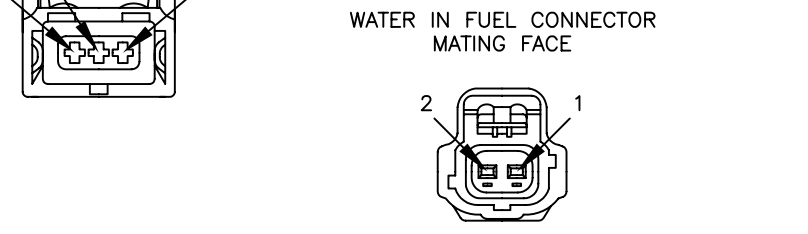
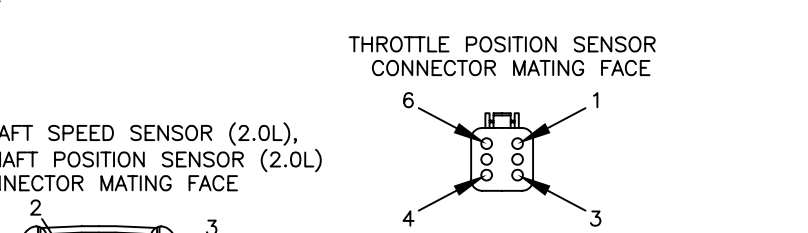
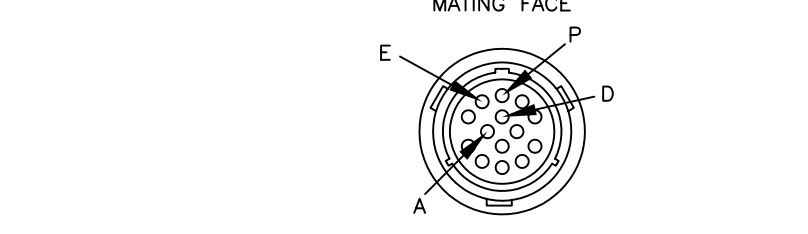
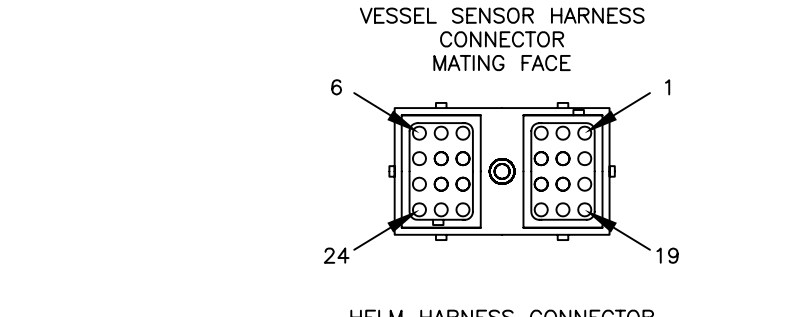
