
mini spectrometer

C13016

INSTRUCTION MANUAL



Read this instruction manual carefully before using this product.
Improper handling and operation that does not comply with the instructions in this manual may result in serious accident including injury or death.
Keep this instruction manual handy so that you can easily refer to it when needed.
使用本产品前请仔细阅读本说明书。
不按照本手册的说明进行处理和操作可能会导致严重的事故，包括人身伤害甚至死亡。
请将本说明书放在手边，以便在需要进行参考。



Introduction/ 概述

Please read carefully / 请仔细阅读

- Please carefully read the “Precautions” before using.
使用前请仔细阅读“注意事项”。
- Please read this manual carefully and use the product correctly.
请仔细阅读本说明书，并正确使用本产品。
- Please keep this manual and read when it is necessary.
请妥善保管本说明书，在必要时进行阅读。

This manual uses the following safety alert symbols and signal words.
本说明书使用以下安全警示符号和信号词。

 DANGER/危险	Indicates an imminently hazardous situation which if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations. 用于警示紧急的危险情形，若不可避免，将会导致人员死亡或严重的人身伤害。这一信号词仅限于在最极端的情况下使用。
 WARNING/警告	Indicates a potentially hazardous situation which if not avoided, could result in death or serious injury. 用于警示潜在的危险情形，若不可避免，可能会导致人员死亡或严重的人身伤害。
 CAUTION/注意	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It is permitted for property damage only accidents. 用于警示潜在的危险情形，若不可避免，可能会导致人员受到轻微或中等伤害。这一信号词仅允许在发生财产损失事故的情况下使用。

	Indicates a note to help you get the best performance from the system. Read the contents of the note carefully to ensure correct and safe use. Failure to observe one of these notes might impair the performance of the system. 本注意事项用于帮助您从系统中获得最佳性能。请仔细阅读注意事项内容，以确保正确、安全地进行使用。未遵循其中任何一项注意事项都可能会影响系统性能。
	Indicates a cautionary item that should be obeyed when handling the system. Read the contents carefully to ensure correct and safe use. 表示操作本系统时应遵守的注意事项。请仔细阅读其中内容，以确保正确、安全地进行使用。
	Indicates an action that is forbidden. Read the contents carefully and be sure to obey them. 表示禁止的操作。请仔细阅读其中内容并予以遵守。
	Indicates a compulsory action or instruction. Read the contents carefully and be sure to obey them. 表示强制性操作或注意事项。请仔细阅读其中内容并予以遵守。

Safety consideration / 安全考虑

Make sure you follow the instructions / 确保你遵循指示

This product is intended for use in general electronic equipment (Measurement equipment, office equipment, information and communications equipment, home appliances, etc.). Do not use this product for special purposes (Nuclear control equipment, Aerospace equipment, Medical equipment and Transport equipment that directly affect human life, disaster prevention and safety equipment, etc.) that require extremely high reliability and safety, except as described in the individual product documentation. In order to use this product correctly and safely, make sure to follow the safety notices below when operating this product. Hamamatsu Photonics is neither responsible nor liable for damages caused by using this product contrary to the safety notices.

本产品适用于一般电子设备（测量设备、办公设备、信息通信设备、家用电器等）。除非个别产品文档中另有说明，否则请勿将本产品用于需要极高可靠性和安全性的特殊用途（核控制设备、航空航天设备、直接影响人类生命的医疗设备和运输设备、防灾和安全设备等）。为了正确、安全地使用本产品，操作产品时请务必遵守以下安全注意事项。对于违反安全注意事项使用本产品所造成的损害，Hamamatsu Photonics 不负任何责任。



WARNING/ 警告

● **In case an abnormality has occurred / 在发生异常情况时**

Do not use this product if smoke, unusual odor, abnormal noise, or heat is generated during operation. Continuing operation may cause a fire or electrical shock. In this case, immediately turn off the PC (personal computer) connected to this product, and then unplug the USB cable. After making sure that the abnormal condition has disappeared, contact our sales office. Never attempt to repair this product yourself since it can be dangerous.

如果操作过程中出现烟雾、异味、异常噪音或发热情况，请勿使用本产品。继续操作可能会引发火灾或触电。在这种情况下，请立即关闭连接本产品的 PC（个人电脑），然后拔下 USB 线。确认异常情况消失后，请与我们的销售办公室联系。切勿尝试自行维修本产品，因为这样做可能十分危险。

● **Do not use this product above its absolute maximum ratings / 使用本产品时，切勿超过其绝对最大额定值**

Do not use this product above values stated in the absolute maximum ratings. Using this product beyond its absolute maximum ratings may cause damage or fires.

使用本产品时，切勿超过其标注的绝对最大额定值。使用本产品时超过其绝对最大额定值可能会造成产品损坏或导致火灾。

● **Do not apply vibration or shock / 请勿施加振动或冲击**

Excessive vibration or shock may damage parts or cause misadjustment, resulting in fire or electric shock.

过度的振动或冲击可能会损坏零件或引起误调整，从而导致火灾或触电。

● Do not change or modify / 请勿更改或修改

Disassembling, changing internal adjustments, or modifying the product may cause malfunction of the device, resulting in fire or electric shock.

拆卸、改变内部调整或改造产品可能会导致设备故障，从而引发火灾或触电。

● Do not allow foreign objects or water to enter the product. / 请勿让异物或水进入产品。

If flammable materials, metal, or water get inside, it may cause fire or electric shock.

如果易燃材料、金属或水进入内部，可能会引起火灾或触电。

● Absolutely do not make mistaken connections / 绝对不要搞错关系

Doing so may cause overcurrent, causing damage or fires in parts and devices.

这样做可能会引起过电流，导致零件和设备损坏或起火。

● Handling of power supply cords / 电源线的处理

Turn off the power supply and hold the plug before attaching or detaching cords.

Also, do not operate this product or attach/detach cords when your hands are wet. Doing so brings risk of electric shock or failure, which is extremely dangerous.

在连接或拆卸电线之前，关闭电源并握住插头。

此外，请勿操作本产品或在您的手湿了时连接/拆卸电线。这样做会带来触电或故障的危险，这是极其危险的。

● Power supply adapter and USB cable / 电源适配器和 USB 电缆

When using this device, make sure to use the AC adapter and USB cable that come with the device.

使用此设备时，请务必使用设备附带的 AC 适配器和 USB 电缆。

● Connect only to compatible products. / 仅连接到兼容产品。

This product is designed to connect to the USB ports of personal computers and the packaged USB cable.

Using a voltage other than the specified supply voltage can cause a fire or electric shock.

本产品设计用于连接个人电脑的 USB 端口和包装内的 USB 线缆。

使用非指定电源电压可能会导致火灾或触电。

● Damage to cords / 电线损坏

Do not scratch, damage, modify, or place heavy objects on top of cords. Doing so can break cords and cause electric shock or fire.

请勿刮伤、损坏、改装电线，或在电线上放置重物。否则，可能会导致电线断裂，并导致触电或火灾。

**CAUTION / 注意**

This is a precision optical instrument. Do not subject it to excessive vibration or shock. Doing so may result in deterioration and performance may not be fully demonstrated.

Note

本产品为精密光学仪器，请勿使其受到过度振动或冲击。
否则可能会导致仪器性能下降，无法充分发挥其性能。

Do not store or operate the product in a dusty or wet environment such as outdoors, or in a high temperature and humidity environment.

Note

It may deteriorate, and performance may not be fully demonstrated.

请勿在室外等多尘或潮湿的环境中，或高温高湿的环境中存放或操作本产品。
否则，产品性能可能会下降，无法充分发挥。



Never insert protrusions into the SMA optical connector section.
It will result in damage to the internal optical components.

切勿将突出物插入 SMA 光纤连接器部分。否则会导致内部光学元件损坏。



Do not use the product at altitudes exceeding 2000M.
In the worst case, the product may be damaged by air pressure and rendered unusable.

请勿在海拔超过 2000 米的地方使用。
在最坏的情况下，产品可能会因大气压力而损坏并无法使用。



This equipment is designed for Pollution Degree 2.
Storage or operation in an environment with a contamination level of 3 or higher may result in product failure, fire, or electric shock. Never do so.

本产品设计用于污染等级 2。在污染等级 3 级以上的环境中存放或操作产品，可能会导致产品故障、火灾、触电等，请不要这样做。



This equipment is classified as an overvoltage category I product.
Please handle the equipment properly in accordance with the category level.

本产品属于过电压类别 I。请根据类别级别妥善处理设备。



Do not use organic solvents such as thinner or acetone for cleaning.
Rub with a clean, soft cloth.

请勿使用稀释剂或丙酮等有机溶剂进行清洁。请用干净的软布擦拭。

	The power of this product is supplied from the USB port of a PC, etc. Due to the standard for the power supply from the USB port, the power exceeding 5V-500mA cannot be supplied to a device for one port. The power supply is not designed for use with a USB port. 本产品通过 PC 等设备的 USB 端口供电。由于 USB 端口供电标准，单个端口无法向设备提供超过 5V-500mA 的电流。本电源并非设计用于 USB 端口。
	Some PC models stop external power supply from the USB port of the PC when the PC is in power-saving mode, screen saver, or other functions are activated. In such cases, the device will be stopped when the power supply is stopped, which may cause problems in the operation of the device when the PC is restored from the power-saving mode, screen saver, etc. and the power supply is resumed. When using such a PC, please disable the power-saving mode, screen saver, and other functions. (For details on PC functions and settings, please refer to the user's manual of your PC.) 某些型号的电脑在省电模式、屏幕保护程序或其他功能启用时，会切断通过电脑 USB 端口的外部供电。在这种情况下，设备会在电源切断时停止运行，这可能会导致电脑从省电模式、屏幕保护程序等模式恢复并重新供电时，设备运行出现问题。 使用此类电脑时，请禁用省电模式、屏幕保护程序和其他功能。（有关电脑功能和设置的详细信息，请参阅您电脑的用户手册。）

Precautions for use / 使用注意事项

Make sure you follow the instructions / 确保你遵循指示

Before using this product, be sure to read the following precautions to ensure proper use.

使用本产品前，请务必阅读以下注意事项，确保正确使用。

- The product is a precision optical instrument. Do not subject the Product to excessive vibration or shock. Avoid operation and storage in dusty, watery, high temperature and humid environments. Also, never remove the mini spectrometer while power is being supplied to the drive circuit board. Doing so may cause the mini spectrometer and drive circuit board to malfunction.

该产品是一种精密光学仪器。不要使产品受到过度振动或冲击。避免在灰尘、潮湿、高温和潮湿的环境中操作和储存。此外，在向驱动电路板供电时，切勿拆卸微型光谱仪。这样做可能会导致微型光谱仪和驱动电路板发生故障。

- Use the camera within the range where the A/D count of each pixel is not saturated by the incident light. If saturation of A/D counts occurs, set a shorter accumulation time. If the accumulation time cannot be set short, the use of a light-reducing filter is recommended at the user's side.

在每个像素的 A/D 计数未被入射光饱和的范围内使用相机。如果 A/D 计数出现饱和，设定较短的累积时间。如果不能缩短累积时间，建议用户使用减光过滤器。

- Even in the absence of incident light, the product has an output consisting of an offset component and a dark output. Note that the offset component does not depend on the accumulation time, but the dark output does.

即使在没有入射光的情况下，产品也具有由偏置组件和暗输出组成的输出。注意，偏移组件不依赖于累积时间，但是暗输出依赖于累积时间。

- Window / 窗户

- Do not apply strong friction or pressure to prevent scratching or cracking of the window material. Avoid contact with sharp or hard objects and window materials.

不要施加强烈的摩擦或压力以防止刮伤或开裂的窗户材料。避免接触尖锐或坚硬的物体和窗户材料。

- Dust on the window material should be removed using an air blower. It is recommended that an ionizer be used in conjunction with an ionizer.

窗户上的灰尘应使用鼓风机清除。建议将电离器与电离器结合使用。

- If the window material is contaminated with oil, grease, or other contaminants that cannot be removed by air blow, gently wipe it off with a cotton swab or similar object moistened with ethyl alcohol to avoid scratching. Hard rubbing or repeated wiping may cause scratches, resulting in deterioration of electrical/optical characteristics and reliability.

如果窗户材料被油、油脂或其他空气吹不掉的污染物污染，用棉签或类似的物体用乙醇液轻轻擦拭，以免划伤。用力摩擦或反复擦拭可能会造成划痕，导致电气/光学特性和可靠性下降。

- Care should also be taken when packing and transporting equipment with the product incorporated to prevent dirt and scratches on the window material.

在包装和运输设备时也应注意与产品结合，以防止污垢和划伤窗户材料。

● Static electricity management / 静电管理

A static electricity caution label [Figure 1] is displayed to prevent destruction and deterioration due to static electricity. The following precautions should be taken when handling this product.

为了防止因静电造成的损坏和劣化，产品上贴有静电警告标签[图 1]。使用本产品时，请采取以下预防措施。

Fig.1 Static electricity caution label / 静电警告标签



(1) Workplace and equipment, etc. / 工作场所和设备等

- The surface of the work desk should be grounded with a conductive mat (750 kΩ to 1 GΩ).
工作台表面应使用导电垫（750 kΩ ~ 1 GΩ）接地。
- The floor of the work area should be grounded by using conductive flooring or by laying down conductive mats.
工作区域地面应使用导电地板或铺设导电垫接地。
- All manufacturing and inspection equipment should be grounded.
所有制造和检查设备均应接地。
- Humidity should be around 50 %. Low humidity tends to generate static electricity, while high humidity tends to absorb moisture.

湿度应在 50% 左右。低湿度容易产生静电，而高湿度容易吸收水分。

(2) handling / 处理

- It is recommended that ionizers or similar devices be used to eliminate static when handling the product.

操作本产品时，建议使用静电消除器或类似装置消除静电。

- Wear antistatic clothing and conductive shoes (100 k Ω to 100 M Ω).

穿着防静电服和导电鞋（100 k Ω ~ 100 M Ω ）。

- Wrist straps should be worn in direct contact with bare skin and grounded. Use a wrist strap with a protective resistance of 750 k Ω to 35 M Ω when measured with the strap in place. If the wrist strap does not have a protective resistance, there is a risk of electric shock due to electrical leakage, which is extremely dangerous. Also, use conductive finger sacks or gloves.

腕带应直接接触裸露皮肤并接地。请使用保护电阻为 750 k Ω ~ 35 M Ω （带上测量）的腕带。如果腕带没有保护电阻，则可能会因漏电而导致触电，非常危险。此外，请使用导电指套或手套。

- Tools such as tweezers for handling the product may also be electrically charged. Ground them as necessary. 用于操作产品的镊子等工具也可能带电。请根据需要将其接地。

- Use a soldering iron with an insulation resistance of 10 M Ω or higher and a grounded tip.

使用绝缘电阻为 10 M Ω 或更高且尖端接地的烙铁。

- If the product is induction-charged and comes into contact with a metal, excessive current may flow due to discharge, resulting in electrostatic breakdown. To prevent induction charging, keep objects (insulators such as plastic and vinyl, PC displays and keyboards, etc.) that may be electrically charged away from the product. Simply bringing them close to the product may cause the product to become induction-charged. If it is unavoidable to bring the product closer to such objects, use an ionizer or similar device to eliminate static from the objects that may be charged.

如果本产品带有感应电荷并接触金属，可能会因放电而流过过大的电流，导致静电击穿。为防止感应带电，请将可能带电的物体（例如塑料和乙烯基等绝缘体、PC 显示器和键盘等）远离本产品。仅仅将它们靠近本产品可能会导致本产品感应带电。如果无法避免，请使用静电消除器或类似装置消除可能带电物体上的静电。

- Friction may cause electrification of the product. If friction is unavoidable, use an ionizer to eliminate static electricity.

摩擦可能导致本产品带电。如果无法避免摩擦，请使用静电消除器消除静电。

- Peripheral devices must be grounded to prevent surges due to leakage voltage. Do not apply voltages exceeding the absolute maximum ratings from measuring instruments, etc. (especially when turning power on and off). If there is a possibility that a surge may be applied, use a filter (consisting of resistors and capacitors) for protection. Do not attach or remove any connectors, etc. connected to the power supply line or output line during operation.

外围设备必须接地，以防止漏电电压引起的浪涌。请勿施加超过测量仪器等绝对最大额定值的电压（尤其是在打开和关闭电源时）。如果可能施加浪涌，请使用滤波器（由电阻器和电容器组成）进行保护。请勿在运行过程中装卸连接到电源线或输出线的任何连接器等。

(3) Transportation, storage, packaging / 运输，储存，包装

- Insert the product into a conductive mat (shorting the leads) and place it in a conductive case. Do not use plastic, Styrofoam, etc., as vibration during transportation generates static electricity, which may cause destruction or deterioration of the product.

