Single Photon Counter Modules (Page 1 of 2)

NEW products

SPCM50A

SPCM20A/M
Cables and Power Supply Included

Features

- Low Dark Counts
  - SPCM20A(/M): 25 Hz (Typical)
  - SPCM50A(/M): 150 Hz (Typical)
- Two Detector Sizes
  - SPCM20A(/M): Ø20 µm Active Area
  - SPCM50A(/M): Ø50 µm Active Area
- Active Quenching
- Temperature Stabilized
- USB Interface and Pulse Output
- TTL Gating/Trigger Input

Thorlabs' Photon Counter Modules use a silicon avalanche photodiode to detect single photons. An active quenching circuit has been integrated into the diode, thereby enabling high count rates. An integrated Peltier element stabilizes the diode's temperature below the ambient temperature to reduce the dark count rate.

In addition, these photon counters are capable of detecting photons emitted in the 350 to 900 nm range with the maximum sensitivity at 500 nm. Two models are available that provide an active area of either Ø20 µm or Ø50 µm. These single photon counters are incredibly fast, allowing users to count a photon every 35 – 45 ns, depending on the model chosen. In addition, the SPCM20A and SPCM50A have a low typical dark count rate of 25 and 150 counts per second, respectively, which allows the module to detect power levels down to 0.14 fW.

These single photon counters work by converting an incoming photon into a TTL pulse in the detector, which is counted by the internal 31-bit counter, while the USB connection offers a direct readout of the counts. The software enables not only the setting of the time bin length but also a second pulse blind time in addition to the one inherently associated with the avalanche photodiode. During the user-defined pulse blind time, the counter will disregard all pulses, thus reducing higher dark count rates attributed to after pulses. Additionally, the output pulse signal from the module can be viewed on an oscilloscope or connected to an external counter.

Thorlabs' photon counter modules can be integrated into larger systems with additional DLL and LabVIEW drivers. With a compact housing that measures only 85 mm x 67.5 mm x 37.7 mm (3.4" x 2.7" x 1.5"), these modules feature an external SM1 (1.035"-40) thread and internal SM05 (0.535"-40) thread that is compatible with Thorlabs' lens tubes and cage assemblies. Post mounting in horizontal or vertical orientation is possible via two 8-32 or M4 mounting holes. Included with the detector is a USB cable, a power supply with adapters for US, EU, UK, and Australia outlets, and the software package.

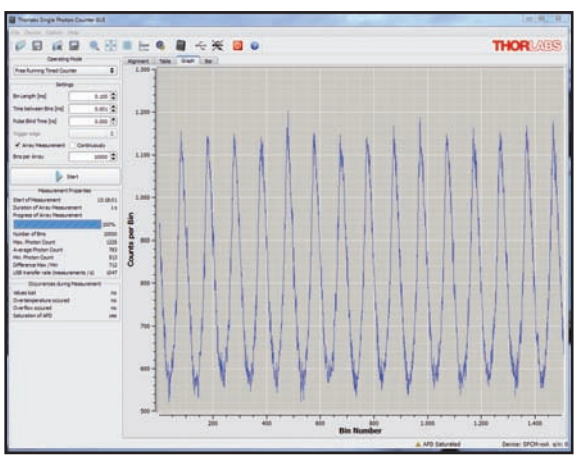
Software

The following operating modes can be set by the software:

Manual Mode: The counter is started and stopped manually by pressing the Start/Stop button (toggle function). The timer will be reset at each start.

Free Running Timed Counter: The counter is enabled for a certain number of "Time Bin Lengths" when in this mode. Both the number of time bins (i.e., the number of measurements) as well as the minimum interval between two subsequent bins can be set. Please note that the minimum interval between two subsequent bins is 1 µs. In this mode, the pulse blind time of the APD can also be increased.

Externally Triggered Timed Counter: In this mode, the timer is started by an external trigger signal and counts incident photons during the set time bin length. The active trigger slope (rising or falling) can be selected.



Graphical User Interface (Graph Display)

Externally Triggered Counter: In this mode, the external trigger signal will start and stop the counter.

External Gating: The counter and the APD are activated externally.

Measurement Settings: In the array mode, each data value is recorded to an array. In the continuous mode, the measurement is restarted after the preset number. Both modes can be saved as a .txt file. The measurement results can be represented as a bar (XY bar with counts vs. number of measurements), graph (curve), table (numeric), or alignment (numeric with additionally information) display. The number of measurements can be defined, and the measurements can be repeated.

