Survey Grade INS

External Trimble GNSS integration

Operating handbook

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SBG SYSTEMS

This brief document guides you in the process of connecting a SplitBox-T or an external Trimble GNSS receiver to your SBG Unit (All-in-One or Navsight system).

Step 1: GNSS and Sensor connections

In case you are using a SplitBox-T, including an embedded Trimble receiver, the receiver COM3 is connected to the All-in-One Ekinox or Apogee PORT D internally. In addition, the PPS signal is connected to the device Sync IN D.

In case you are using an external Trimble receiver, connect GPS Tx signal(s) to one of the following Rx pins on Sensor connectors: PORT A, B, C, D, E.

You can also use an Ethernet connection if required – not fully covered by this document.

Also connect the GPS PPS signal to one of the Sync In signals A, B, C, D or E.

Note 1: Only the physical PORT A is available for the All-in-One Ekinox-A. However, you can still use Eth 1 to Eth 4 virtual serial ports to input GPS data.

Note 2: Trimble PPS signal strength is usually very weak (3.3V pulse with a few microseconds duration). If the PPS cable is too long or split, this signal may require pre-amplification using third party hardware to work properly.

Step 2: GNSS module configuration

In case you are using a SplitBox-T, the receiver is already pre-configured, so you can skip this step.

Trimble configuration can be performed through the embedded web interface. The following section details how to access the web interface.

Accessing the Trimble web interface

By default, the receiver is set in DHCP mode and to access its web interface you should simple type http://bd982.local. in your web browser.

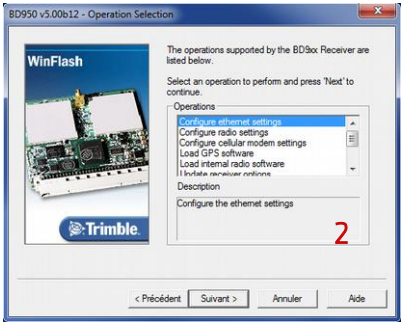
A user name and password will be asked to access the configuration. The factory default login credentials are reminded below:

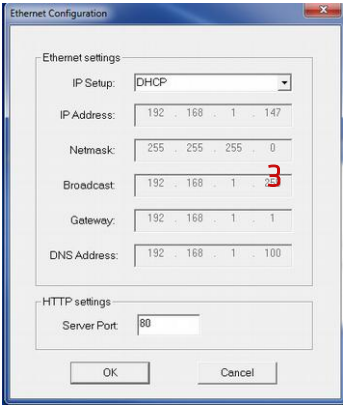
- **Username:** admin
- **Password:** password

If you have trouble to access the receive web interface, you can try to read the current receiver IP address and type it in your web browser. A serial connection can be used to retrieve the current IP address of the receiver using Trimble configuration software such as WinFlash or WinPan.

Those software can be found on Trimble support site. The following shows an example to configure Ethernet parameters using WinFlash

- Select device type and serial port to connect onto
- Select option to Configure Ethernet Settings
- You can read and modify if needed the IP settings for the GNSS receiver.



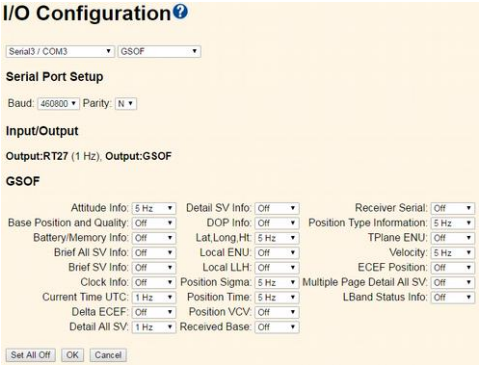


Once the IP is defined, you can access the web interface through your default web browser by entering the IP address or the GNSS receiver name.

Basic Messages output configuration

Configure the following outputs in GSOF format and output rates on your GPS receiver:

- **Lat, Long, Ht** @ 5 Hz
- **Position Sigma** @ 5 Hz
- **Position time** @ 5 Hz
- **Position Type Information** @ 5 Hz (optional)
- **Velocity** @ 5Hz
- **Current Time UTC** @ 1Hz
- **Detail All SV** @ 1Hz
- **Attitude Info** @ 5 Hz (for dual antenna systems)



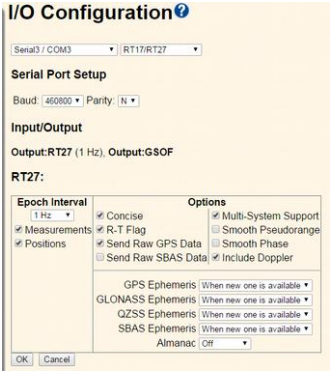
Note 1: For best accuracy and integration, SBG Systems recommend using the Trimble Binary Format (GSOF) protocol rather than NMEA outputs.

