Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
Catalyst Bank 1	P0420	oxygen storage of catalyst	normalized oxygen storage	<1 factor	exhaust gas mass flow	>40kg/h	max. 18 sec.	once per trip	1 trip
			less than normalized oxygen storage of a limit catalyst		exhaust gas mass flow	<120kg/h	continuous		
					catalyst temp. model	<700° C			with: 0.4 sec continuous
					catalyst temp. model	>480°C			
					engine speed	>1200rpm			or 4 sec cum
					engine speed	<2760rpm			
					engine load (RLKTDMN)	>18%			
					engine load (RLKTDMX)	<55... .65%			
					modeled catalyst temp. gradient	<2.5° C / sec			
					exhaust gas mass flow gradient	<8.33g/sec²			
					fuel system closed loop	active			
					time after dew point exeeded at secondary O2 sensor * (TVKTDMTPE)	10 ... 40 sec.			
					ambient temperature	>-48° C			
					secondary O2 sensor voltage	> 0.55 V			
					error: fuel system trim rich or lean (P2177,P2178,P2187,P2188)	not set			
					short term fuel trim (< max)	<1.25factor			
					short term fuel trim (> min)	>0.75factor			
					error: critical misfire rate (P0300-P0306)	not set			
					error: cat. damaging misfire rate exceeded (P0300-P0306)	not set			
Misfire Emission Level Multiple Cylinder	P0300	crankshaft speed fluctuation cylinder 1 to cylinder 6	emissions relevant misfire rate	> 2,38%	engine speed	> 450rpm	first Interval: 1000 revs.	continous	2 trips
Cylinder #1	P0301				engine speed	< 6500rpm			with: 0.4 sec
Cylinder #2	P0302				indicated torque (idle, no drive)	> 5,47%	remaining intervals: 4000 revs.	continous	continuous

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
Cylinder #3	P0303				indicated torque (drive) (MISALUN)	> 5,47 . . . 20,7%			or 4 sec cum
Cylinder #4	P0304				engine speed gradient (NGALUN)	<12800 rpm/sec			
Cylinder #5	P0305				volumetric efficiency gradient	<768%/rev			
Cylinder #6	P0306				cylinder events after engine start	> 6ignitions			
					engine coolant temperature	> -30°C			
					intake air temperature	> -30°C			
					error: crankshaft sensor (P0335, P0336, P0338)	not set			
					error: ref.mark of crank sensor (P0016-P0019)	not set			
Catalyst Damaging Level									
Multiple Cylinder	P0300		Catalyst damaging misfire rate	> 16,7 . . . 4,7%	Includes all the above with the following exceptions:				First
Cylinder #1	P0301		(KFKSWFS; AHEKSB1)	see Misfire supplemental data (h) (2.5.1)	First interval when engine coolant start temperature is	< 0 °C	First Interval: 1000 revs	continous	occurance:
Cylinder #2	P0302				First interval when engine coolant start temperature is	> 0 °C	First Interval: 200 revs	continous	immediate
Cylinder #3	P0303								MIL flashing
Cylinder #4	P0304						Remaining intervals	continous	
Cylinder #5	P0305						200 revs		Second
Cylinder #6	P0306								occurance:
									immediate
									MIL flashing with constant MIL afterwards

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
Fuel evaporative system (monitor during engine run)									
canister ventilation valve (AAV)	P0446	monitoring of tank pressure while	tank pressure too low because	< -25 hPa	engine start temperature (TMSTLDMN, TMSTDLDMX)	2 °C ... 38 °C	approx. 10 sec	once per trip	2 trips
		AAV is open and CPV is closed	canister vent. defective & closed		ambient temperature (TUMTLDU, TUMTLDO)	2 °C ... 38 °C			
					difference ambient temperature and engine start temperature	< 15°C			
canister purge valve (CPV)	P0496	monitoring of tank pressure while	final pressure too low because	< -0.6 hPa	ambient pressure	>= 680.00 hPa	approx. 10 sec	once per trip	
		CPV and AAV are closed	CPV defective and open		vehicle speed	<= 1,86 mph			
					angle accelerator pedal	0 °			
	P0497	monitoring of tank pressure while	purge control stuck closed	> -0.2 hPa	unfiltered tank pressure	>= -40.00 hPa			
		CPV and AAV are closed			and unfiltered tank pressure	<= 10.00 hPa			
					battery voltage	>= 10.45 V			
tank leak rough	P0455	AAV is closed and CPV is open	vacuum pressure built up gradient too low (KLTLDSFS05)	> 0.100 … 0.150 hPa/s	and battery voltage	<= 18.00 V	approx. 20 sec	once per trip	
					fuel system status	closed loop			
			because of large tank leakage	> -10 hPa	secondary air system *	inactive			
			(for example: open gas filler cap)		tank fuel level (FSTDMN, FSTDMX)	10 l ... 70 l			
					error: fuel system trim rich or lean (P2177,P2178,P2187,P2188)	not set			
					multiplicative fuel trim adaption integrator deviation	< 0.015			
					for time	6 sec.			
					lambda controller deviation	< 0.03			
					or time since engine start exceeds threshold	> 400 sec			
					error: tank pressure sensor (P0450-P0453)	not set			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
					error: engine speed sensor (P0335, P0336, P0338)	not set			
					error: ambient temperature sensor (U0073)	not set			
					error: canister purge valve (P0496,P0497)	not set			
					error: engine coolant temperature sensor (P0116-P0119)	not set			
					error: canister ventilation valve (P0446)	not set			
					error: critical misfire rate (P0300-P0306)	not set			
					error: fuel level sensor (P0461-P0463, P2066-P2068)	not set			
Fuel Evaporative System (monitor after ignition off)	P0442	Monitor fuel tank's pressure after engine stop and ignition off			Engine coolant temperature at start.	<= 42°C	max. 4 trips	once per trip	1 trip
tank leak smallest					engine coolant temp. at start - intake air temp.	<= 15°C	for each trip max. 2900s		
		Filter the normalized pressure from each trip			ambient air temperature	>= 2°C	continuous		
		with an EWMA filter.			ambient air temperature	<= 38°C	after engine stop		
		Compare filtered result with threshold.	Filtered normalized pressure	> 0.5	engine has been running for a cal. min. time	>600sec	and ignition off		
				> 0.4 if previous result detected a leak	engine coolant temp. at engine stop	>60°C			
					ambient pressure	>= 680hPa			
		Pressure threshold for each trip	Absolute max. neg. pressure + Max. pos. pressure (KFEONVPT)	> 1.11 … 3.00 hPa	driving distance (in current trip) covered	>= 6500m			
					driving distance (for vehicle lifetime) covered	>= 20km			
		For each trip following strategy:			the fuel tank's level isn't at its minimum	10l			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
		Look for maximum positive pressure.			the fuel tank's level isn't at its maximum	70 l			
		Abort if:			battery's voltage	>11V			
		- max. pos. pressure >=	Max. pos. pressure	1.11 … 3.00 hPa	no refueling activity				
		threshold.	(KFEONVPT)		error: intake air temperature (P0111-P0114)	not set			
		- max. pressure - current	max. pressure - current pressure	>= 0.05 hPa	error: canister purge valve (P0496,P0497)	not set			
		pressure >= threshold		100s	error: ambient pressure sensor (P2227-2229)	not set			
		for a specific time.			error: vehicle speed sensor (P0501-P0503)	not set			
		- pressure stays in range	absolute pressure	<= 0.69946 hPa	error: engine coolant temperature sensor (P0116-P0119)	not set			
		near zero for		300s	error: tank pressure sensor (P0450-P0453)	not set			
		a specific time.			error: battery voltage	not set			
		- pressure <=	pressure	<= -0.75 hPa	error: air mass flow sensor (P0100-P0103)	not set			
		threshold		25s	error: canister ventilation valve (P0446)	not set			
		for a specific time			error: tank leak rough (P0455)	not set			
		(vacuum build-up instead of pressure build-up)							
		- pressure-phase-time >= threshold.	pressure phase time	>= 2400.00 s					
		- diagnostic-time >= threshold	diagnostic time	>= 2900.00 s					
		Look for absolut maximum negative pressure							
		Abort if:							

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
		- max. neg. pressure <= threshold	Abs . max. neg. Pressure (KFEONVPT)	> 1,11 …. 3,00 hPa					
		- diagnostic time >= threshold	diagnostic time	>= 2900.00 s					
		- current pressure - neg. pressure >= threshold for a specific time	current pressure - neg. pressure	>= 0.05 hPa 100s					
		- pressure stays in ambient range for a specific time	absolute pressure	<= 0.69946 hPa 300s					
		- canister vent valve re-opened for a more than N times	no. canister vent valve openings	> 2					
		because the pressure exceeds a threshold	pressure	0.74951 hPa					
Secondary Air System	P0411	passive functional check	relative secondary air mass flow. Ratio from calculated secondary air mass by pressure sensor signal and secondary air mass model	< 0.45 > 1.2	catalyst heating * secondary air system * intake air temperature	active active > 0 °C	max. 60s	once per trip	2 trips
Secondary Air Valve stuck open check	P2440	Look for pressure pulsations	Top peak of pulsation Bottom peak of pulsation Average of absolute value of pulsations	> 30 hpa < -30 hPa > 10 hPa	intake air temperature engine coolant temperature engine coolant temperature ambient pressure	< 80.3 °C > 0 °C < 120 °C > 680 hPa.			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
					error: ambient pressure sensor (P2227-2229)	not set			
					error: intake air temperature (P0111-P0114)	not set			
					error: engine coolant temperature sensor (P0116-P0119)	not set			
					error: secondary air pump (power stage) (P0418, P2258,P2257)	not set			
					error: battery voltage	not set			
					mass airflow	> 6 kg/h			
					mass airflow	< 130 kg/h			
					change in air charge per working cycle	<= 7 %			
Pressure sensor	P2432	cirtcuit continuity - low	measured sensor voltage	< 0,498 V			0.5 sec	continuous	2 trips
secondary air system	P2433	cirtcuit continuity - high or open	measured sensor voltage	> 4,501 V					
	P2431	rationality -	during ECU init-	< -50 hPa	error: ambient pressure sensor (P2227-2229)	not set			
		comparisson between: SAI system pressure signal & Barometric pressure signal	difference SAI pressure vs BARO pressure	> 50 hPa	secondary air system *	active			
Fuel System Rich/Lean							35 sec.	continuous	2 trips
					general enable contitions:				
					fuel system status	closed loop			with: 0.4 sec
Multiplicative					for time	>2,6 sec.			continuous
and Additive					engine coolant temperature	>60.8°C			or 4 sec cum
					canister vent valve closed	TRUE			
					intake air temperature	<=65.3°C			
					lambda setpoint	0.98 < x < 1.02			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
					error: camshaft control *	not set			
					error: reference mark sensor (P0335,P0336,P0338)	not set			
					error: throttle position sensor (P0121-P0123,P0221-P0223)	not set			
					error: engine coolant temperature sensor (P0116-P0119)	not set			
					error: power supply voltage	not set			
					error: power stage throttle actuator (P0221-P0223)	not set			
					error: intake air temperature (P0111-P0114)	not set			
					error: power stage canister purge valve (P0443, P0458, P0459)	not set			
					error: multiple misfire (P0300-P0306)	not set			
					error: lambda sensor upstream catalyst (P0130-P0134)	not set			
					error: lambda sensor heating upstream catalyst (P0134,P0135)	not set			
					error: canister purge system *	not set			
					special enable contitions				
	P2177	fuel trim limits exceedes range multiplicative	delta lambda correction	>1.175factor					
					indicated torque	> 17% … 11% < 37% .. 46%			
	P2178	fuel trim limits exceedes range multiplicative	or delta lambda correction	<0.825factor		>= 1280 rpm			
					engine speed	<= 3000rpm			
	P2187	system too lean at idle	delta fuel load correction	>5.25%					
					indicated torque	> 4.8%			
	P2188	system too rich at idle	or delta fuel load correction	<-5.25%		< 17.3% … 11%			
					engine speed	>= 520rpm <= 960rpm			
Fuel System Control Module					**general enabling conditions**		0.6 sec	continuous	2 trips
					battery voltage	< 17.9 V > 10 V			
					locking request immobilizer	not avtive			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
					special enabling condition				
	P0629	diagnosis short circuit to battery voltage	backward powerstage voltage of	> 2.21 V	fuel pump relay commanded "OFF"	TRUE			
			fuel pump diagnosis for a time	0.1 sec.					
			and backward powerstage voltage of fuel pump diagnosis	>=- 2.74 V					
	P0628	diagnosis short circiut to ground only active if powerstage on	backward powerstage voltage of fuel pump diagnosis	<= 2.21 V	fuel pump relay commanded "ON"	TRUE			
			for a time	> 0.5 sec.					
	P0627	diagnosis wire interruption	backward powerstage voltage of fuel pump diagnosis	> 2.74 V	condition output duty cycle PCM for power on diagnosis	TRUE			
			and		fuel pump relays commanded "OFF"	TRUE			
			max-error: powerstage diagnosis set	FALSE					
	P0627	powerstage locked	condition fault message of PCM powerstage is locked	TRUE					
Oxygen sensor (primary O2) bank 1 sensor 1									
	P0131	short circuit to ground for a cold sensor	primary sensor voltage	< 0.06 V	engine coolant temperature	< 39.8 °C	0.1 sec.	Monitor runs	2 trips
					engine stop temperature last driving cycle	> 60 °C		whenever enable	with: 0.4 sec
					dew point exeeded at primary O2 sensor *	TRUE		conditions are met	continuous
					primary sensor heating active *	TRUE			or 4 sec cum

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
					heating power primary O2 sensor	> 80 %			
					for more than	10 sec.			
					engine speed	> 680 rpm			
					battery voltage	> 10.5 V			
	P0131	short circuit to ground	primary sensor voltage	< 0.06 V	secondary O2 sensor voltage	> 0.5 V	10 sec.	Monitor runs	2 trips
		for a warm sensor			fuel system status (primary O2 sensor)	closed loop		whenever enable	with: 0.4 sec
					secundary air system *	inactive		conditions are met	continuous
					error: secondary air system (P0411,P0418,P2258,P2257, P2431-P2433)	not set			or 4 sec cum
					Fuel evaporative system monitoring (during engine run)	inactive			
					air passed at primary O2 sensor	2200g			
					dew point exeeded at primary O2 sensor *	TRUE			
					primary sensor heating active *	TRUE			
					heating power primary O2 sensor	> 80 %			
					for more than	10 sec.			
					engine speed	> 680 rpm			
					battery voltage	> 10.5 V			
bank 1 sensor 1	P0132	short circuit to battery voltage	primary O2 sensor voltage	>1.08V	dew point exeeded at primary O2 sensor *	TRUE	5 sec.	Monitor runs	2 trips
					primary sensor heating active *	TRUE		whenever enable	with: 0.4 sec
					heating power primary O2 sensor	> 80 %		conditions are met	continuous
					for more than	10 sec.			or 4 sec cum
					desired A/F ratio	> 0.995			
					engine speed	> 680 rpm			
					battery voltage	> 10.5 V			
bank 1 sensor 1	P0134	open circuit signal or ground line	when modelled exhaust gas temperature		battery voltage	> 10.5 V	9 sec.	Monitor runs	2 trips
		primary O2 sensor	at primary O2 sensor	< 800 °C	dew point exeeded at primary O2 sensor *	TRUE		whenever enable	with: 0.4 sec

