Fiero Ignition Systems

January 20, 2018

Rock Chevrolet

Northern Illinois Fiero Enthusiasts

Presented by Art Hall and Ray Dyreson

The Stock Fiero has Two Types of Ignition Systems

Distributor

4 cyl: 84, 85-86

6 cyl: 85-88

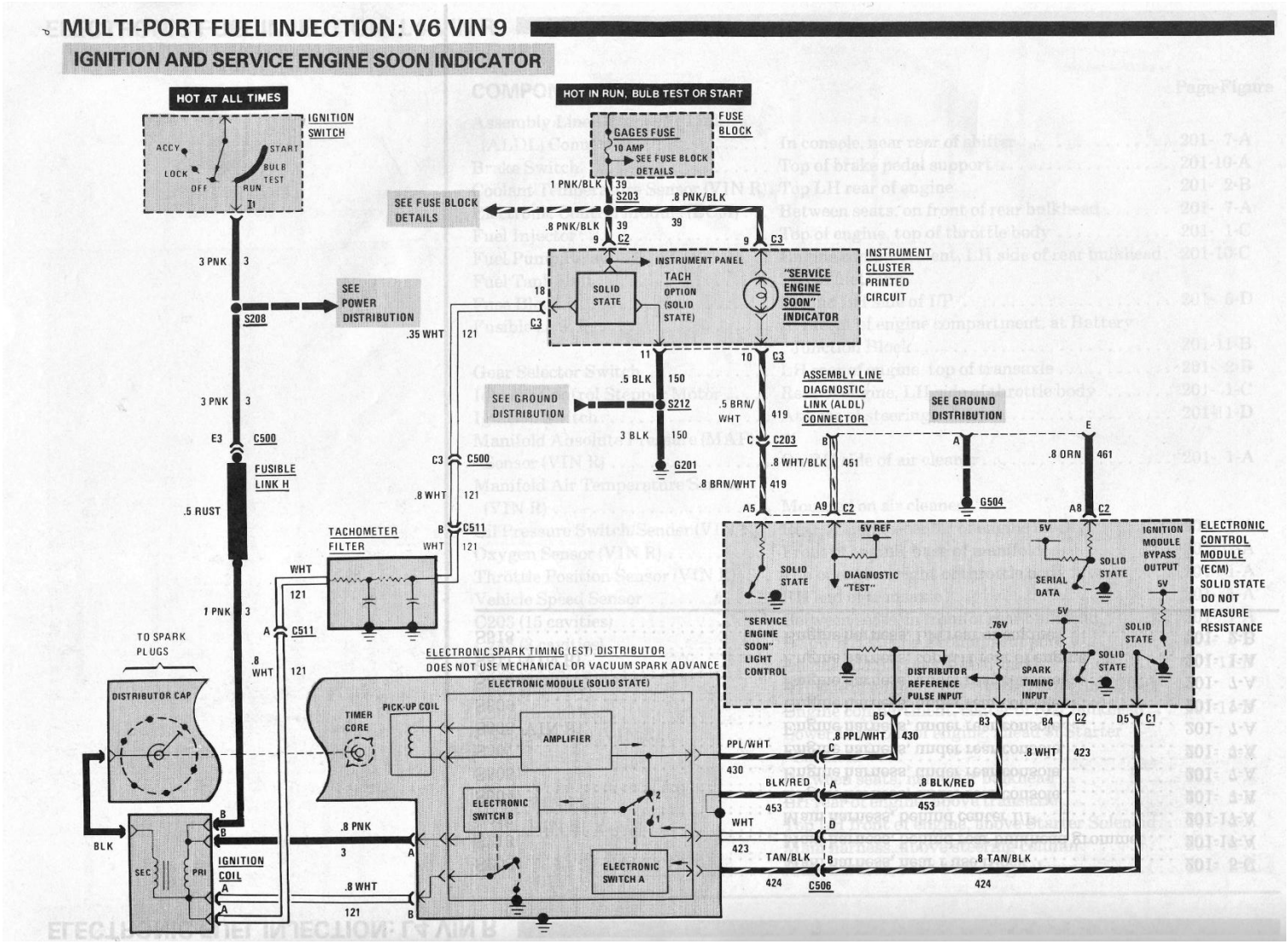
Direct Ignition System (DIS)

4 cyl: 87-88

Types of Automotive Ignition Systems

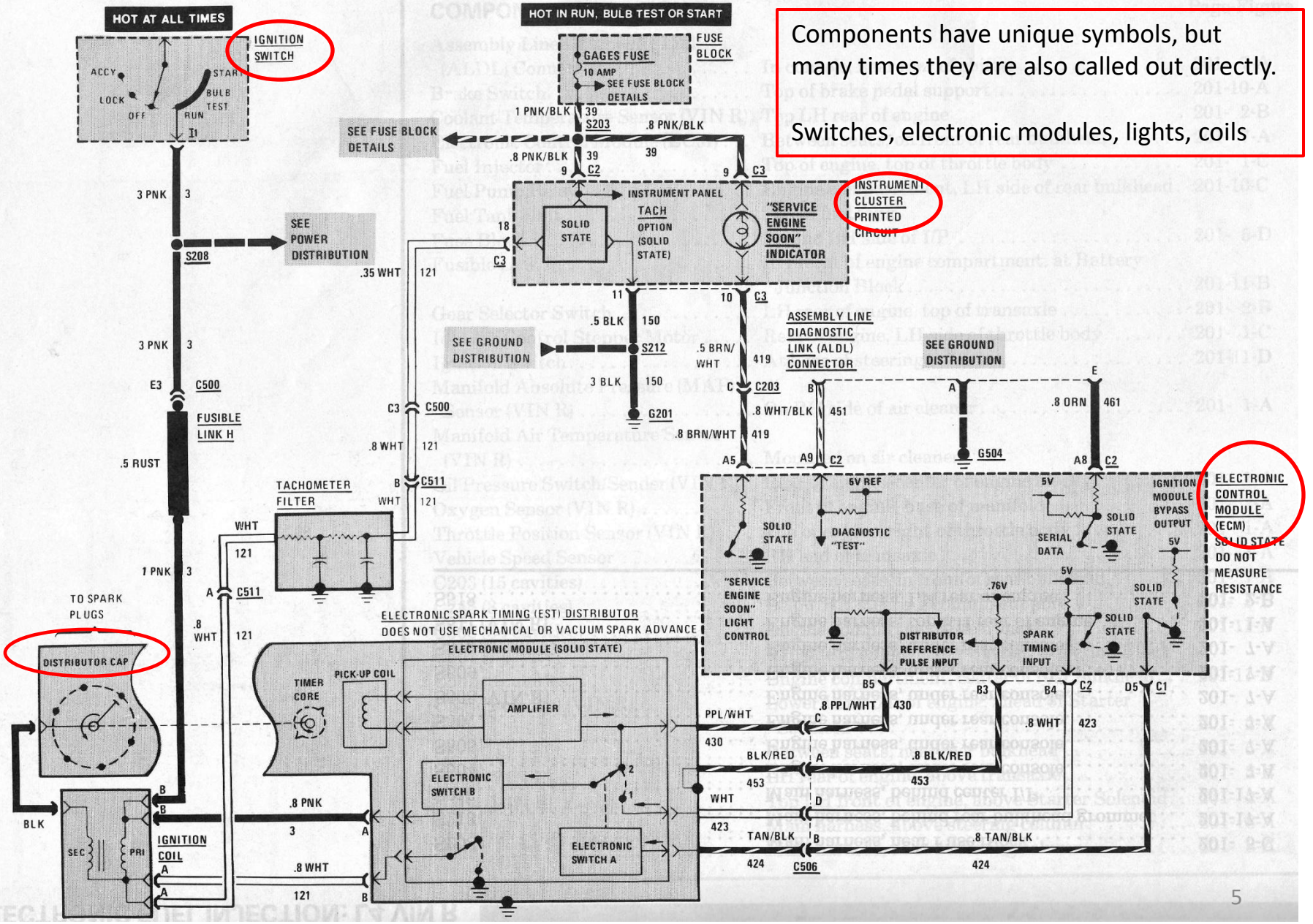
- Distributor
  - Mechanical Points
  - Electronic Ignition (EI)
- Direct Ignition System (DIS) or Distributorless or Waste-Spark Ignition
- Coil on Plug (COP)
- Coil Near Plug (CNP)

To Understand Ignition Systems it Would Be Good to Understand Automotive Wiring Diagrams



MULTI-PORT FUEL INJECTION: V6 VIN 9

IGNITION AND SERVICE ENGINE SOON INDICATOR



Components have unique symbols, but many times they are also called out directly.

Switches, electronic modules, lights, coils

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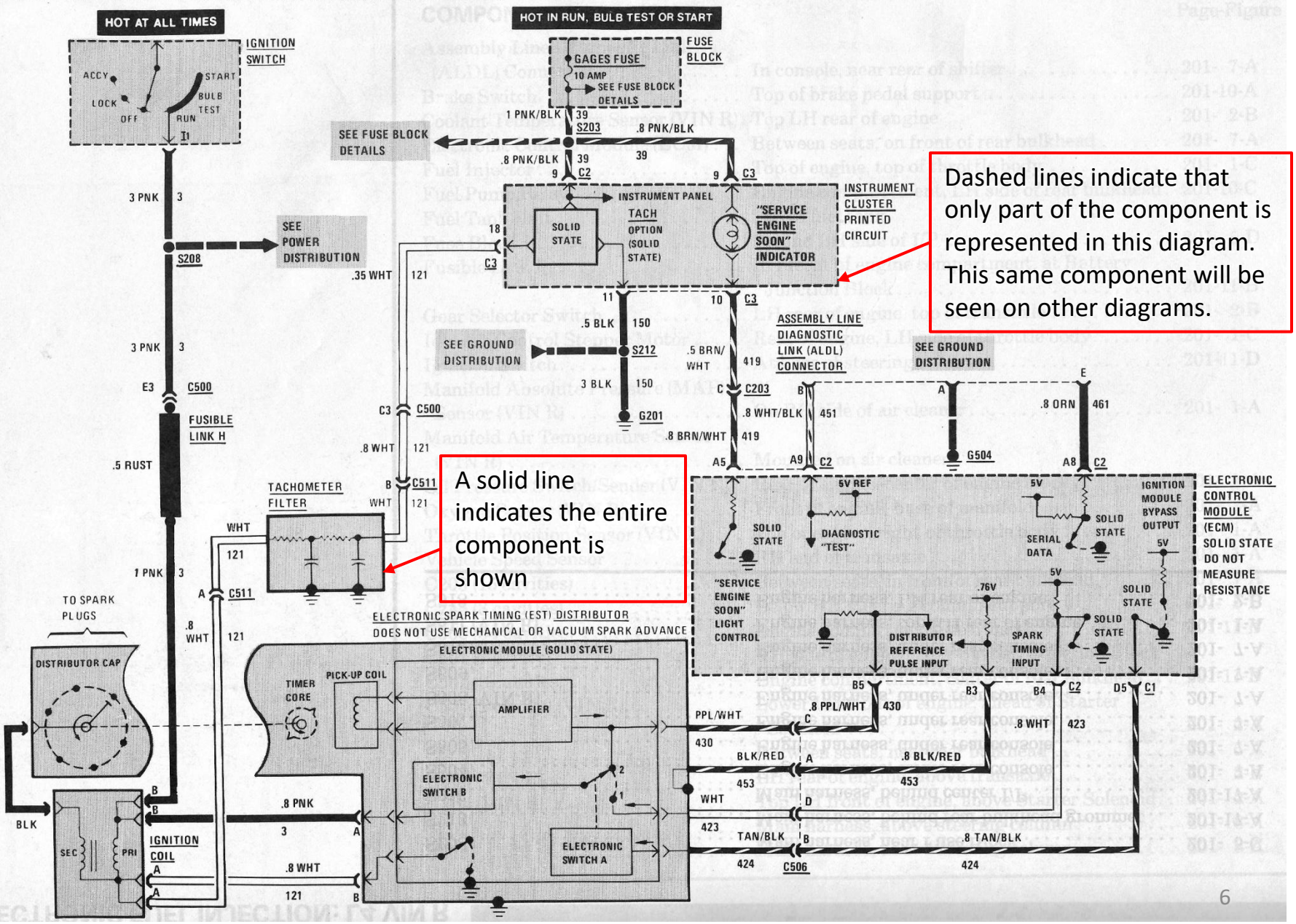

