GarminBinary Setup and Usage

Contents:

A. Equipment List

1. Computer running Windows 7, 8, or 10.
2. Garmin GPS receiver. Compatible models made in early 2000's use RS-232 serial cable.
3. Garmin serial connection cable.
4. USB to serial converter cable.

B. Example Setup

1. Dell Vostro 3550 PC running Windows 7
2. Garmin Etrex Vista with serial cable ($46 recent Buy-It-Now price on eBay)
3. StarTech USB to RS-232 Serial Adapter Cable, Model ICUSB2321F ($20 recent price on Amazon)

C. Initial Software Setup

1. Make sure the USB to RS-232 serial adapter is connected and the driver is set up properly in Windows. Open up the Windows Device Manager to determine which COM port number is mapped. For example, in my setup it is COM16 as shown in Figure 1.

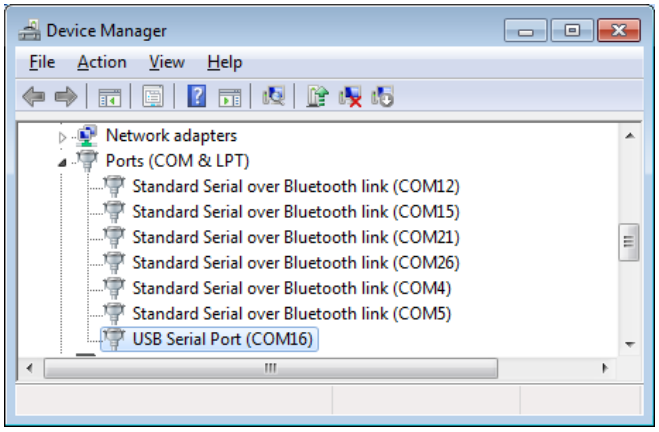


Figure 1, Device Manager

2. Make a new folder on the PC, and copy in the executables GarminBinary.exe and Gar2rnx.exe.
3. Run the program GarminBinary.exe once, and then just exit the program. Running the program and exiting will cause it to create a default configuration file named GarminBinary.XML. The program folder should now look similar to Figure 2.

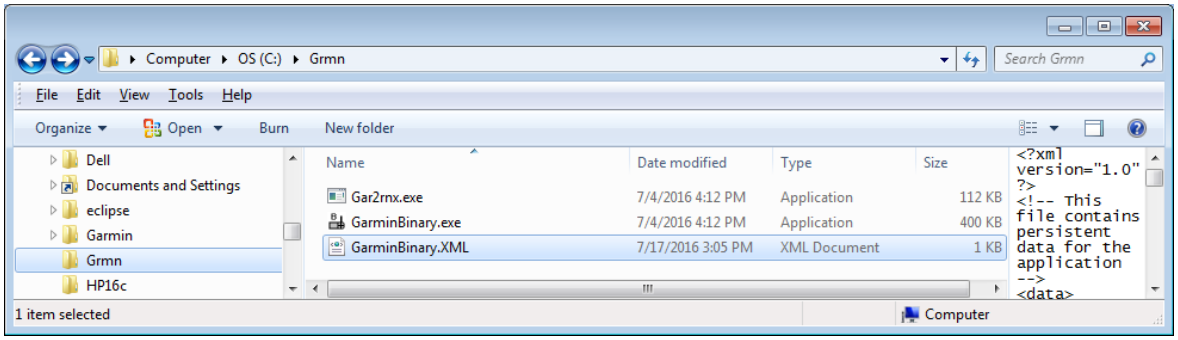


Figure 2, Program Folder

4. Open the file GarminBinary.XML with an editor like Notepad, and change the element entry "Gar2RnxPath" to correctly point to the location where the Gar2rnx program lives. The configuration element Gar2RnxOptions can also be adjusted here if desired. The default option is just "-etrex". See Figure 3.

