

Antitheft System - Immobilizer System Overview

NO: 36-35

DATE: 8-01-2002

MODEL/YEAR: MY99- S80, MY01- S60, V70, V70XC

SUBJECT: Immobilizer System Information

CHASSIS: N/A

REFERENCE: N/A

BACKGROUND:

This Tech Net Note is intended to provide a general system overview of the Immobilizer system for 560, V70, V70 XC, and S80.

NOTE : The C70, MY00 and older S/V/XC70, and S/V40 immobilizer system is significantly different than described in this document. Therefore, this Tech Net Note cannot be applied to those vehicles. Some specific real world" cases are also described from a technical point of view and a customer perspective. Although this information is accurate, it is impossible to describe all possible scenarios and faults in this document. This Tech Net Note is intended to supplement, not replace, the fault tracing provided in VADIS.

In order to ensure a proper repair, it is critical to have a detailed description of the customer complaint; "the car will not start" is not sufficient. The customer must describe the no start condition in terms of: no crank, crank no start, or start stall. The exact text displayed in the DIM message display is also important.

The immobilizer check is only performed during the initial start-up. Once the engine is running, the immobilizer check has passed. Therefore, in the event of engine stalling after initial start, the immobilizer system is not the cause.

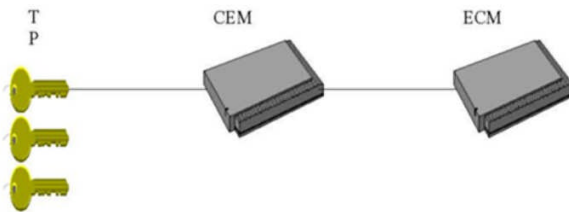
DESCRIPTION:

Document layout:

- ^ System functionality. This section gives some basic explanation of the immobilizer functionality.
- ^ Symptom Overview. This section provides examples of possible faults based on text message in the DIM and DTC's: No crank, no text (in DIM), no DTC's; no crank, text (in DIM), no DTC's; and No crank, text (in DIM), and DTC's.
- ^ Tips and Hints. This section includes some "quick sheets" which provide a system overview and some quick fault tracing tips. The "quick sheets" cover various starting situations described as: No crank, no start; Crank, no start; Start - stall.

The Three Parts of the S60, V70, V70XC, and S80 Immobilizer system are:

- The Ignition Key with a Transponder (TP)
- The Central Electronic Module (CEM)
- The Engine Control Module (ECM)

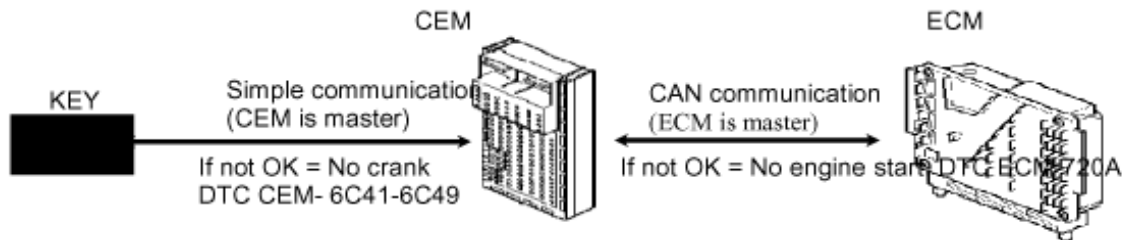


System Functionality

NOTE : There are other components involved in transmitting the start request (such as immo antenna ring and wiring). The components listed above are vehicle specific and can not be swapped.

