

FASTCAM Multi

Hardware Manual



Rev. 2.04 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 users will be required to correct the interference at their 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.

- The copyright of this manual is held by PHOTRON LIMITED.
- Product specifications and manual contents are subject to change without notice.
- PHOTRON LIMITED bears no responsibility for any results by using our products nor by applying this manual to any operations.

Introduction

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

This manual contains the operating instructions and warnings necessary for using the system.

Before using the system, please 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.

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.
 Supplement	This symbol indicates supplementary items to be aware of when using the system.
 Reference	This symbol indicates the location of a reference.
 MEMO	This symbol indicates a space for you to make notes.
“ ”	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 Manual

This section explains the layout of the manual. For other options, please refer to each manual.

◆ Introduction

The introduction explains the manual and safety precautions.

◆ Chapter 1. Overview

This chapter gives an overview of the system and an explanation of its features.

◆ Chapter 2. 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.

◆ Chapter 3. System Connections

This chapter explains the procedure for connecting each component of the system and to a PC.

◆ Chapter 4. Functions

This chapter explains the system's functions. Refer to the "Photron FASTCAM Viewer User's Manual" for additional details on using a PC to control the system.

◆ Chapter 5. Product Specification

This chapter explains the system's specifications.

◆ Chapter 6. Warranty

This chapter explains about the warranty.

◆ Chapter 7. 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.

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. Please 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 produces 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.



- Please consult us 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.



- Do not obstruct the air intake and exhaust port, when the system is installed.



- Ambient temperature 0-45° C, humidity 80% RH or lower, maximum altitude 2,000m 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. Also, prevent condensation from forming during shipment.



- 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, please 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. Please 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.



- Please 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.)



Camera Cable



- Minimum curve radius of the camera cable is 125mm. Be careful when using or storing camera cable to give an ample space for the curvature.



- Do not give an excessive impact or load to camera cables to avoid damage.



- Whenever the cables are out of use, place the attached connector caps for protection of the connectors.



- In operation, connect the main unit's connector cap and the camera cable's connector cap each other to avoid dirt and pollution and to keep clean inside.



The camera cable includes optics fibers. If dust or dirt is in inside of a connector, it may cause a communication error. Keep clean the inside of connectors. If a connector is polluted, clean the fiber edges by following instruction or using the bundled cleaning kit.



- DO NOT use hard and/or sharp materials for cleaning.



- 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.
- Fibers are indicated with a red circle over the cable cross-section.

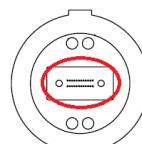




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Chapter 1. Overview

1.1. Product Overview and Features

1.1. Product Overview and Features

This product is a detachable high-speed camera that can connect up to two compact camera heads simultaneously. Since the Multi can be easily set up for synchronized recording by attaching two camera heads to the main unit, this system is optimum for applications such as multi-angle recording and 3D video analysis. It is simple to exchange color/monochrome camera head(s) since camera heads and the main unit are detachable.

The Multi has adopted a special robust multi-optical cable to connect between the main unit and camera head(s). There are 5 m-cable and 10 m-cable options. They can be used for explosion, ignition, and shock tests where dangerous phenomena will be recorded. This will allow the main unit to be set at a safe location and important data will be protected.

The main unit has adopted a robust design where circuit boards are completely sealed from the outside. The system is not only equipped with input/output terminals for triggering and synchronizing with external devices, but also supports a variety of functions such as video output and Gigabit Ethernet control by a PC and Remote Controller (Optional). Photron has software for control, image analysis, and processing.

Use the Multi in a variety of applications with its multi-function, high-performance, robust, and expandable specifications to take full advantage of it.



FASTCAM Multi

Chapter 2. Setup

2.1. System's Components and Accessories

2.2. Accessories/Options

2.3. Part Names

2.1. System's Components and Accessories

2.1.1. Components

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



As to the ancillary items, such as AC adapter and AC cable, use those components, accessories and optional items that are shown in "2.1. System's Components and Accessories" section only.

2.1.2. Type

This product has 1 or 2 data recording channels depending on the number of cameras to be connected. Also, each system has a memory capacity of 8GB, standard, or larger capacity of 16GB or 32GB. Memory capacity, together with the number of recording channels, can be selected to the user's particular needs at the time of purchase. The below table shows combinations of the number of recording channels and memory capacity available to choose from:

- Camera's types and specifications

FASTCAM Multi Main Unit type 1ch-32GB-FD

Product Name Channel Memory FAST Drive

Item	symbols	Descriptions
Channel	1ch	Channel 1
	2ch	Channel 2
Memory	8GB	8 Gigabytes
	16GB	16 Gigabytes
	32GB	32 Gigabytes
FAST Drive	FD	FAST Drive / FAST Dock-compatible
	N/A	FAST Drive / FAST Dock-noncompatible



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 using your camera outside Japan, check with Photron first. Contact information is given in 7.1 Contact Information.

- FAST Drive / FAST Dock

Type	Descriptions
FAST Drive type 2TB	High-Speed SSD Box (2TB)
FAST Drive Cable	High-Speed SSD Box Cable (50cm)
FAST Dock	High-Speed SSD Box Dock Station

2.2. Accessories/Options

This camera system is used in conjunction with various accessories and optional items as necessary.

Accessories and optional items available as of March 2016, are shown in the following subsections:

2.2.1. Camera Head

- FASTCAM Multi Camera Head HS-01 type 750K-M (Monochrome) (102479)
- FASTCAM Multi Camera Head HS-01 type 750K-C (Color) (102480)
- FASTCAM Multi Camera Head HS-01 type 200K-M (Monochrome) (102829)
- FASTCAM Multi Camera Head HS-01 type 200K-C (Color) (102830)

The camera head incorporates an area sensor with the full resolution of 1280 x 1024 pixels, maximum frame rate of 4,800 fps (at full frame recording), up to 750,000 fps (at segmented frame recording, at type 750K). Regarding type 200K, its maximum frame rate is 200,000 fps.

Reference

- Refer to "FASTCAM Multi Camera Head HS-01 Hardware Manual".

Caution

- Export-controlled model type 200K is subject to restriction on the frame rate and shutter speed.
- 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 using your camera outside Japan, check with Photron first. Contact information is given in 7.1. Contact Information.

2.2.2. Camera Cable

- FASTCAM Multi Camera Cable 5 m (102481)
- FASTCAM Multi Camera Cable 10 m (102482)
- FASTCAM Multi Camera Bulkhead Cable 5 m
- FASTCAM Multi Camera Bulkhead Cable 10 m

They are cables to connect between the camera head and processor.

The Bulkhead Cable is an optional cable, which can segment the camera cable in the middle. It can be attached to the special camera housing. The length can be extended to a maximum of 50 m by combining it with the normal camera cable.



- Minimum curve radius of the camera cable is 125 mm. Be careful when using or storing camera cable to give an ample space for the curvature.
- Do not give an excessive impact or load to camera cables to avoid damage.
- Whenever the cables are out of use, place the attached connector caps for protection of the connectors.

2.2.3. LED Light

■ FASTCAM Multi LED Light Option (102483)

This lighting unit is attached to the camera head.

Reference

- Refer to “FASTCAM Multi LED Light Option Hardware Manual”.

2.2.4. Micro Four Thirds Lens Option

■ Micro Four Thirds Lens Option For FASTCAM Multi (102484)

This is the lens mount, to be fitted to the camera head, to take the Micro Four Thirds lens.

Reference

- Refer to “Micro Four Thirds Lens Option For FASTCAM Multi Hardware Manual”.

2.2.5. Remote Controller

■ Remote Controller

These are the external control, to be used in connection with the body.

Reference

- Refer to “Remote Controller User’s Manual”.

2.3. Part Names

This product comprises the following components: the camera and processor, AD adapter and control software [The Photron FASTCAM Viewer ("PFV" hereinafter)]. It is used in conjunction with various optional items as necessary.



For each of the system components.

- Do not expose 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 excessive force.

2.3.1. Main Unit

The processor (Main Unit) incorporates a memory unit, which is so designed to allow the high-speed image to be recorded as uncompressed digital data. The front panel has connectors installed for video output, which makes it possible to monitor the recorded image being played back, the Gigabit Ethernet interface to connect to the PC for full control and data download. Also installed are such connectors as IN/OUT connectors for external sync and trigger signal, and interface for the IRIG time code input. FAST Drive models have their own connection terminal.

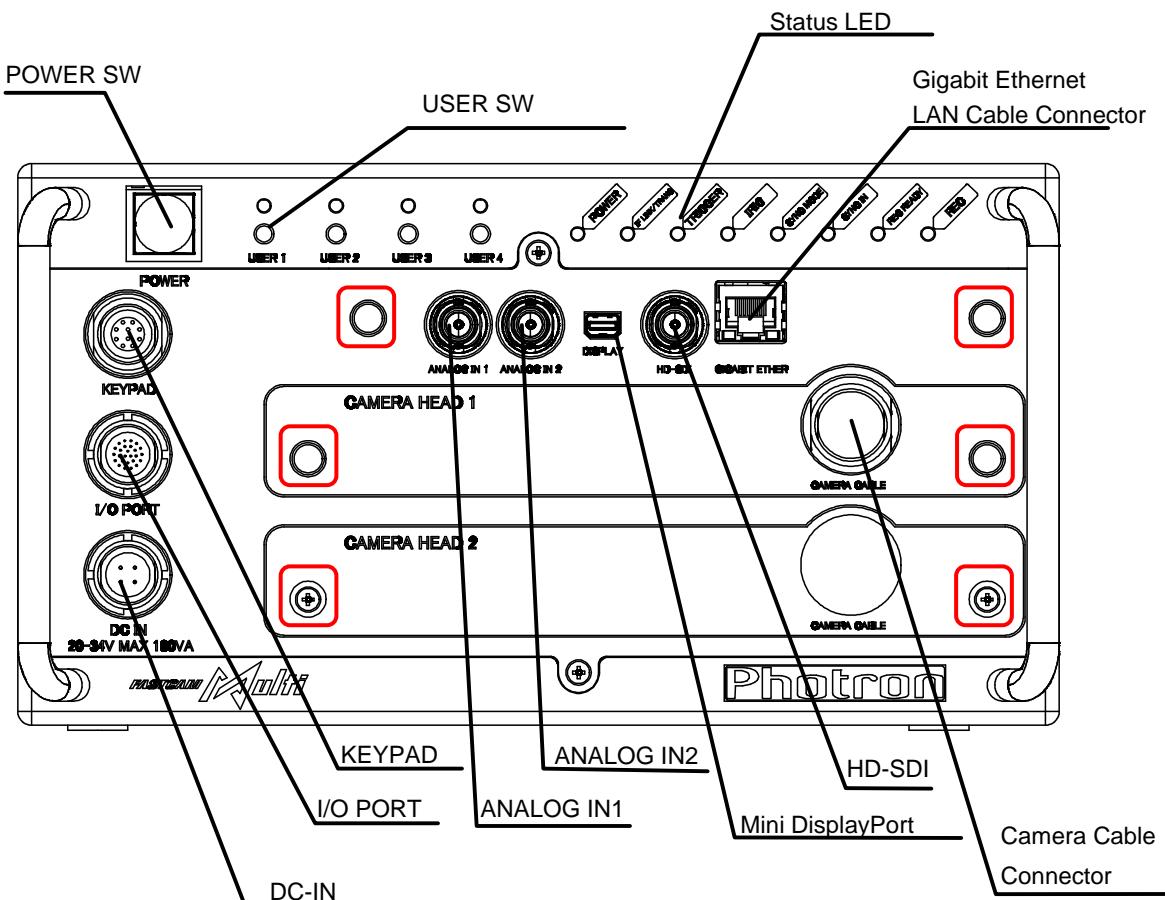


FASTCAM Multi Main Unit



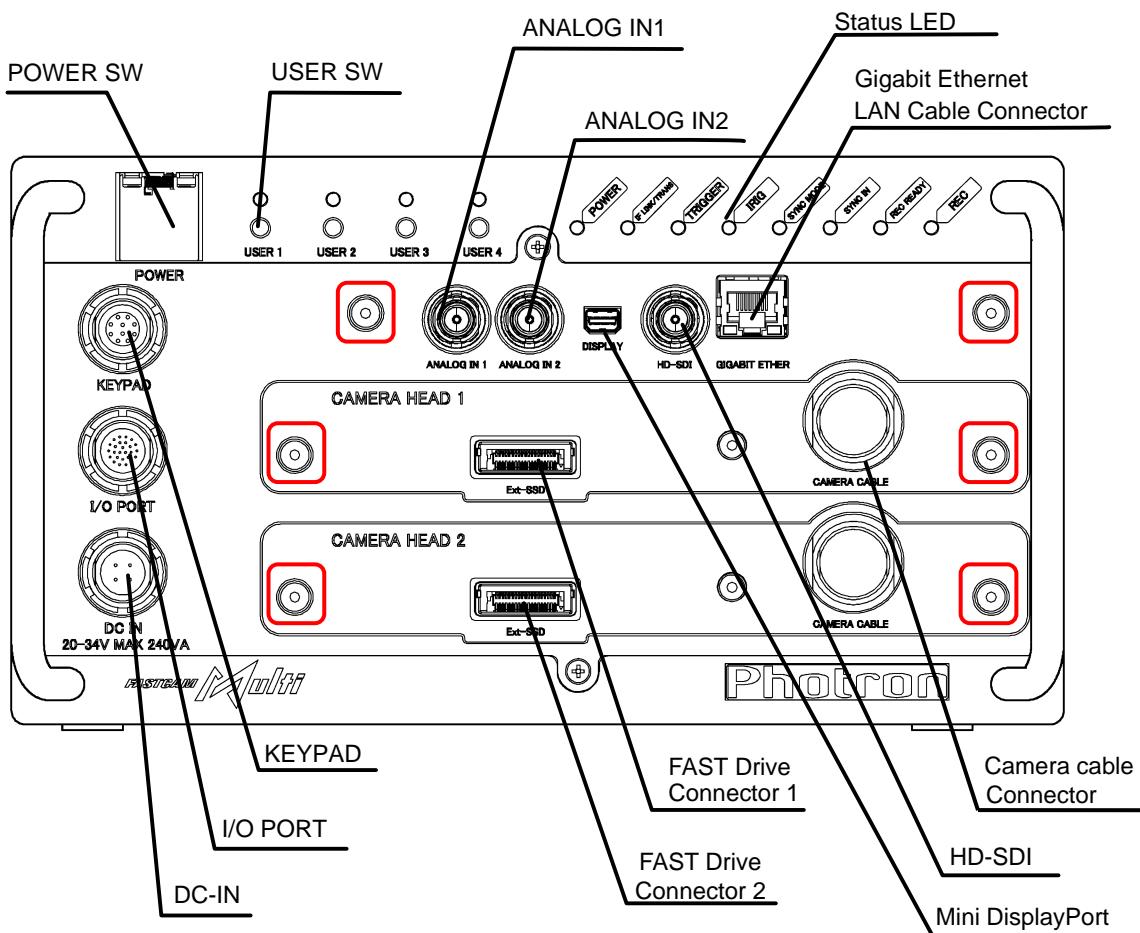
FASTCAM Multi Main Unit (FAST Drive)

2.3.2. Main Unit Part Names



Front Side

FASTCAM Multi Main Unit (FAST Drive)



Front Side



Above red marked six knobs are only for Photron service engineers.

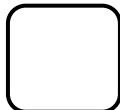
Do Not loosen or remove them.

2.3.3. Main Power Switch

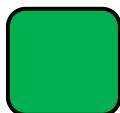
This is the main power switch for the processor. To turn the unit on or off, press the ON/OFF switch with the cover flipped up.

The power status is shown as follows:

- Indicator off: Power to the system is off.



- Indicator ON (green): Power is on, that is the camera head is active with power.

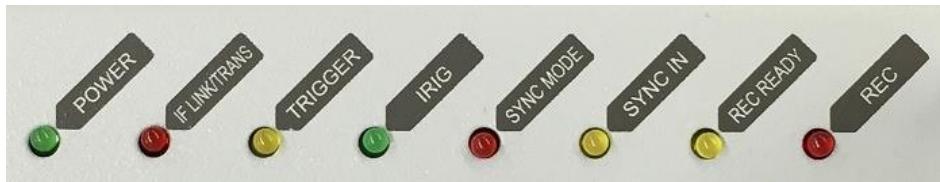


- Indicator OFF (red): Power to the processor is on, but the camera head is NOT powered.
Press the switch to shut down the system to double-check the cable connections.
If all connections are correctly made, press the main switch again to activate the whole system.



2.3.4. Status LEDs on the Front Side

There are eight LED indicators on the upper right front part of the front panel of the processor. The meaning of the LED indicators is explained in this subsection.



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

- ◆ Illumination/blinking in operational states
 - During low light mode
Operation LEDs other than POWER (green) and IF LINK/TRANS (red) blink at a regular interval.
 - 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 a number of times.

 Reference

- For how to initialize the Gigabit Ethernet interface, refer to “3.4.4 Initializing Gigabit Ethernet Interface and Camera IP Address” page 24.

2.3.5. Remote Controller (Optional)

The system can be operated while checking the monitor by connecting the optional Remote Controller to the “KEYPAD” connector on the front side. The Remote Controller is also hot-pluggable; it can be plugged into and unplugged from the camera while the power is on.



Camera Body Connector	Signal	Camera Body Connector Model Name (Manufacturer)	Keypad Connector Model Name (Manufacturer)
KEYPAD	Keypad signal	ECG.2B.310.CLN (LEMO)	S22L0C-P10MJG0-820S (ODU)

Supplement

- The Remote Controller is optional. It is not included in the standard configuration.

Reference

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

Reference

- For the dimensions of the Remote Controller, refer to “5.2.2 Remote Controller (Optional)” page 58.

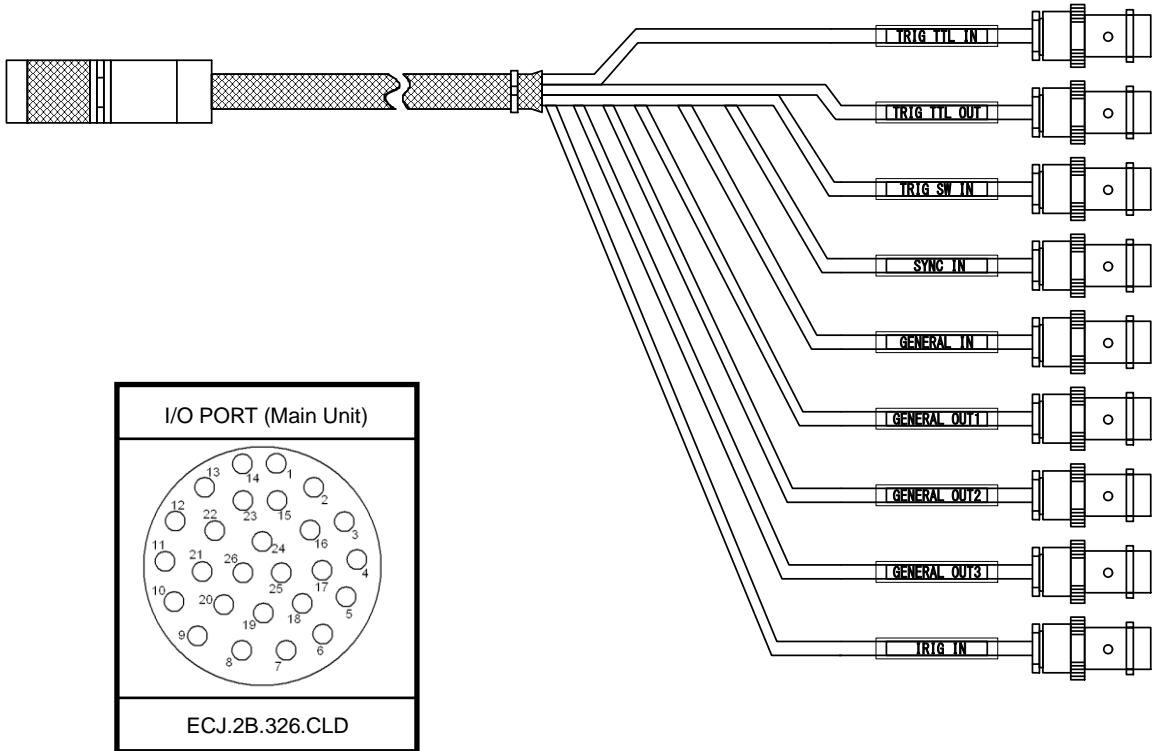
2.3.6. I/O PORT Connector

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 "4.1. Input / Output Signals" page 28.

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	ECJ.2B.326.CLD (LEMO)	FGJ2B326CLLD92Z (LEMO)	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
	-	23			-
	-	24			-
	-	25			-
	GND	26			-

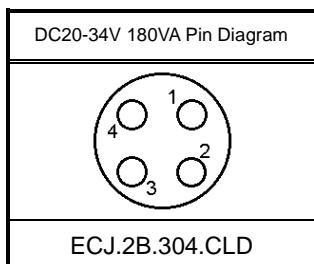
Supplement

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

2.3.7. Power Supply Connector

The DC power supply input connector. Connect to the supplied AC adapter or the optional High-G Battery.

The cable connector is optionally available. When using other power supplies, construct a cable using the pin diagram below as a reference.



Connector Name	Signal Name	Pin No.	Camera Body Connector Model Name (Manufacturer)	Cable Connector Model Name (Manufacturer)
DC20-34V 180VA	+20V - +34V IN	1	ECJ.2B.304.CLD (LEMO)	FGJ.2B.304.CYMD82Z (LEMO)
	GND	2		
	GND	3		
	+20V - +34V IN	4		



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

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

Chapter 3. System Connections

- 3.1. Camera Head Connection**
- 3.2. AC Power Supply Connection**
- 3.3. Remote Controller Connection (Optional)**
- 3.4. PC Connection**
- 3.5. Video Monitor Connection**

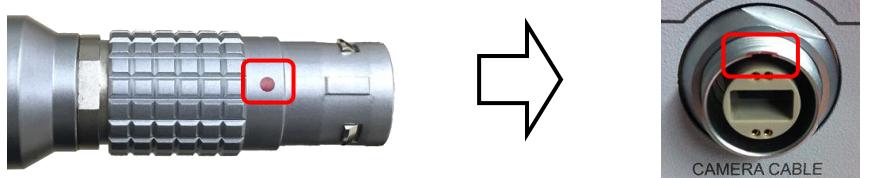
3.1. Camera Head Connection

Following the below steps, connect between the Main Unit and a camera head using the dedicated cables.

1. Make sure the power to Main Unit is off.
2. Grasp and slide the grip of the connector, and then remove the cap from the camera cable. Connect the caps each other to avoid dirt and pollution and to keep clean inside.



3. Connect the camera cable. Make sure of the connector on the camera head and Main Unit. See the position of the red mark on the cable-mount connector and the box-mount connector to be connected.



Camera Cable Connector

Main Unit Connector

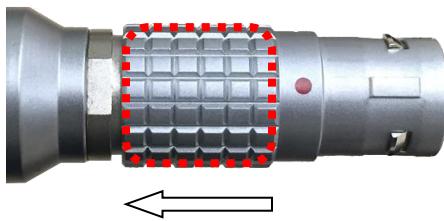


Main Unit



Camera Head

4. When disconnecting the camera cables, first shut down the system.
Grasp and slide the grip of the connector, and then disconnect the camera cable.



Camera Cable Connector

 **Supplement**

- The camera cable has no dedicated orientation: the connector on either end can be connected to either the Main Unit or the camera head.



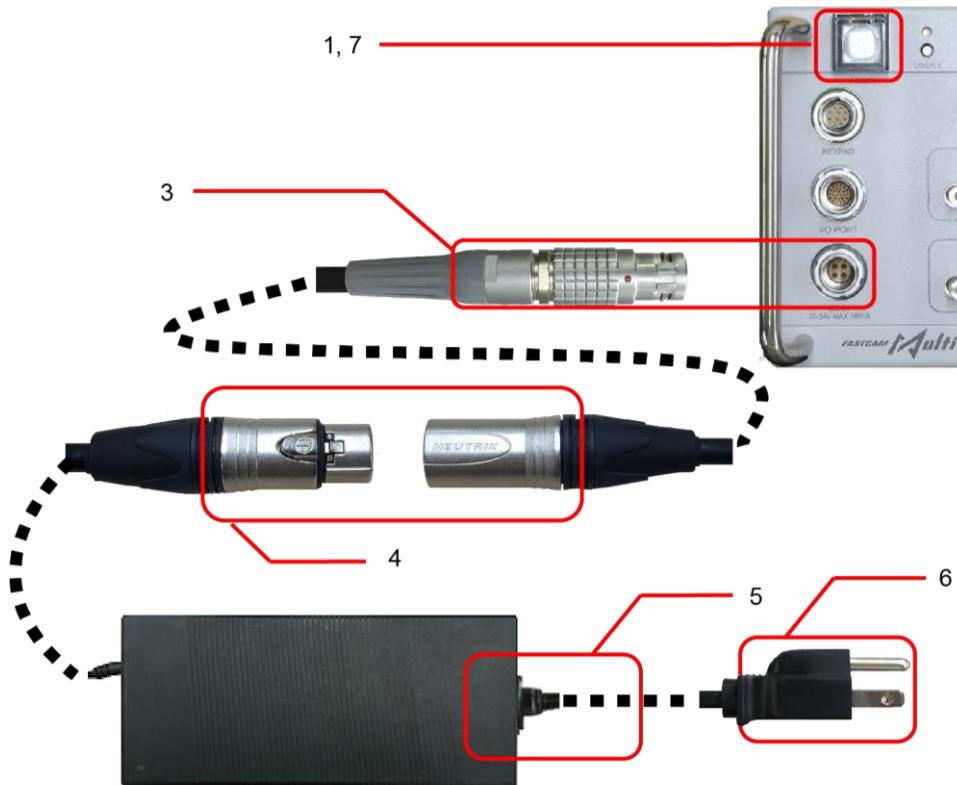
Be sure to verify if the camera cable has been correctly and firmly inserted. If the camera cable is disconnected for any reason while the camera is active, an error will result.



Be sure to shut down the Main Unit before connecting or disconnecting the camera head. If the camera head is connected or disconnected while the system is powered, an error will result.

3.2. AC Power Supply Connection

Connect the supplied AC adapter to the power supply.



1. Confirm the Power SW is turned off.
2. Connect the options/accessories.
3. Connect the AC adapter to the “DC20-34V 180VA” connector on the front of the Main Unit.
4. Connect the DC cable to the DC connector of the AC adapter.
5. Connect the AC cable to the AC adapter.
6. Connect the AC cable to the power outlet.
7. Turn on the Power SW one the system.

Reference

- For the specification of the power supply which can be used, refer to “5.1.2. General Specifications” page 55.

3.3. Remote Controller Connection (Optional)

If you have the optional Remote controller, connect it by plugging the keypad connector into the connector labeled “KEYPAD” on the front side.



Supplement

- The Remote controller is hot-pluggable. It can be plugged in and removed while the system's power is on.

Reference

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

3.4. PC Connection

The system can have the operation of its functions performed from a PC using the Gigabit Ethernet interface. This section explains the required setup when connecting the system to a PC.

To connect a PC to the system, connect the system to a commercially available 1000BASE-T compatible interface board with a LAN cable. For the LAN cable, prepare a UTP or STP CAT5E (enhanced category 5) or higher category LAN cable. (UTP: Unshielded Twisted Pair, STP: Shielded Twisted Pair)

The maximum cable length between the PC and the system is 100 m (compliant to the 1000BASE-T specification). One PC can connect to a maximum of 64 Photron Gigabit Ethernet interface equipped cameras using a hub. When connecting multiple devices, connect through a switching hub that can connect at 1000BASE-T. The maximum length of the cable that connects the system (or PC) to the switching hub is also 100 m.

Reference

- For the setting method of control PC, refer to “Photron FASTCAM Viewer User’s Manual”.
- For detail instruction on PC connection setting, refer to “Gigabit Ethernet Interface Connection Tutorial Manual”.

Supplement

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

Important

The system’s factory default IP address is below:

IP ADDRESS: 192.168.0.10
NETMASK: 255.255.255.0
GATEWAY ADDRESS: 0.0.0.0
PORT: 2000 (Fixed, not changeable)

3.4.1. Connecting the Main Unit and a PC

Connect a LAN cable to the system as shown below.



Insert the LAN cable into the “GIGABIT ETHER” connector.

A bundled LAN cable may be different from the cable in the figure.

3.4.2. Setting the IP Address

The IP address can be specified using a remote controller (option) or using the PFV software.

Reference

- For the procedure for setting the IP address of the system, refer to the “Photron FASTCAM Viewer User’s Manual” or the “Remote Controller User’s Manual”.

Caution

- When connecting the system to a PC or when connecting other Gigabit Ethernet interface compatible Photron cameras, set each of those devices to a different IP address. Also, when connecting the system to an existing network, do not use IP addresses that are already in use on the network.

3.4.3. Connecting Multiple Systems and a PC

With PFV, the system’s control software, one PC can connect to and control multiple FASTCAM series camera systems.

Caution

- When connecting to multiple systems, set the IP address of each one to a unique setting.

3.4.4. Initializing Gigabit Ethernet Interface and Camera IP Address

You could reset the IP address back to the factory setting (192.168.0.10) by going through below steps. This could be useful at times when you could not connect to the camera while running PFV, the product's control software, or when you accidentally changed your camera's IP address and lost it.

1. Out of 4 programmable switches (USER SW) on the front panel, hold either USER1 or USER4 for at least 10 seconds.
2. Front panel's LEDs will be turned on in sequence from left to right then right to left, which means initialization of Gigabit Ethernet Interface and Camera's IP address has been successful.

! **Caution**

- Holding the programmable switch (USER SW) for more than 15 seconds will execute initialization to factory default settings.

3.4.5. Initializing to Factory Default Settings

Below operation will reset the camera to the factory default settings.

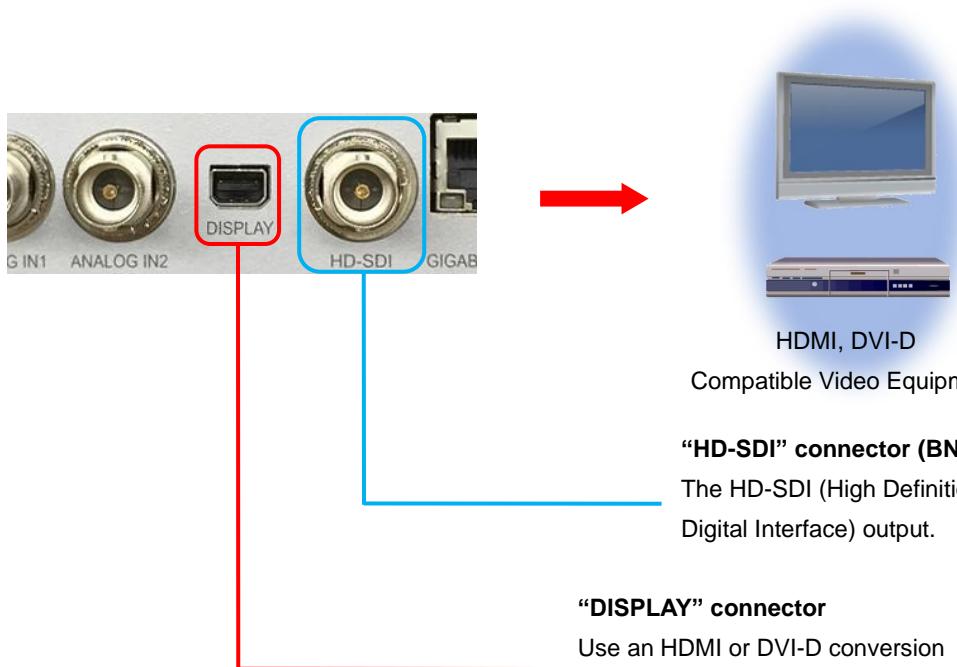
1. Out of 4 programmable switches (USER SW) on the front panel, hold either USER1 or USER4 for at least **15 seconds**.
2. Front panel's LEDs will be turned on in sequence from left to right then right to left, which means initialization of Gigabit Ethernet Interface and Camera's IP address has been successful.

! **Caution**

- For the firmwares before Ver.2.00, holding USER1 or USER4 switches for more than 10 seconds will initialize Gigabit Ethernet Interface, holding USER1 or USER4 for more than 15 seconds will initialize camera's IP address.

3.5. Video Monitor Connection

A video monitor is connected to visually confirm the image data, live feed from the camera or replay data from the memory. Using the “DISPLAY” connector or the “HD-SDI” OUT connector on the front body, connect the video input connector BNC cable according to the video signal type of monitor that displays. Which from the connector to output, in the “Remote Controller (optional)” or the “PFV”, can set.



Supplement

- Conversion adapter or converter for HDMI or DVI-D connector is not included in the product package.
- You can switch the display for one output format between the live feed or memory. The other output continuously displays the Live screen.
- Use a 5C-FB standard cable for the HD-SDI output.



Important

- An adapter/equipment for converting to HDMI or DVI-D connector has to be supported the following specification.

Convertor type: Passive

Other conditions: DP++ (DisplayPort++), supporting signal pass through



Chapter 4. Functions

- 4.1. Input / Output Signals**
- 4.2. External Triggering**
- 4.3. External Synchronization Signals**
- 4.4. GENERAL Signal Setting**
- 4.5. Setting of Input/Output Signals and Sync Output Rate**
- 4.6. Using Programmable Switch (USER SW)**
- 4.7. IRIG Time Code (External Time Synchronization)**
- 4.8. IRIG-sync Operation**
- 4.9. AUTO EXPOSURE Operation**
- 4.10. Built-in DAQ (2ch)**
- 4.11. Error Code**

4.1. Input / Output Signals

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.

4.1.1. 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 ns or greater.

4.1.2. TRIG TTL OUT Connector

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

4.1.3. 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 avoid contacting with other pins.

4.1.4. 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 ns or greater.

4.1.5. 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 ns or greater.

TRIG POS/NEG	Inputs a TTL trigger signal.
READY POS/NEG	Inputs a change recording ready status signal (READY ON/OFF).

4.1.6. GENERAL OUT (1, 2, 3) Connector

These are also BNC connectors. The signals below can be changed and output from the menu or PFV.

(POS: positive polarity, NEG: negative)

SYNC POS/NEG	Outputs a vertical synchronization signal.
EXPOSE POS/NEG	Outputs the camera's exposure period signal. * Outputs during both LIVE and recording.
REC POS/NEG	Outputs a signal during recording.
TRIG POS/NEG	Outputs the trigger signal the camera received.
READY POS/NEG	Outputs a signal that indicates the recording ready state.



Reference

- For details refer to “3.8 Other Settings” of the “Photron FASTCAM Viewer User’s Manual”, or “10.6.1 Setting External I/O Port” of “Photron FASTCAM Viewer 4 User’s Manual.”

4.2. External Triggering

With the system, you can record by receiving various trigger signals matched to the recording application. The trigger signals that can be used on the system are explained here, along with a description of how to use them.

4.2.1. Inputting External Trigger Signal

The external trigger signals that can be used with the system and their input system are listed below.

The signals input from the TRIG TTL IN and GENERAL IN connectors are explained in section “2.3.6. I/O PORT Connector”.

Connector Name (Input System)	Menu	Signal
TRIG TTL IN	TRIG POS	FET Input 0V - +12V (H level +3.3V to +12V), Positive Polarity
	TRIG NEG	FET Input 0V - +12V (H level +3.3V to +12V), Negative Polarity
GENERAL IN	TRIG POS	FET Input 0V - +12V (H level +3.3V to +12V), Positive Polarity
	TRIG NEG	FET Input 0V - +12V (H level +3.3V to +12V), Negative Polarity
TRIG SW IN	None	Contact signal

Set the signal type to be input to GENELAL IN from the menu in advance.



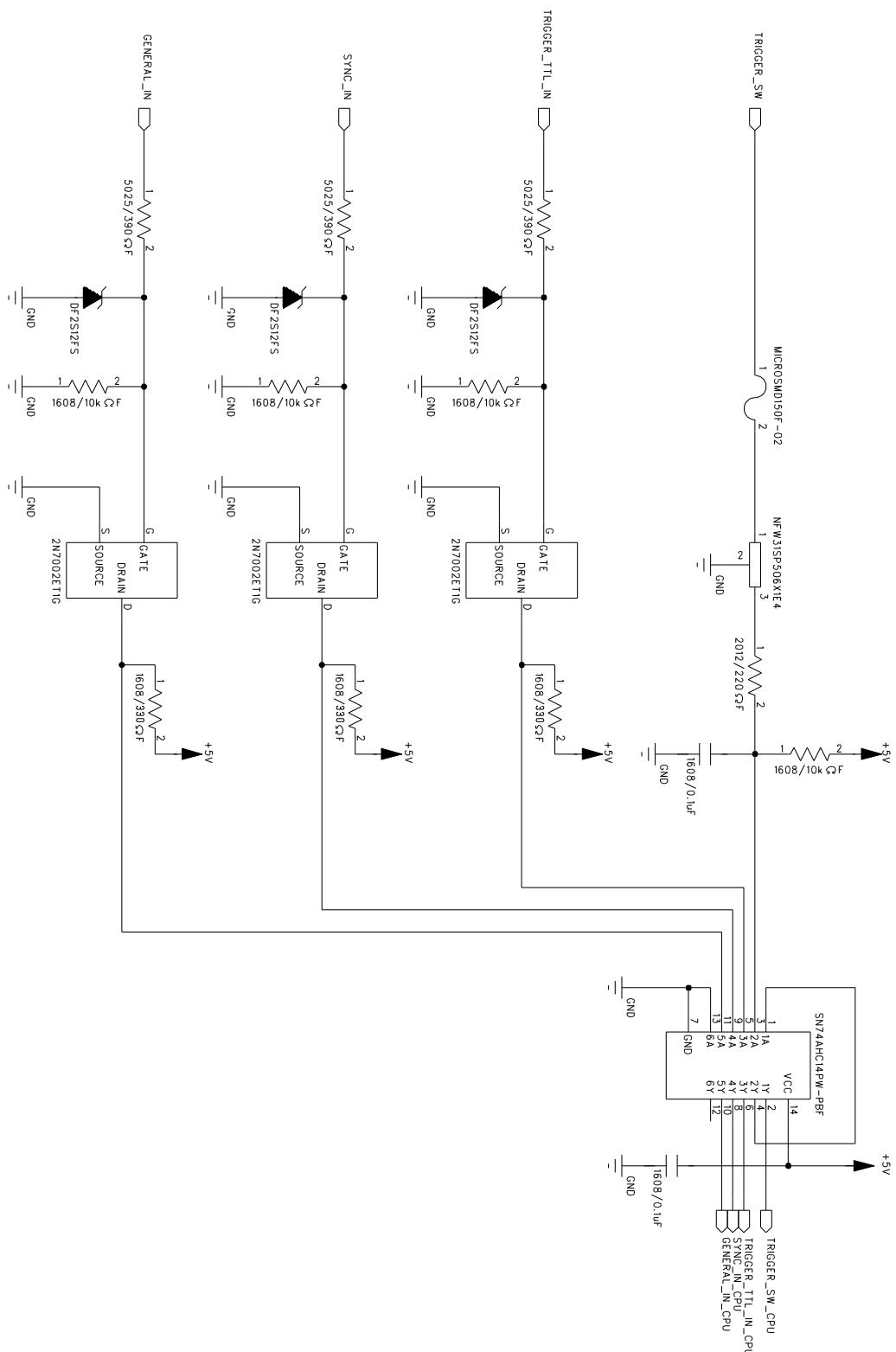
Use caution not to input more than specified voltage or current to the TRIG TTL IN and GENERAL IN trigger signal inputs as there is a risk of damage to the equipment.



Reference

- For the setting method of the signal inputted into GENERAL IN, refer to “4.4.1.GENERAL IN Signal Setting” page 39.
- For each external trigger signal input setting refer to “3.8 Other Settings” of the “Photron FASTCAM Viewer User’s Manual”, or “10.6.1 Setting External I/O Port” of “Photron FASTCAM Viewer 4 User’s Manual”.

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



4.2.2. Outputting External Trigger Signals

With the system, you can externally output trigger signals. Output is performed with the TRIG TTL OUT connector's dedicated trigger output system provided by the system, and additionally, output can also be optionally set from the GENERAL OUT connector. External trigger signal output settings are also made by PFV, selecting [TRIG TTL OUT] or [GENERAL OUT] from [Camera Option] – [I/O] - [External Signal I/O Port].

Signal output is performed from the TRIG TTL OUT connector and the GENERAL OUT connector explained in section “2.3.6. I/O PORT Connector”.

The chart below summarizes the output systems and the signals that can be output.

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. 19.6 μ sec. For TRIG TTL IN, approx. POS: 98 nsec. NEG: 107 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. 49 nsec
	TTL IN THRU NEG	TRIG TTL IN through output CMOS (74ACT541 buffer) output, Negative Polarity.	For TRIG TTL IN NEG, approx. 65 nsec
GENERAL OUT	TRIG POS	TTL, SW, SOFT, all TRIG pulse output CMOS (74ACT541 buffer) output, Positive Polarity.	For TRIG SW IN, approx. 19.6 μ sec. For TRIG TTL IN GENERAL IN, approx. POS: 98 nsec. NEG: 107 nsec
	TRIG NEG	TTL, SW, SOFT, all TRIG pulse output CMOS (74ACT541 buffer) output, Negative Polarity	

Signal cable condition: 50 cm

4.3. External Synchronization Signals

An external synchronization mode to synchronize to an external signal is provided on the system. By using an external synchronization signal, recording can be conducted using multiple cameras to synchronize the timing of the shots or to also synchronize the shots with external measuring devices and lighting. The procedure and precautions for using the external synchronization signal are explained below.

4.3.1. Inputting External Synchronization Signal

An external synchronization signal can be input with the system. See the chart below for external synchronization input settings.

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 - +12V (H level +3.3V to +12V), Positive Polarity
ON CAM NEG	Synchronizes to a negative polarity signal from Photron products.	FET Input 0V - +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 - +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 - +12V (H level +3.3V to +12V), Negative Polarity

4.3.2. Outputting External Synchronization Signal

The system can externally output a synchronization signal. Output of the external synchronization signal is performed from the GENERAL OUT connector explained in section “2.3.6. I/O PORT Connector”. See the chart below for external synchronization output settings.

Menu Display	Contents	Signal Type	Delay Time
SYNC POS	Outputs a positive polarity vertical synchronization signal.	CMOS (74ACT541 buffer) output, positive polarity	Approx. 140 nsec
SYNC NEG	Outputs a negative polarity vertical synchronization signal.	CMOS (74ACT541 buffer) output, negative polarity	Approx. 145 nsec

Signal cable condition: 50 cm

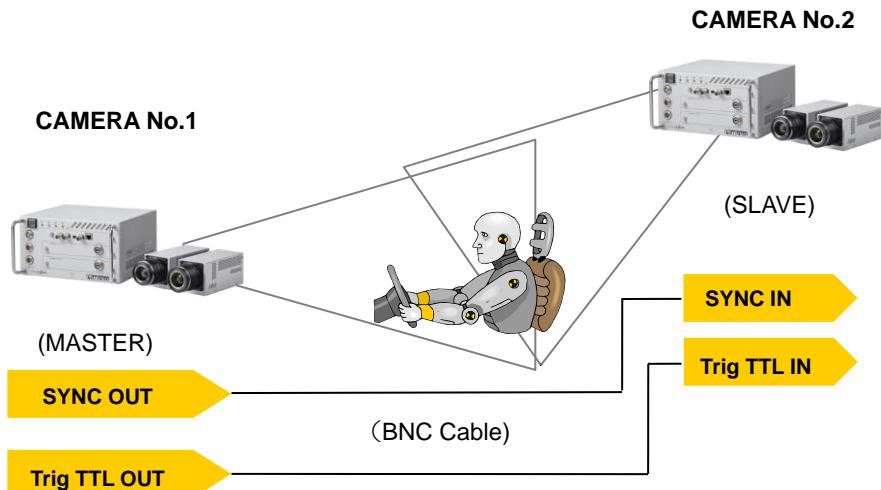
4.3.3. Synchronization with a variable frequency

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 60Hz (50Hz) following to the input signal, even under the recording mode.

4.3.4. Synchronizing Multiple FASTCAM Multi Systems (Multiple Unit Synchronized Recording)

The system can perform synchronized recording by synchronizing multiple units using external synchronization input/output.

◆ Conceptual Diagram of Synchronous Connection



Synchronized recording settings using the system are made with the “remote controller (optional)” or PFV. The conceptual settings when performing synchronized recording using two systems are explained here. First, decide which camera to make the master camera (outputs the synchronization signal) and the slave camera (receives the synchronization signal) from the two systems to use for synchronized recording.

◆ Setting the Master Camera (Outputs Synchronization)

Set the signal output for the master camera which will output the synchronization signal. Synchronization signal settings are made with the PFV.

● For PFV (Standard)

1. Verify that the camera mode is in LIVE mode (the image displayed is passed through from the camera). If the system is in a mode other than LIVE mode, check “Live” on the camera control panel.
2. Select I/O on the left tree from “Camera Option” on the camera control panel.
3. Set “GENERAL OUT1”.

◆ Setting the Slave Camera (Receives the Synchronization Signal)

Next, set the synchronization signal input for the slave camera which will receive the synchronization signal supplied by the master camera. Synchronization signal settings are made with PFV.

Reference

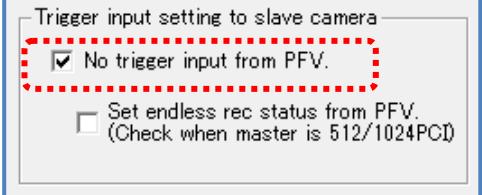
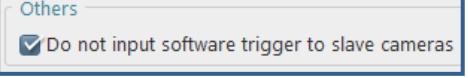
- For the setting method of the signal inputted into GENERAL IN, refer to “4.4.1.GENERAL IN Signal Setting” page 39.

- For PFV (Standard)

4. Input the slave camera's synchronization. Connect the slave camera's SYNC IN connector with the master camera's GENERAL OUT1 connector using a BNC cable. When the synchronization signal is input to the SYNC IN connector, the SYNC IN LED (yellow) on the rear of the slave camera illuminates.
5. Verify that the camera mode is in LIVE mode (the image displayed is passed through from the camera). If the system is in a mode other than LIVE mode, check "Live" on the camera control panel.
6. Select I/O on the left tree from "Camera Option" on the camera control panel.
7. Set SYNC IN to "ON CAM POS".

Caution

- To start recording using the "Record" button, setting from PFV side is also required besides the above mentioned setting.

PFV3	PFV4
<p>From [Configuration] - [Record Option], under "Trigger input setting to slave camera", check to "No trigger input from PFV".</p>  <p>Set endless rec status from PFV. (Check when master is 512/1024PCI)</p>	<p>From [MENU] - [Configuration] - [Trigger] - [Others], check to "Do not input software trigger to slave cameras".</p> 

Important

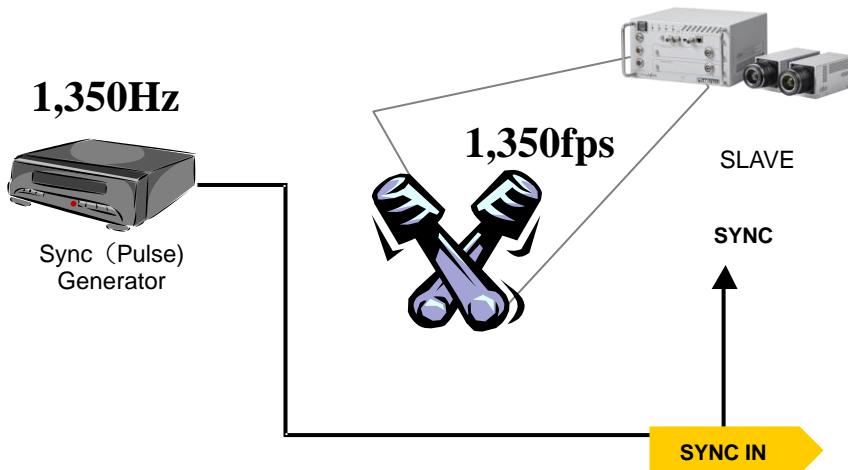
- When no synchronization signal is being input, the camera will not operate normally. As detailed in the procedure, make the settings when the signal is being input.
- It is necessary to connect a "Trigger signal" separate from a "Synchronized signal".
- Please connect a "Trig TTL OUT" on a master camera and "Trig TTL IN" on any slave cameras, if you need to operate multiple camera system with a Trigger signal on a master camera.

4.3.5. Synchronizing FASTCAM Multi with Other External Devices (Frame Rate Synchronized Recording)

With the system, in addition to the frame rate preset in the system, a function has been provided where you can receive a synchronization signal externally; set the frame rate with that frequency, and record.

In this way, for example, the system can be synchronized with a dynamic body that spins at 1,350 revolutions a second to conduct high-speed recording at 1,350 fps. This can open up broad applications that were unavailable until now.

◆ Conceptual Diagram of External Synchronized Recording



This function using an external synchronization signal to synchronize the camera to the desired frame rate is explained here.

Important

- When conducting frame rate synchronization recording with the system, the input signal must meet the following conditions.
 - FET Input 0V - +12V (H level +3.3V to +12V), positive polarity or negative polarity
 - 50 Hz - 750,000 Hz (With HS-01. The fastest frequency depends on a connected camera head.)

Caution

- There are frequencies which cannot be set due to export-controlled model Camera Head HS-01 type 200K is subject to restriction.

◆ System Settings

● For PFV (Standard)

1. Input the synchronization signal from the device that generates the signal to the system. Connect the synchronizing device's output signal to the system's SYNC IN connector using a BNC cable.
2. When the synchronization signal is input to the SYNC IN connector, the SYNC IN LED (yellow) on the front side illuminates (* If the synchronization signal is lost, the LED goes out).
3. Verify that the camera mode is in LIVE mode (the image displayed is passed through from the camera). If the system is in a mode other than LIVE mode, check "Live" on the camera control panel.
4. Select I/O on the left tree from "Camera Option" on the camera control panel.
5. Set SYNC IN to "ON OTHERS POS/NEG".



Caution

- If no synchronization signal is input, the input signal is less than 50 Hz or the synchronization signal is lost, the display shows "NO SYNC!" If input signal is over a maximum frequency (e.g. camera head HS-01: 480,000 Hz), the display shows "OVER SYNC!" In either case, you cannot record normally.
- A minute error occurs in the input synchronization signal due to the construction of the internal circuitry of this function. An error of ± 10 nsec occurs for the input synchronization signal in the actual operation. Since the frame rate display value on the monitor is in 1 Hz units, the error may be shown larger than the actual operation (an error of about $\pm 1\text{-}5$ Hz is produced). For example, when performing external device synchronization inputting a synchronization signal of 10,000 Hz, the monitor display error is: $10,000 \text{ Hz } \pm 1\text{Hz} = 9,999 \text{ fps to } 10,001 \text{ fps}$.

4.3.6. Synchronizing the System with Other Cameras (Mixed Device Synchronized Recording)

Using the function (Frame Rate Synchronization Recording) in the previous section, “4.3.5.

Synchronizing FASTCAM Multi with Other External Devices

(Frame Rate Synchronized Recording)”, mixed-type synchronized recording can be performed with Photron’s other high-speed cameras (except for some older products).

In particular, FASTCAM SA series, FASTCAM Mini series, FASTCAM APX-RS and FASTCAM MC2, FASTCAM MC2.1, FASTCAM MH4-10K are compatible with collective control by the PFV control software.

◆ Basic Process

1. Decide the master camera (the source of the synchronization signal) and the slave camera (the camera that will operate according to the synchronization signal from the master). Basically, by making the master camera the camera with the lowest maximum frame rate that can be set, you can avoid setting a synchronization signal speed the slave camera cannot receive.
2. Connect the master camera’s Sync output connector to the slave camera’s V-SYNC input connector with a BNC cable, select the synchronization signal output polarity on the master camera, and then set the slave camera to be operated by that signal.



Reference

- For camera models that can perform synchronized recording or for detailed instructions on making the settings, contact Photron at the contact information in “7.1. Contact Information” page 66.

4.4. GENERAL Signal Setting

4.4.1. GENERAL IN Signal Setting

Details of the signals output from the GENERAL OUT connector explained in section “4.1. Input / Output Signals” are shown in the chart below.

Menu Display	Contents	Signal (Input Signal Conditions)
TRIG POS	Inputs a positive polarity trigger signal.	FET Input 0V - +12V (H level +3.3V to +12V), Positive Polarity
TRIG NEG	Inputs a negative polarity trigger signal.	FET Input 0V - +12V (H level +3.3V to +12V), Negative Polarity
READY POS	Inputs a positive polarity READY signal. READY ON/OFF is switched by a pulse input.	FET Input 0V - +12V (H level +3.3V to +12V), Positive Polarity
		FET Input 0V - +12V (H level +3.3V to +12V), Negative Polarity
READY NEG	Inputs a negative polarity READY signal. READY ON/OFF is switched by a pulse input.	FET Input 0V - +12V (H level +3.3V to +12V), Positive Polarity
		FET Input 0V - +12V (H level +3.3V to +12V), Negative Polarity



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

4.4.2. GENERAL OUT Signal Settings

Details of the signals output from the GENERAL OUT connector explained in section “4.1. Input / Output Signals” are shown in the chart below. There are three GENERAL OUT connectors and individual settings can be made for each connector.

Menu Display	Contents	Signal Type
SYNC POS	Outputs a positive polarity vertical synchronization signal.	+5V CMOS output, Positive Polarity
SYNC NEG	Outputs a negative polarity vertical synchronization signal.	+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.	+5V CMOS output, Positive Polarity
TRIG NEG	Outputs the trigger signal received by the camera at L level.	+5V CMOS output, Negative Polarity
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 H level.	+5V CMOS output, Negative Polarity



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

4.5. Setting of Input/Output Signals and Sync Output Rate

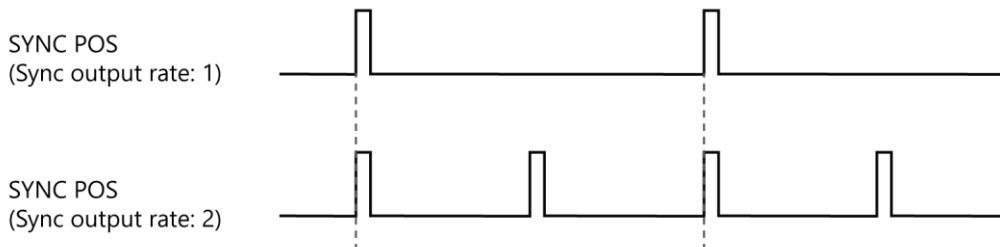
With the system, you can set the signal delay time or pulse width for the various signals that are input and output. Pulse width and delay settings for the various signals to input/output are made with PFV or the Remote Controller (optional). The content of each setting is listed in the chart below.

Setting Item	Setting Range (Value)
TRIG TTL IN DELAY	0 - 60 (sec) 100 nsec units
SYNC IN DELAY	0 - 1/frame rate (sec) 100 nsec units
GENERAL IN DELAY	0 - 60 (sec) 100 nsec units
TRIG OUT WIDTH	0 - 1 (msec) 100 nsec units
SYNC OUT DELAY	0 - 1/frame rate (sec) 100 nsec units
SYNC OUT WIDTH	0 - 500 (μ sec), 1/frame rate (sec) at 2,000 fps or higher 100 nsec units
EXPOSE OUT DELAY	0 - 1/frame rate (sec) 100 nsec units
Sync output rate	0.5, 1, 2, 4, 6, 8, 10, 20, 30 (* x1 is standard output)

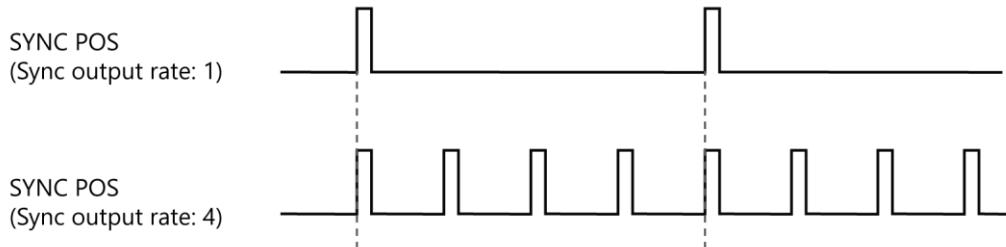
◆ Sync output rate

The Sync output rate shows the times to magnify the SYNC signal (vertical sync signal) that is output from SYNC OUT.

Example: Sync out rate setting of 2.



Example: Sync out 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.



Caution

- There are following limitations in Sync output rate function.

Frame Rate		Restriction
-	60,000 fps	No limit
60,001 fps	- 90,000 fps	x30 is unavailable
90,001 fps	- 500,000 fps	x20 and x30 are unavailable
500,001 fps	- 700,000 fps	x8, x10, x20 and x30 are unavailable
700,001 fps	- Max Frame Rate	x6, x8, x10, x20 and x30 are unavailable

- During a delay period, no next input signal is accepted.

For example, when a delay of 100 msec is being applied, a trigger coming after the 100 msec duration is recognized, but a trigger that is input during the 100 msec period is cancelled or neglected.

- There are frame rates which cannot be set due to export-controlled model Camera Head HS-01 type 200K is subject to restriction.

4.6. Using Programmable Switch (USER SW)

There are four switches that can be set on the front side. 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.

As an example, setting the USER1 switch on the back of the camera body is explained here.

◆ PFV

Setting	Explanation
OFF	Does not assign a function.
Frame Rate	Raises the frame rate.
Resolution	Lowers the resolution.
Shutter	Increases the shutter speed.
Trigger Mode	Changes the trigger mode.
Head Select	Switches the camera heads to select one camera head which is outputted on the video output (It is available only at using 2 camera heads).
Image Fit	Adjusts the size of the image displayed on the video output to be the maximum for the current resolution.
Status	Displays the status of camera settings on the video output.
Live/Memory	Switches between LIVE and MEMORY states.
Rec Ready	Sets the record ready state.
Rec	Starts recording.
Low Light	Turns low-light mode ON/OFF.

4.7. 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 the "Photron FASTCAM VIEWER" software.

◆ IRIG Code Input Specification

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



Supplement

- 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 grey. At that time, the counter is the camera's internal counter and it continues to count.



Caution

- **Limitation of use of IRIG code**

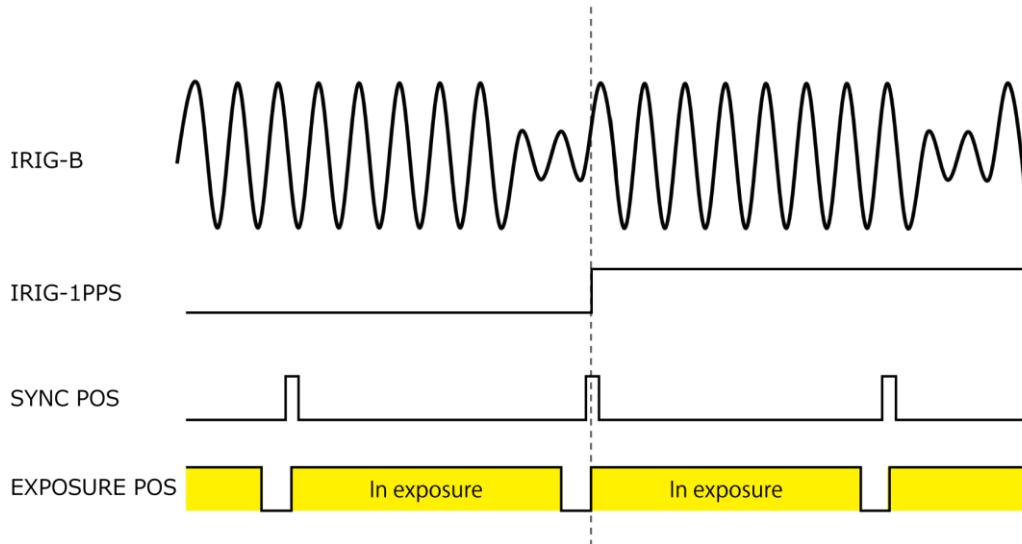
With the Image Trigger function, IRIG code cannot be used when the specified number of frames is 32 or fewer in RANDOM CENTER or RANDOM MANUAL trigger mode.

4.8. 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 ends 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 "Photron FASTCAM Viewer User's Manual" or "Remote Controller User's Manual".

4.9. AUTO EXPOSURE Operation

The system has a function that automatically varies the shutter (the sensor's exposure time) for the quantity of light input so that it will achieve the desired image output level.

After the settings are made once, in a situation where settings cannot be changed, this function displays its effect when recording in an environment where the subject's amount of light changes.

When using this function, the following four items must be set in advance.

“AREA”, “TARGET VALUE”, “RANGE”, “SHUTTER”

Each of these settings is explained below.

◆ AREA

Sets the image area.

The auto exposure function operates so that the average value of the image output level in the area specified here becomes the desired image output level.

◆ TARGET VALUE

Sets the desired image output level. Set this value as a 10-bit gradation (0 to 1023).

◆ RANGE

Gives the desired image output level a range. Set this value as a 10-bit gradation (0 to 1023).

The auto exposure function operates so that the average value of the image output level in the area specified here becomes the desired image output level.

◆ SHUTTER

Sets the maximum exposure time. Set in order to prevent subject blur from an exposure time that is too long.



Important

- The Auto Exposure function keeps a constant image brightness by varying the shutter speed (sensor's exposure time).

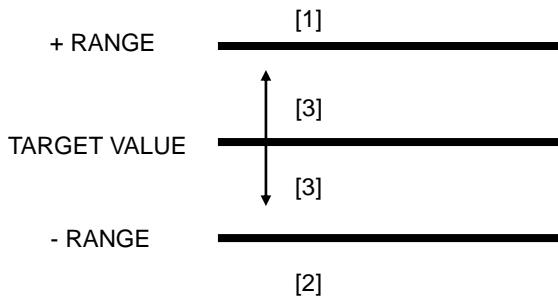
Therefore, the image may deteriorate as the shutter speed varies from the calibrated setting while using this function.



Important

- When the auto exposure function is operating, the camera will not perform a shutter operation with an exposure time longer than the shutter value set here.

These settings are shown in the diagram below.



If the image level being output (the average value of the area set with AREA) is [1], [2], or [3], the function operates as below.

◆ For position [1]

Since the image level being output is higher than the range **TARGET_VALUE±RANGE**, the function operates to close the shutter (shorten the exposure time).

◆ If position [2]

The image level being output is lower than the range **TARGET_VALUE±RANGE**, so the function operates to open the shutter (lengthen the exposure time).

◆ If position [3]

The image level being output is within the range of **TARGET_VALUE±RANGE**, so the operation of the shutter is not varied.

- The DS SHUTTER function is inactive while the AUTO EXPOSURE function is being used.
- When the RANGE setting is a small value, the range of the desired image output level narrows.
- If the RANGE value is made smaller than necessary, the image level is difficult to place in the desired [3] position.

In this case, the variable shutter operation cannot place the image level in the desired [3] position and a phenomenon occurs where the image output level is unstable.

When a situation like this occurs, it can be resolved by making RANGE a larger value.

4.10. Built-in DAQ (2ch)

You can record the input waveform data (analog 2ch) by sampling it and synchronizing with the image.

The recorded data can be played back as a waveform image with the PFV.

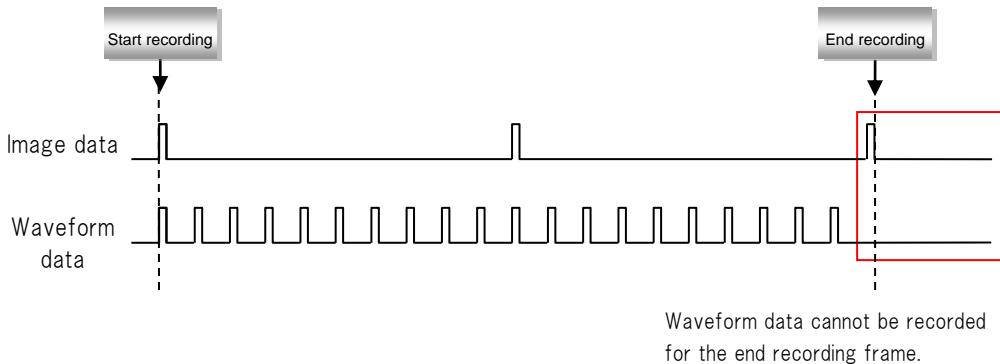
◆ Analog input specifications

Input specifications	Non-insulated
Input method	Single end
Input impedance	50 Ω
Input voltage range	Switch between the ranges of V _{pp} = 8V(±4V), 4V(±2V), 2V(±1V)
Maximum input rating	V = ±10V (however, it is clamped to the input range [V _{pp} = 8V, 4V, 2V])
Conversion speed	2.2 Msps
Resolution	AD 12-bit
Cutoff frequency	1 MHz
Number of data recordings	10 points per image (10 points per 1V)

◆ Sampling

The sampling rate is 10 times the frame rate.

The sample timing is the period for each frame rate equally divided by 10.



Waveform data cannot be recorded for the end recording frame.

Supplement

- If the frequency of the synchronization signal is changed while using external synchronization, the sample timing cannot follow the synchronization signal.
- Waveform data cannot be recorded for the image when the number of random images is set to 1 in random trigger mode.
- The waveform data for the recording end frame is shown as 0V on the PFV waveform graph.



Caution

- The input impedance of built-in DAQ is 50Ω (fixed). Depending on the type of signal source, waveform data cannot be recorded correctly in some cases. Make sure that the recording can be done correctly in advance.
- If you need to save all the frames with waveform data to the FAST Drive, add one frame in the end of selected sequence and save it.

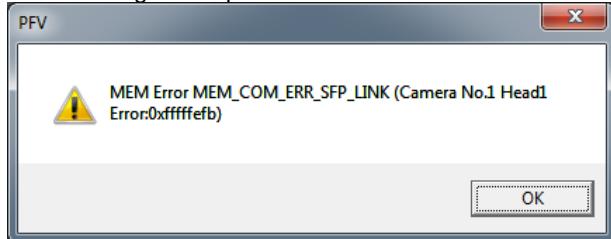
Example)

To save the image data with waveforms in the sequence starting at the 5th frame and ends in the 20th frame; Select sequence from the 5th frame to 21st frame.

4.11. Error Code

An error message is displayed on PFV, when an error happens at starting up or in operation the system.

Error message example



4.11.1. Startup Errors

Error	Description
SFP link error	Camera Head and Main Unit are not connected. Confirm the camera cable is connected to Camera Head and Main Unit correctly. Clean the camera cable and the connector's fibre end face. If the cable connection is correct but the error message is displayed, contact Photron.
MPO signal detect error	Camera Head and Main Unit are not connected. Confirm the camera cable is connected to Camera Head and Main Unit correctly. Clean the camera cable and the connector's fibre end face. If the cable connection is correct but the error message is displayed, contact Photron.
MPO frequency lock error	Camera Head and Main Unit are not connected. Confirm the camera cable is connected to Camera Head and Main Unit correctly. Clean the camera cable and the connector's fibre end face. If the cable connection is correct but the error message is displayed, contact Photron.
MPO calibration error	Camera Head and Main Unit are not connected. Confirm the camera cable is connected to Camera Head and Main Unit correctly. Clean the camera cable and the connector's fibre end face. If the cable connection is correct but the error message is displayed, contact Photron.
Sensor initialization error	Camera Head is broken. Contact Photron.
Flash ROM error	Camera Head is broken. Contact Photron.
Communication error	Camera Head and Main Unit are not connected. Confirm the camera cable is connected to Camera Head and Main Unit correctly. If the cable connection is correct but the error message is displayed, contact Photron.
Head ID error	Camera Head and Main Unit are not connected. Confirm the camera cable is connected to Camera Head and Main Unit correctly. If the cable connection is correct but the error message is displayed, contact Photron.
Unknown error	Contact Photron.

4.11.2. Operation Errors

Error	Description
XAUI Error XAUI_ERR_TO	A communication error happened at inside of Main Unit. Restart Main Unit. If the error message remains after restarting, contact Photron.
XAUI Error XAUI_ERR_RECV_SIZE	A communication error happened at inside of Main Unit. Restart Main Unit. If the error message remains after restarting, contact Photron.
MEM Error MEM_COM_ERR_VERIFY_REG0	A communication error happened at inside of Main Unit. Restart Main Unit. If the error message remains after restarting, contact Photron.
MEM Error MEM_COM_ERR_VERIFY_REG1	A communication error happened at inside of Main Unit. Restart Main Unit. If the error message remains after restarting, contact Photron.
MEM Error MEM_COM_ERR_INIT_DONE	A memory module is broken. Contact Photron.
MEM Error MEM_COM_ERR_TYPE	Camera Head type does not match with Main Unit. Confirm the system components.
MEM Error MEM_COM_ERR_SFP_LINK	The communication between Camera Head and Main Unit has been interrupted. Confirm the camera cable is connected to Camera Head and Main Unit correctly. Clean the camera cable and the connector's fibre end face.
MEM Error MEM_COM_ERR_MPO_LINK	The communication between Camera Head and Main Unit has been interrupted. Confirm the camera cable is connected to Camera Head and Main Unit correctly. Clean the camera cable and the connector's fibre end face.
HEAD Error F1_HEAD_ERR_TO	The communication between Camera Head and Main Unit has been interrupted. Confirm the camera cable is connected to Camera Head and Main Unit correctly. Clean the camera cable and the connector's fibre end face.
HEAD Error F1_HEAD_ERR_NAK	The communication between Camera Head and Main Unit has been interrupted. Confirm the camera cable is connected to Camera Head and Main Unit correctly. Clean the camera cable and the connector's fibre end face.
HEAD Error F1_HEAD_ERR_CALIBRATE_SUM	Camera Head is broken. Contact Photron.
HEAD Error F1_HEAD_ERR_PIXELGAIN_SUM	Camera Head is broken. Contact Photron.



Chapter 5. Product Specification

5.1. Specifications

5.2. Dimensions

5.1. Specifications

5.1.1. Product Specifications

Recording Method	IC memory
Recording Memory Capacity	8GB, 16GB, 32GB
Pixel Size	10 µm
Gain Control	Hardware LUT on camera Controllable via software
Image Output Customization	Customizable LUT, brightness is changeable
Camera Cable	Exclusive multi optical cable
External Synchronization Input Signal	+3.3 to +12Vp-p, negative polarity/positive polarity (switchable)
External Synchronization Output Signal	5 Vp-p, negative polarity/positive polarity (switchable)
Trigger Input Signal	TTL (+3.3 to +12V), contact
Other Output Signals	Other timing signal outputs
External Control	Remote Controller, Gigabit Ethernet IF(PC)
Video Output	Mini DisplayPort
Digital Interface	Gigabit Ethernet x1 (1000BASE-T) FAST Drive option

5.1.2. General Specifications

Environment Conditions	
Storage Temperature	-20°C to 60°C (No Condensation) -4°F to 140°F (No Condensation)
Storage Humidity	85% or less (No Condensation)
Operating Temperature	0 to 45°C (No Condensation) 32°F to 104°F (No Condensation)
Operating Humidity	80% or less (No Condensation)
Pollution degree	Degree 2 according to IEC60664-1
Ovvovoltage category	Category II according to IEC60664-1
Maximum use altitude	2,000 m or lower
External Dimensions	
Main Unit	140.0 (H) x 260.0 (W) x 223.0 (D) mm, excluding protrusion 5.5" (H) x 10.2" (W) x 8.8" (D)
AC Adapter	47.0 (H) x 116.0 (W) x 254.0 (D) mm, excluding protrusion 1.85" (H) x 4.57" (W) x 10.0" (D)
AC Power Supply	
Supply Voltage	100V to 240V (type A cable: up to 125V)
Supply Frequency	50Hz to 60Hz
Power Consumption	200W (FAST Drive-suit: up to 266W)
DC Power Supply	
Power Voltage	20V to 34 V
Power Consumption	180VA (FAST Drive-suit: up to 266W)
Weight	
Main Unit	7.8 kg (17.2 lbs), excluding protrusion
AC Adapter	1.6 kg (3.5 lbs)

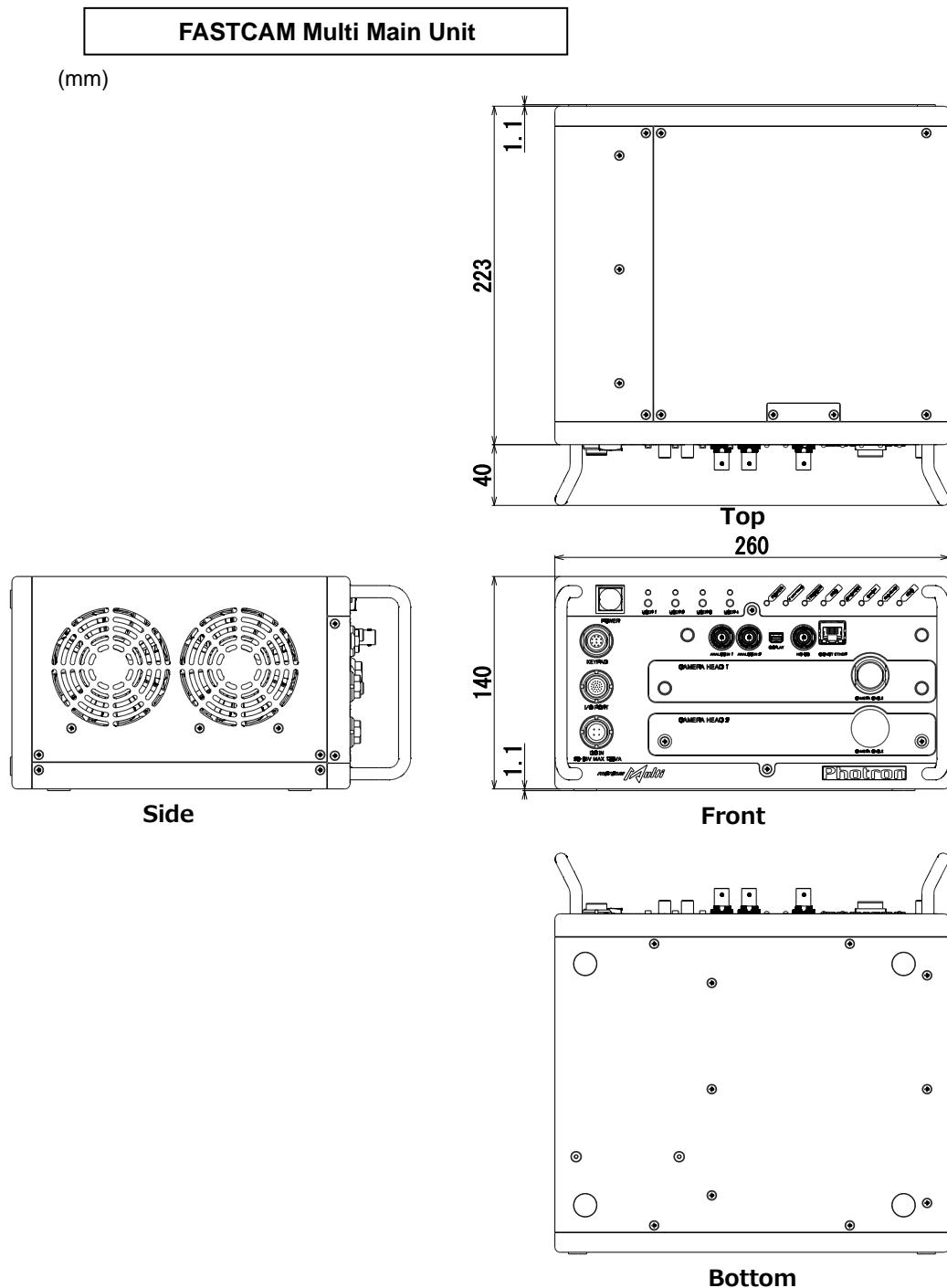


Photron has verified two types of AC cables, type A (standard for Japan, USA, Canada, etc.) and type SE (standard for Germany, France, etc.). However, when those cables cannot properly receive power when plugged in, use the proper AC cable for the region's standards and verify that AC cable works properly.

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

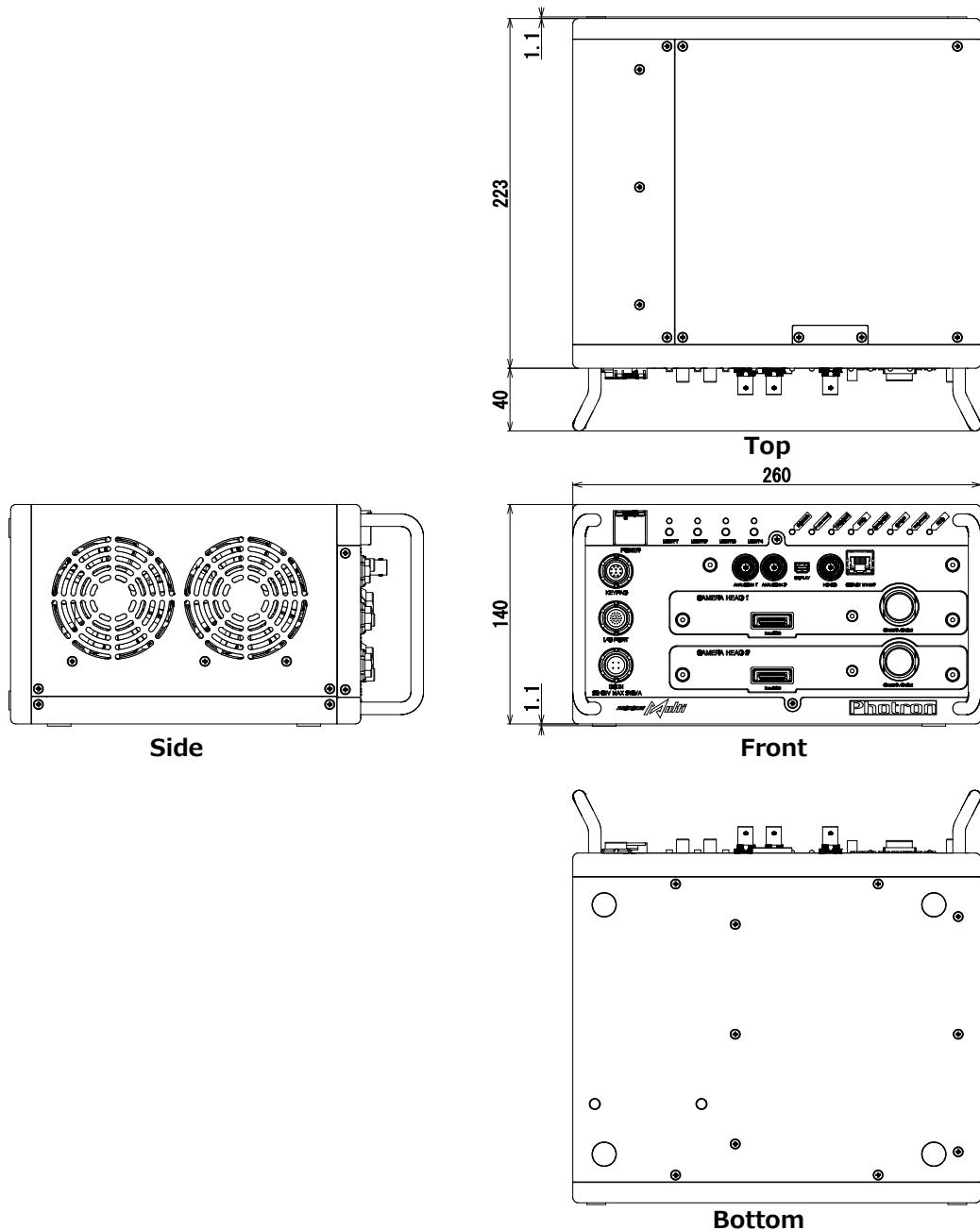
5.2. Dimensions

5.2.1. Main Unit



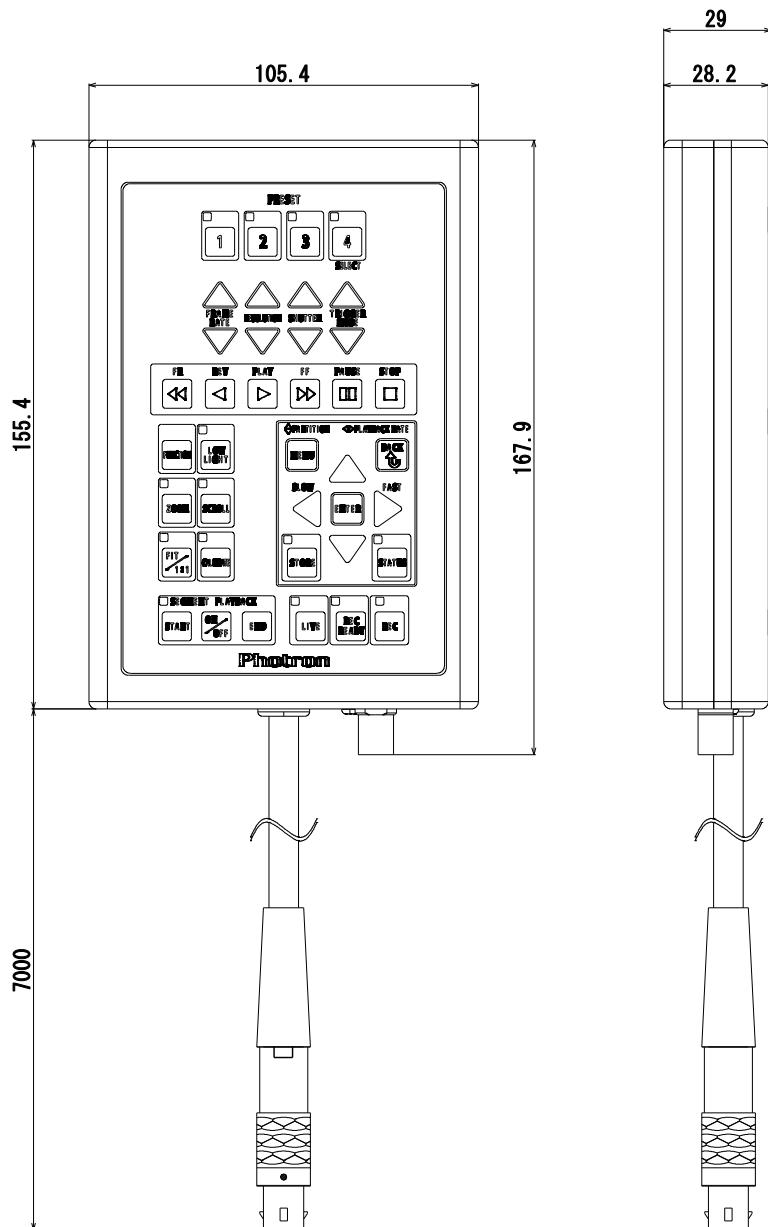
FASTCAM Multi Main Unit (FAST Drive)

(mm)



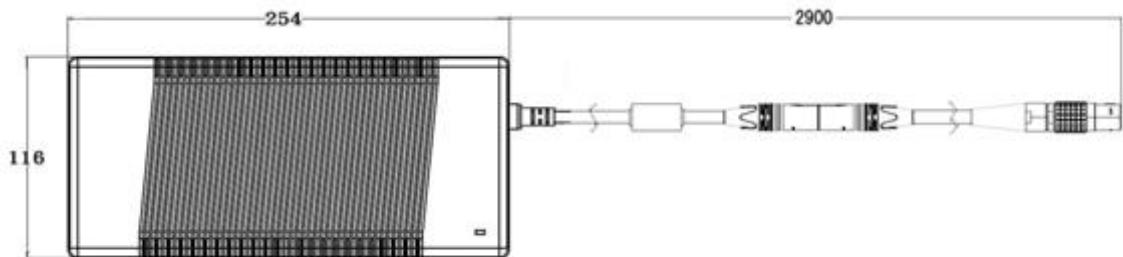
5.2.2. Remote Controller (Optional)

(mm)



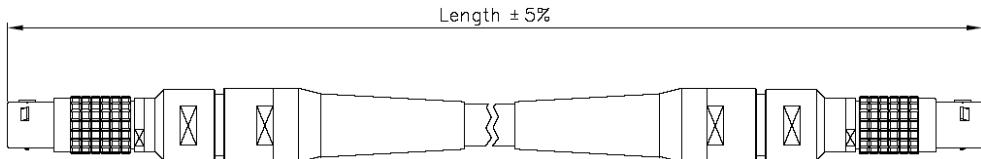
5.2.3. AC Adapter

(mm)

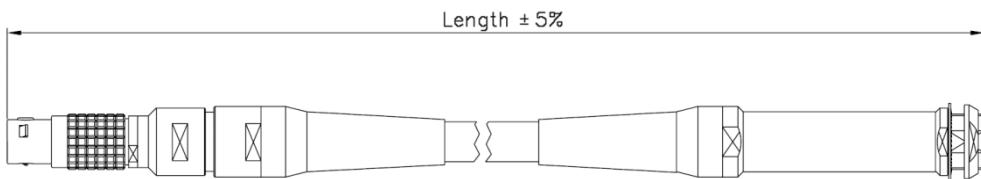


5.2.4. Camera Cable

- FASTCAM Multi Camera Cable 5 m
- FASTCAM Multi Camera Cable 10 m



- FASTCAM Multi Camera Bulkhead Cable 5 m
- FASTCAM Multi Camera Bulkhead Cable 10 m

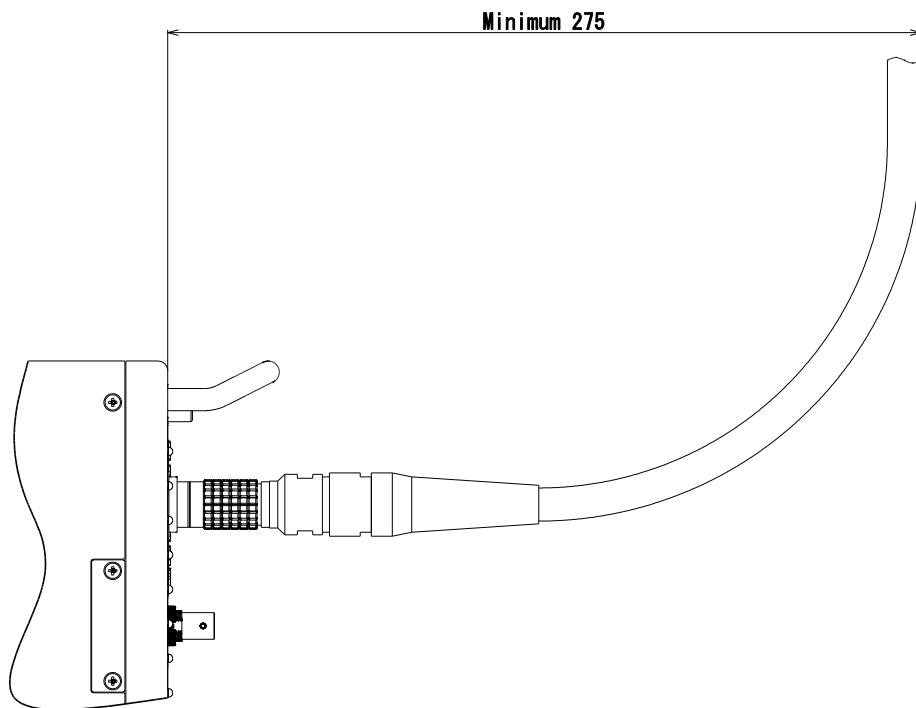


Caution

- The FASTCAM Multi Camera Bulkhead Cable can be extended up to a maximum distance of 50 m.

5.2.5. Clearance for Camera Cable Connection

(mm)





Chapter 6. Warranty

6.1. About the Warranty

6.1. 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 alteration 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 inquiries related to malfunction, contact the dealer where the product was purchased, or the nearest Photron office.

Reference

- For inquiries related to our product, refer to "7.1. Contact Information" page 66.

Chapter 7. Contacting Photron

7.1. Contact Information

7.1. Contact Information

For inquiries related to FASTCAM Multi, contact Photron at the contact information listed below. Additionally, the following items will be verified when inquiring, so please prepare them in advance.

Items Verified	Concrete Example
Contact Information	Company, school or organization name, customer contact name, contact phone number, contact e-mail address.
Product Name	FASTCAM Multi
Serial Number	Check on the nameplate seal.
Condition of the system and what is known about it.	

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@photon.com Web: www.photon.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@photon.com Web: www.photon.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@photon.com Web: www.photon.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@photon.cn.com Web: www.photon.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@photon.co.jp Web: www.photon.co.jp

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