

Using GPS Receivers to Set Computer Time for Fielded Digital Modes and Logging From the Field

Keeping Time Using GPS Satellites at Remote Locations -- Great for Field Day & DXpeditions

by Gene Hinkle, K5PA

Introduction to GPS Time Sync

It is important to have time set correctly on computer platforms so Amateur Radio digital mode applications such as WSJT-X are synchronized independent of each other and to allow logging programs to save the correct time. Many solutions exist when connected to network infrastructures. Indeed, Windows based platform can use network time servers to gather time automatically. When operating remotely however, it is a different story. How can you set time automatically when disconnected from networks? This is the situation during field activities and DXpeditions to areas where the internet time is unavailable or unreliable. You can manually set the time using shortwave time broadcasts such as WWV where it can be received but there are little alternatives other than highly accurate clocks such as Rubidium standards. I was looking for a slick solution that could be used at home, in the field or during DXpeditions equally and was fool proof.

There are now inexpensive GPS "hockey puck" style receivers readily available from vendors on the internet. These receivers have USB serial data interfaces and the power is provided through the data cable. Just by adding the GPS puck to the computer's USB port, it is possible both read position and time information from the the constellation of satellites. An example of one GPS "hockey puck" style unit I use is the GlobalSat BU-353-S4 USB GPS Receiver (Black)¹ shown in Figure 1. The puck design has a magnetic on its back side making it easy to stick to any metallic surface.



Price class: \$30

Figure 1. Photograph of the GlobalSat Model BU-353-S4 USB GPS Receiver

With the addition of the GPS receiver to a computer system, what is needed is a method to read the GPS time information and set the computer clock automatically. This can be accomplished readily available

computer applications such as **NMEA Time**, available from VisualGPS, LLC². Figure 2 shows the NEMA Time Properties Panel that is used to monitor GPS during operation and to set the time now.

