



## MotoHawk Control Solutions

### **ECM-0S12-024-0502-C/F**

#### **Engine Control Modules**

(Part Nos. 1751-6427 / 1751-6370)

### **Description**

Presenting the ECM-0S12-024-0502-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. Hundreds of successful industrial applications prove the capability of this module. Based on a proven microprocessor, the ECM-0S12-024-0502-C/F is capable of delivering complex control strategies. The CAN 2.0B datalink ensures interoperability with other system components.

The ECM-0S12-024-0502-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.

#### **IMPORTANT**

The ECM-0S12-024-0502-C/F modules are obsolete. The replacement modules are:

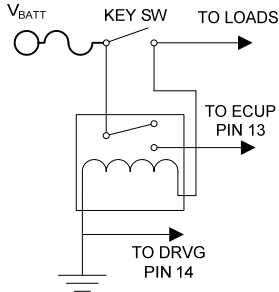
- ECM-0S12-024-0802-C, part number 1751-6507 or 8923-1710 (w/ mounting hardware)
- ECM-0S12-024-0802-F, part number 1751-6428 or 8923-1578 (w/ mounting hardware)

- **Microprocessor:**  
Freescale  
MC9S12DT128,  
24 MHz
- **Memory:**  
(MC9S12DT128BMPV)  
128K Flash, 8K RAM;  
16K external RAM  
("-C" calibratable  
development module)
- **Operating Voltage:**  
8–20 Vdc
- **Operating Temperature:** –40 to +105 °C (in benchmark marine engine application)
- Sealed connectors operable to 10 ft (3 m) submerged
- **Inputs:**  
8 Analog  
1 VR/Digital Frequency
- **Outputs:**  
3x TTL Level Ignition System  
2x 10 A Low Side PWM  
1x 1.0 A Tachometer Output  
1x 5 A H-Bridge PWM
- **Datalinks:**  
1 CAN 2.0B Channel

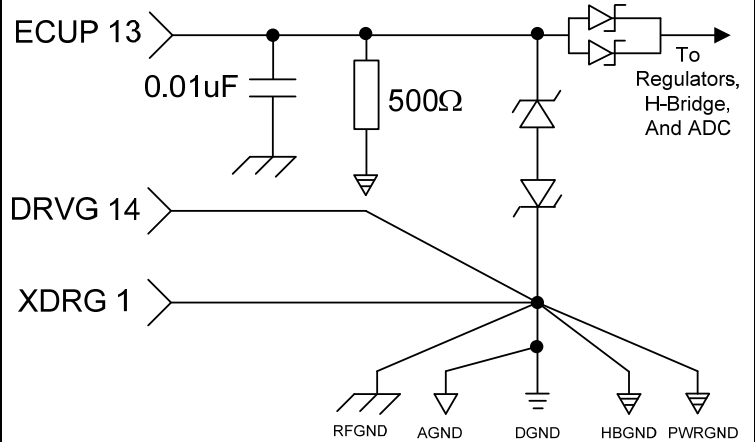
## 1-Input Signal Conditioning

### 1.1 ECUP/AN1M (13), DRVG (14), XDRG (1)

Power (Key) switch input ECUP supplies module power. Input is monitored by the processor.

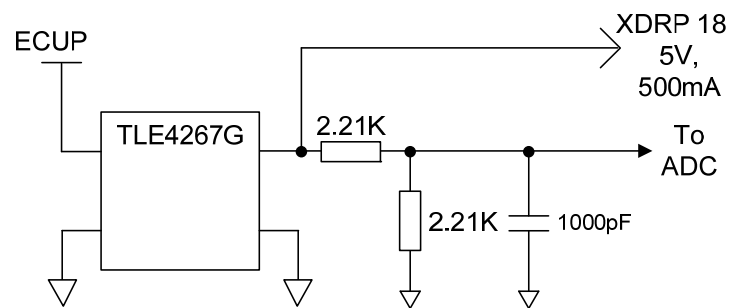


E-Stop switches are placed between the NO contact and pin 13 of the module.  
The XDRG is the transducer ground return.



