PicoHarp 330 NEW

Precise and versatile event timer & TCSPC unit

- Up to four independent input channels with 1 ps base resolution
- Outstanding timing precision of 2 ps RMS (single channel, 3 ps RMS across channels)
- Common sync channel (trigger rate up to 640 MHz)
- Versatile trigger methods (CFDs and level triggers)
- USB 3.0 super speed (5 Gbps) enables sustained time tagging with up to 85 Mcps
- Ultrashort dead time (680 ps), no dead time across channels
- 65536 histogram bins per channel, minimum width 1 ps
- Multi-stop capability for efficiency at slow repetition rates
- External synchronization signals for (fluorescence lifetime) imaging or other control events

Applications

- Time-resolved fluorescence and luminescence spectroscopy
- Fluorescence Lifetime Imaging (FLIM)
- Single Molecule Spectroscopy (SMS)
- Time response characterization of optoelectronic devices
- Quantum optics
- Coincidence Correlation / Antibunching
- Quantum Communication
- Quantum Key Distribution
- Linear Optical Quantum Computation
- Diffuse Optical Tomography
- LIDAR / Ranging / SLR
- Time-Resolved Fluorescence

The PicoHarp 330 is an easy-to-use, plug-and-play event timer and Time-Correlated Single Photon Counting (TCSPC) device with either up to four input channels. Its extremely fast signal processing leads to an exceptionally high data throughput via USB 3.0 interface. The PicoHarp 330 offers outstanding precision, high time resolution and short dead time. It is compact, robust and reliable. The high quality is reflected by our unique 5-year limited warranty.

Outstanding time resolution and timing precision
The PicoHarp's smartly designed time-to-digital converters with 1 ps base resolution, a jitter of 2 ps RMS (single channel)* and 3 ps RMS (between channels), as well as <680 ps dead time allow to fully exploit the count rate limits of TCSPC, without having to compromise on the time resolution and precision. With its ultrashort dead time, multiple photons per excitation cycle can be detected even at the highest repetition rates achievable by modern picosecond pulsed lasers (requires a detector from the PMA Hybrid Series).

User selectable trigger method

In order to support the widest possible variety of single photon detectors, the PicoHarp 330 provides software-configurable input circuitry. For optimal timing with e.g., Superconducting Nanowire Single Photon Detectors (SNSPD) the inputs can be configured as edge triggers while for best performance with Hybrid Photodetectors (HPD) or Micro Channel Plates (MCP) they can be configured as Constant Fraction Discriminators (CFD). This way the overall system IRF may be tuned to become narrower. The same could not be achieved with a simple level trigger (comparator). Particularly with PMTs and MCPs, constant fraction discrimination is very important as their pulse amplitudes vary significantly.

Multiple input channels, outstanding flexibility

The PicoHarp 330 is available with either 1 to 4 identical detection channels, which are synchronized but independent, offering 1 ps base resolution. Each model features also one common synchronization input. All channels including the sync input can be used as detector inputs, e.g., for coincidence correlation or coincidence counting. The PicoHarp 330 is also ideally suited for performing TCSPC with multiple detectors using forward start-stop operation, which benefits experiments with low repetition rate as well. The common sync channel allows for synchronization with an excitation source.

High data throughput and ultrashort dead time

The design of the PicoHarp 330 allows high measurement rates up to 85 million counts/sec over all channels (up to up to 80 million counts/sec per single channel) and provides a highly stable, crystal calibrated (and optionally temperature controlled) time resolution of 1 ps.

The ultra short dead time of 680 ps when using edge trigger allows to detect multiple photons per excitation cycle even at the highest repetition rates achievable by modern picosecond pulsed lasers (requires a detector from the PMA Hybrid Series).

Operation as time tagger

The Time-Tagged Time-Resolved (TTTR) modes supported by the PicoHarp 330 record all relevant time and channel routing information of each detected individual photon event. By storing this full data set, it becomes possible to carry out the most comprehensive and sophisticated analysis of photon dynamics. Additionally, the PicoHarp 330 can be synchronized with other hardware such as scanners when operated in TTTR mode.

