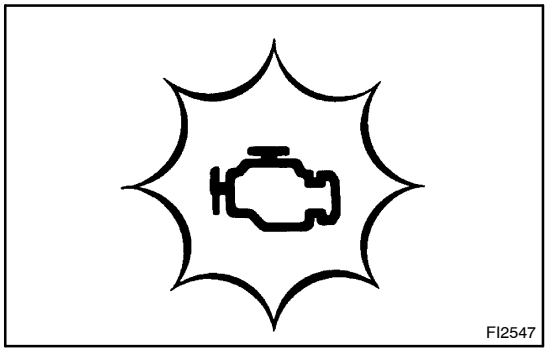
DIAFX–01

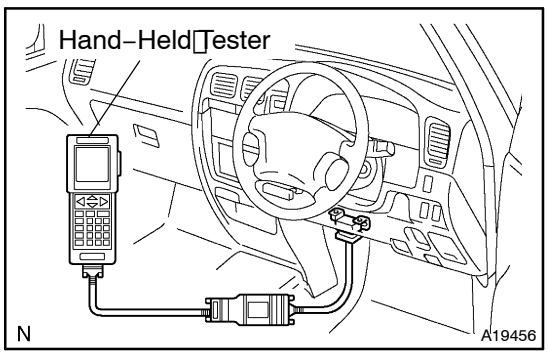

FI2547

PRE–CHECK

1. DIAGNOSIS SYSTEM

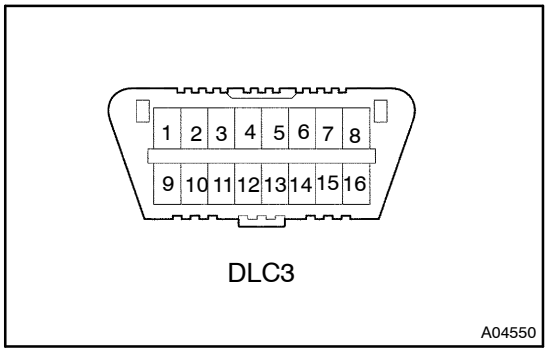
(a) Description

- When troubleshooting Multiplex OBD (M–OBD) vehicles, the only difference from the usual troubleshooting procedure is that you connect the vehicle to the hand–held tester, and read off various data output from the vehicle's engine (and ECT) ECU.
- The vehicle's on–board computer indicates the CHK ENG on the instrument panel when the computer detects a malfunction in the computer itself or in the drive system components. In addition to an indication of the CHK ENG when a malfunction is detected, the applicable Diagnostic Trouble Codes (DTCs) are recorded in the engine (and ECT) ECU memory (See page DI–16). When the malfunction does not reoccur, the CHK ENG is indicated until the ignition switch is turned OFF, but the CHK ENG is not indicated when the ignition switch is turned ON again. However, the DTCs remain recorded in the engine (and ECT) ECU memory.



- To check the DTCs, connect the hand–held tester to DLC3 on the vehicle or read the number of blinks of the check engine warning light when TC and CG terminals on DLC3 are connected. The hand–held tester also enables you to erase DTC, the freeze frame data and various forms of engine data (For operating instructions, see the instruction book.).
- The diagnosis system operates in the normal mode general check. It also has the check (test) mode for technicians to simulate malfunction symptoms and conduct the troubleshooting. Most DTC use *2 trip detection logic to prevent the erroneous detection and ensure the thorough malfunction detection. By switching the engine (and ECT) ECU to the check (test) mode using the hand–held tester, the technician can cause the CHK ENG to light up for a malfunction that is detected only once or momentarily. (Hand–held tester only) (See step 2)

- * 2 trip detection logic
  As differ to the 1 trip detection logic, same malfunction needs to be find two times to turn on the CHK ENG light in the 2 trip detection. When a malfunction is first detected, the malfunction is temporarily stored in the engine (and ECT) ECU memory.
  If the same malfunction is detected again for the second time after the ignition switch is once turned off and on again, then the CHK ENG light to tight up.
- Freeze frame data:
  Reed freeze frame data using the hand–held tester, as freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air–fuel ratio was lean or rich, etc. at the time of the malfunction.



