PwrPak7® Family

QUICK START GUIDE

This guide provides the basic information needed to set up and use a NovAtel® PwrPak7. The PwrPak7 is a compact enclosure that delivers scalable positioning performance and contains internal storage. There are several variants of the PwrPak7 to meet a range of GNSS applications:

PwrPak7   The PwrPak7 provides a high precision position, velocity and time (PVT) solution.

PwrPak7D   The PwrPak7D is a dual antenna enclosure that provides a high precision PVT and ALIGN® heading solution.

PwrPak7-E1   The PwrPak7-E1 combines a GNSS receiver and an Epson EG320N IMU in a single enclosure to provide an easy to deploy SPAN® GNSS+INS system.

PwrPak7D-E1   The PwrPak7D-E1 combines a dual antenna GNSS receiver and an Epson EG320N IMU in a single enclosure to provide an easy to deploy SPAN GNSS+INS and ALIGN system.

> ⓘ In this document, the term PwrPak7 is used to represent all variants of the PwrPak7 enclosure (PwrPak7, PwrPak7D, PwrPak7-E1 and PwrPak7D-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)
- PwrPak7 DB26 to DB9 COM1 cable (01019765)
- USB A to USB micro B cable (60723175)

ADDITIONAL EQUIPMENT REQUIRED

The additional equipment listed below is required for a typical setup.

- 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 (PwrPak7 or PwrPak7-E1), or
  Two antenna cables with an SMA male connector at the receiver end such as NovAtel's 2.5 m SMA to TNC cable (60723177) or 5 m SMA to TNC cable (60723178) (PwrPak7D or PwrPak7D-E1)
- Four M5 or #10 size screws for mounting

- 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
- A Micro A to USB stick adapter, such as Tensility 10-00649 or equivalent, if you want to connect a USB stick to the PwrPak7 TRANSFER port.

OPTIONAL ACCESSORIES

The following optional accessories are available from NovAtel:

- PwrPak7 All I/O with SPAN cable (01020004)
  Provides connections for all of the signals available on the PwrPak7 COM port, including connections for an external IMU.
- PwrPak7 I/O Extension cable (01020005)
  An accessory cable for the PwrPak7 All I/O with SPAN cable that breaks out the I/O signals on the DB15 connector to individual leads.
- Optional external SPAN compatible IMU
  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).

For more 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 and information regarding PwrPak7 logs and commands.

Table 1: PwrPak7 - Connector Definitions

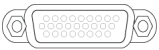| Connector Type	Connector Label	Description
GNSS Antenna	ANT	TNC connector for the GNSS antenna (PwrPak7 and PwrPak7-E1)
GNSS Antenna	ANT1	SMA connector for the primary GNSS antenna (PwrPak7D and PwrPak7D-E1)
	ANT2	SMA connector for the secondary GNSS antenna (PwrPak7D and PwrPak7D-E1)
Power	PWR	SAL M12, 5-pin Male connector
USB	TRANSFER	USB 2.0 Micro A/B data transfer port

Table 1: PwrPak7 - Connector Definitions

Connector Type	Connector Label	Description
USB	COM PORTS	USB 2.0 Micro A/B 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:
		    • 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 User Accuracy Level (UAL) Operational (STEADYLINE)
	Green slow blink	RTK integer ambiguity
	Green fast blink	Single point or SBAS position UAL Warning
	Yellow solid	No solution UAL Out of Bounds
	If the PwrPak7 is configured as a Base	
	Green solid	Fixed position
	Yellow solid	Pending fixed position
	Yellow blink	Invalid fix
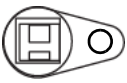
Table 4: INS LED Description

LED Label	LED State	Description
INS indicates the INS status of the receiver (PwrPak7-E1, PwrPak7D-E1, or PwrPak7 / PwrPak7D with an external IMU)	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, mounted and idle (lots of available memory) Transfer port connected to a computer
Green slow blink	Logging to stick (lots of available memory)
Green fast blink	Transferring files to stick (lots of available memory)
Green/Yellow alternating slow blink	Logging to stick (low available memory)
Green/Yellow alternating fast blink	Transferring files to stick (low memory)
Yellow solid	Stick plugged in, mounted and idle (low available memory)
Yellow fast blink	Stick mounting or unmounting/busy
Red solid	Stick plugged and mounted, but memory full
Red fast blink for 3 seconds	Push button error or stick mount error
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
	Red fast blink for 3 seconds	Push button error
	Off	PwrPak7 is connected to a computer as a mounted device

