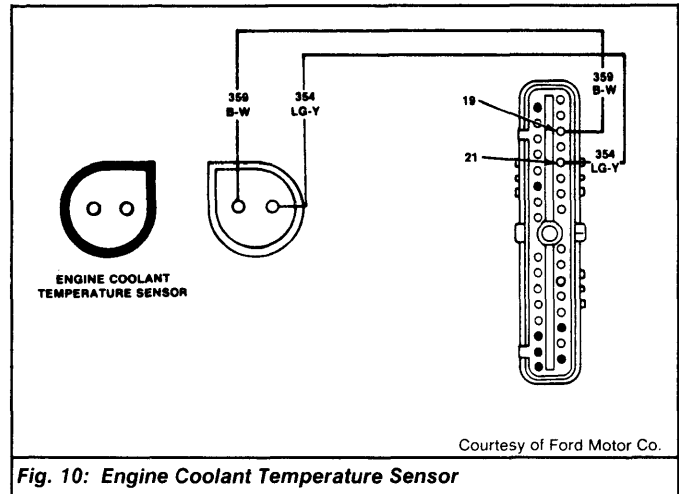


Courtesy of Ford Motor Co.

Fig. 9: Throttle Position Sensor Circuit

ENGINE COOLANT TEMPERATURE SENSOR

The ECA reads the resistance in the ECT circuit through a sort of "voltage back-pressure" on the Light Green/Yellow sensor wire (circuit No. 354). See Fig. 10. A high reading on circuit No. 354 indicates too much resistance in the circuit, an open circuit in harness or connector, or a burnt out sensor. A normal voltage reading on this circuit with the engine warmed up would be .75-2.8 volts.



Courtesy of Ford Motor Co.

Fig. 10: Engine Coolant Temperature Sensor

BAROMETRIC/MANIFOLD ABSOLUTE PRESSURE (B/MAP) SENSOR

1) Check that source vacuum hose from the B/MAP sensor goes directly to manifold vacuum. Also, make sure that no hoses are connected to the vent port and that the source vacuum hoses are in good condition.

2) The voltage reading from Light Green/Black wire (circuit No. 358) and Dark Blue/Light Green wire (circuit No. 356) should be 7.5-8.5 volts, when measured with Key On/Engine Off (KOEO). See Fig. 11.

3) As vacuum is applied to the manifold absolute pressure sensor vacuum connection, the voltage reading should change smoothly to about 2.0 volts at 22 in. Hg vacuum.

NOTE: B/MAP sensor voltages with KOEO should be within 0.75 volt of each other.

B/MAP SENSOR SPECIFICATIONS

Elevation (Feet)	Voltage Reading
0-1500	7.6-8.4
1501-2500	7.2-8.1
2501-3500	6.9-7.8
3501-4500	6.7-7.3
4501-5500	6.6-7.2
5501-6500	6.3-7.0
6501-7500	6.1-6.7
7501-8500	5.8-6.5
8501-9500	5.6-6.3
9501-10,500	5.4-6.0

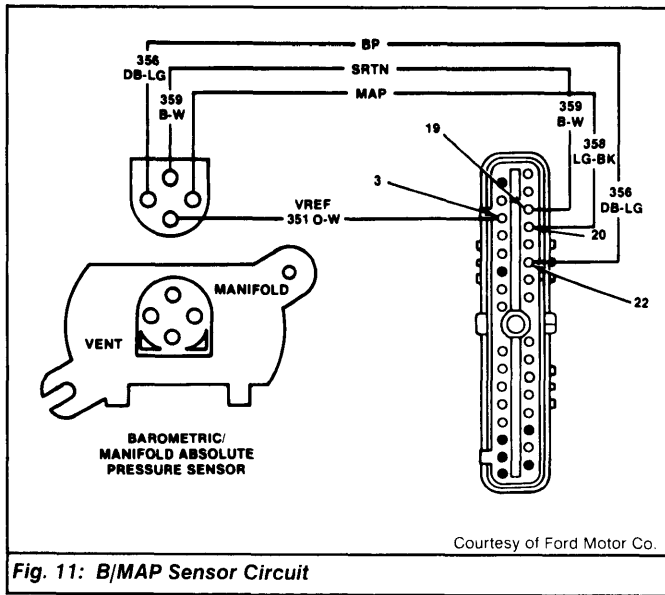


Fig. 11: B/MAP Sensor Circuit

EGR VALVE POSITION SENSOR

Test Orange/White wire (circuit No. 351) for 9-volt Reference Voltage (Vref) input. See Fig. 12. The EGR valve position sensor output voltage on circuit No. 352 should increase smoothly as vacuum is applied to valve and may go to as high as 8.5 volts. Remember that this sensor operates like a throttle position sensor, and could stick or hang-up inside the device, causing a false reading to be sent to the ECA of EGR flow rate.

