





BOSCH

Invented for life

# **Diagnostics:** Vehicle Service Information



This series of technical articles from Bosch focuses on how to get the best out of its ESI[tronic] 2.0 software, which is used in conjunction with the KTS range of diagnostic tools for vehicle fault diagnosis and service function procedures.

In this installation we're going to look through the diagnostic capabilities and usefulness of the Global OBD II functions offered by the ESI 2.0 software, which can often be overlooked in vehicle diagnosis. The American OBD (On Board Diagnosis) standard was introduced in 1988 in California in an attempt to reduce traffic-related air pollution. OBD regulations involve self monitoring by electronic control units of all vehicle systems and components which influence exhaust emissions. In 1996 this standard was succeeded by OBD II to meet with more stringent emission limit values. In Europe, EOBD (European On Board Diagnostics) is based on the more comprehensive OBD II concept and applies to gasoline vehicles registered from 01/01/2001 and diesel vehicles registered from 01/01/2004.

### System fault

The standardised OBD system enables constant monitoring of vehicle components influencing exhaust emissions. If a system fault is detected that leads to an increase in emissions, the driver is informed accordingly with a malfunction indicator lamp (MIL). If the fault that is detected is severe enough to cause damage to a component such as the catalytic converter then the MIL will flash and action can be taken, such as fuel injector shut off by the control unit to protect components at risk. Fault codes will be stored by the controller with a description of the malfunction and relevant information.

The five digit OBD fault codes always begin with 'P0' and have standardised description designations for all VMs. For example 'P0301' will mean 'Cylinder 1 misfire detected', regardless of the vehicle make and model. For system analysis and fault finding, the OBD system data is accessed via the 16 pin diagnosis connection to the Bosch KTS using one of the five permitted communication protocols. The Bosch ESI 2.0 software offers the Global OBD II (EOBD) diagnosis mode at the top of the 'System group selection' list for every applicable vehicle selection (RB key).





Typically the Global OBD II functions consist of diagnosis modes one to nine and in Bosch ESI 2.0 there are also some useful extra features (see below).

ESI[tronic] 2	.0	· Caller	mar an		-
BO	SCH KIA 538	/ KIA / Sportage 1.6 GDI	/ SL / 1.6 / 99.0	) kW / 07/2010 - / G4FD	+
i Veh	icle info	Jiagnosis	2	Trouble-shooting	
lobal OBI	D II 🦛				
Selection o Continue w	f required func ith "Continue".	tion			
Systems	found				
Onboard	diagnosis over	view			
Mode 1,	Actual data				
Mode 2,	Operating co	nditions			
Mode 3/7	/A, read fault n	nemory			
Mode 4,	Erase error r	nemory for all system	IS		
Mode 5,	Oxygen sens	or data			
Mode 6,	Test data for	monitored systems			
Mode 8,	Actuators				
Mode 9,	Vehicle inform	mation			
Readines	s Tests				

The first extra feature in ESI 2.0 on the selection screen is 'Systems found'. This will display compatible ECUs and usually lists the engine control and transmission control, if the vehicle has an automatic gearbox.

The next additional feature is the 'Onboard diagnosis overview', which is a quick and accurate method to assess the state of the vehicle system and can provide essential data to help you find an emissions related fault. Now let's go through the nine OBD modes mentioned earlier:

Mode 1: reads the actual data that is processed by the ECU from the sensor input signals. The available data depends on the vehicle configuration and, in true KTS style, can be displayed in different ways to suit your preference. From the start, you're presented with a full scrollable list of values displayed as live readings. The standard OBD II PIDs (Parameter identifications), as defined by the Society of Automotive Engineers standard – SAE J1979, are shown in the right hand column.

You may be surprised by the large amount of data available on some cars, such as DPF, NOx and SCR information on the very latest diesel cars (see below).

