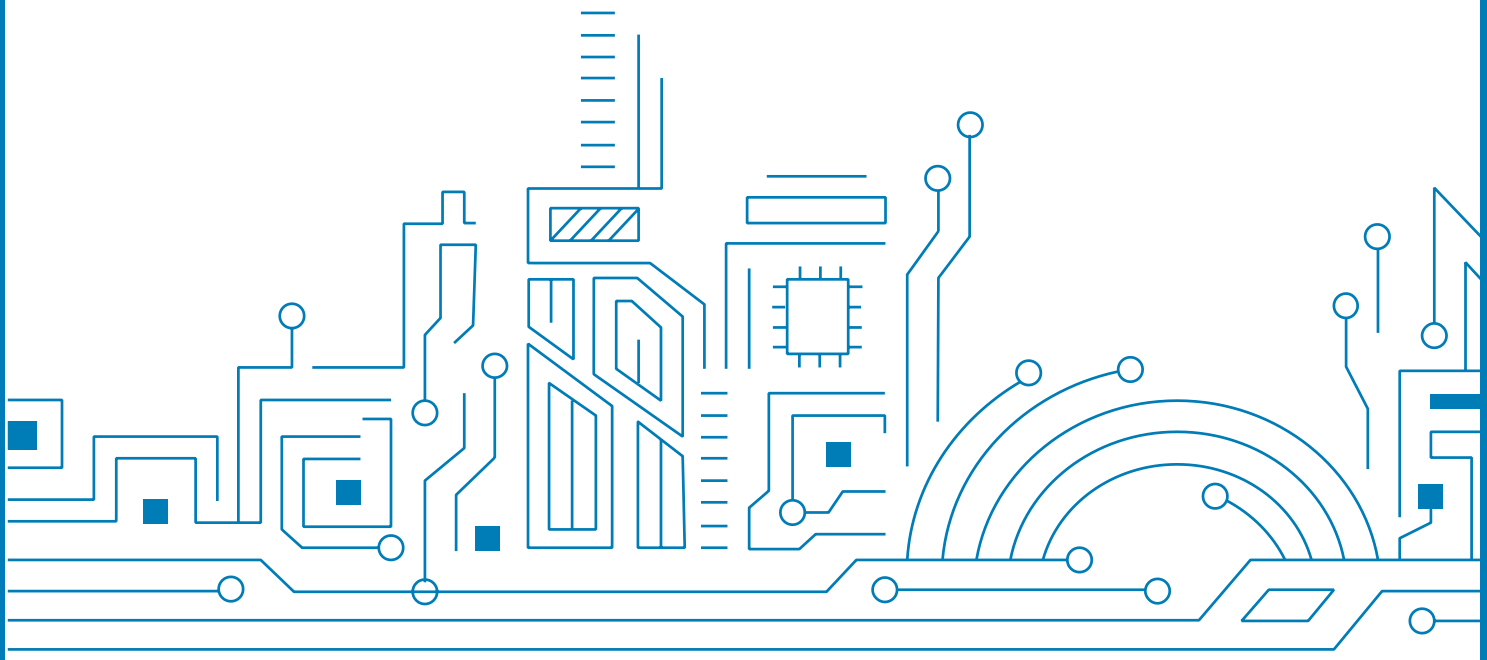
GNSS Evaluation Software

Satrack V1.29.1

User Manual



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1 OVERVIEW

1.1 General description

Satrack is an evaluation software, providing system integrators and end users with a quick and simple way to interface with ALLYSTAR GNSS chipsets, modules and boards. It enables easy Satellite tracking, GNSS messages analyzing, logging data receiving, and graphical representation of signaling, satellite communication and geographical information.

Satrack is designed to communicate with ALLYSTAR's Cynosure GNSS receiver via serial port or USB port. It provides general GNSS functions as well as real time and playback evaluation tools.

The purpose of Satrack is to enable users to:

- Conduct performance tests on ALLYSTAR and other GNSS devices.
- Configure ALLYSTAR GNSS positioning chips and modules.
- Update the firmware on GNSS modules.

1.2 Features

- Control of ALLYSTAR GNSS evaluation kits
- Display of Cynosure Binary Protocol
- Export data files to Google Earth
- Display of NMEA output
- File-logging of NMEA output
- Support for Windows® XP, Windows® 7 and Windows® 8.1

1.3 Applicability table

Products					
HD8020	HD8020D	HD8020S	HD8021	HD8021D	HD8021S
HD8022	HD8030	HD8030D	HD8030S	HD8031	HD8031D
HD8031S	HD8032	HD8040	HD804X	HD8040D	HD8041D
HD8089A	HD8089AF	HD8090A	HD8090AF	HD9301	HD9311

1.4 Software version

Satrack V1.29.XXX

2 GETTING STARTED

2.1 Installation of Satrack

For each type of receiver, please refer to the Applicability Table for the supported ALLYSTAR GNSS modules in order to install the applicable USB drivers and connect the receiver to the PC.

2.1.1 System requirements

Satrack is built on top of Microsoft .NET Framework 4.0. Please make sure it is installed on the user's PC. It can be downloaded from Microsoft:
http://download.microsoft.com/download/2/0/e/20e90413-712f-438c-988e-fdaa79a8ac3d/dotnetfx40.exe
Some features of Satrack require the support from Google Earth. In order to let Satrack reach its best performance, it is highly recommended to install Google Earth on the user's PC. It can be downloaded from Google: http://earth.google.com

2.2 Connect an evaluation kit to the PC

This section assumes that you have an ALLYSTAR evaluation kit. The evaluation kit can be connected to the PC by using either an USB or a serial cable. In case of using the USB port, a driver is required (please contact our technical support to get the USB driver if necessary). Be sure to install the driver before connecting the evaluation kit to the PC.

1) Connect one end of the USB cable to the USB connector on the evaluation kit.
2) Connect the other end of the USB cable to your PC. The USB cable now supplies power to the unit.
3) Connect the GNSS antenna to the interface unit. For the best GNSS reception, place the antenna outside or near a window.

2.3 Start using Satrack

Satrack is a Windows application. After connecting a GNSS receiver to the PC, double click on the Satrack application icon to start using it.

2.3.1 Select the COM port or USB port

To connect Satrack with a GNSS receiver through a COM port or USB port on PC, follow these steps:
From the main menu, check the Device combo box, and then choose the desired port.

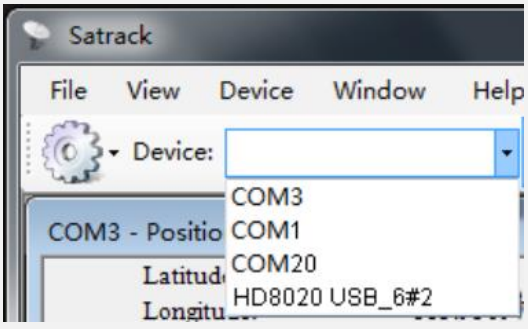


Figure 1 List of available com and usb ports

2.3.2 Select the baud rate

Select either icon named with "**Device settings**" on strip toolbar. You can change your bits per second (baud rate) (It is only availability on com mode).

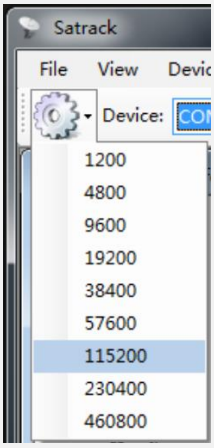


Figure 2 List of available baud rates

If the port is selected and the baud rate is set correctly, Satrack program will show the serial data activities on the screen, as well as the data plots in its open windows. The status bar will show the current communication state.

2.3.3 Select the TCP/IP port

To connect Satrack with a GNSS receiver through TCP/IP port on PC, follow these steps:

From the Device menu, check the TCP/IP Set, and then put in the IP Address and port of the TCPIP. Check "Enable TCP/IP Port", then, check the Device combo box, and choose the TCP/IP port. Or, uncheck "Enable TCP/IP Port", the Device combo box TCPIP is deleted.

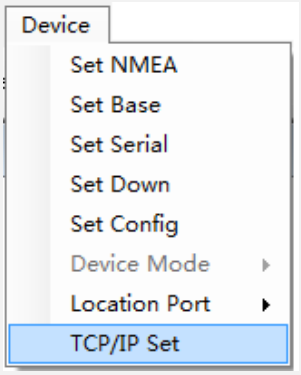


Figure 3 Open TCP/IP Set from Device menu

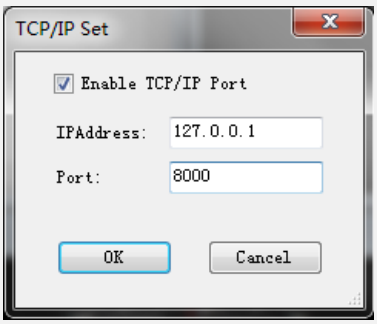


Figure 4 TCP/IP Set form

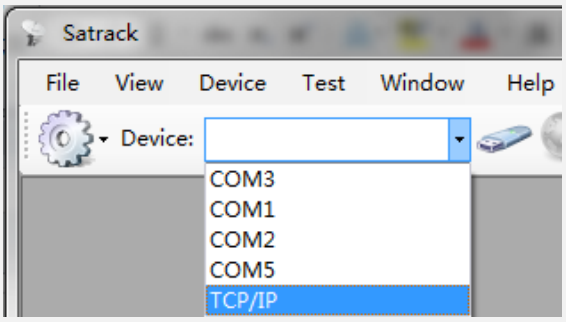


Figure 5 List of available TCP/IP port

2.3.4 Select the Location Api Port

To connect Satrack with a GNSS receiver through Location Api on PC, follow these steps:

From the Device menu, check the Location Port, select open, then, check the Device combo box, and choose the Location Api port. Or, selected close, the Device combo box Location Api is deleted.

The Location Api port only support Position Information.

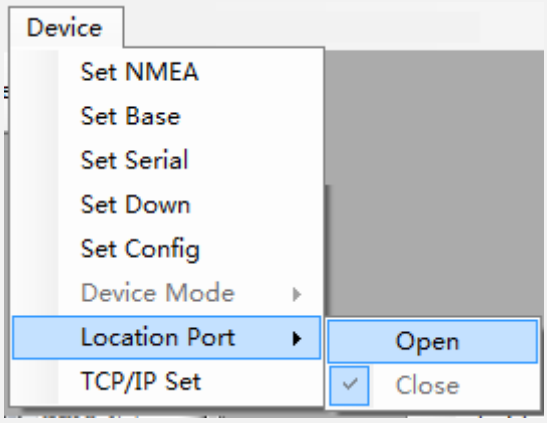


Figure 6 Open or Close Location Api port

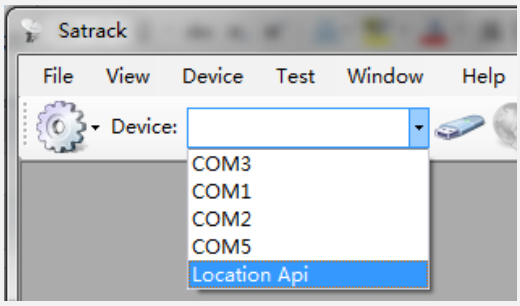


Figure 7 List of available Location Api port

3 INTRODUCTION TO MENUS AND TOOLBAR

3.1 Main screen

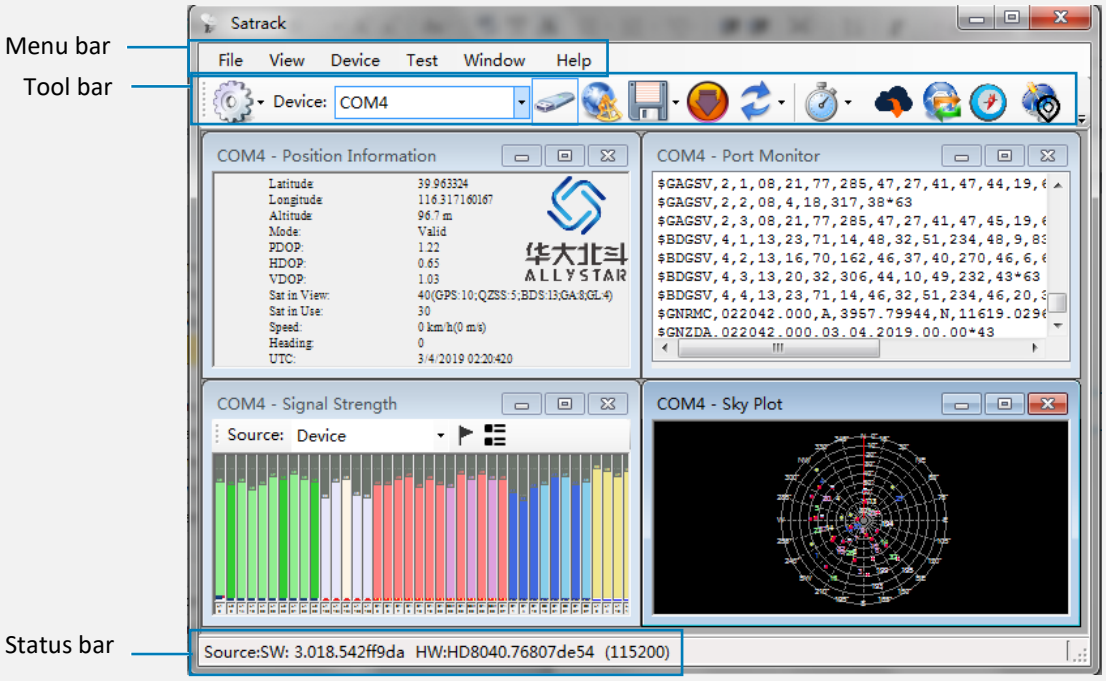


Figure 8 Satrack main screen

3.2 Menu bar

This section describes the drop-down menu entries. All Satrack functions can be accessed through the menu bar. Commands can also be accessed by shortcuts that are listed in the menus. Some often used operations are also available in the different toolbars.

3.2.1 File menu

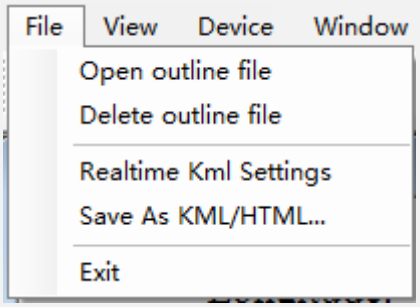


Figure 9 File menu

Table 1 File menu entries

Name	Description
Open outline file	Open a previously recorded log file
Delete outline file	Stop replaying the previously recorded log file
Realtime Kml Settings	Real time KML configurations.
Save as KML…	Convert raw data to KML/KMZ files in order to view them in Google Earth after tracking finishes.
Exit	Exit Satrack.

