PFE (EEC-IV)

Circuit Description

Pressure Feedback (PFE)/**Delta PFE** (DPFE) EGR sensor converts a varying exhaust gas pressure value into an analog voltage which is sent to the EEC-IV module. The EEC-IV module uses this information to compute the optimal EGR flow. The PFE sensor can be tested using a vacuum pump and gauge. Begin by checking the pressure input hose to the sensor for blockage and correct as necessary.

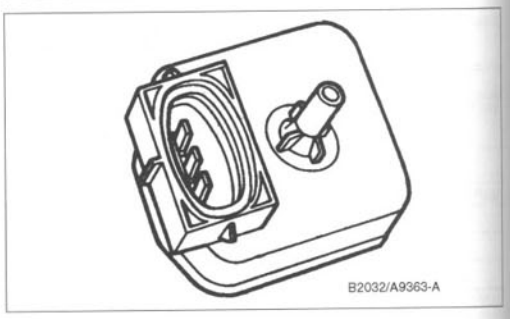
CAUTION —
To avoid possible sensor damage, do not exceed pressure/vacuum range shown below when testing.

NOTE —
Trouble code 34/335 could be due to a lack of exhaust system pressure, caused by shop exhaust extraction equipment.

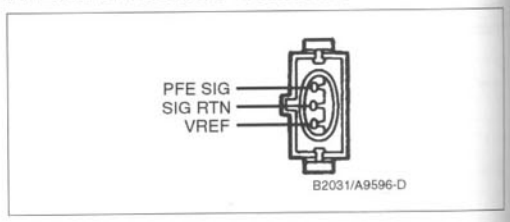
PFE/DPFE Inputs/Outputs

Signal	Description
PFE/DPFE SIG	Signal to EEC-IV module
SIG RTN	Signal return
VREF	Reference voltage input

PFE Sensor



PFE/DPFE Sensor Connector



PFE Sensor Test Values

Pressure/Vacuum			PFE Voltage
psi	in-Hg.	kPa	Volts
1.82	3.70	12.5	4.75
1.36	2.79	9.42	4.38
0.91	1.85	6.25	4.0
0.46	0.94	3.17	3.63
0	0	0	3.25
–2.47	–5.03	–17.0	1.22
–3.63	–7.40	–25.0	0.25
Note: values may vary ± 15 percent due to sensor and VREF variations			

DPFE Sensor Test Values

Pressure/Vacuum			DPFE Voltage
psi	in-Hg.	kPa	Volts
4.34	8.83	29.81	4.56
3.25	6.62	22.36	3.54
2.17	4.41	14.90	2.51
1.08	2.21	7.46	1.48
0	0	0	0.45
Note: values may vary ± 15 percent due to sensor and VREF variations			

PFE/DPFE Electrical Tests

Test	Conditions	Test Results	If Not
For Code 31/327 (PFE/DPFE signal less than 0.2 volts)	–Key off, disconnect PFE/DPFE sensor connector –Jumper PFE/DPFE circuit to VREF at harness connector –Perform KOEO Self-Test	Code 35/337 generated (ignore other codes)	–No codes at all: internal short in wiring to control unit, or control unit faulty –If 35/337 generated, replace PFE/DPFE sensor –If 35/337 not generated, check VREF
For code 35/337 (PFE/DPFE signal more than 4.8 volts)	–Key off, disconnect PFE/DPFE sensor connector –Perform KOEO Self-Test	Code 31/327 generated (ignore other codes)	–If 31/327 generated, replace PFE/DPFE sensor –If 31/327 not generated, either internal short in wiring to control unit, or control unit faulty
VREF	–Key off, disconnect PFE/DPFE connector –KOEO, measure voltage between VREF and SIG RTN at vehicle harness connector	4 to 6 volts dc (VREF)	Check VREF circuit
PFE/DPFE Sensor	–Connect PFE/DPFE connector –Connect DVOM (backprobe or BOB) between PFE wire and SIG RTN –ER, vary vacuum using pump	See table above	PFE/DPFE sensor may be faulty

TAB/TAD (EEC-IV)

Circuit Description

Thermactor Air Bypass/Thermactor Air Diverter (TAB/TAD*) solenoids (also known as AM1/AM2) direct secondary air to either the engine or exhaust manifold and catalytic converter. Opening and closing of the solenoids is controlled by the control module.

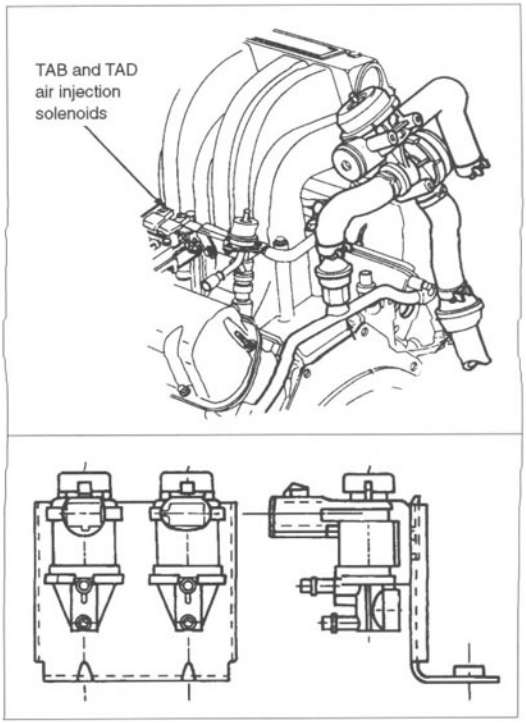
TAB Signal Wire Color

Engine Family	Wire color
Car:	
2.3L HSC MFI	W/R
5.0L SFI	W/R
5.0L MA SFI	*1992–On Mustang: W/Y* all others: W/R
Truck:	
4.9L MFI	1988–89: W/R 1991 E-series: O all other 1990–On: W/O
5.0L MFI	1988–89: W/R 1990 E-series: W/R *all other 1990–On:* W/O
5.8L MFI	1988–89: W/R 1990–91 F-series: W/O 1990–91 E-series: W/R 1992–On: W/O

TAD Signal Wire Colors

Engine Family	Wire color
Car:	
5.0L SFI	1990 Town Car: O all others: LG/BK
5.0L MA SFI	1988–90 all other: LG/BK 1990 Town Car: O 1991–On: W/LG
Truck:	
4.9L MFI	1988–90: W/BK 1990 E-series: W/BK 1991–On: B/R
5.0L MFI	1988–90: W/BK 1990 F-series, Bronco: B/R 1990 E-series: W/BK 1991–On: B/R
5.8L MFI	1988–90: W/BK 1990 F-series, Bronco: B/R 1990 E-series: W/BK 1991–On: B/R
Wiring Color Code BK–Black, BL–Blue, BR–Brown, DB–Dark Blue, DG–Dark Green, GR–Green, GY–Gray, LB–Light Blue, LG–Light Green, N–Natural, O–Orange, P–Purple, PK–Pink, R–Red, T–Tan, W–White, Y–Yellow	

Component Locator



Typical location of TAB and TAD. Engine shown is F-series, Bronco 5.0 L.

Test Data

Check the TAB/TAD solenoids for internal vacuum leaks by connecting a vacuum pump to the supply port and a vacuum gauge to the output port of one solenoid. Apply a vacuum of 15 in-Hg. (51 kPa) and observe gauge. Gauge reading should hold for each solenoid.

Check for VPWR with the key on, engine off (KOEO) after disconnecting the solenoid connector. VPWR should be 10.5 volts or greater. If not, check wiring for continuity or corrosion.

Solenoid resistance at solenoid terminals should be 51–108 ohms. If not replace the solenoid.

If solenoid operates and wiring to the control unit is OK, then the control unit may be faulty.

*1993 and later called AIRB/AIRD—see glossary

TFI-IV (EEC-IV)

Circuit Description

Thick Film Ignition-IV (TFI-IV*) and **Thick Film Ignition with Computer Controlled Dwell** (TFI-CCD*) are ignition systems that use solid state integrated circuits. A Hall sender in the distributor creates a signal (PIP) indicating crankshaft position for the EEC control module. The EEC control module triggers the TFI module with a signal (SPOUT) to fire the ignition coil. On models with Closed-Bowl Distributor, two PIP signals are sent, one to the TFI module and one to the EEC module.

Remember that a no-spark condition may also be caused by a fault in power to the coil, or by a faulty coil. Always begin by checking the power supply and ground to the module.

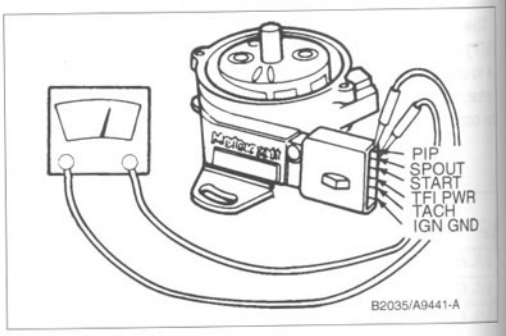
On TFI-IV and TFI-CCD, if there is no PIP signal but the module has power and ground and there is continuity in the module (PIP IN to PIP) then the Hall sender is probably faulty. On TFI with closed-bowl distributor, if there is no PIP signal but the Hall sender has power and ground, then the Hall sender is probably faulty. Perform the tests in the order shown below.

WARNING —
The TFI-IV ignition system is a high-energy system operating in a dangerous voltage range which could prove to be fatal if exposed terminals or live parts are contacted. Use extreme caution when working on a vehicle with the ignition on or the engine running.

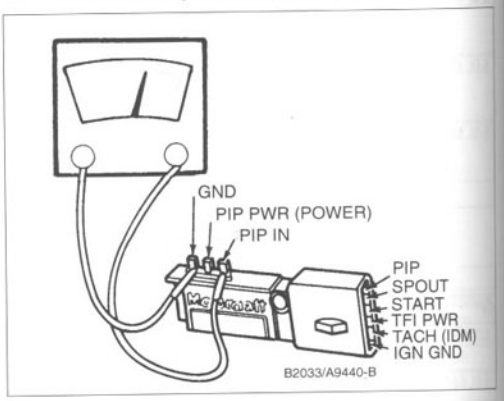
TFI-IV Inputs/Outputs

Signal	Description
START	Battery voltage input with ignition switch in start position
RUN (TFI PWR)	Battery voltage input with ignition switch in run position
COIL (TACH)	Switched output to ignition coil
PIP	PIP signal output to EEC-IV
IGN GND	Ignition ground
SPOUT	Spark out signal from EEC-IV
FTO	Filtered Tach Output signal
PIP IN	PIP signal from Hall sender
PIP PWR	Power to Hall sender

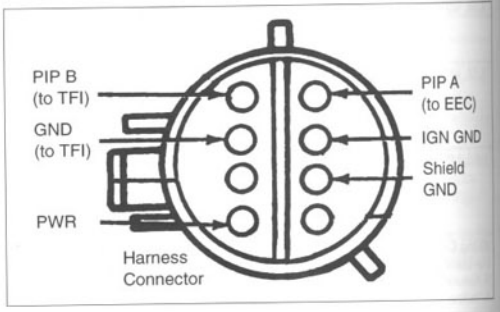
TFI-IV Module (Testing)



TFI-IV Module (Hall sender connector)



TFI Closed-Bowl Distributor Connector



*1993 and later called DI—see glossary

TFI-IV (EEC-IV)

