Attitude Heading 8 eference System **AHRS-10**

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Inertial Labs

AHRS-10 Datasheet Rev. 4.6

The **Inertial Labs Attitude and Heading Reference System, AHRS-10** is a high-performance strapdown system 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-10 utilizes 3-axes each of precision accelerometers, magnetometers and gyroscopes to provide accurate Heading, 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.

Parameter	AHRS-10B	AHRS-10P
Heading dynamic accuracy in temperature range, RMS	1 deg	0.6 deg
Pitch & Roll dynamic accuracy in temperature range, RMS	0.5 deg	0.08 deg
Gyroscopes Bias instability in temperature range, RMS	0.2 deg/sec	0.008 deg/sec
Accelerometers Bias instability in temperature range, RMS	0.5 mg	0.5 mg
Dimensions	90 × 27 × 26 mm	90 × 27 × 26 mm
Weight	77	84
Interface	RS-232, RS-422, CAN	RS-232, RS-422, CAN

KEY FEATURES AND FUNCTIONALITY

- Two models (10B and 10P) with differentiated performance and price
- State-of-the-art algorithms for different dynamic motions of Robots, UAV, UUV, UGV, AGV, ROV, Gimbals and Antennas
- Highly accuracy Magneto-Inductive and Fluxgate magnetometers
- Gyro-Stabilized Slaved Magnetic Heading
- Suitable for Primary Attitude Reference
- Advanced Kalman Filter based sensor fusion algorithms
- Embedded 2D and 3D magnetic calibration on hard and soft iron
- All solid state components (no moving parts)
- Full temperature calibration of all sensing elements
- Environmentally sealed (IP67) and Compact design

One of the key elements to the success of Inertial Labs AHRS is its use of **Inertial Labs 8mm Fluxgate Magnetometers** which has 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.





Inertial Labs

AHRS-10 Datasheet Rev. 4.6

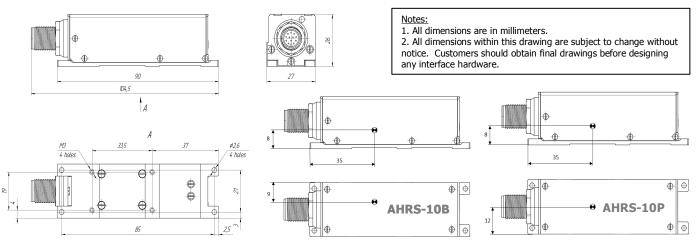
Start-up time sec. < 1	Parameter	Units	AHRS-10B	AHRS-10P
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MagnetometersUnitsAHRS-10BAHRSTechnologyMagneto InductiveFluxgMeasurement rangeGauss ± 8 ± 11 Bias in-run stability, RMSnT0.80.Noise density, PSDnT \sqrt{Hz} 0.50.SF accuracy%0.10.0EnvironmentUnitsAHRS-10BAHRSOperating temperaturedeg C-40 to +75-40 to 0.0Shock & VibrationsMIL-STD-810GMIL-STDMTBF (G_M)hours100,000100,				0.1 mrad
TechnologyMagneto InductiveFluxqMeasurement rangeGauss ± 8 ± 11 Bias in-run stability, RMSnT0.80.Noise density, PSDnT \sqrt{Hz} 0.50.SF accuracy%0.10.0EnvironmentUnitsAHRS-10BAHRSOperating temperaturedeg C-40 to +75-40 toShock & VibrationsMIL-STD-810GMIL-STDMTBF (G_M)hours100,000100,				2000
Measurement range Gauss ± 8 ± 11 Bias in-run stability, RMS nT 0.8 0. Noise density, PSD nT \sqrt{Hz} 0.5 0.0 SF accuracy % 0.1 0.0 Environment Units AHRS-10B AHRS Operating temperature deg C -40 to +75 -40 to to +75 Storage temperature deg C -50 to +85 -50 to to +85 Shock & Vibrations MIL-STD-810G MIL-STD MTBF (G _M) hours 100,000 100,		Units		AHRS-10P
Bias in-run stability, RMS nT 0.8 0. Noise density, PSD nT√Hz 0.5 0. SF accuracy % 0.1 0.0 Environment Units AHRS-10B AHRS Operating temperature deg C -40 to +75 -40 to 0.5 Storage temperature deg C -50 to +85 -50 to 0.5 Shock & Vibrations MIL-STD-810G MIL-STD MTBF (G _M) hours 100,000 100,	Technology		Magneto Inductive	Fluxgate
Noise density, PSD nT√Hz 0.5 0. SF accuracy % 0.1 0.0 Environment Units AHRS-10B AHRS Operating temperature deg C -40 to +75 -40 to Storage temperature deg C -50 to +85 -50 to Shock & Vibrations MIL-STD-810G MIL-STD MTBF (G _M) hours 100,000 100,			±8	±1.6
SF accuracy % 0.1 0.0 Environment Units AHRS-10B AHRS Operating temperature deg C -40 to +75 -40 to 0 Storage temperature deg C -50 to +85 -50 to 0 Shock & Vibrations MIL-STD-810G MIL-STD MTBF (G_M) hours 100,000 100,				0.2
SF accuracy % 0.1 0.0 Environment Units AHRS-10B AHRS Operating temperature deg C -40 to +75 -40 to 0 Storage temperature deg C -50 to +85 -50 to 0 Shock & Vibrations MIL-STD-810G MIL-STD MTBF (G _M) hours 100,000 100,	Noise density, PSD	nT√Hz	0.5	0.3
Operating temperature deg C -40 to +75 -40 to Storage temperature deg C -50 to +85 -50 to Shock & Vibrations MIL-STD-810G MIL-STT MTBF (G _M) hours 100,000 100,			0.1	0.02
Operating temperature deg C -40 to +75 -40 to Storage temperature deg C -50 to +85 -50 to Shock & Vibrations MIL-STD-810G MIL-STT MTBF (G _M) hours 100,000 100,	· /	Units	AHRS-10B	AHRS-10P
Storage temperature deg C -50 to +85 -50 to Shock & Vibrations MIL-STD-810G MIL-STT MTBF (G _M) hours 100,000 100,			-40 to +75	-40 to +75
Shock & Vibrations MIL-STD-810G MIL-STT MTBF (G _M) hours 100,000 100,				-50 to +85
MTBF (G _M) hours 100,000 100,		2		MIL-STD-810G
	MTBF (G _M)	hours		100,000
		Units	AHRS-10B	AHRS-10P
	Supply voltage			9 to 28
				2.0
				RS-232 / RS-422 / CAN
				Binary, NMEA ASCII
				AHRS-10P
	Cizo			90 x 27 x 26
				84