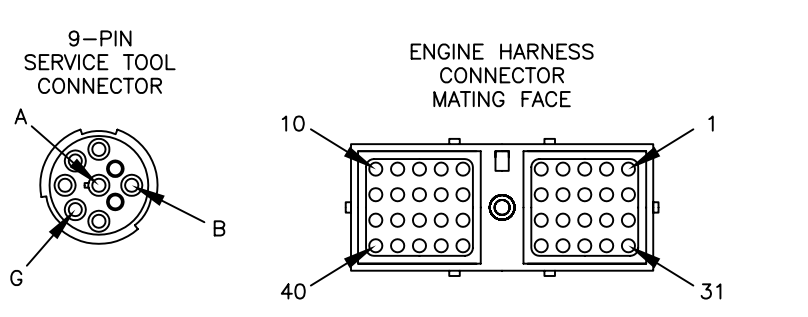
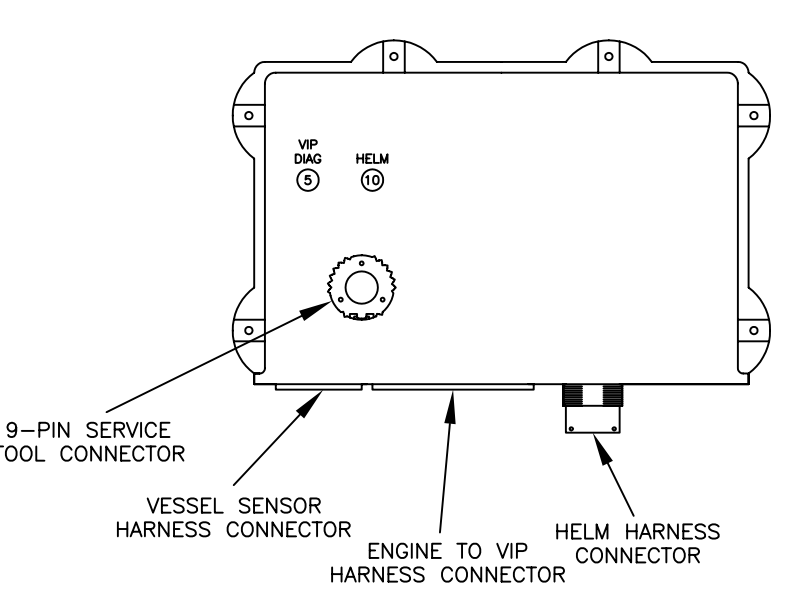
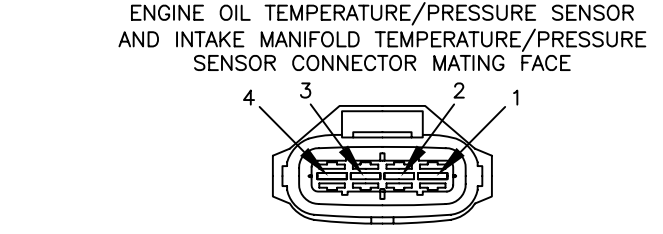
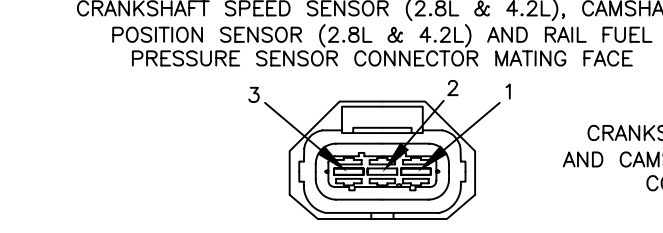