Dashed lines indicate that only part of the component is represented in this diagram. This same component will be seen on other diagrams.

A solid line indicates the entire component is shown

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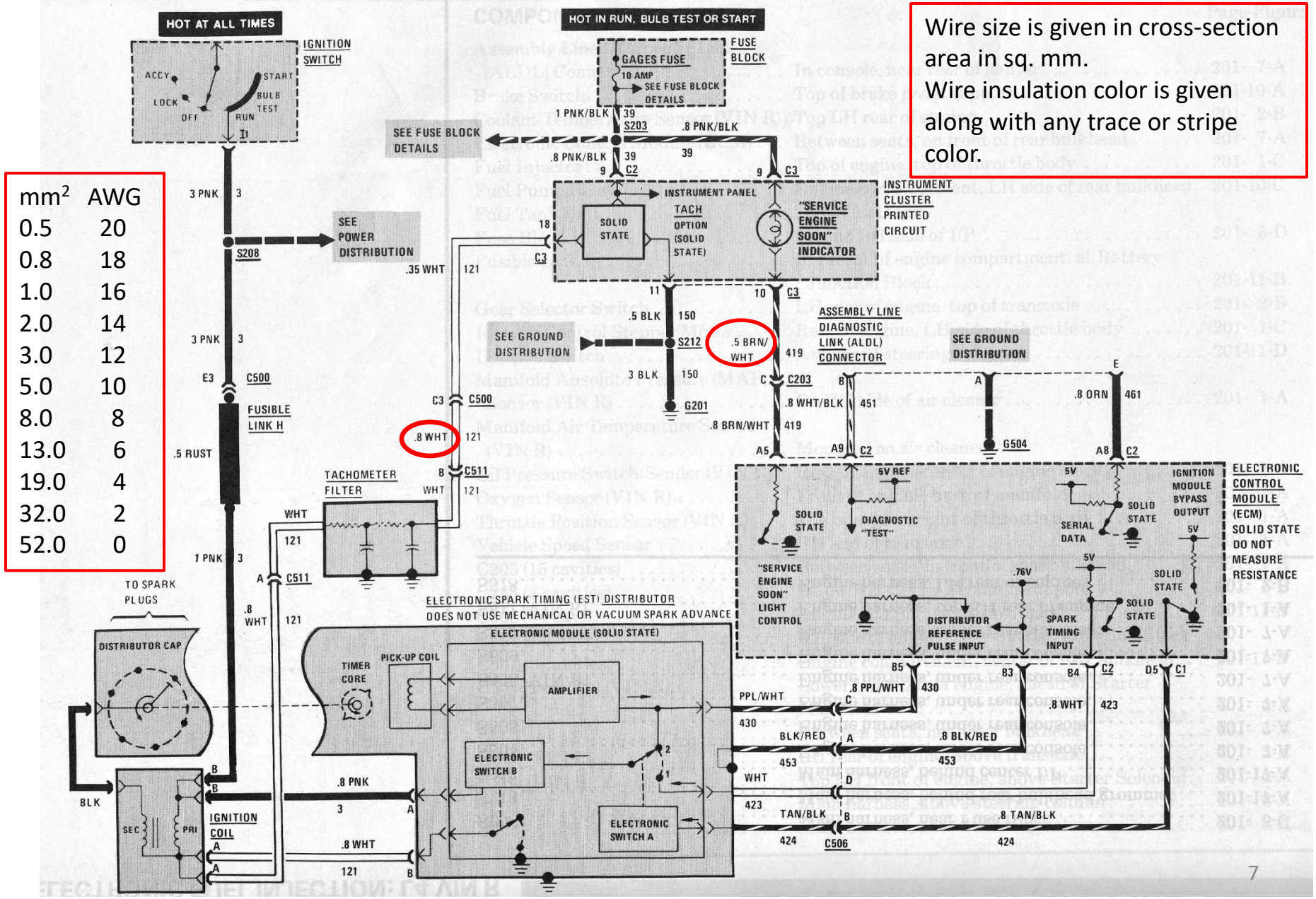
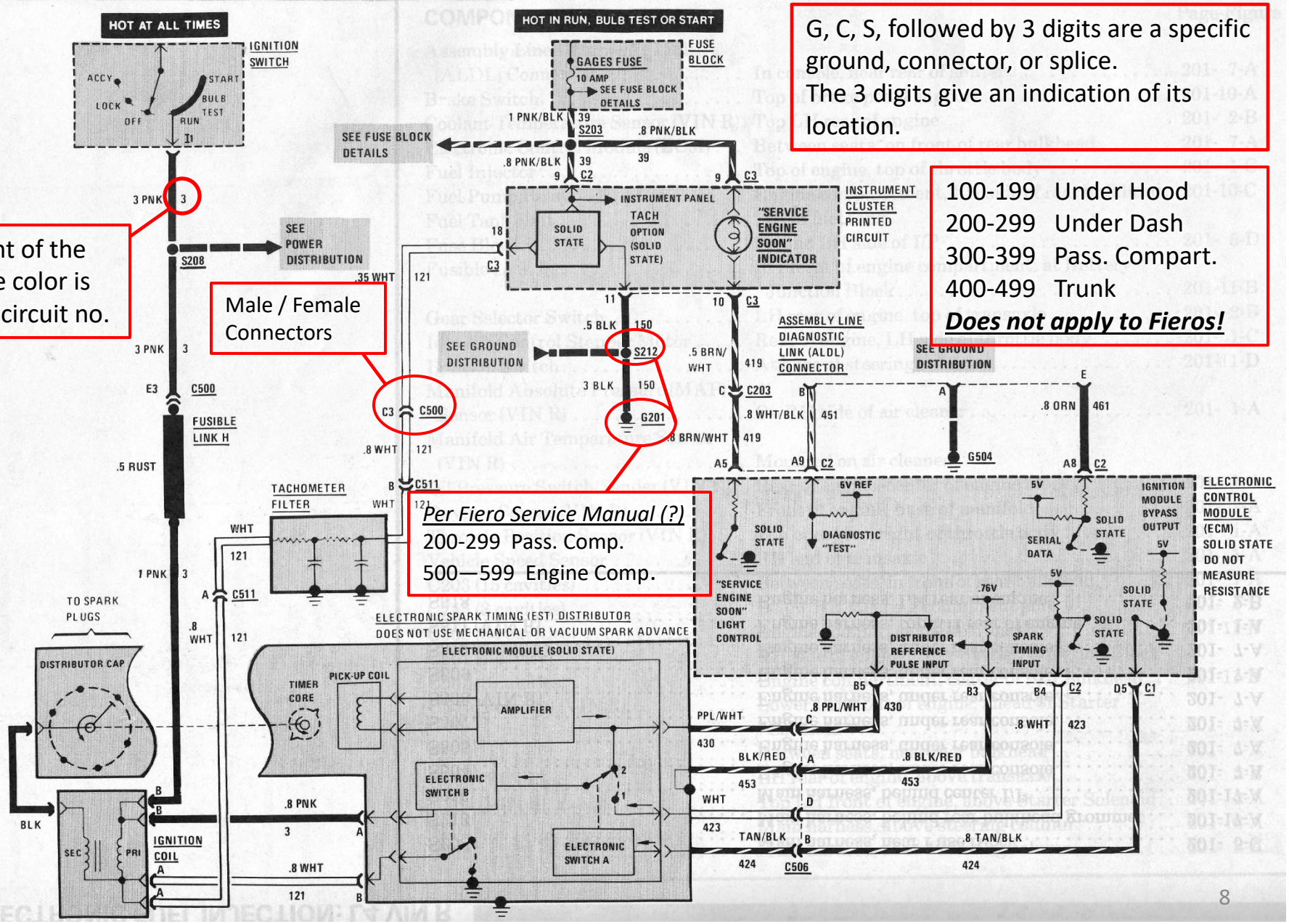


mm^2	AWG
0.5	20
0.8	18
1.0	16
2.0	14
3.0	12
5.0	10
8.0	8
13.0	6
19.0	4
32.0	2
52.0	0

Wire size is given in cross-section area in sq. mm.
Wire insulation color is given along with any trace or stripe color.

MULTI-PORT FUEL INJECTION: V6 VIN 9

IGNITION AND SERVICE ENGINE SOON INDICATOR



Right of the wire color is the circuit no.

Male / Female Connectors

Per Fiero Service Manual (?)
200-299 Pass. Comp.
500—599 Engine Comp.

G, C, S, followed by 3 digits are a specific ground, connector, or splice.
The 3 digits give an indication of its location.

100-199 Under Hood
200-299 Under Dash
300-399 Pass. Compart.
400-499 Trunk
Does not apply to Fieros!

