



**HEXAGON**



D102829

# Application Note

## Agriculture Software Configuration Guide



## HEXAGON AUTONOMOUS SOLUTIONS DIVISION

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## Introduction

This guide provides an overview of the steps required to configure a Hexagon | NovAtel GNSS receiver to be integrated into an agriculture application, providing examples of typical configurations for various accuracy levels and use cases specific to this industry. NovAtel has introduced various software features tailored to agriculture over its long history of providing global navigation satellite system (GNSS) and inertial navigation system (INS) technology to the industry. Some examples include GLIDE, STEADYLINE and RTK ASSIST. This guide aims to bring together all these unique agriculture features into one document and introduce the possible configuration options to the integrator.

## Entry-level positioning

For entry-level positioning, the user will typically be seeking to maximise the accuracy and robustness of their position without access to a paid correction service such as TerraStar precise point positioning (PPP). The options available depend on the operating location, with some regions, such as North America and Europe, having the benefit of satellite-based augmentation system (SBAS) corrections available. But there are various configuration settings which are not dependent on free regional corrections, for example, the [GLIDE feature](#) (PDP relative positioning filter)\*, which is tuned and optimised for error consistency rather than absolute accuracy and improves the pass-to-pass accuracy of the operation, particularly useful in agriculture. Another great example is STEADYLINE\*, [NovAtel's STEADYLINE technology](#) reduces position jumps that can occur when a GNSS receiver changes positioning modes. Smooth transitions are extremely important for precision steering applications where sudden jumps are disruptive.



### NOTE

\*SMART2 software product option requires 'G' character for GLIDE, or 'W' for GLIDE + STEADYLINE.

## Entry-level software models

In agriculture applications, entry-level position accuracy can often be adequate for a variety of field operations such as spraying or spreading. Entry-level accuracy could be achieved with the following configurations:

- SBAS with GLIDE
- GLIDE
- TerraStar-L PPP corrections

Entry-level positioning up to TerraStar-L accuracy can be achieved with a 'basic' software model, typical examples for NovAtel SMART antenna hardware are listed here:

- SMART7: **SM7-DDN-LNN-TMN** (SMART7 with GPS+GLO+QZSS, L1/L2, Single Point+DGPS PNT, 20 Hz Data Output Rate, Measurements Only, No Base Station Corrections).
- SMART2: **SM2-DDN-LNN-TMN-G** (SMART2 with GPS+GLO+QZSS, L1/L2, Single Point+DGPS PNT, GLIDE, 20 Hz Data Output Rate, Measurements Only, No Base Station Corrections).

## Entry-level configuration

In the example below, we see a typical entry-level positioning configuration with descriptions of each line.

[INTERFACEMODE](#) sets serial port 'COM1' to send/receive NOVATEL messages and turns response generation 'ON'.

```
INTERFACEMODE COM1 NOVATEL NOVATEL ON
```

[SERIALCONFIG](#) sets serial port 'COM1' to a baud rate of 115,200 bps and sets the parity, databits, stopbits, handshaking and break detection to standard settings.

```
SERIALCONFIG COM1 115200 N 8 1 N OFF
```

[PDPFILTER](#) enables [GLIDE](#).

```
PDPFILTER ENABLE
```

The [PDPMODE](#) command can be set to 'RELATIVE AUTO' to optimise GLIDE for agriculture applications and automatically detect dynamics. This is the recommended setting for the majority of agriculture use cases: performance is optimised to obtain a consistent error in latitude and longitude over time periods of 15 minutes or less, rather than to obtain the smallest absolute position error.

```
PDPMODE RELATIVE AUTO
```

The [ASSIGNLBANDBEAM](#) command enables L-band tracking; the 'AUTO' setting is recommended so the receiver can automatically track and use the best available L-band satellite. Enabling L-band tracking by default is useful so the receiver is always ready to receive a subscription should the user wish to upgrade their position accuracy from entry-level to PPP.

```
ASSIGNLBANDBEAM AUTO
```

