Instruction Manual

AEM
PERFORMANCE ELECTRONICS

P/N 30-2203
VEHICLE DYNAMICS MODULE

STOP! - READ THIS BEFORE INSTALL OR USE!

WARNING:
THIS INSTALLATION MAY REQUIRE WELDING OR INTEGRATION INTO A VEHICLE'S ELECTRICAL SYSTEM. DAMAGE TO SENSITIVE ELECTRONICS, FIRE, OR EXPLOSION MAY OCCUR IF PROPER PRECAUTION IS NOT TAKEN. IF THERE IS ANY DOUBT, **DO NOT** ATTEMPT THE INSTALLATION AND CONSULT A PROFESSIONAL.
NOTE: IT IS THE RESPONSIBILITY OF THE ENGINE TUNER TO ULTIMATELY CONFIRM THE CALIBRATION USE FOR ANY PARTICULAR ENGINE IS SAFE FOR ITS INTENDED USE. AEM HOLDS NO RESPONSIBILITY FOR ANY ENGINE DAMAGE THAT RESULTS FROM THE MISUSE OF THIS PRODUCT.
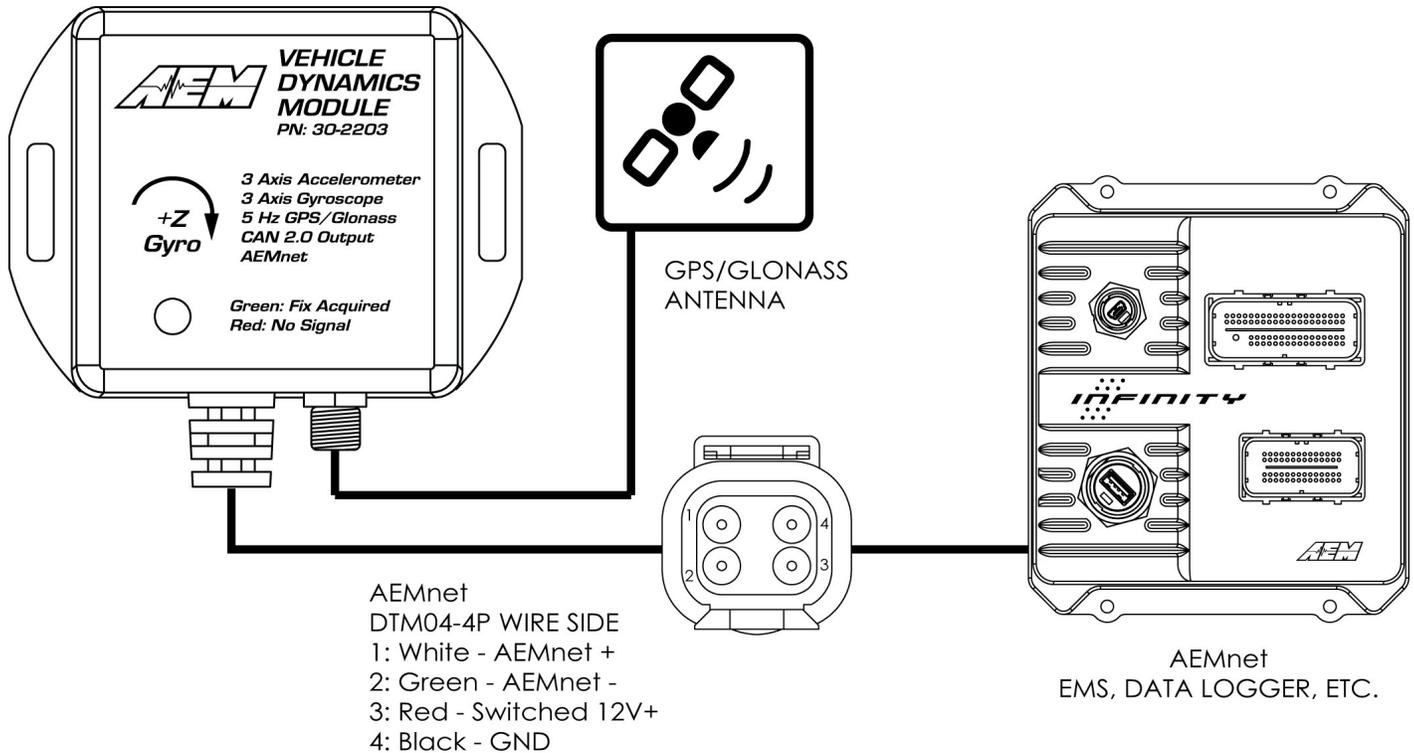
The AEM Vehicle Dynamics Module (VDM) features a a 5Hz GPS/GLONASS receiver, 3-axis accelerometer/gyro, external antenna, and AEMnet/CAN 2.0 output in a weather resistant enclosure. The VDM is ideal for generating track maps when used in concert with an AEM ECU and AEMData analysis software. In association with the GPS data, the accelerometer and gyro data can be analyzed to unlock more lap time from your race vehicle.

