

LandMark™ 10 VG/GPS



- **Small, Light Weight and Low Power MEMS GPS-Aided Vertical Gyro**
- **Rugged Environmentally Sealed Packaging & MILSPEC Connector**
- **Low Noise Gyros** $0.012^\circ/\text{sec}/\sqrt{\text{Hz}}$
- **Low Noise Accels** $0.07\text{mg}/\sqrt{\text{Hz}}$
- **In-Run Gyro Bias** $25^\circ/\text{hour } 1\sigma$
- **Heading** $\pm 0.5^\circ$ stationary
- **Pitch & Roll Angles** $\pm 0.25^\circ$ stationary
- **GPS Altitude** ± 3 meter typical
- **Fully Compensated Bias, Scale Factor, Misalignment, g-Sensitivity, Heading & Altitude**
- **GPS-Aiding of Velocity**
- **Single RS485 Data Rate** 100Hz
- **GPS Receiver – 50 Channel & 5 Hz Position Data Update Rate**
- **GPS Accuracy** $\pm 2.5\text{m CEP}$
- **Supports WAAS, EGNOS and MSAS**
- **Low Power** $< 775 \text{ mW typical}$
- **Low Voltage** $+3.3\text{V}$ (single sided power)
- **Light Weight** $< 156 \text{ grams}$
- **Small Size** $< 108\text{cm}^3/6.6\text{in}^3$

**Light Weight & Low Power
GPS-Aided Vertical Gyro**

The newest version of our LandMark™ 10 VG/GPS is our economy class model of our standard LandMark™ VG/GPS. The unit features low noise gyros and accelerometers with exceptional bias in-run and bias over temperature performance with integrated GPS-Aiding in a small, light weight and low power ruggedized package at **very low cost**. The unit provides RS485 output of delta velocity, delta theta, heading, pitch and roll angles, altitude information, position, velocity and precision time. The inertial suite is integrated with a 50 channel C/A code GPS receiver with 5Hz position update rate. GPS aiding is included in all units **for turning error correction** as well as for continued angle output during short-term GPS dropouts. The signature feature is the low noise inertial sensors that provide **fully compensated bias, scale factor, misalignment, g-sensitivity, heading, pitch and roll angles and redundant altitude information**. The unit employs a Kalman Filter to integrate the GPS data and GPS-Aiding in a **ruggedized environmentally sealed package** that is EMI resistant and includes a **MILSPEC connector**. This GPS-Aided VG is highly durable and can withstand environmental vibration, shock and EMI typically associated with commercial aircraft requirements. The LandMark™ 10 VG/GPS is well suited for low cost applications including flight control, navigation, image stabilization, antenna stabilization and pointing, general aviation, automotive testing and laboratory use.



Export Classification: Commerce ECCN7A994



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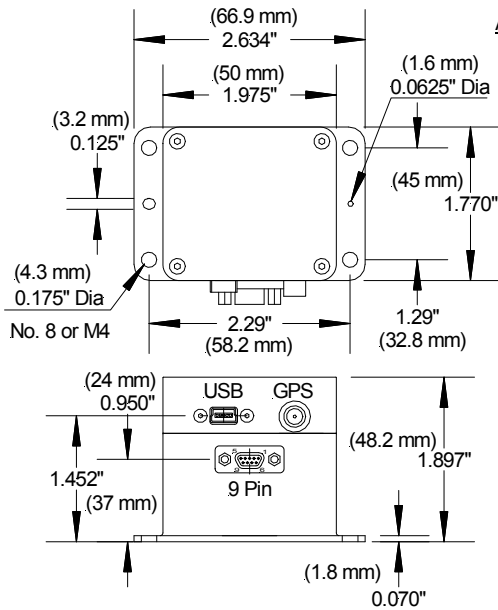
High Performance Inertial MEMS

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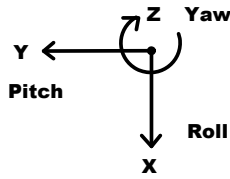
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Mating Connector: M83513/01-AN

