

## OS3D-FG MINIATURE ATTITUDE & HEADING REFERENCE SYSTEM

Datasheet Rev. 2.3 .

### **Inertial Labs** OS3D-FG Datasheet rev. 2.3

The **Inertial Labs OS3D-FG** is a multi-purpose miniature 3D orientation sensor – Attitude and Heading Reference System, designed for use in real-time orientation tracking applications. It includes three types of sensing elements: tri-axial MEMS Gyroscopes, tri-axial high precision MEMS Accelerometers, and tri-axial Fluxgate Magnetometers. The **OS3D-FG** also comes equipped with an onboard processor and embedded orientation algorithms allowing for direct integration into systems without interfacing a PC. Additionally, **OS3D-FG** comes with hard and soft 2D and 3D magnetic calibration algorithms make the **OS3D-FG** eliminate the magnetic influence in the magnetic interference environment.



#### **Applications:**

- Digital inclinometers
- Miniature sonars
- Small gimbals and EOS stabilization
- Robots
- Marine antenna stabilization systems
- Motion Capture Systems
- Training, Simulation and Head Tracking Systems
- Helmets Orientation Systems
- Quadrotor Helicopters and micro UAV
- Small Unmanned Underwater Vehicles, ROV

#### **KEY FEATURES AND FUNCTIONALITY**

- Affordable price
- Fully calibrated in operational temperature range
- Real-time Heading, Pitch and Roll orientation information
- Small size, lightweight and low power consumption (45 × 16 × 14.5 mm; 12 gram; 0.15W)
- 0.8 deg Heading and 0.1 deg Pitch & Roll dynamic accuracy
- State-of-the-art algorithms for different dynamic motions of Robots, micro UAV, small UUV, small Gimbals and Antennas stabilization
- Ideal solution for Free Space Tracking Systems
- Gyro-Stabilized Slaved Magnetic Heading
- Embedded 2D and 3D magnetic calibration on hard and soft iron
- Environmentally sealed (IP67)

Data from the Gyroscopes, Accelerometers, and Magnetometers, as well as the internal temperature sensor are gathered and processed by the on-board digital signal processor (DSP). The fusion algorithm processes these data and outputs the final orientation solution directly from the sensor. Data of the following types can be requested: raw inertial sensors data and/or quaternion data.

Each **OS3D-FG** module is individually calibrated in a special non-magnetic laboratory where reference accelerations, angular rates, and magnetic fields are applied to the device and measured at constant temperature. Additionally, temperature cycling is performed to obtain temperature calibration parameters for the gyro and accelerometer elements. Once fielded, **OS3D-FG** is able to be customer calibrated against softand hard-iron interference present in the end application.

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#### **OS3D-FG Specifications**