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
			primary O2 sensor voltage in a range	0.4 … 0.6 V	for more than	30 sec.		conditions are met	continuous
				(USDBO, USREF)	air passed at primary O2 sensor	2200g			or 4 sec cum
					for more than	10 sec.			
			when modelled exhaust gas temperature		engine running	> 680 rpm			
			at primary O2 sensor	> 800 °C					
			primary O2 sensor voltage in a range	0.4 … 0.55 V(USDBO,USREFHOT)					
bank 1 sensor 1	P0134	open circuit signal or ground line	internal resistance of the				0.1 sec.	Monitor runs	2 trips
		primary O2 sensor	primary O2 sensor	> 20.000 Ohms	battery voltage	> 10.5 V		whenever enable	with: 0.4 sec
					dew point exeeded at primary O2 sensor *	TRUE		conditions are met	continuous
					for more than	30 sec.			or 4 sec cum
					air passed at primary O2 sensor	2200g			
					for more than	10 sec.			
					engine running	> 680 rpm			
					modelled exhaust gas temperature	> 600 °C			
bank 1 sensor 1	P0130	heater coupling to the signal	primary O2 sensor voltage in range of	0.06 … 0.4 V	battery voltage	> 10.5 V	10 sec.	Monitor runs	2 trips
		primary O2 sensor	(USMIN, USREMH)		dew point exeeded at primary O2 sensor *	TRUE		whenever enable	with: 0.4 sec
					for more than	30 sec.		conditions are met	continuous
					air passed at primary O2 sensor	2200g			or 4 sec cum
					for more than	10 sec.			
					engine running	> 680 rpm			
					fuel system status (primary O2 sensor)	closed loop			
					secundary air system *	inactive			
					error: secondary air system (P0411,P0418,P2258,P2257, P2431-P2433)	not set			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
					Fuel evaporative system monitoring (during engine run)	inactive			
					secondary O2 sensor voltage	> 0.5 V			
					air passed at primary O2 sensor	2200g			
	P0130	heater coupling to the signal	primary O2 sensor voltage in range of	0.6 … 1.08 V	battery voltage	> 10.5 V	10 sec.	Monitor runs	2 trips
		primary O2 sensor	(USREFHKLT, USMAX)		dew point exeeded at primary O2 sensor *	TRUE		whenever enable	with: 0.4 sec
					for more than	30 sec.		conditions are met	continuous
					air passed at primary O2 sensor	2200g			or 4 sec cum
					for more than	10 sec.			
					engine running	> 680 rpm			
					fuel system status (primary O2 sensor)	closed loop			
					secondary O2 sensor voltage	< 0.1 V			
	P0130	heater coupling to the signal	primary O2 sensor voltage	> 2.0 V	dew point exeeded at primary O2 sensor *	TRUE	25 sec.	Monitor runs	2 trips
		primary O2 sensor	within time after heater turn on	<0.04sec	for more than	10 sec.		whenever enable	with: 0.4 sec
			for occurrences	> 4	heating power primary O2 sensor	> 80 %		conditions are met	continuous
			out of heater turn ons	= 6	for more than	10 sec.			or 4 sec cum
					engine running	> 680 rpm			
					battery voltage	> 10.5 V			
Oxgen sensor (primary O2) bank 1 sensor 1	P0133	dynamic response	time of lambda period		fuel system status (primary O2 sensor)	closed loop	10 lambda period	Monitor runs	2 trips
		slow or low amplitude	corrected and weighted over		lambda controller	0.95 - 1.05	measurements	whenever enable	with: 0.4 sec
			engine speed and load	> 3 sec.	engine speed in a range of (NTPKTU, NTPKTO)	1200 … 3000 rpm		conditions are met	continuous
					engine load in a range of	18 … 79.5 %			or 4 sec cum
					modelled exhaust gas temperature	> 300 °C			
					purge not longer active than	4 sec.			
					secondary air system *	inactive			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
					error: fuel system trim rich or lean (P2177,P2178,P2187,P2188)	not set			
					Fuel evaporative system monitoring (during engine run)	inactive			
					Adaption of purge mass	< 25			
					error: camshaft system *	not set			
Oxgen sensor (primary O2) bank 1 sensor 1	P2097	offset check enrichment	adaption value		fuel system status (secondary O2 sensor)	closed loop	60 sec.	Monitor runs whenever enable conditions are met	2 trips with: 0.4 sec continuous or 4 sec cum
			closed loop secondary lambda control	> 0.79 sec.	secondary air system *	inactive			
			after an acummulated monitoring time of	> 60 sec.	error: fuel system trim rich or lean (P2177,P2178,P2187,P2188)	not set			
					Fuel evaporative system monitoring (during engine run)	inactive			
					Adaption of purge mass	< 25			
					error: camshaft system *	not set			
	P2096	offset check enleanment	adaption value		fuel system status (secondary O2 sensor)	closed loop			
			closed loop secondary lambda control	< - 0.79 sec.	secondary air system *	inactive			
			after an acummulated monitoring time of	> 60 sec.	error: fuel system trim rich or lean (P2177,P2178,P2187,P2188)	not set			
					Fuel evaporative system monitoring (during engine run)	inactive			
					Adaption of purge mass	< 25			
					error: camshaft system *	not set			
Oxygen Sensor Heating heater performance (primary O2) bank 1 sensor 1 (primary)	P0135	primary O2 sensor internal resistance above threshold	measured primary O2 sensor internal resistance	>88 . . . 328Ohms (KFRINV)	battery voltage	>10.5V	6 sec	continuous	2 trips with: 0.4 sec continuous or 4 sec cum
					battery voltage	<18V			
			nominal internal resistance		engine running	> 680 rpm			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
			multipy times degradation factor	>3 . . . 20factor	fuel system status	no fuel cut			
				(FRINV1)	dew point exeeded at primary O2 sensor	TRUE			
			for time	>6sec	intake air temperature	>-30°C			
					engine off soak time	>120sec			
					modeled exhaust temp. at primary O2 sensor	in range 300 . . . 550C (TADHMNV, TADHMXV)			
					error: primary O2 sensor electrical (P0130-P0134)	not set			
Oxygen Sensor sensor circuit (secondary O2)									
bank 1 sensor 2	P0137	short circuit to ground	secondary O2 sensor voltage	<0.06V	secondary O2 heated	> 10sec	40 sec.	Monitor runs	2 trips
			with a demandet lambda value	<= 1.005	and mod. exhaust gas temp. (dew point exceeded)	>250° C		whenever enable	with: 0.4 sec
					for time	>90sec		conditions are met	continuous
					engine running	> 680 rpm			or 4 sec cum
					battery voltage	>10.7V			
					mod. exhaust-gas temp.	<800° C			
					engine temp at stop	>60° C			
					engine coolant temperature	<40° C			
					error: engine coolant temperature sensor (P0116-P0119)	not set			
bank 1 sensor 2	P0138	short circuit to battery voltage	secondary O2 sensor voltage >	>1.08V	secondary O2 heated	> 10sec	5 sec	Monitor runs	2 trips
					and mod. exhaust gas temp. (dew point exceeded)	>250° C		whenever enable	with: 0.4 sec
					for time	>90sec		conditions are met	continuous
					engine running	> 680 rpm			or 4 sec cum
					battery voltage	>10.7V			
					mod. exhaust-gas temp.	<800° C			
bank 1 sensor 2	P0140	sensor line disconnection	secondary O2 sensor voltage	>0.401V	secondary O2 heated	> 10sec	max 150 sec	Monitor runs	2 trips

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
			and secondary O2 sensor voltage	<0.499V	and mod. exhaust gas temp. (dew point exceeded)	>250° C		whenever enable conditions are met	with: 0.4 sec continuous
					for time	>90sec			
					engine running	> 680 rpm			or 4 sec cum
			or						
			secondary O2 sensor internal resistance	>40000Ohm	battery voltage	>10.7V			
			when modeled exhaust gas temperature	>600° C	mod. exhaust-gas temp.	<800° C			
bank 1 sensor 2	P2232	sensor line short circuit	secondary O2 sensor	> 2 V	dew point exeeded at primary O2 sensor *	TRUE	10 sec	Monitor runs whenever enable conditions are met	2 trips with: 0.4 sec continuous
		to heater output line	within time after heater turn on	<0.04sec	for more than	20 sec.			
			for occurrences	>4count	heating power primary O2 sensor	> 50 %			or 4 sec cum
			out of heater turn offs	=6count	for more than	20 sec.			
					engine running	> 680 rpm			
					battery voltage	> 10.5 V			
Oxygen Sensor Heating heater performance (secondary O2) bank 1 sensor 2 (secondary)	P0141	secondary O2 sensor internal resistance above threshold	measured secondary O2 sensor internal resistance nominal internal resistance	>120 . . . 560Ohms (KFRINH)	battery voltage	>10.7V	6 sec	Monitor runs whenever enable conditions are met	2 trips with: 0.4 sec continuous or 4 sec cum
					battery voltage	<18V			
					engine running	> 680 rpm			
			multipy times degradation factor	>4 . . . 30factor (FRINH1)	fuel system status	no fuel cut			
					dew point exeeded at secondary O2 sensor *	TRUE			
			for time	>6sec	intake air temperature	>-30°C			
					engine off soak time	>150sec			
					modeled exhaust temp.	350 . . . 550C (TADHMNH, TADHMXH)			
					at secondary O2 sensor error: secondary O2 sensor electrical (P0137,P0138,P0140,P2232)	not set			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
sensor response (secondary O2)									
bank 1 sensor 2	P2270	oscillation check low	secondary O2 sensor voltage	>0.602 . . . 0.621V	dew point exeeded at secondary O2 sensor *	TRUE	max.	Monitor runs	2 trips
			for time	> 0.2 sec	for time	>10sec	600 sec	whenever enable	with: 0.4 sec
			then		fuel system status (secondary O2 sensor)	closed loop		conditions are met	continuous
			ramping in enrichment by	= 0.15 lambda	all injectors activated	> 0.8 ms			or 4 sec cum
			at gradient	0.0488 l / sec	engine air flow (intrusive test)	>5,56 g/sec			
			for time (after enrichment limit reached)	>7 sec	and engine air flow	<41,6 g/sec			
					for time	>3sec			
					engine air flow (passive monitor)	>7,78 g/sec			
					error: secondary O2 sensor electrical (P0137,P0138,P0140,P2232)	not set			
					lambda controller	0.92 … 1.07			
					engine running	> 680 rpm			
					battery voltage	>10.7V			
bank 1 sensor 2	P2271	oscillation check high	secondary O2 sensor voltage	>0.602 . . . 0.621V	dew point exeeded at secondary O2 sensor *	TRUE	max.	Monitor runs	2 trips
			for time	> 0.2 sec	for time	>10sec	600 sec	whenever enable	with: 0.4 sec
			then		fuel system status (secondary O2 sensor)	closed loop		conditions are met	continuous
			ramping in enleanment by	=0.10lambda	all injectors activated	> 0.8 ms			or 4 sec cum
			at gradient	0.0488 l / sec	engine air flow (intrusive test)	>5,56 g/sec			
			for time (after enleanment limit reached)	>7 sec	and engine air flow	<41,6 g/sec			
					for time	>3sec			
					engine air flow (passive monitor)	>7,78 g/sec			
					error: secondary O2 sensor electrical (P0137,P0138,P0140,P2232)	not set			
					lambda controller	0.92 … 1.07			
					engine running	> 680 rpm			
					battery voltage	>10.7V			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
bank 1 sensor 2	P2271	fuel cut off check high	secondary O2 sensor voltage	>0.149V	dew point exeeded at secondary O2 sensor *	TRUE	0.2 sec	Monitor runs	2 trips
			time after fuel cut off	>6,2sec	for time	>30sec		whenever enable	with: 0.4 sec
					air passed after fuel cut off	>15g		conditions are met	continuous
					modeled exhaust temp	>350° C			or 4 sec cum
					at secondary O2 sensor				
					dew point exeeded at primary O2 sensor *	TRUE			
					primary O2 sensor voltage	< 0.149 V			
					error: cam sensor *	not set			
					error: evap canister purge sys. *	not set			
					error: evap purge valve electrical (P0443, P0458, P0459)	not set			
					error: battery voltage	not set			
bank 1 sensor 2	P013A	fuel cut off check transient time	secondary O2 sensor time	> 0.15 sec	air passed after fuel cut off	< 3 g	0.15 sec	Monitor runs	1 trip
			for voltage drop from	0.4 V	bank 1 sensor 2 voltage	> 0,5 V		whenever enable	with: 0.4 sec
			to	0.2 V	for time	> 1 sec		conditions are met	continuous
					at fuel cut off				or 4 sec cum
					dew point exeeded at secondary O2 sensor *	TRUE			
					dew point exeeded at primary O2 sensor *	TRUE			
					modeled exhaust temp	> 450° C			
					air flow over catalyst	> 4.17 g/sec			
					engine speed in range	1100 - 3300 rpm			
					engine load in range	10 - 30 %			
					battery voltage	> 11,0V			
bank 1 sensor 2	P013E	fuel cut off check response time	secondary O2 sensor voltage	> 0.152 V	air passed after fuel cut off	< 3 g	5 sec	Monitor runs	1 trip
			time after fuel cut off	> 5 sec.	bank 1 sensor 2 voltage	> 0,5 V		whenever enable	with: 0.4 sec

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
					for time	> 1 sec		conditions are met	continuous
					at fuel cut off				or 4 sec cum
					dew point exeeded at secondary O2 sensor *	TRUE			
					dew point exeeded at primary O2 sensor *	TRUE			
					modeled exhaust temp	> 450° C			
					air flow over catalyst	> 4.17 g/sec			
					engine speed in range	1100 - 3300 rpm			
					engine load in range	10 - 30 %			
					battery voltage	> 11,0V			
Camshaft Control System - Locking Pin									2 trips
Bank 1 Intake	P0011	rationality high	average of actual angle measurements	> +/- 10degrees	engine speed	>560rpm	10 sec	0.01 sec	with: 0.4 sec
Bank 2 Intake	P0021		versus locked position angle		engine run time	< 1 sec.			continuous
Bank 1 Exhaust	P0014				camshaft control circuit test	complete			or 4 sec cum
Bank 2 Exhaust	P0024				error: camshaft control circuit *	not set			
System - Control		rationality low / high	difference to start test (filtered actual	> 6 . . . 11 degrees (intake)	engine speed	>560rpm	approx.	0.01 sec	2 trips
Bank 1 Intake	P000A		angle versus filtered desired angle)	(KFDWNWDMXE)	engine run time	> 1sec	20 … 80 sec	continuous	with: 0.4 sec
Bank 2 Intake	P000C		(desired must remain above value	> 6 . . . 9 degrees (exhaust)	camshaft control circuit test	complete	depending on drive pattern		continuous