SETTING UP A PWRPAK7

Complete the following steps to connect and power the PwrPak7.
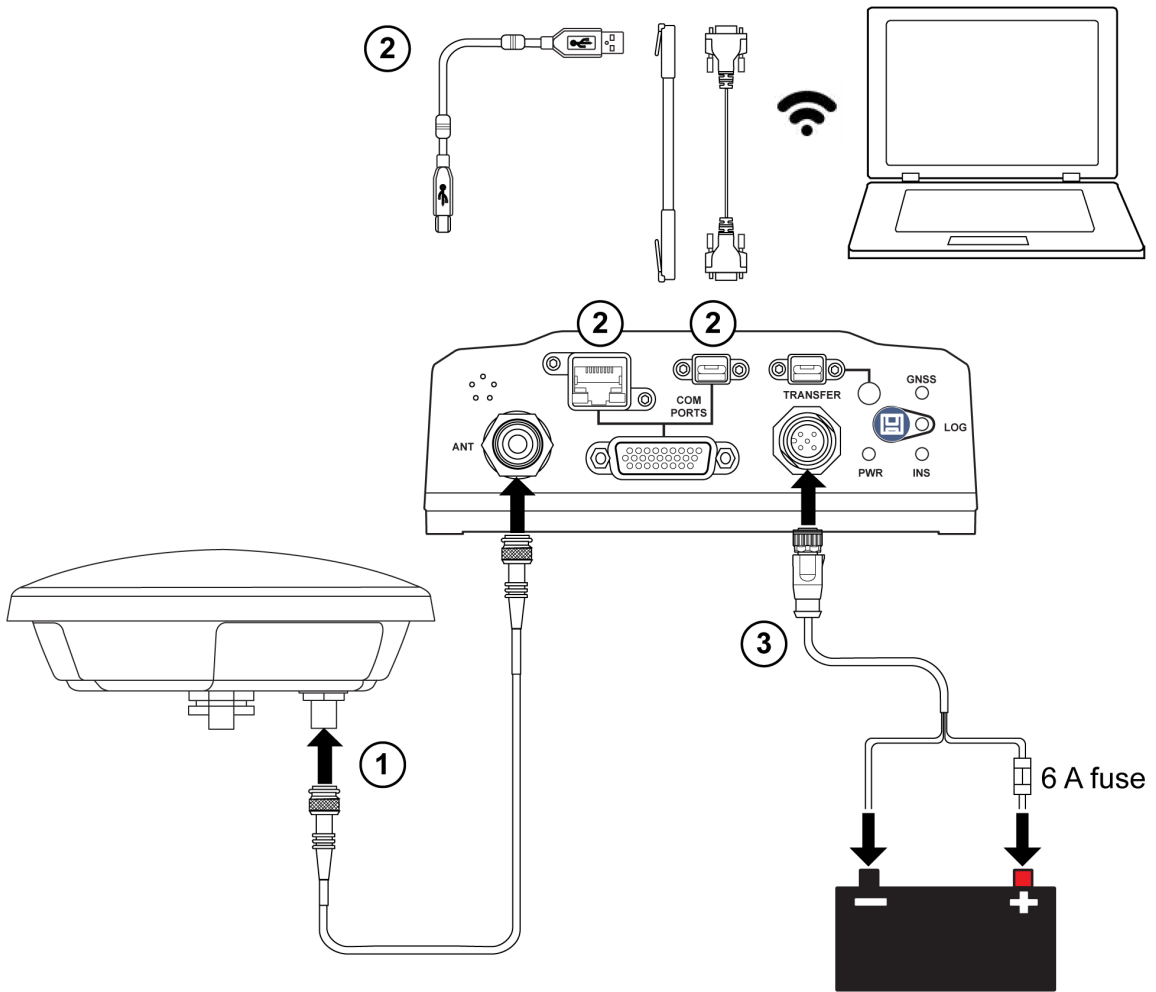
1. Connect the GNSS antenna to the ANT port and mount the antenna to a secure, stable structure with an unobstructed view of the sky.
   For PwrPak7D and PwrPak7D-E1, connect the primary GNSS antenna to the ANT1 port and the secondary GNSS antenna to the ANT2 port.

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.

Vehicle Install

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.
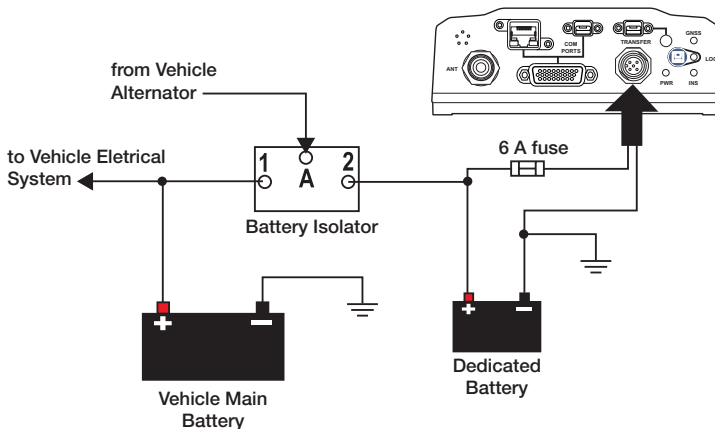
PWRPAK7 MOUNTING

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 and PwrPak7D-E1 have additional mounting considerations. See *PwrPak7-E1 Mounting* on page 7 for more information.