In this example, NMEA0183 logs [GPGGA](#), [GPVTG](#) and [GPZDA](#) are output at 10 Hz and 1 Hz respectively, these output rates can be adjusted to suit the application. Visit [NMEA Standard Logs](#) to review the full list of available NMEA0183 logs.

```
LOG COM1 GPGGALONG ONTIME 0.1  
LOG COM1 GPVTG ONTIME 0.1  
LOG COM1 GPZDA ONTIME 1
```

A [SAVECONFIG](#) command is required to save the configuration to the receiver's internal memory.

```
SAVECONFIG
```

Where SBAS corrections are available in the operating region, the following command is recommended. [SBASCONTROL](#) command is used to enable SBAS positioning, it is recommended to use the 'AUTO' setting in the majority of cases.

```
SBASCONTROL ENABLE AUTO
```

### Full configuration:

```
INTERFACEMODE COM1 NOVATEL NOVATEL ON
SERIALCONFIG COM1 115200 N 8 1 N OFF
PDPFILTER ENABLE
PDPMODE RELATIVE AUTO
ASSIGNLBANDBEAM AUTO
LOG COM1 GPGGALONG ONTIME 0.1
LOG COM1 GPVTG ONTIME 0.1
LOG COM1 GPZDA ONTIME 1
SAVECONFIG
*Optional*
SBASCONTROL ENABLE AUTO
```

## PPP positioning

[NovAtel's TerraStar PPP corrections](#), positioning algorithms and hardware are designed side-by-side to ensure a seamless solution with powerful performance. TerraStar PPP Correction Services unlock high-performance real-time positioning for agriculture applications around the world, resulting in 24/7/365, all-weather operation, even in challenging environments.

One major benefit of TerraStar corrections is the L-band delivery method (with internet delivery as a backup option), which simplifies the integration of this correction service with no need for an internet modem and relying on good internet coverage in the area of operation.

Users of TerraStar-C PRO positioning can expect superior accuracy and repeatability for agriculture operations requiring the ultimate precision, such as cultivation and planting. The global coverage and availability also make PPP the recommended choice for users who also need to maintain uptime in addition to accuracy.

### PPP software models

PPP TerraStar positioning can be achieved with various software models, dependent on the PPP service required. Typical examples for NovAtel SMART antenna hardware are listed here:

#### ***TerraStar-C PRO***

- SMART7: **SM7-FDN-PNN-TMN** (SMART7 with GPS+GLO+GAL+BDS+QZSS, L1/L2/E1/E5B/B1/B2, PPP+Single Point+DGPS PNT, 20 Hz Data Output Rate, Measurements Only, No Base Station Corrections).
- SMART2: **SM2-FDN-PNN-TMN-G** (SMART2 with GPS+GLO+GAL+BDS+QZSS, L1/L2/E1/E5b/B1/B2, PPP+Single Point+DGPS PNT, GLIDE, 20 Hz Data Output Rate, Measurements Only, No Base Station Corrections).

#### ***TerraStar-L***

- SMART7: **SM7-DDN-LNN-TMN** (SMART7 with GPS+GLO+QZSS, L1/L2, Single Point+DGPS PNT, 20 Hz Data Output Rate, Measurements Only, No Base Station Corrections).
- SMART2: **SM2-DDN-LNN-TMN-G** (SMART2 with GPS+GLO+QZSS, L1/L2, Single Point+DGPS PNT, GLIDE, 20 Hz Data Output Rate, Measurements Only, No Base Station Corrections).

## PPP positioning configuration

In terms of software configuration for PPP positioning, the only essential setting is to enable L-band tracking with the command **ASSIGNLBANDBEAM AUTO**, but there are some other considerations. In the example below, we see a typical PPP positioning configuration with descriptions of each line.

