FASTCAM SA1
Hardware Manual

Revision 1.03E

Photron

Introduction

Thank you for your purchase of Photron's high-speed camera system, the "**FASTCAM SA1**" (referred to below as **the system**).

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

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

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

Using the Manual

This section explains the layout of the manual.

- Introduction

  The introduction explains the manual and safety precautions.

- Chapter 1. Overview

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

- Chapter 2. Setup

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

- Chapter 3. Recording

  This chapter explains operations related to recording.

- Chapter 4. Playback

  This chapter explains operations related to playing back 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. System Settings

  This chapter explains display settings and other detailed system settings.

- Chapter 7. Specifications

  This chapter explains the system’s specifications.

- Chapter 8. Warranty

  This chapter explains about the warranty.

- Chapter 9. Contacting Photron

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

Using the System Safely and Correctly

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

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

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

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

This symbol indicates actions that require caution.

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

This symbol indicates actions that must always be performed.

Warning

■ Do not perform actions that will damage the AC cable or plug.
(Do not damage the cable, modify it, use it near a heater, excessively bend, twist or pull upon it, place heavy objects on it, or excessively twist it.)
Using a damaged cable might 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 under 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 place 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, possibly causing a fire.

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

■ Ambient temperature 0 ~ 40°C (32 ~ 104F), Humidity 85% RH or lower, Maximum altitude 2000m (6500') or lower and 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 (-4F) or higher than 60°C (140F).
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 (-4F) or higher then 60°C (140F). Also, prevent condensation from forming during shipment

Table of Contents

Chapter 1. Overview

1.1. Product Overview and Features

1.1. Product Overview and Features

The FASTCAM SA1 is a powerful engineering tool for use in research and development, design, production, and quality control, and in numerous fields such as science, medicine, biology, aviation and space. The system features superior basic performance with mega pixel resolution, an ultra-sensitive image sensor capable of clear recording in low-light, and an ultra-high speed frame rate of a maximum of 150,000 fps (frame per second). It also employs a hybrid design to allow operation via a LCD monitor keypad and operation from the PC software via a gigabit Ethernet connection to more easily implement analysis of dynamic bodies that had been difficult to analyze until now.

Use the state-of-the-art technology in the FASTCAM SA1 to slow down and observe high-speed dynamic bodies or events, and also as an input component for a dynamic image measurement system.

Chapter 2. Setup

2.1. About the System's Components and Accessories

2.2. Part Names

2.3. Device Connections

2.4. Basic Keypad Operation

2.1. About the System's Components and Accessories

2.1.1. Components

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

1.	Camera Body (with Nikon F-mount)	1
2.	AC Power Supply Unit/AC Cable	1
3.	C-mount	1
4.	Hexagonal Wrench for Changing Lens Mounts (1.5 mm, 2 mm, 3 mm, 4 mm)	1 each
5.	Lens Mount Cap (built into the camera body)	1
6.	I/O (Input and Output) Cable	1
7.	FASTCAM Series Setup Disk (Driver/Application CD)	1
8.	FASTCAM SA1 Hardware Manual (this manual)	1
9.	Photron FASTCAM Viewer (PFV) User's Manual	1
10.	How to Make a Gigabit Ethernet Connection (Simple Procedure Manual)	1
11.	Warranty Card	1
12.	Gigabit Ethernet Interface Cable (LAN Cable)	1
13.	IP Address Sticker	4
14.	Software Consent Agreement	1

2.1.2. Accessories/Options

The following options are available for the system.

1. LCD Monitor Keypad
2. Photo-Sonics mount Kit
3. 4 channels Output Trigger Box
4. MCDL (Analog Waveform Synchronized Recording Unit)
5. Dedicated Carrying Case
6. Spare Power Supply Connector (for custom cable construction)
7. LAN Connector Anti-Dust Shell

2.2. Part Names

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

For each of the system's components:

- Do not expose to shock outside of stated specifications.
- Do not use in an area with flammable gas or dust present.
- Do not place in an unstable location such as on a unstable platform or an incline.
- Do not disassemble or modify.
- Do not expose to liquids such as water.
- Do not subject to excessive force.

2.2.1. Camera Body

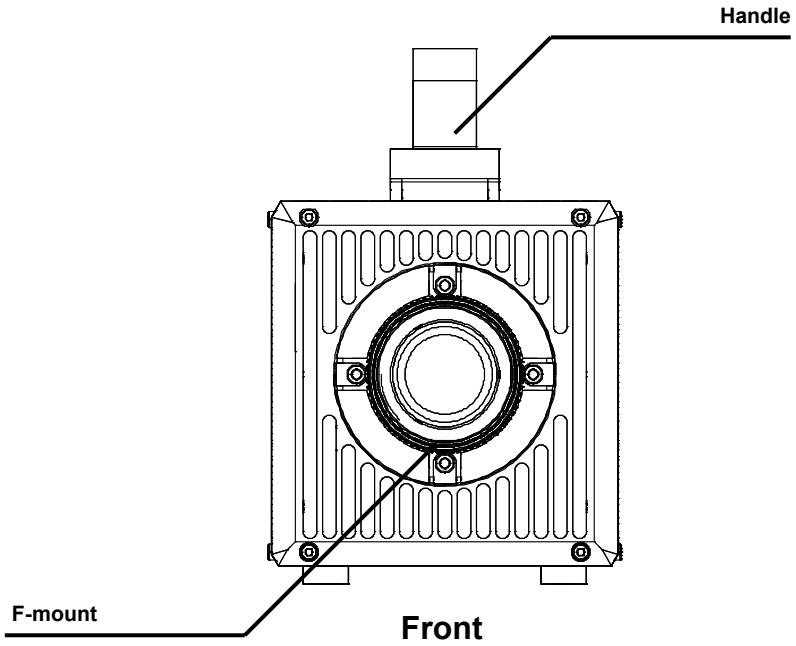
For the FASTCAM SA1 system, there are monochrome and a color version, and for each of these versions, there are 8 GB standard memory capacity type (model 1) and 16 GB high capacity type (model 2). When purchasing, it is possible to select from these models according to the application or your demands.

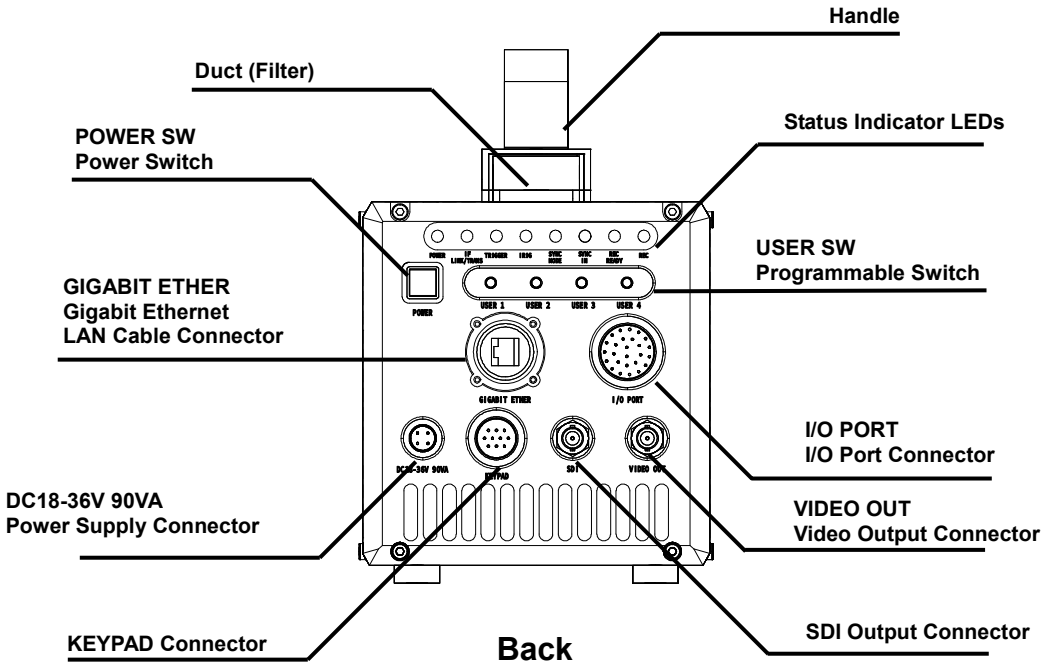
The camera body contains IC memory for image recording and has been designed to be able to record high-speed images uncompressed. The back of the camera body is equipped with the video output terminals, which can playback the recorded images on a video monitor; the Gigabit Ethernet interface, which permits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

Camera Body Exterior

Camera Body Back

2.2.2. Camera Body Part Names





2.2.3. Camera Body Rear Status Indicator LED's

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

- POWER (Green)
  LED ON: Power On
  LED OFF: Power Off

- IF LINK/TRANS (Red)
  LED ON: The Gigabit Ethernet interface is connected
  LED FLASHING: Data is transferring
  LED OFF: The Gigabit Ethernet interface is not connected

- TRIGGER (Yellow)
  LED ON: A trigger signal is present (being input) (The LED will illuminate for 0.1 second when the trigger signal is input.)
  LED OFF: The trigger signal is not present

- IRIG (Green)
  LED ON: The IRIG/GPS signal is present (being input)
  LED OFF: The IRIG/GPS signal is not present

- SYNC MODE (Red)
  LED ON: In external synchronization mode (synchronized to an external signal)
  LED OFF: In internal synchronization mode (synchronized to the internal signal)

- SYNC IN (Yellow)

  LED ON: A synchronization signal is present (being input)

  LED OFF: A synchronization signal is not present

- REC READY (Yellow)

  LED ON: Ready to record

  LED FLASHING: ENDLESS recording (The REC (Red) LED is also flashing)

  LED OFF: Not ready to record

- REC (Red)

  LED FLASHING: Recording

  LED OFF: Not recording

2.2.4. Interchangeable Lens Mount

The lens mount on the system can be changed according to the recording purpose.

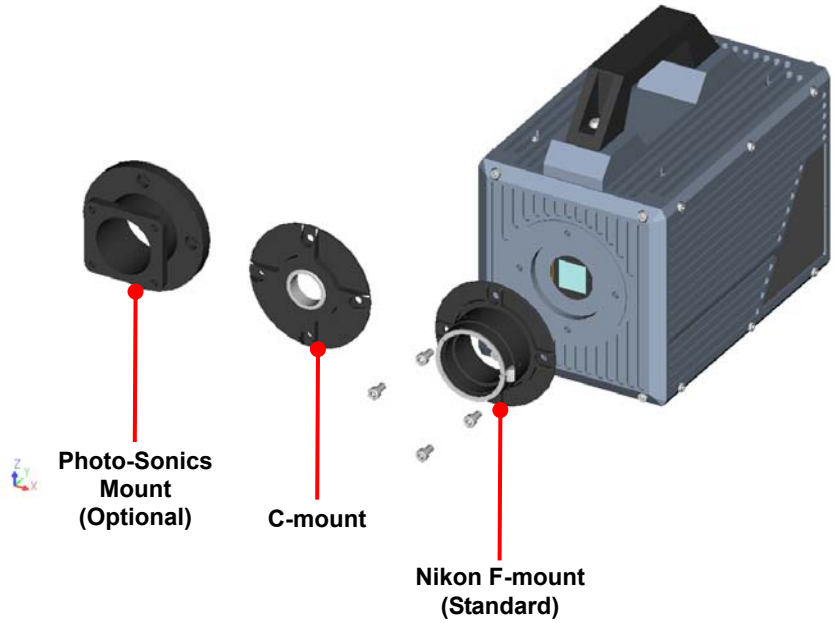
There are 3 types of interchangeable lens mounts: “Nikon F-mount”, “C-mount”, and “Photo-Sonics Mount” (optional).

■How to change the lens mount (Nikon F-mount → C-mount)

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

■How to change the lens mount (Nikon F-mount → Photo-Sonics mount)

1. Remove the M5 bolts with the hexagonal holes using the hexagonal wrench.
2. Remove the Nikon F-mount portion as a unit.
3. Install the Photo-Sonics mount and the Photo-Sonics mount adapter.
4. Adjust the flange back with the lens' flange back adjustment shim.



2.2.5. LCD Monitor Keypad (Optional)

The system can be operated by connecting the optional LCD monitor keypad (referred to below as the keypad) to the **KEYPAD** connector on the back of the camera body. The keypad is also hot-pluggable, meaning it can be plugged in to the camera body while the power is on.

Connector Name on Body	Signal Name	Connector Model Name on Body (Maker)	Connector Model Name on Keypad (Maker)
KEYPAD	Keypad Signal	PT02A-12-10S (023) (Amphenol)	PT06A-12-10P (023) (Amphenol)

* The LCD monitor keypad is optional. It is not included in the standard configuration.

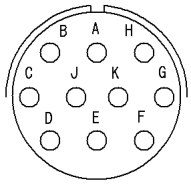
2.2.6. About RS422 Serial Control

The system is compatible with serial control via an RS422 connection through the KEYPAD connector.

A separate command list is available for the serial control commands. Please contact Photron or the store where the system was purchased for the command list. (See: 9.1 Contracting Photron)

A cable is also not offered as an accessory. When using RS422 control, construct a cable using the pin diagram below as a reference.

【KEYPAD Pin Diagram】



PT02A-12-10S (023)

Connector Name	Signal Name	Pin Num.	Connector Name on Body (Maker)	Connector Name on Cable (Maker)	Input Connector
KEYPAD	+12V OUT	A	PT02A-12-10S (023) (Amphnol)	PT06A-12-10P (023) (Amphenol)	Not Specified
	SIGNAL GND	B			
	RXD+	C			
	RXD-	D			
	TRIGGER SW	E			
	TXD-	F			
	TXD+	G			
	POWER GND	H			
	VBS GND	J			
	VBS	K			

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

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

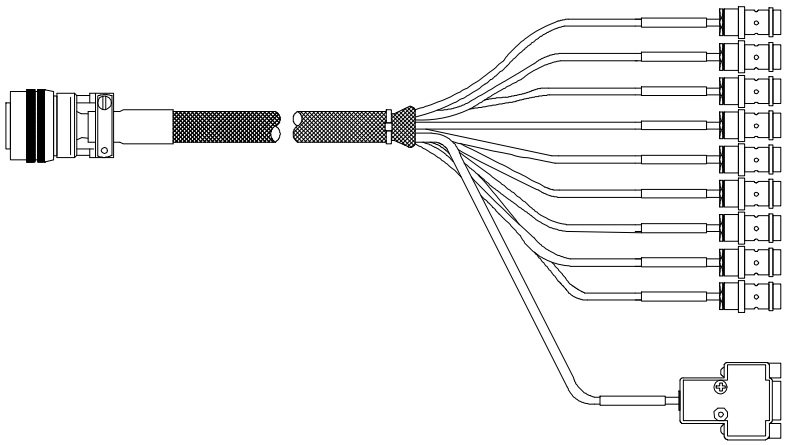
By setting the STATUS OUT menu to ON, the system status can be output via the serial connection. For details, check the command list.

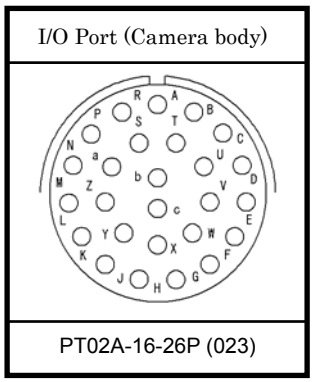
2.2.7. I/O Port Connector

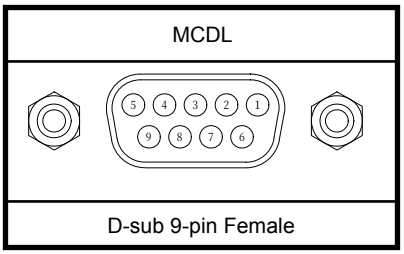
By inputting an external trigger or synchronization signal and by outputting an exposure timing or synchronization signal, these signals can be used as a part of the system. The input/output signal connectors on the system have been bundled into a single connector, the **I/O port connector**, and it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

A signal other than the specified signal must not be input to the each of the 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, refer to “3.12. Input/Output Signal Types”.







Connector Name	Signal Name	Pin Num.	Connector Model, Body (Maker)	Connector Model, Cable (Maker)	Input Connector (Pin Num.)
I/O PORT	TRIGGER TTL IN	A	PT02A-16-26S (023) (Amphenol)	PT02A-16-26P (023) (Amphenol)	BNC
	TRIGGER TTL OUT	B			BNC
	TRIGGER SW	C			BNC
	SYNC IN	D			BNC
	GENERAL IN	E			BNC
	GENERAL OUT1	F			BNC
	GENERAL OUT2	G			BNC
	MCDL CLK-	H			D-sub 9 pin (5)
	MCDL CLK+	J			D-sub 9 pin (4)
	MCDL SYNC-	K			D-sub 9 pin (1)
	MCDL SYNC+	L			D-sub 9 pin (2)
	MCDL DATA_B-	M			D-sub 9 pin (6)
	MCDL DATA_B+	N			D-sub 9 pin (9)
	MCDL DATA_A-	P			D-sub 9 pin (7)
	MCDL DATA_A+	R			D-sub 9 pin (8)
	POWER GND	S			
	GENERAL OUT3	T			BNC
	SIGNAL GND	U			BNC
	SIGNAL GND	V			
	N.C.	W			
	SIGNAL GND	X			
	+22 – +V32	Y			
	+22 – +V32	Z			
	+22 – +V32	a			
	IRIG	b			BNC
	IRIG GND	c			BNC

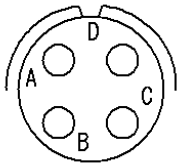
Pin U's SIGNAL GND signal is the common ground for BNC.

2.2.8. DC 18-36V 90VA Power Supply Connector

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

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

【DC 18-36V 90VA Pin Diagram】



PT02A-8-4P (023)

Connector Name	Signal Name	Pin Num.	Connector Model, Body (Maker)	Connector Model, Cable (Maker)
DC18-36V 90VA	N.C.	A	PT02A-8-4P (023) (Amphenol)	PT06A-8-4S (424) (Amphenol)
	SIGNAL GND	B		
	POWER GND	C		
	+18V～+36V IN	D		

Warning

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

If the wiring is incorrect, not only is there the danger of the system malfunctioning, but also of fire and electric shock.

Warning

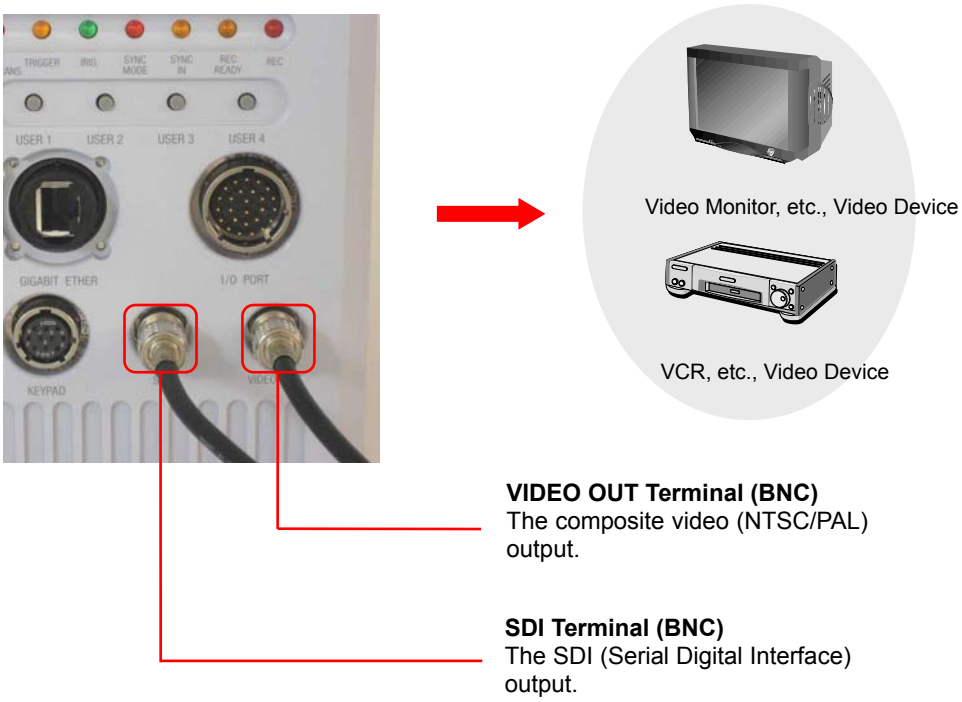
Do not use a power supply which does not meet the system's specifications, or a power supply you cannot guarantee the safety of.

By using a power supply outside of the system specifications, not only is there the danger of the system malfunctioning, but also of fire and electric shock.

2.3. Device Connections

2.3.1. Connecting a Video Monitor

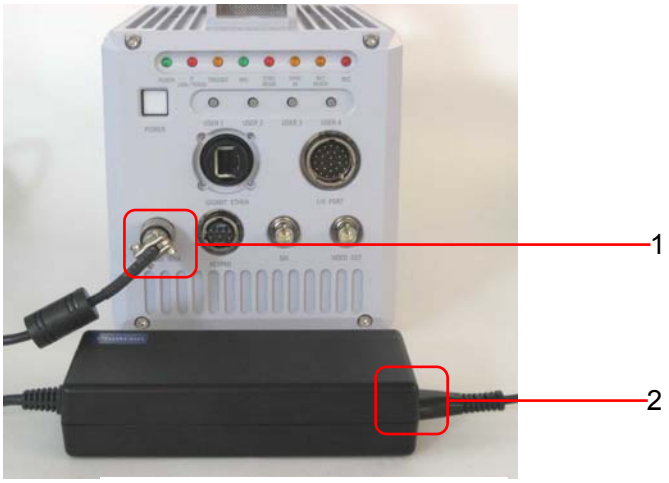
A video monitor connected to the camera controller can be used to check the **live** image (**camera pass-through image**). Connect the video input connector according to the type of video signal to display on the monitor to the "**VIDEO OUT**" terminal or the "**SDI OUT**" terminal with a BNC cable.



2.3.2. Connecting the AC Adapter

Connect the supplied AC adapter to the power supply.

For power supplies that can be used, refer to the DC power item in section "**7.1.2. General Specifications**".



AC Adapter Connection

1. Connect the AC adapter to the "**DC18-36V 90VA**" connector on the back of the camera body.

2. Connect the AC cable to the AC adapter.

3. Connect the AC cable to the power outlet.

2.3.3. Connecting the Keypad

If you have the optional LCD monitor keypad, it is connected by plugging the keypad connector in to the connector terminal labeled "**KEYPAD**" on the back of the camera body.

* The keypad is hot-pluggable. It can be plugged in and unplugged while the system's power is on.

2.4. Basic Keypad Operation

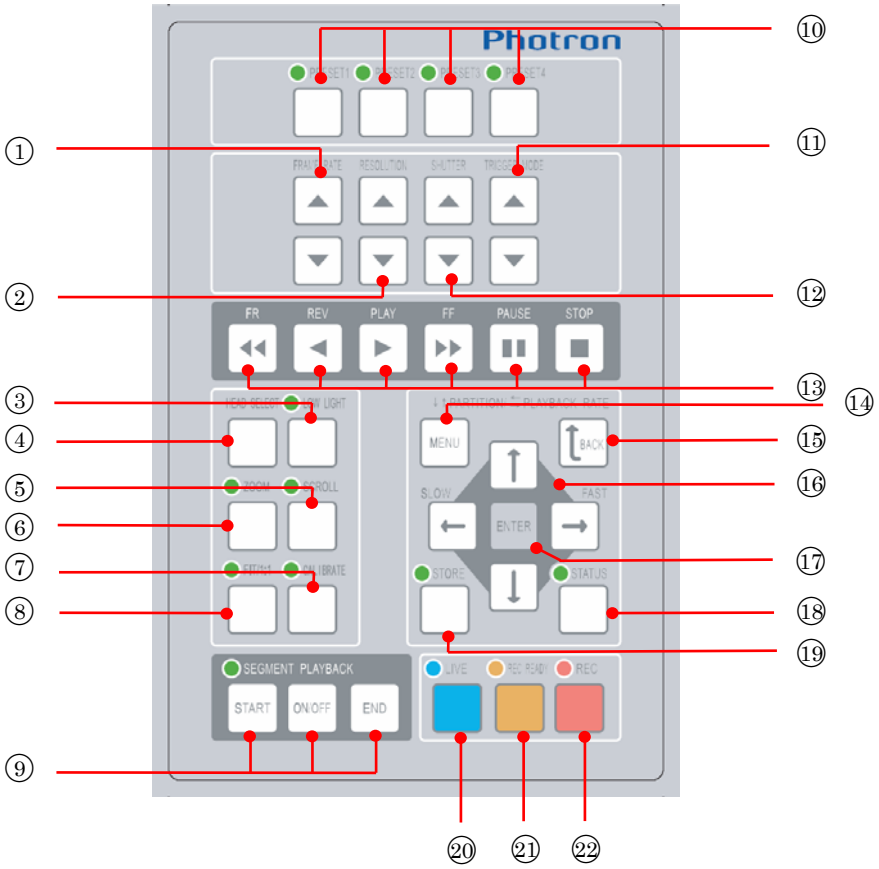
The keypad has been designed with the intention of making frequently repeated functions easily accessible. Detailed settings have also been organized in a menu which can be operated efficiently by using the **ARROW** keys.

This section explains the basic keypad operations when taking images with the system.

