User Manual

Version V1.1-20211109

User Manual
For Tersus GNSS Center

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Revision History

Version	Revision Date	Change Summary
1.0	20200909	Initial release
1.1	20211109	Upgrade section 2.3.3&3.4

Table of Content

List of Figures

List of Tables

1. Introduction

This user manual introduces how to use Tersus GNSS Center software.

1.1 Overview

The Tersus GNSS Center is a configuration tool for Tersus GNSS products. This software integrates configuration, monitoring, data logging, firmware upgrade and other useful tools. With Tersus GNSS Center, you can communicate over the on-board serial ports, key in commands to configure the board, upgrade firmware, store data, playback data, convert data to RINEX format, display rover's trajectory in Google / Baidu map, calculate the average position of the base station, view status of the board and positioning results.

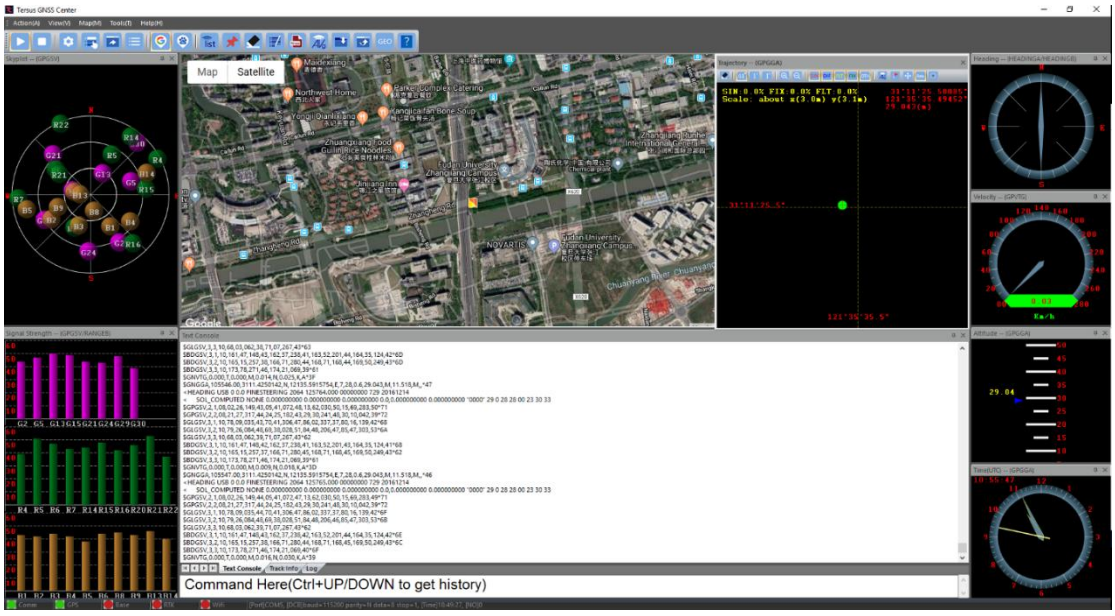

Figure 1.1 Tersus GNSS Center main interface

1.2 Features

Tersus GNSS Center has following features:

- Communicate over the on-board serial ports
- Key in commands to configure the board
- Upgrade firmware
- Store data, playback data
- Convert data to RINEX format
- Display the rover's trajectory in Google / Baidu map
- Calculate the average position of the base station
- View status of the board and positioning results

1.3 System Requirements

Tersus GNSS Center is to run on a wide range of different computer configurations. The systems requirements are listed as below:

Table 1 System Requirements for Tersus GNSS Center

Operating System	Microsoft Windows 7, 8, 10 (32-bit and 64-bit)	
Hardware	Minimum	Recommended
Processor	Intel Core i3	Intel Core i5
RAM	4GB	8GB
Hard disk	10GB	1TB
Graphics card	Direct X9 compatible integrated graphics	Direct X9 compatible 2GB discrete graphics
Internet Connection	Ability to originate both http and https (SSL) connections	

2. Functions

This chapter describes the detailed operations of Tersus GNSS Center

Before using Tersus GNSS Center software, ensure one BX board or one receiver of David series GNSS Receiver is powered up and connected to the computer via serial port. The physical connection refers to corresponding user manual which can be downloaded from Tersus website https://tersus-gnss.com/document.

2.1 Config window

When launching Tersus GNSS Center, the config window pops up automatically. This window can also be found in the menu bar Tools -> Config.

2.1.1 Connection

Under the connection tab, there are two options:

1) Serial

   If choosing Serial as connection type, choose the right port when a Tersus GNSS board or receiver is connected to computer via serial port. The baud rate is 115200 bps by default. It is not recommended to change baud rate. The serial port can be found in the windows device manager.

   The 'Save Received Data' function is turned on by default. It can be turned off manually.

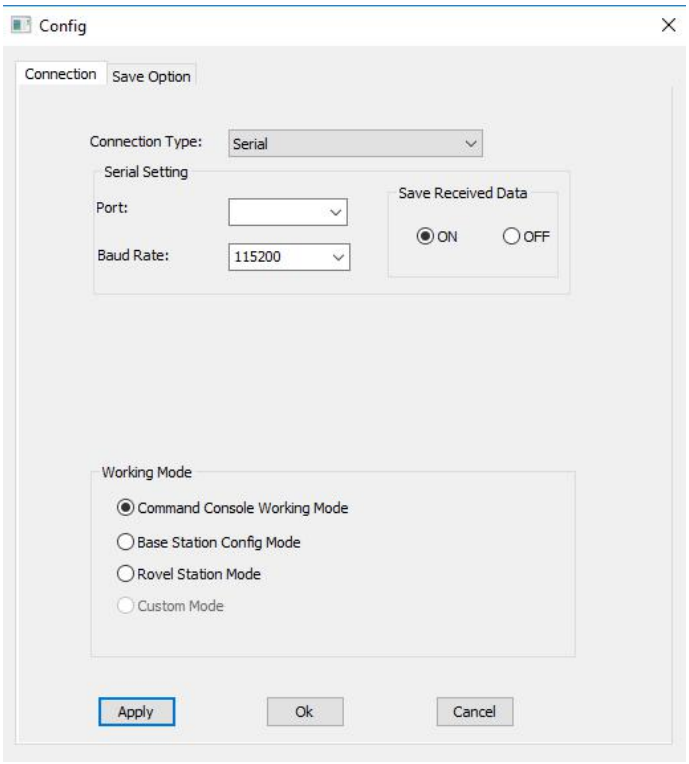

Figure 2.1 Connection config – serial connection

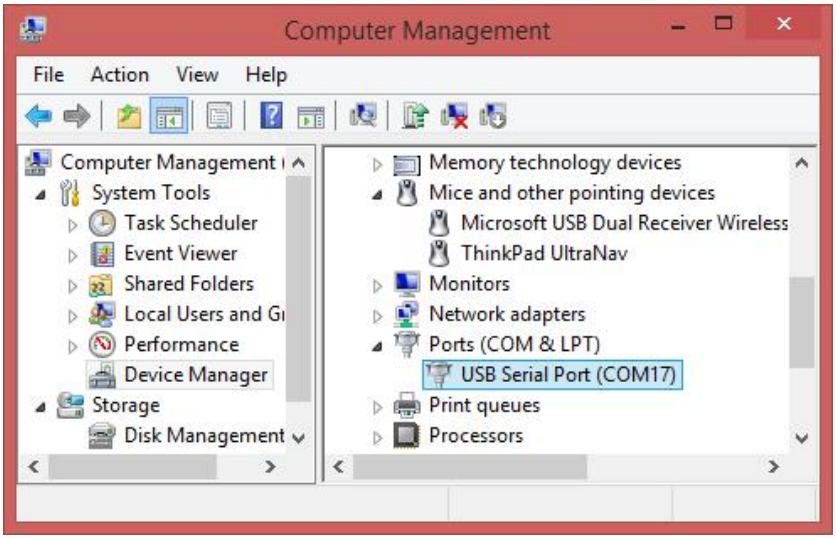

Figure 2.2 Device manager

2) Demo file

If choosing demo file as connection type, click the file path and choose the demo file, selecting loop can play the demo repeatedly, then click [OK] to start playing demo file. The demo file can be .dat format files.

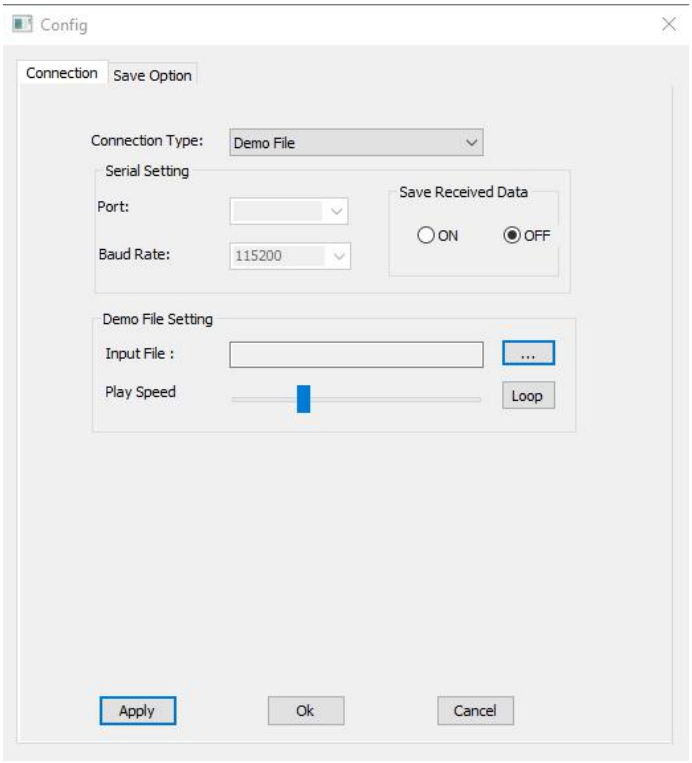

Figure 2.3 Connection config – demo file

2.1.2 Working mode

There are three working mode to choose: command console working mode, base station config mode, and rover station mode.

1) Command console working mode

   This mode is the major mode that is introduced in this user manual.

2) Base station config mode

   If choosing base station config mode, it pops out below config window. Configuring parameters for base station by selecting in drop-down options is another method which is different from command configuration.

   You can fill in the coordinates of the base station or tick Posave on to enable auto base station.

