

# Spectral Products

Spectrometers · Spectrophotometers · Color Instruments · Spectrographs · Monochromators

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## Triggering Options

## Instructions for Spectrometers

## “N” series

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## Overview

Optical spectrometers provide several methods to obtain data:

In Free-Run mode, the spectrometer operates freely, so the spectrometer continuously measures data internally according to the settings in the software, and when transmission is requested, the current data or previous data is transmitted. In Free-Run mode, the retrieval, collection, and transmission of data cannot be synchronized with external events, but it is possible using External Trigger mode and Software Trigger mode.

In External Trigger Mode, the measurement starts when an external trigger device is connected to the spectrometer and a TTL signal is sent to the spectrometer. The measurement's start time and the time it takes to complete the measurement are slightly different for each CCD type of the spectrometer. In Software Trigger mode, calling a data acquisition function instead of a TTL signal becomes a trigger signal.

External Synchronous Trigger Mode is a measurement method that uses the period of the TTL signal generated by the external trigger device as the light exposure time.

Triggering Mode	Description
Free-run Mode	The spectrometer periodically measures the spectrum inside.  If you make a request to transmit measurement data to the spectrometer (API function call), the current measurement data or previous data is transmitted.
Software Trigger Mode	Inside the spectrometer, it is in a waiting state until a data transmission request (API function call) arrives, and measurement starts when the request occurs.
External trigger mode	A method of measuring light by sending a TTL signal to the spectrometer using an external trigger device connected to the spectrometer when an external event occurs.  Since the measurement start time and measurement completion time are different for each model of the spectrometer, it is necessary to refer to the operation timing chart of each model and apply it when applying to a system with a sensitive measurement cycle.
External Synchronous Trigger Mode	A measurement method that uses the period of the TTL signal generated by an external trigger device as the light exposure time.

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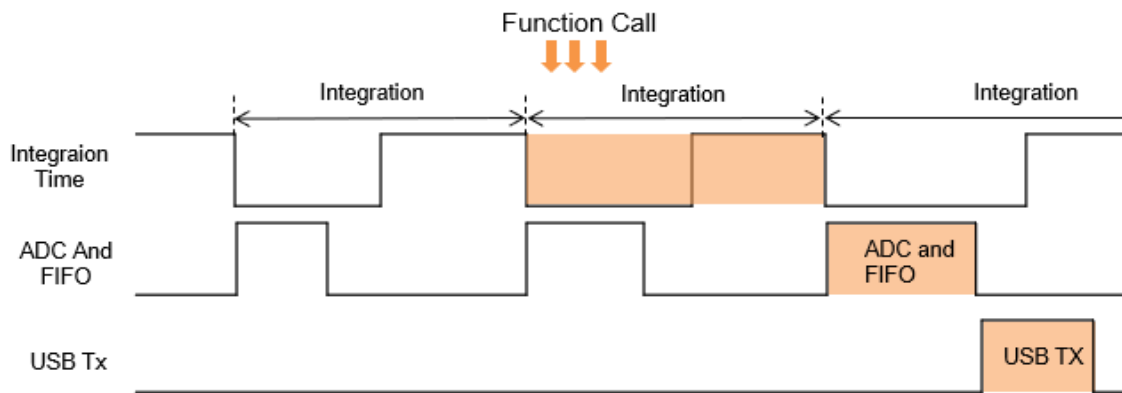
## Internal Trigger Mode

### Free Run Mode

In Free Run Mode, optical measurement is performed periodically by repeating the work as much as the Integration Time set inside the spectrometer until the function is called. When calling a function, data is transferred via USB or Ethernet after ADC And FIFO operation. It consists of Free Run Previous and Free Run Next Mode depending on whether data before or after the function call is sent.