2.4.1. Keypad Parts

■ **Keypad Exterior**

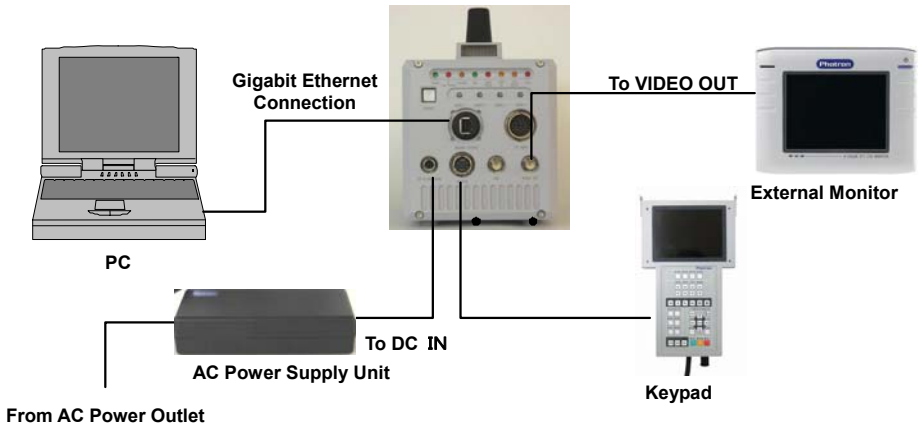
■ Key Explanation



Num.	Key Name	Function	Num.	Key Name	Function
①	FRAME RATE	Frame Rate setting	⑫	SHUTTER	Shutter speed setting
②	RESOLUTION	Resolution setting	⑬	PLAYBACK	Playback key
③	LOW LIGHT	Low light mode	⑭	MENU	Display menu
④	HEAD SELECT	Not used on this system.	⑮	BACK	Setting condition return
⑤	SCROLL	Scroll	⑯	ARROW KEYS	Move up, down, left, right
⑥	ZOOM	Zoom	⑰	ENTER	Confirm key
⑦	CALIBRATE	Sensor calibration	⑱	STATUS	Display status
⑧	FIT/1:1	Display fit monitor screen / 1:1	⑲	STORE	Store settings, store a marker
⑨	SEGMENT PLAYBACK	Segment playback keys	⑳	LIVE	Change LIVE/MEMORY
⑩	PRESET	Access preset	㉑	REC READY	Record ready
⑪	TRIGGER MODE	Set trigger mode	㉒	REC	Record key

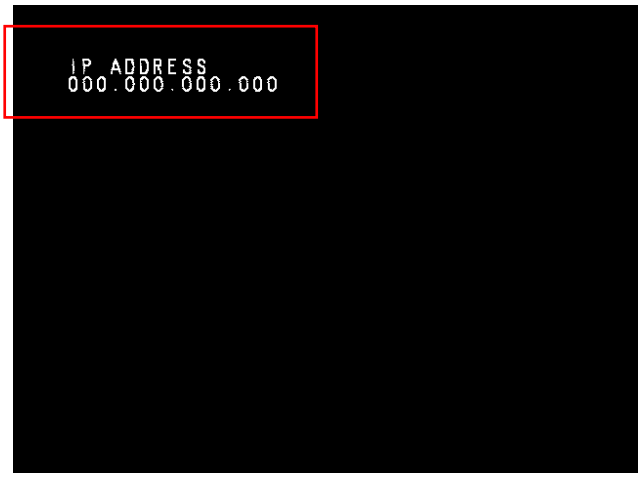
2.4.2. Startup Screen

1. After attaching the cables, keypad, and external devices as explained in the previous section, turn the power on by pressing the power switch on the back of the camera body.

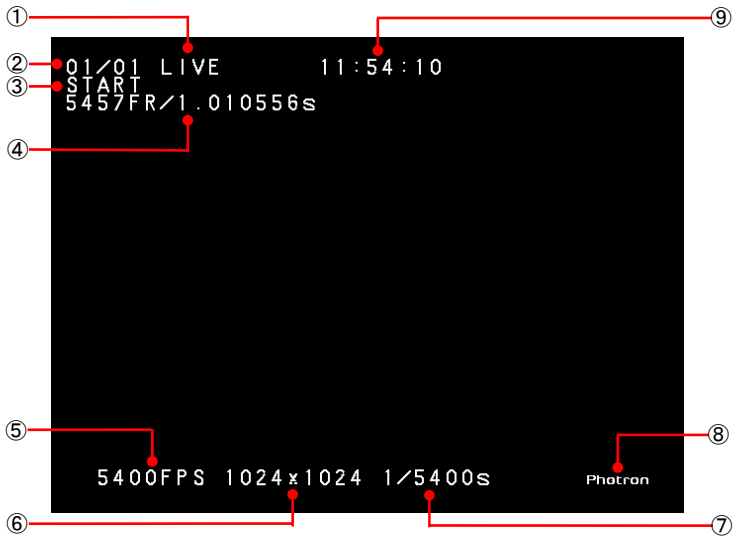


Example Cable/Device Connections

2. After switching on the power, the current IP address setting is displayed as text in the upper-left of the video monitor screen.

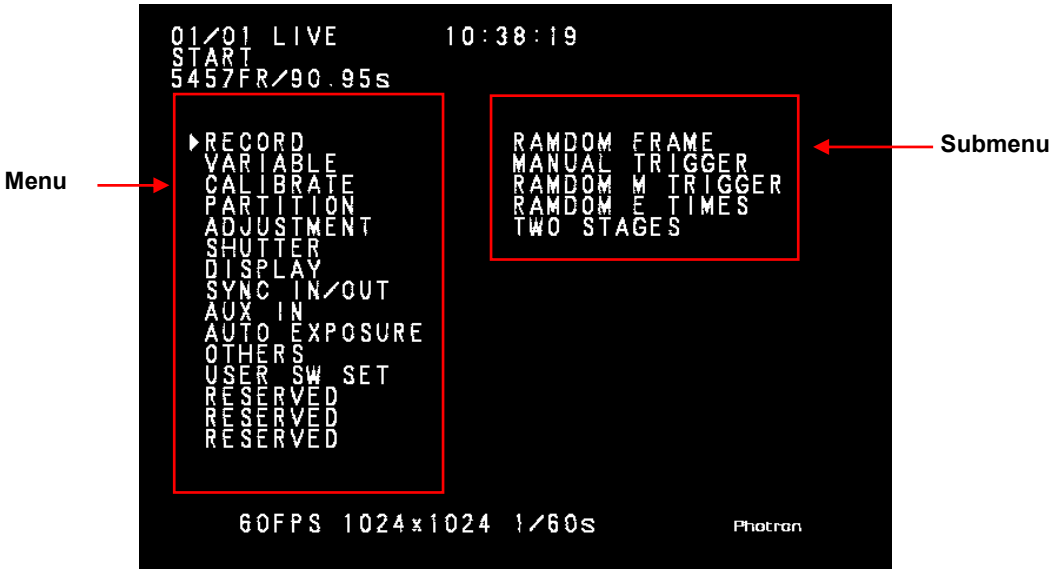


3. After a short time, a screen like the one shown below is displayed.
4. The meaning of the text displayed on the screen is explained below.



2.4.3. Displaying the Menu List

The menu list is displayed on the video monitor screen by pressing the keypad **MENU** key.



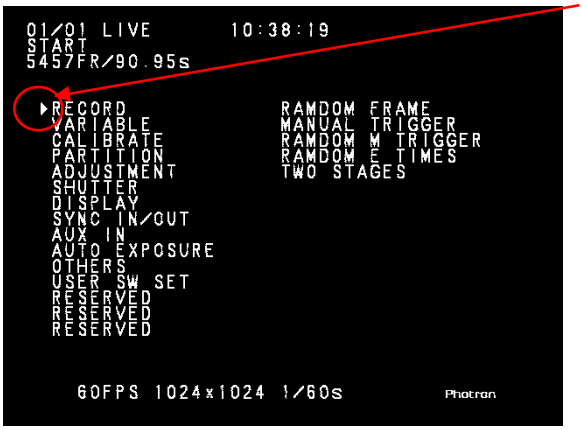
Menu List Screen

To leave the menu list screen without making a selection (cancel), press the **MENU** key or the **BACK** key.

2.4.4. Menu Selection/Confirmation/Cancellation

1. The menu list has a hierarchical structure made of the "**menu**", "**submenu**", and "**setting**" layers, in that order. The cursor " ▶ " on the menu can be moved and the necessary menu commands can be selected by pressing the keypad **ARROW** keys.
2. The procedure for changing a setting is explained next.

3. Select an item on the menu using the ↑ ↓ (up and down) keys.



The ▶ cursor on the left side of the menu can be moved by pressing the ↑ ↓ **keys**.

4. Find the item to set in the submenu and press the → (Right) key to move to the submenu. To return to the menu from the submenu, press the ← key.

5. Move to the item to set using the ↑ ↓ keys and press the **ENTER** key.

6. The setting item will appear on the left side of the screen that had displayed the menu. Use the **ARROW** keys to change the setting. To return to the submenu from the setting item, press the **MENU** key or the **BACK** key.

7. After changing the setting, complete your selection by pressing the **ENTER** key.

2.4.5. Saving Recording Settings

After using the procedure explained in “2.4.4. Menu Selection/Confirmation/Cancellation” to change settings, press the keypad STORE key to save your settings for the frame rate, shutter speed, and resolution as explained in “Chapter 3. Recording”. The contents of the saved settings are maintained in the keypad’s internal memory even when the power is turned off. However, use caution as the settings listed below are not saved when settings are saved in this manner.

ZOOM Setting
FIT Setting
LOW LIGHT Setting
MENU->DISPLAY->KEYPAD Setting

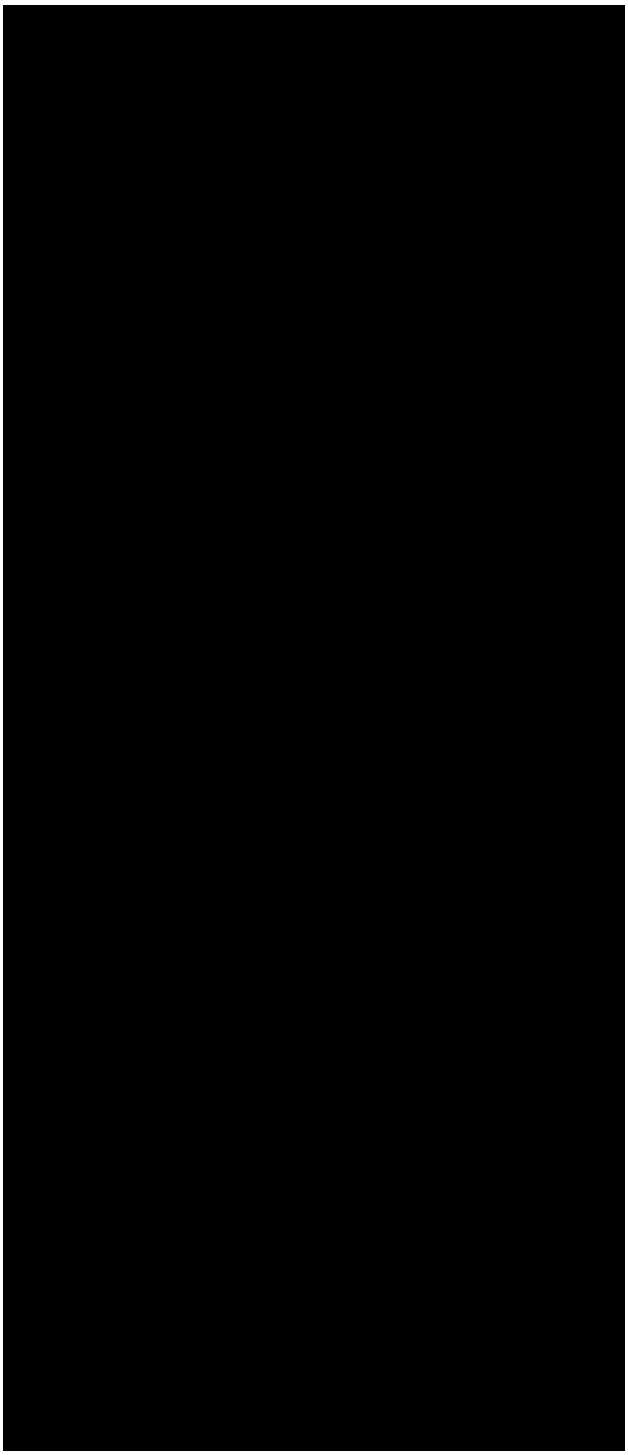
The following settings are saved by menu selection, regardless of saving.

MENU->OTHERS->DIGITAL I/F SET Setting
MENU->DISPLAY->NTSC/PAL Setting

2.4.6. Menu/Manual Reference List

The menu has the structure shown below.

The reference page describes the settings and method of using each function.



2.4.7. Saving/Accessing Settings

A maximum of four configuration settings can be saved. How to save/access those settings is explained next. In addition, refer to “Chapter 3. Recording” for details on how to make the settings.

1. On the keypad, press the numbered **PRESET** key to be set.
2. Make the settings. Refer to “Chapter 3. Recording” for how to make the settings.
3. Press the **STORE** key. By saving the settings, the current settings are saved to the numbered preset selected in the first step.
4. To access the saved settings, press the numbered **PRESET** key that the settings were saved to.

2.4.8. Using Low Light Mode

The more you increase the frame rate or shutter speed of the camera, the more the amount of light entering the camera decreases, making the displayed image darker. Low light mode is a function that temporarily increases the exposure time, making the displayed image easier to see to enable you to focus and setup camera. 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 and returns you to the selected record and shutter speed.

When in low light mode, “LOW LIGHT” will be displayed in the lower left corner of the screen, and five LEDs, all of the MAIN LEDs except the POWER LED, will blink.

Chapter 3. Recording

3.1. Image Initialization (Calibration)

In order to maximize the image quality of the system, it is necessary to correct the non-uniformity in each pixel that is inherent in high speed image sensors.

The system is equipped with a function to correct the output value for each pixel using the black level as a standard correction (calibration) to zero the dark signal for all the pixels, it is then possible to obtain correct image output for the different input light levels.

In order to obtain correct image output, it is highly recommended to execute calibration when the following settings are changed, especially before recording a sequence

- **When the frame rate is changed**
- **When the shutter speed is changed**
- **When the resolution is changed**

Also, depending on the settings, phenomena such as the following may occur.

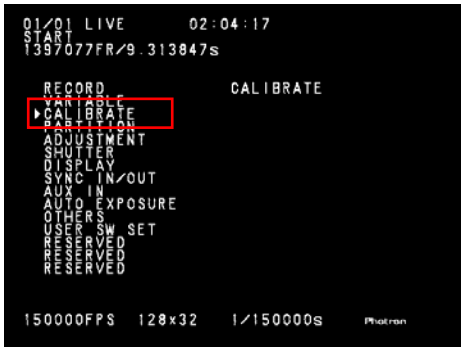
- **Fixed noise - horizontal bands - appear**
- **A portion of the screen is clear, but noise appears in the area around it**

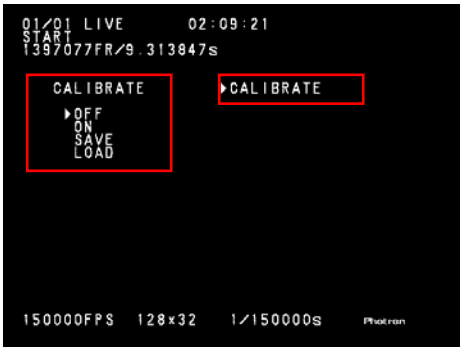
These phenomena can be resolved by recalibration.

3.1.1. Execute Calibration

The procedure for executing calibration is explained below.

1. Set the desired **FRAME RATE** and **SHUTTER** with the keypad ↑ ↓ keys.
2. Cover the lens using the lens cap or similar. The resultant black image will be used as the correction standard, verify that the lens is completely shielded and that no light is leaking into the sensor.
3. Press the **MENU** key on the keypad and the menu will display.
4. Using the keypad **ARROW** keys, select the **CALIBRATE** menu, and then from the submenu, select the **CALIBRATE** menu.

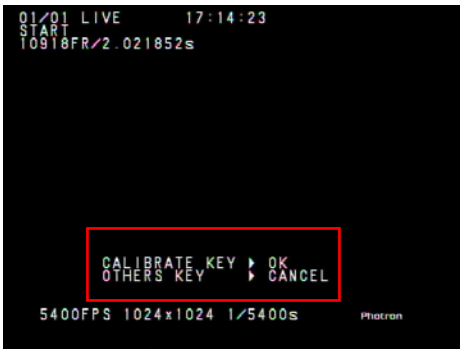




5. With the keypad ↑ ↓ keys, move to **ON**, verify that the lens is shielded and press the keypad **ENTER** key.
6. Calibration execution is completed with this operation when the screen text reappears.
7. Remove the lens cap and verify that the image is displayed correctly.

Sensor calibration can also be carried out in an easier way by operating the CALIBRATE key in the following steps:

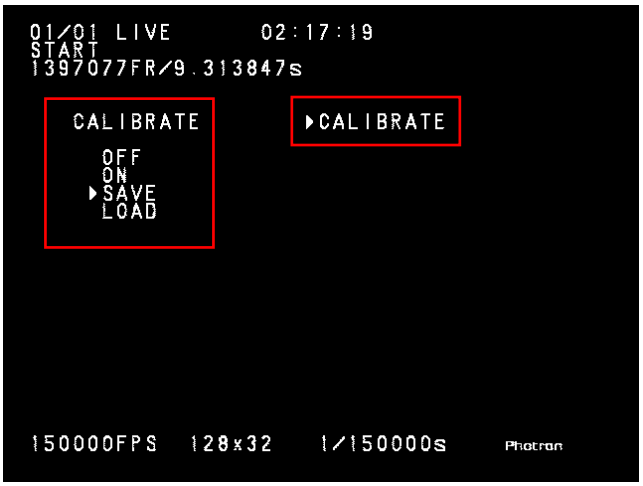
1. Press the CALIBRATE key on the keypad and the menu is displayed.
2. Press the CALIBRATE key one more time and calibration is completed.



3.1.2. Save Calibration Settings

The black image data obtained from the calibration can be saved as one pattern internally on the system. The procedure for doing this is explained below.

1. Press the **MENU** key on the keypad and the menu will display.
2. Using the keypad ↑ ↓ keys, select the **CALIBRATE** menu.
3. Press the **ENTER** key to select.
4. Select the **SAVE** item with the keypad ↑ ↓ keys, and press the **ENTER** key to execute the save.

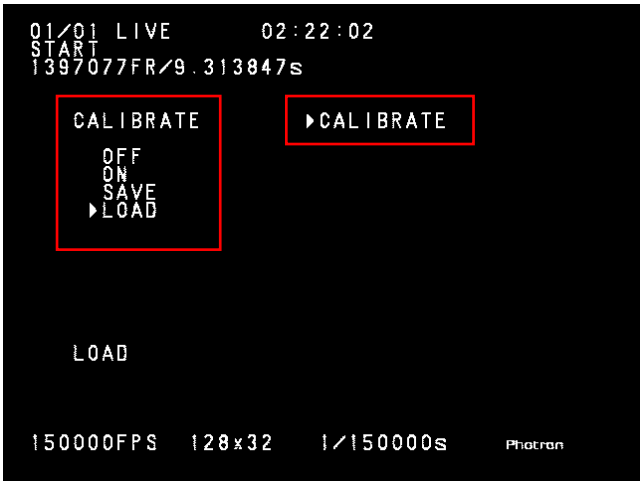


The save process might take a few minutes.

3.1.3. Loading Calibration Settings

This item explains how to load the saved black image data for.

1. Press the **MENU** key on the keypad and the menu will display.
2. Using the keypad ↑ ↓ keys, select the **CALIBRATE** menu.
3. Press the **ENTER** key to select.
4. Select the **LOAD** item with the keypad ↑ ↓ keys, and press the **ENTER** key.
5. The saved black image data for correction is loaded from internal memory and the output image reflects this correction.



3.2. Selecting the Frame Rate

Images can be recorded with the system from 60 (50) to 5400 fps using the full 1024x1024 pixel resolution of the image sensor. For frame rates higher than 5400 fps, high-speed recording is achieved by limiting the read area of the image sensor. Binning is NOT used.

The procedure for selecting the frame rate is explained next.

1. Verify that the camera is in the **LIVE** mode (the image displayed is passed through from the camera). If the system is in a mode other than **LIVE** mode, press the keypad **LIVE** key. When the system is in **LIVE** mode, the **LIVE** key **LED** will be lit.

Verify that **LIVE** is displayed at the top of the monitor.

2. Press the **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 in the lower part of the screen changes

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

For frame rates faster than **5400 fps**, the resolution is automatically set to the maximum available at that frame rate. For more details, refer to “7.1.4. Frame Rate and Resolution”.

The minimum frame rate in **PAL** mode is **50 fps**.
The minimum frame rate in **NTSC** mode is **60 fps**.

3.3. Selecting the Resolution

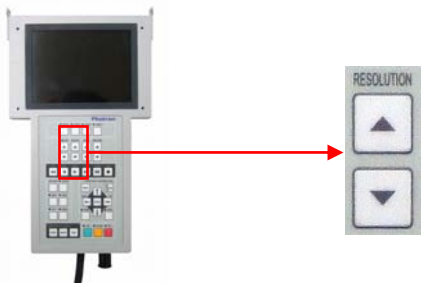
Images with a maximum size of 1,048,576 pixels can be taken with the system using the high-speed image sensor, which has a maximum size of 1024x1024 pixels. By reducing the resolution, images can be taken with even faster frame rates, or the recording duration can be extended accordingly.

The procedure for selecting the resolution is explained next.

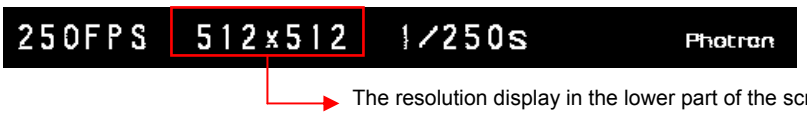
1. Verify that the camera mode is **LIVE** mode.

Verify that **LIVE** is displayed at the top of the monitor.

2. Press the **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 corner of the video monitor changes as the resolution is changed.



The resolution display in the lower part of the screen changes.

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

(Reference: “7.1.4 Frame Rate and Resolution”)

3.4. Selecting the Shutter Speed

The shutter speed is independent of the frame rate, and it is possible to control the exposure time in the frame using the electric shutter. By making an exposure that is of a shorter period than the frame rate, high-speed objects can be photographed blur-free.

The shutter speed can be set from 1/frame sec to a maximum of 1/500,000 sec (approximately 2μ sec). (Reference: “7.1.6. Shutter Speed List”)

The procedure for selecting the shutter speed is explained here.

3.4.1. Setting the Shutter Speed

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

Verify that **LIVE** is displayed at the top of the monitor.

2. Press the **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 corner of the video monitor changes as the shutter speed is changed.

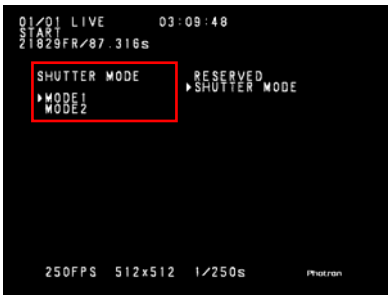
The shutter speed in the lower part of the screen changes.

3.4.2. Changing the SHUTTER MODE

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

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 value.



3.4.3. DS SHUTTER Setting

The **DS SHUTTER** is a mode that records the high brightness and low brightness portions in one image at the same time by adjusting the light exposure internally in the sensor. By using this function, when recording a subject with an extremely large difference in the brightness in the image, the sensor functions so that it can record at the proper light exposure for both the high brightness and low brightness portions.

The light exposure adjustment can be set from 0% to 95% in 5% increments according to the subject to be recorded.

* The amount of adjustment is expressed in %. For the strength of the adjustment, 0% is no adjustment, 95% is the maximum effect.

1. Press the **MENU** key on the keypad and the menu will display.
2. Using the keypad ↑ ↓ keys, select the **SHUTTER** menu.

3. Select the **DS Shutter** submenu. The **DS SHUTTER** menu is displayed.

This function cannot be used with the operations below.

- When the **AUTO EXPOSURE** function is used
- When the trigger mode is **RANDOM RESET**

When using the **DS SHUTTER** function on a color model, there are situations where the colors become unbalanced and the color quality degrades.

3.4.4. AUTO EXPOSURE Operation

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

After the settings are made once, this function works when recording in a situation where the settings cannot be easily changed, in an environment where the subject's lighting condition changes.

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

AREA, **TARGET_VALUE**, **RANGE**, **SHUTTER**

Each of these settings is explained below.

- **AREA**

Set the image area.

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

- **TARGET_VALUE**

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

- **RANGE**

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

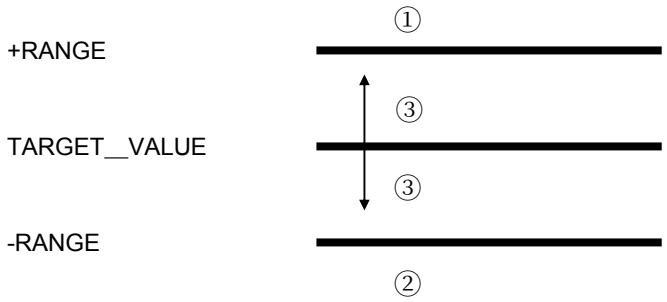
The auto exposure function will operate so that the average value of the image output level in the area specified by **AREA** is in the range of **TARGET_VALUE ±RANGE**.

- **SHUTTER**

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

When the auto exposure function is operating, the shutter will not operate at an exposure time longer than the shutter value set here.

These settings are shown in the diagram below.



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

- If position ①

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

- If position ②

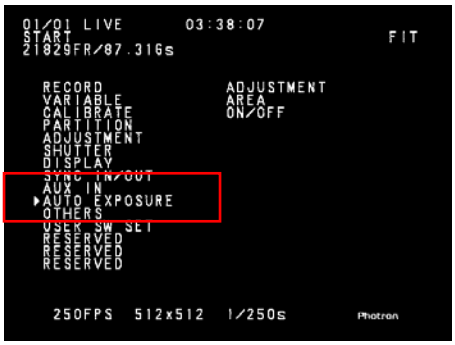
The image level being output is lower than the range **TARGET_VALUE±RANGE**, so the function operates to open the shutter (lengthen the exposure time).

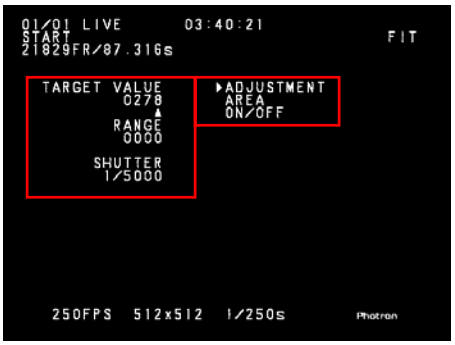
- If position ③

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

- Setting **TARGET_VALUE**

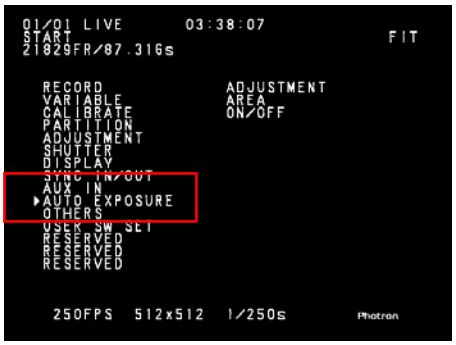
1. Press the **MENU** key on the keypad and the menu will display.
2. Select **AUTO EXPOSURE** on the main menu with the keypad ↑ ↓ keys, then select **ADJUSTMENT** on the submenu and press the **ENTER** key.
3. On the **TARGET_VALUE** menu, make the settings using the keypad **ARROW** keys.
4. When the values have been set, press the **ENTER** key.

