OtO Photonics

Red Sparrow Series Product sheet (RS Series)

Description

Red Sparrow Series near infrared spectrometers are constructed using proprietary MEMS freeform grating-collimator technology.

The RS series combines high optical resolution and fast spectral response with compact size and low weight. They are therefore ideal for integration into portable or handheld systems and provide OEM customers with increased product design and integration flexibility.

The RS1680 features a 128-pixel InGaAs linear sensor and the RS1780 is a 256-pixel design.

We provide the related information and the detailed instructions of how to operate with RS Series in this guide.

Red Sparrow Series

RS1680
RS1780

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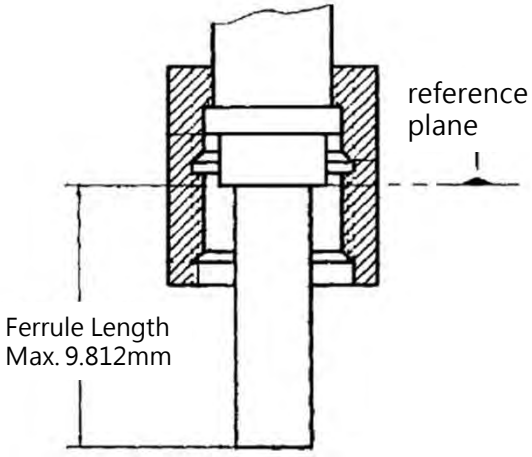
Attention

Picture	Description
	Screw in the fiber optic connector with fingers. Do not use any tool to tighten it. Using tools such as wrenches to tighten the connector may cause the connector to press against and damage the inlet slit of the spectrometer. Such damage is not covered by the warranty. In cases where the connector needs to be firmly in place for long-term use, it is advised to apply a little glue to where the SMA905 connector is connected to the spectrometer.
	The SMA905 connectors on all spectrometers made by OtO Photonics is manufactured in accordance with international standards. Customers should ensure that the ferrule length of the fiber used is not longer than 9.812mm to avoid damaging the slit in the SMA950 connector. Such damage is not covered by the warranty.

