08 GRP11 Two - Mode Hybrid Electric Motor Control Processor - A (MCP- A)

Component/System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Req'd	MIL Illum
MCP A Phase Current Diagnostics:								
Drive Motor "A" Phase U-V-W Correlation	P0BFD	To detect electrical failure of phase current sensor.	Sum of 3 phase currents	> 75 A	Main Relay Wakeup Signal	Closed On	8 ms	One Trip
Drive Motor "A" Phase U-V-W Current Sensor Overcurrent	P0C01	To detect 3 Phase over current and to protect IGBT.	U, V, or W Phase current sensor	> 680 A	Wakeup Signal	On	2ms	One Trip
Drive Motor "A" Phase U-V-W Circuit/Open	P0C05	Drive Motor "A" Invalid Current	Motor Current	< 9 A	Wakeup Signal	On	17ms	One Trip
Drive Motor "A" Phase U Current Sensor Circuit Low	P0BE7	Circuit Low monitor to detect the failure of U-phase current sensor circuit below valid range	U Phase current sensor output at highside	< -700 A	Wakeup Signal	On	21ms	Two Trips
					PWMOutputEnable	FALSE		
Drive Motor "A" Phase U Current Sensor Circuit High	P0BE8	Circuit High monitor to detect the failure of U-phase current sensor circuit above valid range	U Phase current sensor output at highside	> 700 A	Wakeup Signal	On	21ms	Two Trips
					PWMOutputEnable	FALSE		
Drive Motor "A" Phase U Current Sensor Offset Out-of Range	P0BE6	Offset Circuit monitor to detect the failure of U-phase offset current above valid range	U Phase offset current output at highside	>30 A	Wakeup Signal	On	208ms	Two Trips
					Power Stage	OPEN		
					P0BE7/P0BE8	NOT ACTIVE		
Drive Motor "A" Phase V Current Sensor Circuit Low	P0BEB	Circuit Low monitor to detect the failure of V-phase current sensor circuit below valid range	V Phase current sensor output at highside	< -700 A	Wakeup Signal	On	21ms	Two Trips
					PWMOutputEnable	FALSE		
Drive Motor "A" Phase V Current Sensor Circuit High Voltage	P0BEC	Circuit High monitor to detect the failure of V-phase current sensor circuit above valid range	V Phase current sensor output current at highside	> 700 A	Wakeup Signal	On	21ms	Two Trips
					PWMOutputEnable	FALSE		
Drive Motor "A" Phase V Current Sensor Offset Out-of Range	P0BEA	Offset Circuit monitor to detect the failure of U-phase offset current above valid range	V Phase offset current output at highside	>30 A	Wakeup Signal	On	208ms	Two Trips
					Power Stage	OPEN		
					P0BEB/P0BEC	NOT ACTIVE		
Drive Motor "A" Phase W Current Sensor Circuit Low	P0BEF	Circuit Low monitor to detect the failure of W-phase current sensor circuit below valid range	W Phase current sensor output at highside	< -700 A	Wakeup Signal	On	21ms	Two Trips
					PWMOutputEnable	FALSE		
Drive Motor "A" Phase W Current Sensor Circuit High	P0BF0	Circuit High monitor to detect the failure of W-phase current sensor circuit above valid range	W Phase current sensor output at highside	> 700 A	Wakeup Signal	On	21ms	Two Trips
					PWMOutputEnable	FALSE		
Drive Motor "A" Phase W Current Sensor Offset Out-of Range	P0BEE	Offset Circuit monitor to detect the failure of U-phase offset current above valid range	W Phase offset current output at highside	>30 A	Wakeup Signal	On	208ms	Two Trips

