



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

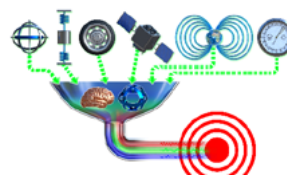
FEATURES



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

Spatial Dual's precision marine grade aluminium enclosure is waterproof and dirtproof to the IP67 standard and shockproof to 2000g, allowing it to be used in the most extreme conditions. A sophisticated venting system allows the unit to measure air pressure whilst keeping water out. Its minimal size, weight and power requirements allow for easy integration into almost any system.



RTK GNSS RECEIVER

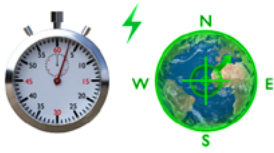
Spatial Dual contains a triple frequency Trimble RTK GNSS receiver that provides up to 8mm accuracy positioning and supports all of the current and future satellite navigation systems, including GPS, GLONASS, GALILEO and BeiDou. It also supports the Omnistar service for hassle free high accuracy positioning.



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.

NAVIGATION

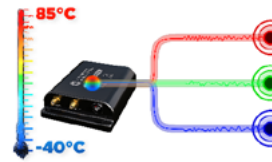
Horizontal Position Accuracy	1.2 m
Vertical Position Accuracy	2.0 m
Horizontal Position Accuracy (with SBAS)	0.5 m
Vertical Position Accuracy (with SBAS)	0.8 m
Horizontal Position Accuracy (with RTK or Kinematic PPK)	0.008 m
Vertical Position Accuracy (with RTK or Kinematic PPK)	0.015 m
Velocity Accuracy	0.007 m/s
Roll & Pitch Accuracy	0.1 °
Heading Accuracy (1m Antenna Separation)	0.1 °
Roll & Pitch Accuracy (Kinematic post processing)	0.03 °
Heading Accuracy (Kinematic post processing)	0.06 °
Slip Accuracy	0.1 °
Heave Accuracy (whichever is greater)	5 % or 0.05 m
Range	Unlimited
Hot Start Time	500 ms
Internal Filter Rate	1000 Hz
Output Data Rate	Up to 1000Hz

HARDWARE

Operating Voltage	9 to 36 V
Input Protection	-40 to 100 V
Power Consumption (typical)	2.64 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	IP67 MIL-STD-810G
MTBF	> 50,000 hrs
Shock Limit	75 g
Dimensions	90 x 127 x 33 mm
Weight	285 grams

SENSORS

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



CALIBRATED DYNAMIC RANGING SENSORS

Spatial Dual contains very high performance MEMs inertial sensors. These are put through Advanced Navigation's intensive calibration process to increase their performance further still and provide consistently accurate data over an extended temperature range of -40°C to 85°C. Advanced Navigation's custom calibration process is the only full sensor calibration that can provide dynamic ranging, allowing the user to select a sensor range for high accuracy or high accelerations on the fly. As part of this calibration, every Spatial Dual unit spends 8 hours in our specially built rotating temperature chamber.

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
Acceleration Limit	11 g

COMMUNICATION

Interface	RS232 or RS422
Speed	4800 to 2M baud
Protocol	AN Packet Protocol or NMEA
Peripheral Interface	2x GPIO and 1x Auxiliary RS232
GPIO Level	5 V or RS232
GPIO Functions	1PPS Odometer Stationary Pitot Tube NMEA input/output Novatel GNSS input Trimble GNSS input AN Packet Protocol input/output Packet Trigger Input Event Input