将产品插入导电垫（缩短引线）并将其放入导电盒中。不要使用塑料、泡沫塑料等，因为运输过程中的振动会产生静电，从而导致产品损坏或变质。

- Transport cases and storage shelves should be conductive.

运输箱和储存架应具有导电性。

- Do not store the product near equipment that generates high voltage or high electromagnetic fields.

请勿将产品存放在产生高压或高电磁场的设备附近。

- When packaging the product, short-circuit the leads to make them equipotential and use conductive materials.

Note: It is not necessary to take all of the above measures against static electricity. Take measures according to the degree of possible damage.

包装产品时，请将引线短路使其等电位，并使用导电材料。

注意：无需全部采取上述防静电措施。请根据可能造成的损害程度采取措施。

【Examples of anti-static measures / 防静电措施示例】

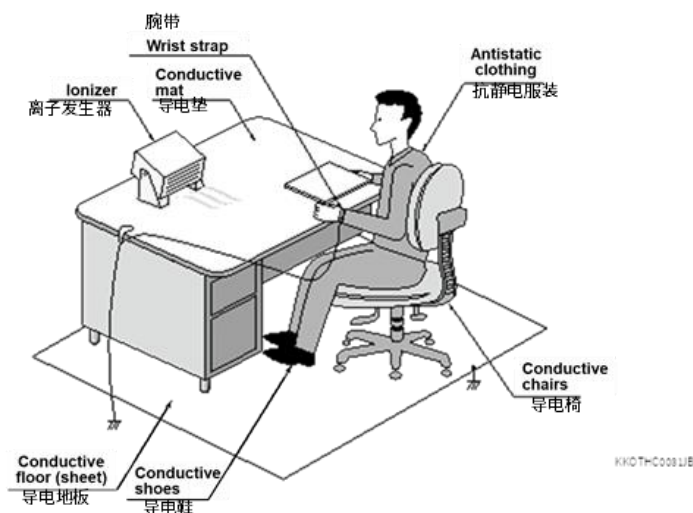


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1. Check package contents

After unpacking, make sure to check that there are the following components: In the unlikely event that the delivered products are incorrect, incomplete, or damaged, do not operate the products, and make sure to contact Hamamatsu Photonics or our distributor.

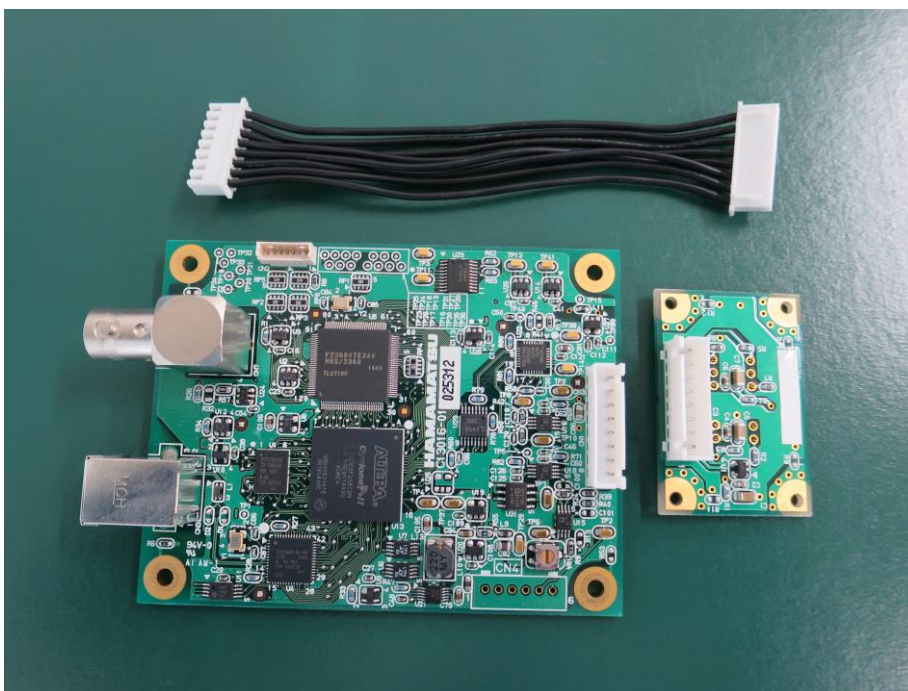
Packaged item list

	Contents	Photo	Description
1	drive circuit board		This is a board that drives the mini spectrometer and performs data communication with a PC.
2	sensor board		This is a board for mounting a mini spectrometer.
3	Board connection cable		This is a cable for connecting the drive circuit board and sensor board.
4	software URL document		A document with links to download software.

2. Outline

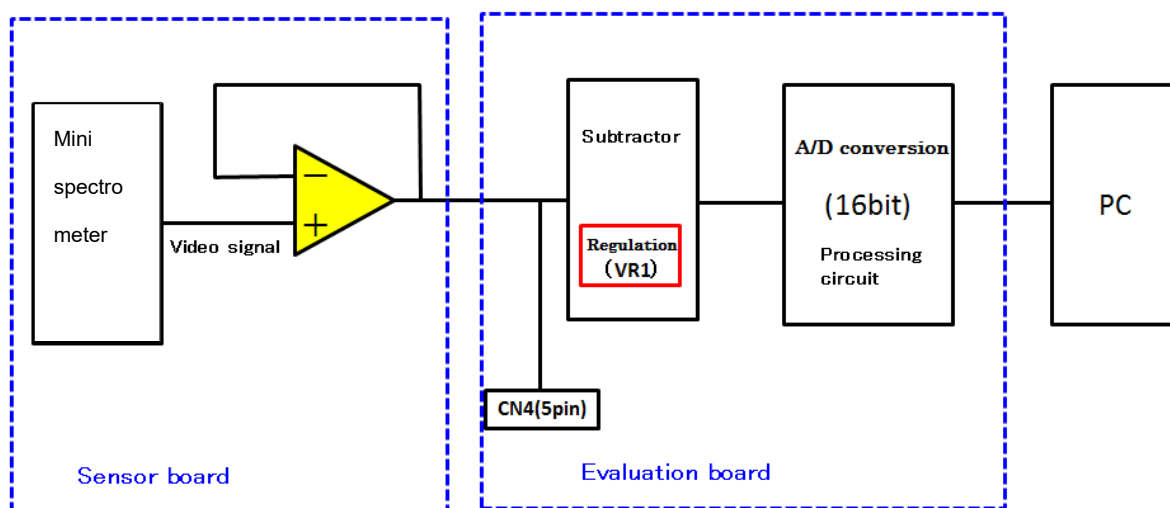
The mini spectrometer drive circuit board C13016 (hereinafter referred to as C13016) is a flat board for driving the C12880M or C16767MA (hereinafter referred to as the mini spectrometer) and importing the data to a PC.

*Please refer to each instruction manual for the specifications of the mini spectrometer.



C13016

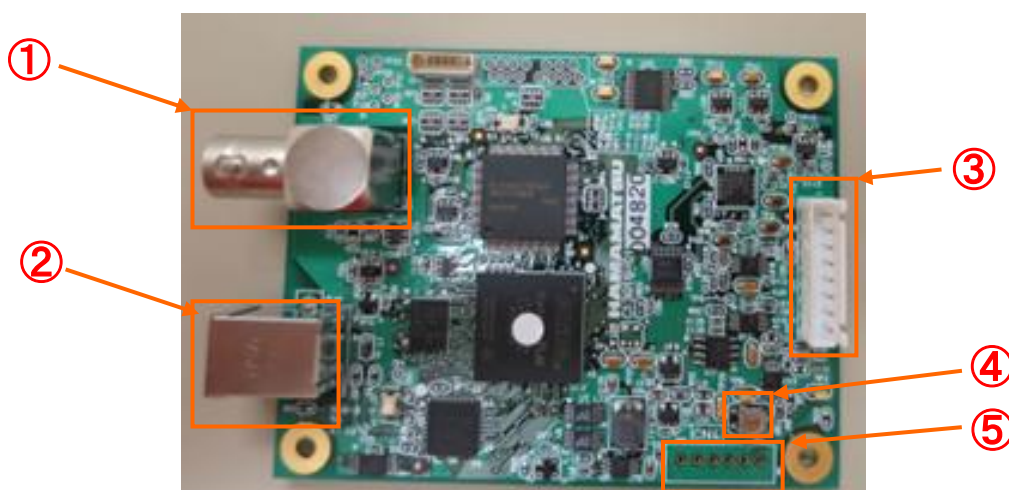
■ About flow of VIDEO signal



3. Setup

3-1. Names and descriptions of each Part

■Drive Circuit Board



① BNC Connector

This connector is used to connect the trigger I/O signal when using the trigger measurement mode.

② USB Connectors

This connector is used to connect a USB cable (USB cable A9160) to a PC

③ Connection Connectors

Connector for board connection cable to connect to the sensor board.

④ VR1

The offset voltage level of the Video signal output by AD conversion can be adjusted.

⑤ Through-hole for monitor

Through-holes are available for observing the main input/output signals of the driver circuit board and the mini-spectrometer.

(Please refer to the instruction manual of the mini-spectrometer regarding the input/output signals of the mini-spectrometer.)

When attaching a connector, a connector (B6B-XH-A) manufactured by Japan Aviation Electronics Inc. is recommended.

**WARNING**

When soldering connectors, please pay attention to soldering temperature, soldering time, etc.

Soldering may damage the substrate.

The board may be damaged by soldering. As a rule of thumb, when hand soldering, solder each terminal at 370°C for 3.5 seconds or less.

Soldering should be done at 370°C for 3.5 seconds or less.

焊接连接器时，请注意焊接温度、焊接时间等。

焊接可能会损坏基材。

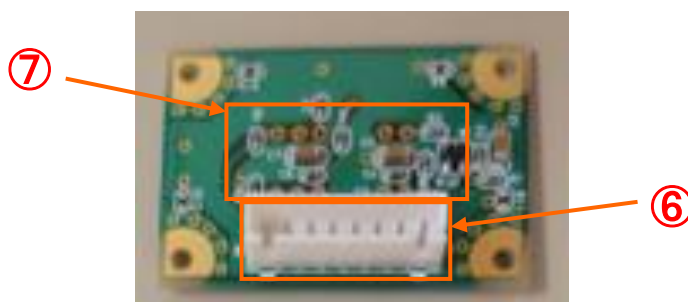
板可能因焊接而损坏。根据经验，手工焊接时，每端在 370°C 下焊接 3.5 秒或更短时间。

焊接应在 370°C 下进行 3.5 秒或更短时间。

Through-hole No.	Function	Through-hole No.	Function
1	EOS signal output of mini-spectrometer	4	ST signal input for mini-spectrometer
2	CLK signal input for mini-spectrometer	5	Video signal output of mini-spectrometer *1
3	TRG signal output of mini-spectrometer	6	Analog GND on drive circuit board

*1: Video signal is output via a buffer amplifier mounted on the sensor board.

■ Sensor Substrate



⑥ Connection Connectors

Connector for board connection cable to connect to the drive circuit board.

⑦ Through-hole for mini-spectrometer insertion

Through-holes for mounting mini-spectrometers.

■ Board connection cable



⑧ Connection plug

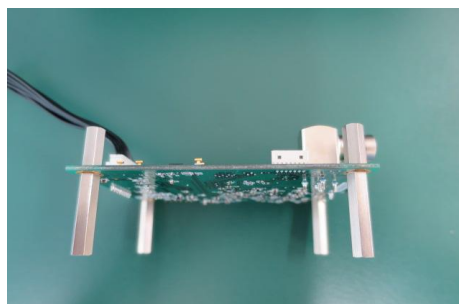
Connect both boards by inserting them into the connection connectors on the drive circuit board or the connection board.

**WARNING / 警告**

- Board connection cables with different cable lengths are not available. If you need a board connection cable with a different cable length
不能使用不同电缆长度的板连接电缆。如果您需要不同电缆长度的板状连接电缆。
- If you need a board connection cable with a different cable length, please make your own.
如果您需要不同电缆长度的电路板连接电缆，请自行制作。
- Use the nylon connector XHP-8 made by Japan Aviation Electronics Industry, Ltd. as the connecting plug.
If the cable length is too long, the characteristics of the mini-spectrometer may not be fully evaluated.
使用日本航空电子工业株式会社生产的 XHP-8 尼龙连接器作为连接插头。
如果电缆长度过长，微型光谱仪的特性可能无法得到充分的评估。

3-2. Attaching pillars to each board

When using the board, attach a prop or the like to the board to prevent the board from short-circuiting.



4. Evaluation software overview

4-1. Outline of evaluation software

The C13016 is connected to a PC via a USB 2.0 interface. Various operations of the mini-spectrometer are performed from the PC, and the measured data are also transferred to the PC.

The evaluation software is a free accessory designed to simplify the basic operation of the mini-spectrometer. By using the evaluation software, you can immediately perform measurements using the mini-spectrometer.

The evaluation software provides functions such as data acquisition, real-time graphing of measured data, and storage of such data.

The evaluation software is designed for C13016. Other mini-spectrometers and driver circuit boards manufactured by us are not included.

4-2. System operating conditions for evaluation software

Evaluation software has been confirmed to work in the following system. However, operation in other environments cannot be guaranteed.

OS	Microsoft(R) Windows 10(Japanese/English) 32bit, 64bit Microsoft(R) Windows 11(Japanese/English) 64bit
.Net Framework	4.8
Monitor	XGA(1024×768) and above

It is necessary to use PC with the above-mentioned system requirements condition to operate the evaluation software. There is no other special requirements, but we recommend that use PC with the higher performance CPU, memory etc.

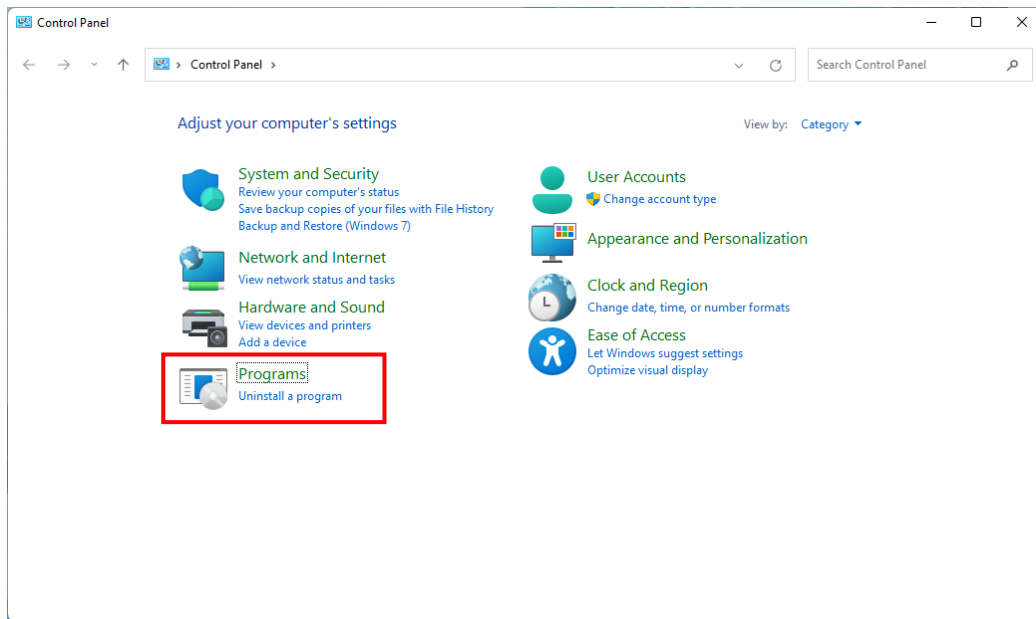
About .NET Framework

Either of .Net Framework 4.6 through 4.8 is preinstalled on Windows 10, 11. So you can run this software without a care basically.

