

MotoTron Control Solutions



**ECM-0555-080-0702-C / -F
Engine Control Modules
(Part Nos. 1751-6397 /
1751-6398)**

Description

Presenting the ECM-0555-080-0702-C / -F engine control modules from Woodward's new MotoTron 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-0555-080-0702-F is 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-0555-080-0702-C / -F modules are part of the ControlCore™ family of embedded control systems. MotoTron 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 MotoTron Control Solutions sales for more information.

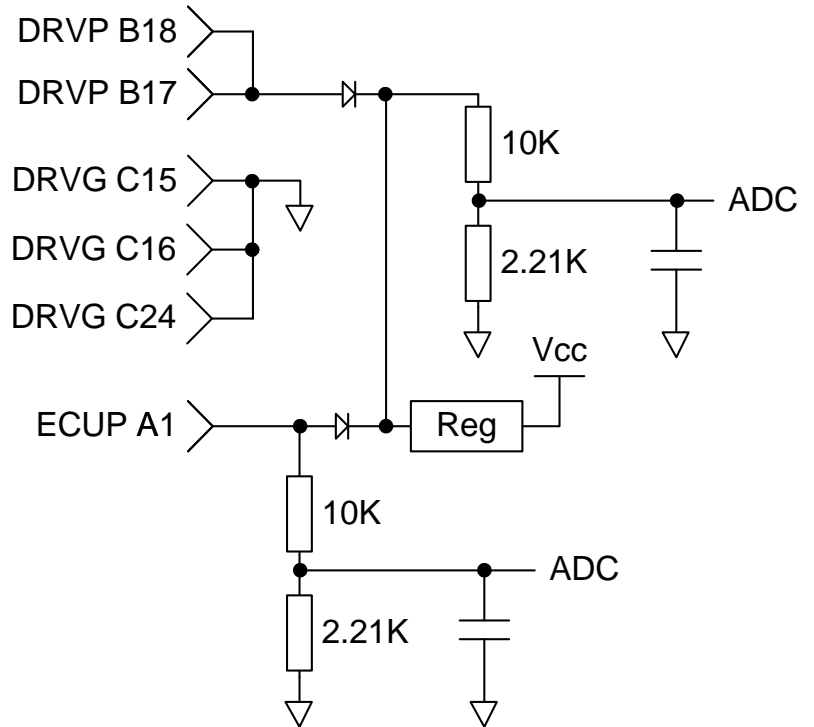
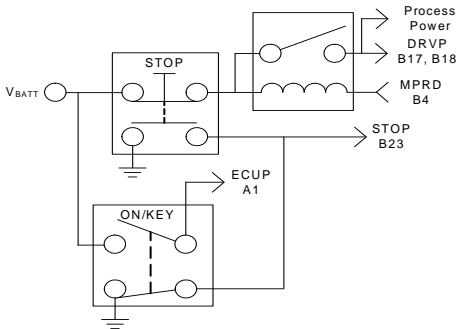
- **Microprocessor:** Freescale MPC555, 40MHz
- **Memory:** 448K Flash, 26K RAM, 8K EEPROM
128Kx8 Parallel EEPROM (ECM-0555-080-0702-C)
- **Operating Voltage:** 9-16VDC
- **Operating Temperature:** -40° to 105° C
- Sealed connectors operable to 10 ft. submerged.
- **Inputs:**
 - 19 Analog
 - 3 Low Frequency Digital
 - 1 VR Frequency Input
 - Up to 2 Hall Effect Frequency
 - 1 Dual Sensor Wide Band Knock Detection
 - 1 Emergency Stop
- **Outputs:**
 - 12 3A Peak/1A Hold Injector Drivers
 - 8 TTL Level Ignition System
 - 6 6A Low Side PWM
 - 1 5A Discrete H-Bridge
 - 1 5A PWM H-Bridge
 - 1 Relay Driver (Main Power)
 - 2 1.5 A Low Side PWM
- **Datalinks:**
 - 2 CAN 2.0B Channels
 - 1 RS485 Channel

1 INPUT SIGNAL CONDITIONING

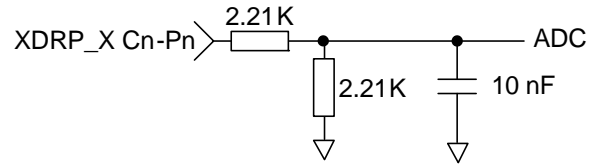
See Freescale MPC555 datasheet for description of processor resources.

1.1 ECUP (A1), DRVP (B17, B18), DRVG (C15, C16, C24)

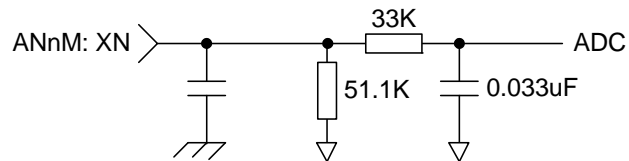
Power (Key) switch input ECUP supplies module power to initiate the process under control. The DRVP inputs are wired to the Main Power Relay which will supply the process while the MPRD signal is asserted and will hold the module power on after the ECUP signal is removed until the MPRD signal is released 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)**

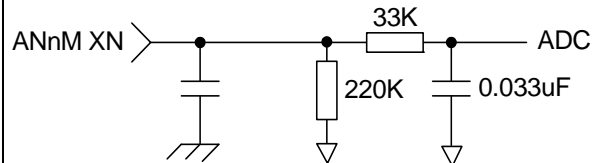
The XDRP monitors are scaled for 10V 5V = 512 counts.
(See Sec. 2.1)

**1.3 AN1M...AN3M, (A3, A4, A5).**

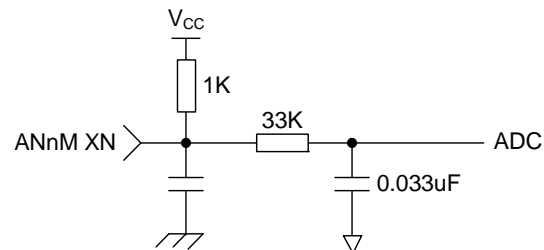
These inputs are 10-bit 0-5V ADC's, $\tau = 1\text{ms}$. They are intended for pressure sensors.