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
Bank 1 Exhaust	P000B		to test to complete the evaluation)	(KFDWNWDMXA)	error: camshaft control circuit *	not set			or 4 sec cum
Bank 2 Exhaust	P000D			< 6 . . . 11 degrees (intake)	coolant temperature	< 143° C			
			filtered actual angle remains						
			filtered desired angle from test start	< 6 . . . 9 degrees (exhaust)	coolant temperature	>-48° C			
			within time	= 1.5 … 2 sec (exhaust)	engine oil temperature	< 180° C			
			(detects 5 sec slow [time constant])	(KFTDDNWNPA)	engine oil temperature	>-48° C			
				= 1.2 … 2 sec (intake)	cam-crank alignment adaptation	complete			
				(KFTDDNWNPE)	catalyst heating *	inactive			
			for multiple activation occurrences	>7 counts (exhaust)					
			(decrements upon activations where no difference is seen between desired and actual)	>8 counts (intake)					
			difference (filtered actual angle max versus actual at test start) (to detect slow response versus stuck cam if above this limit)	>2degrees exh 1.8degrees in					
			at time (overlaps with time to detect above)	=3sec					
			(passes after multiple good activations in both cam phase rotation directions)						
System Control CSERS									

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
Bank 1 Intake	P052B		differnce between desired and		engine speed	>560rpm	10 sec	0.01 sec	2 trips
Bank 2 Intake	P052D		actual camshaft angle	> 0°	engine run time	>1sec		continuous	with: 0.4 sec
Bank 1 Exhaust	P054B		for time		camshaft control circuit test	complete			continuous
Bank 2 Exhaust	P054D				error: camshaft control circuit *	not set			or 4 sec cum
					coolant temperature	< 143° C			
					coolant temperature	>-48° C			
					engine oil temperature	< 180° C			
					engine oil temperature	>-48° C			
					cam-crank alignment adaptation	complete			
					catalyst heating *	active			
System - Cam - Crank Alignment									
Bank 1 Intake	P0016	cam-crank adapted angle	adapted angle	> 10.8 degrees	engine run time >	>2sec	approx.	0.2 sec	2 trips
Bank 2 Intake	P0018	limit chekc	or adapted angle	< -12.7 degrees	offset between camshaft and crankshaft	< 1 °	600 sec	continuous	with: 0.4 sec
Bank 1 Exhaust	P0017	(applies for each camshaft)	or actual angle with parked cams	> 15 degrees	error: camshaft sensor (P0011,P021,P014,P024,P000A-P000D)	not set			continuous
Bank 2 Exhaust	P0019		and	< 21 degrees	error: camshaft control circuit *	not set	fail after		or 4 sec cum
			for a time	> 10 sec.			2 adaptation cycles - required		
Bank 1 / Idler Sprocket	P0008		adapted angle for both cams	> 6.7 degrees					
Bank 2 / Idler Sprocket	P0009		adapted angle for both cams	< -7.9 degrees					
Engine coolant temperature sensor	P0117	range check high	coolant temperature	>142.5°C	intake air temperature difference between intake air temp and intake air temp. at engine shut down last driving cycle	< 75°C < 20…9°C	0.1 sec	continous	2 trips with: 0.4 sec continuous

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
	P0118	range check low	coolant temperature	<-38.3° C	error: engine coolant temperature sensor (P0116-P0119)	not set			or 4 sec cum
					or time after engine start	>=60sec			
	P0116	plausibility check (low side check)	calculated coolant temperature model		error: engine coolant temperature sensor (P0116-P0119)	not set	3 sec.	once per trip	2 trips
			minus measured temperature	>9.8° C	measured coolant temperature	<93.8° C			with: 0.4 sec
					engine speed	>1000rpm			continuous
					integrated air mass	>1500g			or 4 sec cum
		plausibility check (high side check)	measured temperature	>9.8°C	error: engine speed sensor (P0335, P0336, P0338)	not set			
			minus calculated coolant temperature model		error: air mass flow sensor (P0100-P0103)	not set			
					error: engine coolant temperature sensor (P0116-P0119)	not set			
	P0119	intermittent (discontinuity)	delta coolant temperature	< -10°C	ignition	=ON	0,03 sec.	continuous	2 trips
			or						with: 0.4 sec
			delta coolant temperature	> 10°C					continuous
			(between A/D read sample count offset)	=3count					or 4 sec cum
	P050C	difference from intake air	filtered difference		time after engine start	>= 5 sec	0.1 sec.	continuous	1 trip
		temperature after soaking	(ECT at key on - IAT at key on)	>10°C	previous accumulated air mass	>4000g			with: 0.4 sec
					previous engine run time	>500sec			continuous
					ECT at shut down	>84.75° C			or 4 sec cum
			or		coolant temp. calculated out of model	<=50.3°C			
			filtered difference (ECT at key on - IAT at key on)	<-10° C	engine off time	>21600sec			
					error: intake air temperature (P0111-P0114)	not set			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
					error: range check coolant temperature sensor (P0117,P0118)	not set			
					Block Heater	not detected			
Engine Coolant Thermostat Monitoring	P0128	Coolant Temperature Below Thermostat Regulating Temperature (plausibility check)	calculated coolant temp model minus measured coolant temperature	>5.3° C	debouncing time	>10 sec	approx. 900 sec	once per trip	2 trips with: 0.4 sec continuous
					error: coolant temperature sensor (P0116-P0119,P050C)	not set			
					error: vehicle speed sensor (P0501-P0503)	not set			
			model calculation limit	82°C	est. ambient temperature	> -8.3°C			or 4 sec cum
			Thermostat regulating temperature: 82°C (All critical OBD and emission functions are enabled above 64°C.)		est. ambient temperature	<50°C			
					vehicle speed	>=3.125mph			
					engine speed	>960rpm			
					coolant temperature at start	< 51.0°C			
					integrated air mass flow	>3458g			
					time after start to run the model (depending on engine coolant temp at start)	>= 22…16 sec (TWADTHMS)			
Intake air temperature sensor	P0111	response check	difference: max intake air temperature - min intake air temperature	>1,5° C	DRIVE PERIOD - COUNT		5 x 9 sec.	Monitor runs whenever enable conditions are met	2 trips with: 0.4 sec continuous
					EACH WITH:				
					vehicle speed	>=24,8mph			or 4 sec cum
					mass flow	<250g / sec			
					mass flow	>15,6 g/sec			
					coolant temperature at start	<=120° C			
					no fuel shut-off				
					AND				
					IDLE PERIOD - COUNT		5 x 11 sec.		
					vehicle speed	<=1.55mph			
					coolant temperature at start	<=120° C			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
					coolant temperature integrated air mass increases (KLTFA1ML)	>75° C > 4000 . . . 15000 g			
	P0111	Difference from coolant temperature sensor	difference: intake air temperature - engine	>+35,3°C	engine temperaure at start	<35,3°C	300 sec. after start	once per trip	2 trips
			coolant temperature	or	coolcant temperature decrease since		(block heater delay)		with: 0.4 sec
				<-20,3°C	engine stall	> 39,8°C			continuous
					minimum coolant temperature				or 4 sec cum
					at engine stall last trip	>80°C			
	P0112	range check low	intake air temperature	>124,9° C	time after start	> 15sec	0.1 sec.	once per trip	2 trips
	P0113	range check high	intake air temperature	<-34,9° C	then time in idle	>3sec			with: 0.4 sec
					and intake air temperature	<-35.3° C			continuous
					then | IAT change | (abs value)	<=2.3° C			or 4 sec cum
					while integrated air mass increases	>=0g			
	P0114	out of range check (Jump check)	difference: sensor signal - low pass filtered sensor signal	> + / - 0.55 V	IGNITION	=ON	5 sec.	continous	2 trips
			for a time	> 5 sec.					
Mass air flow sensor	P0101	plausibility check low	mass air flow	<0 . . . 190g/sec	**general enabling conditions**		2 sec	Monitor runs whenever enable conditions are met	2 trips
		plausibility check high	mass air flow	>7 . . . 390 g/sec	battery voltage	>10.5V			with: 0.4 sec
					time after start	>0.3sec			continuous
					crankshaft revolution counter	>150rev			or 4 sec cum
					error: throttle position sensor (P0121-P0123,P0221-P0223)	not set			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
					error: intake air temperature (P0111-P0114)	not set			
					error: preassure sensor in front of throttle plate (P236-P238)	not set			
					error: camshaft control *	not set			
					error: power stage throttle actuator (P2100-P2103)	not set			
					error: ambient prassure (P2227-P2229)	not set			
					error: electrical failure air flow sensor (P100,P102,P103)	not set			
					error: canister purge valve (P0443,P0458,P0459,P0496,P0497)	not set			
		or fuel trim exceeded a max range limit (multiplicative)	or delta lambda correction (1 - fuel trim factor)	>0.12					
		and correction factor (ratio modeled air mass at throttle to air mass measured by air mass flow meter)	and correction factor air mass	<0.85	**special enabling conditions** multiplicative fuel trim adaption integrator deviation	< 0.015			
					for time	6 sec.			
		or fuel trim exceeded a min range limit (multiplicative)	or delta lambda correction (1 - fuel trim factor)	<-0.12	lambda controller deviation ratio: manifold pressure to pressure in front of throttle	< 0.03 < 1			
		and correction factor (ratio modeled air mass at throttle	and correction factor air mass	>1,15	time after start coolant temperature	>1 sec >9°C			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
		to air mass measured by air mass flow meter)							
	P0101	PCV detection in front of TC correction factor (ratio modeled air mass at throttle to air mass measured by air mass flow meter)	2nd correction factor air mass (higher load - boost)	< 0.869	**special enabling conditions** multiplicative fuel trim adaption integrator deviation for time lambda controller deviation ratio: manifold pressure to pressure in front of throttle time after start coolant temperature throttle position throttle position	< 0.015 6 sec. < 0.03 < 1 >1 sec >9°C > 30% < 41%			
	P0100	circuit check (short circuit)	duty cylce	0	battery voltage key on	>7.5V > 0.2 sec	0.2 sec	continous	2 trips with: 0.4 sec
	P0102	circiut check (unsound contact with high frequency)	duty cylce	<32us					continuous or 4 sec cum
	P0103	circiut check (unsound contact with low frequency)	duty cylce	>910us					
pressure sensor upstream throttle valve	P0238	cirtcuit continuity - high or open	measured sensor voltage	> 4.88 V	engine speed	> 25 rpm	0.5 sec	continuous	2 trips

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
	P0237	cirtcuit continuity - low	measured sensor voltage	< 0.45 V					
	P0238	range check - high	measured pressure	> 300 kPa			2 sec		
	P0237	range check - low	measured pressure	< 50 kPa					
	P0236	rationality high - comparsion between measured pressure and measured ambient pressure	diefference measured press. (incl. tolerance) minus measured ambient pressure (inc. tolerance)	> 0 hPa	engine speed throttle position error: ambient pressure sensor (rationality) (P2227-P2229) error: ambient pressure sensor (electrical) (P2228,P2229) error: pressure sensor upstream throttle plate (electrical) (P0237,P0238) error: throttle position sensor (P0121-P0123,P0221-P0223)	< 1120 rpm < 10% not set not set not set not set	6 sec	Monitor runs whenever enable conditions are met	2 trips
		rationality low - comparsion between measured pressure and measured ambient pressure	diefference measured press. (incl. tolerance) minus measured ambient pressure (inc. tolerance)	< 0hPa					

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
Boost pressure control	P0299	comparison between desired boost pressure and current boost pressure	difference (positive) between set-point boost pressure and measured boost pressure	270 hPa	boost pressure control engine speed (NDLDRAPU) atmospheric pressure error: boost pressure sensor(P0236/P0237/P0238) error: throttle control unit (P0121-P0123,P0221-P0223,P2100-P2103) error: air mass flow sensor (P0100-P0103) difference between desired boost pressure - pressure before throttle (ambient pressure minus pressure loss of intake)	active > 2120 … 3720 rpm > 66 kPa not set not set not set > 0	6 sec	continuous	2 trips
			(boost pressure too low)						
	P0234	comparison between desired boost pressure and current boost pressure	difference (negative) between set-point boost pressure and measured boost pressure	> 220 … 1466 hPa (KLDLUL)	error: boost pressure sensor(P0236/P0237/P0238)	not set	1.2 s	continuous	2 trips
			or						
		max check	measured boost pressure	> 2200 …. 2560 hPa (KLMXDLDR)	intake air temperature	< +30°C	0,30 s	continuous	2 trips
			(boost pressure too high)						
Dump valve	P2261	counting of increased pulsation in the intake manifold	normalized difference between measured MAF sensor value and	>0,5	intake air temperature error: intake air temperature (P0111-P0114)	> 15 °C not set	0.48 sec	Monitor runs whenever enable	2 trips

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
			modeled value		error: air mass flow sensor (P0101)	not set		conditions are met	
		(increased pulsation may occure							
		when dump valve is jammed	for		conditions for an active supervision phase are				
		in closed position)	number of times	> 9 counts	Rel. load gradient	< 0%			
					- ratio of pressure in front of throttle valve to minimum pressure after air filter	> 1.05 to 3.12			
					- dump valve is active	TRUE			
Barometric Pressure Sensor	P2227	rationality	diefference measured press. (incl. tolerance)	> 0 hPa	error: pressure sensor in front of throttle (P0236-P0238)	not set	9 sec	Monitor runs	2 trips
(ambient air pressure sensor)		signal discontinuity			error: ambient pressure sensor (electrical) (P2228, P2229)	not set		whenever enable	with: 0.4 sec
			minus pressure in front of throttle (inc. tolerance)		throttle angle	< 10%		conditions are met	continuous
			or		engine speed	< 1120rpm			or 4 sec cum
			diefference measured press. (incl. tolerance) minus pressure in front of throttle (inc. tolerance)	< 0hPa					
			barometric pressure jump in a curtain time	> 5kPa	difference at start: actual pressure to prassure at last key off	> 10kPa	20 sec	Monitor runs	2 trips
				< 5kPa	error: air mass flow sensor (P0100-P0103)	not set		whenever enable	with: 0.4 sec
					error: intake air temperature (P0111-P0114)	not set		conditions are met	continuous
					error: pressure sensor upstream throttle (P0236-P0238)	not set			or 4 sec cum
					error: throttle position sensor (P0121-P0123,P0221-P0223)	not set			
					error: ambient pressure sensor (electrical) (P2228, P2229)	not set			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
	P2228	range check low	sensor signal sensor voltage	<45kPa < 0.2V	key on	> 0.2 sec	2 sec 0.5 sec	continous	2 trips with: 0.4 sec continuous
	P2229	range check high	sensor signal sensor voltage	>115kPa >4,8V	key on	> 0.2 sec			or 4 sec cum
Idle Speed System (disabled during cold start)	P0506	functional check	desired rpm - actual rpm	>100rpm	coolant temp.	>-11.25° C	10 sec	Monitor runs	2 trips
			and idle speed controler limit reached		intake air temp	>-11.25° C		whenever enable	with: 0.4 sec
	P0507		desired rpm - actual rpm	<-200rpm	engine speed	at idle		conditions are met	continuous
			and idle speed controler limit reached		altitude factor (sea level = 1.0)	>0.703factor			or 4 sec cum
			or		time after engine start	> 4 sec.			
			fuel cut off due to overspeed	>3count	cat heating *	inactive			
			during this idle		intrusive evap test	not active			
					vehicle speed	= 0 km/h			
					error: throttle control unit (P0121-P0123,P0221-P0223,P2100-P2103)	not set			
					error: crankshaft sensor (P0335, P0336, P0338)	not set			
Idle Speed System (enabled during cold start)	P050A	functional check	desired rpm - actual rpm	>100rpm	Engine coolant start temp.	< 69°C	5 sec	Monitor runs	2 trips
			during catalyst heating on		engine speed	at idle		whenever enable	with: 0.4 sec