These core configuration commands are identical to the entry-level positioning example:

```
INTERFACEMODE COM1 NOVATEL NOVATEL ON
SERIALCONFIG COM1 115200 N 8 1 N OFF
PDPFILTER ENABLE
PDPMODE RELATIVE AUTO
ASSIGNLBANDBEAM AUTO
LOG COM1 GPGGALONG ONTIME 0.1
LOG COM1 GPVTG ONTIME 0.1
LOG COM1 GPZDA ONTIME 1
```

**PPPSOURCE** states the type of PPP corrections the receiver will use as a source. The default is 'AUTO'; with this setting, the receiver will automatically select and use the best correction source.

```
PPPSOURCE AUTO
```

The **PPPSEED** command controls the seeding of the PPP filter. Accurate position seeding can accelerate PPP convergence.

```
PPPSEED AUTO
```

The **PPPDYNAMICS** command configures the dynamics assumed by the PPP filter. AUTO detects the antenna dynamics and adapts filter operation accordingly.

```
PPPDYNAMICS AUTO
```

The **STEADYLINE** command is used in this example to set the STEADYLINE transition time to 60 seconds. With a high-accuracy position available, STEADYLINE can smooth transitions between this high-accuracy PPP position and a lower-accuracy position, such as GLIDE/PDP.

```
STEADYLINE PREFER_ACCURACY 60
```

The **TERRASTARINFO** log contains details on the TerraStar subscription.

```
LOG COM1 TERRASTARINFO ONCHANGED
```

The **TERRASTARSTATUS** log contains status information for the TerraStar decoder and subscription.

```
LOG COM1 TERRASTARSTATUS ONCHANGED
```

A **SAVECONFIG** command is required to save the configuration to the receiver's internal memory.

```
SAVECONFIG
```

### Full configuration:

```
INTERFACEMODE COM1 NOVATEL NOVATEL ON
SERIALCONFIG COM1 115200 N 8 1 N OFF
PDPFILTER ENABLE
PDPMODE RELATIVE AUTO
ASSIGNLBANDBEAM AUTO
LOG COM1 GPGGALONG ONTIME 0.1
LOG COM1 GPVTG ONTIME 0.1
LOG COM1 GPZDA ONTIME 1
PPPSOURCE AUTO
PPPSEED AUTO
PPPDYNAMICS AUTO
STEADYLINE PREFER_ACCURACY 60
LOG COM1 TERRASTARINFO ONCHANGED
LOG COM1 TERRASTARSTATUS ONCHANGED
SAVECONFIG
```

## RTK positioning

RTK corrections can be transmitted from a base station or NTRIP network to a rover receiver to improve position accuracy. The base station is the GNSS receiver that acts as the stationary reference, or in the case of Network RTK, a series of base stations which create a reference station network across a regional area. The rover is the GNSS receiver that does not know its exact position and requires correction messages from a base station or NTRIP network to calculate a differential GNSS position.

In agriculture operations, RTK can allow users to achieve a highly accurate and repeatable position, which is suited to cultivation and planting operations. Unlike PPP, there are some additional considerations in terms of hardware and software setup since the RTK corrections are typically delivered via internet or radio. The examples in this document show the typical software configuration for an RTK rover receiver.

### RTK software models

RTK positioning can be achieved with various software models; a typical example for NovAtel SMART7 hardware is listed here:

- SMART7: **SM7-FFN-RNN-TBN** (SMART7 with GPS+GLO+GAL+BDS+QZSS, L1/L2/L5/E1/E5a/E5b/AltBOC/B1/B2/B3, RTK+PPP+Single Point+DGPS PNT, 20 Hz Data Output Rate, Base Station Corrections + Measurements).

## RTK positioning example configuration

These core configuration commands are identical to the entry-level positioning example.

```
INTERFACEMODE COM1 NOVATEL NOVATEL ON
SERIALCONFIG COM1 115200 N 8 1 N OFF
PDPFILTER ENABLE
PDPMODE RELATIVE AUTO
STEADYLINE PREFER ACCURACY 60
ASSIGNLBANDBEAM AUTO
LOG COM1 GPGGALONG ONTIME 0.1
LOG COM1 GPVTG ONTIME 0.1
LOG COM1 GPZDA ONTIME 1
```



### NOTE

This example dedicates COM3 for RTK corrections. The port/port number is arbitrary, and any port can be used for this purpose, provided the port is dedicated to this task.

