

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 | Value | | | |
|---|-------|---|--------------------|-------------------|---------------|
| Output signals | | Accelerations, Angular rates, Magnetic field, Temperature, Pressure, Quaternion, Heading, Pitch and Roll | | | |
| Update rate | Hz | 500 | | | |
| Start-up time | sec | <1 | | | |
| Latency | msec | | | 2 | |
| Heading | | | | | |
| Range | deg | | 0 to | 360 | |
| Angular Resolution | deg | | 0. | 01 | |
| Static accuracy in whole Operational Temperature Range ⁽¹⁾ , RMS | deg | | 0 | .5 | |
| Dynamic Accuracy ⁽²⁾ , 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 ⁽²⁾ 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 |
| Random Walk | | 0.36 deg∕√hr | 0.045 m/sec/√hr | 0.06 m/sec/√hr | |
| Power Spectral Density | | 0.006 deg/√Hz | 0.08 mg/√Hz | 0.1 mg/√Hz | 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 | - | | Ν | lo | |
| Physical | | | | | |
| Size | mm | 45 × 16 × 14.5 | | | |
| Weight | gram | 1 | 1 | .2 | |

Specifications Notes:

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

⁽²⁾ 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

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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