TFI-IV Electrical Tests

Test	Conditions	Test Results	If Not
Distributor ground	–Connect DVOM between distributor base and engine block	Continuity (less than 2 ohms)	Fault in distributor ground, check distributor mounting
Power to TFI module or closed-bowl distributor, engine run	–Key off, disconnect TFI-IV/distributor connector –Measure voltage at vehicle harness connector between TFI PWR/PWR and distributor base (ground) –KOEO	Battery voltage	Fault in power circuit from ignition switch
Power to TFI module, engine crank	–Key off, disconnect TFI-IV connector –Measure voltage at vehicle harness connector between START and distributor base (ground) –Engine Crank	8 to 10 volts	Fault in power circuit from ignition switch
Power to Hall sender (closed-bowl distributor)	–Key off, disconnect distributor connector –Measure voltage between PWR at harness connector and distributor base (ground) –KOEO	Battery voltage	Fault in power circuit from ignition switch
PIP signal (TFI, TFI-CCD)	–TFI connector connected –Backprobe TFI connector at PIP with DVOM or LED test lamp –Engine Crank	3 to 6 volts, or LED test lamp blinks	If TFI module tests OK as shown below then Hall sender is faulty
PIP signal (TFI with closed-bowl distributor)	–Distributor connector connected –Backprobe distributor connector at PIP A/B with DVOM or LED test lamp –Engine Crank	3 to 6 volts, or LED test lamp blinks	Hall sender faulty
SPOUT	–TFI connector connected –Backprobe TFI connector at SPOUT with DVOM or LED test lamp –Engine Crank	3 to 6 volts or LED test lamp blinks	Check wiring to control module. If OK, control module may be faulty
TFI Module tests (See illustration above, **TFI Module (Hall sender connector)**			
GND to PIP IN	–Remove distributor from engine –Remove TFI module from distributor –Probe with ohmmeter at Hall sensor connector	Greater than 500 Ohms	TFI module faulty
PIP PWR to PIP IN	–Probe with ohmmeter at Hall sensor connector	Less than 2000 Ohms	TFI module faulty
PIP PWR to TFI PWR	–Probe with ohmmeter at Hall sensor connector	Less than 200 Ohms	TFI module faulty
GND to IGN GND	–Probe between TFI module connectors	Less than 2 Ohms	TFI module faulty
PIP IN to PIP	–Probe between TFI module connectors	Less than 200 Ohms	TFI module faulty

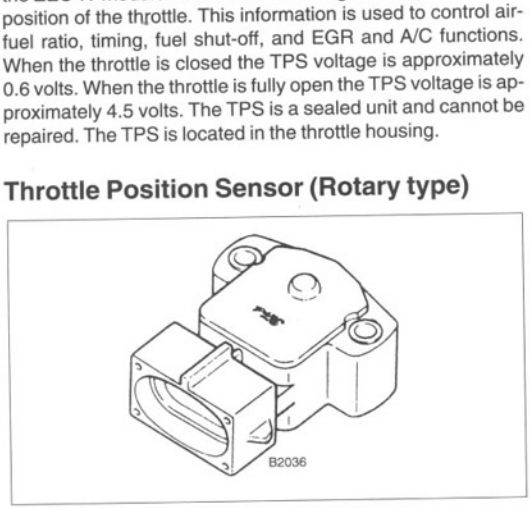
12

TPS (EEC-IV)

Circuit Description

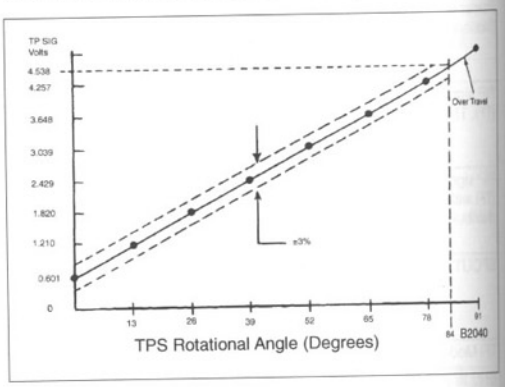
Throttle Position Sensor (TPS) is a sensor that provides the EEC-IV module with a variable voltage that represents the position of the throttle. This information is used to control air-fuel ratio, timing, fuel shut-off, and EGR and A/C functions. When the throttle is closed the TPS voltage is approximately 0.6 volts. When the throttle is fully open the TPS voltage is approximately 4.5 volts. The TPS is a sealed unit and cannot be repaired. The TPS is located in the throttle housing.

Throttle Position Sensor (Rotary type)



Throttle Position Sensor Vehicle Harness Connectors

Throttle Position Sensor Output Voltage



TPS Inputs/Outputs

Signal	Description
TP SIG	Variable voltage from approximately 0 to 5 volts
VREF	Reference voltage
SIG RTN	Signal return

TPS Electrical Tests

Test	Conditions	Test Results	If Not
VREF	–Key off, wait 10 seconds –Disconnect TPS connector –Probe between VREF and SIG RTN at TPS vehicle harness connector –KOEO	4 to 6 volts	Check VREF circuitry and wiring
TP SIG	–Backprobe TPS connector between TPS and SIG RTN –KOEO –Move throttle through entire range	–Variable voltage from 0 to 5 volts without any breaks as throttle is moved through range	Faulty TPS

VAF/VAT (EEC-IV)

Circuit Description

Vane Airflow Sensor (VAF*) is a sensor that provides the EEC-IV module with a voltage signal that represents the amount of air flowing into the engine. The VAF sensor consists of an air vane that is attached to a potentiometer. The air vane moves as the intake air volume changes, changing the voltage. When troubleshooting the VAF sensor, begin by checking for air leaks in the intake system that cause unmetered air to enter. Check that the VAF sensor is not binding or sticking and remove all residue and intake deposits using a cleaner. The VAF sensor cannot be repaired. The VAF sensor is located in the vane air meter in the throttle housing.

Vane Air Temperature (VAT*) sensor provides the EEC-IV module with a voltage that changes with ambient temperature. The VAT sensor is similar in operation to the ACT sensor. The VAT sensor is in the vane air meter and is not replaceable. It can be tested using an ohmmeter using the values shown below.

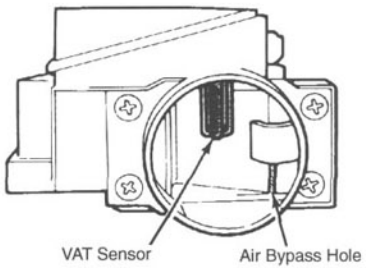
VAF/VAT Inputs/Outputs

Signal	Description
VAF SIG	Variable voltage to EEC-IV module
VAT SIG	Variable voltage to EEC-IV module
VREF	Reference voltage
SIG RTN	Signal return

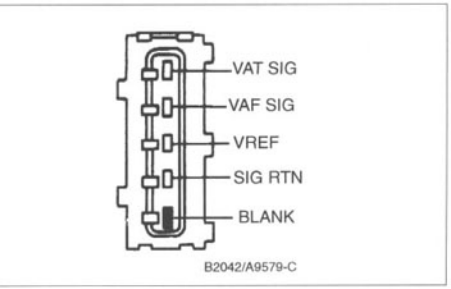
VAT Sensor Values

Temperature	Resistance
32° F	5800 ohms
65° F	2700 ohms
185° F	300 ohms
220° F	180 ohms
240° F	125 ohms

Vane Air Meter



VAF/VAT Sensor Connector



VAF/VAT Electrical Tests

Test	Conditions	Test Results	If Not
VREF	–Key off, wait 10 seconds –Disconnect VAF connector –Probe between VREF and SIG RTN at VAF vehicle harness connector –KOEO	4 to 6 volts	Check VREF circuitry and wiring
VAF SIG	–Key off, wait 10 seconds –Backprobe VAF connector between VAF and SIG RTN with DMM –KOEO –Move air vane meter through entire range	–Variable voltage from 1 to 5 volts without any breaks as vane is moved through range	Faulty Vane Air Meter
VAT SIG	–Key off, wait 10 seconds –Disconnect VAF connector –Probe VAF connector between VAT SIG and SIG RTN with DMM	–Resistance value as specified at a particular temperature (See table above)	Faulty Vane Air Meter

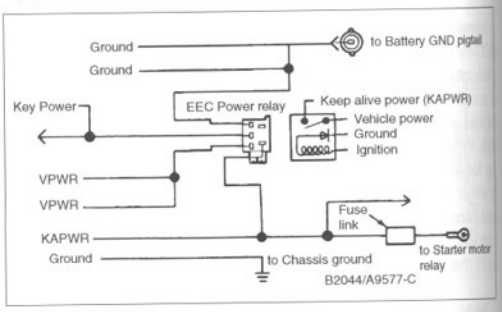
*1993 and later called VAF/IAT—see glossary

VPWR (EEC-IV)

Circuit Description

Vehicle Power (VPWR) is battery voltage distribution to certain output actuators when the key is on. The EEC Power Relay located in the IRCM supplies VPWR to these various electrical components. A failure in the VPWR circuit will result in a no start condition.

Typical VPWR Circuit



VPWR Inputs/Outputs

Signal	EEC-IV Module Pin	Description
VPWR	37, 57	Power distribution
KEY POWER		Ignition key input to EEC power relay in IRCM
KAPWR		Battery voltage at all times
GND or PWR GND	40, 60	Ground

VPWR Electrical Tests

Test	Conditions	Test Results	If Not
VPWR	–Key On or Key in Crank position –Measure voltage with DMM between VPWR and battery negative (–) terminal	10.5 volts or greater	–Check for open or short in VPWR circuit –Check EEC Power Relay in IRCM, ground wiring, and key power circuit –Check continuity of VPWR wiring from IRCM to EEC-IV module
KEY POWER	–Key On, Engine Off –Engine Running	10.5 volts or greater	–Check ignition switch and wiring
GROUND	*–Measure continuity to battery negative (–) terminal*	*5 Ohms or less*	*Check ground cable and straps*
KAPWR		10.5 volts or greater	Check battery positive (+) cable and battery

VREF (EEC-IV)

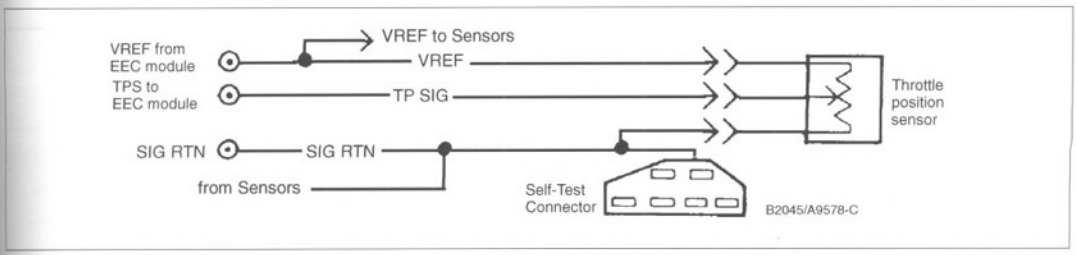
Circuit Description

Reference Voltage (VREF) is a voltage supply used for various sensors such as TPS, EVP/PFE, MAP, 4EAT and VAF. The VREF voltage should be 5 volts, with just a small variance (± 0.1v.) an acceptable range. The VREF supply is generated internally by the EEC-IV module. Always begin troubleshooting by checking for VPWR and GND to the EEC-IV module. To isolate problems with sensors that use VREF, disconnect one sensor at a time and re-measure VREF.

VREF Inputs/Outputs

Signal	EEC-IV Module Pin	Description
VREF	26	Reference voltage of 4 to 6 volts from EEC-IV module
SIG RTN	46	Signal return (ground) for VREF
VPWR	37, 57	Battery voltage with key on or key in crank position
GND or PWR GND	40, 60	Ground

Typical VREF Circuit



VREF Electrical Tests

Test	Conditions	Test Results	If Not
VREF	–Key on or Key in crank position –Measure voltage with DMM between VREF and SIG RTN –Note: measure VREF and TPS	5 ± 0.1 volts	–Check for power and ground to EEC-IV module –Check for open or short in VREF circuit –Check for faulty sensor connected to VREF, check continuity of wiring
VPWR	–Key On, Engine Off –Key On, Engine Running	10.5 volts or greater	–Check EEC Power Relay in IRCM
KEY POWER	–Key On, Engine Off –Key On, Engine Running	10.5 volts or greater	–Check ignition switch and wiring
GROUND	–Measure continuity to battery negative (–) terminal	5 Ohms or less	Check ground cable and straps
SIG RTN	–Measure continuity between SIG RTN and battery negative (–) terminal	5 Ohms or less	Check wiring to EEC-IV module

BP (MECS)

Circuit Description

Barometric Pressure (BP*) sensor is used to sense barometric pressure so the control module can compensate for changes in altitude. The sensor can be checked using a volt meter and a hand-held vacuum pump with gauge. Begin by checking that the sensor holds vacuum.

NOTE —
On all except 1.6L engines, if a trouble code 14 exists and it cannot be erased, the control module must be replaced. The BP sensor is integral with the module and cannot be replaced separately.

