COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Camshaft Control								
Electrical								
Bank 1 Intake	P0010	circuit continuity - open	Voltage	IC Internal -	engine speed	> 80 rpm	1.5 sec	two driving
	P2088	circuit continuity - ground			battery voltage	> 10 V		cycles
	P2089	circuit continuity - voltage			battery voltage	< 25.5 V		
Bank 1 Exhaust	P0013	circuit continuity - open			output	activated and deactivated for complete checking		
	P2090	circuit continuity - ground						
	P2091	circuit continuity - voltage						
Bank 2 Intake	P0020	circuit continuity - open						
	P2092	circuit continuity - ground						
	P2093	circuit continuity - voltage						
Bank 2 Exhaust	P0023	circuit continuity - open						
	P2094	circuit continuity - ground						
	P2095	circuit continuity - voltage						
System - Control								
Bank 1 Intake	P0011	rationality - target error	difference to start test >	6.0 . . . 11.0 degrees	engine speed	> 480 rpm	approx.	two driving
Bank 1 Exhaust	P0014		(actual angle versus desired angle)	KFDWNWDMXE / 2	engine run time	> 1 sec	600 sec	cycles
Bank 2 Intake	P0021		(desired must remain above start value	KFDWNWDMXA / 2	error: camshaft control circuit	not set - -		
Bank 2 Exhaust	P0024		for a complete evaluation)		camshaft adaptation	complete - -		
			difference (target error) <	2.5 degrees				
			(to detect target error versus slow response if below this limit)					
			actual angle < target angle within time	2.5 sec				
			error count >=	10 count				
			or					
			error count (cold start only) >=	4 count				
			(both error counters decrement upon activations where no difference is seen between desired and actual)					
	P000A	rationality - slow response	difference to start test >	6.0 . . . 11.0 degrees				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
	P000B		(actual angle versus desired angle)	KFDWNWDMXE / 2							
	P000C		(desired must remain above start value	KFDWNWDMXA / 2							
	P000D		for a complete evaluation)								
			difference (slow response) >	2.5	degrees						
			(to detect slow response versus stuck cam if above this limit)								
			actual angle < target angle within time	2.5	sec						
			(detects >= 4 sec slow [time constant])								
			error count >=	10	count						
			or error count (cold start only) >=	4	count						
			(both error counters decrement upon activations where no difference is seen between desired and actual) in both cam phase rotation directions)								
System - Cam - Crank Alignment											
Bank 1 Intake	P0016	cam-crank adapted angle	adapted angle >	11.7	degrees	engine run time	>	50	sec	approx.	two driving
Bank 1 Exhaust	P0017	limit check	or adapted angle <	11.7	degrees	engine coolant temp	>	0	° C	600 sec	cycles
Bank 2 Intake	P0018	(applies for each camshaft)	or actual angle with parked cams >	15	degrees	engine coolant temp	<	95.25	° C		
Bank 2 Exhaust	P0019		and <	21	degrees	camshaft adaptation	complete	-	-	fail after	
Bank 1 / Idler Sprocket	P0008	cam-crank adapted angle	adapted angle for both cams >	7.3	degrees	error: camshaft position sensor	not set	-	-	2 adaptation	
Bank 2 / Idler Sprocket	P0009	limit check	adapted angle for both cams <	7.3	degrees	error: camshaft control circuit	not set	-	-	cycles -	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
		(applies for each bank)					required	
Primary O2 Sensor Heating								
heater circuits - electrical								
bank 1 sensor 1 (primary)	P0030	circuit continuity - open	measured voltage at power stage output <	3.6 V	battery voltage	> 10 V	5 sec	two driving
bank 2 sensor 1 (primary)	P0050	circuit continuity - open	and		battery voltage	< 25.5 V		cycles
			measured voltage at power stage output >	2.34 V	engine speed	> 240 rpm		
					primary O2 voltage supply	= ON -		
bank 1 sensor 1 (primary)	P0031	circuit continuity - ground	measured voltage at power stage output <=	2.34 V				
bank 2 sensor 1 (primary)	P0051	circuit continuity - ground						
bank 1 sensor 1 (primary)	P0032	circuit continuity - battery	measured voltage at power stage output >=	3.6 V				
bank 2 sensor 1 (primary)	P0052	circuit continuity - battery						
Air / Fuel Ratio Sensor Heating and Oxygen Sensor Heating								
heater circuits - electrical								

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
bank 1 sensor 2 (secondary)	P0036	circuit continuity - open	Voltage	IC Internal	-	engine speed	>	80	rpm	1.5 sec	two driving
	P0037	circuit continuity - ground				battery voltage	>	9.9	V		cycles
	P0038	circuit continuity - voltage				battery voltage	<	25.5	V		
bank 2 sensor 2 (secondary)	P0056	circuit continuity - open				secondary O2 sensor heating active	TRUE	-	-		
	P0057	circuit continuity - ground				secondary O2 sensor dew point reached	TRUE	-	-		
	P0058	circuit continuity - voltage				output	activated and deactivated for complete checking				
HO2S Signals Swapped sensors											
bank 1 sensor 2	P0041	Swapped secondary O2 sensors	HO2S sensor voltage B1S2 >=	0.6797	V	following conditions for time				60 sec	two driving
						depending on catalyst aging factor:	>	.3 …. 5.(	sec		cycles
			HO2S sensor voltage B2S2 <=	0.1816	V						
bank 2 sensor 2 **(GMX521 Camaro only)**						air mass flow	>=	8.33	g/s		
						air mass flow	<=	33.33	g/s		
						following conditions met for time:	>	8	sec		
			Or			Primary O2 closed loop control	TRUE	-	-		
			HO2S sensor voltage B1S2 <=	0.6797	V	for time	>	1	sec		
						modeled exhaust gas temp at B1S2 and B2S2	>	250	° C		
			HO2S sensor voltage B2S2 >=	0.1816	V	short term fuel trim	<	1.25	-		
						short term fuel trim	>	0.75 … 0.95	-		
						error: Evap system	not set	-	-		
						error: Air mass flow sensor	not set	-	-		
						error: Secondary O2 sensor stuck check	not set	-	-		
						error: Primary O2 sensor heater performance	not set	-	-		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						error: Secondary O2 sensor heater performance	not set	-	-		
						error: Fuel system monitoring	not set	-	-		
						error: Canister purge valve power stage	not set	-	-		
High Pressure Fuel Control System Rationality											two driving cycles
	P0087	pressure deviation from desired: under pressure	difference (desired versus actual fuel rail pressure) >	1000	Kpa	error: electrical diagnosis of fuel volume control valve	not set	-	-	5 sec	
						error: electrical diagnosis of fuel rail pressure sensor	not set	-	-		
	P0088	pressure deviation from desired: over pressure	difference (desired versus actual fuel rail pressure) <	-2000	Kpa	tester request for open fuel flow control valve	FALSE	-	-		
						airbag deployed (see descriptions for details)	FALSE	-	-		
	P0089	C/L controller output value: above expected	controller output value (amount of C/L correction) >	2000	Kpa	battery voltage	>	9.9	V		
						battery voltage	<	25	V		
	P0089	C/L controller output value: below expected	controller output value (amount of C/L correction) <	-2000	Kpa	fuel level	>	11	%		
						engine speed (exceeded once during engine start)	>	600	rpm		
						for time	>	5.1	sec		
						first engine start at assembly plant	FALSE	-	-		
						DFCO active	FALSE	-	-		
						engine start temperature	>	-48	C		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
High Pressure Fuel Volume Control Valve Circuit rationality											code set
	P0090	feedback voltage - open load	voltage test pulse - off command within range >=	2.749	V	battery voltage	>	9.9	V	3 sec	then 5 sec
			and			battery voltage	<	25	V		
			voltage test pulse - off command within range <=	4.502	V	error: 5 volt supply	not set	-	-		
	P0091	feedback voltage - short to ground	voltage test pulse - off command <	2.749	V						
	P0092	feedback voltage - short to battery	voltage test pulse - on command >	4.502	V						
Mass Air Flow (MAF) Sensor											
Rationality	P0101	range check low	Maximum modeled mass air flow /			battery voltage	>	10	V	2 sec	two driving
			measured mass air flow >	1	factor	for time	>	0.1	sec	modeled	cycles
		or				time after start	>	0.3	sec	range check	
						crankshaft revolution counter	>	150	rev		
		fuel trim limits exceeded	> delta long term fuel trim correction	0.18	factor	error: ambient press. sensor range or electrical	not set	-	-	~ 200 sec	
		range - multiplicative				error: camshaft response	not set	-	-	on cycle	
						long term fuel trim adaptation active	TRUE	-	-	for adaptation	
		and correction factor (modeled air	< correction factor air mass	0.8	factor	multi-point throttle adaptation active	TRUE	-	-	diagnosis	
		mass at throttle / air mass				error: MAF range check	not set	-	-	due to fuel	
		measured by air mass flow meter)				error: throttle position sensor	not set	-	-	adaptation	
						error: intake air temp. sensor	not set	-	-	learn time	
						error: MAF sensor electrical	not set	-	-		
		range check high	minimum modeled mass air flow /								
			measured mass air flow <	1	factor						
		or									

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
Range Check		fuel trim limits exceeded range - multiplicative	< delta long term fuel trim correction	-0.18	factor						
		and correction factor (modeled air mass at throttle / air mass measured by air mass flow meter)	> correction factor air mass	1.2	factor						
	P0101	range check - high	mass air flow >	291.7	g / sec	battery voltage	>	10	V	2 sec	two driving
						for time	>	0.1	sec	range check	cycles
						time after start	>	0.3	sec		
		range check - low	mass air flow <	0.3	g / sec	crankshaft revolution counter	>	150	rev		
						error: MAF sensor electrical	not set	-	-		
Mass Air Flow (MAF) Sensor Electrical / Range	P0100	circuit - open / short	sensor signal in period time =	0.0	uS	battery voltage	>	9.9	V	5 sec	two driving
						Key on	TRUE	-	-		cycles
						for time	>	0.1	sec		
	P0102	electrical check low	sensor signal in period time >	595.0	uS	or engine speed	>	25	rpm		
	P0103	electrical check high	sensor signal in period time <	79.0	uS						
Intake Air Temperature Sensor Rationality	P0111	response check	temperature delta during evaluation period: (max intake air temp. - min intake air temp.) <	1.5	° C	drive period - count	>=	10	count	~ 600 sec on cycle	two driving cycles
						each with the following conditions for time for one count increment:	>	5	sec		
						coolant temperature at start	<=	110.3	° C		
						Mass Air Flow	<	66.7	g / sec		
						Mass Air Flow	>	7.8	g / sec		
						Vehicle speed	>	18.75	mph		
						and					

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Circuit Continuity Check					idle period - count >= 3 count each with the following conditions for time for one count increment: > 10 sec coolant temperature at start <= 110.3 ° C Mass Air Flow < 7.8 g / sec Vehicle speed < 3.1 mph engine coolant temperature > 60 ° C		
	P0112	circuit - low	voltage <	0.21 V			5 sec	two driving cycles
	P0113	circuit - high	voltage >	4.87 V	Engine Coolant Temperature > -9.8 ° C Mass air flow < 27.8 g / sec Vehicle speed < 2.5 mph			
Engine coolant temperature sensor	P0116	difference from Engine temperature model after soaking	EWMA filtered difference (ECT at key on - ECTmodel at key on) >	14.3 ° C	Engine coolant model (cooled down) < 50 ° C Soaking time after shut down > 19800 sec		35 sec for block heating check	code set then 5 sec approx.
			or		previous drive cycle accumulated air mass > 6000 g previous drive cycle engine run time > 600 sec **or** previous drive cycle accumulated air mass > 6000 g		One EWMA filter update per cold start	6 test average run length (15°C delta)
			EWMA filtered difference (ECT at key on - ECTmodel at key on) <	-14.3 ° C	ECT at shut down > 81.75 ° C			

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						Controller Shut Down at end of last cycle	TRUE	-	-	EWMA Filter	
						Error - Engine Off Timer	not set	-	-	initialized	
			Temperature Factor for ECT mode	0.008 …. 0.996	-	Powerfail during previous drive (loss of battery voltage)	not detected	-	-	after powerfail	
			(based on EOT)			Block Heater (see P0116 descriptions for details or parameter)	not detected	-	-	or codeclear	
										to 13.0° C	
Engine coolant temperature sensor	P0117	range check high	coolant temperature >	140.3	° C	if Startup IAT	>	72	° C	1.1 sec	two driving cycles
						hot restart delay timer	>=	60	sec		
	P0118	range check low	coolant temperature <	-42	° C	-	-	-	-		
	P0119	intermittent (discontinuity)	delta coolant temp. during evaluation period <	-4.5	° C	ignition on	TRUE	-	-	1.1 sec	
			delta coolant temp. during evaluation period >	4.5	° C						
			weighted counter >	60000	count						
			(counter incremented by 5,000 w/jump detected; decremented by 1 with steady ECT signal every 100ms) (fail counter initialized to 10000)								
Throttle Position Sensor 1 (primary)	P0121	plausibility	sensor difference >	9	%	battery voltage	>	7	V	1.2 sec	two driving cycles
			(actual throttle position as a percentage of angle versus a modeled throttle position. The model output is the expected throttle angle based on the current engine airflow rate and engine speed)								
	P0122	circuit - low	voltage <	0.176	V	battery voltage	>	7	V	1.2 sec	code set
	P0123	circuit - high	voltage >	4.629	V						then 5 sec

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
Sensor 2 (redundant)	P0221	plausibility	sensor difference > (actual throttle position as a percentage of angle versus a modeled throttle position. The model output is the expected throttle angle based on the current engine airflow rate and engine speed)	9	%	battery voltage	>	7	V	1.2 sec	two driving cycles
	P0222	circuit - low	sensor circuit low voltage <	0.156	V	battery voltage	>	7	V	1.2 sec	code set then 5 sec
	P0223	circuit - high	sensor circuit high voltage >	4.883	V						
Engine coolant Temperature sensor	P0128	Coolant Temperature Below Model Temperature (additional pinpointing for coolant sensor, failures detected , by this monitor, would also be detected by Thermostat monitor)	calculated coolant temperature model minus measured temperature >	9.8	° C	error: engine coolant temp	not set	-	-	approx. 500 sec	two driving cycles
						engine speed	>	25	rpm		
			coolant temp. reference model calculation limit = (detection of blockheater resets modeled engine coolant temperature calculation)	50.3	° C						

