Mercedes-Benz

Fuel Supply & ME-SFI Engine Management Ignition (Part 9)

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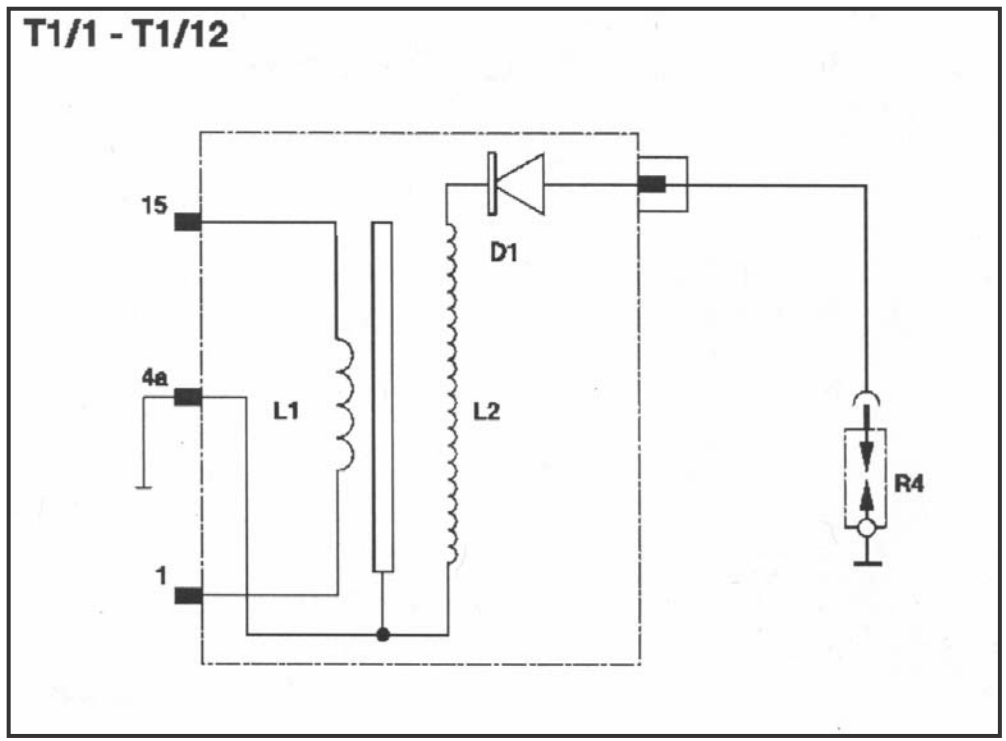
Coil Control

- Power supply to the coils is fused.
- Ground side of each coil is controlled by the ME control module.



Ignition Control

1. Determining ignition angle based on:
   - hot film mass air flow sensor
   - crankshaft position sensor
   - camshaft position sensor
   - coolant temperature sensor
   - intake air temperature sensor

Ignition Angle Adaptation

2. Ignition angle adaptation

   2.1 Catalytic converter heating
   - timing retarded for ~20 s in P or N

   2.2 Idle speed
   - retarded up to 36^{O}
   - advanced up to 20^{O}

   2.3 Inertia fuel shutoff (Decel shutoff)
   - briefly retards timing when fuel commences

Ignition Angle Adaptation

2.4 Intake/coolant temperature

- Timing retarded under load if:
  - Intake air temperature > 35^{O}C
  - Coolant temperature > 105^{O}C

2.5 Transmission overload protection

- Timing briefly retarded during shift under load (1-2-1, 2-3-2)