**1.4 AN4M...AN8M (A6, A7, A8, A9, A10)**

These inputs are 10-bit 0-5V ADC's, $\tau = 1\text{ms}$. They are intended for potentiometers.

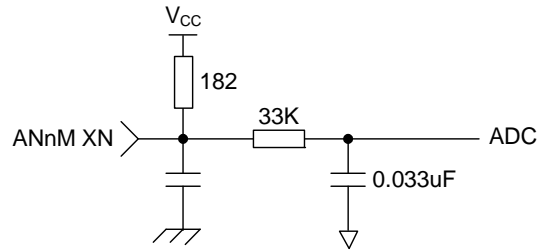
**1.5 AN9M...AN12M (A14, A15, A16, A17)**

These inputs are 10-bit 0-5V ADC's, $\tau = 1\text{ms}$. They are intended for variable resistance sensors such as thermistors.

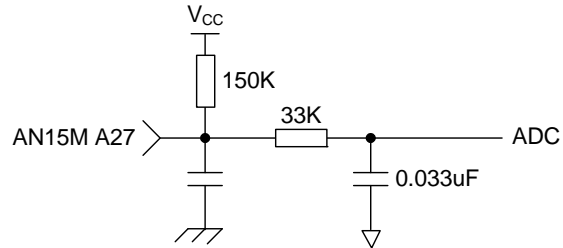


1.6 AN13M, AN14M**(A25, A26)**

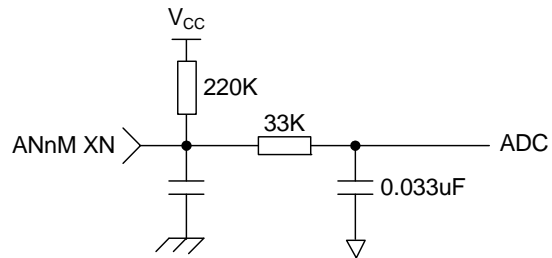
These inputs are 10-bit 0-5V ADC's, $\tau = 1\text{ms}$. They are intended for variable resistance sensors.

**1.7 AN15M****(A27)**

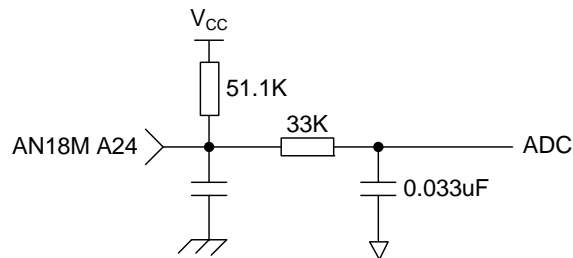
This input is a 10-bit 0-5V ADC, $\tau = 1\text{ms}$. This input is intended for a variable conductivity sensor such as a water in fuel sensor

**1.8 AN16M, AN17M****(A2, A12)**

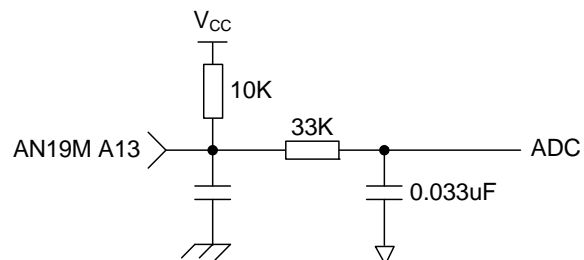
These inputs are 10-bit 0-5V ADC's, $\tau = 1\text{ms}$. They are intended for potentiometers.

**1.9 AN18M****(A24)**

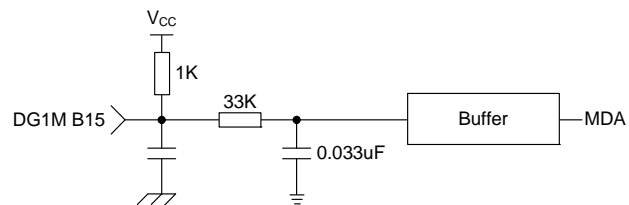
This input is a 10-bit 0-5V ADC's, $\tau = 1\text{ms}$. It is intended for a pressure sensor.

**1.10 AN19M****(A13)**

This input is a 10-bit 0-5V ADC's, $\tau = 1\text{ms}$. It is intended for a variable resistance sensor.

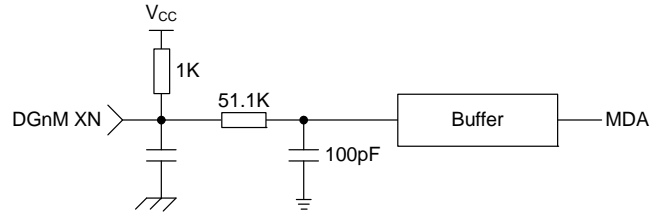
**1.11 DG1M****(B15)**

Digital switch input. $V_{IL}=2.0\text{Vmax}$. $V_{IH}=2.5\text{Vmin}$, $\tau = 1\text{ms}$.



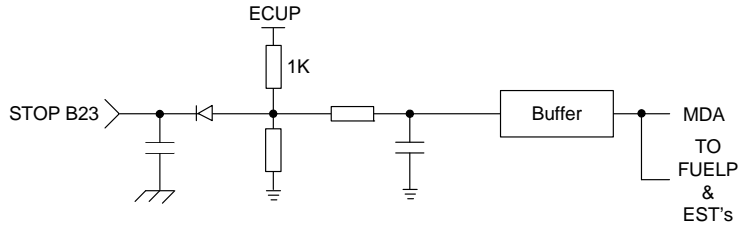
1.12 DG2M, DG4M**(B16, B3)**

Digital switch input. $V_{IL}=2.0V_{max}$.
 $V_{IH}=2.5V_{min}$,
 $\tau = 5.1\mu s$.