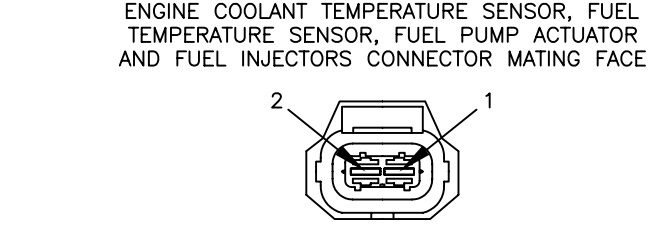
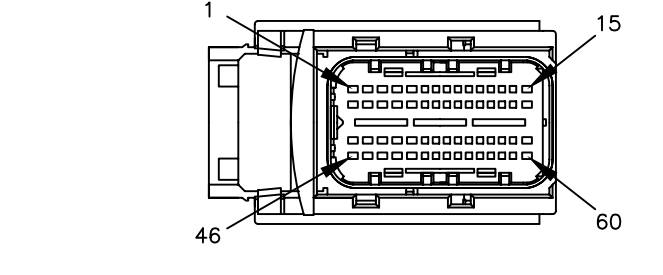
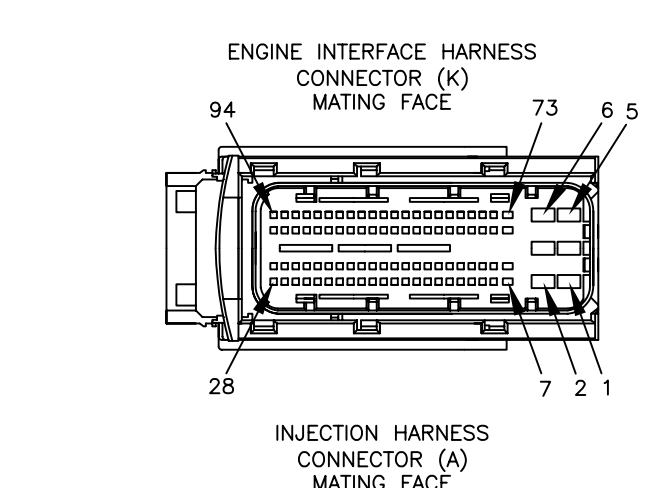
