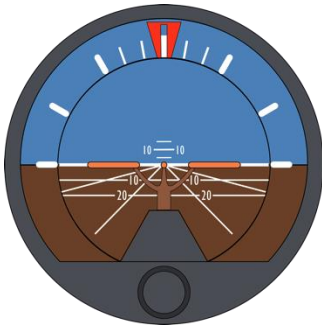


# Attitude & Heading Reference System AHRS-II-P



The **Inertial Labs Attitude and Heading Reference Systems, AHRS-II** is the next generation of enhanced, high-performance strapdown systems that determines absolute orientation (**Heading, Pitch and Roll**) for any device on which it is mounted. Orientation is determined with high accuracy for both motionless and dynamic applications.



The Inertial Labs AHRS-II-P utilizes Tactical-grade IMU: 3-axes each of precision accelerometers & gyroscopes and Ultra High precision, gyro-compensated, embedded Fluxgate Compass to provide accurate Heading/Yaw, Pitch and Roll of the device under measure.

Integration of gyroscopes' output provides high frequency, real-time measurement of the device rotation about all three rotational axes. Accelerometers and Fluxgate magnetometer measure absolute Pitch, Roll and magnetic Azimuth at AHRS initial alignment as well as providing ongoing corrections to gyroscopes during operation.




### KEY FEATURES AND FUNCTIONALITY

- State-of-the-art Kalman Filter based algorithms for different dynamic motions of UAV, Aircrafts, Helicopters, Vessels, Ships, ROV, UUV, Robots, UGV, AGV, Gimbals and Antennas
- Highly accurate, sensitive, and temperature stable Fluxgate magnetometers (in-house technology)
- Input from External GNSS Receiver;
- 0.6 deg Gyro-Stabilized Heading and 0.08 deg Pitch & Roll Dynamic Accuracy over operational temperature range
- 1 deg/hr gyroscopes Bias in-run stability
- 5  $\mu$ g accelerometers Bias in-run stability
- Suitable for Primary Attitude Reference and as Motion Control System for marine applications
- Embedded 2D and 3D magnetic calibration on hard and soft iron
- RS-232, RS-422, and CAN 2.0 interfaces
- Full temperature calibration of all sensing elements
- Up to 200 Hz data update rate (AHRS) and 2000 Hz data rate (IMU)
- Compact design. Environmentally sealed (IP67)

One of the key elements to the success of Inertial Labs AHRS-II is its use of **Inertial Labs 8mm Fluxgate Magnetometers**, which have distinct advantages over commonly used magneto-inductive or magneto-resistive magnetometers. In operation over time and temperature fluxgate magnetometers have superior stability and repeatability. In terms of sensitivity, fluxgate magnetometers provide up to two orders of magnitude increased sensitivity.

In addition to the performance advantages, unlike the chip-level magnetometer technology, fluxgate magnetometer technology has been depended on for over 70 years to provide an accurate reference to North. It remains the most reliable magnetic sensor technology for determining an object's heading.