**1.13 STOP****(B23)**

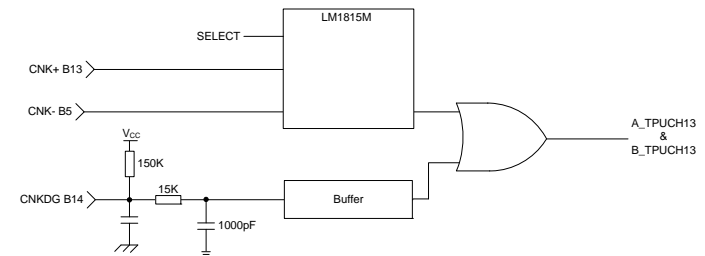
This is the emergency stop input.
 Switching to ground will disable the fuel pump
 and spark coil outputs.

Note:
 Loss of ECUP will also trigger the STOP func-
 tion.

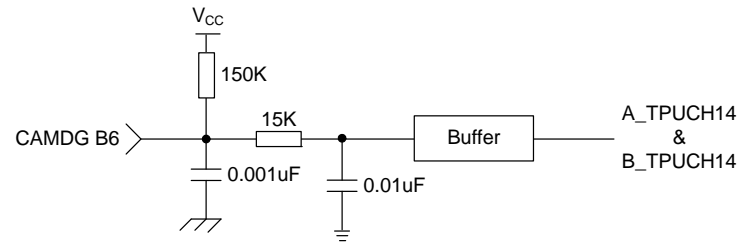
**1.14 CNK+, CNK-, CNK_DG****(B13, B5, B14)**

CNK+ and CNK- are variable reluctance sensor
 inputs.

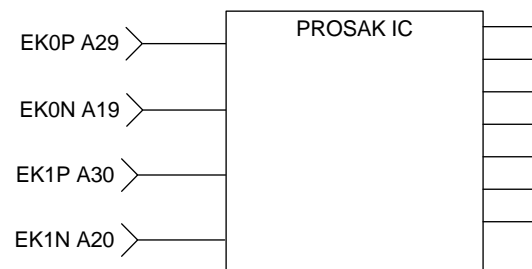
CNK_DG is a switch input for a Hall Effect sen-
 sor or switch to ground.
 Only one should be wired in at a time.

**1.15 CAM_DG****(B6)**

CAM_DG is a switch input for a Hall Effect sen-
 sor or switch to ground.

**1.16 EK0P, EK0N, EK1P, EK1N****(A29, A19, A30, A20)**

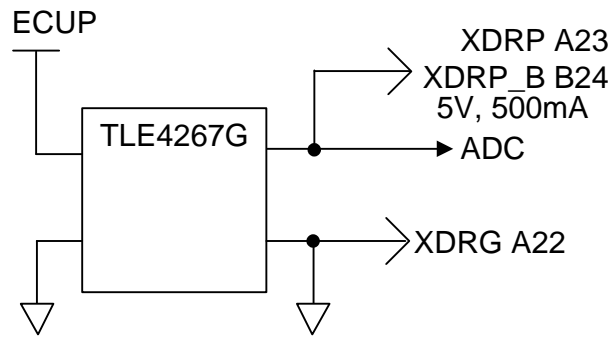
These inputs are for wide band piezoelectric
 knock sensors.



2 Output Signal Conditioning

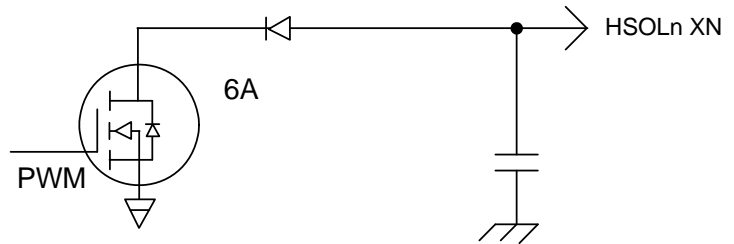
2.1 XDRP, XDRP_B, XDRG (A23, B24, A22)

These outputs are for powering sensor transducers. 5V 500mA max.
They are monitored by the processor.
(See Sec. 1.2)
XDRG is the sensor return.



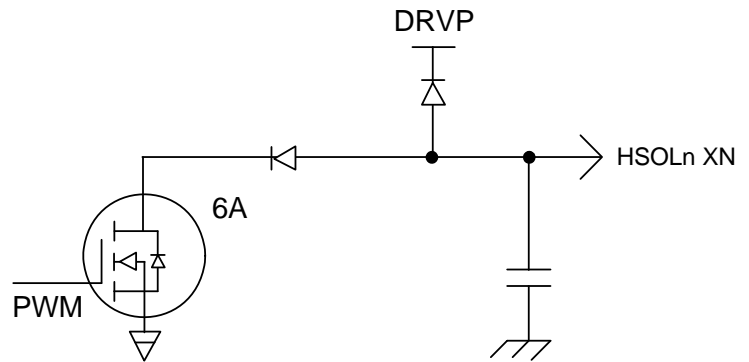
2.2 HSOL1, HSOL2 (C1, C19)

These outputs are high current sink drivers, 6A max.
Short circuit protection, open circuit and short circuit detection.



