RaceGrade Specification

Document Number	RG_SPEC-0027		
Title	Inertial Measurement Unit - IMU		
CAN Speed: 1Mbps	**Base CAN ID:** 0x470h	**Serial Number:**	**Checked By:**
Accelerometer Range: +/- 4G	**Angular Rate Range:** +/- 250deg/s		**CAN Mode:** Standard
Accelerometer & Gyro Filter Settings: Values Range From 0 to 255 where 0 is raw			
Lateral: 100	**Longitudinal:** 100	**Vertical:** 150	**Gyros:** 90

Firmware Revision	Date	Prepared By	Change History
2.0	11/20/2018	V. Mikitchenko	Firmware overhaul – improved zero and filter methods.
2.01	11/12/2019	V. Mikitchenko	improved range of allowable zero

The RaceGrade IMU contains a three-axis accelerometer and a three-axis angular rate sensor designed to measure and communicate all values over the CAN bus.

Part # RG IMU

Specifications:

Acceleration Ranges:	+/- 2, 4, 8, 16 G
Angular Rate Ranges:	+/- 250, 500, 2000 deg/s
CAN bus speeds:	1 Mbps, 500 Kbps, 250 Kbps, 125 Kbps
Supply Voltage:	9 - 36 VDC
Supply Current:	30 mA
Temperature Range:	-20°C to +85°C
Dimensions:	92 x 57 x 15 mm
	3.625 x 2.25 x 0.59 in
Wire Lead Length:	4"
Weight:	95 grams
Ingress Protection Rating:	IP 68

CAN Messaging:

All channels are 16 bit signed Motorola style.

Capable of standard and compound CAN message structures

Accelerations are transmitted in G per bit with a resolution of 0.001.

Angular rates are transmitted in hertz with a resolution of 0.001.

(multiply by 360 for deg/s)

Maximum transmission rate for 1 Mbps and 500 Kbps CAN speeds are 500Hz for acceleration, 125Hz for angular rates.

Maximum transmission rate for 250 Kbps and 125 Kbps CAN speeds are 166Hz for acceleration, 100Hz for angular rates.

Standard CAN Message Structure:

Base CAN ID:

Byte 0/1 = Lateral Acceleration

Byte 2/3 = Longitudinal Acceleration

Byte 4/5 = Vertical Acceleration

Base CAN ID+1:

Byte 0/1 = Yaw Rotational Rate

Byte 2/3 = Pitch Rotational Rate

Byte 4/5 = Roll Rotational Rate

Compound CAN Message Structure:

Base CAN ID:

Message 0:

Byte 0 = message ID

Byte 1 = N/A

Byte 2/3 = Lateral Acceleration

Byte 4/5 = Longitudinal Acceleration

Byte 6/7 = Vertical Acceleration

Message 1:

Byte 0 = message ID

Byte 1 = N/A

Byte 2/3 = Yaw Rotational Rate

Byte 4/5 = Pitch Rotational Rate

Byte 6/7 = Roll Rotational Rate

Connection:

Mating Connector: ASL606-05SN
pin 1 – Ground
pin 2 – N/C
pin 3 – Power
pin 4 – CAN Lo
pin 5 – CAN Hi

Mounting Considerations:

Do not firmly mount sensor to the chassis as this will induce unwanted engine vibration. Use the soft type of hook & loop tape for mounting, not the industrial type. This will reject the most amount of engine vibration through the chassis. Mount on a solid structure of the chassis. Do not mount on any type of thin sheet metal.

Manager:

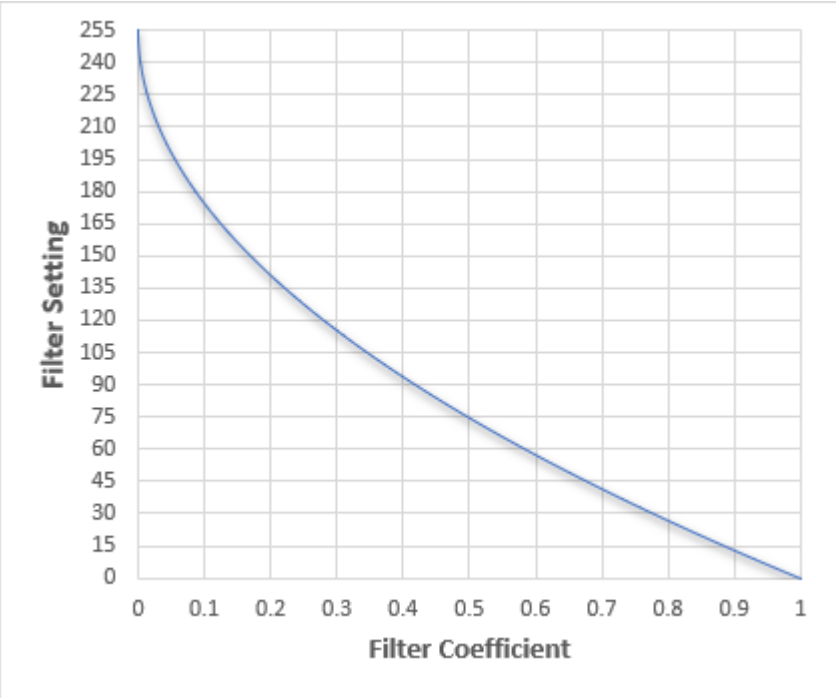
The manager software uses a PCAN-USB by Peak Systems to communicate with the IMU over CAN. The manager lets the user change accelerometer range, gyro range, CAN ID, CAN message Structure, CAN bus speed, and has the ability to zero the accelerometer sensor.

