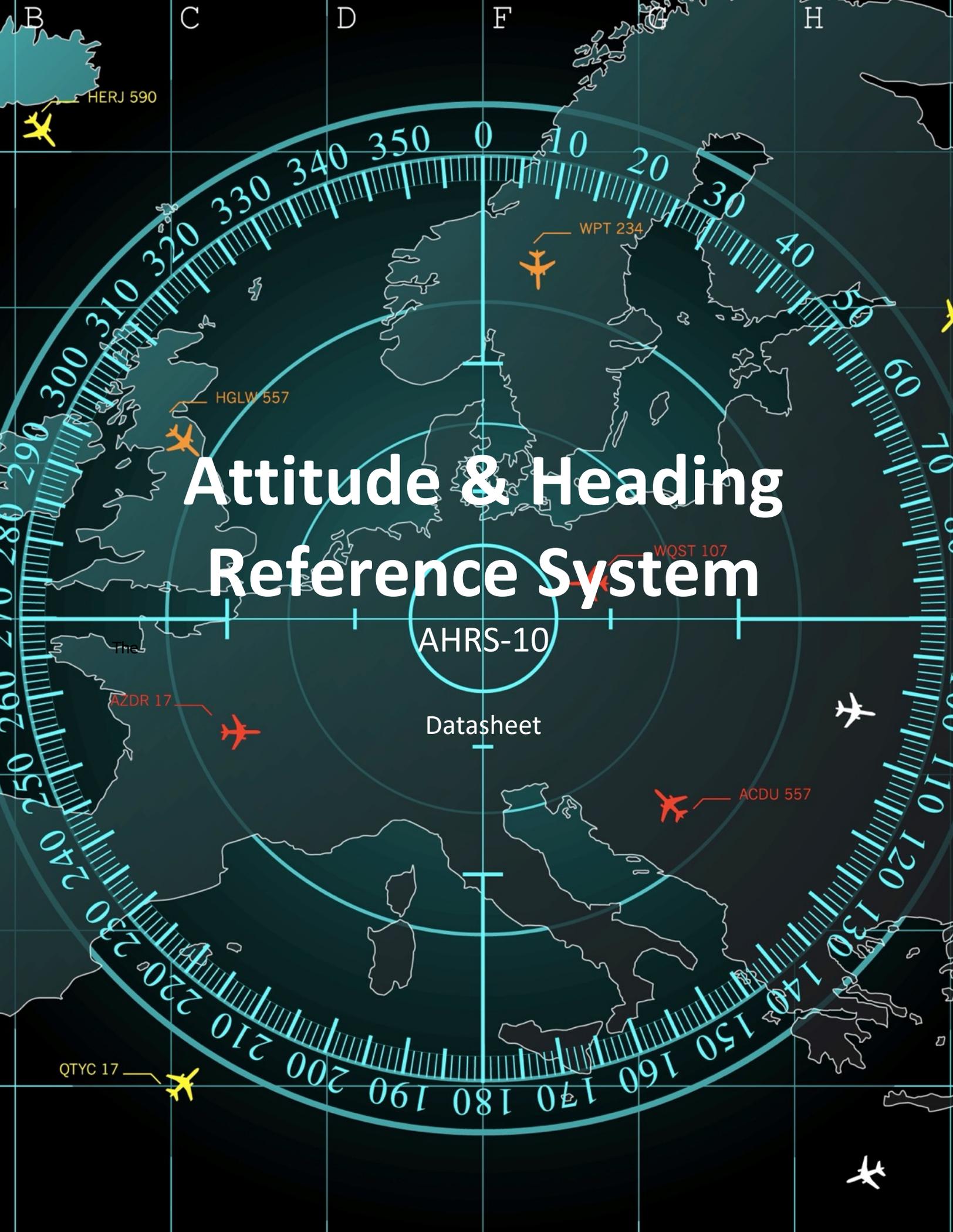


Attitude & Heading Reference System

AHRS-10

Datasheet



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.



