MotoHawk Control Solutions

ECM-0555-080-0703-C/F

Engine Control Modules

(Part Nos. 1751-6510 / 1751-6400)

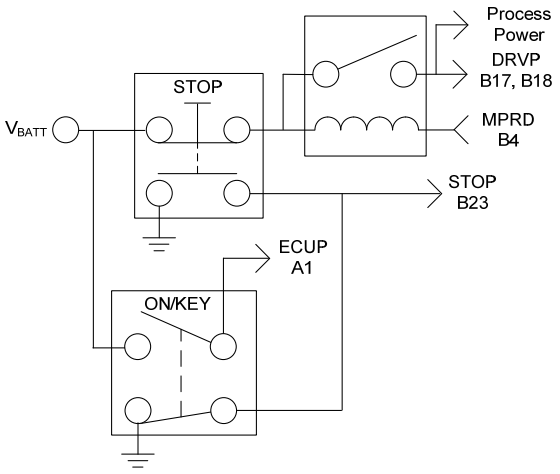
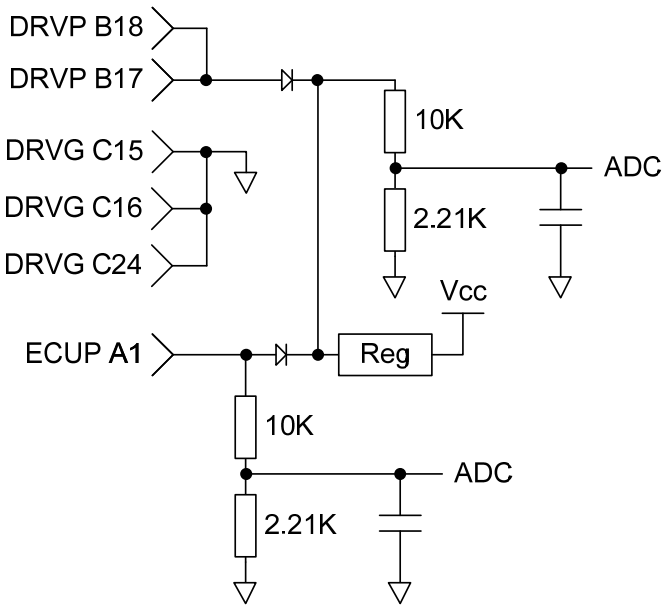
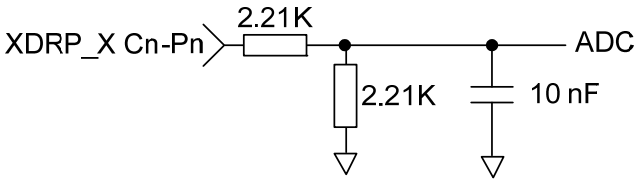
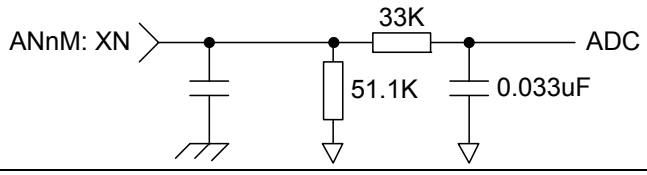
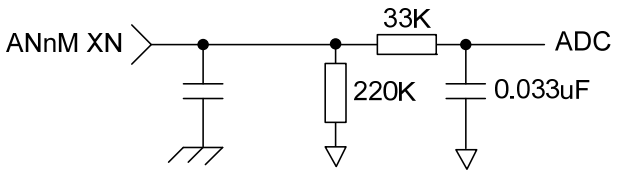
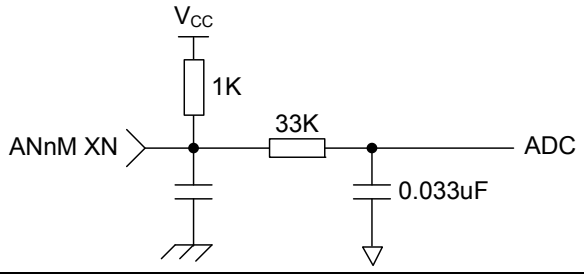
Description

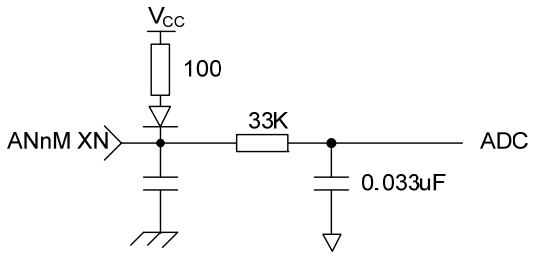
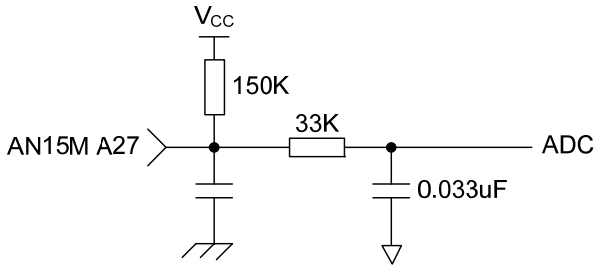
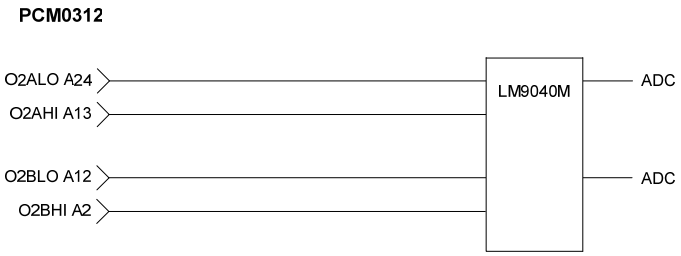
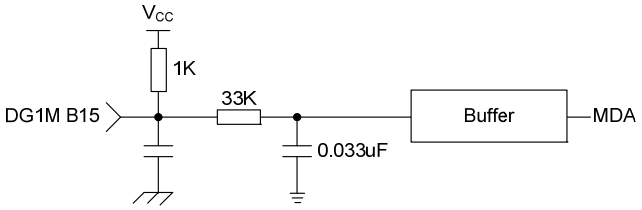
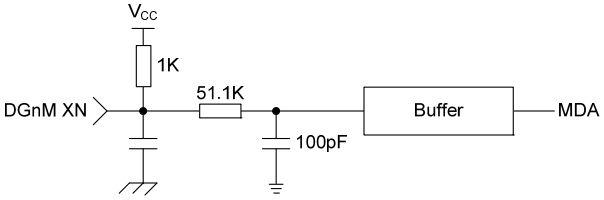
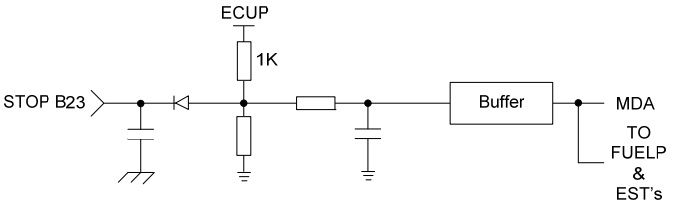
Presenting the ECM-0555-080-0703-C/F engine control modules from Woodward's new MotoHawk Control Solutions product line. These rugged embedded controllers are capable of operating in harsh automotive, marine, and off-highway applications. Over 300,000 successful marine applications prove the capability of this module. Based on a proven microprocessor, the ECM-0555-080-0703-C/F controllers are capable of delivering complex control strategies. The onboard floating point unit and the high clock frequency allow software to be developed in shorter times. Dual CAN 2.0B datalinks ensure interoperability with other system components.

