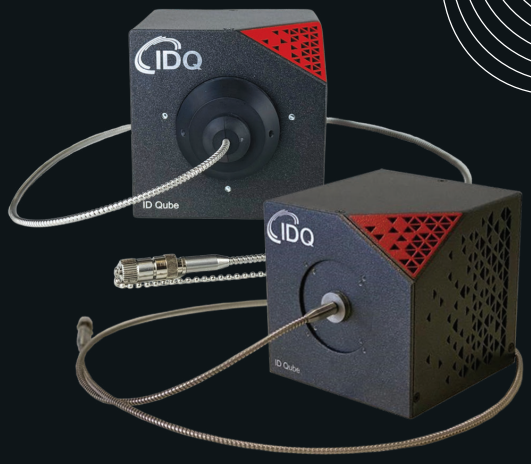
IDQ an IonQ company

IONQ

ID Qube Free-Running

NIR Single Photon Detector

Synchronous and Asynchronous
Single-Photon Detection from 900 nm to 1700 nm



The ID Qube is a cost-effective solution delivering precise and reliable single photon detection, with high detection efficiency, precise timing jitter and low detector noise.

The **ID Qube-NIR Free-Running** model is best suited for application in which asynchronous photon detection is essential, such as photon correlation, QKD or time of flight measurements.

All ID Qube models offer a gate input port connector, dedicated to avoid satuation or undesired detections. The cooled InGaAs/InP avalanche photodiode and associated electronics have been designed to achieve especially low afterpulsing and dark count rates.

Get the best out of your photonic experiments and applications with the ID Qube NIR Series today.

Key Features

- **Compact, cost effective and dependable performance**
- **Ultra-low noise** (<200 cps at 10%)
- **Low jitter** (<200 ps, typically <150 ps)
- **Fibre coupled optical input**
- **Broadband detection** (900–1700 nm)
- **Intuitive GUI & Linux API**

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**

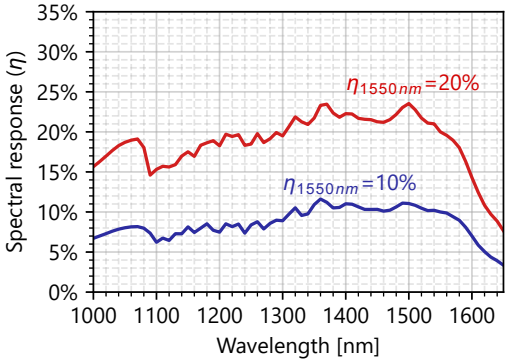
Ordering guide

ID Qube-NIR-FR-XX-YY

- XX: MMF *(Fiber coupled model, compatible with SMF and MMF FC/PC couplers)* or FS *(Freespace model)*
- YY : LN *(Low noise model)* or ULN *(Ultra-low noise model)*

Broadband performance

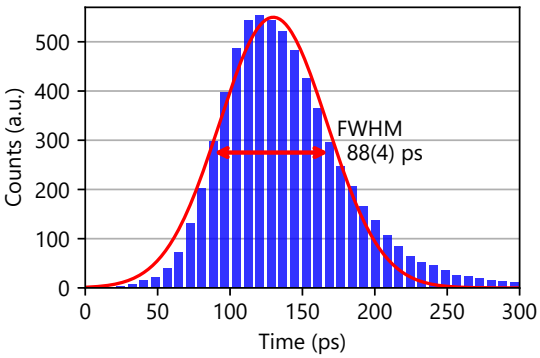
High system detection efficiency (SDE) across a broad range, characterized with equipment carefully calibrated by METAS.



(Above) Spectral response measurement for a typical ID Qube NIR device.

High precision

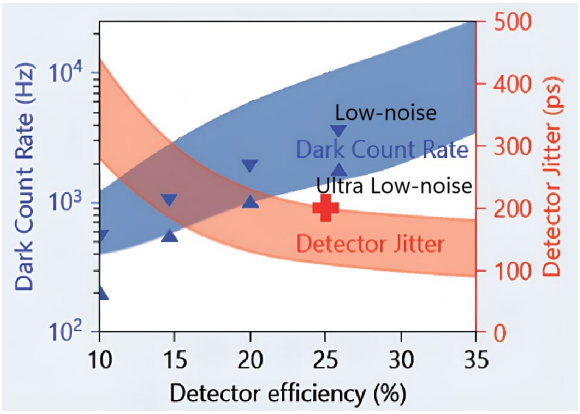
See the best timing resolution with the lowest detection timing jitter.



