SPCM | Single Photon Counting Modules Product Catalog



excelitas®

Excelitas® – Single Photon Counting Modules

Excelitas Technologies® high performance Single Photon Counting Modules (SPCMs) combine more than 40 years of photon counting design and engineering expertise to deliver superior technology for the most demanding low-light-level detection applications. With the broadest range of SPCM modules, combined with the technical expertise and global resources to support our customers, Excelitas® has the solution to best meet your photon counting needs.

As the first to introduce single photon counting modules using silicon avalanche photodiodes (Si-APDs), Excelitas remains committed to delivering innovative and market-leading photon counting technology to provide high Photon Detection Efficiency (PDE), low afterpulsing, unmatched uniformity over a large active area, high linear dynamic range and low dark counts.

Typical photodiodes that generate an electrical current output when illuminated by light offer a one-to-one ratio of electrons to photons. With avalanche photodiodes (APDs), however, these photon-generated electrons then liberate a greater number of electrons to produce more than a one-to-one ratio of electrons to photons. Excelitas SPCM modules are designed with a unique built-in silicon avalanche photodiode (SLiK APD) that operates in Geiger mode, which means operated above breakdown voltage, to create an avalanche effect resulting in an internal gain that can be as high as 106 electrons per photon detected. This innovative capability has enabled a wide range of applications requiring extreme low-light-level detection.

Excelitas' self-contained modules have all the APD control and output pulse generation circuitry built-in for easy and user-friendly adaptation in both research and OEM environments. Due to rapid and recent advances in the technology, SPCMs are now being integrated into sophisticated OEM devices used for detecting and measuring materials such as environmental toxins, proteins, particles in emulsions and solutions, as well as for drug development, cancer and genetic research and in clinical lab diagnostics. In addition, SPCM modules are useful in super-resolution microscopy, fluorescence, particle sizing, single photon 3D LiDAR imaging and nanotechnology.

Excelitas SPCMs are designed and built to be fully compliant with the European Union's RoHS Directive 2011/65/EU and Directive 2015/863/EU.



SPCM – Advantages & Applications

Utilizing a unique silicon avalanche photodiode (SLiK), Excelitas SPCMs can achieve maximum peak photon detection over its active area. The photodiode is temperature-controlled by a thermoelectric cooler, ensuring stabilized performance and optimal signal to noise ratio despite ambient temperature changes.

Excelitas SPCMs provide as standard a dark count as low as < 25 counts per second, which when combined with the large active area, makes for easy optical alignment, wavelength responsiveness from UV to NIR and after-pulsing probability considerably less than 1%, as well as very short dead times. Thus, our SPCMs offer the most comprehensive combination of capabilities for any single photon application without comprising on performance or affordability.

Excelitas offers a comprehensive series of SPCMs suitable for a variety of cutting-edge applications including:

- Particle Sizing (DLS)
- STED & Multi-Photon Microscopy
- Ultra-Sensitive Fluorescence
- Luminescence
- Time-Correlated Single Photon Counting (TCSPC)
- Single Molecule Detection
- Diffused Correlation Spectroscopy (DCS)
- Single Photon LiDAR
- Optical Range Finding
- Quantum Cryptography (QKD)
- Photon Entanglement Experiments

Excelitas SPCMs offer several optical interface options that include free space window, FC fiber adaptor, and C-mount or tube cage mount bracket/ adaptors. Please refer to the product datasheet for the ordering information.