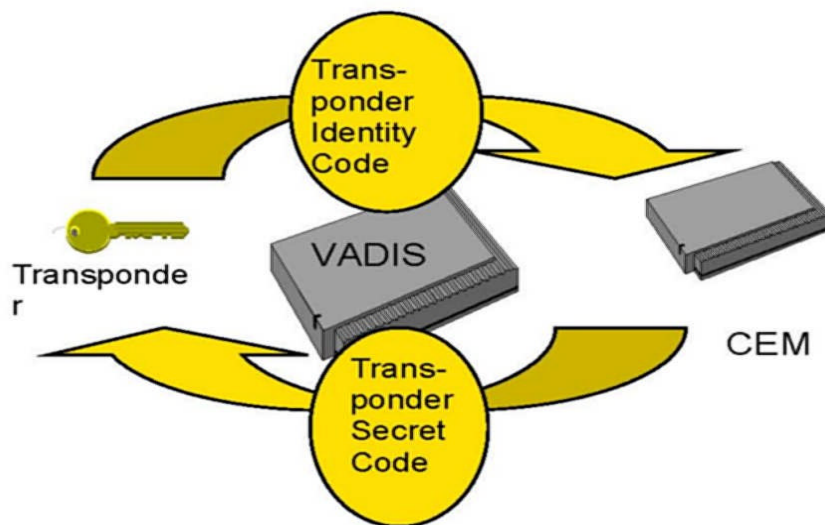
The functions controlled by the immobilizer are the starter motor, ignition and fuel supply.

S60, V70, V70XC, and S80 Immobilizer system and codes



S60, V70, V70XC and S80 Immobilizer system and codes

The GEM Transponder Secret code, is the same for all ignition keys (for a specific car) and is stored in a central database (VITaL). Each key also has a unique Transponder Identity code (stored in GEM) which is not stored in VITaL. When using the "ADD KEY" function, the transponder identity code is written and stored in GEM.



Another code is used in the communication between CEM and ECM. That code is also stored in the database and is automatically handled when replacing the ECM or CEM. Therefore, the CEM and ECM can not be swapped between vehicles; even for test purposes.

^ When programming new keys, the code handling is carried out by VADIS.

^ A spare transponder (key) is delivered with Transponder Identity code but without Transponder Secret code.

^ The new Transponder Identity code is transferred to the existing CEM and Transponder Secret code is transferred to the transponder from CEM when adding keys with VADIS. The Transponder Secret code can only be written once, i.e. a transponder can only be programmed to one vehicle.

^ If a transponder (key) is lost, it is necessary to erase all keys and then add all the remaining transponders (keys) again. In this sequence, the key in the ignition is programmed automatically.

Symptom Overview

NOTE :

^ As for all problems, always check the basics! fuel, fuel pressure, injectors, sparks, battery.

^ If the problem only occurs when parking downhill for example, make sure enough fuel gets to the engine.

^ Some no-crank or crank-no-start situations can occur in a workshop environment by a combination of key cycles. This means that it is not advisable to repeatedly crank and start engine to test the system. The Immo verification is only done once per key cycle and it will not add any value to stress ignition switch on and off. This may create false immo messages or DTCs.

No Crank, no text (in DIM), no DTC

S60, V70, V70XC, and S80 will not allow you to crank the car if:

^ The gearshift is not in park / neutral mode

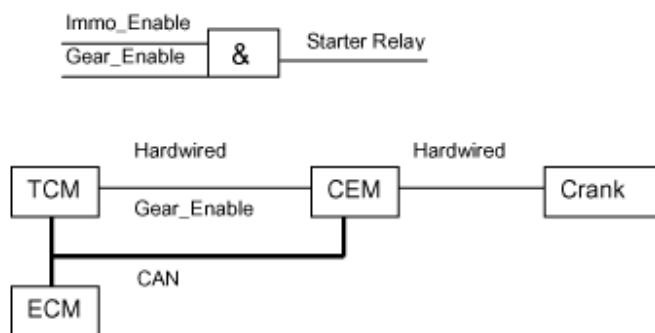
^ Clutch not pressed (Manual with start blocking)

The following information depends on vehicle equipment and structure week. The different versions are described below:

1. GM4T65 Transmission (early S80 production) with good ECM-TCM CAN communication.

Immo_Enable = 1 when start is approved from the immobilizer

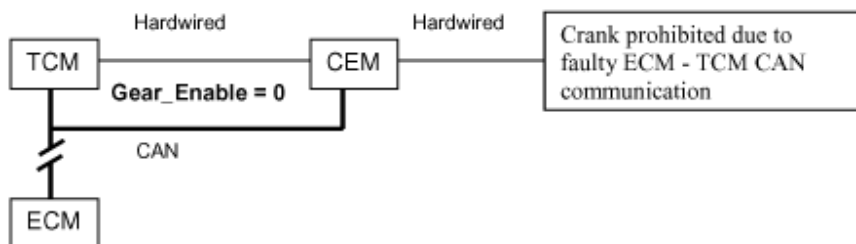
Gear_Enable = 1 when start is approved from start blocking due to gear position.



