

Multi-purpose True Event Timer Module

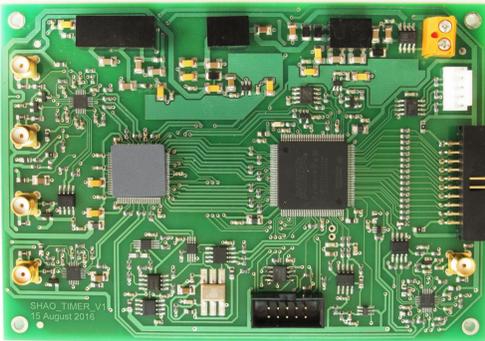
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For applications where the time matters

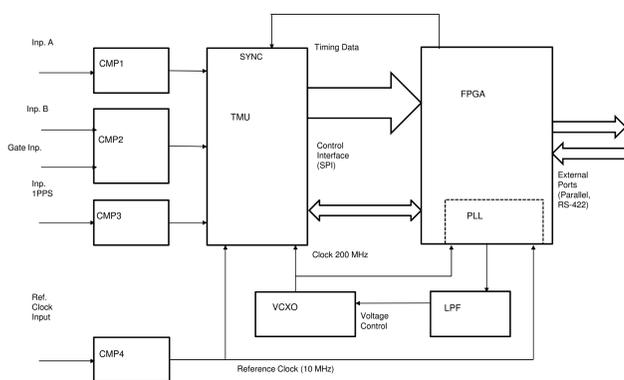
Technical solution for obtaining very accurate time-stamps of events that are taken with respect to Coordinated Universal Time (UTC).

The solution is based on utilizing the chip THS788 (Texas Instruments) in combination with a time scale implemented in an FPGA.

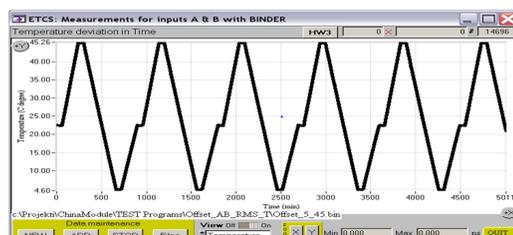
The external UTC-based 1PPS (One Pulse Per Second) signals are time-stamped during measurements too, which allows monitoring the offset drift of the timer's internal time scale with respect to the 1PPS signal and performing the necessary correction with the picosecond accuracy.



The device consists of : four Comparators (CMP1...CMP4), Time Measurement Unit (TMU – THS788), 200 MHz Voltage Controlled Crystal Oscillator (VCXO), Phase Locked Loop (PLL), Low Pass Filter (LPF), and FPGA.



- Two independent measurement channels A and B
- Inputs – NIM or TTL (reconfigurable by onboard resistors)
- Dead time for each channel - **5 ns**
- Dedicated input for the 1PPS signal
- Gate input for the input B
- Accuracy (single shot RMS resolution of time stamping) – **6 ps**
- Input to input offset drift (for all inputs) – less than **0.2 ps/°C**
- On-board high quality PLL that can lock to the external 10 MHz signal
- Internal time scale repetition period - 42.949672960 sec
- **Continuous time stamping** –
timing range with the support of an external processor - **unlimited**
- On-board FIFO for 2K events
- Maximum event rate for bursts of up to 16 events, each channel – **200 MHz**
average event rate until the FIFO is full – 1.5 MHz
- Parallel interface for communicating with an external controller
- RS-422 interface - optional
- Power consumption - external power supply: +9...28V (8W)
- Small size of the board – 100mm x 140mm

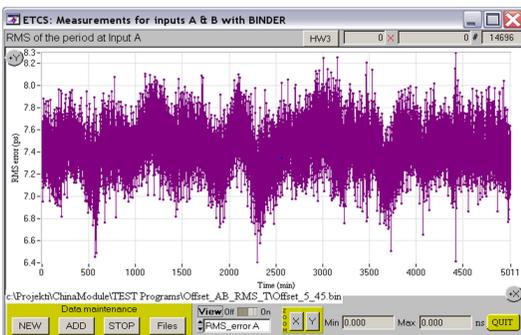


The temperature cycling during the tests – from 5°C to 45°C

The performance parameters of the Module were estimated with the use of:

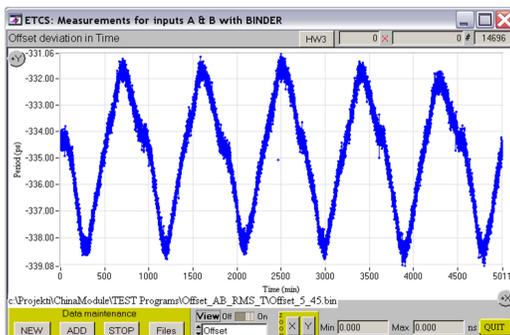
Time and Frequency Standard: Pendulum GPS-12R
Test Generator with ultra-low jitter: Eventech ETTG-100-TTL
Temperature Chamber: Binder KB115

Estimation of the single-shot RMS resolution



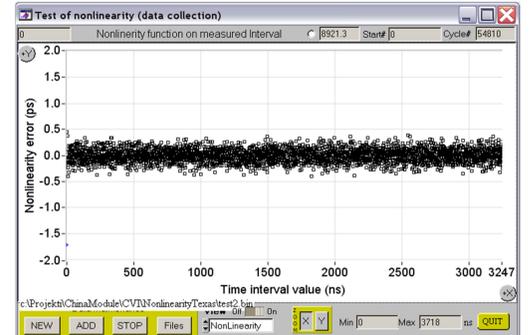
RMS error of the measured intervals in the Input A is shown here. Each point on the trace is the RMS error estimation for 1018 intervals between the adjacent events in the Input A. Dependence on temperature is very weak and the RMS error for intervals does not exceed 8.3 ps, in the case of a single time-tag it is 5.9 ps. The results for the channel B is pretty close (8.6 and 6.3 ps correspondingly).

Estimation of the input-to-input offset drift



The drift of the offset between inputs A and B during the test are shown here. Each point of the trace is the averaged value of the intervals between events in the Input A and closest events in the input B, averaging volume is 1018 such intervals. The offset slightly varies with temperature with the coefficient of 0.2 ps/°C.

Estimation of the interval nonlinearity



Interval non-linearity error is a systematic error in measurement of time interval between adjacent events that depends on the value of this interval. The Module has two independent measurement channels A and B. To check the possible cross-talk between channels, the same method, which has been used for many years for calculating the non-linearity correction tables for the devices A033-ET, has been used. The obtained results confirm that the interval non-linearity error is less than 0.5 ps for any intervals in the range from 0 up to 3.25 us.