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
	P050A		desired rpm - actual rpm	<-200rpm	altitude factor (sea level = 1.0)	>0.703factor		conditions are met	continuous
					time after engine start	> 100sec.			or 4 sec cum
			during catalyst heating on						
					cat heating active *	TRUE			
					intrusive evap test	not active			
					vehicle speed	= 0 km/h			
					error: throttle control unit (P0121-P0123,P0221-P0223,P2100-P2103)	not set			
					error: crankshaft sensor (P0335, P0336, P0338)	not set			
Vehicle speed sensor									
	P0503	rationality (high range check)	vehicle speed for time	> 170.87mph > 0.2 sec.			0.4 sec continuous or 4 sec	continous	2 trips with: 0.4 sec continuous
	P0501	rationality	vehicle speed minus	=0mph	vehicle speed	> 6.213 mph	cumulative		or 4 sec cum
		(stuck check)	previous vehicle speed		vehicle speed	< 317.51 mph			
					time	>10sec			
	P0501	CAN wheel speed message check	CAN wheel speed message corrupt	=corrupt					
			or missing	=missing					
	P0501	plausibility check	vehicle speed	< 3.107 mph	Fuel system status	Fuel cut		Monitor runs whenever enable conditions are met	
		during fuel cut off	engine speed (NDV, NDV0)	3000 - 1400 rpm	coolant temperature	> 64.5 °C			
			for a time	> 4 sec.					
	P0501	plausibility check	vehicle speed	< 2.485 mph	coolant temperature	> 64.5 °C			
			engine load	> 80.3 %	all injectors active	> 0,8 ms			
			for a time	> 4 sec.	engine speed	> 3520 rpm			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
Crankshaft Position Sensor	P0335	circuit continuity	no engine signal	=0rpm	camshaft revolutions detected	>12counts	approx.	0.01 sec	1 trip
			but phase signals available				5 sec	continuous	with: 0.4 sec continuous
		rationality check	reference gap missing (sensor signal but no reference)	>=6gaps	engine speed signal detected	> 1 rev			or 4 sec cum
	P0336	rationality check	unexpected re-synchronization (loss of reference mark)	>6count					
		rationality check	intermittent loss of engine speed signal	> 10 count					
	P0338	rationality check	difference in counted teeth between reference gap position events	>8teeth			approx. 2 sec	1 per rev continuous	1 trip 0.4 s cont. or 4 s cum.
Camshaft Position Sensor									
Bank 1 Intake	P0342	Circuit low	differenece between 2 workingcycles	< 1 teeth	engine in synchronized mode	TRUE	10	1 per rev	2 trips
			depending on engine speed (KLPHNOKA)	> 8 - 72 count			revolutions	continuous	
	P0343	Circuit continuity or circuit high	differenece between 2 workingcycles	> 1 teeth					
			depending on engine speed (KLPHNOKA)	> 8 - 72 count					
	P0341	Plausibility check	differenece between 2 workingcycles	> 1 or < 1 teeth					
			depending on engine speed (KLPHNOKA)	> 8 - 72 count					
	P0341	Signal check	no cam position sensor signal	> 6 count					

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
Bank 1 Exhaust	P0367	Circuit low	differenece between 2 workingcycles	< 1 teeth	engine in synchronized mode	TRUE			
			depending on engine speed (KLPHNOKA)	> 8 - 72 count					
	P0368	Circuit continuity or circuit high	differenece between 2 workingcycles	> 1 teeth					
			depending on engine speed (KLPHNOKA)	> 8 - 72 count					
	P0366	Plausibility check	differenece between 2 workingcycles	> 1 or < 1 teeth					
			depending on engine speed (KLPHNOKA)	> 8 - 72 count					
	P0366	Signal check	no cam position sensor signal	> 6 count					
Bank 2 Intake	P0347	Circuit low	differenece between 2 workingcycles	< 1 teeth	engine in synchronized mode	TRUE			
			depending on engine speed (KLPHNOKA)	> 8 - 72 count					
	P0348	Circuit continuity or circuit high	differenece between 2 workingcycles	< 1 teeth					
			depending on engine speed (KLPHNOKA)	> 8 - 72 count					
	P0346	Plausibility check	differenece between 2 workingcycles	< 1 teeth					
			depending on engine speed (KLPHNOKA)	> 8 - 72 count					
	P0346	Signal check	no cam position sensor signal	> 6 count					
Bank 2 Exhaust	P0392	Circuit low	differenece between 2 workingcycles	< 1 teeth	engine in synchronized mode	TRUE			
			depending on engine speed (KLPHNOKA)	> 8 - 72 count					
	P0393	Circuit continuity or circuit high	differenece between 2 workingcycles	> 1 teeth					
			depending on engine speed (KLPHNOKA)	> 8 - 72 count					
	P0391	Plausibility check	differenece between 2 workingcycles	> 1 or < 1 teeth					
			depending on engine speed (KLPHNOKA)	> 8 - 72 count					

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
	P0391	Signal check	no cam position sensor signal	> 6 count					
Fuel tank pressure sensor	P0450	rationality -	fuel tank pressure difference	>= 218 Pa	time after canister vent valve open	> 4 sec.	4,5	continous	2 trips
		sensor signal change within time	within	= 1 sec	vehicle speed	<= 0 mph			
		(oscillation check)	for integrated time	>= 4.5 sec	calc. ambient temperature	> -7.5 °C			
					canister purge flow (closed)	<= 0 g/sec			
					time after purge valve closes	> 0.2 sec.			
	P0451	rationality - signal range check	change of fuel tank pressure	> 1219 Pa	time after engine start	>5 sec.	20 sec.		
				< -3968 Pa	time after canister vent valve open	> 4 sec.			
					vehicle speed	> 6.25 mph			
					for time	>= 30 sec.			
					and integrated purge mass flow	>= 0.3 g			
					calculated ambient air temperature	> -7.5 °C			
					ambient pressure	> 68000 Pa			
					fuel level	< 70 l			
					fuel level	> 10 l			
		OR							
		rationality - drift check	difference between fuel tank pressure	> +/- 688 Pa	time after engine start	> 5 sec.	60 sec.		
			and fuel tank pressure at engine start		Vent solenoid valve open	TRUE			
					Caniter purge flow (closed)	<= 0 g/sec			
					ambient pressure	> 68000 Pa			
					fuel level	< 70 l			
					fuel level	> 10 l			
					Vehicle speed	> 0 mph			
					for time	>= 30 sec.			
					and integrated purge mass flow	>= 0.3 g			
					Vehicle speed	<= 0 mph			
					Canister load	< 6			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
					calculated ambient air temperature (TUMDSTDMN, TUMDSTDMX)	3.8 < … < 39.8 °C			
					difference (ECT at start - ambient temperature)	< 9.8°C			
	P0452	circuit continuity - ground	sensor voltage	< 0.1 V	Engine cranking	FALSE	10 sec	continuous	2 trips
	P0453	circuit continuity - voltage	sensor voltage	> 4.9 V					
Knock control sensor's evaluation IC Bank 1	P0327	Monitoring via knock-sensor- and cylinder-based basic reference noise	Cylinder individual signal value (UDKSNU) (depends on engine speed)	< 0.15015 - 0.29297 V	Knock control is active.	TRUE	0,3 sec	continuous	2 trips
					engine coolant tempetature	> 45 °C			
	P0328	signal (voltage).	Cylinder individual signal value (UDKSNO) (depends on engine speed)	> 5 .. 18,6 V	engine load (lower treshold)	35 - 65 %			
					Engine speed for strong signals.	> 2000 rpm			
					Engine speed for weak signals.	> 2000rpm			
	P0326	non plausible signal		> 25 counts	Error: Camshaft sensor (during engine start)	not set			
					Engine speed gradient at a working cycle (NGKRWN)	< 1400 … 3700 1/min*sec.			
					delta partial pressure (10 ms grid) in manifold (KFDYESPF)	< 20 … 35 hPa			
					Error: knock-control circuit (P0324)	not set			
					error: crankshaft sensor (P0335, P0336, P0338)	not set			
Bank 2	P0332	Monitoring via knock-sensor- and cylinder-based basic reference noise	Cylinder individual signal value (UDKSNU) (depends on engine speed)	< 0.15015 - 0.29297 V	Knock control is active.	TRUE	0,3 sec	continuous	2 trips
					engine coolant tempetature	> 45 °C			
	P0333	signal (voltage).	Cylinder individual signal value (UDKSNO)	> 5 .. 18,6 V	engine load (lower treshold)	35 - 65 %			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
			(depends on engine speed)		Engine speed for strong signals.	> 2000 rpm			
					Engine speed for weak signals.	> 2000 rpm			
	P0331	non plausible signal		> 25 counts	Error: Camshaft sensor (during engine start)	not set			
					Engine speed gradient at a working cycle (NGKRWN)	< 1400 … 3700 1/min*sec.			
					delta partial pressure (10 ms grid) in manifold (KFDYESPF)	< 20 … 35 hPa			
					Error: knock-control circuit (P0324)	not set			
					error: crankshaft sensor (P0335, P0336, P0338)	not set			
Knock control sensor's evaluation IC	P0324	Parity Check	number of counts	> 5 counts	knock control active	TRUE	250 working	Zero and	2 trips
		monitoring of the coefficient RAM of the IC	out of	600	Engine speed gradient at a working cycle (NGKRWN)	< 1400 … 3700 1/min*sec.	cylces	Test pulse	
			combustions events		delta partial pressure (10 ms grid) in manifold	< 20 … 35 hPa		alternate every 250 working cycles.	
					error suspicison: knock control test pulse (P0324)	not set			
					engine speed	> 2000 rpm			
	P0324	Response to Zero Pulse monitor IC's integrator gradient	integrator gradient	< 200 V/s	same as for IC integrator's offset monitoring				
	P0324	Response to Test Pulse integrator value check	integrator value of test pulse	< 4.0 V					
					coolant temperature	> 45 °C			
					Engine speed gradient at a working cycle (NGKRWN)	< 1400 … 3700 1/min*sec.			
					delta partial pressure (10 ms grid) in manifold (KFDYESPF)	< 20 … 35 hPa			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
					error suspicison: knock control zero test (P0324)	not set			
fuel injector cylinder #1	P0201	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	2 trips
	P0261	circuit continuity - ground			battery voltage	> 9,99 V			
	P0262	circuit continuity - voltage			battery voltage	< 17,90 V			
cylinder #2	P0202	circuit continuity - open			output activated and				
	P0264	circuit continuity - ground			deactivated for complete				
	P0265	circuit continuity - voltage			checking	TRUE			
cylinder #3	P0203	circuit continuity - open							
	P0267	circuit continuity - ground							
	P0268	circuit continuity - voltage							
cylinder #4	P0204	circuit continuity - open							
	P0270	circuit continuity - ground							
	P0271	circuit continuity - voltage							
cylinder #5	P0205	circuit continuity - open							
	P0273	circuit continuity - ground							
	P0274	circuit continuity - voltage							
cylinder #6	P0206	circuit continuity - open							
	P0276	circuit continuity - ground							
	P0277	circuit continuity - voltage							

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
canister ventilation valve	P0449	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	2 trips
	P0498	circuit continuity - ground			battery voltage	> 9,99 V			
	P0499	circuit continuity - voltage			battery voltage	< 17,90 V			
					output activated and deactivated for complete checking	TRUE			
canister purge valve	P0443	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	2 trips
	P0458	circuit continuity - ground			battery voltage	> 9,99 V			
	P0459	circuit continuity - voltage			battery voltage	< 17,90 V			
					output activated and deactivated for complete checking	TRUE			
upstream oxygen sensor heater Bank #1	P0030	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	2 trips
	P0031	circuit continuity - ground			battery voltage	> 9,99 V			
	P0032	circuit continuity - voltage			battery voltage	< 17,90 V			
					output activated and deactivated for complete checking	TRUE			
downstream oxygen sensor heater Bank #1	P0036	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	2 trips
	P0037	circuit continuity - ground			battery voltage	> 9,99 V			
	P0038	circuit continuity - voltage			battery voltage	< 17,90 V			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
					output activated and deactivated for complete checking	TRUE			
secondary air pump	P2258	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	2 trips
	P2257	circuit continuity - ground			battery voltage	> 9,99 V			
	P0418	circuit continuity - voltage			battery voltage	< 17,90 V			
					output activated and deactivated for complete checking	TRUE			
intake camshaft control									
Intake Bank #1	P0010	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	2 trips
	P2088	circuit continuity - ground			battery voltage	> 9,99 V			with: 0.4 sec
	P2089	circuit continuity - voltage			battery voltage	< 17,99 V			continuous
Intake Bank #2	P0020	circuit continuity - open			output activated and				or 4 sec cum
	P2092	circuit continuity - ground			deactivated for complete				
	P2093	circuit continuity - voltage			checking	TRUE			
exhaust camshaft control	P0013	circuit continuity - open							
Exhaust Bank #1	P2090	circuit continuity - ground							
	P2091	circuit continuity - voltage							
Exhaust Bank #2	P0023	circuit continuity - open							
	P2094	circuit continuity - ground							
	P2095	circuit continuity - voltage							

