



QD800c-fQ

► Single Photon Detection Module

Description

QD800c-fQ series of Single Photon Counting Modules offers a unique combination of low dark count rates, very low jitter and a fast quenching circuit in a miniature package. The special mechanical design allows a flexible combination with existing systems in the laboratory. Incoming photons generate corresponding electrical pulses which may be conveniently read out at the digital output.

Features

- Low dark rates
- Very low jitter
- Fast quenching circuit
- High detection efficiency (400 nm to 1000 nm)
- Digital output pulse (2 V) at SMA connector
- Single 5 V DC supply operation
- Compatible with third party adapters

Applications

- Quantum optics, quantum cryptography
- Fiber optics characterization
- Time Correlated Single Photon Counting (TCSPC)
- Fluorescence, fluorescence life time spectroscopy, Raman spectroscopy
- Single photon source characterization
- Eye-safe laser ranging (lidar)
- Time-of-flight measurements (ranging)
- Time-resolved fluorescence spectroscopy
- Fluorescence Lifetime Imaging (FLIM)
- Fluorescence Correlation Spectroscopy (FCS)
- Fluorescence Lifetime Correlation Spectroscopy (FLCS)
- Single molecule spectroscopy
- Optical Time Domain Reflectometry (OTDR)
- Optical tomography





Maximum Ratings

Parameter	Symbol	Values		Unit
		Min.	Max.	
Supply voltage	V_S	4.5	5.2	V
Operating temperature	T_{OPR}	0	+ 40	°C
Storage temperature	T_{STG}	- 20	+ 70	°C
Count rate			10	MCOUNTS/s

Electro-Optical Characteristics

Parameter	Symbol	Values			Unit
		min.	Typ.	Max.	
Active diameter	d		500		µm
Quantum efficiency at 830 nm	η_λ		60		%
Dark count rate @ -20°C for double stage cooling (DSC)* ¹	D500			500	Counts/s
	D50			50	Counts/s
	D20			20	Counts/s
Dark count rate @ -40°C for triple stage cooling (TSC)* ¹	T50			50	Counts/s
	T10			10	Counts/s
	T5			5	Counts/s
Timing resolution	t_S		300		ps
Dead time	t_D		300		ns
Output pulse amplitude (into 50 Ohm)			2.0		V
Digital out – T-OK * ²		0		3.3	V
Analog out – Tmp * ³		0		1.5	V
Supply voltage	V_S	4.8	5.0	5.2	V
Supply current * ⁴	I_S		230		mA

*¹ Dark count rate at 5% photon detection probability (830 nm, ambient temperature of 22°C).

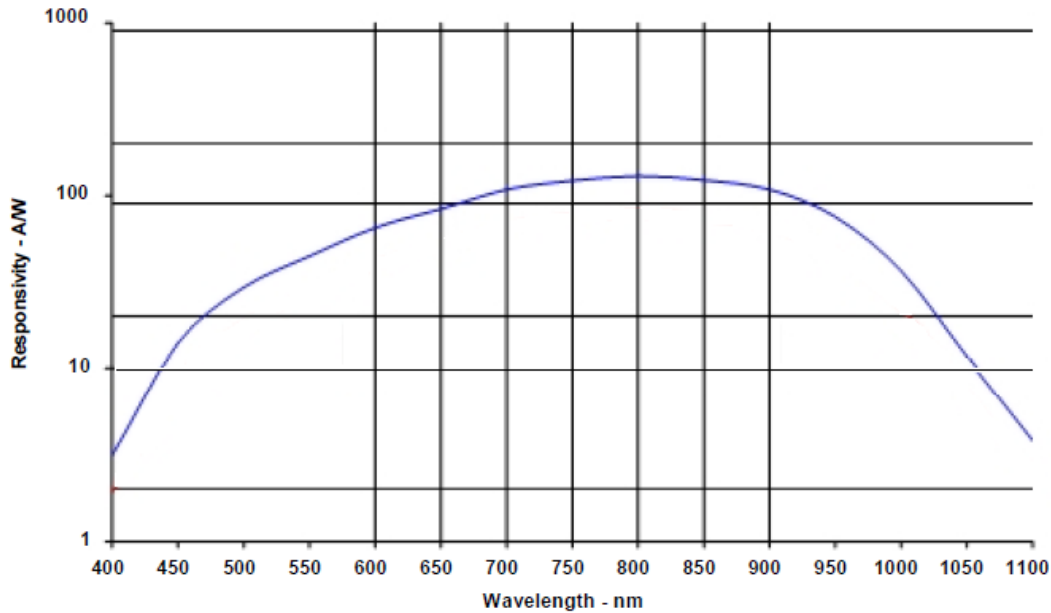
*² If the temperature is sufficiently low (Tmp = set point), T-OK goes high

