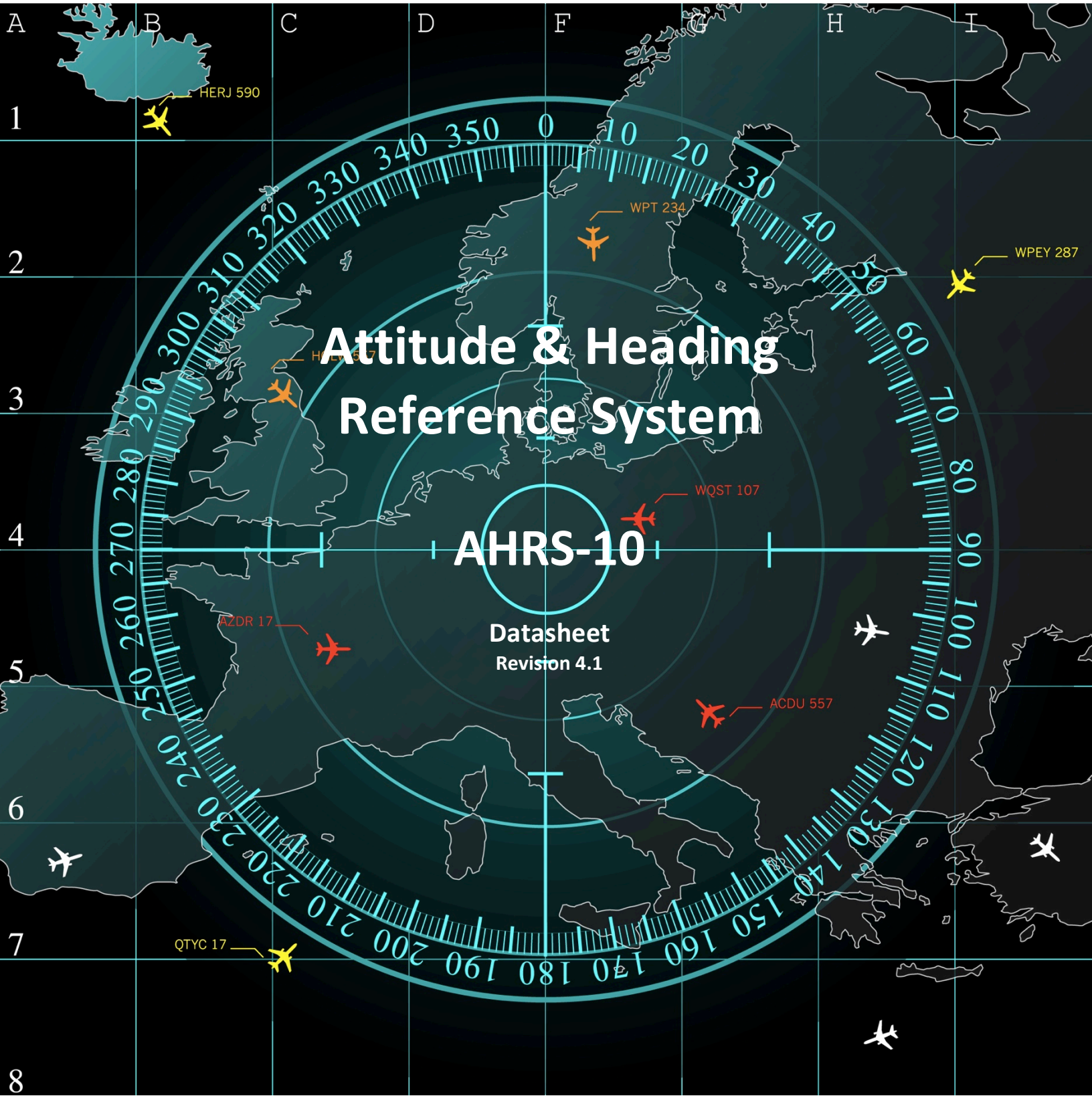


Attitude & Heading Reference System

AHRS-10

Datasheet

Revision 4.1

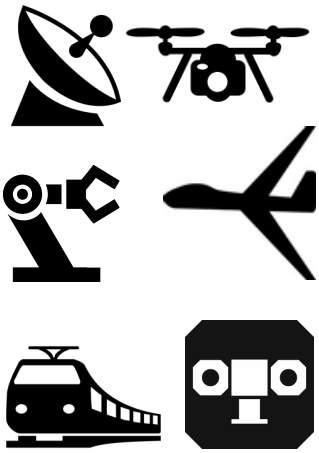
The **Inertial Labs Attitude and Heading Reference System, AHRS-10** is a high-performance strapdown system that determines absolute orientation (heading, pitch and roll) for any device on which it is mounted. Orientation is determined with high accuracy for both motionless and dynamic applications.