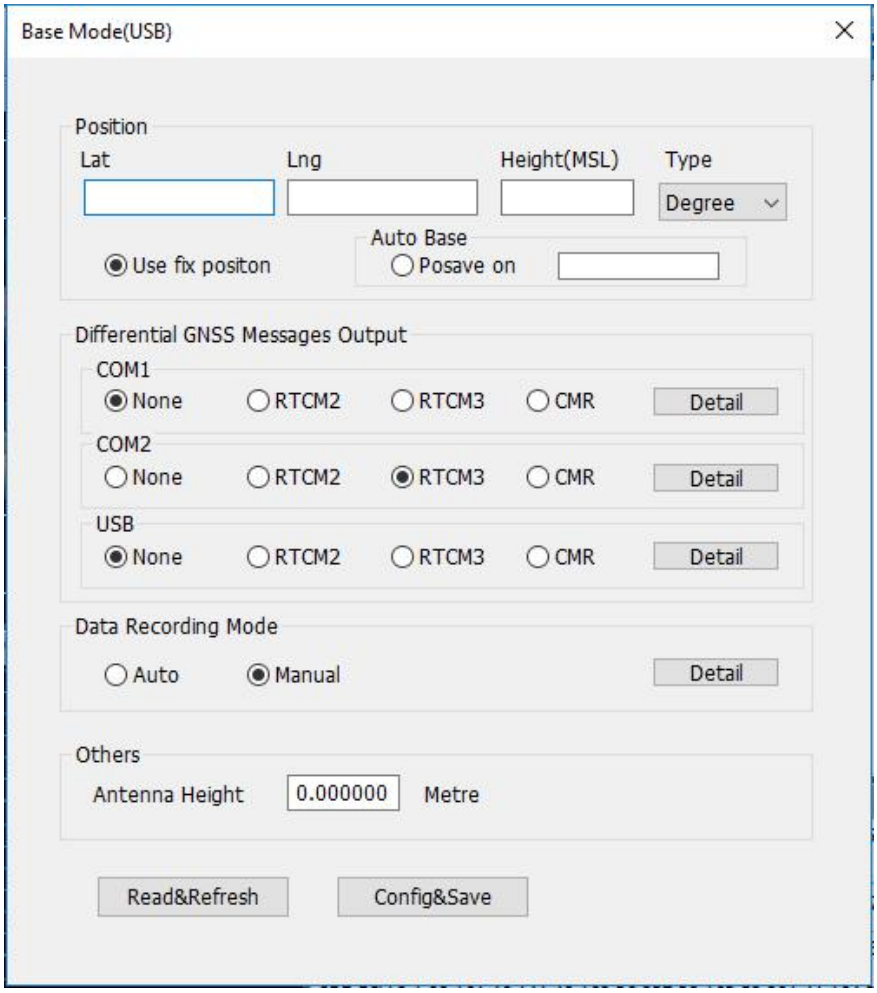

Figure 2.4 Base mode configuration

For differential GNSS message output, you can configure RTCM2, RTCM3 or CMR message for the current communication port. Click [Detail] to configure corresponding message types.

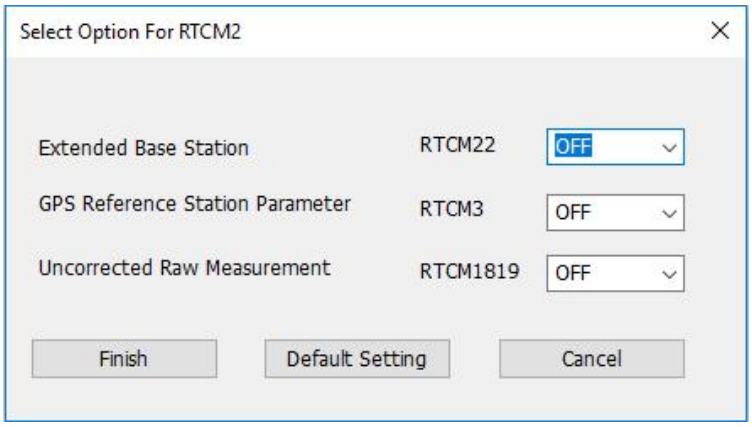

Figure 2.5 Options for RTCM2

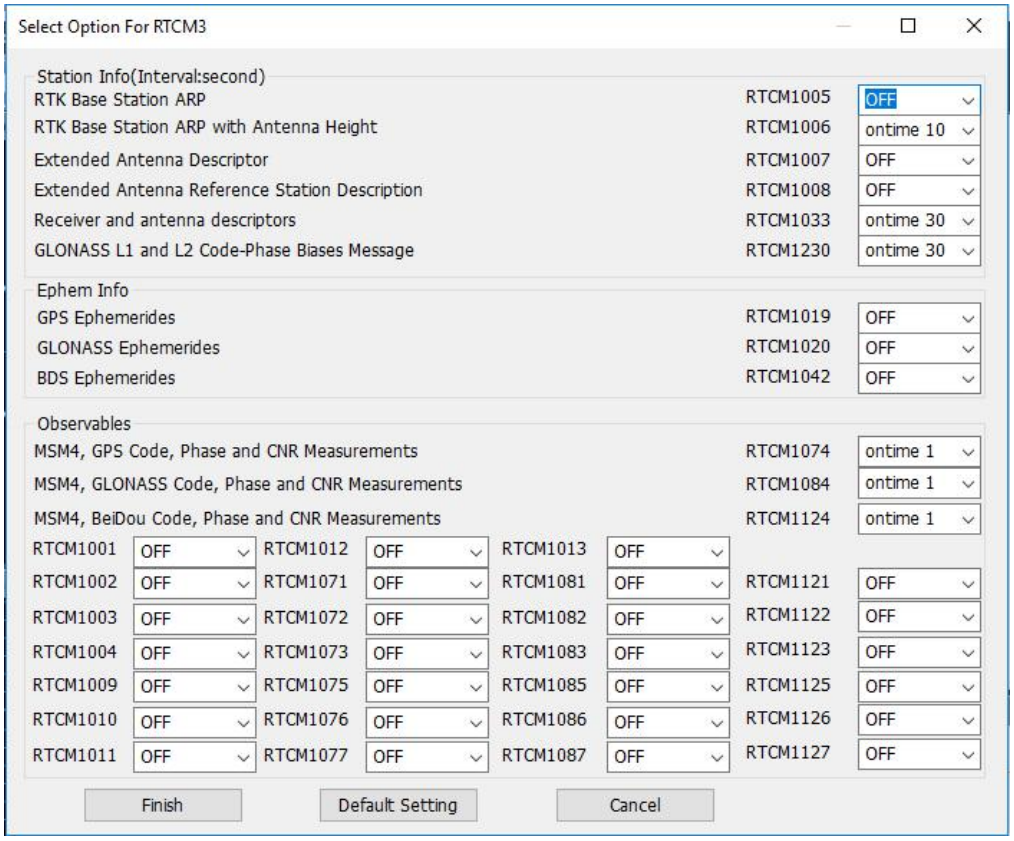

Figure 2.6 Options for RTCM3

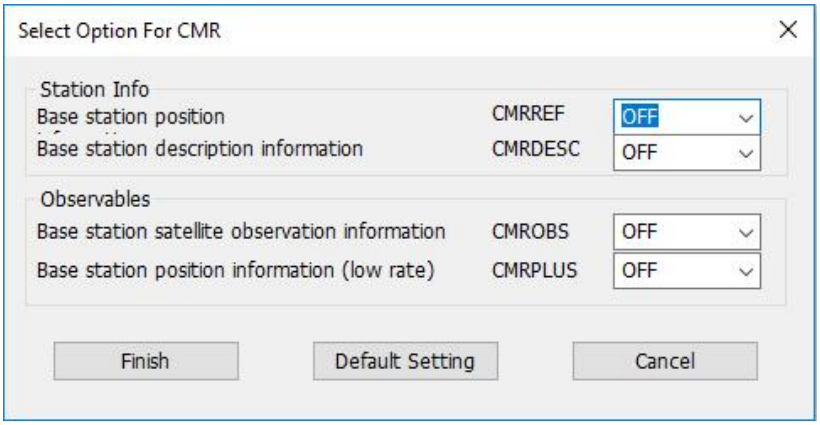

Figure 2.7 Options for CMR

For data recording mode, you can choose auto or manual, click [Detail] to configure corresponding output options.

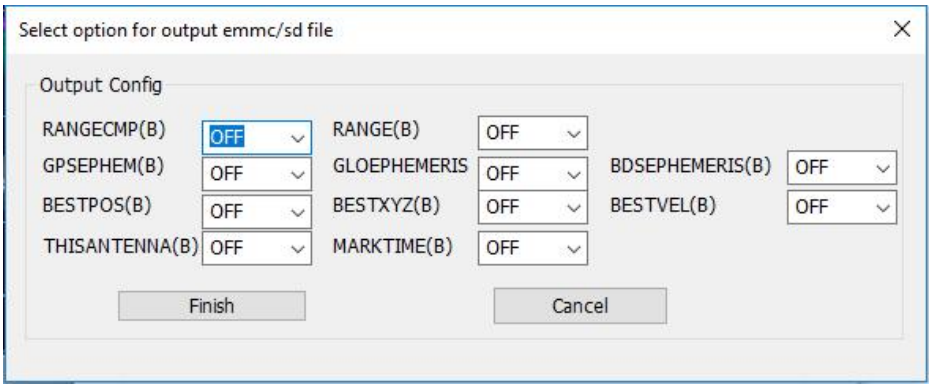

Figure 2.8 Output options

You can also set antenna height under Others. Click [Config&Save] to finish the base mode configuration.

3) Rover station mode

If choosing rover station mode, it will pops out a notice to confirm this action.

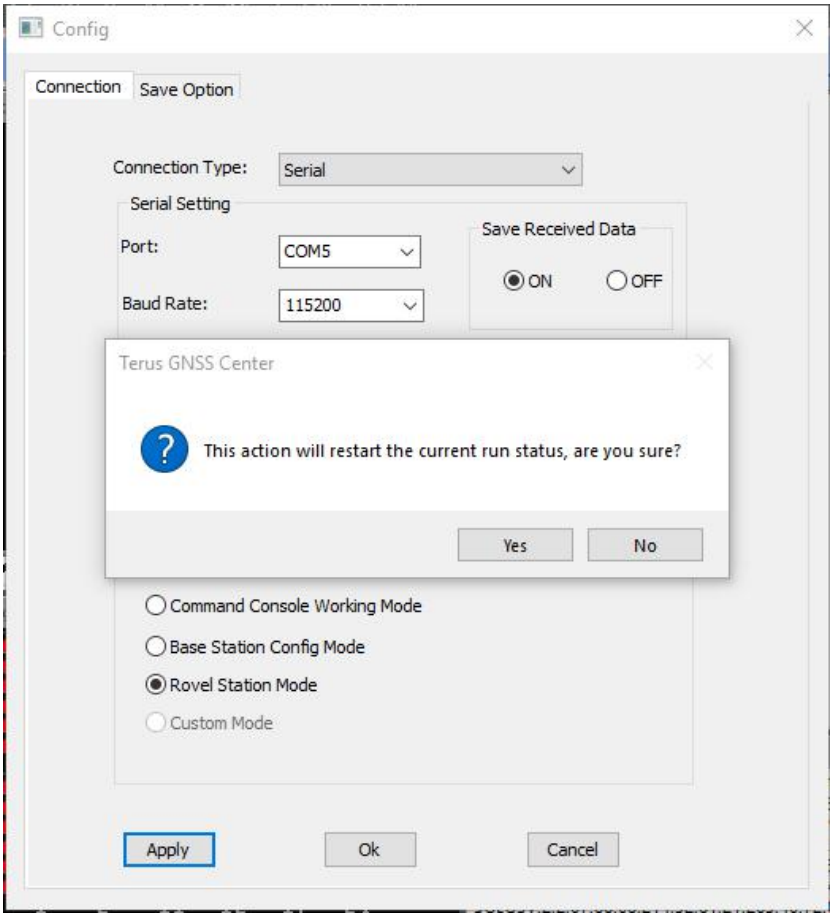

Figure 2.9 Change to rover mode

In the rover mode configuration interface, you can configure rover's output from COM1/COM2/USB/File.