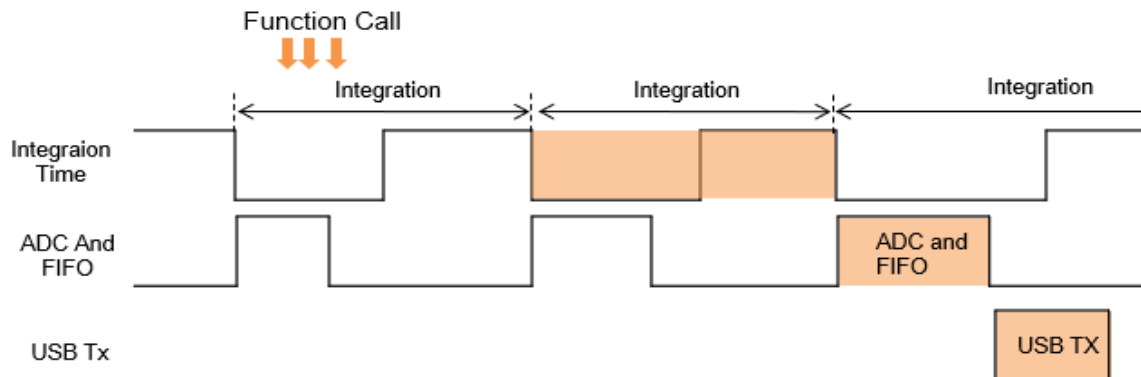
#### 1. Free Run Previous

How to get the result value by using the data immediately before the function call.



#### 2. Free Run Next

A method to obtain a result value using the next optical measurement data after completing the current measurement cycle.



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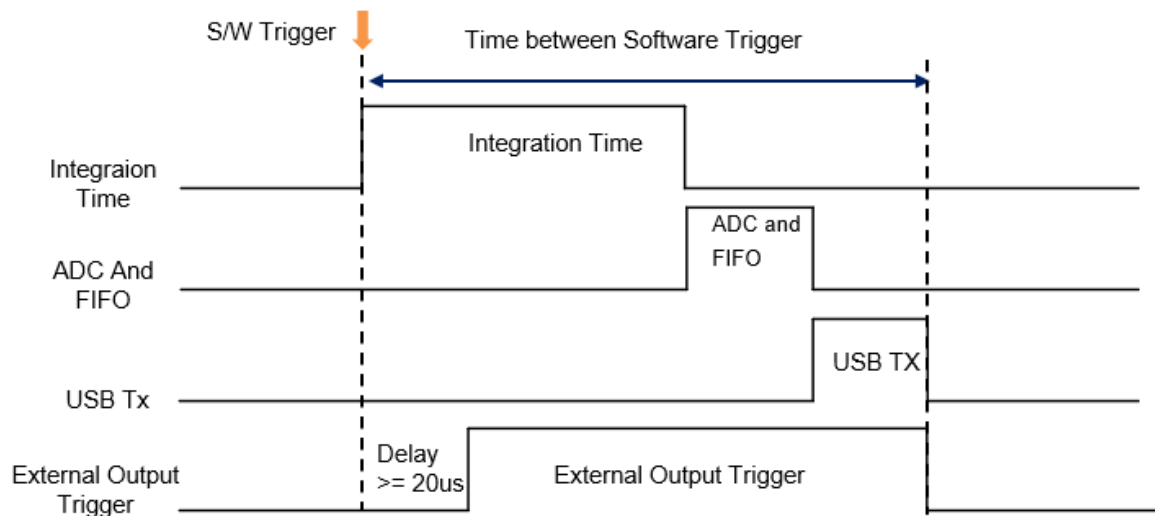
## Software Trigger

### 1. Timing Chart

Software Trigger Mode waits for the measurement signal inside the spectrometer in a standby state until trigger input. If the function is called while the spectrometer is in the waiting state, measurement starts immediately without a separate waiting time. After collecting the light as much as the set Integration Time, analog to digital (ADC) is performed using the AD converter, and the data accumulated in the FIFO is transferred through USB or Ethernet. The time required for measurement is Integration Time + ADC and FIFO + USB Tx. After the measurement is completed, it is in the standby state until the next S/W Trigger occurs.

