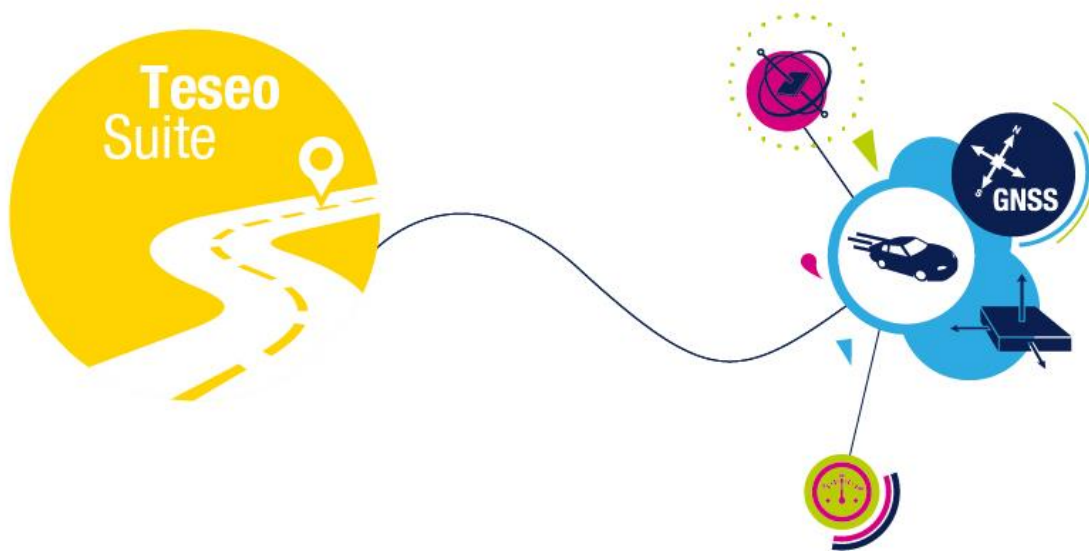




Automotive Product Group Automotive Infotainment Division

Navigation & Multimedia System & Architecture Teseo-Suite User Manual



1 Introduction

This document contains the information necessary for correct use of the Teseo-Suite tool and describes all its functionality.

The functions offered by the tool can be divided into two main areas:

1. Viewer: NMEA or binary protocol decoding and display of some views;
2. Test plan: module for writing and running scripts on ST GNSS receivers.

2 Dependencies

This application requires the following components to be installed to run properly:

- The .NET Framework 4.5 (<http://www.microsoft.com/en-us/download/details.aspx?id=30653>) or higher
- Visual C++ Redistributable Packages for Visual Studio 2013 (<http://www.microsoft.com/en-us/download/details.aspx?id=40784>)

This software uses parts of source code developed by other companies or groups.

- Maps for Windows forms:

Copyright © Radioman

- Output log:

Copyright © Apache Software Foundation

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4 Document Management

4.1 Revision History

Rev	Date	Author	Notes
1.00	22/02/2013	Francesco Caccavale	
1.01	27/09/2013	F.Deruy V.Delaunay	Binary monitoring & data base
1.02	30/10/2013	F.Deruy V.Delaunay	Binary monitoring/graphic display & data base
1.02	18/11/2013	F.Deruy	Update for main GUI and PVT
1.03	20/12/2013	F.Deruy	Update for main GUI, PVT, NMEA message view and NMEA DB viewer
1.04	16/04/2014	F.Deruy	Update for main GUI, chart view, NMEA to KML converter
1.05	17/06/2014	F.Deruy	Update for main DR panel, chart view and FW plugins
1.06	26/06/2014	F. Deruy	Update for FW configuration panel
1.07	05/01/2014	F.Deruy	DV4.2
1.08	09/04/2015	F.Deruy	DV4.3
1.09	09/10/2015	B. Feildel	DV4.4
1.10	02/11/2015	B. Feildel	Update screenshots and menus descriptions
1.11	31/03/2016	F. Deruy	DV4.6
1.12	22/07/2016	F. Deruy	DV4.7
1.13	06/10/2016	V.Delaunay	Update Tools/Diagnosis note2
1.14	09/12/2016	F. Deruy	DV4.8
1.15	30/03/2017	V.Delaunay	Firmware loader and upgrade.

4.2 Acronyms

Keyword	Definition
AGPS	Assisted GPS

CNO	Carrier to Noise Ratio - Identifies the quality of a received signal
Cold start	Start Condition for a GPS system having no position nor time. Almanac and Ephemeris is not available, too.
DR	Dead Reckoning. Sensor based process to determine the movement of a mobile unit, utilizing Gyro, Odometer and Wheel Pulses.
GNSS	Global Navigation Satellite System - Satellite based system to calculate the position of the receiver on the earth surface.
GPS	Global Positioning System - United States Satellite Navigation System
GUI	Graphical User Interface
Hot start	Start Condition for a GPS System having position, time, Almanac and Ephemeris already available. High time accuracy is required
NMEA	National Marine Electronics Association - United States Standards Organization For Marine Equipment
MDI	Multiple Document Interface
PGPS	Server based assistance done by ST-AGPS™ using GPStream™ technology from RxNetworks
ST-AGPS™	Autonomous ephemeris prediction algorithm by STMicroelectronics
UART	Universal Asynchronous Receiver Transmitter
Warm start	Start Condition for a GPS system having current Almanac, position and time availability. Ephemeris are not available. Time needs to be available with reasonable accuracy (some seconds).

4.3 Reference Documents

None

5 Getting started with the Teseo-Suite

When the application is started for the very first time, Teseo-Suite scans all available UART COM ports to detect any connected receiver whatever the protocol used.

In case that no receiver has been found, the Teseo-Suite opens the configuration session panel (see section [Create New Session \(View Session\)](#)) to allow the user to add them manually.

The Teseo-Suite can manage up to four receivers in parallel. In this case, the display of data in real-time cannot be guaranteed, especially when graphical view are open.

5.1 Create New Session (View Session)

When there is no device, the session panel is empty. The user can add up to 4 devices by clicking on the “Add Device” button.

If the session panel is not yet open, go in the "File" menu, select "New Session" and **enter a session name to enable** the “Add Device” button.

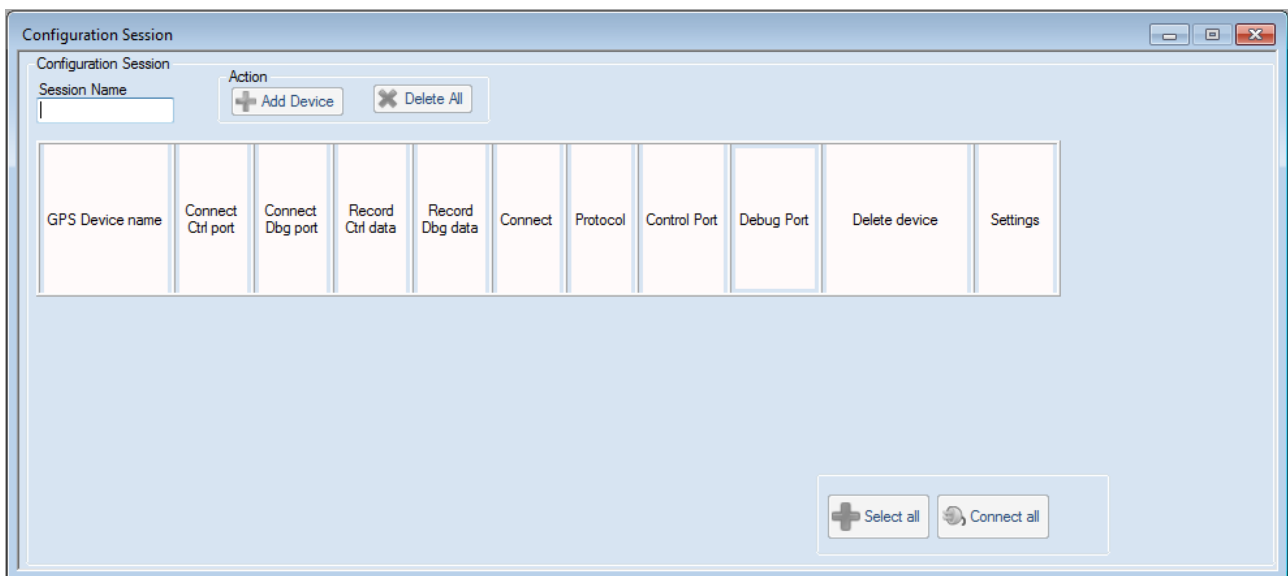


Figure 1: New Session panel

A button “Edit Session configuration”, as shown in figure 3, allows to open and close the session configuration panel.

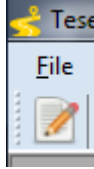


Figure 2: Open Edit Session configuration

5.2 Add/Delete Device in Session – Configuration Device

Via the form of "Session Configuration", you can add / remove GNSS devices in the work session, and monitor existing ones.

To enable the functionality of adding / removing devices, you must first set the name of the work session.

Pressing the button "Add Device" is shown the "Device Configuration" form.

The Binary SW image version, the hardware type and the GNSS device name are set to a default value.

The user has to change the value of the Binary SW image version and of the hardware type according to the device used and the SW binary downloaded.

This step is compulsory to allow a proper binary or NMEA payload decoding.

There is the possibility to select up to two ports, Control and / or Debug port, and to choose the parameters of the serial connection.

On Control port, the user can select which protocol is used by the GNSS device (NMEA or Binary).

The user must select the DTR option when using a virtual UART port over USB.

Press the "OK" button to create the device.

Figure 3: Configuration Device panel

When selecting the port name, the Teseo-Suite provides an enumeration of all the COM ports available (including BT-SPP COM ports) even if these COM ports are already used by another application

Please note that the protocol of the device and its name cannot be changed once the “OK” button has been clicked.

To delete a device from the session, disconnect the device first and press the corresponding delete button in the “Delete Device” column from the "Configuration Session" form.

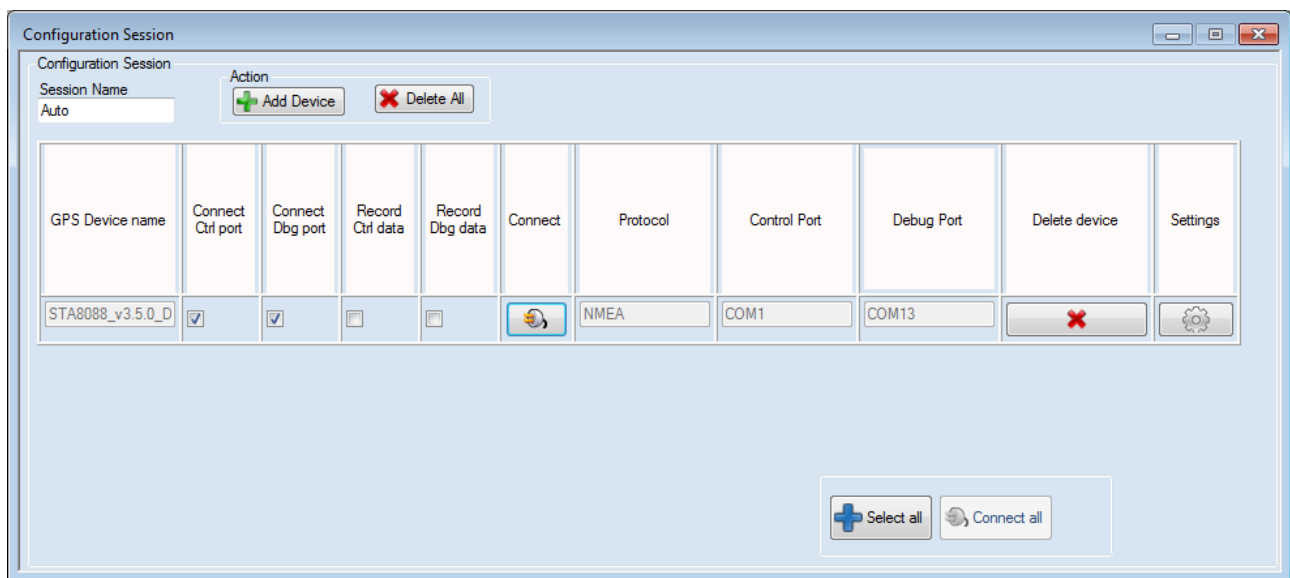


Figure 4: Configuration session panel with one device added

The button “Delete All” removes all the devices of the current session.

5.3 Connect or disconnect Control / Debug Ports

The ports defined when devices have been added can be opened. If a port is defined, the corresponding checkbox is enabled. Selecting the checkboxes in the “Connect Ctrl ports” column and in the “Connect Debug port” column enables the corresponding connection buttons.

Click on the connect button to open the selected ports. Then the appearance of the button changes to show that you can disconnect the device.

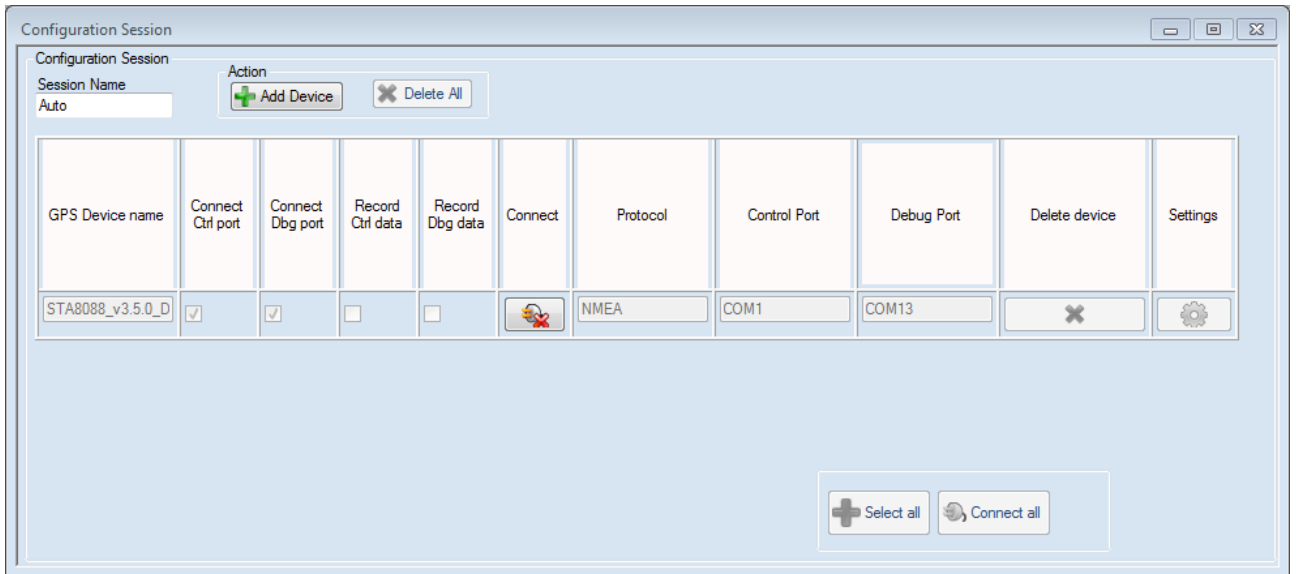


Figure 5: Ports connection

6 Database

Database is a collection of stream inputs, sorted by protocol commands, recordable and editable in the Database monitor.

7 Teseo-Suite menus and windows

7.1 Main GUI and toolbars

The main GUI is the preliminary display screen of Teseo-Suite. It displays all the views and tool bars. A status window is displayed on the right side of the screen for each receiver.

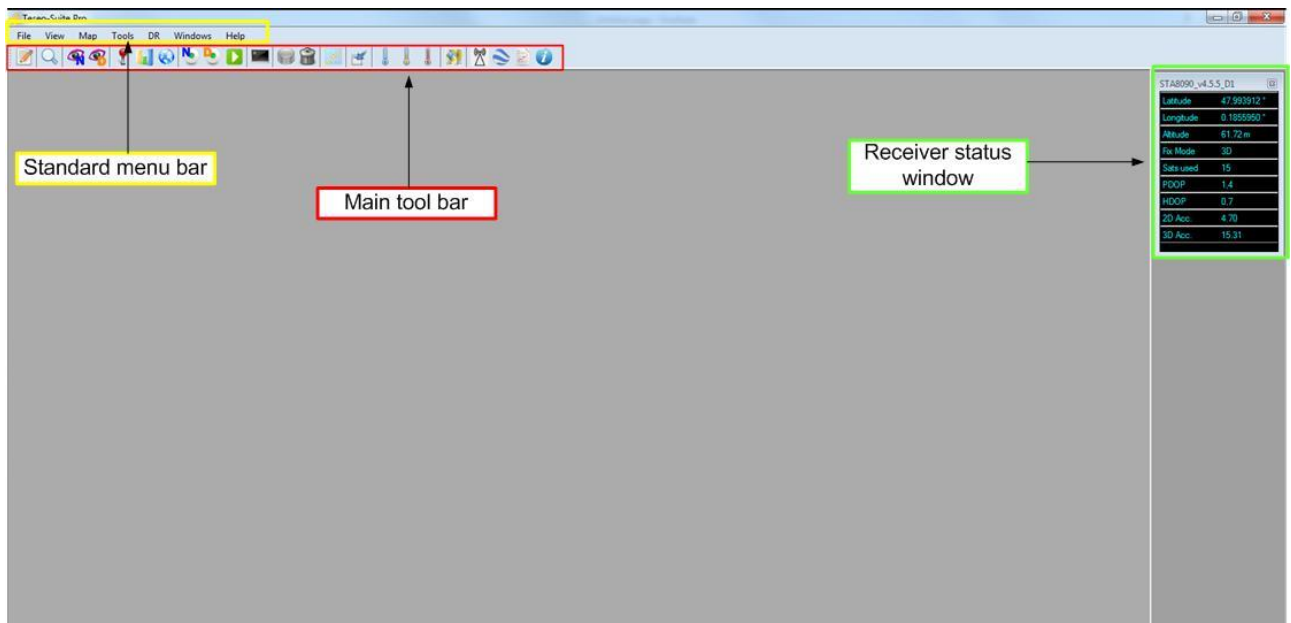


Figure 6: Main GUI

7.1.1 Standard menu bar

All main functionalities of Teseo-Suite can be accessed through the standard menu.

