

# Real Time Kinematics DEWESoft® RTK

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SOFTWARE USER MANUAL

RTK V23-1



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## 2. About this document

This is the users manual for the Real Time Kinematics - RTK module.

### 2.1. Legend

The following symbols and formats will be used throughout the document.



#### **Important**

It gives you important information about the subject.  
Please read carefully!



#### **Hint**

It gives you a hint or provides additional information about a subject.



#### **Example**

Gives you an example of a specific subject.


## 3. RTK setup options

There are several different RTK-GNSS options, which are supported in Dewesoft. RTK can be established either with:

- **Internal RTK-GNSS receiver:**
  - Any Dewesoft GNSS and DS-IMU2 device can be upgraded with an RTK **license** which provides accuracy up to 1 cm.

Device		Rover	Base station
DS-VGPS-HS		YES	YES
DS-VGPS-HSC		YES	NO
Embedded S-BOX receiver		YES	YES
DS-IMU2		YES	NO

- Navion i2 and DS-IMU1 (from hardware versions 7.0) already come with the RTK **license by default**. The RTK on DS-IMU1 is a single frequency *L1 RTK*.

Device	Rover	Base station
DS-IMU1 	YES	NO
Navion i2 	YES	NO

- and GNSS/INS platforms (Genesys, OxtS).

For additional information about devices, check the [technical specifications](#) on our website.



### Important

DS-IMU1 needs DS-IMU2 cable to power the RTK module!

## 3.1. Features

- **RTK license upgrade** - any Dewesoft 100 Hz GNSS and DS-IMU device can be upgraded with RTK.
- Dewesoft provides **all hardware accessories** needed for the RTK upgrade - base station, antennas and 3G and RF modems for data transmission between car and base station.
- Internal RTK-GNSS receiver achieves up to **1 cm horizontal** and **2 cm vertical accuracy**.
- Portable and rugged instruments.
- **Expandable** with SIRIUS slices or DEWE-43.
- **Easy-to-install.**
- **Easy-to-use.**
- **Many additional synchronized data sources** like video, CAN, FlexRay, XCP, OBDII, multi sensor inputs, advanced counter inputs.
- RTK technique can also be **used for accurate relative positions** with the use of a **movable base station**. The absolute accuracy of this system is as good as is the solution of the moving base station. However centimeter accuracy between the base station and the rover is achievable. Movable base techniques are used in **ADAS (Advanced Drivers Assistance) tests** where relative position between two vehicles has to be measured.



*Image 1: Moving RTK Base station in correlation with RTK Rover for ADAS testing.*



*Image 2: Moving RTK base in correlation with RTK rover on waterborne vessels.*



## 3.2. Requirements

Due to the nature and accuracy of RTK solution there are certain requirements that have to be met to acquire and maintain the RTK fix solution:

- **RTK license** installed on used devices (for up to 1 cm accuracy)
- only satellites that are visible to both the base station and the rover can be used in RTK calculation, RTK receivers normally require **at least 5 common satellites**,
- the **best accuracy** is met with **clear sky environment** and in a **good weather conditions** - signal obstructions that cause multipath or cause loss of satellite visibility can cause a loss of RTK fix and partial or even full recalculation of cycle ambiguity,
- RTK solution is valid only in **the range of 15-20 km around the base station**, this **can be increased to the maximum of 80 km** with the use of a network of RTK base stations **NRTK**.

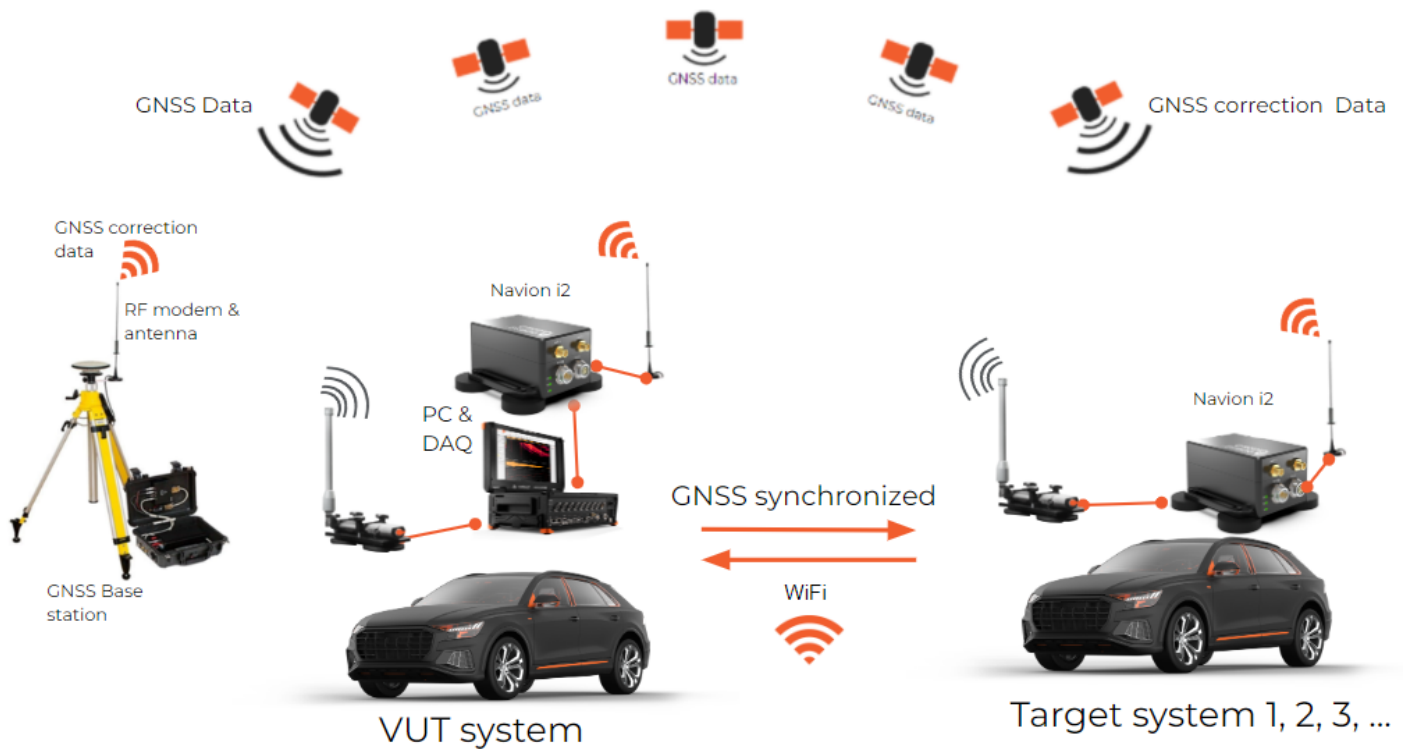


Image 3: Example of a fixed base station system setup



## 4. Scope of supply

### 4.1. Base station

DEWESoft directly provides a complete base station based on a **DS-VGPS-HS device**. As a base station device can also be used **S-BOX with embedded 100 Hz Topcon receiver**. Both mentioned devices need to be upgraded with an **RTK license** to provide accuracy up to 1 cm.

#### 4.1.1. Other informations

Base station has autonomous operation and its configuration and monitoring is resolved via Bluetooth.



Base station example
GNSS-RTK receiver (DS-VGPS-HS or S-BOX)
Battery pack
RF Modem
RF Antenna
RF Antenna cable
GNSS Antenna
GNSS Antenna cable
RS232-USB converter
Power supply connector for RF Modem and device (DS-VGPS-HS or S-BOX)
In case built GNSS and RF connector
Mounting bracket for RF Antenna
Mounting bracket for GNSS Antenna



## 4.2. Rover with internal GNSS

Dewesoft provides different options that can be used as a **rover devices**:

- DS-VGPS-HSC,
- embedded 100 Hz S-BOX receiver,
- Navion i2
- DS-IMU1,
- DS-IMU2,
- DS-VGPS-HS (only as a *standalone* rover - see [4.2.1. Synchronization](#)).

### 4.2.1. Synchronization

- **Navion i2, DS-IMU1, DS-IMU2** and **DS-VGPS-HSC** have an option of synchronizing the measurement data with any other connected Dewesoft hardware (e.g.: SIRIUS, ...).
- **DS-VGPS-HS** has no sync output, therefore it cannot be directly synchronized with any other device. If it is used as a rover, it has to be used as a *standalone* device, where it sends a *PPS signal to the PC*.

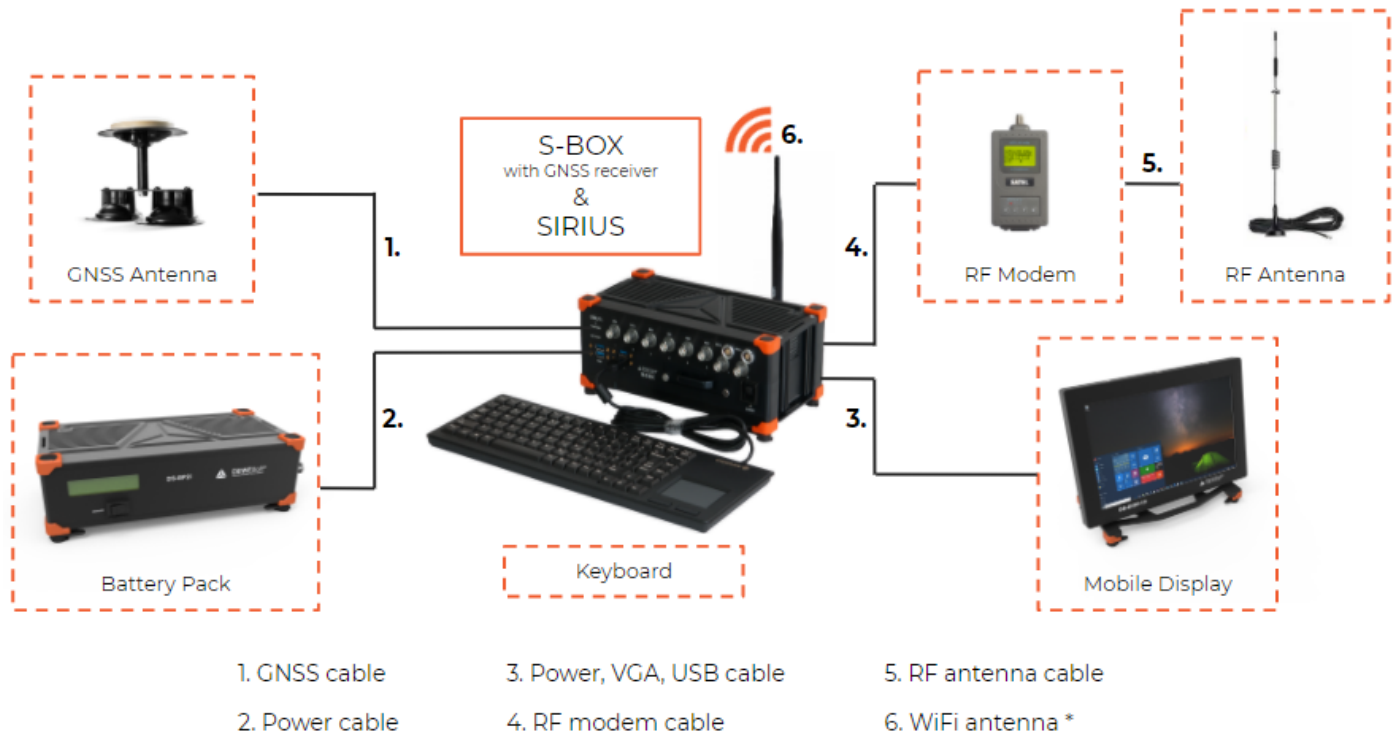


#### Important

Usually a computer device is used to collect measured data from the rover. As a computer you can use either your laptop or a S-BOX with an additional display.

The table below shows the minimal needed equipment for the Rover, where the system can be extended with various options. Systems in general differ from one to another according to different setups, so for the exact configuration please contact your *regional sales representative*.

Minimal needed equipment for the Rover with internal GNSS in S-BOX
S-BOX receiver with embedded 100 Hz Topcon receiver with RTK license
OPT: Battery pack or cigarette lighter plug cable for S-BOX
GNSS Antenna and vehicle mount
GNSS Antenna cable
RF Antenna
RF Antenna cable
WiFi Antenna (OPT: WiFi 3 modem for longer range)
OPT: Mobile display and suction cup



\* optionally - for wider range choose WiFi modems

Image 4: Example of possible equipment combination and setup for RTK Rover with S-BOX and SIRIUS

### 4.3. Power supply options

Both the base station and rovers need to be powered by a power supply. DEWESoft provides various power supply options such as:

- **Battery Pack 2i or 4i** (BP2i, BP4i),
- **Cigarette lighter plug cable.**

BP2i/BP4i is the most frequently used power supply device. It is used in case you want to remain your measurement running after a vehicle is already shutted down. If you do not need such measurement data, you can simply use cigarette lighter plug cable.

### 4.5. System expandability

You can expand your measurement system by adding DEWESoft DAQ devices and have completely synchronized measured data between them. For example if you need to have the data from video, CAN, FlexRay, XCP, OBDII, multi sensor inputs, advanced counter inputs.