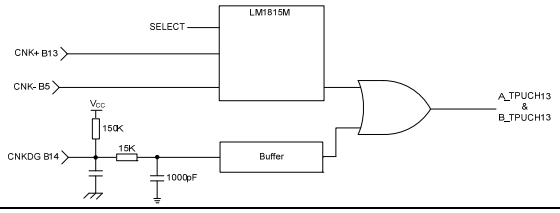
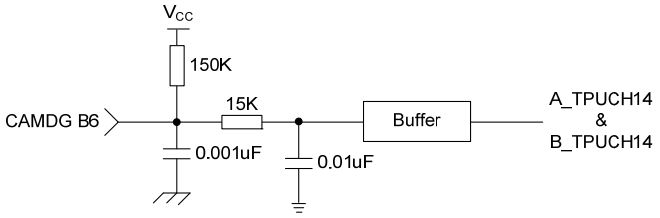
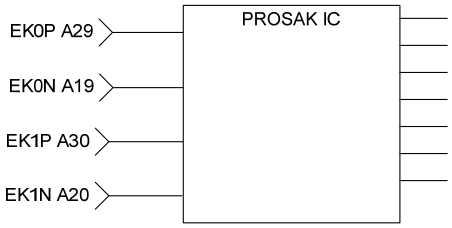
The ECM-0555-080-0703-C/F modules are part of the ControlCore® family of embedded control systems. MotoHawk Control Solutions' ControlCore operating system, MotoHawk® code-generation product, and MotoHawk's suite of development tools enable rapid development of complex control systems.

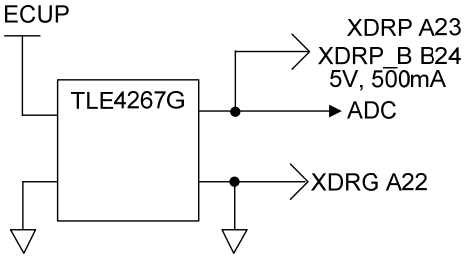
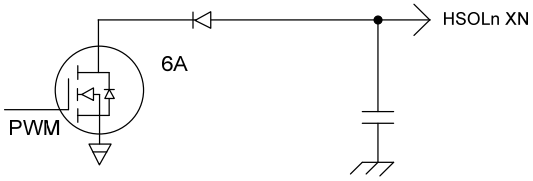
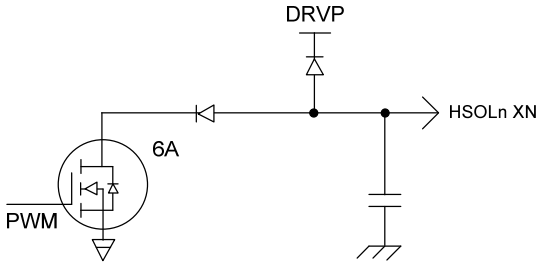
IMPORTANT **Woodward does not warranty these ECMs based on information supplied in this datasheet, but only with an express and specific production supply agreement based on customer's operating mode. Information in this datasheet is subject to change without prior notice. Please contact MotoHawk Control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

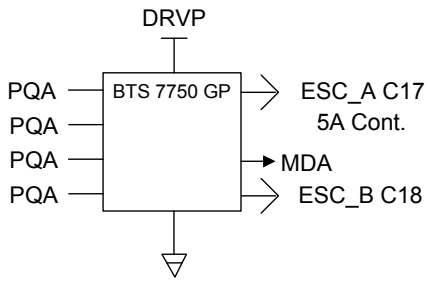
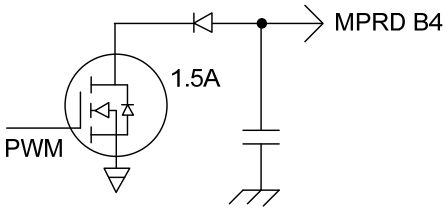
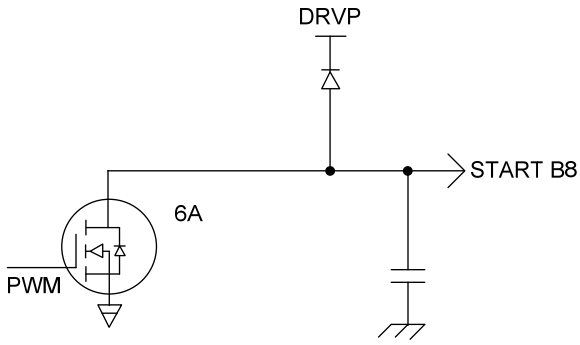
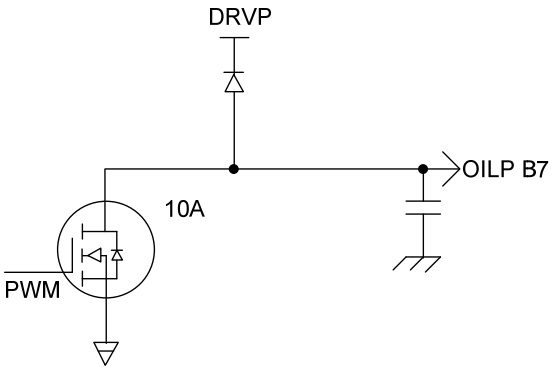
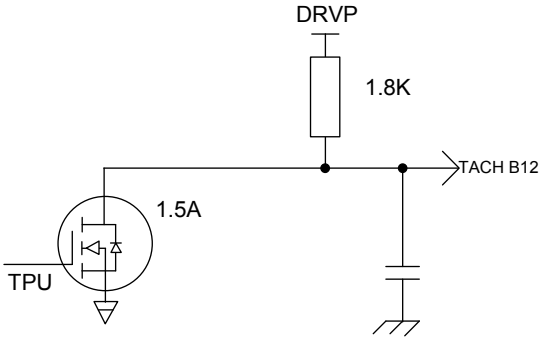
- **Microprocessor**: Freescale MPC555, 40 MHz
- **Memory**: 448K Flash, 26K RAM, 8K EEPROM, 128Kx8 parallel EEPROM (ECM-0555-080-0703-C)
- **Operating Voltage**: 9–16 Vdc
- **Operating Temperature**: –40 to +105 °C
- Sealed connectors operable to 10 ft (3 m) submerged
- **Inputs:**
  15 Analog
  3 Low Frequency Digital
  1 VR Frequency
  Up to 2 Hall Effect Frequency
  1 Dual Sensor Wide Band Knock Detection
  1 Dual O_2 Lambda Sensor
  1 Emergency Stop
- **Outputs:**
  12x 3 A Peak/1 A Hold Injector Drivers
  8x TTL Level Ignition System
  6x 6 A Low Side PWM
  1x 5 A Discrete H-Bridge
  1x 5 A PWM H-Bridge
  1x Relay Driver (Main Power)
  2x 1.5 A Low Side PWM
- **Datalinks:**
  2 CAN 2.0B Channels
  1 RS-485 Channel