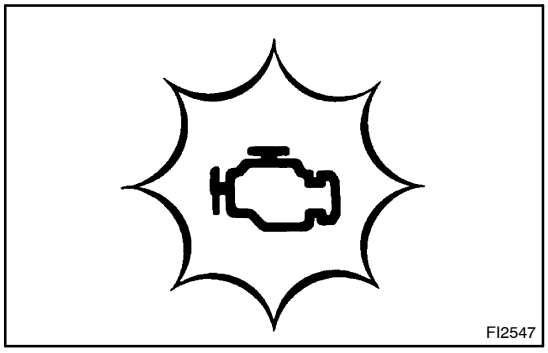
DLC3

(b) Check DLC3.
The vehicle's engine (and ECT) ECU uses the ISO 14230 (M–OBD) communication protocol. The terminal arrangement of the DLC3 complies with ISO 15031–3 and matches the ISO 14230 format.

Terminal No.	Connection/Voltage or Resistance	Condition
7	Bus ⊕ Line/Pulse generation	During transmission
4	Chassis Ground ↔ Body Ground/1 Ω or less	Always
5	Signal Ground ↔ Body Ground / 1 Ω or less	Always
16	Battery Positive ↔ Body Ground/9 – 14 V	Always

HINT:
If your display shows "UNABLE TO CONNECT TO VEHICLE" when you connected the cable of the hand–held tester to DLC3, turned the ignition switch ON and operated the hand–held tester, there is a problem on the vehicle side or tool side.

- If communication is normal when the tool is connected to another vehicle, inspect DLC3 on the original vehicle.
- If communication is still not possible when the tool is connected to another vehicle, the problem is probably on the tool itself, so consult the Service Department listed in the tool's instruction manual.



2. INSPECT DIAGNOSIS (Normal Mode)

(a) Check the DTC using the hand–held tester.

NOTICE:

Hand–held tester only: When the diagnosis system is switched from normal mode to check (test) mode, it erases all DTC and the freeze frame data recorded in normal mode. So before switching modes, always check the DTCs and the freeze frame data, and note them down.

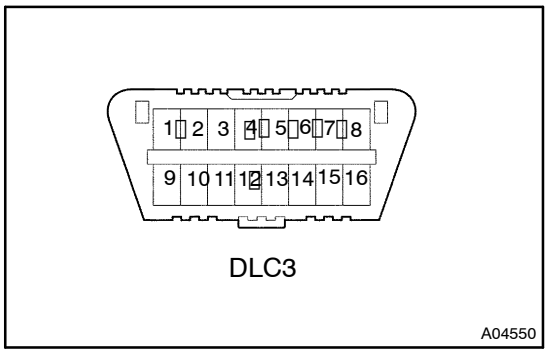
(1) Prepare the hand–held tester.

(2) Connect the hand–held tester to DLC3.

(3) Turn the ignition switch ON and push the hand–held tester main switch ON.

(4) Use the hand–held tester to check DTC and the freeze frame data, note them down. (For operating instructions, see the hand–held tester instruction book.).

(5) See page DI–16 to confirm the details of the DTCs.

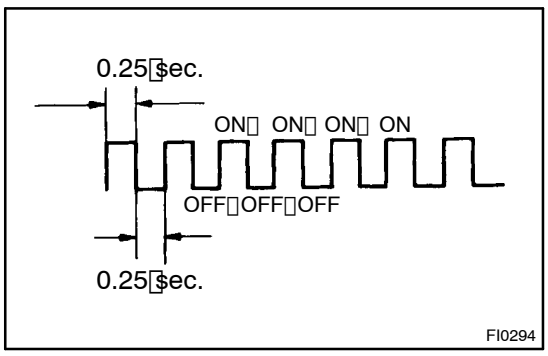


(b) Check the DTC not using the hand–held tester.

(1) Turn the ignition switch ON.

(2) Using SST, connect between terminals 13 (TC) and 4 (CG) of DLC3.