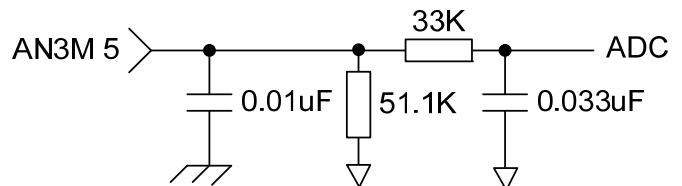
### 1.2 XDRP/AN2M (18)

This pin is the transducer power source. It is monitored by the processor.



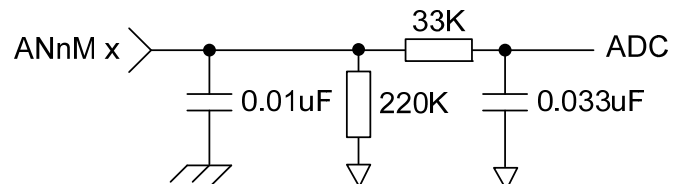
### 1.3 AN3M (5)

This input is a 10 bit 0-5 V ADC,  $\tau = 1$  ms.



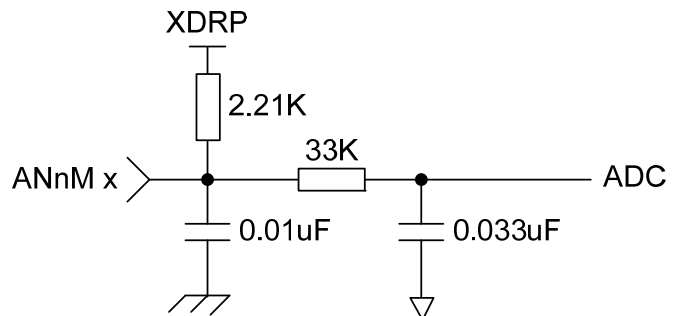
### 1.4 AN4M, AN8M, AN9M (17, 15, 2)

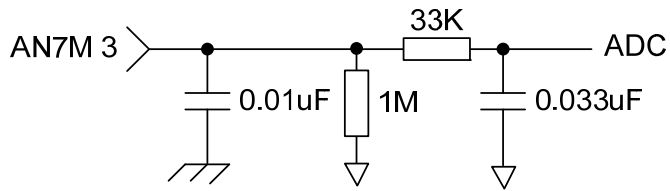
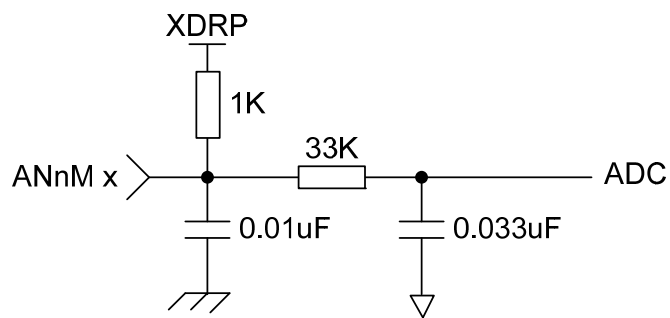
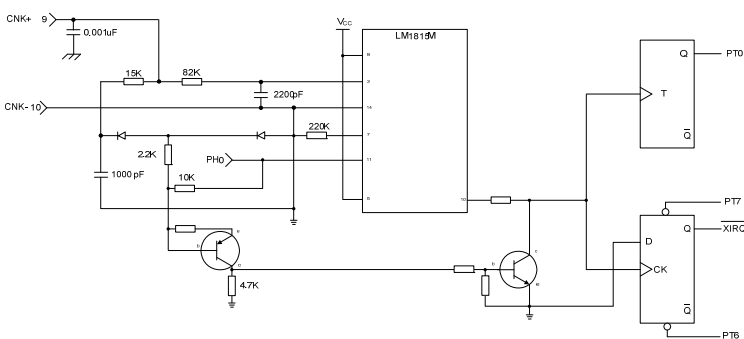
These inputs are 10 bit 0-5 V ADCs,  $\tau = 1$  ms.