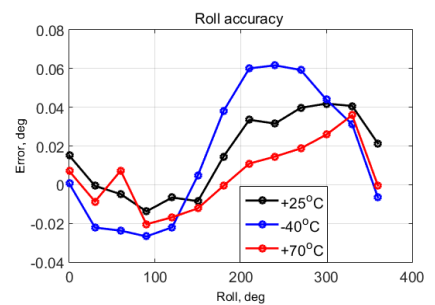
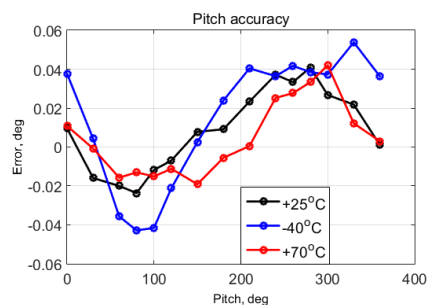
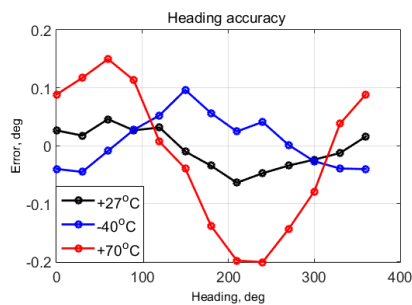
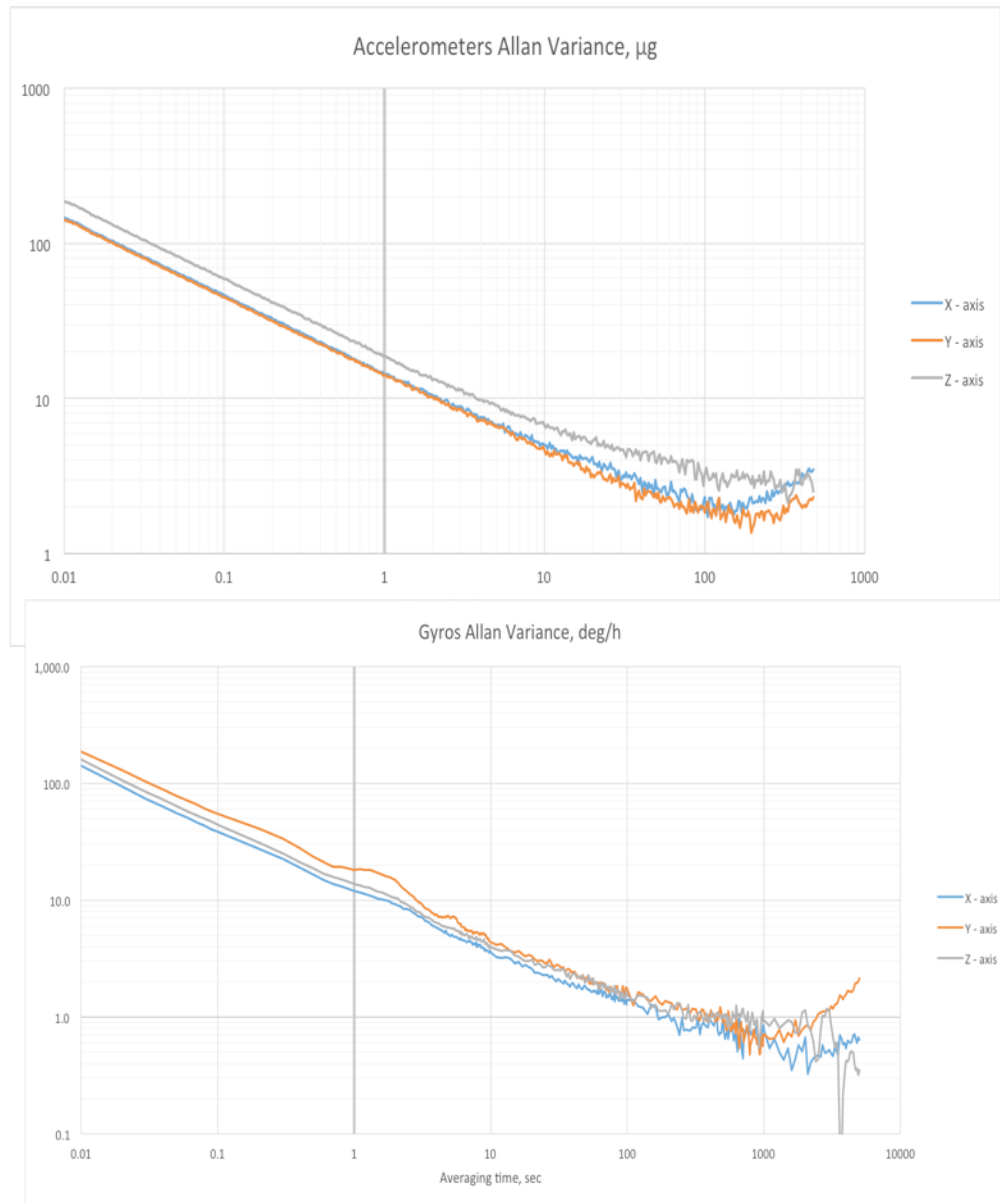
### AHRS-II-P key specifications summary