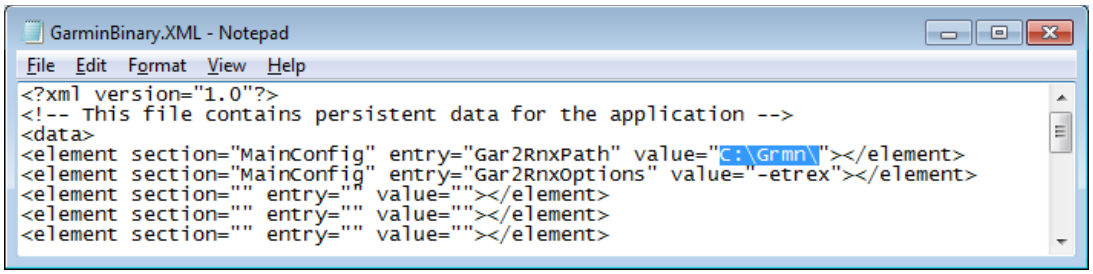


Figure 3, Adjusting Configuration File

5. Run the program GarminBinary. Make sure the GPS receiver is connected and powered on. Set the COM port to the correct port as determined above. In this example, COM16 as shown in Figure 4.

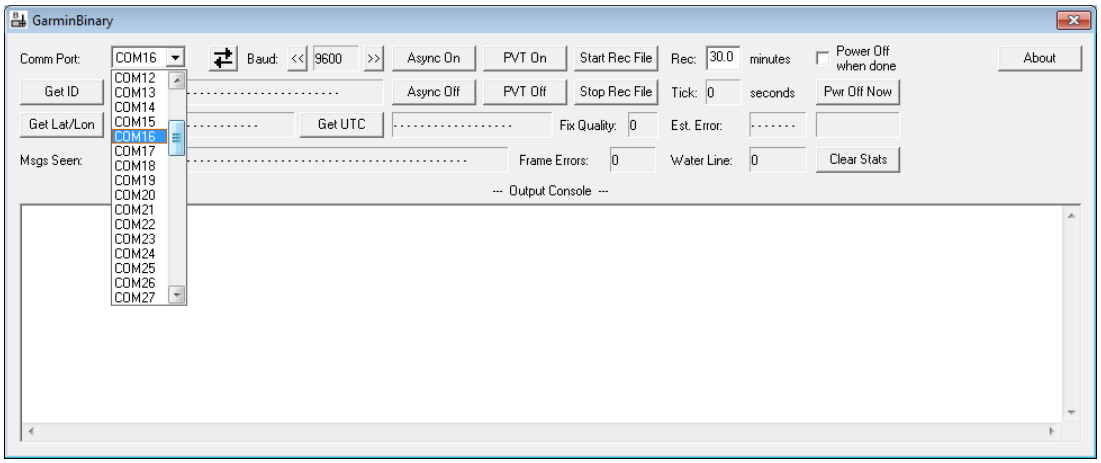


Figure 4, Setting COM Port

6. Test communications by pressing the “Get ID” button. If all is well and the GPS receiver is communicating with the PC, it should respond by reporting its ID and Software version number. This information is shown in raw hex form in the “Output Console” window and also in decoded form in the box beside the Get ID button. The display should look similar to the example shown in Figure 5.

