The goal of the OBD II regulation is to provide the vehicle with an on-board diagnostic system capable of continuously monitoring the efficiency of the emission control systems, and to improve diagnosis and repair efficiency when system failures occur. The ECM performs on-board tests.

Beginning with the 2000 model year, manufactures will be required to phase-in diagnostic strategies to monitor the thermostat operation on vehicles so equipped. In addition beginning with the 2002-model year, manufacturers will begin to phase-in diagnostic strategies to monitor the PCV system on vehicles so equipped for system integrity.

List of modes that every OBD II compatible scan tool and vehicle must support.

MODE	GENERIC TITLE	TOYOTA/LEXUS TITLE
Mode 1	Current Powertrain Diagnostic Data	DATA LIST and READINESS TESTS
Mode 2	Powertrain Freeze Frame Data	FREEZE DATA
Mode 3	Emission Related Powertrain DTC's	Daces
Mode 4	Clear/Reset Emission Related Diagnostic Information	CLEAR DIAG INFO
Mode 5	Oxygen Sensor Monitoring Test Results	O2S TEST RESULTS
Mode 6	On-Board Monitoring Test Results for Non- Continuously Monitoring Systems	NON-CONTINUOUS
Mode 7	On-Board Monitoring Test Results for Continuously Monitored Systems	CONTINUOUS
Mode 8	Request Control of On-Board System Test or Component	EVAP LEAK TEST
Mode 9	Request Vehicle Information	INFORMATION MENU

Mode 1 (Current Powertrain Diagnostic Data) **(obd2_14_.gif)** mode provides access to current emission related data values such as inputs, outputs, and system status. All input values that are displayed are current values. No substitute values are permitted if there is a problem with the input sensor/circuit. This information is referred to as serial data and found under Data List.

Current Data		Data List	
Scan display	Measurement Item	Normal Condition	
FUEL SYS #N	Fuel System Bank N	Idling after warming Up:	
	OPEN: Air Fuel Ratio feedback stopped	Closed	
	CLOSED: Air Fuel Ratio feedback operating.		
CALC LOAD (Idle), %	Calculator Load: Current Intake Air Volume as a Proportion of max. Intake Air Volume	Idling: 10-20 % Racing without Load (2500 rpm): 14-45 %	1
COOLANT TEMP	Engine Coolant Temp. Sensor Value	After warming Up: 80-95 °C (175-203 °F)	
SHORT FT#N	Short-term Fuel Trim Bank N	0...-/+20 %	2
LONG FT#N	Long-term Fuel Trim Bank N	0...-/+20 %	3
ENG SPD	Engine Speed	Idling: 700-800 rpm	
VEHICLE SPD	Vehicle Speed	Vehicle stopped: 0 mph	
IGN ADVACE	Ignition Advance: Ignition Timing of Cylinder No.1	Idling: 5-15 °BTDC	4
INTAKE AIR	Intake Air Temp. Sensor Value	Equivalent to ambient T	
MAF	Air Flow Rate through Mass Air Flow Meter	Idling: nn gm/sec Racing without Load (2500 rpm): mm gm/sec	
Or MAP	Absolute Pressure Inside Intake Manifold	Throttle Fully Closed: 20-48 kPa Racing without Load (2500 rpm): 19-47 kPa	
THROTTLE POS	Voltage Output of Throttle Position Sensor Calculated as a percentage: 0 V->0%, 5 V ->100 %	Throttle fully closed: 8-20% Throttle fully open: 64-96%	
O2S B1 S1	Voltage Output of Oxygen Sensor Bank 1 Sensor 1	Idling: 0-1.0 V Driving (50 km/h, 31 mph) 0-1.0 V	
O2 FT B1 S1	Oxygen Sensor Fuel Trim Bank 1 Sensor 1 (Same as SHORT FT #1)	0 ± 20 %	5
O2S B2 S1	Voltage Output of Oxygen Sensor Bank 2 Sensor 1	Idling: 0-1.0 V Driving (50 km/h, 31 mph) 0-1.0 V	
O2 FT B2 S1	Oxygen Sensor Fuel Trim Bank 2 Sensor 1 (Same as SHORT FT #2)	0 ± 20 %	
O2S B1 S2	Voltage Output of Oxygen Sensor	Idling: 0-1.0 V (.660V)	

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[1] Calculated load value [1] refers to an indication of the percent engine capacity (J1979 "E/E Diagnostic Test Modes – Equivalent to ISO/DIS 15031-5). For diesel applications, the calculated load value is determined by the ratio of current output torque to maximum output torque at current engine speed.