Two conditions must be fulfilled to let the starter motor run. Both logical states "Immo_Enable" and "Gear_Enable" must be set to true. (= 1)

NOTE : Although these states can not be determined using VADIS, they can be concluded by using CAN communication DTC, gear position, and immobilizer parameter readouts.

2. GM4T65 Transmission (early S80 production) and Faulty ECM-TCM CAN communication.



In the case with a 4T65 gearbox of early S80 production, the starter motor will not run if the TCM has lost CAN communication with ECM. The TCM will then not set the hardwired signal Gear_Enable to 1. The starter motor will therefore not be enabled by CEM.

Note , in later MY vehicles this feature is taken away.

3. S80 GM4T65 (later production)

Will enable crank (Gear Enable=1) even with faulty ECM-TCM CAN communication.

4. S60, V70, and V70XC with AW 55-50



In the case with an AW gearbox the starter motor will be allowed to crank even with faulty ECM-TCM CAN communication. The signal Gear Enable is hardwired directly from the gearbox.

No Crank, Text (in DIM), No DTC

IMMOBILIZER SEE MANUAL

The above text message may be displayed in the DIM.

Verify that no metal objects or other transponder keys are on the key ring when the message was displayed.

NOTE : Remember the customer may not leave the complete key ring when the car is left for service. It may be necessary to ask the customer about the "normal" key ring. Verify that starter motor gets power and is functioning properly.

START PREVENTED TRY AGAIN

The above text message may be displayed in the DIM.

Verify all ignition positions through VADIS together with other immo communication parameters.

No Crank, Text (in DIM), DTC

Text "Immobilizer start prevented"

DTC 6C41	ICK short to plus
DTC 6C42	ICK short to gnd/OC
DTC 6C43	IDS short to plus
DTC 6C44	IDS short to gnd/OC
DTC 6C46	IAU internal fault
DTC 6C48	Wrong, not programmed, not recognized or no transponder in key currently inserted
DTC 6C49	Wrong transponder response

ICK = Immo clock, IDS = Immo data signal, IAU = antenna

Points towards antenna ring or key, but can randomly occur due to other communication disturbances. NOTE! If this has been a single incident, it is not likely to be a faulty antenna ring. Check counters in the Vehicle communication / extended fault-tracing information window.

Crank - No Start

If a S60, V70, V70XC, or S80 vehicle cranks but does not start there may be a CAN communication problem in the high speed network. This can be verified by checking CAN related fault codes from all nodes.

A crank and no start situation occurs also if the CEM is in pre-set mode, i.e. the diagnostic command for security access (code handling) has been sent to the CEM, but the command for closing the security access is not sent. This may occur after programming a CEM or installing new keys.

"Crank - No start" can also occur if ECM and CEM are not coded to each other. (E.G. If for some reason the ECM has already been programmed to another car.)

Crank, Start and Stall

Crank, start and stall can occur if the ECM and GEM are not coded together in a certain circumstance,

If you turn the key very quickly from position 2 to position 3 the ECM may do a "prestart" . When the immobilizer communication gets NOK the ECM will then stall the engine.

For the normal symptom when ECM and GEM are not coded together, see above.

Tips and hints

- ^ Check the keys you get as spare parts. There is a red dot for S60, V70, V70XC, and S80 cars.
- ^ Make sure to check that coil is energized in the S60, V70, V70XC, and S80 starter motor relay. A volt meter can make you draw the wrong conclusions since you will measure 0V constantly on relay.
- ^ Use VADIS to check the key inserted in the ignition and all activity between key and CEM (very useful).
- ^ Check for "low relay" for the ECM and TCM.
- ^ Verify the function of any new key which has been programmed to the vehicle. If any of the keys fail to crank the vehicle, this may be due to a key programming error, not immobilizer system failure.