The two online databases used by professional garages are:

1. AllData
2. Shopkey

This is an example of a ShopKey (Mitchell) electrical diagram. On ShopKey diagrams, each component is only shown once and all of the wire connections are included.

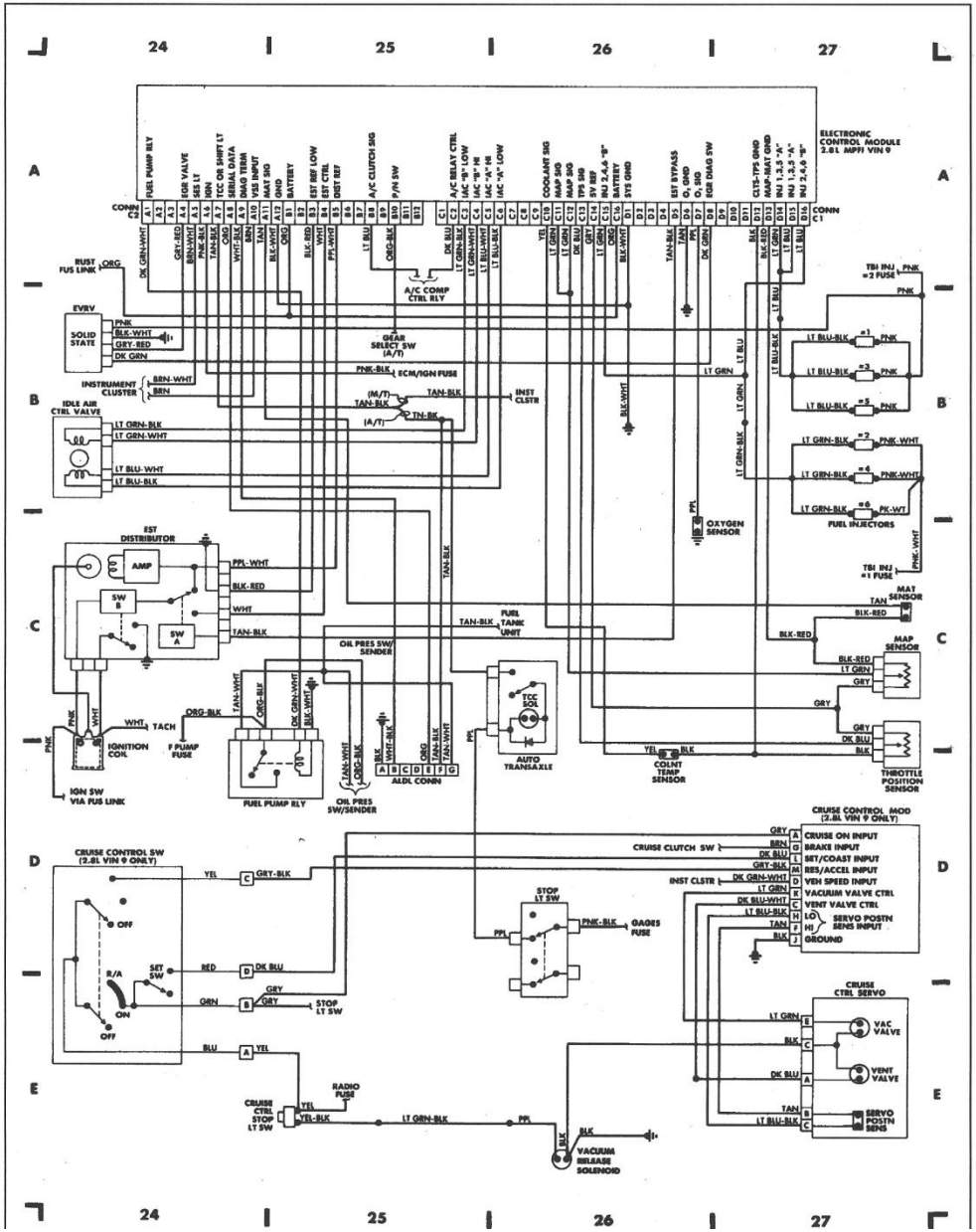
The previously shown diagrams were copied from the factory service manual, which is what is used in AllData.

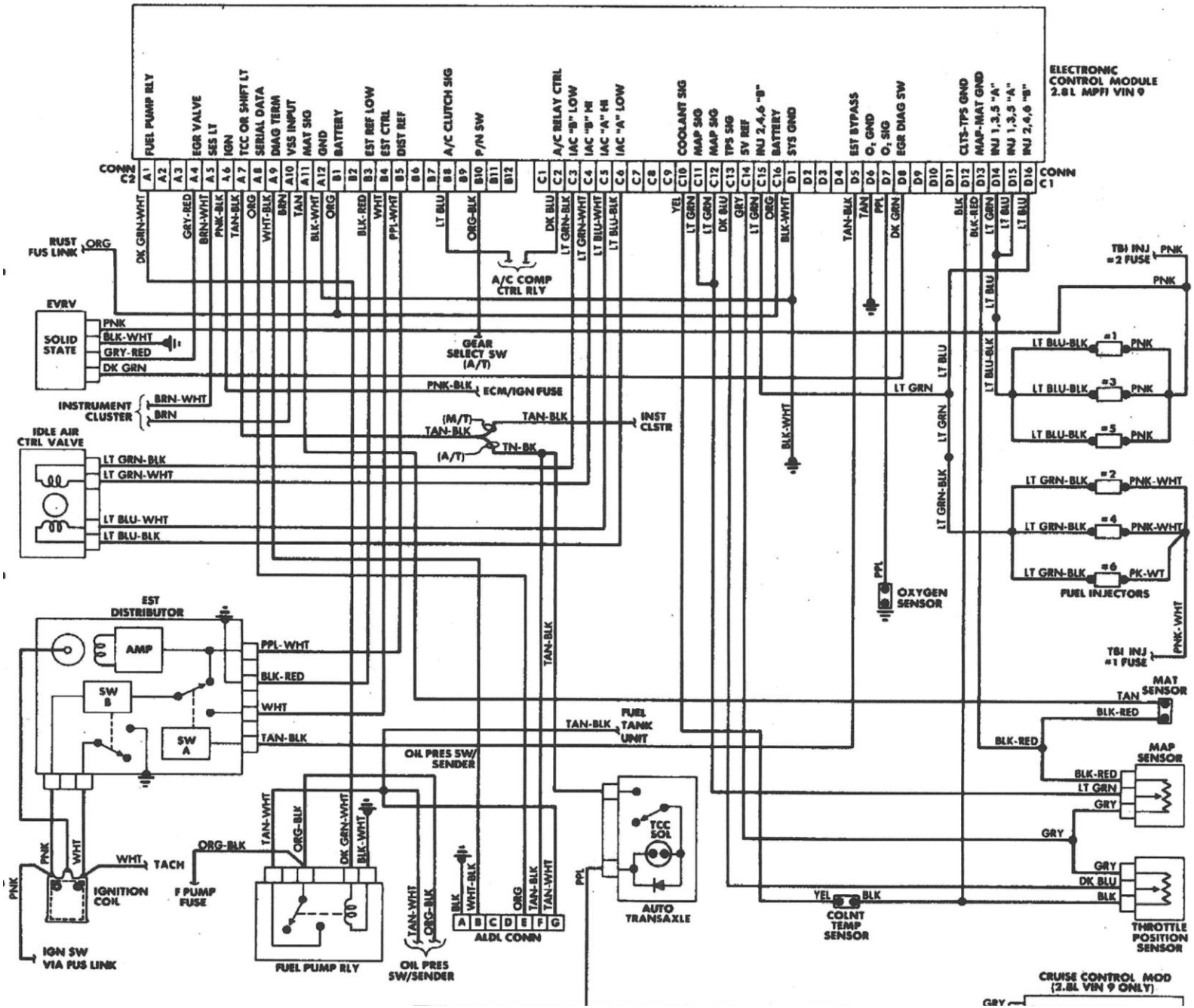
Alldata also has a consumer service, AlldataDIY, priced based on the number of vehicles registered on the site.

$30/yr for one vehicle

$20/yr for each added vehicle

Fig 7: Computer Engine Control (2.8L V6)




ELECTRONIC CONTROL MODULE 2.8L MPFI VIN 9
CONN C2
CONN C1
FUEL PUMP RLY
EGR VALVE
SES LT
IGN
TCC OR SHIFT LT
SERIAL DATA
DIAG TERM
VSS INPUT
MAT SIG
GND
BATTERY
EST REF LOW
EST CTRL
DIST REF
A/C CLUTCH SIG
P/N SW
A/C RELAY CTRL
IAC "B" LOW
IAC "B" HI
IAC "A" HI
IAC "A" LOW
COOLANT SIG
MAP SIG
MAP SIG
TPS SIG
5V REF
INJ 2,4,6 "B"
BATTERY
SYS GND
EST BYPASS
O2 GND
O2 SIG
EGR DIAG SW
CLTS-TPS GND
MAP-MAT GND
INJ 1,3,5 "A"
INJ 1,3,5 "A"
INJ 2,4,6 "B"
RUST FUS LINK
ORG
A/C COMP CTRL RLY
EVRV
SOLID STATE
PNK
BLK-WHT
GRY-RED
DK GRN
GEAR SELECT SW (A/T)
INSTRUMENT CLUSTER
BRN-WHT
BRN
PNK-BLK
ECM/IGN FUSE
(M/T)
(A/T)
TAN-BLK
TN-BK
INST CLSTR
IDLE AIR CTRL VALVE
LT GRN-BLK
LT GRN-WHT
LT BLU-WHT
LT BLU-BLK
EST DISTRIBUTOR
AMP
SW B
SW A
PPL-WHT
BLK-RED
WHT
TAN-BLK
OIL PRES SW/ SENDER
FUEL TANK UNIT
TBI INJ #2 FUSE
TBI INJ #1 FUSE
FUEL INJECTORS
OXYGEN SENSOR
MAT SENSOR
MAP SENSOR
THROTTLE POSITION SENSOR
COLNT TEMP SENSOR
AUTO TRANSAXLE
TCC SOL
ALDL CONN
IGNITION COIL
TACH
F PUMP FUSE
FUEL PUMP RLY
IGN SW VIA PUS LINK
CRUISE CONTROL MOD (2.8L VIN 9 ONLY)