Note 2: Some Trimble GNSS can't output the Position Type Information message. However, this message is not mandatory for correct INS operations.

Note 3: If your receiver doesn't support the Detail All SV message log, you can use the Brief All SV Info or the Multiple Page Detail All SV one.

Configuration for post-processing

Post processing requires getting RAW measurement data from the GNSS receiver. Trimble GNSS receivers use the RT-17 or RT-27 protocols to do so. The RT-27 protocol support all constellations whereas the RT-17 only supports the GPS system.



The following RT-17/27 configuration should be set on the Trimble GNSS for correct post processing operations:

- **Epoch Interval:** Measurements / Positions @ 1Hz
- **Concise:** enabled
- **R-T Flag:** enabled
- **Send Raw GPS Data:** enabled
- **Multi-System Support**: enabled
- **Include Doppler**: enabled
- **GPS Ephemeris, GLONASS Ephemeris, QZSS Ephemeris**: When new one is available

Note: Please select a sufficient baud rate to transfer all enabled data. If post processing (RT-17/27) outputs are enabled, please select at least 230 400 bps.

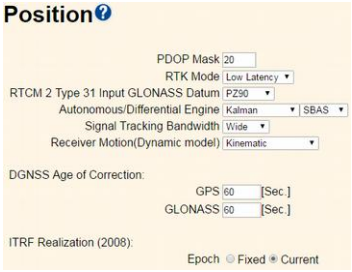
Other GNSS Configuration:

General Configuration:

- **1PPS On/Off:** Enable
- **1PPS Always On:** Disable

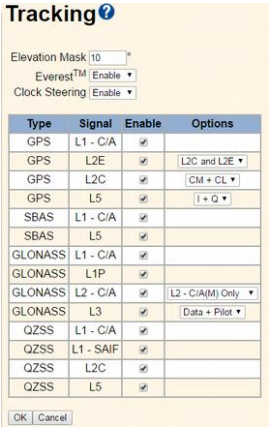
Position Configuration:

- **PDOP Mask:** 20
- **RTK Mode:** Low Latency
- **Autonomous Engine:** Kalman
- **Motion:** Kinematic



Tracking Configuration:

- **Elevation Mask:** 10
- **Everest:** Enable
- **Clock Steering:** Enable



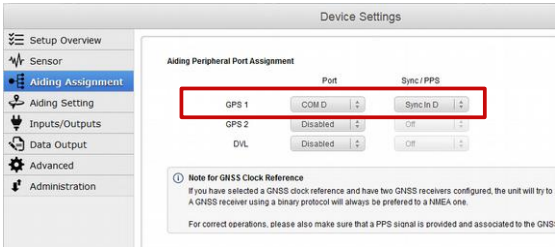
Step 3: Sensor configuration

In order to configure the Inertial device, you need to connect to the Web interface and open the configuration window. Simply follow those instructions:

Set Aiding Assignment

In this window, you just indicate where you connected your GNSS receiver.

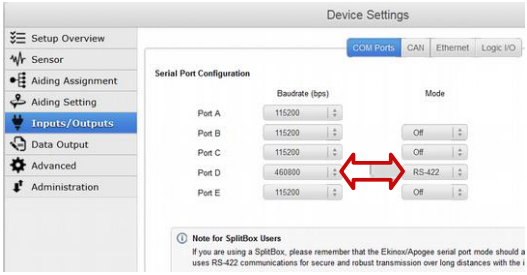
Both communication port **and** Sync In pin must be set.



Set correct baudrate and mode for serial port

In our example we configured the GPS to be connected on PORT D in RS-422 mode.

Set corresponding baudrate, that has been configured on GNSS receiver board



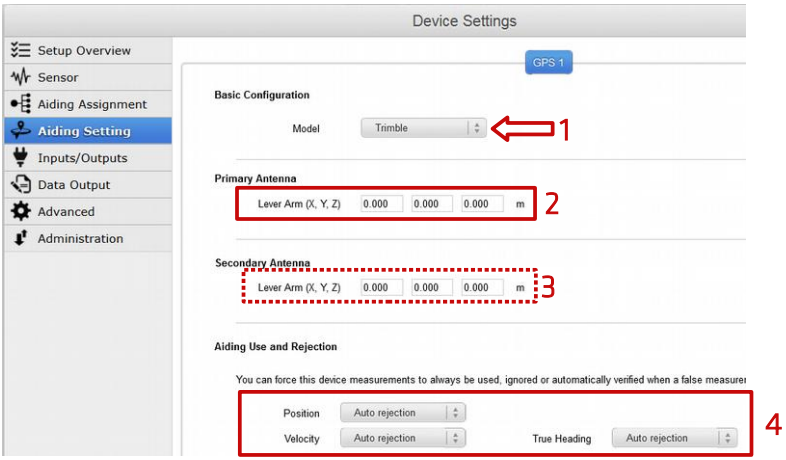
Set Logic input configuration for PPS signal