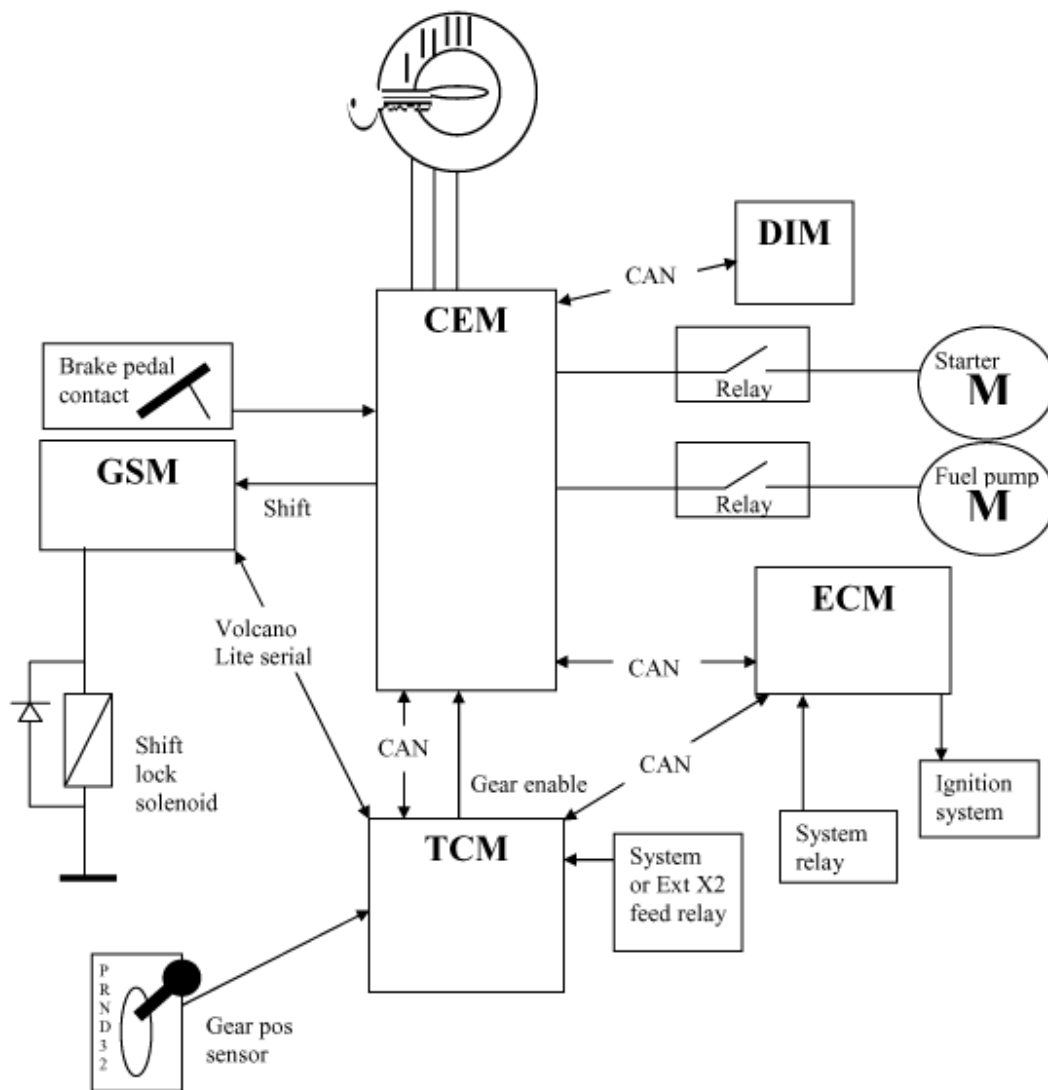
Quick Sheets:

This section provides examples of possible faults based on various cranking conditions: No crank, no start; Crank, no start; Start - stall.