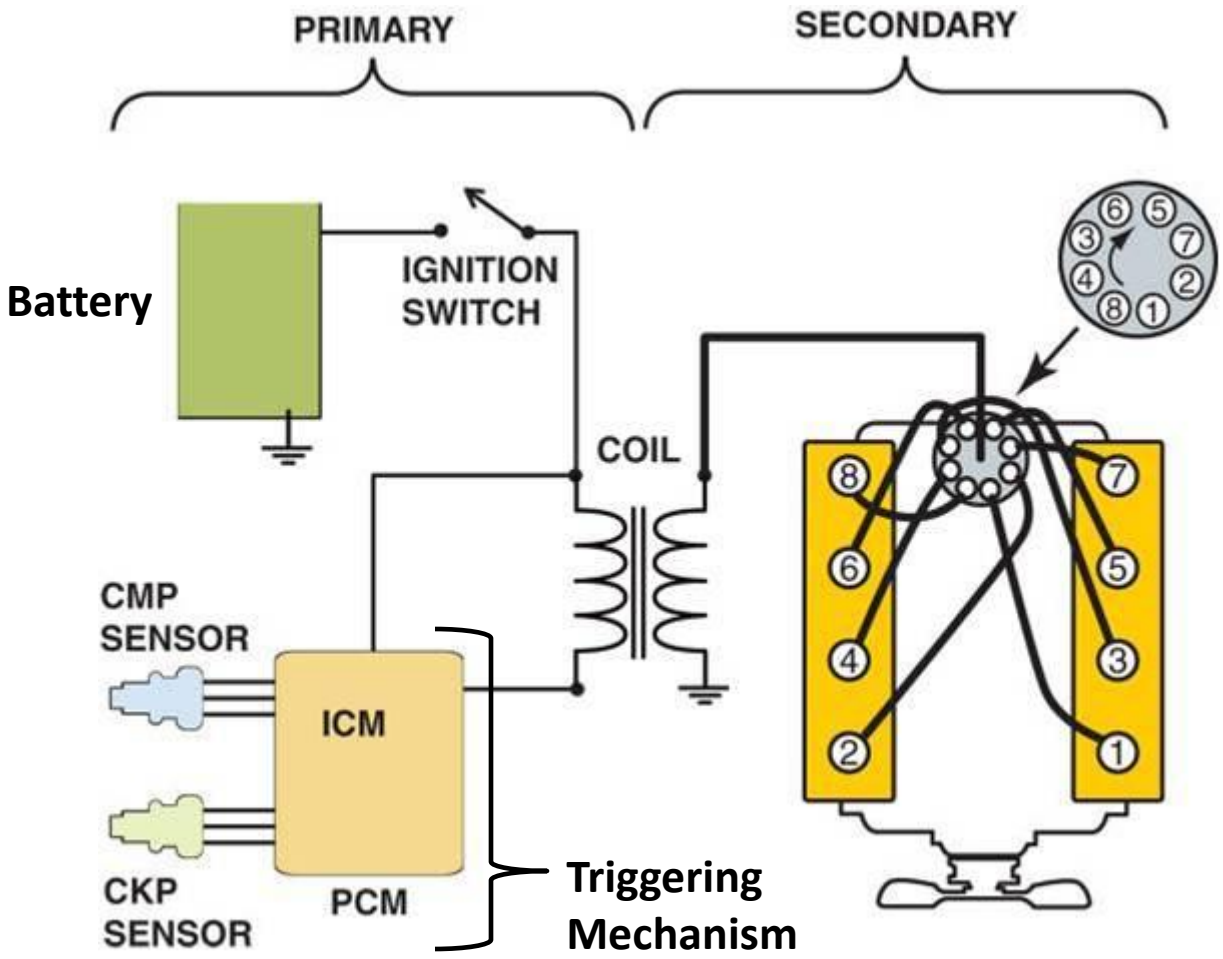
There are 3 Parts to Every Modern Automotive Ignition System

- Primary Circuit (low voltage)
- Secondary Circuit (high voltage)
- Triggering Mechanism

Basic Components of a Distributor Ignition

Primary voltage approx. 12 volts

Secondary voltage approx. 30,0000 volts



Ignition Coils

- For each type of system, the ignition coil is the interface between the primary and secondary system, transforming 12 volt battery voltage to 30,000^{+} volts to fire the spark plugs.

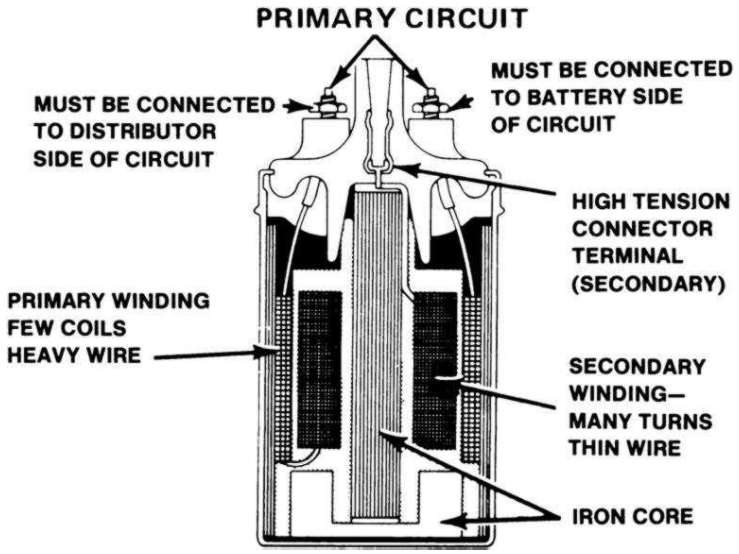
Ignition Coil Basic Operation

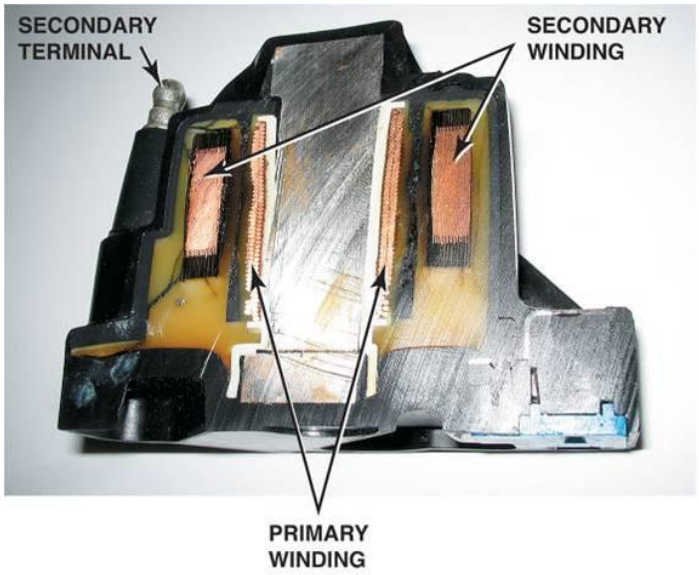
How Voltage is Increased

- Battery voltage flows through primary windings of coil. These wire windings are around an steel core. A strong magnetic field is created around the core when the primary circuit is closed.
- The triggering mechanism (there are various kinds for the different systems) opens the primary circuit, i.e. turns it off.
- The secondary windings are wound around the same steel core, away from the primary winding but still close enough to be within the magnetic field of the iron core. There can be 100 times more secondary windings than primary windings. The wire for the secondary windings are much smaller than the primary wire.
- The collapsing magnetic field induces a voltage in the secondary windings. The large number of windings creates a large voltage, but lower amperage than the primary circuit.
- Stopping the current flow in the primary circuit triggers the current flow in the secondary circuit that fires the spark plug.

Ignition Coil Basic Operation

How Voltage is Increased





- Collapsing magnetic field induces a voltage of approx. 400 volts in the primary circuit
- With a a 100 times more secondary windings than the primary windings, the secondary voltage is stepped up to 400 x 100 = 40,000 volts
- The primary circuit draws 6 -10 amps. The secondary circuit is 0.02-0.08 amps
- Current never flows in the primary and secondary circuits at the same time

Coil Output of Secondary Circuit
Per Fiero Store website

Stock coil: 30k volts ($25)

MSD coil: 45k volts ($60)

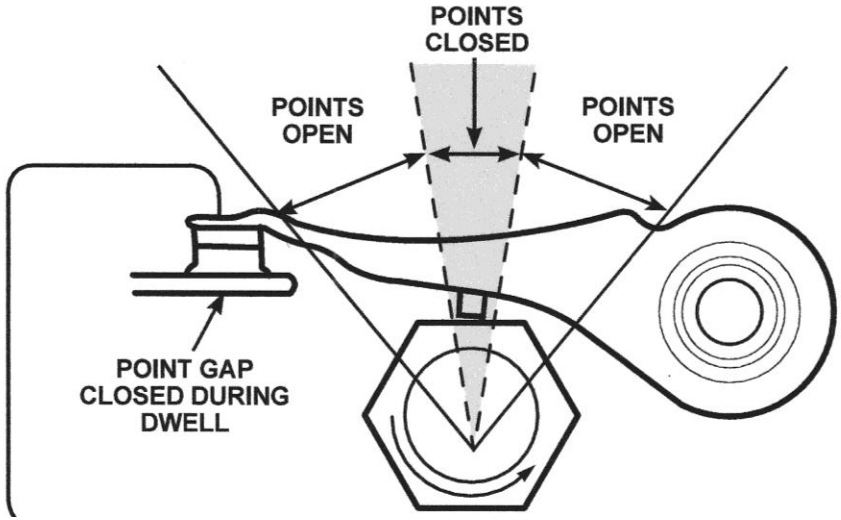
Accel coil: 48k volts ($68)

Triggering Mechanisms

- Can be located in the distributor, near the ignition coil, or as part of the engine control module (ECM)
- Also known as a driver

