CONTINUOUS AND ROBUST INERTIAL NAVIGATION SYSTEM (INS) POSITIONING

Piksi Multi Inertial combines the RTK GNSS and inertial fusion capabilities of Swift Navigation’s Starling® Positioning Engine to deliver a continuous and robust positioning system for a variety of applications. INS integration provides positioning during GNSS outages and times where there is little to no GNSS visibility.

CENTIMETER-LEVEL ACCURACY

Autonomous systems require precision navigation—especially those that perform critical functions. Swift Navigation solutions utilize real-time kinematic (RTK) technology, providing location solutions that are 100 times more accurate than traditional GPS.

FAST CONVERGENCE TIMES

Multiple signal bands enable faster convergence times to high-precision mode. Single band RTK systems converge in minutes, while Piksi Multi converges to a high-precision solution within seconds. This allows for much faster system start times, as well as faster reacquisitions, which is critical to robotic systems.

ROBUST GNSS POSITIONING PERFORMANCE

Piksi Multi Inertial supports GPS L1/L2, GLONASS G1/G2, BeiDou B1/B2, Galileo E1/E5b for RTK measurements and positioning and SBAS for robust sub-meter positioning in non-RTK mode. Additional constellations create more robust positioning performance in a variety of challenging skyview environments. Integrated MEMS oscillator technology enhances robustness under vibration and shock.

RAPID PROTOTYPING

Piksi Multi Inertial is designed to be easy to use. The Piksi Multi Inertial Receiver Pack includes: 1 Piksi Multi Inertial GNSS receiver; 1 integrator-friendly Evaluation Board; a 6-month free trial license of Skylark™, a power supply and cables to ease prototyping and integration.
## GNSS Characteristics

**GNSS Signal Tracking**
- GPS L1/L2, GLONASS G1/G2, BeiDou B1/B2, Galileo E1/E5b
- SBAS

**GNSS Data Rates**
- Standard Position Outputs: Up to 10 Hz
- RTK Position Outputs: Up to 10 Hz
- Swift Binary Protocol (SBP) and NMEA-0183

**Maximum Operating Limits**
- Velocity: 151 m/s

### Electrical & I/O

**Power**
- Input Voltage: 5 - 15 V DC
- Typical Power Consumption: 2.9 W

**Antenna LNA Power Specifications**
- Output Voltage: 4.85 V DC
- Max Output Current: 100 mA

**Connectors**
- 1 x 20 Pin SAMTEC Connector (PN: TMM-110-03-F-D)
- 2 x 60 Pin High Density Connectors (PN: 61082-0614060LF)
- 1 x MMCX Female Antenna Port

### Communication

**Navigation Outputs**
- SBP and NMEA 0183
- RTCM 3.x

**Reference Inputs / Outputs**
- RTCP 3.x
- NTRIP Client

### Position Performance Specifications

**Position, Velocity & Time Accuracy**
- Horizontal Position Accuracy (CEP 50 in SBAS Mode): 0.75 m
- Velocity Accuracy: 0.03 m/s RMS
- Time Accuracy: 60 ns RMS

**Real Time Kinematic (RTK Accuracy)**
- Horizontal: 0.010 m + 1 ppm
- Vertical: 0.015 m + 1 ppm

### Time to First Fix (TTFF) Specifications

<table>
<thead>
<tr>
<th>Mode</th>
<th>Hot Start</th>
<th>Cold Start</th>
<th>Reacquisition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 5 s</td>
<td>&lt; 60 s</td>
<td>&lt; 2 s</td>
</tr>
</tbody>
</table>

## IMU Specifications

**Angular Range**
- +/- 250 deg/sec (Default)
- +/- 125 / 500 / 1000 / 2000 (Configurable)

**Acceleration**
- +/- 4 g (Default)
- +/- 2 / 8 / 16 g (Configurable)

**IMU Raw Data Rate**
- 25 - 200 Hz (100Hz recommended)

## Physical & Environmental

**Dimensions**
- 48 mm x 71 mm x 12.4 mm
- Form factor compatible with common GNSS modules

**Weight**
- 26 g

**Temperature**
- Operating: -40° C to +85° C
- Storage: -40° C to +85° C

**Humidity**
- 95% non-condensing as measured by MIL-STD-810G, Method 507.5 Procedure II

**Vibration (Operating and Survival)**
- Random: MIL-STD 810G, Method 516.6, Category 24, 7.7 g RMS
- Sinusoidal: IEC 60068-2-6, (Test Fc–5g)

