FASTCAM MC2

Hardware Manual

Revision 1.00E

Photron

Introduction

Thank you for your purchase of Photron's high-speed camera system, the "**FASTCAM MC2**" (referred to below as **t**he 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.

Using the Manual

This section explains the layout of the manual.

- **Introduction**
  This section explains the manual and safety precautions.

- **Chapter 1. Overview**
  This chapter contains an overview of the system and an explanation of its features.

- **Chapter 2. Setup**
  This chapter explains the system's components and device connections.

- **Chapter 3. Recording**
  This chapter explains operations related to recording.

- **Chapter 4. Playback**
  This chapter explains operations related to the playback of recorded images.

- **Chapter 5. Connecting a PC**
  This chapter explains the procedure for connecting the system to a PC. Refer to the "PHOTRON FASTCAM Viewer User's Manual" for additional details on using a PC to control the system.

- **Chapter 6. Specifications**
  This chapter lists the system's specifications.

- **Chapter 7. Warranty**
  This chapter explains the warranty.

- **Chapter 8. Contacting Photron**
  This chapter lists contact information to use when contacting Photron if the system malfunctions or 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 cable is fully inserted 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.

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.

■ 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 0-40°C, humidity 85% RH or lower, maximum altitude 2000 m or lower.

In addition, if exceeding these limits, use in a condensation-free environment.

Using the system outside of these 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, keep condensation from forming inside the system.

■ This device is for indoor use, do not use it outdoors.

Do not use in a location that has dust.

Doing so can cause malfunction.

■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 then 60°C. Also, prevent condensation from forming during shipment

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Table of Contents

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Chapter 1. Overview

1.1. Product Overview and Features

1.1. Product Overview and Features

The FASTCAM MC2 is a high-speed camera system that uses small camera heads to make recording possible in narrow spaces, spaces in which it had been difficult to place conventional camera heads.

The recording performance of the system is 2,000 fps at a maximum resolution of 512x512 pixels using the full frame, but you can also record at a maximum of 10,000 fps when using a segment of the frame.

*10k model only. That specification depends on the products model.

The system is operated by the LCD Monitor Keypad and from the PC software over the Gigabit Ether connection.

Additionally, with the programmable switch function that allows you to set the desired function settings, the operation of the camera can be matched to the situation/scene.

This system pursue both of recording capability and operability. It excels in cost performance and is easy for everyone to use.

Use this state-of-the-art technology to record high-speed phenomena in slow motion and also as an input component for a dynamic image measurement system. This manual explains the operating procedures for the system.

Chapter 2. Setup

2.1. System Components and Accessories

2.2. Part Names

2.3. Device Connections

2.1. System Components and Accessories

2.1.1. Components and Accessories

The system's standard components are listed below. Remove the camera controller and components from the packaging and check them.

1. Camera Controller 1
2. Camera Head(s) (with tripod adapter) (depends on configuration)
3. Camera Cable(s) (depends on configuration)
4. AC Adapter/AC Cable 1
5. Hexagonal Wrench for Flange Back Adjustment (1.5 mm)
6. Gigabit Ether Interface Cable (LAN Cable) 1
7. FASTCAM Series Setup Disk (Driver/Application CD) 1
8. FASTCAM MC2 Hardware Manual (this manual) 1
9. Photron FASTCAM Viewer User's Manual 1
10. Making a Gigabit Ether Connection (Simple Procedure Manual) 1
11. Warranty Card 1
12. IP address Label 5

2.1.2 Accessories/Options

The following options are available for the system.

① External Battery for Operation

② LCD Monitor Keypad

2.1.3 Models

The system is split into models depending on the frame rate, number of camera heads, amount of memory,

And color/monochrome.

The models are listed below.

Maximum Frame Rate	Number of Camera Heads	Memory	Model Name
500 FPS	Single Head	1 GB	FASTCAM MC2 500-S1
		2 GB	FASTCAM MC2 500-S2
	Dual Head	1 GB	FASTCAM MC2 500-D1
		2 GB	FASTCAM MC2 500-D2
2000 FPS	Single Head	1 GB	FASTCAM MC2 2K-S1
		2 GB	FASTCAM MC2 2K-S2
	Dual Head	1 GB	FASTCAM MC2 2K-D1
		2 GB	FASTCAM MC2 2K-D2
10000 FPS	Single Head	1 GB	FASTCAM MC2 10K-S1
		2 GB	FASTCAM MC2 10K-S2
	Dual Head	1 GB	FASTCAM MC2 10K-D1
		2 GB	FASTCAM MC2 10K-D2

*There are color/monochrome models for each camera head.

2.2. Part Names

The system is composed of multiple components which includes the camera controller, camera head(s), the AC adapter, and the control software "**Photron FASTCAM Viewer**" (referred to below as **PFV**).

For each of the system components,

·Do not use in an area with flammable gas or dust present.

·Do not place in an unstable location such as on a wobbly platform or an incline.

·Do not disassemble or modify.

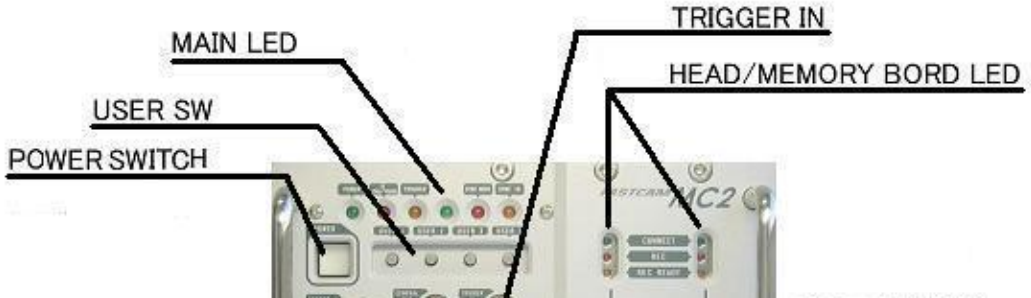
·Do not expose to liquids such as water.

·Do not use in a manner with excessive force.

2.2.1. Camera Controller

The camera controller has two models depending on the amount of memory, a 1 GB model and a 2 GB model. The system is further separated by maximum frame rate, there are three types of camera controllers, a model (500) that can record at up to 500 FPS, a model (2K) that can record up to 2,000 FPS, and a model (10K) that can record up to 10,000 FPS. They contain IC memory for saving images and have been designed with the capability to save high-speed images as uncompressed digital data. The camera controller has a video output connector to display live and recorded images on a video monitor, a Gigabit Ether interface to connect to a PC to fully control the camera or download data, and various I/O (input/output) connectors for external synchronization/trigger signals.

2.2.2. Camera Cor

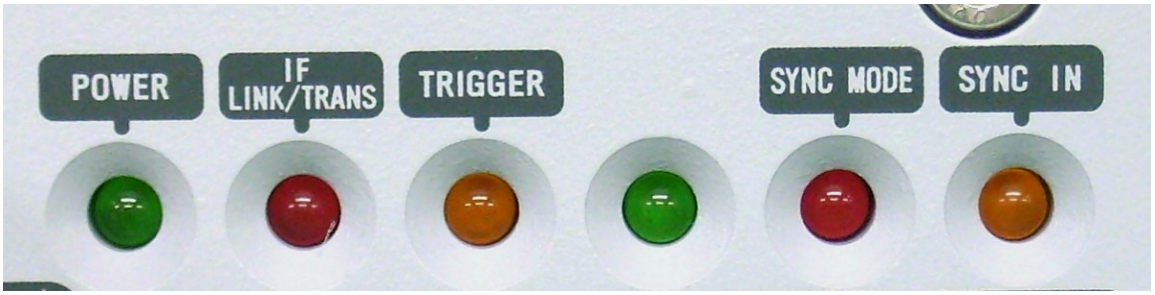


Front

2.2.3. LED Explanation

There are a number of LEDs on the front of the system's camera controller. These LEDs indicate the status
of the system. The meaning of each LED is explained here.

■ MAIN LEDs

- 

LED OFF: Power off.

- IF LINK/TRANS (Red)

LED ON: The Gigabit Ether interface is connected.
LED FLASHING: Data is transferring.
LED OFF: The Gigabit Ether interface is not connected.

- TRIGGER (Yellow)

LED ON: A trigger signal is present (being input).
(The LED illuminates for 0.1 second when the trigger signal is input.)

LED OFF: The trigger signal is not present.

- SYNC MODE (Red)

LED ON: External synchronization mode (synchronized to an external signal).
LED OFF: 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.

■ HEAD/MEMORY BOARD LEDs

- CONNECT (Green)

LED ON: The camera controller is communicating with the camera head(s).
The LED does not illuminate by only connecting the camera cable.

LED OFF: The camera controller is not communicating with the camera head.

- REC (Red)

LED FLASHING: Recording.

LED OFF: Not recording.

- REC READY (Yellow)

LED ON: Ready to record.

LED FLASHING: ENDLESS recording. (The REC (Red) LED also flashes)

LED OFF: Not ready to record.

2.2.4. Camera Heads

The system's camera heads have been designed to be smaller than conventional camera heads. They have been reduced to a revolutionary small size, while maintaining high specifications such as a 512x512 resolution at recording rates up to 2,000 fps. (Maximum: “2k” and “10k” model) *It depends product model. The camera heads can be selected from two types, color or monochrome.

* The maximum frame rate that can be set depends on the camera controller model.

2.2.5. Camera Cable

A cable is required to connect the camera controller and the camera head(s) on the system. The length of the camera cable is 7 m. Since the camera heads and cable connectors are small, you can record in narrow spaces.

■ Photo of the camera cable attached to the camera head

When securing the camera cable, do not bend it R50 or lower.

Always secure the camera cable externally in one location within 60 cm of the connector.

2.2.6. Lens Mount

The lens mount on the system is the C mount. The C mount is widely used on CCTV cameras and microscopes.

2.2.7 LCD Monitor Keypad (Optional)

The **system** can be operated while checking the monitor by connecting the optional LCD Monitor Keypad to the **KEYPAD** connector on the front of the camera controller. The LCD Monitor Keypad is also hot-pluggable, it can be plugged into and unplugged from the camera controller while the power is on.

Refer to the "**LCD Monitor Keypad User's Manual**" for how to operate the remote controller.

Camera Connector Name	Signal Name	Connector Model Name (Camera)	Connector Model Name (LCD Monitor Keypad, Optional)
KEYPAD	LCD Monitor Keypad (Optional)	PT02A-12-10S (023)	PT06A-12-10P (023)

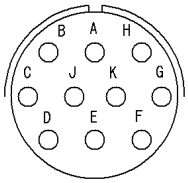
* The LCD Monitor Keypad is optional. It is not included in the standard configuration.

2.2.8 About RS-422

The system supports **serial control via an RS-422 connection** through the **KEYPAD** connector. Serial control commands are available as separate list of commands. Please contact Photron or the store where the system was purchased about the command list. (See: 8.1 Contacting Photron)

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

[Keypad Pin Diagram]



PT02A-12-10S (023)

When using the connec

Incorrect wiring can ca

The voltage on pin A (+12V OUT) is used to power the LCD Monitor Keypad (optional), do not use It for other purposes.

By setting the **STATUS OUT** menu to **ON**, the system status can be output via the serial connection.

For details, check the command list.

2.2.9. BNC Connectors

Signals can be used as a part of the system by inputting an external trigger or synchronization signal, or by outputting an exposure timing or synchronization signal. BNC connectors are provided on the camera controller for the input/output of the TRIGGER IN, SYNC IN, GENERAL OUT signals, and you can connect to each signal's connector.

①┌ TRIGGER IN Connector (Switch SLIDE SWITCH to SW/TTL matched to the input signal.)

② SYNC IN Connector

③ GENERAL OUT Connector

④ SLIDE SWITCH

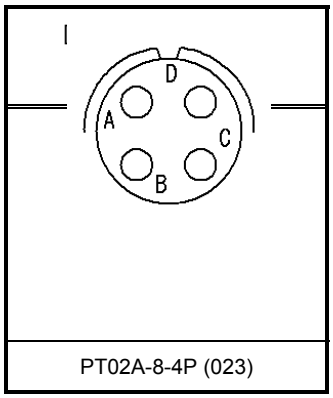
A signal other than the specified signal must not be input to the various connectors.

Use extreme caution as there is a risk of damage to both devices, the input device and the output device.

For signals that can be input, see "3.11. Input/Output Signal Types".

2.2.10. DC 18-36V 45VA Connector

This connector is the connector to input the DC power supply. Connect the supplied AC adapter or the optional external battery for operation.



PT02A-8-4P (023)

Connector Name	Signal Name	Pin Num.	High-Speed Camera Connector Model Name	Cable Connector Model Name
DC18-36V 45VA	RESERVE	A	PT02A-8-4P (023)	PT06A-8-4S (424)
	SIGNAL GND	B		
	POWER GND	C		
	+18-36V IN	D		

2.3. Device Connections

2.3.1. Connecting a Camera Head

Follow the procedure below to connect a **camera head** to the **camera controller**.

① Verify the **camera controller's** power is off.

② Connect the **camera cable**. Check the connector part of the **camera head** and **camera controller** and connect them as shown in the pictures below.

■ **Camera Controller**

■ **Camera Head**

③ Verify that the connector's **screws** are correctly tightened.

Always secure the camera cable by tightening the screws attached to the camera cable's connector. If the camera cable is pulled out while the power is on, it can cause a malfunction.

Always turn the camera controller's power off when attaching or removing camera heads. Adding or removing camera heads with the power on can cause a malfunction.

2.3.2. Connecting the LCD Monitor Keypad (Optional)

If you have the optional LCD Monitor Keypad, connect it by plugging the LCD Monitor Keypad connector into the connector terminal labeled "**KEYPAD**" on the rear of the camera controller.

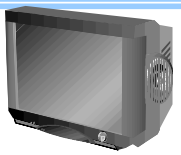
Refer to the "**LCD Monitor Keypad User's Manual**" for how to operate the remote controller.

* The LCD Monitor Keypad is hot-pluggable. It can be plugged in and removed while the system's power is on.

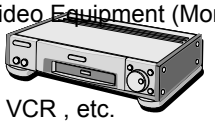
2.3.3. Connecting a Video Monitor

A video monitor connected to the camera controller can be used to check the **live** image (**camera pass-through image**). Connect the **VIDEO OUT** connector on the front of the camera controller to the video input on the video monitor with a BNC cable.

V



Video Equipment (Monitor)

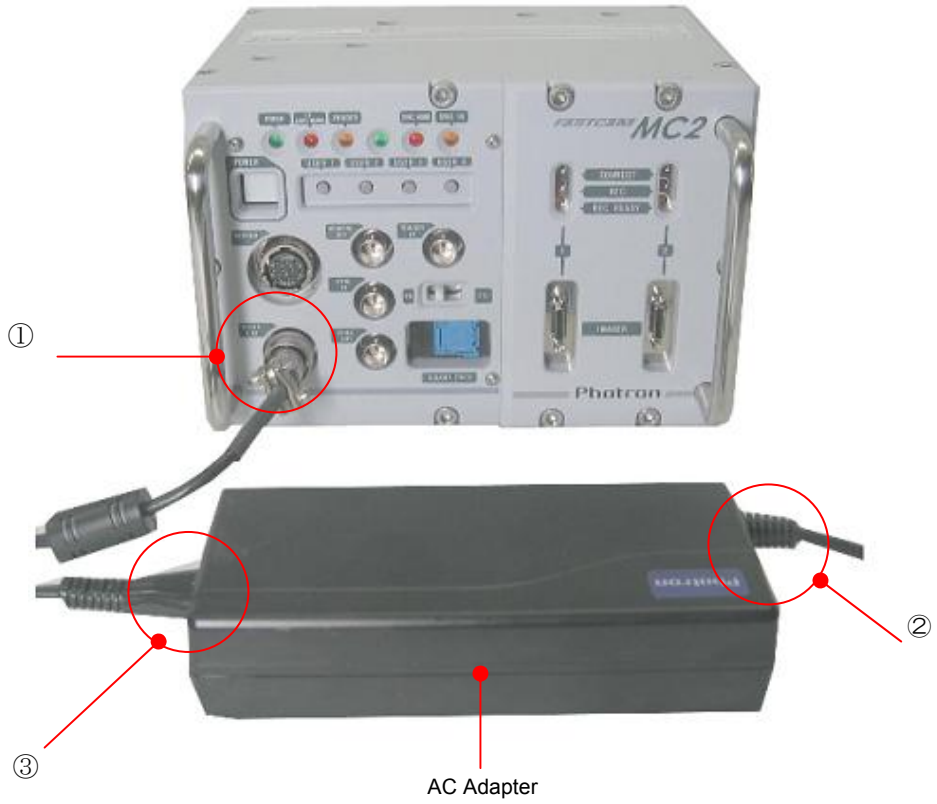


VCR , etc.

2.3.4. Connecting the AC Adapter

Connect the supplied AC adapter to a power supply.

For power supplies that can be used, see the DC power supply item in section "**6.1.2. General Specifications**".



① Connect the AC adapter to the **DC18-36V 45VA** connector on the front of the camera controller.

② Connect the DC cable to the AC adapter.

③ Connect the AC cable to the power outlet.

2.3.5. Connecting a PC

The system can have the operation of its functions performed from a **PC** using the **Gigabit Ether** interface.

Refer to the "**PHOTRON FASTCAM Viewer User's Manual**" for how to operate the software.

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 Cat 5e** (enhanced category **5**) or higher LAN cable.

The maximum cable length between the **PC** and the system is, compliant to the **1000BASE-T** specification, up to **100 m**. **One PC** can theoretically connect to a maximum of **64** Photron Gigabit Ether 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**.

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Chapter 3. Recording

3.1. Selecting the Frame Rate

With the system, you can record images from 60 (50 PAL) to 2,000 fps using the full 512x512 pixel resolution
of the image sensor. For frame rates higher than 2,000 fps, high-speed photography is achieved by limiting
the read area of the image sensor.

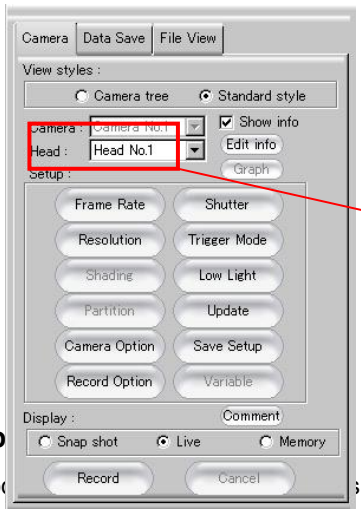
* The maximum frame rate that can be set depends on the camera controller model.

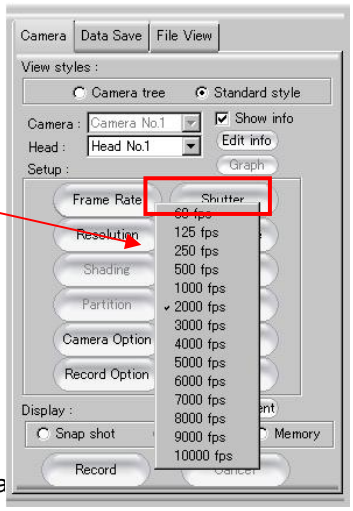
For PFV (Standard)

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 the frame rate from "Frame Rate" on the camera control panel.

③ When you change the frame rate, the "Live Info" display in the upper left of the screen also changes.。





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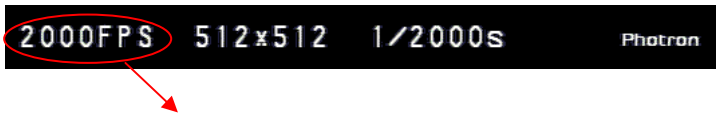
camera). If the system is in a mode other than **LIVE** mode, press the **LIVE key** on the LCD Monitor Keypad. When the system is in **LIVE** mode, the **LIVE key** LED illuminates.

Verify the monitor's upper display is "**LIVE**"

② Press the LCD Monitor Keypad's FRAME RATE ▲▼ keys. Pressing the ▲ key raises the frame rate and pressing the ▼ key lowers the frame rate.

③ Verify that the frame rate displayed in the lower left corner of the video monitor changes as the frame

rate is changed.



The FPS display changes in the lower screen

④ The display of the time available for recording also changes at the same time.

For frame rates over 2000 fps, the resolution is automatically set to the maximum available at that frame

rate. For details, see "6.1.4. Frame Rate and Resolution".

The minimum frame rate in PAL mode is 50 fps.

The minimum frame rate in NTSC mode is 60 fps.

3.2. Selecting the Resolution

With the system, you can record images with a maximum size of approximately 260,000 pixels using the high-speed image sensor, which has a maximum size of 512x512 pixels. You can also record at even faster frame rates or reduce the amount of image data to make even longer recordings by limiting the resolution according to the application.