[INTERFACEMODE](#) sets serial port 'COM3' to receive RTCMV3 correction messages and send NOVATEL messages, and turns response generation 'ON'.

```
INTERFACEMODE COM3 RTCMV3 NOVATEL ON
```

[SERIALCONFIG](#) sets serial port 'COM3' to a baud rate of 115,200 bps and sets the parity, databits, stopbits, handshaking and break detection to standard settings.

```
SERIALCONFIG COM3 115200 N 8 1 N OFF
```

The [RTKSOURCE](#) command determines what corrections the RTK filter can use. This is useful when the receiver is receiving corrections from multiple base stations. The default setting is 'AUTO' correction type 'ANY' base station ID.

```
RTKSOURCE AUTO ANY
```

The [PSRDIFFSOURCE](#) command determines what differential corrections the PSR and PDP (GLIDE) filters can use. By setting this command to 'NONE', this prevents the receiver from using differential corrections in the PSR and PDP filters, resulting in these position engines being 'uncorrected'; this can be a useful comparison to the 'corrected' RTK engine.

```
PSRDIFFSOURCE NONE
```

The [STEADYLINE](#) command is used in this example to set the STEADYLINE transition time to 60 seconds. With a high-accuracy position available, STEADYLINE can smooth transitions between this high-accuracy RTK position and a lower-accuracy position, such as GLIDE/PDP.

```
STEADYLINE PREFER ACCURACY 60
```

Typically, NTRIP RTK servers/casters require the RTK rover to send their position back to the NTRIP server, so here the [GPGGA](#) log is sent on 'COM3' once every 5 seconds for this purpose.

```
LOG COM3 GPGGA ONTIME 5
```

A [SAVECONFIG](#) command is required to save the configuration to the receiver's internal memory.

```
SAVECONFIG
```

Full configuration:

```
INTERFACEMODE COM1 NOVATEL NOVATEL ON
SERIALCONFIG COM1 115200 N 8 1 N OFF
PDPFILTER ENABLE
PDPMODE RELATIVE AUTO
STEADYLINE PREFER ACCURACY 60
ASSIGNLBANDBEAM AUTO
LOG COM1 GPGGALONG ONTIME 0.1
LOG COM1 GPVTG ONTIME 0.1
LOG COM1 GPZDA ONTIME 1
INTERFACEMODE COM3 RTCMV3 NOVATEL ON
SERIALCONFIG COM3 115200 N 8 1 N OFF
RTKSOURCE AUTO ANY
PSRDIFFSOURCE NONE
LOG COM3 GPGGA ONTIME 5
SAVECONFIG
```

## ALIGN relative positioning and heading

NovAtel's ALIGN technology combines two or more NovAtel receivers to generate precise relative positioning and heading for dynamic applications. ALIGN can be used in two different applications: ALIGN Heading and ALIGN Relative Positioning.

An ALIGN solution typically utilises two receivers: a Base and a Rover. The Base receiver sends correction information to the other receiver operating as the Rover (an ALIGN base can have multiple Rover receivers at a time). The Rover requires either the ALIGN Heading or ALIGN Relative Positioning model to use the ALIGN messages from the Base. ALIGN can be utilised with any OEM7 receiver model tracking at least GPS L1 & L2; however, it is recommended to implement a minimum tracking capability of GPS + GLONASS L1 & L2. For examples on the typical agriculture use cases for ALIGN, please see the dedicated [ALIGN in Agriculture](#) Application Note.

### ALIGN software models

ALIGN relative positioning and heading only can be achieved with various software model combinations. A typical ALIGN heading example for NovAtel SMART antenna hardware pairs is listed here:

- SMART7 (ALIGN Base): **SM7-FDN-PNN-TMN** (SMART7 with GPS+GLO+GAL+BDS+QZSS, L1/L2/E1/E5B/B1/B2, PPP+Single Point+DGPS PNT, 20 Hz Data Output Rate, Measurements Only, No Base Station Corrections).
- SMART2 (ALIGN Rover): **SM2-FDN-NZN-NNN-B** (SMART2 with GPS+GLO+GAL+BDS+QZSS, L1/L2/E1/E5b/B1/B2I/B2b, SBAS L1, No Positioning, ALIGN Heading only).