Most frequently used devices in RTK applications are:

- **SIRIUS** and
- **DEWE-43.**

## Connections and configurations

### 5. BASE STATION

#### 5.1. Fixed RTK Base station

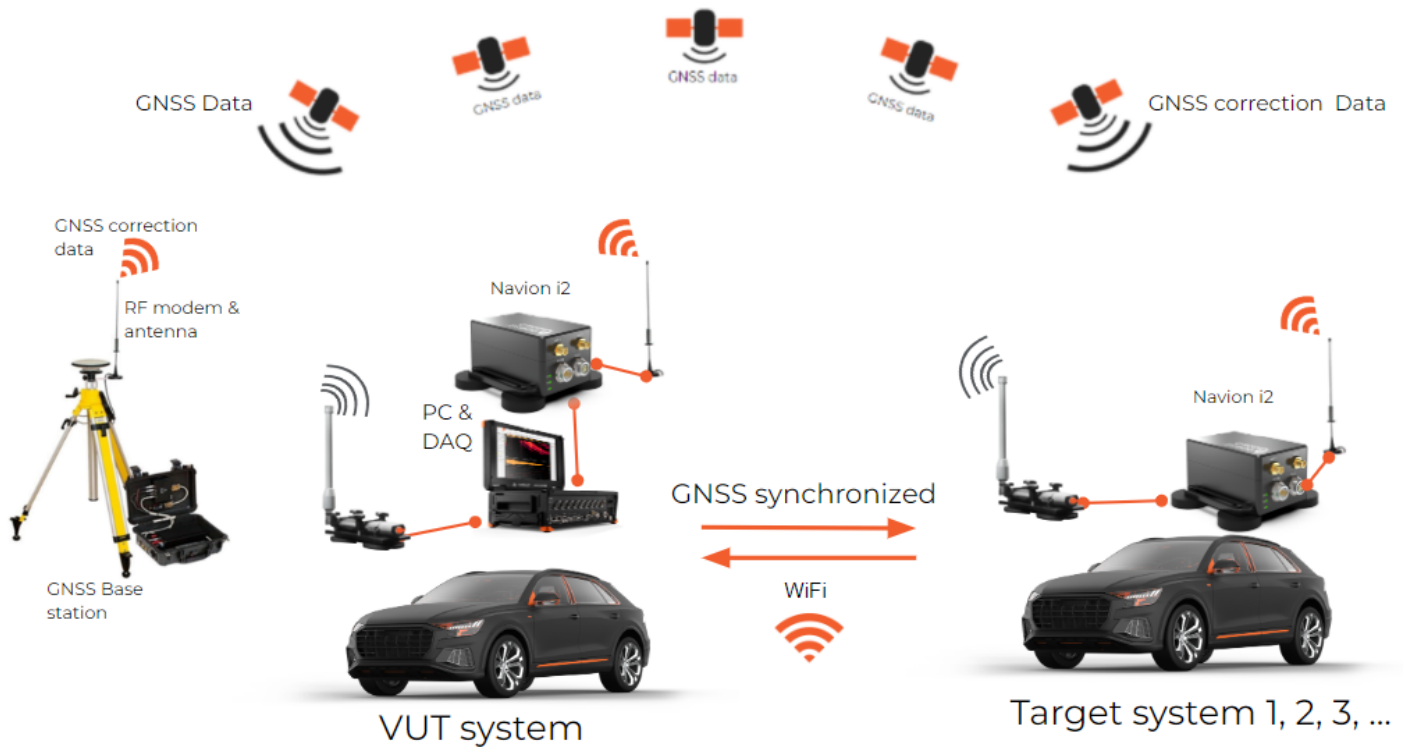


Image 5: Example of a system with a Fixed Base station

##### 5.1.1. Connection

1. When you receive the base station, you have to unpack the RF and the GNSS antenna and also the cables and mounting brackets for both antennas.
2. Now assemble the RF antenna and screw the GNSS mounting bracket into the GNSS antenna. Place both antennas to a position where they can have **a clear view of the sky** without any obstructions nearby.



##### Important

A small hole which is on the black plastic, has to be turned to the ground.

3. Plug the **RF antenna cable** on one side to the RF antenna and on the other side to the correct in-case connector, which connects the RF antenna with the RF modem.

4. Then follow the same procedure for connecting GNSS antenna and DS-VGPS-HS with **GNSS antenna cable**. If the RF or GNSS antenna cables are too short, it is possible to extend the line with **extended Antenna cables**.
5. Plug **power supply cable** for RF Modem and DS-VGPS-HS to the **Battery pack**
6. Connect the **Base station to the PC**:
  - a. **With a cable:**  
**RS232-USB converter** and RS232 cable extender connect to the **DS-VGPS-HS** and the other end into the **USB port of a laptop or SBOX**
  - b. **Over bluetooth connection:**  
with the supplied Parani-SD1000 modems. The modems come pre-configured with automatic connection each time the system is powered on. *First modem* should be connected to the **DS-VGPS-HS** and the *second modem* should be connected directly to the **PC** with **RS232-USB converter**.

In case of *losing a connection*, the bluetooth modems should be **reconfigured**. To reconfigure the bluetooth modems, follow chapter [8.1. Reconfiguring the PARANI Bluetooth modems](#).

#### 5.1.2.2. Set the SATEL modems

Go to chapter [7. SATEL RF modem configuration for different RTK options](#) and set the SATEL RF modem.

#### 5.1.2.3. Topcon Receiver Firmware and RTK Options check

Check the Base station VGPS with **Topcon Receiver Utility**.

1. *Connect the device* to your **PC**, and check in the **Device manager** on which *COM port* the device is connected to.
2. Open *Topcon Receiver Utility* -> Click on **Device** -> Choose **Connect**.

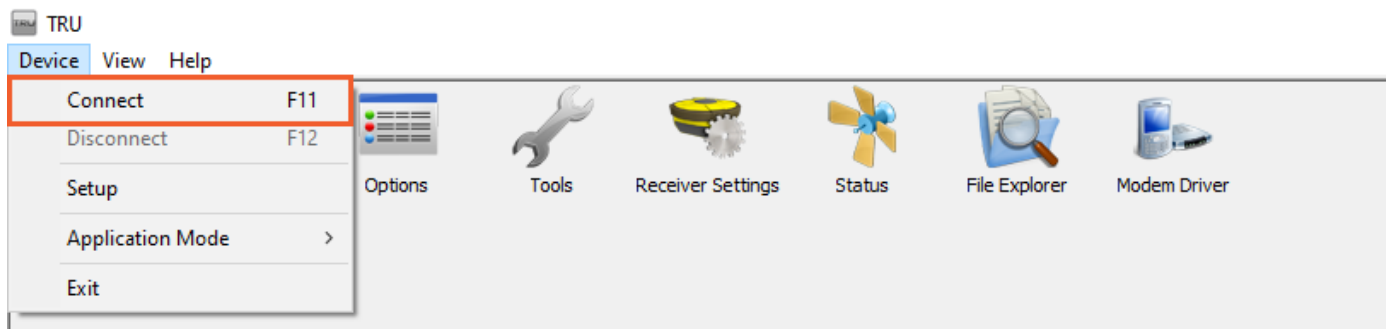


Image 6: Connect to the VGPS in Topcon Receiver Utility application

3. Select **Serial Port**, elect the proper serial COM port and click **Connect**.

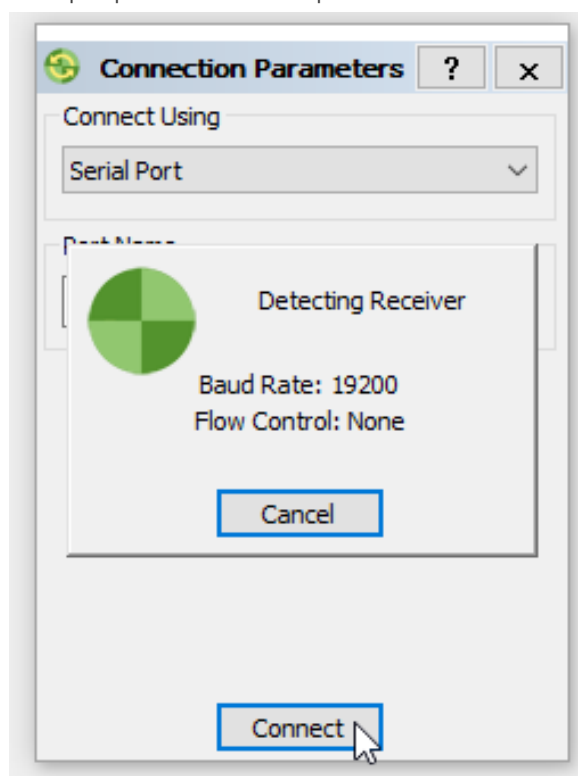


Image 7: Select Serial Port connection and click Connect button

4. Go to the **Information** tab and check if the latest Firmware version is on the device. It should be: **4.7Feb, 21,2019 p10**

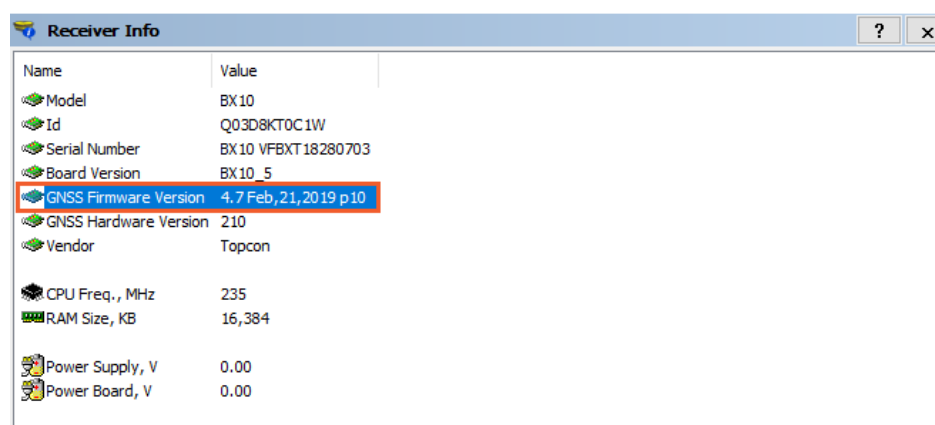


Image 8: Open Information icon and check the GNSS Firmware Version

- a. If the Firmware is outdated, you have to update it accordingly to the *Board* type you have in your device:

Board	Recommended Firmware
GMSX	<a href="#">4.7.p10</a>
BX10	<a href="#">4.8</a>

You can find the instruction manual on how to upgrade the firmware [here](#) and needed software for doing the upgrade [here](#). Dewesoft *should be closed* during the update process.

For upgrading the firmware on DS-VGPS-HSC, a cable to connect RS232 via the display port is needed. For this the device can be sent back to us for a free firmware upgrade.

- Go to **Options** now, and check if everything is set correctly. For **RTK option** everything should be set like on the following images (look at the Current column):

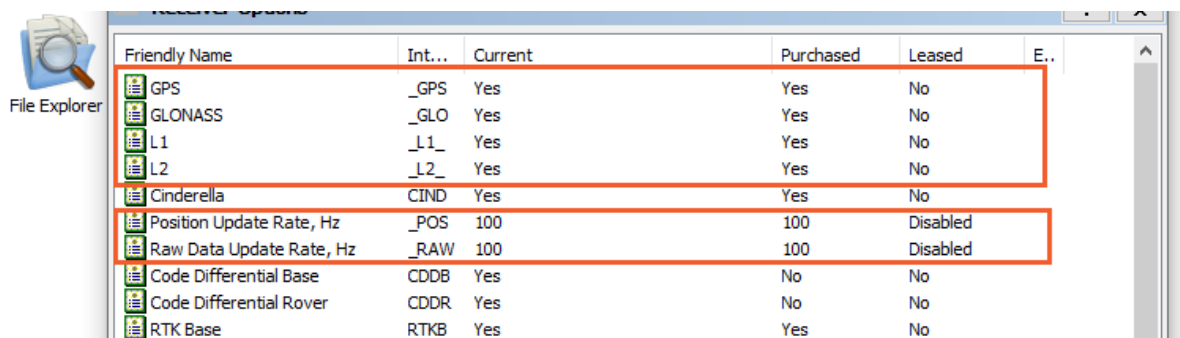


Image 9: Check the GPS, GLONASS, L1, L2, Position update rate, and Raw data update rate

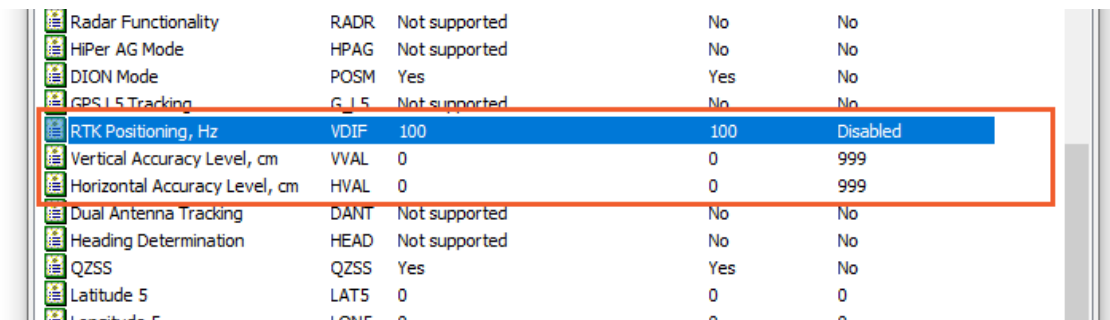



Image 10: Check RTK Positioning, Vertical Accuracy level, and Horizontal Accuracy level

If the settings differ from the listed one, please contact the Dewesoft support team on [support@dewesoft.com](mailto:support@dewesoft.com).



### 5.1.3. Configuration

After connecting all hardware together, **run Dewesoft X software** to make proper configuration for the GNSS receiver.

1. Configuration can be done in: **Options -> Settings -> Devices**
2. In Devices tab under Settings click on  button to **add a new GNSS device**.
3. Then select the Dewesoft **RS232** device and add it to your Devices window.