Ignition Control

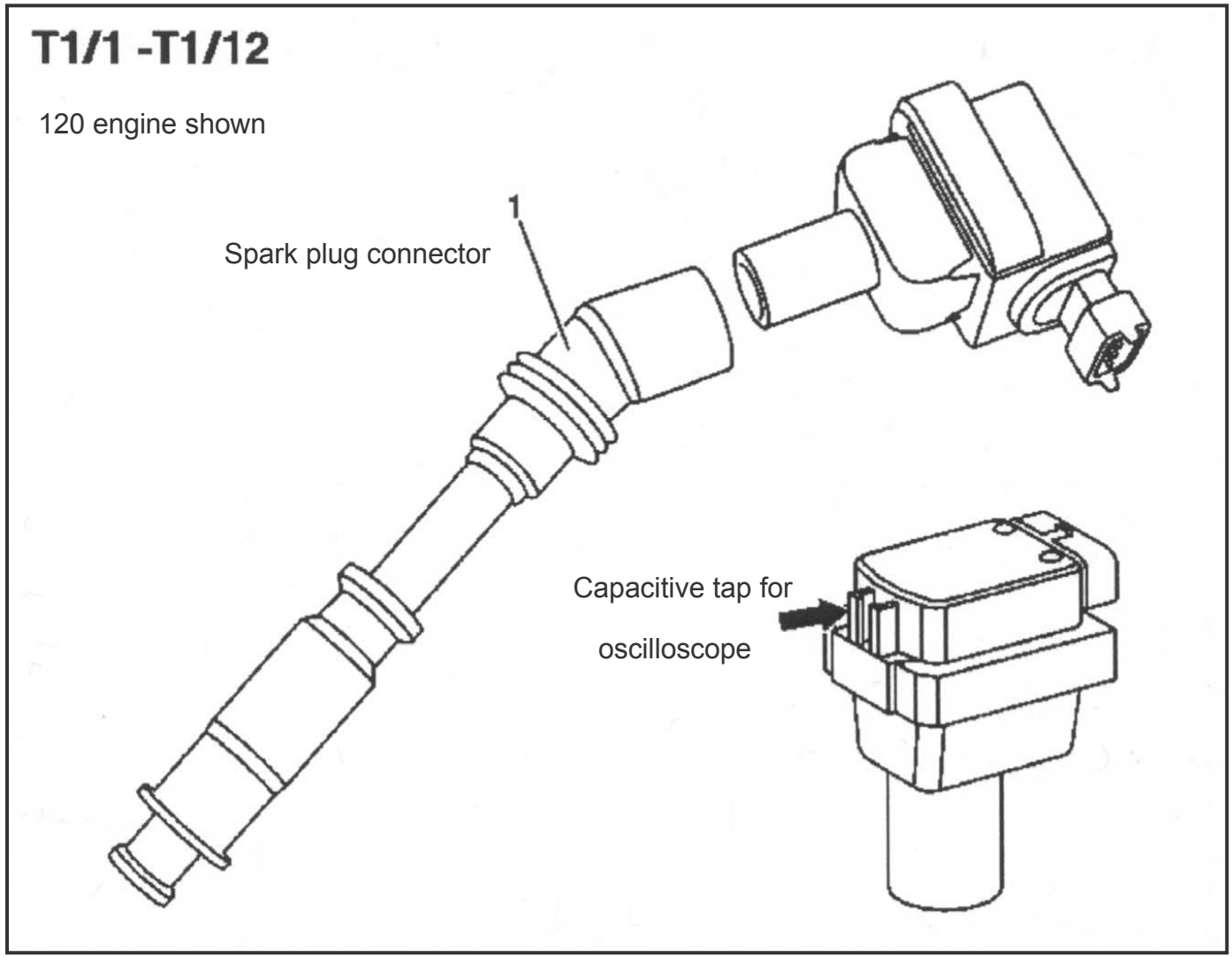
2.6 ESP/ASR control

- used to reduce engine torque

2.7 Knock sensor system

- can retard the ignition angle at relevant cylinders

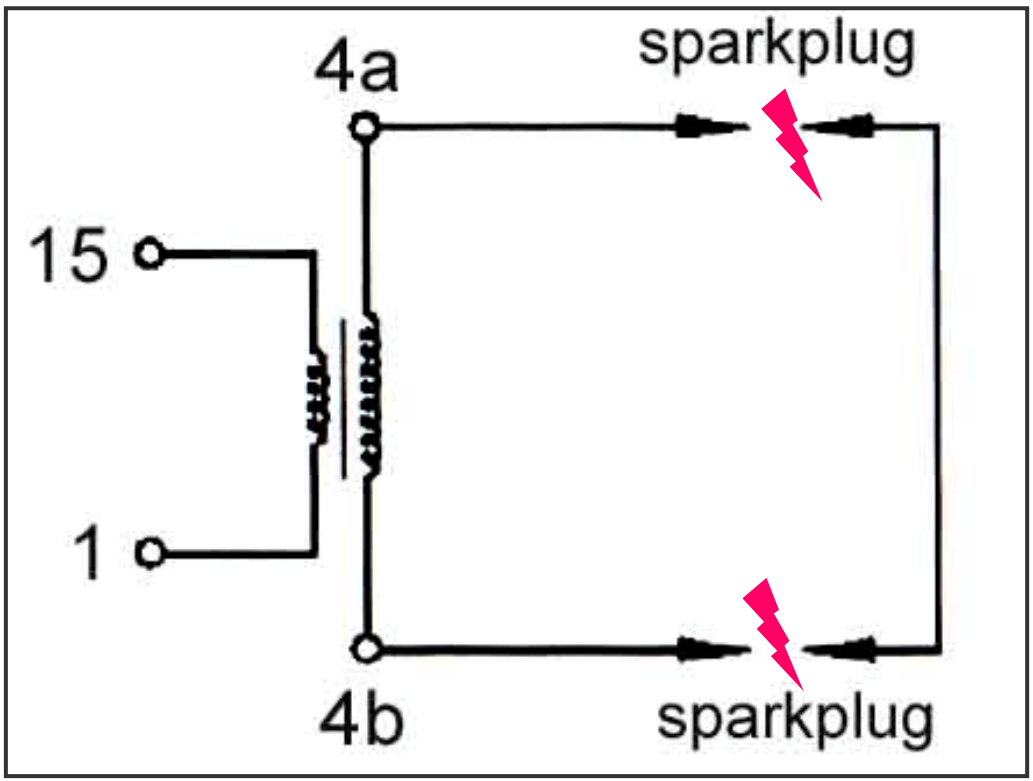
Ignition Coil



111 Coil

Each coil fires two spark plugs

111 coil