7.1.1.1 File

The file menu proposes the following items:

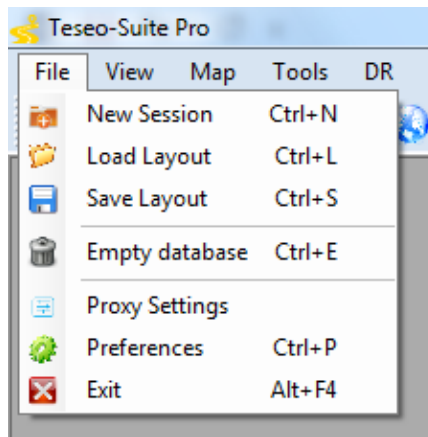


Figure 7: File menu

New session	Kill the current session if any. An empty session panel is then displayed
Load Layout	Restore saved state of the tool
Save layout	Save the state of the tool in a binary file i.e. location and size of the views, serial connection settings etc...
Empty database	Clear the database of the current session
Proxy settings	User can configure a global proxy for the application. Proxy settings will be used when the application will have to download files from the internet for ST-AGPS. User's credentials are encrypted before being saved into the user setting file.
Preferences	<p>User settings</p> <p><i>Application log path:</i> the path where the application log files will be saved (e.g. database log file).</p> <p><i>NMEA/Binary/debug log path:</i> the path where the files (Recording Files and tests results) will be saved.</p> <p>To load the latest session configuration when the application starts, select the check box "<i>Load last layout at start-up</i>".</p> <p><i>Detect devices at start-up:</i> allows to detect and mount all the connected device at the application start-up. Please note that if the check box "<i>Load last layout at start-up</i>" is checked, this feature is disabled.</p> <p><i>Auto baud rate at start-up:</i> it enables the baud rate detection at the application start-up. Please, note that enabling this feature can lead to slow down drastically the start-up of the application.</p> <p><i>Player: go straight to the selected scroll bar position:</i> if this option is selected, the history in graph and map view won't be deleted when user</p>

moves the player cursor backward, the cursor moves directly to the choose position without any replay of the previous database content.

GNSS settings

NMEA start-up synchro message: string associated with the device start-up (used by test module).

NMEA trigger synchro message: give the very first message received at a given fix rate. This trigger determines the beginning of a sequence (i.e. a set of messages received periodically at 1Hz). For instance, \$GPRMC is the first message to be received in a typical ST GNSS binary SW. **The trigger cannot be a message that can be received several times like \$PSTMTS messages.**

Binary start-up synchro message: command id associated with the device start-up.

Binary trigger synchro message: command id used by the database to start to record data from a message sequence

Exit	Exit the application
-------------	----------------------

7.1.1.2 View

The View menu proposes the following entries:

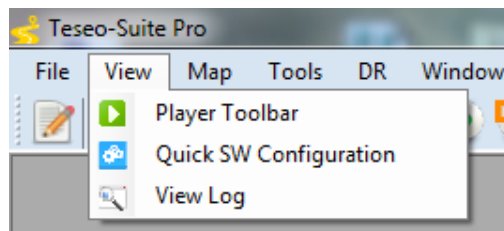
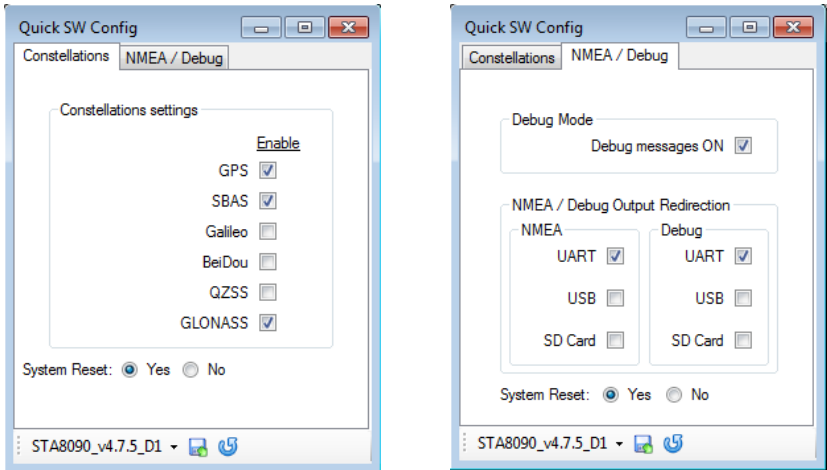


Figure 8: File menu

Player Toolbar	Open the log file toolbar
Quick SW Configuration	Open a window to perform some changes in the receiver's firmware configuration such as constellations enabling, debug output activation or NMEA/Debug output redirection.



View log Open an window with application’s errors or information

7.1.1.3 Map

The Map menu proposes the following entries:

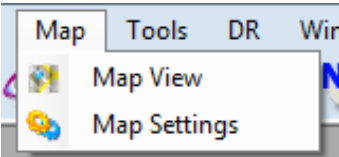


Figure 9: Map menu

Map View Open the map window. Note that this window requires a valid internet connection to work properly. If your internet connection goes through a proxy, make sure to enter your credentials by opening your usual internet browser first.

Map Settings Open the map window with the settings panel.

7.1.1.4 Tools

The Tools menu proposes the following entries:

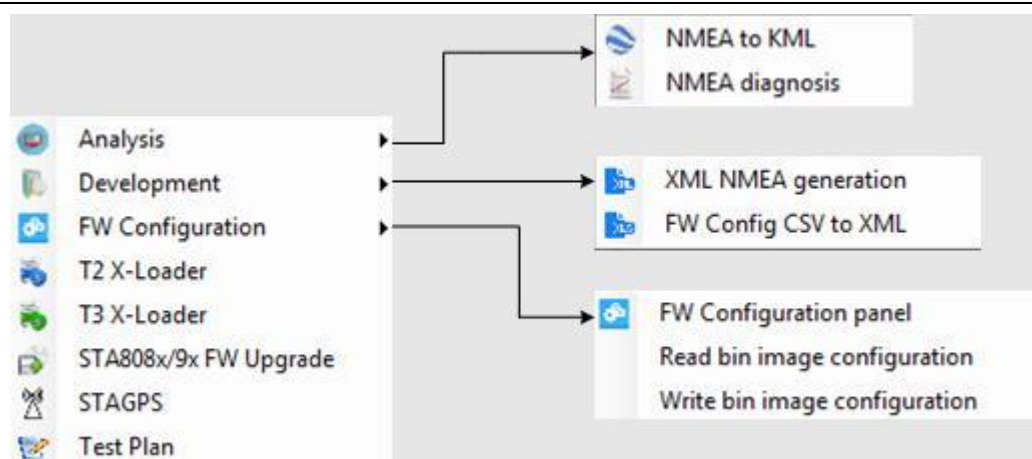


Figure 10: Map menu

Analysis / NMEA to KML	Export data of a NMEA log into KML data format for displaying with Google Earth. See Note 1 below.
Analysis / NMEA diagnosis	NMEA log post processing tool which generates a report file in html format. This report is a first help to analyze a log and the file can be opened thanks to a Web browser. This report file contains statistics and anomalies detected when parsing the log. See Note 2 below.
Development / XML NMEA generation	<p>This menu is intended for developers only. Trying to modify XML payload files is at your own risk!</p> <p>This menu allows to generate a NMEA XML payload file from a CSV file.</p>
Development / FW config CSV to XML	<p>This menu is intended for developers only. Trying to modify XML payload files or FW configuration files is at your own risk!</p> <p>This menu allows to generate the FW configuration XML file from a CSV file.</p>
FW Configuration / FW configuration panel	Open the FW configuration panel which allows to read and write FW configuration parameters of a connected receiver
FW Configuration / Read binary image configuration	Read the FW configuration of a binary image. This feature relies on the FWconfig.exe.
FW Configuration / Write binary image configuration	Write a user's defined FW configuration into a binary image. This feature relies on the FWconfig.exe.
T2 X-Loader	Run the STA8088 X-Loader. See Figure 13
T3 X-Loader	Run the STA8089/90 X-Loader. See Figure 13
STA808x/9x FW Upgrade	Run the STA8089/90 FW upgrade. See Figure 14

STAPGS	Open the STAGPS testing panel
Test Plan	Open the scripting panel

Note 1:

The “NMEA to KML” feature is based on Capture2map which is a program converting NMEA log files into kml format. The tool, which supports GNSS and DR outputs, is available through the Teseo-Suite but is also provided inside the DRAW binary release package as an executable which can be called from DOS command prompt.

Select menu Tools>analysis>NMEA to KML to open the KML window as shown in the picture below:

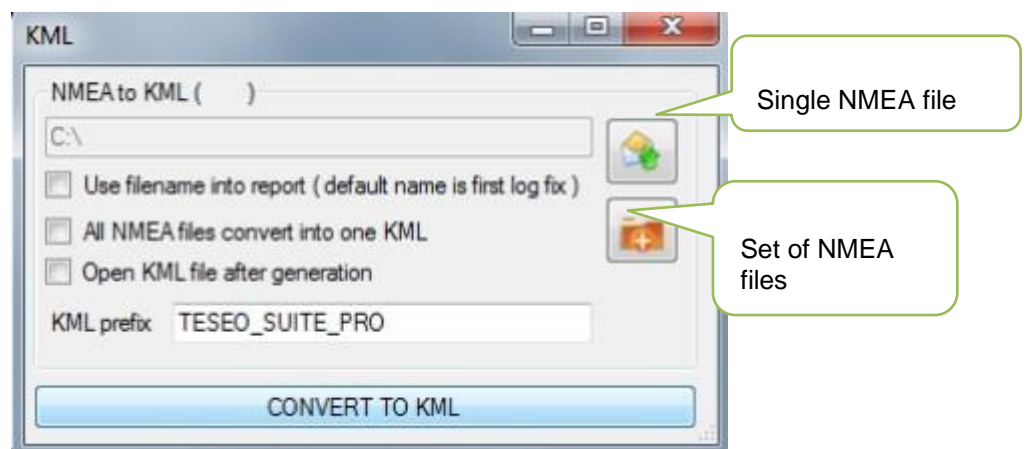


Figure 11: NMEA to KML panel

Note 2:

The “Diagnosis” feature generates an HTML report, where physical values extracted from the NMEA file are printed out. Settings, defects, sensors outputs and setup, CPU load, can be found into this document. Diagnosis chapter will help you to understand quickly what goes wrong during your trip record.

Select menu Tools>analysis>NMEA diagnosis to open the KML window as shown in the picture below:

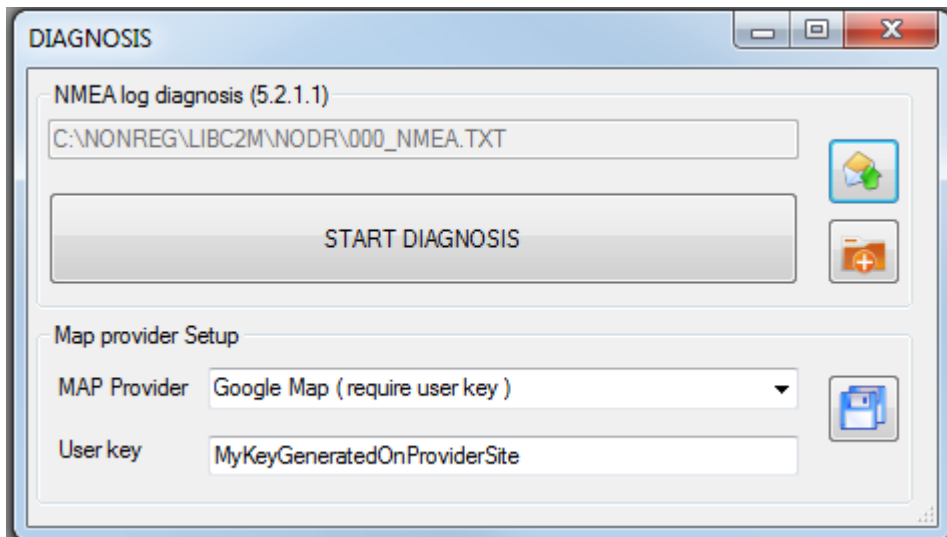


Figure 12 : Diagnosis

Diagnosis feature is able to generate (optionally) map preview of events, like tunnels & GNSS versus DR residuals. In this case, a map provider must be selected in second part of panel. Three providers are available in the combo-box "MAP Provider":

- Open street map (<https://openstreetmap.fr/>) offers map tile for free, nevertheless the access of server is not unlimited. The access is quickly prohibited after some download.
- MapQuest (<https://www.mapquest.com/>) offers a high level of services under "open street map" content. It's possible to register on site and obtains commercial or free access key (<https://developer.mapquest.com/>). This key must be registered into panel and follow by pressing save button.
- GoogleMap (<https://www.google.fr/maps>) requires user key access which can be subscribed with your own google account. Assistance is available at this address: <https://developers.google.com/maps/faq>. This key must be registered into panel and follow by pressing save button.
- If network access is not available, select "None".

Note 3:

Xloader Teseo allows to load boot & firmware. The boot sequence is associated to Teseo component pinout, documented in dedicated hardware documentation.

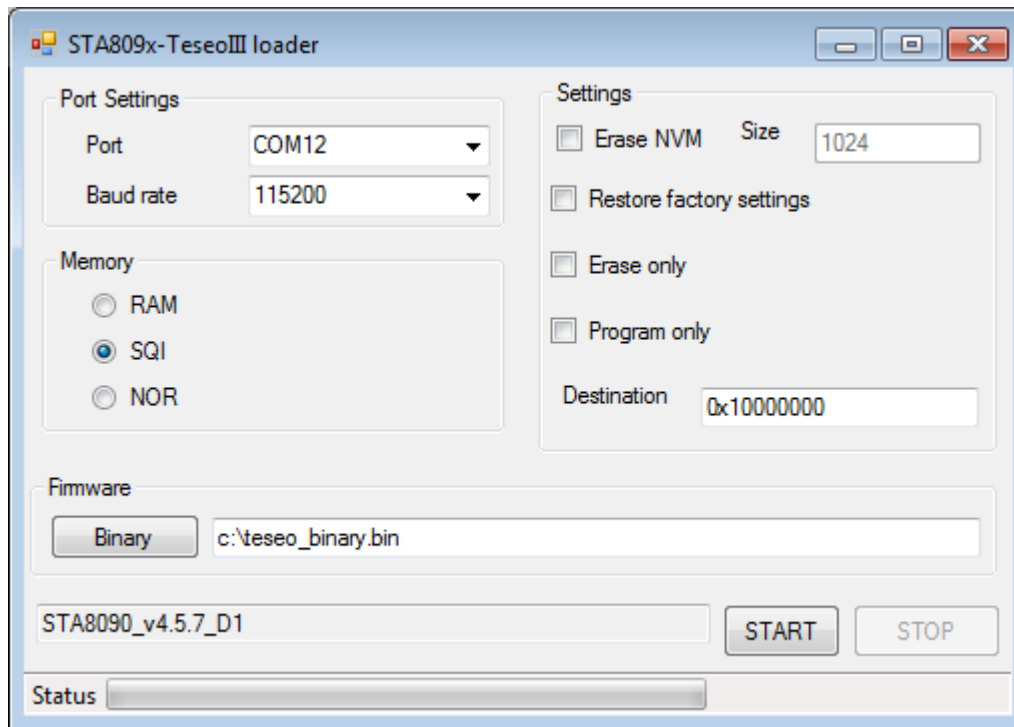


Figure 13 : loader

- **Port Settings:** define UART port number and its baud rate for loading.
- **Memory :** type of memory
- **Settings :**
 - **Erase NVM :** erase settings of Teseo
 - **Restore factory settings :** copy default settings in current configuration
 - **Erase Only :** erase firmware area
 - **Program only :** load firmware without perform erase (only available if flash is previously erased)
 - **Destination:** Start address of firmware. Modify memory type to get default one.
- **Firmware:** edit firmware binary or press Binary button to browse your file system.
- **START** initiates programming. **STOP** cancels programming sequence.

Note 4:

- Firmware upgrade allows to update firmware. The initial Teseo configuration is the current mode (no boot sequence pinout)

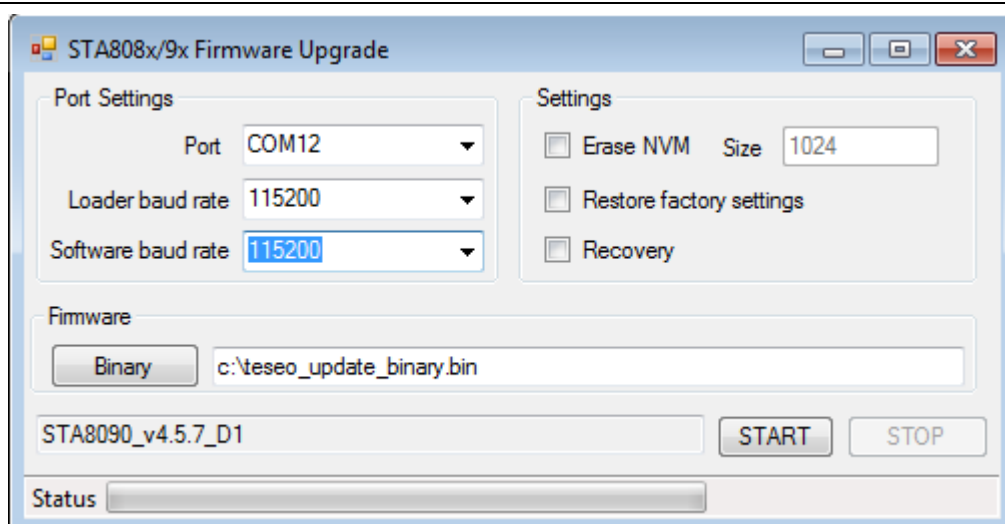


Figure 14 : firmware upgrade

- **Port Settings:**
 - **Port** : define UART port number.
 - **Loader baud rate**: define programming baud rate.
 - **Software baud rate**: define NMEA baud rate of current firmware loaded.
- **Settings :**
 - **Erase NVM** : erase settings of Teseo
 - **Restore factory settings** : copy default settings in current configuration
 - **Recovery**: *If your previous firmware is erased or last loading has been interrupted or failed, enable recovery mode and **restart your product after START**.*
- **Firmware**: edit firmware binary or press Binary button to browse your file system.

START initiates programming. **STOP** cancels programming sequence.

7.1.1.5 DR

The DR (Dead Reckoning) menu open the Dead reckoning panel.

