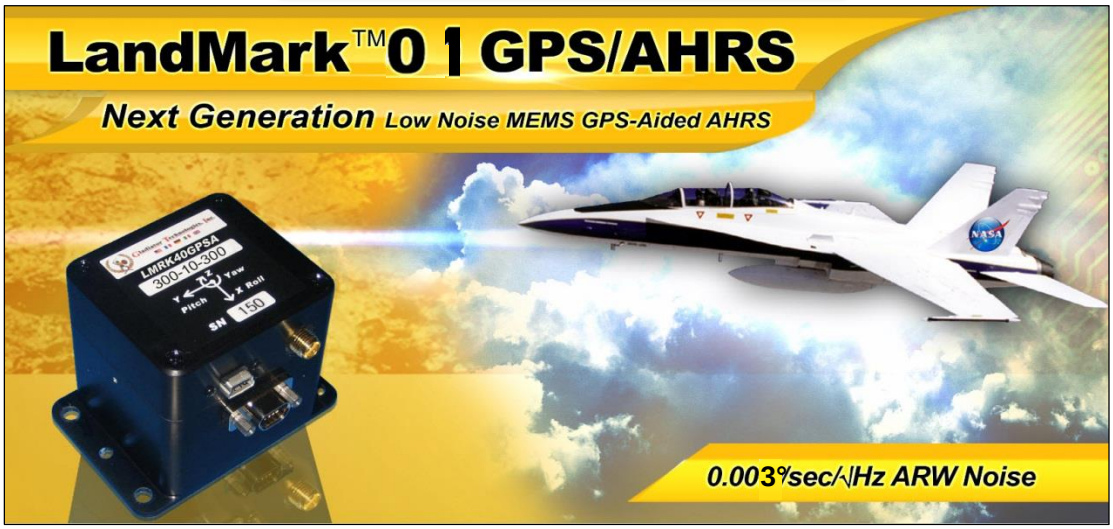
LandMark™ 01 GPS/AHRS



- Low Cost Non-ITAR Commercial MEMS GPS-Aided AHRS
- 72 channel GPS 18 Hz Position Update Rate
- GPS Accuracy *±2.0m CEP with SBAS*
- Supports SBAS: *WAAS, EGNOS & MSAS*
- GPS Altitude *±3 meter typical*
- GPS-Aided Velocity & Built-in Turning Error Correction
- Heading Angle *±0.5°*
- Pitch & Roll Angles *±0.25°*
- Fully Compensated Bias & Scale Factor Over Temperature *-40°C to +85°C*
- Low Noise Gyros *0.003°/sec/√Hz*
- Low Noise Accels *0.09mg/√Hz*
- In-Run Gyro Bias *5°/hour 1σ*
- Single RS485 Data Rate to *250Hz*
- Low Power *< 550 mW typical*
- Low Voltage *+3.3V (single sided power)*
- Light Weight *< 50 grams*
- Small Size *< 24.6cm³/1.5 in³*
- Rugged Environmentally Sealed Package

LandMark™ 01 GPS/AHRS Applications

- Platform Stabilization
- EO/IR Stabilization
- Antenna Stabilization & Pointing
- Flight Control
- Navigation
- Automotive Testing
- Laboratory Use

Export Classification:
Commerce ECCN7A994

Light Weight & Low Power
GPS-Aided AHRS

www.willburger-gmbh.eu, info@willburger.de

Gladiator Technologies
Division of LKD Aerospace
High Performance Inertial MEMS

Gladiator Technologies Division
LKD Aerospace, Inc
8020 Bracken Place SE
Snoqualmie, WA 98065 USA
Tel: 425.396.0829 Fax: 425.396.1129
Email: sales@gladiatortechnologies.com
Web: www.gladiatortechnologies.com

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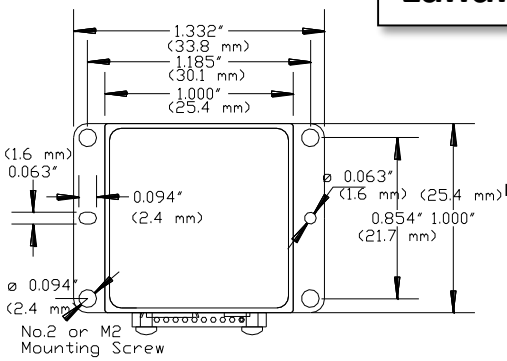
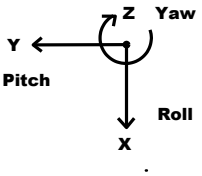
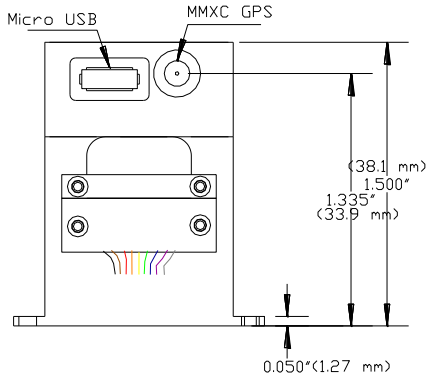
LandMark™ 01 GPS/AHRS



Axes (Top View)
Right Hand Rule



LandMark™ 01 GPS/AHRS
LMRK01GPSA-250-06-**100**
LMRK01GPSA-250-10-**100**
LMRK01GPSA-490-06-**100**
LMRK01GPSA-490-10-**100**



Wire lengths to 16" or 4cm

Pin No.	GPS/AHRS 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 +3.5V Input Power**
6	RS-485 B (-) Combined GPS/AHRS
7	Case
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, 12, 13	Airspeed, VPOD, HDOP
14, 15	Airspeed, Longitude, Latitude
16, 17, 18	Time ms, Time Week, Baro Alt
19, 20, 21	GPS: Altitude, Velocity, Heading
22	No. of SV's
23, 24, 25	IMU Status, Status, Checksum

