

PC Clock Accuracy

The following is based on my own experiences with Windows XP Home. I would imagine that the following could apply to other *recent* versions of the Windows OS from Windows 2000 to Vista, but I have no way of confirming that. Prices quoted were correct as at September 2007. They may have changed.

Note that in the first section I refer to changes in the Windows Registry. If you are not confident of making these changes with regedit *exactly* as described, then don't make the attempt. I don't want to be held responsible for your machine going awry.

How far you go down the path of setting and maintaining the exact time on your computer depends on your requirements. For the average user it may not matter that the clock is in error by tens of seconds, or even a few minutes. Provided you remember to do it, it could easily be checked and adjusted manually to the time shown on an accurate clock or watch, but the operating system has a feature that is very easy to set up so that the PC's clock checks itself automatically against an accurate time standard on a weekly basis.

Start->Control Panel->Date and Time (or, if you have your clock on the taskbar, double click on it) then select the Internet Time tab.

Tick 'Automatically synchronize...'

Select a suitable time server. The default servers are typically based in the USA. I have been using time.demon.co.uk as I use Demon Internet as my ISP. I would suggest the Manchester University ntp (Network Time Protocol) servers ntp2b.mcc.ac.uk, ntp2c.mcc.ac.uk or ntp2d.mcc.ac.uk as alternatives.

To pick a random (UK) time server use 0.uk.pool.ntp.org, 1.uk.pool.ntp.org, 2.uk.pool.ntp.org or 3.uk.pool.ntp.org.

A comprehensive list of alternatives can be found at:

<http://www.chronosatomic.com/secondary-servers.html>

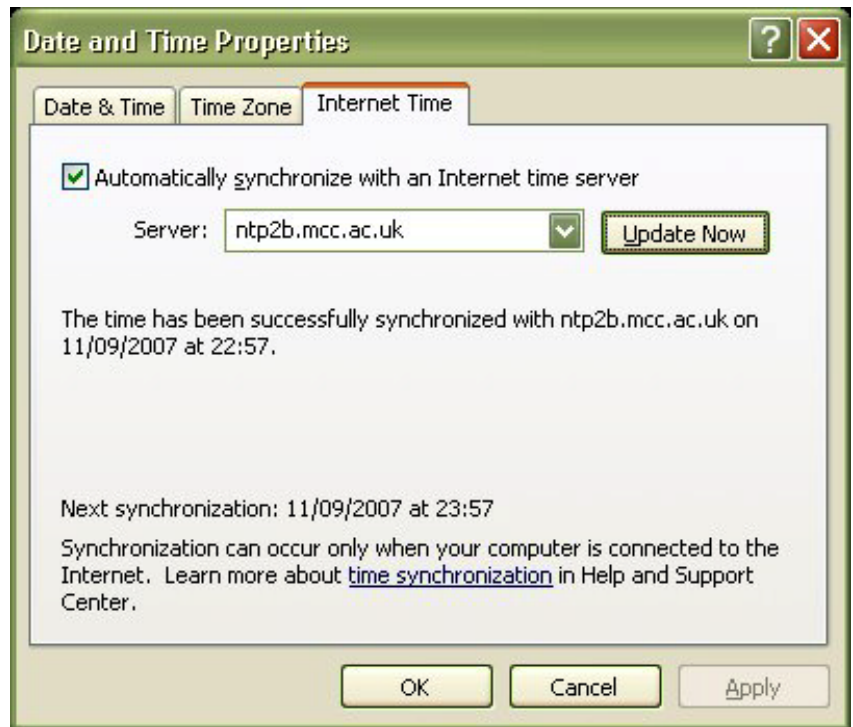
Note that many are 'open access' but some require you to 'register' by sending an email.

If the server you wish to use is not on the Windows drop-down menu, enter the server name in the box, click Apply, then click Update Now.

Hopefully the result is similar to this.

One piece of information that this in-built facility doesn't tell you is how far out your clock was when the adjustment was made.

If weekly updates are good enough for you then the remainder of this article may be academic.