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.

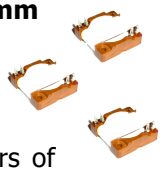
Parameter	AHRS-10B	AHRS-10P
Heading dynamic accuracy in temperature range, RMS	1 deg	0.6 deg
Pitch & Roll dynamic accuracy in temperature range, RMS	0.5 deg	0.3 deg
Gyroscopes Bias instability in temperature range, RMS	0.2 deg/sec	0.008 deg/sec
Accelerometers Bias instability in temperature range, RMS	0.5 mg	0.5 mg
Dimensions	90 × 27 × 26 mm	90 × 27 × 26 mm
Weight	77	84
Interface	RS-232, RS-422	RS-232, RS-422

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.



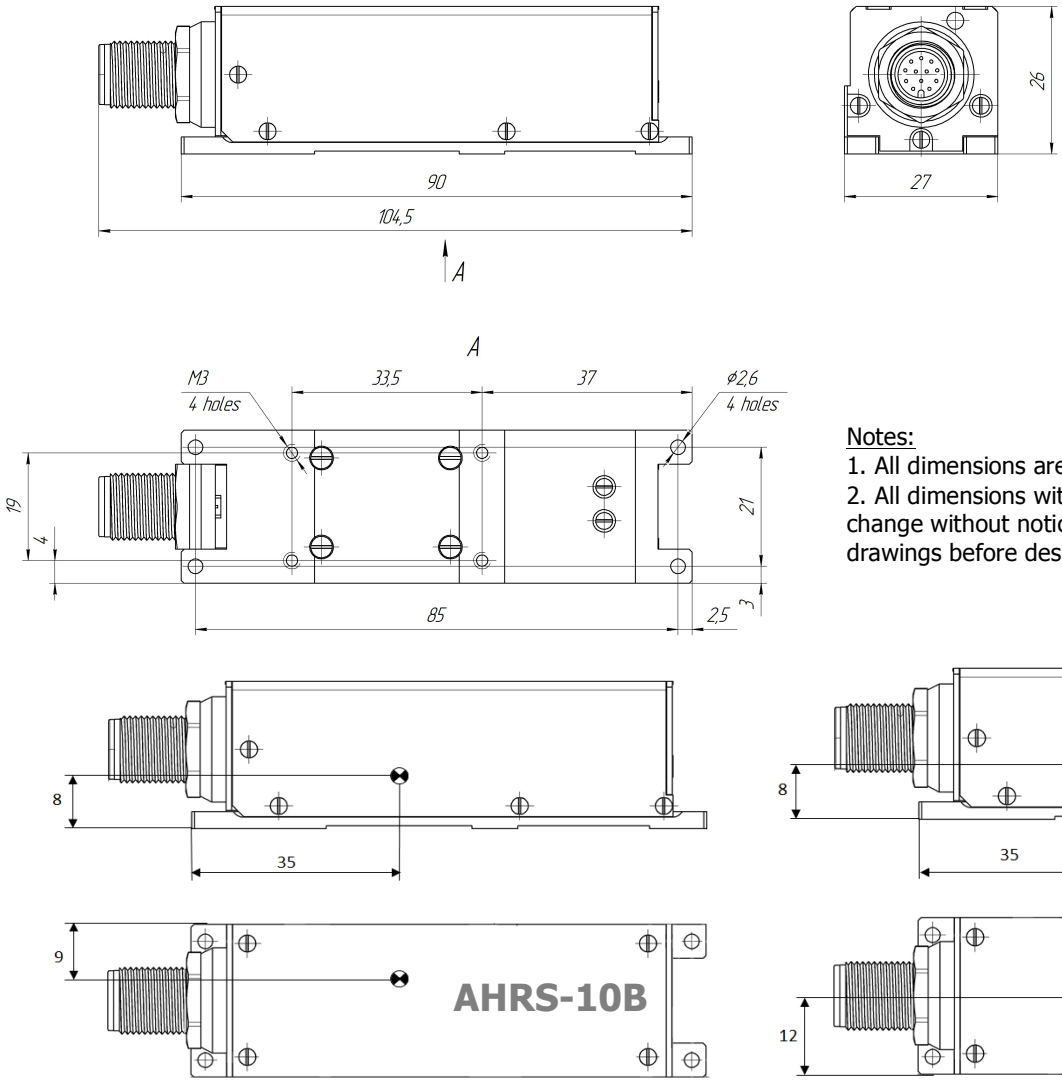
In operation over time and temperature fluxgate magnetometers have superior stability and repeatability. In terms of sensitivity, fluxgate magnetometers provide up to two orders of magnitude increased sensitivity.