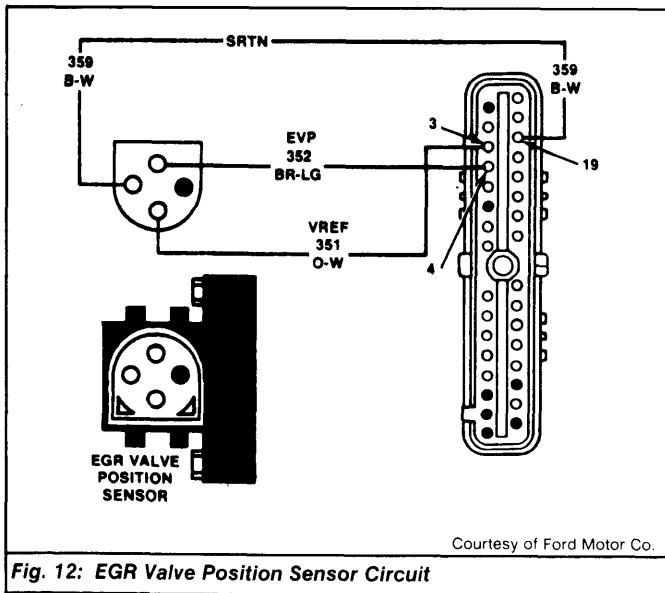


Fig. 12: EGR Valve Position Sensor Circuit

EXHAUST GAS OXYGEN SENSOR

- 1) The exhaust gas oxygen sensor output on Dark Green/Purple Hash wire (circuit No. 94) can be measured with a 10 megohm impedance voltmeter. To check EGO sensor operation, you can force the air/fuel mixture lean or rich. When vacuum leaks are artificially created to the intake manifold, the exhaust gas oxygen sensor output voltage should go to around 0.10 volt.
- 2) The exhaust gas oxygen sensor ground circuit can be checked by using an ohmmeter to check the continuity of Black wire (circuit No. 89). See Fig. 13. The exhaust gas oxygen sensor output wire can be disconnected to make it easier to measure the circuit output voltage.



Fig. 13: Exhaust Gas Oxygen Sensor Circuit

THROTTLE KICKER SOLENOID

- 1) Test for battery voltage at the throttle kicker solenoid or on Red wire (circuit No. 361) with the Key On/Engine Off (KOE). The throttle kicker solenoid can also be checked for opens or shorts with an ohmmeter. The solenoid resistance should be 45-85 ohms.
- 2) The vacuum source to the solenoid should be over 12 in. Hg with the engine running. The throttle kicker actuator can be checked with an external vacuum pump. The engine RPM should increase when vacuum is applied externally and immediately decrease when the vacuum is removed.
- 3) Remember that the ECA completes the throttle kicker solenoid circuit by grounding Red/Light Green wire (circuit No. 69) coming from the throttle kicker solenoid. See Fig. 14.

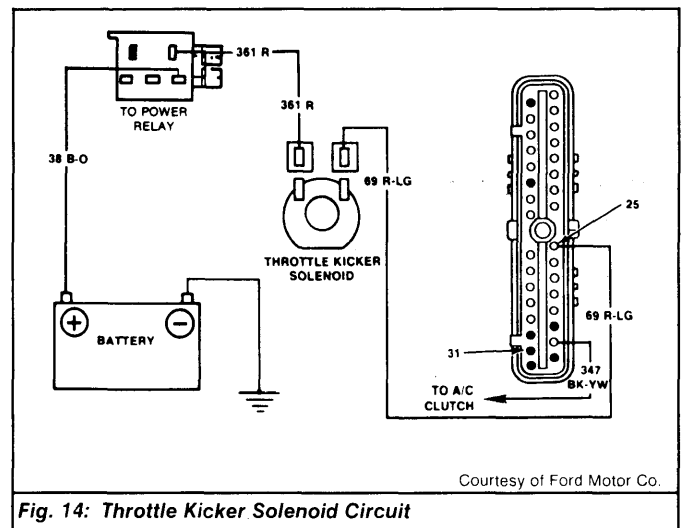


Fig. 14: Throttle Kicker Solenoid Circuit

CANISTER PURGE SOLENOID

- 1) With ignition on, test for battery voltage at Red wire (circuit No. 361) at canister purge solenoid. If battery voltage is available on circuit No. 361, you can ground Gray/Yellow Hash wire (circuit No. 101) and the canister purge solenoid should open. See Fig. 15.
- 2) By applying 15-20 in. Hg vacuum to carburetor side of solenoid (with both vacuum hoses removed), you can check canister purge solenoid operation. Solenoid should hold vacuum when closed and release it when opened. Solenoid resistance is 45-85 ohms when measured across terminals.