08 GRP11 Two - Mode Hybrid Electric Motor Control Processor - A (MCP- A)

Component/System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Req'd	MIL Illum
					Power Stage	OPEN		
					P0BEF/P0BF0	NOT ACTIVE		
MCP A IGBT Diagnostics								
Drive Motor "A" Inverter Performance	P0A78	Detects IGBT Saturation Faults	Phase A, B, or C High or Low Side Devices	OVERDRIVEN (Status Fault Bit)	Wakeup Signal	On	1042ms	One Trip
Drive Motor "A" Inverter Power Supply Circuit/Open	P0C0B	Detects IGBT Bias Faults	Phase A, B, or C Power Supply	FAILED (Status Fault Bit)	Inverter State	Initialization Complete	1 fail	One Trip
MCP A High Voltage (HV) Diagnostics:								
Drive Motor "A" Hybrid Battery System Voltage High	P1AEE	To detect over voltage and to protect TPIM Vdc Circuit	Average of first and third previous HV readings	> 475V	WakeUp Signal	On	0.4ms	One Trip
Drive Motor "A" Control Module Hybrid Battery Voltage Sense Circuit Low Voltage	P1AE8	Circuit Low monitor to detect the failure of HV output voltage sensor circuit below valid range	HV Sensor Voltage	<0V	Inverter State	Initialization Complete	146ms	Two Trips
Drive Motor "A" Control Module Hybrid Battery Voltage Sense Circuit High Voltage	P1AE9	Circuit High monitor to detect the failure of HV output voltage sensor circuit above valid range	HV Sensor Voltage	>564V	Inverter State	Initialization Complete	104ms	Two Trips
Drive Motor "A" Control Module Hybrid Battery System Voltage	P1AEC	To check correlation of HV_MCP with HV_Midpack and HV_Battery Voltages.	ABS(MCP HV voltage - HV Battery voltage) OR ABS(MCP HV voltage - MidPack voltage)	>= 34 V >= 90 V	Valid HV CAN Msg	TRUE	187ms	One Trip
Drive Motor "A" HV Interlock (HVIL) Break Detected	P1B05	To detect interlock circuit open.	HV Interlock Status Discrete Input	TRUE	WakeUp Signal	On	304ms	Special Type C
					HV CAN Msg Rx	TRUE		
					BPCM Sourcing MCP HVIL Status	TRUE		
Drive Motor "A" Control Module Hybrid Battery Voltage System Isolation Fault	P1AF0	Isolation Lost between Battery Pack and Chassis	Isolation Ratio (MidPack Voltage / HV Battery Voltage)	< 0.27 OR >1.85	No HV Clamp Fault or MidPack Sensor OOR Faults: P1AEE, P1AF4, and P1AF5 AND HV Sensor Voltage	NOT ACTIVE > 50V	5208ms	Non-MIL
Drive Motor "A" Control Module Hybrid Battery Voltage Isolation Sensor Circuit Low	P1AF4	Circuit Low monitor to detect the failure of HV MidPack voltage sensor circuit below valid range	MidPack Voltage	<0V	Inverter State	Initialization Complete	729ms	Two Trips
Drive Motor "A" Control Module Hybrid Battery Voltage Isolation Sensor Circuit High	P1AF5	Circuit High monitor to detect the failure of HV MidPack voltage sensor circuit above valid range	MidPack Voltage	>564V	Inverter State	Initialization Complete	521ms	Two Trips
Motor A Temperature Sensor								