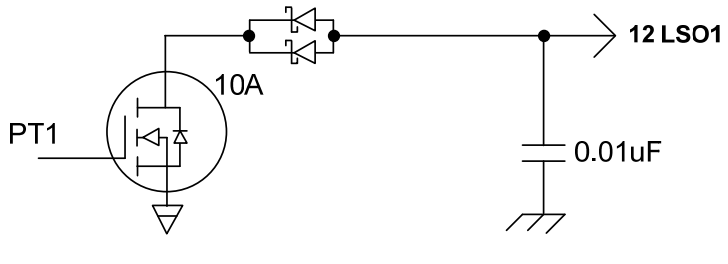
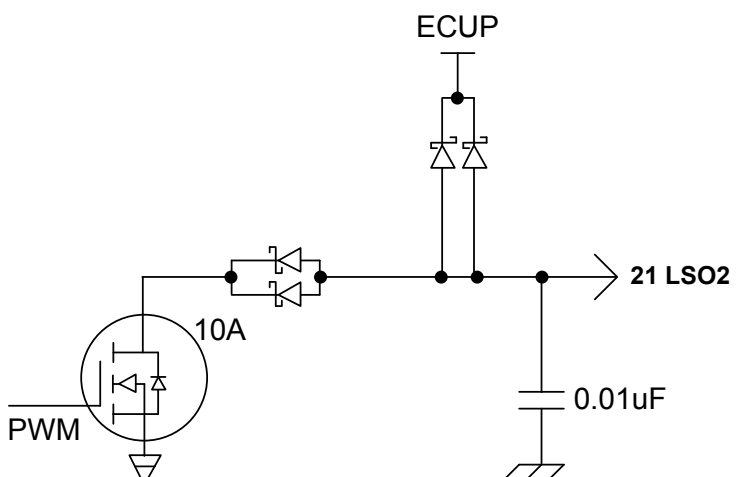


### 1.5 AN5M, AN6M (4, 16)

These inputs are 10 bit 0-5 V ADCs,  $\tau = 1$  ms.



1-Input Signal Conditioning	(continued)
<p><b>1.6 AN7M (3)</b> This input is a 10 bit 0–5 V ADC, <math>\tau = 1</math> ms.</p>	
<p><b>1.7 AN10M (23)</b> This input is a 10 bit 0–5 ADC, <math>\tau = 1</math> ms.</p>	
<p><b>1.8 CNK+/CNK_DG, CNK- (9, 10)</b> CNK+ and CNK- are variable reluctance sensor inputs. CNK_DG is a switch input for a Hall Effect sensor. Only one should be wired in at a time.</p>	

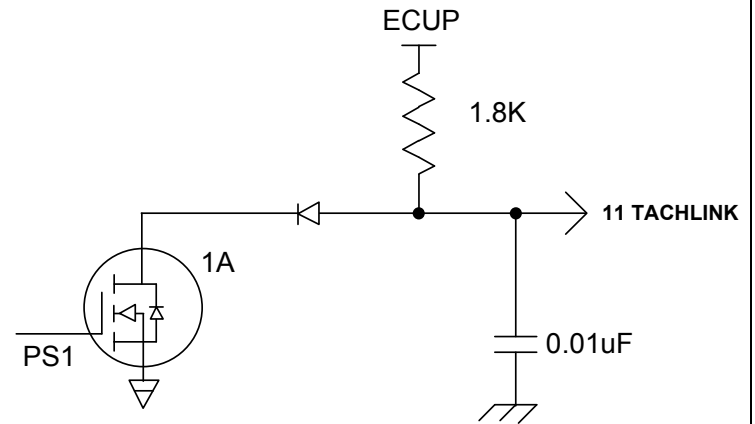
2-Output Signal Conditioning	
<p><b>2.1 LSO1 (12)</b> This output is a high current sink driver. 10 A max.</p>	
<p><b>2.2 LSO2 (21)</b> This output is a high current sink driver. 20 V, 10 A max. It includes the freewheeling diodes to ECUP.</p>	

**2-Output Signal Conditioning**

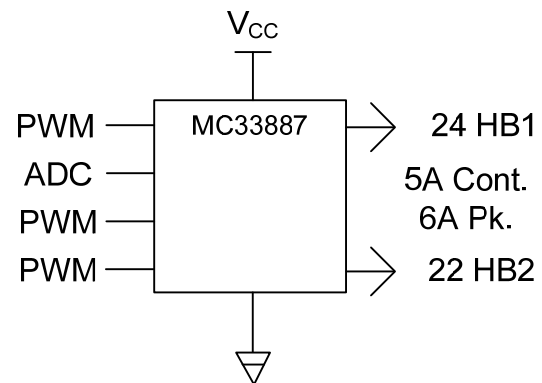
(continued)