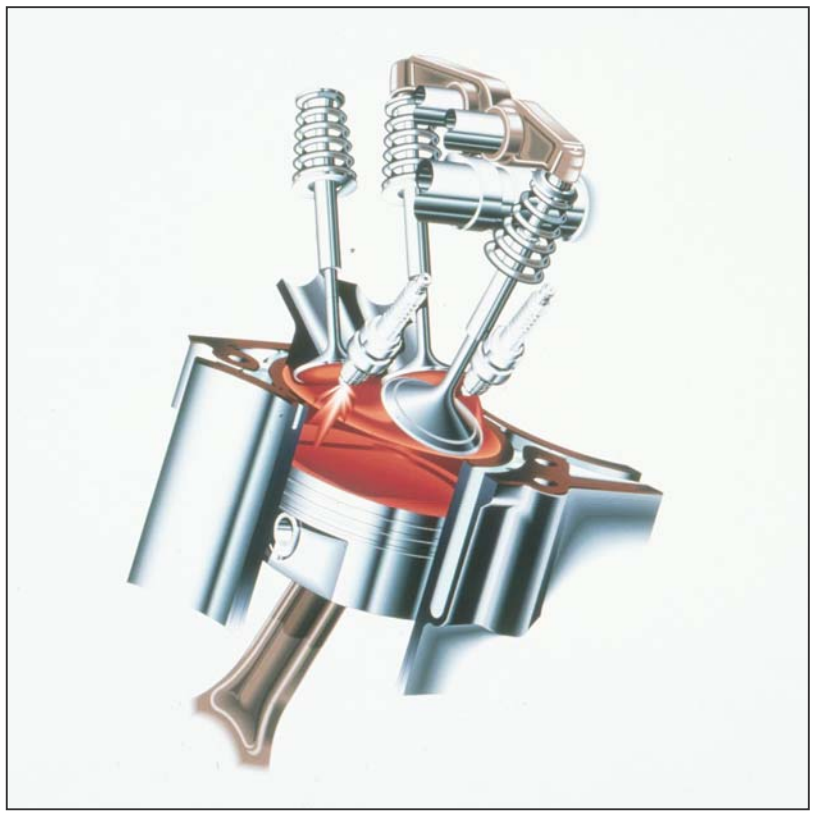


ME controls the primary by controlling the ground at terminal 1.

Both sparkplugs fire, one on the power stroke and the other on the exhaust stroke.

The spark in the exhaust stroke requires less energy, so that practically all of the energy is available for the spark on the power stroke.

