Motus is a miniature ultra high accuracy MEMS IMU. It features some of the highest accuracy MEMS accelerometers and gyroscopes currently available combined with magnetometers.

Motus is fully calibrated for all sensor errors over a wide temperature range and can be software upgraded to AHRS or INS functionality. It is available in both OEM and enclosed packages.

**PERFORMANCE**
- 0.05 ° Roll and Pitch
- 0.8 ° Heading (magnetic)
- 0.2 °/hr MEMS Gyroscope
- 1000 Hz Update Rate
- 150 g 6 ms Shock Limit

**KEY FEATURES**
- IMU, AHRS and INS options
- Rugged and OEM versions
- 500 ms Hot Start

**APPLICATIONS**
- **AIR**
  - UAV Geopointing
  - UAV Lidar
  - Gimbal Stabilisation
- **LAND**
  - Gimbal Stabilisation
  - Structural Monitoring
  - Vehicle Navigation
- **SEA**
  - AUV Navigation
  - ROV Navigation
  - Hydrography
Motus samples its sensors synchronously at 1000Hz through six individual 24-bit differential ADCs which minimizes noise as well as providing optimal thermal calibration and performance characteristics.

14 separate heavily filtered regulated power supplies ensure that each sensor and ADC is operating off the cleanest possible power supply.

Motus features some of the highest accuracy MEMS accelerometers and gyroscopes currently available. Motus’s inertial performance exceeds some FOG IMUs and is up to 100x smaller and 10x cheaper. Motus is put through Advanced Navigation’s intensive calibration process to provide consistently accurate data over an extended temperature range of -40°C to 85°C.

Motus has been designed from the ground up for mission critical control applications where reliability is very important. It is built on top of a safety oriented real time operating system and all software is designed and tested to safety standards with fault tolerance in mind.

The hardware is designed and manufactured to MIL standards.

Motus outputs temperature calibrated sensor data at 1000 Hz as well as filtered attitude at the same rate. This allows for control of dynamically unstable platforms.
**SPECIFICATIONS**

**NAVIGATION**
- Roll & Pitch Accuracy: 0.05°
- Heading Accuracy (magnetic): 0.8°
- Roll & Pitch Accuracy (external GNSS aided): 0.03°
- Heading Accuracy (external GNSS aided): 0.05°
- Horizontal Position Accuracy (external GNSS aided): 0.8 m
- Vertical Position Accuracy (external GNSS aided): 1.5 m
- Velocity Accuracy (external GNSS aided): 0.007 m/s
- Orientation Range: Unlimited
- Hot Start Time: 500 ms
- Internal Filter Rate: 1000 Hz
- Output Data Rate: Up to 1000 Hz

**HARDWARE**
- Operating Voltage (OEM): 4.5 to 5.5 V
- Operating Voltage (Enclosed): 5 to 36 V
- Input Protection (Rugged only): ± 60 V
- Power Consumption (Typical): 1.4 W
- Hot Start Battery Capacity: > 48 hrs
- Hot Start Battery Charge Time: 30 mins
- Hot Start Battery Endurance: > 10 years
- Operating Temperature: -40 °C to 85 °C
- Environmental Protection (Enclosed): MIL-STD-810G
- MTBF: 200,000 hrs
- Shock Limit: 150 g, 6 ms, half sine
- Vibration Limit: 8 g RMS
- Dimensions (OEM): 34 x 39 x 24 mm
- Dimensions (Enclosed): 42 x 67 x 30 mm
- Weight (OEM): 26 grams
- Weight (Enclosed): 98 grams

**COMMUNICATION**
- Interface (OEM): UART
- Interface (Enclosed): RS232 (RS422 version available)
- Speed: 4800 to 2M baud
- Protocol: AN Packet Protocol or NMEA
- Peripheral Interface: 2x GPIO and Auxiliary RS232
- GPIO Level: 5 to 20 V
- GPIO Functions: 1PPS Input, Sensor sync input, Sensor sync output, Odometer, Stationary, Air Data Input, NMEA input/output, Novatel GNSS input, Trimble GNSS input, AN Packet Protocol

**SENSORS**

<table>
<thead>
<tr>
<th>SENSOR</th>
<th>ACCELEROMETERS</th>
<th>GYROSCOPES</th>
<th>MAGNETOMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>± 10 g</td>
<td>± 475 °/s</td>
<td>± 8 G</td>
</tr>
<tr>
<td>Bias Instability</td>
<td>8 ug</td>
<td>0.2 °/hr</td>
<td>-</td>
</tr>
<tr>
<td>Initial Bias</td>
<td>&lt; 0.45 mg</td>
<td>&lt; 3 °/hr</td>
<td>-</td>
</tr>
<tr>
<td>Initial Scaling Error</td>
<td>&lt; 0.03 %</td>
<td>&lt; 0.02 %</td>
<td>&lt; 0.07 %</td>
</tr>
<tr>
<td>Scale Factor Stability</td>
<td>&lt; 0.04 %</td>
<td>&lt; 0.03 %</td>
<td>&lt; 0.09 %</td>
</tr>
<tr>
<td>Non-linearity</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.03 %</td>
<td>&lt; 0.08 %</td>
</tr>
<tr>
<td>Cross-axis Alignment Error</td>
<td>&lt; 0.05 °</td>
<td>&lt; 0.05 °</td>
<td>&lt; 0.05 °</td>
</tr>
<tr>
<td>Noise Density</td>
<td>2 ug/√Hz</td>
<td>6 °/hr/√Hz</td>
<td>210 uG/√Hz</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>250 Hz</td>
<td>200 Hz</td>
<td>110 Hz</td>
</tr>
</tbody>
</table>

**SENSOR ACCELEROMETERS**

- **Bias Instability**: 8 ug
- **Initial Bias**: < 0.45 mg
- **Initial Scaling Error**: < 0.03 %
- **Scale Factor Stability**: < 0.04 %
- **Non-linearity**: < 0.05 %
- **Cross-axis Alignment Error**: < 0.05 °
- **Noise Density**: 2 ug/√Hz
- **Bandwidth**: 250 Hz
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