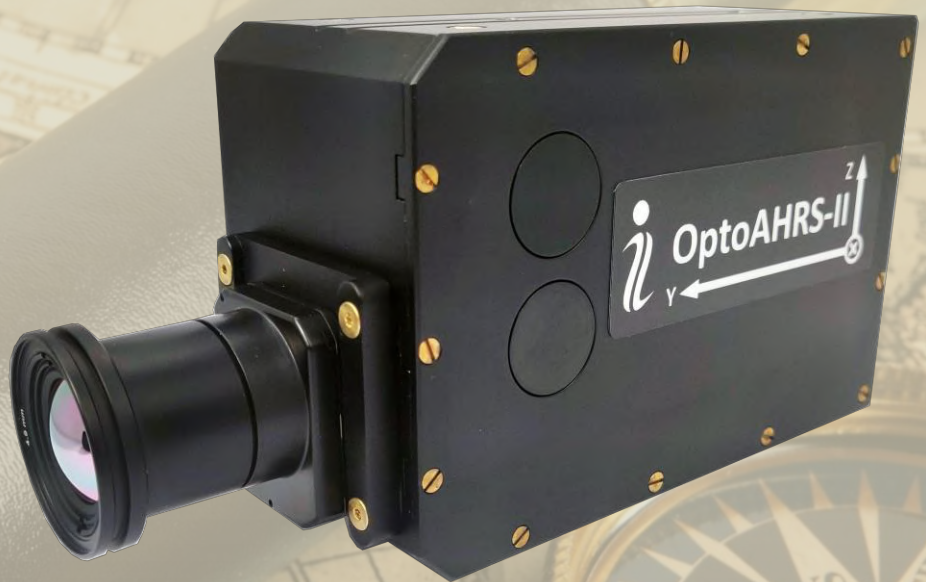Inertial Labs

Attitude is Everything

Optically Enhanced Attitude & Heading Reference System
"OptoAHRS™-II"

Developed by **Inertial Labs,** the Optically-enhanced **Attitude and Heading Reference System – OptoAHRS^{TM}-II** is a small size, lower power consumption, precise North-finding and North-keeping system. It combines technologies of inertial sensors with optical image tracking resulting in a robust and reliable 3DOF orientation module capable of operation in virtually any environment.

After a successful magnetic calibration, high precision magnetometer headings can be obtained in environments with an undisturbed Earth magnetic field. With the addition of optical image tracking, the Inertial LabsTM OptoAHRS-II is also able to mount directly to the device under measure, and with one known reference direction, can be turned on and operated immediately without any magnetic calibration or reliance on magnetic field whatsoever.

OptoAHRS^{TM}-II works through the use of reference images. A reference image can be any picture of the horizon or nearby environment in a single direction. Within the reference image, the system identifies a constellation of visual features. From any subsequent image collected by the camera, heading is determined by comparing the new constellation of features back to that of the appropriate reference.

By incorporating optical orientation data into the sensor fusion solution, the device can be resilient against changes in magnetic interferences present in the environment during operation.

Each of the technologies compensate for each other's deficiencies and errors, acting as a self checking and calibrating system. For example, if a magnetic change is sensed, but the camera and accelerometers see no change - the magnetic change is ignored.

Applications:
- Land Survey;
- Geodesy and Cartography;
- Crane Safety and Control Systems;
- Geospatial Systems;
- Oil & Gas Drilling;
- Antenna Pointing Systems;
- Platforms for North-Finding and North-Keeping.
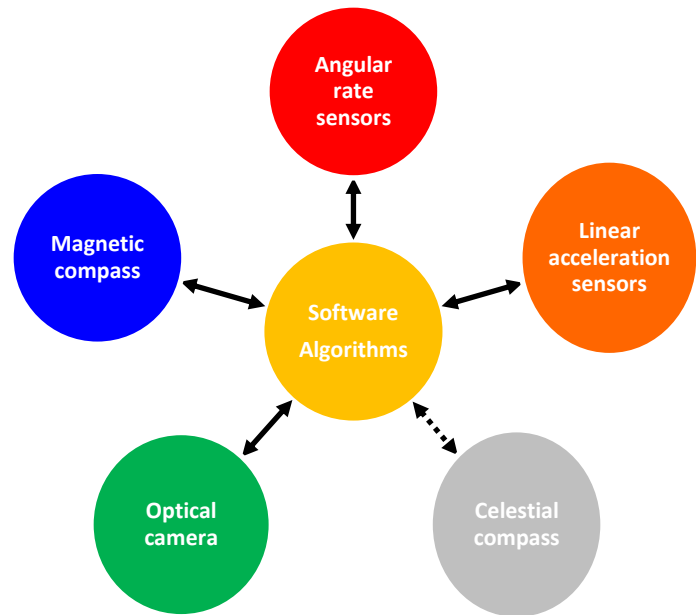
KEY FEATURES AND FUNCTIONALITY