Features

- 5Hz GPS/GLONASS GPS receiver
- Latitude, Longitude, Speed, Altitude, Course, Satellite Count, UTC Time, UTC Date
- 3-axis accelerometer +/- 8g
- 3-axis gyroscope +/- 500 deg/s
- External magnetic antenna
- Supports vehicle/system voltages up to 16V
- Low-profile, weather resistant enclosure
- AEMnet (CAN bus) Output

PN	Description
35-2203	MODULE, VEHICLE DYNAMICS
10-2203	INST, VDM
1-3079	ANTENNA, GPS/GNSS
4-4065	VELCRO, 1.25" (2)

Installation

VEHICLE DYNAMICS MODULE
PN: 30-2203

+Z Gyro

3 Axis Accelerometer
3 Axis Gyroscope
5 Hz GPS/Glonass
CAN 2.0 Output
AEMnet

Green: Fix Acquired
Red: No Signal

GPS/GLONASS ANTENNA

AEMnet
DTM04-4P WIRE SIDE
1: White - AEMnet +
2: Green - AEMnet -
3: Red - Switched 12V+
4: Black - GND

INFINITY

AEMnet
EMS, DATA LOGGER, ETC.

The VDM is equipped with an AEMnet connector (power, ground, and CAN) so that it is a true plug and play experience when used with other AEMnet products such as the Infinity ECU.

Ideally, the VDM module should be installed near the center (both fore/aft and side-to-side) of the vehicle and as low as possible. For example, the module may be mounted to the floor of the vehicle between the two front seats. The module should be mounted using the provided "hook-and-loop" material or may be more rigidly mounted using fasteners through the module's mounting ears. Take care to avoid over-torquing mounting fasteners, if used.

The external markings on the module indicate the orientation of the accelerometer and gyro axes. Typically, the module is mounted so that "+x Accel" is pointed towards the front of the vehicle in the direction of travel. Please make note of this orientation for use when analyzing the data later on.

The antenna should be mounted in a location where the top is pointed towards, and has a clear view of, the sky. The bottom of the antenna is magnetic or additional hook-and-loop material is provided for mounting; the dashboard or rear package shelf are **not** acceptable locations. The antenna should be mounted as high as possible in the center of a metal roof away from other antennas or structures. If the roof of the vehicle is non-metallic then a flat piece of metal at least five inches in diameter, to function as a ground plane, should be fabricated upon which the antenna should be placed.

VDM
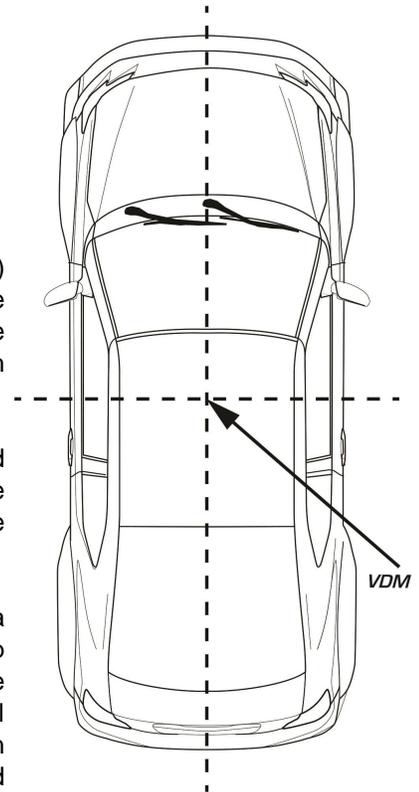
Status LED

There is a status LED located on the top of the VDM module that gives an indication of its operating status, specifically the quality of the current GPS signal:

LED	Description
OFF	The device is not powered
FLASHING RED	No valid GPS fix
RED	Valid fix, zero satellites in view
FLASHING GREEN	Less than 4 satellites in view
GREEN	4 or greater satellites in view
OTHER	Please contact AEM Support

Channels / Data

GPS

The VDM utilizes an internal 5Hz GPS/GLONASS receiver with a matching external active antenna. Faster time to fix, and better global coverage is afforded by the support of both the GPS and GLONASS constellations. The module is designed with an internal super capacitor that will retain the last known satellite position (ephemeris) while power is disconnected from the VDM for up to 2.5 hours. This will allow for a very fast time to fix (<1 sec typ) once the device is turned on again; if power is removed for greater than the 2.5 hours then the time to fix will increase. The capacitor is automatically recharged and never needs to be replaced such as is the case with a more traditional battery.

The following GPS channels are output on AEMnet for logging on your Infinity ECU or other device:

Channel Name	Notes
GPS Latitude [deg]	+ = North, - = South
GPS Longitude [deg]	+ = East, - = West
GPS Speed [mph]	Speed
GPS Altitude [ft]	Above Mean Sea Level (MSL)
GPS Course [deg]	Course over ground, NOT heading
GPS Satellite Count	"Visible" number of satellites
GPS Valid	1 = Valid Fix, 0 = No Fix
GPS Year	UTC Time
GPS Month	UTC Time
GPS Day	UTC Time
GPS Hours	UTC Time
GPS Minutes	UTC Time
GPS Seconds	UTC Time

Accelerometer / Gyroscope

The following accelerations and yaw rate channels are output on AEMnet for logging on your Infinity ECU or other device:

Channel Name	Notes
Acceleration X [g]	*Longitudinal
Acceleration Y [g]	*Lateral
Acceleration Z [g]	*Vertical
YawRate X [deg/s]	*Roll
YawRate Y [deg/s]	*Pitch
YawRate Z [deg/s]	*Yaw

*If +x is mounted in the direction of travel
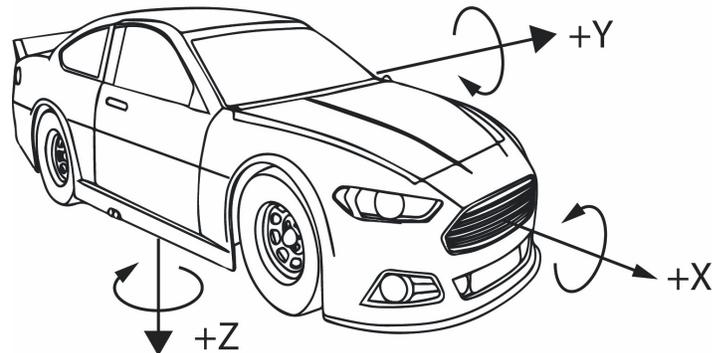
AEMnet (CAN Bus) Output

WHITE WIRE WITH BLACK STRIPE = AEMnet+ / CANH
GREEN WIRE WITH BLACK STRIPE = AEMnet- / CANL

The AEMnet output is suitable for output to AEM devices such as the AQ-1 data logger or Infinity ECU. The following CAN configuration and message definition information is provided below to facilitate interface with third-party devices.

Bus Termination

All AEMnet/CAN networks must be terminated to have an equivalent of approximately 60 Ohms of resistance. Generally, this means a 120 Ohm resistor connected in parallel to AEMnet+/AEMnet- (or CANH/CANL) at both physical ends of the bus run. The VDM does not have any internal termination and is intended to be connected to a pre-existing, properly terminated network. Please refer to the Bosch CAN2.0B specification for further detail.

bit rate	500	kb/sec
format	29	bit ID
transmit rate	100	hz
terminating resistor	none	
endianness	big / Motorola	
DLC	8	

0x0000A0000 at 10hz

Byte	Label	Data Type	Scaling	Offset	Range
0	GPS Latitude	32 bit float	Degrees	0	+90.00 (north) to -90.00 (south) Degrees
1			reference		
2			WGS-84 datum		
3			North is positive		
4	GPS Longitude	32 bit float	Degrees	0	+180.00 (east) to -180.00 (west) Degrees
5			reference		
6			WGS-84 datum		
7			East is positive		