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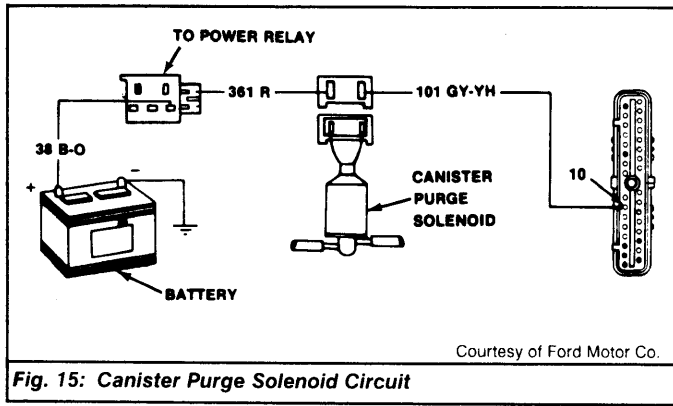


Fig. 15: Canister Purge Solenoid Circuit

CRANKING SIGNAL

The voltage reading on Red/Light Blue wire (circuit No. 32) while cranking engine should be about 1.0 volt less than battery voltage. See Fig. 16. The battery feed for this circuit comes from the ignition switch on circuit No. 32 and splits off to the starter relay "S" terminal and to ECA terminal No. 1. An open circuit on the line to the ECA could cause a no-start or hard cold start condition during the crank period because the ECA would not pulse the fuel injectors.

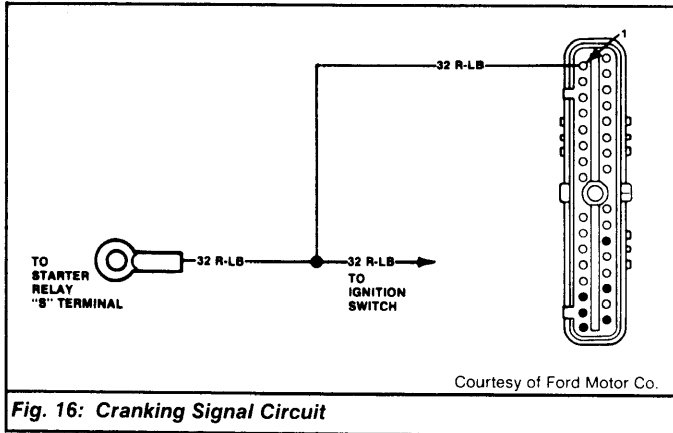


Fig. 16: Cranking Signal Circuit

CRANKSHAFT POSITION SENSOR

1) Visually inspect crankshaft position sensor and pulse ring for physical damage. The output signal of the sensor is measured on the AC voltage scale of a multimeter.
 2) The cranking signal should be .15 volt during cranking and .20-.60 volt with engine running. The resistance of the sensor is 100-640 ohms. The polarity is positive on Dark Blue wire (circuit No. 349) and negative on Gray Wire (circuit No. 350). See Fig. 17.

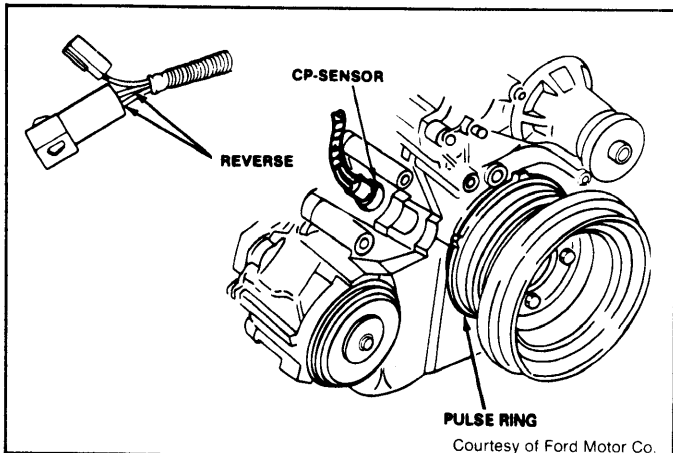


Fig. 17: Crankshaft Position Sensor Circuit

3) To check initial (base) ignition timing setting, align the engine timing pointer to specification shown in IGNITION TIMING CHECK in this article. With rotor aligned, the pulse ring lobe should be centered on the crankshaft position sensor.

