

Enclosures PwrPak7D™



COMPACT DUAL ANTENNA ENCLOSURE DELIVERS SCALABLE POSITIONING PERFORMANCE WITH INTERNAL STORAGE



FUTURE PROOFED SCALABILITY

Capable of tracking all present and upcoming Global Navigation Satellite System (GNSS) constellations and satellite signals, the PwrPak7D is a robust, high precision receiver that is software upgradable in the field to provide the custom performance required for your application.

DUAL ANTENNA INPUT

Multi-frequency, dual antenna input allows the PwrPak7D to harness the power of NovAtel CORRECT® with RTK and ALIGN functionality. This makes the PwrPak7D ideal for ground vehicle, marine or aircraft based systems, providing industry leading GNSS multi-constellation heading and position data in static and dynamic environments.

BASE STATION OR ROVER

Compact and lightweight, the PwrPak7D is well suited for base or rover applications. It has a powerful OEM7® GNSS engine inside and offers built in Wi-Fi, on board NTRIP client and server support and 16 GB of internal storage. It also has enhanced connection options including serial, USB, CAN and Ethernet.

PRECISE THINKING MAKES IT POSSIBLE

Developed for efficient and rapid integration, our GNSS products have set the standard in quality and performance for over 20 years. State-of-the-art, lean manufacturing facilities in our North American headquarters produce the industry's most extensive line of OEM receivers, antennas and subsystems. All of our products are backed by a team of highly skilled design and customer support engineers, ready to answer your integration questions.

FEATURES

- + 555 channel, all-constellation, multi-frequency positioning solution
- + Multi-channel L-Band supports TerraStar correction services
- + Multiple communication interfaces for easy integration and installation
- + Built-in Wi-Fi support
- + ALIGN® heading solution
- + 16 GB of internal storage
- + SPAN® INS functionality

If you require more information about our enclosures, visit www.novatel.com/products/gnss-receivers/enclosures/

PERFORMANCE¹

Channel Configuration

555 Channels

Signal Tracking

Primary RF²

GPS L1 C/A, L1C, L2C, L2P, L5

GLONASS³ L1 C/A, L2 C/A, L2P, L3, L5

Galileo E1, E5 AltBOC, E5a, E5b

BeiDou⁴ B1I, B1C, B2I, B2a

QZSS L1 C/A, L1C, L2C, L5

NavIC (IRNSS) L5

SBAS L1, L5

L-Band up to 5 channels

Secondary RF²

GPS L1 C/A, L1C, L2C, L2P, L5

GLONASS³ L1 C/A, L2 C/A, L2P, L3, L5

Galileo E1, E5 AltBOC, E5a, E5b

BeiDou⁴ B1I, B1C, B2I, B2a

QZSS L1 C/A, L1C, L2C, L5

NavIC (IRNSS) L5

Horizontal Position Accuracy (RMS)

Single point L1 1.5 m

Single point L1/L2 1.2 m

SBAS⁵ 60 cm

DGPS 40 cm

TerraStar-L⁶ 40 cm

TerraStar-C PRO⁶ 2.5 cm

RTK 1 cm + 1 ppm

Initialization time <10 s

Initialization reliability >99.9%

Maximum Data Rate

Measurements up to 100 Hz

Position up to 100 Hz

Time to First Fix

Cold start^{7,8} <40 s

Hot start^{9,8} <19 s

Signal Reacquisition

L1 <0.5 s (typical)

L2 <1.0 s (typical)

