



PwrPak7™ & PwrPak7-E1

QUICK START GUIDE

GM-14915152

Rev 3

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This guide provides the basic information needed to set up and use a NovAtel® PwrPak7 or PwrPak7-E1. Both the PwrPak7 and PwrPak7-E1 are compact enclosures that deliver scalable positioning performance and contain internal storage. The PwrPak7-E1 contains an Epson EG320N MEMS IMU to deliver world class NovAtel SPAN® technology in an integrated, single box solution. The PwrPak7 does not contain an IMU, but can deliver SPAN technology using a SPAN compatible external IMU



In this document, the term PwrPak7 is used to represent both the PwrPak7 and PwrPak7-E1. When a section applies to a specific variant of the PwrPak7 enclosure, the applicable receiver is identified (e.g. PwrPak7-E1 only).

USER DOCUMENTATION

For detailed information on the installation, operation, logs and commands for the PwrPak7, refer to the OEM7 User Documentation (docs.novatel.com/OEM7).

BOX CONTENTS

The following is provided with the PwrPak7:

- Power cable (01019764)
- USB A to USB micro B cable (60723175)

Additional Equipment Required

The additional equipment listed below is required for a typical setup (refer to the OEM7 User Documentation (docs.novatel.com/OEM7) for further details).

- A 9-36 VDC, fuse protected power supply capable of at least 15 W
- A quality GNSS antenna, such as NovAtel's VEXXIS® GNSS-500 or GNSS-800 series antennas
- An antenna cable with a TNC male connector at the receiver end such as NovAtel's GPS-C016 model
- A computer/tablet/smartphone with Wi-Fi and a web browser and/or a computer with an RS-232 DB-9, Ethernet or USB port

Optional Accessories

The following optional accessories are available from NovAtel:

- PwrPak7 COM cable (01019765)
Provides connection to the COM1 serial port on the PwrPak7 COM port (DB26 to DB9)
- PwrPak7 All I/O cable (01019766)
Provides connections for all of the signals available on the PwrPak7 COM port

- Optional external SPAN compatible IMU (PwrPak7 only)
www.novatel.com/products/span-gnss-inertial-systems/span-imus
- PwrPak7 IMU cable (01019767)
Provides connection from the COM1 serial port on the PwrPak7 to an IMU Enclosure (IMU-HG1900, IMU-ENC-LN200, IMU-ISA-100C or IMU-μIMU-IC) (DB26 to M12 5-pin)
- NovAtel recommends using a Micro A to USB stick adapter, such as Tensility 10-00649 or equivalent, to connect a USB stick to the PwrPak7 TRANSFER port.
- Four M5 or #10 size screws for mounting.

For information about these accessories refer to the OEM7 User Documentation (docs.novatel.com/OEM7).

GETTING TO KNOW THE PWRPAK7

Refer to the OEM7 User Documentation (docs.novatel.com/OEM7) for details on all PwrPak7 connectors, labeling and LEDs as well as detailed installation and operation instructions. The OEM7 User Documentation (docs.novatel.com/OEM7) also has information regarding PwrPak7 logs and commands.

Table 1: PwrPak7 - Connector Definitions







Connector Type	Connector Label	Description
 GNSS Antenna	ANT	GNSS TNC
 Power	PWR	SAL M12, 5-pin Male connector
 USB	TRANSFER	USB 2.0 Micro A/B data transfer port
 USB	COM PORTS	USB 2.0 Micro A/B Device virtual COM port
 Ethernet		Ethernet RJ45 connector
 DSUB HD26		3 Event inputs (LVCMOS) 3 Event outputs (LVCMOS) 1 Pulse Per second output (LVCMOS) 1 CAN 3 Serial ports: <ul style="list-style-type: none"> • COM1 RS-232/RS-422 user selectable • COM2 RS-232/RS-422 user selectable • COM3 RS-232
		Wheel Sensor RS-422 quadrature input

Table 2: Power LED Description

LED Label	LED State	Description
PWR	Green solid	Operational mode
	Yellow solid	In process of booting
	Red solid	Error, for example, invalid receiver AUTH code Firmware/Web UI update in progress