Easy-to-use software included, custom programming supported

The PicoHarp 330 comes with a Windows software that provides all important functions such as setting measurement parameters, displaying results, loading/saving of measurement parameters and measurement curves. Important measurement data, including count rate, count maximum, position and peak width are continuously displayed. A comprehensive online help system eases the user into fully employing the capabilities of the PicoHarp 330. A library for custom programming, e.g., with LabVIEW is also included. For advanced T2 data collection and analysis SymPhoTime and QuCoa software suites are offered by PicoQuant. SymPhoTime is focused on typical life science applications while QuCoa is oriented towards typical quantum optics applications. Alternatively, a relatively advanced and highly flexible API package for Python called “snAPI” is also available. It readily provides many real-time analysis methods such as histograming, intensity and coincidence time traces, FCS and g(2) correlation. PicoQuant is committed to the support and development of their software and upgrades with extended functionality will be made available.

Specifications

Input Channels and Sync	
Number of detector channels (in addition to Sync input)	1 (Base model) 2, 3 or 4 (Base model + channel upgrade)
Input voltage operating range (pulse peak into 50 Ohms)	-1500 mV to 1500 mV
Input voltage max. range (damage level)	U ≤ - 2000 mV; U ≥ 3000 mV
Trigger edge	CFD: falling edge / Edge Trigger: falling or rising edge, software adjustable
Trigger pulse width	> 250 ps
Trigger pulse required rise/fall time	≤ 20 ns
Time to Digital Converters	
Minimum time bin width	1 ps
Timing precision*	3 ps RMS typ.
Timing precision / √2*	2 ps RMS typ.
Dead time	680 ps for edge trigger, 4.2 ns with CFD
Adjustable dead time	> 160 ns in steps of min 1 ns
Adjustable programmable time offset for each input channel	± 100 ns, resolution 1 ps
Differential non-linearity	< 10 % peak, < 1 % rms (over full measurement range)
Max sync rate (periodic pulse train)	640 MHz
Histogrammer	
Count depth	32 bit (4 294 967 295 counts)
Maximum number of time bins	65 536 (via GUI), 524 288 (via DLL)
Full scale time range	65 536 ps – 549.7 ms
Acquisition time	1 ms - 100 h
Peak count rate per input channel	1.47×10^9 cps for burst durations up to 1000 events
Total sustained count rate, sum over all input channels	85 Mcps
TTTR Engine	
T2 mode resolution	1 ps
T3 mode resolution	1 ps, 2 ps, 4 ps, 8 ps, …, 4.19 µs [2**n]
FiFo buffer depth (records)	256 M events
Acquisition time	1 ms to 100 hours
Peak count rate per input channel	1.47×10^9 counts/sec for 1000 events
Sustained count rate per input channels**	80 Mcps
Total sustained count rate, sum over all input channels**	85 Mcps via USB 3.0 interface
Trigger Output	
Period	programmable, 0.1 µs - 1.678 s (0.596 Hz - 10 MHz)
Pulsed width	10 ns
Baselin level	0 V typ.
Active level (pulse peak)	- 0.6 V typ. (50 Ohm)

External Marker Inputs	
Number	4
Input type	> 1.7 V = HIGH (< 50 ns rise/fall time, pulse width > 50 ns) < 1.1 V = LOW (< 50 ns rise/fall time, pulse width > 50 ns) max 5 V
External Synchronization	
Ref. IN	10 MHz, 100 MHz, or 500 MHz 200 … 1500 mV p.p. 50 Ohm; AC coupled
Ref. OUT	Default: 10 MHz 1000 mV 50 Ohm; DC coupled
Operation	
PC interface	USB 3.0 (5 Gbps)
PC requirements	Quad core CPU or better, min. 2 GHz CPU clock, min. 4 GB memory
Operating system	Windows 10/11
Power consumption	< 25 W
Operation altitude	Indoor use only, Max. 2000 m above sea level
Dimensions	
Size	305 × 240 × 95 mm
Weight	2.5 kg

* In order to determine the timing precision it is necessary to repeatedly measure a time difference and to calculate the standard deviation (rms error) of these measurements. This is done by splitting an electrical signal from a pulse generator and feeding the two signals each to a separate input channel. The differences of the measured pulse arrival times are calculated along with the corresponding standard deviation. This latter value is the rms jitter which we use to specify the timing precision. However, calculating such a time difference requires two time measurements. Therefore, following from error propagation laws, the single channel rms error is obtained by dividing the previously calculated standard deviation by √(2). We also specify this single channel rms error here for comparison with other products

** Sustained throughput depends on configuration and performance of host PC.

PicoQuant GmbH
Rudower Chaussee 29 (IGZ)
12489 Berlin
Germany

Phone +49-(0)30-1208820-0
Telefax +49-(0)30-1208820-90
Email info@picoquant.com
Web www.picoquant.com