

## TIME-TO-DIGITAL CONVERTER

### ID800/ID801: 8 CHANNEL TIME TO DIGITAL CONVERTER

IDQ's ID800/ID801-TDC is an 8-channel time-to-digital converter, coincidence counter, and time interval analyzer. This system is used to transfer the time-tags of registered events with picosecond precision and at high rates to a PC. Additionally, it can count single and multiple channel coincident events at even higher rates internally and report the totals to a PC.

The ID800/ID801-TDC registers incoming signal events on 8 independent channels, records their exact time (bin size 81 ps) and channel number and broadcasts these to a PC. A graphical user interface is supplied for Windows®, software examples are available for C and Labview™.

There are four ways of interfacing:

- Graphical User Interface Software
- Command Line Interface
- LabView sub-VIs and sample program
- C user libraries

#### NEW KEY FEATURES

- High event count rates up to 15 million events per second
- Data transfer up to 5 million events per second
- Clock divider for synchronisation up to 100MHz
- NIM - TTL - LVTTTL and variable inputs

#### KEY FEATURES

- 8 channels
- Easy to use control software
- High timing resolution with bin size as low as 81ps
- Integrated coincidence counter
- Minimal time between two consecutive counts in the same channel is 5.5ns



The difference between the ID800 and ID801 is in the input conditioning: the ID800 accepts LVTTTL or TTL signals, while the ID801 adds programmable input discriminators (-2V and 3V, 1.22mV step). The ID801 also features a clock divider on channel 1, which allows it to be synchronized to high repetition-rate lasers up to 100 MHz.

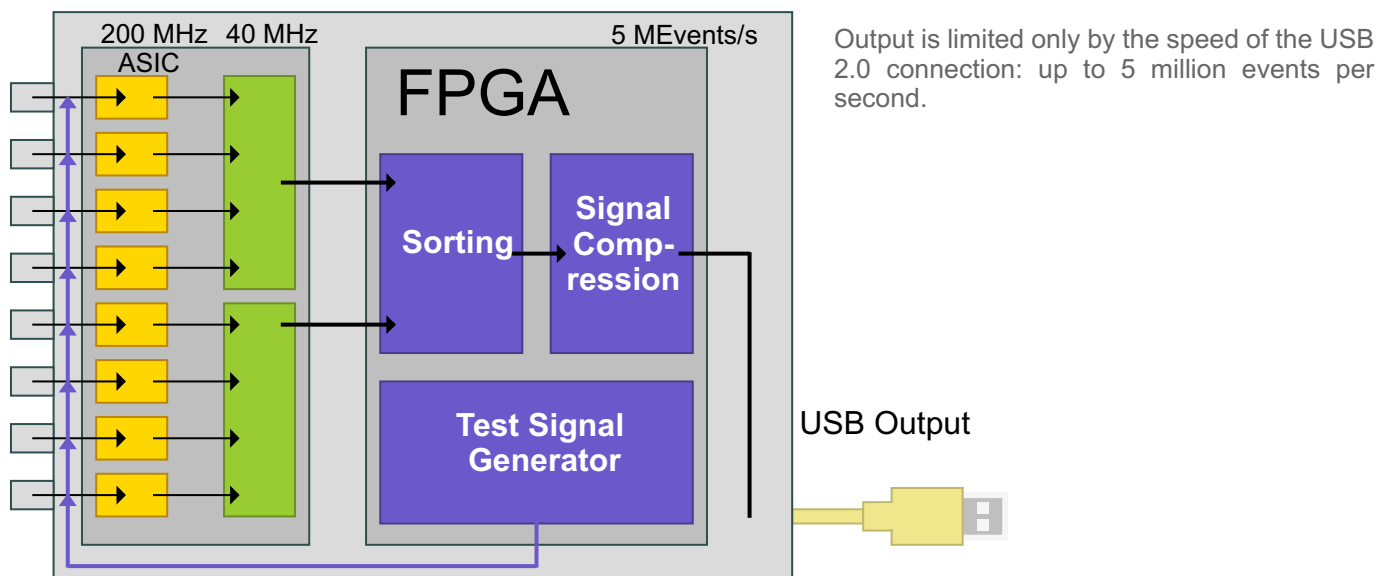
#### APPLICATIONS

- Time correlated single photon counting (TCSPC)
- Fluorescence lifetime imaging
- High energy physics
- Fluorescence correlation spectroscopy
- Single photon counting
- Quantum cryptography
- Precision time measurement
- LIDAR
- Correlation measurement
- Quantum optics
- Optical measurements

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### PRINCIPLE OF OPERATION

The ID801 contains an ASIC which time-tags events on 8 input channels and multiplexes them together. An FPGA takes these tags, sorts and compresses them for output. The FPGA also counts coincidences between channels, allowing accurate real-time reporting of coincidences at high signal rates.