4) If pulse ring lobe and sensor are not aligned, the engine has a mechanical problem. Check crankshaft pointer, pulse ring, pulse ring, crankshaft position sensor retainer, vibration damper, etc. If leads in crankshaft position sensor are reversed, the initial ignition timing setting will be out of limits.

THERMACTOR AIR SYSTEM CHECK

NOTE: For complete Thermoactor air system description and test procedures, go to FORD MOTOR CO. THERMACTOR I SYSTEM article in EXHAUST EMISSION SYSTEMS section. Only the EEC-II control portion of system is covered in this article.

1) Check Thermoactor Air By-Pass (TAB) solenoid and Thermoactor Air Diverter (TAD) solenoid for physical damage. Check for open circuit in Light Green/Black Dot wire (circuit No. 99) and White/Red Dot wire (circuit No. 100). If reading is greater than 10 volts, repair open in wiring harness between solenoids and ECA connector.

2) To determine if solenoid is open, check Red wire (circuit No. 361) at both solenoids. See Fig. 18. If reading is greater than 10 volts at both solenoids, replace TAB/TAD solenoid assembly. If reading is less than 10 volts, repair open in Red wire.

3) Check resistance of solenoids and wiring. With key off and electrical leads plugged into TAB/TAD solenoid assembly, check resistance across terminals of each solenoid. If reading is 45-90 ohms, replace ECA.

4) If reading is less than 45 ohms or more than 90 ohms, disconnect wiring harness from both solenoids and measure resistance of each solenoid. If reading is now 45-90 ohms, repair short in wiring harness. If reading is less than 45 ohms or more than 90 ohms, replace TAB/TAD solenoid assembly.

5) With connector disconnected at ECA, check for short circuits in harness. For TAB solenoid, measure resistance between White/Red Dot wire (circuit No. 100) and Black ground wire (circuit No. 57/60), Light Green/Black Dot (circuit No. 99), and Red wire (circuit No. 361). If reading is 10,000 ohms or more, reconnect all connectors. If reading is less than 10,000 ohms, repair short in harness.

6) For TAD solenoid, measure resistance between Light Green/Black Dot (circuit No. 99) and Black ground wire (circuit No. 57/60), White/Red Dot wire (circuit No. 100), and Red wire (circuit No. 361). If reading is 10,000 ohms or more, reconnect all connectors. If reading is less than 10,000 ohms, repair short in harness.

7) If all electrical circuits are okay, ensure belt, air pump and check (relief) valve of Thermoactor system are in good working condition. Ensure vacuum supply hoses are not blocked, pinched, cracked or improperly seated.

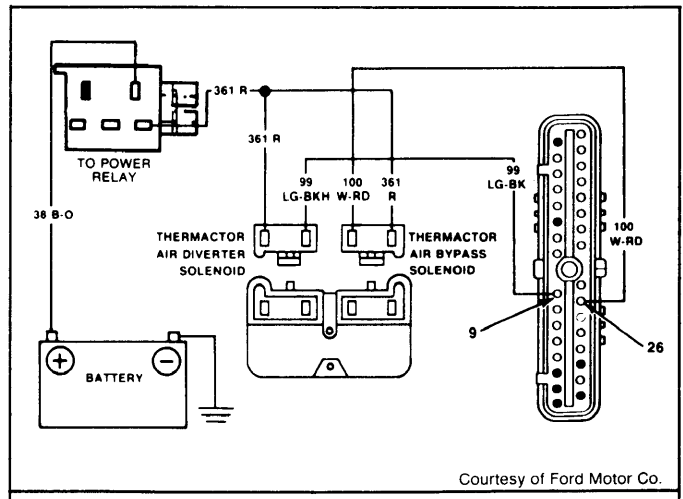


Fig. 18: TAB/TAD Solenoid Circuit

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Ford Motor Co. Electronic Engine Control II (Cont.)

8) Ensure vacuum pulses are present at TAB/TAD solenoid assembly. If no vacuum is present at TAB/TAD solenoid assembly, check ECA power relay. If vacuum is steady at TAB/TAD solenoid assembly, or never drops below 1 in. Hg, replace TAB/TAD solenoid assembly.

EGR SYSTEM CHECK

NOTE: For complete EGR system description and test procedures, go to FORD MOTOR CO. EXHAUST GAS RECIRCULATION SYSTEM article in EXHAUST EMISSION SYSTEMS section. Only the EEC-II control portion of system is covered in this article.

Valve Closed Position Test - 1) With Key On/Engine Off (KOEO), verify that 9-volt Reference Voltage (Vref) input is available at EGR Valve Position (EVP) sensor Orange wire. See Fig. 19.

2) Connect digital volt/ohmmeter to EVP sensor Brown/Light Green output wire. With EGR valve vacuum hose disconnected from valve and KOEO, observe EVP sensor output voltage. If reading is less than 1.40 volts, replace EVP sensor.