7.1.1.6 Windows

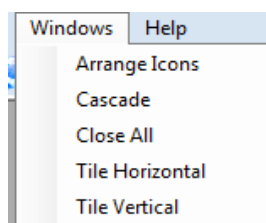


Figure 15: Windows menu entries

Arrange icons	Arranges the icons at the bottom of the window.
Cascade	Arranges all open dialogs cascaded.
Close All	Closes all open dialogs and windows.
Tile Horizontal	Arranges all open dialogs horizontally.
Tile Vertical	Arranges all open dialogs vertically.

7.1.1.7 Help

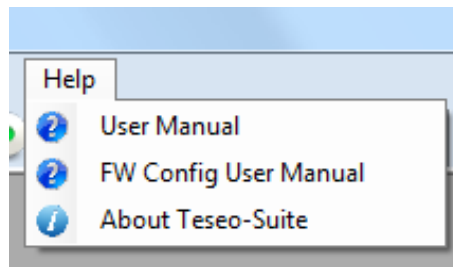


Figure 16: Help menu entries

User manual	Open the Teseo-Suite user guide
FW Config User Manual	Open the FW config user manual
About Teseo-Suite	Open the Teseo-Suite information panel

7.2 Main Toolbar

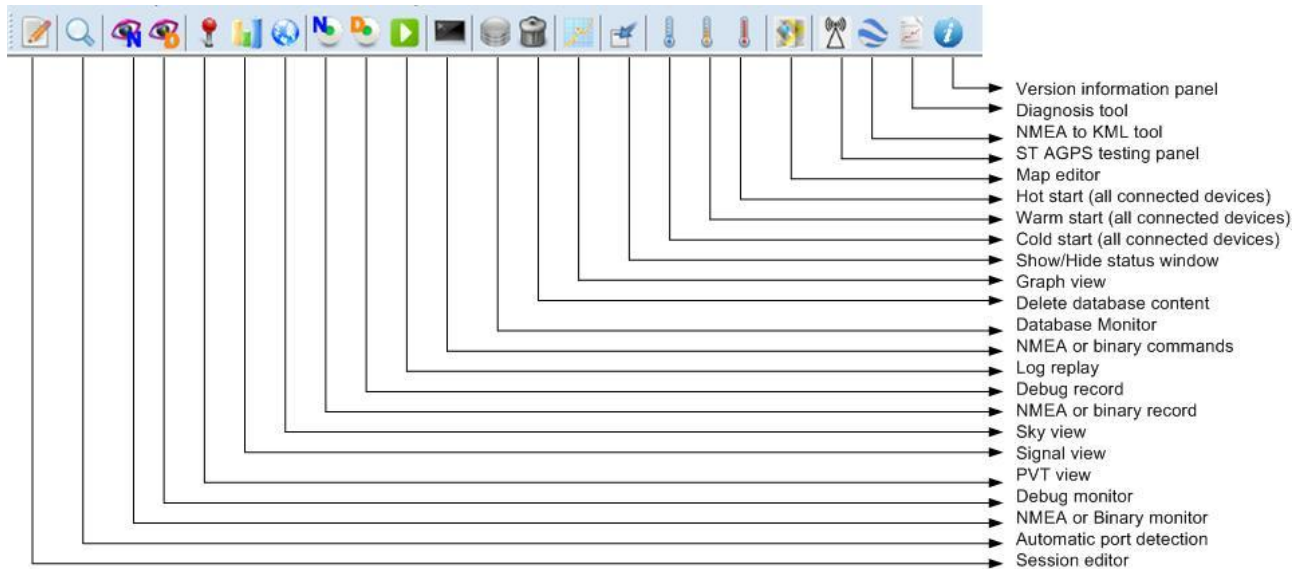


Figure 17: Main toolbar

7.3 Log file toolbar

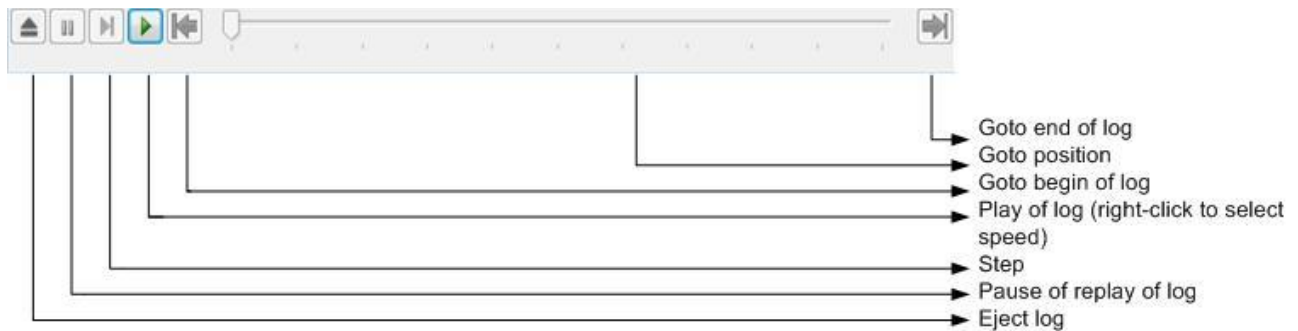

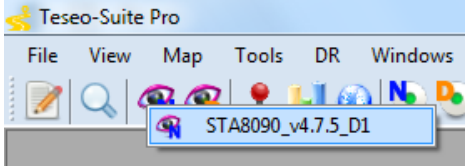


Figure 18: Log file toolbar

7.4 Views and windows

7.4.1 NMEA monitor

Control	Action	
	Mouse left-click	Mouse right-click
	Open a NMEA or Binary monitor for all the devices connected (according to the protocol selected in the device setup)	Open NMEA or Binary monitor for the selected connected device (according to the protocol selected in the device setup) as shown in figure below: 

The NMEA monitor is shown in the figure below:

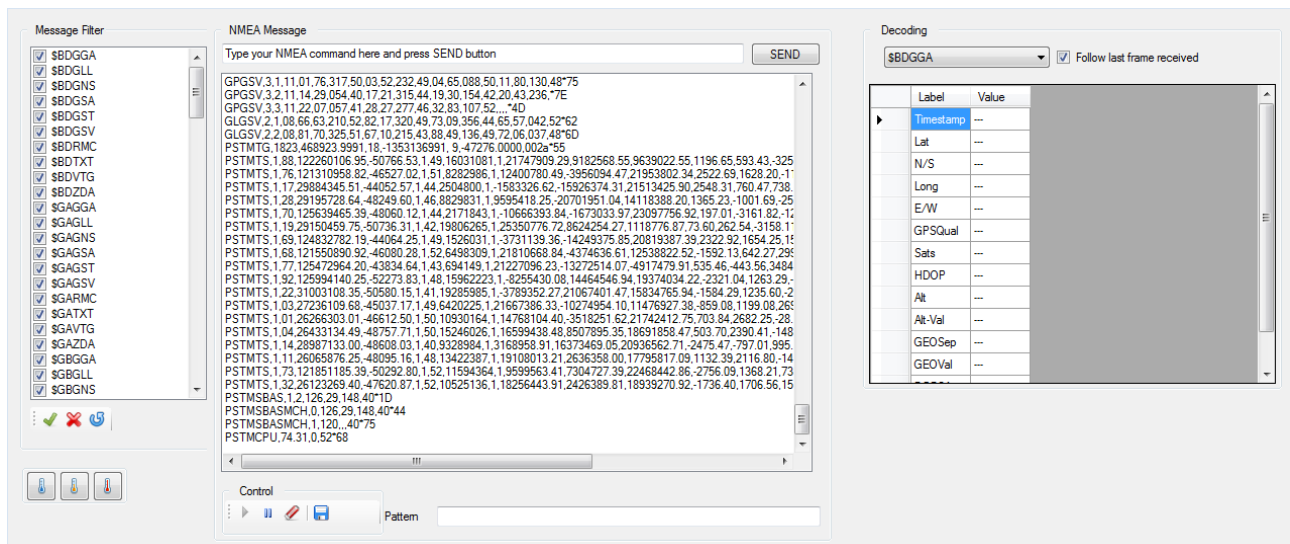


Figure 19: NMEA Monitor

This form gathers:

- A filter functionality on the left
- A message viewer in the middle
- A decoding panel on the right

- A send command line on top of the message viewer
- A pattern filter at the bottom
- A Cold start button
- A Warm start button
- A Hot start button

7.4.1.1 Filters

The message filter role is to select the messages to be displayed and stored in the buffer. By default all messages defined in the NMEA xml configuration file are selected and, though, displayed and saved in the buffer. If one or several messages are unchecked in the list, they won't be displayed nor saved anymore once the update is done. This feature can be useful to decrease the size of a log for instance.

Any changes in the list box must be validated by clicking on the update button to be taken into account by the application.

The figure below shows the controls associated to the filters:



Figure 20: Filter controls

From the left to the right:

1. Check all items
2. Uncheck all items
3. Apply changes in filter

The pattern filter at the bottom allows to show only the messages matching the pattern as shown in following figure:

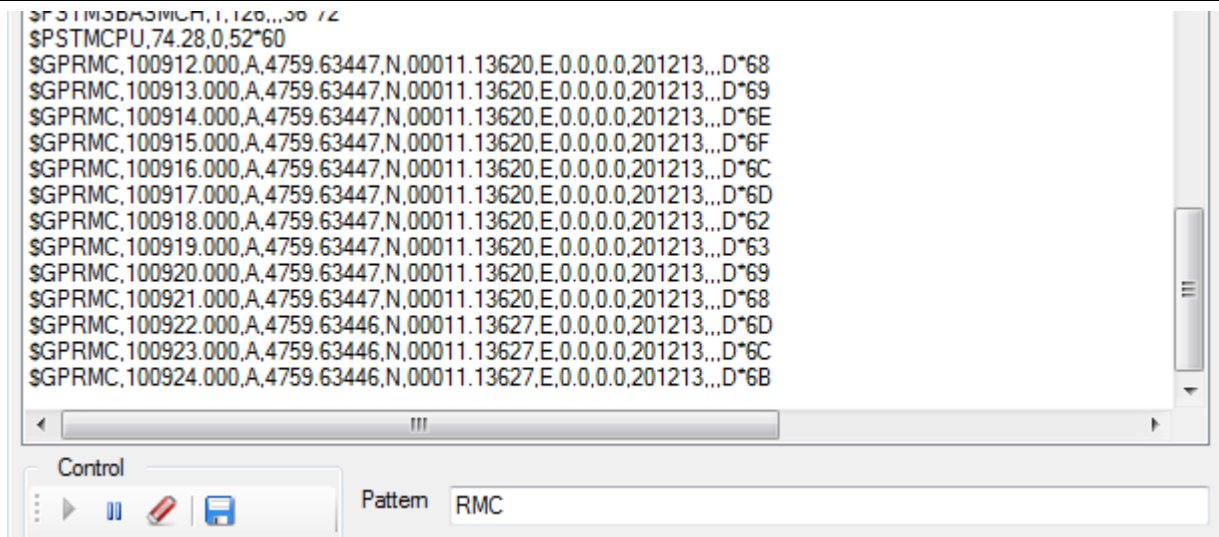


Figure 21: Pattern filter

7.4.1.2 NMEA message view

The NMEA message view displays all the messages that have not been filtered before.

Double-clicking on line will allow to decode the content of the message. If the “follow last frame received” feature was enabled in the decoding window, it is disabled.

The figure below shows the controls associated to the view:



Figure 22: View controls


From the left to the right:

1. Resume
2. Pause (suspend refresh of the message view)
3. Erase the content of message view
4. Save content of the NMEA monitor buffer

7.4.1.3 NMEA decode

This form decodes the NMEA messages received from the device. Through the combo box, it is possible to select the message to be decoded. The selectable messages are those defined in an xml file. The list box changes appearance, displaying the fields of the selected message.

7.4.2 Debug monitor

Control	Action	
	Mouse left-click	Mouse right-click
	Open Debug monitor for all the devices connected	Open Debug monitor for the selected connected device

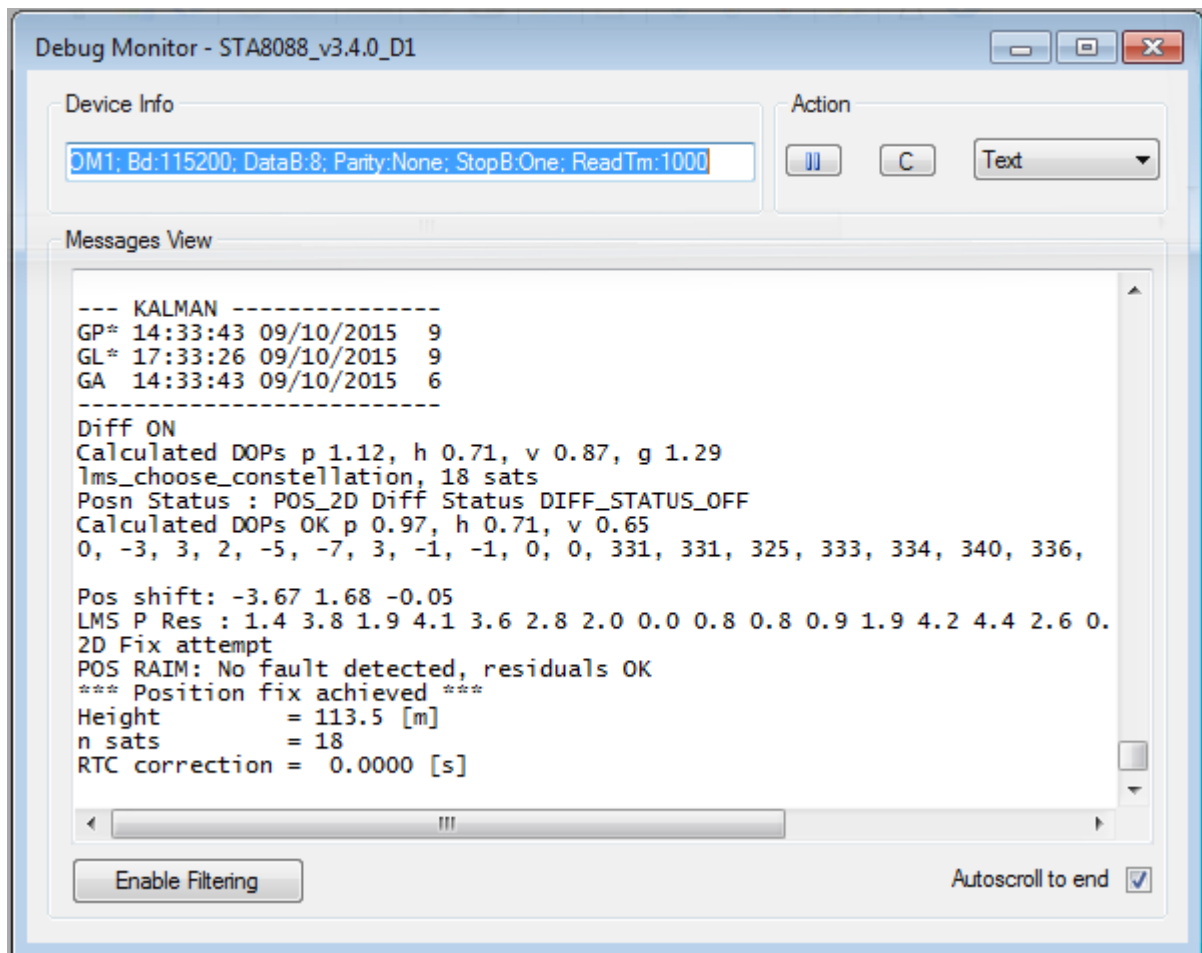


Figure 23: Debug Monitor

Debug monitor has the following features:

- 1: **Play / Pause:** stops the logging data on the monitor;
- 2: **Clear Data:** Clears the data displayed;
- 3: **Display data:** textual and hexadecimal format view.
- 4: **Filtering data:** Filter the debug trace

Figure 24: Action Debug Monitor

7.4.2.1 Filtering the debug trace

The Debug monitor allow you to filter the debug trace.

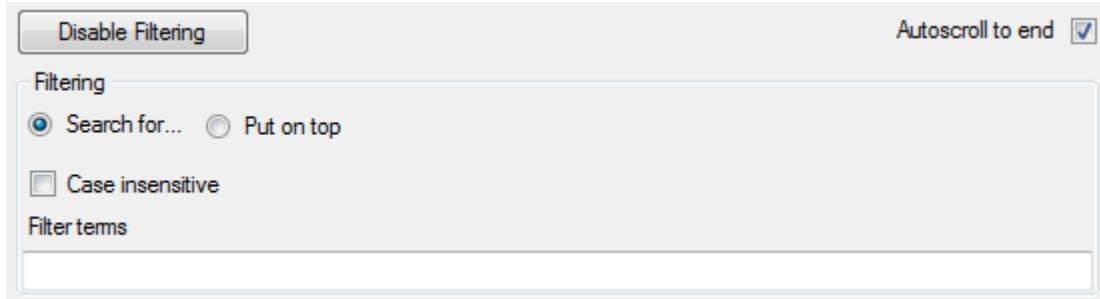



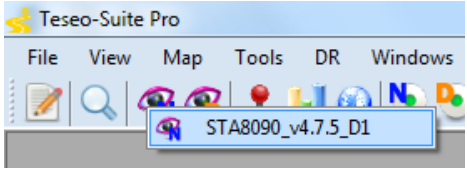
Figure 25: Filtering Panel

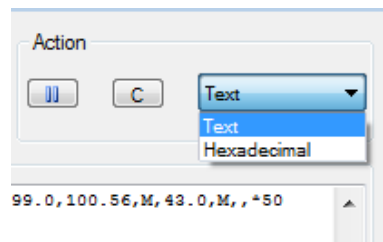
Two filtering mode are available:

- **Search for...** : allow you to only display line that contains your “filter terms”
- **Put on top** : will display at the top of the “Messages View” the last line that match you “Filter Terms”

You may also make the matching case insensitive by using the corresponding checkbox; and you can stop the auto-scrolling feature so you can concentrate on some data.

7.4.3 Binary monitor

Control	Action	
	Mouse left-click	Mouse right-click
	Open a NMEA or Binary monitor for all the devices connected (according to the protocol selected in the device setup)	Open NMEA or Binary monitor for the selected connected device (according to the protocol selected in the device setup) as shown in figure below: 



This form gathers:

- A filter functionality on the left (input message filter + view message filter)
- A message viewer in the middle
- A decoding and send message panels on the right
- A binary data display at the bottom
- A Cold start button
- A Warm start button
- A Hot start button

The selected device and used port com are shown at the bottom right of the monitor.