**2.3 TACHLINK (11)**

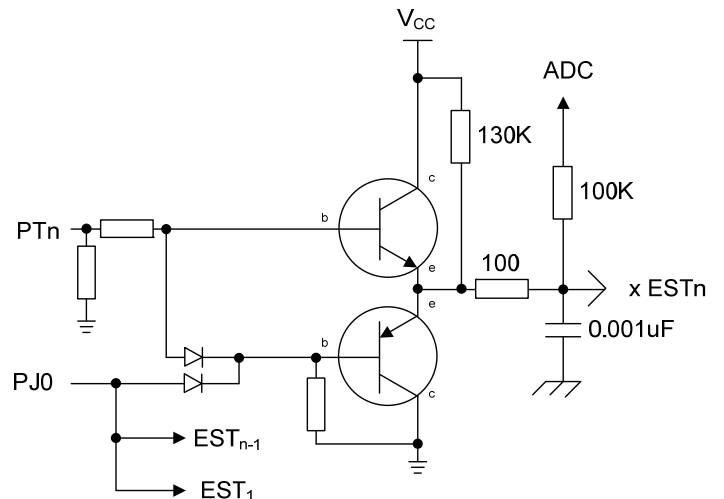
This output is capable of sinking 1 A max.

**2.4 HB1, HB2, (24, 22)**

This is a high current H-bridge output. 5 A cont., 6 A pk.

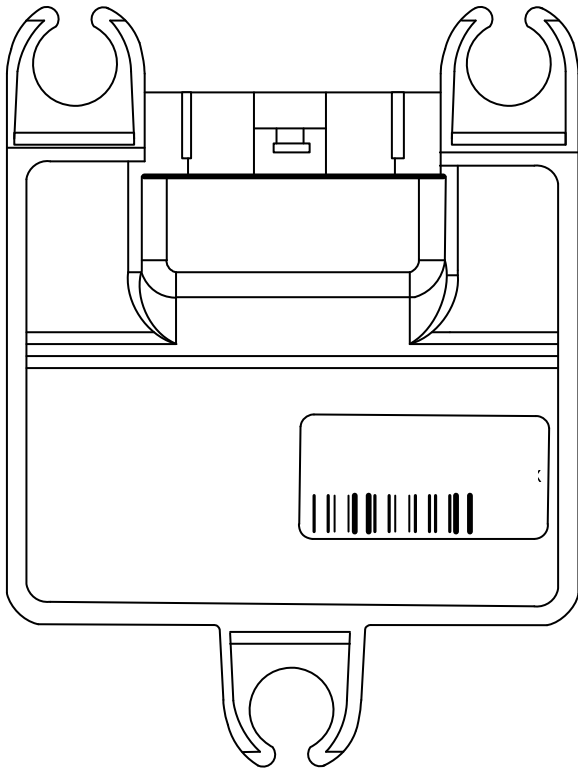
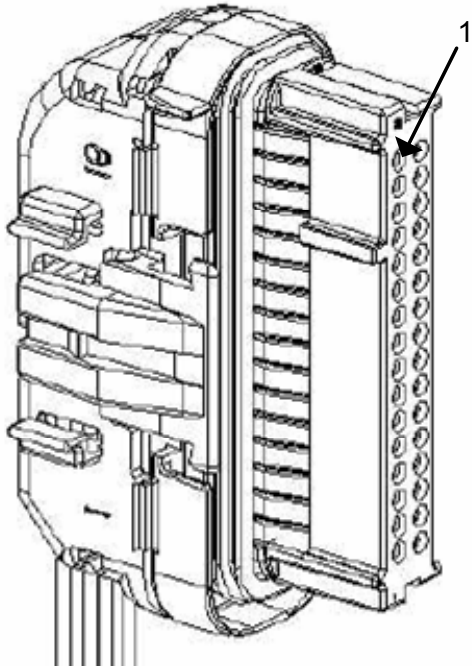
**2.5 EST1...EST3, (7, 20, 8)**

These outputs are capable of sourcing 0.5 mA and sinking 1 mA.