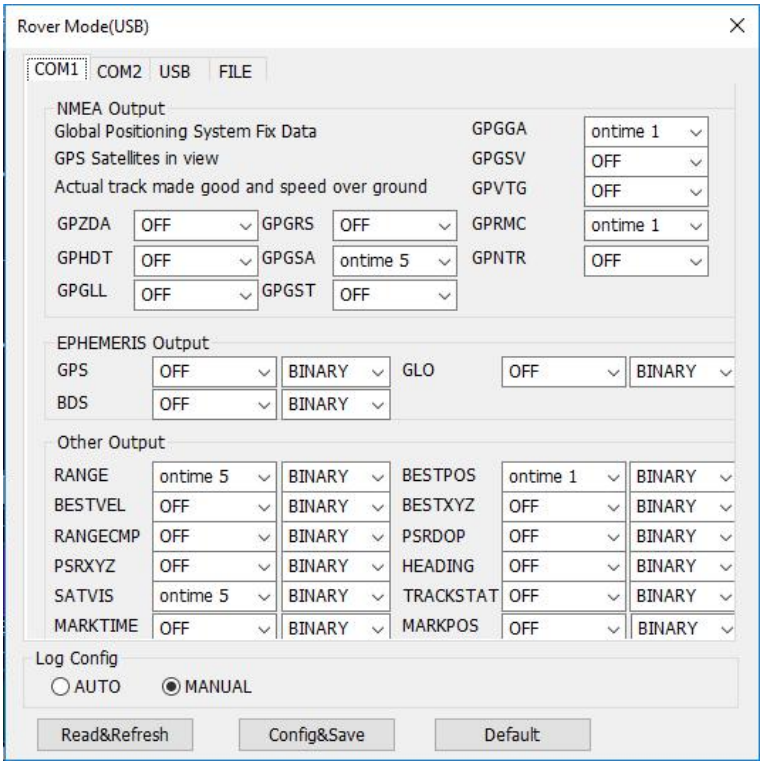

Figure 2.10 Configure COM1 for rover mode

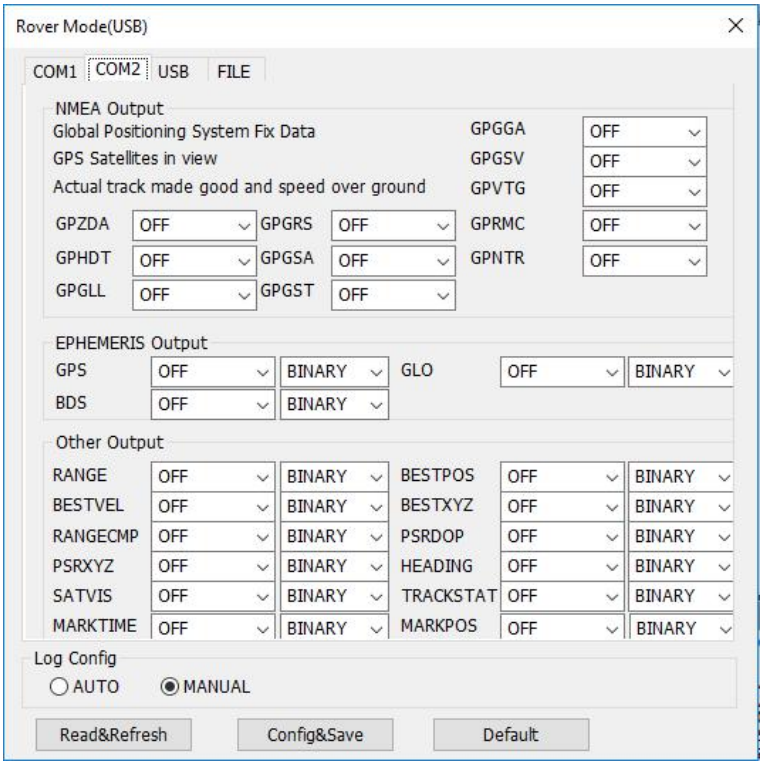

Figure 2.11 Configure COM2 for rover mode

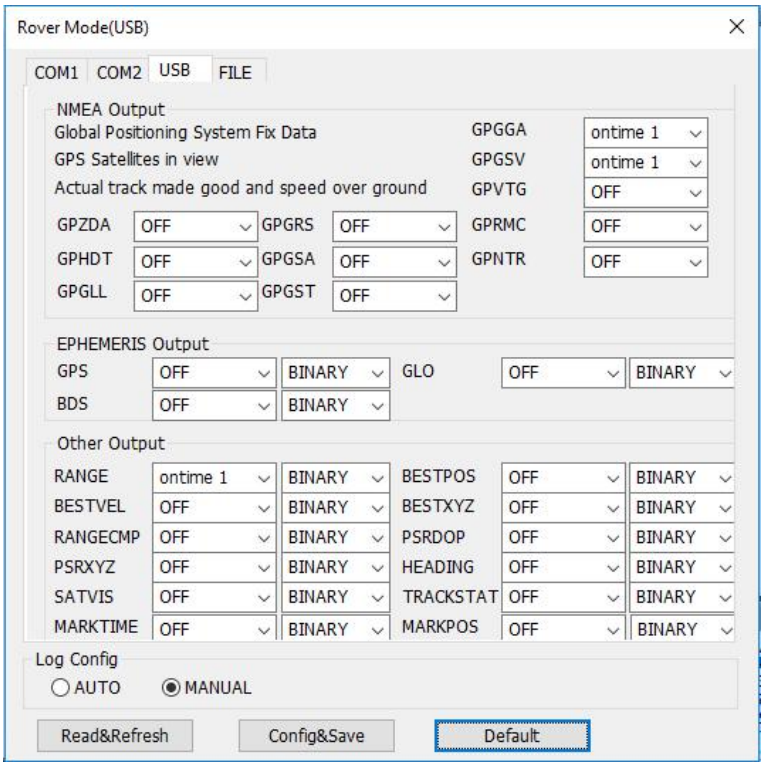

Figure 2.12 Configure USB for rover mode

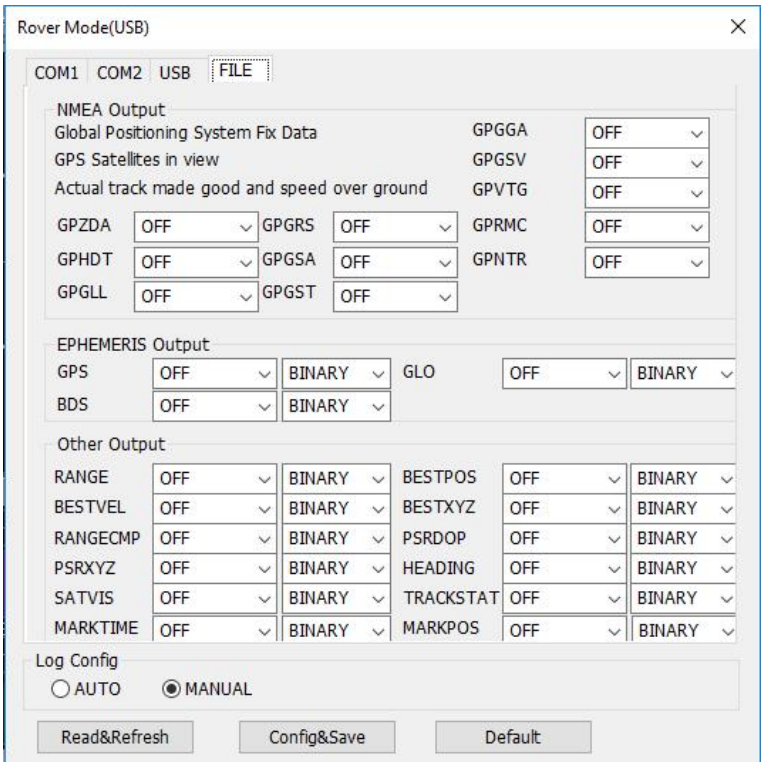

Figure 2.13 Configure FILE for rover mode

After setting all required parameters, click [Config&Save] to finish the rover mode configuration.

2.1.3 Save option

Under the save option tab, the output directory can be set, the data format options can be checked according to different requirement. The log option is .log by default.

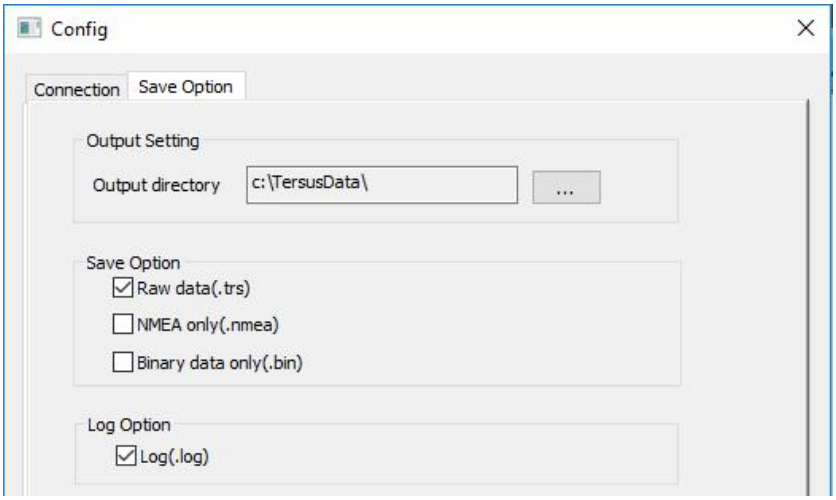

Figure 2.14 Save option config

2.2 Interface and functions

The main interface of Tersus GNSS Center is shown as below.

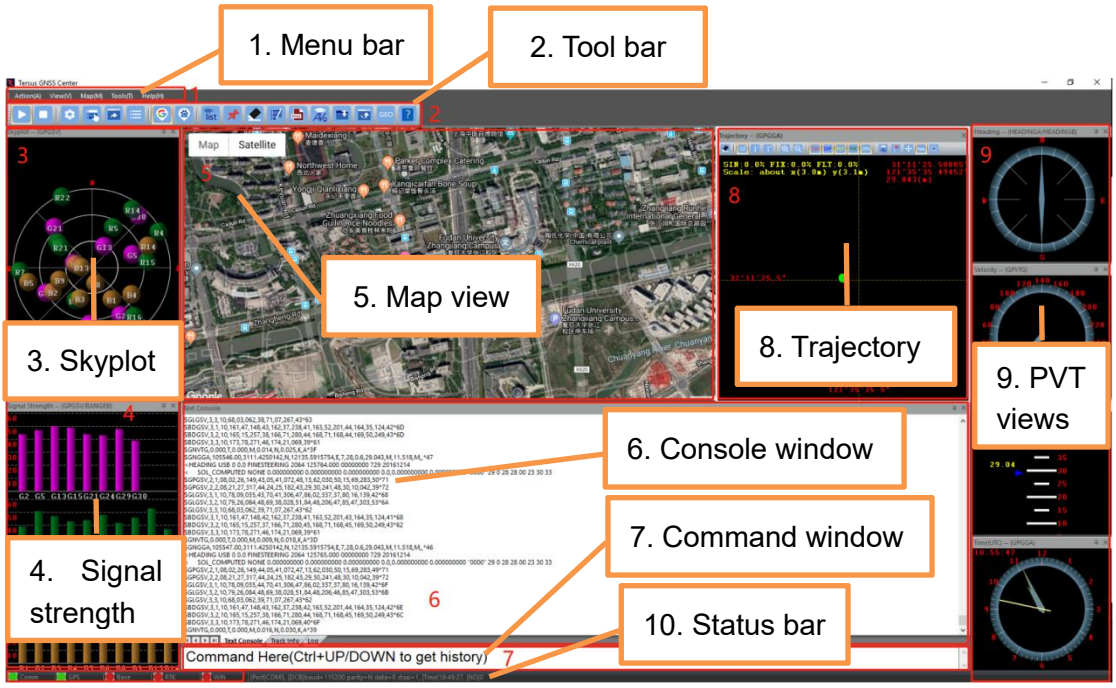

Figure 2.15 Tersus GNSS Center main interface

2.2.1 Menu bar

The menu bar includes below options:

1) Action

Under the action tab, it has three options: play, stop and quit.

2) View

Under the view tab, it has three options: windows, status bar and skin. For windows, you can check which window to display. For status bar, you can check to display status bar or not display this bar at the bottom. For skin, you can choose from seven skin types for this software.

3) Map

Under the map tab, it has two options: Google map and Baidu map.

4) Tools

Under the tools tab, it has three categories:

a. Config, References, and Restore Layout;

b. Show position summary, auto base station list, pin output, and erase Trajectory;

c. Data recording, RINEX converter, Position averaging, Download File, Update Firmware, and GeoPix. These are useful tools for different applications.

