ID1000
Time Controller Series

All in one time tagging, coincidence correlation and delay/pulse generation

Observe detection rates for up to five single-photon detectors, generate up to four coincidence histograms between any pair of connected detectors or trigger signals, and record every time tag for an exceptionally high number of detected photons, all with picosecond precision.

Beyond measurement, access four outputs with customizable and conditional pulses, to control and react to your experiments and applications in real time.

Get the most out of your photonic experiments and applications with the ID1000 Time Controller Series today.

KEY FEATURES

- **Five interchangeable input and reference channels**
  - High-resolution mode: up to 300 MHz across all inputs, with 1 ps resolution
  - High speed mode: up to 100 MHz per input, with 100 ps resolution
- **Measure four coincidence histograms in parallel**
- **Record the precise arrival time of every detection event,** with or without coincidence filtering
- **Tailored pulses (NIM or TTL) from four output channels,** with customizable patterns and widths
- **Advanced integrated logic:** filter events for two-, three- and four-fold coincidences in real time
- **Quick and easy lab integration:** suite of LabView and Python scripts

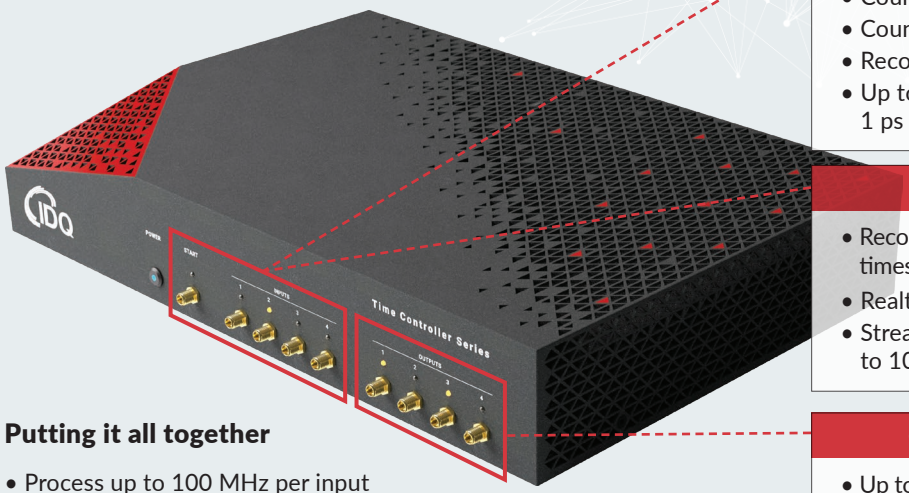
APPLICATIONS

- QKD and quantum communication
- Quantum optics and computing
- Single-photon source characterisation
- Fluorescence lifetime imaging
- Failure analysis of integrated circuits
- VIS, NIR and MIR spectroscopy

NEW

- Measure more: multi-device synchronisation for over 64 input channels
- Enhanced precision: 1 ps resolution with < 4 ps rms jitter, and excellent DNL for low signal applications

ID1000 Time Controller Series



Counting and histograms

- Count single channel input rates
- Count 2/3/4-channel correlation rates
- Record four histograms simultaneously
- Up to 16,384 time bins, each between 1 ps and 4 ms wide

Time tagging

- Record every detection event, up to four timestamp measurements simultaneously
- Realtime 2/3/4-coincidence filtering
- Stream timestamps (raw or filtered) up to 10 M events/s

Output/delay generation

- Up to 4 x 250 MHz output pulses
- Customizable periodic or conditional on demand pulse sequences
- Digital NIM or TTL pulses, ideal for experimental instrument control

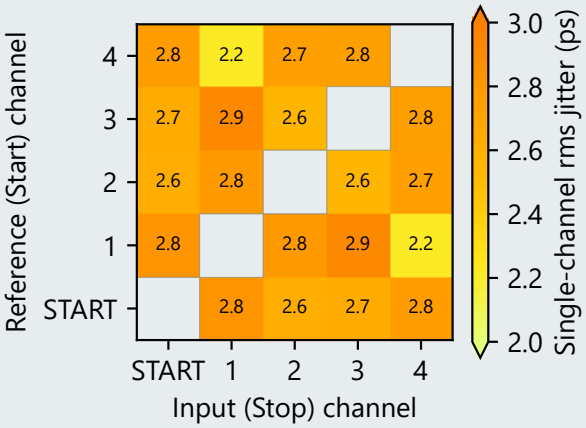
Putting it all together

- Process up to 100 MHz per input
- < 4 ps rms jitter (single-channel, HR)
- 1 ps digital resolution (HR)
- Five interchangeable input and reference channels
- Four programmable outputs

The last word in precision

Thanks to the advanced discrimination electronics of the ID1000 Time Controller, the precision and throughput of device will be future-proof for your lab, all in a versatile and cost-effective solution.