[2] "Fuel trim" refers to feedback adjustments to the base fuel schedule (FINAL REGULATION ORDER). Short-term fuel trim refers to dynamic or instantaneous adjustments.

[3] Long-term fuel trim refers to much more gradual adjustments to the fuel calibration schedule than short-term trim adjustments.

[4] Ignition timing Spark Advance or Retard signal based on output calculated by the vehicle ECU; based on engine load, engine RPM and Throttle Position.

[5] Зависит от региона

	Bank 1 Sensor 2	
O2 FT B1 S2		UNUSED
O2S B2 S2	Voltage Output of Oxygen Sensor Bank 2 Sensor 2	Driving (50 km/h, 31 mph) 0-1.0 V
O2 FT B2 S2		UNUSED
MIL	ON if stored DTC in memory ECM	OFF if "all is O'k" [6]
#CODES	Numbers DTC	

Readiness Test Status (obd2_15_.gif). The above example shows which monitors have completed and which monitors are available or not available (do not apply this Vehicle). The non-continuous monitors have all completed. The continuous monitors are available and run continuously. Two types of on-board test monitoring are supported: Continuous and Non-Continuous. Continuous monitors test components and systems many times, conditions permitting, when the engine is running.

Readiness Test Status		
MISFIRE MON	AVAIL	Available (Continuous)
FUEL SYS MON	AVAIL	Available (Continuous)
COMP MON	AVAIL	Available (Continuous)
CAT EVAL	COMPL	Completed (Non- continuous)
HTD CAT EVAL	N/A	Not Available
EVAP EVAL	COMPL	Completed (Non- continuous)
2nd AIR EVAL	N/A	Not Available
A/C EVAL	N/A	Not Available
O2S EVAL	COMPL	Completed (Non- continuous)
O2S HTR EVAL	COMPL	Completed (Non- continuous)
EGR EVAL	COMPL	Completed (Non- continuous)

INCMPL stands for incomplete. Incomplete can mean the monitor did not complete, judgment is withheld pending further testing, the monitor did not operate, or the monitor operated and recorded a failure. Please see Modes 6 and 7 for additional details.

Readiness Test Status [7]		
MISFIRE MON	AVAIL	Available (Continuous)
FUEL SYS MON	AVAIL	Available (Continuous)
COMP MON	AVAIL	Available (Continuous)
CAT EVAL	INCMPL	Incomplete
HTD CAT EVAL	N/A	Not Available
EVAP EVAL	INCMPL	Incomplete
2nd AIR EVAL	N/A	Not Available
A/C EVAL	N/A	Not Available
O2S EVAL	INCMPL	Incomplete
O2S HTR EVAL	INCMPL	Incomplete
EGR EVAL	INCMPL	Incomplete

Continuous monitored systems/components are:
　　　　Engine Misfire
　　　　Fuel System (Trim)
　　　　Comprehensive Components
Non-continuous monitors test components and systems one time, conditions permitting, when the engine is running. Non-continuous monitored systems/components are:
　　　　Oxygen/Air Fuel Sensor
　　　　Oxygen/Air Fuel Sensor Heater
　　　　EGR System
　　　　Evaporative System
　　　　Catalyst
　　　　Secondary Air System
　　　　Thermostat

In **Mode 2** (Powertrain Freeze Frame Data) displays emission related values that are stored when the ECM has determined there has been an emission related failure. The manufacturer can add more values beyond the emission related values. All values are actual readings, none are substituted values. Manufacturers are free to add additional freeze frames. If a fault is detected and recorded, that information is stored as a "freeze frame." The ECM uses this data for identification and comparison of similar operating conditions

