

# User Guide for HAT Boards with RtkBase

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## Description

**ELT\_RTKBase** is a stationary **GNSS** base using multi-system, multi-frequency receivers like Unicore **UM980** or **Bynav M20** or **Septentrio mosaic-X5**. It offers advanced connectivity options via the internet or local network, complete with a detailed guide for inexperienced users.

**ELT\_RTKBase** can operate as an **NTRIP** server (2 connections), **NTRIP** caster, **TCP** server, or **TCP** client (2 connections as well), record measurements, and allow downloading in **RTCM3** and **RINEX** formats.

Typical Uses:

- Cryptocurrency mining with base station networks like **Onocoy** and **RtkDirect**.
- A local base for dozens or hundreds of rovers (drones or tractors).
- A geodetic base (except for systems using the **Bynav M20** receiver).

Advantages:

- **ELT\_RTKBase** is the Swiss Army knife of base stations. We believe that if a feature is needed by 1% of users now, it will be used by 10% in 10-20 years. Over 80% of users will use at least one additional feature during the device's lifetime. Therefore, we actively add features that are currently needed by only a small number of users.
- Being open source, custom modifications can be made by advanced users. You can modify and add functionality, but results must be shared with the community under the AGPL 3.0 license.
- It is designed not just for professionals but also for beginners. One of our goals was to lower the entry barrier into base station technology significantly. Our documentation is very detailed and includes many illustrations, making setup easier than with other stations.
- Modern multi-system, multi-frequency receivers.
- Affordable price.

## Feature list

- 1) Two **NTRIP v1** servers, which can also function as **TCP** clients.
- 2) Documentation with many screenshots tailored for beginners.
- 3) **NTRIP v1** caster supporting hundreds of clients (for connecting rovers directly to the device).
- 4) **TCP** server.
- 5) Data output to a connected **USB-COM**.
- 6) Measurement logging in **RTCM3** and **RINEX** formats.
- 7) A choice of three modern multi-system, multi-frequency receivers from **Unicore**, **Bynav**, and **Septentrio**. If you don't need configuration and detection features, you can use any receiver that outputs **RTCM3** data.
- 8) Built-in splitter for triple mining with **Geodnet**.
- 9) Built-in **PPP** with coordinate display on a detailed world map for quality evaluation.
- 10) Internet-based version updates via a button in the **web** interface.
- 11) Wired **Ethernet** and **WiFi**.
- 12) **PoE** (Power over Ethernet) or **USB** power, at your choice.
- 13) Dynamic (**DHCP**) and static **IP** options.
- 14) Ability to use it as a **Raspberry Pi** (a **LINUX** computer) for other purposes, such as **ADS-B** mining.
- 15) Antenna coordinate configuration through the **web** interface.
- 16) Four methods for determining base coordinates.

- 17) Antenna type configuration through the **web** interface.
- 18) Selection of **RTCM3** packet types for transmission.
- 19) Built-in **VPN** from [TailScale](#) for remote management, allowing control of the base station even when traveling.
- 20) Ability to operate as a rover (currently only with **Windows**).
- 21) Internet connection status indicator (not just **WiFi**, but actual internet connectivity).
- 22) Temperature monitoring.
- 23) Disk space monitoring.
- 24)** Four mounting options.
- 25) **DIY** mode using your own **Raspberry Pi**. In this case, you only need to buy a **USB** or **HAT** receiver and an antenna.
- 26)** User-modifiable functionality with open-source code available on [GitHub](#).
- 27) **NTRIP** server interface indicating connection interruption reasons.
- 28) Service logs showing connection interruption reasons and extensive technical information.
- 29) Entering Exotic Characters in **SSID** and Passwords.

I might have missed something, so don't be too harsh. **ELT\_RTKBase** doesn't bake pies or make coffee — yet.

## Future Plans

In upcoming versions, we expect:

- **NTRIP 2.0 HTTP**.
- **NTRIP 2.0 RSTP**.
- **NTRIP 2.0 UDP**.
- Five **NTRIP** servers, each capable of operating with five protocols.
- “**MOVED BASE**” mode, enabling simultaneous rover and base operation.
- Automatic shutdown in case of overheating.
- **USB** modem support.

## Receiver Options

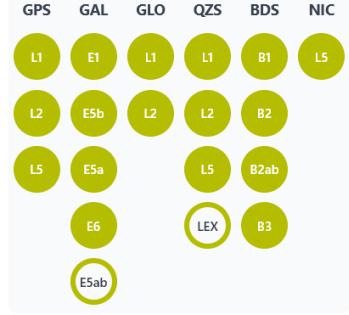
The three [ELT\\_RTKBase](#) models from [gnss.store](#) differ in their receivers.

[\*\*Unicore UM980\*\*](#) — a mid-range geodetic receiver similar to those used by other **Onocoy** miners. Differences may lie in configuration and firmware versions. Example base station: [LVARIGRIG10](#). It typically tracks 145 signals with an average quality of 0.976.

[\*\*Bynav M20\*\*](#) — a simpler and cheaper receiver. It tracks slightly fewer signals and provides a slightly lower reward. Compared to **UM980**, it lacks signals such as **GPS L1C** and **L2P(Y)**, **Galileo E6**, **Beidou B1C** and **B2b**, and **QZSS L1C**. Fortunately, for **Onocoy**, only the absence of **Galileo E6** matters. This receiver is not geodetic-grade and is suitable as a base for tractors, drones,

or **GNSS** mining, but not for serious geodesy. Example base station: [LVARIGRIG11](#). It typically tracks 126 signals with an average quality of 0.906.

**Septentrio Mosaic X5** — a premium, high-quality geodetic receiver. It features **AIM+** technology for interference mitigation and anti-spoofing and **OSNMA** technology for distinguishing genuine signals from spoofed ones. It supports two additional signals (**Galileo E5ab** and **QZSS L6**) compared to **UM980**. However, it can only track 60 satellites simultaneously, so it needs slight adjustments based on the region. Otherwise, you might receive a lower reward or the same as the **UM980**. Our base station is configured for Europe. For India and neighboring regions, it needs to be slightly reconfigured to include **IRNSS**. Example base station: [LVARIGRIG9](#). It typically tracks 170 signals with an average quality of 0.964.

	<b>Bynav M20</b>	<b>Unicore UM980</b>	<b>Septentrio Mosaic X5</b>
Satellites	48	47	46
Signals	126	145	170
Quality	0.906	0.976	0.964
	<b>LVARIGRIG11</b>  56.905 24.201  <a href="#">Status</a> <a href="#">Signals</a> <b>Messages:</b> 1077(1),1087(1),1097(1),1117(1),1127(1),1137(1) 	<b>LVARIGRIG10</b>  56.898 24.194  <a href="#">Status</a> <a href="#">Signals</a> <b>Messages:</b> 1077(1),1087(1),1097(1),1117(1),1127(1),1137(1) 	<b>LVARIGRIG9</b>  56.902 24.195  <a href="#">Status</a> <a href="#">Signals</a> <b>Messages:</b> 1077(1),1087(1),1097(1),1117(1),1127(1),1137(1) 

If you are interested in the reward, it depends on the number of “green circles”.

This directly influences positioning.

[ELT0631](#) with **Bynav M20**: The most affordable multi-frequency, full-featured base station on the market and the cheapest miner. Ideal for cost-conscious users.

[ELT0231](#) with **Unicore UM980**: A great balance between price and quality. Perfect for those who foresee needing not only mining features but also additional functions over the next 10–20 years.

[ELT0731](#) with **Septentrio Mosaic X5**: The most affordable base station with a **Mosaic X5** receiver. Ideal for perfectionists and those requiring a high-quality base station for geodetic work.

# Getting started

To begin, insert the **SD** card into your computer's card reader and download the files **WinRtkBaseConfigure.exe** and **WinRtkBaseUtils.exe** from it. For more details, refer to “Installation from a Preloaded SD Card”

If you are using **WiFi**, launch **WinRtkBaseUtils.exe** without removing the **SD** card. Check the boxes for “**WiFi**” and “**WiFi Country**”. Enter the **WiFi** details and your country name. Click **Save**. For more details, refer to “Configuring Raspberry Pi”.

Remove the **SD** card and insert it into the **Raspberry Pi**. Mount the antenna on the roof and connect its cable to the **SMA** connector on the **Raspberry Pi**. For details on antenna installation, refer to [our blog](#) and the “Connection” section.

If you are connecting via **Ethernet**, plug it into the port on the right. Then, insert the power cable into the **USB Type-C** port on the left, but **do not plug** the power adapter into the socket yet. The other **USB** and **HDMI** ports are disabled. For more details, refer to “Connection”.

If you wish, you can mount the **Raspberry Pi** to a table, wall, or rack as described in “Mounting”.

Turn on the **Raspberry Pi** and **wait** a couple of minutes (do not disconnect the power during this time).

Open your browser and go to <http://rtkbase.local> as described in “Address of Raspberry pi in the Local Network”. Enter the admin password and change it as described in “Changing the Password”.

Check the functionality and set rough coordinates as described in “Rough Coordinates”. If needed (for example, for **RtkDirect**), set the precise coordinates using one of the methods described in “Determining Coordinates”.

If you want to earn cryptocurrency mining with base station networks like **Onocoy** and **RtkDirect**, refer to “NTRIP Configuration for Onocoy” and “NTRIP Configuration for RtkDirect” for detailed instructions.

If you want to connect rovers directly to your base, configure the **NTRIP Caster** as described in “NTRIP Caster Setup”.

If you encounter any issues, read the relevant section or check “Troubleshooting”.

## Installation

There are three installation methods: using a preloaded **SD** card, using a system image, and installing on an existing system. Installing with a preloaded **SD** card is the simplest option. Installing from a system image is the most versatile method. And finally, using a script to install on an existing system is for those who already have a **Raspberry Pi** running **Raspberry Pi OS** and are comfortable with command-line instructions.

### Installation from a Preloaded SD Card

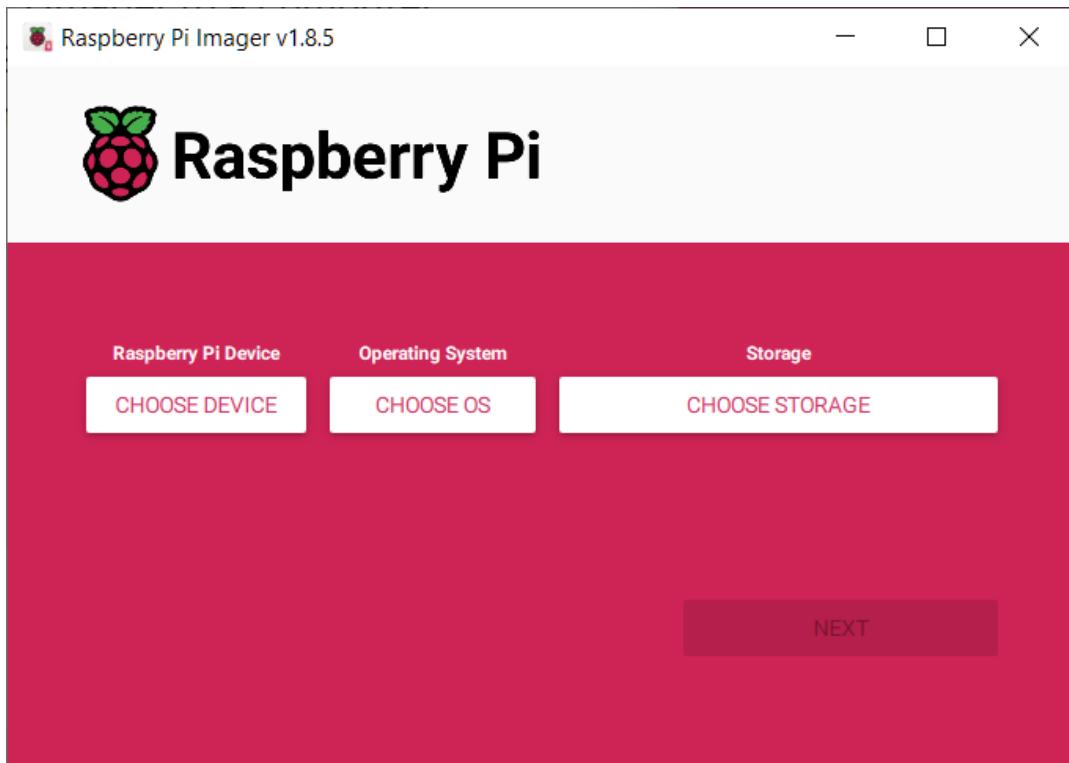
To begin, insert the **SD** card into your computer's card reader and download the files **WinRtkBaseConfigure.exe** and **WinRtkBaseUtils.exe** from it. If you don't have a card reader, you can get these files from [our repository](#) on **GitHub**.

Disconnect the **Raspberry Pi** from power. Simply insert the **SD** card with the preloaded system image into your **Raspberry Pi**, turn it on, and wait a couple of minutes (do not disconnect the power during this time). **RtkBase** will appear on the local network at <http://rtkbase.local>. This is the easiest method, and nothing else needs to be done. For setup, use the method described in the “Configuring Raspberry Pi” section.

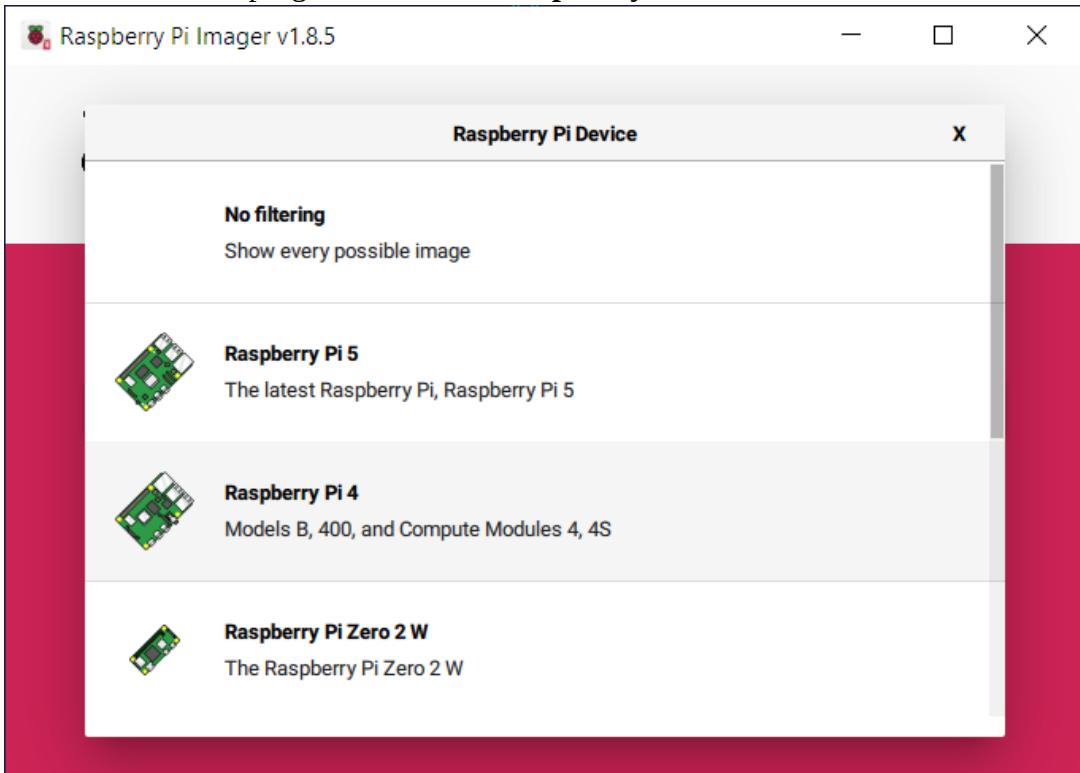
## Installing the System Image

This is the most versatile method but requires a **Windows** computer. Buy the most reliable **SD** card from a reputable brand. The size should be at least 8 **GB**. Download [Raspberry Pi Imager](#) and the [system image](#).

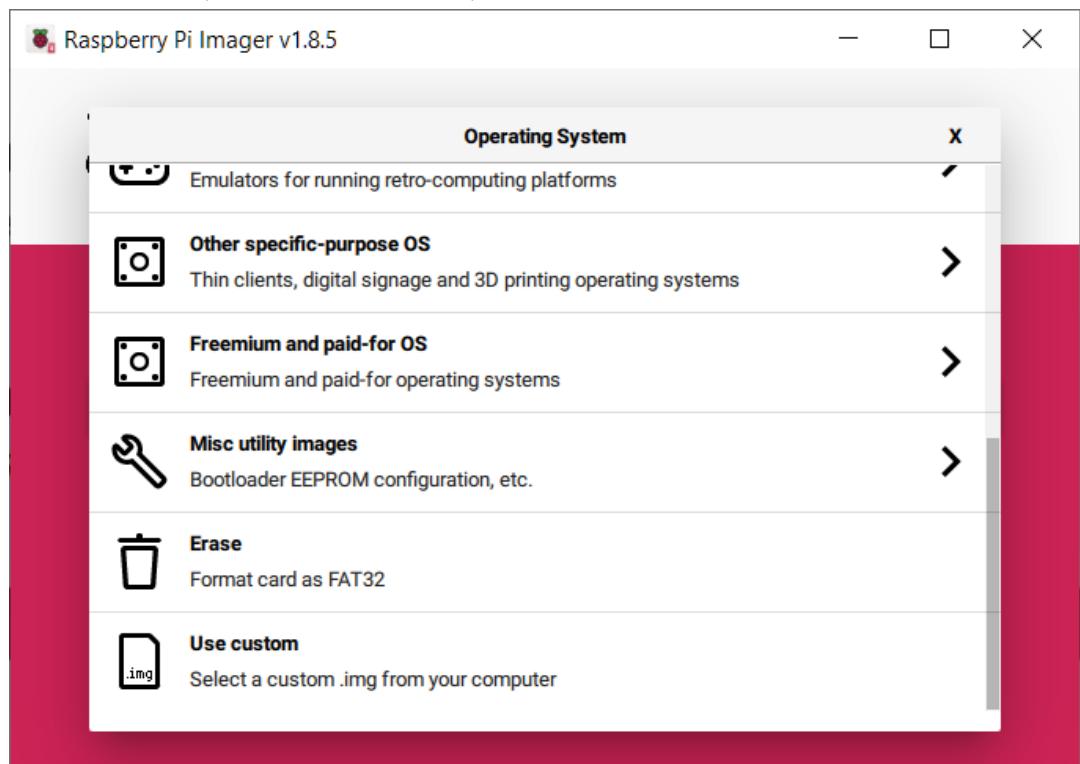
Launch **Raspberry Pi Imager**.



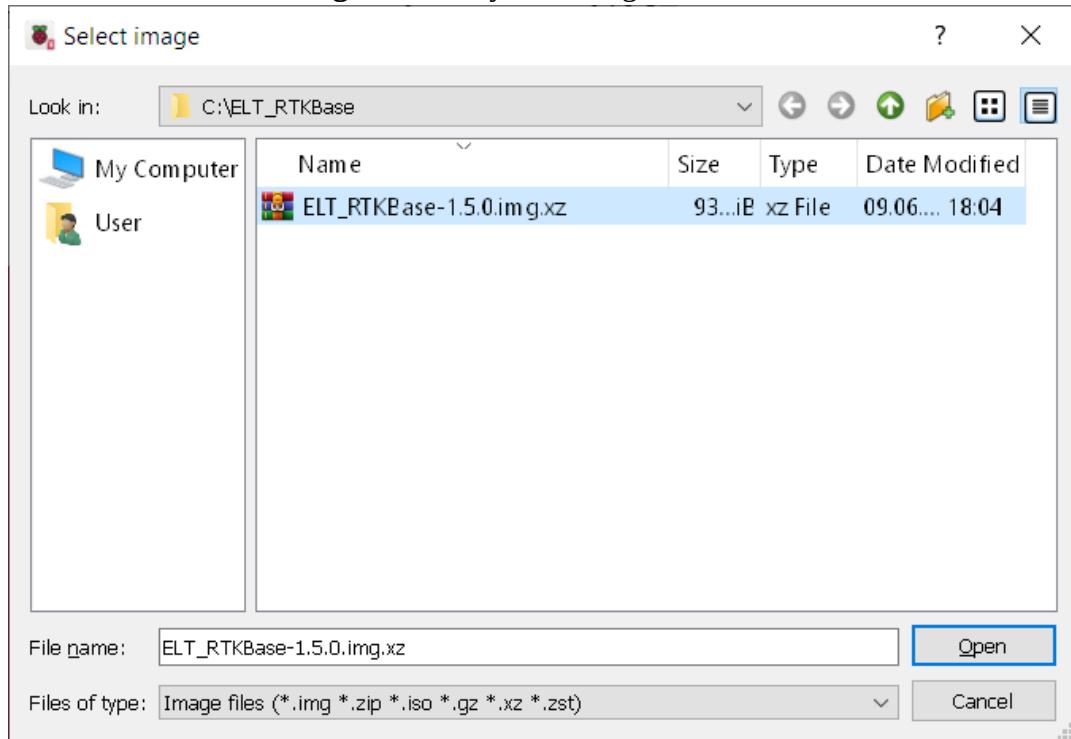
Click the left button of the program and select **Raspberry Pi 4**.



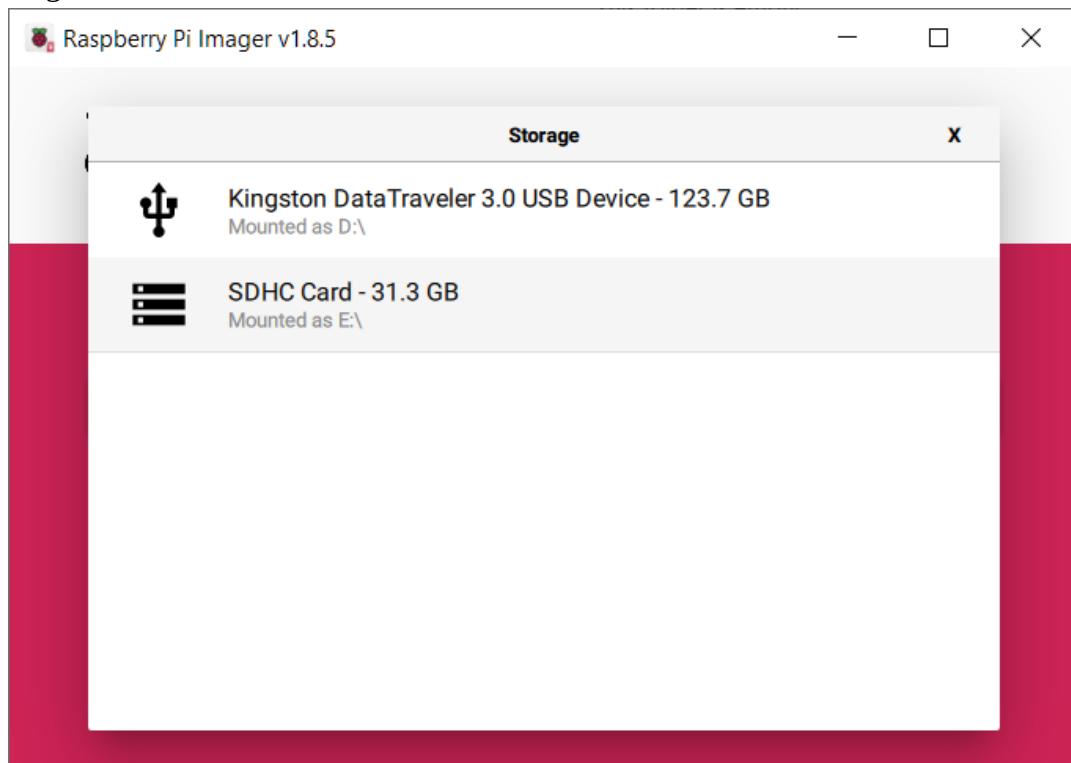
Click the middle button, scroll to the bottom, and select “Use custom”.



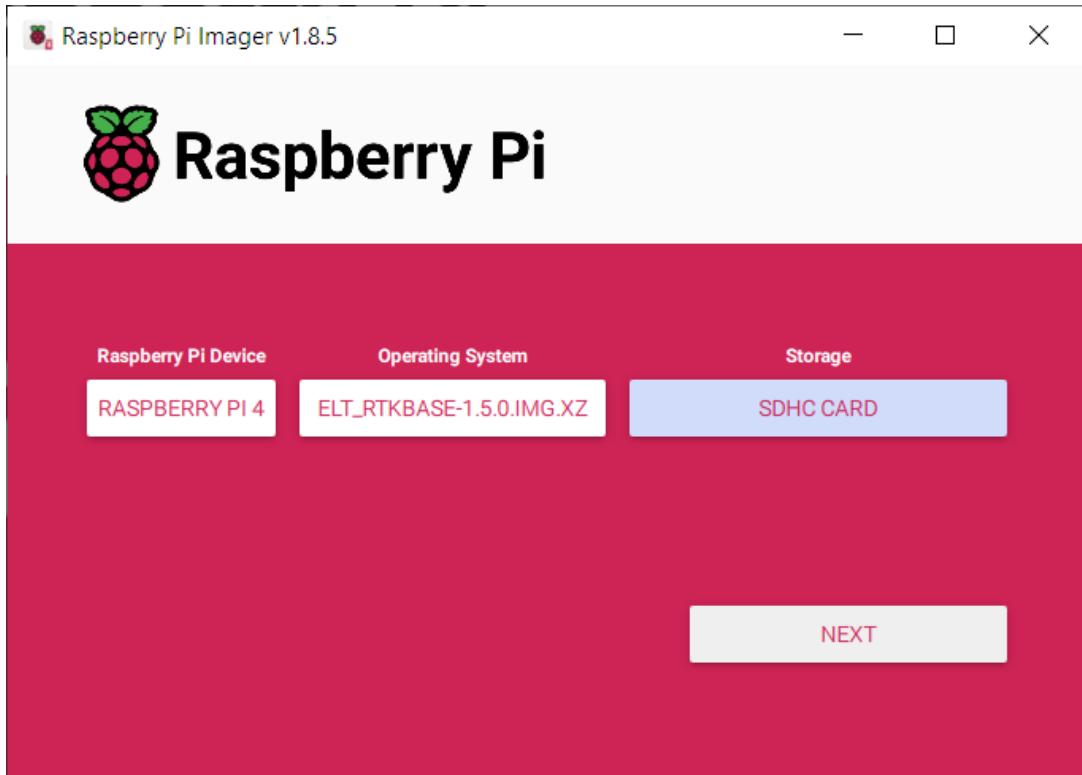
Choose **ELT\_RTKBase-1.5.0.img.xz** as the system image to load.



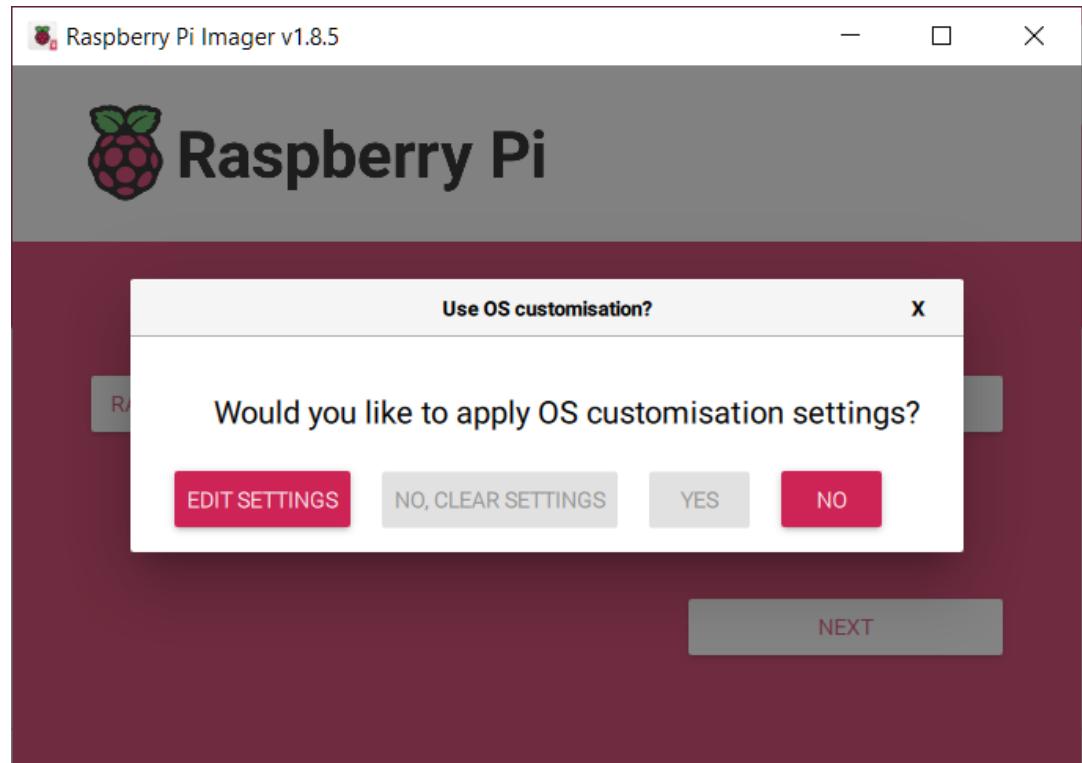
Click the right button and select the **SD** card.



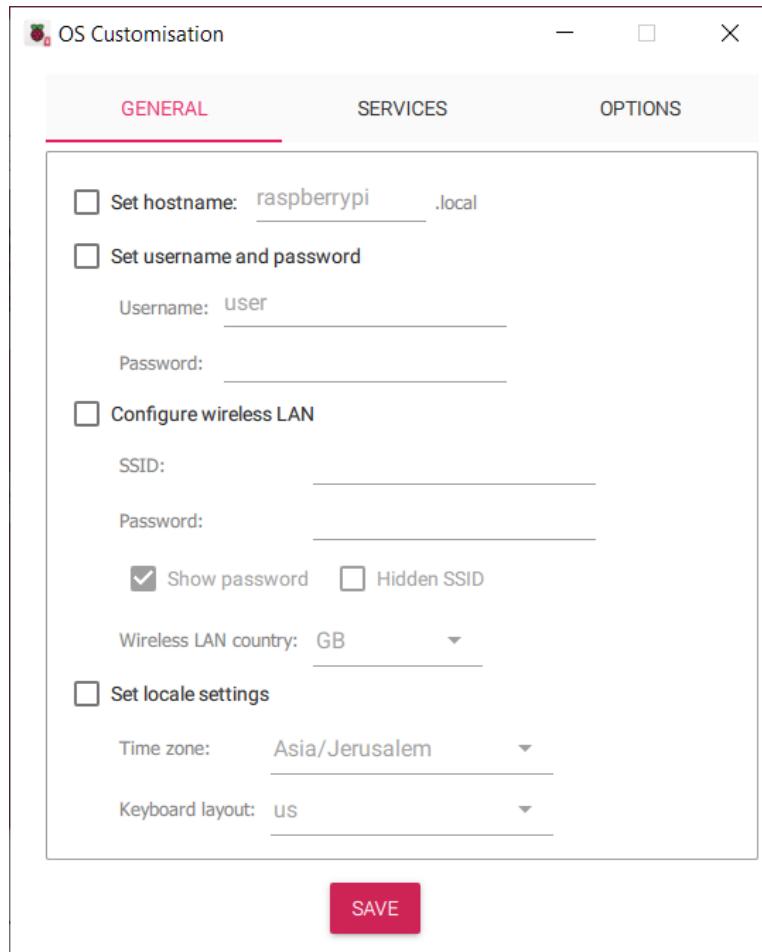
Click **NEXT**.



Click “**EDIT SETTINGS**”.



The settings editor opens.



Fill in the “**General**” page. If you will connect the **Raspberry Pi** via **WiFi**, enter the **WiFi SSID** and password, and whether the **SSID** is hidden. If you do not enter a **hostname**, you can access it as <http://rtkbase.local>. If you do enter a hostname, access it by the entered name with the suffix local, <http://myname.local>.

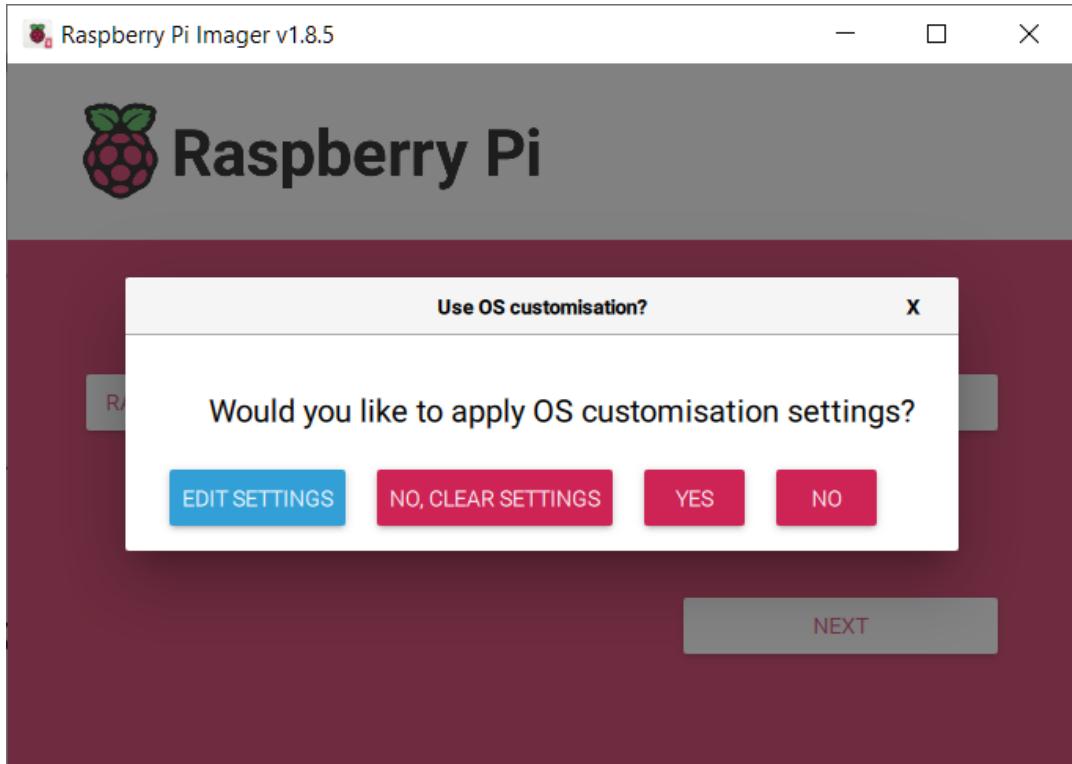
The screenshot shows the "OS Customisation" window with the "GENERAL" tab selected. The window has three tabs: "GENERAL", "SERVICES", and "OPTIONS".

**GENERAL Tab Settings:**

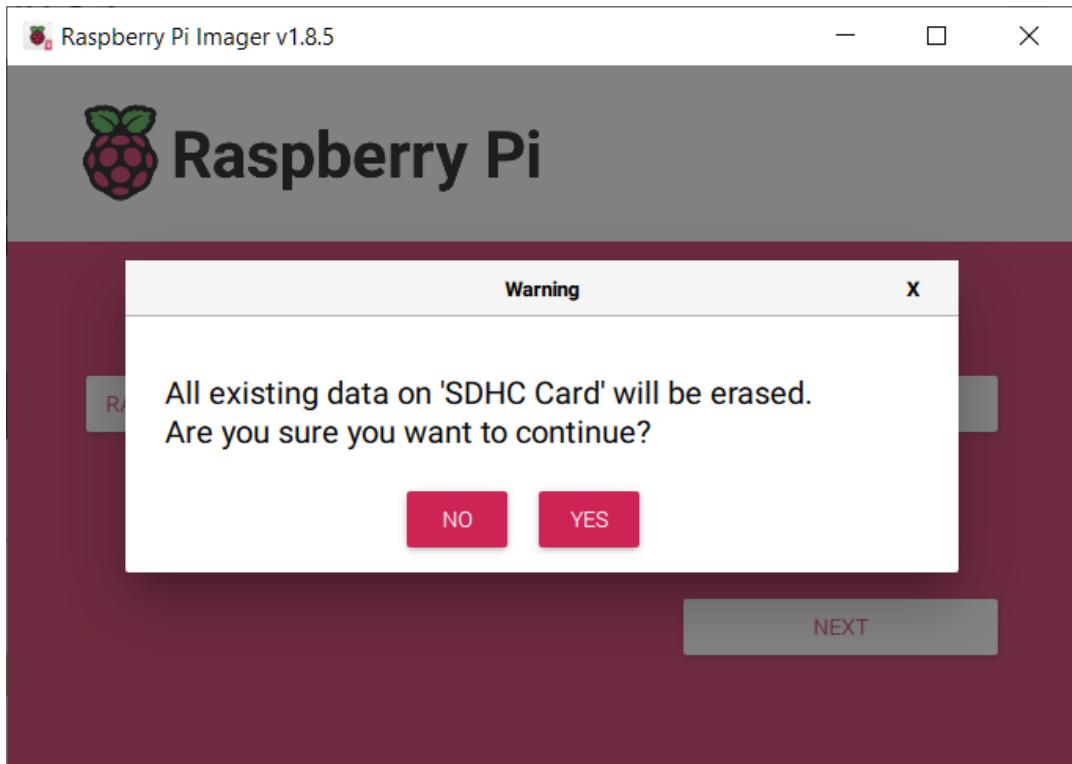
- Set hostname: raspberry .local
- Set username and password
  - Username: user
  - Password: \_\_\_\_\_
- Configure wireless LAN
  - SSID: myWifi
  - Password: 1234567890
  - Show password     Hidden SSID
- Set locale settings
  - Time zone: Asia/Jerusalem
  - Keyboard layout: us

**SAVE** button at the bottom.

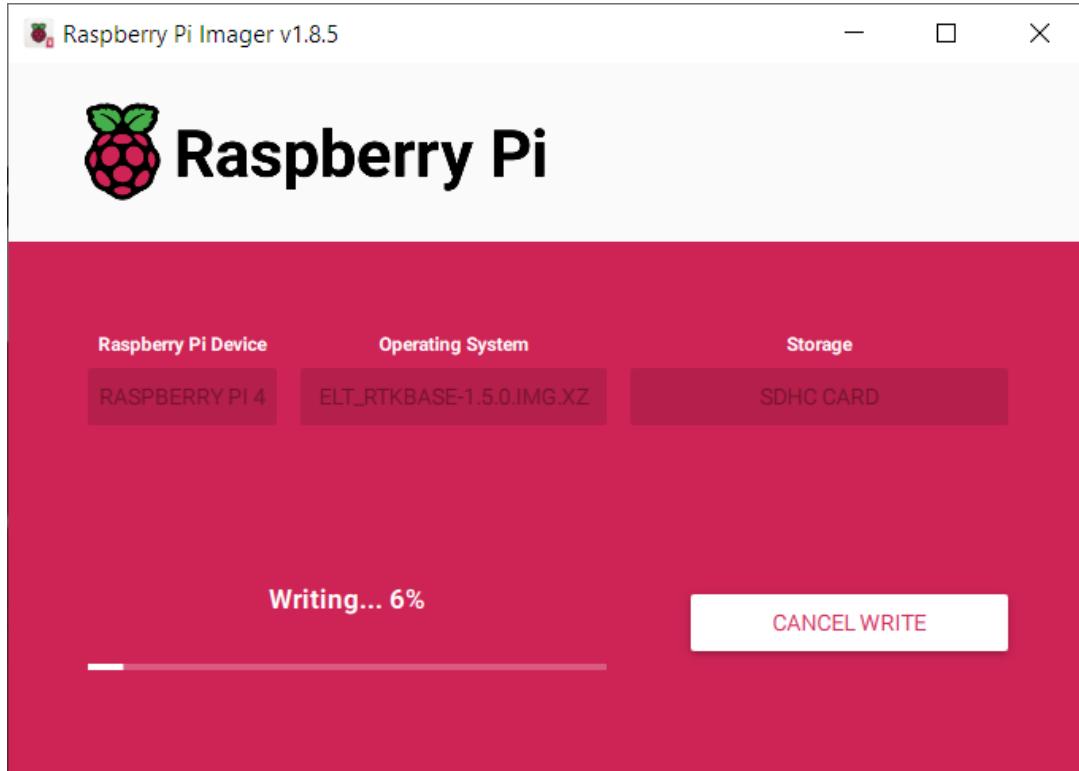
After editing, click **SAVE**, then **YES**.



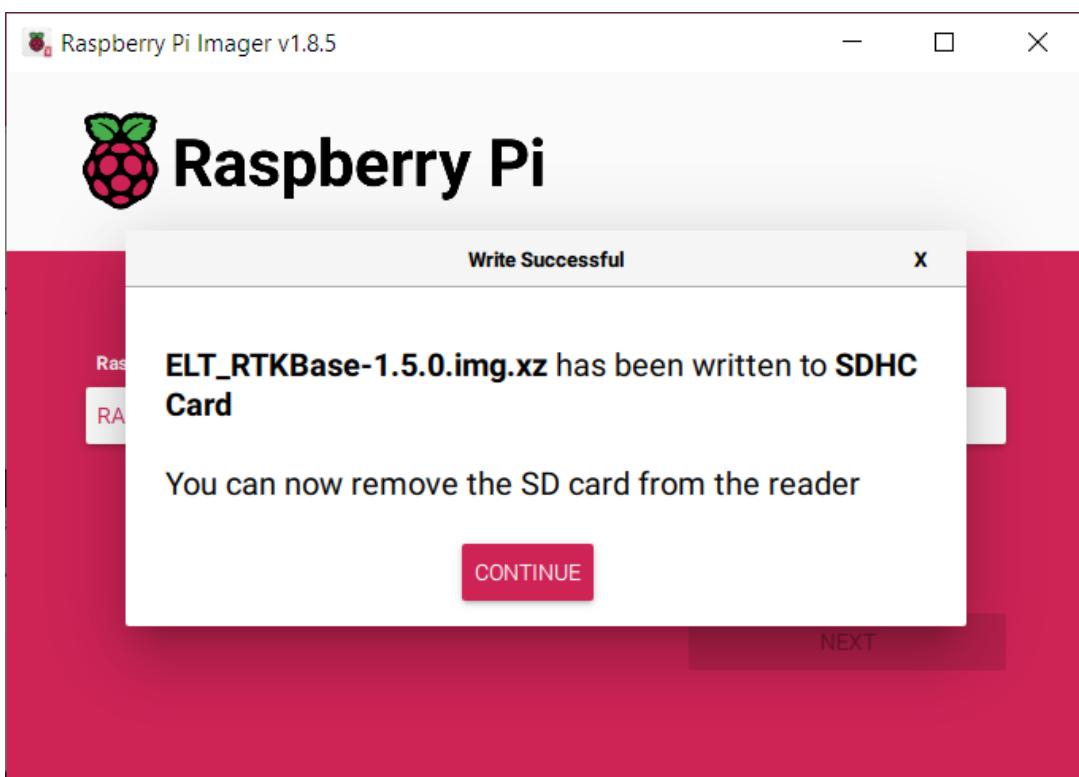
Confirm that the **SD** card will be completely erased.



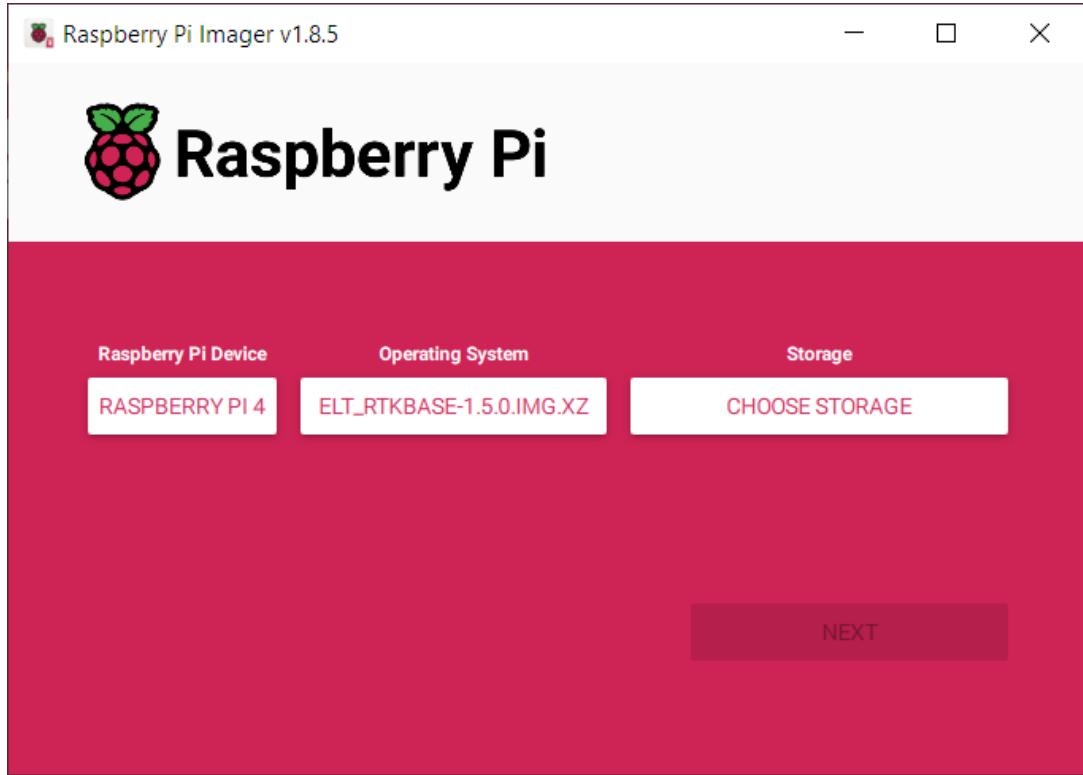
The writing process to the card begins.



After writing completes, a message appears.



Click **CONTINUE**, then close **Raspberry Pi Imager**.



Disconnect the power from the **Raspberry Pi**. Remove the **SD** card from the computer and insert it into the **Raspberry Pi**. Turn it on and **wait a few minutes** (do not disconnect the power during this time). **RtkBase** will appear on the local network at <http://rtkbase.local> (if you changed the hostname, the name will be different).

## Installation on an Existing System

This method is for geeks who know how to use the **Linux** command line. No special knowledge is required, just the ability to access the command line and copy commands into it. **Attention!** Before installation, make sure **to connect** the **GNSS** receiver to the **Raspberry Pi**. The installation is designed for **Raspberry Pi OS** version **12** with **aarch64** (64-bit) or **armv7l** (32-bit) architecture, meaning an **ARMv8A** processor.

First, download **install.sh** using the command  
**wget [https://github.com/GNSSOEM/ELT\\_RTKBase/raw/main/install.sh](https://github.com/GNSSOEM/ELT_RTKBase/raw/main/install.sh)**

```
jef@rtkbase:~  
Last login: Tue Jun 11 00:19:33 2024 from 192.168.172.231  
jef@rtkbase:~ $ wget https://github.com/GNSSOEM/ELT_RTKBase/raw/main/install.sh  
--2024-06-11 00:23:18-- https://github.com/GNSSOEM/ELT_RTKBase/raw/main/install  
.sh  
Resolving github.com (github.com) ... 140.82.121.3  
Connecting to github.com (github.com) |140.82.121.3|:443... connected.  
HTTP request sent, awaiting response... 302 Found  
Location: https://raw.githubusercontent.com/GNSSOEM/ELT_RTKBase/main/install.sh  
[following]  
--2024-06-11 00:23:18-- https://raw.githubusercontent.com/GNSSOEM/ELT_RTKBase/m  
ain/install.sh  
Resolving raw.githubusercontent.com (raw.githubusercontent.com) ... 185.199.108.1  
33, 185.199.109.133, 185.199.110.133, ...  
Connecting to raw.githubusercontent.com (raw.githubusercontent.com) |185.199.108.  
133|:443... connected.  
HTTP request sent, awaiting response... 200 OK  
Length: 15709771 (15M) [application/octet-stream]  
Saving to: 'install.sh'  
  
install.sh          100%[=====] 14.98M 11.0MB/s    in 1.4s  
  
2024-06-11 00:23:21 (11.0 MB/s) - 'install.sh' saved [15709771/15709771]  
jef@rtkbase:~ $
```

Give it execution rights with the command **chmod +x install.sh**

```
jef@rtkbase:~ $ wget https://github.com/GNSSOEM/ELT_RTKBase/raw/main/install.sh
--2024-06-11 00:23:18-- https://github.com/GNSSOEM/ELT_RTKBase/raw/main/install.sh
Resolving github.com (github.com)... 140.82.121.3
Connecting to github.com (github.com)|140.82.121.3|:443... connected.
HTTP request sent, awaiting response... 302 Found
Location: https://raw.githubusercontent.com/GNSSOEM/ELT_RTKBase/main/install.sh
[following]
--2024-06-11 00:23:18-- https://raw.githubusercontent.com/GNSSOEM/ELT_RTKBase/main/install.sh
Resolving raw.githubusercontent.com (raw.githubusercontent.com)... 185.199.108.1
33, 185.199.109.133, 185.199.110.133, ...
Connecting to raw.githubusercontent.com (raw.githubusercontent.com)|185.199.108.133|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 15709771 (15M) [application/octet-stream]
Saving to: 'install.sh'

install.sh      100%[=====] 14.98M 11.0MB/s    in 1.4s

2024-06-11 00:23:21 (11.0 MB/s) - 'install.sh' saved [15709771/15709771]

jef@rtkbase:~ $ chmod +x install.sh
jef@rtkbase:~ $
```

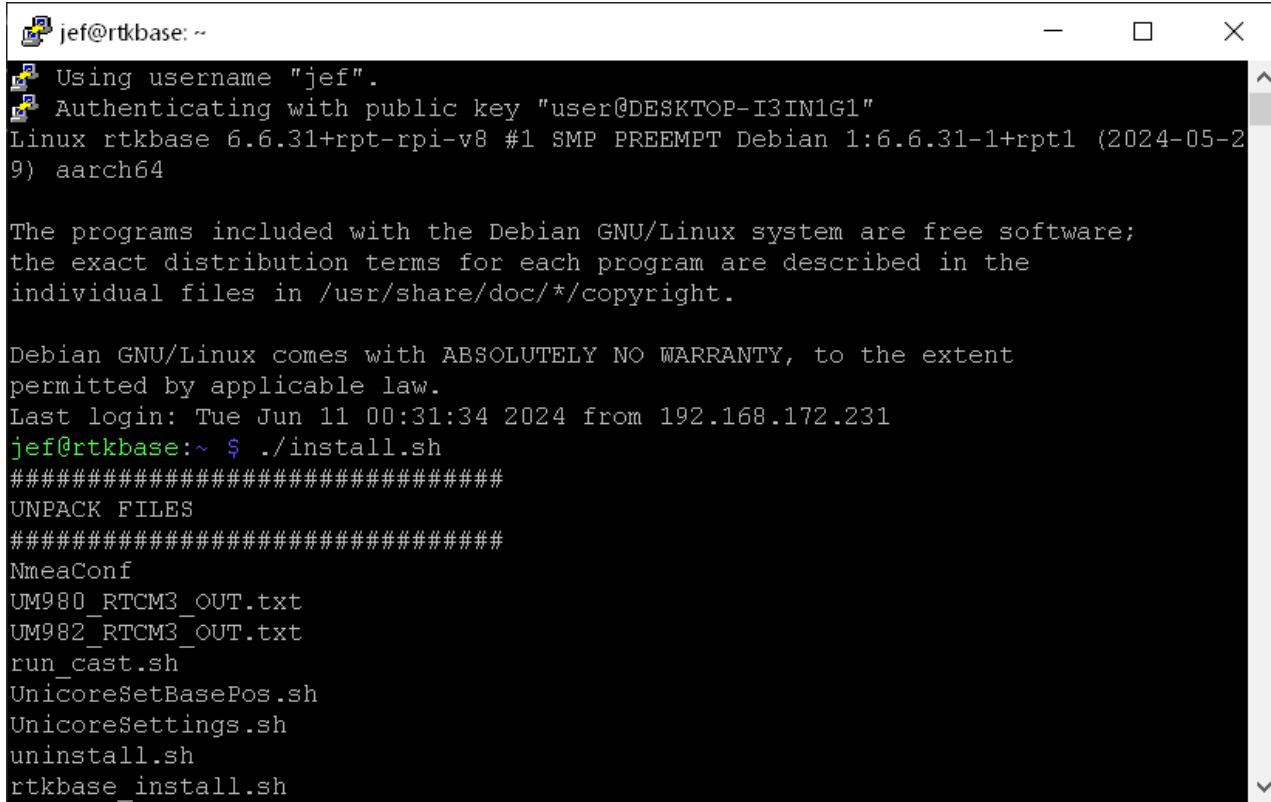
Run the script with the command **./install.sh**. The first run may cause a reboot, do not be alarmed.

```
PuTTY (inactive)
RtkbaseSystemConfigureProxy.sh
server_py.patch
status_js.patch
tune_power.sh
config.txt
rtklib/convbin
rtklib/rtkrcv
rtklib/str2str
version.txt
settings_js.patch
base_html.patch
settings_html.patch
Bynav_RTCM3_OUT.txt
#####
CHECK BOOT CONFIGURATION
#####
Cnahged /boot/firmware/cmdline.txt
Please try again ./install.sh after reboot

Broadcast message from root@rtkbase on pts/1 (Tue 2024-06-11 00:53:36 BST):
The system will reboot now!

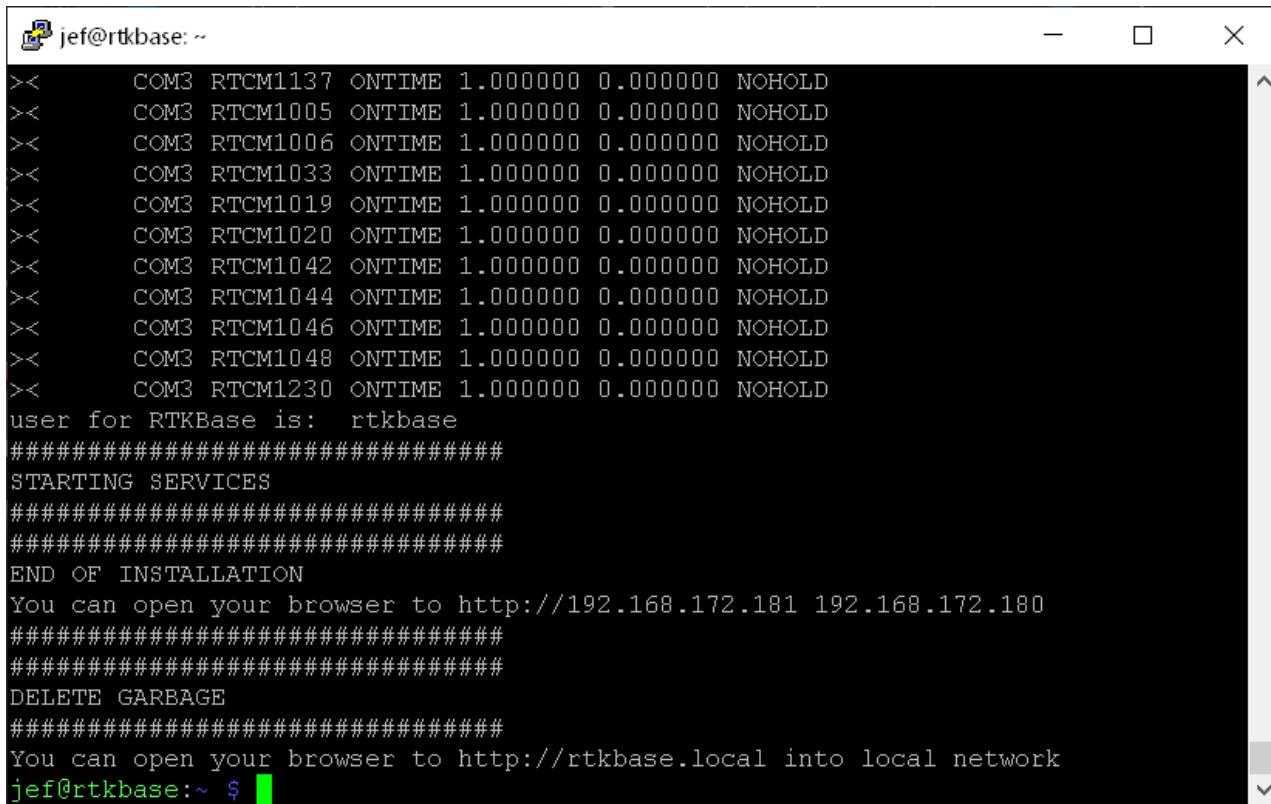
jef@rtkbase:~ $
```

The next run of **./install.sh** begins the installation.



```
jef@rtkbase:~  
Using username "jef".  
Authenticating with public key "user@DESKTOP-I3IN1G1"  
Linux rtkbase 6.6.31+rpt-rpi-v8 #1 SMP PREEMPT Debian 1:6.6.31-1+rpt1 (2024-05-29) aarch64  
  
The programs included with the Debian GNU/Linux system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/*copyright.  
  
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent  
permitted by applicable law.  
Last login: Tue Jun 11 00:31:34 2024 from 192.168.172.231  
jef@rtkbase:~ $ ./install.sh  
#####  
UNPACK FILES  
#####  
NmeaConf  
UM980_RTCM3_OUT.txt  
UM982_RTCM3_OUT.txt  
run_cast.sh  
UnicoreSetBasePos.sh  
UnicoreSettings.sh  
uninstall.sh  
rtkbase_install.sh
```

After it completes, you can proceed with the configuration.



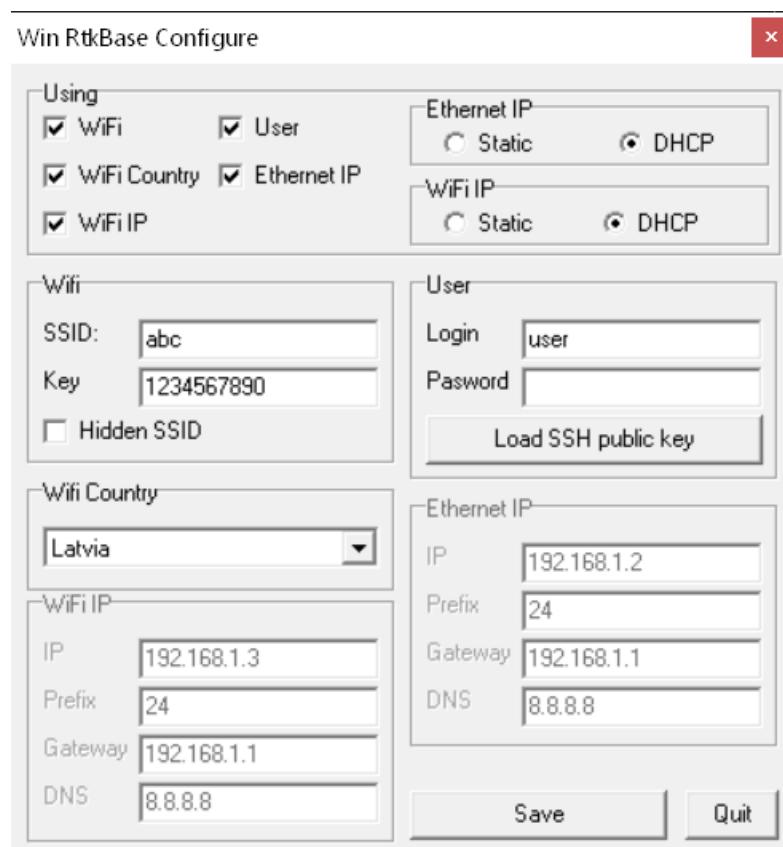
```
jef@rtkbase:~  
>< COM3 RTCM1137 ONTIME 1.000000 0.000000 NOHOLD  
>< COM3 RTCM1005 ONTIME 1.000000 0.000000 NOHOLD  
>< COM3 RTCM1006 ONTIME 1.000000 0.000000 NOHOLD  
>< COM3 RTCM1033 ONTIME 1.000000 0.000000 NOHOLD  
>< COM3 RTCM1019 ONTIME 1.000000 0.000000 NOHOLD  
>< COM3 RTCM1020 ONTIME 1.000000 0.000000 NOHOLD  
>< COM3 RTCM1042 ONTIME 1.000000 0.000000 NOHOLD  
>< COM3 RTCM1044 ONTIME 1.000000 0.000000 NOHOLD  
>< COM3 RTCM1046 ONTIME 1.000000 0.000000 NOHOLD  
>< COM3 RTCM1048 ONTIME 1.000000 0.000000 NOHOLD  
>< COM3 RTCM1230 ONTIME 1.000000 0.000000 NOHOLD  
user for RTKBase is: rtkbase  
#####  
STARTING SERVICES  
#####  
#####  
END OF INSTALLATION  
You can open your browser to http://192.168.172.181 192.168.172.180  
#####  
#####  
DELETE GARBAGE  
#####  
#####  
You can open your browser to http://rtkbase.local into local network  
jef@rtkbase:~ $
```

# Configuring Raspberry Pi

Configure the **Raspberry Pi** by inserting the **SD** card into a card reader and creating a **system.txt** file in the root directory of the first (the only one visible, if you have **Windows**) partition of the card. This file sets parameters with simple pairs consisting of the parameter name, equal sign, and value. Each line contains one pair, if there are spaces inside the value, the entire value must be in quotes. Line endings can be any (both **Windows** and **Linux**).

The file is applied at **Raspberry Pi** startup and is then deleted from the disk after being applied. Information about the application of the settings (both success and errors) is visible at the bottom of the **Diagnostic** page in the section related to the **RtkbaseSystemConfigure** service. For instructions on how to open the Diagnostic page, see the “Diagnostics” section.

The simplest way to create such a file is to run the **WinRtkBaseConfigure.exe** application. You can find the application on the **SD** card or download it from [the provided link](#).



The application has five sections described below. Check the boxes for what you want to set up, then enter the values. To load an **SSH** public key, click the “**Load SSH public key**” button, select the key, and click **Open**. The application suggests using your own public key (it is created in the **.ssh** folder in the user directory when you install the **SSH** client on your computer) but allows you to choose any other key. After entering all the values, click **Save**. The application will automatically find where the **SD** card is inserted and write the **system.txt** file to it.

## WiFi Standard

Different countries allow different frequencies for **WiFi** operation, so the standard is set by choosing the country according to the **ISO 3166-1** two-letter code. For example, the string **country=LV** means Latvia. For the USA, you should write **COUNTRY=US**.

## Connecting to WiFi

The **SSID** (name) of the **WiFi** network is set in the **SSID** parameter, and the key (password) for access to the network is set in the **KEY** parameter (which can be omitted). For a network with a hidden **SSID**, add **HIDDEN=Y**. For example:

```
SSID=$'A B C'  
KEY=$'`$\\\"|/\\x7F\\u0409\\u00B6'  
HIDDEN=Y
```

The **SSID** and password, as well as the user password, can be defined using [ANSI C string rules](#), allowing the use of characters in both **HEX** and **UNICODE** formats.