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Overview

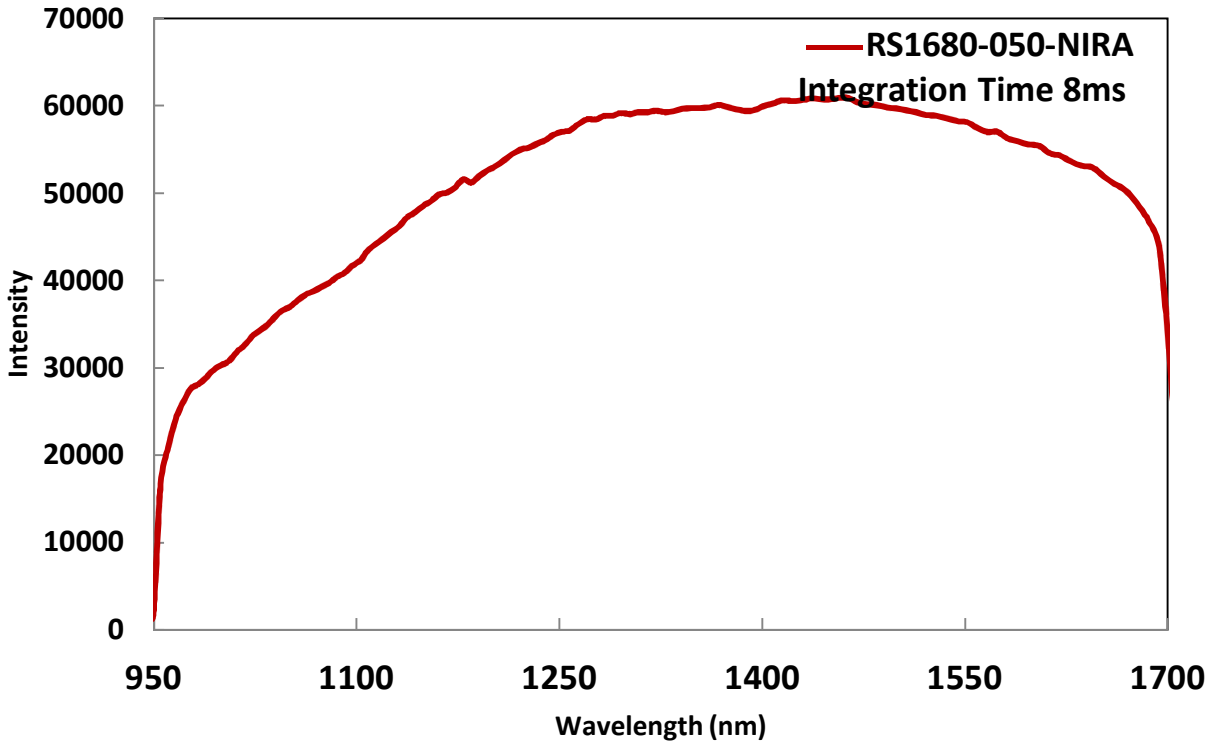
1.1 RS series Specification

Module Name	Spectral Response Range(nm)		Slit (μm)	Resolution*1 (nm)	Gain	Dynamic Range*2	SNR*3	Stray Light*4
	NIRA 950 ~ 1700	NIRC 900 ~ 1700						
RS1680	√	√	50	9~15nm	High	6000	2500	<0.7%
					Low	6500	4000	
RS1780				8~10nm	High	6000	2000	
					Low	6500	4000	

*1 :The resolution of 1083.84nm, 1262.34nm & 1473.28nm with Xenon lamp. *2 : 65535/Dark Noise(average)
*3 : Single acquisition *4 :Stray light <0.7% at 1000nm, detected with FEL1300 longpass filter.
(The transmission of H_2O at 1420nm <0.5% . Reference to air, cuvette size 10*10mm)

Specification		Content	
		RS1680	RS1780
Sensor		NIR InGaAs 128 Pixels Sensor	NIR InGaAs 256 Pixels Sensor
Optical System		MEMS	
Parameters of Optical System		f/# : 3.8, NA :0.1 Focal Length(R1-R2) :130-112	
Dimension		40(L)*40(W)*18(H)mm	
Weight		40g	
Dark Noise (average)	High Gain	11	
	Low Gain	10	
IntegrationTime		10us~24sec (High gain: 0.5sec, Baseline Noise 30000 count)	
Storage Temperature		-20°C to +70°C	
Operation Temperature		0°C to +50°C	
Interfaces		USB 2.0 @ 480 Mbps (High-speed)	
Input Fiber Connector		SMA905: Φ3.20±0.01mm	
Power		Power requirement : USB, 280mA at +5VDC Supply voltage : 4.5-5.5V Power-up time : < 1.5s	