*³ The voltage of the analog out Tmp represents the temperature of the SPAD. See diagram below.

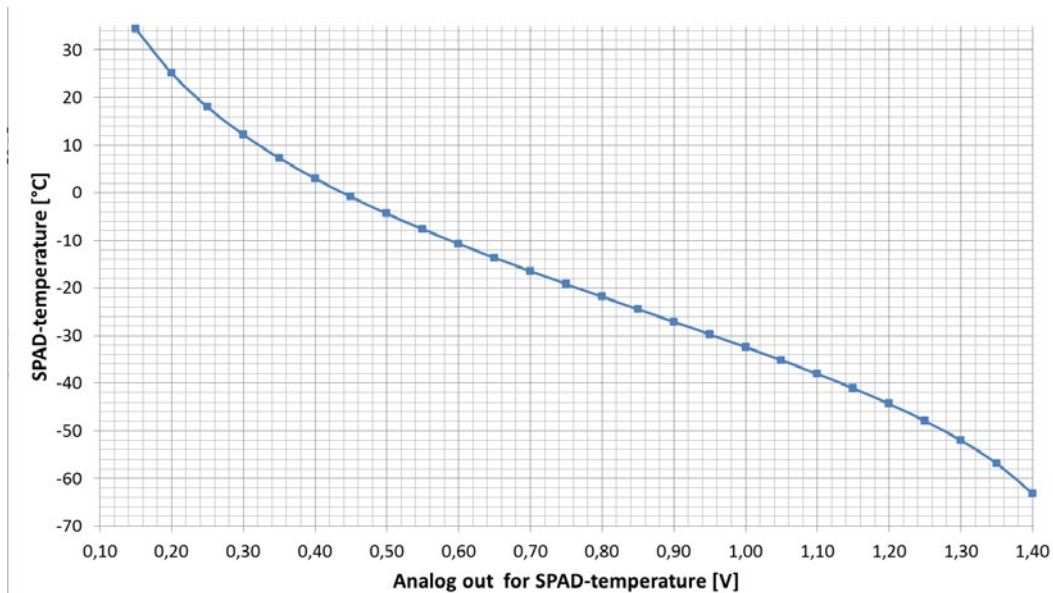
*⁴ 600mA for triple stage cooling;