## Adding Users

To add a user, you need to set their login (**LOGIN**), password (**PWD**), and/or SSH public key (**SSH**) for the user who will log in to the **Raspberry Pi**. For example:

```
LOGIN=abc  
PWD="1 23"  
SSH="ssh-rsa AAAAB3NzaC1yc2E18cu66peHViu0U5CQF abc@comp"
```

Quotes for **SSH** are mandatory. The username is specified in lowercase Latin letters and can include numbers, underscores, and hyphens. The password can include **HEX** and **UNICODE** characters and must also follow [ANSI C string rules](#).

## Static IP

To assign a static IP, you need to set the static address of the **Raspberry Pi**, the subnet prefix (usually 24 or 16), the gateway address for internet access, and the **DNS** server address. Fields starting with **ETH** are used for Ethernet, and those starting with **WIFI** are used for **WiFi**. For example:

```
ETH_IP="192.168.1.2/24"  
ETH_GATE="192.168.1.1"  
ETH_DNS="1.1.1.1"  
  
WIFI_IP="192.168.1.3/24"  
WIFI_GATE="192.168.1.1"  
WIFI_DNS="8.8.8.8"
```

If you are using the **Raspberry Pi** in a network without internet access, do not specify a **DNS**. If your network has no gateway (for example, a direct connection between the **Raspberry Pi** and a laptop), do not specify a gateway.

## Connection

First, you need to mount the antenna on the roof or a high pole. For details on antenna installation, refer to [our blog](#). The key is to give the antenna as much open sky as possible and minimize reflected satellite signals. The antenna itself is sealed, but its connector is not. Therefore, it is recommended to seal the connection point between the antenna and the cable with heat shrink tubing or special self-vulcanizing tape.

First, insert the **SD** card into the right slot and connect the antenna to the **IN (SMA type)** connector on the left. The **OUT** connector (also **SMA type**) is the output of the built-in splitter. You can connect another **GNSS** receiver to it, for example, for **GEODNET**.



If you are connecting via **WiFi**, don't forget to set the **SSID**, password, and country of your **WiFi** network, as described in the “Connecting to WiFi” section. If you are connecting via **Ethernet**, plug it into the port on the left. Then, connect the power cable to the **USB Type-C** port on the right. The other **USB** and **HDMI** ports are disabled.



The indicators on the front panel signal power status, internet connection, and satellite signal reception.

Finally, plug the power adapter into the electrical outlet. The power adapter has interchangeable plugs and adapts to most types of sockets.



**Important:** After turning it on, do not turn off the device for at least five minutes as slow installation and setup operations are being performed.

## **Mounting**

The device should be placed in a cool, dust-free, and dry location. Avoid direct sunlight, exposure to rain, snow, hail, and protect it from domestic and wild animals, birds, snakes, fish, and insects.

Besides “tabletop” placement, there are four mounting options:

### **“Bent End Plate Bracket”**



“Clip On Bracket”



“Linc Lugs”



Rail Mount for 19-inch Racks



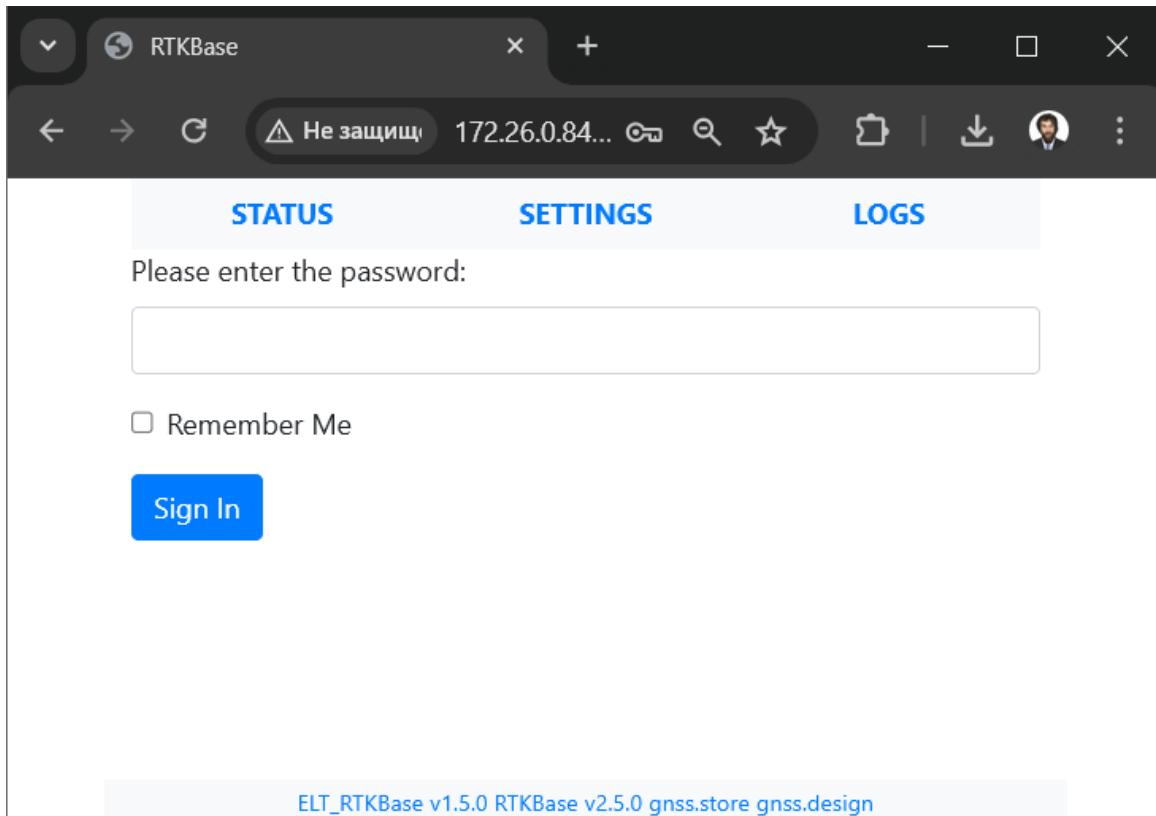
# Configuring RtkBase

## Address of Raspberry pi in the Local Network

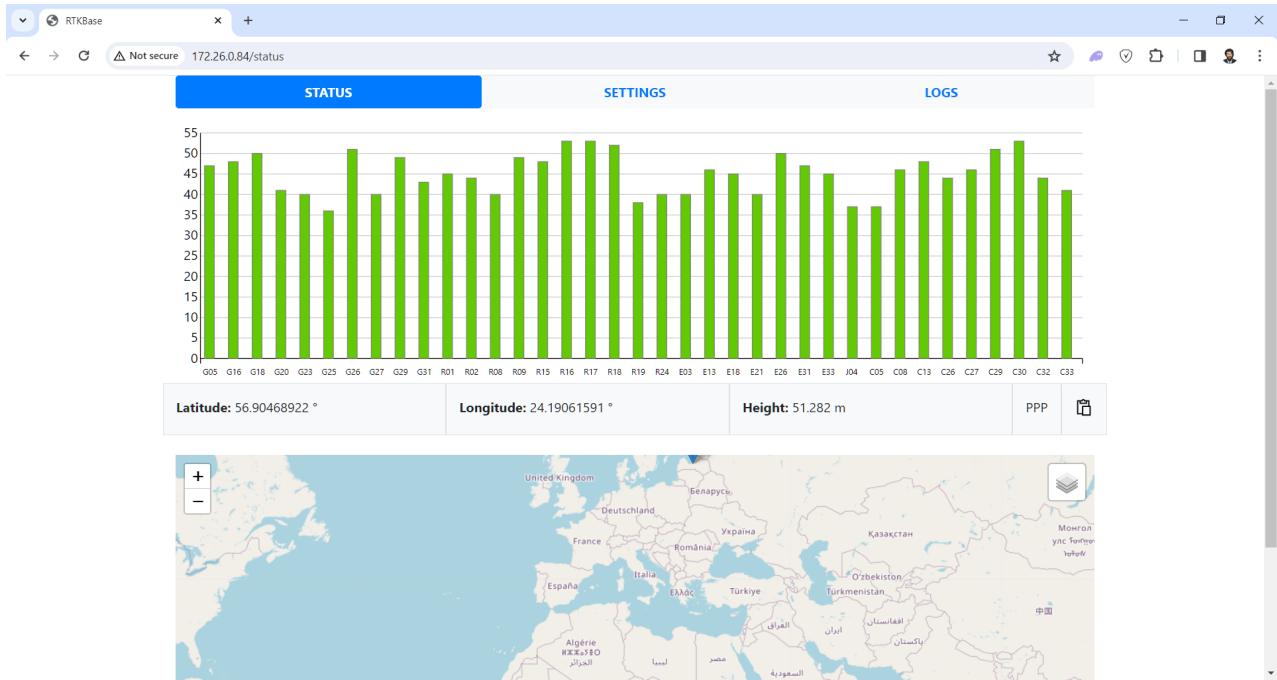
At the end of the installation, **RtkBase** will display the IP addresses of **Raspberry pi** on the screen. However, there is another way for modern operating systems — the address **rtkbase.local**, which means the site can be opened as <http://rtkbase.local>. Unfortunately, this method works only in the local network.

## Changing the Password

Log in to the site for the first time (using <http://rtkbase.local> as the address).



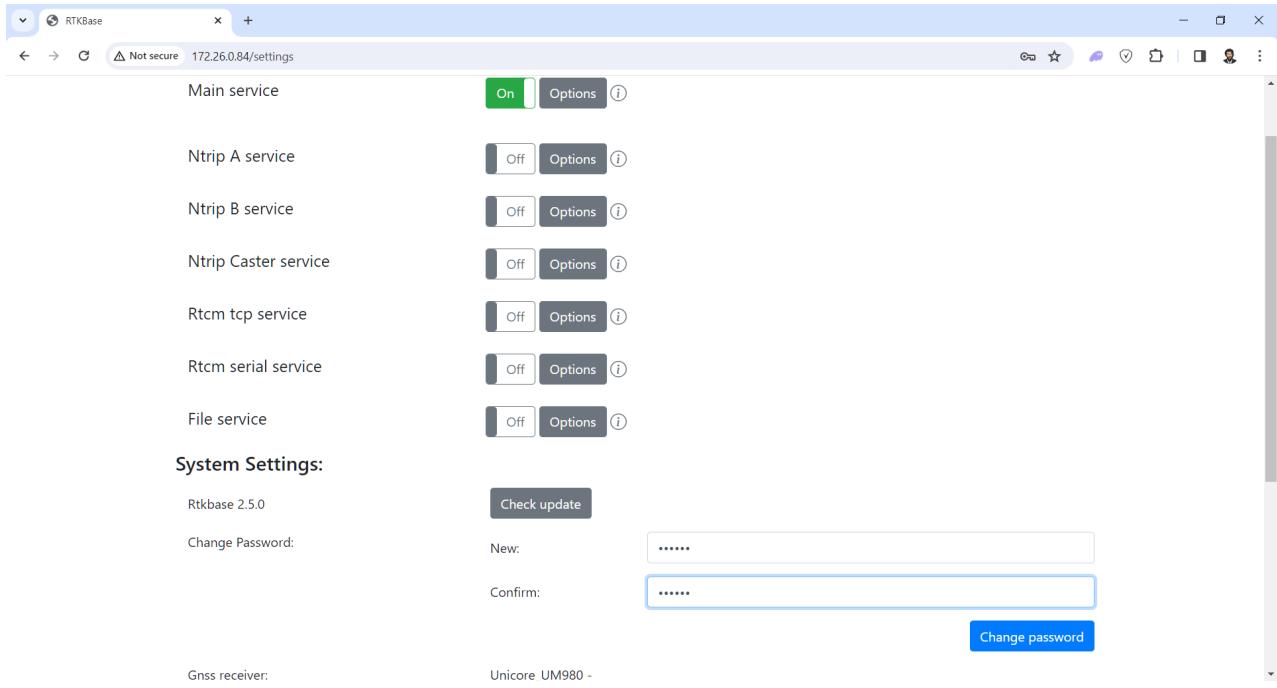
Enter the password “**admin**”.



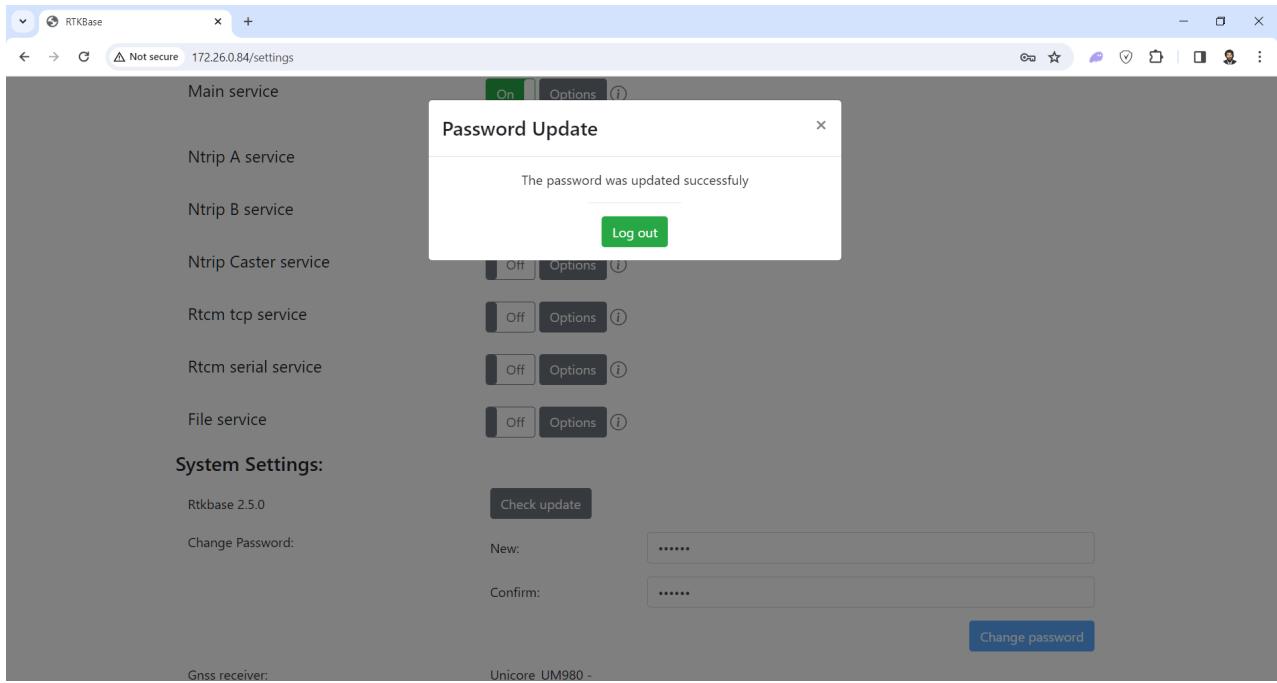
Click on **Settings** at the top.

The screenshot shows the RTKBase settings page. At the top, there are three tabs: STATUS, SETTINGS (highlighted in blue), and LOGS. The main area is divided into two sections: Services: and System Settings:. The Services: section lists several services with control buttons: Main service (On), Ntrip A service (Off), Ntrip B service (Off), Ntrip Caster service (Off), Rtcn tcp service (Off), Rtcn serial service (Off), and File service (Off). The System Settings: section includes a "Check update" button, a "Change Password:" field with "New:" and "Confirm:" input fields, and a "Rtkbase 2.5.0" label.

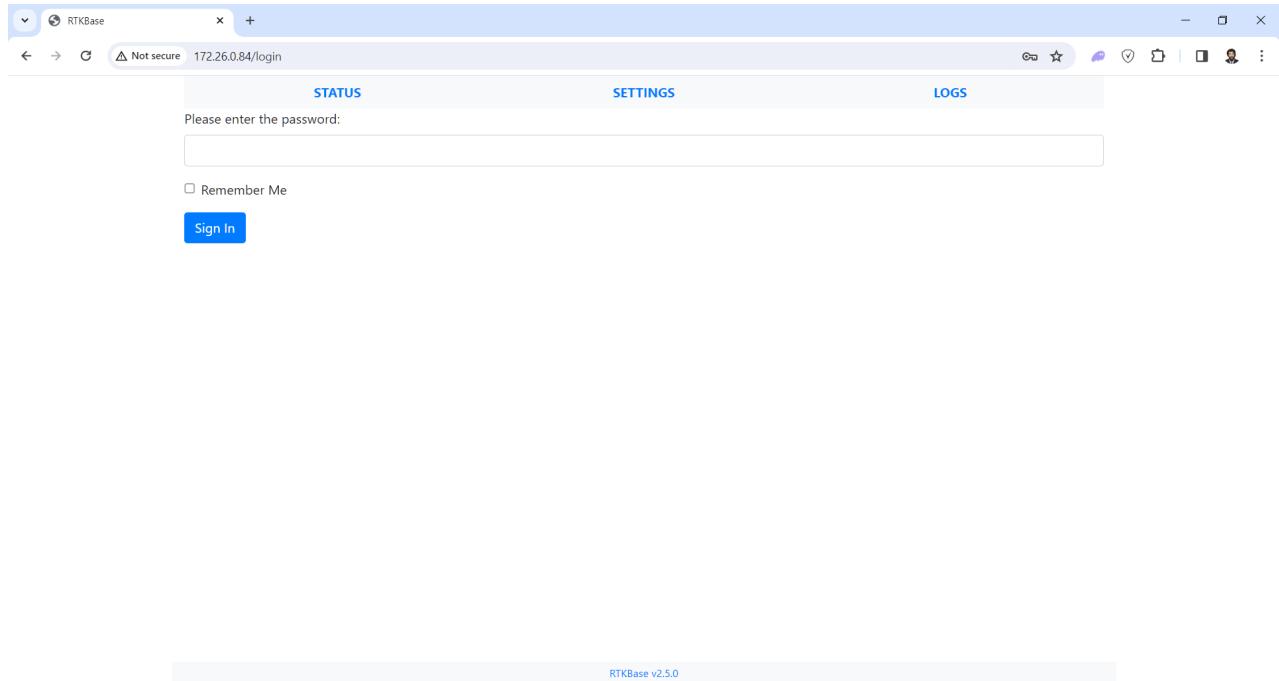
At the bottom, in the “**System Settings**” section, find “**Change Password**” and enter the new password.



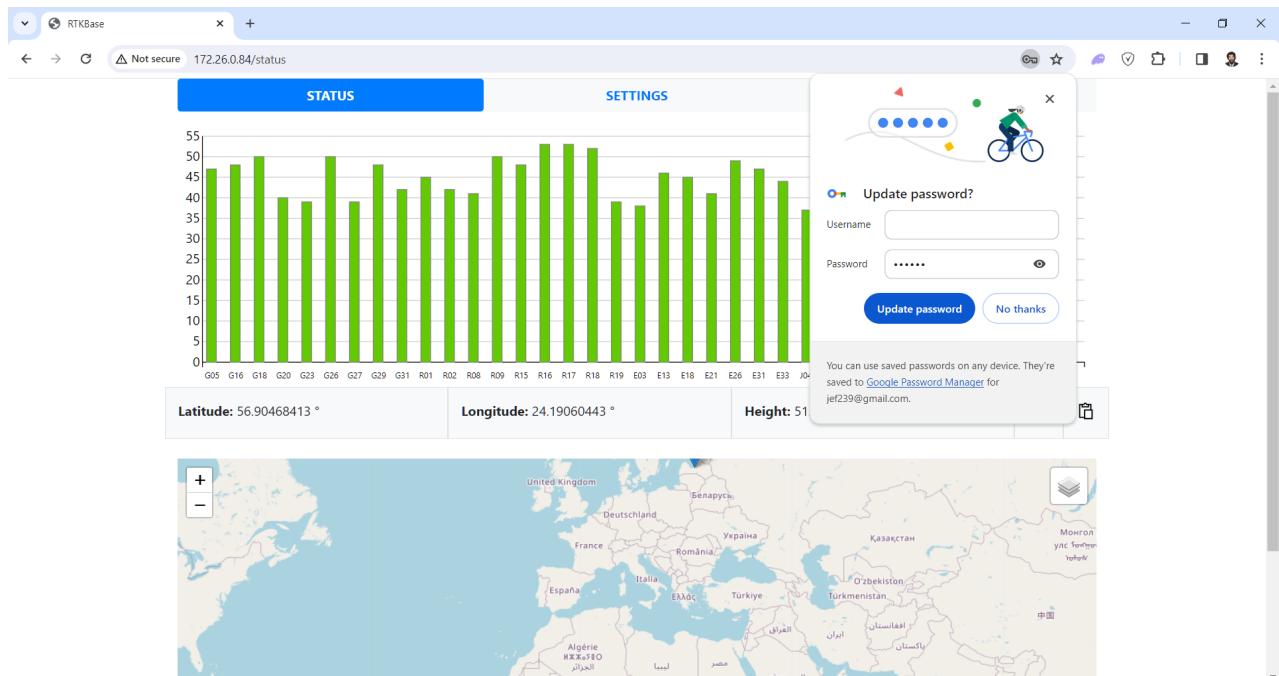
Click on the “**Change Password**” button and see the message on the screen. Now click on the “**Log Out**” button and log out.



You will end up on the login screen again. Enter the new password and check the “remember me” box.



You will be taken to the **Status** page.



## Shutdown

You can turn off the device by disconnecting the power. However, the most gentle method is to press the “**Shutdown**” button in the web interface.

Gnss receiver:	Bynav_M2-0 - V7.82_118A5B_T
Board:	Raspberry Pi 4 Model B Rev 1.5
Os:	Debian 12 (Bookworm)
CPU Temp:	50,1 C° - (highest record: 57,0C°)
Uptime:	15d 12h 51mn 11s
Storage:	20.59GB available of 30.83GB - (30.3 % used)
Settings:	<button>Backup</button> <button>Restore</button> <button>Reset</button>
Diagnostic:	<button>View</button>
Power:	<button>Reboot</button> <button>Shutdown</button>

ELT\_RTKBase v1.5.0 RTKBase v2.5.0 gnss.store gnss.design

## Configuring the Receiver

Receiver configuration is performed automatically during installation. Manual configuration is needed only when replacing the receiver.

## USB Receivers

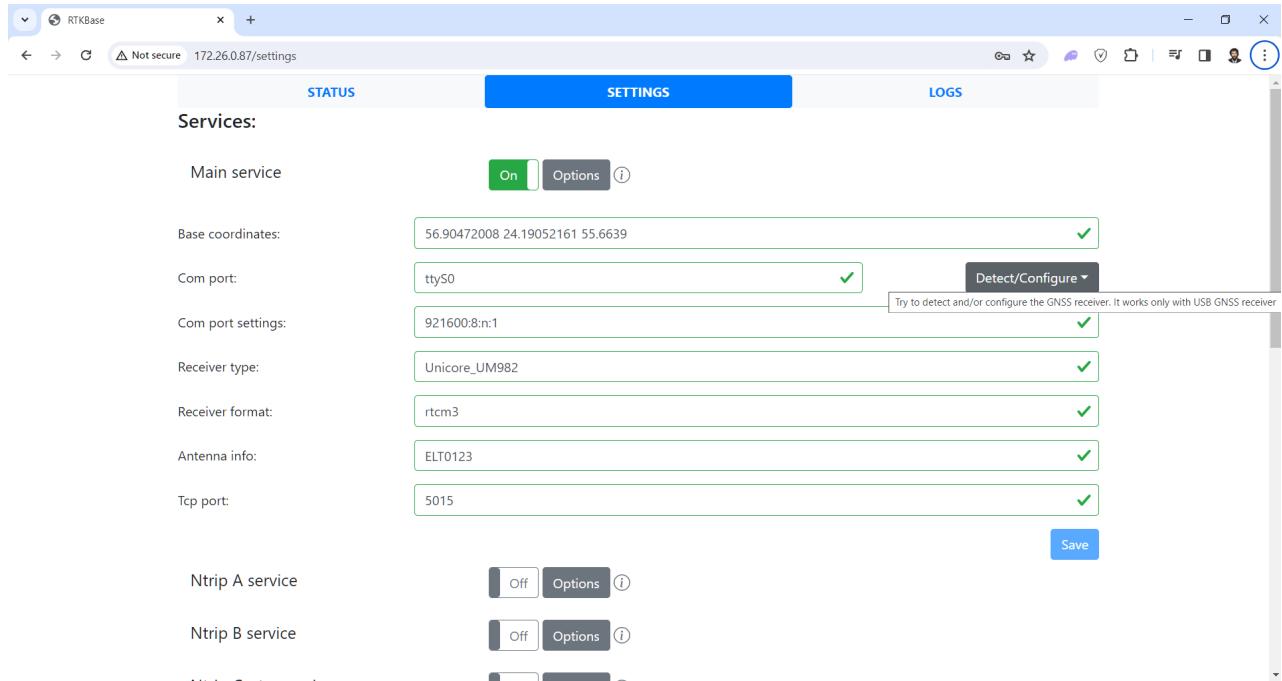
In the current version, the power to the **USB** ports is always on, so there are no specific considerations for **USB** receivers.

However, in previous versions, the power to the **USB** ports was turned off to reduce energy consumption. If you are using version 1.6.0 or earlier and want to use a **USB** receiver, set the “**Com port**” field to **ttyUSB0** (or any other **USB** port) in the settings, save the settings, and reboot the **Raspberry Pi**. After rebooting, power will be supplied to the **USB** ports, and detection and configuration will complete successfully.

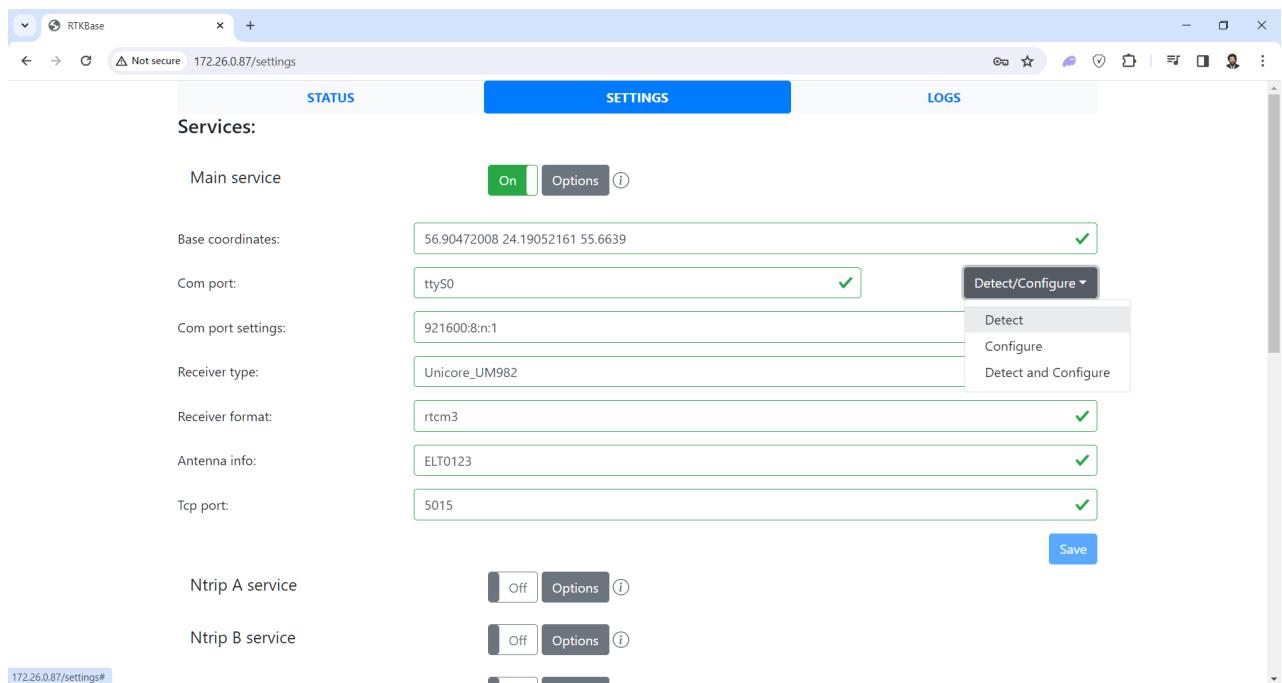
# Detection

To detect a USB receiver, you need to perform the “**Detect**” operation in the settings.

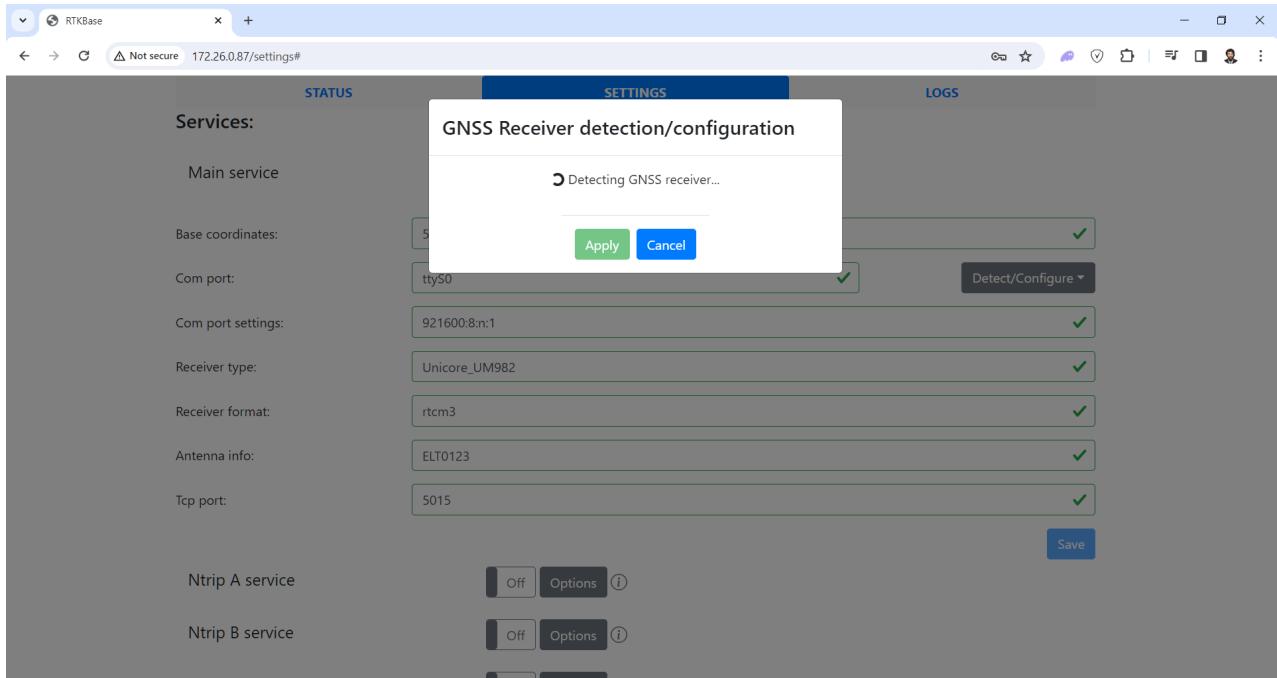
Go to the **Settings** page, and to the right of “**Main service**”, click the **Options** button.



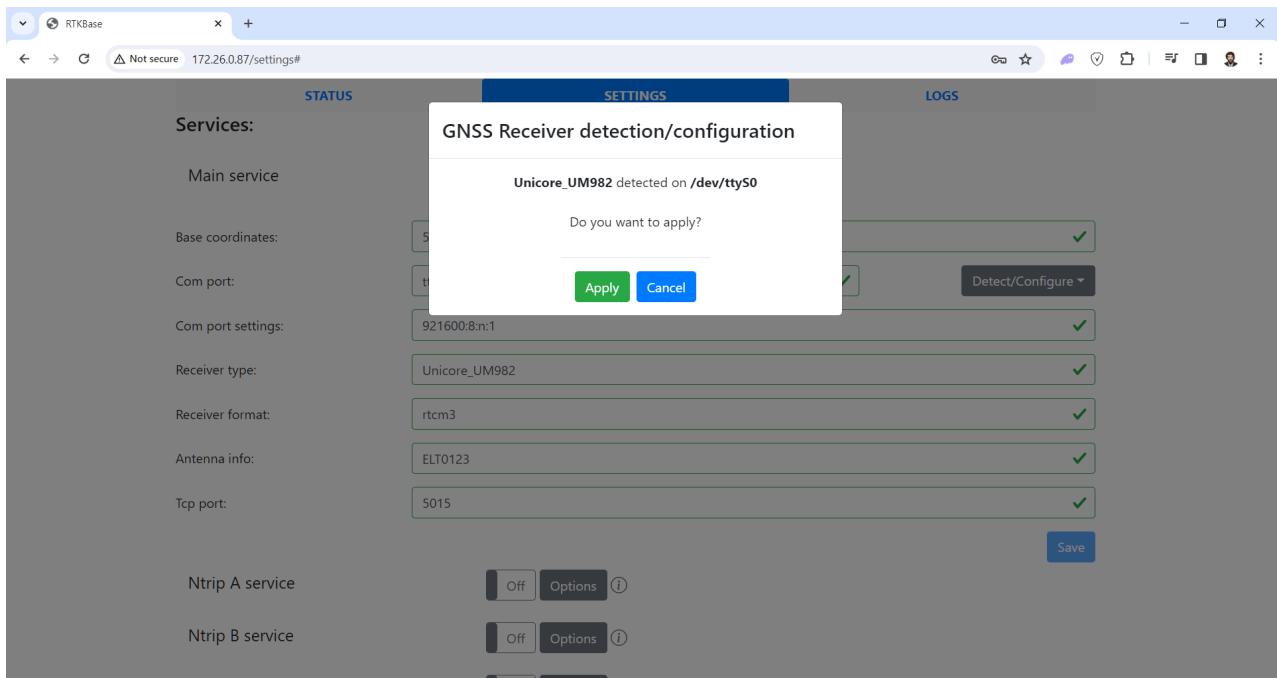
Click the “**Detect/Configure**” button and select “**Detect**” from the drop-down menu.



Detection is in progress.



The receiver is detected.

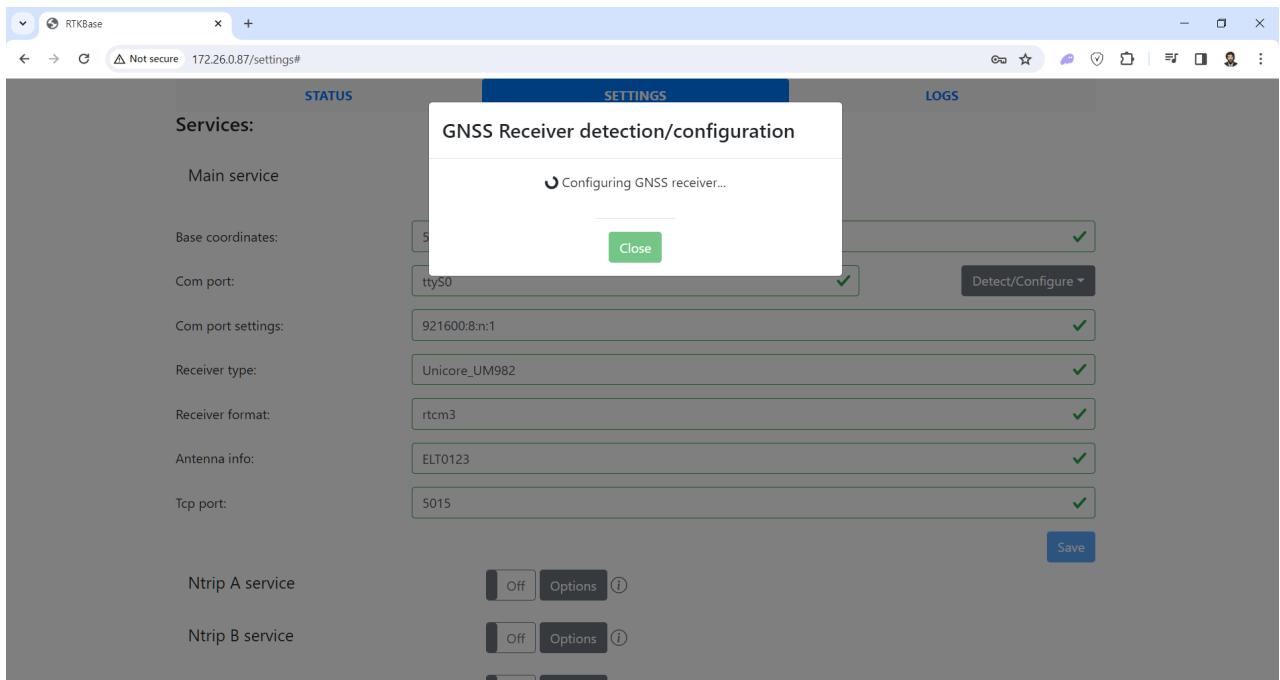


Then you can click the **Apply** button to save the detected receiver's settings (port, speed, receiver name, and protocol type). These four settings will be used later during the receiver configuration.

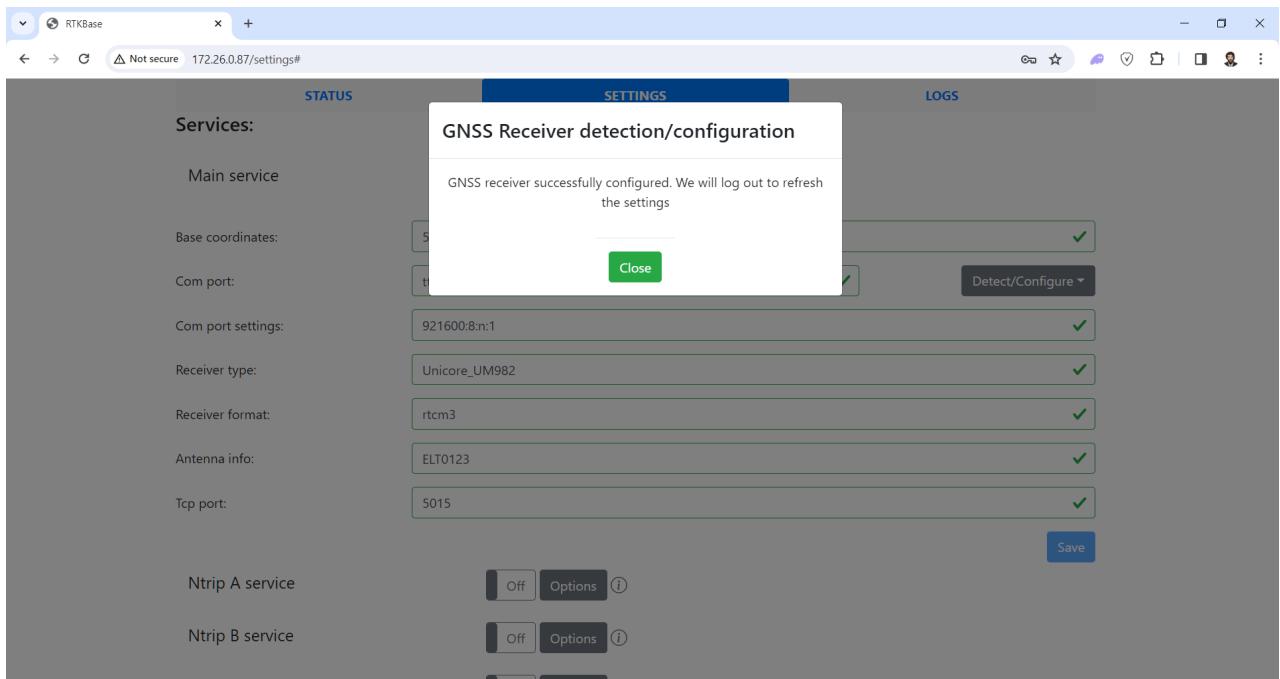
**Septentrio** receivers can operate using either the **rtcm3** protocol (by default) or the **sbf** protocol. To select the **sbf** protocol, change the protocol after detection and then proceed with the configuration.

# Configuration

To configure the receiver, do as described in the Detection section, but click the “Configure” button.



After configuration is complete, click the “Close” button.



During configuration, the receiver speed is reset to **115200**, and all services are disabled.

If the receiver was not at **115200** speed and the configuration ended with an error, the receiver speed will not match the speed specified in the settings. In this situation, you need to perform detection as described in the Detection section. In general, detection is a universal way to fix various issues.

## Checking the Receiver Firmware Version

After configuring the receiver, the firmware version is displayed at the bottom of the “Settings” page. For **Unicore UM980**, the required version is **R4.10Build10231** and above, for **Unicore UM982 – R4.10Build10186** and above, for **Bynav M2-0 — V7.81\_19D751\_T** and above, and for **Septentrio mosaic-X5 – 4.14.4** and above. If the version is older, update the firmware as described in the sections “Updating Receiver Firmware”, “Bynav M20” and “Septentrio Mosaic X5”.

Gnss receiver:

Unicore UM980 - R4.10Build10231

Board:

Raspberry Pi 4 Model B Rev 1.5

Os:

Debian 12 (Bookworm)

CPU Temp:

54,5 C° - (highest record: 56,0C°)

Uptime:

39mn 30s

Storage:

26.71GB available of 30.83GB - (8.7 % used)

Settings:

[Backup](#) [Restore](#) [Reset](#)

Diagnostic:

[View](#)

Power:

[Reboot](#) [Shutdown](#)

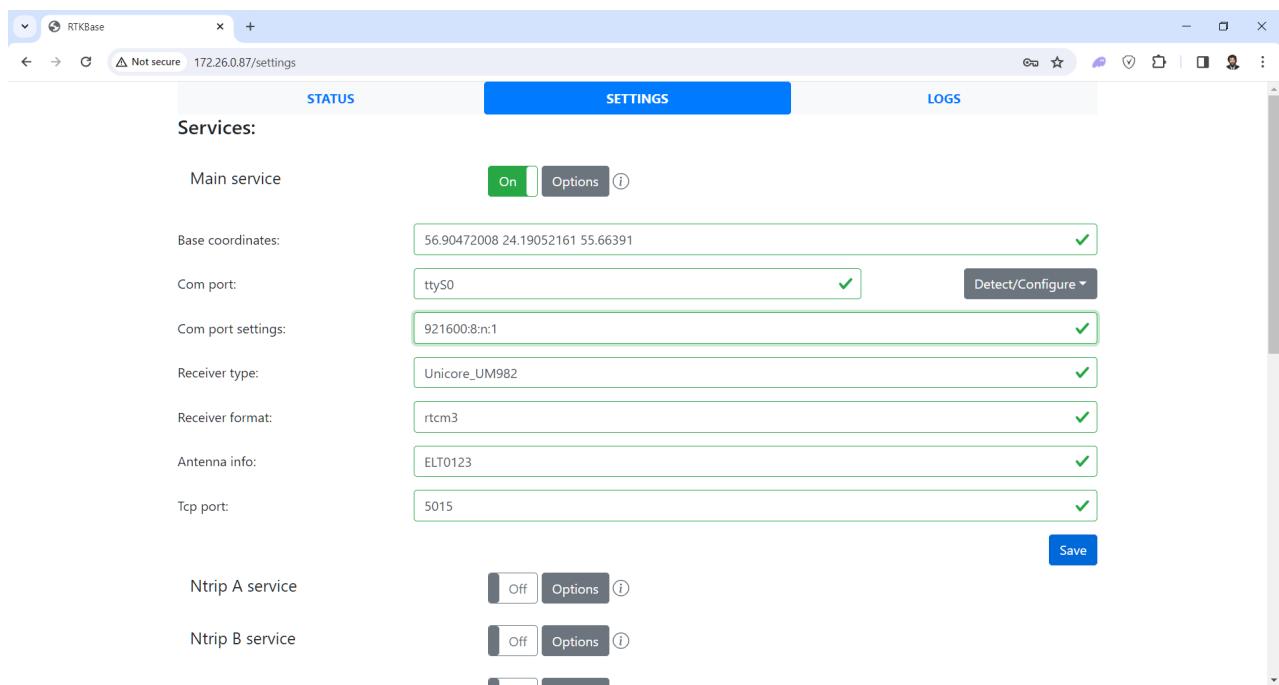
[ELT\\_RTKBase v1.5.0](#) [RTKBase v2.5.0](#) [gnss.store](#) [gnss.design](#)

# Changing the Speed

To reduce the delay time between measurements and data transmission, it can be helpful to increase the speed to **921600**. However, equipment from some manufacturers may work unstably at this speed. If you want to change the speed, simply adjust it in the settings and click the **Save** button. During saving, the receiver is reconfigured to the required speed. However, although you can enter any speed, only the speeds **115200:8:n:1**, **230400:8:n:1**, **460800:8:n:1**, **921600:8:n:1** are allowed. All other speeds are not allowed.

Manually changing other parameters (except for speed, coordinates, and antenna name) is strictly not recommended.

When the **Save** button is clicked, all services are stopped. If the main service was running at the time of clicking **Save**, it will restart, but the other services will remain stopped.

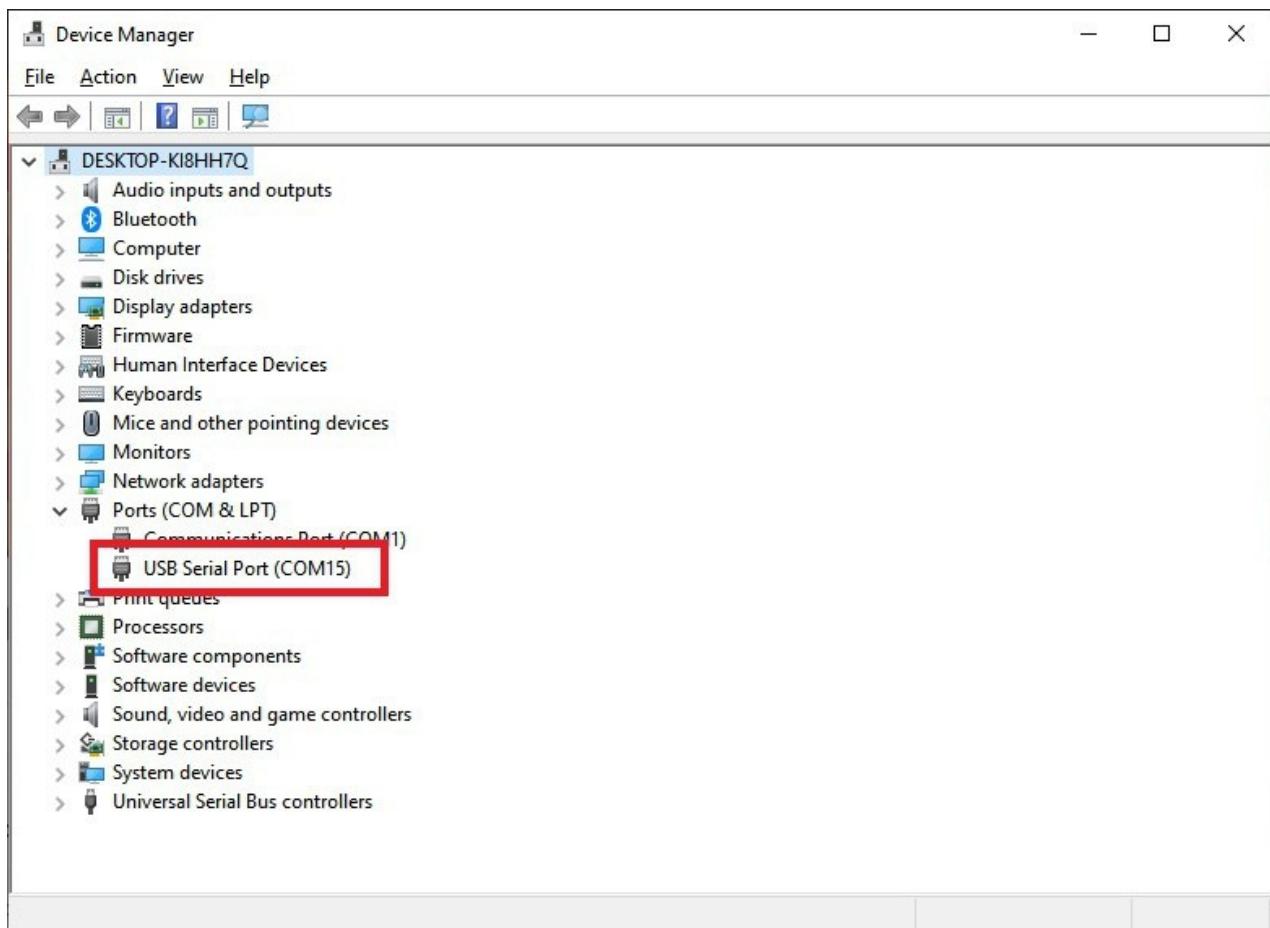


## Configuring through the USB Port

If you need to change the receiver settings in a non-standard way, you can use the **USB Type-C** connector in the corner of the receiver board. Open the case, insert the **USB** cable into the connector on the receiver board, and the other end into a Windows computer. In the photo, it's the white cable.



On the computer, open “**Device Manager**” and check the name of the newly appeared **COM** port.



# Configuring the Septentrio Receiver

## Septentrio Mosaic Website

Find the button to open the **mosaic** receiver's website on the **Settings** page and click it.

The screenshot shows the 'Mosaic Web server' interface. It includes the following information:

- Gnss receiver: Septentrio\_mosaic-X5 - 4.14.4
- Board: Raspberry Pi 4 Model B Rev 1.5
- Os: Debian 12 (Bookworm)
- CPU Temp: 58,4 C° - (highest record: 60,4C°)
- Uptime: 5h 18mn 22s
- Storage: 26.5GB available of 30.83GB - (9.4 % used)
- Settings: Backup, Restore, Reset
- Diagnostic: View
- Power: Reboot, Shutdown

At the bottom, there is a footer bar with the text: ELT\_RTKBase v1.5.5 RTKBase v2.6.0 gnss.store gnss.design

On the website that opens, you can configure the receiver.

The screenshot shows the Septentrio GNSS web interface with the following sections:

- Receiver:** mosaic-X5 S/N 3671000, IP Address:, Uptime: 0d 01:31:51
- Position:** Lat: N56°54'16.7518" 0.000m, Lon: E24°11'25.8500" 0.000m, Hgt: 47.730m, Time: 2024-08-09 22:33:09, Temp: 58.00 °C
- Status:** Tracked Sats: 60
- Quality Indicators:** Overall Quality 10/10, Main RF power 10/10, Main signals 10/10, CPU 10/10
- GNSS:** Fixed, showing connections to GPS (Position: 10, Track: 11), GLONASS (Position: 8, Track: 11), Galileo (Position: 9, Track: 10), SBAS (Position: 0, Track: 5), BeiDou (Position: 14, Track: 19), QZSS (Position: 1, Track: 1), and NavIC (Position: 0, Track: 3).

## RxTools

You can use **RxTools** utilities (such as **RxControl**) to configure the **Mosaic X5** receiver. To do this, connect via **TCP/IP**, using <rtkbase.local> or the **Raspberry Pi's IP** address as the address, and port **28784** as the port number.

## Internet Access

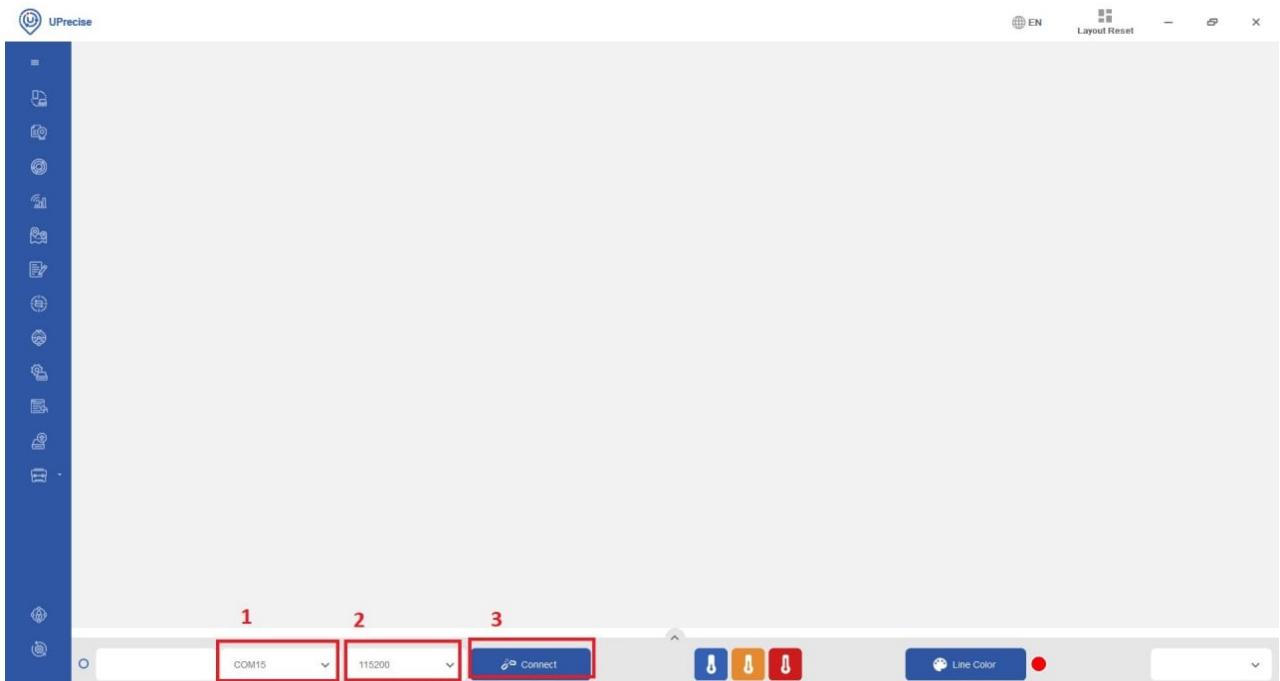
The **Mosaic X5** receiver is connected to the **Raspberry Pi** via **USB**. This means the receiver has the address **192.168.3.1**, and the **Raspberry Pi** performs **NAT** functions for it. The **Mosaic X5** receiver has nearly full internet access with a few exceptions:

- For incoming connections (**IPR** or the receiver's built-in **NTRIP** caster), only ports **3000-3009** (both **TCP** and **UDP**) are available.
- **FTP** access is not functional. Since the **Mosaic X5** does not have its own **SD** card, **FTP** is unnecessary.
- The **Mosaic X5** acts as the time server (**NTP** and **PTP** protocols), not the **Raspberry Pi**.
- Access to the **Mosaic X5**'s web interface is through port **9090**, while ports **80** and **443** are routed to the **Raspberry Pi**.
- **DNS** servers **8.8.8.8** and **1.1.1.1** are used for the **Mosaic X5**.
- The “**Outgoing Internet Access Over USB**” setting **must not** be disabled.
- The “**Ethernet Interface Mode**” setting **must not** be enabled.
- The “**TCP/IP Settings**” must be set to **DHCP**.

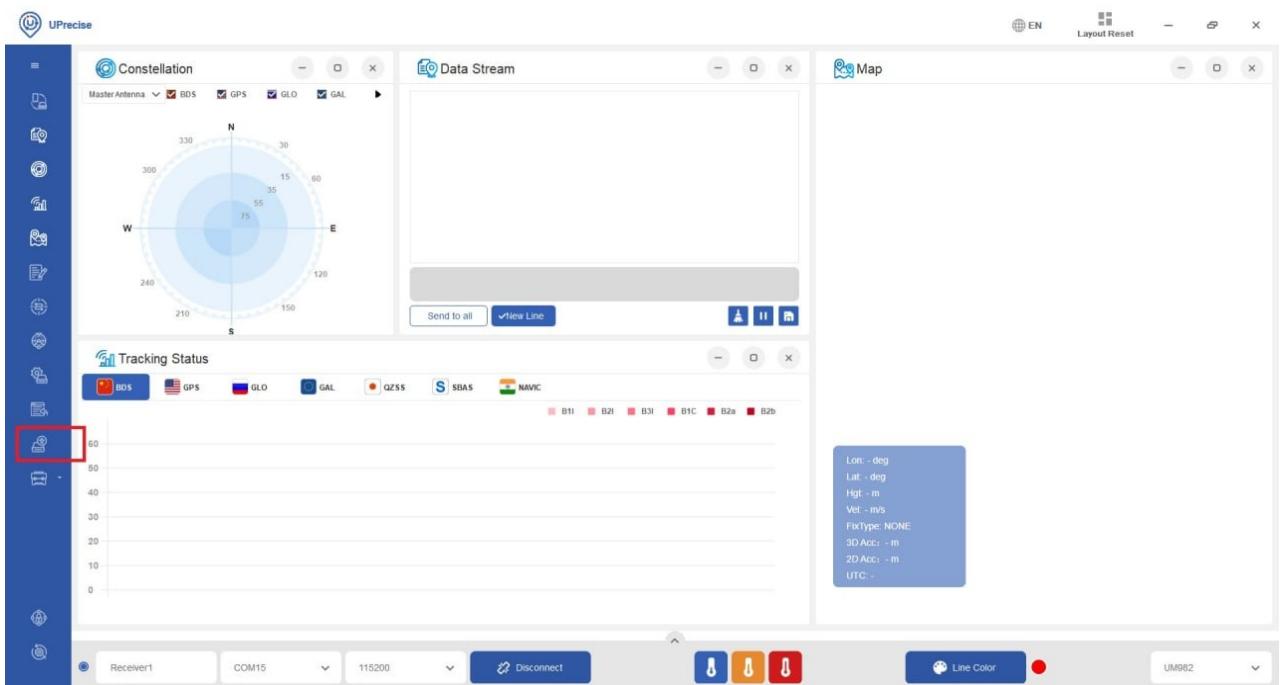
# Updating Receiver Firmware

## Unicore UM980

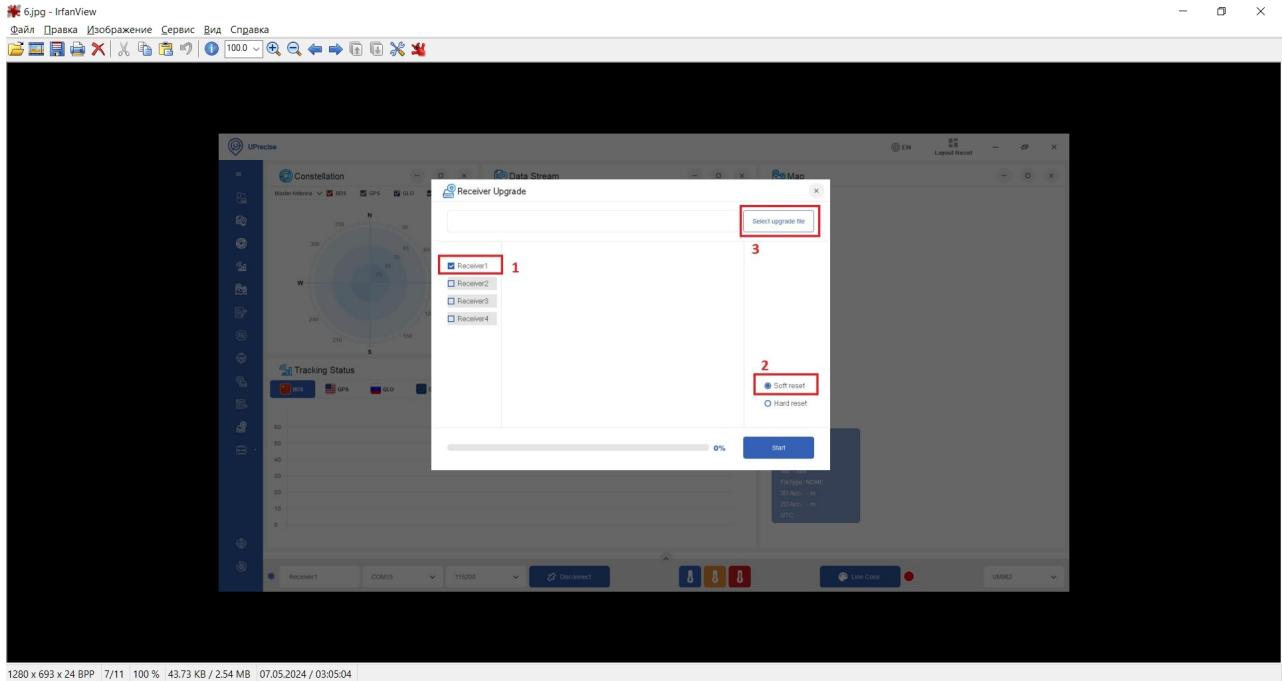
Download and run **UPrecise** from the [website](#). Enter the **COM** port (see above) and speed **115200** in the lower part (since a different receiver port is used on **USB** than on the **Raspberry Pi**, the speed will always be **115200**), then click **Connect**.



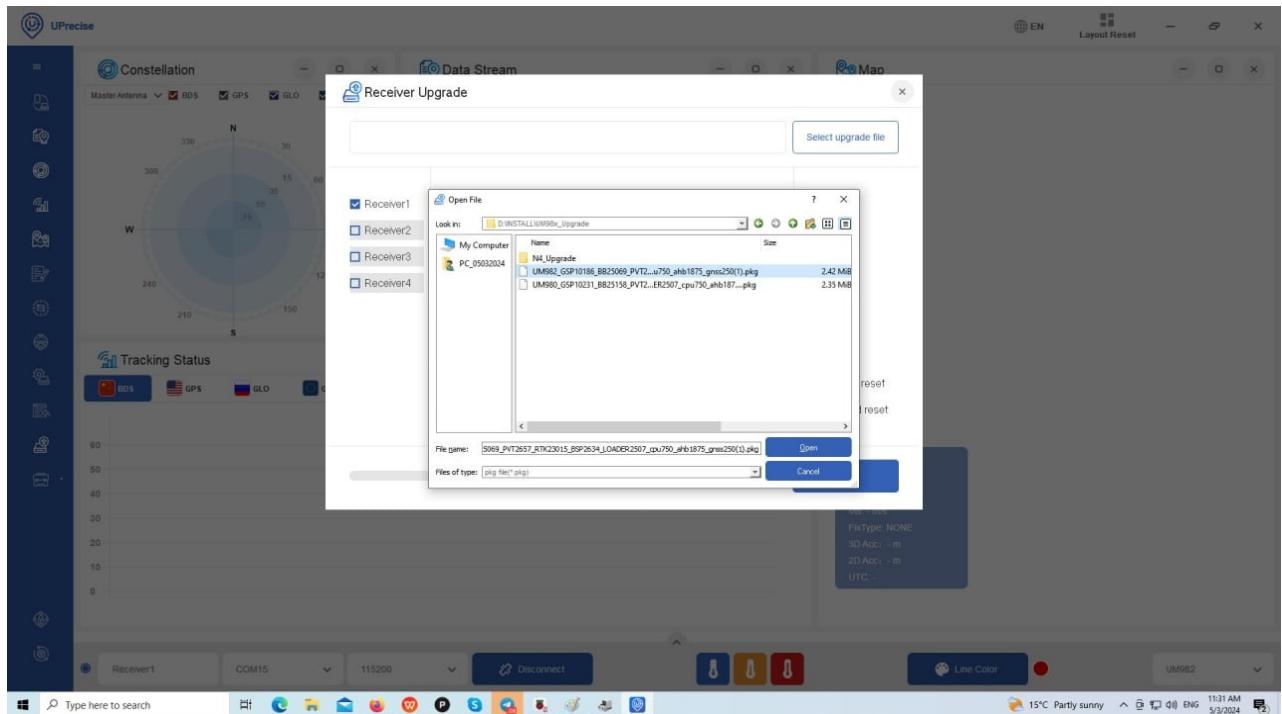
On the left panel, click the “**Receiver Upgrade**” button.