Axes (Top View) Right Hand Rule



LandMark™ 10 VG/GPS

LMRK10VGGPS-075-02-**200**
LMRK10VGGPS-075-10-**200**
LMRK10VGGPS-150-02-**200**
LMRK10VGGPS-150-10-**200**
LMRK10VGGPS-300-02-**200**
LMRK10VGGPS-300-10-**200**

Specification

Pin No.	VG/GPS Pin Assignment
1	RS-485 A (+) AHRS
2	RS-485 B (-) AHRS
3	Power Ground
4	RS-485 A (+) Combined GPS/AHRS
5	+3.1V to +5.5V Input Power
6	RS-485 B (-) Combined GPS/AHRS
7	+5V Regulator Output
8	Signal Ground
9	Self Test

Outputs	Serial Sequence at 100Hz
1, 2, 3	Gyros: Roll (X), Pitch (Y), Yaw (Z)
4, 5, 6	Accelerometers: (X), (Y), (Z)
7	Temperature
8, 9, 10	Angles: Roll (X), Pitch (Y), NO Yaw
11, 12, 13	Airspeed, Longitude, Latitude
14, 15, 16	Time ms, Time Week, NO Baro
17, 18, 19	GPS: Altitude, Velocity, Heading
20	No. of SV's
21, 22, 23	AHRS Status, Status, Checksum

PARAMETER	RATE AXES	ACCEL AXES
Power Requirements		
Input Voltage	+3.1V to +5.5VDC	
Power Typical (Max)	775mW (1050mW)	
Inertial Performance		
Standard Full Scale Ranges	±75°/sec	±150°/sec
Scale Factor Error %	≤0.2% (over temperature) 1σ	
Bias In-Run Stability	25°/hour 1σ	0.1mg 1σ
Bias Over Temperature	<0.1°/sec 1σ	< 3mg 1σ
Sensor Resolution	0.007°/sec	0.035mg
Angle Random Walk	0.012°/ sec/√Hz 1σ	0.07mg /√Hz 1σ
Alignment	1mrad 1σ	
G-Sensitivity	≤0.03°/sec/g 1σ	
GPS/AHRS System Performance		
GPS Accuracy	±2.5m CEP stationary	
Heading (GPS only)	< 0.75° when moving > 1 m/s	
Pitch & Roll Angles	± 0.25° stationary	
Start-Up Time (inertial)	< 0.65 sec	
GPS Acquisition (Cold Start)	< 30 sec	
GPS Reacquisition (Warm Start)	< 1 sec	
Update Rate (inertial)	100 Hz	
Data Rate (GPS)	5 Hz Position Data typical	
Physical		
Weight	< 150 grams	
Size	U.S.: Metric:	1.770 x 1.975 x 1.882 = 6.58 in ³ 4.5 x 5.0 x 4.78 = 107.6 cm ³
Operating Life	10 Years typical	
Environments		
Operating Temperature	-40°C to +85°C	
Storage Temperature	-55°C to +100°C	
Vibration Operating	6gRMS (20Hz to 2KHz ~ 10g accelerometers)	
Shock	500g's ½ sine 30 msec powered, any axis	