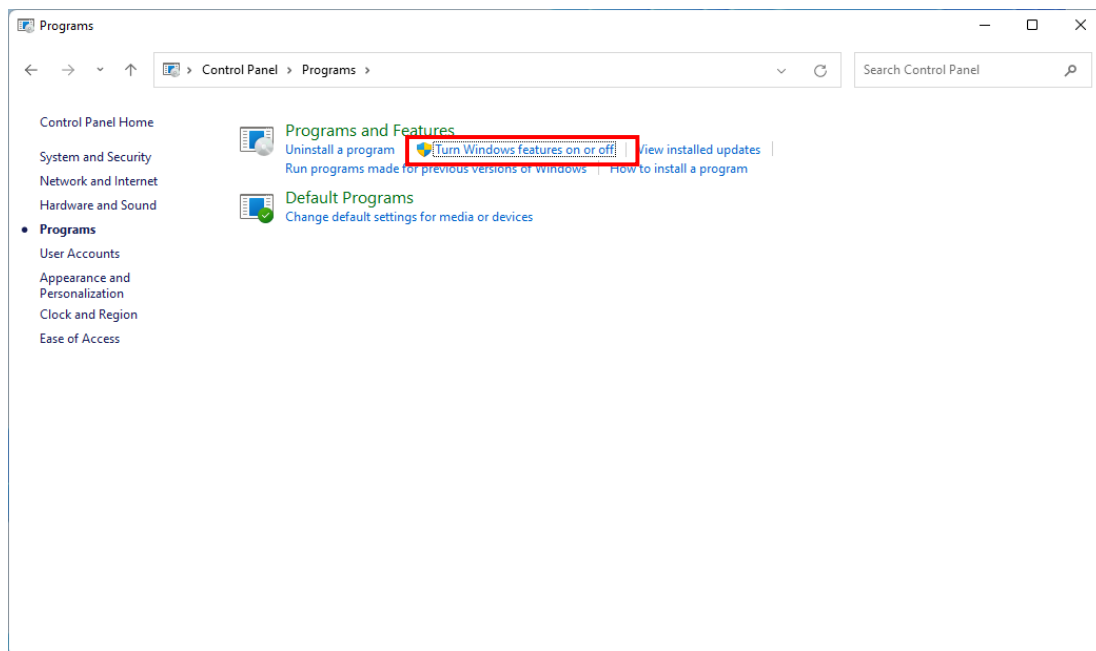
If not, please take a look at the setting for activating .Net Framework.

The procedure described below is for activating .Net Framework 4.8.

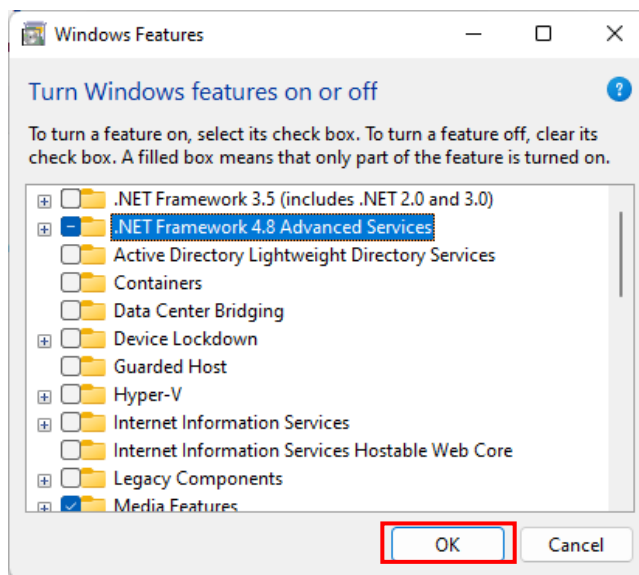
Open [Control Panel] and select [Programs]



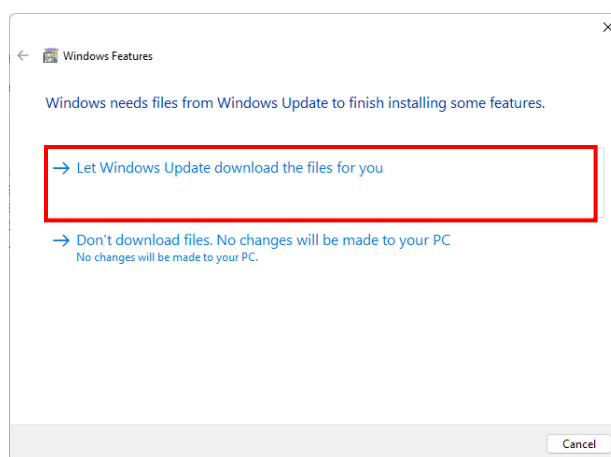
Select [Turn Windows features on or off].



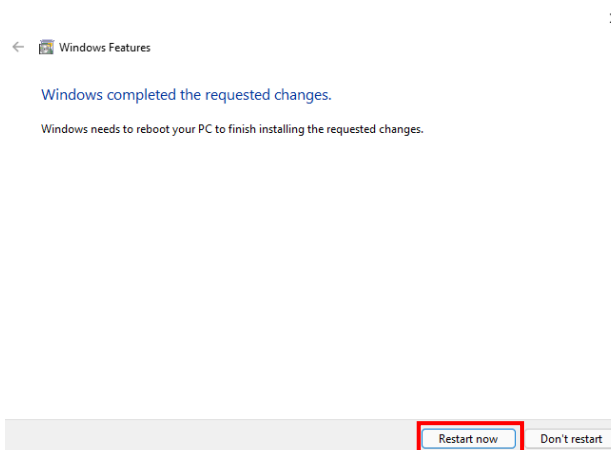
Confirm if .Net Framework 4.8 is activated. If not, check it and click [OK] button.



If the following message is displayed, Select
[Let Windows Update download the files for you].



Please reboot PC after clicking a [Close] button.



4-3. Evaluation software function list

● Measurement Mode

This software provides four kinds of measurement modes that are Monitor mode measurement, Measure mode measurement, Dark mode measurement, Reference mode measurement.

The feature of each measurement mode is described below.

Mode	Use to:	Features
Monitor Mode	Monitor measurement data without saving it.	Graphically displays "pixel count vs. A/D output count" data in real time.
		Graphically displays "wavelength vs. A/D output count" data in real time.
		Can not save measurement data
		Performs dark subtraction.
		Displays reference data.
		Measurement scan number can not be set, no limit for scan number.
Measure Mode	Measurement mode to save measurement data	Graphically displays "pixel count vs. A/D output count" data in real time.
		Graphically displays "wavelength vs. A/D output count" data in real time.
		Save measurement data
		Performs dark subtraction.
		Displays reference data.
		Specifies the number of measurement scans
Dark mode	Acquire data to perform dark subtraction	"pixel count vs. A/D output count" data in real time is not displayed graphically.
		"wavelength vs. A/D output count" data in real time is not displayed graphically.
		Saves measurement data.
		Specifies the number of measurement scans
Reference mode	Measurement mode to acquire reference data.	"pixel count vs. A/D output count" data in real time is not displayed graphically.
		"wavelength vs. A/D output count" data in real time is not displayed graphically.
		Saves measurement data.
		Specifies the number of measurement scans.

- **Calculation function**

This software provides the following arithmetic functions.

Functions	Features
Dark subtraction function	It is possible to display the subtracted value of the dark reference pixel from the measuring data
Reference data measurement and display	Measures reference data and displays it graphically.
Gauss fitting function	Gaussian function fits the data within the specified range

- **Limitations**

There are limitations in measurements.

Item	Limitations
Number of measurements (Number of stored data)	Within 1-5000 times
Integration time	Within range 11-1000000usec(Specified by 1usec)
Average count (Average count per measurement)	Within 255 times

- **Save measurement data**

The data acquired in the Measure mode measurement can be saved.

Functions	Features
csv file format save	Readable in Microsoft Excel

5. Software

5-1. Software installation

- Please agree to the "Software License Agreement" before installing the software on your PC.
- Please install the evaluation software by logging in as a user with administrative privileges.

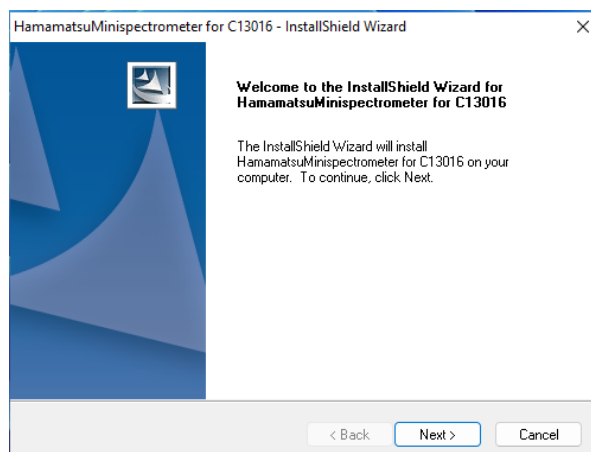
Software License Terms

Please read the following terms and conditions ("License Terms") carefully. Please read the following terms and conditions ("Terms and Conditions") carefully. Hamamatsu Photonics K.K. ("Hamamatsu", "we", "us", or "our") accepts these terms and conditions. (hereinafter referred to as "Hamamatsu") grants a license to use this software only to users of the mini-spectrometer evaluation software and software such as DLL files (hereinafter referred to as "the Software") who accept these License Terms and Conditions. By installing the Software or copying these files, the user agrees to be bound by these License Terms. If you do not agree to all or part of these terms and conditions, you may not install or use the Software.

1. Purpose of this software
This software is a control software licensed free of charge and without warranty, for the convenience of users who wish to use Hamamatsu Photonics mini-spectrometers (hereinafter referred to as "mini-spectrometers") in a simple manner. Use of this software is at the user's own risk and discretion.
2. license agreement
We grant the right to install and use this software only for the purpose of controlling the mini-spectrometer only to the user who agrees to these terms and conditions.
3. Attribution of Copyrights and Other Rights
All proprietary rights, intellectual property rights, and all other rights related to this software and accompanying documentation are reserved. This software is protected by copyright laws and other intellectual property laws and international treaties. The user may not alter or remove any rights notices attached to the software or accompanying documentation.
Except as expressly granted in these terms and conditions, we do not transfer or grant any rights to you, and all rights to the Software and accompanying documentation are reserved.
4. duplication
You may copy the Software for backup purposes, provided that you comply with all terms and conditions of this License.
5. prohibition clause
The User may not However, if the User transfers, leases or rents the mini-spectrometer to a third party and delivers the Software together with the mini-spectrometer to such third party, and such third party agrees to the terms and conditions of this License, we will continue to grant the third party a license to use the Software under the terms and conditions of this License.
 - (1) Sell or otherwise distribute this software to a third party, or advertise, display, use, reproduce, or conduct business for the purpose of selling or otherwise distributing this software to a third party.
 - (2) Transfer or sublicense the right to use this software to a third party.
 - (3) To lend, lease, or grant a security interest in the Software to a third party.
 - (4) To alter or remove all or part of the Software, including this License and other accompanying documents.
 - (5) reproduce, adapt, translate, reverse engineer, disassemble, decompile, or otherwise attempt to derive the source code of the Software, in whole or in part.
6. Limitation of Liability
We make no warranty of any kind regarding this software and accompanying documentation, including, but not limited to, its quality, performance, or fitness for a particular purpose. In no event shall we be liable for any computer failure or damage, loss of information, or any other direct or indirect damages resulting from the use or inability to use this software and accompanying documentation. We do not provide maintenance or support for this software, and we assume no responsibility for any malfunction or failure of this software, including but not limited to repair or modification of the software.
The software installation procedure is shown below. Be sure to follow these steps to install the software.
Insert the included CD-ROM into the CD-ROM drive. (Do not connect the drive circuit board set to the PC before installing the software.)

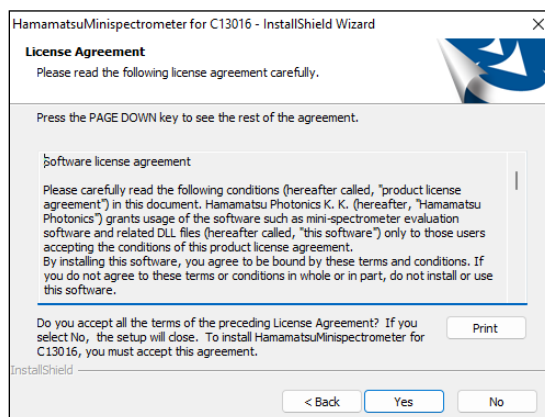
If CD autorun is enabled, the installation will start automatically when the original CD-ROM of the evaluation software is inserted into the CD-ROM drive. Click [drive:\Setup.exe] (where drive is the drive letter of the CD-ROM, or [D:\Setup.exe] if the CD-ROM is in the D drive) and click [OK].

The installer will start. Click [Next (N)].



Read through the license agreement to the end and click "Yes(Y)" only if you agree to the terms.

Note: If you do not agree to the license agreement, you will not be able to install the software.

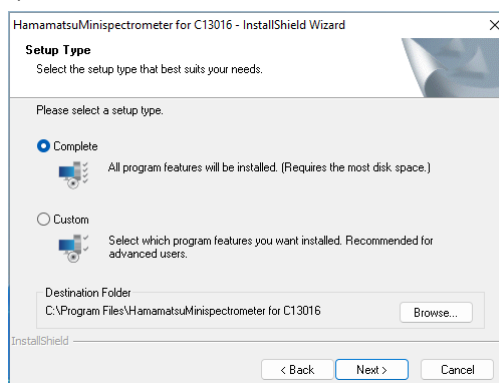


Select the components to be installed.

[Select "All (C)"] to install all components included in this version of the CD-ROM.

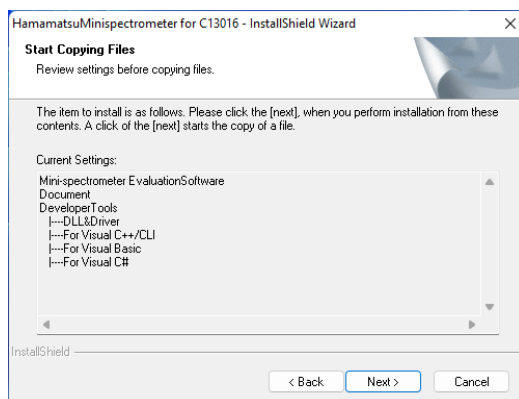
If you select [Custom], you can choose which components to install.

Normally, you should select "All (C)".

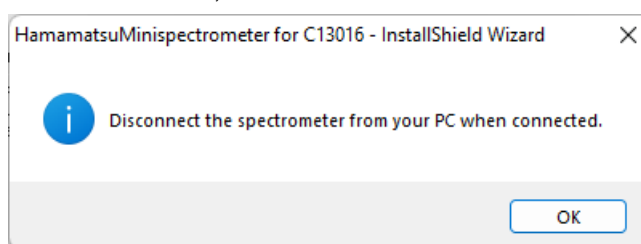


This is the confirmation screen before starting file copy. A list of components to be installed is displayed.

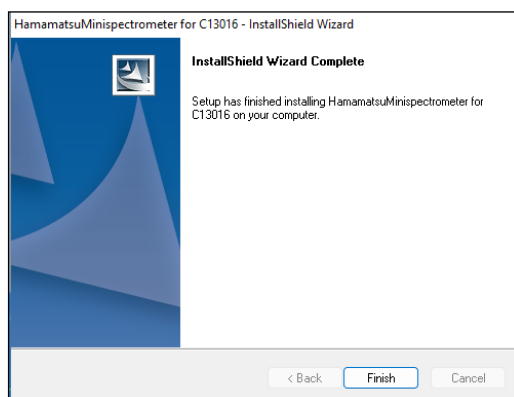
Click [Next (N)].



If the PC and mini-spectrometer are connected, disconnect them and click "OK."

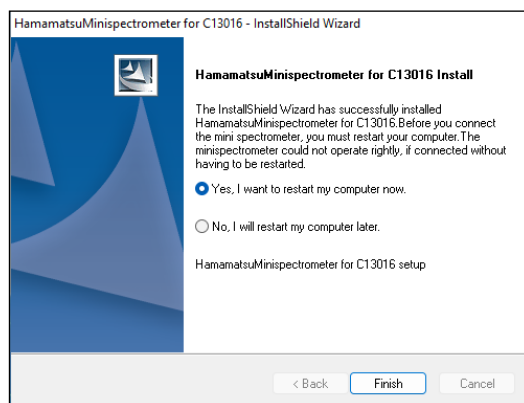


An installation completion message will appear. Click "Finish."



A confirmation screen for restart will appear.

[Select "Yes, I would like to restart my computer now."] and click "Finish."



Remove the CD-ROM from the CD-ROM drive of your PC.

5-2. Uninstalling Software

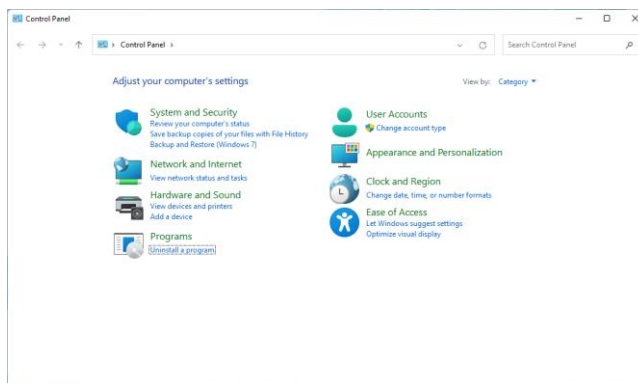
Uninstalling the software removes all installed components.