► 1.2 Efficiency



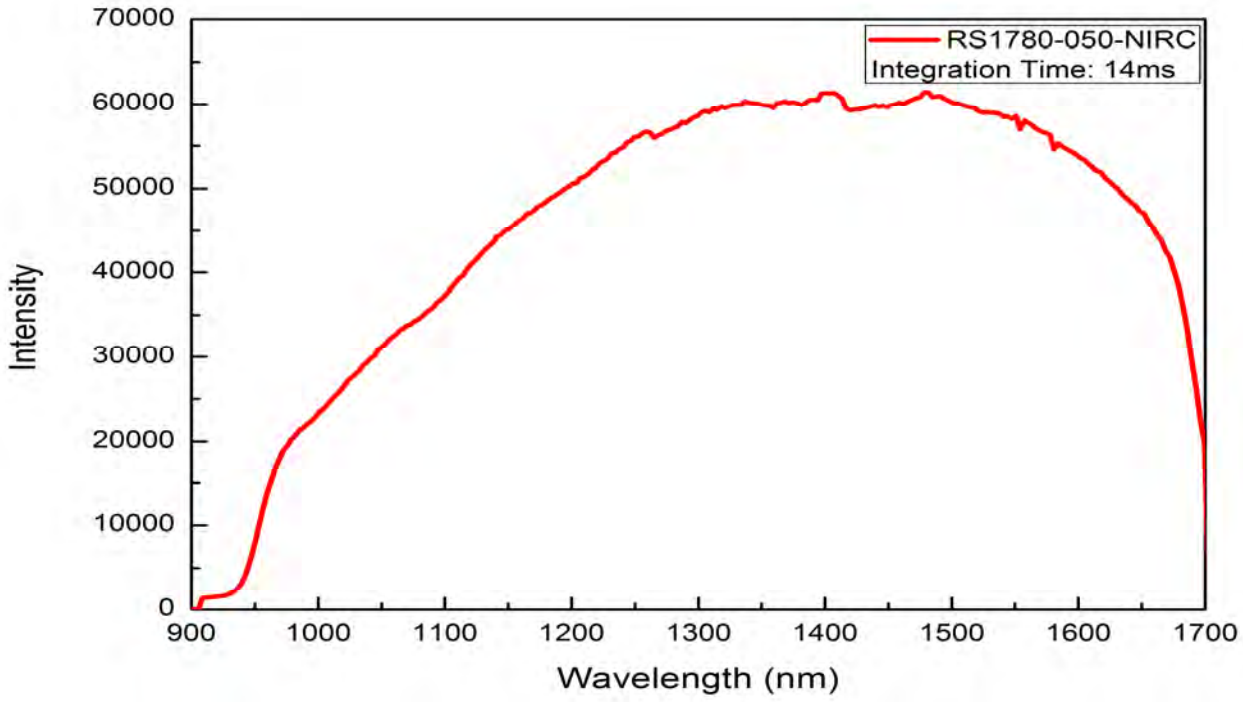


Fig. 1: RS1680 & RS1780 Integration Time 8ms with Halogen lamp

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Structure

2.1 Mechanical Diagram

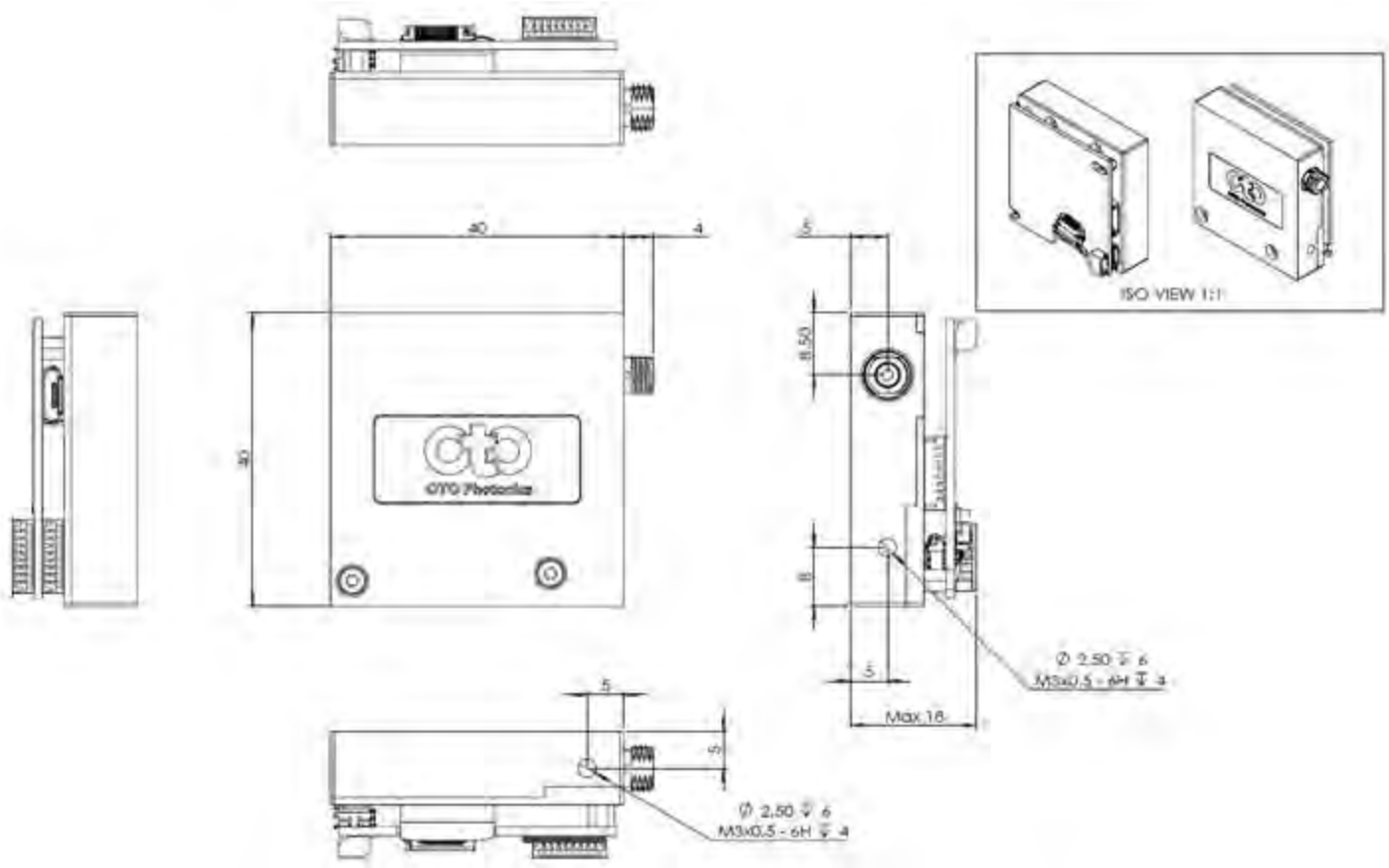


Fig. 2: RS1680/1780 Mechanical Diagram

