

Crystal Oscillator Temperature Calibration via WWVB

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Preliminary testing and datasheet information convinced me that crystal oscillators used with my microprocessor data gathering systems had 'small' temperature coefficients. To prove this I gathered data on the crystal rate as compared to WWVB received on a \$20 'atomic clock' made by Oregon Scientific. The clock was slightly modified to allow raw signal from WWVB to be sampled by a microprocessor and compared to the microprocessor's own crystal timebase. Data was taken continuously over 4 months.

Reception of WWVB is noisy, in fact, the standard deviation of the signal edge is on the order of 50 microseconds. Also there is no reception sometimes for several minutes or an hour because of atmospheric and solar effects. This makes it necessary to average a great deal of data to confirm my assumption.

Over 57,000 good quality data points were found for the temperature range of 14 to 27 degrees C. These points are plotted below fitted with a linear regression line. The regression shows the slope is about 0.15 microseconds per degree C. Since my #7 clock shows 1 to 5 (or more depending on configuration) microseconds per degree C, I conclude that the crystal effect is 'small.'