- OptoAHRS^{TM}-II eliminates large errors inherent with Digital Magnetic Compass technology
- Hybrid North Finding and North Keeping System
- Real-time optical and inertial sensors orientation tracking
- Highly accurate, sensitive, and temperature stable Fluxgate magnetometers (in-house technology)
- Advanced, extendable, embedded Kalman Filter based sensor fusion algorithms
- Embedded 2D and 3D magnetic calibration on hard and soft iron
- Environmentally sealed (IP67)

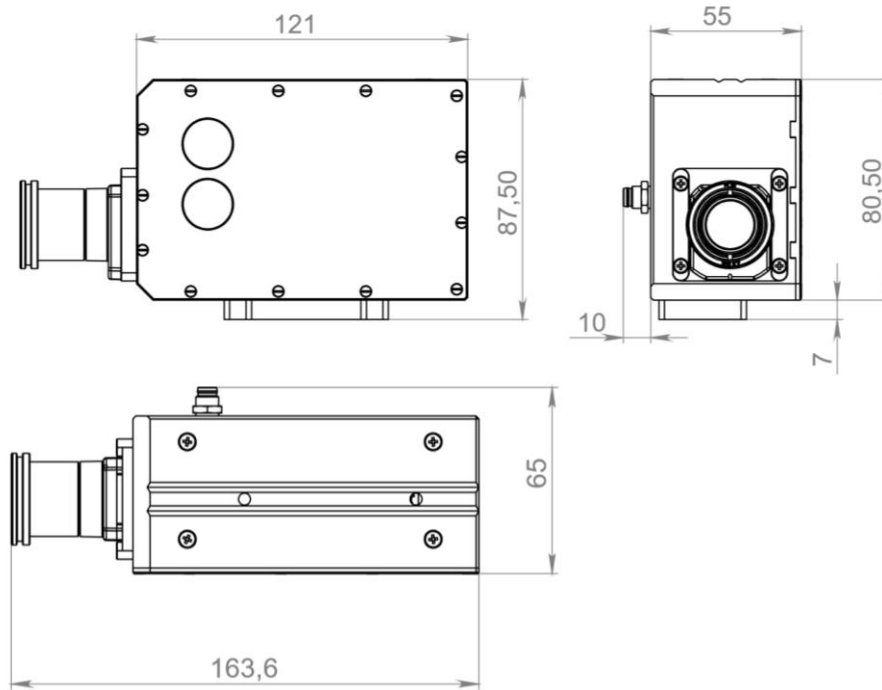**Inertial Labs Inc.^{TM}** Address: 39959 Catoctin Ridge Street, Paeonian Springs, VA 20129, USA
Tel: +1 (703) 880-4222, Fax: +1 (703) 991-5378 Website: www.inertiallabs.com
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OptoAHRS™-II Specifications

Parameter	Units	
Output signals		Heading, Pitch, Roll; Azimuth and Elevation
Update rate	Hz	100
Start-up time [1]	sec	40
Initial Alignment Time [2]	sec	5
Heading		
Range	deg	0 to 360
Angular resolution	deg	0.01
Accuracy (0 to 360 deg, relative to the 1st reference)	deg	<0.2
Noise (at 100 Hz output)	deg RMS	<0.02
Attitude		
Range: Pitch, Roll (autonomous)	deg	0 to 360
Angular resolution	deg	0.01
Accuracy in whole temperature range	deg	0.08
Noise (@100 Hz)	deg RMS	0.02
IMU		
Gyroscopes bias in-run stability	deg/hr	1
Accelerometers bias in-run stability	mg	0.005
Magnetometer bias in-run stability	nT	0.1
Environment		
Operating temperature	deg C	-30 to +70
MTBF	hours	55500
Electrical		
Supply voltage	V DC	7.5 to 14
Power consumption	W	5.5[3]
Interface		
Standard	-	Ethernet
Rate	Mbit/sec	100
Physical		
Size	mm	163.6 × 80.5 × 55
Weight	gram	784