5) Help

Under the help tab, it shows the Tersus GNSS Center version.

2.2.2 Tool bar

The tool bar shows different tools in icons.

 Play: play demo file like a video, or enable the serial port connection.

 Stop: stop playing demo file, or disable the serial port connection.

 Config: configure connection and save option, details refer to section 2.1.

 Environment preferences: set environment preferences as shown below. You can switch google map URL, set Baidu map option, set map option with GCJ-02, set satellite color, set trajectory view display colors, set limit for tracing point clear interval, set limit for output session interval, and set text console clear interval.

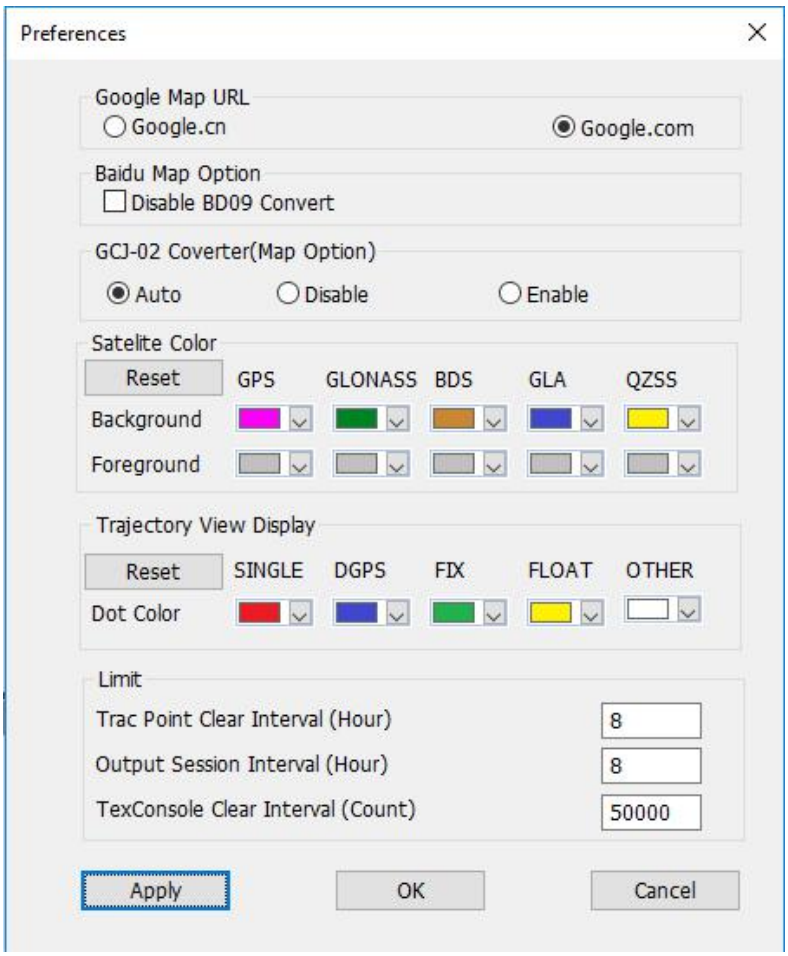

Figure 2.16 Set environment preferences

Restart the app to restore: restore to the default display after restart.

Position summary: shows the summary of position parameters including status, differential angel, satellite numbers, HDOP, ground speed, ellipsoidal height, longitude, latitude, UTC time, date and quality indicator.

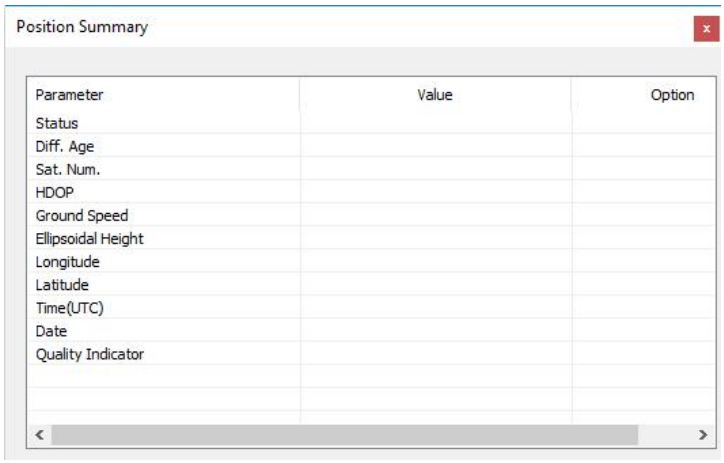

Figure 2.17 Position summary

 Google map: click it to display in google map.

 Baidu map: click it to display in baidu map.

 Base network for posave: it pops out the Auto Base Station List window to set PosAve on or off and show the base station position network as below.

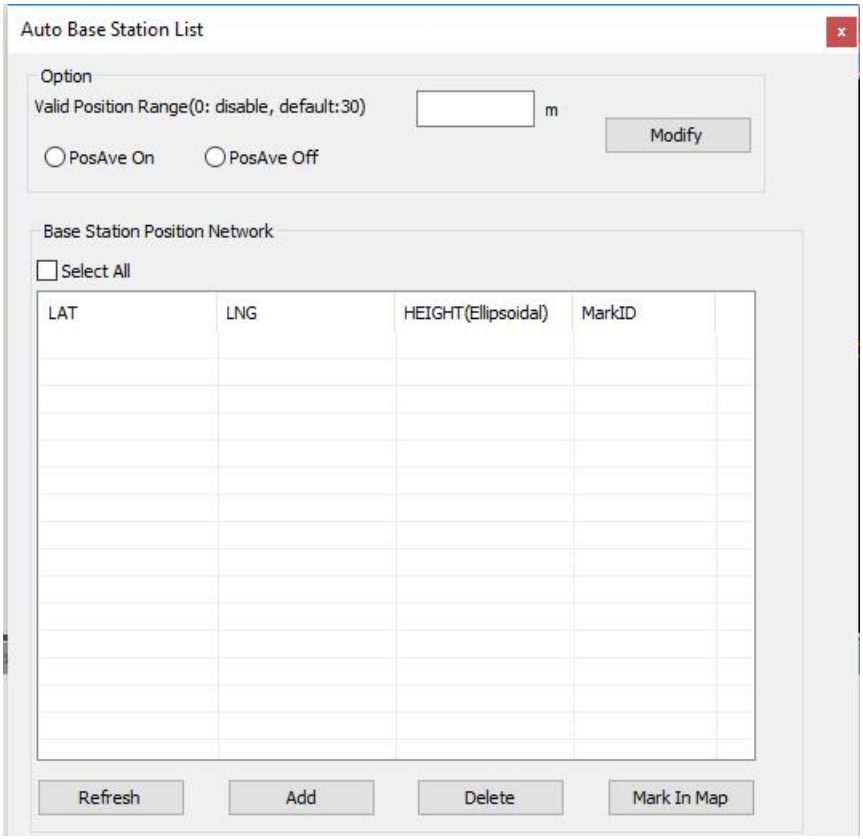

Figure 2.18 Auto base station list

If a base is setup with command POSAVE, according to its original definition, after a power cycle, the fixed position may be different even if the receiver is installed at the same point. Auto base station list function is for the users who need the base to keep the same fixed position after a power cycle.

Fill the valid position range, check PosAve On, and click [Modify]. It is recommended that valid position range is >20m. After the specific time (in the example, 0.01 hour is 36 seconds), the base is fixed with the 36 seconds averaging position. Click [Refresh], the fixed position is displayed as below.

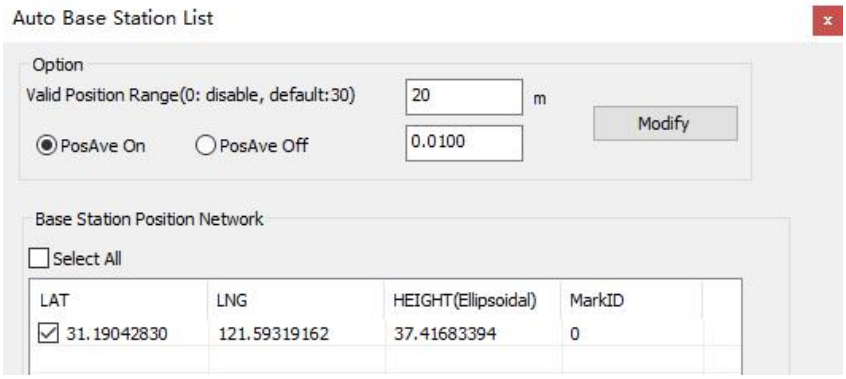

Figure 2.19 Fixed position for base station

After a power cycle, if the base is moved less than 20m away from the last position, it would fix with the same position. In the above example, latitude keeps 31.19042830, longitude keeps 121.59319162 and ellipsoid height keeps 37.4168.

 Pin output: pause the message output in text console window.

 Clear the trac point both in trajectory and map: click it to clear the track point both in trajectory and map.

 Data recording: view data recording status shown as below. This function is only available after configuring raw data storage command. Only when turning on the raw data recording, it will show the data recording status.

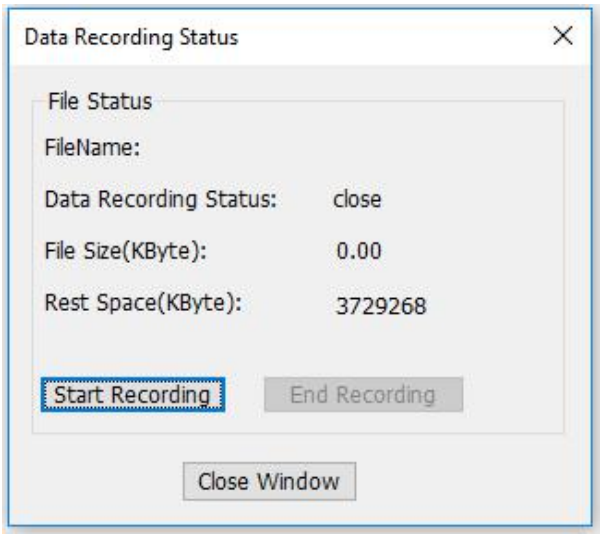

Figure 2.20 Data recording status

Convert to RINEX 2.10/3.02/3.04: click this icon to view below setting window.

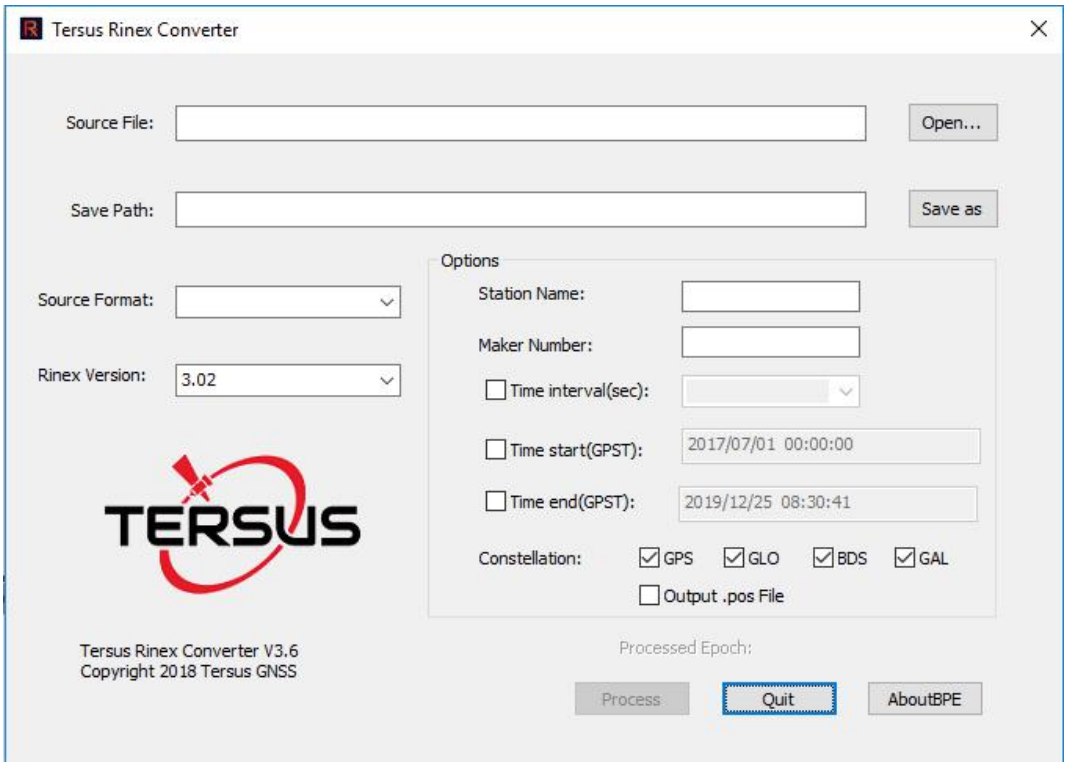

Figure 2.21 Tersus Rinex Converter

Position averaging for base stations: set input and output parameters for position averaging.