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Inertial Labs

AHRS-10 **Datasheet Rev. 4.6**

AHRS-10B and AHRS-10P mechanical interface drawing



AHRS-10B & AHRS-10P electrical interface description

	RS-232 and RS-422 interfaces				RS-232 and CAN interfaces			
	PIN Signal Description				PIN	Signal	Description	
	1	RS422-A	RS-422 Non-Inverting input RS-232 Receiver Input		1	RS232-RX-2	Secondary RS-232 Receiver Input	
	2	RS232-RX			2	RS232-RX	RS-232 Receiver Input	
$(^4 O O O O^8)$	3	RS232-TX	RS-232 Transmitter Output		3	RS232-TX	RS-232 Transmitter Output	
	4	Power	Power Supply Input 9V-30V DC		4	Power	Power Supply Input 9V-30V DC	
	5	ExtInp	3.3 V External input		5	ExtInp	3.3 V External input	
	6	1PPS/TOV	Pulse Per Second/ Time of validity output		6	1PPS/TOV	Pulse Per Second/ Time of validity output	
	7	RS422-Z	RS-422 Inverting Output		7	CAN-L	CAN (Low) - Bus differential signal	
859-012-103R004 NorComp	8	RS422-Y	RS-422 Non-Inverting Output		8	CAN-H	CAN (high) - Bus differential signal	
12 Position Circular Connector	9	RS422-B	RS-422 inerting Input		9	RS232-Tx-2	Secondary RS-232 Transmitter Output	
Receptacle, Male Pins Solder 10		LD	Load		10	LD	Load	
Cup Gold	11	Ground	Power Supply Return		11	Ground	Power Supply Return	
	12	GND	Ground signal		12	GND	Ground signal	

AHRS-10B part numbers description

Model	Gyro	Accel	Calibration	Connector	Color	Version	Interface
AHRS-10B	G1860	A8	TMGA	C1 (default)	B (default)	V1	12
		A15		C4 (obsolete)	D		13
		A40			G		

Example: AHRS-10B-G1864-A8-TMGA-C1-V1.12

	AHRS-10P part numbers description										
Model	Gyro	Accel	Calibration	Connector	Color	Version	Interface				
AHRS-10P	G450	A8	TMGA	C1 (default)	B (default)	V1	12				
	G950	A15		C4 (obsolete)	D		13				
		A40		. ,	G						

Example: AHRS-10P-G450-A8-TMGA-C1-V1.1

Description:

- G450: Gyroscopes measurment range = \pm 450 deg/sec
- G950: Gyroscopes measurment range = ±950 deg/sec
- G1864: Gyroscopes measurment range = ± 1864 deg/sec A8: Accelerometers measurement range = ± 8 g
- A15: Accelerometers measurement range = ± 15 g
- A40: Accelerometers measurement range = $\pm 40 \text{ g}$
- TMGA: Magnetometers, Gyroscopes and Accelerometers C1: 12 pins connector (859-012-103R004 NorComp 12 Position Circular Connector Receptacle, Male Pins Solder Cup Gold)
- C4: 4 inch (10 cm) cord, terminated by Binder 6 PIN connector not recommended for new design
- B: Black color
- D: Desert tan color
- G: Green color
- V1.12: RS-232 and RS-422 V1.13: RS-232 and CAN