Redefining Measurement

ID Qube Series: NIR Gated version

Synchronous Single-Photon Detection at Telecom Wavelengths

COMPACT & COST-EFFECTIVE

The ID Qube NIR Gated SPAD modules are a breakthrough in single-photon detection especially dedicated to synchronous detection at telecom wavelength's.

They provide a cost-effective solution for applications in which synchronous photon detection is essential such as quantum communications especially Quantum Key Distribution. They are 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. The fiber coupled version is equipped with a reinforced metallic fiber optic cable, which offers robustness and total immunity to ambient light for extremely low light measurements.

Applications

- Quantum communication
- Quantum physics and optics
- Time of flight measurements (OTDR, LiDAR)
- Fluorescence Lifetime measurements

Key Benefits

- Compact & cost-effective
- Fast gating (up to 100 MHz) & free-running
- Ultra-low noise (800 cps at 10%)
- Low jitter (150 ps)

ID Qube NIR Gated

Gated and free-running modes at telecom wavelengths

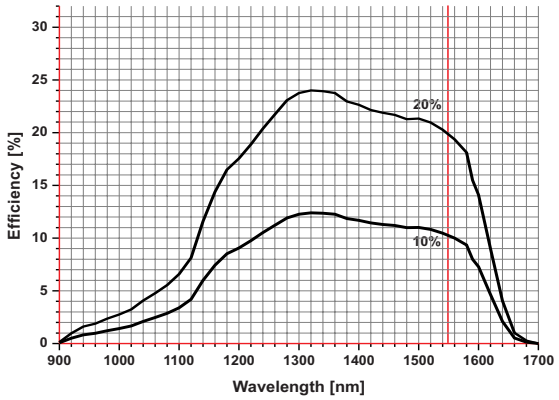
The ID Qube has been specially designed to achieve low dark count and afterpulsing rates in fast gated mode.

The ID Qube NIR Gated can operate at four detection probability levels of 10%, 15%, 20% and 25% with a deadtime between 100 ns and 80 µs. In gated mode it accepts gates as short as 3 ns with a maximum repetition frequency of 100 MHz. The arrival time of photons is reflected by a 10 ns LVTTL/NIM (user-selectable) pulse available at the SMA connector with a timing resolution as low as 150 ps at 25% efficiency. A simple USB interface allows the user to set the efficiency level and the deadtime.

EFFICIENCY

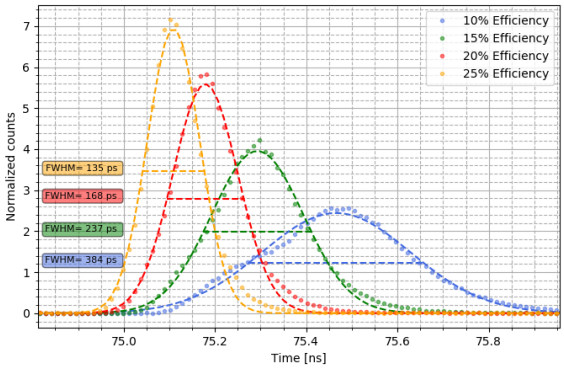
The ID Qube response calibration is carefully carried out in-house using equipment's calibrated by the Swiss Institute of Metrology (METAS).

Efficiency versus wavelength



LOW JITTER

The jitter of a SPAD is greatly reduced when the quantum efficiency is increased. The ID Qube NIR Gated offers a jitter as small as 150 ps or less at 25% efficiency at 1550 nm. The here below figure shows typical jitter figures. Note that these may vary from diode to diodes.



DARK COUNT RATE

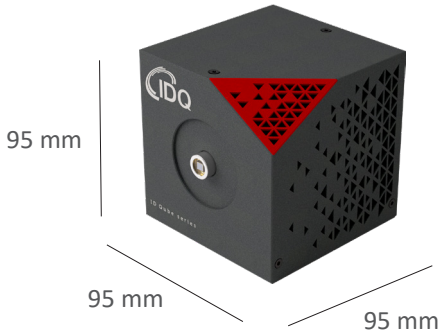
The measured dark count rate strongly depends on two settings: efficiency and deadtime. By playing with them, it is possible to optimize efficiency, afterpulsing and dark count rate (DCR) for each dedicated experiment. In gated mode, the DCR per gate also depends on the gate width. In gated mode, the DCR per gate also depends on the gate width, i.e. shorter gates showing lower DCR rates. Note that the actual optical gate width is equal or shorter than the electrical gate width. As a result the measured DCR per gate is always less than the prorate value calculated based on the gate width and the gate repetition period.