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SPCM-AQRH

STANDARD PRODUCT RANGE WITH OPTION DETAILS

Excelitas SPCM-AQRH

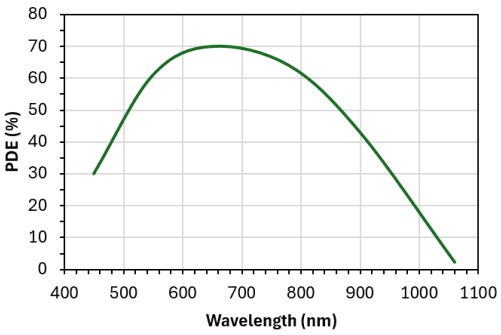
The Excelitas SPCM-AQRH Single Photon Counting Module detects single photons over the wavelength range of 400 to 1060 nm with performance parameters superior to other solid state or vacuum-tube based photon counters

The SPCM-AQRH achieves typical peak photon detection efficiency greater than 70% at 700 nm over a 180 µm diameter, with unmatched uniformity over the full active area. Featuring a simple 5V power input, a TTL voltage pulse is generated for each photon detected with the signal available at the BNC connector at the rear of the module.

With a wide operating temperature range, the SPCM-AQRH will function between 5 and 70°C.

The SPCM-AQRH comes with 6 standard output pulse options to match any photon count read-out instrument requirements.

With an enhanced electronic circuit, the SPCM-AQRH provides reduced minimum dead-time to less than 25 ns, thereby enabling increased linearity and improved dynamic range. The SPCM-AQRH has internal protection circuitry that protects the avalanche photodiode and the module electronics from any damage due to accidental overload from exposure to ambient lighting.





SINGLE PHOTON COUNTING MODULES – SPCM-AQRH-WX

Part Number	Active Area Diameter	Maximum Dark Count Rate	Photon Detection Efficiency @ 650 nm	Typ. Count Rate before Saturation	Dead Time[1]	Pulse Width[2]
Unit	mm	c/s	%	c/s	ns	ns
SPCM-AQRH-10	180	1500	65	37M	22	10
SPCM-AQRH-11	180	1000	65	37M	22	10
SPCM-AQRH-12	180	500	65	37M	22	10
SPCM-AQRH-13	180	250	65	37M	22	10
SPCM-AQRH-14	180	100	65	37M	22	10
SPCM-AQRH-15	180	50	65	37M	22	10
SPCM-AQRH-16	180	25	65	37M	22	10

1. Option for 28 and 35 ns Dead Time available.
2 Option for 18 and 28 ns Pulse Width available.

SPCM-AQRH-TR

PERFORMANCE-OPTIMIZED FOR TIMING RESOLUTION

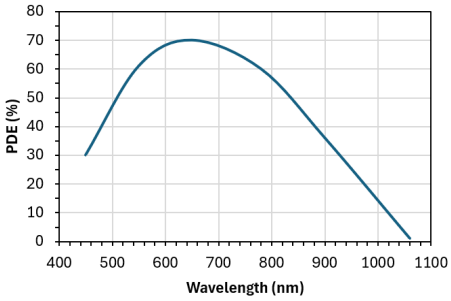
Excelitas SPCM-AQRH-TR

The Excelitas SPCM-AQRH-XX-TR is a subset of the SPCM-AQRH series specifically selected and performance optimized for timing resolution.

The SPCM-AQRH-XX-TR uses a specially selected SLiK silicon avalanche photodiode with timing resolution better than 250 ps while maintaining peak photon detection efficiency (PDE) of more than 75% at 650 nm over a 180 µm diameter active area. This new timing-optimized module offers multiple optical interfaces and output pulse options of the standard SPCM-AQRH, as well as performance parameters such as outstanding uniformity, over-load protection, temperature stability, and linearity.

The SPCM-AQRH-XX-TR is suitable for applications in time correlated single photon counting (TCSPC), fluorescence lifetime measurements and fluorescence lifetime imaging microscopy (FLIM).

As with the standard SPCM family of parts, the "-TR" series of photon counting modules is designed and built to be fully RoHS compliant.