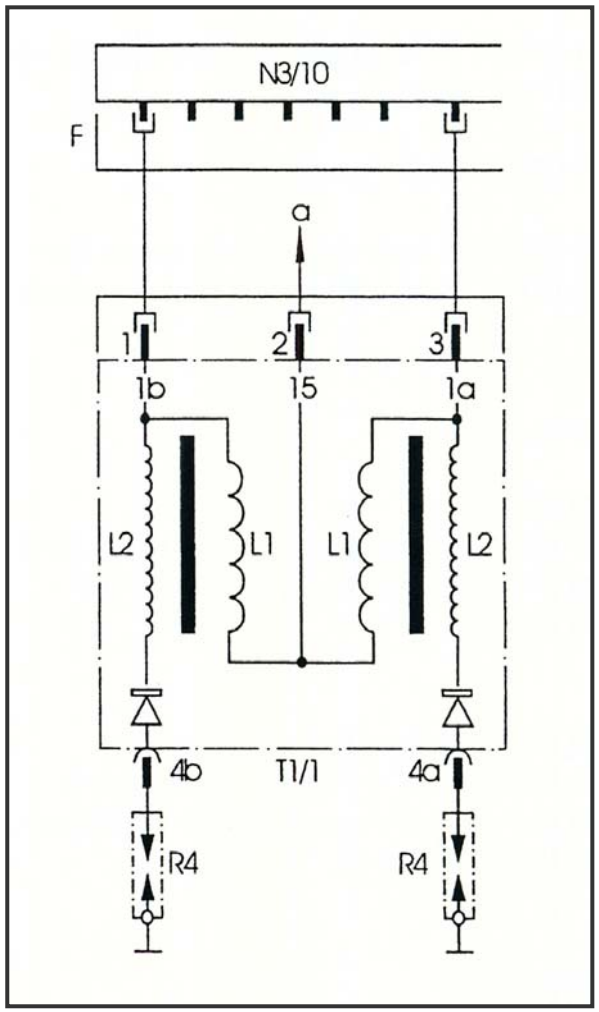
Dual Spark Plug System



Advantages.

- Increases the combustion efficiency.
- Combustion noise reduced.
- More complete combustion.
- Reduces thermal stress.
- Provides optimum ignition timing for changing engine, vehicle and driving conditions

Ignition Coil



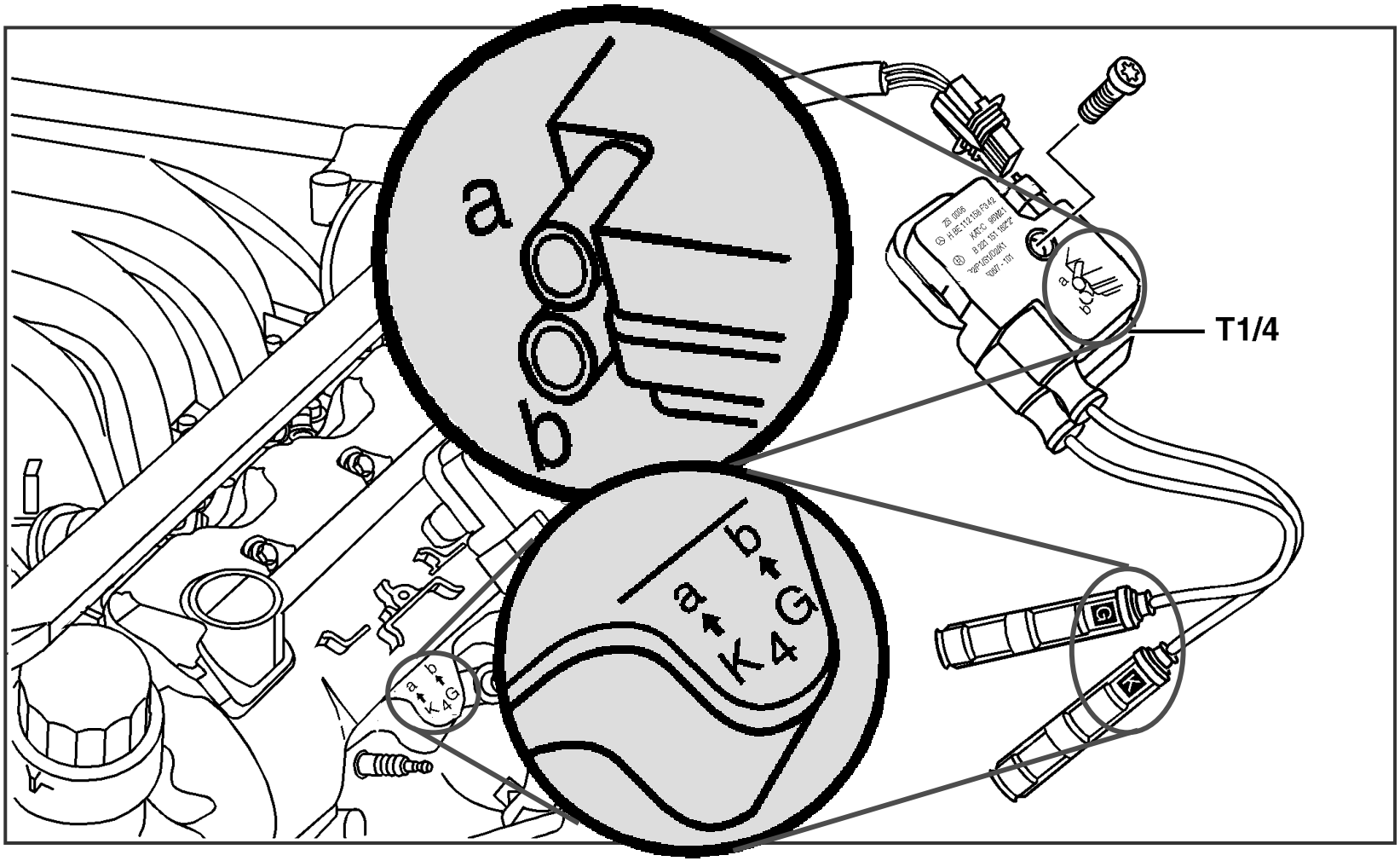
- Each cylinder has a double coil set, and its own dedicated plug wires.
- The 2 coil set is controlled by the ME-SFI Control module (N3/10).
- The 2 coils will fire simultaneously or in phases.