Performance Characteristics

Typical Spectral responsivity



Temperature diagram

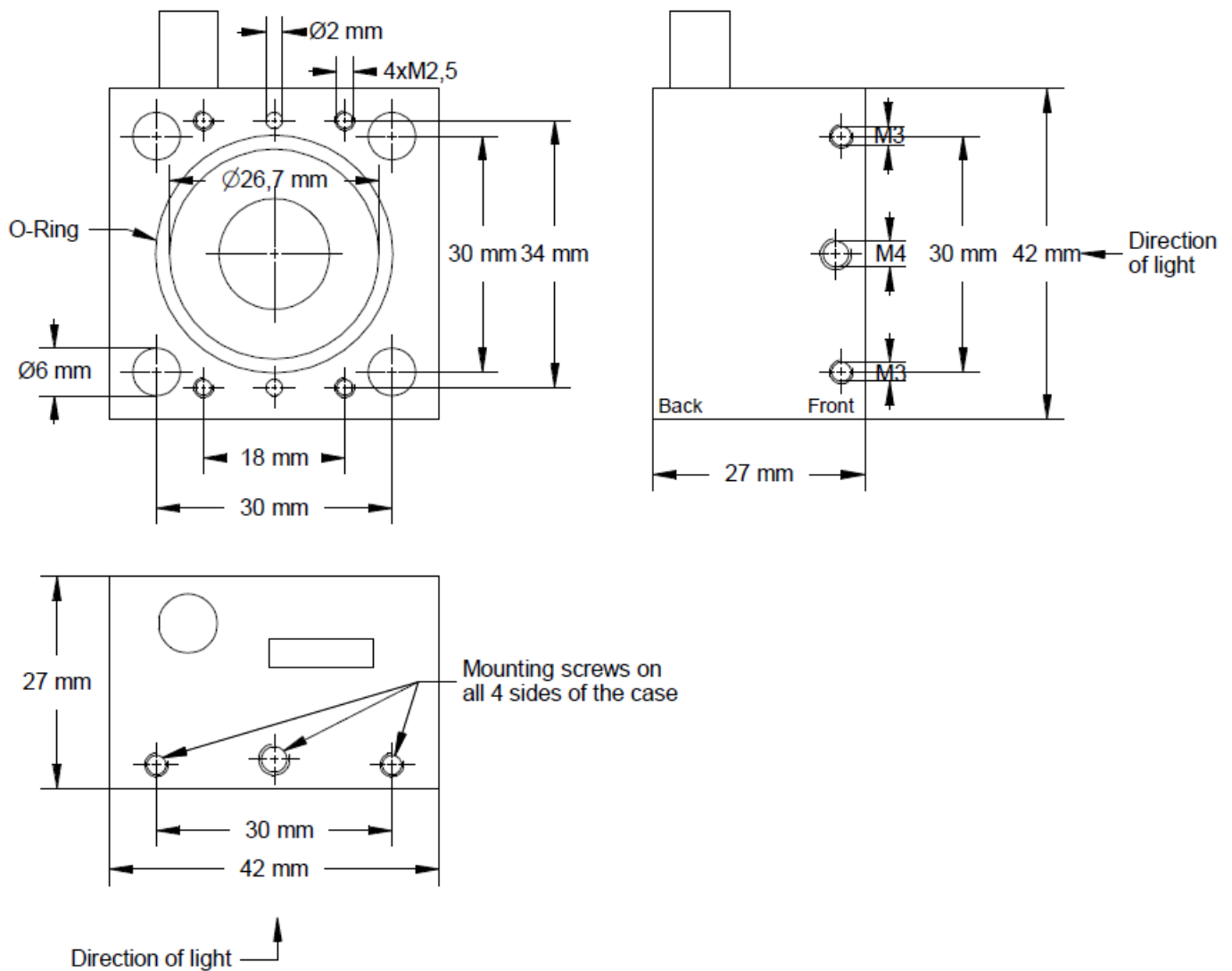


See also formula on page 5



Outline Dimensions

QD800c-fQ



all dimensions in mm



Connector Description

SMA connector:

Output Pulse: 2V on 50 Ohm (positive edge)

5-pole board connector:



... Power in (+5V DC, 500mA)
... Power Ground



... Analog Output (T_{mp}) 0-1,5V (represents the temperature of the SPAD. See formula below)
... Analog Ground
... Digital Input (+5V disables the SPAD bias voltage)
... Digital Output (T-OK): Output is high if the temperature is sufficient low (T_{mp} = set point)

(Connector plug: 2pol. Molex 51021-0200, 4pol. Molex 51021-0400)

Temperature formula:

$$T[^\circ\text{C}] = 3200 / \ln(U[\text{V}] * 296594 / (1,5 - U[\text{V}])) - 273,15$$

Adjustments procedure:

The SPAD temperature (T_{mp}) and the quantum efficiency (QE) can be adjusted with two potentiometers.

Step 1: adjust Temp anti clockwise (decrease temperature) until the desired temperature is achieved.

