

Advanced Precision System

# SAL SPU-200




Tested and Proven for Resilience  
in Real-world Jamming and  
Spoofing Environments



SAL NAVIGATION





An aerial photograph of a ship's wake in the ocean, showing white foam and dark blue water. The wake curves from the bottom right towards the top left, creating a strong sense of motion and depth. The text is overlaid on the left side of the image.

# Unmatched Performance Under Real Jamming and Spoofing Conditions

Threats of GNSS signal jamming and spoofing have increased dramatically in recent years, posing serious risks to maritime navigation with potentially severe consequences. For years, SAL Navigation, in collaboration with Norwegian partners, has been at the forefront of addressing GNSS vulnerabilities, rigorously testing our systems under real-world jamming and spoofing conditions.

Put to the test under what is considered the largest open PNT/GNSS resilience test in the world, SAL SPU-200 consistently outperforms traditional SOLAS-class GPS/GNSS systems – delivering exceptional resilience and reliability every time.

## **Essential Backup and Protection for Every Vessel**

Even under high-power, military-grade jamming, SAL SPU-200, equipped with advanced CRPA anti-jamming antenna technology, proves its superiority. With unmatched protection against GNSS interference, it serves as a crucial backup when primary systems are disrupted—an indispensable part of any vessel's navigation setup.



# SAL SPU-200

## Proven Resilience Against Jamming and Spoofing: Unmatched Performance Even Under Extreme GNSS Jamming Scenarios

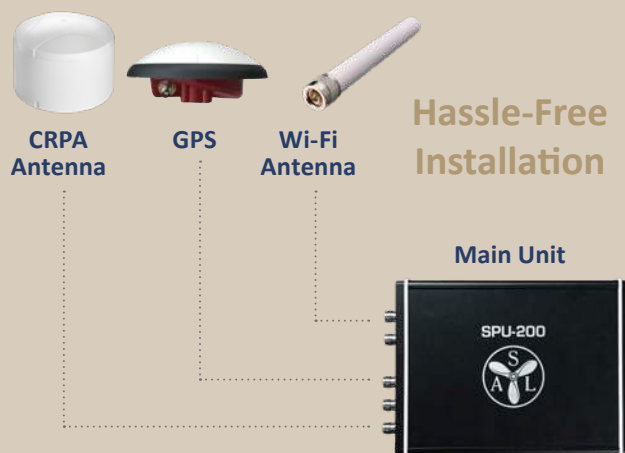
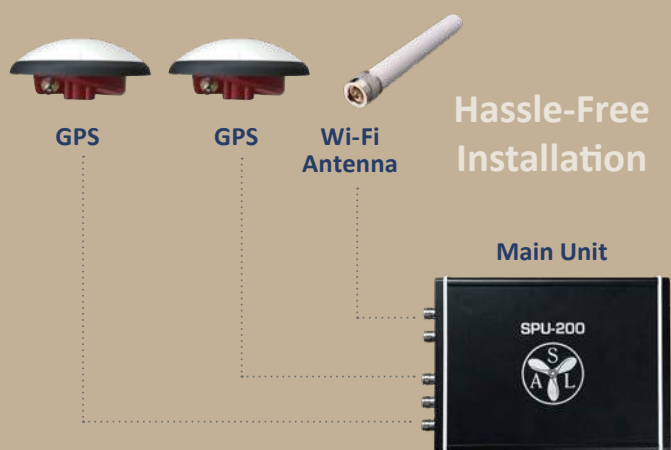
Protect your operations with SAL SPU-200, a unique and advanced precision system. Rigorously tested in real-world jamming and spoofing conditions, SAL SPU-200 delivers unmatched and reliable performance even under severe, high-power jamming scenarios.

### Key Capabilities:

- **Unmatched 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 Authorities, confirm the system's superiority over traditional SOLAS-class systems, consistently delivering reliable and uninterrupted data throughout the tests.
- **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 unmatched 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.
- **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.
- **SAL SPU-200 Compatible With:** Any Chart Software or ECDIS system accepting NMEA-0183 data input.

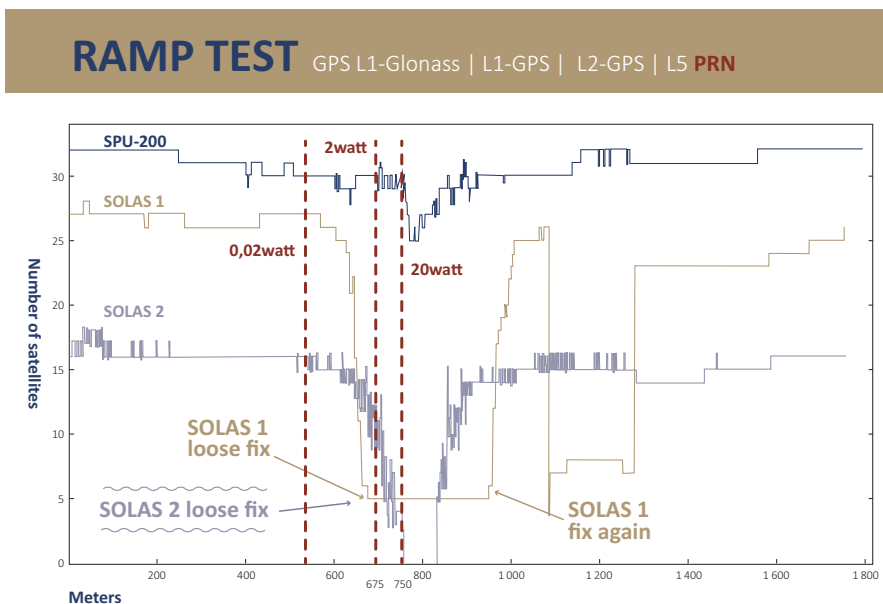
## Key Figures

GNSS	GPS, QZSS, Galileo, GLONASS, BeiDou
IMU	Ultra low noise gyro (0.08°/Vhr)
Wi-Fi	IEEE 802.11 a/b/g/n
Battery Back-up	> 7.5 hours of operation
Data output	GGA, VTG, HDT, GSA, GSV
Serial communication	RS232/422
Operating Temperature	−20°C to +70°C



# 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.



- **Superior Performance:** While traditional SOLAS receivers lose their positioning as early as 2 watts of jamming power, SAL SPU-200 maintains reliable positioning throughout the test. Even under the highest jamming intensity, SAL SPU-200 loses no more than 5 out of its 32 satellites, demonstrating unmatched 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



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

### Wi-Fi Antenna

High gain Wi-Fi antenna.



Length: 35 meter  
Weight: 2.5 kg

### Antenna Cable

35m High gain antenna RF cable both end pre-made antenna connectors.



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.



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

### Wi-Fi Antenna

High gain Wi-Fi antenna.



Length: 35 meter  
Weight: 2.5 kg

### Antenna Cable

35m High gain antenna RF cable both end pre-made antenna connectors.



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

### CRPA Antenna

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



Length: 3 meter  
Weight: 0.5 kg

### Wi-Fi Cable

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

## Optional



Length: 45 meter  
Weight: 3.3 kg

### Antenna Cable

45m High gain antenna RF cable both end pre-made antenna connectors.



# Navigation Towards a Sustainable Future

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**SAL NAVIGATION**