This section is intended to provide a graphical overview of the components involved in cranking and starting.

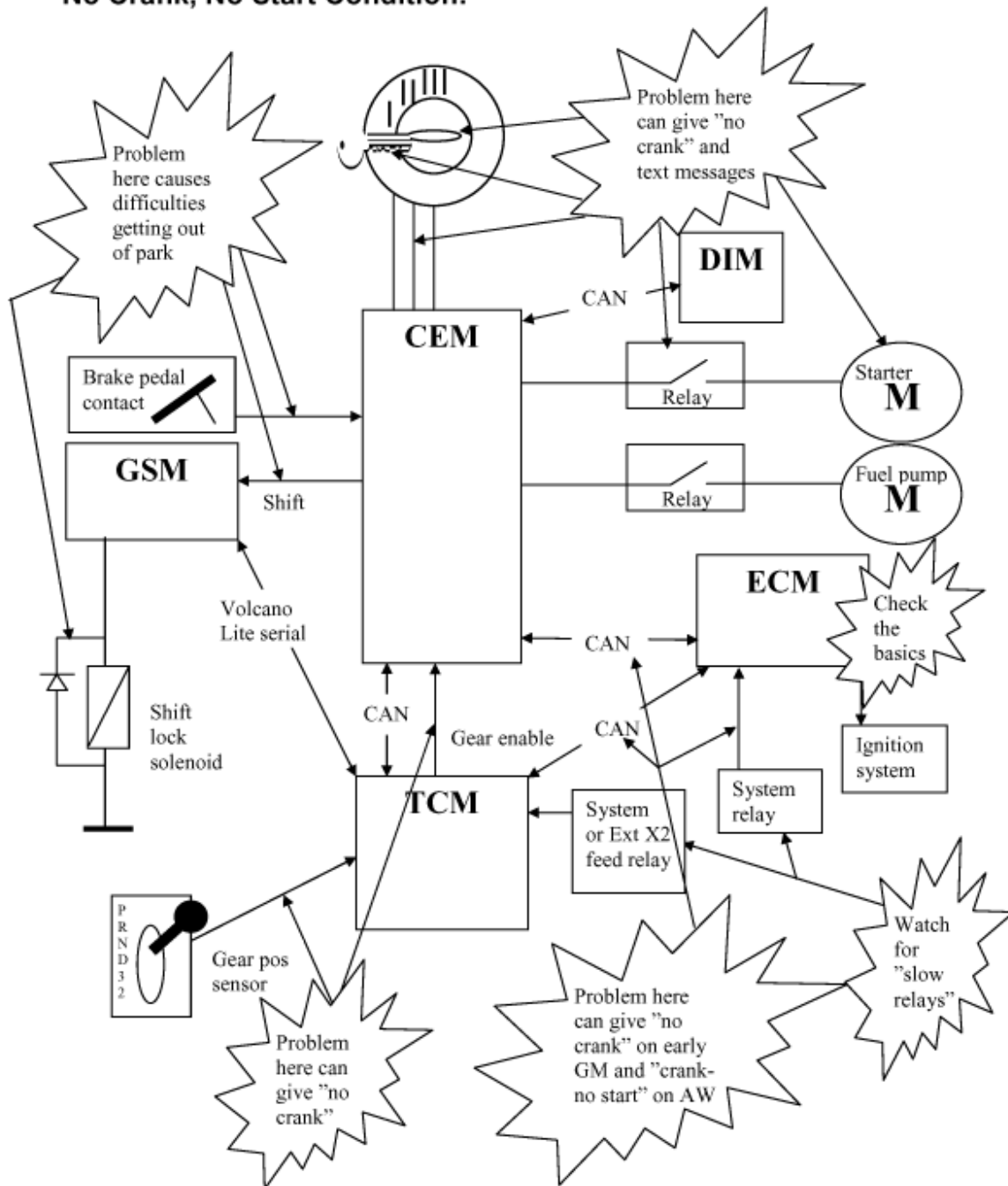
Note! This is NOT to be viewed as the only possible causes. Refer to the section SYMPTOM OVERVIEW for more detailed information.