The binary monitor is shown below:

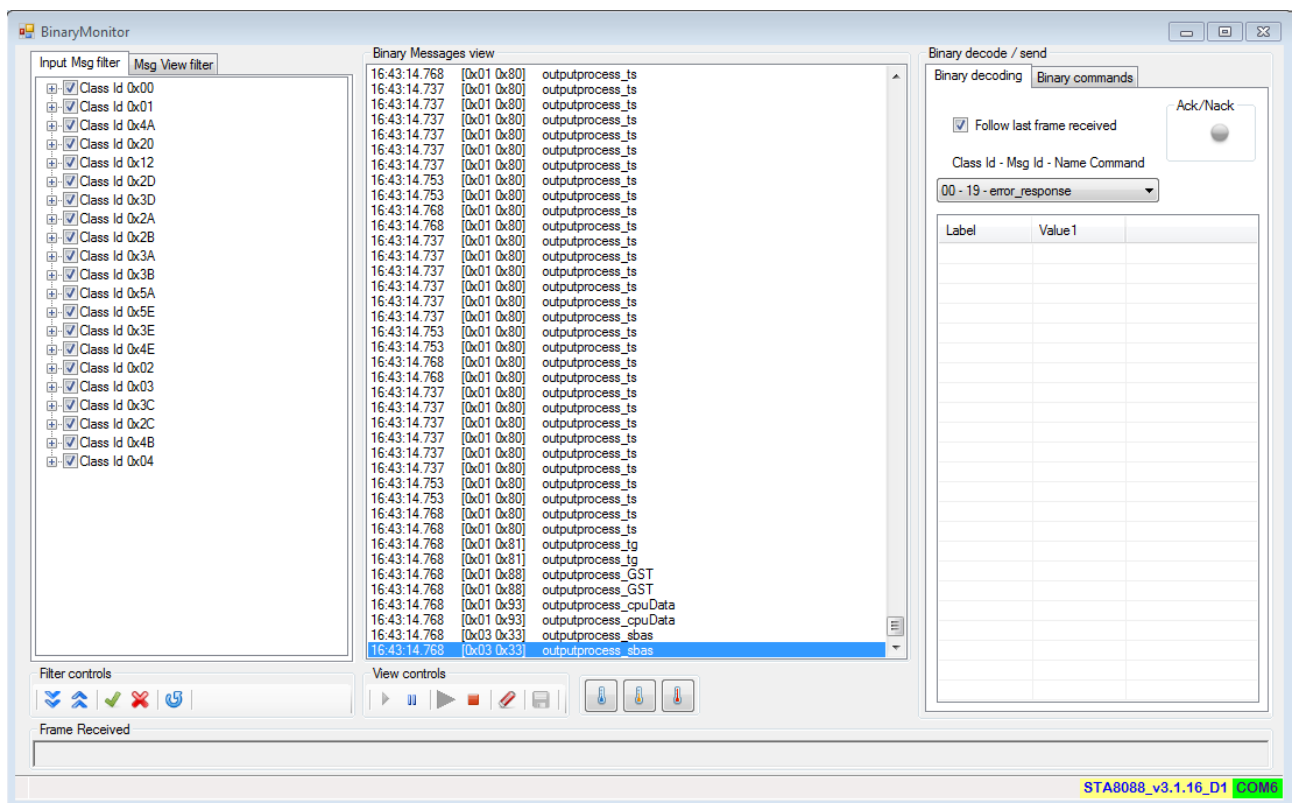


Figure 26: Binary Monitor

7.4.3.1 Filters

The input message filter role is to select the messages to be displayed and stored in the viewer buffer. By default all messages defined in the binary xml configuration file are selected and, though, displayed and saved in the buffer. If one or several messages are unchecked in the list, they won't be displayed nor saved anymore once the update is done. This feature can be useful to decrease the size of a log for instance.

The view message filter selects which messages are displayed in the view form. By default all messages defined in the binary xml configuration file are selected and displayed. This action is possible only when the stop button has been pressed before.

Any changes in the list box must be validated by clicking on the update button to be taken into account by the application.

The figure below shows the controls associated to the filters:

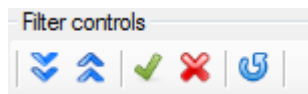


Figure 27: Filters controls

From the left to the right:

4. Expand the list of items
5. Collapse the list of items
6. Check all items
7. Uncheck all items
8. Apply changes in filter

7.4.3.2 Binary message view

The binary message view displays all the messages that have not been filtered before.

Display format is the following:

Class Id	Message Id	Message name
----------	------------	--------------

Double-clicking on line will allow to decode the content of the message. If the “follow last frame received” feature was enabled in the decoding window, it is disabled.

The figure below shows the controls associated to the view:

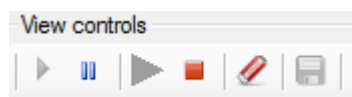


Figure 28: View controls

From the left to the right:

5. Resume
6. Pause (suspend refresh of the message view)
7. Start receive incoming messages (message history is cleared)
8. Stop receiving incoming messages (new incoming messages are lost)
9. Erase the content of message view (message history is lost in the binary monitor buffer)
10. Save content of the binary monitor buffer

7.4.3.3 Binary decode

This form decodes the binary message received from the device, in ASCII format (see figure 18).

A binary message is identified by a Class Id, Message Id and Command Name, as defined in an xml file. Through the combo box, it is possible to select the message to be decoded. The selectable messages are those defined in the xml file. The list box changes appearance, displaying the fields of selected message.

Label	Value1
iTOW	379714
RESERVED01	4294967295
RESERVED02	-1
year	2013
month	10
day	31
hour	9
minute	28
second	35
valid	7

Figure 29: Binary Decode

A led for the reception of Ack and Nack signals is placed in the form. The LED turns red on receiving a Nack signal, green on receiving an Ack signal (see figure below):

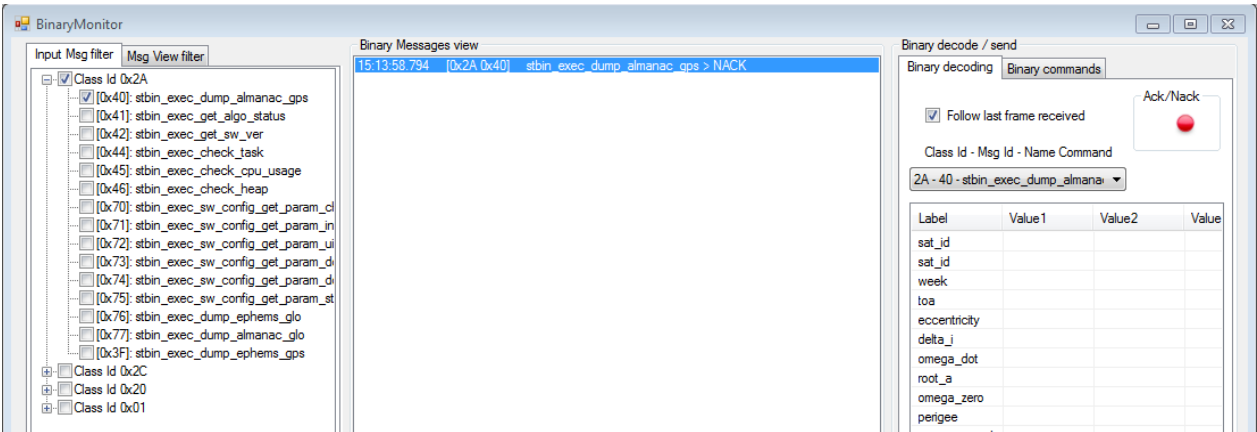


Figure 30: Binary decoding form – NACK received

If ticked, the “follow last frame received” feature (see next figure) decodes the last message (selected in the combo box) received and not filtered. This feature is automatically disabled by double-clicking in the message view.

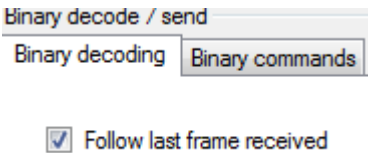



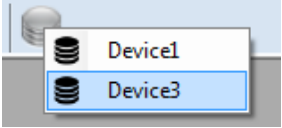
Figure 31: follow last frame feature

7.4.3.4 Binary commands

The functionality is similar to the standard binary command form described in section 7.6.2.

7.4.4 Database monitor

Through the button shown in the table below, it is possible to activate the "Database Monitor" form that shows the collection of data coming from the receiver whatever the protocol supported by the device.

Control	Action	
	Mouse left-click	Mouse right-click
	Open a database viewer for all the binary devices connected	Open a database viewer for the selected connected binary device as shown in figure below: 

Commands highlighted in bold in the command tree on the right are those that have been received. Click on bold command to open the dedicated tab page or select the tab page directly.

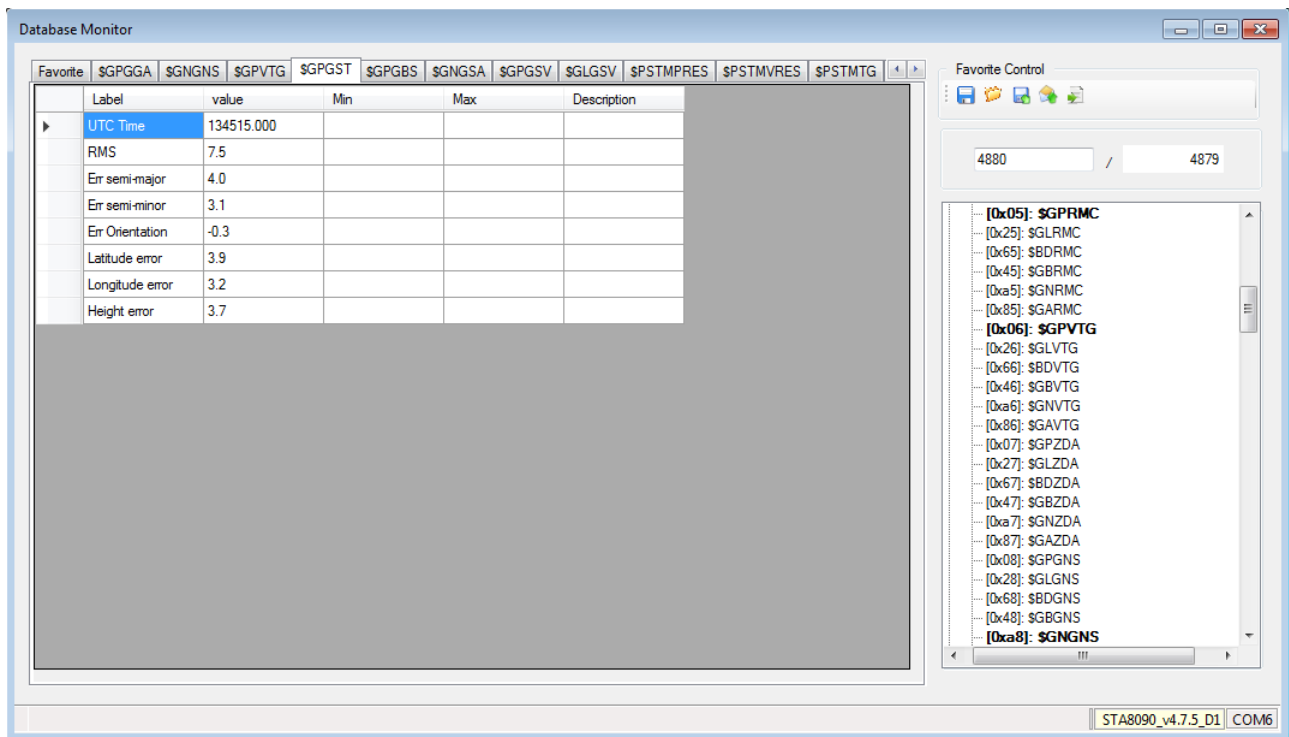
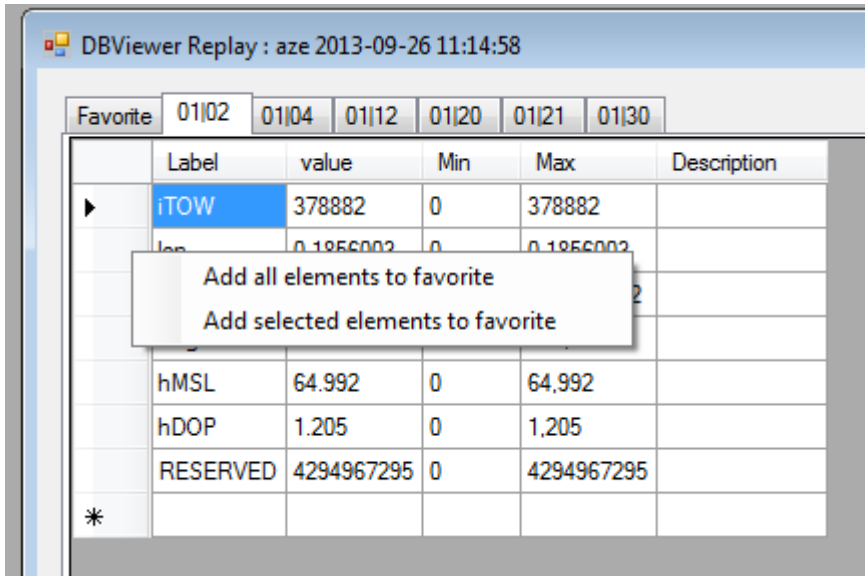


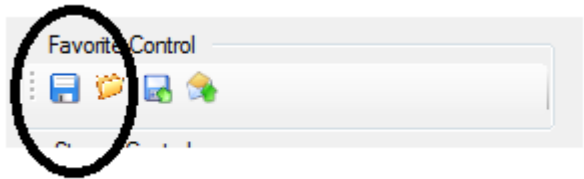
Figure 32: Database monitor

7.4.4.1 Favorite management

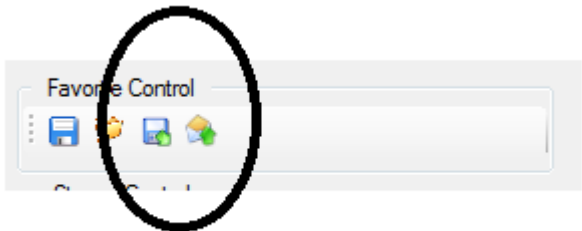
To select new favorite items, go on command page, click on right button, and select option. Select only dedicated lines, if whole parameters are not interesting.



To save and restore your configuration use first twins button in Favorite control panel:



To save and restore your configuration as default one, use the last twins buttons:


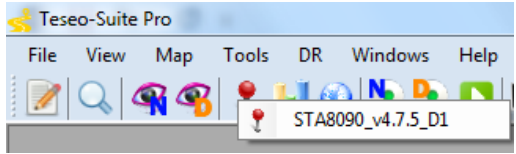


The default configuration is loaded at each DB Viewer form start-up. The configuration is not link to device or session.

is opened for all replay type. The title of panel and foot bar contain file name played. Stream control group box allows user to navigate into records.

7.4.5 Positioning

Through the button shown in the table, it is possible to activate the "View Positioning" form that shows some information about GPS positioning of device.

Control	Action	
	Mouse left-click	Mouse right-click
	Open a positioning form for all the devices connected (according to the protocol selected in the device setup)	Open a positioning form for the selected connected device (according to the protocol selected in the device setup) as shown in figure below: 

For a device running either with the NMEA protocol or the ST binary protocol, the form is fed by the database linked to the device.

PVT

Label	STA8090_v4.7.5_D1
Latitude	47°59.63294
North/South	N
Longitude	000°11.13508
East/West	E
Altitude	66.86 m
Geoid	47,5 m
Fix Mode	3D
TTFF	
Filter Mode	
Nb sats used	18
GPSQual	DGPS
Speed	0 km/h
Heading	0°
UTC Time	12:41:07
Day	
Month	
Year	
Week	1905
TOW	218483.9995
RTC Time	
RTC Date	
RTC Error	0
RTC ticks/s	0
PDOP	1
HDOP	0,6
VDOP	0,8

Reference Position

Ant Latitude
4759.63720__ N

Ant Longitude
00011.13624__ E

Height Ant
76.29

Set Reference Position

Save Reference Position

Coordinates Format

☒ MinDec

☐ Decimal degrees

Figure 33: PVT positioning form

Right-clicking in the binary device positioning form makes appearing a context menu to add or remove a device.

FormPVT

Label	Device1	Device2
Latitude	47.9938959	
Longitude	0.1855945	
North/South		
Est./West		
Altitude	116.195	
Fix Mode	255	
TTFF		
Filter Mode		
Speed	0.01 km/h	

Device1

Device2

Figure 34: Add/ remove device with context menu

7.4.5.1 Antenna reference position


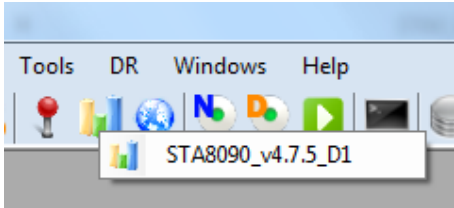
The right panel is used to set the lab antenna reference position according to user location. Some default coordinates are set during start up. This is up to the user to change those coordinates to fit with its current reference position. 2D and 3D position accuracy values are computed with this reference position.

To change your antenna reference position:



- Enter new coordinates (lat format = DDMM.mmmmmmm, lon format = DDDMM.mmmmmmm).
- Click on “Set reference position” button
- Click on “Save reference position” button to keep new coordinates in the user settings. The reference position will be restored at the next start up.

7.4.6 Signal Level

Through the button shown in figure, it is possible to activate the form "Signal Level View," that shows the signal level of satellites in view (flags with transparency), satellites used for fix (solid bar) and SBAS satellites (green bar).

Control	Action	
	Mouse left-click	Mouse right-click
	Open a signal level form for all the devices connected	Open a signal level form for the selected connected device as shown in figure below: 

An icon in the bottom of the form indicates which protocol is used by the device:

	ST binary protocol
	NMEA protocol

The CN0 level is indicated above each flag. Below are displayed information such as the PRN, the frequency band used by the satellite, the azimuth and the elevation of the satellite.