Mechanical Contact Points

Dwell angel, measured in degrees, is the amount of time the points are closed



Triggering Mechanisms

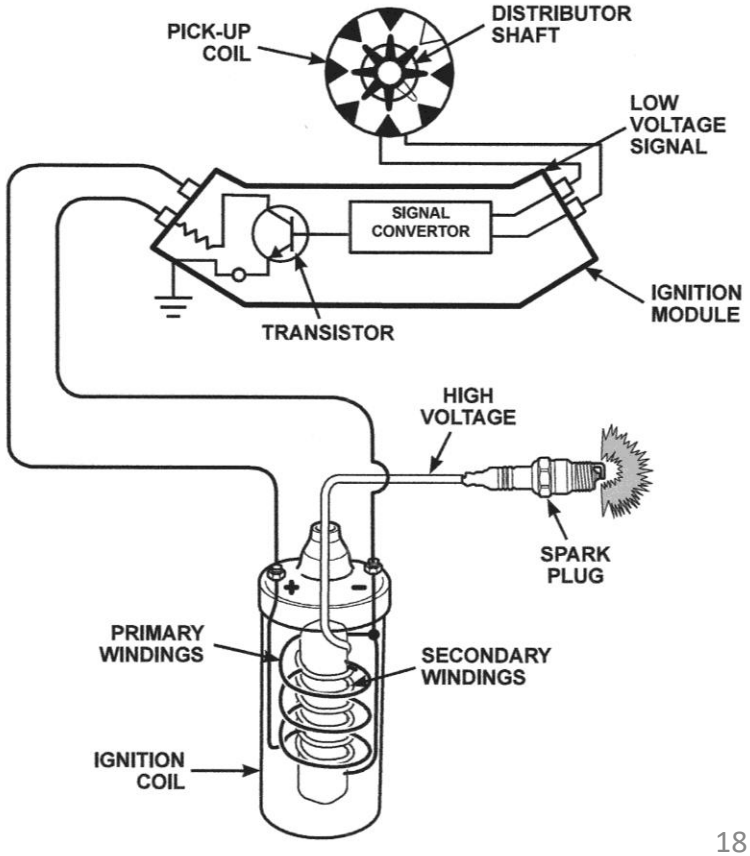
Ignition Modules

Uses input from engine sensors

Install with dielectric grease on backing plate to dissipate heat

Distributor Systems

DIS Systems

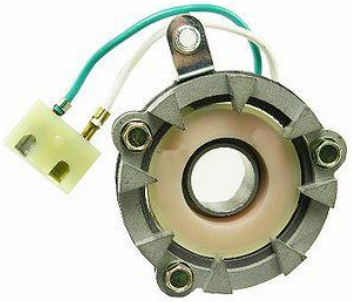


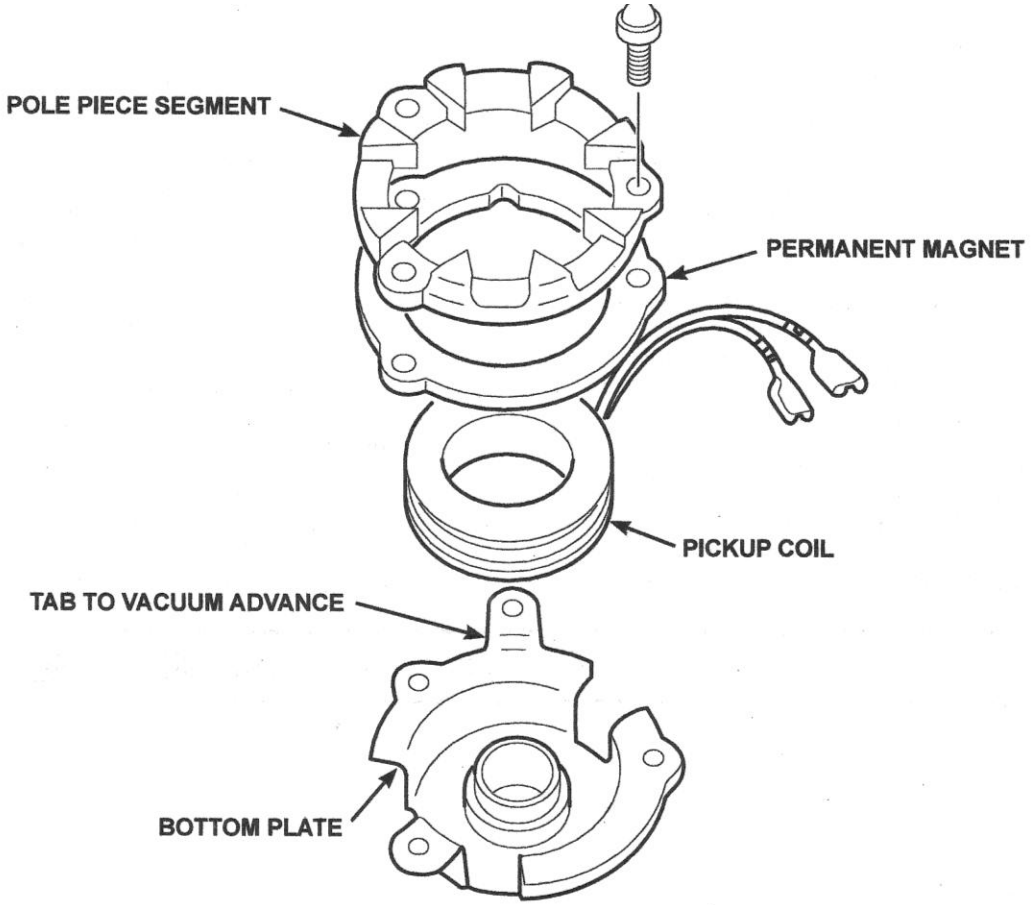
Engine Sensors

Located Inside the Distributor

- Magnetic Pick-up Coil

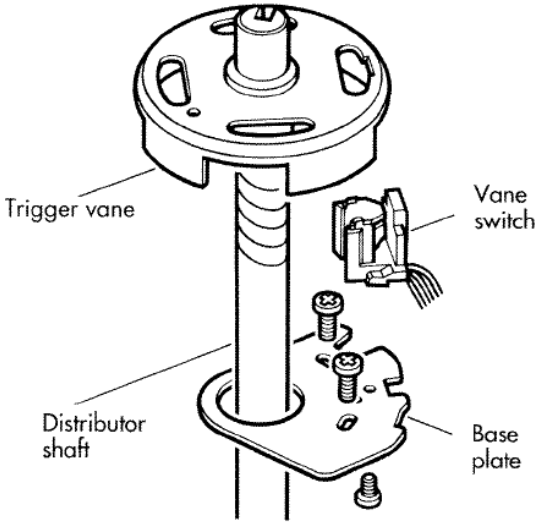
  Analog output converted to a digital signal by the Ignition Module

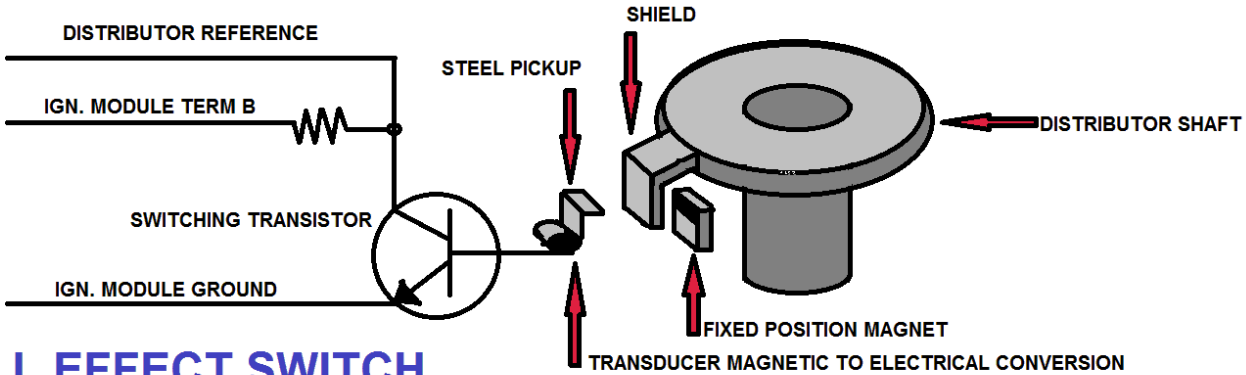




Engine Sensors
Located Inside the Distributor

- Hall Effect Sensor
  Using a small voltage and a permanent magnet, generates a digital signal