Table 3: GNSS LED Description

LED Label	LED State	Description
GNSS (indicates the position status of the receiver)	Green solid	PPP Solution
	Green slow blink	RTK integer ambiguity
	Green fast blink	Single point or SBAS position
	Yellow solid	No solution
	Yellow blink	User Accuracy Level (UAL) out of bounds (STEADYLINE)
	If PwrPak7 configured as Base	
	Green solid	Fixed position
	Yellow solid	Pending fixed position
	Yellow blink	Invalid fix


Table 4: INS LED Description

LED Label	LED State	Description
(INS indicates the INS status of the receiver (PwrPak7-E1 or PwrPak7 using an external IMU only))	Off	INS inactive
	Green solid	INS solution good
	Green slow blink	INS alignment complete
	Green fast blink	INS solution free
	Green/Yellow alternating blink	High variance
	Yellow solid	INS aligning/determining orientation
	Red solid	Error

Table 5: USB TRANSFER LED Description

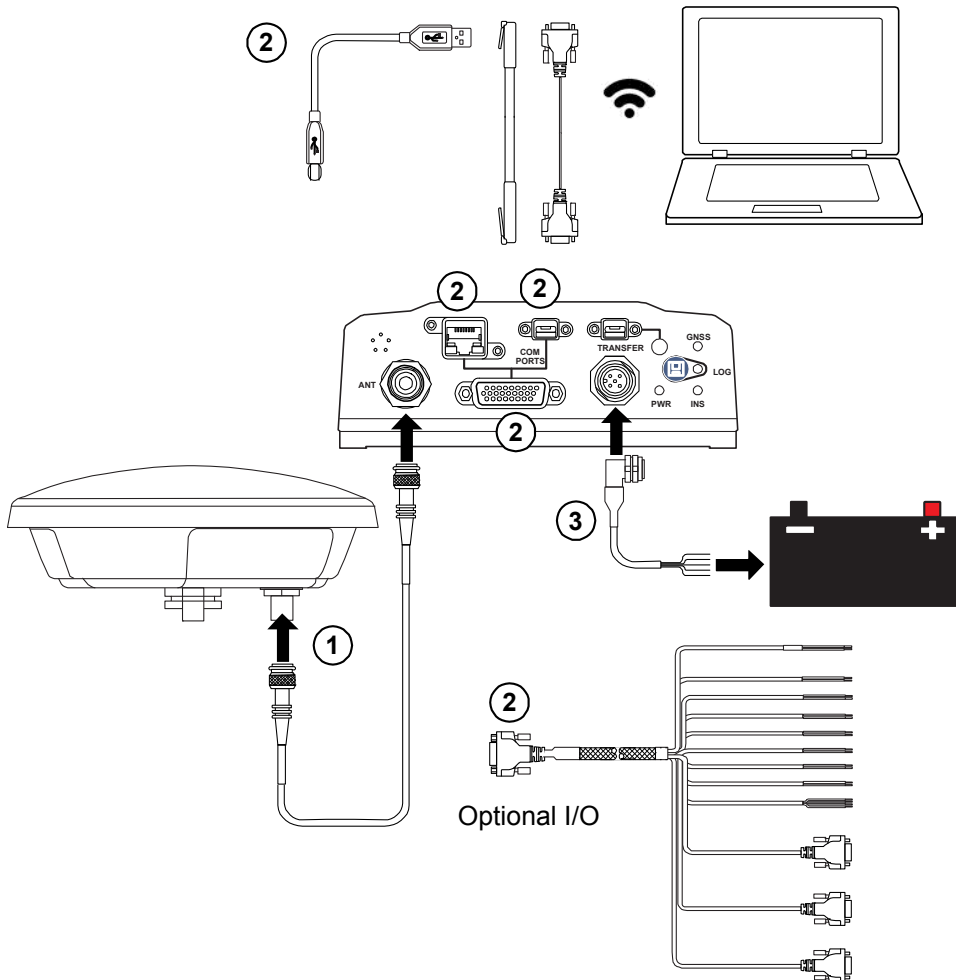
LED State	Description
Green solid	Stick plugged in, no activity
Green slow blink	Logging to stick with lots of available memory
Green fast blink	Transferring files to stick with lots of available memory
Green/Yellow alternating blink	Logging to stick but low available memory
Yellow solid	Stick plugged in but low available memory
Yellow fast blink	Stick mounting or unmounting/busy
Red solid	Stick plugged in memory full
Red fast blink for 3 seconds then Red solid	Stick mount error: Stick plugged in but corrupt or unsupported format
Off	No connection to the TRANSFER port or stick is unmounted