BP Sensor Inputs/Outputs

Signal	Description
BP SIG	Signal to EEC-IV module
SIG RTN	Signal return
VREF	Reference voltage input

BP Sensor Test Values (all except '93 and later 2.0 L EAT)

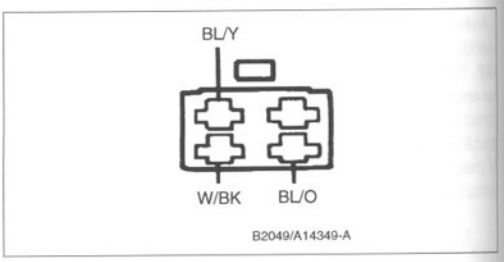
Volts (±15%)	Vacuum	
	in-Hg.	kPa
3.26 to 4.42	0	0
2.86 to 3.86	5	16.7
2.26 to 3.06	10	33.7
1.64 to 2.22	15	50.7
1.07 to 1.45	20	67.7
0.49 to 0.67	25	84.7

BP Sensor Test Values ('93 and later 2.0 L EAT)

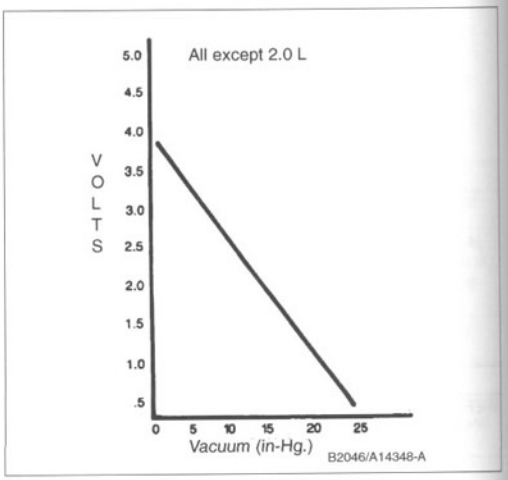
Volts (±15%)	Vacuum	
	in-Hg.	kPa
3.9	0	0
3.6	3.94	10.0
3.1	7.87	20.0
2.5	11.81	30.0
2.0	15.75	40.0
1.5	19.69	50.0
0.9	23.62	60.0
0.4	27.56	70.0

*1993 and later called BARO—see glossary

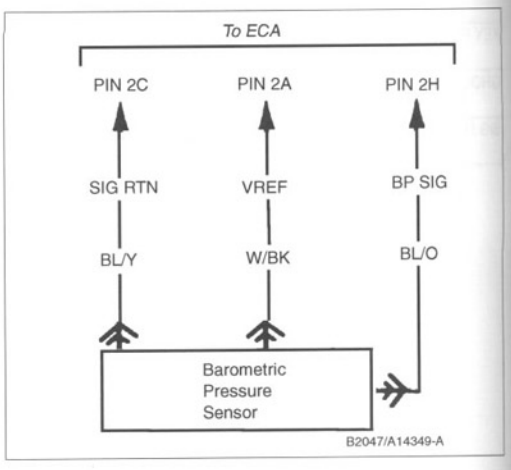
BP Sensor Harness Connector



BP Sensor Test Data

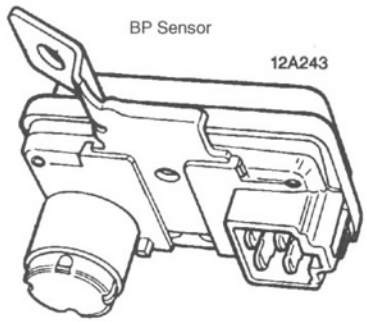


BP Sensor Schematic

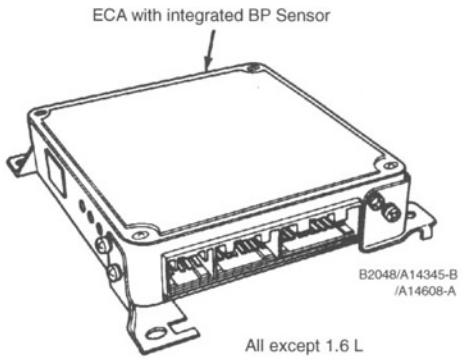


BP (MECS)

BP Sensor



1.6 L



All except 1.6 L

BP Sensor Electrical Tests

Test	Conditions	Test Results	If Not
BP SIG	–Using a DMM, backprobe between BP SIG wire and SIG RTN wire at the sensor connector –Remove dust cover from BP sensor –Apply vacuum as shown in table –KOEO	See **BP Sensor Test Values** for test results	BP sensor may be faulty
VREF	–Disconnect BP sensor connector –DMM connected between VREF wire and SIG RTN wire –KOEO	4.5 to 5.5 volts	–Check wiring to control module, check VPWR and ground to module –Possible faulty control module
SIG RTN		Continuity to ground	Check wiring to control module

CANP (MECS)

Circuit Description

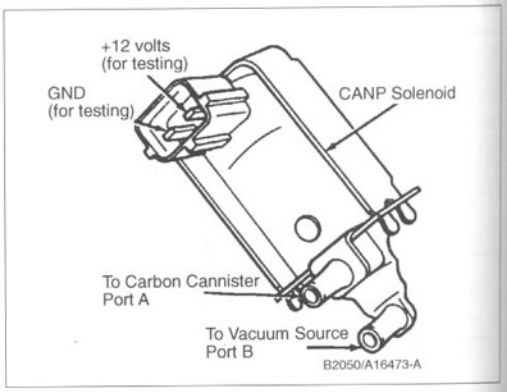
Canister Purge (CANP) solenoid is controlled by the control module to regulate the flow of fuel vapors from the EVAP canister to the intake system. The solenoid is normally closed. When the control unit energizes the solenoid to open, the fuel vapors are drawn into the engine using vacuum. The CANP solenoid is located near the center of the cowl panel. If the solenoid checks out OK and there are no wiring faults to the control module, then the control module may be faulty.

NOTE —
Excessive fuel tank pressure could be caused by the fuel cap and does not necessarily indicate a problem with the CANP solenoid or canister.

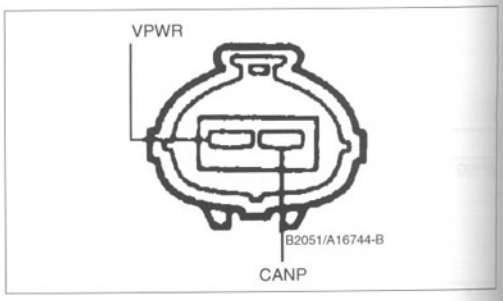
CANP Inputs/Outputs

CANP	Input to solenoid from control module
VPWR	Vehicle power

CANP Solenoid



CANP Solenoid Connector



CANP Solenoid Tests

Test	Conditions	Test Result	If Not
CANP solenoid	–Disconnect solenoid connector –Disconnect vacuum hoses A and B –Blow air through port A	No air flows from port B	Replace CANP solenoid
	–Disconnect solenoid connector –Disconnect vacuum hoses A and B –Apply 12 volts and ground as shown above –Blow air through port A	Air flows from port B	Replace CANP solenoid

CID (MECS)

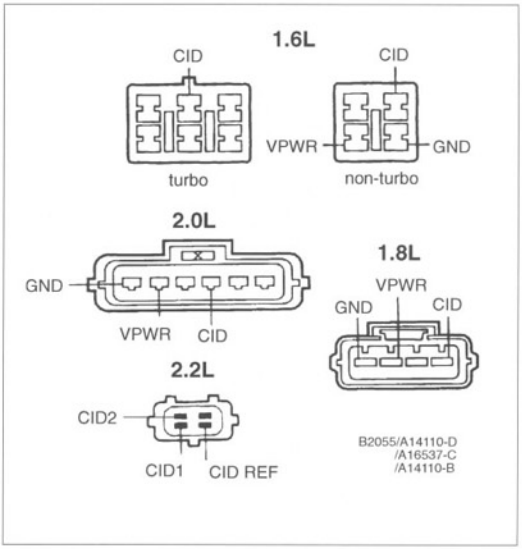
Circuit Description

Cylinder Identification (CID) sensor employs a distributor mounted rotor and sensor. The CID sensor provides accurate crankshaft position information to the control module. The 2.2L engine has two sensors, CID1 and CID2. When troubleshooting the CID sensor, begin by checking for VPWR (vehicle power) and GND (ground) at the distributor connector.

WARNING —
The ignition system is a high-energy system operating in a dangerous voltage range which could prove to be fatal if exposed terminals or live parts are contacted. Use extreme caution when working on a vehicle with the ignition on or the engine running.

Engine	CID Sensor
1.6L turbo 1.6L non-turbo	Detects cylinder no.1 top dead center
1.8L, 2.0L	Detects cylinder no.1 on compression stroke
2.2L	Detects cylinder no.1 and cylinder no.4 using two magnetic pickups (CID1 and CID2)

Distributor Harness Connectors



CID Sensor Tests

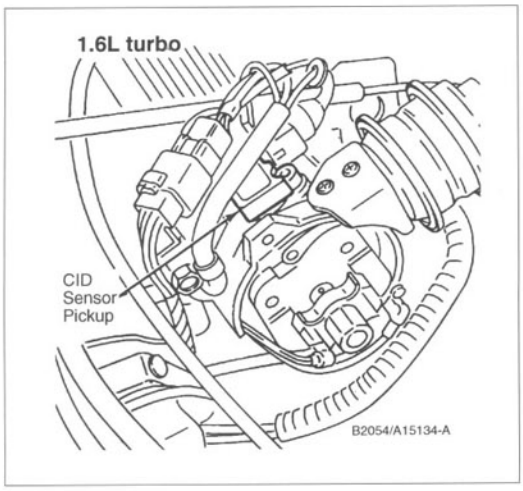
Test	Conditions	Test Result	If Not
CID (except 2.2L)	–Key off –Backprobe between CID wire and GND wire at distributor connector –Crank engine	Voltage alternates between 0 and 5 volts or LED test light blinks	–Check VPWR and GND to distributor –CID sensor may be faulty
CID1 (2.2L engines)	–Key off –Backprobe CID1 wire and CID REF wire at distributor connector –Crank engine	0.6 to 0.8 volts	–Check VPWR and GND to distributor –CID1 sensor or wiring may be faulty
CID2 (2.2L engines)	–Key off –Backprobe CID2 wire and CID REF wire at distributor connector –Crank engine	0.6 to 0.8 volts	–Check VPWR and GND to distributor –CID2 sensor or wiring may be faulty

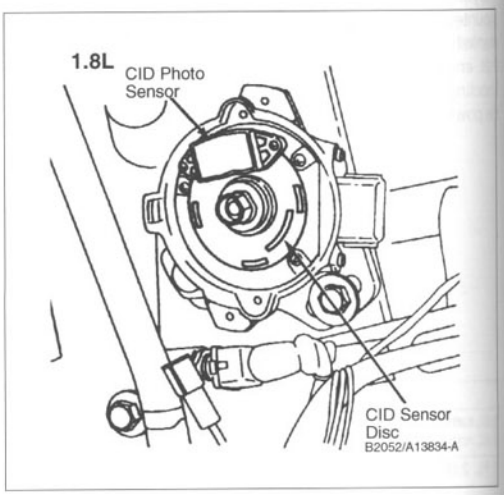
12

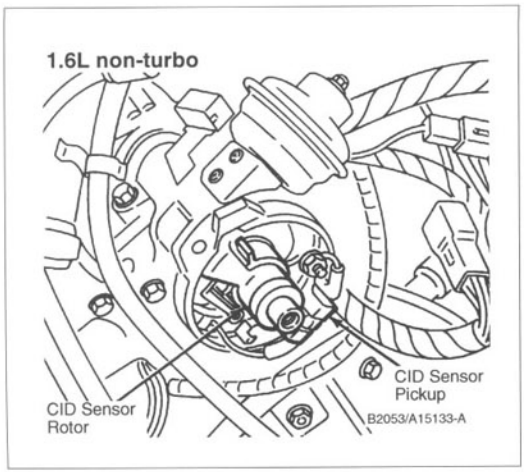
continued on next page

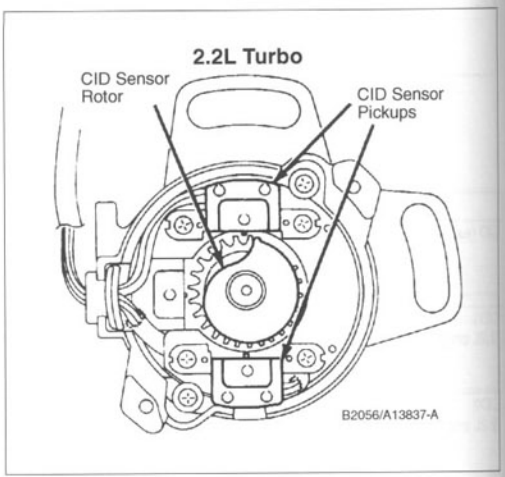
CID (MECS)

Component Locator









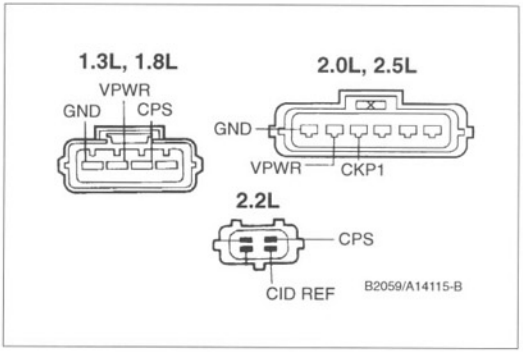
CPS (MECS)

Circuit Description

Crankshaft Position Sensor (CPS*) is a distributor mounted rotor and sensor. The rotor has slots or teeth that pass through the sensor to generate a signal. The CPS provides accurate engine speed information for the control module. When troubleshooting the CPS, begin by checking for VPWR (vehicle power) and GND (ground) at the distributor connector, and correct any faults found.

