IDQ
FROM VISION TO TECHNOLOGY

GATED VISIBLE SINGLE-PHOTON COUNTER

ID110 ADVANCED SYSTEM FOR SINGLE PHOTON DETECTION WITH 100MHz GATED MODE AND FREE-RUNNING MODE

The ID110 brings a major breakthrough for single photon detection at visible wavelengths in demanding conditions. Conventional single-photon detectors based on Silicon Avalanche Photodiodes (APD) are typically operated in free-running mode. Their performance can be strongly impacted by intense optical pulses. The detector is blinded by the intense pulse due to the dead-time effect occurring after each detection. This deadtime can extend to 100's of ns. In addition, the charges trapped in the APD junction, as a result of intense optical pulses, increase the noise level, potentially masking the signal of interest. The ID110 Gated Visible Single Photon Detector brings a solution to these problems by operating the APD in gated mode. The bias voltage is kept below breakdown to deactivate the detector and enhance trap discharge, except when detection is specifically enabled. Contrary to other products on the market, which simulate gated mode by controlling the activation of the output avalanche signal (also called post-gating), the ID110 operates in real gated mode and offers the best discrimination performance.

KEY FEATURES

- Up to 100MHz external / internal gating frequency
- Free gating mode
- Adjustable photon detection probability
- Adjustable delays, gate width and deadtime
- Universal Inputs/Outputs
- Two-channel auxiliary event counter
- Auxiliary coincidence counter
- Setup storage in internal memory
- Real time statistics, charts, sound alarms
- Data export through USB memory
- Ethernet remote control (Option)

APPLICATIONS

- Quantum optics
- Quantum memory
- Optical tomography
- Photoluminescence
- Fluorescence, fluorescence life time

PHOTONIC SOLUTIONS
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Best-in-Class Performance

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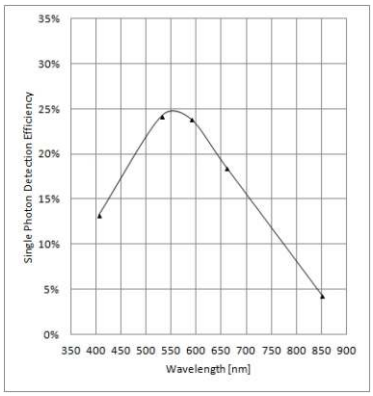
SPECIFICATIONS

Parameter	Min	Typical	Max	Units
Wavelength range	350		900	nm
Optical fiber type		MMF (diam. 105 um)		
Single-photon detection probability (SPDE) 1				
at 405nm		13		%
at 530nm		24		%
at 590nm		24		%
at 660nm		17		%
at 850nm		4		%
Deadtime range	0.070		100	us
Deadtime step		10		ns
Timing resolution at max. efficiency (25%) 2			200	ps
External trigger frequency			100	MHz
Internal trigger frequency	1,2,5,10,20,50,100,200,500 kHz		1,2,5,10,20,50,100 MHz	
Effective gate width range	0.5		25	ns
Gate width step		10		ps
Trigger delay range			20	ns
Trigger delay resolution		10		ps
Optical connector		FC/APC		

1 Photon Detection Probability versus λ



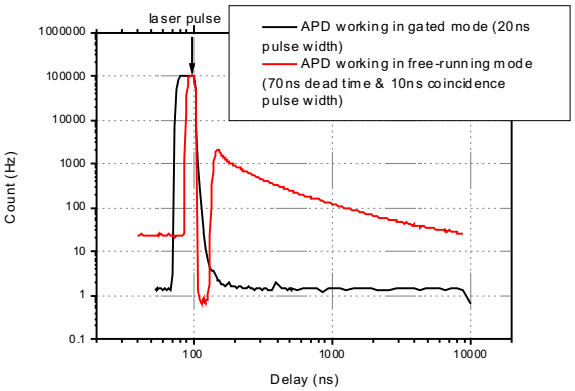
2 Calibrated at λ=530 nm.

Probability of dark count rate at 530nm for a 1ns effective gate width in gated mode:

	Freq.=100kHz, 70ns deadtime		Freq.=100MHz, deadtime=1μs	
Model	**10% efficiency**	**20% efficiency**	**10% efficiency**	**20% efficiency**
ID110-MMF105	0.1Hz	0.25Hz	100Hz	250Hz

APPLICATION

The figure on the right shows the detection rate after sending an intense light pulse on the APD (1000 photons) at 100kHz repetition rate. The extra-noise originated by the strong pulses in free-running mode (due to afterpulsing effect) is larger than the one in gated mode (due to charge persistence) whereas the noise level is higher in free-running mode. Additionnaly, in gated mode, the APD is NOT blinded.