[1] Start-up time assumes the boot up of the system from initial power on or system reboot

[2] Initial alignment involves the time that the system takes to analyze the sensor biases prior to outputting accurate orientation data. This parameter is configurable and can be set as low as 1 sec, but 5 seconds is recommended for peak performance

[3] This parameter is based on day camera version only. Different camera options have different power requirements

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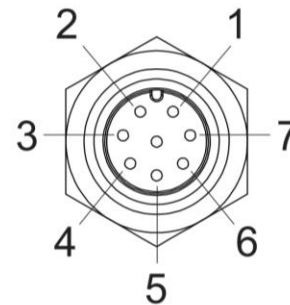**OptoAHRS™-II Mechanical Interface Drawing (Day/Night Camera Version)**

OptoAHRS™-II Mechanical Interface Drawing (Day Camera Version)
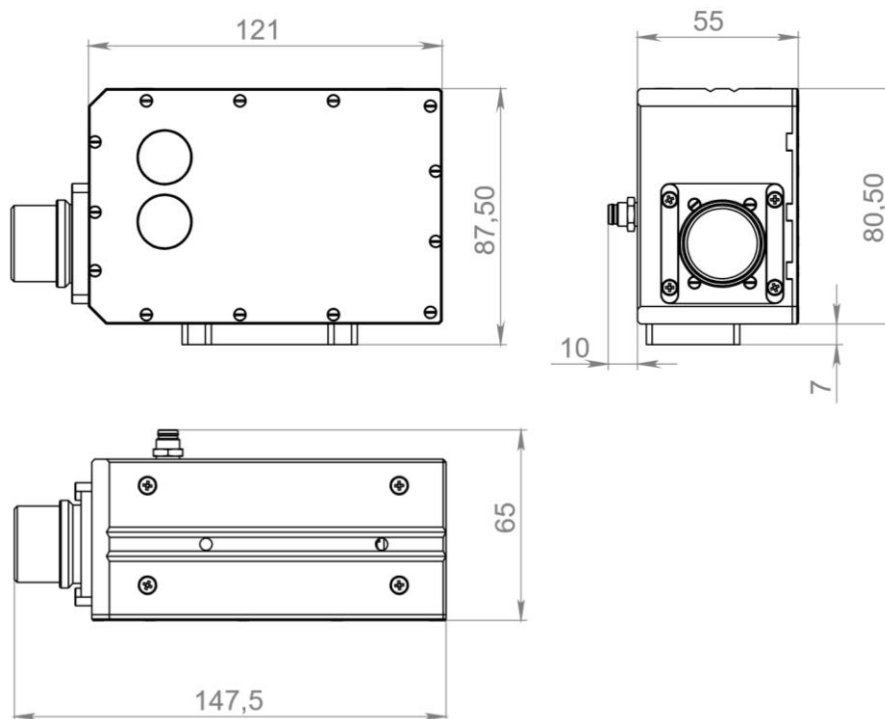
OptoAHRS^{TM}-II Electrical Interface Diagram and Pinout
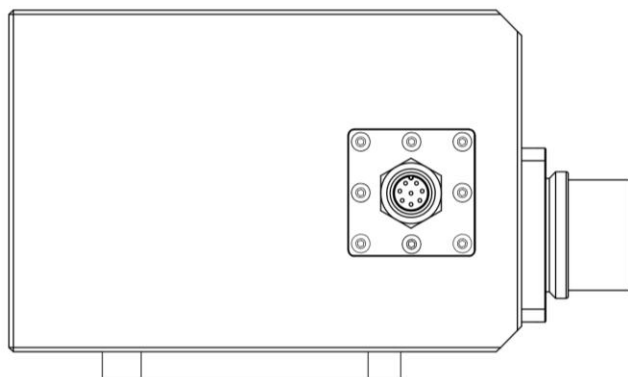
Binder 09-3487-86-08

POWER PINS	
POWER	1
GROUND	2

DATA PINS	
ERHX-	3
ERHX+	4
ETHX-	5
ETHX+	6

AUX. PINS	
URT_TX	7
URT_RX	8

URT_RX - leave unconn
URT_TX - leave unconn

Notes:
1.   All dimensions are in millimeters.
2.   All dimensions within these drawings are subject to change without notice. Customers should obtain final drawings before designing any interface hardware.
3.   Refer to the OptoAHRS^{TM}-II Interface Control Document for complete details.

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