Advanced Precision System

SAL SPU-200

Proven Resilience in Real-world Jamming and Spoofing Conditions

TITAN MARINE TECHNOLOGY

SAL NAVIGATION

Protect Against Extreme GNSS Disruption

The frequency and complexity of GNSS jamming and spoofing have risen sharply, posing serious risks to safe and reliable navigation. For years, SAL Navigation has been at the forefront of countering these evolving threats — rigorously testing our technology under real-world jamming and spoofing conditions.

Put to the test in the world's largest open PNT/GNSS resilience trial, SAL SPU-200 consistently outperforms traditional SOLAS-class GPS/GNSS systems — delivering exceptional resilience and reliability in every test scenario. Equipped with advanced CRPA anti-jamming antenna technology, SAL SPU-200 provides essential backup even under extreme interference — at levels comparable to those seen in conflict zones.

Proven Through Extensive Field Testing in High-Risk Environments
The system has also proven its strength during extensive field trials in some of the world's most interference-affected areas — such as the Baltic Sea — maintaining uninterrupted, high-precision navigation even as surrounding vessels experienced significant signal degradation.

SAL SPU-200

Detect, Suppress, and Safeguard: Proven GNSS Resilience
Detect and visualize jamming and spoofing incidents in real-time – and protect your operations with SAL SPU-200, a unique and advanced precision system. Robust, reliable anti-jamming and spoofing technology – proven in real-world interference environments.

Key Capabilities:

- **Superior Performance:** Regularly tested under real-world GPS/GNSS jamming and spoofing conditions in large-scale trials at Andøya, Norway, SAL SPU-200 demonstrates superior resilience. The trials, vetted by researchers from the Norwegian Coastal Administration, confirm the system's superiority over traditional SOLAS-class systems tested, consistently delivering reliable and uninterrupted data throughout.
- **Proven Protection for Extreme Jamming Exposure:** SAL SPU-200 demonstrates superior resilience, maintaining robust satellite tracking and reliable data under extreme jamming conditions. With interference suppression levels of 20 dB using a standard antenna and up to 50 dB with an advanced CRPA anti-jamming antenna, it delivers exceptional performance in demanding environments, including scenarios typical of regions with geopolitical tensions.
- **Time Spoofing Protection:** SAL SPU-200 demonstrates superior protection against time spoofing attacks, detecting anomalies, halting position computation, and recovering quickly.
- **Jamming/Spoofing Detection:** Real-time identification and visualization of jamming and spoofing attacks via the SAL SPU-200 app. Key features include audio alerts, push notifications, and optional tablet integration for enhanced visibility and usability on the bridge.
- **Critical Backup:** SAL SPU-200 serves as an essential safeguard when primary navigation systems are disrupted.
- **Global Utility:** Provides superior navigational support for safe passage through complex waterways worldwide.
- **Navigational Accuracy:** Provides highly precise, independent data on positioning, speeds, heading, Course over Ground and Rate of Turn, trusted by pilot organizations and mariners globally.
- **Backup Power:** A backup battery ensures uninterrupted operation during power outages.
- **SAL SPU-200 Application:** Engineered to facilitate direct interaction with the SAL Navigation SPU-200 device via Wi-Fi. Core functionalities include installation verification, sensor diagnostics, and real-time data feedback for accurate setup, connectivity, and monitoring.
- **Compatibility:** Any Chart Software or ECDIS system accepting NMEA-0183 data input.

Key Figures

GNSS	GPS, Galileo, GLONASS, BeiDou, QZSS
Heading	0.02 deg , 20 m GNSS heading baseline
Positioning	0.6 m, SBAS corrected
Rate of Turn	0.1 deg/min
Battery Back-up	>12 hours of operation
Data output	GGA, VTG, HDT, ROT, ZDA
Communication	3 x RS422 serial ports, Ethernet, WLAN
Power input	90-220 VAC

Standard

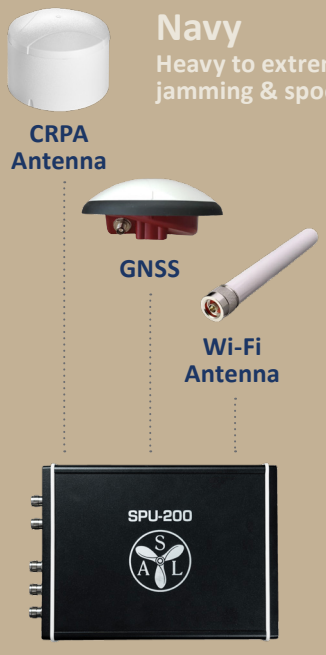
Light to medium jamming & spoofing

Advanced

Medium to heavy jamming & spoofing

Navy

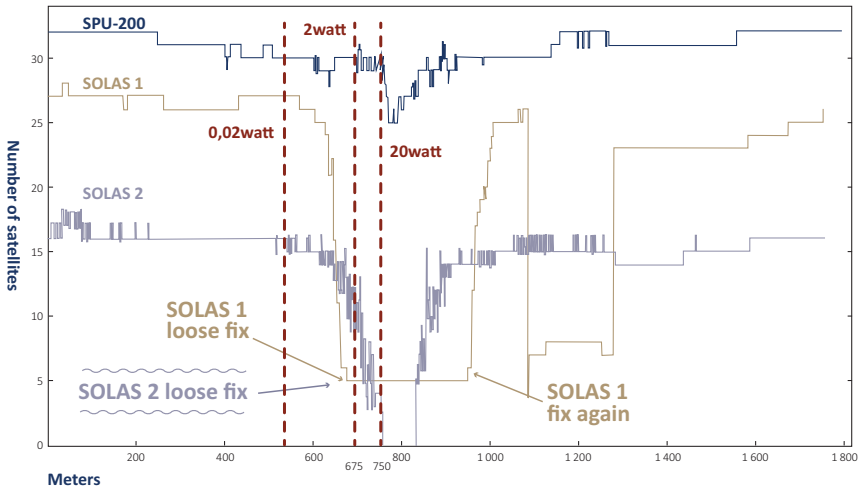
Heavy to extreme jamming & spoofing



How SAL SPU-200 Performs Under Extreme Jamming:

The graph illustrates the results from a rigorous Power Ramp Test, designed to evaluate the resilience of the SAL SPU-200 against jamming power. This test simulates real-world conditions by gradually increasing and decreasing the power of a jammer positioned 1,100 meters away, with a maximum output of 20 watts across L1, G1, L2, and L5 frequency bands.

RAMP TEST GPS L1-Glonass | L1-GPS | L2-GPS | L5 PRN



- **Superior Performance:** While traditional SOLAS receivers lose their positioning as early as 2 watts of jamming power, SAL SPU-200 maintains reliable positioning throughout testing. Even under the highest jamming intensity, SAL SPU-200 loses no more than 5 out of its 32 satellites, demonstrating outstanding resilience and stability.
- **Challenging Scenarios:** The test highlights the significant impact of PNR (Pseudo-Random Noise) jamming compared to continuous wave (CRW) jamming. Despite these challenges, SAL SPU-200 consistently delivers dependable data, ensuring navigation safety.
- **Critical Insights:** The results underscore the importance of the Signal-to-Noise Ratio (SNR) as a reliable metric for detecting and responding to jamming incidents, further enhancing SAL SPU-200's robust performance.

System Components

Standard

Height: 82 mm
Width: 143 mm
Depth: 200 mm
Weight: 2.5 kg

Main Unit
The SPU-200 boasts state-of-the-art GNSS positioning and inertial components, robustly tested under real GNSS jamming and spoofing signal scenarios, ensuring dependable performance under challenging conditions.

Height: 79 mm
Diameter: 170 mm
Weight: 0.5 kg

GNSS Antenna
Full GNSS Precision Antenna. GPS/QZSS-L1/L2/L5, QZSS-L6, GLONASS-G1/G2/G3, Galileo-E1/E5a/E5b/E6,BeiDou-B1/B2/B2a/B3, NavIC-L5.

Standard cont.

Height: 200 mm
Diameter: 15 mm
Weight: 0.03 kg

Wi-Fi Antenna
High gain Wi-Fi antenna.

Length: 3 meter
Weight: 0.5 kg

Wi-Fi Cable
3m High gain antenna RF cable both end pre-made antenna connectors.

Advanced

Height: 82 mm
Width: 143 mm
Depth: 200 mm
Weight: 2.5 kg

Main Unit
The SPU-200 boasts state-of-the-art GNSS positioning and inertial components, robustly tested under real GNSS jamming and spoofing signal scenarios, ensuring dependable performance under challenging conditions.

Advance cont.

Height: 180 mm
Diameter: 90 mm
Weight: 0,245 kg

GNSS Antenna
GPS/QZSS L1–L5, Galileo E1/E5a/E5b, BeiDou B1/B2a/B2b, GLONASS G1–G3 and NavIC L5. Triple-band GNSS antenna with a low-elevation nulling radiation pattern that provides about 20 dB of suppression for signals arriving from 0–15°.

Height: 200 mm
Diameter: 15 mm
Weight: 0.03 kg

Wi-Fi Antenna
High gain Wi-Fi antenna.

Length: 3 meter
Weight: 0.5 kg

Wi-Fi Cable
3m High gain antenna RF cable both end pre-made antenna connectors.

Navy

Height: 82 mm
Width: 143 mm
Depth: 200 mm
Weight: 2.5 kg

Main Unit
The SPU-200 boasts state-of-the-art GNSS positioning and inertial components, robustly tested under real GNSS jamming and spoofing signal scenarios, ensuring dependable performance under challenging conditions.

Height: 95 mm
Diameter: 140 mm
Weight: 1.7 kg

CRPA Antenna
GNSS Signals
GPS L1, QZSS L1, SBAS L1 1575.42 MHz ±12 MHz
GPS L2, QZSS L2 1227.6 MHz ±12 MHz, Galileo E1 1575.42 MHz ±12 MHz
Interference Rejection Simultaneous L1/E1 and L2
Interference suppression 40 dB (typical) 50 dB (max).

Height: 79 mm
Diameter: 170 mm
Weight: 0.5 kg

GNSS Antenna
Full GNSS Precision Antenna. GPS/QZSS-L1/L2/L5, QZSS-L6, GLONASS-G1/G2/G3, Galileo-E1/E5a/E5b/E6,BeiDou-B1/B2/B2a/B3, NavIC-L5.

Height: 200 mm
Diameter: 15 mm
Weight: 0.03 kg

Wi-Fi Antenna
High gain Wi-Fi antenna.

Length: 3 meter
Weight: 0.5 kg

Wi-Fi Cable
3m High gain antenna RF cable both end pre-made antenna connectors.

Product images not to scale, please refer to actual measurements.
For more technical details, please see separate datasheets.

SAL NAVIGATION

Navigation Towards a Sustainable Future

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