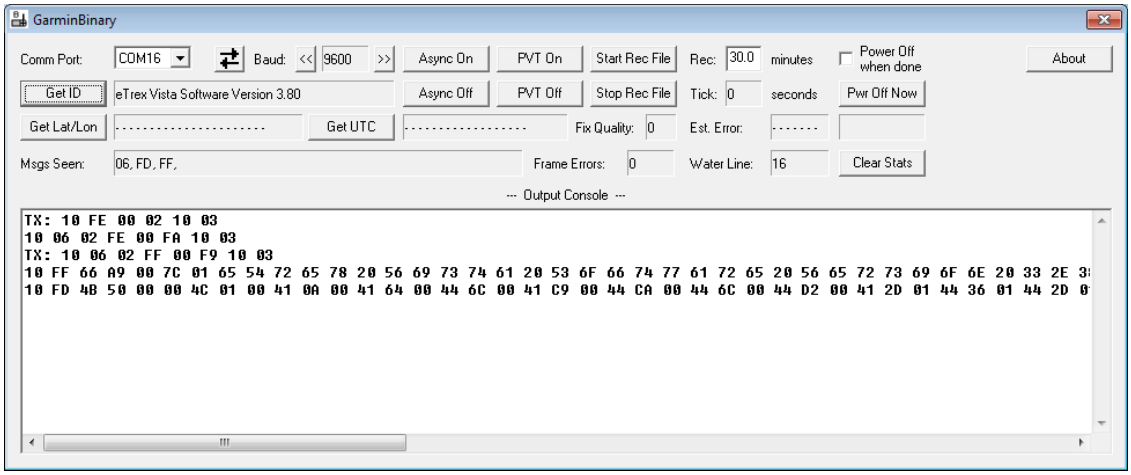


Figure 5, Confirming Communication with GPS Receiver

D. Collecting Data for Precise Point Positioning

1. Command the GPS to change to the high baud rate by pressing the button labeled “>>” near the “Baud” label. The Output Console window should confirm that the GPS has changed to the higher baud rate, as shown in Figure 6.

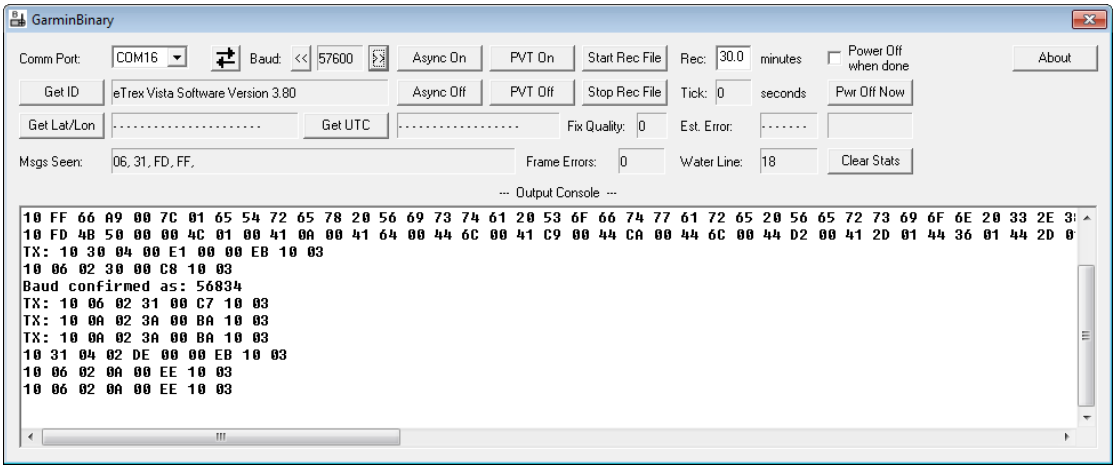


Figure 6, Increasing Baud Rate

2. Command the GPS to begin sending once per second PVT messages (Position, Velocity, Time) by pressing the button “PVT On”. Confirm that the GPS receiver has a decent fix by observing the “Fix Quality” and “Est. Error” fields. The fix quality should be 3 if WAAS is turned off, or 5 if WAAS is turned on. A fix quality less than 3 will not give good results. The estimated error relates to the satellite geometry, and should be less than 10 meters for good results.

3. Type a number in the “Rec” field to set the observation recording time. The value can be decimal such as 8.5 minutes[1]. The shortest period for reasonable PPP post processing is 10 minutes, and it’s better to use at least 20 minutes.

