GPS Clock TCXO & OCXO options

In the rare occasions the satellite view of your GPS Clock antenna is blocked, or atmospheric conditions are such that your Microchip clock cannot “see” sufficient satellites, the time output of the clock will be derived from its internal oscillator. These oscillators are typically not as good as the GPS source, so can only be used for a short period.

There are three main options, the TCXO which is a temperature compensated crystal oscillator, the more expensive OCXO oven controlled crystal oscillator and then as a premium option for larger clocks a Rubidium atomic oscillator.

The Sync Holdover Time setting is used to determine the period after loss of satellite sync that will be tolerated before Microchip “Tekron” clocks will show the “loss of sync” status. The TCG 01-E manual for example advises the accuracy for TCXO is to the sub-microsecond level over short periods (a few minutes), and to within 10 µs for up to 40 minutes.

The clock development team initially conducted tests to verify the performance of the Temperature-Compensated Crystal Oscillators (TCXOs) used in Tekron GPS clocks to maintain output during loss of satellite. The lab test analysed the 1PPS (one pulse per second) output drift at various temperatures within a 24 hour period.

The results show that Tekron TCXO’s holdover accuracy outperforms comparable competitor products currently available in the market. Considering a benchmark of maintaining 0.5 ms accuracy (drift), the tests show that with constant 25 deg C temperature the clock maintained output to the desired accuracy for over 20 hours. Using a more severe test of subjecting the clock to a temperature ramp of +25 to -40 to +80 to +25 deg C over 24 hours, the GPS clock maintained the 0.5 ms accuracy for over 5 hours. During this test, the worst case drift over the full 24 hour of temperature cycle did not exceed 1.2 ms.

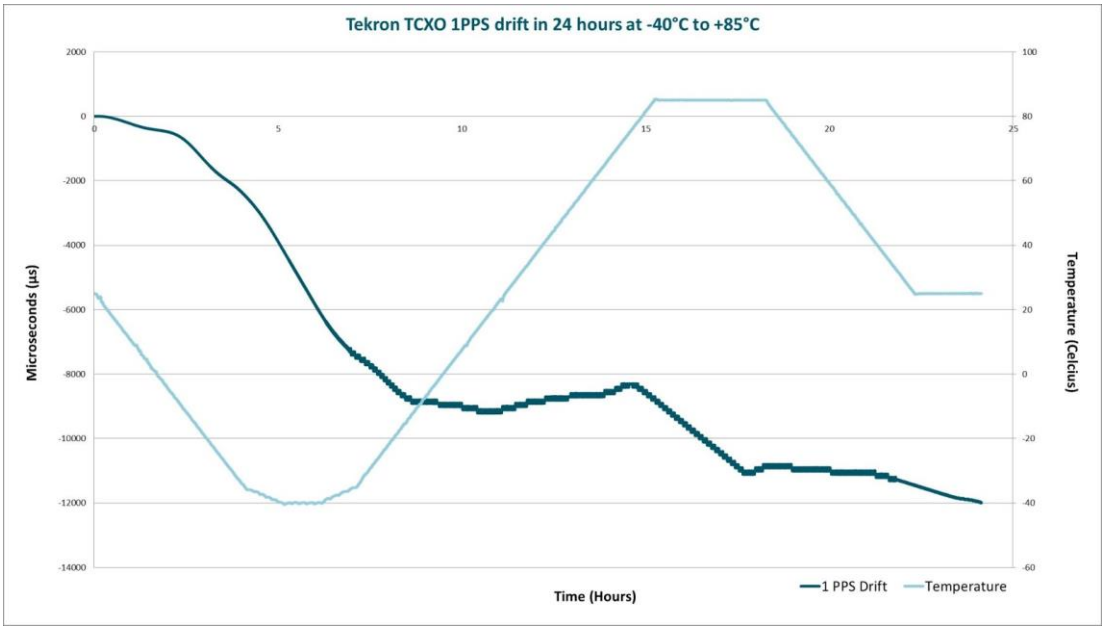

Figure 1 TXCO performance.

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An Oven Controlled Crystal Oscillator (OCXO) option is now available for larger clocks. This is an enhancement from the standard Temperature Compensated Chrystal Oscillators (TCXO) normally used as the oven-controlled option provides a controlled environment for the oscillator to provide more stability. Thus, the output of the GPS clock will remain accurate for longer, allowing a longer 'holdover' time to be provided.

Comparing between the above test and these new tests we have picked the closest comparable test data between the two units. At 20 deg C, the TCG 01-E TCXO was reported to maintain a 0.5 ms accuracy for 20 hours. For the TCG 02-E with OCXO, a significant improvement is provided with the output maintaining an accuracy of +/- 10 us over 24 hours (based on +25 deg C, and clock having 7 days prior operation).

The OCXO option should be considered by all those looking for highly-accurate long-term GPS holdover performance.

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