Optically Enhanced
Weapon Orientation Module
OptoWOM

Datasheet

Revision 1.11

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The **Inertial Labs**^{TM}**, O**ptically enhanced **W**eapon **O**rientation **M**odule - **OptoWOM**, 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. With the addition of optical image tracking the system is now able to mount directly to a device under measure, and with one known reference direction, can be turned on and operated immediately without any magnetic calibration whatsoever. During operation, the device's magnetometer calibrations are able to be derived on-the-fly allowing for the device to operate with both optical and magnetic heading determination.

OptoWOM works through the use of reference images. A reference image is literally a picture of the horizon in a given direction. Within the reference image the system identifies a constellation of identifiable features. Then, from any subsequent image collected by the camera, heading is determined by comparing those images back to the most appropriate reference. As long as the system can identify 20% of the features of a previously collected reference, it can provide an accurate assessment of the change in heading.

Additionally, when the system is operating with good optical data, it uses the information it collects to continuously check results against magnetic heading information and dynamically calibrates the device against magnetic interferences present in the application.

KEY FEATURES AND FUNCTIONALITY

- Hybrid Inertial Orientation System
- Real-time optical and inertial sensors weapon orientation tracking
- Highly accurate, sensitive, and temperature stable Fluxgate magnetometers (in-house technology)
- Gyro-Stabilized Slaved Magnetic Heading
- Advanced, extendable, embedded 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
- Up to 100Hz data update rate
- Tested to MIL-STD-810F, MIL-STD-461D and DO-160D standards
- Environmentally sealed (IP67)

Reference Frame (Target 1)
Heading: 263.5 deg
Pitch: 60 deg

Features from original reference are visible in new image and tracked

Target 4
Actual Heading: 239.88 deg
Measured Heading: 239.84
Pitch: 51.6 deg

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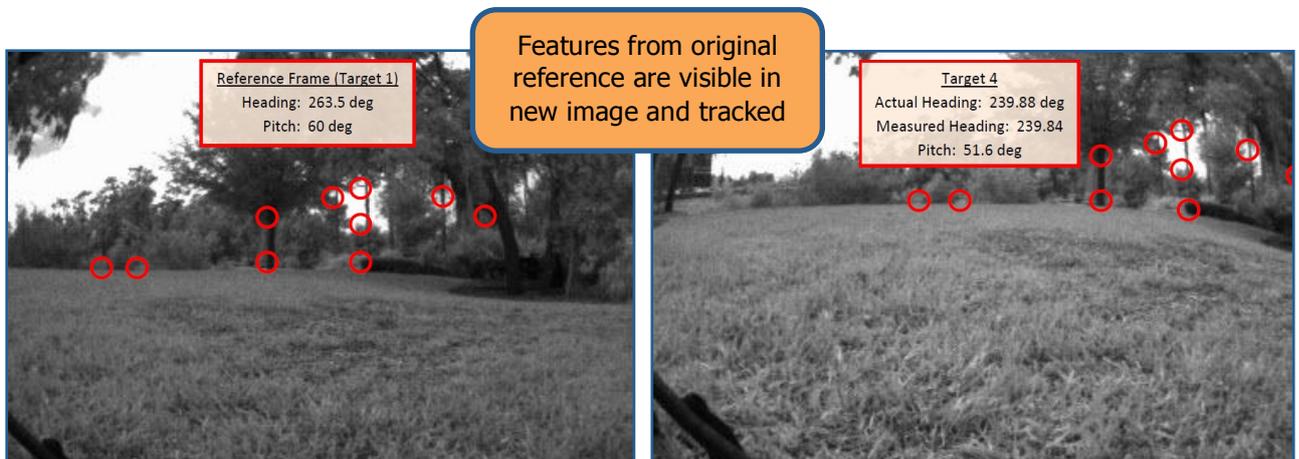
OptoWOM specifications

Parameter	Units	
Output signals		Heading, Pitch, Roll; Azimuth and Elevation
Update rate	Hz	100
Start-up time [1]	sec	10
Full accuracy data (Warm-up Time) [2]	sec	30
Heading		
Range	deg	0 to 360
Angular resolution	mils	0.8
Accuracy (0 to 360 deg, relative to the 1st reference) [3]	mils	<3
Noise (at 100 Hz output)	mils	0.3
Attitude		
Range: Pitch, Roll (autonomous)	deg	0 to 360
Range: Pitch, Roll (optical)	deg	±22.5
Angular resolution	mils	0.8
Static accuracy in whole temperature range	mils	1.7
Noise (@100 Hz)	deg RMS	0.02
Angular Rate		
Gyroscopes measurement range	deg/sec	±300
In-run bias stability (RMS, Allan Variance)	deg/hr	<30
Scale factor accuracy	%	0.1
Gyroscopes noise	deg/sec√Hz	0.035
Axis misalignment	mrad	0.15
Resolution	deg/sec	0.01
Bandwidth	Hz	50
Linear Acceleration		
Accelerometers measurement range	g	±2
In-run bias stability at constant temperature	mg RMS	0.05
Bias stability in whole temperature range	mg RMS	1
Bias turn-on, turn-on repeatability	mg RMS	0.1
Scale factor accuracy	%	0.1
Accelerometers noise	mg√Hz	0.04
Axis misalignment	mrad	0.15
Resolution	mg	0.1
Bandwidth	Hz	50
Environment		
Operating temperature	deg C	-30 to +70
Non-operating vibration [4]	g, Hz	10-50Hz, 0.15mm/55-500Hz 2.0g
Non-operating shock [5]	g, ms	50g, 11ms, half sine wave
MTBF	hours	55500
Electrical		
Supply voltage	V DC	12 to 36
Power consumption	W	3.5
Interface		
Standard	-	USB
Rate	Mbit/sec	480
Physical		
Size	mm	129 × 48 × 48
Weight	gram	400 (w/o camera cap, splitter box, and cable); 600 (full set)