► 2.2 Electrical Pinout

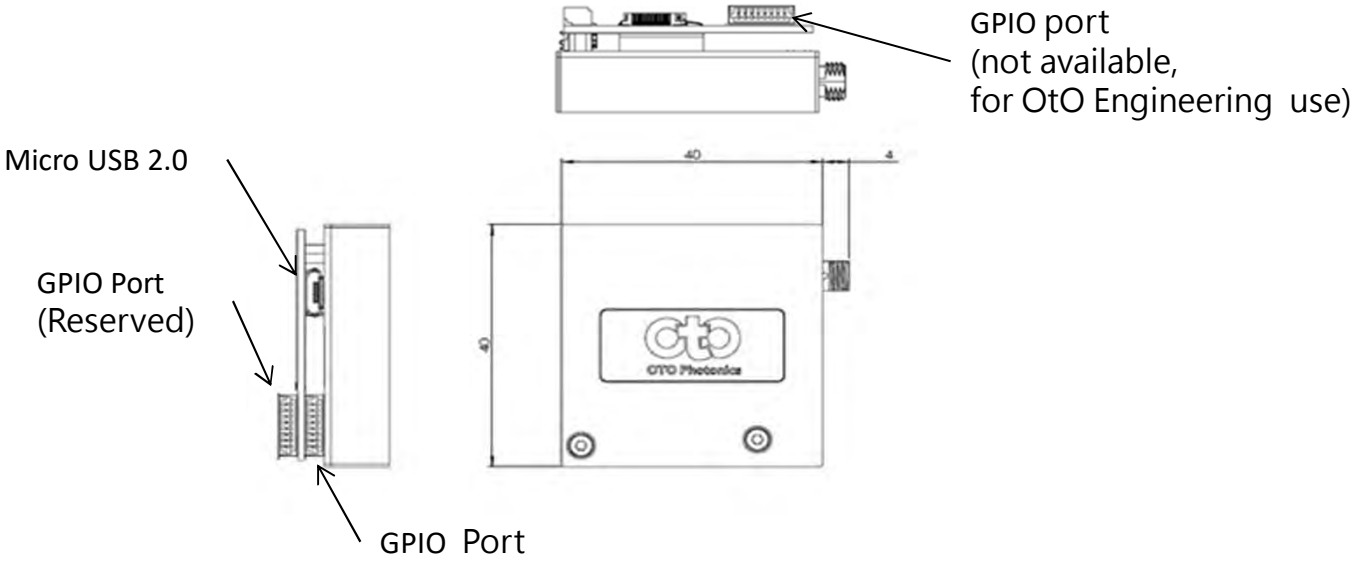


Fig. 3: RS1680 Electrical Pinout Position

● USB port

The electronics system is powered by USB port and RS Series communicates with the PC through the USB port. It also provides 6 I/Os for external interface extension.