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
Engine Coolant Thermostat Monitoring		Coolant Temperature Below Thermostat Regulating Temperature (plausibility check)	(calculated reference model coolant temp minus measured coolant temperature) > reference model calculation limit =	10.5 90	° C ° C	error debouncing time with below conditions: error: engine coolant temp error: vehicle speed sensor est. ambient temperature (based on modeled IAT) est. ambient temperature (based on modeled IAT) vehicle speed engine speed coolant temperature at start integrated air mass flow	> not set not set > < >= > < >	10 - - -12.8 100 4.6875 760 69.8 1000	sec - - °C °C mph rpm °C g	approx. 900 sec	two driving cycles
			(development vehicles indicated steady thermostat regulating temperatures of 90°C, as measured by the engine coolant temp. sensor. The thermostat opening temp. is 82°C. The thermostat is fully open by 95°C. All critical OBD and emission functions are enabled above 60°C.)								
Primary O2 sensor circuit											
bank 1 sensor 1 bank 2 sensor 1	P0130 P0150	sensor line short circuit to heater output line	secondary O2 sensor voltage delta > within time after heater turn off < for occurrences > out of heater turn offs >=	2 0.04 4 6	V s count count	engine speed battery voltage following conditions met for time: primary O2 heater control active primary O2 heating power factor relative to nominal primary O2 sensor dew-point end reached error: injector circuit fault error: injector circuit fault	> > > TRUE > TRUE not set not set	25 10.4 5 - 0.9 - - -	rpm V sec - - - - -	5 sec	two driving cycles
			or primary O2 sensor voltage >=	0.52	V	engine speed	>	25	rpm		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
			and primary O2 sensor voltage <=	1.15	V	battery voltage	>	10.4	V		
			and secondary O2 sensor voltage <	0.1	V	following conditions met for time:	>	5	sec		
						primary O2 heater control active	TRUE	-	-		
						primary O2 heating power factor relative to nominal	>	0.9	-		
						following conditions met for time:	>	30	sec		
						primary O2 sensor dew-point end reached	TRUE	-	-		
						primary O2 heating power factor relative to nominal	>	0.68	-		
						or					
						Primary exhaust gas temp. model	>	600	°C		
						(Primary O2 sensor voltage	>=	0.548	V		
						or					
						Primary O2 Internal Resistance Valid	TRUE	-	-		
						or					
						following conditions met for time:	>	5	sec		
						secondary O2 sensor ready for operation	set	-	-		
						or					
						integrated exhaust mass flow)	>	220	g		
						error: Primary O2 sensor short to ground	not set	-	-		
						Intrusive Evap. Leak diagnosis active	FALSE	-	-		
						error: injector circuit fault	not set	-	-		
			or			engine speed	>	25	rpm		
			primary O2 sensor voltage >=	0.06	V	battery voltage	>	10.4	V		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
			and primary O2 sensor voltage <	0.4	V	following conditions met for time:	>	5	sec		
			and secondary O2 sensor voltage <	0.5	V	primary O2 heater control active	TRUE	-	-		
						primary O2 heating power factor relative to nominal	>	0.9	-		
						following conditions met for time:	>	30	sec		
						primary O2 sensor dew-point end reached	TRUE	-	-		
						primary O2 heating power factor relative to nominal	>	0.68	-		
						or					
						Primary exhaust gas temp. model	>	600	°C		
						(Primary O2 sensor voltage	>=	0.548	V		
						or					
						Primary O2 Internal Resistance Valid	TRUE	-	-		
						or					
						following conditions met for time:	>	5	sec		
						secondary O2 sensor ready for operation	set	-	-		
						or					
						integrated exhaust mass flow)	>	220	g		
						error: Primary O2 sensor short to ground	not set	-	-		
						Intrusive Evap. Leak diagnosis active	FALSE	-	-		
						error: injector circuit fault	not set	-	-		
bank 1 sensor 1 bank 2 sensor 1	P0131 P0151	circuit - low	primary O2 sensor voltage < and Secondary O2 sensor voltage >	0.06 0.5	V V	engine speed battery voltage	> >	25 10.4	rpm V	5 sec	two driving cycles
						following conditions met for time:	>	5	sec		
						primary O2 heater control active	TRUE	-	-		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						primary O2 heating power factor relative to nominal	>	0.9	-		
						primary O2 sensor dew-point end reached	TRUE	-	-		
						error: injector circuit fault	not set	-	-		
						commanded lambda	<	1.005	lambda		
						integrated exhaust mass flow	>	220	g		
						lambda closed loop control active	TRUE	-	-		
						Intrusive Evap. Leak diagnosis act	FALSE	-	-		
			or primary O2 sensor voltage <	0.06	V	engine speed	>	25	rpm	1.1 sec	
						battery voltage	>	10.4	V		
						following conditions met for time:	>	5	sec		
						primary O2 heater control active	TRUE	-	-		
						primary O2 heating power factor relative to nominal	>	0.9	-		
						primary O2 sensor dew-point end reached	TRUE	-	-		
						error: injector circuit fault	not set	-	-		
						engine coolant temperature	<	40	°C		
						engine coolant temperature at ignition off	>	60	°C		
						time after engine start	>	1	sec		
			or primary O2 sensor voltage <	0.06	V	engine speed	>	25	rpm	33 sec	
			Secondary O2 sensor voltage >	0.5	V	battery voltage	>	10.4	V		
			average difference of voltage between loaded			following conditions met for time:	>	5	sec		
			and unloaded pri. O2 sensor voltage <	0.015	V	primary O2 heater control active	TRUE	-	-		
			(3 data sample average)			primary O2 heating power factor relative to nominal	>	0.9	-		
						primary O2 sensor dew-point end reached	TRUE	-	-		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						error: injector circuit fault	not set	-	-		
						following conditions met for time:	>	3	sec		
						Primary O2 sensor voltage	<	0.06	V		
						Decel. Fuel cut-off	not set	-	-		
bank 1 sensor 1 bank 2 sensor 1	P0132 P0152	circuit - high	primary O2 sensor voltage >	1.15	V	engine speed	>	25	rpm	5 sec	two driving cycles
						battery voltage	>	10.4	V		
						following conditions met for time:	>	5	sec		
						primary O2 heater control active	TRUE	-	-		
						primary O2 heating power factor relative to nominal	>	0.9	-		
						primary O2 sensor dew-point end reached	TRUE	-	-		
						commanded lambda	>	0.995	lambda		
						error: injector circuit fault	not set	-	-		
Primary O2 sensor slow response Bank 1 Bank 2	P0133 P0153	slow response	Continuously filtered normalized switching cycle duration >	2	s	closed loop control active	TRUE			approximately 600 sec	two driving cycles
						engine speed	<	2520	rpm		
						engine speed	>	1200	rpm		
						engine load	<	54.8	%		
			valid closed loop switching cycles >	15	count	engine load	>	12.8	%		
						exhaust gas temperature model	>	350	° C		
			(note: normalization of cycle duration ia a function of engine speed and load)			purge off or has been on for time scheduled by System Manager	>	10	sec		
							TRUE	-	-		
						Primary O2 heater diagnosis finished	TRUE	-	-		
						high purge vapor concentration	FALSE	-	-		
						Intrusive Evap. Leak diagnosis active	FALSE	-	-		
						error: fuel system monitor	FALSE	-	-		
						error: purge valve circuit	FALSE	-	-		
						error: misfire	FALSE	-	-		
						error: primary O2 heater performance	FALSE	-	-		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						error: secondary O2 heater performance	FALSE	-	-		
						error: secondary O2 oscillation check	FALSE	-	-		
						error: secondary O2 sensor electrical	FALSE	-	-		
Primary O2 sensor circuit											
bank 1 sensor 1 bank 2 sensor 1	P0134 P0154	circuit - open	primary O2 sensor voltage >	0.4	V	engine speed	>	25	rpm	10 sec	two driving cycles
			primary O2 sensor voltage <	0.52	V	battery voltage	>	10.4	V		
			or			following conditions met for time:	>	5	sec		
			primary O2 sensor voltage <	0.55	V	primary O2 heater control active	TRUE	-	-		
			modeled exhaust gas temperature >	800	° C	primary O2 heating power factor relative to nominal	>	0.9	-		
						following conditions met for time:	>	30	sec		
						primary O2 sensor dew-point end reached	TRUE	-	-		
			or			primary O2 heating power factor relative to nominal	>	0.68	-		
			primary O2 sensor internal resistance >	40000	Ohm	or					
			modeled exhaust gas temperature >	600	° C	Primary exhaust gas temp. model	>	600	°C		
						(Primary O2 sensor voltage	>=	0.548	V		
						or					
						Primary O2 Internal Resistance	TRUE	-	-		
						or					
						following conditions met for time:	>	5	sec		
						secondary O2 sensor ready for operation	set	-	-		
						or					
						integrated exhaust mass flow)	>	220	g		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					error: Primary O2 sensor short to ground	not set - -		
					Intrusive Evap. Leak diagnosis active	FALSE - -		
					error: injector circuit fault	not set - -		
			Or primary O2 sensor voltage >=	0.4 V	engine speed	> 25 rpm	33 sec	
			primary O2 sensor voltage <=	0.52 V	battery voltage	> 10.4 V		
			average difference voltage between loaded pulse and unloaded pulse pri. O2 sensor voltage < (3 data sample average)	0.28 V	following conditions met for time: primary O2 heater control active primary O2 heating power factor relative to nominal following conditions met for time: primary O2 sensor dew-point end reached primary O2 heating power factor relative to nominal or Primary exhaust gas temp. model (Primary O2 sensor voltage or Primary O2 Internal Resistance Valid or following conditions met for time: secondary O2 sensor ready for operation or integrated exhaust mass flow)	> 5 sec TRUE - - > 0.9 - > 30 sec TRUE - - > 0.68 - > 600 °C >= 0.548 V - TRUE - > 5 sec set - - > 220 g		
					error: Primary O2 sensor short to ground	not set - -		
					Intrusive Evap. Leak diagnosis active	FALSE - -		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						error: injector circuit fault	not set	-	-		
Oxygen Sensor Heating											
heater performance (primary O2)											
bank 1 sensor 1 (primary)	P0135	primary O2 sensor	measured primary O2 sensor internal			battery voltage	>	10	V	approx.	two driving
bank 2 sensor 1 (primary)	P0155	internal resistance	resistance >			battery voltage	<	25.5	V	100 sec	cycles
		above threshold	nominal internal resistance	96 . . . 128	Ohms	engine speed	>	240	rpm		
			multiplied by	KFRINV / 2		fuel cut off	FALSE	-	-		
			specification limit factor	6.25 … 7.75	factor	primary O2 internal resistance valid	TRUE	-	-		
				FRINV1 / 2		intake air temperature	>	-30	°C		
						engine off soak time	>	0	sec		
						modeled primary exhaust temp.	<	750	°C		
						suspicion of primary O2 sensor open circuit	FALSE				
						primary O2 voltage supply on	TRUE				
						scheduled by Diagnostic System Manager					
						for time	>	120	sec		
						primary O2 sensor dewpoint exceeded for time	>	10	sec		
						Mode$04 request during drive cycle not received	TRUE	-	-		
Secondary O2 sensor circuit											
bank 1 sensor 2	P0137	circuit - low	secondary O2 sensor voltage <	0.06	V	following conditions met for time:	>	0.2	sec		two driving
bank 2 sensor 2	P0157					engine speed	>	240	rpm		cycles

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						battery voltage	>	10.4	V		
						battery voltage	<	25.5	V		
						following conditions met for time:	>	40	sec		
						modeled exhaust gas temp. at Sec. O2 sensor	>=	700	° C		
						or					
						sec. O2 heating power factor relative to nominal	>=	0.5	-		
						secondary O2 dew point end reached	TRUE	-	-		
						or					
						secondary O2 internal resistance valid	TRUE	-	-		
						error: O2 sensor heater circuit	not set	-	-		
						engine coolant temperature	>	-9.8	° C		
						(commanded lambda reached target value	TRUE	-	-	40 sec	
						and					
						following conditions met for time:	>	40	sec		
						commanded lambda	<=	1.005	-	OR	
						short term fuel trim)	<	1.25	-		
						or					
						following conditions met for time:	>	5	sec	5 sec	
						time after engine start	>	5.1	sec		
						engine coolant temperature	<	39.8	° C		
						engine coolant temperature at ignition off	>	60	° C		
			Or			following conditions met for time:	>	0.2	sec	33 sec	
			secondary O2 sensor voltage <	0.06	V	engine speed	>	240	rpm		
			and average difference voltage between loaded			battery voltage	>	10.4	V		
			pulse and unloaded pulse sec. O2 sensor voltage <	0.015	V	battery voltage	<	25.5	V		
			(3 data sample average)			following conditions met for time:	>	40	sec		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
					modeled exhaust gas temp. at Sec. O2 sensor	>=	700	° C		
					or					
					sec. O2 heating power factor relative to nominal	>=	0.5	-		
					secondary O2 dew point end reached	TRUE	-	-		
					or					
					secondary O2 internal resistance valid	TRUE	-	-		
					error: O2 sensor heater circuit	not set	-	-		
					engine coolant temperature	>	-9.8	° C		
					following conditions met for time:	>	3	sec		
					Secondary O2 sensor voltage	<	0.6	V		
					Decel. Fuel cut-off active	FALSE	-	-		
					catalyst clear out after DFCO active	FALSE	-	-		
bank 1 sensor 2 bank 2 sensor 2	P0138 P0158	circuit - high	secondary O2 sensor voltage >	1.15 V	following conditions met for time:	>	0.2	sec	5 sec	
					engine speed	>	240	rpm		
					battery voltage	>	10.4	V		
					battery voltage	<	25.5	V		
					following conditions met for time:	>	40	sec		
					modeled exhaust gas temp. at Sec. O2 sensor	>=	700	° C		
					or					
					sec. O2 heating power factor relative to nominal	>=	0.5	-		
					secondary O2 dew point end reached	TRUE	-	-		
					or					
					secondary O2 internal resistance valid	TRUE	-	-		
					error: O2 sensor heater circuit	not set	-	-		
					engine coolant temperature	>	-9.8	° C		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Delayed response voltage during DFCO bank 1 sensor 2 bank 2 sensor 2	P013E P014A	secondary O2 sensor delayed response to DFCO	time from start of DFCO till secondary O2 sensor voltage below the lower threshold or the oxygen mass integration from start of DFCO exceeded upper threshold > before voltage crossed the lower voltage threshold lower voltage threshold <	4 sec 15 g 0.14 V	deceleration fuel cut-off (DFCO) active prior to DFCO, Secondary O2 sensor voltage for time primary O2 sensor voltage primary O2 sensor ready for operation for time secondary O2 sensor ready for operation for time temperature of secondary O2 Sensor length of previous DFCO event or time without DFCO battery voltage exhaust gas mass flow rate exhaust gas mass flow difference (within 100ms) error: primary O2 sensor electrical error: primary O2 sensor response error: primary O2 sensor heater circuit error: primary O2 sensor heater performance error: secondary O2 sensor electrical error: secondary O2 sensor heater circuit	TRUE - - >= 0.59 V > 1 sec < 0.138 V TRUE - - > 5 sec TRUE - - > 30 sec > 450 ° C < 30 sec > 60 sec > 9.9 V > 2.22 g/s < 2.78 g/s not set - - not set - - not set - - not set - - not set - - not set - -	4sec	two driving cycles