Time Accuracy¹⁰ 20 ns RMS

Velocity Accuracy

0.03 m/s RMS

Velocity Limit¹¹ 515 m/s

COMMUNICATION PORTS

1 RS-232 up to 460,800 bps

2 RS-232/RS-422 selectable

up to 460,800 bps

1 USB 2.0 (device) HS

1 USB 2.0 (host) HS

1 Ethernet 10/100 Mbps

1 CAN Bus 1 Mbps

3 Event inputs

3 Event outputs

1 Pulse Per Second output

1 Quadrature Wheel Sensor input

PHYSICAL AND ELECTRICAL

Dimensions 147 x 125 x 55 mm

Weight 500 g

Power

Input voltage +9 to +36 VDC

Power consumption¹² 1.8 W

2 Antenna LNA Power Outputs

Output voltage 5 VDC ±5%

Maximum current 200 mA

Connectors

2 Antenna SMA

USB device Micro A/B

USB host Micro A/B

Serial, CAN, Event I/O

DSUB HD26

Ethernet RJ45

Data Logging Push button

Power SAL M12, 5 pin, male

Status LEDs

Power

GNSS

INS

Data Logging

USB

ENVIRONMENTAL

Temperature

Operating -40°C to +75°C

Storage -40°C to +85°C

Humidity 95% non-condensing

Waterproof IEC 60529 IPX7

Dust IEC 60529 IP6X

Vibration (operating)

Random MIL-STD-810 514.6

Category 24, 20g RMS

Sinusoidal IEC 60068-2-6

Acceleration (operating)

MIL-STD 810G, Method 513.6

Procedure II (16 g)

Bump ISO 9022-31-06 (25g)

Shock (non-operating)

MIL-STD-810G, 516.6,

Procedure 1,

40 g 11 ms terminal sawtooth

Compliance Industry Canada,

FCC, CE, RoHS, WEEE

FEATURES

- NovAtel OEM7 positioning engine
- Standard 16 GB internal storage
- Support for logging to external USB storage device
- Built-in Wi-Fi support
- Optional integrated Epson G320N MEMs IMU
- Web GUI

FIRMWARE SOLUTIONS

- ALIGN®
- SPAN®
- RTK
- RTK ASSIST™
- TerraStar PPP
- API

INCLUDED ACCESSORIES

- Power cable
- USB cable
- DSUB HD26 to DB9 RS-232 cable

OPTIONAL ACCESSORIES

- Full breakout cable for DSUB HD26 connector
- DSUB HD26 to M12 IMU cable
- RJ45 Ethernet cable
- VEXXIS® GNSS-500 and GNSS-800 series antennas
- ANT series antennas
- GrafNav/GravNet®
- Inertial Explorer®
- NovAtel Connect

For the most recent details of this product:

www.novatel.com/products/gnss-receivers/enclosures/pwrpak7D

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¹ Typical values. Performance specifications subject to GNSS system characteristics, Signal-in-Space (SIS) operational degradation, ionospheric and tropospheric conditions, satellite geometry, baseline length, multipath effects and the presence of intentional or unintentional interference sources.

² Model-configurable to track L5/E5a (all / Galileo) through L2 (GPS) or L3/E5b/B2 (GLONASS / Galileo / BeiDou) through L2 (GLONASS). See manual for details.

³ Hardware ready for L3 and L5.

⁴ Designed for BeiDou Phase 2 and 3, B1 and, B2 compatibility.

⁵ GPS only.

⁶ Requires a subscription to a TerraStar data service. Subscriptions available from NovAtel.

⁷ Typical value. No almanac or ephemerides and no approximate position or time.

⁸ Available in Q2 2019.

⁹ Typical value. Almanac and recent ephemerides saved and approximate position and time entered.

¹⁰ Time accuracy does not include biases due to RF or antenna delay.

¹¹ Export licensing restricts operation to a maximum of 515 metres per second, message output impacted above 500 m/s.

¹² Typical value. Consult the OEM7 User Documentation for power supply considerations.

SPAN® IMU-μIMU-IC



HIGH PERFORMING MEMS IMU
COMBINES WITH NOVATEL'S GNSS
TECHNOLOGY TO PROVIDE 3D POSITION,
VELOCITY AND ATTITUDE SOLUTION



SPAN: WORLD-LEADING GNSS+INS TECHNOLOGY

Synchronous Position, Attitude and Navigation (SPAN) technology brings together two different but complementary technologies: Global Navigation Satellite Systems (GNSS) positioning and inertial navigation. The absolute accuracy of GNSS positioning and the stability of Inertial Measurement Unit (IMU) gyro and accelerometer measurements are tightly coupled to provide an exceptional 3D navigation solution that is stable and continuously available, even through periods when satellite signals are blocked.