Table 6: LOG LED and Button Description

LOG Button with LED	LED State	Description
 Logging	Green slow blink	Logging to Internal (lots of memory available)
	Green solid	Internal logging stopped (lots of memory available)
	Green/Yellow alternating blink	Logging to Internal (low memory)
	Yellow solid	Internal logging stopped (low memory)
	Yellow fast blink	Memory is mounting or unmounting/busy
	Off	PwrPak7 is connected to a PC as a mounted device
Push Button Error	Red fast blink for 3 seconds then Red solid	Not enabled, memory full or corrupt, unsupported file system

SETTING UP A PWRPAK7

Complete the following steps to connect and power the PwrPak7. Be sure to mount the antenna to a secure, stable structure with an unobstructed view of the sky.



1. Connect the GNSS antenna to the ANT port and mount the antenna to a secure, stable structure with an unobstructed view of the sky.
2. Connect the USB, Ethernet or a COM port on the receiver to a USB, Ethernet or serial port on a computer.
If using a USB connection, install the USB drivers (refer to *Connect to the PwrPak7* on page 7 to obtain drivers).
A wired connection is not needed if using the NovAtel Web User Interface through a Wi-Fi connection.
3. Connect the power cable connector to the PWR port. The exposed wires can then be tied to a 9-36 VDC power supply capable of at least 15 W.
4. Install a user supplied 6 A slow blow fuse in the positive line of the connection to the power source to protect the power supply wiring and your warranty.

Table 7: Fuse/Holder Recommendations 12 V System

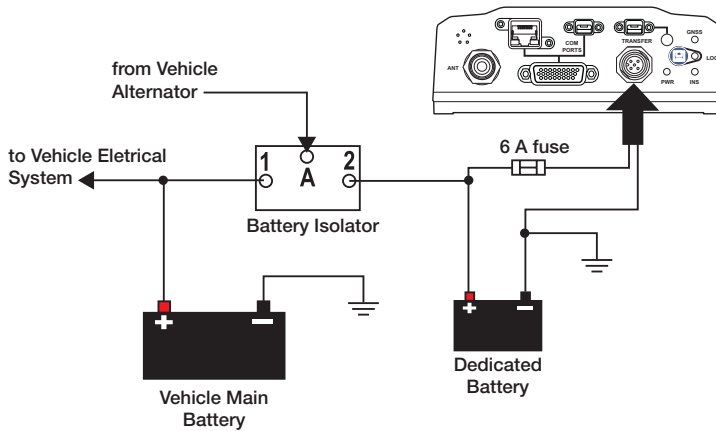
Fuse	Holder
BK/MDA-6-R Fuse (or equivalent) BK/MDL-6-R Fuse (or equivalent)	BK/HFA-R-R Fuse (or equivalent)



The fuse and holder are made by Cooper/Bussmann; available from Digikey.

Battery Backup

If the receiver is installed in a vehicle, it is recommended that a dedicated battery be provided for the receiver that is isolated from the engine starter battery. When a vehicle engine is started, the voltage on the starter battery can dip below the PwrPak7 minimum voltage or cut-out to ancillary equipment causing the receiver and/or IMU to lose lock and calibration settings.



PWRPAK7 MOUNTING

Mount the PwrPak7 in the desired fixed position using four M5 or #10 size screws at a torque not exceeding 15 Inch-Lb.



The PwrPak7-E1 has additional mounting considerations. See *PwrPak7-E1 Mounting* on page 6 for more information.

Refer to the PwrPak7 Specifications in the OEM7 User Documentation (docs.novatel.com/OEM7) for details regarding PwrPak7 mounting.

PwrPak7-E1 Mounting

Mount the PwrPak7-E1 and antenna securely to a vehicle. For the simplest operation, align the Y-axis of the PwrPak7-E1 with the forward axis (direction of travel) of the vehicle. Ensure the Z-axis is pointing up. Ensure that the GNSS antenna and PwrPak7 cannot move relative to each other. The distance and relative direction between them must be fixed.