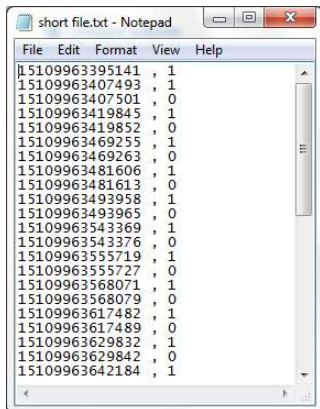


### SPECIFICATIONS

Parameter	ID800	ID801
Bin size, timing resolution	81 ps	81 ps
Channels	8	8
Maximum Count Rate, Total	15 MHz	15 MHz
Data Transfer Rate	5 MHz	5 MHz
Input levels	LVTTL / TTL	-2V to +3V / NIM / LVTTL / TTL
Sync input divider	NO	8/16/32/64/128 up to 100MHz
Minimum Pulse Interval	5.5 ns	5.5 ns
Minimum Pulse Width	4 ns	4 ns
Maximum Count Rate per Channel	10 MHz	10 MHz
Input Connectors	BNC	BNC
PC Interface	USB 2.0	USB 2.0
Dimensions	W:25cm H:10cm D:30cm	W:25cm H:10cm D:30cm
Power supply	110 - 230 VAC	110 - 230 VAC

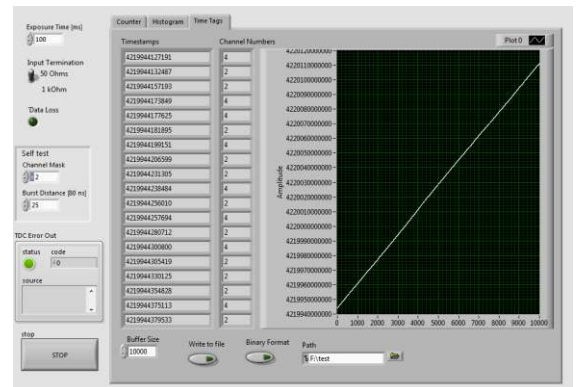
# TIME-TO-DIGITAL CONVERTER

## INDIRECT MEASUREMENT (POST-PROCESSING)



The supplied software can write time-tags to file, and from this file coincidences can be counted after detection.

## DIRECT MEASUREMENT



Using a supplied LabView program, real-time plots of singles and coincidence rates can be generated, useful for real-time experiment optimization. Histograms and raw time-tags can also be displayed.

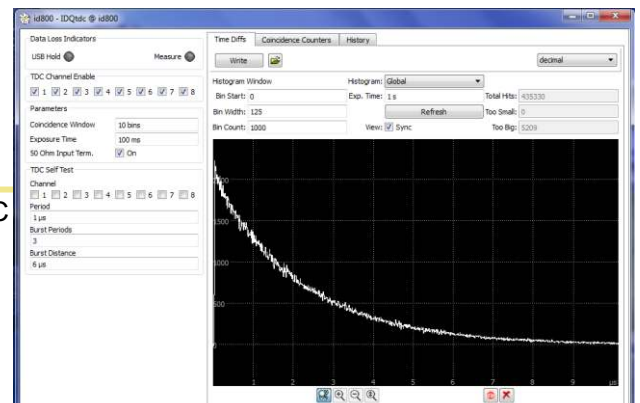
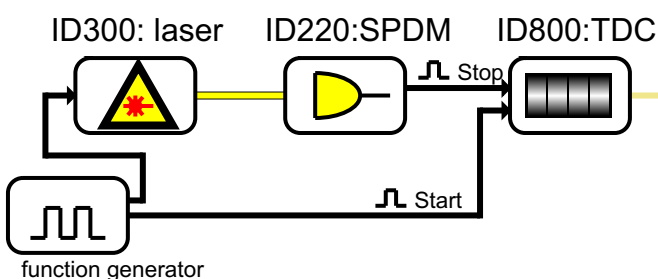
## INTERFACES WITH THE ID800/ID801

There are four provided ways of interfacing with the ID800/ID801:

- Graphical User Interface Software
- Command Line Interface
- LabView sub-VIs and sample program
- C user libraries