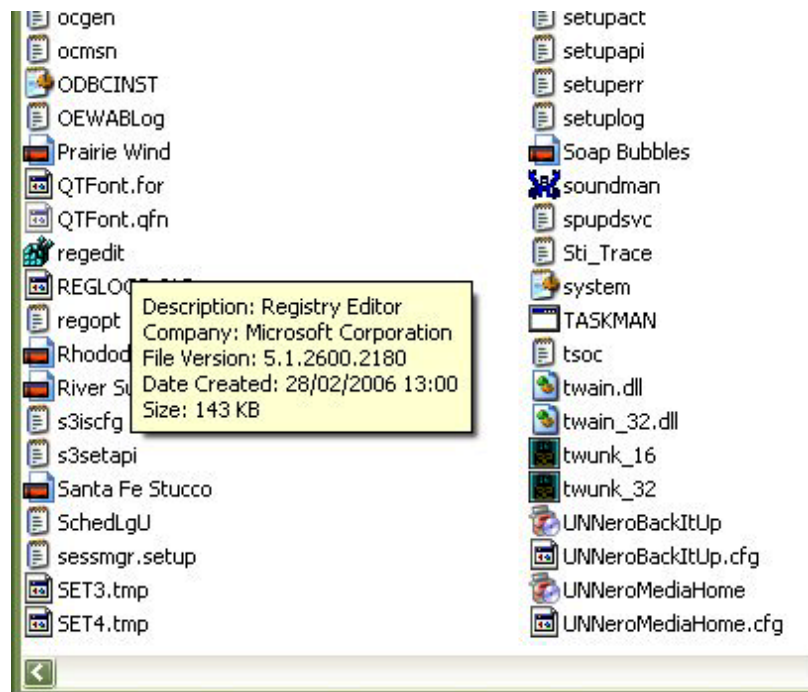
Update interval

I was experiencing quite large errors with my PC clock. It was always gaining time, and over a week it could be several minutes fast, so I started to look on the internet for free (or very cheap) solutions.

I discovered that it was possible to change the update interval from the default '1 week'.