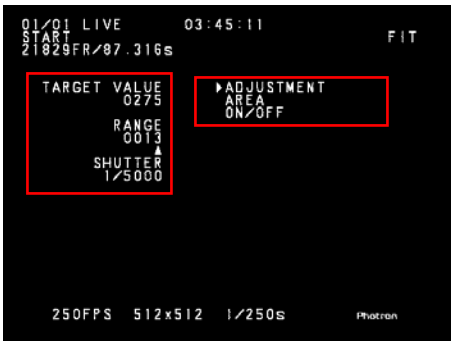




- Setting **RANGE**

1. Press the **MENU** key on the keypad and the menu will display.
2. Select **AUTO EXPOSURE** on the main menu with the keypad ↑ ↓ keys, then select **ADJUSTMENT** on the submenu and press the **ENTER** key.
3. On the **TARGET_VALUE** menu, select **RANGE** and set using the keypad **ARROW** keys. When the values have been set, press the **ENTER** key.

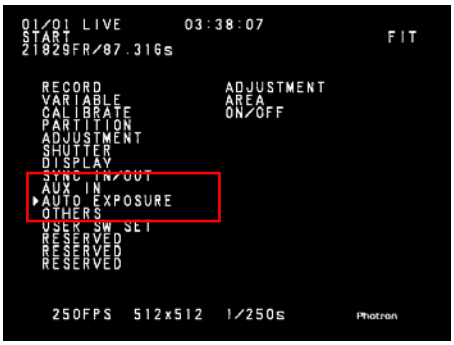


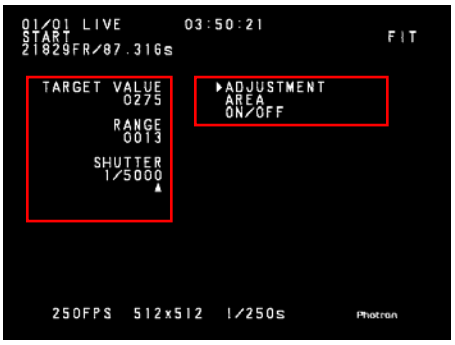


- Setting **SHUTTER**

1. Press the **MENU** key on the keypad and the menu will display.
2. Select **AUTO EXPOSURE** on the main menu with the keypad ↑ ↓ keys, then select **ADJUSTMENT** on the submenu and press the **ENTER** key.

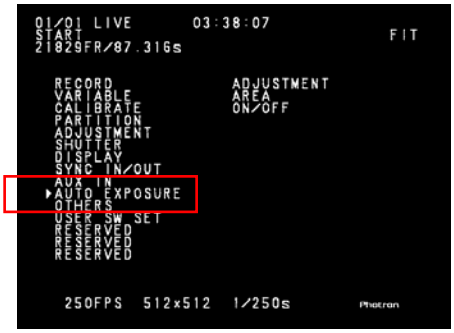
3. On the **TARGET_VALUE** menu, select **SHUTTER** and set using the keypad **ARROW** keys. When the values have been set, press the **ENTER** key.

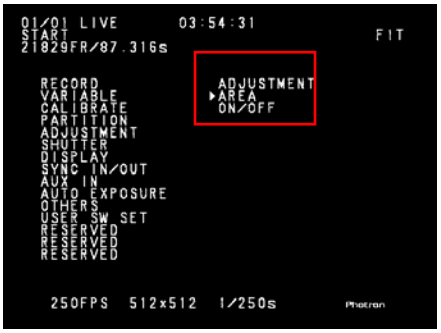




- Setting **AREA**

1. Press the **MENU** key on the keypad and the menu will display.
2. Select **AUTO EXPOSURE** on the main menu with the keypad ↑ ↓ keys, then select **AREA** on the **ADJUSTMENT** submenu and press the **ENTER** key.

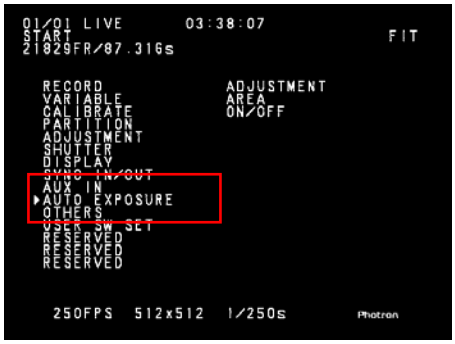


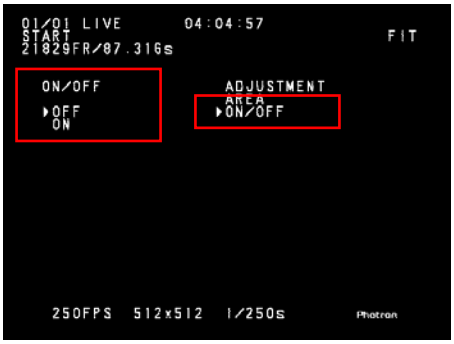


3. When the **ENTER** key is pressed, you will enter the **POSITION ADJUSTMENT** setting menu as shown below. Choose the position using the keypad ↑ ↓ keys. When the position has been set, press the **ENTER** key.
4. Next, you will enter the **AREA ADJUSTMENT** setting menu.
5. Choose the area's size using the keypad ↑ ↓ keys. When the position has been set, press the **ENTER** key.

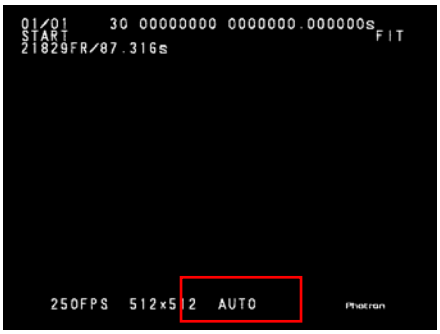
■ Setting **ON/OFF**

1. Press the **MENU** key on the keypad and the menu will display.
2. Select **AUTO EXPOSURE** on the main menu with the keypad ↑ ↓ keys, then select **ON/OFF** on the **ADJUSTMENT** submenu and press the **ENTER** key.
3. To activate **AUTO EXPOSURE**, select **ON**. To deactivate, select **OFF**. Then press the **ENTER** key.





4. When **AUTO EXPOSURE** has been activated, "■" is displayed next to the shutter display, as shown in the lower left diagram, to indicate the function is active.
5. The shutter notation will also be **AUTO** during playback as shown in the lower right diagram.



The **DS SHUTTER** function is not active while the **AUTO EXPOSURE** function is being used. If the **RANGE** setting is small, the range of the desired image output level narrows.

If the **RANGE** value is made smaller beyond what is necessary, it becomes difficult to put the image level in the desired ③ position.

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

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

3.5. Selecting the Trigger Mode

In order to reliably capture high-speed phenomena, many kinds of trigger modes are available on the system. These trigger modes are explained next.

* This explanation relates to the direct trigger mode setting when the **"AUTO PLAY** (See: 6.2.2.)" and "**READY AND TRIG** (See: 6.2.3.)" settings are off. If the settings differ and those settings have been turned on, the use of the system will differ from the explanation below.

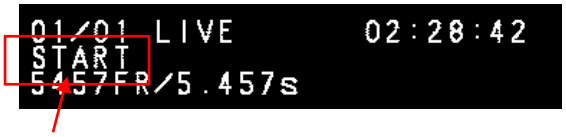
The procedure for selecting the trigger mode is explained here first. Following that is the basic explanation for using each trigger mode.

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

Verify that **LIVE** is displayed at the top of the monitor.

2. Press the **TRIGGER ▲▼** keys and select the trigger mode.

3. The mode selected will be 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 in the upper part of the screen changes.

There are nine types of trigger modes, listed below.

・START ・CENTER ・END ・MANUAL+1FR ・RANDOM 1FR

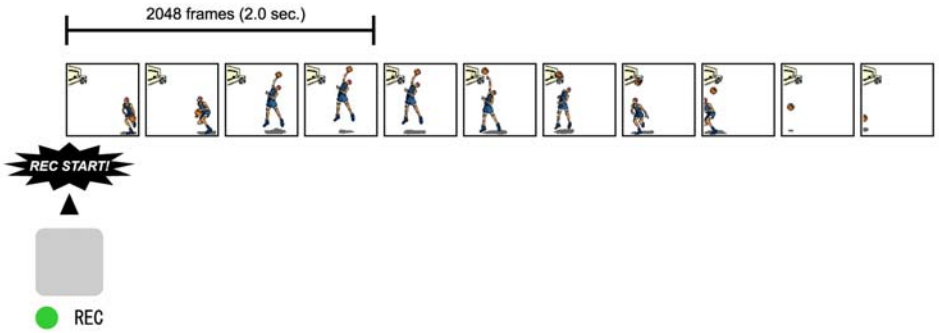
・RANDOM RESET 1FR ・RANDOM CENTER ・RANDOM+1FR 1FR

・TWO STAGE

3.5.1. START Mode

START mode is a trigger mode where recording starts the instant the trigger is input, and 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 happens, and when it will happen, is known in advance.

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

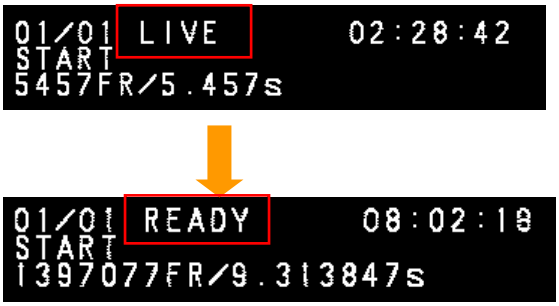


• Recording in START Mode

The procedure for recording in **START** mode is explained next.

1. Following the directions in “3.5. Selecting the Trigger Mode”, verify that the camera mode is **LIVE** mode and the trigger mode is **START**.

2. Press the **REC READY** key on the keypad. The system enters the recording ready state. Verify that the **LIVE** display in the top of the screen has changed to **READY**.



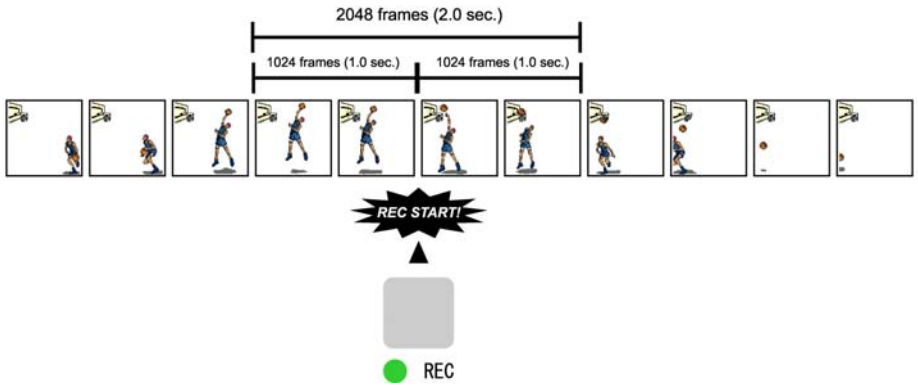
3. To start recording, press the **REC** key, the trigger signal is input. The screen displaying the camera status changes from **READY** to **REC** during recording, and to **LIVE** when recording is done.

4. Recording is finished.

3.5.2. CENTER Mode

CENTER mode is a trigger mode where an equal number of images are recorded before and after the trigger is input. This mode is suitable for viewing before and after an important event.

For example, in a situation with a maximum useable memory for two seconds of recording, the **REC** key is pressed as shown in the diagram below, and one second before and after the trigger was input is recorded for a total of two seconds of high-speed video.

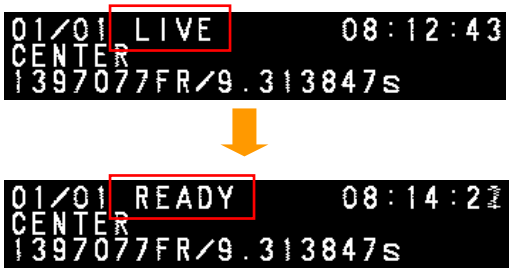


• Recording in CENTER Mode

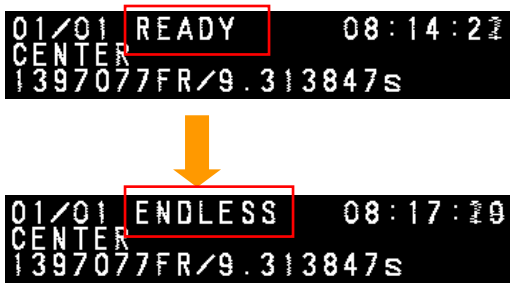
The procedure for recording in **CENTER** mode is explained next.

1. Following the directions in “3.5. Selecting the Trigger Mode”, verify that the camera mode is **LIVE** mode and the trigger mode is **CENTER**.

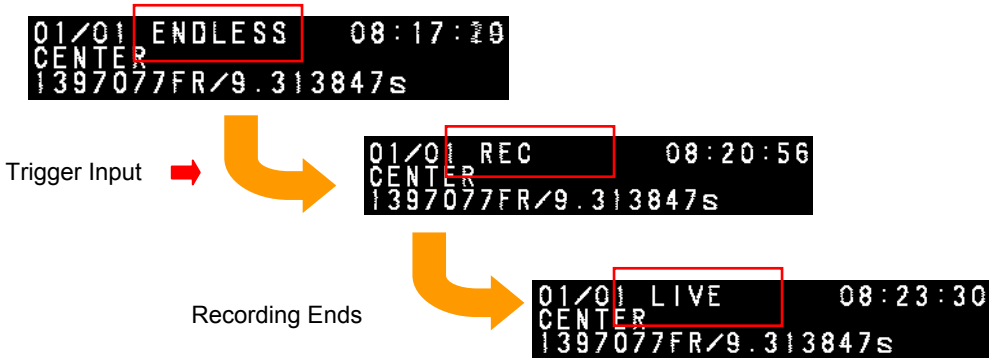
2. Press the **REC READY** key on the keypad. The system enters the recording ready state. Verify that the **LIVE** message displayed in the top of the screen has changed to **READY**.



3. Press the keypad **REC** key and input the trigger. The screen display shows the message **ENDLESS**. This puts the system into a state where the images are continuously written to memory in a loop.



4. Press the keypad **REC** key again and input the trigger. The screen display changes to **REC**. By doing this, the images before and after when the trigger was input are recorded and the recording operation ends. Verify that the **REC** display has changed to **LIVE**.

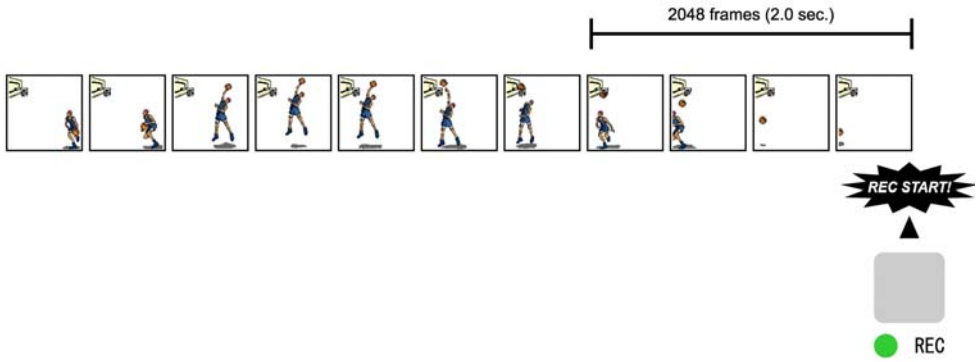


5. Recording is finished.

3.5.3. 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 two seconds of recording, the **REC** key is pressed as shown in the diagram below, and the two seconds of high-speed video immediately before the trigger was input are saved.

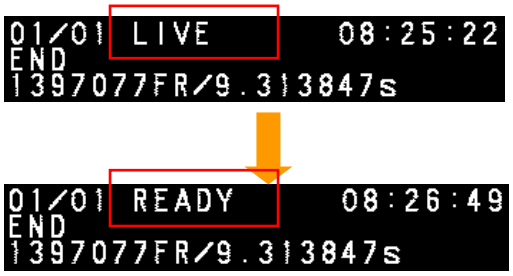


・Recording in END Mode

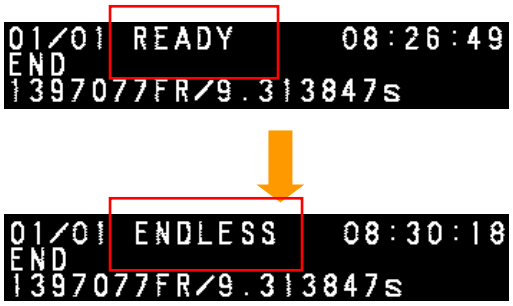
The procedure for recording in **END** mode is explained next.

1. Following the directions in “3.5. Selecting the Trigger Mode”, verify that the camera mode is **LIVE** mode and the trigger mode is **END**.

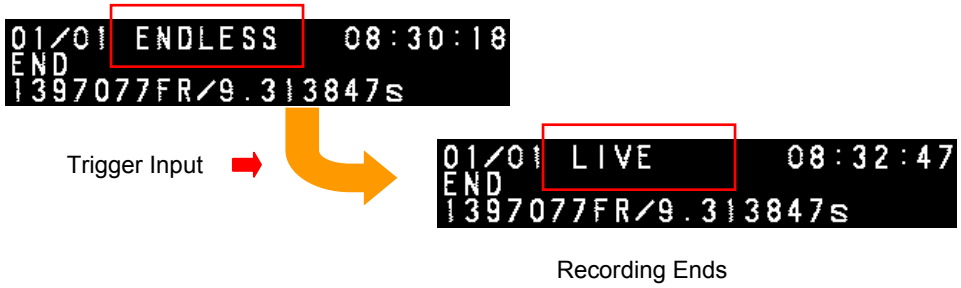
2. Press the **REC READY** key on the keypad. The system enters the recording ready state. Verify that the **LIVE** display in the top of the screen has changed to **READY**.



3. Press the **REC** key on the keypad. The screen display shows **ENDLESS**. This puts the system into a state where the images are continuously written to memory in a loop.



4. Press the **REC** key once the event to be recorded has occurred. By doing this, the images immediately before the trigger point are saved, and the recording operation ends. Verify that the **ENDLESS** display in the upper part of the screen has changed to **LIVE**.



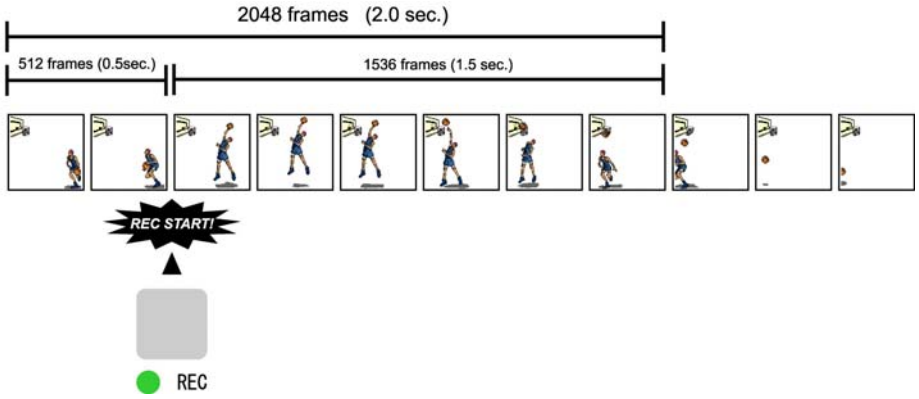
Recording Ends

5. Recording is finished.

3.5.4. 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 by the user.

For example, in a situation with a maximum record time of two seconds, the **REC** key is pressed as shown in the diagram below and 0.5 seconds before and 1.5 seconds, a total of two seconds of high-speed video, after the trigger is input are recorded and saved.



■ Setting MANUAL Mode

To use **MANUAL** mode, the proportion of the number frames to be recorded before and after the trigger must be set in advance before recording. The procedure for making this setting is explained next.

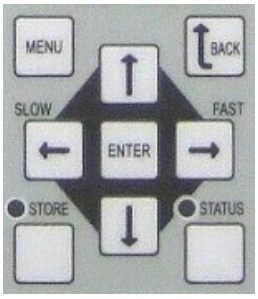
1. Press the **MENU** key on the keypad and the menu list will display.
2. With the keypad ↑ ↓ keys, select **MANUAL TRIGGER** from the **RECORD** submenu and confirm with the **ENTER** key.

3. The display used to specify the before/after trigger frame count is shown on the left side of the screen.

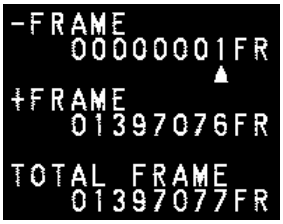
4. The meaning of each item is explained next.

5. Set the number of frames to be recorded before the trigger: the before trigger frame count. Operate the cursor with the keypad **ARROW** keys to set the desired frame count. By changing the before trigger frame count (-**FRAME**), the after trigger frame count (**+FRAME**) increases and decreases automatically in accordance with the available record frame count (**TOTAL FRAME**).

↑
Up
Raise/Lower
Value
Down
↓



←Left Move Frame Count Digit Right→



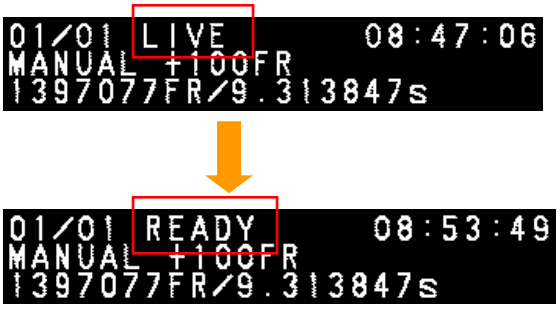
6. When the setting is complete, press the **ENTER** key to finish. If the setting has been made correctly, for example, an after trigger frame count of **100**, the trigger mode display in the upper part of the screen will show **MANUAL +100FR** as shown in the image below.

■ Recording in MANUAL Mode

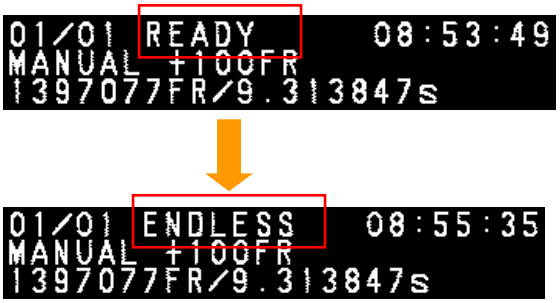
The procedure for recording in **MANUAL** mode is explained next.

1. Following the directions in “3.5. Selecting the Trigger Mode”, verify that the camera mode is **LIVE** mode and the trigger mode is **MANUAL**.

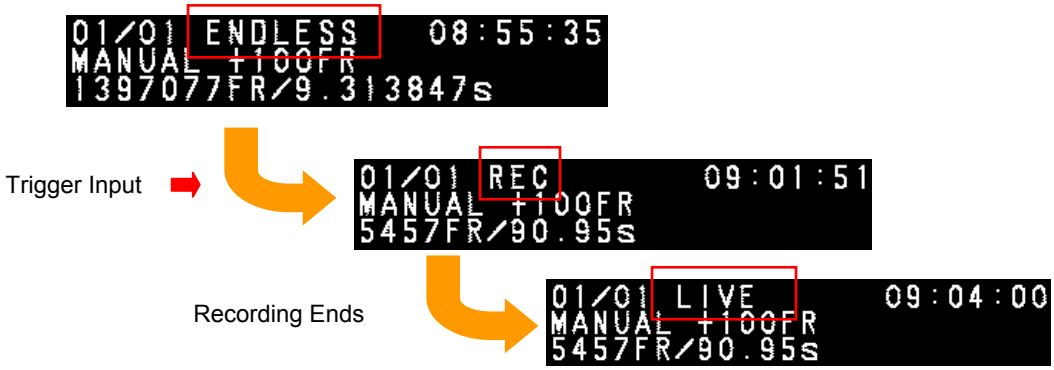
2. Press the **REC READY** key on the keypad. The system enters the recording ready state. Verify that the **LIVE** display in the top of the screen has changed to **READY**.



3. Press the keypad **REC** key and input the trigger. The screen display shows **ENDLESS**. This puts the system into a state where the images are continuously written to memory in a loop.



4. Press the keypad **REC** key again and input the trigger. The screen display changes to **REC**. By doing this, the images before and after when the trigger was input are recorded and the recording operation ends. Verify that the **REC** display has changed to **LIVE**.

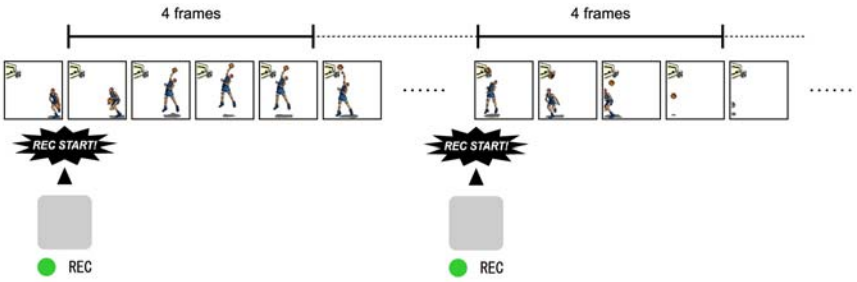


5. Recording is finished.

3.5.5. RANDOM Mode

RANDOM mode is a trigger mode where each time a trigger is input 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.

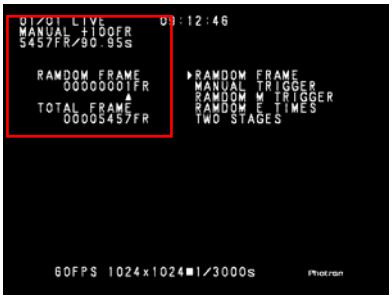


■ Setting RANDOM Mode (Frame Count)

To use **RANDOM** mode, the number of frames to record each time the trigger is input must be set in advance before recording. The procedure for making this setting is explained next.

1. Press the **MENU** key on the keypad and the menu list will display.
2. With the **ARROW** keys on the keypad, select the **RANDOM FRAME** submenu from **RECORD** and confirm with the **ENTER** key.