Below are the instructions for uninstalling the software. Be sure to follow the steps below to uninstall the software.

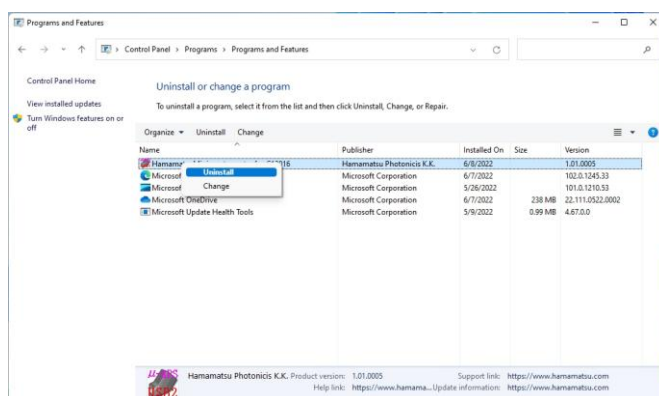
(device drivers are also uninstalled during software uninstallation)

[Open "Control Panel" by clicking on "Start Menu" → "Control Panel".

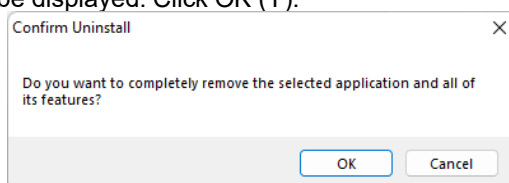
[Under "Control Panel," click "Uninstall a Program.



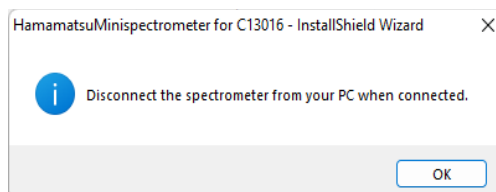
[Select "Hamamatsu Minispectrometer for C13016" and click "Uninstall".



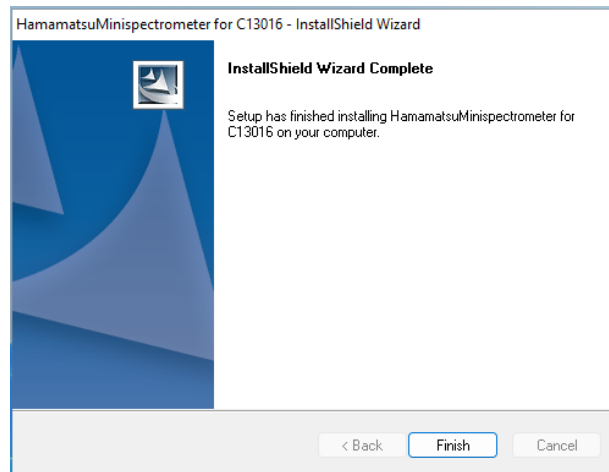
Confirmation of uninstallation will be displayed. Click OK (Y).



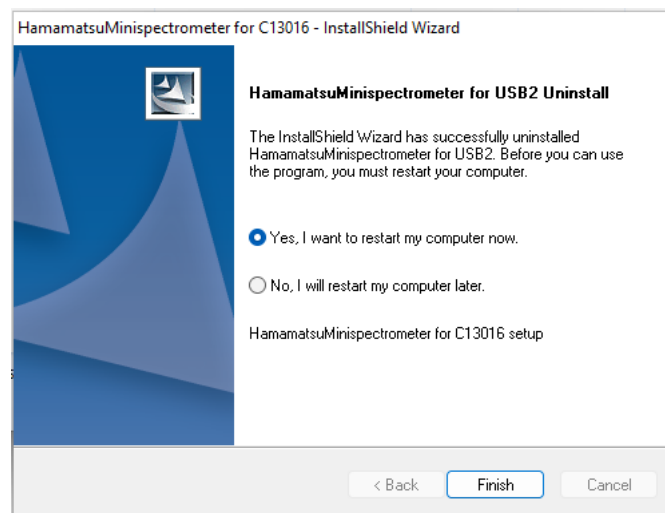
If the PC and mini-spectrometer are connected, disconnect them and click "OK.



When uninstallation is complete, the following screen will appear.

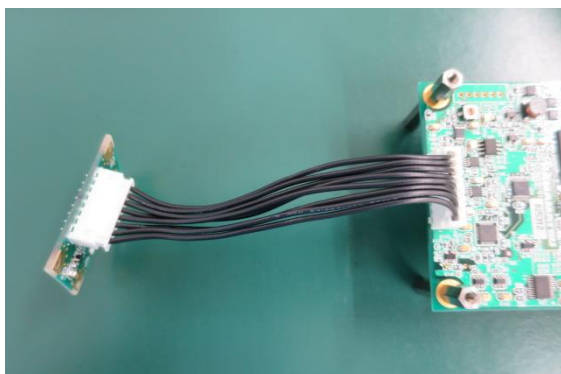


After uninstallation, ask for restart. [Yes, restart computer now.] and click [Finish].

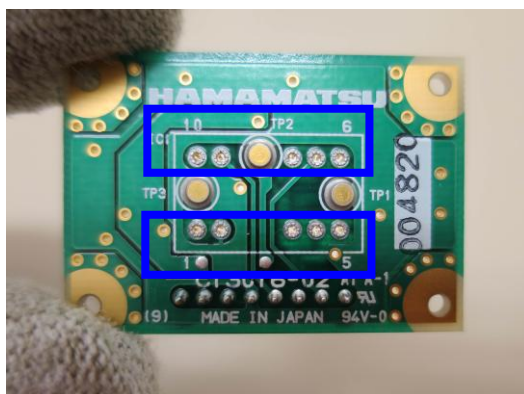


6. Equipment connection

Connect the driver circuit board to the sensor board using the board connection cable. At this stage, do not connect the USB cable to the driver circuit board; connecting the USB cable and proceeding with the work while power is supplied from the PC side may result in failure of the mini-spectrometer.



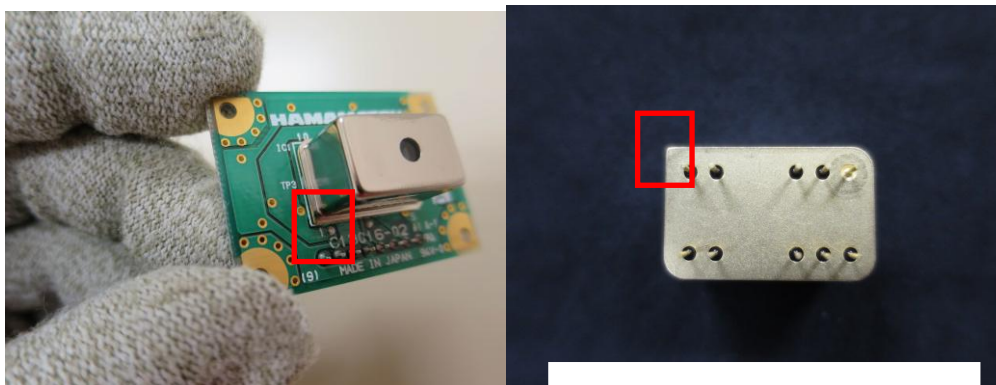
Hold the sensor board and check the through-hole and silk numbers indicated by the blue frame in the photo.



Align the index mark on the mini-spectrometer indicated by the blue frame in the photo with the number 1 (red frame) on the silk, and insert the mini-spectrometer terminal.

The mini-spectrometer should be inserted and removed from the sensor board no more than 30 times.

If the number of insertions and removals exceeds the specified number of times, the mini-spectrometer may have difficulty being fixed to the sensor board.



C12880MA Bottom side

Connect the B plug of the USB cable to the USB connector on the drive circuit board.

*At this point, do not supply power to the drive circuit board from the PC.



Connect the A plug of the USB cable to the PCB port where Windows is running.



Launch the evaluation software on the PC.

***The initial setting contains the provisional coefficient for the C12880MA. It is significantly different from the wavelength conversion coefficient for the C16767MA.**

Please set the wavelength coefficient attached to the mini-spectrometer before using it.

For information on how to set the wavelength coefficient, please refer to the "Wavelength Conversion Coefficient Editing Screen" section.

When disconnecting the device, follow the connection procedure in reverse.

7. How to use the evaluation software

7-1. Main Screen

Main screen is displayed data and information, measurement operations, and setting dialogs are called.

Main screen is displayed after boot of evaluation software and after completion of Wavelength conversion coefficients edit screen.

Main screen has main menus and various toolbars.

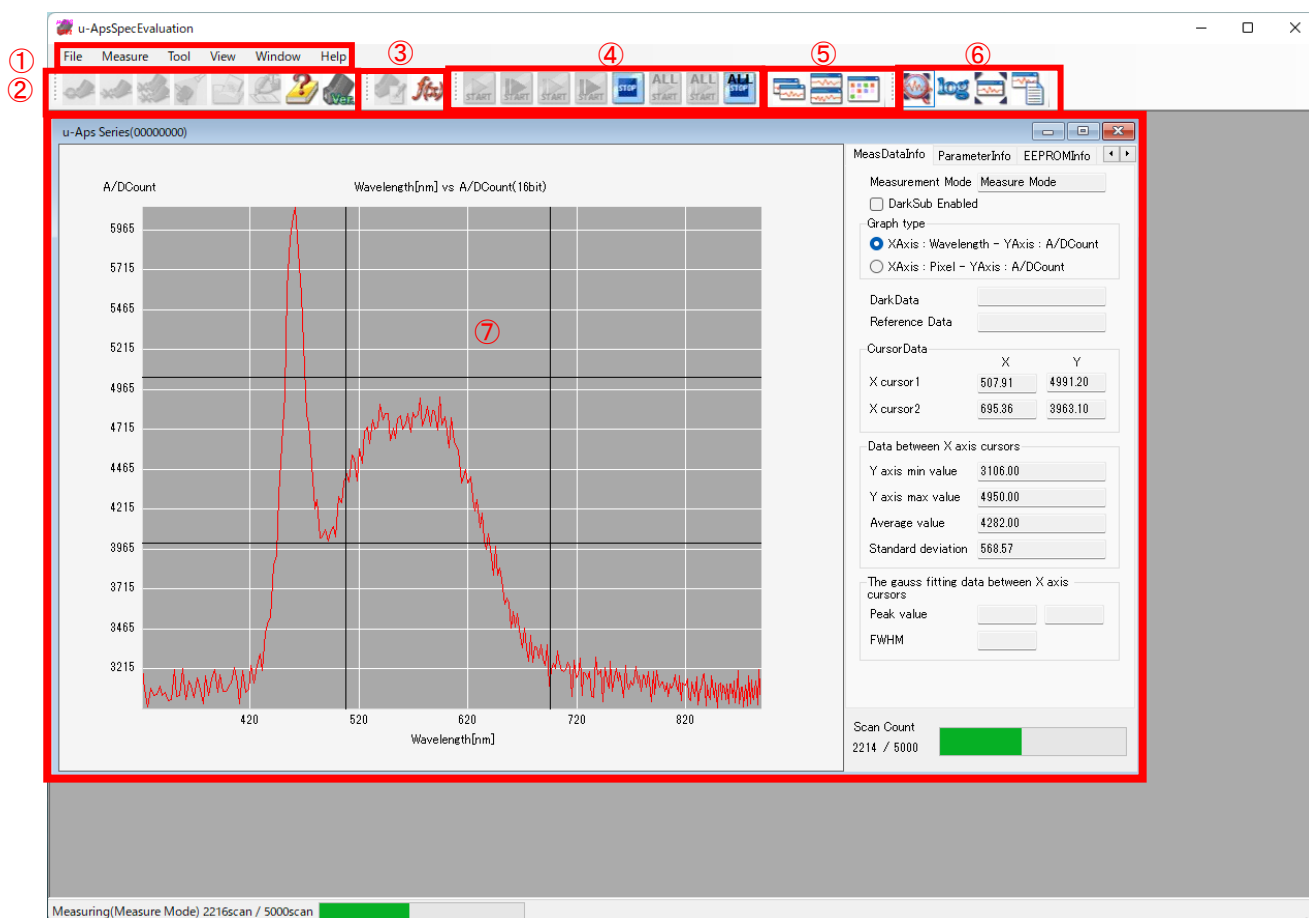
There is ▼ next to various toolbar icons. It is possible to execute it by selecting one from among two or more several similar commands. Please select it from the list displayed by clicking ▼. Various toolbars are changed in floating state by dragging them.

Moreover, show/hide of various toolbars can be set through [View] of main menu.

Graphically displays measurement data of opened spectrometer in main screen.

Here is the name and explanation of each part of the main screen of the evaluation software.

screen of evaluation software



① Main Menu

Main menu contains [File], [Measurement], [Tool], [View], [Help]. Meaning of each item is described below.

Menu	Command	Use to:	Toolbar button	
File	Open spectrometer	Open connected spectrometer.	Main toolbar	
	Close spectrometer	Close connected spectrometer.	Main toolbar	
	Close all spectrometers	Close all spectrometers.	Main toolbar	
	Update list	Update or refresh list of connected spectrometers on the USB bus.	Main toolbar	
	Read data file	Reads measurement data, dark data and reference data file	Main Toolbar	
	Save text data	Saves acquired measurement data	Main Toolbar	
	Close Application	Closes Application		—
Measurement	Start monitor measurement	Starts monitor measurement	Measurement Toolbar	
	Reference measurement	Start reference measurement	Measurement Toolbar	
	Start measure measurement	Starts measure measurement	Measurement Toolbar	
	Dark measurement	Start dark measurement	Measurement Toolbar	
	Stop measurement	Stops measurement	Measurement Toolbar	
Tool	Parameter setting	The measurement parameter is set.	Function Toolbar	
	Operation	Use operation function	Function Toolbar	
	Auto zoom	Uses auto zoom	Graph Toolbar	
	Vertical axis logarithm display	Converts Vertical axis to logarithm display	Graph Toolbar	
	Return to initial display	The graph display area is returned to the initial state.	Graph Toolbar	

	Graph information	Graph information is display.	Graph Toolbar	
View Window	Main toolbar display	Show/Hide of the main toolbar is specified.		
	Measurement toolbar display	Show/Hide of the measurement toolbar is specified.		_____
	Toolbar display	Show/Hide of the toolbar is specified.		_____
	Window toolbar display	Show/Hide of the window toolbar is specified.		_____
	Graph toolbar display	Show/Hide of the graph toolbar is specified.		_____
	Cascade	Display graph windows so they overlap and the title bar of each window is visible.	Window toolbar	_____
Help	Tile	Display graph windows vertically or horizontally so they do not overlap.	Window toolbar	
	Arrange icons	Arrange graph windows when in icon mode.	Window toolbar	
	System information/Setting Display	Displays system information/ Setting	Main Toolbar	
File	Version information...	Displays version information	Main Toolbar	
	Open spectrometer	Open connected spectrometer.	Main toolbar	

② Main Toolbar

It contains icon menu of data read, data save, help.



③ Measurement Toolbar

It contains Start/Stop Icon menu.



④ Function Toolbar

It contains icon menus of parameter setting, operation setting and calculating setting.



⑤ Window Toolbar

This toolbar contains icon buttons for displaying graph windows (graph information window, device information window) and setting the graph window display method.



⑥ Graph Toolbar

Icon menu of graph movement, auto zoom, Y axis logarithmic display is used.