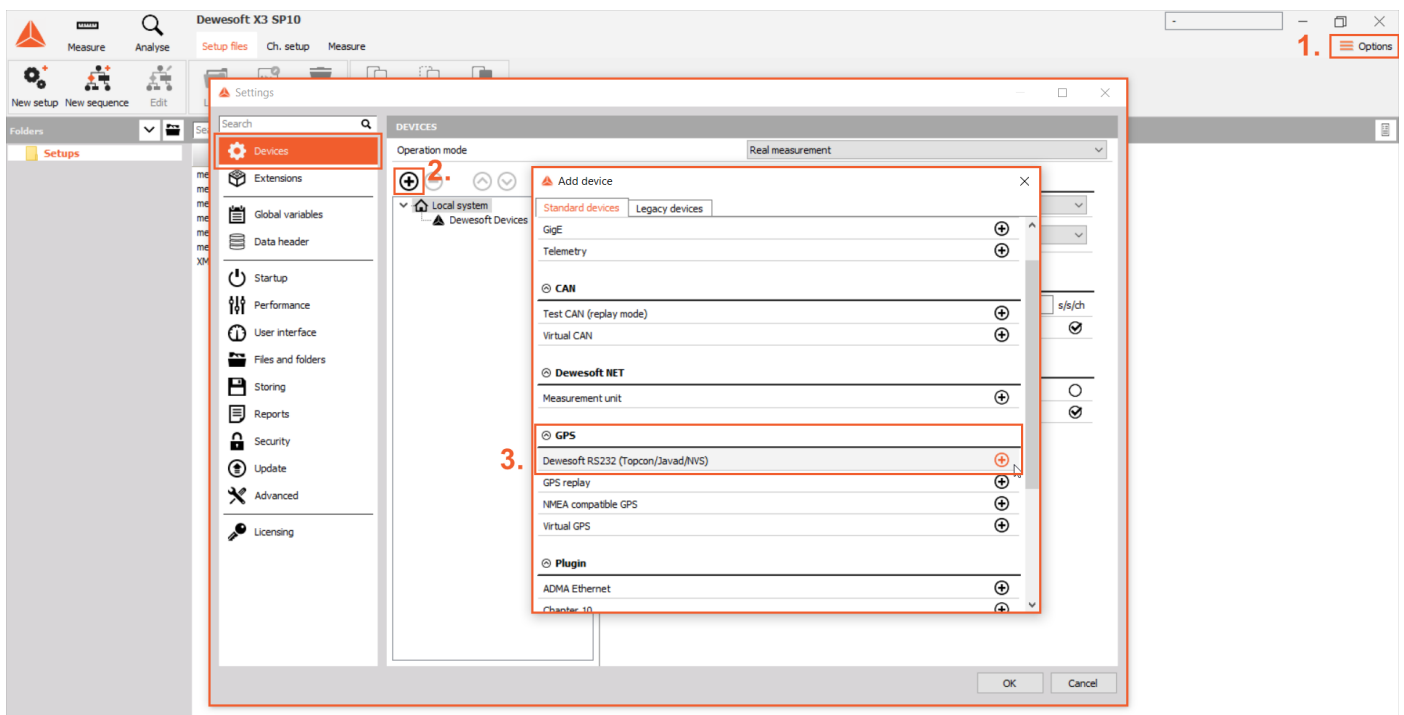



Image 11: Select Dewesoft RS232 Device

4. After adding a new device, select its **COM port** on which you have your RS232-USB converter connected.
5. Now click the **Refresh icon**  and all the data and parameters from GNSS will be read and updated automatically.

6. It is time to **Reset receiver** to make sure that later there will not be any issues getting GNSS fix.

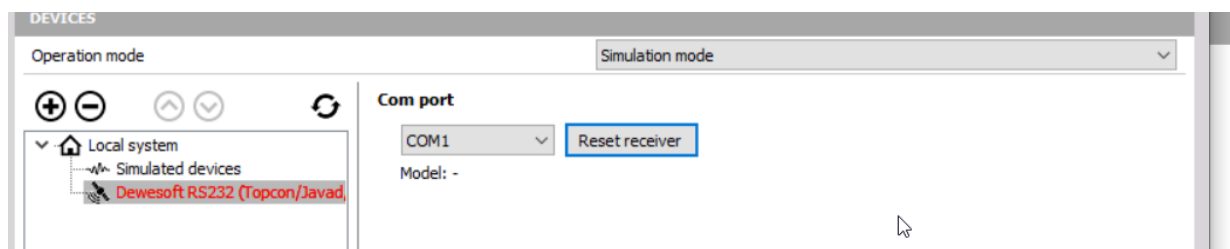


Image 12: Reset the receiver

7. Set **Antenna** as **Ext.** and configure the **Update rate** of the base station to a desired value (default is 100 Hz) and set the **Receiver mode** to **RTK Base station**.

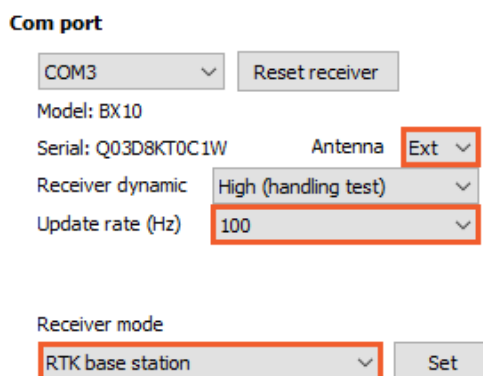


Image 13: Settings for a Base station

8. Set **baud rate** at **38400** and press the '**Set**' button.

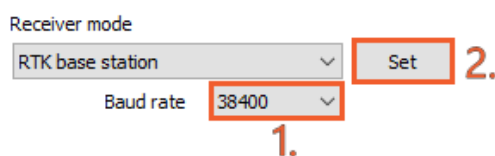


Image 14: Select the Baud rate and confirm with Set button

9. By choosing RTK base station the additional area with **Base station position** appears.

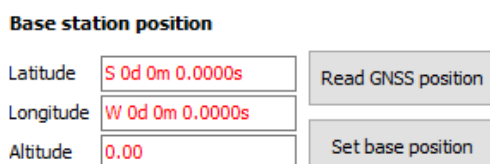


Image 15: Base station position area

10. The images below show parameters where you have to **'Read GNSS position'** and then confirm with **'Set base position'**. By doing this you are *changing the coordinates* of the Base station to the *current position*.

We suggest that you *wait for a minute or two*, so the receiver has some time to find enough satellites (ideally above 10) for better accuracy of coordinates. You can check the number of satellites in the GPS module. Coordinates on images 18 and 19 are marked *red*, because they are not set yet.

- Now start clicking on the **'Read GNSS position'** button, until the *Altitude value* becomes *more or less still*. You will see a blue text above the button, which says how many satellites were used to get a position.
- After successfully reading the coordinates (~ more or less still Altitude value) click on **Set Base position**.

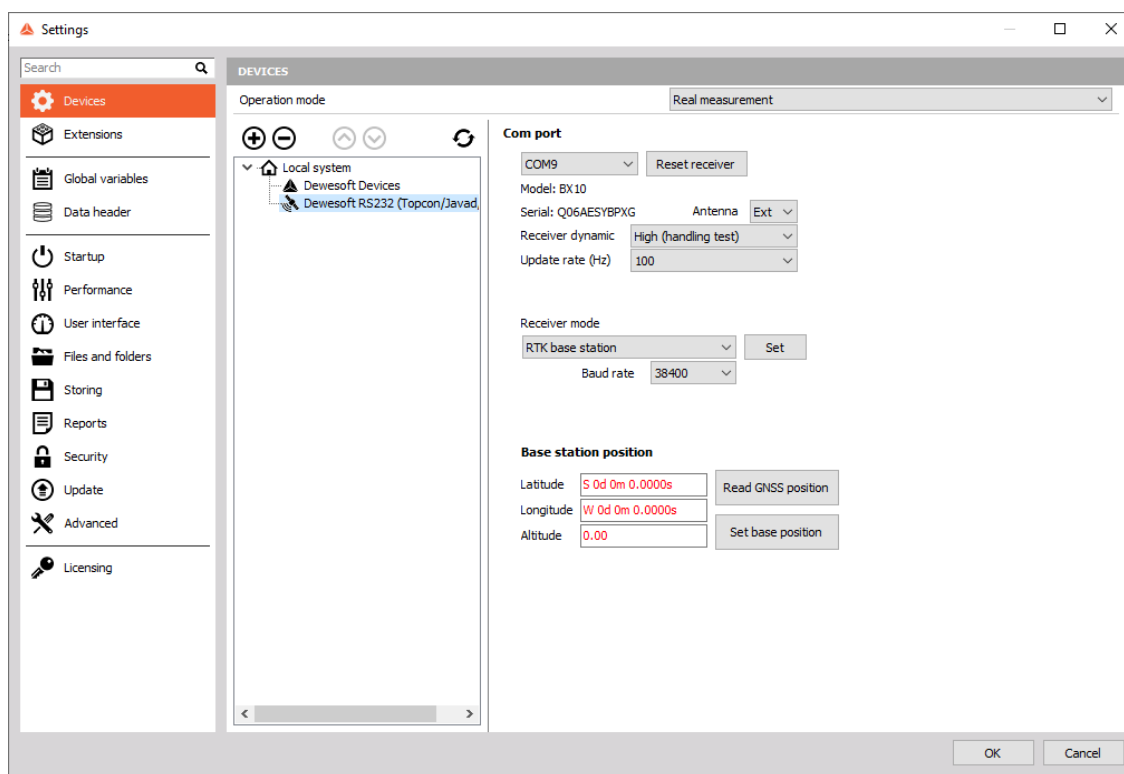


Image 16: Red values of the Latitude, Longitude and Altitude mean not set coordinates

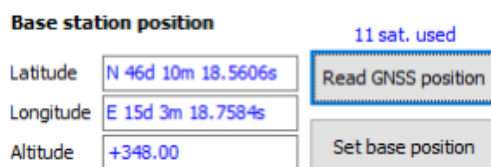


Image 17: Click on **Read GNSS position** button until the Altitude value is **more or less still**

**Base station position**

Latitude	N 46d 10m 18.6054s	Read GNSS position
Longitude	E 15d 3m 18.7527s	
Altitude	+349.60	Set base position

Image 18: When Altitude value is almost still, confirm position with click on the Set base position button

- After configuring the base station you can **disconnect** the RS232-USB converter and close the case.

## 5.2. Moving RTK Base Station

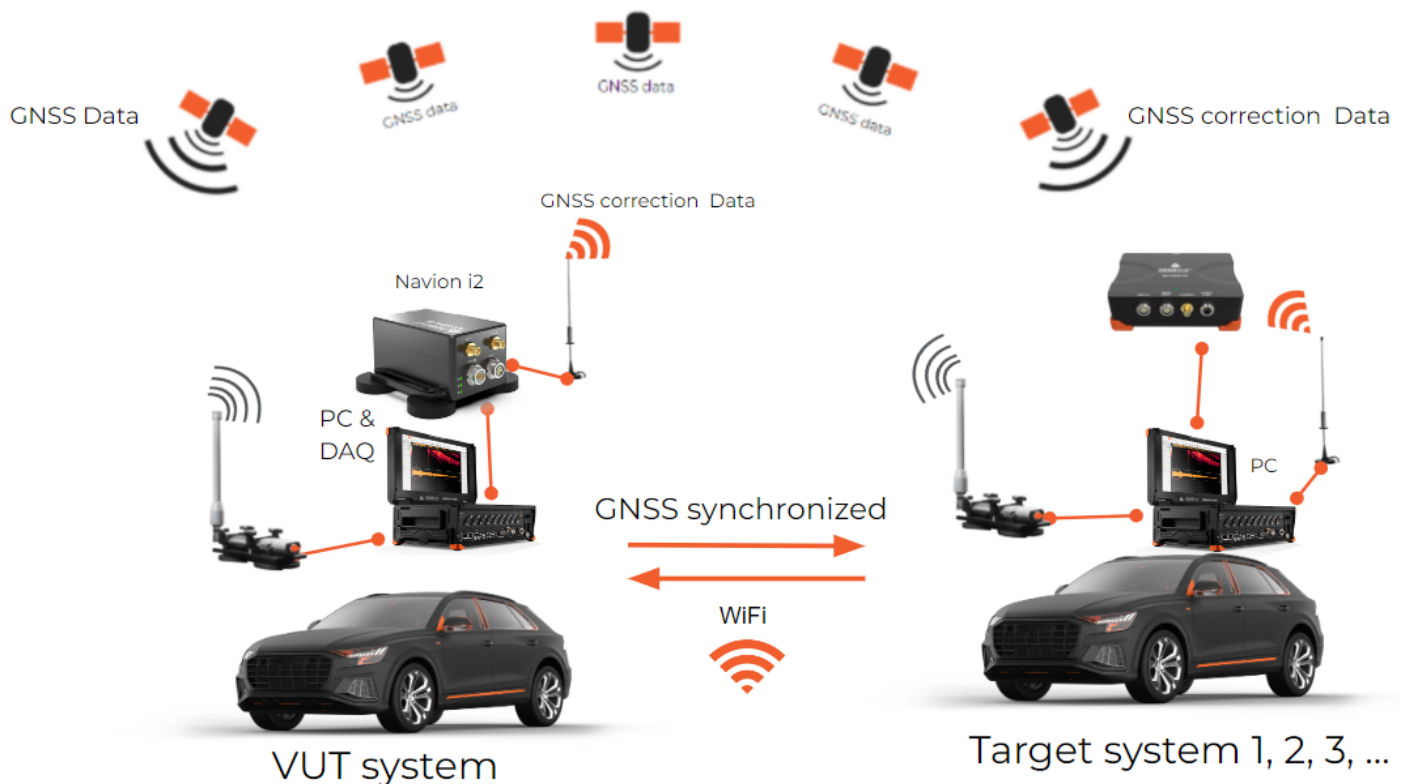


Image 19: Example of a system with Moving base station

### 5.2.1. Additional devices Setup

#### 5.2.1.1. Topcon Receiver Firmware and RTK Options check

Check the Moving station's VGPS with **Topcon Receiver Utility**.

1. Connect the device to your **PC**, and check in the **Device manager** on which **COM port** the device is connected to.
2. Open *Topcon Receiver Utility* -> Click on **Device** -> Choose **Connect**.