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						error: secondary O2 sensor heater performance	not set	-	-		
						error: primary O2 sensor heater circuit	not set	-	-		
						error: primary O2 sensor heater performance	not set	-	-		
						error: secondary O2 sensor electrical	not set	-	-		
						error: secondary O2 sensor heater circuit	not set	-	-		
						error: secondary O2 sensor heater performance	not set	-	-		
	P013A P013C	secondary O2 sensor transient response to DFCO	**EWMA filtered** time required >	0.6	sec	deceleration fuel cut-off (DFCO) active	TRUE	-	-		
			(time required for secondary O2 sensor voltage to transition from upper threshold to lower threshold)			prior to DFCO, Secondary O2 sensor voltage	>=	0.59	V	1 sec	code set
						for time	>	1	sec	after enable	then 5 sec
						primary O2 sensor voltage	<	0.138	V		
			upper voltage threshold	0.4	V	primary O2 sensor ready for operation	TRUE	-	-		
						for time	>	5	sec	**Fast Initialization**	
			lower voltage threshold	0.2	V	secondary O2 sensor ready for operation	TRUE	-	-	3 samples	
						for time	>	30	sec	required for decision	
						temperature of secondary O2 Sensor	>	450	° C		
						length of previous DFCO event	<	30	sec	**Step Change Phase**	
						or time without DFCO	>	60	sec	3 samples	
						battery voltage	>	9.9	V	required for decision.	
						exhaust gas mass flow rate	>	2.22	g/s	Criteria for	
						exhaust gas mass flow difference (within 100ms)	<	2.78	g/s	step change:	
						error: primary O2 sensor electrical	not set	-	-	(new sample -	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						error: primary O2 sensor response	not set	-	-	current EWMA output)	
						error: primary O2 sensor heater circuit	not set	-	-	> 0.50 sec	
						error: primary O2 sensor heater performance	not set	-	-		
						error: secondary O2 sensor electrical	not set	-	-	**Stabilized Phase**	
						error: secondary O2 sensor heater circuit	not set	-	-	sample required for	
						error: secondary O2 sensor heater performance	not set	-	-	decision	
						error: primary O2 sensor heater circuit	not set	-	-		
						error: primary O2 sensor heater performance	not set	-	-		
						error: secondary O2 sensor electrical	not set	-	-		
						error: secondary O2 sensor heater circuit	not set	-	-	enabled	
						error: secondary O2 sensor heater performance	not set	-	-	continuously while	
										conditions are met	
bank 1 sensor 2 bank 2 sensor 2	P0140 P0160	circuit - open	secondary O2 sensor voltage >=	0.401	V	following conditions met for time:	>	0.2	sec	60 sec	two driving cycles
			secondary O2 sensor voltage <=	0.519	V	engine speed	>	240	rpm		
			or			battery voltage	>	10.4	V		
			secondary O2 sensor voltage <=	0.498	V	battery voltage	<	25.5	V		
			modeled exhaust gas temperature at sec. O2 sensor >=	800	° C	following conditions met for time:	>	40	sec		
						modeled exhaust gas temp. at Sec. O2 sensor	>=	700	° C		
			or			or					
			secondary O2 sensor internal resistance >	40000	Ohm	sec. O2 heating power factor relative to nominal	>=	0.5	-		
			modeled exhaust gas temperature at sec. O2 sensor >	500	° C	secondary O2 dew point end reached	TRUE	-	-		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						or secondary O2 internal resistance valid	TRUE	-	-		
						error: O2 sensor heater circuit	not set	-	-		
			or Secondary O2 sensor voltage >=	0.401	V	engine coolant temperature	>	-9.8 350	° C		
			Secondary O2 sensor voltage <=	0.519	V	modeled exhaust gas temp. at Sec. O2 sensor	>=		° C		
			average difference voltage between loaded pulse and unloaded pulse sec. O2 sensor voltage < (3 data sample average)	2.8	V						
Oxygen Sensor Heating heater performance (secondary O2)						following conditions met for time:	>	120	sec		
bank 1 sensor 2 bank 2 sensor 2	P0141 P0161	secondary O2 sensor internal resistance above threshold	measured secondary O2 sensor internal resistance >			battery voltage	>	10	V	approx. 200 sec	two driving cycles
						battery voltage	<	25.5	V		
			nominal internal resistance	104 … 128	Ohms	engine speed	>	240	rpm		
			multiplied by	KFRINH / 2		fuel cut off (DFCO) active	FALSE	-	-		
			specification limit factor	5.25 … 7.75	factor	sec. O2 internal resistance valid	TRUE	-	-		
				FRINH1 / 2		intake air temperature	>	-30	° C		
						engine off soak time	>	0	sec		
						modeled exhaust temp. at secondary O2 sensor	>	300	° C		
						modeled exhaust temp. at secondary O2 sensor	<	700	° C		
						suspicion of secondary O2 sensor open circuit	FALSE	-	-		
						secondary O2 voltage supply on	TRUE				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Fuel Rail Pressure Sensor Rationality	P0191	rationality check low (sensor skewed low in range)	Fuel pressure during power up init. < AND Fuel system fault exists: P0087 or P2178 or P2188	120 KPa	engine speed for time engine run time	> 25 rpm > 0.5 sec > 30 sec	During engine start only	two driving cycles
		rationality check high (sensor skewed high in range)	or Fuel pressure during power up init. > AND Fuel system faults exist: P0088 or P2177 or P2187	1500 KPa	engine speed for time block heater active engine coolant at shutdown engine coolant at start difference : engine coolant at start intake air temperature difference : intake air temperature engine coolant at start engine off time during soak	> 25 rpm > 30 sec FALSE - - > 72 C < 54.8 C < 35.3 C < 9.75 C > 15000 sec		
			or Fuel pressure during power up init. > AND Fuel pressure rise during fuel pump prime >	1500 KPa 350 KPa				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Electrical	P0193	circuit - high	Fuel pressure sensor output voltage >	4.70 V	-	- - -	1.5 sec	code set then 5 sec
	P0192	circuit - low	Fuel pressure sensor output voltage <	0.30 V				
High Pressure Fuel Injection Valve Circuit Continuity - High side (HS) and Low Side (LS)								
Cylinder #1	P0201	circuit continuity - open LS or HS	Voltage	IC Internal -	engine speed	> 80 rpm	1 sec	two driving cycles
	P0261	circuit continuity - ground LS			battery voltage	> 9.9 v		
	P0262	circuit continuity - battery LS			battery voltage	< 25.5 v		
	P2146	circuit continuity - ground or battery HS						
Cylinder #2	P0202	circuit continuity - open LS or HS						
	P0264	circuit continuity - ground LS						
	P0265	circuit continuity - battery LS						
	P2149	circuit continuity - ground or battery HS						
Cylinider #3	P0203	circuit continuity - open LS or HS						
	P0267	circuit continuity - ground LS						
	P0268	circuit continuity - battery LS						
	P2152	circuit continuity - ground or battery HS						
Cylinder #4	P0204	circuit continuity - open LS or HS						
	P0270	circuit continuity - ground LS						
	P0271	circuit continuity - battery LS						
	P2155	circuit continuity - ground or battery HS						
Cylinder #5	P0205	circuit continuity - open LS or HS						
	P0273	circuit continuity - ground LS						

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Cylinder #6	P0274	circuit continuity - battery LS						
	P216A	circuit continuity - ground or battery HS						
	P0206	circuit continuity - open LS or HS						
	P0276	circuit continuity - ground LS						
	P0277	circuit continuity - battery LS						
	P216D	circuit continuity - ground or battery HS						
SPI Communication	P062B	Internal SPI Communication Fault	Message Timeout or Invalid Message Content	IC Internal -	engine speed	> 80 rpm	1.10 sec	
		or			battery voltage	> 9.9 V		
		Internal ADC Voltage Booster Failure	Voltage out of range	IC Internal -	battery voltage	< 25.5 V		
Diagnosis of Stuck Open Fuel Injector Rationality			high pressure fuel system under pressure (P0087)	set -	misfire monitor active (see P0300 details)		approx.	two driving
			and		engine speed	> 1520 rpm	20sec	cycles
	P029D	fuel injector stuck open - cylinder #1	cylinder # 1 misfire counts >	30 counts	engine speed	< 6000 rpm		
			or		relative engine load	< 99.8 %		
	P02A1	fuel injector stuck open - cylinder #2	cylinder # 2 misfire counts >	30 counts	misfire counts accumulate within period	< 40 rev		
			or					
	P02A5	fuel injector stuck open - cylinder #3	cylinder # 3 misfire counts >	30 counts				
			or					
	P02A9	fuel injector stuck open - cylinder #4	cylinder # 4 misfire counts >	30 counts				
			or					
	P02AD	fuel injector stuck open - cylinder #5	cylinder # 5 misfire counts >	30 counts				
			or					
	P02B1	fuel injector stuck open - cylinder #6	cylinder # 6 misfire counts >	30 counts				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Misfire								
Emission Level								
Multiple Cylinder	P0300	crankshaft speed fluctuation cylinder 1 to cylinder 6	emissions relevant misfire rate >	1.17 %	engine speed	> 400 rpm	1000 revs	Fault during 1st interval: 2 faults in 2 different drive cycles.
Cylinder #1	P0301				engine speed	< 7000 rpm		
Cylinder #2	P0302				indicated torque (idle, no drive)	> 5.86 %	After detection, the diagnostic can only pass if similar conditions are encountered	
Cylinder #3	P0303			(GMX322 and GMX295 use	or			
Cylinder #4	P0304				indicated torque (drive) (MISALUN	> 7.42. . . 28.9 %		
Cylinder #5	P0305			2.4% limit,	engine speed gradient (NGALUN)	< 2500 . . . 4600 rpm/sec		
Cylinder #6	P0306			GMX353,	volumetric efficiency gradient (DRSOLA)	< '0 . . . 13 %/rev		
				GMX350 and	cylinder events after engine start	> 6 ignitions		
				GMX521 use	intake air temperature	> -30 ° C		
				1.0% limit)	clutch switch press / release (MT Only)	transition FALSE -		
					Intrusive Evap. Leak diagnosis active	FALSE - -		
					fuel cut off (DFCO) active	FALSE - -		
					fuel level	> 11 %		
					Message Timeout or Invalid Message Content	11 %		
					AND solid misfire MIL	< on - -		
					or fuel level error	set - -		
					error: throttle position	not set - -		
					error: crankshaft position sensor	not set - -		
					error: ref.mark of crank sensor	not set - -		
					momentary re-enable delay:			
					(temporary delay until re-enablement AT:)	for 4 crank revs		
					(temporary delay until re-enablement MT:)	for 8 crank revs		
			OR					

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Catalyst Damaging Level			Catalyst damaging misfire rate >		Includes all the above with the		1000 revs	First
Multiple Cylinder Cylinder #1 Cylinder #2 Cylinder #3 Cylinder #4 Cylinder #5 Cylinder #6	P0300 P0301 P0302 P0303 P0304 P0305 P0306			53.3 . . . 5 % see Misfire supplemental data (i) (2.5.1)	following exceptions: First interval extension by engine coolant temperature fuel level or fuel level and blinking MIL and not first blink event	< 47.3 °C >= 11 % < 11 % blinking - - - - -	First interval 200 revs all remaining intervals	occurence: immediate flashing while error present, then no MIL with no error. Second occurence: immediate flashing while error present, then solid MIL with no error.
Knock Control Internal ECM Circuit	P0324	test pulse	test pulse integral <	4 V	knock control	active - -	1.1 sec	two driving cycles cumulative
			for consecutive events	4 count	zero test , parity fault suspicion duration of measuring window	not set - - > 0.001 sec		
		or null test (zero test)	absolute value (integrator gradient) >	200 V / sec	knock control	active - -		
			for consecutive events	4 count	test pulse , parity fault suspicion	not set - -		
		or parity check	message checksum error in Knock IC >	5 count	engine coolant temp.	> 60 ° C		
			per 250 working cycles		test pulse fault suspicion	not set - -		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
		or SPI communication	check byte errors in knock IC > per 250 working cycles	25 count				
Knock Sensor Bank 1 Circuit check	P0326	circuit - high or low	Knock sensor circuit shorted - IC Internal > per 250 working cycles	25 count	knock control engine speed engine speed gradient (NGKRWN)	active - - > 2200 rpm < 500 … 2300 rpm / sec	approx. 20 sec	two driving cycles
Knock Sensor Bank 1 Performance	P0327	range check low	reference voltage < for consecutive events	0.03 . . . 0.34 V UDKSNU 30 count	intake manifold pressure delta (KFDYESPF) error: knock control circuit (IC)	< 0.88 .. 2.72 kPa not set - -		
	P0328	range check high	reference voltage > for consecutive events	1 . . . 29.5 V UDKSNO 30 count				
Knock Sensor Bank 2 Circuit check	P0331	circuit - high or low	Knock sensor circuit shorted - IC Internal > per 250 working cycles	25 count	knock control engine speed engine speed gradient (NGKRWN)	active - - > 2200 rpm < 500 … 2300 rpm / sec		
Knock Sensor Bank 2 Performance	P0332	range check low	reference voltage < for consecutive events	0.03 . . . 0.34 V UDKSNU 30 count	intake manifold pressure delta (KFDYESPF) error: knock control circuit (IC)	< 0.88 .. 2.72 kPa not set - -		
	P0333	range check high	reference voltage > for consecutive events	1 . . . 29.5 V UDKSNO 30 count				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
Crankshaft Position Sensor	P0335	circuit continuity	no engine signal but camshaft phase signals detected	0	rpm	camshaft revolutions detected	>	12	counts	approx. 5 sec	code set then 5 sec
		rationality check	reference gap missing > (sensor signal but no reference)	6	gaps	-	-	-	-		
	P0336	rationality check	unexpected re-synchronization > (loss of reference mark)	2600	count	-	-	-	-		
		rationality check	intermittent loss of engine speed signal >	25	count	-	-	-	-		
	P0338	rationality check	difference in counted teeth between reference gap position events >	250	crankshaft teeth	-	-	-	-	approx. 2 sec	
Camshaft Position Sensor											
Bank 1 Intake	P0341	plausibility check	signal erratic or out of position	4	counts	engine synchronized	TRUE	-	-	10 revolutions (approx 1.5 sec)	two driving cycles
	P0342	circuit - low	signal permanently low	12 … 144 KLPHNOKA	counts						
	P0343	circuit - continuity or high	signal permanently high	12 … 144 KLPHNOKA	counts						
Bank 2 Intake	P0346	plausibility check	signal erratic or out of position								
	P0347	circuit - low	signal permanently low								
	P0348	circuit - continuity or high	signal permanently high								
Bank 1 Exhaust	P0366	plausibility check	signal erratic or out of position								
	P0367	circuit - low	signal permanently low								
	P0368	circuit - continuity or high	signal permanently high								
Bank 2 Exhaust	P0391	plausibility check	signal erratic or out of position								
	P0392	circuit - low	signal permanently low								

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
	P0393	circuit - continuity or high	signal permanently high					
Ignition Coil circuit continuity Cylinder #1	P0351	circuit continuity - open	Voltage	IC Internal -	engine speed	< 5000 rpm	1 sec	two driving cycles
	P2300	circuit continuity - ground			battery voltage	> 9.9 V		
	P2301	circuit continuity - voltage			battery voltage	< 25.5 V		
Cylinder #2	P0352	circuit continuity - open						
	P2303	circuit continuity - ground						
	P2304	circuit continuity - voltage						
Cylinder #3	P0353	circuit continuity - open						
	P2306	circuit continuity - ground						
	P2307	circuit continuity - voltage						
Cylinder #4	P0354	circuit continuity - open						
	P2309	circuit continuity - ground						
	P2310	circuit continuity - voltage						
Cylinder #5	P0355	circuit continuity - open						
	P2312	circuit continuity - ground						
	P2313	circuit continuity - voltage						
Cylinder #6	P0356	circuit continuity - open						
	P2315	circuit continuity - ground						
	P2316	circuit continuity - voltage						
Ignition Coil Driver Circuit Serial Communication	P167D	Internal SPI communication fault (SPI = Serial Peripheral Interface)	Message Timeout or Invalid Message Content	IC Internal -	engine speed	< 5000 rpm		
					battery voltage	< 25.5 V		
					battery voltage	> 9.9 V		
Catalyst System Performance	P0420	oxygen storage of catalyst	EWMA filtered catalyst aging factor		exhaust gas mass flow - lower range	> 4.44 g/sec	approx.	code set
	P0430		less than catalyst aging factor		exhaust gas mass flow - lower range	< 6.11 g/sec	1000 sec	then 5 sec

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			of a limit catalyst <	0.195 factor	exhaust gas mass flow - upper range	< 13.89 g/sec	during	
					exhaust gas mass flow - upper range	27.78 g/sec		
					catalyst temp. model	> 520 ° C		
					catalyst temp. model	< 860 ° C	active	
					engine speed	> 1160 rpm	driving	
					engine speed	< 2440 rpm		
					engine load (RLKTDMN)	> 12.8 … 20.3 %	**Fast**	approx.
					engine load (RLKTDMX)	< 55.3 … 80 %	**Initialization**	3 tests
					catalyst temperature difference (versus filtered value)	< 40 ° C	phase: 3 checks	average
					(filtered catalyst temperature time constant)	= 10 sec	per driving cycle	
					delay time after catalyst temperature difference	> 5 sec	**Step Change**	
					calculated exhaust gas mass flow difference (versus filtered value)	< 11.11 g/sec	phase: 3 checks	
					(filtered exhaust gas mass flow time constant)	= 5 sec	per driving cycle	
					delay time after calculated exhaust gas mass flow difference	> 1 sec	Step change	
					Number of p-portion jumps after function is enabled	4 -		
					Secondary O2 sensor dewpoint reached	>	triggered if	
					for time (TVKTDMTPE)	> 140 … 210 sec	measured OSC < 0.73 % of current	
					ambient temperature	> -30 ° C	EWMA output	
					catalyst damaging misfire rate exceeded	not set - -		
					error: fuel system monitor	not set - -	**Stabilized**	
					closed loop control at limit	not set - -	phase: 1 check	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						strong transient compensation intervention	not set	-	-	per driving cycle	
						catalyst clear out after DFCO active	not set	-	-		
						fast mixture adaptation completed	set	-	-		
Evaporative System and Leak Monitor											
Small Leak - 0.020 "	P0442	natural pressure/vacuum	filtered fault index >	0.62	-	engine running gross leak test	not complete	(see P0455 for details)		approx.	code set
		in tank				or gross leak test suspects small leak	0.020" leak	(see P0455 for details)		600 sec	then 5 sec
			based on:			calculated ambient air temperature	>	3.8	° C	each test	
			(peak pressure - peak vacuum)	390 . . . 750	Pa	calculated ambient air temperature	<	35.3	° C		
				KFEONVPT		engine coolant temp. at ignition off	>	74.25	° C	EWMA filtered	
						engine run time	>	600	sec	value	
						trip distance traveled	>	5.1	miles	exceeds	approx.
						fuel mixture contribution from purge vapor	<	26.7	%	threshold	6 test
						fuel level	>	11.0	%		average
						fuel level	<	88.0	%		run length
						error: vehicle speed	not set	-	-		
						error: engine coolant temp	not set	-	-		(The MIL
						error: purge valve	not set	-	-		actually is
						error: fuel tank pressure	not set	-	-		requested
						error: system voltage	not set	-	-		during shut
						error: air mass meter	not set	-	-		down soak.
						error: intake air temp	not set	-	-		It becomes
						error: canister vent valve	not set	-	-		visible on
						engine coolant start temp - ambient air temp	<	14.3	° C		the