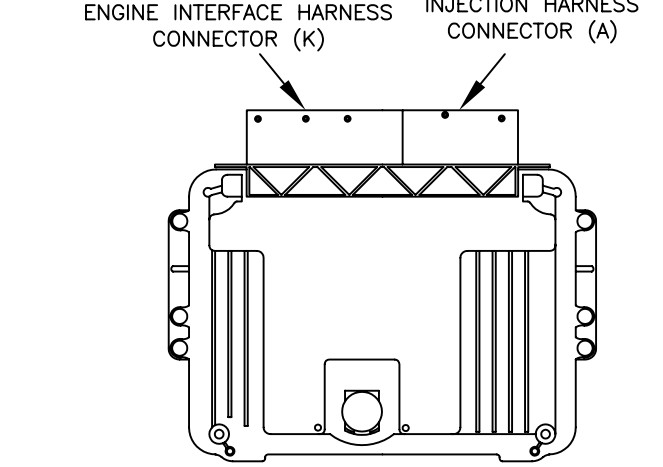
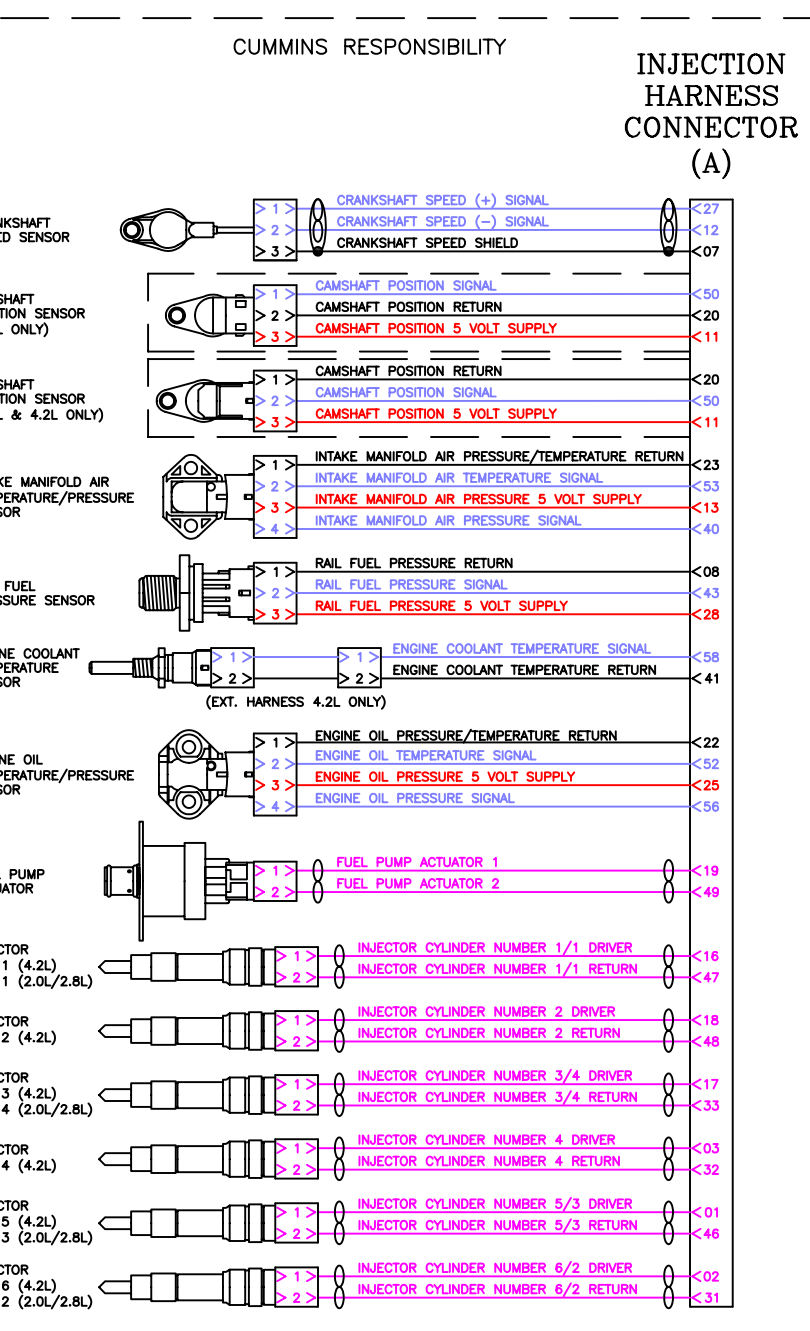
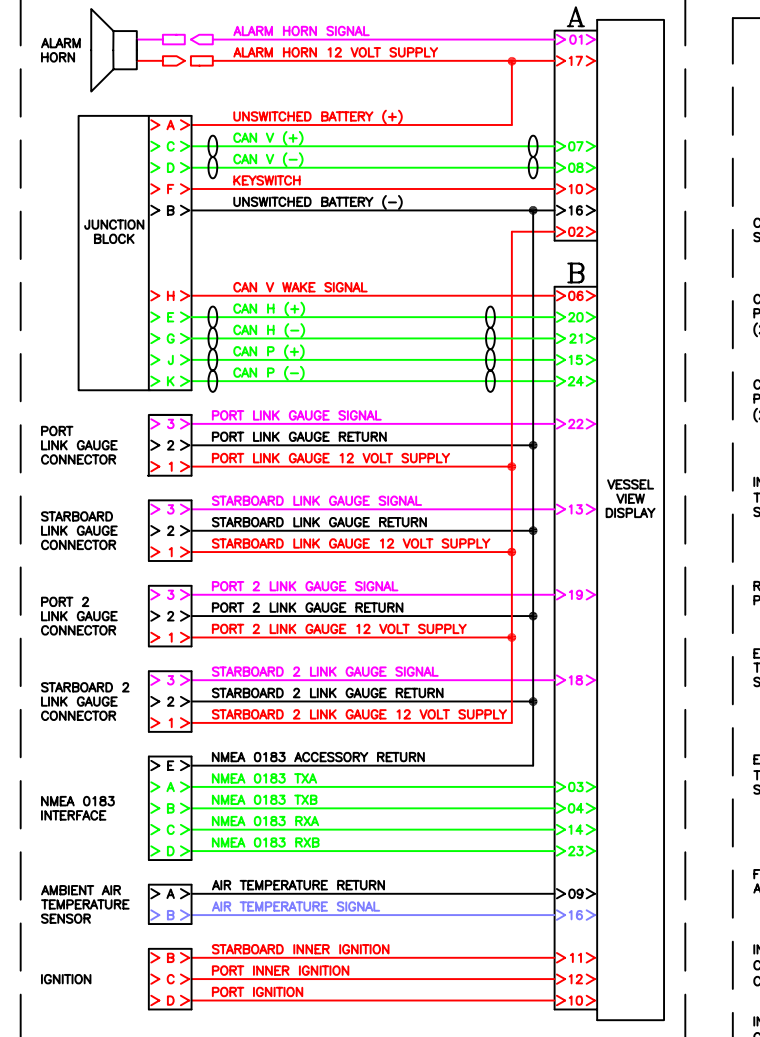
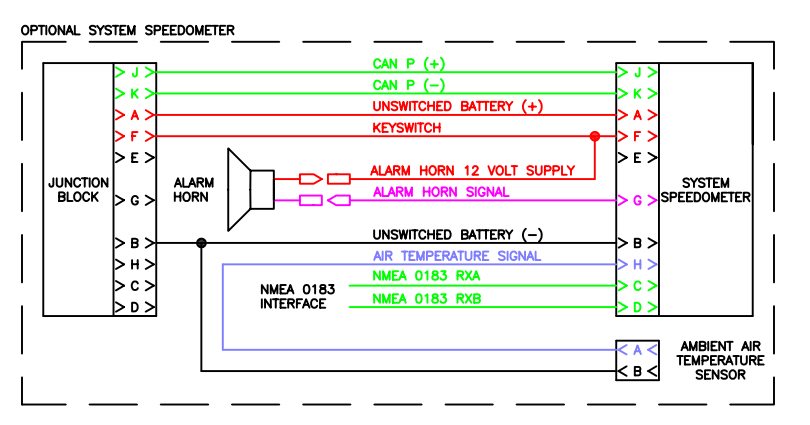
