quTAG LC - Low Cost

Low Cost variant of the quTAG family.



Key Features

- 1 ps digital resolution
- 1 start and 4 stop channels
- Timing jitter <10 ps, typ. 5 ps
- USB 3.0 interface
- Synchronization of multiple devices
- Cost-sensitive

Applications

- Time-correlated Single Photon Counting (TCSPC)
- Quantum Optics / Information / Communication
- Quantum Key Distribution / Quantum Cryptography
- Fluorescence Lifetime Imaging (FLIM)
- Single Photon Emitter Characterization
- Light Detection and Ranging (LIDAR)

quTAG LC Specifications

Time to Digital Converters	
Digital resolution	1 ps
Timing jitter RMS*1	<10 ps, typ. 5 ps
Max. event rate per channel	100 Mcps
Sustained throughput rate	100 Mcps (USB3.0)
Delay range	-100 ... +100 ns
Delay resolution	1 ps
Min. pulse to pulse separation	10 ns
Differential non-linearity	<1 %
Max. acquisition time	13 days

Input channels	
Number of channels	1 start & 4 stop
Signal level	-2 ... +3 V
Offset voltage max.	±10 mV
Min. input level	±50 mV
Min. input pulse width	1 ns
Connector	SMA
Termination	50 Ohm
Threshold range	-2.0 ... +3.0 V
Threshold offset voltage	±20 mV
Threshold setpoint resolution	2.4 mV
Edge	rising, falling

Output Channels	
Number of channels	4
Signal levels	LVTTL
Output Impedance	none
Connector	D-Sub (Pin 5,6,7,8)

Clock Input	
Frequency	10 MHz ±100 ppm
Signal level	max. 5 Vpp
Signal form	sinusoidal, square wave
Min. input level	50 mVpp
Duty cycle	50.00 %
Connector	SMA
Termination	50 Ohm

Clock Output	
Frequency	10 MHz ±100 ppm
Signal level	LVTTL
Output impedance	50 Ohm
Connector	SMA

Electrical Supply	
Power supply	85 - 264 VAC, 47 - 63 Hz
Connector	C8
Power consumption	< 15W

*1: The timing jitter can vary depending on the channel used. See the measurement sheet supplied with the device for detailed specifications.
See also the measurement method on the next page.

Disclaimer: The information contained herein is subject to change without notice. qutools shall not be liable for technical or editorial errors or omissions contained herein.

qutools

qutools GmbH • Kistlerhofstraße 70 (Geb. 88) • 81379 München, Germany
phone: +49 6151 4920179 • e-mail: info@qutools.com

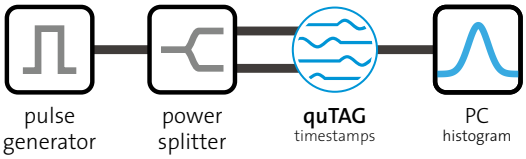
quTAG LC Specifications

Marker Inputs	
Number of channels	4
Signal level	LVTTL (5V tolerant)
Digital resolution	5 ns
Termination	none
Timing Jitter	2-5 ns
Connector	D-Sub (Pin 1,2,3,4)

Operation	
Interface	USB 3.0
Supplied software	GUI, Python, LabView, DLL, command line
Dimensions	160 x 160 x 36 mm
Weight	1 kg

How we measure the Jitter

In order to measure the jitter, we generate periodic electric pulses with steep edges. These pulses are split in two by a power splitter and sent to two different inputs of the quTAG (i.e., start and stop-X, or stop-X and stop-Y).



Then we use the quTAG software to generate a start-stop-histogram. We fit a Gaussian function to this histogram and determine RMS (σ) and FWHM.
The single channel jitter corresponds to $\sigma/\sqrt{2}$ from this two channel measurement, assuming equal Gaussian contributions from both signals. The FWHM can be obtained by the standard deviation with the relation $\mathrm{FWHM} = 2\sqrt{2\ln 2}\,\sigma \approx 2.35\sigma$.

Optional Features

Filters & virtual channels
The device allows to enable virtual channels or user-defined filters. The filtering is based on hardware and happens inside the device to save USB bandwidth.

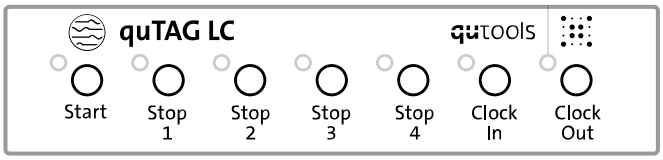
Marker inputs
The device features marker inputs, inserting timestamps in the timeline. Marker inputs are needed e.g. to read a pixel or line clock in a lifetime microscope setup.

Output channels
The four outputs enable conditional measurements, state preparation, gating of detectors, control of shutters and more to synchronize events.

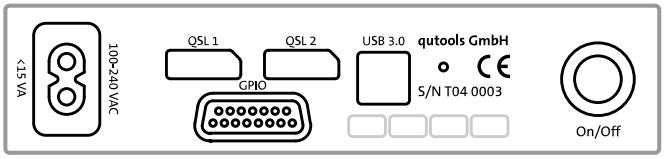
External clock input
The quTAG can be synchronized to an external 10 MHz clock signal via the clock input SMA connector to allow more precise long-term accuracy.

External clock output
The quTAG can synchronize additional quTAG units or other devices via the clock output through the clock output SMA connector.

Schematics



The front side of the quTAG LC features SMA ports for the start and four stop channels, as well as the clock input and output.



The rear side of the quTAG LC features a power plug (C8) and an on switch. The USB 3.0 port is the main connection for accessing the device and streaming the time tags.

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qutools GmbH • Kistlerhofstraße 70 (Geb. 88) • 81379 München, Germany
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