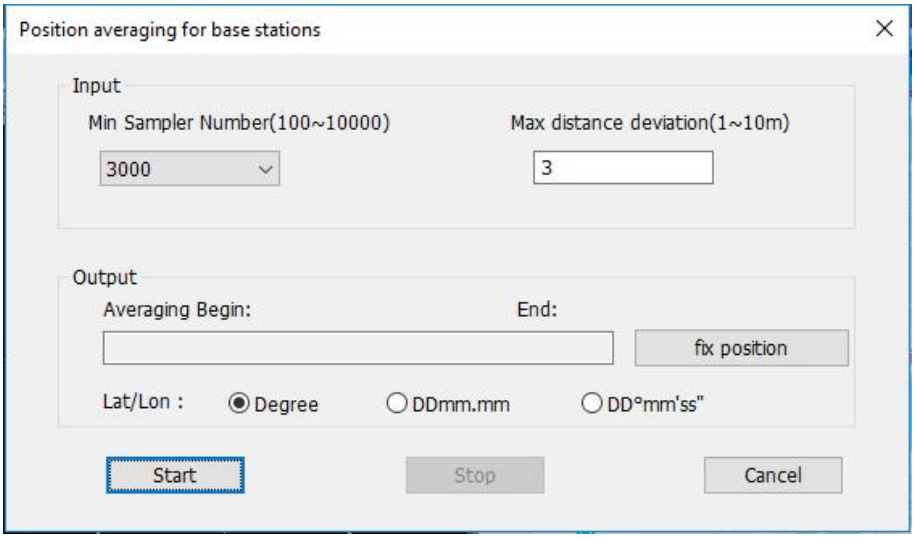

Figure 2.22 Position averaging for base stations

Download SD/EMMC file: download data files from internal storage of the

receiver to the computer.

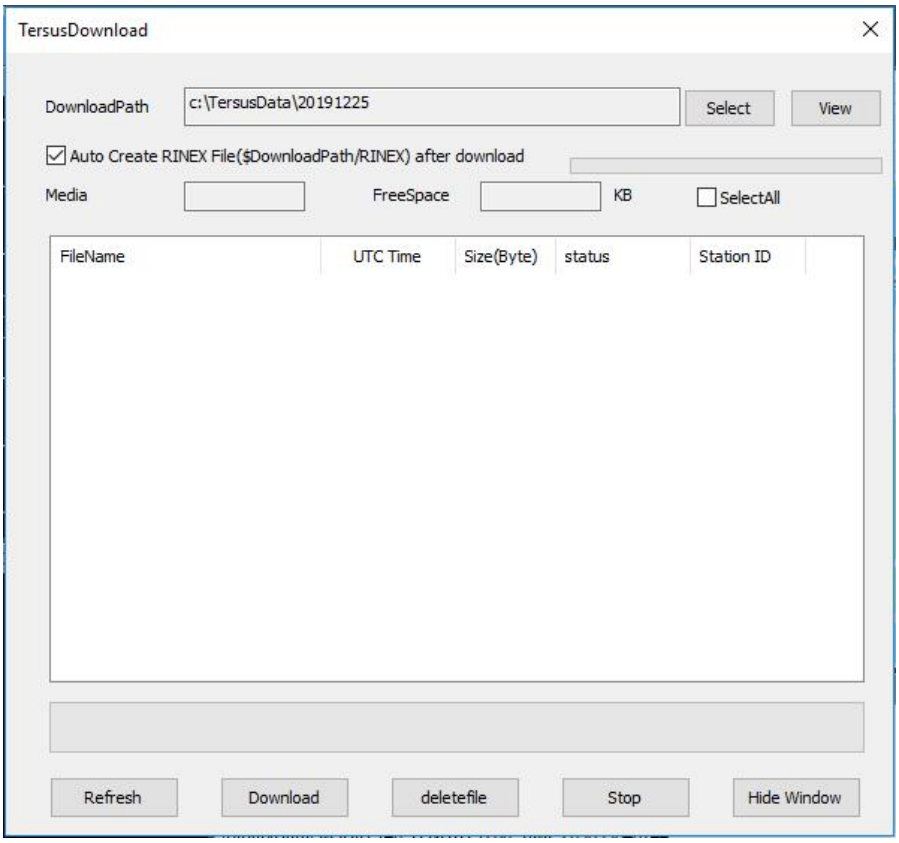

Figure 2.23 Tersus download

 Update firmware: upgrade firmware using serial port.

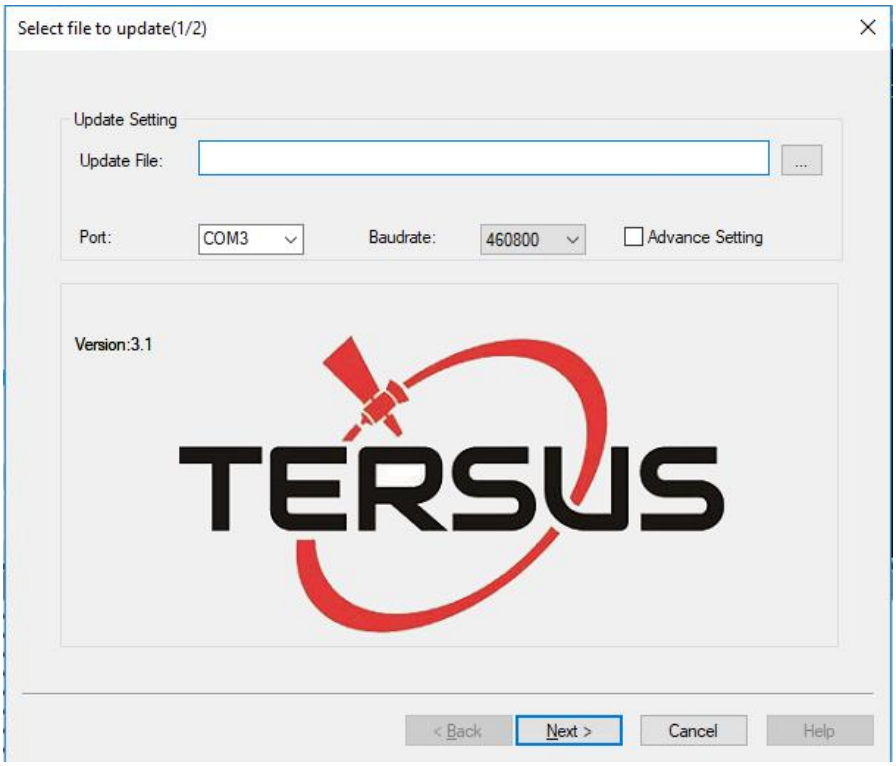

Figure 2.24 Update firmware

GeoPix: launch GeoPix software to process GNSS observations.

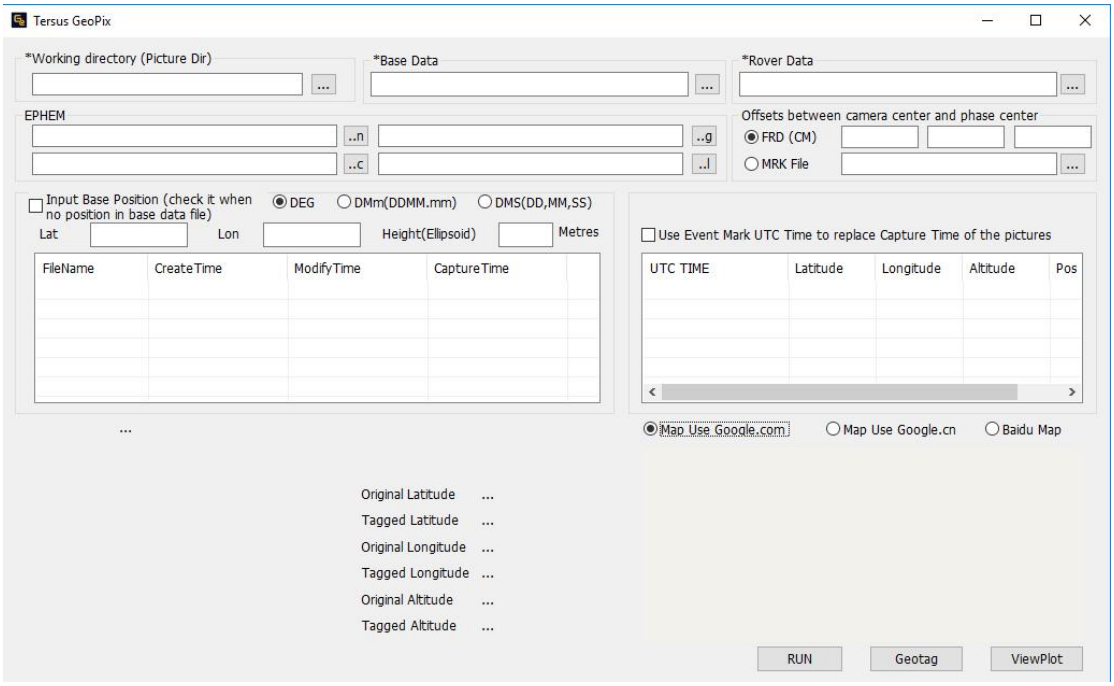

Figure 2.25 GeoPix main interface

About version: view Tersus GNSS Center version.

2.2.3 Skyplot view

The Skyplot view displays the number of GNSS systems (GPS / GLONASS / Beidou / Galileo / QZSS) being tracked by the board or receiver and their elevation / azimuth angle. The different GNSS constellations are distinguished with different colors, which can be configured in Tools - > Preference. The satellite PRN are marked in the figure with capitalized character ‘G’, ’R’, ‘B’, ‘E’, ‘J’ referring GPS, GLONASS, Beidou, Galileo and QZSS constellation respectively. The figure is expressed in polar coordinate system with its direction refers to the azimuth angle and radius refers to its zenith distance (90-elevation angle in degree). Please note the view works only when GPGSV message is logged.

Figure 2.26 Skyplot view

2.2.4 Signal strength view

The Signal strength view shows the signal noise ratio of different frequencies of corresponding GNSS systems (GPS/GLONASS/Beidou/Galileo/QZSS). The

horizontal axes represent the number and the PRN. The vertical axes represent the carrier to noise ratio (C/N0) in dB/Hz. Note: the receiver is capable of tracking multiple frequency signals for some constellation, check the box at the bottom left corner to present the C/N0 of different frequency signals. Please note the view works only when GPGSV message is logged.