WARNING —
The ignition system is a high-energy system operating in a dangerous voltage range which could prove to be fatal if exposed terminals or live parts are contacted. Use extreme caution when working on a vehicle with the ignition on or the engine running.

Distributor Harness Connector



CPS Inputs/Outputs[1]

Signal	Description
CPS	Engine speed signal to ECA
CKP1	Engine speed signal to ECA
VPWR	Vehicle power
GND	Ground
CID REF **2.2 L engines**	Signal reference (ground)
[1] where applicable	

CPS Tests

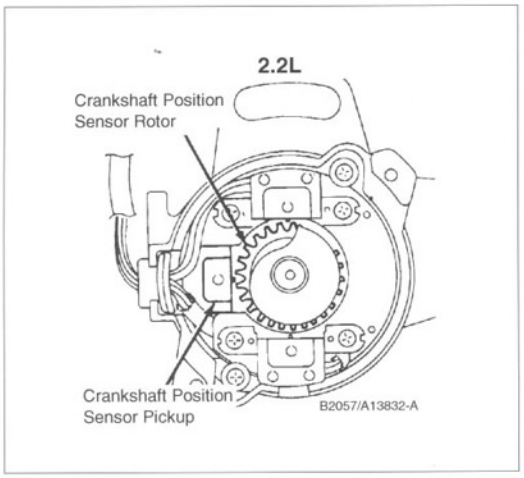
Test	Conditions	Test Result	If Not
CKP1 **2.0 L and 2.5 L engines**	–Key off –Backprobe between CKP1 wire and CID REF wire at distributor connector –Crank engine	Voltage alternates between 0 and 5 volts or LED test light blinks	–Check VPWR and GND to distributor –CKP1 sensor may be faulty
CPS **all other engines**	–Key off –Backprobe between CPS wire and GND wire at distributor connector –Crank engine	Voltage alternates between 0 and 5 volts or LED test light blinks	–Check VPWR and GND to distributor –CPS sensor may be faulty
VPWR	–Key off –Backprobe VPWR wire and GND wire at distributor connector –KOEO	10 volts or greater	–Check VPWR and GND to distributor, –Check wiring to ECA and IRCM
GND		Continuity	Check wiring to battery negative (–) terminal

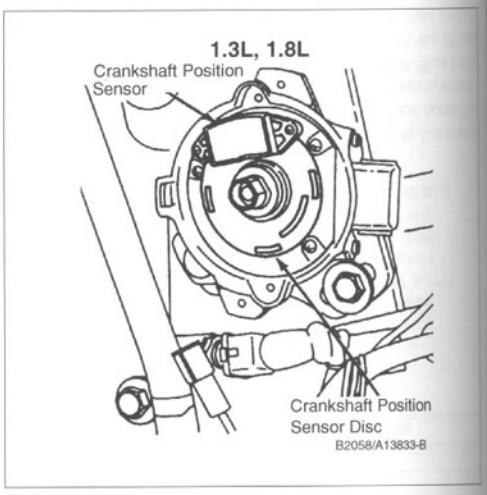
*1993 and later called CKP—see glossary

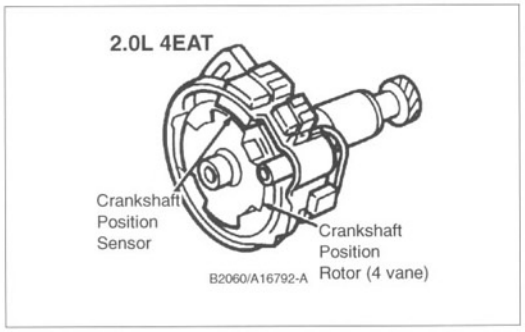
continued on next page

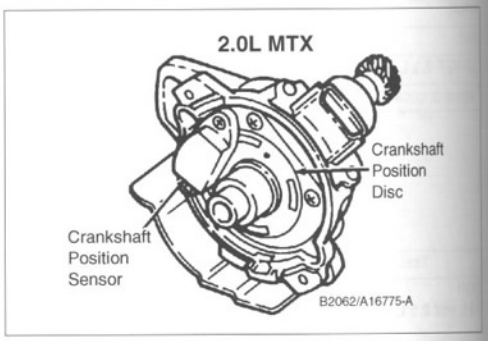
CPS (MECS)

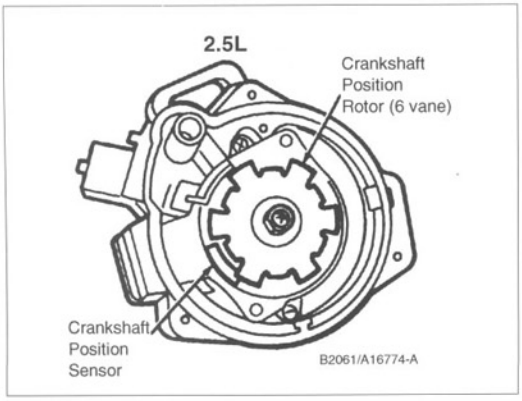
Component Locator











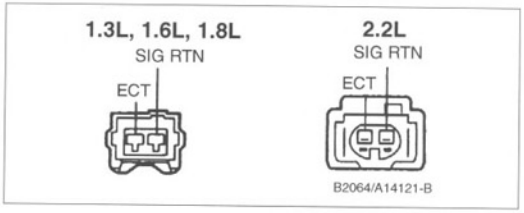
ECT (MECS)

Circuit Description

Engine Coolant Temperature (ECT) sensor provides information about engine temperature by changing resistance. The change in resistance changes voltage in the circuit. The sensor resistance decreases as the surrounding temperature increases.

A short will result in approximately 0 volts in the circuit. Corrosion in the circuit at terminal connections results in higher-than-normal voltage due to the voltage drop at the connection.

ECT Harness Connector



ECT Sensor Location

Engine	ECT Location
1.3 L	Threaded into top of intake manifold
1.6 L	Threaded into underside of intake manifold
1.8 L	Threaded into engine near thermostat housing
2.0 L	Threaded into the coolant temperature sensor housing on the left side of engine
2.5 L	Threaded into the coolant elbow on the right side of engine

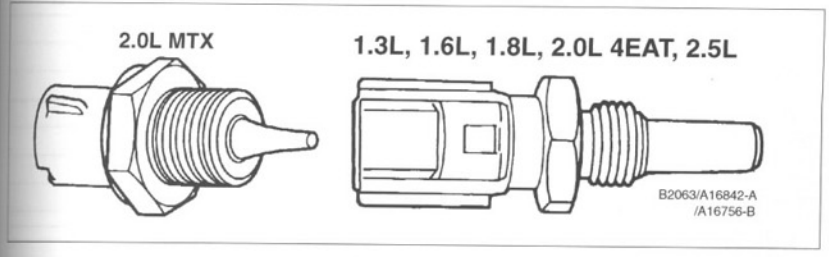
ECT Sensor Test Data

Coolant Temperature		ECT Sensor Resistance
°C	°F	Ohms
–20	–4	14600 to 17800
20	68	2200 to 2700
40	104	1000 to 1300
60	140	500 to 650
80	176	290 to 350

ECT Sensor Tests

Test	Conditions	Test Results	If Not
Sensor resistance	*–Disconnect sensor connector* –Measure across sensor terminals	See table above	Sensor may be faulty

ECT Sensors



EGO (MECS)

Circuit Description

Exhaust Gas Oxygen Sensor (EGO*) is a sensor that detects oxygen content in the exhaust gasses and sends a voltage signal to the control module. The sensor is threaded into the exhaust manifold or connecting pipe. On some engines, the sensor is electrically heated so the sensor output signal stabilizes more quickly.

EGO/HEGO Inputs/Outputs

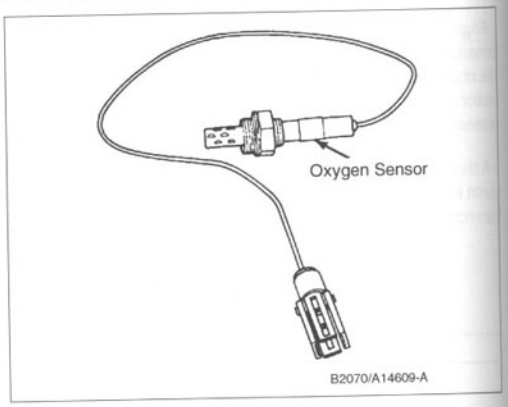
Signal[1]	Description
EGO/HEGO SIGNAL	Oxygen sensor output
SIG RTN	Heated oxygen sensor ground
PWR	Power input for heating element
GND	Heating element ground

[1]=where applicable

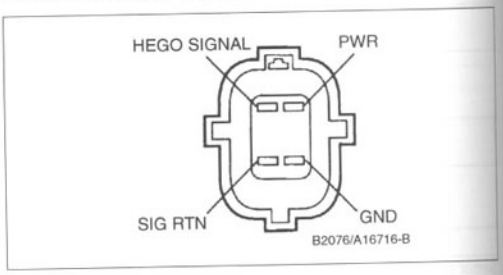
CAUTION —
Do not get any anti-seize compound or RTV sealer on the sensor tip or in the sensor slits. These chemicals will quickly foul the sensor element and render the sensor inoperative.

When troubleshooting, note that the EGO/HEGO signal should only be measured after the engine has run for several minutes. Fuel-contaminated engine oil can affect EGO readings. Always change the oil and oil filter if contamination is suspected.

EGO Sensor



HEGO Sensor Terminals



EGO/HEGO Electrical Tests

Test	Conditions	Test Results	If Not
EGO/HEGO SIGNAL to control unit	–Key off, disconnect EGO sensor connector –Connect DMM between EGO SIGNAL wire and negative (–) battery terminal –Engine at normal operating temperature	Approximately 0.55 volts	EGO sensor may be faulty
EGO/HEGO SIGNAL to control unit	–Key off, disconnect EGO sensor connector –Connect DMM between EGO SIGNAL wire and negative (–) battery terminal –Engine at normal operating temperature –Create vacuum leak (disconnect vacuum hose to intake manifold)	Voltage drops and fluctuates	EGO sensor may be faulty
HEGO heater element	–Key off, disconnect HEGO sensor connector –Connect DMM between KEY POWER wire and POWER GROUND at sensor connector	Approximately 6 ohms at room temperature	HEGO heater element faulty
PWR	–Key off, disconnect HEGO sensor connector –Connect DMM between PWR wire and GROUND at vehicle connector –Key On	10 volts or greater	Check harness wiring and grounds

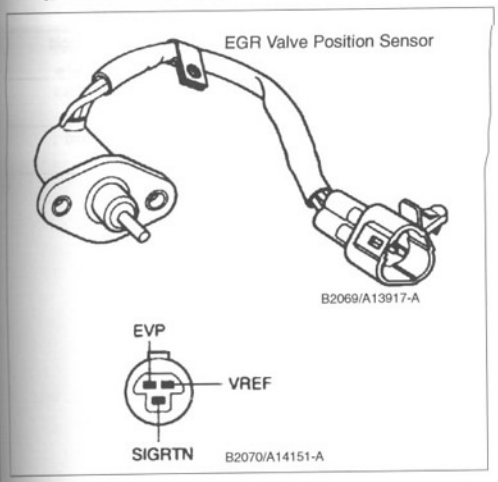
*1993 and later called O2S/HO2S—see glossary

EGR (MECS)

Circuit Description

Exhaust Gas Recirculation (EGR) system is controlled by the control module using a solenoid(s) to port vacuum to an EGR valve. Two types of EGR systems are used. Begin checking the EGR system by inspecting the vacuum hoses for cracks and replace as necessary. The EVP sensor (where applicable) can be tested using a hand held vacuum pump and gauge. The EGR solenoids can be tested by applying voltage to the solenoid and blowing through either ports.