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					engine coolant temperature at start < 45 ° C			following
					barometric pressure > 68 kPa			drive.)
					battery voltage > 10.8 V			
					vehicle odometer > 12.5 miles			
Evaporative Emission System								
Purge Solenoid Control Circuit	P0443	circuit continuity - open	Voltage	IC Internal -	engine speed > 80 rpm		1.5 sec	two driving cycles
	P0458	circuit continuity - ground			battery voltage > 9.99 V			
	P0459	circuit continuity - voltage			battery voltage < 25.5 V			
					output activated and deactivated for complete checking			
Evaporative System and Leak Monitor								
Canister Vent Valve	P0446	under pressure in tank	tank pressure <	-1650 Pa	fuel system closed loop TRUE - -		approx 600 sec	two driving cycles
					vehicle speed < 1.3 mph		(5 sec of intrusive	
					engine idle speed control active (no pedal input) TRUE - -		EVAP test time)	
					battery voltage > 10.5 V			
					battery voltage < 25.6 V			
					fuel tank pressure > -2700 Pa		One successful	
					fuel tank pressure < 1300 Pa		test per trip	
					ratio: (MAP Model / Baro) < 0.812 -		with enable	
					calculated ambient air temperature > 3.8 ° C		conditions met.	
					calculated ambient air temperature < 35.3 ° C			
					fuel level > 11.0 %			

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						fuel level	<	88.0	%	The test	
						engine coolant start temp - ambient air temp	<	14.3	° C	will attempt	
						time after engine start	>	600	sec	to run up	
						or fuel mixture adaptation stable	TRUE	-	-	to 10 times	
						ambient pressure	>	68	kPa	until it	
						maximum number of attempts	<	10	-	successfully	
						error: mass air flow	not set	-	-	completes	
						error: coolant temp	not set	-	-	a test	
						error: intake air temp	not set	-	-		
						error: fuel tank pressure sensor	not set	-	-		
						error: system voltage	not set	-	-		
						error: purge valve circuit	not set	-	-		
						error: vehicle speed	not set	-	-		
						error: canister vent valve circuit	not set	-	-		
						error: purge valve flow	not set	-	-		
						error: accelerator pedal	not set	-	-		
Control Circuit	P0449	circuit continuity - open	Voltage	IC Internal	-	engine speed	>	80	rpm	1.5 sec	two driving cycles
	P0498	circuit continuity - ground				battery voltage	>	9.9	V		
	P0499	circuit continuity - voltage				battery voltage	<	25.5	V		
						output activated and deactivated for complete checking					
Fuel Tank Pressure Sensor	P0450	rationality - signal oscillation	| delta pressure signal | = | current pressure - old pressure | >	813	Pa	calculated ambient air temperature		-7.5	° C	25.5 sec	two driving cycles
						vehicle speed	> <=	18.75	mph		
						time after canister vent valve open	>	4	sec		
	P0451	rationality - signal range check	sensor signal >=	1469	Pa	time after engine start	>	1	sec	10 sec	
						time after canister vent valve open	>	4	sec		
			or sensor signal <=	-3500	Pa	engine idle speed control active (no pedal input)	TRUE	-	-		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						vehicle speed	>	6.25	mph		
						for time	>=	30	sec		
						calculated ambient air temperature	>	-7.5	° C		
						ambient pressure	>	68000	Pa		
						fuel level	>	11.0	%		
						fuel level	<	88.0	%		
		rationality - drift check	or | delta pressure signal | = | current pressure - reference pressure at start | >	688	Pa	following conditions for time:	>	3	sec	approx. 7 sec	
						Vent solenoid valve open	TRUE	-	-	when enable	
						Canister purge valve closed = Purge Flow	<=	0.0	g / sec	condition are met	
						ambient pressure	>	68	kPa		
						fuel level	>	11.0	%		
						fuel level	<	88.0	%		
						Vehicle speed	<	46.875	mph		
						Canister load (HC concentration)	<	8	-		
						calculated ambient air temperature	<=	35.3	° C		
						calculated ambient air temperature	>=	3.8	° C		
						following conditions for time:	>=	30	sec		
						Vehicle speed	>	6.25	mph		
	P0452	circuit - low	sensor signal voltage <	0.2	V	engine speed	>	240	rpm	10 sec	two driving cycles
	P0453	circuit - high	sensor signal voltage >	4.85	V						
Evaporative System and Leak Monitor	P0455	vacuum pull down slope	integrated air mass flow >	1.3 …. 1.95	g	fuel system closed loop	TRUE	-	-	approx 600 sec	two driving

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
Large leak			and tank pressure (during tank pull down) >	-500	Pa	vehicle speed	<	1.3	mph	(30 sec of intrusive	cycles
			Or			engine idle speed control active (no pedal input)	TRUE	-	-	EVAP test time)	
			integrated air mass flow >	2.22	g	battery voltage	>	10.45	V		
			and tank pressure (during tank pull down) >	-600	Pa	battery voltage	<	25.6	V		
						fuel tank pressure	>	-2700	Pa	One successful	
						fuel tank pressure	<	1300	Pa	test per trip	
						ratio: (MAP Model / Baro)	<	0.81	-	with enable	
						calculated ambient air temperature	>	3.8	° C	conditions met.	
						calculated ambient air temperature	<	35.3	° C		
						fuel level	>	11.0	%		
						fuel level	<	88.0	%	The test	
						engine coolant start temp - estimated ambient air temp	<	14.3	° C	will attempt	
						time after engine start	>	600	sec	to run up	
						or fuel trim stabilized	TRUE	-	-	to 10 times	
						ambient pressure	>	68	kPa	until it	
						error: mass air flow	not set	-	-	successfully	
						error: coolant temp	not set	-	-	completes	
						error: intake air temp	not set	-	-	a test	
						error: fuel tank pressure sensor	not set	-	-		
						error: system voltage	not set	-	-		
						error: purge valve circuit	not set	-	-		
						error: vehicle speed	not set	-	-		
						error: canister vent valve	not set	-	-		
						error: purge valve flow	not set	-	-		
						error: accelerator pedal	not set	-	-		
Fuel Level Sensor Circuit	P0461	rationality				Primary fuel level	<	100.0	%	depending	two driving
fuel level sensor 1			fuel level change <	3.6	%						
			and			battery voltage	>=	10.0	V	on time to	cycles

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
(Single Fuel Level Sensing System - applies to GMT96X , GMT561 , and GMX353 applications only)			cumulative driving distance >	75.0 miles	battery voltage engine speed error: fuel level sensor electrical	<= 24.0 V > 240 rpm not set - -	reach total required drive distance	
	P0462	circuit - low	voltage <	0.25 V	battery voltage battery voltage engine speed	> 10.0 V < 24.0 V > 240 rpm	60 sec	
	P0463	circuit -high	voltage >	3.2 V				
Fuel Level Sensor Circuit fuel level sensor 1 (Applies to Saddle Tank with Dual Fuel Level Sensing System - applies to GMX322, GMX295, GMX521 applications only)	P0461	rationality			battery voltage	>= 9.9 V	depending	two driving cycles
			fuel level change < 4.4 %					
			and		battery voltage	<= 24.0 V	on time to	
			cumulative driving distance > 75.0 miles		engine speed	> 240 rpm	reach total	
					error: fuel level sensor(s) electrical	not set - -	required	
					and		drive	
					Primary fuel level	< 47.0 %	distance	
					Secondary fuel level	<= 0.3 %		
					or			
					Primary fuel level	< 47.0 %		
					Secondary fuel level	> 0.3 %		
			Or					
			cumulative driving distance >= 75.0 miles		Primary fuel level	> 47.0 %		
			(while indicated fuel level within un-readable zone)		Secondary fuel level	< 0.3 %		
					battery voltage	> 9.9 V		
					battery voltage	< 24.0 V		
					engine speed	> 240 rpm		
					error: fuel level sensor(s) electrical	not set - -		
	P0462	circuit - low	voltage <	0.25 V	battery voltage battery voltage engine speed	> 10.0 V < 24.0 V > 240 rpm	60 sec	
	P0463	circuit - high	voltage >	3.2 V				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
Fuel Level Sensor Circuit fuel level sensor 2 (Applies to Saddle Tank with Dual Fuel Level Sensing System - applies to GMX322, GMX295, GMX521 applications only)	P2066	rationality	fuel level change < and cumulative driving distance >	4.4 75.0	% miles	battery voltage battery voltage engine speed error: fuel level sensor/s electrical and Primary fuel level Secondary fuel level Or Primary fuel level Secondary fuel level	>= <= > not set >= >= < >	9.9 24.0 240 - 47.0 0.3 47.0 0.3	V V rpm - % % % %	depending on time to reach total required drive distance	two driving cycles
			Or cumulative driving distance >= (while indicated fuel level within un-readable zone)	75.0	miles	Primary fuel level Secondary fuel level battery voltage battery voltage engine speed error: fuel level sensor/s electrical	>= < >= <= > not set	47.0 0.3 9.9 24.0 240 -	% % V V rpm -		
	P2067	circuit - low	voltage <	0.25	V	battery voltage battery voltage engine speed	> < >	10.0 24.0 240	V V rpm	60 sec	
	P2068	cicuit - high	voltage >	3.2	V						
Cooling fan 1 relay Control Circuit	P0480 P0691 P0692	circuit continuity - open circuit continuity - ground circuit continuity - voltage	Voltage	IC Internal	-	engine speed battery voltage battery voltage	> > <	80 9.9 25.5	rpm V V	1.5 sec	two driving cycles

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
Cooling fan 2 relay Control Circuit	P0481 P0693 P0694	circuit continuity - open circuit continuity - ground circuit continuity - voltage	Voltage	IC Internal	-						
Evaporative System and Leak Monitor											
Leaking purge valve	P0496	under pressure in tank	sealed tank pressure gradient <	-47	Pa	fuel system closed loop	TRUE	-	-	approx 600 sec	two driving cycles
						vehicle speed	<	1.3	mph	(24 sec of intrusive	
						engine idle speed control active (no pedal input)	TRUE	-	-	EVAP test time)	
						battery voltage	>	10.45	V		
						battery voltage	<	25.6	V		
						fuel tank pressure	>	-2700	Pa		
						fuel tank pressure	<	1300	Pa		
						ratio: (MAP Model / Baro)	<	0.81	-		
Stuck Closed Purge valve	P0497	vacuum pull down slope	integrated air mass flow >	0.3	g	fuel level	>	11.0	%	One successful	
			tank pressure >	-2.56	Pa	fuel level	<	88.0	%	test per trip	
						engine coolant temp. at start - ambient air temp	<	14.3	° C	with enable	
						time after engine start	>	600	sec	conditions met.	
						or fuel mixture adaptation stable	TRUE	-	-		
						ambient pressure	>	68	kPa		
						maximum number of attempts	<	10	-		
						est. ambient air temp	>	3.8	° C		
						est. ambient air temp	<	35.3	° C	The test	
						error: mass air flow	not set	-	-	will attempt	
						error: coolant temp	not set	-	-	to run up	
						error: intake air temp	not set	-	-	to 10 times	
						error: fuel tank pressure sensor	not set	-	-	until it	
						error: system voltage	not set	-	-	successfully	
						error: purge valve circuit	not set	-	-	completes	
						error: vehicle speed	not set	-	-	a test	
						error: canister vent valve	not set	-	-		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						error: accelerator pedal	not set	-	-		
Idle Speed System (disabled during cold start)	P0506	functional check		100	rpm	engine load (for underspeed and MT applications only)	<	33.75 . . . 39	%	10 sec	two driving cycles
			desired rpm - actual rpm >			engine load (for underspeed and AT applications only)	<	99.75	%		
	P0507		desired rpm - actual rpm <	-200	rpm	engine coolant temperature	>	-11.3	° C		
			or			intake air temperature	>	-11.3	° C		
			fuel cut off events due to over speed >	3	count	vehicle speed	=	0	mph		
						engine idle speed control active (no pedal input)	TRUE				
								-	-		
						altitude factor (sea level = 1.0)	>	0.656	factor		
						time after engine start	>	4	sec		
						evap purge (high HC conc.)	FALSE	-	-		
						cold start idle speed control	FALSE	-	-		
						Intrusive Evap. Leak diagnosis active	FALSE				
								-	-		
						error: throttle position	not set	-	-		
						error: vehicle speed	not set	-	-		
						error: coolant temperature	not set	-	-		
						error: intake air temperature	not set	-	-		
						error: evap purge valve	not set	-	-		
Idle Speed System (enabled during cold start)	P050A	functional check		100	rpm	vehicle speed	=	0	mph	7 sec	two driving cycles
			desired rpm - actual rpm > (during catalyst heating only)			engine idle speed control active (no pedal input)	TRUE				
								-	-		
			desired rpm - actual rpm < (during catalyst heating only)	-200	rpm	altitude factor (sea level = 1.0)	>	0.656	factor		
						Engine coolant start temperature catalyst heating cold start strategy	<	60	° C		
								-	-		
						error: throttle position	active not set	-	-		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					error: vehicle speed error: coolant temperature error: intake air temperature error: evap purge valve	not set - - not set - - not set - - not set - -		
ECM monitoring	P0601	rationality - ROM check	wrong ROM checksum during initialization reaches calibrated number of occurrences	5 times	checksum calculation at power down in the last driving cycle completely finished	TRUE - -	30 sec	code set then 5 sec
			wrong cyclic ROM checksum of critical regions	- -	partial checksum on critical variables during engine running	complete	1 sec	
	P0602	rationality - programming incomplete	service ECU bit set in calibration =	TRUE -	-	- - -	1 sec	
	P0603	ETC monitoring controller reset	SW internal. Error from shut-down path test reaches calibrated number of occurrences	3 times	power down calculation in the last driving cycle	completly - - finished	5 sec	
	P0604	functional check cyclic RAM-check	RAM writeability check read and write test writeability check of RAM	- -	power down calculation in the last driving cycle	completly - - finished	5 sec	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
	P0606	Electronic Throttle Control (ETC) checks ETC monitoring torque comparison	SW internal	SW internal	power down calculation in the last driving cycle	completly - - finished	5 sec	
		ETC monitoring engine speed signal						
		ETC monitoring volumetric efficiency signal						
		ETC mon. vol. Eff., spark advance. A/D conv. grp. A, reaction crosscheck						
		ETC monitoring throttle crosscheck						
		ETC monitoring A/D conv group B, A/D converter supply voltage crosscheck						
		ETC monitoring redundant pedal signal						
		Electronic Throttle Control (ETC) checks SPI failure of throttle output stage	SW internal	SW Internal				
Fuel Pump Relay Control Circuit	P0627	circuit continuity - open	voltage < and	2.74 V	pump command off battery voltage	TRUE - - > 9.99 V	1.0 sec	two driving cycles

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
			voltage >	2.21	V	battery voltage	<	25.5	V		
	P0629	circuit continuity - voltage	voltage >	2.74	V						
	P0628	circuit continuity - ground	voltage <	2.21	V	pump command on	TRUE	-	-	2.0 sec	
						battery voltage	>	9.99	V		
						battery voltage	<	25.5	V		
Electronic Throttle Control	P0638	motor control range check short term	| circuit duty cycle | > (absolute value)	80	%	battery voltage	>	7	V	0.6 sec (recoverable)	code set then 5 sec
		motor control range check long term	| circuit duty cycle | > (absolute value)	80	%	battery voltage	>	7	V	5.0 sec (latched)	
5V reference voltage monitoring	P0641	circuit continuity - open	Voltage	IC Internal	-	ignition on	TRUE	-	-	2 sec	code set
	P0642	circuit continuity - ground				ECM power relay closed	TRUE	-	-		then 5 sec
	P0643	circuit continuity - voltage									
	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									
Fuel Pump Control Module	P069E	OBD emission fault	signal input	-	-	error: CAN communication with FPCM	not set	-	-	0.1 sec	code set