3) If reading is between or equal to 1.40-2.45 volts, go to VALVE LEAKAGE TEST. If reading is greater than 2.45 volts, replace or clean EGR valve and exhaust gas recirculation passage.

Valve Leakage Test - 1) Connect vacuum pump to EGR valve. Apply 5-6 in. Hg vacuum to EGR valve. Trap and hold vacuum to valve. Vacuum should not drop more than 1 in. Hg in 30 seconds.

3) If EGR valve does not hold applied vacuum, replace valve, "O" ring or EVP sensor as needed. If EGR valve holds applied vacuum, go to VALVE OPEN POSITION TEST.

Valve Open Position Test - 1) Connect vacuum pump to EGR valve. With KOEO, slowly apply 5-6 in. Hg vacuum to EGR valve while observing EVP sensor output voltage on Brown/Light Green wire.

2) If reading is less than 6.4 volts, replace EVP sensor. If reading is between or equal to 6.4-10.0 volts, go to EGR FLOW TEST. If reading is greater than 10.0 volts, check Vref circuit for short to battery power (B+).

EGR Flow Test - 1) Connect vacuum pump to EGR valve. Start and warm engine to normal operating temperature (upper radiator hose hot to touch). Slowly apply 5-6 in. Hg vacuum to EGR valve while observing changes in engine RPM.

2) If a noticeable RPM drop occurs or engine stalls, EGR valve and EVP sensor are okay. If no RPM change occurs, check for improper gasket installation and/or plugged EGR passages in intake manifold and EGR valve.

IGNITION TIMING CHECK

NOTE: Initial (base) ignition timing is not adjustable on Dura-Spark III ignition system. The crankshaft position sensor and pulse ring on crankshaft provide an electrical input to ECA. The following procedure is used to check and adjust rotor alignment.

1) Remove distributor cap and wires and position them aside. Remove rotor on late design distributor. DO NOT remove rotor on early design distributor. Rotate engine until No. 1 piston is on compression stroke.

2) Slowly rotate engine until alignment key can be installed. On early design distributor, align upper rotor blade with locating slot in distributor adapter. Drop Alignment Key (T78P-12200A) into place.

3) On late design distributor, use Alignment Key (T79P-12200A) between slot on sleeve and slot on adapter. See Fig. 20. On all models, read timing mark on damper indicated by timing pointer.

4) If timing is within 4 degrees of specification, rotor alignment is correct. Remove alignment key. If alignment is incorrect, remove alignment key and rotate engine until timing pointer is aligned to proper specification.

5) Loosen rotor (sleeve) attaching screws and turn rotor (sleeve) until alignment key can be installed. Tighten screws and remove alignment key. Install distributor cap and wires, making sure wires are firmly seated in distributor cap.

ROTOR ALIGNMENT SPECIFICATIONS

Year	Engine	Mark
1978-79		
12A199 Module	5.0L	TDC
12A244 Module	5.0L	TDC
1979 ¹	5.8L	TDC

