Spatial Dual is a ruggedised miniature GPS aided inertial navigation system and AHRS that provides accurate position, velocity, acceleration and orientation under the most demanding conditions. It combines temperature calibrated accelerometers, gyroscopes, magnetometers and a pressure sensor with a dual antenna RTK GNSS receiver. These are coupled in a sophisticated fusion algorithm to deliver accurate and reliable navigation and orientation.

**PERFORMANCE**

- 0.1 ° Roll and Pitch
- 0.1 ° Heading
- 8 mm RTK Positioning
- 3 °/hr MEMS Gyroscope
- 1000 Hz Update Rate
- 2000 g Shock Limit

**FEATURES**

**DUAL ANTENNA HEADING**

Spatial Dual features dual antenna moving baseline RTK. This allows it to provide highly accurate heading while both stationary and moving. It is an excellent choice for applications where magnetic heading is not usable due to interference or where additional accuracy is required. An added benefit is the ability to accurately measure vehicle slip angle.

**ADVANCED FILTER**

Spatial Dual contains Advanced Navigation’s revolutionary sensor fusion filter. The filter is more intelligent than the typical extended kalman filter and is able to extract significantly more information from the data by making use of human inspired artificial intelligence. It was designed for control applications and has a high level of health monitoring and instability prevention to ensure stable and reliable data.

**RELIABILITY**

Spatial Dual 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 protected from reverse polarity, overvoltage, surges, static and short circuits on all external interfaces. The GNSS contains RAIM, which excludes both malfunctioning, and tampered satellite signals.

**MINIATURE RUGGED ENCLOSURE**

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**RTK GNSS RECEIVER**

Spatial Dual contains a triple frequency Trimble RTK GNSS receiver that provides up to 8mm accuracy positioning and supports all of the current and future satellite navigation systems, including GPS, GLONASS, GALILEO and BeiDou. It also supports the Omnistar service for hassle free high accuracy positioning.

**PERIPHERALS**

Spatial Dual features four general purpose input output pins that support an extensive number of peripherals. Including odometer and wheel encoder inputs for ground vehicles, external RTK GPS systems, NMEA input/output, event triggers and more. For an integration fee, custom peripheral devices can be added.
**HOT START**

Spatial Dual contains a next generation battery backup system that allows it to hot start inertial navigation from its last position in 500 milliseconds and obtain a GNSS fix in approximately 3 seconds. The battery backup system lasts for the lifetime of the product and will provide backup for 48 hours without power. Advanced Navigation’s Spatial series are the only GNSS/INS in the world to provide hot start inertial navigation.

**GNSS**

- **Model**: Trimble BD982
- **Supported Navigation Systems**
  - GPS L1, L2, L5
  - GLONASS L1, L2
  - GALILEO E1, E5
  - BeiDou B1, B2
- **Supported SBAS Systems**
  - WAAS
  - EGNOS
  - MSAS
  - GAGAN
  - QZSS
  - Omnistar HP/XP/G2
  - Trimble RTX
- **Update Rate**: 20 Hz
- **Hot Start First Fix**: 3 s
- **Cold Start First Fix**: 30 s
- **Horizontal Position Accuracy**: 1.2 m
- **Horizontal Position Accuracy (with SBAS)**: 0.5 m
- **Horizontal Position Accuracy (with RTK)**: 0.008 m
- **Velocity Accuracy**: 0.007 m/s
- **Timing Accuracy**: 20 ns
- **Velocity Accuracy**: 0.007 m/s
- **Acceleration Limit**: 11 g

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**SENSORS**

<table>
<thead>
<tr>
<th>SENSOR</th>
<th>ACCELEROMETERS</th>
<th>GYROSCOPES</th>
<th>MAGNETOMETERS</th>
<th>PRESSURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range (dynamic)</td>
<td>± 2 g</td>
<td>± 250 °/s</td>
<td>± 2 G</td>
<td>10 to 120 KPa</td>
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<tr>
<td></td>
<td>± 4 g</td>
<td>± 500 °/s</td>
<td>± 4 G</td>
<td>10 Pa</td>
</tr>
<tr>
<td></td>
<td>± 16 g</td>
<td>± 2000 °/s</td>
<td>± 8 G</td>
<td>&lt; 100 Pa</td>
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<tr>
<td>Bias Instability</td>
<td>20 µg</td>
<td>3 °/hr</td>
<td>-</td>
<td>10 Pa</td>
</tr>
<tr>
<td>Initial Bias</td>
<td>&lt; 5 mg</td>
<td>&lt; 0.2 °/s</td>
<td>-</td>
<td>&lt; 100 Pa</td>
</tr>
<tr>
<td>Initial Scaling Error</td>
<td>&lt; 0.06 %</td>
<td>&lt; 0.04 %</td>
<td>&lt; 0.07 %</td>
<td>-</td>
</tr>
<tr>
<td>Scale Factor Stability</td>
<td>&lt; 0.06 %</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.09 %</td>
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<tr>
<td>Non-linearity</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.08 %</td>
<td>-</td>
</tr>
<tr>
<td>Cross-axis Alignment Error</td>
<td>&lt; 0.05 °</td>
<td>&lt; 0.05 °</td>
<td>&lt; 0.05 °</td>
<td>-</td>
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<tr>
<td>Noise Density</td>
<td>100 µg/√Hz</td>
<td>0.004 µg/√Hz</td>
<td>210 µg/√Hz</td>
<td>0.56 Pa/√Hz</td>
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<tr>
<td>Bandwidth</td>
<td>400 Hz</td>
<td>400 Hz</td>
<td>110 Hz</td>
<td>50 Hz</td>
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