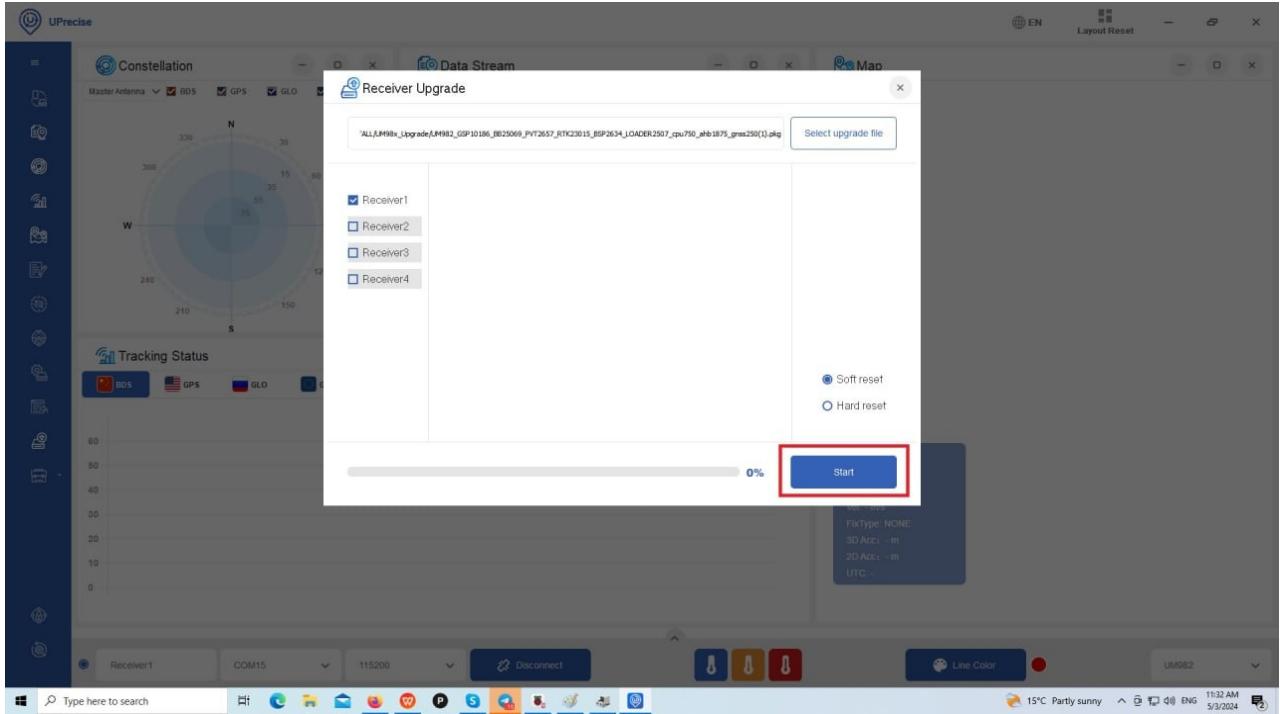
After clicking the button, the firmware update settings window appears. Check the box next to receiver 1 (and do not check the others) — number 1 in the screenshot. Select “**Soft Reset**” — number 2 in the screenshot. Click “**Select upgrade file**” — number 3 in the screenshot.



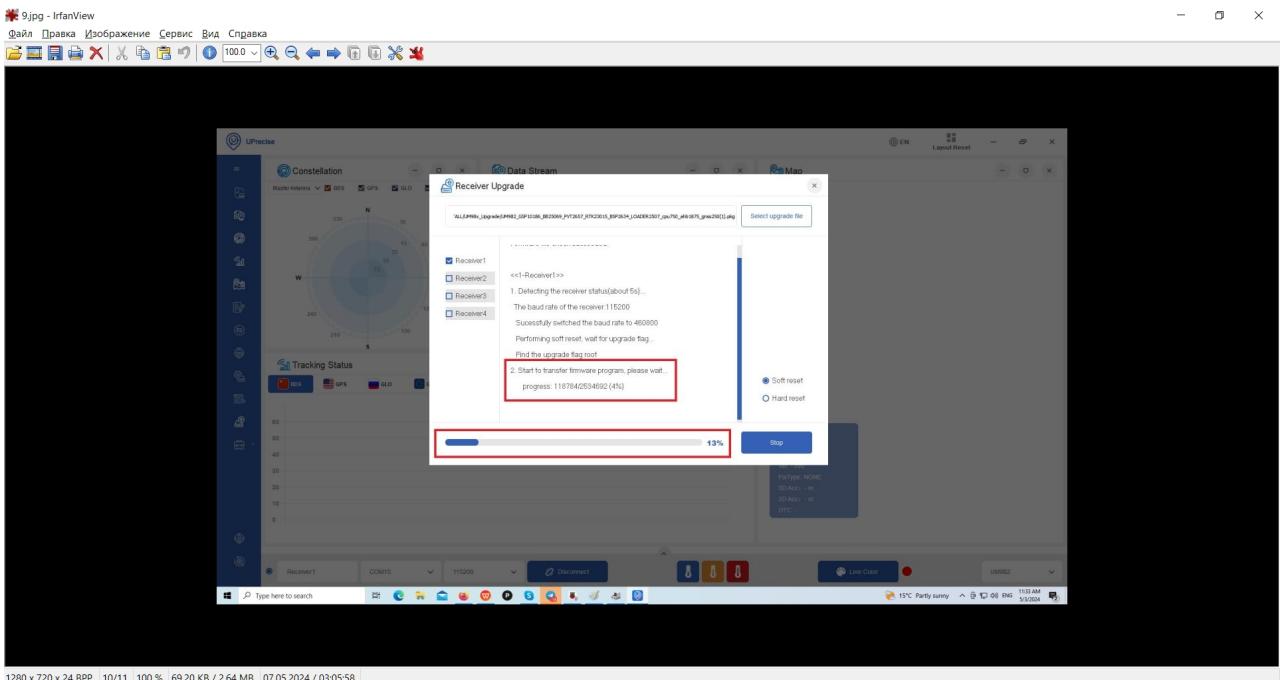
Select the new firmware file.



After selecting the new firmware file, click the **Start** button in the lower right corner of the window.

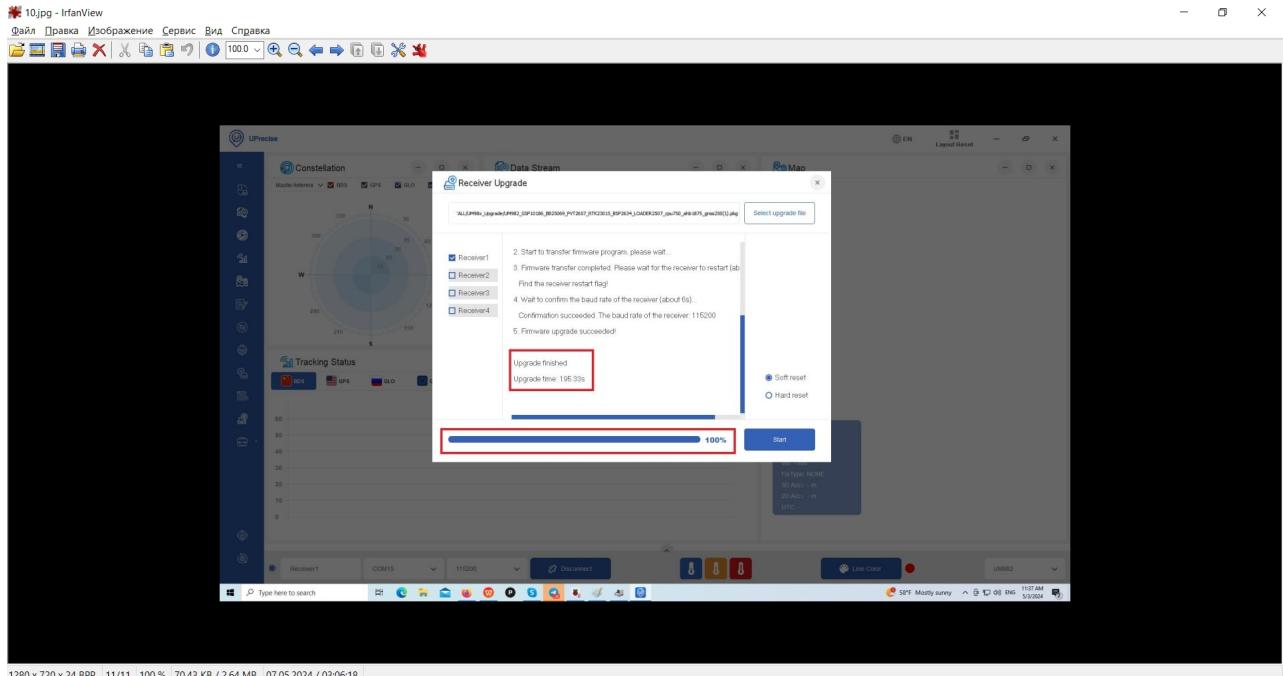


The receiver firmware update process begins.



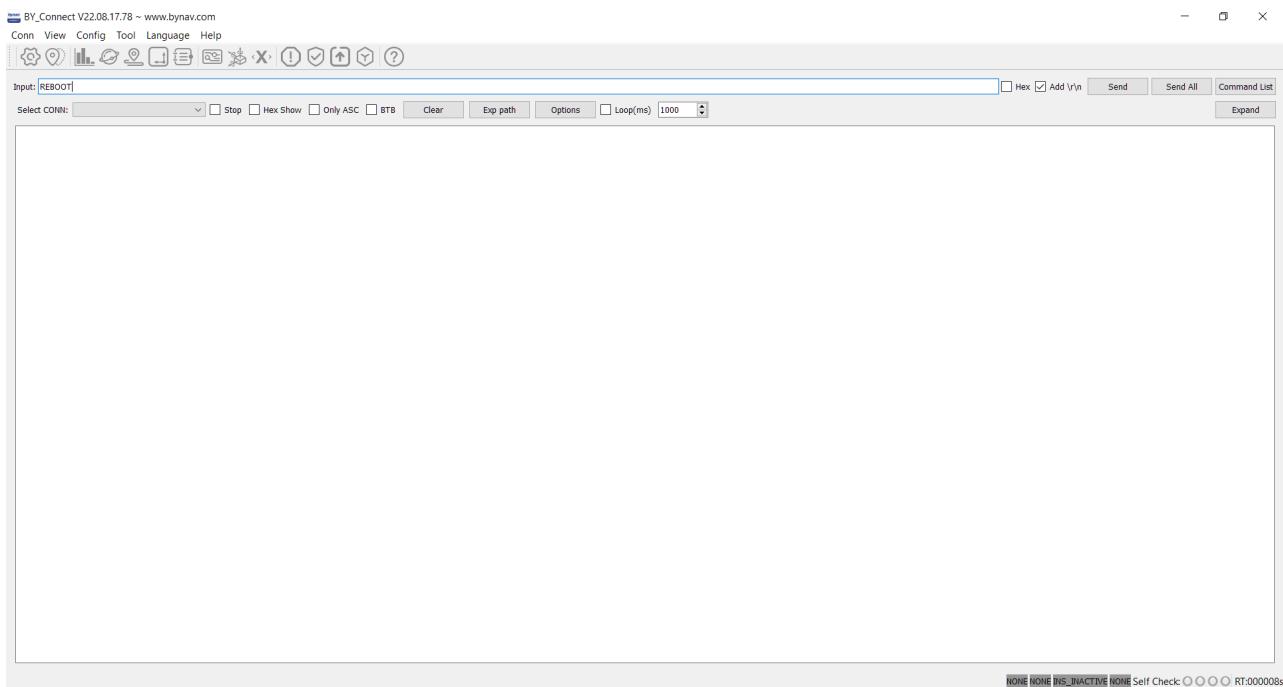
1280 x 720 x 24 BPP 10/11 100 % 69.20 KB / 2.64 MB 07.05.2024 / 03:05:58

After the firmware update is complete, a message appears.

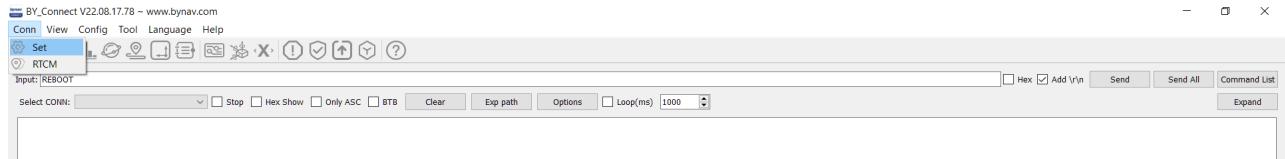


## Bynav M20

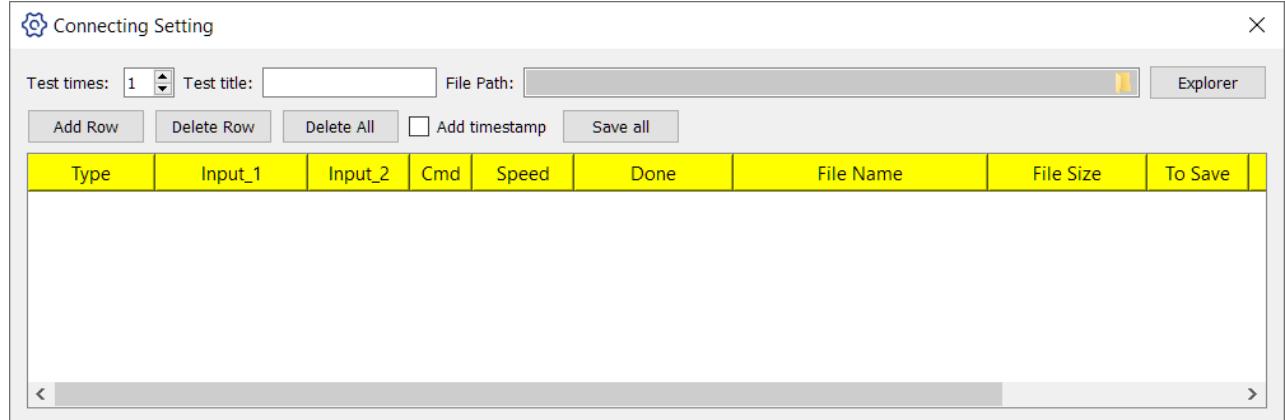
Download, unzip, and run **BY\_connect** from the [website](#).



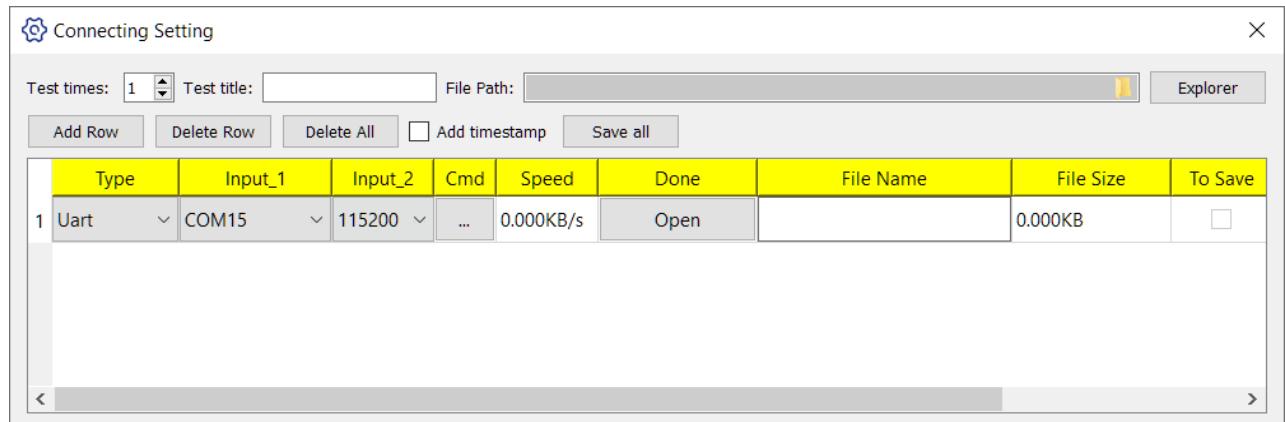
In the **Conn** menu, select **Set**.



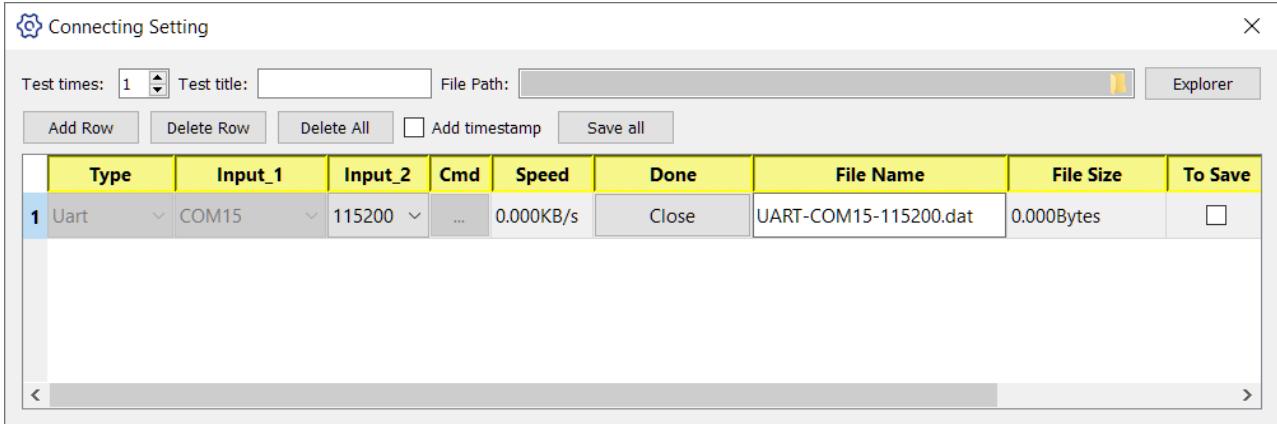
The “Connecting Setting” window opens.



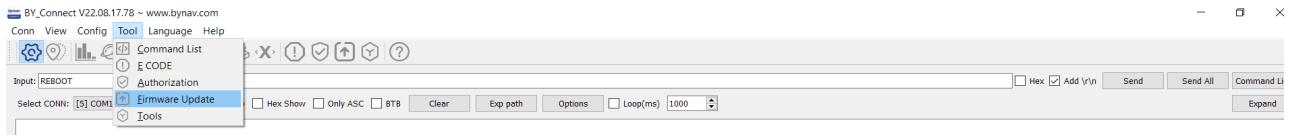
Click “Add Row” and fill in the fields as shown in the screenshot. Use the **COM** port specified in the **Device Manager**.



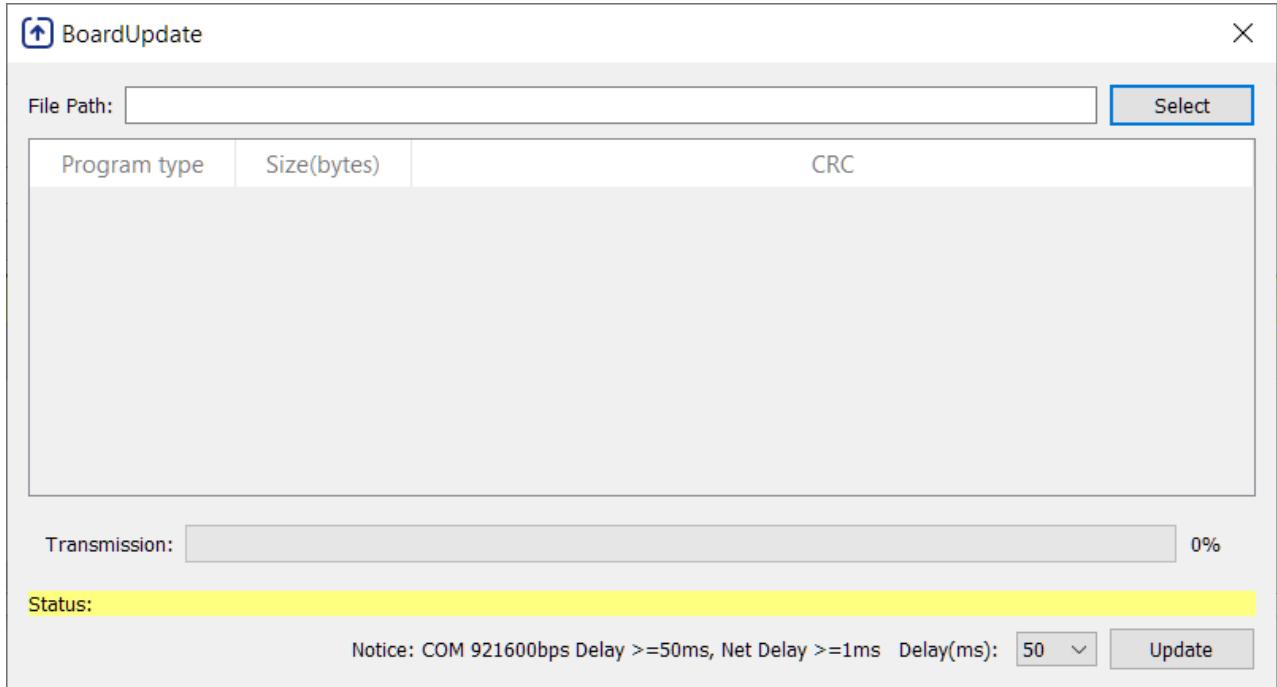
Click Open.



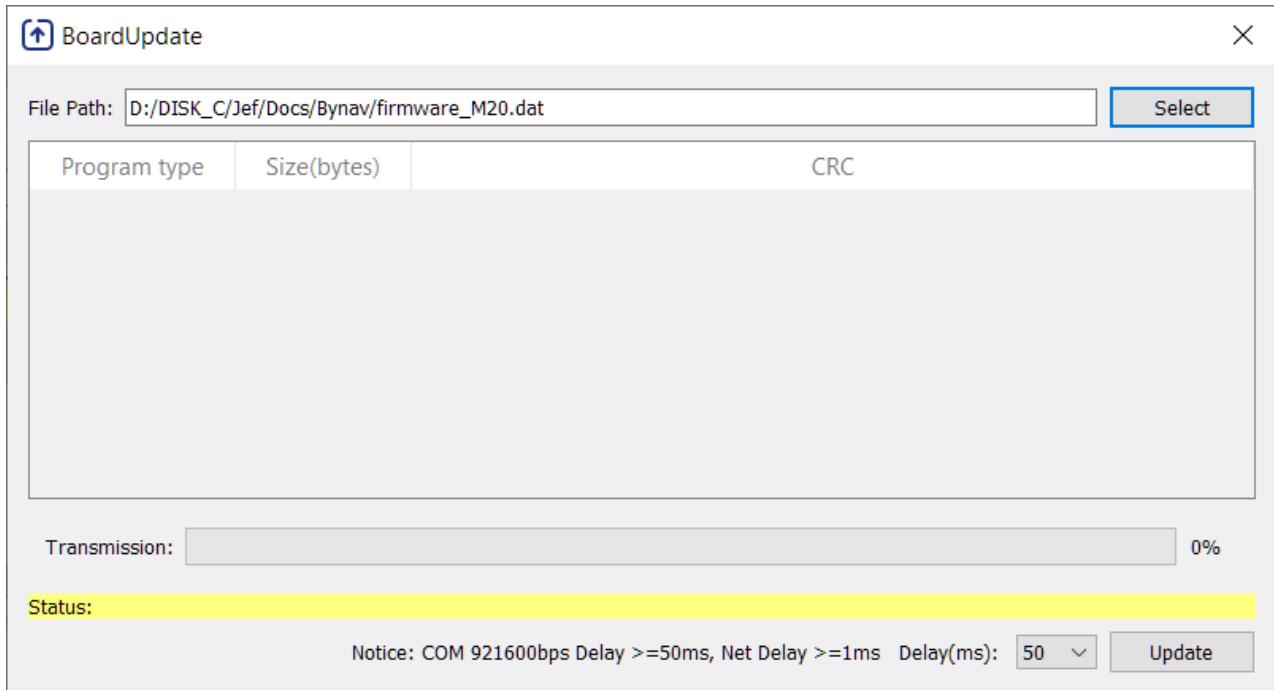
In the **Tool** menu, select “**Firmware update**”.



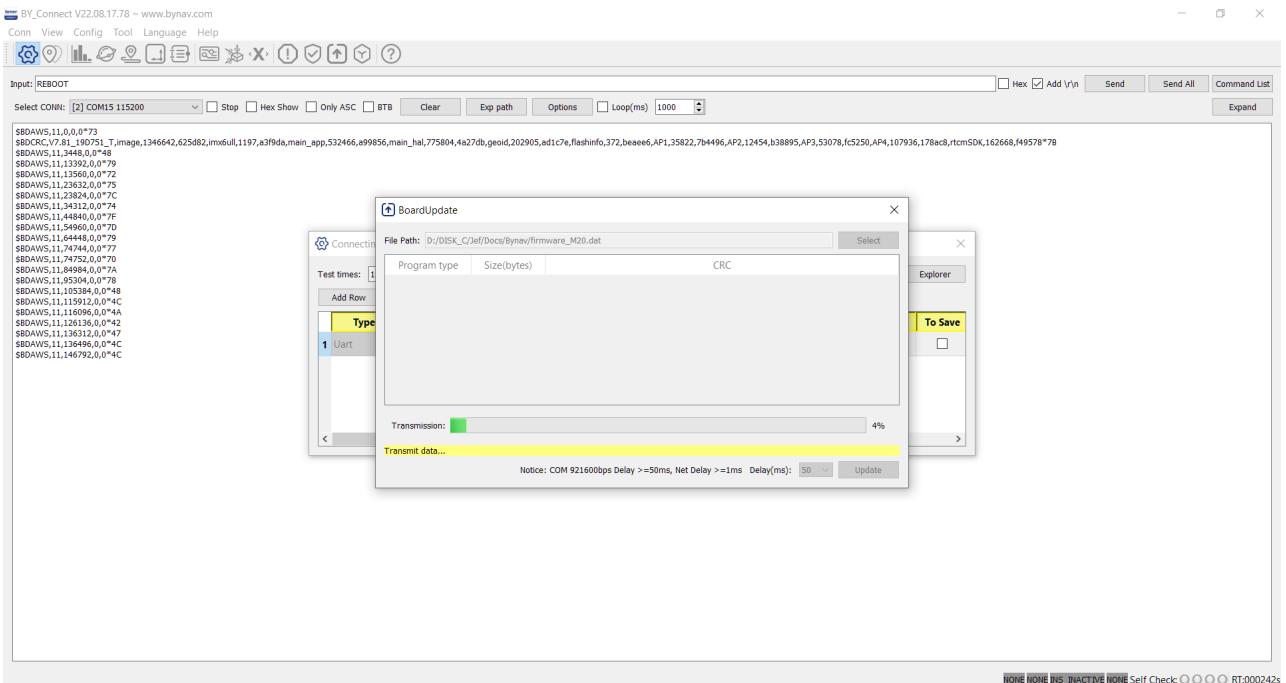
The “**BoardUpdate**” window opens. Click **Select** and choose the firmware update file.



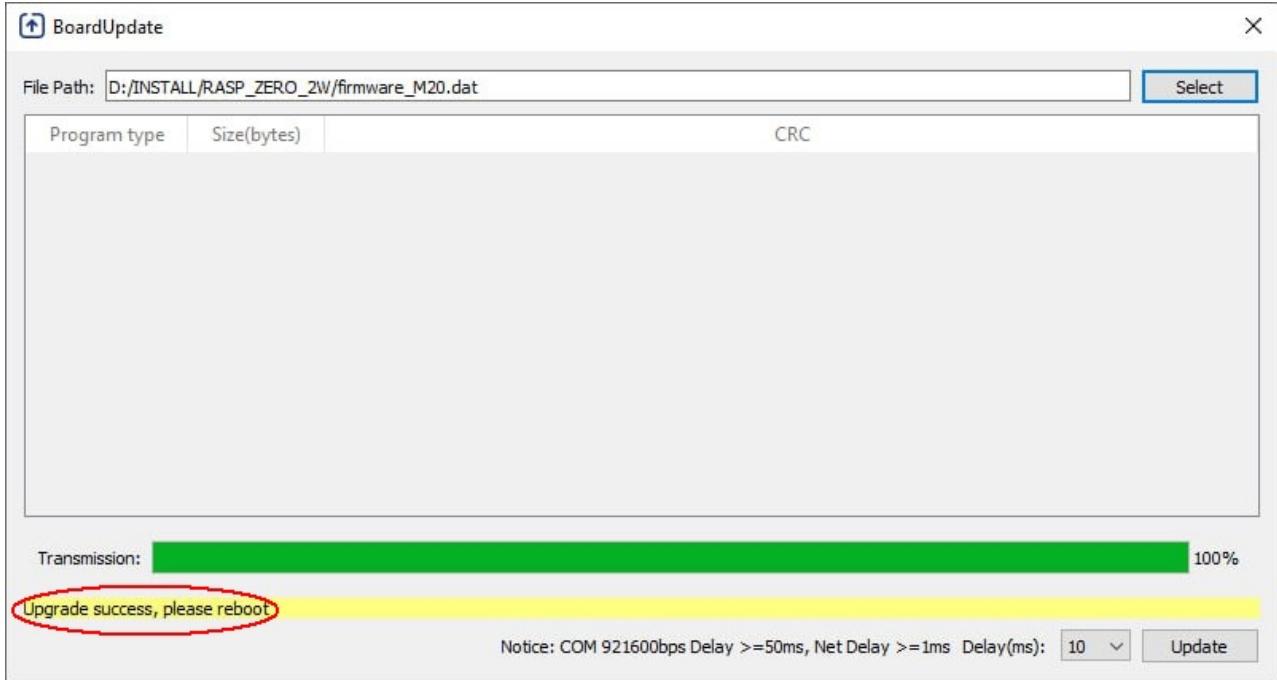
After selecting the new firmware file, click the **Update** button in the lower right corner of the window.



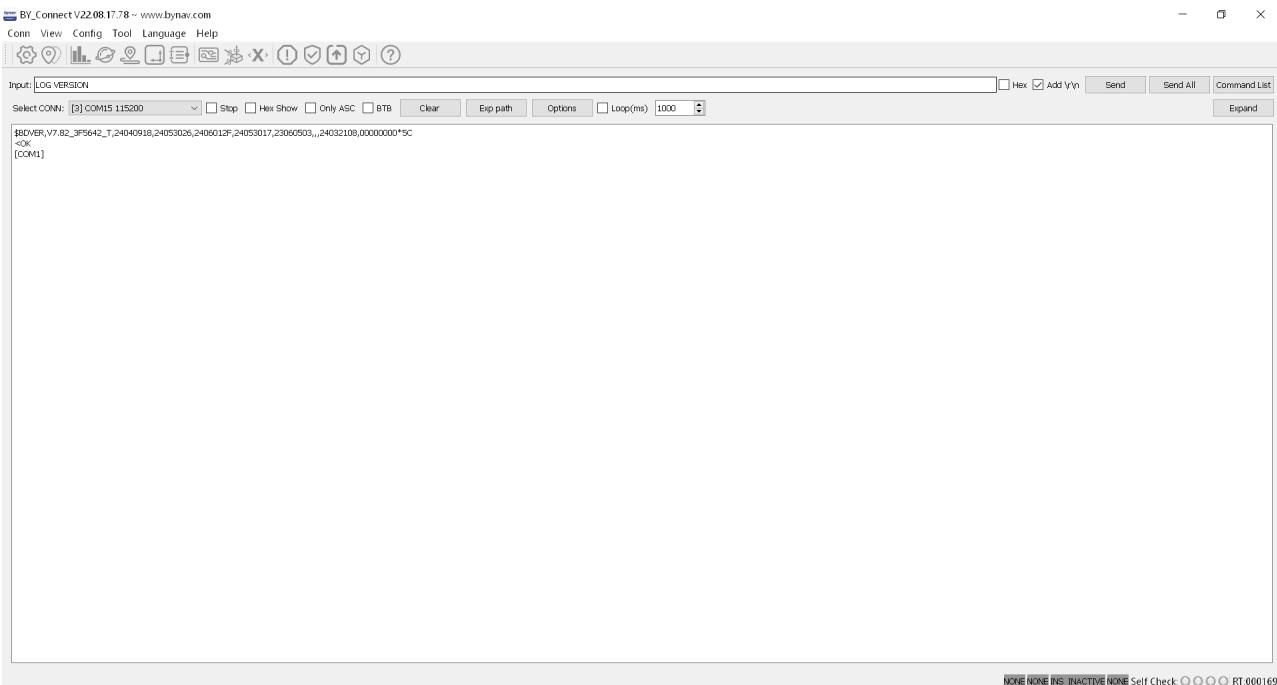
The firmware update process begins.



Wait for the firmware update to complete. On success, the message “**Upgrade success, please reboot**” appears, and on failure, “**Upgrade failure**” appears.



After the firmware update is complete, you need to issue the “**REBOOT**” command, followed by the “**LOG VERSION**” command. If any field (except the last one) in the response to this command shows only zeros, you need to repeat the firmware update.



Then configure the receiver as described in the “Configuration” section and check the receiver firmware version at the bottom of the settings page.

Gnss receiver: Bynav\_M2-0 V7.82\_3F5642\_T

Board: Raspberry Pi 4 Model B Rev 1.5

Os: Debian 12 (Bookworm)

CPU Temp: 51,1 C° - (highest record: 51,6C°)

Uptime: 34mn 23s

Storage: 26.71GB available of 30.83GB - (8.7 % used)

Settings: [Backup](#) [Restore](#) [Reset](#)

Diagnostic: [View](#)

Power: [Reboot](#) [Shutdown](#)

ELT\_RTKBase v1.5.0 RTKBase v2.5.0 gnss.store gnss.design

## Septentrio Mosaic X5

Find the button to open the **mosaic** receiver's website on the **Settings** page and click it.

Gnss receiver: Septentrio\_mosaic-X5 - 4.14.4 [Mosaic Web server](#)

Board: Raspberry Pi 4 Model B Rev 1.5

Os: Debian 12 (Bookworm)

CPU Temp: 58,4 C° - (highest record: 60,4C°)

Uptime: 5h 18mn 22s

Storage: 26.5GB available of 30.83GB - (9.4 % used)

Settings: [Backup](#) [Restore](#) [Reset](#)

Diagnostic: [View](#)

Power: [Reboot](#) [Shutdown](#)

ELT\_RTKBase v1.5.5 RTKBase v2.6.0 gnss.store gnss.design

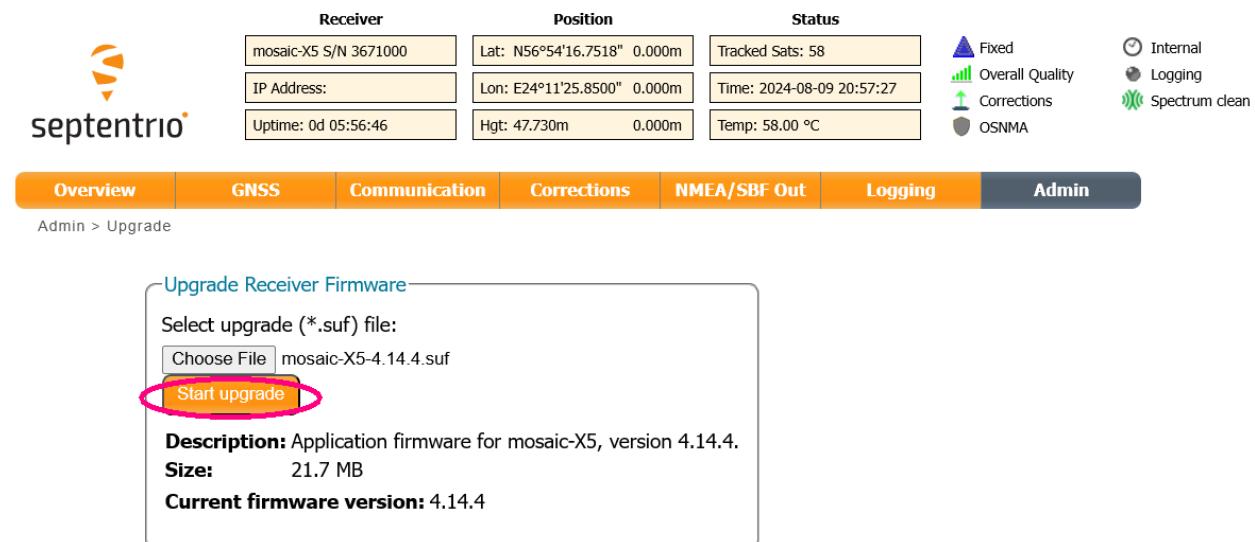
On the receiver's website that opens, go to the **Admin** menu and click the **Upgrade** option.

The screenshot shows the main dashboard of a Septentrio receiver. At the top, there are three tabs: Receiver, Position, and Status. Below these are four boxes: mosaic-X5 S/N 3671000, Lat: N56°54'16.7518" 0.000m, Tracked Sats: 60; IP Address: E24°11'25.8500" 0.000m, Lon: E24°11'25.8500" 0.000m, Time: 2024-08-09 20:22:41; Uptime: 0d 05:22:00, Hgt: 47.730m, 0.000m, Temp: 58.00 °C. To the right are icons for Fixed, Overall Quality, Corrections, OSNMA, Internal, Logging, and Spectrum clean. A navigation bar at the bottom includes Overview, GNSS, Communication, Corrections, NMEA/SBF Out, Logging, and Admin. The Admin menu is open, showing options: Configurations, Reset, Power Mode, **Upgrade** (which is circled in red), User Administration, Expert Control, Receiver Messages, and About.

Click “Choose file” and select the firmware update file.

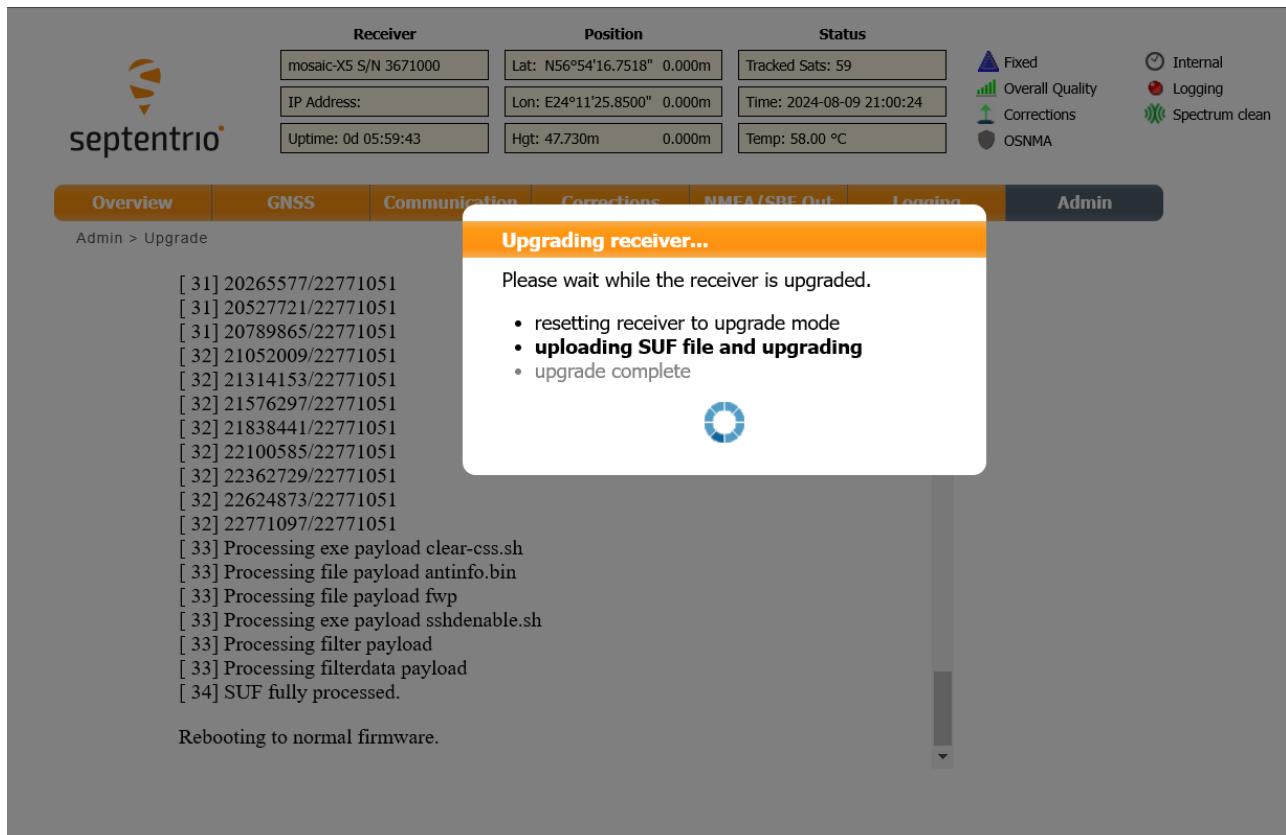
The screenshot shows the Admin > Upgrade page. It has the same header and navigation as the main dashboard. The Admin menu is also open, showing the Upgrade option. The main content area is titled "Upgrade Receiver Firmware". It contains a form with the following fields: "Select upgrade (\*.suf) file:" (with a "Choose File" button circled in red), "No file chosen", and a "Start upgrade" button. Below the form, it says "Current firmware version: 4.14.4".

Then click the “Start Upgrade” button.



The screenshot shows the 'Admin > Upgrade' section of the Septentrio web interface. At the top, there's a header with tabs: Overview, GNSS, Communication, Corrections, NMEA/SBF Out, Logging, Admin. Below the header, it says 'Admin > Upgrade'. A sub-header 'Upgrade Receiver Firmware' is displayed. Underneath, there's a form field 'Select upgrade (\*.suf) file:' with a 'Choose File' button and a selected file 'mosaic-X5-4.14.4.suf'. A prominent orange button labeled 'Start upgrade' is highlighted with a red circle. Below the form, there's a description: 'Description: Application firmware for mosaic-X5, version 4.14.4.', 'Size: 21.7 MB', and 'Current firmware version: 4.14.4'.

The firmware update process begins.



The screenshot shows the 'Admin > Upgrade' section of the Septentrio web interface during the upgrade process. The main area displays a list of log entries from step [31] to [34]. Step [31] through [32] show the receiver being reset and the SUF file being uploaded. Step [33] shows files being processed, and step [34] indicates the SUF file is fully processed. A large orange message box in the center says 'Upgrading receiver...' with a circular progress indicator below it. The message 'Please wait while the receiver is upgraded.' is displayed above the progress bar. The background shows the standard GNSS receiver status and configuration interface.

The firmware is updated. Click the “**identification page**” link to check the version.

**Receiver**      **Position**      **Status**

mosaic-X5 S/N 3671000	Lat: N56°54'16.7518" 0.000m	Tracked Sats: 58
IP Address:	Lon: E24°11'25.8500" 0.000m	Time: 2024-08-09 21:02:44
Uptime: 0d 00:01:26	Hgt: 47.730m 0.000m	Temp: 58.00 °C

**Legend:**

- Fixed
- Overall Quality
- Corrections
- OSNMA

**Internal**    **Logging**    **Spectrum clean**

**Overview**    **GNSS**    **Communication**    **Corrections**    **NMEA/SBF Out**    **Logging**    **Admin**

Admin > Upgrade > After upgrade

**Upgrade successful**

In order to verify the outcome of the upgrade:

- Please consult the [identification page](#) to review the installed versions.
- Please look at the latest upgrade status info below, to observe error messages if any.

```
[ 16] Processing filterdata payload rootfs
[ 17] Volume ID 0, size 63 LEBs (15998976 bytes, 15.3 MiB), LEB size 253952 bytes (248.0 KiB), static, name "gupies_rootfs_3", alignment 1
[ 28] Processing filter payload
[ 28] Processing filterdata payload kernel
[ 28] Volume ID 2, size 16 LEBs (4063232 bytes, 3.9 MiB), LEB size 253952 bytes (248.0 KiB), static, name "gupies_kernel_3", alignment 1
[ 31] Processing filter payload
[ 31] Processing filterdata payload fwfs
[ 31] Volume ID 3, size 12 LEBs (3047424 bytes, 2.9 MiB), LEB size 253952 bytes (248.0 KiB), static, name "gupies_fwfs_3", alignment 1
[ 33] Processing exe payload clear-css.sh
[ 33] Processing file payload antinfo.bin
[ 33] Processing file payload fwp
[ 33] Processing exe payload sshdenable.sh
[ 33] Processing filter payload
[ 33] Processing filterdata payload
[ 34] SUF fully processed.
[ 35] Rebooting to normal firmware.
```

Verify that the version number is correct.

**Receiver**      **Position**      **Status**

mosaic-X5 S/N 3671000	Lat: N56°54'16.7518" 0.000m	Tracked Sats: 59
IP Address:	Lon: E24°11'25.8500" 0.000m	Time: 2024-08-09 21:06:52
Uptime: 0d 00:05:34	Hgt: 47.730m 0.000m	Temp: 57.00 °C

**Legend:**

- Fixed
- Overall Quality
- Corrections
- OSNMA

**Internal**    **Logging**    **Spectrum clean**

**Overview**    **GNSS**    **Communication**    **Corrections**    **NMEA/SBF Out**    **Logging**    **Admin**

**Receiver Identification**

Component	Attribute	Description
hwplatform	product	mosaic-X5
firmware	version	4.14.4
files		
components		No components



Now proceed with the configuration as described in the “Configuration” section.

# Determining Coordinates

Determining coordinates is necessary to find the exact coordinates of the antenna. Start with a rough determination of coordinates using the built-in **PPP**, then refine the coordinates using one of the more accurate methods.

Before determining coordinates, be sure to read the section on [accuracy and stability](#) on our blog.

It is very important to remember about frames and epochs. **Ublox** has a [good tutorial](#) on this topic, and a [brief explanation](#) can also be found on **Onocoy**. The **PPP** and **HAS** methods give results in the **ITRF** frame associated with the Earth's center, while the **RTK** methods sometimes use the **ETRF** frame associated with continents. The difference between frames in Europe is currently about 80 centimeters, so it is recommended to use a [frame calculator](#) for conversion.

The determination time should be no less than a full day, ideally **23 hours and 56 minutes (86160 seconds)**. For high accuracy, it is better to use several daily **RTK** measurements and perform adjustment. The most accurate way is to hire a surveyor or use a paid service.

The main condition is that the antenna should not move relative to the ground. High bending masts are not suitable.

When specifying coordinates, there are two main options. If coordinates “**0.00 0.00 0.00**” are specified, the receiver determines its coordinates by averaging the autonomous solution within a minute. If other values are specified, the receiver tries to establish them.

If the coordinates are incorrectly specified (more than 50 meters from the value determined by the receiver), the **Unicore** receiver will not work. In this situation, only the **Beidou** and **QZSS** satellites will be visible on the **Status** page. To avoid this, when specifying incorrect coordinates in the settings, the receiver uses the averaged value of the autonomous solution. The indicator next to “**Main service**” will be orange, not green.

As for the indicator, green means “everything is fine”, yellow means “the service is running with errors”, and red means “the service is not running”. There is also a blue color, which indicates that the service is currently in the process of starting up.

The screenshot shows the RTKBase application interface with the 'SETTINGS' tab selected. Under the 'Services:' section, there are four groups of services: 'Main service', 'Ntrip A service', 'Ntrip B service', 'Ntrip Caster service', and 'Rtcm tcp service'. Each group has an 'On' button (yellow), an 'Options' button, and an information icon. The 'Main service' group includes fields for 'Base coordinates' (56.90472008 24.19052161 255.6639), 'Com port' (ttyS0), 'Com port settings' (115200:8:n:1), 'Receiver type' (Unicore\_UM982), 'Receiver format' (rtcm3), 'Antenna info' (ELT0123), and 'Tcp port' (5015). The 'Ntrip A service', 'Ntrip B service', and 'Ntrip Caster service' groups each have an 'Off' button (grey) and an 'Options' button. The 'Rtcm tcp service' group also has an 'Off' button and an 'Options' button. A 'Save' button is located at the bottom right of the service configuration area.

## Rough Coordinates

On the **Status** page, check for the presence of the **PPP** mode and click the copy coordinates button. If the **PPP** mode is not available, the coordinates might be incorrect.

The screenshot shows the RTKBase application interface with the 'STATUS' tab selected. A modal dialog box titled 'Coordinates sent to clipboard' displays the coordinates '56.90470999 24.19054032 58.255'. Below the modal, the status bar shows 'Latitude: 56.90470996 °', 'Longitude: 24.19054080 °', and 'Height: 58.403 m'. To the right of the status bar, there are two buttons: 'PPP' (circled in pink) and a clipboard icon (also circled in pink). At the bottom of the screen, there is a map of Europe and Central Asia with country names labeled in multiple languages.

Click **Close** and go to the **Settings** page.

The screenshot shows the RTKBase web interface with the URL `172.26.0.84/settings`. The top navigation bar has tabs for STATUS, SETTINGS (which is highlighted in blue), and LOGS. The main content area is divided into two sections: Services and System Settings.

**Services:**

- Main service: Status is On, with Off, Options, and Info buttons.
- Ntrip A service: Status is Off, with On, Options, and Info buttons.
- Ntrip B service: Status is Off, with On, Options, and Info buttons.
- Ntrip Caster service: Status is Off, with On, Options, and Info buttons.
- Rtcm tcp service: Status is Off, with On, Options, and Info buttons.
- Rtcm serial service: Status is Off, with On, Options, and Info buttons.
- File service: Status is Off, with On, Options, and Info buttons.

**System Settings:**

- Rtkbase 2.5.0: Includes a "Check update" button.
- Change Password: Fields for New password and Confirm password.

To the right of “Main service”, click the **Options** button.

This screenshot is identical to the one above, showing the RTKBase web interface on the `172.26.0.84/settings` page. The focus is on the "Main service" row, where the "Options" button is highlighted with a red box.

The main service settings open.

The screenshot shows the RTKBase web interface with the 'SETTINGS' tab selected. The 'Services:' section contains configuration for the 'Main service'. The 'Base coordinates:' field is set to '0.00.000.000'. Other fields include 'Com port:' (ttyS0), 'Com port settings:' (115200:8:n:1), 'Receiver type:' (Unicore\_UM980), 'Receiver format:' (rtcm3), 'Antenna info:' (ELT0123), and 'Tcp port:' (5015). Each field has a green checkmark indicating it is valid. Below the main service are sections for 'Ntrip A service' (off) and 'Ntrip B service' (off). A 'Save' button is located at the bottom right.

In the “**Base coordinates**” field, simply paste the values from the **clipboard** (for example, using **Ctrl-V**).

The screenshot shows the RTKBase web interface with the 'SETTINGS' tab selected. The 'Services:' section contains configuration for the 'Main service'. The 'Base coordinates:' field now contains the value '56.90471329 24.19059987 56.235'. The other fields remain the same: 'Com port:' (ttyS0), 'Com port settings:' (115200:8:n:1), 'Receiver type:' (Unicore\_UM980), 'Receiver format:' (rtcm3), 'Antenna info:' (ELT0123), and 'Tcp port:' (5015). Each field has a green checkmark. Below the main service are sections for 'Ntrip A service' (off), 'Ntrip B service' (off), 'Ntrip Caster service' (off), and 'Rtcm tcp service' (off). A 'Save' button is located at the bottom right.

Click the **Save** button and click **Options** again.

The screenshot shows the RTKBase Settings page with the following details:

- Services:**
  - Main service: On
  - Ntrip A service: Off
  - Ntrip B service: Off
  - Ntrip Caster service: Off
  - Rtcm tcp service: Off
  - Rtcm serial service: Off
  - File service: Off
- System Settings:**
  - Rtkbase 2.5.0: Check update
  - Change Password: New: [text input], Confirm: [text input], Change password

Go to the **Status** page and see the entered coordinates as a target, and the current coordinates as a blue marker.

The screenshot shows the RTKBase Status page with the following details:

- STATUS:** A bar chart showing signal strength for various satellites (G05, G07, G10, G13, G15, G16, G18, G23, G26, G27, G29, R01, R02, R03, R09, R10, R16, R17, R18, R19, E03, E08, E13, E16, E24, E26, E31, E33, J04, C02, C05, C08, C13, C20, C26, C29, C30).
- SETTINGS:** Latitude: 56.90471493 °, Longitude: 24.19057703 °, Height: 55.472 m, PPP, Print.
- LOGS:** A map view showing a blue marker at the current coordinates and a red polygon representing the base coordinates.

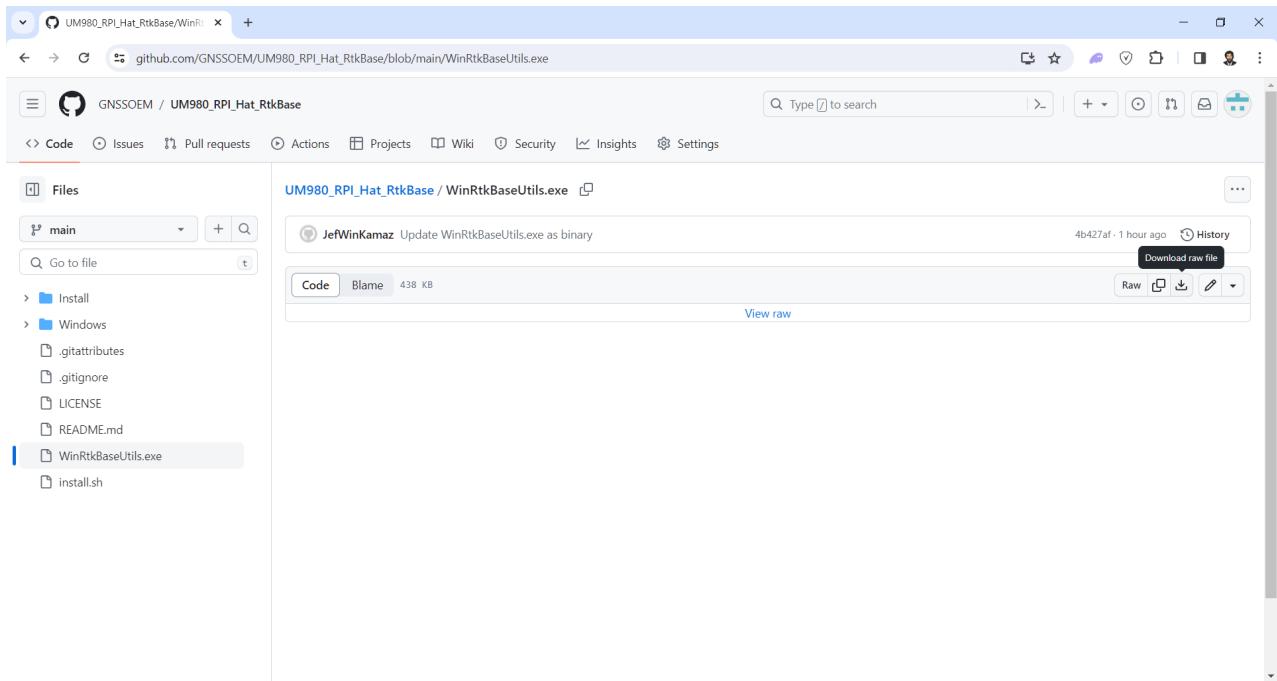
## Determining Coordinates using the PPP Method

To determine coordinates using the built-in **PPP**, go to the **Status** page after a day and copy the coordinates as described above. Note that each time the base coordinates or other main service settings are changed, the **PPP** refinement process starts from scratch.

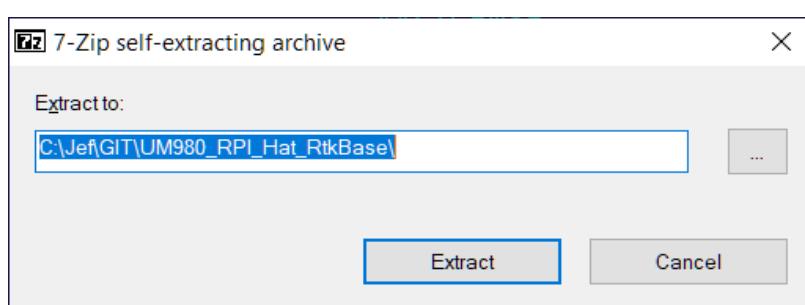
# WinRtkBaseUtils Package

## Download and unpack

Insert the **SD** card sent to you into your computer's card reader and download the self-extracting archive **WinRtkBaseUtils.exe** to your hard drive. You can also download this archive from **GitHub** using the [provided link](#).



Run the file to unpack it. During the run, you can choose the folder for unpacking and click the **Extract** button.



Sometimes the antivirus may give a warning, and you need to explain to it that this file is safe. For example, **Microsoft Defender** may display the following message. In this case, click “**More Info**”.

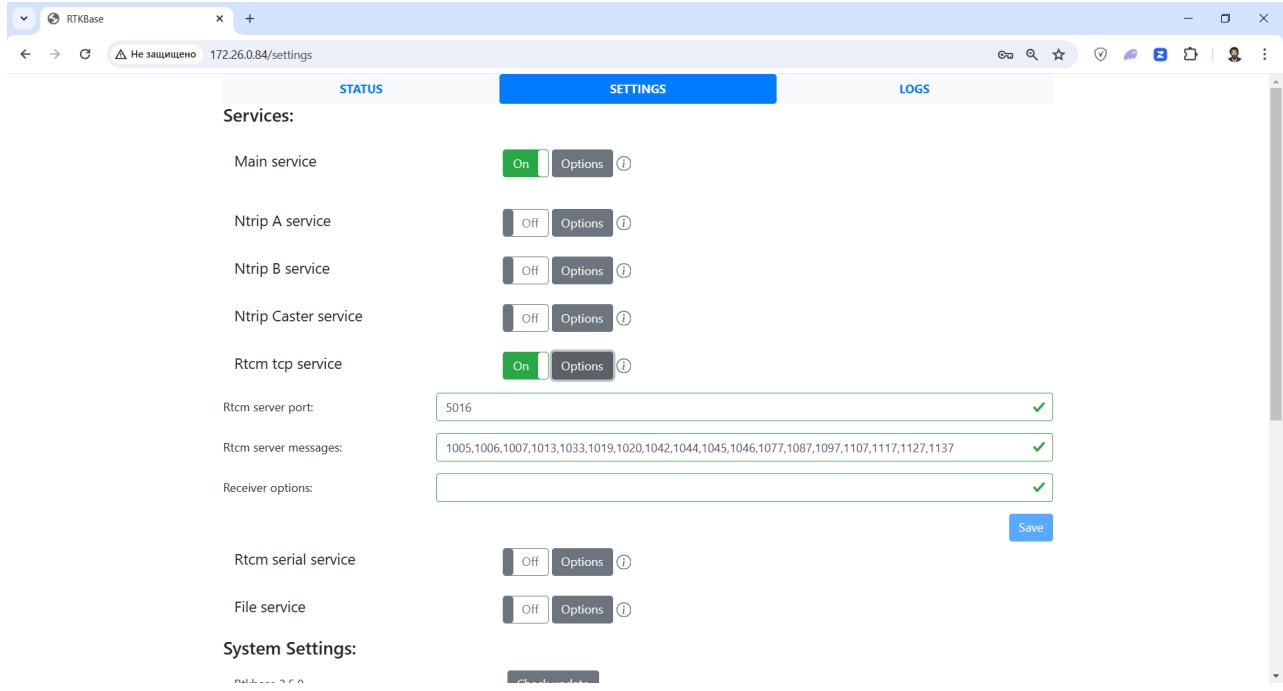


Next, click “Run anyway”.



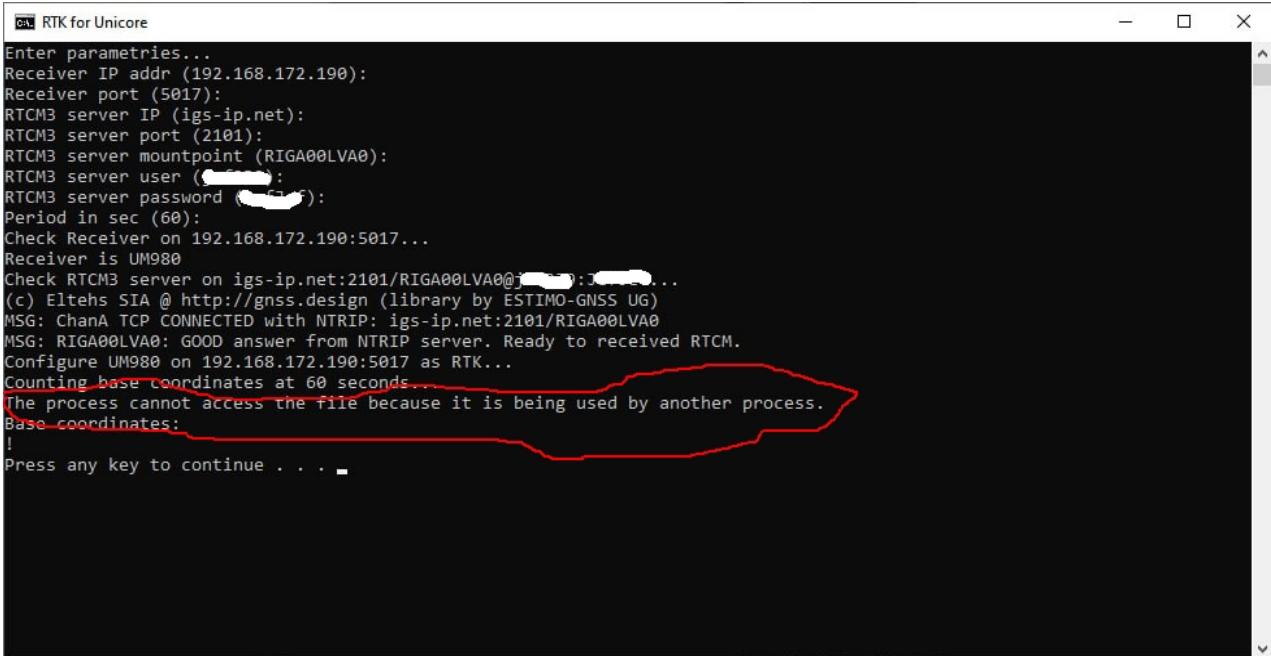
## Important Requirements

To determine coordinates using the **WinRtkBaseUtils** package, you must enable the “**Rtcm tcp service**” by clicking the “**On/Off**” button to the right of “**Rtcm tcp service**”, and after determining the coordinates, disable it again. Enabling this service allows access to change the receiver settings from outside the **Raspberry PI**, and in the worst case, even outside your local network. The list of messages for this service is obsolete and does not affect anything.