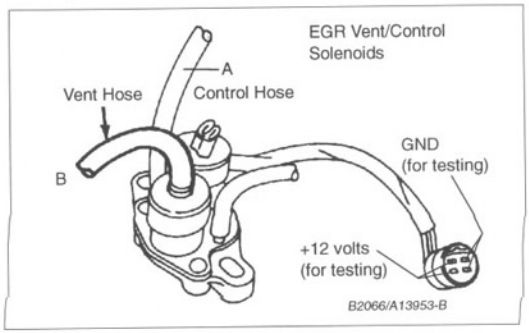
Component Locator

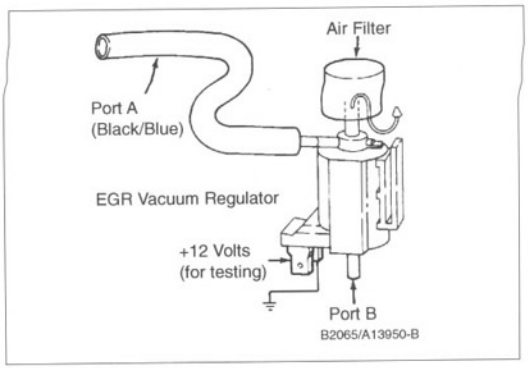


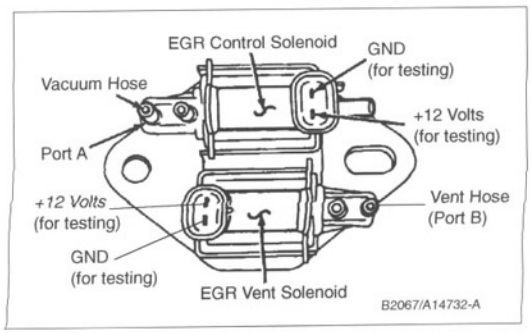
EVP Test Values

Vacuum (in-Hg.)	Volts ±15%
0	0.867
1	0.893
2	0.923
3	1.434
4	1.84
5	2.09
6	3.86
7	4.93
8	4.93

Component Locator







continued on next page

EGR (MECS)

EGR Component Electrical Tests

Test	Conditions	Test Results	If Not
EVP Sensor	–Connect vacuum pump to EGR valve –Backprobe EVP Sensor between EVP wire and SIG RTN wire –KOEO	See Test Values	–EVP sensor faulty –VREF not 4.5 to 5.5 volts –Faulty wiring between sensor and control module
EGR Vacuum Regulator Solenoid	–Disconnect hose at port B –Blow through Black/Blue hose at port A	Air flow from port B	EGR Vacuum Regulator faulty
EGR Vacuum Regulator Solenoid	–Disconnect hose at port B –Apply +12 volts and ground as shown above –Blow through Black/Blue hose at port A	Air flows from air filter	EGR Vacuum Regulator faulty
EGR Control Solenoid	–Blow through hose A	No air flow through solenoid	Replace EGR Control Solenoid
EGR Control Solenoid	–Apply +12 volts and ground as shown above –Blow through hose A	Air flows through solenoid	Replace EGR Control Solenoid
EGR Vent Solenoid	–Blow through hose B	No air flow through solenoid	Replace EGR Vent Solenoid
EGR Vent Solenoid	–Apply +12 volts and ground as shown above –Blow through hose B	Air flows through solenoid	Replace EGR Vent Solenoid

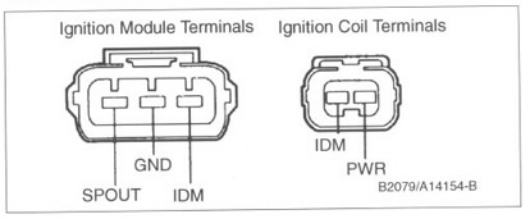
IDM (MECS)

Circuit Description

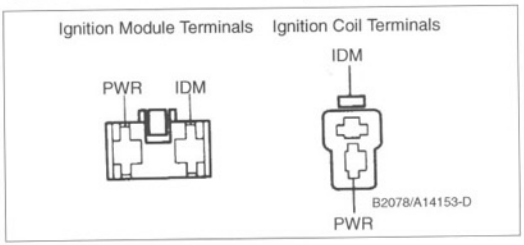
Ignition Diagnostic Monitor (IDM) is an input signal to the control module that detects malfunctions in the ignition system. The IDM signal consists of a single pulse for each successful ignition firing. If the IDM signal is not present there is either an intermittent or malfunction in the ignition system. Begin testing the IDM circuit by checking for a spark at the ignition coil using a spark tester.

WARNING —
The ignition system is a high-energy system operating in a dangerous voltage range which could prove to be fatal if exposed terminals or live parts are contacted. Use extreme caution when working on a vehicle with the ignition on or the engine running.

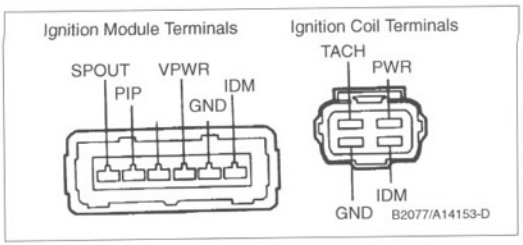
1.3L and 1.8L



1.6L turbo and non-turbo, 2.2L non-turbo



2.2L turbo



IDM Electrical Tests

Test	Conditions	Test Results	If Not
IDM SIGNAL to control unit	–Key off, disconnect ECA connector –Connect LED test light between IDM SIGNAL wire and VPWR (battery voltage) –Crank engine	LED test light flashes	IDM circuit may be faulty
Power to Ignition Control Module	–Key off, disconnect Ignition Module connector –Connect DMM between PWR wire or VPWR wire and ground –Key On	10 volts or greater	–Ignition Module may be faulty –Check wiring to Ignition Module
PIP	–Key off, disconnect Ignition Module connector –Connect LED test light between PIP wire and ground –Crank engine	LED test light blinks	–PIP circuit wiring from ECA faulty –ECA faulty –Crank position sensor faulty
PWR	–Key off, disconnect coil connector –Connect DMM between PWR wire and GROUND at connector –Key On	10 volts or greater	Check harness wiring and grounds

ISC (MECS)

Circuit Description

Idle Speed Control-Bypass Air (ISC-BPA*) solenoid is an actuator that controls engine idle speed by allowing air to pass around the throttle plate. The ISC-BPA is controlled by the control module and by coolant temperature. When troubleshooting the ISC-BPA circuit, always begin by checking for air leaks in the intake system, and check fuel injector O-rings for cracking and sealing. Note that unmetered air can also cause idle problems. The Bypass Air Valve must be replaced if faulty. On 1.8L engines, the ISC and BPA are separate units. Perform the electrical tests in order.

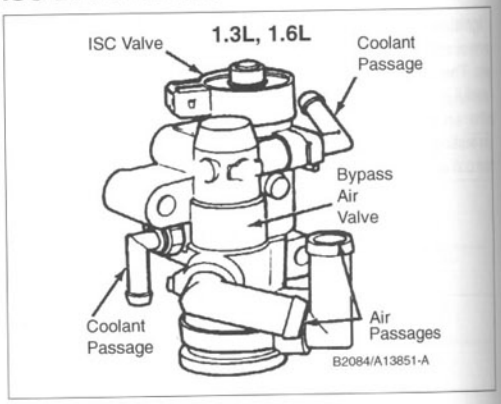
ISC-BPA Inputs/Outputs

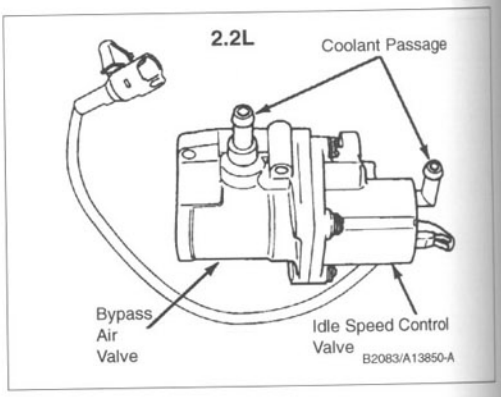
Signal	Description
ISC	Input to solenoid from ECA
VPWR	Input to solenoid

ISC-BPA Solenoid Test Values

Engine	Resistance
1.3L	6 to 14 Ohms
1.6L	6 to 14 Ohms
1.8L	6 to 14 Ohms
2.0L	7.7 to 9.3 Ohms @23°C (73°F)
2.5L	10.7 to 12.3 Ohms @20°C (68°F)
all others	6.3 to 9.9 Ohms

ISC-BPA Solenoid





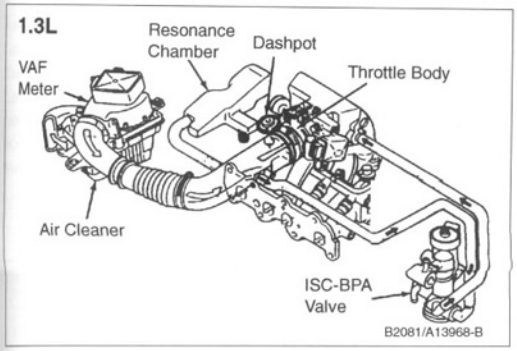
ISC-BPA Electrical Tests

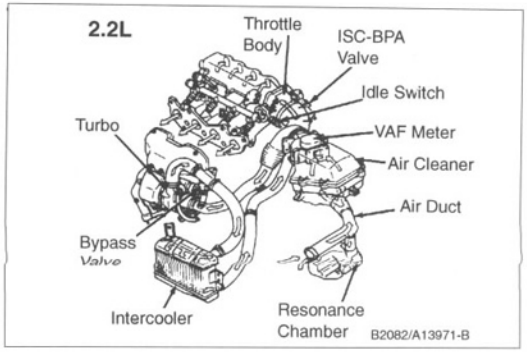
Test	Conditions	Test Results	If Not
ISC-BPA Solenoid	–Engine running	ISC-BPA Solenoid clicking	ISC-BPA solenoid may be faulty
ISC-BPA Solenoid resistance	–Key off, disconnect ISC-BPA solenoid connector –Connect DMM leads to ISC solenoid wires	See test values above	ISC-BPA solenoid may be faulty
VPWR circuit to ISC-BPA	–Key off, disconnect ISC-BPA solenoid connector –Connect DMM between VPWR wire at vehicle harness connector, and battery ground terminal –Key On	10.5 volts or greater	VPWR circuit wiring faulty

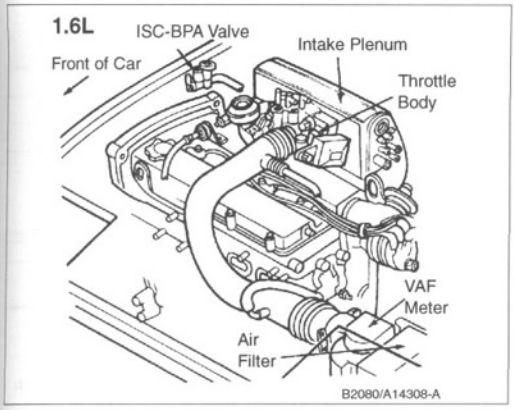
*1993 and later called IAC—see glossary

ISC (MECS)

Component Locator







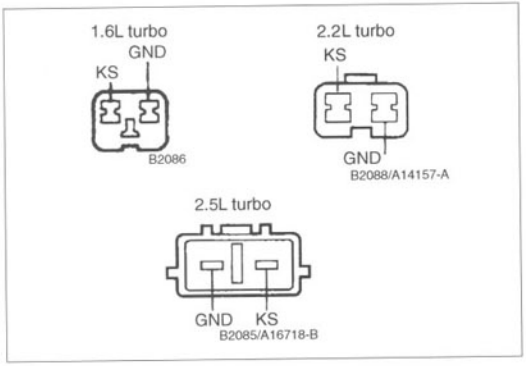
12

KS (MECS)

Circuit Description

Knock Sensor (KS) detects engine detonation (spark knock). The Knock Sensor threads into the side of the engine block and is used on turbo engines only. When knock occurs, the sensor sends a voltage signal to the Knock Control Unit. The Knock Control Unit then signals the control module, which sends a signal to the Ignition Control Unit to retard spark timing. When troubleshooting the knock sensor circuitry, begin by checking the fuel quality, ignition timing, and altitude at which test is being performed.