CONNECT TO THE PWRPAK7

To configure the PwrPak7 and access data from the PwrPak7, establish a communication session with the PwrPak7 using one of the following three methods.

- **Command line**
From a command line session, OEM7 commands and logs are used to configure and monitor the receiver. Refer to the OEM7 User Documentation (docs.novatel.com/OEM7) for more information.
- **NovAtel Connect**
A serial (COM port), USB or Ethernet connection to the PwrPak7 is needed to use NovAtel Connect. To download NovAtel Connect, and the USB drivers, go to the NovAtel website: novatel.com/novatel-connect. For information about using NovAtel Connect, use the help system available in NovAtel Connect.
- **NovAtel Web UI**
An Ethernet or Wi-Fi connection to the PwrPak7 is needed to use NovAtel Web UI.

ETHERNET CONNECTION

The PwrPak7 is equipped with a 10/100 baseT Ethernet port that supports IPv4 Internet layer, TCP/IP transport, ping and connections from the Telnet client. The port can be used to perform remote debugging, receive MRTCA (modified RTCA) data and download firmware. The PwrPak7 is also equipped with NTRIP Version 2.0 client and server capability.

For instructions on configuring Ethernet and NTRIP refer the OEM7 User Documentation at docs.novatel.com/OEM7.

CONNECT TO A WI-FI NETWORK

The PwrPak7 and PwrPak7-E1 ship with the Wi-Fi Access Point enabled by default. This provides easy connection to any laptop/tablet/smartphone with Wi-Fi capability and a web browser.

1. Once the receiver is connected and powered, locate the PwrPak7 in the list of detected Wi-Fi networks and establish a connection. The PwrPak7 SSID is printed on a label on the bottom of the receiver. The format of the SSID is PwrPak7-<Receiver PSN>, e.g. "PwrPak7-ABCDEF1234567".
2. A prompt for a password will appear. The default password, specific to that PwrPak7 unit, is printed on a label on the bottom of the PwrPak7.

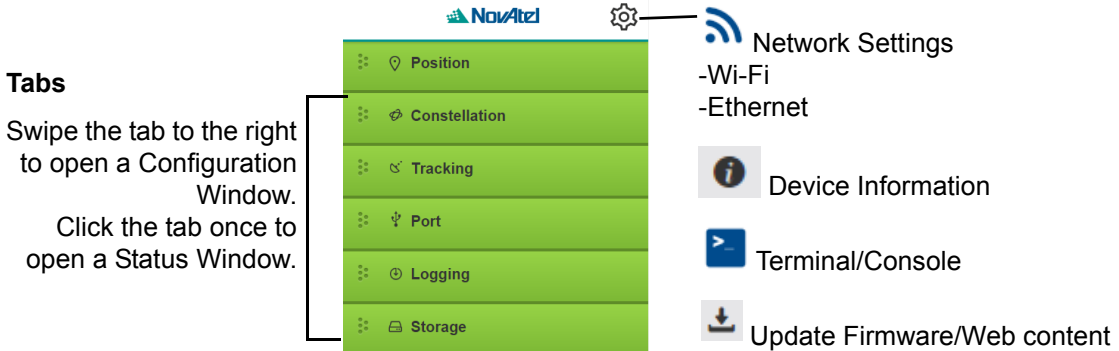


The Wi-Fi Access Point password can be changed using the Network Settings button in the NovAtel Web User Interface or the command line interface.

Refer to the OEM7 User Documentation (docs.novatel.com/OEM7) for more information about Wi-Fi configuration.

NovAtel Web User Interface (UI)

1. Open up a web browser and enter any web address (e.g., novatel.com). The PwrPak7 uses a "captive portal" to automatically redirect you to the NovAtel Web User Interface which is hosted within the PwrPak7.



Cookies should always be on and never blocked on the browser being used to connect to the Wi-Fi network.



Refer to the OEM7 User Documentation (docs.novatel.com/OEM7) for information about using the NovAtel Web User Interface.