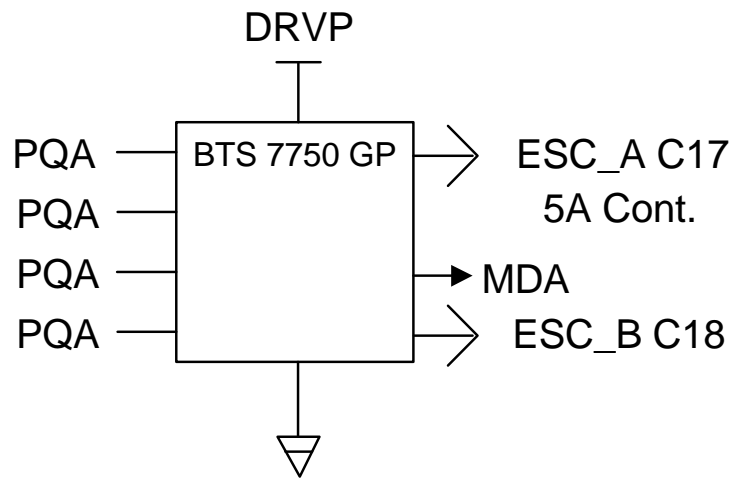
2.3 HSOL 3, HSOL4 (C9, C10)

These outputs are high current sink drivers, 6A max.
They include freewheeling diodes to DRVP,
Short circuit protection, open circuit and short circuit detection.



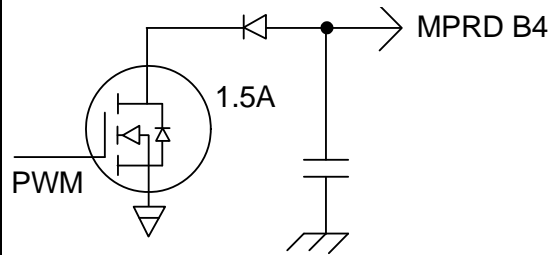
2.4 ESC_A, ESC_B (C17, C18)

This is a 12 volt H-bridge output.
5A cont.

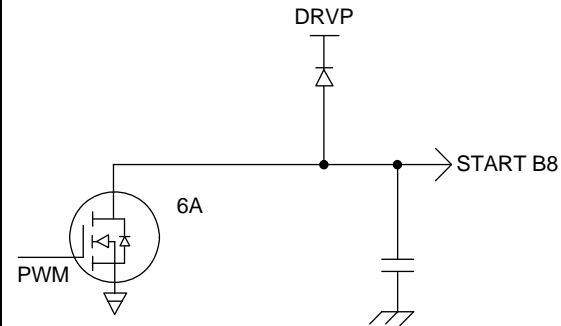


2.5 MPRD**(B4)**

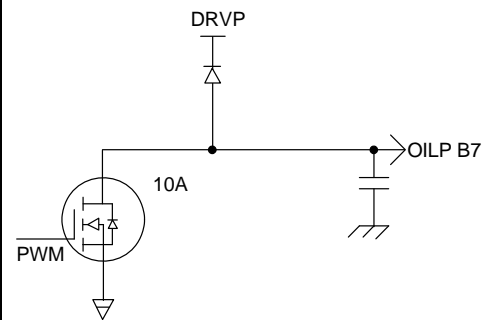
This output energizes the Main Power Relay. Short circuit protection, open circuit and short circuit detection.

**2.6 START****(B8)**

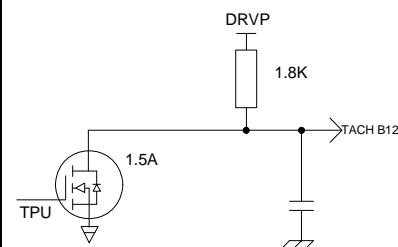
This output is a high current sink driver. 6A max. It includes a freewheeling diode to DRVP, short circuit protection, open circuit and short circuit detection.

**2.7 OILP****(B7)**

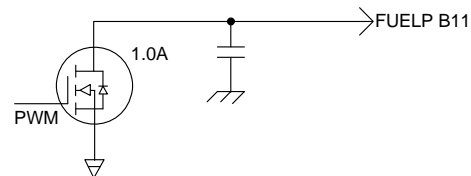
This output is a high current sink driver, 10A max. It includes a freewheeling diode to DRVP, short circuit protection, open circuit and short circuit detection.

**2.8 TACH,****(B12)**

This output is capable of sinking 1.5A max.

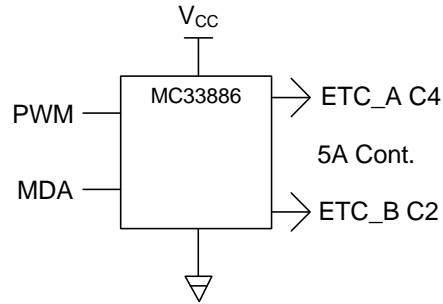
**2.9 FUELP****(B11)**

This output is capable of sinking 1.0A 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)**

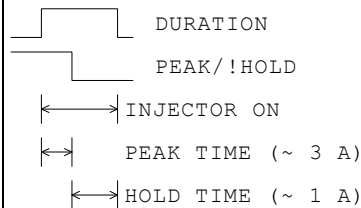
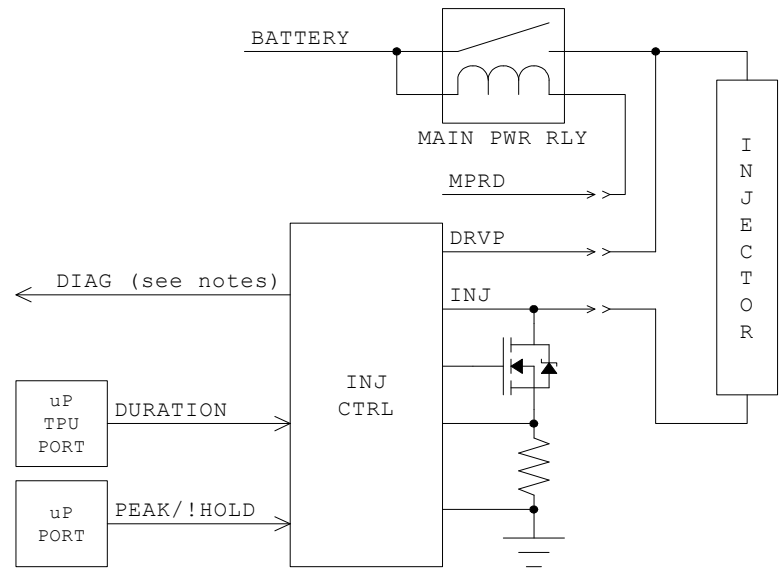
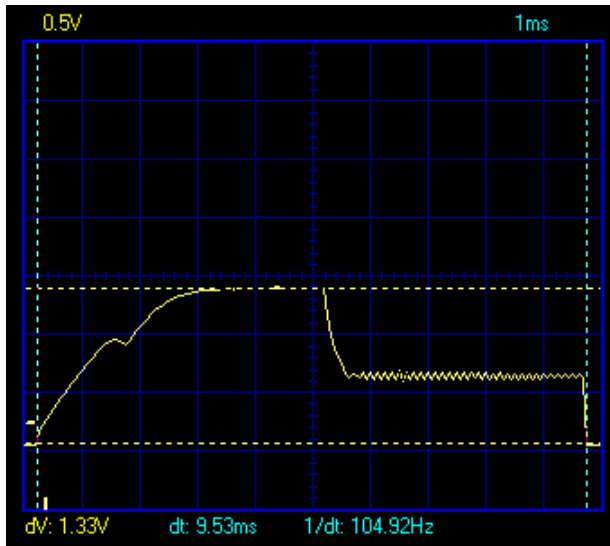
This is a 12 volt H-bridge output.
5A cont., 10A pk..