Parameter	Units		Va	lue	
Output signals		Accelerations, Angular rates, Magnetic field, Temperature, Pressure,			
Undels and		Quaternion, Heading, Pitch and Roll			
Update rate	Hz	500			
Start-up time	sec	<1			
Latency	msec			2	
Heading					
Range	deg			360	
Angular Resolution	deg			01	
Static accuracy in whole Operational Temperature Range <sup>(1)</sup> , RMS	deg			.5	
Dynamic Accuracy <sup>(2)</sup> , RMS	deg		0	.8	
Attitude					
Range: Pitch	deg			90	
Range: Roll	deg		±1	.80	
Angular Resolution	deg	0.01			
Static Accuracy in whole Operational Temperature Range, RMS	deg		0.	.08	
Dynamic Accuracy <sup>(2)</sup> RMS	deg	0.1			
Sensors		Gyroscopes	Accelero	meters	Magnetometers
Measurement range		±1864 deg/s	±15 g	±40 g	±8.0 Gauss
Bandwidth		200 Hz	200 Hz	200 Hz	200 Hz
Bias in-run Stability (Allan Variance)		<8 deg/hr	0.03 mg	0.05 mg	8 µGauss
Bias instability (in temp. range, RMS)		720 deg/hr	1.1 mg	1.5 mg	15 μGauss
Bias one-year repeatability		1800 deg/hr	2.0 mg	2.5 mg	
Scale Factor Accuracy		500 ppm	700 ppm	850 ppm	500 ppm
SF one-year repeatability		1000 ppm	1400 ppm	1700 ppm	1000 ppm
		0.26 day (1)	0.045	0.06	
Random Walk		0.36 deg/vhr	m/sec/vhr	m/sec/vhr	
Power Spectral Density		0.006 deg/√Hz	0.08 mg/vHz	0.1 mg/vHz	15 µGauss/√Hz
Non-linearity		500 ppm	500 ppm	500 ppm	300 ppm
Axis misalignment		0.15 mrad	0.15 mrad	0.15 mrad	0.15 mrad
Environment					
Operating and storage temperature range	deg C	-40 to +85			
Storage temperature range	deg C	-45 to +90			
MTBF	hours	55,000			
Environmentally sealed		IP67			
Electrical					
Supply voltage	V DC	3.3 to 5.5 (or up to 42, see note 3)			
Current consumption	mA, V	26 mA @ 5.0V			
Power Consumption	W	0.15			
Connector type	-	Binder 0931117104			
Output Interface	-	RS-232, RS-422, TIA/EIA-485A (half-duplex), UART (note 3)			
Baud Rate	bps	2400 - 3000000			
Byte Size	bits	8			
Stop Bites	bits	1			
Parity	-	No			
Physical					
Size	mm		45 v 11	5 x 14 5	
Weight	gram	45 × 16 × 14.5 12			
weight .	S'aiii	1	-		

Specifications Notes:

 $^{(1)}$  in homogeneous magnetic environment, for latitude up to  $\pm 65~\text{deg}$ 

<sup>(2)</sup> dynamic accuracy may depend on type of motion

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#### **OS3D-FG** mechanical interface drawing







#### OEM version of OS3D-FG mechanical interface drawing

The straightness tolerance requirement for installation





**Note 2:** All dimensions within this drawing are subject to change without notice. Customers should obtain final drawings before designing any interface hardware.

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#### OEM version of OS3D-FG, installed in half case mechanical interface drawing







#### **OS3D-FG electrical interface description**

No.	Name	Value	Parameters
1	PWR	supply voltage	3.3V to 5.5V
2	GND	ground, shield	-
3	А	A-RS-485	0.024 - 1 Mbps, 120 Ohm
4	В	B-RS-485	0.024 - 1 Mbps, 120 Ohm

#### OEM version of OS3D-FG electrical interface description

No.	Name	Value	Parameters		
1	PWR	supply voltage	3.3V to 5.5V		
2	GND	ground, shield	-		
3	А	A-RS-485	0.024 - 1 Mbps, 120 Ohm		
4	В	B-RS-485	0.024 - 1 Mbps, 120 Ohm		





Brass screws are recommended

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OS3D-FG Connector (Binder 0931117104)



**Note 3:** The wider supply voltage range (4.5V to 42V) and other interface types (RS-232, RS-422, TTL UART) are available, when using the OS3D-FG multiple interfaces cable (see the picture below).

#### OS3D-FG multiple interfaces cable



#### **OS3D-FG** part numbers structure

Model	Gyro	Accel	Calibration	Connector & Enclosure	Version	Interface
OS3D-FG	G1864	A15	TMGA	C1	V9	1

Example: OS3D-FG-G1864-A15-TMGA-C1-V9.1

- OS3D-FG: Multi-purpose miniature 3D orientation sensor
- G1864: Gyroscopes measurement range = ±1864 deg/sec
- A15: Accelerometers measurement range = ±15 g
- TMGA: Magnetometers, Gyroscopes, and Accelerometers
- C1: 4 pins connector (RS-485)
- V9: Version 9
- VX.1: RS-232 interface