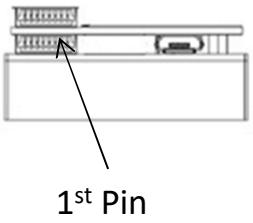
- ☐ **Micro USB @ 480Mbps (High-speed)**
- ☐ **Power Supply**

● GPIO port

The following listed is the pin description for the RS Series Extension Connectors. All the Extension Port is a 8 pin 1.0mm connector.

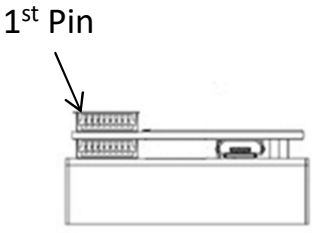
☐ GPIO Pin# Description Alt Function

*All I/Os are TTL-level input/output



Pin No.	Direction	Pin Name	Function Description
1	Power	5V Input/ Output	When connecting to PC USB port, this pin is also connected to VBUS. This pin can provide around 0.1A power for external device.
2	Output	TX	UART TX. TX is the output from the RISC controller.
3	Input	RX	UART RX. RX is the input for the RISC controller.
4	Output	GPIO0	General Purpose Output 0.
5	Output	GPIO1	General Purpose Output 1.
6	Output	LS_ON	Light Source Turn ON.
7	Input	Trigger_IN	External Trigger Input Signal.
8	GND	GND	GND

☐ GPIO Pin(Reserved) # Description Alt Function



Pin No.	Direction	Pin Name	Function Description
1	NC	NC	NC
2~7	-	-	Reserved GPIO
8	GND	GND	GND

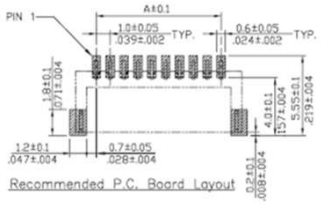


Fig. 4 : GPIO 1.0 mm 8 pin drawing

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► 2.3 Sensor Overview

● InGaAs Sensor

The InGaAs Sensor of RS1680 is a rectangular reduction type InGaAs linear image sensor with Flexible Cable designed for optical measuring equipment use. A built-in timing generator and clock-drivers ensure single 3.3V power supply for use.