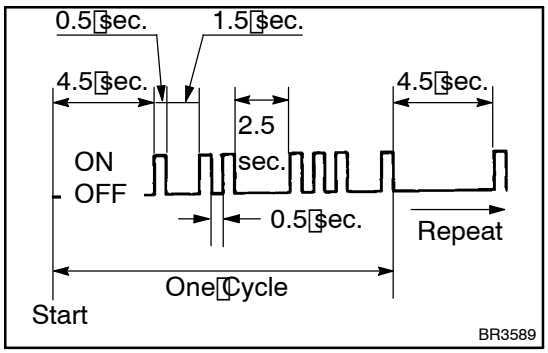
SST 09843–18040



(3) Read the DTC from the check engine warning light (CHK ENG).

HINT:

If DTC is not indicated, check TC terminal circuit (See page DI–19).



(4) As an example, the blinking patterns for codes, normal, 12 and 31 are as shown on the illustration.

(5) Check the details of the malfunction using the DTC chart on page.

(6) After completing the check, disconnect terminals 13 (TC) and 4 (CG) and turn off the display.

HINT:

In the event of 2 or more malfunction cords, indication will begin from the smaller numbered cord and continue in order to the larger.

NOTICE:
When simulating symptoms without the hand–held tester to check the DTCs, use normal mode. For the codes on the DTC chart subject to "2 trip detection logic", turn the ignition switch OFF after the symptom is simulated the first time. Then repeat the simulation process again. When the problem is simulated twice, the CHK ENG light up and DTC is recorded in the engine (and ECT) ECU.

(c) Clear DTC.
DTC and the freeze frame data will be erased by either actions.
(1) Operating the hand–held tester to erase the codes (See the hand–held tester's instruction book for operating instructions.).
(2) Disconnecting the battery terminals of EFI fuse.

NOTICE:
If the hand–held tester switches the engine (and ECT) ECU from the normal mode to the check mode or vice–versa, or if the ignition switch is turned from ON to ACC or OFF during the check mode, DTC and the freeze frame data will be erased.

3. INSPECT DIAGNOSIS (Check (Test) Mode)

HINT:
Hand–held tester only:
As compared to the normal mode, the check mode has an increased sensitivity to detect malfunctions.
Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the check (test) mode.

(a) Initial conditions.
- Battery voltage 11 V or more.
- Throttle valve fully closed.
- Transmission in P or N range.
- A/C switched OFF.

(b) Turn the ignition switch OFF.
(c) Prepare the hand–held tester.
(d) Connect the hand–held tester to the DLC3.
(e) Turn the ignition switch ON and push the hand–held tester main switch ON.
(f) Switch the hand–held tester from the normal mode to the check (test) mode.

NOTICE:
If the hand–held tester switches the engine (and ECT) ECU from the normal mode to the check mode or vice–versa, or if the ignition switch is turned from ON to ACC or OFF during the check mode, the DTCs and freeze frame data will be erased.

(g) Start the engine.
(h) Simulate the conditions of the malfunction described by the customer.

NOTICE:
Leave the ignition switch ON until you finish checking DTC, etc.

(i) After simulating the malfunction conditions, use the hand–held tester diagnosis selector to check the DTCs and the freeze frame data, etc.

HINT:
Take care not to turn the ignition switch OFF. Turning the ignition switch OFF changes the diagnosis system from the check (test) mode to the normal mode, erasing all DTC and other datas stored in the memory.

(j) After checking the DTC, inspect the applicable circuit.

4. FAIL–SAFE CHART

If any of the following codes is recorded, the engine (and ECT) ECU enters into the fail–safe mode.

DTC No.	Fail–Safe Operation	Fail–Safe Deactivation Conditions
P0100/31	Ignition timing fixed at 5° BTDC	Returned to normal condition
P0110/24	Intake air temperature fixed at 20°C (68°F)	Returned to normal condition
P0115/22	Water temperature fixed at 80°C (176°F)	Returned to normal condition
P0120/41	VTA is fixed at 0°	The following condition must be repeated at least 2 times consecutively (a) VTA ≧ 0.1 V and ≦ 0.95 V, vehicle speed ÷ 0 km/h (only ECT) (b) Vehicle speed: 0 km/h (0 mph) (only for A/T)
P0135/21	The heater circuit in which an abnormality is detected is turned off	Ignition switch OFF
P0325/52 P0330/55 P0340/12	Max. timing retardation	Ignition switch OFF
P1300/14	Fuel cut	Returned to normal condition

5. CHECK FOR INTERMITTENT PROBLEMS

HINT:
Hand–held tester only:
By putting the vehicle's engine (engine ECT) ECU in the check (test) mode, 1 trip detection logic is possible instead of 2 trip detection logic and sensitivity to detect open circuits is increased. This makes it easier to detect intermittent problems.