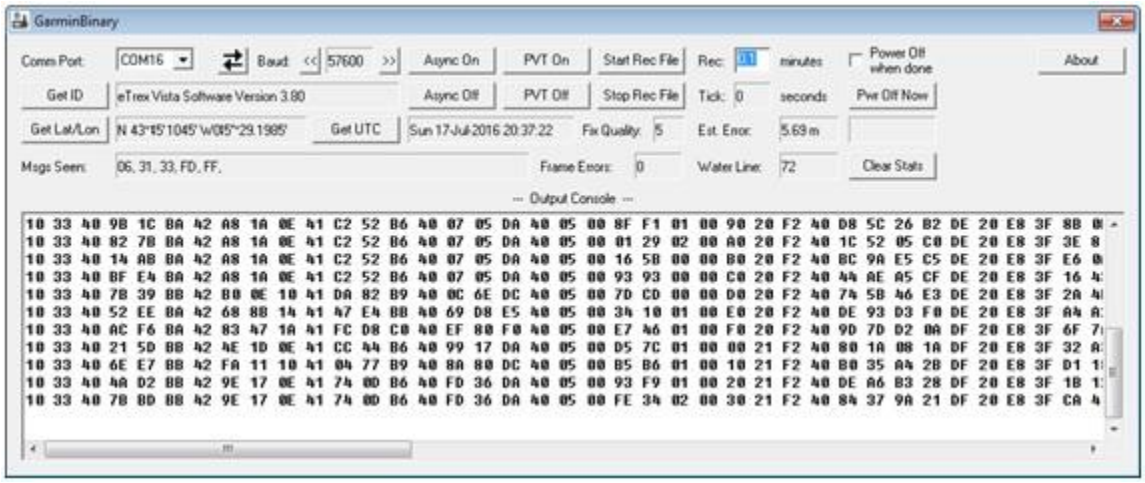


Figure 7, Set Recording Time

4. Start the recording by pressing the “Start Rec File” button. Select a folder location for the recording file, and press “Save” as shown in Figure 8.

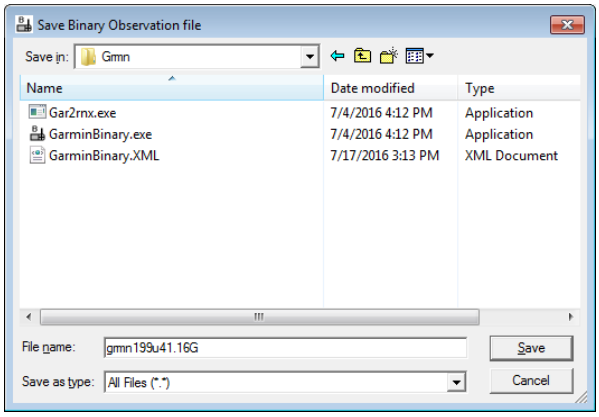


Figure 8, Save Garmin Binary File

5. Watch the “Tick” counter count down the seconds as the data is collected. If the file recording is fairly long, you can put a check mark in the “Power Off when done” control to save the GPS batteries if you want to let it run unattended and return later. When recording is done, the Output Console will show the executed command line to transform the Garmin binary file *.yyG to RINEX format file *.yyO. An example is shown in Figure 9.

[1] A good use of the decimal value is to use a short period such as 0.1 as an initial quick test of the software, as shown in the example Figure 7.