Step 2: adjust QE clockwise (increasing QE) until the desired dark count rate or detection efficiency is achieved

Factory settings:

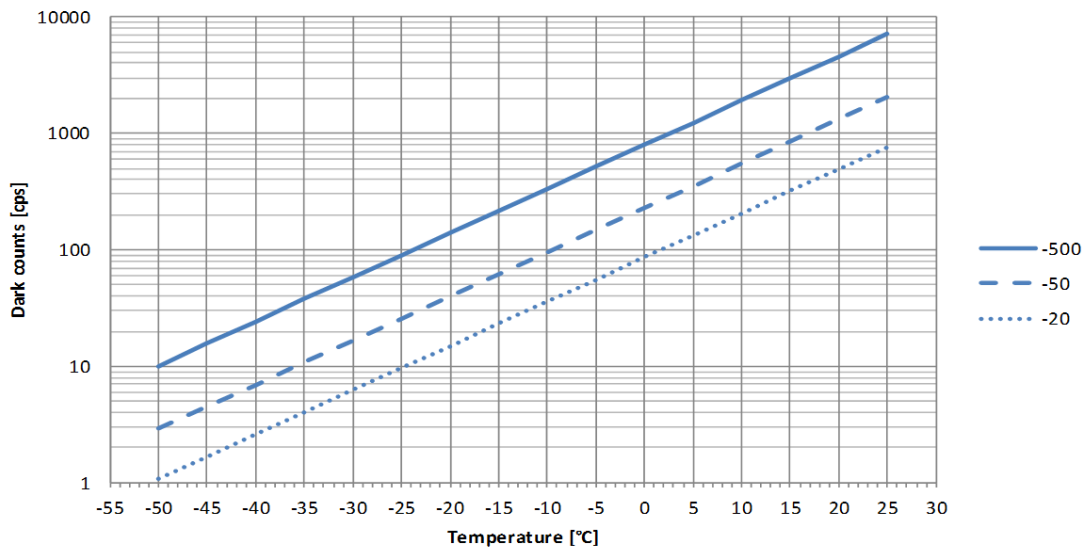
T_{mp} ... -25°C (Temp Analog Output = 0,86)

QE ... ~50%



Cooling, heat sink

Typical Dark Count vs. Temperature at 5% Photon Detection Efficiency (830nm)



Heat sink performance ($T_{amb}=25^{\circ}\text{C}$)

Heat sink configuration	Reachable Temperature	
	DSC*	TSC*
Mounted on optic breadboard	-35 °C	-50 °C
Holder on Mounting Base, no heat sink	-31 °C	-35 °C
Holder on Mounting Base, heat sink HS12, natural convection	-32 °C	-40 °C
Holder on Mounting Base, heat sink HS12, forced convection 100 LFM	-35 °C	-50 °C
Holder on Mounting Base, heat sink HS25, natural convection	-33 °C	-41 °C
Holder on Mounting Base, heat sink HS25, forced convection 100 LFM	-35 °C	-50 °C
Holder on Mounting Base, heat sink HS25-VAN	-35 °C	-50 °C

*(DSC = double stage cooling, TSC = triple stage cooling)