08 GRP11 Two - Mode Hybrid Electric Motor Control Processor - A (MCP- A)

Component/System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Req'd	MIL Illum
Drive Motor "A" Control Module Temperature Sensor Performance	P0A2B	Motor A Temperature Sensor In-Range Rationality Check	ABS(Motor Temp -Avg PIM Temp Avg)	> 22deg C	Ignition Off Time PIM Temp Average and Motor Temp Above Minimum Threshold No PIM or Motor Temp OOR Faults: P0AEF, P0AF0, P0BD3, P0BD4, P0BDD, P0BDE, P0A2C and P0A2D.	>=360 min >-18 degC NOT ACTIVE	2084ms	Two Trips
Drive Motor "A" Control Module Temperature Sensor Circuit Out of Range High	P0A2D	To detect temperature sensor Out of Range high (voltage).	Motor Temperature	< -40 deg C (near 5V)	Wakeup Signal When fault present at start of trip: Cumulative Motor Temp Warmup Time above Motor Temp Warmup Torque Threshold	ON >=1.5min >= 20 Nm	1042ms	Two Trips
Drive Motor "A" Control Module Temperature Sensor Circuit Out of Range Low	P0A2C	To detect temperature sensor Out of Range low (voltage).	Motor Temperature	> 230 degC (near 0V)	WakeUp Signal	On	1042ms	Two Trips
Drive Motor "A" Over Temperature	P0A2F	To detect a sustained motor overtemperature condition	Motor Temperature	>200 degC	Instanteous Motor Temp in Range: No OOR Faults; P0A2C, P0A2D	NOT ACTIVE	3.13 sec	Two Trips
CAN / SPI / SCI Bus Timeout								
Drive Motor "A" Control Module Lost Communication With SPI Bus	P1AFC	To detect loss of communication on the SPI bus with the HCP module SPI Diag Timeout	SPI Receive Timeout flag # Timeout Counts	TRUE 7	Inverter State	RUN	40 ms	One Trip
Drive Motor "A" Control Module Lost Communication With SCI Bus	P1AFD	To detect loss of communication on the SCI bus with Motor "B" Control Module SCI Diag Timeout	SCI_Rx_Timeout	TRUE	Wakeup Signal	On	2083ms	Two Trips
Motor Control Processor Voltage Diagnostics								
Sensor Reference Voltage "A" Circuit Low	P0642	Detects Sensor Voltage (5V) below an acceptable threshold.	Scaled 5V Supply Voltage	< 4.80V	Wakeup Signal	On	729 ms	One Trip
Sensor Reference Voltage "A" Circuit High	P0643	Detects Sensor Voltage (5V) above an acceptable threshold.	Scaled 5V Supply Voltage	> 5.20V	Wakeup Signal	On	729 ms	One Trip
Sensor Power Supply "A" Circuit Low	P06B1	Detects Sensor Power Supply (15V) below an acceptable threshold.	Scaled 15V Supply Voltage	< 12.0V	Wakeup Signal	On	365 ms	Two Trips
Sensor Power Supply "A" Circuit High	P06B2	Detects Sensor Power Supply (15V) above an acceptable threshold.	Scaled 15V Supply Voltage	> 18.0V	Wakeup Signal	On	1042 ms	Two Trips
Control Module Power Supply "A" Circuit Low	P1ADE	Detects Control Module Power Supply (12V) below an acceptable threshold.	Scaled 12V Supply Voltage	< 7.7V	Wakeup Signal	On	365 ms	Special Type C