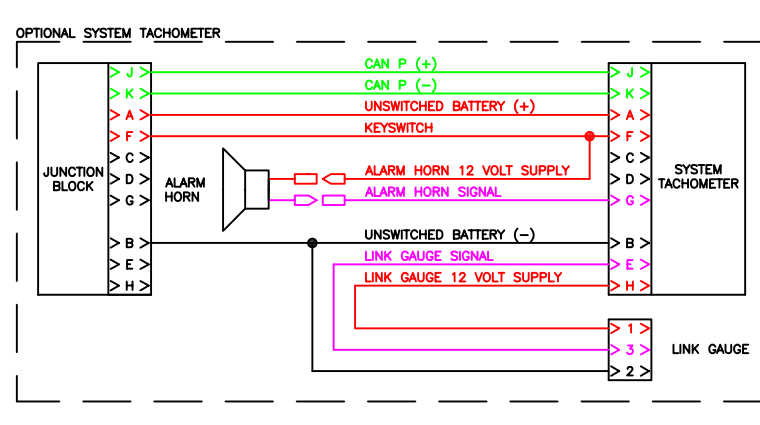
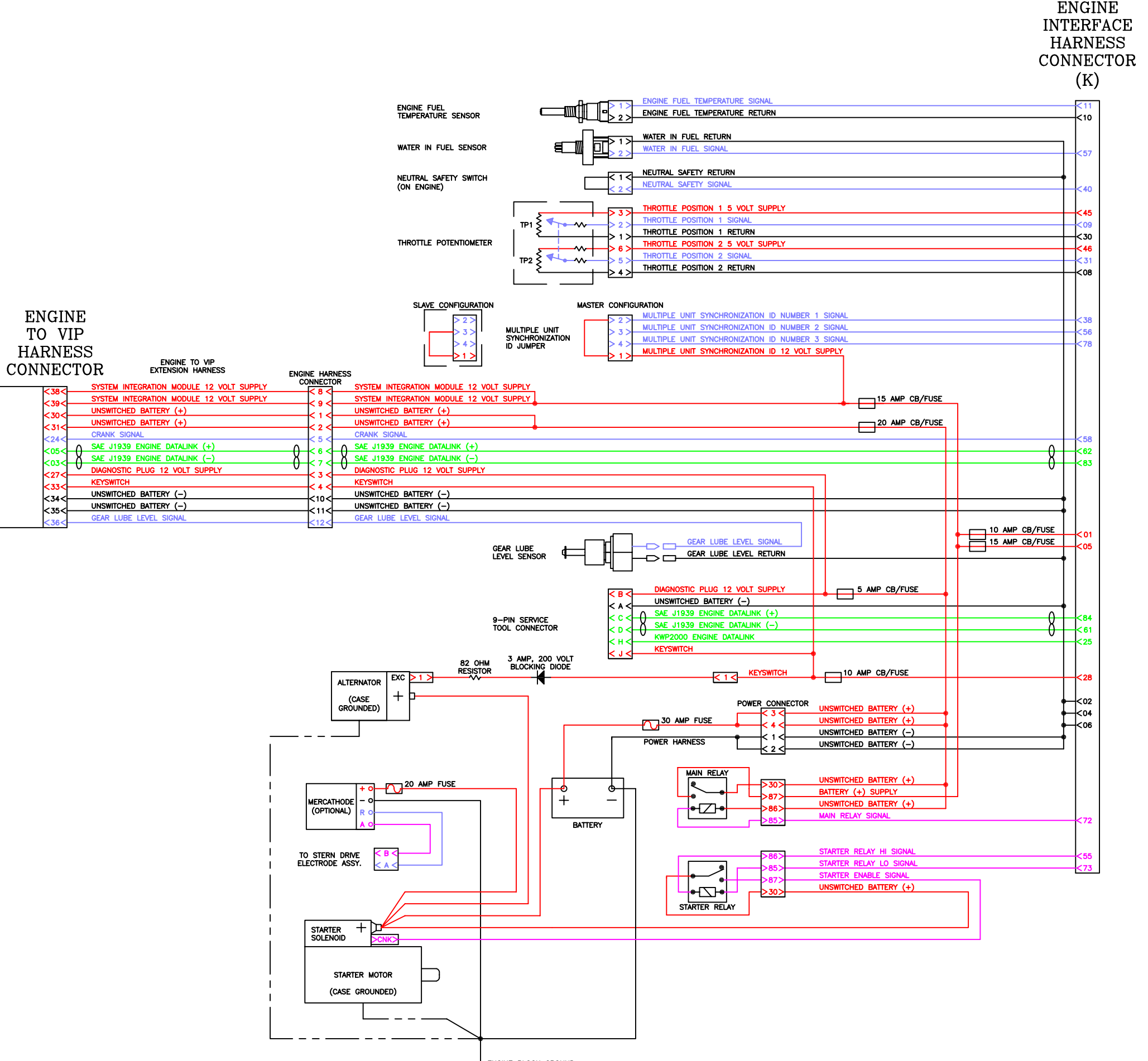
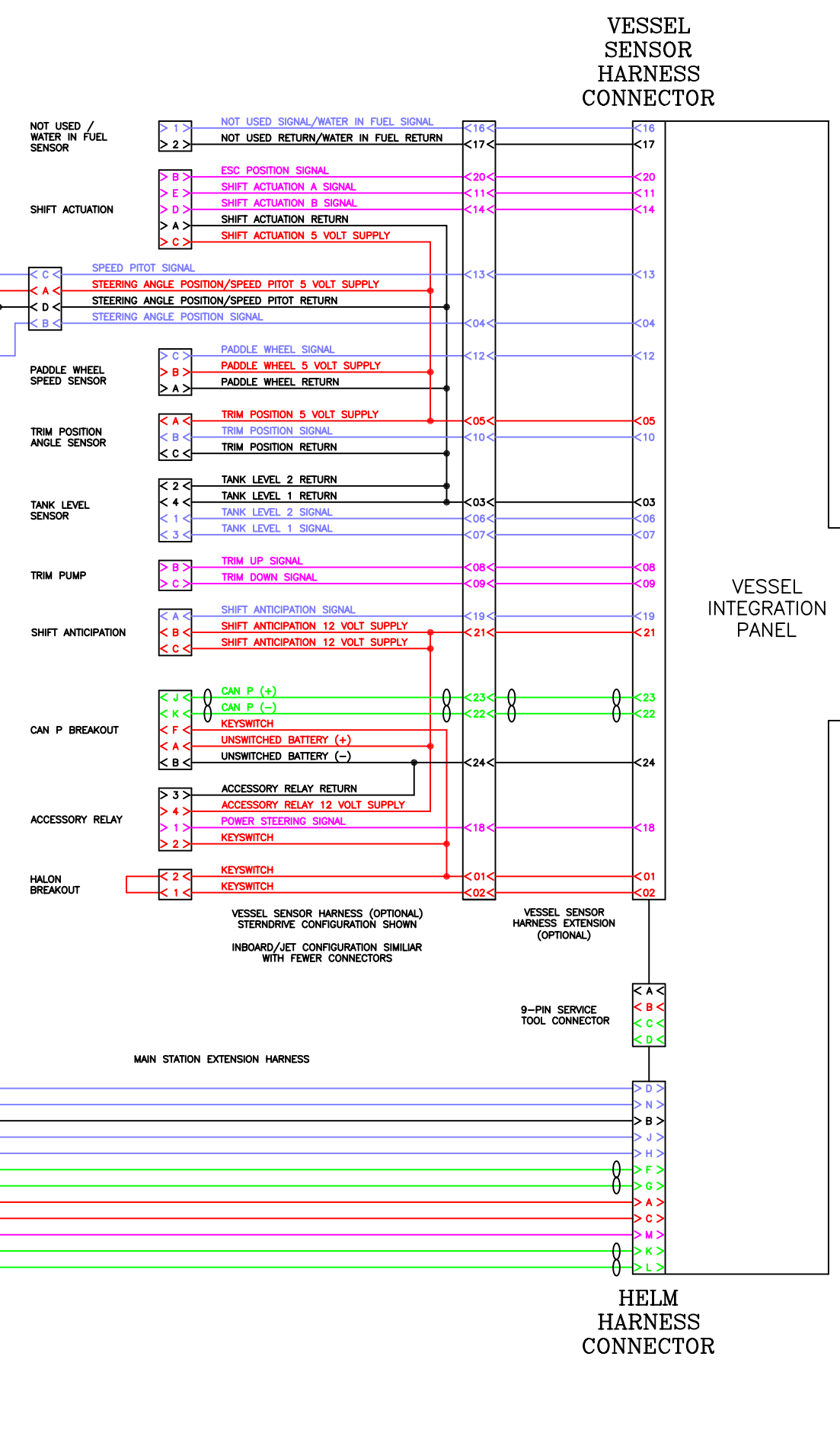
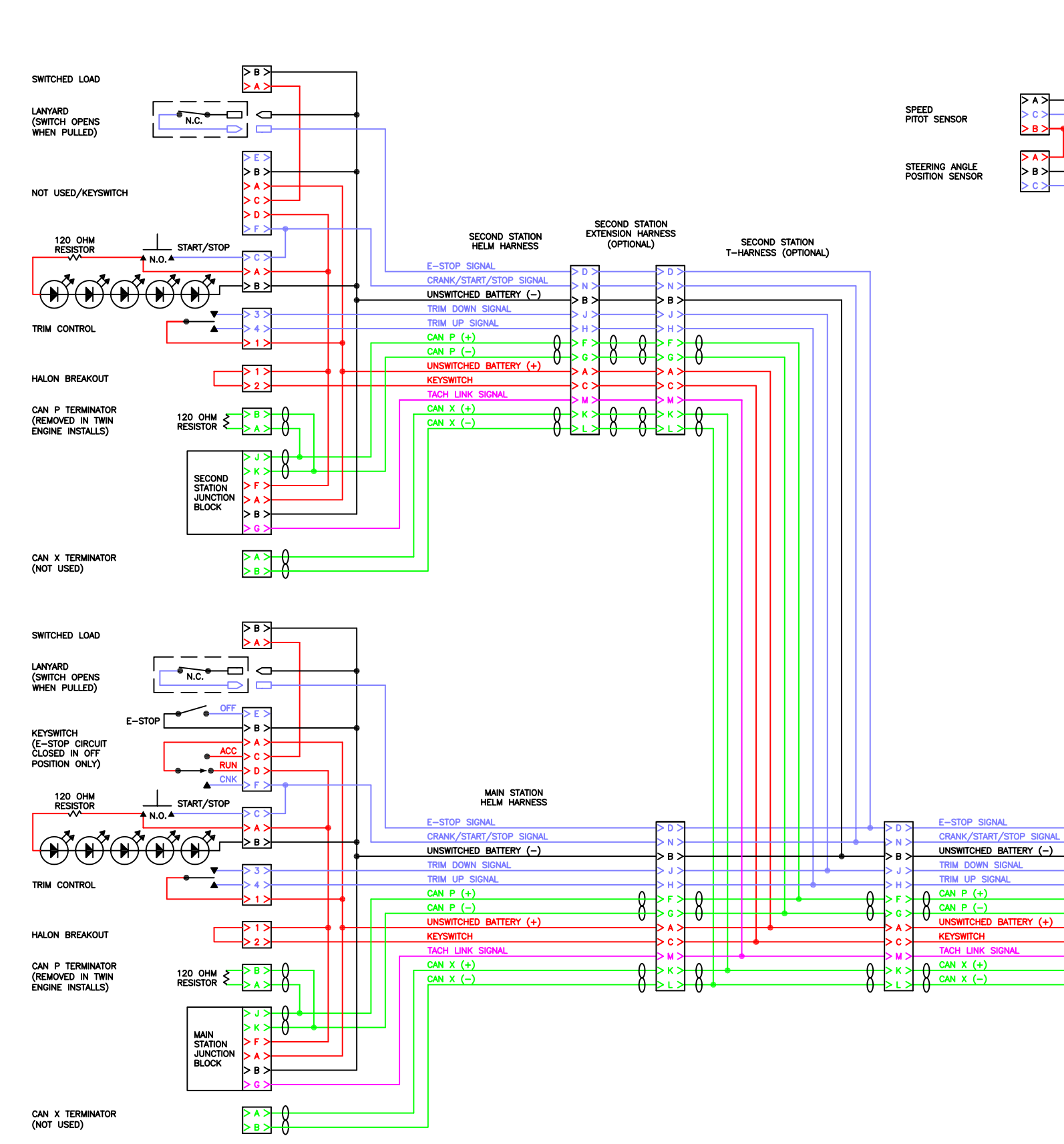