3.2.2 View menu

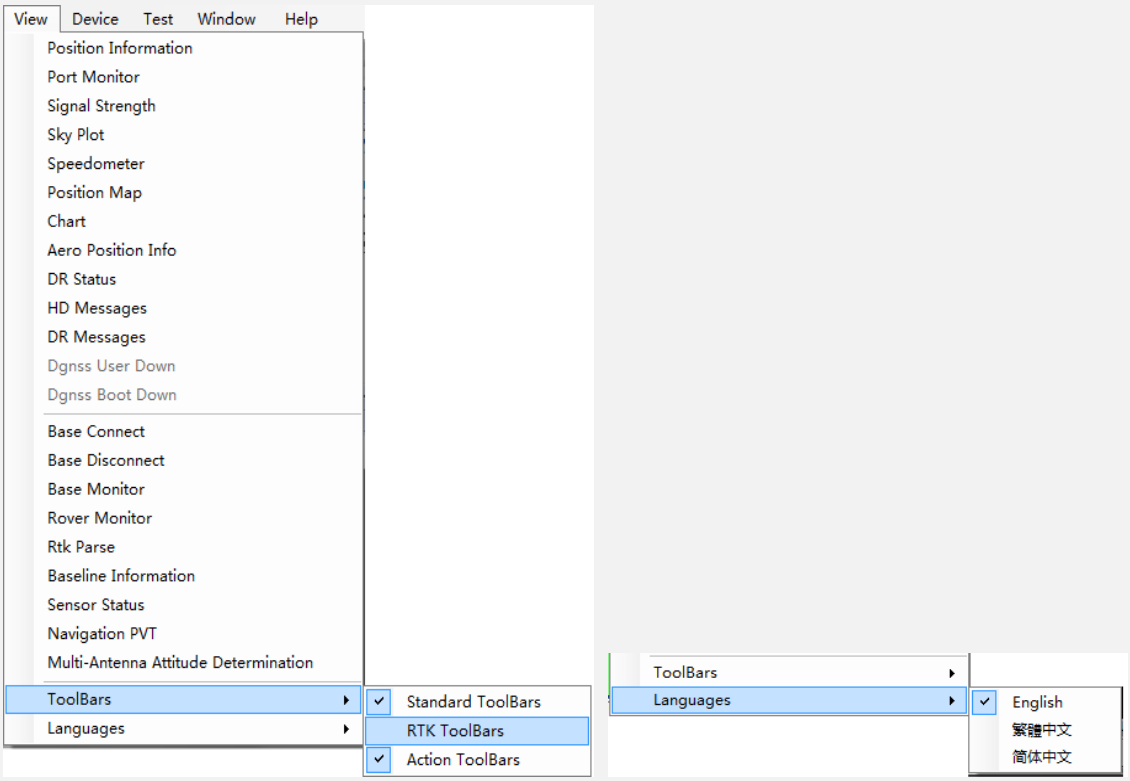


Figure 10 View menu

Table 2 View menu entries

Name	Description
Position Information	Display general position information, including latitude, longitude, altitude, PDOP (Position dilution of precision), HDOP (Horizontal dilution of precision) and VDOP (Vertical dilution of precision), time, etc.
Port Monitor	To view ASCII message data from the GNSS receiver, or view HD message data if your data is Aero.
Signal Strength	Show signal quality of satellites in terms signal-to-noise ratio, in form of CNR bars.
Sky Plot	Display all plots of position of satellites labeled with their identification number.
Speedometer	Shows the current speed information.
Position Map	Shows the position plots.
Chart	Graphical representation of a wide range of combination among various kinds of data.

Aero Position Info	Show the aero position information.
DR Status	Show the DR status.
HD Messages	Binary message view designed for communicating with GNSS receiver via binary protocol. It is available while device mode is HD User or HD Boot.
DR Messages	ASCII message view designed for communicating with GNSS receiver via ASCII protocol. It is available while device mode is DR User or DR Boot.
Dgnss User Down	Download the firmware in DGNSS user mode. It is available while device mode is HD User.
Dgnss Boot Down	Download the firmware in DGNSS boot mode. It is available while device mode is HD Boot.
Base Connect	Connect to base.
Base Disconnect	Disconnect to base.
Base Monitor	Parse the RTK information of Base.
Rover Monitor	Parse the RTK information of Rover device.
Rtk Parse	Parse the RTK detail of Rover and Base.
Baseline Information	Show the baseline status.
Sensor Status	Show the sensor status.
Navigation PVT	Show the navigation PVT information.
Multi-Antenna Attitude Determination	Show Multi-Antenna Attitude Determination information.
ToolBars	Select the toolbars show or hide.
Languages	Set up the display language.

3.2.3 Device menu

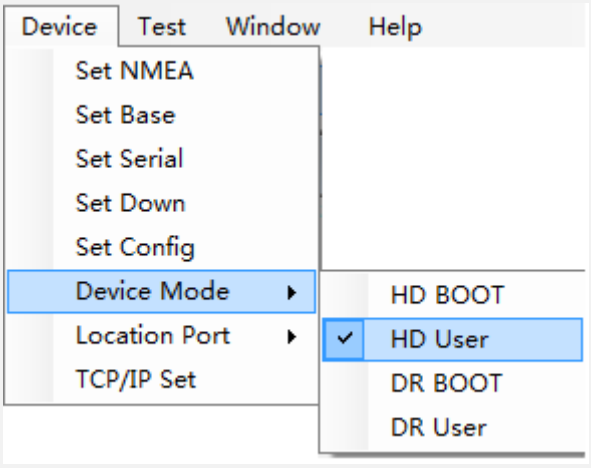


Figure 11 Device menu

Table 3 Device menu entries

Name	Description
Set NMEA rate	Set NMEA message baud rate.
Set Base	Set base parameter.
Set Serial	Set the serial port. (It is only availability on COM mode)
Set Down	Set the firmware downloading baud rate or packet size.

Set Config	Change the fix mode (2D or 3D) on the location judgment. Select save or not save send data to log file.
Device Mode	Set device mode manually.
Location Port	Add or delete the location port.
TCP/IP Set	Add or delete the TCP/IP port, and set the TCP parameter.

3.2.4 Window menu

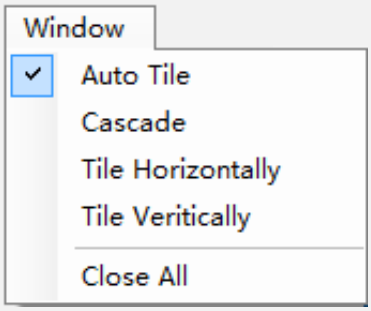


Figure 12 Window menu

Table 4 Window menu entries

Name	Description
Auto Tile	Arranges all open dialogs automatically.
Cascade	Arranges all open dialogs cascaded.
Tile Horizontally	Arranges all open dialogs horizontally.
Tile Vertically	Arranges all open dialogs vertically.
Close All	Closes all open dialogs and windows.

3.2.5 Test menu

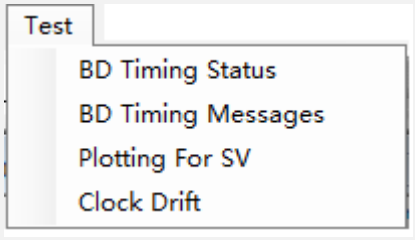


Figure 13 Window menu

Table 5 Test menu entries

Name	Description
BD Timing Status	Shows BD Timing Status information.
BD Timing Messages	Input or output BD timing command.
Plotting For SV	Shows the plot chart for SV.
Clock Drift	Shows. The plot chart for PPM.

3.2.6 Help menu

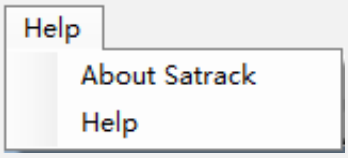


Figure 14 Help menu

Table 6 Window menu entries

Name	Description
About Satrack	Shows the about dialog with the software version.
Help	Help info.

3.3 Tool bar

Figure 15 Tool bar

Table 7 Tool bar entries

Icon	Name	Description
	Baudrate	Change the bits per second (baud rate).
	Connect/Disconnect	Connect or disconnect with the GNSS receiver.
	Real-time Google Earth link	Real-time link to Google Earth.
	Save log	Save log from GNSS receiver.
	Boot Firmware Update	Firmware update in boot mode, only available in boot mode.
	User Firmware Update	Firmware update in user mode, only available in user mode.
	DR Update	Firmware update in user mode, only available in user mode of DR.
	DR Boot Update	Firmware update in boot mode, only available in boot mode of DR.
	Restart	Restart the GNSS receiver.
	Comparison Testing	Test the desired GNSS receivers to make a comparison.
	Aero Position Information	Shows the Aero position information.
	Position Information	Shows the position information.

	Port Monitor	Shows the port monitor.
	Signal Strength	Shows the signal strength.
	Sky Plot	Shows the sky plot.
	Speedometer	Shows the speedometer.
	Chart	Shows the chart.
	Position Map	Shows the position map.
	DR Status	Shows DR Status
	Base Connect	Base Connect
	Base Disconnect	Base Disconnect
	Navigation PVT	Shows the Navigation PVT
	Rover Monitor	Shows Rover monitor
	Base Monitor	Shows Base Monitor
	Rtk Parse	Shows Rtk Parse information.
	Sensor Status	Shows Sensor Status
	Baseline Information	Shows Baseline Information
	Multi-Antenna Attitude Determination	Shows Multi-Antenna Attitude Determination information.

3.4 Status bar

Located at the bottom left corner is the status bar. The standard status bar is updated automatically and shows the information about the opened file and the connection status, such as the:

- Connection state: connected, disconnected, or no connection
- Port parameter: port name and baud rate (when the port is connected)

4 MONITORING PLATFORMS

Various monitoring platforms can be displayed by clicking their names in "**View**" from the menu bar or by the shortcut icons from the tool bar.

The following table shows monitoring platform with their respective related NMEA message(s): (✓: Related).

Platform	GGA	GLL	GSA	GRS	GSV	RMC	VTG	ZDA
User Position	✓	✓	✓	✓	✓	✓	✓	✓
Com Monitor	--	--	--	--	--	--	--	--
Signal Strength	--	--	✓	--	✓	--	--	--
Sky Plot	--	--	✓	--	✓	--	--	--
Speedometer	--	--	-	--	--	✓	✓	--
Position Map	✓	✓	-	--	--	✓	--	--
Chart	✓	--	✓	--	--	✓	--	--
Messages	--	--	--	--	--	--	--	--

* *The graphical representations on these platforms are based on the raw messages output from the GNSS receiver. If the message outputs from GNSS receivers are corrupted due to COM port error or unstable environment, Satrack will not be able to decode the correct data thus the related platforms may not update accordingly.*

4.1 AeroPosition Information

Open "**AeroPosition Information**" from the menu or tool bar, this platform includes all the information of aero position. User can select a device from combo box at the top to view user position information. Those information is displayed as bellows.

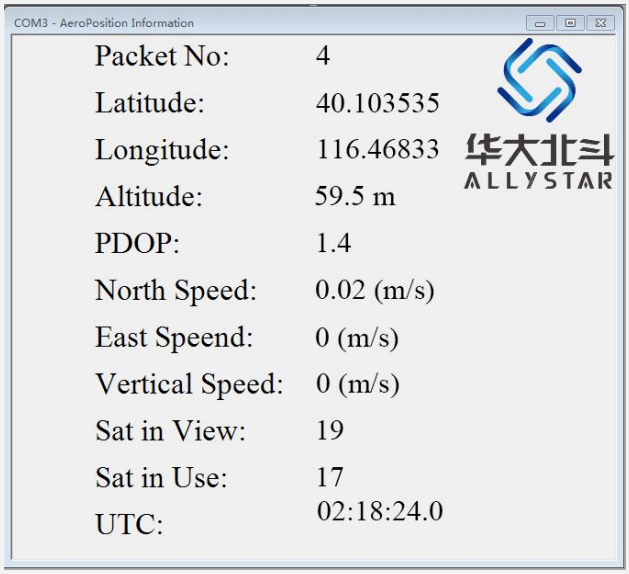


Figure 16 Aero Position information

4.2 Position Information

Open "**Position Information**" from the menu or tool bar, this platform includes all the information of user position like longitude, latitude, altitude, speed, number of satellites in view, etc. User can select a device from combo box at the top to view user position information. Those information is displayed as bellows.

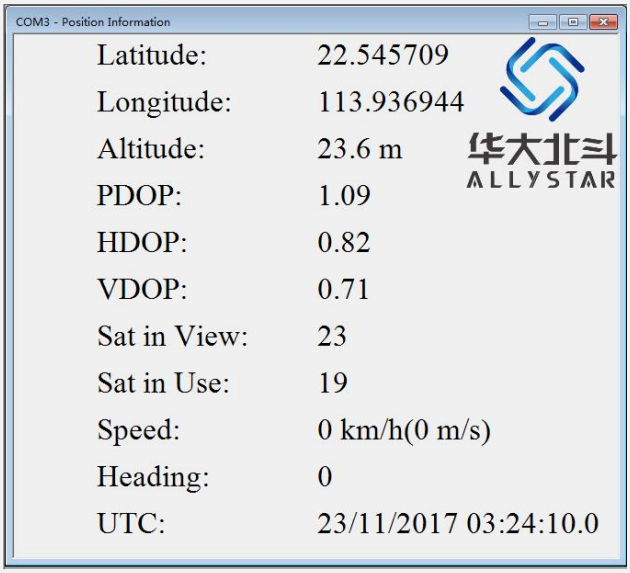


Figure 17 Position information

4.3 Port Monitor

Open "**Port Monitor**" from the menu or tool bar, this platform allows user to view ASCII message data.

