MotoHawk Control Solutions

ECM-0565-128-0704-C

Engine Control Module (Part No. 8237-1448)

Description

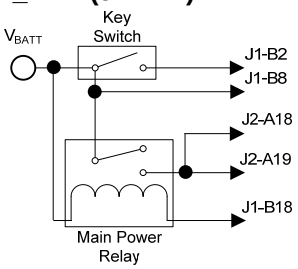
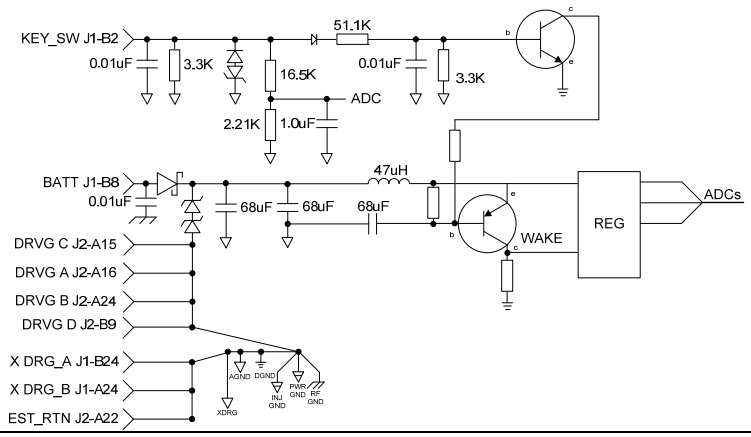
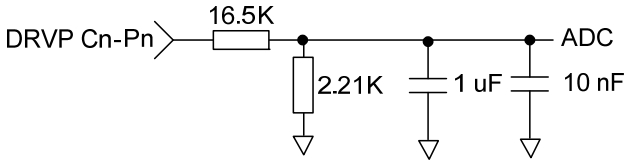
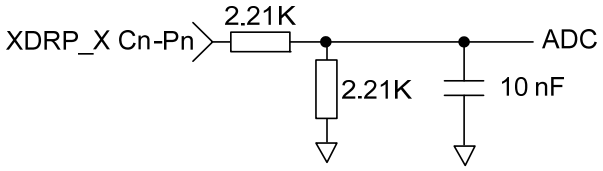
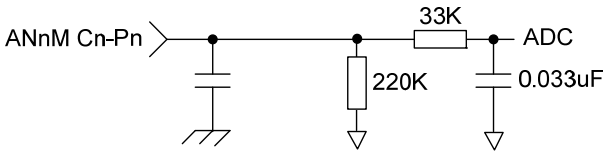
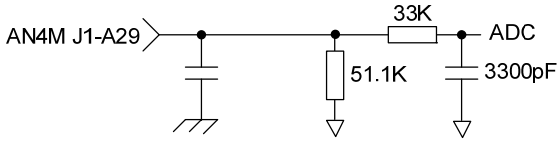
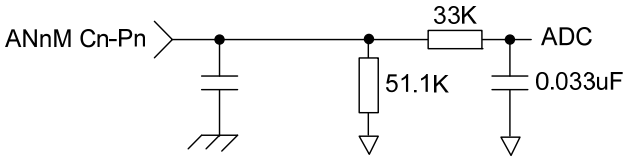
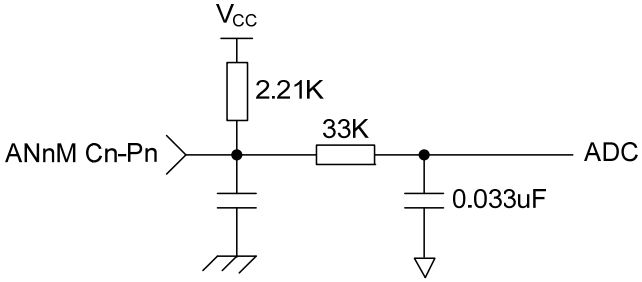
Presenting the ECM-0565-128-0704-C engine control module from Woodward's new MotoHawk Control Solutions product line. This rugged embedded controller is capable of operating in harsh automotive, marine, and off-highway applications. Numerous marine applications have proven the capability of this module. Based on the Freescale MPC565 family of microprocessors, the ECM-0565-128-0704-C modules are capable of delivering complex control strategies. The onboard floating-point unit and high clock frequency allow software to be executed in shorter times. The CAN 2.0B data-link ensures interoperability with other vehicle systems.

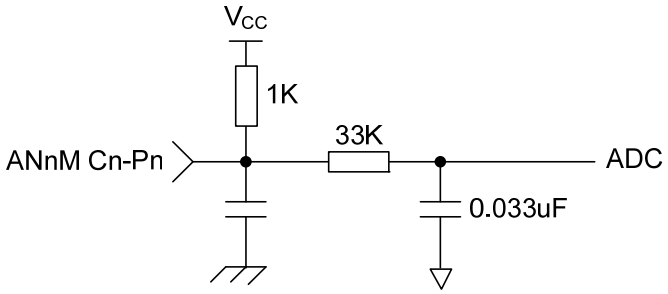
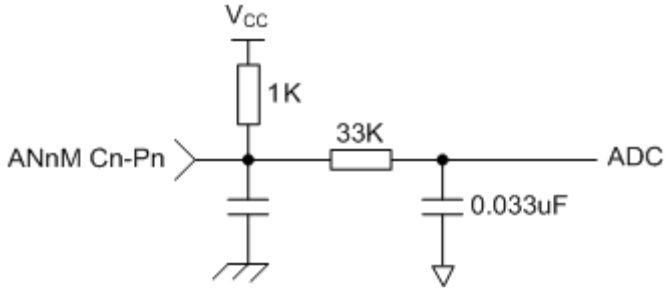
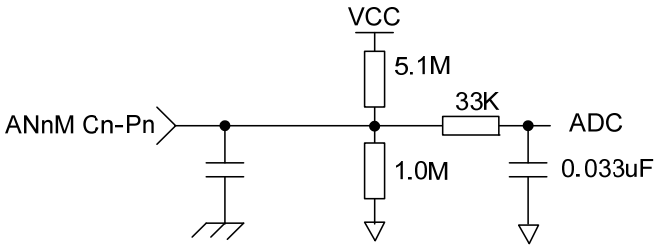
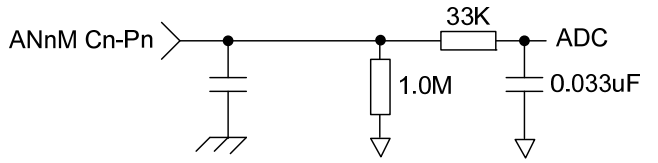
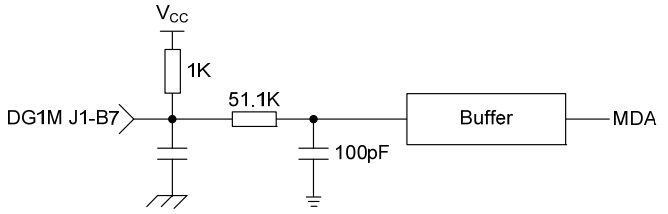
The ECM-0565-128-0704-C module is part of the ControlCore® family of embedded control systems. MotoHawk Control Solutions' ControlCore operating system, MotoHawk® code-generation product, and MotoHawk's suite of development tools enable rapid development of complex control systems.

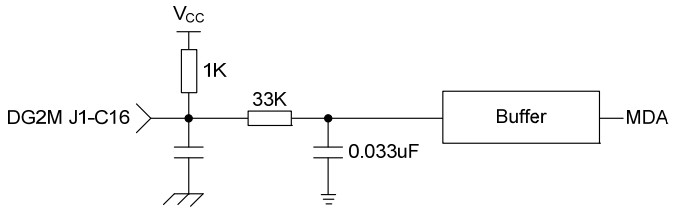
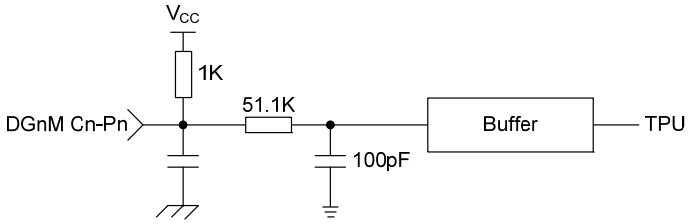
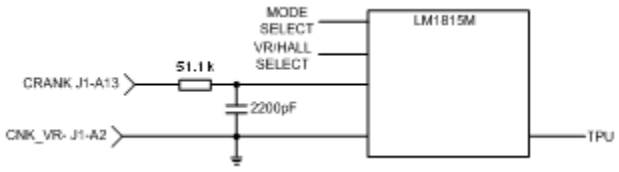
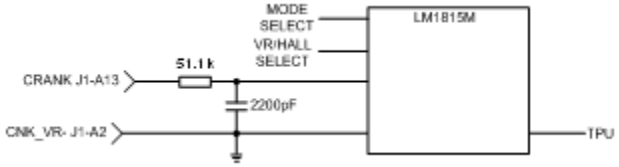
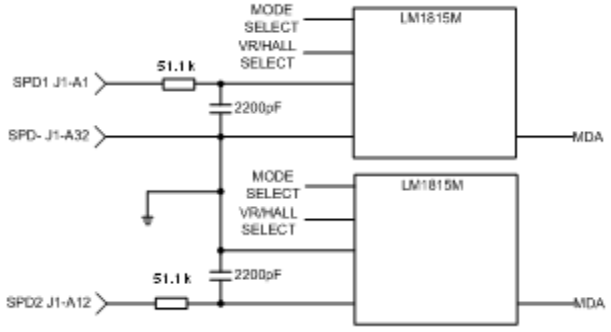
IMPORTANT **MotoHawk version 2010bSP0 or higher is required for this module.**

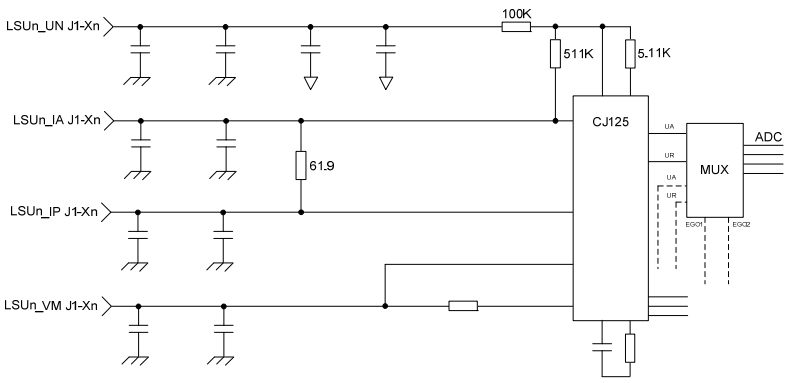
IMPORTANT **Woodward does not warranty this ECM based on information supplied in this datasheet, but only with an express and specific production supply agreement based on customer's operating mode. Information in this datasheet is subject to change without prior notice. Please contact MotoHawk Control Solutions sales for more information.**

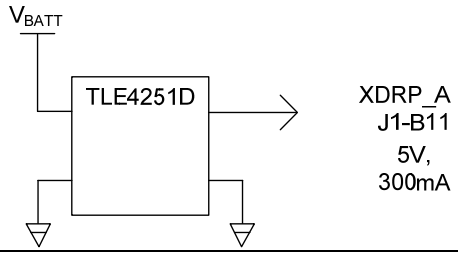
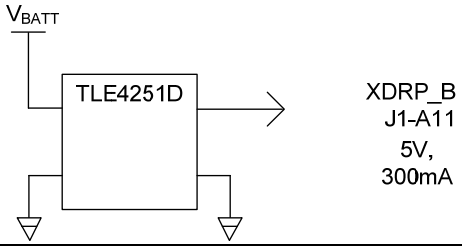
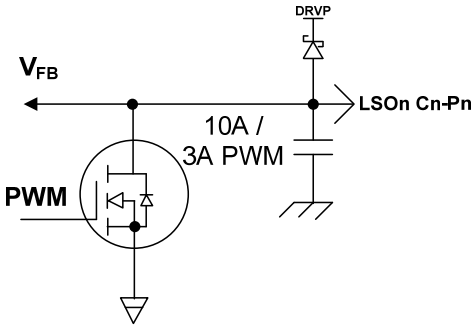
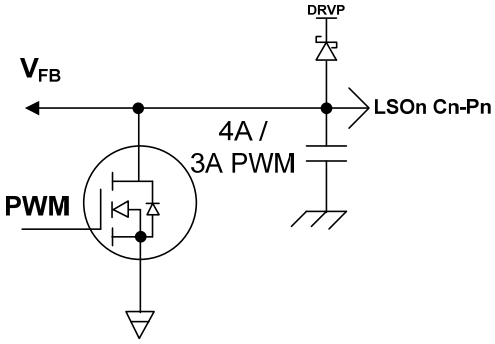
- **Microprocessor**: Freescale MPC565, 56 MHz
- **Memory**: 1M Flash, 36K RAM, 8K Serial EEPROM, 64Kx8 Parallel EEPROM, 512K External RAM
- **Operating Voltage**: 9–32 Vdc
- **Operating Temperature**: –40 to +105 °C (in benchmark marine engine application)
- Sealed connectors operable to 10 ft (3 m) submerged
- **Inputs:**
  34 Analog
  4 Low Frequency Digital
  4 VR Frequency
  2 Wide Range O_2 (I) Sensor—Inputs (Bosch LSU4.2)
  4 Dual Sensor Wide Band Knock Detector Inputs
- **Outputs:**
  6x 3 A Peak/1 A Hold Injector Drivers
  6x 7 A/3 A or 3 A/1 A Peak/Hold Inj. Drivers
  16x TTL Level Ignition System
  Up to 10x 3 A Low Side PWMs
  1x 1.5 A Tachometer Output
  2x 5 A H-Bridge PWM
  1x 10 A H-Bridge PWM
  1x Relay Driver (Main Power)
- **Datalinks:**
  2 CAN 2.0B Channels
  1 ISO 9141 Channel (KWP2000/HWP2000, 10.4 kbps)
  1 RS-485 Channel

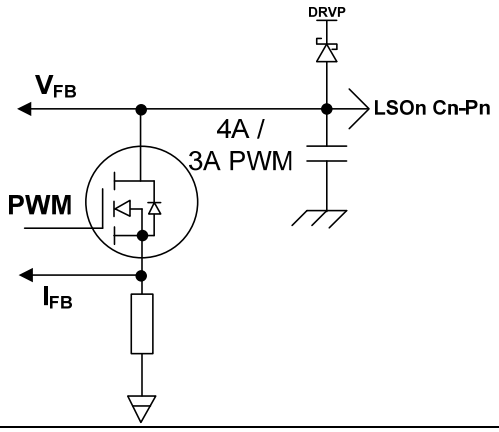
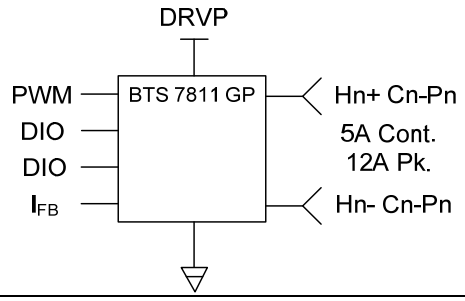
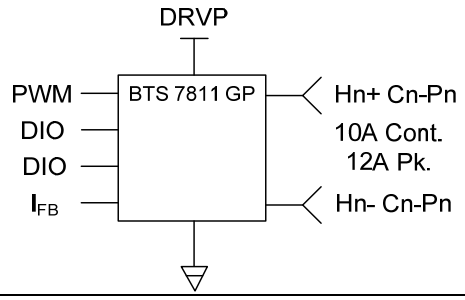
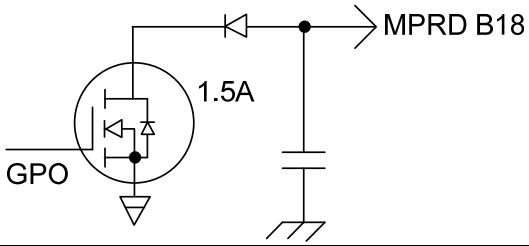
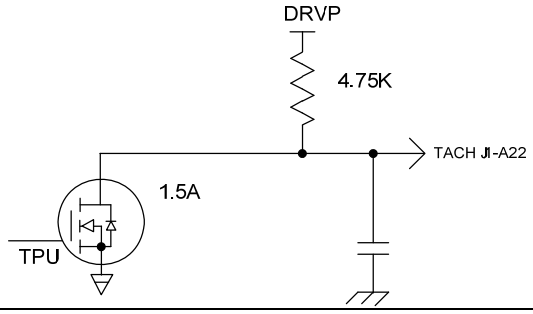
1–Input Signal Conditioning	See Freescale MPC565 Datasheet for description of processor resources.
1.1 KEY_SW (J1-B2), BATT (J1-B8), DRVG A (J2-A16), DRVG B (J2-A24), DRVG C (J2-A15), DRVG D (J2-B9), XDRG_A (J1-B24), XDRG_B (J1-A24), EST_RTN (J2-A22)  DRVG is connected to Battery Ground, XDRG is the transducer return.	
1.2 DRVP **(J2-A18, J2-A19)** This is the source for the H-Bridges (via the Main Power Relay). The DRVP monitor is scaled for 42.5 V 12 V = 290 counts.	
1.3 XDRP_A, XDRP_B **(J1-B11, J1-A11)** The XDRP monitors are scaled for 10 V 5 V = 512 counts.	
1.4 AN1M, AN2M, AN3M **(J1-A14, J1-A18, J1-A8)** These inputs are 10-bit 0–5 V ADCs, τ = 1 ms They are intended for potentiometers	
1.5 AN4M **(J1-A2)** This input is a 10-bit 0–5 V ADCs, τ = 100 µs. It is intended for a MAP sensor.	
1.6 AN5M…AN12M **(J1-A30, J1-A6, J1-A21, J1-A17, J1-A25, J1-A16, J1-A26, J1-A15)** These inputs are 10-bit 0–5 V ADCs, τ = 1 ms. They are intended for pressure sensors.	
1.7 AN13M, AN26M…AN28M **(J1-A10, J1-C12, J1-C15, J1-C7)** These inputs are 10-bit 0–5 V ADCs, τ =1 ms. They are intended for variable-resistance sensors such as thermistors.	

1–Input Signal Conditioning	(continued)
1.8 AN14M–AN17M, AN19M–AN25M, AN33M,AN34M (J1-A28, J1-A5, J1-A27, J1-A7, J1-C11, J1-C9, J1-C2, J1-C4, J1-C5 ,J1-C1, J1-C3, J1-B5,J1-B6) These inputs are 10-bit 0–5 V ADCs, τ =1 ms. They are intended for variable-resistance sensors such as thermistors.	
1.9 AN18M (J1-C10) These inputs are 10-bit 0–5 V ADCs, τ =1 ms. They are intended for variable-resistance sensors such as thermistors.	
1.10 AN29M, AN30M (J1-C6, J1-C8) These inputs are 10-bit 0–5 V ADCs, τ =1 ms. They are intended for switch type Oxygen sensors.	
1.11 AN31M, AN32M (J1-B3, J1-B4) These inputs are 10-bit 0–5 V ADCs, τ =1 ms. They are intended for switch type Oxygen sensors.	
1.12 DG1M (J1-B7) Digital switch input; VIL=2.0 V max., VIH=2.5 V min., τ =5.1 µs.	

1–Input Signal Conditioning	(continued)
1.13 DG2M (J1-C16) Digital switch input; VIL=2.0 V max., VIH=2.5 V min., τ =1 ms.	
1.14 DG3M, DG4M (J1-A19, J1-A9) Digital switch inputs; VIL=2.0 V max., VIH=2.5 V min., τ =5.1 µs. They may be used for high speed MAF sensors.	
1.15 CRANK, CNK_VR– (J1-A13, J1-A2) CRANK input may be used with a Hall-Effect or Variable Reluctance sensor.	
1.16 CAM, CAM_VR– (J1-A20, J1-A31) CAM input may be used with a Hall-Effect or Variable Reluctance sensor	
1.17 SPD1, SPD2, SPD– (J1-A1, J1-A12, J1-A32) Speed inputs may be used with a Hall-Effect or Variable Reluctance sensor.	
1.18 EK1P, EK1N, EK2P, EK2N, EK3P,EK3N,EK4P,EK4N (J1-C19, J1-C20, J1-C21, J1-C22, J1-C23, J1-C24 J1-C13, J1-C14,) These inputs are intended for wide-band piezoelectric knock sensors.	

1–Input Signal Conditioning	(continued)
1.19 LSU1_UN, LSU1_IA, LSU1_IP, LSU1_VM, LSU2_UN, LSU2_IA, LSU2_IP, LSU2_VM (J1-B21, J1-B15, J1-B14, J1-B1, J1-B12, J1-B16, J1-B17, J1-B13) LSU1 & LSU2 are compatible with the Bosch LSU 4.2 sensor.	

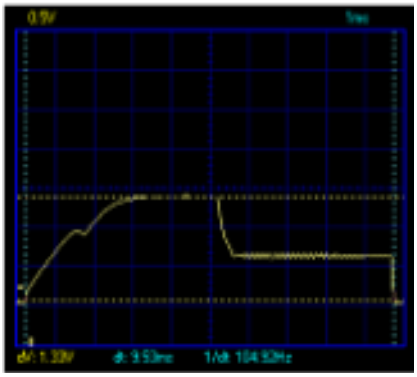
2–Output Signal Conditioning	
2.1 XDRP_A (J1-B11) Independent 5 V, 300 mA transducer power.	
2.2 XDRP_B (J1-A11) Independent 5 V, 300 mA transducer power.	
2.3 LSO1/LSUH1, LSO2/LSUH2 (J1-B20, J1-B19) These are low side drivers intended to drive heaters for the Lambda Sensing Units (1.17), 10 A continuous, 3 A PWM.	
2.4 LSO 5… LSO 10 (J2-B12, J2-B15, J2-B17, J2-B19, J2-B18, J2-B20) These are low side drivers intended to drive inductive loads, 4 A continuous, 3 A PWM.	

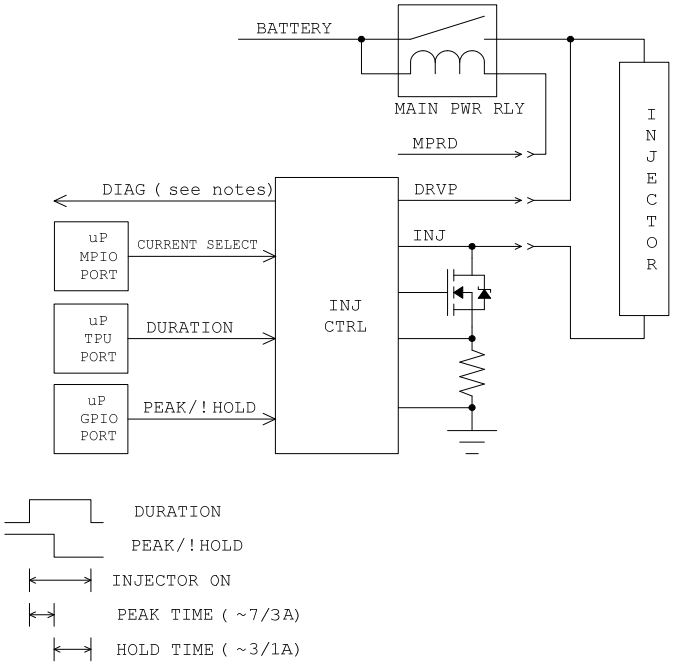
2–Output Signal Conditioning	(continued)
2.5 LSO 3, LSO4 **(J1-A23, J2-B21)** These are low side drivers with current feedback, 4 A continuous, 3 A PWM.	
2.6 H1+, H1–,H2+,H2– **(J2-A9, J2-A17, J2-B22, J2-B23)** These outputs are high current drivers intended for loads that may be operated in either polarity such as DC motors.	
2.7 H3+,H3– **(J2-B16, J2-B24)** These outputs are high current drivers intended for loads that may be operated in either polarity such as DC motors.	
2.8 MPRD **(J1-B18)** This is a 1.5 A low side driver intended to drive a relay coil (1.1) that supplies DRVP used by the loads and H-Bridges (see above).	
2.9 TACH **(J1-A22)** This is a 1.5 A low side driver intended to drive a tachometer.	

2–Output Signal Conditioning (continued)

2.10 INJ04, INJ05, INJ07...INJ09, INJ12 (J2-A6, J2-A8, J2-A2, J2-A4, J2-B3, J2-B1)

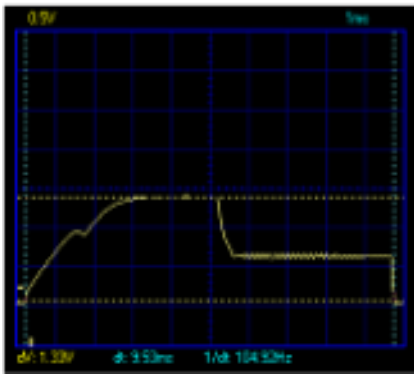
Notes: When the injector output is on (duration) the current is regulated to either the peak or hold level, which is determined by the Current Select signal. Current regulation is implemented via a chopper drive and the recirculation path is via DRVP. If the output is off there is no leakage path to DRVP and flyback energy is dissipated via low-side avalanche.

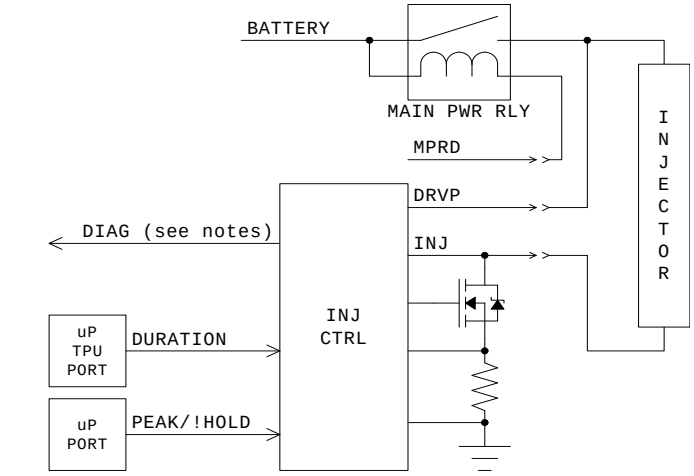


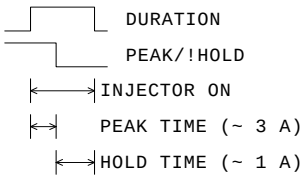


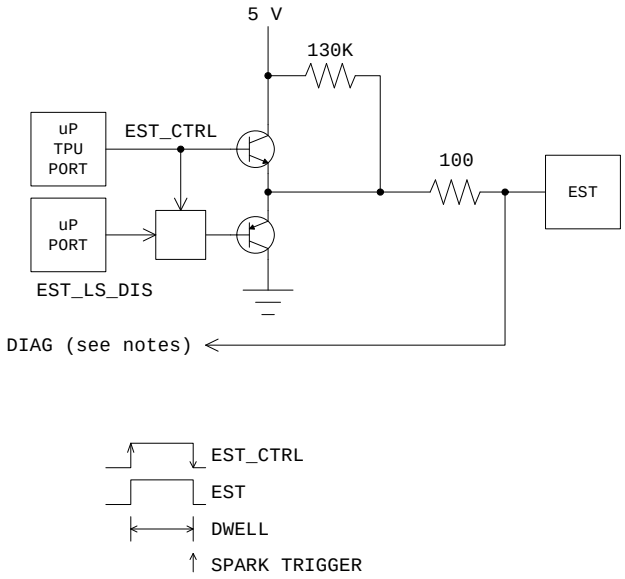
2.10.1 INJ01, ...INJ03, INJ06, INJ10, INJ11 (J2-A1, J2-A3, J2-A7, J2-A5, J2-B2, J2-B4)

Notes: When the injector output is on (duration) the current is regulated to either the peak or hold level. Current regulation is implemented via a chopper drive and the recirculation path is via DRVP. If the output is off there is no leakage path to DRVP and flyback energy is dissipated via low-side avalanche.







2–Output Signal Conditioning	(continued)
2.11 EST1...EST12, EST13/LAMP1...EST16/LAMP4 (J2-A12, J2-A13, J2-A14, J2-A20, J2-A10, J2-A11, J2-A21, J2-A23, J2-B14, J2-B13, J2-B11, J2-B10, J2-B6, J2-B5, J2-B7, J2-B8) These are TTL level outputs intended for intelligent coil modules. **Notes**: Short circuit protection, open circuit and short circuit detection. Since EST_RTN (not shown) is a direct path to the ECM ground care must be taken not to introduce ground loops. EST_RTN is not designed to carry any significant current; it is a reference only. It should be open circuit unless the smart coil electronics provides an isolated logic ground reference. Care must also be taken not to introduce noise on EST_RTN. Electrical transients on EST_RTN can cause module upsets. EST13/LAMP1...EST16/Lamp4 may be used to drive resistive loads requiring up to 1.5 A.	

3–Communications	
3.1 CAN1+, CAN1–, CAN2+, CAN2– (J1-B9, J1-B10, J1-C17, J1-C18)	CAN 2.0B, Standard or Extended ID, up to 1 MBd.
3.2 RS-485+, RS-485– (J1-B22, J1-B23)	RS-485, programmable baud rate 1200 – 57600. 8 Bits, No parity, 1 Stop Bit
3.3 ISO 9141-K, ISO 9141-L (J1-A3, J1-A4) **Note: ISO 9141 is not supported in MotoHawk.**	KWP2000/HWP2000, 10.4 kBd

4–Connector Pinouts					
Pin # ECM	**ControlCore Resource Name**	**Function**	**Notes**	**Wire Color**	**Wire #**
J1-A1	SPD1	Auxiliary Speed Input	VR or HALL Effect	purple/white	1
J1-A2	CNK_VR–	Return for CRANK VR sensor		white/yellow	2
J1-A3	ISO_9141_K	Serial Data Link	ISO 9141 Compliant	yellow	3
J1-A4	ISO_9141_L			blue/black	4
J1-A5	AN15M	Variable Resistance Input	1K Pull Up	white/orange	5
J1-A6	AN6M	Pressure Input	51K Pull Down	light blue/white	6
J1-A7	AN17M	Variable Resistance Input	1K Pull Up	white/yellow	7
J1-A8	AN3M	Pressure Input	220K Pull Down	brown/white	8
J1-A9	DG4	Discrete Switch, Frequency	1K Pull Up	yellow/pink	9
J1-A10	AN13M	Potentiometer Input	2.2K Pull Up	red/pink	10
J1-A11	XDRP_B	Transducer Power B (5 V)	Transducer Power	white	11
J1-A12	SPD2	Auxiliary Speed Input	VR or HALL Effect	white/red	12
J1-A13	CNK	Crank Position Signal	VR or HALL Effect	tan/orange	13
J1-A14	AN1M	Pressure Input	220K Pull Down	tan	14
J1-A15	AN12M	Pressure Input	51K Pull Down	tan/green	15
J1-A16	AN10M	Pressure Input	51K Pull Down	green	16
J1-A17	AN8M	Pressure Input	51K Pull Down	brown	17
J1-A18	AN2M	Pressure Input	220K Pull Down	white/dark blue	18
J1-A19	DG3	Discrete Switch, Frequency	1K Pull Up	black/red	19
J1-A20	CAM	Cam Position Signal	VR or HALL Effect	yellow/orange	20
J1-A21	AN7M	Pressure Input	51K Pull Down	dark blue	21
J1-A22	TACH	Tachometer Output	4.75K Pull Up	black/orange	22
J1-A23	LSO3	PWM with current feedback	4 A continuous, 3 A PWM	purple/yellow	23
J1-A24	XDRG	Transducer Ground	Return for Transducers	red/purple	24
J1-A25	AN9M	Pressure Input	51K Pull Down	light blue/black	25
J1-A26	AN11M	Pressure Input	51K Pull Down	pink/black	26
J1-A27	AN16M	Variable Resistance Input	1K Pull Up	orange/pink	27
J1-A28	AN14M	Variable Resistance Input	1K Pull Up	dark blue/white	28
J1-A29	AN4M	Pressure Input	51K Pull Down	white/light blue	29
J1-A30	AN5M	Pressure Input	51K Pull Down	white/black	30
J1-A31	CAM_VR–	Return for CAM VR sensor		yellow	31
J1-A32	SPD–	Return for SPD VR sensors		brown	32

4–Connector Pinouts **(continued)**					
Pin # ECM	**ControlCore Resource Name**	**Function**	**Notes**	**Wire Color**	**Wire #**
J1-B1	LSU1_VM	Lambda Sensing Unit	See datasheet for Bosch LSU4.x and CJ125.	black/green	33
J1-B2	KEY_SW	ECM Wake	Wake Up Module	green/black	34
J1-B3	AN31M	Switch Type Oxygen Sensors	1M Pull Down	gray/dark blue	35
J1-B4	AN32M	Switch Type Oxygen Sensors	1M Pull Down	yellow/purple	36
J1-B5	AN33M	Variable Resistance Inputs	1K Pull Up	white	37
J1-B6	AN34M	Variable Resistance Inputs	1K Pull Up	white/purple	38
J1-B7	DG1	Discrete Switch, Frequency, IRQ	1K Pull Up	light blue/black	39
J1-B8	BATT	Battery Connection		yellow/black	40
J1-B9	CAN1+	Serial Communications	Terminating Resistance Required	green/purple	41
J1-B10	CAN1–			green/brown	42
J1-B11	XDRP_A	Transducer Power A (5 V)	300 mA Source for Transducers	orange	43
J1-B12	LSU2_UN	Lambda Sensing Unit2	See datasheet for Bosch LSU4.xand CJ125.	gray	44
J1-B13	LSU2_VM			red	45
J1-B14	LSU1_IP	Lambda Sensing Unit1		white/brown	46
J1-B15	LSU1_IA			black/blue	47
J1-B16	LSU2_IA	Lambda Sensing Unit2		orange/black	48
J1-B17	LSU2_IP			red/blue	49
J1-B18	MPRD	Main Power Relay Driver	Wire to Coil of Main Power Relay	red/blue	50
J1-B19	LSO2/LSUH2	PWM Output/ LSU Heater	10 A continuous, 3 A PWM	yellow/white	51
J1-B20	LSO1/LSUH1			pink/light blue	52
J1-B21	LSU1_UN	Lambda Sensing Unit1	See datasheet for Bosch LSU4.x and CJ125.	orange/white	53
J1-B22	SCL+	RS-485 HI		pink/dark blue	54
J1-B23	SCL–	RS-485 LO		black/yellow	55
J1-B24	XDRG	Transducer Ground	Return for Transducers	purple/pink	56

4–Connector Pinouts **(continued)**					
Pin # ECM	**ControlCore Resource Name**	**Function**	**Notes**	**Wire Color**	**Wire #**
J1-C1	AN24M	Variable Resistance Input	1K Pull Up	yellow/orange	57
J1-C2	AN21M	Variable Resistance Input	1K Pull Up	brown/white	58
J1-C3	AN25M	Variable Resistance Input	1K Pull Up	red/white	59
J1-C4	AN22M	Variable Resistance Input	1K Pull Up	brown/yellow	60
J1-C5	AN23M	Variable Resistance Input	1K Pull Up	brown/white	61
J1-C6	AN29M	High Impedance Input	5.1M Pull Up, 1M Pull Down	pink/black	62
J1-C7	AN28M	Potentiometer Input	2.2K Pull Up	green/orange	63
J1-C8	AN30M	High Impedance Input	5.1M Pull Up, 1M Pull Down	green/blue	64
J1-C9	AN20M	Variable Resistance Input	1K Pull Up	yellow/red	65
J1-C10	AN18M	Variable Resistance Input	10K Pull Up	yellow/white	66
J1-C11	AN19M	Variable Resistance Input	1K Pull Up	pink/brown	67
J1-C12	AN26M	Potentiometer Input	2.2K Pull Up	green/red	68
J1-C13	EK4P	Knock Sensor Positive	Compatible with the Motorola PROSAK IC	green/white	69
J1-C14	EK4N	Knock Sensor Negative		green/yellow	70
J1-C15	AN27M	Potentiometer Input	2.2K Pull Up	black	71
J1-C16	DG2	Discrete Switch, Frequency, IRQ	1K Pull Up	black	72
J1-C17	CAN2+	Serial Communications	Terminating Resistance Required	gray/white	73
J1-C18	CAN2–			gray/red	74
J1-C19	EK1P	Knock Sensor Positive	Compatible with the Motorola PROSAK IC	yellow/pink	75
J1-C20	EK1N	Knock Sensor Negative		green/white	76
J1-C21	EK2P	Knock Sensor Positive		pink/purple	77
J1-C22	EK2N	Knock Sensor Negative		light blue/white	78
J1-C23	EK3P	Knock Sensor Positive		pink/orange	79
J1-C24	EK3N	Knock Sensor Negative		black	80

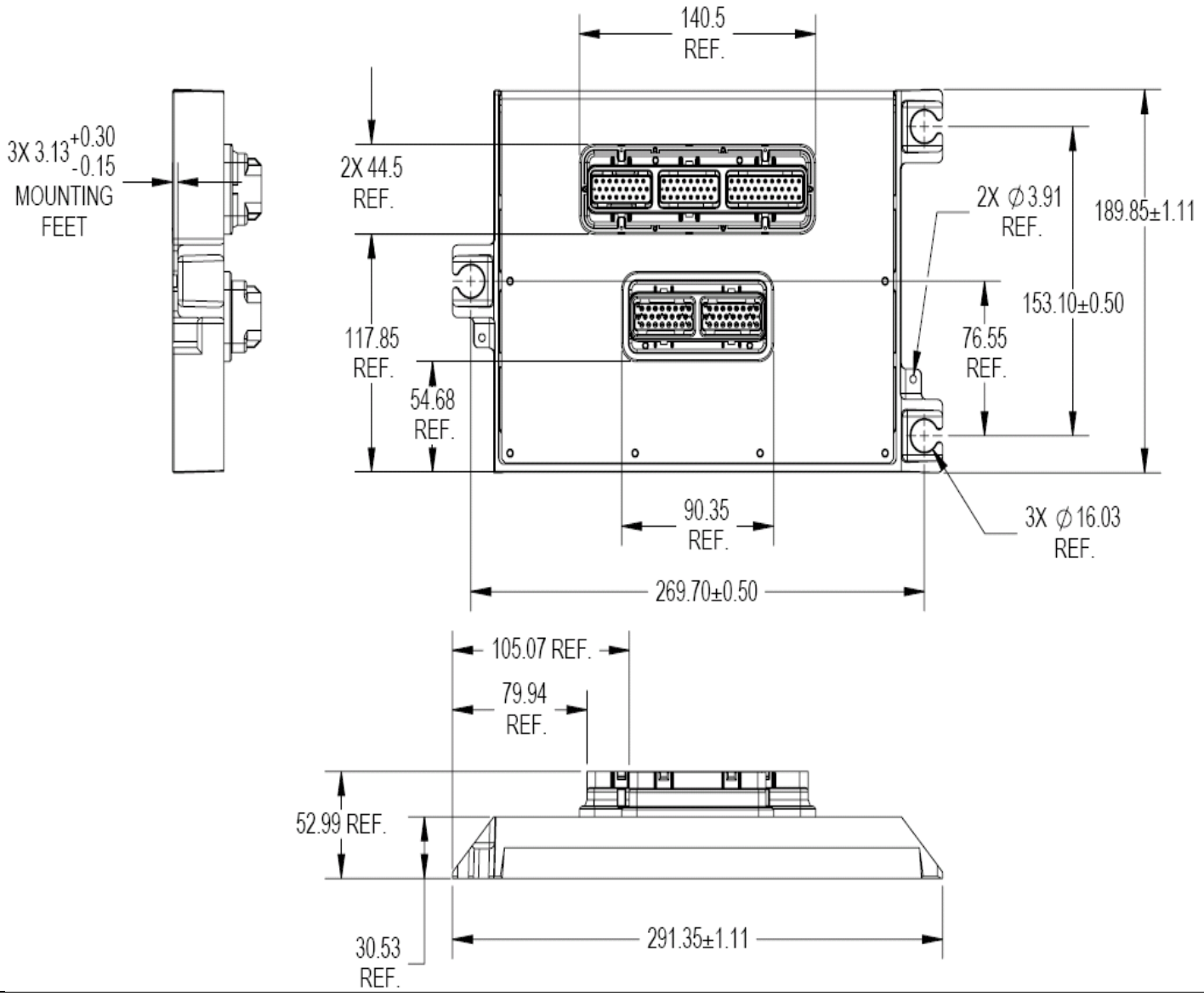
4–Connector Pinouts (continued)					
Pin # ECM	**ControlCore Resource Name**	**Function**	**Notes**	**Wire Color**	**Wire #**
J2-A1	INJ01	Injector 1 Driver	3 A/1 A peak/hold	pink/light blue	81
J2-A2	INJ07	Injector 7 Driver	7 A/3 A or 3 A/1 A peak/hold	pink/orange	82
J2-A3	INJ02	Injector 2 Driver	3 A/1 A peak/hold	yellow/black	83
J2-A4	INJ08	Injector 8 Driver	7 A/3 A or 3 A/1 A peak/hold	white	84
J2-A5	INJ06	Injector 6 Driver	3 A/1 A peak/hold	white/ dark blue	85
J2-A6	INJ04	Injector 4 Driver	7 A/3 A or 3 A/1 A peak/hold	black/red	86
J2-A7	INJ03	Injector 3 Driver	3 A/1 A peak/hold	yellow/orange	87
J2-A8	INJ05	Injector 5 Driver	7 A/3 A or 3 A/1 A peak/hold	light blue	88
J2-A9	H1+	H-Bridge Output	High Current (5 A)	tan/light blue	89
J2-A10	EST5	Electronic Spark Timing	TTL	gray	90
J2-A11	EST6			dark blue	91
J2-A12	EST1			dark blue/white	92
J2-A13	EST2			white/ light blue	93
J2-A14	EST3			white/black	94
J2-A15	DVRG	Driver Ground	Connect to Battery Ground	black/yellow	95
J2-A16	DVRG			black/white	96
J2-A17	H1–	H-Bridge Output	High Current (5 A)	pink/purple	97
J2-A18	DRVP	Driver Power (VBATT)	Power to H-Bridges and Loads	pink/brown	98
J2-A19	DRVP			orange	99
J2-A20	EST4	Electronic Spark Timing	TTL	orange/white	100
J2-A21	EST7			black/blue	101
J2-A22	EST_RTN	Low Current Return		yellow/purple	102
J2-A23	EST8	Electronic Spark Timing	TTL	red/blue	103
J2-A24	DVRG	Driver Ground	Connect to Battery Ground	black/white	104

4–Connector Pinouts (continued)					
Pin # ECM	**ControlCore Resource Name**	**Function**	**Notes**	**Wire Color**	**Wire #**
J2-B1	INJ12	Injector 12 Driver	7 A/3 A or 3 A/1 A peak/hold	black/orange	105
J2-B2	INJ10	Injector 10 Driver	3 A/1 A peak/hold	tan	106
J2-B3	INJ09	Injector 9 Driver	7 A/3 A or 3 A/1 A peak/hold	yellow	107
J2-B4	INJ11	Injector 11 Driver	3 A/1 A peak/hold	dark blue/pink	108
J2-B5	EST14/LAMP2	Electronic Spark Timing/ Low Side Lamp Driver	High Current (1 A)	red/pink	109
J2-B6	EST13/LAMP1			white	110
J2-B7	EST15LAMP3	Electronic Spark Timing/ Low Side Lamp Driver	High Current (1 A)	white/green	111
J2-B8	EST16/LAMP4			brown/white	112
J2-B9	DVRG	Driver Ground	Connect to Battery Ground	gray/red	113
J2-B10	EST12	Low Side Lamp/LED Drivers	Max Current 25 mA	orange/black	114
J2-B11	EST11			blue/black	115
J2-B12	LSO5	PWM Output	4 A continuous, 3 A PWM	white/orange	116
J2-B13	EST10	Low Side Lamp/LED Drivers	Max Current 25 mA	white/yellow	117
J2-B14	EST9			tan/green	118
J2-B15	LSO6	PWM Output	4 A continuous, 3 A PWM	green/yellow	119
J2-B16	H3+	H-Bridge Output	High Current (10 A)	green/red	120
J2-B17	LSO7	PWM Output	4 A continuous, 3 A PWM	black/green	121
J2-B18	LSO9			purple	122
J2-B19	LSO8			tan/purple	123
J2-B20	LSO10	PWM Output	4 A continuous, 3 A PWM	light blue/white	124
J2-B21	LSO4	PWM Output with current feedback	4 A continuous, 3 A PWM	purple/yellow	125
J2-B22	H2+	H-Bridge Output	High Current (5 A)	tan/white	126
J2-B23	H2–			green/black	127
J2-B24	H3–	H-Bridge Output	High Current (10 A)	green/blue	128

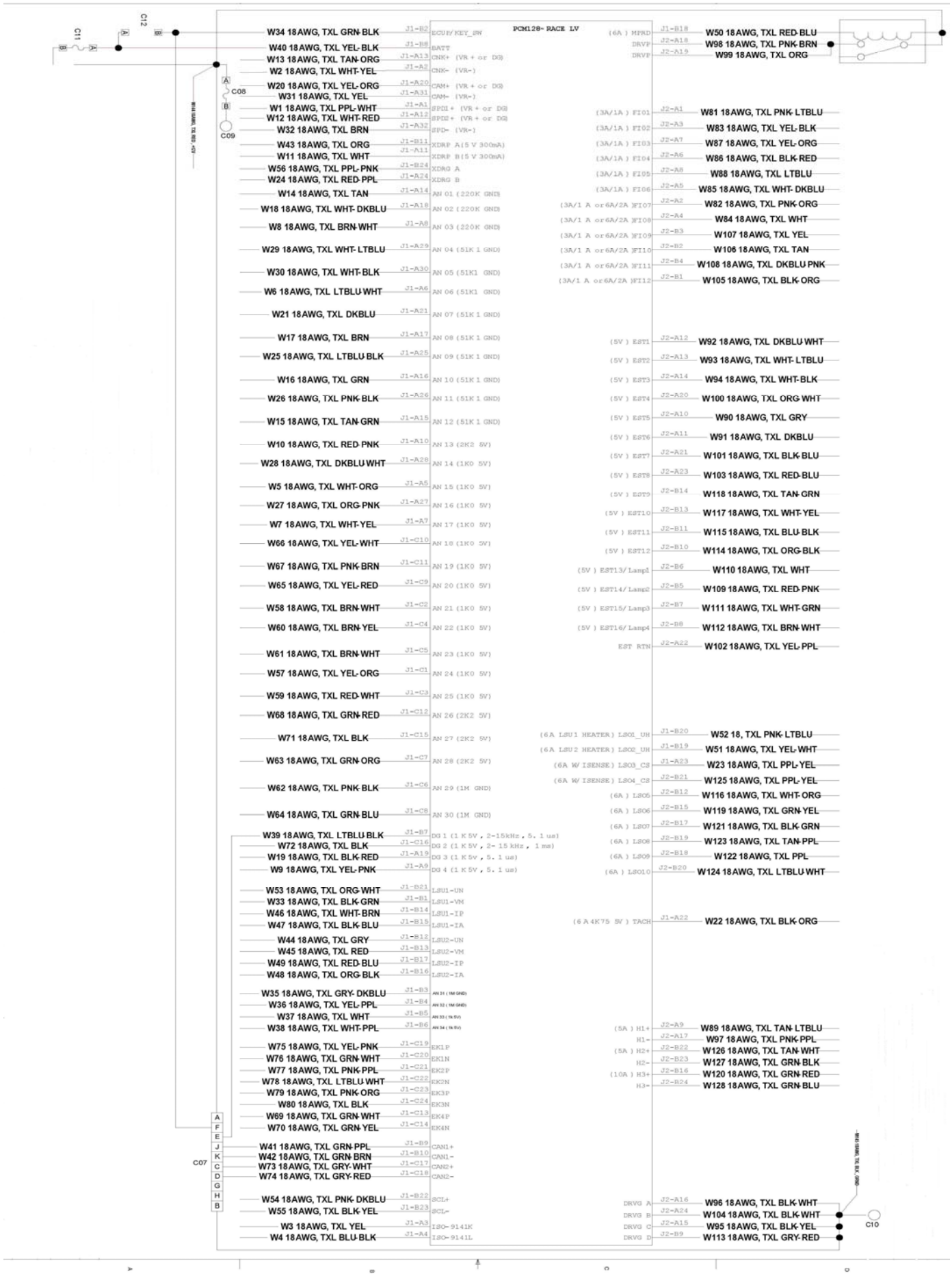
4.1–Additional Development Harness Wires	Highlighted wires are not directly accessible.

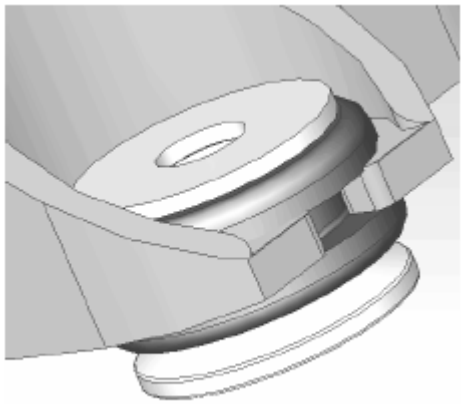
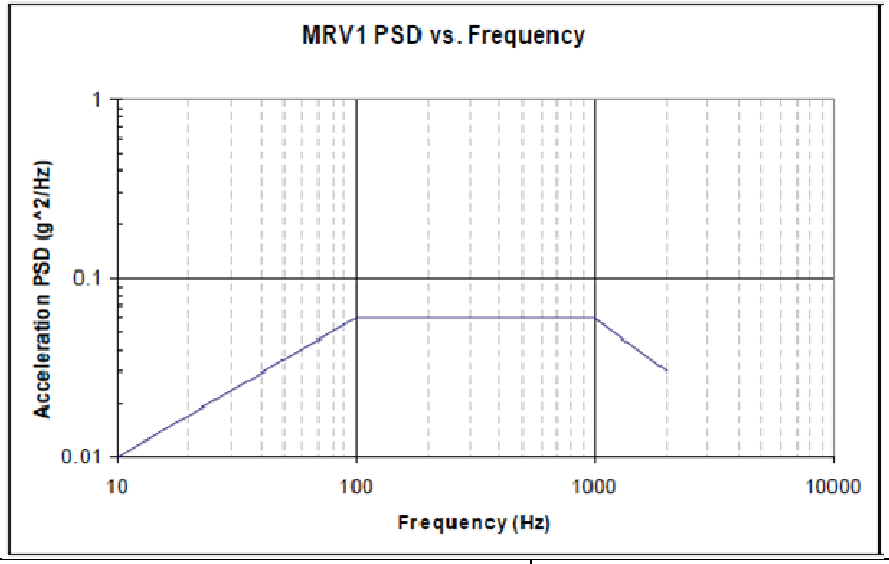
Additional Harness Wires						
Wire #	**FUNCTION**	**COLOR**	**FROM**	**PIN**	**TO**	**PIN**
129	SC GND	BLACK	SPL01	A	C07	B
130	BATTERY +	RED	C09	--	C08	B
131	FUSED PWR	RED	C08	A	SPL04	A
132	SC PWR	RED	SPL04	B	C07	A
133	FUSED PWR	RED	C06	30	SPL04	B
134	COIL PWR	RED	C06	85	SPL04	C
135	DRVP	RED	C06	87	SPL03	A
136	DRVP	RED	SPL03	B	OUTPUT	--
137	BATTERY -	BLACK	SPL02	A	C10	--
138	GND CONN	BLACK	SPL01	A	SPL02	A
139	KEYSWITCH	GRN-BLK	SPL05	A	C07	F
140	BOOT CKT	GRN-BLK	SPL05	C	C12	B
141	BOOT CKT	YEL-BLK	C11	A	SPL06	C
142	BOOT CKT	YEL-BLK	C12	A	SPL06	B
143	BOOT CKT	RED	SPL04	E	C11	B
144	FUSED PWR	RED	SPL04	F	OUTPUT	--
145	GROUND	BLACK	SPL02	A	OUTPUT	--

5–Physical Dimensions	All dimensions are in millimeters.



5.1–Block Diagram	Development Harness Connections (HARN-P128-002)



6–Environmental Ratings	
6.1 GENERAL:	The ECM is designed to meet automotive industry standard under hood environmental requirements for 12 volt and 24 volt systems, and also meets marine industry environmental requirements. Validation tests included extreme operating temperatures (–40 to +105 °C), thermal shock, humidity, salt spray, salt fog, immersion, fluid resistance, mechanical shock, vibration, and EMC. It is the responsibility of the application engineer to assure that the application does not exceed the demonstrated capabilities of the unit; vibration or thermal. It may be necessary to perform additional tests to validate the unit in the application.
6.2 STORAGE TEMPERATURE:	–40 to +125 °C
6.3 OPERATING TEMPERATURE:	–40 to +105 °C
6.4 THERMAL SHOCK:	–40 to +125 °C transition within 10 s for 500 cycles
6.5 FLUID RESISTANCE:	Two stroke motor oil, Four-stroke motor oil, Unleaded gasoline, ASTM Reference 'C' fuel
6.6 HUMIDITY RESISTANCE:	85% humidity at 85 °C for 1000 hours of operation
6.7 SALT FOG RESISTANCE:	1000 hours
6.8 IMMERSION:	Submersible in 8% saltwater solution to 10 ft (3 m)
6.9 MECHANICAL SHOCK:	50 hours of 50 g's
6.10 DROP:	Random drop tests on concrete from 6 ft (1.8 m)
6.11 VIBRATION: For engine-mounted applications, rubber isolators are required and available from Woodward. 	3 hours per axis per the below accelerated hard-mount profile. Application vibration levels must be reviewed and approved by Woodward for warranty coverage. 

6.12 ABNORMAL SUPPLY VOLTAGE RESISTANCE:		
Conditions	**Supply Voltage**	**Time**
Reverse Battery	–24 Vdc	5 Minutes
Abnormal Alternator Output	36 Vdc	5 Minutes
Minimum Battery	6 Vdc	*Indef.*

7–Using a Boot Key/Cable

Errors in configuration, logic and/or other programming made during program development for this module (via .srz file), can cause a persistent loss of CAN communications with the module under development.

If this happens, apply the boot key to force the module into reboot mode, reloading the module with functional program code (a known, valid .srz file) in order to allow resumption of module communication. Follow the steps listed in this section.

Refer to diagram below for connections.

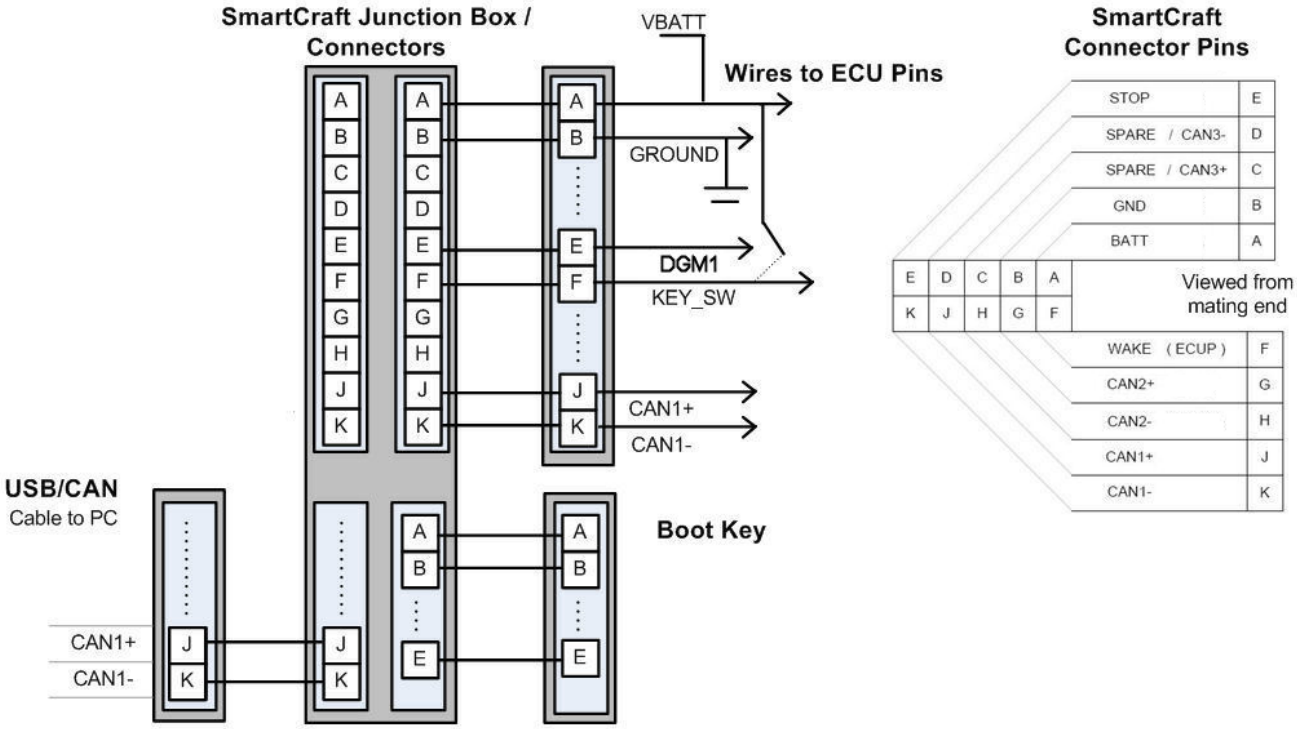
⚠WARNING Remove the ECU from direct control connections before performing the reboot procedure, as outputs are set to defaults or undefined states, with unpredictable and possibly hazardous results if applied.

Use Boot Key and Reprogram the Module

NOTICE Remove other ECUs from CANbus for this procedure.

1. Connect the module for programming via necessary cables, CAN converter, etc.
2. Select a known, valid .srz file for programming.
3. With key off, disconnect battery power from module. With module power off, initiate programming of the module using MotoTune®.
4. When the “Looking for an ECU” prompt appears in the dialog, reconnect Battery, and then turn key on, to power up and “wake-up” ECU.

The module must “wake-up” (KEYSW on) with the boot key or cable connections applied as described in order to initiate a reboot and to absorb the selected program.



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Distributors & Service

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