



Optically Enhanced Attitude & Heading Reference System

“OptoAHRSTM-II”



Developed by **Inertial Labs**, the Optically-enhanced **Attitude and Heading Reference System** – **OptoAHRSTM-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 OptoAHRSTM-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.

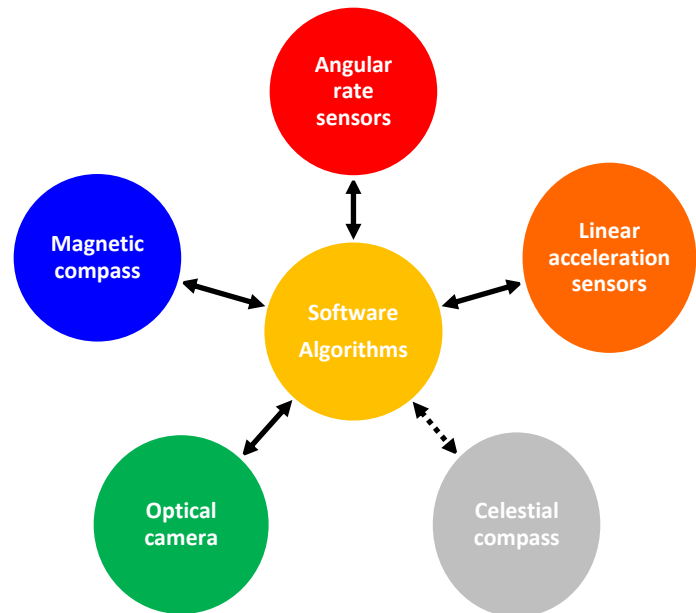
OptoAHRSTM-II works through the use of reference images. A reference image can be any picture of the horizon or nearby environment in a single direction. Within the reference image, the system identifies a constellation of visual features. From any subsequent image collected by the camera, heading is 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

- OptoAHRSTM-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)

OptoAHRSTM-II Specifications

Parameter	Units	Value
Heading		
Range	deg	0 to 360
Magnetic Initialization Accuracy	deg	0.35
Relative Accuracy ⁽¹⁾	deg	0.2
Attitude		
Range: Pitch, Roll	deg	0 to 360
Accuracy	deg	0.05
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		
Lighting Conditions ⁽²⁾		Day & Night
Operating Temperature	deg C	-30 to +75
Operational Vibration	MIL-STD-810G	7g, 20 – 2000 Hz
Operational Shock	MIL-STD-810G	400 g, 0.001 sec
MTBF	hours	55500
Electrical		
Supply Voltage	V DC	9.0 to 14
Power Consumption (Idle)	W	2.0
Power Consumption (Operational) ⁽²⁾	W	5.5
Startup		
Boot Time ⁽³⁾	sec	16
Startup Time ⁽⁴⁾	sec	16
Initial Alignment Time ⁽⁵⁾	sec	5
Interface		
Standard	-	Ethernet
Communication Protocols	-	UDP, TCP
Data Rate	Mbit/sec	100
Update Rate	Hz	100
Orientation Data Format	-	Double Precision Quaternion
Input from External Source of Heading	-	Yes
Physical		
Size ⁽²⁾	mm	163.6 × 80.5 × 55
Weight ⁽²⁾	gram	784