NETWORK SECURITY

By default, minimal network/port security is set. It is the responsibility of the user to assess security requirements and configure the PwrPak7 as necessary. Refer to the OEM7 User Documentation (docs.novatel.com/OEM7) for more information.

DATA LOGGING

An extensive set of logs are available to capture data (refer to the Logs section of the OEM7 User Documentation (docs.novatel.com/OEM7)). Logs can be directed to any of the PwrPak7 communication ports and can be automatically generated at regular intervals or when new or changed data becomes available. Data can also be collected using the Logging tab in the NovAtel Web UI.

Different logging profiles can be created to facilitate different logging requirements. Refer to the OEM7 User Documentation (docs.novatel.com/OEM7) for details on logging.

Log SPAN Data

On SPAN enabled PwrPak7 models, raw GNSS, IMU and navigation data (position, velocity, attitude) are available from the system as ASCII or binary logs.

Data can be collected using the Logging tab of the NovAtel Web UI or sent out a receiver communication port to user supplied data collection software.

For real-time applications, the GNSS+INS solution is available through the SPAN logs listed in the OEM7 User Documentation (docs.novatel.com/OEM7) including INSPOS, INSVEL, INSATT and INSPVA. These logs can be collected at rates up to the IMU data rate; however, there are some rate restrictions. Refer to the *Data Collection* section in the *SPAN Operation* section of the OEM7 User Documentation (docs.novatel.com/OEM7).

ONBOARD MEMORY

The PwrPak7 contains 16 GB of memory for onboard data storage. Data can be logged to the internal memory of the PwrPak7 and downloaded for post-processing. Stored data may be downloaded in three ways:

- transfer to a computer by connecting to the TRANSFER port using the USB cable provided with the PwrPak7 (recommended)
- transfer to a USB stick connected to the TRANSFER port (NovAtel recommends using a Micro A to USB stick adapter, such as Tensility 10-00649 or equivalent, to connect a USB stick to the PwrPak7 TRANSFER port)
- transfer using FTP over Ethernet (refer to the OEM7 User Documentation (docs.novatel.com/OEM7) for Ethernet configuration instructions)

When connected to a computer via the USB TRANSFER port, the PwrPak7 relinquishes control of its onboard memory and PwrPak7 appears as an external drive to the computer. You can use the computer operating system to copy/move/delete files from the PwrPak7. When disconnected from the computer, the PwrPak7 regains control of the onboard memory and the memory is again available for logging. For the fastest data extraction, connect to the PwrPak7 using a computer (Window, Mac or Linux computer).

If transferring files from internal storage to a USB stick, the NovAtel Web UI can be used to select the files to transfer, configure auto or manual transfer and monitor or cancel the transfer action. The files can also be transferred using the command line (refer to the Logging and Retrieving Data section of the OEM7 User Documentation (docs.novatel.com/OEM7) for more information).



To reduce the possibility of potential data corruption, always “Eject” the memory stick prior to physically removing it from the computer.

ENABLING SBAS

The PwrPak7 is capable of SBAS positioning. This positioning mode is enabled using the `SBASCONTROL` command, as follows:

```
SBASCONTROL ENABLE AUTO
```

For details on the `SBASCONTROL` command, refer to the OEM7 User Documentation (docs.novatel.com/OEM7). SBAS can also be enabled using Position Configuration window in the NovAtel Web UI.

Once enabled, the Position type field shown in the Position tab of NovAtel Web UI should change from Single to the appropriate SBAS system (e.g. WAAS). SBAS satellites display in the Constellation tab. The PwrPak7 tracks available SBAS satellites, including WAAS, EGNOS and other SBAS systems.

ENABLING L-BAND

L-Band equipped receivers can achieve sub-metre position accuracy using correction data received from geostationary satellites. To use the L-Band corrections, an L-Band-capable receiver model and antenna are required (refer to our web site www.novatel.com/products/gnss-antennas for information on NovAtel L-Band-capable antennas) along with a subscription service.

PwrPak7 can use the following correction subscriptions:

- NovAtel CORRECT with TerraStar™
- Veripos Apex and Apex²



Receivers must be powered and tracking an L-Band satellite prior to activating a subscription service.