## ALIGN Base example configuration



### NOTE

This example dedicates COM2 for ALIGN communication on both the Base and Rover receivers. The port/port number is arbitrary, and any port can be used for this purpose, provided the port is dedicated to this task.

This example shows the manual method for configuring ALIGN. If using serial ports for the ALIGN communication method, consider using the 'plug and play' [ALIGNAUTOMATION](#) command to configure ALIGN.

The [MOVINGBASESTATION](#) command is used to enable or disable a receiver from transmitting corrections without a fixed position. In this case, the MOVINGBASESTATION needs to be set to 'ENABLE' for the ALIGN function to operate correctly.

```
MOVINGBASESTATION ENABLE
```

[INTERFACEMODE](#) sets serial port 'COM2' to receive NOVATEL messages and send NOVATELX messages and turns response generation 'OFF'.

```
INTERFACEMODE COM2 NOVATEL NOVATELX OFF
```

[SERIALCONFIG](#) sets serial port 'COM2' to a baud rate of 230,400 bps and sets the parity, databits, stopbits, handshaking and break detection to standard settings.

```
SERIALCONFIG COM2 230400 N 8 1 N OFF
```

[NOVATELXOBS](#) is a combined observation and reference station message used to transmit RTK corrections. This is a proprietary message and supports sending data for all systems. The chosen rate here is 10 Hz.

```
LOG COM2 NOVATELXOBS ONTIME 0.1
```

[NOVATELXREF](#) is a proprietary extended reference station message for use in ALIGN configurations only. The chosen rate here is 10 Hz.

```
LOG COM2 NOVATELXREF ONTIME 0.1
```

To output ALIGN heading to the chosen user communication port, use the [HEADING2](#) log.

```
LOG COM1 HEADING2 ONNEW
```

A [SAVECONFIG](#) command is required to save the configuration to the receiver's internal memory.

```
SAVECONFIG
```

**Full configuration:**

```
MOVINGBASESTATION ENABLE
INTERFACEMODE COM2 NOVATELX NOVATEL OFF
SERIALCONFIG COM2 230400 N 8 1 N OFF
LOG COM2 NOVATELXOBS ONTIME 0.1
LOG COM2 NOVATELXREF ONTIME 0.1
LOG COM1 HEADING2 ONNEW
SAVECONFIG
```

**ALIGN Rover example configuration**

[INTERFACEMODE](#) sets serial port 'COM2' to receive NOVATELX messages and send NOVATEL messages and turns response generation 'OFF'.

```
INTERFACEMODE COM2 NOVATELX NOVATEL OFF
```

[SERIALCONFIG](#) sets serial port 'COM2' to a baud rate of 230,400 bps and sets the parity, databits, stopbits, handshaking and break detection to standard settings.

```
SERIALCONFIG COM2 230400 N 8 1 N OFF
```

The [HEADINGEXT2](#) log is sent back to the ALIGN Base 'ONNEW'. This is a proprietary message sent from the rover receiver to the base receiver in an ALIGN or Relative INS configuration.

```
LOG COM2 HEADINGEXT2B ONNEW
```

A [SAVECONFIG](#) command is required to save the configuration to the receiver's internal memory.

```
SAVECONFIG
```

**Full configuration:**

```
MOVINGBASESTATION ENABLE
INTERFACEMODE COM2 NOVATELX NOVATEL OFF
SERIALCONFIG COM2 230400 N 8 1 N OFF
LOG COM2 HEADINGEXT2B ONNEW
SAVECONFIG
```

**SPAN GNSS+INS positioning**

NovAtel's SPAN GNSS+INS technology brings together two very different but complementary positioning and navigation systems, namely GNSS and an INS. By combining the best aspects of GNSS and INS into one system, SPAN technology can offer a solution that is more accurate and reliable than either GNSS or INS could provide alone. The combined GNSS+INS solution has the advantage of the absolute accuracy available from GNSS and the continuity of INS through traditionally difficult GNSS conditions.