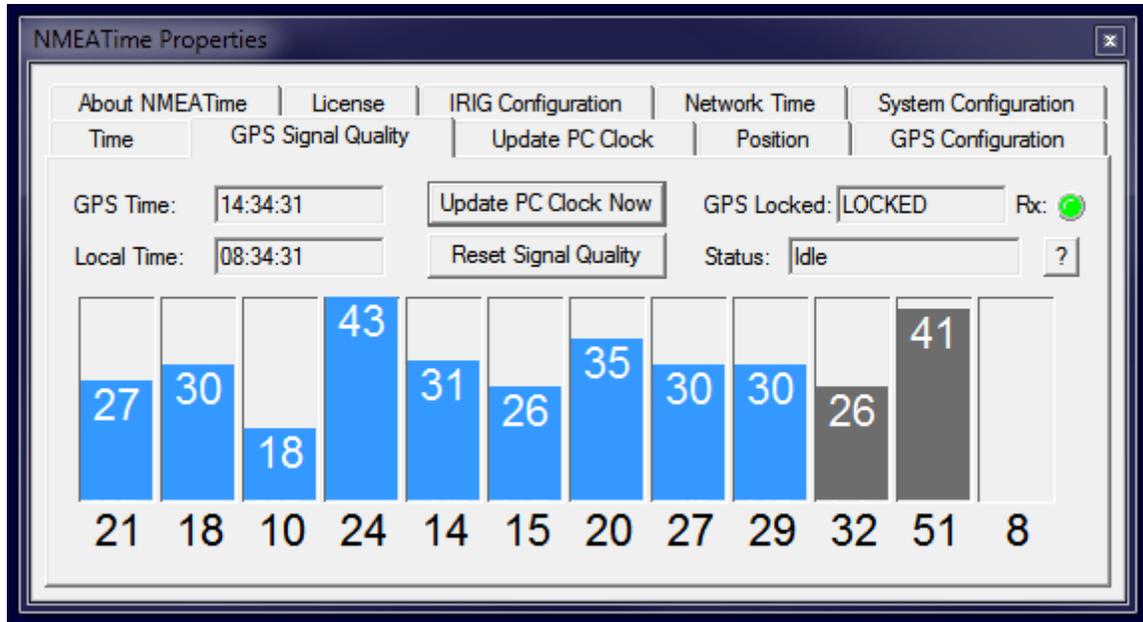


Figure 2. NMEA Time Properties Panel for Time Updates

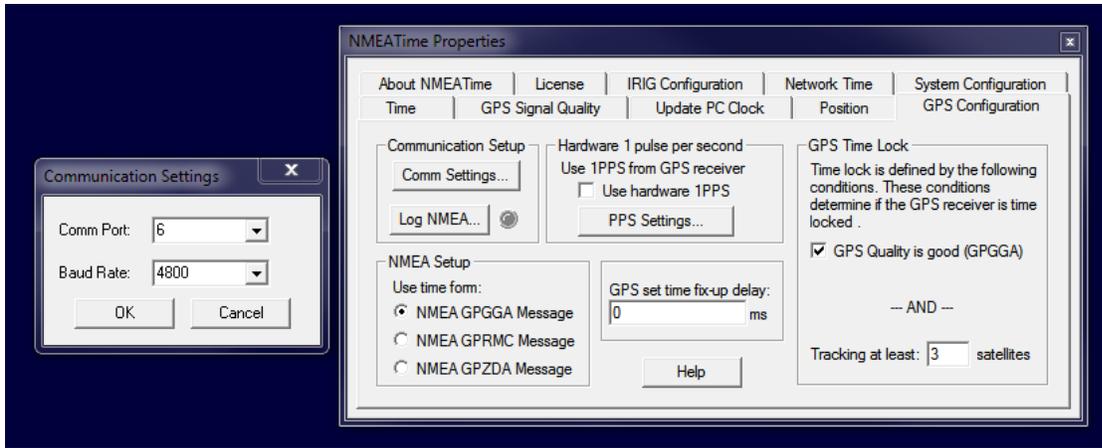
Setup Procedures

1. Tab Name: **GPS Configuration**

a) Select the **Comm Settings...** and enter the **Comm Port** number and **Baud Rate**. Mine are shown below as set to **Comm Port 6** and **Baud Rate 4800**.

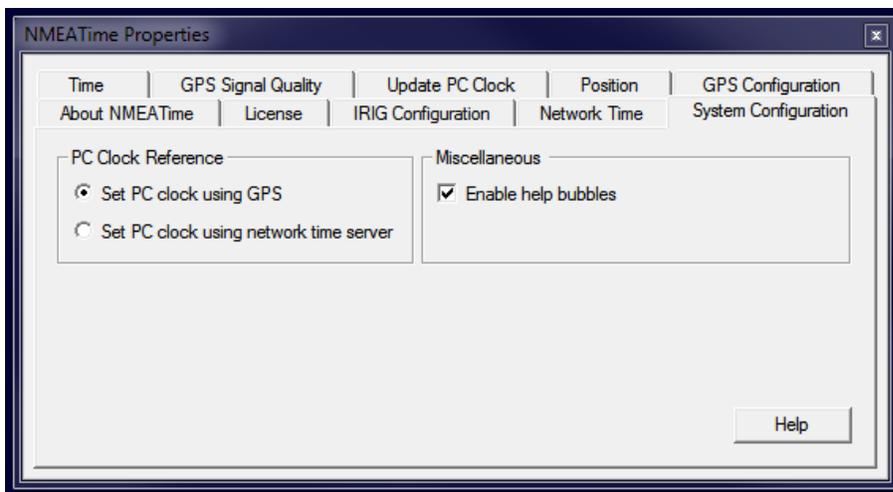
b) Also select the method to get the time from a message type under the **NMEA Setup** subpanel. Mine is selected as the **NMEA GPGGA Message**.

c) You can also select the criteria for **GPS Time Lock** as **GPS Quality is good (GPGGA)** AND number of satellites. I have 3 satellites shown as the criteria.



2. Tab Name: **System Configuration**

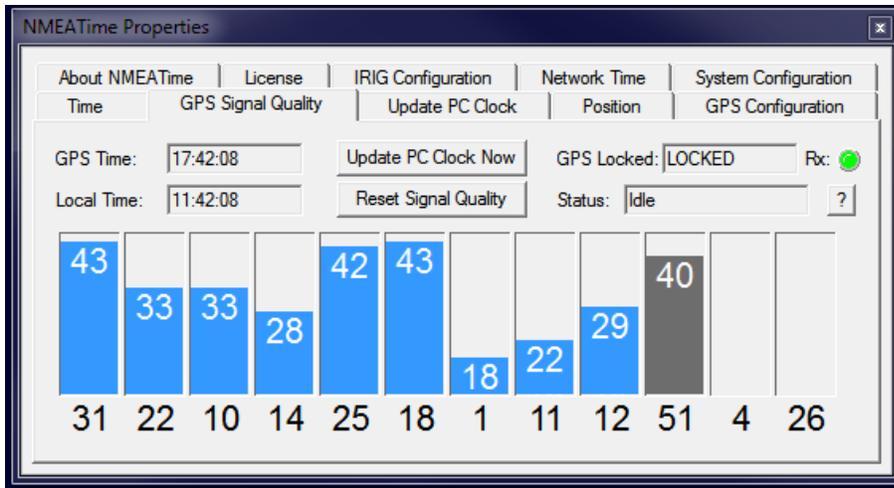
a) This is where you will tell the program how to set the PC clock, from the GPS time or from a network server that has to be selected under the **Network Time** tab. I show the **Set PC clock using GPS** as my choice so the computer will have the correct time while disconnected from any network time servers.



