Trimble NetRS Configuration Guide
For the HamSci TEC Project

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Getting a station running for the HamSci TEC Project involves three main steps: (a) hardware installation; (b) receiver configuration; and (c) software configuration.

Hardware Installation

1. Install antenna in a location with a good sky view. The mount should be sturdy so that the antenna does not move with the wind.

2. Install feedline. The antenna likely uses a type TNC connector; the radio uses a type N connector. For runs of 50 feet or less, cable like good quality RG8X or LMR240 are fine. For longer runs, LMR400 is preferred.

3. Connect the power/ethernet “dongle” to the DE26 connector on the rear of the receiver.

4. Connect antenna, ethernet cable, and power (12 – 24 VDC). Power can be provided either via a dedicated power cable connected to the radio if one is available, or via the barrel socket on the dongle. It doesn’t really matter which one you use.

5. Set up computer that will run file download/conversion software. This can be a Raspberry Pi model 3 or later, or a PC. It is dormant except for daily file processing, nominally at 0230 system time. It needs TCP/IP connectivity to the receiver, and the ability to open an SFTP connection to a remote system.

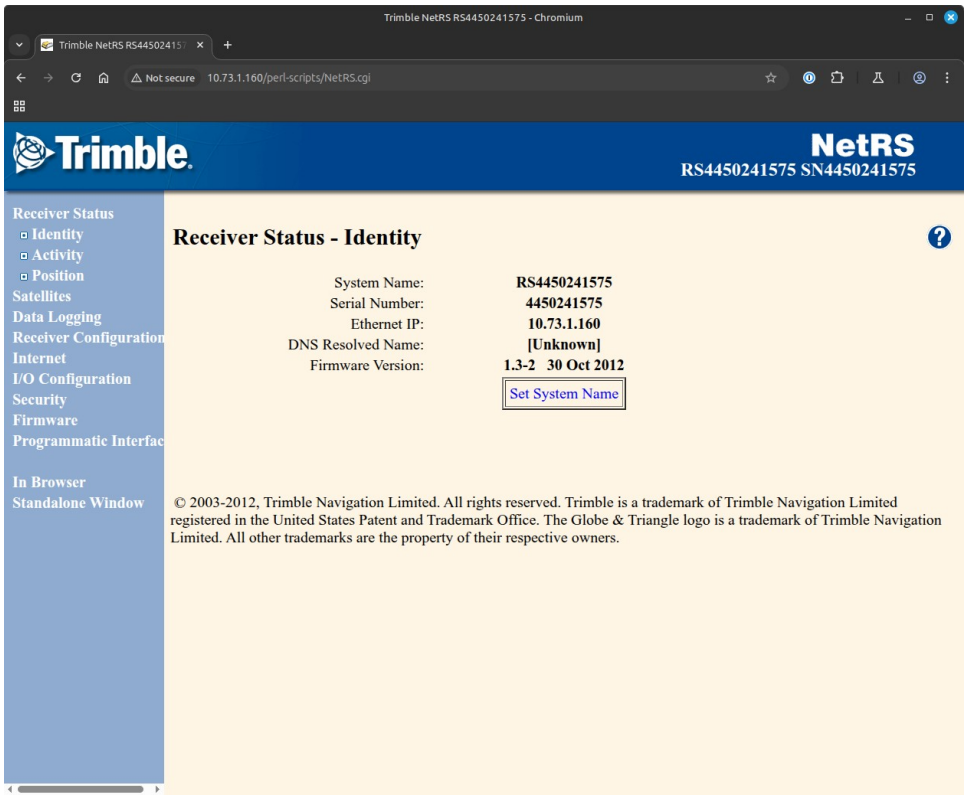
Receiver Configuration

1. Apply power to the receiver. It will probably start to boot up (all LEDs on or flashing) but if it does not, press the front-panel power switch once and it should start.

2. To reset receiver to factory defaults, allow it to finish booting (LEDs stop flashing and only ethernet activity and power LEDs are on), then press the power button until the “EXT REF” LED (the one furthest to the left) turns on after about 15 seconds, and keep pressing it until the EXT REF LED turns off (another 15 seconds). Release the power button and watch the LEDs blink for a couple of minutes until only the ethernet activty and power LEDs remain on. After several minutes you should start to see the satellite LED blinking, indicating that the receiver is tracking.