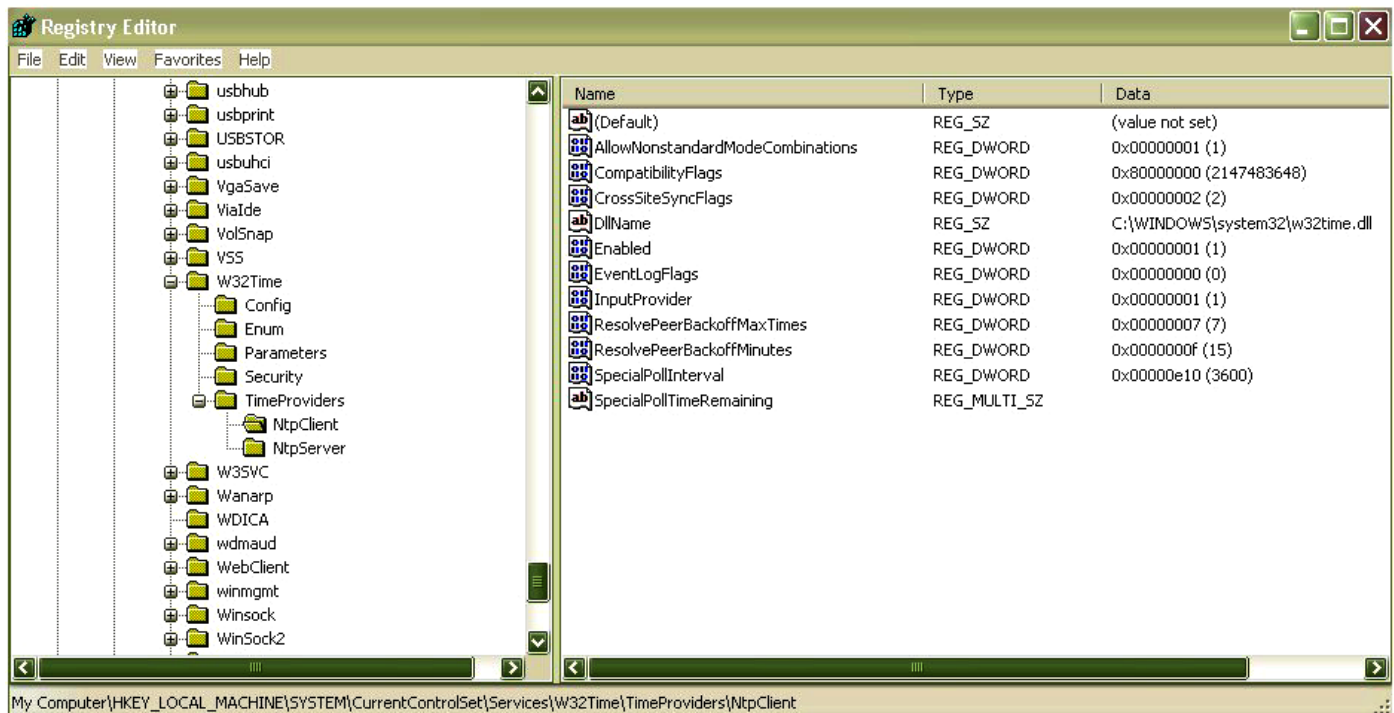
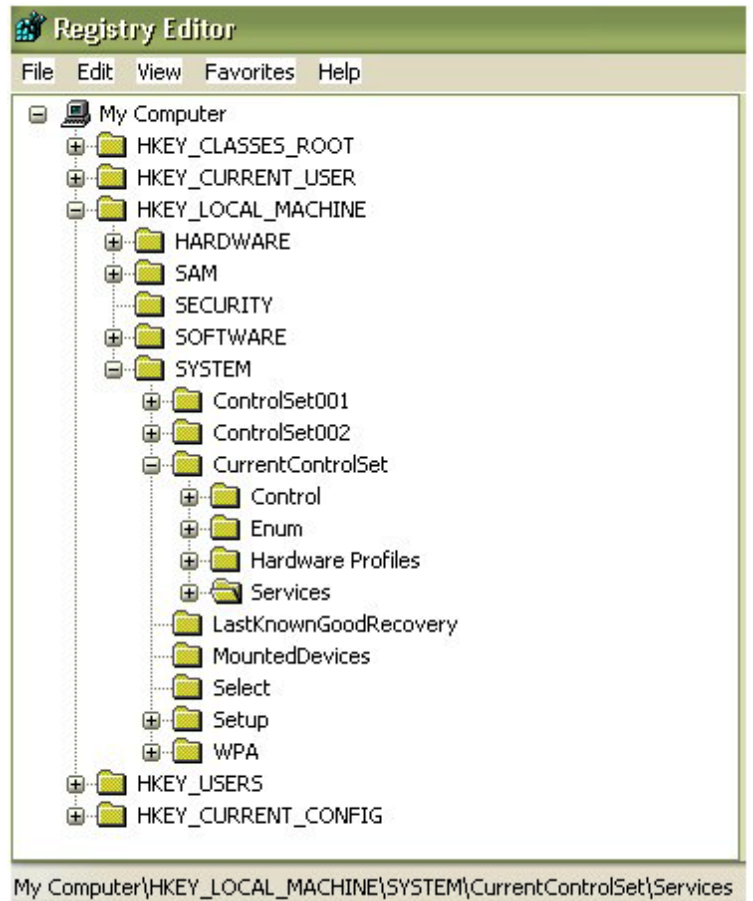
Warning – proceed with caution. Read my note at the start of this article about 'regedit'.

Open C:\WINDOWS
Find regedit and
double-click on it.