### 3-Connector Definitions

### 3.1 Block Diagram



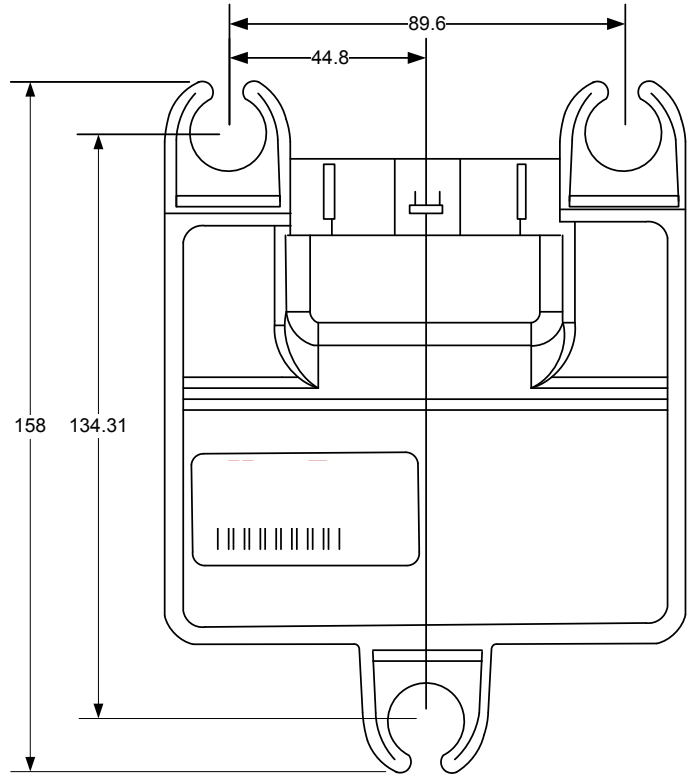
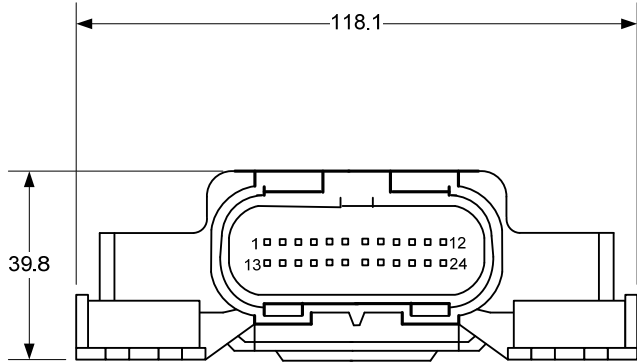
ECM-0S12-024-0502			
13	ECUP (AN1)	12	LSO1
9	CNK+	21	LSO2
10	CNK-	24	H+
18	XDRP (AN2)	22	H-
1	XDRG		
5	AN3 (51K1 GND)		
17	AN4 (220K GND)		
4	AN5 (2K2 5V)	7	(5V) EST1
16	AN6 (2K2 5V)	20	(5V) EST2
3	AN7 (1M GND)	8	(5V) EST3
15	AN8 (220K GND)	11	TACHLINK
2	AN9 (220K GND)	14	DRVG
23	AN10 (1K 5V)		
6	CAN1+		
19	CAN1-		

