



## DIAGNOSIS SYSTEM

### 1. DESCRIPTION

When troubleshooting On-Board Diagnostic (OBD II) vehicles, the vehicle must be connected to the intelligent tester (complying with SAE J1987). Various data output from the vehicle's ECM can then be read.

OBD II regulations require that the vehicle's on-board computer illuminates the Malfunction Indicator Lamp (MIL) on the instrument panel when the computer detects a malfunction in:

1. The emission control system/components
2. The powertrain control components (which affect vehicle emissions)
3. The computers.

In addition, the applicable Diagnostic Trouble Codes (DTCs) prescribed by SAE J2012 are recorded in the ECM memory. If the malfunction does not reoccur in 3 consecutive trips, the MIL turns off automatically but the DTCs remain recorded in the ECM memory.

To check DTCs, connect the intelligent tester to the Data Link Connector 3 (DLC3) of the vehicle. The intelligent tester displays DTCs, the freeze frame data and a variety of the engine data.

The DTCs and freeze frame data can be erased with the intelligent tester. (See page [AT-25](#))

In order to enhance OBD functions on vehicles and develop the Off-Board diagnosis system, CAN communication has been introduced in this system (CAN: Controller Area Network). It minimizes the gap between technician skills and vehicle technology. CAN is a network, which uses a pair of data transmission lines, spanning multiple computers and sensors. It allows high speed communication between the systems and simplification of the wire harness connection.

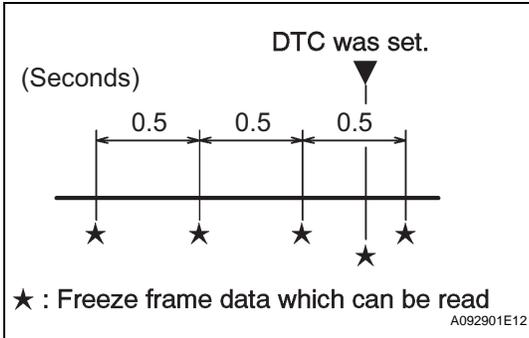
Since this system is equipped with CAN communication, CAN VIM (VIM: Vehicle Interface Module) connecting with an intelligent tester is necessary to display any information from the ECM on the tester. (Also communication between the intelligent tester and the ECM uses a CAN communication signal.) When confirming DTCs and any data of the ECM, connect the CAN VIM between the DLC3 and the intelligent tester.

### 2. NORMAL MODE AND CHECK MODE

The diagnosis system operates in "normal mode" during normal vehicle use. In normal mode, "2-trip detection logic" is used to ensure accurate detection of malfunctions. "Check mode" is also available to technicians as an option. In check mode, "1-trip detection logic" is used for simulating malfunction symptoms and increasing the system's ability to detect malfunctions, including intermittent malfunctions.

**3. 2-TRIP DETECTION LOGIC**

When a malfunction is first detected, the malfunction is temporarily stored in the ECM memory (1st trip). If the ignition switch is turned OFF and then ON again, and the same malfunction is detected again, the MIL will illuminate.



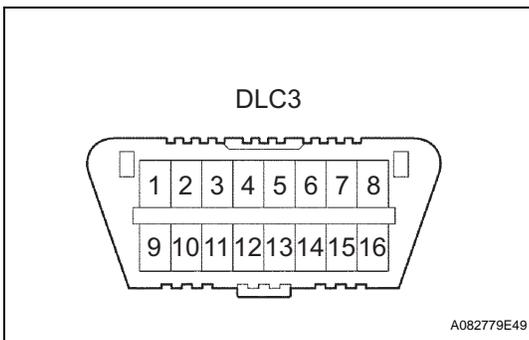
**4. FREEZE FRAME DATA**

Freeze frame data records the engine conditions (fuel system, calculated load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

The ECM records engine conditions in the form of freeze frame data every 0.5 seconds. Using the intelligent tester, five separate sets of freeze frame data, including the data values at the time when the DTC was set, can be checked.

