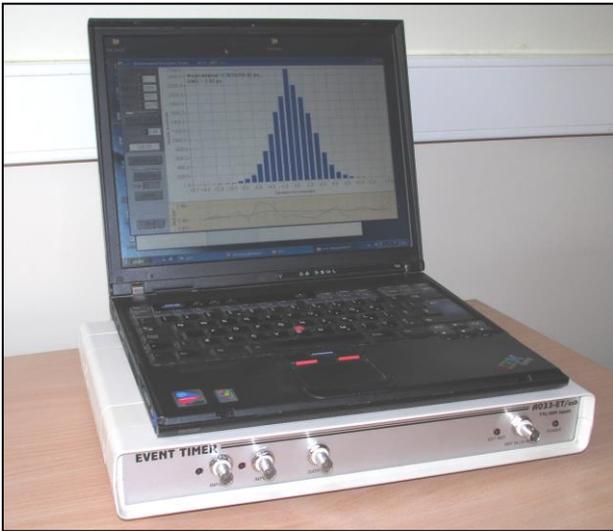# Event Timer A033-ET/usb

OVERVIEW

The Event Timer A033-ET is a computer-based instrument that measures time instants when input events (represented by electrical pulses) occur. Distinguishing feature of the A033-ET is extremely high precision combined with a high measurement rate. In particular, single-shot RMS resolution better than 5 ps and measurement rate up to 20 MEPS in burst make the A033-ET one of a few best event timers currently available. Combining the A033-ET hardware (ET-device) with application-specific software, a number of top-quality and reasonably priced event timer systems can be created. As a A033-ET version with Parallel Port interface the A033-ET/usb with USB2 interface is well suited for applications related to Satellite Laser Ranging (SLR), but having the higher measurement rate (1 MEPS continuously) it can additionally used in many other applications, such as LIDAR and 3-D scan systems, time-of-flight and time-of-life spectroscopy, data transfer by laser link, signal analysis etc.

The ET-device offers two inputs (A and B) to measure events on these inputs alternately with 50 ns dead time. Result of every single measurement (epoch time-tag) is represented in digital form with 1 ps LSB resolution. Time-tags appear at the timer's output in order of event measurement. Each time-tag is marked to indicate the input where the measured event came from. It is well suitable to measure the overlapped time intervals between Start and Stop events that come at the separate inputs (either A or B) of the ET-device in arbitrary order. In particular, this is the case of advanced SLR at KHz repetition rate. The input B can be externally gated by a control signal connected to the input GATE.

The ET-device (with the included networking SW) provides network interface based on TCP/IP communication protocols to interact with any remote application requiring precise event timing. Such interfacing is well suited for designing distributed multi-user event timer systems where user's application software is separated from the specialized software supporting event measurement. In this case the user's software can remotely control the A033-ET/usb full operation.
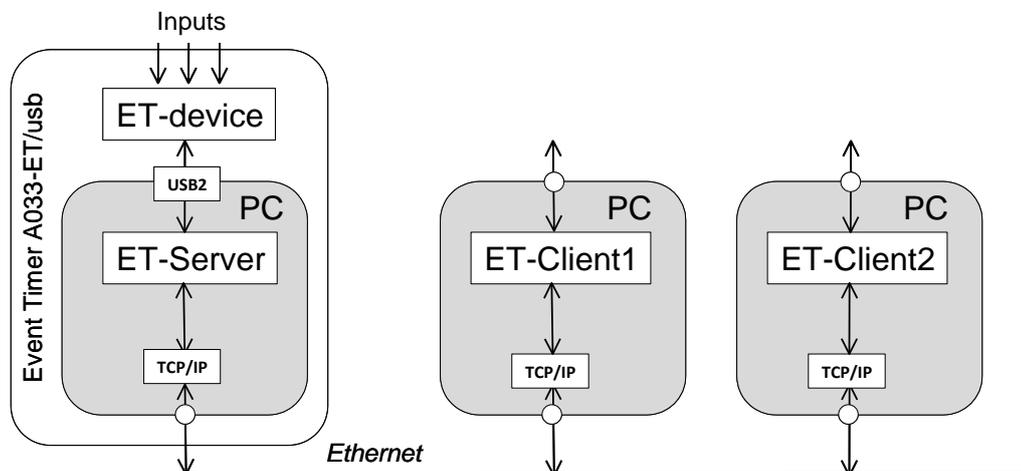
TYPICAL PERFORMANCE CHARACTERISTICS

A033-ET PRECISION CHARACTERISTICS

✳ ✳ ✳

Single-shot RMS resolution is the main parameter specifying the practicable A033-ET precision. For the A033-ET it is defined as the standard deviation of total error in measurement of time intervals between events.