### Mechanical Shock

- Operating: MIL-STD 810G, Method 516.6, Procedure I (40 g)
- Survival: MIL-STD-810G, Method 516.6, Procedure V (75 g)

### Mechanical & Environmental

- **Temperature**
  - Operating: -40° C to +85° C
  - Storage: -40° C to +85° C
- **Humidity**
  - 95% non-condensing as measured by MIL-STD-810G, Method 507.5 Procedure II
- **Mechanical Shock**
  - Operating: MIL-STD 810G, Method 516.6, Procedure I (40 g)
  - Survival: MIL-STD-810G, Method 516.6, Procedure V (75 g)

## Performance During GNSS-RTK Outages

<table>
<thead>
<tr>
<th>Outages</th>
<th>Prior Position Mode</th>
<th>Position Accuracy 2-Sigma (m) RMS</th>
<th>Velocity Accuracy (m/s) RMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 second</td>
<td>RTK</td>
<td>Horizontal: 0.02, Vertical: 0.06</td>
<td>Horizontal: 0.035, Vertical: 0.020</td>
</tr>
<tr>
<td>5 seconds</td>
<td>RTK</td>
<td>Horizontal: 0.05, Vertical: 0.09</td>
<td>Horizontal: 0.040, Vertical: 0.030</td>
</tr>
<tr>
<td>10 seconds</td>
<td>RTK</td>
<td>Horizontal: 0.17, Vertical: 0.16</td>
<td>Horizontal: 0.055, Vertical: 0.045</td>
</tr>
</tbody>
</table>

The accuracy of position and velocity solutions provided during GNSS outages is dependent on the accuracy of solutions prior to the GNSS outage. The table above represents solution performance during GNSS outages directly preceded by RTK fix GNSS solutions.

---

1. SBAS Support includes the United States-based Wide Area Augmentation Systems (WAAS), the pan-European Union-based European Geostationary Navigation Overlay System (EGNOS), the Japanese Multifunctional Transport Satellites (MTSAT) Region Overlay System (MSAS) providing coverage for Japan and Australia and the GPS-Aided GEO Augmented Navigation (GAGAN) regional system operated by the Indian government.
3. As required by the U.S. Department of Commerce to comply with export licensing restrictions.
4. Please refer to the Bosch BMI160 datasheet.
5. Typical power consumption by module in RTK positioning mode.
6. CANBus on Piksi Multi is currently hardware ready and is electrically verified. We do not support any specific CAN output protocol (e.g., J1939) and have no immediate plans to do so.
7. A hardware update on the Piksi Multi to use a higher grade CPU with better thermal characteristics was implemented, resulting in 0.4mm height increase of the Piksi Multi. Contact customer support for more information on this.
8. The use of an on-board heat sink is required in applications where ambient temperatures exceed 65°C. The receiver board ships with a provided heat sink attachment.
9. In open sky and strong signals conditions.
10. The use of an on-board heat sink is required in applications where ambient temperatures exceed 65°C. The receiver board ships with a provided heat sink attachment.
11. Cold Start is the time taken by the receiver to achieve a standard position fix after a prolonged outage. For example, the time taken to achieve a position fix for a car that has been parked overnight in a garage and once it sees the sky view for the first time.
12. Re-acquisition is defined as the time taken to re-acquire position lock after brief moment of outage. For example, a car traveling under a freeway/highway overpass. This can also be simulated by a simple RF on/off test with outages between 30 and 50 seconds.

---

©2022 Swift Navigation, Inc. All rights reserved | 03.01.2022

www.swiftnav.com | @SwiftNav | sales@swiftnav.com