08 GRP11 Two - Mode Hybrid Electric Motor Control Processor - A (MCP- A)

Component/System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Req'd	MIL Illum
Control Module Power Supply "A" Circuit High	P1ADF	Detects Control Module Power Supply (12V) above an acceptable threshold.	Scaled 12V Supply Voltage	> 18.0V	Wakeup Signal	On	1042 ms	Special Type C
Control Module System Voltage "A" Unstable (Interrupt Fault)	P1B09	Detects Control Module Power Supply (12V) intermittently below an acceptable threshold.	System Status Relay	POWER LOSS State	Wakeup Signal	On	104ms	Non-MIL
MCP A Controller Faults								
Drive Motor "A" Control Module Internal Performance	P0A1B	ALU calculation error, Register Overflow, or Watchdog Timer Fault	ALU HWIO Fault OR Stack Address Overrun OR EEPROM not completely written at Powerdown (Watchdog timer fault)	TRUE TRUE	For all: Wakeup Signal For Watchdog Fault Only: No power-on resets or low voltage interrupt faults during powerdown; P1B09 AND P1B13	On NOT ACTIVE	10.4ms	One Trip
Drive Motor "A" Control Module Random Access Memory (RAM)	P1A50	To detect an error in the MCP A RAM write area.	RAM check value	Outside RAM Address Range	Wakeup Signal	On	10.4ms	One Trip
Drive Motor "A" Control Module Read Only Memory (ROM)	P1A51	To detect an error in the MCP A ROM using a checksum calculation	FlashCellError	TRUE	Wakeup Signal	On	10.4ms	One Trip
Drive Motor "A" Control Module EEPROM Error	P1ADC	Detects mismatch between Flash and EEPROM Power Off Levels	EEpromCellStatus	TRUE	Wakeup Signal	On	10.4ms	One Trip
Drive Motor "A" Control Module Programmable Logic Device Not Programmed	P1AFA	Detects if PLD was not successfully programmed during initialization	PLDFault	TRUE	Wakeup Signal	On	10.4ms	One Trip
Drive Motor "A" Control Module Performance - Programmable Logic Device	P1B13	Detects Power On Reset (POR) during WatchDog Timer Test	POR Fault Flag	TRUE	Wakeup Signal	On	10.4ms	Two Trips
MCP A Not Programmed								
Drive Motor "A" Control Module Not Programmed	P1A4F	Drive Motor "A" Control Module Programmed with Test Code, or Motor B calibration (via Cal ID)	Calibration contains Test code identifier or Motor B Identifier	TRUE		Always	10.4ms	One Trip
Motor A Inverter Temperature Sensors								
Drive Motor Inverter Temperature Sensor A Circuit Range/Performance	P0AEE	Phase U Temperature Sensor In-Range Rationality Check	ABS(PIM Temp A - PIM Temp Avg)	>15 deg C	Ignition Off Time PIM Temp Average and Motor Temp PIM or Motor Temp OOR Faults; P0AEF, P0AF0, P0BD3, P0BD4, P0BDD, P0BDE, P0A2C and P0A2D.	>=360 min > -18 degC NOT ACTIVE	2084ms	Two Trips
Drive Motor Inverter Temperature Sensor A Circuit High	P0AF0	To detect inverter Phase U temperature sensor Out of Range high (voltage).	PIM Temp A Temperature	< -40 deg C (near 5V)	Wakeup Signal	ON	1042ms	Two Trips

Component/System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Req'd	MIL Illum
					When fault present at start of trip: Cumulative PIM Temp Warmup Time above PIM Temp Warmup Torque Threshold	>=1.5min >= 20 Nm		
Drive Motor Inverter Temperature Sensor A Circuit Low	P0AEF	To detect inverter Phase U temperature sensor Out of Range low (voltage).	PIM Temp A Temperature	> 230 degC (near 0V)	WakeUp Signal	On	1042ms	Two Trips
Drive Motor Inverter Temperature Sensor C Circuit Range/Performance	P0BD2	Phase V Temperature Sensor In-Range Rationality Check	ABS(PIM Temp B - PIM Temp Avg)	>15 deg C	Ignition Off Time PIM Temp Average and Motor Temp AND No PIM or Motor Temp OOR Faults; P0AEF, P0AF0, P0BD3, P0BD4, P0BDD, P0BDE, P0A2C and P0A2D.	>=360 min > -18 degC NOT ACTIVE	2084ms	Two Trips
Drive Motor Inverter Temperature Sensor C Circuit High	P0BD4	To detect inverter Phase V temperature sensor Out of Range high (voltage).	PIM Temp B Temperature	< -40 deg C (near 5V)	Wakeup Signal When fault present at start of trip: Cumulative PIM Temp Warmup Time above PIM Temp Warmup Torque Threshold	ON >=1.5min >= 20 Nm	1042ms	Two Trips
Drive Motor Inverter Temperature Sensor C Circuit Low	P0BD3	To detect inverter Phase V temperature sensor Out of Range low (voltage).	PIM Temp B Temperature	> 230 degC (near 0V)	WakeUp Signal	On	1042ms	Two Trips
Drive Motor Inverter Temperature Sensor E Circuit Range/Performance	P0BDC	Phase W Temperature Sensor In-Range Rationality Check	ABS(PIM Temp C - PIM Temp Avg)	>15 deg C	Ignition Off Time PIM Temp Average and Motor Temp AND No PIM or Motor Temp OOR Faults; P0AEF, P0AF0, P0BD3, P0BD4, P0BDD, P0BDE, P0A2C and P0A2D.	>=360 min > -18 degC NOT ACTIVE	2084ms	Two Trips
Drive Motor Inverter Temperature Sensor E Circuit High	P0BDE	To detect inverter Phase W temperature sensor Out of Range high (voltage).	PIM Temp C Temperature	< -40 deg C (near 5V)	Wakeup Signal When fault present at start of trip: Cumulative PIM Temp Warmup	ON >=1.5min	1042ms	Two Trips

