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 computer 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, IMU-HG1900 or IMU-HG1930

**INSTALLING NOVATEL PC UTILITIES**

Before setting up your SPAN-SE system, install NovAtel’s PC Utilities on the Windows-based computer that you will use to communicate with it.

1. Start the computer.
2. Insert the accompanying CD in the CD-ROM drive.
3. Select Install the OEMV PC Utilities from the window that is automatically displayed. If the window does not automatically open when the CD is inserted, select Run from the Start menu and select the Browse button to locate Setup.exe on the CD drive.
4. Install the PC Utilities by advancing through the steps provided in the NovAtel GPS PC Utilities setup program.

**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.
2. Connect the 30-pin connector of the I/O 2 Yellow Cable to the yellow port labelled I/O 2 on the SPAN-SE. The cable clicks when connected properly.
3. Connect the GNSS antenna to the port labelled GPS1 on the receiver using an appropriate antenna cable.
4. Connect a communications cable from your computer to the SPAN-SE. If you want to connect via serial, connect the COM1 connector of the I/O 2 Yellow Cable to a computer using a straight-through serial cable.
5. Connect the IMU connector of the I/O 2 Yellow Cable to an IMU with the IMU interface cable.
6. Insert the SD card into the slot behind the front panel door.
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 that 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.

**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

To access and download the most current version of our OEMV PC Utilities, go to the Support page of the NovAtel web site at www.novatel.com.

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 FTP functionality built into the SPAN-SE or by removing the SD card and inserting it into a host computer that has an SD card slot or an adapter attached.

If you want to connect via USB, connect a USB cable from the computer to the USB Device port on the SPAN-SE. If you want to connect via Ethernet, connect a shielded network cable from the computer to the Ethernet port on the SPAN-SE. See the SPAN-SE User Manual for information on communication connection options.
The following table details the states of each LED, which remain solid unless the table indicates a flashing condition.

### Table 1: SPAN-SE LEDs

<table>
<thead>
<tr>
<th>LED</th>
<th>Off</th>
<th>Green</th>
<th>Orange</th>
<th>Red</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>No power to the unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Powered and the unit is off</td>
<td></td>
<td>Flashing: powered and the unit is on</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>No card</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Card in, low space</td>
<td>Flashing: file open</td>
<td>Card in, full</td>
<td></td>
</tr>
<tr>
<td>OEMV3</td>
<td>No board</td>
<td></td>
<td>Solution completes fine steering</td>
<td>Insufficient observations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Receiver status error (bits: 0, 1, 2, 7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OEMV2</td>
<td>No board</td>
<td>Solution completes fine steering</td>
<td>Insufficient observations</td>
<td>Receiver status error (bits: 0, 1, 2, 7)</td>
</tr>
<tr>
<td>INS</td>
<td>GPS only</td>
<td></td>
<td>Alignment complete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aligning</td>
<td>Flashing: solution bad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IMU</td>
<td>No IMU</td>
<td>Good RAWIMU</td>
<td>No RAWIMU (IMU type not set)</td>
<td>IMU status error bits</td>
</tr>
</tbody>
</table>

### ESTABLISHING RECEIVER COMMUNICATION

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

1. Launch **Connect** from the **Start** menu folder specified during the installation process. The default location is **Start | All Programs | NovAtel PC Software | NovAtel Connect**.
2. Select **New** from the **Device** menu.
3. Enter a name for the **Connection setup**.
4. Select **Serial** from the **Type** list.
5. Select the computer port that the SPAN-SE is connected to from the **Port** list.
6. Select **115200** from the **Baud Rate** list.
7. Ensure the **Hardware Handshaking** check box is cleared.
8. Click the **OK** button to save the new device settings.
9. From the **Device** menu, select **Open Connection**.
10. Select the new configuration from the **Available Device Connections** area of the **Open Connection** dialog and click the **Open** button.

**Connect** establishes a communications session with the receiver and displays the progress. Once connected, the progress box disappears and several windows open, including the **Console** window. **Connect** is now ready for use to view status information, enter commands or log data.

### Using Connect

**Connect** 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 the **Tracking Status Window** from the **View** menu. Select **Help** from the main menu for more details on **Connect**, its windows and features.

### Determining When the Position is Valid

When the receiver has a valid position, the **Solution Status** field in the **Connect Position** window shows **Computed**.

### Configuring GNSS

Depending on the accuracy of the solution required, GNSS can be augmented with a number of correction sources including SBAS, L-Band and RTK (RTCA, RTCM, RTCM V3 and CMR). Refer to the **SPAN-SE User Manual** for SBAS, L-Band or RTK setup and operation.
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 latency is recommended. When connecting a base station to a SPAN-SE, the data link must connect to the SPAN-SE OEMV3 COM port, found on the I/O 1 Green Cable.