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[6] After 40 warm-up cycles without the fault being detected the DTC and freeze frame are erased from memory as current, however, the DTC and freeze frame will remain in DTC history as a history code and freeze frame until cleared. MIL will extinguished if after three consecutive trips, fault be not detected.
Note. The MIL will blink when a misfire occurs that will cause the temperature of the catalyst to rise enough to damage the catalytic converter. The blinking may be intermittent, because of changes in engine load and the severity of engine misfire. A misfire that will allow emissions to exceed regulations, but not damage the catalyst will light the MIL, but not blink the light. The MIL will light up on the second trip, if the misfire occurs under similar conditions.
[7] All Non- Continuous Readiness Test evaluations show INCMPL (incomplete) when DTC's are cleared.

when they recur. The data is also available to the diagnostic technician for use in identifying what conditions were present when the DTC was set. This information can only be accessed with the Diagnostic Tester.

Under CARB, only one freeze frame is stored with the required data. In Enhanced OBD II, two freeze frames are stored with additional data. The CARB freeze frame is listed under the CARB menu.

CARB FREEZE FRAME [8]		Freeze frame information typically includes:	Enhanced Freeze Frame Priority
TROUBLE CODE	DTC	DTC involved	Two freeze frames can be stored in the Enhanced OBD II mode in the ECM. The first is reserved for information related to misfire and fuel control, which have priority over other DTC(s). The second, if not occupied by one of the priority DTC(s), will store information for the first non-priority DTC that occurs. The freeze frame information updates if condition recurs.
ENGINE SPD	rpm	Engine rpm	
COOLANT TEMP	°C or °F	Engine coolant temperature	
VEHICLE SPEED	MPH	Vehicle speed	
CALC LOAD	%	Calculated Engine load	
FUEL SYS #1	CL or OPEN	Operating mode (open or closed loop)	
FUEL SYS #2	CL or OPEN		
SHORT FT#1	%	Fuel trim (short and long term)	
LONG FT#2	%		
SHORT FT#2	%		
LONG FT#2	%		
My be: INTAKE AIR FC IDL, STARTER SIG, A/C SIG, PNP SW, ELECT LOAD SIG, STOP SIG, ENG RUN TIME			

In **Mode 3 (**Emission Related Powertrain DTC's) the scan tool retrieves all stored emission related DTC's in the ECM. See MIL On section for additional details.

When **Mode 4 (**Clear/Reset Emission Related Diagnostic Information) is activated by the scan tool, all DTC's, freeze frame data, oxygen sensor monitoring test results, status of monitoring system test (Readiness Tests) results, and on-board test results are cleared and reset. The scan tool and ECM must be able to respond to this request with ignition key on and engine off.

Mode 5 (Oxygen Sensor Monitoring Test Results) displays the test results of the oxygen sensor test monitor. This screen's data can be used as a report on the condition of the oxygen sensor(s).

NOTE. These values are stored values, not current values that are found in Mode 1 (DATA LIST). These values are reported only if the oxygen sensor monitor has run. This information is lost if the ignition key is turned off.

Not all test values are applicable to all manufacturers. The A/F sensor test values are not applicable and are not displayed in Mode 5. Some vehicles use Non-Continuous Test Results mode to report results.

The following is a definition for the displayed terms.

R>>L O2S V Rich to lean threshold voltage – voltage used by the ECM to determine the boundary line when going from rich to lean

L>>R O2S V Lean to rich threshold voltage – voltage used by the ECM to determine the boundary line when going from lean to rich

LOW SW V Low sensor voltage point for switch time calculation – value used by the ECM for switch time calculation

HIGH SW V High sensor voltage point for switch time calculation – value used by the ECM for switch time calculation

R>>L SW TIM Rich to Lean switch time – time in seconds it takes to switch from Rich to Lean based on high to low switch voltages

L>>R SW TIM Lean to rich switch time – time in seconds it takes to switch from Rich to Lean based on low to high switch voltages

MIN O2S V Minimum sensor voltage during the test cycle

MAX O2S V Maximum sensor voltage during the test cycle

O2S TRANS T Time between sensor transitions – time between the rich to lean and lean to rich threshold voltages

TID $30 – the amount of time, used as a reference for the number (counts) each time the O 2 sensor signal crosses the low and high sensor voltage points

TID $70 – The number of counts, determined by the number of times the signal crossed the low and high sensor voltage points

This screen's data can be used as a report on the condition of the oxygen sensor. A malfunctioning sensor will switch slowly or not at all. Please keep in mind that other factors can affect oxygen sensor performance.