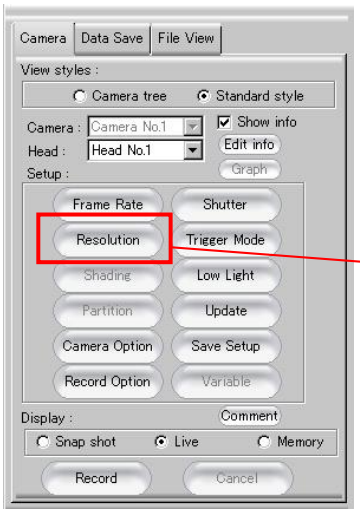
The procedure for selecting the resolution is explained next.

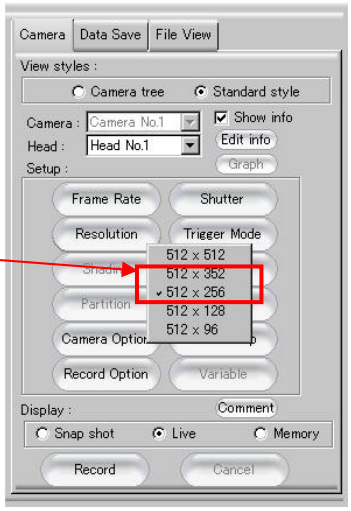
For PFV (Standard)

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 the resolution from "Resolution" on the camera control panel.

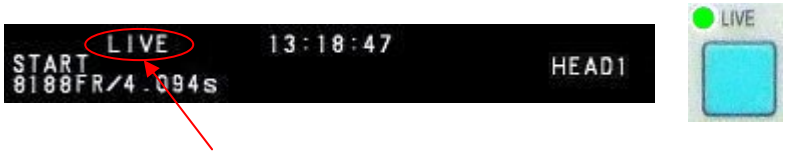
③ When you change the frame rate, the "Live Info" display in the upper left of the screen also changes.





For the LCD Monitor Keypad (Optional)

① Verify that the camera mode is **LIVE** mode.



Verify the monitor's upper display is "**LIVE**"

② Press the LCD Monitor Keypad's **RESOLUTION ▲▼** keys. Pressing the ▲ key raises the resolution and pressing the ▼ key lowers the resolution.

③ Verify that the resolution displayed in the lower left of the video monitor changes as the resolution is changed.

The resolution value changes in the lower screen

④ The display of the time available for recording also changes at the same time.

(See: "6.1.4 Frame Rate and Resolution")

3.3. Selecting the Shutter Speed

With the system, the shutter speed is independent of the frame rate, and you can control the exposure timein

one frame using the electric shutter. By making an exposure that is of a shorter period than the frame rate,

high-speed objects can be recorded blur-free.

Shutter speed can be set from 1/frame sec to a maximum of 1/160,000 s (approximately 6.2 µs). (See: "6.1.6. Shutter Speed List")

The procedure for selecting the shutter speed is explained here.

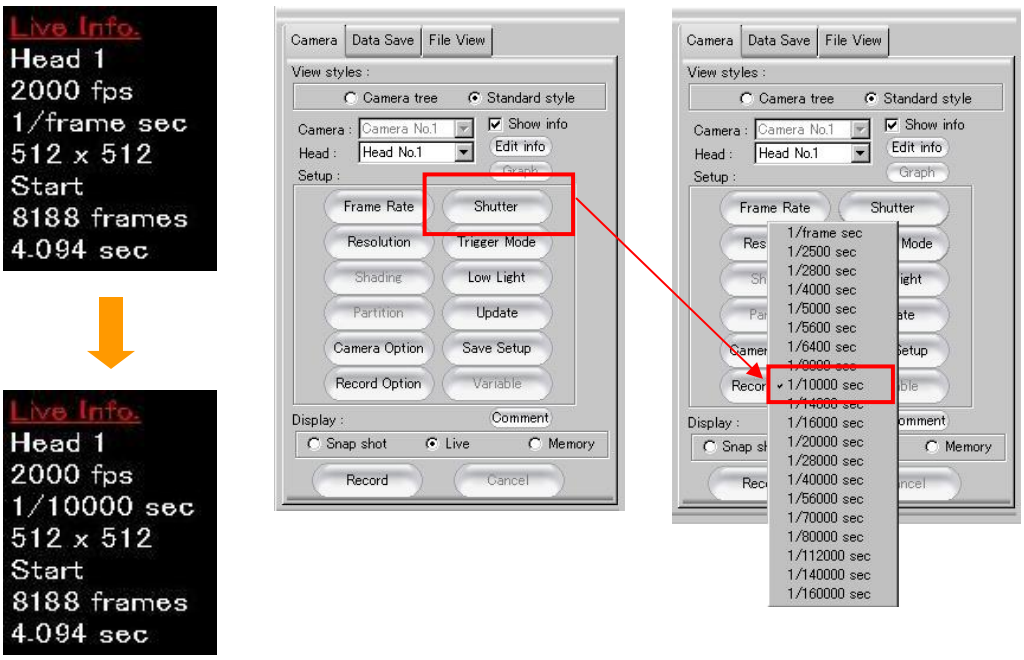
3.3.1. Setting the Shutter Speed

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 the shutter speed from "Shutter Speed" on the camera control panel.

③ When you change the frame rate, the "Live Info" display in the upper left of the screen also changes.



For the LCD Monitor Keypad (Optional)

① Verify that the camera mode is **LIVE** mode.

Verify the monitor's upper display is "**LIVE**"

② Press the LCD Monitor Keypad's **SHUTTER ▲▼** keys. Pressing the ▲ key raises the shutter speed and pressing the ▼ key lowers the shutter speed.

③ Verify that the shutter speed displayed in the lower left of the video monitor changes as the shutter speed is changed.

The shutter speed changes in the lower screen

3.3.2. Changing the Shutter Mode

For PFV (Standard)

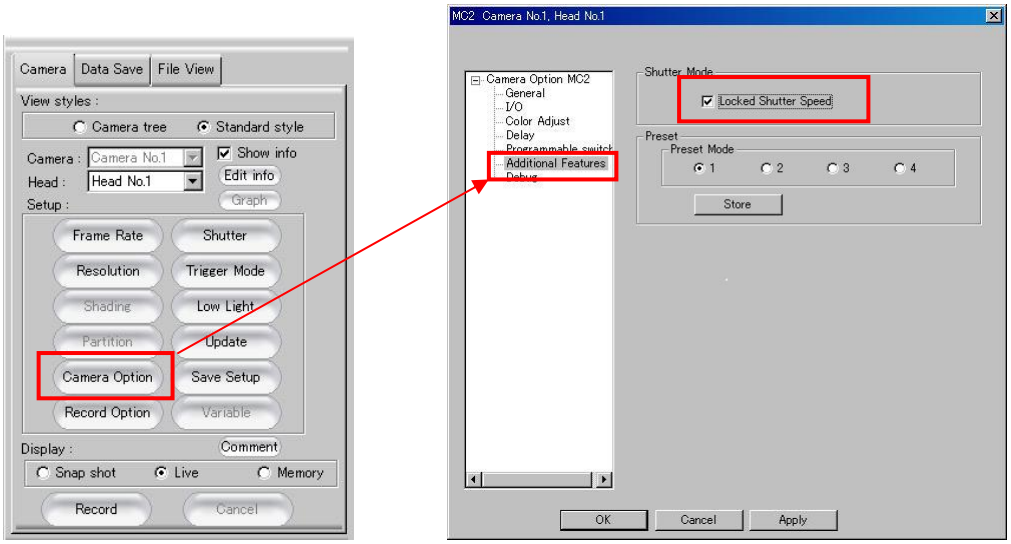
① Verify that the camera mode is in **LIVE mode** (the image displayed is passed through from the camera). If the system is in a mode other than **LIVE mode**, check "Live" on the camera control panel.

② Select "Additional Features" from "Camera Option" on the camera control panel.

③ Set the option by checking "Locked Shutter Speed".

Unchecked: Changing the frame rate automatically sets the shutter speed to 1/frame s.

Checked: Changing the frame rate does not change the shutter speed, it maintains the current setting.



For the LCD Monitor Keypad (Optional)

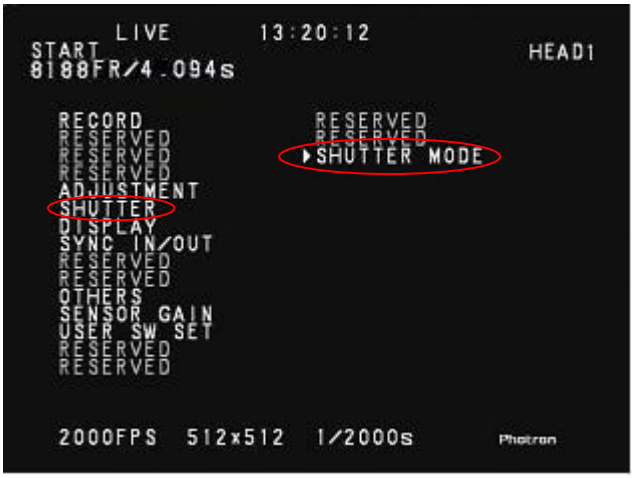
① Verify that the camera mode is in **LIVE** mode.

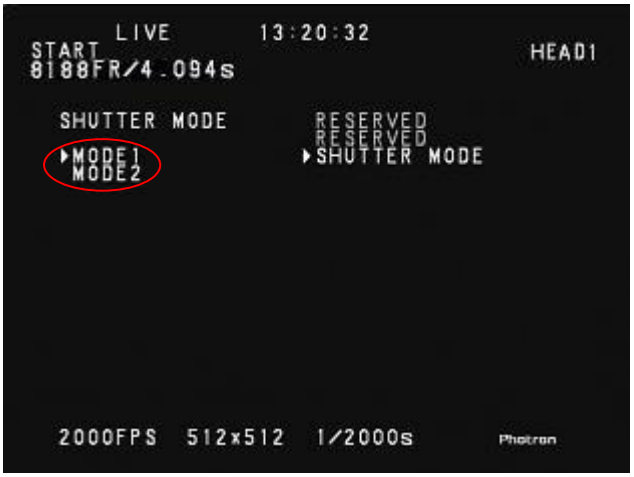
Verify the monitor's upper display is "**LIVE**"

② By switching between **MODE1** and **MODE2** on **SHUTTER MODE** on the **SHUTTER** submenu, the shutter speed value first used when the frame rate is changed can be set.

MODE1: Changing the frame rate automatically sets the shutter speed to 1/frame sec.

MODE2: Changing the frame rate does not change the shutter speed, it maintains the current setting.





3.4. Selecting the Trigger Mode

With the system, in order to reliably capture high-speed phenomena, many kinds of trigger modes have been made available. These trigger modes are explained next.

There are five types of trigger modes which are listed below.

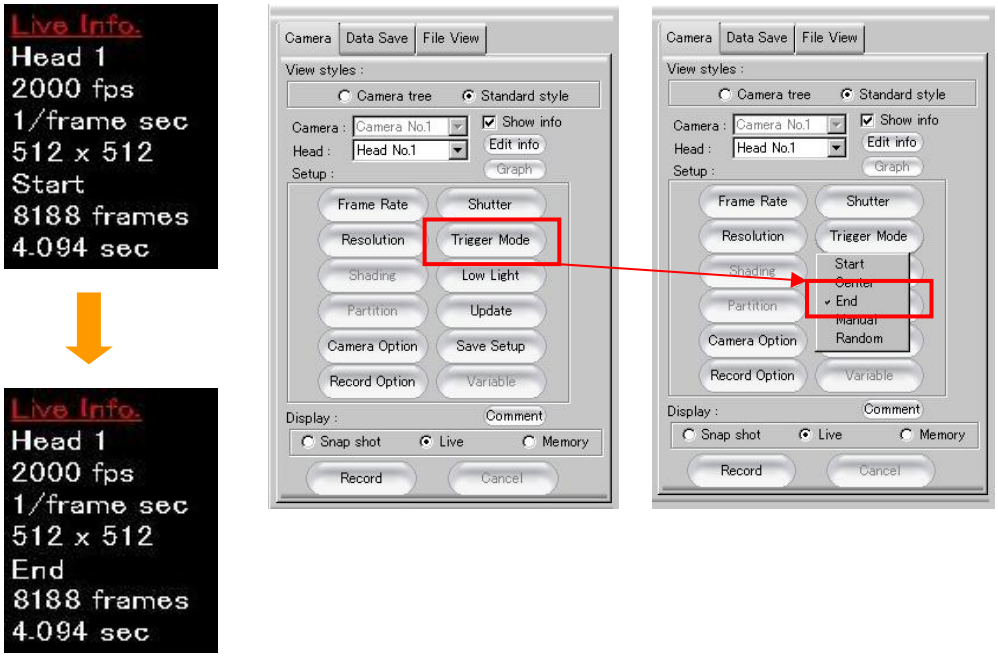
・START ・CENTER ・END ・MANUAL ・RANDOM

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 the trigger mode from "Trigger Mode" on the camera control panel.

③ When you change the trigger mode, the "Live Info" display in the upper left of the screen also changes.

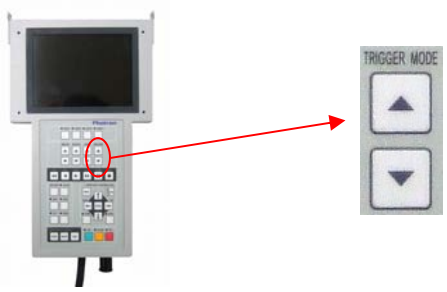


For the LCD Monitor Keypad (Optional)

① Verify that the camera mode is in **LIVE** mode.

Verify the monitor's upper display is "**LIVE**"

② Press the LCD Monitor Keypad's **TRIGGER ▲▼** keys. Pressing the ▲▼ keys selects the trigger mode.



③ The mode selected is displayed on the screen immediately. Verify that the trigger mode display

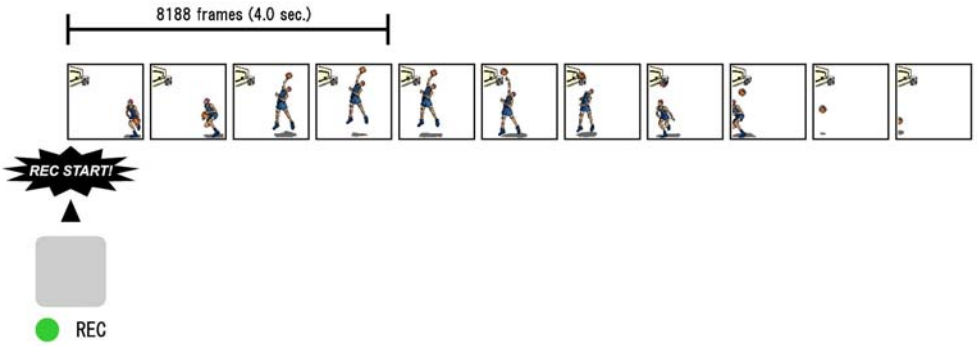
on the screen changes each time the key is pressed.

The trigger mode display changes in the upper part of the monitor

3.4.1. START Mode

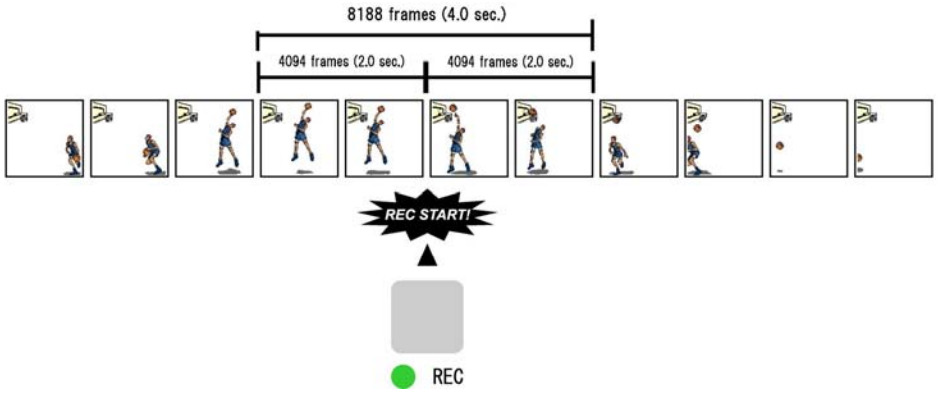
START mode is a trigger mode where recording starts the instant the trigger is input, the scene is recorded until the memory is full, and then recording ends. This mode is suitable for taking images of high-speed phenomena when what will happen, and when it happens, is known in advance.

For example, in a situation with a maximum useable memory of four seconds of recording, the **REC** key is pressed as shown in the diagram below, and four seconds of high-speed video is saved immediately after the trigger is input.



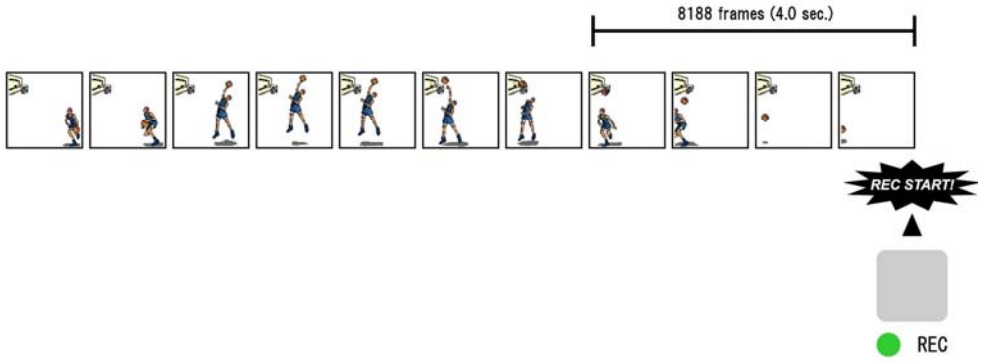
3.4.2. CENTER Mode

CENTER mode is a trigger mode where an equal amount of content recorded before and after the trigger is input is saved to memory. This mode is suitable for viewing before and after an important instant. For example, in a situation with a maximum useable memory for four seconds of recording, the **REC** key is pressed as shown in the diagram below, and two seconds before and two seconds after the trigger was input is recorded for a total of four seconds of high-speed video.



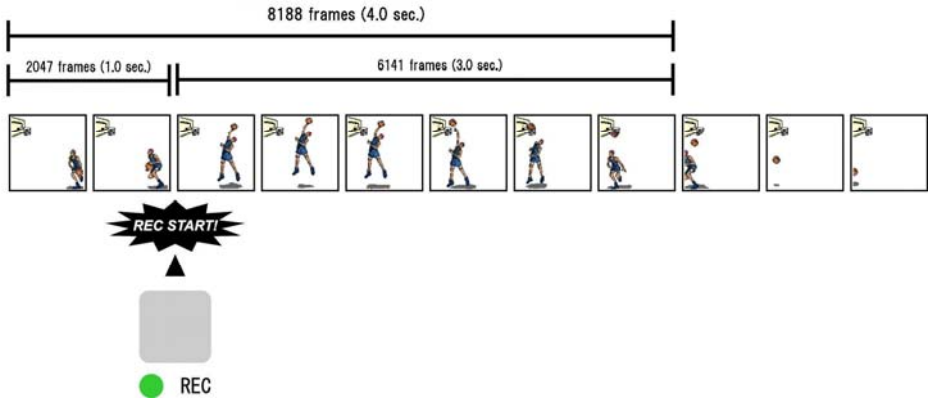
3.4.3. END Mode

END mode is a trigger mode where the content recorded immediately before the trigger is input is saved to memory. This mode is suitable for recording a high-speed phenomenon where it is hard to predict when the important action will start and stop. For example, in a situation with a maximum useable memory for four seconds of recording, the **REC** key is pressed as shown in the diagram below, and the four seconds of high-speed video immediately before when the trigger was input are saved.



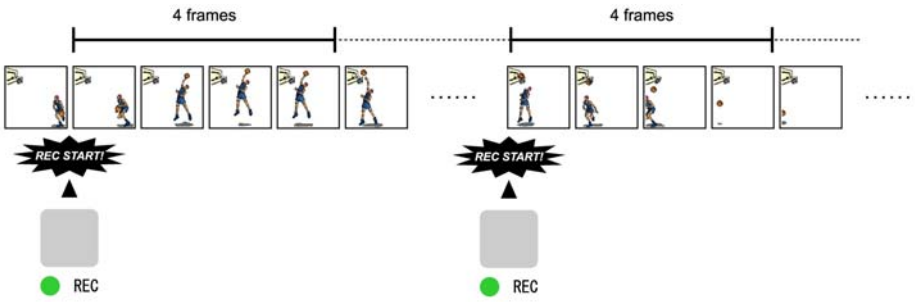
3.4.4. MANUAL Mode

MANUAL mode is a trigger mode, similar to CENTER mode, where the content recorded before and after the trigger is input is saved to memory, but the proportion of time before and after the trigger can be set as required. The system can be easily configured to save 25% of the available time before the trigger is input, and 75% after the **REC** key is pressed as shown in the diagram below. For example, in a situation with a maximum record time of four seconds, one second before and three seconds after the trigger is input are recorded and saved, a total of four seconds of high-speed video.



3.4.5. RANDOM Mode

RANDOM mode is a trigger mode where each time a trigger is input only a predetermined number of frames are saved to memory. For example, this function is convenient for a subject which is an irregular and repeated phenomenon which can have a trigger output produced for each cycle or occurrence. The number of frames recorded each time the trigger is input can be set as desired, in one frame increments, from one frame to the maximum of all the recordable frames available.