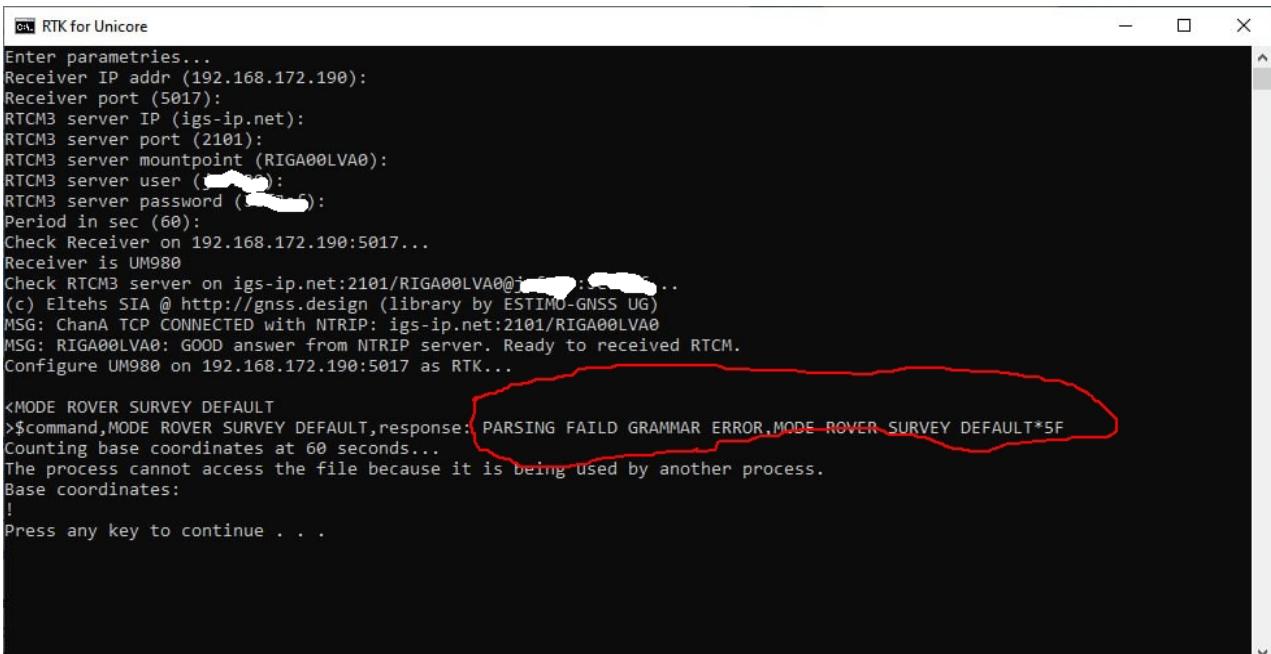
Moreover, if there were failures during the execution of **RTK.bat** or **HAS.bat**, you must reconfigure the receiver as described in the “Configuration” section. The **WinRtkBaseUtils** package reconfigures the receiver, and in case of a failure, it must be reconfigured back.

It is not possible to run multiple **RTK.bat** or multiple **HAS.bat** from the same directory simultaneously, even with different **Raspberry pi** and receivers. This is due to the impossibility of simultaneous use of the same temporary file. Trying to do this will result in a message like the one shown in the picture.



```
RTK for Unicore
Enter parametries...
Receiver IP addr (192.168.172.190):
Receiver port (5017):
RTCM3 server IP (igs-ip.net):
RTCM3 server port (2101):
RTCM3 server mountpoint (RIGA00LVA0):
RTCM3 server user (██████):
RTCM3 server password (██████):
Period in sec (60):
Check Receiver on 192.168.172.190:5017...
Receiver is UM980
Check RTCM3 server on igs-ip.net:2101/RIGA00LVA0@████████:████████...
(c) Eltehs SIA @ http://gnss.design (library by ESTIMO-GNSS UG)
MSG: ChanA TCP CONNECTED with NTRIP: igs-ip.net:2101/RIGA00LVA0
MSG: RIGA00LVA0: GOOD answer from NTRIP server. Ready to received RTCM.
Configure UM980 on 192.168.172.190:5017 as RTK...
Counting base coordinates at 60 seconds...
The process cannot access the file because it is being used by another process.
Base coordinates:
!
Press any key to continue . . .
```

If the receiver firmware version is outdated, there may be messages like the one in the picture. In this case, check the receiver firmware version as indicated in the “Checking the Receiver Firmware Version” section.



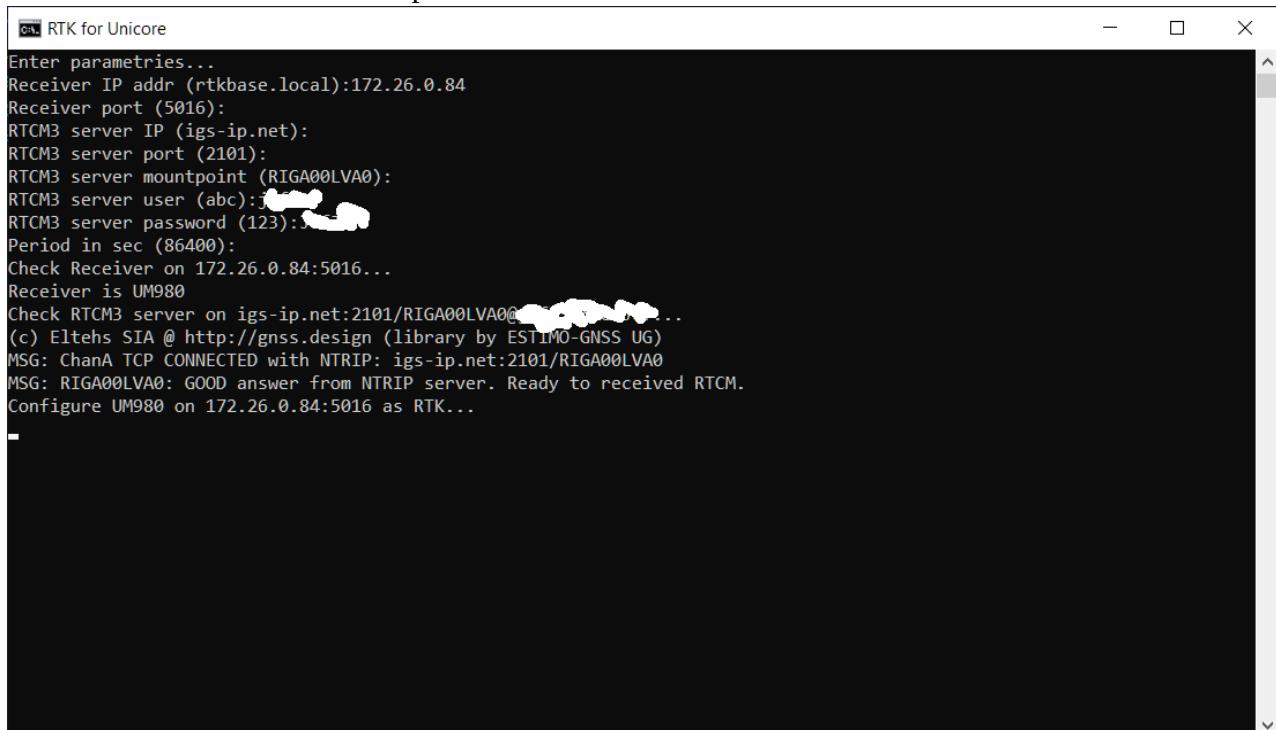
```
RTK for Unicore
Enter parametries...
Receiver IP addr (192.168.172.190):
Receiver port (5017):
RTCM3 server IP (igs-ip.net):
RTCM3 server port (2101):
RTCM3 server mountpoint (RIGA00LVA0):
RTCM3 server user (██████):
RTCM3 server password (██████):
Period in sec (60):
Check Receiver on 192.168.172.190:5017...
Receiver is UM980
Check RTCM3 server on igs-ip.net:2101/RIGA00LVA0@████████:████████...
(c) Eltehs SIA @ http://gnss.design (library by ESTIMO-GNSS UG)
MSG: ChanA TCP CONNECTED with NTRIP: igs-ip.net:2101/RIGA00LVA0
MSG: RIGA00LVA0: GOOD answer from NTRIP server. Ready to received RTCM.
Configure UM980 on 192.168.172.190:5017 as RTK...
<MODE ROVER SURVEY DEFAULT
>$command,MODE ROVER SURVEY DEFAULT,response: PARSING FAILD GRAMMAR ERROR,MODE_ROVER_SURVEY_DEFAULT*5F
Counting base coordinates at 60 seconds...
The process cannot access the file because it is being used by another process.
Base coordinates:
!
Press any key to continue . . .
```

After changing coordinates by clicking the **Save** button, all services are stopped. If the “**Main service**” was running at the time of clicking **Save**, it will restart, but the other services will remain stopped.

## Determining Coordinates via RTK

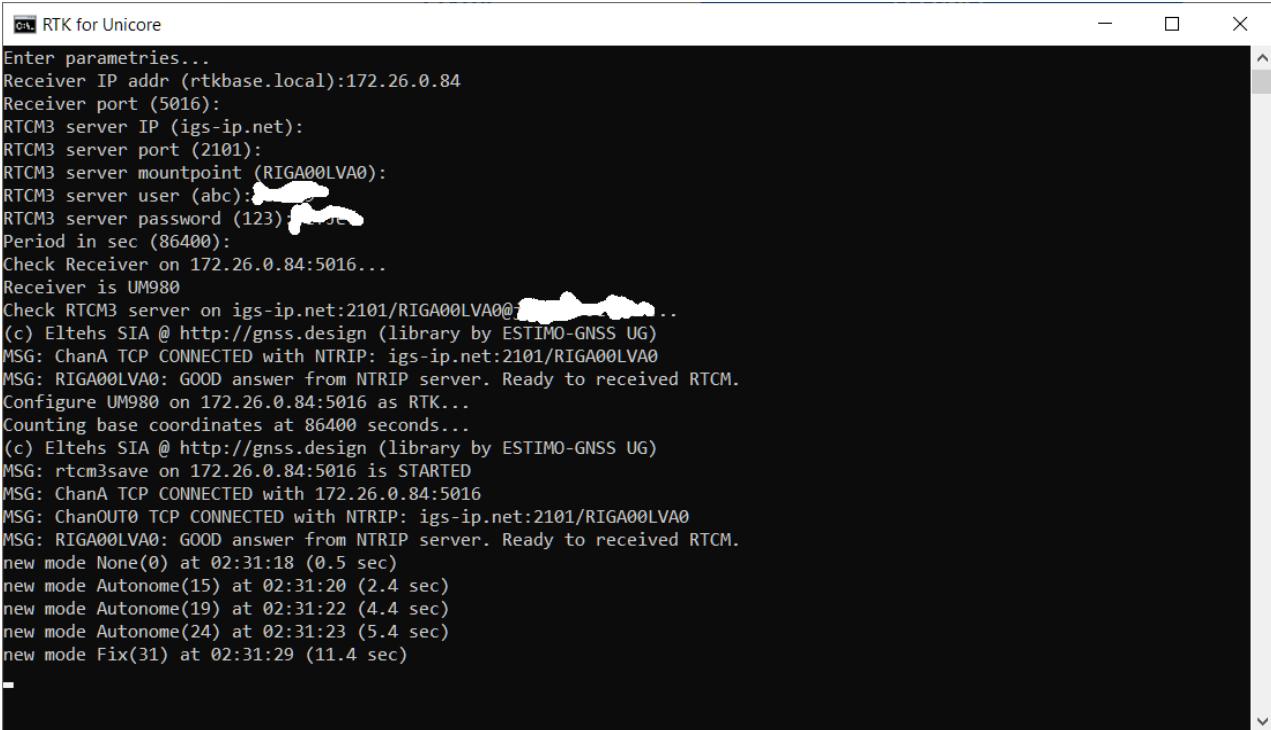
RTK stability on **Unicore** receivers is about 4 mm **CEP50** horizontally and 8 mm **CEP50** vertically. Accuracy is approximately 1mm per kilometer of distance between the receiver and the base. For increased accuracy, network corrections with virtual bases should be used.

To determine coordinates using **RTK**, run the **RTK.bat** file. In the opened window, enter the receiver address and port. If you use **Raspberry pi** on the local network, do not change them. Then enter the address, port, mount point, login, and password for the **NTRIP** server, as well as the measurement time. The entered parameters are saved in the **Ini.cmd** file.



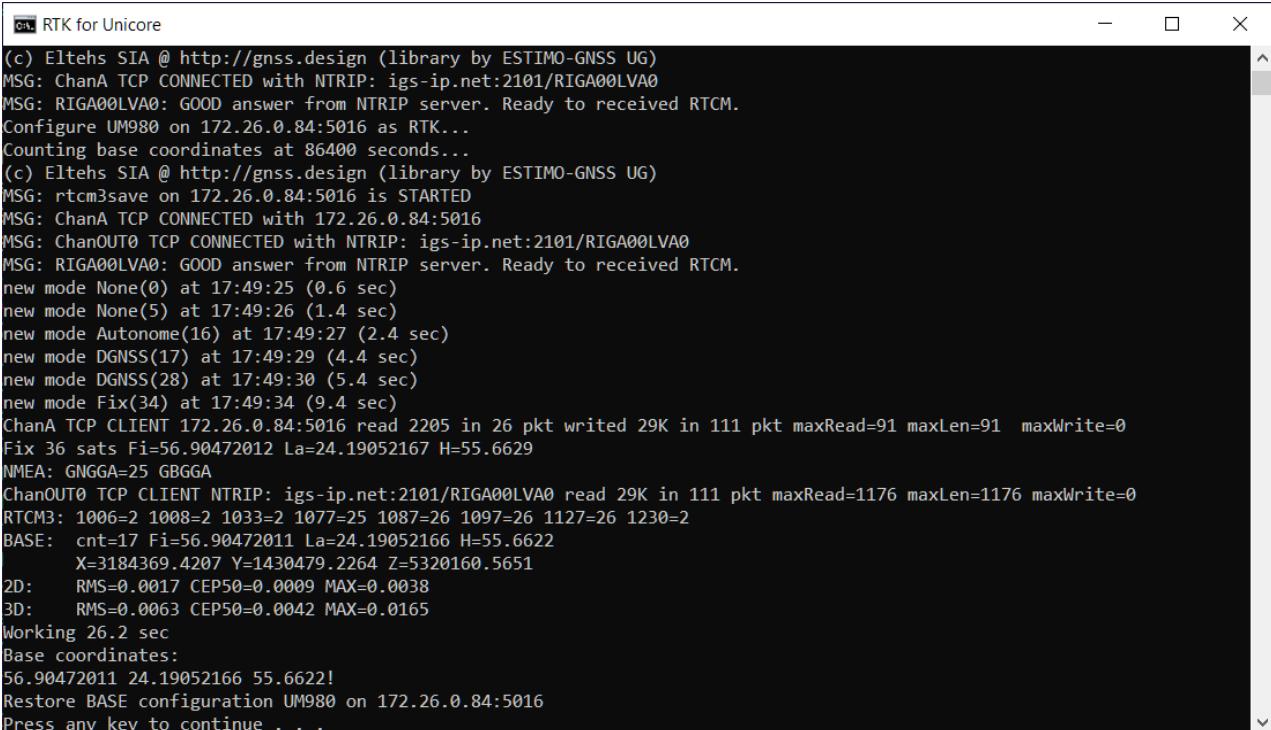
```
RTK for Unicore
Enter parametries...
Receiver IP addr (rtkbase.local):172.26.0.84
Receiver port (5016):
RTCM3 server IP (igs-ip.net):
RTCM3 server port (2101):
RTCM3 server mountpoint (RIGA00LVA0):
RTCM3 server user (abc):[REDACTED]
RTCM3 server password (123):[REDACTED]
Period in sec (86400):
Check Receiver on 172.26.0.84:5016...
Receiver is UM980
Check RTCM3 server on igs-ip.net:2101/RIGA00LVA0... [REDACTED] ...
(c) Eltehs SIA @ http://gnss.design (library by ESTIMO-GNSS UG)
MSG: ChanA TCP CONNECTED with NTRIP: igs-ip.net:2101/RIGA00LVA0
MSG: RIGA00LVA0: GOOD answer from NTRIP server. Ready to received RTCM.
Configure UM980 on 172.26.0.84:5016 as RTK...
-
```

Communication with the receiver and server is checked, then the receiver is configured, and then RTK starts.



```
RTK for Unicore
Enter parametries...
Receiver IP addr (rtkbase.local):172.26.0.84
Receiver port (5016):
RTCM3 server IP (igs-ip.net):
RTCM3 server port (2101):
RTCM3 server mountpoint (RIGA00LVA0):
RTCM3 server user (abc):[REDACTED]
RTCM3 server password (123):[REDACTED]
Period in sec (86400):
Check Receiver on 172.26.0.84:5016...
Receiver is UM980
Check RTCM3 server on igs-ip.net:2101/RIGA00LVA0@... [REDACTED] ...
(c) Eltehs SIA @ http://gnss.design (library by ESTIMO-GNSS UG)
MSG: ChanA TCP CONNECTED with NTRIP: igs-ip.net:2101/RIGA00LVA0
MSG: RIGA00LVA0: GOOD answer from NTRIP server. Ready to received RTCM.
Configure UM980 on 172.26.0.84:5016 as RTK...
Counting base coordinates at 86400 seconds...
(c) Eltehs SIA @ http://gnss.design (library by ESTIMO-GNSS UG)
MSG: rtcm3save on 172.26.0.84:5016 is STARTED
MSG: ChanA TCP CONNECTED with 172.26.0.84:5016
MSG: ChanOUT0 TCP CONNECTED with NTRIP: igs-ip.net:2101/RIGA00LVA0
MSG: RIGA00LVA0: GOOD answer from NTRIP server. Ready to received RTCM.
new mode None(0) at 02:31:18 (0.5 sec)
new mode Autonome(15) at 02:31:20 (2.4 sec)
new mode Autonome(19) at 02:31:22 (4.4 sec)
new mode Autonome(24) at 02:31:23 (5.4 sec)
new mode Fix(31) at 02:31:29 (11.4 sec)
-
```

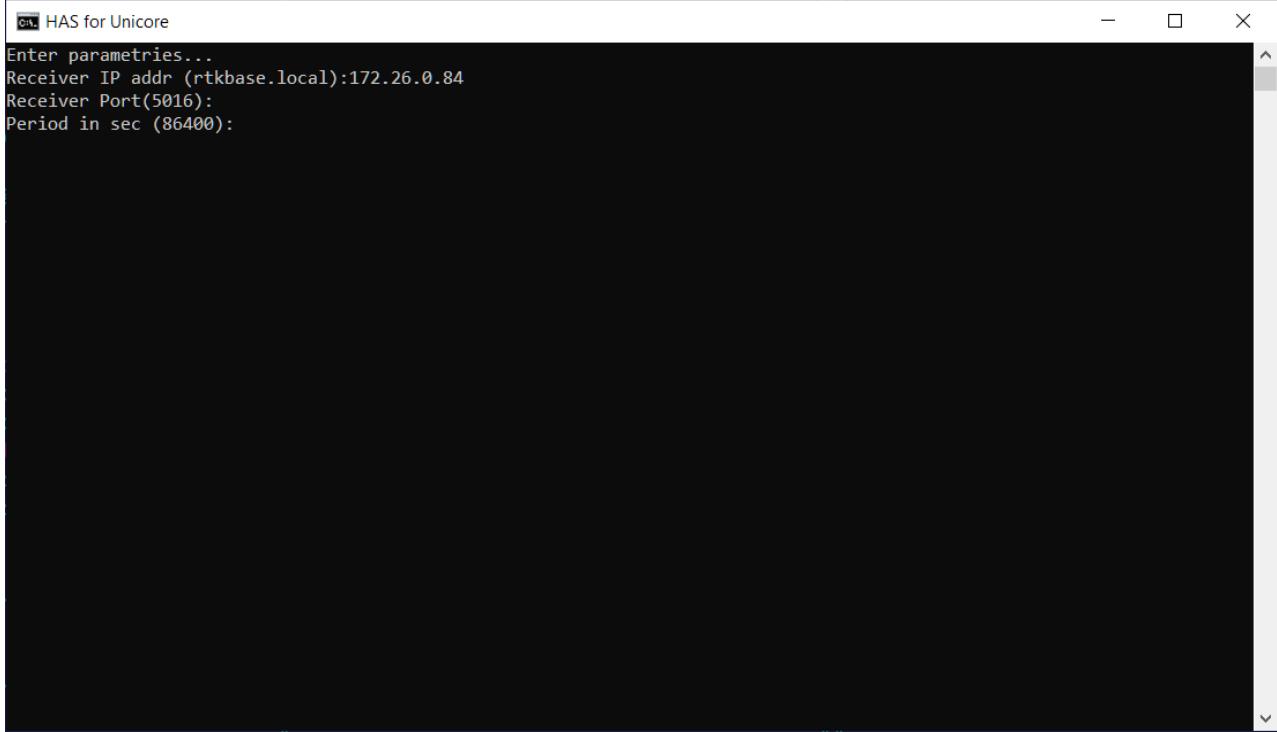
In the end, the coordinates are copied to the clipboard and displayed on the screen, and the receiver is configured back to base mode. For early termination, press the **Q** button. After completion, press any key to close the window.



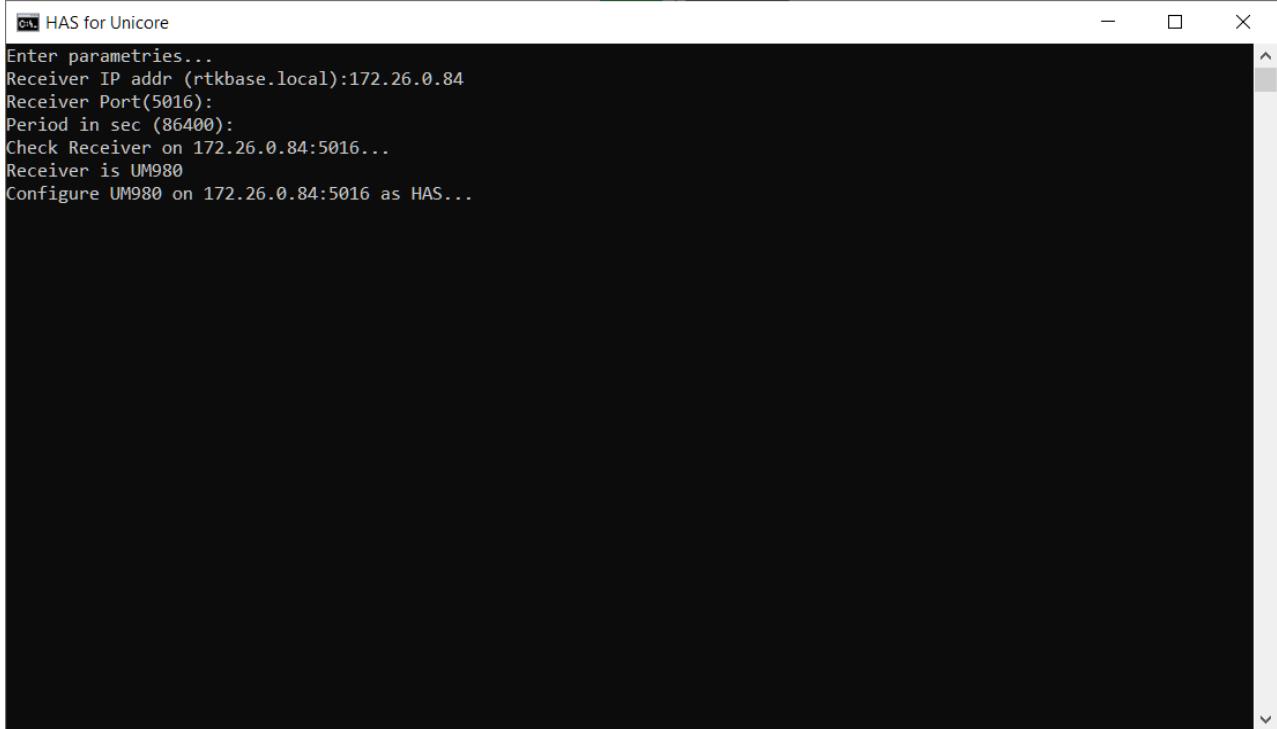
```
RTK for Unicore
(c) Eltehs SIA @ http://gnss.design (library by ESTIMO-GNSS UG)
MSG: ChanA TCP CONNECTED with NTRIP: igs-ip.net:2101/RIGA00LVA0
MSG: RIGA00LVA0: GOOD answer from NTRIP server. Ready to received RTCM.
Configure UM980 on 172.26.0.84:5016 as RTK...
Counting base coordinates at 86400 seconds...
(c) Eltehs SIA @ http://gnss.design (library by ESTIMO-GNSS UG)
MSG: rtcm3save on 172.26.0.84:5016 is STARTED
MSG: ChanA TCP CONNECTED with 172.26.0.84:5016
MSG: ChanOUT0 TCP CONNECTED with NTRIP: igs-ip.net:2101/RIGA00LVA0
MSG: RIGA00LVA0: GOOD answer from NTRIP server. Ready to received RTCM.
new mode None(0) at 17:49:25 (0.6 sec)
new mode None(5) at 17:49:26 (1.4 sec)
new mode Autonome(16) at 17:49:27 (2.4 sec)
new mode DGNSS(17) at 17:49:29 (4.4 sec)
new mode DGNSS(28) at 17:49:30 (5.4 sec)
new mode Fix(34) at 17:49:34 (9.4 sec)
ChanA TCP CLIENT 172.26.0.84:5016 read 2205 in 26 pkt writed 29K in 111 pkt maxRead=91 maxLen=91 maxWrite=0
Fix 36 sats Fi=56.90472012 La=24.19052167 H=55.6629
NMEA: GNGGA=25 GBGGA
ChanOUT0 TCP CLIENT NTRIP: igs-ip.net:2101/RIGA00LVA0 read 29K in 111 pkt maxRead=1176 maxLen=1176 maxWrite=0
RTCM3: 1006=2 1008=2 1033=2 1077=25 1087=26 1097=26 1127=26 1230=2
BASE: cnt=17 Fi=56.90472011 La=24.19052166 H=55.6622
X=3184369.4207 Y=1430479.2264 Z=5320160.5651
2D: RMS=0.0017 CEP50=0.0009 MAX=0.0038
3D: RMS=0.0063 CEP50=0.0042 MAX=0.0165
Working 26.2 sec
Base coordinates:
56.90472011 24.19052166 55.6622!
Restore BASE configuration UM980 on 172.26.0.84:5016
Press any key to continue . . .
```

## Determining Coordinates via HAS (Only Unicore)

Determining coordinates using the **HAS** method is available only for **Unicore** receivers. To do this, run the **HAS.bat** file. In the opened window, enter the receiver address and port. If you use **Raspberry pi** on the local network, do not change them. Then enter the measurement time. The entered parameters are saved in the **Ini.cmd** file.



Communication with the receiver is checked, then the receiver is configured.



## HAS resolution starts in 2-10 minutes.

```
HAS for Unicore
Enter parametries...
Receiver IP addr (rtkbase.local):172.26.0.84
Receiver Port(5016):
Period in sec (86400):
Check Receiver on 172.26.0.84:5016...
Receiver is UM980
Configure UM980 on 172.26.0.84:5016 as HAS...
Counting base coordinates at 86400 seconds...
(c) Eltehs SIA @ http://gnss.design (library by ESTIMO-GNSS UG)
MSG: rtcm3save on 172.26.0.84:5016 is STARTED
MSG: ChanA TCP CONNECTED with 172.26.0.84:5016
new mode None(0) at 02:44:08 (0.6 sec)
new mode Autonome(15) at 02:44:09 (1.8 sec)
new mode Autonome(21) at 02:44:11 (3.8 sec)
new mode Autonome(28) at 02:44:12 (4.8 sec)
new mode DGNSS(45) at 02:46:40 (152.8 sec)
new mode Float(46) at 02:51:49 (461.8 sec)
```

In the end, the coordinates are copied to the clipboard and displayed on the screen, and the receiver is configured back to base mode. For early termination, press the **Q** button. After completion, press any key to close the window.

```
HAS for Unicore
Enter parametries...
Receiver IP addr (rtkbase.local):172.26.0.84
Receiver Port(5016):
Period in sec (86400):
Check Receiver on 172.26.0.84:5016...
Receiver is UM980
Configure UM980 on 172.26.0.84:5016 as HAS...
Counting base coordinates at 86400 seconds...
(c) Eltehs SIA @ http://gnss.design (library by ESTIMO-GNSS UG)
MSG: rtcm3save on 172.26.0.84:5016 is STARTED
MSG: ChanA TCP CONNECTED with 172.26.0.84:5016
new mode None(0) at 17:52:53 (0.8 sec)
new mode Autonome(14) at 17:52:54 (1.9 sec)
new mode Autonome(20) at 17:52:56 (3.9 sec)
new mode Autonome(28) at 17:52:58 (5.9 sec)
new mode DGNSS(45) at 17:55:16 (143.9 sec)
new mode Float(45) at 18:00:15 (442.9 sec)
ChanA TCP CLIENT 172.26.0.84:5016 read 47K in 541 pkt maxRead=92 maxLen=92 maxWrite=0
Float 44 sats Fi=56.90471936 La=24.19053185 H=55.7358
NMEA: GNNGA-541
BASE: cnt=99 Fi=56.90471844 La=24.19053257 H=55.8240
X=3184369.3712 Y=1430479.9327 Z=5320160.5991
2D: RMS=0.0394 CEP50=0.0257 CEP95=0.0917 MAX=0.1076
3D: RMS=0.0692 CEP50=0.0312 CEP95=0.1485 MAX=0.1706
Working 541.0 sec
Base coordinates:
56.90471844 24.19053257 55.8240!
Restore BASE configuration UM980 on 172.26.0.84:5016
Press any key to continue . . .
```

# Determining Coordinates via External Services

Another method is to use an external **RINEX** post-processing service operating in your region. For example, for France, [IGN](#) services (instructions for it [here](#)) and [Orpheon](#) are suitable, and for the rest of the world, [NRCAN](#). Such services are usually paid.

First, enable the “**File Service**” and record the measurements. You need at least one full day according to Greenwich. The fact that recording is in progress is visible on the **Logs** page by the increasing size of the **rtcm3** file. For this, only one file should be recorded per day. Turning off the device or stopping the file or main service will result in the daily archive being unsuitable for conversion to **RINEX**.

The screenshot shows the RTKBase web interface with the URL [172.26.0.84/settings](http://172.26.0.84/settings). The page has a header with tabs for STATUS, SETTINGS (which is active), and LOGS. Below the tabs, there are two sections: **Services:** and **System Settings:**.

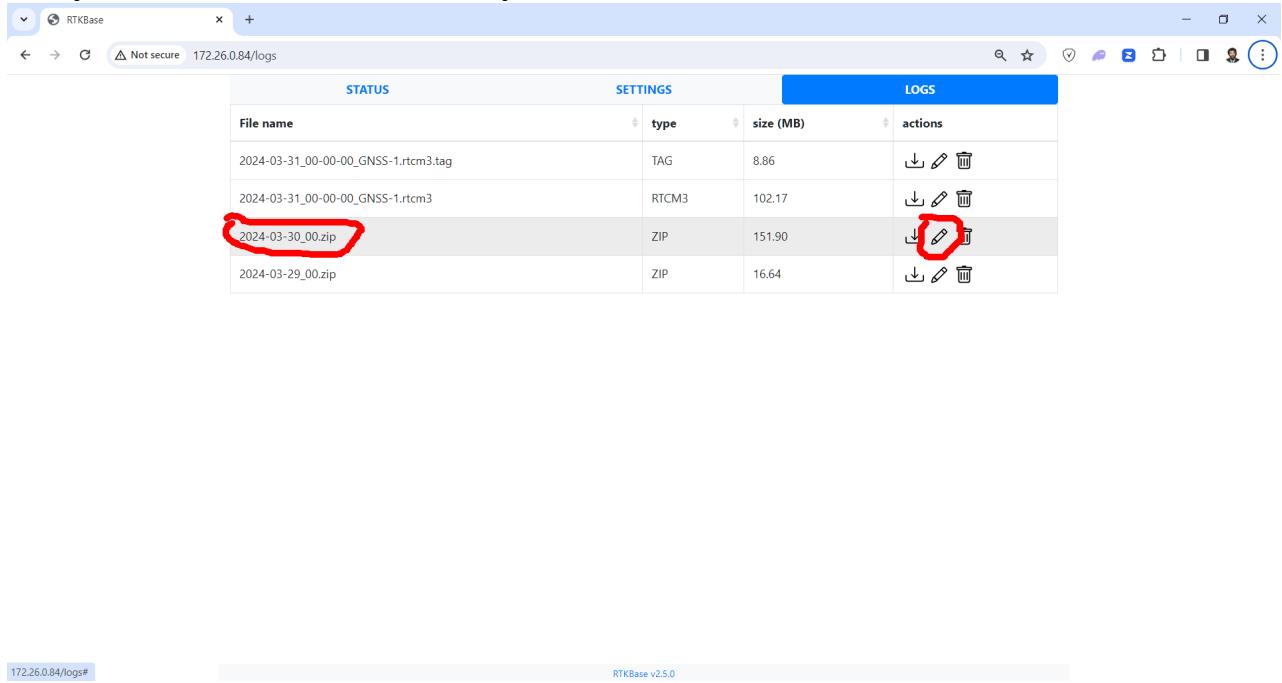
**Services:**

- Main service: On, Options, ⓘ
- Ntrip A service: On, Options, ⓘ
- Ntrip B service: On, Options, ⓘ
- Ntrip Caster service: On, Options, ⓘ
- Rtcm tcp service: Off, Options, ⓘ
- Rtcm serial service: Off, Options, ⓘ
- File service: On, Options, ⓘ

**System Settings:**

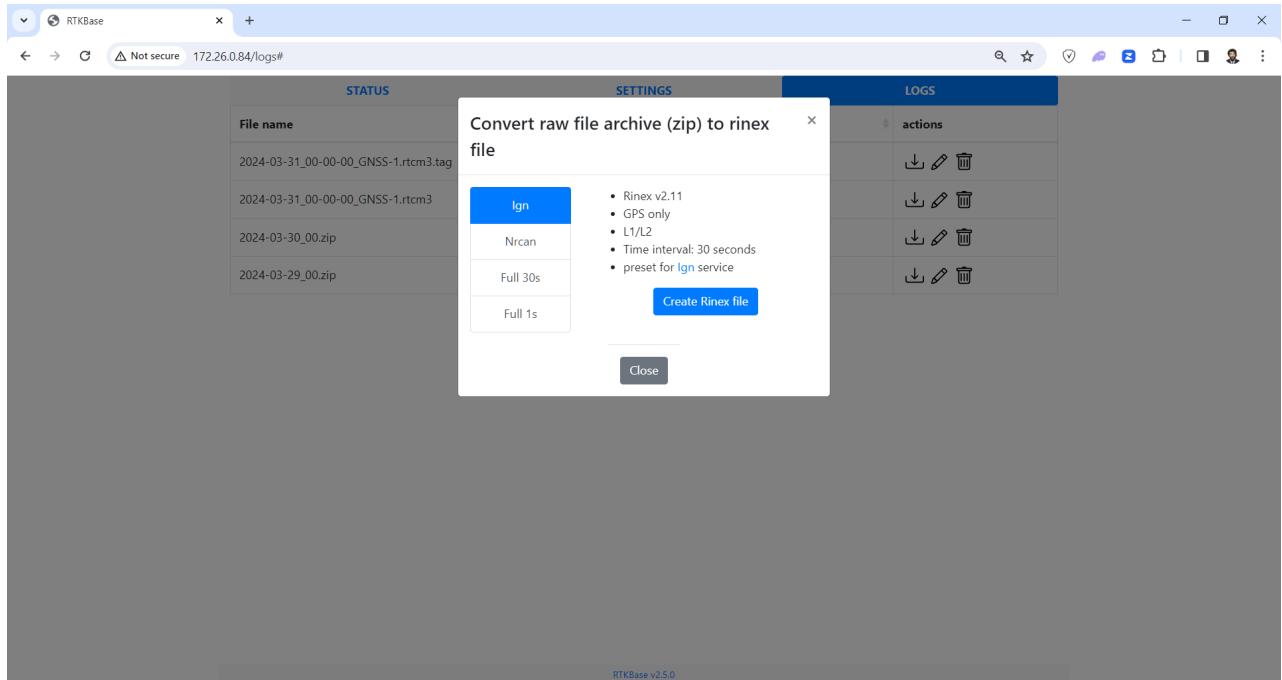
- Rtkbase 2.5.0: Check update button
- Change Password:
  - New: input field
  - Confirm: input field
  - Change password button

After recording, go to the **Logs** page. Click on the pencil icon next to the full-day **ZIP** archive file. Ideally, use an archive older than 15 days so that the service can form final satellite orbits.



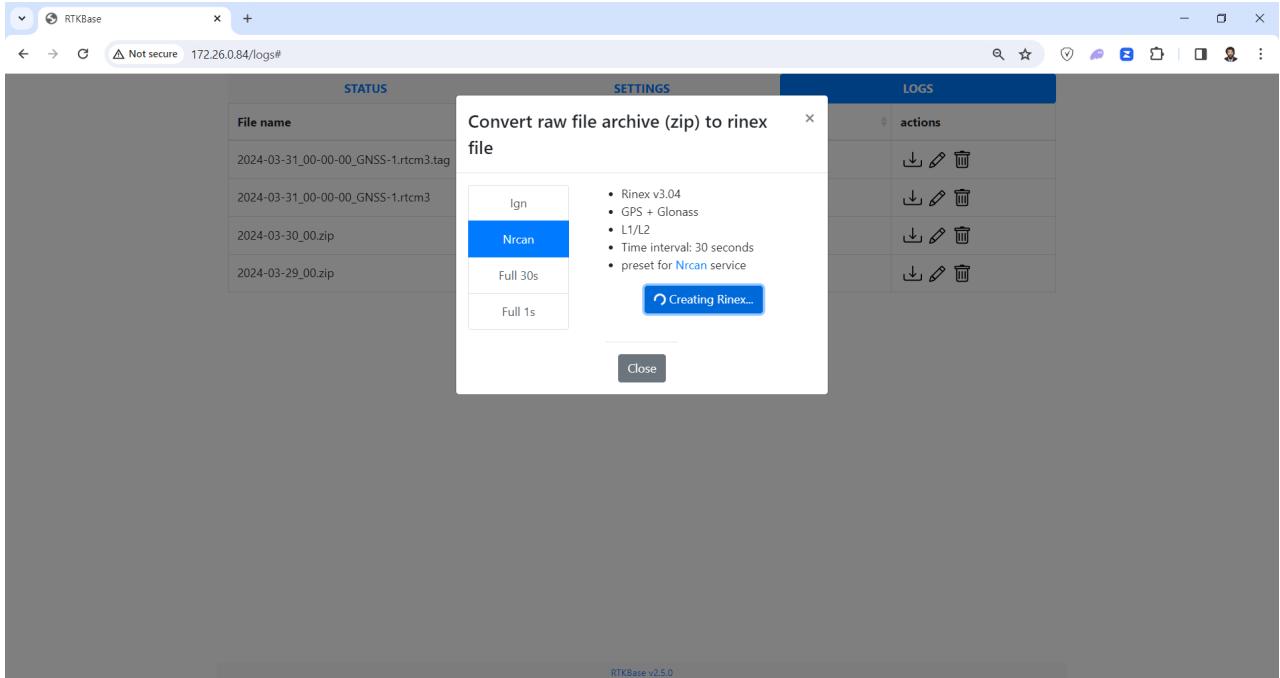
The screenshot shows a web browser window titled "RTKBase" with the URL "172.26.0.84/logs". The page displays a table of recorded files under the "LOGS" tab. The columns are "File name", "type", "size (MB)", and "actions". The "actions" column contains icons for download, edit, and delete. The row for "2024-03-30\_00.zip" is highlighted with a red circle around the file name, and the edit icon in the "actions" column is also circled in red.

A window like this will open. For **NRCAN**, select “**Nrcan**”, for **IGN** - “**Ign**”, and click the “**Create RINEX file**” button.

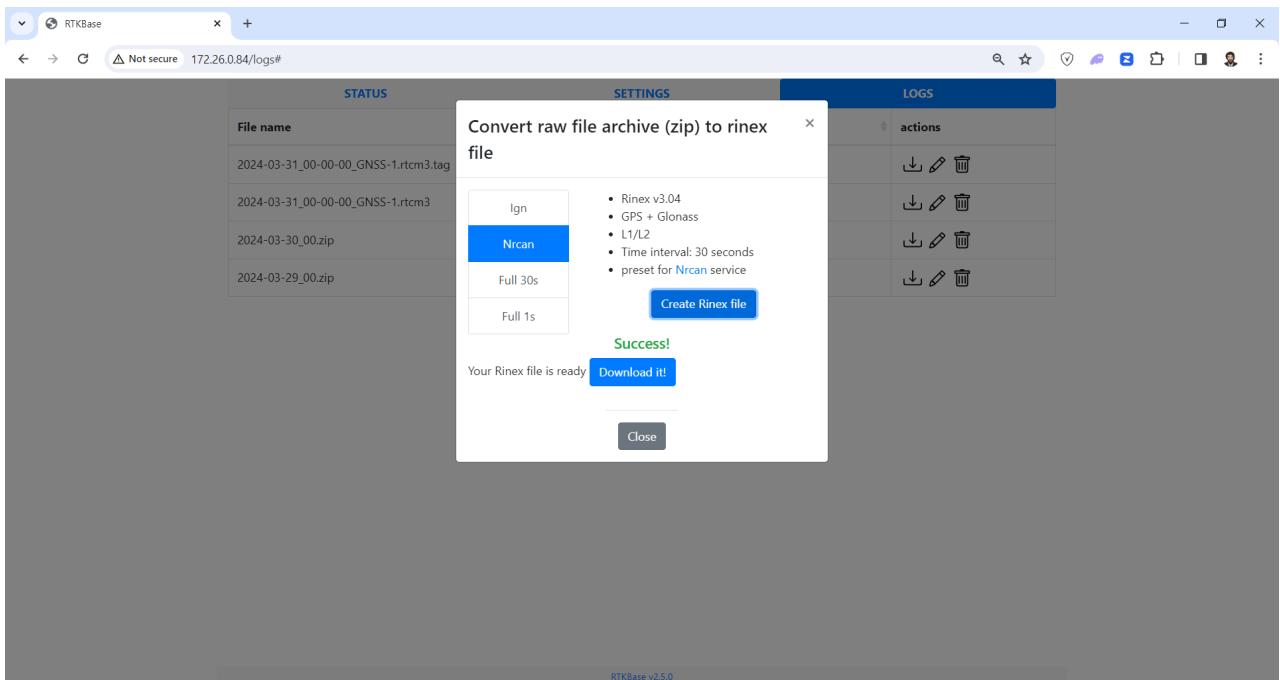


The screenshot shows a modal dialog box titled "Convert raw file archive (zip) to rinex file". It contains a dropdown menu with options: Ign (selected), Nrcan, Full 30s, and Full 1s. To the right of the dropdown is a list of conversion settings: • Rinex v2.11 • GPS only • L1/L2 • Time interval: 30 seconds • Preset for Ign service. At the bottom of the dialog is a blue "Create Rinex file" button. The background of the main logs page is dimmed.

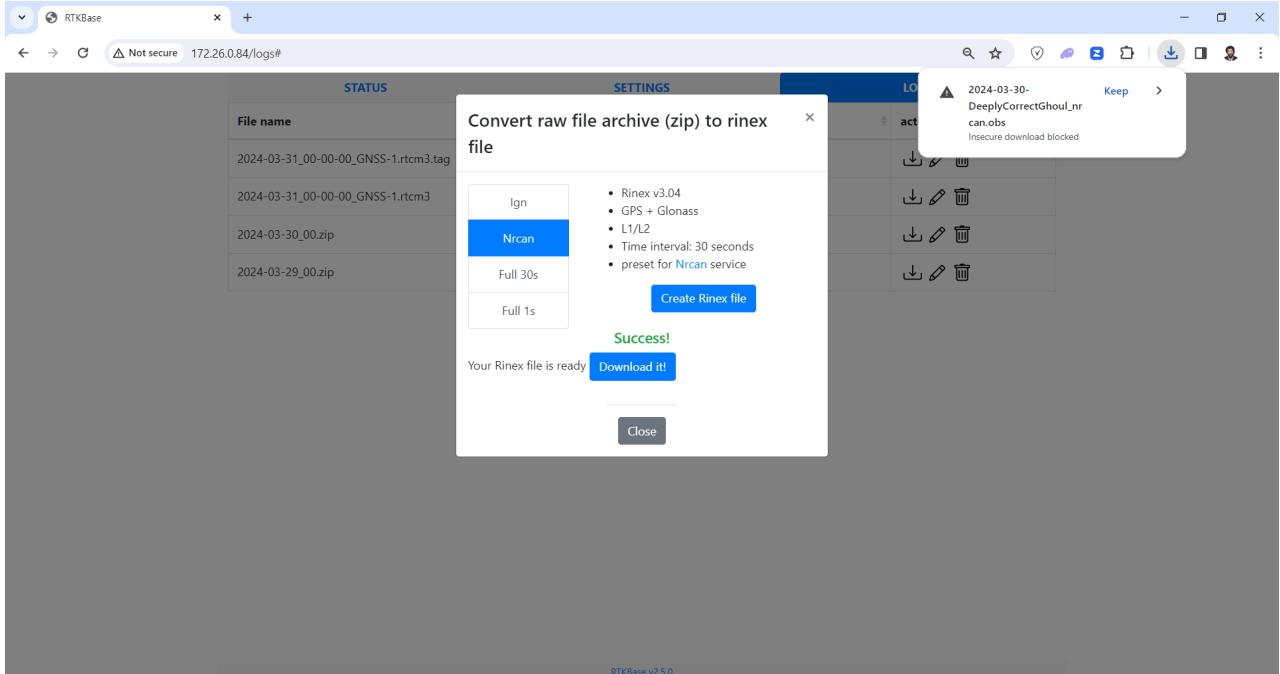
A message indicating the file creation process appears. Wait a few minutes.



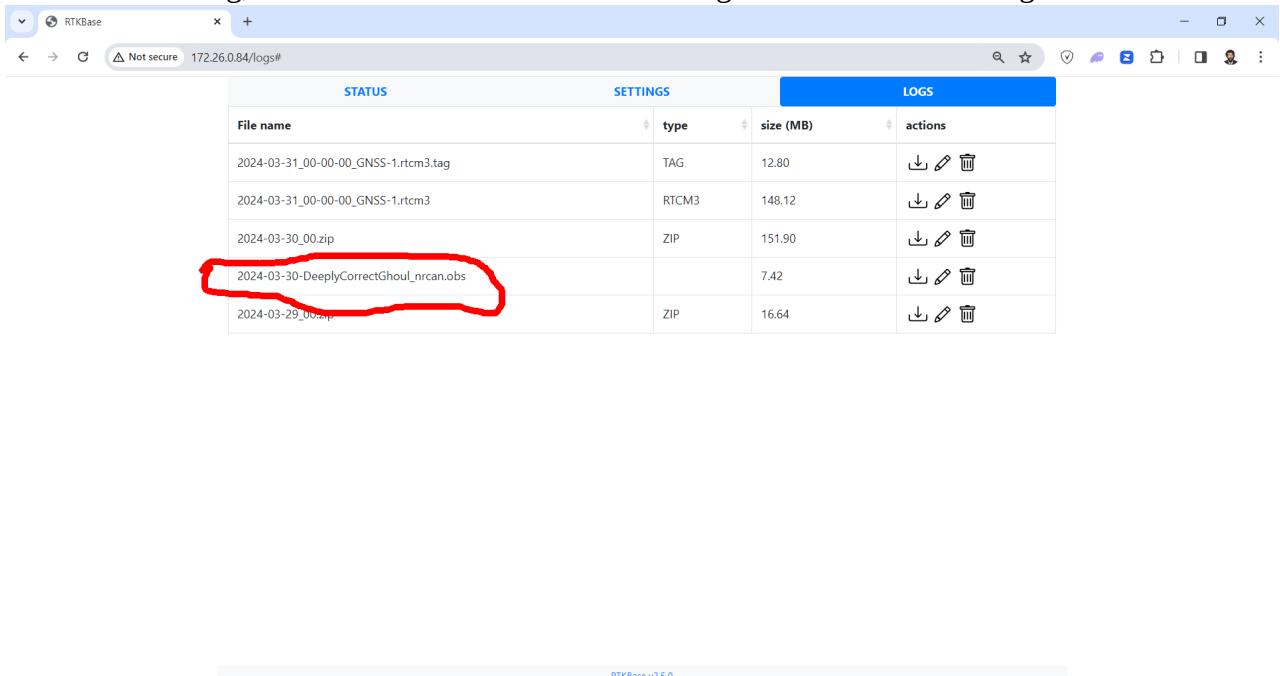
The **RINEX** file is created. Click d “**Download it!**” to download it.



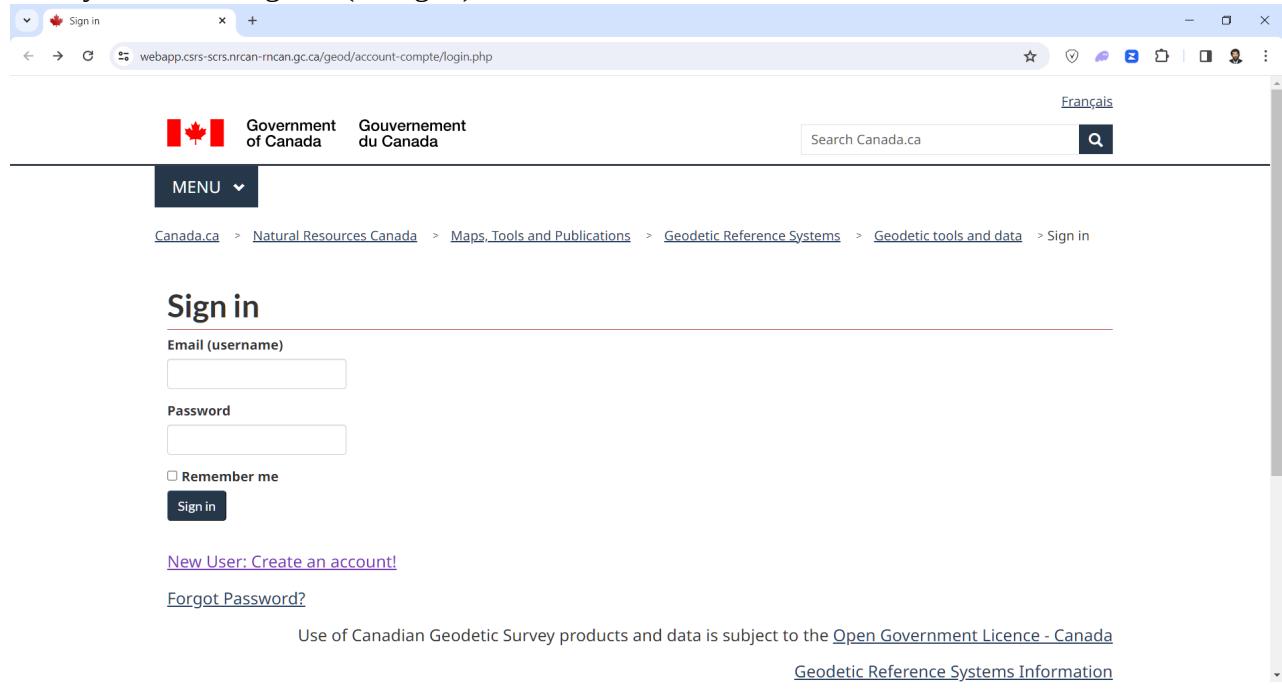
During the download, a message about unsafe downloading may appear. Click “keep”. The downloaded file size is 6-8 megabytes.



After downloading, the created file can be seen in the log list for re-downloading.

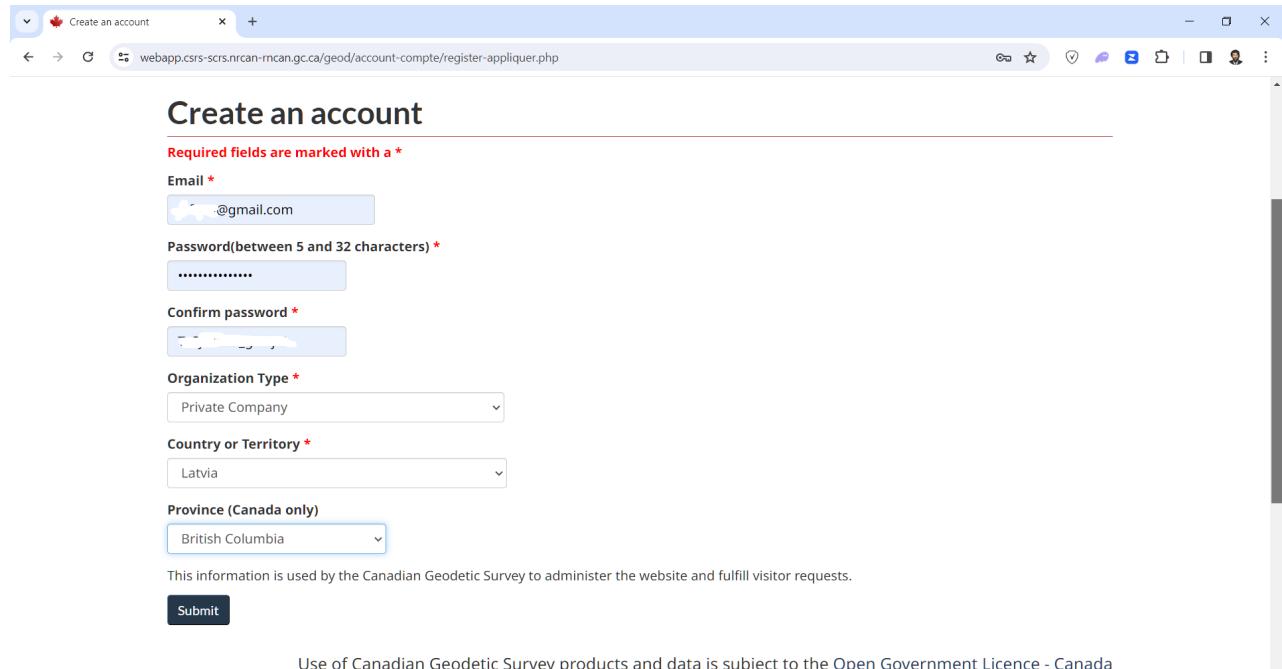


Next, you need to register (or log in) on **Nrcan**.



The screenshot shows the 'Sign in' page of the Canadian Geodetic Survey website. At the top, there's a navigation bar with the Canadian flag, 'Sign in', and the URL 'webapp.crs-scrs.nrcan-rncan.gc.ca/geod/account-compte/login.php'. Below the navigation is the Government of Canada/Gouvernement du Canada logo. A search bar with 'Search Canada.ca' and a magnifying glass icon is on the right. A 'Français' link is also present. A 'MENU' button is at the top left. The main content area has a 'Sign in' heading. It includes fields for 'Email (username)' and 'Password', both with placeholder text. There's a 'Remember me' checkbox and a 'Sign in' button. Below these are links for 'New User: Create an account!' and 'Forgot Password?'. At the bottom, a note states: 'Use of Canadian Geodetic Survey products and data is subject to the [Open Government Licence - Canada](#)' and '[Geodetic Reference Systems Information](#)'.

Click “**New User: Create an account!**” and fill in the details. After completing the form, click “**Submit**”.



The screenshot shows the 'Create an account' page. The title 'Create an account' is at the top. A note says 'Required fields are marked with a \*'. The form contains fields for 'Email \*' (with '@gmail.com entered), 'Password(between 5 and 32 characters) \*' (with redacted text), 'Confirm password \*' (with redacted text), 'Organization Type \*' (with 'Private Company' selected), 'Country or Territory \*' (with 'Latvia' selected), and 'Province (Canada only)' (with 'British Columbia' selected). Below the form is a note: 'This information is used by the Canadian Geodetic Survey to administer the website and fulfill visitor requests.' A 'Submit' button is at the bottom. At the very bottom, a note states: 'Use of Canadian Geodetic Survey products and data is subject to the [Open Government Licence - Canada](#)'.

You will receive a message that an email has been sent to you.

The screenshot shows a web browser window for the Canadian Government's account creation page. The URL is [webapp.crs-scrs.nrcan-rncan.gc.ca/geod/account-compte/register-appliquer.php](https://webapp.crs-scrs.nrcan-rncan.gc.ca/geod/account-compte/register-appliquer.php). The page features the Canadian Government logo and navigation links for Canada.ca, Natural Resources Canada, Maps, Tools and Publications, Geodetic Reference Systems, and Geodetic tools and data. A search bar and a 'Français' link are also present. The main content area is titled 'Create an account' and includes a confirmation message, instructions, and links to the Open Government Licence - Canada and Geodetic Reference Systems Information. At the bottom, there are links to report problems and view the last modified date (2022-04-29).

Open the email and activate your account by clicking on the link.

The screenshot shows a Gmail inbox with 668 messages. An email from 'Do Not Reply / Ne Pas Répondre' is selected, with the subject 'Welcome to the Canadian Spatial Reference System'. The email body contains a welcome message, a link to activate the account (<https://webapp.crs-scrs.nrcan-rncan.gc.ca/geod/account-compte/valid.php?locale=en&qs1=96919&qs2=bPW9RdOcweNltbx>), and a note about password recovery. The message was received at 20:47 (1 minute ago). The inbox sidebar shows categories like Starred, Snoozed, Important, Sent, Drafts, Categories (Social, Updates, Forums, Promotions), Labels (INBOX/Newsletters, INBOX/Social, Personal, Travel), and More.

You will receive a message confirming successful registration and a prompt to log in.

The screenshot shows a web browser window with the following details:

- Title Bar:** Welcome to the Canadian Spatial Reference System - Confirmation Email
- URL:** webapp.crs-scrs.nrcan-rncan.gc.ca/geod/account-compte/valid.php?locale=en&qs1=96919&qs2=bPW9RdOcweNhtbx2
- Language:** Français
- Header:** Government of Canada / Gouvernement du Canada
- Search Bar:** Search Canada.ca
- Menu:** MENU ▾
- Breadcrumbs:** Canada.ca > Natural Resources Canada > Maps, Tools and Publications > Geodetic Reference Systems > Geodetic tools and data > Confirmation Email
- Section Header:** Confirmation Email
- Text:** Your account has been confirmed. You can now [sign in](#).
- Links:** Use of Canadian Geodetic Survey products and data is subject to the Open Government Licence - Canada | Geodetic Reference Systems Information
- Buttons:** Report a problem or mistake on this page | Date modified: 2022-04-29
- Footer:** Contact us, News, Prime Minister, Departments and agencies, Treaties, laws and regulations, About government, Public service and military, Government-wide reporting, Open government. The footer features a dark background with a faint image of the Canadian Parliament buildings.

Click “Sign in” and log in.

The screenshot shows a web browser window with the following details:

- Title Bar:** Welcome to the Canadian Spatial Reference System - Sign in
- URL:** webapp.crs-scrs.nrcan-rncan.gc.ca/geod/account-compte/login.php
- Language:** Français
- Header:** Government of Canada / Gouvernement du Canada
- Search Bar:** Search Canada.ca
- Menu:** MENU ▾
- Breadcrumbs:** Canada.ca > Natural Resources Canada > Maps, Tools and Publications > Geodetic Reference Systems > Geodetic tools and data > Sign in
- Section Header:** Sign in
- Form Fields:** Email (username) (input: r@gmail.com), Password (input: masked), Remember me (checkbox checked), Sign in (button)
- Links:** New User: Create an account! | Forgot Password?
- Text:** Use of Canadian Geodetic Survey products and data is subject to the Open Government Licence - Canada | Geodetic Reference Systems Information

You will be greeted with a message congratulating you on successfully logging in. Click on “**Geodetic tools and data**”.

Canada.ca > Natural Resources Canada > Maps, Tools and Publications > Geodetic Reference Systems > **Geodetic tools and data**

## Confirmation Email

Hello jef239@gmail.com, you are signed in.

Use of Canadian Geodetic Survey products and data is subject to the [Open Government Licence - Canada Geodetic Reference Systems Information](#)

[Report a problem or mistake on this page](#)

Date modified: 2022-04-29

Contact us | News | Prime Minister | Departments and agencies | Treaties, laws and regulations | About government | Public service and military | Government-wide reporting | Open government

You will land on the “**Geodetic tools and data**” page. Click on “**Canadian Spatial Reference System Precise Point Positioning (CSRS-PPP)**”.

Canada.ca > Natural Resources Canada > Maps, Tools and Publications > Geodetic Reference Systems

## Geodetic tools and data

The Canadian Geodetic Survey (CGS) has publicly available tools and desktop applications to help surveyors, engineers, glaciologists and other professionals calculate accurate positions on the Canadian landmass. Learn more about each tool below to understand which one suits your needs.

### Access the tools

[Canadian Spatial Reference System Precise Point Positioning \(CSRS-PPP\)](#)

CSRS-PPP is an online application for global navigation satellite systems (GNSS) data post-processing. It uses precise satellite orbit, clock and bias corrections derived from a global network of receivers to determine accurate user positions anywhere on the globe, regardless of proximity to reference stations. Submit Receiver INdependent Exchange (RINEX) format observation data from single or dual-frequency receivers operating in static or kinematic mode over the Internet, and recover enhanced positioning precisions in the North American Datum of 1983 of the Canadian Spatial Reference System (NAD83(CSRS)) or the International Terrestrial Reference Frame (ITRF).

You will be taken to the [PPP calculation page](#). Select **ITRF** (not **NAD83**) and **Static** (not **Kinematic**).

The screenshot shows the PPP calculation page with the following configuration:

- Processing mode:** Static (radio button selected), Kinematic (radio button unselected). NAD83 (radio button selected), ITRF (radio button unselected). Epoch (Adopted) dropdown menu.
- Vertical datum:** CGVD28(HT2\_0) dropdown menu.
- Contribute to passive control maintenance?** (What is this?) checkbox (unchecked).
- Official Canadian federal or provincial geodetic marker number:** Input field.

Scroll down the page. Click “**Choose File**” to select the **RINEX** file, and then click “**Submit to PPP**”.

The screenshot shows the PPP calculation page with the following configuration:

- Processing mode:** Static (radio button selected), Kinematic (radio button unselected). NAD83 (radio button selected), ITRF (radio button unselected). Note: The epoch will be the same as the GPS data. A UTM zone will be calculated from the longitude.
- Vertical datum:** CGVD2013 dropdown menu.
- Contribute to passive control maintenance?** (What is this?) checkbox (unchecked).
- Official Canadian federal or provincial geodetic marker number:** Input field.
- RINEX observation file(s), 300 MB max (.zip, .gz, .Z, .tar, .?O)** Note: You may submit multiple RINEX files in a single .zip or .tar archive. **Choose File** button (highlighted with a red box) and input field (highlighted with a red box). Remove plots from CSRS-PPP solution PDF report (Why?) checkbox (unchecked).
- Submit to PPP** button (highlighted with a red box).

