

LandMark™ 30 VG/GPS



- **High Performance GPS-Aided Vertical Gyro**
- **Rugged Environmentally Sealed Packaging & MILSPEC Connector**
- **Low Noise Gyros** 0.003% sec/\sqrt{Hz}
- **Low Noise Accels** $0.04mg/\sqrt{Hz}$
- **In-Run Gyro Bias** $8^\circ/hour$ 1σ
- **Pitch & Roll Angles** 0.25° $stationary$
- **Fully Compensated Bias, Scale Factor, Misalignment, g-Sensitivity, Heading & Altitude**
- **GPS-Aiding of Velocity**
- **Single RS485 Data Rate** $100Hz$
- **GPS Receiver – 50 Channel & 4 Hz Position Data Update Rate**
- **GPS Accuracy** $\pm 2.5m$ CEP $Stationary$
- **Supports WAAS, EGNOS and MSAS**
- **Wide Voltage Range** $+6V$ to $36V$
- **Light Weight** < 430 $grams$
- **Small Size** $< 360cm^3/21.8in^3$

High Performance MEMS GPS-Aided Vertical Gyro

Export Classification: Commerce ECCN7A994

The all new MEMS LandMark™ 30 VG/GPS is a high performance inertial sensors, our own G100Z MEMS gyros and A40 MEMS accelerometer, which enable precision measurements including $8^\circ/hour$ in-run and excellent bias over temperature. The inertial suite provides internally temperature compensated integrated GPS-Aided Vertical Gyro. It features high

RS485 output of delta velocity, delta theta, heading, pitch and roll angles and altitude information. All integrated with a 50 channel C/A code GPS receiver with 4Hz position update rate. GPS aiding is included in all units for turning error correction as well as for continued output during short-term GPS dropouts. The signature feature is the integrated GPS and inertial data, which is optimized with **velocity aiding and fully compensated bias, scale factor, misalignment, g-sensitivity, heading, pitch and roll angles, altitude information integrated with a 4Hz GPS position data update rate GPS**. This is in a ruggedized environmentally sealed package that is EMI resistant and includes a MILSPEC connector. The unit is highly durable and can withstand environmental vibration, shock and EMI typically associated with commercial aircraft requirements. The LandMark™ 30 VG/GPS is well suited for commercial flight control, navigation, antenna stabilization and pointing, general aviation as well as laboratory use.



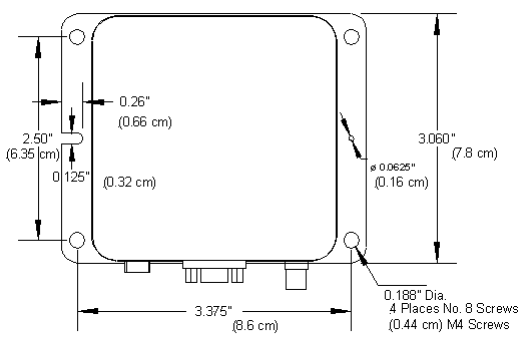
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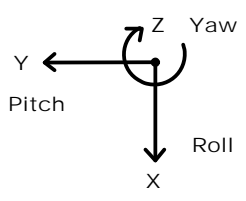
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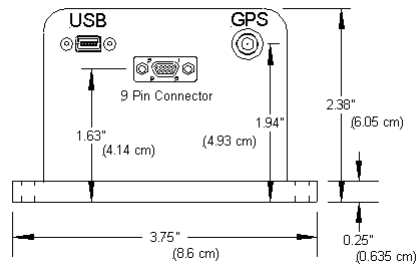


Axes (Top View) Right Hand Rule



Standard LandMark™ 30 VG/GPS

LMRK30VGGPS-100-02-200 or -06 or -10
 LMRK30VGGPS-175-02-200 or -06 or -10
 LMRK30VGGPS-325-02-200 or -06 or -10



Mating Connector: M83513/01-AN

Specification

Pin No.	Assignment
1	RS-485 A (+) AHRS
2	RS-485 B (-) AHRS
3	Power Ground
4	RS-485 A (+) Combined GPS/AHRS
5	+6.0V to +36V Input Power
6	RS-485 B (-) Combined GPS/AHRS
7	1 Pulse Per Second 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), Yaw (Z)
11	No Baro Altitude
12, 13, 14	Analog Airspeed Longitude,
15, 16	Time ms, Time Week
17, 18, 19	GPS: Altitude, Velocity, Heading
20	No. of SV's
21, 22, 23	IMU Status, Status, Checksum