SUPPLIED ACCESSORIES

- Power cable
- Optical fiber cleaner
- User guide on USB memory stick
- Compact USB keyboard
- 1m FC/APC patch cord
- Ethernet cable (optional)

ORDERING INFORMATION

ID110-MMF105-100MHz	module with multimode fibre input (core diameter 105um) 100MHz internal / external trigger rate

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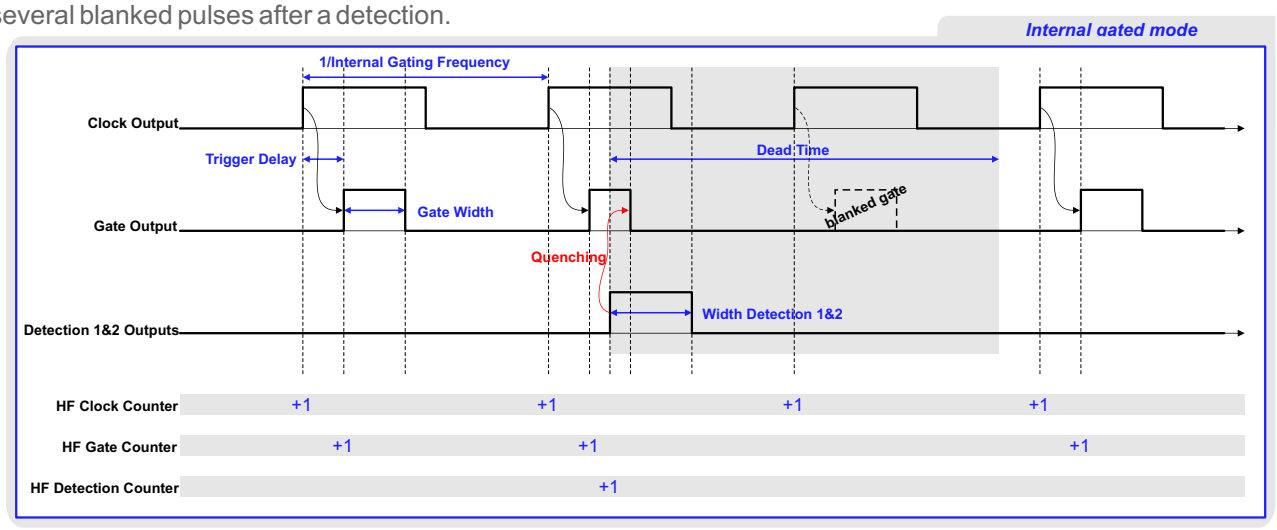
■ The System hardware

The system hardware allows the ID110 to operate in free-running, free-gating, internal gated or external gated modes.

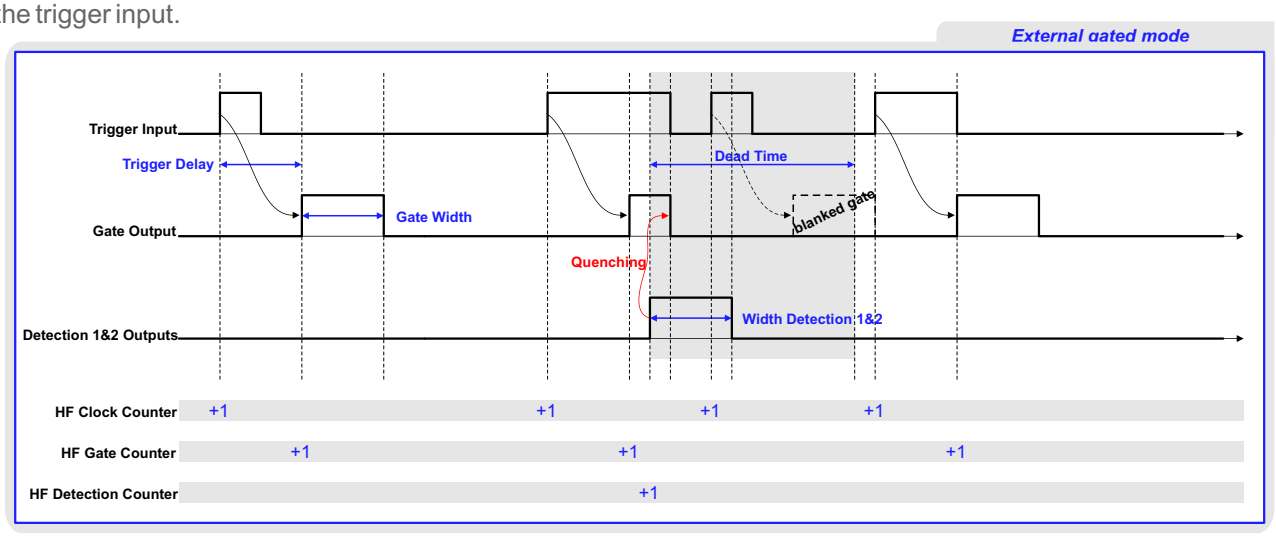
Internal-gating mode:

The APD is biased above breakdown during gates of adjustable width and frequency. Internal gating is a synchronous mode based on a clock provided by the internal clock generator. The 50% duty cycle clock signal is available at the clock output and counted by the HF clock counter. A user-adjustable trigger delay can be set between the clock and the gate signals. A gate of width set by the user is opened on the rising edge of the delayed trigger. An avalanche event within the gate increments the HF detection counter and causes a pulse of adjustable width at detection1 and detection2 connectors. The quenching electronics closes the gate and, if selected by the user, a dead time is applied resulting in one or several blanked pulses after a detection.



External-gating mode:

The operation in external gating mode is very similar to the internal gating mode except that the clock is provided by the user at the trigger input.



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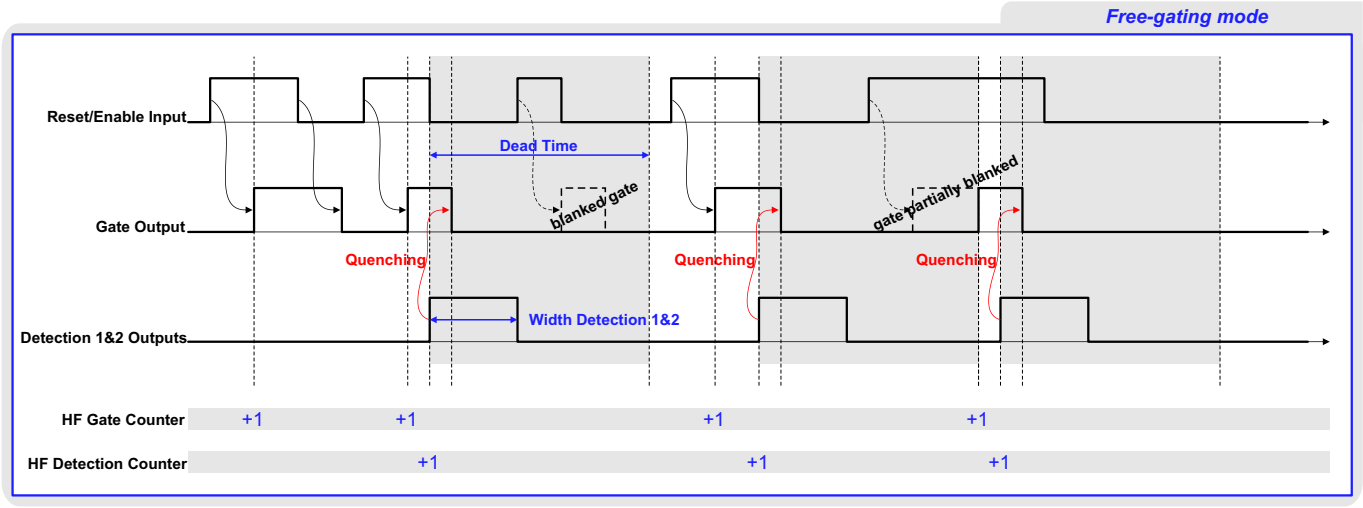
Free-gating mode:

The user supplies an electrical signal at the reset/enable input. When no avalanche occurs, the gate output that reflects the APD state (On/Off) is identical to the reset/enable input signal. When an avalanche occurs during a gate, a pulse of adjustable width is produced at detection1 and detection2 outputs, the HF detection counter is incremented and the quenching electronics stops the gate. When a dead time is applied for limiting the afterpulsing, the gate signal remains at low level whatever the reset/enable state. This results in blanked gate(s) or partially blanked gates. The HF gate counter provides the effective gates rate applied to the APD.



Free-running mode (asynchronous mode):

Until photon absorption or dark count generation, the APD is biased above its breakdown voltage in Geiger mode. The gate output that reflects the APD state (i.e. On:photosensitive or Off:blind) is at high level. When an avalanche takes place in the APD, it is sensed by the capture electronics. A pulse of adjustable width is produced on detection1 and detection2 outputs, the detection HF counter is incremented and the quenching electronics stops the avalanche. To limit afterpulsing, the APD is maintained below breakdown until the end of the dead time. In this mode, the HF gate counter and HF detection counter rates are equal.