Component/System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Req'd	MIL Illum
					Time above PIM Temp Warmup Torque Threshold	>= 20 Nm		
Drive Motor Inverter Temperature Sensor E Circuit Low	P0BDD	To detect inverter Phase W temperature sensor Out of Range low (voltage).	PIM Temp C Temperature	> 230 degC (near 0V)	WakeUp Signal	On	1042ms	Two Trips
Drive Motor "A" Inverter Phase U Over Temperature	P0C11	To detect an in-range overtemperature condition that can potentially damage inverter	Sensor output exceeds fault threshold, and does not decrease below reset threshold	> 91 deg C fault >85 deg C reset	PIM Temp A In Range: P0AEF or P0AF0	NOT ACTIVE	5208ms	Two Trips
Drive Motor "A" Inverter Phase V Over Temperature	P0C12	To detect an in-range overtemperature condition that can potentially damage inverter	Sensor output exceeds fault threshold, and does not decrease below reset threshold	> 91 deg C fault >85 deg C reset	PIM Temp B In Range: P0BD3 or P0BD4	NOT ACTIVE	5208ms	Two Trips
Drive Motor "A" Inverter Phase W Over Temperature	P0C13	To detect an in-range overtemperature condition that can potentially damage inverter	Sensor output exceeds fault threshold, and does not decrease below reset threshold	> 91 deg C fault >85 deg C reset	PIM Temp C In Range: P0BDD or P0BDE	NOT ACTIVE	5208ms	Two Trips
Motor A Resolver Sensors - Discrete								
Drive Motor "A" Position Sensor Circuit	P0A3F	To detect Loss of Signal or converter error (line open, short) in the Motor Resolver circuit	R/D converter error (loss of signal) Sample Counts	>70 cts	Resolver Initialization Delay	500ms	146 ms	One Trip
Drive Motor "A" Position Sensor Circuit Range/Performance	P0A40	To detect a Degradation of Signal fault in the angle data read by the Motor Resolver circuit.	R/D converter error (degradation of signal) Sample Counts	>70 cts	Resolver Initialization Delay	500ms	146 ms	One Trip
Drive Motor "A" Position Sensor Circuit Loss of Tracking	P1B03	To detect a Loss of Tracking fault in the Motor Resolver circuit.	R/D converter error (loss of tracking) Sample Counts	>70 cts	Resolver Initialization Delay	500ms	146 ms	One Trip
Drive Motor "A" Position Sensor Circuit Overspeed	P1B0D	To detect when Motor A has exceeded operational maximum speed	ABS(Motor speed) initially AND then ABS(Motor Speed)	>11500 rpm >10000 rpm	Wakeup Signal	On	104 ms	One Trip
Drive Motor "A" Position Sensor Learn Incorrect	P1B0F	To detect an unvalidated Resolver Offset Learn (OL) Value	Offset Learn DIDN'T complete because: ABS(Motor RPM)	>50	Key Off	TRUE	10.4ms	Non-MIL
			OR Filtered DC Voltage	< 192 V	Wakeup Signl	ON		
			ALLPhase Curr Max-Min Delta	<15 A	ABS(Motor RPM)	< 20		
			For Time Period	> 5 ms	Valid Stored Offset	TRUE		
			OR Offset Learn Completes AND ABS(Offset Correction Angle)	> 25 deg				