3. The **RANDOM FRAME** menu is shown on the left side of the screen. Similar to the image below, this display is used to specify the number of frames to be recoded for each trigger.



4. Set the number of frames to be saved for each trigger input. Operate the cursor with the keypad **ARROW** keys to set the desired frame count.

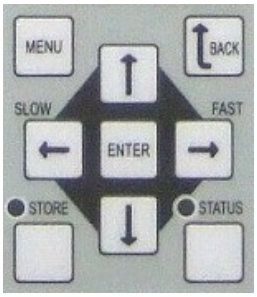
↑

Up

Raise/Lower Value

Down

↓



←Left Move Frame Count Digit Right→

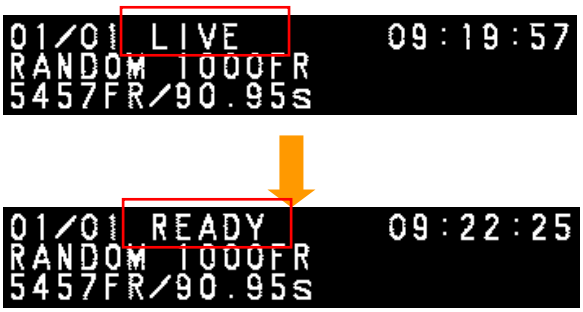
5. When the setting is complete, press the **ENTER** key to finish. If the setting has been entered correctly, for example, when the trigger has been set to save 20 frames, the trigger mode display in the upper part of the screen will show **RANDOM 20 FR**, as shown in the image below.

■ Recording in RANDOM Mode

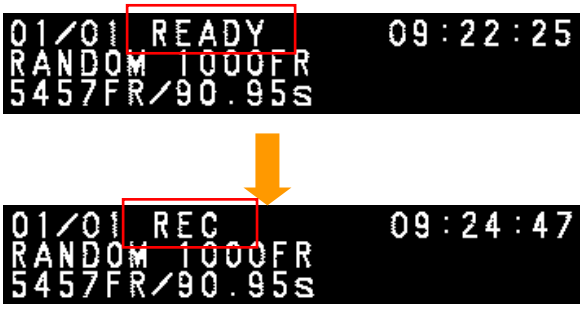
The procedure for recording in **RANDOM** mode is explained next.

1. Following the directions in “3.5. Selecting the Trigger Mode”, verify that the camera mode is **LIVE** mode and the trigger mode is **RANDOM**.

2. Press the **REC READY** key on the keypad. The system enters the recording ready state. Verify that the **LIVE** display in the top of the screen has changed to **READY**.



3. Press the **REC** key on the keypad. The screen display shows **REC**.



4. Press the **REC** key on the keypad. By doing this, the camera records only the number of frames, frame count, specified, and waits for the next trigger signal. Trigger signals can be input by the external trigger input connector, contact signal, or **TTL** signal. (“3.13 Using External Triggers”)

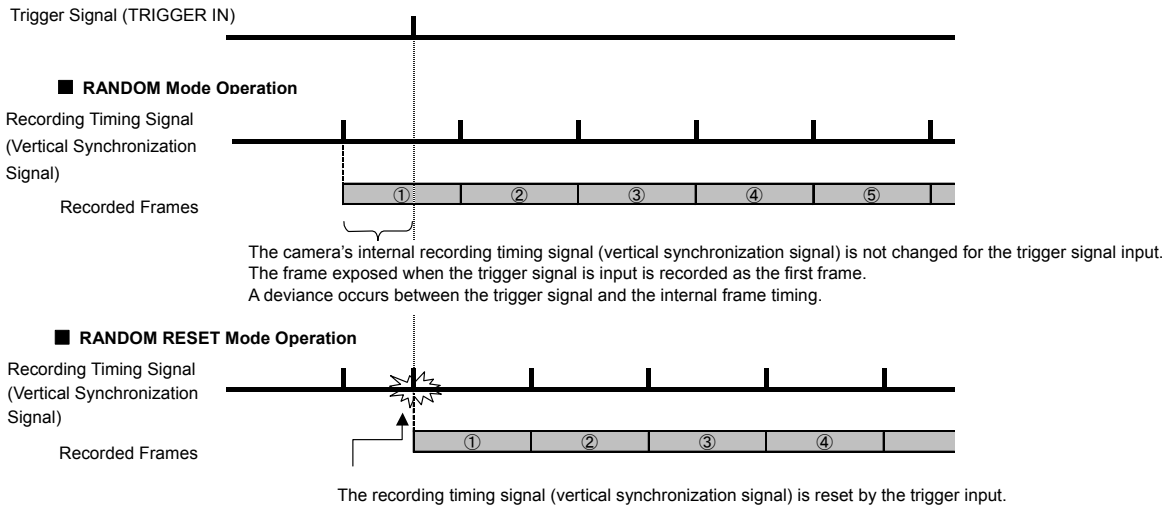
The recording operation ends when the recording memory is completely full (*). Verify that the **REC** display has changed to **LIVE**.

* To stop during the recording operation, press the **REC READY** key.

3.5.6. RANDOM RESET Mode

RANDOM RESET mode is explained here by comparing it with the normal mode.

RANDOM RESET mode is a mode to improve the time accuracy of the recording's start timing and the timing of the trigger input, where, to put it simply, with the input of the trigger signal, at the time it is input, the camera's recording timing is reset.



The difference in the recording operation for the trigger input is shown graphically when the camera is set in the normal **RANDOM** mode (the same as **START** mode) and **RANDOM RESET** mode.

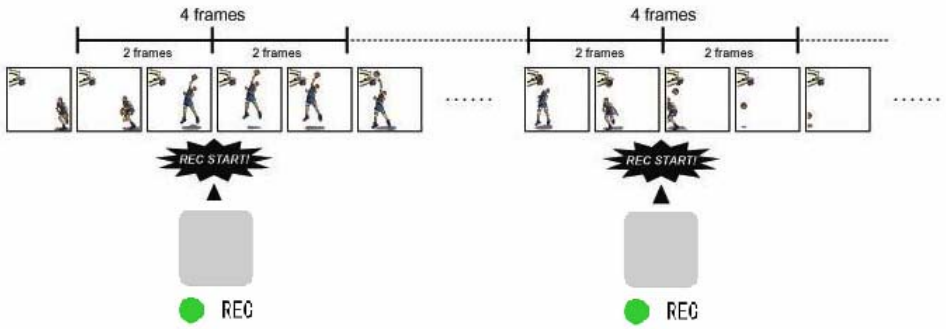
In normal **RANDOM** and **START** mode, the camera starts recording when the trigger is input, however the internal record timing signal is independent, and it operates regardless of when the trigger is input. For this reason, there are situations where the start time for the first frame when the trigger is input can be advanced almost a full frame. Also, the range of this overlap cannot be known.

On the other hand, in **RANDOM RESET** mode, the camera's internal record timing signal is reset by the trigger input, and operates anew. For this reason, the trigger input time and when the first frame starts are the equal. The interval from when the trigger is input until the exposure beings is approximately 2.3 μsec.

3.5.7. RANDOM CENTER Mode

RANDOM CENTER mode is a trigger mode, similar to **RANDOM** mode, where each time a trigger is input only a predetermined number of frames are recorded. The difference between this mode and **RANDOM** mode is that in **RANDOM** mode the number of specified frames is recorded directly after the trigger signal, whereas in **RANDOM CENTER** mode the frames before and after the trigger are saved.

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, and you want to check the action before and after the trigger timing. 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.



■ Setting the **RANDOM CENTER** Mode Frame Count

Setting the frame count in **RANDOM CENTER** mode is the same as in setting **RANDOM** mode. Refer to "**3.5.5. RANDOM Mode**" for how to make the settings.

■ Setting the **RANDOM CENTER** Mode Record Count

The number of trigger inputs that can be accepted in **RANDOM CENTER** mode is a maximum of 10. Set the number of trigger inputs in advance and the recording operation can be ended when that amount of trigger inputs is finished.

The procedure for setting the number of trigger inputs is explained here.

1. Press the **MENU** key on the keypad and the menu list will be displayed.
2. With the **ARROW** keys on the keypad, select **RANDOM E TIMES** from **RECORD** submenu and confirm with the **ENTER** key.

3. The **RANDOM E TIMES** menu is shown on the left side of the screen. Similar to the image below, this display is used to specify the number of triggers to accept.

4. Set the trigger count. Operate the cursor with the keypad **ARROW** keys to set the desired amount of frames.

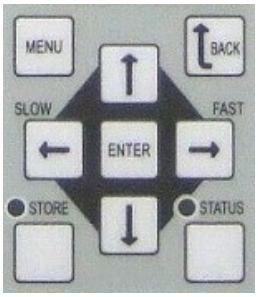
↑

Up

Raise/Lower Value

Down

↓



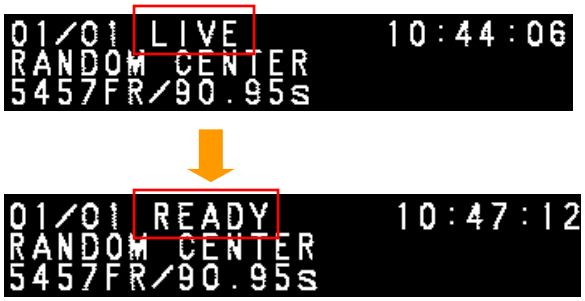
←Left Move Frame Count Digit Right→

■ Recording in RANDOM CENTER Mode

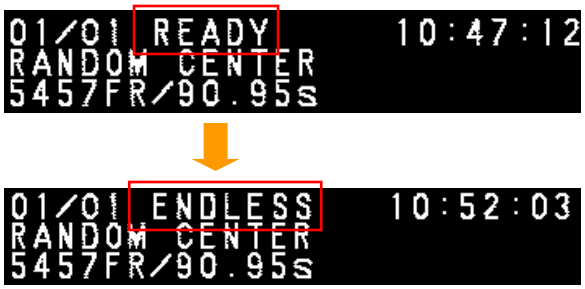
The procedure for recording in **RANDOM CENTER** mode is explained next.

1. Following the directions in “3.5. Selecting the Trigger Mode”, verify that the camera mode is **LIVE** mode and the trigger mode is **RANDOM CENTER**.

2. Press the **REC READY** key on the keypad. The system enters the recording ready state. Verify that the **LIVE** display in the top of the screen has changed to **READY**.



3. Press the **REC** key on the keypad. The screen display shows **ENDLESS**.



This puts the system into a state where the images are continuously written to memory in a 0loop.

4. Press the **REC** key on the keypad. By doing this, the camera records only the frame count specified, and waits for the next trigger signal. Trigger signals can be input by the external trigger input connector, contact signal, or TTL signal.
(See:“3.13 Using External Triggers”)

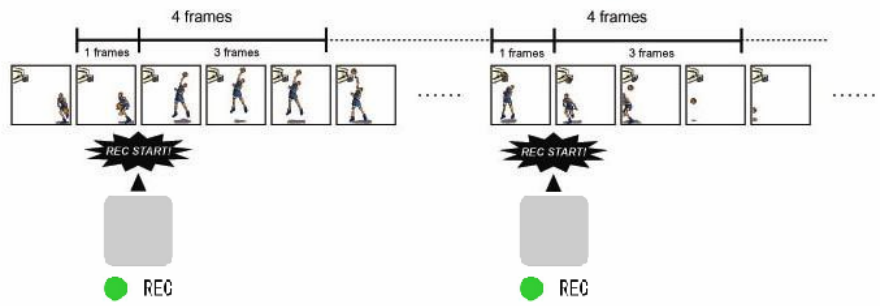
The recording operation ends when the recording memory is completely full (*). Verify that the **REC** display has changed to **LIVE**.

* To stop during the recording operation, press the **REC READY** key.

3.5.8. RANDOM MANUAL Mode

RANDOM MANUAL mode is a trigger mode, similar to **RANDOM** mode, where each time a trigger is input only a predetermined number of frames are saved to memory. The difference between this mode and **RANDOM** mode is that in **RANDOM** mode the number of specified frames is recorded directly after the trigger signal, whereas in **RANDOM MANUAL** mode, when the trigger is input, the frames before and after the trigger, each specified as desired, are recorded.

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, and you want to check the action before and after the trigger timing. 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.



■ Setting the **RANDOM MANUAL** Mode Record Count

Setting the record count in **RANDOM MANUAL** mode is the same as the setting in **RANDOM CENTER** mode.

Refer to "**3.5.5. RANDOM Mode**" for how to make the settings.

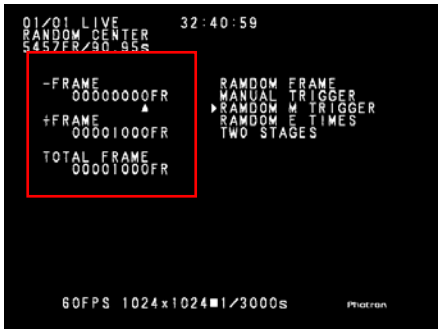
- Setting the **RANDOM MANUAL** Mode Frame Count

To use **RANDOM MANUAL** mode, what proportion of frames to record before and after the trigger must be set in advance before recording.

The procedure for making this setting is explained next.

1. Press the **MENU** key on the keypad and the menu list will display.
2. With the **ARROW** keys on the keypad, select **RANDOM M TRIGGER** from **RECORD** submenu and confirm with the **ENTER** key.

3. The **RANDOM M TRIGGER** menu is shown on the left side of the screen. The display used to specify the before/after trigger frame count is shown below.



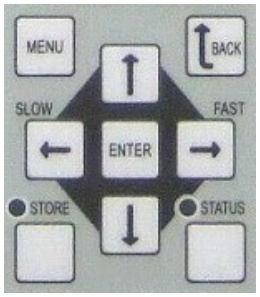
4. The meaning of each item is explained next.

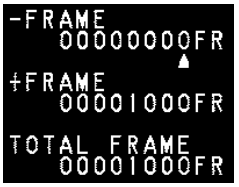
+FRAME	The number of frames to save BEFORE the trigger is received.
-FRAME	The number of frame to save AFTER the trigger is received.
TOTAL FRAME	Shows the frame count to save with 1 trigger.

When -FRAME =1, +FRAME = TOTAL FRAME, same as RANDOM mode
When -FRAME = +FRAME, same as RANDOM CENTER mode

5. Set the before trigger frame count. Operate the cursor with the keypad **ARROW** keys to set the desired frame count. By changing the before trigger frame count (**-FRAME**), the after trigger frame count (**+FRAME**) increases and decreases automatically in accordance with the recordable frame count (**TOTAL FRAME**).

↑
Up
Raise/Lower Value
Down
↓





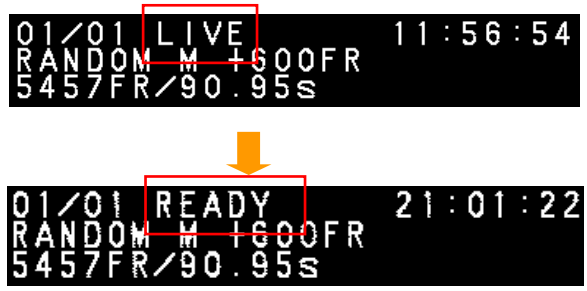
←Left Move Frame Count Digit Right→

■ Recording in **RANDOM MANUAL** Mode

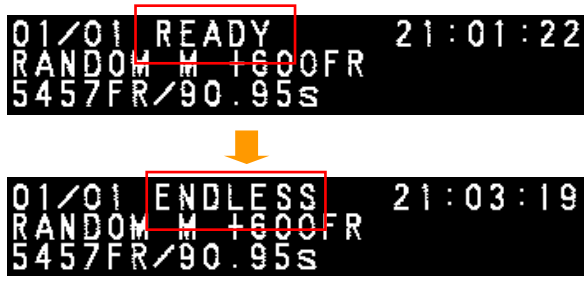
The procedure for recording in **RANDOM MANUAL** mode is explained next.

1. Following the directions in “3.5. Selecting the Trigger Mode”, verify that the camera mode is **LIVE** mode and the trigger mode is **RANDOM M**.

2. Press the **REC READY** key on the keypad. The system enters the recording ready state. Verify that the **LIVE** display in the top of the screen has changed to **READY**.



3. Press the **REC** key on the keypad. The screen display shows **ENDLESS**.



This puts the system into a state where the images are continuously written to memory in a loop.

4. Press the **REC** key on the keypad. By doing this, the camera records only the frame count specified, and waits for the next trigger signal. Trigger signals can be input by the external trigger input connector, contact signal, or TTL signal.
(See:“3.13 Using External Triggers”)

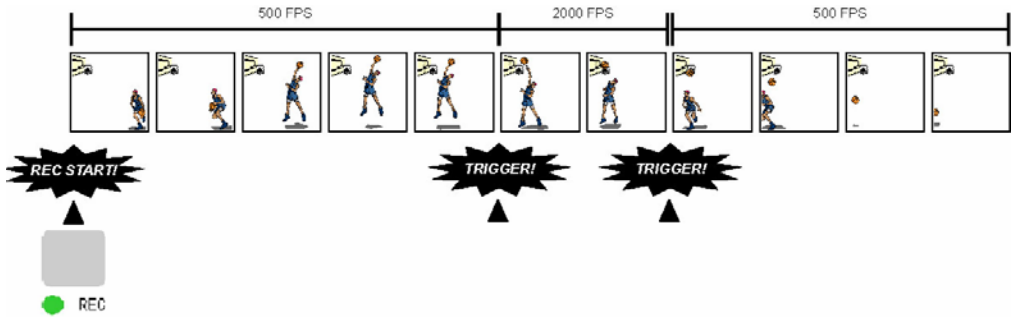
The recording operation ends when the recording memory is completely full (*). Verify that the **REC** display has changed to **LIVE**.

* To stop during the recording operation, press the **REC READY** key.

3.5.9. TWO STAGES Mode

TWO STAGES mode is a recording mode which can vary the frame rate during recording. For example, while continuously recording a basketball player as shown below, the players approach can be recorded at one speed, while his jump can be recorded at a much faster record rate.

How recording in this mode works and how to use it is explained next.



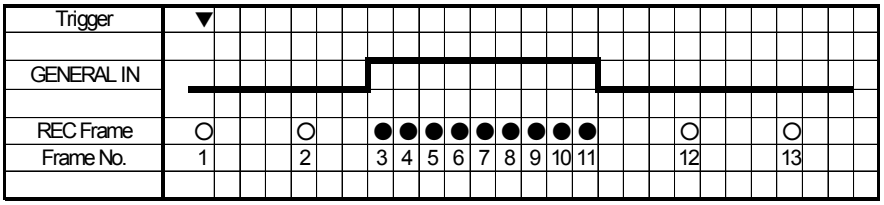
■ TWO STAGES Mode Concept/External Control Signal Input

When using **TWO STAGES** mode, first decide on the frame rate with which to record at high-speed. The low-speed portion of the recording frame rate can be set as a proportion, 1/2,1/4, or 1/8, of the higher speed framing rate.

The timing for the frame rate switch is controlled externally by the TTL signal. Use the [GENERAL IN] terminal for the TTL signal input.

■ TWO STAGES Mode Operation Image

(Relationship between GENERAL IN input and the recorded frames) (when set to x1/4)



The trigger operation in **TWO STAGES** mode is **START** mode.

Control of the switching of the low-speed/high-speed frame rate is done by inputting a **TTL** signal to the **[GENERAL IN]** terminal. There is only one high-speed recording section in the recording.

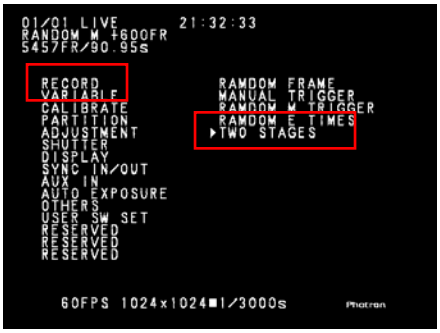
GENERAL_IN Input "H"	High-Speed Setting Operation from Next Frame
GENERAL_IN Input "L"	Low-Speed Setting Operation from Next Frame

(When the polarity is positive)

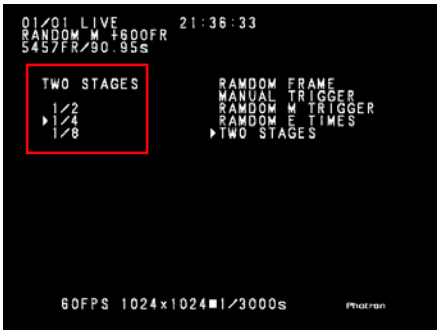
■ Setting the TWO STAGES Mode High-Speed/Low-Speed Recording Speed

The procedure for making this setting is explained next.

1. Press the **MENU** key on the keypad and the menu list will display.
2. With the **ARROW** keys on the keypad, select **TWO STAGES** from the **RECORD** submenu and confirm with the **ENTER** key.



3. The **TWO STAGES** menu is shown on the left side of the screen. The display to specify the ratio of the high-speed frame rate versus the slower speed to be used is shown.



4. Select the frame rate ratio from the proportions shown (**1/2**,**1/4**, or **1/8)**.
5. For example, when the frame rate is set to **2000 fps**, if **1/4** is selected then the frame rate for the low-speed section operates at one quarter, or **500 fps**.

■ Recording in TWO STAGES Mode

The procedure for recording in **TWO STAGES** mode is explained next.

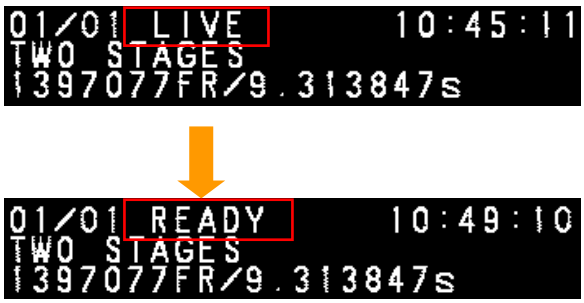
1. Following the directions in “3.5. Selecting the Trigger Mode”, verify that the camera mode is **LIVE** mode and the trigger mode is **TWO STAGES**.

2. Connect the **TTL** signal that will be used to change the recording speed to the **[GENERAL IN]** terminal. The camera operates according to the **TTL** signal input conditions listed below.

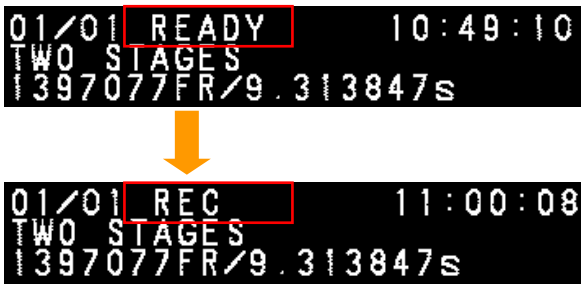
GENERAL_IN Input "H"	High-Speed Setting Operation from Next Frame
GENERAL_IN Input "L"	Low-Speed Setting Operation from Next Frame

(When the polarity is positive)

3. Press the **REC READY** key on the keypad. The system enters the recording ready state. Verify that the **LIVE** display in the top of the screen has changed to **READY**.



4. Press the **REC** key on the keypad. The screen display shows **REC** and recording begins.



5. During **REC**, the frame rate can be switched by the change in the TTL signal input to **[GENERAL IN]**.

(See: "3.13 Using External Triggers")

The recording operation ends when the recording memory is completely consumed (*). Verify that the **REC** display has changed to **LIVE**.

* To stop during the recording operation, press the **REC READY** key.

3.6. VARIABLE Setting

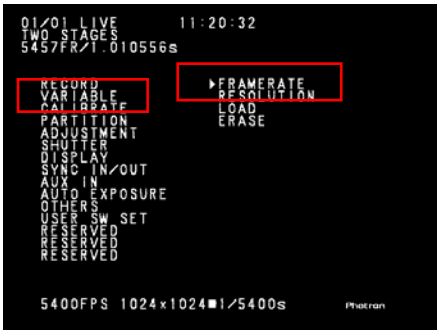
For recording condition settings, the frame rate and resolution can be set to the desired value following the conditions listed below.

- FRAMERATE can be set from 64 frame rates between 60 fps and 150,000 fps.
- The size and horizontal position of the resolution can be set in 128 (horizontal) and 16 (vertical) increments.

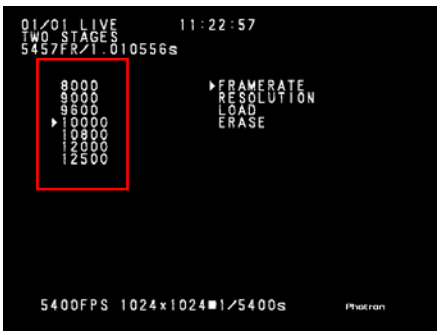
The range cannot be moved in the vertical direction with the system's variable setting.

3.6.1. Setting by Frame Rate

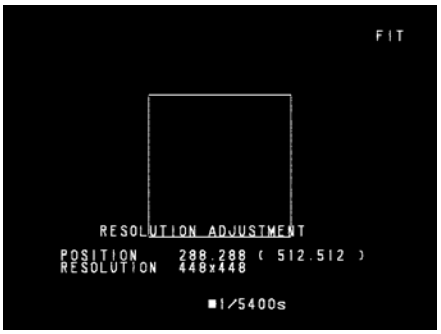
1. Press the **MENU** key on the keypad and the menu list will display.
2. With the **ARROW** keys on the keypad, select **FRAMERATE** from the **VARIABLE** submenu and confirm with the **ENTER** key.



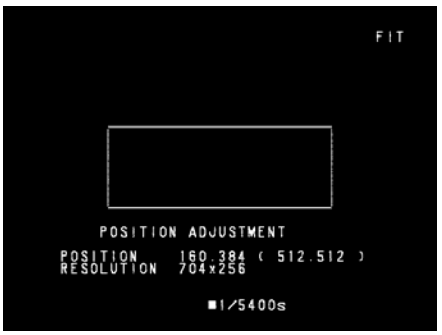
3. The **FRAMERATE** menu is shown on the left side of the screen. With the **ARROW** keys on the keypad, select the value and confirm with the **ENTER** key.



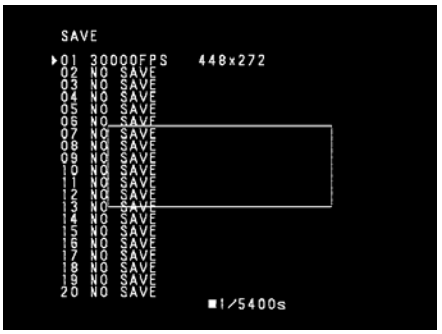
4. The screen becomes the **RESOLUTION ADJUSTMENT** screen.
The maximum resolution that is recordable at the frame rate selected is displayed as white square (the white frame in the diagram below). The maximum resolution is displayed as a square, and **POSITION** displayed on the screen displays the coordinates of the upper-left hand corner of the frame.