Typically the A033-ET supports single-shot RMS resolution in the range of 3-4 ps. In some cases the resolution may be a little better or a little worse depending on the hardware unique features.
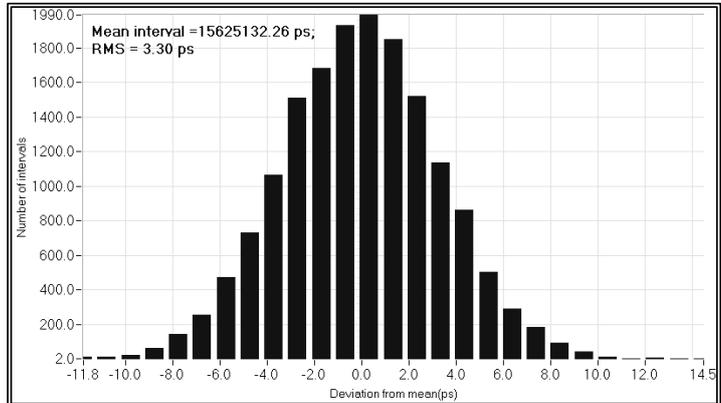
Histogram of errors in measurement of high-stable time intervals

✳ ✳ ✳

Integral non-linearity error is a systematic error in event measurement that depends on the position of measured event over interpolation interval. In the average this error is specified by the value of its standard deviation over interpolation interval.

Typically the A033-ET integral non-linearity RMS error is ranged from 1 to 1.5 ps, and surely less than 2 ps.
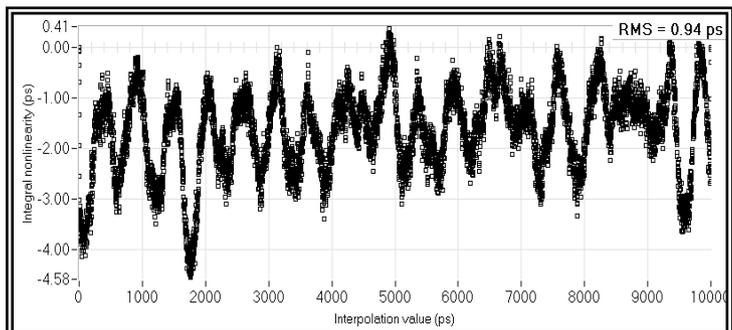
Integral non-linearity error over 10 ns interpolation interval

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Interval non-linearity error is a systematic error in measurement of time interval between adjacent events that depends on the value of this interval.

Typically the A033-ET interval non-linearity error does not exceeds ±0.5 ps for time intervals greater than 100 ns. For smaller time intervals such errors can be a little greater (especially for time intervals that are near to the 50 ns dead time).
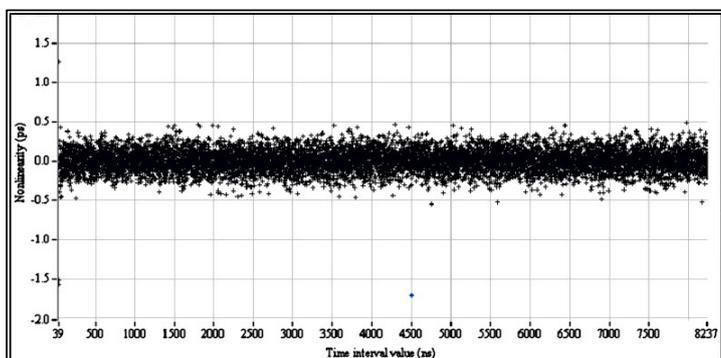
Interval non-linearity error vs. time interval

Single-input offset drift is seen as long-term deviation of systematic error in measurement of events coming at the same input of the event recorder. Such drift reflects long-term instability of the internal time-base relative to the external 10 MHz reference frequency, depending mainly on the ambient temperature variation.