(Above) Timing jitter measurement of an ID Qube NIR detector at 30% SDE, including all other instrument jitter contributions, recorded with an ID1000 Time Controller.

Low noise

Always few dark counts with our Standard Qube models, and even better with the Low Noise model.



(Above) Dependence of detector noise and timing jitter with SDE. Users have the ability to balance the SDE, noise and precision to best fit their needs.

Compact

The ID Qube's small and compact form factor fits well into your experiments, and ideally suited for applications such as LiDAR, where compactness is key for system integration.

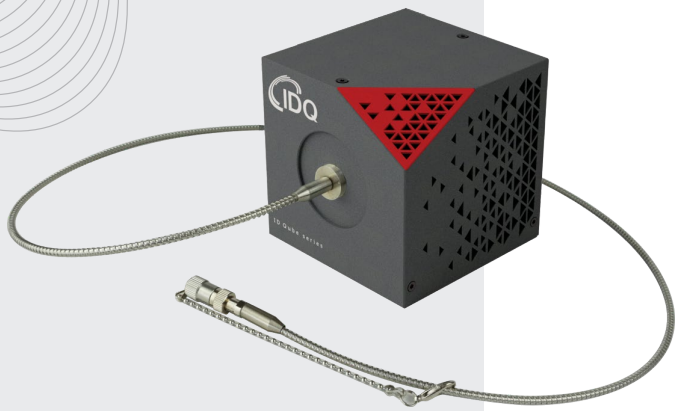
Free-running and gated detection at telecom wavelengths

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

The ID Qube NIR can operate at six detection efficiency levels of 10%, 15%, 20%, 25%, 30% and 35% with a deadtime between 100 ns and 80 µs. The ID Qube Free-running accepts gates as short as 500 ns with a maximum repetition frequency of 1 MHz.

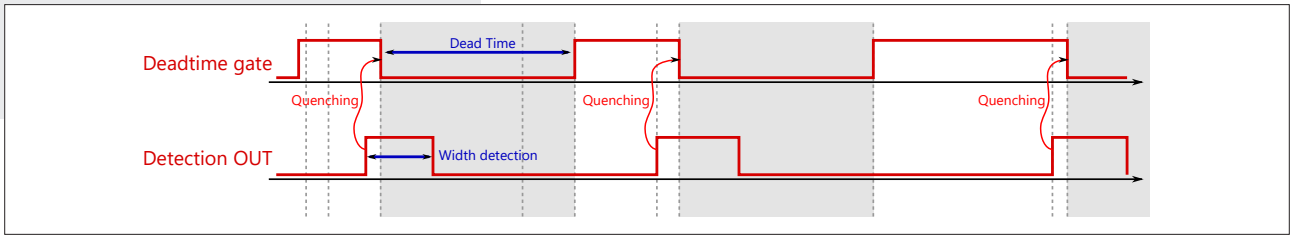
The arrival time of photons is reflected by a 10 ns LVTTL/NIM (user-selectable) pulse available at the SMA connector with a timing resolution typically as low as 150 ps at 25% efficiency.

A simple USB interface with intuitive Graphical User Interface (GUI) allows the user to set the efficiency level and the deadtime as well a set the performance levels and measure photon detections.



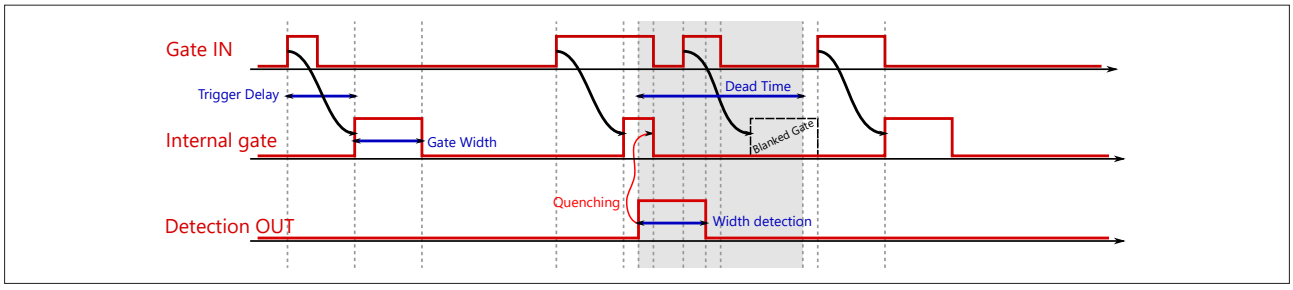
Free-running operation

The ID Qube NIR models can be operated in free-running (asynchronous) mode. The APD is biased above its breakdown voltage in the so-called Geiger mode. Upon a photon absorption of a photon and the associated avalanche, the photon arrival time is reflected by the rising edge of a 10 ns-wide LVTTL/ NIM pulse at the Detection OUT connector.