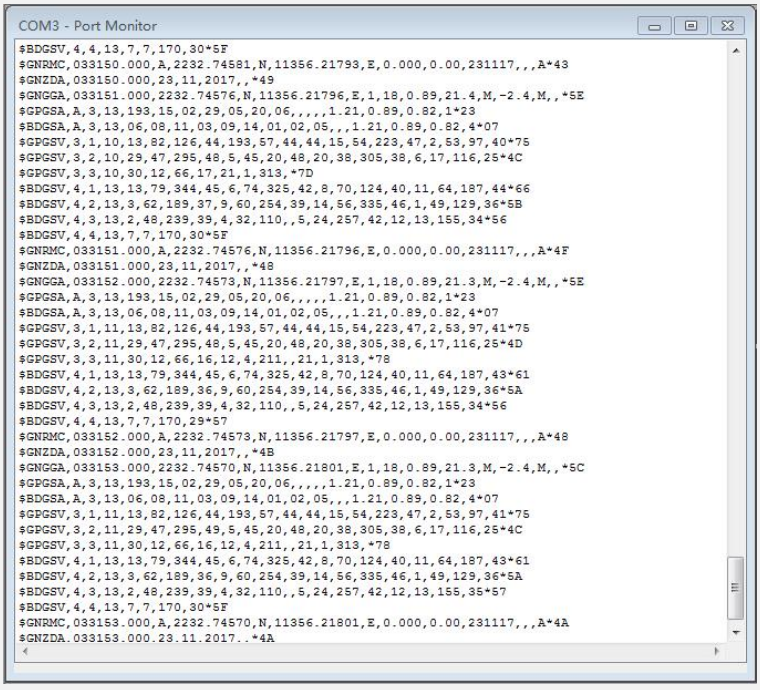


Figure 18 Port Monitor with NMEA messages (ASCII)

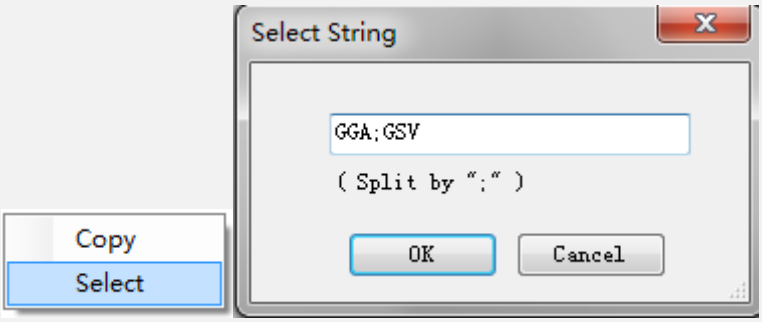


Figure 19 Select display content of Port Monitor

- Re-selection of device from list will refresh the message screen and messages from another device are shown on screen then.
- User can copy the output message by selecting them in Port Monitor window and press Ctrl+C to copy them into the clipboard.
- User can select the output message by click “Select” menu and input select message to the Select String window.

4.4 Signal Quality

Select “**Signal Strength**” from the menu or tool bar, to view signal quality of all satellites from different devices in form of CNR bars. User can select to view only one device or all devices from combo box at the top. The order of SVID displayed follows the original output sequence of the source device. However, when all devices are displayed together, the order of SVID is sorted in ascending order from left to right.

Explanations:

- The Signal Strength platform shows the information of signal quality. It uses the GSV NMEA messages to extract the signal to noise ratio (SNR C/No) and GSA NMEA messages to extract to satellites in use. The number of SNR bars will vary according to the number of satellites in view.
- SNR values are displayed above each corresponding bar. Full scale is considered for any SNR value of 55 dB or above. Satellite IDs are displayed to identify respective satellites below the signal bars.
- Signal bars are displayed in brighter color if the satellite in view is in used as well. Otherwise, signal bars will be displayed with a transparent color.

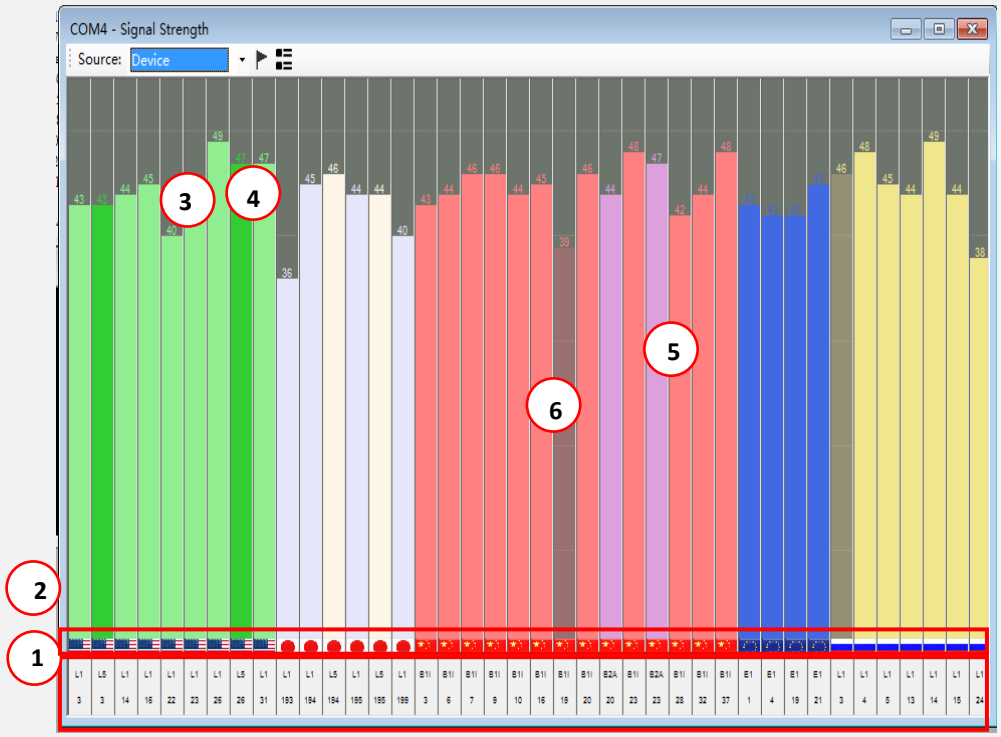


Figure 20 Signal Strength

- (1) - A list of satellite IDs at instance, they are in ascending order. The above means frequency, down means satellite IDs.
- (2) - A list of flags for each satellite.
- (3) – A Signal bar in green color, showing signal-to-noise ratio SNR value (49) in rectangular form from a GPS satellite with ID 26 of frequency GPS L1.
- (4) – A Signal bar in green color, showing signal-to-noise ratio SNR value (47) in rectangular form from a GPS satellite with ID 26 of frequency GPS L5.
- (5) –A Signal bar in green color of USA flag, showing signal-to-noise ratio in rectangular form from a GPS satellite. A Signal bar in red color of China flag, showing signal-to-noise ratio in rectangular form from a BDS satellite. A Signal bar in white color of Japan flag, showing signal-to-noise ratio in rectangular form from a QZSS satellite. A Signal bar in blue color of European Union Nation, showing signal-to-noise ratio in rectangular form from a GALILEO satellite. A Signal bar in yellow color of Russia flag, showing signal-to-noise ratio in rectangular form from a GLONASS satellite.
- (6) - A signal bar and SNR value in a transparent red color, meaning that the BeiDou satellite with ID 19 of B1I is currently not in use.

4.5 Satellites' azimuth and elevation

Select "**Signal Strength**" from the menu or tool bar, to view positions of satellites in form of plots.

- The sky plot can adjust its forward side (upper side) according to the heading direction provided by the GNSS receiver. To enable this, please right click anywhere in the sky plot and select "**Compass**".
- The Sky Plot platform shows the information of azimuth and elevation. It shows satellite position and the physical antenna mask angle. The satellite position is represented using azimuth, ranging from 0° to 360°,

and elevation, ranging from 0° to 90° where 0° is the horizon.

- Similar to the Signal Bar platform, Sky Plot platform uses the GSV NMEA messages to extract azimuth and elevation for each satellite that is in view and GSA NMEA messages to extract the in-use satellites. Satellite IDs are displayed near the "**X**" plot to identify respective satellites.
- Plots are displayed in a brighter color for the in used satellites while with transparent color for the not in use ones.

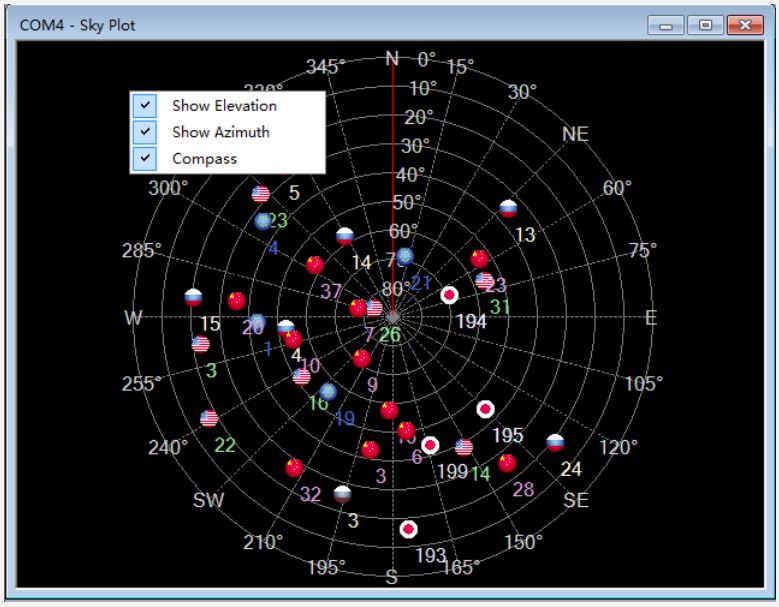


Figure 21 Sky Plots with plots (I)

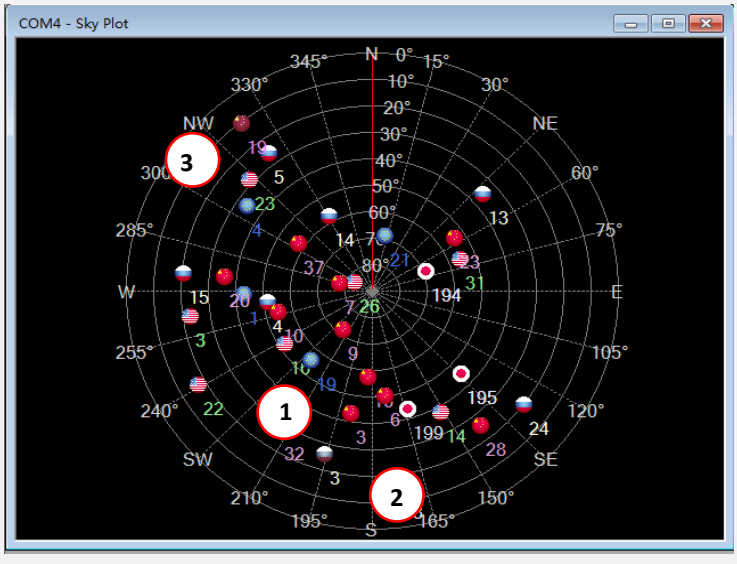


Figure 22 Sky Plots with plots (II)

- (1) - Plot of position of satellite with ID 22 which is in use, flag of USA means GPS signal.
- (2) -Flag of USA means GPS signal. Flag of China means BDS signal. Flag of Japan means QZSS signal. Flag of European Union Nation means GALILEO signal. Flag of Russia means GLONASS signal.
- (3) - Plot of position of satellite with ID 19 of transparent flag of China which means BD signal and not in

use.

4.6 Speedometer

Open "**Speedometer**" from the menu or tool bar, this platform allows user to view the speedometer.

- The speedometer can swap its speed displayed unit between km/hr and m/s. To do the swapping, please right click anywhere on the speedometer and follow instructions.
- The maximum speed speedometer can display is 80m/s or 300km/hr.

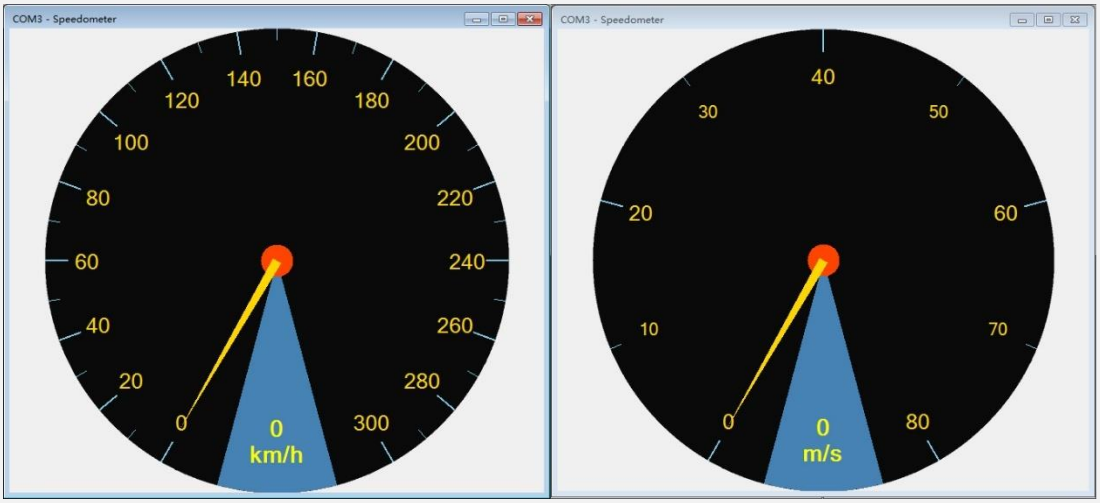


Figure 23 Speedometer

4.7 Position Map

Open "**Position Map**" from the menu or tool bar, this platform allows user to view the deviation positions in longitude and latitude relative to a defined reference position.

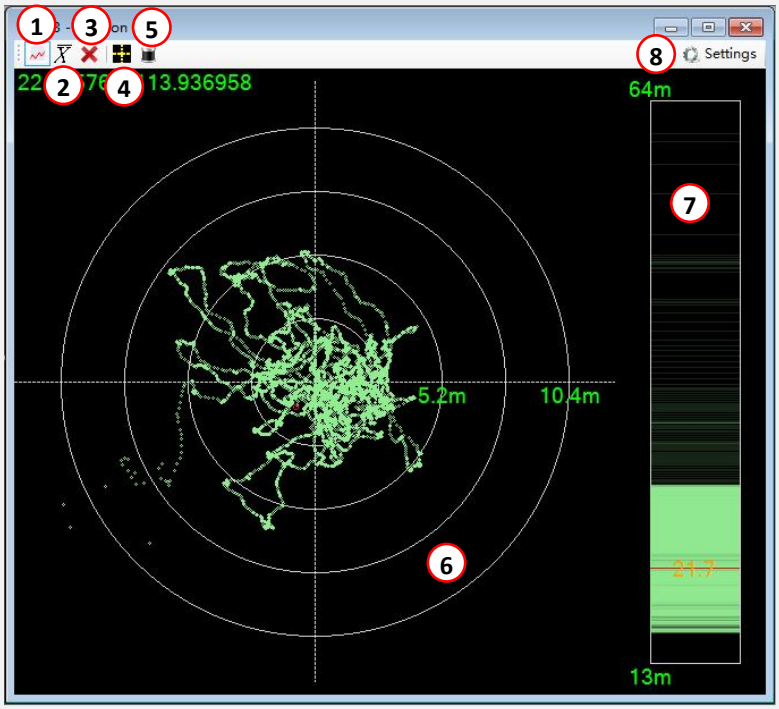


Figure 24 Position Map

(1) Make sure the connection to devices has been started.