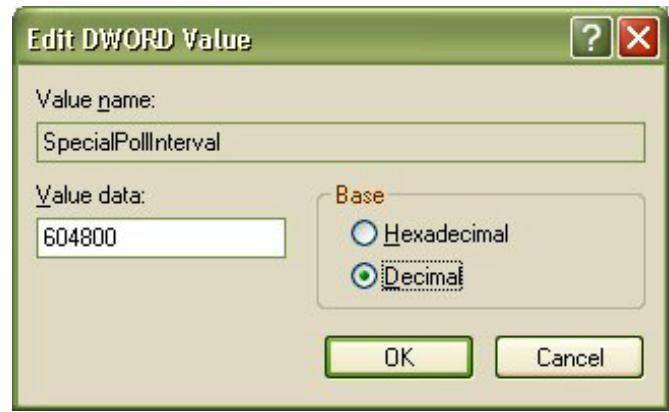
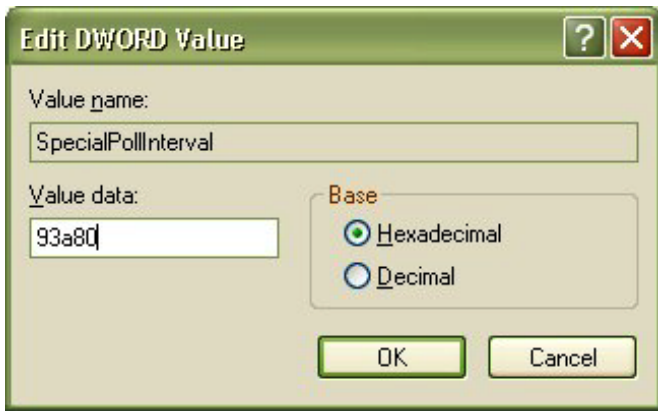


Navigate to

HKEY_LOCAL_MACHINE\SYSTEM\
CurrentControlSet\Services\W32Time\
TimeProviders\NtpClient



In the right-hand pane, double-click on SpecialPollInterval which will open up a window like the left-hand image below.



By default the value is 93a80 Hexadecimal. Clicking Decimal changes this value to 604800. If you get out your calculator you will find that this is the number of seconds in one week.

Decide what update interval (in seconds) you would like, enter this value in the box and click OK. For my requirements I just deleted the last zero thus making the interval 60480 seconds, or 1/10th of a week.

Job done!

More accuracy needed?

I still wasn't satisfied with the accuracy of my clock and reducing the update interval to 3600 seconds (one hour) didn't seem to make much difference.

After another search on Google I found 'Chronos – Atomic Clock Synchronizer – v4.3' and it was free!

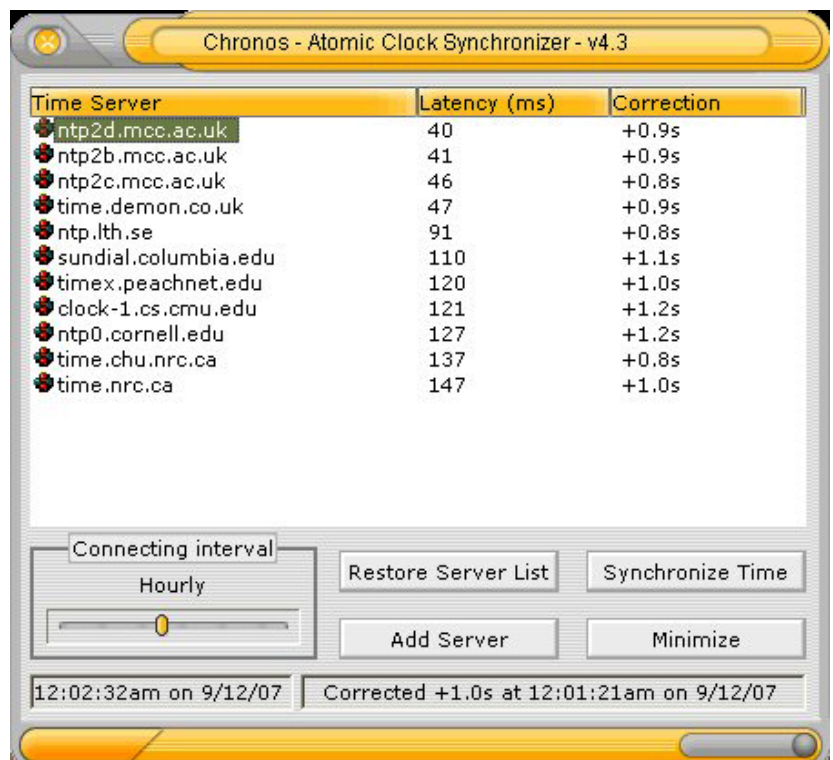
I downloaded this from <http://www.chronosatomic.com/> and installed it after scanning the .exe file with AVG. Here is a screen capture of it in action.