08 GRP11 Two - Mode Hybrid Electric Motor Control Processor - A (MCP- A)

Component/System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Req'd	MIL Illum
Drive Motor "A" Position Sensor Not Learned	P0C17	To detect an unvalidated Resolver Offset Learn Value and No Stored Previously Valid Value	Offset Learn DIDN'T complete because: ABS(Motor RPM)	 >50	 Wakeup Signal	 ON	 10.4ms	Two Trips
			OR Filtered DC Voltage	< 192 V	ABS(Motor RPM)	< 20		
			ALLPhase Curr Max-Min Delta	<15 A	Valid Stored Offset	FALSE		
			For Time Period	> 5 ms				
			OR Offset Learn Completes AND ABS(Offset Correction Angle)	 > 25 deg				
Drive Motor "A" Position Exceeded Learning Limit	P0C4E	To detect a Resolver Correction value greater than an acceptable limit	Offset Learn COMPLETES AND ABS(Offset Correction Angle)	 >25deg	Key Off	TRUE	10.4ms	Non-MIL
					Wakeup Signal	ON		
					ABS(Motor RPM)	< 20		
Motor A Resolver Sensors - Circuit								
Drive Motor "A" Position Sensor Circuit "A" Low	P0C52	To detect Resolver Circuit S1/3 Out of Range Low	Resolver S13 Circuit Reference Voltage	< 0.5 v	Wakeup Signal	On	521ms	One Trip
Drive Motor "A" Position Sensor Circuit "A" High	P0C53	To detect Resolver Circuit S1/3 Out of Range High	Resolver S13 Circuit Reference Voltage	> 3.0 v	Wakeup Signal	On	208ms	One Trip
Drive Motor "A" Position Sensor Circuit "B" Low	P0C5C	To detect Resolver Circuit S2/4 Out of Range Low	Resolver S24 Circuit Reference Voltage	< 0.5 v	Wakeup Signal	On	521ms	One Trip
Drive Motor "A" Position Sensor Circuit "B" High	P0C5D	To detect Resolver Circuit S2/4 Out of Range High	Resolver S24 Circuit Reference Voltage	> 3.0 v	Wakeup Signal	On	208ms	One Trip
Motor A Crank Pulse Faults								
Drive Motor "A" Control Module Crankshaft Position Sensor Circuit	P1AC6	Detects Lack of Response from 58X Crank Sensor	Crank Synchronization	NO ACTIVITY	Wakeup Signal	On	2083ms	Two Trips
Drive Motor "A" Control Module Crankshaft Position Sensor Performance	P1AC7	Detects Invalid 58X Crank Sensor Signal	CPC Signal	NOT VALID	Engine Movment Detected OR Edges Seen	> 5rpm > 0	3125 ms	Two Trips
Torque Security Faults								
Drive Motor A Torque Delivered Performance	P0C19	Fail Case 1: Test of three phase current correlation	The sum of three phase currents is higher than current threshold during more than threshold time	Current threshold: 75 A	Ignition switch	in crank or run	48 fail counts out of 60 sample counts Executes in a 2.08ms loop	One Trip

Component/System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Req'd	MIL Illum
				Time threshold: 100ms			Detects in 100ms	
		Fail Case 2: Static Variable test	Verify the calculated check sum (CRC) is not equal to previous saved check sum (CRC)		Ignition switch	in crank or run	2.08 ms loop	
		Fail Case 3: Monitor torque command by checking the SPI communication status	SPI rolling count fails to update more than threshold time	Threshold time: 90msec	Ignition switch	in crank or run	45 fail counts out of 50 sample counts Detects in 90ms 2.08 ms loop	
		Fail Case 4: Check the DC current flow direction with respect to torque command/motor speed	DC current fails to show correct sign and magnitude more than current threshold during more than threshold time	Current threshold: 10 A to 80 A (function of motor speed.); Time threshold: 200 ms	MCP power stage	Active	96 fail counts out of 120 sample counts Executes in a 2.08ms loop Detects in 200ms	
		Fail Case 5: Check the secured motor torque achieved error with respect to torque command	The absolute error between calculated motor torque achieved and motor torque command is higher than torque threshold during more than threshold time	Torque threshold: 52 Nm	MCP power stage	Active	96 fail counts out of 120 sample counts Executes in a 2.08ms loop	