(2) Select "**Position Map**" in "**View**" menu.

(3) This platform includes information of user position like longitude, latitude and altitude.

(4) User can select a device from combo box at the top to view user position information from that device. Position information is displayed as follows.

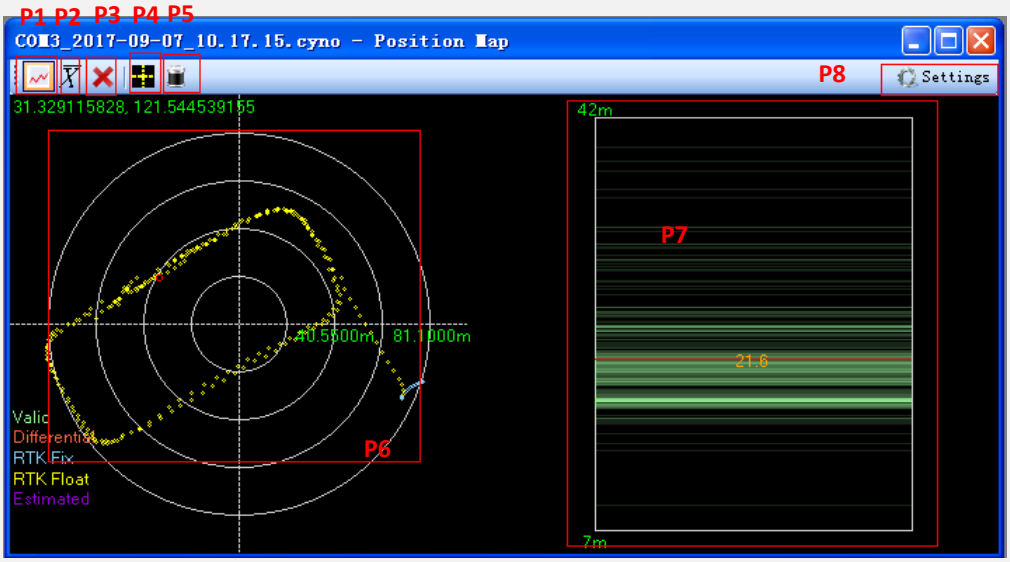


Figure 25 Position Map with default setting

- P1 - Show/Hide information from target device
- P2 - Show/Hide position averaged line from target device
- P3 - Remove all data from target device
- P4 - Show/Hide position averaged line from all device
- P5 - Remove all data from all devices
- P6 - The position chart displaying fixed positions, the different color means different fix mode
- P7 - The height chart displaying fixed altitude
- P8 - Open the setting dialogue of position map platform

- (1) - Show/hide information from target device.
- (2) - Show/Hide position averaged line from target device.
- (3) - Remove all data from target device.
- (4) - Show/Hide position averaged line from all devices.
- (5) - Remove all data from all devices.
- (6) - The position chart displaying fixed positions.
- (7) - The height chart displaying fixed altitude.
- (8) - Open the setting dialogue of position map platform.

4.7.1 Position Map setting

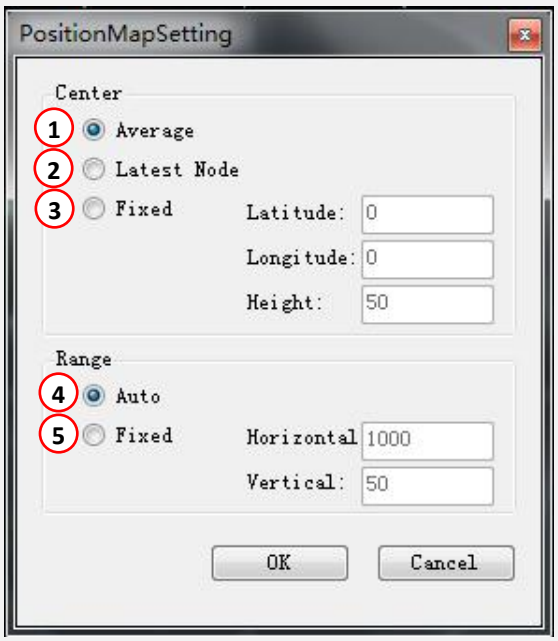


Figure 26 Position Map setting

- (1) - Configure the centre of position map and height chart to be the average value of all devices.
- (2) - Configure the centre of position map and height chart to be the average of all devices' latest node.
- (3) - Customize the centre of position map.
- (4) - Auto tune the range on chart so that it fits all data.
- (5) - Fix the display range to a certain value. By doing this, position chart may not be able to display all data, those out of range data will not be displayed.

4.8 Chart platform

4.8.1 Interface descriptions

Figure 27 Chart Platform

- (1) - Display of graphs plotted with various kinds of data.
- (2) - A list of values can be selected and displayed on Y-axis. Types of value include latitude, longitude, altitude, PDOP, HDOP, VDOP, speed (m/s), direction (degree) and acceleration (m/s2).
- (3) - Several statistical tools to be selected, only standard deviation and difference between any two devices on same value on across time are available. "**None**" means no statistical tool is selected.
- (4) - Fit the Y range.
- (5) - A list of values can be selected and displayed on X-axis. Types of value include latitude, longitude, altitude, PDOP, HDOP, VDOP, speed (m/s), direction (degree), acceleration (m/s2) and time (second).
- (6) - Fit the X range.
- (7) - Graph(s) can be moved inside chart platform. Click and drag/drop the chart.
- (8) - Zoom in the chart by clicking on one point of chart.
- (9) - Zoom out the chart by clicking on one point of chart.
- (10) - The chart is auto-scaled based on X and Y ranges.
- (11) - Draw a line to connect all plots on same device.
- (12) - Adds a moving average. The average is calculated over the number of most recent values, specified with the parameter.

- (13) - Add a function to report significant errors based on the standard deviation of value among all devices across time. Errors are reported and output to a txt file.
- (14) - Enable/disable the chart to discard data automatically.

4.8.2 Error Report

- **Introduction**

At the time more than one is connected and reporting error is set up, an error report is generated. It lists out all significant differences as well as errors in values among all devices. If standard deviation of a value at a time is higher than maximum allowable standard deviation for same value, it will be reported. For example, standard deviation of 1.8 of PDOP is recorded at time 1/6/2009 6:49:14 and maximum allowable standard deviation is 1.0, then it's reported. A line of UTC (Coordinated Universal Time), value type, data from different devices and standard deviation at that time is written on that file.

File name is combination of UTC and names of all devices. The file is then saved in a folder called "**Error report**" at the same directory of Satrack.exe file.

- **Maximum allowable standard deviation**

Values chosen for maximum allowable standard deviation are selected through many tests and appropriate amount of errors are reported in ideal case. Values for maximum allowable standard deviation are listed as below (in terms of standard deviation):

Parameter	Maximum allowable standard deviation
Latitude (x-coordinate)	20.0
Longitude (y-coordinate)	20.0
Altitude (meter)	30.0
PDOP	1.0
VDOP	1.0
HDOP	1.0
Speed (meter/second)	1.5
Direction (degree)	20.0
Acceleration (meter/second2)	2.0

- **Outlook of error report**

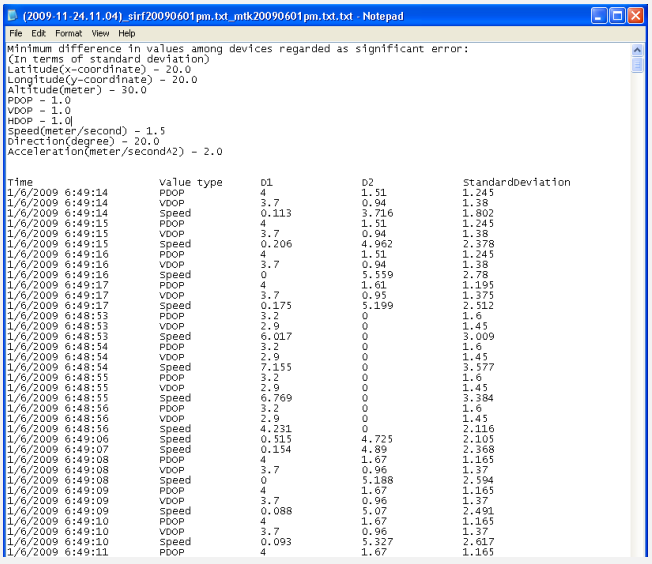


Figure 28 Outlook of error report

4.9 DR Status

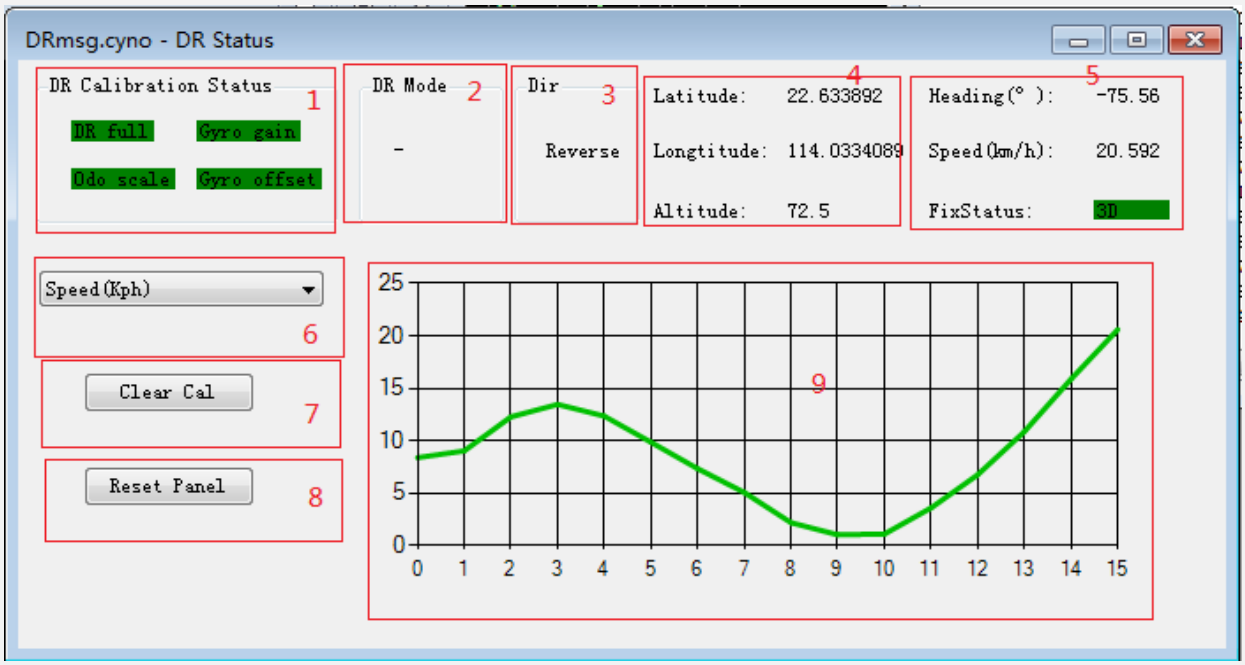


Figure 29 DR Status Form

(1) Show the DR calibration status.

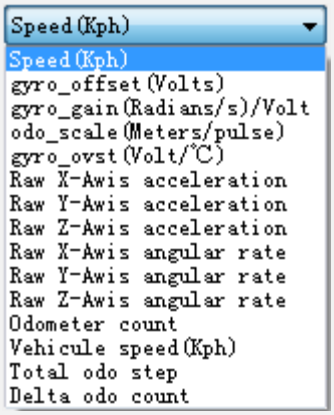
(2) Show the DR mode.

(3) Show the DR dir.

(4) Show the latitude, longitude and Altitude.

(5) Show the heading, speed and fixmode of DR.

(6) Select the date of chart 9.



(7) Clear the dr calibration status in 1.

(8) Reset page display.

(9) The chart, the data of Y is 6, data of X is time.

4.10 RoverMonitor

(1) Make sure the connection to device has been started.

(2) Select "**Rover Monitor**" in "**View**" menu.

(3) User can parse RTK message data from that device.

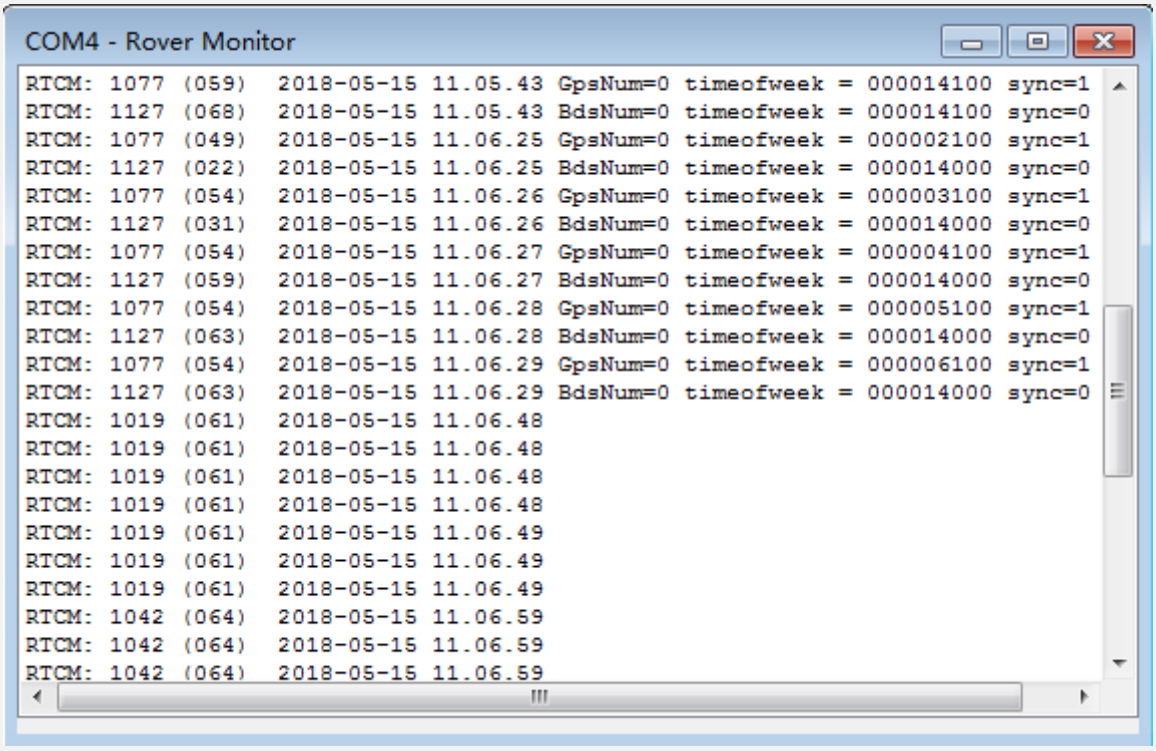


Figure 30 Rover Monitor with RTK messages Displayed

4.11 BaseMonitor

(10) Make sure the connection to base has been started.