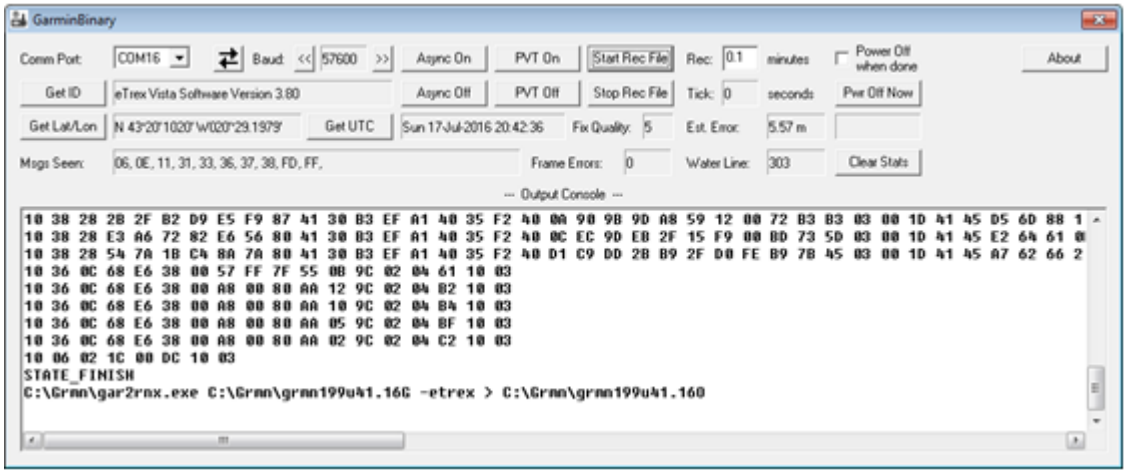


Figure 9, Conversion to RINEX

6. The program folder will now contain the Garmin Binary file as well as the RINEX file, as shown in Figure 10 below[2].

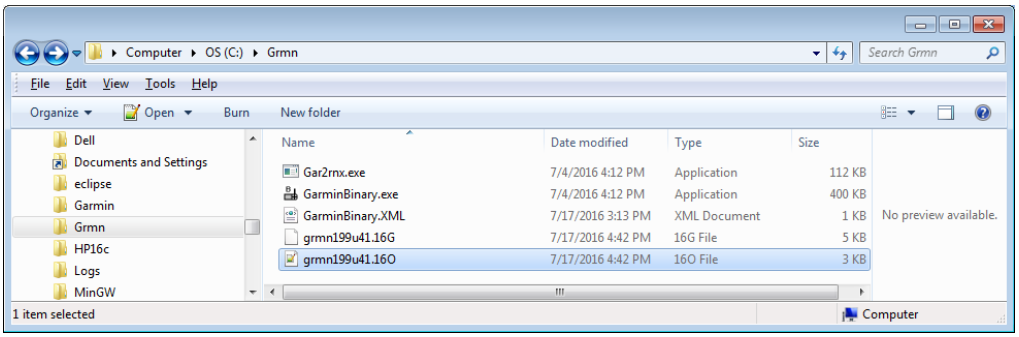


Figure 10, File Folder showing output

7. The output is a RINEX observation file, an example is shown in Figure 11.

[2] In the illustrations, Windows folder properties have been adjusted show file extensions.

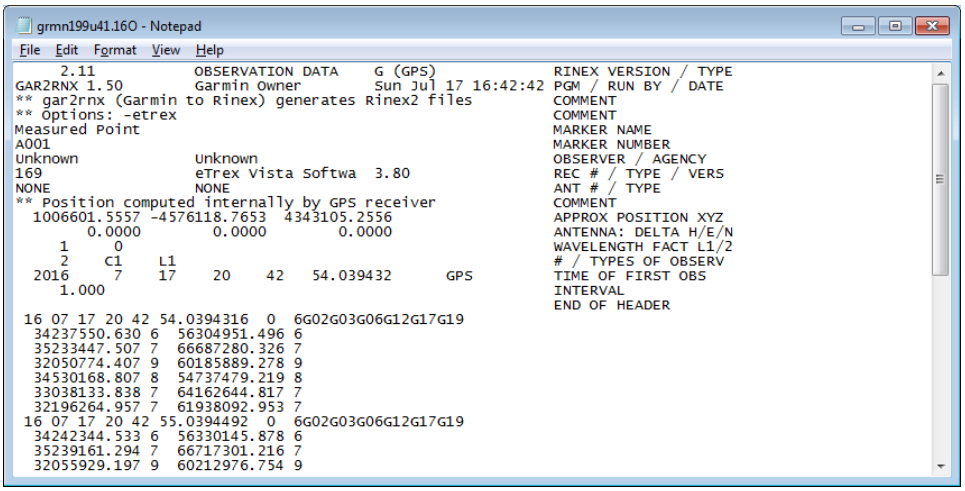


Figure 11, Output RINEX Observation file

8. The RINEX file is in the correct format now for PPP post processing. Of the free PPP online services, the only one that is currently processing L1-only data is the Canadian Spatial Reference System Precise Point Positioning service (CSRS-PPP). Log in, (or register first, then log in), select processing mode “Static” and the “ITRF” tab. Leave “Vertical Datum” as default. Browse and select your RINEX observation file. When all is set, press “Submit to PPP”, as shown in Figure 12.