3.5. Using Low Light Mode

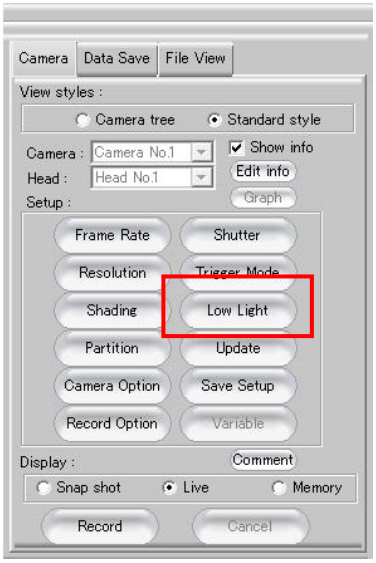
The more you increase the frame rate or shutter speed of a high-speed camera, the more the amount of light entering the camera decreases, making the displayed image dark. Low light mode is a function that temporarily increases the exposure time, making the displayed image easier to see for setting the lens focus or other options.

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.

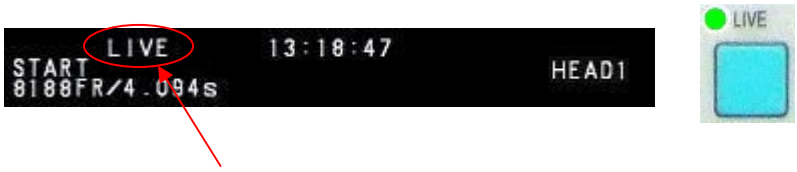
② Click "Low Light" on the camera control panel.

③ The exposure time increases and the screen becomes easier to see.



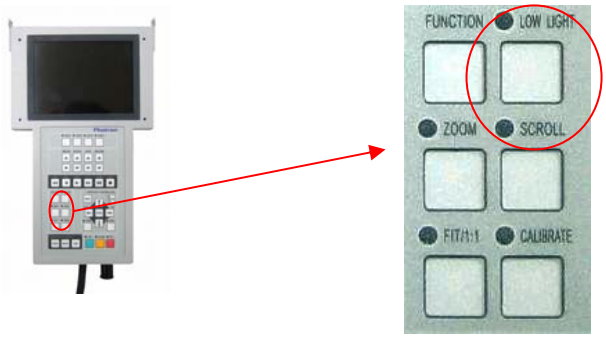
For the LCD Monitor Keypad (Optional)

① Verify that the camera mode is in **LIVE** mode.



Verify the monitor's upper display is "**LIVE**"

② Press the LCD Monitor Keypad's **LOW LIGHT** key.



③ Press the **LOW LIGHT** key once to turn on low light mode. Press the **LOW LIGHT** key once more to clear low light mode. Pressing the **REC READY** key automatically clears low light mode.

3.6. White Balance Adjustment (Color Models Only)

On digital cameras, photographing white as pure white is described as "having the appropriate white balance." On the system's color models as well, in order to take images with the correct color representation, the white balance must be adjusted for the color temperature of the light source used. The intensity of each color, R, G, and B, can be adjusted on this system. By adjusting the balance of those three colors to match the light source used, the appropriate white balance can be achieved and realistic color images recorded.

Two methods are available for adjusting the white balance, preset and user-editable white balance. These methods are explained in this section.

3.6.1. Using Preset White Balance

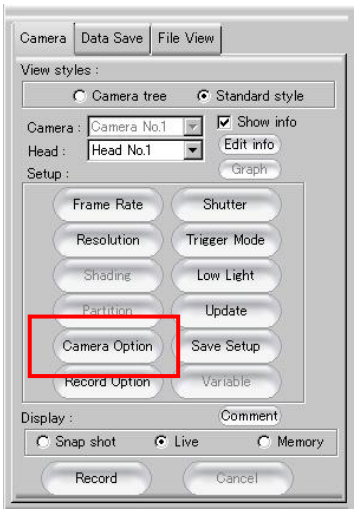
With the system, there are two types of white balance presets (5100K, 3100K) for use with common light sources. The suggested color temperature for these presets is listed below.

5100K (Daylight, Outdoors)

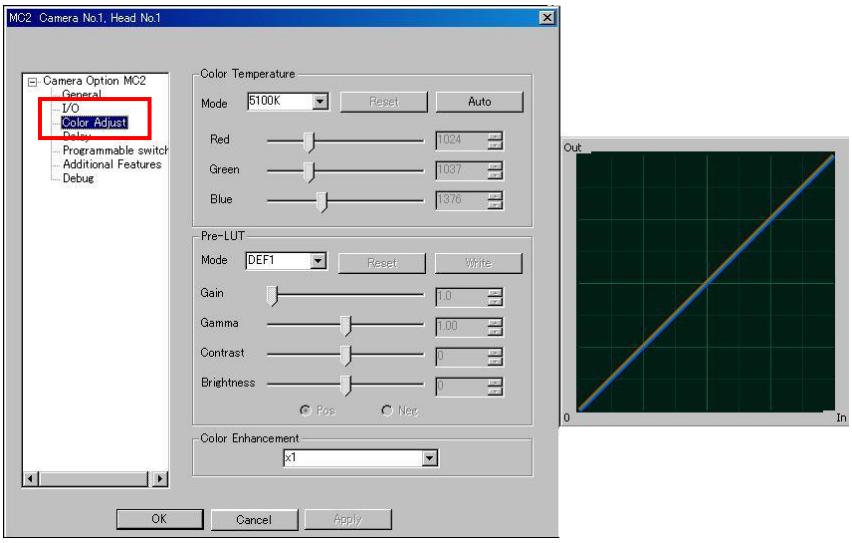
3100K (Halogen Light Source)

For PFV (Standard)

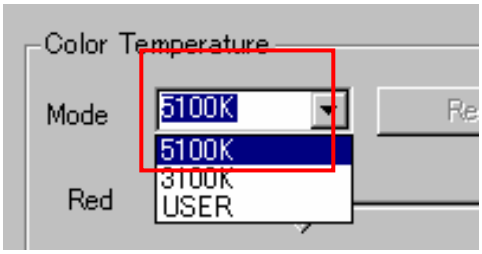
① Verify that the camera mode is in **LIVE mode** (the image displayed is passed through from the camera). If the system is in a mode other than **LIVE mode**, check "Live" on the camera control panel.



② Select color adjust on the left tree from "Camera Option" on the camera control panel.

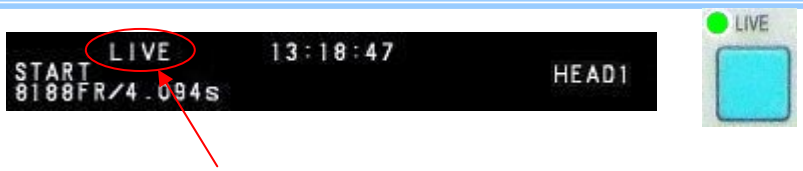


③ Select **5100K** (or **3100K**) from the Mode pull-down menu.



For the LCD Monitor Keypad (Optional)

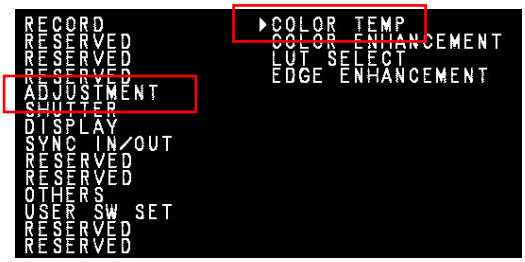
① Verify that the camera mode is in **LIVE** mode.



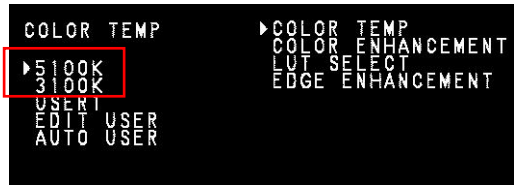
Verify the monitor's upper display is "**LIVE**"

② Press the LCD Monitor Keypad's **MENU** key and the menu list displays.

③ Select **COLOR TEMP** from the **ADJUSTMENT** submenu with the **ARROW** keys on the LCD Monitor Keypad and press the **ENTER** key.



④ Select **5100K** (or **3100K**) and press the **ENTER** key.



⑤ Verify that the white balance has changed on the screen.

3.6.2. Using User White Balance

Each camera head can be assigned a user white balance setting in order to achieve the most appropriate

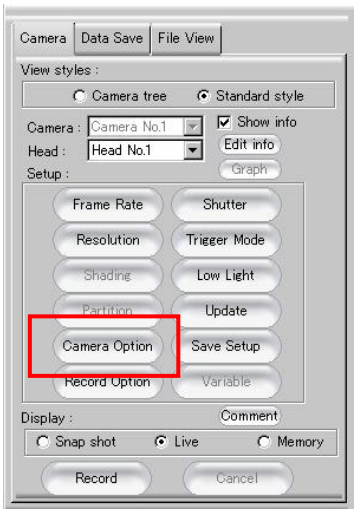
white balance for the light source used and the conditions during recording.

The values set here are stored for each camera head in the camera controller's internal memory as a user preset, and the values can be loaded by selecting **USER**.

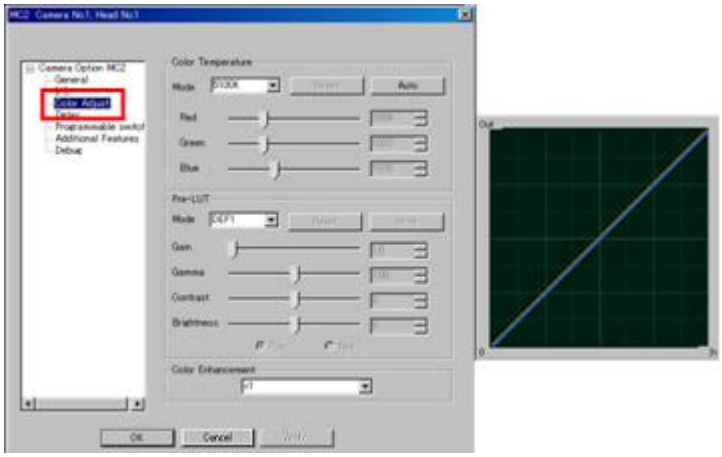
■ Auto Setting

For PFV (Standard)

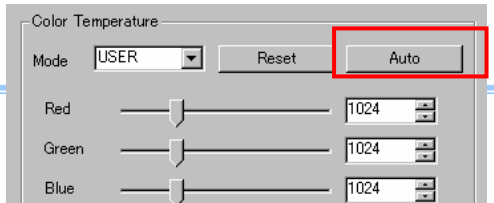
① Verify that the camera mode is in **LIVE mode** (the image displayed is passed through from the camera). If the system is in a mode other than **LIVE mode**, check "Live" on the camera control panel.



② Select color adjust on the left tree from "Camera Option" on the camera control panel.

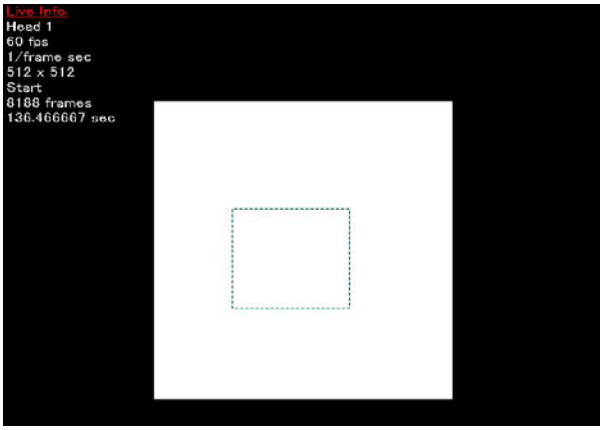


③ Press the color adjustment auto adjustment button.



④ Turn on the lighting to be used during the recording, and in the center of the screen, shoot an object, such as white paper, to be the white standard.

⑤ Enclose the area to be the white standard in a rectangle with the cursor.



⑥ You will obtain the appropriate white ba

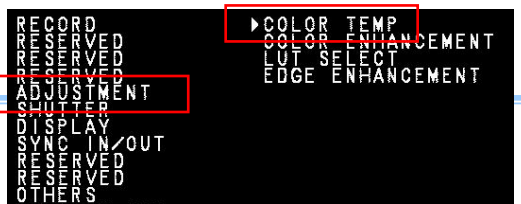
For the LCD Monitor Keypad (Optional)

① Verify that the camera mode is in **LIVE** mode.

Verify the monitor's upper display is "**LIVE**"

② Press the LCD Monitor Keypad's **MENU** key and the menu list will display.

③ Select the **COLOR TEMP** from the **ADJUSTMENT** submenu with the **ARROW** keys on the LCD Monitor Keypad and press the **ENTER** key.

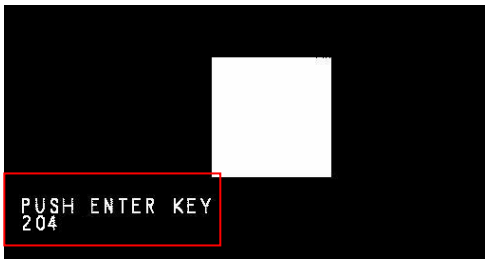


④ Select AUTO USER and press the ENTER key to enter the white balance adjustment mode.

⑤ Verify that a value similar to that shown below is displayed at the bottom left of the screen.

⑥ Turn on the lighting to used for during the recording, and in the center of the screen shoot an object, such as white paper, to be the white standard.

⑦ Adjust the light intensity if **DARK** is displayed in the lower left of the screen until it changes to **PUSH ENTER KEY**. If it is too bright, **BRIGHT** is displayed. Reduce the light intensity.



⑧ Press the ENTER key when the PUSH ENTER KEY display is shown.

⑨ You will obtain the appropriate white balance with this operation.

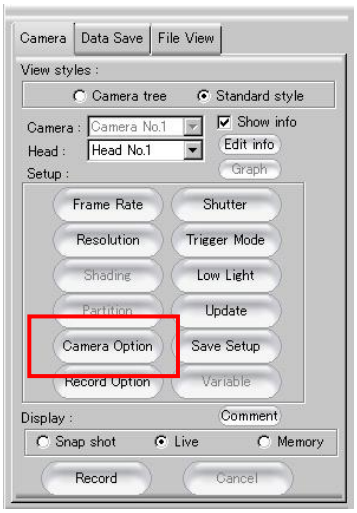
⑩ The set value can be loaded by selecting USER.

■ Edit the Setting

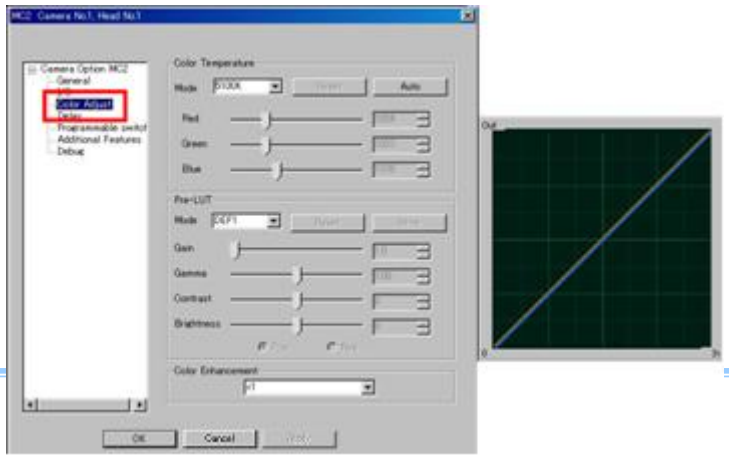
The white balance can be set automatically on the system, or you can also adjust the tint by changing the RGB values.

For PFV (Standard)

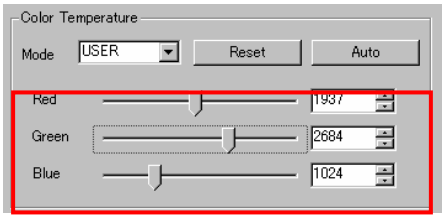
① Verify that the camera mode is in **LIVE mode** (the image displayed is passed through from the camera). If the system is in a mode other than **LIVE mode**, check "Live" on the camera control panel.



② Select color adjust on the left tree from "Camera Option" on the camera control panel.



③ Set the red, green, and blue values for the color temperature.



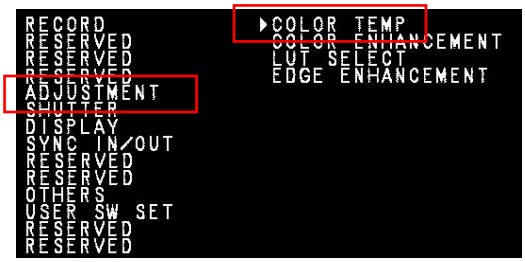
For the LCD Monitor Keypad (Optional)

① Verify that the camera mode is in **LIVE** mode.

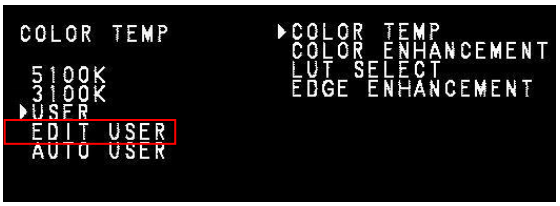
Verify the monitor's upper display is "**LIVE**"

② Press the LCD Monitor Keypad's **MENU** key and the menu list will display.

③ Select the **COLOR TEMP** from the **ADJUSTMENT** submenu with the **ARROW** keys on the LCD Monitor Keypad and press the **ENTER** key.



④ Select EDIT USER and press the ENTER key. The white balance adjustment items will display.



⑤ Use the ARROW keys to set the RGB values, and press the ENTER key to confirm when finished.

⑥ The set value can be loaded by selecting USER.

3.7. Color Enhancement Function (Color Models Only)

Color models feature a color enhancement setting. The image color enhancement level can be adjusted in five steps, including the OFF setting. The content of each item is listed in the chart below.

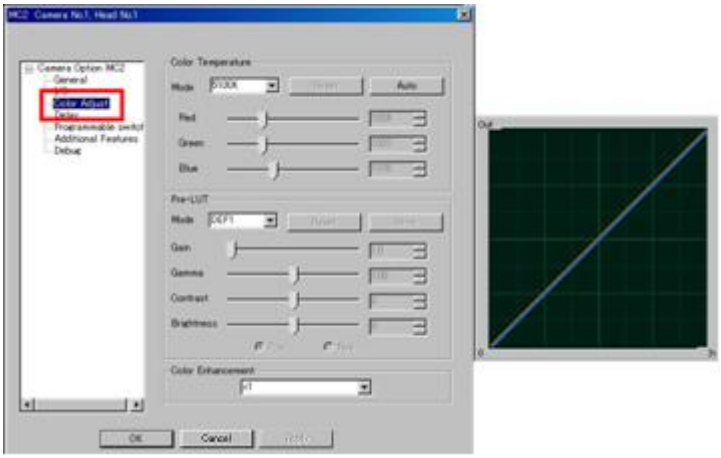
Menu Display	Content
OFF	Turns the color enhancement mode off
x0.5 (MODE1)	Sets x0.5 color enhancement
x1 (MODE2)	Sets x1 (default) color enhancement
x1.5 (MODE3)	Sets x1.5 color enhancement
x2 (MODE4)	Sets x2 color enhancement

For PFV (Standard)

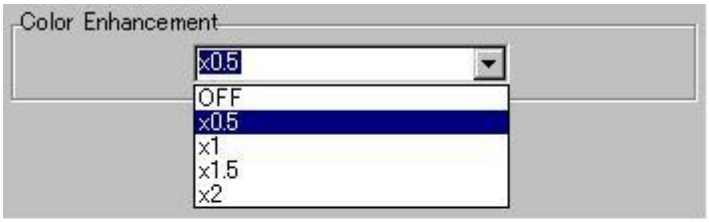
① Verify that the camera mode is in **LIVE mode** (the image displayed is passed through from the camera).

If the system is in a mode other than **LIVE mode**, check "Live" on the camera control panel.

② Select color adjust on the left tree from "Camera Option" on the camera control panel.



③ Set the factor from the color enhancement pull-down menu.

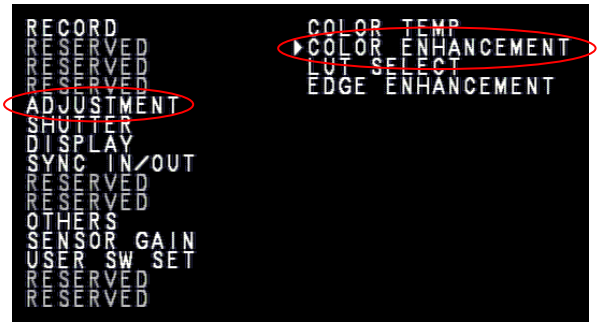


For the LCD Monitor Keypad (Optional)

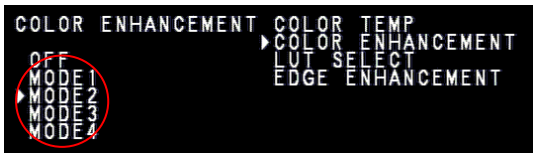
① Verify that the camera mode is in **LIVE** mode.

Verify the monitor's upper display is "**LIVE**"

② Press the **MENU** key on the LCD Monitor Keypad, then select **COLOR ENHANCEMENT** from the **ADJUSTMENT** submenu and press the **ENTER** key.



③ The setting items are displayed. The content of each item is listed in the chart below.



Use the LCD Monitor Keypad's ↑↓ keys to select one of the modes listed above. When finished, press the **ENTER** key to complete the setting.

3.8. LUT (Look-Up Table) Operations

The **LUT** (**Look-Up Table**) refers to a reference table that defines the relationship between the pixel brightness gradation of the original image data taken and the brightness gradation displayed on a computer screen or video monitor.

The **system** contains a hardware LUT function, and you can display the image data taken with improved contrast (light and dark sharpness) or make an object in the image stand out by emphasizing a specified gray level range.

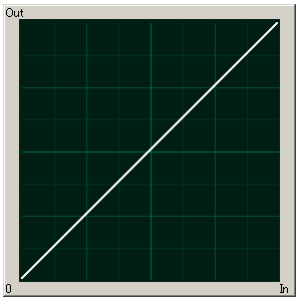
When an image is saved with its brightness converted with the **LUT**, the image saved is the image that has had its brightness converted.

3.8.1. Using Preset LUT Patterns

Six preset **LUT patterns** have been prepared in advance on the system. Each of these patterns is explained in sequence in this section.

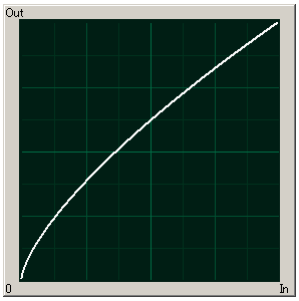
D1: GAIN 1x

The input is always linear output. This **LUT** is used for normal conditions.



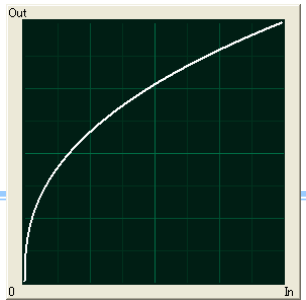
D2: Gamma 0.6

This **LUT** is 0.6 gamma correction.



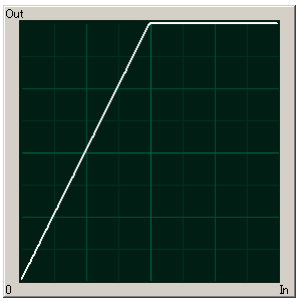
D3: Gamma 0.45

This **LUT** is 0.45 gamma correction.



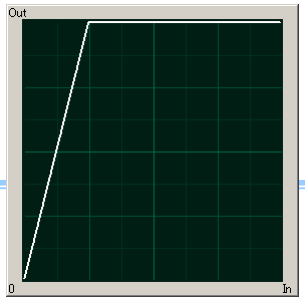
D4: Gain 2x

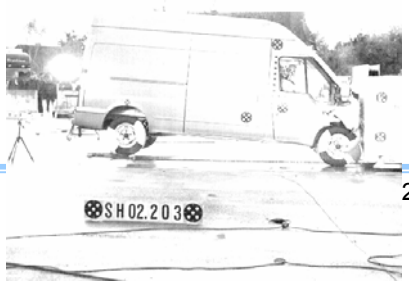
The gain is doubled and you can display the dark areas of the image emphasized.



D5: Gain 4x

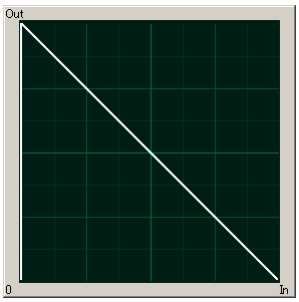
The gain is quadrupled and you can display the dark areas of the image emphasized. This LUT emphasizes the dark portions even more than **D4**.





D6: Reverse Gradation

The input gradation is reversed and then displayed.



3.8.2. Using a Custom LUT

Creating a **LUT pattern** is done with **PFV**. For details, refer to the "**Photron FASTCAM Viewer** User's Manual".

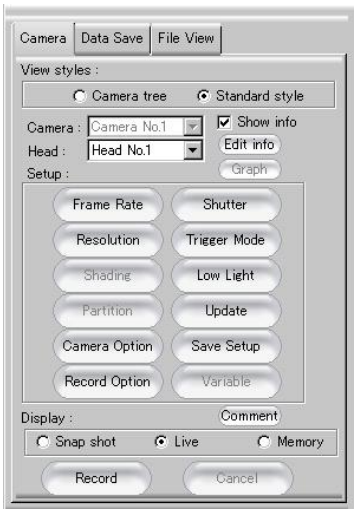
3.9. Edge Enhancement Function

With the systems' edge enhancement setting, you can enhance the edges in the recorded image in three steps. The content of each item is listed in the chart below.

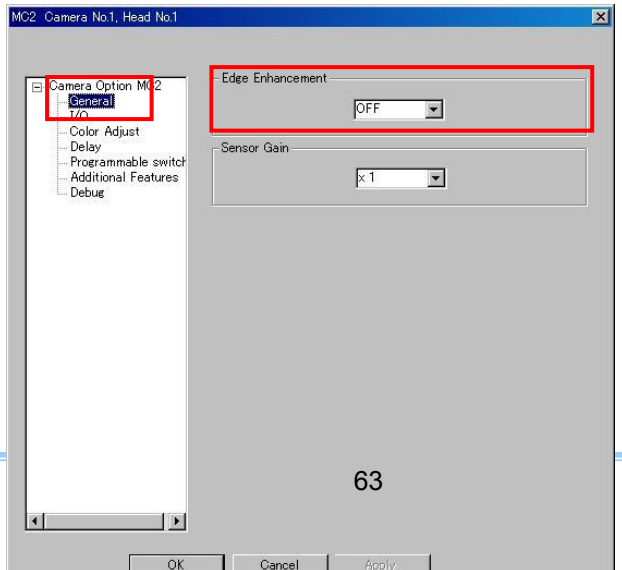
Menu Display	Content
OFF	Turns edge enhancement mode off.
MODE1	Sets the amount of edge enhancement to light.
MODE2	Sets the amount of edge enhancement to medium.
MODE3	Sets the amount of edge enhancement to heavy.

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 general on the left tree from "Camera Option" on the camera control panel.



③ Select the mode from the edge enhancement pull-down menu.

For the LCD Monitor Keypad (Optional)

① Verify that the camera mode is in **LIVE** mode.

Verify the monitor's upper display is "**LIVE**"

② Press the **MENU** key on the LCD Monitor Keypad, then select **EDGE ENHANCEMENT** from the **ADJUSTMENT** submenu and press the **ENTER** key.

③ The setting items are displayed. The content of each item is listed in the chart below.

④ Use the LCD Monitor Keypad's ↑↓ keys to select one of the modes listed above. When finished, press the **ENTER** key to complete the setting.

3.10. Setting the Sensor Gain

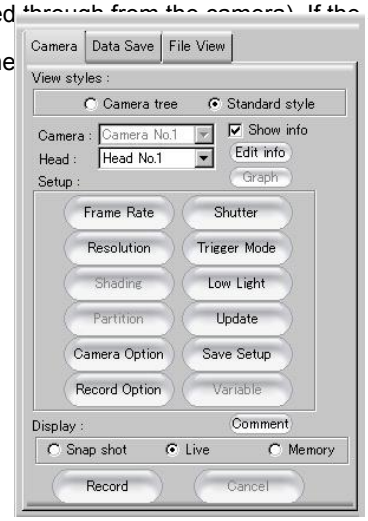
The sensor gain setting adjusts the amplitude voltage inside the sensor. By increasing this setting, when recording in low light, the signal is amplified and the camera can take a higher gain (brighter) image. However, by amplifying the signal, the noise component also increases, resulting in decreased image quality, or more noise.

The sensor gain can be set in two steps according to the object being recorded. The content of each item is listed in the chart below.

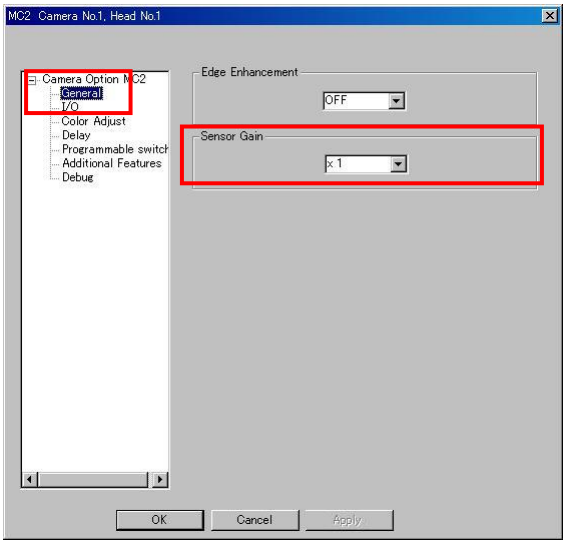
Menu Display	Content
x 1	Sets the sensor gain to standard.
x 3	Sets the sensor gain to 3x.

For PFV (Standard)

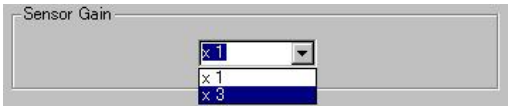
① Verify that the camera mode is in **LIVE mode** (the image displayed is passed through from the camera). If the system is in a mode other than **LIVE mode**, check "Live" on the



② Select general on the left tree from "Camera Option" on the camera control panel.



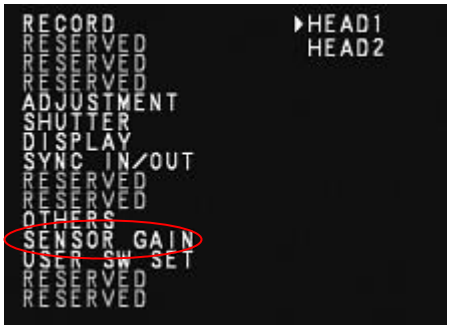
③ Select x 1 (standard) or x 3 (gain amplification) from the sensor gain pull-down menu.



For the LCD Monitor Keypad (Optional)

- Press the LCD Monitor Keypad's **MENU** key and the menu list displays.

- With the ↑↓ keys, select the **SENSOR GAIN** item and press the → key to move to the submenu.



- Select the camera head on which to make the sensor gain setting.

- The setting items will display. Select X1 (standard) or X3 (gain amplification) with the ↑↓ keys.

- When finished, press the **ENTER** key to complete the setting.

3.11. Input/Output Signal Types

With the system, many signals can be input and output through the **BNC connectors**. Signals that can be input and output from the **BNC connectors** 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 devices, the input device and the output device.

- **TRIGGER IN Connector (Switch TTL and SW with the slide switch)**

● When the slide switch is TTL:

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 +4.5V to +12V, positive or negative polarity, pulse width is 50 ns or greater.
Operating current is 10 mA recommended, 30 mA maximum.

● When the slide switch is SW:

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

- **SYNC IN Connector**

The system recognizes a TTL signal from other devices as a synchronization signal.
Input voltage is +4.5V to +12V, positive or negative polarity, pulse width is 50 ns or greater.
Operating current is 10 mA recommended, 30 mA maximum.

● GENERAL OUT Connector

The signals below can be changed from the menu or PFV and output.

See "**3.14 GENERAL OUT Signal Settings**" for details.

SYNC POS/NEG	: Outputs a vertical synchronization signal.
EXPOSE HEAD1 POS/NEG	: Outputs camera head 1's exposure period signal. Outputs during both LIVE and recording.
EXPOSE HEAD2 POS/NEG	: Outputs camera head 2's exposure period signal. Outputs during both LIVE and recording.
REC POS/NEG	: Outputs a period signal during recording.
TRIG POS/NEG	: Outputs the trigger signal received by the camera.
READY POS/NEG	: Outputs a signal that indicates the recording ready state.

3.12. Using External Triggers

With the system, you can record by receiving various trigger signals matched to the recording application. The trigger signals that can be used with the **system** are explained here.

3.12.1. Inputting an External Trigger Signal

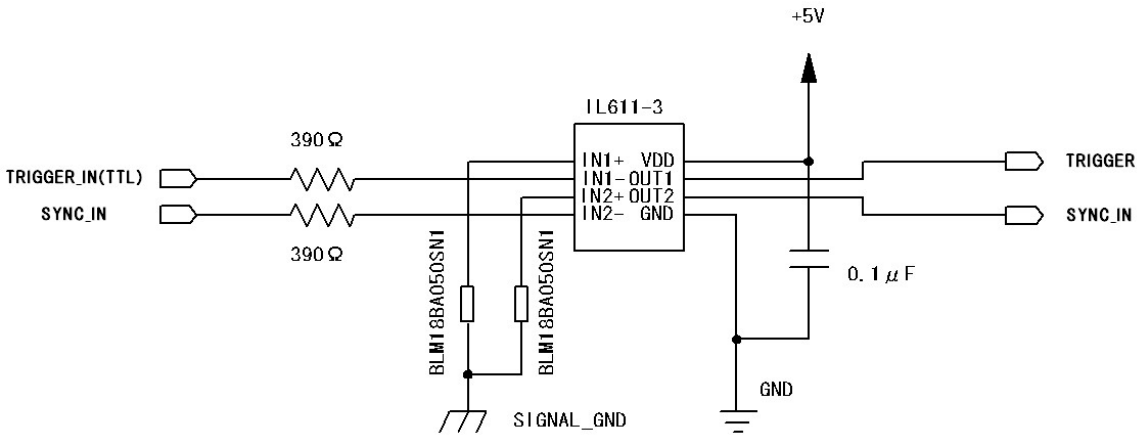
The external trigger signals that can be used with the system and their input systems are listed below.
Switch between SW/TTL type input signals using the "slide switch" on the front panel.
The settings for external trigger signal input are made by selecting "I/O" from "Camera Option" when using **PFV**, or by selecting "**SYNC IN/OUT**" on the menu and making the settings with "**TRIG TTL IN**" in the submenus when using the "LCD Monitor Keypad (optional)".
Signals are input with the **TRIGGER IN** connector explained in section "**2.2.9. BNC Connectors**".

Connector Name (Input System)	Menu Setting	Signal
TRIGGER IN (TTL)	TRIG POS	Isolated IC Input (+4.5V - +12V), Positive Polarity
	TRIG NEG	Isolated IC Input (+4.5V - +12V), Negative Polarity
TRIGGER IN (SW)	(None)	Contact Signal

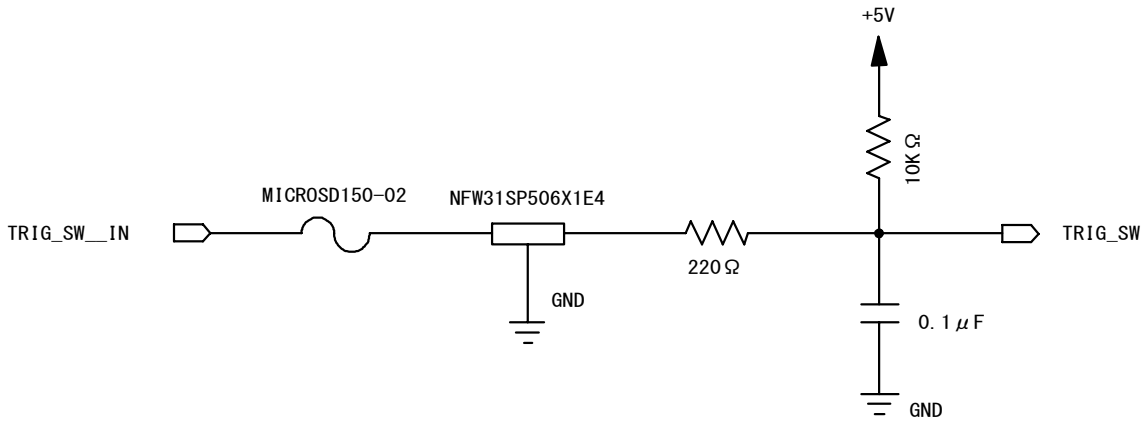
Use caution not to input more than specified voltage or current to the TRIGGER IN trigger signal input as there is a risk of damage to the equipment.

TRIGGER IN (TTL) Circuit Diagram

SYNC IN Circuit Diagram



TRIGGER IN (SW) Circuit Diagram



3.12.2. Outputting External Trigger Signals

With the system, the external output of trigger signals can be optionally set from the **GENERAL OUT** connector. The settings for external trigger signal output are made by selecting "I/O" from "Camera Option" when using **PFV**, or by selecting "**SYNC IN/OUT**" on the menu and making the settings with "**GENERAL OUT**" in the submenus when using the "LCD Monitor Keypad (optional)".
Signals are output with the **GENERAL OUT** connector explained in section "**2.2.9. BNC Connectors**".

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

Connector Name (Output System)	Menu Setting	Signal Type	Reference Delay Amount
GENERAL OUT	TRIG POS	TTL, SW, SOFT, all TRIG pulse output CMOS (74ACT541 buffer) output, positive polarity	For TRIGGER IN (TTL) approx. 100 ns For TRIGGER IN (SW) approx. 15 µs
	TRIG NEG	TTL, SW, SOFT, all TRIG pulse output CMOS (74ACT541 buffer) output, positive polarity	

When a trigger signal is output to GENERAL OUT, set the signal to be output from the menu in advance before using it. For GENERAL OUT settings, see section "3.14. GENERAL OUT Signal Settings" and make the necessary settings.

3.13. Using External Synchronization Signals

An external synchronization mode to synchronize the camera to an external signal is provided on the system. By using an external synchronization signal, you can record synchronizing the timing of the recording using multiple systems or synchronize recording with external measuring devices and lighting. The procedure for using the external synchronization signal is explained below.

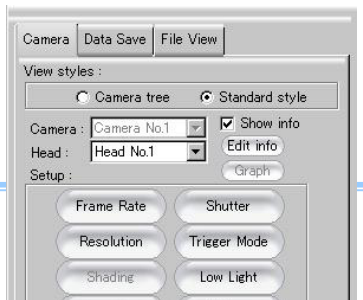
3.13.1. Inputting an External Synchronization Signal

With the system, you can input an external synchronization signal. The content of each item is listed in the chart below.

Menu Display	Content	Signal (Input Signal onditions)
OFF	Turns external synchronization off	(None)
ON CAM POS	Synchronizes with the **FASTCAM MC2**	TTL Level, Positive Polarity
ON CAM NEG	Synchronizes with the **FASTCAM MC2**	TTL Level, Negative Polarity
ON OTHERS POS	Synchronizes with an external device (including other Photron products)	TTL Level, Positive Polarity
ON OTHERS NEG	Synchronizes with an external device (including other Photron products)	TTL Level, Negative Polarity

For PFV (Standard)

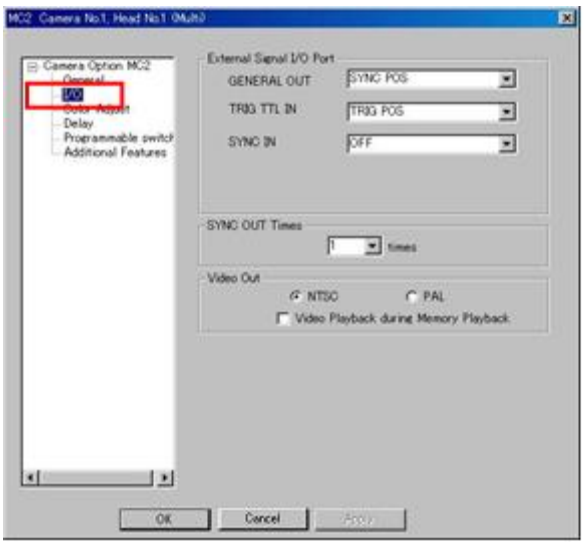
① Verify that the camera mode is in **LIVE mode** (the image displayed is passed through from the camera). If the system is in a mode other than **LIVE mode**, check "Live" on the camera control panel.



② Input the synchronization signal to the camera controller with the **SYNC IN** connector as explained in section "**2.2.9. BNC Connectors**".

③ The LED (yellow) labeled **SYNC IN** on the front of the camera controller illuminates.

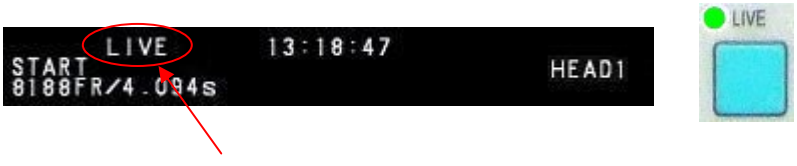
④ Select I/O on the left tree from "Camera Option" on the camera control panel.



⑤ Set "SYNC IN".

For the LCD Monitor Keypad (Optional)

① Verify that the camera mode is in **LIVE** mode.



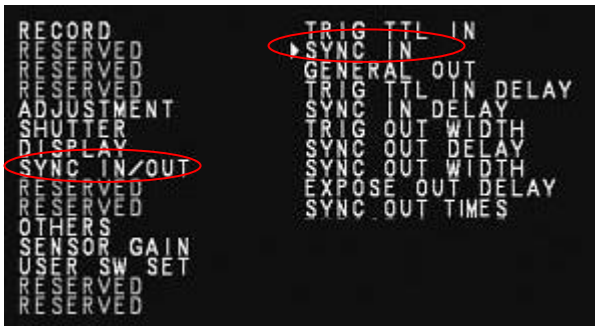
Verify the monitor's upper display is "**LIVE**"

② Input the synchronization signal to the camera controller with the **SYNC IN** connector as explained in section "**2.2.9. BNC Connectors**".

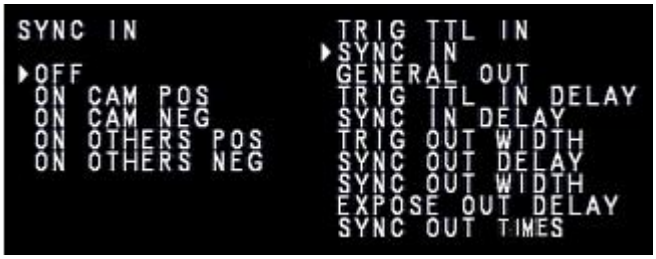
② The LED (yellow) labeled **SYNC IN** on the front of the camera controller illuminates.

③ Press the LCD Monitor Keypad's **MENU** key and the menu list displays.

④ Select **SYNC IN** from the **SYNC IN/OUT** submenu with the LCD Monitor Keypad's **ARROW** keys and press the **ENTER** key.



⑤ The setting items are displayed. The content of each item is listed in the chart below.



⑥ Select the menu to set with the ↑↓ keys.

⑦ When the setting is complete, press the **ENTER** key to finish.

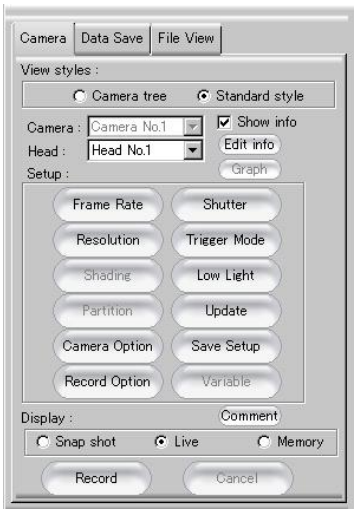
3.13.2. Outputting an External Synchronization Signal

With the system, you can externally output a synchronization signal. External synchronization signals are output from the **GENERAL OUT** connector explained in section "**Input/Output Signal Types**". The procedure for setting the output of an external synchronization signal is explained below.

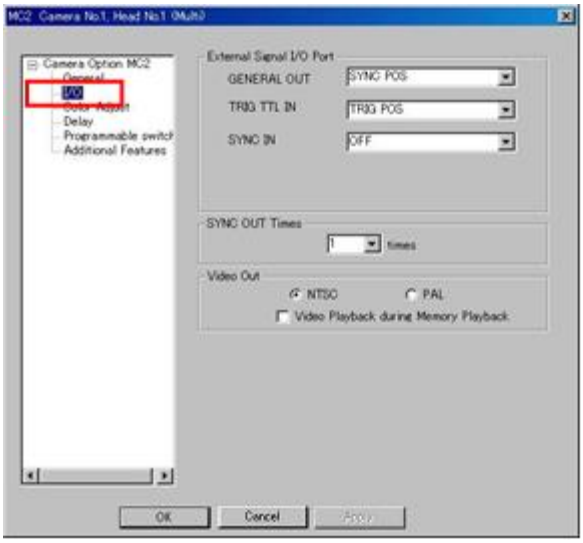
Menu Display	Content	Signal Type	Reference (Input/Output Delay Amount)
SYNC POS	Outputs a positive polarity vertical synchronization signal.	CMOS (74ACT541 buffer) Output, Positive Polarity	Approx. 100 ns
SYNC NEG	Outputs a negative polarity vertical synchronization signal.	CMOS (74ACT541 buffer) Output, Negative Polarity	Approx. 100 ns

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 OUT".

For the LCD Monitor Keypad (Optional)

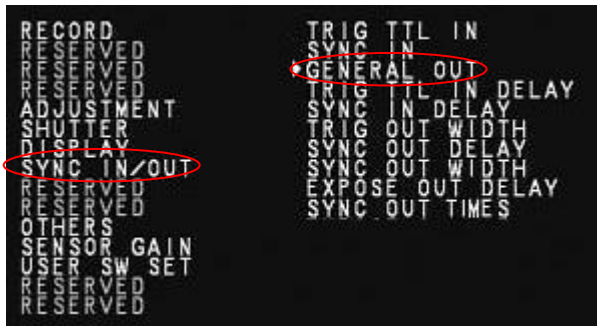
① Verify that the camera mode is in **LIVE** mode.

Verify the monitor's upper display is "**LIVE**"

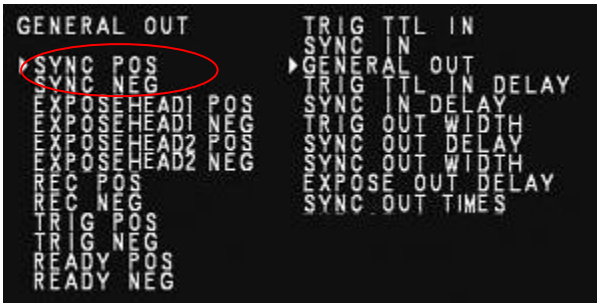
② Press the LCD Monitor Keypad's **MENU** key and the menu list displays.

③ Select **GENERAL OUT** from the **SYNC IN/OUT** submenu with the LCD Monitor Keypad's **ARROW**

keys.



④ The menu is displayed. When performing external synchronization, use either **SYNC POS** or **SYNC NEG**.



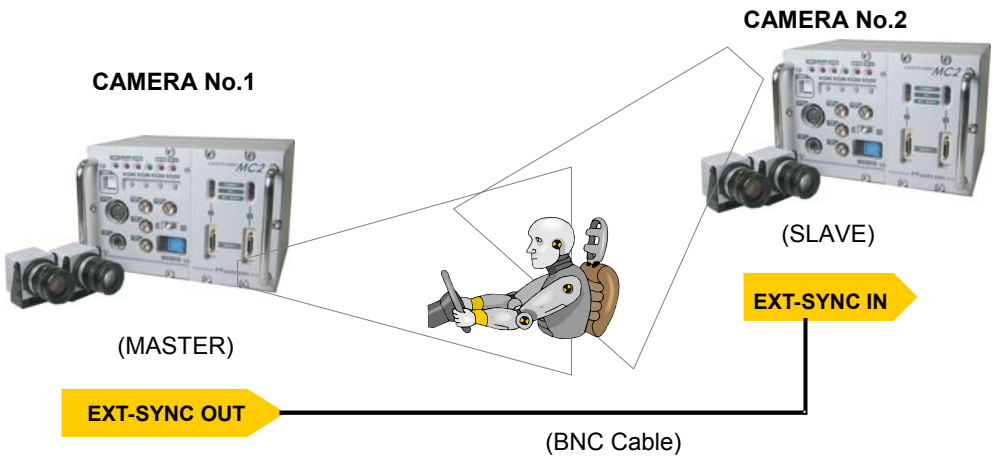
⑤ Select the output signal with the ↑↓ keys.

⑥ When finished, press the **ENTER** key to complete the setting.

3.13.3. Synchronizing Multiple FASTCAM MC2 Systems (Multiple Unit Synchronized Recording)

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

Conceptual Diagram of a Synchronized Connection



Synchronized recording settings using the system are made with the "LCD Monitor Keypad (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 controller (outputs the synchronization signal) and the slave camera controller (receives the synchronization signal) from the two systems to use for synchronized recording.

■ Cable Connection

Connect the master camera controller's **GENERAL OUT** connector to the slave camera controller's **SYNC IN** 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 controller illuminates.

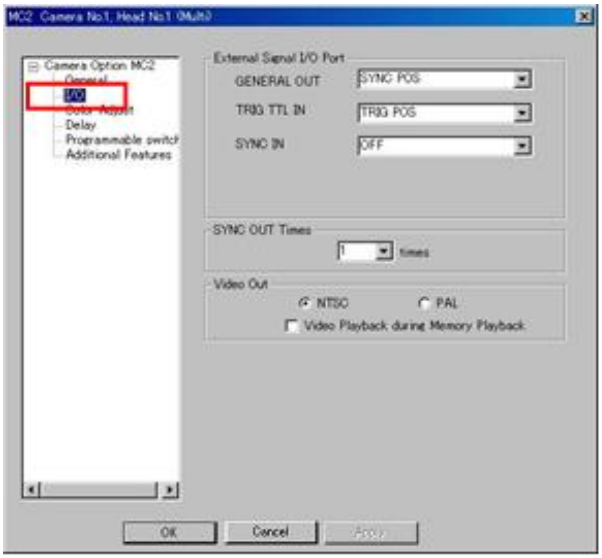
■ Setting the Master Camera Controller (Outputs Synchronization)

Set the signal output for the master camera controller which will output the synchronization signal. Synchronization signal settings are made with the "LCD Monitor Keypad (optional)" or **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.

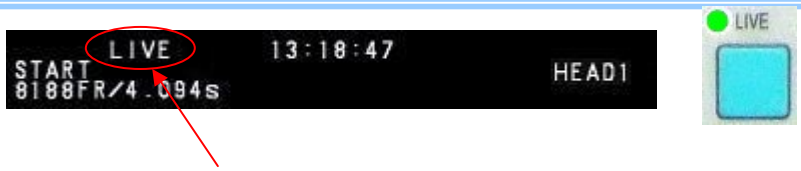


③ Set "GENERAL OUT". Select "**SYNC POS**" here.

④ The master camera controller is set to output a positive polarity vertical synchronization signal from its **GENERAL OUT** connector.

For the LCD Monitor Keypad (Optional)

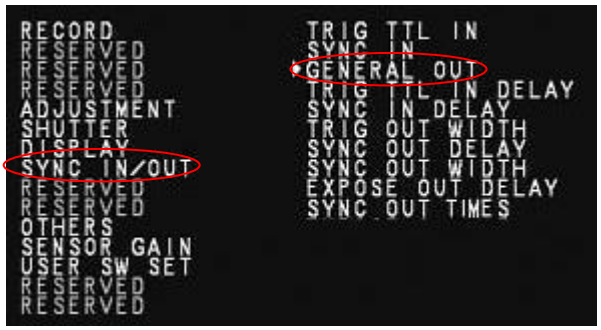
① Verify that the camera mode is in **LIVE** mode.



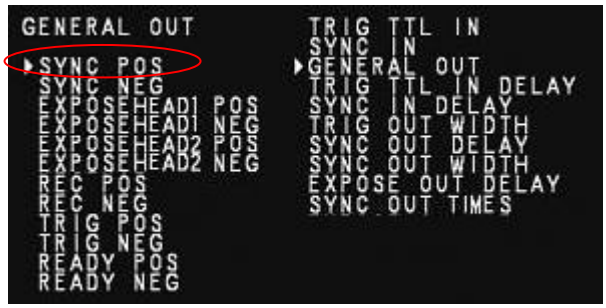
Verify the monitor's upper display is "**LIVE**"

② Press the LCD Monitor Keypad's **MENU** key and the menu list displays.

③ Select **GENERAL OUT** from the **SYNC IN/OUT** submenu with the LCD Monitor Keypad's **ARROW** keys and press the **ENTER** key.



④ Select the signal to be output from the master camera controller's **GENERAL OUT** connector from the menu. Move the cursor here to the **SYNC POS** item with the ↑↓ keys and press the **ENTER** key to select.



⑤ The master camera controller is set to output a positive polarity vertical synchronization signal from its **GENERAL OUT** connector.

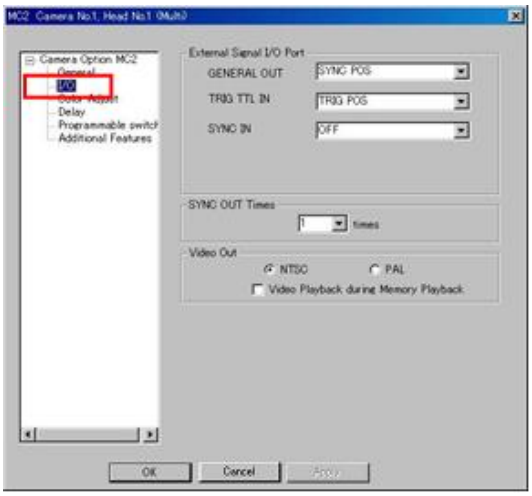
■ Setting the Slave Camera Controller (Receives the Synchronization Signal)

Next, set the synchronization signal input for the slave camera controller which will receive the synchronization signal supplied by the master camera controller. Synchronization signal settings are made with the "LCD Monitor Keypad (optional)" or **PFV**.

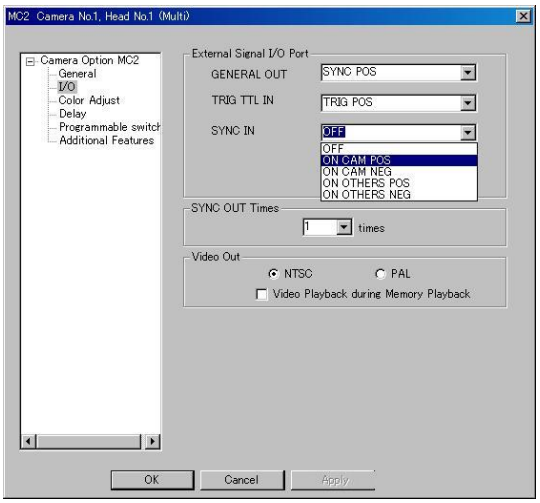
For PFV (Standard)

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 SYNC IN to "**ON CAM POS**".



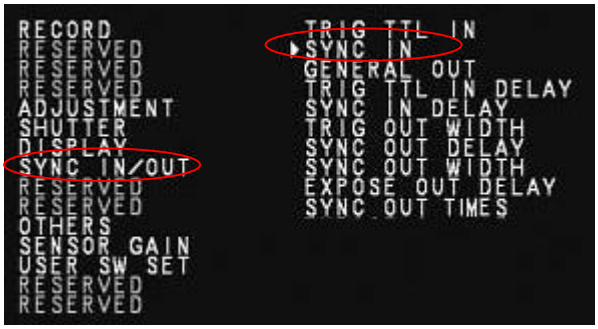
For the LCD Monitor Keypad (Optional)

① Verify that the camera mode is in **LIVE** mode.

Verify the monitor's upper display is "**LIVE**"

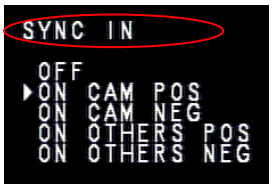
② Set the synchronization signal type that slave camera controller will receive. Press the LCD remote controller's **MENU** key and the menu list displays.

③ Select **SYNC IN** from the **SYNC IN/OUT** submenu with the LCD Monitor Keypad's **ARROW** keys and press the **ENTER** key.



④ The output previously set on the master camera controller has positive polarity (POSITIVE), therefore

it is necessary to make the setting on the slave camera controller the same, positive polarity (POSITIVE). Move the cursor to the **ON CAM POS** item with the ↑↓ keys and press the **ENTER** key to select.



If steps 1-3 are completed when no synchronization signal is being input, the camera will not operate normally.

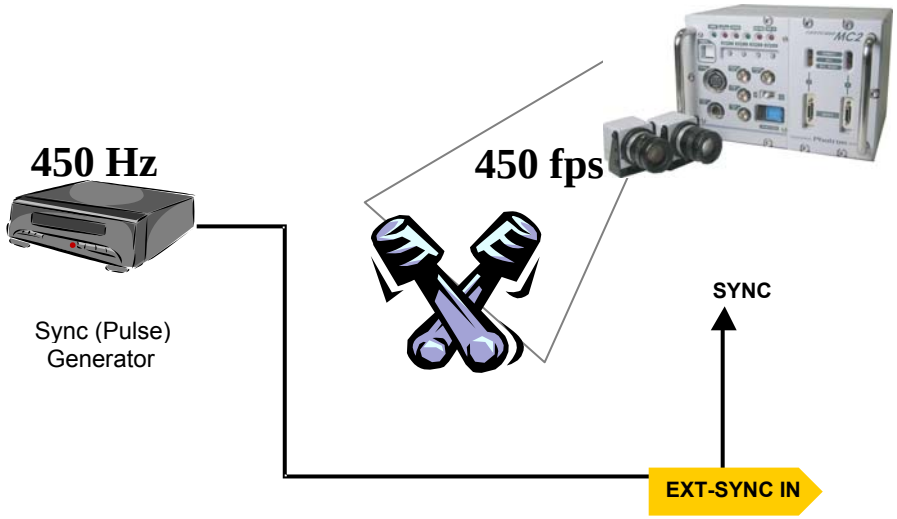
As detailed in the procedure, make the settings when the signal is being input.

3.13.4. Synchronizing the System with Other External Devices (Frame Rate Synchronized Recording)

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

In this way, for example, the system can be synchronized with a dynamic body that spins at 450 revolutions per second to conduct high-speed recording at 450 fps. This can open up broad applications that were unavailable until now.

Conceptual Diagram of External Synchronized Recording



Frame rate synchronization signal settings on the system are made with the "LCD Monitor Keypad (optional)" or **PFV**.

Synchronization Signals That Can Be Input

When conducting frame rate synchronized recording on the system, the signal that can be input must meet the following conditions.

· TTL level, positive polarity or negative polarity

· Frequencies are as shown in the table below.

Model Name	Minimum Frequency	Maximum Frequency
model 500	60 Hz (50 Hz PAL)	500 Hz
model 2K	60 Hz (50 Hz PAL)	2,000 Hz
model 10K	60 Hz (50 Hz PAL)	10,000 Hz

■ Cable Connection

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.
When the synchronization signal is input to the **SYNC IN** connector, the **SYNC IN LED** (yellow) on the rear of the system illuminates. (* If the synchronization signal is lost, the LED goes out.)

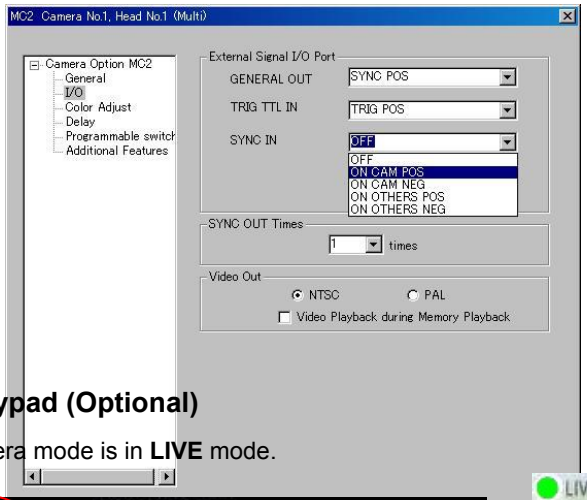
■ System Settings

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 **ON OTHERS POS** (positive polarity) or **ON OTHERS NEG** (negative polarity) according to the polarity of the external synchronization signal.



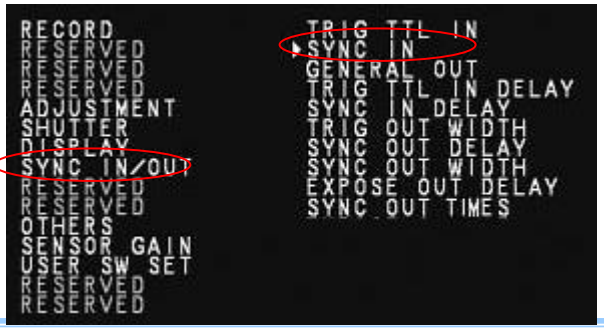
For the LCD Monitor Keypad (Optional)

① Verify that the camera mode is in **LIVE** mode.

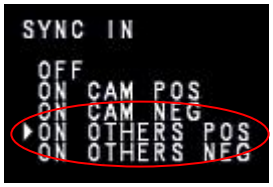
Verify the monitor's upper display is "**LIVE**"

② Press the LCD Monitor Keypad's **MENU** key and the menu list displays.

③ Select **SYNC IN** from the **SYNC IN/OUT** submenu with the LCD Monitor Keypad's **ARROW** keys and press the **ENTER** key.



④ Use the LCD Monitor Keypad's ↑↓ keys to select the input signal. Select **ON OTHERS POS** (positive polarity) or **ON OTHERS NEG** (negative polarity) according to the polarity of the external synchronization signal.



⑤ When finished, press the **ENTER** key to complete the setting.

⑥ Output the signal from the synchronization device and verify that the camera recognizes the output frequency and synchronizes its frame rate. The recognized frame rate will display in the lower left of the video monitor.

⑦ Output the signal from the synchronization device and verify that the camera recognizes the output frequency and synchronizes its frame rate. The recognized frame rate will display in the lower left of the video monitor.

The frequency of the synchronization signal cannot be changed during the LIVE or recording state.
(This is out of spec assurance.)

The synchronization signal can be changed if you repeat steps 1 through 6 after inputting the changed frequency. The system is reset.

If no synchronization signal is input, or the input signal is under 60 Hz (50 Hz), during steps 1-6, the display shows "**NO SYNC INPUT**". The display will show 1 fps, which indicates that there is no synchronization signal present.

If steps 1 through 6 are made when inputting a signal that exceeds the frequency that can be input, the display shows "**OVER SYNC INPUT**".

The illumination of the LED on the front of the camera controller indicates that the synchronization signal is being input. If the synchronization signal is lost, the LED goes out.

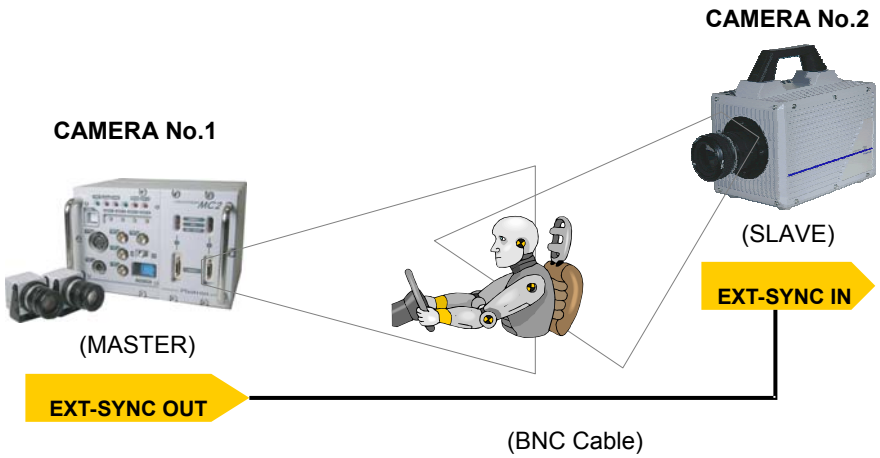
A minute error occurs in the input synchronization signal due to the construction of the internal circuitry of this function. For this system, an error of ±1 Hz can occur.

For example, when performing external device synchronization inputting a synchronization signal of 10,000 Hz, the error is: 10,000 Hz ± 1 Hz = 9999 fps to 10001 fps

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

Using the function (frame rate synchronized recording) in the previous section, "**3.13.4. Synchronizing the System with Other External Devices**", mixed-type synchronized recording can be performed with Photron's other high-speed cameras (except for some older products).

In particular, the FASTCAM APX-RS, FASTCAM SA1.1, FASTCAM SA3 and FASTCAM MH4 are also 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 V-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.

For camera models that can perform synchronized recording or for detailed instructions on making the settings, contact Photron with the contact information in "**8.1. Contacting Photron**".

3.14. GENERAL OUT Signal Settings

Set the signal for output from the **GENERAL OUT** connector as explained in section "**3.11. Input/Output Signal Types**". The content of each item is listed in the chart below.

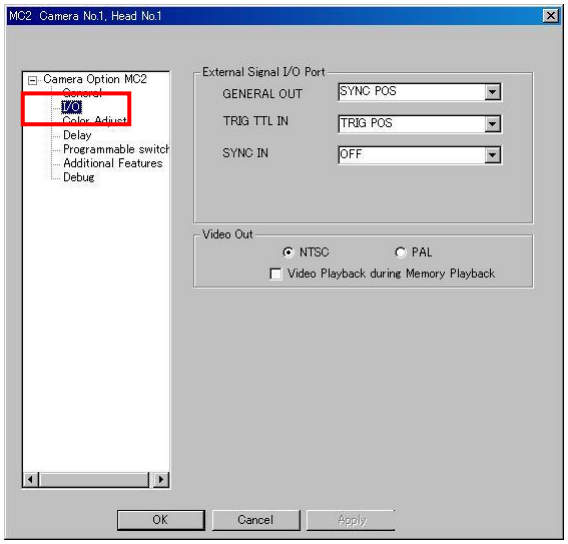
Menu Display	Content	Signal Type
SYNC POS	Outputs a positive polarity vertical synchronization signal.	TTL Level, Positive Polarity
SYNC NEG	Outputs a negative polarity vertical synchronization signal.	TTL Level, Negative Polarity
EXPOSE HEAD1 POS	Outputs camera head 1's image sensor exposure period at H level.	TTL Level, Positive Polarity
EXPOSE HEAD1 NEG	Outputs camera head 1's image sensor exposure period at L level.	TTL Level, Negative Polarity
EXPOSE HEAD2 POS	Outputs camera head 2's image sensor exposure period at H level.	TTL Level, Positive Polarity
EXPOSE HEAD2 NEG	Outputs camera head 2's image sensor exposure period at L level.	TTL Level, Negative Polarity
REC POS	Outputs a period signal during recording at H level.	TTL Level, Positive Polarity
REC NEG	Outputs a period signal during recording at L level.	TTL Level, Negative Polarity
TRIG POS	Outputs the trigger signal the camera controller received at H level.	TTL Level, Positive Polarity
TRIG NEG	Outputs the trigger signal the camera controller received at L level.	TTL Level, Negative Polarity
READY POS	Outputs at H level when in a state waiting for the REC trigger (If in START mode, READY, CENTER, END; If in MANUAL, the ENDLESS recording state). Only valid in START, CENTER, END, and MANUAL mode.	TTL Level, Positive Polarity
READY NEG	Outputs at L level when in a state waiting for the REC trigger (If in START mode, READY, CENTER, END; If in MANUAL, the ENDLESS recording	TTL Level, Negative Polarity

	state). Only valid in START, CENTER, END, and MANUAL mode.	

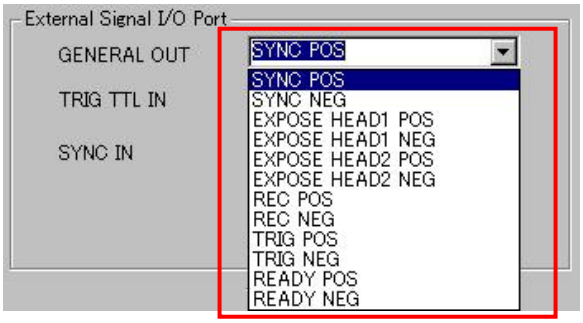
For PFV (Standard)

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 Select the setting from the "**GENERAL OUT**" pull-down menu.



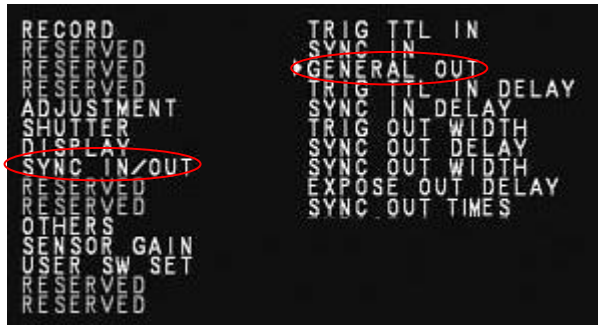
For the LCD Monitor Keypad (Optional)

① Verify that the camera mode is in **LIVE** mode.

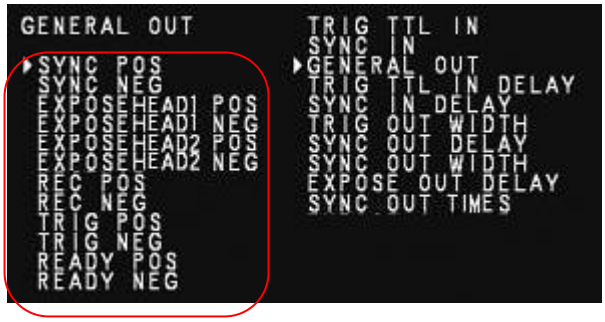
Verify the monitor's upper display is "**LIVE**"

② Press the LCD Monitor Keypad's **MENU** key and the menu list displays.

③ Select **GENERAL OUT** from the **SYNC IN/OUT** submenu with the LCD Monitor Keypad's **ARROW** keys.



④ Select the "**GENERAL OUT**" item.



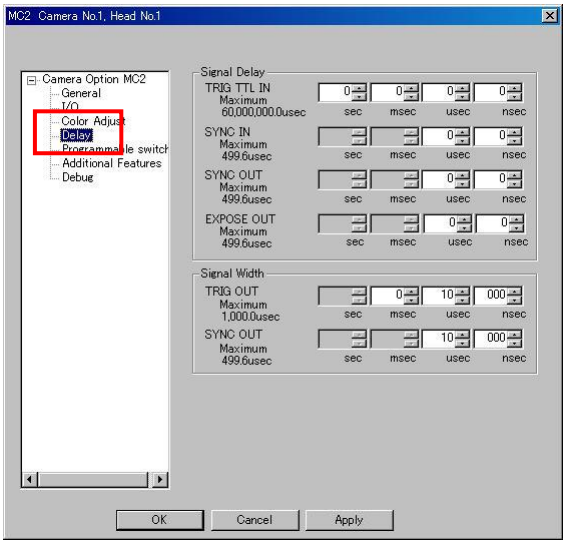
3.15. Signal Delay

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 input/output are made with the "LCD Monitor Keypad (optional)" or **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 signal delay settings on the left tree from "Camera Option" on the camera control panel.



③ Set each item.

For the LCD Monitor Keypad (Optional)

■ **TRIG TTL IN DELAY** Settable Range: 0-60 (s), in 100 ns units

Set from the menu, **SYNC IN/OUT** submenu, **TRIG TTL IN DELAY**.

From the instant the trigger signal is input to the FASTCAM MC2, the system will recognize the trigger input later than normal, after the specified amount of time set has elapsed.

■ **SYNC IN DELAY** Settable Range: 0-1/frame, in 100 ns units

Set from the menu, **SYNC IN/OUT** submenu, **SYNC IN DELAY**.

From the instant the synchronization signal is input to the FASTCAM MC2, the system will recognize the synchronization signal later than normal, after the specified amount of time set has elapsed.

■ **TRIG OUT WIDTH** Settable Range: 0-1 (ms), in 100 ns units

Set from the menu, **SYNC IN/OUT** submenu, **TRIG OUT WIDTH**.

Set the output TTL signal's pulse width (length).

■ **SYNC OUT DELAY** Settable Range: 0-1/frame, in 100 ns units

Set from the menu, **SYNC IN/OUT** submenu, **SYNC OUT DELAY**.

The synchronization signal will be output later than normal, delayed by the amount of time set here.

■ **SYNC OUT WIDTH**

Settable Range: 0-500 (μs), 2000 fps or higher, 1/frame, in 100 ns units

Set from the menu, **SYNC IN/OUT** submenu, **SYNC OUT WIDTH**.

Set the output synchronization signal's pulse width.

■ **EXPOSE OUT DELAY** Settable Range: 0-1/frame, in 100 ns units

Set from the menu, **SYNC IN/OUT** submenu, **EXPOSE OUT DELAY**.

The exposure period signal will be output later than normal, delayed by the amount of time set here.

■ **SYNC OUT TIMES** Setting values: 0.5, 1, 2, 4, 6, 8, 10, 20, 30. 1 is normal output.

Set from the menu, **SYNC IN/OUT** submenu, **SYNC OUT TIMES**.

Outputs SYNC (vertical synchronization signal) from **GENERAL OUT** that is SYNC times the value set.

3.16. Using USER SW (Programmable Switch)

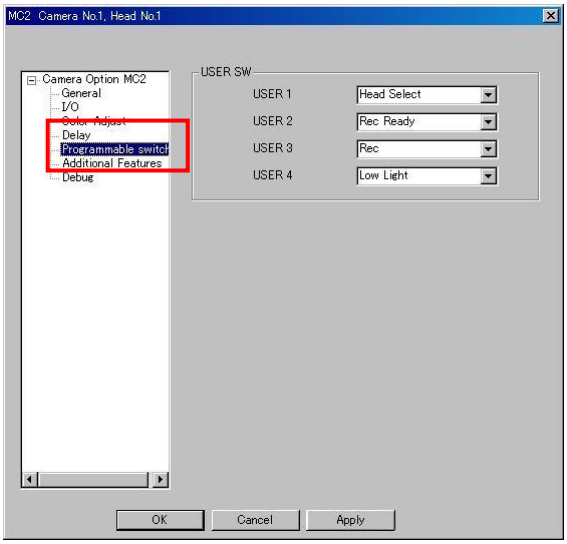
There are four switches that can be set on the front of the camera controller. Settings for the switches are made from **PFV** or the "LCD Monitor Keypad (optional) and they can each be assigned a different function.

As an example, setting the **USER1** switch on the front of the camera controller is explained here.

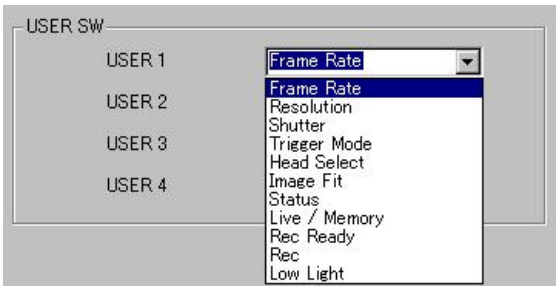
For PFV (Standard)

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 programmable switch on the left tree from "Camera Option" on the camera control panel.



③ The list of functions that can be set is displayed in the pull-down menu. Select the function you wish to use from the list.



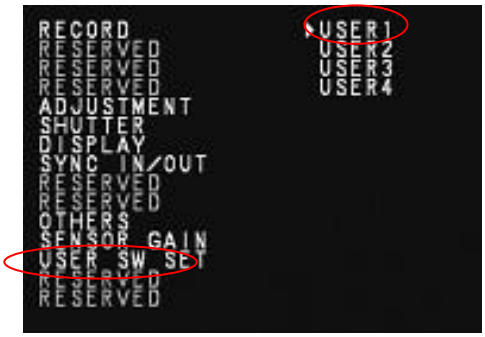
For the LCD Monitor Keypad (Optional)

① Verify that the camera mode is in **LIVE** mode.

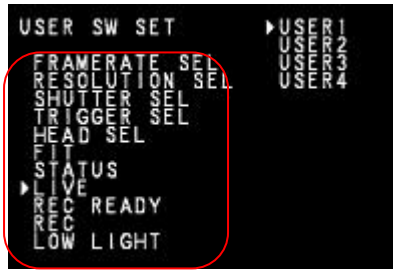
Verify the monitor's upper display is "**LIVE**"

② Press the LCD Monitor Keypad's **MENU** key and the menu list displays.

③ Select the **USER1** from the **USER SW SET** submenu with the LCD Monitor Keypad's **ARROW** keys and press the **ENTER** key.



④ On the left side of the screen, the list of functions that can be set is displayed. Select the function to be used and press the **ENTER** key. The available functions are explained in the chart below.



Setting Name	Explanation
FRAMERATE SEL	Can raise the frame rate.
RESOLUTION SEL	Can lower the resolution.
SHUTTER SEL	Can raise the shutter speed.
TRIGGER SEL	Can change the trigger mode.
HEAD SEL	Same function as the LCD remote controller's [FUNCTION].
FIT	Same function as the LCD remote controller's [FIT] key.
STATUS	Same function as the LCD remote controller's [STATUS] key.
LIVE	Same function as the LCD remote controller's [LIVE] key.
REC READY	Same function as the LCD remote controller's [REC READY] key.
REC	Same function as the LCD remote controller's [REC] key.
LOW LIGHT	Same function as the LCD remote controller's [LOW LIGHT] key.

Chapter 4. Playback

4.1. Recorded Image Playback
4.2. Fast-Forward and Rewind Playback
4.3. Single Frame Advance Playback

4.4. Enlarging and Shrinking the Playback Screen (Zoom, Fit, Scroll)

4.5. Segment of Interest Playback

4.6. Using the Playback Event Marker Function

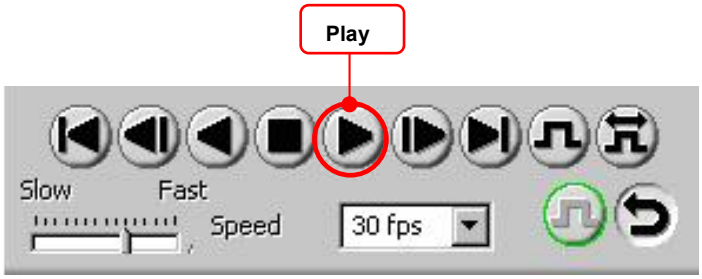
4.1. Recorded Image Playback

The system can immediately playback images recorded to memory on a connected video monitor or on the LCD Monitor Keypad's LCD screen. This procedure is explained here.

For PFV (Standard)

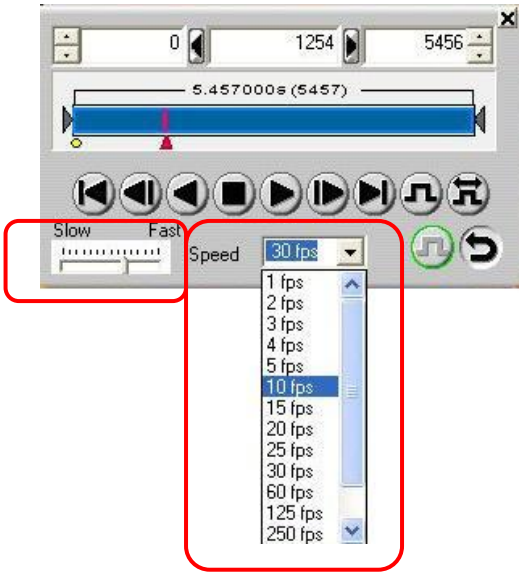
① Verify that the camera mode is in **MEMORY mode** (an image in the camera's memory is displayed). If the system is in a mode other than **MEMORY mode**, check "Memory" on the camera control panel.

② Click the play button on the playback control panel.



③ To play changing the playback speed, select the desired speed (fps) from "Speed" on the playback control panel.

You can also set the speed by dragging the slider on the "Playback Speed Slider Bar".



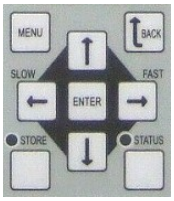
For the LCD Monitor Keypad (Optional)

① Switch from **LIVE** to **MEMORY** mode. If the camera is in **LIVE mode**, press the LCD Monitor Keypad's **LIVE key** and switch to playback (memory) mode. The **LIVE** key **LED** will turn off.

On the screen:

② From the LCD Monitor Keypad, press the **PLAY** key to start playback of the recorded images.

③ The playback speed can be changed with the LCD Monitor Keypad's ←→ keys. The current playback speed is displayed in the upper part of the screen.



←slow fast→

PAL Output Playback Rate	2, 4, 8, 12, 25 fps
NTSC Output Playback Rate	2, 5, 10, 15, 30 fps

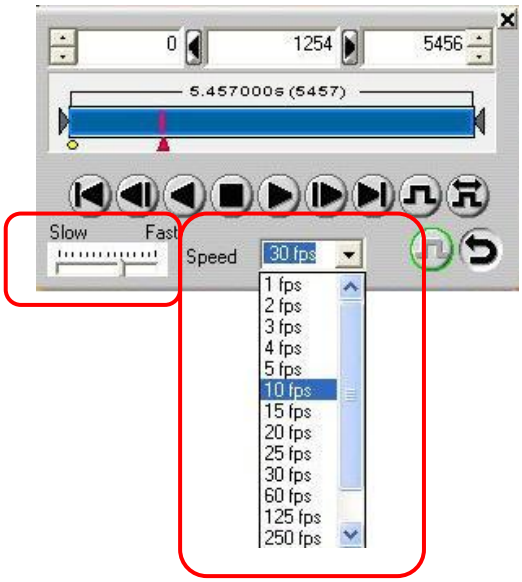
4.2. Fast-Forward and Rewind Playback

For PFV (Standard)

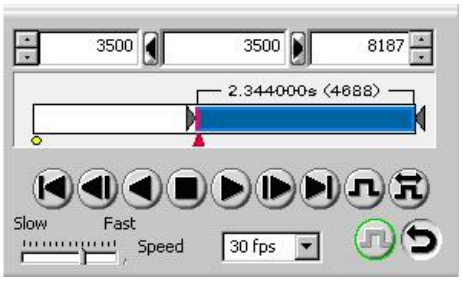
① Verify that the camera mode is in **MEMORY mode** (an image in the camera's memory is displayed). If the system is in a mode other than **MEMORY mode**, check "Memory" on the camera control panel.

② To play changing the playback speed, select the desired speed (fps) from "Speed" on the playback control panel.

You can also set the speed by dragging the slider on the "Playback Speed Slider Bar". Click the play button on the playback control panel.



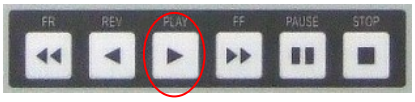
③ Click the "Play" button, the system plays. Images are played at the specified speed.



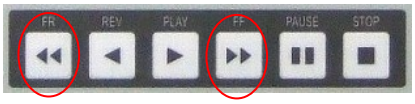
For the LCD Monitor Keypad (Optional)

Setup: Set the camera to **MEMORY** mode.

① Press the **PLAY** key(►).



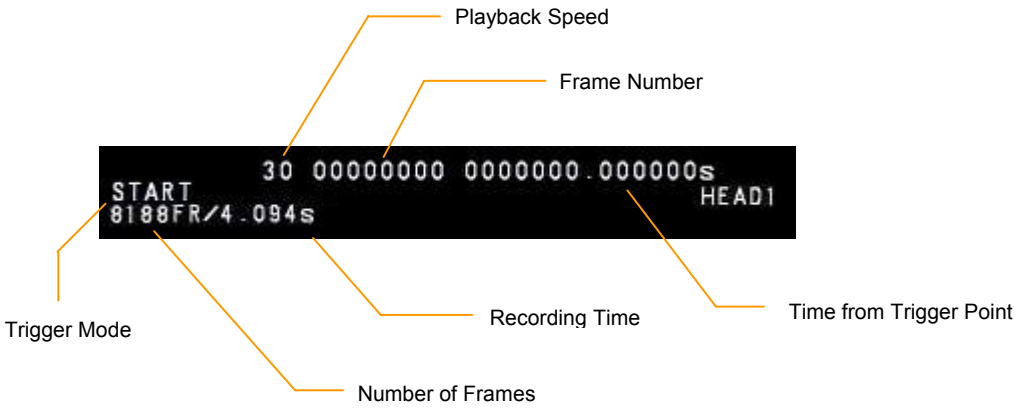
② Press fast-forward, the **FF** key (►►), and rewind, the **FR** key (◄◄), to search for the desired scene.



③ Each time fast-forward, the **FF** key (►►), or rewind, the **FR** key (◄◄), is pressed, the speed changes in three steps, x10, x100, and x1000 the normal playback speed.

④ Press the **PLAY** key (►) to return to normal speed playback or press the **PAUSE** key (▌▌) to pause playback.

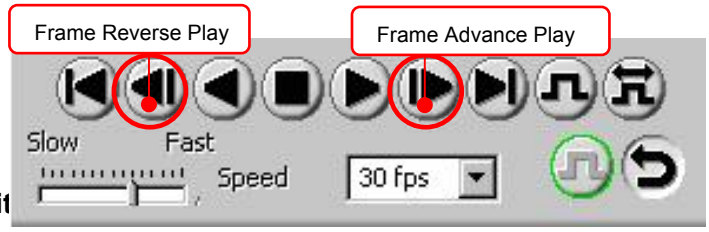
⑤ As an example, the display on the screen will be similar to the image shown below.



4.3. Single Frame Advance Playback

For PFV (Standard)

Click the "Frame Advance" button on the playback control panel.

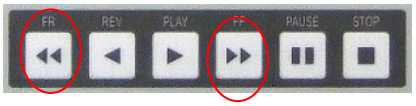


For the LCD Monit

Setup: Set the camera to **MEMORY** mode.

① Press the **PLAY** key (►).

② Press fast-forward, the **FF** key (►►), and rewind, the **FR** key (◄◄), to search for the desired scene.



③ When the desired scene is found, press the **PAUSE** key (❚❚) and playback will be paused.

④ Verify that the (❚❚) mark is displayed on the screen.

⑤ By pressing play, the **PLAY** key (►), or reverse, the **REV** key (◄), the frame is advanced or reversed one frame at a time. By pressing fast-forward, the **FF** key (►►), or rewind, the **FR** key (◄◄), the frame is advanced ten frames at a time.

4.4. Enlarging and Shrinking the Playback Screen (Zoom, Fit, Scroll)

On the system, for recordings done at the sensor's maximum resolution of 512x512 pixels, when displaying the images on an NTSC monitor the resolution of the image is larger vertically than the monitor resolution (640x480 pixels). Therefore a slight portion of the top and bottom of the image will not be displayed on the monitor in the normal 1:1 display mode. Also, when the vertical resolution of the image is lowered, to 512x256 for example, the image will be smaller than the video monitor's resolution in the 1:1 display mode. In these cases, the image is instantly enlarged or shrunk to the appropriate resolution to fill the screen by using the fit function.

Additionally, by using the zoom function, the image can be enlarged or shrunk by the set zoom factor, making it possible to verify details, or look over the entire scene.

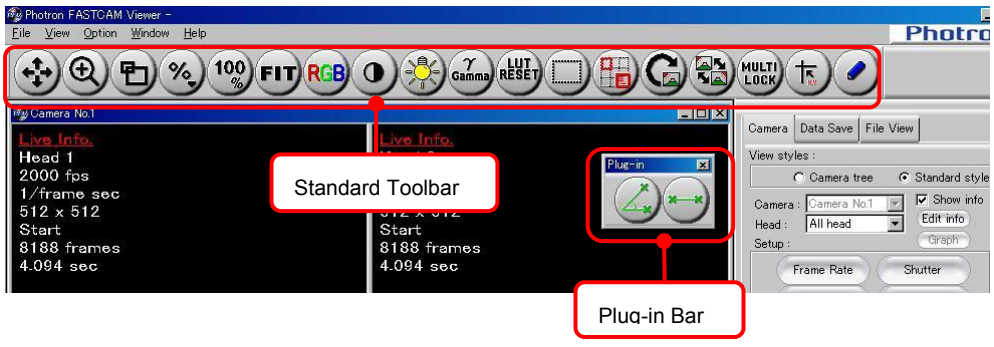
These digital zoom functions for video output, and how to use them, are explained here.

4.4.1. Video Screen Fit Display

For the system's video output, the size of the image at different resolutions is adjusted so that it is displayed at its maximum size on the screen. The following explains an example where a **512x128** pixel screen is being fit to the video output.

For PFV (Standard)

① When **PFV** starts, the standard toolbar and plug-in bar are displayed.

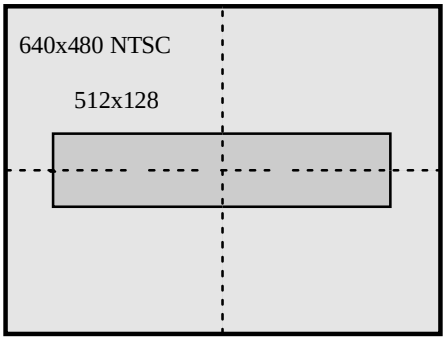


② Display the images using the two standard toolbar buttons below.

100 %	Same Pixel Size Display the image in the view window set to the same pixel size as that of the PC screen.
FIT	Fit Automatically adjust the scaling of the display image to fit the image within the view window.

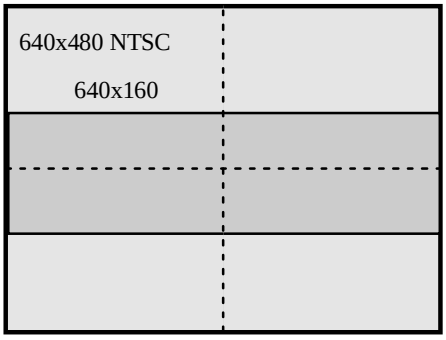
For the LCD Monitor Keypad (Optional)

① Press the LCD Monitor Keypad's **FIT/1:1** key.

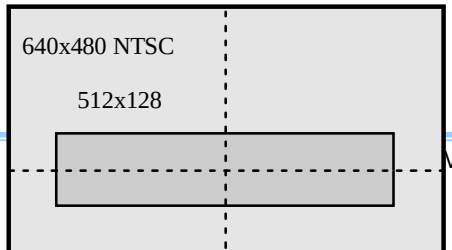


② The video screen's display size changes and the recording area is displayed at its maximum size

on the screen.



③ Press the **FIT/1:1** key again to return to the original size.

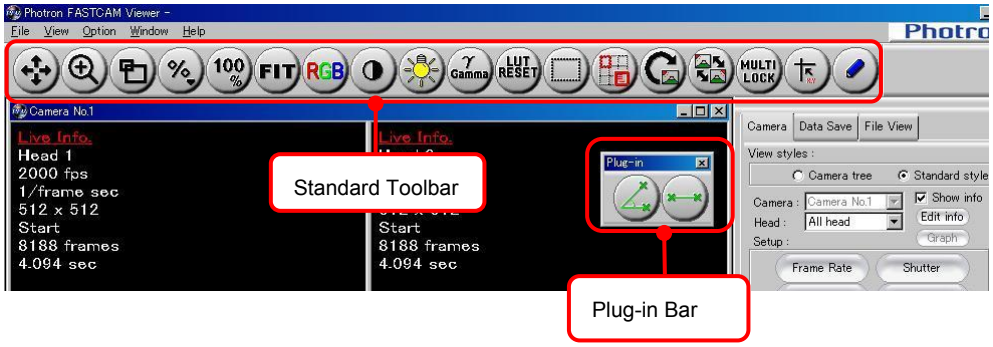


4.4.2. Displaying the Video Screen Enlarged (Zoom)

For the system's video output, the image can be displayed zoomed (enlarged).

For PFV (Standard)

① When **PFV** starts, the standard toolbar and plug-in bar are displayed.



② Zoom (enlarge) using the three standard toolbar buttons below.

	Zoom After clicking this button, dragging up on the view window will enlarge the display, dragging down will shrink the display.
	Zoom Area After clicking this button, drag the cursor to draw a rectangle over the portion of the view window to display, and the specified area will be
	Set Scaling Factor After clicking this button, select the optional scaling factor from the displayed list, and the display will be scaled by that factor.

For the LCD Monitor Keypad (Optional)

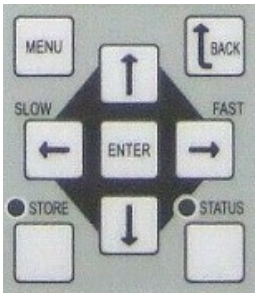
① Press the LCD Monitor Keypad's **ZOOM** key.

② The LCD Monitor Keypad's **ZOOM** key LED illuminates. The ZOOM message and the current zoom factor are also displayed in the upper right of the video output screen.

③ Enlarge or shrink the image with the **ARROW** keys. The center of the image displayed on the screen is maintained while the image is enlarged or shrunk.

↑
Enlarge

Shrink
↓



4.4.3. Scrolling the Video Screen

For the system's video output, the image can be displayed zoomed (enlarged).

For PFV (Standard)

① When **PFV** starts, the standard toolbar and plug-in bar are displayed.

② Scroll the image using the standard toolbar button below.

	Pan or Move After clicking this button, dragging on the view window will scroll the display image in the direction dragged.

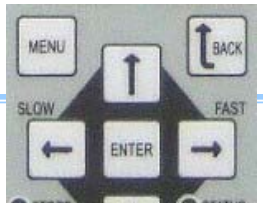
For the LCD Monitor Keypad (Optional)

① Press the LCD Monitor Keypad's **SCROLL** key. This button is shared with the zoom function so verify that the LCD Monitor Keypad's **SCROLL** key LED illuminates.

② The SCROLL message is displayed in the upper right of the video output screen.

③ Scroll the screen with the **ARROW** keys. When the recorded area is already fully displayed in the video screen, scroll cannot be used.

↑
Up



Down

←左　　右→

←Left　　Right→

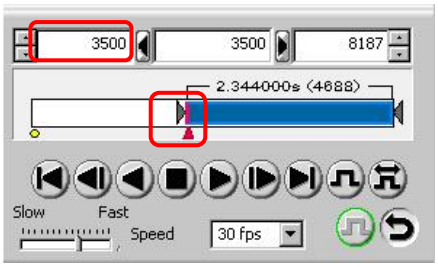
4.5. Segment of Interest Playback

The playback of images shot at high-speed takes an extraordinary amount of time. For example, when played at a normal 30 fps, one second of high-speed video shot at 2,000 fps takes 66 seconds to playback, in other words, over one minute of playback time. In many cases, the desired range of images is only a few images out the 2,000 recorded. With the system, the start and stop points of the desired range of images can be specified, and the segment playback function is available to playback only that range of images. The procedure for using **segment playback** is explained here.

For PFV (Standard)

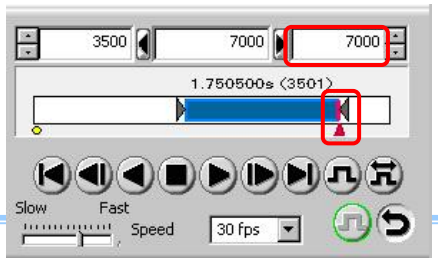
① Specify the start frame of the range to playback.

Enter the start frame number in the [Replay Start Frame Input/Display] box. You can also drag the [Replay Start Frame Handle] on the playback slider.

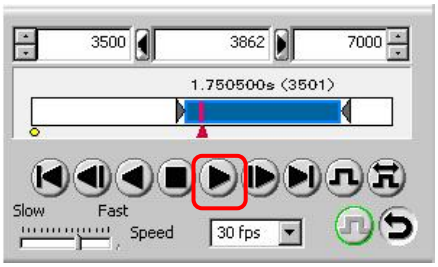


② Specify the end frame of the range to playback.

Enter the end frame number in the [Replay End Frame Input/Display] box. You can also drag the [Replay End Frame Handle].



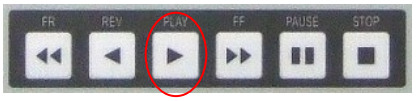
③ Click the "Play" button.
Only the specified range of images is played.



For the LCD Monitor Keypad (Optional)

① Put the camera in **MEMORY** playback mode.

② Playback using the normal **PLAY** procedure.



③ Press the **START** key at the start point of the desired range of images.

④ Press the **END** key at the stop point of the desired range of images.

⑤ Press the **ON/OFF** key in the **SEGMENT PLAY BACK** section of the LCD Monitor Keypad and verify that the **LED** illuminates. This puts the system in **segment playback** mode.

⑥ All of the normal playback operations described above will now occur only within the range specified by the start and stop points.

MEMO

Chapter 5. Connecting a PC

5.1. Connecting a PC to the Camera Controller's Gigabit Ether Interface

5.1. Connecting a PC to the Camera Controller's Gigabit Ether Interface

The system can have the operation of its functions performed from a **PC** using the **Gigabit Ether** interface. Refer to the "**Photron FASTCAM Viewer User's Manual**" for how to operate the software.
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 Cat 5e** (enhanced category **5**) or higher LAN cable.

The maximum cable length between the **PC** and the system is, compliant to the **1000BASE-T** specification, up to **100 m**. **One PC** can theoretically connect to a maximum of **64** Photron Gigabit Ether 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**.

Settings

On the System

· IP Address Setting

On the PC

- IP Address Setting
- Packet Size
- Time Out Length
- Communications Port

For the system's IP address setting, see "**5.1.2. Setting the IP Address**". For the PC settings, refer to the "**Photron FASTCAM Viewer User's Manual**".

The system is only 1000BASE-T compatible. When using a PC compatible with only 10BASE-T

or 100BASE-TX, the PC must be connected through a 10BASE-T, 100BASE-TX, and 1000BASE-T compatible switching hub.

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)

5.1.1. Connecting the System and a PC

Connect the LAN cable to the system as shown below.

LAN cable plugged into the "**GIGABIT ETHER"** connector

5.1.2. Setting the IP Address

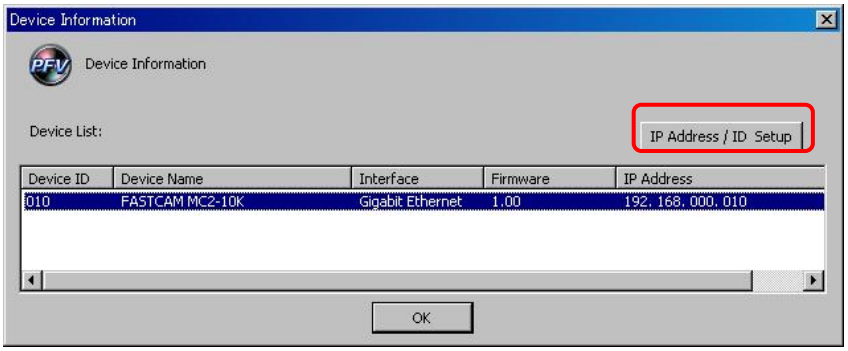
The procedure for setting the system's IP address is shown below.

Setting Procedure

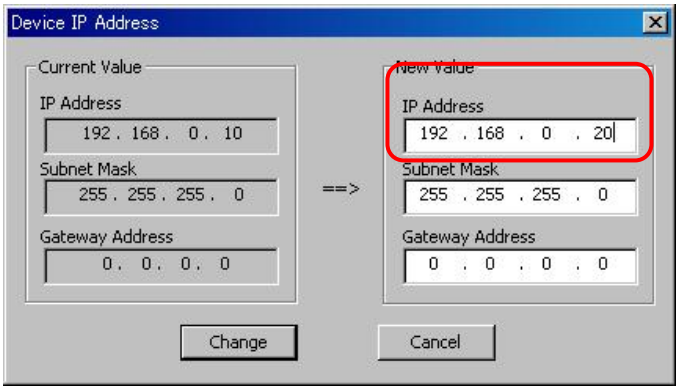
For PFV (Standard)

"Device Information" is displayed with the [Help] menu – [Device Information…].

① Select the camera and click the [IP Address/ID Setup] button.



② Directly enter the IP address in "New Value" and click the [Change] button.



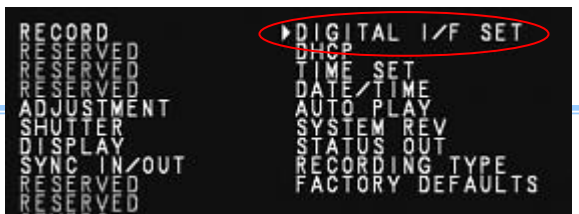
③ After changing the IP address, shut down **PFV** and cycle the system's power.

For the LCD Monitor Keypad (Optional)

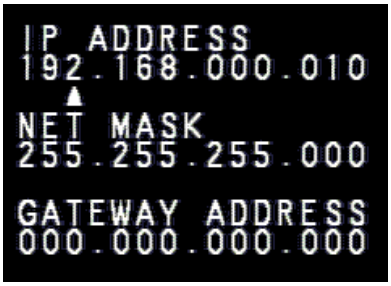
① Press the LCD Monitor Keypad's **MENU** key and the menu list displays.

② Select **DIGITAL I/F SET** from the **OTHERS** submenu with the **ARROW** keys on the LCD remote

controller and press the **ENTER** key.



③ Use the ← → keys to move the digit and the ↑ ↓ keys to set the IP address.



④ Press the **ENTER** key to confirm.

5.1.3. Using DHCP (Dynamic Host Configuration Protocol)

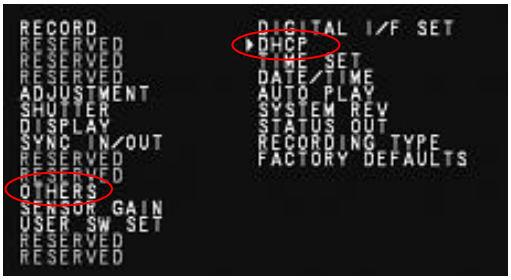
The system is compatible with DHCP. In an environment where DHCP is used, the system's IP address can be acquired from the DHCP server. The **"LCD Monitor Keypad (optional)" is required** for this setting.

Setting Procedure

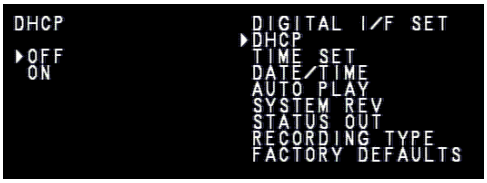
① Press the LCD Monitor Keypad's **MENU** key and the menu list displays.

② Select **DHCP** from the **OTHERS** submenu with the **ARROW** keys on the LCD Monitor Keypad and

press the **ENTER** key.



③ Use the ↑↓ keys to select ON or OFF.



④ Press the **ENTER** key to confirm.

- When OFF is selected, the IP address specified in the previous section "5.1.2. Setting the IP Address" is valid.
- When ON is selected, the IP address is acquired from the DHCP server and that acquired IP address is valid. If the system is not connected to the DHCP server, the IP address is acquired when a connection is made to the server. You can verify the acquired IP address on the DIGITAL I/F SET menu. In this case, the IP address cannot be changed.
- When using the system with DHCP on, set the IP address in PFV to "Auto detection".

5.1.4. Connecting the PC to Multiple Cameras

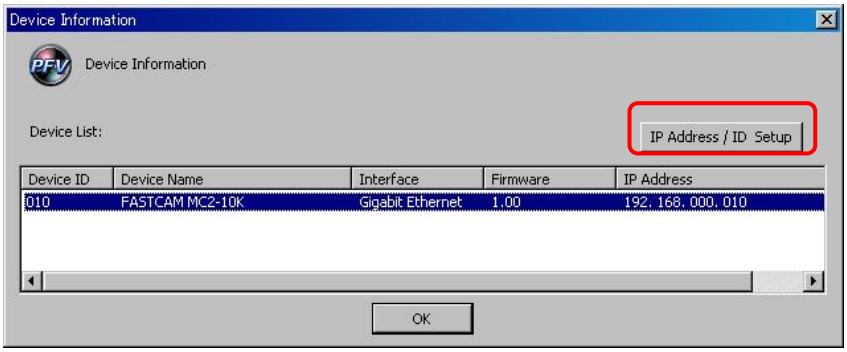
With **PFV**, the system's control software, one PC can connect to and collectively control multiple FASTCAM MC2 systems or other **Photron FASTCAM series** products with the Gigabit Ether interface.