(11) Select "**Base Monitor**" in "**View**" menu.

(12) User can parse RTK message data from Base.

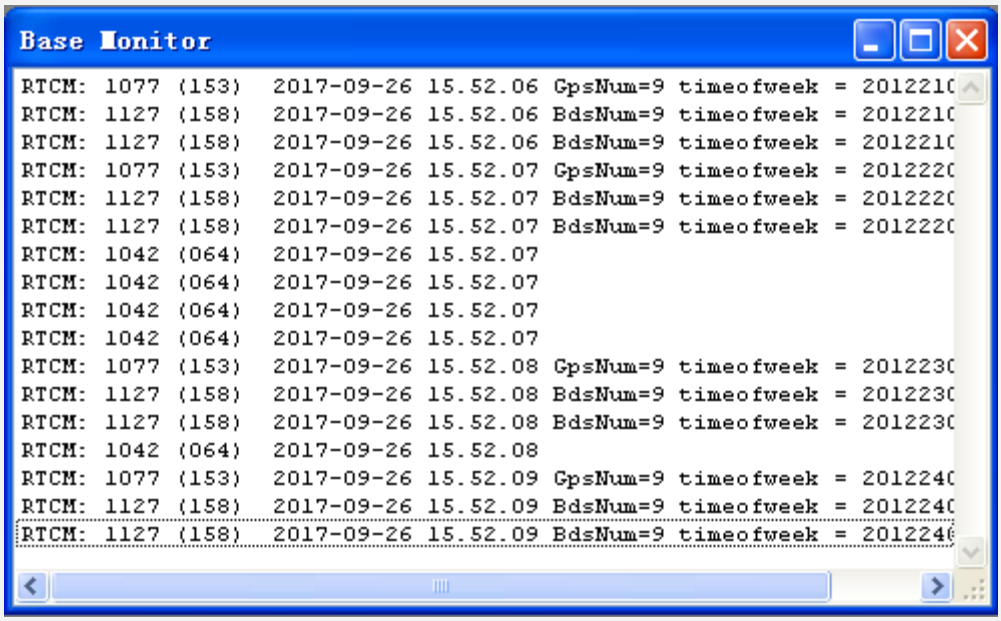


Figure 31 Base Monitor with RTK messages Displayed

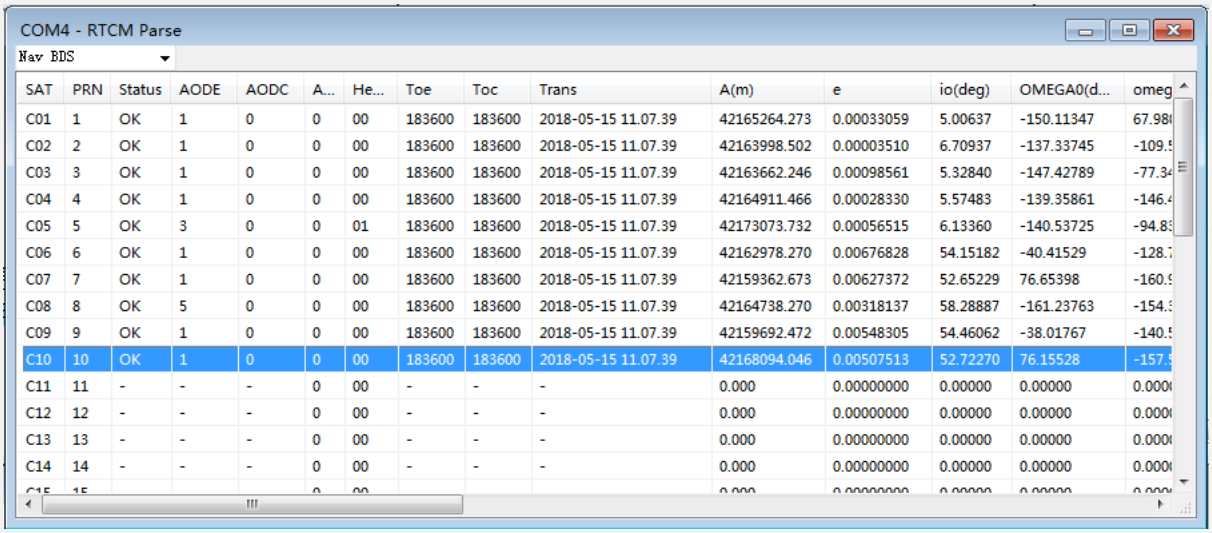
4.12 RTK Parse

(1) Make sure the connection to device or base has been started.

(2) Select "**Rtk Parse**" in in "**View**" menu.

(3) User can parse the RTK detail of rover or base .The RCV is "**base**" means base data, or means rover data.

(4) User can parse the "**Obs data**","**Nav GPS**"and"**Nav BDS**".



SAT	PRN	Status	AODE	AODC	A...	He...	Toe	Toc	Trans	A(m)	e	io(deg)	OMEGA0(d...	omeg
C01	1	OK	1	0	0	00	183600	183600	2018-05-15 11.07.39	42165264.273	0.00033059	5.00637	-150.11347	67.98
C02	2	OK	1	0	0	00	183600	183600	2018-05-15 11.07.39	42163998.502	0.00003510	6.70937	-137.33745	-109.5
C03	3	OK	1	0	0	00	183600	183600	2018-05-15 11.07.39	42163662.246	0.00098561	5.32840	-147.42789	-77.34
C04	4	OK	1	0	0	00	183600	183600	2018-05-15 11.07.39	42164911.466	0.00028330	5.57483	-139.35861	-146.4
C05	5	OK	3	0	0	01	183600	183600	2018-05-15 11.07.39	42173073.732	0.00056515	6.13360	-140.53725	-94.83
C06	6	OK	1	0	0	00	183600	183600	2018-05-15 11.07.39	42162978.270	0.00676828	54.15182	-40.41529	-128.7
C07	7	OK	1	0	0	00	183600	183600	2018-05-15 11.07.39	42159362.673	0.00627372	52.65229	76.65398	-160.9
C08	8	OK	5	0	0	00	183600	183600	2018-05-15 11.07.39	42164738.270	0.00318137	58.28887	-161.23763	-154.3
C09	9	OK	1	0	0	00	183600	183600	2018-05-15 11.07.39	42159692.472	0.00548305	54.46062	-38.01767	-140.5
C10	10	OK	1	0	0	00	183600	183600	2018-05-15 11.07.39	42168094.046	0.00507513	52.72270	76.15528	-157.5
C11	11	-	-	-	0	00	-	-	-	0.000	0.00000000	0.00000	0.00000	0.000
C12	12	-	-	-	0	00	-	-	-	0.000	0.00000000	0.00000	0.00000	0.000
C13	13	-	-	-	0	00	-	-	-	0.000	0.00000000	0.00000	0.00000	0.000
C14	14	-	-	-	0	00	-	-	-	0.000	0.00000000	0.00000	0.00000	0.000

Figure 32 Rtk parse with rover and base

4.13 Baseline Information

Open "**Baseline Information**" from the menu or tool bar, this platform includes all the information of baseline information like north, east, vertical, length, course UTCTime etc. Those information is displayed as bellows.

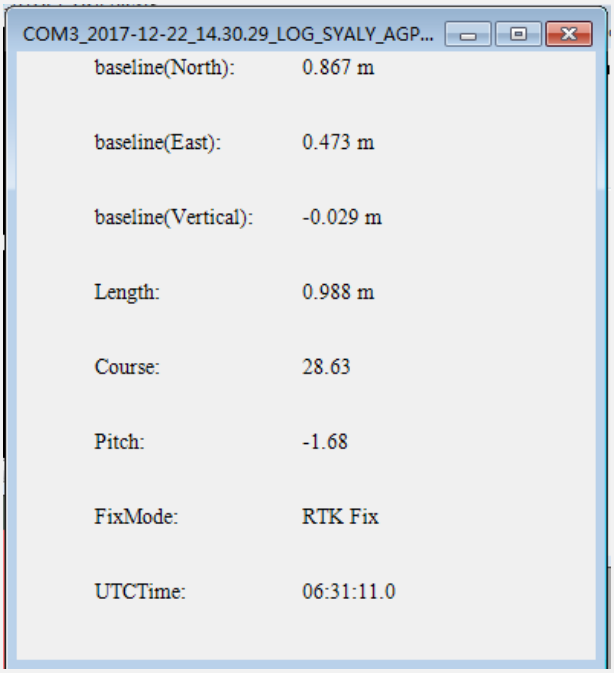


Figure 33 BaseLine Information Form

4.14 Sensor Status

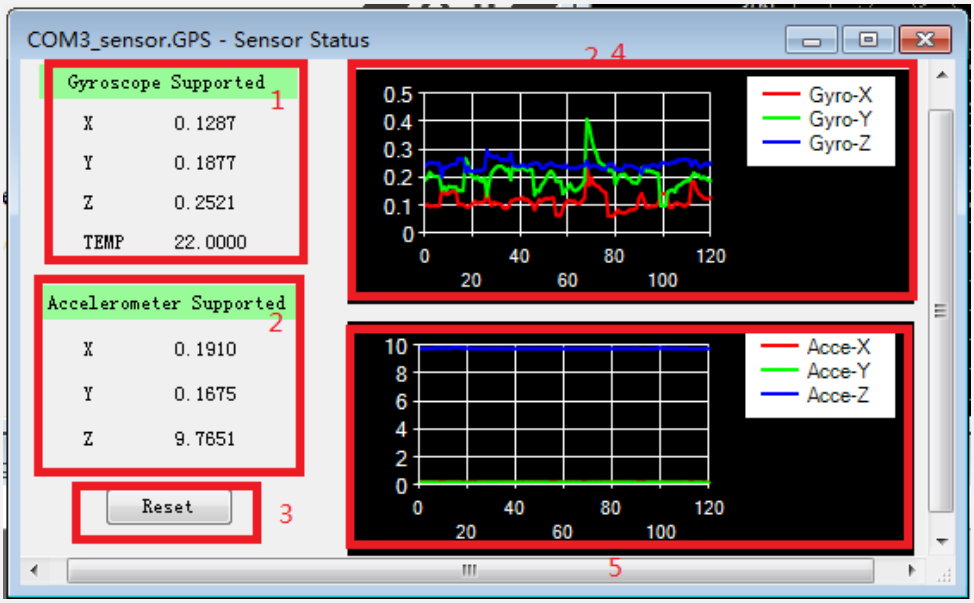


Figure 34 Sensor Status Form

- (1) - Display gyroscope supported x,y,z and temperature.
- (2) – Display accelerometer supported x,y,z and temperature.
- (3) –Reset page display.
- (4) –Show the chart, the red line is Gyroscope X, the green line is Gyroscope Y, the blue line is Gyroscope Z.
- (5) - Show the chart, the red line is Accelerometer X, the green line is Accelerometer Y, the blue line is Accelerometer Z.

4.15 Navigation PVT

Open "**Navigation PVT**" from the menu or tool bar, this platform includes all the information of pvt position information like GPS time, longitude, latitude, altitude, FixType, PDOP and so on. Those information is displayed as bellows.

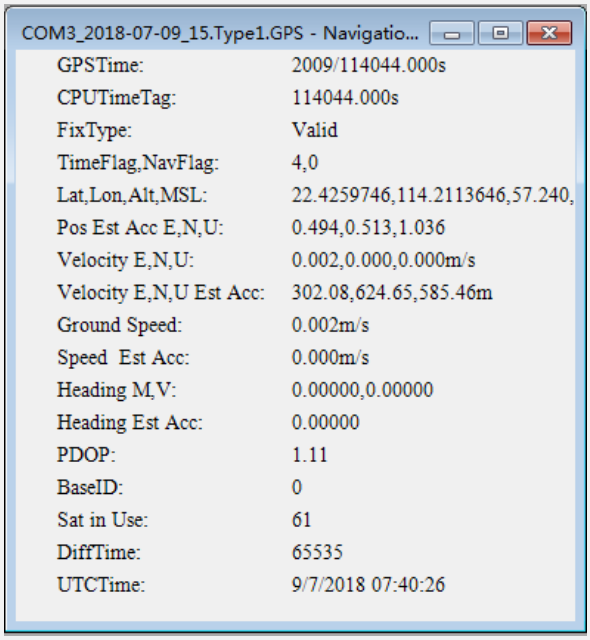


Figure 35 Navigation PVT Form

4.16 Multi-Antenna Attitude Determination

Open "**Multi-Antenna Attitude Determination**" from the menu or tool bar, this platform includes all the information of Multi-Antenna Attitude Determination information like Course, Pitch, Raw of Baseline vector, Baseline projection in East direction, in North direction, in Up direction and so on. Those information is displayed as bellows.