Not only does it check with a number of time servers (I understand XP's in-built synchronizer can do this but I believe it's not easy to configure) but you can also see how much the clock was in error by, and it appears to adjust the clock based on the average error found.

I set it to synchronise hourly.

It may be my imagination, but I do think that the error at successive synchronisations reduced after it had been running for about 24 hours due to it adding some 'drift correction'.

I could not find any information supplied with the software, or pages on the web (or in newsgroup postings) which suggested that it performed this 'feature'.



No such thing as a free lunch?

I was happy that Chronos was keeping my clock more accurate, but...

I wasn't happy that this 'free' software announced, every 30 or so minutes, "To stop this pop-up, upgrade by visiting ...". They wanted money! I investigated further and discovered it was going to cost me a total of £8.75. £5.22 was for the 'upgrade', £2.62 for the download service and 91p VAT). I decided that the software was a considerable improvement over the in-built Windows synchroniser and to me it was worth the money.

I used it for a short while and I found that, updating hourly, the error was often less than half a second.

Still not accurate enough?

I'm a perfectionist and for my application (weather satellite reception) I decided that even 'often less than half a second' was too large an error to tolerate. It would be preferable to have smaller corrections, even if they had to be more frequent. One option was to increase the synchronisation frequency, but this would be an extra burden on all the time servers I was synchronising to. While the NTP time servers are there for that purpose, I don't believe they would be happy for one user to use their services every few minutes when the Windows default interval is one week. See <http://it.slashdot.org/article.pl?sid=07/09/08/1840255&from=rss> (or <http://tinyurl.com/yvcvle>)

In a posting on 'Living with Technology Online' in late 2006, Geoff Baxendale brought up the subject of the USB GPS 'mouse'. At the time, I read the post with interest but could not think of any application where I would need such a device. Surely the prime purpose of these devices is to plug them into a laptop computer (or palm computer?) and plot your position on a map. I can imagine they would be extremely useful on a boat. Using a GPS device (and a map) not only can you see where you are, you can also see what your speed and direction of travel are.

If you would like to know how GPS works I suggest you read <http://electronics.howstuffworks.com/gps.htm>

For my application, I know where I am and I'm not moving! But a GPS can tell you what speed you are moving at because the satellites have onboard atomic clocks and this information is transmitted by the satellites and decoded by the receiver.

A solution is in sight!

I have bought a Globalsat BU-353 GPS mouse (£41 from Expansys), just like the one Geoff mentioned in his posting, and downloaded a 30-day evaluation copy of some software called Presentense Time Client from: <http://www.bytefusion.com>

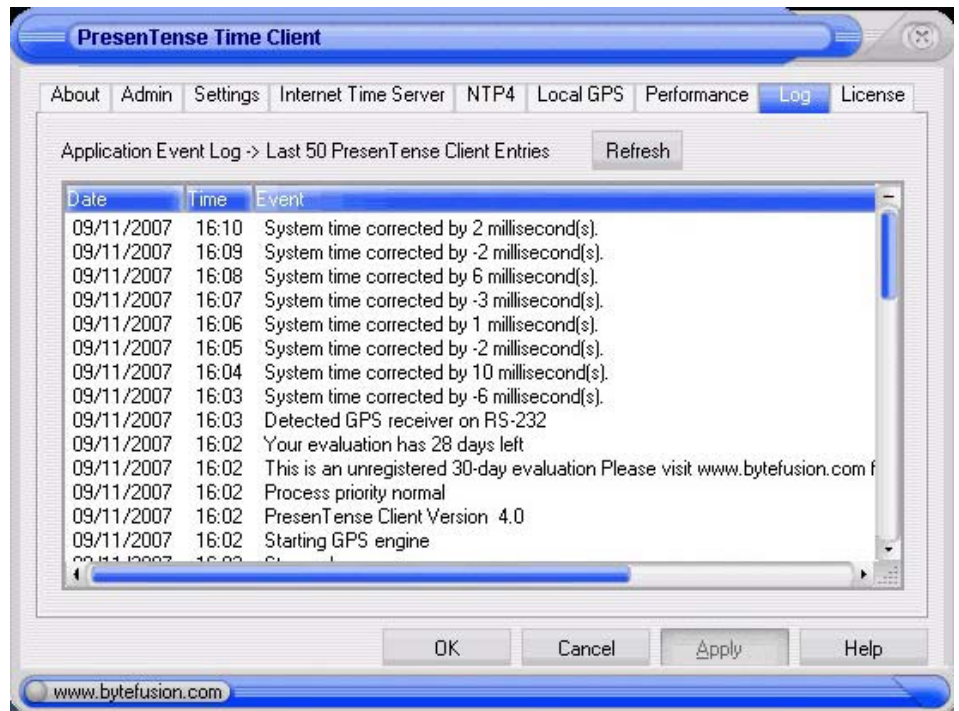
Unlike the Chronos software, I was aware at the outset that I would need to pay for this software (assuming I was happy with it) before the trial period expired. The cost is US\$39.95 (about £20 at the exchange rate in May 2008).