(Right) Timing jitter characterization of an example ID1000 Time Controller Series device in high resolution mode. Measured as the root-mean-squared (rms) width of a start-stop histogram between an Input channel and Reference channel pair, with fast synchronized pulses, divided by a factor of √2.



How to: TCSPC and the Instrument Response Function

The Instrument Response Function (IRF) describes the temporal response of your detection system against the 'true' dynamics of the system under investigation. The IRF takes into account all the detectors, measurement electronics, source precision, and any other instruments contributing to a non-instantaneous response in your experiments. Ultimately, the IRF tells you the best achievable timing precision of your detection system.

In the example to the right—typical for time-correlated single-photon counting (TCSPC)—the overall system response, $R_{Sys}(\tau)$, is a linear combination of the component IRFs, where $\otimes$ is the convolution operator.

The resulting uncertainty — the timing jitter $\Delta\tau_{Sys}$—is thus the quadrature sum of all component timing jitters. Use this insight to find the best ways to improve your experimental precision.

$$R_{Sys}(\tau) = R_{Src}(\tau) \otimes R_{Det}(\tau) \otimes R_{TC}(\tau) \otimes R_{Rest}(\tau)$$

$$(\Delta\tau_{Sys})^2 = (\Delta\tau_{Src})^2 + (\Delta\tau_{Det})^2 + (\Delta\tau_{TC})^2 + (\Delta\tau_{Rest})^2$$

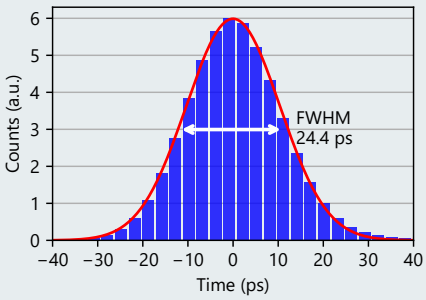
(Above) τ: time delay between detection events, 'Src': photon source, 'Det': single-photon detector pair, 'TC': time correlator (e.g. ID1000), 'Rest': everything else in the detection system contributing to a finite timing response.

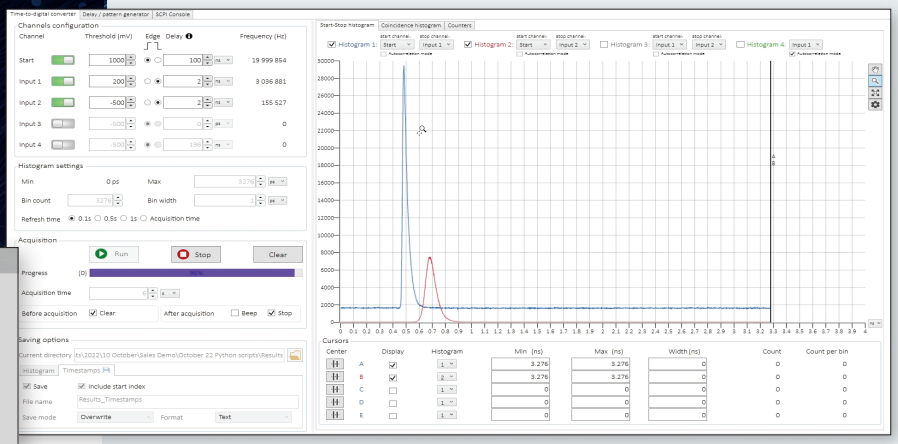
ID1000: made for you

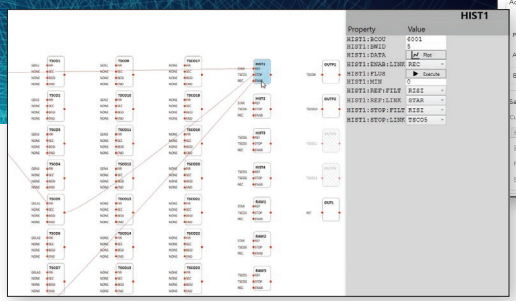
Simpler than ever to use and integrate into your laboratory, **ID1000 Time Controller Series** devices come with a new-and-improved suite of LabView virtual instruments and Python scripts.

ID1000 Time Controllers are available in six combinations depending on your needs (see Specifications on the next page), each upgradeable at any time.

(Right) Example instrument response function of an ID281 SNSPD, at 1550 nm, recorded with an ID1000 Time Controller. The FWHM timing jitter of 24.4 ps includes all instrument jitter contributions, such that the real FWHM of the SNSPD is less than 22.3 ps.