1–Input Signal Conditioning	See Freescale MPC555 datasheet for description of processor resources.
1.1 ECUP (A1), DRVP (B17, B18), DRVG (C15, C16, C24) Power (Key) switch input ECUP supplies module power to initiate the process under control. The DRVP inputs are wired to the Main Power Relay which will supply the process while the MPRD signal is asserted and will hold the module power on after the ECUP signal is removed until the MPRD signal is released by the application (see below). Inputs are monitored by the processor. The DRVG inputs are the system (battery) ground connections. 	
1.2 XDRP, XDRP_B (A23, B24) The XDRP monitors are scaled for 10 V 5 V = 512 counts. (See Sec. 2.1)	
1.3 AN1M...AN3M, (A3, A4, A5) These inputs are 10-bit 0–5 V ADC's, τ = 1 ms. They are intended for pressure sensors.	
1.4 AN4M...AN8M (A6, A7, A8, A9, A10) These inputs are 10-bit 0–5 V ADC's, τ = 1 ms. They are intended for potentiometers.	
1.5 AN9M...AN12M (A14, A15, A16, A17) These inputs are 10-bit 0–5 V ADC's, τ = 1 ms. They are intended for variable resistance sensors such as thermistors.	

1–Input Signal Conditioning	(continued)
1.6 AN13M, AN14M (A25, A26) These inputs are 10-bit 0–5 V ADC's, τ = 1 ms. They are intended for variable resistance sensors.	
1.7 AN15M (A27) This input is a 10-bit 0–5 V ADC, τ = 1 ms. This input is intended for a variable conductivity sensor such as a water in fuel sensor.	
1.8 O_2 (λ) Sensor Interface O2ALO, O2AHI, O2BLO, O2BHI (A24, A13, A12, A2) These are for switch-type oxygen sensors.	
1.9 DG1M (B15) Digital switch input. VIL=2.0 Vmax. VIH=2.5 Vmin, τ = 1 ms.	
1.10 DG2M, DG4M (B16, B3) Digital switch input. VIL=2.0 Vmax. VIH=2.5 Vmin, τ = 5.1 µs.	
1.11 STOP (B23) This is the emergency stop input. Switching to ground will disable the fuel pump and spark coil outputs. **Note**: Loss of ECUP will also trigger the STOP function.	

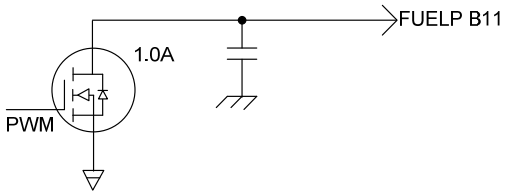
1–Input Signal Conditioning	(continued)
1.12 CNK+, CNK-, CNK_DG **(B13, B5, B14)** CNK+ and CNK- are variable reluctance sensor inputs. CNK_DG is a switch input for a Hall Effect sensor or switch to ground. Only one should be wired in at a time.	
1.13 CAM_DG **(B6)** CAM_DG is a switch input for a Hall Effect sensor or switch to ground.	
1.14 EK0P, EK0N, EK1P, EK1N **(A29, A19, A30, A20)** These inputs are for wide band piezoelectric knock sensors.	

2–Output Signal Conditioning	
2.1 XDRP, XDRP_B, XDRG **(A23, B24, A22)** These outputs are for powering sensor transducers. 5 V 500 mA max. They are monitored by the processor. (See Sec. 1.2.) XDRG is the sensor return.	
2.2 HSOL1, HSOL2 **(C1, C19)** These outputs are high current sink drivers, 6 A max. Short circuit protection, open circuit and short circuit detection.	
2.3 HSOL 3, HSOL4 **(C9, C10)** These outputs are high current sink drivers, 6 A max. They include freewheeling diodes to DRVP, Short circuit protection, open circuit and short circuit detection.	

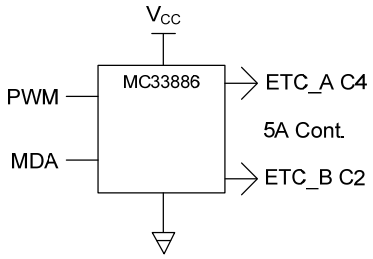
2–Output Signal Conditioning	(continued)
2.4 ESC_A, ESC_B **(C17, C18)** This is a 12 V H-bridge output. 5 A cont.	
2.5 MPRD **(B4)** This output energizes the Main Power Relay. Short circuit protection, open circuit and short circuit detection.	
2.6 START **(B8)** This output is a high current sink driver. 6 A max. It includes a freewheeling diode to DRVP, short circuit protection, open circuit and short circuit detection.	
2.7 OILP **(B7)** This output is a high current sink driver, 10 A max. It includes a freewheeling diode to DRVP, short circuit protection, open circuit and short circuit detection.	
2.8 TACH **(B12)** This output is capable of sinking 1.5 A max.	

