

# 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/](http://www.novatel.com/products/gnss-receivers/enclosures/)

## PERFORMANCE<sup>1</sup>

### Channel Configuration

555 Channels

### Signal Tracking

#### Primary RF<sup>2</sup>

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

GLONASS<sup>3</sup> L1 C/A, L2 C/A, L2P, L3, L5

Galileo E1, E5 AltBOC, E5a, E5b

BeiDou<sup>4</sup> B1I, B1C, B2I, B2a

QZSS L1 C/A, L1C, L2C, L5

NavIC (IRNSS) L5

SBAS L1, L5

L-Band up to 5 channels

#### Secondary RF<sup>2</sup>

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

GLONASS<sup>3</sup> L1 C/A, L2 C/A, L2P, L3, L5

Galileo E1, E5 AltBOC, E5a, E5b

BeiDou<sup>4</sup> 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

SBAS<sup>5</sup> 60 cm

DGPS 40 cm

TerraStar-L<sup>6</sup> 40 cm

TerraStar-C PRO<sup>6</sup> 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<sup>7,8</sup> <40 s

Hot start<sup>9,8</sup> <19 s

### Signal Reacquisition

L1 <0.5 s (typical)

L2 <1.0 s (typical)

Time Accuracy<sup>10</sup> 20 ns RMS

### Velocity Accuracy

0.03 m/s RMS

Velocity Limit<sup>11</sup> 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 consumption<sup>12</sup> 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](http://www.novatel.com/products/gnss-receivers/enclosures/pwrpak7D)

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<sup>1</sup> 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.

<sup>2</sup> 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.

<sup>3</sup> Hardware ready for L3 and L5.

<sup>4</sup> Designed for BeiDou Phase 2 and 3, B1 and, B2 compatibility.

<sup>5</sup> GPS only.

<sup>6</sup> Requires a subscription to a TerraStar data service. Subscriptions available from NovAtel.

<sup>7</sup> Typical value. No almanac or ephemerides and no approximate position or time.

<sup>8</sup> Available in Q2 2019.

<sup>9</sup> Typical value. Almanac and recent ephemerides saved and approximate position and time entered.

<sup>10</sup> Time accuracy does not include biases due to RF or antenna delay.

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

<sup>12</sup> Typical value. Consult the OEM7 User Documentation for power supply considerations.

## SMALL, LIGHTWEIGHT MEMS IMU ENCLOSURE FOR PAIRING WITH NOVATEL'S SPAN TECHNOLOGY



### SPAN: WORLD LEADING GNSS+INS TECHNOLOGY

Synchronous Position, Attitude and Navigation (SPAN) technology brings together two different but complementary technologies: Global Navigation Satellite System (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.

### SPAN ENABLED MEMS ENCLOSURE

NovAtel developed the IMU-IGM-S1 for pairing with a SPAN enabled GNSS receiver. Incorporating Sensor's STIM300 MEMS IMU, the IMU-IGM-S1 delivers the smallest and lightest tactical grade IMU enclosure in our SPAN product portfolio. The IMU-IGM-S1 delivers a rugged product on which to build your SPAN application.

### IMPROVED ACCURACY

Take advantage of NovAtel CORRECT<sup>™</sup> to receive your choice of accuracy and performance, from decimetre to RTK-level positioning. For more demanding applications, Inertial Explorer<sup>®</sup> software from our Waypoint<sup>®</sup> Products Group can be used to post-process SPAN data to provide the highest level of accuracy.

### BENEFITS

- + Small, lightweight and rugged
- + Tactical grade performance
- + Commercially exportable
- + Optimized for SPAN on OEM6<sup>®</sup> enclosures

### FEATURES

- + Regulated 10-30 VDC input
- + 125 Hz navigation solution and raw measurement output
- + Dedicated wheel sensor input

If you require more information about our SPAN products, visit [www.novatel.com/span](http://www.novatel.com/span)

# IMU-IGM-S1™

## SPAN SYSTEM PERFORMANCE<sup>1</sup>

### Horizontal Position Accuracy (RMS)

Single point L1/L2	1.2 m
NovAtel CORRECT™	
» SBAS <sup>2</sup>	60 cm
» DGPS	40 cm
» PPP <sup>3, 4</sup>	4 cm
» RTK	1 cm + 1 ppm

### Data Rates

IMU measurement	125 Hz
INS solution	Up to 125 Hz

**Time Accuracy<sup>5</sup>** 20 ns RMS

**Max Velocity<sup>6</sup>** 515 m/s

## IMU PERFORMANCE<sup>7</sup>

### Gyroscope Performance

Bias instability	0.5 deg/h
Input range	400 deg/sec
Angular random walk	0.15 deg/√hr

