



SPAN CPT7™

QUICK START GUIDE

GM-14915154

Rev 2

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The NovAtel® SPAN CPT7 is a compact, single enclosure GNSS+INS receiver. This guide provides the basic information needed to set up and use a SPAN CPT7.

USER DOCUMENTATION

For detailed information on the installation, operation, logs and commands for the SPAN CPT7, refer to the OEM7 User Documentation (docs.novatel.com/OEM7).

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 9-32 VDC, fuse protected power supply capable of at least 18 W
- Two high quality GNSS antennas, such as NovAtel's VEXXIS® GNSS-500 or GNSS-800 series antennas
- Two antenna cables with an SMA male connector at the SPAN CPT7 end
- Four #6 size screws for mounting.
- A computer with a serial COM, USB or Ethernet port

OPTIONAL ACCESSORIES

The following optional accessory is available from NovAtel:

- SPAN CPT7 I/O1 Cable (60723180)
- SPAN CPT7 I/O2 Cable (60723181)
- SPAN CPT7 Adapter Plate (70023109)
This plate mounts on the SPAN CPT7 and provides SPAN-CPT and SPAN-IGM compatible mounting holes.

For information about this accessory, refer to the OEM7 User Documentation (docs.novatel.com/OEM7).

GETTING TO KNOW THE SPAN CPT7

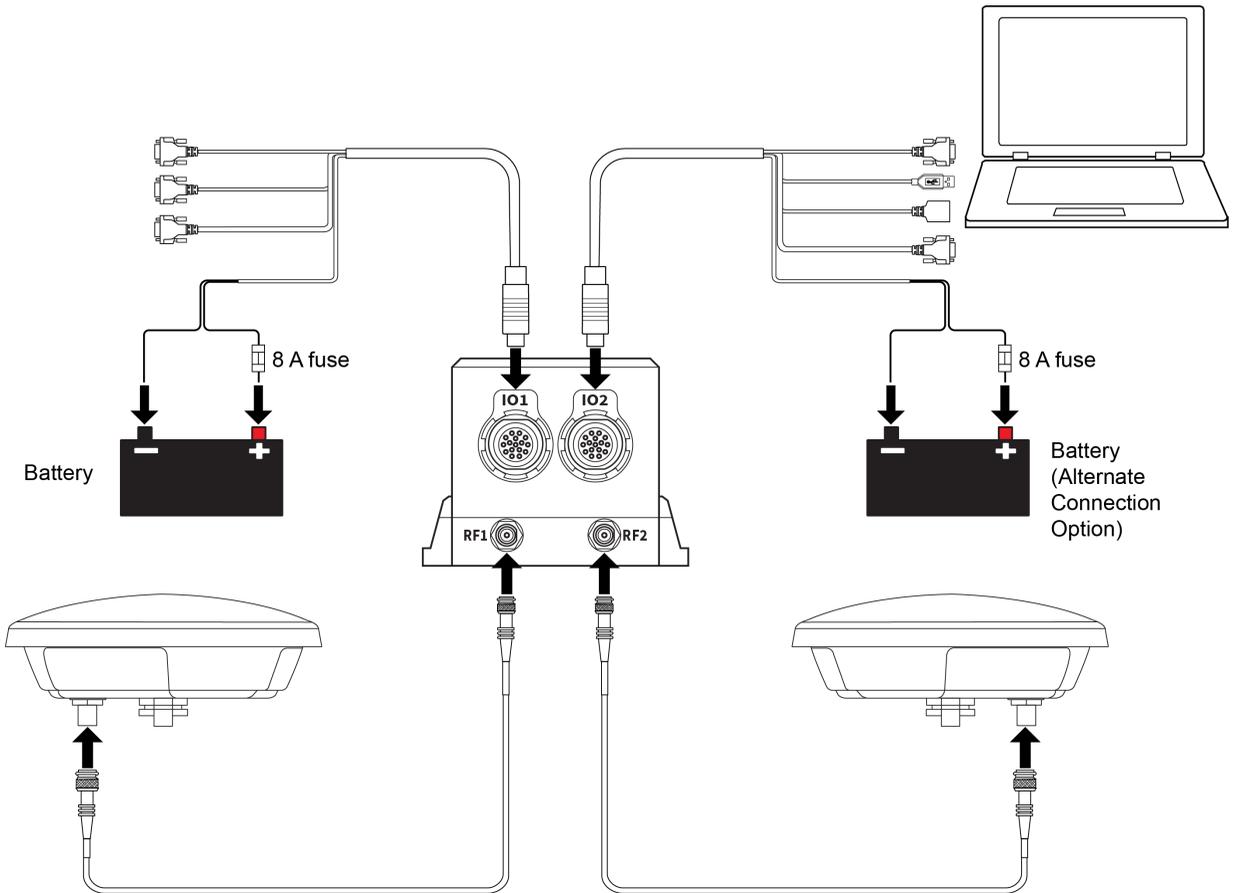
Refer to the OEM7 User Documentation (docs.novatel.com/OEM7) for details on SPAN CPT7 connectors as well as detailed installation and operation instructions and information regarding SPAN CPT7 logs and commands.