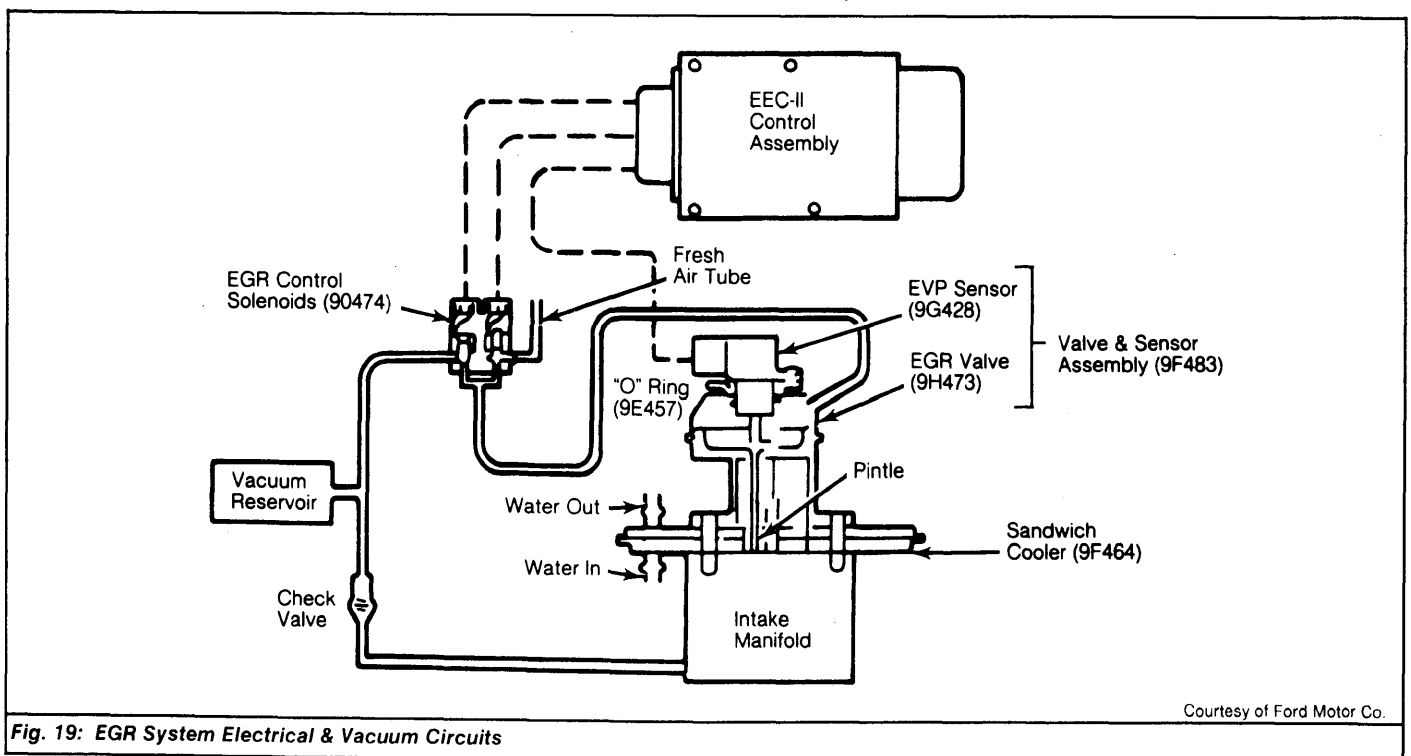


Fig. 19: EGR System Electrical & Vacuum Circuits

Courtesy of Ford Motor Co.

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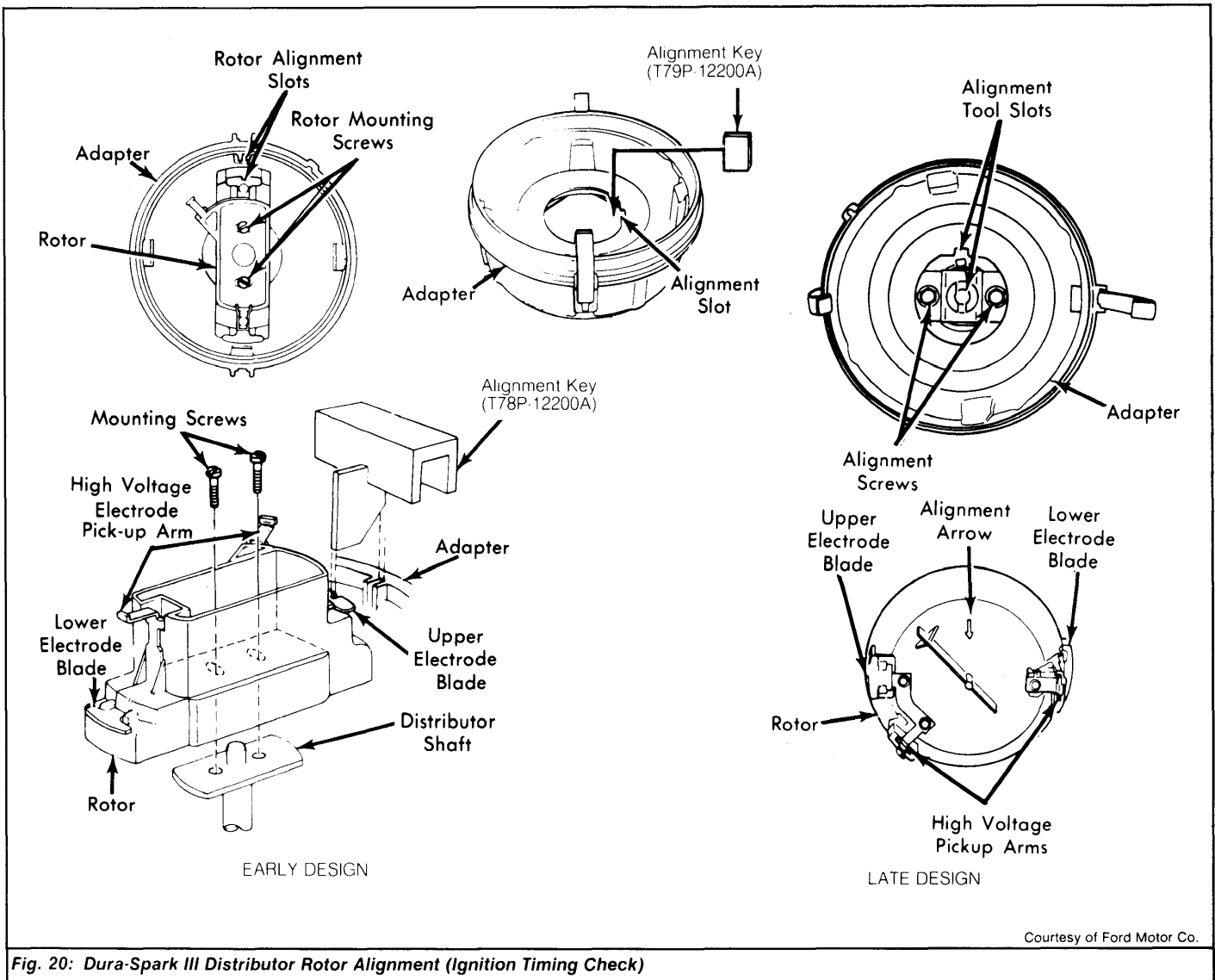