In order to use correctly PPS signal information, you must enable the corresponding logic input. Here we configured PPS on Sync D.

Polarity should be set accordingly with the actual GPS signal.

Set correct GPS model and configuration

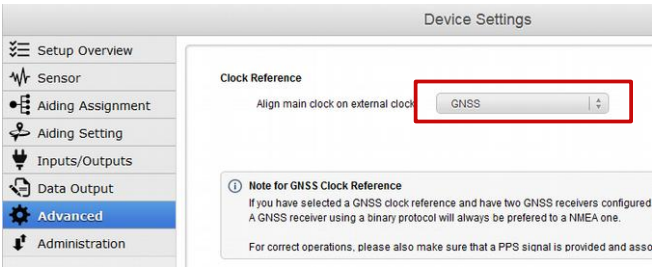
1. GPS model should be set to **Trimble**.
2. GPS lever arm is measured within 5 cm **FROM** the IMU, **TO** the antenna.
3. In case of Dual antenna system, offset for the secondary one (providing heading) must also be entered.
4. Finally, each available measurement (position, velocity and true heading if available) should



be configured to be used or not. Typically, leave it to Auto Rejection mode.

Set Clock alignment

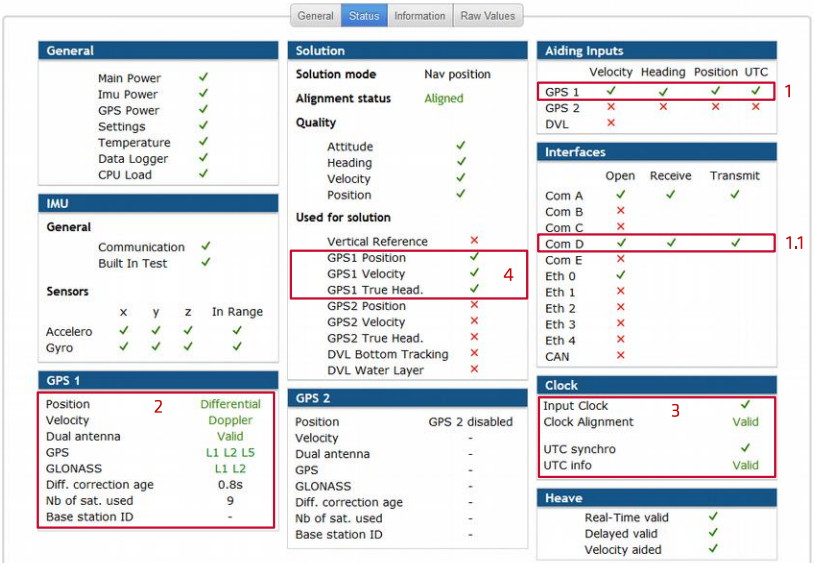
Finally, you should define which Source (GNSS, External Sync, Off) should be used to align the internal clock and provide UTC time data. This is done into the advanced settings section:



Note: If you have two connected GPS receivers, the Sensor doesn't need a PPS signal for the second GPS receiver to accurately time stamp the data.

Step 4: Checking status

Once fully configured, the global status must be checked:



1. GPS 1 or 2 line in "Aiding Inputs" section must show valid data. Check next items otherwise:
   - Check interface configuration (1.1): Corresponding COM port must be opened and Rx flag OK. Baudrate should be the same in the GPS and the SBG unit configuration
   - Check for hardware wiring issues
2. GPS solution is reported in that section. Check if there is a good GPS fix here.
3. Then you can check at the Clock section. Input clock must be OK and UTC time should be set to valid after a few minutes in alignment mode.
4. Once the GPS acquired a solution, the Kalman filter should pass in Full Navigation mode and show active items in the "Used for Solution" field.

Note: The Kalman filter will run into navigation mode once a correct heading could be estimated (requires magnetometers, true heading or some accelerations).

Note 2: Position data should be used in solution in good GNSS environments. In case of RTK fix, the velocity aiding is automatically disabled for optimal performance.