Mode 5. Oxygen Sensor Monitoring Screen		
LOW SW V	0.350V	Low sensor voltage for switch time calculation
HIGH SW V	0.550V	High sensor voltage for switch time calculation
MIN O2S V	0.025V	Minimum Sensor voltage during the test cycle
MAX O2S V	0.790V	Maximum Sensor voltage during the test cycle
O2 RL B1 S1 SW TIME (Time $31)	0-1000 ms	Rich to Lean threshold switch time
O2 LR B 1 S1 SW TIME (Time $32)	0-1000 ms	Lean to Rich threshold switch time
Sub (Rear) O2 Sensor (B1 S1) Test Results		
MIN O2S V	0.085V	

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[8] 40 Warm-up cycles, fault not detected or when cleared with DT.

MAX O2S V	0.785V	The ECM monitors the output voltage of the O_2 sensor. A DTC will set if output voltage remains high or low during the test period (Mode 5).
O2S TRANS T		Time between sensor transition

The A/F Sensor [9] monitor is similar to the O_2 Sensor monitor; however, the A/F Sensor has different characteristics. Therefore, the operating parameters of the monitor also differ.

The A/F Sensor monitor checks for sensor circuit malfunction, slow response rate, and for a malfunction of the sensor's heater circuit. There is a DTC for each condition for each sensor. A/F Sensors are required to be monitored once per trip; however, the ECM does continuously monitor A/F sensor operation.

When the ECM sees the right conditions, the ECM will test the A/F sensors for performance by measuring the signal response as the fuel injected into the cylinder is varied. The faster the A/F sensor responds, the better the sensor. The results of this monitor test are NOT reported in Mode 5. Mode 6 is used to determine if the A/F sensor passed or failed. The repair confirmation drive pattern in the Repair Manual provides the driving conditions for the ECM to operate the A/F sensor monitor.

Mode 6 On-Board Monitoring Test Results for Non-Continuously Monitoring Systems reports on the non-continuous monitors:

- Catalyst
- Evaporative System
- Secondary Air System
- Oxygen/Air Fuel Sensor
- Oxygen/Air Fuel Sensor Heater
- EGR System
- Thermostat

The use of this mode is that you can use the ECM to verify if a problem exists, as determined by the ECM. The ECM compares the non-continuous monitor test data to the test limits and reports to the scan tool a Pass or Fail indication for each monitored system/component. This mode will report results in one trip if the monitor runs and completes its testing. Two different screens showing Pass and Fail. Some vehicles will show TID in place of Time.

[TID]Time$01 Catalyst Deterioration		[TID]Time$05		EGR
[TID]Time$02 Evaporative System Deterioration		[TID]Time$06		A/F Sensor
[TID]Time$03 Not Supported		[TID)Time$07		A/F Sensor Heater
[TIDTime$04 Oxygen Sensor Heater		[TID)Time$08		Thermostat Monitor
NON-CONTINUOUS TEST		NON-CONTINUOUS TEST		
Time$01 CID$01	Pass	Time$01 CID$01	Pass	
Time$02 CID$01	Pass	Time$02 CID$01	Fail	
Time$02 CID$02	Pass	Time$02 CID$02	Fail	
Time$02 CID$03	Pass	Time$02 CID$03	Fail	
Time$02 CID$04	Pass	Time$02 CID$04	Fail	
Time$04 CID$01	Pass	Time$04 CID$01	Pass	
Time$04 CID$02	Pass	Time$04 CID$02	Pass	
Time$05 CID$01	Pass	Time$05 CID$01	Pass	
Time$06 CID$01	Pass	Time$06 CID$01	Pass	
Time$07 CID$01	Pass	Time$07 CID$01	Pass	

Mode 7. On-Board Monitoring Test Results for Continuously Monitored Systems reports test results for emission related powertrain components that are continuously and non-continuously monitored in one trip under normal driving conditions. It will report a failure as a DTC. This allows you to test the vehicle for problems and (after clearing DTC's) to check on a repair in one trip.