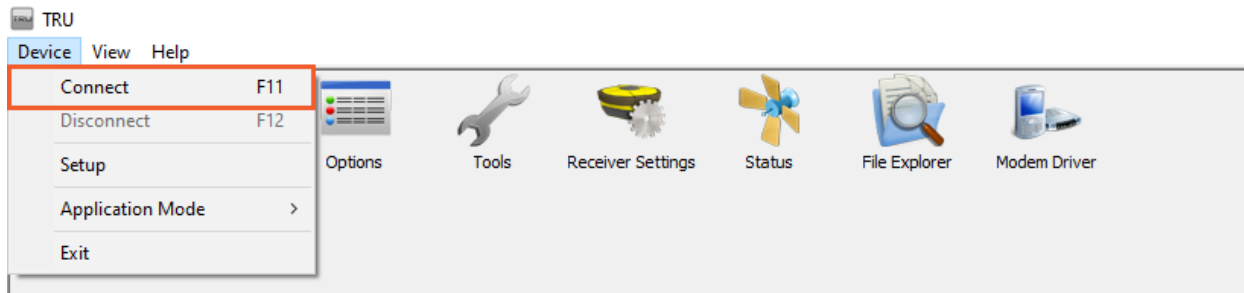


Image 20: Connect to the VGPS in Topcon Receiver Utility application

3. Select **Serial Port**, select the proper serial COM port and click **Connect**.

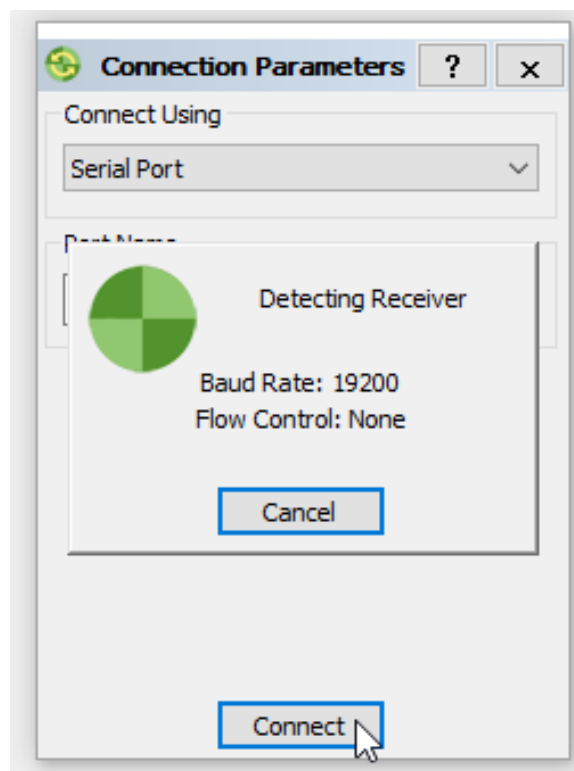


Image 21: Select Serial Port connection and click Connect button

4. Go to the **Information** tab and check if the latest Firmware version is on the device.  
It should be: **4.7Feb, 21,2019 p10**

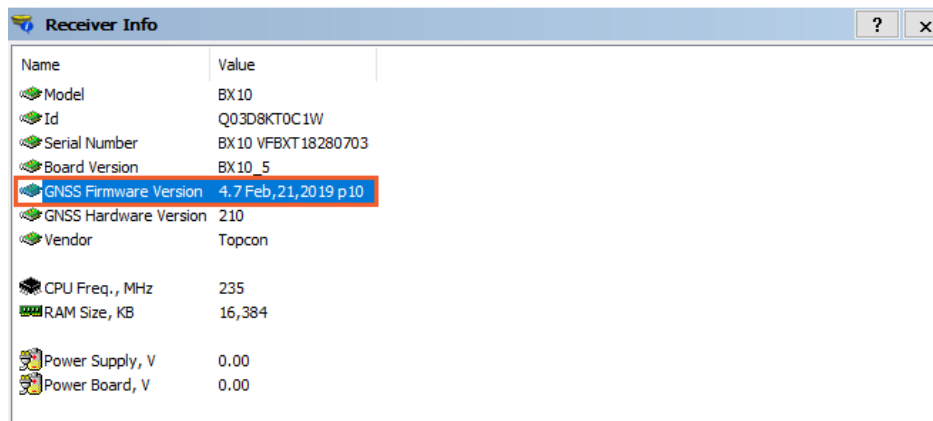


Image 22: Open Information icon and check the GNSS Firmware Version

- a. If the Firmware is outdated, you have to update it accordingly to the *Board* type you have in your device:

Board	Recommended Firmware
GMSX	<a href="#">4.7.p10</a>
BX10	<a href="#">4.7.p10</a>

You can find the instruction manual on how to upgrade the firmware [here](#) and needed software for doing the upgrade [here](#). Dewesoft *should be closed* during the update process.

For upgrading the firmware on DS-VGPS-HSC, a cable to connect RS232 via the display port is needed. For this the device can be sent back to us for a free firmware upgrade.

5. Go to **Options** now, and check if everything is set correctly. For **RTK option** everything should be set like on the following images (look at the Current column):

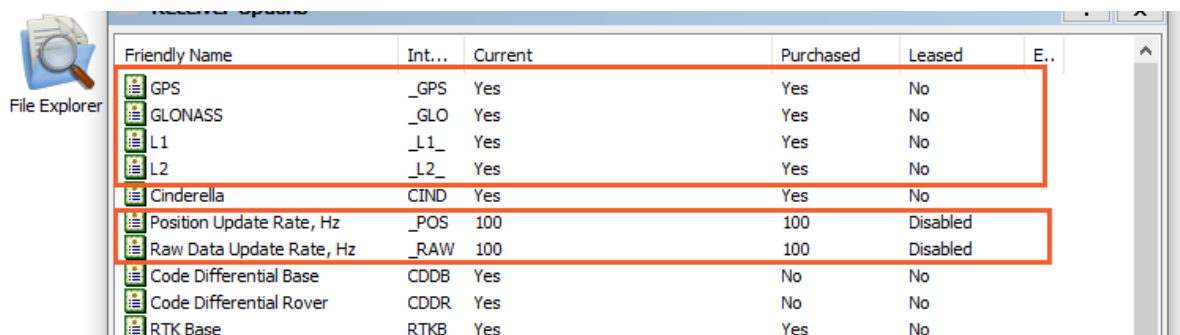
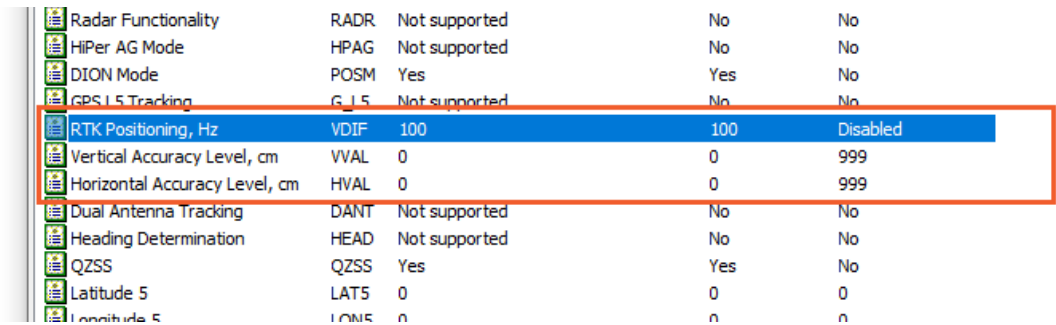


Image 23: Check the GPS, GLONASS, L1, L2, Position update rate, and Raw data update rate



Radar Functionality	RADR	Not supported	No	No
HiPer AG Mode	HPAG	Not supported	No	No
DION Mode	POSM	Yes	Yes	No
GPS L5 Tracking	G_L5	Not supported	No	No
RTK Positioning, Hz	VDIF	100	100	Disabled
Vertical Accuracy Level, cm	VVAL	0	0	999
Horizontal Accuracy Level, cm	HVAL	0	0	999
Dual Antenna Tracking	DANT	Not supported	No	No
Heading Determination	HEAD	Not supported	No	No
QZSS	QZSS	Yes	Yes	No
Latitude 5	LAT5	0	0	0
Longitude 5	LONG5	0	0	0

Image 24: Check RTK Positioning, Vertical Accuracy level, and Horizontal Accuracy level


If the settings differ from the listed one, *contact an Automotive Application Engineer*.

### 5.2.1.2. Set the SATEL modems

Go to chapter **7. SATEL RF modem configuration for different RTK options** and **set the SATEL RF modem**.

## 5.2.2. Configuration

Configure the moving Base station in DEWESoftX software.

1. Start *DEWESoftX* and choose: **Options -> Settings -> Devices**
2. In Devices tab under Settings click on  button to **add a new GNSS device**.
3. Then select the Dewesoft **RS232** device and add it to the Devices window.

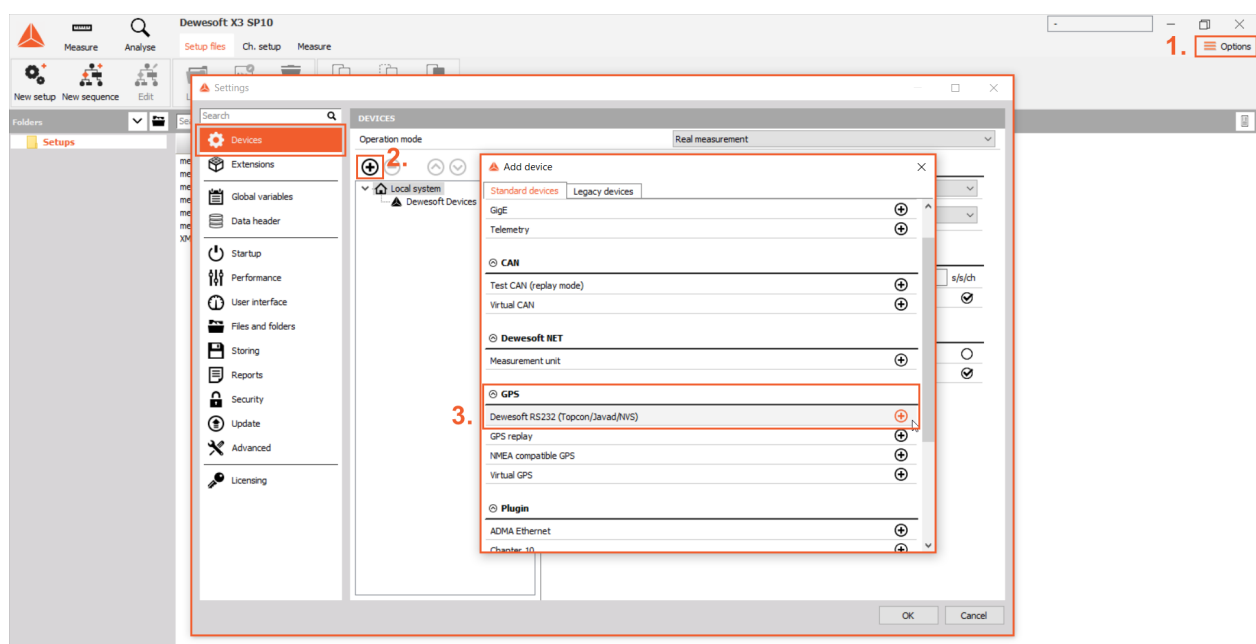


Image 25: Add Dewesoft RS232



4. The next step is to check on which **COM port** is the GNSS Receiver. This can be checked in the **Device Manager**. If it's internally connected to the S-BOX it is always COM3.
5. Now select the same COM port also in **DEWESoftX** for the Moving Base station device.

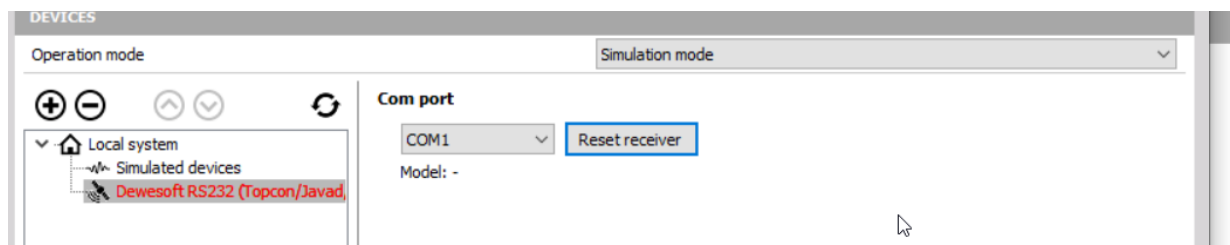



Image 26: Select the proper Com port

6. Click **Reset receiver**, and then again select Com port and connect to the device.
7. Now click the **Refresh icon**  and all the data and parameters from GNSS will be read and updated automatically.
8. Set *Antenna* as **Ext.** and configure the **Update rate** to desired value (Default value is 100Hz).

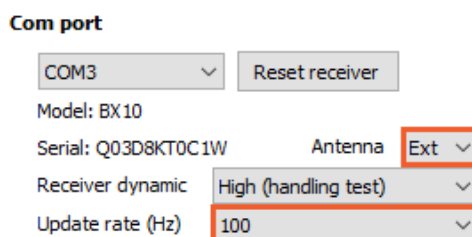


Image 27: Settings for a Base station

9. Below set the **Receiver mode** to **RTK Moving base station** (if the baud rate window appears, write in 38400, if not do not worry about it).
10. Press the **Set** button to confirm the changes which you have made.

## 6. ROVER

### 6.1. DS-VGPS-HS, DS-VGPS-HSC, or S-BOX

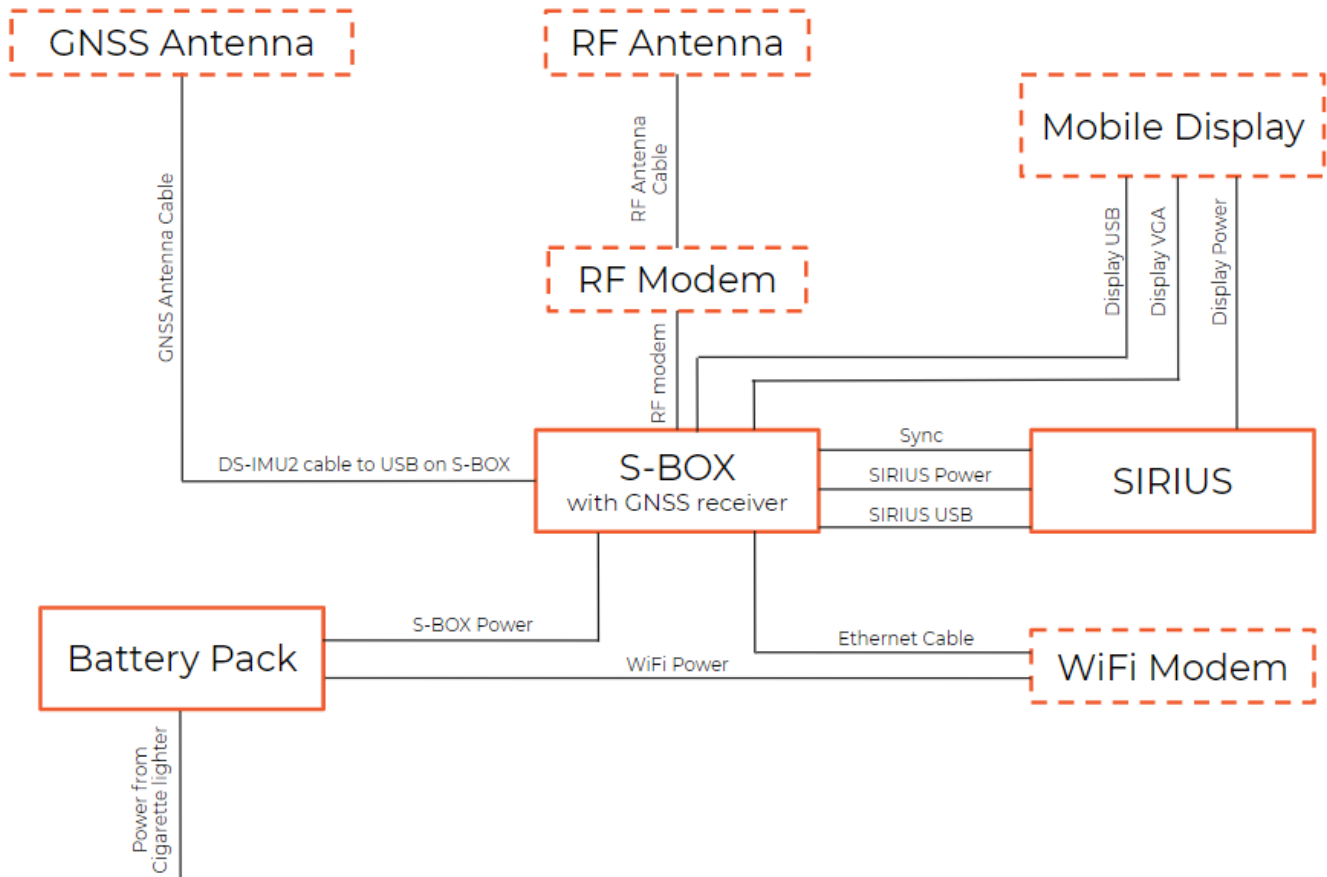


Image 28: Configuration scheme of the Rover - S-BOX with GNSS receiver configuration



#### Important

**Do not power WiFi modem** without antenna connected.

#### 6.1.1. Connection

1. When you receive the rover, you have to unpack all the instruments and the cables. Each of them is marked with a correct name. To simply connect everything together you can follow the schematic above.
2. After unpacking, put the RF antenna, WLAN and GNSS antenna (both with suction cups) on top of the vehicle's roof. Then connect the RF antenna **to the RF modem** with the RF Antenna **cable**. For **GNSS** do the same with **GNSS Antenna cable** and **connect it to the S-BOX**.