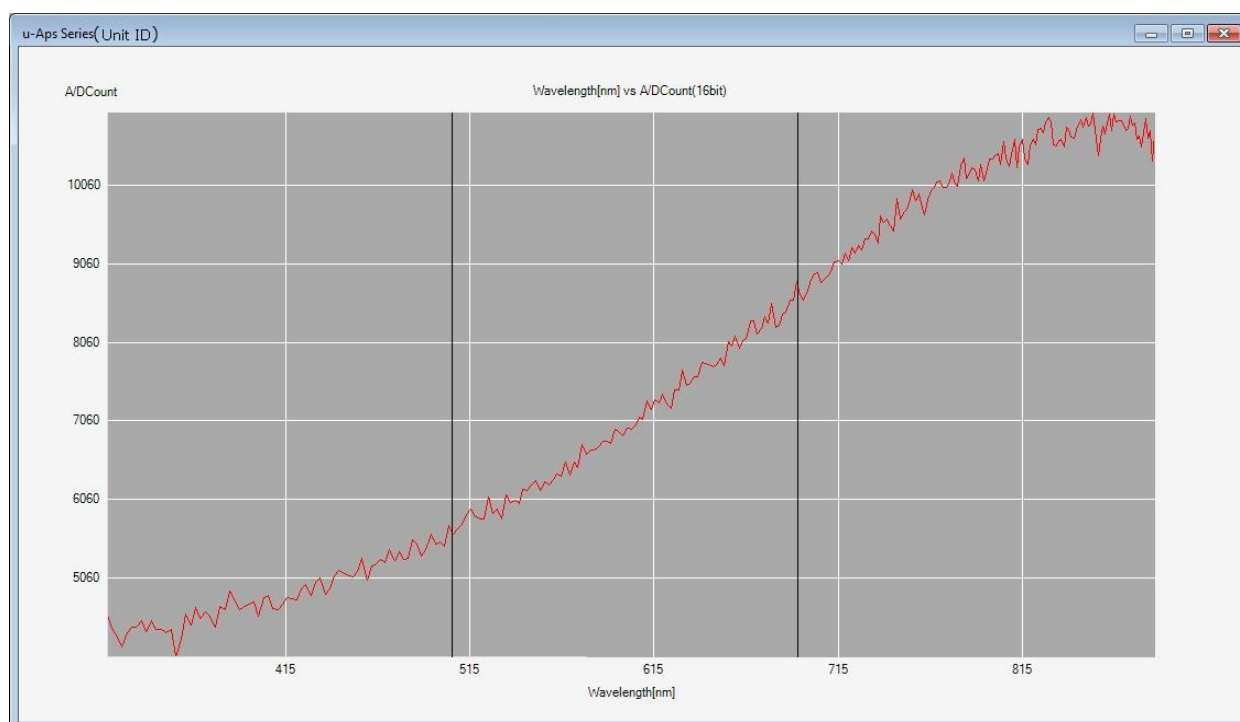


⑦ Graph Window

It shows measurement data graph and various data.

○Graph

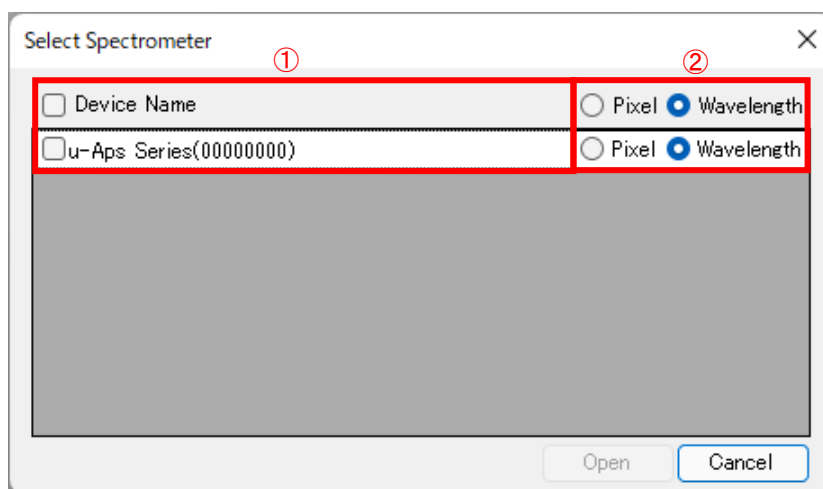
Graph shows raw data retrieved from image sensor. The horizontal axis represents the wavelength of the sensors, or pixels and the vertical axis represents the image sensor output A / D count values. Scan Count below the graph displays the number of measurements from start.



7-2. Selection dialog to open spectrometer

Mini-spectrometer which is to be used is opened through this selection dialog. Only opened spectrometer can be controlled by the software.

The SelectSpectrometer operations can be displayed by clicking  from main toolbar or selecting [File]→[Open spectrometer] from the main menu of the main screen. It specifies the type of graph to be displayed at the time of opening. Here is the explanation of name and description of all parts of the screen to open the selection of the spectrometer.



① Spectrometer (Unit ID)

A list of spectrometers currently connected to the PC is displayed in the combo box.

It is possible to select by checking the spectroscopy name to be used.

② Type of graph

Select the type of graph to display. By default, [Wavelength] is selected.

If the wavelength information of the spectrometer is not valid data, [Pixel] is selected by default.

Select the desired graph function.

7-3. Wavelength conversion coefficients edit screen

It is the screen where wavelength conversion coefficients are edited.

This is displayed immediately after evaluation software starts.

Here is the explanation of each part name of Wavelength conversion coefficients edit screen.

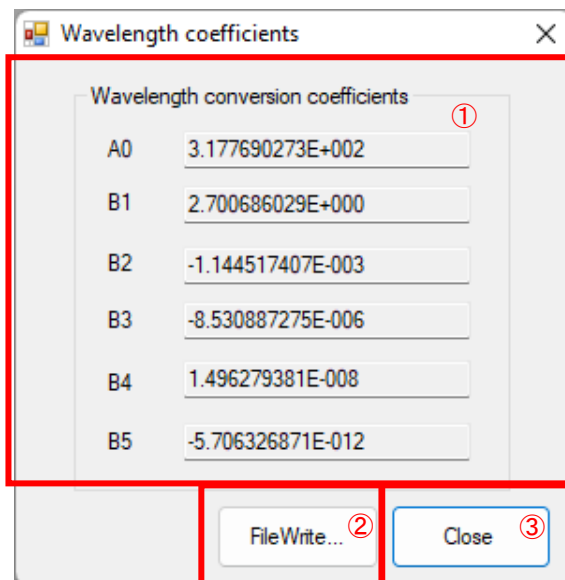
- ① Wavelength conversion coefficients
Wavelength conversion coefficients of current evaluation software are displayed.
- ② FileWrite
Wavelength conversion coefficients file of edit box of A0-B5 is written in wavelength conversion coefficients file.
Please refer to Write wavelength conversion coefficients file for detailed information.
- ③ FileRead
Wavelength conversion coefficients file is read and displayed in A0-B5 edit boxes.
Please refer to Read wavelength conversion coefficients for detailed information.
- ④ Clear
Clears A0-B5 edit boxes.
- ⑤ Close
Main screen is displayed and main screen is closed when Close button is pressed.

7-4. Wavelength conversion coefficients write screen

Wavelength conversion coefficients write screen is a screen which writes to current EEPROM or wavelength conversion coefficients file.

It is displayed at the end of Main Screen.

Here is the explanation of each part name of Wavelength conversion coefficients write screen.



① Wavelength conversion coefficients

Wavelength conversion coefficients of current evaluation software are displayed in read only.

② FileWrite

Wavelength conversion coefficients of edit box of A0-B5 are written in wavelength conversion coefficients file. Please refer to Write wavelength conversion coefficients file for detailed information about wavelength conversion coefficients file write.

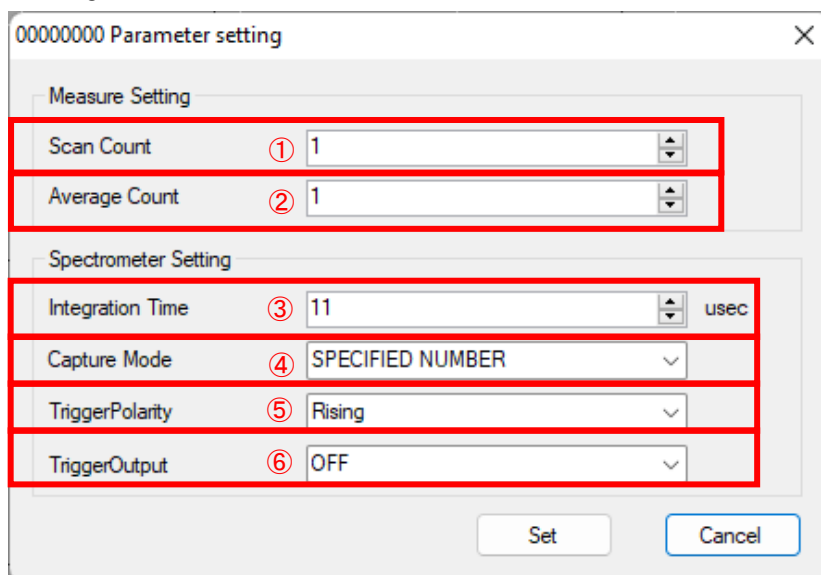
③ Close

Wavelength conversion coefficients write screen is closed and application is ended.

7-5. Parameter setting screen

Parameter setting screen is used to set operating parameters of spectrometer. In

measurement stopped condition, this screen can be displayed by clicking  of [Function Toolbar] or by selecting [Tool] → [Parameter setting] from main menu of main screen. Here is the explanation about each part and name of parameter setting screen.



① Scan Count

Specifies measurement count of measure measurement. Possible range of measurement count is 1-5000. The numerical value can be increased and decreased by clicking a right arrow. It is also possible to input the numerical value directly by keyboard.

② Average Count

The evaluation software will display one profile (spectrum data) after averaging the data over the specified number of scans. Specify the averaging count in the range from 1 to 255.

You can select the desired count from the drop-down list of the combo box that appears by clicking the small down arrow (▼).

③ Integration Tim

Specify the accumulation time in the range from 11 to 1000000 μs in 1 μs steps. You can select the desired time from the drop-down list of the combo box that appears by clicking the small down arrow (▼). You can also directly enter a desired time from the keyboard, even if it is not listed in the combo box

④ Capture Mode^{*1}

Select the Capture Mode (SPECIFIED NUMBER or TRIGGER) from the drop-down list.

⑤ Trigger Polarity^{*2}

Select the Trigger Polarity (Rising or Falling) from the drop-down list.

⑥ Trigger Output^{*3}

Select the Trigger Output (OFF or ON) from the drop-down list.

*1

SPECIFIED NUMBER mode

Mini spectrometer measures in set integration time by a PC.

The data is sent by measurement to the PC.

Data is shown to screen of a PC. After showing data to a screen.

Mini spectrometer begins to measure again. This is repeated measurement count.

TRIGGER mode

Mini spectrometer measures in set integration time by a PC.

The timing mini spectrometer begins to integration is synchronous with a trigger input signal.

Unless a trigger input signal is input, integration of mini spectrometer isn't begun.

The data is sent by measurement to the PC.

Data is shown to screen of a PC. After showing data to a screen.

Even if this whole period inputs a trigger input signal, mini spectrometer doesn't integration.

After showing data to a screen, mini spectrometer begins to measure again.

This is repeated measurement count.

*2

Trigger polarity when being a SPECIFIED NUMBER mode, changes polarity of trigger output.

Trigger polarity when being a TRIGGER mode, changes polarity of trigger input.

*3

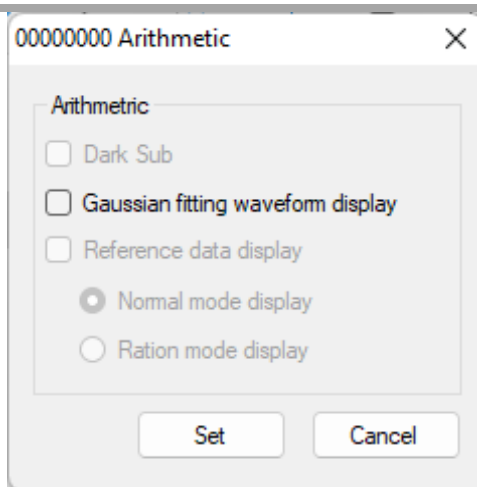
It's able to establish trigger output on at SPECIFIED NUMBER mode. Trigger output will be invalid state, and it can't be set at TRIGGER mode.

7-6. Calculation function screen

Operation function screen is used to set useful operation function for measurement.

This screen can be displayed by clicking  of [Function Toolbar] or by selecting [Tool] → [Operation] from main menu of main screen. This screen has dark subtraction and gauss fitting function and reference data display function (Normal display, Ratio display). Select the required function by adding check mark.

Please refer to Operation function for the details of operation function.



7-7. Measurement Mode

This evaluation software provides two modes of measurements.

This topic describes measurement mode introduction, characteristic of measurement mode and explains how to use them.

Monitor Mode measurement

Monitor mode will display only measured data graph without storing data in memory.

If you want to see output in real time graph or want to observe long time output, this mode is suitable.

Measurement procedure:

Startup procedure

To start measurement click  of [Measurement Toolbar] or select [Measure]→[Start Monitor mode] from main menu of main screen.

Stop procedure

To stop measurement click  from [Measurement Toolbar] or select [Measure]→[Stop Monitor mode] from main menu of main screen.

Measure Mode measurement

Measure mode displays measured data and stores that data in memory. This mode is suitable in the cases like you want to see output value in real time graph and also want to analyze data after measurement. Once the measurement data stored in the memory, data is stored temporarily at the time of evaluation software ends.

Measurement procedure:

Startup procedure

Click  from [Measurement Toolbar] or select [Measure]]→[Start measure mode]

Stop procedure

Automatically stops after reaching specified measurement count. It is also possible to stop measurement before reaching the specified number of scans.

To stop measurement click  or select [Measure]→[Stop measurement] from main menu of main screen. In that case data measured upto that point is valid data.

Dark Mode measurement

The dark subtraction function becomes available after measuring dark data in Dark mode. We strongly recommend that you measure this dark data just after this evaluation software starts.

When the integration time or gain setting is changed, the dark data also varies. So you must measure new dark data again when using the dark subtraction function.

Measurement Procedure:

Start method

Click the  button on the Measurement toolbar or select "Start Dark mode" from the "Measure" menu in the main window.

. Stop method

Dark measurement automatically stops when the specified scan count is reached. But you can stop the

measurement any time before the specified scan count is reached. To stop the measurement, click the  button or select "Stop" from the "Measure" menu in the main window. The data that has been measured up to that point will be effective. Dark data will then be created by averaging the obtained data.

Reference Mode measurement

This mode allows you to measure reference data that is used as comparison criterion. After measuring this reference data, both measurement data and reference data can be displayed. When the integration time*1 or gain*2 setting is changed, the measurement conditions vary as well. So you must measure the new reference data again when using the reference data.

Measurement Procedure:

Start method

Click the  button on the measurement toolbar or select "Start Reference mode" from the "Measure" menu in the main window.

Stop method

Measurement automatically stops when the specified scan count is reached. But you can stop the

measurement any time before the specified scan count is reached. To stop the measurement, click the  button or select "Stop" from the "Measure" menu in the main window. The data that has been measured up to that point will be effective. Reference data will then be created by averaging the obtained data.

7-8. Graph operations



Graph toolbar

AutoZoom

An auto zoom is automatically adjusts range of vertical axis of graph to minimum and maximum range.

Click  of [graph Toolbar] or select [Tool]→[Auto Zoom] from main menu of main screen.

Vertical axis logarithm display

Vertical axis display changes to logarithm display.

Click  of [Graph Toolbar] or select [Tool]→[Log Scale] from main menu of main screen.

Reset graph display to initial state

Graph modified by [Zoom],[Move position], etc is returned to initial state.

Click  of [Graph Toolbar] or select [Tool]→[Reset Graph] from main menu of main screen.

Graph Information

Graph information is display.

Click  of [Graph Toolbar] or select [Tool]→[Graph Information] from main menu of main screen.

• MeasDataInfo

Measurement information is display.

The screenshot shows the 'MeasDataInfo' window with the following settings and callouts:

- ① Measurement Mode: Monitor Mode
- ② DarkSub Enabled: ☐
- ③ Graph type:
 - ☒ XAxis : Wavelength - YAxis : A/DCount
 - ☐ XAxis : Pixel - YAxis : A/DCount
- ④ DarkData: [Empty text box]
- ⑤ Reference Data: [Empty text box]
- ⑥ CursorData:

	X	Y
X cursor1	507.91	3145.14
X cursor2	695.36	3037.90
- ⑦ Data between X axis cursors:

Y axis min value	2934.00
Y axis max value	3228.00
Average value	3073.77
Standard deviation	70.89
- ⑧ The gauss fitting data between X axis cursors:

Peak value	[Empty text box]	[Empty text box]
FWHM	[Empty text box]	

① Measurement Mode

Shows the currently selected measurement mode.

Tip: For more information about measurement modes, see Measurement Modes.

② DarkSub Enabled

Display data is darksub enabled

③ Graph type

Allows selecting the graph type that is displayed in the graph window.

Click the option button for the desired graph type.

④ DarkData

Shows information on the currently retained dark data.

Shows "Data nothing" if no dark data is retained.

⑦ Reference data

Shows information on the currently retained reference data.