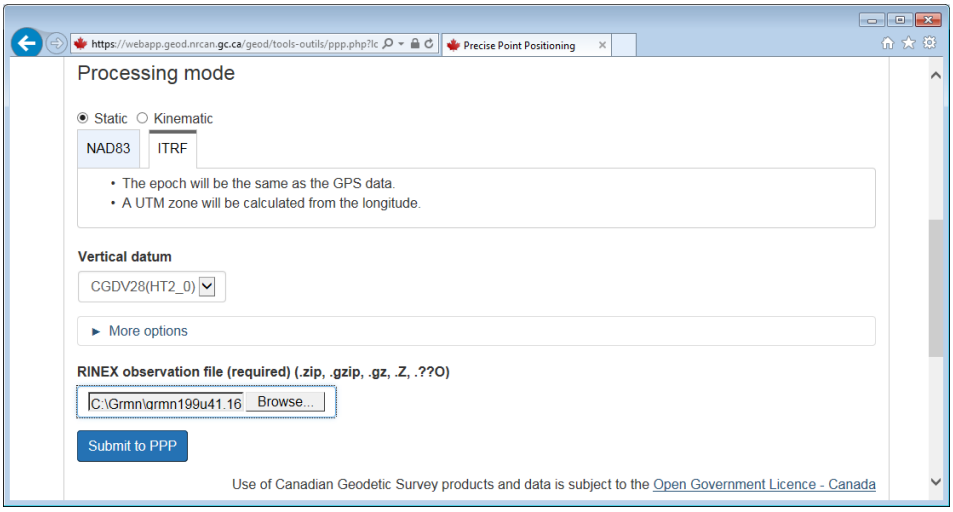
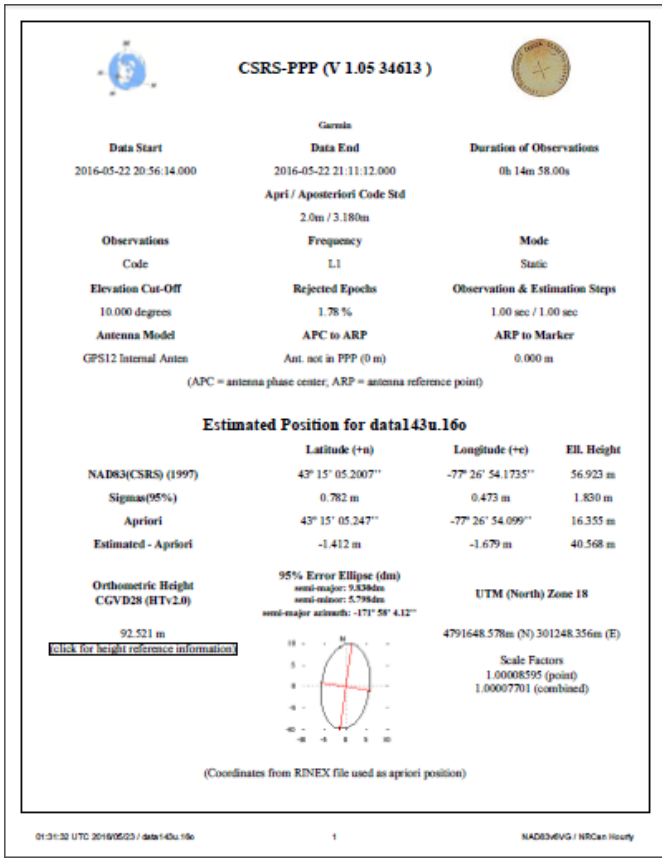


Figure 12, Submitting to CSRS-PPP

9. The PPP report will be returned in email after a few hours. Figure 13 shows an example report for a point measured in a park. The 95% Sigma values are reported as 78cm for latitude and 47cm for longitude. The full report is several pages, this is only page 1.