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
Dump valve turbo	P0033	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	2 trips
	P0034	circuit continuity - ground			battery voltage	> 9,99 V			
	P0035	circuit continuity - voltage			battery voltage	< 17,90 V			
					output activated and deactivated for complete checking	TRUE			
Boost control valve	P0244	circuit continuity - open	Voltage	IC internal	engine speed	> 80 rpm	immediately	continuous	2 trips
	P0245	circuit continuity - ground			battery voltage	> 9,99 V			
	P0246	circuit continuity - voltage			battery voltage	< 17,90 V			
					output activated and deactivated for complete checking	TRUE			
Ignition Coil circuit continuity									
Cylinder #1	P0351	circuit continuity - open or signal not plausible	Voltage > during or minimum two fault counters	>2 sec	engine speed	> 400rpm	approx.	engine	2 trips
					engine speed	<5000rpm	1 sec	cycle	with: 0.4 sec
	P2300	circuit continuity - ground	Voltage > during	>2 sec	battery voltage	>10V		frequency	continuous
	P2301	circuit continuity - voltage	Voltage > during	>2 sec	battery voltage	<18V			or 4 sec cum
Cylinder #2	P0352	circuit continuity - open or signal not plausible	Voltage > during or minimum two fault counters	>2 sec				continuous	
	P2303	circuit continuity - ground	Voltage > during	>2 sec					
	P2304	circuit continuity - voltage	Voltage > during	>2 sec					

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
Cylinder #3	P0353	circuit continuity - open	Voltage > during or minimum two fault counters	>2 sec					
	P2306	circuit continuity - ground	Voltage > during	>2 sec					
	P2307	circuit continuity - voltage	Voltage > during	>2 sec					
Cylinder #4	P0354	circuit continuity - open	Voltage > during or minimum two fault counters	>2 sec					
	P2309	circuit continuity - ground	Voltage > during	>2 sec					
	P2310	circuit continuity - voltage	Voltage > during	>2 sec					
Cylinder #5	P0355	circuit continuity - open	Voltage > during or minimum two fault counters	>2 sec					
	P2312	circuit continuity - ground	Voltage > during	>2 sec					
	P2313	circuit continuity - voltage	Voltage > during	>2 sec					
Cylinder #6	P0356	circuit continuity - open	Voltage > during or minimum two fault counters	>2 sec					
	P2315	circuit continuity - ground	Voltage > during	>2 sec					
	P2316	circuit continuity - voltage	Voltage > during	>2 sec					
cold start ignition timing performance (during catalyst heating)	P050B	ignition timing efficiency to small during idle	averaged differnce between current ignition efficiency and desired ignition efficiency	> 25%	condition idle desired ignition efficiency cat heating * time delay for activation altitude factor (sea level = 1.0)	TRUE < 88% active 3 sec >0.703factor	10 sec cumulative	Monitor runs whenever enable conditions are met	2 trips

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
					engine speed deviaton	< 80rpm			
					engine load dynamic	< 5%			
					vehicle speed	= 0			
					engine load	< 80%			
					fuel system status	no fuel cut			
		ignition timing efficiency to small during part load	averaged differnce between current ignition efficiency	> 25%	condition idle	FALSE			
			and desired ignition efficiency		desired ignition efficiency	< 97%			
					cat heating *	active			
					time delay for activation	3 sec			
					altitude factor (sea level = 1.0)	>0.703factor			
					engine speed deviaton	< 80rpm			
					engine load dynamic	< 5%			
					vehicle speed	> 2 km/h			
					fuel system status	no fuel cut			
Electronic Throttle Control									
	P0638	motor control range check	| powerstage duty cycle |	>80%	battery voltage	> 8V	0.6 sec	0.01 sec	immediate
		short term	for a time	>0.6 sec.			(recoverable)	continuous	
							5.0 sec (latched)		
	P0638	motor control range check	(absolute value)	>80%	engine speed	> 400 rpm			
		long term	for a time	> 5 sec.	coolant temperature	> 5.3 °C			
					intake air temperature	> 5.3 °C			
Electronic Throttle Control									
	P1551	limp-home throttle position	throttle position	< 11.3909%	vehicle speed	<=0mph	5 sec	0.01 sec	immediate
		out of range	OR		engine speed	< 250rpm		at key on	
			throttle position	> 38.7808%	engine coolant temperature	>= 5.3° C			
					engine coolant temperature	<=84.75° C			
					intake air temperature	>= 5.3° C			
					intake air temperature	<=60° C			
					battery voltage	> 8V			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
					accelerator pedal position	<14.9%			
Electronic Throttle Control	P2100	powerstage SPI bus or signal error	output circuits not deactivated	=deactivationfault	-	---	0.1 sec	0.01 sec	immediate
	P2103	powerstage short circuit	as commanded					at key on	
	P2102	powerstage overheating or overcurrent							
	P2101	powerstage open load							
	P2101	difference between set and	difference between set and	>4 . . . 50% (DWDKSBAMX)	electronic throttle adaptation	not active	0.5 sec	0.01 sec	
		actual position of throttle blade	actual position of throttle blade	dep. on rate of change	battery voltage	> 8V		continuous	
			for a time	> 0.5 sec.					
Electronic Throttle Control	P2119	functionality of return spring	throttle blade return response	>0.56sec	vehicle speed	<=0mph	0.56 sec	0.01 sec	immediate
					engine speed	< 250rpm		at key on	
					engine coolant temperature	>= 5.3° C	once		
					engine coolant temperature	<=84.75° C	per		
					intake air temperature	>= 5.3° C	ignition		
					intake air temperature	<=60° C	on		
					battery voltage	> 8V			
					accelerator pedal position	<14.9%			
Electronic Throttle Control	P2176	throttle exchange detection	range check poti1 value at lower stop		vehicle speed	<=0mph	1 sec	0.01 sec	immediate
		learn fail	throttle potentiometer 1 voltage	< 4.102 V	engine speed	<40rpm		at key on	
		or	or		engine coolant temperature	>=5.3° C	once		
	P2176	minimum throttle position	throttle potentiometer 1 voltage	> 4.5642 V	engine coolant temperature	<=100° C	per		
		out of range			intake air temperature	>=5.3° C	ignition		
		or	range check poti2 value at lower stop		intake air temperature	<=143.3° C	on		

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
	P2176	initial throttle learn failed	throttle potentiometer 2 voltage	< 0.3369 V	battery voltage	>9.99V			
		or	or		accelerator pedal position	<14.9%			
	P2176	learning prohibited due to secondary parameters not met	throttle potentiometer 2 voltage	>1.0 V					
Throttle Position									
Sensor 1 (primary)	P0121	plausibility to model	sensor difference	>9%	engine speed	> 480 rpm		continuous	1 trip
			for a time	> 0.28 sec.	accelerator pedal (WOT)	< 48 … 100%	0.4 sec. continuous		with: 0.4 sec continuous
					vehicle speed	<=0mph			
					engine coolant temperature	>= 5.3° C			or 4 sec cum
					battery voltage	>8V			
					intake air temperature	>=5.3° C			
	P0122	range check poti voltage	sensor circuit low voltage	<0.176V	vehicle speed	<=0mph			
			for a time	> 0.14 sec	engine speed	< 250rpm			
	P0123	range check poti voltage	sensor circuit high voltage	>4.629V	engine coolant temperature	>=5.3° C			
			for a time	> 0.14 sec	intake air temperature	>= 5.3° C			
					battery voltage	>8V			
Sensor 2 (redundant)	P0221	plausibility to model	sensor difference	>9%	engine speed	> 480 rpm		continuous	1 trip
			for a time	> 0.28 sec.	accelerator pedal (WOT)	< 48 … 100%	0.4 sec. continuous		with: 0.4 sec continuous
					vehicle speed	<=0mph			
					engine coolant temperature	>= 5.3° C			or 4 sec cum
					battery voltage	>8V			
					intake air temperature	>=5.3° C			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
	P0222	range check poti voltage	sensor circuit low voltage	<0.156V	vehicle speed	<=0mph			
			for a time	> 0.14 sec	engine speed	< 250rpm			
	P0223	range check poti voltage	sensor circuit high voltage	>4.883V	engine coolant temperature	>=5.3° C			
			for a time	> 0.14 sec	intake air temperature	>= 5.3° C			
					battery voltage	>8V			
Function Monitoring of Microcontroller (PCM level 2 command check)	P0606	torque comparison	irreversible error of torque comparison (current and maximum allowed engine torque out of range)	TRUE	engine speed	>1200rpm	5sec	continuous	immediate
		engine speed comparison	irreversible error of engine speed comparison (calculated and measured engine speed out of range)	TRUE	engine speed	>1200rpm			
		accelerator pedal signal comparison	irreversible error of accelerator pedal signal comparison (synchronism between the two pedal sensors out of range)	TRUE	engine speed	>1200rpm			
		monitoring of AD converter queue	irreversible error of AD-converter queue monitoring (queue not running)	TRUE	engine speed	>1200rpm			
		check of AD-converter signal	irreversible error of AD-converter signal check (converted low voltage test impuls out of range)	TRUE	engine speed	>1200rpm			
		check of ignition timing	irreversible error of comparison of ignition timing value	TRUE	engine speed	>1200rpm			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
			(comparison of ignition timing value with its one's complement is wrong)						
		verification of engine load value	irreversible error of engine load value						
			verification	TRUE	engine speed	>1200rpm			
			(engine load value and verification value are not identical)						
		monitoring of injected fuel mass	irreversible error of fuel mass	TRUE	engine speed	>1200rpm			
			(calculated and measured requested fuel mass out of range)						
		monitoring of mixture correction factor	irreversible error of mixture correction factor	TRUE	engine speed	>1200rpm			
			(adapted fuel mixture is out of range)						
		monitoring of desired air/fuel ratio	irreversible error of air/fuel ratio	TRUE	engine speed	>1200rpm			
			(desired air/fuel ration is out of range)						
	P2105	function controller response check	monitoring module has detected a fault						
			of function controller	TRUE	engine speed	>1200rpm			
		watchdog output signal check	WDA signal activated	TRUE					
		overvoltage detection	internal supply voltage exceeded	TRUE					
ECM Monitoring	P0605	rationality check -	wrong ROM checksum	5-times	PCM after-run time of the last	TRUE	30 sec	at key off	immediate

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
		verification of ROM checksum		TRUE	driving cycle completly finished			once per trip	
	P0605	rationality check - verification of ROM checksum	wrong cyclic ROM checksum of critical regions	TRUE	partialchecksum on critcal variables		5 sec	0.04 sec continous	immediate
	P0604	writeability check of RAM	RAM read and write test failed	TRUE	PCM after-run time of the last driving cycle completly finished	TRUE	30 sec	at key off once per trip	immediate
	P0604	writeability check of RAM	cyclic RAM read and write test of critical regions failed	TRUE	power down calculation in the last driving cycle completly finished	TRUE	1 sec	0.04 sec continous	immediate
	P0603	rationality check - programming incomplete	shut down of power stages not possible	service ECU bits TRUE			0.05 sec	at key on once per trip	immediate
	P0603	writeability check of Time Processing Unit (TPU) parameter RAM	TPU parameter RAM read and write test failed	TRUE			0.05 sec	at key on once per trip	immediate
	P0603	rationality check - verification of Time Processing Unit (TPU) code RAM checksum	wrong TPU code RAM checksum	TRUE			0.3 sec	0.1 sec continous	immediate
	P0603	rationality check - time difference check	difference between Time Processing Unit time and PCM time	> 0.001 sec			0.3 sec	0.1 sec continous	immediate
Accelerator pedal position sensor	P 2123	range check high	accelerator position sensor voltage 1 for a time	> 4.824 V > 0.2 sec.	battery voltage is sufficient for 5V accelerator sensor supply	> 8V	0,4s	continuous	immediate with: 0.4 sec

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
	P 2122	range check low	accelerator sensor voltage 1	< 0.742 V	condition upper limit voilated (see max fault path of FP2P) (P2128)	FALSE			continuous
			and		condition upper limit voilated (see max fault path of FP1P) (P2123)	FALSE			or 4 sec cum
			accelerator sensor voltage 2	< 0.625 V	battery voltage is sufficient for 5V accelerator sensor supply	> 8V			
			for a time	> 0.2 sec.	error reaction accelerator-travel sensor limphome (P2127,P2128)	FALSE			
					primary conditions for absolute difference check (P2138)	TRUE			
			or						
			accelerator sensor voltage 1	< 0.742 V	error reaction accelerator-travel sensor limphome	FALSE			
			for time	> 0.2 sec	synchronization between voltages 1 and 2 violated				
					(see values of absolute difference in accelerator sensor				
					voltages depending on ranges in FP1				
					FP1P absolute difference check below	TRUE			
					high contact resistance at accelerator voltage 1	FALSE			
	P 2138	absolute difference check	absolute difference between both		condition lower limit voilated (see min fault path of FP1P) (P2122)	FALSE			
		fault time	accelerator sensor voltages in the range		condition lower limit voilated (see min fault path of FP2P) (P2127)	FALSE			
			from 1.191 V to 1.25 V	> 0.254 V	error reaction accelerator-travel sensor limphome (P2127,P2128)	FALSE			
			or		battery voltage is sufficient for 5V accelerator sensor supply	> 8V			
			absolute difference between both		condition upper limit voilated (see max fault path of FP2P) (P2128)	FALSE			
			accelerator sensor voltages in the range		condition upper limit voilated (see max fault path of FP1P) (P2123)	FALSE			
			from 1.25 V to 2.637 V	> 0.313 V					
			or						
			absolute difference between both						
			accelerator sensor voltages in the range						
			above 2.637 V	> 1.699 V					

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
			and fullfilled for the time	> 0.24 sec					
	P 2128	range check high	accelerator sensor voltage	> 4.824 V	battery voltage is sufficient for 5V accelerator sensor supply	> 8V			
		fault time	for a time	> 0.2 sec.					
	P 2127	range check low	accelerator sensor voltage 1	< 0.742 V	condition upper limit voilated (see max fault path of FP2P) (P2122)	FALSE			
			and		condition upper limit voilated (see max fault path of FP1P) (P2127)	FALSE			
			accelerator sensor voltage 2	< 0.625 V	battery voltage is sufficient for 5V accelerator sensor supply	> 8V			
			for time	> 0.2 sec.	error reaction accelerator-travel sensor limphome (P2127,P2128)	FALSE			
					primary conditions for absolute difference check (P2138)	TRUE			
			or accelerator sensor voltage 2	< 0.625 V	error reaction accelerator-travel sensor limphome (P2127,P2128)	FALSE			
			for time	> 0.2 sec	synchronization between voltages 1 and 2 violated				
					(see values of absolute difference in accelerator sensor				
					voltages depending on ranges in FP1				
					FP2P absolute difference check below)	TRUE			
					high contact resistance at accelerator voltage 1 (P2128)	FALSE			
Transmission Control Module MIL Illumination requested (Specific TCM DTC shown in freeze frame)	P0700	OBD emission fault detected by the TCM	signal input	=TCM MILFAULT	-	---	0.01 sec	0.01 sec continuous	immediate
demand controlled fuel supply	P069E	OBD emission fault	signal input	=FSCM MILFAULT	-	---	0.01 sec	0.01 sec	immediate

