

CNS-5000

KVH's GPS/IMU Continuous Navigation System



Key Features

- FOG-based IMU with GNSS for high reliability and stable performance
- GPS-aided Continuous Navigation System with integrated GPS/IMU in a single enclosure
- Deeply coupled key technology: DSP-3000 FOG-based inertial measurement technology and the NovAtel OEM628 GNSS receiver
- Full 100 Hz position, velocity, and attitude sensing
- IMU data enables 5X faster GPS signal reacquisition
- RTK, L-band and SBAS positioning modes
- Optional dual antenna for precise heading
- Rugged COTS design for demanding environments
- Provides continuous, precision positioning and orientation, even when GPS signals are blocked or unavailable
- Wheel sensor input for ground applications

Applications

The CNS-5000 is the ideal solution for a wide range of motion-control and GNSS-integrated navigation applications:

- Aerial and Land Surveying/Mapping
- Autonomous Vehicles: Robotics, Precision Agriculture, UAVs
- Guidance

CNS-5000 – The Complete Position, Velocity, and Attitude Solution for Challenging Environments

The versatile new KVH CNS-5000 combines two complementary technologies – a highly accurate GPS receiver and a fiber optic gyro (FOG)-based inertial measurement unit (IMU) – all within a single enclosure. Through its seamless integration of these two highly reliable navigation systems, the CNS-5000 provides a groundbreaking low-cost, small form factor solution for 3-D positioning, velocity, and attitude measurement.

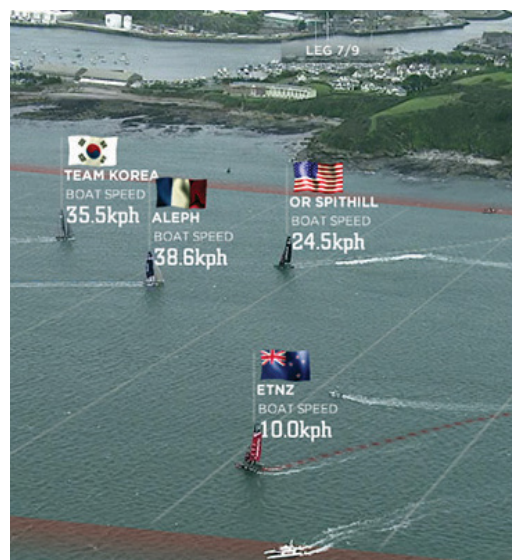
The CNS-5000 deep coupling technology provides uninterrupted navigation information when GPS reception is obstructed, jammed or unavailable. With GPS-only positioning, navigation becomes unreliable when satellite signals are blocked by obstructions like buildings or trees while inertial measurement units (IMUs) will drift over time without an external reference. The CNS-5000 overcomes these individual limitations by combining the two navigation technologies so they augment and enhance each other, creating a powerful precision navigation/positioning system. The absolute position and velocity accuracy of the GPS is used to compensate for IMU drift, while the stable relative position of the highly reliable FOG-based IMU provides superior bridging capability between the two technologies when GPS is degraded or unavailable.

At the same time, the deeply coupled technologies in the CNS-5000 deliver dramatically faster GPS signal reacquisition while maintaining precise inertial navigation. Unlike most GPS/IMU systems that use GPS data to control errors in data from the IMU, KVH's CNS-5000 relies on the inertial data to support the GPS by aiding in satellite reacquisition. That means the CNS-5000 delivers L1/L2 band signal lock in less than 2 seconds, compared with other GPS/IMU systems that typically take 10 seconds or more to deliver L1 band-only signal lock. The CNS-5000 is also ideal for highly dynamic applications with its high rate output of position, velocity and attitude data.

A rugged commercial off-the-shelf product, the reliable and affordable KVH CNS-5000 blends two powerful navigation technologies to deliver superior GPS tracking and performance.

The CNS-5000 precisely determines the exact position, orientation, and movement of the America's Cup catamarans. It overlays that data along with computed distances and laylines to the marks on the race course onto video being shot from helicopters also equipped with the CNS-5000. This is all accomplished in real time for live television coverage.

For detailed interface control drawings (ICD) and technical manuals on this product, please visit:
www.kvh.com/CNS5000
and click on the
Manuals tab.



