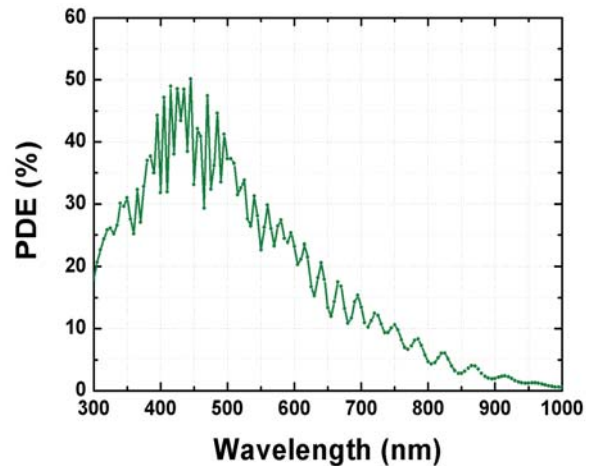




SPC³ Series



SPC³ is based on a 2-D imaging array of 64 x 32 smart pixels, comprising single-photon avalanche diode detector, analogue front-end and digital processing electronics. The **SPC³** provides single-photon sensitivity, high electronic noise immunity, and fast readout speed up to 96'000 frames per second with negligible inter-frame dead time. A common gate input enables counting only during specific time-windows.

Full digital acquisition of light

PDE up to 50% @ 400nm, improved NUV response

Ultra short time gating

< 2ns @ 20ps steps

High frame rate

up to 96 kfps

Low noise

Typical noise of 150cps per pixel, no readout noise.

MODULE FEATURES

- 2048 detectors - full parallel operation
- Three independent counters per pixel, with up-down mode for lock-in acquisition
- USB 3.0 interface with DLLs provided (compatible with C, C++, C#, Matlab etc.)
- Optical port with interchangeable adapter
C-mount adapter available
- Low power consumption
- Robust and compact
- Standard high speed "in-camera" FLIM-mode

BIOMEDICAL APPLICATION

- Confocal Microscopy
- Single Molecule Spectroscopy
- Ultra-Sensitive Fluorescence
- Time-correlated single photon counting
- Single Molecule Detection

INDUSTRIAL APPLICATION

- Particle Sizing
- Optical Testing of integrated circuits
- Metrology by Time of Flight measurements

ASTRONOMY APPLICATION

- Optical Range Finding
- LIDAR & LADAR
- Astronomy Observations & Adaptive Optics

Overview

SPC³ is based on a 2-D imaging array of 64 x 32 (2048) smart pixels. Each pixel comprises a single-photon avalanche diode detector, an analogue front-end and a digital processing electronics. This architecture allows for single-photon sensitivity, high electronic noise immunity, and fast readout speed. The imager can be operated at a maximum frame rate of about 96'000 frames per second with negligible inter-frame dead time. The camera differs from conventional Charge-Coupled Devices or CMOS sensors because it performs a “fully digital” acquisition of the light signal. Each pixel effectively counts the number of photons which are detected by the sensor during the acquisition time.

At the maximum frame-rate photon-counting dynamics is 8-bit, but camera processing electronics allows noiseless frame-binning, thus providing higher dynamics at lower frame-rates. It features also high photon-detection efficiency in the visible and NUV spectral region, very low dark-counting rates, even at room temperature and very low detector dead-time.

Each pixel includes three independent gatable counters, two of them with up-down capability for lock-in acquisition. Such gating capability enables the counting during specific time-windows only, which means that the **SPC³** can also be used for Fluorescence Lifetime Imaging (FLIM) or for indirect ranging measurements (iTOF). The high-speed gated-mode **FLIM acquisition** is fully automated by the camera and can be enabled and configured by user via a simple interface. Application Notes on how to use the camera for ranging measurements will be available on request.

The **SPC³** is easily integrated into common optical setups thanks to the C-mount optical port and a high-speed USB 3.0 computer interface. Cross-platform DLLs/shared libraries for easy integration in most application (C, C++, C#, Objective-C, Matlab, Labview, etc.) are provided.

Hardware connections

- **USB High-speed USB 3.0 connector:** for data download and camera configuration.
- **Multi-coax connector (adapter to SMAs provided)**
 - **SYNC OUT:** Electric 3.3V CMOS (LVCMOS) pulses are generated at this output to synchronize the camera with any external device. Drives 50Ω terminated transmission lines.
 - **TRIG IN:** Requires > 40ns pulse to start the camera acquisition using an external device, e.g. shutter, photo detector. The first frame starts between 20ns and 40 ns after the TRIG IN pulse. 50Ω DC input impedance.
 - **3 GATE IN:** Active-low inputs with 50Ω DC impedance. When GATE IN inputs are OFF, the incoming photons are not counted. The minimum pulse duration is below 5 ns. All the three GATE IN inputs are totally independent. 3.3 V CMOS inputs but 5V tolerant.
 - **DIRECTION:** Input to control direction of up-down counters. 50Ω DC input impedance. Accepts 3.3V CMOS logic levels (5V tolerant)
- **+12Vdc:** Jack for connecting the provided +12V power supply.