⁽¹⁾ Relative Accuracy is the in-operation error from a known initial reference

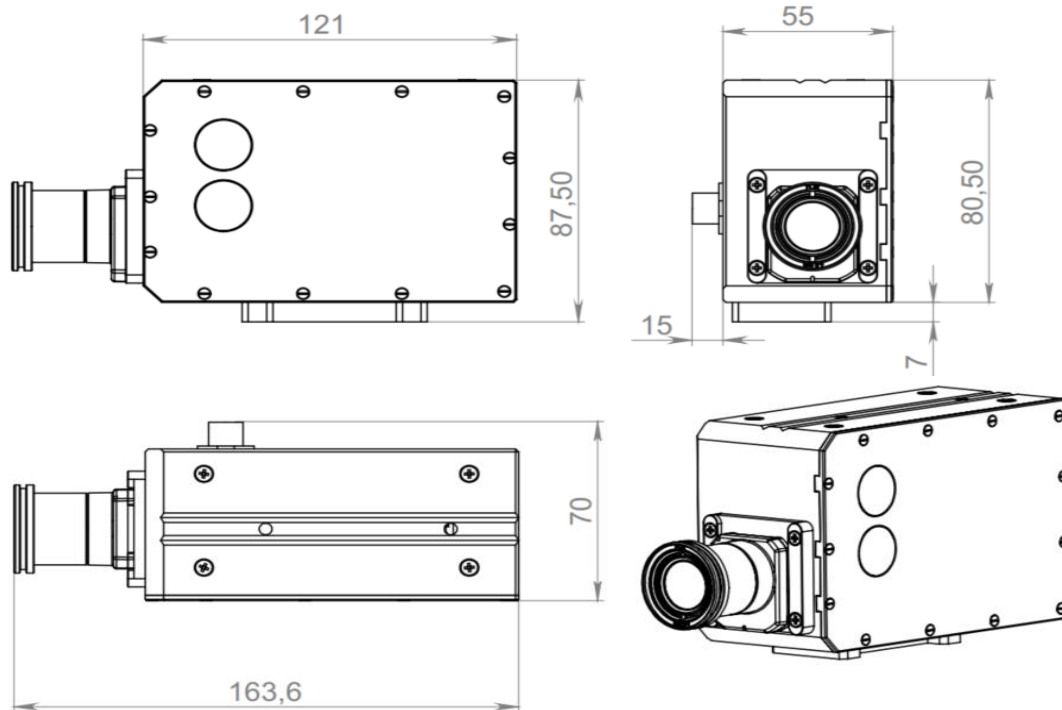
⁽²⁾ This specification is based on Day/Night Camera version OptoAHRSTM-II. The Day Camera version OptoAHRSTM-II will have a slightly different specification.

⁽³⁾ Boot Time defines the time between the moment of power supply and the moment of device readiness. Does not include the Startup Time.

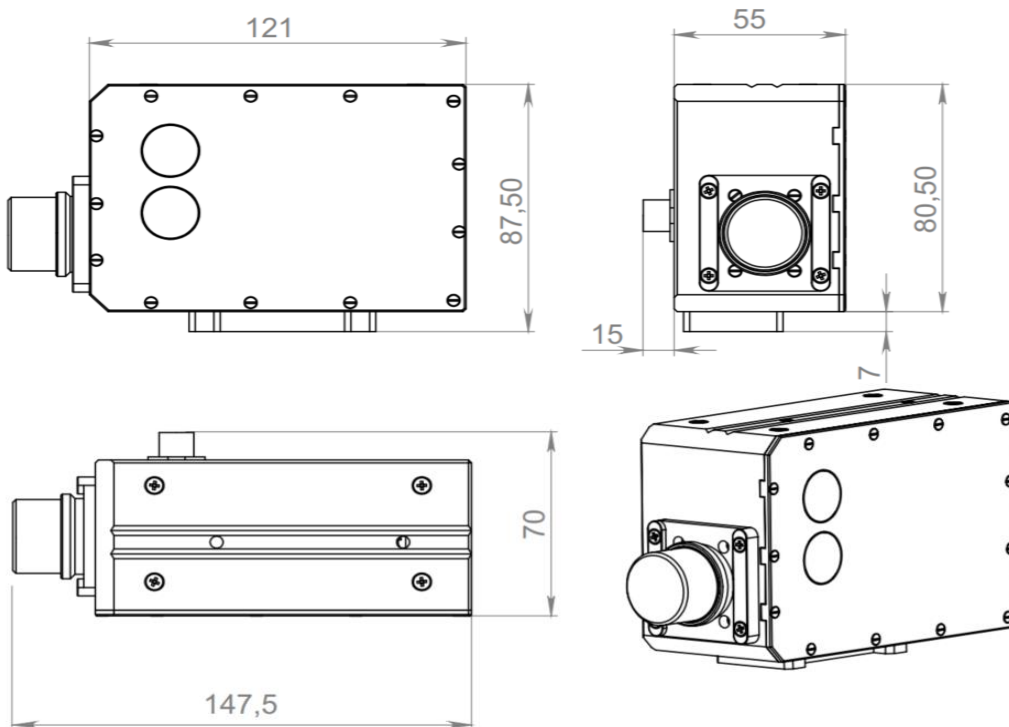
⁽⁴⁾ Startup Time defines the time between the Start Filter command and the first orientation data being produced. Includes the Initial Alignment Time. Does not include the Boot Time.