The manager uses the following CAN ID's to communicate with the IMU: 0x006, 0x007, 0x008, 0x009, and 0x014.

To download the latest software go to: http://www.racegrade.com/downloads.html

Accelerometer Filter:

The IMU has a low pass type filter available that is adjustable on a scale of 0 to 255 with 0 being raw. A value of 255 for the filter will effectively disable rate changes and as such not recommended. The recommended effective range for the filter is in a range of 0 to 230. The IMU uses your requested filter to extrapolate the Filter Coefficient, which becomes more aggressive after 180. Higher degrees of filtering will result in more phase shift delay.



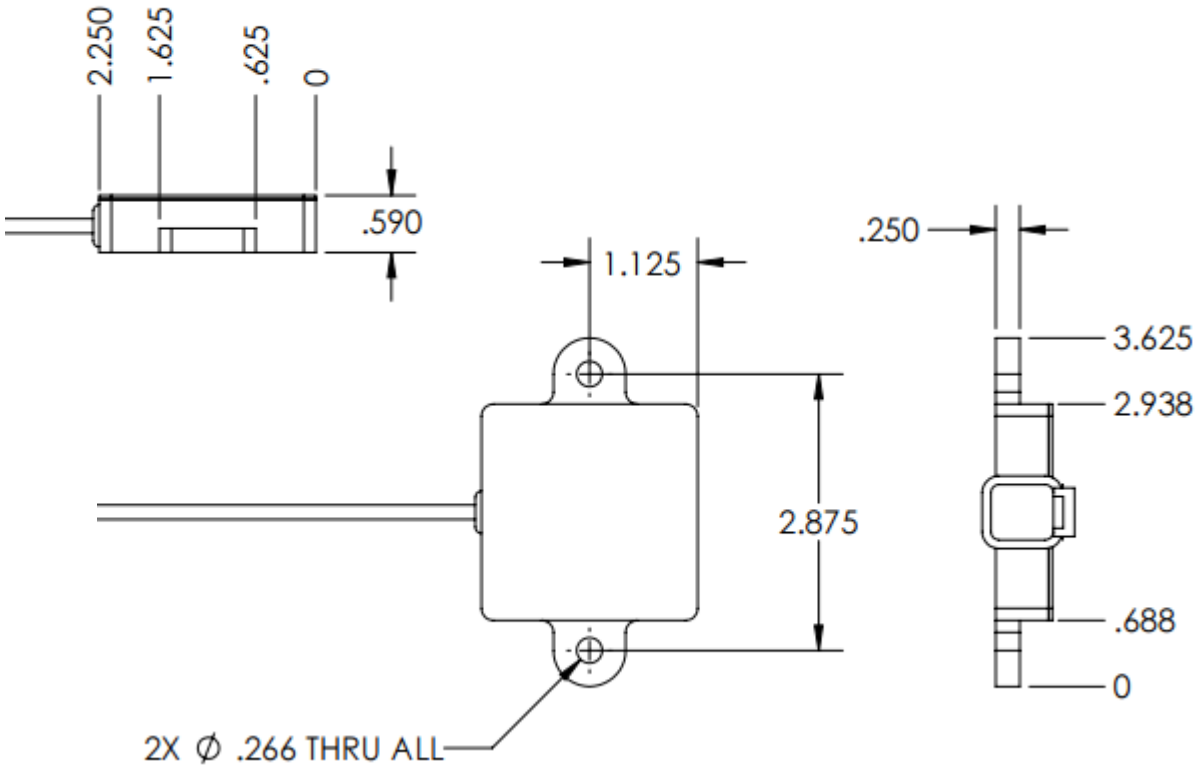
Zeroing the Gyro and Accelerometer Channels:

The device can be zeroed using the IMU manager or by sending the following CAN message on ID 0x010. The zeroing feature assumes that the vertical axis is reading one G and the other two are reading zero Gs. The IMU must not be touched for six (6) seconds after this message is sent as it performs the zeroing and background validation logic.

Message structure (ID 0x010):

```
BYTE(0)   = 0x69 // i
BYTE(1)   = 0x6d // m
BYTE(2)   = 0x75 // u
BYTE(3)   = 0x7a // z
BYTE(4)   = 0x65 // e
BYTE(5)   = 0x72 // r
BYTE(6)   = 0x6f // o
BYTE(7)   = 0x7a // z
```

Drawing:


2.250
1.625
.625
0
.590
1.125
2.875
2X ∅ .266 THRU ALL
.250
3.625
2.938
.688
0