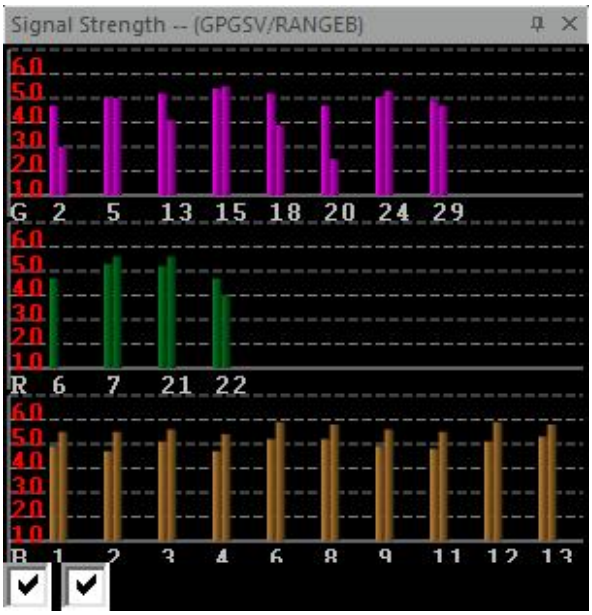

Figure 2.27 Signal strength view

2.2.5 Map view

The map view can be chosen from flat map or satellite map. The map source can be selected from Google map or Baidu map.

Note: In Mainland China it only supports Baidu map, needs proxy network to access Google map.

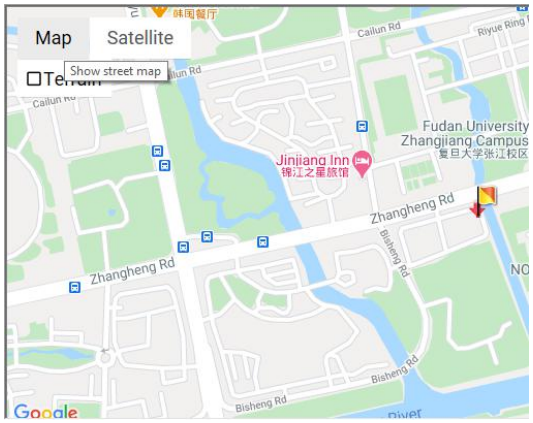

Figure 2.28 Google map

Figure 2.29 Baidu map

2.2.6 Console window

The console window has three tabs: Text Console, Track Info and Log.

- The Text console window provides a way for users to communicate directly with the board. Commands can be sent to the board using this window and all ASCII-format messages are displayed. When binary format data is received, the Text console window will show a summary of the binary data, including message type and data length. If the unrecognizable characters are received, they will be considered as error log and shown in Log view.

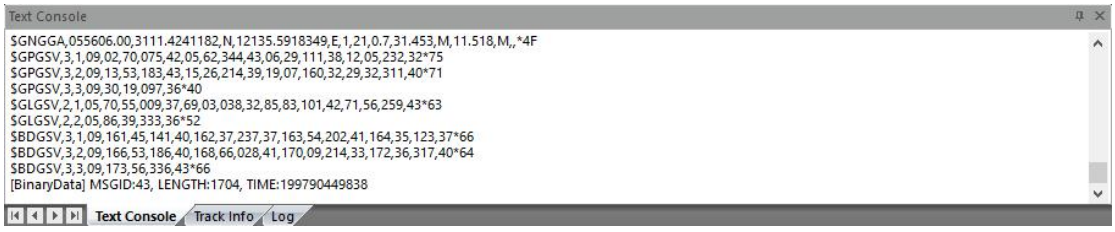

Figure 2.30 Text console window

- The track info window provides the coordinates at a frequency of 1Hz.

Figure 2.31 Track info window

- The log window lists output messages of ASCII or abbreviated ASCII format.

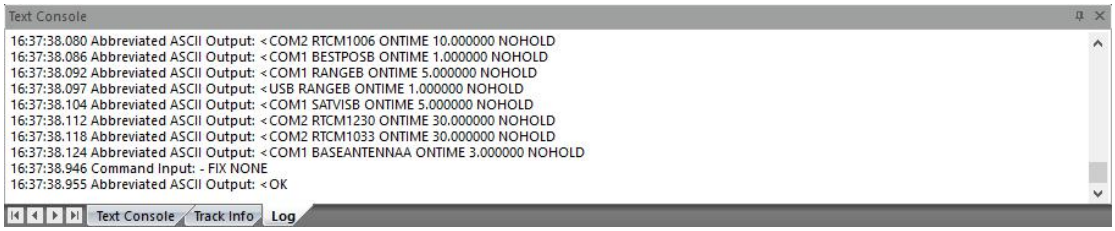

Figure 2.32 Log window

2.2.7 Command window

The command window is to input/type commands. Press Enter to send the commands to the boards or receivers. Press Ctrl + Up/Down to get history commands.

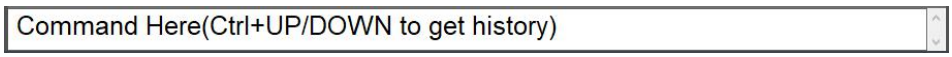

Figure 2.33 Command window

2.2.8 Trajectory view

The Trajectory view provides real-time graphic plotting of the current horizontal position (longitude and latitude). Different solution status are presented in different colors, which are defined as:

- SIN (Single point positioning solution)
- DIF (DGPS solution)
- FLT (RTK float solution)
- FIX (RTK fixed solution)
- OT (others solution status , e.g. Dead Reckoning or invalid solution)

You can turn on certain type of solution status via tool bar. Please note the view works only when GPGGA message is logged.

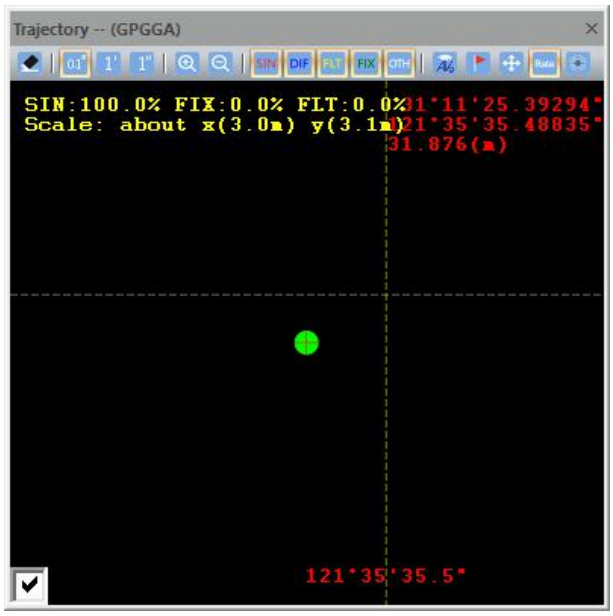

Figure 2.34 Trajectory view

2.2.9 PVT views

The PVT views display the detailed PVT information including heading, position, velocity and time (UTC). Please notice that the unit of velocity is km/h and that of attitude is meter. The time system is UTC time and the time shows in the figure may be different from your local time. Please note these views work only when GPGGA, GPRMC and GPVTG message is logged.

Figure 2.35 Heading info

Figure 2.36 Velocity info

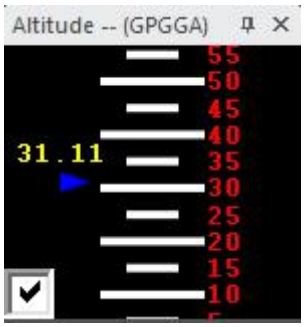

Figure 2.37 Altitude info

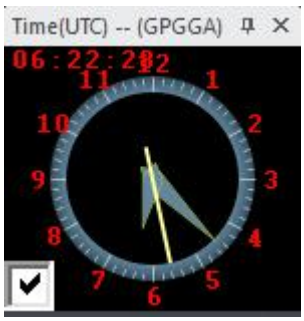

Figure 2.38 UTC time

2.2.10 Status bar

Tersus GNSS Center indicates the working status of the board or receiver with a group of indicators and connection status on the status bar at the bottom of the main interface.

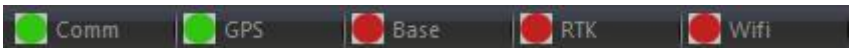

Figure 2.39 Indicators

Table 2 Indicators description

Indicator	Status	Description
Comm	Red	Tersus GNSS Center is not connected to the board
	Green	Tersus GNSS Center is well connected to the board
GPS	Red	No GNSS signal is received
	Green	GNSS signal is received
Base	Red	No data from base station is received
	Green	Data from base station is received
RTK	Red	No RTK solution received

	Yellow	RTK Float solution
	Green	RTK Fix solution
WiFi	Red	Onboard Wifi is not connected
	Green	Onboard Wifi is connected

Figure 2.40 Connection status

2.3 Tools

Besides Tersus GNSS Center, there are other four tools integrated into the Tersus Tool Suite software package: Tersus Download, Tersus GeoPix, Tersus Rinex Converter and Tersus Update.

2.3.1 Tersus Download

Tersus Download is to download data files from internal storage of the receiver to the computer. You can click the icon  in the tool bar or click Tools -> DownloadFile or double-click the desktop shortcut 

to launch the software.

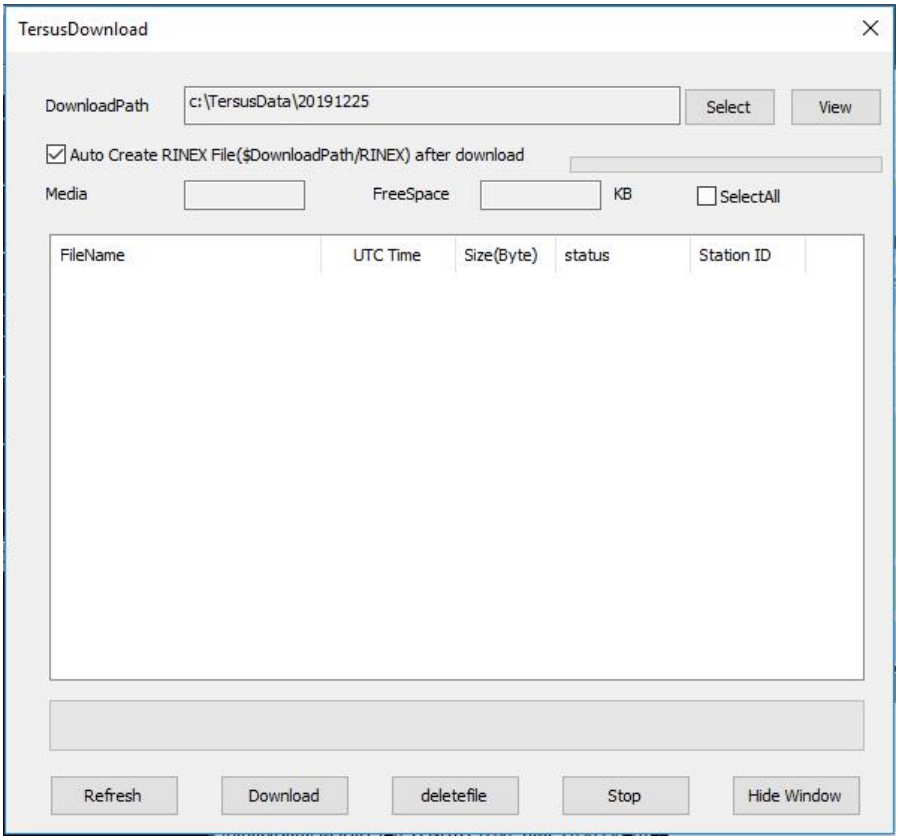

Figure 2.41 Tersus download

Make sure the receiver is connected to the computer through the serial port, click [Refresh] to view the files in the internal storage of the receiver, click

[Select] to choose download path, and click [Download] to download files to the designated folder of the computer.

