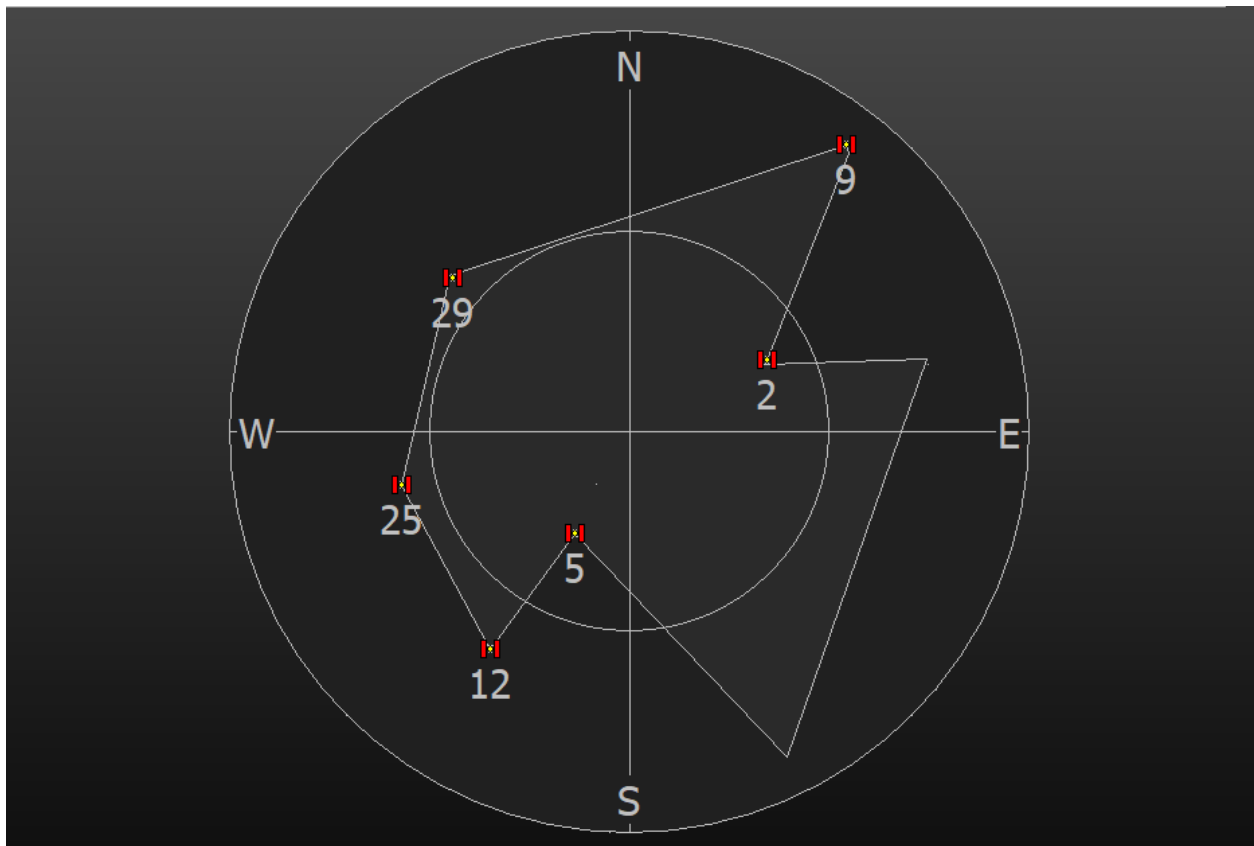




# GNSS Toolkit

## User and Installation Guide



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# 1 Revision History

Revision	Date	Comments
A	7/21/2020	Initial release

## 2 Warnings / Disclaimers

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## 4 Introduction

GNSS Toolkit is a Windows application for the evaluation, configuration, and control of a GNSS receiver over a serial connection. GNSS Toolkit provides a configuration interface for the uAvionix truFYX GNSS receiver and utilizes the truFYX NMEA data interface implementation, which is an adaptation of and extension to the NMEA 0183 Interface Standard.

## 5 Installation

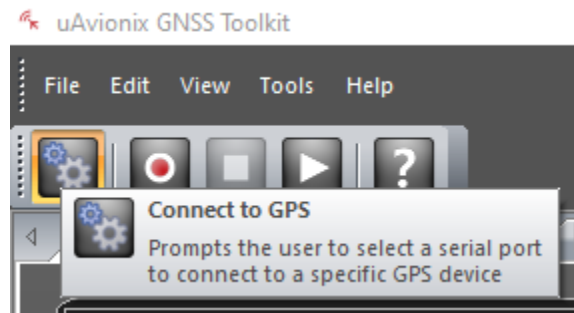
### 5.1 Downloading GNSSToolkit.exe

GNSS Toolkit can be downloaded free-of-charge from our website (<https://uavionix.com/support/>).

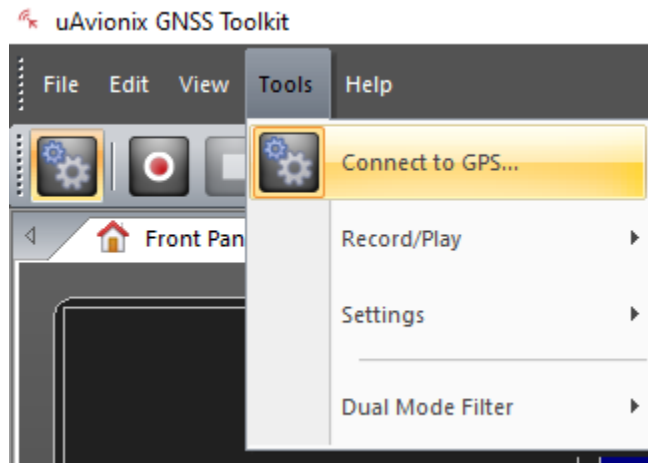
### 5.2 Connecting to a GNSS Receiver

GNSS Toolkit is compatible with GNSS Receivers communicating over a serial interface at a baud rate between 300 and 115200.

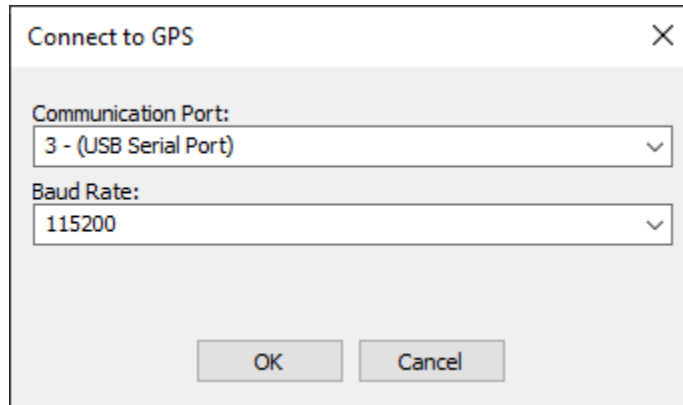
While a receiver is plugged in to the computer, press the toolbar button with the blue and grey cogs:



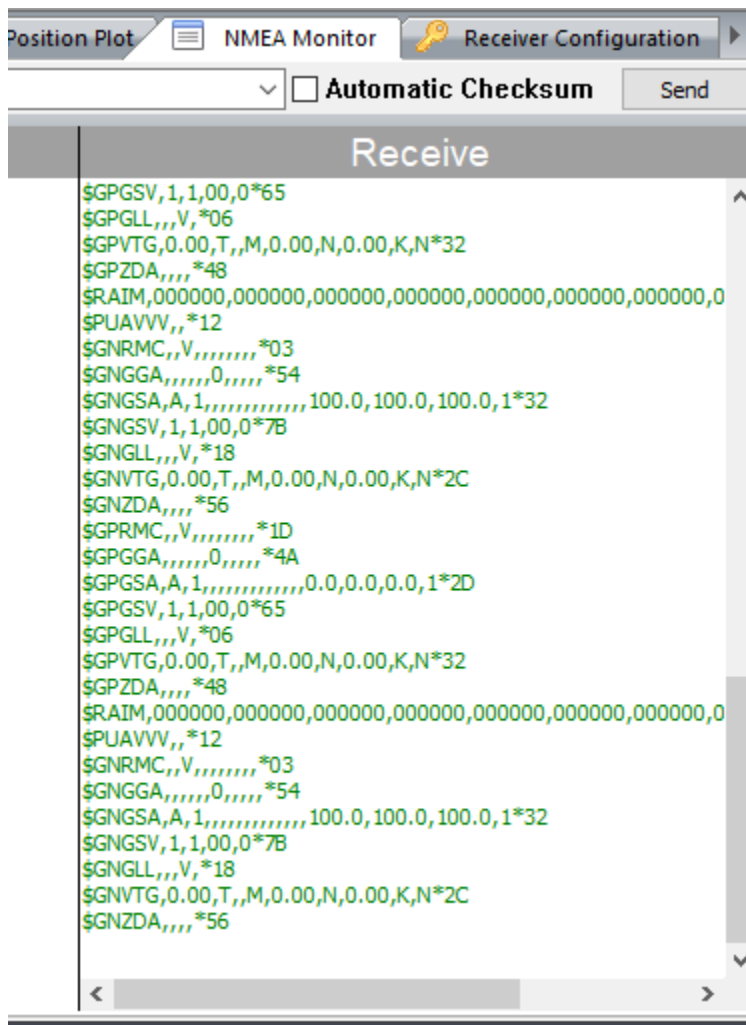
Alternatively, this functionality can be accessed from the menu bar "Tools > Connect to GPS...":



Enter the desired Communication Port and Baud Rate into the window that pops up and click "OK":



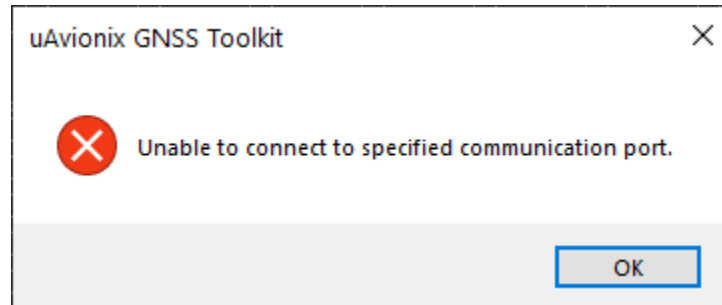
Check the “NMEA Monitor” tab for messages in the “Receive” pane:



If the “Receive” pane is being filled with messages, the GNSS receiver was successfully connected. Data will begin populating the other tabs.



If the “Receive” pane is empty, or if you receive an error indicating GNSS Toolkit was unable to connect to the specified communication port, check that the receiver is fully powered on and is transmitting NMEA messages. Also check your computer’s Device Manager to ensure the device is connected to the computer and appears on a COM port.



Once a GNSS receiver has been connected to GNSS Toolkit successfully, the COM port and baud rate will be automatically saved for the next use.

## 6 Configuration

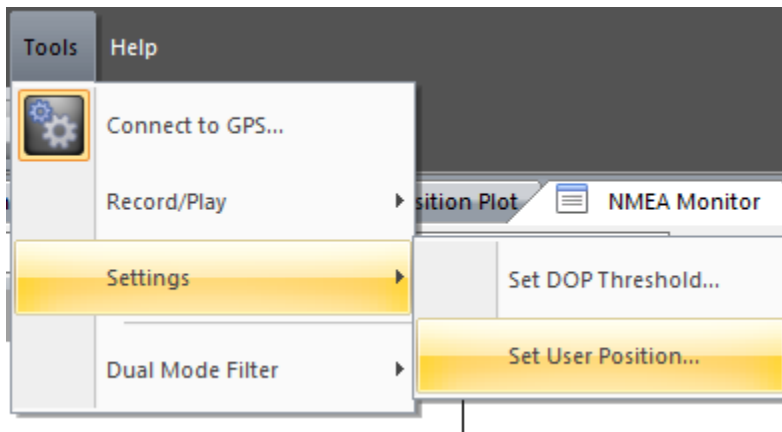
### 6.1 GNSS Toolkit

GNSS Toolkit offers multiple customization options.

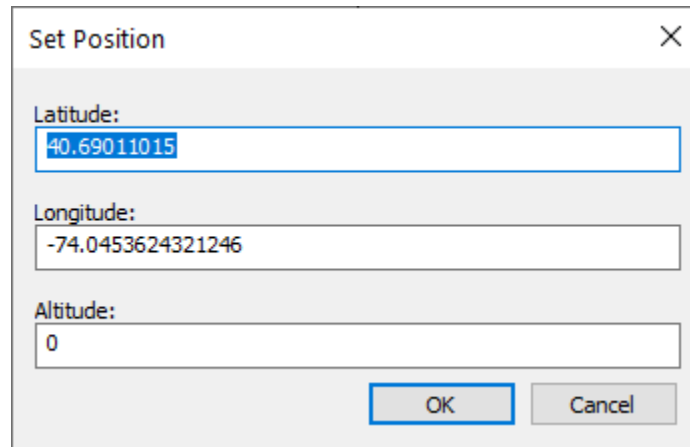
#### 6.1.1 Known User Position

Data of interest such as horizontal error can be calculated once a known user position has been saved in GNSS Toolkit.

From the menu bar, open “Tools > Settings > Set User Position...”:



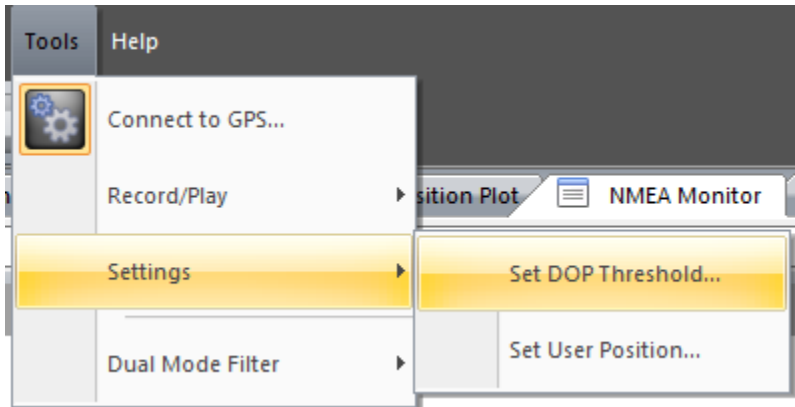
In the window that pops up, enter the coordinates of the receiver’s current known position in signed decimal notation, with altitude in meters, and then click OK:



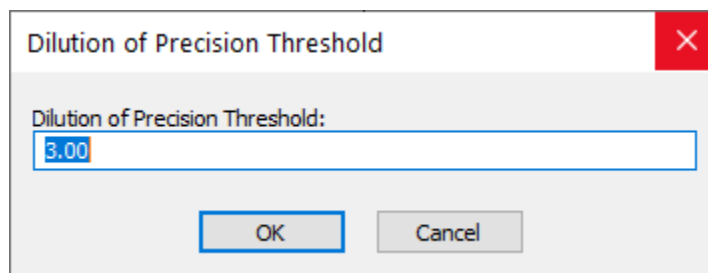
#### 6.1.2 DOP Threshold

A custom Dilution of Precision threshold can be set that is used when accepting data points.