2–Output Signal Conditioning (continued)

2.9 FUELP
(B11)
This output is capable of sinking 1.0 A max.
Note: The STOP signal (1.13) will disable the FUELP output when asserted.
Note: Loss of ECUP will also trigger the STOP function.

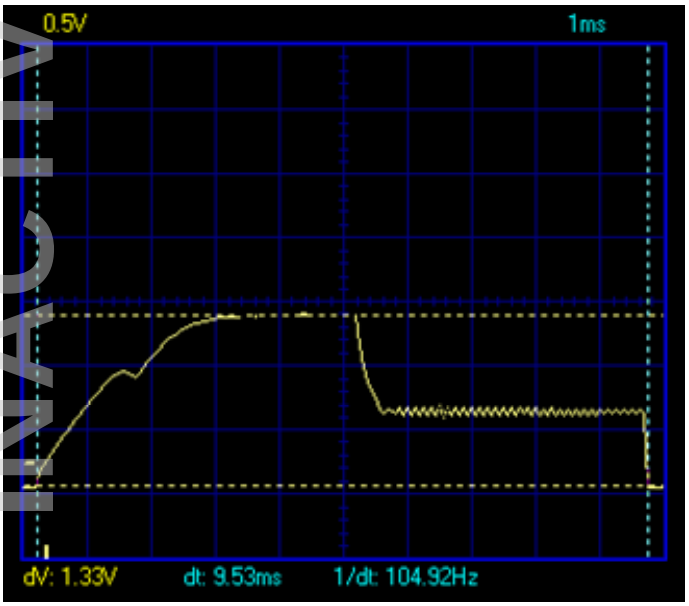


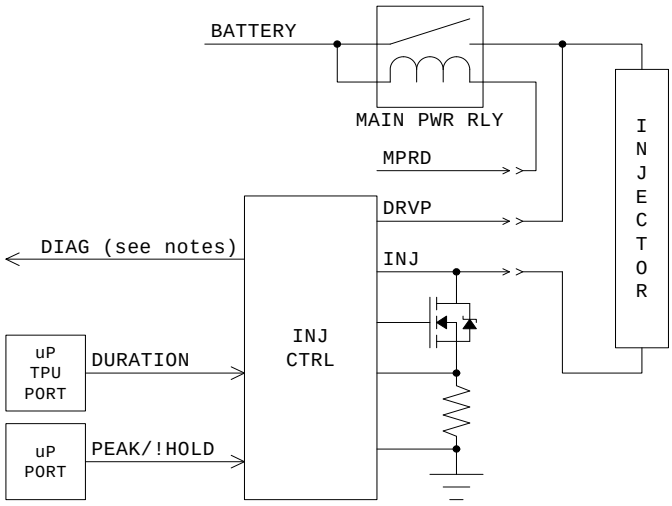
2.10 ETC_A, ETC_B
(C4, C2)
This is a 12 V H-bridge output.
5 A cont., 10 A pk.

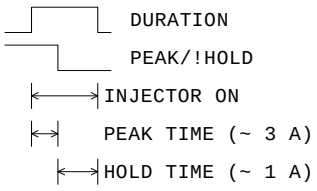


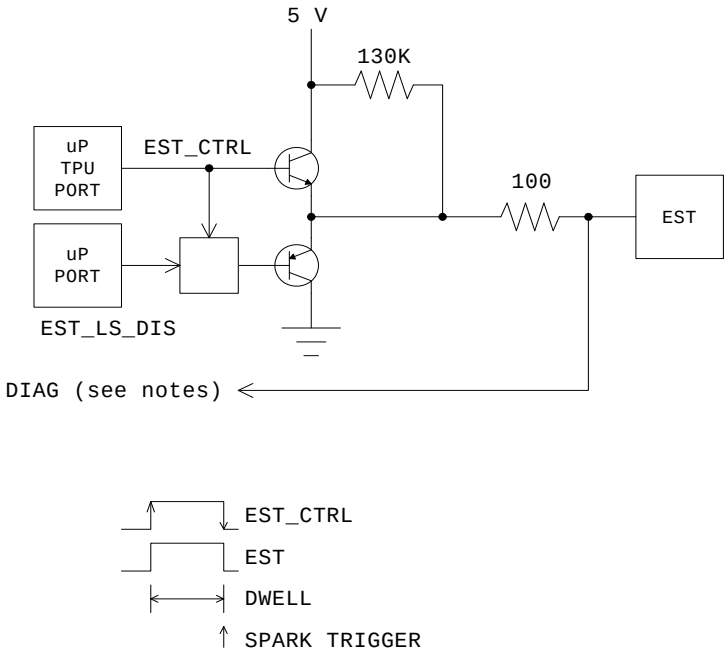
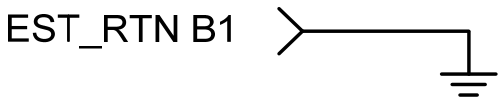
2–Output Signal Conditioning (continued)

2.11 FI1D...FI6D, AI1D...AI6D
(C6, C11, B22, B20, C23, C21, C5, C3, B21, B19, C22, C20)
These outputs are injector coil drivers capable of sinking 3 A pk. and 1 A cont.
Notes:
When the injector output is on (duration), 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. AI1D and AI2D may be used for FI7D and FI8D respectively. Injector trace shown below:
1 A=470 mV.

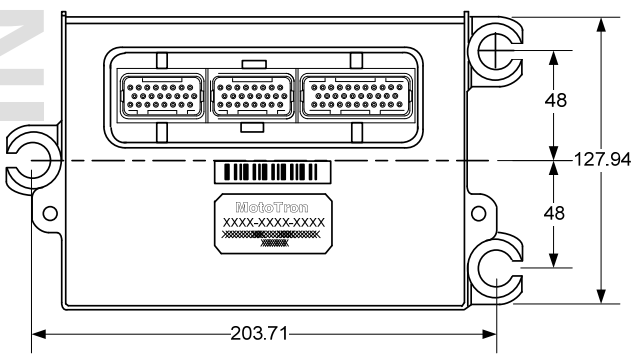
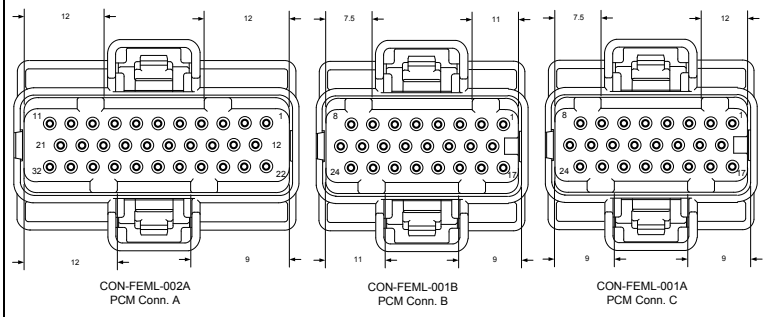