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
MIL Illumination Request **(excludes GMX295)**		detected by the FPCM (FPCM - Fuel Pump Control Module) (Specific FPC Module DTC shown in freeze frame)						then 5 sec
MIL Control Circuit	P0650	circuit continuity - open circuit continuity - ground circuit continuity - voltage	Voltage	IC Internal -	engine speed battery voltage battery voltage output	> 80 rpm > 9.9 V < 25.5 V activated and deactivated for complete checking	1.5 sec	no MIL (but is shown in Mode $03)
Transmission Control Module MIL Illumination Request	P0700	OBD emission fault detected by the TCM (Specific TCM DTC shown in freeze frame)	signal input	- -	-	- - -	0.1 sec	code set then 5 sec
Vehicle speed sensor Manual Transmission Only (Applies to GMX322 & GMX521)	P0501	rationality (high range check)	vehicle speed >	181.3 mph	ignition on	TRUE - -	2 sec	two driving cycles
	P0502	rationality (low range check)	vehicle speed <	3.1 mph	engine speed engine speed DFCO fuel shut off coolant temperature	> 1520 rpm < 3520 rpm active - > 39.8 ° C	3 sec	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
Clutch Pedal Position Sensor	P0806	rationality -	detected clutch pedal press count <	2	count	gear changes detected	>	20	count	approx.	code set
Manual Transmission		input clutch pos. state changes				(ratio of engine speed to				500 sec	then 5 sec
(Applies to GMX322 & GMX521)						vehicle speed -- range change)					
						gear change detection allowed when:					
						delay between shift events	>	4	sec		
						vehicle speed	>	12.5	mph		
	P0807	circuit - low	Voltage <	0.249	V	ignition on	TRUE	-	-	5 sec	
	P0808	circuit - high	Voltage >	4.75	V						
Engine Metal Overtemperature Protection (Limp Home Function Active)	P1258	engine coolant temperature too high	engine coolant temperature >	135.8	° C	engine run time	>	30	sec	1 sec	code set
						error: engine coolant temp	not set	-	-		then 5 sec
Electronic Throttle	P1551	limp-home throttle position out of range	throttle position <	10.1	%	vehicle speed	<=	0	mph	5 sec	code set
			OR			engine speed	<	40	rpm		then 5 sec
		(NOTE: Diagnostic is perform	throttle position >	39.8	%	engine coolant temperature	>=	5.25	° C		
		will intrusively remove power to the throttle				engine coolant temperature	<=	100.5	° C		
		valve to allow the valve to default to its				intake air temperature	>=	5.25	° C		
		pre-defined limp home position. At this time,				intake air temperature	<=	143.8	° C		
		the ECM learns the limp-home position and				battery voltage	>	10.0	V		
		performs the diagnostic comparison)				accelerator pedal position	<	14.9	%		
Ignition Coil Driver Circuit Serial Communication											

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
	P167D	Internal SPI communication fault	Message Timeout or Invalid Messa	IC Internal	battery voltage battery voltage engine speed	< 25.5 v > 9.9 v < 5000 rpm	1.0 sec	two driving cycles
Secondary O2 Trim of primary O2 Sensor								
primary O2 sensor signal RICH / secondary O2 sensor signal LEAN					engine speed	3480 rpm <	approx. 600 sec	two driving cycles
Bank1 Bank 2	P2096 P2098	secondary O2 sensor fuel trim - rich shift - correction above threshold	secondary O2 sensor trim integral control >	1 sec	engine speed engine load engine load (RLLRHUN) closed loop control active for time exhaust gas temp. model at secondary O2 primary closed loop controller	> 1280 rpm < 65.3 % 16.5 …. 20.3 % > TRUE - > 1 sec 250 ° C >		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
primary O2 sensor signal LEAN / secondary O2 sensor signal RICH						- -		
					at upper limit	FALSE		
Bank 1 Bank 2	P2097	secondary O2 sensor fuel	secondary O2 sensor trim		at lower limit	FALSE - -		
	P2099	trim - lean shift	integral control <	-1 sec	secondary O2 sensor ready for operation	TRUE - -		
		- correction below threshold			catalyst clear out after DFCO active	FALSE		
					error: catalyst monitoring	not set - -		
					error: purge valve	not set - -		
					error: secondary O2 sensor oscillation	not set - -		
					error: primary O2 heater performance	not set - -		
					error: secondary O2 heater performance	not set - -		
					error: fuel system monitoring	not set - -		
					error: Evap. System (gross leak / purge valve perf.)	not set - -		
					error: mass air flow sensor	not set - -		
Electronic Throttle Control	P2100	circuit switch-off	output circuits not deactivated as commanded	- -	-	- - -	0.5 sec	code set then 5 sec
	P2101	deviation from commanded	difference between set and actual position of throttle blade > [Table DWDKSBAMX]	4 . . . 50 % dep. on rate of change	electronic throttle adaptation battery voltage	not active - - > 7 V	0.5 sec	
	P2105	Electronic Throttle Control (ETC) checks	ETC monitoring watchdog shutdown path unable to deactivate throttle functionality	- -	power down processing in the last driving cycle	completly - - finished	5 sec	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
	P2119	functionality of return spring	throttle blade return response >	0.56	sec	vehicle speed	<=	0	mph	0.56 sec	
						engine speed	<	40	rpm		
						engine coolant temperature	>=	5.25	° C	once	
						engine coolant temperature	<=	100.5	° C	per	
						intake air temperature	>=	5.25	° C	ignition	
						intake air temperature	<=	143.8	° C	on	
						battery voltage	>	10.0	V		
						accelerator pedal position	<	14.9	%		
Accelerator Pedal Position Sensor 1	P2122	circuit - low	voltage <	0.74	V	battery voltage	>	7	V	0.2 sec	code set
	P2123	circuit - high	voltage >	4.82	V						then 5 sec
Accelerator Pedal Position Sensor 2	P2127	circuit - low	voltage <	0.63	V	battery voltage				0.2 sec	
	P2128	circuit - high	voltage >	4.82	V						
Accelerator Pedal Position 1 versus Position 2	P2138	plausibility	voltage difference > idle range	0.25	V	-	-	-	-	0.24 sec	
			voltage difference > pedal partially pressed	0.31	V						
			voltage difference > pedal fully pressed	1.70	V						
Electronic Throttle Control	P2176	throttle exchange detection	range check poti1 value at lower stop			vehicle speed	<=	0	mph	1 sec	code set
		learn fail	throttle potentiometer 1 voltage <	4.12	V	engine speed	<	40	rpm		then 5 sec
		or	or			engine coolant temperature	>=	5.25	° C	once	
		initial throttle learn failed	throttle potentiometer 1 voltage >	4.55	V	engine coolant temperature	<=	100.5	° C	per ignition cycle	
		or	or			intake air temperature	>=	5.25	° C	(during key on check)	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
		learning prohibited due to	range check poti2 value at lower stop		intake air temperature	<= 143.8 ° C		
		secondary parameters not met	throttle potentiometer 2 voltage <	0.34 V	battery voltage	> 9.99 V		
		or	or		accelerator pedal position	< 14.9 %		
		minimum throttle position	throttle potentiometer 2 voltage >	0.99 V				
		out of range						
Fuel System Lean/Rich								
Multiplicative Bank 1	P2177	fuel trim limits exceeded	delta multiplicative lambda correction >	1.32 factor	engine torque	>= 12.5 %	approx.	two driving
	P2178	range - multiplicative			engine torque	<= 50 %	300 sec	cycles
		(torque within calibrated threshold and	or		engine speed	>= 1200 rpm	from engine	
Bank 2	P2179	engine speed within calibrated threshold)			engine speed	<= 3400 rpm	start (after	
	P2180		delta multiplicative lambda correction <	0.78 factor	engine coolant temperature	>= 60 °C	adaptation	
					intake air temperature	<= 60 °C	has	
					command lambda	> 0.83 -	begun)	
					command lambda	< 1.2 -		
					catalyst heating cold start strategy active	FALSE - -		
					deceleration fuel cut-off (DFCO)	FALSE - -		
					transient compensation	FALSE - -		similar conditions
					wide open throttle	FALSE - -		required to heal failure after
					fuel level	> 11 %		MIL illumination
					or fuel level error	- -		
					error: cam control diagnosis	set not set - -		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						error: fuel injector circuit	not set	-	-		
						error: catalyst damaging misfire	not set	-	-		
Fuel System Lean/Rich Additive Bank 1	P2187	range - additive	delta fuel load correction >	6.0	%	engine torque	>=	0.0	%	approx.	two driving cycles
	P2188	low speed and low load				engine torque	<=	23	%	600 sec	
			or			engine speed	>=	520	rpm	from engine	
Bank 2	P2189					engine speed	<=	1000	rpm	start (after	
	P2190		delta fuel load correction <	-6.0	%	closed loop control active	TRUE	-	-	adaptation	
						engine coolant temperature	>=	60	°C	has	
						intake air temperature	<=	60	°C	begun)	
						command lambda	>	0.83	-		
						command lambda	<	1	-		
						catalyst heating cold start strategy active	FALSE	-	-		
						deceleration fuel cut-off (DFCO)	FALSE	-	-		similar conditions
						transient compensation	FALSE	-	-		required to
						wide open throttle	FALSE	-	-		heal failure after
						fuel level	>	11	%		MIL illumination
						or fuel level error	set	-	-		
						error: cam control diagnosis	not set	-	-		
						error: fuel injector circuit	not set	-	-		
						error: catalyst damaging misfire	not set	-	-		
Barometric Pressure Sensor Rationality											

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
	P2227	range check high	sensor signal >	115 KPa	error: barometric pressure sensor electrical	not set - -	2 sec	two driving cycles
		range check low	sensor signal <	50 KPa				
		sensor jump test high	sensor output difference within 20 sec period >	10 KPa				
Electrical		sensor plausibility high	sensor output > pressure model based on flow and throttle AND sensor change from previous (end of last to beginning of next drive cycle)	2 KPa 30 KPa	error: barometric pressure sensor electrical error: throttle position sensor error: mass air flow sensor engine run time Intrusive Evap. Leak diagnosis active	not set - - not set - - not set - - > 1 sec FALSE - -		
Electrical		sensor jump test low	sensor output difference within 20 sec period <	10 KPa	error: barometric pressure sensor electrical	not set - -		
Electrical		sensor plausibility low	sensor output < pressure model based on flow and throttle AND sensor change from previous key cycle > (end of last to beginning of next drive cycle)	2 KPa 30 KPa	error: barometric pressure sensor electrical error: throttle position sensor error: mass air flow sensor engine run time Intrusive Evap. Leak diagnosis active	not set - - not set - - not set - - > 1 sec FALSE - -		
Electrical	P2228	range check low	voltage <	0.2 V	-	- - -	2 sec	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
	P2229	range check high	voltage >	4.87	V						
Secondary Oxygen Sensor sensor circuit bank 1 sensor 2 bank 2 sensor 2	P2232 P2235	sensor line short circuit to heater output line	secondary O2 sensor voltage delta > within time after heater turn off < for occurrences > out of heater turn offs >=	 2 0.04 4 6	 V sec count count	following conditions met for time: engine speed battery voltage battery voltage engine coolant temperature following conditions met for time: modeled exhaust gas temp. at Sec. O2 sensor or normalized heating power for Sec. O2 heater secondary O2 dew point end reached or Internal resistance of Secondary O2 sensor active error: O2 sensor heater circuit	> > > < > > >= >= TRUE TRUE not set	0.2 25 10.4 25.5 -9.8 40 700 0.5 - -	sec rpm V V ° C sec ° C - - - -	10 sec	two driving cycles
Oxygen Sensor sensor response (secondary O2) bank 1 sensor 2 bank 2 sensor 2	P2270 P2272	oscillation check low	following conditions met for time: secondary O2 sensor voltage < for time > then ramping in enrichment by at gradient for time (after enrichment limit reac	 0.631 100 0.2 0.017 10	 V sec lambda λ / sec sec	following conditions met for time: mean short term fuel trim mean short term fuel trim following conditions met for time: air mass flow air mass flow following conditions met for time: multiplicative long term fuel trim difference	> >= < > > < >= <=	3 0.94 1.07 3 6.94 69.44 9 0.03	sec - - sec g/sec g/sec sec -	approx. 600 sec	two driving cycles

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
					mean short term fuel trim difference	<=	0.045			
					Deceleration fuel cut-off (DFCO)	not set	-	-		
					secondary O2 sensor ready for operation	set	-	-		
					Post fuel trim active	set	-	-		
					if the following conditions met					
					Primary O2 closed loop control	TRUE	-			
					for time	>	1	sec		
					modeled exhaust gas temp at B1S2 and B2S2	>	250	° C		
					engine speed	<=	3480	rpm		
					engine speed	>=	1280	rpm		
					engine load	<=	65	%		
					engine load (RLLRHUN)	>=	16.5 … 20.3	%		
					short term fuel trim	<	1.25	-		
					short term fuel trim (KFFRMIN)	>	0.75 … 0.95	-		
					error: Evap system	not set	-	-		
					error: mass air flow sensor	not set	-	-		
					Or Secondary HO2S short to ground fault (Redundant)					
					following conditions met for time:	>	40	sec		
					commanded lambda	<=	1.005	-		
					short term fuel trim	<	1.25	-		
					Secondary O2 sensor voltage	<	0.06	V		
					Or Secondary HO2S open circuit fault (Redundant)					

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
						following conditions met for time:	>	60	sec		
						secondary O2 sensor voltage	>=	0.401	V		
						and secondary O2 sensor voltage	<=	0.519	V		
						Or secondary O2 sensor voltage	<=	0.498	V		
						exhaust gas temperature	>=	800	° C		
						following conditions met for time:	>	0.2	sec		
						engine speed	>	240	rpm		
						battery voltage	>	10.4	V		
						battery voltage	<	25.5	V		
						following conditions met for time:	>	40	sec		
						modeled exhaust gas temp. at S	>=	700	° C		
						or					
						sec. O2 heating power factor relative to nominal	>=	0.5	-		
						secondary O2 dew point end reached	TRUE	-	-		
						or					
						secondary O2 internal resistance valid	TRUE	-	-		
						error: O2 sensor heater circuit	not set	-	-		
						engine coolant temperature	>	-9.8 350	° C		
						modeled exhaust gas temp. at Sec. O2 sensor	>=		° C		
		Unified Cycle or warm FTP (CVS-72) required for failure detection when on a specific driving cycle									
bank 1 sensor 2 bank 2 sensor 2	P2271 P2273	oscillation check high	secondary O2 sensor voltage >	0.631	V						
			for time >	100	sec	following conditions met for time:	>	3	sec		
			then			mean short term fuel trim	>=	0.94	-		
			ramping in enleanment by	0.2	lambda	mean short term fuel trim	<	1.07	-		
			at gradient	0.017	λ / sec	following conditions met for time:	>	3	sec		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
			for time (after enleanment limit reached)	10 sec	air mass flow	>	6.94	g/sec		
					air mass flow	<	69.44	g/sec		
					following conditions met for time:	>=	9	sec		
					multiplicative long term fuel trim difference	<=	0.03	-		
					mean short term fuel trim difference	<=	0.045	-		
					Deceleration fuel cut-off (DFCO)	not set	-	-		
					secondary O2 sensor ready for operation	set	-	-		
					Post fuel trim active	set	-	-		
					if the following conditions met					
					Primary O2 closed loop control	TRUE	-	-		
					for time	>	1	sec		
					modeled exhaust gas temp at B1S2 and B2S2	>	250	° C		
					engine speed	<=	3480	rpm		
					engine speed	>=	1280	rpm		
					engine load	<=	65	%		
					engine load (RLLRHUN)	>=	16.5 … 20.3	%		
					short term fuel trim	<	1.25	-		
					short term fuel trim (KFFRMIN)	>	0.75 … 0.95	-		
					error: Evap system	not set	-	-		
					error: mass air flow sensor	not set	-	-		
					Or Secondary HO2S short to ground fault (Redundant)					
					following conditions met for time:	>	40	sec		
					commanded lambda	<=	1.005	-		
					short term fuel trim	<	1.25	-		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
					Secondary O2 sensor voltage	<	0.06	V		
					Or Secondary HO2S open circuit fault (Redundant)					
					following conditions met for time:	>	60	sec		
					secondary O2 sensor voltage	>=	0.401	V		
					and secondary O2 sensor voltage	<=	0.519	V		
					Or secondary O2 sensor voltage	<=	0.498	V		
					exhaust gas temperature	>=	800	° C		
					following conditions met for time:	>	0.2	sec		
					engine speed	>	240	rpm		
					battery voltage	>	10.4	V		
					battery voltage	<	25.5	V		
					following conditions met for time:	>	40	sec		
					modeled exhaust gas temp. at Sec. O2 sensor	>=	700	° C		
					or					
					sec. O2 heating power factor relative to nominal	>=	0.5	-		
					secondary O2 dew point end reached	TRUE	-	-		
					or					
					secondary O2 internal resistance valid	TRUE	-	-		
					error: O2 sensor heater circuit	not set	-	-		
					engine coolant temperature	>	-9.8	° C		
					modeled exhaust gas temp. at Sec. O2 sensor	>=	350	° C		
					following conditions met for time:	>	40	sec		
					model exhaust gas temp. S	>=	700	° C		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					Or normalized heat. power Sec. O2 heater	>= 0.5 ° C		
					secondary O2 dew point end Or Internal resistance of Sec. O2 sensor	TRUE - -		
					error: O2 sensor heater circuit	TRUE - - not set - -		
		Unified Cycle or warm FTP (CVS-72) required for failure detection when on a specific driving cycle						
Vehicle speed sensor Automatic Transmission	P2544	Communication with TCM - Static messages	CAN message: static rolling count fault	TRUE -	automatic transmission	equipped - -	1 sec	two driving
		Communication with TCM - Protection value	CAN message: implausible signal (2s complement)	TRUE -	CAN Bus	initialized - -		cycles
			message validation failed		consisting of:	and ready		
					ignition on for time	> 3 sec		
					battery voltage	> 9.9 V		
					battery voltage	< 25.5 V		
Auxiliary Engine Coolant Pump Circuit Continuity (GMX295 only)	P2600	circuit continuity - open	Voltage	IC Internal -	engine speed	> 80 rpm	1.5 sec	two driving
	P2602	circuit continuity - ground	Voltage	IC Internal -	battery voltage	> 9.9 V		cycles
	P2603	circuit continuity - voltage	Voltage	IC Internal -	battery voltage	< 25.5 V		
Rationality	P2601	monitoring of engine coolant	temperature change gradient during soak period >	-3 … -1 ° C	auxiliary coolant pump enabled (coolant temp.	- - TRUE	90 sec	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE		SECONDARY PARAMETERS	ENABLE CONDITIONS			TIME REQUIRED	MIL ILLUM.
(GMX295 only)		temperature change immediately after engine shut off when temperature is sufficiently high at engine shut off	DDTMOTMIN or DDTMOTMIF			at engine shutdown > 110 C) error: coolant temp. sensor error: intake air temp. sensor error: auxiliary coolant pump circuit	- not set - not set - not set	- - - 	 	during after-run when pump is enabled	
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)	3.0	-	engine speed real time clock active	> TRUE	240 -	rpm -	1.0 sec	two driving cycles
Engine off timer Rationality check		engine off timer incremental check	reference clock time delta - Engine Off Timer delta > (for basic operation 6 counts equates to 10 sec) or reference clock time delta - Engine Off Timer delta < (for basic operation 6 counts equates to 10 sec) or reference clock and Engine Off Timer (EOT)	6 6 6	counts counts seconds	engine speed Ref Clock vs EOT test, consecutive failure counts engine speed Ref Clock vs EOT test, consecutive failure counts ECM afterrun complete	> >= > >= TRUE	240 3 240 3 -	rpm counts rpm counts -		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			time to synchronize (at initialization) > (reference clock is an independently captured time value based on the ECM processor clock)					
OBD ISO-15765 Communication Bus	U0073	ISO-15765 Bus Error	Invalid Message Received or Dual Port Ram Hardware Error; or No Communication / Bus Off	invalid content, hardware error, or hardware shutdown -	CAN Bus consisting of: ignition on for battery voltage battery voltage normal bus communication	initialized and ready > 3 sec > 9.9 V < 25.5 V running - -	1 sec	code set then 5 sec
	U0101	Communication with TCM	TCM Message Timeout or Invalid Message Content	message missing, or delayed or invalid content -	automatic transmission CAN Bus consisting of: ignition on for battery voltage battery voltage normal bus communication	equipped - - initialized - - and ready > 3 sec > 9.9 V < 25.5 V running - -	2.5 sec	code set then 5 sec
OBD ISO-15765 Communication Bus Fuel Pump Control Module **(excludes GMX295)**	U0109	Communication with FPCM (FPCM - Fuel Pump Control Module)	FPCM Message Timeout or Invalid Message Content	message missing, delayed, or invalid content -	CAN Bus consisting of: ignition on for battery voltage battery voltage normal bus communication	initialized - - and ready > 3 sec > 9.9 V < 25.5 V running - -	5 sec	two driving cycles