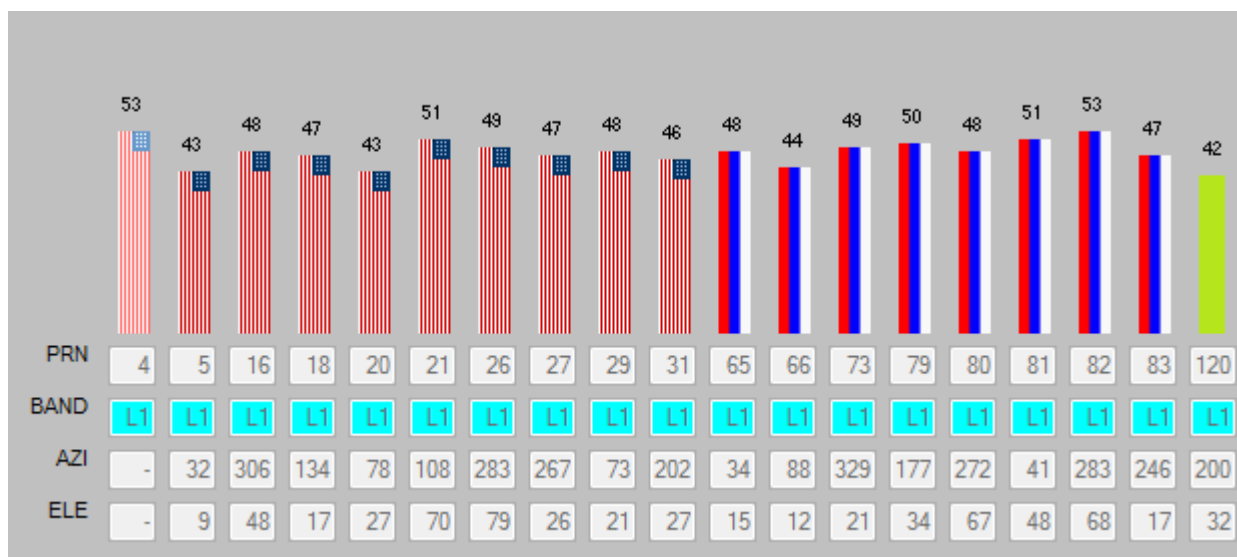


Figure 35: Signal Level form


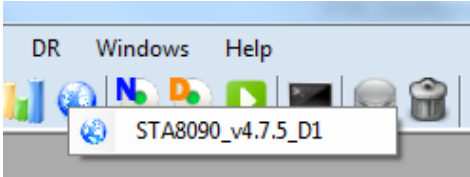
The supported frequencies bands are:

- L1(GPS L1, GLONASS L1, GALILEO E1, BEIDOU, SBAS)
- L2 (GPS L2C)
- L5 (GPS L5 and GALILEO E5a)



Right-clicking in the form makes appearing a context menu to add or remove a device.

7.4.7 Sky View

Through the button shown in the table below, it is possible to activate the "Sky View" form, that shows the current azimuth and elevation of satellites used for the fix.

Control	Action	
	Mouse left-click	Mouse right-click
	Open a sky view form for all the devices connected	Open a sky view form for the selected connected device as shown in figure below: 

An icon in the bottom of the form indicates which protocol is used by the device:

	ST binary protocol
	NMEA protocol

Right-clicking in the form makes appearing a context menu to add or remove a device.

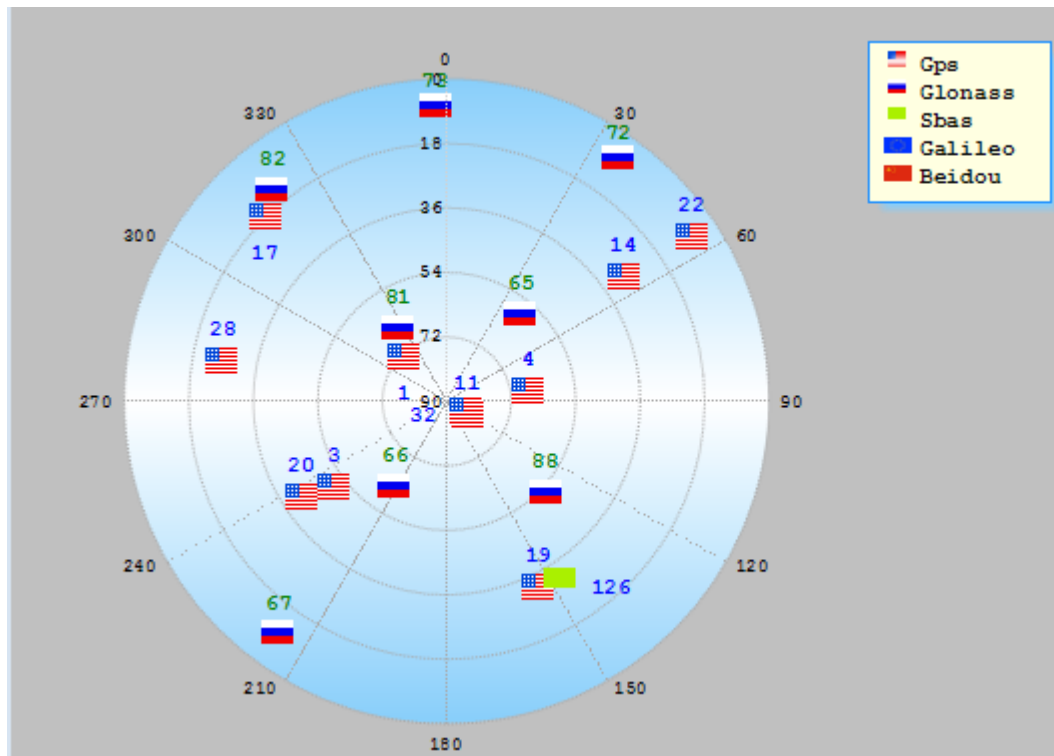



Figure 36: Sky View

7.4.8 Chart

Through the button shown in the table below, it is possible to activate the "Chart View" form that shows the collection of data coming from the GPS device in a chart. If several devices are connected, the corresponding series are stacked in the view.

Control	Action	
	Mouse left-click	Mouse right-click
	Open a chart view for all the devices connected	N.A.

The user can:

- Select the series to display (e.g. Latitude, Longitude etc ...) thanks to a pick list
- Select the chart type (either line either points)
- Show the major axis grid
- Change the X axis and Y axis scales
- Clear the data history for all the series
- Copy the graphic to the clipboard

The data are indexed on the X axis. The X axis value doesn't correspond to a database index.

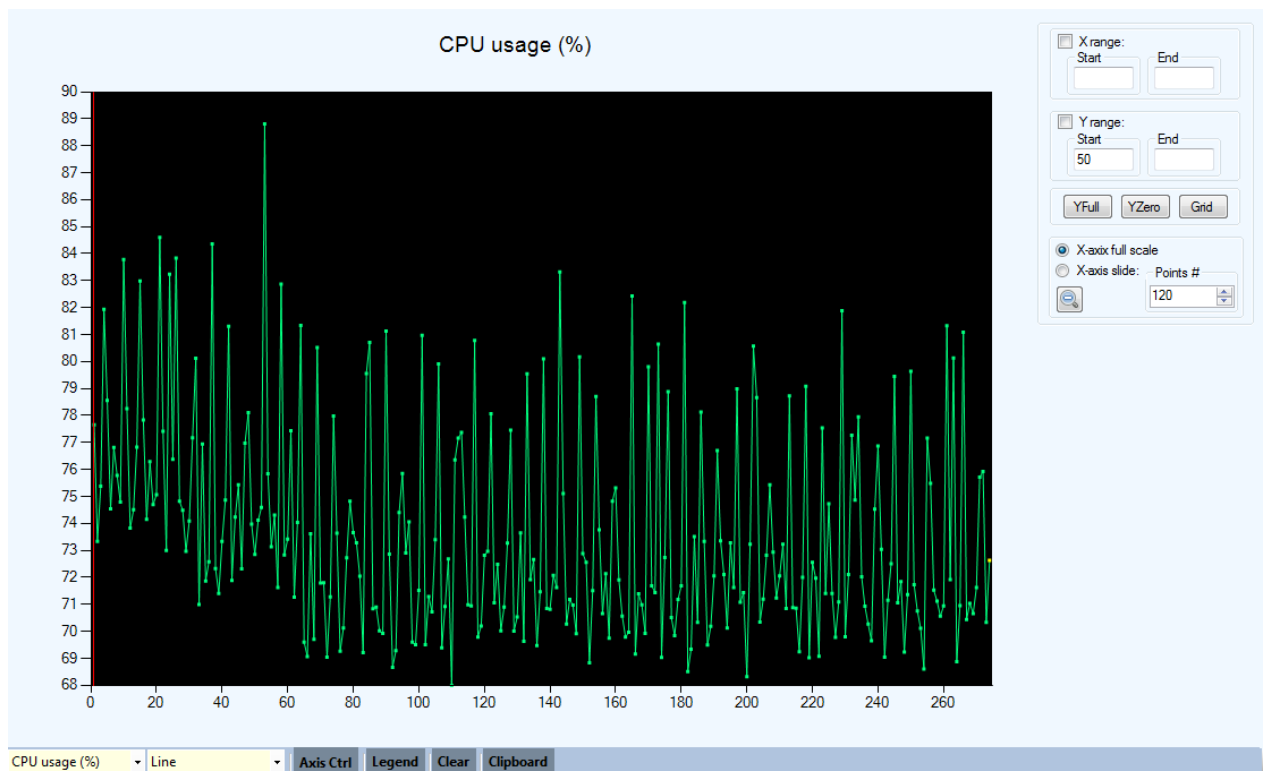


Figure 37: Chart View

All the serie's data is deleted when closing the chart view.

7.4.8.1 X-Axis control

The user can zoom in the graph area with the mouse. Depending on the number of zoom in which have been done, the full scale display can be retrieved by clicking several times on the zoom out button.

The panel offers also an option to enable a slicing window using a limited number of samples by ticking the radio button "X-axis slide". The number of samples can be modified thanks to the combo box. This option is interesting to limit the RAM usage during a long run.

The full scale display can be retrieved by ticking the radio button "X-axis full scale".

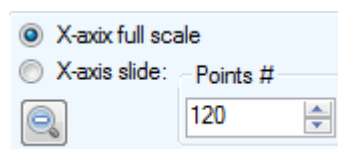


Figure 38: X-axis control

The following figure shows the slicing window usage with 120 samples:

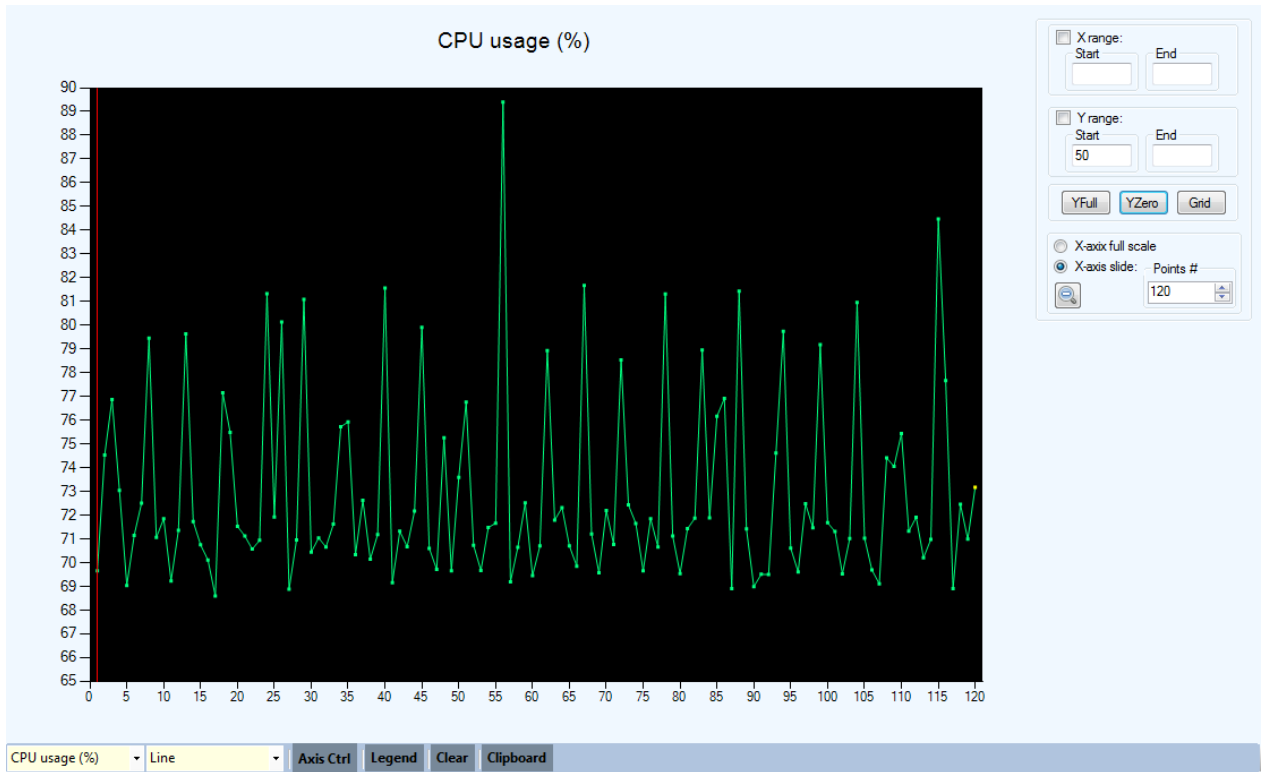


Figure 39: X-axis slicing window

7.4.8.2 X-axis range control

A specific range can be selected by ticking the “X range” check box and providing the start X value and the end X value. In the meantime, the chart continues to store the incoming samples. The full scale display can be retrieved by deselecting the checkbox.

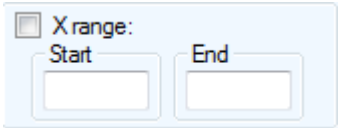


Figure 40: X-axis range

7.4.8.3 Y-axis control

A specific range can be selected by ticking the “Y range” check box and providing the start Y value and the end Y value. The full scale display can be retrieved by deselecting the checkbox.

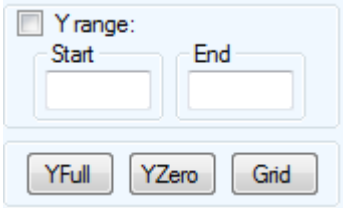


Figure 41: Y-axis range

The following figure shows the Y-axis range usage starting from 50:

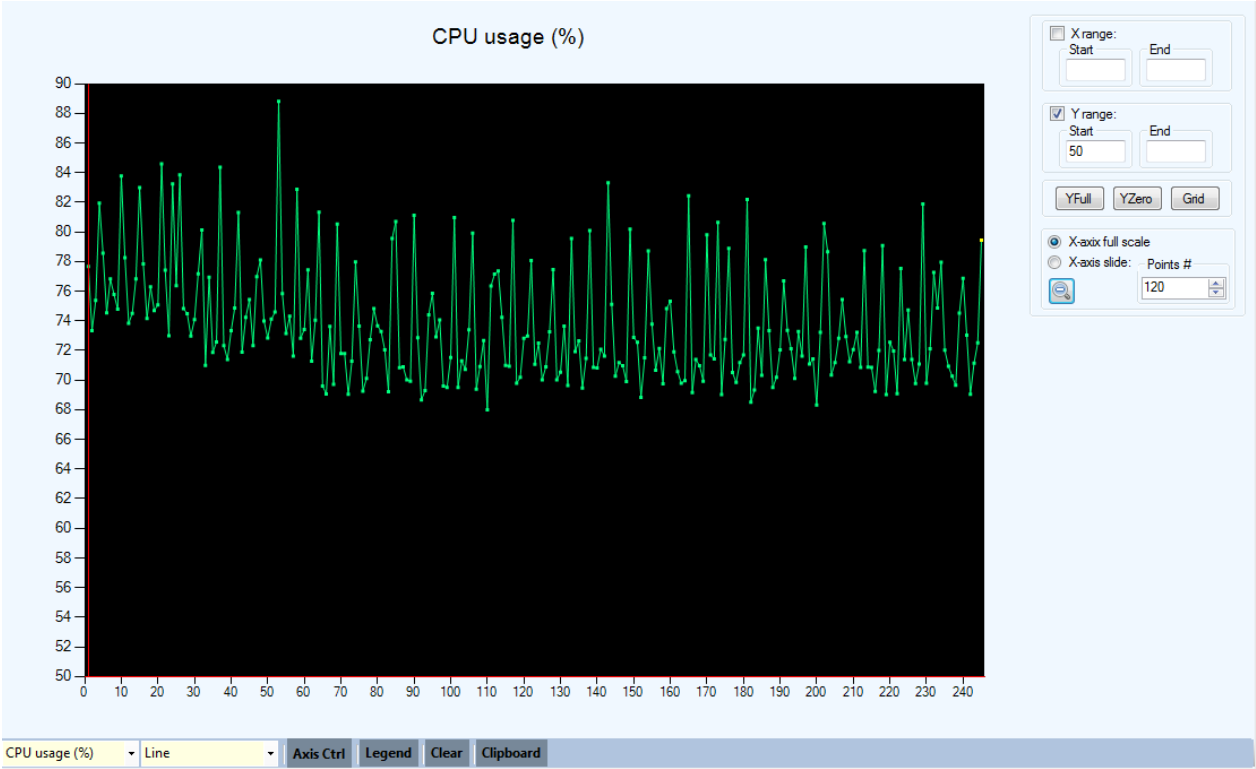


Figure 42: Y-axis range starting from 50

The “YFull” button can be used to retrieve a full scale display based on the current Y min and Y max values when switching from a parameter to another one.