Table 1: SPAN CPT7 - Connector Definitions

Connector	Description
 RF1	SMA connector for the primary GNSS antenna
 RF2	SMA connector for the secondary GNSS antenna
 IO1	16-pin circular connector <ul style="list-style-type: none">• Power• 7720-COM2 (RS-422)• EVENT_IN 1• EVENT_OUT 1
 IO2	16-pin circular connector <ul style="list-style-type: none">• Power• 7720-COM1 (RS-232)• USB• Ethernet• CAN bus• EVENT_IN 2• EVENT_OUT 2

SETTING UP A SPAN CPT7

Complete the following steps to connect and power the SPAN CPT7.



1. Mount the SPAN CPT7. See *SPAN CPT7 Mounting* on page 5 for details.
2. Mount both GNSS antennas to a secure, stable structure with an unobstructed view of the sky.



ALIGN heading accuracy is dependent on the antenna baseline length. For best results, mount the GNSS antennas at least one metre apart.

3. Connect the primary GNSS antenna to the RF1 port and the secondary GNSS antenna to the RF2 port.

4. Connect the interface cable to the SPAN CPT7.
 If RS-422 protocol is used for communication to the other system devices, connect the interface cable (SPAN CPT7 I/O1 Cable (60723180)) to the IO1 port on the SPAN CPT7.
 If RS-232 protocol, USB or Ethernet is used for communication to the other system devices, connect the interface cable (SPAN CPT7 I/O2 Cable (60723181)) to the IO2 port on the SPAN CPT7.
 If signals from both IO ports are needed, connect both interface cables to the SPAN CPT7.
 See *Table 1, SPAN CPT7 - Connector Definitions* on page 2.



If using RS-232 protocol, the maximum data rate on the COM port is 230400 bit/s.

5. Connect a USB, COM or Ethernet port on the receiver to a USB, serial or Ethernet port on a computer.
 If using a USB connection, install the USB drivers (refer to *Connect to the SPAN CPT7* on page 5 to obtain drivers).
 If RS-232 protocol is required, use COM1 which is available on the IO2 port.
 If RS-422 protocol is required, use COM2 which is available on the IO1 port.
6. Connect the power leads on the interface cable to a 9-32 VDC power supply capable of at least 18 W.



Power can be connected to **either** the IO1 or IO2 port.

Do not connect a power supply to both ports.



Ensure the VIN line is connected to the positive pole of the power source and the GND line is connected to the negative pole of the power source.

Install a user supplied 8 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 2: Fuse/Holder Recommendations 12 V System

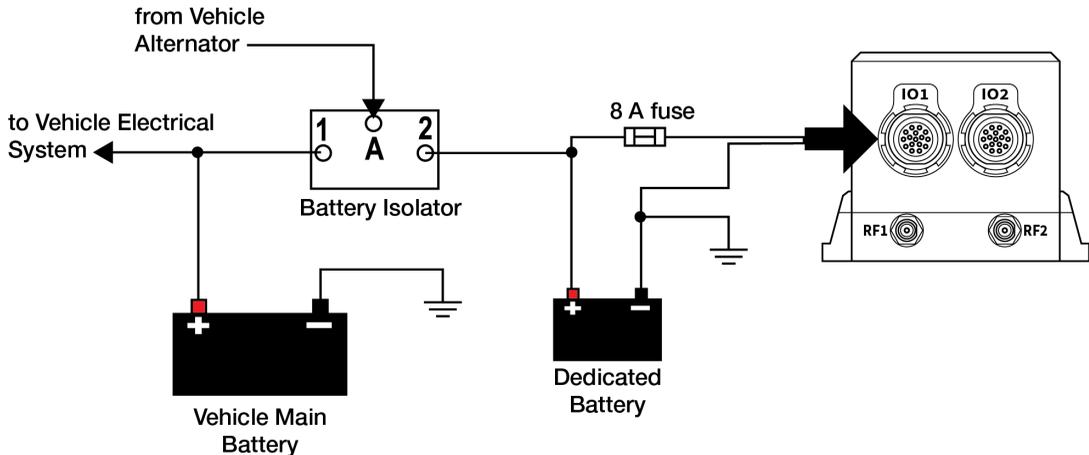
Fuse	Holder
BK/MDA-8-R Fuse (or equivalent) BK/MDL-8-R Fuse (or equivalent)	BK/HFA-R-R Fuse (or equivalent)



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

Vehicle Installation

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 SPAN CPT7 minimum voltage or cut-out to ancillary equipment causing the receiver and/or IMU to lose lock and calibration settings.



Power can be connected to **either** the IO1 or IO2 port.
Do not connect a power supply to both ports.

SPAN CPT7 MOUNTING

Mount the SPAN CPT7 and GNSS antennas securely to the vehicle. For the simplest operation, align the X-axis of the SPAN CPT7 with the forward axis (direction of travel) of the vehicle and mount the Z-axis down. When mounted with X-axis forward, the default RBV configuration is valid. Any other mounting requires the SETINSROTATION RBV command to be sent. Ensure that the GNSS antennas and SPAN CPT7 cannot move relative to each other. The distance and relative direction between them must be fixed.