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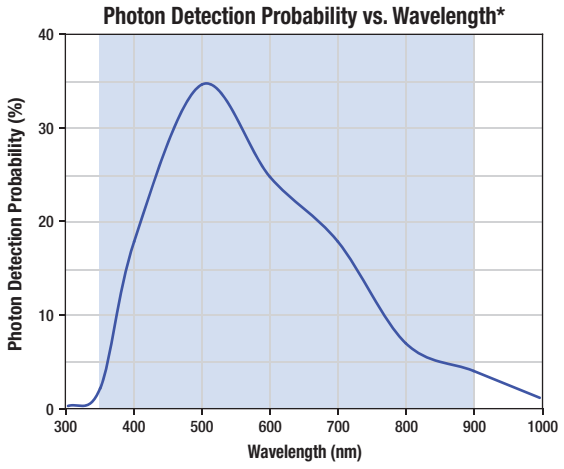
Operating Principle

Avalanche photodiodes operated in the Geiger Mode have the ability to detect single photons. This single photon sensitivity can be achieved by biasing the APD above the breakdown voltage (Point A in Fig. 1). The APD will remain in a metastable state until a photon arrives and generates an avalanche (Point B). This avalanche is quenched by an active quenching circuit inside the APD (Point C), which lowers the bias voltage below the breakdown voltage (labeled V_{BR} in Fig. 1). Afterwards the excess bias voltage can be restored.

During this time, which is known as the pulse blind time of the diode, the APD is insensitive to any other incoming photons. Spontaneously triggered avalanches are possible while the diode is in a metastable state. If these spontaneous avalanches occur randomly, they are called dark counts. If the spontaneously triggered avalanches are correlated in time with a pulse caused by a photon, it is called an afterpulse. To block such afterpulses in the measurement, an additional pulse blind time can be set in the software, which will cause the internal counter of the SPCM to ignore all pulses occurring during this pulse blind time.

Applications

- Spectroscopy with Single Molecules
- Spectro-Photometrical Measurements
- Flow Cytometry
- Photon Correlation Spectroscopy
- Lidar



*Shaded region indicates operating range of the single photon counters

ITEM #	SPCM20A	SPCM20A/M	SPCM50A	SPCM50A/M
Detector Type	Si-APD (Operating in Geiger Mode)			
Wavelength Range	350 - 900 nm			
Peak Responsivity	35% @ 500 nm			
Active Detector Size	Ø20 µm		Ø50 µm	
Dark Count Rate	60 Hz (Max); 25 Hz (Typical)		200 Hz (Max); 150 Hz (Typical)	
Count Rate (Max)[a]	28 MHz		22 MHz	
Blind Time (Typical)[b]	35 ns		45 ns	
Afterpulsing Probability[c]	3%			
Gating/Trigger Input	TTL 50 Ω			
Pulse Output	TTL 50 Ω			
Dimensions	85 mm x 67.5 mm x 37.7 mm (3.4" x 2.7" x 1.5")			
Power Supply (Included)	6 V DC, 1.5 A			
Mounting Hole	8 - 32	M4	8 - 32	M4

[a]Pulsed Light
[b]This is the Inherent Blind Time of the APD
[c]Percentage of Total Counts, Including Dark Counts, that are After Pulses

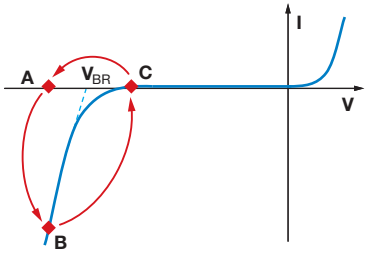


Figure 1: Current voltage characteristics of an avalanche photodiode operated in Geiger mode

Definitions

Geiger Mode: In this mode, the diode is operated slightly above the breakdown threshold voltage. Hence, a single electron-hole pair (generated by absorption of a photon or by a thermal fluctuation) can trigger a strong avalanche.

Dark Count Rate: This is the average rate of registered counts in the absence of any incident light and determines the minimum count rate at which the signal is dominantly caused by real photons. The false detection events are mostly of thermal origin and can therefore be strongly suppressed by using a cooled detector.

Active Quenching occurs when a fast discriminator senses the steep onset of the avalanche current and quickly reduces the bias voltage so that it is below breakdown momentarily. The bias is then returned to a value above the breakdown voltage in preparation for detection of the next photon.

Blind Time is the time interval the detector spends in its recovery state. During this time, it is effectively blind to incoming photons. The blind time fraction, which is an inherent feature of an active quenching circuit, may be defined as the ratio of missed to incident events.

Afterpulsing: During an avalanche, some charges can be trapped inside the high field region. When these charges are released, they can trigger an avalanche. These spurious events are called Afterpulses. The life of those trapped charges is on the order of a few tenths of a microsecond. Hence, it is likely that an afterpulse occurs directly after a signal pulse.

ITEM #	$	£	€	RMB	DESCRIPTION
SPCM20A	$ 4,050.00	£ 2,916.00	€ 3.523,50	¥ 32,278.50	Single Photon Counter Module, Active Area: Ø20 µm, Imperial Taps
SPCM20A/M	$ 4,050.00	£ 2,916.00	€ 3.523,50	¥ 32,278.50	Single Photon Counter Module, Active Area: Ø20 µm, Metric Taps
SPCM50A	$ 4,500.00	£ 3,240.00	€ 3.915,00	¥ 35,865.00	Single Photon Counter Module, Active Area: Ø50 µm, Imperial Taps
SPCM50A/M	$ 4,500.00	£ 3,240.00	€ 3.915,00	¥ 35,865.00	Single Photon Counter Module, Active Area: Ø50 µm, Metric Taps