<b>3.2 Connector Pinouts</b>			
<b>3.2.1 Resource by Connector Pin</b>			
<b>Pin # ECM</b>	<b>ControlCore Resource Name</b>	<b>Function Name</b>	<b>Notes</b>
1	XDRG	Transducer Ground	Ground
2	AN9	Analog Input	220K Pull Down
3	AN7	Analog Input	1M Pull Down
4	AN5	Analog Input	2.2K Pull Up
5	AN3	Analog Input	51K Pull Down
6	CAN+	CAN	Terminating Resistance Required
7	EST1	Electronic Spark Timing	Low Current
8	EST3	Electronic Spark Timing	Low Current
9	CNK+/ CNK_DG	Crank Position HI/ Hall Effect Crank Sensor	Variable Reluctance Sensor Compatible with NSC LM1815 or Hall Effect sensor
10	CNK-	Crank Position LO	Variable Reluctance Sensor Only
11	CAN+	CAN	Terminating Resistance Required
12	LSO1	Low Side Driver	10 A Max.
13	ECUP	Module Power	Power to Module (via Key Switch)
14	DRVG	Power Ground	Connect to Battery Ground
15	AN8	Analog Input	220K Pull Down
16	AN6	Analog Input	2.2K Pull Up
17	AN4	Analog Input	220K Pull Down
18	XDRP/AN2	Transducer Power	5 V, 500 mA
19	CAN-	CAN	Terminating Resistance Required
20	EST2	Electronic Spark Timing	Low Current
21	LSO2	Low Side Driver	10 A Max.
22	H+	H-Bridge Output	10 A Max.
23	AN10	Analog Input	1K Pull Up
24	H-	H-Bridge Output	10 A Max.

<b>3.2 Connector Pinouts</b>			
<b>3.2.2 Resource by Resource Name</b>			
<b>ControlCore Resource Name</b>	<b>Function Name</b>	<b>Notes</b>	<b>Pin # ECM</b>
AN3	Analog Input	51K Pull Down	5
AN4	Analog Input	220K Pull Down	17
AN5	Analog Input	2.2K Pull Up	4
AN6	Analog Input	2.2K Pull Up	16
AN7	Analog Input	1M Pull Down	3
AN8	Analog Input	220K Pull Down	15
AN9	Analog Input	220K Pull Down	2
AN10	Analog Input	1K Pull Up	23
CAN-	CAN	Terminating Resistance Required	19
CAN+			6
TACH/LINK	Tachometer/Serial Communications	1.8K Pull Up	11
CNK-	Crank Position LO	Variable Reluctance Sensor Compatible with NSC LM1815 or Hall Effect sensor	10
CNK+/ CNK_DG	Crank Position HI/ Hall Effect Crank Sensor		9
DRVG	Power Ground	Connect to Battery Ground	14
ECUP/AN1	Module Power	Power to Module (via Key Switch)	13
EST1	Electronic Spark Timing	Low Current	7
EST2	Electronic Spark Timing	Low Current	20
EST3	Electronic Spark Timing	Low Current	8
H+	H-Bridge Output	10 A Max.	22
H-			24
LSO1	Low Side Driver	10 A Max.	12
LSO2	Low Side Driver	10 A Max.	21
XDRG	Transducer Ground		1
XDRP/AN2	Transducer Power	5 V, 400 mA	18

## 4-Physical Dimensions

All dimensions are in millimeters.



## 5-Environmental

### 5.1 Multi-Environment Stress Test

The MEST shall run for 240 hours (8 cycles of the MEST profile). When powered, the module shall operate in "Life Test Mode" using Factory Test software, and any faults shall be logged to the test equipment.

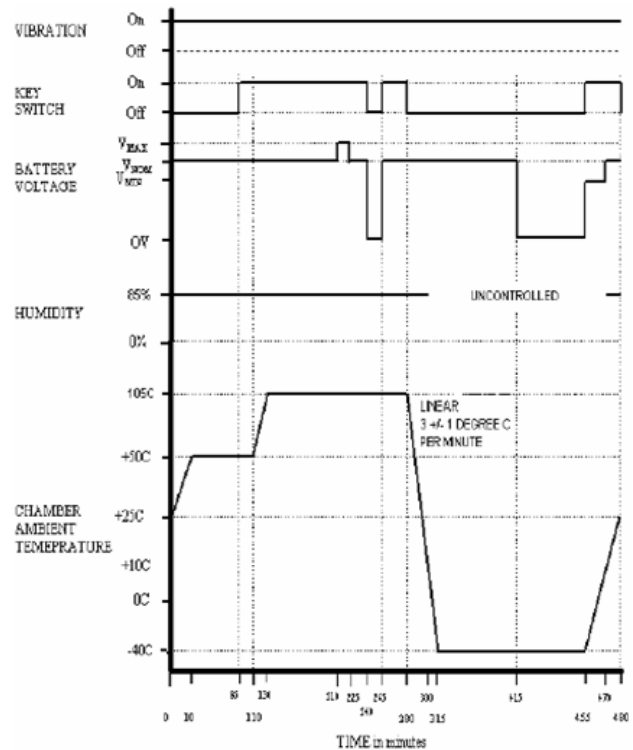
The module will normally be mounted to an engine via isolation bushings or a vibration isolated mounting plate. The normal operating environment includes high vibration, high temperature, and high humidity. Electrical noise (conducted and radiated) is also prevalent.