Parameter	Units		
Status		In production (Since 2006)	
Heading static accuracy	deg	0.3	
Heading dynamic accuracy	deg	0.6 (gyro magnetic)	
Heading dynamic accuracy	deg	0.1 (with GNSS input)	
Pitch & Roll static accuracy	deg	0.05	
Pitch & Roll dynamic accuracy	deg	0.08	
Gyroscopes Bias in-run stability	deg/hr	1	
Accelerometers Bias in-run stability	mg	0.005	

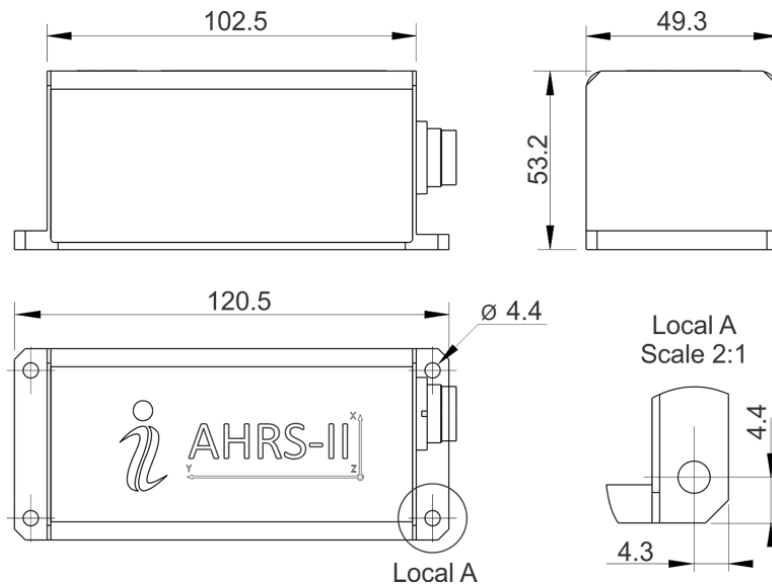


### Inertial Labs AHRS-II-P key performance

Parameter	Units	AHRS-II-P
Status		In production
Output signals	Without GNSS input	Euler angles; Quaternion; Relative Altitude; IMU data (angular rates, accelerations); Magnetic field; Pressure; Delta Theta, Delta Velocity
	With GNSS input	Horizontal & Vertical Positions (LAT, LONG); Heading, Pitch, Roll, Velocity, PPS time, IMU data (angular rates, accelerations)
Input signals		External GNSS receiver, External magnetic compass
Update rate (AHRS data)	Hz	1 ... 200 (user settable)
Update rate (IMU data)	Hz	2000
Start-up time	sec	<1
Full Accuracy Data (Warm-up Time)	sec	10
<b>Heading</b>	<b>Units</b>	
Range	deg	0 to 360
Angular Resolution	deg	0.01
Static Accuracy Over Operational Temperature Range	deg RMS	0.3
Dynamic Accuracy Over Operational Temperature Range	deg RMS	0.6
Dynamic Accuracy with GNSS input	deg RMS	0.1
<b>Pitch and Roll</b>	<b>Units</b>	
Range: Pitch, Roll	deg	±90, ±180
Angular Resolution	deg	0.01
Static Accuracy in whole Temperature Range	deg	0.05
Dynamic Accuracy Over Operational Temperature Range	deg RMS	0.08
Dynamic Accuracy with GNSS input	deg RMS	0.05
<b>Relative altitude</b>	<b>Units</b>	
Measurement range	meters	-600 to 9000
Resolution	meters	0.01
Relative accuracy	meters	<1
<b>Gyroscopes</b>	<b>Units</b>	
Type		Tactical-grade
Measurement range	deg/sec	±450 / ±950 / ±2000
Bandwidth	Hz	262
Bias in-run stability (RMS, Allan Variance)	deg/hr	1
Bias residual error over operational temperature range	deg/hr, RMS	<35
SF accuracy	ppm	1000
Noise (Angular Random Walk)	deg/√hr	<0.2
Non-linearity	ppm	100
Axis misalignment	mrad	0.15
<b>Accelerometers</b>	<b>Units</b>	
Type		Tactical-grade
Measurement range	g	±8 g / ±15 g / ±40 g
Bandwidth	Hz	262
Bias in-run stability (RMS, Allan Variance)	mg	0.005 (±8 g) / 0.02 (±15 g) / 0.03 (±40 g)
Bias error over temperature range (RMS)	mg	0.5 (±8 g) / 0.7 (±15 g) / 1.2 (±40 g)
Bias one-year repeatability	mg	1.0 (±8 g) / 1.3 (±15 g) / 1.5 (±40 g)
Velocity Random Walk	m/s/√hr	0.015 (±8 g) / 0.035 (±15 g) / 0.045 (±40 g)
SF accuracy	ppm	150 (±8 g) / 300 (±15 g) / 500 (±40 g)
Non-linearity	ppm	100