OVERVIEW

The μIMU features Northrop Grumman Litef GmbH's proven inertial measurement technology offering exceptional performance when paired with a NovAtel SPAN enabled receiver. The μIMU interfaces with NovAtel's OEM6 and OEM7 receivers through a highly reliable IMU interface. IMU measurements are used by the SPAN receiver to compute a blended GNSS+INS position, velocity and attitude solution at up to 200 Hz. Small size, low weight and power consumption makes the μIMU ideal for heading reference, flight control and stabilization applications.

The IMU-μIMU is available as a complete assembly in an environmentally sealed enclosure. The μIMU is also available as a stand alone OEM product that can be easily paired with a SPAN enabled GNSS receiver.

IMPROVE SPAN ACCURACY

Take advantage of NovAtel CORRECT™ to receive your choice of accuracy and performance, from decimetre to RTK-level positioning. For more demanding applications, Inertial Explorer® post-processing software from our Waypoint® Product Group can be used to post-process SPAN IMU-μIMU data to offer the highest level of accuracy with the system.

BENEFITS

- + Fully commercial MEMS IMU
- + Continuous, stable positioning
- + Easy integration with NovAtel's OEM6 and OEM7 series GNSS+INS receivers
- + Ideal for aerial and hydrographic survey as well as industrial applications

FEATURES

- + MEMS gyros and MEMS accelerometers
- + 200 Hz data rate
- + 10-34 VDC power input
- + SPAN GNSS+INS functionality

If you require more information about our SPAN products, visit www.novatel.com/span

IMU- μ IMU-IC



SPAN SYSTEM PERFORMANCE¹

Horizontal Position Accuracy (RMS)

Single point L1/L2	1.2 m
NovAtel CORRECT	
» SBAS ²	60 cm
» DGPS	40 cm
» PPP ^{3, 4}	
TerraStar-L	40 cm
TerraStar-C	4 cm
» RTK	1 cm +1 ppm

Data Rate

IMU measurements	200 Hz
INS position	200 Hz
INS velocity	200 Hz
INS attitude	200 Hz

Time Accuracy⁵ 20 ns RMS

Max Velocity⁶ 515 m/s

IMU PERFORMANCE⁷

Gyroscope Performance

Input range	± 499 deg/sec
Bias stability	≤ 6 deg/hr
Scale factor error	≤ 1400 ppm
Angular random walk	≤ 0.3 deg/ $\sqrt{\text{hr}}$

Accelerometer Performance

Range ⁸	± 15 g
Bias repeatability	≤ 3 mg
Scale factor error	≤ 1500 ppm
Velocity random walk	≤ 0.25 mg/ $\sqrt{\text{Hz}}$

PHYSICAL AND ELECTRICAL

Dimensions

130 x 130 x 115 mm

Weight 2.57 kg

Power

Power consumption

11 W (typical)

Input voltage +10 to +34 V

Connectors

Power SAL M12, 5 pin, male

Data SAL M12, 4 pin, female

Wheel sensor SAL M12, 8 pin, male

ENVIRONMENTAL

Temperature

Operating -40°C to +55°C

Storage -40°C to +80°C

Humidity

MIL-STD-810G(Ch1), Method 507.6

Random Vibe

MIL-STD-810G(CH1), Method 514.7 (2.0g)

Environment

MIL-STD-810G(Ch1), Method 512.6 (IEC 60529 IP67)

INCLUDED ACCESSORIES

- Power cable
- Communication cable
- Wheel sensor cable

OPTIONAL ACCESSORIES

- Mounting plate
- Inertial Explorer post-processing software

For the most recent details of this product:

www.novatel.com/products/span-gnss-inertial-systems/span-imus/micro-imu

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PERFORMANCE DURING GNSS OUTAGES^{1,9}

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	SP	1.00	0.60	0.015	0.010	0.010	0.010	0.030
	RTK ¹⁰	0.02	0.03	0.015	0.010	0.010	0.010	0.030
	PP ¹¹	0.01	0.02	0.010	0.010	0.005	0.005	0.009
10 s	SP	1.10	0.68	0.030	0.013	0.017	0.017	0.038
	RTK ¹⁰	0.16	0.10	0.030	0.013	0.017	0.017	0.038
	PP ¹¹	0.01	0.02	0.020	0.010	0.005	0.005	0.009
60 s	SP	4.25	1.25	0.150	0.020	0.025	0.025	0.050
	RTK ¹⁰	3.55	0.75	0.150	0.020	0.025	0.025	0.050
	PP ¹¹	0.15	0.05	0.02	0.01	0.006	0.006	0.010