After processing, you will receive a message that the result has been sent to your email.

The file **2024-03-30-DeeplyCorrectGhoul\_nrcan.obs** was successfully submitted for processing.  
The results will be emailed to [jef239@gmail.com](mailto:jef239@gmail.com).

Email for results (required)  
jef239@gmail.com

Processing mode  
Static (selected) Kinematic  
NAD83 ITRF  
• The epoch will be the same as the GPS data.  
• A UTM zone will be calculated from the longitude.

Vertical datum  
CGVD2013

Contribute to passive control maintenance? ([What is this?](#))  
 Authorize the Canadian Geodetic Survey to archive and publish CSRS PPP submission and solution

Official Canadian federal or provincial geodetic marker number  
[empty input field]

► More options

Open the email and click on the “summary” link.

CSRS-PPP SPARK Results for 2024-03-30-DeeplyCorrectGhoul\_nrcan

Do Not Reply / Ne Pas Répondre <DoNotReply-NePasRepondre@nrcan-rncan.gc.ca>  
to me ▾

CSRS-PPP SPARK Latest update: 2023-01-09  
CSRS-PPP SPARK [Latest news](#)

Software Version: 3.54.2

CSRS-PPP SPARK Results for 2024-03-30-DeeplyCorrectGhoul\_nrcan.obs [full\\_output.zip](#)

2024-03-30-DeeplyCorrectGhoul\_nrcan.obs [summary](#) [graphics](#) [residuals](#) GPS & GLONASS NRCan Ultra-rapid

Warning: Although an antenna record was located in the RINEX file, no phase centre information could be found in the IGS/NGS file for your antenna. Estimated height should be used with caution. Ensure that both the antenna type and the RINEX header record "ANT # / TYPE" are valid.

Natural Resources Canada does not assume any liability deemed to have been caused directly or indirectly by any content of its CSRS-PPP online precise positioning service.

To contact us  
[geodeticinformation-informationgeodesique@nrcan-rncan.gc.ca](mailto:geodeticinformation-informationgeodesique@nrcan-rncan.gc.ca)

Follow the link to view the coordinates in the **ITRF2020** frame.

The estimated coordinates **ITRF20 2024-03-30** for the **2024-03-30-DeeplyCorrectGhoul\_rncan.obs** RINEX file are as follows:

Latitude	N $56^{\circ} 54' 17.0041'' \pm 0.003$ m (95%)
Longitude	E $24^{\circ} 11' 25.9110'' \pm 0.002$ m (95%)
Ellipsoidal Height	$55.8290 \pm 0.008$ m (95%)

[56.90472336,24.19053083,55.8291]

UTM Zone 35 (North)

Northing	6310295.252 m
Easting	328922.468 m
Scale factor (point)	0.99995892
Scale factor (combined)	0.99995017

[6310295.252,328922.468,55.829]

Cartesian coordinates

X	3184368.998 $\pm 0.005$ m (95%)
Y	1430479.649 $\pm 0.003$ m (95%)
Z	5320160.902 $\pm 0.007$ m (95%)

[3184368.998,1430479.649,5320160.902]

Orbits and Clocks Used: **NRCan Ultra-rapid**  
GNSS Data: **GPS & GLONASS**  
GRS80 ellipsoid used for (x,y,z) to (lat,lon,h) transformation

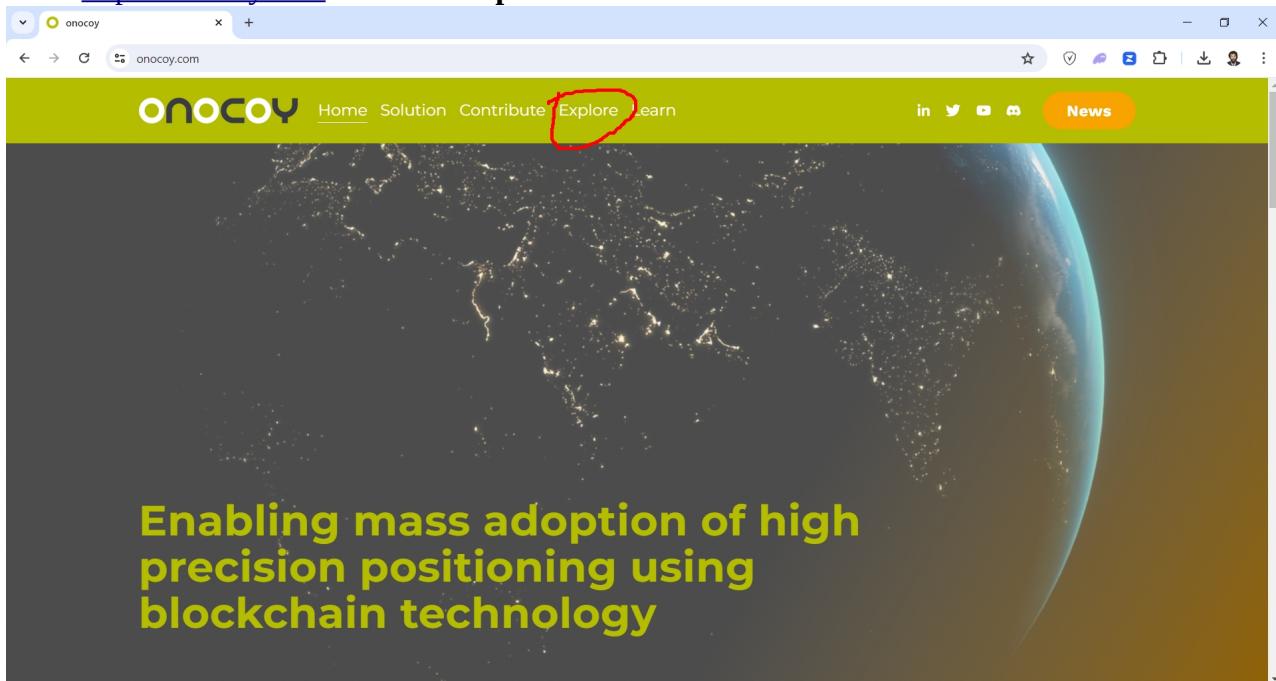
Another interesting section in the report is “**Orbits and Clocks Used**”. In our example, it shows “**Ultra-rapid**”, but if we had waited 15 days, we would have received the much more accurate “**Final**”.

# NTRIP Configuration for Onocoy

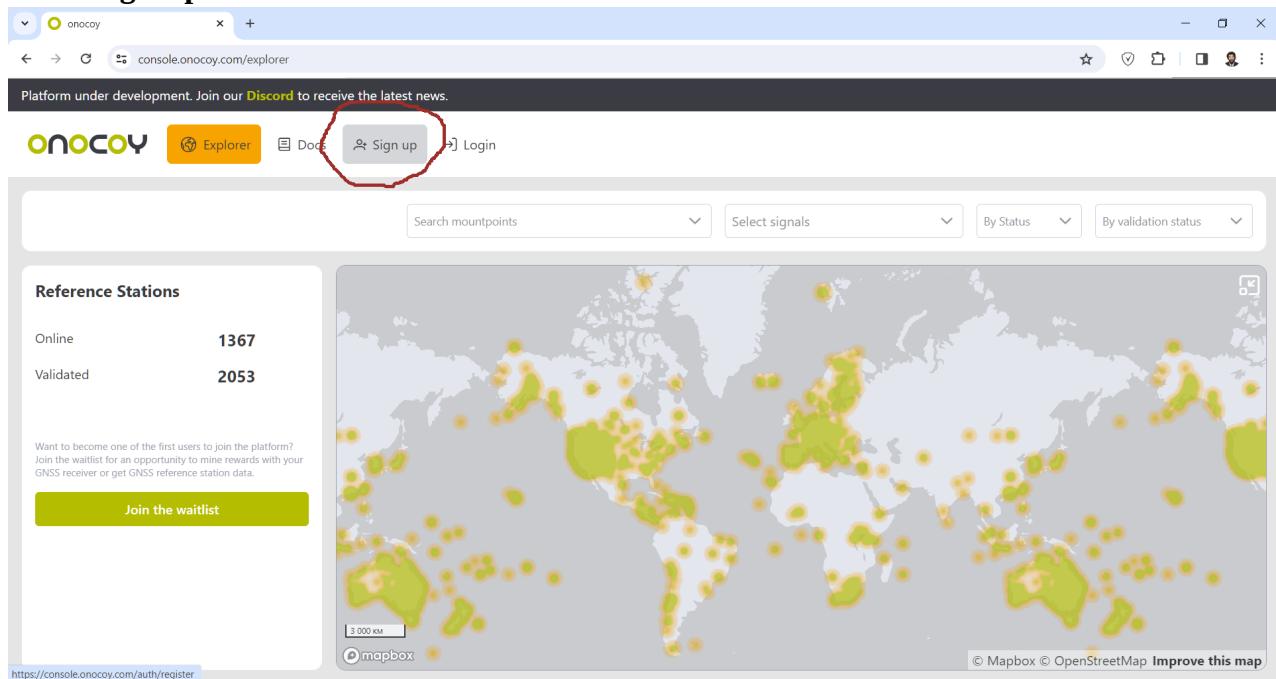
<https://www.onocoy.com> is a service that allows you to earn money using base stations. Documentation can be read at <https://docs.onocoy.com>, and we will provide a brief description for **RtkBase**. Additionally, the Onocoy project's "White paper can be read at the [link](#). Technical support and project news can be obtained on [Discord](#).

## Registration

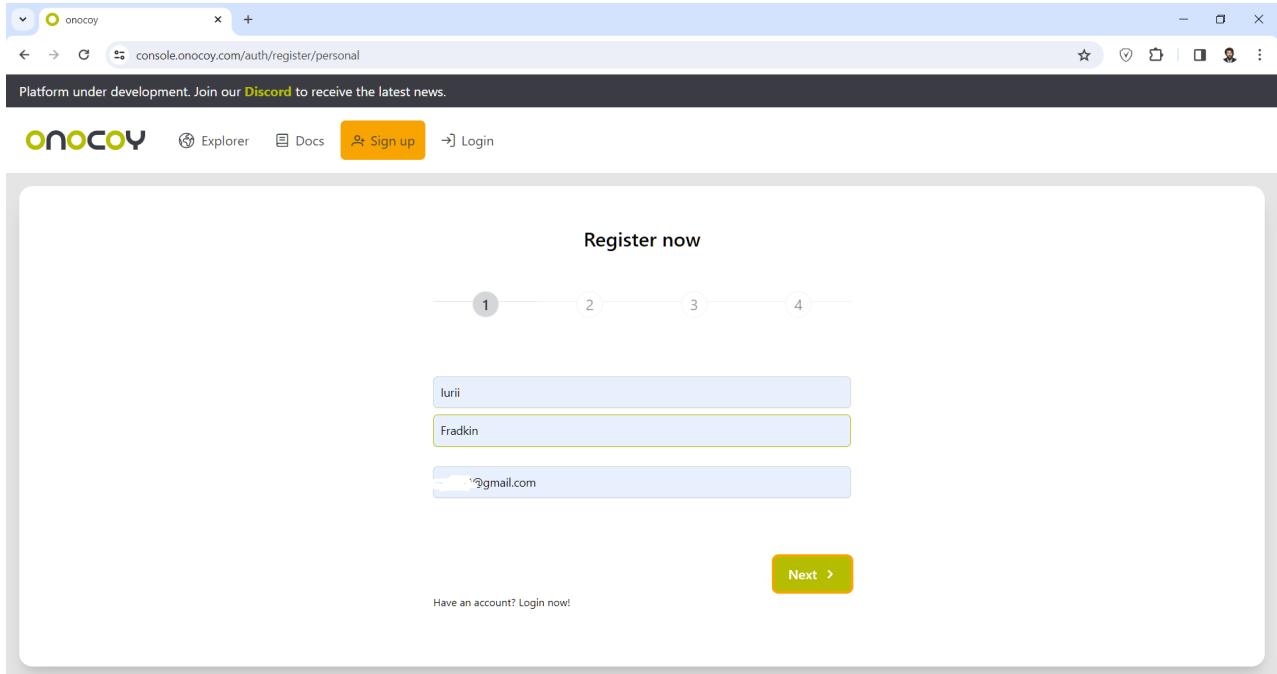
Go to <https://onocoy.com> and click **Explore**.



Click "Sign Up".

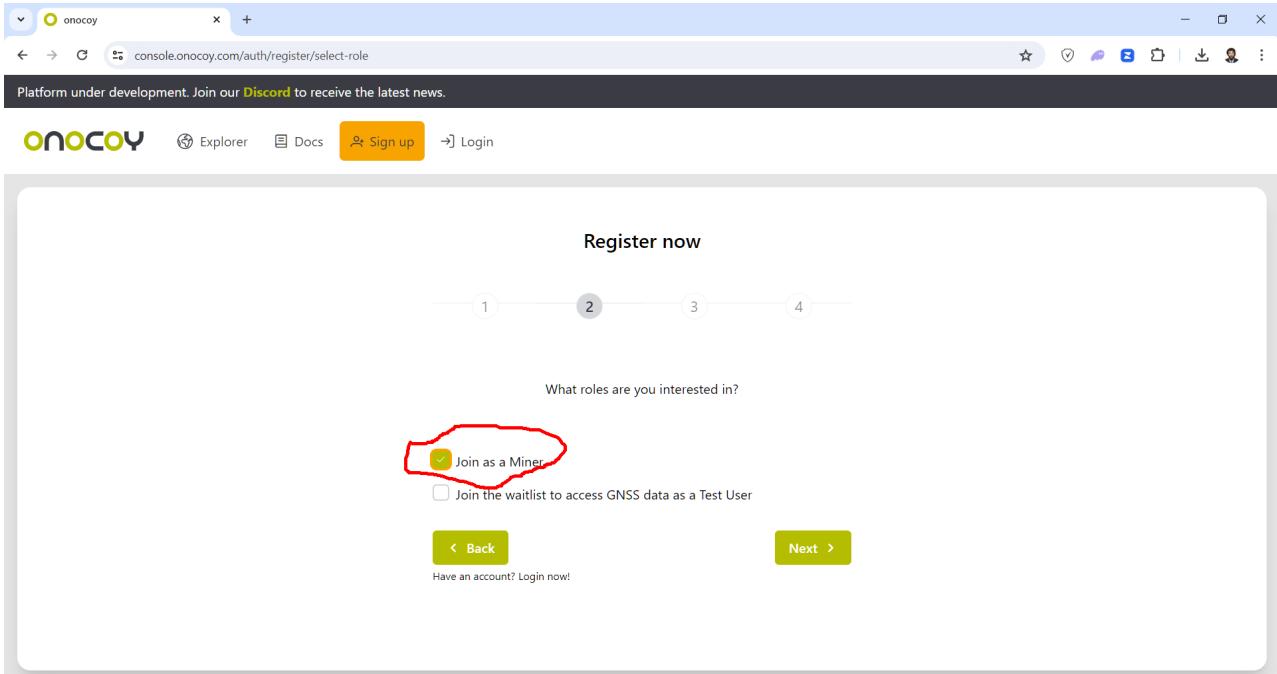


Enter your first name, last name, and email and click **Next**.



Screenshot of the Onocoy registration process, Step 1: Personal Information. The page title is "Register now". A progress bar shows step 1 of 4 completed. Three input fields are filled: First Name (lurii), Last Name (Fradkin), and Email (lurii@gmail.com). A yellow "Next >" button is visible at the bottom right.

Check “Join as a Miner”. Do not check the rover access box.



Screenshot of the Onocoy registration process, Step 2: Role Selection. The page title is "Register now". A progress bar shows step 2 of 4 completed. Two checkboxes are present: "Join as a Miner" (checked) and "Join the waitlist to access GNSS data as a Test User". A red oval highlights the checked "Join as a Miner" checkbox. A yellow "Next >" button is visible at the bottom right.

Set your **GNSS** knowledge level to “**Novice**”, mark that you have a **GNSS** station, and set the station type to “**Eltehs RtkBase**”. All these answers are only for collecting statistics, so they do not affect anything.

The screenshot shows a registration form titled "Register now" with a progress bar at the top indicating "1 of 2". Step 3 is highlighted. The form fields include:

- A dropdown menu showing "Novice".
- A checkbox labeled "I have a GNSS reference station" which is checked.
- A dropdown menu showing "Other".
- A text input field asking "Please enter your stations name" containing "Eltehs RtkBase".

At the bottom are "Back" and "Next" buttons, and a link "Have an account? Login now!".

Set your knowledge level about cryptocurrencies to “**Novice**”. Again, this does not affect anything.

The screenshot shows a registration form titled "Register now" with a progress bar at the top indicating "2 of 2". Step 3 is highlighted. The form fields include:

- A dropdown menu showing "Novice".
- A checkbox labeled "I had a blockchain wallet before I became aware of onocoy" which is unchecked.

At the bottom are "Back" and "Next" buttons, and a link "Have an account? Login now!".

The last question is about your motivation, i.e., money, fame, love for humanity... Just make sure to check “**I accept the privacy policy**”. Then click “**Register now**”.

Testing  
505 characters left

Others

I accept the [privacy policy](#)  
 I want to receive the newsletter ⓘ

< Back      Register now >

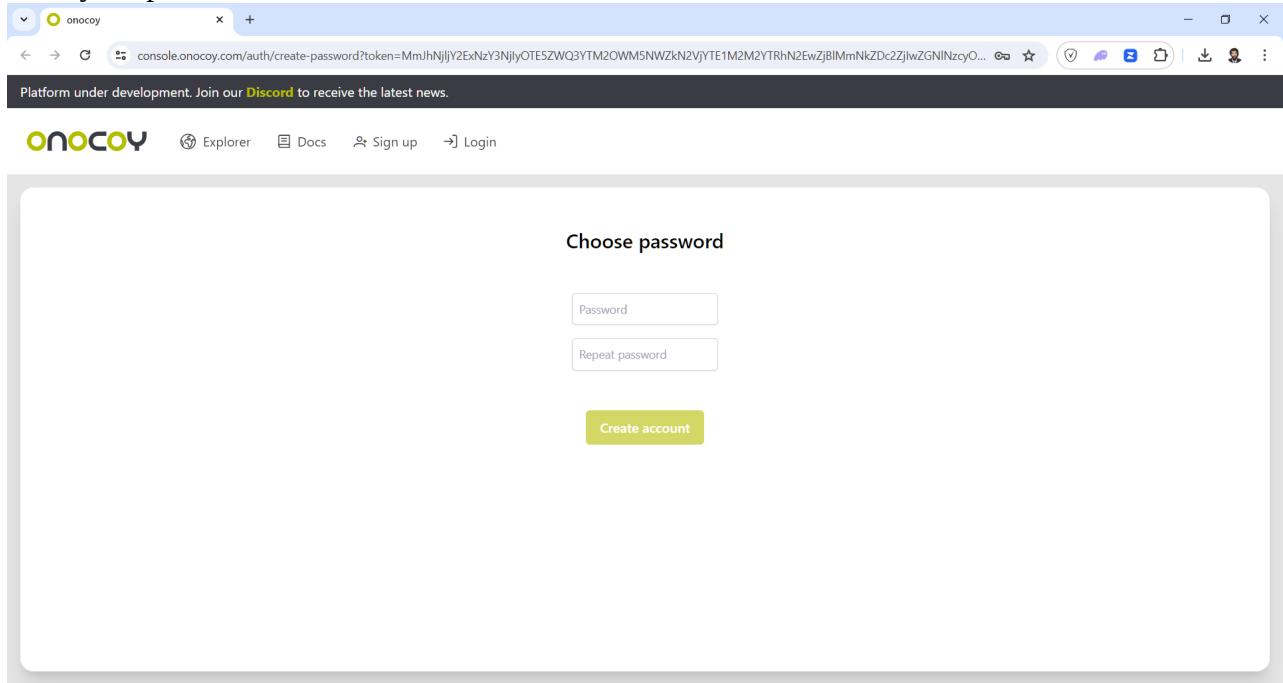
You will be asked to wait for an email.

Platform under development. Join our [Discord](#) to receive the latest news.

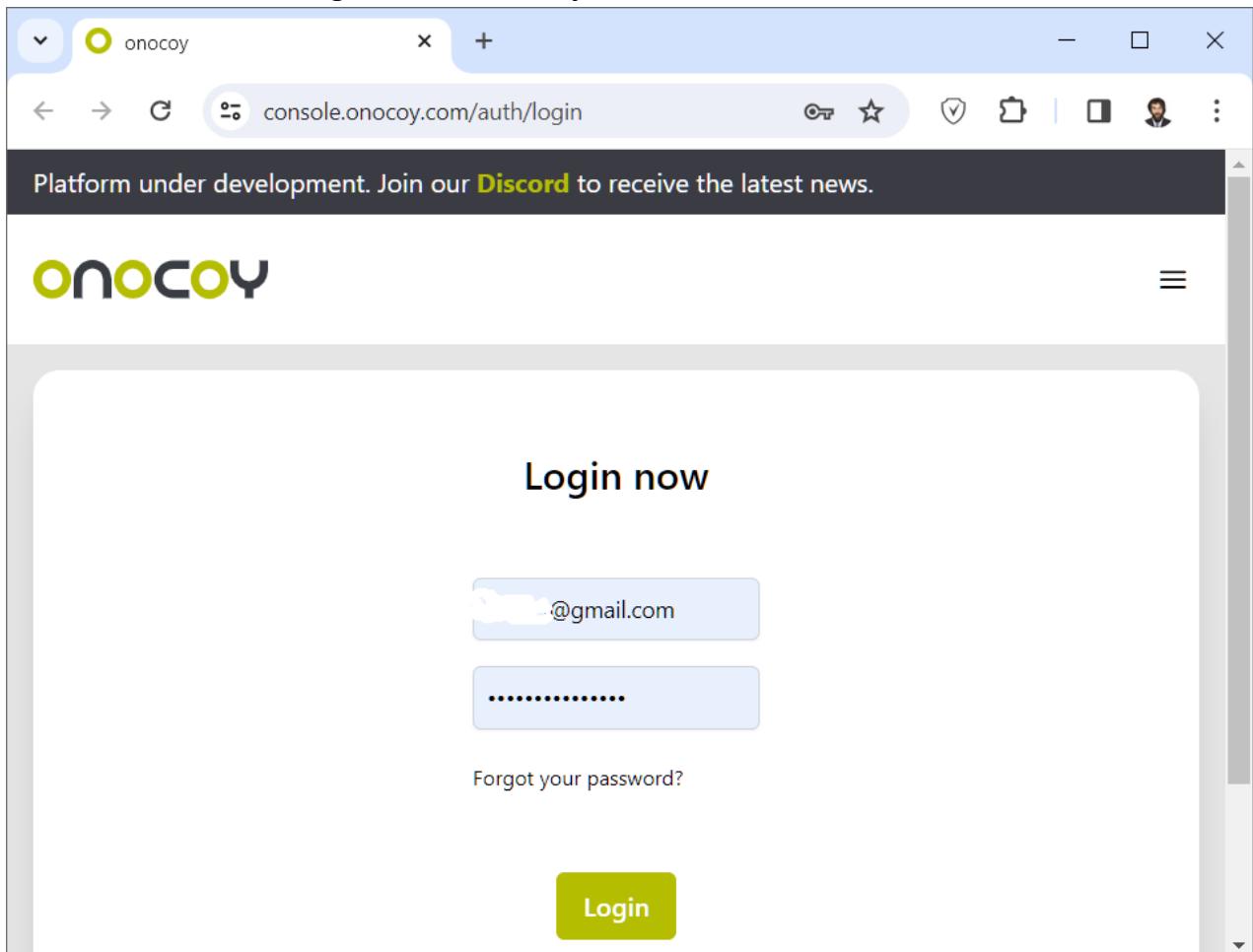
onocoy Explorer Docs Sign up Login

Thank you for joining onocoy!  
To be able to use your account, please check your email and follow the link to activate your account

Wait for the email with a big blue **JOIN** button. Click it and go to the password setting page. Sometimes you may receive another email indicating you are on the waiting list before this one. Enter your password and create an account.



You will be taken to the login window where you need to click “**LOGIN**”.



# Getting Credentials

Log in with your username and password.

The screenshot shows a web browser window for the Onocoy console at [console.onocoy.com/explorer](https://console.onocoy.com/explorer). The title bar says "onocoy". The top navigation bar includes links for "Explorer" (highlighted in orange), "Reference Stations", "NTRIP Clients (Coming soon...)", and "Docs". A message at the top states "Platform under development. Join our [Discord](#) to receive the latest news." On the right, it shows "BONO Balance: 0 Beta" and a user profile icon. Below the navigation is a search bar with dropdowns for "Search mountpoints", "Select signals", "By Status", and "By validation status". A sidebar on the left titled "Reference Stations" displays two statistics: "Online" (1375) and "Validated" (2057). The main area features a world map with a legend for "3,000 km" and a copyright notice for "© Mapbox © OpenStreetMap [Improve this map](#)".

Click “Reference Station” at the top.

The screenshot shows a web browser window for the Onocoy console at [console.onocoy.com/servers](https://console.onocoy.com/servers). The title bar says "onocoy". The top navigation bar includes links for "Explorer", "Reference Stations (highlighted in orange)", "NTRIP Clients (Coming soon...)", and "Docs". A message at the top states "Platform under development. Join our [Discord](#) to receive the latest news." On the right, it shows "BONO Balance: 0 Beta" and a user profile icon. Below the navigation is a search bar with dropdowns for "Show Columns", "Search...", "By Status", and "By Credential". A table header row includes columns for "Credential ↑↓", "Mountpoint ↑↓", and "Validation ↑↓". A message below the table says "No NTRIP server devices". At the bottom, there are navigation arrows and a page number "Total: 0 10".

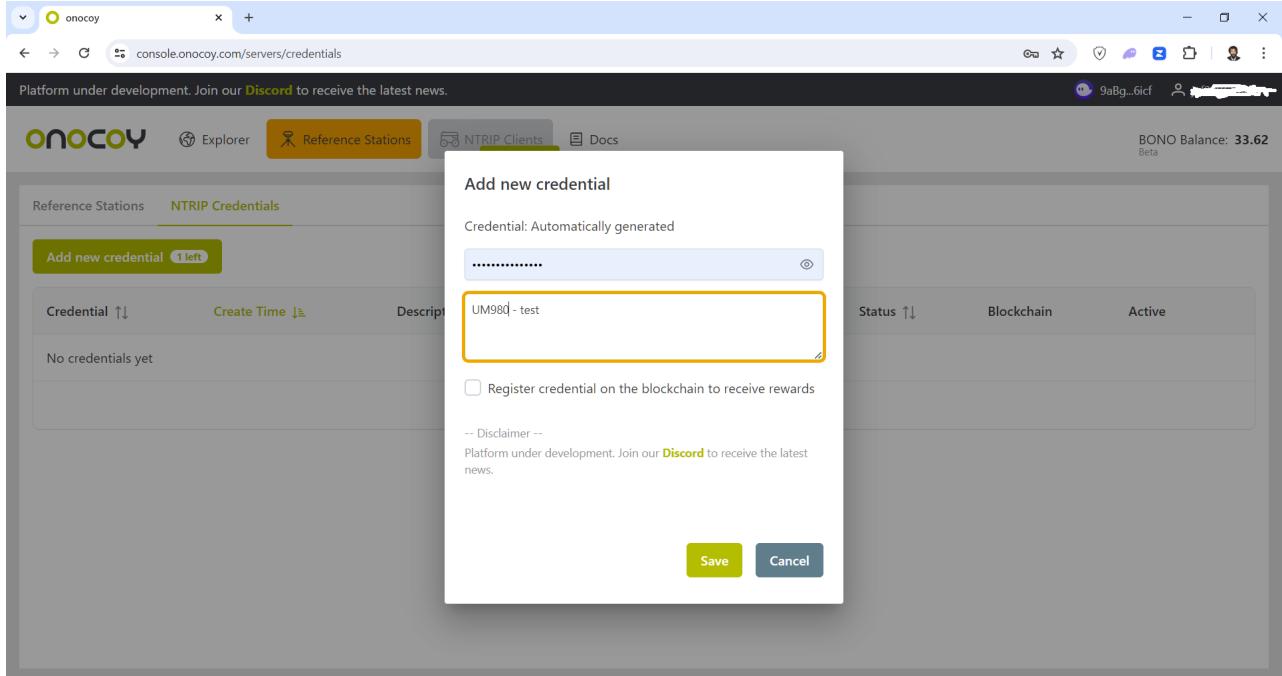
## Click “NTRIP Credential”.

The screenshot shows a web browser window for the Onocoy platform at [console.onocoy.com/servers](https://console.onocoy.com/servers). The title bar says "onocoy". The main navigation bar includes "Reference Stations", "NTRIP Clients" (highlighted in yellow), and "Docs". A message at the top says "Platform under development. Join our [Discord](#) to receive the latest news." On the right, it shows "BONO Balance: 0 Beta" and a user icon. The "NTRIP Clients" section has a sub-menu "Coming soon...". Below the navigation is a table header for "NTRIP Credentials" with columns: Credential ↑↓, Create Time ↓↑, Description ↑↓, Password, Usage ↑↓, Status ↑↓, Blockchain, and Active. A button "Add new credential 1 left" is highlighted in yellow. The table body below says "No credentials yet". At the bottom are pagination controls and a "Total: 0" message.

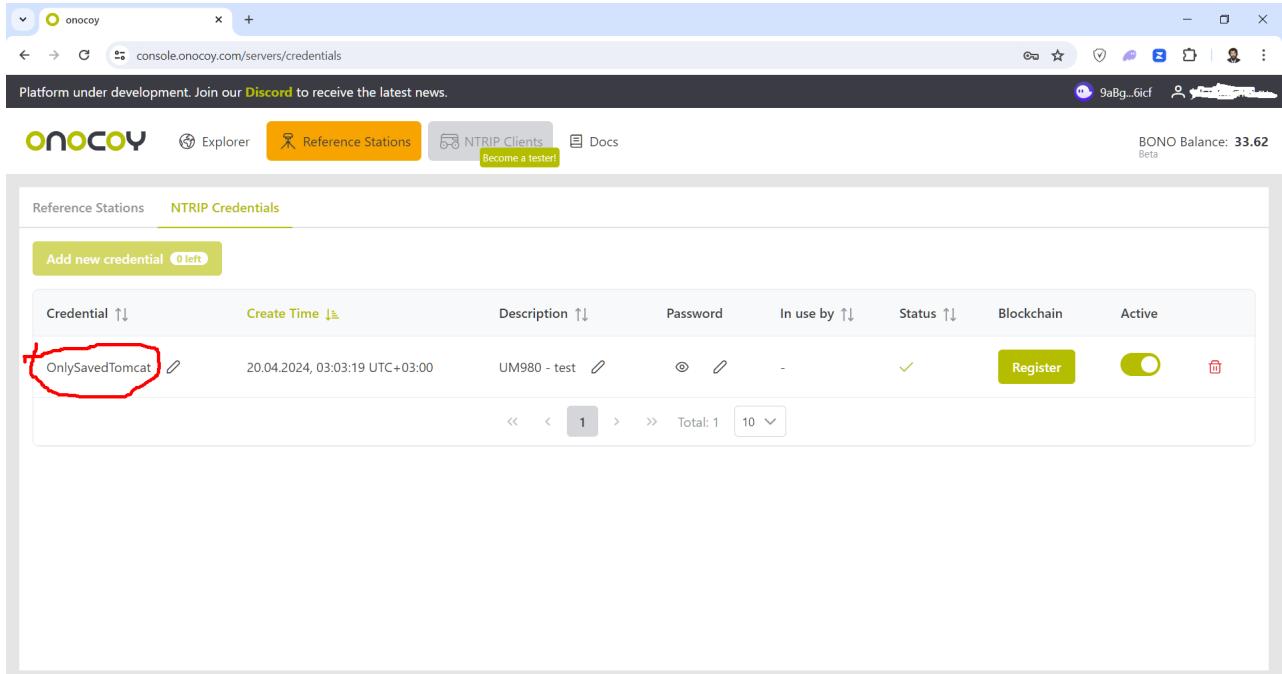
## Click “Add New Credential”.

The screenshot shows the same browser window as the previous one, but with a modal dialog box in the foreground titled "Add new credential". The dialog contains fields for "Password" and "Description (Optional)". There is a checkbox labeled "Register credential on the blockchain to receive rewards". Below the checkbox is a disclaimer: "-- Disclaimer -- Platform under development. Join our [Discord](#) to receive the latest news." A note at the bottom says "At least 8 characters required. At least one letter and one number". At the bottom of the dialog are "Save" and "Cancel" buttons.

Enter a password, description, and click **Save**. Remember the password as it will be needed for the **RtkBase** settings.



After successfully creating it, you will receive a mount point name, referred to as **Credential**. Remember this name as well.



# NTRIP Server Setup

**NTRIP Server** is a mechanism for transmitting data from the base station receiver to a large **NTRIP Caster**, which then distributes (and sells) these data to clients.

Go to **RtkBase** and click the **Options** button next to “**Ntrip A service**”.

The screenshot shows the RTKBase settings interface. The top navigation bar includes tabs for STATUS, SETTINGS (which is selected), and LOGS. Below the tabs, there's a section titled "Services:" with several service entries:

- Main service: Status is "On", with an "Options" button.
- Ntrip A service: Status is "Off", with an "Options" button. This entry has several configuration fields:
  - Caster address: servers.onocoy.com
  - Caster port: 2101
  - Caster password: (redacted)
  - Mount name: Your\_mount\_name
  - Rtcm messages: 1005(10),1033(10),1077,1087,1097,1107,1117,1127
  - Receiver options: (empty)
- Ntrip B service: Status is "Off", with an "Options" button.
- Ntrip Caster service: Status is "Off", with an "Options" button.
- Rtcm tcp service: Status is "Off", with an "Options" button.
- Rtcm serial service: Status is "Off", with an "Options" button.

A blue "Save" button is located at the bottom right of the service configuration area.

Enter the data from **Onocoy**. In the “**Caster password**” field, enter the password you set for the **Credential**. In the “**Mount name**” field, enter the name from the **Credential**. **Important!** Due to **Onocoy**'s specifics for the **NTRIP v1** protocol, the “**Mount name**” field should contain the **Credential** name, not the **mountpoint** name.

The “**Receiver Options**” field is intended for **Ublox** receivers, and information about the “**Rtcm messages**” field can be found in the “**RTCM3 Proposals**” section.

This screenshot shows the same RTKBase settings interface as the previous one, but with the "Caster password" field filled with ".....". The other fields remain the same as in the first screenshot.

Click **Save**, then **Options**, then **Off** to turn on the service.

The screenshot shows the 'SETTINGS' tab of the RTKBase interface. It lists several services with their current status (On or Off) and an 'Options' button. The services include Main service, Ntrip A service, Ntrip B service, Ntrip Caster service, Rtcn tcp service, Rtcn serial service, and File service. Below the services, there is a section for 'System Settings' with fields for 'Rtkbase 2.5.0' (Check update), 'Change Password' (New and Confirm fields), and a 'Change password' button.

## Connection Check

Return to **Onocoy**, click “**Reference Stations**”, and after a couple of minutes, see that your server is running, and the light on the left is green. Click anywhere on the gray stripe (e.g., the server name).

The screenshot shows the 'Reference Stations' page of the Onocoy console. At the top, there are tabs for 'Explorer', 'Reference Stations' (which is active and highlighted in yellow), 'NTRIP Clients', and 'Docs'. A 'Become a tester!' button is also visible. The main area displays a table of reference stations. One row is highlighted with a red circle around the 'Up since 2m 56s' status message, indicating the server is active. Below the table is a map showing the location of the server. The top right corner shows a user profile and a 'BONO Balance: 33.62 Beta' message.

You will be taken to a window with server data. The “Enable live feed” button is on the top right, which will be discussed later.

The screenshot shows the Onocoy server interface. At the top, there's a header with a logo, navigation links (Explorer, Reference Stations, NTRIP Clients, Docs), and user info (BONO Balance: 33.62). Below the header, the main area displays:

- Mountpoint:** fast-bird-18593
- Credential:** OnlySavedTomcat
- UM980 - test**
- Reference ID:** 4095
- Messages:** 1077(1),1087(1),1097(1),1117(1),1127(1)
- Signals:** 116
- Satellites:** 40
- Latency:** 0.296 s
- Rewards earned:** Not registered
- Status:** Up since 5m 9s
- Validation:** Unvalidated

In the center, there's a "Connection History" section showing a single entry: 20.04.2024, 03:44:29, 185.81.48.117:53934. To the right is a map of Riga, Latvia, with a green dot indicating the location. A legend at the bottom right says "Satellites" and "24 Hours".

Scroll down and see the received and unreceived signals.

The screenshot shows the same Onocoy interface as above, but with more detailed signal information. The left panel now includes:

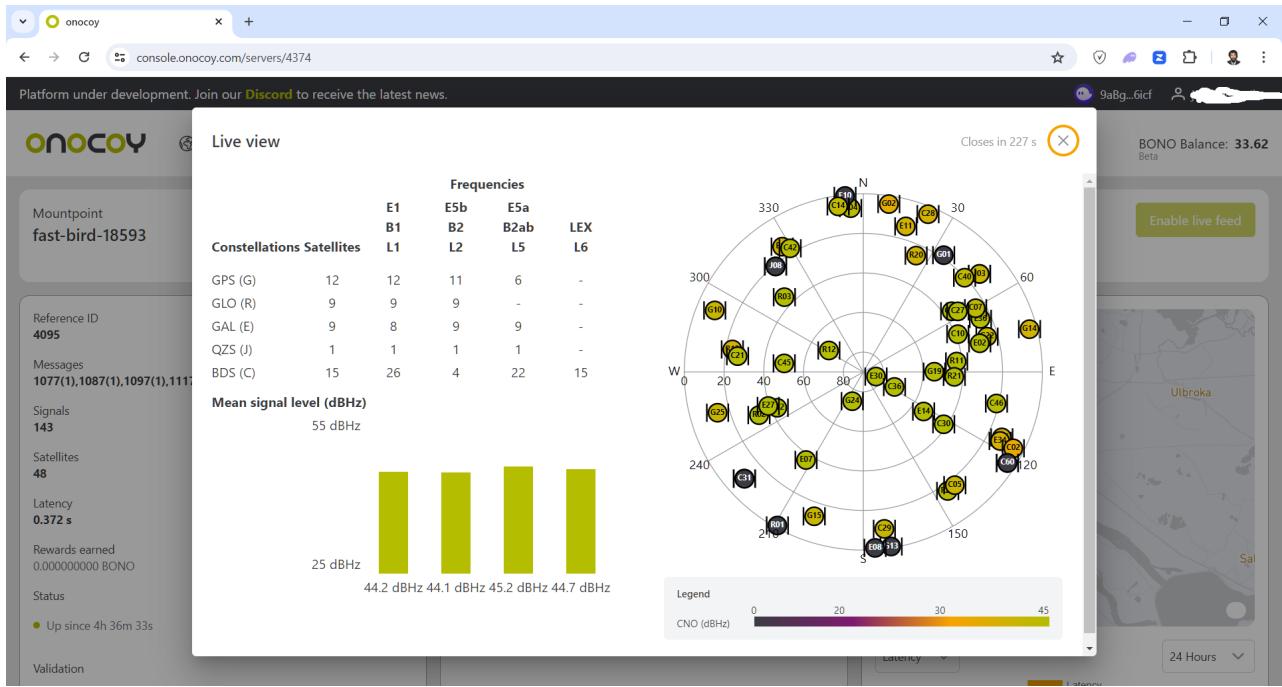
- Satellites:** 40
- Latency:** 0.296 s
- Rewards earned:** Not registered
- Status:** Up since 6m 18s
- Validation:** Unvalidated
- Bands:** GPS (L1, L2, L5, E1, E5b, E5a, E6, ESab), GAL (E1), GLO (L1, L2, L5), QZS (L1, L2, L5, LEX), BDS (B1, B2, B2ab, B3), NIC (L5).

The right side features a "Connection History" section with multiple entries and a graph showing the number of satellites and signals over a 24-hour period from 02:00 to 00:00. The graph has a yellow line for "Satellites" and a white line for "Signals".

The green signals are received, and the white signals are not. On the right, there is a graph of the number of satellites and signals. If you see signals like in the screenshot or better, everything is fine. If you see only **Beidou** signals with a **Unicore** receiver, it means the base station coordinates are entered incorrectly. How to enter them correctly is described in the “Determining Coordinates” section.

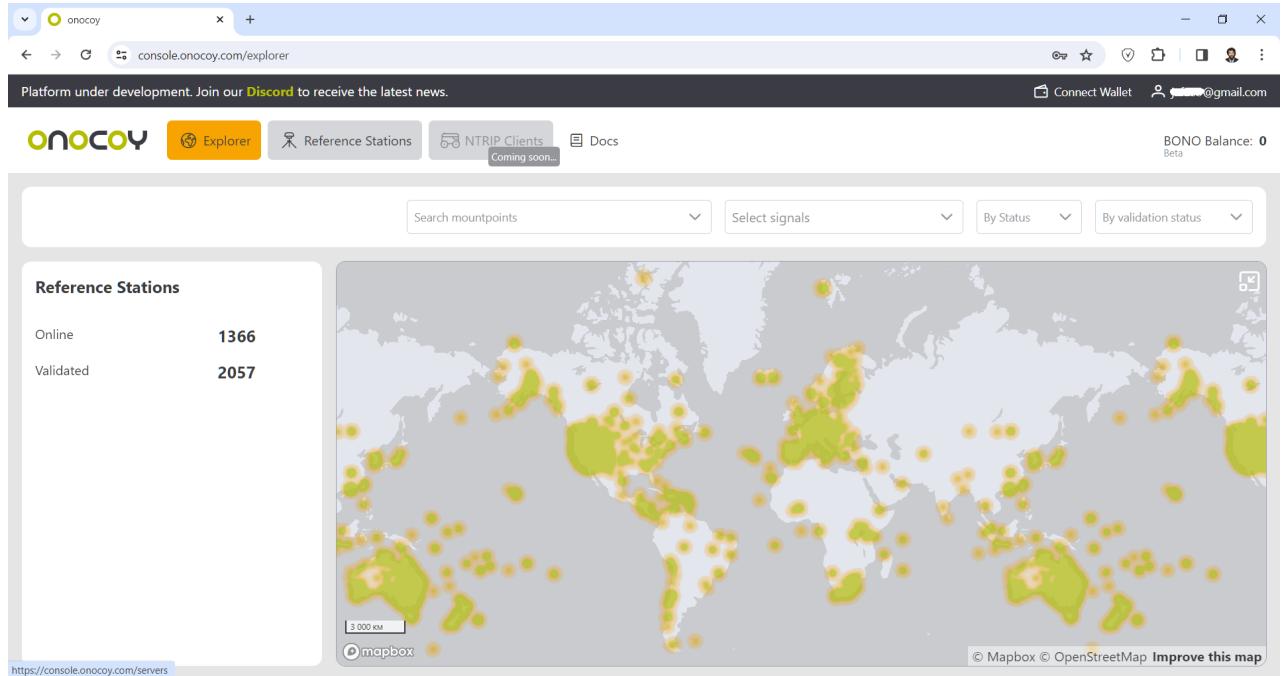
If you have two receivers connected to one antenna, you will not be able to double the benefits on **Onocoy**; in this case, only one receiver will connect.

If you click the “**Enable live feed**” button in the top right corner, you will get a display like this showing the satellite positions in the sky and the signal levels by frequency.

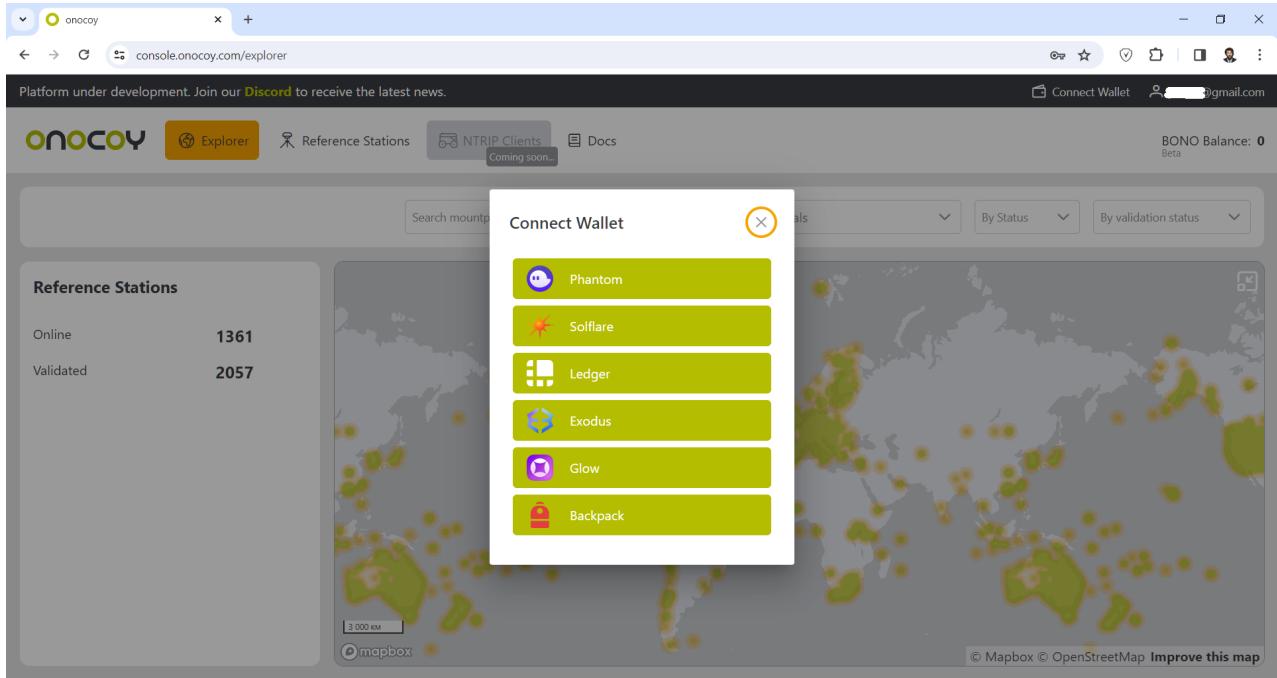


## Creating a Wallet

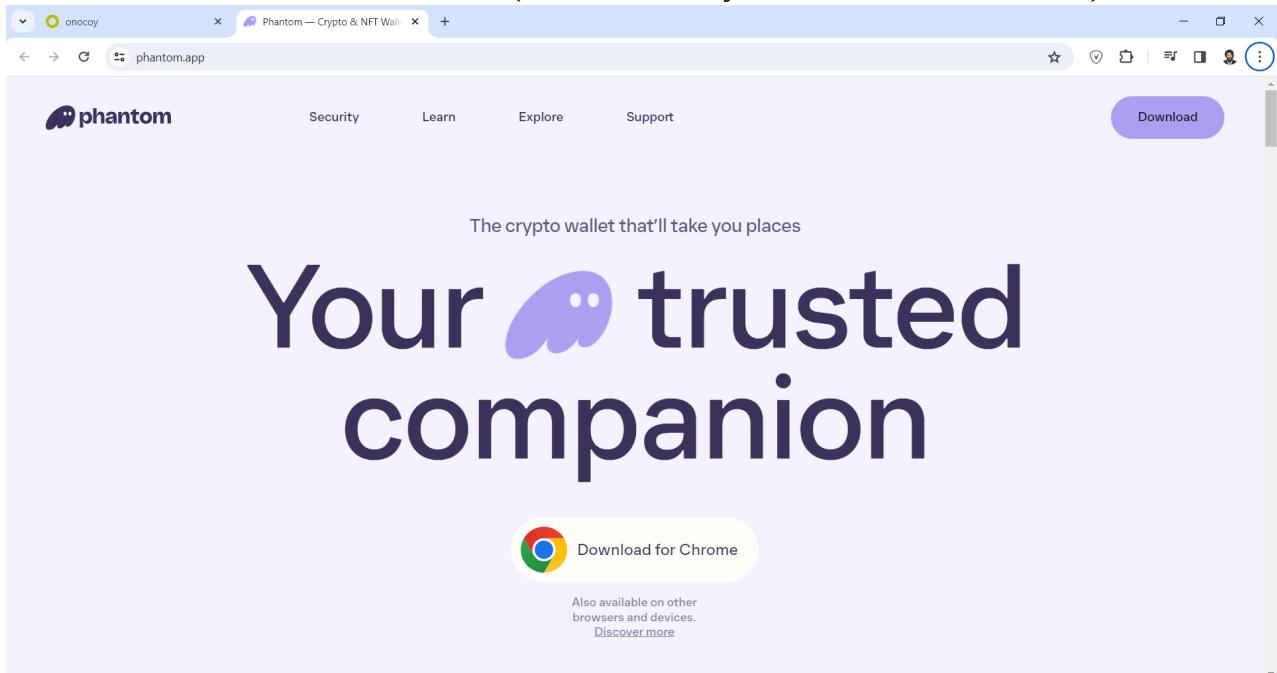
Log in with your username and password.



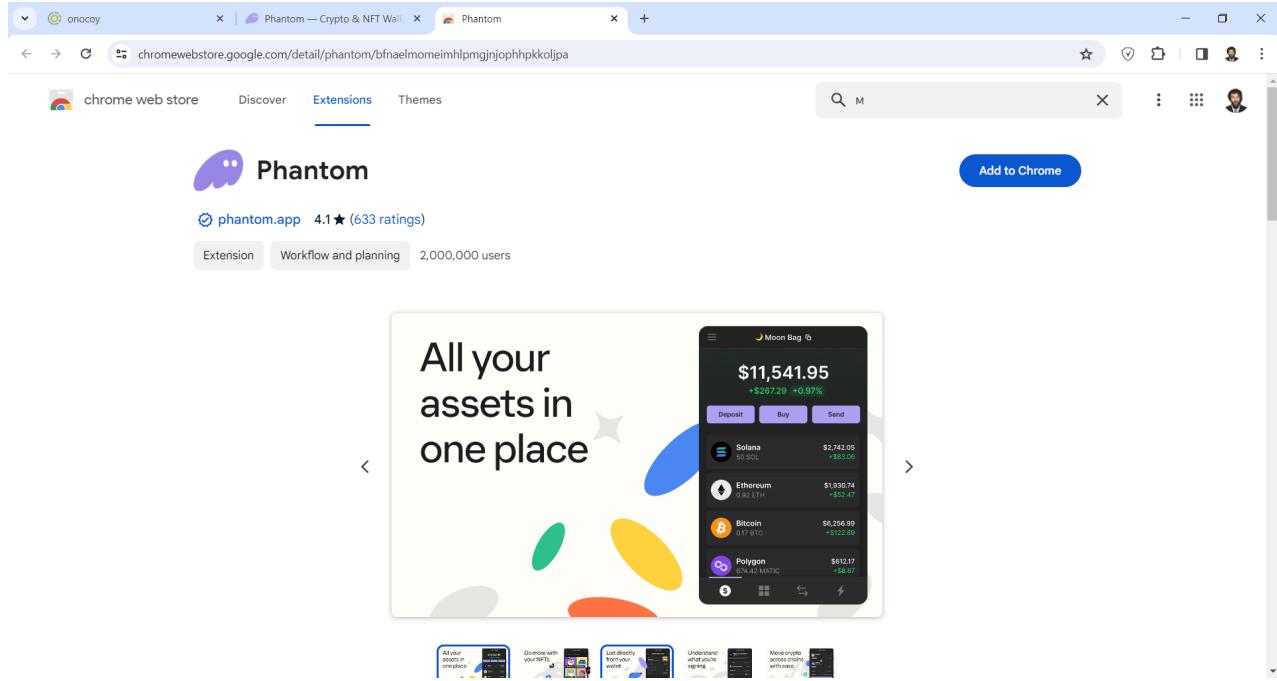
Click “**Connect Wallet**” at the top right, then select the top wallet — **Phantom**.



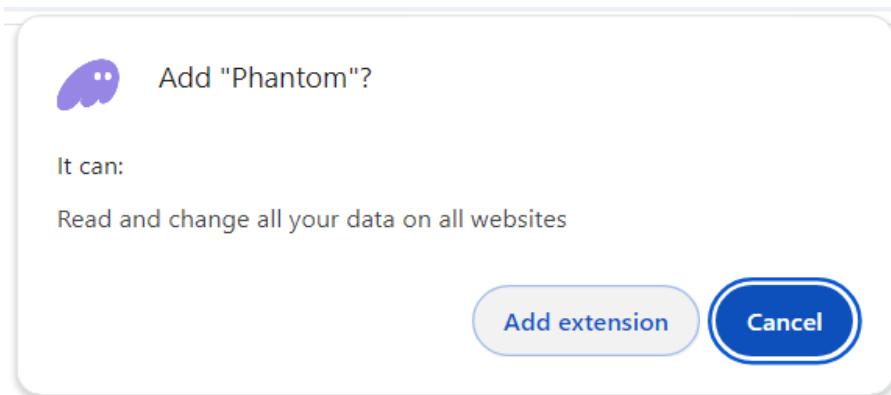
There is a [video](#) on setting up and configuring **Phantom** for **Onocoy**. It is slightly outdated. On this screen, click “**Download for Chrome**” (or otherwise, if you have a different browser).



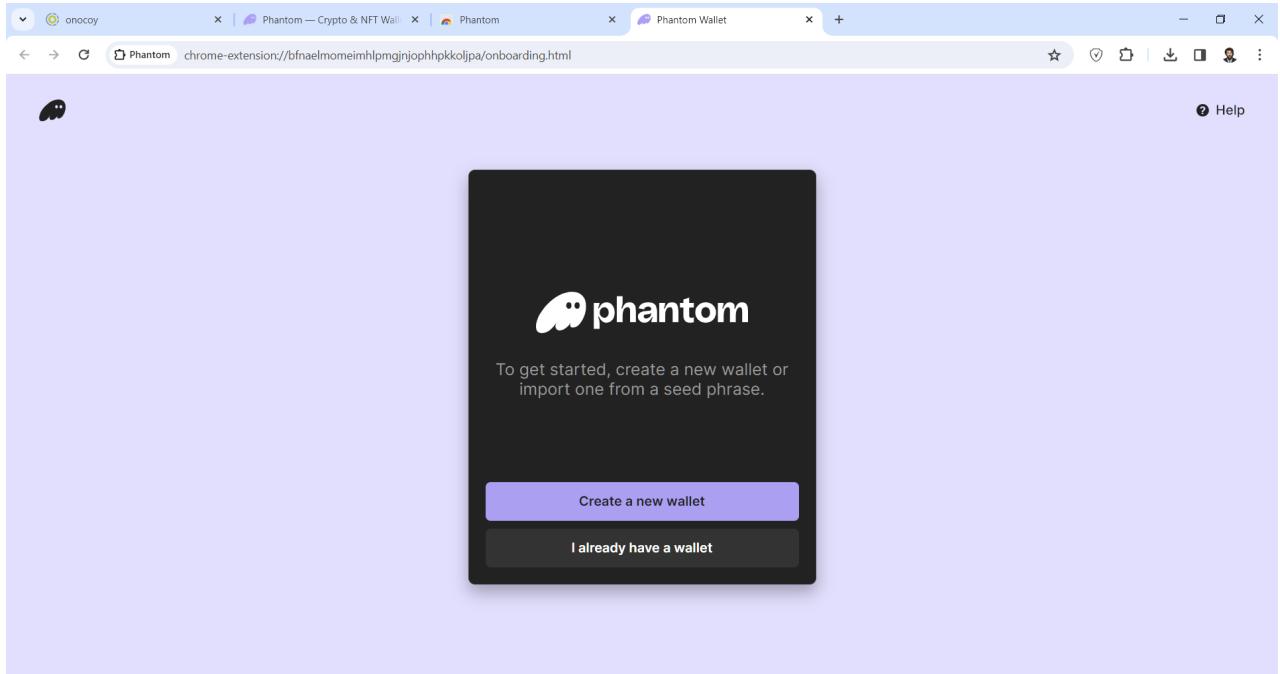
After clicking the button, go to the **Chrome web store** and click “**Add to Chrome**” to install the extension.



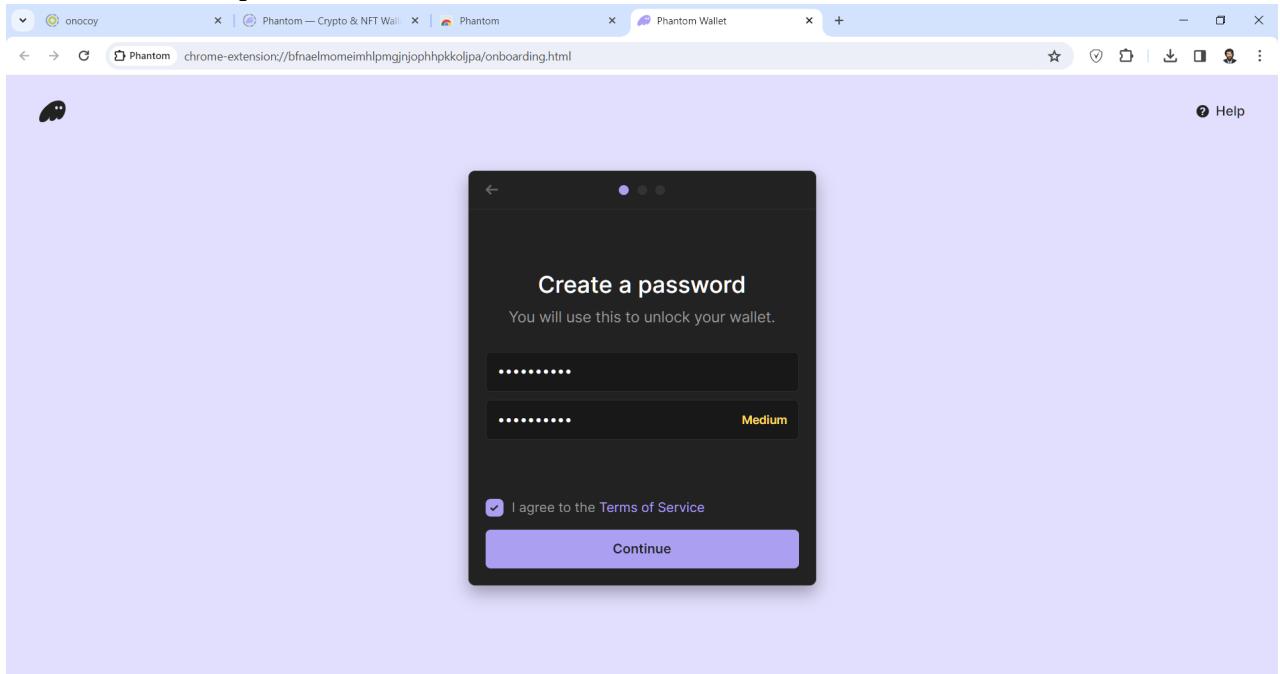
Click “**Add Extension**”.



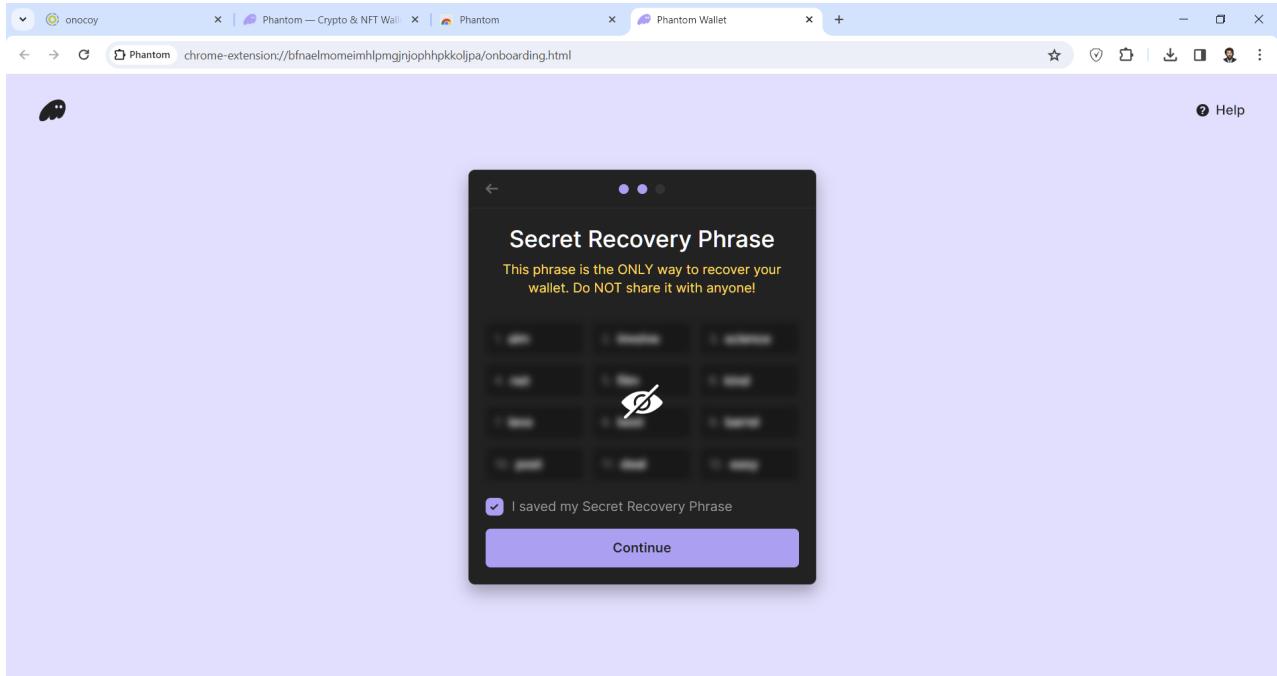
The wallet window opens, where you click “**Create a new wallet**”.



