

## SY-SNSPD-001 Superconducting Nanowire Single Photon Detector System





### www.ali-us.com



SY-SNSPD-001 Superconducting Nanowire Single Photon Detector System V1.00

#### Overview

Advanced Lab Instruments' SY-SNSPD-001 single-photon detectors system is integrated one or more units Advanced Lab Instruments superconducting nanowires single photon detector (SNSPDs) into a 2.2 K low temperature cooling system to approach a real single photon detector system.

The system can be used in Quantum Communication, Optical Quantum Computation, Laser Communication, Laser Radar, Quantum Light Source Characterization, Biological Fluorescence Detection Non-Destructive Chip Testing.



The Basic Operation Principle



# The basic operation principle of the superconducting nanowire single-photon detector (SNSPD)

(a) A schematic illustrating the detection cycle.

(i) The superconducting nanowire maintained well below the critical temperature is direct current (DC) biased just below the critical current.

(ii) When a photon is absorbed by the nanowire creating a small resistive hotspot. (iii) The supercurrent is forced to flow along the periphery of the hotspot. Since the superconducting nanowires are narrow, the local current density around the hotspot increases, exceeding the superconducting critical current density.

(iv) This in turn leads to the formation of a resistive barrier across the width of the nanowire .

(v) Joule heating (via the DC bias) aids the growth of resistive region along the axis of the nanowire until the current flow is blocked and the bias current is shunted by the external circuit.

(vi) This allows the resistive region to subside and the wire becomes fully superconducting again. The bias current through the nanowire returns to the original value.

(b) A simple electrical equivalent circuit of a SNSPD.

Lk is the kinetic inductance of the superconducting nanowire and Rn is the hotspot resistance of the SNSPD.

The SNSPD is current biased at Ibias. Opening and closing the switch simulates the absorption of a photon. An output pulse is measured across the load resistor.

(c) A simulation of the output voltage pulse of the SNSPD (approximating the pulse shape typically observed on an oscilloscope after amplification). Values of Lk and Rn have been used for this simulation (for simplicity the Rn is assumed fixed, although a more detailed treatment. The solid blue line is the leading edge of the SNSPD output pulse, whilst the dotted red line is the trailing edge of the output pulse. The time constants relate to the phases of the detection cycle.



SY-SNSPD-001 Superconducting Nanowire Single Photon Detector System V1.00

#### Applications



**Optical Quantum Computation** 



Quantum Light Source Characterization



Quantum Communication



Laser Communication



**Biological Fluorescence Detection** 



Non-Destructive Chip Testing



SY-SNSPD-001 Superconducting Nanowire Single Photon Detector System V1.00

#### Feature:

- ✤ Based on small-cold-capacity air-cooling cryocooler without liquid helium ;
- ✤ Highly integrated using standard chassis ;
- ✤ 7×24 hours nonstop running ability ;
- ✤ Highly reliable, have already been verified in various applications ;
- Professional and efficient technical support ;

#### Specification

Parameters		Typical*	Optimum
	1550 nm	≥70%	≥90%
	1064 nm	≥70%	≥80%
	850 nm	≥70%	≥80%
Detection Efficiency	532 nm	≥70%	≥80%
Dark count rate		≤100 Hz	≤1 Hz
Timing jitter		40-70 ps	≤20 ps
Counting rate		≥20 MHz	≥100 MHz

Channels:	1 - 9 Channel Option		
Optical interface:	SM (9 μm) or MM (50 or 100 μm) fiber		
Input Connector	FC/UPC		
	SMA (pulses with amplitude higher than 150 mV or		
Electronic interface:	TTL signals)		
Working			
environments:	-10°C-30°C; Humidity ≤ 60%		
Dimensions:	600 mm (w) × 800 mm (l)× 1200 mm (h)		
Weight:	~100 kg		
Power supply:	110-240 V (single phase), 50 ~ 60 Hz		
Power consumption:	≤ 2 kW		



SY-SNSPD-001 Superconducting Nanowire Single Photon Detector System V1.00

#### SDE and DCR Curve



#### **Outline Drawing**





SY-SNSPD-001 Superconducting Nanowire Single Photon Detector System V1.00

#### **Liability Note:**

This document is sole property of Advanced Lab Instruments Corp. No part of this document may be copied without written acceptance of Advanced Lab Instruments Corp. All statements related to the products herein are believed to be reliable and accurate. However, the accuracy is not guaranteed and no responsibility is assumed for any inaccuracies or omissions. Advanced Lab Instruments Corp. reserves the right to make changes in the specifications at any time without prior notice.