System Operation.

1. Coils are “Phase-shift” triggered,
   - firing plugs A-B, then B-A, then A-B etc.
   - Offset between the plug firing varies from 0 to 10^{o}

2. Timing can be retarded by as much as 14.5^{o}

Coil Installation Note



Irregular Engine Running Analysis.

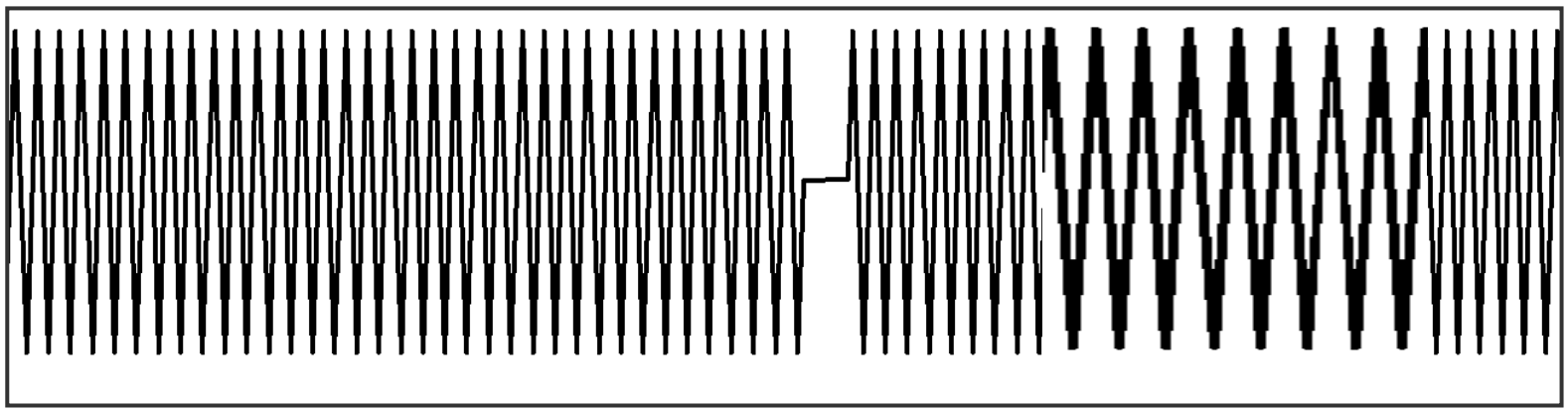
The ME system recognizes misfiring caused by:

- ignition system
- fuel injection system
- mechanical engine components

Misfiring is Detected by:

Signal from crank shaft sensor

- Watches the speed changes of the flywheel



(Flywheel must be adapted)

Flywheel Adaptation

Flywheel needs to be adapted if:

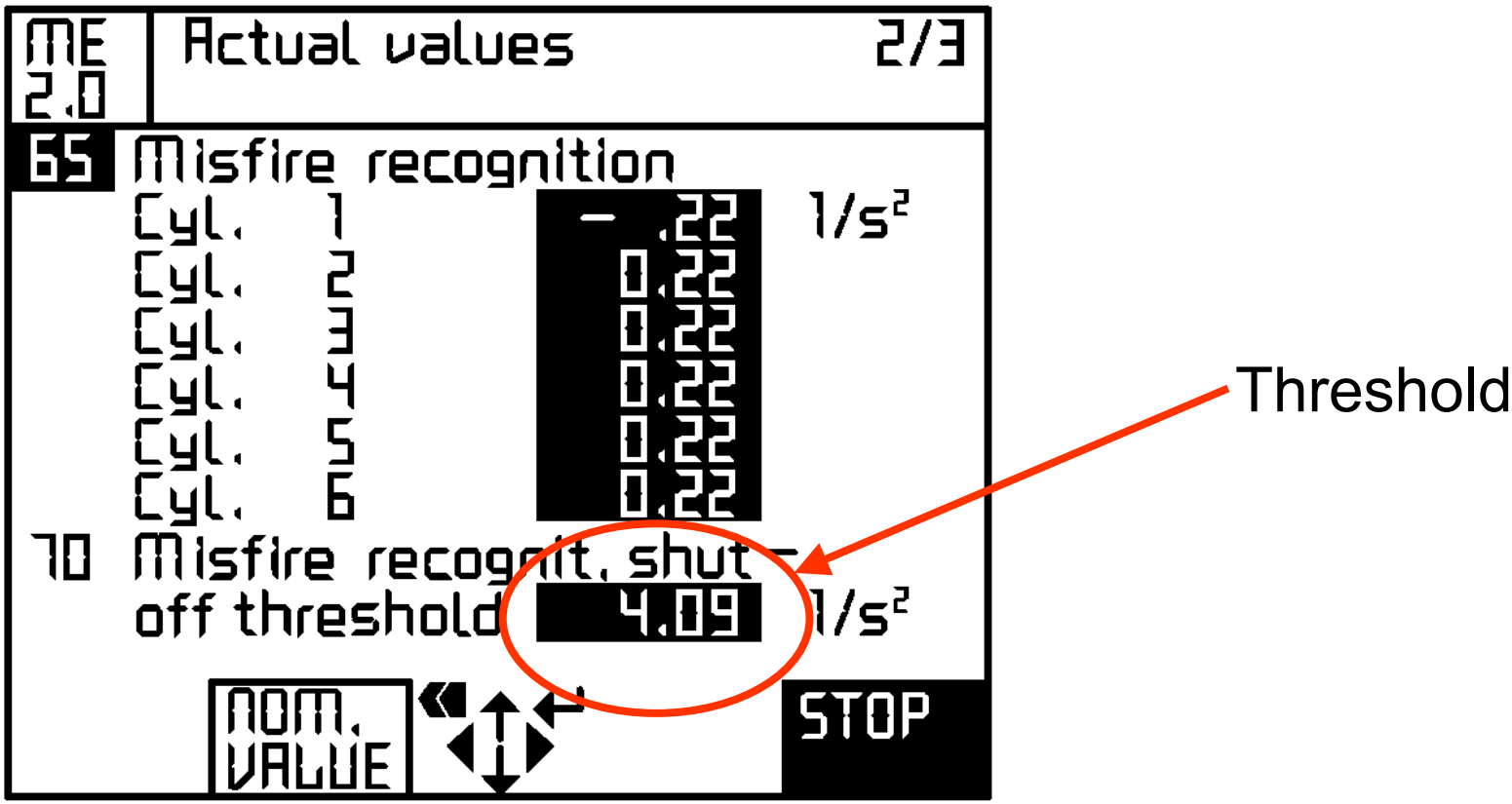
- replacing the flywheel
- replacing ME control unit
- replacing crankshaft sensor
- replacing the engine
- disconnecting the battery

Irregular Engine Running Analysis.

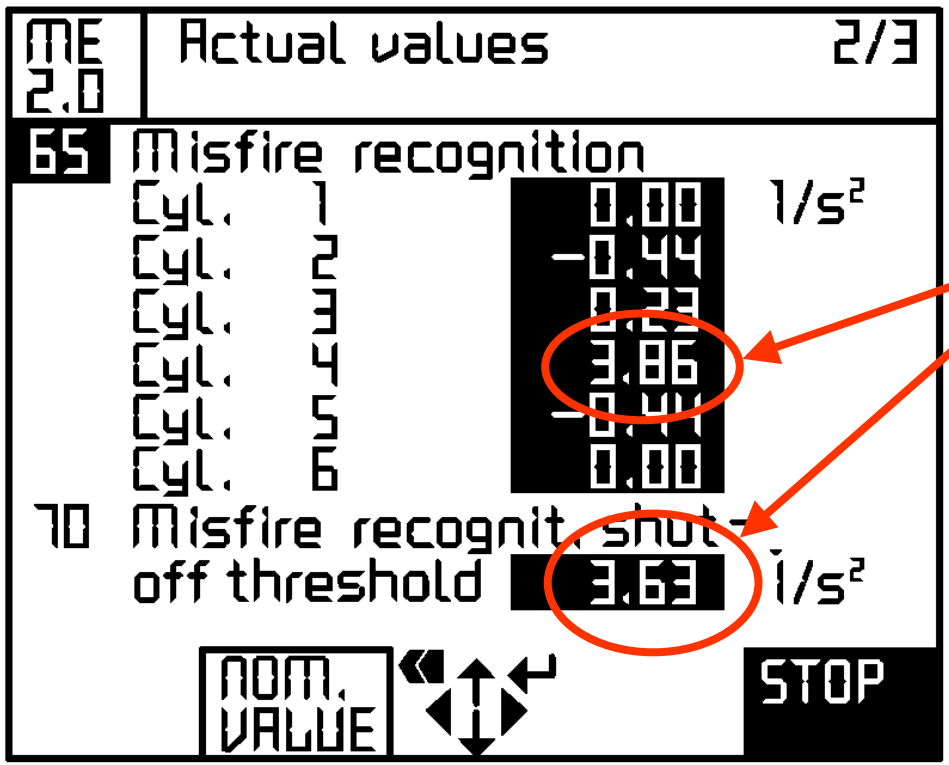
The following factors are analyzed.