3. The receiver will get an IP address via DHCP. Connect to it with a web browse. (Note: the receiver can use either HTTP on port 80 or HTTPS on port 443, but your browser will probably complain about a bad SSL certificate. Ignore the warning and venture on.)

4. The first page you see will be like this:



Click on "**Set System Name**" and change the name to something that makes sense for you. (Note – the receiver will use its system name as part of its data logging filenames. We will override that with the correct station name in the download/conversion process.)

5. Click on "**Receiver Configuration**".

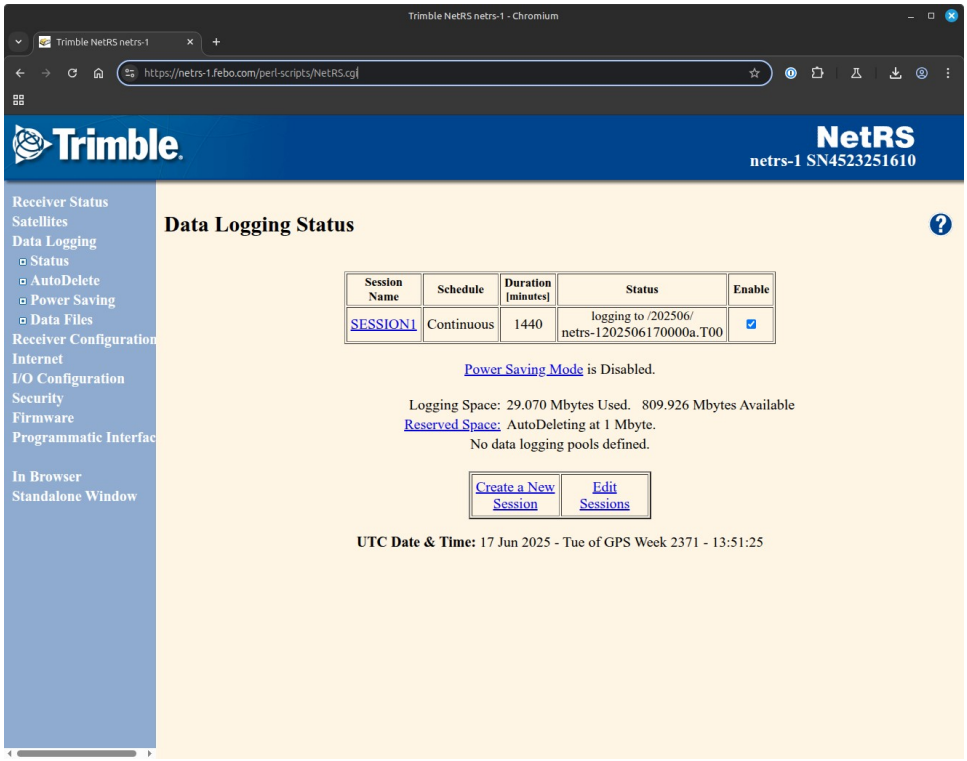
A. Click on "**Antenna**". Select the best match for the Antenna Name. If you have a "real" survey/geodetic antenna, set its NCG/IGS name (you can search https://www.ngs.noaa.gov/ANTCAL/ for it). Leave the height at 0.000 unless you want to offset your measurement plane from the antenna height. Then click "OK".

B. Click on "**Clock Steering**" and make sure that is **enabled**, unless you are using an external 10 MHz reference, in which case you **MUST** set it to "disabled." Click OK.

C. Click on "**L2 Tracking**" and select "**L2C and L2-Y Code**". Click OK.

D. You shouldn't need to change anything else under Receiver Configuration for now, though you might want to experiment with things like Elevation Mask and PDOP Mask if your antenna location is challenged.