3). Tab Name: **GPS Quality**

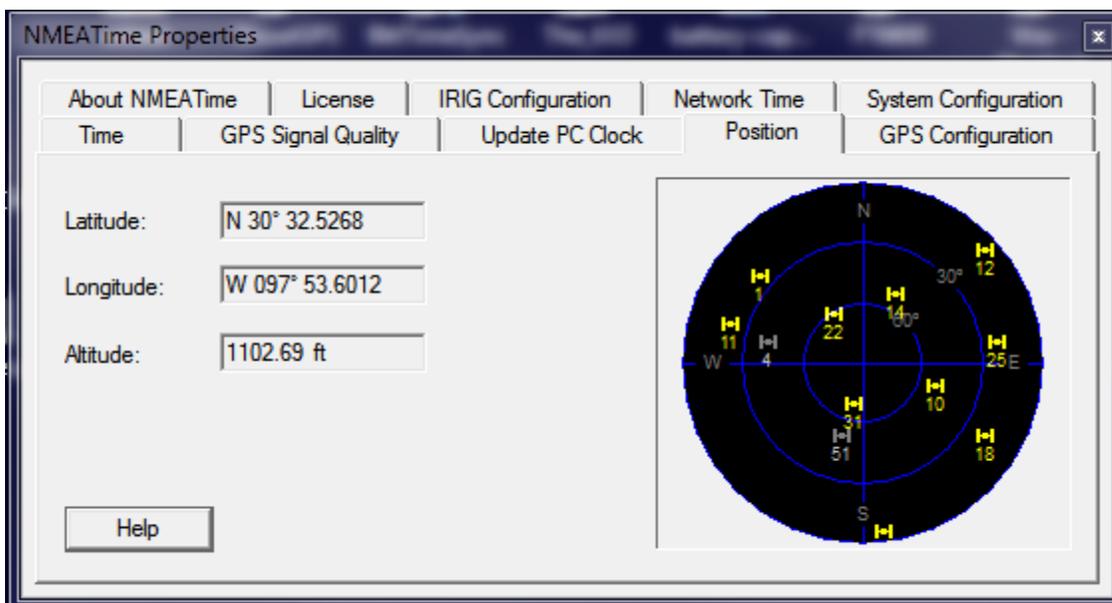
This is the screen you can view to check the signal quality of each satellite. The bottom line, **31, 22, 10, 14, ...** are call the Space Vehicle (SV) numbers. They identify each satellite individually by number. The numbers in the blue bars is the Signal to Noise (SNR) ratio of each satellite. Numbers in the 40's are good signal levels while 20-30's are low. To get higher numbers require a better field of view to each satellite as it moves through its orbit. Darkened or missing bars. e.g. 40 in the graph, are satellites that will be coming into view shortly.

If the **GPS Locked** message says **LOCKED** and the indicator **Rx** LED is Green, then time is being derived from the messages received and all is good.



4) Tab Name: **Position**

This tab brings up the graphic of each Space Vehicle (SV) number during its current orbit above your location. The graph gives the compass cardinals and where in the view above you the satellites are moving. The tab also gives you your **Latitude**, **Longitude** and **Altitude** from the measurements.



Lessons Learned

Here is a brief summary of my lessons learned while using the GPS Module with the NMEATime Software.

- The GlobalSat GPS Receiver must always have a view of the sky in order to see line-of-sight to the GPS constellation. The constellations are constantly moving so, as satellites leave the field of view, others are emerging.
 - For Time measurement, only one satellites needs to be seen in the clear. When more satellites are observable the system will be more robust.
 - This particular satellite receiver has 48-channel all in view tracking, built in antenna, SiRF Star IV GPS Chipset and WAAS/EGNOS support. These features are simply phenomenal for the money.
 - The USB connection on the GPS Module can be extended with a USB port extension. I have mounted the GPS modules outside the home, approximately 15 feet away from my computer's USB ports, without problems. (The maximum distance specification for the USB2 standard is 5 meters (16.4 feet), that is based on signal delay through the cable)
 - The GPS receiver with internal patch antenna are lightweight, small, water proofed, and rugged and are easily carried with a notebook or tablet computer to the field.
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Frequency Asked Questions (FAQ)

Q1. Does Using an USB Port GPS Interface Affect Time Accuracy?