Components involved in start request. These components can all give similar symptoms to an immobilizer fault.



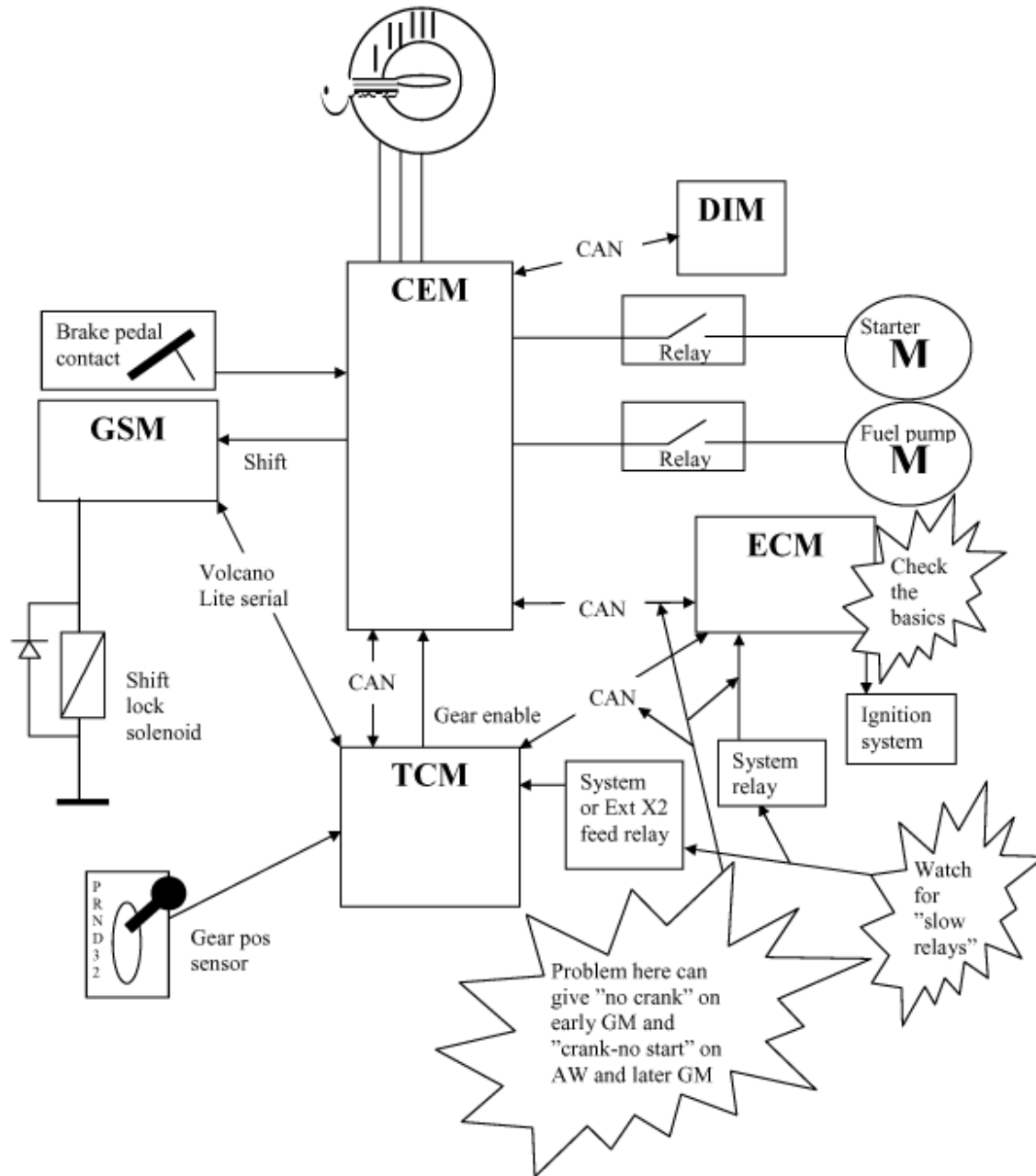
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No Crank, No Start Condition:



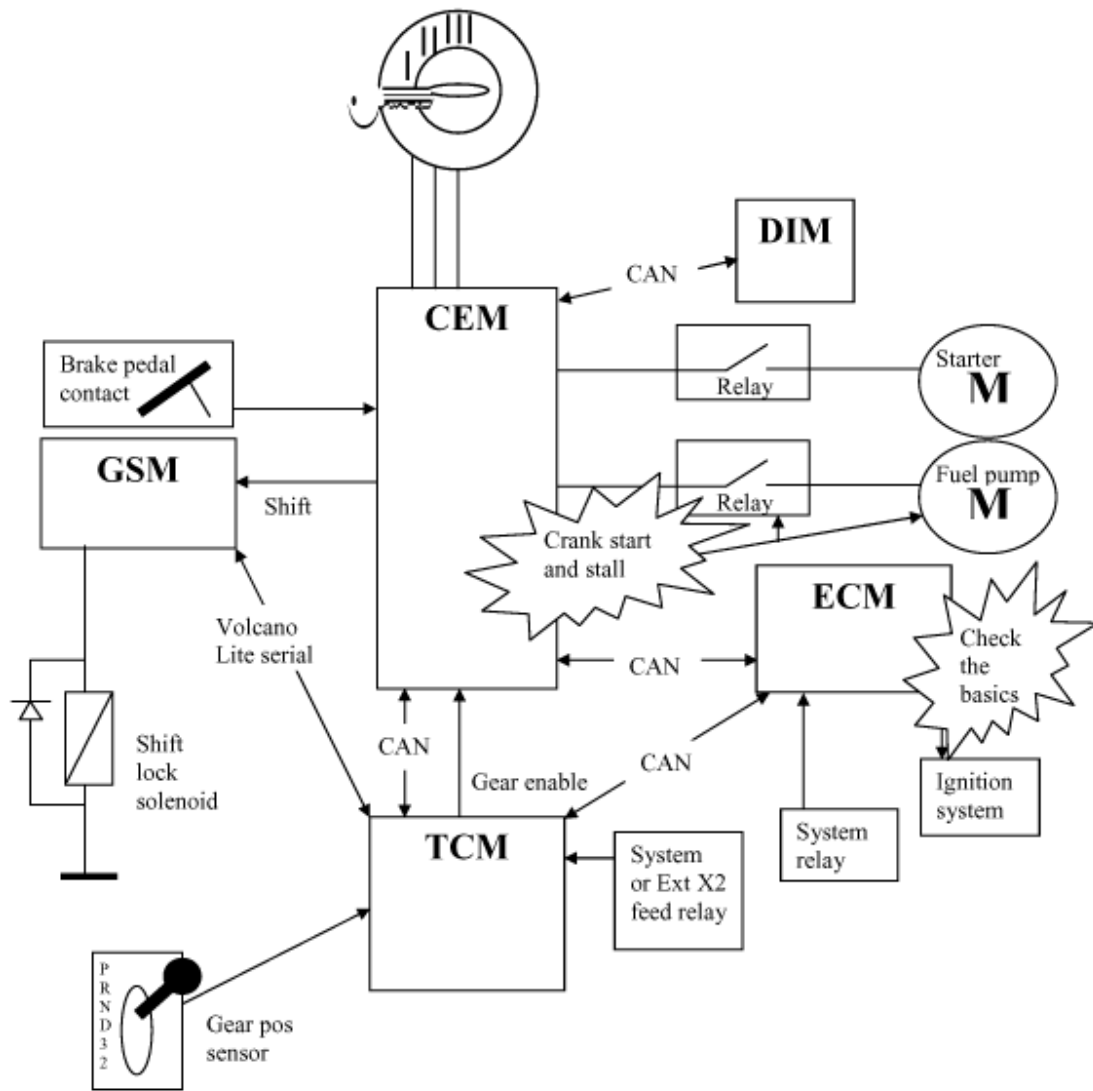
No Crank, no Start Condition:

Crank, No Start Condition:



Crank, No Start Condition:

Start - Stall Condition:



Start - Stall Condition: