FASTCAM SA-X2

Hardware Manual

Rev. 4.04 E

Photron

WARNING

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CAUTION:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Introduction

Thank you for your purchase of Photron's high-speed camera system, the "FASTCAM SA-X2" (referred to below as the system).

This manual contains the operating instructions and warnings necessary for using the system. Before using the system, read the entire manual.

If any part of this manual is unclear, contact Photron using the contact information printed at the back of the manual.

After you finish reading the manual, store it in a safe place along with the warranty card and refer back to it when necessary.

Using the Manual

This section explains the layout of the manual.

● Introduction

The introduction explains the manual and safety precautions.

● Chapter 1, Setup

This chapter gives an overview of the components that make up the system. It also explains basic keypad operation and a list of items that should be checked before using the system.

● Chapter 2, Recording

This chapter explains operations related to recording.

● Chapter 3, Product Specifications

This chapter explains the system's specifications.

● Chapter 4, Warranty

This chapter explains about the warranty.

● Chapter 5, Contacting Photron

This chapter lists the contact information to use when contacting Photron if the system malfunctions or if a portion of the manual is unclear.

Manual Notation

The following icons and symbols are used in the explanations in this manual.

Icon/Symbol	Description
 IMPORTANT	This symbol indicates content that should always be read.
 CAUTION	This symbol indicates instructions that should always be followed when using the software, or things to be careful of when using the software.
 NOTE	This symbol indicates supplementary items to be aware of when using the system.
 REFERENCE	This symbol indicates the location of a reference.
“ ”	This symbol is used to indicate the names of items on a screen, references, dialog names, and connectors.
[ ]	This symbol is used to indicate menu names, and sub-menu names.

Using the System Safely and Correctly

In order to prevent injury to yourself and others, and to prevent damage to property, carefully observe the following safety precautions.

Photron has given its full attention to the safety of this system. However, the extent of damage and injury potentially caused by ignoring the content of the safety precautions and using the system incorrectly is explained next. Pay careful attention to the content of the safety precautions when using the system.

Warning	This symbol indicates actions that carry the risk that a person could receive a serious injury.

Caution	This symbol indicates actions that carry the risk that a person could receive a moderate injury, or that damage to physical property might occur.

- The safety precautions to be observed are explained with the following symbols.

This symbol indicates actions that require caution.

This symbol indicates actions that are prohibited and must be avoided.

This symbol indicates actions that must always be performed.

Warning

■ Do not perform actions that will damage the AC cable or plug.
(Do not damage the cable, modify it, use it near a heater, excessively bend, twist or pull on it, place heavy objects on it, or bundle it.)
Using the cable when damaged can cause fire, electric shock, or a short circuit.

■ Do not use the system in a manner which will exceed the rating of the power outlet or wiring equipment used.
Exceeding the power rating might cause a fire from excessive heat.

■ Do not insert metallic objects inside, or pour liquids such as water on, the system.
Doing so can cause fire, electric shock, or malfunction from short circuit or heat.

■ Do not disassemble or modify the system.
There are high voltages inside the system that can cause electric shock.

■ Do not plug in or unplug the power cord with wet hands.
Doing so can cause electric shock.

■ Make sure the power plug is fully insert into the socket.
Not fully plugging in the power cable can cause fire from electric shock or heat.

■ When something is wrong with the system, unplug the power cable immediately.
- When a foreign substance or liquid, such as metal or water, gets inside.
- When the outer case is broken or damaged, such as from a fall.
- When the system emits smoke, a strange smell, or strange sound.

Using the system in these conditions might cause a fire or electric shock.

■ Do not use the accessories by the usage that a manufacturer does not specify.
It may cause damage of protection.

Caution

■ Always unplug the system when cleaning it or when it is unused for a long period of time. Leaving or storing the system connected to the power source might cause fire from insulation deterioration or electrical discharge.

■ Consult Photron in advance when you perform an event by which laser light or direct rays fall on the image sensor surface.

■ Do not set the system in a location where the temperature gets unusually hot.
The trunk and inside of a car can get especially hot in summer.
Doing so can cause the outer case and internal components to deteriorate or cause a fire.

■ Do not place the system in a location prone to oily smoke or steam, or in a location with a lot of humidity or dust.
Oil, moisture, and dust conduct electricity, which can cause a fire or electric shock.

■ Ambient temperature 0 to 45 °C, humidity 80 % RH or lower, maximum altitude 2,000 m or lower. In addition, if exceeding these limits, use in a condensation-free environment.
Use in a condition out of the above limits can cause malfunction.

■ Do not store the equipment in a location where the temperature goes below -20 °C or higher than 60 °C. Be sure not to allow condensastion to form inside the system.

■ When shipping, remove the connecting cable and use the original packaging or a dedicated carrying case.
Do not ship the equipment in an environment where the temperature goes below -20 °C or higher than 60 °C. Also, prevent condensation from forming during shipment.

■ The rubber foot used in this product might be hydrolyzed if it is stored or used in a high humidity environment for a long time.
Moreover, it might be hot melted if it is stored or used in a high temperature environment for a long time.

European Union (and EEA) only

"CE" mark indicates that this product complies with the European requirements for safety, health, environment, and customer protection. "CE" mark equipments are intended for sales in Europe.

These symbols indicate that this product is not to be disposed of with your household waste, according to the WEEE Directive (2002/96/EC), the Battery Directive (2006/66/EC) and/or your national laws implementing those Directives.

This product should be handed over to a designated collection point, e.g., on an authorized one-for-one basis when you buy a new similar product or to an authorized collection site for recycling waste electrical and electronic equipment (EEE) and batteries and accumulators. Improper handling of this type of waste could have a possible impact on the environment and human health due to potentially hazardous substances that are generally associated with EEE. Your cooperation in the correct disposal of this product will contribute to the effective usage of natural resources.

For more information about the recycling of this product, contact your local city office, waste authority, approved scheme or your household waste disposal service or visit www.photron.com.

(EEA: Norway, Iceland, and Liechtenstein)

This product is in conformity with the protection requirements of EU Council Directive 2014/30/EU (Class A) on the approximation of the laws of the Member States relating to electromagnetic compatibility.

Warning: This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

Cleaning of the Image Sensor Surface

Electrostatic Discharge (ESD) events may cause immediate and unrecoverable damage to the image sensor.

Read the following instructions and take EXTREME CARE when cleaning the image sensor surface.

- ALWAYS take appropriate anti-static precautions when cleaning or working near the Image sensor.
- DO NOT use any form of cleaning equipment using electrostatic or ‘charged fiber’ technology.

- Discharge any electrostatic build up in your body by touching a grounded metallic surface before working near the camera sensor.
- Very gently, use only clean and dry air to remove dust from surface of the image sensor.
- To remove stubborn contamination, use the highest grade (e.g. VLSI grade) pure Isopropyl alcohol (IPA) with optical wipes of ‘clean room’ grade.
- Extreme care must be taken! Gently wipe across the sensor in a single action.

  DO NOT rub to avoid abrasive damage to delicate optical coatings on the glass surface.

Put the ferrite core to the AC adapter

To assist in preventing data lost by a system shutdown induced from a lightning surge and the like, attach the supplied ferrite core to the power cable approximately 200 mm (approximately 8 inches) from the system connector. The power cable should pass through the core three times. See illustrations below.

Contents

1

Chapter 1 Setup

This chapter gives an overview of the components that make up the system. It also explains a list of items that should be checked before using the system.

1.1 About the System's Components and Accessories

1.1.1 Components

Refer to the attached packing list for this product's standard components and accessories.

1.1.2 Accessories/Options

The following options are available for the system.

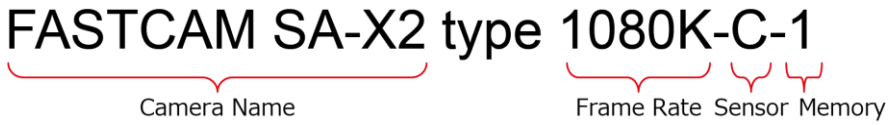
1. Remote Controller for SA8 / SA-X / SA-X2 / SA-Z
2. Remote Controller with LCD for SA-X2 / SA-Z
3. EF Remote Controll Mount Option for SA-X2
4. FASTCAM SA-X2 Specialized Carrying Case
5. Photron Trigger Box
6. Mount with Filter changer (3 type)
7. Mount with Filter changer (1 type)

Use only the components and accessories/options specified on the "1.1 About the System's Components and Accessories" for AC power adapter / AC cable and others.

1.1.3 Type

For the FASTCAM SA-X2 system, there are monochrome and color versions, and for each of these versions, there are 8 GB standard memory capacity type and 16 GB (or 32GB, 64GB, 128GB) high capacity type. When purchasing, it is possible to select from these models according to the application or your demands. The type categories are listed as follows.

◆ Camera type name and category



Item	list	Explanation
Frame Rate	1080K	1,080,000 fps
	480K	480,000 fps
	200K	216,000 fps
	200KS	216,000 fps (Shutter speed 1 µsec control type)
Sensor	M	monochrome
	C	color
Memory	1	8 gigabytes
	2	16 gigabytes
	3	32 gigabytes
	4	64 gigabytes
	5	128 gigabytes

CAUTION

- Export-controlled model type 480K/200K/200KS is subject to certain restriction on the frame rate.
- Export-controlled model type 480K/200KS are subject to restriction on the shutter speed.

NOTE

- Export EF-mount is available with any of the types.
  Example: FASTCAM SA-X2 type 1080K -C1E (E: EF-mount available)
- "RV (Range Version) type" is prepared for each type. It has been sealed-up a camera chassis for keep it free of dust.
  Example: FASTCAM SA-X2 RV type 1080K -C1

REFERENCE

Subject to restrictions under Export Trade Control Order, your camera may NOT be used depending on the country where you intend to use. If you are considering exporting your camera, check with Photron first.
Contact information is given in "Chapter 5 Contacting Photron" on page 58

1.2 Part Names

The system is composed of components including the camera body, AC power supply, and the “Photron FASTCAM Viewer” control software (referred to below as PFV).

For the camera body and the AC power adapter

- Do not expose the camera body, AC power adapter and other optional components to shock.
- Do not use in an area where flammable gas or dust is present.
- Do not place in an unstable location such as on an unstable platform or an incline.
- Do not disassemble or modify.
- Do not expose to liquids such as water.
- Do not subject to an excessive force.

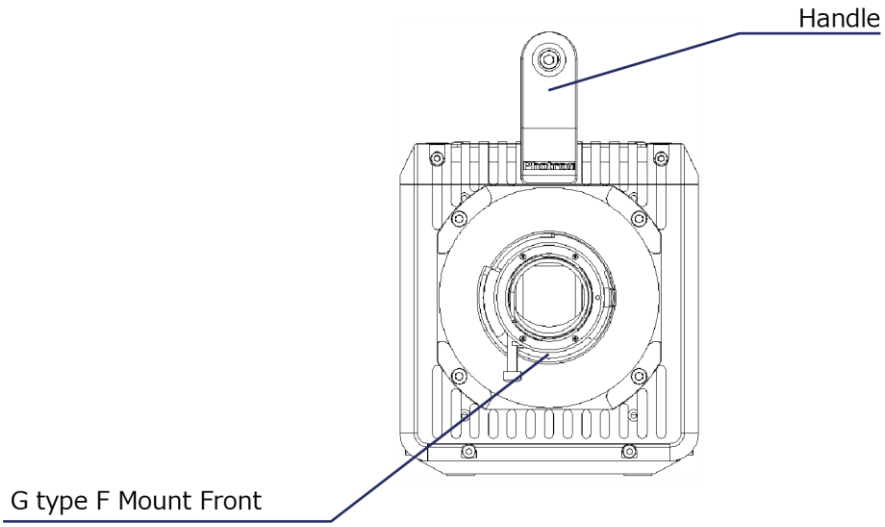
1.2.1 Camera Body

The camera body contains IC memory for image recording and has been designed to be able to record high-speed images uncompressed. The back of the camera body is equipped with the video output terminals, which can playback the recorded images on a video monitor; the Gigabit Ethernet interface, which permits full camera control and data download possible via connection to a PC; the input/output connector, which allows external synchronization signals, trigger signals, IRIG time code.

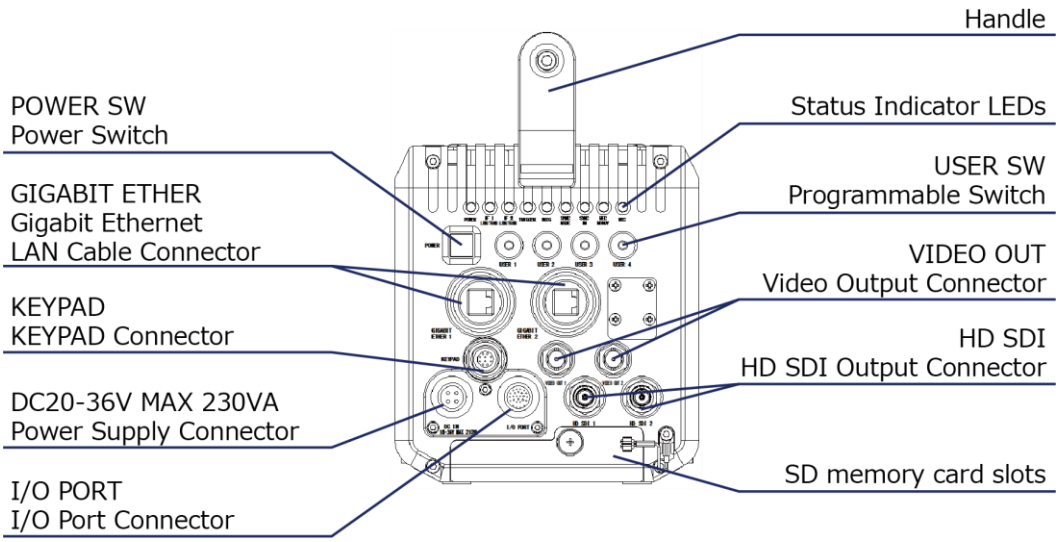
1.2.2 Camera Body Part Names

◆ FASTCAM SA-X2

FRONT View

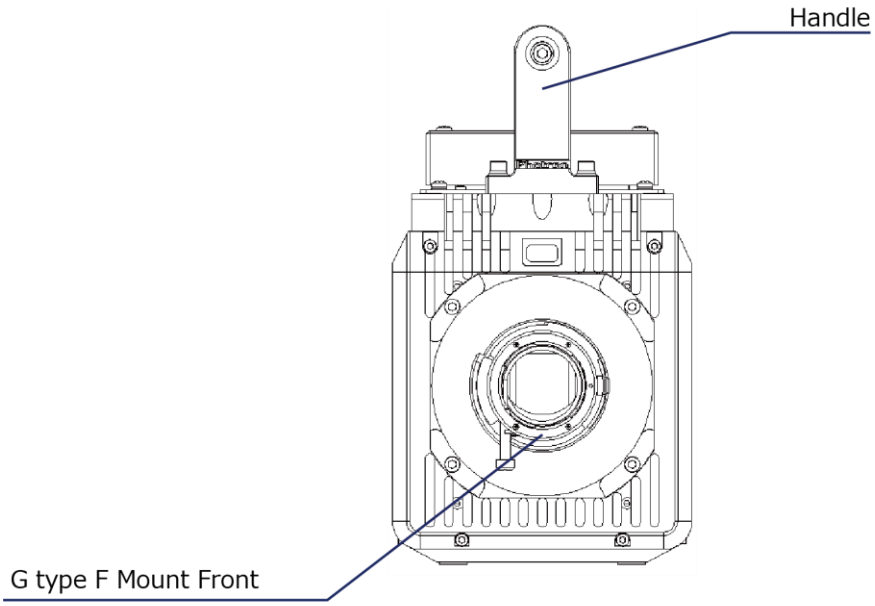


Rear View

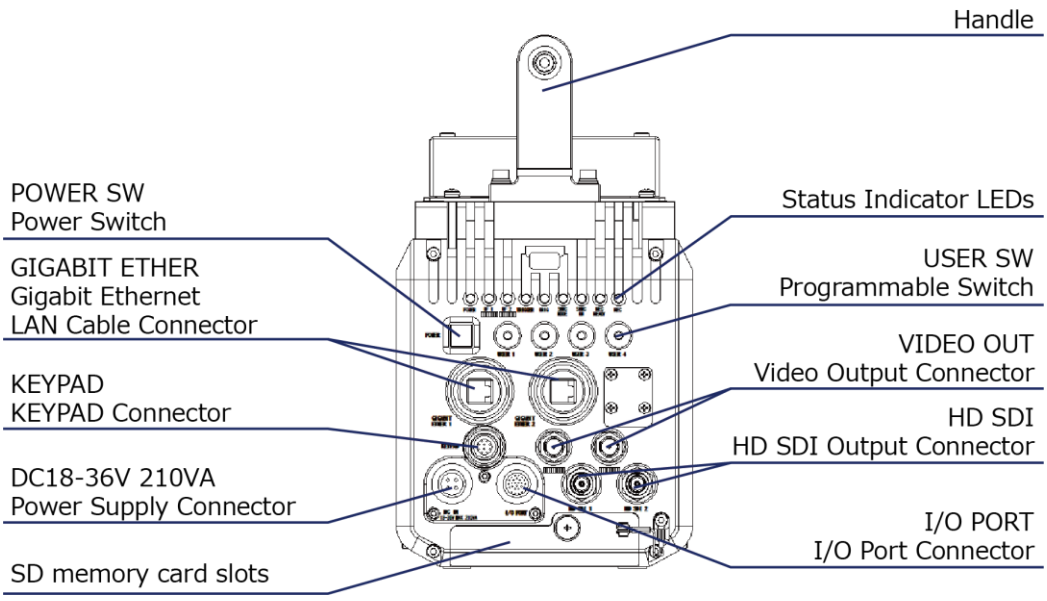


FASTCAM SA-X2 RV

FRONT View



Rear View

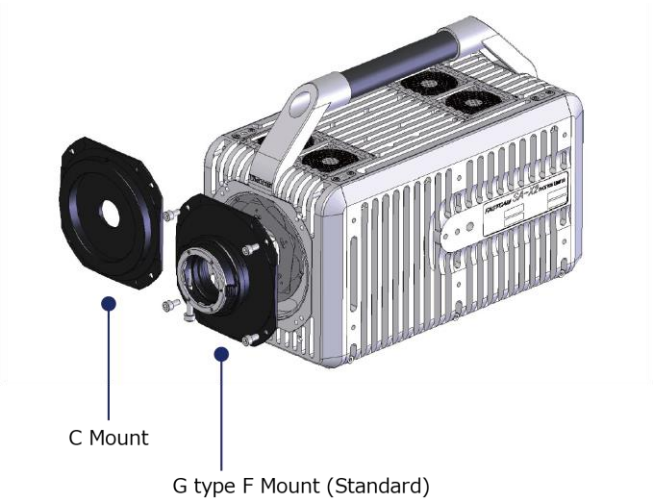


1.2.3 Interchangeable Lens Mount

The lens mount on the system can be changed according to the recording purpose. There are three types of interchangeable lens mounts: “G type F Mount”, “C Mount”, and “EF Mount (Option)”.
The system has mechanical shutter as a standard feature.

- How to change the lens mount (G type F Mount to C Mount)

1. Remove the four M5 bolts with the hexagonal holes using the hexagonal wrench.
2. Remove the G type F Mount portion as a unit.
3. Install the C Mount unit using the bolts with hexagonal holes in the 90° diagonal holes.
4. After installation, always verify that the unit is not loose and does not rattle.



1.2.4 Status Display LEDs on the Rear of the Camera Body

There are a number of LEDs on the rear of the system's camera body. These LEDs indicate the status of the system. The function of each LED is explained here.

Item	Color	ON	FLASHING	OFF
POWER		Power On	—	Power Off
IF LINK/TRANS		The Gigabit Ethernet interface is connected	Data is transferring	The Gigabit Ethernet interface is not connected
TRIGGER		A trigger signal is present (being input) (The LED will illuminate for 0.1 second when the trigger signal is input)	—	The trigger signal is not present
IRIG		The IRIG/GPS signal is present (being input)	—	The IRIG/GPS signal is not present
SYNC MODE		In external synchronization mode (synchronized to an external signal)	—	In internal synchronization mode (synchronized to the internal signal)
SYNC IN		A synchronization signal is present (being input)	—	A synchronization signal is not present
REC READY		Ready to record	ENDLESS recording (The REC (Red) LED is also flashing)	Not ready to record
REC		Ready to record (The case of RANDOM types trigger mode)	Recording	Not recording

◈ Illumination/blinking in operational states

- **During low light mode operation**

  LEDs other than POWER (green) and IFLINK/TRANS (red) blink at a regular interval.

- **When calibration is run from USER SW or the remote controller**

  LEDs other than POWER (green) and IF LINK/TRANS (red) blink alternately from right to left three times and from left to right three times.

- **During the Gigabit Ethernet interface initialization**

  LEDs other than POWER (green) and IF LINK/TRANS (red) blink alternately from right to left and from left to right several times.

REFERENCE

For how to initialize the Gigabit Ethernet interface, refer to "1.2.5 Programmable Switch (USER SW)" on page 9.

1.2.5 Programmable Switch (USER SW)

There are four switches that can be set on the back of the system. Settings for the switches are made from the menu and they can each be assigned a different function. The content of each setting is listed in the chart below.

Functions list		
OFF	Change Frame Rate	Change Resolution
Change Shutter Speed	Change Trigger Mode	Fitting image
Status display	Switch Live/Memory	Record Ready
Record	Low-Light	Shading

◆ Camera IP Address Initialization

By pressing and holding USER1 for **more than 10 seconds**, you can use the IP address reset function.

The LEDs on the rear of the camera body will illuminate back and forth from left to right and from right to left and inform you that the initialization of the Gigabit Ethernet interface and IP address has completed normally.

◆ Reset to the Factory Default

By pressing and holding USER1 for **15 seconds or longer**, you can use the reset function to the factory default.

When the LEDs blink from left to right and then from right to left alternately, it indicates the initialization operation is accomplished.

CAUTION

- For resetting only “Camera IP Address”, release pressing on USER1 before 15 seconds pass.
- On the firmware ver. 1.13 or earlier, pressing and holding USER1 for more than 10 seconds will result in Gigabit Ethernet Interface Initialization, and for more than 15 seconds will result in Camera IP Address Initialization.

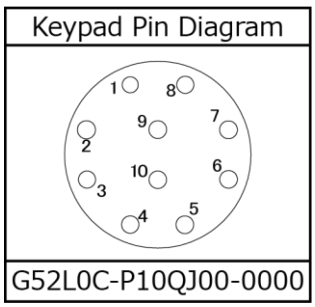
1.2.6 RS-422 Serial Control

The system supports serial control via an RS-422 connection through the “KEYPAD” connector.

By setting the [STATUS OUT] menu to ON, the system status can be output via the serial connection. For details, check the command list.

Serial control commands are available as separate list of commands. Contact Photron or the dealer where the system was purchased regarding the command list.

A cable is also not offered as an accessory. When using RS-422 control, construct a cable using the pin diagram below for reference.



Connector Name	Signal Name	Pin No.	Camera Body Connector Model Name (Manufacturer)	Cable Connector Model Name (Manufacturer)	Input Connector
KEYPAD	VBS	1	G52L0C-P10QJ00-0000 (ODU)	S22L0C-P10MJG0-820S (ODU)	Not Specified
	GND	2			
	RXD+	3			
	RXD-	4			
	TXD+	5			
	TXD-	6			
	GND	7			
	TRIGGER SW	8			
	GND	9			
	+12V OUT	10			

When using the connector pins directly, refer to the chart above and ensure the wiring is correct.
Incorrect wiring can cause malfunction.

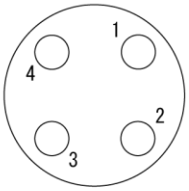
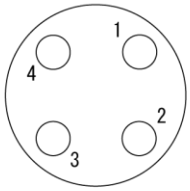
The voltage on pin 10 (+12V OUT) is used to power the remote controller, do not use it for other purposes.

REFERENCE

For inquires related to our product, refer to “5.1 Contact Information” on page 59.

1.2.7 Power Supply Connector, DC Cable

This is a DC power supply input connector. Connect to the supplied AC adapter. The cable connector is optionally available. When using other power supplies, construct a cable using the pin diagram below as a reference.

DC 18-36V 210VA Pin Diagram	Cable (Body side) Pin Diagram	Cable (Adapter side) Pin Diagram
		
AA3L0C-P04RT00-0000	K23L0C-P04LTQ0-5205	NC6MXX

Connector Name	Signal Name	Pin No.	Connector Model Name (Manufacturer)
DC 20-36V 230VA	+18V - +36V IN	1	AA3L0C-P04RT00-0000 (ODU)
	GND	2	
	GND	3	
	+18V - +36V IN	4	
Cable (Body side)	+18V - +36V IN	1	K23L0C-P04LTQ0-5205 (ODU)
	GND	2	
	GND	3	
	+18V - +36V IN	4	
Cable (Adapter side)	+18V - +36V IN	1	NC6MXX (NEUTRIK)
	GND	2	
	GND	3	
	GND	4	
	+20V - +36V IN	5	
	+20V - +36V IN	6	

Warning When using the connector pins directly, refer to the chart above and ensure the wiring is correct. If the wiring is incorrect, not only is there the danger of the system malfunctioning, but also of fire and electric shock.

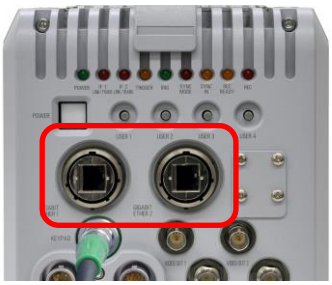
Warning Do not use a power supply which does not meet the system's specifications, or a power supply you cannot guarantee the safety of.
By using a power supply outside of the system specifications, not only is there the danger of the system malfunctioning, but also of fire and electric shock.

Warning Use an external power supply with the suitable rating which was estimated by IEC/EN 61010-1 3rd Edition (compiled with CI. 6.3 and CI. 2.5) and separated from the main circuit by double insulation or reinforced insulation.

1.2.8 Gigabit Ethernet Connector

It is an Ethernet connector for communicating with the PC and is a common RJ45 connector.

Connect a 1000BASE-T compatible interface board and this product with a LAN cable. For the LAN cable, prepare a UTP or STP Cat 5e (enhanced category 5) or higher LAN cable (UTP: Unshielded Twisted Pair, STP: Shielded Twisted Pair).



The system has two sets of Gigabit Ethernet interface connectors incorporated. Using these two connectors simultaneously will make much faster download of image data possible.

IMPORTANT

The system's factory default IP address is below:

- IP ADDRESS
  GIGABIT ETHER 1: 192.168.0.10, GIGABIT ETHER 2: 192.168.1.10
- NETMASK
  GIGABIT ETHER 1: 255.255.255.0, GIGABIT ETHER 2: 255.255.255.0
- GATEWAY ADDRESS: 0.0.0.0
- PORT: 2000 (Fixed, not changeable)

NOTE

Photron recommends using an STP cable over long distances or in noisy locations.

1.2.9 SD Memory Card Slots

These slots are for an SD Memory Card to save image data. Insert an SD Memory Card which is on the market.

Recorded image data can be saved on an SD card and the saved data can be played and converted to other formats by “PFV”.

REFERENCE

Refer to “SD Memory Card User’s Manual” for the details of operation.

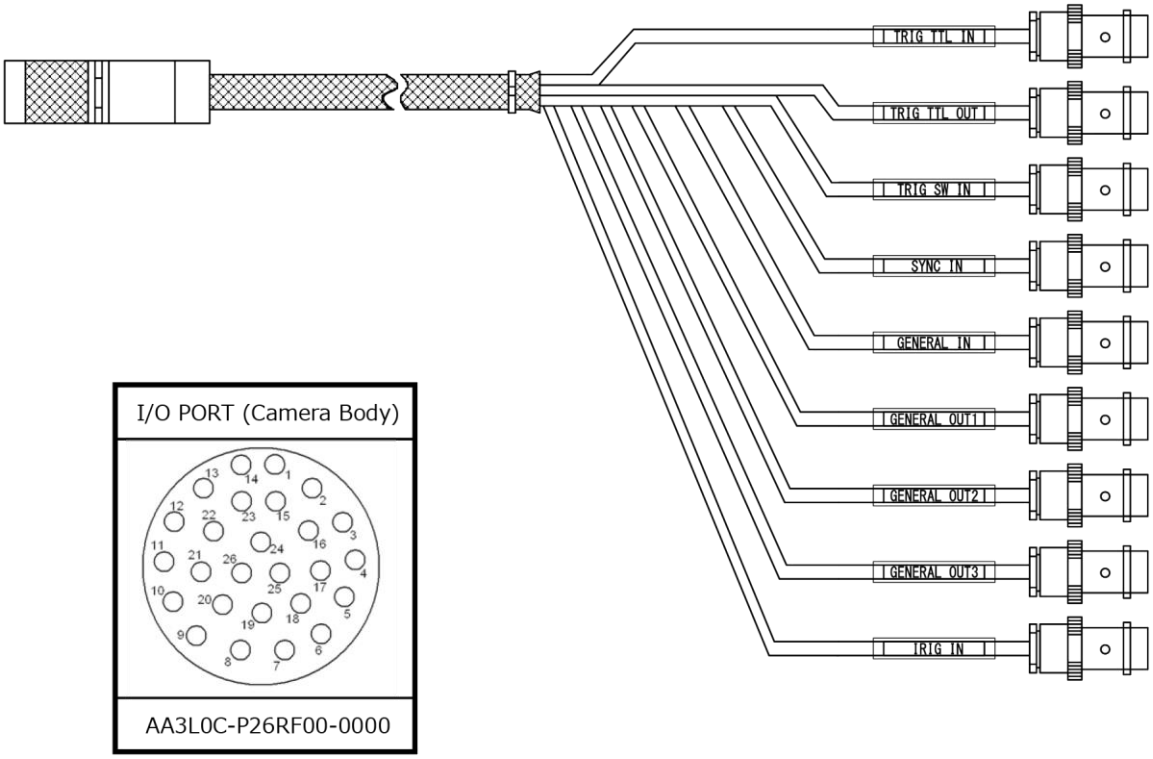
NOTE

If a SD Memory Card’s performance is not enough the required specifications, there is possibility that the writing speed will become slow and/or there will be an error. Refer to “SD Memory Card User’s Manual” for the required specifications.

1.2.10 I/O Port Connector

The input/output signal connectors on the system have been bundled into a single connector, the “I/O PORT” connector, and it is possible to connect to and access each type of signal by using the specialized multi-connector. By inputting an external trigger or synchronization signal and by outputting exposure timing or synchronization signal, these signals can be used as a part of the system.

A signal other than the specified signal must not be input to the various connectors.
Use extreme caution as there is a risk of damage to both devices, the input device and the output device.



REFERENCE

For the signal which can be inputted, refer to “1.3 Input/Output Signal Types” on page 16.

Connector Name	Signal Name	Pin No.	Camera Body Connector Model No. (Manufacturer)	Cable Connector Model No. (Manufacturer)	Input Connector (Pin No.)
I/O PORT	GENERAL OUT2	1	AA3L0C-P26RF00-0000 (ODU)	FGJ2B326CLLD92Z (ODU)	BNC
	GENERAL OUT3	2			BNC
	GND	3			-
	RESERVE	4			-
	RESERVE	5			-
	RESERVE	6			-
	RESERVE	7			-
	RESERVE	8			-
	IRIG GND	9			BNC
	IRIG	10			BNC
	SYNC IN	11			BNC
	TRIGGER TTL IN	12			BNC
	TRIGGER TTL OUT	13			BNC
	GENERAL OUT1	14			BNC
	GND	15			-
	GND	16			-
	RESERVE	17			-
	RESERVE	18			-
	GND	19			-
	RESERVE	20			-
	GENERAL IN	21			BNC
	TRIGGER SW	22			BNC
	+18V - +36V	23			-
	+18V - +36V	24			-
	+18V - +36V	25			-
	GND	26			-

NOTE

Pin 3, 15, 16, 19, 26's GND signal is the common ground for BNC.

1.3 Input/Output Signal Types

With the system, many signals can be input and output through the I/O cable. Signals that can be input and output from the I/O cable are listed below.

A signal other than the specified signal must not be input to the various connectors.
Use extreme caution as there is a risk of damage to both, the input device and the output device.

1.3.1 TRIG TTL IN Connector

The system recognizes an external TTL signal as a trigger during the READY or ENDLESS recording state. Starting and stopping recording (in the selected recording mode) is controlled with this signal.

Input voltage is 0V to +12V (H level +3.3V to +12V), positive or negative polarity, pulse width is 200 nsec or greater.

Connector Name (Input System)	Menu	Signal
TRIG TTL IN	TRIG POS	FET Input 0V to +12V (H level +3.3V to +12V), Positive Polarity
	TRIG NEG	FET Input 0V to +12V (H level +3.3V to +12V), Negative Polarity

1.3.2 TRIG SW IN Connector

This trigger is input during the READY or ENDLESS recording state by contact between the BNC connector's shield and a center pin (switch closure). The center pin normally has voltage flowing through it. Use caution to avoiding contact with other pins.

Connector Name (Input System)	Menu	Signal
TRIG SW IN	None	Contact signal

1.3.3 SYNC IN Connector

The system recognizes a TTL signal from other devices as a synchronization signal. Input voltage is 0V to +12V (H level +3.3V to +12V), positive or negative polarity, pulse width is 200 nsec or greater.

Menu Display	Contents	Signal (Input Signal Conditions)
OFF	Sets external synchronization off, operates independently.	(none)
ON CAM POS	Synchronizes to a positive polarity signal from Photron products.	FET Input 0V to +12V (H level +3.3V to +12V), Positive Polarity
ON CAM NEG	Synchronizes to a negative polarity signal from Photron products.	FET Input 0V to +12V (H level +3.3V to +12V), Negative Polarity
ON OTHERS POS	Synchronizes to a positive polarity signal from an external device (including other Photron products).	FET Input 0V to +12V (H level +3.3V to +12V), Positive Polarity
ON OTHERS NEG	Synchronizes to a negative polarity signal from an external device (including other Photron products).	FET Input 0V to +12V (H level +3.3V to +12V), Negative Polarity

1.3.4 GENERAL IN Connector

The effect when a signal is input is described below and can be optionally selected and set. The input voltage is 0V to +12V (H level +3.3V to +12V), positive or negative polarity, pulse width is 200 nsec or greater.

Menu Display	Contents	Signal (Input Signal Conditions)
TRIG POS	Inputs a positive polarity trigger signal. The camera recording can be controlled.	FET Input 0V to +12V (H level +3.3V to +12V), Positive Polarity
TRIG NEG	Inputs a negative polarity trigger signal. The camera recording can be controlled.	FET Input 0V to +12V (H level +3.3V to +12V), Negative Polarity
READY POS	Inputs a positive polarity READY signal. By inputting in the live state, switch READY ON/OFF. In addition, by inputting while recording, cancel the recording state.	FET Input 0V to +12V (H level +3.3V to +12V), Positive Polarity
READY NEG	Inputs a negative polarity READY signal. By inputting in the live state, switch READY ON/OFF. In addition, by inputting while recording, cancel the recording state.	FET Input 0V to +12V (H level +3.3V to +12V), Negative Polarity
EVENT POS	Input the signal with positive polarity. By inputting during recording, “Event marker” is displayed separately from the trigger point in the data after recording.	FET Input 0V to +12V (H level +3.3V to +12V), Positive Polarity
EVENT NEG	Input the signal with negative polarity. By inputting during recording, “Event marker” is displayed separately from the trigger point in the data after recording.	FET Input 0V to +12V (H level +3.3V to +12V), Negative Polarity

NOTE

Event markers can be moved in the same way as the trigger frame during playback, and up to 10 points can be recorded.

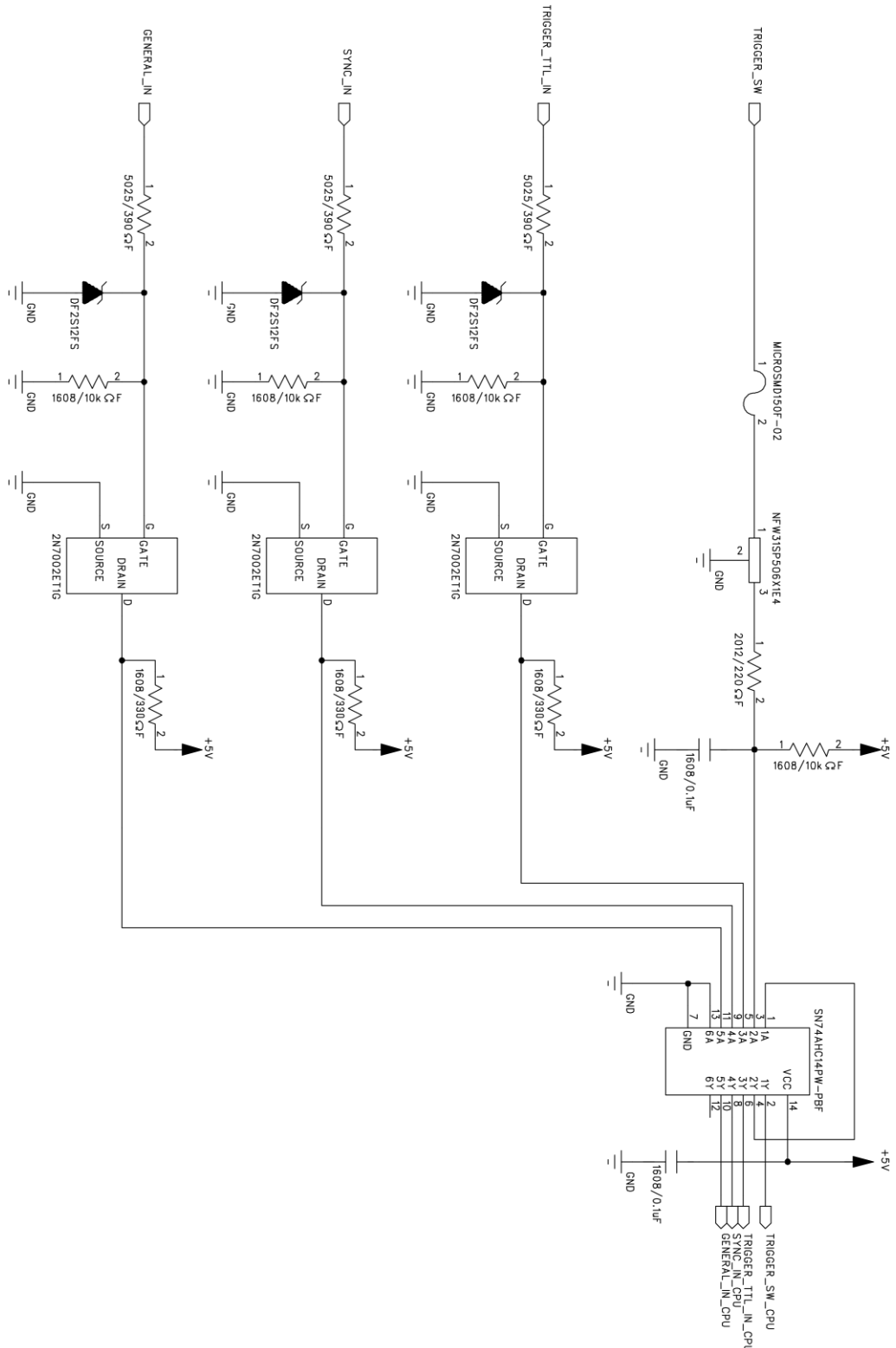
1.3.5 Synchronization with a Variable Frequency

When synchronizing with a varying input frequency signal, the frame rate and resolution specified before recording will be kept as a maximum value, and the camera frequency can alternate to a minimum of about 60 Hz (50 Hz) following to the input signal, even under the recording mode.

NOTE

- When an input sync signal is variable, the output image quality might be worse.
- If this phenomenon happens, the image quality can be recovered by reducing about 16 to 40 pixels of vertical resolution.

- TRIG TTL IN, GENERAL TTL IN, TRIG SW IN, SYNC IN Circuit Diagram



1.3.6 TRIG TTL OUT Connector

A 5V TTL trigger signal is output for input to an external device.

Connector Name (Output System)	Menu Setting	Signal Type	Delay Time
TRIG TTL OUT	TRIG POS	TTL, SW, SOFT, all TRIG pulse output CMOS (74ACT541 buffer) output, Positive Polarity.	For TRIG SW IN, approx. 14.5 µsec. For TRIG TTL IN, approx. POS: 95 nsec. NEG: 110 nsec.
	TRIG NEG	TTL, SW, SOFT, all TRIG pulse output CMOS (74ACT541 buffer) output, Negative Polarity.	
	TTL IN THRU POS	TRIG TTL IN through output CMOS (74ACT541 buffer) output, Positive Polarity.	For TRIG TTL IN POS, approx. 40 nsec. For TRIG TTL IN NEG, approx. 53 nsec.
	TTL IN THRU NEG	TRIG TTL IN through output CMOS (74ACT541 buffer) output, Negative Polarity.	

When using 50 cm cable from the signal generator to the camera

1.3.7 GENERAL OUT (1, 2, 3) Connector

It is a BNC connector. The following signals are switched from menu or PFV and output.
Since there are three GENERAL OUT connectors, three settings can be made separately.

Menu Display	Contents	Signal Type
SYNC POS	Outputs a positive polarity vertical synchronization signal.	Delay Time: Approx. 315 nsec. +5V CMOS output, Positive Polarity
SYNC NEG	Outputs a negative polarity vertical synchronization signal.	Delay Time: Approx. 330 nsec. +5V CMOS output, Negative Polarity
EXPOSE POS	Outputs the sensor's exposure interval at H level.	+5V CMOS output, Positive Polarity
EXPOSE NEG	Outputs the sensor's exposure interval at L level.	+5V CMOS output, Negative Polarity
REC POS	Outputs an interval signal during recording at H level.	+5V CMOS output, Positive Polarity
REC NEG	Outputs an interval signal during recording at L level.	+5V CMOS output, Negative Polarity
TRIG POS	Outputs the trigger signal received by the camera at H level.	Delay Time: For TRIG SW IN, approx. 14.5 µsec. For TRIG TTL IN GENERAL IN, approx. 95 nsec.
TRIG NEG	Outputs the trigger signal received by the camera at L level.	Delay Time: For TRIG SW IN, approx. 14.5 µsec. For TRIG TTL IN GENERAL IN, approx. 110 nsec.
READY POS	Outputs a signal at H level during the trigger wait state (READY in START mode). Only valid during START, CENTER, END, and MANUAL modes.	+5V CMOS output, Positive Polarity
READY NEG	Outputs a signal at L level during the trigger wait state (ENDLESS recording state in CENTER, END, MANUAL). Only valid during START, CENTER, END, and MANUAL modes.	+5V CMOS output, Negative Polarity
IRIG RESET POS	Outputs the camera's internal IRIG reset signal (1PPS) at H level.	+5V CMOS output, Positive Polarity
IRIG RESET NEG	Outputs the camera's internal IRIG reset signal (1PPS) at L level.	+5V CMOS output, Negative Polarity
STRADDLING	Outputs pulse signals for frame straddling (PIV).	+5V CMOS output, Positive Polarity

When using 50 cm cable from the signal generator to the camera

When using as a part of a system, verify the characteristics of the output signals before using them.

1.3.8 IRIG Time Code (External Time Synchronization)

The system supports IRIG-B input and can add an IRIG code to each recorded frame. The sample timing for the IRIG code is once each frame.

The recorded IRIG code is displayed on a video monitor, an HD SDI monitor or “PFV”.

IRIG Code Input Specification

Connector	BNC
Code Format	IRIG-B (122) Analog
Amplitude	1.0Vp-p min, 8.0Vp-p max
Modulation Ratio	3:1 to 6:1
Typical modulated carrier signal ratio	10:1

CAUTION

Limitation of use of IRIG code

With the Image Trigger function, IRIG code cannot be used when the specified number of frames is 32 or fewer in RANDOM CENTER or RANDOM MANUAL trigger mode.

NOTE

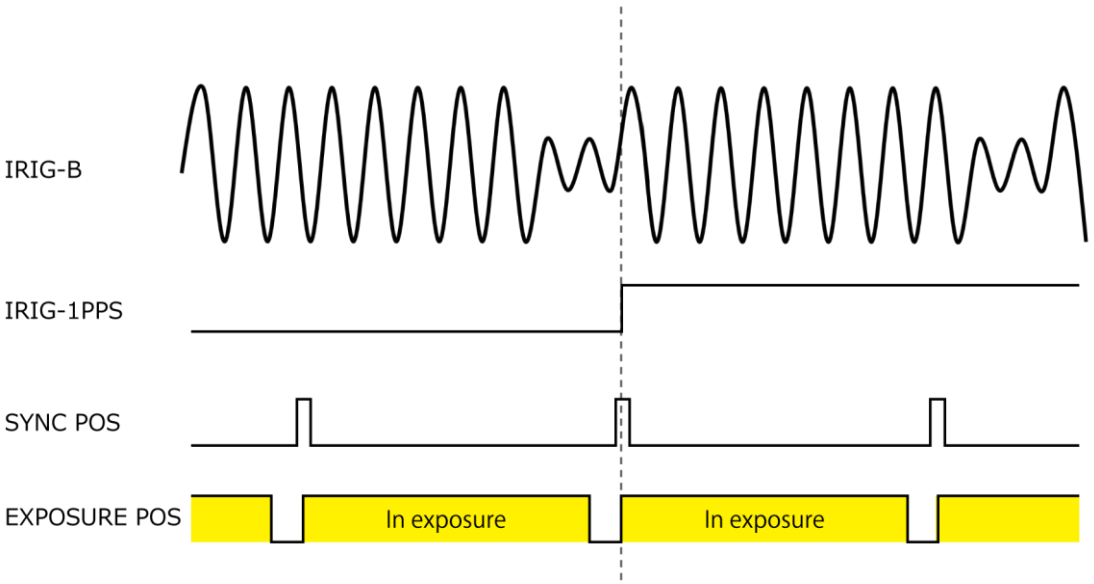
- IRIG Time Code is used when synchronizing a camera with external equipment in time.
  It is a convenient function when apparatus is physically separated.
- When the IRIG code is being input, the IRIG code is displayed in white, and □ is displayed to the left.
  The IRIG offset time is also displayed below it. When the IRIG code is not being input, the IRIG code is displayed in gray. At that time, the counter is the camera’s internal counter and it continues to count.

1.3.9 IRIG-sync Operation

This camera system supports IRIG-sync operation, in which the sensor drive signal is synchronized with the input of IRIG-B signal.

◆ How IRIG-sync operation works?

In IRIG-sync operation, the image sensor is driven by the timing signal shown below. Exposure to the sensor starts at the start of the IRIG-1PPS signal.



IRIG-B : IRIG code that is input to the camera
IRIG-1PPS : 1PPS timing of the IRIG code
SYNC POS : Camera's vertical sync signal
EXPOSURE POS : Exposure to the camera sensor

REFERENCE

For the setting about the function, refer to the "Photron FASTCAM Viewer User's Manual" or the "Remote Controller User's Manual".

1.3.10 Frame Straddling Pulse Output

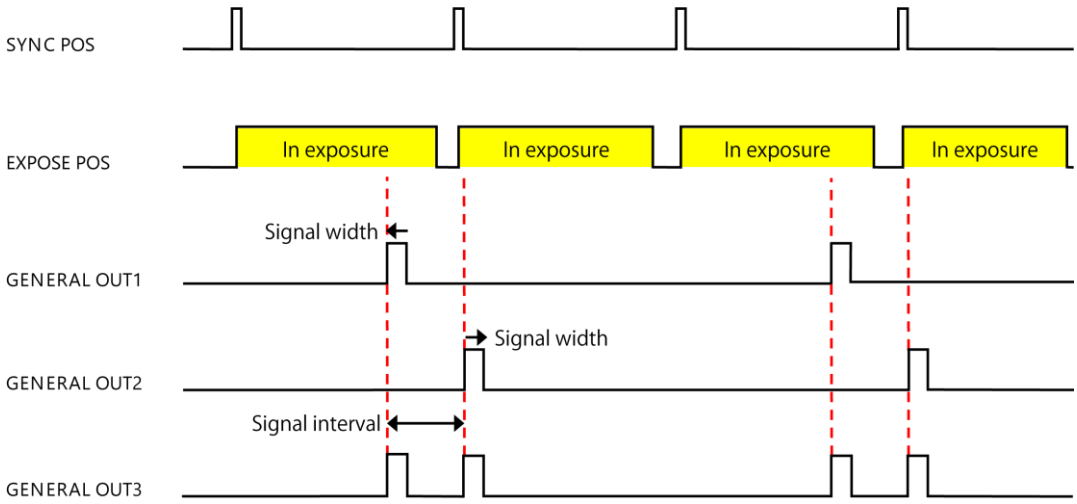
Frame straddling recording usually requires timing adjustment using a pulse generator, but with this product, you can output signals from the camera for simple straddling recording.

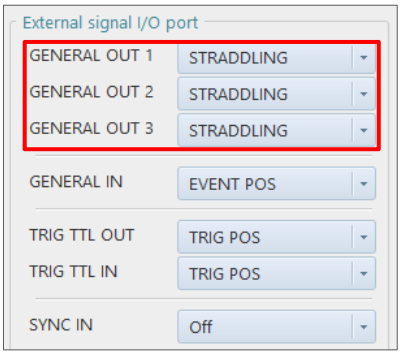
■ How to use

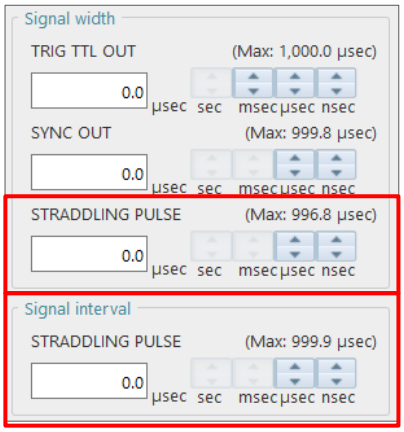
Set the External signal I/O port settings, signal width, and signal interval for straddling pluse settings of [MENU] - [Configuration] - [I/O] in PFV4.

Input the signal from GENERAL OUT connector to the pulse laser.

The output signal varies depending on the number of the GENERAL OUT connector.







1.3.11 Setting of Input/Output Signals and Sync Output Rate

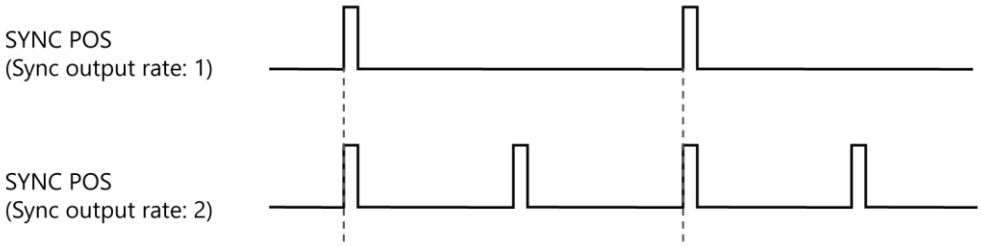
With the system, you can set the signal delay time or pulse width for the various signals that are input and output. Pulse width and delay settings for the various signals to input/output are made with PFV or the remote controller (optional). The content of each setting is listed in the chart below.

Setting Item	Setting Range (Value)
TRIG TTL IN DELAY	0 to 60 (sec) 100 nsec units
SYNC IN DELAY	0 to 1/frame rate (sec) 100 nsec units
GENERAL IN DELAY	0 to 60 (sec) 100 nsec units
TRIG OUT WIDTH	0 to 1 (msec) 100 nsec units
SYNC OUT DELAY	0 to 1/frame rate (sec) 100 nsec units
SYNC OUT WIDTH	0 to 500 (µsec), 1/frame rate (sec) at 2,000 fps or higher 100 nsec units
EXPOSE OUT DELAY	0 to 1/frame rate (sec) 100 nsec units
Sync output rate	0.5, 1, 2, 4, 6, 8, 10, 20, 30 (* 1 is the default setting)

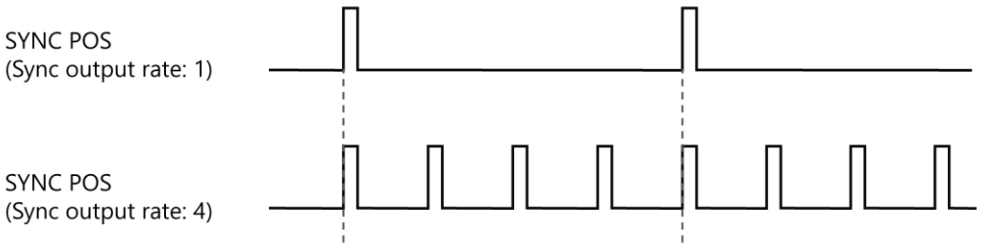
◆ Sync output rate

Output a SYNC (vertical synchronization signal) from SYNC OUT that is X times SYNC.

■ Example: For Sync output rate setting of 2.



■ Example: For Sync output rate setting of 4.



CAUTION

- An accurate frequency is output, but when Sync output rate is set to a large value with a high frame rate, the setting may result in frequency errors.
- There are following limitations in Sync output rate setting.

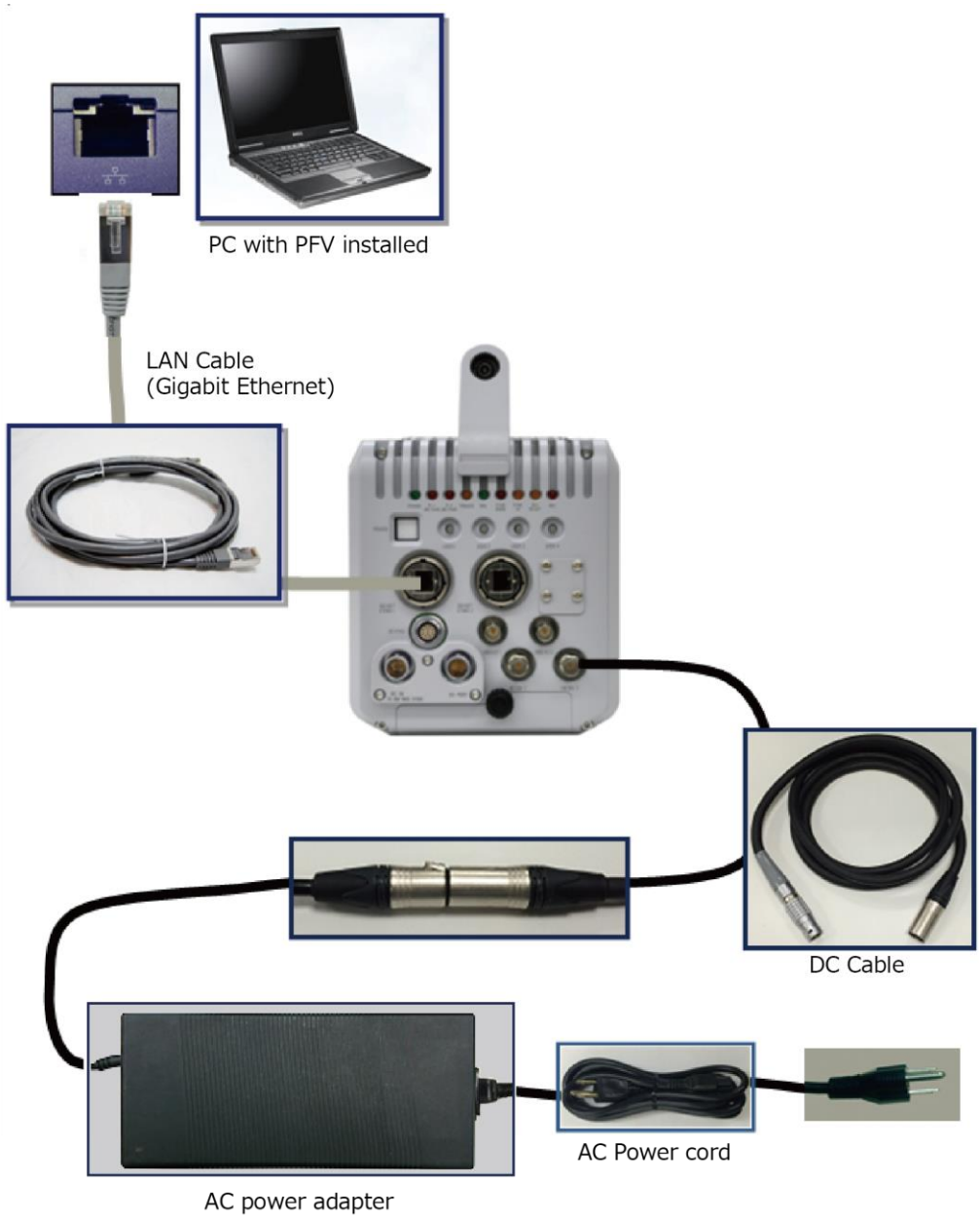
Frame Rate			Restriction
	to	60,000 fps	No Limit
60,001 fps	to	90,000 fps	x30 is unavailable
90,001 fps	to	500,000 fps	x20 and x30 are unavailable
500,001 fps	to	700,000 fps	x8, x10, x20 and x30 are unavailable
700,001 fps	to	1,080,000 fps	x6, x8, x10, x20 and x30 are unavailable

- The following signal input can not be accepted during the delay period.
  For example, if 100 msec of delay is applied, the trigger is recognized 100 msec after trigger input, but the trigger input during that 100 msec will be canceled.

1.4 Device Connections

1.4.1 Minimum Equipment Connection

The minimum connection for using the camera is as follows.



REFERENCE

Refer to “Photron FASTCAM Viewer 4 User’s Manual” for software operation.

1.4.2 Remote Controller (Optional)

The system can be operated while checking the monitor by connecting the optional remote controller to the “KEYPAD” connector on the rear of the camera body. The remote controller is also hot-pluggable; it can be plugged into and unplugged from the camera while the power is on.

There are two types of remote controllers; with LCD and without LCD.

Camera Body Connector	Signal	Camera Body Connector Model Name (Manufacturer)	Keypad Connector Model Name (Manufacturer)
KEYPAD	Keypad signal	G52L0C-P10QJ00-0000 (ODU)	S22L0C-P10MJG0-820S (ODU)

REFERENCE

The remote controller is optional. It is not included in the standard configuration.

NOTE

For how to operate of the Remote Controller, refer to “Remote Controller User’s Manual”.

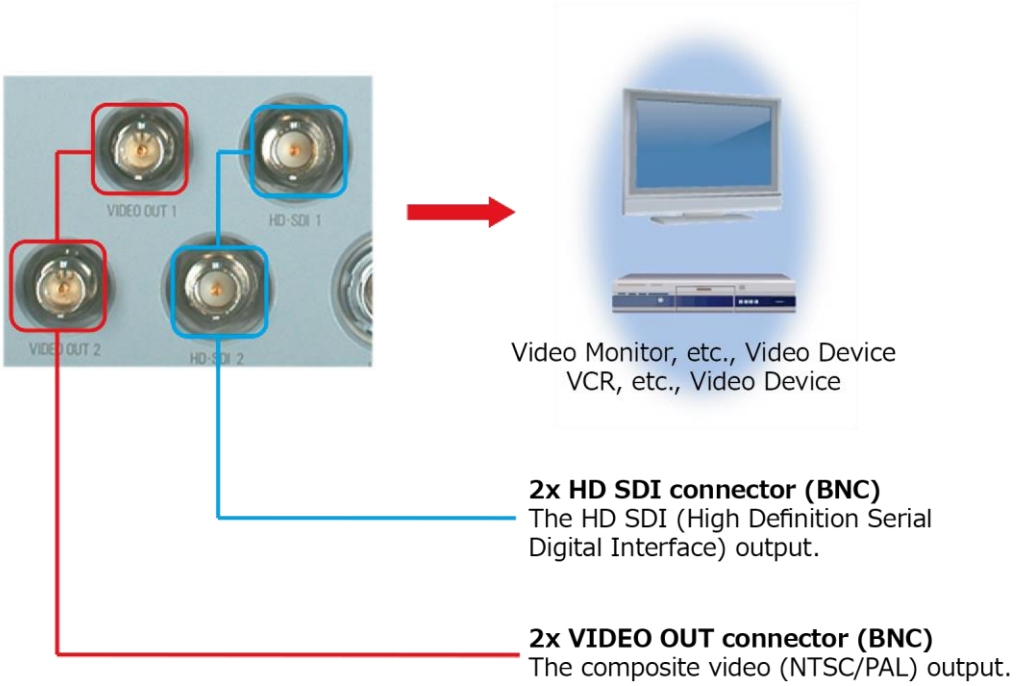
1.4.3 Connecting a Video Monitor

Connecting video monitors to the system for checking the live image (camera pass-through image).

Connect a video input connector on a video monitor to the “VIDEO OUT” connector or the “HD SDI” connector with a BNC cable according to the type of video signal to display.

Connectors that output the signals are selectable from the PFV software or the optional remote keypad.

NTSC	1080i	60 Hz, 59.94 Hz
	1080p	30 Hz, 29.97 Hz, 24 Hz, 23.98 Hz, 24 Hz (sF), 23.98 Hz (sF)
PAL	1080i	50 Hz
	1080p	25 Hz, 24 Hz, 23.98 Hz, 24 Hz (sF), 23.98 Hz (sF)



NOTE

- Since the output of composite video/HD SDI is exclusive, color bars are displayed on the output not selected. (Color bars are a reference guide).
- One of the connectors can switch the output signal between Live mode and Memory mode, and the other connector will always output Live signal simultaneously.
- Use 5C-FB specification cables for HD SDI output.

2

Chapter 2 Recording

This chapter explains operations related to recording.

2.1 Selecting Frame Rate / Resolution

Images can be recorded with the system from 60 (50 with PAL) fps to 12,500 fps using the full 1,024 x 1,024 pixels (1,048,576 pixels) resolution of the image sensor. For frame rates higher than 12,500 fps, the high-speed recordings are achieved by restricting the readout area of the image sensor.

Restricting resolution enables higher speed recording. It also reduces data amount and then it enables longer time shooting/recording.

NOTE

- The minimum frame rate in NTSC mode is 60 fps.
- The minimum frame rate in PAL mode is 50 fps.
- For the detailed setting, refer to “3.1.5 Frame Rate and Resolution” on page 51.

2.1.1 Switching Frame Rate (13.5K mode Function)

This camera has two different frame rate setting modes, which can be switched from one to the other as needed. The 13.5K mode is set ON by default. By setting it OFF, however, the system can be operated with higher image quality. The details of each mode are shown below:

◆ 13.5K Mode ON (Note: Export-controlled models have a different maximum frame rate)

- The maximum frame rate is 216,000 fps to 1,080,000 fps (with image resolution of 128 x 8 pixels).
- When full frame: 12,500 fps max.
- The image resolution is slightly higher than that of the 13.5K mode “OFF” at the same frame rate.

◆ 13.5K Mode OFF (Note: Export-controlled models have a different maximum frame rate)

- The maximum frame rate is 216,000 fps to 324,000 fps (with image resolution of 128 x 16 pixels).
- When full frame: 10,000 fps max.
- The image resolution is slightly lower than that of the 13.5K mode “ON” at the same frame rate.
- The image quality of the 13.5K mode “OFF” can be higher than that of the 13.5K mode “ON” at the same frame rate.

IMPORTANT

The shading calibration has to be executed since there may be adverse effect to the image quality (such as horizontal line-like noise) when the frame rate or shutter speed is changed.

REFERENCE

Table of frame rates and image resolutions, refer to “3.1.8 Frame Rate and Resolution” on page 39.

2.2 Selecting Shutter Speed

The shutter speed (Exposure time) is independent of the frame rate, and it is possible to control the exposure time in the frame using the electric shutter. By making an exposure that is of a shorter period than the frame rate, high-speed objects can be shot without blur.

When the frame rate is lower than 1,000 fps, the shutter speed can be changed from 1/1,000 (1 msec), and when the frame rate is 1,000 fps or higher, it can be changed from one step shorter shutter speed than '1/frame' second to maximum 1/3,410,526 second (293 nsec) (it depends on the setting).

REFERENCE

For more information of Shutter Speed, refer to “3.1.9 Shutter Speed List (Uncertain interval extension: Disable)” on page 43 and “3.1.10 Shutter Speed List (Uncertain interval extension: Enable)” on page 44.

NOTE

- For lower frame rates 60 (50) fps to 1,000 fps, longer than 1/1,000 sec shutter speeds cannot be set because the system uses a special high-speed sensor.
- For example, when working under 500 fps, the available shutter speed varies from 1/1,000 to 1/3,410,526 second. When working under 2,000 fps, a shutter speed varying from one faster step than 1/2,000 second, 1/2,020 second, to 1/3,410,526 second can be obtained.

IMPORTANT

The exposure starts at the rising edge of the EXPOSE POS signal (or the falling edge of the EXPOSE NEG signal). The exact exposure end point is on the preceding of the falling edge of the EXPOSE POS signal in the range of maximum $\triangle t$ second (referred to below as exposure uncertain interval) and the position of the point varies according to the integral of the quantity of light input to the camera. Moreover, the relation between the light input and the output of the camera is non-liner during the exposure uncertain interval as it is different from the other exposure intervals. For more information, refer to “3.1.3 Uncertain intervals” on page 35.

3

Chapter 3 Product Specifications

This chapter explains the system's specifications.

3.1 Specifications

3.1.1 Product Specifications

Image Sensor	CMOS image sensor	
Sensor Resolution	1,024 x 1,024 pixels	
Pixel Size	20 µm square	
Frame Rate	For full frame operation: 12,500 fps maximum For segmented frame operation: FASTCAM SA-X2 (type 1080K): 1,080,000 fps maximum FASTCAM SA-X2 (type 480K): 480,000 fps maximum FASTCAM SA-X2 (type 200K): 216,000 fps maximum FASTCAM SA-X2 (type 200KS): 216,000 fps maximum	
Accuracy of frame rate	50 ppm	
Lens Mount	G type F mount, C mount, EF mount (optional)	
Recording Color Depth	Monochrome	12 bit / 8 bit
	Color	RGB, each 12 bit / 8 bit (Bayer color filter method)
Shutter Method	Electronic shutter (Global shutter)	
Recording Method	IC memory	
Recording Memory Capacity	8GB, 16GB, 32GB, 64GB, 128GB	
Trigger Method	START, CENTER, END, MANUAL, RANDOM, RANDOM RESET, RANDOM CENTER, RANDOM MANUAL, REC ON CMD, RANDOM LOOP	
Gain Control	Hardware LUT on camera Controllable via Remote Controller or software	
Image Output Customization	Customizable LUT, brightness is changeable	
External Synchronization Input Signal	+3.3 to +12Vp-p, negative polarity / positive polarity (switchable),	
External Synchronization Output Signal	5Vp-p, negative polarity / positive polarity (switchable)	
Trigger Input Signal	TTL (+3.3 to +12 V), contact	
Other Output Signals	Other timing signal outputs	
External Control	Remote Controller, RS-422 external control I/F, Gigabit Ethernet I/F (PC)	
Video Output Signal	NTSC/PAL, HD SDI (Compliant with SMPTE 292M) • (NTSC mode) 1080i / 60 Hz, 59.94 Hz 1080p / 30 Hz, 29.97 Hz, 24 Hz, 23.98 Hz, 24 Hz (sF), 23.98 Hz (sF) • (PAL mode) 1080i / 50 Hz 1080p / 25 Hz, 24 Hz, 23.98 Hz, 24 Hz (sF), 23.98 Hz (sF) With digital zoom, scroll, fit functions	
Digital Interface	2x Gigabit Ethernet port (1000BASE-T), 2x SD Card slots	

3.1.2 Frame Rate Modes

This product has two frame rate modes, low/high frame rate modes which are automatically switched internally within the camera according to the frame rate when 13.5K mode is ON.

Exposure uncertain intervals, random reset delay and inter frame time differ between these modes.

- Conditions for frame rate mode is as per the below table:

Frame Rate Mode	Setup
Low frame rate mode	13.5K mode ON, under 720,000 fps (Standard)
High frame rate mode	13.5K mode ON, with 720,001 fps or more

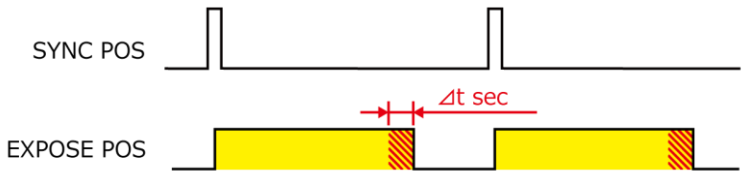
3.1.3 Uncertain intervals

It is possible to exclude the uncertain interval with the setting (It is excluded at the factory default setting). The exclusion is applied to just for the shutter speed display and the EXPOSE POS/NEG signal, the exposure uncertain intervals are remains still actually.

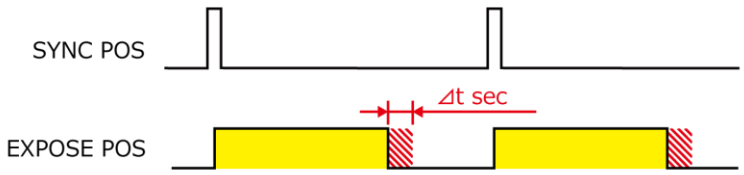
The uncertain interval ⊿t depends on a mode setup as a following table.

Setup	Uncertain intervals
13.5K mode ON and low frame rate mode	Approx. 700 nsec
13.5K mode ON and high frame rate mode	Approx. 360 nsec
13.5K mode OFF	Approx. 1.11 µsec

- EXPOSE POS signal: the ‘uncertain interval extension’ is enabled



- EXPOSE POS signal the: The ‘uncertain interval extension’ is disabled



3.1.4 Random Reset Delay

Random reset delay is the delay between trigger input and exposure time in random reset trigger mode.

Mode	Random Reset Delay
13.5K mode ON with high frame rate	Approx 0.57 µsec
13.5K mode ON with low frame rate	Approx 0.95 µsec
13.5K mode OFF	Approx 1.75 µsec

NOTE

- If you want to check the detailed value of “High frame rate”, contact Photron.

3.1.5 Inter Frame Time

Inter frame time is the shortest duration without exposure between frames.

Mode	Inter Frame Time
13.5K mode ON with high frame rate	0.67 µsec
13.5K mode ON with low frame rate	1.02 µsec
13.5K mode OFF	2.79 µsec

NOTE

- If you want to check the detailed value of “High frame rate”, contact Photron.

3.1.6 Other Supported Function

Supported Function		
Variable Framerate/Resolution	Auto Exposure	Dual Slope Shutter
Resolution Lock	Fan Control	Lens Control (optional)
IRIG Input	IRIG Synchronization	Variable Synchronization
Signal Delay Setting	Sync output rate	Event Marker
Straddling Pulse Output	8bit Recording Mode	Record While Save
Hardware Image Trigger	Mechanical Shutter	Programmable Switch
Exposure Display with Auto Exposure	TRG-EXP Display	
IRIG Time Stamp's selection function at exposure start/end	Shutter lock	

REFERENCE

Refer to "Photron FASTCAM Viewer 4 User's Manual" for other functions.

3.1.7 General Specifications

Environment Conditions		
Storage Temperature		-20 to 60 deg C (No Condensation) -4 to 140 deg F (No Condensation)
Storage Humidity		85% or less (No Condensation)
Operating Temperature	SA-X2	0 to 40 deg C (No Condensation) 32 to 113 deg F (No Condensation)
	SA-X2 RV	0 to 45 deg C (No Condensation) 32 to 109 deg F (No Condensation)
Operating Humidity		80% or less (No Condensation)
Pollution degree		Degree 2 according to IEC60664-1
Overvoltage category		Category II according to IEC60664-1
Maximum use altitude		2,000 m or lower
External Dimensions		
Camera Body	SA-X2	177.7 (H) x 160.0 (W) x 310.0 (D) mm, excluding protrusion 7.0” (H) x 6.3” (W) x 12.2” (D)
	SA-X2 RV	231.7 (H) x 160.0 (W) x 310.0 (D) mm, excluding protrusion 9.1” (H) x 6.3” (W) x 12.2” (D)
AC Adapter		47.0 (H) x 116.0 (W) x 254.0 (D) mm, excluding protrusion 1.9” (H) x 4.6” (W) x 10.0” (D)
AC Power Supply		
Supply Voltage		100 V - 240 V (type A cable: up to 125 V)
Supply Frequency		50 Hz to 60 Hz
Power Consumption		210 W
DC Power Supply		
Power Voltage		18 V to 36 V
Power Consumption		210 VA
Weight		
Camera Body	SA-X2	8.8 kg 19.4 lbs, excluding protrusion
	SA-X2 RV	12.6 kg 27.8 lbs, excluding protrusion
AC Adapter		1.6 kg 3.5 lbs

Photron has verified two types of AC cables, type A (standard for Japan, USA, Canada, etc.) and type SE (standard for Germany, France, etc.). However, when those cables cannot properly receive power when plugged in, use the proper AC cable for the region’s standards and verify that AC cable works properly.

For inquiries regarding the recommended AC cable for each region, contact that region’s Photron branch office or the distributor.

3.1.8 Frame Rate and Resolution

◆ type 1080K/480K/200K/200KS (13.5K Mode ON) (1,024 x 1,024 - 640 x 256)

Frame rate (fps) \ Resolution	1,024 x 1,024	1,024 x 1,000	1,024 x 896	1,024 x 672	1,024 x 512	896 x 896	896 x 496	896 x 368	768 x 768	768 x 512	768 x 328	768 x 272	640 x 512	640 x 256
50 (PAL)	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
60	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
125	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
250	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
500	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
1,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
2,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
3,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
4,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
5,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
6,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
7,200	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
8,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
9,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
10,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
12,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
12,500	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
13,500		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
20,000				✔	✔		✔	✔	✔	✔	✔	✔	✔	✔
30,000							✔	✔		✔	✔	✔	✔	✔
40,000								✔			✔	✔		✔
50,000											✔	✔		✔
60,000												✔		✔
72,000														✔
81,000														
100,000														
200,000														
type 200K / type 200KS														
300,000														
480,000														
type 480K														
540,000														
675,000														
900,000														
1,080,000														

The ✔ mark indicates a possible setting. Light blue items are the maximum resolution setting at that frame rate.
This table shows default settings. Even finer settings are possible with the variable setting feature.

◆ (512 x 512 - 128 x 8)

Resolution / Frame rate (fps)	512 x 512	512 x 272	384 x 256	384 x 264	256 x 256	256 x 152	256 x 128	256 x 80	128 x 128	128 x 48	128 x 40	128 x 16	128 x 8
50 (PAL)	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
60	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
125	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
250	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
500	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
1,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
2,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
3,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
4,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
5,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
6,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
7,200	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
8,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
9,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
10,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
12,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
12,500	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
13,500	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
20,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
30,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
40,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
50,000		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
60,000		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
72,000		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
81,000		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
100,000				✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
210,000						✔	✔	✔	✔	✔	✔	✔	✔
type 200K / type 200KS													
300,000								✔		✔	✔	✔	✔
480,000										✔	✔	✔	✔
type 480K													
540,000											✔	✔	✔
675,000												✔	✔
900,000													✔
1080,000													✔

The ✔ mark indicates a possible setting. Light blue items are the maximum resolution setting at that frame rate.
This table shows default settings. Even finer settings are possible with the variable setting feature.

◆ type 1080K/480K/200K/200KS (13.5K Mode OFF) (1,024 x 1,024 - 512 x 256)

Frame rate (fps) \ Resolution	1,024 x 1,024	1,024 x 1,000	1,024 x 888	1,024 x 704	1,024 x 512	896 x 768	768 x 768	768 x 624	640 x 640	640 x 512	512 x 512	512 x 376	512 x 284	512 x 256
50 (PAL)	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
60	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
125	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
250	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
500	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
1,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
2,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
3,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
4,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
5,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
6,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
7,200	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
8,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
9,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
10,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
12,000			✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
15,000				✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
20,000					✔			✔	✔	✔	✔	✔	✔	✔
30,000											✔	✔	✔	✔
40,000												✔	✔	✔
50,000													✔	✔
60,000														
72,000														
80,000														
90,000														
100,000														
120,000														
200,000														
type 200K / type 200KS														
259,200														
270,000														
324,000														

The ✔ mark indicates a possible setting. Light blue items are the maximum resolution setting at that frame rate.
This table shows default settings. Even finer settings are possible with the variable setting feature.

◆ (384 x 272 - 128 x 8)

Resolution / Frame rate (fps)	384 x 272	256 x 256	256 x 224	256 x 192	256 x 168	256 x 128	256 x 56	128 x 128	128 x 64	128 x 32	128 x 16	128 x 8
50 (PAL)	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
60	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
125	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
250	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
500	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
1,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
2,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
3,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
4,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
5,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
6,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
7,200	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
8,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
9,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
10,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
12,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
15,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
20,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
30,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
40,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
50,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
60,000	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
72,000		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
80,000			✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
90,000				✔	✔	✔	✔	✔	✔	✔	✔	✔
100,000					✔	✔	✔	✔	✔	✔	✔	✔
120,000						✔	✔	✔	✔	✔	✔	✔
200,000							✔		✔	✔	✔	✔
type 200K / type 200KS												
259,000										✔	✔	✔
270,000										✔	✔	✔
324,000											✔	✔

The ✔ mark indicates a possible setting. Light blue items are the maximum resolution setting at that frame rate.
This table shows default settings. Even finer settings are possible with the variable setting feature.

3.1.9 Shutter Speed List (Uncertain interval extension: Disable)

Shutter Speed						
1,000	2,105	3,077	5,714	12,308	22,857	160,000
1,020	2,128	3,125	5,882	12,500	23,529	200,000
1,042	2,151	3,175	6,061	12,698	24,242	266,667
1,064	2,174	3,226	6,250	12,903	25,000	400,000
1,087	2,198	3,279	6,452	13,115	25,806	800,000
1,111	2,222	3,333	6,667	13,333	26,667	996,923
1,136	2,247	3,390	6,897	13,559	27,586	1,246,154
1,163	2,273	3,448	7,143	13,793	28,571	1,661,538
1,190	2,299	3,509	7,407	14,035	29,630	2,700,000
1,220	2,326	3,571	7,692	14,286	30,769	3,410,526
1,250	2,353	3,636	8,000	14,545	32,000	
1,282	2,381	3,704	8,333	14,815	33,333	
1,316	2,410	3,774	8,696	15,094	34,783	
1,351	2,439	3,846	9,091	15,385	36,364	
1,389	2,469	3,922	9,524	15,686	38,095	
1,429	2,500	4,000	10,000	16,000	40,000	
1,471	2,532	4,082	10,127	16,327	42,105	
1,515	2,564	4,167	10,256	16,667	44,444	
1,563	2,597	4,255	10,390	17,021	47,059	
1,613	2,632	4,348	10,526	17,391	50,000	
1,667	2,667	4,444	10,667	17,778	53,333	
1,724	2,703	4,545	10,811	18,182	57,143	
1,786	2,740	4,651	10,959	18,605	61,538	
1,852	2,778	4,762	11,111	19,048	66,667	
1,923	2,817	4,878	11,268	19,512	72,727	
2,000	2,857	5,000	11,429	20,000	80,000	
2,020	2,899	5,128	11,594	20,513	88,889	
2,041	2,941	5,263	11,765	21,053	100,000	
2,062	2,985	5,405	11,940	21,622	114,286	
2,083	3,030	5,556	12,121	22,222	133,333	

Unit for the numbers is 1/x seconds (x being the number of fps)

CAUTION

- With type 200K, the shutter speed can be set between 1/1,000 and 1/996,923 seconds.
- With other model types (type 200K and type 1080K) there is no limit.

3.1.10 Shutter Speed List (Uncertain interval extension: Enable)

Shutter Speed						
999	2,102	3,070	5,691	12,203	22,500	144,000
1,019	2,124	3,118	5,858	12,392	23,151	175,609
1,040	2,147	3,167	6,035	12,587	23,841	225,000
1,063	2,170	3,218	6,222	12,788	24,573	313,043
1,086	2,194	3,271	6,422	12,996	25,352	514,285
1,109	2,218	3,325	6,635	13,211	26,181	589,090
1,110	2,243	3,381	6,863	13,432	27,067	939,130
1,189	2,295	3,500	7,369	13,899	29,032	1,012,500
1,218	2,321	3,562	7,651	14,145	30,125	
1,248	2,349	3,627	7,955	14,400	31,304	
1,280	2,377	3,694	8,285	14,663	32,579	
1,314	2,405	3,763	8,643	14,937	33,962	
1,350	2,434	3,835	9,033	15,221	35,467	
1,387	2,464	3,910	9,461	15,517	37,113	
1,427	2,495	3,988	9,931	15,824	38,918	
1,469	2,527	4,070	10,055	16,143	40,909	
1,513	2,559	4,154	10,183	16,475	43,113	
1,560	2,592	4,242	10,315	16,822	45,569	
1,611	2,626	4,334	10,449	17,183	48,322	
1,664	2,661	4,430	10,588	17,560	51,428	
1,722	2,697	4,531	10,730	17,955	54,961	
1,783	2,734	4,636	10,876	18,367	59,016	
1,849	2,772	4,746	11,026	18,798	63,716	
1,920	2,811	4,861	11,180	19,251	69,230	
1,997	2,851	4,982	11,338	19,726	75,789	
2,017	2,892	5,110	11,501	20,224	83,720	
2,037	2,935	5,243	11,669	20,749	93,506	
2,058	2,978	5,385	11,842	21,301	105,882	
2,080	3,023	5,534	12,020	21,884	122,033	

Unit for the numbers is 1/x seconds (x being the number of fps)

CAUTION

- With type 200KS / type 480K, the shutter speed can be set between 1/999 and 1/589,090 seconds.
- With other types (types 200K and 1080K), there is no limit on the shutter speed.

3.1.11 Shutter Speed List (Special mode)

Shutter Speed
type 1080K
1,378,723
1,542,857

Unit for the numbers is 1/x seconds (x being the number of fps)

3.1.12 Shutter Speed List (13.5K mode OFF / Uncertain interval extension: Enable)

Shutter Speed						
998	2,100	3,066	5,678	12,141	22,291	135,849
1,019	2,122	3,114	5,844	12,328	22,929	163,636
1,040	2,145	3,163	6,020	12,521	23,606	205,714
1,062	2,168	3,214	6,206	12,720	24,324	276,923
1,085	2,192	3,266	6,405	12,926	25,087	423,529
1,109	2,216	3,321	6,617	13,138	25,899	472,992
1,134	2,241	3,377	6,844	13,358	26,765	675,000
1,161	2,267	3,435	7,086	13,584	27,692	712,087
1,188	2,292	3,495	7,346	13,819	28,685	
1,217	2,319	3,557	7,627	14,062	29,752	
1,248	2,346	3,621	7,929	14,314	30,901	
1,280	2,374	3,688	8,256	14,574	32,142	
1,313	2,403	3,757	8,612	14,845	33,488	
1,349	2,432	3,829	9,000	15,126	34,951	
1,386	2,462	3,904	9,424	15,417	36,548	
1,426	2,493	3,982	9,890	15,720	38,297	
1,468	2,524	4,063	10,013	16,035	40,223	
1,512	2,556	4,147	10,140	16,363	42,352	
1,559	2,589	4,235	10,271	16,705	44,720	
1,610	2,623	4,326	10,404	17,061	47,368	
1,663	2,658	4,422	10,541	17,433	50,349	
1,720	2,694	4,522	10,682	17,821	53,731	
1,782	2,731	4,627	10,827	18,227	57,600	
1,848	2,769	4,736	10,975	18,652	62,068	
1,918	2,808	4,851	11,128	19,098	67,289	
1,995	2,848	4,972	11,285	19,565	73,469	
2,015	2,889	5,099	11,446	20,055	80,898	
2,036	2,931	5,232	11,612	20,571	90,000	
2,057	2,975	5,373	11,783	21,114	101,408	
2,078	3,020	5,521	11,960	21,686	116,129	

Unit for the numbers is 1/x seconds (x being the number of fps)

CAUTION

- With type 200KS / type 480K, the shutter speed can be set between 1/999 and 1/472,992 seconds.
- With other type models (types 200K and 1080K), there is no limit on the shutter speed.

3.1.13 Recordable Image Count / Resolution (12bit)

Resolution	8GB Model Rec. Frames	16GB Model Rec. Frames	32GB Model Rec. Frames	64GB Model Rec. Frames	128GB Model Rec. Frames
1,024 × 1,024	5,455	10,916	21,839	43,684	87,375
1,024 × 1,000	5,586	11,178	22,363	44,733	89,472
1,024 × 672	8,313	16,635	33,280	66,568	133,144
896 × 496	12,874	25,760	51,531	103,074	206,160
896 × 368	17,352	34,720	69,456	138,927	277,868
768 × 328	22,714	45,448	90,914	181,848	363,715
768 × 272	27,391	54,805	109,632	219,287	438,597
640 × 256	34,924	69,877	139,782	279,592	559,212
512 × 272	41,088	82,209	164,450	328,932	657,897
384 × 264	56,445	112,934	225,912	451,868	903,779
256 × 152	147,058	294,227	558,564	1,177,238	2,354,587
256 × 80	279,413	559,033	1,118,274	2,236,755	4,473,717
128 × 48	931,382	1,863,450	3,727,585	7,455,855	14,912,396
128 × 40	1,117,659	2,236,140	4,473,103	8,947,027	17,894,875
128 × 16	2,794,152	5,590,355	11,182,760	22,367,571	44,737,192
128 × 8	5,588,307	11,180,712	22,365,523	44,735,144	89,474,387

* Recording Time = Rec. Frames x 1/frame rate (fps)

3.1.14 Recordable Image Count / Resolution (8bit)

Resolution	8GB Model Rec. Frames	16GB Model Rec. Frames	32GB Model Rec. Frames	64GB Model Rec. Frames	128GB Model Rec. Frames
1,024 × 1,024	8,186	16,378	32,762	65,530	131,066
1,024 × 1,000	8,382	16,771	33,548	67,102	134,211
1,024 × 672	12,474	24,958	49,924	99,856	199,720
896 × 496	19,317	38,645	77,302	154,617	309,246
896 × 368	26,036	52,088	104,191	208,397	416,810
768 × 328	34,081	68,181	136,381	272,781	545,581
768 × 272	41,098	82,219	164,460	328,942	657,907
640 × 256	52,401	104,830	209,687	419,402	838,833
512 × 272	61,648	123,329	246,691	493,415	986,862
384 × 264	84,690	169,423	338,890	677,823	1,355,691
256 × 152	220,643	441,395	882,901	1,765,912	3,531,935
256 × 80	419,223	838,654	1,677,514	3,355,236	6,710,679
128 × 48	1,397,416	2,795,518	5,591,720	11,184,126	22,368,936
128 × 40	1,676,900	3,354,622	6,710,065	13,420,951	26,842,724
128 × 16	4,192,254	8,386,558	16,775,166	33,552,382	67,106,814
128 × 8	8,384,510	16,773,118	33,550,334	67,104,766	134,213,630

* Recording Time = Rec. Frames x 1/frame rate (fps)

3.1.15 Recordable Times/Resolution (12bit)

Resolution	Max Framerate	8GB Model Rec. Frames	16GB Model Rec. Frames	32GB Model Rec. Frame	64GB Model Rec. Frame	128GB Model Rec. Frame
1,024 × 1,024	12,500	0.436	0.873	1.747	3.495	6.990
1,024 × 1,000	13,500	0.414	0.828	1.657	3.314	6.628
1,024 × 672	20,000	0.416	0.832	1.664	3.328	6.657
896 × 496	30,000	0.429	0.859	1.718	3.436	6.872
896 × 368	40,000	0.434	0.868	1.736	3.473	6.947
768 × 328	50,000	0.454	0.909	1.818	3.637	7.274
768 × 272	60,000	0.457	0.913	1.827	3.655	7.310
640 × 256	72,000	0.485	0.971	1.941	3.883	7.767
512 × 272	81,000	0.507	1.015	2.030	4.061	8.122
384 × 264	100,000	0.564	1.129	2.259	4.519	9.038
256 × 152	200,000	0.735	1.471	2.943	5.886	11.773
type 200K / type 200KS						
256 × 80	300,000	0.931	1.863	3.728	7.456	14.912
128 × 48	480,000	1.940	3.882	7.766	15.533	31.067
type 480K						
128 × 40	540,000	2.070	4.141	8.284	16.569	33.139
128 × 16	675,000	4.139	8.282	16.567	33.137	66.277
128 × 8	900,000	6.209	12.423	24.851	49.706	99.416
128 × 8	1,080,000	5.174	10.353	20.709	41.421	82.847

The unit in the chart is seconds.

3.1.16 Recordable Times/Resolution (8bit)

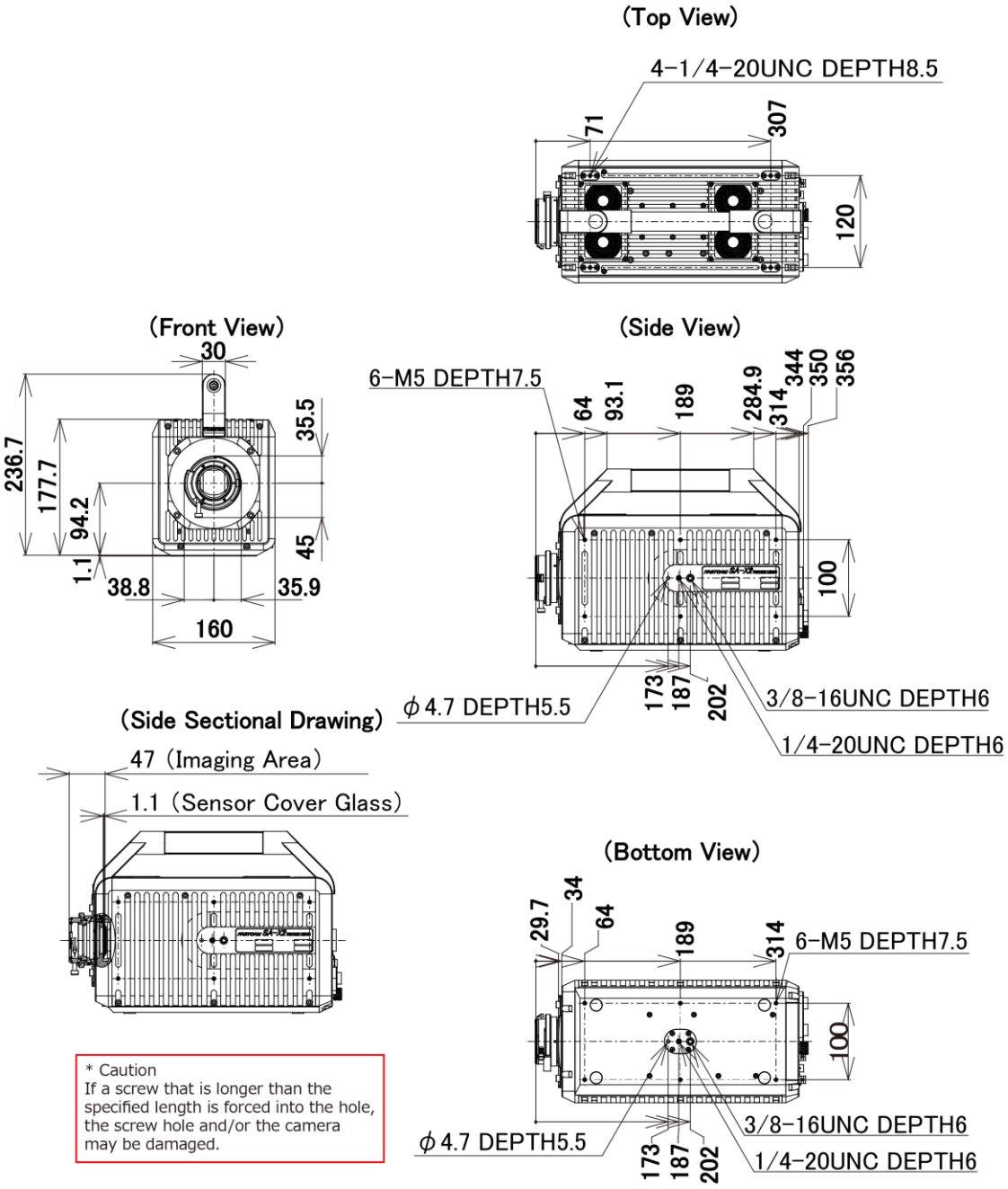
Resolution	Max Framerate	8GB Model Rec. Frames	16GB Model Rec. Frames	32GB Model Rec. Frame	64GB Model Rec. Frame	128GB Model Rec. Frame
1,024 × 1,024	12,500	0.655	1.310	2.621	5.242	10.485
1,024 × 1,000	13,500	0.621	1.242	2.485	4.971	9.942
1,024 × 672	20,000	0.624	1.248	2.496	4.993	9.986
896 × 496	30,000	0.644	1.288	2.577	5.154	10.308
896 × 368	40,000	0.651	1.302	2.605	5.210	10.420
768 × 328	50,000	0.682	1.364	2.728	5.456	10.912
768 × 272	60,000	0.685	1.370	2.741	5.482	10.965
640 × 256	72,000	0.728	1.456	2.912	5.825	11.650
512 × 272	81,000	0.761	1.523	3.046	6.092	12.183
384 × 264	100,000	0.847	1.694	3.389	6.778	13.557
256 × 152	200,000	1.103	2.207	4.415	8.830	17.660
type 200K / type 200KS						
256 × 80	300,000	1.397	2.796	5.592	11.184	22.369
128 × 48	480,000	2.911	5.824	11.649	23.300	46.602
type 480K						
128 × 40	540,000	3.105	6.212	12.426	24.854	49.709
128 × 16	675,000	6.211	12.425	24.852	49.707	99.418
128 × 8	900,000	9.316	18.637	37.278	74.561	149.126
128 × 8	1,080,000	7.763	15.531	31.065	62.134	124.272

The unit in the chart is seconds.

3.2 Dimensions

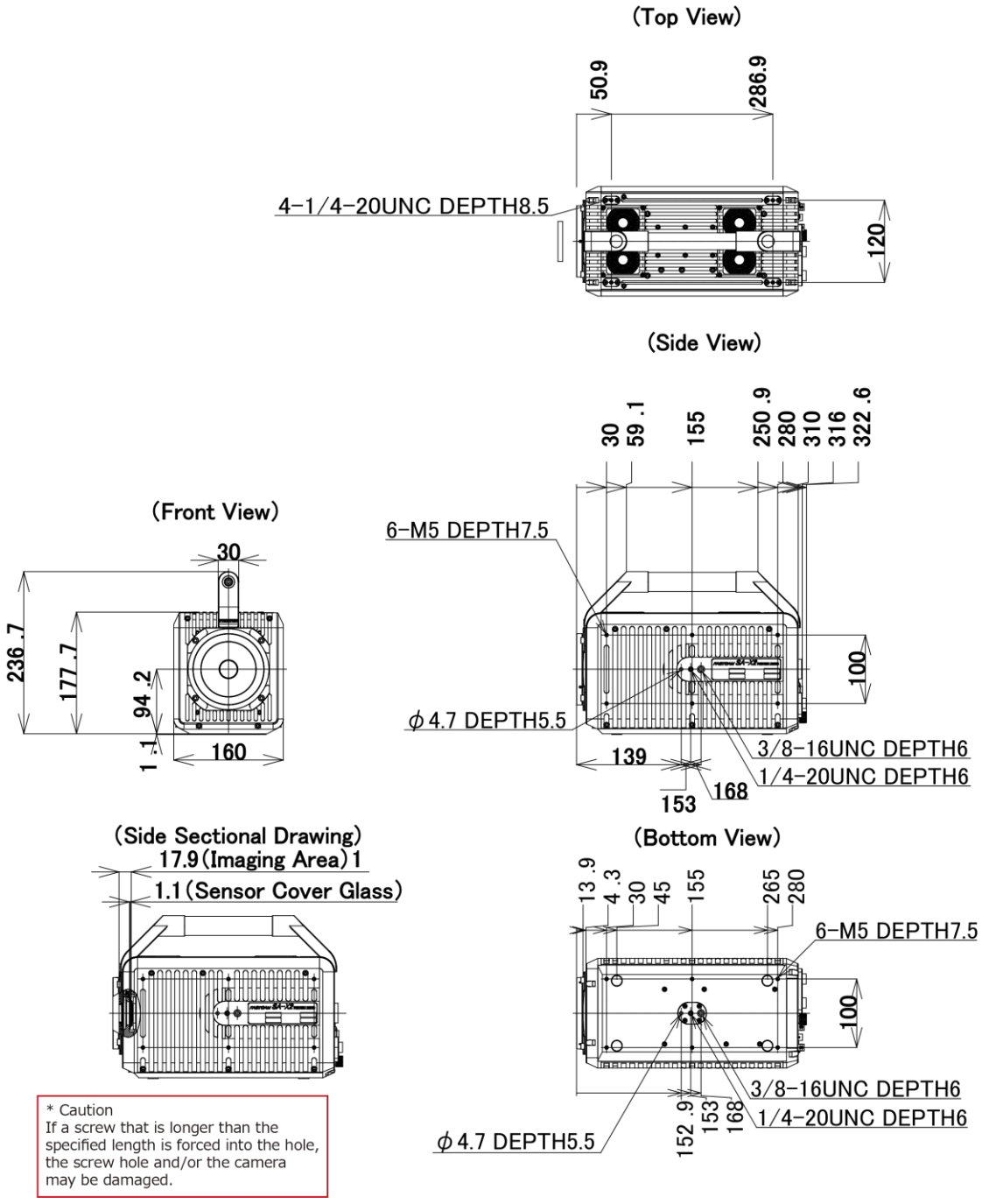
3.2.1 Camera Body

◆ FASTCAM SA-X2 G type F mount
(mm)



* Caution
If a screw that is longer than the specified length is forced into the hole, the screw hole and/or the camera may be damaged.

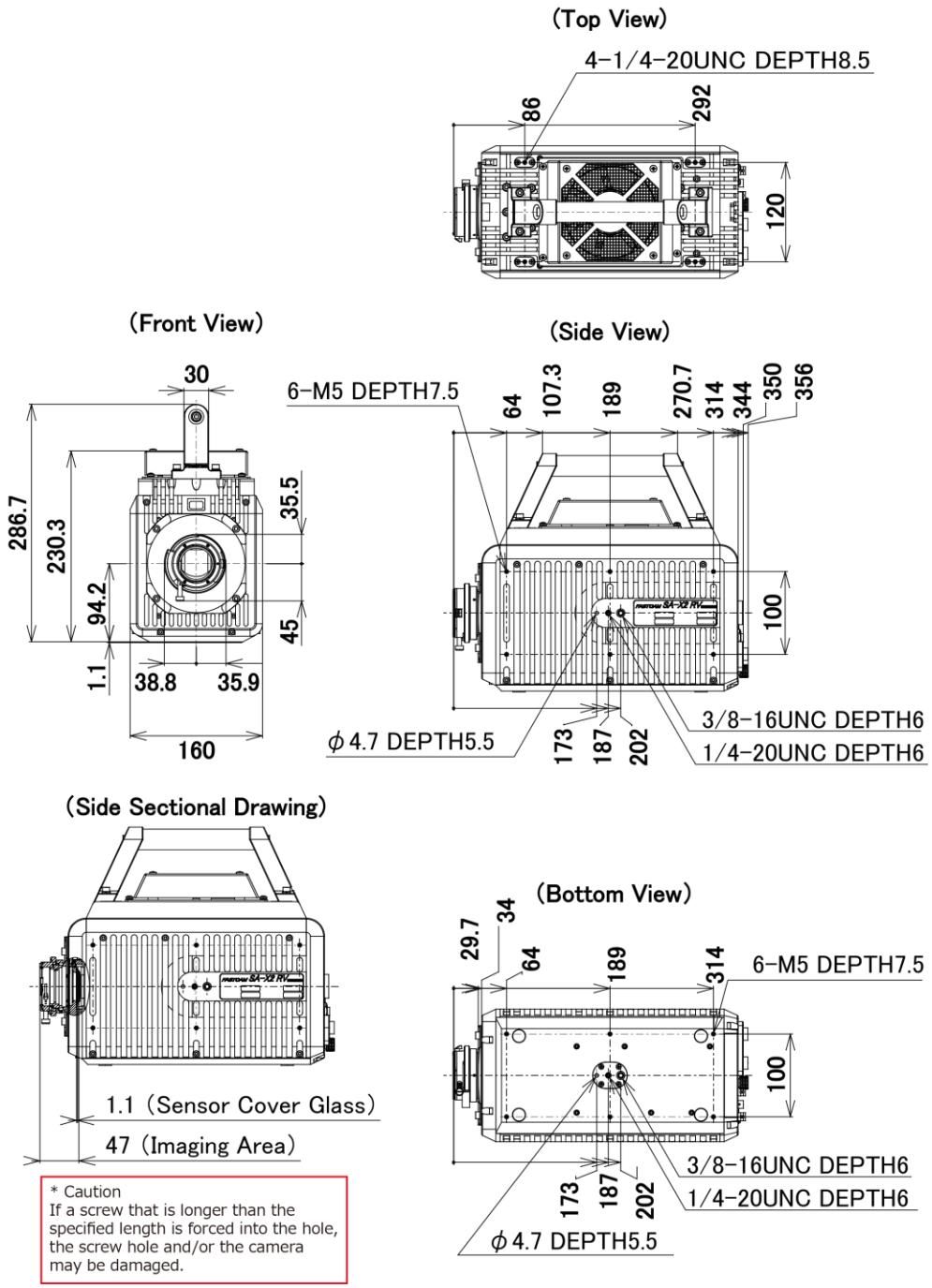
◆ FASTCAM SA-X2 C mount
(mm)



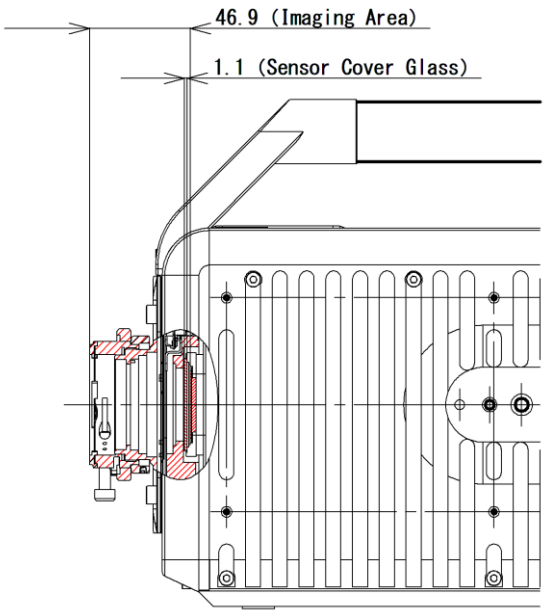
* Caution
If a screw that is longer than the specified length is forced into the hole, the screw hole and/or the camera may be damaged.