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
(FSCM) MIL Illumination requested		detected by the FSCM							
OBD ISO-15765 Communication Bus	U0101	Communication with TCM	TCM Message Timeout	=message	Automatic Transmission	equipped	5 sec	0.01 sec	immediate
	U0402		or Invalid Message Content	=missing, delayed, or invalid content	CAN Bus consisting of: ignition on for battery voltage battery voltage normal bus communication	initialized and ready >3sec >10V <18V running		continuous	
	U0073	ISO-15765 Bus Error	Invalid Message Received	=invalid	CAN Bus	initialized	0.5 sec	0.01 sec	immediate
			or Dual Port Ram Hardware Error; or No Communication / Bus Off	=error =bus off	consisting of: ignition on for battery voltage battery voltage normal bus communication	and ready >3sec >10V <18V running--	0.01 sec 0.03	continuous	
	U0109	Communication with FSCM	FSCM Message Timeout	=message	FSCM	equipped--	2 sec	0.01 sec	immediate
			or Invalid Message Content	=missing, delayed, or invalid content	CAN Bus consisting of: ignition on for battery voltage battery voltage normal bus communication	initialized-- and ready >3sec >10V <18V running		continuous	
Diagnosis Tuning Recognition	P160D	Engine performance identification	internal performance comparison external performance comparison (CAN)	+/- 2 kW +/- 2 kW	engine speed	TRUE	5 sec.	1 sec. continuous	immediate

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
Diagnosis of ECU programming: RPO	P160E	ECU RAM check	Diagnosis programming of Engine System Regular Production Option Identifier	IC internal	ignition on	TRUE	2 sec.	1 sec. continuous	immediate
Diagnosis of ECU programming: "Service ECU"	P0602	ECU RAM check	Codeword: calibration for service ECM	>0			4 sec.	continuous	
Diagnosis of ECU programming: "Variantcode"	P0610	ECU RAM check	variant code not programmed	IC internal			2 sec.		
Diagnosis of ECU programming: "VIN"	P0630	ECU RAM check	vehicle identification number not programmed	IC internal			2 sec.		
Fuel level sensor	P0463	fuel level sensor short circuit to battery voltage	sensor voltage	> 4.75 V	**general enabling conditions** battery voltage battery voltage	 >10V <18V	2 sec.	continuous	2 trips with: 0.4 sec continuous
	P0462	fuel level sensor short circiut to ground	sensor voltage for a time	< 0.25 V			2 sec.		or 4 sec cum
	P0461	fuel level sensor stuck	fuel level stays in a band of for a distance of	2 l	**special enabeling conditions** Error: fuel level sensor (P0461-P0463) Error: secondary fuel level sensor (P2066-P2068) error: vehicle speed sensor (P0501-P0503) engine speed	 not set not set not set > 80 rpm	239 miles		

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
Diagnosis Tank 2 - fuel level sensor	P2068	secondary fuel level sensor short circuit to battery voltage	sensor voltage	> 4.75 V	**general enabling conditions**		2 sec.	continuous	2 trips
			for a time		battery voltage	>10V			with: 0.4 sec
					battery voltage	<18V			continuous
	P2067	secondary fuel level sensor short circuit to ground	sensor voltage	< 0.25 V			2 sec.		or 4 sec cum
			for a time						
	P2066	secondary fuel level sensor stuck	fuel level stays in a band of	2 l					
					special enabeling conditions		220 miles		
			for a distance of		Error: fuel level sensor (P0461-P0463)	not set			
					Error: secondary fuel level sensor (P2066-P2068)	not set			
	P2066	Transfer pump failure	fuel level primary tank	< 4 l	error: vehicle speed sensor (P0501-P0503)	not set	250 sec.		
			and secondary fuel tank level	> 16 l	engine speed	> 80 rpm			
			for a time	> 250 sec.					
Ignition driver 1	P06D1	Internal SPI communication	IC-Internal		Engine speed	< 5000 rpm	4 sec.	0.01 sec.	2 trips
					Battery voltage	> 10 V		continuous	
					Battery voltage	< 18 V			
5V reference voltage monitoring	P0641	circuit continuity - open	Voltage	IC Internal	ignition key on	TRUE		3 sec	2 trips
	P0642	circuit continuity - ground			ECM power relay	TRUE			
	P0643	circuit continuity - voltage							

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
	P0651	circuit continuity - open	Voltage	IC Internal					
	P0652	circuit continuity - ground							
	P0653	circuit continuity - voltage							
	P0697	circuit continuity - open	Voltage	IC Internal					
	P0698	circuit continuity - ground							
	P0699	circuit continuity - voltage							
Real time clock Engine off timer Status Check	P2610	engine off timer signal check	engine off timer state >= (State 3 corresponds to engine off time which does not match the time from the ETC watchdog time, and a battery disconnection has not been detected)	3	engine speed real time clock active	> 240 rpm TRUE		0.1 sec.	2 trips
Real time clock Engine off timer Rationality check	P2610	engine off timer incremental check	reference clock time delta - Engine Off Timer delta	> 6 counts	engine speed failure counts	> 240 rpm >= 3 counts		0.1 sec.	2 trips
			reference clock time delta - Engine Off Timer delta or	< 6 counts	engine speed failure counts	> 240 rpm >= 3 counts			

Component/ System	Fault Code	Monitor Strategy Description	Primary Malfunction Signal and Criteria	Threshold Conditions	Secondary Parameters	Enable Conditions	Time Required	Frequency of Checks	MIL Illum.
			reference clock and Engine Off Timer (EOT) required synchronization time > (reference clock is an independently captured time value based on the ECM processor clock)	> 6 seconds	ECM afterrun complete	TRUE			
end							* see glossary of secondary parameter		

Supporting Tables

P000A, P000C, P000B, P000D

KFDWNWDMXE (internal manufacturer cross reference)

Maximum Allowed Deviation - Intake Camshaft Position

degrees crank	Engine Speed (rpm)					
Modeled Engine Oil Temperature (° C)	800	1200	1600	2000	2500	4000
0	6.00	6.00	6.00	6.00	6.00	6.00
60	6.00	6.00	6.00	6.00	6.00	6.00
80	7.00	6.00	6.00	6.00	6.00	6.00
100	9.00	6.00	6.00	6.00	6.00	6.00
130	11.00	7.00	7.00	6.00	6.00	6.00

KFDWNWDMXA (internal manufacturer cross reference)

Maximum Allowed Deviation - Exhaust Camshaft Position

degrees crank	Engine Speed (rpm)					
Modeled Engine Oil Temperature (° C)	800	1200	1600	2000	2500	4000
0	6.00	6.00	6.00	6.00	6.00	6.00
60	6.00	6.00	6.00	6.00	6.00	6.00
80	7.00	6.00	6.00	6.00	6.00	6.00
100	8.00	6.00	6.00	6.00	6.00	6.00
130	9.00	7.00	7.00	7.00	7.00	7.00

KFTDDNWNPE (internal manufacturer cross reference)

Maximum Allowed Deviation - Intake Camshaft Position

degrees crank	Engine Speed (rpm)			
Modeled Engine Oil Temperature (° C)	800	2000	4000	6000
-30	2.00	2.00	2.00	2.00
20	1.60	1.60	1.60	1.60
40	1.20	1.20	1.20	1.20
110	1.20	1.20	1.20	1.20
120	1.20	1.20	1.20	1.20

KFTDDNWNPA (internal manufacturer cross reference)

Maximum Allowed Deviation - Exhaust Camshaft Position

degrees crank	Engine Speed (rpm)			
Modeled Engine Oil Temperature (° C)	800	2000	4000	6000
-30	2.00	2.00	2.00	2.00
20	1.60	1.60	1.60	1.60
40	1.50	1.50	1.50	1.50
110	1.50	1.50	1.50	1.50
120	1.50	1.50	1.50	1.50

P0111

KLTFA1ML (internal manufacturer cross reference)

Minimum airmass to enable the stuck check monitor

temperature difference engine coolant - ambient temperature (°C)	-30	-9.75	0
airmass (kg)	15.019	11.014	4.005

P0128

TWADTHMS (internal manufacturer cross reference)

Engine start temperature depend. time for freezing temperature model of thermostat monitoring

	Engine Coolant Temperature at start (°C)					
	-48.00	-40.50	-33.00	-10.50	12.00	27
Time (sec)	22.00	18.00	16.00	16.00	16.00	16.00

P0134

(internal manufacturer cross reference)

USDB0	Minimum Voltage for evaluation	**0.400** V
USREF	Maximum Voltage for evaluation cold sensor	**0.600** V
USREFHOT	Maximum Voltage for evaluation hot sensor	**0.550** V

Supporting Tables

P0130

USMIN	Minimum Voltage for evaluation	**0.060**	V
USREMH	Maximum Voltage for evaluation	**0.400**	V
USREFHKLT	Minimum Voltage for evaluation	**0.600**	V
USMAX	Maximum Voltage for evaluation	**1.080**	V

P0133

(internal manufacturer cross reference)

NTPVKU	Minimum engine speed	**1200.000**	rpm
NTPVKO	Maximum engine speed	**3000.000**	rpm
RLTPVKU	Minimum load	**18.000**	%
RLTPVKO	Maximim load	**79.500**	%

P0135

KFRINV (internal manufacturer cross reference)

Sensor Element (Ceramic) Impedance, Nominal Value - Secondary O2 Sensor

Ohms	Modeled Exhaust Gas Temperature at Secondary O2 Sensor (° C)				
Normalized Heater Power	300.0	375.0	450.0	525.0	600.0
0.68	328	256	192	136	104
0.78	232	192	144	112	88
1.00	136	120	104	88	88

FRINV1 (internal manufacturer cross reference)

Multiplication Factor for Internal Resistance KFRINH Nominal Value - Secondary O2 Sensor

	Modeled Exhaust Gas Temperature at Secondary O2 Sensor (° C)				
	270	350	430	510	590
factor	20.00	10.00	5.00	3.00	3.00

(internal manufacturer cross reference)

TADHMNV	Minimum modelled exhaust temperature	**300**	°C
TADHMXV	Maximum modelled exhaust temperature	**550**	°C

P0141

KFRINH (internal manufacturer cross reference)

Sensor Element (Ceramic) Impedance, Nominal Value - Secondary O2 Sensor

Ohms	Modeled Exhaust Gas Temperature at Secondary O2 Sensor (° C)				
Normalized Heater Power	300	375	450	525	600
0.68	560	424	344	272	208
0.78	344	288	240	200	176
1.0	184	168	152	136	120

FRINH1 (internal manufacturer cross reference)

Multiplication Factor for Internal Resistance KFRINH Nominal Value - Secondary O2 Sensor

	Modeled Exhaust Gas Temperature at Secondary O2 Sensor (° C)				
	270	350	430	510	590
factor	30.00	20.00	10.00	6.00	4.00

(internal manufacturer cross reference)

TADHMNH	Minimum modelled exhaust temperature	**350**	°C
TADHMXH	Maximum modelled exhaust temperature	**550**	°C

P0234

KLMXDLDR (internal manufacturer cross reference)

Error threshold for absolute boost pressure too high

Intake air temperature (°C)	-48	-21	7	30	62	89	116	143
pressure threshold (hPa)	2200	2300	2400	2560	2560	2560	2560	2560

Supporting Tables

KLDLUL (internal manufacturer cross reference)

Error threshold for boost pressure control deviation too high

Difference between desired boost pressure and basic boost pressure (hPa)	-50	-20	-10	0	50	100	600	800
pressure threshold (hPa)	1466	1466	1466	500	310	220	220	220

P0299

NDLDRAPU (internal manufacturer cross reference)

Engine speed threshold to enable diagnosis

ambient pressure (hPa)	600	980
engine speed (1/min)	3720	2120

P0300, P0301, P0302 P0303, P0304, P0305, P0306

MISALUN (internal manufacturer cross reference)

Indicated drive torque for enabling the misfire monitor

	Engine Speed (RPM)							
	600.00	1320.00	2400.00	3120.00	3800.00	4720	5520	6120
Torque (%)	5.47	8.20	9.77	10.94	12.89	16.015625	18.75	20.70313

NGALUN (internal manufacturer cross reference)

Engine Speed Gradient for disabling the misfire monitor

	Engine Speed (RPM)							
	600.00	1320.00	2400.00	3120.00	3800.00	4720	5520	6120
Engine Speed Gradient (RPM / s)	12799.99	12799.99	12799.99	12799.99	12799.99	12799.99	12799.99	12799.99

KFKSWFS (internal manufacturer cross reference)

Misfire Weighing Factors for Catalyst Protection

	Indicated Engine Torque					
Engine Speed (RPM)	14.84375	30.078125	39.84375	50	60.15625	75
1000	32	32	32	32	37	37
2000	32	32	37	32	37	59
3000	32	32	37	37	48	48
4000	32	37	43	53	69	64
5000.00	32	43	59	75	85	85
6000.0	32	59	96	107	114	80

AHEKSB1 Summary Counter weighed misfire for Catalyst Gemaging Misfire **3200.00**

Misfirerate for Catalyst Protection in % Calculated from KFKSWFS and AHEKSB1: Value=AHEKSB1/KFKSWFS/600*100 (%)

	Indicated Engine Torque					
Engine Speed (RPM)	14.84375	30.078125	39.84375	50	60.15625	75
1000	16.67	16.67	16.67	16.67	14.41	14.41
2000	16.67	16.67	14.41	16.67	14.41	9.04
3000	16.67	16.67	14.41	14.41	11.11	11.11
4000	16.67	14.41	12.40	10.06	7.73	8.33
5000.00	16.67	12.40	9.04	7.11	6.27	6.27
6000.0	16.67	9.04	5.56	4.98	4.68	6.67

P0326, P0327, P0328, P0331, P0332, P0333

NGKRWN (internal manufacturer cross reference)

RPM dynamic threshold for disabling knock diagnosis

RPM	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400
RPM per second	1400	1550	1700	1950	2200	2450	2650	2800	3000	3100	3250	3400	3500	3600	3700	3700

Supporting Tables

KFDYESPF (internal manufacturer cross reference)
Intake Manifold Pressure delta for disabling knock diagnosis

Intake Manifold Press (hPa)	Engine Speed (RPM)															
Engine Load (%)	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400
50.25	35	34	24	20	19	19	18	18	18	19	19	19	19	20	21	21
69.75	30	28	27	23	21	21	20	20	20	20	20	20	20	19	20	20
90	24	24	25	22	22	22	22	22	22	22	21	21	21	19	20	20
120	22	21	21	23	22	24	25	23	24	22	20	20	20	19	20	20

P0327, P0332

UDKSNU (internal manufacturer cross reference)
Reference voltage threshold for knock sensor diagnosis - Lower Limit