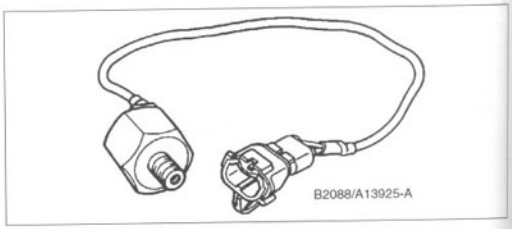
Knock Sensor Harness Connector



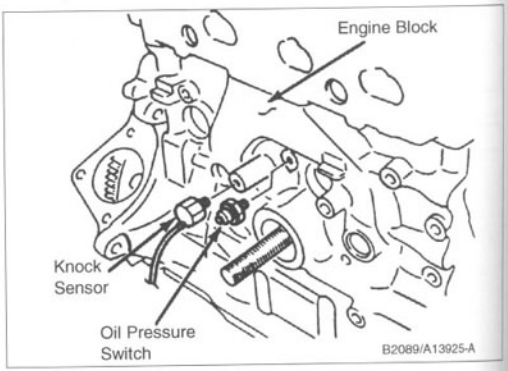
KS Inputs/Outputs

Signal	Description
KS	Input to Knock Control Unit from sensor
KC	Signal from Knock Control Unit to control module
VPWR	Battery power to Knock Control Unit
GND	Signal return

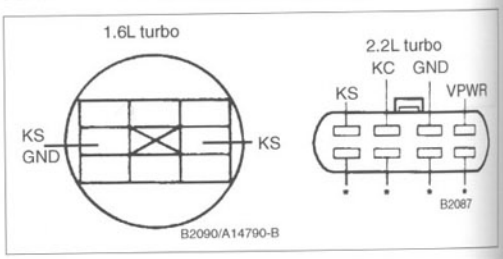
Knock Sensor



Component Locator



Knock Control Unit Connector



KS Electrical Tests

Test	Conditions	Test Results	If Not
Knock Sensor (2.2L turbo)	–Key off, wait 10 seconds –Disconnect knock sensor connector –Measure voltage between KS wire and GND at sensor harness connector	30 mV (0.030 volts) or greater	Knock Sensor faulty
Knock Sensor (all others)	–Timing light connected –Disconnect distributor vacuum hose –Engine running, knock sensor connected –Tap intake plenum with plastic hammer	Ignition timing retards	–Knock Sensor may be faulty –Knock Control Unit or wiring faulty
VPWR (all)	–DMM connected to VPWR wire and ground at Knock Control Unit –KOEO	10 volts or greater	Check wiring to Knock Control Unit

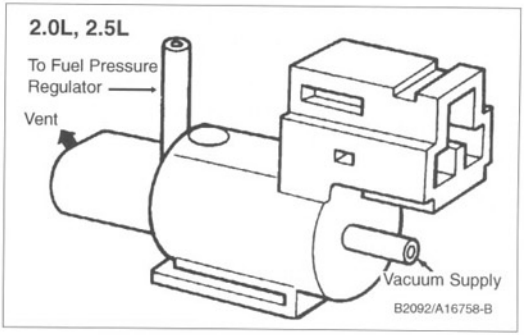
PRC (MECS)

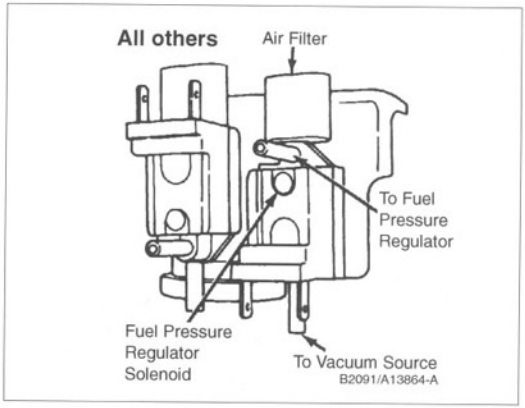
Circuit Description

Pressure Regulator Control (PRC) controls vacuum to the fuel pressure regulator. The solenoid is normally open, but on hot start, the control module activates the solenoid, venting the fuel-pressure regulator to the atmosphere. Vacuum to the fuel regulator is reduced to increase fuel pressure. This action helps to avoid hot start problems. Troubleshooting the PRC solenoid should also take into consideration a basic fuel pressure test and fuel pump electrical tests.

WARNING —
When working on the fuel system, do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher nearby.

Pressure Regulator Control Solenoid





PRC Solenoid Inputs/Outputs

Signal	Description
PRC	Input to solenoid from ECA
VPWR	Vehicle power

PRC Solenoid Location

Engine	Location
1.6L (all)	Mounted on firewall next to CANP solenoid
1.8L	Mounted on engine below Fuel Pressure Regulator
2.0L	Mounted on lower righthand side of intake manifold
2.2L non turbo	Mounted on firewall between CANP and EGR Solenoids
2.2L turbo	Mounted on firewall next to CANP solenoid
2.5L	Mounted on VAF meter housing

12

PRC Solenoid Electrical Tests

Test	Conditions	Test Results	If Not
VPWR	–Backprobe VPWR wire at PRC solenoid –Key On	10 volts or greater	Check VPWR wiring from ECA
PRC	–Key Off –Measure continuity with ohmmeter from PRC wire at solenoid to control module	Continuity	PRC wiring faulty

TPS (MECS)

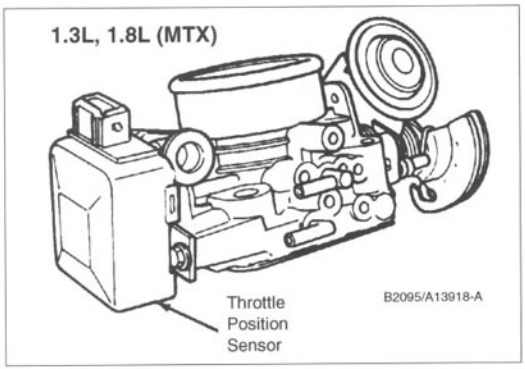
Circuit Description

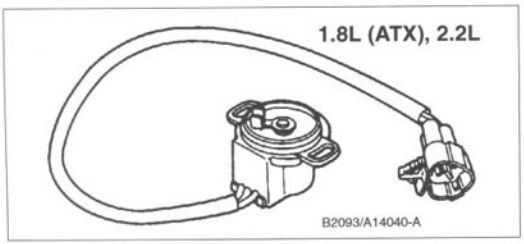
Throttle Position Sensor (TPS) Most provide the control module with a variable voltage that represents the position of the throttle. This information is used to control air-fuel ratio, timing, fuel shut-off, and EGR and A/C functions. The TPS is a sealed unit and cannot be repaired. On the 1.8L (ATX) engine, the TPS combines an idle switch and a potentiometer. On the 1.3L, 1.6L, and 1.8L (MTX) engines the TPS is two switches that sense idle (IDL) and wide open throttle (WOT). All other engines use a potentiometer.

TPS Inputs/Outputs

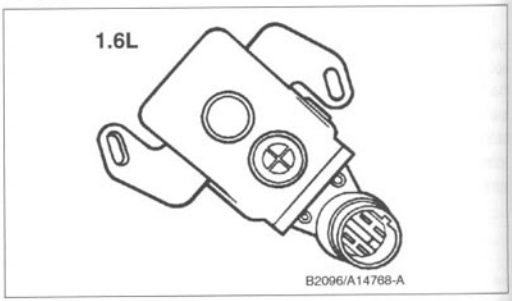
Signal	Description
TP SIG	Variable voltage from approximately 0 to 5 volts
VREF	Reference voltage
SIG RTN	Signal return

Component Locator

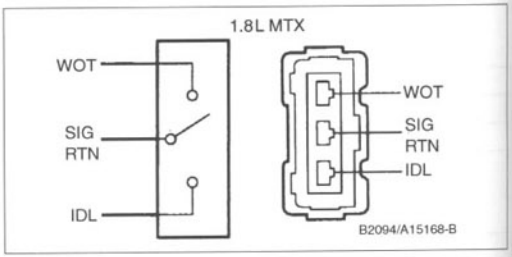


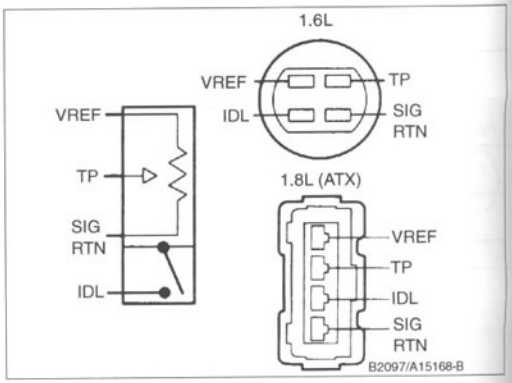


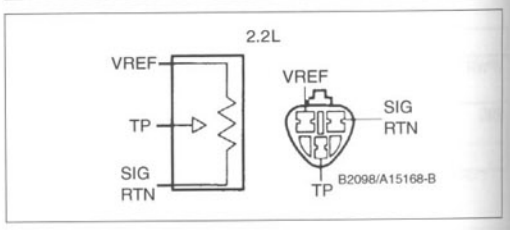
Component Locator



TPS Harness Connector Terminals







TPS (MECS)

TPS Potentiometer Test Values*

Throttle Position	Volts
1/8	0.998
2/8	1.60
3/8	2.37
4/8	2.74
5/8	3.15
6/8	3.43
7/8	3.60
8/8	4.02

* test values are ±15%

TPS Potentiometer Electrical Tests

Test	Conditions	Test Results	If Not
VREF	–Key off, wait 10 seconds –Disconnect TPS connector –Probe between VREF wire and SIG RTN at TPS vehicle harness connector –KOEO	4 to 6 volts	Check VREF circuitry and wiring
TP SIG	–Backprobe TPS connector between TPS and SIG RTN –KOEO –Move throttle through entire range	Variable voltage (see **Test Values** above) without any breaks as throttle is moved through range	Faulty TPS
IDL	–Throttle in rest position	Continuity with SIG RTN	Faulty TPS or wiring
WOT	–Throttle fully open	Continuity with SIG RTN	Faulty TPS or wiring

TPS Switch Tests (MTX - 1.3L, 1.6L, 1.8L)

Test	Conditions	Test Results	If Not
IDL	–Backprobe IDL and SIG RTN –KOEO	4 to 6 volts	Faulty VREF or wiring
	–Move throttle just off idle	0 to 0.5 volts	Faulty TPS
WOT	–Backprobe WOT and SIG RTN –KOEO –Throttle closed	0 to 0.5 volts	Faulty VREF or wiring
	–Move throttle wide open	4 to 6 volts	Faulty TPS

12

VAF/VAT (MECS)

Circuit Description

Vane Air Flow (VAF*) sensor provides the control module with a voltage signal that represents the amount of air flowing into the engine. The VAF sensor consists of an air vane that is attached to a potentiometer. The air vane moves as the throttle is opened changing the voltage. When troubleshooting the VAF sensor, begin by checking for air leaks in the intake system that cause unmetered air to enter. Check that the VAF sensor is not binding or sticking and remove all residue and intake deposits using a cloth. The VAF sensor cannot be repaired. The VAF sensor is located in the vane air meter in the throttle housing.

Vane Air Temperature (VAT*) sensor provides the control module with a voltage that changes with ambient temperature. The VAT sensor is similar in operation to the ACT sensor. The VAT sensor is in the vane air meter and is not replaceable. It can be tested using an ohmmeter using the values shown below.