- Engine speed.
- Engine load.
- Recognition of irregular road surfaces.
- Cylinder recognition.

Misfire Screen



Misfire Screen



Threshold exceeded - misfire detected

PO300 - 312

A. Misfire
ME continuously checks the signal for limit values, if:

Limit threshold - Maximum 20 combustion misfires within 1000 engine revolutions

Then after two consecutive driving-cycles:

PO300 - 312

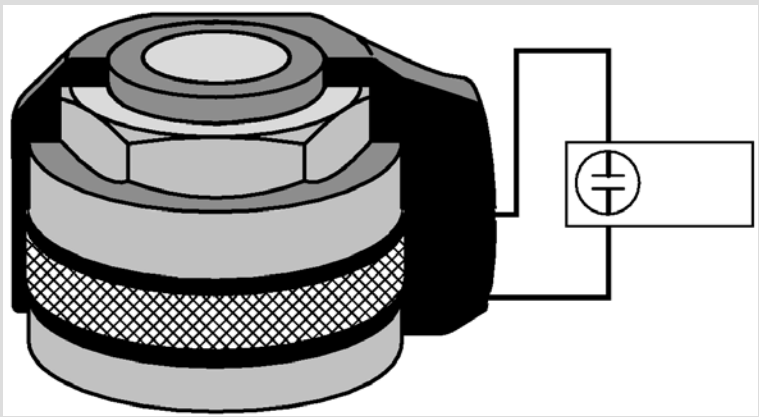
B. TWC damaging
ME continuously checks the signal for limit values, if:

Limit threshold - Maximum 4-35 combustion misfires within 200 engine revolutions (varies with rpm & load)

After one occurrence the MIL will blink, if misfire continues - MIL will stay on

Then after two consecutive driving-cycles:

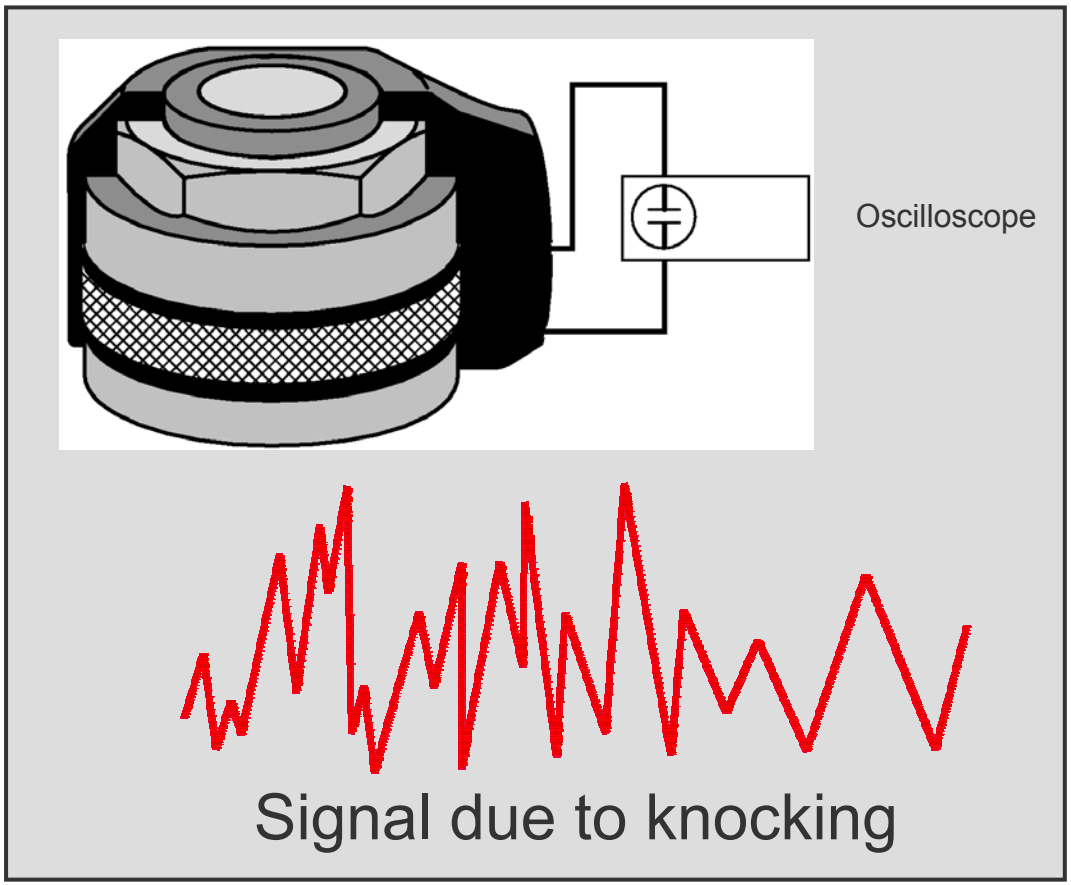
Knock Sensor (KS)