Gated operation

Detector gating – fast switching of the detector response – is achieved through an external electrical pulse source, which the ID1000 Time Controller can provide. The ID Qube Free-running can be gated with a maximum repetition frequency of 1 MHz. The gated operation of the ID Qube Free-running detector is ideal for mitigating background noise.



(Above) Detector operation in Gated mode. Outside of a gate pulse, the ID Qube is insensitive to photon arrivals. In the case of small gate widths, the Gate IN signal can be used to trigger an internal adjustable-width gate. Whichever mode chosen, a photon-induced avalanche event inside a gate generates an electrical pulse, sent to the Detection OUT connector as a user's photon detection event signal. The quenching electronics then close the gate, halting the avalanche, while a user-adjustable deadtime is applied.

Both the ID Qube Gated and ID Qube Free-running models are designed for fast avalanche quenching, strongly limiting after-pulsing (where additional 'false' detections are triggered by the tail of a 'real' detection pulse). This allows for even shorter deadtimes, increasing the maximum count rate without sacrificing performance.

Time Controller series bundle

Take your experiment to the next level. Use the ID1000 Time Controller to register single-photon pulses and control the gates of up to four ID Qube detectors, within a combined time-tagger, pulse generator, delay generator package. All with advanced on-board logic for real-time four-fold coincidence measurements.

Specifications

ID Qube Free-Running				
Wavelength range	900 nm to 1700 nm			
Deadtime range	100 ns to 80 µs, in 100 ns steps			
Output pulse format	LVTTL or NIM			
Output pulse width	10 ns			
Optical coupling	Free space or optical fibre (MMF62.5)			
Efficiency range [1] calibrated at λ = 1550 nm	10%, 15%, 20%, 25%			
Extended efficiency range [2]	30%, 35%			
Timing jitter @ 25% efficiency level	Maximum 200 ps (150 ps typical)			
Noise performance @ efficiency level [3]	10%	15%	20%	25%
LN model (Max. dark count rate)	0.5 kHz	1 kHz	1.5 kHz	2 kHz
ULN model (Max. dark count rate)	0.3 kHz	0.5 kHz	0.8 kHz	1.2 kHz
Gate-in max frequency	1 MHz			
Gate-in min pulse duration	500 ns			
Gate-in voltage range	-2 V to 3 V			
Gate-in coupling	50 Ω DC			
Gate-in threshold voltage range	-2 V to 2 V, in 1 mV steps			
Output connector	SMA			
Operating temperature	+10°C to +35°C, max. 60% humidity			
Dimensions (W x H x L)	95 mm x 95 mm x 95 mm			
Weight	1 kg			
Cooling time @ power-on	LN model: < 3 minutes / ULN model: < 5 minutes			
Power supply	100-240 VAC ; 1.4 A ; 50-60 Hz			
Storage temperature	+5°C to +50°C, max. 60% humidity			

Supplied Accessories:

- *+12V, 60 W, AC/DC power adapter, with AC power cord*
- *Region adapted power cord*
- *1.8 m USB cable*
- *Optical fibre cleaner (fibre-coupled model)*
- *C-mount adapter (free space model)*
- *C-mount adapter (free space model)*
- *Optical table mechanical adapter (M4 taps)*
- *4 x Adhesive rubber feet*

Notes:

[1] Additional efficiency levels can be calibrated on demand.

[2] The extended detection range is provided without guarantees of the device's noise performance. Above 25% efficiency, ID Qube devices start exhibiting non negligible afterpulsing, and detector dark counts can rise significantly. However, detector timing jitter has also been observed to improve with increasing detection efficiency.

[3] Dark count rate measured in free running mode with a 80 µs deadtime.

Applicable Standards

Safety US: UL 61010-1:2012 (3rd Ed.), AMD1
Safety CAN: C22.2 No 61010-1:2012 + U1:2015 + U2:2016 AMD1:2018

Safety: EN 61010-1:2010, AMD1:2016
EMC: EN 55032:2015, EN 55035:2017, EN 61326-1:2013
RoHS: 2011/65/EU (RoHS 2) amended by (EU) 2015/863 (RoHS 3)

Title 47 Part 15:2019
Subpart B as a Class B device

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