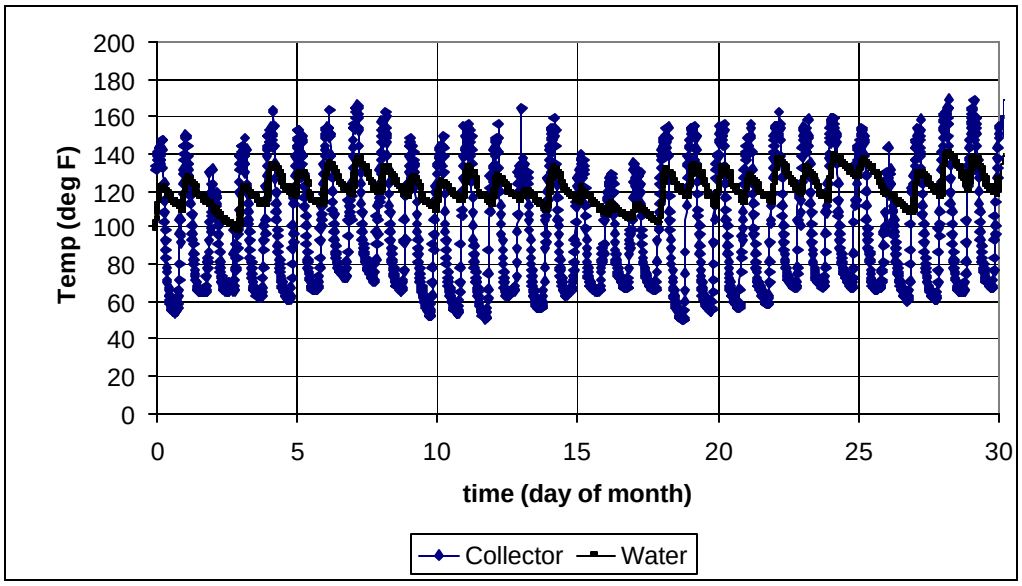
Monitoring Performance of a hot water solar system

In order to evaluate the performance of my solar hot water system, I purchased a temperature monitor unit, Model Hobo U12 4-Channel monitor from Onset Computer Corp (www.onsetcomp.com). The monitor box is battery operated and can accommodate up to 4 external temperature probes. It stores the readings at selectable time intervals (I have used 10 or 20 minute intervals) and can easily hold values for one month. The values are read out via a USB cable into your PC using software sold with the unit. The total cost including 2 temperature probes was $242.

I typically export the temperature readings into an Excel spreadsheet, so that I can perform additional analysis of the data. For example, I know that my storage tank holds 80 gallons. A gallon of water weighs 8.33 lbs. One BTU is the amount of heat necessary to heat one pound of water by one degree F. Therefore, if the temperature of the water in my storage tank rises by 1 degree, the solar heat has generated 1 degree*8.33 (lbs/gallon)*80 gallons = 666 BTU. A typical plot for the month of July 2007 is shown below. One temperature probe is attached to output pipe of the collector, a second probe is attached to the hot water tank to measure the water temperature.



I have also used the temperature monitor to estimate the water flow through the system. By reducing the time interval to 2 seconds and attaching an additional probe to the pipe coming from the collector at water storage tank, I could measure the temperature rise at the collector and at the tank. It can be seen from the plot below that the collector temperature rises sharply at 11 minutes (blue curve), the temperature at the tank (red curve) first drops, since there is still cold glycol in the pipe, then rises sharply shortly after 12 minutes. It then follows the collector temperature with a time delay of about 1.3

minutes, which is the transit time of the glycol from the collector to the storage tank. Since I know the pipe diameter and the length of the path from the collector to the tank, I can calculate the volume of water in gallons/minute that the pump is circulating through the glycol loop.