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

2. GPS-only.

3. Requires subscription to TerraStar data service. Subscriptions available from NovAtel.

4. TerraStar service available depends on the SPAN receiver used. See the receiver product sheet for details.

5. Time accuracy does not include biases due to RF or antenna delay.

6. Export licensing restricts operation to a maximum of 515 metres/second.

7. Supplied by IMU manufacturer.

8. GNSS receiver sustains tracking up to 4 g.

9. Steady state and outage performance remains the same for the -L model.

10. 1 ppm should be added to all values to account for additional error due to baseline length.

11. Post-processing results using Inertial Explorer software.

VEXXIS™ Antennas GNSS-501



HIGH PERFORMANCE ANTENNA FOR TERRESTRIAL APPLICATIONS



PATENTED TECHNOLOGY

The VEXXIS GNSS-500 series antennas provide outstanding circularly polarized, symmetric radiation patterns with superior multipath rejection performance. This is achieved with a patented multi-point feeding network which provides uniquely low loss and frequency independent amplitude/phase balance. Strictly balancing signals and sequentially feeding the GNSS antenna at multiple points is the key to achieving remarkable performance.

OPTIMIZED FOR TERRESTRIAL APPLICATIONS

The GNSS-501 antenna is designed with a low profile, aerodynamic enclosure, ideal for ground vehicles in applications such as agriculture, machine control and mobile mapping. Magnetic mounts makes the antenna easy to install or move between ground vehicle platforms. The combination of intelligent enclosure design along with multi-constellation and L-Band support makes it ideal for any terrestrial application.

RUGGEDIZED FOR CHALLENGING ENVIRONMENTS

The GNSS-501 has been thoroughly tested to withstand even the most challenging environments. It endured over 1000 hours of intense vibration testing to earn its MIL-STD-810G rating. It is also water resistant under heavy rainfall or high pressure spray, ensuring its long survivability under the toughest operating conditions.

FEATURES

- + Supports single-frequency GPS, GLONASS, Galileo and BeiDou signals
- + L-Band signal reception, supporting correction services such as TerraStar
- + Multi-point antenna feed provides stable phase center and enhanced multipath rejection
- + Designed for high quality performance when used with NovAtel's STEADYLINE® technology
- + Low-profile design ideal for machine control applications

If you require more information about our antennas, visit www.novatel.com/antennas

GNSS-501



PERFORMANCE

Signal Received

GPS	L1
GLONASS	L1
Galileo	E1
BeiDou	B1
L-Band	

Pass Band (typical)

Upper passband	1569.0 ± 43.0 MHz
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Out-of-Band Rejection

Band edges ± 50 MHz	15 dB (typical)
Band edges ± 100 MHz	25 dB (typical)

LNA Gain	29 dB (typical)
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Gain at Zenith (90°)

L1/B1/E1/G1	+4.0 dBic minimum
L-Band	+4.0 dBic minimum

Gain Roll-Off (from Zenith to Horizon)

L1/B1/E1/G1	12 dB
L-Band	12 dB

Phase Center Stability	<5.0 mm
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Noise Figure	2.5 dB (typical)
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VSWR	≤2.0 : 1
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Group Delay Ripple	<15 ns
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Nominal Impedance	50 Ω
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PHYSICAL AND ELECTRICAL

Dimensions	155 mm D × 45 mm H
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Weight	450 g
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Connector	TNC female
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Mounting	2 × magnetic mounts 2 × M4 screw inserts
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Power

Input voltage	+3.3 to +18.0 VDC
Current	20 mA (typical)

ENVIRONMENTAL

Temperature

Operating	-40°C to +85°C
Storage	-55°C to +85°C

Humidity	95% non-condensing
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Salt Fog	MIL-STD-810G (CH1), 509.6
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Water/Dust Resistance	IP67, IP69K
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Vibration (operating)