	Engine Speed (rpm)															
	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400
Peak RMS Voltage (V)	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.293	0.293	0.293	0.293	0.293	0.293	0.293	0.293	0.293

P0328, P0333

UDKSNO (internal manufacturer cross reference)
Reference voltage threshold for knock sensor diagnosis - Upper Limit

	Engine Speed (rpm)															
	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400
Peak RMS Voltage (V)	5.000	5.000	5.000	5.000	5.000	5.400	6.000	6.600	7.800	9.000	10.350	11.850	13.500	15.300	17.100	18.600

P0341, P0342, P0343
P0346, P0347, P0348
P0366, P0367, P0368
P0391, P0392, P0393

KLPHNOKA (internal manufacturer cross reference)
Threshold for number of counts for detection of camshaft position sensor error

	Engine Speed (RPM)			
	600.000	1600.000	3200.000	7200.000
Number of Counts	8.000	17.000	34.000	72.000

P0420

RLKTDMN (internal manufacturer cross reference)
Engine Load lower limit for enabling catalyst monitor

	Engine Speed (RPM)				
	1000.000	1520.000	2000.000	2520.000	3000.000
Engine Load (%)	18.000	18.000	18.000	18.000	18.000

RLKTDMX (internal manufacturer cross reference)
Engine Load upper limit for enabling catalyst monitor

	Engine Speed (RPM)				
	1000.000	1520.000	2000.000	2520.000	3000.000
Engine Load (%)	65.300	65.300	77.250	62.300	54.800

TVKTDMTPE (internal manufacturer cross reference)
Time Delay for enabling catalyst monitor after secondary O2 sensor has reached dewpoint end

	Engine Coolant Temperature at Start (° C)			
	0.000	20.250	39.750	60.000
Time Delay (sec)	10.000	20.000	30.000	40.000

P0446, P0496, P0497, P0455

FSTDMN	Minimum Fueltanklevel	10.0
FSTDMX	Maximum Fueltanklevel	70.0
TUMTDLU	Minimum Ambient Temperature	2.0
TUMTDLO	Maximum Ambient Temperature	38.0
TMSTLDMN	Minimum Coolant Temperature at Engine Start	2.0
TMSTLDMX	Maximum Coolant Temperature at Engine Start	38.0

Supporting Tables

P0442 **KFEONVPT** (internal manufacturer cross reference)

Vacuum / Pressure Threshold for Fuel Tank Leak Detection

Vacuum / Pressure (hPa)	Ambient Temperature (Model) (° C)								
Fuel Level (%)	0	5.25	9.75	15	20.25	24.75	30	35.25	39.75
5	2.00	2.00	2.20	2.20	2.40	2.40	2.60	2.80	3.00
10	2.00	2.00	2.20	2.20	2.40	2.40	2.60	2.80	3.00
20	1.82	1.82	1.98	2.10	2.30	2.43	2.58	2.72	2.85
30	1.70	1.80	1.90	2.00	2.20	2.32	2.45	2.58	2.70
40	1.58	1.69	1.79	1.90	2.10	2.20	2.33	2.45	2.55
50	1.46	1.56	1.65	1.75	1.89	2.01	2.14	2.28	2.40
60	1.35	1.44	1.51	1.60	1.74	1.86	1.99	2.13	2.25
70	1.23	1.31	1.37	1.45	1.59	1.71	1.84	1.98	2.10
80	1.11	1.18	1.23	1.30	1.44	1.56	1.69	1.83	1.95

Tank Capacity **82.5 Liters**

Vacuum / Pressure (Pa)	Ambient Temperature (Model) (° C)								
Fuel Level (%)	0	5.25	9.75	15	20.25	24.75	30	35.25	39.75
5	200	200	220	220	240	240	260	280	300
10	200	200	220	220	240	240	260	280	300
20	182	182	198	210	230	243	258	272	285
30	170	180	190	200	220	232	245	258	270
40	158	169	179	190	210	220	233	245	255
50	146	156	165	175	189	201	214	228	240
60	135	144	151	160	174	186	199	213	225
70	123	131	137	145	159	171	184	198	210
80	111	118	123	130	144	156	169	183	195

P0455 **KLTLDSFS05** (internal manufacturer cross reference)

Vacuum Gradient Threshold for Fuel Tank Leak Detection

Fuel Level liters	0	10	20	30	40	50	60	70	75	80
hPa / sec	0.100	0.100	0.108	0.116	0.124	0.132	0.140	0.148	0.150	0.150

Tank Capacity 82.5 Liters

Fuel Level (%)	0	12.1	24.2	36.4	48.5	60.6	72.7	84.8	90.9	97.0
Pa / sec	10.0	10.0	10.8	11.6	12.4	13.2	14.0	14.8	15.0	15.0

P0451

TUMDSTDMN	Minimum Coolant Temperature at Engine Start	3.8 °C
TUMDSTDMX	Maximum Coolant Temperature at Engine Start	39.8 °C

P0501 (internal manufacturer cross reference)

NDV	Minimum engine speed for diagnosis	**1400** rpm
NDV0	Maximum engine speed for diagnosis	**3000** rpm

P2101 **DWDKSBAMX** (internal manufacturer cross reference)

Maximum Throttle Angle Deviation per computation cycle

	Percent Throttle Opening (%)				
	0	0.3	1.0	5.0	15.0
Percent Throttle Delta (%)	4	6	11	20	50

End Cal Tables

Glossary of Secondary Parameters

Secondary parameters	Enable condition	Definition
dew point exeeded at primary O2 sensor	TRUE	time integrated heat quantity is larger than calibrated map values dependent on engine start temperature (0.46 .. 1262 KJ) exhaust pipe temperature at primary oxygen sensor > 60°C
dew point exeeded at secondary O2 sensor	TRUE	time integrated heat quantity is larger than calibrated map values dependent on engine start temperature (1.8 … 1400 KJ) exhaust pipe temperature at primary oxygen sensor > 60°C
primary sensor heating active	TRUE	dew point exeeded at primary O2 sensor engine speed > 680 rpm battery voltage < 18 V engine temperature > -9.8 °C error: primary oxygen sensor --> not set
secondary air system	active	intake air temperature > - 11 … < 80 °C engine coolant temperature > - 11 … < 120 °C engine speed < 3500 rpm mass airflow < 100 g/sec. battery voltage > 10 … < 18 V cat heating --> active
cat heating	active	nmot > 680rpm altitude < 3000m intake air temp. > -12°C engine start temperature -10,5°C < … < 69,75°C difference of intake air. temp minus engine coolant start temp. <=15°C error: air flow meter --> not set error: intake air temperature sensor -->not set error: engine temperature sensor --> not set error: ambient pressure sensor --> not set
error: camshaft control system	not set	P0011, P0021, P0014, P0024, P000A, P000B, P000C, P000D P0341-P0343, P0366-P0368, P0346-P0348, P0391-P0393
error: evap. canister purge system	not set	P0449, P0498, P0499, P0443, P0458, P0459, P0442, P0446, P0455, P0496, P0497
error: camshaft control circuit	not set	P0341-P0346, P0366-P0368, P0346-P0348, P0391-P0393

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
Fuel Rail Pressure (FRP) Sensor Performance (Rationality)	P018B	This DTC detects if the fuel pressure sensor is stuck within the normal operating range	Absolute value of change in fuel pressure as sensed during intrusive test.	<= 30 kPa			Frequency: Continuous; 12.5 ms loop. 60 seconds between intrusive tests that pass Intrusive test requested if fuel system is clamped for >= 5 seconds or fuel pressure error variance <= typically (0.3 to 0.6) (calculated over a 2.5sec period); otherwise report pass	DTC Type A 1 trip
					1. FRP Circuit Low DTC (P018C)	not active		
					2. FRP Circuit High DTC (P018D)	not active		
					3. FuelPump Circuit Low DTC (P0231)	not active	Duration of intrusive test is fueling related (5 to 12 seconds).	
					4. FuelPump Circuit High DTC (P0232)	not active		
					5. FuelPump Circuit Open DTC (P023F)	not active	Intrusive test is run when fuel flow is below Max allowed fuel flow rate (Typical values in the range of 11 to 50 g/s)	
					6. Reference Voltage DTC (P0641)	not active		
					7. Reference Voltage DTC (P06A6)	not active		
					8. Fuel Pump Control Module Driver Over-temperature DTC's (P064A, P1255)	not active		
					9. Control Module Internal Performance DTC (P0606)	not active		
					10. Engine run time	>=5 seconds		
					11. Emissions fuel level (PPEI $3FB)	not low		
					12. Fuel pump control	enabled		

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
					13. Fuel pump control state	normal or FRP Rationality control		
					14. Engine fuel flow	> 0.047 g/s		
					15. ECM fuel control system failure (PPEI $1ED)	failure has not occurred		
Fuel Rail Pressure (FRP) Sensor Circuit Low Voltage	P018C	This DTC detects if the fuel pressure sensor circuit is shorted to low	FRP sensor voltage	< 0.14 V			72 failures out of 80 samples	DTC Type A 1 trip
							1 sample/12.5 ms	
					Ignition	Run or Crank		
Fuel Rail Pressure (FRP) Sensor Circuit High Voltage	P018D	This DTC detects if the fuel pressure sensor circuit is shorted to high	FRP sensor voltage	> 4.86 V			72 failures out of 80 samples	DTC Type A 1 trip
							1 sample/12.5 ms	
					Ignition	Run or Crank		
Fuel Pump Control Circuit Low Voltage	P0231	This DTC detects if the fuel pump control circuit is shorted to low	Fuel Pump Current	> 14.48A			72 test failures in 80 test samples if Fuel Pump Current <100A	DTC Type A
					Ignition	Run or Crank		
					OR		3 test failures in 15 test samples if Fuel Pump Current >=100A	
					HS Comm	enabled		
					OR		1 sample/12.5 ms	
					Fuel Pump Control	enabled		
					AND			
					Ignition Run/Crank Voltage	9V < voltage < 18V		
Fuel Pump Control Circuit High Voltage	P0232	This DTC detects if the fuel pump control circuit is shorted to high	Voltage measured at fuel pump circuit	> 3.86 V	Commanded fuel pump output	0% duty cycle (off)	36 test failures in 40 test samples; 1 sample/12.5ms	DTC Type A
					Fuel pump control enable	False	Pass/Fail determination made only once per trip	
					Time that above conditions are met	>=4.0 seconds		

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
Fuel Pump Control Circuit (Open)	P023F	This DTC detects if the fuel pump control circuit is open	Fuel Pump Current AND Fuel Pump Duty Cycle	<=0.5A >20%	Ignition OR HS Comm OR Fuel Pump Control AND Ignition Run/Crank Voltage	Run or Crank enabled enabled 9V < voltage < 18V	72 test failures in 80 test samples; 1 sample/12.5ms	DTC Type A
Fuel System Control Module Enable Control Circuit	P025A	This DTC detects if there is a fault in the fuel pump control enable circuit	PPEI (PPEI (Powertrain Platform Electrical Interface) Fuel System Request ($1ED)	≠ Fuel Pump Control Module Enable Control Circuit	Ignition AND PPEI Fuel System Request ($1ED)	Run or Crank valid	72 failures out of 80 samples 1 sample/12.5 ms	DTC Type A 1 trip
Control Module Read Only Memory (ROM)	P0601	This DTC will be stored if any software or calibration check sum is incorrect	Calculated Checksum (CRC16)	≠ stored checksum for any of the parts (boot, software, application calibration, system calibration)	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	1 failure if it occurs during the first ROM test of the ignition cycle, otherwise 5 failures Frequency: Runs continuously in the background	DTC Type A 1 trip
Control Module Not Programmed	P0602	Indicates that the FSCM needs to be programmed	This DTC is set via calibration, when KeMEMD_b_NoStartCal	TRUE	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	Runs once at power up	DTC Type A 1 trip

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
Control Module Long Term Memory Reset	P0603	Non-volatile memory checksum error at controller power-up	Checksum at power-up	≠ checksum at power-down	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	1 failure Frequency: Once at power-up	DTC Type A 1 trip
Control Module Random Access Memory (RAM)	P0604	Indicates that control module is unable to correctly write and read data to and from RAM	Data read	≠ Data written	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	1 failure if it occurs during the first RAM test of the ignition cycle, otherwise 5 failures Frequency: Runs continuously in the background.	DTC Type A 1 trip
Control Module Internal Performance 1. Main Processor Configuration Register Test 2. Processor clock test	P0606	This DTC indicates the FSCM has detected an internal processor fault or external watchdog fault (PID 2032 can tell what causes the fault.)	1. For all I/O configuration register faults: •Register contents 2. For Processor Clock Fault: •EE latch flag in EEPROM. OR	Incorrect value. 0x5A5A	Ignition OR HS Comm OR Fuel Pump Control 1. For all I/O configuration register faults: •KeMEMD_b_ProcFltCfgRegEnbl	Run or Crank enabled enabled TRUE	Tests 1 and 2 1 failure Frequency: Continuously (12.5ms) Test 3 3 failures out of 15 samples 1 sample/12.5 ms	DTC Type A 1 trip

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
3. External watchdog test			• RAM latch flag. 3. For External Watchdog Fault: • Software control of fuel pump driver	0x5A Control Lost	2. For Processor Clock Fault: •KeMEMD_b_ProcFltCLKDiagEnbl 3. For External Watchdog Fault: •KeFRPD_b_FPExtWDogDiagEnbl 3. For External Watchdog Fault: •Control Module ROM(P0601) 3. For External Watchdog Fault: •Control Module RAM(P0604)	TRUE TRUE not active not active		
Control Module Long Term Memory (EEPROM) Performance	P062F	Indicates that the NVM Error flag has not been cleared	Last EEPROM write	Did not complete	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	1 test failure Once on controller power-up	DTC Type A 1 trip
5 Volt Reference Circuit (Short High/Low)	P0641	Detects a continuous short on the #1 5V sensor reference circuit	Reference voltage AND Output OR Reference voltage AND Output OR Reference voltage AND Output	>= 0.5V . inactive >= 5.5V active <= 4.5V active	Ignition	Run or Crank	15 failures out of 20 samples 1 sample/12.5 ms	DTC Type A 1 trip