Shows "Data nothing" if no reference data is retained.

⑧ Cursor data

Shows the data at each cursor position displayed on the graph window.

⑥ Data between X-axis cursors

Shows typical statistical data in the area enclosed by graph cursors

⑦ Gaussian fitting data between X-axis cursors

Shows Gaussian fitting data information when the "Gaussian fitting waveform display" check box in the "Arithmetic Functions" dialog box is selected.

TIP: For detailed information on the Gaussian fitting waveform display, see "Gaussian fitting waveform display".

•ParameterInfo

Parameter information is display.

MeasDataInfo	ParameterInfo	EEPROMInfo	W	◀	▶
Scan Count	1				
Average Count	1				
Capture Mode	SPECIFIED NUMBER				
Integration Time[usec]	11				
Trigger Polarity	Rising				
Trigger Output	OFF				

EEPROMInfo

EEPROM information is display.

Wavelength conversion coefficients	
A0	3.177690273E+002
B1	2.700686029E+000
B2	-1.144517407E-003
B3	-8.530887275E-006
B4	1.496279381E-008
B5	-5.706326871E-012

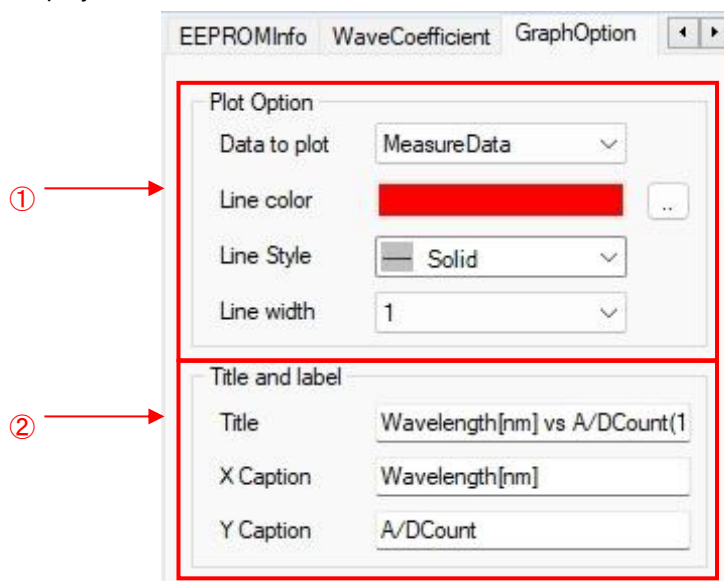
WaveCoefficients

Wavelength conversion coefficients of the application and wavelength conversion coefficients of the EEPROM are display.

	Application	EEPROM
A0	3.177690273E+002	3.177690273E+002
B1	2.700686029E+000	2.700686029E+000
B2	-1.144517407E-003	-1.144517407E-003
B3	-8.530887275E-006	-8.530887275E-006
B4	1.496279381E-008	1.496279381E-008
B5	-5.706326871E-012	-5.706326871E-012

Graph option

Graph option is display.



① Plot option

Allows setting the line color, width and marker that are used to draw a waveform in the graph window. Select the desired setting from each drop-down list that appears by clicking the down arrow (▼).

② Title and label

Allows setting the title and labels for the graph.

Enter the title and labels as needed from the keyboard.

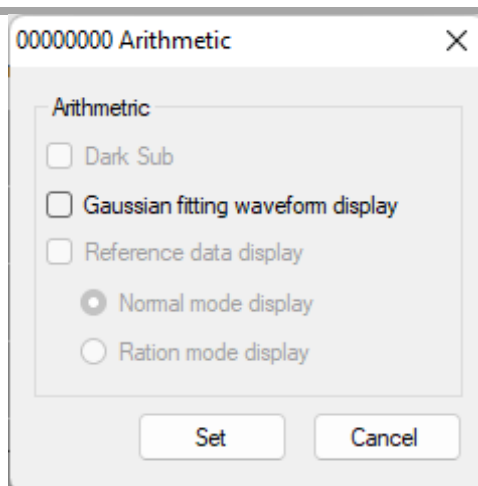
7-9. Operation Function

This evaluation software uses several operation function during measurement. This topic describes how to use operation function provided by this evaluation software.

Following operation function is used by this evaluation software.

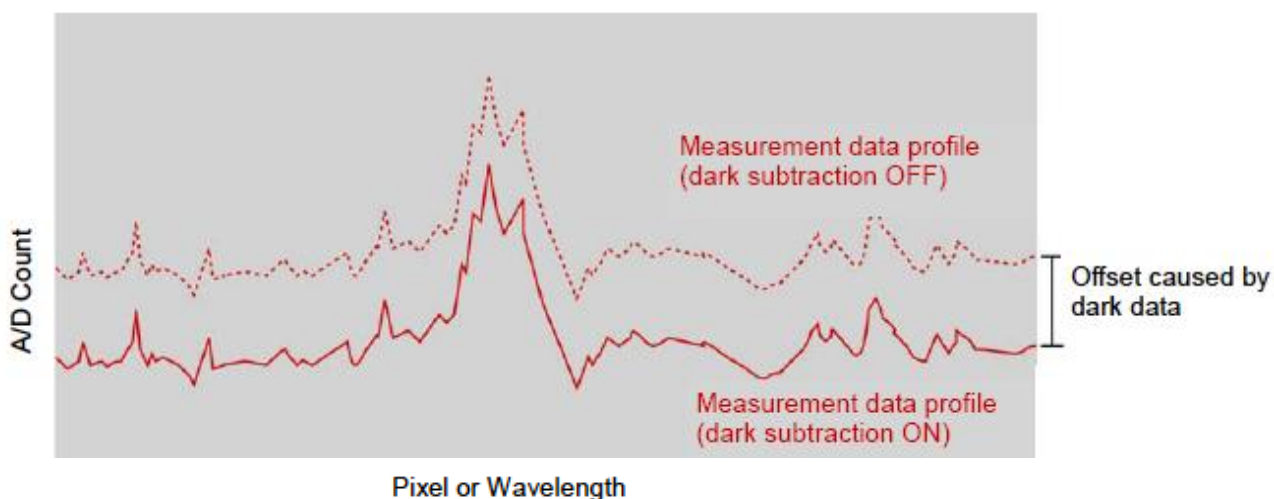
Function name		Function detail
Dark subtraction		Subtracts dark data (acquired beforehand) from the currently measured data. This function is not available if dark data has not yet been acquired. This function is not available if dark data has not yet been acquired.
Reference data display	Normal mode display	Displays reference data along with the currently measured data. This function is not available when reference data has not yet been acquired.
	Ratio mode display	Displays the ratio of the measurement data (transmittance, reflectance) to reference data. This ratio is calculated as follows. $\text{Currently measured data profile} / \text{Reference data profile} \times 100$. This function is not available if reference data has not yet been acquired.
Gaussian fit waveform display		Fitting is performed by gauss function for the area enclosed by cursor. Shows current measurement profile with fitting result.

Operation function setting is done by following screen. Select [Tool]→[Operation] from main menu of main screen to get this screen.



Dark sub

It is a function which subtracts dark offset from a present measurement profile by using the sensor dark reference pixel value. Please select following offset according to dark.



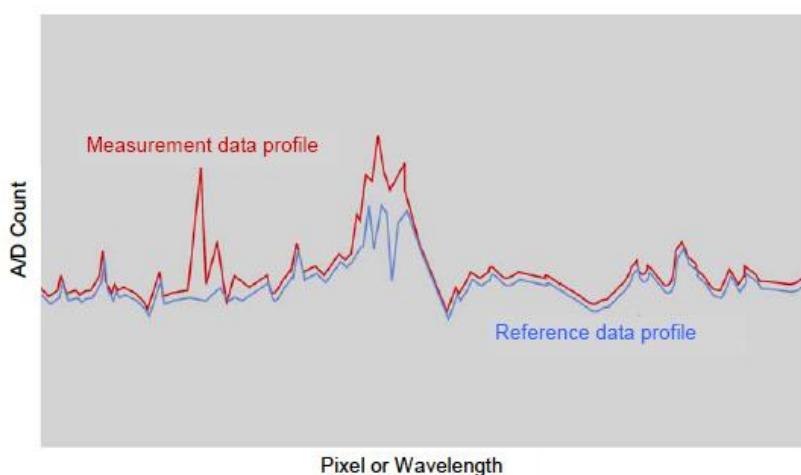
Displaying Reference data

This function displays the currently measured data profile along with premeasured reference data profile.

There are two methods for reference data display: Normal mode display and ratio mode display

[Normal mode display]

Displays reference data and measurement data simultaneously. An example is shown below. The blue plot represents the reference data profiles and the red plot represents the currently measured data profile. The reference data profile is shown in blue on the actual software display. This function is useful for comparing currently measured spectrum data with reference data to see how it changes.

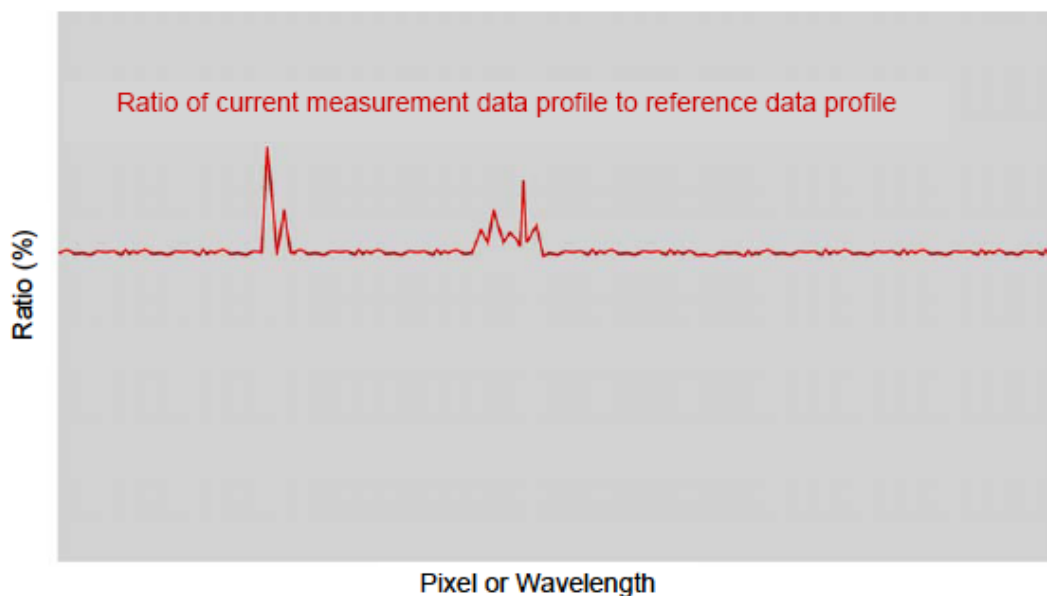


- [Ratio mode display]

Displays a data profile indicating the ratio of current measurement data profile (transmittance or reflectance) to reference data profile. This ratio profile is defined as follows:

$$\text{Ratio profile} = \text{Currently measured data profile} / \text{Reference data profile} \times 100 [\%]$$

The ratio mode display is useful for checking the transmission or reflection ratio versus the reference data. The graph below shows a ratio profile created from the profile data shown above in the normal mode.



Waveform Display

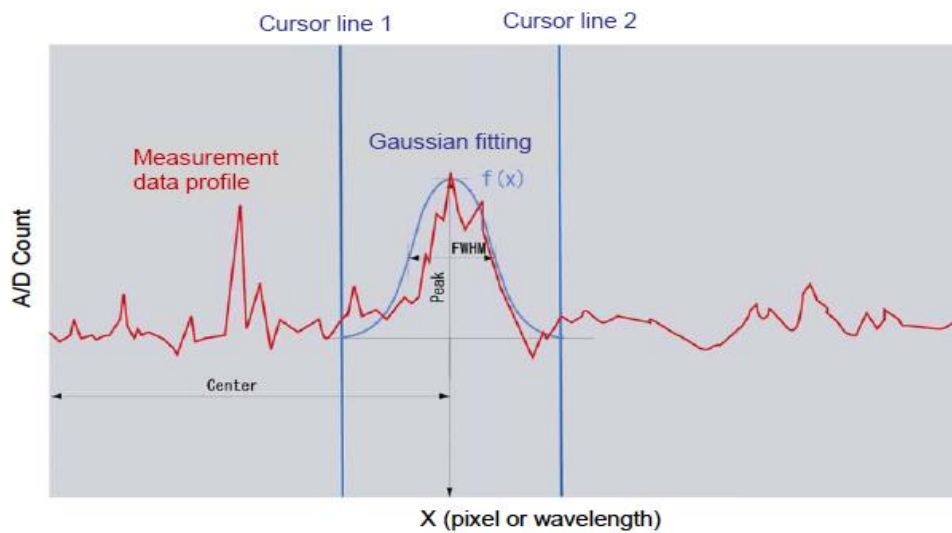
Fitting is performed by gauss function for the area enclosed by cursor and Shows current measurement profile with fitting result. The following Gauss functions are used for the fitting.

$$f(x) = C_0 + C_1x + C_2 \exp \left\{ - \left(\frac{x - C_3}{C_4} \right)^2 \right\}$$

Here, C_0 - C_4 is a coefficients obtained by the fitting. x shows the value of a horizontal axis(pixel or wavelength) in the graph.

This function is used to get exact peak position from the spectrum retrieved by measurement

The following figure shows an example. In figure, red color shows current measure profile and blue color shows gauss fit results based on measured profile data enclosed by a cursor. When graph fit is effective, acquired gauss fit data is displayed on 'Measure data information' tab time to time.



7-10. Save Measurement data

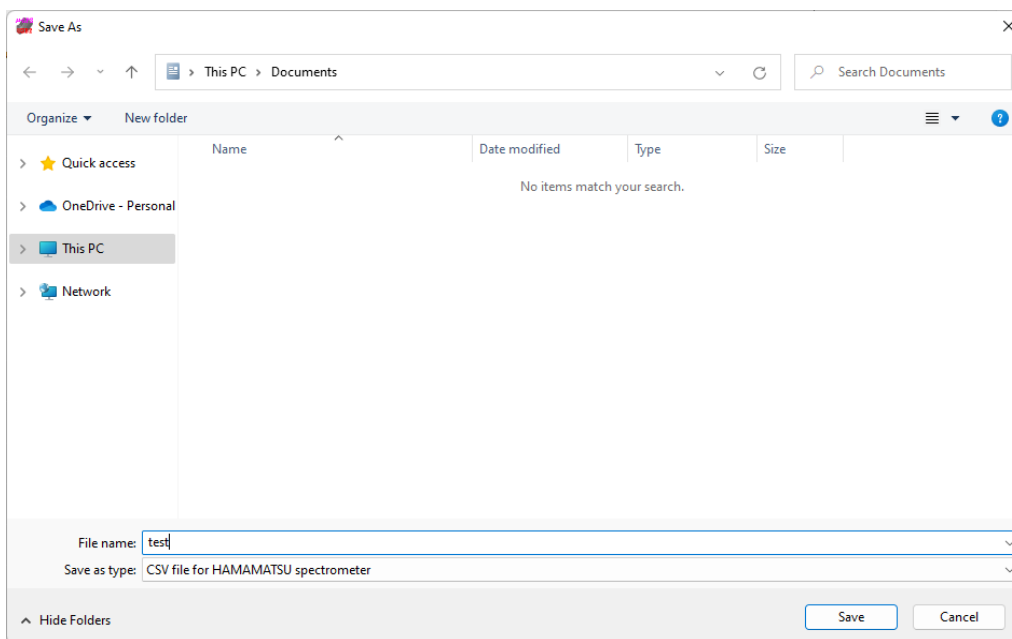
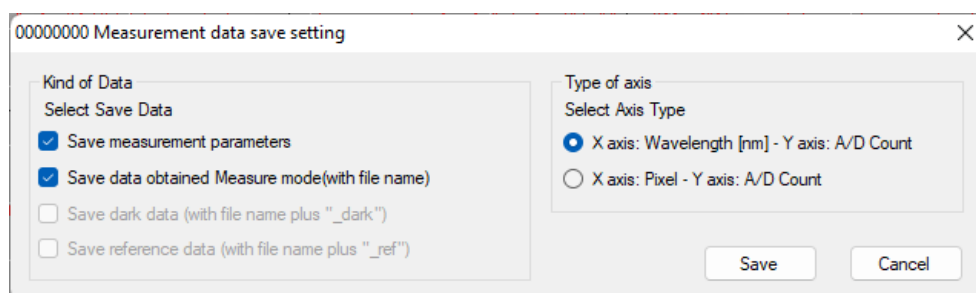
This evaluation software can save measurement data as a text data in a file. Here is the explanation about data save method, format and important points.