SINGLE PHOTON COUNTING MODULES – SPCM-AQRH-WX-TR

Part Number	Active Area Diameter	Maximum Dark Count Rate	Photon Detection Efficiency @ 650 nm	Max. Count Rate before Saturation	Dead Time[1]	Pulse Width[2]
Unit	mm	c/s	%	c/s	ns	ns
SPCM-AQRH-11-TR	180	1000	75	37M	22	10
SPCM-AQRH-12-TR	180	500	75	37M	22	10
SPCM-AQRH-13-TR	180	250	75	37M	22	10
SPCM-AQRH-14-TR	180	100	75	37M	22	10

1. Option for 28 and 35 ns Dead Time available.
2 Option for 18 and 28 ns Pulse Width available.

SPCM-NIR

MODELS WITH ENHANCED NIR PDE

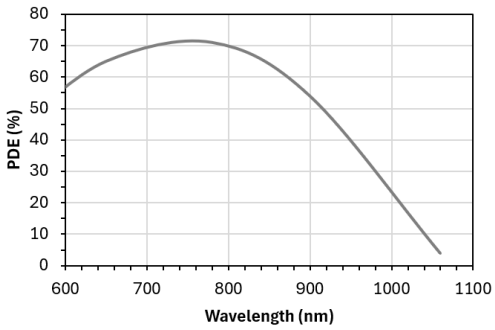
Excelitas SPCM-NIR

The Excelitas SPCM-NIR is a Single Photon Counting Module specifically selected and performance-optimized for the near-infrared wavelength spectrum between 780-900 nm.

The SPCM-NIR uses a specially selected silicon avalanche photodiode (SLiK) with peak single photon detection efficiency (PDE), typically 70% at 780 nm and 45% at 900 nm, while maintaining uniformity over a 180 µm diameter active area. This module achieves enhanced red and NIR sensitivity while maintaining other performance parameters of our standard SPCM-AQRH, such as outstanding uniformity, overload protection, temperature stability and linearity.

This NIR-spectrum enhanced device is designed to support microscopy, long-range single photon LiDAR, quantum key distribution, photon entanglement experiments as well as many other NIR single photon applications.

Users will benefit from the choice of output pulse options as well as optical interfaces available to this RoHS-compliant NIR series of photon counting modules.





SINGLE PHOTON COUNTING MODULES – SPCM-NIR[1]-WX

Part Number	Active Area Diameter	Maximum Dark Count Rate	Photon Detection Efficiency @ 780 nm	Max. Count Rate before Saturation	Dead Time[2]	Pulse Width[3]
Unit	mm	c/s	%	c/s	ns	ns
SPCM-NIR-10	180	1500	70	37M	22	10
SPCM-NIR-11	180	1000	70	37M	22	10
SPCM-NIR-12	180	500	70	37M	22	10
SPCM-NIR-13	180	250	70	37M	22	10
SPCM-NIR-14	180	100	70	37M	22	10

1. Options available with PDE measured at 780, 800, 850 or 900 nm. When ordered, the -NIR- is replaced by the wavelength chosen.
2. Option for 28 and 35 ns Dead Time available.
3. Option for 18 and 28 ns Pulse Width available.

SPCM-1064

MODELS WITH ENHANCED PDE AT 1064 NM

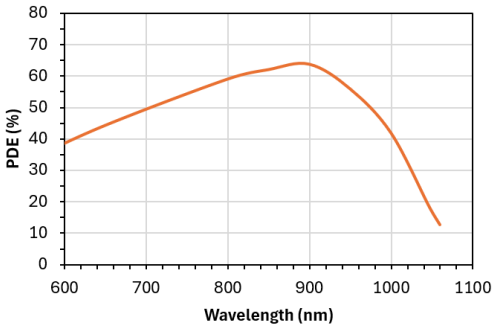
Excelitas SPCM-1064

The Excelitas SPCM-1064 is a Single Photon Counting Module tailored for applications at wavelengths between 900-1064 nm.

The SPCM-1064 uses unique silicon avalanche photodiode (SLiK) with 500 µm active diameter that can achieve photon detection efficiency (PDE) over 10% at 1064 nm. This module achieves enhanced NIR sensitivity while maintaining other performance parameters of our standard SPCM-AQRH, such as outstanding uniformity, overload protection, temperature stability and linearity.