For more information on L-Band positioning:

- Refer to a NovAtel Application Note: APN-061 NovAtel CORRECT with TerraStar, APN-062 NovAtel CORRECT with Veripos or APN-051 Positioning Modes of Operation (service dependent) available from www.novatel.com/support/search/items/Application%20Note
- Refer to the Enabling NovAtel CORRECT with PPP section in the OEM7 User Documentation (docs.novatel.com/OEM7)
- Refer to the OEM7 User Documentation (docs.novatel.com/OEM7) for log and command details
- Visit www.novatel.com/support and speak with an Applications Engineer
- Visit www.novatel.com/products/novatel-correct

REAL-TIME KINEMATIC (RTK) POSITIONING

Corrections can be transmitted from a base station to a rover station to improve position accuracy to centimetre level. The base station is the GNSS receiver that is acting as the stationary reference. It has a known position and transmits correction messages to the rover station. The rover station is the GNSS receiver that does not know its exact position but which can receive correction messages from a base station to calculate differential GNSS positions.

In most cases, a data link between the base station and rover station (two NovAtel receivers) is required in order to receive corrections. It is also possible to receive and use RTK corrections from established networks. SBAS and L-Band corrections can be acquired with one receiver and are exceptions to the base/rover concept, although neither are considered RTK positioning. Generally a link capable of data throughput at a rate of 19200 bits per second, and less than 4.0 s latency, is recommended.

Once the base and rover are set up, configure them for RTCA, RTCM, RTCMV3, CMR+, CMR or NOVATELX corrections. Below is a NOVATELX example (replace the latitude, longitude and height coordinates shown with those of the base):

Base

```
serialconfig com2 115200 n 8 1 n on  
fix position [latitude] [longitude] [height] (enter your own lat, long and hgt  
values)  
generatertkcorrections novatelx com2
```

Rover

```
serialconfig com2 115200 n 8 1 n on  
interfacemode com2 novatelx none off
```

NovAtel CORRECT with RTK are real-time kinematic software products developed by NovAtel. Optimal RTK performance is achieved when both the base and rovers are NovAtel products; however, NovAtel CORRECT with RTK will operate with equipment from other manufacturers when using RTCM, RTCMV3 and CMR messaging.

Refer the Transmitting and Receiving Corrections section in the OEM7 User Documentation (docs.novatel.com/OEM7) for additional information.

PWRPAK7 POST PROCESSING

Post-mission data processing refers to cases where GNSS data collected by the receiver is processed after the entire data collection session is complete.

PwrPak7 output is compatible with post-processing software from NovAtel's Waypoint® Products Group. For details, see [www.novatel.com/Products/Waypoint Software](https://www.novatel.com/Products/Waypoint_Software).

PwrPak7-E1 Post-Process Data

Post-processing requires collection of simultaneous data from the base and rover stations. This includes accurate coordinates of the base station and accurate measurement of the IMU to antenna separation.

Collect the following data for post-processing:

- From the base station
 - RANGECMPB ontime 1
 - RAWEPHEMB onchanged
 - GLOEPHEMERISB onchanged (if using GLONASS)
- From the rover station(s)
 - RANGECMPB ontime 1
 - RAWEPHEMB onchanged
 - GLOEPHEMERISB onchanged (if using GLONASS)
 - RAWIMUSXB onnew (if using SPAN)
 - INSCONFIGB onchanged (if using SPAN)
 - HEADING2B onnew (if using ALIGN dual antenna solution)

SPAN system output is compatible with Inertial Explorer® post-processing software from the Waypoint® Products Group, NovAtel Inc. Visit our website at www.novatel.com/products/software/ for details.

ADDITIONAL FUNCTIONALITY

Refer to the OEM7 User Documentation (docs.novatel.com/OEM7) for set up and installation instructions for CAN, COM port configuration and other functionality.

QUESTIONS OR COMMENTS

If you have any questions or comments regarding your PwrPak7 product, contact NovAtel Customer Service using one of these methods

Log a Case and Search Knowledge:

Website: www.novatel.com/support

Log a Case, Search Knowledge and View Your Case History: (login required)

Web Portal: <https://novatelsupport.force.com/community/login>

Email:

support@novatel.com

Telephone:

U.S. and Canada: 1-800-NOVATEL (1-800-668-2835)

International: +1-403-295-4900

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