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Cold Start Emissions Reduction Strategy	-	Cold start spark angle limitation (spark angle limitation imposed through torque reserve limit)	commanded torque reserve forced to remain above limitation value: value = nominal torque reserve x FACTOR (determination of FACTOR: the reduced level of torque reserve that does not result in a measureable increase in FTP emissions as compared to baseline)	0.5 -	limitation active continuously while cold start strategy is active	- - -	0.1 sec	n/a
		Momentary spark angle limitation over-ride	over-ride allowed if requested torque reserve deviates below the limitation value	0 %	time since engine start number of over-ride events time duration of current over-ride event above conditions present delay time until active Cold start strategy extension with over-ride events time extension = number of over-ride events x FACTOR FACTOR	> 0.6 sec <= 4 counts <= 0.5 sec > 0.1 sec = 2 sec		

Parameter Definitions

Contains definitions of secondary parameters which are used in the parameter document.
These secondary parameters conditions are shown in the respective physical parameters which define each condition.

Secondary Enable Parameter	Defined by:	Enable Conditions	Enable Value	Units
Block Heater Detected	difference between ECT and IAT	<	16.5	° C
	difference between ECT and IAT	>	5.3	° C
	maximum temperature of ECT or IAT at start	<	20.3	° C
	IAT temperature drop after engine start	>	2.3	° C
	within time	<	10	sec
Camshaft Adaptation Complete	error: camshaft positions sensor	not set	-	-
(adaptation is performed to adapt the	error: camshaft / crankshaft misalignment	not set	-	-
manufacturing camshaft position offset from	catalyst heating cold start strategy	FALSE	-	-
nominal, which occurs after ECM powerfail or replace)	camshaft and crankshaft deviation	<	6	degrees crankshaft
(one adaptation flag for each independent camshaft)				
Catalyst Clear Out after DFCO Active	secondary O2 sensor voltage	<	0.082	V
(system is enriched to purge catalyst of excess oxygen following DFCO)	to continue catalyst clean-out			
Fast mixture adaptation completed	following conditions met for time:	>	0.5	sec
(used to quickly adapt fuel mixture prior to	conditions to run catalyst monitor are fulfilled	TRUE	-	-
execution of catalyst monitor)	transient fuel compensation	FALSE	-	-
Fuel Cut-Off (DFCO) Active	time after start	>	5	sec
	catalyst heating	FALSE		
	received transmission gear via CAN (AT applications)	>	1	gear
	or			
	calculated transmissions gear - N/V ratio (MT only)	>	1	gear
	clutch not applied (MT only)	TRUE		
	error: engine misfire	not detected		
	engine speed (KFNWEGM)	>	920 …. 4000	rpm
	accelerator pedal position	=	0	%

Secondary Enable Parameter	Defined by:	Enable Conditions	Enable Value	Units
Fuel Mixture Adaptation Stable	error: multiplicative fuel system	FALSE	-	-
	error: additive fuel system	FALSE	-	-
	following conditions for time:	>	9	sec
	engine torque	>=	12.5	%
	engine torque	<=	50	%
	engine speed	>=	1200	rpm
	engine speed	<=	3400	rpm
	difference between current multiplicative adaptation factor and previous multiplicative adaptation factor	<	0.03	factor
	filtered short-term fuel control factor	<	0.045	factor
Knock Control Active	engine load (LKRN)	>	26.0 … 35.4	%
	engine coolant temperature	>	60	° C
	or (for IC diagnostics only)			
	engine coolant temperature	>	60	° C
	engine load	>	26.0 … 35.4	%
	or			
	intake manifold pressure delta (KFDYESPF)	>	0.88 .. 2.72	kPa
Long Term Fuel Adaptation Active	engine coolant temperature	>=	60	° C
	intake air temperature	<=	60	° C
	commanded lambda	=	1	-
	catalyst heating	FALSE		
	short-term closed loop fuel control active	TRUE		
Multi-point Throttle Adaptation Active	air flow delta	<	0.25	-
	throttle angle delta	<	2	-
	engine speed	>	25	rpm
	engine coolant temperature	>	9.8	° C
	engine running time	>	1	sec
	ratio: (MAP model / BARO)	<	0.8	-
	or			
	ratio: (MAP model / BARO) during DFCO	<	0.5	-
	for time	>	0.5	sec
Normal (CAN) Bus Communication Running	control module programming	FALSE	-	-

Secondary Enable Parameter	Defined by:	Enable Conditions	Enable Value	Units
	(normal bus communition is disabled if module is being programmed)			
	CAN Bus	initialized	-	-
	consisting of:	and ready	-	-
	ignition on for	>	3	sec
	battery voltage	>	9.9	V
	battery voltage	<	25.5	V
Primary O2 Heater Control Active (Full heating power applied after primary O2 sensor dewpoint end has been reached)	following conditions for time:	>	0.2	sec
	battery voltage	<	25.6	V
	engine speed	>	240	rpm
Primary O2 Internal Resistance Valid	following conditions for time:	>	1	sec
	difference between loaded and unloaded primary O2 sensor voltage	>	0	V
	following conditions for time:	>	30	sec
	primary O2 sensor dewpoint end reached	TRUE	-	-
	normalized heating power of primary O2 sensor	>=	0.68	-
	modeled exhaust gas temp. at Primery HO2S	>=	600	° C
Primary O2 Sensor Closed Loop Control Active	primary O2 sensor dewpoint reached	TRUE	-	-
	primary O2 heater control active	TRUE	-	-
	commanded lambda	=	1	-
	primary O2 sensor ready for operation	TRUE	-	-
	battery voltage	>	10	V
	catalyst clear out after DFCO active	FALSE	-	-
	catalyst damaging misfire present	FALSE	-	-
	error: fuel injection valve	FALSE	-	-
	error: primary HO2S circuit	FALSE	-	-
	error: primary HO2S heater electrical	FALSE	-	-
	error: primary HO2S heater performance	FALSE	-	-
	engine speed	>	240	rpm
	for time based on engine coolant temperature at start: (TLRTMS)	>	1 …. 20	sec
Primary O2 Sensor Dewpoint Reached	integrated heat quantity (KFWMABG)	>	0.91 …. 300	kJ
	(result of modeled exhaust gas temp. at primary			

Secondary Enable Parameter	Defined by:	Enable Conditions	Enable Value	Units
	HO2S and exhaust gas mass flow)			
Primary O2 Sensor Ready for Operation	following conditions for time:	>	0.2	sec
	primary O2 sensor voltage	<=	0.4	V
	or			
	primary O2 sensor voltage	<=	1.15	V
	and			
	primary O2 sensor voltage	>=	0.52	V
	primary O2 sensor dewpoint end reached	TRUE	-	-
	following conditions for time:	>	5	sec
	primary O2 heater control active	TRUE	-	-
	primary O2 heating power factor relative to nominal	>=	0.9	-
Secondary O2 Heater Control Active	following conditions for time:	>	0.2	sec
(Full heating power applied after primary	battery voltage	<	25.6	V
O2 sensor dewpoint end has been reached)	engine speed	>	240	rpm
Secondary O2 Internal Resistance Valid	following conditions for time:	>	1	sec
	difference between loaded and unloaded secondary			
	O2 sensor voltage	>	0	V
	following conditions for time:	>	30	sec
	secondary O2 sensor dewpoint end reached	TRUE	-	-
	secondary O2 heater control active	TRUE	-	-
Secondary O2 Sensor Dewpoint Reached	integrated heat quantity (KFWMKAT)	>	5.01 …. 500	kJ
	(result of modeled exhaust gas temp. at primary			
	HO2S and exhaust gas mass flow)			
Secondary O2 Sensor Ready for Operation	following conditions for time:	>	0.6	sec
	secondary O2 sensor voltage	<=	0.4	V
	or			
	secondary O2 sensor voltage	<=	1.15	V
	secondary O2 sensor voltage	>=	0.52	V
	following conditions for time:	>	30	sec
	secondary O2 sensor dewpoint end reached	TRUE	-	-
	secondary O2 heater control active	TRUE	-	-

Cal Tables

P0011, P0021, P000A, P000C
P0021, P0024, P000B, P000D

KFDWNWDMXE (internal manufacturer cross reference)

KFDWNWDMXA (internal manufacturer cross reference)

Maximum Allowed Deviation - Intake Camshaft Position

degrees crank	Modeled Engine Oil Temperature (° C)				
Engine Speed (rpm)	-30	60	80	100	130
800	6.00	6.00	7.00	9.00	11.00
1200	6.00	6.00	6.00	6.00	7.00
1600	6.00	6.00	6.00	6.00	7.00
2000	6.00	6.00	6.00	6.00	6.00
2500	6.00	6.00	6.00	6.00	6.00
4000	6.00	6.00	6.00	6.00	6.00

P0116

KLTCWCSTAB (internal manufacturer cross reference)

Engine coolant temperature model based on ambient temperature + engine off timer output

Time (seconds)	1000	7200	10800	14400	21600	32400	43200	50400
Coefficient:	0.996	0.488	0.270	0.191	0.106	0.063	0.031	0.008

P0135, P0155

KFRINV / 2 (internal manufacturer cross reference)

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

Ohms	Modeled Exhaust Gas Temperature at Secondary O2 Sensor (° C)				
O2 Heater Power (watts)	350	450	550	650	750
0.70	128	128	120	104	96
0.80	128	128	120	104	96
1.00	128	128	120	104	96

FRINV1 / 2 (internal manufacturer cross reference)

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

	Modeled Exhaust Gas Temperature at Secondary O2 Sensor (° C)				
	350	450	550	650	750
factor	7.75	7.00	6.75	6.75	6.25

P0141, P0161

KFRINH / 2 (internal manufacturer cross reference)

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

Ohms	Modeled Exhaust Gas Temperature at Secondary O2 Sensor (° C)				
O2 Heater Power (watts)	350	450	550	650	750
0.7	128	128	120	112	104
0.8	128	128	120	112	104
1.0	128	128	120	112	104

FRINH1 / 2 (internal manufacturer cross reference)

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

	Modeled Exhaust Gas Temperature at Secondary O2 Sensor (° C)				
	350	450	550	650	750
factor	7.75	7.00	6.75	6.25	5.75

Cal Tables

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

MISALUN (internal manufacturer cross reference)

Indicated drive torque for enabling the misfire monitor

	Engine Speed (RPM)							
	800.00	1680.00	2560.00	3440.00	4360.00	5240	6120	7000
Torque (%)	7.42	8.98	9.38	9.77	16.41	23.83	28.13	28.91

NGALUN (internal manufacturer cross reference)

Engine Speed Gradient for disabling the misfire monitor

	Engine Speed (RPM)							
	800.00	1680.00	2560.00	3440.00	4360.00	5240	6120	7000
Engine Speed Gradient (RPM / s)	2500.03	4600.06	4600.06	4600.06	4600.06	4600.06	4600.06	4600.06

DRLSOLA (internal manufacturer cross reference)

Volumetric Efficiency Gradient for disabling the misfire monitor

	Engine Load (%)							
	7.81	10.16	14.84	19.92	35.16	50	60.16	75
Volumetric Efficiency Grad. (% / rev)	90.00	130.01	160.01	450.00	450.00	450	450	450

P0327, P0332, P0328,
P0333

NGKRWN (internal manufacturer cross reference)

RPM dynamic threshold for disabling knock diagnosis

RPM	400.0	800.0	1200.0	1600.0	2000.0	2400.0	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400
RPM per second	500	600	800	1000	1200	1400	1600	1700	1800	1900	2000.03	2100	2100	2100	2300	2300

KFDYESPF (internal manufacturer cross reference)

Intake Manifold Pressure delta for disabling knock diagnosis

Intake Manifold Press (kPa)	Engine Speed (RPM)															
ECT (° C)	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400
39.8	2.3945	2.293	2.1953	2.0938	1.9961	1.8945	1.793	1.6914	1.5898	1.4883	1.3867	1.2852	1.1836	1.082	0.9805	0.8828
50.3	2.4883	2.3867	2.2891	2.1875	2.0898	1.9883	1.8867	1.7852	1.6836	1.582	1.4805	1.3789	1.2773	1.1758	1.0742	0.9766
60	2.6289	2.5273	2.4297	2.3281	2.2305	2.1289	2.0273	1.9258	1.8242	1.7227	1.6211	1.5195	1.418	1.3164	1.2148	1.1172
83.3	2.7227	2.6211	2.5234	2.4219	2.3242	2.2227	2.1211	2.0195	1.918	1.8164	1.7148	1.6133	1.5117	1.4102	1.3086	1.2109

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)	0.032	0.036	0.040	0.044	0.048	0.052	0.056	0.067	0.087	0.107	0.107	0.150	0.151	0.219	0.278	0.345

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)	0.956	1.924	2.655	3.257	5.023	8.029	9.073	10.294	11.365	13.500	14.745	18.182	21.894	26.393	28.636	29.592

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	1200.000	3000.000	7200.000
Number of Counts	12.000	24.000	60.000	144.000

Cal Tables

P0420, P0430

RLKTDMN (internal manufacturer cross reference)

Engine Load lower limit for enabling catalyst monitor

	Engine Speed (RPM)				
	1160.000	1480.000	1800.000	2120.000	2440.000
Engine Load (%)	12.800	12.800	12.800	16.500	20.300

RLKTDMX (internal manufacturer cross reference)