NOTE: SOME OF THE CIRCUITS SHOWN HERE WILL NOT BE ACTIVE IN ALL APPLICATIONS. CONSULT THE EQUIPMENT MANUFACTURER'S LITERATURE TO DETERMINE WHICH CIRCUITS ARE USED.

RED DC VOLTAGE
 BLUE INPUT SIGNALS
 BLACK GROUNDS, SHIELDS AND RETURNS
 PURPLE OUTPUT SIGNALS
 GREEN DATA/LINKS
 REPRESENTS MALE PINS
 REPRESENTS FEMALE PINS



General Information

The diagram is provided as a diagnostic tool for trained, experienced technicians only. Improper trouble-shooting or repair can result in severe personal injury or death or property damage. See important instructions in Service Manual.

Electrical Specifications

J1939 BACKBONE RESISTANCE

- CAN Hi to LO wire - 50 to 70 Ω
- J1939 Termination Resistance

ECM

- Retaining capscrew torque = 10.8 N•m [95 in-lb]

ALL CONTINUITY CHECKS

- OK (no open circuit) if less than 10 Ω

ALL SHORT TO GROUND

- OK (no short circuit) if more than 100k Ω

Specifications

WARNING

SHORT CIRCUIT TO EXTERNAL VOLTAGE

- OK if less than 1.5 VDC

SENSOR SUPPLY VOLTAGE

- At ECM: - 4.75 to 5.25 VDC

SOLENOIDS

- Fuel pump actuator = 2.6 to 3.15 Ω
- Retaining capscrew torque = 6 N•m [50 in-lb]
- Injectors = Less than 0.295 Ω
- Injector bracket bolt torque = 28 N•m [20.7 ft-lb]
- Injector bracket plug bolt torque = 7 N•m [60 in-lb]

Sensor Specifications

NOTE: To convert gauge pressure on all psia sensors, subtract the barometric pressure from the absolute pressure.

Rail Fuel Pressure Sensor Torque = 70 N•m [51.6 ft-lb]			Fuel Temperature Sensor Torque = 18 N•m [13.3 ft-lb]		
Pressure (bar)	Pressure (psia)	Voltage (VDC)	Temperature (°C)	Temperature (°F)	Resistance (Ω)
0	0	0.50	-30	-22	23.5k to 28.7k
400	580.1	1.39	0	32	5.47k to 6.33k
700	1015.3	2.06	25	77	1.94k to 2.17k
1000	1450.4	2.72	60	140	573 to 619
1400	2030.5	3.61	100	212	182 to 190
1800	2610.7	4.50	110	230	140 to 148

Intake Manifold Pressure Sensor Torque (capscrew) = 5.6 N•m [49 in-lb]			Intake Manifold Air Temperature Sensor Torque (capscrew) = 5.6 N•m [49 in-lb]			
Pressure (mm Hg)	Pressure (in Hg)	Pressure (psia)	Voltage (VDC)	Temperature (°C)	Temperature (°F)	Resistance (Ω)
0	0	0	0.09 to 0.10	-10	14	8.95k to 9.90k
381	15	7	0.83 to 0.91	0	32	5.61k to 6.17k
635	25	12	1.31 to 1.45	20	68	2.40k to 2.62k
1549	61	30	3.07 to 3.39	40	104	1.15k to 1.25k
2057	81	40	4.04 to 4.47	70	158	431 to 462k

Oil Pressure Sensor Torque (capscrew) = 11 N•m [97 in-lb]			Oil Temperature Sensor Torque (capscrew) = 11 N•m [97 in-lb]		
Pressure (kPa)	Pressure (psia)	Voltage (VDC)	Temperature (°C)	Temperature (°F)	Resistance (Ω)
0	0	0.68 to 0.75	0	32	5.67k to 6.12k
101	15	0.83 to 0.91	25	77	1.99k to 2.12k
274	40	1.37 to 1.52	50	122	811 to 857
446	65	2.06 to 2.28	75	167	365 to 383
584	85	2.61 to 2.88	100	212	183 to 190
722	105	3.16 to 3.50			
860	125	3.71 to 4.11			
1000	145	4.27 to 4.73			

Coolant Temperature Sensor Torque = 22 N•m [16.2 ft-lb]			Throttle Potentiometer Torque (capscrew) = 10.8 N•m [95 in-lb]		
Temperature (°C)	Temperature (°F)	Resistance (Ω)	Throttle (%)	TP1 Vout Voltage (VDC)	TP2 Vout Voltage (VDC)
0	0	5.47k to 6.33k	0 (IDLE)	0.88	0.56
0	32	1.16	0	1.16	0.67
25	77	1.94k to 2.17k	20	1.43	0.77
60	140	573 to 618	30	1.71	0.87
80	176	313 to 332	40	1.98	0.98
100	212	182 to 191	50	2.25	1.08
			60	2.53	1.19
			70	2.8	1.29
			80	3.07	1.39
			90	3.35	1.5
			100 (WOT)	3.62	1.6

Crankshaft Speed Sensor Torque (capscrew) = 8 N•m [71 in-lb] Sensor Resistance = 850 - 1000 Ω			Camshaft Position Sensor Torque (capscrew) = 8 N•m [71 in-lb]		
Temperature (°C)	Temperature (°F)	Resistance (Ω)	Throttle (%)	TP1 Vout Voltage (VDC)	TP2 Vout Voltage (VDC)
0	32	5.47k to 6.33k	0 (IDLE)	0.88	0.56
25	77	1.94k to 2.17k	20	1.43	0.77
60	140	573 to 618	30	1.71	0.87
80	176	313 to 332	40	1.98	0.98
100	212	182 to 191	50	2.25	1.08
			60	2.53	1.19
			70	2.8	1.29
			80	3.07	1.39
			90	3.35	1.5
			100 (WOT)	3.62	1.6

Water-in-Fuel Sensor Torque = 1.2 N•m [10.6 in-lb]		
Temperature (°C)	Temperature (°F)	Resistance (Ω)
0	32	5.47k to 6.33k
25	77	1.94k to 2.17k
60	140	573 to 618
80	176	313 to 332
100	212	182 to 191