This 1064-nm enhanced device is designed to support long-range single photon LiDAR, IR photoluminescence, Raman spectroscopy, atmospheric physics experiments as well as many other single photon applications at 1064 nm.

Users will benefit from the choice of output pulse options as well as optical interfaces available to this RoHS-compliant 1064 series of photon counting modules.





SINGLE PHOTON COUNTING MODULES – SPCM-1064-WX

Part Number	Active Area Diameter	Maximum Dark Count Rate	Photon Detection Efficiency @ 1064 nm	Max. Count Rate before Saturation	Dead Time	Pulse Width
Unit	µm	c/s	%	c/s	ns	ns
SPCM-1064-30	500	1500	10	21M	44	10
SPCM-1064-31	500	1000	10	21M	44	10
SPCM-1064-32	500	500	10	21M	44	10

OPTICAL COUPLING ACCESSORIES

TO MAKE THE INTEGRATION EASIER

Optical Interface Configurations

Each module comes with the option of a free space window, FC fiber adapter, C-mount or tube cage mount bracket. The fiber connector and mounting brackets are factory installed and cannot be removed.

Part Number Suffix	Description
(empty)	Free space window
-FC	FC/PC fiber connector
-BR1	Bracket with 1" tube mount (1.035" x 40 TPI) and 30 mm cage mount system
-BR2	Bracket with C-mount system (1.0" x 32 TPI) and 30 mm cage mount system

Optical Fibers and Connector Kits

A range of compatible accessories, including optical fibers and connector kits, is available to simplify system integration and optimize optical performance.

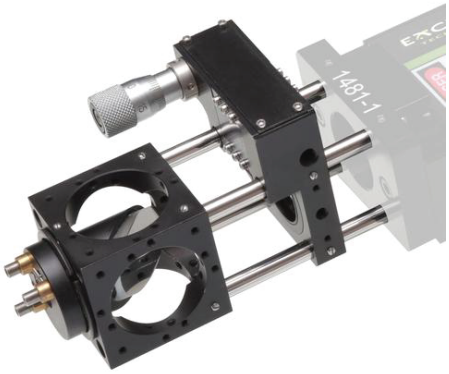
SPCM FIBERS (COMPATIBLE WITH -FC FIBER CONNECTOR ONLY)

Part Number	Fiber Type	Fiber Length	Free end connection	Diameter			Numerical Aperture
				Core	Cladding	Outer	
SPCM-QC4	Multimode	1 m	Bare fiber	62.5 µm	125 µm	2.5 mm	0.27
SPCM-QC6	Multimode	1 m	Bare fiber	100 µm	140 µm	2.5 mm	0.29
SPCM-QC8	Multimode	1 m	SMA 905	100 µm	140 µm	2.5 mm	0.29
SPCM-QC9	Multimode	1 m	FC/PC	100 µm	140 µm	2.5 mm	0.29

SPCM CONNECTOR KITS (COMPATIBLE WITH -BR2 C-MOUNT SYSTEM ONLY)

Part Number	Fiber Type
G060412000	Optical fiber
G060413000	Free-space optics





About Excelitas Technologies

Excelitas is a leading industrial technology company enabling precision instrumentation, sensing and controls, advanced automation and performance materials that deliver current and next-generation innovation that enrich lives. Headquartered in Pittsburgh, PA, Excelitas partners with market-leading OEMs across attractive end markets. The company's mission-critical sensing, detection, imaging, optics, specialty illumination solutions and high-performance materials are engineered into applications where precision, reliability and performance are essential. With a global footprint and a history of deep technical expertise and next-generation innovation, Excelitas is positioned at the intersection of powerful secular demand growth trends, including AI, semiconductor equipment and data center connectivity, industrial automation, minimally invasive & advanced diagnostic healthcare, aerospace, global defense and security systems.

excelitas Enabling the future

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