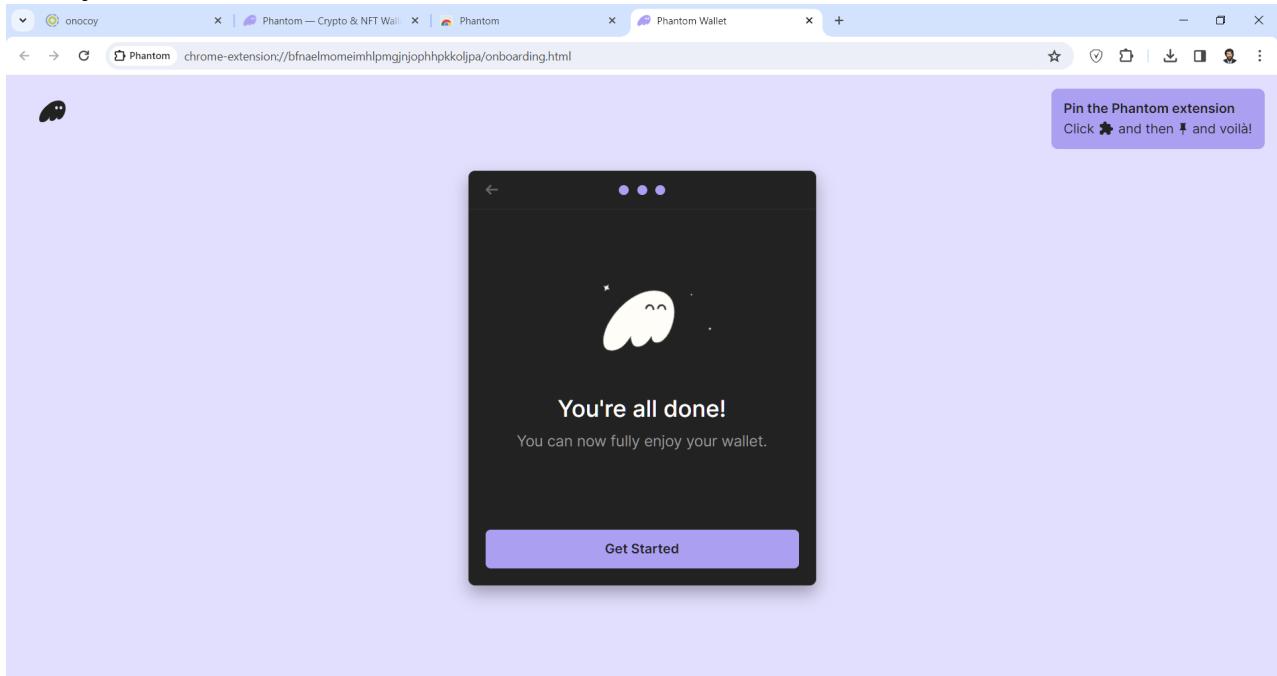
Create and enter a password twice, check the box, and click **Continue**.



Write down the 12 secret words (or take a screenshot). Again, check the box and click **Continue**.

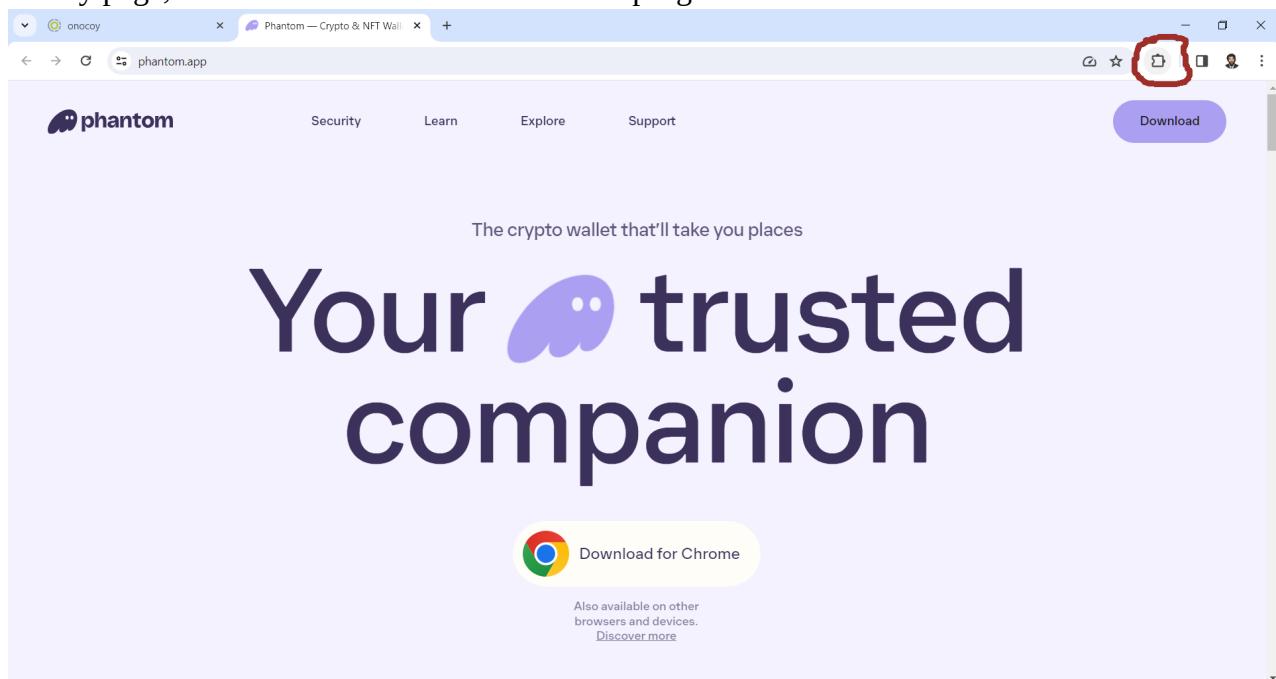


Finally, click “Get Started”.

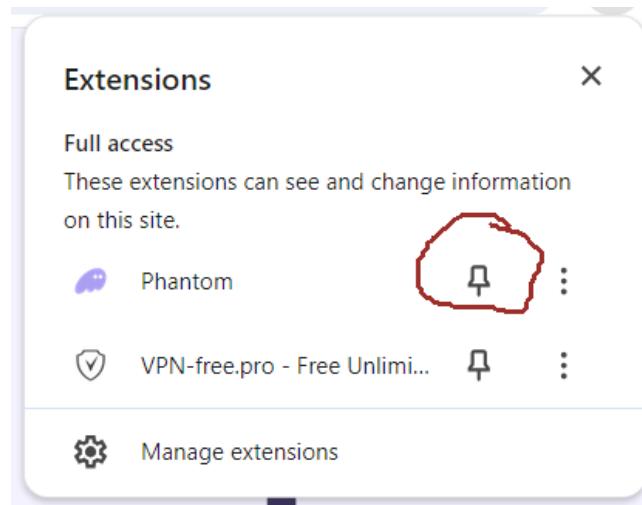


## Enabling the Plugin

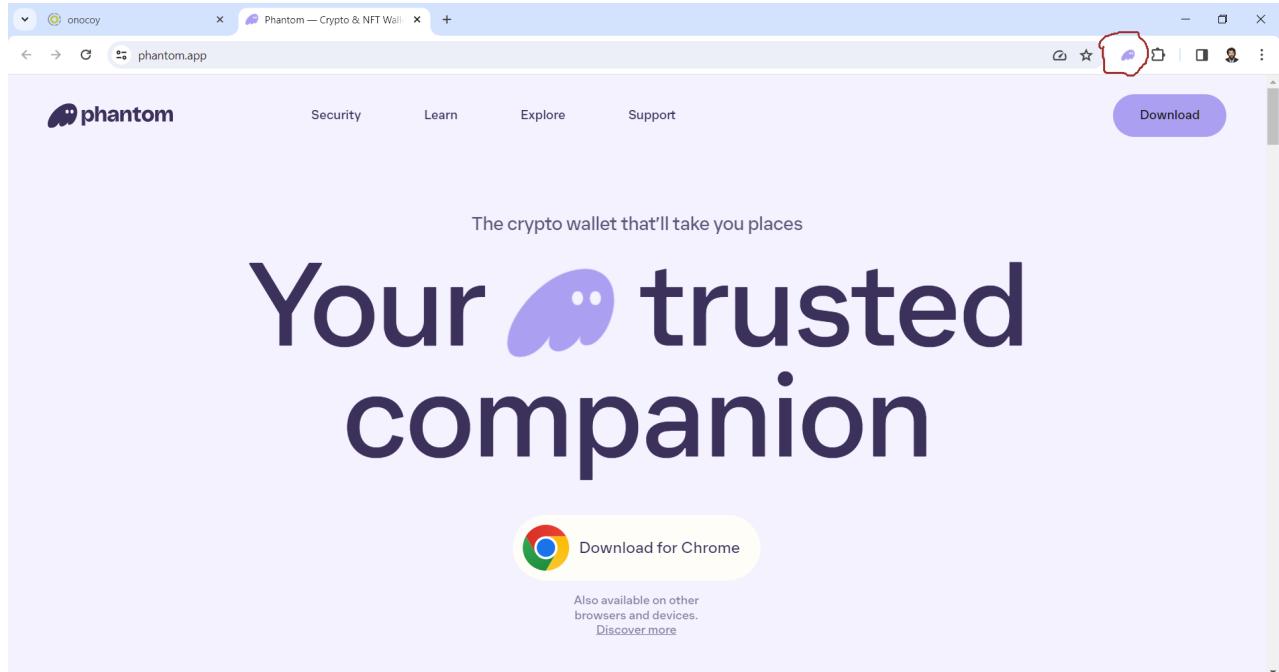
On any page, click the **Extension** button at the top right.



In the dropdown menu, click the button next to **Phantom**.

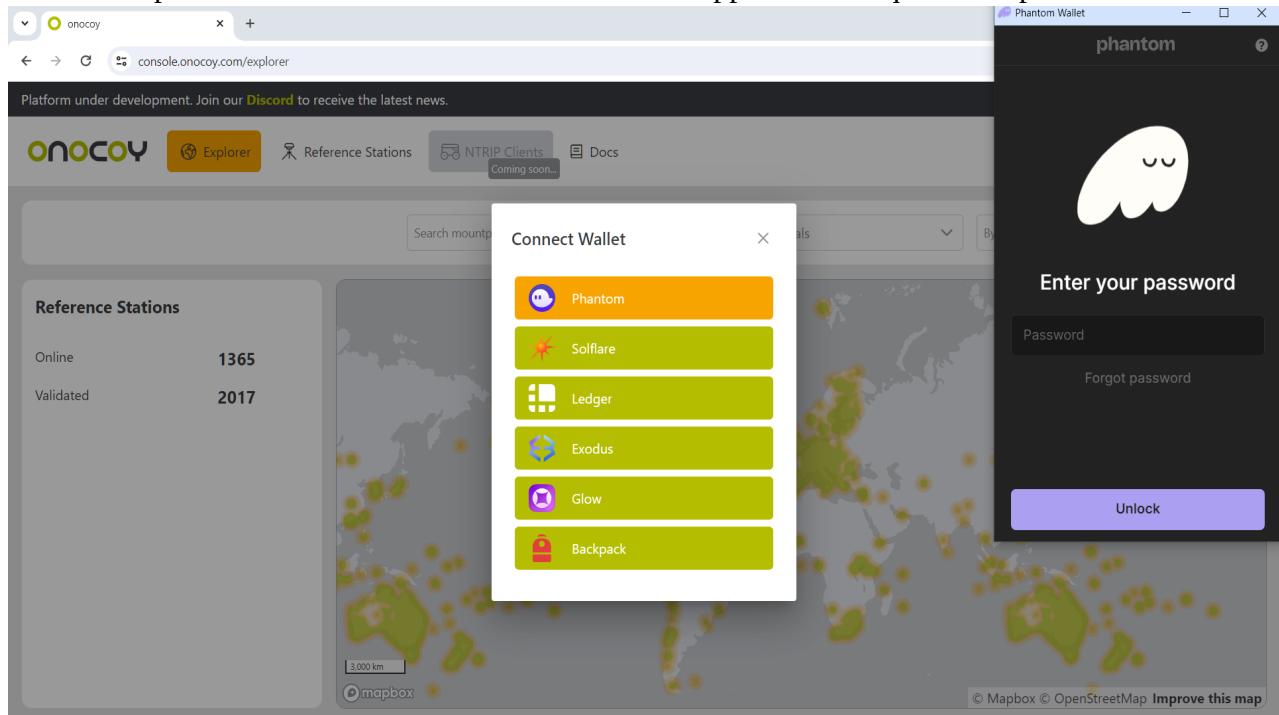


As a result, the **Phantom** icon will appear at the top right of the page.

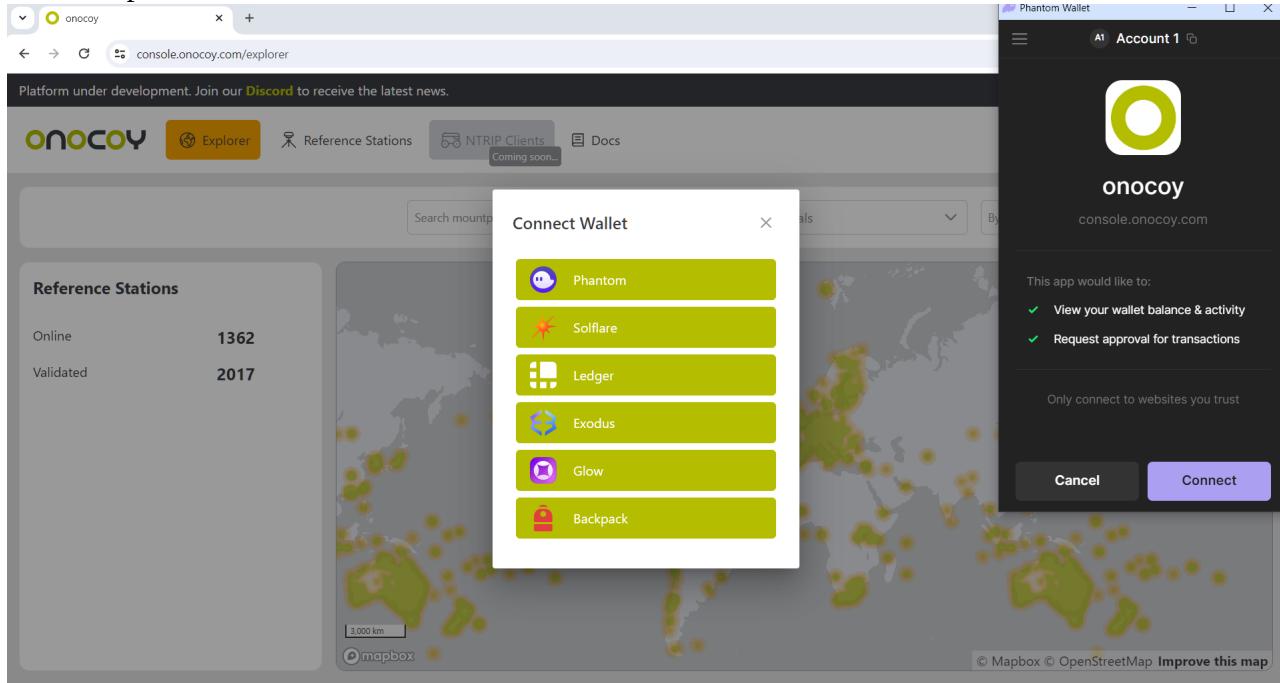


## Connecting the Wallet

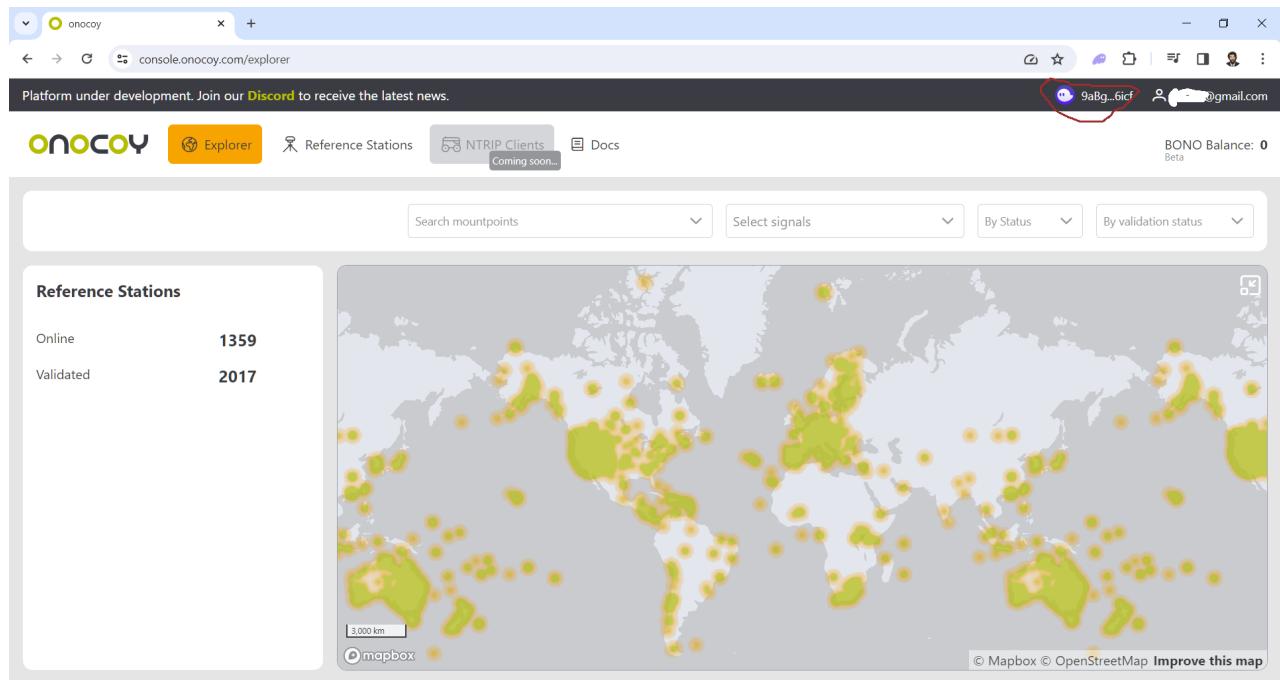
Return to the **Onocoy** page. As described earlier, click “**Connect Wallet**” at the top right, then select the top wallet — **Phantom**. The wallet window appears and requests the password.



Enter the password.

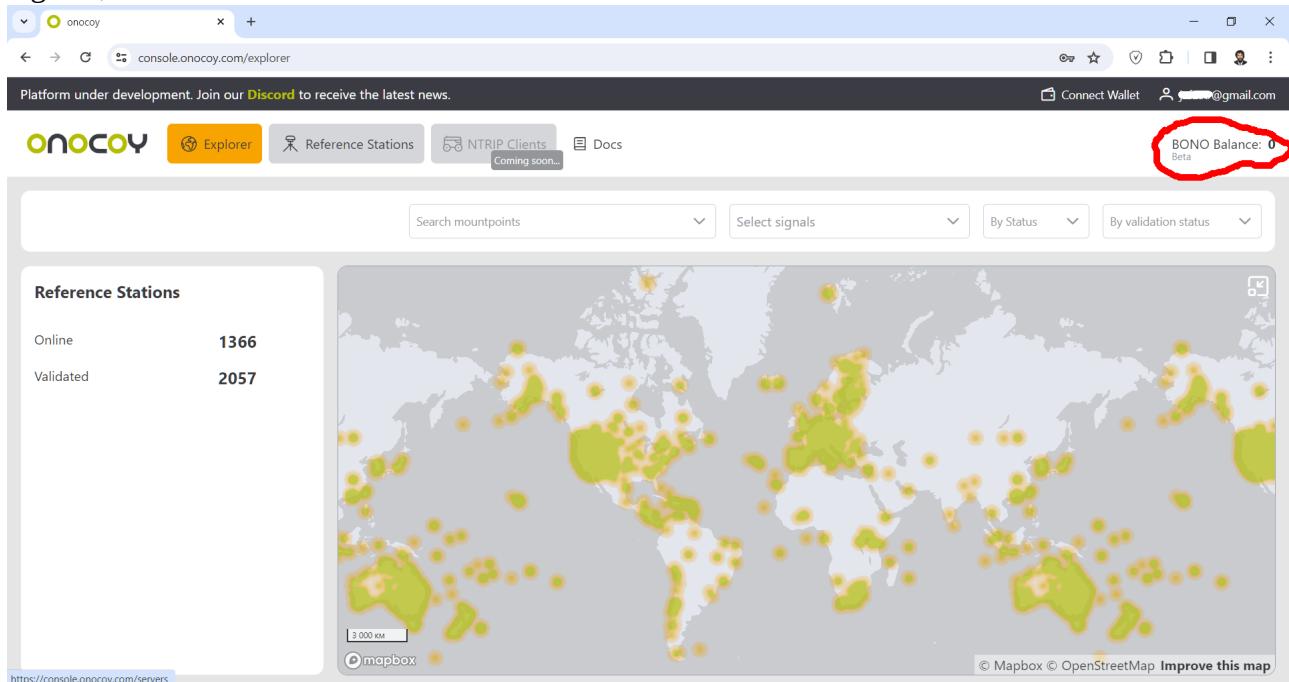


Click **Connect**. The wallet is connected.



# Registering the Wallet

Log in with your username and password. Registering the wallet makes sense only with a positive balance, i.e., after validating your station and starting to earn cryptocurrency. If you decide to register, click “**Reference Station**”.



Platform under development. Join our [Discord](#) to receive the latest news.

Connect Wallet [@gmail.com](#)

ONOCOY Explorer Reference Stations NTRIP Clients Coming soon... Docs

BONO Balance: 0 Beta

Search mountpoints Select signals By Status By validation status

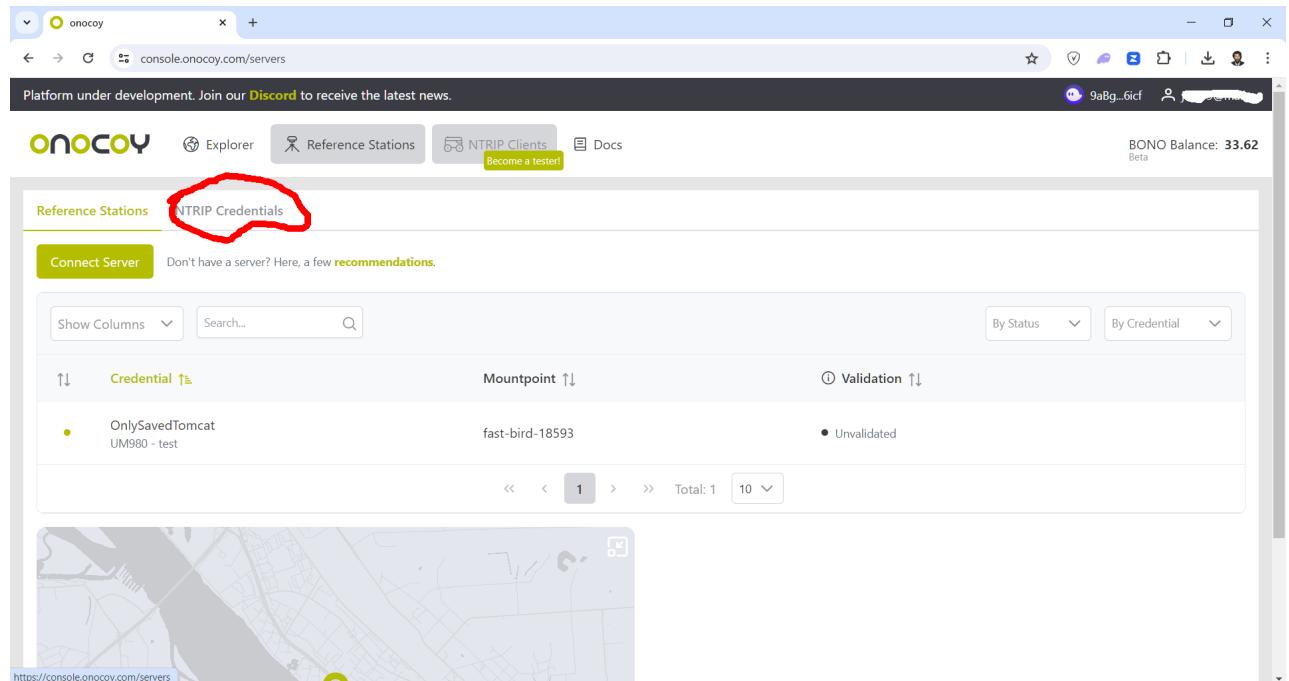
Reference Stations

Online	1366
Validated	2057

3 000 KM mapbox © Mapbox © OpenStreetMap Improve this map

<https://console.onocoy.com/servers>

Click “**NTRIP Credential**”.



Platform under development. Join our [Discord](#) to receive the latest news.

9aBg...6icf

ONOCOY Explorer Reference Stations NTRIP Clients Become a tester! Docs

BONO Balance: 33.62 Beta

Reference Stations NTRIP Credentials

Connect Server Don't have a server? Here, a few [recommendations](#).

Show Columns Search... By Status By Credential

Credential ↑↓	Mountpoint ↑↓	Validation ↑↓
OnlySavedTomcat UM980 - test	fast-bird-18593	● Unvalidated

<< < > >> Total: 1 10

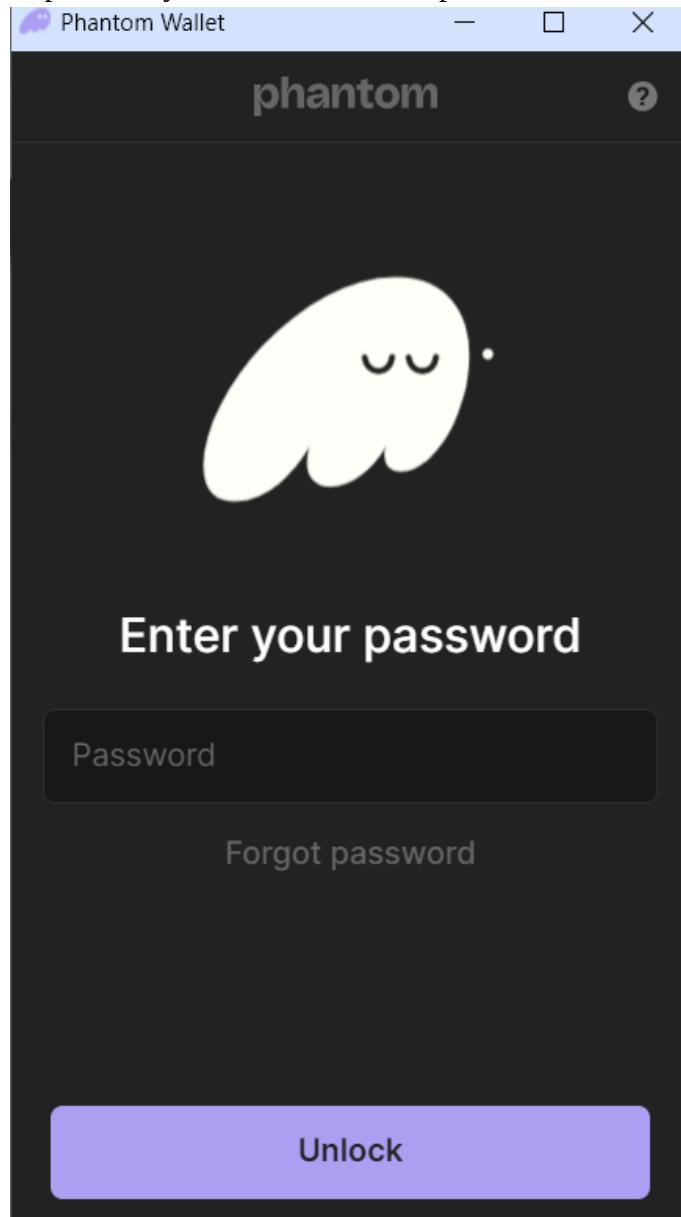
<https://console.onocoy.com/servers>

## Click Register.

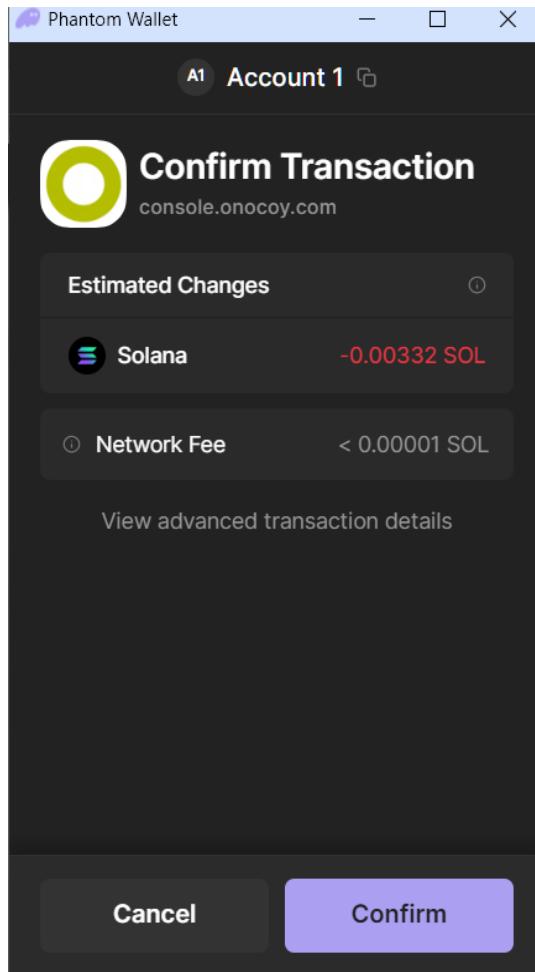
The screenshot shows a web browser window for the Onocoy platform at [console.onocoy.com/servers/credentials](https://console.onocoy.com/servers/credentials). The title bar says "onocoy". The main content is titled "NTRIP Credentials". A green button labeled "Add new credential" is visible. Below it is a table with one row of data. The table has columns: Credential, Create Time, Description, Password, In use by, Status, Blockchain, and Active. The first column contains "OnlySavedTomcat". The second column contains "20.04.2024, 03:03:19 UTC+03:00". The third column contains "UM980 - test". The fourth column contains an eye icon. The fifth column contains "fast-bird-18593" with a checkmark. The sixth column contains a green "Register" button, which is circled in red. The seventh column contains a green switch icon. The eighth column contains a red trash bin icon. At the bottom of the table, there is a page navigation section with links like <<, <, 1, >, >>, and Total: 1.

Credential ↑↓	Create Time ↓↑	Description ↑↓	Password	In use by ↑↓	Status ↑↓	Blockchain	Active
OnlySavedTomcat	20.04.2024, 03:03:19 UTC+03:00	UM980 - test	👁️	fast-bird-18593 ✓		<span style="background-color: green; color: white; padding: 2px 10px; border-radius: 5px;">Register</span>	<input checked="" type="checkbox"/>

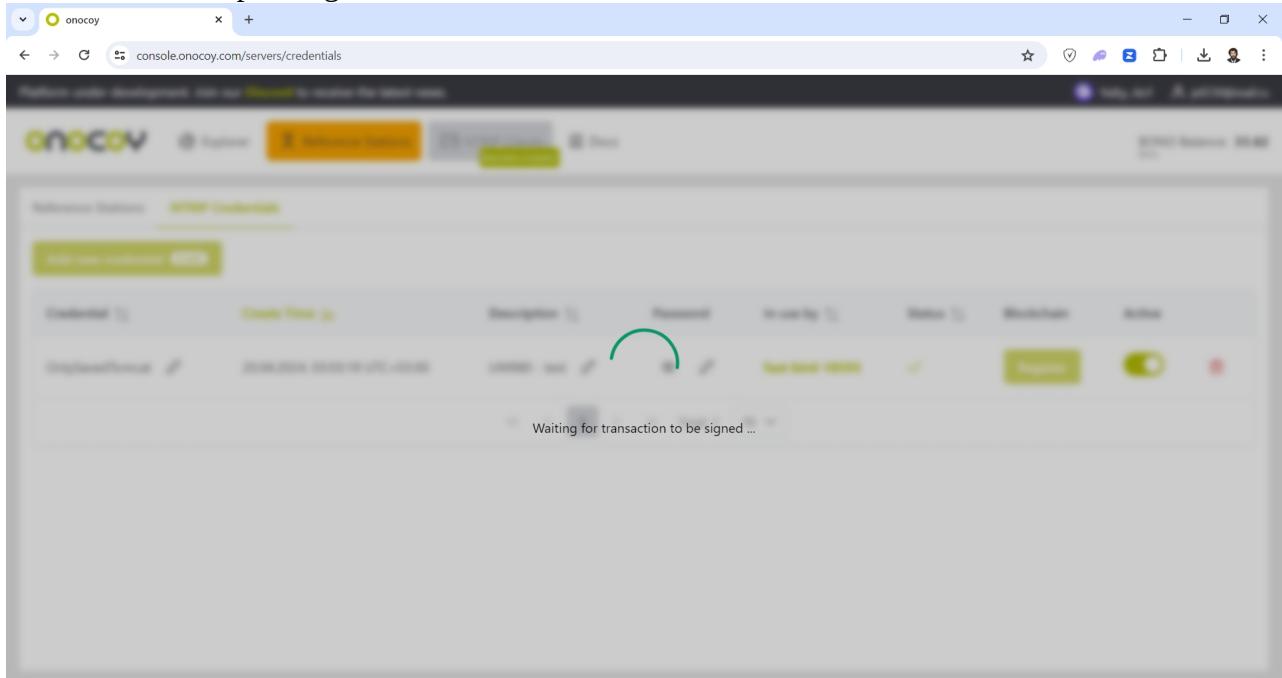
The wallet window pops up, where you need to enter the password and click **Unlock**.



Click **Confirm**.



The transaction is pending.



After successful registration, the screen looks like this. If the registration was unsuccessful, wait a day or two. This means that the blockchain refuses to make a free transaction, and you have not yet accumulated enough cryptocurrency for a paid one.

The screenshot shows a web browser window for the Onocoy platform at [console.onocoy.com/servers/credentials](https://console.onocoy.com/servers/credentials). The title bar says "onocoy". The header includes the Onocoy logo, navigation links for "Explorer", "Reference Stations", "NTRIP Clients", "Docs", and a "Become a tester!" button. A message at the top says "Platform under development. Join our **Discord** to receive the latest news." On the right, it shows "BONO Balance: 33.62 Beta" and a user profile icon. The main content area is titled "NTRIP Credentials" and contains a table with one row of data. The table columns are: Credential (with a dropdown arrow), Create Time (20.04.2024, 03:03:19 UTC+03:00), Description (UM980 - test), Password (two eye icons), In use by (fast-bird-18593 with a checkmark), Status (green checkmark), Blockchain (green checkmark), and Active (green switch). A red "Unregister" button is next to the status. Below the table is a pagination control with pages 1-10. The URL in the address bar is <https://console.onocoy.com/servers/credentials>.

Credential	Create Time	Description	Password	In use by	Status	Blockchain	Active
OnlySavedTomcat	20.04.2024, 03:03:19 UTC+03:00	UM980 - test	Two eye icons	fast-bird-18593 ✓	✓	✓	Unregister

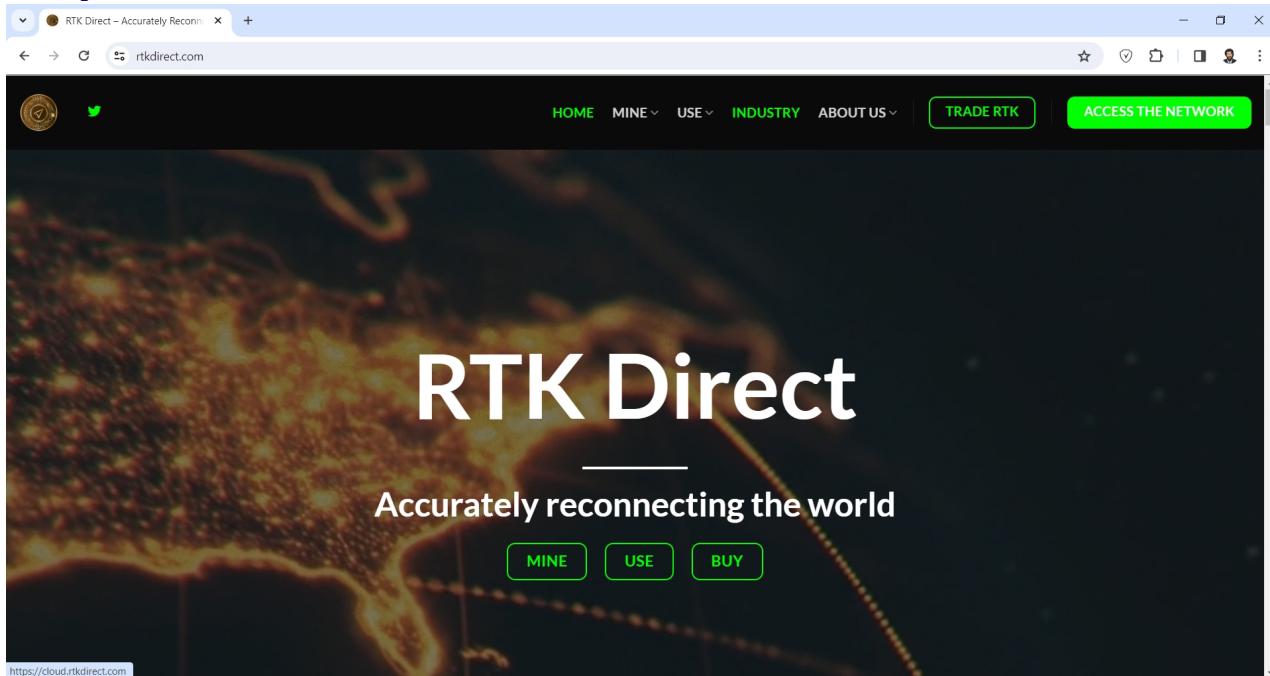
# NTRIP Configuration for RtkDirect

<https://rtkdirrect.com/> is another service that allows you to earn money using base stations. A brief connection guide is available at <https://rtkdirrect.com/buy-a-hotspot/>, and we will provide a brief description for **RtkBase**.

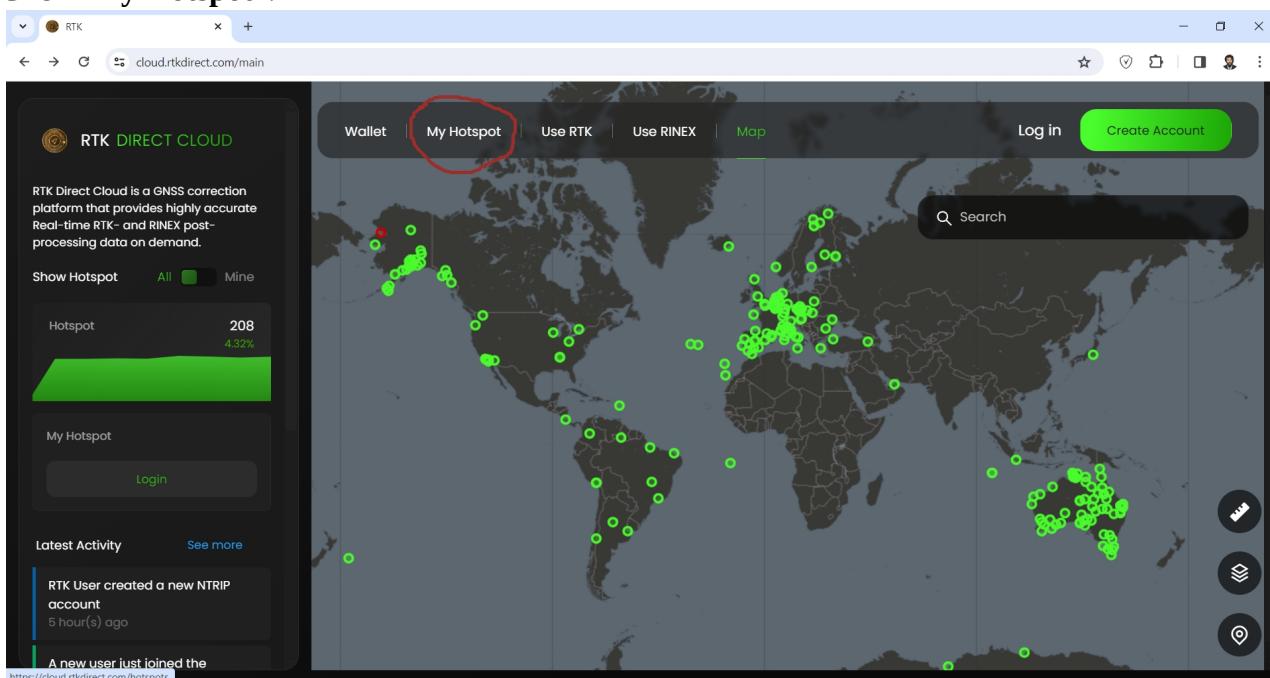
Before connecting to **RtkDirect**, set the precise coordinates of your base as described in “Determining Coordinates”.

## Registration

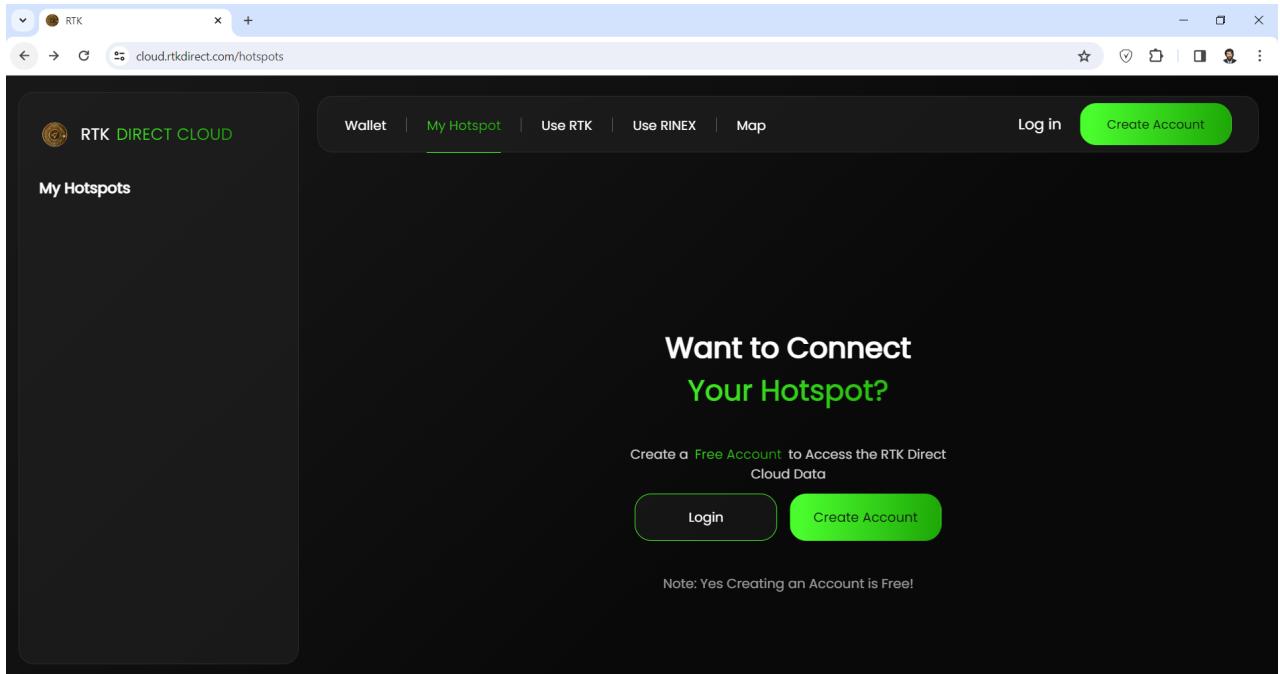
On <https://rtkdirrect.com/>, click the “Access The Network” button.



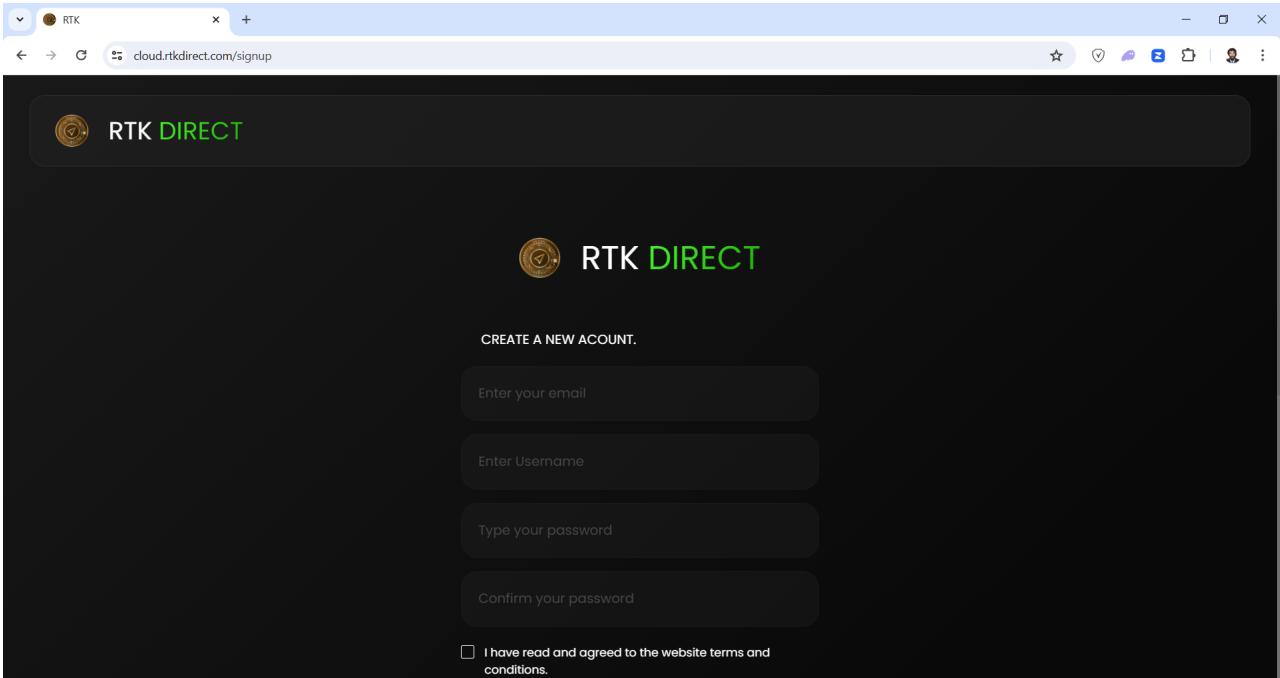
Click “My Hotspot”.



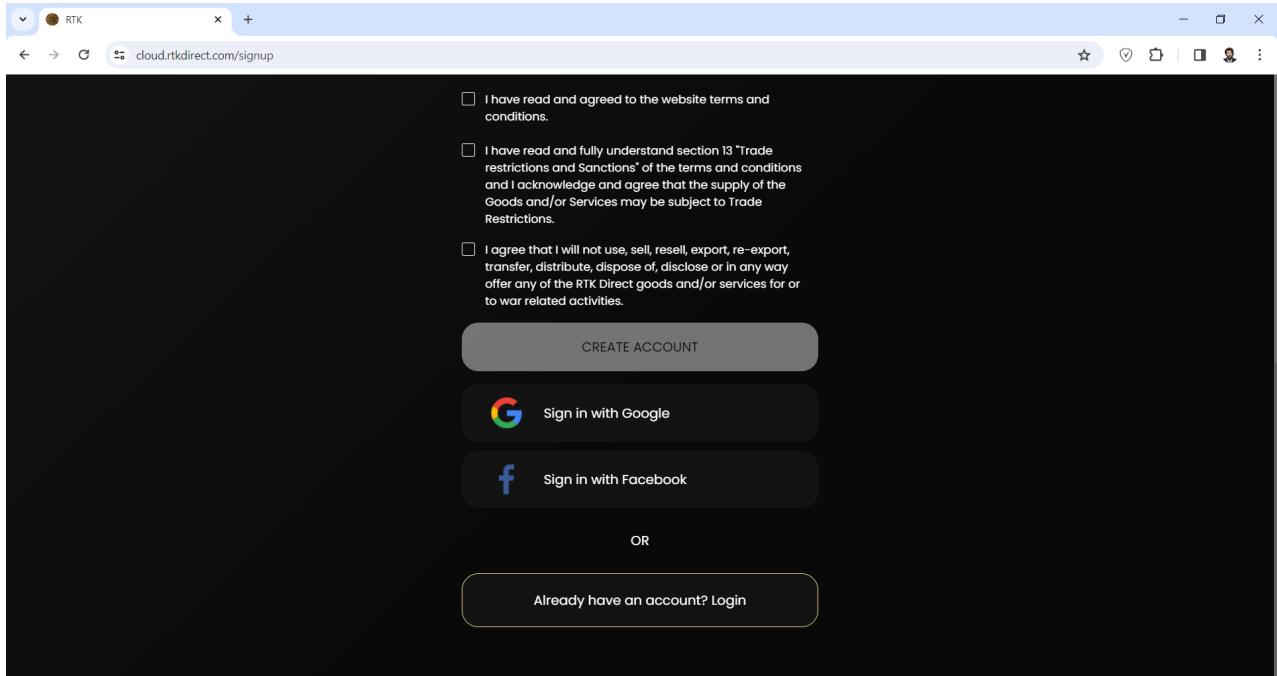
Click “Create Account”.



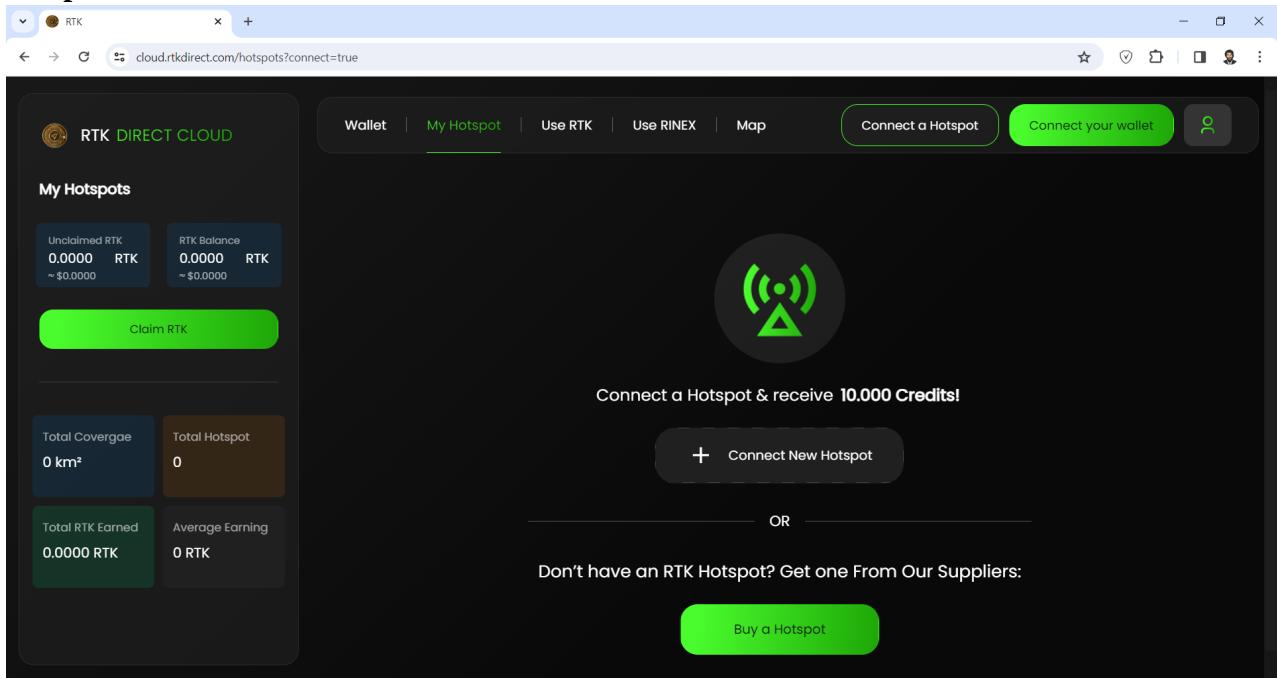
Scroll down.



The simplest way is to register through **Google**.

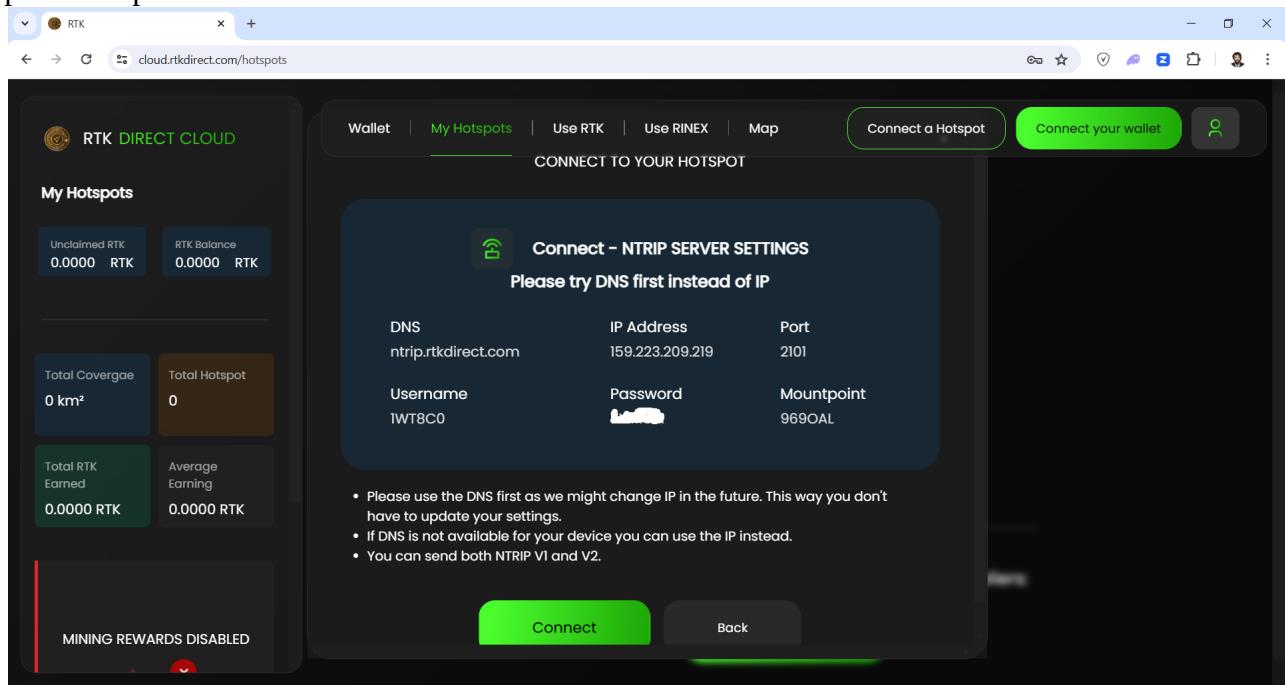


After registration, you can proceed to connect the station. To do this, click "**Connect New Hotspot**".



# Getting Credentials

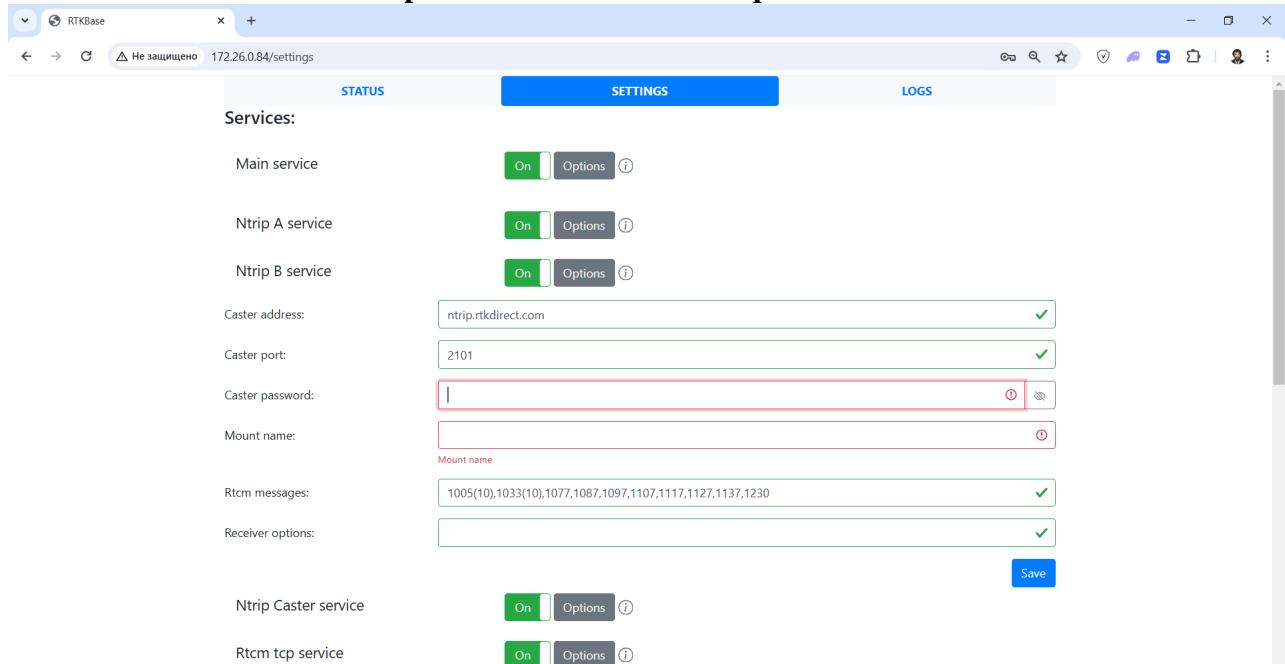
After clicking “**Connect New Hotspot**”, you will receive a login, password, and mount point for entry. The login is used only in the **NTRIP v2** protocol, so we do not need it. Record the mount point and password.



# NTRIP Server Setup

**NTRIP Server** is a mechanism for transmitting data from the base station receiver to a large **NTRIP Caster**, which then distributes (and sells) these data to clients.

Go to **RtkBase** and click the **Options** button next to “**Ntrip B service**”.



- Enter the “**Caster password**” and “**Mount name**” as written on the **RtkDirect** website

The screenshot shows the RTKBase settings interface. The 'SETTINGS' tab is active. Under 'Services:', the 'Main service' is set to 'On'. Other services listed include 'Ntrip A service', 'Ntrip B service', 'Ntrip Caster service', 'RtcM tcp service', and 'RtcM serial service'. Configuration fields include:

- Caster address: ntrip.rtkdirect.com
- Caster port: 2101
- Caster password: ..... (redacted)
- Mount name: 9690AL
- RtcM messages: 1005(10),1033(10),1077,1087,1097,1107,1117,1127,1137,1230
- Receiver options: (empty)

A 'Save' button is located at the bottom right.

Click **Save**, then **Options**, then **Off** to turn on the service.

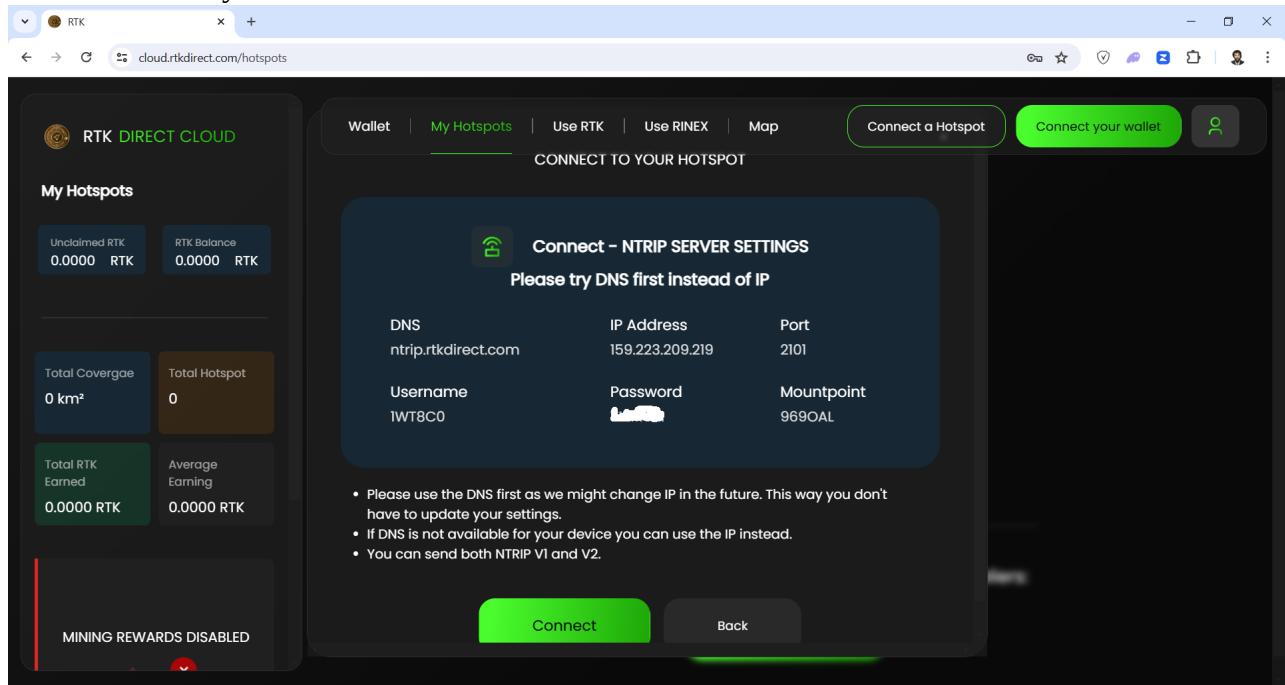
The screenshot shows the RTKBase settings interface after saving changes. The 'SETTINGS' tab is active. Under 'Services:', all services are now set to 'Off':

- Main service
- Ntrip A service
- Ntrip B service
- Ntrip Caster service
- RtcM tcp service
- RtcM serial service
- File service

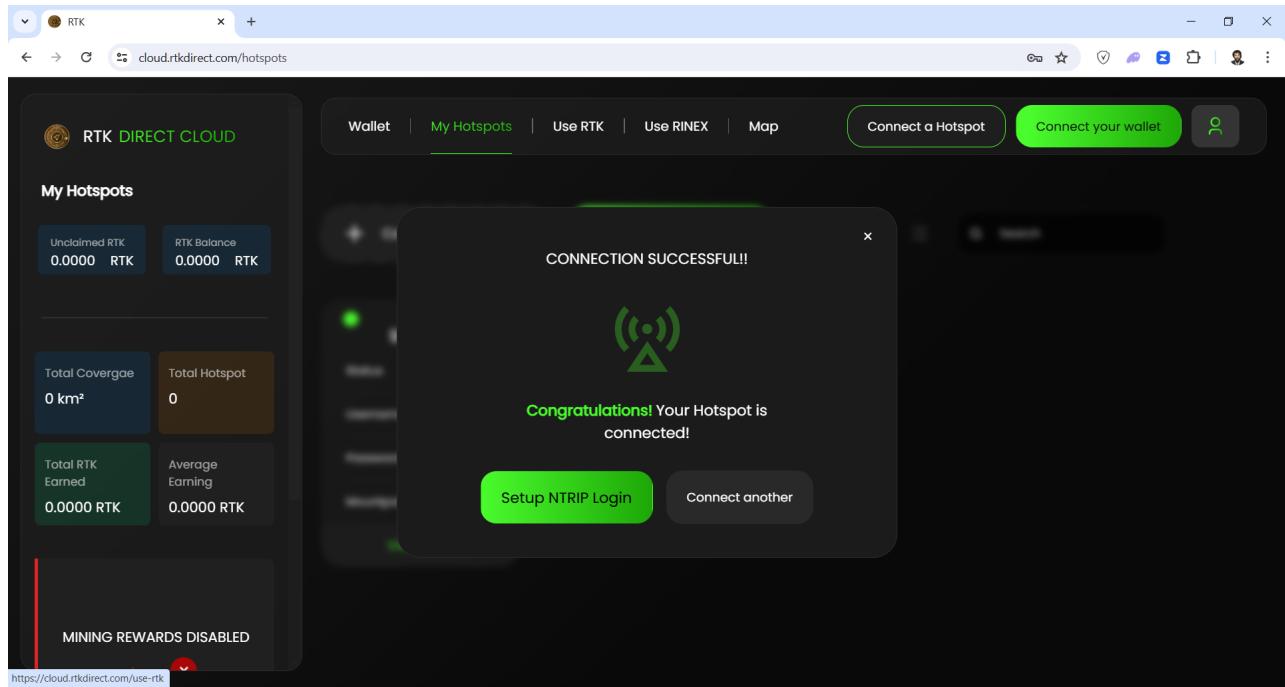
Under 'System Settings:', the 'Rtkbase 2.5.0' section includes a 'Check update' button. The 'Change Password:' section has fields for 'New:' and 'Confirm:' and a 'Change password' button.