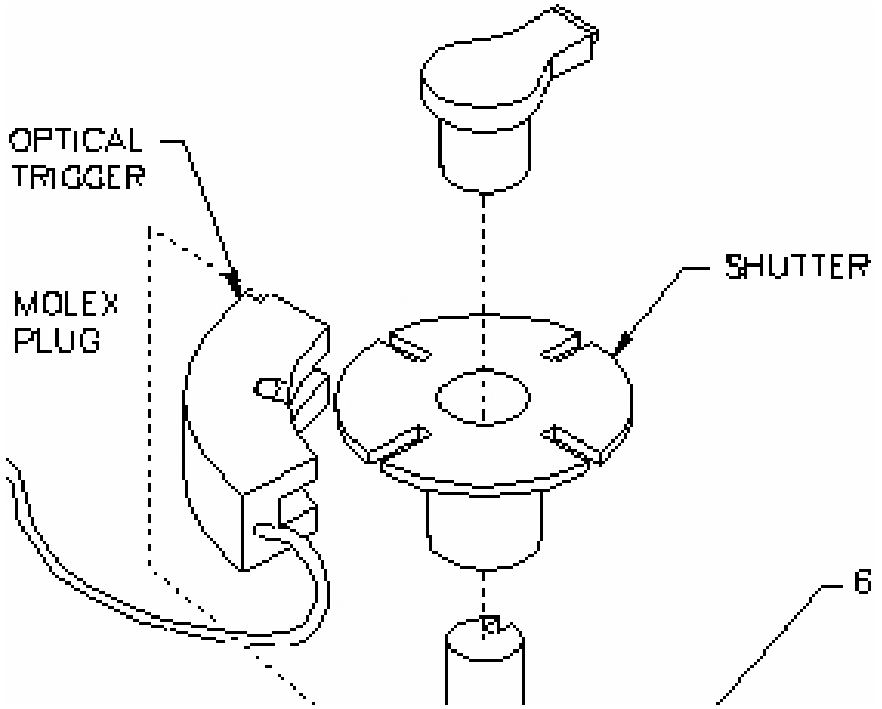




Engine Sensors
Located Inside the Distributor

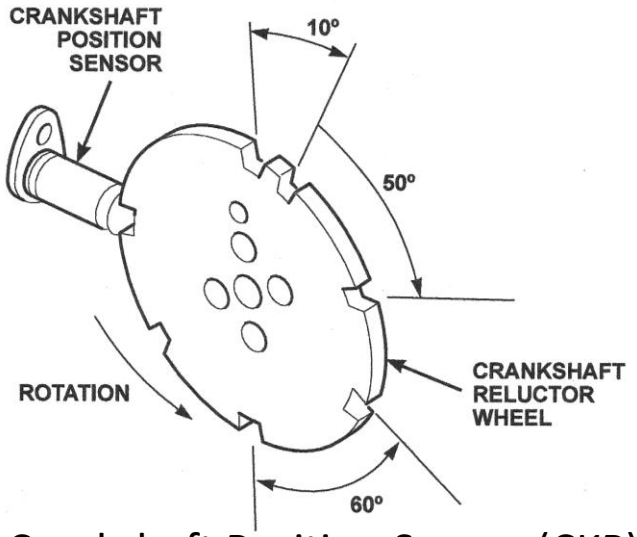
- Optical Sensor

  Using light from an LED and a phototransistor to signal the computer

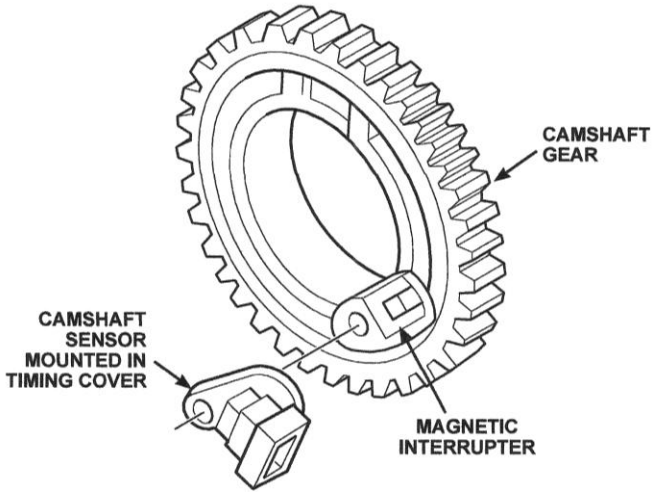


Engine Sensors

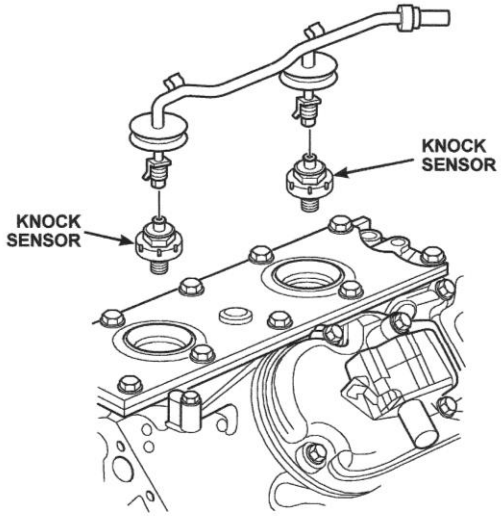
Other Sensors Located on the Engine

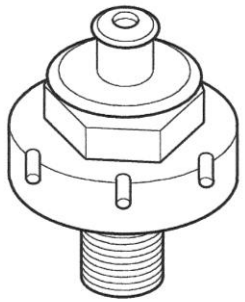


•Crankshaft Position Sensor (CKP)



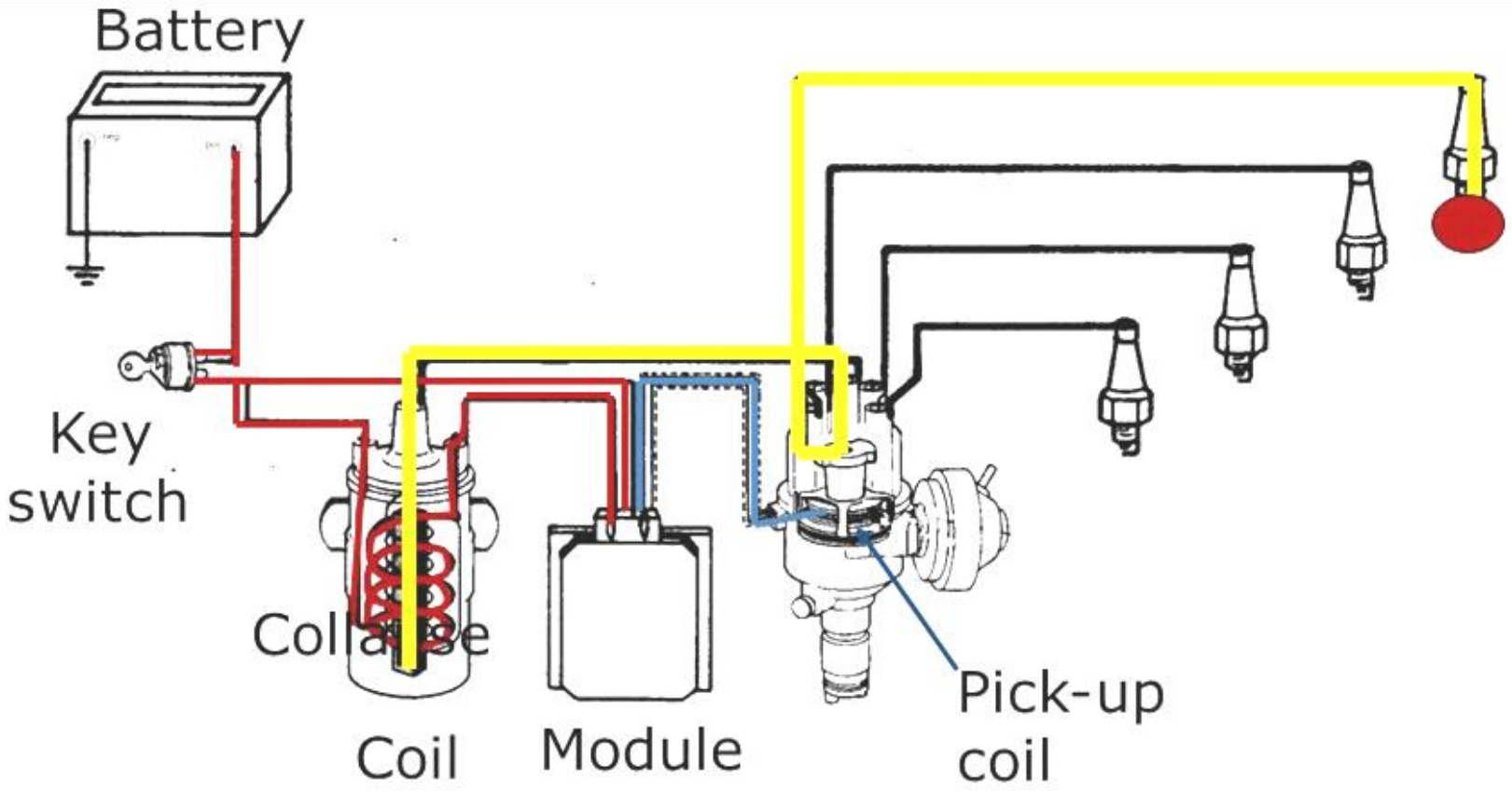
•Camshaft Position Sensor (CMP)





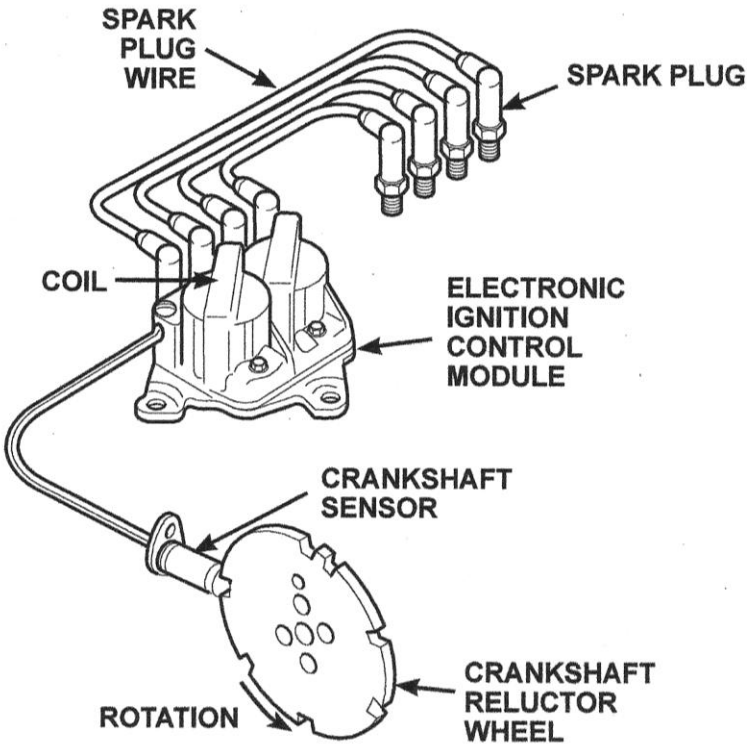
•Knock Sensors

Distributor Ignition System



Direct Ignition System (DIS)
(Waste Spark System)

- One ignition coil for every 2 cylinders
- Each coil fires 2 cylinders simultaneously, one cylinder on the power stroke, and its companion cylinder on the exhaust stroke
- Most of the electrical energy goes to the power cylinder, due to the high pressure in that cylinder. The waste spark only requires 2-3 kV to fire.



