SPAN-SE Receiver

QUICK START GUIDE

This guide provides the basic information you need to set up and begin using your SPAN-SE receiver.

BOX CONTENTS

In addition to this *Quick Start Guide*, the following is provided in your SPAN-SE package:

- **1** SPAN-SE receiver
- **2** multi-connector cables
- **1** mounting bracket with screws
- **1** 6-foot USB 2.0 cable
- **1** industrial SD memory card
- **1** power cable
- **1** multi I/O connector cover
- **1** CD containing PC Utilities and product documentation
- **1** patent notice and manual request postcard

ADDITIONAL EQUIPMENT REQUIRED

The following additional equipment is needed for a basic setup:

- A Windows-based PC with an RS-232 DB9, USB or Ethernet port
- A power supply that produces 12 – 28 volts DC
- A quality dual frequency GNSS antenna such as the GPS-702, the GPS-702-GG, the ANT-A72GA-TW-N for airborne/high speed applications, or the GPS-702L antenna for L-Band corrections
- A TNC to appropriate antenna connector RF cable
- A SPAN-supported IMU such as NovAtel numbers: IMU-H58, IMU-H62, IMU-H00, IMU-LN200, IMU-FSAS-EI, IMU- FSAS-EI-O, IMU-CPT, UIMU-LCI, HG1900 or HG1930

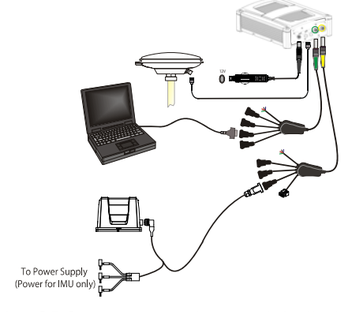
INSTALLING NOVATEL'S PC UTILITIES

1. Start the computer.
2. Insert the accompanying CD in the CD-ROM drive.
3. Select *Install the OEMV GPS PC Utilities* from the window that opens automatically. If the window does not open automatically when the CD is inserted, select *Run* from the *Start* menu and navigate to *Setup.exe* on the CD.
4. Follow the on-screen instructions to complete the software installation.

SPAN HARDWARE SET-UP

Complete the following steps to set up and power your SPAN-SE.

1. Mount the IMU and antenna securely to a vehicle. Ensure that the devices cannot move and that the distance and relative direction between them is fixed. See also *Step 2* in the *Configure SPAN Manually* section of this guide.
2. Connect the yellow cable's 30-pin connector directly into the yellow port labelled I/O 2 on the SPAN-SE. The cable clicks when connected properly.

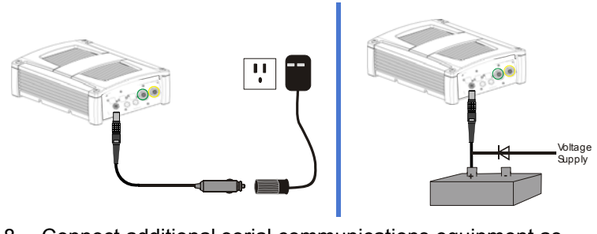


3. Connect the GPS antenna to the port labelled GPS1 on the receiver using an appropriate antenna cable.
4. Connect the yellow cable's COM1 connector to a computer COM port using a straight-through serial cable.

   Alternatively, you can connect the receiver to a computer with either a USB or Ethernet connection. See the SPAN-SE User Manual for information on USB or Ethernet connection options.
5. Connect the yellow cable's IMU connector to an IMU with the IMU's interface cable.
6. Insert the SD card into the slot behind the front panel door.

✉ Files stored on the SD card can be transferred to a host computer for data analysis or other types of post-processing by using the **CDU** utility or by removing the SD card and inserting it into a host computer that has an SD card slot or an adapter attached.