### Accelerometer Performance

Bias instability	0.05 mg
Range	10 g
Velocity random walk	0.06 m/s/√hr

## PHYSICAL AND ELECTRICAL

### Dimensions

152 × 137 × 51 mm

**Weight** 500 g

### Power

Input voltage 10-30 VDC

Power consumption<sup>8</sup> <4.6 W

### Connectors

Main port and AUX port  
DB-HD15

## COMMUNICATION PORTS

1 RS-232/RS-422 IMU data port

1 Wheel sensor port

### Status LEDs

Power  
GNSS status  
INS status

## ENVIRONMENTAL

### Temperature

Operating -40°C to +65°C

Storage -50°C to +80°C

**Humidity** MIL-STD-810G

95% Non-condensing

### Vibration (operating)

Random MIL-STD-810G (7.7 g)

Sinusoidal IEC 60068-2-6 (5 g)

**Bump** IEC 60068-2-27 (25 g)

**Shock** MIL-STD-810G (40 g)

**Immersion** IEC 60529 IPX7

**Compliance** FCC, CE marking, Industry Canada

## INCLUDED ACCESSORIES

- Combined power and data cable

## OPTIONAL ACCESSORIES

- I/O and wheel sensor accessory cable
- Inertial Explorer post-processing software

## OPTIONAL CONFIGURATION

Stackable with FlexPak6™ for a SPAN solution (shown)



For the most recent details of this product: [www.novatel.com/products/span-gnss-inertial-systems/span-imus/span-mems-imu/imu-igm-s1/](http://www.novatel.com/products/span-gnss-inertial-systems/span-imus/span-mems-imu/imu-igm-s1/)

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## PERFORMANCE DURING GNSS OUTAGES<sup>9</sup>

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 <sup>10</sup>	0.02	0.03	0.020	0.010	0.015	0.015	0.080
	SP	1.00	0.60	0.020	0.010	0.015	0.015	0.080
	PP <sup>11</sup>	0.01	0.02	0.020	0.010	0.006	0.006	0.019
10 s	RTK <sup>10</sup>	0.27	0.14	0.051	0.017	0.025	0.025	0.095
	SP	1.22	0.71	0.051	0.017	0.025	0.025	0.095
	PP <sup>11</sup>	0.02	0.02	0.020	0.010	0.007	0.007	0.021
60 s	RTK <sup>10</sup>	6.61	1.46	0.280	0.051	0.044	0.044	0.130
	SP	7.56	2.03	0.280	0.051	0.044	0.044	0.130
	PP <sup>11</sup>	0.22	0.10	0.024	0.011	0.008	0.008	0.024

1. Performance obtained when using an OEM6 Family receiver (contact NovAtel Sales for purchase information). For detailed receiver specifications, see NovAtel's OEM615 receiver product sheet and NovAtel Receivers brochure.  
2. GPS-only.  
3. Requires subscription to TerraStar data service. Subscriptions available from NovAtel.  
4. An OEM628, OEM638, FlexPak6 or ProPak6 receiver is required.  
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. Typical, 12 V, 25 °C, IMU only. System with FlexPak6 requires 7 W.  
9. Outage performance information is applicable for firmware version OEM060240RN0000 and up.  
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.

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# VEXXIS™ Antennas GNSS-501

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## HIGH PERFORMANCE ANTENNA FOR TERRESTRIAL APPLICATIONS

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### 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

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- + 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](http://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)

<b>LNA Gain</b>	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

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

<b>Dimensions</b>	155 mm D × 45 mm H
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<b>Weight</b>	450 g
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<b>Connector</b>	TNC female
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<b>Mounting</b>	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

<b>Humidity</b>	95% non-condensing
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<b>Salt Fog</b>	MIL-STD-810G (CH1), 509.6
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<b>Water/Dust Resistance</b>	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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<b>Shock</b>	MIL-STD-810G (CH1), 516.7 (40 g) Procedure 1
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<b>Bump</b>	IEC 68-2-27 Ea (25 g)
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<b>Regulatory Compliance</b>	FCC, CE
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<b>RoHS</b>	EU Directive 2011/65/EU
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For the most recent details of this product:  
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# VEXXIS™ Antennas GNSS-502

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## HIGH PERFORMANCE ANTENNA FOR TERRESTRIAL APPLICATIONS

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### 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

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- + 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
- 

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# 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

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