

SWISS QUANTUM

Redefining Measurement ID Qube Series - NIR Gated version Synchronous Single-Photon Detection at Telecom Wavelengths

COMPACT & COST-EFFECTIVE

The ID Qube NIR Gated is a fast-gated single photon detector optimized for telecom wavelengths.

It provides a cost-effective solution for applications in which synchronous photon detection is essential such as quantum communications especially Quantum Key Distribution. It is also well suited to applications such as LiDAR where compactness is required.

The detector offers a gate input designed to avoid saturation or undesired detections and can also be operated in Free-Running mode. The cooled InGaAs/InP avalanche photodiode and associated electronics have been specially designed to achieve low dark count and afterpulsing rates for fast gated operations.

The device is available in free-space or fibre-coupled version (MMF62.5) compatible with both SMF and MMF62.5 fibre.



Applications



Quantum communication & Quantum Key Distribution



Quantum physics and optics



Time of flight measurement (OTDR, LIDAR)



Fluorescence Lifetime measurements

Key Benefits



Compact & cost-effective



Fast gated (up to 100 MHz) & free-running



Ultra low noise (800 cps at 10%)



Low jitter (150 ps)

Gated and free-running modes at telecom wavelengths

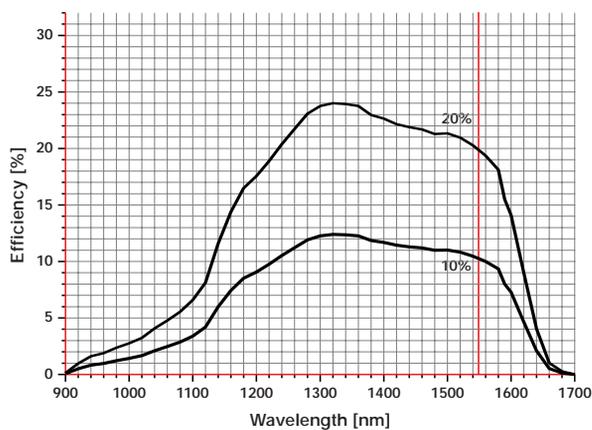
The ID Qube has been especially designed to achieve low dark count and afterpulsing rates in fast gated mode.

The ID Qube NIR Gated can operate at detection probability levels from 10% to 25% with a deadtime between 100 ns and 100 μ s. In gated mode it accepts gates as short as 1 ns with a maximum repetition frequency of 100 MHz. The arrival time of photons is reflected by a 100 ns LVTTTL/NIM (user-selectable) pulse available at the SMA connector with a timing resolution as low as 150 ps at 20% efficiency..

EFFICIENCY

The calibration is carefully performed in house using equipment calibrated by the Swiss metrology institute (METAS).

Efficiency versus wavelength



DARK COUNT RATE

The dark count rate strongly depends on 2 settings: efficiency and deadtime. By playing with the 2 settings, it is possible to optimize efficiency, afterpulsing and dark count rate (DCR) for each dedicated experiment. In gated mode, the DCR per gate also depends on the gate duration. Shorter gates allow for a lower DCR rate.

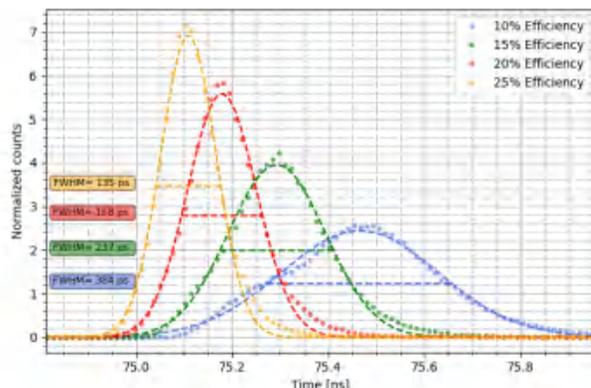
Dark count probability measurement in gated mode

Pulsed mode: 10 MHz gate frequency, 2 ns pulse width, no deadtime. The values strongly vary depending on the APD.

Detection efficiency (%)	10	20
Dark count probability /gate	$5 \cdot 10^{-7}$	$2 \cdot 10^{-6}$
Afterpulse probability (%)	1.5	7

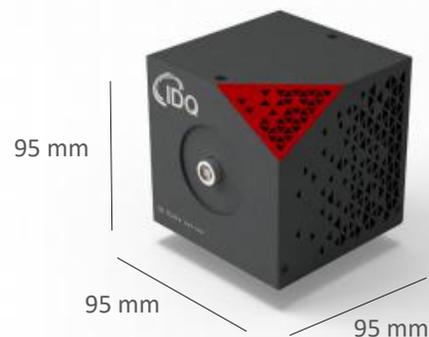
LOW JITTER

The jitter of a SPAD strongly improves with its quantum efficiency. The ID Qube NIR Gated offers a best-in-class jitter of 150 ps at 20% efficiency at 1550 nm. The here below represented jitter figures may vary from diode to diodes. Note that the 25% efficiency setting is only available with the ID Qube NIR Gated version.