BOSCH LRG 166 /	LAND ROVER GROUP / Disc	overy Sport 2.0 TD4 AWD / 85 /	2.0 / 132.0 kW / 09/2015 - / AJ			KTS 570 🚙 💦	-	
Vehicle info	Ciagnosis	Trouble-shooting	T Maintenance	Circuit diagrams	Equipment			
lobal OBD II					Protoci CAN_IS	et SO_15765_08D_II		
Search								
			U	nselect all	Show selected	only		
ECU	Actual value				Value	Unit	PID	
III FCM1	Exhaust cas to	mn (hank 1 sensor 1)			120.8	°C	78	
IT ECM1	Exhaust gas te	mp. (bank 1, sensor 4)			35.2	*0	78	
IT ECM1	Engine oil temp	perature			31	°C	50	
ECM1	Fuel level input				52.9	96	21	
IT ECM1	Fuel Rail Press	aure A			26070	kPa	6d	
IT ECM1	Rail temperatur	A ar			27	°C	6d	
IT ECM1	Fuel system co	mpleted			Yes		41	
ECM1	Fuel System R	eady			Yes		01	
ECM1	Fuel Injection 1	Timing			2.37		5d	
ECM1	NMHC catalyst	completed			No		41	
ECM1	NMHC catalyst	ready			No		01	
ECM1	Intake air temp	erature			22	°C	Of	
ECM1	Oxygen sensor	value (Bank1 - Sensor1)			1.000		34	
ECM1	Calculated load	t value			39.2	96	04	
DCM/ECM2	Calculated load	d value			38.8	96	04	
ECM1	Air flow rate fre	om MAE sensor			8.30	9/s	10	
ECM1	MIL status				MIL status OFF		01	
III DCM/FCM2	MII status				MII status OFF		01	
Return			Save	Time profile				

You can manipulate and filter the 'Actual data' list with several methods. Firstly, our good friend the 'search bar' is present at the top of the data field. Typing any text into here will instantly change the list to only display actual values that contain that text in their name (see below).

DPF	
ECU	Actual value
ECM1	DPF delta pressure (bank 1)
ECM1	DPF Bank 1 Inlet Temperature Sensor
ECM1	DPF inlet pressure (bank 2)
ECM1	Distance Between DPF Regeneration
ECM1	Norm. Trigger for DPF Regeneration

#### **Scrolling list**

All values are displayed on a scrolling list and, if you want to be more specific, you can select up to any eight particular values by clicking the 'check box' in the left ECU column and then choosing the 'Show selected only' option to filter out values you don't want displayed. As we covered in a previous article, the selected OBD actual values can also be displayed in a colourful graph format by using the 'Time profile' F6 soft key (see below)



Some really useful values are usually present in the OBD actual data program, such as 'Distance travelled while MIL is activated' and 'number of warm up cycles since DTC clear'. This type of information can be essential if you have a problem vehicle with a suspicious repair history.

Mode 2: provides freeze frame data associated to any stored DTCs which, if supported by the controller, can give a help-ful guide as to what the ambient conditions were when that particular fault was logged. This 'snap shot' information is especially beneficial when testing for intermittent faults.

Mode 3, 7 & A: are grouped together to report any stored fault codes, whether they are confirmed, pending or permanent, along with associated readiness tests status.





## Diagnostics

		V WILLIAM.	131173066		-			
Vehic	e info		ブ Diagnosis	Trouble	shooting	C Maintenance		-
de 3/7/A, i	l ead fau	t memo	vry				Protocol: K_ISO_9141_2	
rror code	ECU	Status	Path		Туре			
P0420	ECM	Stored	Catalyst system effici	ency (bank 1)	Below min	. threshold value		
eadiness 1	īests							
eadiness T	ïests orehen.	compone	ents since fault erased	Ready				
eadiness T CM Com CM Catal	fests prehen. yst since	compone e fault er	ents since fault erased ased	Ready Ready				
eadiness CM Com CM Catal CM Evap	fests prehen. yst since prative s	compone e fault er system si	ents since fault erased rased nce fault erased	Ready Ready Ready				
eadiness 1 CM Com CM Catal CM Evap CM Oxyg	fests prehen. yst since orative s en sens	compone e fault er system si or since	ents since fault erased ased ince fault erased fault erased	Ready Ready Ready Ready				
Readiness 1 ECM Com ECM Catal ECM Evap ECM Oxyg	Tests prehen. yst since orative s en sens	compone e fault er system si or since	ents since fault erased 'ased ince fault erased fault erased a since fault erased	Ready Ready Ready Ready				

The fault code, status, description and type are all listed. As the OBD II fault codes are standardised the information will be reliable and there won't be any unknown descriptions. The error memory can be saved, cleared or re-read directly using the soft keys along the bottom of the screen.