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

ⓘ The Wi-Fi interface SSID and default password are printed on a label on the bottom of the PwrPak7. If you intend to use the Wi-Fi interface and NovAtel Web User Interface, record the SSID and default password before securing the PwrPak7 in its mounting location.

PwrPak7-E1 Mounting

Mount the PwrPak7-E1 or PwrPak7D-E1 and antenna securely to a vehicle. For the simplest operation, align the Y-axis of the PwrPak7-E1 or PwrPak7D-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.

- NovAtel Web UI
  An Ethernet or Wi-Fi connection to the PwrPak7 is needed to use NovAtel Web UI.
  Refer to *Ethernet Connection* or *Connect to a Wi-Fi network* for information about establishing a connection and *NovAtel Web User Interface (UI)* of information about using NovAtel Web UI.

- 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.

- 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.

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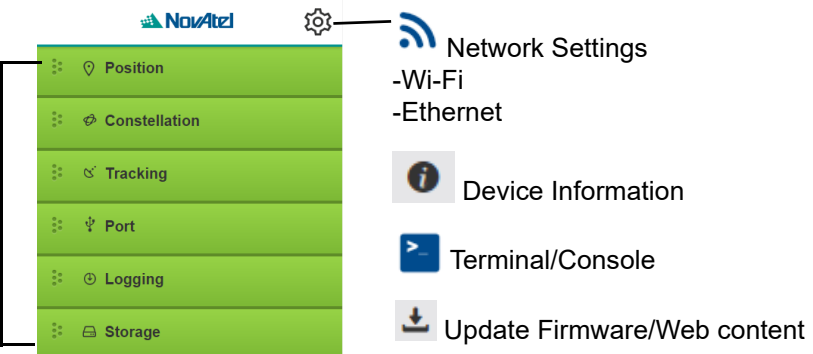
> ⓘ Refer to the OEM7 User Documentation (docs.novatel.com/OEM7) for more information about Wi-Fi configuration.

NOVATEL WEB USER INTERFACE (UI)

1. Open up a web browser and enter any web address (e.g., novatel.com). The PwrPak7 automatically redirects you to the NovAtel Web User Interface which is hosted on the PwrPak7.

Tabs

Swipe the tab to the right to open a Configuration Window.
Click the tab once to open a Status Window.

NovAtel

- Position
- Constellation
- Tracking
- Port
- Logging
- Storage

Network Settings
-Wi-Fi
-Ethernet

Device Information

Terminal/Console

Update Firmware/Web content

> 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.

CHECK THAT THE PWRPAK7 IS OPERATING

After the PwrPak7 is installed, powered up and connected to a GNSS antenna, use the following procedure to ensure the receiver is operating.

1. Check that the PWR LED is solid green.

2. Check that the GNSS LED is green (solid or blinking).

3. Connect to the PwrPak7 Wi-Fi network using a Wi-Fi capable smartphone, tablet or laptop.

4. Open a web browser and enter any web address (e.g. novatel.com) to launch the Web UI.

5. Click the **Constellation** tab to open the Constellation window.

6. Check that there are satellites visible with a status of good (green).

DATA LOGGING

An extensive set of logs are available to capture data. 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.

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 (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 TRANFER 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.

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 using the Log button or the USBSTICKEJECT command 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 the 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 Apex[2]

> ⚠ 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. 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 is a real-time kinematic software product 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 to 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/software.

PwrPak7 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)
    - GALFNAVEPHEMERIS ONCHANGED (if using Galileo)
    - GALINAVEPHEMERIS ONCHANGED (if using Galileo)
    - BDSEPHEMERIS ONCHANGED (if using BeiDou)
- From the rover station(s)
    - RANGECMPB ontime 1
    - RAWEPHEMB onchanged
    - GLOEPHEMERISB onchanged (if using GLONASS)
    - GALFNAVEPHEMERIS ONCHANGED (if using Galileo)
    - GALINAVEPHEMERIS ONCHANGED (if using Galileo)
    - BDSEPHEMERIS ONCHANGED (if using BeiDou)
    - RAWIMUSXB onnew (if using SPAN)
    - INSCONFIGB onchanged (if using SPAN)
    - HEADING2B onnew (if using ALIGN dual antenna solution)

For more information about data logging for post-processing, refer to *APN-076: SPAN Data Logging for Inertial Explorer* (www.novatel.com/assets/Documents/Bulletins/APN-076-SPANLoggingEI8.7.pdf).

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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