3. To connect **RF Modem with S-BOX** use **RF Modem cable** and connect it to the GNSS **connector** on the **S-BOX**.
4. For the WiFi connect the **WiFi Antenna cable**, which is mounted to the suction cup, **to WiFi Modem on the MAIN port**. In the next step you have to connect **Ethernet cable from WiFi Modem to S-BOX**.



**Important**

Connect the WiFi antenna **before** applying the power to the WiFi Modem!

5. To connect **SIRIUS slice with S-BOX** use the **SIRIUS USB** and **Power cables**. For the **synchronization** use **SYNC connector**, which is on the **RF Modem cable**, and **connect it to the SIRIUS slice**.
6. On the **Mob Display** connect the **VGA, USB and Power Display cables**. Lead the **VGA and USB cable to the S-BOX** and **Power cable to the SIRIUS slice**.
7. The last step is to **connect S-BOX and WiFi Power cables to the Battery pack 2**. After this, connect the **BP Power cable to the cigarette lighter** in the vehicle.




**Important**

Charge the Battery pack to 100% before using it in the vehicle, otherwise it might burn the fuse in the vehicle.

## 6.1.2. Configuration

### 6.1.2.1. Rover for Fixed RTK Base station

The next step is to configure the Rover in DEWESoft X3 software.

1. After starting DEWESoft you have to configure the GNSS receiver.
2. Configuration can be done in: **Options -> Settings -> Devices**
3. In Devices tab under Settings click on  button to **add a new GNSS device**.
4. Then select **Dewesoft RS232** device and add it to your device's window.

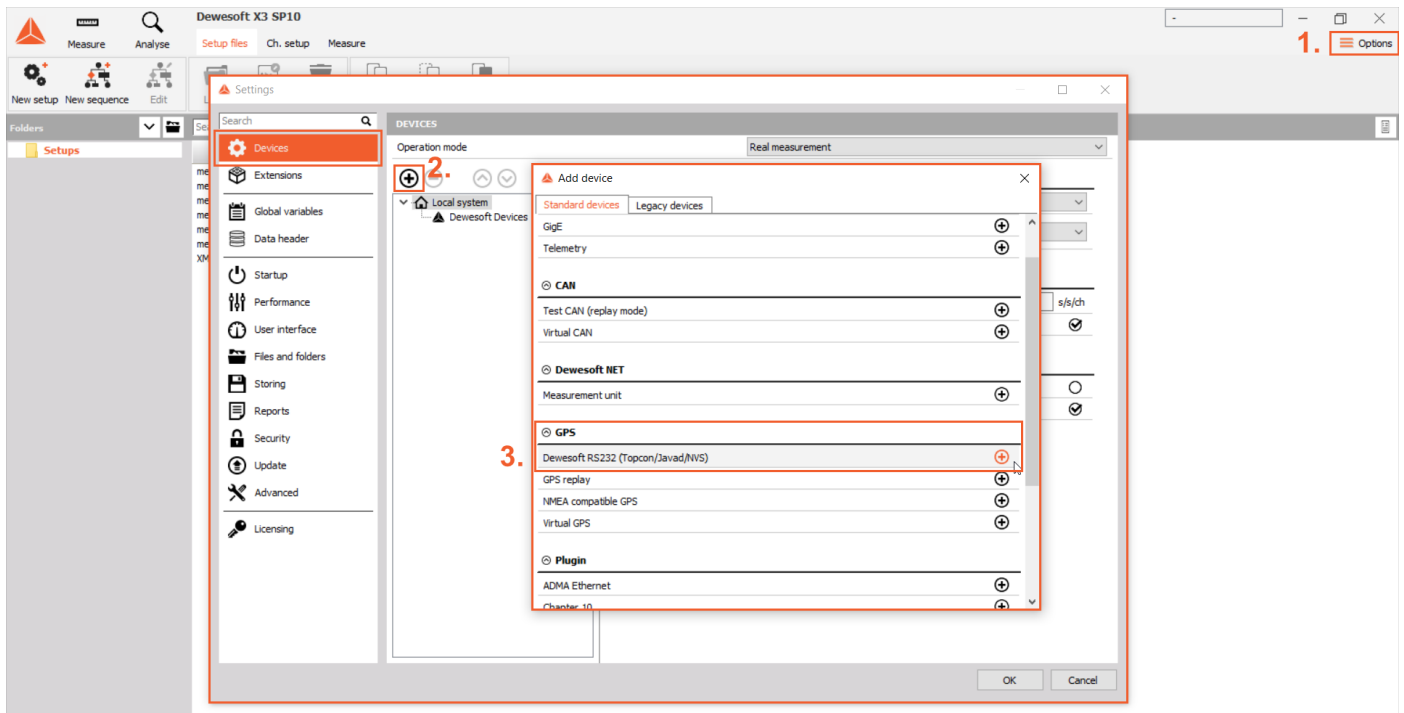


Image 29: Add Dewesoft RS232

5. The next step is to check on which **COM port** is the GNSS Receiver. This can be checked in the **Device Manager**. If it's internally connected to the S-BOX it is always COM3.
6. Now select the same COM port also in **DEWESoftX**.

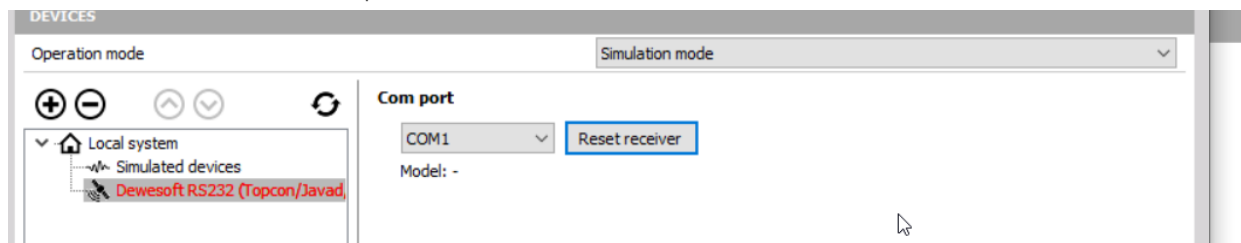


Image 30: Select a proper Com port

7. Click on the **Refresh** button, so all the parameters from GNSS will be shown.
8. Set **Antenna** as **Ext.** and configure the **Update rate** of the rover to a desired value (default value is 100 Hz).

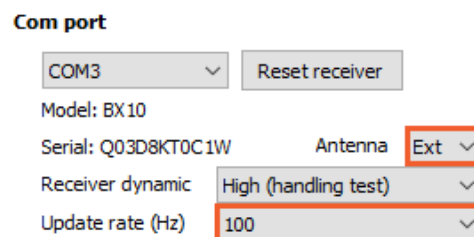



Image 31: Settings for a Base station

9. Set the **Receiver mode** to **RTK Rover**.
10. Press the **Set** button to confirm the changes which you have made.
11. Continue now with the:
  - a. **SATEL RF modem check** chapter, and then follow to the
  - b. **Synchronization for any RTK Base station and any RTK Rover** chapter.

### 6.1.2.2. Rover for RTK Moving Base station

1. Start *DEWESoftX* and choose: **Options -> Settings -> Devices**
2. In Devices tab under Settings click on  button to **add a new GNSS device**.
3. Then select the Dewesoft **RS232** device and add it to the Devices window.

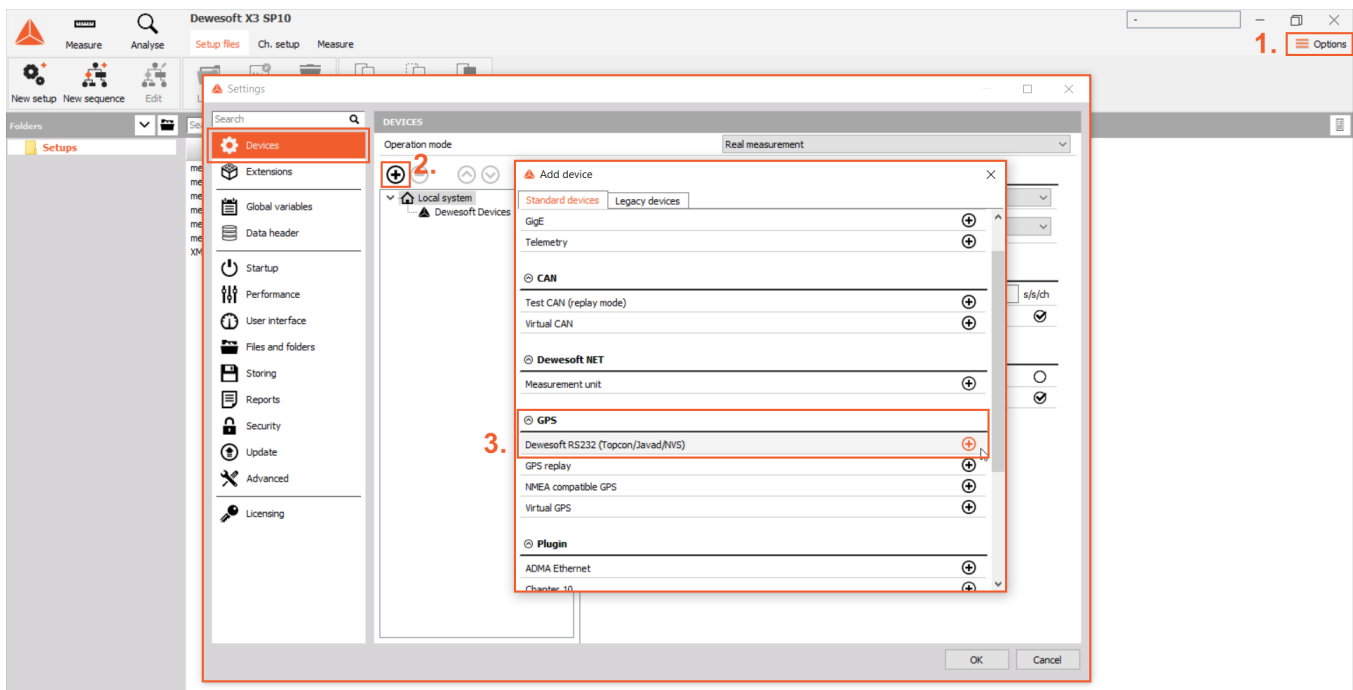


Image 32: Add Dewesoft RS232

4. The next step is to check on which **COM port** is the GNSS Receiver. This can be checked in the **Device Manager**. If it's internally connected to the S-BOX it is always COM3.
5. Now select the same COM port also in **DEWESoftX**.

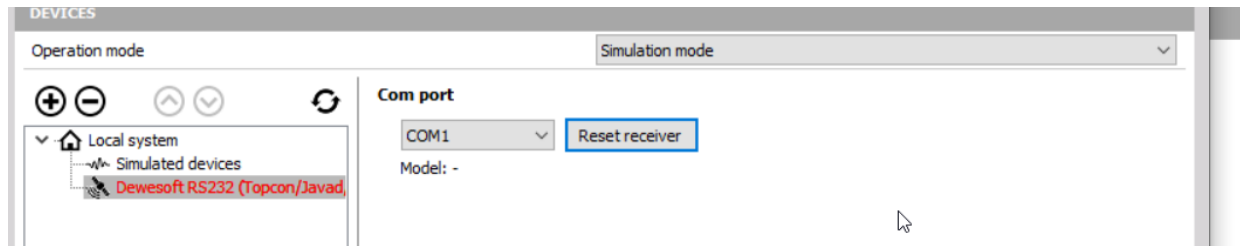



Image 33: Select a proper Com port

6. Now click the **Refresh icon**  and all the data and parameters from GNSS will be read and updated automatically.
7. Set **Antenna** as **Ext.** on both devices and configure the **Update rate** of both devices to a desired value (default is 100 Hz).

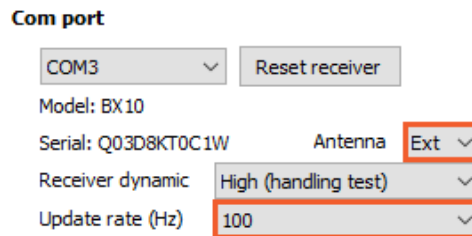


Image 34: Settings for a Base station

8. Set the **Receiver mode** to **RTK Rover (with moving base station)**.
9. Press the **Set** button to confirm the changes which you have made.
10. Continue now with the:
  - a. [SATEL RF modem check](#) chapter, and then follow to the
  - b. [Synchronization for any RTK Base station and any RTK Rover](#) chapter.