The “YZero” button can be used to show the graph with the Y axis starting at zero or not. The following figure shows the result of the action:

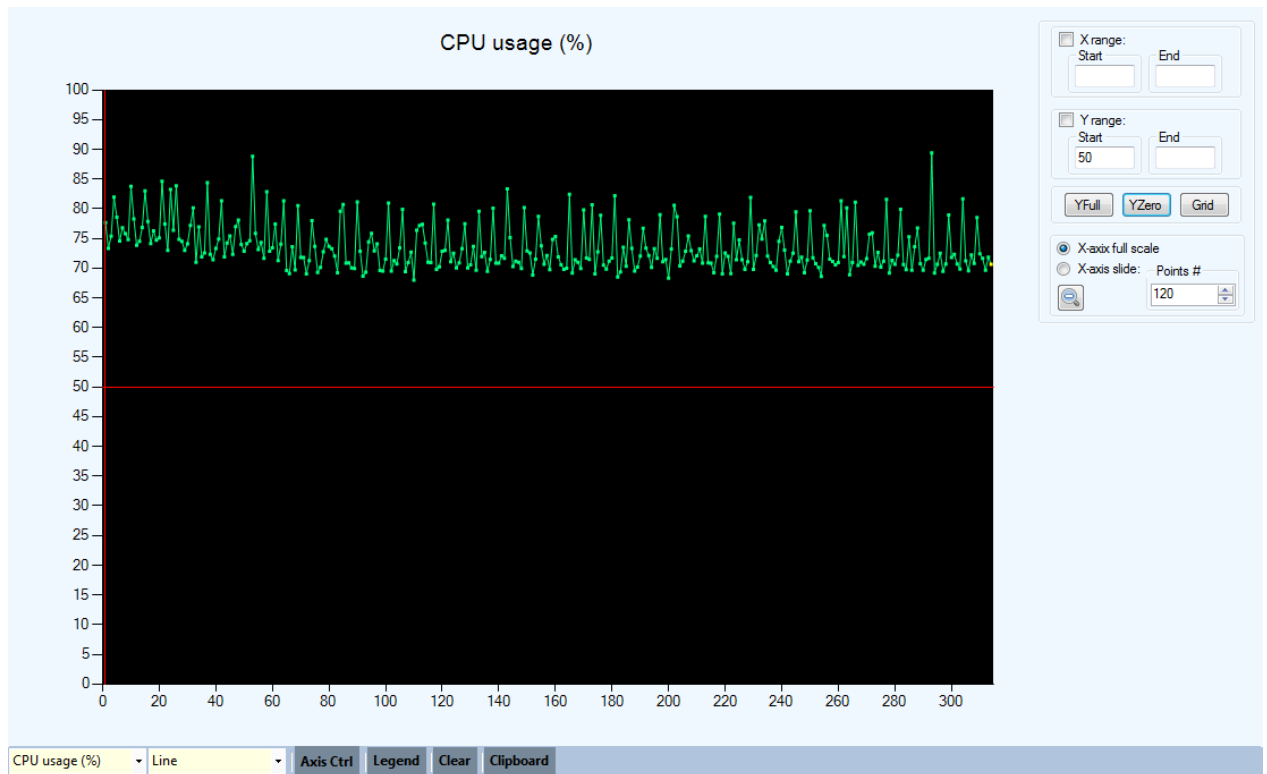


Figure 43: Y axis starting from 0

The “Grid” button shows or hide the major axis grid.


7.4.8.4 Panel foot bar

The panel foot bar gathers several controls:

- a pick list to select the parameter to monitor
- a pick list to choose the graph type (either lines either points)
- an “Axis Ctrl” button to show or hide the axis control panel on the right
- a “legend” button to show or hide the graph legend
- a “clear” button to delete all samples from the graph
- a “clipboard” button to copy the graph to the Windows’s clipboard

7.4.9 Map

Thanks to the button shown in the table below, it is possible to activate the "Map View" form that shows the current position of the device on map.

Control	Action	
	Mouse left-click	Mouse right-click
	Open a map view for the selected device	N.A.

If a fix is available for the selected device, a marker indicates the current position on the map. Otherwise the default map is the map of the city of Paris, France.

If the device is moving, the marker is automatically centered each time it is going to go out of the map boundaries. The user can disable this feature in the settings:

- Right-click > Select the “View settings” menu > Disable the “Auto Follows” option

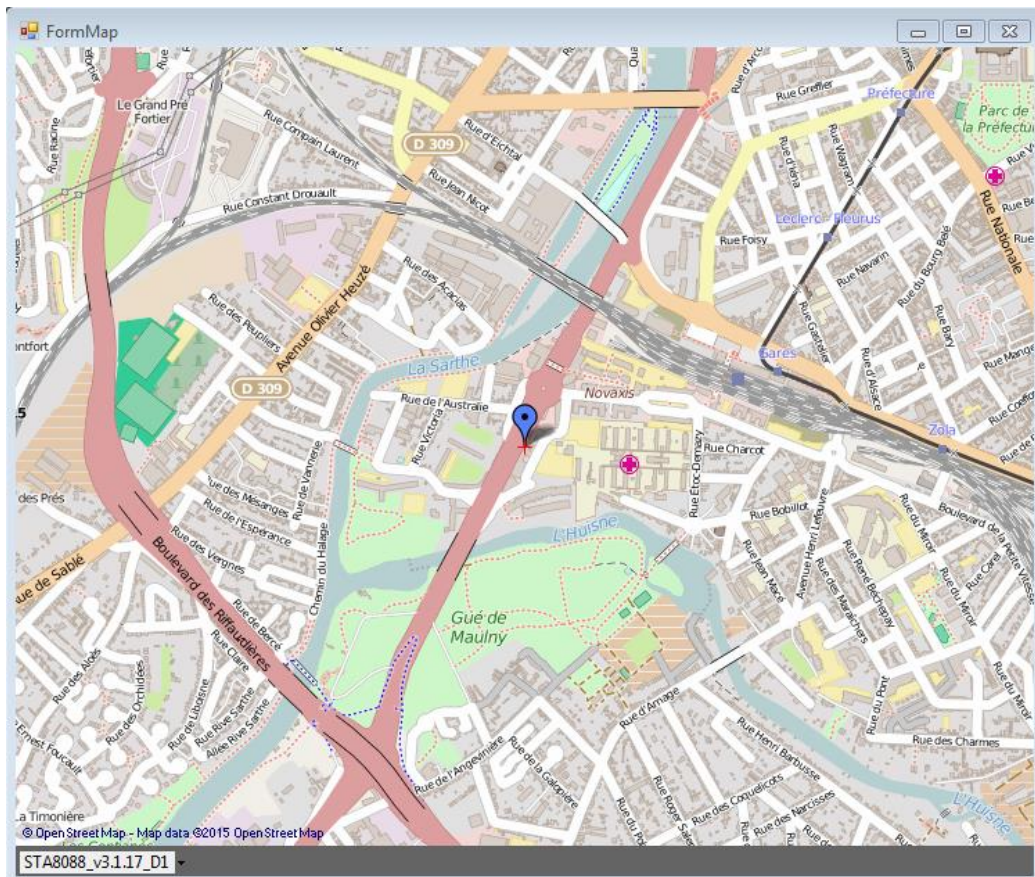


Figure 44: Map view

The user can also switch in between a map view and a satellite view by selecting the “satellite” option in the “View settings” menu.

The user may also display the Dead Reckoning positions. To enable the DR positions check the “Plot DR” checkbox in the Map Settings.

7.4.10 Dead Reckoning panel

The DR main panel allows to monitor the main DR parameters.

The panel reports the following information:

- GNSS Info (type of fix, number of satellites used for the fix, number of no fix, CN0 min and max.). The “no fix” event is triggered when there is no fix information during more than 1.2 s.
- GNSS/DR errors values (from \$PSTMDRDEBUG)
- DR calibration status (from \$PSTMDRCAL)
- DR mode and rate (from \$STMDRTYPE and \$STMDRSTEP)
- DR direction (reverse or forward)

The panel offers two areas of graphics. These areas share a common X-axis by design. Two pick lists allow user to select the parameter to monitor.

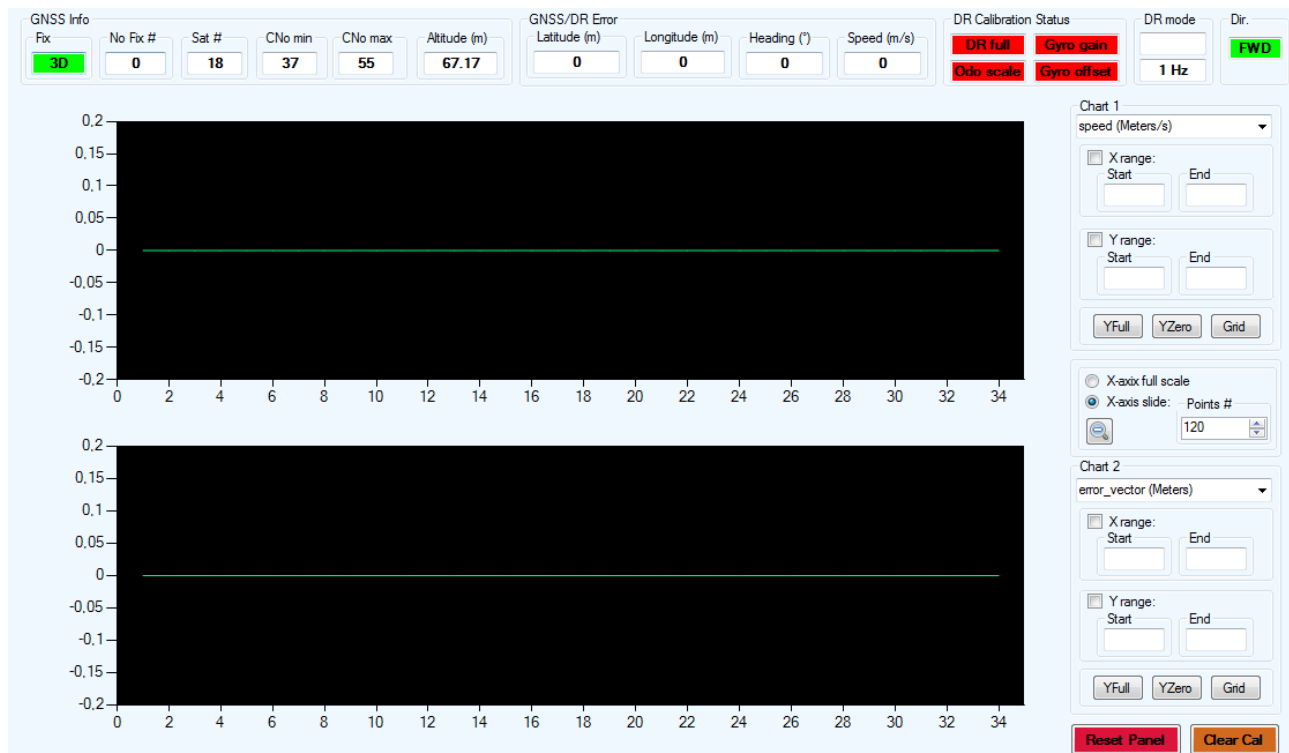


Figure 45: Main DR panel

By default, the chart stores all the values once the panel is opened. All these values are lost once the panel is closed.

It is possible to select another device thanks to the pick list at the bottom right of the panel.

A reset button is available to clear all the graphs and text boxes.

7.4.10.1 Common X-Axis control

If the user zooms in one of two areas of graph with the mouse, the zoom applies in both areas. Depending on the number of zoom in which have been done, the full scale display can be retrieved by clicking several times on the zoom out button.

The panel offers also an option to enable a slicing window (in the two graph areas) using a limited number of samples by ticking the radio button “X-axis slide”. The number of samples can be modified thanks to the combo box. This option is interesting to limit the RAM usage during a long run.

The full scale display can be retrieved by ticking the radio button “X-axis full scale”.

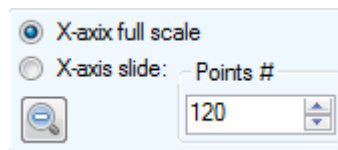


Figure 46: Common X-axis control

7.4.10.2 X-axis range control

A specific range can be selected by ticking the “X range” check box and providing the start X value and the end X value. It doesn't affect the second graphic area. In the meantime, the chart continues to store the incoming samples. The full scale display can be retrieved by deselecting the checkbox.

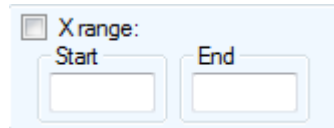


Figure 47: X-axis range

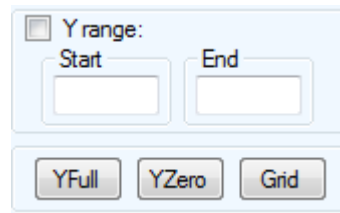
7.4.10.3 Y-axis control

A specific range can be selected by ticking the “Y range” check box and providing the start Y value and the end Y value. It doesn't affect the second graphic area. The full scale display can be retrieved by deselecting the checkbox.

The “YFull” button can be used to retrieve a full scale display based on the current Y min and Y max values when switching from a parameter to another one.

The “YZero” button can be used to show the graph with the Y axis starting at zero or not.

The “Grid” button shows or hide the major axis grid.



A light blue dialog box for configuring the Y-axis range. It features a checkbox labeled "Y range:" at the top left. Below the checkbox are two input fields: "Start" on the left and "End" on the right. At the bottom of the dialog, there are three buttons: "YFull", "YZero", and "Grid".

Figure 48: Y-axis range

7.4.11 ST-AGPS Testing

7.4.11.1 Testing panel

This panel makes available the commands used for testing the STAGPS™ performance in different working scenarios. It supports commands to enable/disable usage of real or predicted ephemeris, to enable/disable real ephemeris update or to upload real ephemeris into the device.

The panel also displays the predicted ephemeris ages for the GPS and GLONASS constellations if the \$PSTMAGPS and \$PSTMAGLO messages are reported by the receiver.

The STAGPS functionality must be enabled first in the firmware configuration.

The user can select one of the 3 modes:

- Autonomous AGNSS (to transfer real ephemeris data to the device)
- Predictive AGPS (to download predicted ephemeris from RXN)
- Real time AGNSS (not available yet)

Depending on the mode selected, the user must open first the corresponding configuration tab to enter the configuration to be tested.

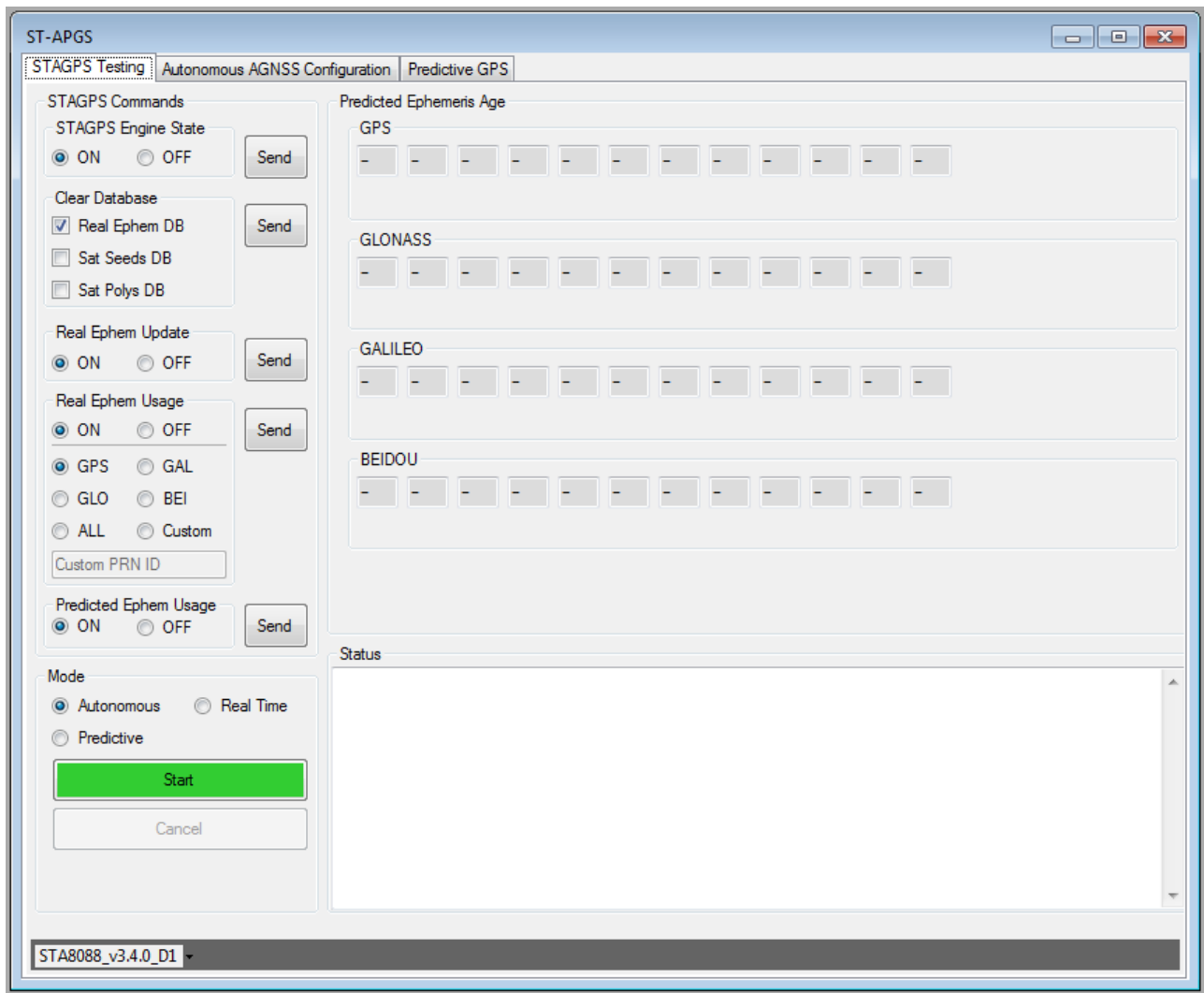


Figure 49: ST-AGPS testing panel

7.4.11.2 Autonomous AGNSS configuration panel

The user can choose to use either a GPS or GLONASS RINEX ephemeris file downloaded from the CDDIS ftp server either a RINEX file already saved on the computer. In both cases, the user must give the path to save or read the RINEX files on the computer.

Only RINEX V3 files are supported. They support GPS, Glonass, Galileo, QZS and Beidou constellations.

The starting directory for these files is <ftp://cddis.gsfc.nasa.gov/gnss/data/campaign/mgex/>

Append the following directory and file names to the starting directory:

- `daily/rinex3/YYYY/brdm/brdmDDD0.YYp.Z`

as described in the table below:

Code	Meaning
YYYY	4-digit year
YY	2-digit year
DDD	3-digit day of year
.Z	compressed Unix file

Pressing the start button in the testing panel will start an automatic sequence which extracts the ephemeris data from the RINEX file according to the constellation and the time chosen.

The ephemeris data is then sent to the device with some “\$PSTMINDBEPHEM” NMEA commands.

Before sending the data to the device, the application takes care of stopping the STAGPS engine and to clear all device’s databases. Once the data transferred, the application starts again the STAGPS engine unless stated otherwise from the user

If a proxy is used to access the internet, the user has to give his credentials to access the CDDIS ftp server.