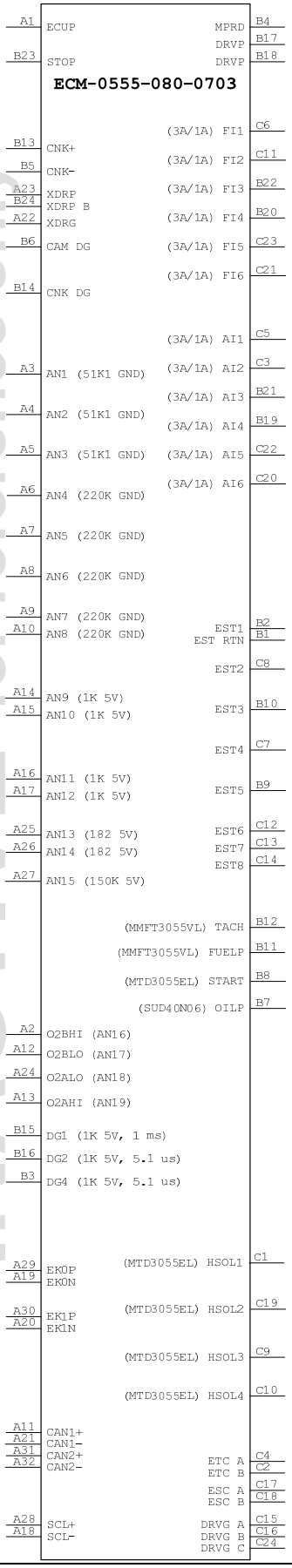
2–Output Signal Conditioning	(continued)
2.12 EST1...EST8 **(B2, C8, B10, C7, B9, C12, C13, C14)** These are TTL level outputs. **Note**: Since EST_RTN (2.13) is a direct path to the ECM ground care must be taken not to introduce ground loops. EST_RTN is not designed to carry any significant current; 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 (2.9). Electrical transients on EST_RTN can cause module upsets. The STOP signal (1.13) will disable these outputs when asserted. **Note**: Loss of ECUP (1.1) will also trigger the STOP function.	
2.13 EST_RTN **(B1)** Low current ground reference for SmartCoils.	

3–Communications	
3.1 CAN1+, CAN1- **(A11, A21)** CAN1 also useful for programming the unit.	CAN 2.0B, Standard or Extended ID, up to 1 Mbps.
3.2 CAN1+, CAN1- **(A11, A21)**	CAN 2.0B, Standard or Extended ID, up to 1 Mbps.
3.3 SCL+, SCL- **(A28, A18)** RS-485 is also used for programming the unit, but not when applications use this channel.	RS-485, programmable baud rate 1200 - 57600. 8 Bits, No parity, 1 Stop Bit.