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

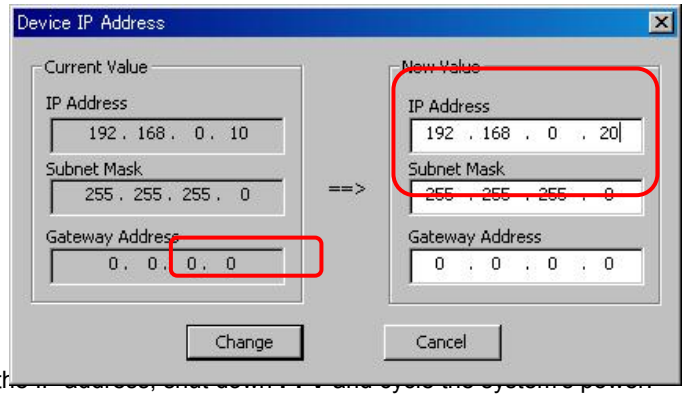
For PFV (Standard)

"Device Information" is displayed with the [Help] menu – [Device Information…].

① Select the camera and click the [IP Address/ID Setup] button.



② Directly enter the IP address in "New Value" and click the [Change] button.



③ After changing th

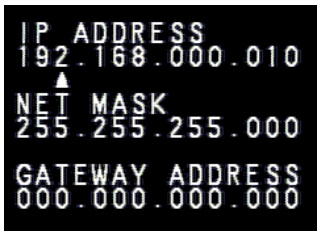
For the LCD Monitor Keypad (Optional)

① Press the LCD Monitor Keypad's **MENU** key and the menu list displays.

② Select **DIGITAL I/F SET** from the **OTHERS** submenu with the **ARROW** keys on the LCD remote

controller.

③ The IP address menu is displayed.



④ Assign each camera a unique IP address setting with the **ARROW** keys and press the **ENTER** key.

⑤ Press the **MENU** key to close the menu list, the settings are stored.

⑥ The settings are reflected when the PC is connected.

Chapter 6. Product Specifications

6.1. Specifications
6.2. Dimensions

6.1. Specifications

6.1.1. Product Specifications

Image Sensor	CMOS image sensor	
Sensor Resolution	512x512 pixels	
Frame Rate	500fps full frame (500 model) , 2,000 fps full frame(2k/10k model)	
Lens Mount	C mount (adapter)	
Recording Color Depth	Monochrome	8-bit
	Color	RGB, each 8-bit (Bayer color filter method)
Shutter	Electronic shutter	
Recording Method	IC memory	
Recording Memory Amount	1 GB standard, 2 GB maximum	
Trigger Methods	START, CENTER, END, MANUAL, RANDOM	
Gain Control	Hardware LUT on camera, controllable via LCD Monitor Keypad (optional) or software	
Image Output Customization	Customizable LUT, brightness is changeable	
External Synchronization Input Signal	5Vp-p, negative polarity/positive polarity (switchable)	
External Synchronization Output Signal	5Vp-p, negative polarity/positive polarity (switchable)	

Trigger Input Signal	TTL, contact
Other Output Signals	5Vp-p, negative polarity/positive polarity (switchable)
External Control	LCD Monitor Keypad (optional), RS-422 external control I/F, digital IF (PC)
Video Output Signal	RS170 (NTSC/PAL), digital zoom function, with scroll, fit functions
Digital Interface	Gigabit Ether (1000BASE-T)

6.1.2. General Specifications

Environmental Conditions	
Storage Temperature	-20ºC - 60ºC (no condensation)
Storage Humidity	85% or less (no condensation)
Operating Temperature	0ºC - 40ºC (no condensation)
Operating Humidity	85% or less (no condensation)
External Dimensions	
Camera Controller	195 (W) x 159 (H) x 130 (D) mm
Camera Head	35 (W) x 35 (H) x 33.3 (D) mm
AC Adapter	63.5 (H) x 95 (W) x 178 (D) mm, excluding protrusions
LCD Monitor Keypad (Optional)	105 (H) x 140 (W) x 20.8 (D) mm, excluding protrusions
AC Power Supply	
Supply Voltage	Japan 100V, US 120V, EU 240V
Supply Frequency	50 Hz – 60 Hz
Power Consumption	45 VA
DC Power Supply	
Supply Voltage	18V – 36V
Power Consumption	45 VA
Weight	
Camera Controller	5 kg
Camera Head	90 g
AC Adapter	670 g
LCD Monitor Keypad (Optional)	1.31 kg (no handle)

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 inquires regarding the recommended AC cable for each region, contact that region's Photron branch office or a Photron-authorized distributor.

6.1.3. Options

User Options
External battery for operation
LCD Monitor Keypad

6.1.4. Frame Rate and Resolution

model 10K / model 2K / model 500

Maximum Resolution	Frame Rate (fps)	Settable Resolution				
		512x512	512x352	512x256	512x128	512x96
512x512	50 (PAL)	OK	OK	OK	OK	OK
	60	OK	OK	OK	OK	OK
	125	OK	OK	OK	OK	OK
	250	OK	OK	OK	OK	OK
	500	OK	OK	OK	OK	OK
	1000	OK	OK	OK	OK	OK
	2000	OK	OK	OK	OK	OK
512x352	3000	x	OK	OK	OK	OK
512x256	4000	x	x	OK	OK	OK
512x128	5000	x	x	x	OK	OK
	6000	x	x	x	OK	OK
	7000	x	x	x	OK	OK
	8000	x	x	x	OK	OK
512x96	9000	x	x	x	x	OK
	10000	x	x	x	x	OK

6.1.5. Recordable Image Count/Resolution

Resolution	Recordable image count with 1 GB of memory	Recordable image count with 2 GB of memory
512x512	4092	8188
512x352	5952	11909
512x256	8184	16376
512x128	16368	32752
512x96	21824	43669

*Recording Time = Recordable Image Count x 1/frame rate (fps)

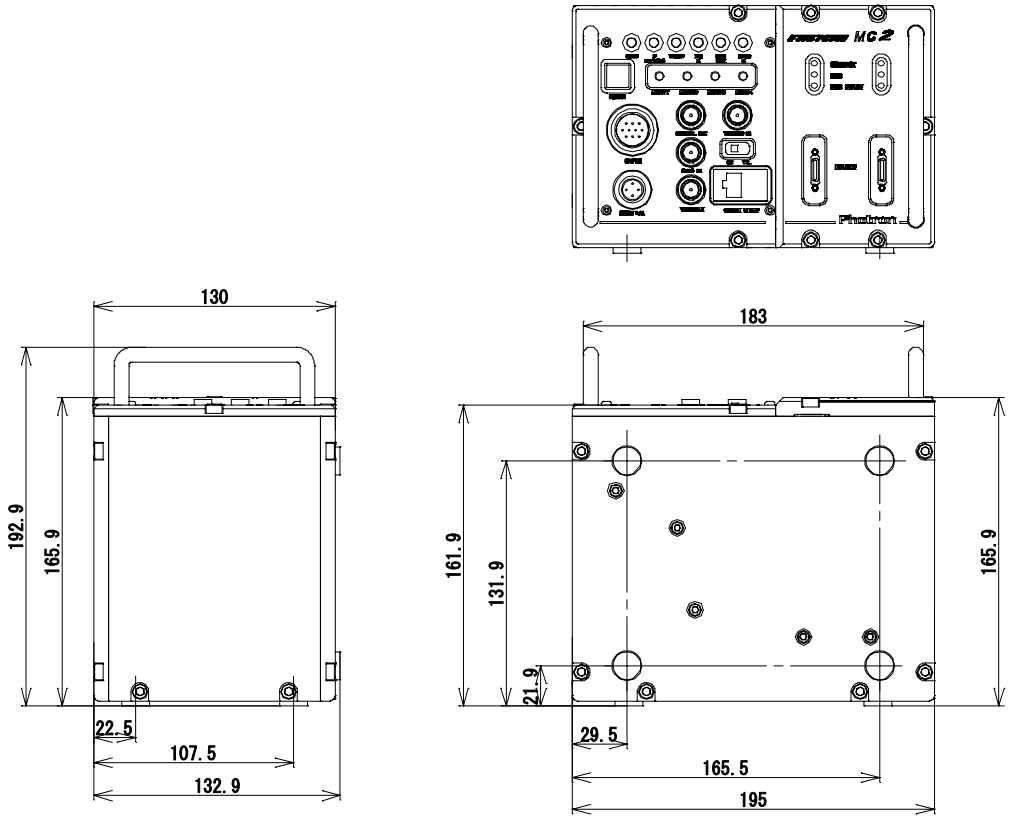
6.1.6. Shutter Speed List

1/frame					
1/125	1/250	1/500	1/700	1/1000	1/1250
1/1600	1/2000	1/2500	1/2800	1/4000	1/5000
1/5600	1/6400	1/8000	1/10000	1/14000	1/16000
1/20000	1/28000	1/40000	1/56000	1/70000	1/80000
1/112000	1/140000	1/160000			

6.2. Dimensions

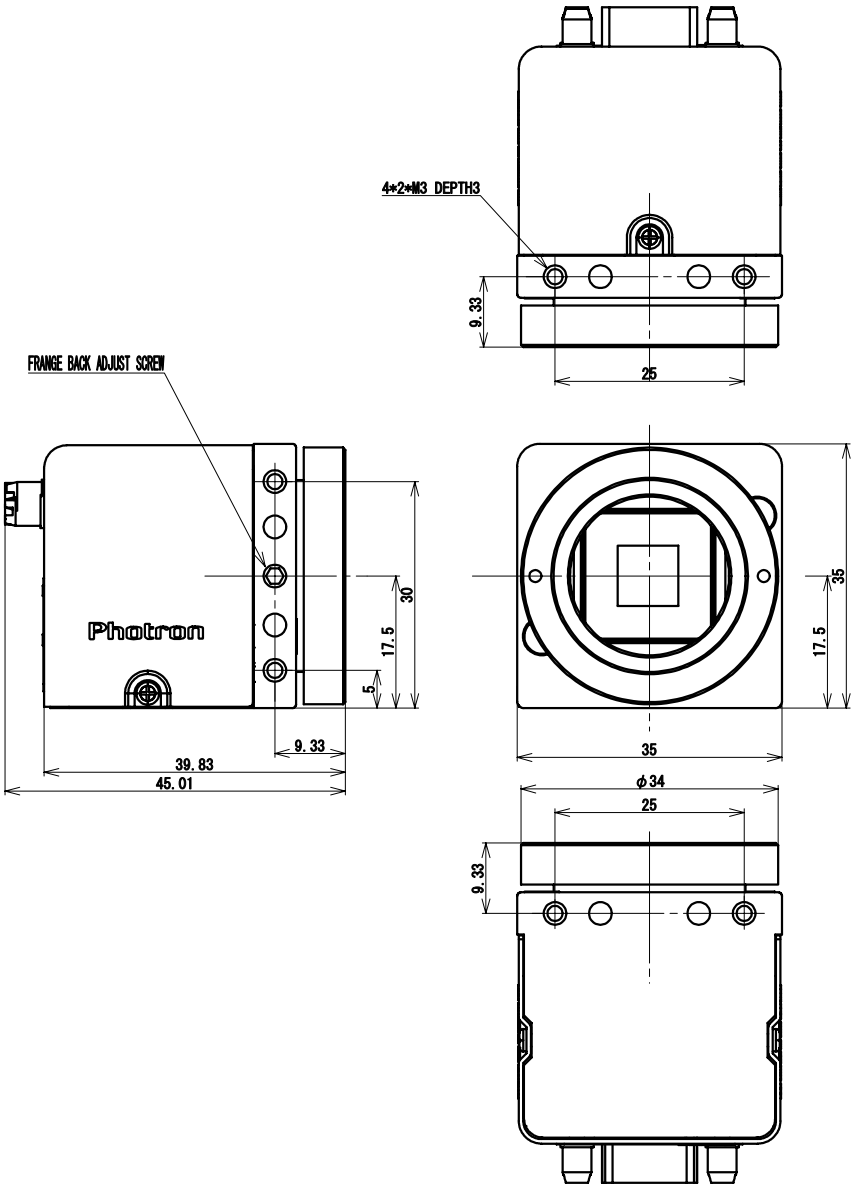
6.2.1. Camera Controller

*** All dimensions are in millimeters (mm) – 25.4 mm equals one inch. These diagrams are not shown to scale.**



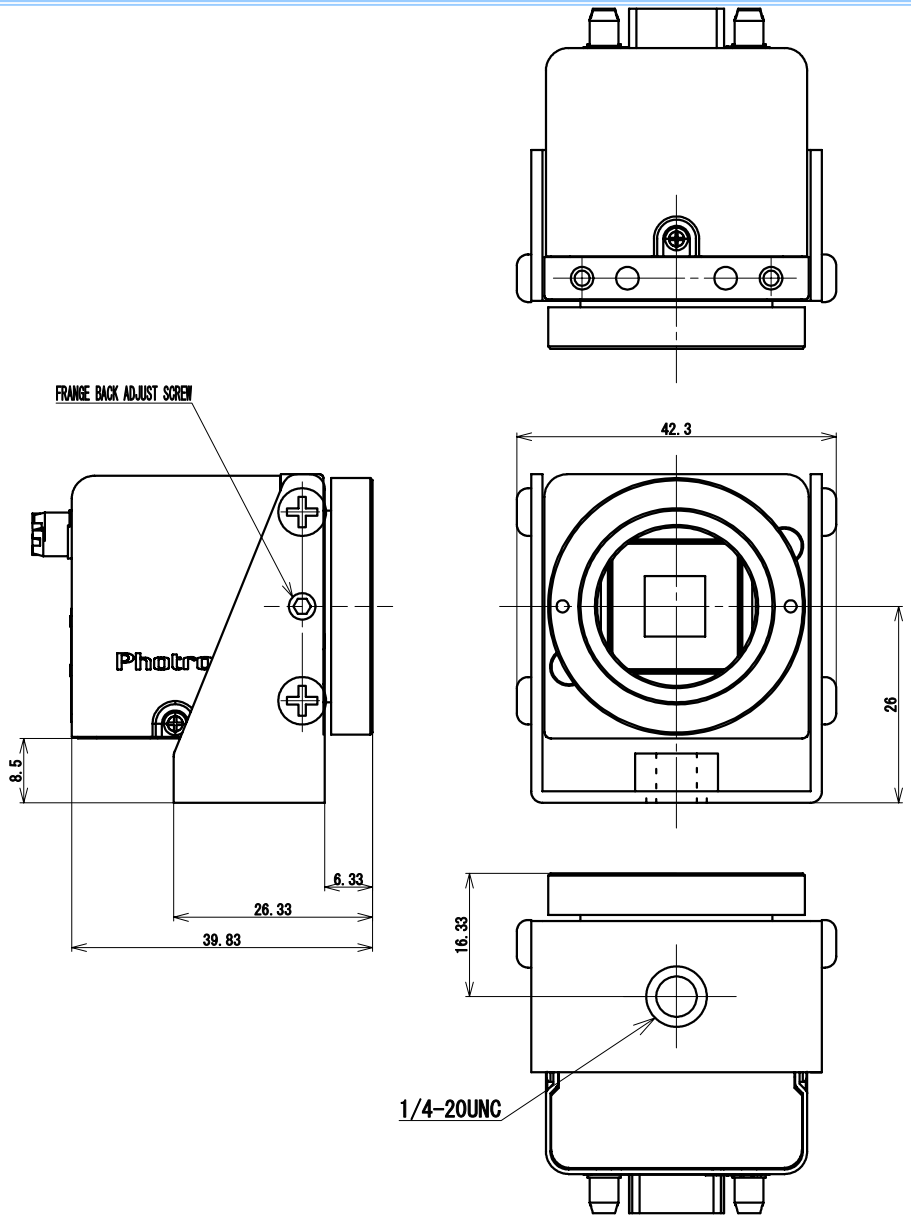
6.2.2. Camera Head

*** All dimensions are in millimeters (mm) – 25.4 mm equals one inch. These diagrams are not shown to scale.**



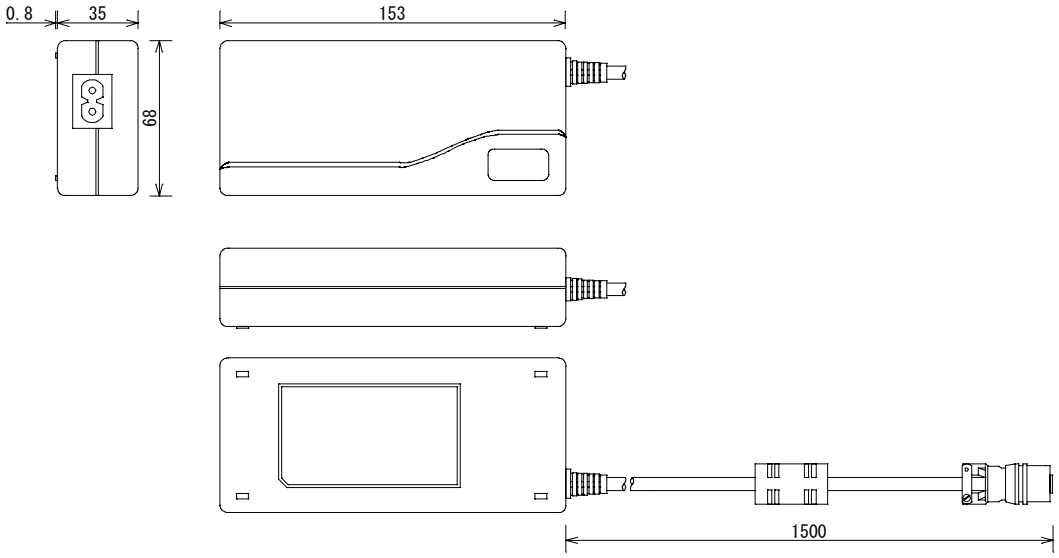
With Tripod Adapter Attached

***All dimensions are in millimeters (mm) – 25.4 mm equals one inch. These diagrams are not shown to scale.**


FRANGE BACK ADJUST SCREW
Photro
42.3
26
8.5
6.33
26.33
39.83
16.33
1/4-20UNC

6.2.3. AC Adapter

*** All dimensions are in millimeters (mm) – 25.4 mm equals one inch. These diagrams are not shown to scale.**



Chapter 7. Warranty

7.1. About the Warranty

7.1. About the Warranty

This system has been shipped having undergone 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.

When submitting the system for repair, be sure to include the warranty card with the system. In addition, when the system to repair is shipped, the shipping expense is covered by Photron.

Warranty Period

1 year from the day of purchase.

Warranty Exceptions

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

1. When the warranty card is not presented.
2. When the prescribed items on the warranty card are not completed, or they have been overwritten, or the name of the dealer is missing.
3. Damage or malfunction as a result of fire, earthquake, water damage, lightning, other natural disasters, pollution, or the effects of abnormal voltage.
4. Damage or malfunction as a result of dropping or mishandling during shipment or when moving after purchase or misuse.
5. Consumable goods (battery, cables)
6. 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 (see 8.1. Contacting Photron).

Chapter 8. Contacting Photron

8.1. Contacting Photron

8.1. Contacting Photron

For technical inquires related to the system, or for inquires related to the user's manual, telephone, FAX, or e-mail Photron using the contact information listed below.

In addition, the following items will be verified when inquiring, so note them in advance.

1. Contact Information: Company name, school name, customer name, phone number
2. Product Name: FASTCAM MC2
3. Serial Number: Check on the nameplate seal.
4. Reason for Inquiry: Condition of the system and what is known about it.

Customer Service Hours

Monday to Friday 9:00-12:00, 13:00-17:00

(Excluding Photron's summer/New Year's holiday and national holidays)

Contact Information

In Americas and Antipodes:

PHOTRON USA, INC.
9520 Padgett Street, Suite 110
San Diego, CA 92126-4446, USA
Phone: +1-858-684-3555
Fax: +1-858-684-3558
E-mail: image@photron.com
www.photron.com

In Europe, Africa and India:

PHOTRON (Europe) Limited
The Barn, Bottom Road
West Wycombe

HP 14 4BS, Bucks, United Kingdom
Phone: +44(0) 1494 481011
Fax: +44(0) 1494 487011
E-mail: image@photron.com
www.photron.com

In other areas:

PHOTRON LIMITED
Fujimi 1-1-8, Chiyoda-Ku
Tokyo 102-0071, Japan
Phone: +81-(0)3- 3238-2107
Fax: +81-(0)3-3238-2109
E-mail: image@photron.co.jp
www.photron.co.jp

MEMO

FASTCAM MC2
Hardware Manual

Publication Date April, 2008

Publisher PHOTRON LIMITED

Chiyoda Fujimi Bldg., Fujimi 1-1-8, Chiyoda-ku, Tokyo 102-0071, JAPAN

(Control No. E08042525U)