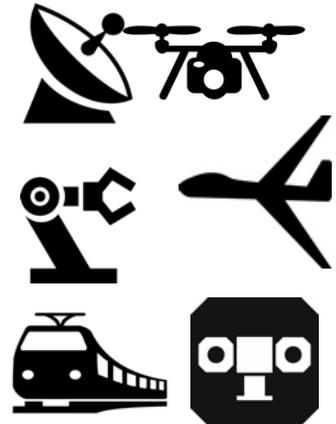
The Inertial Labs AHRS-10 utilizes 3-axes each of precision accelerometers, magnetometers and gyroscopes to provide accurate Heading, Pitch and Roll of the device under measure. Integration of gyroscopes' output provides high frequency, real-time measurement of the device rotation about all three rotational 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	0.6 deg	0.6 deg
Pitch & Roll dynamic accuracy in temperature range, RMS	0.08 deg	0.08 deg
Gyroscopes Bias instability in temperature range, RMS	72 deg/hr	35 deg/hr
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-422	RS-232, RS-422, CAN

KEY FEATURES AND FUNCTIONALITY

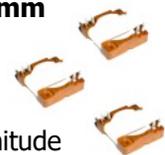
- Two models (10B and 10P) with differentiated performance and price
- State-of-the-art algorithms for different dynamic motions of Robots, UAV, UUV, UGV, AGV, ROV, Gimbals and Antennas
- Highly accuracy Magneto-Inductive and Fluxgate magnetometers
- Gyro-Stabilized Slaved Magnetic Heading
- Suitable 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.

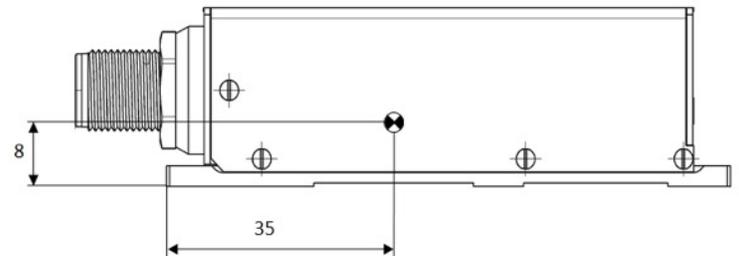
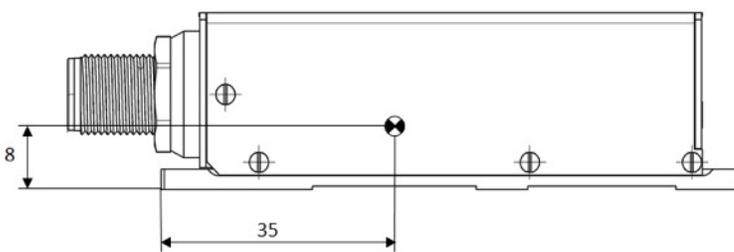
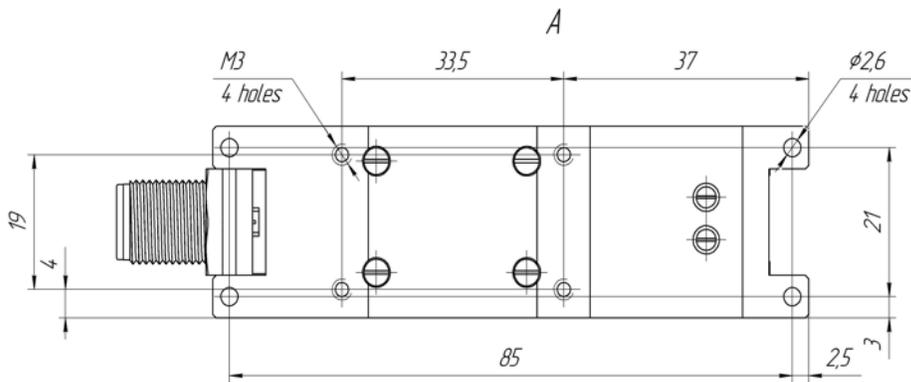
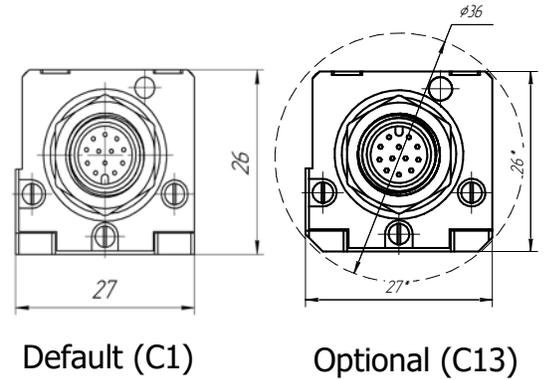
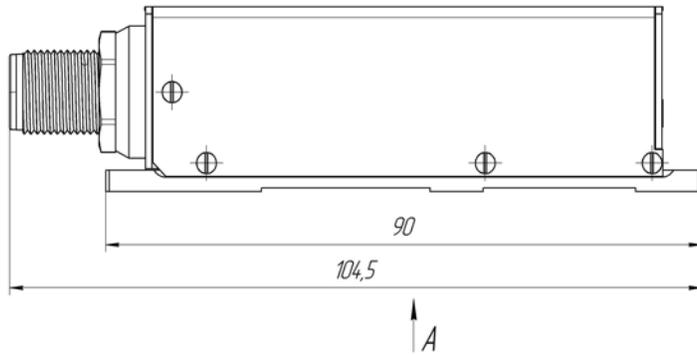
In operation over time and temperature fluxgate magnetometers have superior stability and repeatability. In terms of sensitivity, fluxgate magnetometers provide up to two orders of magnitude increased sensitivity.