Engine Load upper limit for enabling catalyst monitor

	Engine Speed (RPM)				
	1160.000	1480.000	1800.000	2120.000	2440.000
Engine Load (%)	69.800	80.300	77.300	65.300	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)			
	-30.000	0.000	30.000	90.000
Time Delay (sec)	140.000	140.000	160.000	210.000

P0442

KFEONVPT (internal manufacturer cross reference)

Vacuum / Pressure Threshold for Fuel Tank Leak Detection

Vacuum / Pressure **(hPa)**	Ambient Temperature (Model) (° C)								
Fuel Level (%)	2.3	6	9.8	14.3	18	21.8	26.3	30.8	35.3
10%	5.00	5.25	5.55	5.99	6.14	6.20	6.75	7.25	7.55
20%	4.90	5.25	5.50	5.95	6.05	6.15	6.60	7.15	7.34
30%	4.75	5.05	5.35	5.75	5.75	6.05	6.55	7.05	7.25
40%	4.55	4.94	5.25	5.50	5.65	5.95	6.55	7.05	7.25
50%	4.45	4.74	5.15	5.35	5.50	5.85	6.50	6.90	7.10
60%	4.25	4.54	5.00	5.15	5.25	5.75	6.25	6.75	7.00
68%	4.15	4.35	4.85	4.94	5.15	5.65	6.05	6.55	7.00
78%	4.05	4.25	4.55	4.85	5.05	5.40	5.60	6.25	6.50
88%	3.95	4.25	4.50	4.65	4.80	5.20	5.40	6.00	6.20

Tank Capacity **82.5 Liters**

Vacuum / Pressure **(Pa)**	Ambient Temperature (Model) (° C)								
Fuel Level (%)	2.3	6	9.8	14.3	18	21.8	26.3	30.8	35.3
10%	500	525	555	599	614	620	675	725	755
20%	490	525	550	595	605	615	660	715	734
30%	475	505	535	575	575	605	655	705	725
40%	455	494	525	550	565	595	655	705	725
50%	445	474	515	535	550	585	650	690	710
60%	425	454	500	515	525	575	625	675	700
68%	415	435	485	494	515	565	605	655	700
78%	405	425	455	485	505	540	560	625	650
88%	395	425	450	465	480	520	540	600	620

Cal Tables

P0455

KLTLDSFS05 (internal manufacturer cross reference)

Vacuum Gradient Threshold for Fuel Tank Leak Detection

Fuel Level **liters**	0	8	16	24	32	40	48	56	64	72
hPa / sec	0.042	0.041	0.033	0.032	0.036	0.039	0.038	0.046	0.046	0.046

Tank Capacity 82.5 Liters

Fuel Level **(%)**	0	9.7	19.4	29.1	38.8	48.5	58.2	67.9	77.6	87.3
Pa / sec	4.2	4.1	3.3	3.2	3.6	3.9	3.8	4.6	4.6	4.6

P050A

RLMDVERL (internal manufacturer cross reference)

Engine Load Threshold for Enabling the Idle Speed Diagnosis (MT Only)

	Engine Drag Torque (%)		
	10.0	16.0	20.0
Engine Load (%)	33.8	37.5	39.0

RLMDVERL (internal manufacturer cross reference)

Engine Load Threshold for Enabling the Idle Speed Diagnosis (AT Only)

	Engine Drag Torque (%)		
	10.0	16.0	20.0
Engine Load (%)	99.8	99.8	99.8

P2096, P2097

RLLRHUN (internal manufacturer cross reference)

Engine Load Enable Range for Post Catalyst Fuel Trim

	Engine Speed (RPM)							
	1320.0	1600.0	1920.0	2200.0	2520.0	2800.0	3320.0	3800.0
Engine Load (%)	20.3	18.0	16.5	16.5	16.5	16.5	16.5	16.5

P2101

DWDKSBAMX (internal manufacturer cross reference)

Maximum Throttle Angle Deviation per computation cycle

	Percent Throttle Opening (%)				
	0	0.3	1	5	15
Percent Throttle Delta (%)	4	6	11	20	50

P2270, P2271, P2272, P2273

RLLRHUN (internal manufacturer cross reference)

Engine Load Enable Range for Post Catalyst Fuel Trim

	Engine Speed (RPM)							
	1320.0	1600.0	1920.0	2200.0	2520.0	2800.0	3320.0	3800.0
Engine Load (%)	20.3	18.0	16.5	16.5	16.5	16.5	16.5	16.5

KFFRMIN (internal manufacturer cross reference)

Short term Fuel Trim factor for enabling Secondary O2 Signal Oscillation Diagnosis

Short-Term Fuel Trim Factor	Engine Coolant Temperature (° C)				
Time after Engine Start (sec)	-10.5	0.0	9.8	15.0	20.3
1.7	0.95	0.90	0.83	0.75	0.75
26.0	0.95	0.90	0.83	0.75	0.75
53.0	0.95	0.90	0.83	0.75	0.75
70.0	0.95	0.90	0.83	0.75	0.75
320.0	0.95	0.90	0.83	0.75	0.75

Cal Tables

P2601

DDTMOTMIN (internal manufacturer cross reference)
Maximum Second Derivative of tmot in Post Run

	Ambient Temperature (Model) (° C)			
	-20.3	0	15	50.3
2nd derivative (degC)	-3	-2.5	-2	-1

DDTMOTMIF
Maximum Second Derivative of tmot in Post Run with Fans Active

	Ambient Temperature (Model) (° C)			
	-20.3	0	15	50.3
2nd derivative (degC)	-3	-2.5	-2	-1

Parameter Definition - Calibration Tables

Knock Control Active

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

Intake Manifold Press (kPa)	Engine Speed (RPM)															
ECT (° C)	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400
39.8	2.3945	2.293	2.1953	2.0938	1.9961	1.8945	1.793	1.6914	1.5898	1.4883	1.3867	1.2852	1.1836	1.082	0.9805	0.8828
50.3	2.4883	2.3867	2.2891	2.1875	2.0898	1.9883	1.8867	1.7852	1.6836	1.582	1.4805	1.3789	1.2773	1.1758	1.0742	0.9766
60	2.6289	2.5273	2.4297	2.3281	2.2305	2.1289	2.0273	1.9258	1.8242	1.7227	1.6211	1.5195	1.418	1.3164	1.2148	1.1172
83.3	2.7227	2.6211	2.5234	2.4219	2.3242	2.2227	2.1211	2.0195	1.918	1.8164	1.7148	1.6133	1.5117	1.4102	1.3086	1.2109

LKRN (internal manufacturer cross reference)
Engine Load Threshold for enabling Knock Control

	Engine Speed (RPM)															
	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400
Engine Load (%)	30.00	29.48	28.82	27.98	27.05	26.02	27.05	29.48	30.56	30.98	31.55	32.86	33.98	34.64	35.39	35.48

Fuel Cut-Off (DFCO) Active

KFNWEGM (internal manufacturer cross reference)
Engine Speed for Activating DFCO

Engine Speed (RPM)	Engine Coolant Temperature (° C)				
Transmission Gear (-)	-20.3	0	20.3	39.8	80.3
Neutral	8000	8000	2760	1280	1280
1	8000	4000	2760	2760	2760
2	8000	4000	2760	1680	1680
3	8000	4000	2760	1680	1680
4	8000	4000	2760	1680	1120
5	8000	4000	1680	1200	1160
6	8000	4000	1680	1120	920
Reverse	8000	8000	8000	8000	8000

Cal Tables

Primary O2 Sensor Dewpoint Reached

KFWMABG (internal manufacturer cross reference)

Integrated Heat Quantity required for Dew-Point End at Primary HO2S

Integrated Heat Quantity (kJ)	Modeled Primary Sensor Exhaust Gas Temperature at Engine Start (° C)									
Engine Coolant Temperature (° C)	-39.994	-20.002	-5.002	-0.009	14.991	24.998	35.006	59.991	80.006	89.991
-39.8	299.92	219.82	175.22	125.16	75.09	35.95	20.02	15.02	15.02	15.02
-20.3	219.82	199.79	130.16	100.12	50.06	20.02	20.02	15.02	15.02	15.02
-5.3	175.22	130.16	100.12	75.09	28.22	8.19	20.02	15.02	15.02	15.02
0	125.16	100.12	75.09	65.08	18.2	8.19	20.02	15.02	15.02	15.02
15	125.16	100.12	75.09	65.08	10.01	8.19	20.02	15.02	15.02	15.02
24.8	125.16	100.12	75.09	65.08	8.19	8.19	20.02	15.02	15.02	15.02
35.3	125.16	100.12	75.09	65.08	8.19	8.19	20.02	15.02	15.02	15.02
60	125.16	100.12	75.09	65.08	8.19	8.19	20.02	15.02	15.02	15.02
80.3	125.16	100.12	75.09	65.08	8.19	8.19	20.02	15.02	0.91	0.91
90	125.16	100.12	75.09	65.08	8.19	8.19	20.02	15.02	0.91	0.91

Secondary O2 Sensor Dewpoint Reached

KFWMKAT (internal manufacturer cross reference)

Integrated Heat Quantity required for Dew-Point End at Secondary HO2S

Integrated Heat Quantity (kJ)	Modeled Secondary Sensor Exhaust Gas Temperature at Engine Start (° C)									
Engine Coolant Temperature (° C)	-39.994	-20.002	-5.002	-0.009	14.991	24.998	35.006	59.991	80.006	89.991
-39.8	500.17	440.09	299.92	249.86	229.83	209.81	196.15	140.17	119.24	84.2
-20.3	440.09	410.06	284.9	244.85	224.82	160.2	120.15	100.12	85.11	65.08
-5.3	299.92	284.9	249.86	229.83	186.14	111.96	70.09	55.98	45.06	28.22
0	249.86	244.85	229.83	219.82	168.39	106.5	63.26	49.15	35.04	20.94
15	239.84	224.82	209.81	180.22	111.96	98.3	55.98	44.15	30.04	6.37
24.8	229.83	209.81	189.78	126.07	98.3	76.91	45.06	40.05	15.93	6.83
35.3	199.79	184.78	140.17	111.96	70.09	55.98	35.04	25.03	10.01	5.01
60	170.21	155.19	84.2	70.09	55.98	40.05	31.86	30.04	5.01	5.01
80.3	150.19	130.16	55.98	41.87	35.04	30.04	25.03	20.02	5.01	5.01
90	100.12	96.94	28.22	14.11	14.11	6.83	5.92	5.01	5.01	5.01

Primary O2 Sensor Closed Loop Control

TLRTMS (internal manufacturer cross reference)

Delay time for activating Closed Loop Fuel Control based on ECT at Start

	Engine Coolant Temperature at Start (° C)				
	-9.8	0	20.3	50.3	80.3
Delay time (sec)	20	10	5	2	1

GENERAL MOTORS

2011 Engine Diagnostic Summary Table--3.6L/LLT--Content

OBD GROUP: 11OBDG06 **EMISSION STDS: CAL--- ULEV 2 /PC**
TEST GROUP: BGMXJ03.6151 **FED---Bin 5 / PC**

This document was prepared in the following main sections (worksheets) for MY11 ERFS Diagnostics in Group 6

Section 1 : S1-C202_Common_LLT

Contains information that is common to all C202-ERFS applications within 11OBDG6 with RPO LLT 3.6L SIDI V-6 engine

VPPC with ERFS in Group 6
- GMT561, GMT967, GMT968
- GMX206, GMX226, GMX295, GMX322, GMX353

Section 2 : S2-C101_Common_LLT

Contains information that is common to all C101-ERFS applications within 11OBDG6 with RPO LLT 3.6L SIDI V-6 engine

VPPC with ERFS in Group 6
- GMX511, GMX521

Original submission Nov 5, 2009

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 a fuel pressure sensor response stuck within the normal operating range	Absolute value of change in fuel pressure as sensed during intrusive test.	<= 30 kPa	1. FRP Circuit Low DTC (P018C) 2. FRP Circuit High DTC (P018D) 3. FuelPump Circuit Low DTC (P0231) 4. FuelPump Circuit High DTC (P0232) 5. FuelPump Circuit Open DTC (P023F) 6. Reference Voltage DTC (P0641) 7. Fuel Pump Control Module Driver Over-temperature DTC's (P064A, P1255) 8. Control Module Internal Performance DTC (P0606) 9. Engine run time 10. Emissions fuel level (PPEI $3FB) AND Engine Run Time 11. Fuel pump control 12. Fuel pump control state	not active not active not active not active not active not active not active >=5 seconds not low > 30 sec enabled normal or FRP Rationality control	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 Duration of intrusive test is fueling related (5 to 12 seconds). 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)	DTC Type A 1 trip

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					13. Engine fuel flow 14. ECM fuel control system failure (PPEI $1ED)	> 0.047 g/s 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 < 32V	72 test failures in 80 test samples if Fuel Pump Current <100A 3 test failures in 15 test samples if Fuel Pump Current >=100A 1 sample/12.5 ms	DTC Type A 1 trip
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 1 trip
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< 32V	72 test failures in 80 test samples; 1 sample/12.5ms	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 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
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	Run or Crank enabled	1 failure Frequency: 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 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	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	Incorrect value.	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	Tests 1 and 2 1 failure Frequency: Continuously (12.5ms)	DTC Type A 1 trip
2. Processor clock test			2. For Processor Clock Fault: •EE latch flag in EEPROM. OR • RAM latch flag.	0x5A5A 0x5A	1. For all I/O configuration register faults: •KeMEMD_b_ProcFltCfgRegEnbl 2. For Processor Clock Fault: •KeMEMD_b_ProcFltCLKDiagEnbl	TRUE TRUE	Test 3 3 failures out of 15 samples 1 sample/12.5 ms	
3. External watchdog test			3. For External Watchdog Fault: • Software control of fuel pump driver	Control Lost	3. For External Watchdog Fault: •KeFRPD_b_FPExtWDogDiagEnbl 3. For External Watchdog Fault: •Control Module ROM(P0601)	TRUE not active		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					3. For External Watchdog Fault: •Control Module RAM(P0604)	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
5Volt Reference Circuit (Short High/Low/Out of Range)	P0641	Detects continuous short or out of range 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
			OR Reference voltage □	> 102.5% nominal (i.e., 5.125V) OR <97.5% nominal (i.e., 4.875V)				

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 Continental 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 AND Ignition Run / Crank KeFRPD_b_FPOverTempDiagEnbl	Run or Crank Enabled Enabled 9V<voltage<32V TRUE	3 failures out of 15 samples 1 sample/12.5 ms	DTC Type B 2 trips
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 **AND** Fuel pump driver Temp	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.) > 190C	Ignition OR HS Comm OR Fuel Pump Control AND Ignition Run / Crank KeFRPD_b_FPOverTempDiagEnbl	Run or Crank Enabled Enabled 9V<voltage<32V TRUE	3 failures out of 15 samples 1 sample/12.5 ms	DTC Type B 2 trips
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 (rationality)	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) OR >= High Threshold (function of desired fuel rail pressure and fuel flow rate. 15% of resultant Target Pressure) **(See Supporting Tables tab)**	1. FRP Circuit Low DTC (P018C) 2. FRP Circuit High DTC (P018D) 3. Fuel Pressure Sensor Performance DTC (P018B) 4. FuelPump Circuit Low DTC (P0231) 5. FuelPump Circuit High DTC (P0232)	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.
					6. FuelPump Circuit Open DTC (P023F)	not active		
					7. Reference Voltage DTC (P0641)	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. An ECM fuel control system failure (PPEI $1ED)	has not occurred		
					11. The Barometric pressure (PPEI $4C1) signal	valid (for absolute fuel pressure sensor)		
					12. Engine run time	>= 30 seconds		
					13. Emissions fuel level (PPEI $3FB) AND Engine Run Time	not low > 30 sec		
					14. Fuel pump control	enabled		
					15. Fuel pump control state	normal		
					16. Battery Voltage	11V<=voltage=<32V		
					17. Fuel flow rate **(See Supporting Tables tab)**	> 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)		
					18. 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	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 11V<=voltage=<32V not active	12 failures out of 12 samples (12 seconds)	DTC Type B 2 trips

Supporting Tables

P2635 Fuel Pump Performance Maximum Fuel Flow map (grams / s)

X-axis= Desired Fuel Pressure (kiloPascals)
Y-axis= Battery voltage (volts)

	200	250	300	350	400	450	500	550	600
4.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	19.57031	16.26563	13.01563
6	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	19.57031	16.26563	13.01563
7.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	19.57031	16.26563	13.01563
9	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	19.57031	16.26563	13.01563
10.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	19.57031	16.26563	13.01563
12	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
13.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
15	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
16.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
18	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
19.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
21	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
22.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
24	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
25.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
27	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
28.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844