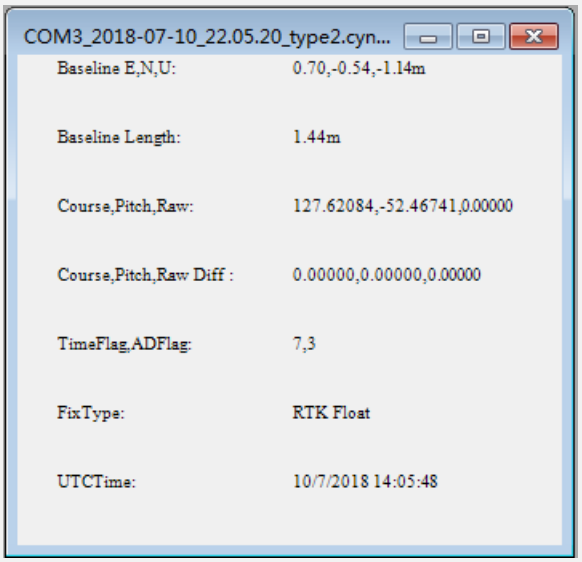


Figure 36 Multi-Antenna Attitude Determination Form

4.17 Plotting For SV

Open "**Plotting For SV**" from the menu, this platform display a chart CNR of the PRN 202 with the time as

below. It is also show the average cnr, max cnr and min cnr.

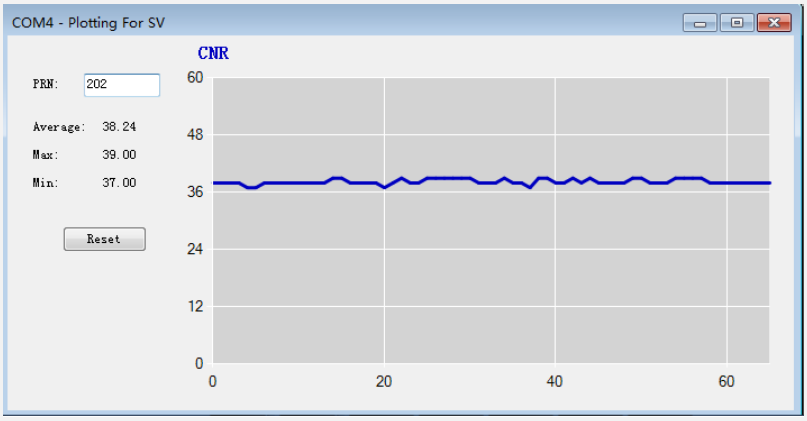


Figure 37 Plotting For SV Form

4.18 Clock Drift

Open "**Clock Drift**" from the menu, this platform display a chart PPM with the time and PPM rate with the time as below.

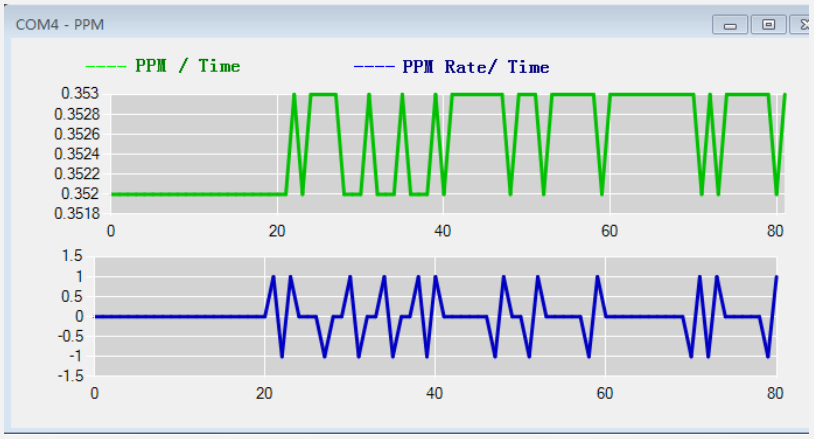


Figure 38 Clock Drift Form

4.19 Communicate with GNSS receiver (HD8020/8030 series)

Open "**Messages**" from the "**View**", the Messages handled the communication in binary protocol between computer and GNSS receiver, for the details on how to use binary protocol, please refer to the protocol specification.

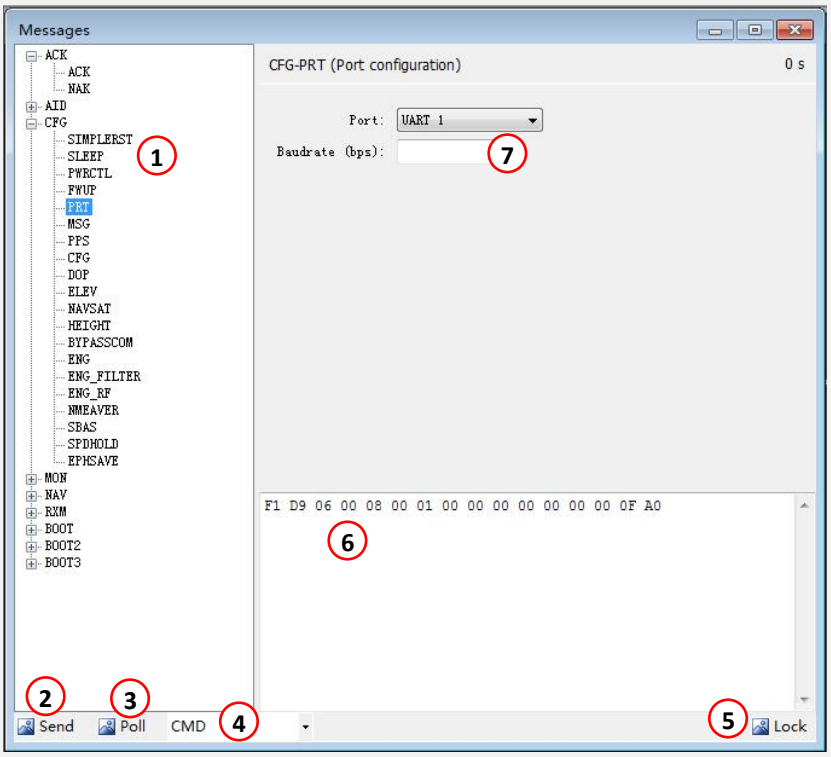


Figure 39 Messages form

- (1) - List of messages to communicate with GNSS receiver.
- (2) - Button to send binary message if applicable.
- (3) - Button to poll binary message if applicable.
- (4) - Command mode, you can select HEX mode or txt mode.
- (5) - Button to lock screen update to region (6) and (7).
- (6) - It has different orientation for its respective binary message, depending on the node selected in (1).
- (7) - Region show binary message going to send/received in HEX.

4.20 Communicate with GNSS receiver (HD8089A/8090A series)

Open "**DRMessages**" from the "**View**", the Messages handled the communication in ASCII protocol between computer and GNSS receiver, for the details on how to use DR ASCII protocol, please refer to the protocol specification.

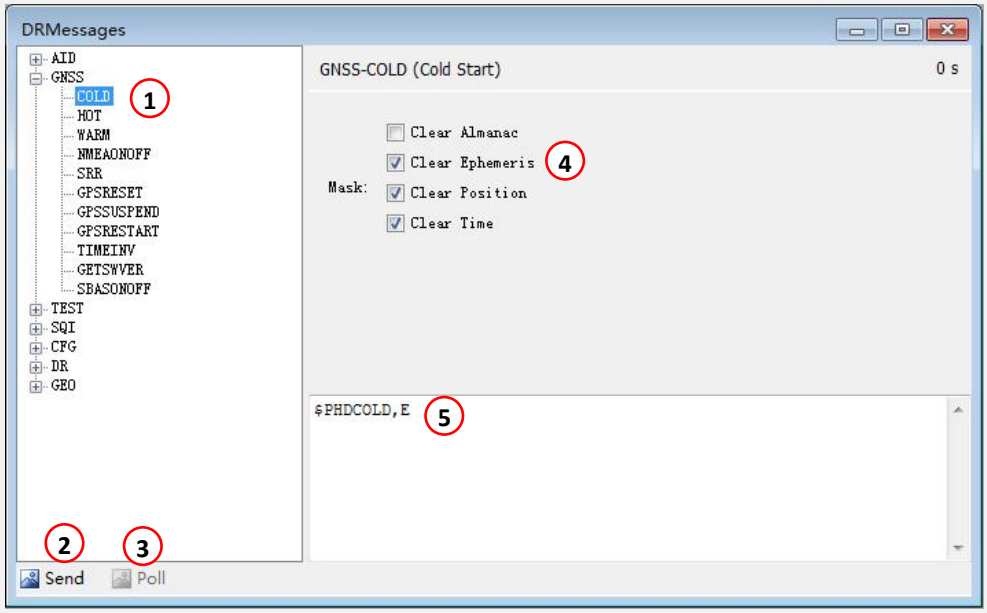


Figure 40 Messages form

- (1) - List of messages to communicate with GNSS receiver of DR.
- (2) - Button to send ASCII message if applicable.
- (3) - Button to poll ASCII message if applicable.
- (4) - It has different orientation for its respective ASCII message, depending on the node selected in (1).
- (5) - Region show message going to send/received in ASCII.

5 SET

5.1 Set NMEA

To enter the rate setting dialog, go to menu “**Device**” and select “**Set NMEA**”. User can set the nmea rate of GGA,GLL,GSA GRS,GSV,RMC,VTG and ZDA as below.

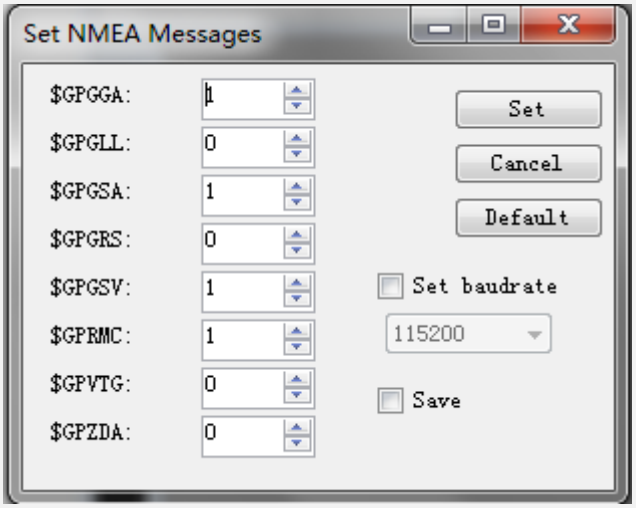


Figure 41 Set NMEA Form

5.2 Set Base

To enter the base setting dialog, go to menu “**Device**” and select “**Set Base**”.

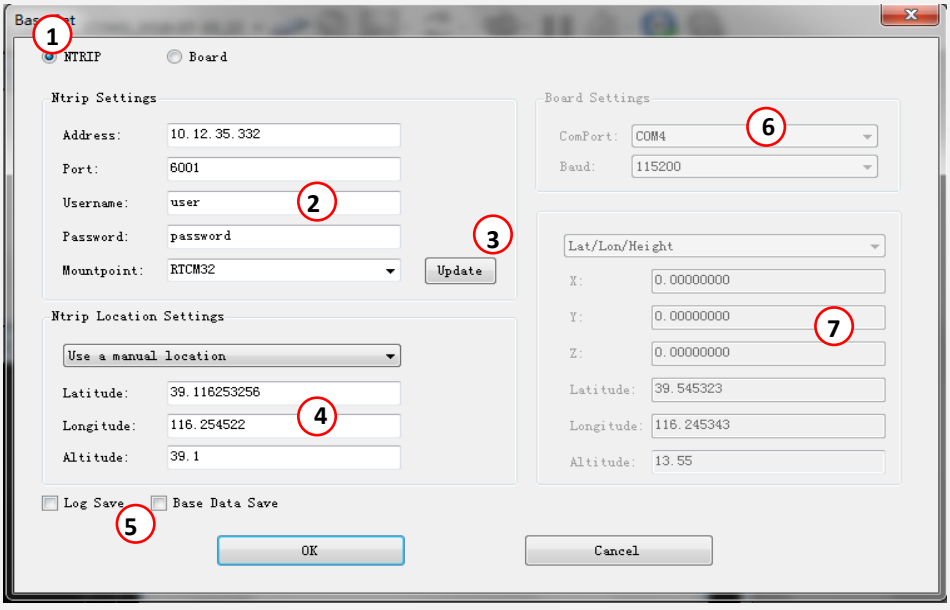


Figure 42 Set Base Form

(1) Chose the Base source, NTRIP or Board.

(2) If (1) choose NTRIP, input NTRIP settings as address, port, username, password.

(3) If (1) choose NTRIP, press update button to get mountpoint, or input manually.

(4) If (1) choose NTRIP, input the location settings. If choose “Use a manual location”, input the longitude, latitude, altitude, or use the rover position.

(5) User can choose save or no save base data and base log to the log file.

(6) If (1) choose Board, input the board com port and baud rate.

(7) If (1) choose Board, input the longitude, latitude, altitude, or XYZ of the board position.

5.3 Set Serial

To enter the serial setting dialog, go to menu “**Device**” and select “**Set Serial**”.
User can change the COM port as DRT, RTS, and read the status of COM port as DCD, DRT, DSR, RTS, and CTS as below.

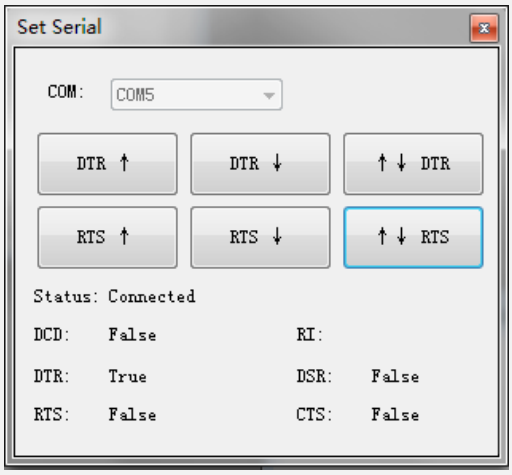


Figure 43 Set Serial Form

5.4 Set Down

To enter the down setting dialog, go to menu “**Device**” and select “**Set Down**”.
User can change the download baudrate from 1200 to 921600, or user defined baud (It is only availability on com mode).User can change the download packet size (It is only availability on HD BOOT mode).

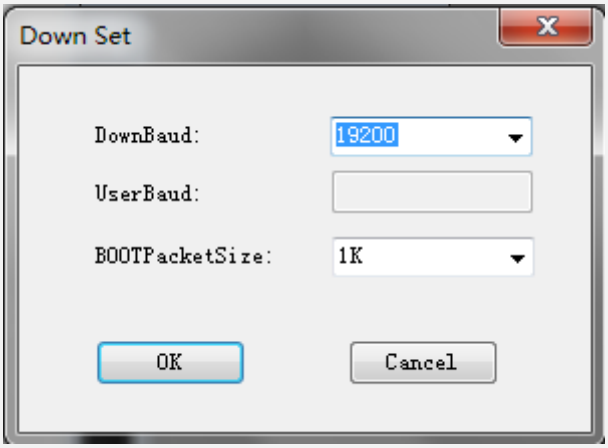


Figure 44 Set Down Form

5.5 Set Config

To enter the config setting dialog, go to menu "**Device**" and select "**Set Config**".
User can select the fix mode 2D or 3D .And user can choose the fix time include initialization time or not. User can also select save the send data to the log file or not.

