



Operating manual
Single photon detector
AD200

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Introduction

Redwave Labs' AD200 is a compact and affordable single-photon detector module with a built-in counter. The AD200 is based on a reliable silicon avalanche photodiode sensitive in the visible spectral range. The detector of the AD200 has high efficiency values in the near visible region (around 650 nm). The AD200 features active quenching and full digital temperature control. A separate power supply is provided as standard.



Key Features	70% quantum efficiency at 650 nm 55% quantum efficiency at 800 nm Tunable temperature of the diode Low dark and after pulsing rates Software included	
Applications	Time correlated single photon counting Single molecule detection Laser scanning microscopy Particle physics Spectrophotometry	
Specifications	Parameter	Value
Power	Single	+12 V
Photodiode	Wavelength	400 – 1100 nm
	Breakdown Voltage	125V@ 25C (test result sheet supplied with unit will include more detail)
	Active Area	500 μm
Single-Photon Detection Probability	At 650nm	70%
	At 800nm	55%
Dark Count Rate		25 @ -20C, typical
Deadtime		65 ns
Output pulse		20 ns
Connectors	Power	Molex 2 PIN
	Output	SMB
	USB	USB TYPEB
	Timing Gate	SMB
Dimensions (WxHxD)		120 x 92 x 30 mm
Weight		350 g
Storage Temp		-20 to 85 C
Operating Temp		-20 to 60 C

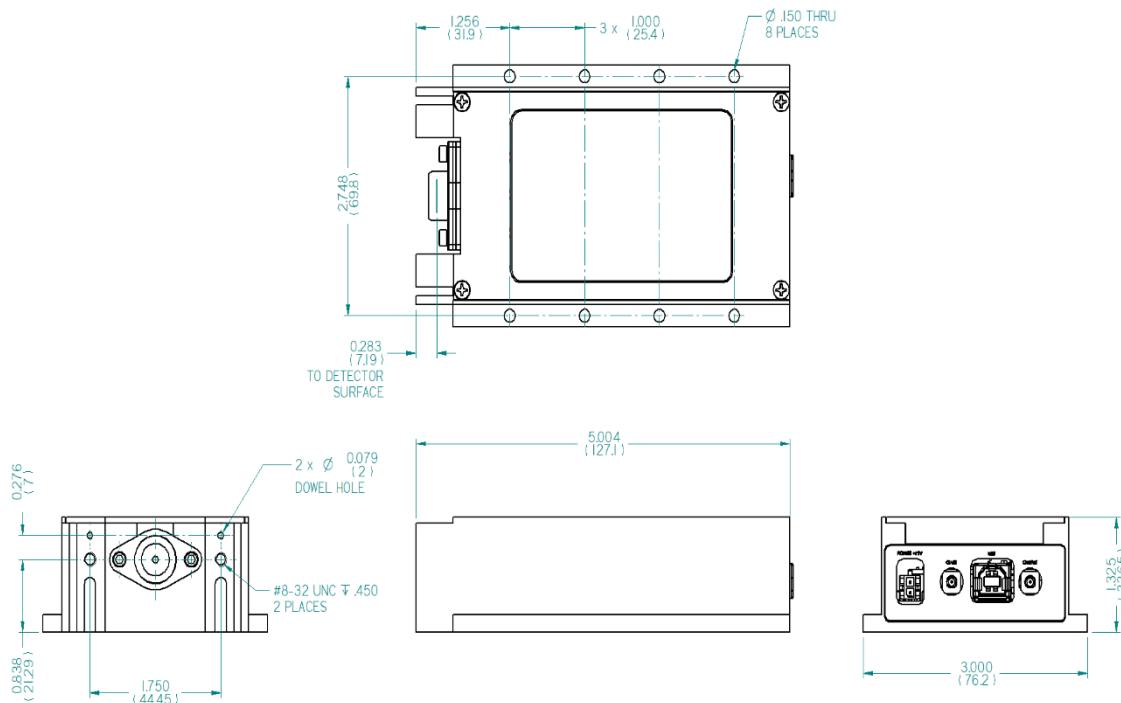
RedWave Labs Ltd continually improves products and therefore some specifications can vary.