SMART7-S and SMART7-SI have been designed specifically for the agriculture use case and combine the GNSS+INS technology into one rugged enclosure. The SMART7 SPAN enclosure can be used as a single antenna, standalone GNSS+INS receiver or combined with a secondary GNSS receiver to complement the INS solution with GNSS Heading updates, which will allow static alignment of the SPAN solution and aid the azimuth.

## SPAN software models

SPAN GNSS+INS positioning can be achieved with various software models. A typical SPAN software model example for a NovAtel SMART7 receiver is shown below:

- SMART7 SPAN: **SM7S-FDN-PNN-TMN-P1** (SMART7 with GPS+GLO+GAL+BDS+QZSS, L1/L2/E1/E5B/B1/B2, PPP+Single Point+DGPS PNT, 20 Hz Data Output Rate, Measurements Only, No Base Station Corrections, SPAN Enabled with Profiles, level 1 IMU).

## SPAN GNSS+INS positioning example configuration

Configuration for SPAN positioning should be carefully considered. It is highly recommended to review the full and comprehensive documentation on SPAN in the [NovAtel Documentation Portal](#) before configuring a receiver for SPAN. Further recommended reading can be found in the [SPAN Overview and Integration Guide](#) and the [Inertial Navigation Systems and Vibration](#) application notes.

## Single receiver SPAN



### NOTE

This example is based on a single SMART7 SPAN receiver with PPP positioning.

These core configuration commands are identical to the PPP positioning example:

```
INTERFACEMODE COM1 NOVATEL NOVATEL ON
PDPFILTER ENABLE
PDPMODE RELATIVE AUTO
ASSIGNLBANDBEAM AUTO
PPPSOURCE AUTO
PPPSEED AUTO
PPPDYNAMICS AUTO
STEADYLINE PREFER_ACCURACY 60
LOG COM1 TERRASTARINFO ONCHANGED
LOG COM1 TERRASTARSTATUS ONCHANGED
SAVECONFIG
```

[SETINSROTATION](#) is used to specify rotational offsets between the IMU frame and other reference frames. In this case, the 'RBV' rotation is specified from the IMU body frame to the vehicle frame. The values in this example align with the standard SMART7-S/SI mounting position (SMART7 connector points to the rear of the vehicle). For more details on SMART7-S/SI mounting, please review [SPAN translations and rotations](#).

```
SETINSROTATION RBV 180 0 90 1.0 1.0 1.0
```

The [SETINSPROFILE](#) command sets specific filter behaviour depending on the environment the system is installed in. AGRICULTURE is recommended for any agriculture use case.

```
SETINSPROFILE AGRICULTURE
```

[SERIALCONFIG](#) sets serial port 'COM1' to a baud rate of 460,800 bps and sets the parity, databits, stopbits, handshaking and break detection to standard settings. In this example, a high baud rate is recommended for higher rate INS logs which are typical for this application.

```
SERIALCONFIG COM1 460800 N 8 1 N OFF
```

The [INSPVA](#) log reports position, velocity and attitude information from the INS positioning engine and is the recommended SPAN log for navigation purposes and can be logged at high rates. There are other variants of this log available, dependant on user requirements, including [INSPVAX](#) (extended), [INSPVAS](#) (short header) and [INSPVACMP](#) (compressed as a NMEA 2000 fast packet message for CAN output). It is recommended to log in binary format, so in this example, we use the 'B' appended to the end of each log to request the binary version.

```
LOG COM1 INSPVAB ONTIME 0.05
```

The [INSSTDEV](#) log displays the INS PVA standard deviations and is useful in determining the estimated error values for the various INS output fields. Again, this log is requested in binary format.

```
LOG COM1 INSSTDEVB ONTIME 1
```