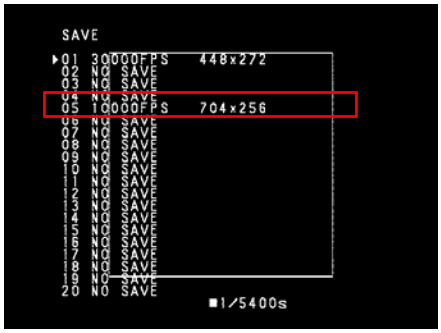
5. Set the resolution. With the **ARROW** keys on the keypad, select the resolution and confirm with the **ENTER** key.
The step change is a distance horizontally of 128 dots and vertically of 16 lines.
The screen changes to the **POSITION ADJUSTMENT** screen.



6. Next, set the image position. With the **ARROW** keys on the keypad, set the position and confirm with the **ENTER** key.
The step change is a distance horizontally of 32 dots. (You cannot move vertically.)
The screen changes to the **SAVE** screen.

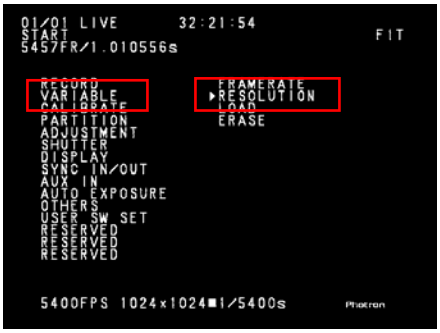


7. Save the settings. With the **ARROW** keys on the keypad, specify a location (between 01 and 20) to save this speed/resolution/position combination to, and confirm with the **ENTER** key.

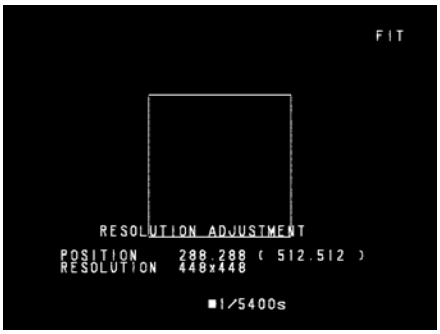


3.6.2. Setting by RESOLUTION

1. Press the **MENU** key on the keypad and the menu list will be displayed.
2. With the **ARROW** keys on the keypad, select **RESOLUTION** from the **VARIABLE** submenu and confirm with the **ENTER** key.



3. The screen becomes the **RESOLUTION ADJUSTMENT** screen.
The maximum resolution that is recordable at the frame rate set is displayed as a white square (the white frame in the diagram below). The maximum resolution is displayed as a square, and **POSITION** displayed on the screen displays the coordinates of the upper-left of the frame.

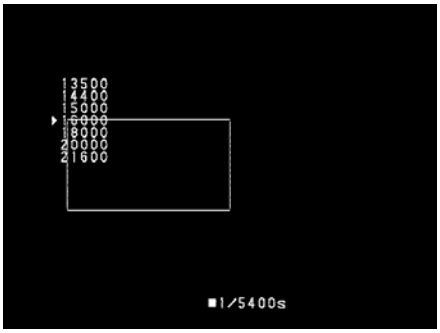


4. Set the resolution. With the **ARROW** keys on the keypad, select the resolution and confirm with the **ENTER** key.
The step change is a distance horizontally of 128 dots and vertically of 16 lines.
The screen changes to the **POSITION ADJUSTMENT** screen.

5. Next, set the image position. With the **ARROW** keys on the keypad, set the position and confirm with the **ENTER** key.

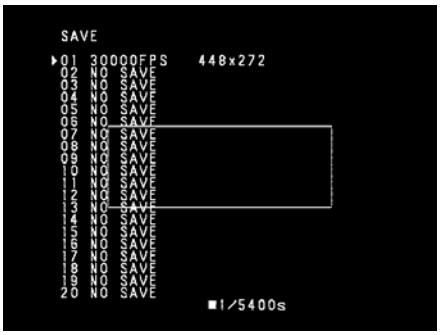
The step change is a distance horizontally of 32 dots. (You cannot move vertically.)

The screen changes to the resolution selection screen.



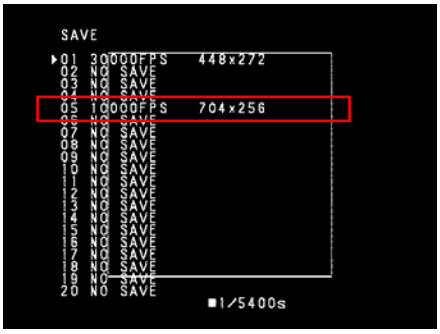
6. The list of **FRAMERATE** values available at the selected resolution is shown on the left side of the screen. With the **ARROW** keys on the kepad, select the value and confirm with the **ENTER** key.

The screen changes to the **SAVE** screen.



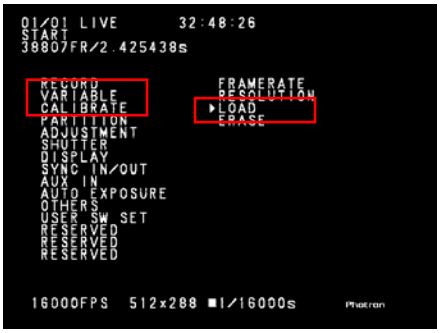
7. Save the settings. With the **ARROW** keys on the keypad, set the location number to store this frame rate/resolution combination to (between 01 and 20) and confirm with the **ENTER** key.

20 patterns can be saved.



3.6.3. Loading VARIABLE Setting Data

1. Press the **MENU** key on the keypad and the menu list will display.
2. With the **ARROW** keys on the keypad, select **LOAD** from the **VARIABLE** submenu and confirm with the **ENTER** key.

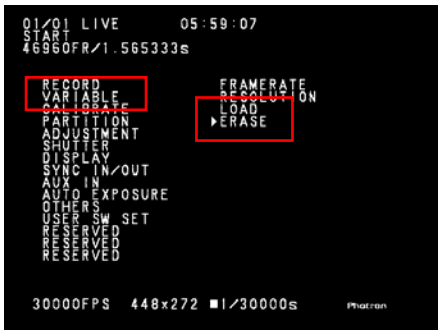


3. The settings list is shown on the left side of the screen. With the **ARROW** keys on the keypad, select the desired settings and confirm with the **ENTER** key.

4. The recorded data is reflected on the screen, and when you leave the menu, the screen will return to the normal **LIVE** screen.

3.6.4. Deleting VARIABLE Setting Data

1. Press the **MENU** key on the keypad and the menu list will display.
2. With the **ARROW** keys on the keypad, select **ERASE** from the **VARIABLE** submenu and confirm with the **ENTER** key.



3. The settings list is shown on the left side of the screen. With the **ARROW** keys on the keypad, select the setting to delete and confirm with the **ENTER** key.

4. The setting is deleted and the entry changes to the **NO SAVE** display.

*While using one of the listed settings that were created with **VARIABLE**, this Erase function does not work.

3.7. White Balance Adjustment (Color Models Only)

On digital cameras, photographing white as pure white is described as “having the appropriate white balance.” In order to take images with the correct color representation with this system’s color models, the white balance must be adjusted for the correct 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.

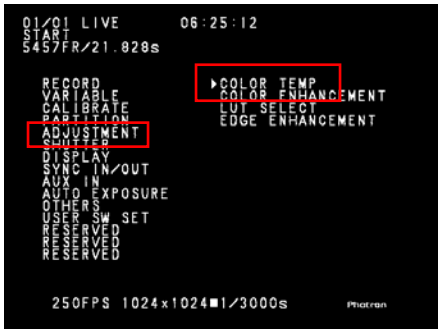
3.7.1. Using Preset White Balance

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.

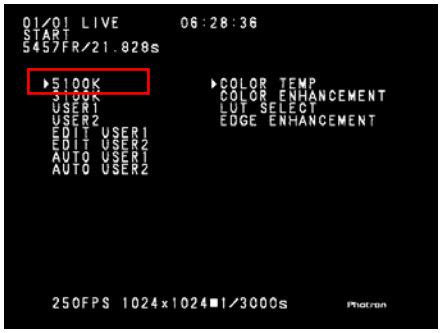
5100K (Daylight, Outdoors)

3100K (Halogen Light Source)

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **COLOR TEMP** from the **ADJUSTMENT** submenu with the **ARROW** keys on the keypad and press the **ENTER** key.



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



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

3.7.2. Using User White Balance

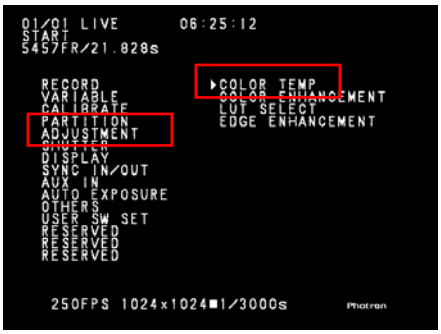
User white balance can be set in order to achieve the most appropriate white balance for the lighting and conditions during recording.

The values set here are stored in the camera internal memory as a user preset, and the values can be later loaded by selecting **USER**.

There are also two methods for setting user white balance, **AUTO USER** and **EDIT USER**. Both of these methods are explained here.

■ Making Settings with AUTO USER

1. Set the desired conditions (frame rate, shutter speed, resolution) with which to make the recording.
2. Press the **MENU** key on the keypad and the menu list will display.
3. Select **COLOR TEMP** from the **ADJUSTMENT** submenu with the **ARROW** keys on the keypad and press the **ENTER** key.



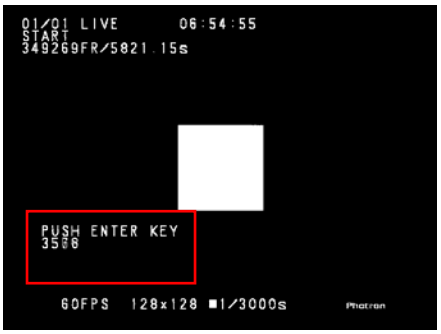
4. Select **AUTO USER1** or **AUTO USER2** and press the **ENTER** key to enter the white balance adjustment mode.

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 be used during the recording, and in the center of the screen, shoot an object, such as a sheet of white paper, to provide white calibration.

7. Adjust the lens aperture and the light intensity, as you do this verify that the value at the bottom left of the screen changes with the intensity of the light entering the camera. If the brightness on the screen is changing but the display does not, verify that the white object is seen in the middle of the screen.

8. 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** will be displayed, reduce the light intensity to rectify this.

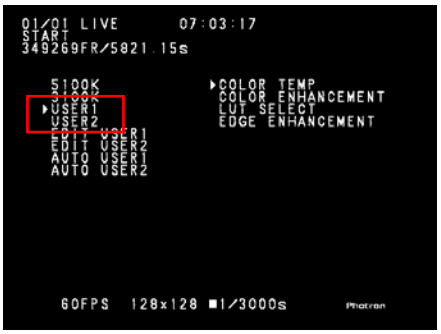


9. Press the **ENTER** key when the **PUSH ENTER KEY** message is shown.

10. With this operation, the camera acquires the appropriate white balance value. Visually verify that the display image has been adjusted.

11. These values can be loaded by selecting **USER1** or **USER2**.

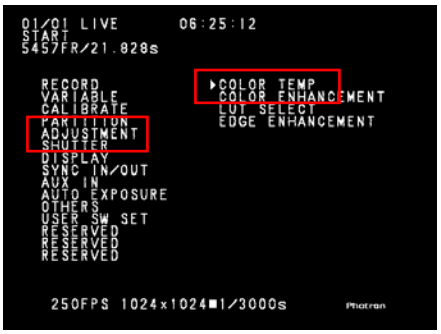
* **AUTO USER1** is saved in **USER1**. **AUTO USER2** is saved in **USER2**.



■ Making Settings with EDIT USER

The white balance can be set automatically, and the user can adjust the tint by changing the RGB values. The value acquired by **AUTO USER1** or **AUTO USER2** can also undergo fine adjustment. The method for using **EDIT USER1** or **EDIT USER2** to make settings is explained here.

1. Set the desired conditions (frame rate, shutter speed, resolution) with which to make the recording.
2. Press the **MENU** key on the keypad and the menu list will display.
3. Select **COLOR TEMP** from the **ADJUSTMENT** submenu with the **ARROW** keys on the keypad and press the **ENTER** key.



4. Select **EDIT USER1** or **EDIT USER2** 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 **USER1** or **USER2**.

* **EDIT USER1** is saved in **USER1**. **EDIT USER2** is saved in **USER2**.

3.8. Color Enhancement (Color Models Only)

For color models, the image color enhancement level can be adjusted in five steps including the OFF setting.

1. Press the **MENU** key on the keypad, then select **COLOR ENHANCEMENT** from the **ADJUSTMENT** submenu and press the **ENTER** key.

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

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

3. Use the ↑ ↓ keys to select one of the modes listed above. When finished, press the **ENTER** key to complete the setting.

3.9. 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 that can display the image data taken with improved contrast (light and dark sharpness), or it can make an object in the image stand out by emphasizing a specified gray level range.

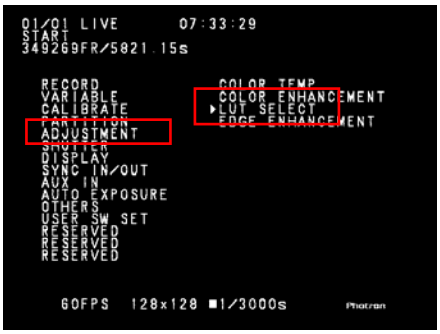
The **LUT** in the system and the relationship between video output and the **PC** software is explained in this section.

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

3.9.1. Using Preset LUT Patterns

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

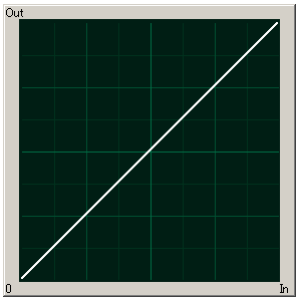
1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **LUT SELECT** from the **ADJUSTMENT** submenu with the **ARROW** keys on the keypad and press the **ENTER** key.



3. Select a setting, **D1** through **D6**, and that **LUT** setting is loaded.

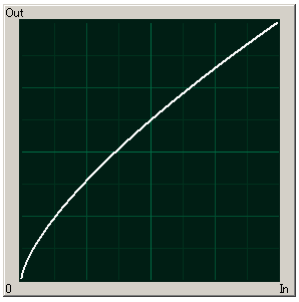
D1: GAIN 1x

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



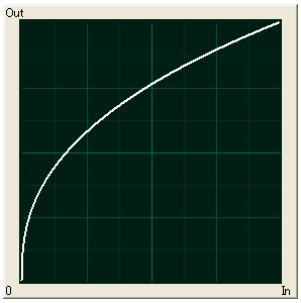
D2: Gamma 0.6

This **LUT** with 0.6 gamma correction.



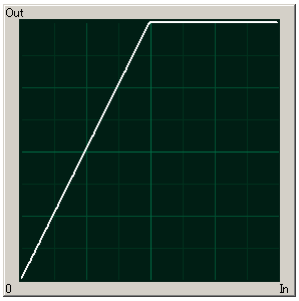
D3: Gamma 0.45

This **LUT** with 0.45 gamma correction.



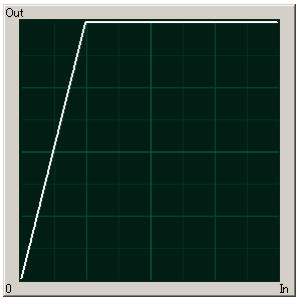
D4: Gain 2x

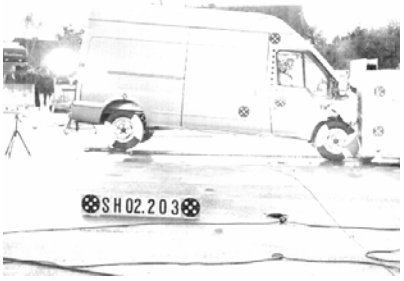
The gain is doubled, and it emphasizes the dark areas of the image.



D5: Gain 4x

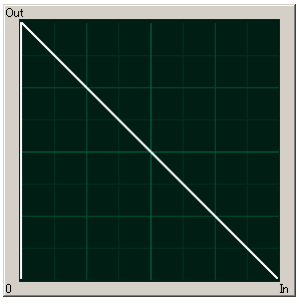
The gain is quadrupled, and it can display the dark areas of the image emphasized. This LUT emphasizes the dark portions even more than **D4**.





D6: Reverse Gradation

The input gradation is reversed and then displayed.

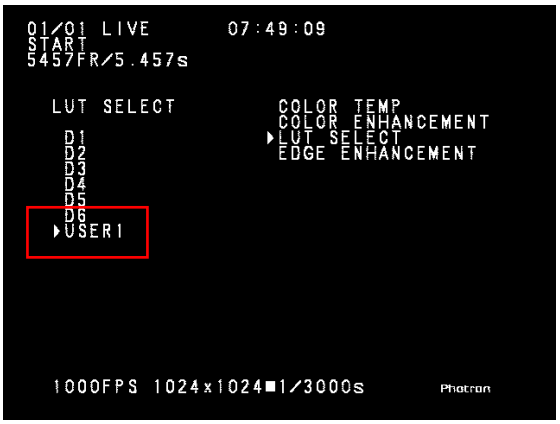


3.9.2. Using a Custom LUT

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

- **About USER1**

Use a custom **LUT** created with **PFV**.

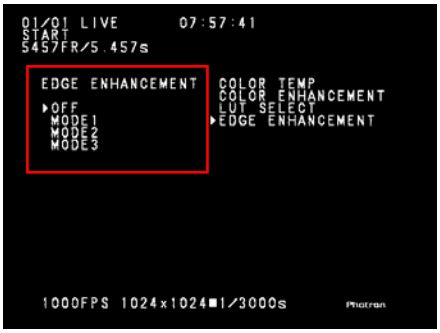


3.10. Edge Enhancement Function

Edges within the recorded image are enhanced in three steps with the system's edge enhancement setting.

1. Press the **MENU** key on the keypad, then select **EDGE ENHANCEMENT** from the **ADJUSTMENT** submenu and press the **ENTER** key.

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



3. Use the **ARROW** keys to select one of the modes listed above. When finished, press the **ENTER** key to complete the setting.

3.11. Partition Memory and Recording

The system includes either standard 8 GB, or maximum 16 GB of high-capacity memory for recording use.

These recording memory can be partitioned and assigned to different recordings. The memory partitions are partitioned into equal sizes and a maximum of 64 partitions can be set. The partitioned section is managed by an ID number.

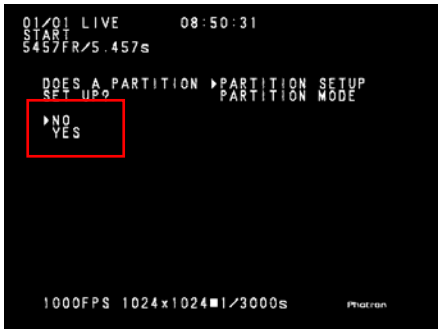
Each of the sections can be set with completely independent recording conditions, so this feature is convenient when taking consecutive recordings with variable conditions.

3.11.1. Preparing a Memory Partition

To use memory partitions, the partition the memory must be set in advance before recording. The procedure for making these settings is explained here.

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **PARTITION SETUP** from the **PARTITION** submenu with the **ARROW** keys on the keypad and press the **ENTER** key.

3. A message to confirm whether or not to setup partitions is displayed.
   To setup the partitions, select **YES**. The setup menu is displayed.



4. Select the partition number with the **ARROW** keys. When finished, press the **ENTER** key to complete the setting.

* Verify that the **ID** display on the screen has changed to the fraction display.

3.11.2. Record to a Partitioned Section

How to record in the memory partition mode is explained here.

1. Verify that the system is in the **LIVE** mode.
2. Select the section **ID** you wish to record to with the **ARROW** keys.

Verify the **ID** display on the screen.

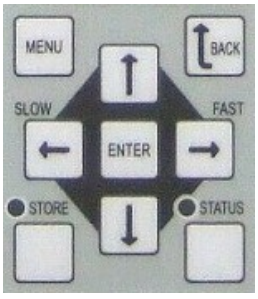
↑

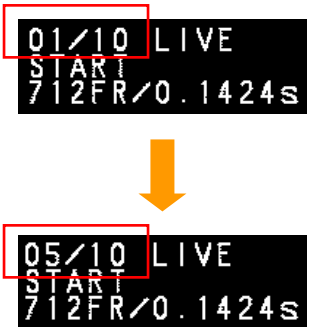
Up

Select ID

Down

↓





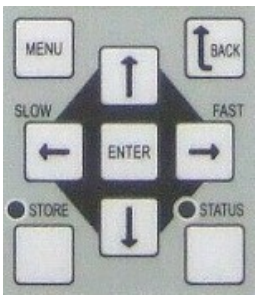
3. When the partition **ID** you wish to record to is set, record using the normal recording procedure.

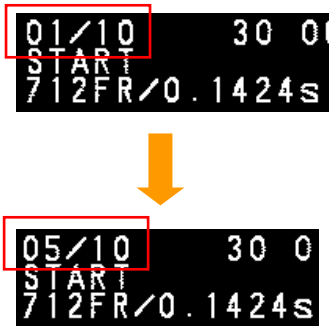
3.11.3. Play a Recorded Section

The images recorded to each of the partition sections can be played by selecting the relevant partitions **ID**.

1. Verify that the system's mode is **MEMORY** mode.
2. Select the section **ID** you wish to play with the **ARROW** keys. Verify the **ID** display on the screen.

↑
Up
Select ID
Down
↓





3. When the section **ID** you wish to play is set, play it following the normal recording procedure.

3.11.4. PARTITION MODE

Section “3.11.2 Record to a Partitioned Section” explained the operation when **MODE1** is selected on the **PARTITION MODE** menu. When **MODE2** is selected, it is not necessary to manually the **ID**.

■ **The operation shown below is when the partition count is set to10.**

1. Put the system in the **READY** state with **ID01**.
2. Input the **REC** trigger and start recording.
3. Recording ends.
4. The **ID** automatically changes to **02** and the system is waiting for the next **REC** trigger input. While waiting for the **REC** trigger, the system is in the **READY** state in **START** mode and the **ENDLESS** state in **CENTER**, **END**; and **MANUAL** modes.
5. Input the **REC** trigger and start recording.
6. Recording ends.
7. The **ID** automatically changes to **03** and the system waits for the next **REC** trigger input.
8. After that, steps 2, 3, and 4 are repeated, recording finishes when ID10 is recorded, and then the system returns to the **LIVE** mode.

This saves having to increment the IDs by hand each time and returning the system into **READY** state, so it is better suited for consecutive recordings.

MODE2 operation is only valid when the trigger mode is the following modes.
START, **CENTER**, **END**, **MANUAL**

3.12. Input/Output Signal Types

Many signals can be input and output on the system using the **I/O cable**. These signals are listed below.

Do not input signal other than the specified signal.

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

3.12.1. TRIG TTL IN Connector

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

Input voltage is 0 V to +12 V (H level +4.5 V to +12 V), positive or negative polarity, pulsewidth is 50 ns or greater.

Operating current is 10 mA recommended, 30 mA maximum.

3.12.2. TRIG TTL OUT Connector

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

3.12.3. TRIG SW IN Connector

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

3.12.4. SYNC IN Connector

The system recognizes a TTL signal from other devices as a synchronization signal.

Input voltage is 0 V to +12 V (H level +4.5 V to +12 V), positive or negative polarity, pulsewidth is 50 ns or greater.

Operating current is 10 mA recommended, 30 mA maximum.

3.12.5. GENERAL IN Connector

The effect when a signal is input is described below, and can be optionally selected and set. The setting is made from the menu or PFV. To make the setting from the menu, refer to "**3.15.1 GENERAL IN Signal Settings**". To make the setting from PFV, refer to the "**Photron FASTCAM Viewer User's Manual**".

The input voltage is 0 V to +12 V (H level +4.5 V to +12 V), positive or negative polarity, pulsewidth is 50 ns or greater.

Operating current is 10 mA recommended, 30 mA maximum.

EVENT	Input an event signal (event marker).
TRIG POS/NEG	Input a TTL trigger signal.
READY	Input a change recording ready status signal (READY

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

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

Refer to "**3.15.2 GENERAL OUT Signal Settings**" for details.

SYNC POS/NEG	Output a vertical synchronization signal.
EXPOSE POS/NEG	Output an exposure time signal. * Output both during LIVE and recording.
REC POS/NEG	Output an interval signal during recording.
TRIG POS/NEG	Output the trigger signal the camera received.
READY POS/NEG	Output a signal that indicates the recording ready state.

3.13. Using External Triggers

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

3.13.1. Using External Triggers

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

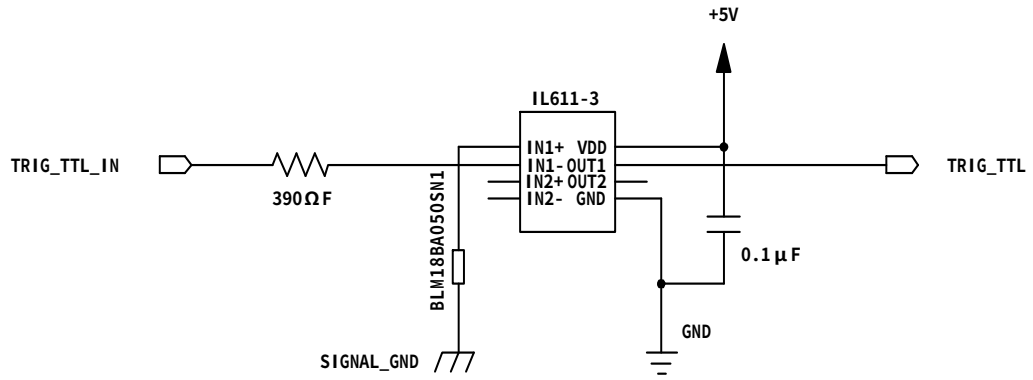
External trigger signal input settings are also made by selecting **SYNC IN/OUT** from the menu, and then **TRIG TTL IN** and **GENERAL IN** from the submenu.

The signals input from the **TRIG TTL IN** connector and the **GENERAL IN** connector explained in section “2.2.7. I/O Cable”.

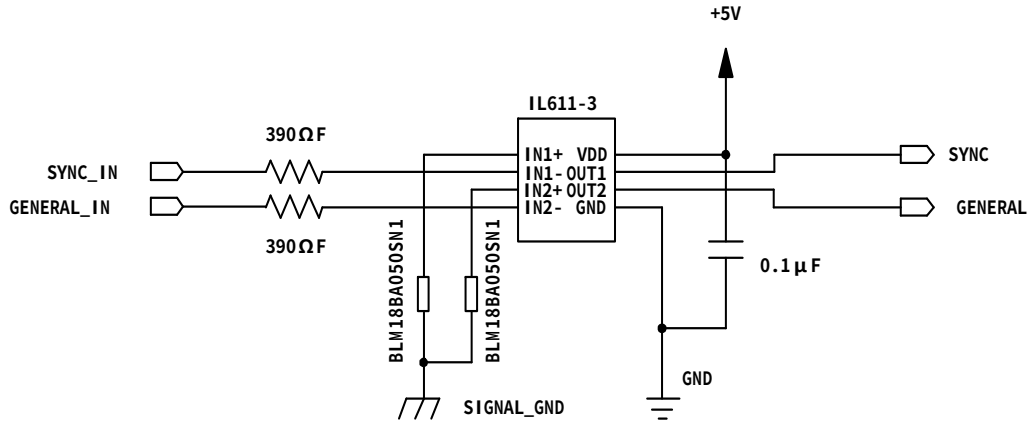
When a trigger signal is input to GENERAL IN, set the signal to be input from the menu prior use. For GENERAL IN settings, refer to section “3.15.1. GENERAL IN Signal Settings” and make the necessary settings.

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

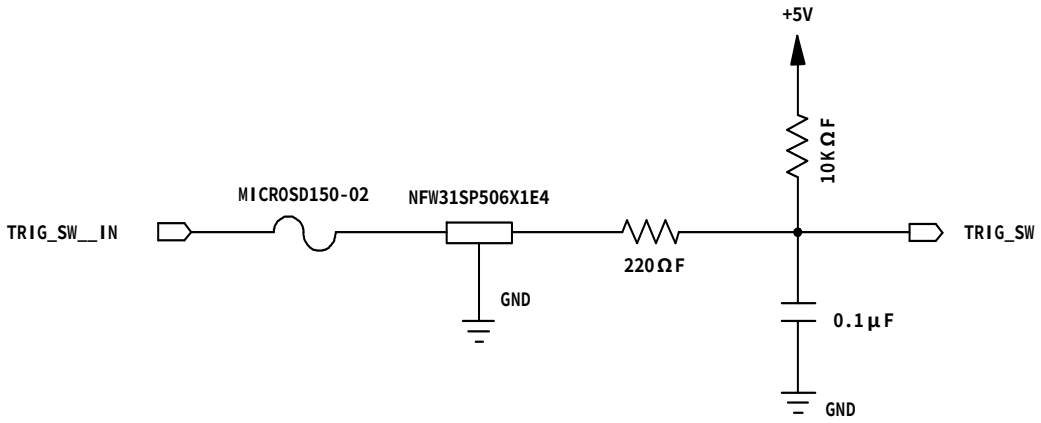
TRIG TTL IN Circuit Diagram



GENERAL IN Circuit Diagram



SW IN Circuit Diagram



3.13.2. Outputting External Trigger Signals

Trigger signals can be output externally from the system. Output can be made with the provided **TRIG TTL OUT** connector's specialized trigger output system, and output can also be optionally set from the **GENERAL OUT** connector. External trigger signal output settings are also made by selecting **SYNC IN/OUT** from the menu, and then **TRIG TTL OUT** and **GENERAL OUT** from the submenu.

The signals are output from the **TRIG TTL OUT** connector and the **GENERAL OUT** connector explained in section "**2.2.7. I/O Cable**".

When a trigger signal is output from **GENERAL OUT**, it is necessary to set the signal to be output from the menu in advance. For **GENERAL OUT** settings, refer to section "**3.15.2. GENERAL OUT Signal Settings**" and make the necessary settings.

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

Connector Name	Menu Setting	Signal Type	Reference Delay Amount
TRIG TTL OUT	TRIG POS	TTL, SW, SOFT, all TRIG pulse output CMOS (74ACT541 buffer) output, positive polarity	Approx. 40 µsec for TRIG SW IN Approx. 100 ns for TRIG TTL IN, GENERAL IN
	TRIG NEG	TTL, SW, SOFT, all TRIG pulse output CMOS (74ACT541 buffer) output, negative polarity	
	TTL IN THRU POS	TTL IN through output CMOS (74ACT541 buffer) output, positive polarity	Approx. 50 ns for TRIG TTL IN
	TTL IN THRU NEG	TTL IN through output CMOS (74ACT541 buffer) output, negative polarity	
GENERAL OUT	TRIG POS	TTL, SW, SOFT, all TRIG pulse output CMOS (74ACT541 buffer) output, positive polarity	Approx. 40 µsec for TRIG SW IN Approx. 100 ns for TRIG TTL IN, GENERAL IN
	TRIG NEG	TTL, SW, SOFT, all TRIG pulse output CMOS (74ACT541 buffer) output, negative polarity	

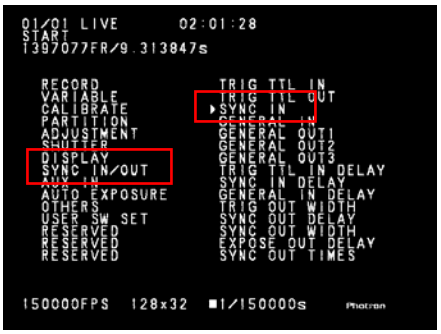
3.14. Using External Synchronization Signals

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

3.14.1. Inputting an External Synchronization Signal

An external synchronization signal can be input on the system. The procedure for setting external input is explained below.

1. Input the synchronization signal via the SYNC IN BNC connector as explained in section "2.2.7. I/O Cable".
2. The LED (yellow) labeled **SYNC IN** on the back of the camera body will illuminate.
3. Press the **MENU** key on the keypad and the menu list will display.
4. Select **SYNC IN** from the **SYNC IN/OUT** submenu with the **ARROW** keys and press the **ENTER** key.



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

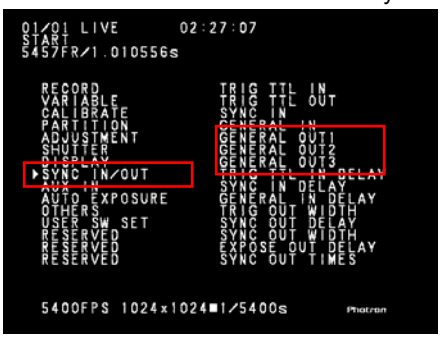
Menu Display	Content	Signal (Input Signal
OFF	Turns external synchronization off, operate	(none)
ON CAM POS	Synchronize to a positive polarity signal from a FASTCAM SA1.	TTL level, positive polarity
ON CAM NEG	Synchronize to a negative polarity signal from a FASTCAM SA1.	TTL level, negative polarity
ON OTHERS POS	Synchronize to a positive polarity signal from an external device (including other Photron products).	TTL level, positive polarity
ON OTHERS NEG	Synchronize to a negative polarity signal from an external device (including other Photron products).	TTL level, negative polarity

6. Select the menu to set with the **ARROW** keys.
7. When the setting is complete, press the **ENTER** key to finish.

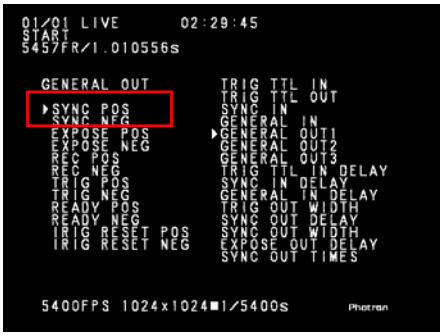
3.14.2. Outputting an External Synchronization Signal

The system can output a synchronization signal externally. The external synchronization signal is output from the **GENERAL OUT** connector explained in section “2.2.7. I/O Cable”. The procedure for setting external synchronization signal output is explained below.

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **GENERAL OUT1** (When setting the **GENERAL OUT2** connector, **GENERAL OUT2**) from the **SYNC IN/OUT** submenu with the **ARROW** keys.



3. The menu is displayed. When performing external synchronization, use either **SYNC POS** or **SYNC NEG**. View the chart on the next page for details.



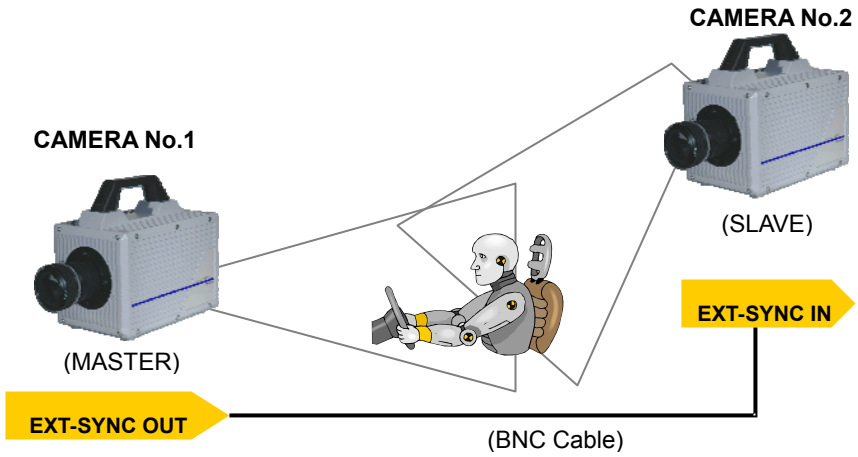
Menu Display	Content	Signal Type	Input/Output Delay Amount
SYNC POS	Output a vertical synchronization	CMOS (74ACT541 buffer) Output Positive Polarity	Approx. 100 ns
SYNC NEG	Output a vertical synchronization	CMOS (74ACT541 buffer) Output Negative Polarity	Approx. 100 ns

4. Select the output signal with the **ARROW** keys.
5. When the setting is complete, press the **ENTER** key to finish.

3.14.3. Synchronizing Multiple FASTCAM SA1 Systems

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

Conceptual Diagram of a Synchronized Connection



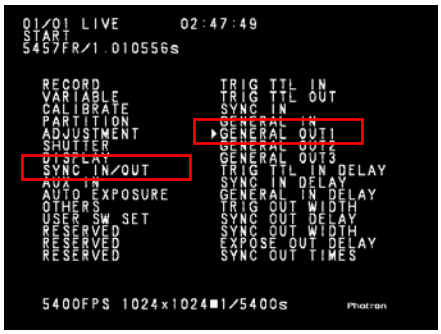
The external synchronization signal settings are explained here for when it is necessary to use two systems to make a synchronized recording.

First, decide on the camera to make the master camera (synchronization output) and the slave camera (synchronization signal receiver) from the two systems to use for synchronized recording.

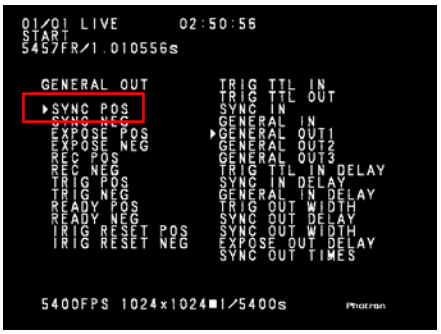
■ Setting the Master Camera (Synchronization Output)

Select the master camera and set signal output which will output the synchronization signal to any slaves.

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **GENERALOUT1** from the **SYNC IN/OUT** submenu with the **ARROW** keys on the keypad and press the **ENTER** key.



3. From the menu, select the signal to output from the master camera's **GENERAL OUT1** connector. Move the cursor to the **SYNC POS** item with the **ARROW** keys and press the **ENTER** key to select.



4. The master camera is set to output a positive polarity vertical synchronization signal from its **GENERAL OUT1** connector.

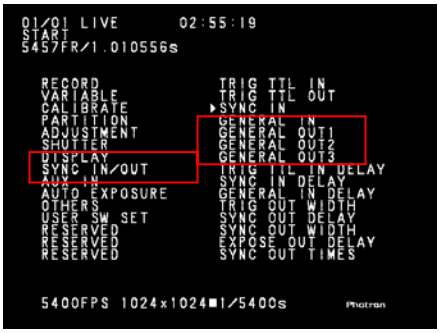
■ Setting the Slave Camera (Synchronization Signal Receiver)

Next, set the synchronization signal input for the slave camera which will receive the synchronization signal supplied by the master camera.

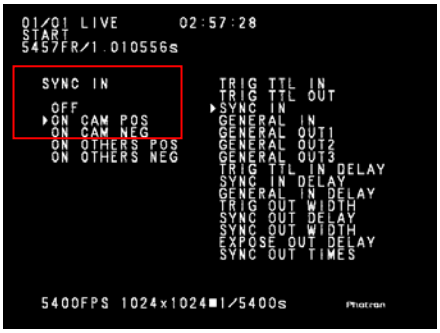
1. Input the slave camera's synchronization. Connect the master camera's **GENERAL OUT1** connector and the slave camera's **SYNC IN** connector using a **BNC** cable. When the synchronization signal is input to the **SYNC IN** connector, the **SYNC IN LED** (yellow) on the back of the slave camera will illuminate.

2. Set the synchronization signal type that slave camera will receive. Press the **MENU** key on the keypad and the menu list will display.

3. Select **SYNC IN** from the **SYNC IN/OUT** submenu with the **ARROW** keys and press the **ENTER** key.



4. The output previously set on the master camera 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 **ARROW** keys and press the **ENTER** key to select.



If steps 2-4 are completed when no synchronization signal is being input, the camera will not operate normally.

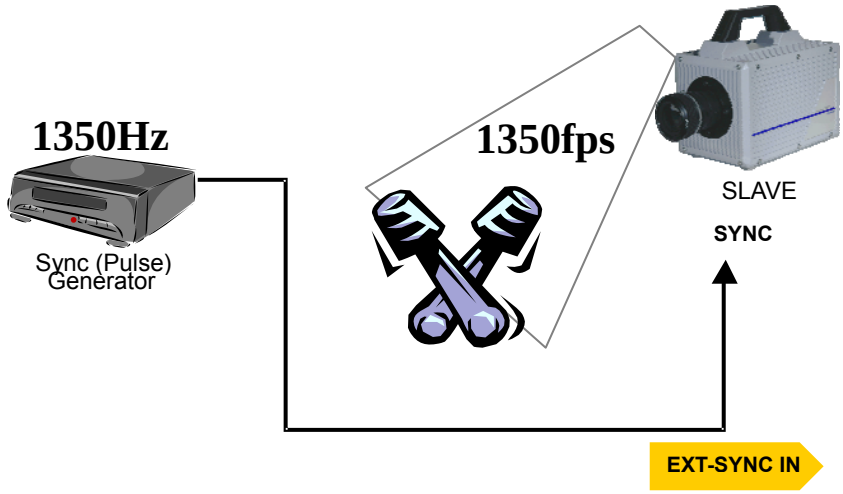
As detailed in the procedure, make the settings after the signal has been input.

3.14.4. Synchronizing the System with Other External Devices (Frame Rate Synchronization Recording)

In addition to the frame rate setting on the system, a function has been provided that can record by receiving an external synchronization signal after setting the frame rate to the frequency of the signal.

In this way, for example, the system can be synchronized with a dynamic body that spins at 1350 revolutions a second to conduct high-speed recording at 1350 fps. This can open up broad applications that were unavailable until now.

Conceptual Diagram of External Synchronized Recording



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

■ Synchronization Signals That Can Be Input

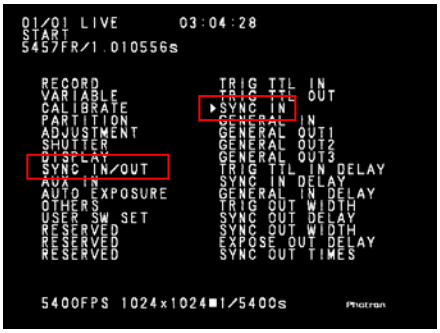
When conducting frame rate synchronization recording with the system, the signal that can be input must meet the following conditions.

- **TTL** level, positive polarity or negative polarity
- **60 Hz** (**50 Hz** for PAL) to **150,000 Hz**

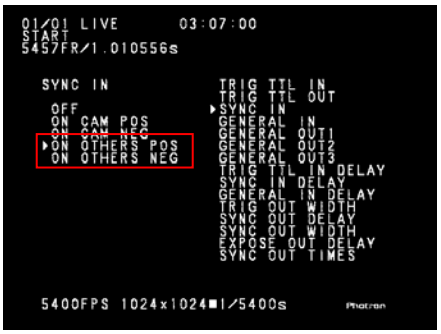
■ System Settings

1. Input the synchronization signal from the generating device to the system. Connect the synchronizing device's output signal to the system's **SYNC IN** connector using a **BNC** cable.
2. When the synchronization signal is input to the **SYNC IN** connector, the **SYNC IN LED** (yellow) on the back of the system will illuminate. (* If the synchronization signal is lost, the LED goes out.)
3. Press the **MENU** key on the keypad and the menu list will display.

4. Select **SYNC IN** from the **SYNC IN/OUT** submenu with the **ARROW** keys and press the **ENTER** key.



5. Select the input signal with the **ARROW** keys. Select **ON OTHERS POS** (positive polarity) or **ON OTHERS NEG** (negative polarity) according to the polarity of the external synchronization signal.



6. When the setting is complete, press the **ENTER** key to finish.
7. Output the signal from the synchronization device and verify that the system recognizes the output frequency and synchronizes the frame rate accordingly. 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 7 after changing the frequency. The settings are redone.

If no synchronization signal is input, the input signal is under 60 Hz (50 Hz), during steps 3-7, or the synchronization signal is lost, the display shows "**NO SYNC INPUT**".

If steps 3 through 7 are set with inputting a signal over 150,000 Hz, the display shows "**OVER SYNC INPUT**".

In either case, normal recording cannot be done.

The particular nature of the internal circuitry for this feature inevitably causes a minute error in the internal electronics against the input sync signal.

In the actual operation of the circuitry, an error of ±18.5 ns is caused to the input sync signal. In addition, because the frame rate indication on the monitor screen is made at 1 Hz increment, this error may be displayed with a larger number than the actual error being caused (an error of ±1 to 5 Hz may be displayed).

For example, when operating the camera with an external sync signal of 10,000 Hz, the indication on the monitor may be:

10000 Hz ±1 Hz = 9999 to 10001 FPS

3.14.5. Synchronizing the System with Other Cameras (Mixed-Type Synchronized Recording)

Using the function (frame rate synchronization recording) in the previous section, "**3.14.4 Synchronizing the System with Other External Devices**", mixed-type synchronized recording can be performed with other Photron high-speed cameras (except some older products).

In particular, the FASTCAM-APX RS and the FASTCAM MH4-10K are also compatible with collective control by the PFV control software.

The Standard Procedure

1. Decide the master camera (the source of the synchronization signal) and the slave camera (the cameras that will operate synchronized to the 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 that the slave camera cannot accept.

2. Connect the master camera's V-SYNC output connect 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.

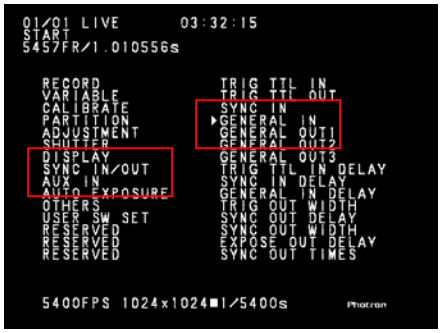
For camera models that can do synchronized recordings or for detailed instructions on making the settings, contact Photron.

3.15. GENERAL Signal Settings

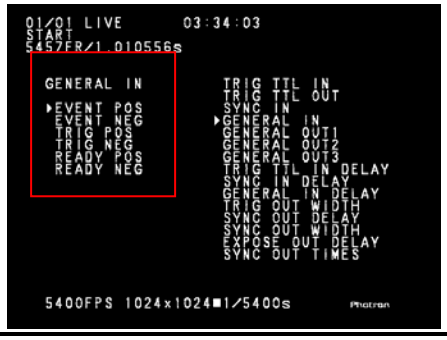
3.15.1. GENERAL IN Signal Settings

Select a signal for output from the **GENERAL IN** connector as explained in section "**3.12. Input/Output Signal Types**".

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **GENERAL IN** from the **SYNC IN/OUT** submenu with the **ARROW** keys on the keypad and press the **ENTER** key.



3. The **GENERAL IN** menu is displayed. The content of each item is listed in the chart below.



Menu Display	Content	Reference (Input Signal Conditions)
EVENT POS	Input a positive polarity event signal.	TTL Level, Positive Polarity
EVENT NEG	Input a negative polarity event signal.	TTL Level, Negative Polarity
TRIG POS	Input a positive polarity trigger signal.	TTL Level, Positive Polarity
TRIG NEG	Input a negative polarity trigger signal.	TTL Level, Negative Polarity
READY POS	Input a positive polarity READY signal. The camera's READY ON/OFF is switched by a pulse input.	TTL Level, Positive Polarity
READY NEG	Input a negative polarity READY signal. The camera's READY ON/OFF is switched by a pulse input.	TTL Level, Negative Polarity

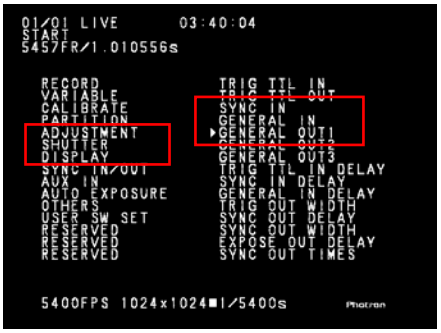
* For details on the **EVENT POS/NEG** setting, refer to "3.17. Event Marker Function".

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

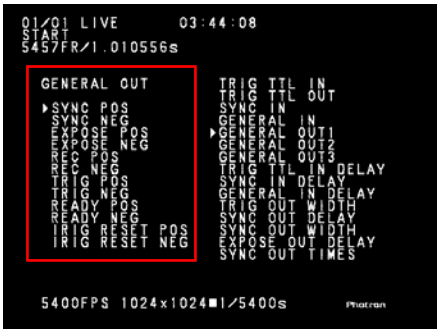
3.15.2. GENERAL OUT Signal Settings

Select a signal for output from the **GENERAL OUT** connector as explained in section "**3.12. Input/Output Signal Types**". There are three **GENERAL OUT** connectors and settings can be made for each connector individually.

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **GENERAL OUT1** (When setting connector 2, select **GENERAL OUT2**) from the **SYNC IN/OUT** submenu with the **ARROW** keys on the keypad and press the **ENTER** key.



3. The **GENERAL OUT1** menu is displayed. The content of each item is listed in the chart below.



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

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

3.16. Signal Delay

A signal delay time or pulsewidth for the various signals that are input and output can be set on the system. The procedure for making these settings is explained here.

- **TRIG TTL IN DELAY**

  Setting Range: **0-60 (s)**, in **100 ns** units

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

A pre-specified delay is implemented from the instant the trigger signal is input, the system will recognize and respond to the trigger input only after the specified amount of time set has elapsed. Increase or decrease the value with the **ARROW** ↑ ↓ keys, move the digit with the ←→ keys.

- **SYNC IN DELAY**

  Setting Range: **0-1**/frame rate **(s)**, in **100** ns units

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

From the instant the synchronization signal is input, the system will recognize the synchronization signal later than normal, after the specified amount of time set has elapsed. Increase or decrease the value with the **ARROW** ↑ ↓ keys, move the digit with the ←→ keys.

- **GENERAL IN DELAY**

  Setting Range: **0-60** (s), in **100 ns** units

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

From the instant the **GENERAL** signal is input, the system will recognize the **GENERAL** signal later than normal, after the specified amount of time set has elapsed. Increase or decrease the value with the **ARROW** ↑ ↓ keys, move the digit with the ←→ keys.

■ **TRIG OUT WIDTH**

Setting Range: **0-1 (ms)**, in **100 ns** units

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

Set the output **TTL** signal's pulsewidth (length). Increase or decrease the value with the **ARROW** ↑ ↓ keys, move the digit with the ←→ keys.

■ **SYNC OUT DELAY**

Setting Range: **0-1**/frame rate **(s)**, in **100 ns** units

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

The synchronization signal will be output later than normal, delayed by the amount of time set here. Increase or decrease the value with the **ARROW** ↑ ↓ keys, move the digit with the ←→ keys.

■ **SYNC OUT WIDTH**

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

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

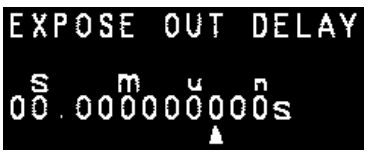
Set the output synchronization signal's pulsewidth. Increase or decrease the value with the **ARROW** ↑ ↓ keys, move the digit with the ←→ keys.

■ **EXPOSE OUT DELAY**

Setting Range: **0-1**/frame rate **(s)**, in **100 ns** units

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

The exposure period signal will be output later than normal, delayed by the amount of time set here. Increase or decrease the value with the **ARROW** ↑ ↓ keys, move the digit with the ←→ keys.



■ **SYNC OUT TIMES**

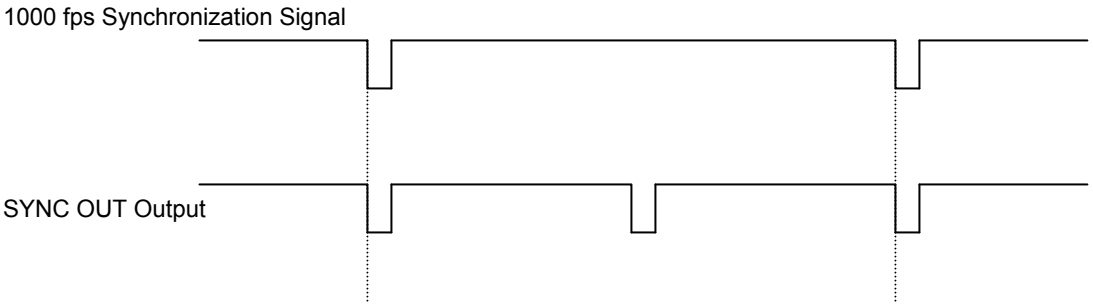
Values 1, 2, 4, 6, 8, 10. A value of 1 is normal output.