Absolute Maximum Ratings

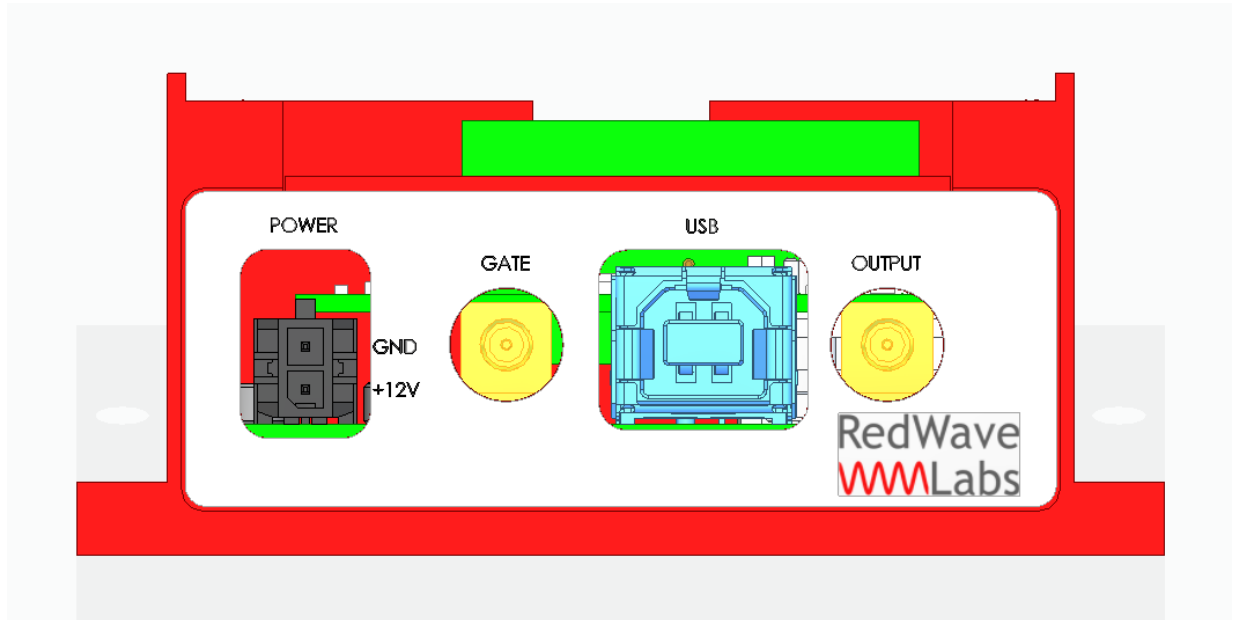
Symbol	Parameter	Ratings	Unit
V_{dd}	Supply Voltage	+12	Volt
T_{op}	Operational Temperature	-40 to 85	Deg C
T_{st}	Storage Temperature	-55 to 100	Deg C

Mechanical Information

Parameter	Value	Unit
Length	5.004 (127.1)	Inch (mm)
Width	3.000 (76.2)	Inch (mm)
Height	1.325 (33.65)	Inch (mm)
Weight	350	gram