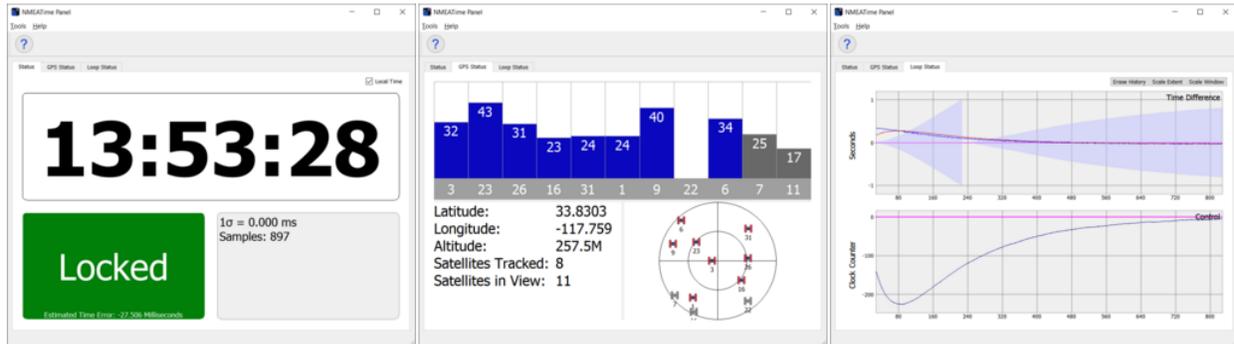
A1. A serial port and USB port are both serial device interfaces with a difference of the hardware implementation. The bit rate is still set by the driver software and is more than accurate enough for logging purposes. If you were trying to get down to sub-microsecond accuracy, then you would need to use a GPS with 1 pulse per second (pps) output and synchronize to it. But for time synchronization, the GPS messages contain the time of day information that is used to set the clocks. Good enough for logging.

Addendum

I new technique for time synchronization is under implementation by the author of the NEMATime software. I was contacted by Monte, KE6GQO via e-mail. He said, the new program under development is called NMEATime2 and ...

"It will take the serial string, characterize it and use it as a timing reference by time-tagging the incoming message to the PC clock for the short term. Using digital filters and software algorithms, the signal is used to discipline the PC clock to the incoming filtered signal giving a long term accuracy of around 1ms."

The download path to the program is at the link <http://visualgps.net/nmeatime2/>. The screen shots of the program as of this writing are shown below.



I have not tested the program but the reader is welcome to download the *beta* version and test it out. Monte welcomes all comments and feedback (Monte can be reached at his e-mail address: visualgps@gmail.com). It would be interesting to test the program's accuracy and repeatability by comparing it to the one (1) pps output from a Rubidium frequency/time standard. This would be a good science project for a reader!

Internet Link References

1. GlobalSat, GPS Receiver (Price Class \$30 Online)
http://www.globalsat.com.tw/products-page_new.php?menu=2&gs_en_product_id=2&gs_en_product_cnt_id=76
2. NMEATime Software, Sets Time on PC From GPS Receiver (Price Class \$15 Online, Free Trial Period)
<http://www.visualgps.net/NMEATime/default.htm>

Appendix / Brochure Information

BU-353S4

GPS Receiver

- SiRF Star IV
- 48-Channel All-In-View Tracking
- NMEA 0183
- WAAS/ EGNOS Support
- 2.08" Diameter X 0.75"
- Built-In Supercap For Rapid Acquisition
- Built-In GPS Patch Antenna
- Built-In Roof Mount Magnet
- USB 2.0 Interface



The BU-353-S4 is a USB GPS receiver that features a highly sensitive, low power consumption chipset in a ultra compact form factor. The BU-353-S4 is powered by a SiRF Star IV GPS chipset, and will provide you with superior performance in urban canyons, and in dense foliage. With the SiRF CGEE (Client Generated Extended Ephemeris) technology, has the capability of predicting satellite positions for up to 3 days in advance, and will deliver a CGEE-start time of less than 15 seconds under most conditions without any network assistance. The BU-353-S4's MicroPower mode allows the receiver to stay in a hot start-like condition almost continuously while consuming very little power.