USER FRIENDLY SOFTWARE

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

COMPACT

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



The ID Qube Series exists in 2 versions:

- ID Qube NIR Free-running
- ID Qube NIR Gated

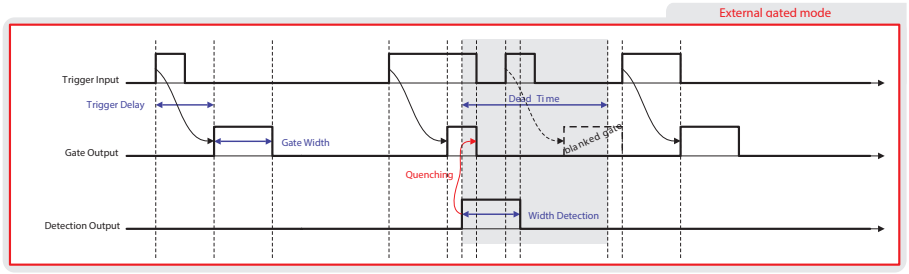
Compact

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

PRINCIPLE OF OPERATION

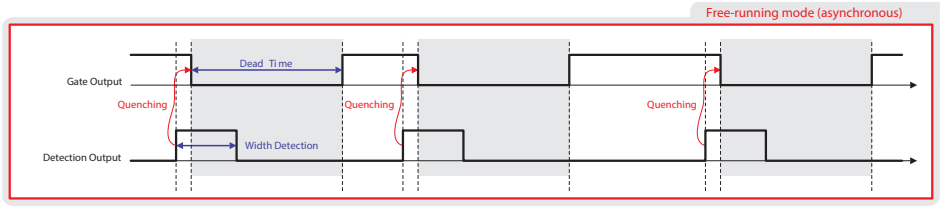
External-gating mode

The avalanche photodiode (APD) is biased above its breakdown voltage during the gate width. External gating enables a synchronous detection mode based on signal provided by the user at the GATE-IN connector. An amplitude discrimination is applied to the signal voltage using an adjustable threshold level between -2 V to +2 V. The user has the choice between positive or negative logic by selecting the relative trigger edge reference. In the case of small gate width, GATE-IN signal input can be used as a trigger to generate an internal adjustable gate width with steps of 0.1 ns. Whichever the mode chosen, a photon-absorption-induced avalanche event within the gate results in the incrementation of the detection counter and an electrical pulse is generated and sent to the Detection OUT connector. The quenching electronics closes the gate stopping the avalanche and an adjustable dead time is applied.



Free-running mode

The ID Qube NIR Gated can also be operated in free-running (asynchronous) mode. The APD is biased above its breakdown voltage in the so-called Geiger mode. Upon absorption of a photon and the associated avalanche, the photon arrival time is reflected by the rising edge of a 10 ns width LVTTL/NIM pulse at the Detection OUT connector. The ID Qube NIR Gated has been designed to provide a fast avalanche quenching, thus strongly limiting the afterpulsing rate. This allows operation at reasonably short deadtimes which can be further optimized depending on the application and the efficiency level selected.



TIME CONTROLLER SERIES BUNDLE

Take your experiment a step further. Operate the ID Qube with a Time Controller, 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.

SPECIFICATIONS

Parameter				Units
Wavelength range	900 - 1700			nm
Deadtime range	0.1 - 80			µs
Deadtime step	100			ns
Output pulse voltage	LVTTL / NIM			
Output pulse width	10			ns
Optical fibre coupling	MMF62.5 or free-space			
Efficiency range calibrated at λ=1.55 µm (free-running)	10 - 25 [1]			%
Efficiency resolution (steps)	5			%
Timing resolution (FWHM) at 25% efficiency	Typ. 150 / Max. 225			ps
Dark count rate at (efficiency) [2]	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	3			ns
Gate-in voltage range	-2 to 3			V
Gate-in coupling	50 DC			Ω
Gate-in threshold voltage range	-2 to 2			V
Gate-in threshold voltage resolution (steps)	1			mV
Output connector	SMA			
Optical connector	FC / PC fiber pigtail with metallic outer protection or Free-space			
Operating temperature	+10 to +35			°C
Dimensions	95 x 95 x 95			mm
Weight	1			kg
Cooling time	<5			min
Power supply				
Consumption	100-240 VAC; 1.4 A; 50-60 Hz			
Supplied AC/DC adapter	+12 VDC; 60 W			

[1] Other efficiencies can be calibrated on demand
[2] DCR measured in free running mode

Supplied Accessories	
+12V, 60 W, AC/DC power adapter, with AC power cord	C-mount adapter (free space model)
Region adapted power cord	Optical table mechanical support
1.8 m USB cable	Rubber feet
Optical fiber cleaner	

World Headquarters

ID Quantique SA
Chemin de la Marbrerie 3 bis
1227 Carouge/Geneva Switzerland
info@idquantique.com
www.idquantique.com

Sales Offices and Engineering Labs

- **Switzerland** Geneva
- **America** Boston
- **South Korea** SungNam-si