Save Text data

In measure measurement, acquired measure data can be saved as text data in a file. Text data can be saved in CSV format which can be read in Microsoft excel also, so it is easier to perform processes like reading stored data in excel, graphing, carrying out operations etc.



Click of [Main Toolbar] or select [File]→[Save Data File] from main menu of main screen. Dialog displayed, please specify the type of data, and horizontal axis data. The following dialog box then appears. Please set name and place of file to save in File Dialog and then click [Save(S)] button.



Text data Types

There are 3 types of text data to be saved Measure, Dark, Reference.

These are stored in the CSV file format.

The files that can be generated when saving are listed below.

File name specified in File name box	File name	File is created when:	Contents
File_name	File_name.csv	If you have data	Measure data
	File_name_dark.csv	If you have dark data	Dark measure data
	File_name_ref.csv	If you have reference data	Reference measure data

Example: If you save all data under a file name of "test" after making measurements in Dark, Reference and Measure modes.

The following 3 files are created.

File name	Content
test.csv	Measure data
test_dark.csv	Dark measure data
test_ref.csv	Reference measure data

Data format of each file is shown below.

The first row in each CSV file indicates the pixel number or wavelength, depending on which was selected as the horizontal axis data form.

File_name.csv

pixel ,	Average,	1 ,	2	3	4	...	MAX_SCAN-1 ,	MAX_SCAN	LF
1,	XXX ,	XXX ,	XXX ,	XXX ,	XXX ,	...	XXX ,	XXX	LF
2,	XXX ,	XXX ,	XXX ,	XXX ,	XXX ,	...	XXX ,	XXX	LF
3,	XXX ,	XXX ,	XXX ,	XXX ,	XXX ,	...	XXX ,	XXX	LF
...	...	...	...	...	...	...	XXX ,	XXX	LF
287,	XXX ,	XXX ,	XXX ,	XXX ,	XXX ,	...	XXX ,	XXX	LF
288,	XXX ,	XXX ,	XXX ,	XXX ,	XXX ,	...	XXX ,	XXX	LF

XXX...A/D count value acquired during measurement

MAX_SCAN...Scan count you specified

LF...Line feed

File_name_dark.csv

pixel ,	Average,	1 ,	2	3	4	...	MAX_SCAN-1 ,	MAX_SCAN	LF
1,	XXX ,	XXX ,	XXX ,	XXX ,	XXX ,	...	XXX ,	XXX	LF
2,	XXX ,	XXX ,	XXX ,	XXX ,	XXX ,	...	XXX ,	XXX	LF
3,	XXX ,	XXX ,	XXX ,	XXX ,	XXX ,	...	XXX ,	XXX	LF
...	...	...	...	...	...	...	XXX ,	XXX	LF
287,	XXX ,	XXX ,	XXX ,	XXX ,	XXX ,	...	XXX ,	XXX	LF
288,	XXX ,	XXX ,	XXX ,	XXX ,	XXX ,	...	XXX ,	XXX	LF

XXX...A/D count value acquired during measurement

MAX_SCAN...Scan count you specified

LF...Line feed

File_name_ref.csv

pixel ,	Average,	1 ,	2	3	4	...	MAX_SCAN-1 ,	MAX_SCAN	LF
1,	XXX ,	XXX ,	XXX ,	XXX ,	XXX ,	...	XXX ,	XXX	LF
2,	XXX ,	XXX ,	XXX ,	XXX ,	XXX ,	...	XXX ,	XXX	LF
3,	XXX ,	XXX ,	XXX ,	XXX ,	XXX ,	...	XXX ,	XXX	LF
...	...	...	...	...	...	...	XXX ,	XXX	LF
287,	XXX ,	XXX ,	XXX ,	XXX ,	XXX ,	...	XXX ,	XXX	LF
288,	XXX ,	XXX ,	XXX ,	XXX ,	XXX ,	...	XXX ,	XXX	LF

XXX...A/D count value acquired during measurement

MAX_SCAN...Scan count you specified

LF...Line feed

File_name.txt

```

UnitID = xxxxxxxx LF
SerialNo = xxxxxxxx LF
Date = xxxx/xx/xx xx:xx:xx LF
Integration=xx LF
CaptureMode = xxxxLF
A0 = x LF
B1 = x LF
B2 = x LF
B3 = x LF
B4 = x LF
B5 = x LF
Averaging = x LF
TriggerPolarity = x LF
TriggerOutput = x LF

```

Item	Meaning
UnitID	Unit id
SerialNo	Serial number
Date	File save date
Integration	Integration time
CaptureMode	Capture mode
A0	Zero-order coefficients of quintic equation for pixel-to-wavelength conversion
B1	1st-order coefficients of quintic equation for pixel-to-wavelength conversion
B2	2nd-order coefficients of quintic equation for pixel-to-wavelength conversion
B3	3rd-order coefficients of quintic equation for pixel-to-wavelength conversion
B4	4rd-order coefficients of quintic equation for pixel-to-wavelength conversion
B5	5rd-order coefficients of quintic equation for pixel-to-wavelength conversion
Averaging	Average count
TriggerPolarity	Trigger polarity
TriggerOutput	Trigger output

Guidelines for saved text data

This spectrometer configured as light receiving image sensor of multiple optical devices at grating spectrometer. This mini-spectrometer uses a multi-element (256 valid pixels) linear image sensor that detects a spectrum formed by the grating..Therefore acquired data becomes A/D conversion value for each pixel of image sensor.

Each corresponding pixel and wavelength of image sensor is shown in the following approximation formula using 5 degrees.

$$wavelength[nm]=A0+B1pix+B2pix^2+B3pix^3+B4pix^4+B5pix^5$$

Note)Pix is arbitrary pixel(1-) of the image sensor.

Moreover, in this case it is not necessary that calculated value is integer value. Considering only the values calculated by the simple approximation, please note that there will be some difference in values compared to known values of emission.

While saving data, each coefficients of a₀-a₅ is recorded in measurement parameter file.

7-11. Read measurement data file

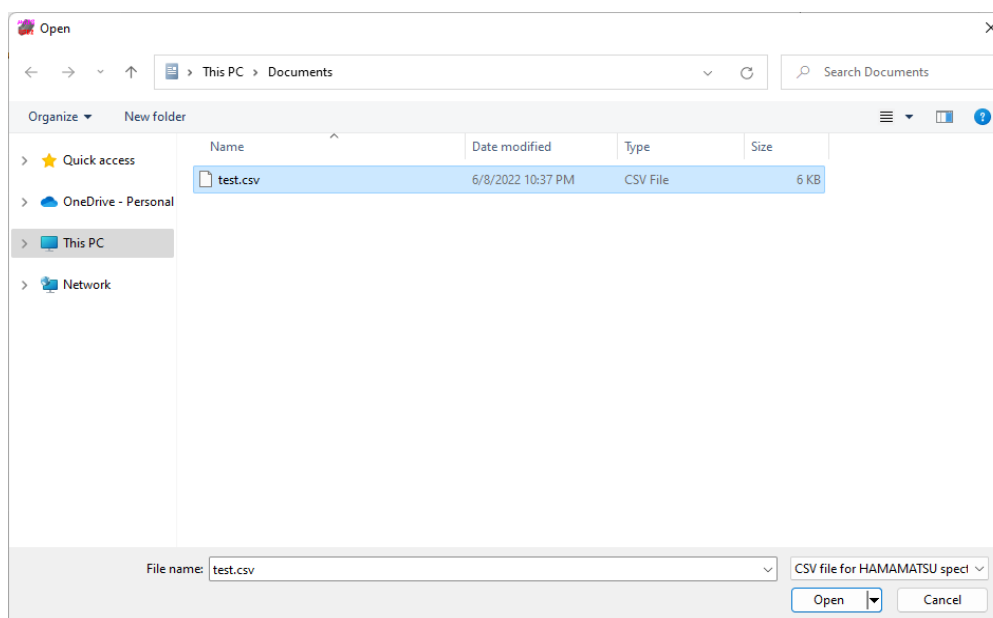
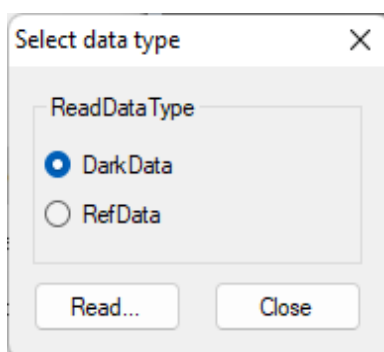
In previously measured evaluation software, stored text data file is read for the reference and can be displayed in respective graph.

Loadable data type

You can load text data files with an extension ".csv" that contain data measured with the evaluation software and then saved in a CSV format.

Reading method of measurement data file

Please click  of [Main Toolbar] or select [File]→[Load Data File] from main menu of main screen. Please set name and place of file to read in File Dialog and then click [Open(O)] button.



7-12. Write wavelength conversion coefficients file

In this evaluation software, you can save the wavelength conversion coefficients in text file.

Here is the explanation about method for saving wavelength conversion coefficients data in text file, format and important notes.

Method for saving wavelength conversion coefficients data

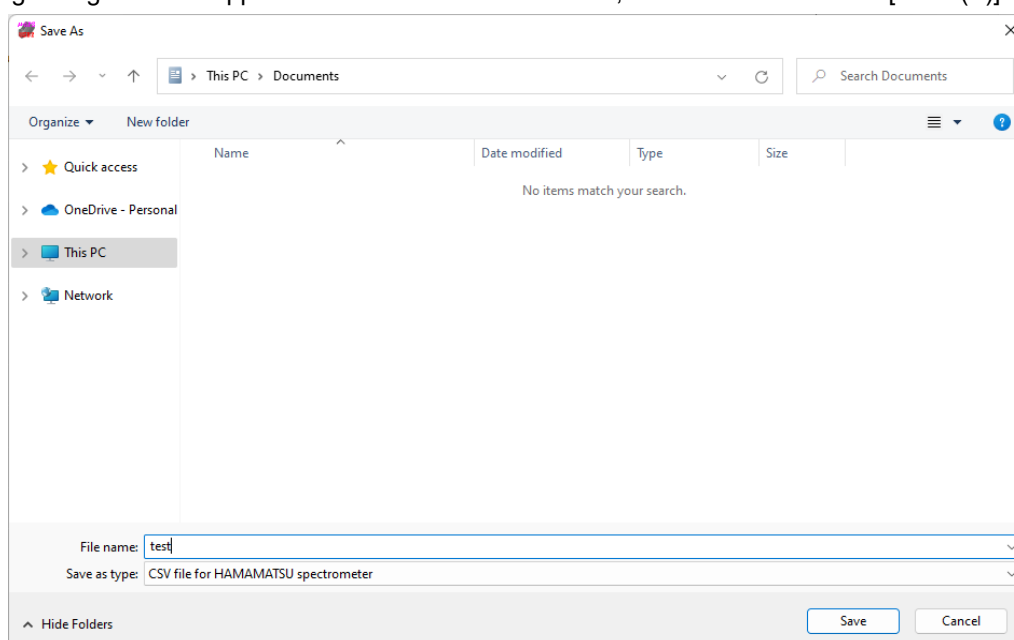
Wavelength conversion coefficients of evaluation software can be saved as text data in file.

Extension of wavelength conversion coefficients is .wc and saved in INI file format.

Please click 'FileWrite' button of Wavelength conversion coefficients edit screen.

or click 'FileWrite' button of Wavelength conversion coefficients write screen.

The following dialog box then appears. Select the location to store, file name and click the [Save (S)] button.



Wavelength conversion coefficients data format is as follow.

```
[Setting]
A0=+6.000000000e+000
B1=+5.000000000e+000
B2=+4.000000000e+000
B3=-3.000000000e+000
B4=-2.000000000e+000
B5=-1.000000000e+000
```

※A0-B5 Wavelength conversion coefficients data

7-13. Read wavelength conversion coefficients

Previously stored wavelength conversion coefficients file can be read.

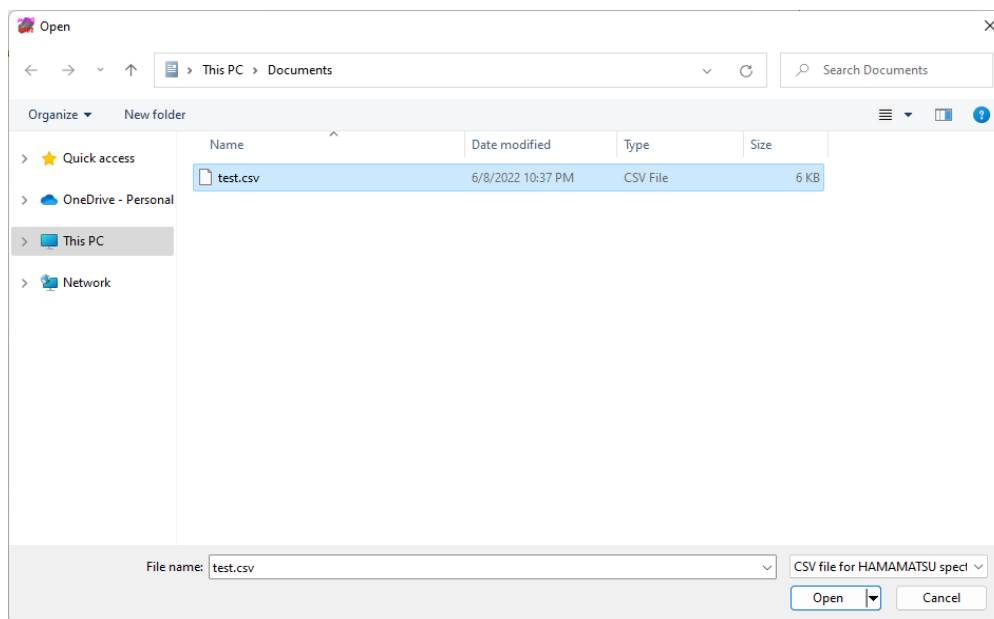
Read data type

You can load wavelength conversion coefficients data files with an extension ".wc" that contain with the evaluation software

Read wavelength conversion coefficients

Please click 'File write' button of Wavelength conversion coefficients edit screen.

The following dialog box then appears. Select the file name to be read, and click the [Open] button.



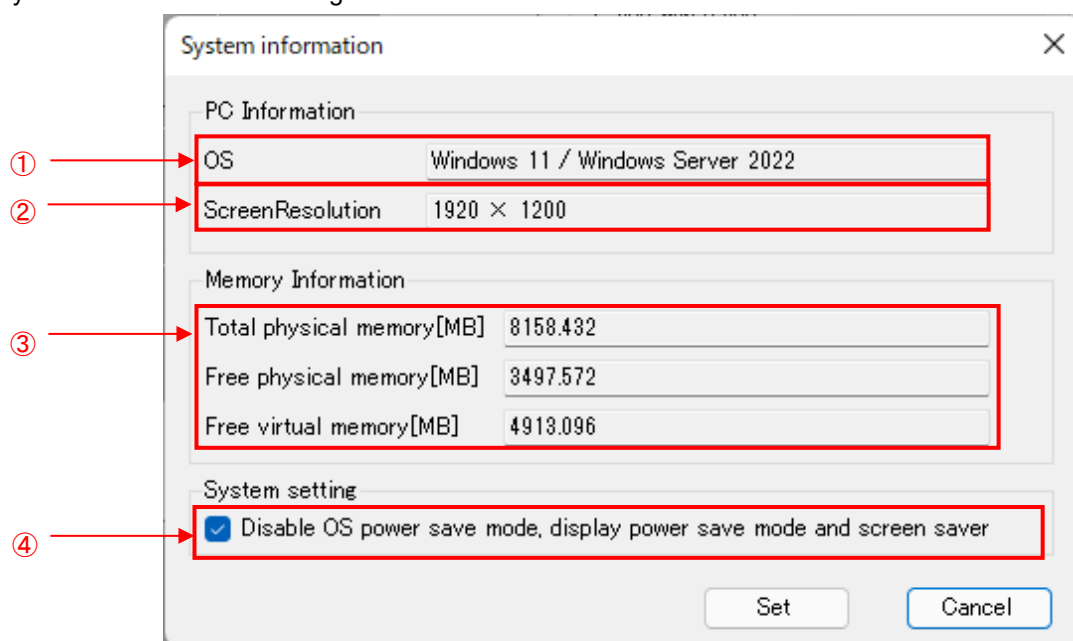
7-14. Other operations

Help

Help displays PC system information and settings, software version of driven spectrometer.