The screenshot shows the 'Autonomous AGNSS Configuration' tab of the ST-APGS software. The interface includes the following elements:

- STAGPS Testing** (selected tab)
- Autonomous AGNSS Configuration** (active tab)
- Predictive GPS** (inactive tab)
- RINEX File Date**: A date picker showing 2015 / 10 / 08.
- Reset Command**: A dropdown menu set to 'none'.
- GNSS Ephemeris Time**: A section with radio buttons for GPS (selected), GAL, and GLO. Each has associated hour and minute spinners. GPS is set to 12:00, GAL to 12:00, and GLO to 12:15.
- Output**: Checkboxes for 'Transfer to device' and 'Restart ST-AGNSS engine' are both checked. A 'Retry Delay' spinner is set to 5.
- RINEX file**: Radio buttons for 'Use existing file' (selected) and 'Download file'.
- Rinex Files Directory**: A text field containing 'C:\' with 'Browse ...' and 'Save' buttons.
- Close**: A red button in the top right corner.

Figure 50: Autonomous AGNSS configuration panel

7.4.11.3 Predictive GPS configuration panel

The predictive GPS configuration panel allow the user to configure the testing process of the PGPS functionality.

The user can select a custom date and time, or use the current one. The constellation can also be selected. By default GPS and GLONASS are used.

The user must specify a folder to store Binary seeds and NMEA seeds (can be the same folder or distinct folders).

The user can choose to use existing seeds and avoid downloads from the internet; and may choose to only download and convert seed without sending it to the device.

When starting the PGPS procedure Teseo-Suite will first ask the device for a download password, then a binary seed will be downloaded from RXN servers. If the download was successful the seed will be converted to an NMEA script. Finally the NMEA script is parsed and the NMEA commands are sent to the device.

The screenshot shows the 'ST-APGS' application window with the 'Predictive GPS' tab selected. The window contains several configuration sections:

- Seed date:** Radio buttons for 'Current date' (selected) and 'Custom date'. A text field shows '09/10/2015'.
- Seed time:** Radio buttons for 'Current time' (selected) and 'Custom time'. A text field shows '17:12:52'.
- Constellation:** Checkboxes for 'Default' (checked), 'GPS' (checked), and 'GLONASS' (checked).
- Output:** Checkbox for 'Transfer to device' (checked). A 'Retry delay' spinner box is set to '5'.
- Seeds options:** Radio buttons for 'Use existing binary seed' and 'Download binary seed' (selected). A 'Configure Proxy' button is to the right.
- Binary Seed folder path:** A text field showing 'C:\' with a 'Browse...' button.
- NMEA Seed folder path:** A checked checkbox 'Use the same as binary seed folder' and a text field showing 'C:\' with a 'Browse' button.

Figure 51: Predictive GPS configuration panel

7.4.12 FW configuration

The Teseo-Suite FW configuration panel is built from an xml file describing all the parameters.

There is one FW configuration XML file coming with each official binary SW delivery. FW configuration XML files describing the binary SW configuration must be located in the Teseo-Suite installation directory (in the "FW_Settings" sub-directory).

It includes a SW binary image version that guarantees the consistency of the FW configuration xml vs the binary SW loaded on the device.

The following figure shows the FW configuration panel. It is split in 3 areas:

- A tree view on the left that allow to select the parameters. Parameters are sorted either by group either by family (according to the action button below).
- A panel showing the selected parameter's detail on the right
- Some action commands at the panel's footer

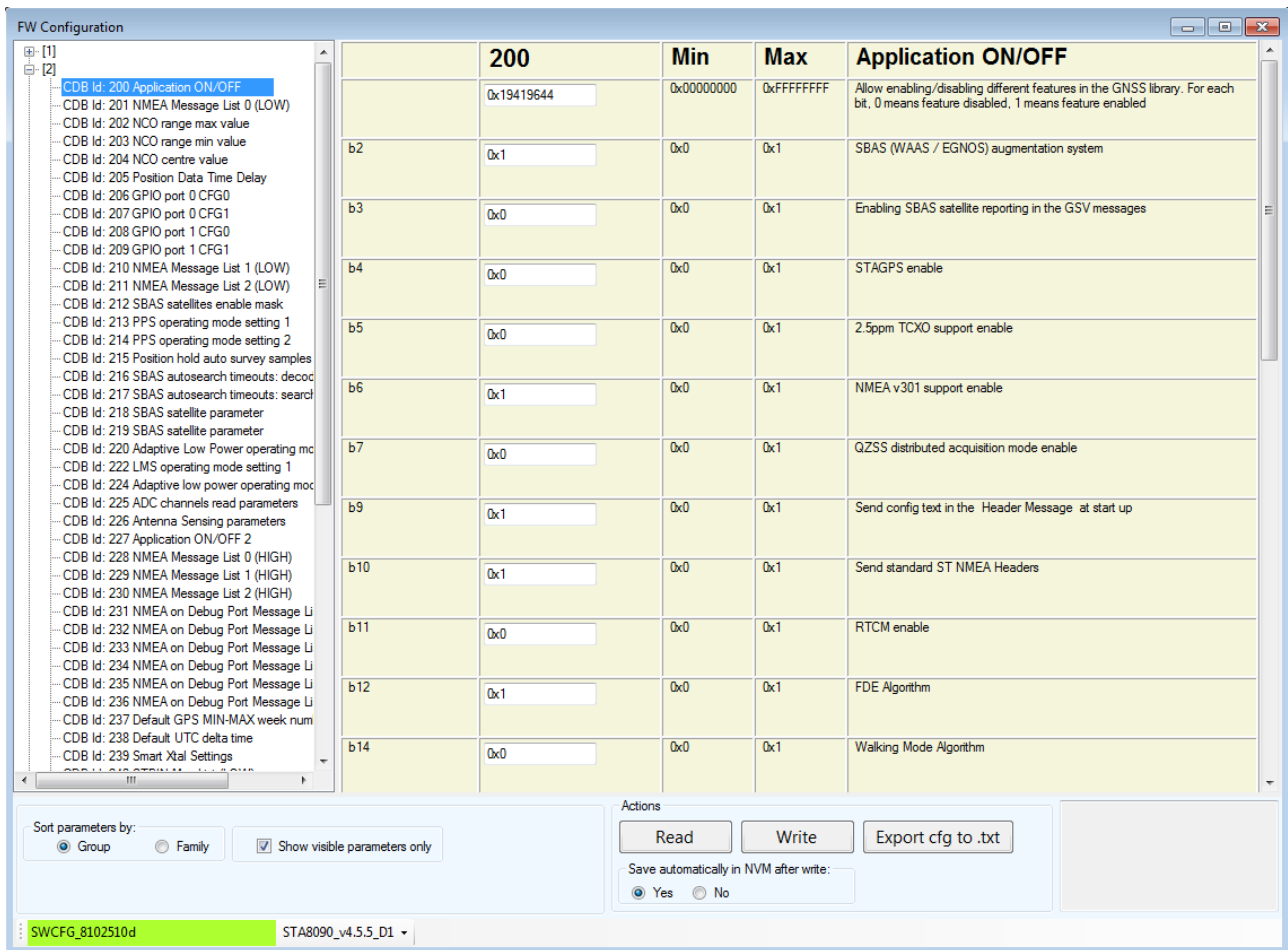


Figure 52: FW configuration panel





When launching the panel, a command is sent to the connected device to get the SW binary version used and the application looks for the corresponding FW configuration XML file on the computer (Teseo-Suite's installation directory).

If there is no corresponding XML file, the user is invited to provide the proper XML file (which is part of the binary SW delivery). The file given will be then stored on the computer for a further usage.

If the proper XML file is found or provided by the user, a command to read all the device data blocks is sent and the answer is decoded to fill in all the parameter's values. Then this is the current device configuration which is displayed when opening the panel

7.5 Recording/playing a log file

Teseo-Suite allows recording and playing log files. Use the main toolbar controls to start and stop logging data of control and debug ports:


Control	Action	
	Mouse left-click	Mouse right-click
	Start record of data coming from all connected control ports	Start record of data coming from the selected connected control port
	Stop record of data coming from all connected control ports	Stop record of data coming from the selected connected control port
	Start record of data coming from all connected debug ports	Start record of data coming from the selected connected debug port
	Stop record of data coming from all connected debug ports	Stop record of data coming from the selected connected debug port

Note that the log files will be created in the directory chosen through the "Preferences" form, accessible from the "File -> Preferences" Menu.

Use the player controls to record or playback a log file. Select the log file to be opened through the log file toolbar. The series of buttons in the player toolbar can be used to navigate through the log file. The records will be displayed on the navigation display window, in the same way that live GNSS data is displayed when using Teseo-Suite.

7.6 Sending commands

Through the button shown in the table below, it is possible to activate the "Binary Commands" and/or the "NMEA Commands" form.

Control	Action	
	Mouse left-click	Mouse right-click
	Open a binary command form	N.A.

The forms allow to broadcast a message to the connected devices. The message fields are edited in ASCII format according to the specifications in the file ConfigPayloadBinary.xml, and before sending the message is decoded in ST binary protocol.

7.6.1 NMEA Commands

This panel proposes a list of devices. Press the refresh button to see the latest list of NMEA devices. The commands are sent to the selected device only.

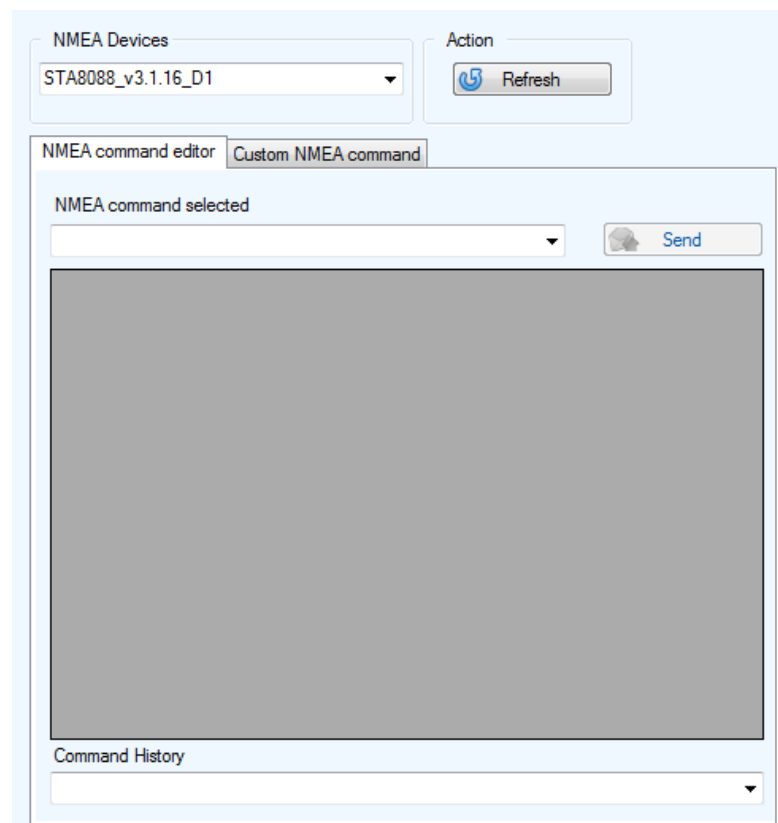


Figure 53: NMEA commands form

Two tabs are displayed:

1. The first one is a NMEA command editor based on a NMEA payload xml file (depending on the SW binary image version and the HW type).
2. The second one is a NMEA custom command editor. The user can send its own NMEA commands. This is convenient for development purpose.

7.6.1.1 NMEA command editor

The payload of the NMEA command selected is displayed in the frame below. The user must fill in the fields and click on the “Send” button to send the command to the selected device.

The command sent is saved in the history list and can be recall later on.

NMEA Devices: STA8088_v3.1.16_D1

Action: Refresh

NMEA command editor: Custom NMEA command

NMEA command selected: \$PSTMGESWVER

Send

	Label	Value	Description
▶	id		id Integer Depending on the value of the...

Command History

Figure 54: NMEA command editor

7.6.1.2 NMEA custom command editor

This panel allows to send some custom NMEA command to the selected device.

The command is written down by the user in the box highlighted in the figure red below.

Press “Add” to add the command to the list. The command can be inserted before any command selected in the list. The user can also replace a command in the list with the new one or remove a selected command from the list.

Pressing the “Send” button, all the commands in the list are sent with the defined delay in between.

A single command can be sent by selecting it then pressing the “Send selected” button.

The command list can be saved in a text file (press “Save as”) and reloaded (press “Load”).

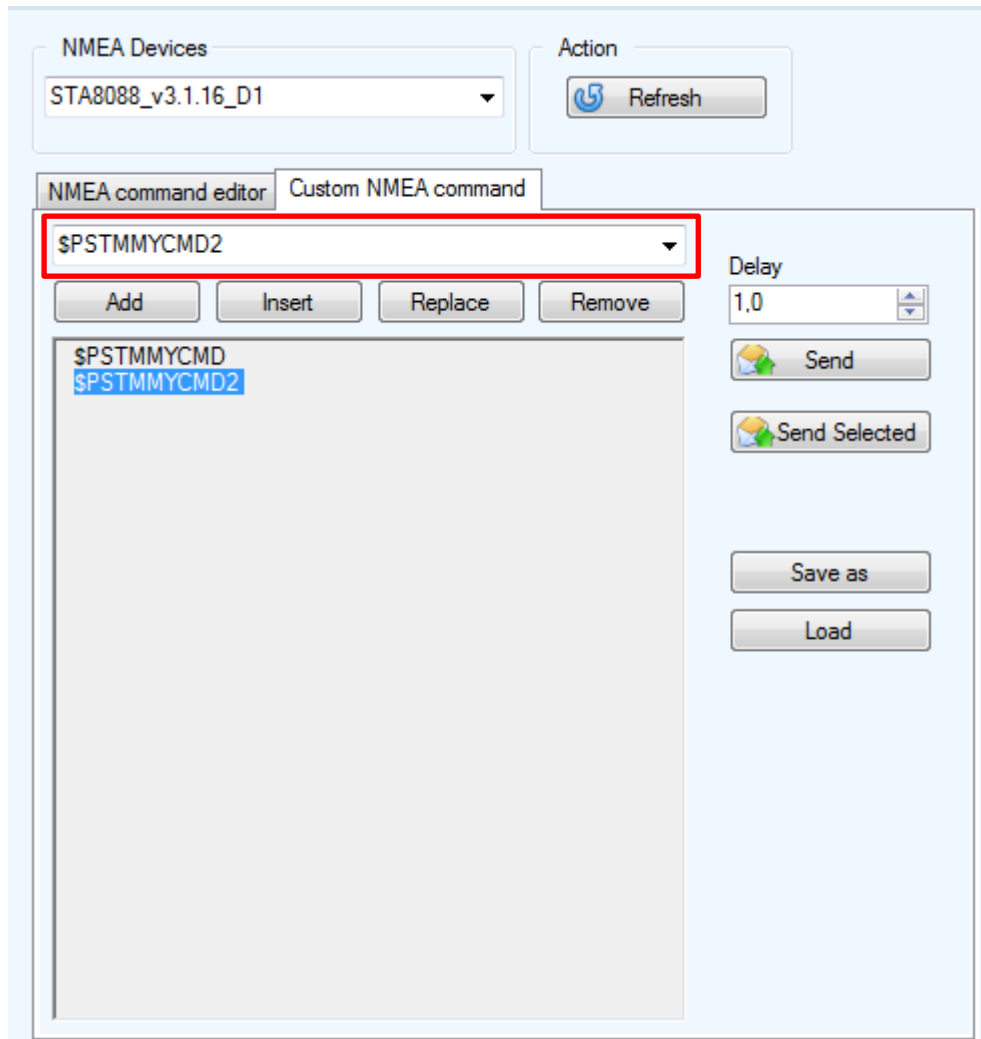


Figure 55: Custom NMEA command editor

7.6.2 Binary commands

Press the refresh button to see the latest list of binary devices.

Binary Commands

Device

☒ Device 1

Action

Refresh

Send

Edit/Send Command

Class Id - Msg Id - Name Command

2A - 40 - stbin_exec_dump_almanac_gps

	Label	Value
▶	Reserved	
	Sat_id_min	
	Sat_id_max	

Figure 56: Binary commands form

The message to send is chosen thanks to the combo box. The messages that can be sent are defined in an xml file.

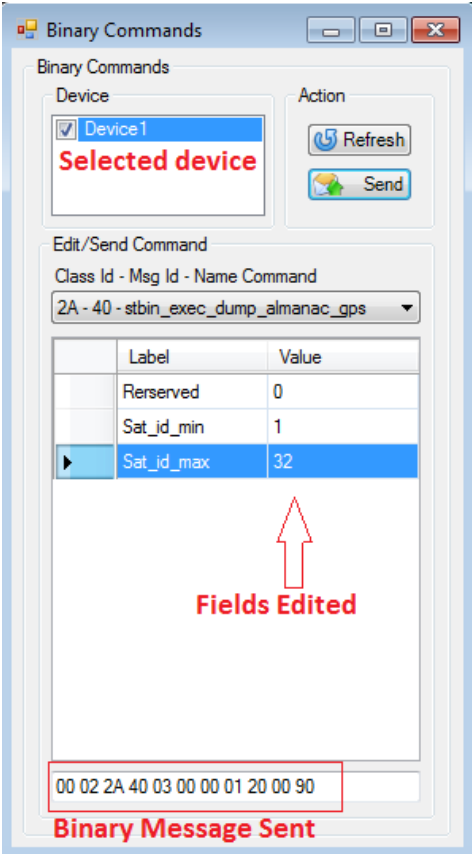


Figure 57: Binary Commands Details

8 Test Plan

The tool provides a test module, accessible from the "Tools - Test Plan" menu; through a scripting language, it is possible to write and execute tests on one or more devices connected.

8.1 Test Plan Form

The "Test Pan" form is divided into four panels, which are described below.