OptoWOM Specifications Notes
[1] it may be reduced on request
[2] including the time of initial alignment
[3] upon loop closure (see the corresponding section of the OptoWOM Demo Program user's manual)
[4] MIL-STD 810F. Method 514.5. Procedure I
[5] MIL-STD 810F. Method 516.5. Procedure I

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OptoWOM Mechanical Interface Drawing
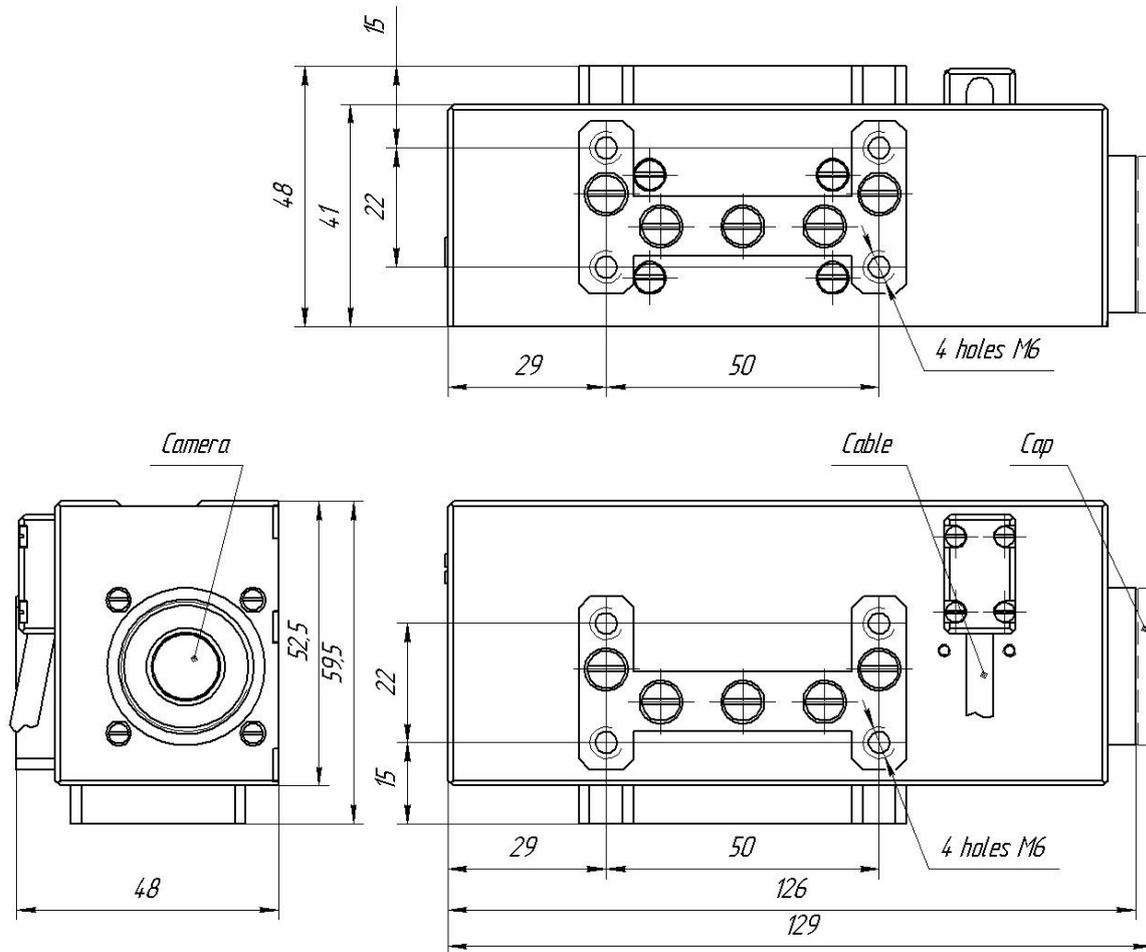
Notes:
1.   All dimensions are in millimeters.
2.   All dimensions within this drawing are subject to change without notice. Customers should obtain final drawings before designing any interface hardware.

OptoWOM Electrical Interface Description

The Inertial Labs[TM] OptoWOM is equipped with a USB Cable with a USB standard "Type A" plug to connect it to PC or Tablet PC. The USB port of a PC/Tablet PC shall meet the requirements of Universal Serial Bus Specification Revision 2.0 (USB 2.0).

To connect it to power, the device is equipped with a male DC PC-GP2.1 power plug. The "+" outlet of a power source shall be connected to the inner contact of the device power plug. The device shall be powered with DC power in the range of 12…36V.

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