### 2. External Output Trigger Signal

When the External Output Trigger Signal function is activated with the 'spSetOutTrgEnable' function in Software Trigger Mode, the Trigger Output Pin of the rear connector outputs the Output Trigger Signal during measurement time. You can set the output pin number and delay with the 'spSetOutTrgPin' function. The external output trigger signal output starts after the delay as much as the delay from the start of measurement, and the output ends after the integration time is completed. Delay can be set from 5.4us to 95000us in the case of SM245N, but cannot be set higher than the currently set Integration Time. SM642N can be set from 20us to 6000us.



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## Minimum Integration Time

The minimum integration time that can be set for each operation mode is different. It is 1ms for SM245N, 0.01ms for SM445N, and 7ms for SM642N.

	Free Run Previous	Free Run Next	Software Trigger
SM245N	1ms	1ms	1ms
SM445N	0.01ms	0.01ms	0.01ms
SM642N	7ms	7ms	7ms
SM303N	7ms	7ms	7ms
SM303NP	10ms	10ms	10ms

*Minimum Integration Time for each operation mode*

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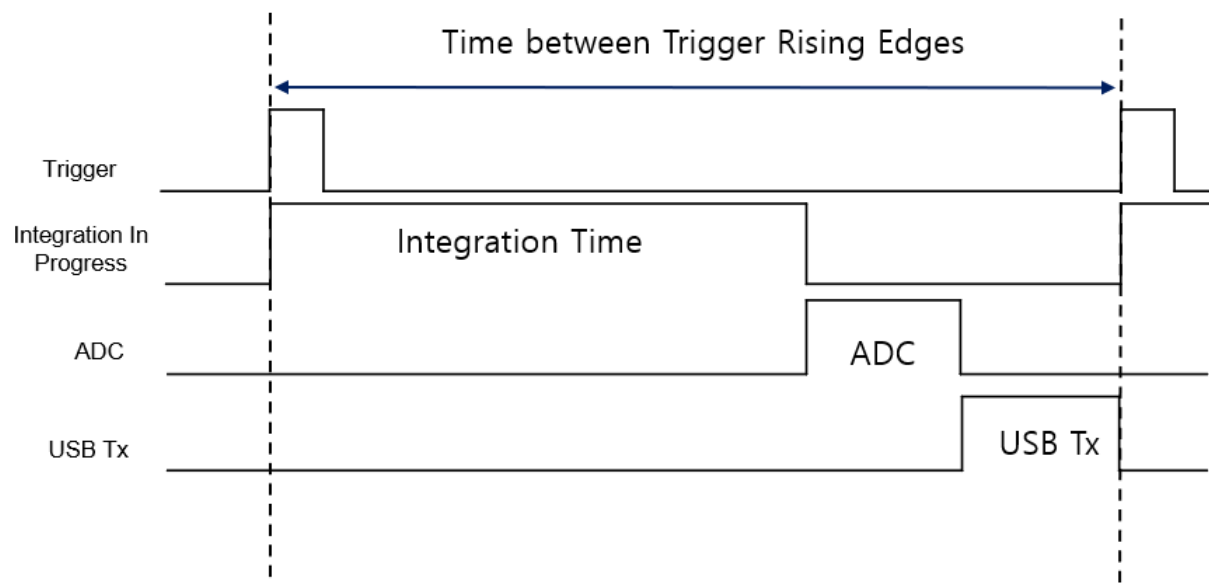
## External Trigger Mode

### Timing Chart

External Trigger Mode determines whether a trigger is generated through the External Trigger Input Pin (Pin 1) on the rear of each spectrometer. The spectrometer is in a standby state until a trigger is input, and when a trigger is input while waiting, measurement starts immediately without a separate waiting time. For measurement, optical data is collected as much as integration time, Analog to Digital conversion (ADC) is performed using AD converter, and data accumulated in FIFO is transferred through USB or Ethernet. The data transferring time varies depending on the connection conditions and the system resource status.