**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 3A pk. and 1A 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: 1A=470mV.



2.12 EST1...EST8**(B2, C8, B10, C7, B9, C12, C13, C14)**

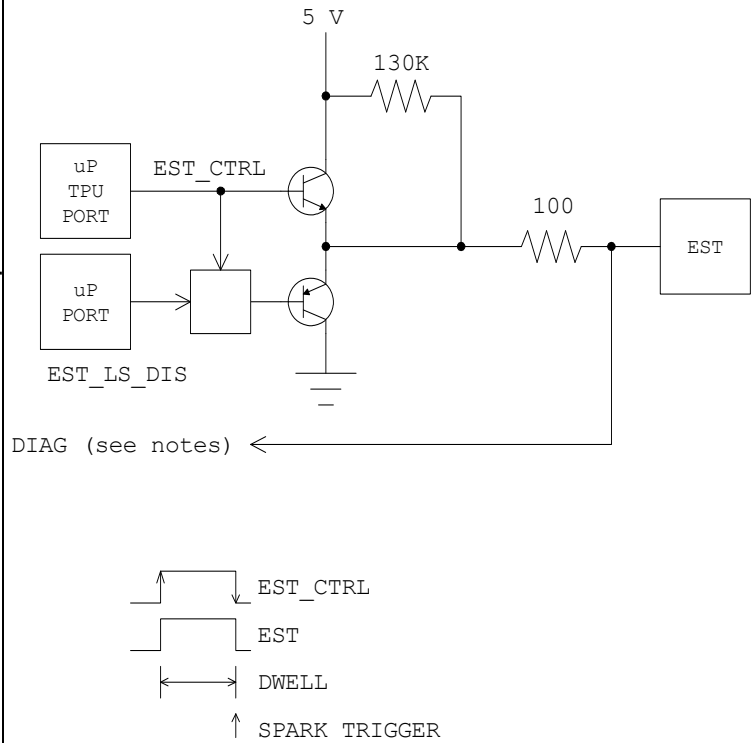
These are TTL level outputs.

Note:

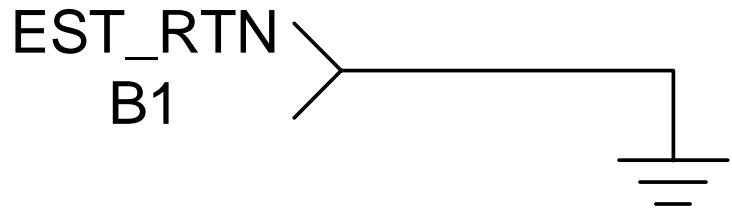
Since EST_RTN (2.13) is a direct path to the ECM ground care must be taken not to introduce ground loops. EST_RTN is not designed to carry any significant current; it is a reference only. It should be open circuit unless the smart coil electronics provides an isolated logic ground reference. Care must also be taken not to introduce noise on EST_RTN (2.13). 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)**

Note:

CAN1 may also be used for programming the unit.

CAN 2.0B, Standard or Extended ID, up to 1Mbps.

3.2 CAN2+, CAN2-**(A31, A32)**

CAN 2.0B, Standard or Extended ID, up to 1Mbps.

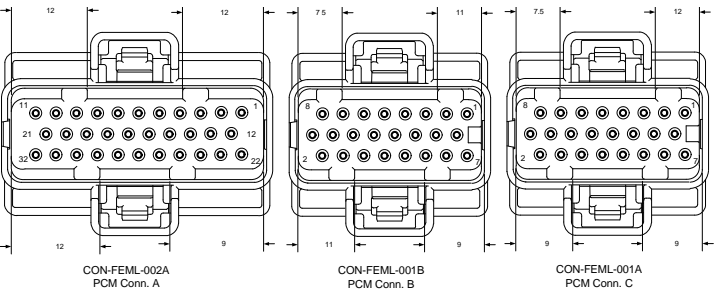
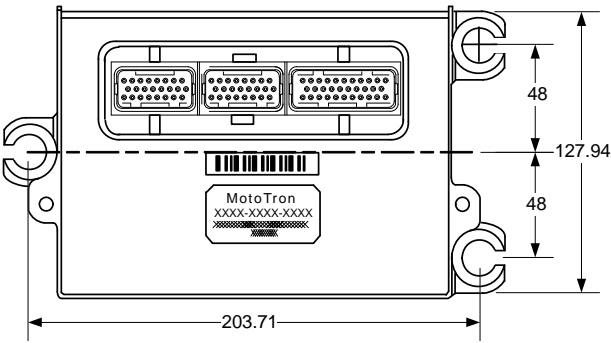
3.3 SCL+, SCL-**(A28, A18)**

Note:

RS485 is also used for programming the unit. The function is disabled when applications use this channel.

