Synchronizing the Logger Clock and Keeping it Synchronized

Why does the logger clock need to be synchronized?

Electronic devices are manufactured and calibrated in controlled environments. The temperature is controlled, the relative humidity is low and conditions are, in a word, ideal. When the device is installed and operated out in the real world, those perfect conditions often cease to exist and in many cases, they are replaced with conditions that are quite the opposite. As the temperature varies, electronic components drift and vary in their operation. The real time clock of the data logger and any other electronic device will also drift with this temperature change. Different devices have a different specification as to the accuracy or drift of the real time clock. The newer generation of loggers (CR800, CR1000, CR3000) have a much improved clock stability specification when compared with that of the older generation of loggers (CR510, CR10X, CR23X). If the logger clock drifts significantly, the data stored with that time stamp may not truly represent the time at which it was measured. So, this leads to two questions:

How much drift is significant and how can I synchronize the clock?

The answer to the second question depends largely on the answer to the first question. How accurate does the clock have to be? The answer to this question can vary quite a lot depending on the application.
For a stand-alone weather station, it may mean making sure that the clock matches the PC time once a month and as long as the logger and the PC clocks are within a minute of one another, that may be satisfactory.
For a high frequency system such as an eddy covariance monitoring station, which logs data at 10Hz or 20Hz, a difference in logger and PC clocks of one second may prove to be significant in the frequency response of the system.
For a system where multiple loggers are in a network and the measurements and data set from different loggers must be integrated and processed together and a high level of confidence in synchronized measurements is required, then sub-second synchronization is important.

How to synchronize the clocks?

1. The simplest way to synchronize the clock(s) of the data logger(s) is to use the Set clock button on the Connect screen of Loggernet. This will set the logger clock to be the same as the PC time.

2. To synchronize a network of loggers via a telemetry link, the best option is to use a single PC/server as the master time for all loggers. Loggernet software can be configured (through the Setup screen) to check the logger clock on some automated interval and synchronize it if it has drifted by more than some predefined amount. As long as this server maintains an accurate clock, then the loggers will all have an accurate clock (limited by the latency of passing the data across the telemetry link).

3. For a network of loggers connected via radio, RS485 or some other media that doesn't involve Loggernet, one logger can pass clock data to another logger using Pakbus protocol and synchronize the clocks without the need for a PC or human interaction. This has limitations due to the latency of passing the data from one logger to another over whatever communications path is being utilized.

4. The most accurate way to synchronize the logger clocks is by using GPS receivers. All GPS receivers output posi tion, heading, speed and time information and many also output pulse per second information, which can be used to set the logger clock to 10 microsecond resolution. The CR800, CR1000 and CR3000 data loggers (hardware revi sion 007 and later) all have a GPS() instruction that can be used to capture position and speed information (or any other information of interest that is being output from the GPS) as well as keeping the clock synchronized.

For information about how to use the GPS() instruction, look at the help in Loggernet and CRBasic or contact an Application Engineer at CSA.