Mode 4: is used to erase the fault code error memory for the OBD systems after repairs have been carried out. When the fault code memory is cleared within the OBD system, the adaptation values and readiness tests are also reset. A specific road test (drive cycle) will need to be performed in order for the OBD internal checks to be completed. Usually a fault code of 'P1000' will be logged until the internal systems OBD checks are satisfied.

Mode 5: provides more in-depth 'Oxygen sensor data' and air/fuel mixture test results, but is not supported by all vehicle brands.

Mode 6: is the 'Test data for monitored systems' and gives useful information, such as Lambda sensor parameters. Graphical display bars of the values contain red and green colour coding which give a quick guide as to whether the parameters are running within their tolerances (green) or outside them (red).

Oxygen sensor and variable valve timing data, along with misfire counters, can be a real emissions fault finding aid (see below).

BOSCH KIA 538 / KIA / Sportage 1.6 GDI / SL / 1.6 / 99.0 kk	V / 07/2010 - / G4FD						KTS 570	~ ?	-
Vehicle info Diagnosis	ouble-shooting	Maintenance	Circuit diagram	• 00 •	quipment				
lobal OBD II					Protocol CAN_ISO_15765	.080_8			
Idode 6, Test data for monitored systems									
Monitor ID Name	Rance of validity	Value	Rance	Unit	Scaling	Status	MID	TID	ECU
Oxygen Sensor B1, S1		0.906952	0.250122 . 1.999969				1	30	ECM1
Oxygen Sensor B1, S1		2666.870	0.000	mV	Voltage		1	32	ECM1
Oxygen Sensor B1, S1		274.536	9.766 7999.878	mV	Voltage		1	33	ECM1
Oxygen Sensor B1, S1		0.003265	-0.050110 0.050049				1	34	ECM1
Dxygen Sensor B1, S2 ( Rich to lean sensor threshold volt. )		659.180	659.180 659.180	mV	Voltage		2	1	ECM1
Oxygen Sensor B1, S2 ( Lean to rich sensor threshold volt. )		659.180	659.180 659.180	mV	Voltage		2	2	ECM1
Oxygen Sensor B1, S2 ( Low sensor volt. switch time calc. )	-	668.945	0.000 668.945	mV	Voltage		2	3	ECM1
Oxygen Sensor B1, S2 ( High sensor volt, switch time calc. )		668.945	668.945 1245.117	mV	Voltage		2	4	ECM1
Dxygen Sensor B1, S2 ( Rich to lean sensor switch time )		0.080	0.000 0.300	s	Measuring time		2	5	ECM1
Oxygen Sensor B1, S2 ( Lean to rich sensor switch time )		0.050	0.000 0.450	5	Measuring time		2	6	ECM1
Oxygen Sensor B1, S2 ( Min. sensor voltage for test cycle )	-	207.031	0.000 248.779	mV	Voltage		2	7	ECM1
Oxygen Sensor B1, S2 ( Max. sensor voltage for test cycle )	-	708.008	661.011 1250.732	mV	Voltage		2	8	ECM1
Catalyst Bank 1		150.95	100.00 655.35	96	96		21	80	ECM1
/VT Monitor Bank 1	-	4.57	-5.94 14.06		Angle difference		35	91	ECM1
/VT Monitor Bank 1	the second se	4.57	-5.94 14.06		Angle difference		35	92	ECM1
/VT Monitor Bank 1	-	22.76	13.00 27.20		Angle difference		35	93	ECM1
VVT Monitor Bank 1	-	22.76	13.00 27.20		Angle difference		35	94	ECM1
/VT Monitor Bank 1	-	-13.14	-269.98 242.00	* N	Angle difference		35	95	ECM1
/VT Monitor Bank 1		25.31	-228.79 283.20		Angle difference		35	96	ECM1
02 Sensor Heater B1, S1	_	780.0	720.0 . 6513.5	°C	Temperature sens		41	81	ECM1
02 Sensor Heater B1, S2		110	03080	Ohm	Resistance in ohms		42	80	ECM1
Misfire detection Cvl. 1 ( )	-	0	0 65535	counts	counts		82	b	FCM1
Return		Save	Update "						

Mode 8: is the 'Actuators' function and can offer on board system activations like an evaporative system leakage test, but these tests may not be supported by all European vehicles.

