



# SPATIAL FOG DUAL FOG GNSS/INS

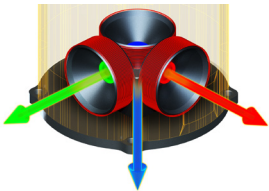
Spatial FOG Dual is a ruggedised GPS aided inertial navigation system and AHRS that provides accurate position, velocity, acceleration and orientation under the most demanding conditions. It combines ultra high accuracy fibre optic gyroscopes, accelerometers, magnetometers and a pressure sensor with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



## PERFORMANCE

- 0.01 ° Roll and Pitch
- 0.01 ° Heading
- 8 mm RTK Positioning
- 0.05 °/HR FOG Gyroscope
- Heave : 2 % or 0.02 m (whichever is greater)

## FEATURES



### EXTREME INERTIAL PERFORMANCE

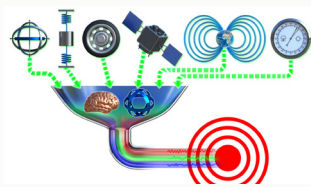
Spatial FOG Dual contains the KVH Industries 1750 fiber optic gyroscope (FOG) IMU, which provides extremely accurate inertial data far beyond the best MEMS technology available. This

allows Spatial FOG Dual to achieve very high accuracies and dead reckon without GNSS for extended periods of time. Despite the high accuracy FOG IMU, Spatial FOG Dual has a very competitive price tag that is lower than many MEMS systems on the market.



### RELIABILITY

Spatial FOG 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 place. 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. Spatial FOG Dual contains a secondary MEMS IMU, which it uses to detect faults with the primary IMU.



### ADVANCED FILTER

Spatial FOG 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.



### RTK GNSS RECEIVER

Spatial FOG Dual contains a dual 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. Spatial FOG Dual supports both real time RTK positioning and logging of raw satellite data for kinematic post-processing.



### PERIPHERALS

Spatial FOG Dual features two general purpose input output pins and two auxiliary RS232/RS422 ports that support an extensive number of peripherals. Including odometer based

input for ground vehicles, DVLs and USBLs for underwater navigation, NMEA input/output and more. For an integration fee, custom peripheral devices can be added.



### HIGH UPDATE RATE

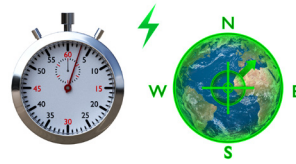
Spatial FOG Dual's internal filter runs at 1000Hz and data can also be output at this rate over high speed RS232 or RS422. This allows for control of dynamically unstable platforms.



## DUAL ANTENNA HEADING

Spatial FOG 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 with low dynamics where single antenna systems struggle or any application

where additional heading accuracy is required. An added benefit is the ability to accurately measure vehicle slip angle.



## HOT START

Spatial FOG Dual contains a next generation battery backup system that allows it to hot start inertial navigation from its last position in 2 seconds 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.

# SPECIFICATIONS

## NAVIGATION

Horizontal Position Accuracy	0.8 m
Vertical Position Accuracy	1.5 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	0.005 m/s
Roll & Pitch Accuracy	0.01 °
Heading Accuracy	0.01 °
Roll & Pitch Accuracy (Kinematic post-processing)	0.005 °
Heading Accuracy (Kinematic post-processing)	0.007 °
Slip Accuracy	0.01 °
Heave Accuracy (whichever is greater)	2 % or 0.02 m
Orientation Range	Unlimited
Hot Start Time	2 s
Internal Filter Rate	1000 Hz
Output Data Rate	Up to 1000 Hz

## HARDWARE

Operating Voltage	9 to 36 V
Input Protection	-40 to 100 V
Power Consumption (typical)	6.12 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 75 °C
Environmental Protection	IP67 MIL-STD-810G
MTBF	> 36,000 hrs
Shock Limit	40 g
Vibration Limit	12 g
Dimensions	94 x 94 x 95 mm
Weight	740 grams

## SENSORS

SENSOR	ACCELEROMETERS	GYROSCOPES	MAGNETOMETERS	PRESSURE
Range	± 10 g	± 490 °/s	± 8 G	10 to 120 kPa
Bias Instability	15 ug	0.05 °/hr	-	10 Pa
Initial Bias	< 1 mg	< 1 °/hr	-	< 100 Pa
Initial Scaling Error	< 0.03 %	< 0.01 %	< 0.07 %	-
Scale Factor Stability	< 0.04 %	< 0.02 %	< 0.09 %	-
Non-linearity	< 0.03 %	< 0.005 %	< 0.08 %	-
Cross-axis Alignment Error	< 0.04 °	< 0.02 °	< 0.05 °	-
Noise Density	120 ug/√Hz	0.7 °/hr/√Hz	210 uG/√Hz	0.56 Pa/√Hz
Bandwidth	200 Hz	440 Hz	110 Hz	50 Hz

## GNSS

Model	Trimble MB-Two
Supported Navigation Systems	GPS L1, L2 GLONASS L1, L2 GALILEO E1 BeiDou B1
Supported SBAS Systems	WAAS EGNOS MSAS GAGAN QZSS 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	0.005 m/s
Timing Accuracy	20 ns
Acceleration Limit	11 g

## COMMUNICATION

Interface	RS422 (RS232 optional)
Speed	4800 to 10M baud
Protocol	AN Packet Protocol or NMEA
Peripheral Interface	2x GPIO and 2x 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