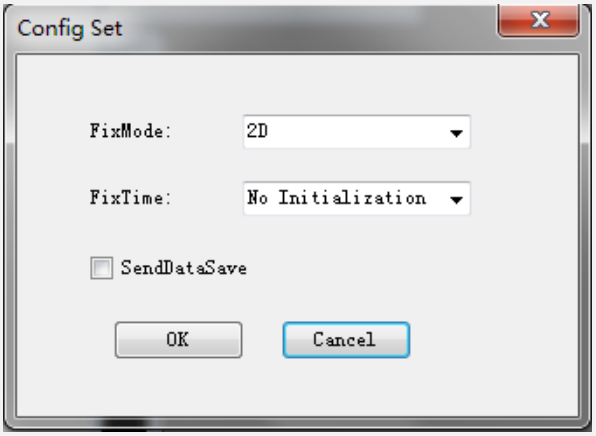


Figure 45 Set Config Form

6 HOW TO

6.1 Raw data logging/replaying

Satrack allows recording and playing log files. After connected to COM port or USB device, user can choose to save immediate data from GNSS receiver through COM port or USB into log files by clicking icon named "**Save Log**" on the tool bar.

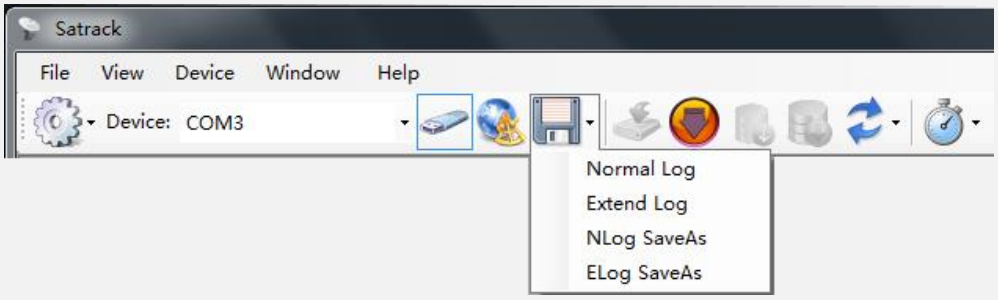


Figure 46 Save Log entries

6.1.1 Raw data logging

1) Click the "**Save Log**" button to start raw data logging.
2) Choose the following options to set file format and file directory.
   - "**Normal log**": save only NMEA messages. Directory of the saved normal log files is at My Documents\Satrack\logs. File name format: <Port name>_<Date>_<Log Start Time>.cyno.
   - "**Extend log**": save all messages. Directory of the saved extend log files is at My Documents\Satrack\logs. File name format: <Port name>_<Date>_<Log Start Time>.GPS.
   - "**NLog SaveAs**": save extend log to the address user selected.
   - "**ELog SaveAs**": save extend log to the address user selected.

3) Click the "**Save Log**" button again to finish raw data logging and save the log file.

6.1.2 Raw data replaying

After finish raw data logging and save the log file to the desired file directory, user can click "**File**" in the menu bar to choose "**Open outline file**" to select the log file to replay it. To stop replaying the log file, click "**Delete outline file**".

6.2 Set NMEA message rate

Satrack allows user to change each NMEA message output interval, click "**Device**" in the menu bar to choose "**Set NMEA rate**". Select the target option, and then modify the message rate values. (0 refers to disabling that message output, any values greater than 0 refer to the interval in seconds that message should output. The maximum output interval for a message is 255 seconds). Click "**Save**" to confirm and transmit the configure messages.

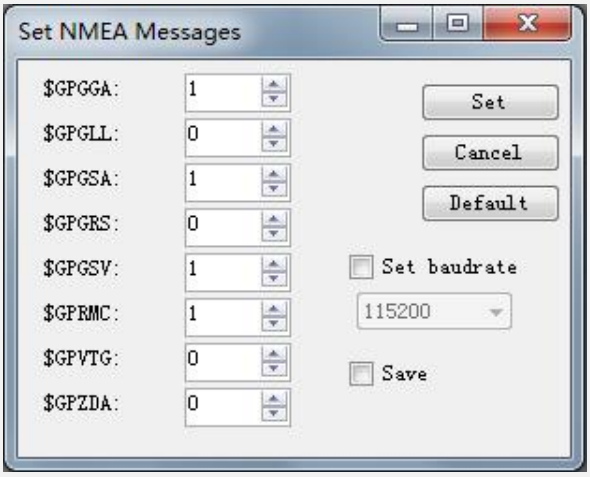


Figure 47 Set NMEA message rate

- The default values of NMEA messages rate is the recommended minimum output for Satrack to gather information. If too few messages are enabled, some views in Satrack may not work probably as their required information does not exist.
- The more messages output every second means more information could be shown. However, more message output requires higher bit rates. Recommended baudrate for normal usage is 115200kbps.

6.3 Cold/Warm/Hot start

Select "**Restart**" from the tool bar, you can send a cold/warm/hot start to the receiver. After a cold/warm/hot start, you can check the result from the status bar.

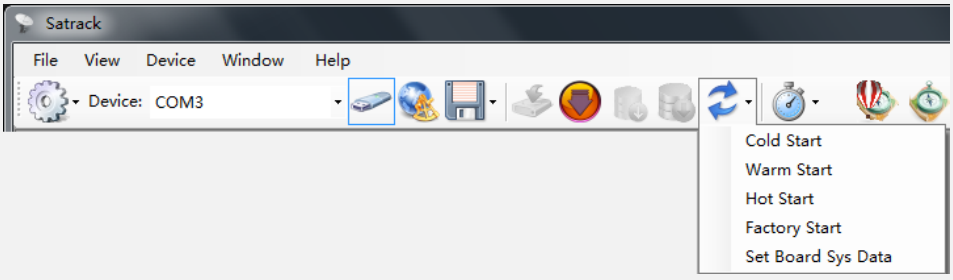


Figure 48 Cold/Warm/Hot start

Table 8 Cold/Warm/Hot start description

Function	Description
Cold start	Sends a cold start command to the receiver. All information is deleted from the memory.
Warm start	Sends a warm start command to the receiver. Only the ephemeris is deleted from the memory.
Hot start	Sends a hot start command to the receiver. No data is deleted in the receiver.

6.4 A-GNSS online and offline

Satrack allows user to save the time, location and ephemeris information to the receiver, thus it provide A-GNSS for a cold or warm start online or offline. Click "**Restart**" from the tool bar to choose "**Set Board Sys Data**". You can get ephemeris information from online mode or offline mode. Ephemeris information from online mode is getting information from website http://agnss.hdbds.com. Ephemeris information from offline mode is getting information from self-board, or another board.

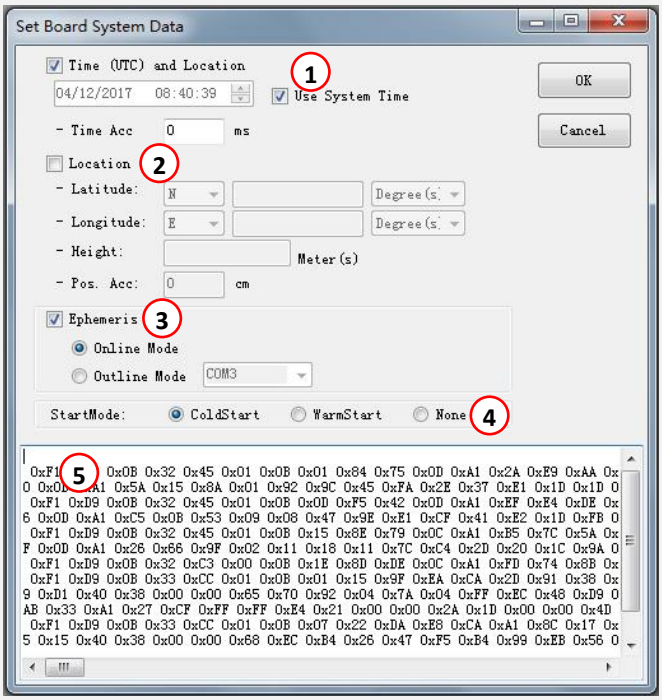


Figure 49 A-GNSS online and offline

- (1) - Send time to assistant position. Or use system time or user set time.
- (2) - Send location to the assistant position, including latitude, longitude, height and position accuracy.
- (3) - Send ephemeris information to the assistant position. User can choose to get ephemeris information online or offline mode.
- (4) - The cold start mode or warm start mode.
- (5) - The ephemeris information. If the "**Ephemeris**" is checked, then press F1, you can get the ephemeris information.

6.5 Compare testing

If there are multiple receivers connected, Satrack allows user to make comparison of those receivers at the same time. Just click "**Comparison Testing**" from the tool bar to choose the desired test item: Cold start, Warm start, Hot start, Reset, Factory reset and Ephs start (A-GNSS).

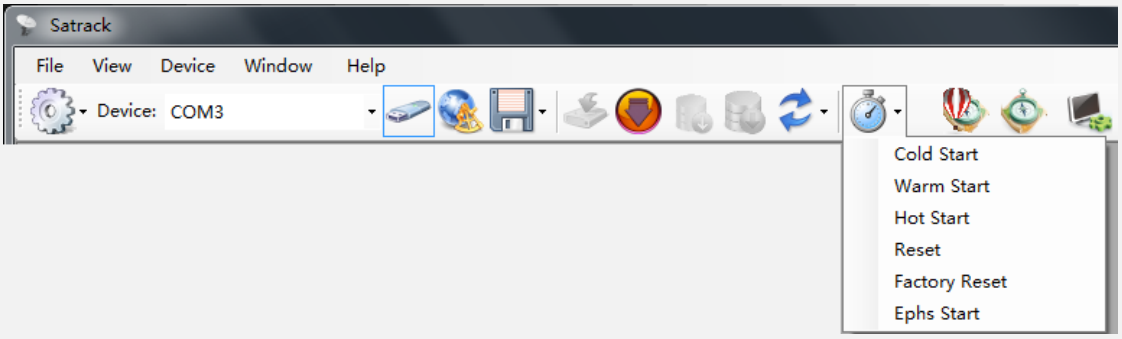


Figure 50 Compare testing

7 GOOGLE EARTH SERVER

This section gives an overview of the Google Earth server support in Satrack. The Google Earth server can continuously send positioning data in a specific format to the Google Earth application. By hosting such a server in Satrack we are able to visualize positioning data in real time.

7.1 Real time tracking with Google Earth

1) In order to use real time tracking with Google Earth, please make sure Google earth is installed on the computer.
2) Establish the communication between Satrack and the receiver.
3) Select "**Real-time Google Earth Link**" from the tool bar to direct to Google Earth.
4) Only some limit latest nodes are showed, if it is needed to investigate a long chain of nodes, please log the raw messages from device and use Save KML dialog to convert raw data to KML/KMZ files in order to view them in Google Earth after tracking finishes.

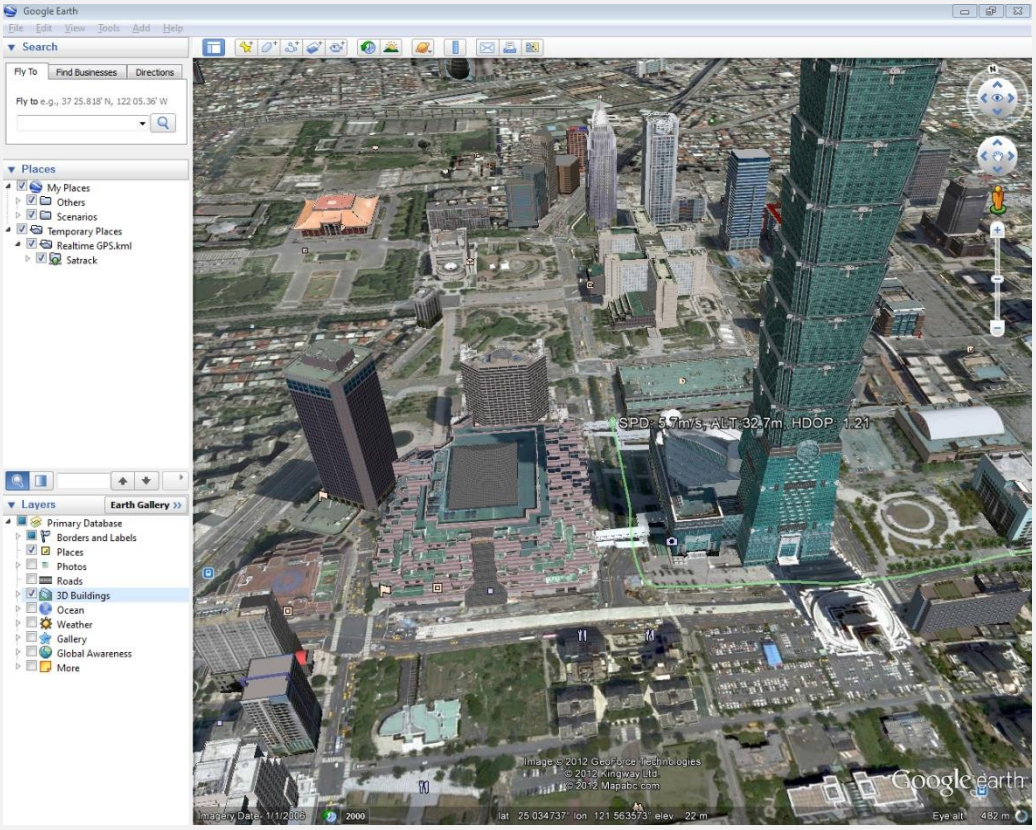


Figure 51 Google Earth

7.1.1 Real time tracking setting

After real time tracking is enabled, the option for real time tracking will be available. To enter the setting dialog, go to menu "**File**" and select "**Real Time Kml Settings**".