From the menu bar, open “Tools > Settings > Set DOP Threshold...”:



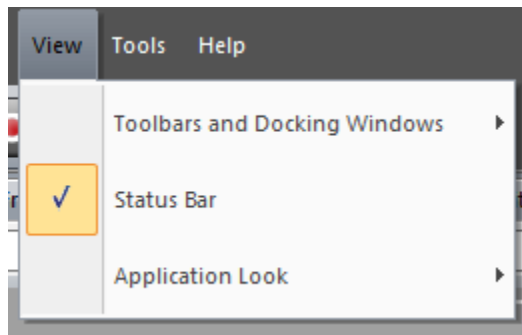
In the window that pops up, enter the desired DOP threshold and click OK:



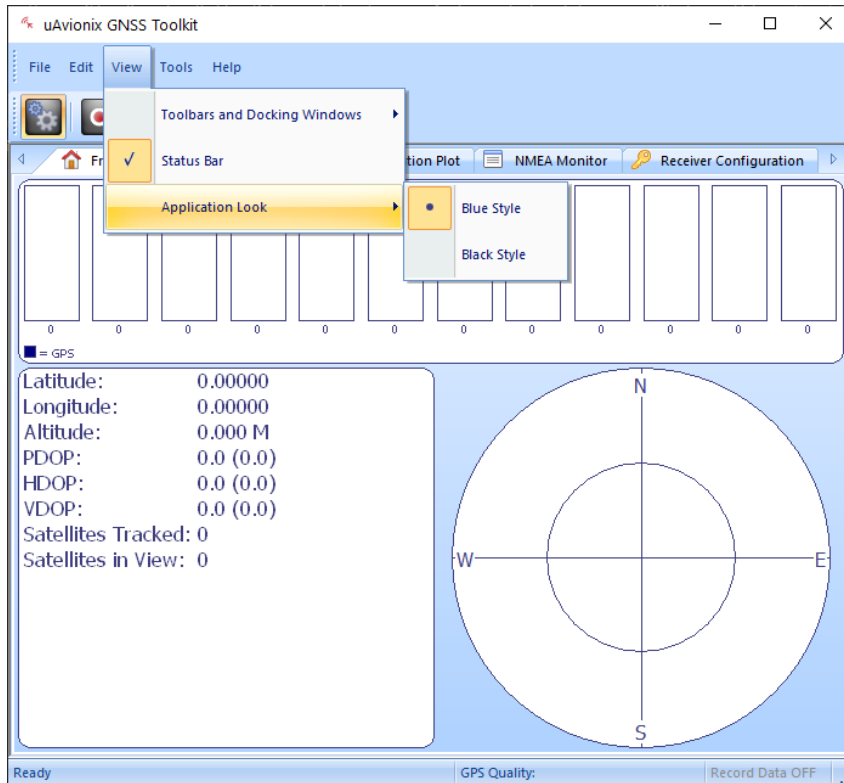
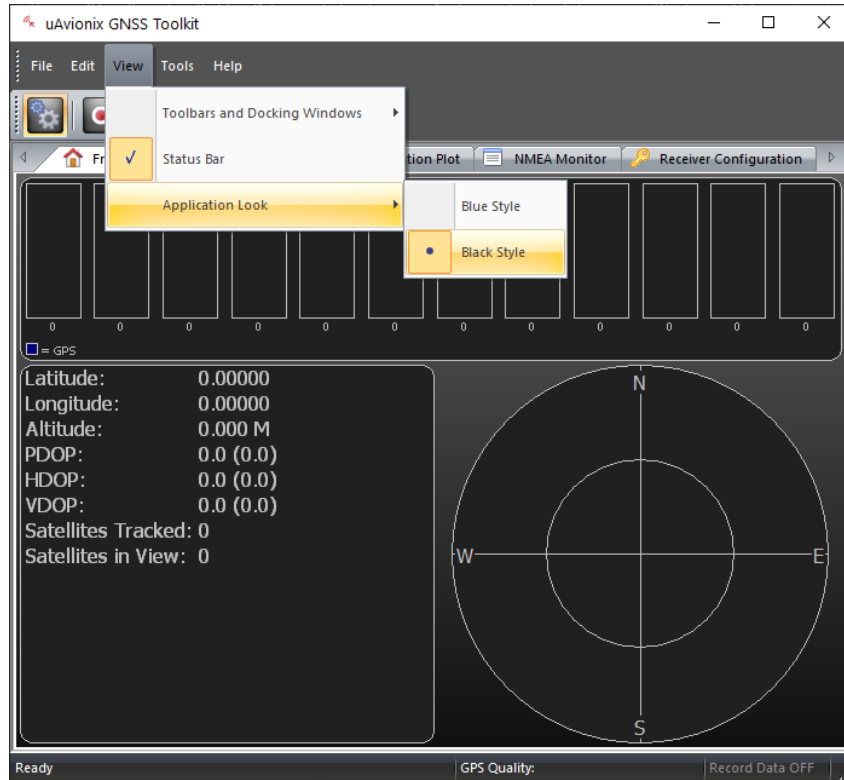
### 6.1.3 Appearance and Toolbar Customization

The appearance of the application as well as the buttons which appear in its toolbars and menus can be edited for easy access to frequently-used controls.

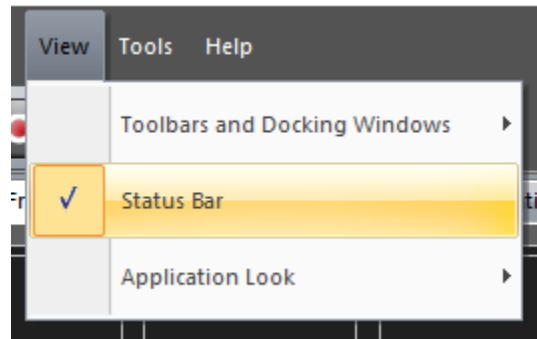
To access these customization options, navigate to the View menu in the menu bar:



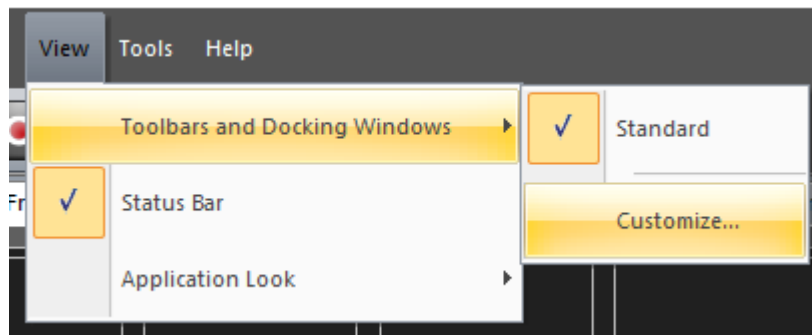
Within "Application Look," the theme of the application can be changed to a dark theme or a blue theme:



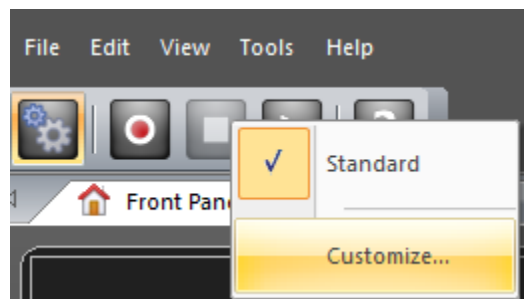
The “Status Bar” option toggles whether the status bar at the bottom of the window is shown. The status bar displays useful information such as GPS Quality and Transmit/Receive status:



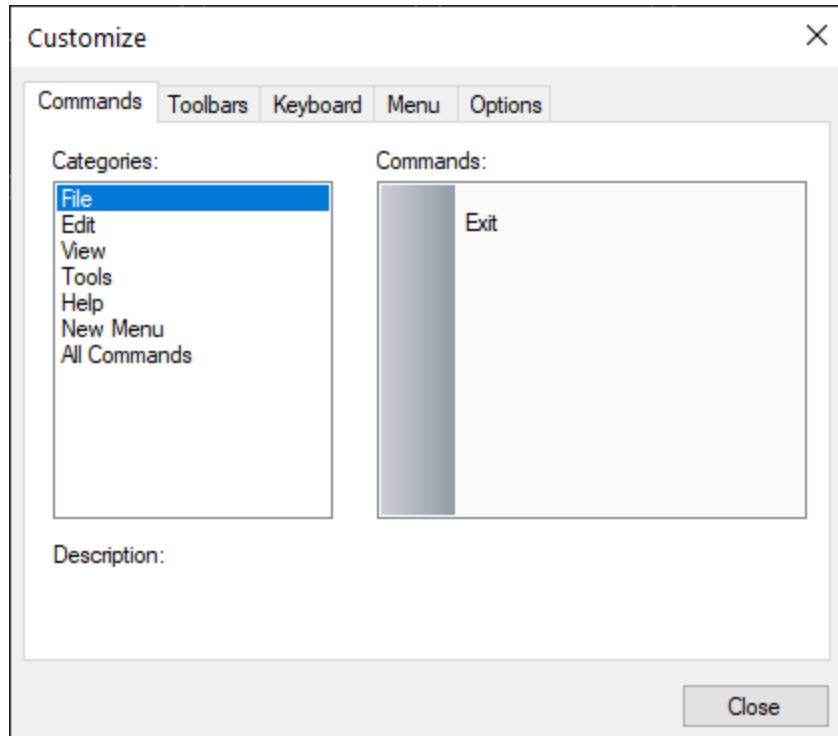
Unchecking the “Status Bar” option hides this information until the button is rechecked. Controls such as those found in the menu bar can be added to the tool bar through “View > Toolbars and Docking Windows > Customize...”:



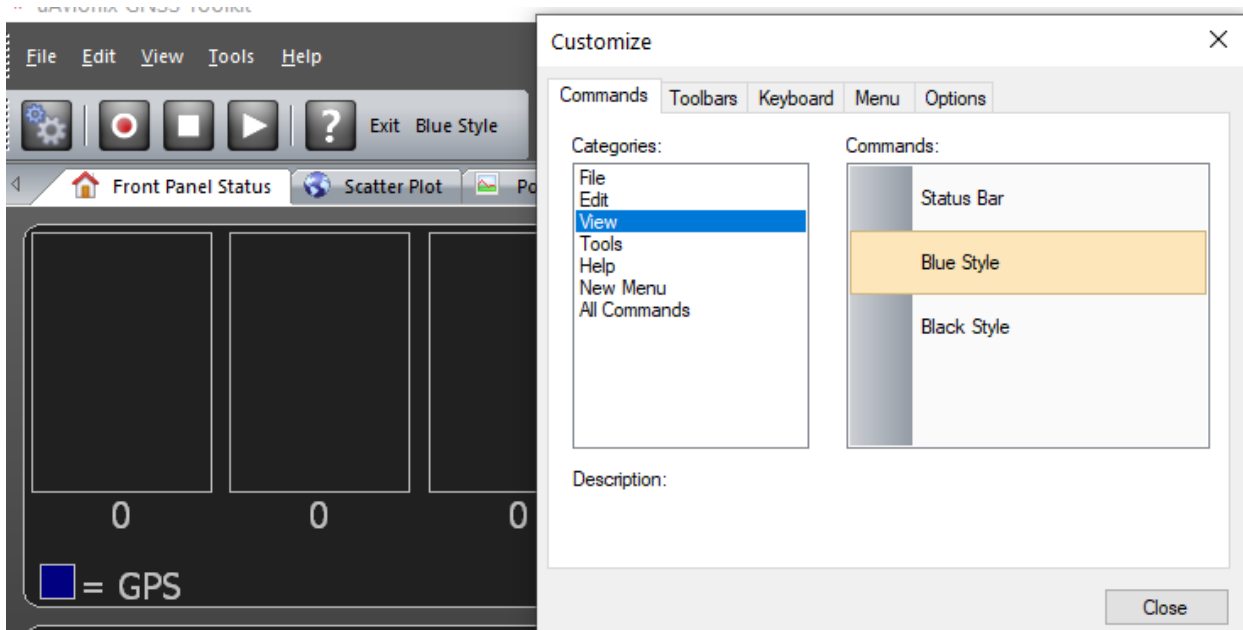
This option can also be accessed by right clicking the tool bar:



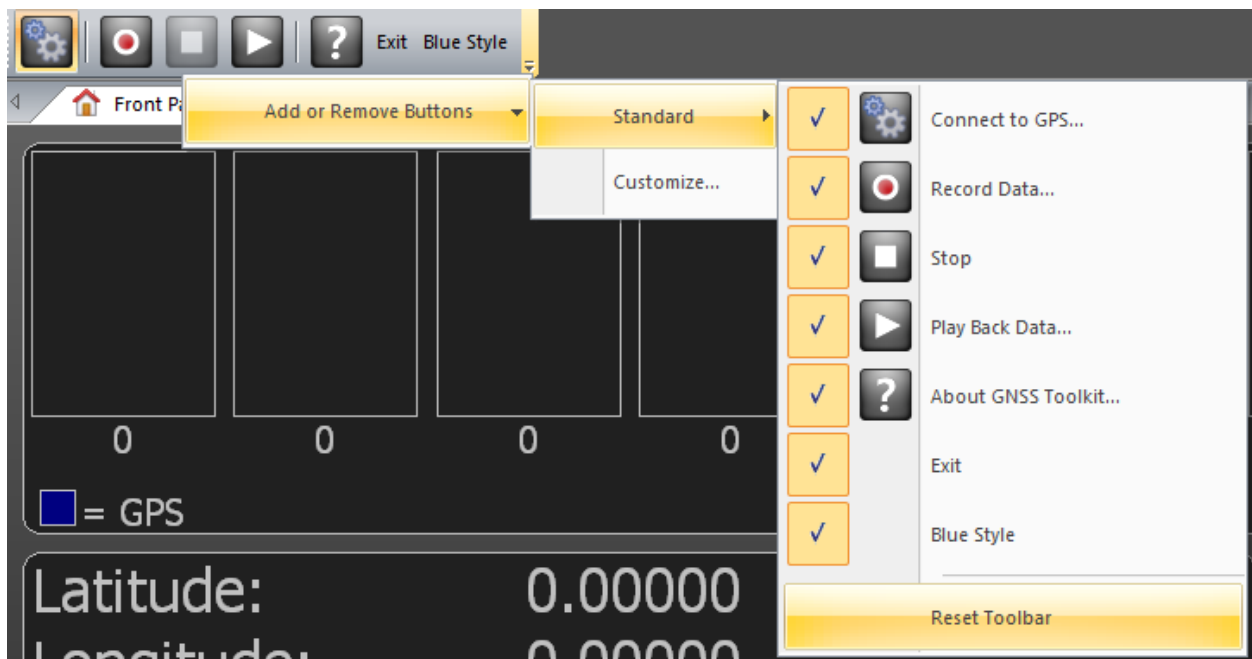
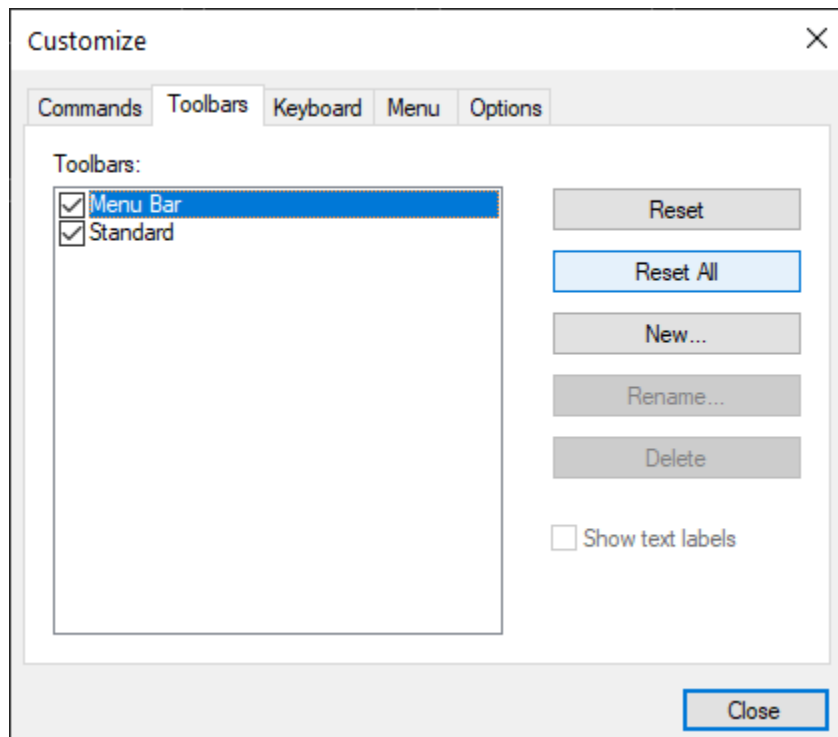
A window will appear with several more customization menus:



While this window is open, right clicking on any button in the main GNSS Toolkit window will offer options to edit the appearance of the button. Additionally, buttons found in the “Commands” pane of the “Commands” tab of the customization window can be dragged into the menu bar or onto the tool bar:



To reset the toolbars to their original appearance, use the “Reset All” button in the Toolbars tab of the customization window, or click the downward arrow on the toolbar and then navigate to “Add or Remove Buttons > Standard > Reset Toolbar...”:



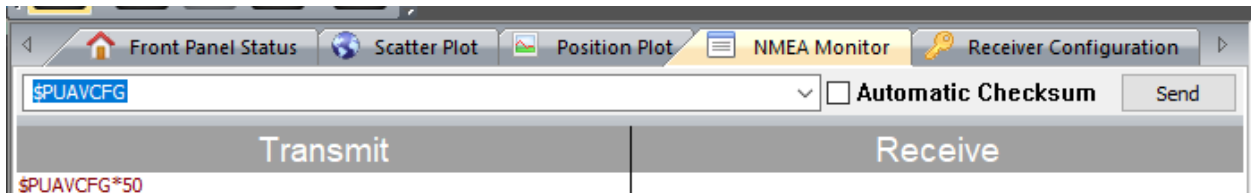
Additional functionality in these menus should only be used by advanced users.

## 6.2 Receiver Configuration

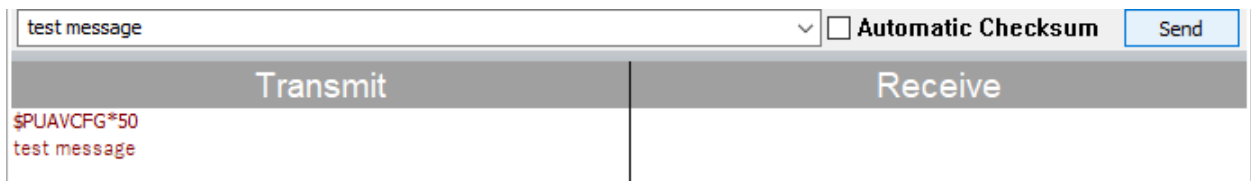
A connected receiver can be configured through NMEA messages sent from GNSS Toolkit via the NMEA Monitor tab. Specific configuration messages for the truFYX can be found in the Receiver Configuration tab.

### 6.2.1 General Configuration

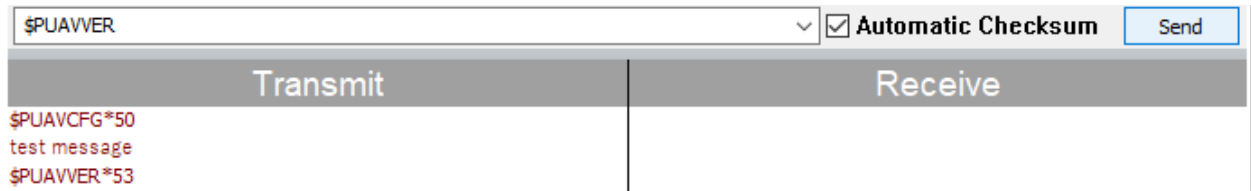
To send NMEA messages to the connected receiver, navigate to the NMEA Monitor tab:



Enter a valid NMEA sentence in the text box at the top of this pane and click the “Send” button to transmit it to the receiver. All messages sent by GNSS Toolkit are displayed in the “Transmit” pane:



The “Automatic Checksum” checkbox toggles whether GNSS Toolkit calculates and appends a valid NMEA checksum to the transmitted message:

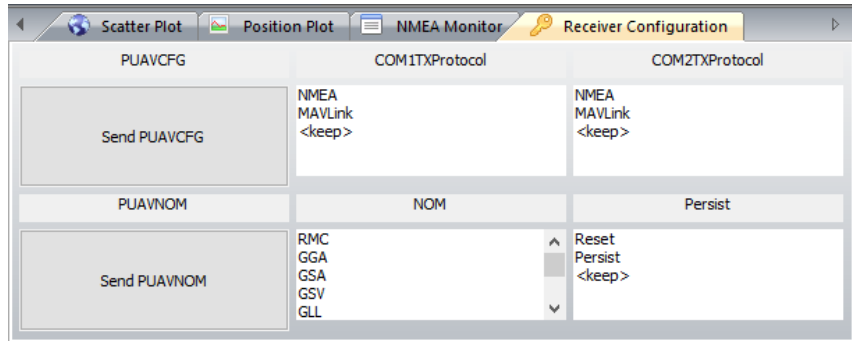


Review your device’s Integration Control Document to find which NMEA commands it accepts and their syntaxes. Full information on the NMEA interface definition for truFYX, refer to the uAvionix truFYX NMEA ICD (UAV-1002084-001).

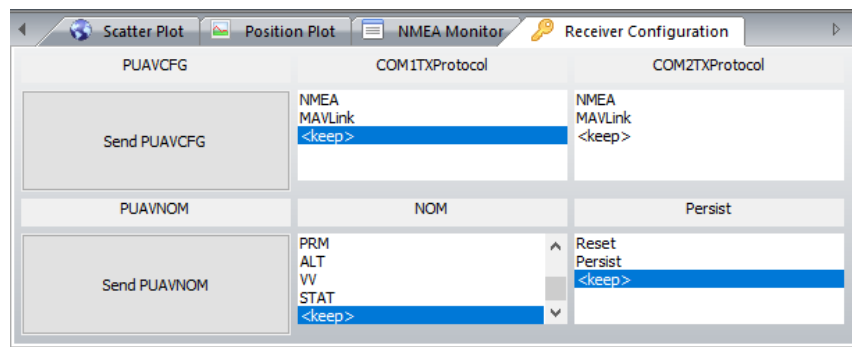
### 6.2.2 truFYX Configuration

Some truFYX-specific configuration messages can be built and sent through the Receiver Configuration tab:

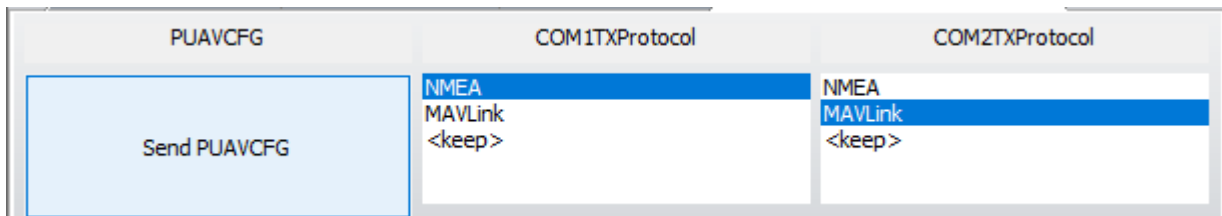




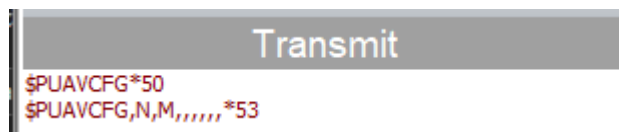
Each command corresponds to a row on this screen, and each column in the row corresponds to a field of the message. By selecting the “<keep>” option in a selection box, the existing configuration for the corresponding setting will be maintained:



Selecting items in a selection box or entering valid values in a text box and then clicking the corresponding “Send” button will send the message with those settings:



The resulting message can be viewed on the NMEA Monitor tab:



The PUAVNOM selection box under “NOM” supports selecting multiple items:

PUAVNOM	NOM	Persist
Send PUAVNOM	RMC	Reset
	GGA	Persist
	GSA	<keep>
	GSV	
	GLL	
	VTG	
	ZDA	
	RAIM	
	SBMC	
	PRM	
	ALT	
	VV	
	STAT	
	<keep>	

For the PUAVNOM message, the selected messages in the NOM box will be enabled and all unselected messages will be disabled.

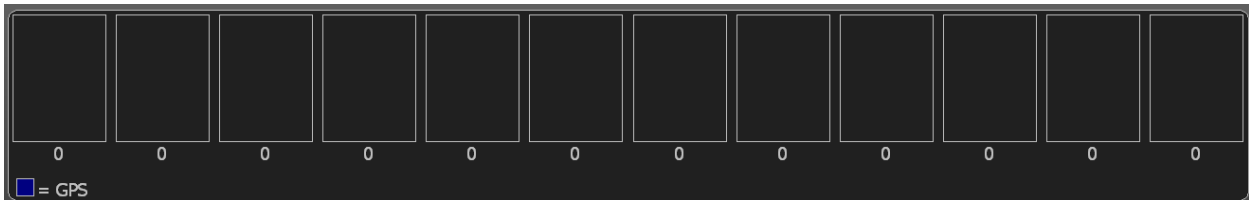
## 7 GNSS Evaluation

Once a GNSS receiver has been connected and NMEA messages are being shown in the NMEA Monitor tab, a GNSS fix will become available for evaluation on the Front Panel Status, Scatter Plot, and Position Plot tabs.

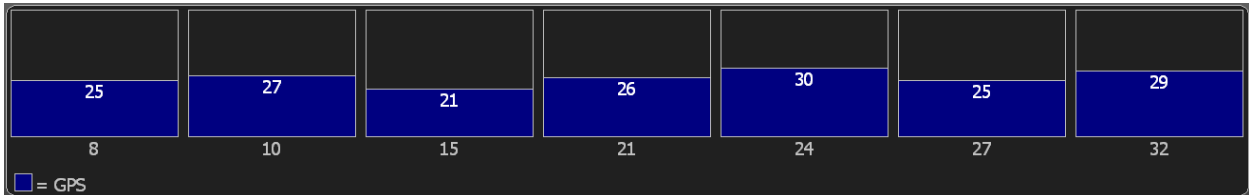
### 7.1 Front Panel Status

The Front Panel Status tab displays basic, real-time information about the GNSS fix and the satellites providing the solution.

The top pane several colored bars, each corresponding to a visible satellite. When no satellites are visible to the receiver, twelve empty bars are shown:



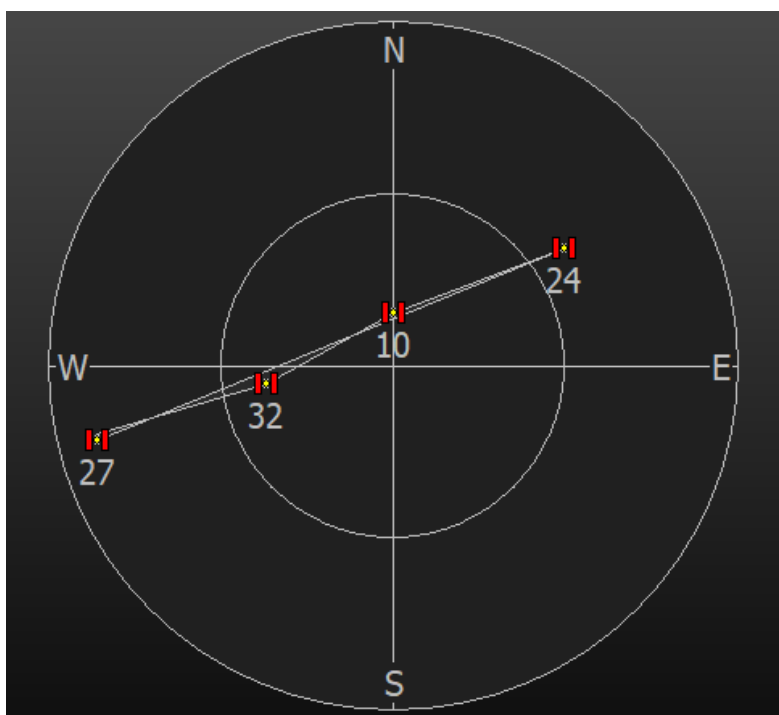
When satellites are visible to the receiver, the number of bars changes to match the number of visible satellites. Each bar shows the corresponding satellite's ID as a number below the bar, its signal-to-noise ratio (SNR) as the height of the colored portion of the bar, and its type as shown by the color of the bar:



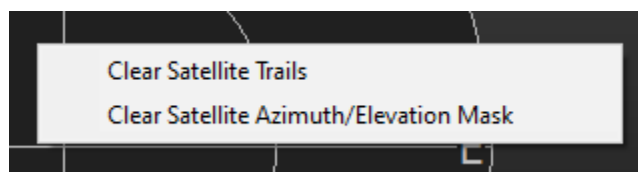
The bottom left pane shows information about the GNSS solution:

```
Latitude:      0.00000
Longitude:    0.00000
Altitude:     0.000 M
PDOP:        0.0 (0.0)
HDOP:        0.0 (0.0)
VDOP:        0.0 (0.0)
Satellites Tracked: 0
Satellites in View: 0
```

The bottom right pane shows satellite position, trails, and the azimuth/elevation mask:

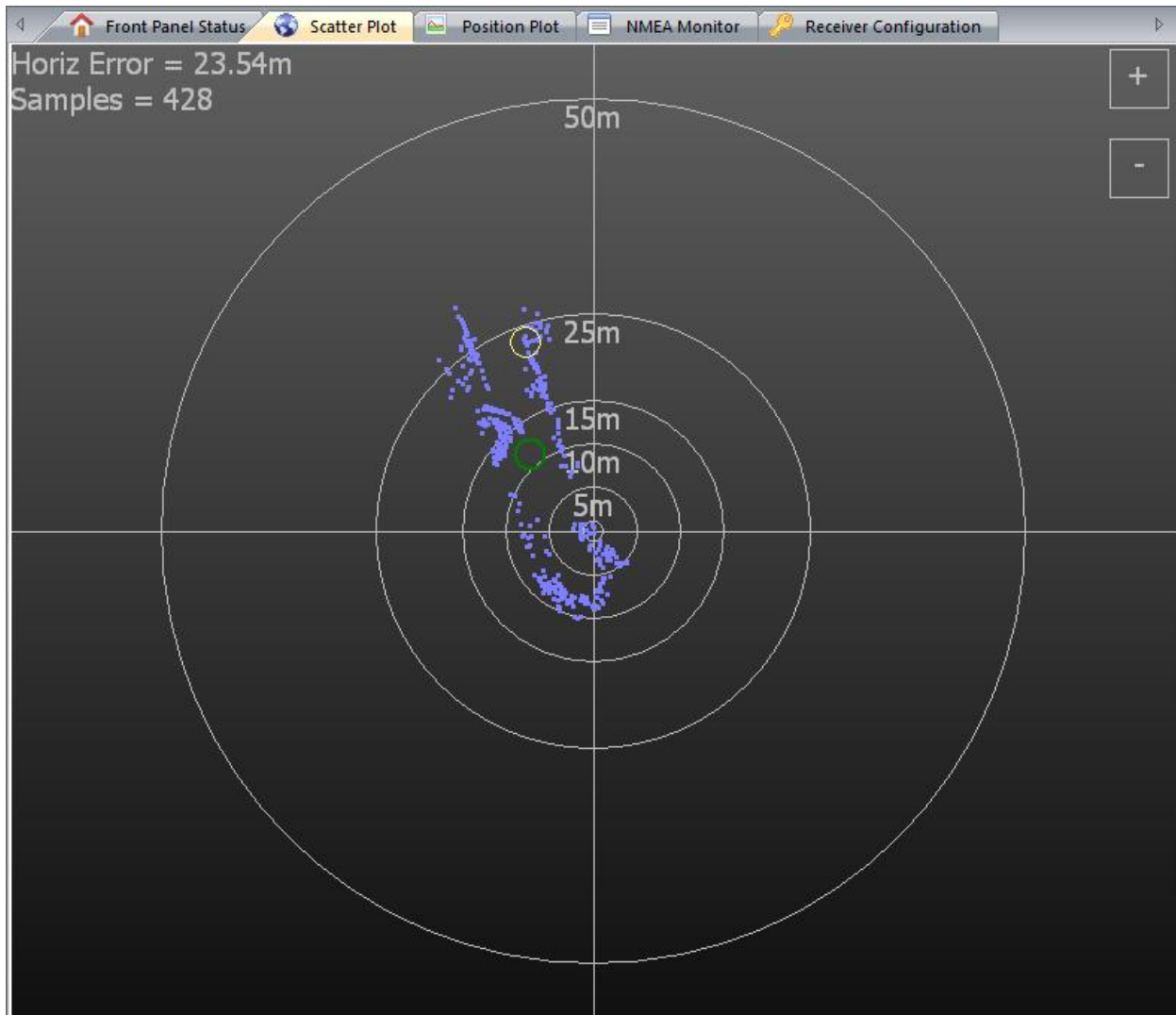


Right clicking anywhere in this tab brings up a context menu to clear satellite trails or the azimuth/elevation mask:



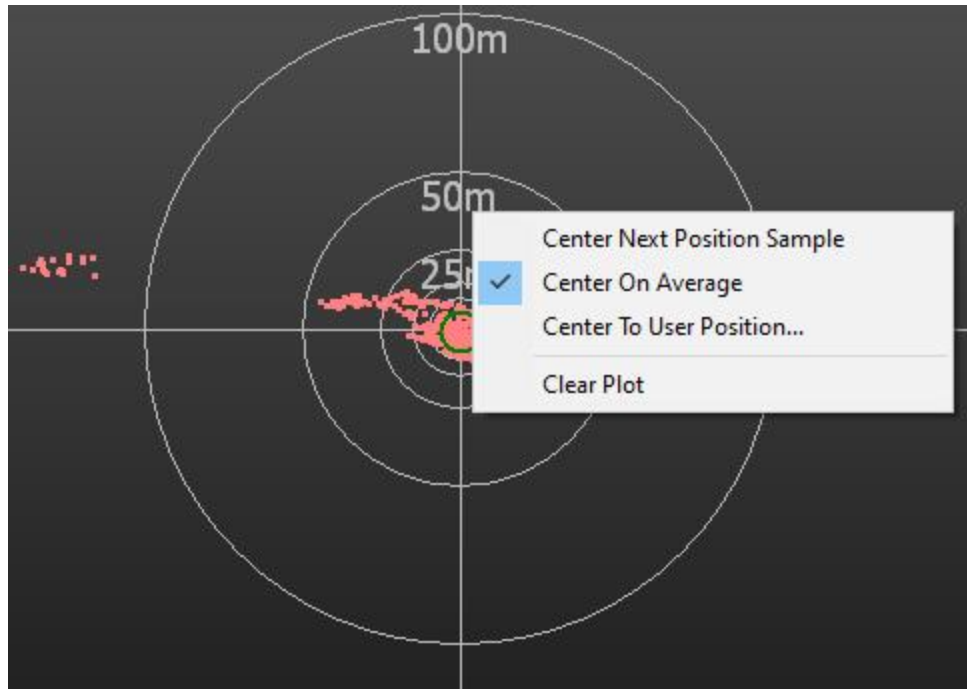
## 7.2 Scatter Plot

The Scatter Plot tab shows the GNSS solution on a scatter plot, with new position samples being drawn as they are reported by the receiver:



The latest position sample is circled in yellow, while the average of all samples is indicated by a green circle. On the top left, the horizontal error from the latest sample relative to the known user position (See Section 6.1.1) is displayed, as is the number of samples so far. On the top right, + (plus) and - (minus) sign buttons control the zoom level of the plot, with - zooming out and + zooming in. The zoom level can also be adjusted by scrolling the mouse wheel.

The center or origin of the plot can be set to one of three positions: the next position sample, the average position, and the known user position. To change this setting, right-click anywhere on the scatter plot to open a contextual menu:



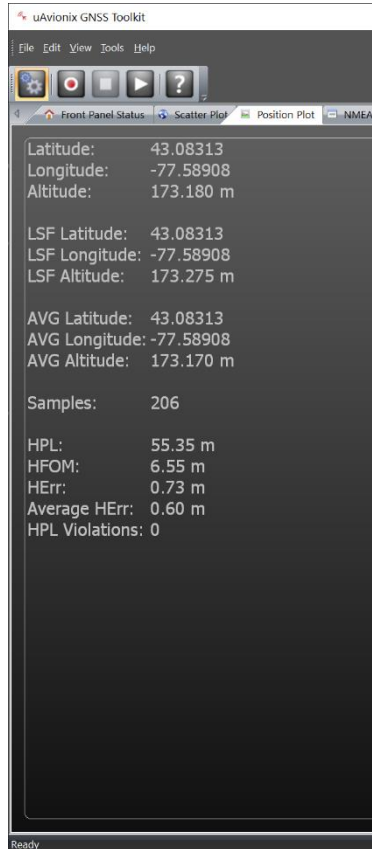
Select the desired center from the contextual menu that appears. Note that the “Center Next Position Sample” will change the center of the plot only once; it will not follow position samples as they are reported. Conversely, the “Center On Average” option will follow the green circle as it is updated.

The “Clear Plot” button in this contextual menu will remove all samples from the scatter plot, clear the average, and reset the sample count on the top left.

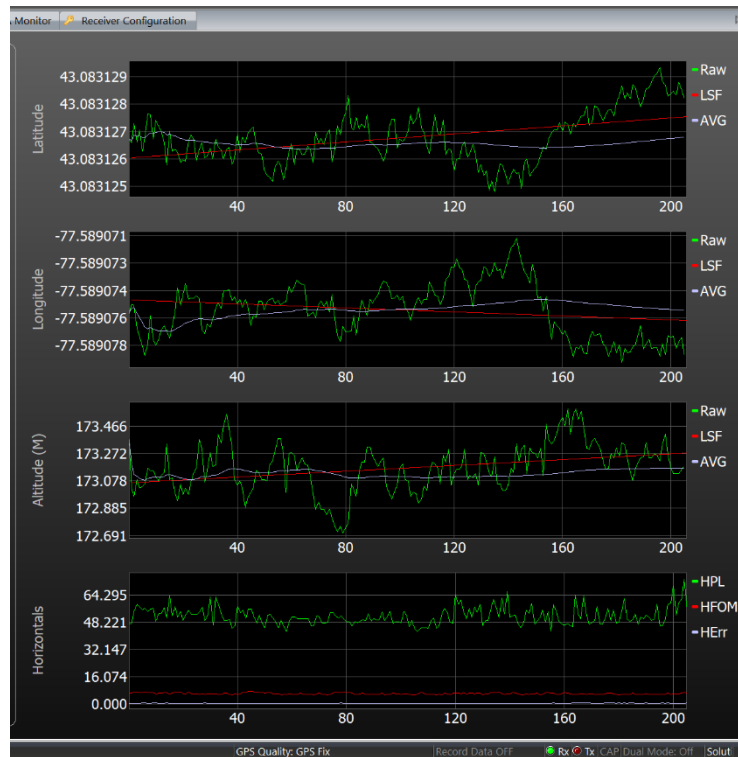
### 7.3 Position Plot

The Position Plot shows detailed real-time GNSS information, positional line graphs, and horizontal accuracy and precision measures.