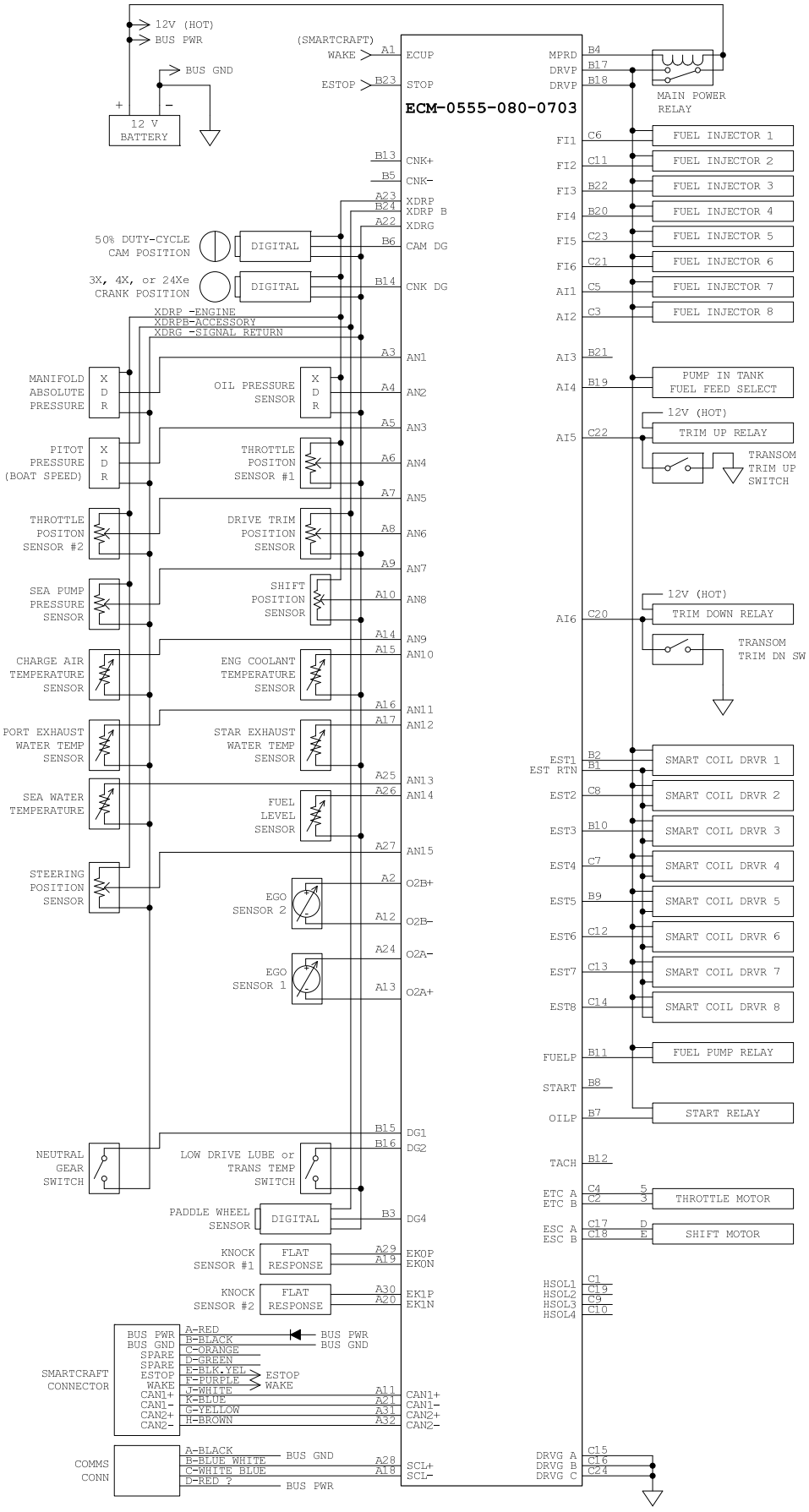
4–Connector Definitions	
	

4.1 Block Diagram

ECM-0555-080-0703-C/F



Typical Drive-by-Wire Application



5–Connector Pinouts			5.1 Resource by Connector Pin P/N: HARN-PCM-008-D0	
Pin # ECM	**ControlCore Resource Name**	**Function Name**	**Notes**	**Wire Number Color Code**
A1	ECUP	ECU Power	Power to Module	1 Purple/White
A2	O2B+	Oxygen Sensor Low Input	LM9040	2 White/Yellow
A3	AN1	Pressure Input	51K Pull Down	3 Yellow
A4	AN2	Pressure Input	51K Pull Down	4 Blue/Black
A5	AN3	Pressure Input	51K Pull Down	5 White/ Orange
A6	AN4	Potentiometer Input	220K Pull Down	6 Light Blue/White
A7	AN5	Potentiometer Input	220K Pull Down	7 White/Yellow
A8	AN6	Potentiometer Input	220K Pull Down	8 Brown/White
A9	AN7	Potentiometer Input	220K Pull Down	9 Yellow/Pink
A10	AN8	Potentiometer Input	220K Pull Down	10 Red/Pink
A11	CAN1+	Serial Communications	Terminating Resistance Required	11 White
A12	O2B-	Oxygen Sensor Low Input	LM9040	12 White/Red
A13	O2A+	Oxygen Sensor Low Input	LM9040	13 Tan/Orange
A14	AN9	Variable Resistance Input	1K Pull Up	14 Tan
A15	AN10	Variable Resistance Input	1K Pull Up	15 Tan/Green
A16	AN11	Variable Resistance Input	1K Pull Up	16 Green
A17	AN12	Variable Resistance Input	1K Pull Up	17 Brown
A18	SCL-	RS-485 LO		18 White/Dark Blue
A19	EK0N	Knock Sensor Negative	Motorola PROSAK Compatible	19 Black/Red
A20	EK1N	Knock Sensor Negative		20 Yellow/Orange
A21	CAN1-	Serial Communications	Terminating Resistance Required	21 Dark Blue
A22	XDRG	Transducer Ground	Return for Transducers	22 Black/ Orange
A23	XDRP	Transducer Power (5 V)	500 mA Source for Transducers	23 Purple/ Yellow
A24	O2A-	Oxygen Sensor Low Input	LM9040	24 Red/Purple
A25	AN13	Variable Resistance Input	100 Ω Pull Up via Diode	25 Light Blue/ Black
A26	AN14	Variable Resistance Input	100 Ω Pull Up via Diode	26 Pink/Black
A27	AN15	Variable Resistance Input	150 Ω Pull Up	27 Orange/Pink
A28	SCL+	RS-485 HI		28 Dark Blue/ White
A29	EK0P	Knock Sensor Positive	Motorola PROSAK Compatible	29 White/Light Blue
A30	EK1P	Knock Sensor Positive		30 White/Black
A31	CAN2+	Serial Communications	Terminating Resistance Required	31 Yellow
A32	CAN2-			32 Brown

5–Connector Pinouts			5.1 Resource by Connector Pin (continued)	
Pin # ECM	**ControlCore Resource Name**	**Function Name**	**Notes**	**Wire Number Color Code**
B1	EST_RTN	Electronic Spark Timing Return	Low Current Return from Spark Coils	33 Black/Green
B2	EST1	Electronic Spark Timing	SmartCoil Driver	34 Green/Black
B3	DG4	Discrete Switch, Frequency, IRQ	1K Pull Up	35 Gray/Dark Blue
B4	MPRD	Main Power Relay Driver	Wire to Main Power Relay Coil	36 Yellow/Purple
B5	CNK-	Crank Position LO	Variable Reluctance Sensor Compatible with LM1815	37 White
B6	CAM_DG	Hall Effect Cam Sensor	150K Pull Up	38 White/Purple
B7	OILP	Oil Pump	20 A	39 Light Blue/Black
B8	START	Starter Solenoid Relay	High Current (6 A)	40 Yellow/Black
B9	EST5	Electronic Spark Timing	SmartCoil Driver	41 Green/Purple
B10	EST3	Electronic Spark Timing	SmartCoil Driver	42 Green/Brown
B11	FUELP	FUEL Pump	PWM	43 Orange
B12	TACH	Tachometer Output	1.8K Pull Up	44 Gray
B13	CNK+	Crank Position HI	Variable Reluctance Sensor Compatible with LM1815	45 Red
B14	CNK_DG	Hall Effect Crank Sensor	150K Pull Up	46 White/Brown
B15	DG1	Discrete Switch, Frequency, IRQ	1K Pull Up	47 Black/Blue
B16	DG2	Discrete Switch, Frequency, IRQ	1K Pull Up	48 Orange/Black
B17, 18	DRVP	Driver Power (VBATT)	Power to Module and Loads	49 & 50 Red/Blue
B19	AI4D	Air Injector 4 Driver	3 A peak/1 A hold	51 Yellow/White
B20	FI4D	Fuel Injector 4 Driver		52 Pink/Light Blue
B21	AI3D	Air Injector 3 Driver		53 Orange/White
B22	FI3D	Fuel Injector 3 Driver		54 Pink/Dark Blue
B23	STOP	Discrete Switch	1K Pull Up to ECUP, 15K Pull Down, Wire to Ground via E-STOP Switch	55 Black/Yellow
B24	XDRP_B	Transducer Power B (5 V)	500 mA Source for Transducers	56 Purple/Pink