### External Output Trigger Signal

When the External Output Trigger Signal function is activated with the 'spSetOutTrgEnable' function in External Trigger Mode, the Trigger Output Pin of the rear connector outputs the Output Trigger Signal during the measurement time. You can set the output pin number and delay with the 'spSetOutTrgPin' function. The external output trigger signal output starts after the delay as much as the delay from the start of measurement, and the output ends after the integration time is completed. Delay can be set from 5.4us to 95000us in the case of SM245N, but cannot be set higher than the currently set Integration Time. SM642N can be set from 20us to 6000us.



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## Minimum Process Time

	Min Integration Time	ADC	USB Tx	ETH Tx	Min Trigger Cycle(ms)		Max Trigger Rate(Hz)	
					USB	ETH	USB	ETH
SM245N	1 ms	4.1ms	~2-4ms	~1-2ms	7.1 ms	6.1ms	140.8 Hz	163.9 Hz
SM445N	0.01 ms	7.3 ms	~2-4ms	~1-2ms	9.31 ms	8.31 ms	107.4 Hz	120.3 Hz
SM642N	7 ms	5.2 ms	~2-4ms	~1-2ms	14.2 ms	13.2 ms	70.4 Hz	75.75 Hz
SM303N	7 ms	2.6 ms	~2-4ms	~1-2ms	12.6 ms	11.2 ms	79.36 Hz	89.28 Hz
SM303NP	10ms	8.1ms	~2~4ms	1~2ms	8.1 ms	7.1ms	49.7 Hz	52.3 Hz

*Time required for detailed operation by model*

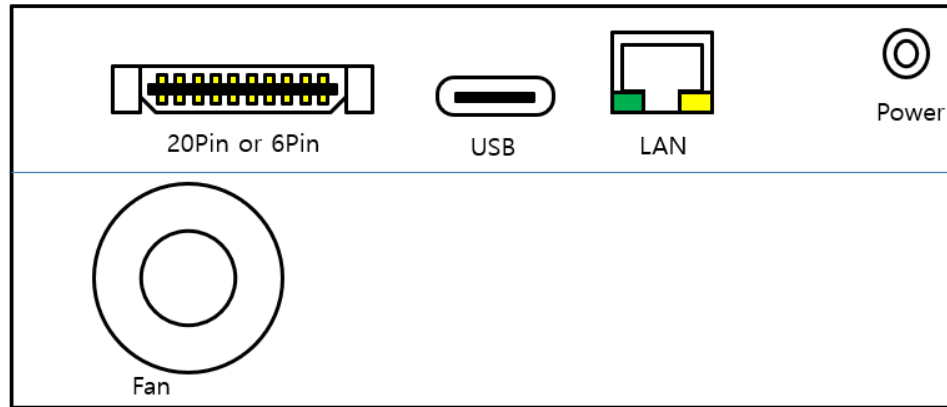


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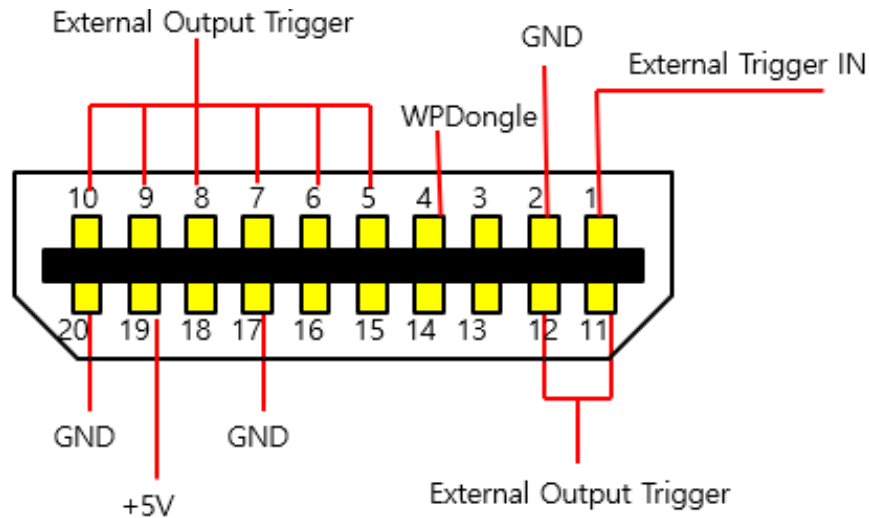
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## Pinout Diagrams for spectrometers