P2635 Fuel Pump Performance Filtered Pressure Error Fault Threshold High map (kiloPascals)

X-axis= Target Fuel Pressure (kiloPascals)
Y-axis= Fuel Flow (grams / s)

	200	250	300	350	400	450	500	550	600
0	30	37.5	45	52.5	60	67.5	75	82.5	90
1.5	30	37.5	45	52.5	60	67.5	75	82.5	90
3	30	37.5	45	52.5	60	67.5	75	82.5	90
4.5	30	37.5	45	52.5	60	67.5	75	82.5	90
6	30	37.5	45	52.5	60	67.5	75	82.5	90

Supporting Tables

P2635 Fuel Pump Performance Filtered Pressure Error Fault Threshold High map (kiloPascals) (Con't)

X-axis= Target Fuel Pressure (kiloPascals)
Y-axis= Fuel Flow (grams / s)

7.5	30	37.5	45	52.5	60	67.5	75	82.5	90
9	30	37.5	45	52.5	60	67.5	75	82.5	90
10.5	30	37.5	45	52.5	60	67.5	75	82.5	90
12	30	37.5	45	52.5	60	67.5	75	82.5	90
13.5	30	37.5	45	52.5	60	67.5	75	82.5	90
15	30	37.5	45	52.5	60	67.5	75	82.5	90
16.5	30	37.5	45	52.5	60	67.5	75	82.5	90
18	30	37.5	45	52.5	60	67.5	75	82.5	90
19.5	30	37.5	45	52.5	60	67.5	75	82.5	90
21	30	37.5	45	52.5	60	67.5	75	82.5	90
22.5	30	37.5	45	52.5	60	67.5	75	82.5	90
24	30	37.5	45	52.5	60	67.5	75	82.5	90
25.5	30	37.5	45	52.5	60	67.5	75	82.5	90
27	30	37.5	45	52.5	60	67.5	75	82.5	90
28.5	30	37.5	45	52.5	60	67.5	75	82.5	90
30	30	37.5	45	52.5	60	67.5	75	82.5	90
31.5	30	37.5	45	52.5	60	67.5	75	82.5	90
33	30	37.5	45	52.5	60	67.5	75	82.5	90
34.5	30	37.5	45	52.5	60	67.5	75	82.5	90
36	30	37.5	45	52.5	60	67.5	75	82.5	90
37.5	30	37.5	45	52.5	60	67.5	75	82.5	90
39	30	37.5	45	52.5	60	67.5	75	82.5	90
40.5	30	37.5	45	52.5	60	67.5	75	82.5	90
42	30	37.5	45	52.5	60	67.5	75	82.5	90
43.5	30	37.5	45	52.5	60	67.5	75	82.5	90
45	30	37.5	45	52.5	60	67.5	75	82.5	90
46.5	30	37.5	45	52.5	60	67.5	75	82.5	90
48	30	37.5	45	52.5	60	67.5	75	82.5	90

Supporting Tables

P2635 Fuel Pump Performance Filtered Pressure Error Fault RePass Threshold High map (kiloPascals)

X-axis= Target Fuel Pressure (kiloPascals)
Y-axis= Fuel Flow (grams / s)

	200	250	300	350	400	450	500	550	600
0	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
1.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
3	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
4.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
6	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
7.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
9	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
10.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
12	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
13.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
15	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
16.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
18	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
19.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
21	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
22.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
24	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
25.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
27	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
28.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
30	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
31.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
33	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
34.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
36	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
37.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
39	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
40.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
42	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
43.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5

Supporting Tables

P2635 Fuel Pump Performance Filtered Pressure Error Fault RePass Threshold High map (kiloPascals) (Con't)

X-axis= Target Fuel Pressure (kiloPascals)
Y-axis= Fuel Flow (grams / s)

45	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
46.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
48	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5

P2635 Fuel Pump Performance Filtered Pressure Error Fault Threshold Low map (kiloPascals)

X-axis= Target Fuel Pressure (kiloPascals)
Y-axis= Fuel Flow (grams / s)

	200	250	300	350	400	450	500	550	600
0	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
1.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
3	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
4.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
6	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
7.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
9	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
10.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
12	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
13.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
15	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
16.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
18	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
19.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
21	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
22.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
24	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
25.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
27	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
28.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
30	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90

Supporting Tables

P2635 Fuel Pump Performance Filtered Pressure Error Fault Threshold Low map (kiloPascals) (Con't)

X-axis= Target Fuel Pressure (kiloPascals)
Y-axis= Fuel Flow (grams / s)

31.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
33	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
34.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
36	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
37.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
39	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
40.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
42	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
43.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
45	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
46.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
48	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90

P2635 Fuel Pump Performance Filtered Pressure Error Fault RePass Threshold Low map (kiloPascals)

X-axis= Target Fuel Pressure (kiloPascals)
Y-axis= Fuel Flow (grams / s)

	200	250	300	350	400	450	500	550	600
0	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
1.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
3	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
4.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
6	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
7.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
9	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
10.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
12	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
13.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
15	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
16.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
18	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5

Supporting Tables

P2635 Fuel Pump Performance Filtered Pressure Error Fault RePass Threshold Low map (kiloPascals) (Con't)

X-axis= Target Fuel Pressure (kiloPascals)
Y-axis= Fuel Flow (grams / s)

19.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
21	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
22.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
24	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
25.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
27	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
28.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
30	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
31.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
33	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
34.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
36	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
37.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
39	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
40.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
42	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
43.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
45	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
46.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
48	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5

GENERAL MOTORS

2011 Engine Diagnostic Summary Table--3.6L/LLT--Content

OBD GROUP: 11OBDG06 **EMISSION STDS: CAL--- ULEV 2 /PC**
TEST GROUP: BGMXJ03.6151 **FED---Bin 5 / PC**

This document was prepared in the following main sections (worksheets) for MY11 ERFS Diagnostics in Group 6

Section 1 : S1-C202_Common_LLT

Contains information that is common to all C202-ERFS applications within 11OBDG6 with RPO LLT 3.6L SIDI V-6 engine

VPPC with ERFS in Group 6
- GMT561, GMT967, GMT968
- GMX206, GMX226, GMX295, GMX322, GMX353

Section 2 : S2-C101_Common_LLT

Contains information that is common to all C101-ERFS applications within 11OBDG6 with RPO LLT 3.6L SIDI V-6 engine

VPPC with ERFS in Group 6
- GMX511, GMX521

Original submission Nov 5, 2009

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 a fuel pressure sensor response stuck within the normal operating range	Absolute value of fuel pressure change as sensed during intrusive test.	<= 30 kPa	1. FRP Circuit Low DTC (P018C) 2. FRP Circuit High DTC (P018D) 3. FuelPump Circuit Low DTC (P0231) 4. FuelPump Circuit High DTC (P0232) 5. FuelPump Circuit Open DTC (P023F) 6. Reference Voltage DTC (P0641) 7. Fuel Pump Control Module Driver Over-temperature DTC (P064A) 8. Control Module Internal Performance DTC (P0606) 9. Engine run time 10. Emissions fuel level (PPEI $3FB) 11. Fuel pump control 12. Fuel pump control state	not active not active not active not active not active not active not active >=5 seconds not low enabled normal or FRP Rationality control	<u>Frequency:</u> 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 Duration of intrusive test is fueling related (5 to 12 seconds). 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)	DTC Type A 1 trip

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					13. Engine fuel flow 14. ECM fuel control system failure (PPEI $1ED)	> 0.047 g/s failure has not occurred		
Fuel Rail Pressure (FRP) Sensor Circuit Low Voltage	P018C	This DTC detects if the fuel pressure sensor circuit is shorted 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 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 < 32V	72 test failures in 80 test samples if Fuel Pump Current <100A 1 sample/12.5 ms	DTC Type A 1 trip
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	0% duty cycle (off) False	36 test failures in 40 test samples; 1 sample/12.5ms Pass/Fail determination made only once per trip	DTC Type A 1 trip

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					Time that above conditions are met	>=4.0 seconds		
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 < 32V	72 test failures in 80 test samples; 1 sample/12.5ms	DTC Type A 1 trip
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 discriminates the source of the fault)	1. For all I/O configuration register faults: •Register contents 2. For Processor Clock Fault: •EE latch flag in EEPROM. OR • RAM latch flag.	Incorrect value. 0x5A5A 0x5A	Ignition OR HS Comm OR Fuel Pump Control 1. For all I/O configuration register faults: •KeMEMD_b_ProcFltCfgRegEnbl 2. For Processor Clock Fault: •KeMEMD_b_ProcFltCLKDiagEnbl	Run or Crank enabled enabled TRUE TRUE	Tests 1 and 2 1 failure Frequency: Continuously (12.5ms) 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			3. For External Watchdog Fault: • Software control of fuel pump driver	Control Lost	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 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
5Volt Reference Circuit (Short High/Low/Out of Range)	P0641	Detects continuous short or out of range 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
			OR Reference voltage	> 102.5% nominal (i.e., 5.125V) OR <97.5% nominal (i.e., 4.875V)				
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 HS Comm OR	Run or Crank enabled	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.
					Fuel Pump Control KeFRPD_b_FPOverTempDiagEnbl Ignition Run/Crank	enabled TRUE 9V<voltage<32V		
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	200 samples 1 sample/25.0 ms	DTC Type A 1 trip
Fuel Pump Flow Performance (rationality)	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) OR >= High Threshold (function of desired fuel rail pressure and fuel flow rate. 15% of resultant Target Pressure) **(See Supporting Tables tab)**	1. FRP Circuit Low DTC (P018C)	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.
					2. FRP Circuit High DTC (P018D)	not active .		
					3. Fuel Rail Pressure Sensor Performance DTC (P018B)	not active		
					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. Fuel Pump Control Module Driver Over-temperature DTC's (P064A)	not active		
					9. Control Module Internal Performance DTC (P0606)	not active		
					10. An ECM fuel control system failure (PPEI $1ED)	has not occurred		
					11. The Barometric pressure (PPEI $4C1) signal	valid (for absolute fuel pressure sensor)		
					12. Engine run time	>= 30 seconds		
					13. Emissions fuel level (PPEI $3FB)	not low		
					14. Fuel pump control	enabled		
					15. Fuel pump control state	normal		
					16. Battery Voltage	11V<=voltage=<32V		
					17. Fuel flow rate **(See Supporting Tables tab)**	> 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)		
					18. 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	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 11V<voltage<32V not active	12 failures out of 12 samples (12 seconds)	DTC Type B 2 trips

Supporting Tables

P2635 Fuel Pump Performance Maximum Fuel Flow map (grams / s)

X-axis= Desired Fuel Pressure (kiloPascals)
Y-axis= Battery voltage (volts)

	200	250	300	350	400	450	500	550	600
4.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	19.57031	16.26563	13.01563
6	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	19.57031	16.26563	13.01563
7.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	19.57031	16.26563	13.01563
9	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	19.57031	16.26563	13.01563
10.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	19.57031	16.26563	13.01563
12	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
13.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
15	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
16.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
18	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
19.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
21	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
22.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
24	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
25.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
27	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844
28.5	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844	20.39844

P2635 Fuel Pump Performance Filtered Pressure Error Fault Threshold High map (kiloPascals)

X-axis= Target Fuel Pressure (kiloPascals)
Y-axis= Fuel Flow (grams / s)

	200	250	300	350	400	450	500	550	600
0	30	37.5	45	52.5	60	67.5	75	82.5	90
1.5	30	37.5	45	52.5	60	67.5	75	82.5	90
3	30	37.5	45	52.5	60	67.5	75	82.5	90
4.5	30	37.5	45	52.5	60	67.5	75	82.5	90
6	30	37.5	45	52.5	60	67.5	75	82.5	90

Supporting Tables

P2635 Fuel Pump Performance Filtered Pressure Error Fault Threshold High map (kiloPascals) (Con't)

X-axis= Target Fuel Pressure (kiloPascals)
Y-axis= Fuel Flow (grams / s)

7.5	30	37.5	45	52.5	60	67.5	75	82.5	90
9	30	37.5	45	52.5	60	67.5	75	82.5	90
10.5	30	37.5	45	52.5	60	67.5	75	82.5	90
12	30	37.5	45	52.5	60	67.5	75	82.5	90
13.5	30	37.5	45	52.5	60	67.5	75	82.5	90
15	30	37.5	45	52.5	60	67.5	75	82.5	90
16.5	30	37.5	45	52.5	60	67.5	75	82.5	90
18	30	37.5	45	52.5	60	67.5	75	82.5	90
19.5	30	37.5	45	52.5	60	67.5	75	82.5	90
21	30	37.5	45	52.5	60	67.5	75	82.5	90
22.5	30	37.5	45	52.5	60	67.5	75	82.5	90
24	30	37.5	45	52.5	60	67.5	75	82.5	90
25.5	30	37.5	45	52.5	60	67.5	75	82.5	90
27	30	37.5	45	52.5	60	67.5	75	82.5	90
28.5	30	37.5	45	52.5	60	67.5	75	82.5	90
30	30	37.5	45	52.5	60	67.5	75	82.5	90
31.5	30	37.5	45	52.5	60	67.5	75	82.5	90
33	30	37.5	45	52.5	60	67.5	75	82.5	90
34.5	30	37.5	45	52.5	60	67.5	75	82.5	90
36	30	37.5	45	52.5	60	67.5	75	82.5	90
37.5	30	37.5	45	52.5	60	67.5	75	82.5	90
39	30	37.5	45	52.5	60	67.5	75	82.5	90
40.5	30	37.5	45	52.5	60	67.5	75	82.5	90
42	30	37.5	45	52.5	60	67.5	75	82.5	90
43.5	30	37.5	45	52.5	60	67.5	75	82.5	90
45	30	37.5	45	52.5	60	67.5	75	82.5	90
46.5	30	37.5	45	52.5	60	67.5	75	82.5	90
48	30	37.5	45	52.5	60	67.5	75	82.5	90

Supporting Tables

P2635 Fuel Pump Performance Filtered Pressure Error Fault RePass Threshold High map (kiloPascals)

X-axis= Target Fuel Pressure (kiloPascals)
Y-axis= Fuel Flow (grams / s)

	200	250	300	350	400	450	500	550	600
0	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
1.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
3	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
4.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
6	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
7.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
9	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
10.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
12	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
13.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
15	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
16.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
18	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
19.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
21	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
22.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
24	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
25.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
27	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
28.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
30	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
31.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
33	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
34.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
36	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
37.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
39	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
40.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
42	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
43.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5

Supporting Tables

P2635 Fuel Pump Performance Filtered Pressure Error Fault RePass Threshold High map (kiloPascals) (Con't)

X-axis= Target Fuel Pressure (kiloPascals)
Y-axis= Fuel Flow (grams / s)

45	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
46.5	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5
48	25.5	31.875	38.25	44.625	51	57.375	63.75	70.125	76.5

P2635 Fuel Pump Performance Filtered Pressure Error Fault Threshold Low map (kiloPascals)

X-axis= Target Fuel Pressure (kiloPascals)
Y-axis= Fuel Flow (grams / s)

	200	250	300	350	400	450	500	550	600
0	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
1.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
3	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
4.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
6	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
7.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
9	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
10.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
12	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
13.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
15	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
16.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
18	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
19.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
21	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
22.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
24	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
25.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
27	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
28.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
30	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90

Supporting Tables

P2635 Fuel Pump Performance Filtered Pressure Error Fault Threshold Low map (kiloPascals) (Con't)

X-axis= Target Fuel Pressure (kiloPascals)
Y-axis= Fuel Flow (grams / s)

31.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
33	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
34.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
36	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
37.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
39	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
40.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
42	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
43.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
45	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
46.5	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90
48	-30	-37.5	-45	-52.5	-60	-67.5	-75	-82.5	-90

P2635 Fuel Pump Performance Filtered Pressure Error Fault RePass Threshold Low map (kiloPascals)

X-axis= Target Fuel Pressure (kiloPascals)
Y-axis= Fuel Flow (grams / s)

	200	250	300	350	400	450	500	550	600
0	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
1.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
3	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
4.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
6	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
7.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
9	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
10.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
12	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
13.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
15	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
16.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
18	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5

Supporting Tables

P2635 Fuel Pump Performance Filtered Pressure Error Fault RePass Threshold Low map (kiloPascals) (Con't)

X-axis= Target Fuel Pressure (kiloPascals)
Y-axis= Fuel Flow (grams / s)

19.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
21	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
22.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
24	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
25.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
27	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
28.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
30	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
31.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
33	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
34.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
36	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
37.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
39	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
40.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
42	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
43.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
45	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
46.5	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5
48	-25.5	-31.875	-38.25	-44.625	-51	-57.375	-63.75	-70.125	-76.5