This software will also work with a 'Generic' GPS receiver and Garmin 38 or Garmin II Plus models. There are other options in the software for synchronising to a network time server or an NTP4 server (see http://en.wikipedia.org/wiki/Network_Time_Protocol for more details).

Setting up the USB GPS mouse with this software took less than 15 minutes.

Although the BU-353 is fitted with a USB plug, the software provided redirects this to a COM port.

My computer clock is updated *every minute* (one minute appears to be the default update interval) and typically, the error found (and correction made) is less than 0.01 seconds.



I have since discovered that the actual accuracy may not be as good as that reported by the software and there are two aspects to this.

Firstly, although the software reports errors (and corrections) of the order of tens of milliseconds, I have seen errors in excess of 10 seconds when comparing it to my Iyonix clock or my MSF clock. I have no idea why this should be. The GPS receiver is in a good location (south-west facing window sill) and it 'sees' a reasonable number of satellites.

Secondly, see the posting (as above):

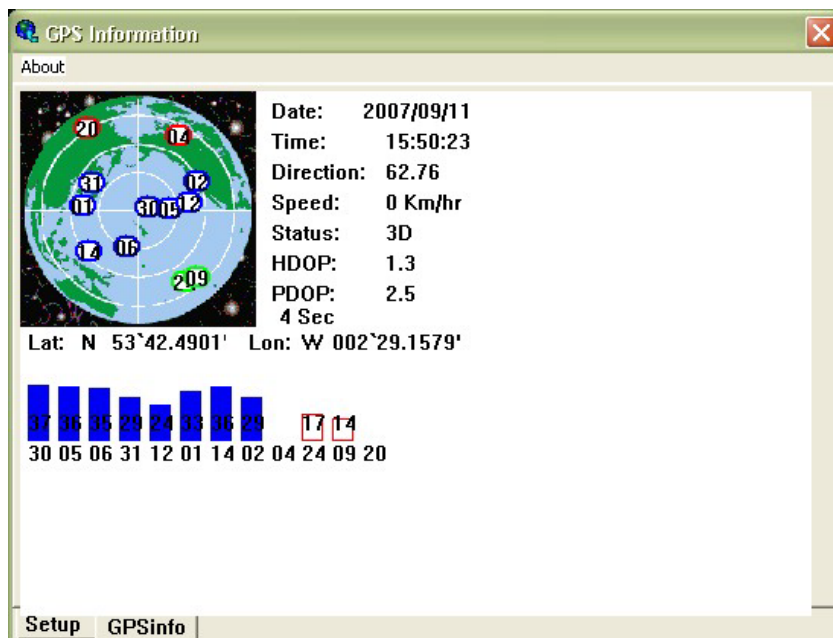
<http://it.slashdot.org/article.pl?sid=07/09/08/1840255&from=rss> (<http://tinyurl.com/yvcvle>)

and read the responses to 'GPS time with OpenBSD' about half way down the page. It refers to USB latency and inaccuracies in the NMEA output. It suggests a GPS receiver with a PPS (Pulse Per Second) output will provide much better accuracy. Also see:

<http://groups.google.co.uk/group/comp.protocols.time.ntp/msg/7caefadf0e9bd50d?hl=en> (<http://tinyurl.com/2btya9>).