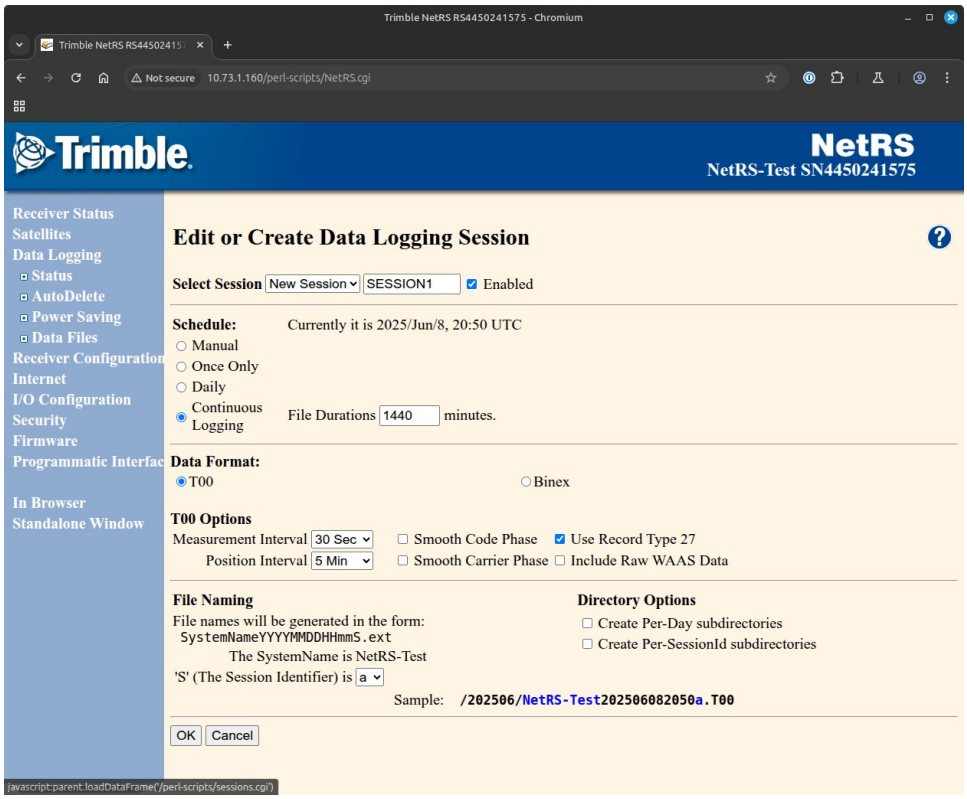
6. Click on “**Data Logging**” and you’ll see a screen like this:



If there are any logging sessions shown, click on the session name to edit, then click “Delete” at the bottom of the screen to delete them.

7. Click on “**Data Logging / Data Files**” which will show the currently saved files. Unfortunately, doing a reset does not delete existing files. You’ll need to manually delete the files shown on this screen. Click to select the directory, then click “**Delete All Files and Subdirectories in this directory**” to delete them. It’s tedious but should be done to maximize the free space for new files.

8. Then, click on “Create a New Session” and set it up like this:



9. Click on “**Data Logging / AutoDelete**” and make sure the AutoDelete box is clicked. The default of 1MB is OK.

10. Click on “**I/O Configuration / Reference Station**”. If the receiver is already locked to satelltes and tracking, click “Here” to set an initial estimate of the location, then click OK. (You can come back later to set this much more accurately. You can set the RTCM, CMR, and BINEX parameters, but the conversion software will override those settings in the data file headers.)

11. That completes the basic setup. Click on “**Receiver Configuration**” and you’ll see a summary of the settings. Click on “**Receiver Status**” and “**Satellites**” and their submenus to see how the receiver is doing.

Getting A More Accurate Location

Every day the receiver will create a data file with .T00 extension. The logging will start as soon as you enable the session. A new file will start at midnight UTC every day. You can check for files by going to "**Data Logging/Data Files**" and clicking on the appropriate YYYYMM directory.

Once you have a file that includes 24 hours of data, download it by clicking on the file name. Then use the convert_trimble.py program to convert it to a RINEX file:

```
convert_trimble.py <filename>
```

This will result in a file with the same name but ".obs" extension. This file can be processed to determine your location to within a few millimeters.

Be very patient and wait until at least 1800 UTC the next day,[1] then go to the Natural Resources Canada Precise Point Position ("PPP") service at **webapp.csrs-scrs.nrcan-rncan.gc.ca/geod/tools-outils/ppp.php**.

Scroll down the page and enter your email address, then make sure the "**Static**" button is clicked, and select the "**ITRF**" tab. Then use "**Choose File**" to select the RINEX file to upload (uncompressed or zipped both work), and click "**Submit to PPP**".

If all goes well, you will see a notice that the file was successfully submitted for processing. The results will be emailed to you, usually within a few minutes to a couple of hours.