Signal due to normal combustion

- Piezo type sensor
- Monitors vibration of the crankcase.
- Controls timing on the relevant cylinder

Knock Sensor



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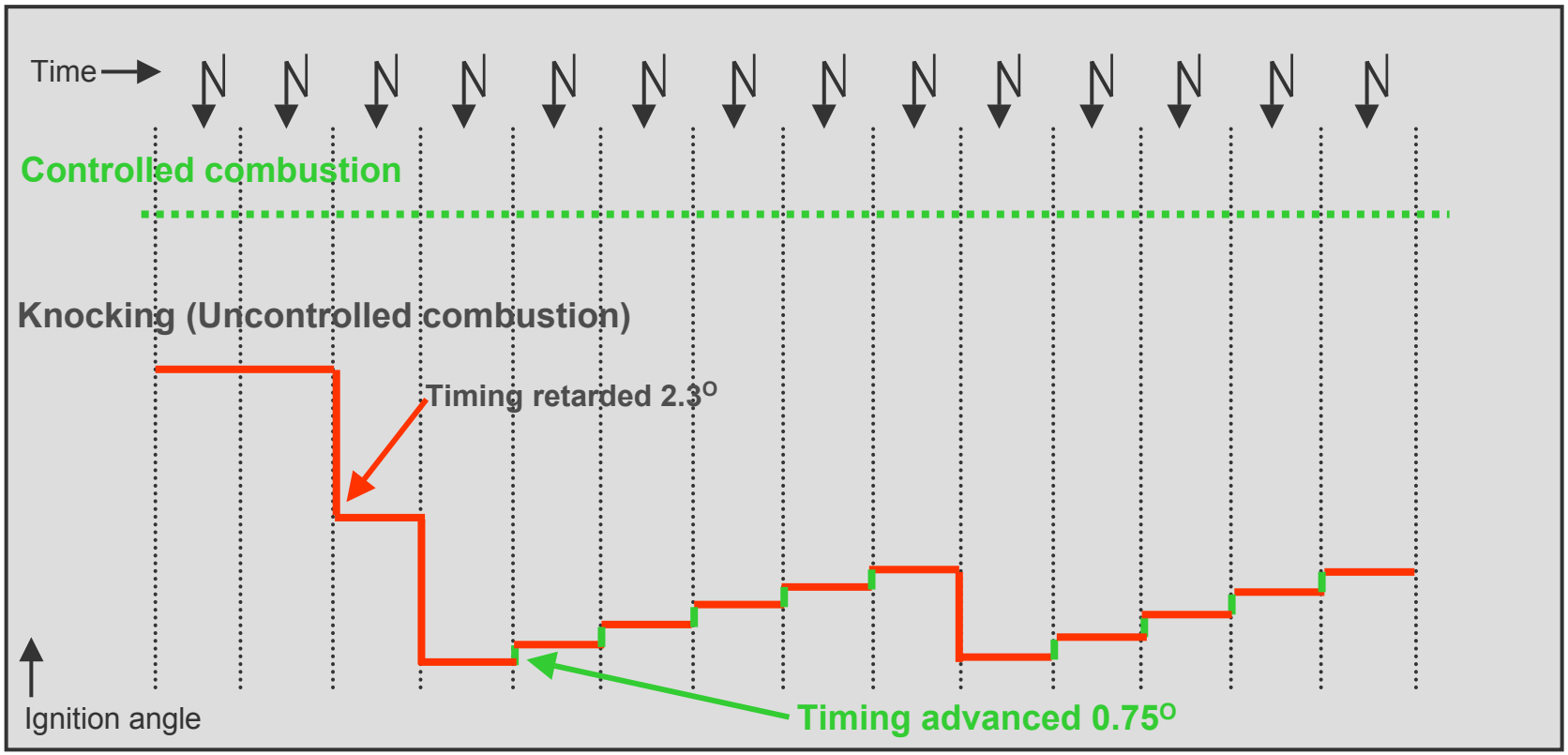
Timing Control



Acronyms

ASR - Anti Slip Regulation
ESP - Electronic Stability Program
KS - Knock Sensor