Diagnostic Trouble Code Information

DTC	SMARTCRAFT DISPLAY TEXT	DTC TEXT & REASON	EFFECT
P0016		Crankshaft / Camshaft Sensor Correlation. The ECM has detected that the engine speed/position sensor data is inconsistent.	None - No engine protection for circuit or sensor failure.
P0087	2249 Low Fuel Press2	Fuel Rail Pressure Low Warning. Fuel rail pressure signal indicates that fuel pressure is below the minimum limit for the given engine rating.	No effect from ECM.
P0088	553 High Fuel Pressure	Fuel Rail Pressure Higher Than Commanded. The ECM has detected that the fuel rail pressure is higher than the commanded pressure.	Engine speed derate due to fuel quantity limitation.
P0090	449 Fuel Press Very High	Fuel Rail Pressure High Warning. Fuel rail pressure signal indicates that fuel pressure has exceeded the maximum limit for the given engine rating.	No effect from ECM.
P0091	559 Low Fuel Pressure	Fuel Rail Pressure Lower Than Commanded. The ECM has detected that the fuel rail pressure is lower than commanded pressure.	Engine speed derate due to fuel quantity limitation.
P0092	554 Fuel Pressure InRange Error	Fuel Rail Pressure Data Invalid. The ECM has detected that fuel rail pressure is not responding to fuel flow correctly.	None - No engine protection for circuit or sensor failure.
P0110	153 Sensor IMT High 154 Sensor IMT Low	Intake Air Temperature Sensor Voltage Out Of Range. The intake manifold air temperature sensor output voltage is above the upper limit or below the lower limit.	None - No engine protection for circuit or sensor failure.
P0113	155 IMT High	Intake Air Temperature High Warning. Intake air temperature signal indicates the intake manifold air temperature is above the engine protection critical limit.	No effect from ECM.
P0115	144 Sensor Cool T High 145 Sensor Cool T Low	Coolant Temperature Sensor Voltage Out Of Range. The engine coolant temperature sensor output voltage is above the upper limit or below the lower limit or there is an implausibility with the oil temperature sensor.	None - No engine protection for circuit or sensor failure.
P0118	151 Cool T High	Coolant Temperature High Warning. Engine coolant temperature signal indicates engine coolant temperature is above the engine protection critical limit.	Engine speed derate.
P0120	131 Sensor Throt High 132 Sensor Throt Low	Throttle Position Sensor 1 Voltage Out Of Range. The throttle position 1 sensor output voltage is above the upper limit or below the lower limit.	None - No engine protection for circuit or sensor failure.
P0180		Fuel Temperature Sensor Voltage Out Of Range. The fuel temperature signal output voltage is above the upper limit or below the lower limit.	None - No engine protection for circuit or sensor failure.
P0190	451 Sensor Fuel P High 452 Sensor Fuel P Low	Fuel Rail Pressure Sensor Voltage Out Of Range. The fuel pressure signal output voltage is above the upper limit or below the lower limit.	Engine speed derate due to fuel quantity limitation.
P0195	212 Sensor Oil T High 213 Sensor Oil T Low	Oil Temperature Sensor Voltage Out Of Range. The engine oil temperature signal output voltage is above the upper limit or below the lower limit or there is an implausibility with the coolant temperature sensor.	None - No engine protection for circuit or sensor failure.

DTC	SMARTCRAFT DISPLAY TEXT	DTC TEXT & REASON	EFFECT
P0198	214 Oil Temperature High	Oil Temperature High Warning. Engine oil temperature signal indicates the engine oil temperature is above the engine protection critical limit.	Engine speed derate.
P0201	322 Injector 1 Error	Cylinder 1 - Injector Open Circuit. High resistance detected in injector number 1 circuit or no current detected at number 1 injector driver or return pin when voltage supplied.	Engine power derate.
P0202	331 Injector 2 Error	Cylinder 2 - Injector Open Circuit. High resistance detected in injector number 2 circuit or no current detected at number 2 injector driver or return pin when voltage supplied.	Engine power derate.
P0203	324 Injector 3 Error	Cylinder 3 - Injector Open Circuit. High resistance detected in injector number 3 circuit or no current detected at number 3 injector driver or return pin when voltage supplied.	Engine power derate.
P0204	332 Injector 4 Error	Cylinder 4 - Injector Open Circuit. High resistance detected in injector number 4 circuit or no current detected at number 4 injector driver or return pin when voltage supplied.	Engine power derate.
P0205	323 Injector 5 Error	Cylinder 5 - Injector Open Circuit. High resistance detected in injector number 5 circuit or no current detected at number 5 injector driver or return pin when voltage supplied.	Engine power derate.
P0206	325 Injector 6 Error	Cylinder 6 - Injector Open Circuit. High resistance detected in injector number 6 circuit or no current detected at number 6 injector driver or return pin when voltage supplied.	Engine power derate.
P0220	131 Sensor Throt High 132 Sensor Throt Low	Throttle Position Sensor 2 Voltage Out Of Range. The throttle position 2 sensor output voltage is above the upper limit or below the lower limit.	None - No engine protection for circuit or sensor failure.
P0221		Throttle Position Sensor Voltage Out Of Sync. The throttle position sensor output voltages are not consistent with each other.	None - No engine protection for circuit or sensor failure.
P0235	122 Sensor Boost High 123 Sensor Boost Low 2973 Snr Boost InRange Error	Boost Pressure Sensor Voltage Out Of Range. The intake manifold air pressure sensor output voltage is above the upper limit or below the lower limit or there is an implausibility with the barometric pressure sensor.	None - No engine protection for circuit or sensor failure.
P0238	124 Boost Press High	Boost Pressure High Warning. Intake manifold pressure signal indicates the intake manifold pressure has exceeded the maximum limit for the given engine rating.	Engine speed derate.
P0252		Fuel Pressure Solenoid Open Circuit. The ECM has detected no load, excess temperature, or open circuit on the fuel pressure solenoid circuit.	Engine speed derate due to fuel quantity limitation.
P0253	271 IMV Shorted Low	Fuel Pressure Solenoid Shorted Low. The fuel pressure solenoid output voltage is below normal or shorted to a low source.	Engine will shut down.
P0254	272 IMV Shorted High	Fuel Pressure Solenoid Shorted High. The fuel pressure solenoid output voltage is above normal or shorted to a high source.	Engine speed derate due to fuel quantity limitation.