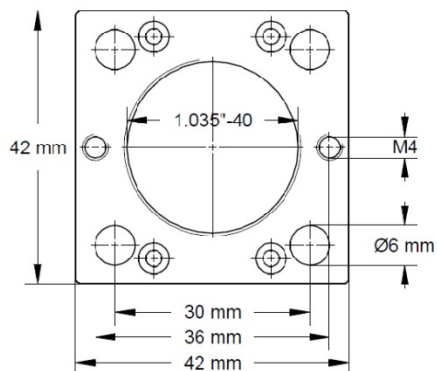


Accessories

Lens holder adapter

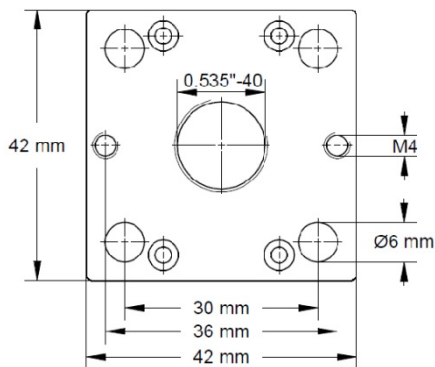
ADAPT-C-SM1

Roithner LaserTechnik GmbH



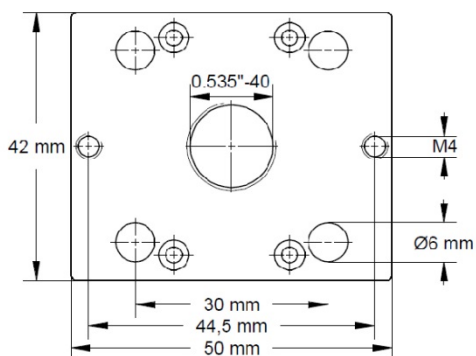
ADAPT-C-SM05

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ADAPT-C-SM05-P

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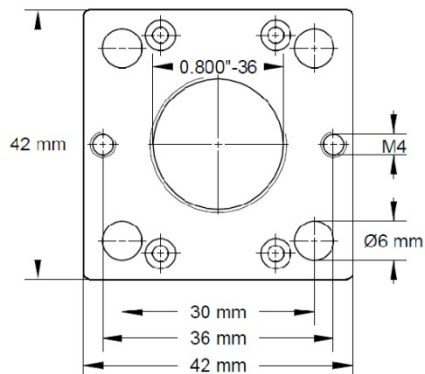




Accessories

ADAPT-C-RMS

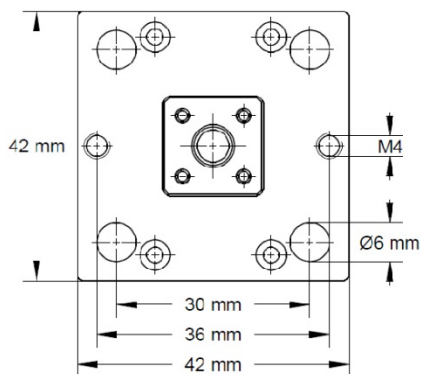
Roithner LaserTechnik GmbH



FC/PC fiber adapter

ADAPT-C-FC

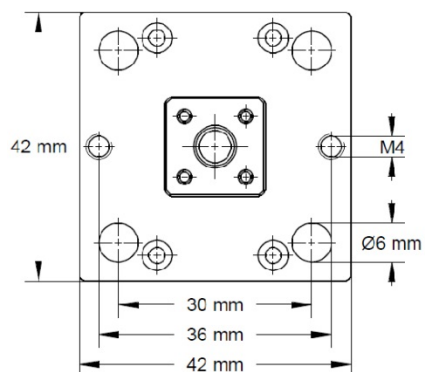
Roithner LaserTechnik GmbH



FC/PC fiber adapter with Filter holder

ADAPT-C-FC-FLT

Roithner LaserTechnik GmbH

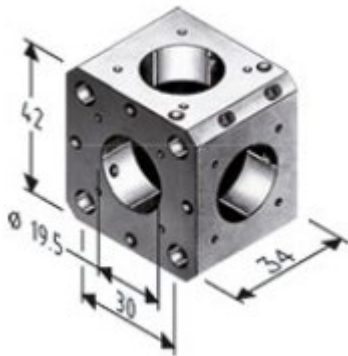




Accessories

Multicube® System

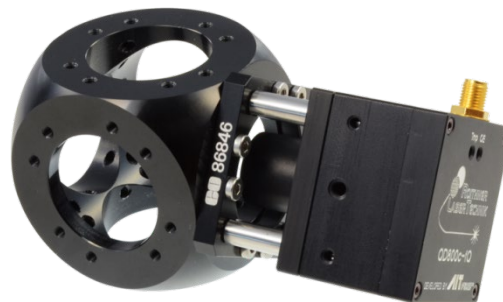
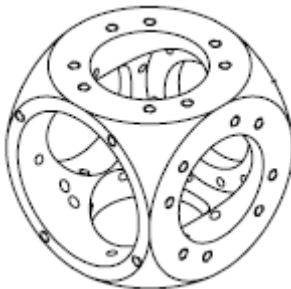
48MC-SM-19.5 Schäfter+Kirchhoff GmbH



Cage System Spheres

#85-624 Cage Sphere with (5) 30mm Ports and (1) 43mm Port Edmund Optics Inc.