NOTE. The DTCs that are initially reported in Mode 7 are pending DTCs and are NOT reported in any other screen or mode. If conditions persist, DTCs will be stored in the normal areas.

For a DTC to be reported, the monitor has to be operating, though the monitor may not go to completion. This is the first place a DTC will show up. A two trip DTC reported in this mode on the first trip may not be accurate and may change during monitoring. Another trip is needed to confirm that the reported DTC is valid. If a DTC is reported in this mode there is good reason to suspect that there is a problem with the vehicle and further checks are necessary before returning to the owner.

Mode 8. Request Control of On-Board System Test or Component enables the scan tool to control the ECM, to test the system and related components. Currently, the EVAP leak test procedure is under this mode. When the EVAP leak test is enabled, it sets the conditions for leak testing, it does not conduct a leak test.

Mode 9. Request Vehicle Information reports the following if the ECM supports this function:

- Vehicle Identification Number (for example, JT6HF10V4V0048807)

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[9] The A/F sensor is designed so that at stochiometry, there is no current flow and the voltage put out by the detection circuit is 3.3 volts. A rich mixture, which leaves very little oxygen in the exhaust stream, produces a negative current flow. The detection circuit will produce a voltage below 3.3 volts. A lean mixture, which has more oxygen in the exhaust stream, produces a positive current flow. The detection circuit will now produce a voltage signal above 3.3 volts.

- Calibration Identification [10] (ECU $10, CAL ID:01 73309069. ECU $10, CAL ID:02 83309012.)
- Calibration Verification (ECU $10, CVN: 4567)

CARB mandated signals		
Scan display	Measurement Item	Normal Condition
MISFIRE RPM	Engine RPM for first misfire range	Misfire 0: 0 rpm [11]
MISFIRE LOAD	Engine load for first misfire range	Misfire 0: 0g/r
INJECTOR	Fuel injection time for cylinder No.1	1.8-3.2 ms
STARTER SIG	Starter Signal	Cranking: ON
A/C SIG	A/C Switch Signal	A/C ON: ON
A/C MAG CLUTCH	A/C Cutch signal (Air Conditioning switch status as input to ECM).	A/C ON: ON [12]
PNP SW	Park/Neutral Position Switch Signal	P or N position: ON
ELECTCL LOAD SW	Electrical Load Signal	Defogger SW ON: ON
INTAKE CTRL VSV	Intake control VSV signal	**13**
VVT CTRL	VVT control signal	VVT operating: ON
CTP	Closed Throttle Position	Throttle fully closed: ON
STOP LIGHT SW	Stop Light Switch Signal	Stop light switch ON: ON
FC IDL	Fuel Cut Idle: Fuel cut when throttle valve fully closed, during deceleration	Fuel cut operating: ON [14]
FC TAU	Fuel Cut TAU: Fuel cut during very light load	Fuel cut operating: ON
CYL #N	Abnormal revolution variation for each cylinder	Misfire Percentage
IGNITION	Total number of ignition for every 1,000 (200) revolutions	V8: 0-4000 [15] (For 200 rev. on 4cyl: 0-400)
FUEL PUMP	Fuel Pump Signal	Idling: On
EVAP (PURGE) VSV	EVAP VSV Signal (Normally Closed)	VSV operating: ON
CCV	Canister Closed Valve	Normally Open [16]
VAPOR PRESS	EVAP pressure is measured by the vapor pressure sensor.	760 mmHg^{-a} (Time 030 seconds) [17]
VAPOR PRESS VSV	Vapor Pressure VSV Signal	VSV operating: ON
THROTTE POS#2	Throttle Position sensor No.2 output voltage	