Connectors



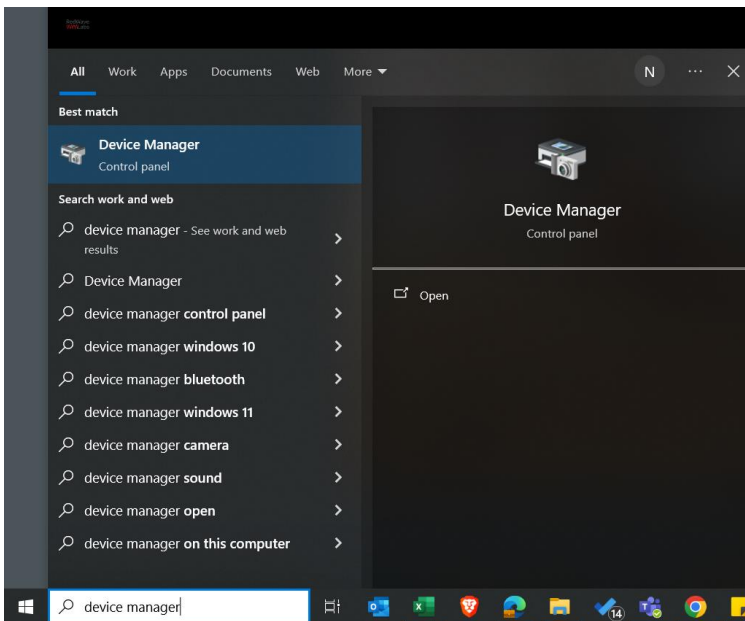
Connection	Name	Description
Power	Power	12V 5A
SMB	Gate	Gate Function
USB -B	USB	USB TYPE B; Digital Interference
SMB	Output	Photon Count Output

Setting Up

The following instructions will guide you through set up for a first measurement. More detailed instructions for the term tool are given in the term tool manual.

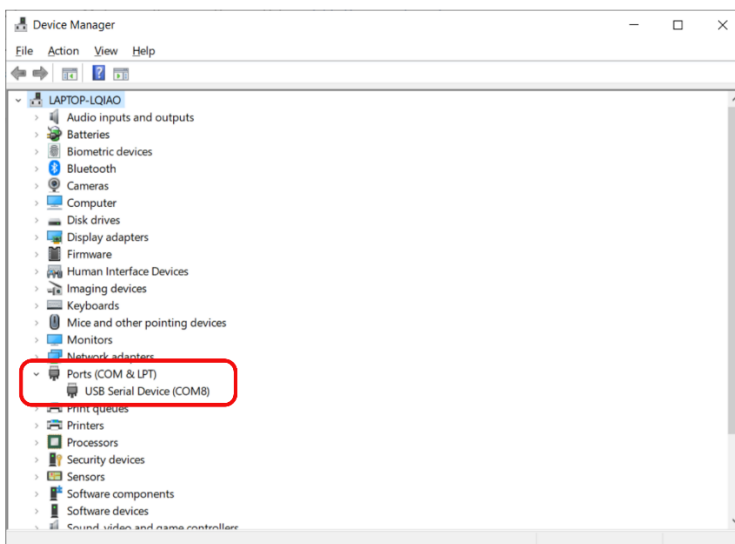
Step A: Connect the AD200 to the power supply. Then connect to a computer via USB-B