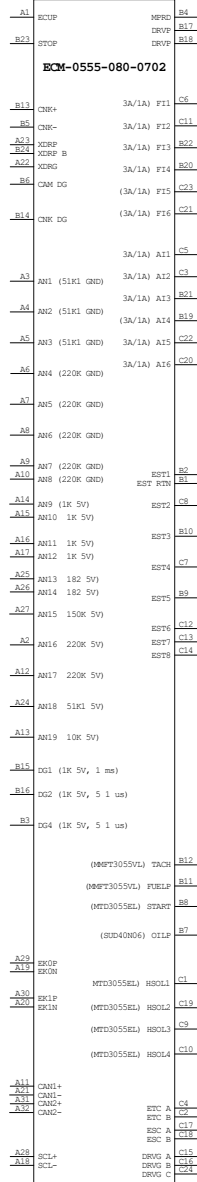
RS485, programmable baud rate 1200 - 57600.
8 Bits, No parity, 1 Stop Bit

4 CONNECTOR DEFINITIONS

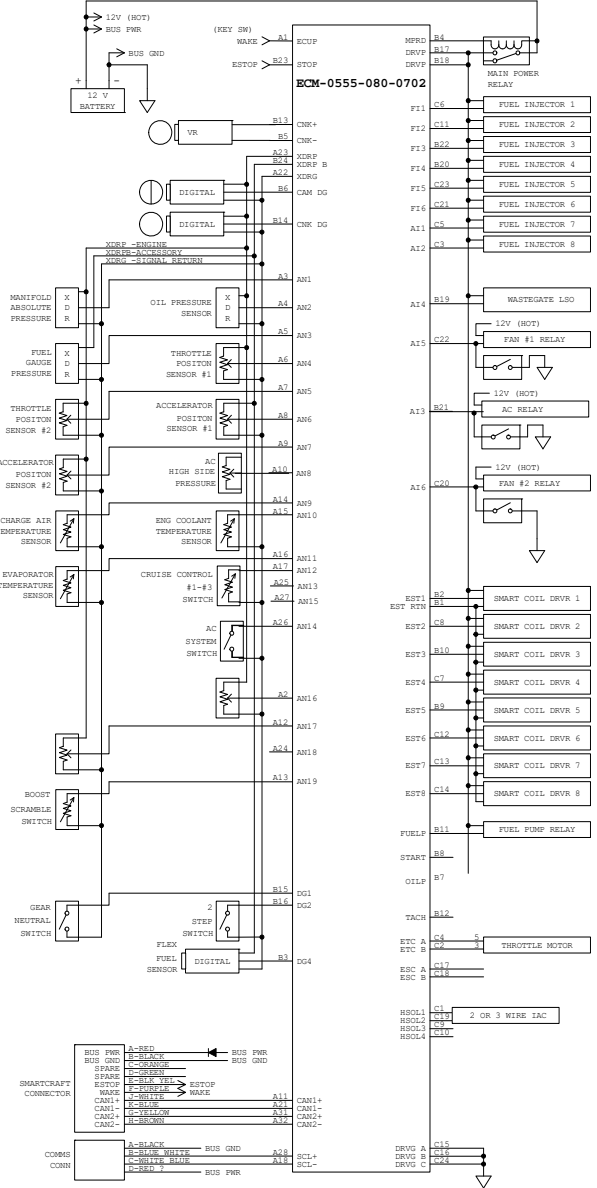


4.1 BLOCK DIAGRAMS

ECM-0555-080-0702-C/F



Typical Drive By Wire Application



| 5 CONNECTOR PINOUTS | | | P/N: HARN-PCM-008-D0 | |
|-------------------------------|---------------|---|---------------------------------|----------------------|
| 5.1 RESOURCE BY CONNECTOR PIN | | | | |
| Pin # | ControlCore | Function | Notes | Wire Number |
| ECM | Resource Name | Name | | Color Code |
| A1 | ECUP | ECM Power | Power to Module | 1 Purple/White |
| A2 | AN16 | Potentiometer Input | 220K Pull Up | 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 | AN17 | Potentiometer Input | 220K Pull Up | 12 White/Red |
| A13 | AN19 | Variable Resistance Input (e. g.: thermistor) | 10K Pull Up | 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- | RS485 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 (5V) | 500mA Source for Transducers | 23 Purple/ Yellow |
| A24 | AN18 | Pressure Input | 51K Pull Up | 24 Red/Purple |
| A25 | AN13 | Variable Resistance Input | 180 Ohm Pull Up | 25 Light Blue/ Black |
| A26 | AN14 | Variable Resistance Input | 180 Ohm Pull Up | 26 Pink/Black |
| A27 | AN15 | Variable Resistance Input | 150 Ohm Pull Up | 27 Orange/Pink |
| A28 | SCL+ | RS485 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 |

| Pin # | ControlCore | Function | Notes | Wire Number |
|---------|---------------|---------------------------------|---|---------------------|
| ECM | Resource Name | Name | | 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 | 20A | 39 Light Blue/Black |
| B8 | START | Starter Solenoid Relay | High Current (6A) | 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 | FUEI 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 | 3A peak/1A 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 (5V) | 500mA Source for Transducers | 56 Purple/Pink |

| Pin # | ControlCore | Function | Notes | Wire Number |
|-------------|---------------|---|---------------------------|----------------------|
| ECM | Resource Name | Name | | Color Code |
| C1 | HSOL1 | PWM Output | 6A | 57 Yellow/Orange |
| C2 | ETC_B | H-Bridge | 5A | 58 Brown/White |
| C3 | AI2D/FI8D | Air Injector 2 Driver/ Fuel Injector 8 Driver | 3A peak/1A hold | 59 Red/White |
| C4 | ETC_A | H-Bridge | 5A | 60 Brown/Yellow |
| C5 | AI1D/FI7D | Air Injector 1 Driver/ Fuel Injector 7 Driver | 3A peak/1A 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 | 6A | 65 Yellow/Red |
| C10 | HSOL4 | PWM Output | | 66 Yellow/White |
| C11 | FI2D | Fuel Injector 2 Driver | 3A peak/1A 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 | 6A | 73 Gray/White |
| C18 | ESC_B | H-Bridge | | 74 Gray/Red |
| C19 | HSOL2 | PWM Output | 6A | 75 Yellow/Pink |
| C20 | AI6D | Air Injector 6 Driver | 3A peak/1A 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 |