⁽⁵⁾ Initial Alignment is the period during which sensor biases are observed and adjusted prior to outputting accurate orientation data. During this period, the device must be kept still (and away from magnetic influences when using magnetic initialization).

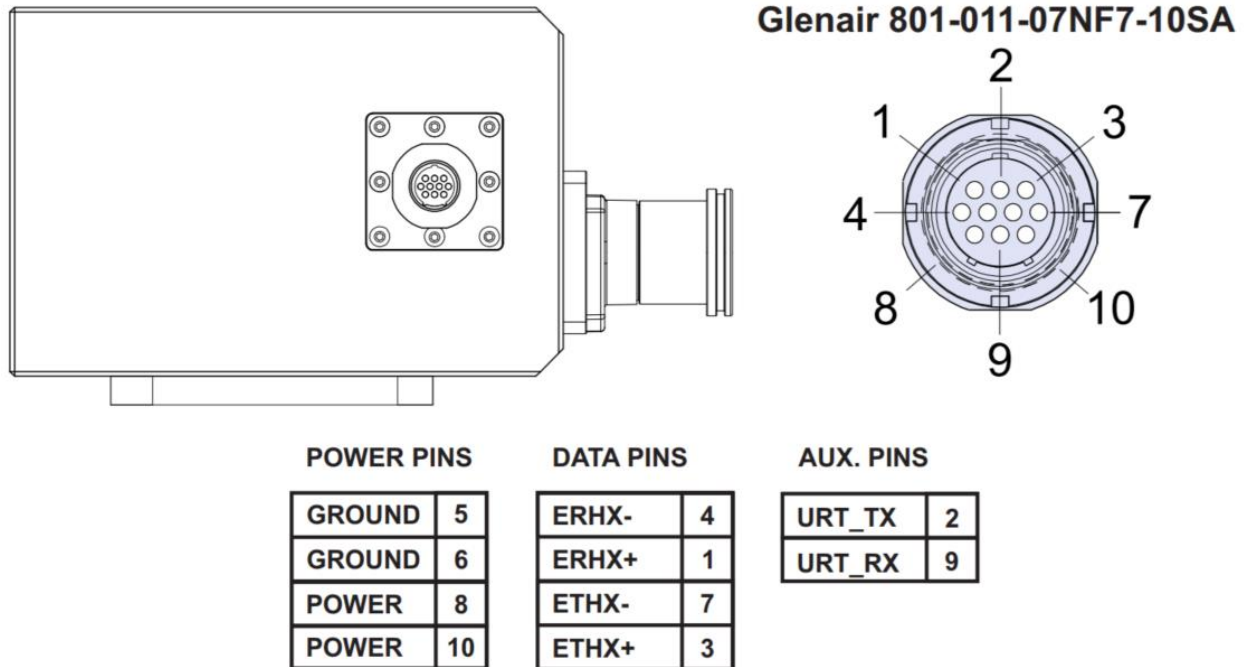
OptoAHRSTM-II Mechanical Interface Drawing (Day/Night Camera Version)



OptoAHRSTM-II Mechanical Interface Drawing (Day Camera Version)



OptoAHRSTM-II Electrical Interface Diagram and Pinout



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 OptoAHRSTM-II Interface Control Document for complete details.