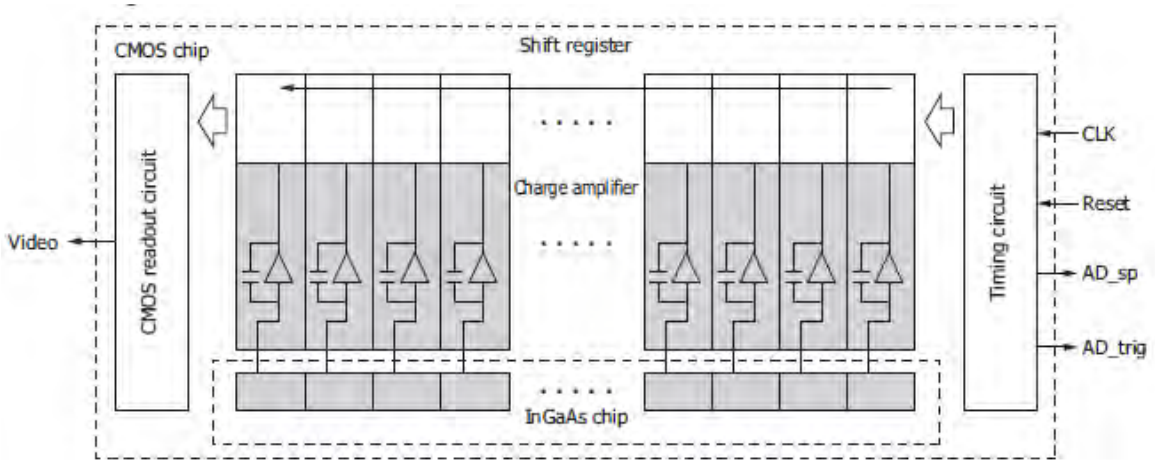

Fig. 5: RS1680/1780 InGaAs Sensor Block Diagram

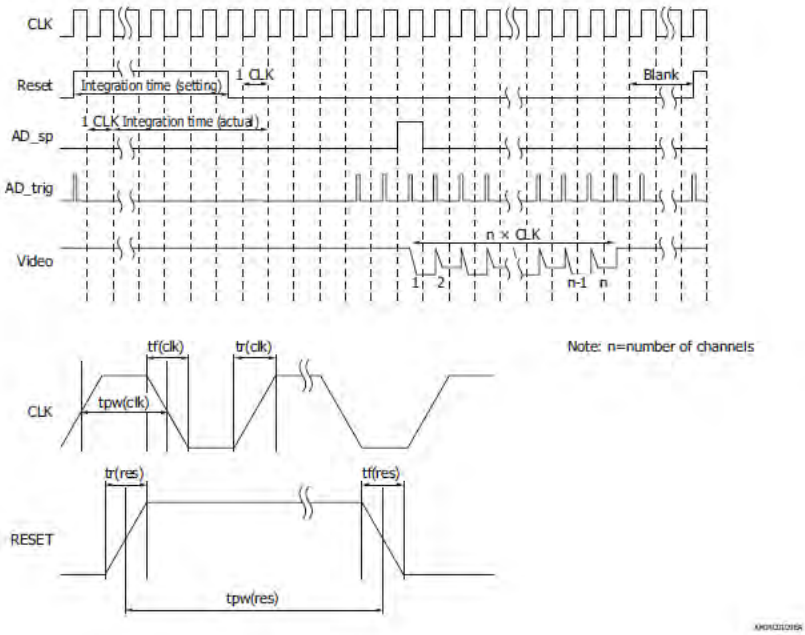

Fig.6: RS1680/1780 InGaAs Sensor operation timing waveform

SENSOR/SYSTEM NOISE

There are three major sources impact the Vout signal reading. One is the light source stability, the second is the electronics noise, and the other is CCD detector noise. If we don't consider the outer light source influence, we can check the dark noise performance of this system first. The dark noise we define here is the RMS of Vout signal under 1ms integration time in dark condition. So the dark noise will be only contributed by electronics readout noise and the sensor.

The other major parameter to define the noise performance is the SNR. The SNR we define here is the ratio of the full signal (65535 counts) to the RMS value under the full signal condition. The higher SNR performance indicates the readout signal is more stable. It will be helpful for the low signal differentiation.

SIGNAL AVERAGING

The software-SpectraSmart provides two options for the signal curve operations. The first one is the signal averaging. By the averaging method, we can reduce the noise impact on each pixel. Surely, more sampling points will bring the better averaging performance. But it will need more time to get one spectra. When we use the time-base type of signal averaging, the S:N increases by the square root of the number of samples. Thus, a S:N is readily 10x achieved by averaging 100 spectra.

The other curve smoothing is boxcar filter. It can average the adjacent points to show the smoother curve, but it will lower optical resolution. So if the target signal is peak type, the boxcar may not be suitable for this.

These two methods can be enabled at the same time if the measurement target is suitable for this operation. But if the user would like to check all the original data and performance, time-based average or boxcar smoothing needs to be un-checked. The default setting for these two average methods is un-checked.

Internal Operation

► Pixel Definition

The baseline signal is around 1,000 counts in our current system. We can provide the tool/command to manually adjust the baseline. (adjust the AFE OFFSET) The other baseline adjustment method is to enable the background removal from the software. It depends on the user how to use the baseline.

Pixel	Decription
1-128	Optical active pixels