Enhanced Signals		
Scan display	Measurement Item	Normal Condition
IAC DYTY RATIO	Intake Air Control Valve Duty Ratio (Opening ratio rotary solenoid type IAC valve)	Idling: 22.5-43 %
EGR SYSTEM	EGR system operating condition	Idling: ON
EGRT GAS	EGR gas Temperature Sensor Value	
PS OIL PRESS SW	Power Steering Oil Pressure Switch Signal	Turning steering wheel: ON
ACCEL POS	Acceleration pedal position sensor N.1 output voltage	Accelerator released: 0.25-0.9 V Accelerator depressed: 3.2-4.8 V
ACCEL POS #2	Acceleration pedal position sensor N.2 output voltage	Accelerator released: 1.8-2.7 V Accelerator depressed: 4.7-5.0 V
THROTTLE TARGET POS	Target position throttle valve	Idling: 0.4-1.1 V
THROTTLE OPEN	Throttle motor opening duty ratio	Throttle fully closed: 0 %

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[10] Also take a look Authorized Modification Label. 1 to 3 ID Numbers may be displayed.

[11] "Engine misfire" means lack of combustion in the cylinder due to absence of spark, poor fuel metering, poor compression, or any other cause. This does not include lack of combustion events in non-active cylinders due to default fuel shut-off or cylinder deactivation strategies.

[12] Сигнал включения э/м сцепления кондиционера (ON/OFF). A/C CLUTCH SIG.

[13] Intake Air Control Valve (IACV) closed (VSV: ON if Throttle valve opening angle>30° and Engine Speed>3700 rpm (see Variable Induction Control Valve ACIS)

[14] Отключение подачи топлива при полностью закрытой дроссельной заслонке, но достаточно высокой скорости вращения при замедлении двигателя.

[15] Счетчик числа импульсов зажигания. Используется для mifire monitoring. При обнаружении misfire, в соответствующей строке будет указан процент пропусков вспышки для «виновника» т.е. для конкретного цилиндра (например, Cyl #3 .... 5%). В Toyota моделях 1994-1998 и части 1999 г.в. проверка проводилась для каждой 1000 оборотов двигателя. Согласно новым требованиям правил OBDII, Toyota стала применять более жесткие рамки (рассчитываются пропуски зажигания для каждых 200 оборотов).

[16] CCV is install between Charcoal Canister и Charcoal Canister Filter (Perform CCV Test using the Diagnostic Tester).

[17] Take a look EVAP System Information.

DUTY		When acceleration pedal is depressed, duty ratio is increased
THROTTLE CLOSE DUTY	Throttle motor closed duty ratio	Throttle fully closed: 0 % When acceleration pedal is depressed, duty ratio is increased
THROTTLE MOTOR CTL	Whether or not motor control is permitted	Idling: ON
THROTTLE CLUTCH CTL	Whether or not magnetic clutch control is permitted	Idling: ON
+BM	Whether or not electric throttle control system power is inputted is permitted	Idling: ON
ACCEL IDL	Whether or not accelerator pedal position sensor is detecting idle	Idling: ON
THROTTLE IDL	Whether or not throttle position sensor is detecting idle	Idling: ON
FAIL #1	Whether or not tail fail safe function is executed	ETCS is failed: ON
FAIL #2	Whether or not tail fail safe function is executed	ETCS is failed: ON
THROTTLE LEAN VALUE	Throttle fully closed learning value	0.4-0.8 V
ACCEL LEAN VALUE	Accelerator fully closed learning value	0.4-0.8 V
THROTTLE MOTOR	Throttle motor control current	Idling: 0-3.0 A
ETCS MAG CLUTCH	Throttle clutch control current	Idling: 0.8-1.0 A
TOTAL FT B N	Total Fuel Trim Bank N: Average value for fuel trim system of bank N	Idling: 0.5-1,4 (0,8-1,2)
O2 LR BN SM	Oxygen Sensor Lean Rich Bank N Sensor M: Response time for oxygen sensor output to switch from lean to rich	Idling after warming up: 0-1,000 ms
O2 RL BN SM	Oxygen Sensor Rich Lean Bank N Sensor M: Response time for oxygen sensor output to switch from rich to lean	Idling after warming up: 0-1,000 ms

Also take a look files Acronyms.pdf and ScannerPID.pdf on my WEB-site http://alflash.com.ua/toyota.htm

Note.