# Connection

Now we are ready. Click **Connect** and wait for the connection.

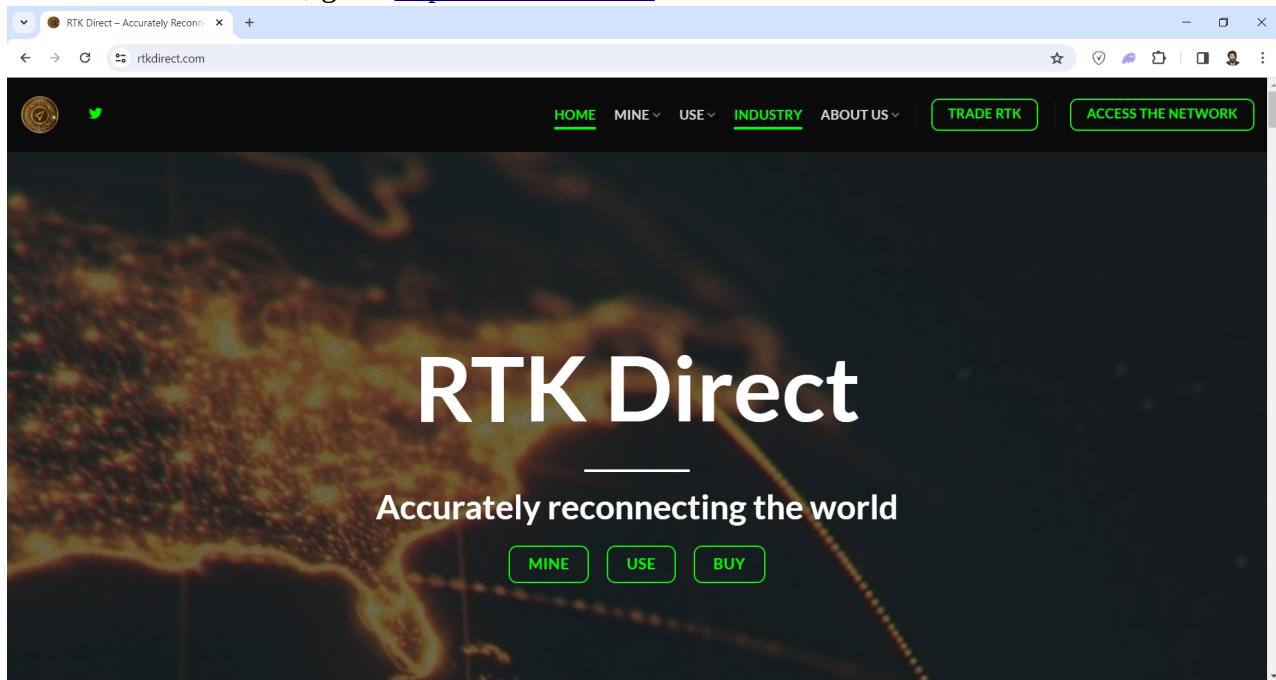


The connection was successful. Click “**Connect another**”.

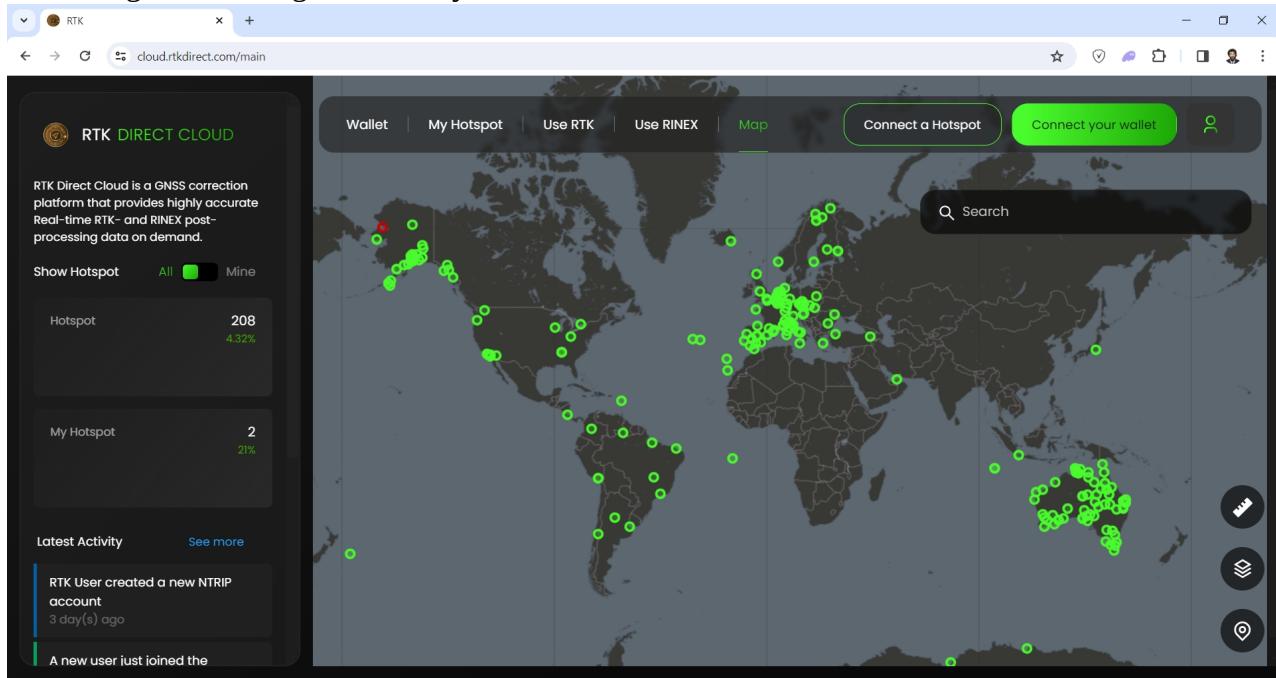


# Choosing a Wallet

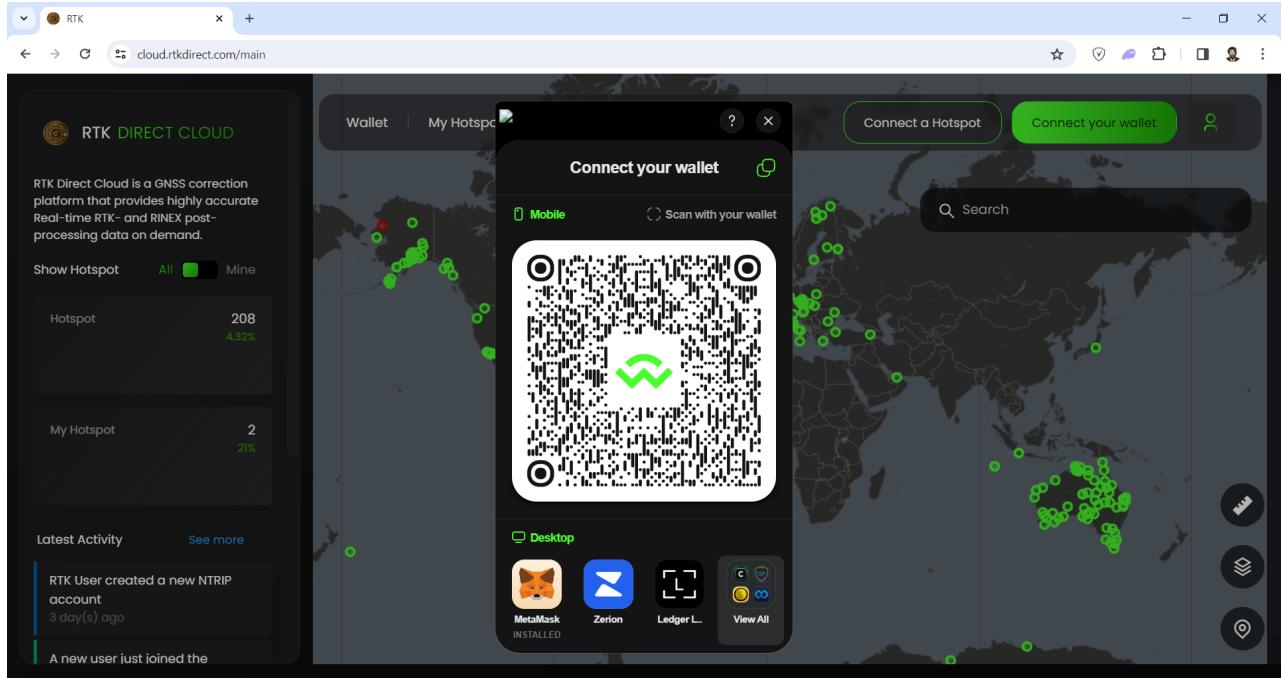
Start from scratch. First, go to <https://rtkdirct.com> and click the “Access The Network” button.



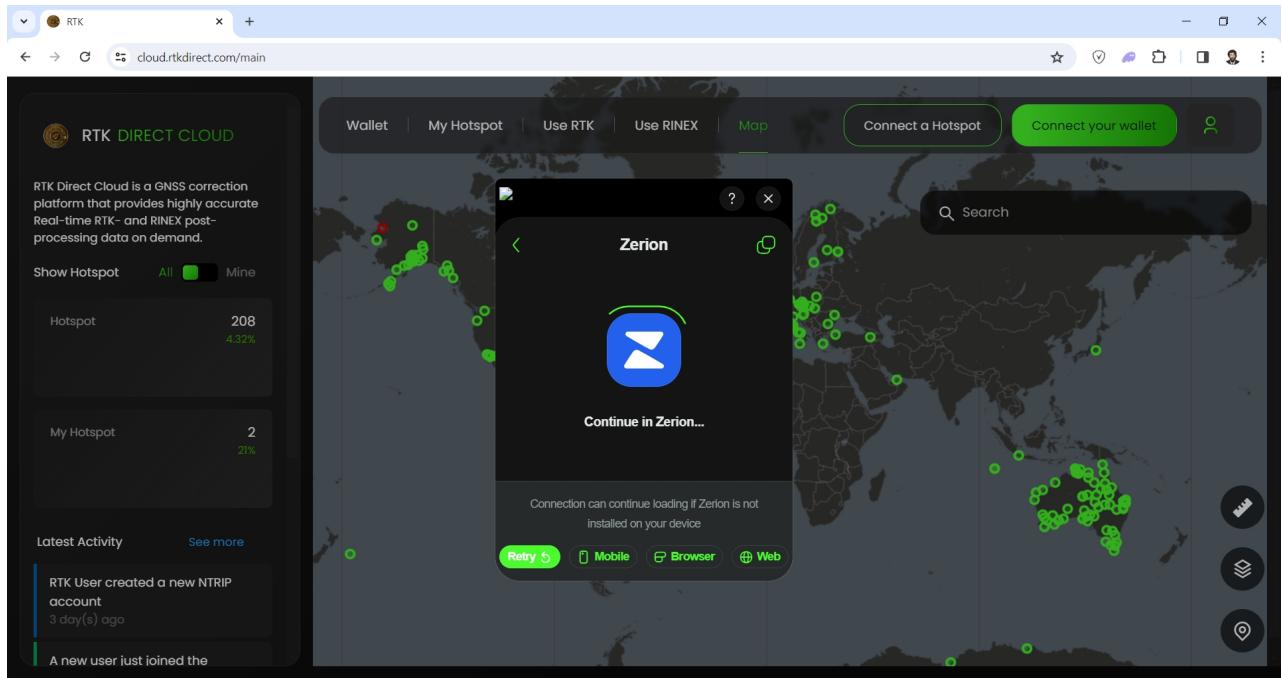
Click the green enticing “Connect your wallet” button.



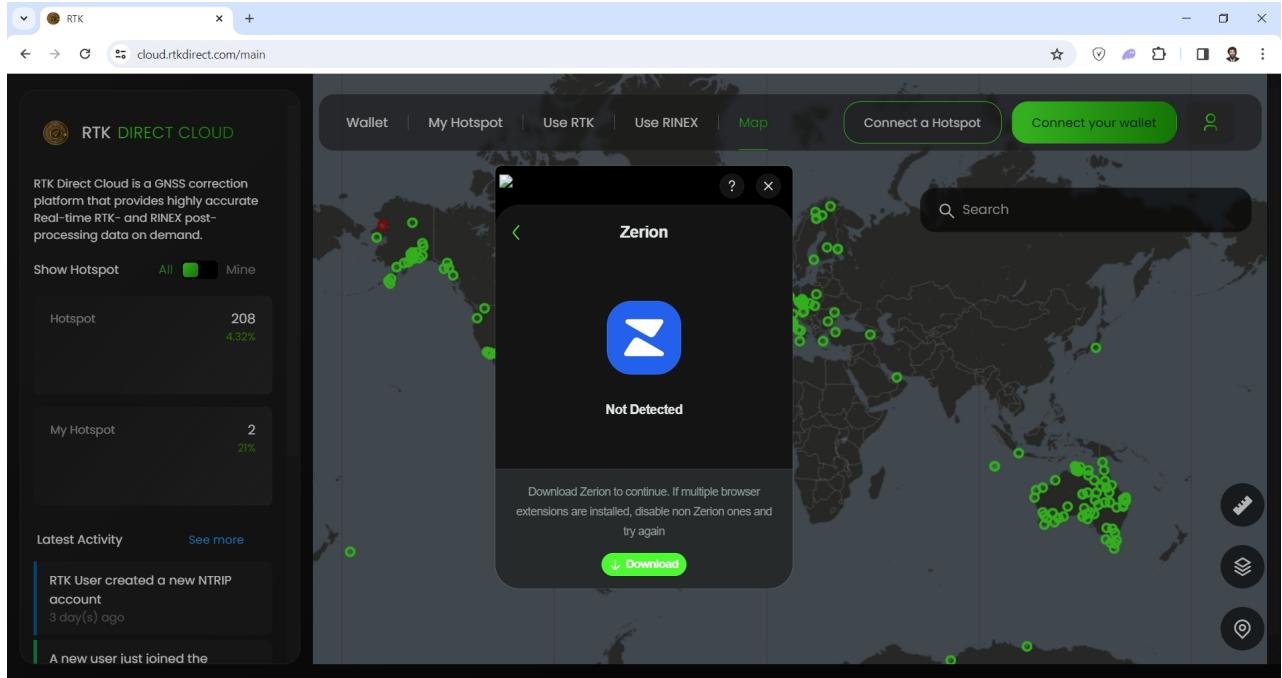
Select the **Zerion** wallet and click on it.



It tries to connect, but we do not have a wallet. Therefore, click the **Browser** button.

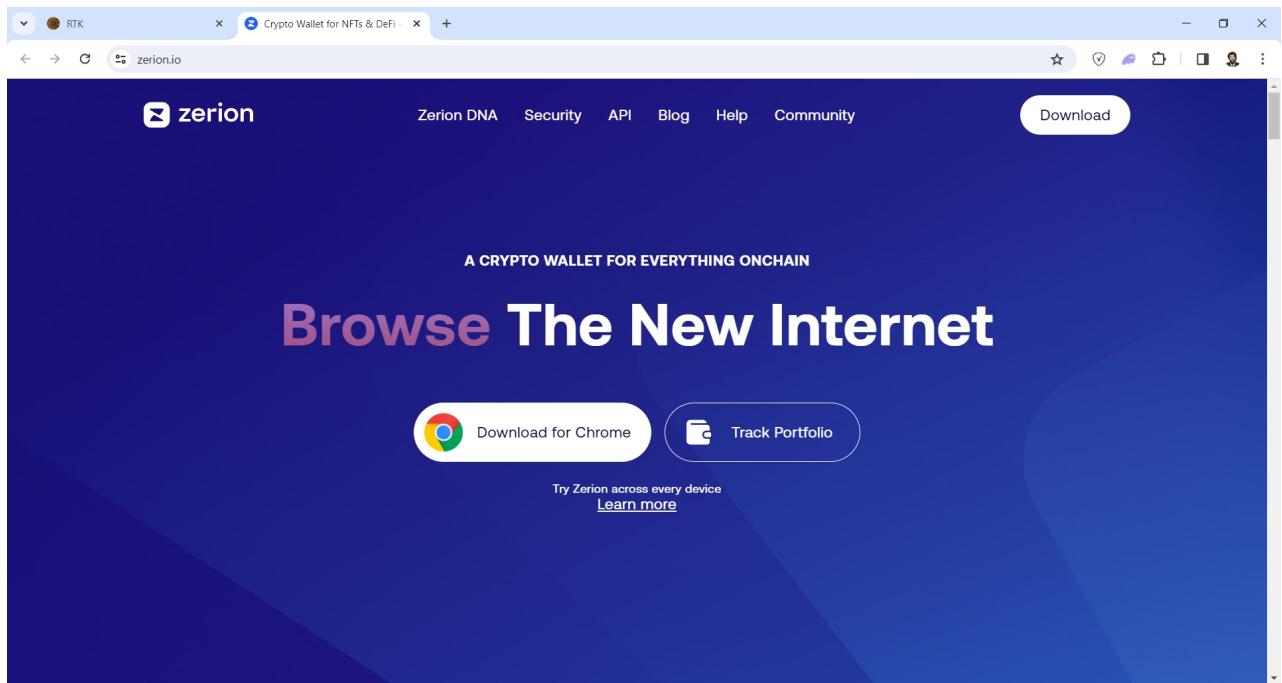


## Click Download.

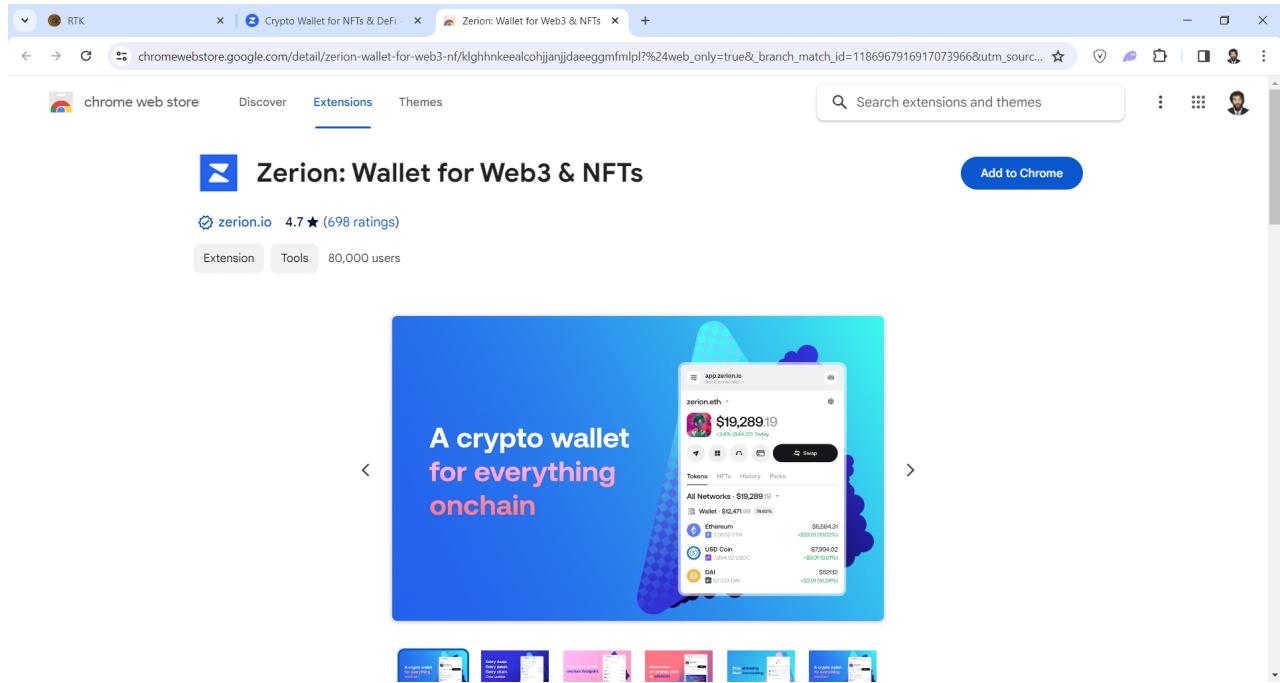


## Installing the Wallet

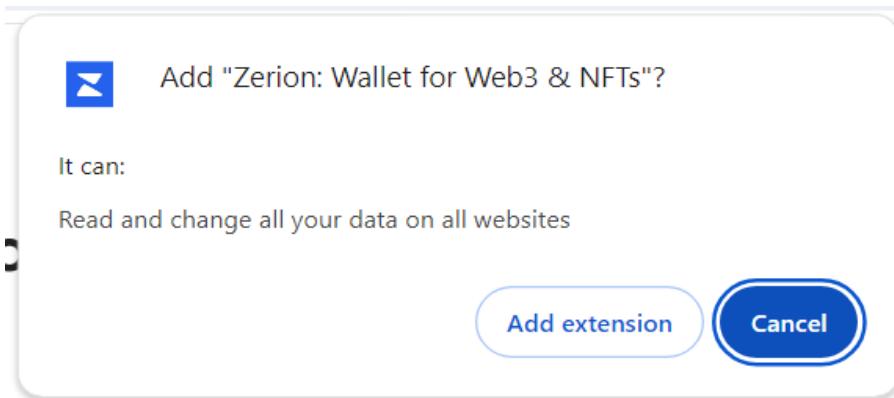
After performing the previous section, go to the **Zerion** wallet installation and click “**Download for Chrome**”.



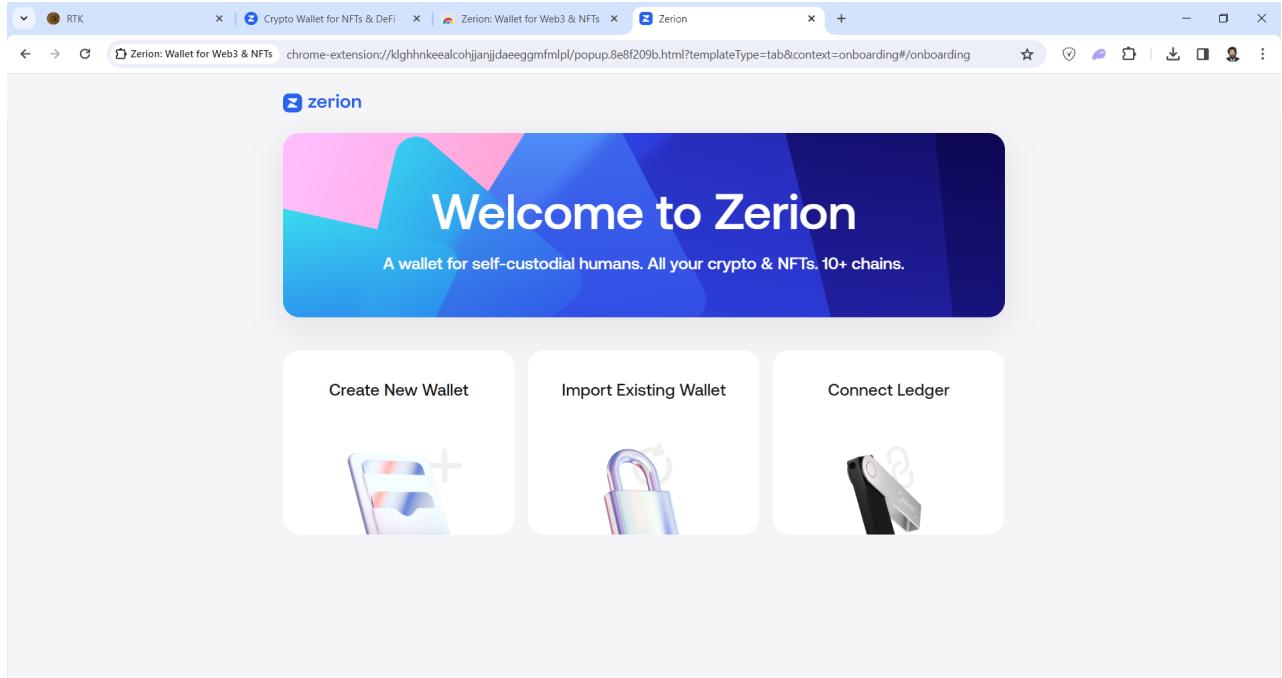
Click “Add to Chrome”.



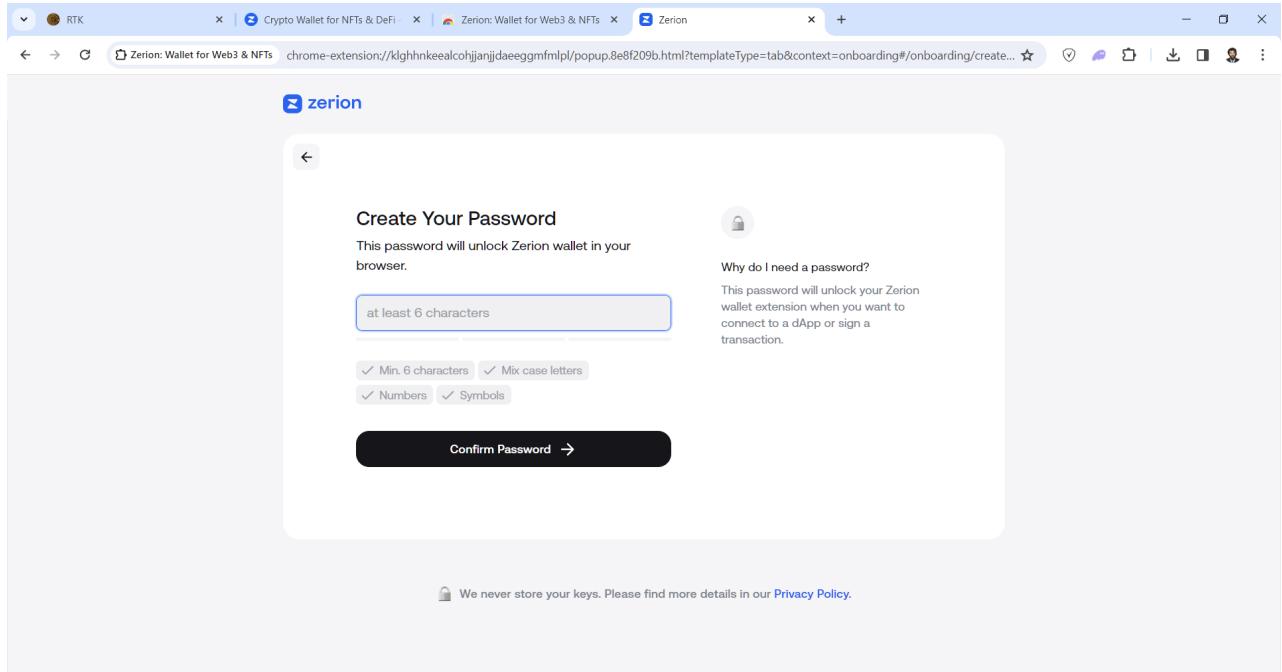
Allow the installation of the extension by clicking “Add Extension”.



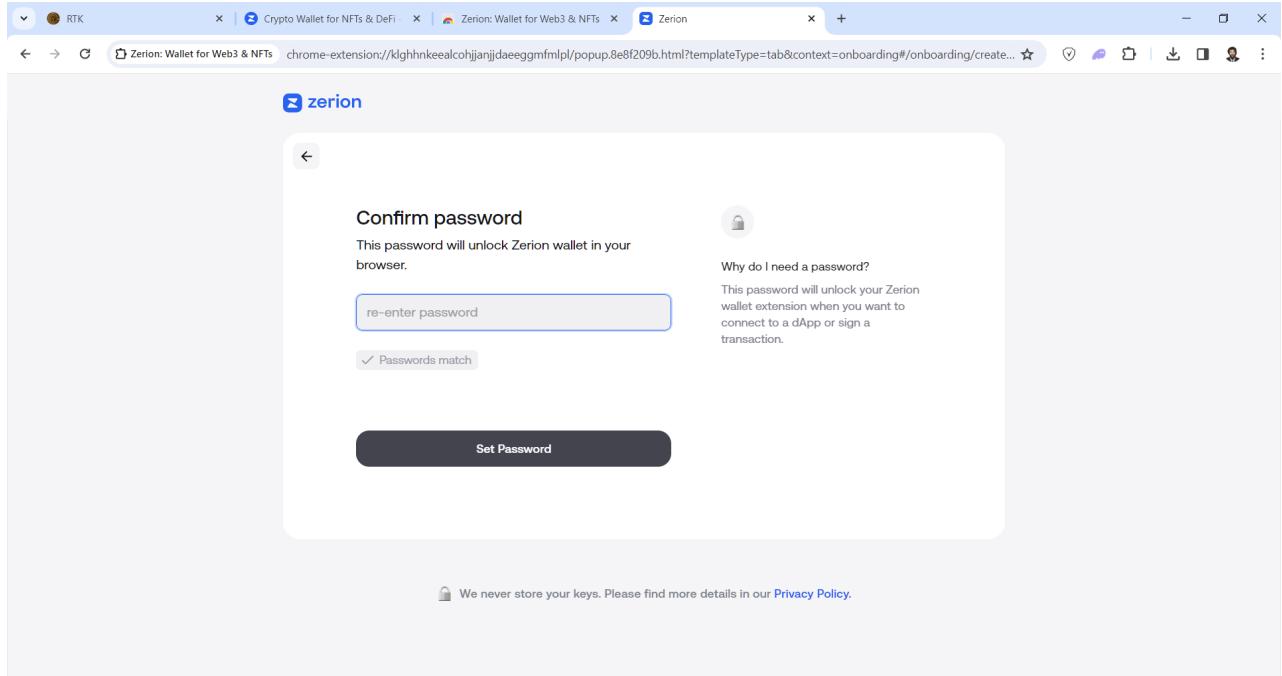
After installation, you will see the wallet management screen. Click “Create New Wallet”.



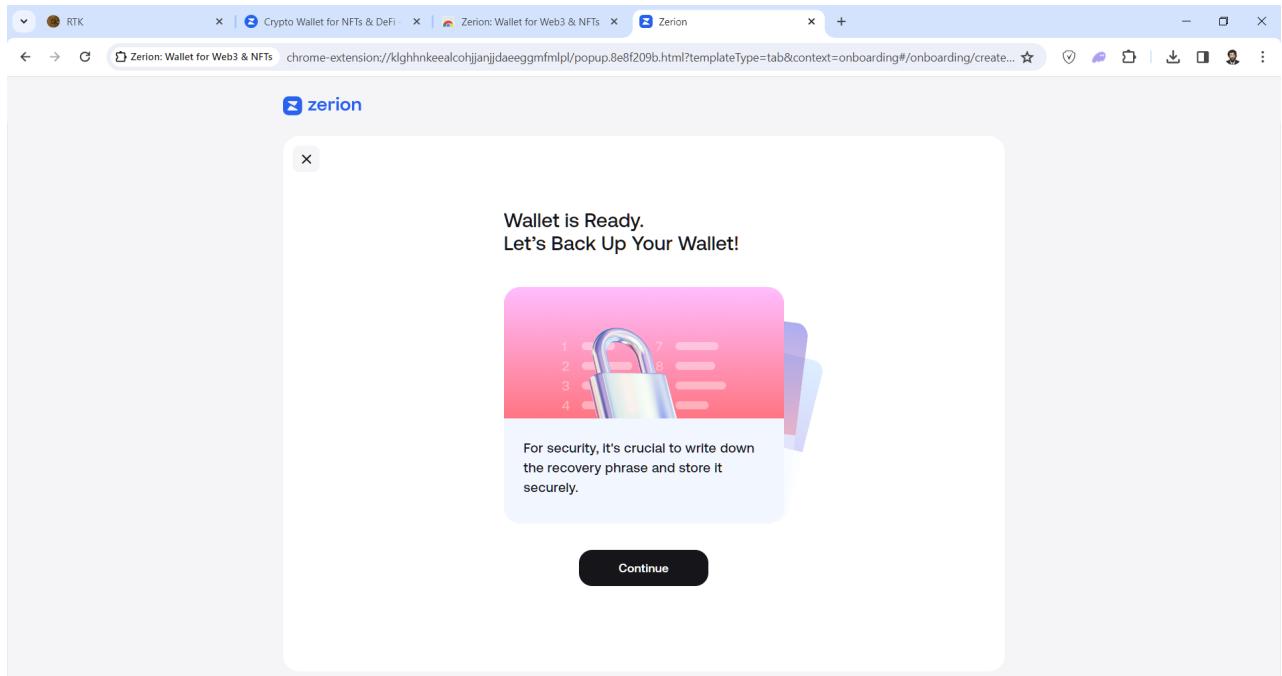
Create and enter a password.



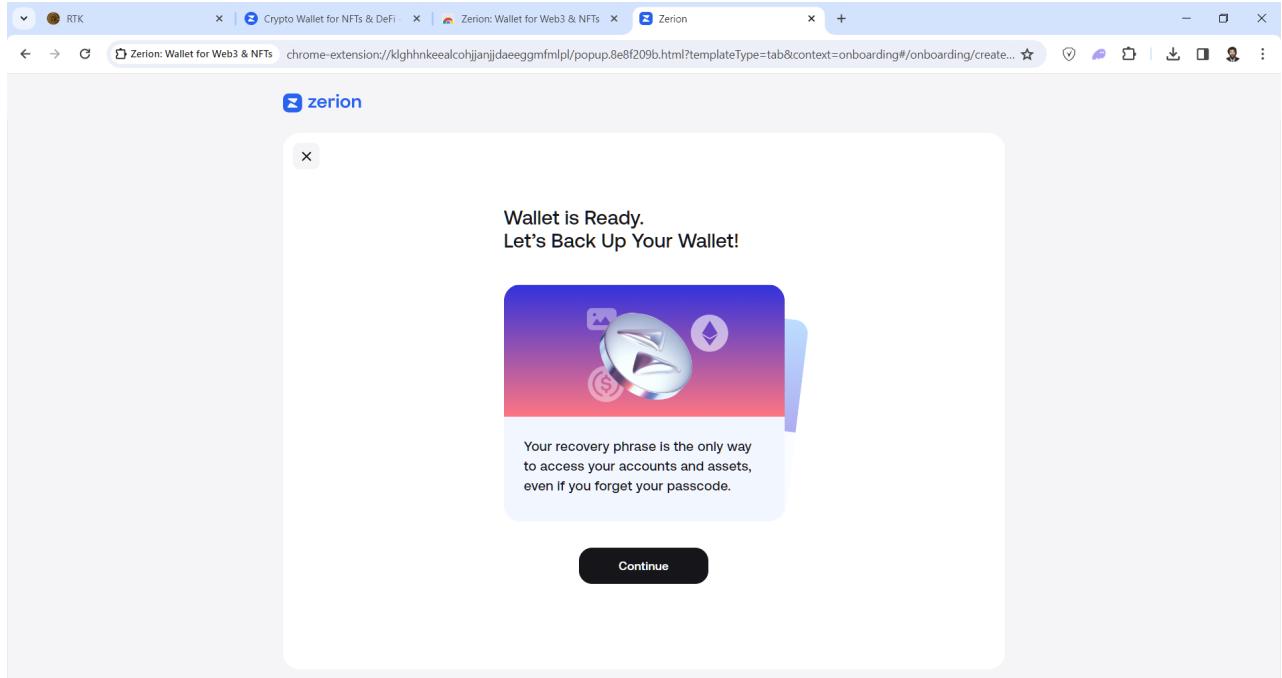
## Repeat the password.



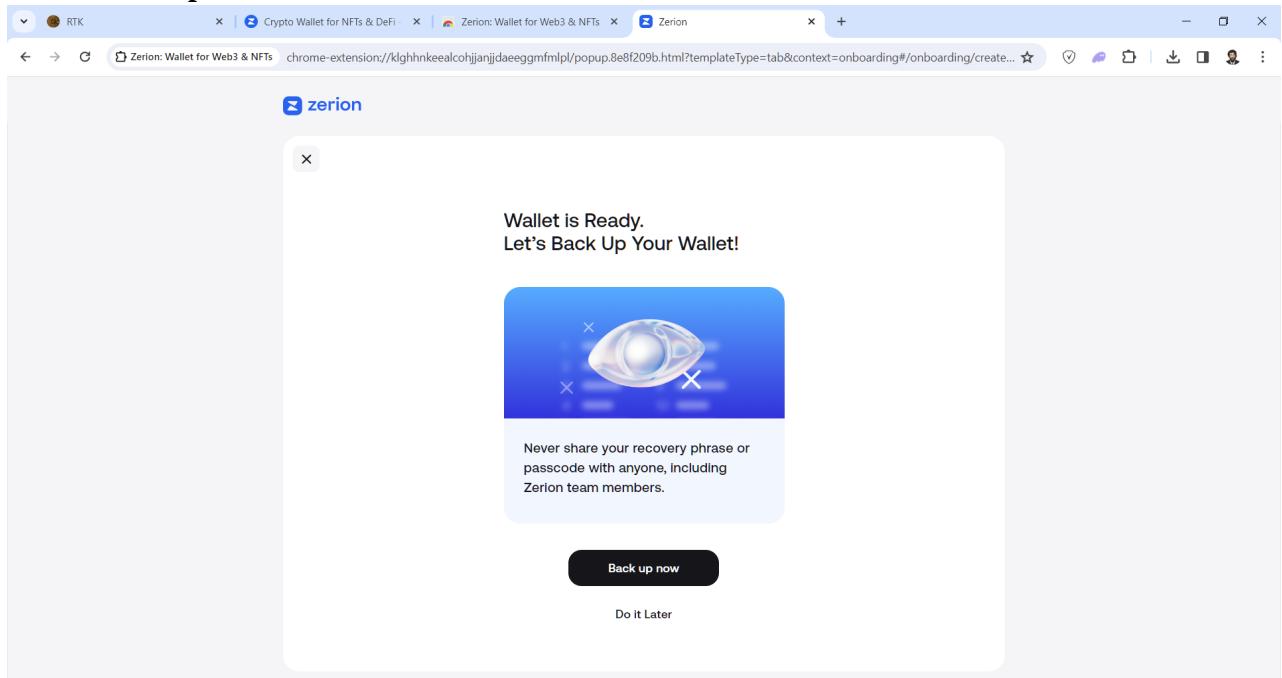
The wallet is created. Click **Continue**.



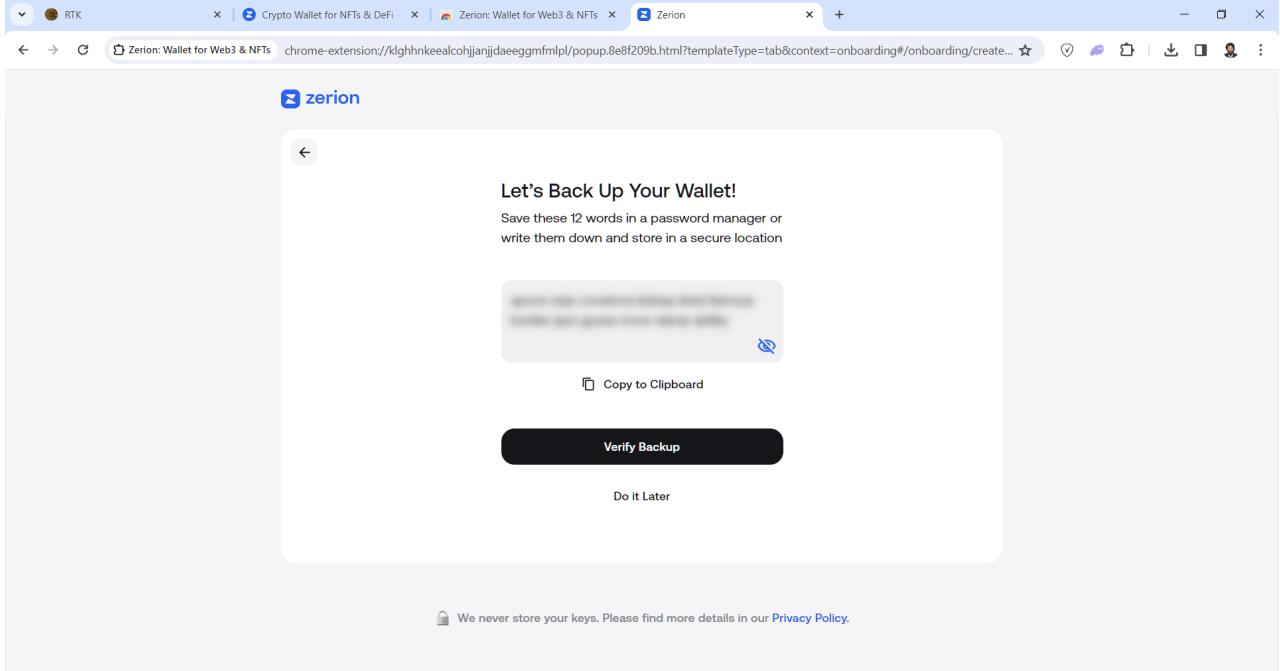
**Click Continue again.**



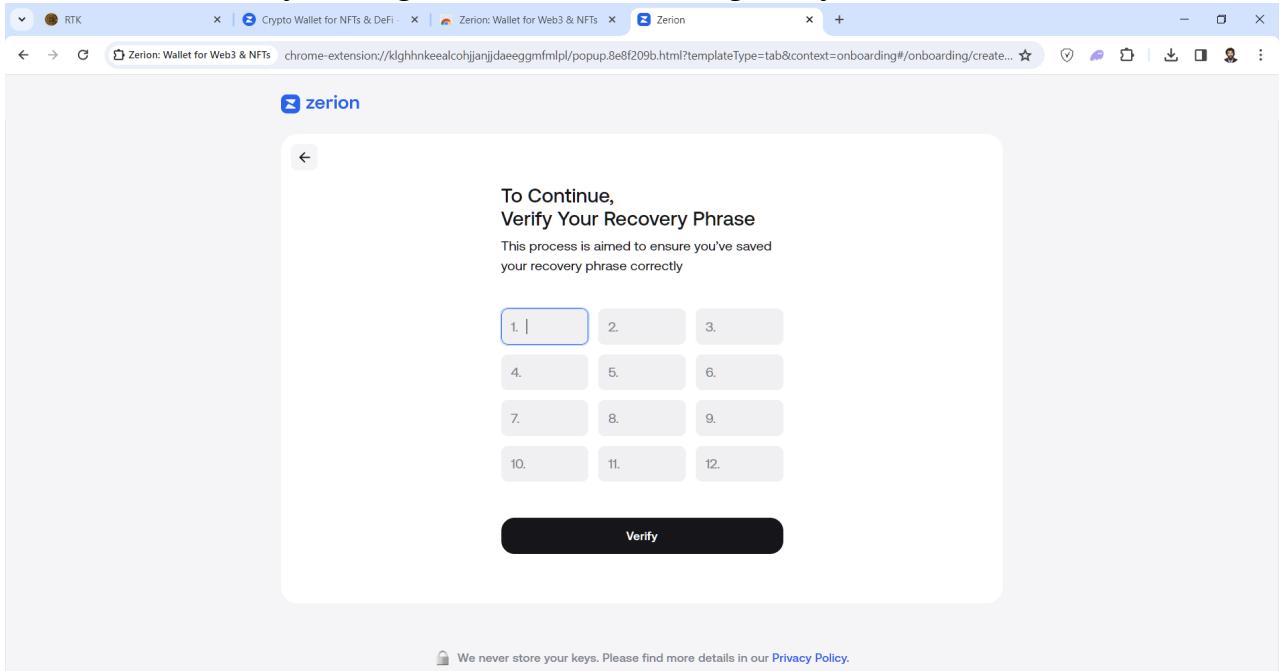
**Click “Back up now”.**



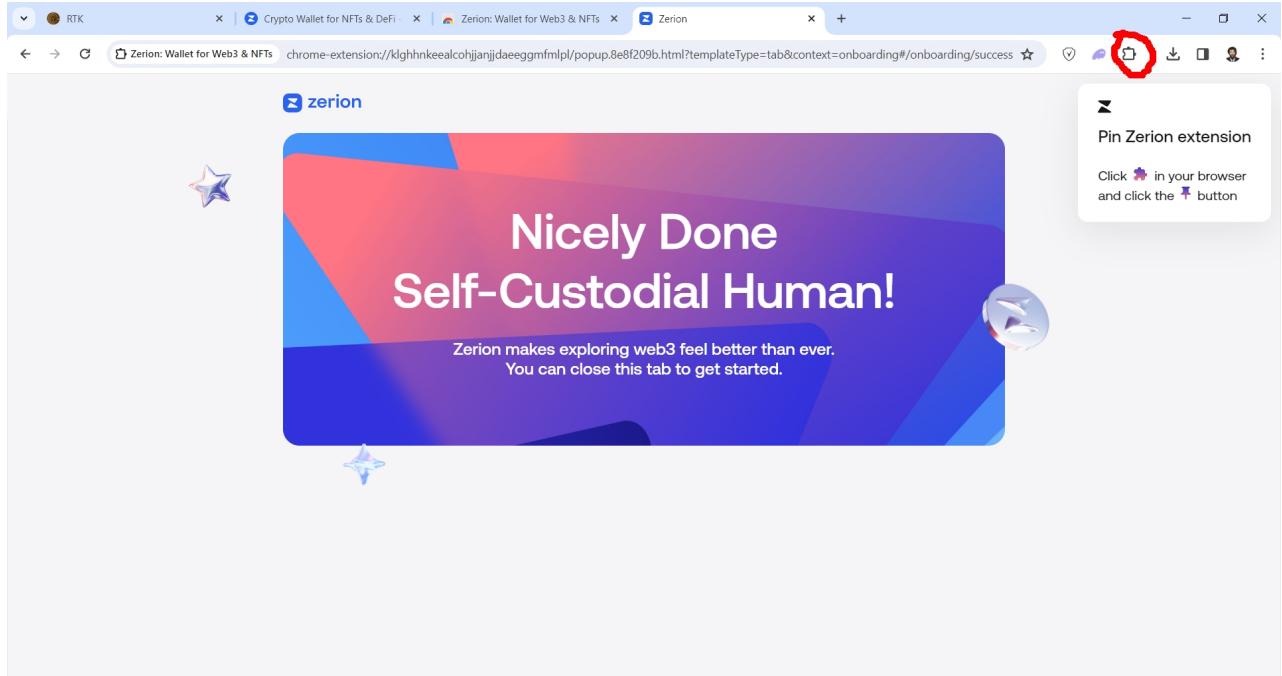
Get a list of 12 words that must be saved. Click “**Copy to clipboard**” and save it to **Notepad**. Click “**Verify Backup**”.



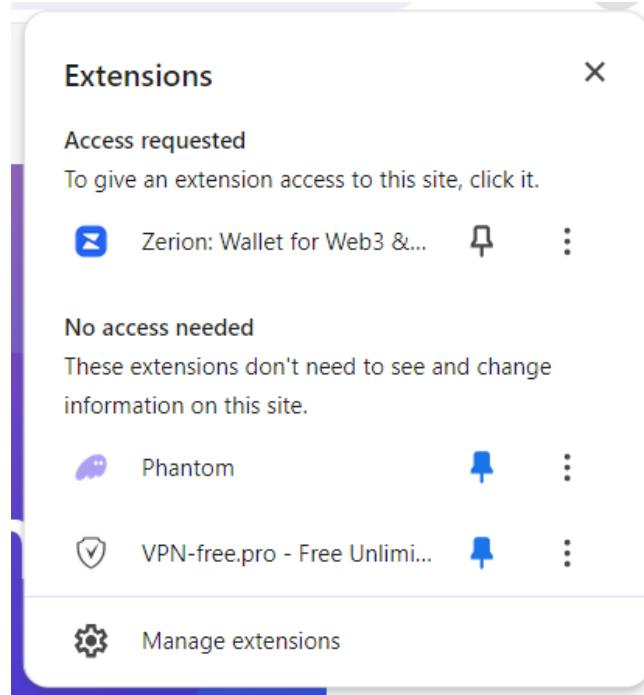
Perform verification by entering all 12 words and clicking **Verify**.



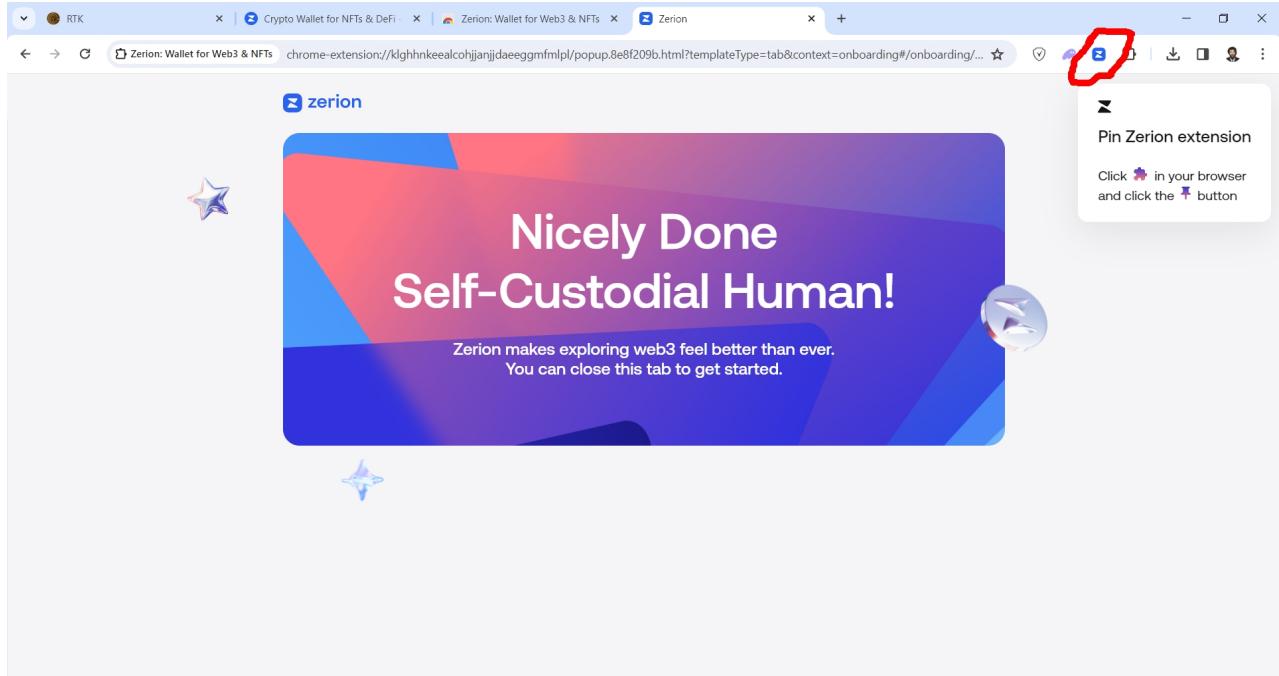
Verification is successful. Click the extension management icon at the top right.



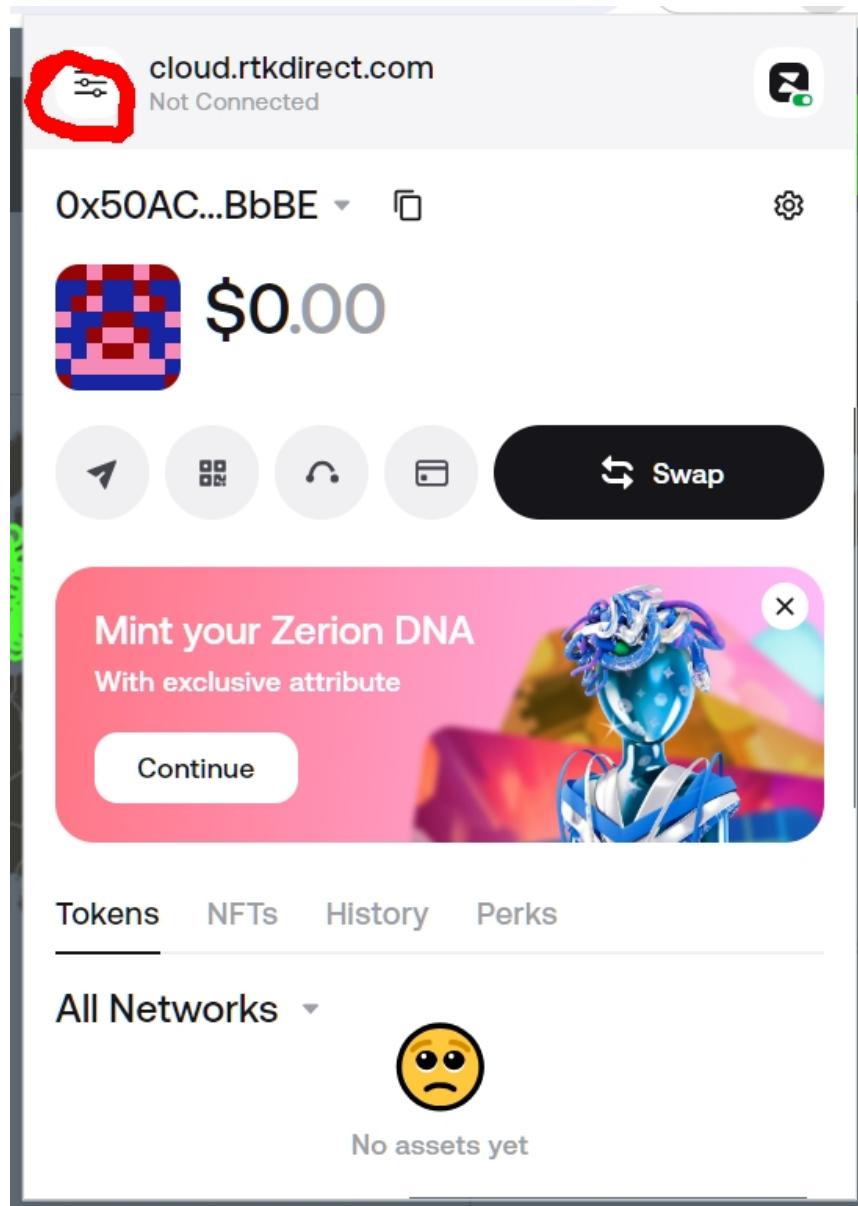
In the extension management window, click the button next to **Zerion**.



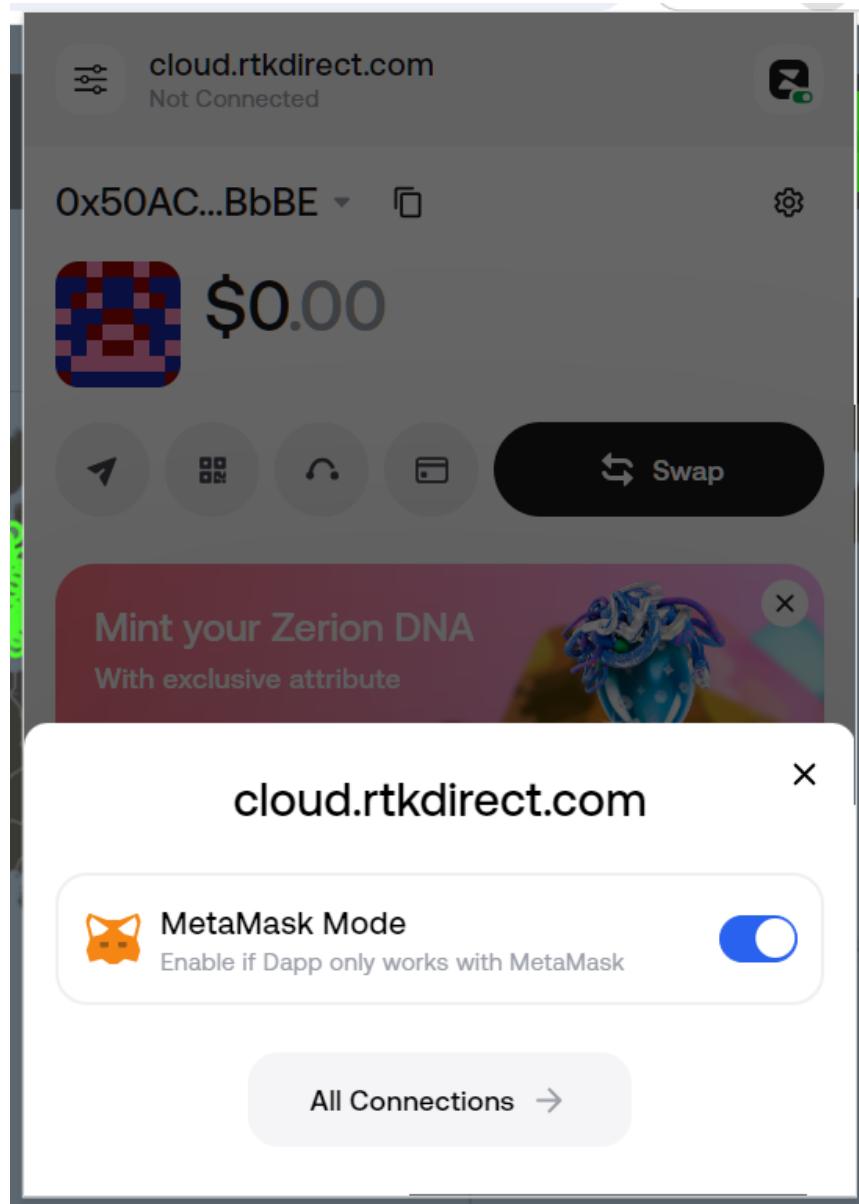
You will see the **Zerion** icon among the extensions.



Click on it to see the settings button in the top left corner.

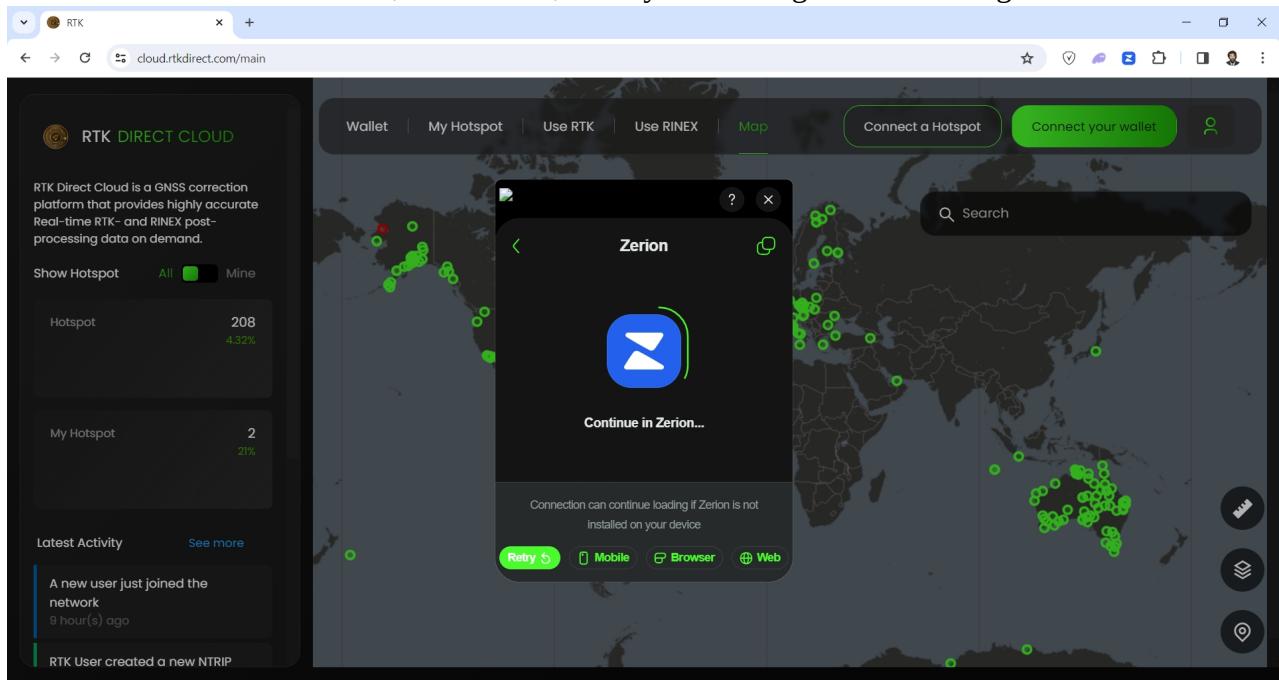


Click the settings button and disable the **MetalMask** mode.