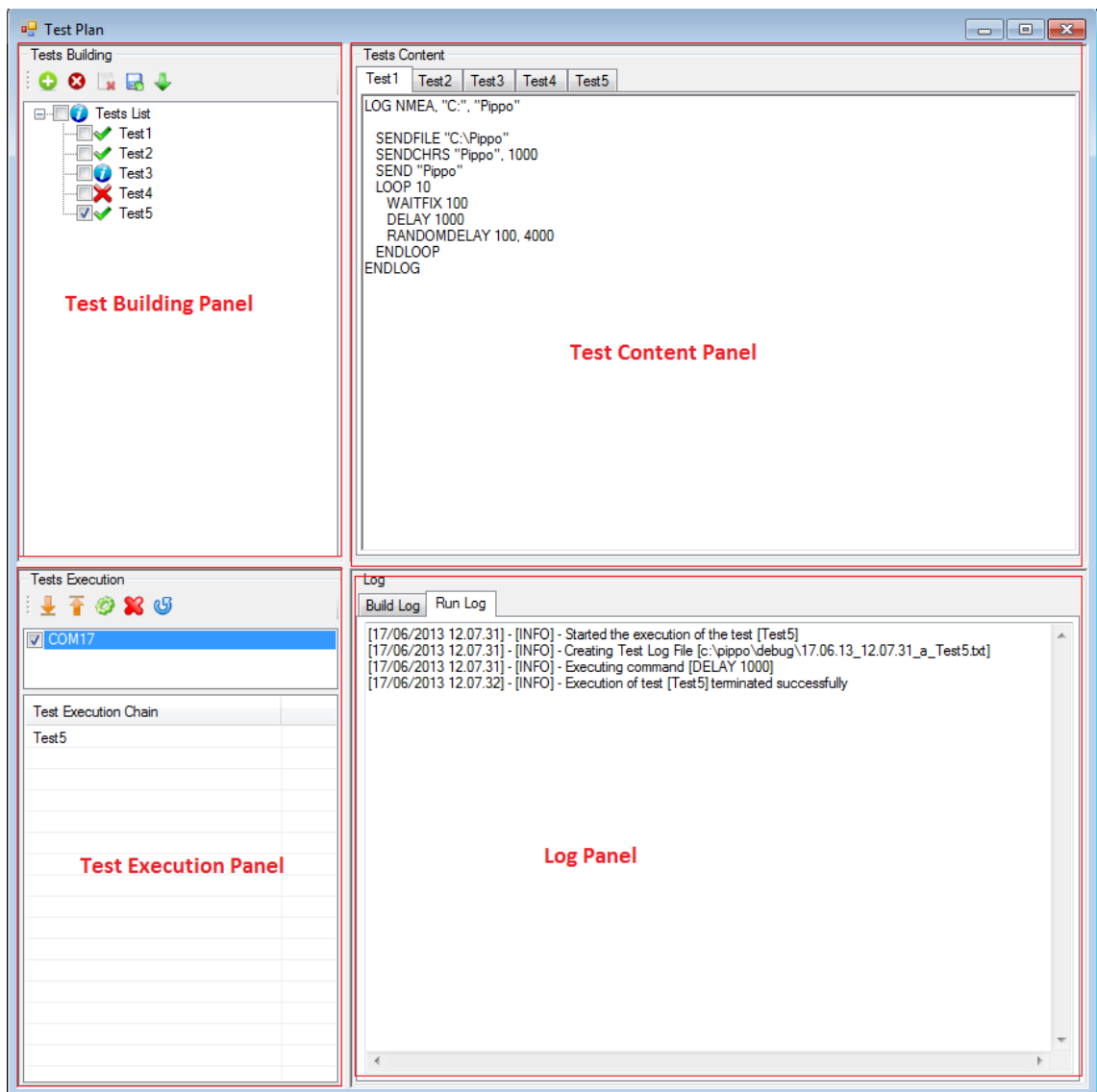


Figure 58: Test Plan Form

8.1.1 Tests Building Panel

This panel provides functionality for adding, removing, saving and compiling test:

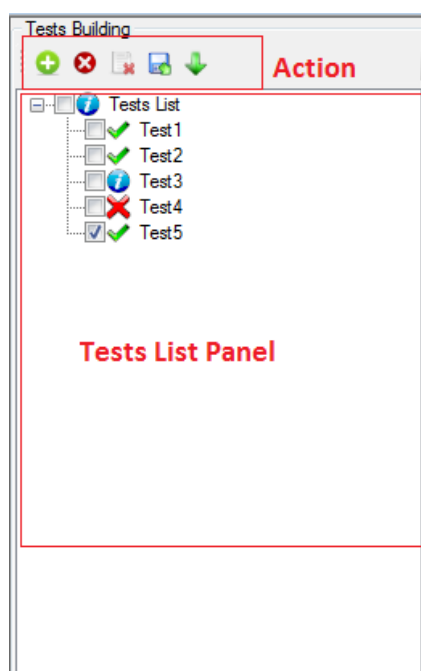


Figure 59: Tests Building Panel

	Add Test: adds a new test to be edited in “Tests List” Panel
	Remove Checked Test: Removes the checked tests in Tests List
	Close Checked Tab Test: Closes the tabs associated to the test checked, in Tests Content Panel.
	Save checked tests: saves the content of the tests checked.
	Compile checked tests: compiles the tests checked.
One click on Test in Tests List	Renames the test name
Double click on Test in Tests List	Opens the tab associated to the test, in Tests Content Panel

Figure 60: Actions in Tests Building Panel

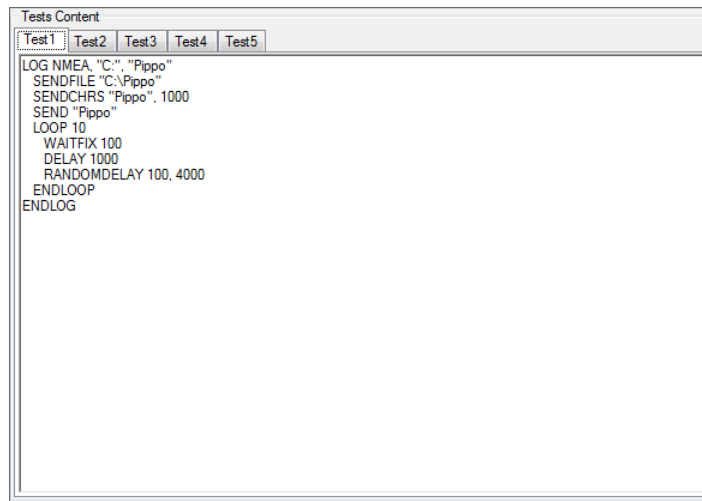
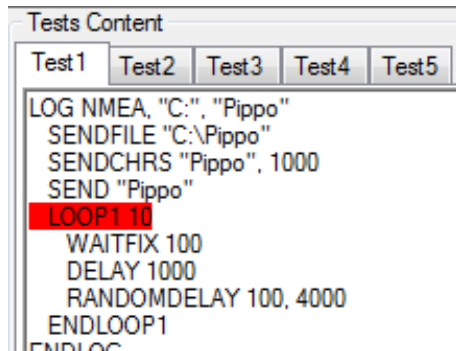
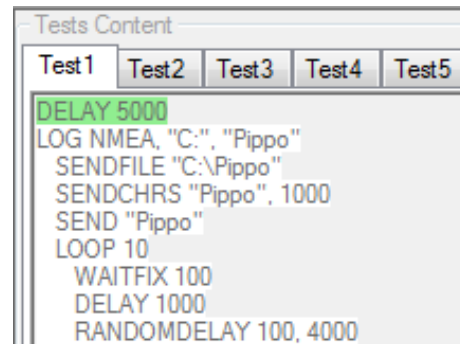
To compile a test, it must be saved before.

8.1.2 Tests Content Panel

It is the multi-tab editor, where to write the script associated with the test.

At compile time, if an error occurred, the incorrect line is highlighted in red.

At run time, the running current line is highlighted in green.

**Figure 61: Multi-tab Editor****Figure 62: Incorrect Line
(At compile Time)****Figure 63: Running current line
(At run time)**

8.1.3 Tests Execution Panel

This is the panel that exposes the functionalities for the tests execution.

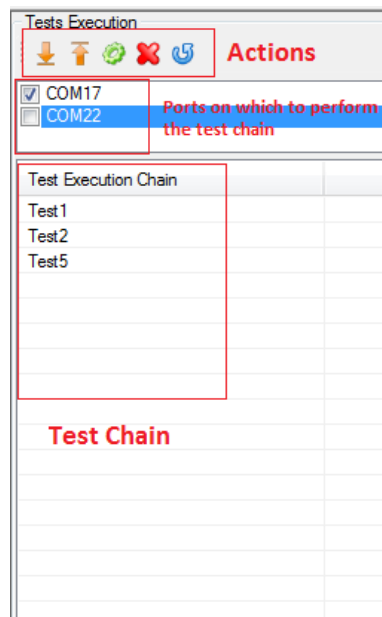


Figure 64: Tests Execution Panel






	Adds the tests checked and compiled in Tests Execution Chain
	Removes the selected test from the execution chain
	Runs the tests execution chain
	Stops the tests execution chain
	Refresh the Nmea com

Figure 65: Actions in Tests Execution Panel

The tests will be performed in parallel on the devices checked.

The test execution produces a test result file in the directory specified in the "Preferences" form.

8.1.4 Log panel

This panel contains the log information concerning the test module; this log is grouped into two tabs:

Build log: it contains information about the building and compiling of tests;

Run Log: it contains information about the execution of tests.

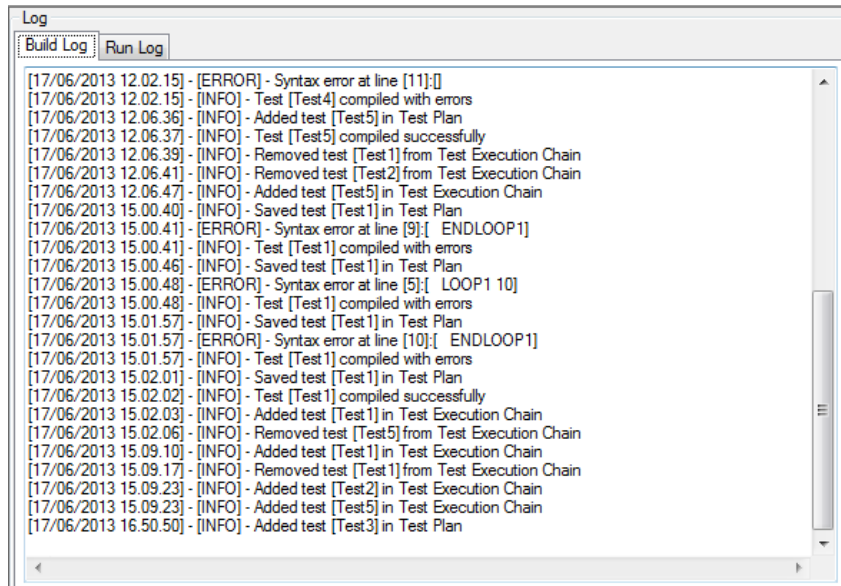


Figure 66: Log Panel: Build

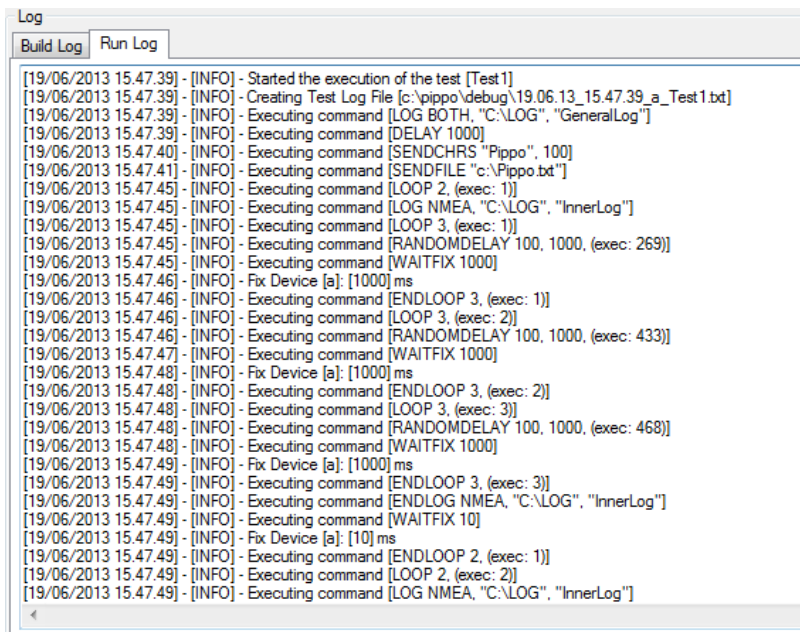


Figure 67: Log Panel: Run

8.2 Scripting language for writing tests

The scripting language used for writing test consists of the following constructs:

DELAY msDelay	Waits msDelay milliseconds.
RANDOMDELAY msDelayMin , msDelayMax	Waits for an interval between msDelayMin and msDelayMax milliseconds.
SEND "contentSend"	Sends to device the content (contentSend) of the ascii string.
SENDCHRS "contentSend", msDelay	Sends to device a sequence of characters, waiting msDelay millisecond for each character.
SENDFILE "absolutepathFile"	Sends to device the contents of the file with path absolutepathFile.
WAITFIX msFix	Waits the fix of device for msFix milliseconds. If fix is within msFix milliseconds, the fix time is recorded in the test log file. The test log file is created in directory chose through the "Preferences" Form
LOOP nCounter ... other construct ... ENDLOOP	Repeats the execution of the constructs in the loop for nCounter times. Nested loops are allowed.
LOG NMEA DEBUG BOTH, "absolutePath", "nameFileLog" ...	Records the contents of the NMEA or/and DEBUG por,t in the file with

<p>other construct</p> <p>...</p> <p>ENDLOG</p>	<p>“absolutePath “ absolute path and “nameFileLog “ name.</p> <p>absolutePath: If it does not exist, it is created.</p> <p>BOTH: If this option is choice, are automatically created two files, one for each port</p> <p>If this construct is inside nested loop constructs, the name of the log file will contain the current counters of Loop instruction.</p> <p>Nested LOG are allowed.</p>
--	--

```

LOG BOTH, "C:\LOG", "GeneralLog"
  DELAY 1000
  SENDCHRS "Pippo", 100
  SENDFILE "c:\Pippo.txt"
  LOOP 2
    LOG NMEA, "C:\LOG", "InnerLog"
    LOOP 3
      RANDOMDELAY 100,1000
      WAITFIX 1000
    ENDLOOP
  ENDLOG
  WAITFIX 10
ENDLOOP
SEND "Pippo"
RANDOMDELAY 100,1000
ENDLOG

```

Figure 68: Script File Example

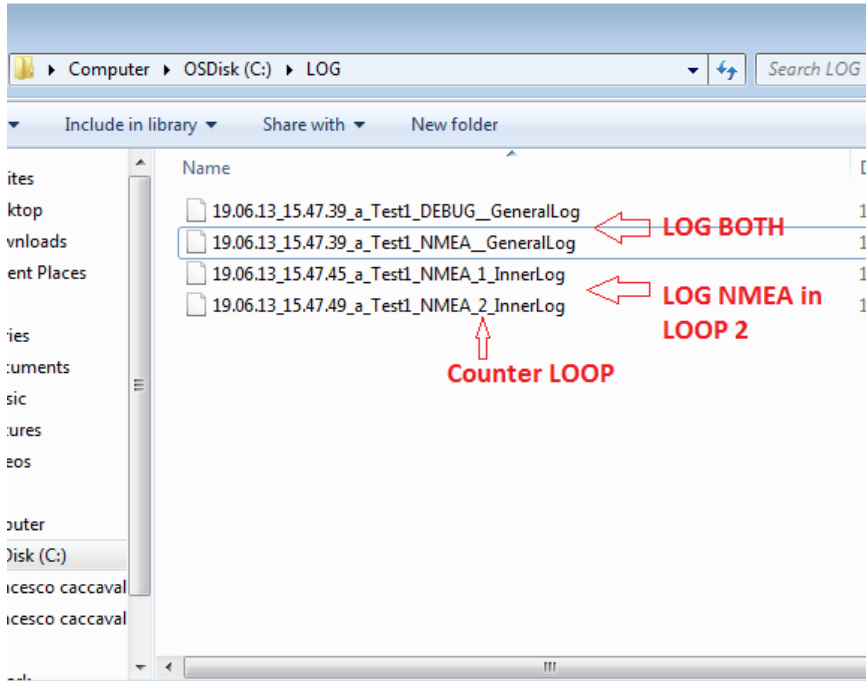


Figure 69: Log files generated

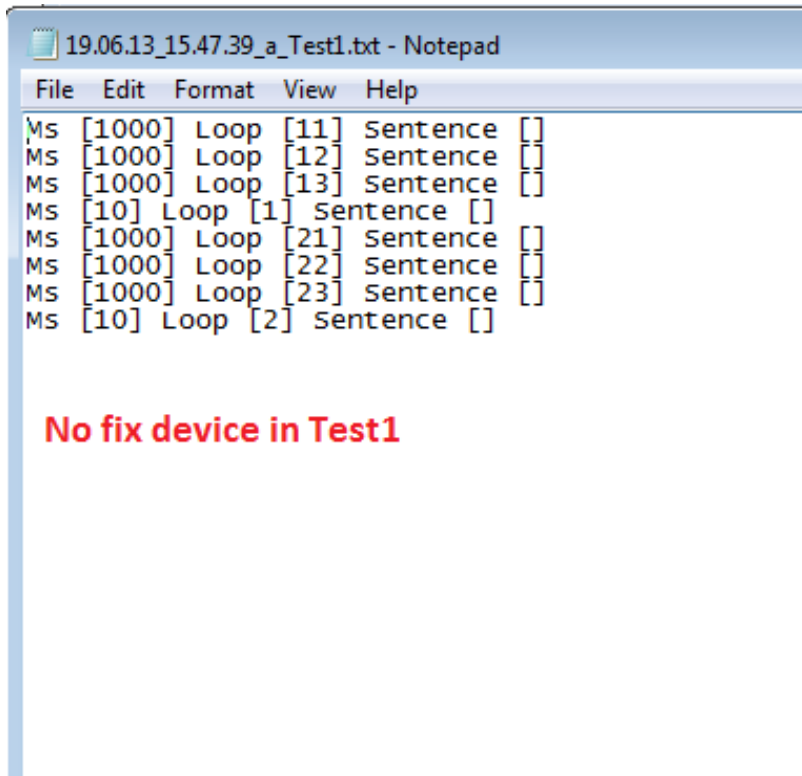


Figure 70: File Test Results

9 Configuration Files

The NMEA and ST Binary payload files are respectively located in the NMEA_Payload directory and in the STBIN_Payload directory in the Teseo-Suite installation directory.

It is strongly recommended to not modify them.

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