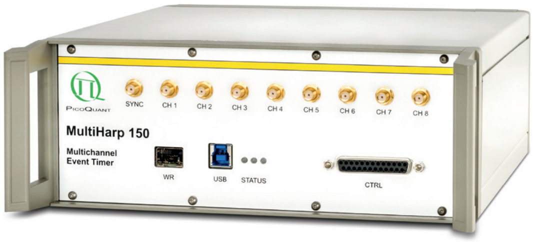
# MultiHarp 150

## High-Throughput Multichannel Event Timer & TCSPC Unit

- 4, 8, or 16 independent input channels
- one common sync channel (up to 1.2 GHz)
- High sustained data throughput (80 Mcps in time tagging mode, 180 Mcps in histogramming mode)
- 80ps base resolution
- Ultra short dead time (650 ps) per channel, no dead time across channels
- USB 3.0 interface
- Marker inputs for external synchronization signals or other events
- White Rabbit ready




## Applications

- Time-resolved fluorescence and luminescence spectroscopy
- Coincidence correlation, antibunching
- Quantum optics
- FLIM, FRET, FCS
- Multicolor lifetime imaging
- Time-of-Flight (ToF) measurements, LIDAR
- Single Molecule Spectroscopy (SMS)

The MultiHarp 150 is an easy-to-use, plug-and-play multi-channel event timer and Time-Correlated Single Photon Counting (TCSPC) device. Its outstanding features are an extremely fast signal processing along with an extraordinarily high sustained data throughput via USB 3.0 interface. The MultiHarp 150 is a compact, robust and reliable device whose high quality is refl ected by our unique 5-year limited warranty.

**Multiple input channels, outstanding flexibility**
Three MultiHarp 150 models are available with either 4, 8 or 16 identical detection channels, which are synchronized but inde-pendent. 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 MultiHarp 150 is also ideally suited for performing TCSPC with multiple detectors using forward start-stop operation. Here the common sync channel allows for synchronization with the excitation source.

**Ultrashort dead time for high data throughput**
The smartly designed timing electronics allows to fully exploit the count rate limits of time-correlated single photon counting, without having to compromise on the time resolution for many modern single photon detectors. The ultra short dead time of 650 ps allows detecting 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).

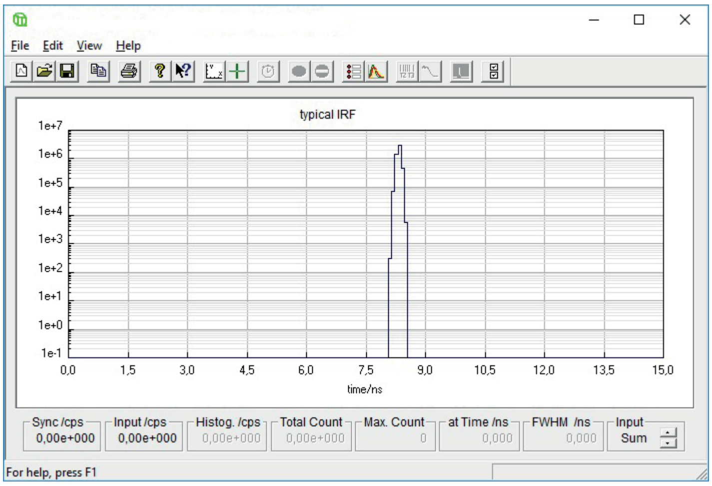
**Adjustable timing offsets for each input channel**
Each input channel has internal adjustable timing off sets with ±100 ns range at 80 ps steps. This greatly simplifi es the cabling requirements for experimental set-ups, as selecting cable lengths to compensate for signal delays is no longer needed.

**Time-Tagged Time-Resolved modes**

The Time-Tagged Time-Resolved (TTTR) modes supported by the MultiHarp 150 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 after a measurement. A real time data correlator is included to monitor FCS experiments at count rates of up to 1 000 000 counts/sec. Furthermore, the MultiHarp 150 can be synchronized with other hardware such as scanners when operated in TTTR mode.

**White Rabbit ready**

White Rabbit is a fully deterministic, Ethernet-based timing network which provides sub-nanosecond accuracy and precise synchronization of devices over large distances. Thanks to its White Rabbit interface, the MultiHarp 150 is prepared to be used in networks that are based on this emerging technology.




**Easy to use software included, custom programming supported**

The MultiHarp 150 comes with a Windows software package that providing 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 MultiHarp 150. A library for custom programming, e.g., with LabVIEW is also included. PicoQuant is committed to the support and development of this software and upgrades with extended functionality will be made available.

The MultiHarp 150 can be used in different operation modes:
Integration mode, oscilloscope mode, Time-Tagged Time-Resolved mode (listing each event arrival time), on-line („real-time“) correlator for FCS

# Specifications

| **Input Channels and Sync** | Constant level trigger on all inputs, software adjustable |
|---|---|
| Number of detector channels | 4 (MultiHarp 150 4N), 8 (MultiHarp 150 8N), or 16 (MultiHarp 150 16N) |
| Input voltage operating range (pulse peak into 50 Ohms) | - 1 200 mV to 1 200 mV |
| Input voltage max. range (damage level) | ± 2 500 mV |
| Trigger edge | falling or rising edge, software adjustable |
| Trigger pulse width | > 0.4 ns (rise time max. 20 ns) |
| **Time to Digital Converters** | |
| Time bin width (adjustable) | 80 ps, 160 ps, 320 ps, […], 335.5 µs |
| Timing precision* | < 85 ps rms |
| Timing precision / √2* | < 60 ps rms |
| Dead time | < 650 ps |
| Adjustable programmable time offset for each input channel | ± 100 ns, resolution 80 ps |

| | |
|---|---|
| Differential non-linearity | < 10 % peak, < 1 % rms (over full measurement range) |
| Maximum sync rate (periodic pulse train) | 1.2 GHz |
| **Histogrammer** | |
| Count depth | 32 bit (4 294 967 296 counts) |
| Full scale time range | 5.24 µs to 21.99 s |
| Maximum number of time bins | 65 536 |
| Peak count rate per input channel | $1.5 \times 10^9$ counts/sec for 1 200 events |
| Total sustained count rate, sum over all input channels** | $180 \times 10^6$ counts/sec |
| **TTTR Engine** | |
| T2 mode resolution | 80 ps |
| T3 mode resolution | 80 ps, 160 ps, 320 ps, […], 335.5µs |
| FiFo buffer depth (records) | 134 217 728 events |
| Peak count rate per input channel | $1.5 \times 10^9$ counts/sec for 1 200 events |
| Total sustained count rate, sum over all input channels** | $80 \times 10^6$ counts/sec |
| **Operation** | |
| PC interface | USB 3.0 |
| PC requirements | Dual core CPU or better, min. 2 GHz CPU clock, min. 4 GB memory |
| Operating system | Windows 8/10 |
| Power consumption | 50 W |

* 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 sqrt(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