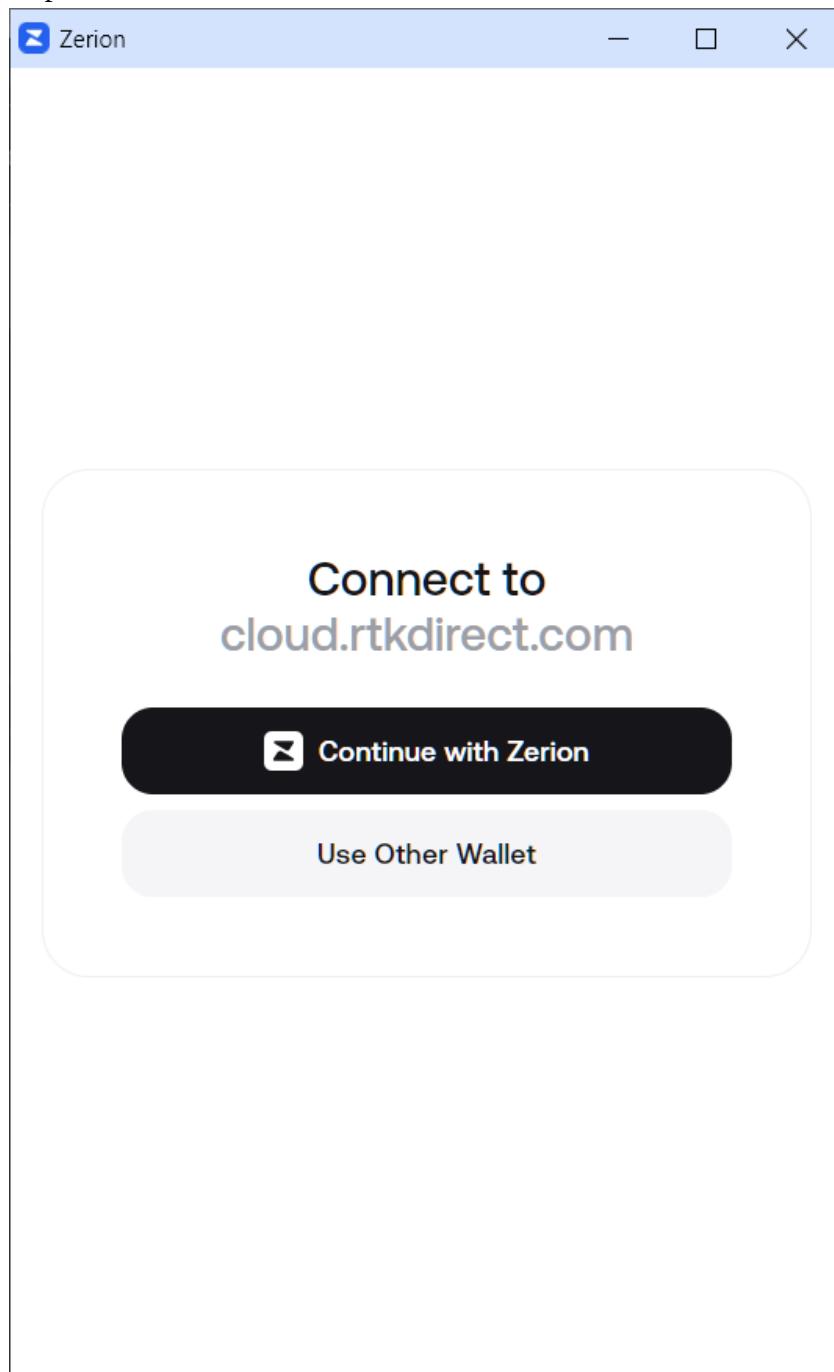


# Connecting the Wallet

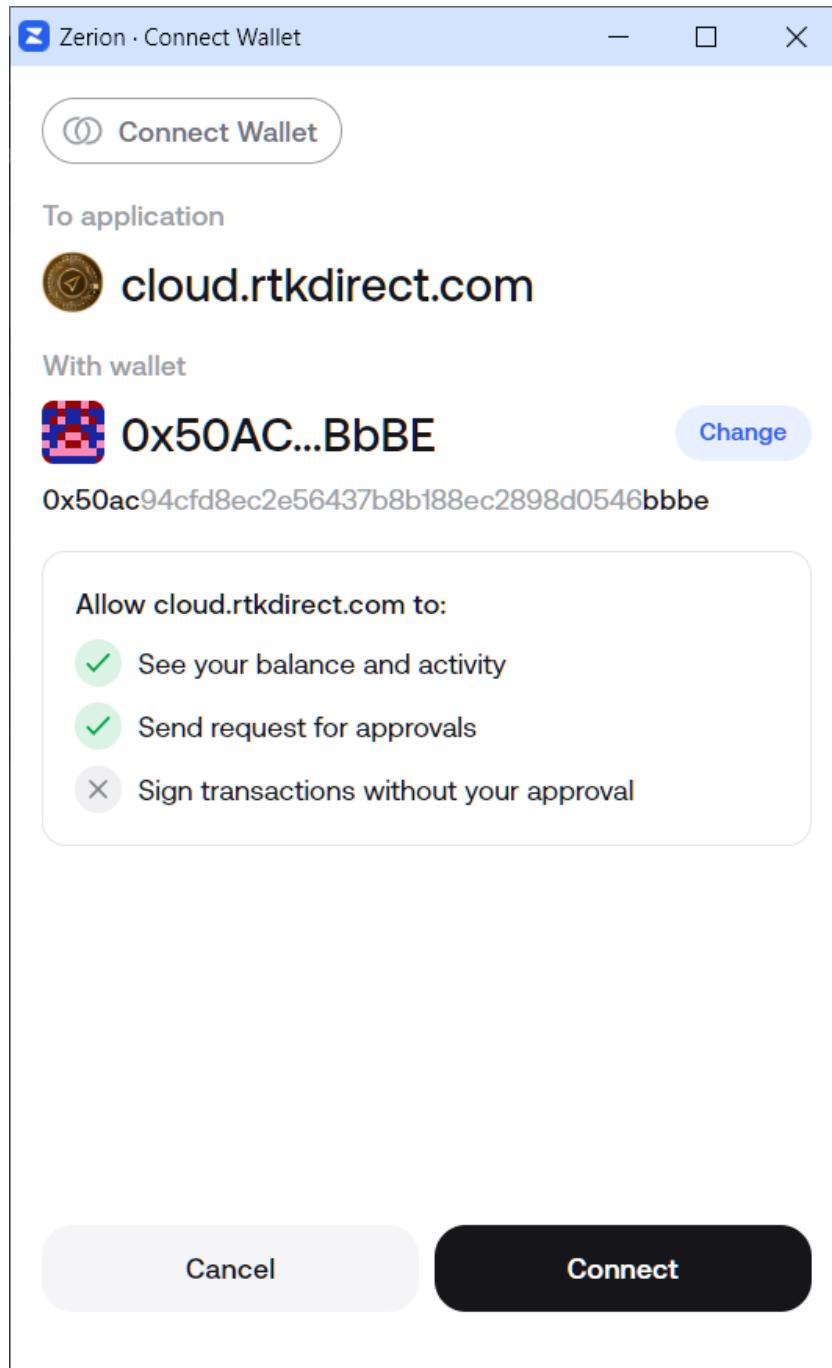
Close the wallet and extra tabs, return back, and try connecting with **Zerion** again.



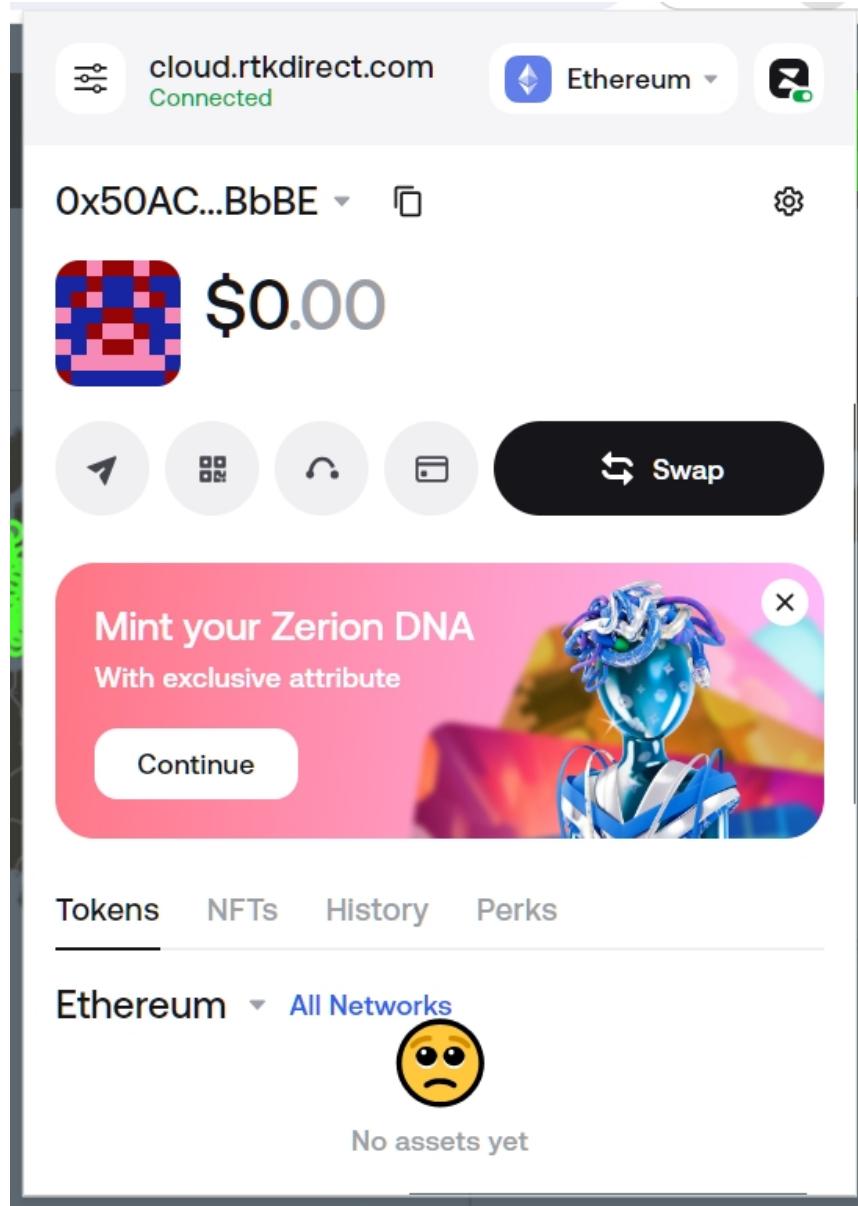
The window pops up, click “**Continue with Zerion**”.



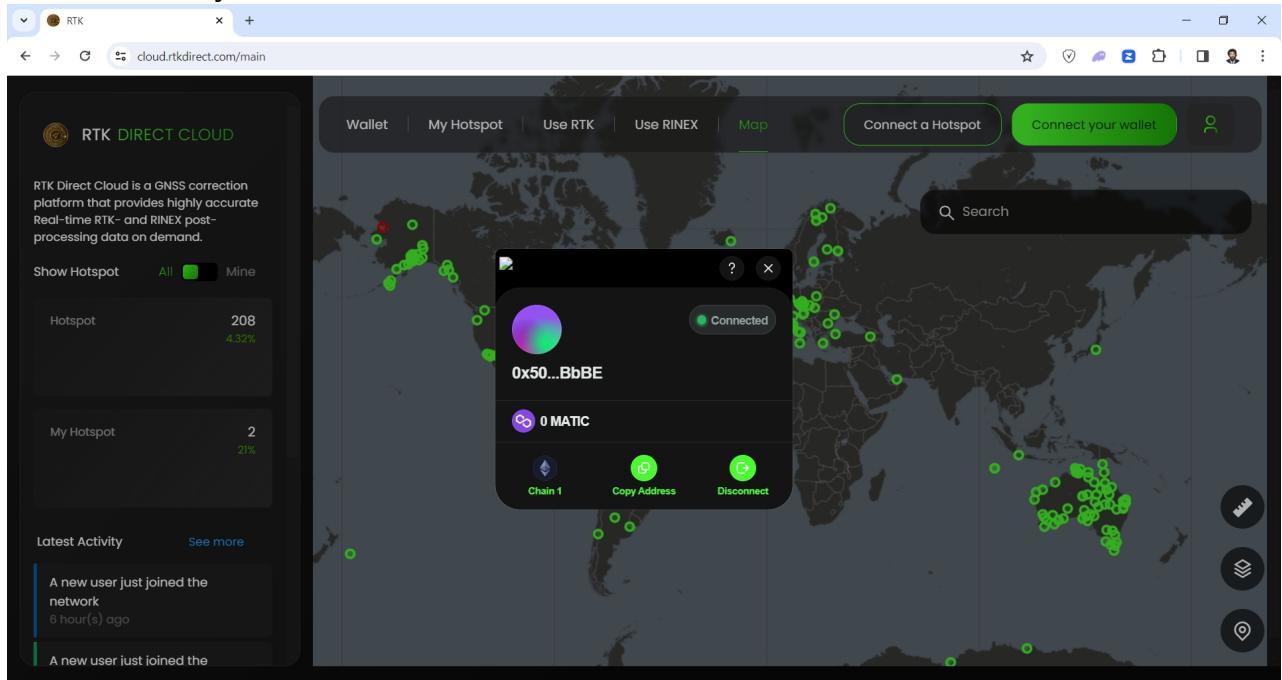
In the next window, click **Connect**.



Check the drop-down wallet window by clicking the extension icon at the top right — the connection is visible.



Click “**Connect your wallet**” — the connection is visible.

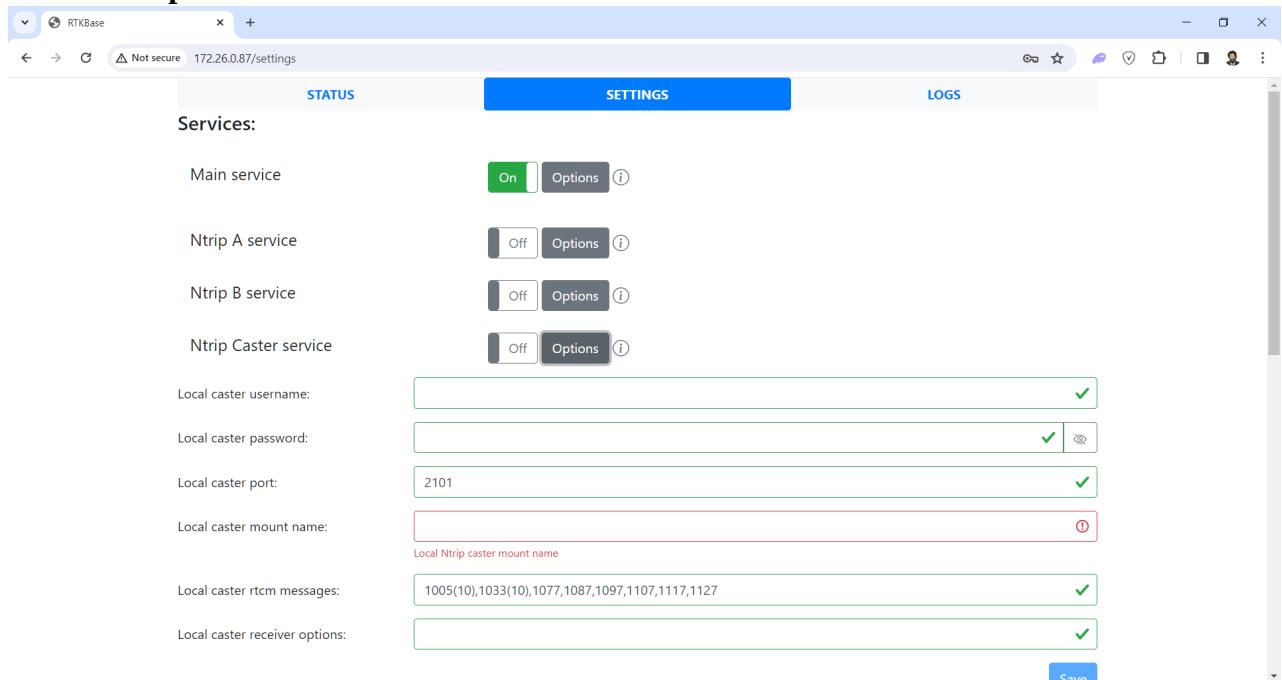


## Other

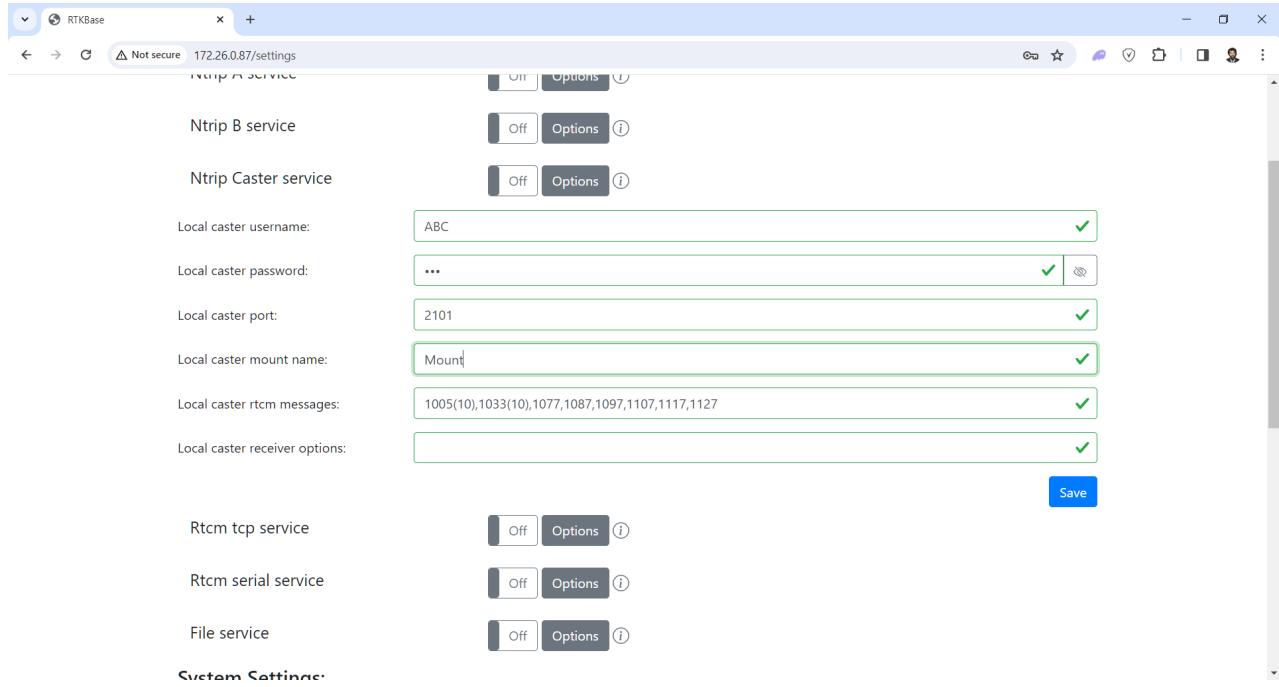
### NTRIP Caster Setup

**NTRIP Caster** is a mechanism for distributing data from the base receiver. Typically, **NTRIP Server** transmits data from the receiver to the **NTRIP Caster**, and the **NTRIP Caster** distributes data from various receivers to several rovers. **RtkBase** has a simple **NTRIP Caster** that allows you to avoid additional (external) **NTRIP Caster**.

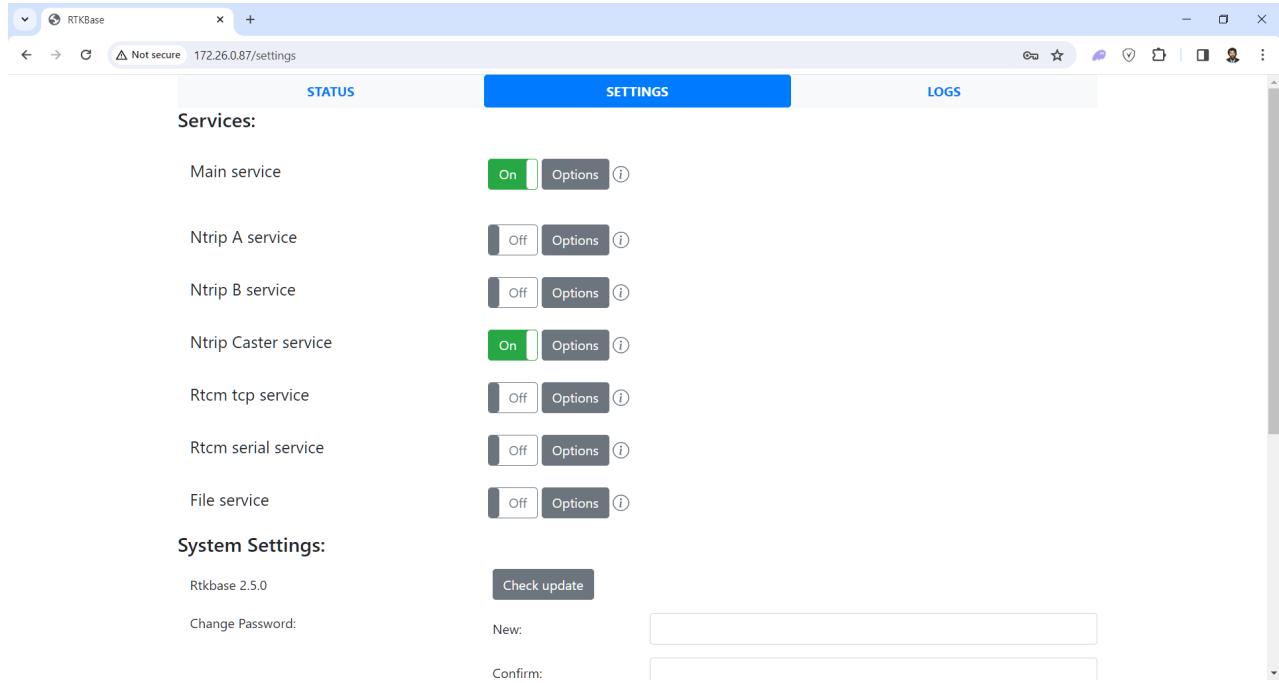
To make **RtkBase** work as an **NTRIP Caster**, go to the **Settings** page and click the **Options** button next to “**Ntrip Caster Service**”.



Enter the username, password, and mount point name, then click **Save**.



After that, close the settings with the **Options** button and turn on the **NTRIP caster** by clicking the **Off** button.



## RTCM3 Proposals

In the settings of all services, except for **Main** and **File**, there is a list of transmitted **RTCM3** proposals. After the proposal number, you can specify the period (time in seconds between proposal transmissions) in parentheses. This is especially relevant for the caster.

The **Unicore** receiver transmits the following proposals:

1. Base coordinates: 1005 and 1006
2. Antenna name: 1007 and 1033
3. Ephemerides: 1019 (GPS), 1020 (Glonass), 1042 (Beidou), 1044 (QZSS), 1045 (Galileo FNAV), 1046 (Galileo INAV)
4. Measurements **MSM7**: 1077 (GPS), 1087 (Glonass), 1097 (Galileo), 1107 (SBAS), 1117 (QZSS), 1127 (Beidou), 1137 (IRNSS)

The **Bynav** receiver transmits the following proposals:

1. Base coordinates: 1005 and 1006
2. Antenna name: 1033
3. Ephemerides: 1019 (GPS), 1020 (Glonass), 1042 (Beidou), 1044 (QZSS), 1046 (Galileo INAV), 1048 (IRNSS)
4. Measurements **MSM7**: 1077 (GPS), 1087 (Glonass), 1097 (Galileo), 1107 (SBAS), 1117 (QZSS), 1127 (Beidou), 1137 (IRNSS)
5. Measurement offset information: 1230 (Glonass)

The **Septentrio** receiver transmits the following proposals:

1. Base coordinates: 1005 and 1006
6. Antenna name: 1007 and 1033
7. System Parameters: 1013
8. Ephemerides: 1019 (GPS), 1020 (Glonass), 1042 (Beidou), 1044 (QZSS), 1045 (Galileo FNAV), 1046 (Galileo INAV)
9. Measurements **MSM7**: 1077 (GPS), 1087 (Glonass), 1097 (Galileo), 1107 (SBAS), 1117 (QZSS), 1127 (Beidou), 1137 (IRNSS)
10. Measurement offset information: 1230 (Glonass)

## TCP Client Setup

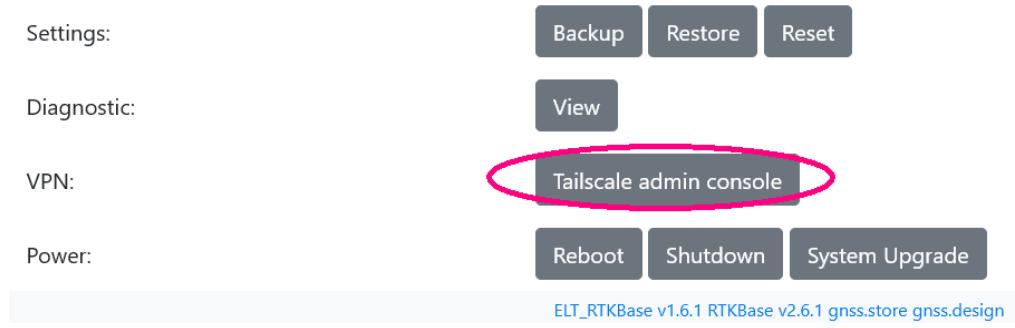
If you write **TCP** in the mount point and password fields in the **NTRIP** service settings (either **A** or **B**), it will connect as a **TCP** client instead of an **NTRIP** client.

Thus, our equipment can act as both a **TCP** Server (see “Important Requirements”) and a **TCP** client.

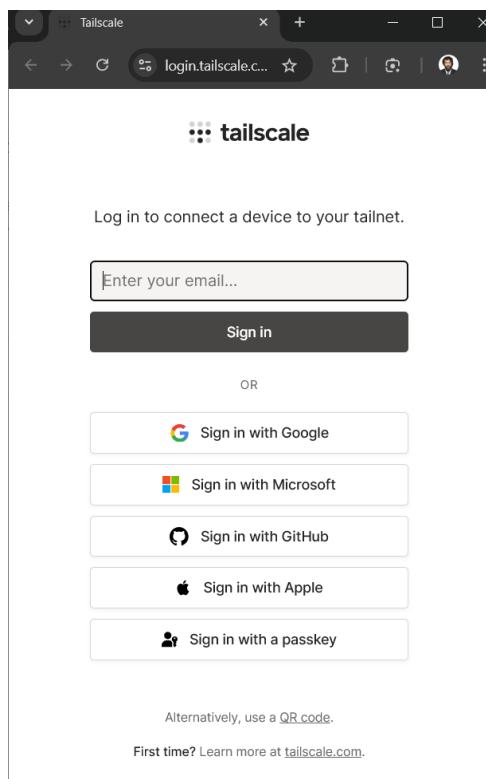
## Built-in VPN from Tailscale

Imagine you went on vacation, but you urgently need to fix something in your base settings. For such cases, we have equipped the base with a built-in **VPN** from [Tailscale](#). With this **VPN**, you can access the connected devices as if they were all on the same local network. Tailscale is free for up to [100 devices](#) and has apps for [all operating systems](#), including iPhone and Android smartphones. For more information, visit [tailscale.com](#).

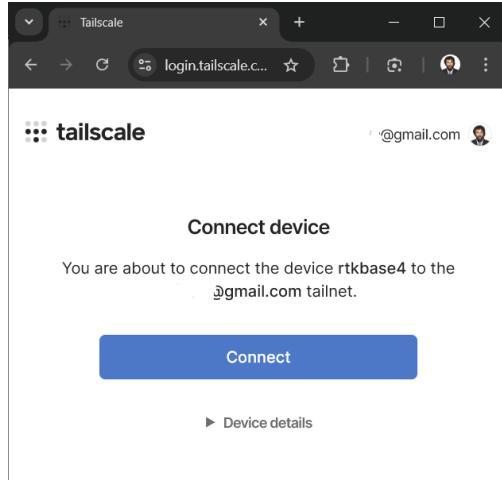
Open the **Settings** page. At the bottom, you will see the “**Tailscale admin console**” button.



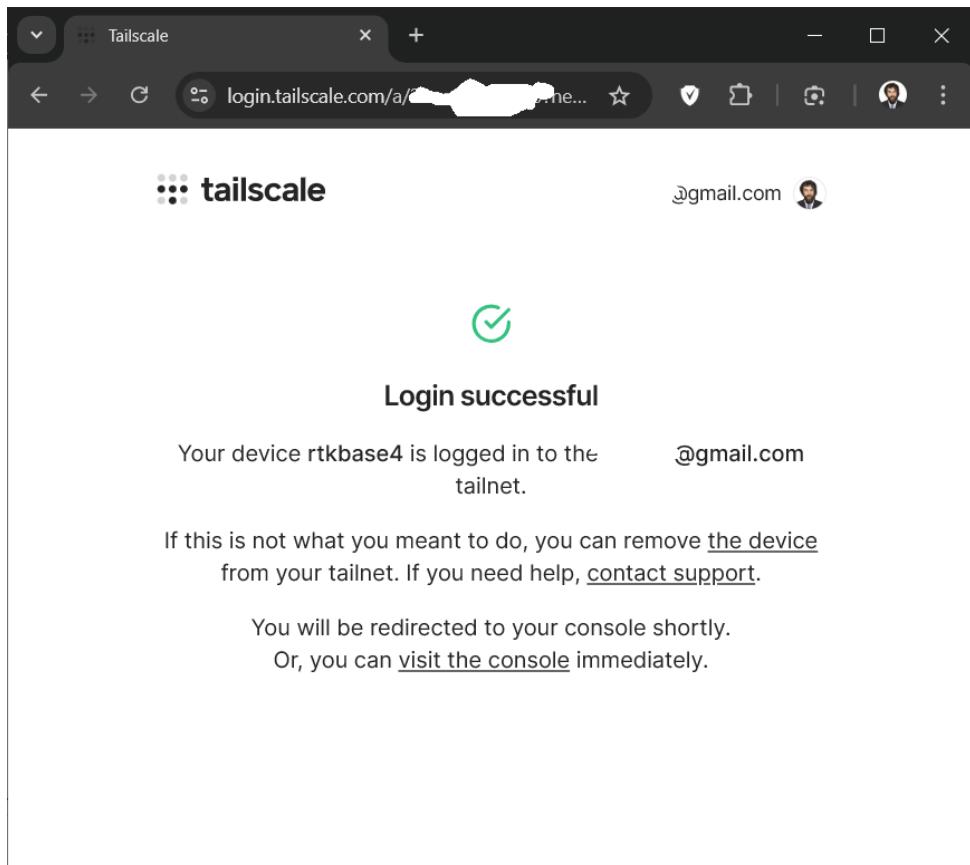
Click it, and you will be taken to the **Tailscale** login screen.



Register with **Tailscale**. You will see a screen with a large “**Connect**” button.



Click it, and you will see messages confirming a successful login.



After a few seconds, you will be directed to the Tailscale admin console.

The screenshot shows the Tailscale admin console interface. At the top, there's a navigation bar with links for Machines, Apps, Services, Users, Access controls, Logs, DNS, Settings, and Get started. On the left, a sidebar has sections for Machines, Apps, Services, Users, and Settings. The main content area is titled "Machines" and displays a list of connected devices. One device, "rtkbase4", is listed with the IP address "100.122.232.45". A red arrow points to the dropdown menu next to the IP address. Below the list, there's a section titled "Add devices to your network" with options for Operating systems (Linux, Mac, Windows), Cloud providers (Amazon Web Services, Microsoft Azure, Google Cloud Platform), and Containers (Docker, Kubernetes).

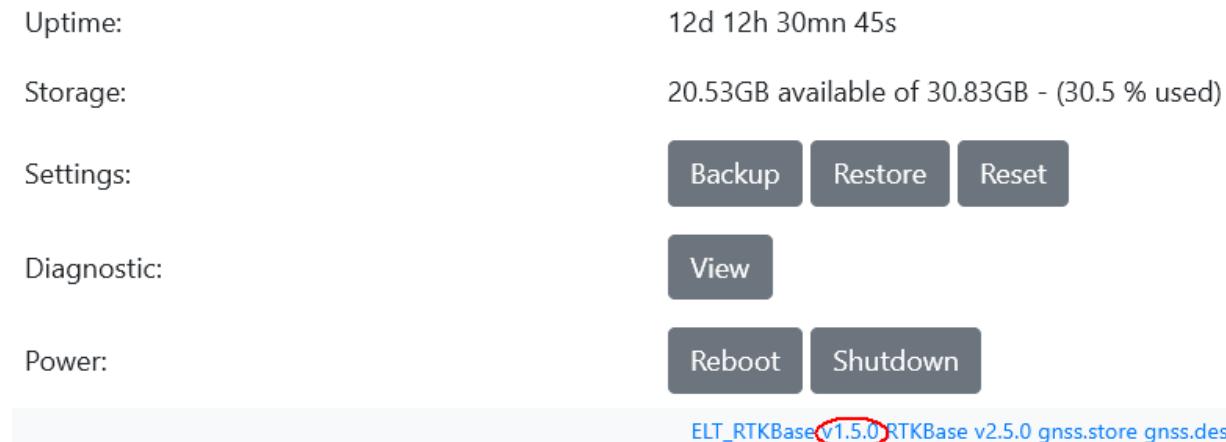
Now, you need to download the client, install it on your laptop or smartphone, and register your device with **Tailscale** in the same way. After that, you will be able to open the web interface of the device in several ways. To view all the device's addresses, click the arrow to the right of its IP address.

This screenshot is similar to the one above, showing the Tailscale admin console. However, a large red circle highlights the dropdown menu next to the IP address "100.122.232.45" for the "rtkbase4" device. This indicates that clicking the arrow will reveal more IP addresses for the device.

# Software Update

Like any other company, we continuously release new versions. We add functionality, fix bugs, and generally do everything to make life easier and more convenient for our users. There are three methods to install updates: “Updating Over the Internet”, “Updating from a File” and “Updating via SD Card”. Additionally, it is recommended to periodically perform a “Linux Update”.

To determine the current version number, look at the bottom of any page.



## Updating Over the Internet

To check for updates, click the “**Check Update**” button.

---

### System Settings:

ELT Rtkbase 1.6.2

**Check update**

Change Password:

New:

Confirm:

Gnss receiver:

LG290P - V7.81\_19D751\_T

Board:

Raspberry Pi 4 Model B Rev 1.5

Os:

Debian 12 (Bookworm)

CPU Temp:

49,7 C° - (highest record: 52,1C°)

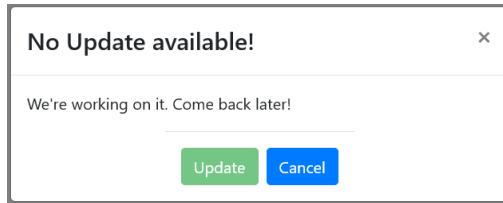
Uptime:

1d 15h 14mn 51s

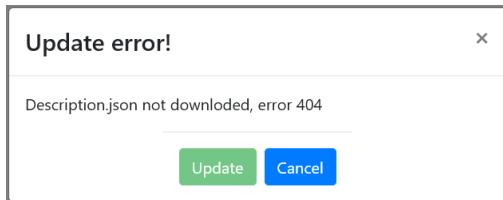
Storage:

22.06GB available of 30.83GB - (25.3 % used)

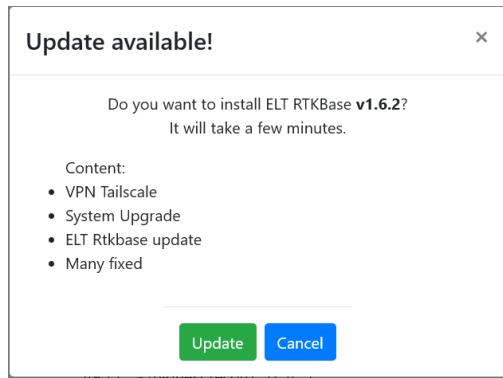
If there are no updates, a window will appear:



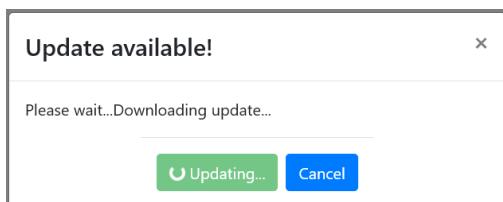
In case of an error, you will see a message like this:



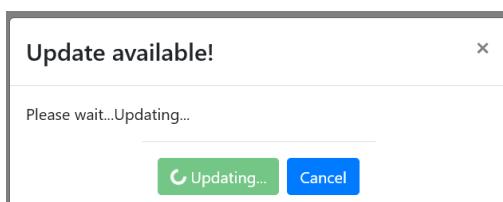
If an update is available, the window will look like this:



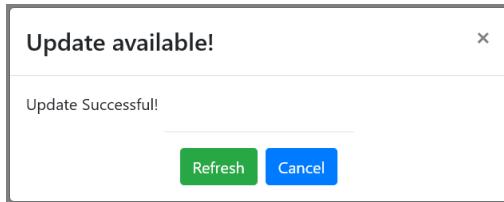
To update, click the “**Update**” button. A message will appear indicating that the update is being downloaded from the website.



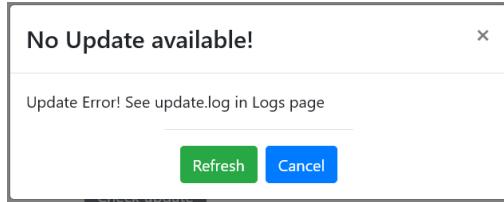
Then, you will see a message about the ongoing update:



Once the update is complete, you will see a message confirming its completion. Next, click the “**Refresh**” button to reload the page.



In case of an error, there will be a different message, after which you should also click the “**Refresh**” button to reload the page.



In this case, go to the **Logs** page, download the update log, and send it to [rtkbase@eltehs.com](mailto:rtkbase@eltehs.com).

STATUS	SETTINGS	LOGS	
File name	type	size (MB)	actions
2024-09-28_03-43-08_UPDATE.log		0.02	

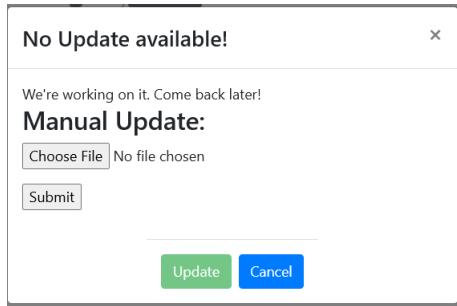
If you have multiple **ELT\_RTKBase** units on different **Raspberry Pi** devices, make sure that only one site from one **ELT\_RTKBase** is open before starting the update. Verify this by going to the **Status** page to ensure you are not prompted for a password. If you skip this step, it may appear that the update is never completing. In this case, simply refresh the page after 10 minutes. This applies only when using multiple **ELT\_RTKBase** units.

## Updating from a File

In some situations, you may need to update from a file. For example, a file provided by technical support, a file downloaded from the debug branch on **GitHub**, or if you want to reinstall the current version. A version with an earlier number cannot be installed this way, but a version with the same number can be.

To do this, go to <http://rtkbase.local/settings?update=manual> or navigate to the **Settings** page and add “[update=manual](#)” to the end of the **URL**.

After clicking the “**Check Update**” button, the following form will appear:



Click “**Choose file**”, select the file, and then click the “**Submit**” button. After this, the file will upload, and the update process will begin, as described in the “Software Update” section.

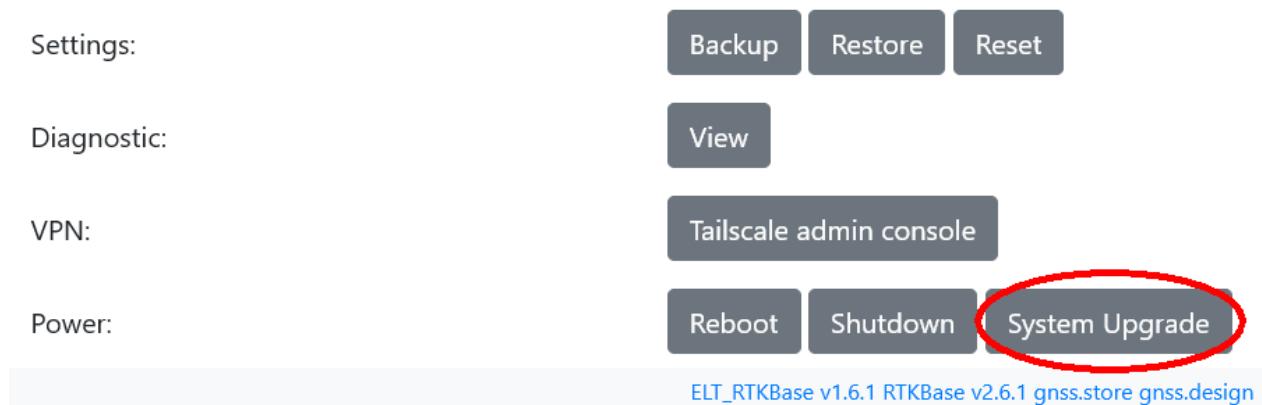
## Updating via SD Card

Update the **Raspberry Pi** firmware by inserting the **SD** card into a card reader and copying the **install.sh** file to the root directory of the first (the only one visible, if you have **Windows**) partition of the card. The update occurs at startup and takes 5-10 minutes. This update will **not work** if you installed the system using the **install.sh** file instead of an SD card image (or purchased a pre-configured system from gnss.store). Internet **is required** for the update.

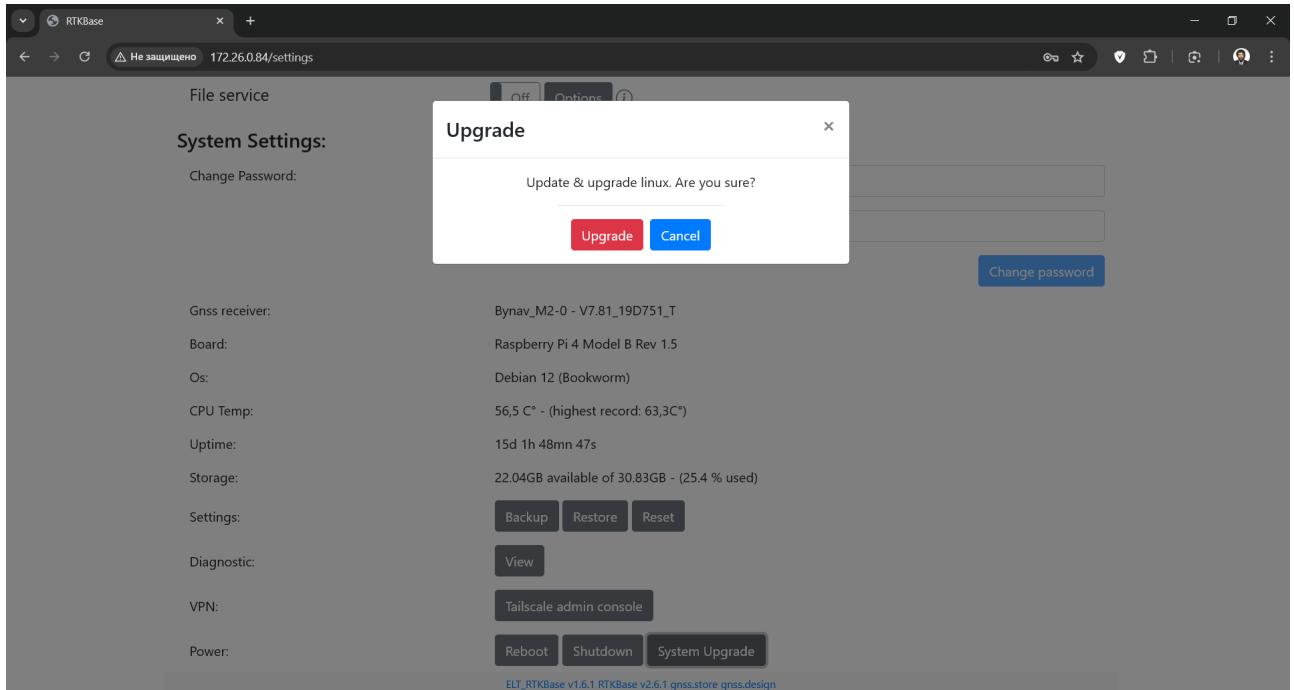
## Linux Update

All operating systems occasionally encounter bugs, and these bugs are fixed by updating the system. **Linux** differs in that not only the operating system gets updated, but all installed programs as well. Sometimes, a bug is so critical that it gets covered in the press. In such cases, updating is absolutely necessary. In other situations, you can update once a month or every six months. The update process takes about 3-10 minutes if done monthly or up to an hour if done every six months.

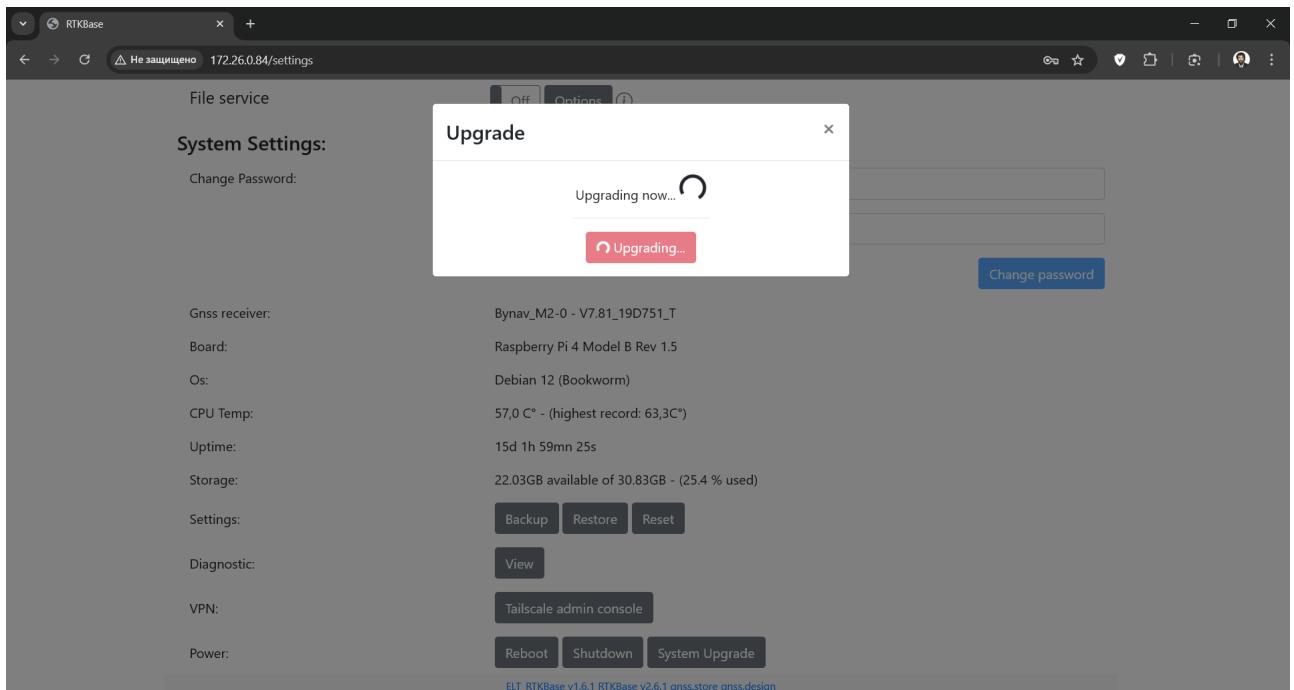
To update, click the “**System Upgrade**” button on the **Settings** page.



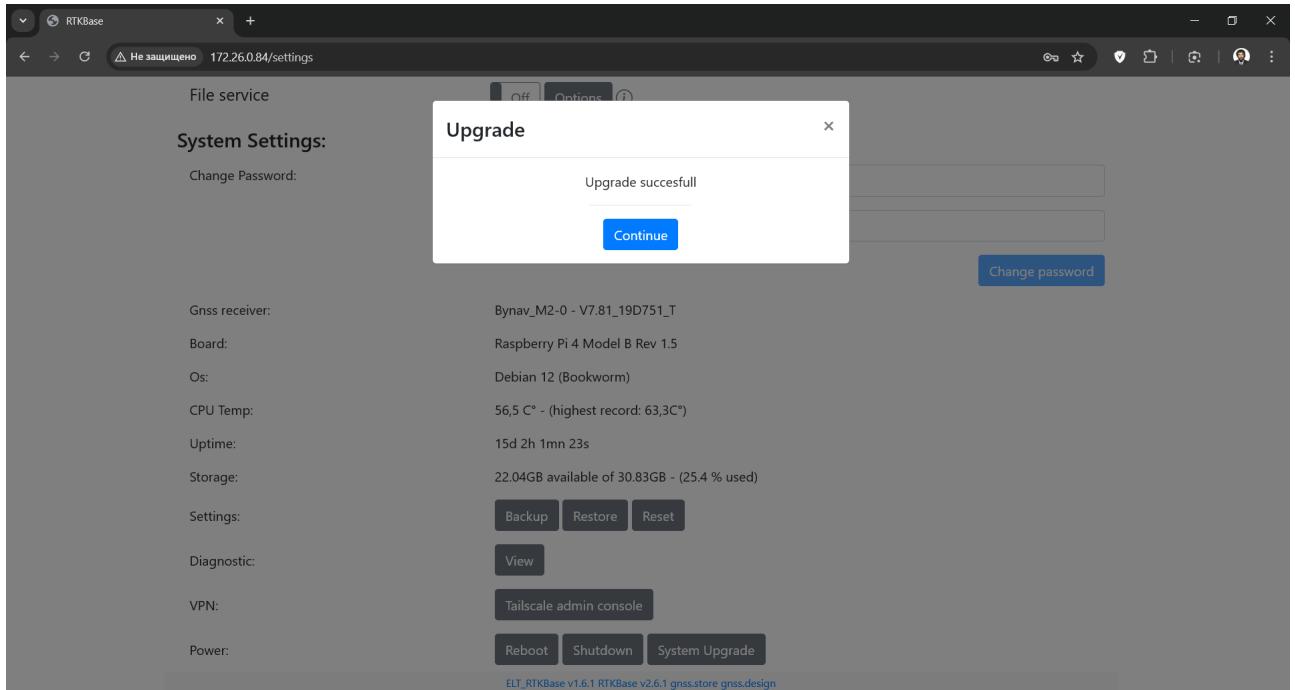
A confirmation window will appear. Click the red **Upgrade** button.



After that, the Linux update process will begin.

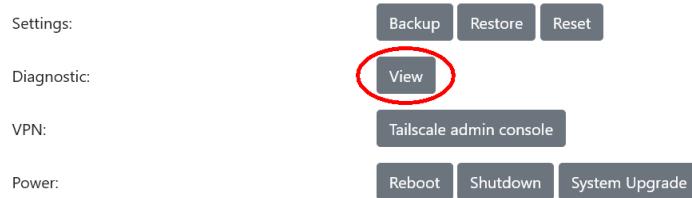


Once it's complete, you will see a blue **Continue** button. Click it. This concludes the **Linux** update process. Of course, it is recommended to reboot by pressing the **Reboot** button after the update.



## Diagnostics

To diagnose issues, click the “View” button.



A diagnostics page will open:

STATUS	SETTINGS	LOGS
	str2str_tcp.service : Active	
	str2str_ntrip_A.service : Active	
	str2str_ntrip_B.service : Active	
	str2str_local_ntrip_caster.service : Inactive	
	str2str_rtcm_svr.service : Active	
	str2str_rtcm_serial.service : Inactive	
	str2str_file.service : Inactive	
	rtkbase_archive.timer : Active	
	rtkbase_archive.service : Inactive	
	rtkbase_raw2nmea.service : Inactive	
	rtkbase_gnss_web_proxy.service : Active	
	rtkbase_web.service : Active	
	rtkbase_check_internet.service : Active	
	RtkbaseSystemConfigure.service : Inactive	

The diagnostics content is intended for advanced users.

## Temperature Check

In the web interface on the **Settings** page, you can view both the current temperature and the maximum temperature since the **Raspberry Pi** was powered on.

Gnss receiver:	Septentrio_mosaic-X5 - 4.14.4 -	Mosaic Web server
Board:	Raspberry Pi 4 Model B Rev 1.5	
Os:	Debian 12 (Bookworm)	
CPU Temp:	40,4 C° - (highest record: 46,3C°)	
Uptime:	1d 9h 46mn 32s	
Storage:	26.43GB available of 30.83GB - (9.6 % used)	

## Troubleshooting

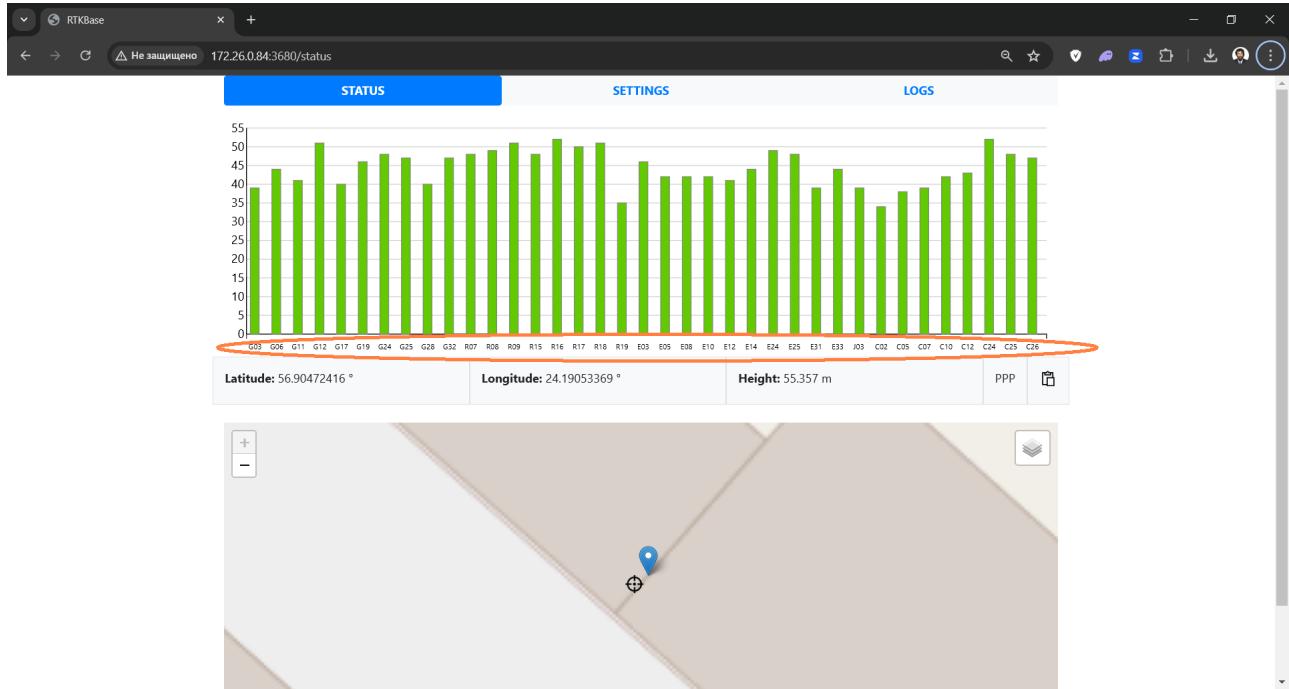
### Detecting Issues on the Status Page

To check for issues, go to the **Status** page.

First, look at the names of the received satellites. You should see satellites labeled **G (GPS)**, **R (Glonass)**, **E (Galileo)**, **C (Beidou)**. Additionally, you may see satellites labeled **J (QZSS)**, **I (IRNSS)**, **S (SBAS)**. If you have a **Unicore** receiver and see only **C (Beidou)** satellites, the problem lies in incorrect coordinates (more than 50 meters off from the true coordinates) in the main service settings. In other cases, it is likely due to incorrect receiver settings.

Next, check the number of received satellites. Typically, 40-50 satellites are received, which is more than the 36 visible on the screen. If there are fewer satellites, consider the length and quality of the antenna cable and the correctness of the antenna installation.

Then, look at the signal strength of the received satellites. If most are above 35, and some are above 50, it indicates good reception quality. If not, there may be issues with the length and quality of the antenna cable and its proper connection to the connectors.



Now, let's look at the middle section. If, despite having a good satellite signal, the coordinates remain zero for more than 15 seconds, the issue lies in the receiver settings. In this case, configure the receiver as described in the “Configuration” section.

Finally, the bottom section with the map. The blue marker represents the current **PPP** solution, while the target represents the coordinates set in the base settings. About an hour after the solution begins, the blue marker should almost stop moving. If the blue marker continues to move significantly after an hour, it indicates multipath reception. This means the antenna is receiving not only direct signals from the satellites but also reflected ones. To correct this, it is recommended to use a **groundplane**, as described in [our blog](#).

## No Connection with Onocoy

For **Onocoy**, in the **NTRIP Server** settings, the “**Mount name**” field should contain the **Credential** name, not the mount point name.

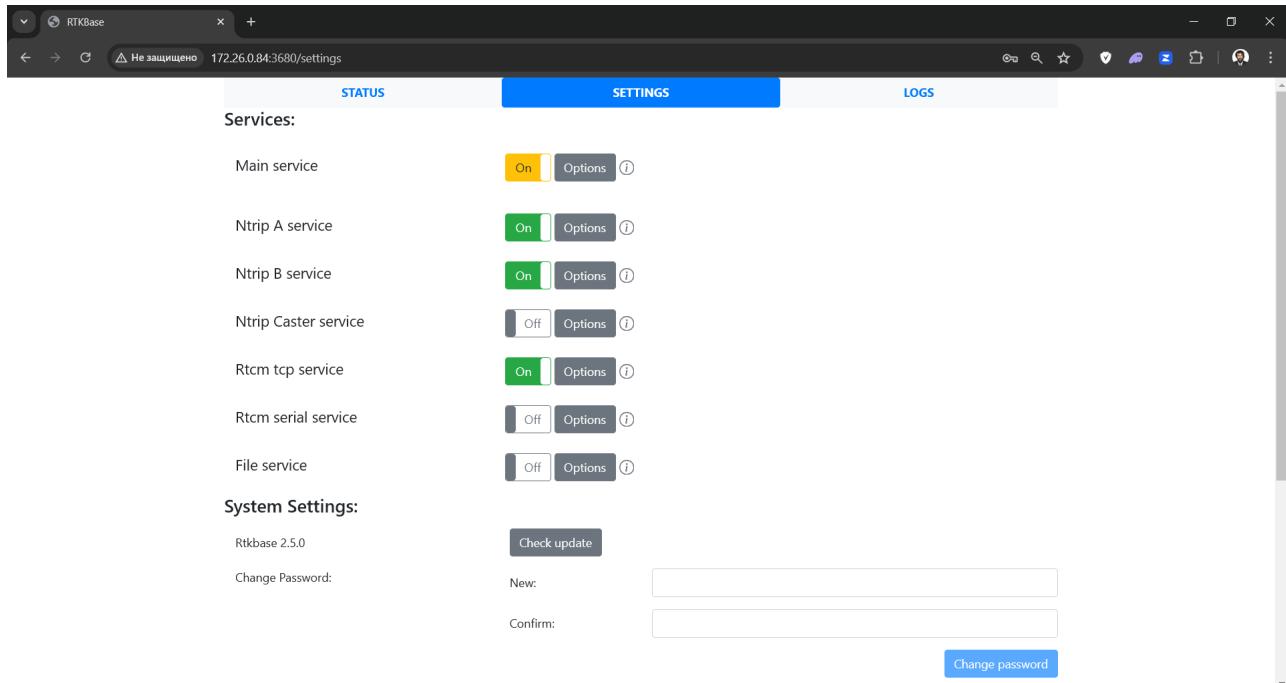
## Receiver Problem Resolution

To check the connection with the receiver, perform detection as described in the “Detection” section. If the receiver is not detected the first time, it makes sense to repeat the operation. If the receiver is not detected twice in a row, it means the program has no connection with the **GNSS** receiver, the receiver is not operational, or it is not powered.

The only method to resolve receiver issues is configuration, as described in the “Configuration” section. If the configuration fails, perform detection (since configuration resets the receiver speed) and repeat the configuration.

## Service Statuses

The service status can be blue, green, yellow, or red. Blue means “the service is in the process of starting up”, green means “everything is fine”, yellow means “the service is running with errors”, and red means “the service is not running”.



The screenshot shows the RTKBase web interface with the URL 172.26.0.84:3680/settings. The interface has three tabs: STATUS (selected), SETTINGS, and LOGS. The STATUS tab displays a list of services with their current status (On/Off), options, and error information. The services listed are Main service, Ntrip A service, Ntrip B service, Ntrip Caster service, Rtcn tcp service, Rtcn serial service, and File service. Most services are currently On. The System Settings section includes a 'Check update' button and fields for changing the password, with 'New:' and 'Confirm:' input fields and a 'Change password' button.

The main reason for a yellow status is parameter errors. For “**main service**”, there are several common reasons for a yellow status:

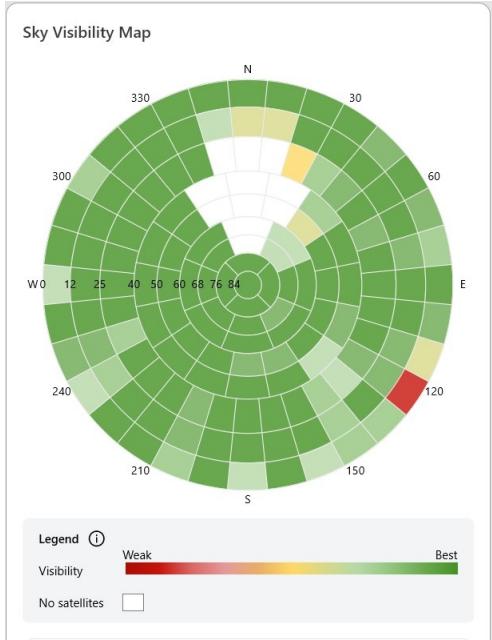
- A speed other than the allowed **115200:8:n:1, 230400:8:n:1, 460800:8:n:1, 921600:8:n:1**.
- Coordinates more than 50 meters off from the true coordinates (only for **Unicore** receivers).
- Very rarely: receiver errors when changing speed or setting coordinates.

A yellow status for **NTRIP** servers indicates a lack of connection with the **NTRIP** caster. In this case, the reason is displayed to the right of the status icon.

If you find an error in the settings, correct it and save the settings. The status should correct itself within a minute. If it is due to rare receiver errors, wait 5 minutes; they usually resolve on their own.

## Northern Gap

Users often ask about the “gap in the north”. This refers to an image like this:



The orbital inclination of **GPS** and **Beidou** satellites is 55 degrees, **Galileo** is 56 degrees, and **GLONASS** is 64.8 degrees. This means that if you are at a latitude greater than the orbital inclination, you will never see these satellites on the northern side of the sky in the northern hemisphere and on the southern side in the southern hemisphere. To check satellite visibility, you can use the [GNSS Mission Planning](#) website.

What about satellites at the far north? From this side, you can receive satellites that fly in a geosynchronous “[Tundra](#)” orbit (also known as **IGSO**). This includes some **QZSS**, **IRNSS**, and **Beidou** satellites. Good animations of this orbit can be found on [Wikipedia](#). The apogee of such an orbit is more than three Earth diameters, so at distant points in the orbit, satellites are visible not only on the side of the Earth they face but also on the northern side of the opposite part of Earth, though at a very low angle.

## Antenna Relocation

If you plan to relocate the antenna and are using a **Unicore UM980** or **UM982** receiver, you must set the coordinates to “**0.00 0.00 0.00**” before moving it. If you skip this step, nothing will work until you reconfigure the receiver as described in the “Configuration” section. The reason is that if the coordinates calculated by the receiver differ from the entered coordinates by more than 50 meters, the receiver stops functioning and generates significant error messages.

## Customize web service port

The **RTKBase** web server runs on port **80** by default. If you want to use other applications (e.g. Wingbits) in parallel with **RTKBase** that already use port **80**, you can adjust this as follows:

Open **settings.conf**:

```
sudo nano /usr/local/rtkbase/rtkbase/settings.conf
```

Change the **web\_port=80** parameter at the beginning of the file. For example, to **8080**, save the file and restart the web service with:

```
sudo systemctl restart rtkbase_web.service
```

The web server can then be reached under the new port.

## Bug reports

Send bug reports to [rtkbase@eltehs.com](mailto:rtkbase@eltehs.com). Try to describe both the error manifestation and the history leading up to it as detailed as possible.