This document does not define the exact environmental characteristics of any specific application. Nor can it specify the exact environmental characteristics of any future application. This document does describe a series of validation tests that window anticipated application requirements.

The tests described in this document mirror the tests in the validation test plan. In the event of conflicting test requirements, the validation test plan takes precedence over this documents.

#### NOTES

- A. Vibration. The vibration levels specified in these tests are not engine or application vibration levels. They are accelerated levels derived from windowed data taken from multiple engines and then accelerated based on mission time and test time.
- B. Temperature. The module shall be designed with automotive grade internal components(-40 to +125 °C or better) and have an external ambient air operating temperature of -40 to +105 °C. Convective air flow may be assumed, and most applications will have additional air flow while the engine is running. However, maximum allowable ambient temperature shall be based on internal power dissipation airflow and hot-soak characteristics. All of these factors are application-dependent, and some applications may not be capable of 105 °C operation.
- C. It is the responsibility of the application engineer to assure that the application does not exceed the demonstrated capabilities of the module; vibration or thermal. It may be necessary for the application engineer to perform additional testing in order to validate the module in the application.

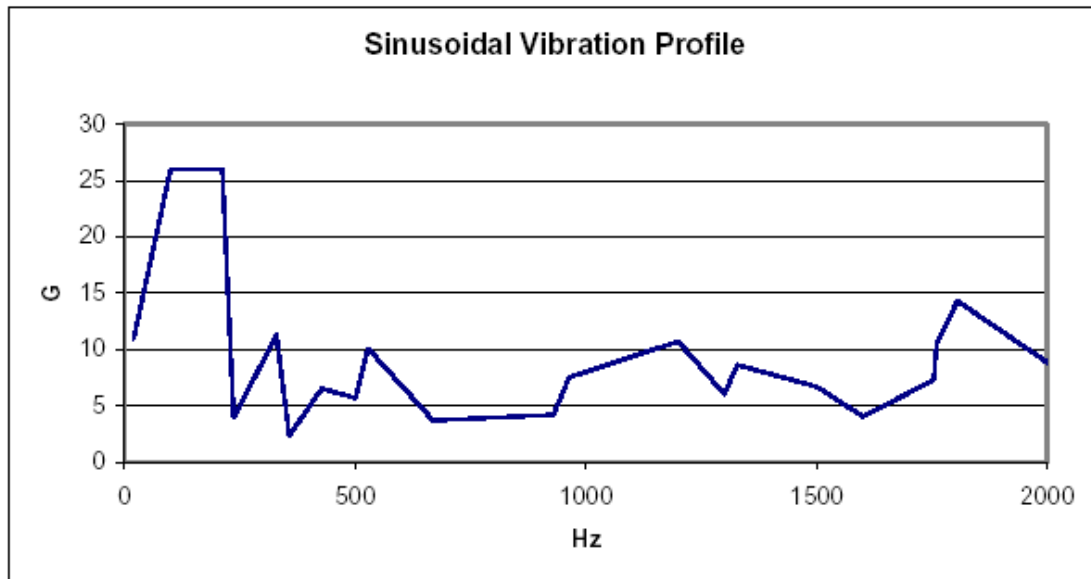




## 5.2 Sinusoidal Vibration

The sinusoidal vibration test shall run for 24 hours each axis at ambient temperatures. The module shall operate in "Life Test Mode" using Factory Test software and any faults shall be logged to the test equipment.

HZ	G'S
20	10.96
100	26
153	26
212	26
237	3.93
330	11.31
357	2.34
428	6.53
501	5.7
528	10.08
669	3.7
930	4.18
964	7.53
1200	10.71
1300	6.05
1328	8.62
1500	6.69
1600	4.03
1754	7.28
1760	10.46
1805	14.31
2000	8.85





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