Step B: Launch the device manager on the computer



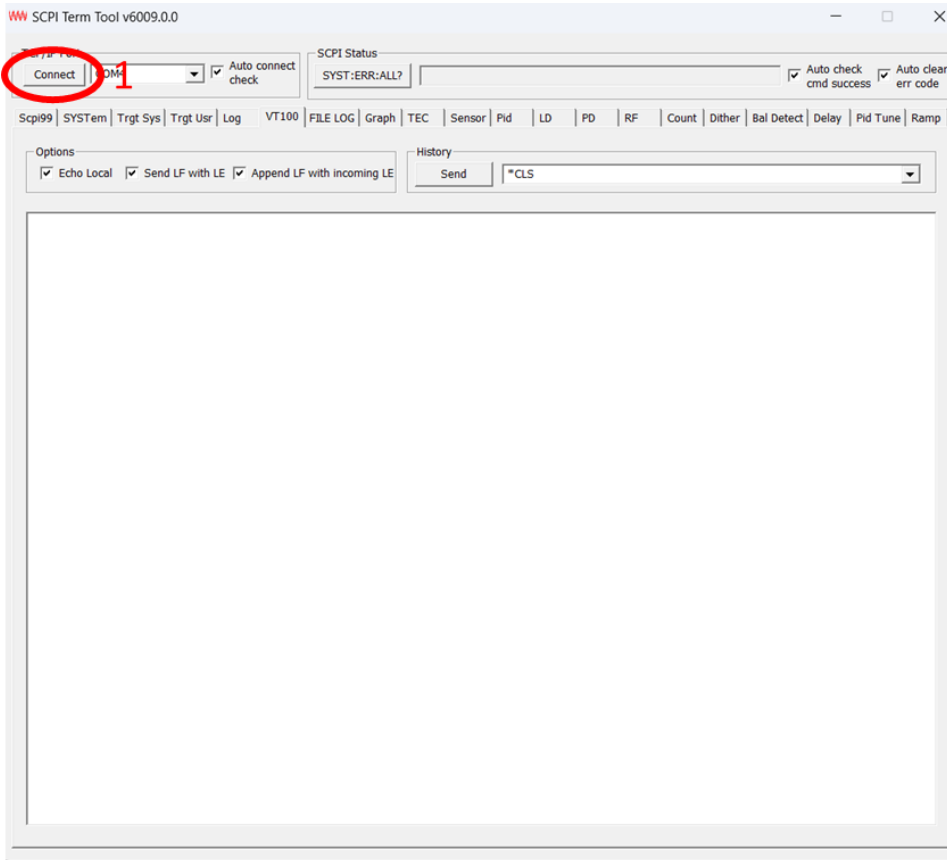
Step C: Find the USB Serial Device (COM)

USB Serial Device (COM?) can be found in the Device Manager (COM8 in the example shown). Double-click this to open the Term tool.



Step D: Connect to the AD200

Click "Connect" Button. Some information about the AD200 should then appear in the text box below.



Step E: Set Temperature of the APD.

To set the temperature of the APD, select the TEC tab.

- 1) Enter the temperature (-20 °C recommended)
- 2) Press TEC:T[SET?] to set this temperature
- 3) Change the output to MOD_ON
- 4) Press TEC:OUTPUT to turn the TEC on
- 5) Press TEC:T? To monitor the TEC temperature. It will take about a minute to decrease to -20 °C from room temperature.

The screenshot shows the SCPI Term Tool v6009.0.0 interface with the TEC tab selected. The interface is divided into several sections:

- Current:** Contains fields for TEC:I:MAX, TEC:I:LIMIT, and TEC:I[:SET?].
- Current Slope:** Contains fields for TEC:I:SLOPE:MAX, TEC:I:SLOPE[:SET?], and TEC:I:SLOPE?.
- Voltage:** Contains fields for TEC:V:MAX, TEC:V:LIMIT, and TEC:V[:SET?].
- TEC:** Contains fields for TEC:MODE, TEC:OUTPUT (circled 4), TEC:PID, TEC:PID:RATE, and TEC:FAULT?. The Mode dropdown is set to TEC_MODE_INT_TEMP, and the Output dropdown is set to MOD_ON (circled 3).
- Temperature:** Contains fields for TEC:T:MAX, TEC:T[:SET?] (circled 2), TEC:T? (circled 5), and TEC:T?. The TEC:T[:SET?] field is set to -20.0 (circled 1).

Step F: Set the Bias Voltage of the APD.