0x0000A0001 at 10hz

Byte	Label	Data Type	Scaling	Offset	Range
0	GPS Speed	16 bit unsigned	0.01 mph/bit	0	0 to 655.35 MPH
1					
2	GPS Altitude	16 bit signed	1 ft/bit	0	-32,768 to 32,767 Feet
3					
4	GPS True Course	16 bit unsigned	0.01 deg/bit	0	0 to 655.35 degrees
5					
6	GPS Satellites in Use	8 bit unsigned	1	0	0 to 255 Satellites
7	GPS Valid	8 bit unsigned	0 = N/G, 1 = OK	0	0 to 255

0x0000A0002 at 5hz

Byte	Label	Data Type	Scaling	Offset	Range
0	GPS Valid	8 bit unsigned	0 = N/G, 1 = OK	0	0 to 255
1	UTC Date Year	8 bit unsigned	1	0	0 to 255 Years
2	UTC Date Month	8 bit unsigned	1	0	0 to 255 Months
3	UTC Date Day	8 bit unsigned	1	0	0 to 255 Days
4	-	-	-	-	-
5	UTC Time Hours	8 bit unsigned	1	0	0 to 255 Hours
6	UTC Time Minutes	8 bit unsigned	1	0	0 to 255 Minutes
7	UTC Time Seconds	8 bit unsigned	1	0	0 to 255 Seconds

0x0000A0003 at 100hz

Byte	Label	Data Type	Scaling	Offset	Range
0	X-Axis Acceleration	16 bit signed	0.000244141	0	+8g to -8g
1					
2	Y-Axis Acceleration	16 bit signed	0.000244141	0	+8g to -8g
3					
4	Z-Axis Acceleration	16 bit signed	0.000244141	0	+8g to -8g
5					
6	-	-	-	-	
7	-	-	-	-	

0x0000A0004 at 100hz

Byte	Label	Data Type	Scaling	Offset	Range
0	X-Axis Yaw Rate	16 bit signed	0.015258789	0	+500deg/s to -500 deg/s
1					
2	Y-Axis Yaw Rate	16 bit signed	0.015258789	0	+500deg/s to -500 deg/s
3					
4	Z-Axis Yaw Rate	16 bit signed	0.015258789	0	+500deg/s to -500 deg/s
5					
6	-	-	-	-	
7	-	-	-	-	

FAQ / Troubleshooting_2

I just installed my VDM, why is the accelerometer or gyro output not zero when my car is stationary?
The VDM's internal accelerometer/gyro is zeroed at the factory and requires no further action by the end user. The module must be mounted perfectly flat and in line with the axes of the vehicle. In addition, the use of screw fasteners to mount the module may induce stress into internal sensor causing a slight offset. Please also remember that the module's vertical axis will always read the Earth's 1g (gravity) in addition to any vehicle accelerations induced while in motion.
For support, contact AEM Technical Support at 1-800-423-0046 or gentech@aemelectronics.com.

12 Month Limited Warranty

Specifications

Dimensions	width	2.6 / 66	in / mm
	length (incl coax)	2.3 / 58	in / mm
	height	0.8 / 21	in / mm
Supply Voltage	min	7	VDC
	max	18	VDC
Supply Current (13.8V)	nominal	175.0	mA
Operating Temperature	min	-4 / -20	degF / degC
	max (16V Supply)	185 / 85	degF / degC
CAN 2.0B Output	bit rate	500	kb/sec
	format	29	bit ID
	terminating resistor	none	
	endianness	big / Motorola	
	DLC	8	
GPS	Channels	52, parallel tracking	
	Correlators	~ 400,000	
	Frequency (GPS)	(L1) 1,575	MHz
	Frequency (GNSS)	(FDM L1) 1,602	MHz
	Tracking Sensitivity	-165	dBm
	Horizontal Position Accuracy	< 2.5 m CEP (SA off)	
	*Time To First Fix - TTFF**		
	Obscuration recovery	0.1	sec
	Hot start^	< 1	sec
	Warm	< 30	sec
	Cold	< 35	sec
Notes	*=theoretical minimum values; values in real world may differ		
	^=Hot start battery backup lasts 2.5hr w/o 12V supply		