7. Apply power to the receiver. Do not press the power button; the receiver powers up automatically. If possible, add a back-up battery between the receiver and its voltage supply if installed in a vehicle. The backup battery acts as a buffer to prevent power dips tyhat can cause the receiver and IMU to lose lock and calibration settings.



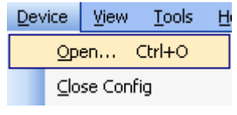
8. Connect additional serial communications equipment as needed. The following ports are available:
   - 4 UART serial (RS-232/RS-422 configurable)
   - 1 USB
   - 1 Ethernet

✉ Refer to the SPAN-SE User Manual for detailed information on configuring the SPAN-SE communication ports.

ESTABLISHING RECEIVER COMMUNICATION

To open a serial port to communicate with the receiver, complete the following:

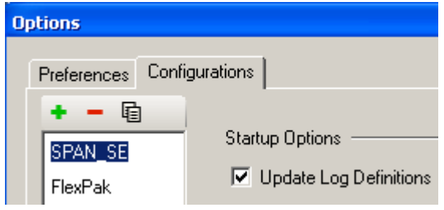
1. Open **CDU** from the *Start* menu folder specified during the installation process. The default location is *Start* | *Programs* | *NovAtel PC Software* | *NovAtel CDU*.
2. Select *Open....* from the *Device* menu.



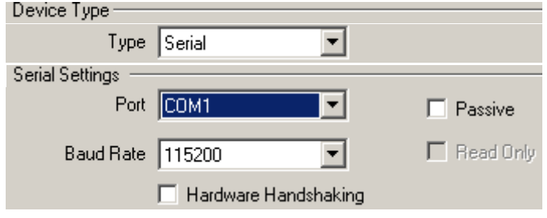
3. Select the *New...* button in the *Open* dialog box. The *Options* | *Configuration* dialog opens.

4. Click the ✚ button to add a new configuration. To delete a configuration, select it from the list and click the ▬ button. To duplicate an existing configuration, click the button.

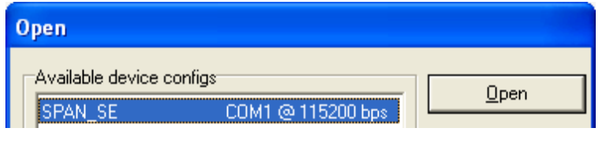
You can select any name in the list to edit.



5. Select *Serial* from the *Type* list and select the computer port, that the SPAN-SE is connected to, from the *Port* list.



6. Select *115200* from the *Baud Rate* list.
7. Uncheck the *Use hardware handshaking* checkbox.
8. Click *OK* to save the new device settings.
9. Select the new configuration from the *Available device configs* area of the *Open* dialog.
10. Click the *Open* button to open SPAN-SE communications.



A progress box appears as **CDU** establishes communication with the receiver.

Entering Commands and Receiving logs

SPAN-SE has a comprehensive command/log interface that can be used with any command console.

Using CDU

CDU provides access to key information about your receiver and its position. The information is displayed in windows accessed from the *View* menu. For example, select *Position Window* from the *View* menu to display the position solution of the receiver. To show details of the GNSS and geostationary (SBAS) satellites being tracked, select a *Tracking Status Window* (*GPS* or *GLONASS*) from the *View* menu. Select *Help* from the main menu for more details on **CDU**, its windows and features.

CONFIGURING GNSS

Enabling SBAS

Use the `SBASCONTROL` command to enable SBAS positioning. The following commands are used to enable the WAAS (North America) and EGNOS (Europe) systems respectively:

```
SBASCONTROL ENABLE WAAS
SBASCONTROL ENABLE EGNOS
```

When SBAS is enabled, the *Position Type* field in **CDU**'s *Position* window changes from *Single* to *WAAS* and SBAS satellites may appear in the *Constellation window*.