### 6.1.3. SATEL RF modem check

1. Check if the RTK is working correctly:
  - a. Check the **SATEL modems**:
    - i. On the *Base station modem* you should see red **Tx light** blinking
    - ii. On the *Rover modem* you should see red **Rx light** blinking
  - b. Go to the **Channel setup** -> select **GPS** module (tab).
  - c. In the status windows you should see **RTK fixed** status, as it is shown in the image below.



Image 35: RTK fixed

2. Continue with the [6.1.4 Synchronization Chapter](#).

### 6.1.4. Synchronization for any RTK Base station and any RTK Rover

1. Go back to **Settings** -> **Devices**
2. In the *Local system* select **External** time source.
3. Select the proper **Clock provider** and set the **Time source** to **GNSS PPS**. See the image below.

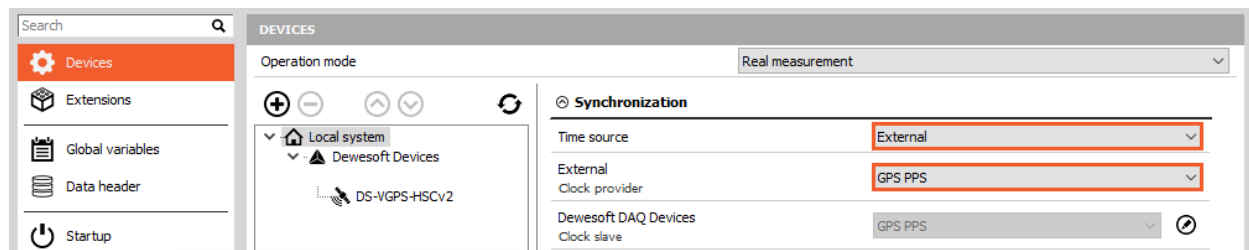


Image 36: Set External time source and select GPS PSS as a Clock provider

Now the data between master and slave measurement units will be synchronized over GNSS PPS.



## 6.2. DS-IMU

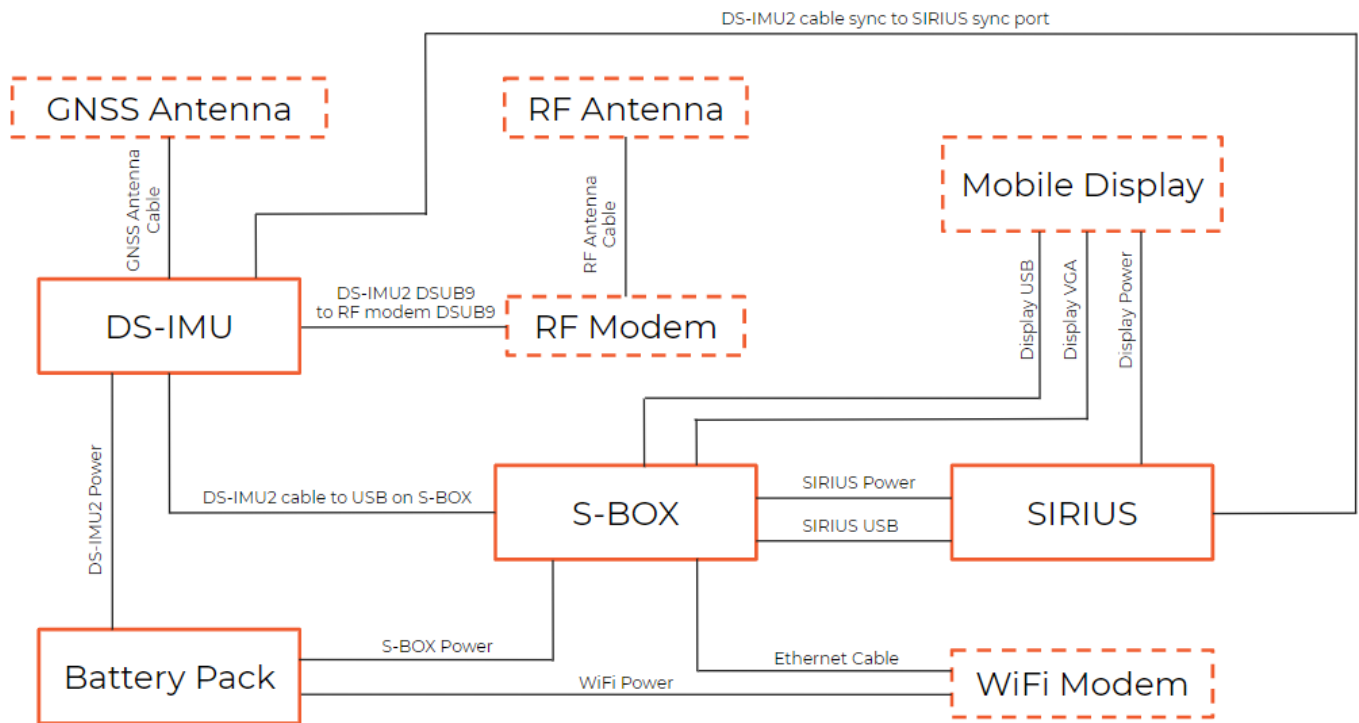


Image 37: Configuration of the Rover with the IMU device



### Important

Do not power WiFi modem without antenna connected!

For setting up the DS-IMU as a rover, **you will need**:

- DS-IMU2
- GNSS antenna
- IMU 2 cable with Power, USB and sync out from adapter. Also on the side of this adapter there is a 9 pin D-SUB connector which is used for RF modem connection. Through this DSUB 9 pin connector RF modem is being powered and at the same time it is used for communication of the correction data between DS-IMU2 and RF modem.

### 6.2.1. Connection

1. When you receive the Rover with a DS-IMU device, unpack all the instruments and the cables. Each of them is marked with a correct name. For easier connection take a look at Image 40, on which is a schematic of all the cables and instruments.
2. After unpacking, place the **DS-IMU2** on the top of the vehicle's roof with suction cups and connect the **GNSS Antenna** with **GNSS Antenna cable** to it. In case you have two antennas, connect and place both of them - one on the front side and one on the rear side

of DS-IMU2. GNSS Antenna has a magnet on the bottom side, so you can just easily pop it on a metal roof

3. Now connect the **DS-IMU2 to S-BOX or SIRIUS** over **DS-IMU2 to RS232** cable, which has on the one side a **LEMO power connector for DS-IMU2** and on the other side it splits from adapter in three connectors you also have to connect:
  - **USB cable** connect to a PC,
  - **LEMO power cable** connect to a **S-BOX or SIRIUS power out** and
  - **Sync** cable (for this take a look at the Synchronization chapter).
4. On the side of the adapter of a **DS-IMU2 to RS232** cable is located a **9 pin D-SUB connector** for the **RF Modem**. Connect the **RF Modem with RF Modem** cable on DS-IMU2 to RS232 adapter.



### Important

DS-IMU2 to RS232 cable is in case of connection to the RF Modem intended for communication between RF Modem and DS-IMU2 and at the same time it is used as a power supply for the RF Modem.

5. Next to the base station receiver Dewesoft RS232 (Topcon) **add** a **DS-IMU** device in **DewesoftX Settings**.
6. In the Local system set the synchronization as it's described in [6.2.2. Synchronization](#) chapter.
7. Then go to the **Channel setup -> DS-IMU** and set the following:

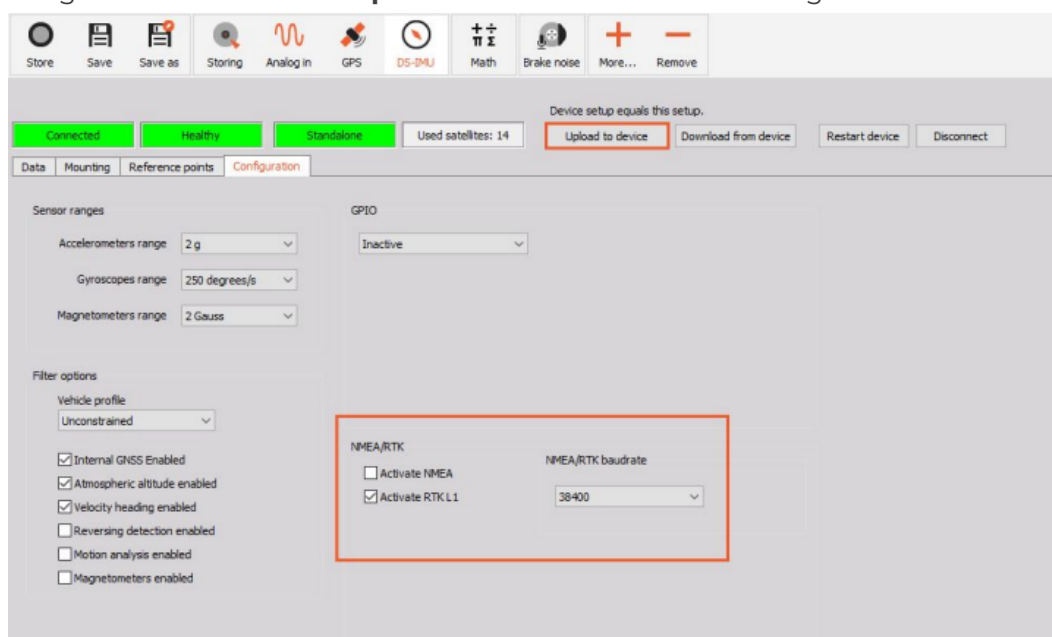


Image 38: : In DS-IMU tab under Configuration enable Activate RTKL1 option and set baud rate on the baud rate that was set on SATEL modems (in the instructions is an example of 38400) -> Then Upload to device.

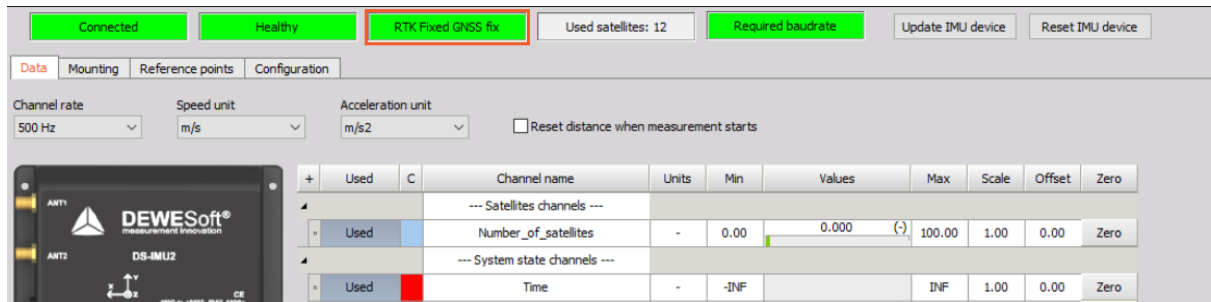


Image 39: When you will get RTK data to the DS-IMU the Standalone status will change to **RTK Fixed GNSS fix**



### Important

Charge the Battery pack to 100% before using it in the vehicle, otherwise it might burn the fuse in the vehicle.

## 6.2.2. Synchronization

DS-IMU is using GPS PPS synchronization. There are two synchronization possible for DS-IMU regarding to the system configuration:

- **DS-IMU and PC only:**
  - Over USB you will get a PPS signal on a computer.
  - Set the IMU device as a clock provider with GPS PPS signal.
- **DS-IMU, PC, some device ex: SIRIUS:**
  - SIRIUS and DS-IMU have to be connected over Sync cable, where the DS-IMU device sends out the IRIG signal to the SIRIUS.
  - Set the **DS-IMU** as a clock provider, where DS-IMU has a '**GPS PPS out**' setting, and SIRIUS has '**GPS PPS in**' setting.