- 1) Set the bias voltage of the APD using the box below. A good initial value is 5V higher than the breakdown voltage specified in the test report.
- 2) Press LD:V[SET?] to set the bias voltage
- 3) Use the drop down menu to select MOD_ON
- 4) Press LD:OUTPUT to apply a bias voltage to the APD

The screenshot shows the SCPI Term Tool v6009.0.0 interface. The 'LD' section is expanded, showing various control parameters. The following table summarizes the visible controls and their values:

Section	Control	Value / Selection
Current	LD:I:MAX	(max A) 0.0
	LD:I:LIMIT	(max A) 0.0
	LD:I[:SET?]	(A) 0.0
Current Slope	LD:I:SLOPE:MAX	(min A/s) 0.0
	LD:I:SLOPE[:SET?]	(A/s) 0.0
	LD:I:SLOPE?	(A/s) 0.0
Voltage	LD:V:MAX	(max V) 130.0
	LD:V:LIMIT	(max V) 130.0
	LD:V[:SET?]	(V) 95.0
Voltage Slope	LD:V:SLOPE:MAX	(min V/s) 10.0
	LD:V:SLOPE[:SET?]	(V/s) 100.0
	LD:V:SLOPE?	(V/s) 100.0
LD Mode	LD:MODE	LD_MODE_VOLTAGE
	LD:CONTROL	BIPOLAR
	LD:OUTPUT	MOD_ON
	LD:FAULT?	Mask 0, MASK_NONE
Pulse	LD:PULSE:TRIG	active MOD_OFF
	LD:PULSE:TRIG:SEL	sel LD_TRIG_SEL_INTERNAL
	LD:PULSE:MAX	(min Hz) 0.0
		(max Hz) 0.0
		(min Duty%) 0.0
		(max Duty%) 0.0

Step G: Count photons.

To start counting photons, select the Count tab. Then click “Count:MEASure:START” button followed by the “Start Polling” button.

The screenshot shows the SCPI Term Tool v6009.0.0 interface. The 'Count' tab is selected. The 'Photon Counter' is set to 'CNT_1'. The 'Control' section has 'COUNT:MEASure:START' highlighted. The 'Setup' section shows 'COUNT:GATE:MODE' set to 'CNT_GATE_MODE_MANUAL', 'COUNT:GATE:APERTure' at 0 us, 'COUNT:GATE:DELay' at 0 us, 'COUNT:ARRay:NPOInts' at 0, and 'COUNT:ARRay:STATE' set to 'CNT_ARRAY_STATE_CONTINUOUS'. The 'Results' section shows 'COUNT:DATA?' with Counter 8, Status 1, and Index 10. The 'COUNT:MEASurement?' section shows Status 0. The 'COUNT:SATuration:VOLTagE' section shows three voltage inputs at 0.0. The terminal window at the bottom displays the following data:

```
bin=0003 count=5
bin=0004 count=4
bin=0005 count=3
bin=0006 count=5
bin=0007 count=9
bin=0008 count=2
bin=0009 count=5
bin=0010 count=8
```

Certification

RedWave Labs Ltd certifies that: i) the parts and/or materials were produced in conformance with all contractually applicable Government and/or Buyer's specification as referenced in, or furnished with, the above purchase order and ii) all processes required in the production of these parts and/or materials are listed and were performed by a facility or by personnel specifically approved or certified by the seller's cognizant government quality control agency when such approval or certification is required by an applicable specification. RedWave Labs products are not authorized for use in safety-critical applications (such as life support) where a failure of the product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use of the products.

Warranty and returns

RedWave Labs Ltd products are warranted against defects in materials and workmanship for a period of 180 days from date of shipment. During the warranty period RedWave Labs Ltd will replace or repair products which prove to be defective or damaged. Our warranty shall not apply to defects or damages resulting from: i) misuse of the product or ii) operation beyond specifications detailed in the current manual.

Return procedure

Customer must obtain a valid RMA number by contacting RedWave Labs prior to the return. In all cases the customer is responsible for duty fees incurred on all received shipments and on all international returns for both warranty and non-warranty items; the customer is responsible for any duties, brokers fees or freight charges deemed chargeable to RedWave Labs Ltd.

Revisions

Revision 1.0: First revision

Revision 2.0:

- Improved dark count rate to 25 cps
- Substantial electronics redesign.

Revision 3.0

- Reformatted manual to include screenshots of updated TermTool