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

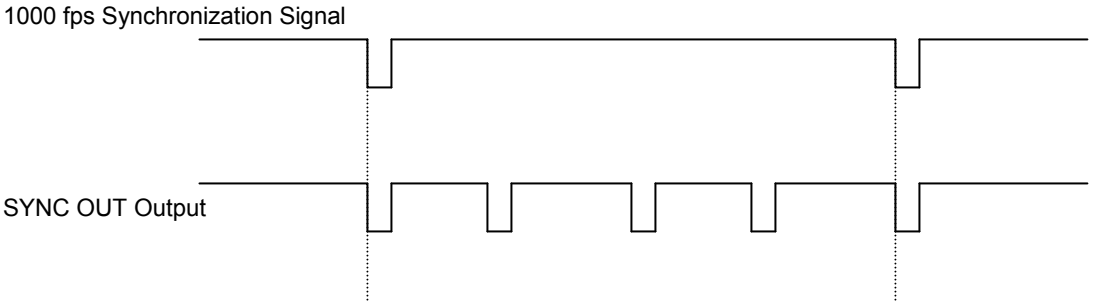
Output a SYNC (vertical synchronization signal) from SYNC OUT that is X times SYNC.

Increase or decrease the value with the ↑ ↓ keys.

Example: For a frame rate of 1000 fps, SYNC OUT TIMES setting of 2.



Example: For a frame rate of 1000 fps, SYNC OUT TIMES setting of 4.

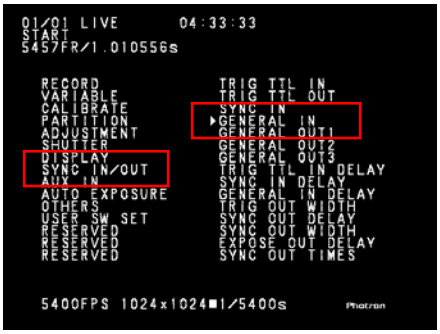


3.17. Event Marker Function

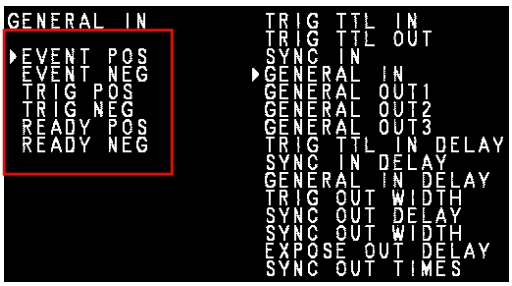
It is possible to input an external signal during recording, at that instant the frame number is stored, and during playback the stored frame numbers (event markers) can be immediately accessed, or jumped to. This a separate feature from the trigger point, and by marking interesting points during recording, these points can be easily called up for review during playback. The event marker can store **10** positions within a single sequence.

The frame number recording occurs on the pulse's edge, and the next frame after the pulse's edge is input is stored as the event marker.

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **GENERAL IN** from the **SYNC IN/OUT** submenu with the **ARROW** keys and press the **ENTER** key.



3. Select **EVENT POS** or **EVENT NEG** on the **GENERAL IN** menu. Select the polarity setting according to the signal to be used. The frame number is stored on the rising edge for **POS** and the falling edge for **NEG**.



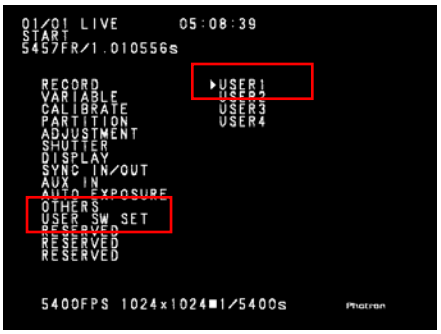
4. During the recording operation, provide a pulse to the **GENERAL IN** connector.
5. A maximum of **10** pulse inputs can be received.
6. Recording ends.
7. Put the camera in **MEMORY** playback mode.
8. Jump to the event frames with the **FRAME RATE ▲▼** keys.
9. The screen text displays **EVENT FRAME X** when displaying an event frame. (Where **X** is a number from **1-10**.)

3.18. Using USER SW (Programmable Switch)

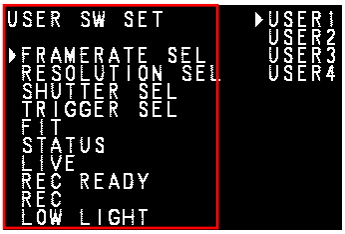
There are four switches that can be set on the back of the system. Settings for the switches are made from the menu, and they can each be assigned a different function.

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

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **USER1** from the **USER SW SET** submenu with the **ARROW** keys on the keypad and press the **ENTER** key.



3. 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	Raise the frame rate.
RESOLUTION SEL	Lower the resolution.
SHUTTER SEL	Raise the shutter speed.
TRIGGER SEL	Change the trigger mode.
FIT	The same function as the keypad's FIT key.
STATUS	The same function as the keypad's STATUS key.
LIVE	The same function as the keypad's LIVE key.
REC READY	The same function as the keypad's REC READY key.
REC	The same function as the keypad's REC key.
LOW LIGHT	The same function as the keypad's LOW LIGHT key.

■ About the STATUS Key

The **STATUS** key is a display key that can be used to summarize and verify the status of the system's settings. Each press of the **STATUS** key will display the screens below in order.

1. The various signal settings.

2. The camera settings.

3. The recording settings.

4. The programmable switch settings.

3.19. Using MCDL (Multi Channel Data Link)

The system supports an optional **MCDL** (Multi Channel Data Link: analog waveform synchronized recording unit). The waveform data (analog **4 ch**. max., digital **6 ch**.) that is output from the **MCDL** is sampled, synchronized with the image, and saved.

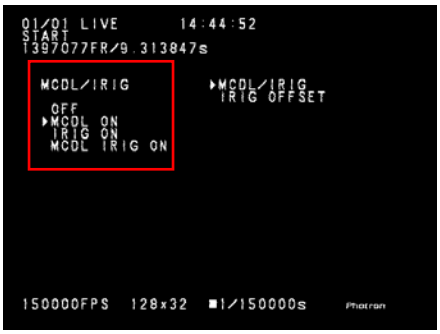
The sampling rate is **10** times the frame rate, and the timing of the sample is **1/10th** of the interval of each frame rate. The saved data can be played at a waveform image on the "**Photron FASTCAM VIEWER**" (PFV) software. Additionally, it can easily be played on the VIDEO display.

■ Using MCDL

Connect the **MCDL's** output connector to the **MCDL** connector of the I/O cable from the camera.

Select **MCDL/IRIG** from the **AUX IN** submenu with the **ARROW** keys and press the **ENTER** key.

From the **MCDL/IRIG** settings menu, set **MCDL ON**.



The waveform value input is displayed on the screen's text.

If you record in this state, the **MCDL** waveform is sampled, synchronized to the image, and saved.

* The waveform value corresponding to each frame is displayed in **MEMORY** mode.

MCDL Restrictions on 16 GB Models

For models with 16 GB of memory, there is a large capacity of memory for images, so with a resolution setting of 128x48 or lower, the total number of images that can be acquired increases and the same amount of data cannot be saved in the **MCDL/IRIG** save data memory.

If the resolution is set to those settings, **MCDL ON** (and **MCDL IRIG ON**) is not valid even if it is selected.

Also, if **MCDL ON** (and **MCDL IRIG ON**) is set when the resolution is lowered to 128x48 or lower, the **MCDL ON** (and **MCDL IRIG ON**) setting is cleared.

3.20. Using IRIG Time Codes

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

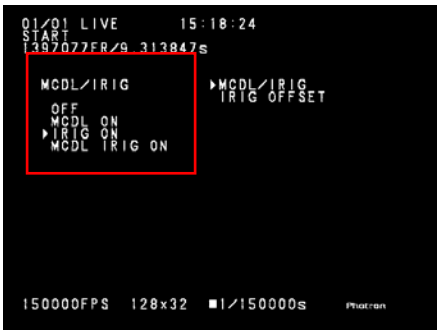
The recorded **IRIG** code is displayed in the **VIDEO** display or the "**Photron FASTCAM VIEWER**" software.

■ IRIG Code Input Specification

■ Using IRIG Time Codes

Connect the output connector from the **IRIG** source to the **IRIG_IN** connector on the camera body.
Select **MCDL/IRIG** from the **AUX IN** submenu with the **ARROW** keys and press the **ENTER** key.

From the **MCDL/IRIG** settings menu, set **IRIG ON**.

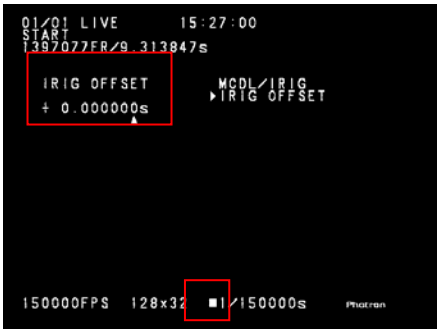


The **IRIG** code is displayed on the screen's text.
If you record in this state, an **IRIG** code is saved for every frame.
* The **IRIG** code corresponding to each frame is displayed in **MEMORY** mode.

■ Attach an Offset to a Sampled IRIG Code

Select **IRIG OFFSET** from the **AUX IN** submenu with the **ARROW** keys and press the **ENTER** key.

Set the menu's **IRIG OFFSET** value.



* Specify the offset in the range of **+0.999999s ~ - 0.999999s**

* The display for all **IRIG** codes takes into account the specified offset.

* When the **IRIG** code is being input, the **IRIG** code is displayed in white, and "□"(white square) is displayed to the left. Also, the **IRIG** offset time is displayed below it.

When the **IRIG** code is not being input, or the signal is lost for some reason, the **IRIG** code is displayed in gray. At that time, the camera's internal counter is used as it continues to count.

Chapter 4. Playback

4.1. Video Playback

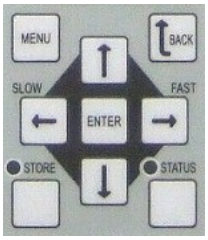
Upon completing a recording, the system can immediately playback the images recorded on a connected video monitor or on the keypad's LCD screen. This procedure is explained here.

1. Switch from **LIVE** to **MEMORY** mode. If the system is in **LIVE** mode, press the keypad's **LIVE** key and you can switch to playback (memory) mode. The **LIVE** key **LED** will turn off.

On the screen:

2. Press the **PLAY** key on the keypad to start playback of the recorded images.

3. The playback speed can be changed with the **ARROW** keys on the keypad. The current playback speed is displayed in the upper part of the screen.



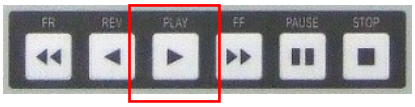
← slow fast →

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

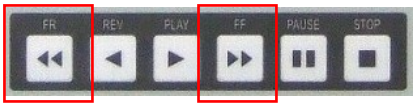
4.2. Fast-Forward and Fast-Reverse

Set the camera to **MEMORY** mode.

1. Press the **PLAY** key (►).

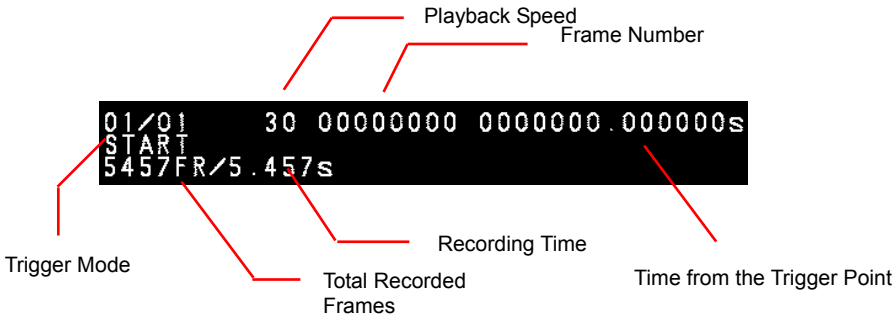


2. Press fast-forward, the **FF** key (►►), and fast-reverse, the **FR** key (◄◄), to search for the desired scene.



3. Each time fast-forward, the **FF** key (►►), or fast-reverse, the **FR** key (◄◄), is pressed, it changes the normal playback speed in three steps: by x10, x100, or x1000.
4. Press the **PLAY** key (►) to return to normal speed playback, or press the **PAUSE** key (❚❚) to pause playback.

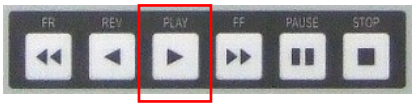
5. As an example, the display on the screen will be similar to the image shown below.



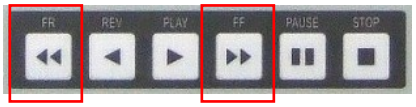
4.3. Single Frame Advance Playback

Set the camera to **MEMORY** mode.

1. Press the **PLAY** key (►).



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

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

For recordings made with the system at a resolution of **640×480** pixels or higher, the images displayed on an **NTSC** monitor are larger (vertically) than the monitor's resolution (**640×480** pixels or lower). 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 **512×256** 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 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 zoom factor set, making it possible to verify details or look over the entire scene.

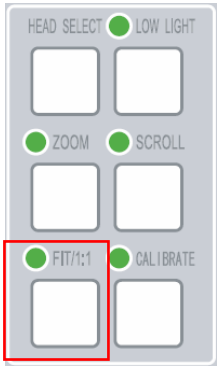
In the event that only one dimension is smaller than the monitors, for example an image resolution of 640 x 240 pixels, then the vertical height will not be stretched to fill the screen, rather the extra space will be displayed black. The pixels normal aspect ratio is maintained at all times.

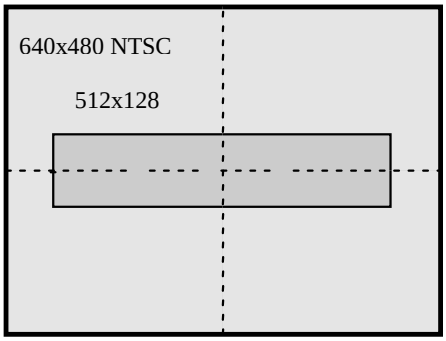
These digital zoom functions for video output, and how to use them, are explained here.

4.4.1. Video Screen Fit Display

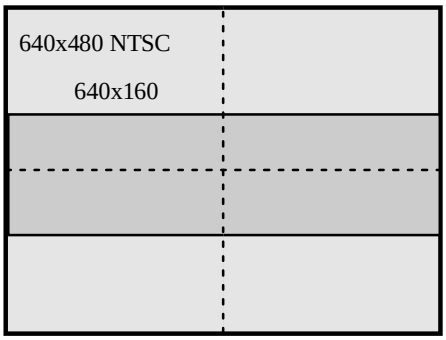
For the system's video output, the size of the image at different resolutions is adjusted so that it is displayed at its maximum size on the screen. The following example explains an example where a **512×128** pixel screen is being fit to the video output.

1. Press the **FIT/1:1** key on the keypad.

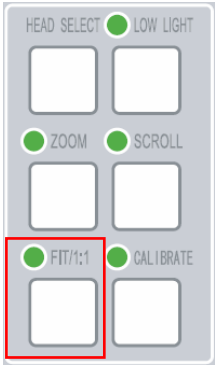


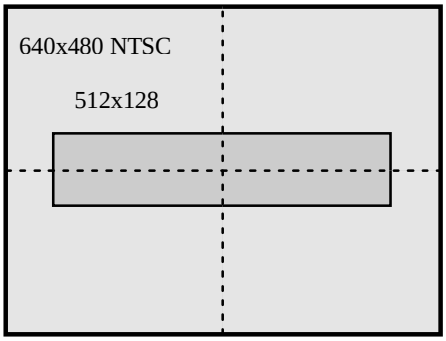


2. The video screen's display size changes, and the recording area is displayed at its maximum size on the screen.



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

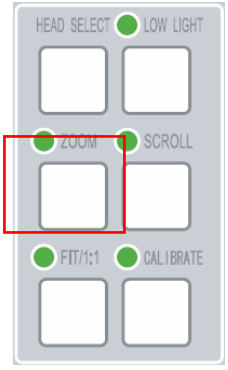




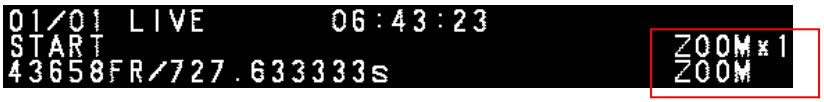
4.4.2. Displaying the Video Screen Enlarged (Zoom)

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

1. Press the **ZOOM** key on the keypad.



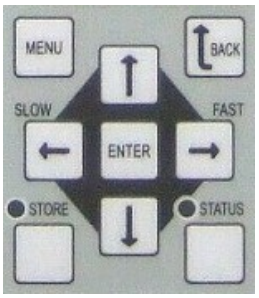
2. The **ZOOM** key **LED** on the keypad will light. The **ZOOM** message and the current zoom factor will also be displayed in the upper right of the video output screen.



3. With the **ARROW** keys, enlarge or shrink the screen. The center of the image displayed on the screen is maintained while the image is enlarged or reduced.

↑
Enlarge

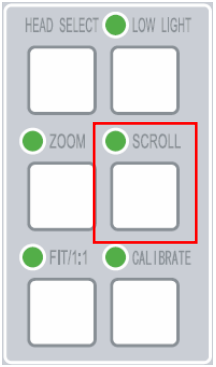
Shrink
↓



4.4.3. Scrolling the Video Screen

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

1. Press the **SCROLL** key on the keypad. This button is shared with the zoom function, so verify that the **SCROLL** key **LED** on the keypad is illuminated.

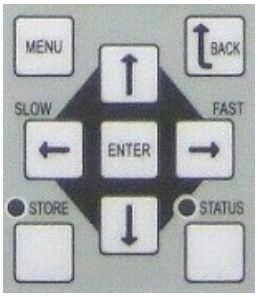


2. The **SCROLL** message is displayed in the upper right of the video output screen.

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

↑
Up

Down
↓



← Left Right →

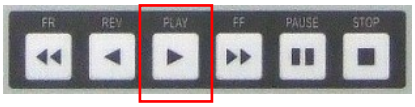
4.5. Segment of Interest Playback

The playback of images recorded at high-speed takes an extraordinary amount of time. For example, when played back at a normal **30** fps, **one** second of video recorded at high-speed at **2000** frames a second 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 **2000** recorded. On 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.

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

2. **Playback** using the normal 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.

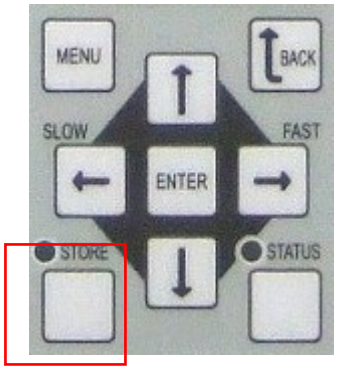
5. Press the **ON/OFF** key in the **SEGMENT PLAY BACK** section of the keypad, and verify that the **LED** is lit. This puts the system in segment playback mode.

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

4.6. Using the Playback Event Marker Function

During **MEMORY** mode, **10** playback image frame numbers can be stored, and those stored frame numbers (event marker frames) can be immediately accessed, or jumped to. By marking the desired position while the image is playing, this convenient function can easily recall those positions.

1. Put the system in **MEMORY** playback mode.
2. **Playback** using the normal procedure.
3. When the desired frame is displayed, press the **STORE** key to save it.



4. Repeat steps 2 and 3 above, a total of up to **10** points can be stored.
5. The marker frames can be jumped to with the **SHUTTER ▲▼** keys.

6. When a marker frame is displayed, "**MARKER FRAME X**" will appear on the text on screen. (Where **X** is a number between **1** and **10**)

When storing frames if more than **10** points are entered, the frame numbers will be overwritten sequentially from the first stored.

Chapter 5. Connecting a PC

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

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

The system can be controlled from a **PC** using the **Gigabit Ethernet** interface. Refer to the "**PHOTRON FASTCAM Viewer User's Manual**" for how to operate the software.

This section explains the necessary preparation when connecting the system to a **PC**.

To connect a **PC** to the system, connect the system with a LAN cable to a PC with a commercially available **1000BASE-T**-capable interface board. 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 connect to a maximum of **64** Photron Gigabit Ethernet interface equipped cameras using a **hub**. When connecting multiple devices, connect through a switching **hub** that can connect at **1000BASE-T**. The maximum length of the cable that connects the system (or **PC**) to the switching hub is also **100 m**.

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, refer to "5.1.2. Setting the System's IP Address". For the PC settings, refer to the "Photron FASTCAM Viewer User's Manual".

The system is only 1000BASE-T capable. When using a PC capable of only 10BASE-T or 100BASE-TX, the PC must be connected through a switching hub capable of 10BASE-T, 100BASE-TX, and 1000BASE-T.

The camera'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.

Insert the LAN cable into the **GIGABIT ETHER** connector.

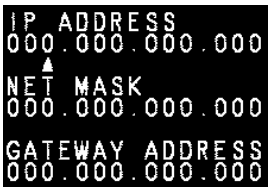
5.1.2. Setting the System's IP Address

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

■ Setting Procedure

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **DIGITAL I/F SET** from the **OTHERS** submenu with the **ARROW** keys on the keypad and press the **ENTER** key.

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



4. Press the **ENTER** key to confirm.

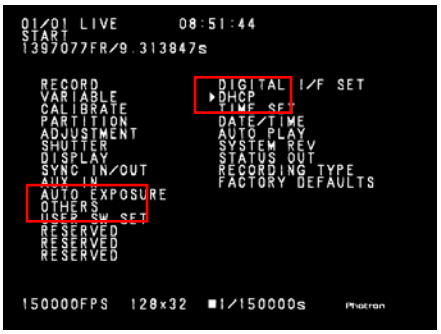
When connecting the system to a PC, or when connecting other Gigabit Ethernet interface compatible Photron cameras, set each of those devices to a different IP address. Also, when connecting to an existing network, do not use IP addresses that are already in use on the network.

5.1.3. Using DHCP (Dynamic Host Configuration Protocol)

The system is DHCP capable. In an environment where DHCP is used, the system's IP address can be acquired from the DHCP server.

■ Setting Procedure

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **DHCP** from the **OTHERS** submenu with the **ARROW** keys on the keypad and press the **ENTER** key.



3. Select **ON/OFF** with the **ARROW** keys.

4. Press the **ENTER** key to confirm.

- When OFF is selected, the IP address specified in the previous section "5.1.2. Setting the System's IP Address" is valid.
- When ON is selected, the IP address is acquired from the DHCP server, and the acquired IP address is valid. If the system is not connected to the DHCP server, the IP address is acquired when a connection to the server is made. It is possible to 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 on PFV to "Auto detection".

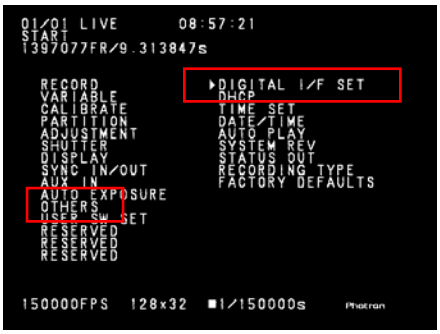
For details, refer to the "Photron FASTCAM Viewer User's Manual".

5.1.4. Connecting Multiple Systems to a PC

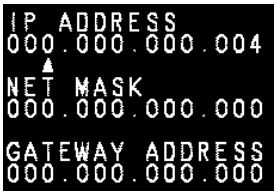
With PFV, the system's control software, one PC can connect to and control multiple FASTCAM SA1, FASTCAM MH4-10K and FASTCAM-APX RS (Gigabit Ethernet) systems.

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

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **DIGITAL I/F SET** from the **OTHERS** submenu with the **ARROW** keys on the keypad.



3. The IP address menu is displayed.



4. Assign each system 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. System Settings

6.1. Display Settings

6.2. Other Detailed Settings

6.1. Display Settings

As well as the image, the system can display many types of information necessary for recording on the video monitor. The procedure for setting the display of this information on the video monitor is explained here.

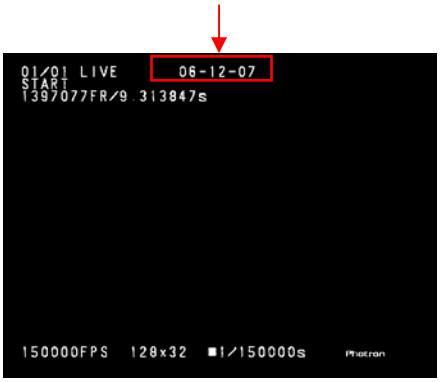
6.1.1. Changing the Date/Time Display

Either the date or the time can be selected and displayed on the screen. The procedure for the displaying this is explained here.

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **DATE/TIME** from the **OTHERS** submenu with the **ARROW** keys on the keypad and press the **ENTER** key.
3. The **DATE/TIME** menu is displayed.

4. Select **DATE** or **TIME** with the ↑ ↓ keys. The selected option is displayed on the screen.
5. When the setting is complete, press the **ENTER** key to finish.
6. Verify that the date or the time is displayed according to the option set.

Date Display Setting



Time Display Setting

6.1.2. Display/Hide On Screen Display (OSD) Text

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **OSD SELECT** from the **DISPLAY** submenu with the **ARROW** keys and press the **ENTER** key.

3. Select **ON/OFF** with the **ARROW** keys. When **ON**, text is displayed on the screen. When **OFF**, text on the screen is not displayed.

4. When the setting is complete, press the **ENTER** key to finish.
5. Verify that the screen's text display is **ON** or **OFF**.

6.1.3. Display a Reference Line

Display a reference line (reticule) on the video monitor. They can be used to determine the position of an object within the image or as an aid when viewing the playback.

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **CURSOR** from the **DISPLAY** submenu with the **ARROW** keys and press the **ENTER** key.

3. Select either **OFF**, **ON1**, or **ON2** with the ↑↓ keys on the keypad and press the **ENTER** key. Two types of cursors are provided, a white line (ON1) and a black line (ON2).

4. When **ON1** or **ON2** is selected, a reference line cross (reticule) is displayed on the screen. At the same time, the coordinate value for the center point of the cross is displayed on the screen.
5. The reference line can be moved to any position using the **ARROW** keys.

6.1.4. Display R/G/B Elements (Color Models Only)

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **R/G/B** from the **DISPLAY** submenu with the **ARROW** keys and press the **ENTER** key.

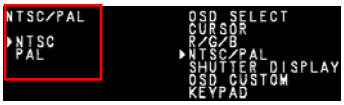
3. Select the **R/G/B** element to be displayed, or all of the **RGB** elements, with the keypad ↑↓ keys. Press the **ENTER** key to complete the setting.