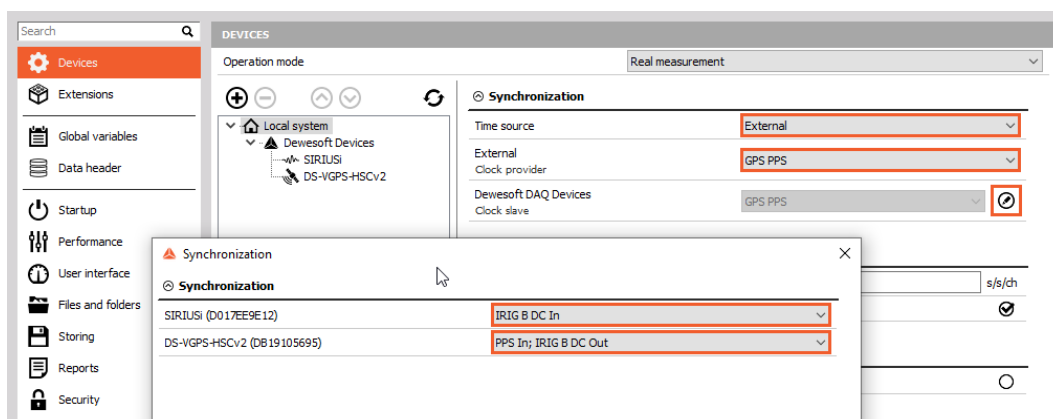


Image 40: Select proper GPS PPS synchronization for each device

## 6.3. Navion i2

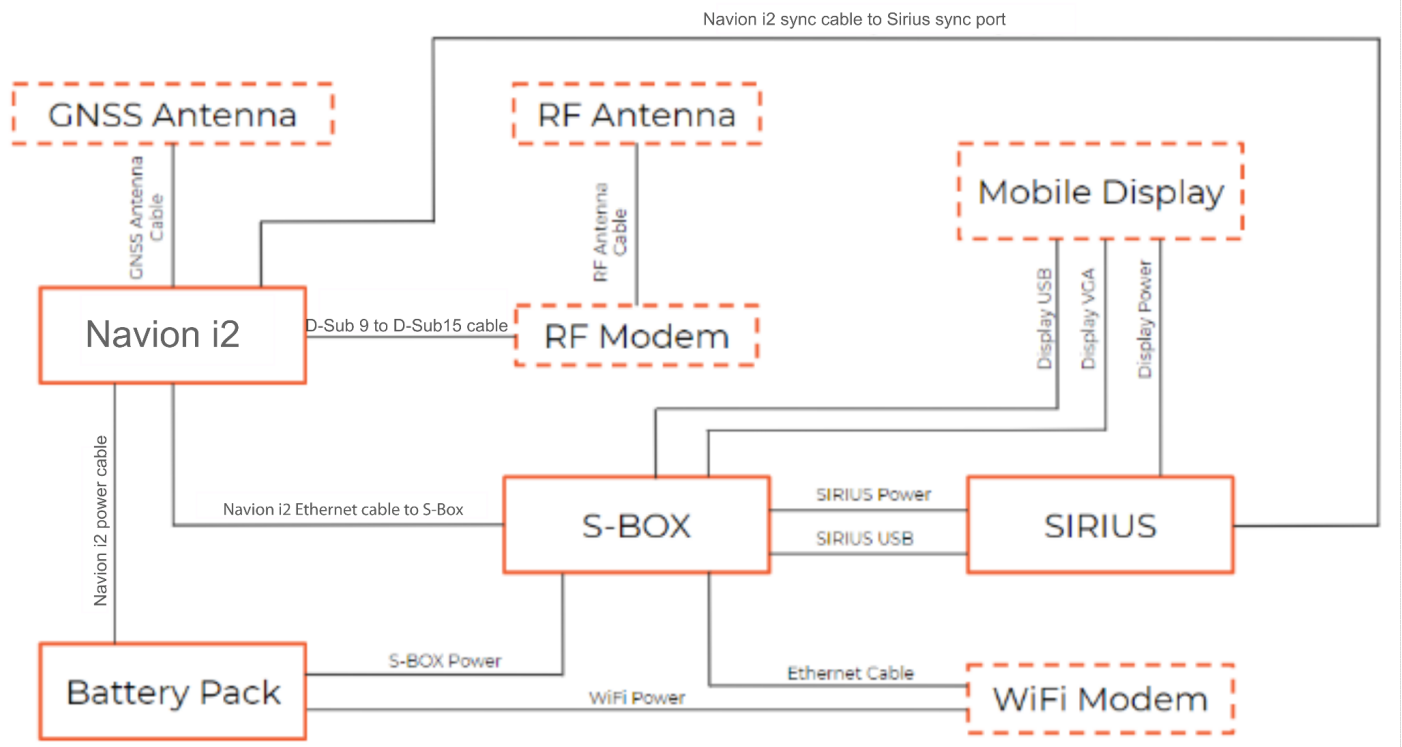


Image 41: Configuration of the Rover with the Navion i2 device

For setting up the Navion i2 as a rover, **you will need**:

- Navion i2
- GNSS antenna
- Navion i2 connection box with Ethernet port, power in & out, sync, CAN output, RTK correction data input, event input and NMEA output

### 6.3.1 Connection

1. When you receive a NAVION i2 device, unpack all the instruments and the cables. For easier connection take a look at Image 44, on which is a schematic of all the cables and instruments.
2. After unpacking, place the **Navion i2** on the top of the vehicle's roof and connect the **GNSS Antenna** with **GNSS Antenna cable** to it, also connect the instrument with the connection box. In case you have two antennas, connect and place both of them - one on the front side and one on the rear side of Navion i2. GNSS Antenna has a magnet on the bottom side, so you can just easily pop it on a metal roof.
3. Now connect the **Navion i2 connection box to S-BOX, computer or DS-WIFI4** using ethernet cable.
4. On the **connection box**, there is a COM I/O RTK port for the 9 pin **D-SUB connector** for the RF Modem. Connect the **RF Modem** with **RF Modem cable** on the **connection box**.



### Important

Connection box is in case of connection to the RF Modem intended for communication between RF Modem and NAVION i2 and at the same time it is used as a power supply for the RF Modem.

5. Next to the base station receiver Dewesoft RS232 (Topcon) **add** a **NAVION i2** device in **DewesoftX Settings**.
6. In the Local system set the synchronization as it's described in [6.3.2. Synchronization](#) chapter.
7. Then go to the **Channel setup -> Navion** and set the following:

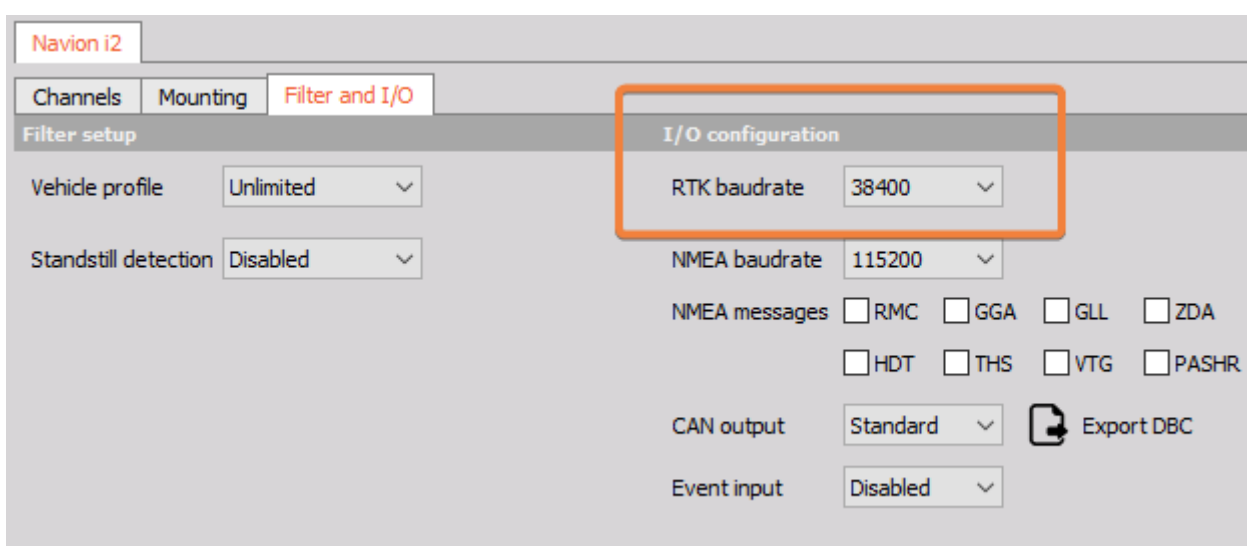


Image 42: In the Navion tab under Configuration set baud rate on the baud rate that was set on SATEL modems (in the instructions is an example of 38400) -> Then Upload to device.

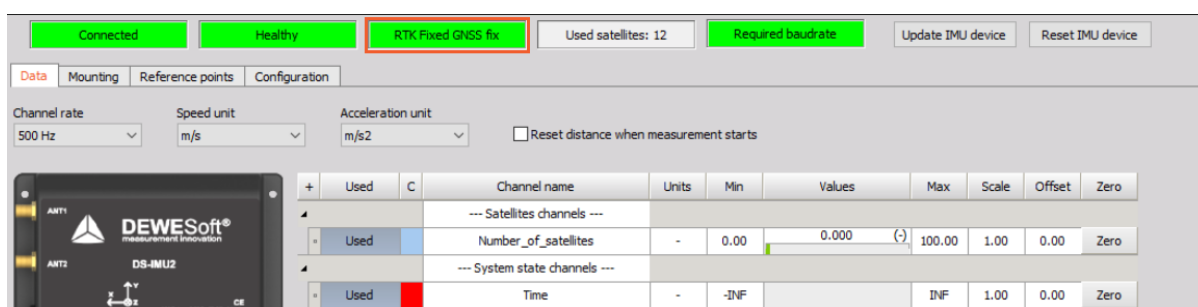


Image 43: When you will get RTK data to the NAVION i2 the Standalone status will change to **RTK Fixed GNSS fix**



### Important

Charge the Battery pack to 100% before using it in the vehicle, otherwise it might burn the fuse in the vehicle.

### 6.3.2 Synchronization

NAVION i2 is using GPS PPS synchronization. There are two synchronization possible for NAVION i2 regarding to the system configuration:

- **NAVION i2 and PC only:**
  - Set the NAVION i2 as a clock provider with GPS PPS signal.
- **NAVION i2, PC, some device ex: SIRIUS:**
  - SIRIUS and NAVION i2 have to be connected over Sync cable, where the NAVION i2 device is clock provider and the Dewesoft DAQ Device (Sirius) is clock slave

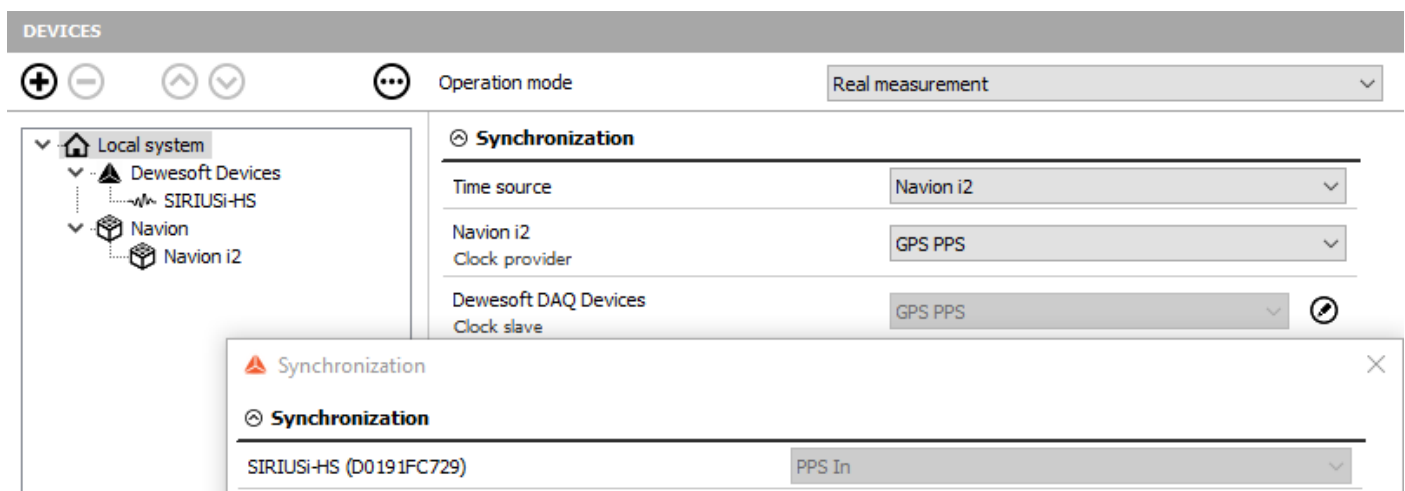


Image 44: Synchronization settings in DewesoftX device settings

## 7. SATEL RF modem Configuration for different RTK options

RF modems are always configured for one option; either for a **fixed** base station or for a **moving** base station.

This has to be managed, because at a **fixed base station** there is not so much data, which has to be transferred to the rover and we want to have as wide range of sending correction parameters as possible. Therefore we use a 19200 baud rate on the GNSS Receiver (which is set internally) and both RF modems have to be set manually to 19200 with Channel spacing 12.5 kHz.

For a **moving base station** many more parameters have to be transferred and therefore we have to increase the baud rate and the channel spacing, but still try to keep as wide range of sending correction information as possible. Therefore GNSS Receivers are internally set to baud rate of 38400, but you have to manually set RF modems to this value and change the Channel spacing to 25 kHz.

**First** connect both modems to a **power** - over DS-IMU2 cable and/or from the base station Box.

### 7.1. Configuration of RF modem with Display

1. To make changes on the SATEL modem with Display, there is no need to put it into programming mode. Instead it can be done online. For configuring it use the buttons on the SATEL modem.

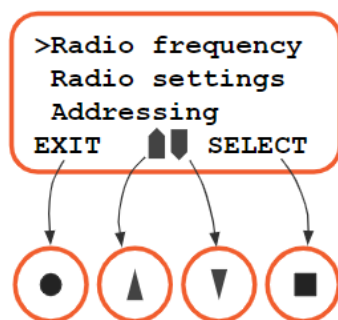


Image 45: Cursor buttons for menu select



2. First you have to do the factory reset. Open **Setup** with pressing on a **square button** and with up and down arrows find the **Factory reset** option and select it again with a **square button**.
3. Select EXIT -> Store? -> Select YES.
4. After the RF modem has been reseted, again return into **Setup** by pressing a square button.



5. Now press the square button again to **SELECT** (image 45) the Radio frequency option. In this screen **CHANGE** both **Tx & Rx frequency** with pressing on the square button. Then press the square button one more time to **SET** the values.

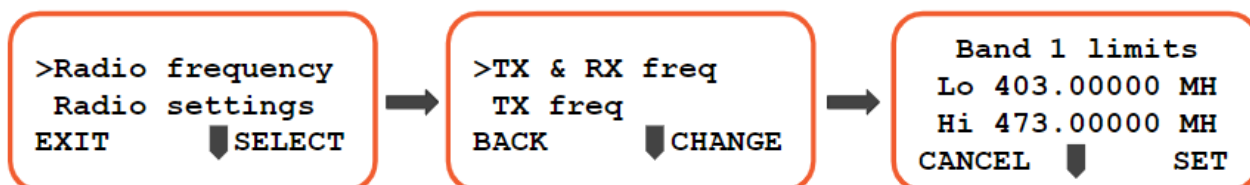


Image 46: Setup screen -> Radio frequency screen -> Tx & Rx frequency screen

6. Now you are able to change the settings. With **up and down arrow** buttons you **change** the numbers on the selected (look at the pictures below - ^) decimal value. With pressing on the **square button** you can **move** to the next decimal value.

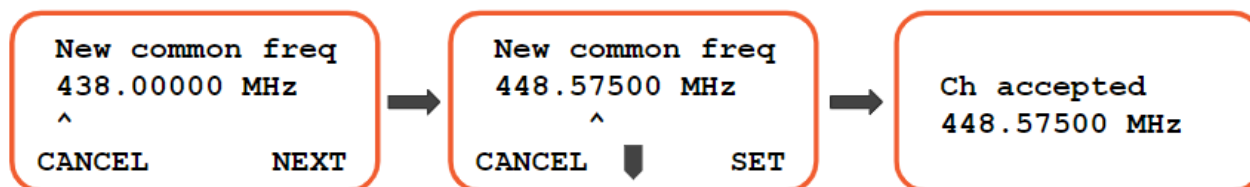


Image 47: Setting of new frequency -> New frequency set -> Confirmation of the frequency

7. As you write in the desired frequency value, and you come to the end of the decimal values, you are able to **SET the value** by clicking on the **square button**. After you will get the confirmation note that frequency change was accepted also this new frequency value will be written.



### Important

If you make a mistake press cancel and repeat the procedure from point 4-6. You can also do a factory reset and make those settings all over again.