Mode 9: holds 'Vehicle information' including the chassis number (VIN) and engine/automatic transmission control unit calibration numbers and test condition counters.

Readiness tests: are the last selection on the selection list and report the status of the monitor tests of either 'ready' or 'not ready' and whether the test is 'completed' or 'not completed' (see below). This operation acts as a valuable confirmation of a successful repair to the system if all OBD monitor tests are completed and passed.

BO2	CIT NIA 538 / NIA / Sportage 1.6 GDI / SL / 1.6 / 99.					
Vehicl	e info 🧹 Diagnosis 🔗	Trouble-	shooting	The Maintenance	N I	Circuit diagram
lobal OBD I eadiness Te	sts					
eadiness Te	sts					
ECM1	Misfire detection since fault erased	Ready	Misfire	detection in driving cycle		Completed
ECM1 ECM1	Misfire detection since fault erased Fuel system since fault erased	Ready Ready	Misfire Fuel sy	detection in driving cycle stem in driving cycle		Completed Completed
ECM1 ECM1 ECM1	Misfire detection since fault erased Fuel system since fault erased Comprehen. components since fault erased	Ready Ready Ready	Misfire Fuel sy Compre	detection in driving cycle stem in driving cycle ahen. components in drivi	ng cycle	Completed Completed Completed
ECM1 ECM1 ECM1 DCM/ECM2	Misfire detection since fault erased Fuel system since fault erased Comprehen. components since fault erased Comprehen. components since fault erased	Ready Ready Ready Ready	Misfire Fuel sy Compre	detection in driving cycle stem in driving cycle shen. components in drivi	ng cycle	Completed Completed Completed
ECM1 ECM1 ECM1 DCM/ECM2 ECM1	Misfire detection since fault erased Fuel system since fault erased Comprehen. components since fault erased Catalyst since fault erased	Ready Ready Ready Ready Ready	Misfire Fuel sy Compre Catalys	detection in driving cycle stem in driving cycle shen. components in drivi t in driving cycle	ng cycle	Completed Completed Completed Not completed
ECM1 ECM1 ECM1 DCM/ECM2 ECM1 ECM1	Misfire detection since fault erased Fuel system since fault erased Comprehen. components since fault erased Catalyst since fault erased Oxycen sensor since fault erased	Ready Ready Ready Ready Ready Ready	Misfire Fuel sy Compre Catalys Oxygen	detection in driving cycle stem in driving cycle ehen. components in drivi t in driving cycle sensor in driving cycle	ng cycle	Completed Completed Completed Not completed Not completed
ECM1 ECM1 ECM1 DCM/ECM2 ECM1 ECM1 ECM1	Misfire detection since fault erased Fuel system since fault erased Comprehen. components since fault erased Catalyst since fault erased Oxygen sensor since fault erased Oxygen sensor heating since fault erased	Ready Ready Ready Ready Ready Ready Ready	Misfire Fuel sy Compre Catalys Oxyger Oxyger	detection in driving cycle stem in driving cycle shen. components in drivin t in driving cycle sensor in driving cycle sensor heating in driving	ng cycle I cycle	Completed Completed Completed Not completed Completed

#### Soft key

As with previous topics we've covered in these articles, whenever the 'Save' soft key is shown along the bottom of the ESI 2.0 screen, any data that is displayed on screen will be added to the job 'protocol' report that can be saved and printed for reference. In most cases the Global OBD II function in Bosch ESI 2.0 gives you an additional way to interrogate the vehicle power train systems for emissions related data.

The method described here will sometimes give more specific detail about the engine fuel trim analysis, closed loop control and associated components that are critical to keep the vehicle exhaust emissions within their prescribed limits.

The Global OBD II functions of ESI 2.0 can be a great diagnostic aid when used to supplement the specific engine control diagnosis. We've seen some cars that will store error codes in the OBD II memory

which may not be evident in the manufacturer-specific ECU software. With this in mind, it's always worth checking the OBD II diagnostic functions within Bosch ESI 2.0 when you're working on a vehicle

with emissions related faults, to ensure that no vital data has been missed.

The OBD II capabilities within Bosch ESI 2.0 and on board system test monitors provide a more robust diagnostic process which can give you more confidence in returning a fully tested and verified vehicle back to the customer after a repair.