(a) Clear the DTCs (See step 2).
(b) Set the check (test) mode (See step 3).
(c) Perform a simulation test (See page IN–10).
(d) Check the connector and terminal (See page IN–20).
(e) Handle the connector (See page IN–20).

6. BASIC INSPECTION

When the malfunction code is not confirmed in the DTC check, troubleshoot all the possible circuits considered as a cause of the problems. In many cases, by carrying out the basic engine check shown in the following flow chart, the location causing the problem can be found quickly and efficiently. Therefore, use of this check is essential in the engine troubleshooting.

1	**Is battery voltage 11 V or more when engine is stopped?**

NO → **Charge or replace battery.**

YES

2	**Is engine cranked?**

NO → **Proceed to problems symptoms table on page DI–21.**

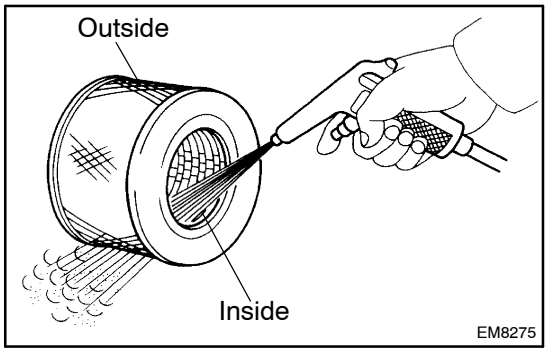
YES

3	**Does engine start?**

NO → **Go to step 7.**

YES

4	**Check air filter.**

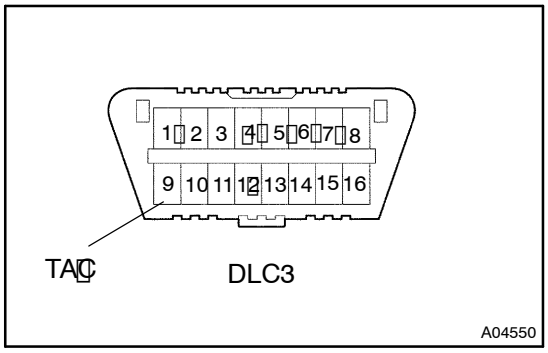


PREPARATION:
Remove the air filter.
CHECK:
Visually check that the air filter is not dirty or too oily.
HINT:
If necessary, clean the air filter with compressed air. First blow from the inside thoroughly, and then blow from the outside of the air filter.

NG → **Repair or replace.**

OK

5	Check idle speed.



PREPARATION:

(a) Warm up the engine to the normal operating temperature.
(b) Switch off all the accessories.
(c) Switch off the A/C.
(d) Shift the transmission into the N range.
(e) Connect the hand–held tester to DLC3 on the vehicle.
(f) If you have no hand–held tester, connect tachometer test probe to terminal 9 (TAC) of DLC3.
SST 09843–18030

NOTICE:

As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility with your unit before use.

CHECK:

Check the idle speed.

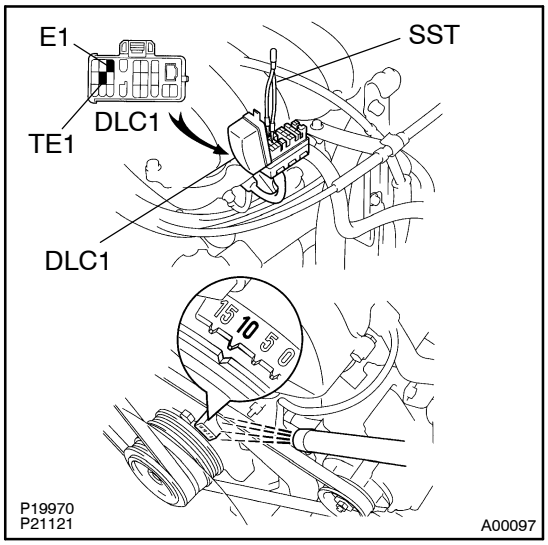
OK:

Idle speed: 650 – 750 rpm

NG	Proceed to problem symptoms table on page DI–21.