The left panel shows positional information for the current sample, the least-squares fitting, and the average. It also displays the number of samples, horizontal precision limit (HPL), horizontal figure-of-merit (HFOM), horizontal error (HErr), and the number of HPL Violations detected so far:

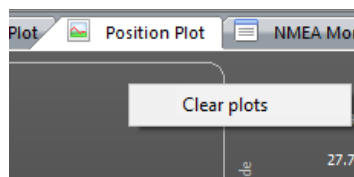


The right side of the tab displays four line graphs. They plot latitude, longitude, altitude, and horizontal precision and accuracy measures:



The legend to the right of each graph identifies the dataset to which each line belongs. Some datasets do not appear until they have samples to show, such as HPL Violations.

Right-clicking anywhere on the Position Plot tab will show a context menu with the option to clear all graphs and statistics on the tab:

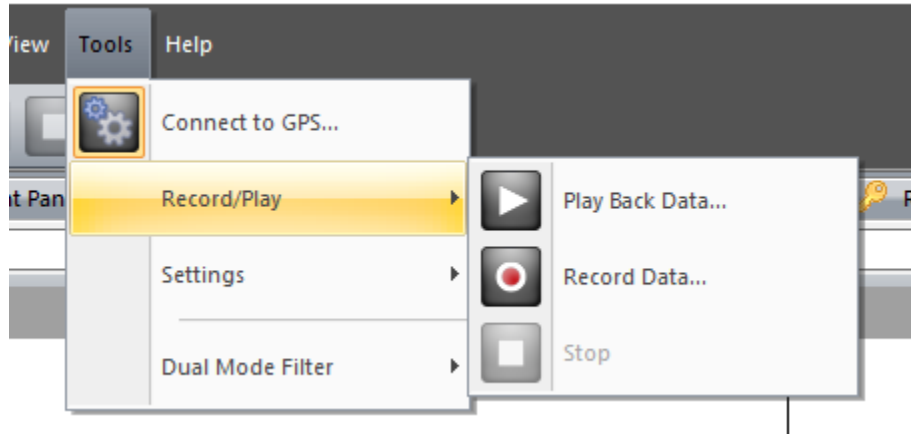


## 7.4 Recording/Playback

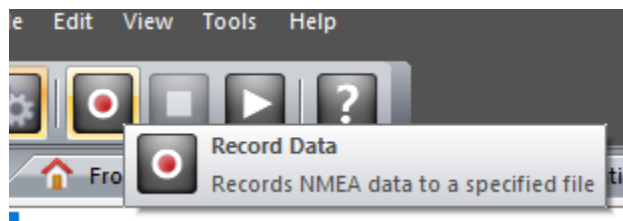
NMEA messages can be saved to a text file and opened for playback at a later time.

From the menu bar, navigate to "Tools > Record/Play":

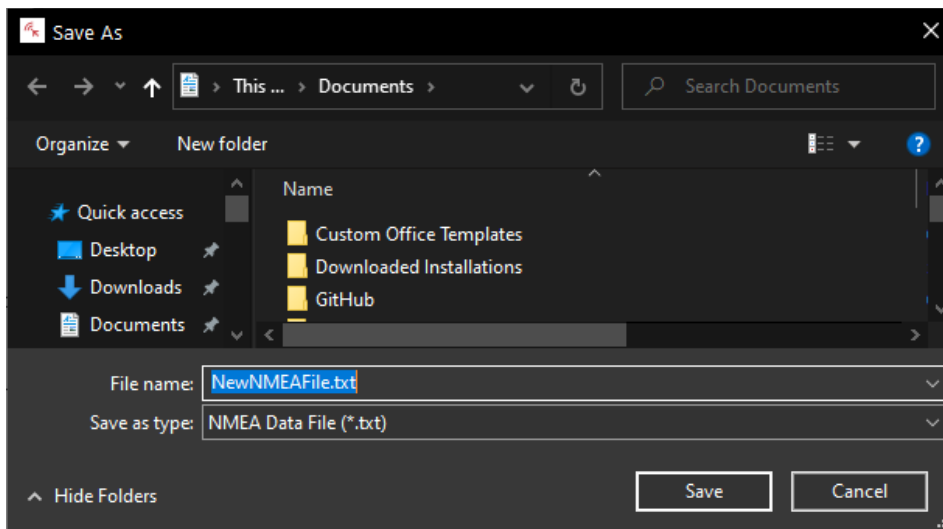




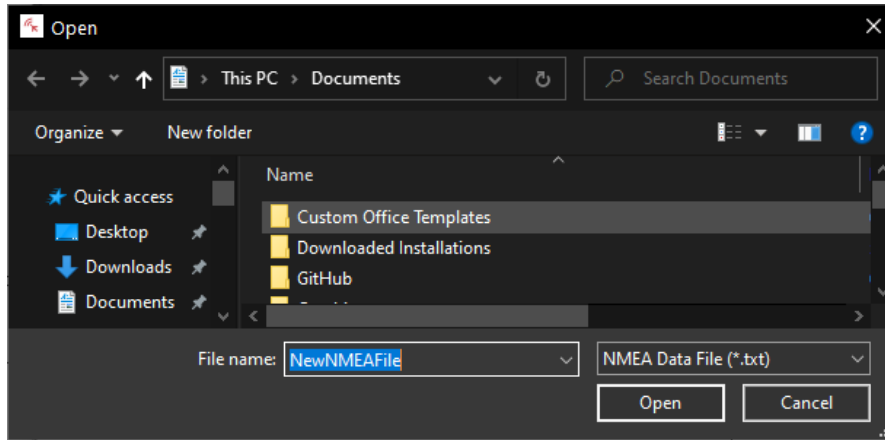
These options can also be accessed through the toolbar:



The Record Data button will open a file explorer window through which a file can be selected or created as the destination for NMEA messages obtained in the current session to be saved:



The “Play Back Data” button will open a similar window through which a text (\*.txt) file containing NMEA messages can be selected:

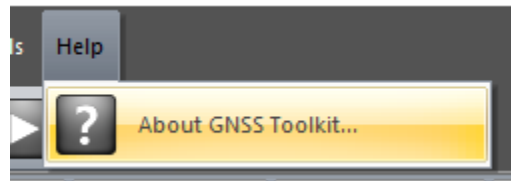


Clicking the Open button will send the NMEA messages contained in the file to GNSS Toolkit, as if they were being sent by a GNSS receiver. The front panel, plots, and NMEA monitor will display content from these recorded messages, again just as if a GNSS receiver were sending the NMEA messages.

During playback or recording, the Stop button will become usable. Clicking it will close the currently opened NMEA file, saving the recorded NMEA messages or allowing a different NMEA source to be used by GNSS Toolkit,

## 8 Product Information

Information about GNSS Toolkit, including the version number, part number, and copyright, can be found by navigating to Help > About:



The ? (question mark) button on the toolbar will also show the product information:



The product information is displayed in a pop-up window:



Click OK to close the pop-up window and resume use of GNSS Toolkit.