2.3.2 Tersus GeoPix

Tersus GeoPix is a software for processing GNSS observation data collected by UAVs and ground base stations, and tagging EXIF coordinate information of EVENT moment photos. You can click the icon 

in the tool bar or click Tools -> GeoPix or double-click the desktop shortcut 

to launch the software.

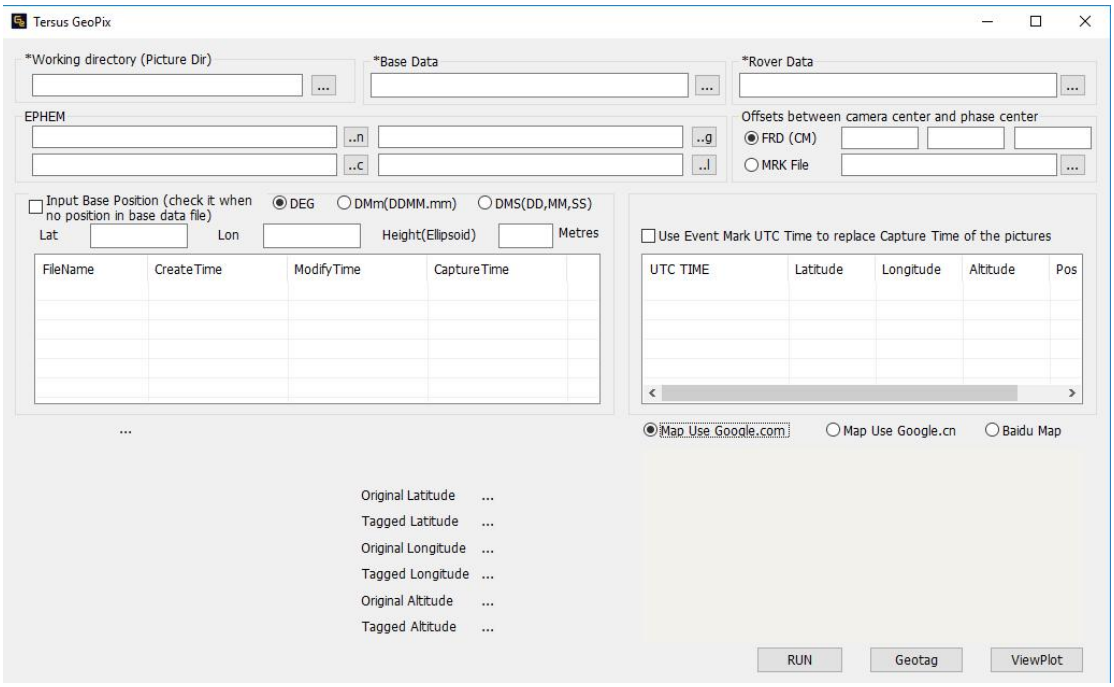

Figure 2.42 GeoPix main interface

The detailed usage of GeoPix refers to the User Manual for UAV PPK Solution which is available on www.tersus-gnss.com/product/uav-ppk-solution.

2.3.3 Tersus Rinex Converter

Tersus Rinex Converter is a tool to convert the logged binary observation data into RINEX3.02/3.04 or RINEX2.10 format. You can click the icon  in the tool bar or click Tools -> RINEX Converter or double-click the desktop shortcut 

to launch the software.

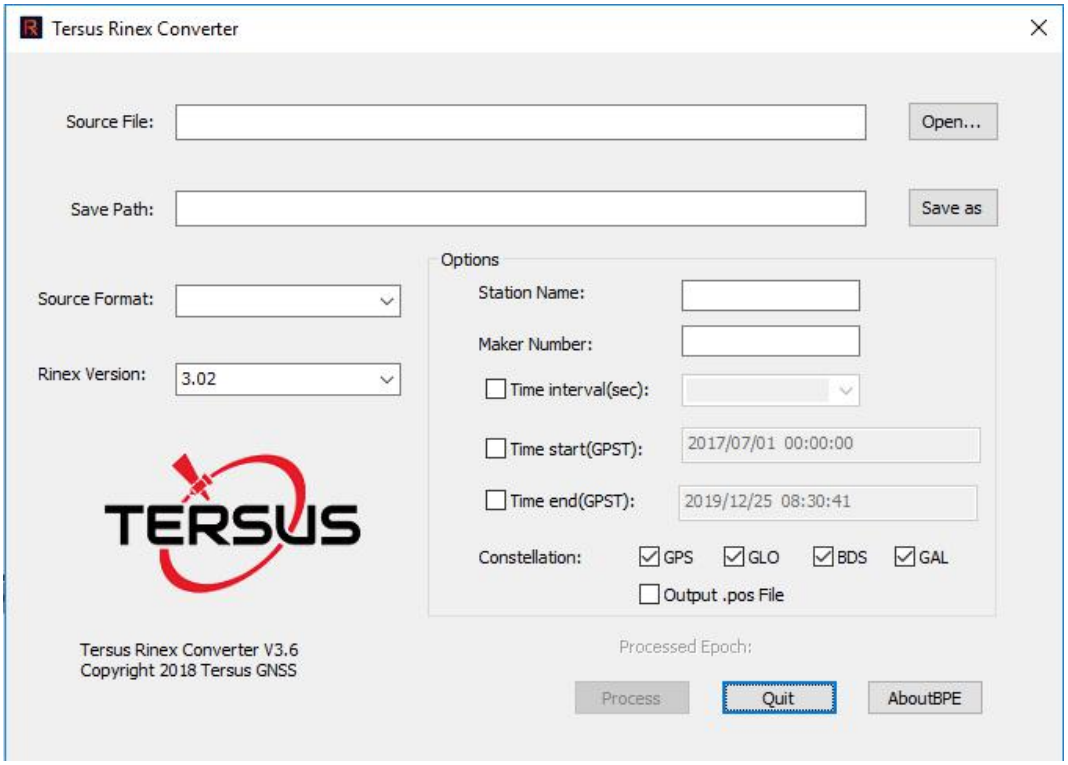

Figure 2.43 Tersus Rinex Converter

The detailed usage of Tersus Rinex Converter refers to section 3.4 Convert Raw Data into Rinex.

2.3.4 Tersus Update

Tersus Update is a tool to upgrade firmware for Tersus GNSS products via serial ports. You can click the icon  in the tool bar or click Tools ->Upgrade

Firmware or double-click the desktop shortcut 

to launch the software.

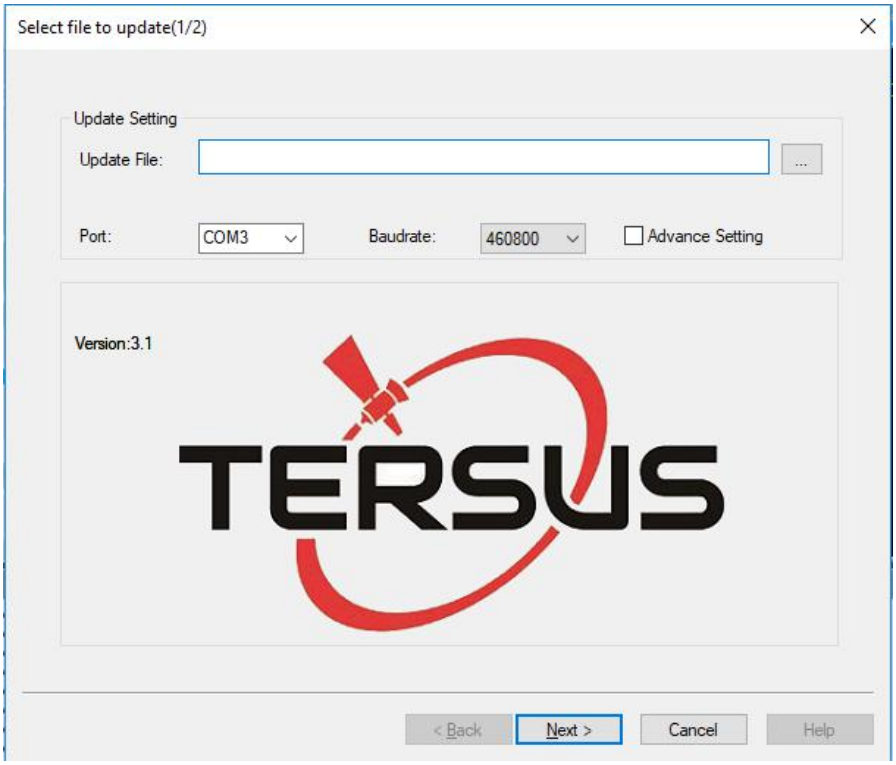

Figure 2.44 Update firmware

Select the upgrade file, select port and baud rate, and click [Next]. After the firmware is upgraded successfully, it will prompt a windows indicating successful update. Click [OK] and [Finish] buttons to close the firmware upgrade windows, the receiver will reset automatically.

Take BX306 board for example, download the latest firmware file from Tersus official website, and put it in the designated folder of your computer. Launch the Tersus Update software, select the firmware file (.bin format), port, baud rate as 115200 and click [Next] for the firmware update. Details refer to section 3.2 in *User Manual for BX Series GNSS Receiver*.

3. General operations

This chapter describes generation operations of Tersus GNSS Center software.

3.1 Connect to a BX RTK board

Before connecting the board with Tersus GNSS Center, please make sure the board is powered up and physically connected to the computer via its serial ports. The detailed to establish a physical connection between the board and PC can be found in the User Manual for BX series board or David series receiver. (Available at www.tersus-gnss.com/document). The following steps show how to connect the Tersus GNSS Center software to the board:

1) Launch Tersus GNSS Center, the **Config** dialog pops up automatically. The dialog can also be found in menu bar **Tools -> Config**.
2) Choose Serial as Connection type and choose the correct port. The baud rate of the board is 115200 by default and changing baud rate is not recommended. The serial port can be found in your windows device manager.

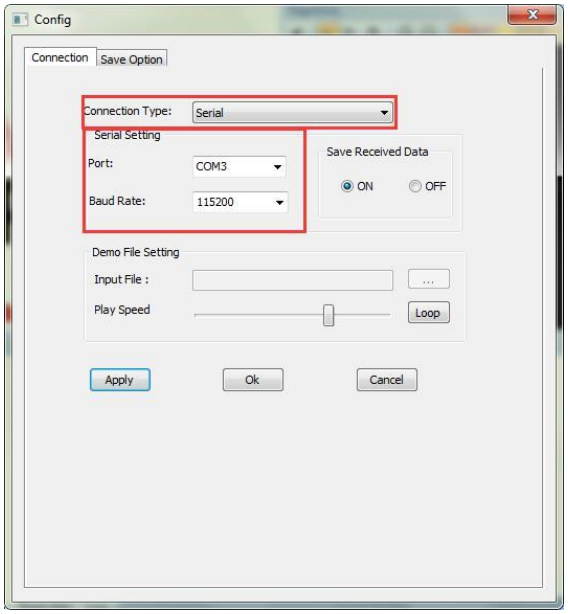

Figure 3.1 Connection configuration

3) Click [OK] to establish the connection. If the connection is established, the COMM indicator on the status bar will turn to green.

3.2 Configure RTK board with commands

Before starting field work, configure the RTK board or receiver with the Tersus GNSS Center software.

The board or receiver can be configured with commands which you can key in via the **Text Console** window of Tersus GNSS Center.