A [SAVECONFIG](#) command is required to save the configuration to the receiver's internal memory.

```
SAVECONFIG
```

Full configuration:

```
INTERFACEMODE COM1 NOVATEL NOVATEL ON
SERIALCONFIG COM1 460800 N 8 1 N OFF
PDPFILTER ENABLE
PDEMODE RELATIVE AUTO
ASSIGNLBANDBEAM AUTO
PPPSOURCE AUTO
PPPSEED AUTO
PPPDYNAMICS AUTO
STEADYLINE PREFER ACCURACY 60
LOG COM1 INSPVAB ONTIME 0.05
LOG COM1 INSSTDEVB ONTIME 1
LOG COM1 TERRASTARINFO ONCHANGED
LOG COM1 TERRASTARSTATUS ONCHANGED
SETINSROTATION RBV 180 0 90 1.0 1.0 1.0
SETINSPROFILE AGRICULTURE
SAVECONFIG
```

## Dual receiver SPAN

SPAN is complemented by adding a secondary antenna/receiver to the setup. This gives the INS solution the benefit of access to GNSS-based heading, a component of navigation which is difficult to determine using an IMU alone. From the initial alignment phase of the INS system, changes in GNSS heading are continually used in the solution to estimate the current heading in attitude.

A dual receiver SPAN setup can be used very effectively in agriculture, especially where low operating speeds are required. A typical agriculture setup might include a SMART7-S base/primary receiver and a SMART2 rover/secondary receiver.

## Dual receiver SPAN positioning example configuration (Base receiver)

This example is based on a **dual receiver SPAN solution**, with a SMART7-S/SI Base receiver and a secondary SMART antenna acting as the Rover receiver. The Base receiver uses PPP positioning.

These core configuration commands are identical to the PPP positioning example:

```
INTERFACEMODE COM1 NOVATEL NOVATEL ON
PDFFILTER ENABLE
PDPMODE RELATIVE AUTO
ASSIGNLBANDBEAM AUTO
PPPSOURCE AUTO
PPPSEED AUTO
PPPDYNAMICS AUTO
STEADYLINE PREFER_ACCURACY 60
LOG COM1 TERRASTARINFO ONCHANGED
LOG COM1 TERRASTARSTATUS ONCHANGED
SAVECONFIG
```

[SETINSTRANSALATION](#) is used to specify translational offsets between the IMU frame and the phase centre of the secondary GNSS antenna (rover receiver).



### NOTE

**DO NOT** use ANT1 if configuring a SMART7-S/SI as this will overwrite the factory-installed internal antenna offset.

```
SETINSTRANSALATION ANT2 1.0 2.0 3.0 0.0500 0.0500 0.0500 VEHICLE
```

[SETINSROTATION](#) is used to specify rotational offsets between the IMU frame and other reference frames. In this case, the 'RBV' rotation is specified from the IMU body frame to the vehicle frame. The values in this example align with the standard SMART7-S/SI mounting position (SMART7 connector points to the rear of the vehicle). For more details on SMART7-S/SI mounting, please review [SPAN translations and rotations](#).

```
SETINSROTATION RBV 180 0 90 1.0 1.0 1.0
```

The [SETINSPROFILE](#) command sets specific filter behaviour depending on the environment the system is installed in. AGRICULTURE is recommended for any agriculture use case.

```
SETINSPROFILE AGRICULTURE
```

The [MOVINGBASESTATION](#) command enables or disables a receiver from transmitting corrections without a fixed position. The MOVINGBASESTATION must be set to 'ENABLE' for the ALIGN function to operate correctly.

```
MOVINGBASESTATION ENABLE
```

The [INSALIGNCONFIG](#) command is used to configure ALIGN for a SPAN base receiver to a secondary rover receiver. The command will configure the port on the base and rover and set up corrections at the desired rate. It also attempts to re-establish these corrections should they stop.

```
INSALIGNCONFIG COM2 COM2 230400 1
```