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.



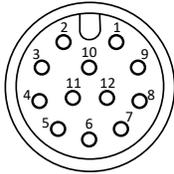
Parameter	Units	AHRS-10B	AHRS-10P
Output signals	Heading, Pitch, Roll; Quaternion; Relative Altitude; PPS Time; Accelerations; Angular rates; Magnetic field; Delta Theta & Delta Velocity		
Available colors of enclosure	Black (default), Desert Tan or Green (optional)		
Update rate	Hz	1 ... 200 (Heading, Pitch, Roll)	
Update rate	Hz	200 (IMU data)	2000 (IMU data)
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, RMS	0.3	0.3
Dynamic Accuracy	deg RMS	0.6	0.6
Data rate	Hz	200	200
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, RMS	0.05	0.05
Dynamic Accuracy	deg RMS	0.08	0.08
Data rate	Hz	200	200
Relative altitude	Units	AHRS-10B	AHRS-10P
Measurement range	meters	-600 to 9000	-600 to 9000
Resolution	meters	0.01	0.01
Gyroscopes	Units	AHRS-10B	AHRS-10P
Measurement range	deg/sec	±2000	±450 / ±950 / ±2000
Bandwidth	Hz	260	260
Bias in-run stability (RMS, Allan Variance)	deg/hr	2	1
Bias residual error in temperature range, RMS	deg/hr	72	35
SF accuracy	ppm	1000	1000
Noise (ARW)	deg/hr	0.38	0.2
Non-linearity	ppm	350	100
Axis misalignment	mrad	0.15	0.15
Accelerometers	Units	AHRS-10B	AHRS-10P
Type	Tactical-grade		Tactical-grade
Measurement range	g	±8 g / ±15 g / ±40 g	±8 g / ±15 g / ±40 g
Bandwidth	Hz	260	260
Bias in-run stability (RMS, Allan Variance)	mg	0.005 (±8 g) / 0.02 (±15 g) / 0.03 (±40 g)	0.005 (±8 g) / 0.02 (±15 g) / 0.03 (±40 g)
Bias instability over temp. range (RMS)	mg	0.5 (±8 g) / 0.7 (±15 g) / 1.2 (±40 g)	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)	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)	0.015 (±8 g) / 0.035 (±15 g) / 0.045 (±40 g)
SF accuracy	ppm	150 (±8 g) / 300 (±15 g) / 500 (±40 g)	150 (±8 g) / 300 (±15 g) / 500 (±40 g)
Non-linearity	ppm	150	150
Axis misalignment	mrad	0.1 (±8 g) / 0.1 (±15 g) / 0.15 (±40 g)	0.1 (±8 g) / 0.1 (±15 g) / 0.15 (±40 g)
Magnetometers	Units	AHRS-10B	AHRS-10P
Technology	Magneto Inductive		Fluxgate
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 +75	-40 to +75
Storage temperature	deg C	-50 to +85	-50 to +85
Shock & Vibrations	MIL-STD-810G		MIL-STD-810G
MTBF (G _M)	hours	100,000	100,000
Electrical	Units	AHRS-10B	AHRS-10P
Supply voltage	V DC	5 to 15	9 to 28
Power consumption	Watts	0.5	2.0
Output Interface	-	RS-422	RS-232 / RS-422 / CAN
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.