## APPLICATION #1: TIME INTERVAL ANALYZER

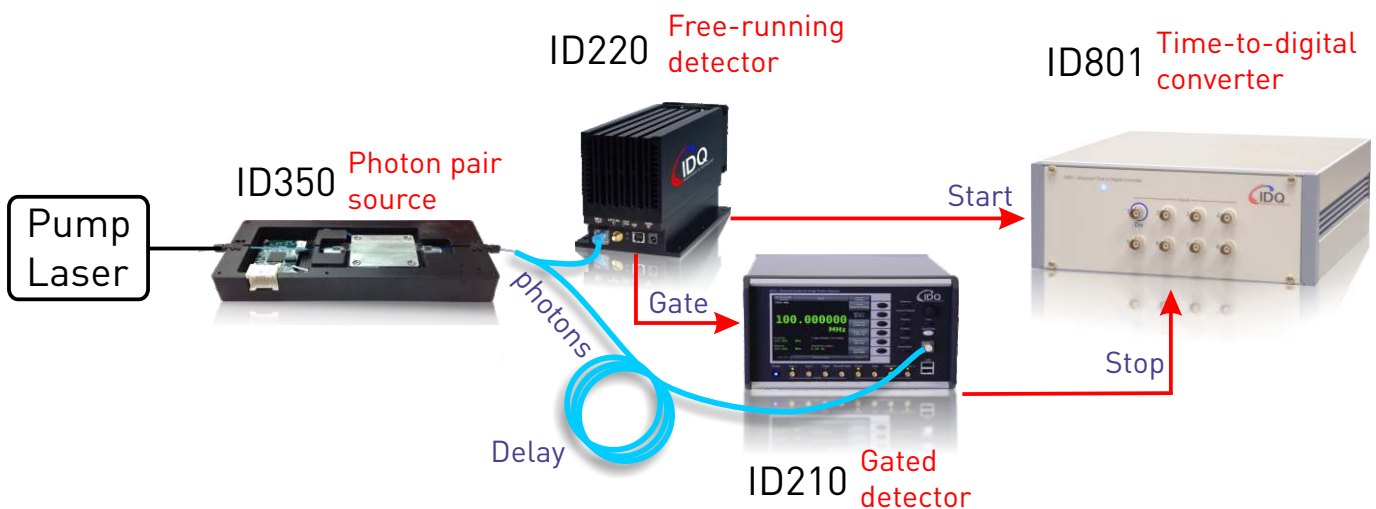
The ID800/ID801 is supplied with software for building histograms of time differences between time-tags. This is useful for analysing timing jitter or after-pulsing probabilities of detectors. For example, a function generator can be used to generate pulses from an ID300 short-pulse laser source, which are then attenuated and detected by an ID220 free-running single photon detection module. The time differences can be measured by the ID800/ID801, and investigated with the provided software. In this example, the start of the measurement is triggered with a pulse from the user. The ID800/ID801 can also perform continuous timing measurements without requiring an external trigger.



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### APPLICATION #2: HERALDED SINGLE-PHOTON SOURCE

A single photon source can be made and tested using ID Quantique instrumentation: one starts with the ID350 PPLN producing correlated photon pairs. These are split either on a 50/50 beamsplitter or WDM. One photon from the pair is detected on the free-running ID220, thus heralding the other single photon. The ID220 triggers the ID210 to detect the heralded single photon. The perfect time correlation can be verified with the ID801 time-to-digital converter.



### VISIBLE PHOTON COUNTERS

SILICON AVALANCHE PHOTODIODE

#### ID120 350-1000nm

- 80% quantum efficiency
- 500um active area
- Free-running
- Adjustable settings

#### ID100 350-900nm

- Free-running
- 40ps timing resolution
- Low dark count rate (2Hz)
- 35% quantum efficiency

#### ID110 350-900nm

- Gated up to 100MHz
- Free-running
- 25% quantum efficiency
- Low dark count

### INFRARED PHOTON COUNTERS

INGaAs/InP AVALANCHE PHOTODIODE

#### ID220 900-1700nm

- Free-running
- Dark count rate below 1kHz
- 20% quantum efficiency
- 250ps timing resolution

#### ID230 900-1700nm

- Free-running
- Dark count rate below 25Hz
- 25% quantum efficiency
- 200ps timing resolution

#### ID400 1064nm

- Gated up to 10MHz
- Free-running
- 30% quantum efficiency
- Low dark count

### OTHER PRODUCTS

PPLN - TDC - QKD

#### ID350 PPLN

- Type 0 Spontaneous parametric down-conversion
- From 775nm to 1550nm
- From 780nm to 1560nm

#### ID800/ID801 TDC

- 8 channels
- 81ps timing resolution
- Coincidence counter
- Time interval analyser

#### CLAVIS QKD

- Quantum Key Distribution
- Auto-compensating optical set-up
- Secure key exchange up to 100km
- BB84 and SARG protocols