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
Fuel Pump Control Module - Driver Over-temperature 1	P064A	This DTC detects if an internal fuel pump driver overtemperature condition exists under normal operating conditions (Tier 1 supplier Continetal responsibility)	Module Range of Operation **AND** Fuel pump driver Temp	1. Module is within Acceptable Operation Range (Motorola's responsibility - FSCM is in normal operating range for module voltage versus PWM duty cycle. Linear range from 100% @ 12.5V to 70% @ 18V.) > 190C	Ignition OR HS Comm OR Fuel Pump Control KeFRPD_b_FPOverTempDiagEnbl Ignition Run/Crank	Run or Crank enabled enabled TRUE 9V<voltage<18V	3 failures out of 15 samples 1 sample/12.5 ms	DTC Type B 2 trips
5 Volt Reference Circuit (Out of Range)	P06A6	Detects that the #1 5 V sensor reference circuit is out of range	Reference voltage	> 102.5% nominal (i.e. 5.125V) OR < 97.5% nominal (i.e. 4.875V)	Ignition	Run or Crank	72 failures out of 80 samples 1 sample/12.5 ms	DTC Type A 1 trip
Fuel Pump Control Module - Driver Over-temperature 2	P1255	This DTC detects if an internal fuel pump driver overtemperature condition exists under extreme operating conditions (GM's responsibility)	Module Range of Operation	Outside normal range (FSCM is NOT in normal operating range for module voltage versus PWM duty cycle. Linear range from 100% @ 12.5V to 70% @ 18V.)	Ignition OR	Run or Crank	3 failures out of 15 samples 1 sample/12.5 ms	DTC Type B 2 trips

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
			AND Fuel pump driver Temp	 > 190C	HS Comm OR Fuel Pump Control KeFRPD_b_FPOverTempDiagEnbl Ignition Run/Crank	enabled enabled TRUE 9V<voltage<18V		
Ignition 1 Switch Circuit Low Voltage	P2534	This DTC detects if the Ignition1 Switch circuit is shorted to low or open	Ignition 1 voltage	<= 6 V	Engine	Running	180 failures out of 200 samples 1 sample/25.0 ms	DTC Type A 1 trip
Fuel Pump Flow Performance	P2635	This DTC detects degradation in the performance of the SIDI electronic return-less fuel system	Filtered fuel rail pressure error	<= Low Threshold (function of desired fuel rail pressure and fuel flow rate. 15% of resultant Target Pressure in the range of -28.4 to -193.5 kPa.) . **OR** <= High Threshold (function of desired fuel rail pressure and fuel flow rate. 15% of resultant Target Pressure in the range of +19.5 to +166.5 kPa.) .	1. FRP Circuit Low DTC (P018C) 2. FRP Circuit High DTC (P018D) 3. Fuel Rail Pressure Sensor Performance DTC (P018B) 4. FuelPump Circuit Low DTC (P0231) 5. FuelPump Circuit High DTC (P0232) 6. FuelPump Circuit Open DTC (P023F) 7. Reference Voltage DTC (P0641) 8. Reference Voltage DTC (P06A6)	not active not active . . . . . not active not active not active not active not active not active	Filtered fuel rail pressure error Time Constant = 12.5 seconds Frequency: Continuous 12.5 ms loop	DTC Type B 2 trips

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
					9. Fuel Pump Control Module Driver Over-temperature DTC's (P064A, P1255)	not active		
					10. Control Module Internal Performance DTC (P0606)	not active		
					11. An ECM fuel control system failure (PPEI $1ED)	has not occurred		
					12. The Barometric pressure (PPEI $4C1) signal	valid (for absolute fuel pressure sensor)		
					13. Engine run time	>= 30 seconds		
					14. Emissions fuel level (PPEI $3FB)	not low		
					15. Fuel pump control	enabled		
					16. Fuel pump control state	normal		
					17. Battery Voltage	11V<=voltage=<18 V		
					18. Fuel flow rate	> 0.047 g/s **AND** <= Max allowed fuel flow rate as a function of desired rail pressure & Vbatt (Typical values in the range of 11 to 50 g/s)		
					19. Fuel Pressure Control System	Is not responding to an over-pressurization due to pressure build during DFCO or a decreasing desired pressure command.		

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
Control Module Communication Bus “A” Off	U0073	Detects that a CAN serial data bus shorted condition has occurred to force the CAN device driver to enter a bus-off state	Bus Status	Off	1. Power mode	Run/Crank	5 failures out of 5 samples (5 seconds)	DTC Type B 2 trips
Lost Communication With ECM/PCM “A”	U0100	Detects that CAN serial data communication has been lost with the ECM	Message $0C9	Undetected	1. Power mode 2. Ignition Run/Crank Voltage 3. U0073	Run/Crank (11 – 18 V) not active	12 failures out of 12 samples (12 seconds)	DTC Type B 2 trips

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
Fuel Rail Pressure (FRP) Sensor Performance (Rationality)	P018B	This DTC detects if the fuel pressure sensor is stuck within the normal operating range	Absolute value of change in fuel pressure as sensed during intrusive test.	<= 30 kPa			Frequency: Continuous; 12.5 ms loop. 60 seconds between intrusive tests that pass Intrusive test requested if fuel system is clamped for >= 5 seconds or fuel pressure error variance <= typically (0.3 to 0.6) (calculated over a 2.5sec period); otherwise report pass	DTC Type A 1 trip
					1. FRP Circuit Low DTC (P018C)	not active		
					2. FRP Circuit High DTC (P018D)	not active		
					3. FuelPump Circuit Low DTC (P0231)	not active	Duration of intrusive test is fueling related (5 to 12 seconds).	
					4. FuelPump Circuit High DTC (P0232)	not active		
					5. FuelPump Circuit Open DTC (P023F)	not active	Intrusive test is run when fuel flow is below Max allowed fuel flow rate (Typical values in the range of 11 to 50 g/s)	
					6. Reference Voltage DTC (P0641)	not active		
					7. Reference Voltage DTC (P06A6)	not active		
					8. Fuel Pump Control Module Driver Over-temperature DTC (P064A)	not active		
					9. Control Module Internal Performance DTC (P0606)	not active		
					10. Engine run time	>=5 seconds		
					11. Emissions fuel level (PPEI $3FB)	not low		
					12. Fuel pump control	enabled		

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
					13. Fuel pump control state	normal or FRP Rationality control		
					14. Engine fuel flow	> 0.047 g/s		
					15. ECM fuel control system failure (PPEI $1ED)	failure has not occurred		
Fuel Rail Pressure (FRP) Sensor Circuit Low Voltage	P018C	This DTC detects if the fuel pressure sensor circuit is shorted to low	FRP sensor voltage	< 0.14 V	Ignition	Run or Crank	72 failures out of 80 samples 1 sample/12.5 ms	DTC Type A 1 trip
Fuel Rail Pressure (FRP) Sensor Circuit High Voltage	P018D	This DTC detects if the fuel pressure sensor circuit is shorted to high	FRP sensor voltage	> 4.86 V	Ignition	Run or Crank	72 failures out of 80 samples 1 sample/12.5 ms	DTC Type A 1 trip
Fuel Pump Control Circuit Low Voltage	P0231	This DTC detects if the fuel pump control circuit is shorted to low	Fuel Pump Current	> 14.48A	Ignition OR HS Comm OR Fuel Pump Control AND Ignition Run/Crank Voltage	Run or Crank enabled enabled 9V < voltage < 18V	72 test failures in 80 test samples if Fuel Pump Current <100A 1 sample/12.5 ms	DTC Type A
Fuel Pump Control Circuit High Voltage	P0232	This DTC detects if the fuel pump control circuit is shorted to high	Voltage measured at fuel pump circuit	> 3.86 V	Commanded fuel pump output Fuel pump control enable Time that above conditions are met	0% duty cycle (off) False >=4.0 seconds	36 test failures in 40 test samples; 1 sample/12.5ms Pass/Fail determination made only once per trip	DTC Type A

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
Fuel Pump Control Circuit (Open)	P023F	This DTC detects if the fuel pump control circuit is open	Fuel Pump Current AND Fuel Pump Duty Cycle	<=0.5A >20%	Ignition OR HS Comm OR Fuel Pump Control AND Ignition Run/Crank Voltage	Run or Crank enabled enabled 9V < voltage < 18V	72 test failures in 80 test samples; 1 sample/12.5ms	DTC Type A
Fuel System Control Module Enable Control Circuit	P025A	This DTC detects if there is a fault in the fuel pump control enable circuit	PPEI (PPEI (Powertrain Platform Electrical Interface) Fuel System Request ($1ED)	≠ Fuel Pump Control Module Enable Control Circuit	Ignition AND PPEI Fuel System Request ($1ED)	Run or Crank valid	72 failures out of 80 samples 1 sample/12.5 ms	DTC Type A 1 trip
Control Module Read Only Memory (ROM)	P0601	This DTC will be stored if any software or calibration check sum is incorrect	Calculated Checksum (CRC16)	≠ stored checksum for any of the parts (boot, software, application calibration, system calibration)	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	1 failure if it occurs during the first ROM test of the ignition cycle, otherwise 5 failures Frequency: Runs continuously in the background	DTC Type A 1 trip
Control Module Not Programmed	P0602	Indicates that the FSCM needs to be programmed	This DTC is set via calibration, when KeMEMD_b_NoStartCal	TRUE	Ignition OR HS Comm OR	Run or Crank enabled	Runs once at power up	DTC Type A 1 trip

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
					Fuel Pump Control	enabled		
Control Module Long Term Memory Reset	P0603	Non-volatile memory checksum error at controller power-up	Checksum at power-up	≠ checksum at power-down	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	1 failure Frequency: Once at power-up	DTC Type A 1 trip
Control Module Random Access Memory (RAM)	P0604	Indicates that control module is unable to correctly write and read data to and from RAM	Data read	≠ Data written	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	1 failure if it occurs during the first RAM test of the ignition cycle, otherwise 5 failures Frequency: Runs continuously in the background.	DTC Type A 1 trip
Control Module Internal Performance 1. Main Processor Configuration Register Test 2. Processor clock test	P0606	This DTC indicates the FSCM has detected an internal processor fault or external watchdog fault (PID 2032 can tell what causes the fault.)	1. For all I/O configuration register faults: •Register contents 2. For Processor Clock Fault: •EE latch flag in EEPROM. OR	Incorrect value. 0x5A5A	Ignition OR HS Comm OR Fuel Pump Control 1. For all I/O configuration register faults: •KeMEMD_b_ProcFltCfgRegEnbl	Run or Crank enabled enabled TRUE	Tests 1 and 2 1 failure Frequency: Continuously (12.5ms) Test 3 3 failures out of 15 samples 1 sample/12.5 ms	DTC Type A 1 trip

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
3. External watchdog test			• RAM latch flag. 3. For External Watchdog Fault: • Software control of fuel pump driver	0x5A Control Lost	2. For Processor Clock Fault: •KeMEMD_b_ProcFltCLKDiagEnbl 3. For External Watchdog Fault: •KeFRPD_b_FPExtWDogDiagEnbl 3. For External Watchdog Fault: •Control Module ROM(P0601) 3. For External Watchdog Fault: •Control Module RAM(P0604)	TRUE TRUE not active not active		
Control Module Long Term Memory (EEPROM) Performance	P062F	Indicates that the NVM Error flag has not been cleared	Last EEPROM write	Did not complete	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	1 test failure Once on controller power-up	DTC Type A 1 trip
5 Volt Reference Circuit (Short High/Low)	P0641	Detects a continuous short on the #1 5V sensor reference circuit	Reference voltage AND Output OR Reference voltage AND Output OR Reference voltage AND Output	>= 0.5V . inactive >= 5.5V active <= 4.5V active	Ignition	Run or Crank	15 failures out of 20 samples 1 sample/12.5 ms	DTC Type A 1 trip
Fuel Pump Control Module - Driver Over-temperature 1	P064A	This DTC detects if an internal fuel pump driver overtemperature condition exists under normal operating conditions	Pump Driver Temp	> 150C	Ignition OR	Run or Crank	3 failures out of 15 samples 1 sample/12.5 ms	DTC Type B 2 trips

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
					HS Comm OR Fuel Pump Control KeFRPD_b_FPOverTempDiagEnbl Ignition Run/Crank	enabled enabled TRUE 9V<voltage<18V		
5 Volt Reference Circuit (Out of Range)	P06A6	Detects that the #1 5 V sensor reference circuit is out of range	Reference voltage	> 105% nominal (i.e. 5.25V) OR < 95.0% nominal (i.e. 4.75V)	Ignition	Run or Crank	72 failures out of 80 samples 1 sample/12.5 ms	DTC Type A 1 trip
Ignition 1 Switch Circuit Low Voltage	P2534	This DTC detects if the Ignition1 Switch circuit is shorted to low or open	Ignition 1 voltage	<= 6 V	Engine	Running	180 failures out of 200 samples 1 sample/25.0 ms	DTC Type A 1 trip
Fuel Pump Flow Performance	P2635	This DTC detects degradation in the performance of the SIDI electronic return-less fuel system	Filtered fuel rail pressure error	<= Low Threshold (function of desired fuel rail pressure and fuel flow rate. 15% of resultant Target Pressure in the range of -28.4 to -193.5 kPa) . **OR** <= High Threshold (function of desired fuel rail pressure and fuel flow rate. 15% of resultant Target Pressure in the range of +19.5 to +166.5 kPa).	1. FRP Circuit Low DTC (P018C) 2. FRP Circuit High DTC (P018D) 3. Fuel Rail Pressure Sensor Performance DTC (P018B)	not active not active . . . . . not active	Filtered fuel rail pressure error Time Constant = 12.5 seconds Frequency: Continuous 12.5 ms loop	DTC Type B 2 trips

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
					4. FuelPump Circuit Low DTC (P0231)	not active		
					5. FuelPump Circuit High DTC (P0232)	not active		
					6. FuelPump Circuit Open DTC (P023F)	not active		
					7. Reference Voltage DTC (P0641)	not active		
					8. Reference Voltage DTC (P06A6)	not active		
					9. Fuel Pump Control Module Driver Over-temperature DTC's (P064A)	not active		
					10. Control Module Internal Performance DTC (P0606)	not active		
					11. An ECM fuel control system failure (PPEI $1ED)	has not occurred		
					12. The Barometric pressure (PPEI $4C1) signal	valid (for absolute fuel pressure sensor)		
					13. Engine run time	>= 30 seconds		
					14. Emissions fuel level (PPEI $3FB)	not low		
					15. Fuel pump control	enabled		
					16. Fuel pump control state	normal		
					17. Battery Voltage	11V<=voltage=<18V		
					18. Fuel flow rate	> 0.047 g/s **AND** <= Max allowed fuel flow rate as a function of desired rail pressure & Vbatt (Typical values in the range of 11 to 50 g/s)		

Component/ System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Required	MIL illum.
					19. Fuel Pressure Control System	Is not responding to an over-pressurization due to pressure build during DFCO or a decreasing desired pressure command.		
Control Module Communication Bus “A” Off	U0073	Detects that a CAN serial data bus shorted condition has occurred to force the CAN device driver to enter a bus-off state	Bus Status	Off	1. Power mode	Run/Crank	5 failures out of 5 samples (5 seconds)	DTC Type B 2 trips
Lost Communication With ECM/PCM “A”	U0100	Detects that CAN serial data communication has been lost with the ECM	Message $0C9	Undetected	1. Power mode 2. Ignition Run/Crank Voltage 3. U0073	Run/Crank (11 – 18 V) not active	12 failures out of 12 samples (12 seconds)	DTC Type B 2 trips