8. Then in the same Setup screen where you have changed Tx & Rx frequency, scroll down with the down arrow button, until you find the **Ch. Spacing** and press CHANGE (square button). Then select **25 kHz**.

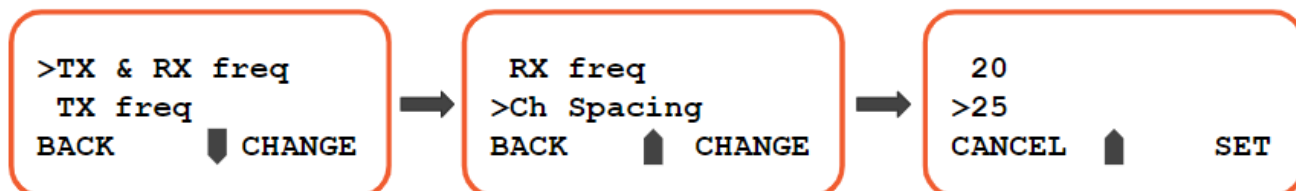


Image 48: Radio frequency screen -> Scrolled down to Ch Spacing -> Channel Spacing set

9. Now go back to the first Setup screen and scroll down and select Port 1. There change **the Baud Rate:**

- **19200 bit/s** for a fixed base station or
- **38400 bit/s** for a moving base station.

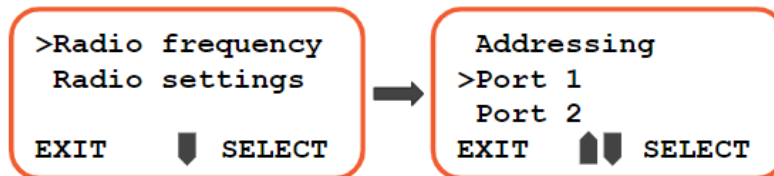


Image 49: Setup screen -> Scrolled down to Port 1

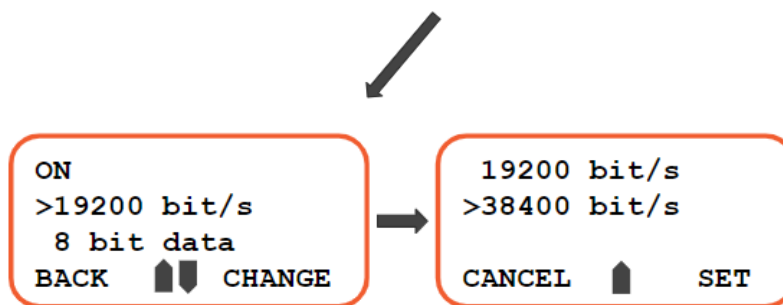


Image 50: Port 1 screen -> Set the Baud Rate

10. After making all those changes go back and press **Exit** and **Yes** to save *changes*. The modem is now set to correct frequency, channel spacing and baud rate.

11. Check the Modems if they work correctly:

- On the *Base station modem* you should see red **Tx light** blinking.
- On the *Rover modem* you should see red **Rx light** blinking.

## 8. Troubleshooting

### 8.1. Reconfiguring PARANI Bluetooth modems

In case of *losing a connection*, the bluetooth modems should be **reconfigured**:

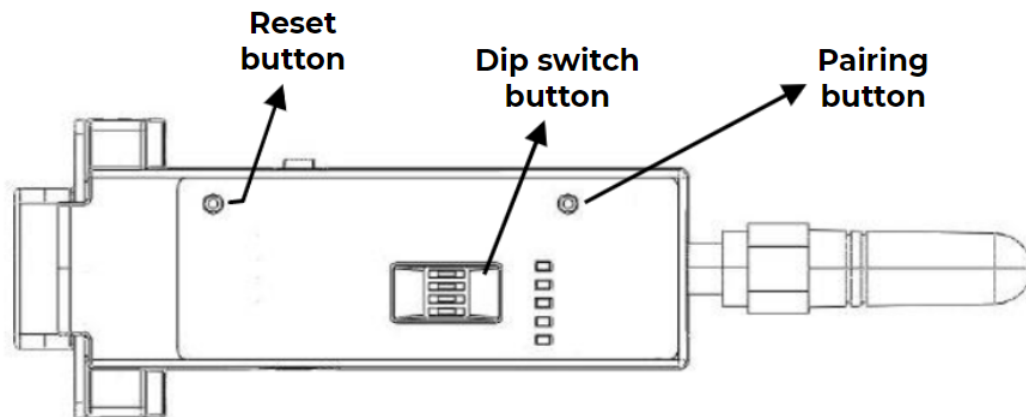


Image 51: Buttons on Parani-SD1000 modem

- **Dip switch** should be set at a **Baud Rate** of **115.2K**. This equals to the switch position:



Image 52: DipSwitch configuration for 115.2K Baud rate

- **Dip switch** of a **Hardware Flow Control Handshaking** should be set on **off**:



Image 53: DipSwitch set on off

- **Reset** and **pair** the Parani modem:

SD1			SD2		
	Status	LED		Status	LED
1. Hold Factory reset	Mode0	Mode LED turns on	1. Hold Factory reset	Mode0	Mode LED turns on
2. Hold Pairing button	Mode3	Mode LED blinks 3 times every 3 seconds	2. Hold pairing button	Mode3	Mode LED blinks 3 times every 3 seconds
			3. Hold pairing button again	Mode1	Mode LED blinks every second
4. Connected	Slave	Connect LED blinks every second	4. Connected	Master	Connect LED blinks every second

Follow the pattern: 1. SD1 -> 1. SD2 -> 2. SD1 -> 2. SD2 -> 3. SD2 -> 4. SD1 -> 4. SD2

7. **Turn on** the base station.

## 9. Warranty information

### Notice

The information contained in this document is subject to change without notice.

### Note:

Dewesoft d.o.o. shall not be liable for any errors contained in this document. Dewesoft MAKES NO WARRANTIES OF ANY KIND WITH REGARD TO THIS DOCUMENT, WHETHER EXPRESS OR IMPLIED. DEWESOFT SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Dewesoft shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory, in connection with the furnishing of this document or the use of the information in this document.

The copy of the specific warranty terms applicable to your Dewesoft product and replacement parts can be obtained from your local sales and service office. To find a local dealer for your country, please visit <https://dewesoft.com/support/distributors>.

### 9.1. Calibration

Every instrument needs to be calibrated at regular intervals. The standard norm across nearly every industry is annual calibration. Before your Dewesoft data acquisition system is delivered, it is calibrated. Detailed calibration reports for your Dewesoft system can be requested. We retain them for at least one year, after system delivery.

### 9.2. Support

Dewesoft has a team of people ready to assist you if you have any questions or any technical difficulties regarding the system. For any support please contact your local distributor first or Dewesoft directly.

Dewesoft d.o.o.  
Gabrsko 11a  
1420 Trbovlje Slovenia

Europe Tel.: +386 356 25 300  
Web: <http://www.dewesoft.com>  
Email: [Support@dewesoft.com](mailto:Support@dewesoft.com)  
The telephone hotline is available Monday to Friday from 07:00 to 16:00 CET (GMT +1:00)

### 9.3. Service/repair

The team of Dewesoft also performs any kinds of repairs to your system to assure a safe and proper operation in the future. For information regarding service and repairs please contact your local distributor first or Dewesoft directly on <https://dewesoft.com/support/rma-service>.

### 9.4. Restricted Rights

Use Slovenian law for duplication or disclosure. Dewesoft d.o.o. Gabrsko 11a, 1420 Trbovlje, Slovenia / Europe.

## 9.5. Printing History

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# 10. Safety instructions

Your safety is our primary concern! Please be safe!

## 10.1. Safety symbols in the manual



### **Warning**

Calls attention to a procedure, practice, or condition that could cause the body injury or death



### **Caution**

Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.

## 10.2. General Safety Instructions



### **Warning**

The following general safety precautions must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. Dewesoft d.o.o. assumes no liability for the customer's failure to comply with these requirements.

All accessories shown in this document are available as an option and will not be shipped as standard parts.

### 10.2.1. Environmental Considerations

Information about the environmental impact of the product.

### 10.2.2. Product End-of-Life Handling

Observe the following guidelines when recycling a Dewesoft system:

### 10.2.3. System and Components Recycling

Production of these components required the extraction and use of natural resources. The substances contained in the system could be harmful to your health and to the environment if the system is improperly handled at its end of life! Please recycle this product in an appropriate way to avoid unnecessary pollution of the environment and to keep natural resources.



This symbol indicates that this system complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). Please find further information about recycling on the Dewesoft web site [www.dewesoft.com](http://www.dewesoft.com)

 Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment and is outside the scope of the 2002/95/EC RoHS Directive. However, we take care of our environment and the product is lead-free.

### 10.2.4. General safety and hazard warnings for all Dewesoft systems

Safety of the operator and the unit depend on following these rules.

- Use this system under the terms of the specifications only to avoid any possible danger.
- Read your manual before operating the system.
- Observe local laws when using the instrument.
- DO NOT touch internal wiring!
- DO NOT use higher supply voltage than specified!
- Use only original plugs and cables for harnessing.
- You may not connect higher voltages than rated to any connectors.
- The power cable and connector serve as Power-Breaker. The cable must not exceed 3 meters, the disconnect function must be possible without tools.
- Maintenance must be executed by qualified staff only.
- During the use of the system, it might be possible to access other parts of a more comprehensive system. Please read and follow the safety instructions provided in the manuals of all other components regarding warning and security advice for using the system.
- With this product, only use the power cable delivered or defined for the host country.
- DO NOT connect or disconnect sensors, probes or test leads, as these parts are connected to a voltage supply unit.
- Ground the equipment: For Safety Class 1 equipment (equipment having a protective earth terminal), a non-interruptible safety earth ground must be provided from the mains power source to the product input wiring terminals.
- Please note the characteristics and indicators on the system to avoid fire or electric shocks. Before connecting the system, please read the corresponding specifications in the product manual carefully.

- The inputs must not, unless otherwise noted (CATx identification), be connected to the main circuit of category II, III and IV.
- The power cord separates the system from the power supply. Do not block the power cord, since it has to be accessible for the users.
- DO NOT use the system if equipment covers or shields are removed.
- If you assume the system is damaged, get it examined by authorized personnel only.
- Adverse environmental conditions are Moisture or high humidity Dust, flammable gases, fumes or dissolver Thunderstorm or thunderstorm conditions (except assembly PNA) Electrostatic fields, etc.
- The measurement category can be adjusted depending on module configuration.
- Any other use than described above may damage your system and is attended with dangers like short-circuiting, fire or electric shocks.
- The whole system must not be changed, rebuilt or opened.
- DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until the safe operation can be verified by service-trained personnel. If necessary, return the product to Dewesoft sales and service office for service and repair to ensure that safety features are maintained.
- If you assume a more riskless use is not provided anymore, the system has to be rendered inoperative and should be protected against inadvertent operation. It is assumed that a more riskless operation is not possible anymore if the system is damaged obviously or causes strange noises. The system does not work anymore. The system has been exposed to long storage in adverse environments. The system has been exposed to heavy shipment strain.
- Warranty void if damages caused by disregarding this manual. For consequential damages, NO liability will be assumed!
- Warranty void if damage to property or persons caused by improper use or disregarding the safety instructions.
- Unauthorized changing or rebuilding the system is prohibited due to safety and permission reasons (CE).
- Be careful with voltages >25 VAC or >35 VDC! These voltages are already high enough in order to get a perilous electric shock by touching the wiring.
- The product heats during operation. Make sure there is adequate ventilation. Ventilation slots must not be covered!
- Only fuses of the specified type and nominal current may be used. The use of patched fuses is prohibited.
- Prevent using metal bare wires! Risk of short circuit and fire hazard!
- DO NOT use the system before, during or shortly after a thunderstorm (risk of lightning and high energy over-voltage). An advanced range of application under certain conditions is allowed with therefore designed products only. For details please refer to the specifications.
- Make sure that your hands, shoes, clothes, the floor, the system or measuring leads, integrated circuits and so on, are dry.
- DO NOT use the system in rooms with flammable gases, fumes or dust or in adverse environmental conditions.
- Avoid operation in the immediate vicinity of high magnetic or electromagnetic fields, transmitting antennas or high-frequency generators, for exact values please refer to enclosed specifications.
- Use measurement leads or measurement accessories aligned with the specification of the system only. Fire hazard in case of overload!



- Do not switch on the system after transporting it from a cold into a warm room and vice versa. The thereby created condensation may damage your system. Acclimatise the system unpowered to room temperature.
- Do not disassemble the system! There is a high risk of getting a perilous electric shock. Capacitors still might be charged, even if the system has been removed from the power supply.
- The electrical installations and equipment in industrial facilities must be observed by the security regulations and insurance institutions.
- The use of the measuring system in schools and other training facilities must be observed by skilled personnel.
- The measuring systems are not designed for use in humans and animals.
- Please contact a professional if you have doubts about the method of operation, safety or the connection of the system.
- Please be careful with the product. Shocks, hits and dropping it from already- lower level may damage your system.
- Please also consider the detailed technical reference manual as well as the security advice of the connected systems.
- This product has left the factory in safety-related flawlessness and in proper condition. In order to maintain this condition and guarantee safety use, the user has to consider the security advice and warnings in this manual.

#### EN 61326-3-1:2008

IEC 61326-1 applies to this part of IEC 61326 but is limited to systems and equipment for industrial applications intended to perform safety functions as defined in IEC 61508 with SIL 1-3.

The electromagnetic environments encompassed by this product family standard are industrial, both indoor and outdoor, as described for industrial locations in IEC 61000-6-2 or defined in 3.7 of IEC 61326-1.

Equipment and systems intended for use in other electromagnetic environments, for example, in the process industry or in environments with potentially explosive atmospheres, are excluded from the scope of this product family standard, IEC 61326-3-1.

Devices and systems according to IEC 61508 or IEC 61511 which are considered as “operationally well-tried”, are excluded from the scope of IEC 61326-3-1.

Fire-alarm and safety-alarm systems, intended for the protection of buildings, are excluded from the scope of IEC 61326-3-1.

## 11. Documentation version history

Version	Date	Notes
V14-1	12-02-2014	Initial revision.
V20-1	12-10-2020	Updated template, corrected information and updated devices.
V21-1	22-02-2021	Template corrections.
V23-1	15.09.2023	Added IMU1 and Navion i2