Axis misalignment	mrad	0.15
<b>Magnetometers (Embedded Fluxgate Compass)</b>	<b>Units</b>	
Measurement range	Gauss	±1.6
Bias in-run stability, RMS	nT	0.2
Noise density, PSD	nT/√Hz	0.3
SF accuracy	%	0.02
Bandwidth	Hz	50
<b>Pressure</b>	<b>Units</b>	
Measurement range	hPa	300 – 1100
Bandwidth	Hz	50
Resolution	Pa	2
Bias in-run stability (RMS, Allan Variance)	Pa	0.8
Noise density	Pa/√Hz	1
<b>Environment</b>	<b>Units</b>	
Operating temperature	deg C	-40 to +70
Storage temperature	deg C	-50 to +85
MTBF (G <sub>M</sub> @ +65degC)	hours	100,000
Vibration & Shock		MIL-STD-810G
EMC/EMI		MIL-STD-461
<b>Electrical</b>	<b>Units</b>	
Supply voltage	V DC	9 to 36
Power consumption	Watts	1.4 (2.4 with data logger)
Output Interface	-	RS-232, RS-422, CAN 2.0
Output data format	-	Binary, NMEA 0183 ASCII characters
<b>Physical</b>	<b>Units</b>	
Size	mm	120 x 50 x 53
Weight	gram	280



## AHRS-II-P mechanical interface drawing



### Notes:

1. All dimensions are in millimeters.
2. All dimensions within this drawing are subject to change without notice. Customers should obtain final drawings before designing any interface hardware.

Connector type: Binder Series 723. Male receptacle, 24 pin, shielded, rear-mounting

AHRS-II-P part numbers description								
Model	Gyro	Accel	Calibration	Connector	Color	Data Logger	Version	Interface
AHRS-II-P	G450	A8	TMGA	C3 (default)	B (default)	S64 (option)	V1	1
	G950	A15			D			2
	G2000	A40			G			4
					W			5
								11
								22
								145
<u>Example:</u> AHRS-II-P-G450-A8-TMGA-C3B-V1.11								245

### Description:

- AHRS-II-P: Professional Version of Attitude and Heading Reference System
- G450: Gyroscopes measurement range =  $\pm 450$  deg/sec
- G950: Gyroscopes measurement range =  $\pm 950$  deg/sec
- G2000: Gyroscopes measurement range =  $\pm 2000$  deg/sec
- A8: Accelerometers measurement range =  $\pm 8$  g
- A15: Accelerometers measurement range =  $\pm 15$  g
- A40: Accelerometers measurement range =  $\pm 40$  g
- TMGA: Magnetometers, Gyroscopes and Accelerometers
- C3: 24 pins connector (RS-232, RS-422, CAN, Ethernet interfaces)
- B - Black Color (default)
- D - Desert Color (Desert tan, color code 33446 (tan 686A) per FED-STD-595, Change Notice 1.)
- G - Green
- W - White
- S64: 64GB embedded Data Logger (optional)
- VX.1: RS-232 interface
- VX.2: RS-422 interface
- VX.4: CAN interface
- VX.5: Ethernet interface
- VX.11: two RS-232 interfaces
- VX.22: two RS-422 interfaces
- VX.145: RS-232, CAN and Ethernet interfaces
- VX.245: RS-422, CAN and Ethernet interfaces