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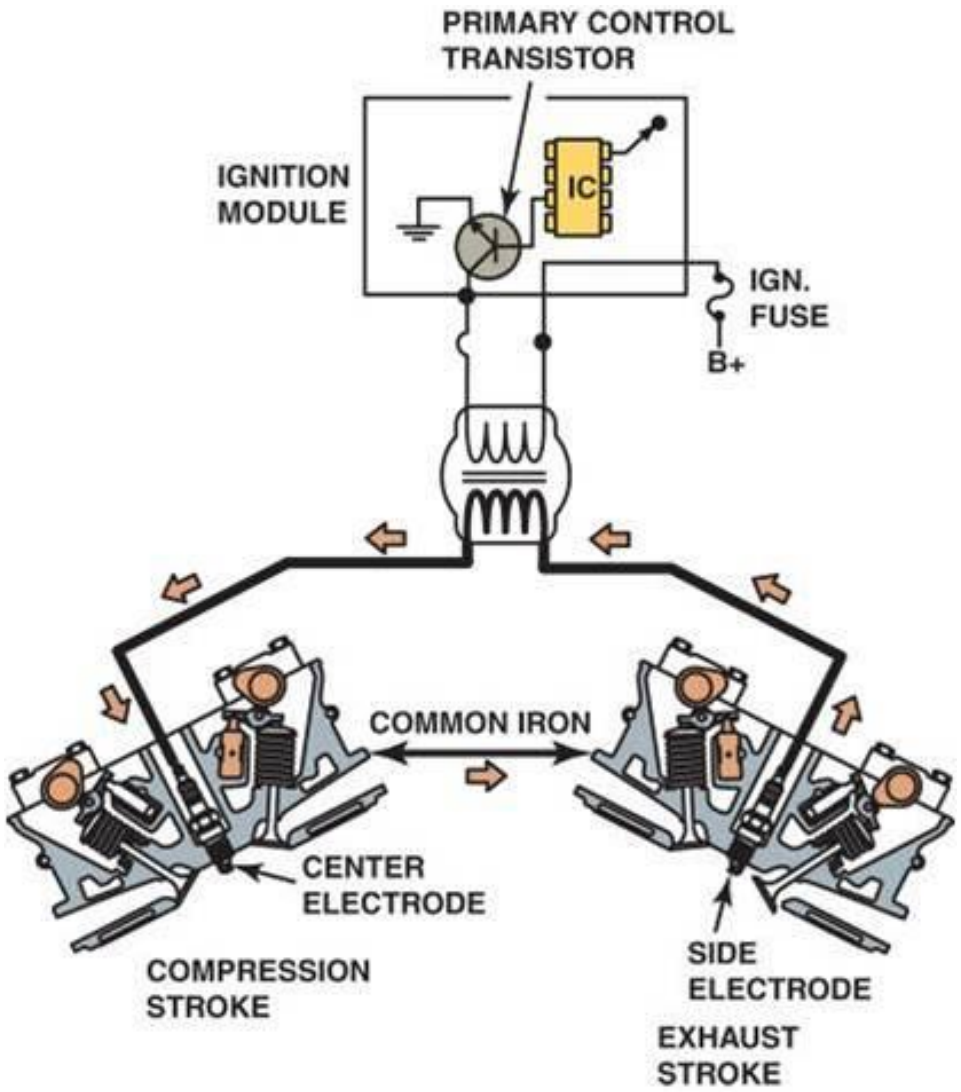
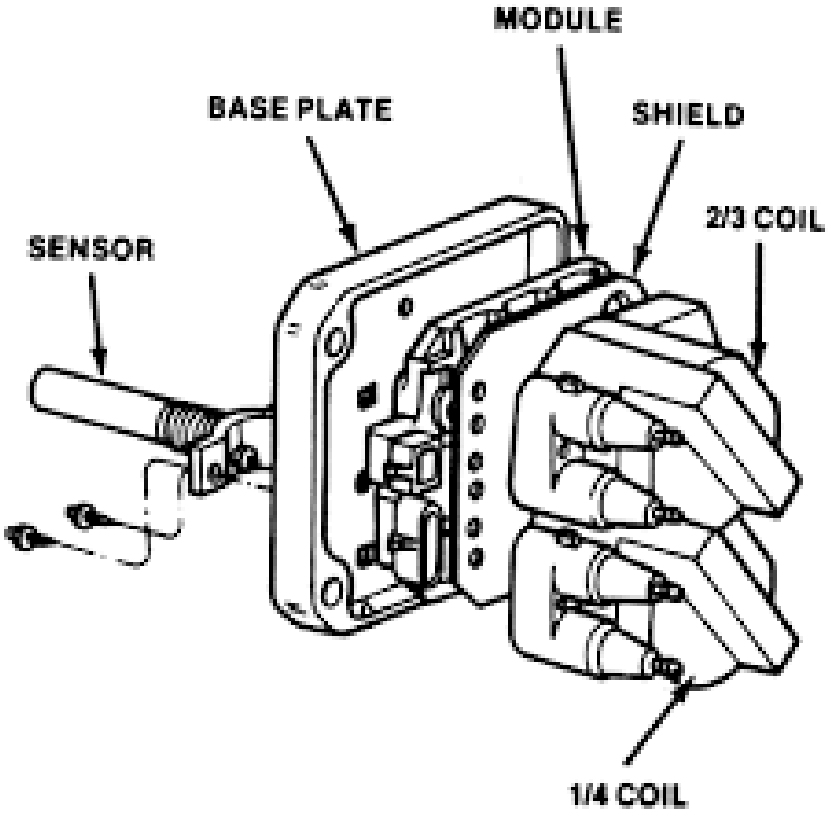
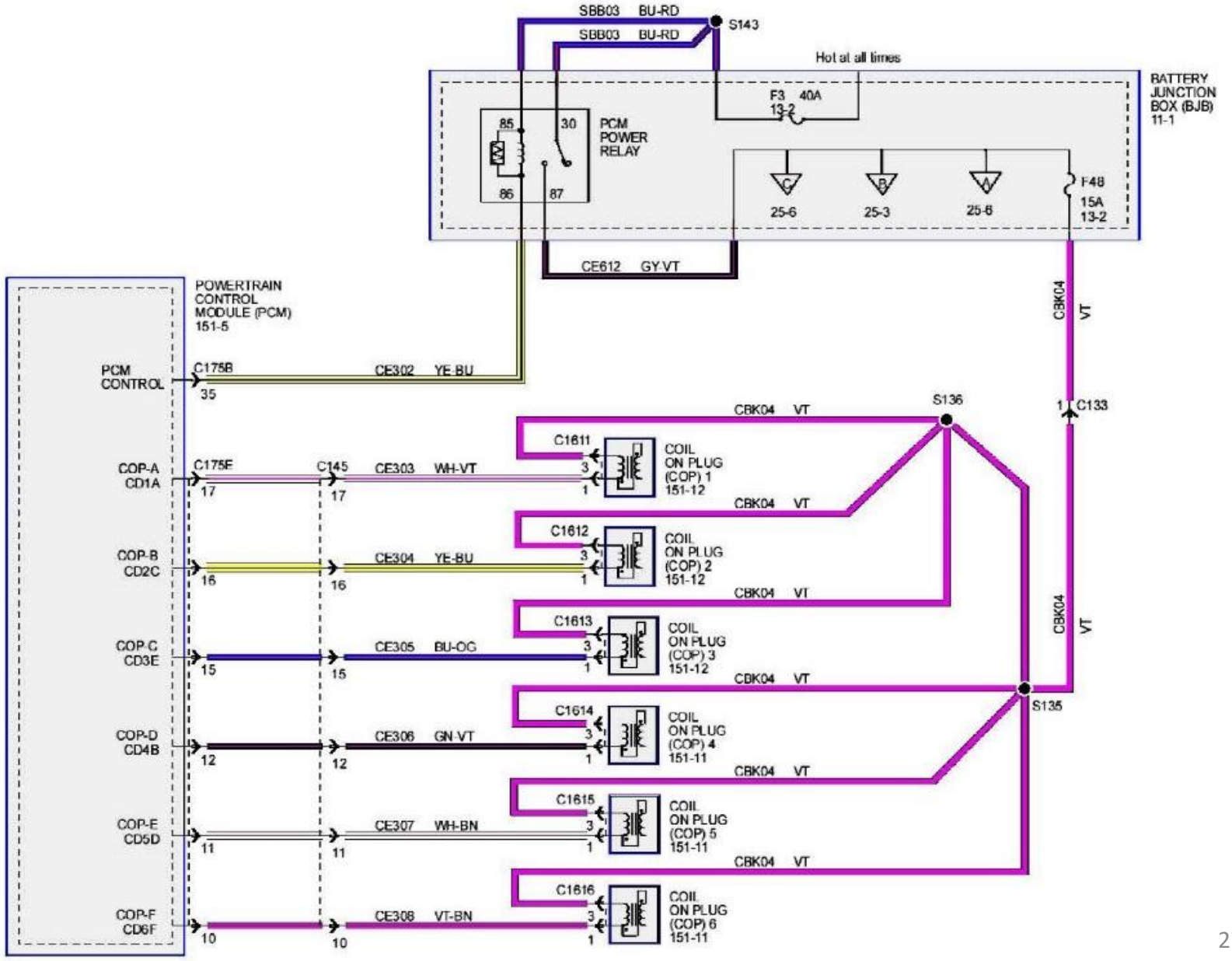




Coil on Plug System (COP)

- Separate ignition coil for each cylinder
- Some systems incorporate the ignition module in the PCM/ ECM
- Some systems incorporate the ignition module inside the coil
  - Ignition coil/module assembly
  - PCM sends a trigger signal to the ignition coil
- Timing can be individually controlled on each cylinder
- Ignition coil is mounted directly above the spark plug

COP - 2010 Ford Fusion 3.5



Coil on Plug

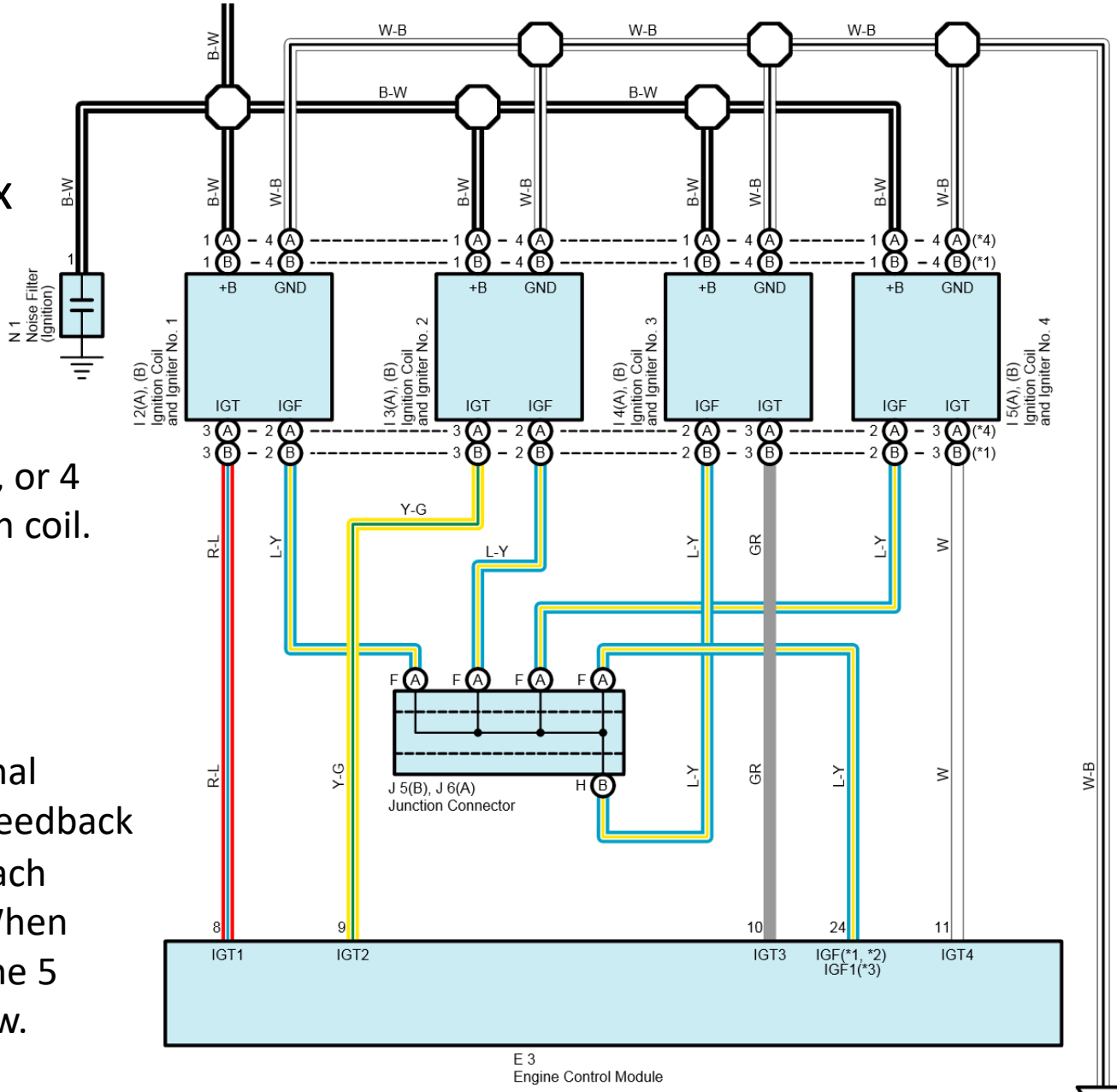
2006 Toyota Matrix

COP systems can have 2, 3, or 4 wires going to each ignition coil.