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.

AHRS-10B and AHRS-10P Specifications

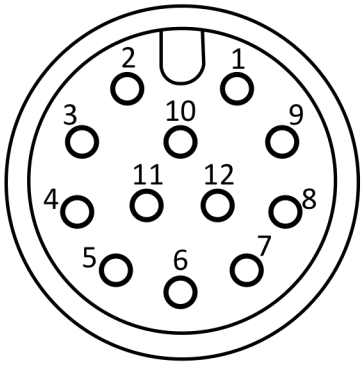
Parameter	Units	AHRS-10B	AHRS-10P
Output signals	Heading, Pitch, Roll; Quaternion; Relative Altitude; PPS Time; Accelerations; Angular rates; Magnetic field; Delta Theta & Delta Velocity		
Update rate	Hz	1 … 200 (user settable)	
Start-up time	sec	< 1	
Heading	**Units**	**AHRS-10B**	**AHRS-10P**
Range	deg	0 to 360	0 to 360
Angular Resolution	deg	0.01	0.01
Static Accuracy in Temperature Range	deg	0.8	0.3
Dynamic Accuracy	deg RMS	1	0.6
Pitch and Roll	**Units**	**AHRS-10B**	**AHRS-10P**
Range: Pitch, Roll	deg	±90, ±180	±90, ±180
Angular Resolution	deg	0.01	0.01
Static Accuracy in Temperature Range	deg	0.2	0.1
Dynamic Accuracy	deg RMS	0.5	0.3
Relative altitude	**Units**	**AHRS-10B**	**AHRS-10P**
Measurement range	meters	-600 to 9000	-600 to 9000
Resolution	meters	0.01	0.01
Relative accuracy	meters	<1	<1
Gyroscopes	**Units**	**AHRS-10B**	**AHRS-10P**
Measurement range	deg/sec	±2000	±450
Bandwidth	Hz	50	50
Bias in-run stability (RMS, Allan Variance)	deg/hr	8	1
Bias residual error in temperature range, RMS	deg/hr	720	<30
SF accuracy	%	0.5	0.05
Noise density	deg/sec√Hz	0.006	0.004
Non-linearity	%	0.1	0.01
Axis misalignment	mrad	0.2	0.15
Accelerometers	**Units**	**AHRS-10B**	**AHRS-10P**
Measurement range	g	±8	±8
Bandwidth	Hz	50	50
Bias in-run stability (RMS, Allan Variance)	mg	0.005	0.005
Bias residual error in temperature range, RMS	mg	<0.5	<0.5
SF accuracy	%	0.01	0.01
Noise density	mg√Hz	0.025	0.025
Non-linearity	%	0.05	0.05
Axis misalignment	mrad	0.1 mrad	0.1 mrad
Magnetometers	**Units**	**AHRS-10B**	**AHRS-10P**
Measurement range	Gauss	±8	±1.6
Bias in-run stability, RMS	nT	0.8	0.2
Noise density, PSD	nT√Hz	0.5	0.3
SF accuracy	%	0.1	0.02
Environment	**Units**	**AHRS-10B**	**AHRS-10P**
Operating temperature	deg C	-40 to +70	-40 to +70
Storage temperature	deg C	-50 to +85	-50 to +85
MTBF (G_M)	hours	100,000	100,000
Electrical	**Units**	**AHRS-10B**	**AHRS-10P**
Supply voltage	V DC	9 to 28	9 to 28
Power consumption	Watts	0.75	2.0
Output Interface	-	RS-232, RS-422	RS-232, RS-422
Output data format	-	Binary, NMEA ASCII	Binary, NMEA ASCII
Physical	**Units**	**AHRS-10B**	**AHRS-10P**
Size	mm	90 x 27 x 26	90 x 27 x 26
Weight	gram	77	84

AHRS-10B and AHRS-10P 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.

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



859-012-103R004 NorComp
12 Position Circular Connector Receptacle, Male Pins Solder Cup Gold

1	RS422-A	RS-422 Non-Inverting Input
2	RS232-RX	RS232 Receiver Input
3	RS232-TX	RS232 Transmitter Output
4	Power	Power Supply Input 9V-28V
5	ExtInp	3.3 V External input
6	1PPS	Pulse Per Second
7	RS422-Z	RS-422 Inverting Output
8	RS422-Y	RS-422 Non-Inverting Output
9	RS422-B	RS-422 Inverting Input
10		Reserved
11	Ground	Power Supply Return
12	GND	Ground signal