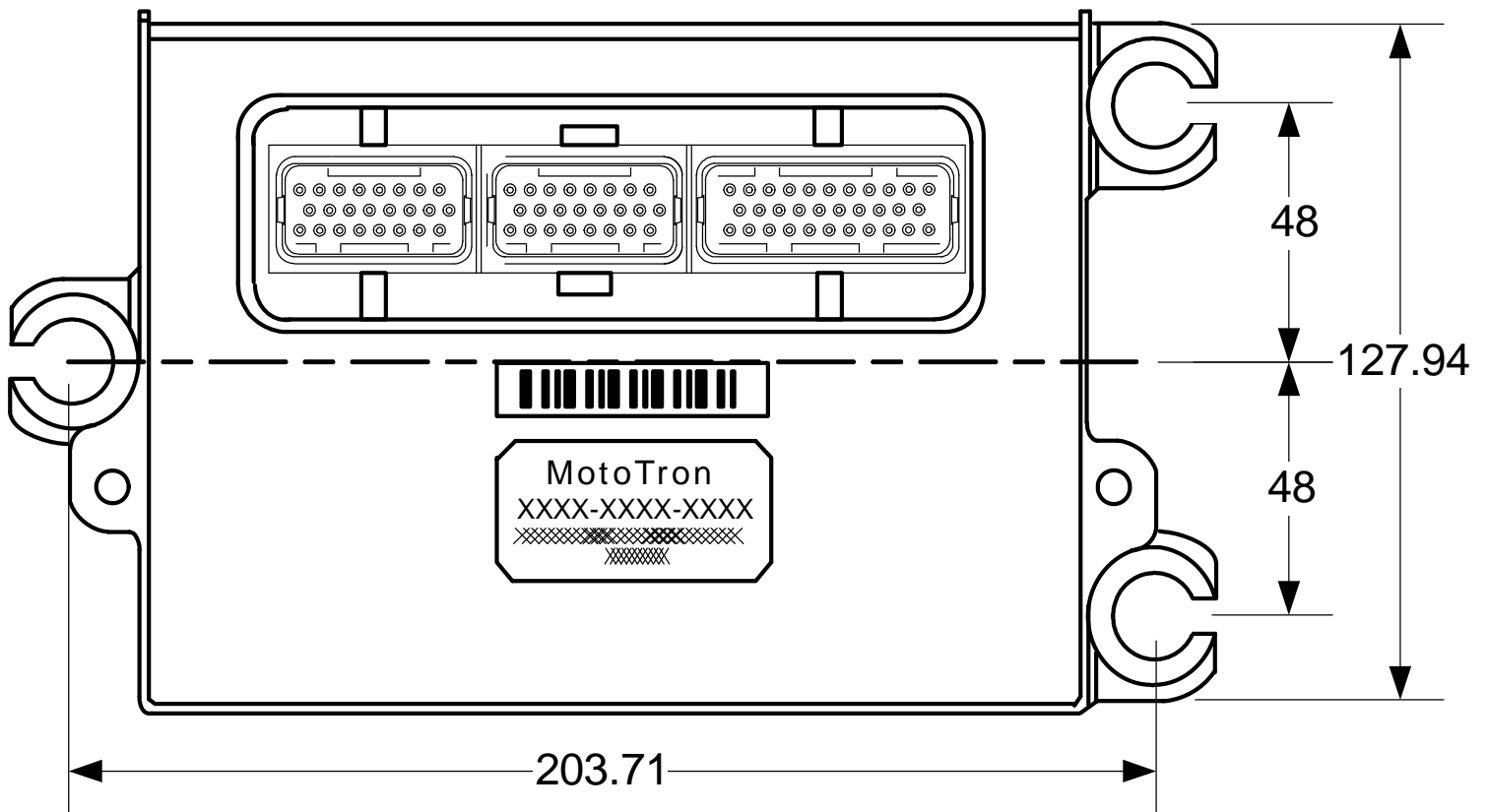
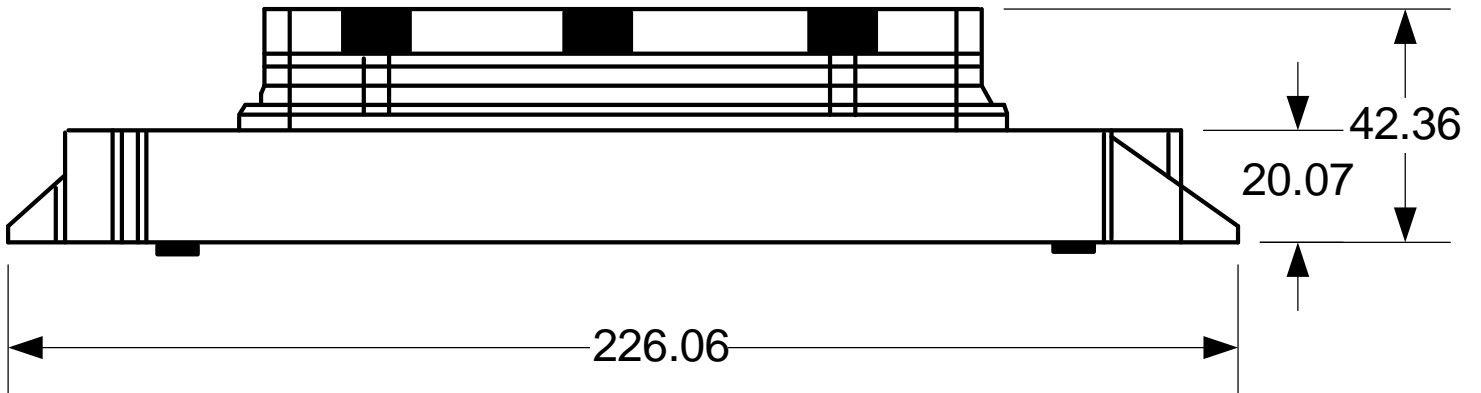
5.2 ADDITIONAL DEVELOPMENT HARNESS WIRES