<http://www.gpscloc.com/gps.html> gives a summary of the potential problems of using a basic GPS receiver for timekeeping (and they would like to sell you a suitable device for \$380!). Other devices are available, e.g. <http://www.london-electronics.com/rugby.php>

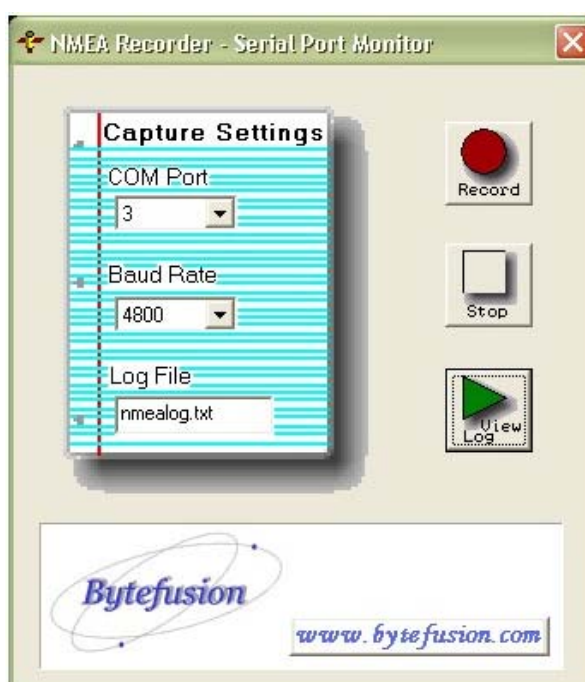
Other 'toys' to play with when the BU-353 is connected are 'GPS Information' (on the CD supplied with the unit) which shows a real-time graphical representation of where the satellites are...



...and 'NMEA recorder'

(free from <http://www.bytefusion.com>)

which creates a textfile (see below) of the data from the GPS satellites it is receiving.



```
01:38:30.531 $GPVTG,67.53,T,,M,0.31,N,0.6,K*53
01:38:31.172 $GPGGA,003831.000,5342.4942,N,00229.1695,W,2,08,0.9,154.5,M,48.8,M,0.8,0000*6B
01:38:31.297 $GPGSA,A,3,14,01,19,23,11,17,20,28,,,,,1.6,0.9,1.3*3D
01:38:31.453 $GPRMC,003831.000,A,5342.4942,N,00229.1695,W,0.04,249.35,120907,,*11
01:38:31.547 $GPVTG,249.35,T,,M,0.04,N,0.1,K*6C
01:38:32.172 $GPGGA,003832.000,5342.4943,N,00229.1691,W,2,08,0.9,154.6,M,48.8,M,1.8,0000*6F
01:38:32.297 $GPGSA,A,3,14,01,19,23,11,17,20,28,,,,,1.6,0.9,1.3*3D
```

With information gleaned from the web, you would be able to decode this.

Note that the COM port can only be interrogated by one piece of software at time (unless you buy additional software to allow sharing) so the software you are not using needs to be 'disabled'. This can be done quite easily by selecting a different COM port and only selecting the correct COM port for the software you want to work.

Conclusions

After using the BU-353 with the Presentense Time Client software for several months, I was disappointed. On more than a few occasions I came home from work to find that although the software declared that the time was synchronised, the clock was out of synchronisation by many tens of seconds. Restarting the software and correcting the clock using an NTP source brought the PC's clock back into synchronisation. Once synchronisation had been achieved I restarted it using the GPS signals as the source. The time stayed accurate for maybe a week or two, then slipped again.

I have now reverted to using the Chronos software and synchronise to the Demon and Manchester University time servers once every six hours. The largest error I see is usually only 0.2 seconds, good enough for my weather satellite software to plot coastline overlays (refer to previous article) in the correct position.

My weather satellite images can be found at: <http://www.g4iat.co.uk/wx/noaa>

And so I can now move on to my next project, my own weather station which will initially record wind speed, wind direction, temperature, humidity, atmospheric pressure and rainfall. Once I've made significant progress with that I will write an article about my experiences with it. Other measurements which may be added later are solar radiation and lightning detection.

Barry Smith
May 2008