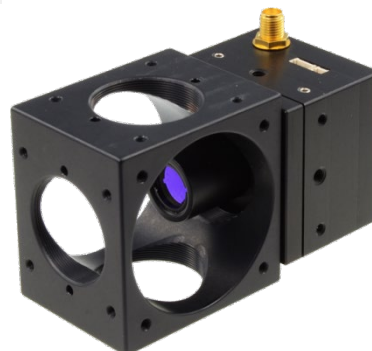
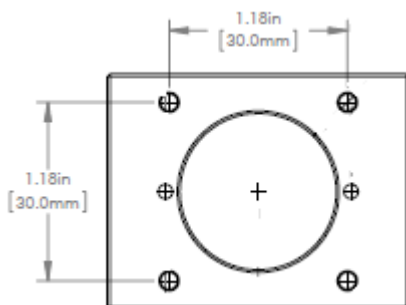
#85-846 Cage System Adapter Plate Edmund Optics Inc.



30 mm Cage Cube

C4W 4-Way Mounting Cage Cube Thorlabs Inc.

C6W 30 mm Cage Cube: 6 mm Through Holes Thorlabs Inc.

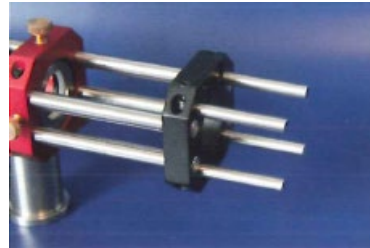




Adapter Radiant Dyes

RD-BGS-AP Adapter plates for 6mm rods

Radiant Dyes Laser ACC. GmbH



Holder on Mounting Base

BA3/M Mounting Base, 50 mm x 75 mm x 10 mm

Thorlabs Inc.

PH2 Post Holder, Spring-Loaded Thumbscrew

Thorlabs Inc.

TR30/M Optical Post, SS, M4 Setscrew, M6 Tap

Thorlabs Inc.



Accessories

Heat Sink

HS12 Heat Sink 12 mm

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HS25 Heat Sink 25 mm

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HS25-FAN Heat Sink 25 mm with fan

Roithner LaserTechnik GmbH





Order Information

Part No.	Cooling	Dead Time	Dark Count Rate	Timing Resolution	Availability
QD800c-fQ-300D500	DSC	300 ns	<500 counts/s	300 ps	available
QD800c-fQ-300D50	DSC	300 ns	<50 counts/s	300 ps	available
QD800c-fQ-300D20	DSC	300 ns	<20 counts/s	300 ps	available
QD800c-fQ-300T50	TSC	300 ns	<50 counts/s	300 ps	Q1/2016
QD800c-fQ-300T10	TSC	300 ns	<10 counts/s	300 ps	Q1/2016
QD800c-fQ-300T5	TSC	300 ns	<5 counts/s	300 ps	Q1/2016
QD800c-fQ-25D500	DSC	25 ns	<500 counts/s	300 ps	Q3/2016
QD800c-fQ-25D50	DSC	25 ns	<50 counts/s	300 ps	Q3/2016
QD800c-fQ-25D20	DSC	25 ns	<20 counts/s	300 ps	Q3/2016
QD800c-fQ-300D500-100	DSC	300 ns	<500 counts/s	100 ps	Q2/2016
QD800c-fQ-300D50-100	DSC	300 ns	<50 counts/s	100 ps	Q2/2016
QD800c-fQ-300D20-100	DSC	300 ns	<20 counts/s	100 ps	Q2/2016

(DSC = double stage cooling, TSC = triple stage cooling)

→ Do not hesitate to ask for special features: office@roithner-laser.com

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