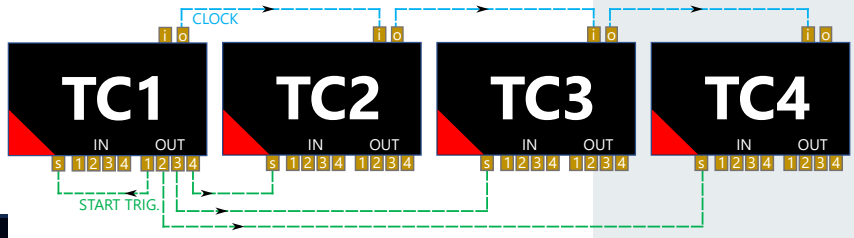


(Above) Control, operate and display measurements of your ID1000 Time Controller with the included GUI application.

(Left) Directly access and intuitively configure the ID1000 Time Controller's internal logic, with the included Configuration Editor application, for limitless customization.

In good company

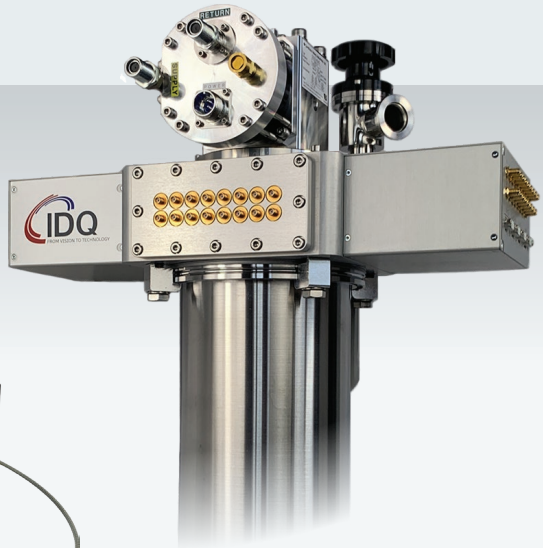
- Operate multiple ID1000 Time Controller devices in unison
- Up to >64 synchronized input channels



(Above) Example of four ID1000 Time Controllers in a multi-device configuration, giving access to 16 interchangeable input and reference channels.

You'll need some photons

The ID1000 Time Controller Series is designed especially for IDQ's range of single-photon detection solutions, from our versatile and easy-to-use semiconductor SPADs, to the game-changing performance of our SNSPDs.



SPECIFICATIONS

Functional specifications	High Speed	High Resolution[1]	MASTER	TCSPC
# Inputs channels per device	5		✓	✓
# Input channels in multi-device mode [2]	> 64		✓	
Min. time bin width (digital resolution)	100 ps	1 ps	✓	✓
Timing jitter (single-channel, rms) [3]	< 28 ps	< 4 ps	✓	✓
Max. DNL (rms)	< 10 ps	< 0.2 ps	✓	✓
Max. input count rate [4]	5 x 100 MHz	300 MHz	✓	✓
Max. timestamp rate [5]	10 M events/s		✓	✓
Input voltage range	-2 V to +2 V		✓	✓
Input channel delay	1 ps to 4 ms (in 1 ps steps)		✓	✓
# Output channels	4		✓	
Output pulse format	NIM or TTL		✓	
Max. rate per output channel	250 MHz		✓	
Min. output pulse width	6 ns (TTL), 1 ns (NIM)		✓	
Input — Output latency	400 ns	1500 ns	✓	
Electrical & Environmental specifications				
Power supply requirements	100 V to 240 V, 50 Hz to 60 Hz, 1 A to 2.5 A			
Operational temperature	5°C to 35°C			
Max. environment humidity	80% up to 31°C, 50% up to 35°C			
Device dimensions (W x H x L)	380 mm x 63 mm x 255 mm			

(1) HR add on license required.

(2) Number of accessible input channels when 16 Time Controllers are synchronised

(3) Measured as the width of a two channel start stop histogram with fast input pulses, divided by a factor of √2 to give the single channel jitter. Timing jitter for high speed mode is a worst case estimate with an assumed Gaussian instrument response profile.

(4) Count rates available for single channel counters, coincidence counters, and histogram processing, across all input channels of a single device.

(5) Measure up to four sets of timestamps (detection event time tags) in parallel, in total up to the max. timestamp rate.

On request, the two core ID1000 versions can be remotely upgraded with these add-on licenses:

Available add-ons	Core ID1000 version	
	MASTER	TCSPC
HR - Access to 'high resolution' (1 ps resolution, < 4 ps jitter) mode for the 5 input channels	⬇	⬇
PRCSG - Access to the internal FPGA logic, to configure real time selection filters for up to four fold coincidences	✓	⬇
4OUT - Access to the 4 output channels and the internal delay / pulse generator functionality	✓	⬇

⬇ Upgrade available ✓ already included

IDQ

WORLD HEADQUARTERS

ID QUANTIQUE SA

Rue Eugène-Marziano 25
1227 Acacias/Geneva
Switzerland

www.idquantique.com | info@idquantique.com

SALES OFFICES AND ENGINEERING LABS

Switzerland
Geneva

USA
Boston, MA

South Korea
SungNam-si