When the base and rover stations are set up, you can configure them for RTCA, RTCM, RTCMv3, CM+ or CMR corrections. Below is an RTCM example. Replace the latitude, longitude and height coordinates shown with those of your base:

```
fix position 51.11358042 -114.04358013 1059.4105
```

When you have made your selections in the SPAN wizard, click OK button to enable the SPAN system. When the system is enabled, raw IMU data becomes available and the INS filter starts. The inertial filter starts when the GNSS solution is solved and the IMU is connected.

### Configure SPAN with Connect

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

1. Select Wizards | SPAN Alignment from the Connect toolbar. This wizard takes you through the steps to complete a coarse or fast alignment, select the type of IMU and configure the receiver to IMU port to accept IMU data.

When you have made your selections in the SPAN wizard, you can configure the receiver to IMU port to accept IMU data.

#### RT-2 and RT-20

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

### Table 2: Enable INS Commands

<table>
<thead>
<tr>
<th>IMU Type</th>
<th>SETIMUTYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LN-200</td>
<td>IMU_LN200</td>
</tr>
<tr>
<td>IMU-FSAS</td>
<td>IMU_MAR_FSAS</td>
</tr>
<tr>
<td>IMU-CPT</td>
<td>IMU_KVH_COTS</td>
</tr>
<tr>
<td>IMU-LCI</td>
<td>IMU_LITE_LCI</td>
</tr>
<tr>
<td>IMU-HG1700</td>
<td>IMU_HG1700_AG11, or</td>
</tr>
<tr>
<td>IMU-HG1900</td>
<td>IMU_HG1900_AG11, or</td>
</tr>
<tr>
<td>IMU-HG1930</td>
<td>IMU_HG1930_AG11, or</td>
</tr>
<tr>
<td>IMU-HG1900</td>
<td>IMU_HG1900_AG58, or</td>
</tr>
<tr>
<td>IMU-HG1930</td>
<td>IMU_HG1930_AG58, or</td>
</tr>
<tr>
<td>IMU-HG1900</td>
<td>IMU_HG1900_CA20</td>
</tr>
<tr>
<td>IMU-HG1930</td>
<td>IMU_HG1930_A09</td>
</tr>
</tbody>
</table>

#### Configuration for Alignment

A coarse alignment routine requires the vehicle to remain stationary for at least 1 minute. If that is not possible, an alternate fast alignment routine is available. The fast or moving alignment is performed by estimating the attitude from the GPS velocity vector and injecting it into the SPAN filter as the initial system attitude.

A static coarse alignment is not available for the IMU-CPT or IMU-HG1930 IMUs. The fast, or kinematic alignment must be used instead. A stationary alignment is only possible with a dual antenna SPAN-SE-D, or if the SETINITAZIMUTH or SETINITATTITUDE commands are issued. See the SPAN-SE User Manual for more information.

If your have a dual antenna system (SPAN-SE-D), the default alignment mode is a dual antenna alignment. Once you enter the primary and secondary antenna offsets (with SETIMUTOANTOFFSET and SETIMUTOANTOFFSET2 respectively) the system will automatically align as soon as it computes a dual antenna solution. See the SPAN-SE User Manual for more information.
LOGGING DATA
You can collect data logs through any I/O port on the SPAN-SE receiver into any data capture software, including Connect. SPAN-SE also has a SD card for data collection. To send data to the SD card, open a file, then use FILE as the port designator in log requests. 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 alignment is complete.

INS data is available when the GNSS solution has solved for time (i.e., FINE/STEERING status). An antenna must be connected and tracking satellites for the system to function.

If performing a static alignment, allow the system to be stationary for at least one minute after the GNSS solution is computed for its initial system alignment.

If performing a kinematic alignment, move the vehicle forward at a speed faster than 1.15 m/s.

The status may occasionally change to INS_BAD_GPS_AGREEMENT. This status indicates that the inertial solution has detected poor quality GNSS 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 GNSS quality to improve. The solution is still valid during this status, but it is a warning that the GNSS/INS solution is more reliable than the GNSS-only solution.

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 GLONSS:
- GLOEPHEMERISB onchanged
- GLOPREMERSB 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 www.novatel.com/products/waypoint-software for more details.

The status changes from INS_INACTIVE to INS_ALIGNMENT when the alignment starts.

The status changes to INS_ALIGNMENT_COMPLETE when the alignment is complete. Typically, this state continues until the system senses motion. After some motion (stops, starts, and turns), the attitude solution converges to within specifications, and the status changes to INS_SOLUTION_GOOD.