The results email will contain several links. The "full output" link provides a multi-page PDF file that has (almost) everything you'd want to know about your location. Open the PDF file and the first page will show you your antenna's coordinates, often with an uncertainty of just a few millimeters.

^For signals without PCO calibrations, CSRS-PPP applies and/or estimates the PCOs relative to the REF PCO

Estimated Position for n8ur1570.25o

	Latitude (+n)	Longitude (+e)	Ell. Height
ITRF20 (2025.4)	39° 43' 42.67317"	-84° 10' 41.53389"	247.119 m
Sigmas(95%)	0.004 m	0.004 m	0.016 m
A priori*	39° 43' 42.53789"	-84° 10' 41.53079"	267.813 m
Estimated – A priori	4.172 m	-0.074 m	-20.694 m

Note the latitude, longitude, and ellipsoidal height in the box – those are the location of your antenna. The "Sigmas" gives you an idea of the uncertainty – here, just a few millimeters (note that height always has more uncertainty than horizontal position).

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1 To do its magic, the PPP service relies on data generated by monitoring stations around the world. There are three levels of this correction data – ultra, rapid, and final. "Final" gives the most precise results, but the correction data for a given day are not available until more than two weeks later. The "Ultra" results, on the other hand, are available a few hours after the end of the data, but are less precise. The "Rapid" results are available about 18 hours after the end of each day, and are usually the best compromise between quality and impatience.

When you have the more precise location, you can go back into the receiver and click on "**I/O Configuration / Reference Station**" and enter the coordinates there. This isn't strictly necessary because the conversion software will override that position, but it's good practice.

Software Installation and Configuration

The gnss_ftp_tools software package runs once daily to perform three steps:

a. Download the prior day's .T00 data file from the receiver
b. Convert the .T00 file into an industry-standard RINEX file
c. Upload the RINEX file to the central data collection server

1. On the system that will be running the processing software, do:

```
sudo apt install python3-paramiko ftp
```
(SFTP library and ftp client for testing)

2. If the system is a Raspberry Pi, do:

```
sudo apt install qemu-user-static binfmt-support
```
(emulation support)

3. Download the latest release package from https://github.com/n8ur/gnss_ftp_tools/release

4. Install the package:

```
sudo tar xzf get_trimble_ftp-2025-06-07.tar.gz -C /
```

5. Edit /usr/local/bin/get_gnss_ftp.sh:

```
#!/bin/bash
/usr/local/bin/get_gnss_ftp.py \
    -m /data/path -f <netrs_ip_address \
    --station <station_name> \
    --organization "HamSci TEC Project" \
    --user "<user_name>" \
    --antenna_type "<antenna_type>" \
    --station_llh "lat_deg lon_deg height_meters" \
    --sftp_host files.tapr.org \
    --sftp_user <usename>
    --sftp_pass <password>
```

-m is the "measurement_path" -- the absolute path where the RINEX files will be stored.

<**station_name**> should be an identifier for your station. **NOTE – We are waiting for instructions on what this should be.** For now, use your callsign but be prepared to change this later.

<**user_name**> should be your name and callsign.

<**antenna_type**> is the IGS identifier for your antenna if known. You can search for the ID at the NGS antenna calibrations site https://www.ngs.noaa.gov/ANTCAL/ . The ID will look something like "TRM41249.00". If you can't find your antenna in the database, leave this blank.

<**station_llh**> should be the coordinates you got from the NRCan PPP report referred to above.

sftp_user and **sftp_pass** should be the user and password TAPR assigned for access to the file collection server.

6. Enable the systemd unit to run the program nightly:

```
sudo systemctl enable –now gnss_ftp.timer
```

When the get_gnss_ftp.sh script is triggered nightly by the systemd timer, it will download the prior day's .T00 file from the receiver and process it through two free-but-not-open-source programs – runpkr00 which converts the proprietary Trimble .T00 file to an intermediate text form, and teqc which converts the intermediate form into an industry-standard RINEX file. Teqc also edits the command line options for station name, location, etc., into the RINEX header file.

The RINEX file is placed in the download/ directory of the measurement path. Then, the program uses sftp to copy the file to the collection server. Once that has successfully occurred, the file is moved from the download/ directory to the processed/ directory where it is retained unless the disk space checking routine triggers, in which case the oldest files will be deleted to reclaim space.

The program logs its operation in /var/log/get_gnss_ftp.log if run as root, or in ~/.local/log if run as a non-privileged user.