CSRS-PPP (V 1.05 34613)

Garmin

Data Start	Data End	Duration of Observations
2016-05-22 20:56:14.000	2016-05-22 21:11:12.000	0h 14m 58.00s
	Apri / Aposteriori Code Std	
	2.0m / 3.180m	
Observations	Frequency	Mode
Code	L1	Static
Elevation Cut-Off	Rejected Epochs	Observation & Estimation Steps
10.000 degrees	1.78 %	1.00 sec / 1.00 sec
Antenna Model	APC to ARP	ARP to Marker
GPS12 Internal Anten	Ant. not in PPP (0 m)	0.000 m

(APC = antenna phase center; ARP = antenna reference point)

Estimated Position for data143u.16o

	Latitude (+n)	Longitude (+e)	Ell. Height
NAD83(CSRS) (1997)	43° 15' 05.2007''	-77° 26' 54.1735''	56.923 m
Sigmas(95%)	0.782 m	0.473 m	1.830 m
Apriori	43° 15' 05.247''	-77° 26' 54.099''	16.355 m
Estimated - Apriori	-1.412 m	-1.679 m	40.568 m

Orthometric Height CGVD28 (HTv2.0)

92.521 m

click for height reference information

95% Error Ellipse (dm)
semi-major: 9.838dm
semi-minor: 5.798dm
semi-major azimuth: -171° 58' 4.12''

UTM (North) Zone 18

4791648.578m (N) 301248.356m (E)

Scale Factors
1.00008595 (point)
1.00007701 (combined)

(Coordinates from RINEX file used as apriori position)

01:31:32 UTC 2016/05/23 / data143u.16o 1 NAD83v6VG / NRCan Hourly

Figure 13, CSRS-PPP Output Report

E. All Controls Explained

Refer to Figure 14 for the key to the application control descriptions.