The X, Y and Z axis are marked on the SPAN CPT7 enclosure.

CONNECT TO THE SPAN CPT7

To configure the SPAN CPT7 and access data from the SPAN CPT7, establish a communication session with the SPAN CPT7 using one of the following methods.

- **NovAtel Connect**
A serial (COM port), USB or Ethernet connection to the SPAN CPT7 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 SPAN CPT7. Refer to the OEM7 User Documentation (docs.novatel.com/OEM7) for more information.

CONFIGURE THE SPAN SYSTEM

Follow these steps to enable INS as part of the SPAN system using software commands.

1. Establish a connection to the SPAN CPT7.



A GNSS antenna must be connected and tracking satellites for operation.

2. Enter the distance from the SPAN CPT7 center of navigation to the phase center of the GNSS antennas using the **SETINSTRANSLATION** command. Use **SETINSTRANSLATION ANT1** for the distance to the primary GNSS antenna and **SETINSTRANSLATION ANT2** for the distance to the secondary GNSS antenna.

The offset between the antenna phase center and the SPAN CPT7 axes must remain constant and be known accurately. The X (pitch), Y (roll) and Z (azimuth) directions are clearly marked on the SPAN CPT7. The **SETINSTRANSLATION** parameters are (where the standard deviation fields are optional):

```
x_offset y_offset z_offset [x_stdev] [y_stdev] [z_stdev]
```



The measurements for the translational offsets should be done as accurately as possible, preferably to within millimetres especially for RTK operation. Any error in the offsets will translate into an error in the INS position.

3. The SPAN-CPT7 comes pre-configured with an RBV of 180 0 90. This configuration is valid if mounting is done as described in *SPAN CPT7 Mounting* on page 5. If the SPAN CPT7 is mounted in an orientation other than the default orientation, the **SETINSROTATION** command must be sent. Using the RBV parameter, enter the Euler Angle rotation from the IMU Body frame to the Vehicle frame.

Accurate knowledge of the rotational offset between the IMU Body frame and the Vehicle frame (the RBV rotation) is critical to correctly computing an attitude solution, and is required before a Kinematic alignment is possible.

The **SETINSROTATION** parameters are (where the standard deviation fields are optional):

```
RBV x_rotation y_rotation z_rotation [x_stdev] [y_stddev] [z_stdev]
```



The order of rotations is Z-X-Y. All rotations are right handed.

Configuration for Alignment

The SPAN CPT7 can use a kinematic alignment routine or a dual antenna alignment. The kinematic or moving alignment is performed by estimating the attitude from the GNSS velocity vector and injecting it into the SPAN filter as the initial system attitude. A dual antenna alignment uses the heading information from a NovAtel Dual Antenna ALIGN solution to rapidly perform an alignment. For information about these alignment techniques, refer to the OEM7 User Documentation (docs.novatel.com/OEM7).



Regardless of system configuration and IMU orientation, the **SETINSTRANSLATION** command must be sent to the receiver before attempting a kinematic alignment.

OPERATE THE SPAN SYSTEM

The system is ready to go once it is powered and the GNSS and INS are configured using the previously shown commands.

Observe the status of the system in the NovAtel Connect *INS Window* or in the status field of any of the INS solution logs (for example INSPOS, INSVEL, INSATT and INSPVA).

If performing a kinematic alignment, move the vehicle forward at a speed faster than 5 m/s. The following status stages may be observed:

- The status changes from INS_INACTIVE through DETERMINING_ORIENTATION, WAITING_INITIALPOS and INS_ALIGNING as the initial alignment routine starts.
- The status changes to INS_ALIGNMENT_COMPLETE when the alignment is complete. After some motion (stops, starts and turns), the attitude solution converges to within specifications and the status changes to INS_SOLUTION_GOOD.
- The status may occasionally change to INS_SOLUTION_FREE. This status indicates that the inertial solution has detected poor quality GNSS positions from the receiver due to limited satellite visibility or high multi-path conditions. The inertial filter may choose to disregard this information and wait for the GNSS quality to improve. The solution is still valid during these times, it is simply a notification that the GNSS+INS solution is more reliable than the GNSS-only solution.

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 SPAN CPT7 communication ports and can be automatically generated at regular intervals or when new or changed data becomes available. Data can also be collected using NovAtel Connect.

Refer to the OEM7 User Documentation (docs.novatel.com/OEM7) for details on logging.

Log SPAN Data

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 window of NovAtel Connect 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).

SPAN CPT7 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.

SPAN CPT7 output is compatible with post-processing software from NovAtel's Waypoint® Products Group. For details, see www.novatel.com/Products/Waypoint Software.

SPAN CPT7 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
 - INSCONFIGB onchanged
 - 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

Additional features, such as RTK, PPP, SBAS and the Interference Toolkit, are available on the SPAN CPT7. Refer to the OEM7 User Documentation (docs.novatel.com/OEM7) for set up and installation instructions for other functionality.

QUESTIONS OR COMMENTS

If you have any questions or comments regarding your SPAN CPT7 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

SPAN CPT7 Quick Start Guide

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