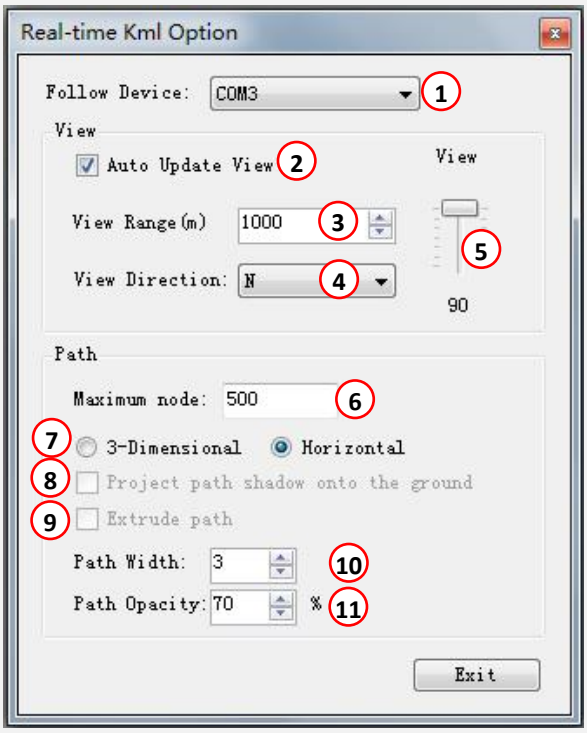


Figure 52 Real time Kml option

- (1) - Choose the GNSS device to follow when adjusting view.
- (2) - Auto update view to the latest position of following device.
- (3) - The distance of the view point from the last position fix node.
- (4) - Select fixed view direction or relative angle with heading direction.
- (5) - View angle relative to sea level. 90 degrees means perpendicular.
- (6) - Maximum latest node to store and display.
- (7) - Track orientation.
- (8) - Project path shadow onto the ground. (Only applicable in 3D mode.)
- (9) - Extrude path onto the ground. (Only applicable in 3D mode.)
- (10) - Width of the path.
- (11) - Opacity of the path.

7.2 Convert raw data to KML/HTML files

After logging the raw messages from the receiver, Satrack allows user to convert raw data to KML/HTML files. And then user can view them in Google Earth.

1) Go to menu "**File**" and select "**Save KML/HTML**".
2) Choose "**Input**" to browse for the desired output folder with raw data messages. The file list is read from folder under user profile, My Documents\Satrack\logs.
3) Click "**Browse…**" to set the file directory where the saved files should be stored.
4) There are some options for KML file settings. Set advanced options if needed (e.g. line color, alpha, time constrain, indicator).
5) Choose the files, and then click "**Save(Google)**" to start converting the files. When finishes the KML files converting, user can view the file in Google earth.
6) Choose the files, and then click "**Save(GAD)**" to start converting the files. When finishes the HTML files converting, user can view the file in Golden Map.
7) Choose the files, and then click "**Save(Baidu)**" to start converting the files. When finishes the HTML files converting, user can view the file in Baidu Map.

* *For details of viewing the converted files by using Google Earth, please refer to Google Earth User Guide:* *http://www.google.com/earth/learn/*

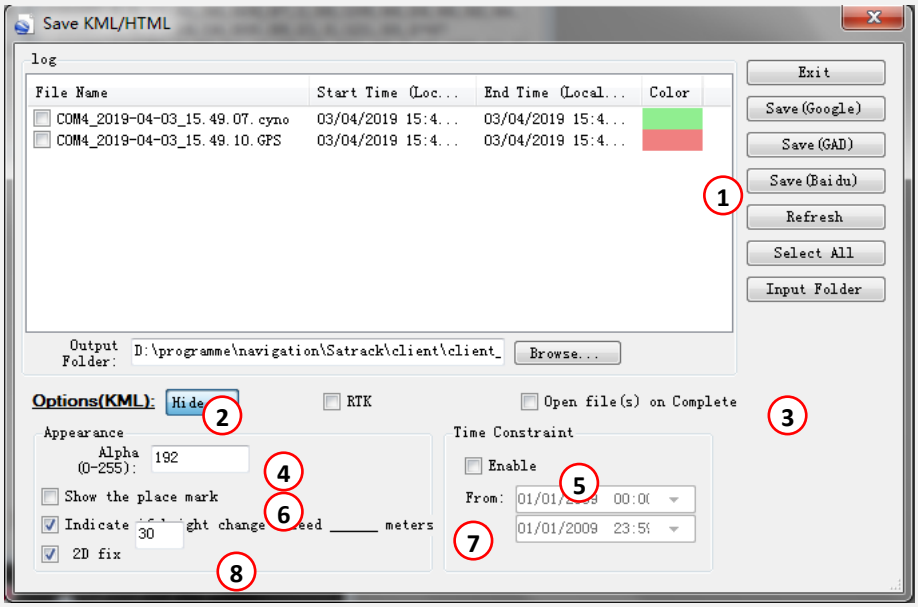


Figure 53 Save as Map file

- (1) - Click to change the track color in the output file.
- (2) - Show or hide advanced options.
- (3) - Indicate whether to open the saved files automatically when saving completes. It is highly recommend installing Google Earth for opening the converted files.
- (4) - Set the alpha of the path viewing under Google Earth.
- (5) - Set to extract a period of time from the input files to be converted.
- (6) - If checked, there will always have a node code beside the node icon.
- (7) - If checked, the icon of a node will be in green color if the statement holds.
- (8) - If checked, the icon of a node will be in red color to indicate 2D position fix.

8 FIRMWARE UPDATE

8.1 Preparation

To update firmware please ensure the following steps have been done before proceed:

- You have prepared a write version of the firmware file.
- You sure you have the need to update firmware.
- Make sure your receiver can enter BOOT mode.

8.2 Firmware updating for HD8020/8030 series

8.2.1 Updating in User normal mode

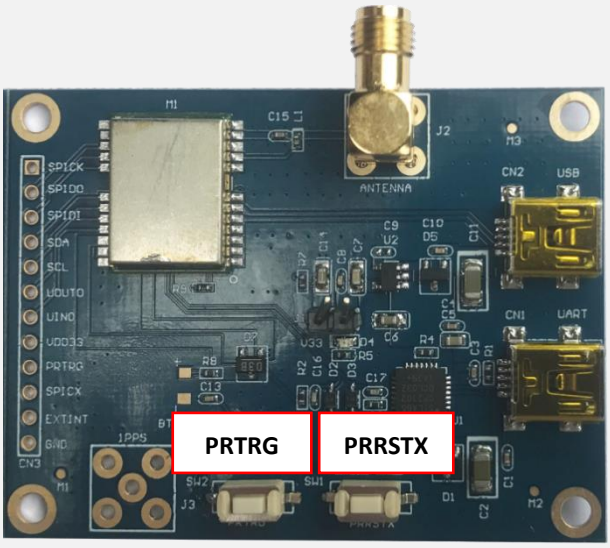
1) Connect to the target receiver through COM ports or USB ports.
2) Select "**User Firmware Update**" from the tool bar.

Figure 54 User firmware update

3) A file choosing dialog will be shown.
4) Find the file to send and press "**Open**" to start sending the file and finish firmware updating.

8.2.2 Updating in BootROM command mode

1) Connect to the target receiver through COM ports or USB ports.
2) User needs to use the **PRTRG** and **PRRSTX** buttons on the EVK board. Press the **PRTRG** button first, and then press **PRRSTX** button. After that, release the **PRRSTX** first, and then release the **PRTRG** button.



3) Disconnect the receiver first by clicking "**DisConnect**" from the tool bar and then reconnect the receiver

again by clicking “**Connect**” from the tool bar. The receiver will enter the BootROM command mode.

4) Select “**Boot Firmware Update**” from the tool bar.

Figure 55 Boot firmware update

5) A file choosing dialog will be shown.
6) Find the file to send and press “**Open**”.
7) Press “**Send**” to start sending the file and click “**Close**” to close the updating window after firmware updating finishes.
8) After firmware updating completed, press **PRRSTX** button on the EVK board to restart the receiver.

8.3 Firmware updating for (HD8089A/8090A series)

8.3.1 Updating in User normal mode (DR update)

1) Connect to the target receiver through COM ports.
2) Select “**DR Update**” from the tool bar.

Figure 56 User firmware update

3) A file choosing dialog will be shown.
4) Find the file to send and press “**Open**” to start sending the file and finish firmware updating.

8.3.2 Updating in BootROM command mode (DR Boot update)

1) Connect to the target receiver through COM ports.
2) Enters the BootROM command mode.
3) Select “**DR Boot Update**” from the tool bar.

Figure 57 Boot firmware update

4) A file choosing dialog will be shown.
5) Find the file to send and press “**Open**” to start sending the file and finish firmware updating.

8.4 DGNSS Boot Down

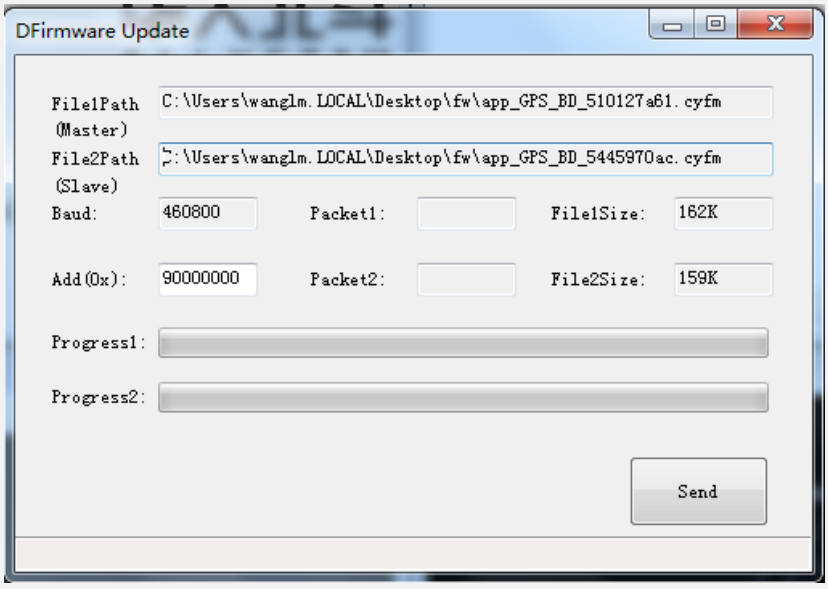


Figure 58 Dgnss Boot down

1) Connect to the target dgnss receiver through COM ports in boot mode.
2) Select "**Dgnss Boot Down**" from the tool menu.
3) Two files choosing dialog will be shown.
4) Find the files to send and press "**Send**" to start sending the file and finish firmware updating.

8.5 DGNSS User Down

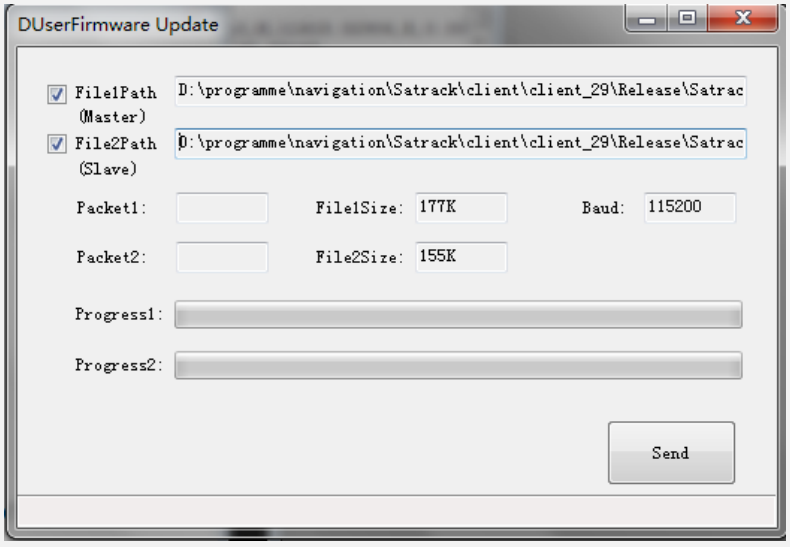


Figure 59 Dgnss User down

1) Connect to the target dgnss receiver through COM ports in user mode.
2) Select "**Dgnss User Down**" from the tool menu.
3) Two files choosing dialog will be shown.
4) Find the files to send and press "**Send**" to start sending the file and finish firmware updating.

8.6 Firmware updating caution

DO NOT interrupt file transfer, keep program running and make sure all cables are well connected when file is transmitting.

9 RELATED DOCUMENTS

[1] HD8020/8030/8089A Series Datasheet

[2] Cynosure Receiver Protocol

10 REVISION HISTORY

Revision	Date	Author	Status / Comments
v1.00	2009-08-10	Thompson Lau	First Draft
V1.01	2011-03-30	Gary Hau	Updated screenshots
V1.02	2011-04-20	Paul Lam	restructure document hierarchy
V1.03	2011-04-29	Paul Lam	Added master firmware update
V1.04	2011-05-04	Paul Lam	Set NMEA message rate
V1.05	2011-05-17	Paul Lam	Update screenshot and include position map.
V1.06	2011-06-23	Paul Lam	Typo correction
V1.07	2011-06-30	Paul Lam	Real time Tracking part changed. Corrected some typing errors in Save Kml files.
V1.08	2011-07-11	Paul Lam	SaveKML update
V1.09	2012-05-05	Paul Lam	Update
V1.10	2013-08-29	Mingo Tsai	Updated Contents
V1.11	2014-05-20	Yunzhi Li	Updated
V1.12	2015-04-02	LiminWang	Updated Contents
V1.14	2015-04-02	LiminWang	Updated Contents
V1.15	2015-08-21	LiminWang	Updated Contents
V1.16	2015-11-12	LiminWang	Updated Contents
V1.17	2016-03-22	LiminWang	Updated Contents
V1.18	2017-06-21	LiminWang	Updated Contents
V1.19	2017-08-03	Daisy yin	Change to ALLYSTAR word format
V1.20	2017-09-03	LiminWang	SW updated
V1.21	2017-09-15	LiminWang	SW updated
V1.22	2017-10-03	LiminWang	SW updated
V1.23	2017-10-15	LiminWang	SW updated
V1.24	2017-11-03	LiminWang	SW updated
V1.25	2017-11-15	LiminWang	SW updated
V1.26	2017-12-12	Daisy yin	File content updated, and add DR mode descriptions.
V1.29	2019-04-03	LiminWang	SW updated
V1.29.1	2020-06-10	Vita Wu	Updates table of content

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