Enabling L-band

L-band equipped receivers can achieve sub-meter accuracy. To use this positioning mode, enable L-band tracking to the OmniSTAR signal. A subscription to OmniSTAR is required to use the OmniSTAR VBS, XP or HP service (visit http://www.omnistar.com with your receiver serial number ready).

Use the `ASSIGNLBAND` command to set OmniSTAR base station communication parameters. The parameters must include a relevant frequency and data rate. The frequency assignment can be made in Hz or KHz. For example:

Hz: `assignlband omnistar 1536782000 1200`
KHz: `assignlband omnistar 1536782 1200`

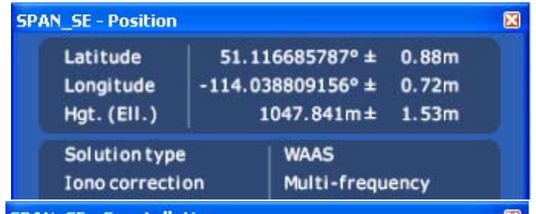
✉ A value entered in Hz is rounded to the nearest 500 Hz.

To confirm that your receiver is tracking an L-band signal, log the L-band status information by entering: `log lbandstat`.

To specify the correction source, use the `PSRDIFFSOURCE` command as shown in the example below:

```
PSRDIFFSOURCE OMNISTAR
```

Otherwise, leave the setting at the default `AUTO`.



✉ Refer to the *OEMV Family Firmware Reference Manual* for more on individual L-band, GLONASS or SBAS commands and logs.

Enabling Real-Time Kinematic (RTK) Positioning

Corrections can be transmitted from a base station to a rover station to improve position accuracy. The base station is the GNSS receiver that acts 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 and can receive correction messages from a base station to calculate differential GNSS positions.

You must create a data link between the base station and rover station (two NovAtel receivers) to transfer corrections. SBAS and L-band corrections can be accomplished with one receiver and are exceptions to the base/rover concept. A link capable of at least 9600 bits per second and less than 4.0 seconds of latency is recommended.

When the base and rover stations are set up, you can configure them for RTCA, RTCM, RTCMV3, CMR+ or CMR corrections. Below is an RTCM example. Replace the latitude, longitude and height coordinates shown with those of your base:

Base

```
interfacemode com2 none rtcm off
fix position 51.11358042 -114.04358013
1059.4105
log com2 rtcm3 ontime 10
log com2 rtcm22 ontime 10 1
log com2 rtcm1819 ontime 1
log com2 rtcm1 ontime 5
log com2 rtcm31 ontime 5,1
(optional GLONASS PSRDIFF)
log com2 rtcm32 ontime 10,2
```

Rover

```
gnsscardconfig rtcm none off
```

RT-2 and RT-20-capable SPAN-SE receivers with AdVance RTK are real-time kinematic products developed by NovAtel. Optimal RTK performance requires both the base and rovers be NovAtel products. However, AdVance RTK operates with equipment from other manufacturers when using RTCM messaging.

RT-2 and RT-20 are supported by GPS+GLONASS and GPS-only OEMV-based models. Also, RT-20 with GPS+GLONASS provides faster convergence.

1. Refer to the GPGST log's usage box in the *OEMV Firmware Reference Manual* for a definition of RMS and other statistics.
2. For more base/rover configurations, search for "rover base" on our Knowledge Database at: http://support.novatel.com/home

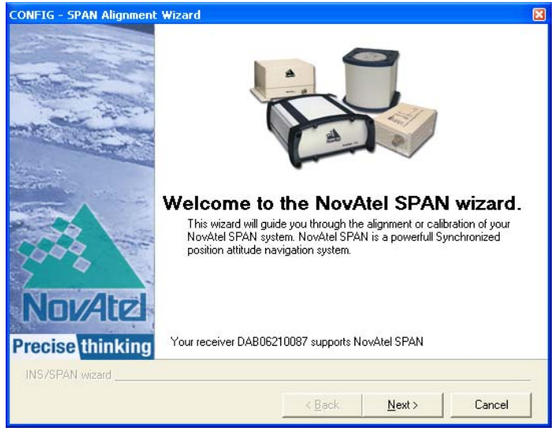
CONFIGURING THE SPAN IMU

Configure SPAN with CDU

Follow these steps to enable INS as part of the SPAN system using the NovAtel **CDU** software utility:

1. Select *Tools* | *SPAN Alignment Wizard* from the **CDU** menu to configure the lever arm and vehicle-to-body rotation information. The wizard guides you through the processes of completing a coarse or fast alignment, selecting the type of IMU and configuring the receiver to IMU port to accept IMU data.
2. Select *Tools* | *SPAN Calibration Wizard* to calibrate the lever arm or vehicle-to-body rotation information. The wizard guides you through the processes of calibrating the lever arm and/or vehicle to body rotation, as well as select the type of IMU and configure the receiver port connected to the IMU and to accept data.

When you have made your selections in the SPAN wizard, click the *OK* button to enable the SPAN system. When the system is enabled, raw IMU data becomes available and the INS filter starts.



Configure SPAN Manually

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

1. Issue the SETIMUTYPE command to specify the IMU (*Table 1*).

Table 1: Enable INS Commandsdd

IMU Type	SETIMUTYPE
LN-200	IMU_LN200
iIMU-FSAS	IMU_IMAR_FSAS
IMU-CPT	IMU_KVH_COTS
UIMU-LCI	IMU_LITEF_LCI
HG1700	IMU_HG1700_AG11, *or* IMU_HG1700_AG17, *or* IMU_HG1700_AG58, *or* IMU_HG1700_AG62
HG1900	IMU_HG1900_CA29
HG1930	IMU_HG1930_AA99

The inertial filter starts when the GPS solution is solved and the IMU is connected.

A GPS antenna must be connected and actively tracking satellites for correct operation.

2. Use the `SETIMUTOANTOFFSET` command to set the distance from the IMU to the GNSS antenna. The offset between the antenna phase centre and the IMU axes must remain constant and be accurate (m). The X (pitch), Y (roll) and Z (azimuth) directions are clearly marked on the IMU enclosure. The `SETIMUTOANTOFFSET` parameters are (where the standard deviation fields are optional):

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

   A typical RTK GPS solution is accurate to within a few centimeters. For the integrated INS/GPS system to have this level of accuracy, the offset must be measured to within a millimeter. Any bias between the two systems appears in the output position. For example, a 10 cm error in recording this offset will result in at least a 10 cm error in the output.

   If you cannot measure the IMU to GPS antenna offset precisely, perform the lever arm calibration routine to estimate offset. Refer to the *SPAN-SE User Manual* for details.

LOGGING DATA

You can collect data logs through any I/O port on the SPAN-SE receiver into any data capture software, including **CDU**.

SPAN-SE also has a SD card for data collection. To send data to the SD card, open a files, then use FILE as the port designator in log requests. You must close the file when collection is complete.

The SPAN-SE has a default logging profile with all raw data needed for post-processing. If you press the SD logging button, this profile automatically logs to a uniquely named file until the SD logging button is pressed again. To change the default logging profile, send the log requests that you want, the command: SETAUTOLOGGING ON and then SAVECONFIG. The newly-defined profile is automatically logged to the SD card on power up.

For example:

```
LOGFILE OPEN TEST.GPS
LOG FILE RANGECMPB ONTIME 1
LOGFILE CLOSE
```

Save logs and commands with the `SAVECONFIG` command to ensure that the same logging configuration starts whenever the receiver is powered on. Remove the SD card from the receiver and plug it into a computer to download data from the card. The data logging button, located beside the SD card, stops and starts the data logging if you must change cards during operation.

You can monitor the logs' output to determine the system status. Multiple CDU windows show the status of various receiver subsystems. Light Emitting Diodes (LEDs) on the front of the SPAN-SE receiver also show the status of many subsystems.