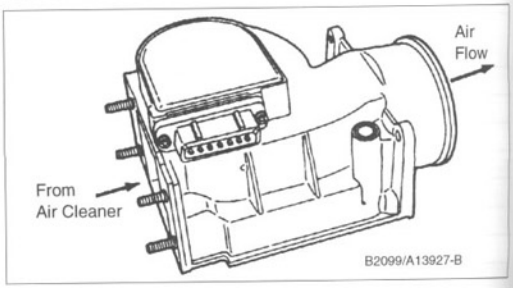
VAF/VAT Inputs/Outputs

Signal	Description
VAF SIG	Variable voltage to control module
VAT SIG	Variable voltage to control module
VMREF	Reference voltage
VREF	Reference voltage
VPWR	Battery voltage
SIG RTN	Signal return

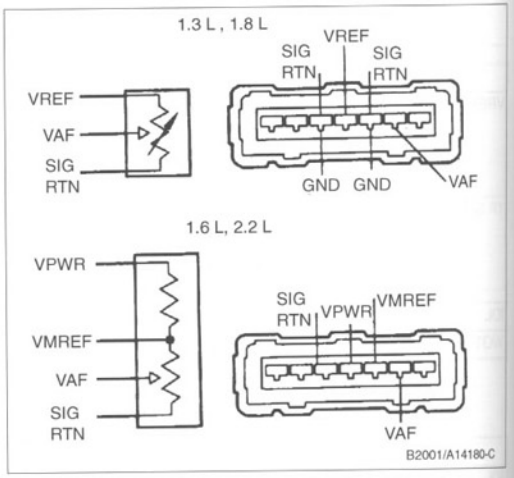
VAT Sensor Values

Temperature	Resistance
32° F	5200 ohms
68° F	2500 ohms
104° F	1100 ohms
140° F	600 ohms
176° F	300 ohms

Vane Air Meter



VAF/VAT Harness Connector Terminals



*1993 and later called VAF/IAT—see glossary

VAF/VAT (MECS)

VAF/VAT Electrical Tests

Test	Conditions	Test Results	If Not
VREF	–Key off, wait 10 seconds –Disconnect VAF connector –Probe between VREF wire and SIG RTN wire at VAF vehicle harness connector –KOEO	4.5 to 5.5 volts	Check VREF circuitry and wiring
VMREF	–Key off, wait 10 seconds –Disconnect VAF connector –Probe between VREF wire and SIG RTN wire at VAF vehicle harness connector –KOEO	7 to 9 volts	Check VMREF circuitry and wiring
VPWR	–Key off, wait 10 seconds –Disconnect VAF connector –Probe between VREF wire and SIG RTN wire at VAF vehicle harness connector –KOEO	10 volts or greater	Check VPWR circuitry and wiring
VAF SIG	–Key off, wait 10 seconds –Backprobe VAF connector between VAF wire and SIG RTN with DMM –KOEO –Move air vane meter through entire range	Variable voltage from 1 to 5 volts without any breaks as throttle is moved through range	Faulty Vane Air Meter
VAT SIG	–Key off, wait 10 seconds –Disconnect VAF connector –Probe VAF connector between VAT SIG wire and SIG RTN with DMM	Resistance value as specified at a particular temperature (See table above)	Faulty Vane Air Meter

VPWR (MECS)

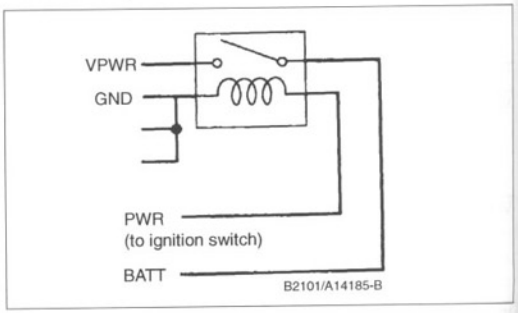
Circuit Description

Vehicle Power (VPWR) is battery voltage distribution to certain output actuators when the key is on. VPWR is distributed from the main relay. A failure in the VPWR circuit will result in a no-start condition.

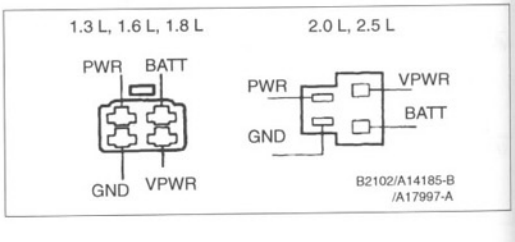
VPWR Inputs/Outputs

Signal	Engine	ECA Pin	Description
VPWR	1.3L 1.6L 1.8L 2.0L 2.2L 2.5L	1B 3I 1B 1B, 1U 1B 1B	Power distribution
PWR or KEY POWER			Ignition key input to main relay
BATT			Battery voltage at all times
GND or PWR GND	1.3L 1.6L 1.8L 2.0L 2.2L non-turbo (MTX) 2.2L (4EAT) 2.2L turbo 2.5L	2A, 2B, 2C 2R, 3A, 3G 2A, 2B, 2C 3A, 3B, 3C 2A, 2B, 2C 3A, 3B, 3C 3A, 3B, 3C 3A, 3B, 3C, 3D	Ground

Main Relay



Main Relay Harness Connector Terminals



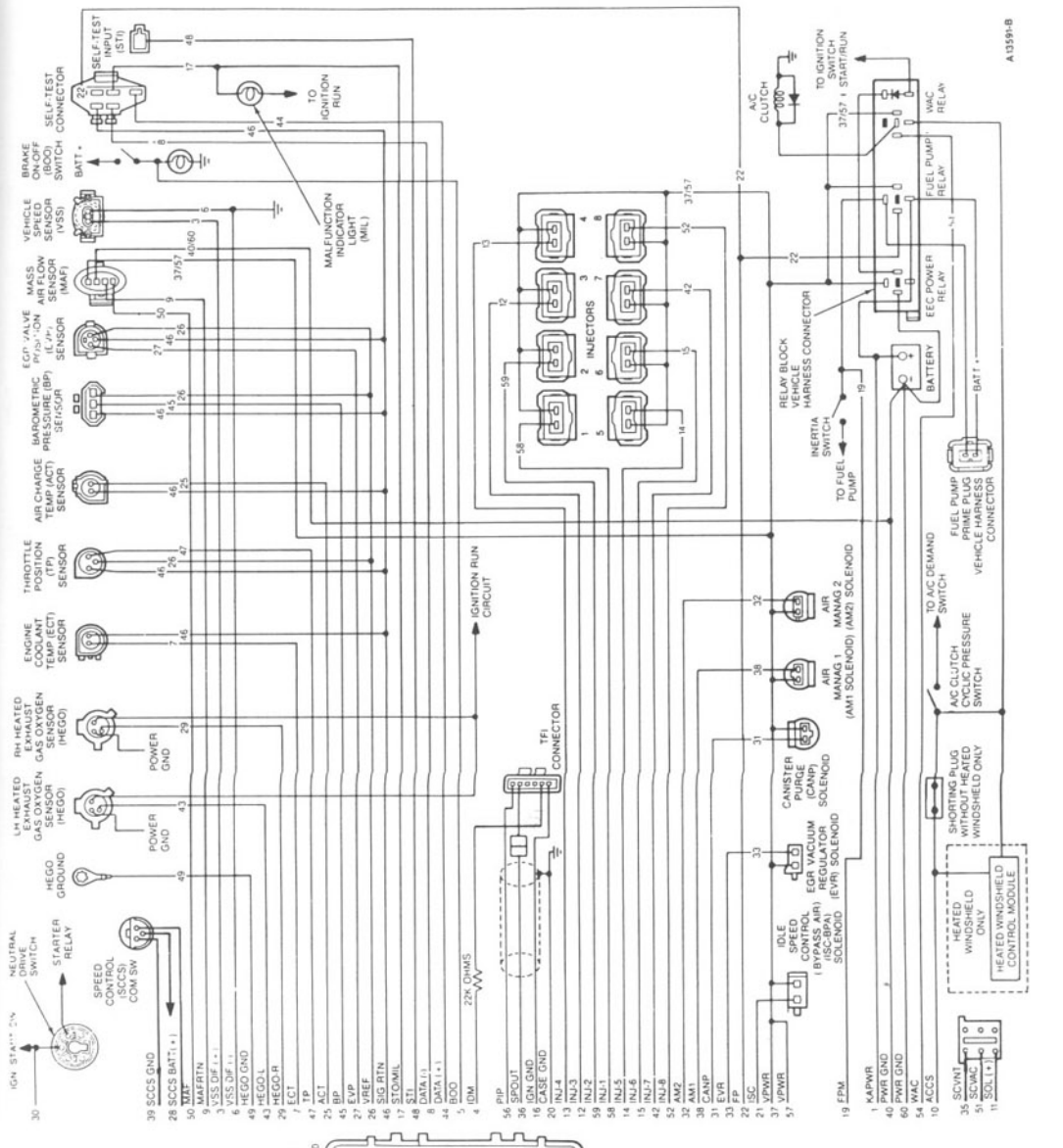
VPWR Electrical Tests

Test	Conditions	Test Results	If Not
VPWR	–Key on or Key in crank position –Measure voltage with DMM between VPWR and battery negative (–) terminal	10.5 volts or greater	–Check for open or short in VPWR circuit –Check Power Relay, ground wiring, and key power circuit –Check continuity of VPWR wiring from power relay to control module
KEY POWER	–KOEO –ER	10.5 volts or greater	–Check ignition switch and wiring
GROUND	–Measure continuity to battery negative (–) terminal	5 Ohms or less	Check ground cable and straps
BATT		10.5 volts or greater	Check battery positive (+) cable and battery

1991
Crown Victoria, Grand Marquis (CA)

5.0L MAF-SFI
(VIN Code E)

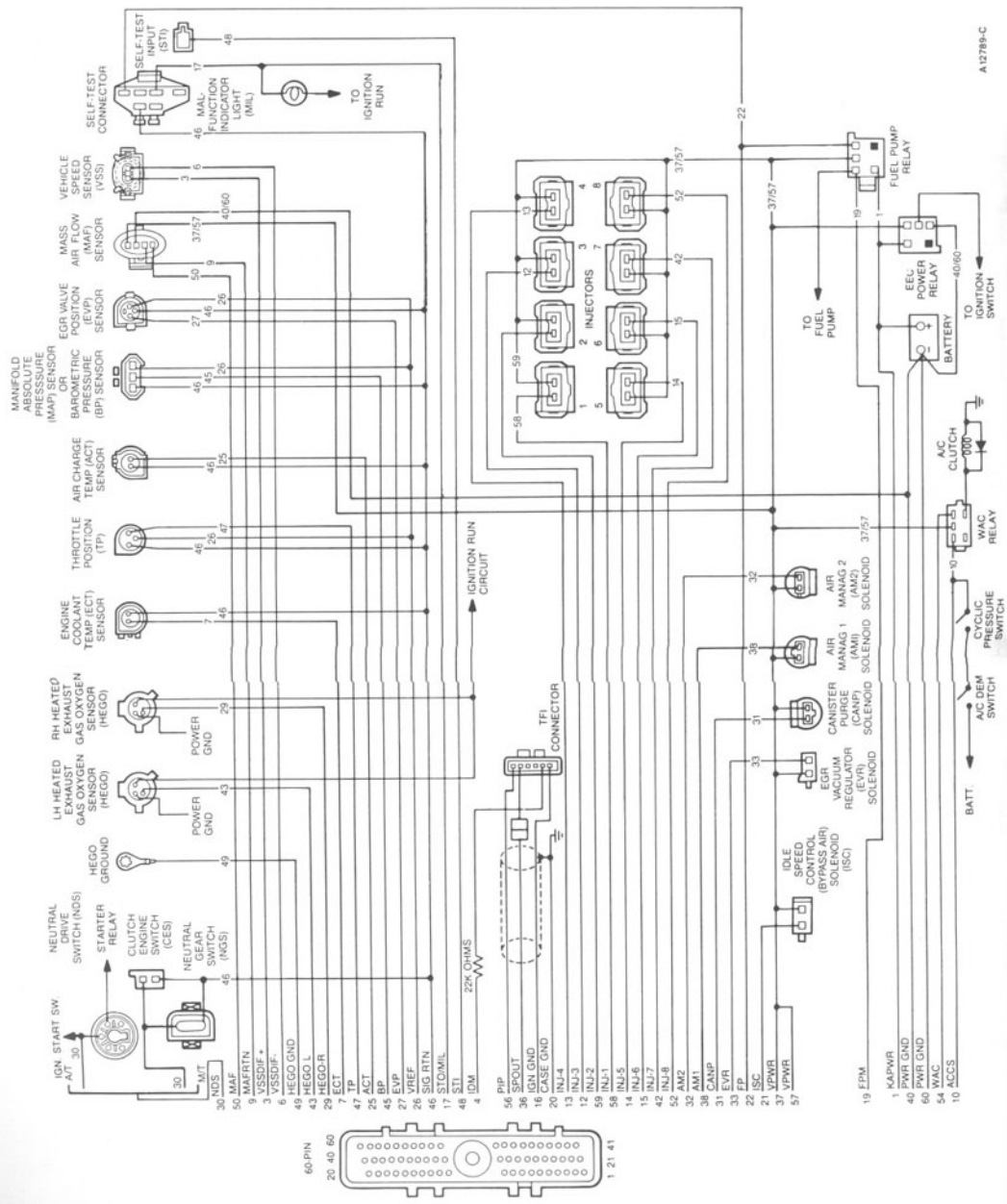
VIN: 1 2 3 4 5 6 7 8 ... 17
Engine code



5.0L MAF-SFI
(VIN Code E)