System requirements

- High-speed USB 3.0 interface (USB 2.0 is supported, but will reduce performance).
- Host computer (minimum requirements)
 - 2 GHz processor and 2 GB of RAM
 - SSD recommended for full speed continuous acquisition
- Supported operating systems
 - VisualSPC3
 - Microsoft Windows 7, 8, 10, 32 or 64 bit versions
 - SDK and ImageJ Plugin
 - Microsoft Windows 7, 8, 10, 32 or 64 bit versions
 - Linux Ubuntu 12.04 LTS, CentOS 6.5, 6.6, 6.7 or compatible distributions, 32 or 64 bit versions. Different distributions should work, but were not tested.
 - Mac OS X 10.8 and above

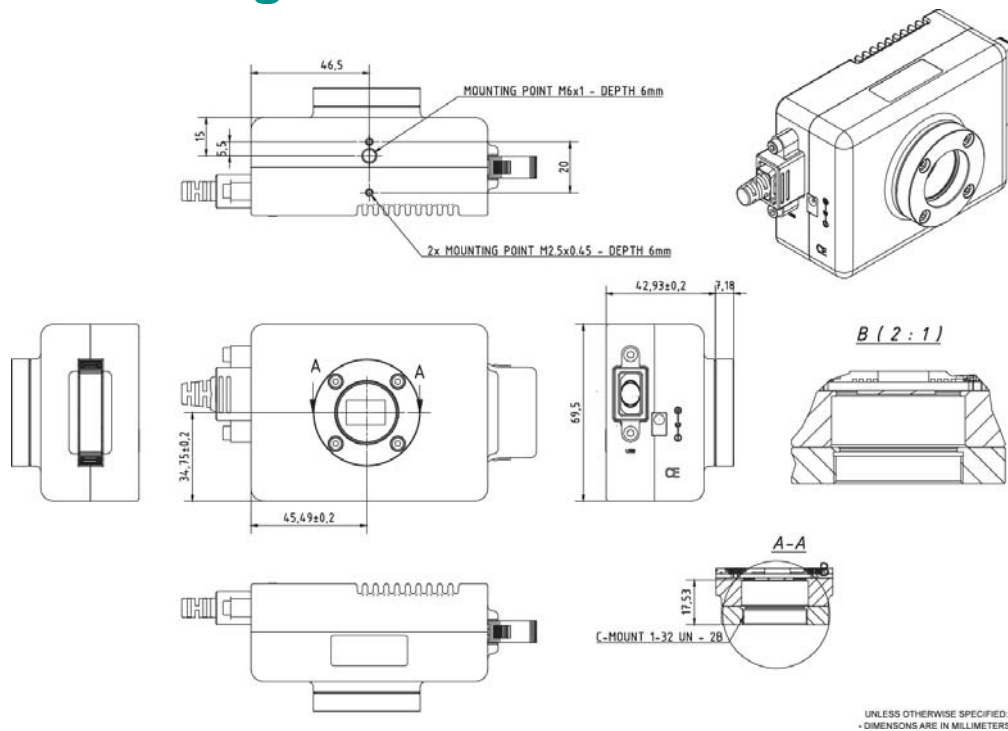
Specifications

Specifications @ 25°C and 5V overvoltage

	Min	Typ	Max	Units
Photon Detection Efficiency (PDE) Average on entire array @ 320 nm @ 400 nm @ 650 nm @ 800 nm		25 50 14 4		%
Dark-counting rate (DCR) 50 th percentile ¹ of entire array 95 th percentile ² of entire array		150 300		cps
Optical crosstalk			0.01	%
Afterpulsing probability (at 50ns SPAD dead-time)		1		%
SPAD dead-time (user adjustable) ³	50		125	ns
Active area diameter of each SPAD		30		µm
SPAD pitch		150		µm
Defective pixels per array (i.e. with DCR>100kps)		2	5	
Frame-rate			96	kframe/s
Interframe dead-time			10	ns
Time-Gated FLIM mode ⁴ Gate Width Gate Steps Step Size Measurement Time range Laser Sync Out	1.5	800 20 16 50	20	ns ps ns MHz
Photon Counting Dynamics @ 96 kframe/s @ 6 kframe/s @ 375 frame/s Higher frame-rates are possible by reducing the number of acquired pixels.			8 12 16	bit
Supply Voltage	+12Vdc			
USB connector All coaxial Inputs SYNC OUT output	USB 3.0 compliant 3.3V CMOS ; 5V-tolerant 3.3V CMOS			
Objective mounting	Flange for interchangeable adapter (Standard C-mount adapter available)			
Dimensions	40 mm (H) x 70 mm (W) x 93 mm (L) M6 threading for fixing			
Weight	360g (camera only) + 140g (USB and Coax)			

1. 50th percentile means 50% of devices satisfying the specified value
2. 95th percentile means 95% of devices satisfying the specified value
3. actual maximum dead-time is calibrated for each camera and may differ from the written value
4. see user manual

Mechanical drawing



Ordering Information

Products can be ordered directly from Micro Photon Devices or its representatives. For a complete list of representatives, visit our website at www.micro-photon-devices.com. Custom designed products are available upon request.

Warranty

A standard legal warranty according to local legislation applies following shipment. Any warranty is null and void if the module case has been opened or if the absolute maximum ratings are exceeded. Specifications are subject to change without any notice. Document version 1.0.3 – March 2016

Contacts

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Packing list

Accessories included in the box with the purchased camera.

<i>Power Supply with socket adaptors</i>	<i>Custom USB 3.0 cable</i>	<i>I/O Multicoax connector and camera thread adapter</i>
		