Log SPAN Data

Raw GPS, IMU and navigation data (position, velocity and attitude) are available from the system as ASCII or binary logs.

Data can be collected through **CDU** using the *Logging Control* window, or sent through the receiver COM port to user-supplied data collection software.

For post-processing applications, collect the data shown in the

Post-Processing section near the end of this guide.

OPERATING THE SPAN SYSTEM

Observe the status of the system in **CDU**'s *INS* window or in the status field of any of the INS solution logs (for example `INSPOS`, `INSVEL`, `INSATT` and `INSPVA`).

✉ INS data is available when the GPS solution has solved for time (i.e., FINESTEERING status). So, an antenna must be connected and tracking satellites for the system to function.

Allow the system to be stationary for at least one minute after the GPS solution is computed for its initial system alignment. The following status stages may be observed:

- The status changes from INS_INACTIVE to INS_ALIGNING when the coarse alignment starts
- The status changes to INS_ALIGNMENT_COMPLETE when the coarse alignment is complete. Typically, the this state continues until the system senses motion. When the attitude solution converges to within specifications, the status changes to INS_SOLUTION_GOOD.

  When using an IMU-CPT, a stationary alignment is only possible with a dual antenna SPAN-SE-D, or if the SETINITAZIMUTH or SETINITATTITUDE commands are issued. See the user manual for more information.

The status may occasionally change to INS_BAD_GPS_AGREEMENT. This status indicates that the inertial solution has detected poor quality GPS positions from the receiver due to limited satellite visibility or high multipath conditions. The inertial filter may choose to disregard this information and wait for the GPS quality to improve. The solution is still valid during this status, but it is a warning that the GPS/INS solution is more reliable than the GPS-only solution.

LED STATUS INDICATORS

There are six LEDs on the front of the SPAN-SE receiver that represent the following status categories:

- Power
- SD card memory
- Internal OEMV-3 card status (GPS 1)
- Internal OEMV-2 card status (GPS 2)
- INS filter
- IMU communication

The following table details the states of each LED, which remain solid unless the table indicates a flashing condition.

LED	OFF	GREEN	ORANGE	RED
Power	No power to the unit	Powered and the unit is off Flashing: powered and the unit is on	N/A	N/A
SD	No card	Card in Flashing: file open	Card in, low space Flashing: file open	Card in, full
OEMV3	No board	Solution complete + fine steering Flashing: coarse steering	Insufficient observations	Receiver status error (bits: 0,1,2, 7)
OEMV2	No board	Solution complete + fine steering Flashing: coarse steering	Insufficient observations	Receiver status error (bits: 0,1,2, 7)
INS	GPS only	Solution good Flashing: alignment complete	Aligning Flashing: solution bad	INS inactive
IMU	No IMU	Good RAWIMU packets	No RAWIMU (IMU type not set)	IMU status error bits

POST-PROCESSING

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.

The following logs are required for post-processing:

- From the base station
  - `RANGECMPB ontime 1`
  - `RAWEPHEMB onchanged`
- From the rover station(s)
  - `RANGECMPB ontime 1`
  - `RAWEPHEMB onchanged`
  - `RAWIMUSB onnew`

In addition, the following is required to log GLONASS:

- `GLOEPHEMERISB onchanged`
- `GLOCLOCKB onchanged`

The SPAN-SE system output is compatible with post-processing software from the Waypoint Products Group, NovAtel Inc. Visit their web page at http://www.novatel.com/products/waypoint-software for more details.

QUESTIONS OR COMMENTS

If you have any questions or comments regarding your SPAN-SE system, please contact NovAtel Customer Service by:

Email: support@novatel.ca

Web: www.novatel.com

Phone: 1-800-NOVATEL (U.S. & Canada)
403-295-4900 (International)

Fax: 403-295-4901

GM-14915082 Rev 2 28/07/2011