Specification

PARAMETER	RATE AXES		ACCEL AXES	
Power Requirements				
Input Voltage	+3.1V to 3.5VDC			
Power *Typical (Max)*	550mW (600mW)			
Inertial Performance				
Standard Full Scale Ranges	±250°/sec	±490°/sec	±6 g's	±10 g's
Scale Factor Error %	≤0.1% *(over temperature) 1 σ*			
Bias In-Run Stability	5°/hour *1 σ*		0.05mg *1 σ*	
Bias Over Temperature	<0.05°/sec *1 σ*		<1.0mg *1 σ*	
Sensor Resolution	0.002°/sec		0.05mg	
Angle Random Walk	0.003° sec/√Hz *1 σ*	0.0035°	0.09mg /√Hz *1 σ*	0.10mg
Alignment	0.5mrad *1 σ*			
G-Sensitivity	≤0.001°/sec/g *1 σ*			
GPS/AHRS System Performance				
Channels	72 Channels			
Receiver Type	GPS L1C/A SBAS L1C/A QZSS L1C/A GALILEO E1B/C			
GPS Horizontal Position Accuracy	Autonomous 2.5 m			
SBAS - EGNOS WAAS SBAS	<2.0 m CEP			
Accuracy of time pulse signal	RMS 30ns 99% 60ns			
Velocity Accuracy	0.1 m/s			
Heading *(GPS)*	± 0.5°			
Pitch & Roll Angles	± 0.25°			
Altitude *(barometric)*	± 3m *1 σ*			
Start-Up Time *(inertial)*	<0.65 sec			
GPS Acquistion *(Cold Start)*	29 sec			
GPS Reacquisition *(Aided Starts)*	5 sec			
GPS Reacquisition *(Hot Start)*	1 sec			
Update Rate *(inertial)*	250 Hz			
Max Navigation Update Rate (GPS)	18 Hz			
Sensitivity				
Tracking	-167 dBm			
Cold Starts	-148 dBm			
Warm Starts	-156 dBm			
RTC crystal	Built-In			
Anti jamming	Active CW detection and removal			
Physical				
Weight	< 50 grams			
Size *U.S.:*	1.0 x 1.0 x 1.5 = 1.5 in^3			
Metric:	2.54 x 2.54 x 3.81 = 24.6 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 1 msec powered, any axis			

Specification subject to change without notice

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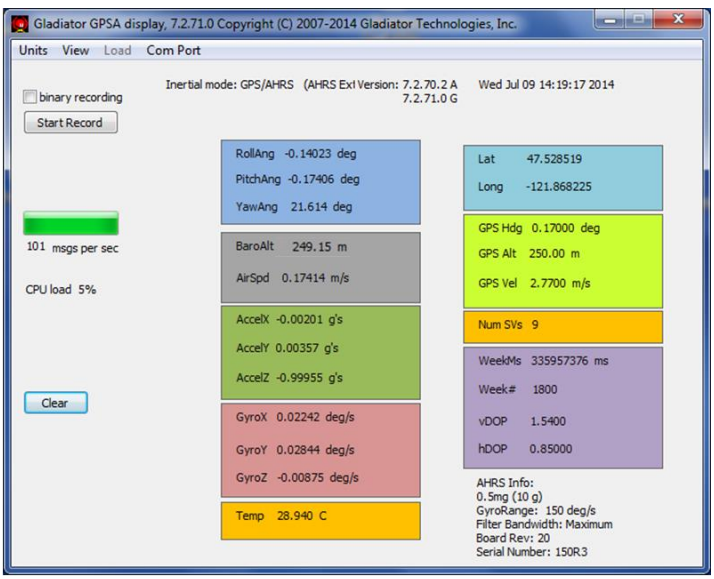
LandMark™ 01 GPS/AHRS Feature Guide

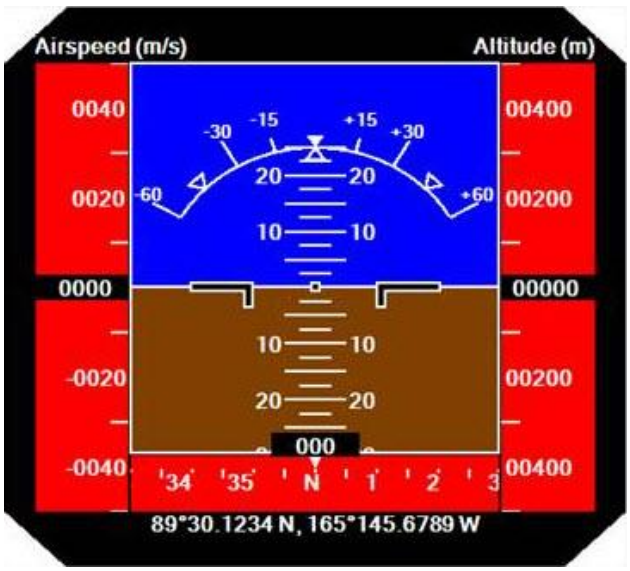
GPS/AHRS Feature Guide	GPS-Aided AHRS with Velocity Correction, Mags. & Barometric Pressure
Inertial	
Magnetic Heading	√
Pitch, Roll & Yaw Angles - X, Y & Z	√
Inertial Data Accels - X, Y & Z	√
Inertial Data Gyros - X, Y & Z	√
Redundant Altitude (Barometric Pressure)	√
Temperature	√
Magnetometer Data - X, Y & Z	√
External Sync	√
In-Field Calibration AHRS Capable	√
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	√
Barometric Aiding	√

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	AHRS (magnetometer)	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:

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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