OK

6	Check ignition timing.



PREPARATION:

(a) Warm up the engine to normal operating temperature.
(b) Shift transmission into the "N" range.
(c) Keep the engine speed at idle.
(d) Using SST, connect terminals TE1 and E1 of the DLC1.
SST 09843–18020
(e) Using a timing light, connect the tester to the No. 1 high–tension cord.

CHECK:

Check the ignition timing.

OK:

Ignition timing: 10° BTDC at idle

Using a timing light, connect the tester to the ignition coil connector wire.

CHECK:

Check the ignition timing.

OK:

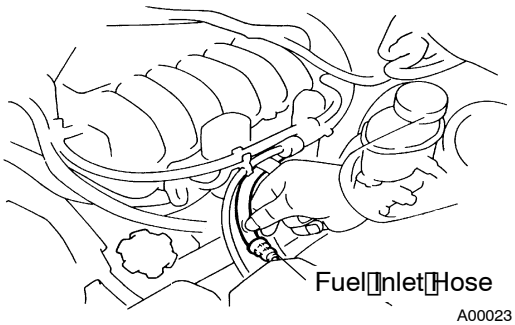
Ignition timing: 3–7° BTDC at idle

NG → **Proceed to Pub. No. RM519E, page IG–3 and continue to troubleshoot.**

OK

Proceed to problem symptoms table on page DI–21.

7	Check fuel pressure.



PREPARATION:

(a) Be sure that enough fuel is in the tank.
(b) Connect the hand–held tester to DLC3.
(c) Turn the ignition switch ON and push hand–held tester main switch ON.
(d) Use ACTIVE TEST mode to operate the fuel pump.
(e) Refer to the hand–held tester operator's manual for further details.
(f) If you have no hand–held tester, connect the positive (+) and negative (–) leads from the battery to the fuel pump connector (See Pub. No. RM519E, page EG–130).

CHECK:

Check that the pulsation damper screw pop up when fuel pump operates.

HINT:

At this time, you will hear a fuel flowing noise.

NG → **Proceed to See Pub. No. RM519E, page EG–130 and continue to troubleshoot.**

OK

8	Check for spark (See Pub No. RM519E, page IG–3).

NG → **Proceed to Pub. No. RM519E, page IG–3 and continue to troubleshoot.**

OK

Proceed to problem symptoms table on page DI–21.

7. DATA LIST

HINT:

Following the DATA LIST displayed by the OBD scan tool or the hand–held tester, you can read the value of the switch, sensor, actuator and so on without parts removal. Reading the DATA LIST as a first step of troubleshooting is one of the method to shorten the labor time.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the OBD scan tool or the hand–held tester to the DLC3.
(d) Turn the ignition switch ON.
(e) Read the ”DATA LIST” on the display of the tester.

Item	Measurement Item/Range (Display)	Normal Condition	Diagnostic Note
INJECTOR	Injection period of the No.1 cylinder/ Min.: 0 ms, Max.: 32.64 ms	Idling: 1.92 – 3.15 ms	
IGN ADVANCE	Ignition timing advance for No.1 cylinder/ Min.: –64 deg., Max.: 63.5 deg.	Idling: BTDC 12.5 – 22.0˚	
IAC DUTY RATIO	Duty ratio of the IAC valve Min.: 0%, Max.: 99%	Idling: 22 – 46 %	
CALC LOAD	Calculated load by engine (and ECT) ECU/ Min.: 0%, Max.: 100%	• Idling: 14.9 – 21.3% • Racing without load (2,500 rpm): 16.6 – 23.5%	
MAF	Air flow rate from MAF sensor/ Min.: 0 gm/s, Max.: 655 gm/s	• Idling: 3.3 – 4.7 gm/sec. • Racing without load (2,500 rpm): 12.9 – 18.9 gm/sec.	
ENGINE SPD	Engine Speed/ Min.: 0 rpm, Max.: 16,383 rpm	Idling: 650 – 750 rpm	
COOLANT TEMP	Coolant temperature/ Min.: –40˚C, Max.: 140˚C	After warming up: 80 – 95˚C (176 – 203˚F)	If the value is ”–40˚C” or ”140˚C”, sensor circuit is open or shorted.
INTAKE AIR	Intake air temperature/ Min.: –40 ˚C, Max.: 140 ˚C	Equivalent to Ambient Temp.	
THROTTLE POS	Absolute throttle position sensor/ Min.: 0%, Max.: 100%	• Throttle fully closed: 7 – 11% • Throttle fully open: 65 – 75%	
VEHICLE SPD	Vehicle speed/ Min.: 0 km/h, Max.: 255 km/h	Vehicle stopped: 0 km/h (0 mph)	
02S B1 S1	Oxygen sensor output voltage of the bank 1 sensor 1/ Min.: 0 V, Max.: 1.275 V	Idling: 0.1 – 0.9 V	
SHORT FT #1	Short term fuel trim of bank 1/ Min.: –100%, Max.: 100%	0 ± 20%	
LONG FT #1	Long term fuel trim of bank 1/ Min.: –100%, Max.: 100%	0 ± 20%	
TOTAL FT #1	Total fuel trim of bank 1/ Min.: 0.5, Max.: 1.496	Idling: 0.8 – 1.2	
02FT B1 S1	Short term fuel trim associated with the bank 1, sensor 1/ Min.: –100%, Max.: 100%	0 ± 20%	
CTP SW	Closed throttle position switch/ ON or OFF	• Throttle fully closed: ON • Throttle open: OFF	