1988–1991
Mustang

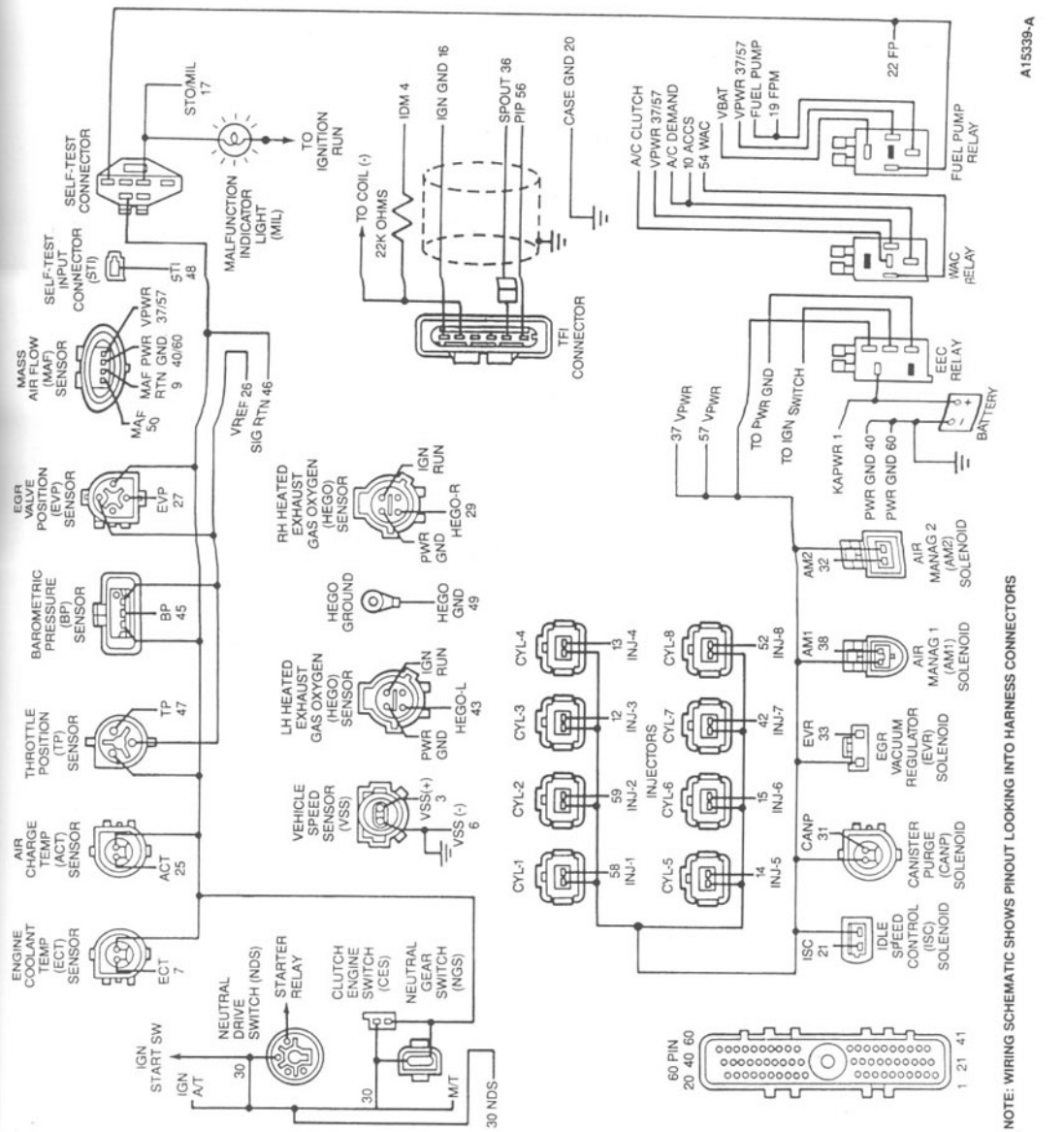
VIN: 1 2 3 4 5 6 7 8 ... 17
Engine code



1992–1993 Mustang HO

5.0L MAF-SFI (VIN Code E)

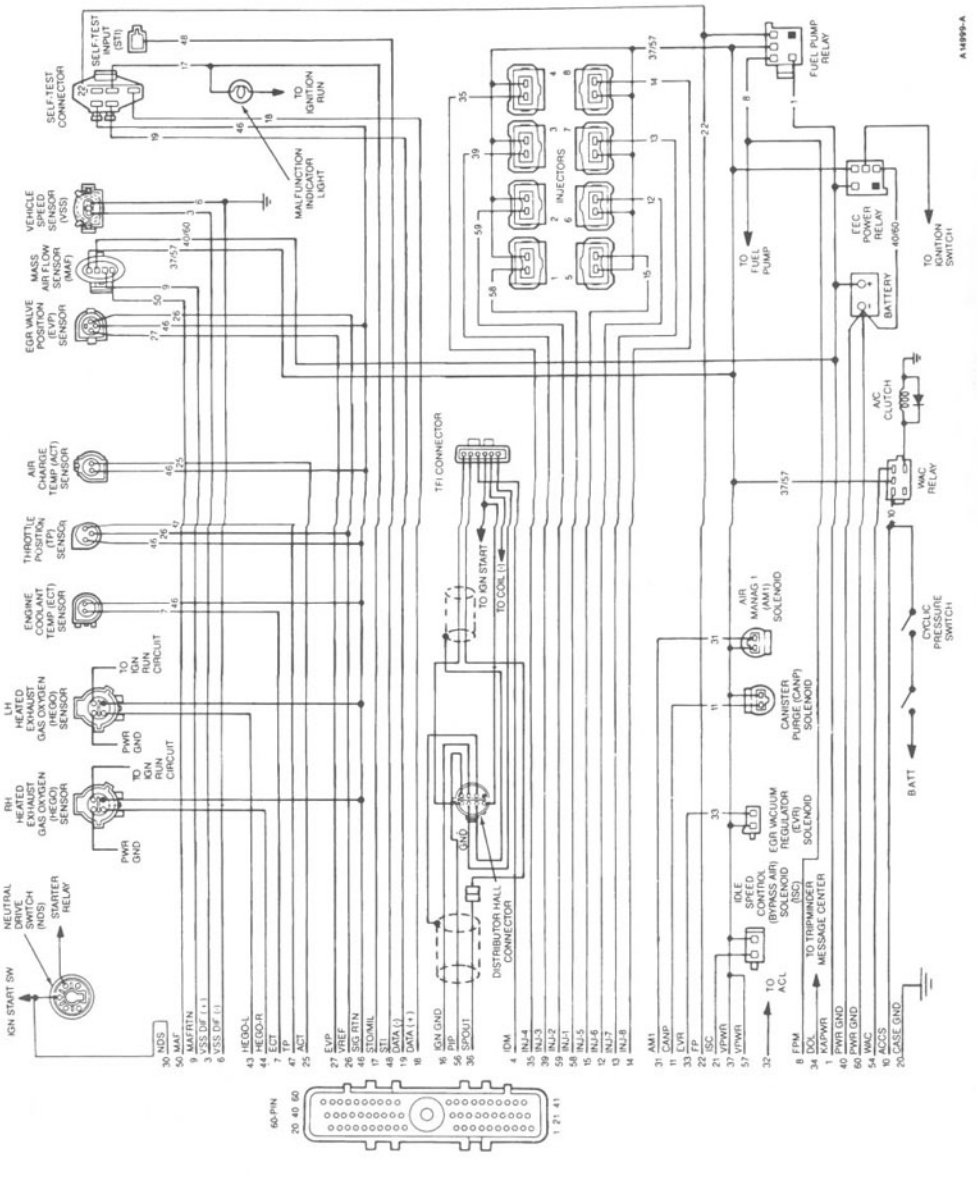
VIN: 1 2 3 4 5 6 7 8 ... 17
8 = Engine code



5.0L MAF-SFI
(VIN Code E)

1991
T-Bird, Cougar

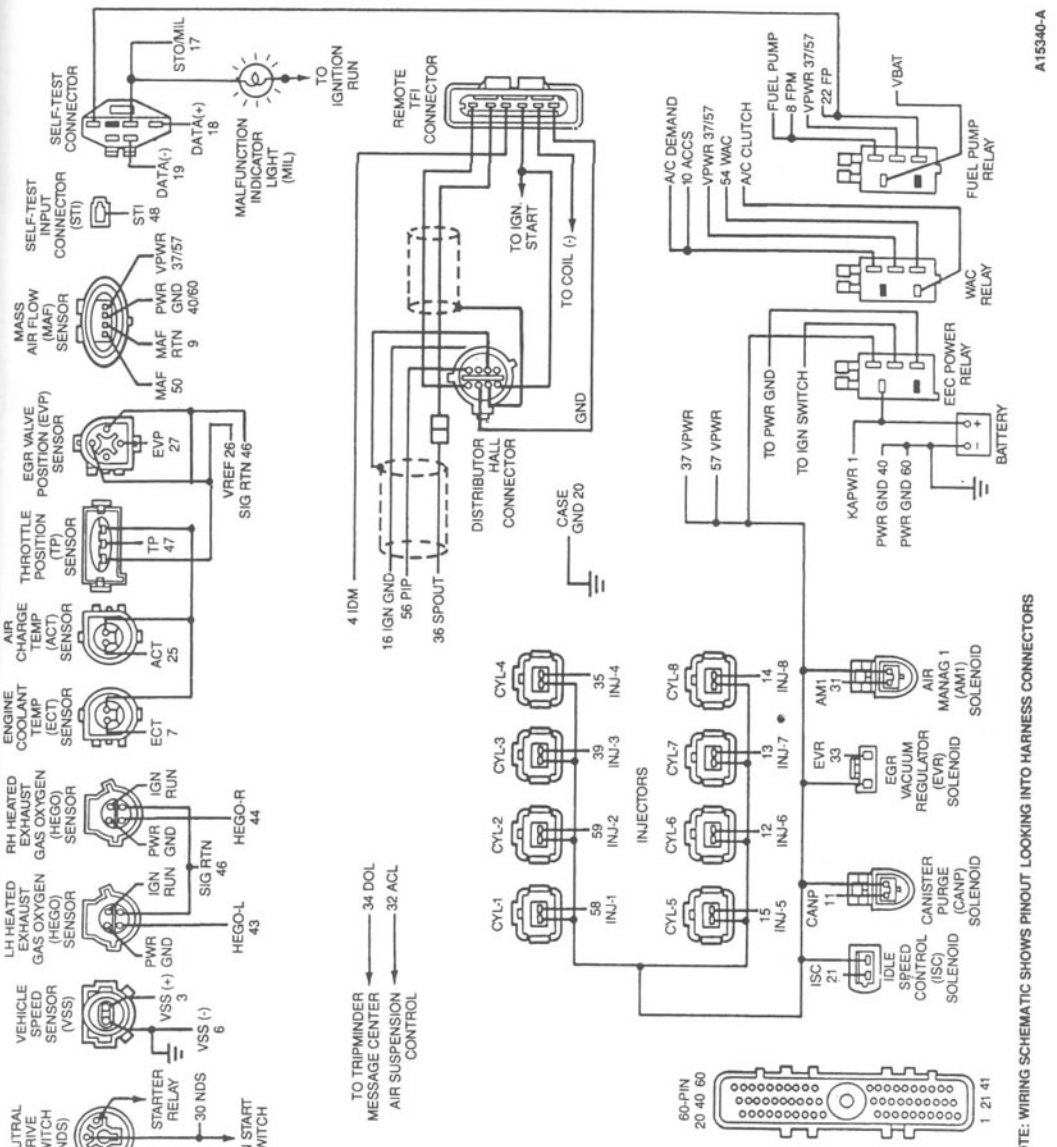
VIN: 1 2 3 4 5 6 7 8 ... 17
Engine code



1992–1993 T-Bird, Cougar

5.0L MAF-SFI (VIN Code E)

VIN: 1 2 3 4 5 6 7 8 ... 17
Engine code



5.0L MAP-SFI
(VIN Code E)

VIN: 1 2 3 4 5 6 7 8 ... 17
Engine code

1988–1989
Crown Victoria, Grand Marquis