Random	MIL-STD-810G (CH1), 514.7 (15 g) Annex E Procedure 1, Category 24
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Shock	MIL-STD-810G (CH1), 516.7 (40 g) Procedure 1
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Bump	IEC 68-2-27 Ea (25 g)
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Regulatory Compliance	FCC, CE
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RoHS	EU Directive 2011/65/EU
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For the most recent details of this product:
www.novatel.com/products/gnss-antennas/vexxis-series-antennas/gnss-500-series-antennas/

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VEXXIS™ Antennas GNSS-502



HIGH PERFORMANCE ANTENNA FOR TERRESTRIAL APPLICATIONS



PATENTED TECHNOLOGY

The VEXXIS GNSS-500 series antennas provide outstanding circularly polarized, symmetric radiation patterns with superior multipath rejection performance. This is achieved with a patented, multi-point feeding network which provides uniquely low loss and frequency independent amplitude/phase balance. Strictly balancing signals and sequentially feeding the GNSS antenna at multiple points is the key to achieving remarkable performance.

OPTIMIZED FOR TERRESTRIAL APPLICATIONS

The GNSS-502 antenna is designed with a low profile, aerodynamic enclosure, ideal for ground vehicles in applications such as agriculture, machine control and mobile mapping. Magnetic mounts make the antenna easy to install or move between ground vehicle platforms. The combination of intelligent enclosure design along with multi-constellation and L-Band support makes it ideal for any terrestrial application.

RUGGEDIZED FOR CHALLENGING ENVIRONMENTS

The GNSS-502 has been thoroughly tested to withstand even the most challenging environments. It endured over 1000 hours of intense vibration testing to earn its MIL-STD-810G rating. It is also water resistant under heavy rainfall or high pressure spray, ensuring its long survivability under the toughest operating conditions.

FEATURES

- + Supports dual-frequency GPS, GLONASS, Galileo, BeiDou and SBAS signal reception
 - + L-Band signal reception, supporting correction services such as TerraStar
 - + Multi-point antenna feed provides stable phase center and enhanced multipath rejection
 - + Designed for high quality performance when used with NovAtel's STEADYLINE® technology
 - + Low-profile design ideal for machine control applications
-

If you require more information about our antennas, visit www.novatel.com/antennas

GNSS-502



PERFORMANCE

Signal Received

GPS	L1, L2
GLONASS	L1, L2
Galileo	E1, E5b
BeiDou	B1, B2
L-Band	

Pass Band (typical)

Upper passband	1569.0 ± 43.0 MHz
Lower passband	1220.0 ± 31.0 MHz

Out-of-Band Rejection

Band edges ± 50 MHz	15 dB (typical)
Band edges ± 100 MHz	25 dB (typical)

LNA Gain

29 dB (typical)

Gain at Zenith (90°)

L1/B1/E1/G1	+4.0 dBic minimum
L2/B2/E5b/G2	+4.0 dBic minimum
L-Band	+4.0 dBic minimum

Gain Roll-Off (from Zenith to Horizon)

L1/B1/E1/G1	12 dB
L2/B2/E5b/G2	12 dB
L-Band	12 dB

Phase Center Stability

<5.0 mm

Noise Figure

2.5 dB (typical)

VSWR

≤2.0 : 1

L1-L2 Differential Propagation Delay

7 ns (maximum)

Group Delay Ripple

<15 ns

Nominal Impedance

50 Ω

PHYSICAL AND ELECTRICAL

Dimensions 155 mm D × 45 mm H

Weight 450 g

Connector TNC female

Mounting 2 × magnetic mounts
2 × M4 screw inserts

Power

Input voltage +3.3 to +18.0 VDC
Current 20 mA (typical)

ENVIRONMENTAL

Temperature

Operating -40°C to +85°C
Storage -55°C to +85°C

Humidity 95% non-condensing

Salt Fog MIL-STD-810G (CH1), 509.6

Water/Dust Resistance IP67, IP69K

Vibration (operating)

Random MIL-STD-810G (CH1),
514.7 (15 g) Annex E
Procedure 1, Category 24

Shock MIL-STD-810G (CH1),
516.7 (40 g) Procedure 1

Bump IEC 68-2-27 Ea (25 g)

Regulatory Compliance FCC, CE

RoHS EU Directive 2011/65/EU

For the most recent details of this product:
www.novatel.com/products/gnss-antennas/vexxis-series-antennas/gnss-500-series-antennas/

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