5–Connector Pinouts			5.1 Resource by Connector Pin (continued)	
Pin # ECM	**ControlCore Resource Name**	**Function Name**	**Notes**	**Wire Number Color Code**
C1	HSOL1	PWM Output	6 A	57 Yellow/Orange
C2	ETC_B	H-Bridge	5 A	58 Brown/White
C3	AI2D/FI8D	Air Injector 2 Driver/ Fuel Injector 8 Driver	3 A peak/1 A hold	59 Red/White
C4	ETC_A	H-Bridge	5 A	60 Brown/Yellow
C5	AI1D/FI7D	Air Injector 1 Driver/ Fuel Injector 7 Driver	3 A peak/1 A hold	61 Brown/White
C6	FI1D	Fuel Injector 1 Driver		62 Pink/Black
C7	EST4	Electronic Spark Timing	SmartCoil Driver	63 Green/Orange
C8	EST2	Electronic Spark Timing	SmartCoil Driver	64 Green/Blue
C9	HSOL3	PWM Output	6 A	65 Yellow/Red
C10	HSOL4	PWM Output		66 Yellow/White
C11	FI2D	Fuel Injector 2 Driver	3 A peak/1 A hold	67 Pink/Brown
C12	EST6	Electronic Spark Timing	SmartCoil Driver	68 Green/Red
C13	EST7	Electronic Spark Timing	SmartCoil Driver	69 Green/White
C14	EST8	Electronic Spark Timing	SmartCoil Driver	70 Green/Yellow
C15, 16, 24	DRVG	Driver Ground	Connect to Battery Ground	71, 72 & 80 Black
C17	ESC_A	H-Bridge	6 A	73 Gray/White
C18	ESC_B	H-Bridge		74 Gray/Red
C19	HSOL2	PWM Output	6 A	75 Yellow/Pink
C20	AI6D	Air Injector 6 Driver	3 A peak/1 A hold	76 Green/White
C21	FI6D	Fuel Injector 6 Driver		77 Pink/Purple
C22	AI5D	Air Injector 5 Driver		78 Light Blue/ White
C23	FI5D	Fuel Injector 5 Driver		79 Pink/Orange

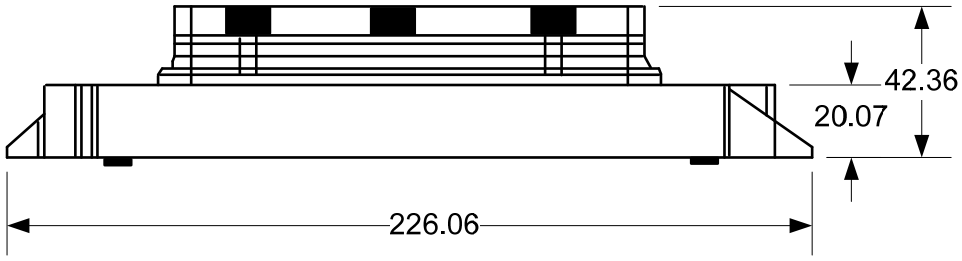
5–Connector Pinouts			5.2 Additional Development Harness Wires	
From	**Pin**	**To**	**Pin**	**Wire# & Color**
+12 VOLTS		SPL04	B	81 RED
SPL04	A	C06	A	82 RED
SPL04	A	C04	A	83 RED
C04	B	SLP03	A	84 RED
SPL03	A	C05	30	85 RED
SPL03	A	C05	85	86 RED
C05	87	SPL02	B	87 YEL-PPL
SPL01	B	C06	B	88 BLK
SPL02	B	OUTPUT BRANCH	--	"49/50" PPL-WHT
SPL01	B	12 VOLT GROUND	--	"71/72/80" BLK

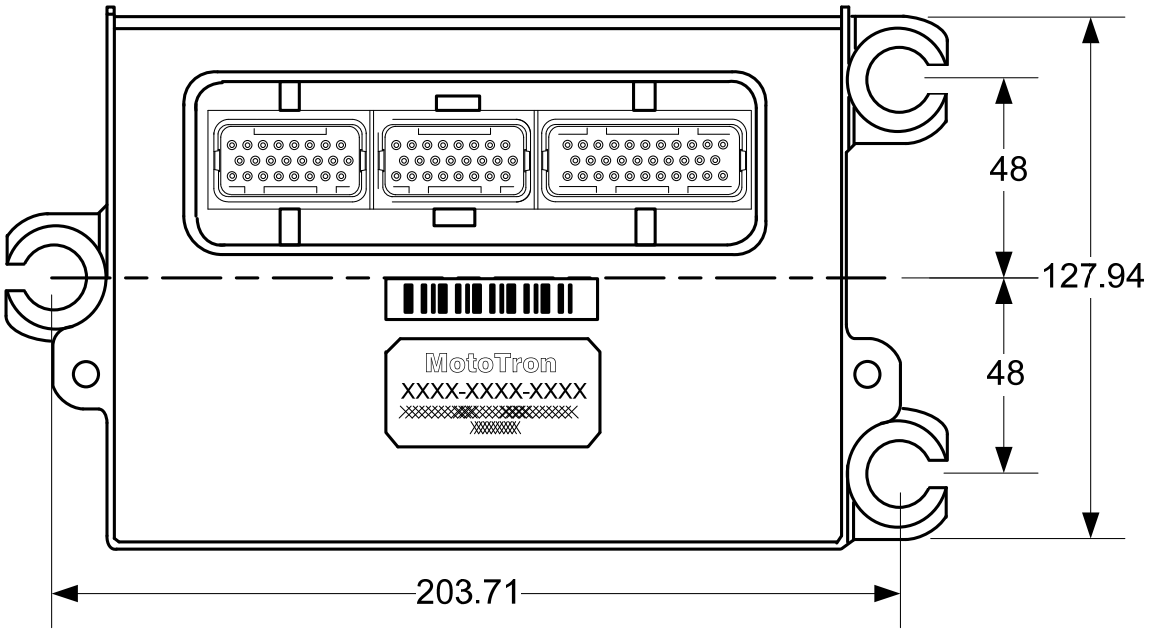
5–Connector Pinouts			5.3 Resource by Name	
ControlCore Resource Name	**Pin # ECM**	**Function Name**	**Notes**	**Wire Number Color Code**
AI1D/FI7D	C5	Air Injector 1 Driver/ Fuel Injector 7 Driver	3 A peak/1 A hold	61 Brown/White
AI2D/FI8D	C3	Air Injector 2 Driver/ Fuel Injector 8 Driver		59 Red/White
AI3D	B21	Air Injector 3 Driver		53 Orange/White
AI4D	B19	Air Injector 4 Driver		51 Yellow/White
AI5D	C22	Air Injector 5 Driver		78 Light Blue/ White
AI6D	C20	Air Injector 6 Driver		76 Green/White
AN1	A3	Pressure Input	51K Pull Down	3 Yellow
AN2	A4	Pressure Input	51K Pull Down	4 Blue/Black
AN3	A5	Pressure Input	51K Pull Down	5 White/ Orange
AN4	A6	Potentiometer Input	220K Pull Down	6 Light Blue/ White
AN5	A7	Potentiometer Input	220K Pull Down	7 White/Yellow
AN6	A8	Potentiometer Input	220K Pull Down	8 Brown/White
AN7	A9	Potentiometer Input	220K Pull Down	9 Yellow/Pink
AN8	A10	Potentiometer Input	220K Pull Down	10 Red/Pink
AN9	A14	Variable Resistance Input	1K Pull Up	14 Tan
AN10	A15	Variable Resistance Input	1K Pull Up	15 Tan/Green
AN11	A16	Variable Resistance Input	1K Pull Up	16 Green
AN12	A17	Variable Resistance Input	1K Pull Up	17 Brown
AN13	A25	Variable Resistance Input	180 Ω Pull Up	25 Light Blue/ Black
AN14	A26	Variable Resistance Input	180 Ω Pull Up	26 Pink/Black
AN15	A27	Variable Resistance Input	150 Ω Pull Up	27 Orange/Pink
CAM_DG	B6	Hall Effect Cam Sensor	150K Pull Up	38 White/Purple
CAN1-	A21	Serial Communications	Terminating Resistance Required	21 Dark Blue
CAN1+	A11			11 White
CAN2-	A32	Serial Communications	Terminating Resistance Required	32 Brown
CAN2+	A31			31 Yellow
CNK-	B5	Crank Position LO	Variable Reluctance Sensor Compatible with LM1815	37 White
CNK_DG	B14	Hall Effect Crank Sensor	150K Pull Up	46 White/Brown
CNK+	B13	Crank Position HI	Variable Reluctance Sensor Compatible with LM1815	45 Red
DG1	B15	Discrete Switch, Frequency	1K Pull Up	47 Black/Blue
DG2	B16	Discrete Switch, Frequency	1K Pull Up	48 Orange/Black
DG4	B3	Discrete Switch, Frequency	1K Pull Up	35 Gray/ Dark Blue
DRVG	C15, 16, 24	Driver Ground	Connect to Battery Ground	71, 72 & 80 Black
DRVP	B17, 18	Driver Power (VBATT)	Power to Module and Loads	49 & 50 Red/Blue
ECUP	A1	ECU Power	Power to Module	1 Purple/White
EK0N	A19	Knock Sensor Negative	Motorola PROSAK Compatible	19 Black/Red
EK0P	A29	Knock Sensor Positive	Motorola PROSAK Compatible	29 White/ Light Blue