Component/System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Req'd	MIL Illum
				Time threshold: 200 ms			 Detects in 200ms	
		Fail Case 6: Check the Task1 reported motor torque achieved vs. torque command	The absolute error between Task1 reported motor torque achieved and motor torque command is higher than torque threshold during more than threshold time	Torque threshold: 52 Nm Time threshold: 200 ms	Ignition switch	in crank or run	96 fail counts out of 120 sample counts Executes in a 2.08ms loop Detects in 200ms	
Drive Motor A Torque Delivered Performance	P0C19	Fail Case 7: Check the secured calculated three phase short motor torque vs. the reported task1 motor torque	The absolute error between secured calculated three phase short torque vs. Task1 reported motor torque is higher than torque threshold during more than threshold time	Torque threshold: 52 Nm Time threshold: 200 ms	MCP power stage	Motor 3-phase short	96 fail counts out of 120 sample counts Executes in a 2.08ms loop Detects in 200ms	One Trip
		Fail Case 8: Check the secured calculated three phase open motor torque vs. the reported task1 motor torque	The absolute error between secured calculated three phase open torque vs. Task1 reported motor torque is higher than torque threshold during more than threshold time	Torque threshold: 52 Nm	MCP power stage	Motor 3-phase open	96 fail counts out of 120 sample counts Executes in a 2.08ms loop	

Component/System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Req'd	MIL Illum
				Time threshold: 200 ms			Detects in 200ms	
Drive Motor A Control Module Programmable Logic Device Security Code	P1AFB	Fail Case 1: Detect the validity of the Seeds sent by PLD	The number of identical seed in consecutive loops sent from PLD is higher than threshold	191 counts	Ignition switch	in crank or run	191 fail counts out of 250 sample counts 0.083 ms to 0.5 ms (function of motor speed.);	One Trip
		Fail Case 2: Detect the validity of response by PLD when MCP sends repeated bad keys to PLD	The number of bad response from PLD when MCP is sending bad key is higher than threshold	191 counts	Ignition switch	in crank or run	191 fail counts out of 250 sample counts 0.083 ms to 0.5 ms (function of motor speed.);	
Drive Motor "A" Control Module Shutdown Performance	P1AF8	Detect the duration MCP used to conduct shut down path verification after key-on initialization.	The number of Task 2 loops used in shut down path verification is higher than threshold	40 counts	Initialization	ON	40 fail counts out of 50 sample counts 10 ms loop	One Trip
Communication Diagnostics								
Lost Communication With Battery Pack Control Module	U1875	Detects that CAN serial data communication has been lost with the BPCM on Bus A	Missed BPCM Messages		Ignition switch	Run	12 seconds	Type B
Lost Communication With ECM/PCM	U1876	Detects that CAN serial data communication has been lost with the ECM	Missed ECM Messages		Ignition switch	Run	12 seconds	Type B

APPENDIX

Inverter Temperature Sensor Mapping Grid	SAE

08 GRP11 Two - Mode Hybrid Electric Motor Control Processor - A (MCP- A)

Component/System	Fault Code	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters	Enable Conditions	Time Req'd	MIL Illum
Drive Motor A		Phase U	PIM_A	A				
		Phase V	PIM_B	C				
		Phase W	PIM_C	E				
Drive Motor B		Phase U	PIM_A	B				
		Phase V	PIM_B	D				
		Phase W	PIM_C	F				

HWIO= Hardware Input/Output
OOR= Out of Range
IGBT= Insulated Gate Bipolar Transistors (Phase Current Controllers)
BPCM= Batt Pack Ctrl Module
ALU= Arithmetic Logic Unit