DTC	SMARTCRAFT DISPLAY TEXT	DTC TEXT & REASON	EFFECT
P0262	322 Injector 1 Error	Cylinder 1 - Injector Circuit Shorted. The ECM has detected a short circuit on low-side to battery, a general short circuit, or a short circuit from low-side to high-side on the injector solenoid driver cylinder 1 circuit.	Engine will shut down.
P0265	331 Injector 2 Error	Cylinder 2 - Injector Circuit Shorted. The ECM has detected a short circuit on low-side to battery, a general short circuit, or a short circuit from low-side to high-side on the injector solenoid driver cylinder 2 circuit.	Engine will shut down.
P0268	324 Injector 3 Error	Cylinder 3 - Injector Circuit Shorted. The ECM has detected a short circuit on low-side to battery, a general short circuit, or a short circuit from low-side to high-side on the injector solenoid driver cylinder 3 circuit.	Engine will shut down.
P0271	332 Injector 4 Error	Cylinder 4 - Injector Circuit Shorted. The ECM has detected a short circuit on low-side to battery, a general short circuit, or a short circuit from low-side to high-side on the injector solenoid driver cylinder 4 circuit.	Engine will shut down.
P0274	323 Injector 5 Error	Cylinder 5 - Injector Circuit Shorted. The ECM has detected a short circuit on low-side to battery, a general short circuit, or a short circuit from low-side to high-side on the injector solenoid driver cylinder 5 circuit.	Engine will shut down.
P0277	325 Injector 6 Error	Cylinder 6 - Injector Circuit Shorted. The ECM has detected a short circuit on low-side to battery, a general short circuit, or a short circuit from low-side to high-side on the injector solenoid driver cylinder 6 circuit.	Engine will shut down.
P0335	115 Main/Crank EPS Error 689 Main/Crank EPS Error	Crankshaft Speed Sensor Data Error. The crankshaft speed sensor data lost, erratic, intermittent, or incorrect.	Engine will shut down.
P0338	234 Engine Overspeed	Engine Overspeed Warning. Engine speed signal indicates engine speed above engine protection limit.	Engine speed derate.
P0340	121 Bkup/Cam EPS Error 778 Bkup/Cam EPS Error	Camshaft Position Sensor Data Error. The camshaft position sensor data lost, erratic, intermittent, or incorrect.	None - No engine protection for circuit or sensor failure.
P0520	135 Sensor Oil Press High 141 Sensor Oil Press Low	Oil Pressure Sensor Voltage Out Of Range. The engine oil pressure sensor output voltage is above the upper limit or below the lower limit.	None - No engine protection for circuit or sensor failure.
P0522	415 Oil Pressure Low	Oil Pressure Critical Low Warning. Engine oil pressure signal indicates engine oil pressure is well below engine protection limit.	Engine speed derate.
P0524	143 Oil Press Low	Oil Pressure Low Warning. Engine oil pressure signal indicates engine oil pressure is below engine protection limit.	Engine speed derate.
P0560	ECM Hi Battery Volts ECM Lo Battery Volts	ECM Battery Voltage Out Of Range. ECM supply voltage is above the maximum limit or below the minimum limit.	No effect from ECM.

NOTES

DTC	SMARTCRAFT DISPLAY TEXT	DTC TEXT & REASON	EFFECT
P0606		ECM Internal Malfunction. Error internal to the ECM related to memory hardware failures, internal voltage supply, or communication circuits.	No effect from ECM.
P0616		Starter Relay Low-Side Shorted. No load or short circuit to ground or battery detected at low-side starter relay circuit.	Engine will not start.
P0617		Starter Relay High-Side Shorted. Short circuit to ground or battery detected at high-side starter relay circuit.	Engine will not start.
P0641		Sensor Supply 1 Voltage Out Of Range. The sensor supply 1 circuit output voltage is above the upper limit or below the lower limit. This circuit supplies power to the throttle position 1 sensor and camshaft position sensor.	Engine speed derate.
P0651		Sensor Supply 2 Voltage Out Of Range. The sensor supply 2 circuit output voltage is above the upper limit or below the lower limit. This circuit supplies power to the throttle position 2 sensor, fuel rail pressure sensor, and boost pressure sensor.	Engine speed derate due to fuel quantity limitation.
P0685		Main Relay Control Timing Error. The ECM has detected that the main relay did not energize within the specified window of time.	None - No engine protection for circuit or sensor failure.
P0697		Sensor Supply 3 Voltage Out Of Range. The sensor supply 3 circuit output voltage is above the upper limit or below the lower limit. This circuit supplies power to the oil pressure sensor.	Engine speed derate.
P1605		Keyswitch Signal Circuit Error. The ECM has detected an error in the keyswitch circuit signal.	None - No engine protection for circuit or sensor failure.
P1606		Crank Signal Circuit Error. The ECM has detected the crank signal is always active.	None - No engine protection for circuit or sensor failure.
P1628		ECM Dataset Variant Coding Error. The dataset variant coding is invalid or not set.	No effect from ECM.
P2148		Injector Bank 1 Circuit Error. The ECM has detected a short circuit on low-side to ground or a general short circuit on the Injector Bank 1 Circuit.	Engine will shut down.
P2151		Injector Bank 2 Circuit Error. The ECM has detected a short circuit on low-side to ground or a general short circuit on the Injector Bank 2 Circuit.	Engine will shut down.
P2226	221 Snr Amb Air Press High 222 Snr Amb Air Press Low	Atmospheric Pressure Sensor Voltage Out Of Range. The barometric pressure sensor output voltage is above the upper limit or below the lower limit or there is an implausibility with the boost pressure sensor.	None - No engine protection for circuit or sensor failure.
P2269	418 Water In Fuel	Water In Fuel Detected Warning. Water has been detected in the fuel filter.	Engine speed derate.
P2293		Fuel Rail Pressure Relief Valve Error. The ECM has detected that the fuel rail pressure relief valve is not responding correctly.	No effect from ECM.
U0101		CAN Communication Error. SAE J1939 ECM network communication data erratic, intermittent, or incorrect.	None - No engine protection for circuit or sensor failure.

DTC	SMARTCRAFT DISPLAY TEXT	DTC TEXT & REASON	EFFECT
U1001		No DTS CAN Message Or Throttle Lever Signal Present. The ECM is not receiving throttle information.	None - No engine protection for circuit or sensor failure.
U1002		DTS CAN Message Error (if DTS Installed). The commanded output from the multiplexed throttle is incorrect or the ECM did not receive the digital throttle commands in time.	None - No engine protection for circuit or sensor failure.