The [INSPVA](#) log reports position, velocity and attitude information from the INS positioning engine and is the recommended SPAN log for navigation purposes and can be logged at high rates. There are other variants of this log available dependant on user requirements, including [INSPVAX](#) (extended), [INSPVAS](#) (short header) and [INSPVACMP](#) (compressed as a NMEA 2000 fast packet message for CAN output). It is recommended to log in binary format, so in this example we use the 'B' appended to the end of each log to request the binary version.

```
LOG COM1 INSPVAB ONTIME 0.05
```

The [INSSTDEV](#) log displays the INS PVA standard deviations and is useful in determining the estimated error values for the various INS output fields. Again, this log is requested in binary format.

```
LOG COM1 INSSTDEVB ONTIME 1
```

A [SAVECONFIG](#) command is required to save the configuration to the receiver's internal memory.

```
SAVECONFIG
```

Full configuration:

```
INTERFACEMODE COM1 NOVATEL NOVATEL ON
SERIALCONFIG COM1 460800 N 8 1 N OFF
PDPFILTER ENABLE
PDEMODE RELATIVE AUTO
ASSIGNLBANDBEAM AUTO
PPPSOURCE AUTO
PPPSEED AUTO
PPPDYNAMICS AUTO
STEADYLINE PREFER ACCURACY 60
LOG COM1 INSPVAB ONTIME 0.05
LOG COM1 INSSTDEVB ONTIME 1
LOG COM1 TERRASTARINFO ONCHANGED
LOG COM1 TERRASTARSTATUS ONCHANGED
SETINSTRANSFORMATION ANT2 1.0 2.0 3.0 0.0500 0.0500 0.0500 VEHICLE
SETINSROTATION RBV 180 0 90 1.0 1.0 1.0
SETINSPROFILE AGRICULTURE
MOVINGBASESTATION ENABLE
INSALIGNCONFIG COM2 COM2 230400 1
SAVECONFIG
```

### Dual receiver SPAN positioning example configuration (Rover receiver)

In the case of using the automated '[INSALIGNCONFIG](#)' command, the secondary/rover receiver may not require any manual configuration, as the INSALIGNCONFIG command sent from the base receiver will configure this secondary receiver automatically. However, some basic configuration settings may be needed to set up communication to user system or to provide a secondary, independent position output. In this case, please refer to one of the corresponding previous sections for the required position accuracy for the SPAN secondary/rover receiver.

## Acronyms

Table 1: Acronym list

Term	Description
<b>CAN</b>	controller area network
<b>GNSS</b>	global navigation satellite system
<b>INS</b>	Inertial navigation system
<b>NMEA</b>	National Marine Electronics Association
<b>NTRIP</b>	Networked Transport of RTCM via Internet Protocol
<b>PPP</b>	precise point positioning
<b>PVA</b>	position velocity attitude
<b>RTK</b>	real-time kinematic
<b>SBAS</b>	satellite-based augmentation system
<b>SPAN</b>	Synchronized Position and Attitude Navigation

## Support

To help answer questions and/or diagnose any technical issues that may occur, the [NovAtel Support Centre](#) is a first resource.

Remaining questions or issues, including requests for test subscriptions or activation resends, can be directed to [NovAtel Support](#).

Before contacting Support, it is helpful to collect data from the receiver to help investigate and diagnose any performance-related issues. A list of appropriate troubleshooting logs can be found on the [OEM7 Documentation Portal](#) (the LOG command with the recommended trigger and data rate is included with each log).

The data can also be collected using [NovAtel Application Suite](#).

## Documentation

For any questions on logs and commands, please visit the [OEM7 Documentation Portal](#). Technical documents, along with firmware and software downloads, can be found on the [NovAtel Support website](#).

## Contact Hexagon | NovAtel

[support.novatel@hexagon.com](mailto:support.novatel@hexagon.com) 1-800-NOVATEL (U.S. and Canada) or 1-403-295-4900  
For more contact information, please visit [novatel.com/contact-us](http://novatel.com/contact-us)