- 3 data sets before the DTC was set
- 1 data set when the DTC was set
- 1 data set after the DTC was set

These data sets can be used to simulate the condition of the vehicle around the time the occurrence of the malfunction. The data may assist in identifying of the cause of the malfunction, and in judging whether it was temporary or not.



**5. DLC3 (Data Link Connector 3)**

The vehicle's ECM uses the ISO 15765-4 communication protocol. The terminal arrangement of the DLC3 complies with SAE J1962 and matches the ISO 15765-4 format.

**HINT:**

Connect the cable of the intelligent tester to the DLC3, turn the ignition switch ON and attempt to use the intelligent tester. If the screen displays UNABLE TO CONNECT TO VEHICLE, a problem exists in the vehicle side or the tester side.

If the communication is normal when the tester is connected to another vehicle, inspect the DLC3 on the original vehicle.

If the communication is still impossible when the tester is connected to another vehicle, the problem is probably in the tester itself. Consult the Service Department listed in the tester's instruction manual.

Symbol	Terminal No.	Name	Reference terminal	Result	Condition
SIL	7	Bus "+" line	5 - Signal ground	Pulse generation	During transmission
CG	4	Chassis ground	Body ground	Below 1 Ω	Always
SG	5	Signal ground	Body ground	Below 1 Ω	Always
BAT	16	Battery positive	Body ground	11 to 14 V	Always
CANH	6	HIGH-level CAN bus line	CANL	54 to 69 Ω	Ignition switch OFF

Symbol	Terminal No.	Name	Reference terminal	Result	Condition
CANH	6	HIGH-level CAN bus line	Battery positive	1 M $\Omega$ or higher	Ignition switch OFF
CANH	6	HIGH-level CAN bus line	CG	1 k $\Omega$ or higher	Ignition switch OFF
CANL	14	HIGH-level CAN bus line	Battery positive	1 M $\Omega$ or higher	Ignition switch OFF
CANL	14	HIGH-level CAN bus line	CG	1 k $\Omega$ or higher	Ignition switch OFF

## 6. CHECK BATTERY VOLTAGE

### Standard battery voltage:

**11 to 14 V**

If the voltage is below 11 V, replace the battery before proceeding.

## 7. CHECK MIL

(a) Check that the MIL illuminates when turning the ignition switch ON.

If the MIL does not illuminate, there is a problem in the MIL circuit (refer to MIL CIRCUIT on page [ES-439](#)).

(b) When the engine is started, the MIL should turn off.

## 8. ALL READINESS

For this vehicle, using the intelligent tester allows readiness codes corresponding to all DTCs to be read. When diagnosis (normal or malfunctioning) has been completed, readiness codes are set. Enter the following menus: ENHANCED OBD II/ MONITOR STATUS on the intelligent tester.

## DTC CHECK / CLEAR

### 1. CHECK DTC

DTCs which are stored in the ECM can be displayed with the intelligent tester.

The intelligent tester can display pending DTCs and current DTCs.

Some DTC aren't stored if the ECM doesn't detect a malfunction during consecutive driving cycles. However, malfunctions detected during a single driving cycle are stored as pending DTCs.

(a) Connect the intelligent tester to the Controller Area Network Vehicle Interface Module (CAN VIM). Then connect the CAN VIM to the Data Link Connector 3 (DLC3).

(b) Turn the ignition switch to the ON position.

(c) Enter the following menus: DIAGNOSIS/ ENHANCED OBD II/ DTC INFO/ CURRENT CODES (or PENDING CODE).

(d) Confirm the DTCs and freeze frame data and then write them down.

(e) See page [AT-30](#) to confirm the details of the DTCs.

### 2. CLEAR DTC

(a) Connect the intelligent tester to the CAN VIM. Then connect the CAN VIM to the DLC3.

(b) Turn the ignition switch to the ON position.