5–Connector Pinouts			5.3 Resource by Name (continued)	
EK1N	A20	Knock Sensor Negative		20 Yellow/Orange
EK1P	A30	Knock Sensor Positive		30 White/Black
ESC_A	C17	H-Bridge	High Current (10 A pk., 5 A cont.)	73 Gray/White
ESC_B	C18			74 Gray/Red
EST_RTN	B1	Electronic Spark Timing Return	Low Current Return from Spark Coils	33 Black/Green
EST1	B2	Electronic Spark Timing	SmartCoil Driver	34 Green/Black
EST2	C8	Electronic Spark Timing	SmartCoil Driver	64 Green/Blue
EST3	B10	Electronic Spark Timing	SmartCoil Driver	42 Green/Brown
EST4	C7	Electronic Spark Timing	SmartCoil Driver	63 Green/Orange
EST5	B9	Electronic Spark Timing	SmartCoil Driver	41 Green/Purple
EST6	C12	Electronic Spark Timing	SmartCoil Driver	68 Green/Red
EST7	C13	Electronic Spark Timing	SmartCoil Driver	69 Green/White
EST8	C14	Electronic Spark Timing	SmartCoil Driver	70 Green/Yellow
ETC_A	C4	H-Bridge	High Current (5 A)	60 Brown/Yellow
ETC_B	C2			58 Brown/White
FI1D	C6	Fuel Injector 1 Driver	3 A peak/1 A hold	62 Pink/Black
FI2D	C11	Fuel Injector 2 Driver		67 Pink/Brown
FI3D	B22	Fuel Injector 3 Driver		54 Pink/Dark Blue
FI4D	B20	Fuel Injector 4 Driver		52 Pink/Light Blue
FI5D	C23	Fuel Injector 5 Driver		79 Pink/Orange
FI6D	C21	Fuel Injector 6 Driver		77 Pink/Purple
FUELP	B11	FUEl Pump	1.5 A	43 Orange
HSOL1	C1	PWM Output	3 A peak/1 A hold	57 Yellow/Orange
HSOL2	C19	PWM Output		75 Yellow/Pink
HSOL3	C9	PWM Output	5 A	65 Yellow/Red
HSOL4	C10	PWM Output		66 Yellow/White
MPRD	B4	Main Power Relay Driver	Wire to Main Power Relay Coil	36 Yellow/Purple
O2A+	A13	Oxygen Sensor Low Input	LM9040	13 Tan/Orange
O2A-	A24	Oxygen Sensor Low Input	LM9040	24 Red/Purple
O2B+	A2	Oxygen Sensor Low Input	LM9040	2 White/Yellow
O2B-	A12	Oxygen Sensor Low Input	LM9040	12 White/Red
OILP	B7	Oil Pump	High Current (10 A)	39 Light Blue/Black
SCL-	A18	RS-485 LO		18 White/ DarkBlue
SCL+	A28	RS-485 HI		28 Dark Blue/White
START	B8	Starter Solenoid Relay	High Current (5 A)	40 Yellow/ Black
STOP	B23	Discrete Switch	1K Pull Up to ECUP, 15K Pull Down, Wire to Ground via E-STOP Switch	55 Black/ Yellow
TACH	B12	Tachometer Output	1.8K Pull Up, 1.5 A	44 Gray
XDRG	A22	Transducer Ground	Ground Return for Transducers	22 Black/ Orange
XDRP	A23	Transducer Power (5V)	500 mA Source for Transducers	23 Purple/ Yellow
XDRP_B	B24	Transducer Power B (5V)	500 mA Source for Transducers	56 Purple/Pink

6–Physical Dimensions

(All dimensions are in millimeters.)





7–Environmental	
7.1 General	The ECM is designed to meet automotive industry standard under-hood environmental requirements for 12-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.
7.2 Vibration Engine mountable and tested to high-performance levels, the ECM has been successfully deployed on engines having the vibration profiles shown at right: Electrical and mechanical isolation is via a bushing, grommet, and washer, as shown below:	
7.3 Transient Power Spike Resistance:	±200 Vdc

WOODWARD

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