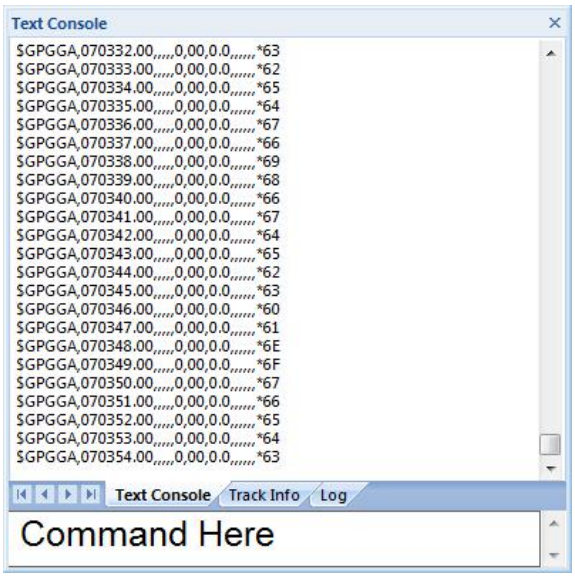

Figure 3.2 Command prompt and text console

3.2.1 Configure the board into base station mode

Commands for base station mode:

fix position 31.1874808 121.58111234 41.4618

log com2 rtcm1074 ontime 1

log com2 rtcm1084 ontime 1

log com2 rtcm1124 ontime 1

log com2 rtcm1005 ontime 10

saveconfig

These commands fix the coordinate of the base station and configure RTCM message to be transmitted. The coordinates are expressed in degree/meter. After each command is sent, the board will automatically acknowledge a '>OK', which means the configuration takes effect. If no acknowledge is received, please refer to 'trouble shooting' section in the user guide or contact Tersus Technical Support. If the base station coordinate is unknown, you can get it by averaging the point position solution for a while.

Table 3 Common used RTCM messages

Message type	Message Name
1074	Full GPS Pseudoranges and PhaseRanges plus CNR
1084	Full GLONASS Pseudoranges and PhaseRanges plus CNR
1124	Full BeiDou Pseudoranges and PhaseRanges plus CNR
1033	Receiver and Antenna Descriptors
1005 or 1006	Station Description

3.2.2 Configure the board into rover mode

Commands for rover mode:

fix none

interfacemode com2 automatic automatic on

log com1 GPGGA ontime 1

saveconfig

The rover can automatically recognize the RTCM message and compute RTK solution, so what you need is to make sure the rover position is not fixed, the serial port is in correct mode and it output RTK solution as normal.

After configuration, you can see that the board outputs empty NMEA sentences as the GNSS antenna are not connected to the board.

Details of commands and logs could be found in *Log&Command Reference for Tersus BX GNSS OEM boards*. (Available at www.tersus-gnss.com/document).

3.3 Data logging

Tersus GNSS Center allows user logging the raw observation, ephemeris or RTK solution to PC. The procedure of data logging is as follows:

1) Configure the board output according to your requirement with Tersus GNSS Center. (Details of commands and logs could be found in *Log&Command Reference for Tersus BX GNSS OEM boards*, available at www.tersus-gnss.com/document).
2) Make sure the **Save Received Data** option in Config window is turned on. Then go to **Save Option** tab to configure the save directory and log information. Tersus GNSS Center allows to save NMEA data only, binary data only and save all received data. The error messages, e.g. corrupted NMEA sentences, unrecognizable characters will be saved in log file for error diagnosis.

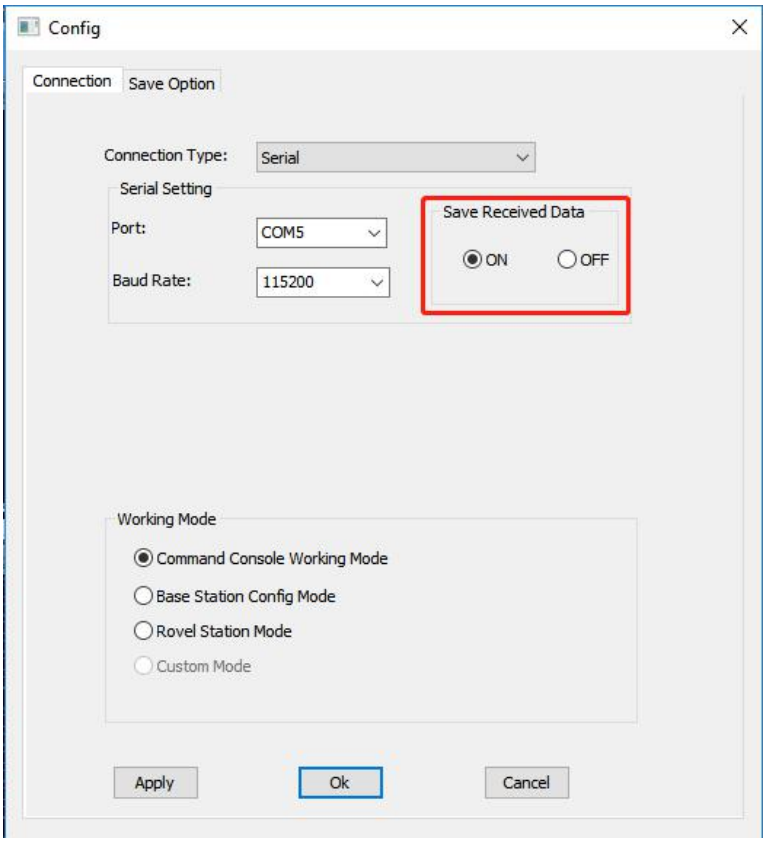

Figure 3.3 Save Received Data option

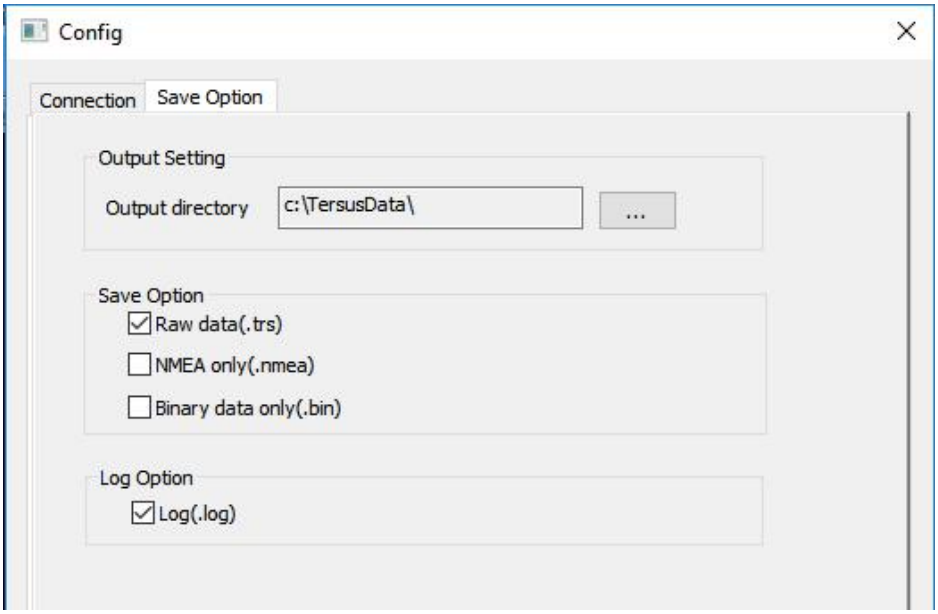

Figure 3.4 Choosing saved data location

3) When Tersus GNSS Center is configured well, it will log received data once the serial connection is established. Tersus GNSS Center will create a sub-directory in the output directory named with the date (in yyyymmdd format) and save the data of each connection with a single file named with the starting time (hhmmss.trs or hhmmss.nmea).

3.4 Convert Raw Data into Rinex

The receiver independent exchange format (RINEX) is commonly used in post GNSS data processing missions. Tersus GNSS Center allows user to convert the logged binary observation data into RINEX3.02/3.04 or RINEX2.10 format. Here is guidance for the conversion:

1) Select **Tools -> RINEX Converter** to initiate the Tersus RINEX Converter.
2) Click [Open] to select the logged binary observation file. An alternative way is drag the file onto the text box. The output RINEX file will be stored in the same directory as the binary file. You can also change it by click [Save as]. Please note that the output RINEX file name is the same as the binary file as well by default.
3) Choose the source format according to your board/receiver type. It also supports converting RTCM3.2 messages into RINEX as well, but an approximate UTC time of start logging need to be provided.
4) A Station Name should be extracted from the source file before the conversion. If the Time Interval option is ticked, the converter also allows to downsampling the observation data.
5) Click **Process** and the RINEX files will be found in the folder of Save Path. There are four kinds of RINEX files, including:
   - .yyo file – observation file
   - .yyn file – GPS ephemeris file
   - .yyg file – GLONASS ephemeris file
   - .yyc file – Beidou ephemeris file
   - .yyl file – Galileo ephemeris file
   - .yyq file – QZSS ephemeris file
   - .yyp file – All ephemeris file

   Note: *yy in file extension is two digits of year.

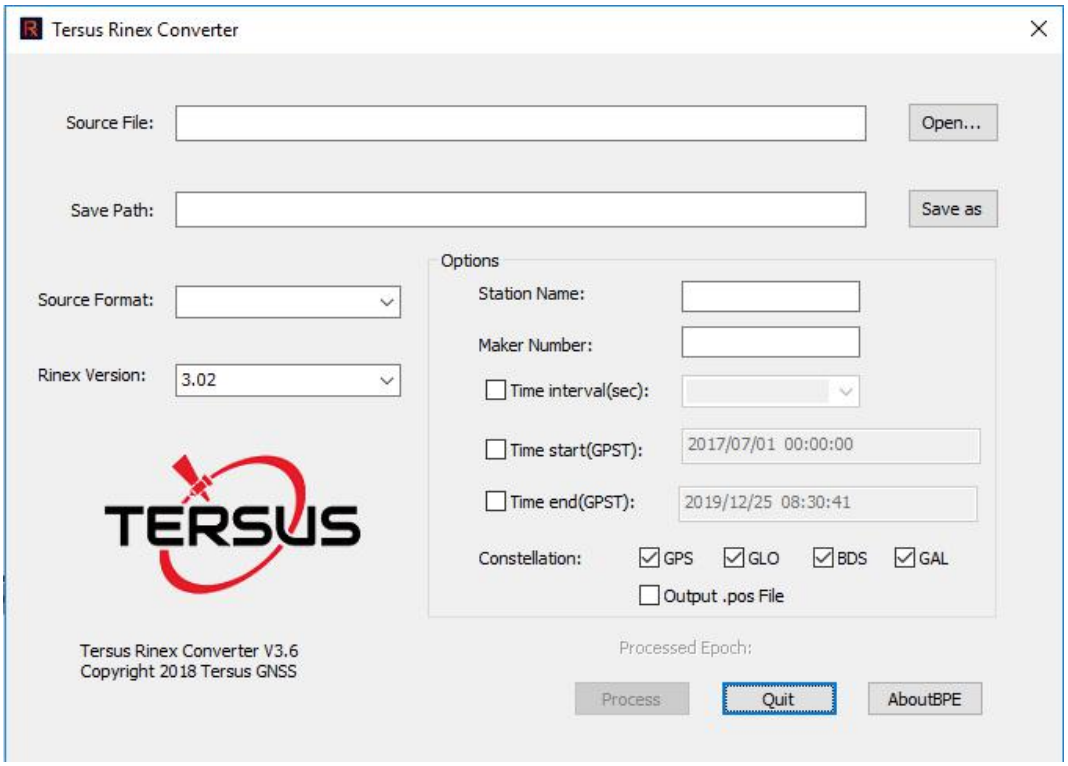

Figure 3.5 Converting data

4. Terminology

BDS	BeiDou Navigation Satellite System
CMR	Compact Measurement Record
eMMC	Embedded Multi Media Card
GLONASS	GLObal NAvigation Satellite System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
PC	Personal Computer
PPK	Post-Processing Kinematic
PPS	Pulse Per Second
RINEX	Receiver Independent Exchange format
RMS	Root Mean Squares
RTK	Real-Time Kinematic
RTCM	Radio Technical Commission for Maritime Services
USB	Universal Serial BUS
UTC	Universal Time Coordinated