Electrical interface description



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

AHRS-10B and AHRS-10P		
RS-422 interface		
PIN	Signal	Description
1	RS422-A	RS-422 Non-Inverting input
2	DNC	Reserved
3	DNC	Reserved
4	Power	Power Supply Input 5V-15V DC
5	ExtTrig	3.3 V External trigger input
6	TOV	3.3 V Time of validity output
7	RS422-Z	RS-422 Inverting Output
8	RS422-Y	RS-422 Non-Inverting Output
9	RS422-B	RS-422 Inverting Input
10	LD	Load (leave floating)
11	Ground	Power Supply Return
12	GND	Ground signal

AHRS-10P only		
RS-232 and CAN interfaces		
PIN	Signal	Description
1	RS232-RX-2	Secondary RS-232 Receiver Input
2	RS232-RX	RS-232 Receiver Input
3	RS232-TX	RS-232 Transmitter Output
4	Power	Power Supply Input 9V-30V DC
5	ExtInp	3.3 V External input
6	1PPS/TOV	Pulse Per Second/ Time of validity output
7	CAN-L	CAN (Low) - Bus differential signal
8	CAN-H	CAN (high) - Bus differential signal
9	RS232-Tx-2	Secondary RS-232 Transmitter Output
10	LD	Load
11	Ground	Power Supply Return
12	GND	Ground signal

AHRS-10B part numbers description

Model	Gyro	Accel	Calibration	Connector	Color	Version	Interface
AHRS-10B	G2000	A8 A15 A40	TMGA	C1 (default) C4 (obsolete) C13 (modified enclosure)	B (default) D G	V2	2

Example: AHRS-10B-G2000-A8-TMGA-C1-B-V1.2

AHRS-10P part numbers description

Model	Gyro	Accel	Calibration	Connector	Color	Version	Interface
AHRS-10P	G450 G950 G2000	A8 A15 A40	TMGA	C1 (default) C4 (obsolete) C13 (modified enclosure)	B (default) D G	V1	12 13

Example: AHRS-10P-G450-A8-TMGA-C1-B-V1.12

Description:

- G450: Gyroscopes measurement range = ± 450 deg/sec
- G950: Gyroscopes measurement range = ± 950 deg/sec
- G2000: Gyroscopes measurement range = ± 2000 deg/sec
- A8: Accelerometers measurement range = ± 8 g
- A15: Accelerometers measurement range = ± 15 g
- A40: Accelerometers measurement range = ± 40 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
- C13: 12 pins connector with modified enclosure (36 mm diameter – see above drawing)
- B: Black color (default)
- D: Desert tan color (optional)
- G: Green color (optional)
- V2.2 RS-422 (AHRS-10B)
- V1.12: RS-232 and RS-422 (AHRS-10P)
- V1.13: RS-232 and CAN