Typically the A033-ET single input offset drift does not exceed 2 ps/^{0}C. It is specified without regard for long-term instability of the reference frequency.
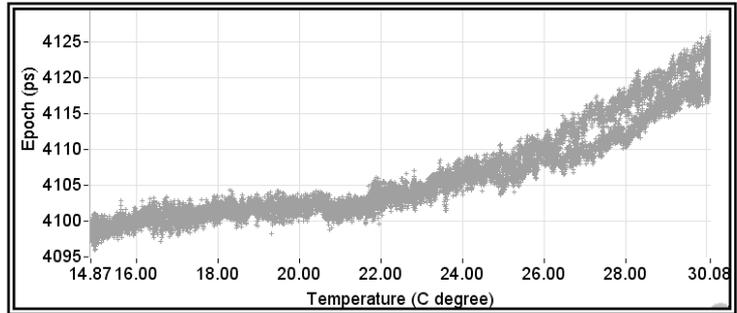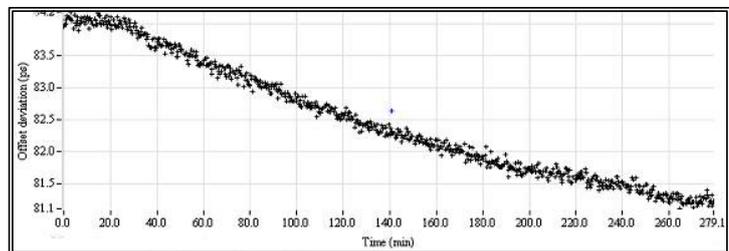
Single-input offset drift vs. changing of ambient temperature from 15 to 30 ^{0}C

* * *

Input-to-input offset drift is seen as long-term deviation of systematic error in time interval measurement between Start and Stop events coming at the different inputs A and B of the event timer respectively.

The A033-ET input-to-input offset drift does not exceed 0.2 ps/^{0}C. It is specified without regard for long-term instability of the reference frequency.

Input-to-input offset drift in line with slow linear changing of ambient temperature from 40 to 10 ^{0}C

A033-ET OPERATION SPEED

* * *

Maximum burst rate means the maximum measurement rate available for a specified amount of sequential events. It is limited by the duration of single measurement and performance of the hardware buffer memory. The A033-ET/usb supports 20 MSPS burst rate for sequences of up to 2 600 events and 12.5 MSPS burst rate for sequences of up to 16 000 events.

* * *

Maximum average rate means the maximum rate of continuous (gapless) event measurement over a long period of time. It is limited by carrying capacity of the timer's hardware interfacing with PC. The A033-ET/usb hardware interacts with the Server PC via USB2 port, providing the average rate more than 1 million events per second.

SUMMARY OF SPECIFICATIONS

Inputs (BNC, 50 Ω)		
	INPUT A:	Fast-negative NIM logic pulses (> 4 ns width)*
	INPUT B:	Fast-negative NIM logic pulses (> 4 ns width)*
	GATE IN:	Fast-negative NIM logic pulses ("1" enables Input B)*
	1 PPS IN:	Positive TTL/LVTTL pulses
	REF IN:	10 MHz (>0.5 V peak-to-peak)
Single-shot RMS resolution:		3 ÷ 4 ps typically, 5 ps maximum
Dead time:		50 ns
Measurement rate		
	Maximum burst rate:	20 MEPS for 2 600 sequential events
		12,5 MEPS for 16 000 sequential events
	Maximum average rate	1 MEPS (million events per second)
Integral non-linearity:		<2 ps RMS
Interval non-linearity:		±0.5 ps maximum (for time intervals greater than 100 ns)
Gating of "INPUT B"		by external pulses at the input GATE IN
Internal clock:		100 MHz, locked to 10 MHz external reference frequency
Hardware interface:		via USB2 port
Application interface:		over TCP/IP communication protocols
Server software:		MS-Windows based
Accessory software:		DEMO Client software (project in LabWindows/CVI 8.0)
Hardware dimension, weight:		367x65x265 mm; 2.0 kg
Power supply:		100…240 VAC

* positive LVTTL pulses are possible optionally

Ordering Information

The A033-ET/usb is a custom instrument manufactured in a limited quantity and only on special request. Modifications of the A033-ET/usb that provide certain special user's requirements are possible on agreement basis.
More info by e-mail: info@eventechsite.com; web: www.eventechsite.com
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