Fig. 20: Dura-Spark III Distributor Rotor Alignment (Ignition Timing Check)

SOLENOID ACTUATOR CHECKS

The following solenoid actuator checks require the use of a digital hi-impedance voltmeter/ohmmeter. The voltages shown were taken from known good vehicles and may vary slightly due to low battery charge or charging system output. Perform test by connecting digital voltmeter/ohmmeter leads between battery ground and ground wire of the particular solenoid being tested.

All solenoid actuators receive battery voltage (B+) from the EEC power relay over Red wire (circuit No. 361). The ECA controls the ground circuit to energize/de-energize solenoid.

SOLENOID ACTUATOR CHECKS

Solenoid	KOEO ¹	OHMS
CANP	12 Volts (Off)	50-100
EGRC	12 Volts (Off)	50-100
EGRV	12 Volts (Off)	50-100
TAB	12 Volts (Off)	50-100
TAD	12 Volts (Off)	50-100
TKS	1 Volt (On) ²	50-100

¹ - Test between ground wire of solenoid to battery ground terminal.

² - During KOEO, throttle kicker is activated (on) and all other solenoids are off.

A reading of 1 volt or less on the solenoid's ground wire is the ECA's command to energize (turn on) the solenoid. A reading of 12-14 volts on the solenoid's ground wire is the ECA's command to de-energize (turn off) the solenoid.

ECA PIN VOLTAGE CHECKS

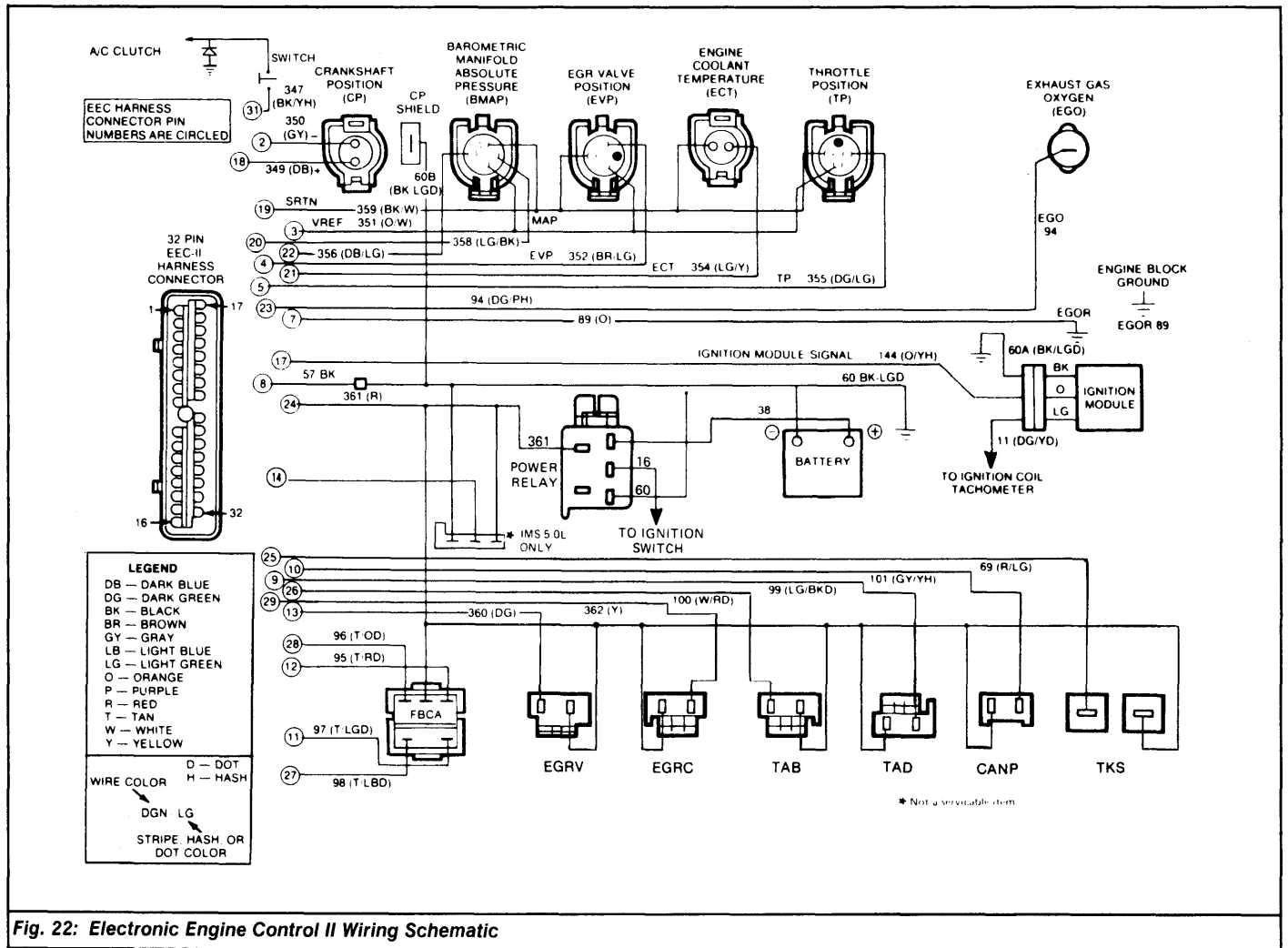
The ECA pin voltage checks require the use of a digital hi-impedance voltmeter/ohmmeter. The voltages shown were taken from known good vehicles and may vary slightly due to low battery charge or charging system output.