System information and settings

Please click  of [Main Toolbar] or select [Help]→[System information] from main menu of main screen. It will show System information and settings screen.



[System information of displayed PC]

① OS

Version of OS(Operation system)is displayed.

⑤ Screen Resolution

Displays currently set resolution of monitor.

For this evaluation software XGA(1024×768) or more is recommended.

③ Memory Information

Physical memory implementation

This shows actual loaded memory to PC.

Free space of physical memory

This shows available free space of physical memory.

Free space of Virtual memory space

This shows available free space of virtual memory.

- You can set the PC setting

④ Disable power save mode, screen saver mode and monitor power save mode

Select this check box when you want to disable the power save mode of the PC.

Selecting this check box disables the power scheme settings you made in the "Power Options Properties" dialog box that appears by clicking "Start" > "Control Panel" > "Power Options".

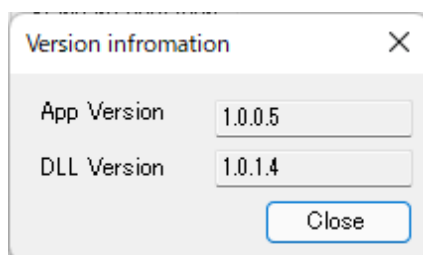
When PC power save mode is activated, the power to the USB port might be interrupted depending on the PC model. This will cause errors in the mini-spectrometer operation since it operates from the USB bus power. In particular, if using a laptop PC to continuously operate the mini-spectrometer, select the above check boxes as needed to enable the power save modes.

The power scheme settings and power supply method to the USB differ depending on the PC model. Refer to the PC user manual to verify them.

Version Information

Please check  of [Main Toolbar] or select [Help]→[Version Information...] from main menu of main screen.

Screen will be displayed as shown below.



The information displayed is as below:

[App Version] Software version of mini spectrometer.

[DLL Version] DLL version of mini spectrometer.

8. Specification

8-1. Composition

Parameter	Specification	Unit
Weight	70	g
Interface	USB2.0	—
USB Connector	B type	—
Trigger Connector	BNC	—
Length of the cable	100	mm

8-2. Absolute maximum ratings

(Ta=25°C, unless otherwise noted)

Parameter	Symbol	Note	Value	Unit
Supply voltage	—		4.75 to 5.25	V
Operating temperature range	Topr	No dew condensation	+5 ~ +40	°C
Storage temperature range	Tstg	No dew condensation	-20 ~ +70	°C
Trigger input voltage	—		0 ~ 6	V

8-3. Electrical characteristics

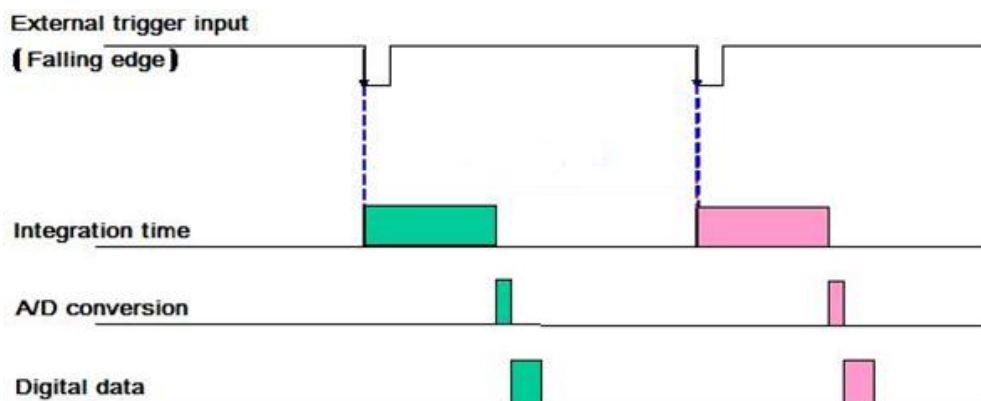
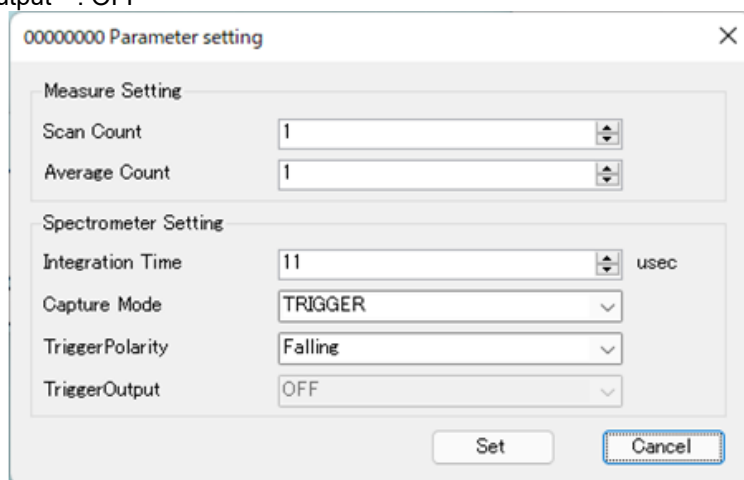
(Ta=25°C, unless otherwise noted)

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Spectrum head drive frequency	f(CLK)	4.75	5	5.25	MHz
video signal rate	Vr	4.75	5	5.25	MHz
Current consumption	Ic	180	210	250	mA
Integration time	Tint	11	—	1000000	μs
A/D conversion	—	—	16	—	bit

8-4. Trigger specification

Parameter		Min.	Typ.	Max.	Unit
Output pulse voltage	High level	4.75	5	5.25	V
	Low level	0	-	0.4	
Output pulse width	High level	10	-	-	μ s
	Low level	10	-	-	
Input detection pulse width	High level	200	-	-	ns
	Low level	200	-	-	
Suggested Input terminal voltage	High level	4.75	5	5.25	V
	Low level	0	-	0.4	

- Trigger input example
- CaptureMode : TRIGGER
- TriggerPolarity : Falling
- TriggerOutput : OFF

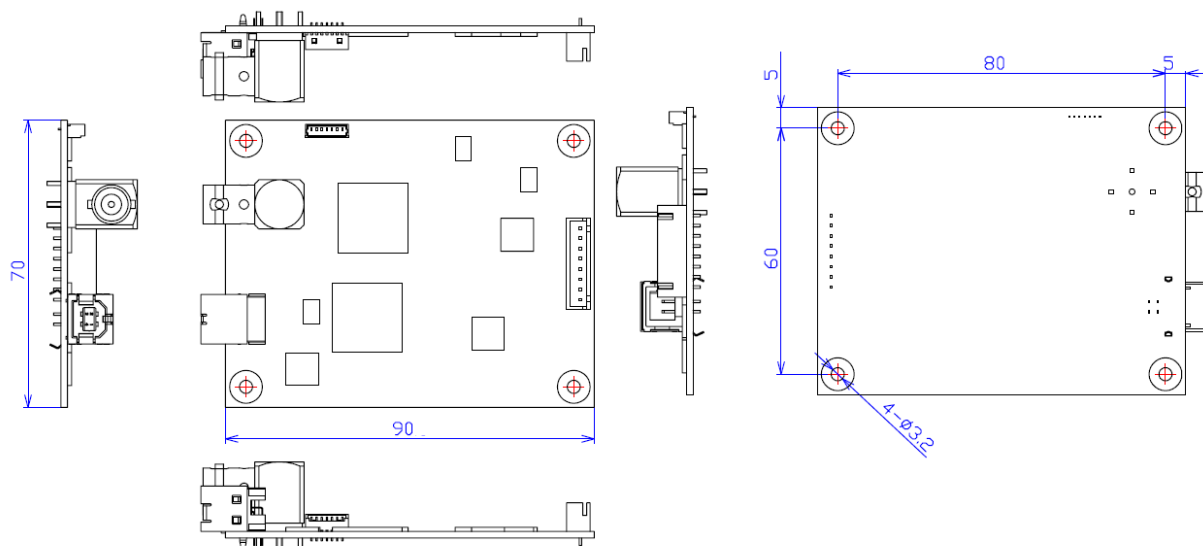


It's able to set a trigger input and a trigger output as rising or falling to change a trigger polarity. Please refer to a parameter setting screen about a setting method in a trigger polarity.

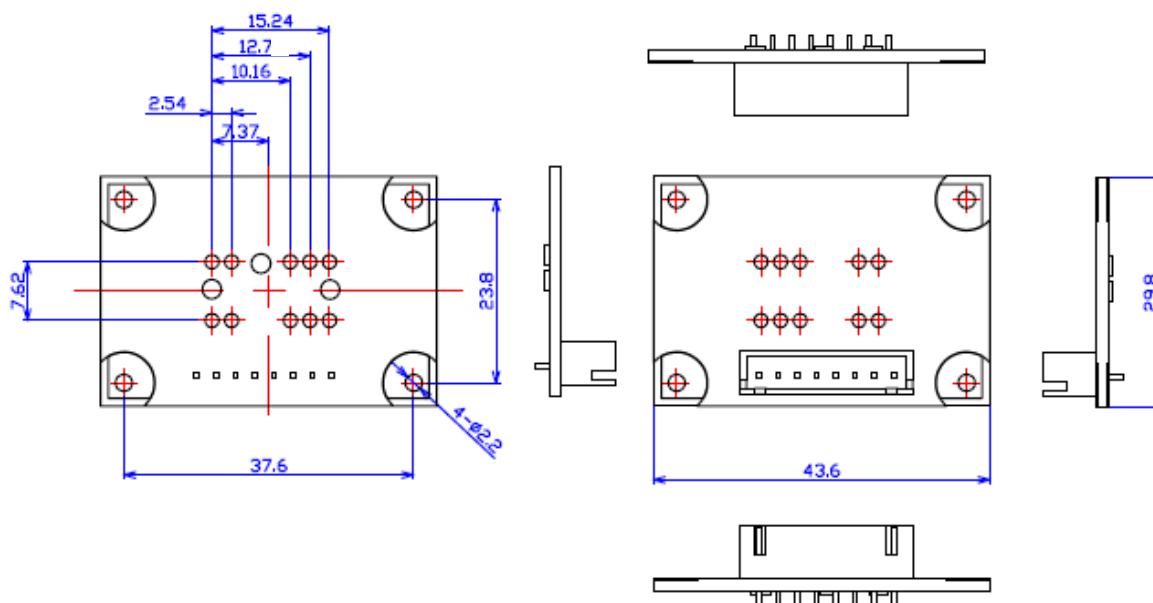
9. Dimensional outline

Unit: mm General tolerance: ± 0.5

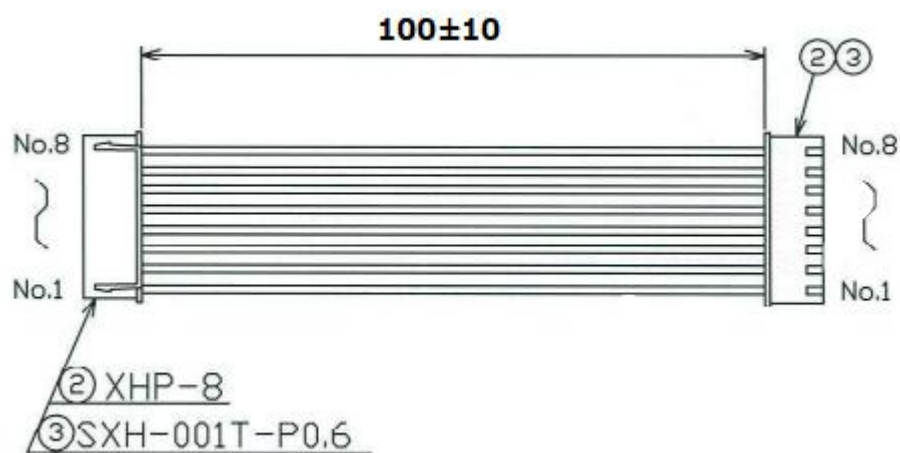
■C13016(Evaluation board)



■C13016(Sensor board)



■ Board connection cable



10. Conformity standards

EMC	IEC 61326-1	
	Emission limit value : CISPR 11, Group 1, Class B	
	Immunity test requirements : Table 1	
	Performance level:	
	Performance standards A	
	USB communication	Signal output from the mini-spectrometer must be available in the evaluation software.
EMC	Performance standards B	
	USB communication	Self-recovering to a state where signal output can be obtained.
	Performance standards C	
	USB communication	Signal output from the mini-spectrometer should be available when the evaluation software is closed, the USB cable is plugged back in, and the evaluation software is restarted.
RoHS	EN IEC 63000: 2018	
FCC	FCC 47 CFR Part15 Subpart B, Class B	
	This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.	
	Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: • Reorient or relocate the receiving antenna. • Increase the separation between the equipment and receiver. • Connect the equipment into an outlet on a circuit different from that to which the receiver is connected. • Consult the dealer or an experienced radio/TV technician for help.	

11. Warranty, Repair/ 保修、维修

● Warranty/ 保修

- When using the product described in this manual, observe the maximum rating and precautions. Our company makes every effort to improve the quality and reliability of this product but does not guarantee the integrity of this product. When the product is used for equipment that may infringe on human life, body or property, it is dangerous unless appropriate safety measures are taken in consideration of possible defects. Our company assumes no responsibility for such use unless the prior written consent of our company such as specifications has been obtained.

使用本说明书中描述的产品时，请遵守最大额定值和注意事项。公司尽一切努力提高本产品的质量和可靠性，但不保证本产品的完整性。当产品用于可能危害人员生命、身体或财产的设备时，除非考虑到可能存在的缺陷，采取适当的安全措施，否则十分危险。除非事先取得本公司的书面同意（例如规格说明），否则本公司对此类使用不承担任何责任。

- When providing guidance on the operation of the product to end users, the reader is requested to carefully explain the function, performance, and handling of the product and equipment using the product, and to give appropriate warnings and indications.

在向最终用户提供产品操作指导时，应仔细解释产品以及使用该产品的设备的功能、性能和处理，并给予适当的警告和提示。

- The warranty of the product in this document is limited to repair of the device or delivery of a substitute if the defect is found within 1 year after delivery and our company is notified thereof. Our specifications (Modification and violation of various conditions concerning the environment, application field, usage, storage, disposal, etc., described in this document), even within the warranty period.

本文档所述的产品保修仅限于在发货后 1 年内发现缺陷并通知我公司的情况下，对设备进行维修或交付替代品。即使在保修期内，本公司的规格（本文档中所述的环境、应用领域、使用、储存、处置等各种条件的修改和违反）也不受此限制。

- Please do not reproduce or produce the contents of this document without our company's permission.

未经本公司许可，请勿对本文档内容进行复制或制作。

- When disposing of this product, treat it as industrial waste according to the regulations of the national or local government.

在处置本产品时，请按照国家或地方政府的规定将产品作为工业废弃物进行处理。

- **Repair / 维修**

If you notice anything unusual, please contact Hamamatsu Photonics or your regional representative with the product name, serial number, and description of the fault (see the end of this document). We try to complete repairs as quickly as possible, but in the following circumstances, there is a possibility that it may be necessary to charge a repair fee or refuse repair:

如果您发现任何异常，请联系 Hamamatsu Photonics 或您所在地区的代表，并提供产品名称、序列号和故障描述（请参阅本文档末尾内容）。我们会尽力尽快完成维修，但在以下情况下，可能需要收取维修费用或拒绝维修：

(1) If a long period of time has passed since you purchased the product

如果您购买本产品已经很长时间

(2) If repair parts are no longer produced

如果维修所需零件已不再生产

(3) If you have made modifications

如果您有模式修改

(4) If the damage is considered to be substantial.

如果认定存在实质性损害。

(5) When an abnormal phenomenon is not reproduced at Hamamatsu Photonics

当 Hamamatsu Photonics 无法再现异常现象时

(6) When it is caused by other devices used at the same time

因同时使用其他设备而引起的故障

Revision history

Revision date	Revision	Revision details
February 2015	-	First issue
July 2015	A	Added Microsoft(R) Windows8 32bit, 64bit to the operation confirmed OS. Screen capture image change Parameter setting screen explanation added Added trigger example
November 2017	B	Added Microsoft(R) Windows10 32bit, 64bit to operation confirmed OS Screen capture image change
April 2022	C	Added Microsoft(R) Windows11 64bit to the operation confirmed OS Screen capture image change
September 2024	D	C16767MA added Format change
April 2025	E	Conformity standard China RoHS compliant addition
December 2025	F	Addition of Chinese text to caution/warning notice Deletion of China RoHS compliant (See attached Document)

For questions or consultations about our products, please use the inquiry form or call the nearest sales office.

Inquiry: <https://www.hamamatsu.com/all/en/support/inquiry.html>

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