| 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 | 12VOLT GROUND | -- | "71/72/80" BLK |

| 5.3 RESOURCE BY NAME | | | P/N: HARN-PCM-008-D0 | |
|----------------------|-------|---|---|----------------------|
| ControlCore | Pin # | Function | Notes | Wire Number |
| Resource Name | ECM | Name | | Color Code |
| AI1D/FI7D | C5 | Air Injector 1 Driver/ Fuel Injector 7 Driver | 3A peak/1A 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 Ohm Pull Up | 25 Light Blue/ Black |
| AN14 | A26 | Variable Resistance Input | 180 Ohm Pull Up | 26 Pink/Black |
| AN15 | A27 | Variable Resistance Input | 150 Ohm Pull Up | 27 Orange/Pink |
| AN16 | A2 | Potentiometer Input | 220K Pull Up | 2 White/Yellow |
| AN17 | A12 | Potentiometer Input | 220K Pull Up | 12 White/Red |
| AN18 | A24 | Pressure Input | 51K Pull Up | 24 Red/Purple |
| AN19 | A13 | Variable Resistance Input | 10K Pull Up | 13 Tan/Orange |
| 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 |

| ControlCore | Pin # | Function | Notes | Wire Number |
|---------------|----------------|---------------------------------------|--|----------------------|
| Resource Name | ECM | Name | | Color Code |
| 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 | ECM 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 |
| EK1N | A20 | Knock Sensor Negative | | 20 Yellow/Orange |
| EK1P | A30 | Knock Sensor Positive | | 30 White/Black |
| ESC_A | C17 | H-Bridge | High Current (10A pk., 5A 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 (5A) | 60 Brown/Yellow |
| ETC_B | C2 | | | 58 Brown/White |
| FI1D | C6 | Fuel Injector 1 Driver | 3A peak/1A 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 | FUEI Pump | 1.5A | 43 Orange |
| HSOL1 | C1 | PWM Output | 3A peak/1A hold | 57 Yellow/Orange |
| HSOL2 | C19 | PWM Output | | 75 Yellow/Pink |

| ControlCore | Pin # | Function | Notes | Wire Number |
|---------------|-------|-------------------------|---|---------------------|
| Resource Name | ECM | Name | | Color Code |
| HSOL3 | C9 | PWM Output | 5A | 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 |
| OILP | B7 | Oil Pump | High Current (10A) | 39 Light Blue/Black |
| SCL- | A18 | RS485 LO | | 18 White/ DarkBlue |
| SCL+ | A28 | RS485 HI | | 28 Dark Blue/White |
| START | B8 | Starter Solenoid Relay | High Current (5A) | 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, 1.5A | 44 Gray |
| XDRG | A22 | Transducer Ground | Ground Return for Transducers | 22 Black/ Orange |
| XDRP | A23 | Transducer Power (5V) | 500mA Source for Transducers | 23 Purple/ Yellow |
| XDRP_B | B24 | Transducer Power B (5V) | 500mA Source for Transducers | 56 Purple/Pink |

6 PHYSICAL DIMENSIONS**6.1 ALL DIMENSIONS ARE IN MILLIMETERS**

7 ENVIRONMENTAL RATINGS

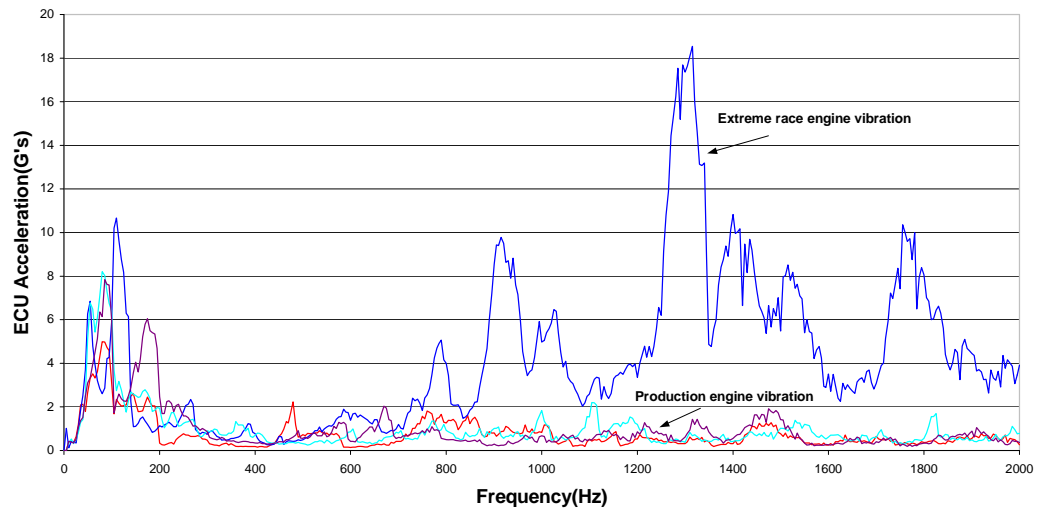
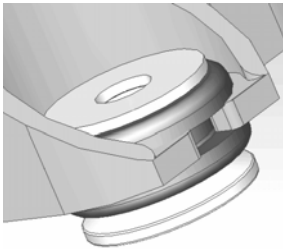
7.1 GENERAL

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



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