COMPACT

The ID Qube is very small and suited for applications such as LiDAR where compactness is strongly required.



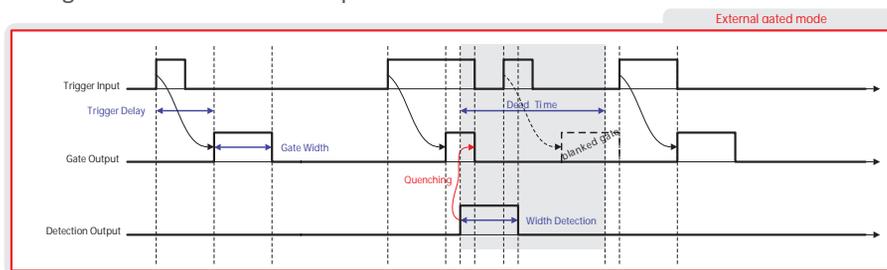
Compact

The ID Qube is specially suited for applications such as Lidar where compactness is strongly required.

PRINCIPLE OF OPERATIONS

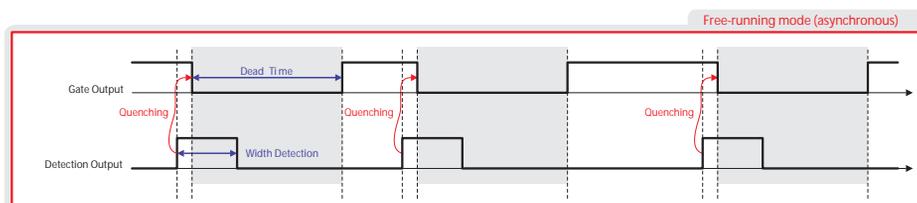
External-gating mode

The avalanche photodiode (APD) is biased above breakdown during gates of adjustable width and frequency. External gating is a synchronous mode based on a gate signal provided by the user at the GATE-IN connector (any logic level between -2V and +2V is accepted). As a consequence of a photon-absorption-induced avalanche event within the gate, the detection counter is incremented and a pulse is outputted at the PHOTON-OUT connector. The quenching electronics closes the gate and a dead time is applied resulting in one or several blanked pulses after a detection.



Free-running mode

The ID Qube NIR Gated can also operate in free-running (asynchronous) mode. The APD is biased above its breakdown voltage in the so-called Geiger mode. Upon photon absorption, the photon arrival time is reflected by the rising edge of a 100 ns width LVTTTL/NIM pulse at the output. The ID Qube NIR Gated has been designed to provide a fast avalanche quenching, thus limiting the afterpulsing rate. This allows operation at reasonably short deadtimes that can be optimized depending on the application and the set efficiency level.



USER FRIENDLY SOFTWARE

The ID Qube comes with an intuitive software that allows the user to set the efficiency level and the deadtime through a simple USB interface. The module can also operate disconnected from the PC. The settings are reloaded upon each power up.

BUNDLE ID900 TIME CONTROLLER

Operate the ID Qube with the ID900 Time Controller, specially suited to generate the gate pulses, counting the coincidences between ID Qube detectors. The ID900 Time Controller is IDQ's central platform which combines the functionalities of a time-tagger, delay and pattern generator. It is even possible to generate conditional pulses thanks to the unique computing capabilities of the Time Controller.



PRELIMINARY SPECIFICATIONS

Parameter					Units
Wavelength range	900 - 1700				nm
Deadtime range	0.1 - 100				µs
Deadtime step	100				ns
Output pulse voltage	LVTTTL / NIM				
Output pulse width	100				ns
Optical fibre coupling	MMF62.5 or free-space				
Efficiency range calibrated at $\lambda=1.55 \mu\text{m}$ (free-running)	2.5 - 10				%
Efficiency range calibrated at $\lambda=1.55 \mu\text{m}$ (gated)	2.5 - 25				%
Efficiency resolution (steps)	2.5				%
Timing resolution (FWHM) at 20% efficiency	150				ps
Dark count rate at (efficiency)	10	15	20		%
STD	1.2	3	6		kHz
LN	0.8	1.5	3		kHz
Gate-in max frequency	100				MHz
Gate-in min pulse duration	1				ns
Gate-in voltage range	-2 to 2				V
Gate-in coupling	DC				
Gate-in threshold voltage range	-2 to 2				V
Gate-in threshold voltage resolution (steps)	1				mV
Output connector	SMA				
Optical connector	FC / PC pigtail				
Operating Temperature	+10 to +35				°C
Dimensions	95 x 95 x 95				mm
Weight	1				kg
Cooling time	5				min
Power supply					
Input voltage	90~264VAC - 135~370VDC				
Frequency range	47~63				Hz
AC current	1.4A / 115VAC 1A / 230VAC				

Supplied Accessories
60W AC/DC +12 V green power adapter
Power cable
1.8 m USB cable
Optical fibre cleaner
User guide on USB key

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