The backside of N series spectrometer



PIN	Description	PIN	Description
1	External Trigger Input	11	External Trigger Output 6
2	GND	12	External Trigger Output 7
3	Reserved	13	Earth
4	WPDongle(EEPROM WP)	14	Reserved
5	External Trigger Output 0	15	Earth
6	External Trigger Output 1	16	Reserved
7	External Trigger Output 2	17	GND
8	External Trigger Output 3	18	Reserved
9	External Trigger Output 4	19	+5V Out (5mA Max)
10	External Trigger Output 5	20	GND

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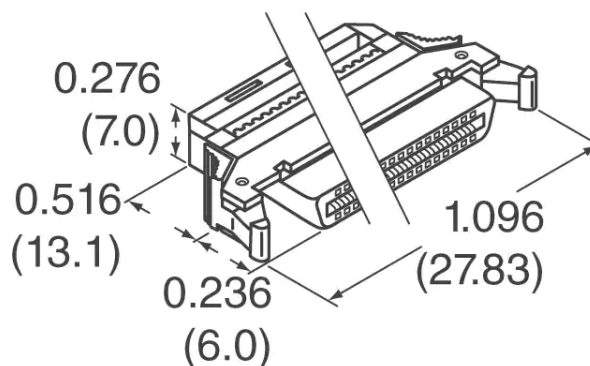
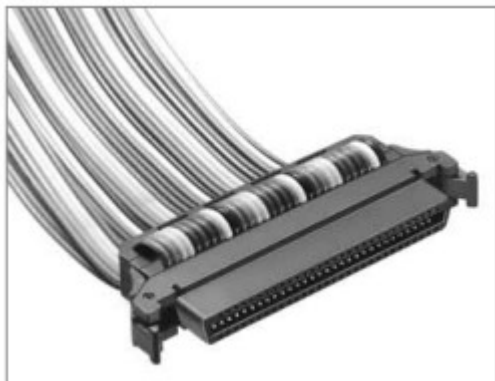
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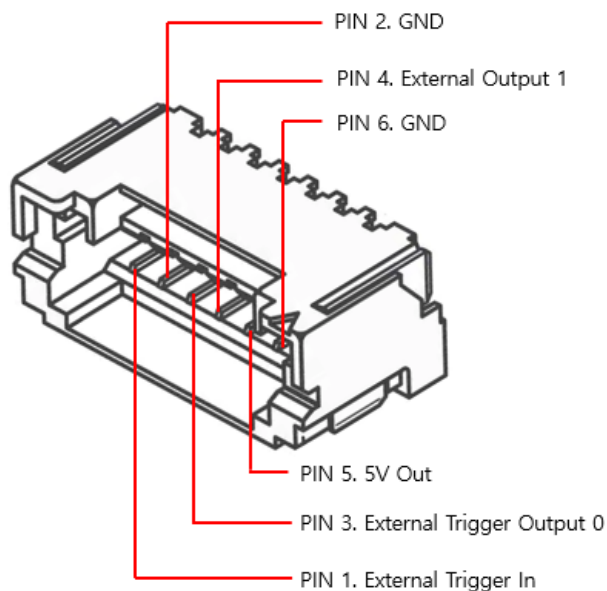
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- Male Connector: FX2B-20SA



## 6Pin – BM06B-ZESS-TBT (SM245N/SM445N)

- Pin map



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PIN	Description
1	External Trigger Input
2	GND
3	External Trigger Output 0
4	External Trigger Output 1
5	5V Out
6	GND

- Male Connector : ZER-06V-S