◆ FASTCAM SA-X2 RV

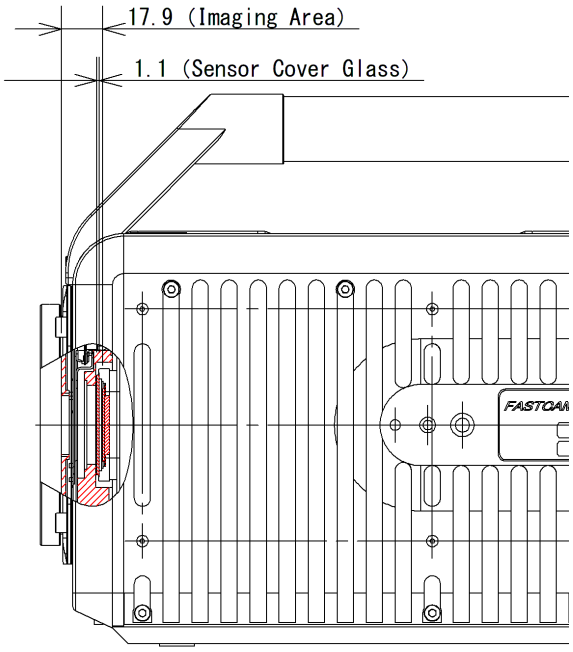
(mm)



- Sensor location (G type F mount)
  (mm)

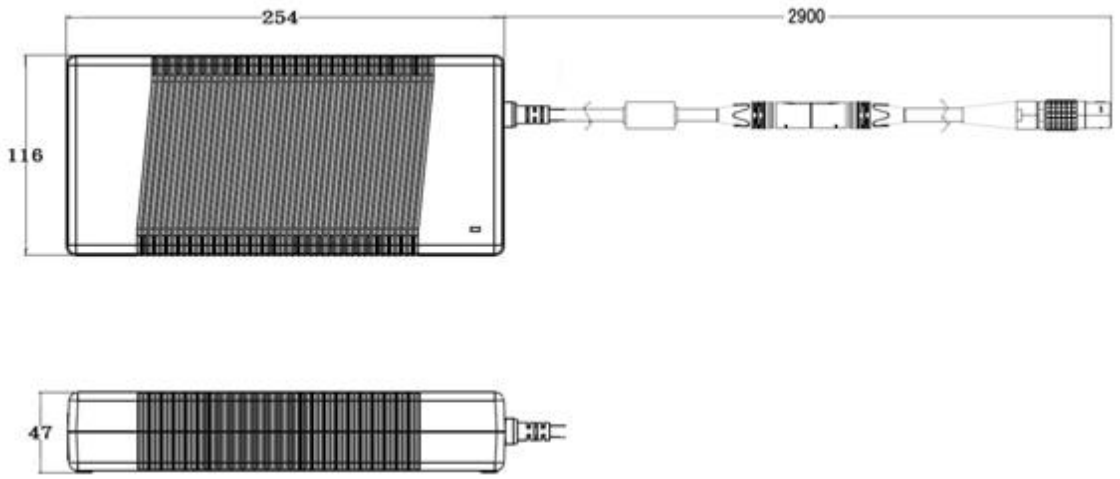


- Sensor location (C mount)
  (mm)



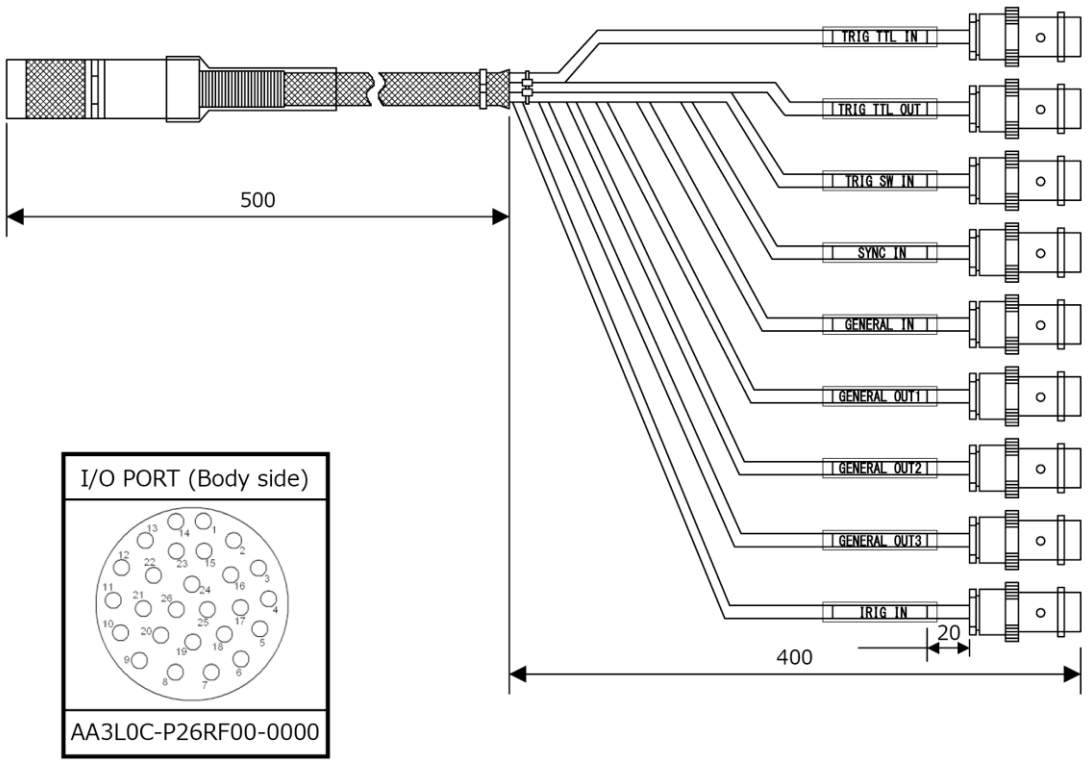
3.2.2 AC Power Supply Unit

(mm)



3.2.3 I/O Cable

(mm)



4

Chapter 4 Warranty

This chapter explains about the warranty.

4.1 About the Warranty

This system has been shipped having undergone rigorous testing. However, in the unlikely event that it malfunctions due to a manufacturing defect, it will be repaired, at no charge, within the warranty period.

Warranty Exceptions

The following exceptions will result in fee-based repair, even within the warranty period.

1. Damage or malfunction as a result of fire, earthquake, water damage, lightning, other natural disasters, pollution, or the effects of abnormal voltage.
2. Damage or malfunction as a result of dropping or mishandling during shipment or when moving after purchase or misuse.
3. Consumable goods (cables)
4. When repair, adjustment, or alternation done by an entity other than Photron service has been performed on the system, or damage or malfunction that is determined to be attributed to a fault in the use the product.

For inquires related to malfunction, contact the dealer where the product was purchased, or the nearest Photron office.

REFERENCE

For inquires related to our product, refer to “5.1 Contact Information” on page 59.

5

Chapter 5 Contacting Photron

This chapter lists the contact information to use when contacting Photron if the system malfunctions or if a portion of the manual is unclear.

5.1 Contact Information

For inquiries related to FASTCAM SA-X2, contact Photron at one of the contact points listed below.

Additionally, the following items will be required for verification when inquiring. You are kindly asked to prepare them in advance.

Items Verified	Required Information
Contact Information	Company, school or organization name, customer contact name, contact phone number, contact e-mail address.
Product Name	FASTCAM SA-X2
Serial Number	Shown in the nameplate seal.
Condition of the system, nature of problem, etc.	

Contact Information	
In Americas and Antipodes	**PHOTRON USA, INC.** 9520 Padgett Street, Suite 110, San Diego, CA 92126-4426, USA Phone: +1 (800) 585 2129 or +1 (858) 684 3555 Fax: +1 (858) 684 3558 E-mail: image@photron.com Web: www.photron.com
In UK, Africa and India	**PHOTRON (EUROPE) LIMITED** The Barn, Bottom Road, West Wycombe, Buckinghamshire HP14 4BS, U.K. Phone: +44 (0) 1494 48 1011 Fax: +44 (0) 1494 48 7011 E-mail: image@photron.com Web: www.photron.com
In Europe outside the UK	**Photron Deutschland GmbH** Ziegelweg 3, 72764 Reutlingen, Germany Phone: +49 (0) 7121 699 7950 Fax: +49 (0) 7121 699 7943 E-mail: image@photron.com Web: www.photron.com
In China	**PHOTRON (SHANGHAI) LIMITED** Room 20C Zhao-Feng World Trade Building, No. 369 Jiangsu Road Chang Ning District, Shanghai 200050, China Phone: +86 (21) 5268 3700 Fax: +86 (21) 5268 3702 E-mail: info@photron.cn.com Web: www.photron.cn.com
In other areas	**PHOTRON LIMITED** 21F, Jinbocho Mitsui Bldg., 1-105 Kanda Jimbocho, Chiyoda-Ku, Tokyo 101-0051, Japan Phone: +81 (3) 3518 6271 Fax: +81 (3) 3518 6279 E-mail: image@photron.co.jp Web: www.photron.co.jp

A

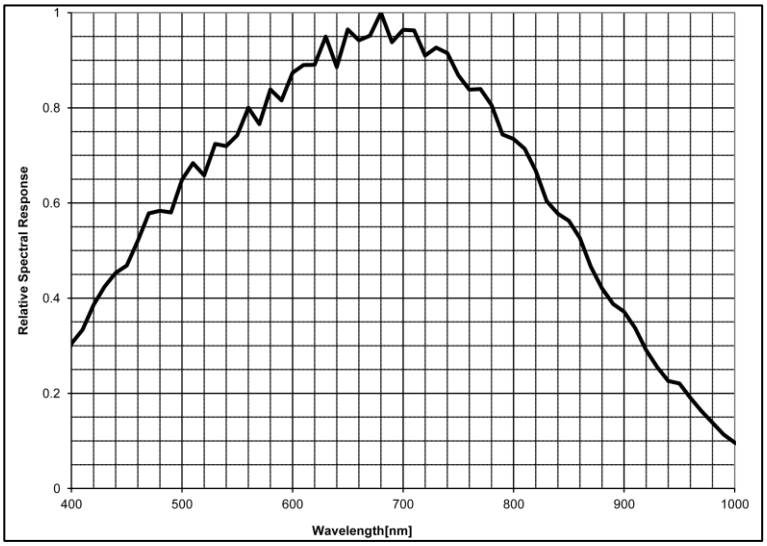
A. Appendix

A.1. Reference Information

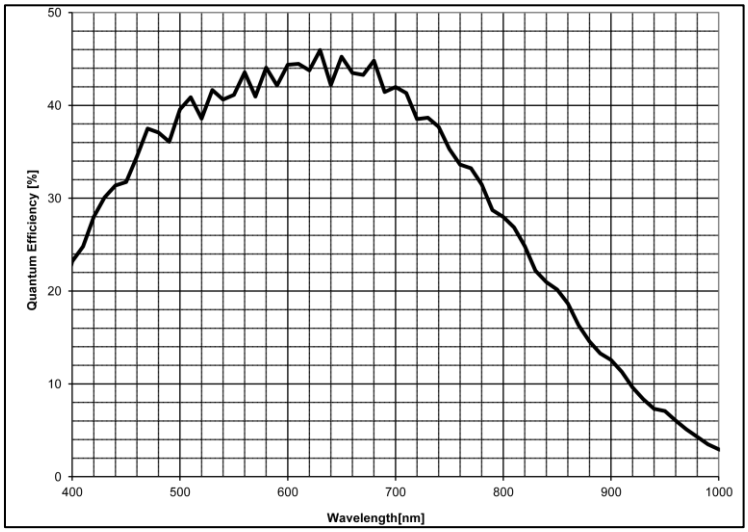
CAUTION

The spectrum response curve and the quantum efficiency curve are nominal (reference) data of the image sensor device.

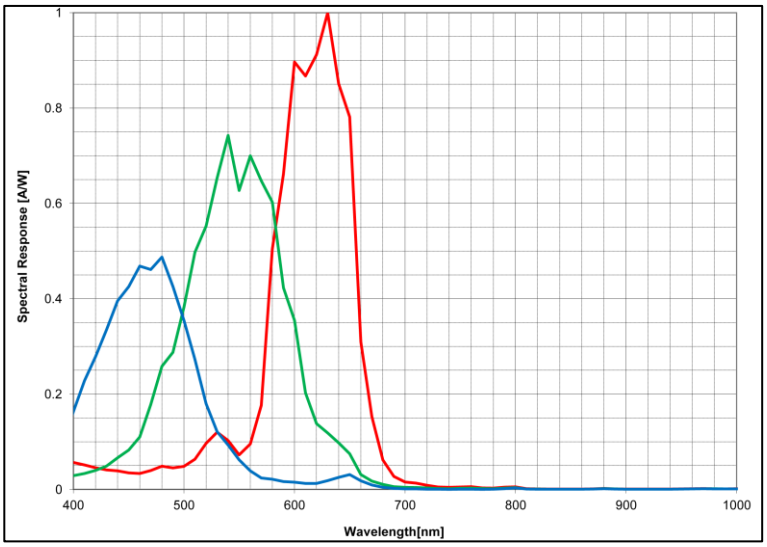
A.1.1 Relative Spectral Response (monochrome)



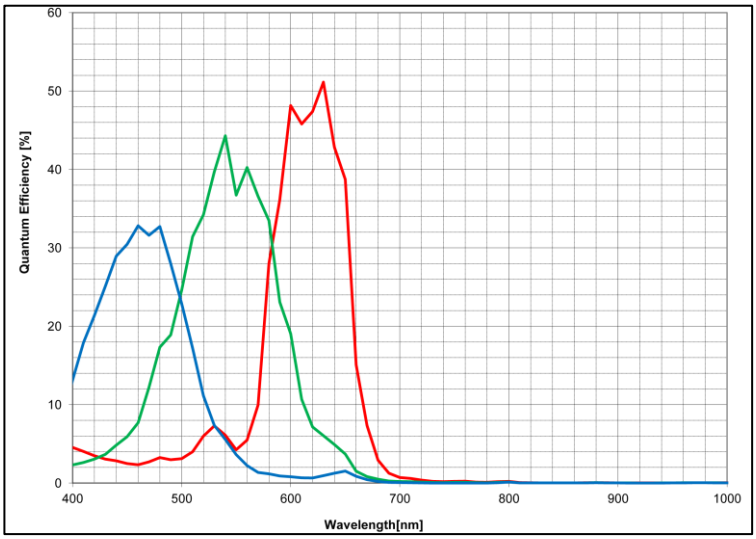
A.1.2 Quantum Efficiency (monochrome)



A.1.3 Relative Spectral Response (color)



A.1.4 Quantum Efficiency (color)



FASTCAM SA-X2

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