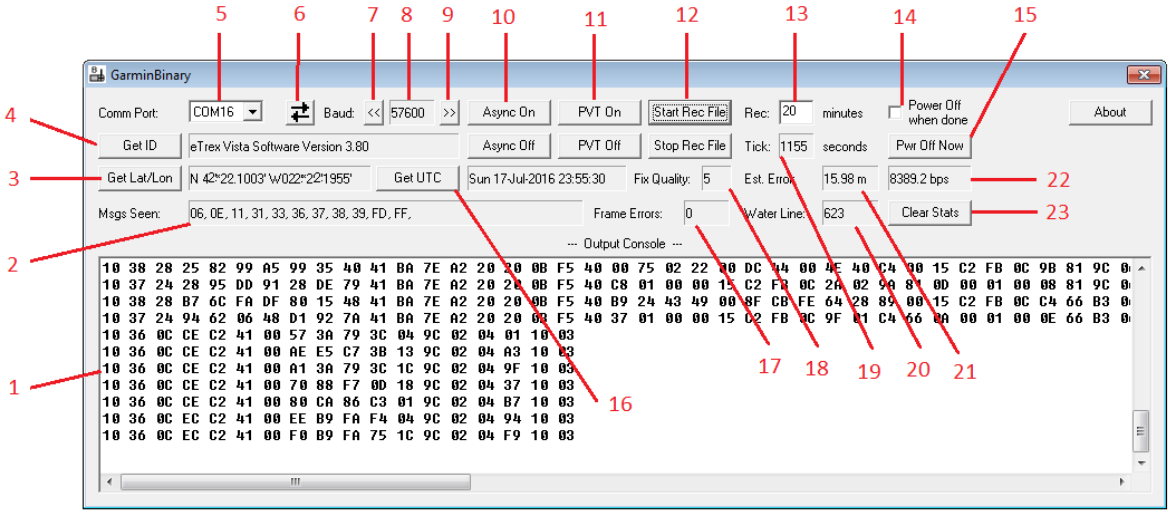


Figure 14, All Controls

1. Output Console, displays all hexadecimal bytes sent to and received from the GPS receiver. Also displays certain status messages and state changes. This list is truncated to show only the last few dozen messages.
2. Messages Seen, displays a list of command IDs of all messages received from the GPS receiver. Can be reset by pressing “Clear Stats” button.
3. Get Lat/Lon, commands the GPS to report current position. Position is displayed in “hddd mm.mmmm” format. The Lat/Lon is also updated in real time once per second when PVT is on.
4. Get ID, commands the GPS to report its ID. The ID includes the software version as part of the string.
5. Controls the PC COM port selection. This value is saved in the configuration file. Clicking the drop down arrow and selecting the same COM port will re-open the port connection while the program is running, which can be useful to re-initialize the port connection.
6. Re-sync, toggles the PC baud rate without attempting to change the GPS baud rate. This is useful if the baud rate of the GPS has gotten out of sync with the program baud rate, such as can happen if the program is restarted.
7. Baud Down “<<”, changes the baud rate of the GPS down to 9600 bps and also changes the PC baud rate to the same value.
8. Baud rate, reports the current baud rate of the PC.
9. Baud Up “>>”, changes the baud rate of the GPS up to 57600 bps and also changes the PC baud rate to the same value.
10. Async On & Async Off, sends the command to the GPS to enable async messages with bit mask 0xFFFF. This enables all possible messages.

11. PVT On & PVT Off, sends the command to enable once-per-second PVT (Position, Velocity, Time) messages. The messages also contain fix quality and estimated error. The position, time, fix quality and estimated error are decoded in dedicated fields on the display.
12. Start Rec File & Stop Rec File, controls a state machine that sends a prescribed set of messages to the GPS and records the responses in a binary format file. This file has the "G12" format defined and understood by the GAR2RNX.exe program. The duration of the file is controlled by the Rec time in field 13. (The Rec time can only be changed prior to the beginning of the recording.) When recording is in progress, the UTC time in field 16 does not update, so this time marks when recording started. The tick countdown in field 19 shows how many seconds remain until the recording is complete. When the tick count reaches zero, the binary file is saved, and then the helper program GAR2RNX is called to process the file to create a RINEX observation file. If the user presses the "Stop Rec File" prematurely, this performs a "polite" stop, meaning it sets the tick count to zero, but otherwise allows the normal file processing to finish, creating a valid but shorter RINEX file.
13. Rec, sets the recording time used by "Start Rec File". This field is a decimal value, e.g. entering 0.1 will result in a 6 second recording file. For good processing results, it is recommended to record at least 15 to 20 minutes or more.
14. Power Off when done, check-marking this box any time before or during a recording session will cause the program to command the GPS to turn off after the recording is done. This can save the GPS batteries if the user wants to start a long recording session and leave it unattended.
15. Power Off Now, commands the GPS to power off immediately. Useful for testing the commanded power off capability of the GPS.
16. Get UTC, commands the GPS to report current time in UTC. Time is displayed in the dedicated field. The UTC time is also updated in real time once per second when PVT is on.
17. Frame Errors, counts the number of messages received from the GPS with bad CRC or other parsing errors. Such messages are thrown away and ignored other than keeping count of them. Can be reset by pressing "Clear Stats" button.
18. Fix Quality, this number is reported by the GPS as part of the PVT message. The meaning as follows: 1- No Fix, 2- 2D Fix, 3- 3D Fix, 4- 2D Fix with WAAS On, 5- 3D Fix with WAAS On.
19. Tick, counts down remaining seconds during a file recording.
20. Water Line, tracks the highest number of characters pending in the serial buffer when the Windows serial I/O read occurs. This is useful to know if there are frame errors. Can be reset by pressing "Clear Stats" button.
21. Est. Error, the estimated error in meters is reported as part of the PVT message.
22. Bits Per Second, reports the instantaneous bps bandwidth utilization of the serial port. This is only measured when a recording session is taking place.
23. Clear Stats, this clears the values in fields 1, 2, 17, and 20. This only affects the displayed values, it has no effect on data being recorded.