Connect positive voltmeter lead to circuit pin number shown and negative lead to a known good ground or to Black ground wire (pin No. 8) at ECA. Wire colors provided should help you locate correct pin numbers.

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WIRING DIAGRAMS



1a-36 **1975-79 COMPUTERIZED ENGINE CONTROLS**
Ford Motor Co. Electronic Engine Control II (Cont.)

Component	ECA Pin #	Wire Color	Volts	Comments
Cranking Signal	1	Red/Lt. Grn	Within 1v of Cranking Voltage	
SRTN-Sensor Return/GND	19	Blk/Wht	0.02-0.40v
VREF-Sensor Voltage Reference	3	Org/Wht	8.0-10.0v
TPS-Throttle Position Sensor Idle	5	Dk. Grn/Lt. Grn	1.8-2.4v	Check TPS circuit as throttle is opened fully looking for any voltage fluctuations that would indicate a dirty sensor
WOT	5	Dk. Grn/Lt. Grn	Over 6.0v	
ECT-Engine Coolant Temperature	21	Lt. Grn/Yel	0.75-2.6v (At Operating Temperature)	Corrosion build-up on the sensor can cause false readings
MAP-Manifold Absolute Pressure (See B/MAP Specifications Table)	20	Lt. Grn/Blk	KOEO 7.6-8.4v (KOER 2.33v) (At Sea Level)	As the vacuum signal into the sensor varies, so does the voltage output reading
BP-Barometric Pressure (See B/MAP Specifications Table)	22	Dk. Blu/Lt. Grn	7.6-8.4v (At Sea Level)	Voltage changes in small amounts as the BP sensor tracks barometric changes
EVP-EGR Position	4	Brn/Lt. Grn	FBCA 1.8-2.45v EFI 1.4-1.95v	If the EGR valve sticks in an open position, this reading will be out of specifications
A/C-On/Off Input to ECA	31	Blk/Yel	ON: 9.0v or More OFF: Under 1v	When ECA gets the signal that A/C is on, the TKS is actuated to increase idle RPM
CP-Crankshaft Position	18	Dk. Blu	0.15-0.6v (AC Voltage Scale)	The CP sensor puts out an AC voltage from its signal generator like a pick-up coil
IMS-Ignition Module Signal	17	Org/Yel	Idle: 2.0v Off Idle: 1.5v	ECA sends a digital signal to the ignition module to control the compensated timing
EGO-Exhaust Gas Oxygen	23	Dk. Grn/Pink	0.2-0.8v (Switching)	Under 0.4v is lean. Over 0.6v is rich.

Fig. 21: Electronic Control Assembly (ECA) Pin Voltage Checks (KOEO)