Toyotas have 4 wires

- +B – Power
- GND - Ground
- IGT – Ignition Timing Signal
- IGF – Ignition Confirm/Feedback

5 volts is sent to each coil at all times. When the coil turns on, the 5 volts gets pulled low.



Coil Near Plug (CNP)

- Separate ignition coil for each cylinder
- Most systems incorporate the ignition module inside the coil
  - Ignition coil/module assembly
  - PCM sends a trigger signal to the ignition coil
- Timing can be individually controlled on each cylinder
- System has short spark plug wires

Ignition Videos on YouTube

- Automotive Basics channel
  - Electronic Ignition (3:44)

    https://www.youtube.com/watch?annotation_id=annotation_2813905289&feature=iv&src_vid=FpGGpgSEU94&v=QYx8J_5l5wY
  - DIS Ignition (5:56)

    https://www.youtube.com/watch?v=FpGGpgSEU94
- AccuSpark Ignition Systems channel
  - Converting Points to Electronic Ignition (6:20)
    https://www.youtube.com/watch?v=2lcx_Qr0KyM

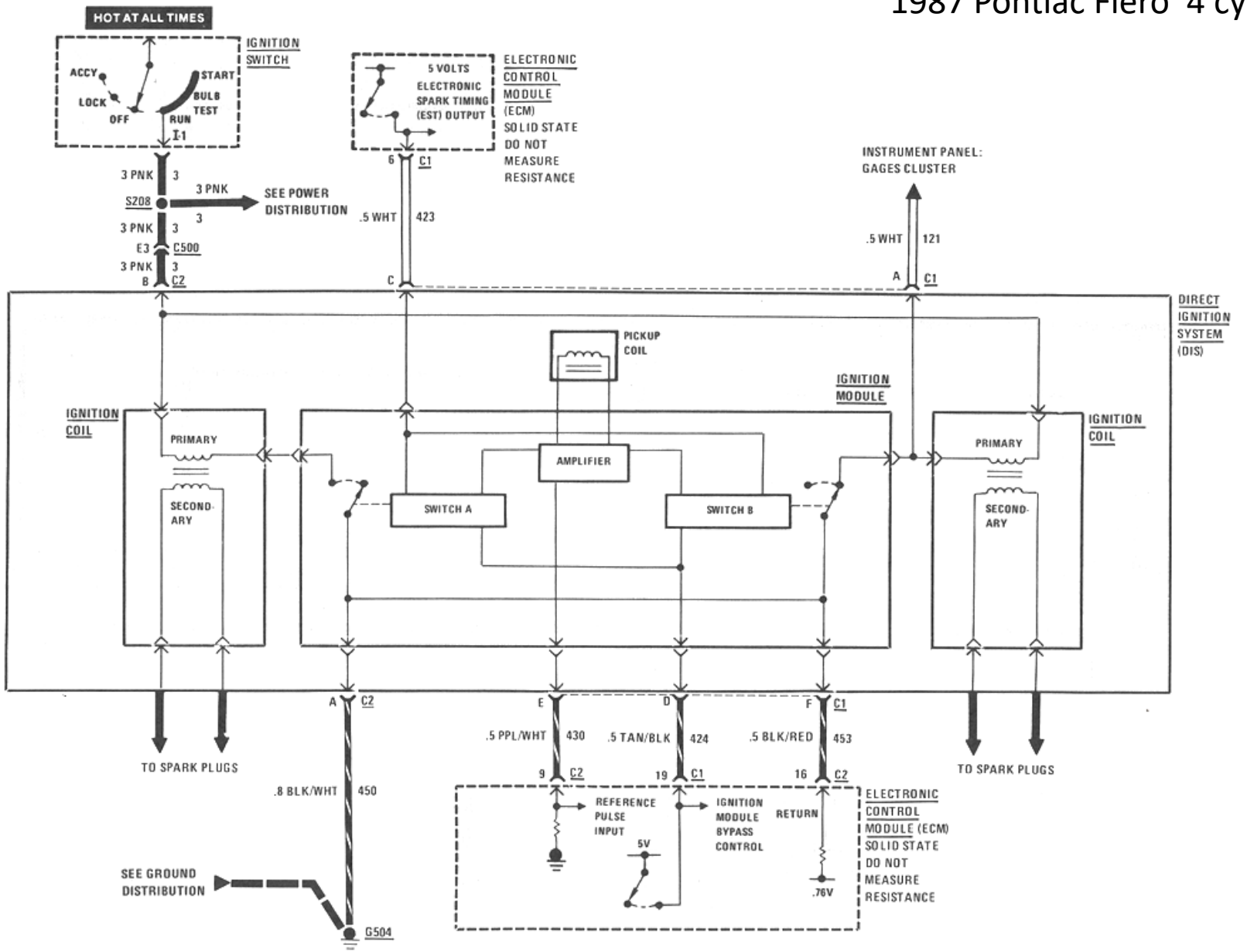
Abbreviations

HEI – High Energy Ignition
EST – Electronic Spark Timing
ECM – Engine Control Module
ESC- Electronic Spark Control
EI- Electronic Ignition
DIS- Direct Ignition System
CMP- Camshaft Position Sensor
CKP- Crankshaft Position Sensor
ICM- Ignition Control Module
PCM- Powertrain Control Module

ELECTRONIC FUEL INJECTION: L4 VIN R

IGNITION

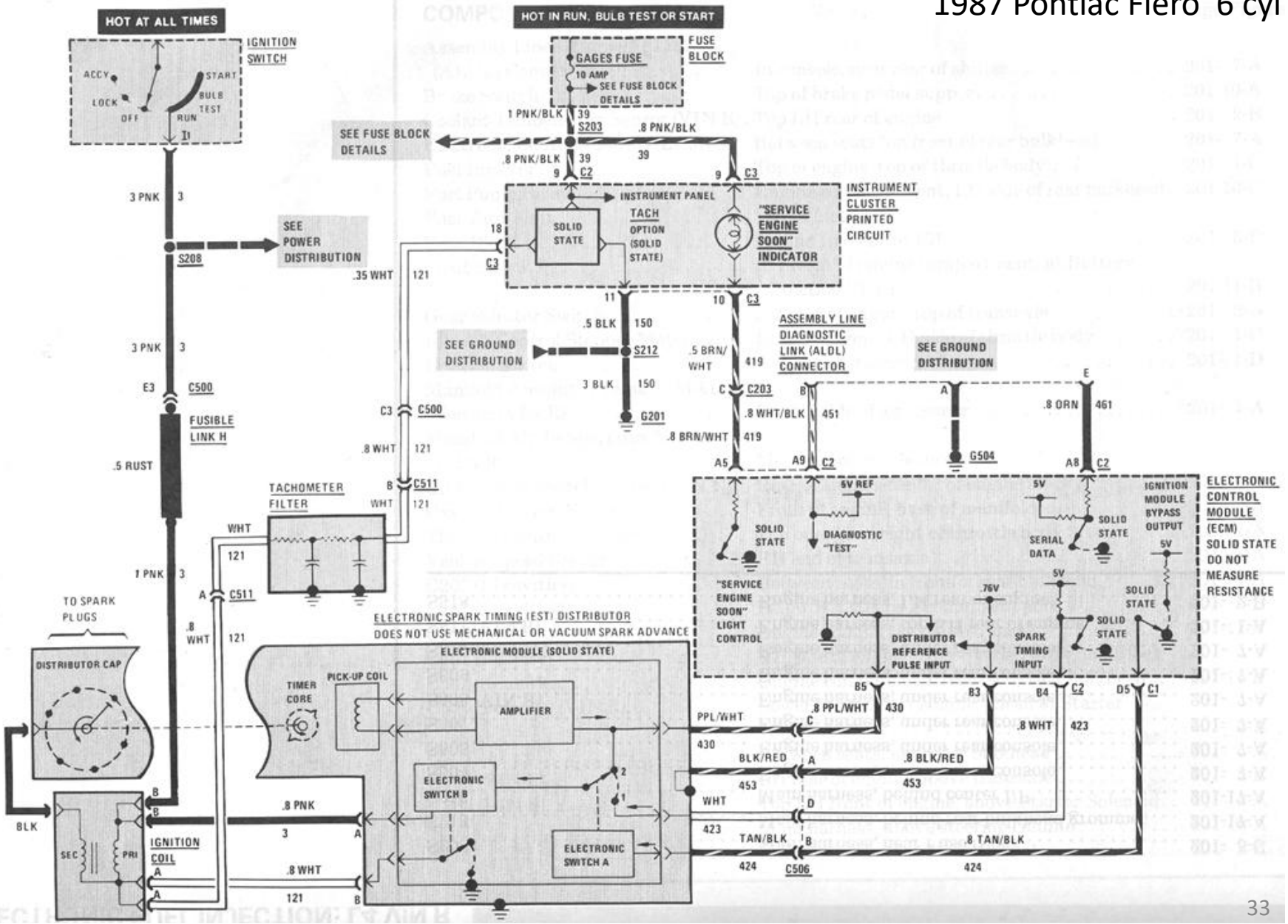
1987 Pontiac Fiero 4 cyl



MULTI-PORT FUEL INJECTION: V6 VIN 9

IGNITION AND SERVICE ENGINE SOON INDICATOR

1987 Pontiac Fiero 6 cyl



1987 Fiero L4-2.5L