FUEL SYS #1	Fuel system status (Bank1)/ OL or CL or OLDRIVE or OL-FAULT	Idling after warming up: CL	• OL: Open Loop–has not yet satisfied conditions to go closed loop. • CL: Closed Loop–using oxygen sensor (s) as feed back for fuel control. • OL DRIVE: Open loop due to driving conditions. (Power enrichment, deceleration enlargement) • OL FAULT: Open loop due to detected system fault.
FC IDL	Idle fuel cut/ ON or OFF	Fuel cut operation: ON	
MIL	MIL status/ ON or OFF	MIL ON: ON	
STARTER SIG	Starter signal/ ON or OFF	Cranking: ON	
A/C SIG	A/C signal/ ON or OFF	A/C ON: ON	
STOP LIGHT SW	Stop light switch/ ON or OFF	• Brake pedal depressed: ON • Brake pedal released: OFF	
PS OIL PRESS SW	Power steering signal/ ON or OFF	Turn steering wheel: ON	
PS SIGNAL	Power steering signal/ ON or OFF	• After engine start: OFF • After steer the steering: ON	
A/C CUT SIG	A/C cut signal/ ON or OFF	A/C S/W OFF: ON	
FUEL PUMP/SPD	Fuel pump/speed status/ ON/H or OFF/M, L	Idling: ON	
EVAP VSV	VSV status for EVAP control/ ON or OFF	VSV operating: ON	

8. ACTIVE TEST

HINT:

Performing the ACTIVE TEST using the hand–held tester allows the relay, VSV, actuator and so on to operate without parts removal. Performing the ACTIVE TEST as a first step of troubleshooting is one of the method to shorten the labor time.

It is possible to display the DATA LIST during the ACTIVE TEST.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the hand–held tester to the DLC3.
(d) Turn the ignition switch ON.
(e) Following the display on tester, perform the ”ACTIVE TEST”.

Item	Test Details	Diagnostic Note
INJ VOL	[Test Details] Control the injection volume. Min.: –12.5%, Max.: 24.8% [Vehicle Condition] Engine speed: 3,000 rpm or less.	

IAC DUTY RATIO	[Test Details] Control the IAC duty ratio. Min.: 0%, Max.: 90% [Vehicle Condition] Vehicle speed: 0 km/h. Engine speed: idling Battery voltage: 8.5 V or more.	When engine speed does not change, IAC system has some failure.
A/C CUT SIG	[Test Details] Control the A/C cut signal. ON or OFF	
EVAP VSV (ALONE)	[Test Details] Activate the VSV for EVAP control. ON or OFF	
FUEL PUMP / SPD	[Test Details] Control the fuel pump speed. ON or OFF	
TC/TE1	[Test Details] Connect the TC and TE1. ON or OFF	Switch to the same state as the connection between terminal TC and TE1.
FC IDL PROHBT	[Test Details] Control the idle fuel cut prohibit. ON or OFF	