Specification subject to change without notice



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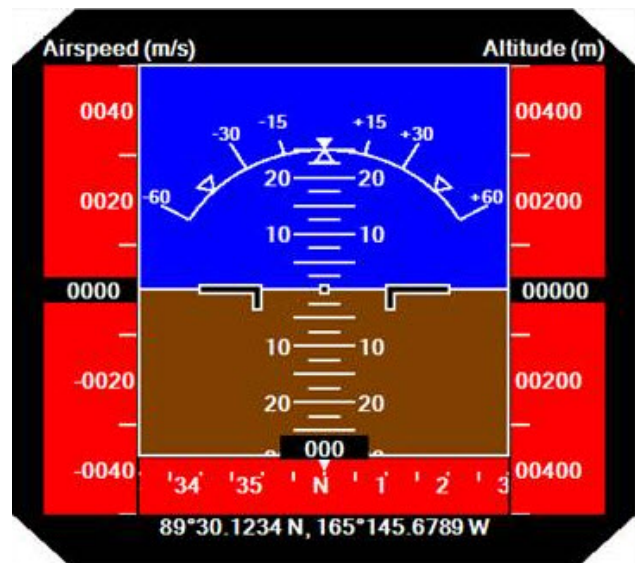
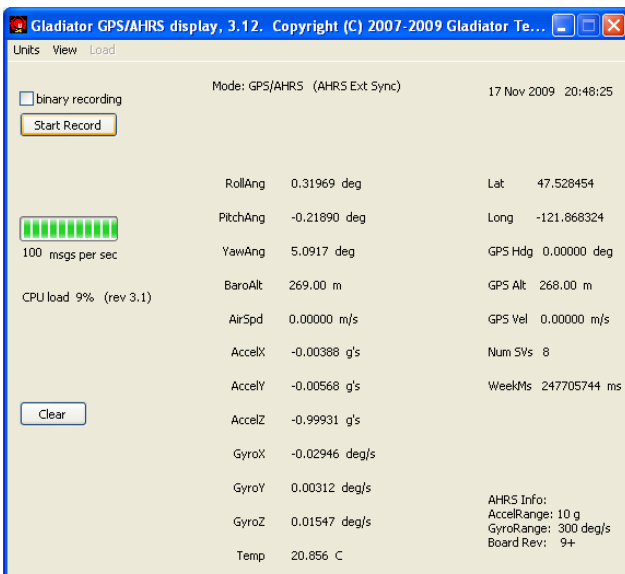
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LandMark™ 10 VG/GPS Feature Guide

VG GPS Feature Guide	GPS-Aided with Velocity Correction	Description	Format	Source	LSB Weight
Inertial		Start of message	U8	Fixed: 0x51	N/A
Pitch, Roll & Yaw Angles - X, Y & Z		Message counter	U8	Mod 256 counter	N/A
Inertial Data Accels - X, Y & Z		Gyro - X axis	I16	AHRS	0.01 deg/sec
Inertial Data Gyros - X, Y & Z		Gyro - Y axis	I16	AHRS	0.01 deg/sec
Temperature		Gyro - Z axis	I16	AHRS	0.01 deg/sec
External Sync		Accel - X axis	I16	AHRS	See note 6.
Unit of Measure Selection		Accel - Y axis	I16	AHRS	See note 6.
Real-Time Display Software (in DEMO KIT)		Accel - Z axis	I16	AHRS	See note 6.
GPS		Temp - X axis	I16	AHRS	0.01 deg C
Latitude		Roll Angle	I16	AHRS	0.01 deg
Longitude		Pitch Angle	I16	AHRS	0.01 deg
GPS Altimeter		Yaw Angle (NONE)	U16	AHRS	0.01 deg
GPS Velocity		Air Speed	I16	N/A	meters/sec
GPS Heading (when moving)		Latitude	I32	POSLLH - Latitude	1e-7 degrees
Number of Satellites		Longitude	I32	POSLLH - Longitude	1e-7 degrees
GPS Week millisecond time (ms)		TimeMs	U32	SOL - ms since start of week	1
GPS Week Number		TimeWeek	U16	SOL - week number	1
EGNOS, WAAS, MSAS Capable		Baro Altitude (NONE)	I16	AHRS	meters
Kalman Filter CCA		Altitude	I16	POSLLH - height above sea level	meters
Single Synchronized (Time Correlated) Output		Velocity	U16	VELNED 3-D velocity	0.01m/s
GPS Turning Error Correction with Short-Term GPS Loss		Heading	U16	VELNED - 2D heading	0.01 deg
		No. of SVs	U8	SOL - Number of SVs	1
		AHRS status	U8	AHRS: See note 4.	n/a
		Status	U8	See note 5.	n/a
		Checksum	U8	See note 1. User's Guide	n/a
		Total size (bytes)	50		
		Output Rate	100Hz		

Messaging Protocol Notes:

1. The checksum byte is the two's complement of the sum of all bytes in the message excluding the checksum byte.
2. All 16-bit data are transferred in little-endian format (LSB first).
3. Total transport time per message packet is 4.8ms:
*Full: (50 bytes * 11 bits/byte) / 115200 bps = 4.8ms*
4. Status byte format: The status byte contains 5 error bits and 3 status bits (see *User Guide*).



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