Technical Specifications

| IMU Specifications | |
|---|---|
| Gyro Technology | FOG |
| Input Range | ±375°/secs |
| Bias Instability (max), (25°C) | ≤1°/hr, 1σ |
| Bias Offset (25°C) | ±20°/hr |
| Bias vs. Temperature (≤1°C/min) max | ≤6°/hr, 1σ |
| Scale Factor Non-Linearity (max rate, 25°C) | ≤1000 ppm, 1σ |
| Scale Factor vs. Temperature (≤1°C/min) | ≤300 ppm, 1σ |
| Angle Random Walk (25°C) | ≤0.067°/√hr (≤4°/hr/√Hz) |
| Accelerometer Technology | MEMS Silicon |
| Input Limit (max) | ±10g |
| Bias Instability (constant temp) | ≤0.25 mg, 1σ |
| Bias Offset (constant temp) | ±5 mg |
| Bandwidth (-3dB) | 50 Hz |
| Scale Factor Temperature Sensitivity | 250 ppm/°C, 1σ max, (≤100 ppm/°C, 1σ typical) |
| Velocity Random Walk (25°C) | ≤0.12mg/√Hz |

| Connectors | |
|---------------|------------------------|
| Power and I/O | MIL-DTL-38999 Series 3 |
| Antenna Input | TNC Female |

| Horizontal Position Accuracy (RMS) | |
|------------------------------------|--------------|
| Single Point L1/L2 | 1.2 m |
| SBAS | 0.6 m |
| DGPS | 0.4 m |
| L-Band | |
| VBS | 0.6 m |
| XP | 0.15 m |
| HP | 0.1 m |
| RT-2™ | 1 cm + 1 ppm |

| Communication Ports | |
|---------------------|---|
| RS-232 UART COM | 2 |
| USB Device | 1 |
| CAN | 1 |
| Event Input Trigger | 1 |
| Configurable PPS | 1 |

| GNSS System Performance ¹ | |
|--------------------------------------|--------|
| Signal Tracking | |
| GPS | L1, L2 |
| GLONASS | L1, L2 |
| SBAS | |
| L-Band | |

¹ Typical values. Performance specifications subject to GPS characteristics, US DOD operational degradation, ionospheric and tropospheric conditions, satellite geometry, baseline length, multipath effects and the presence of intentional or unintentional interference.

| Physical/Electrical/Environmental | |
|-----------------------------------|---|
| Dimensions (max) | 169.4 mm L x 152.4 mm W x 88.9 mm H (6.67" x 6" x 3.5") |
| Weight (max) | 2.4 kg (5.3 lbs) |
| Input Voltage | +9 to +18 VDC |
| Power Consumption max, (typical) | 12W |
| Temperature (operating) | -40°C to +65°C |
| Humidity | 95% non-condensing |

| Data Rates | |
|----------------------------|--------------|
| GPS Measurement | 20 Hz |
| GPS Position | 20 Hz |
| IMU Measurement | 100 Hz |
| INS Solution | Up to 100 Hz |
| Time Accuracy ² | 20 ns RMS |
| Maximum Velocity | 515 m/s |

| Optional Dual Antenna ³ | |
|------------------------------------|------------------|
| Baseline | Heading Accuracy |
| 0.5 m | 0.4° |
| 1.0 m | 0.2° |
| 2.0 m | 0.1° |

² Time accuracy does not include biases due to RF or antenna delay.
³ Dual antenna requires a second receiver to be paired with the CNS-5000.
⁴ Post-processing accuracy using Inertial Explorer processing software.

| CNS-5000 Performance During GNSS Outage ¹ | | | | | | | | |
|--|------------------|---------------------------|----------|-----------------------------|----------|---------------------------------|-------|---------|
| Outage Duration | Positioning Mode | Position Accuracy (m) RMS | | Velocity Accuracy (m/s) RMS | | Attitude Accuracy (degrees) RMS | | |
| | | Horizontal | Vertical | Horizontal | Vertical | Roll | Pitch | Heading |
| 0 s | RTK | 0.020 | 0.050 | 0.020 | 0.010 | 0.015 | 0.015 | 0.050 |
| | HP | 0.100 | 0.080 | 0.020 | 0.010 | 0.015 | 0.015 | 0.050 |
| | SP | 1.200 | 0.600 | 0.020 | 0.010 | 0.015 | 0.015 | 0.060 |
| | PP ⁴ | 0.010 | 0.020 | 0.020 | 0.010 | 0.015 | 0.015 | 0.030 |
| 10 s | RTK | 0.230 | 0.120 | 0.062 | 0.016 | 0.020 | 0.020 | 0.060 |
| | HP | 0.770 | 0.410 | 0.063 | 0.017 | 0.020 | 0.020 | 0.060 |
| | SP | 1.550 | 0.720 | 0.064 | 0.017 | 0.020 | 0.020 | 0.065 |
| | PP ⁴ | 0.020 | 0.020 | 0.020 | 0.020 | 0.015 | 0.015 | 0.030 |
| 60 s | RTK | 5.710 | 1.600 | 0.212 | 0.059 | 0.028 | 0.028 | 0.090 |
| | HP | 6.470 | 1.690 | 0.240 | 0.071 | 0.028 | 0.028 | 0.095 |
| | SP | 7.120 | 1.890 | 0.260 | 0.075 | 0.028 | 0.028 | 0.100 |
| | PP ⁴ | 0.230 | 0.070 | 0.030 | 0.030 | 0.016 | 0.016 | 0.032 |



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