PARAMETER	RATE AXES	ACCEL AXES
Power Requirements		
Input Voltage	+6.0V to +36V Max. Input (single sided)	
Power <i>Typical (Max)</i>	3000mW (3500mw)	
Inertial Performance		
Standard Full Scale Ranges	±100°/sec ±175°/sec ±325°/sec	±2 g's ±6 g's ±10 g's
Bias In-Run Stability	8°/hour <i>1 σ</i>	0.02mg 0.04mg 0.08mg <i>1 σ</i>
Bias Over Temperature	<0.03°/sec <i>2 σ</i>	<1.0mg <1.0mg <1.5mg <i>1 σ</i>
Scale Factor Error %	≤0.08% (<i>over temperature</i>)	
Sensor Resolution	0.0015° 0.002° 0.002° /sec	0.02mg 0.05mg 0.06mg
Angle Random Walk	0.003° 0.0035° 0.004° /sec/√Hz <i>1 σ</i>	0.04mg/√Hz 0.1mg/√Hz 0.12mg/√Hz <i>1 σ</i>
Alignment	1mrad <i>1 σ</i>	
G-Sensitivity	≤0.01°/sec/g <i>1 σ</i>	
VG/GPS System Performance		
GPS Accuracy	2.5 m CEP (<i>Stationary</i>)	
Pitch & Roll	± 0.25° (<i>Stationary</i>)	
Start-Up Time (<i>inertial</i>)	< 0.65 sec at 100 Hz	
GPS Acquisition (<i>Cold Start</i>)	< 30 sec	
GPS Reacquisition (<i>Warm Start</i>)	< 1 sec	
Update Rate (<i>inertial</i>)	100 Hz	
Data Rate (<i>GPS</i>)	4 Hz Position Data <i>typical</i>	
Physical		
Weight	430 grams	
Size	U.S.: 3.0 X 3.06 X 2.38 = 21.8 in ³ Metric: 7.62 X 7.8 X 6.05 = 360 cm ³	
Operating Life	10 Years <i>typical</i>	
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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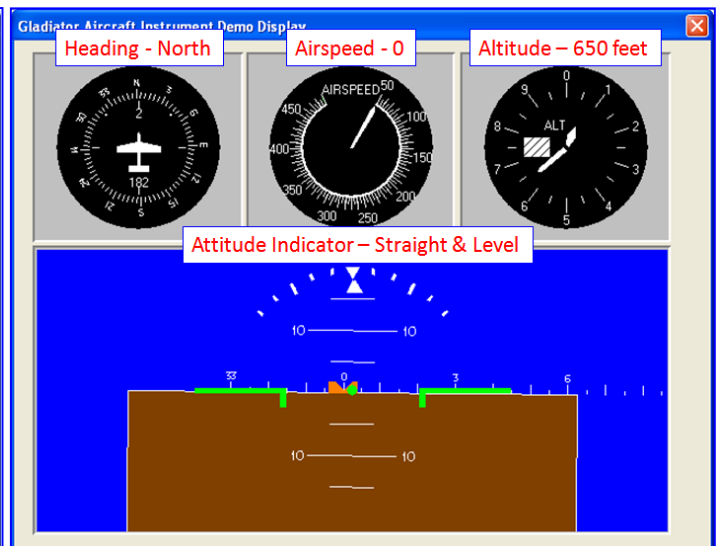
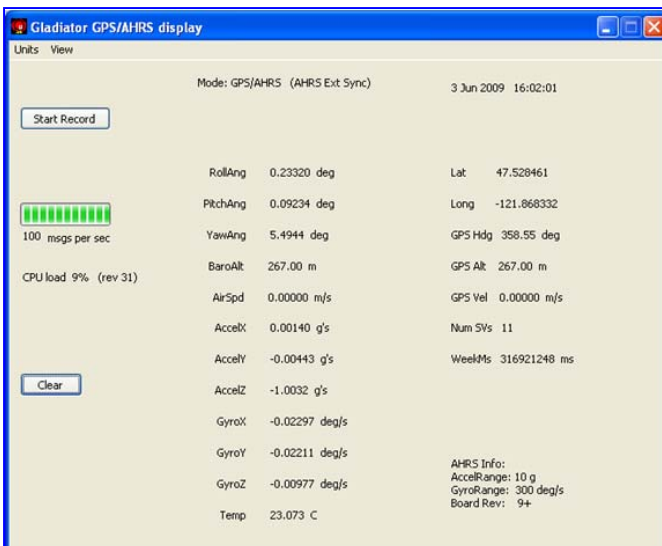
LandMark™ 30 VG/GPS Feature Guide

VG/GPS Feature Guide	GPS-Aided VG with Velocity Correction
Inertial	
Pitch & Roll Angles - X & Y	✓
Raw Inertial Data Accels - X, Y & Z	✓
Raw Inertial Data Gyros - X, Y & Z	✓
Temperature	✓
Raw Inertial Data Accels - X, Y & Z	✓
Raw Inertial Data Gyros - X, Y & Z	✓
External Sync	✓
Unit of Measure Selection	✓
Real-Time Display Software (in DEMO KIT)	✓
GPS	
Latitude	✓
Longitude	✓
GPS Altimeter	✓
GPS Velocity	✓
GPS Heading	✓
Number of Satellites	✓
GPS Week millisecond time (ms)	✓
GPS Week Number	✓
EGNOS, WAAS, MSAS Capable	✓
Kalman Filter CCA	
Single Synchronized (Time Correlated) Output	✓
GPS Turning Error Correction with Short-Term GPS Loss	✓

Description	Format	Source	LSB Weight
Start of message	U8	Fixed: 0x51	N/A
Message counter	U8	Mod 256 counter	N/A
Gyro - X axis	I16	AHRS	0.01 deg/sec
Gyro - Y axis	I16	AHRS	0.01 deg/sec
Gyro - Z axis	I16	AHRS	0.01 deg/sec
Accel - X axis	I16	AHRS	See note 6.
Accel - Y axis	I16	AHRS	See note 6.
Accel - Z axis	I16	AHRS	See note 6.
Temp - X axis	I16	AHRS	0.01 deg C
Roll Angle	I16	AHRS	0.01 deg
Pitch Angle	I16	AHRS	0.01 deg
Yaw Angle	U16	N/A	0.01 deg
Air Speed	I16	N/A	meters/sec
Latitude	I32	POSLLH - Latitude	1e-7 degrees
Longitude	I32	POSLLH - Longitude	1e-7 degrees
TimeMs	U32	SOL - ms since start of week	1
TimeWeek	U16	SOL - week number	1
Baro Altitude	I16	AHRS corrected with GPS	meters
Altitude	I16	POSLLH - height above sea level	meters
Velocity	U16	VELNED 3-D velocity	0.01m/s
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.	n/a
Total size (bytes)	50		
Output Rate	100Hz		

Messaging Protocol Notes:

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



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