6.1.5. Select the Video Signal Standard (NTSC or PAL)

Select the system's video output signal standard. The standard can be selected from **NTSC** or **PAL**.

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **NTSC/PAL** from the **DISPLAY** submenu with the **ARROW** keys and press the **ENTER** key.

3. Select **NTSC** or **PAL** with the keypad ↑ ↓ keys and press the **ENTER** key.



4. Reboot the system to make the setting valid. The video output standard is changed and the system starts.

6.1.6. Switch the Shutter Display (SHUTTER DISPLAY)

The shutter on-screen display's shutter display can be switched in fraction of 1 second, "**1/xxxxxx s**", or in decimal second "**0.000000s**".

As for precision, the **1/xxxxx s** display is numerically cleaner looking (for example **1/1000 s**, **1/3000 s**), whereas the **0.000000s** display is accurate.

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **SHUTTER DISPLAY** from the **DISPLAY** submenu with the **ARROW** keys and press the **ENTER** key.

3. Select **1/xxxS** or **0.xxxS** with the keypad ↑ ↓ keys and press the **ENTER** key.

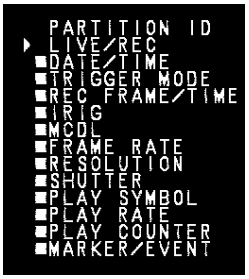
4. The output format is changed.

6.1.7. Display/Hide Individual On Screen Text (OSD CUSTOM)

The entire on-screen display can be switched ON/OFF with **OSD SELECT**, however **OSD CUSTOM** can turn off the on-screen display elements individually.

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **OSD CUSTOM** from the **DISPLAY** submenu with the **ARROW** keys and press the **ENTER** key.

3. With the ↑ ↓ keys on the keypad, select the item and switch show/hide with the ←→ keys.
4. The "☐" (white square) symbol is displayed.



5. The display items are changed.

6.1.8. Keypad LCD Settings

Make settings for the keypad's LCD display. There are three settings for the keypad's LCD display, **BRIGHT** (brightness), **CONTRAST** (contrast), and **COLOR** (tint).

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **KEYPAD** from the **DISPLAY** submenu with the **ARROW** keys and press the **ENTER** key.

3. Select **BRIGHT**, **CONTRAST**, or **COLOR** with the keypad ↑ ↓ keys and press the **ENTER** key.

- **BRIGHT** Setting

Change the LCD's brightness with the keypad ↑ ↓ keys.

The ↑ key brightens, the ↓ key darkens.

- **CONTRAST** Setting

Change the LCD's contrast with the keypad ↑ ↓ keys.

The ↑ key increases the contrast, the ↓ key decreases the contrast.

- **COLOR** Setting

Change the LCD's tint with the keypad ↑ ↓ keys.

6.2. Other Detailed Settings

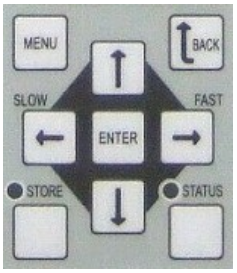
6.2.1. Setting the Date/Time

Set the system's internal clock. Set the date and time for display within the recorded image. Once the date/time is set, the values are saved even when the system power is turned off.

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **TIME SET** from the **OTHERS** submenu with the **ARROW** keys on the keypad and press the **ENTER** key.
3. The **TIME SET** setting items are displayed on the left of the screen.

4. The **ARROW** ←→ keys move to the item, the ↑ ↓ keys can change the setting value.

↑
Increase/
Decrease
Value
↓



← Move to Item →

TIME SET

DATE 00-01-01 — Year – Month – Date

TIME 00:00:00 — Hour : Minute : Second

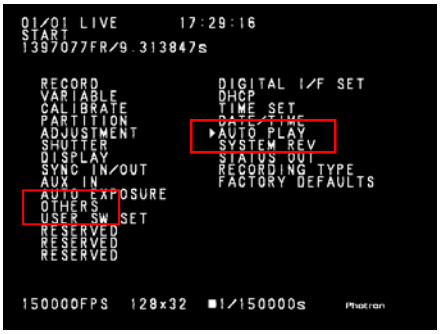
5. When the setting is complete, press the **ENTER** key to finish.

6.2.2. Post-Recording Auto-Playback Setting (AUTO PLAY)

The system is equipped with a mode that automatically switches the system from **LIVE** mode to **MEMORY** (playback) mode, displays the trigger frame and starts playing back immediately after recording is finished. This mode can be used by setting **AUTO PLAY** to **ON**. This function is convenient for immediately verifying the recorded video after recording.

1. Press the **MENU** key on the keypad and the menu list will display.

2. Select **AUTO PLAY** from the **OTHERS** submenu with the keypad **ARROW** keys.



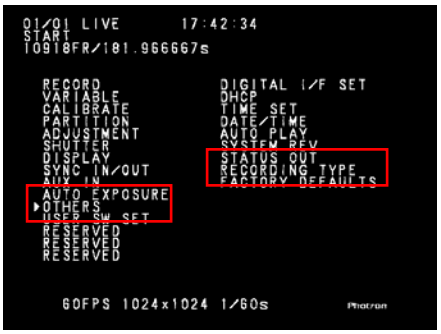
3. The menu to select the **AUTO PLAY** format **ON/OFF** is displayed on the left side of the screen.

4. Select **ON/OFF** with the keypad ↑↓ keys. Press the **ENTER** key, then the **MENU** key to close the menu list. The setting is complete.
5. In **LIVE** mode, perform a recording operation, and verify that the system automatically changes to **MEMORY** mode after recording.

6.2.3. Direct Trigger (RECORDING TYPE)

Normally for recording, the READY key is input and the system is put in the READY state, then the REC trigger is input and the recording operation is performed. However, by setting the direct trigger mode, the recording operation can be performed without the READY key input. System operation can be simplified by using this function.

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **RECORDING TYPE** from the **OTHERS** submenu with the keypad **ARROW** keys.



3. Select either **READY AND TRIG** or **DIRECT TRIG** on the menu.

4. Press the **ENTER** key to confirm.

- The operation of the system for each item is shown below.

・READY AND TRIG

The **READY** key input is always necessary before the **REC** trigger.

* This is the camera's initial setting.

・DIRECT TRIG

The recording operation can be performed with just the **REC** trigger, without the **READY** key input.

・ The operation of the system for each trigger mode is shown below.

[ ] indicates the system's operations, "trigger" indicates the **REC** trigger input.

・ **START, RANDOM, RANDOM_RESET, TWO_STAGES**

[LIVE] → "trigger" → **[*READY]*** → "trigger" → **[*REC]***

・ **CENTER, END, MANUAL、RANDOM_CENTER, RANDOM_ MANUAL**

[LIVE] → "trigger" → **[*ENDLESS]*** → "trigger" → **[*REC]***

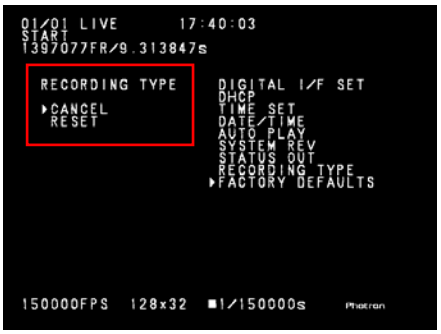
6.2.4. Reset to the Factory Default State

The settings (frame rate, resolution, menu settings, etc.) on the system can be reset to the factory default state.

1. Press the **MENU** key on the keypad and the menu list will display.

2. Move to the **FACTORY DEFAULTS** item from the **OTHERS** submenu with the keypad **ARROW** keys and press the **ENTER** key.

3. Select **CANCEL** or **RESET** with the keypad ↑↓ keys. **CANCEL** cancels the reset operation. **RESET** executes the system reset.

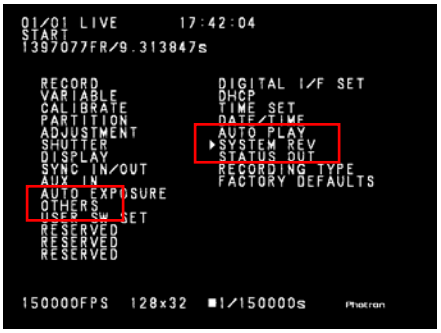


4. Press the **ENTER** key to confirm.

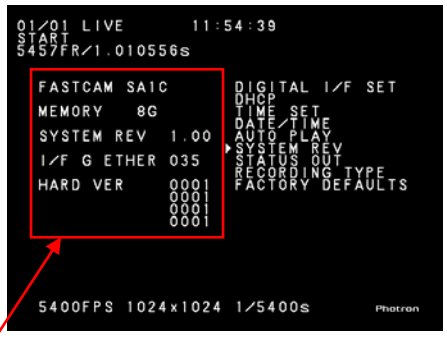
6.2.5. Display the System Revision

Displays the system's version number.

1. Press the **MENU** key on the keypad and the menu list will display.
2. Select **SYSTEM REV** from the **OTHERS** submenu with the **ARROW** keys on the keypad and press the **ENTER** key.



3. The system version of the system currently being used is displayed.



Camera name, memory amount, system revision, I/F version, hardware version are displayed.

Chapter 7. Product Specifications

7.1. Specifications

7.2. Dimensions

7.3. Filter Cleaning

7.1. Specifications

7.1.1. Product Specifications

Image Sensor	C-MOS image sensor	
Sensor Resolution	1024x1024 pixels	
Frame Rate	When full frame: 5,400 fps max. When a frame segment: 150,000 fps max.	
Lens Mount	F mount, C mount, Photosonic mount (optional)	
Recording Color Depth	Monochrom	12-bit
	Color	RGB, each 12-bit (Bayer color filter method)
Shutter Method	Electronic shutter	
Recording Method	IC memory	
Recording Memory Capacity	8 GB (model 1), 16 GB (model 2)	
Trigger Method	START, CENTER, END, MANUAL, RANDOM, RANDOM RESET, RANDOM CENTER, RANDOM MANUAL, TWO STAGE	
Gain Control	Hardware LUT on camera Controllable via keypad or software	
Image Output Customization	Customizable LUT, brightness is changeable	
External Synchronization Input Signal	5 Vp-p, negative polarity/positive polarity (switchable)	
External Synchronization Output Signal	5 Vp-p, negative polarity/positive polarity (switchable)	
Trigger Input Signal	TTL, contact	
Other Output Signals	Other timing signal output, event marker input	
External Control	Keypad, RS422 external control I/F, Gigabit Ether IF (PC)	
Video Output Signal	NTSC/PAL, SDI (Serial Digital Interface) Includes digital zoom, scroll, fit functions	
Digital Interface	Gigabit Ether (1000BASE-T)	

7.1.2. General Specifications

Environmental Conditions	
Storage Temperature	-20ºC ~ 60ºC (no condensation) -4ºF ~ 140ºF (no condensation)
Storage Humidity	85% or less (no condensation)
Operating Temperature	0ºC ~ 40ºC (no condensation) 32ºF ~ 104ºF (no condensation)
Operating Humdity	85% of less (no condensation)
External Dimensions	
Camera Body	153 (W) x 160 (H) x 242.5 (D) mm, excluding protrusion 6.02" (W) x 6.3" (H) x 9.55" (D)
AC Adapter	95 (W) x 63.5 (H) x 178 (D) mm, excluding protrusion 3.74” (W) x 2.5” (H) x 7” (D)
Keypad	140 (W) x 105 (H) x 20.8 (D) mm, excluding protrusion 5.51” (W) x 4.13” (H) x 0.82” (D)
AC Power Supply	
Supply Voltage	100V ~ 240V (type A cable: up to 125V)
Supply Frequency	50 Hz ~ 60 Hz
Power Consumption	90 VA
DC Power Supply	
Supply Voltage	18 V ~ 36 V
Power Consumption	90 VA
Weight	
Camera Body	5.9 kg 13.01 lbs.
AC Adapter	670 g 23.63 oz.
Keypad	1.31 kg 2.89 lbs. (without handle)

Photron has verified two types of AC cables; the type A (standard for Japan, USA, Canada, etc.) and the 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 the Photron-authorized distributor.

7.1.3. Options

User Options
LCD Monitor Keypad
Photosonic Mount Kit
4 Output Trigger Box
MCDL (Analog Waveform Synchronized Recording
Dedicated Carrying Case
Spare Power Supply Connector (for custom cable construction)
LAN Connector Anti-Dust Shell

7.1.4. Frame Rate and Resolution

IMAGE SIZE / FRAME RATE (FPS)	1024 × 1024	1024 × 896	1024 × 752	1024 × 640	1024 × 512	896 × 896	896 × 752	896 × 640	896 × 512	768 × 768	768 × 640	768 × 512	640 × 640	640 × 512	640 × 368	512 × 512	512 × 384	512 × 256	512 × 128	512 × 64	384 × 128	384 × 64	320 × 256	256 × 256	256 × 128	256 × 64	128 × 128	128 × 96	128 × 64	128 × 32
50 (PAL)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
60	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
125	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
250	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
500	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
1000	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
2000	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
3000	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
4000	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
5000	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
5400	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
6000		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
7200			○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
8000							○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
9000								○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
10000											○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
12000													○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
15000														○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
16000																○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
20000															○		○	○	○	○	○	○	○	○	○	○	○	○	○	○
30000																		○	○	○	○	○	○	○	○	○	○	○	○	○
40000																							○	○	○	○	○	○	○	○
50000																			○	○	○	○		○	○	○	○	○	○	○
62500																					○	○		○	○	○	○	○	○	○
75000																									○	○	○	○	○	○
90000																											○	○	○	○
100000																												○	○	○
125000																													○	○
150000																														○

The circle indicates a possible setting. The green items are the maximum resolution setting at that frame rate.

This table is the list of default settings. Even finer settings are possible with the variable setting.

7.1.5. Recordable Image Count/Resolution

Resolution	8 GB Model Image Count	16 GB Model Image Count
1024x1024	5457	10918
1024x869	6236	12478
1024x752	7431	14867
1024x640	8731	17469
1024x512	10914	21837
896x896	7127	14261
896x752	8492	16991
896x640	9979	19965
896x512	12473	24956
768x768	9701	19410
768x640	11642	23293
768x512	14552	29116
640x640	13970	27951
640x512	17463	34939
640x368	24296	48611
512x512	21829	43674
512x368	29105	58232
512x256	43658	87349
512x128	87317	174698
512x64	174634	349397
384x128	116423	232931
384x64	232846	465863
320x256	69853	139758
256x256	87317	174698
256x128	174634	349397
256x64	349269	698794
128x128	349269	698794
128x96	465692	931726
128x64	698538	1397589
128x32	1397077	2795178

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

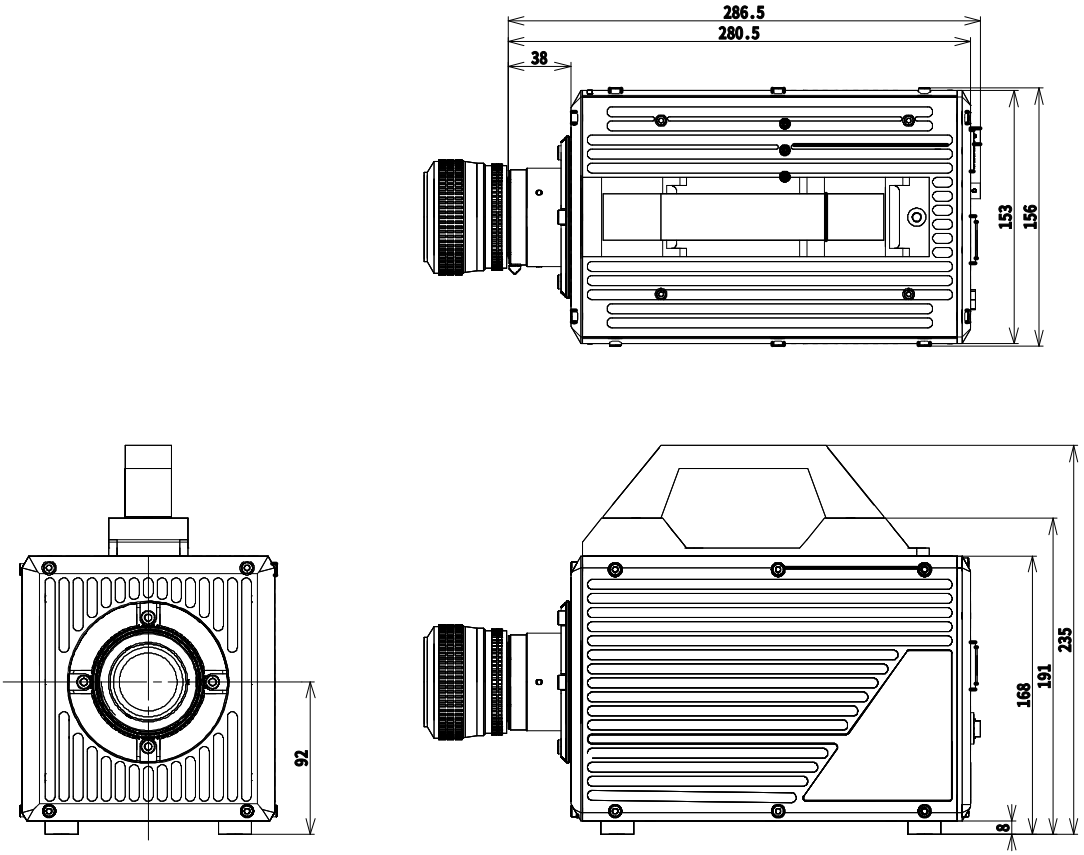
7.1.6. Shutter Speed List

HORIZONAL RESOLUTION	1024	960	896	832	768	704	640	576	512	488	384	320	256	192	128
SHUTTER SPEED	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700
	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900
	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000
	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000
	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000
	9100	9100	9100	9100	9100	9100	9100	9100	9100	9100	9100	9100	9100	9100	9100
	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000
	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000
	17000	17000	17000	17000	17000	17000	17000	17000	17000	17000	17000	17000	17000	17000	17000
	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000
	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000
	30000	31000	30000	30000	30000	30000	30000	30000	30000	30000	30000	30000	30000	30000	30000
	35000	35000	35000	36000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000
	41000	41000	41000	41000	41000	40000	40000	40000	40000	40000	41000	40000	40000	40000	40000
	49000	48000	48000	48000	48000	48000	49000	48000	48000	49000	50000	51000	50000	49000	50000
	57000	56000	54000	54000	54000	54000	54000	56000	55000	55000	56000	56000	55000	56000	55000
	62000	60000	63000	62000	61000	61000	61000	62000	63000	65000	65000	64000	65000	65000	65000
	75000	79000	75000	79000	76000	81000	79000	79000	79000	81000	79000	79000	81000	82000	81000
	84000	88000	92000	97000	102000	108000	103000	100000	99000	106000	100000	103000	102000	100000	102000
	96000	100000	105000	110000	115000	122000	114000	110000	107000	115000	125000	126000	130000	122000	126000
	111000	115000	121000	126000	132000	139000	147000	155000	130000	126000	150000	148000	150000	155000	155000
	131000	136000	142000	148000	155000	163000	171000	180000	165000	155000	214000	201000	218000	180000	175000
	161000	167000	173000	180000	188000	196000	205000	214000	225000	201000	250000	265000	281000	214000	218000
	208000	214000	221000	229000	237000	245000	255000	265000	276000	287000	300000	314000	329000	300000	321000
	293000	300000	30700	314000	321000	329000	338000	346000	355000	365000	375000	386000	397000	409000	422000
	500000	500000	500000	500000	500000	500000	500000	500000	500000	500000	500000	500000	500000	500000	500000

7.2. Dimensions

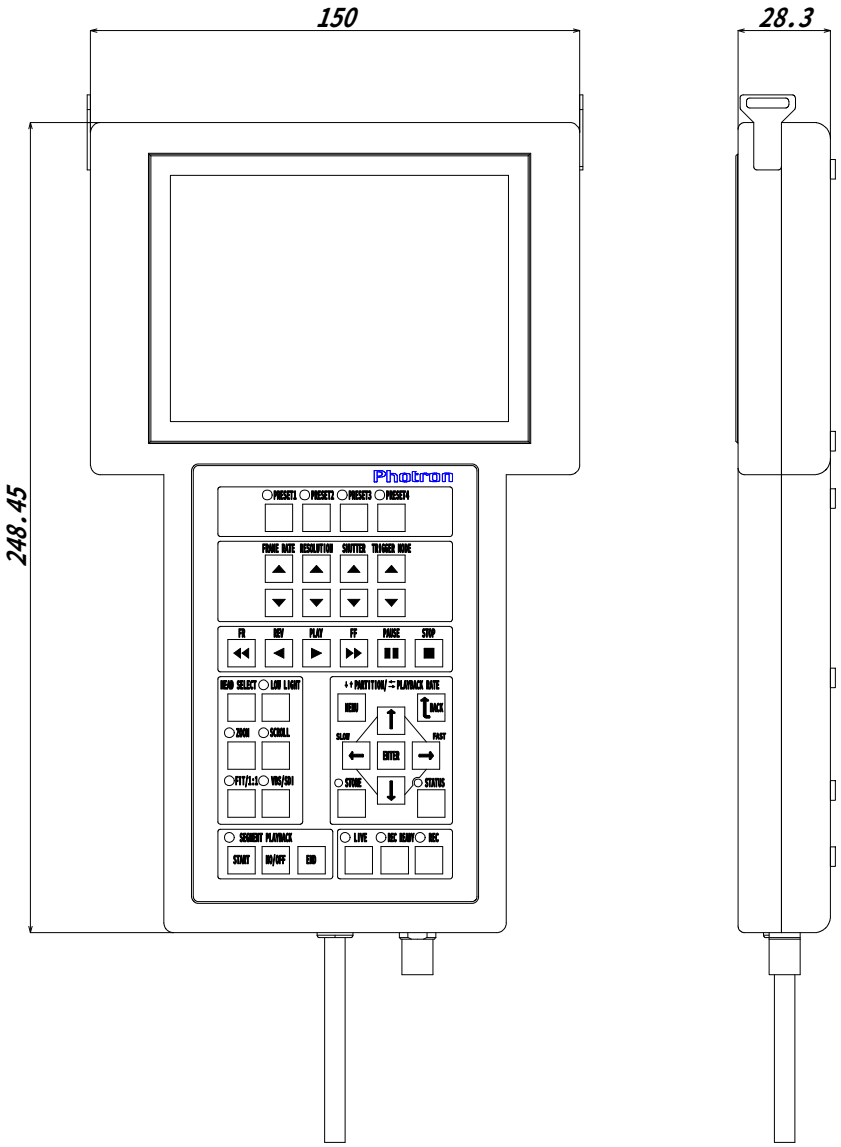
7.2.1. Camera Body

(mm)



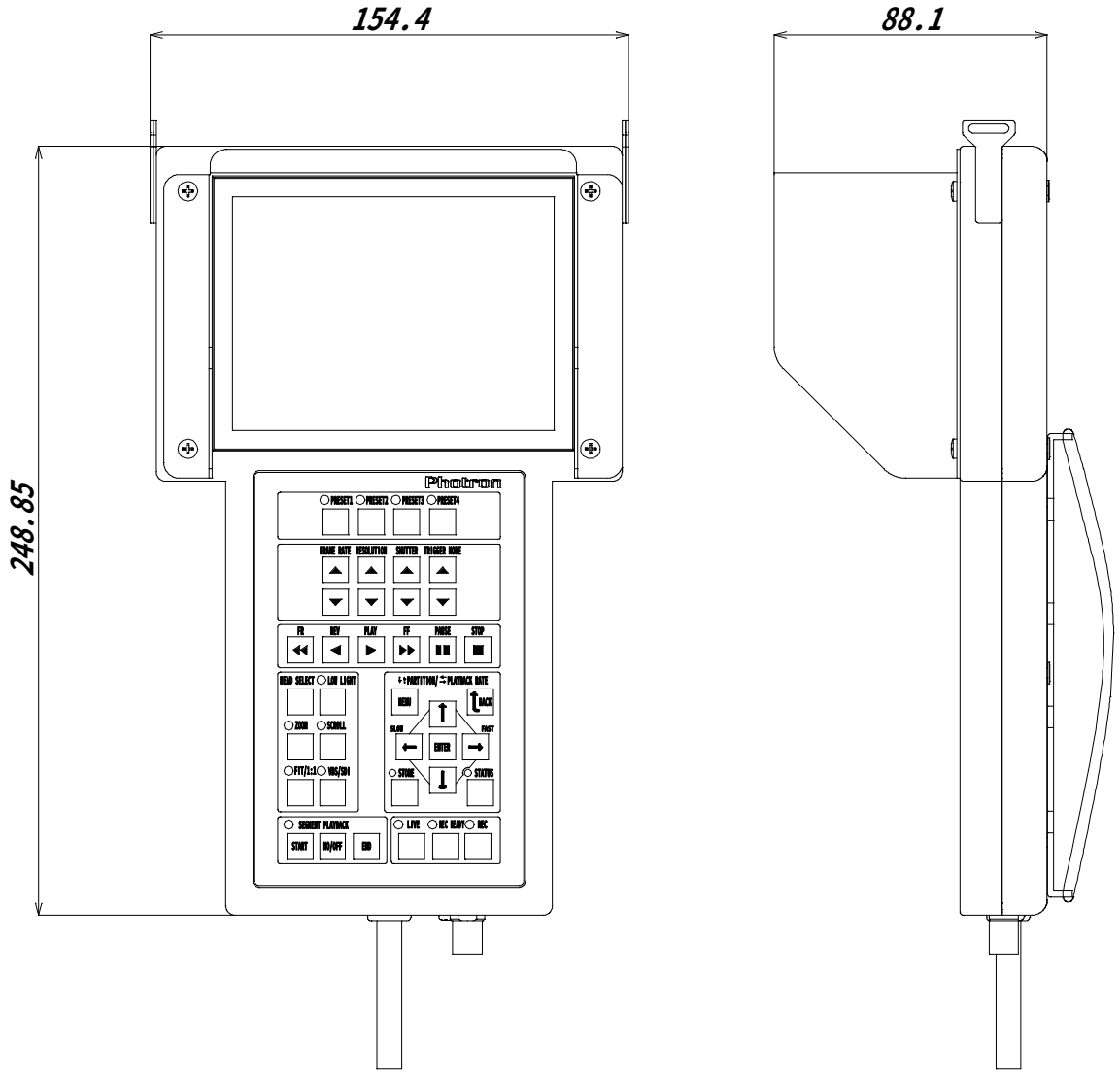
7.2.2. LCD Monitor Keypad

(mm)



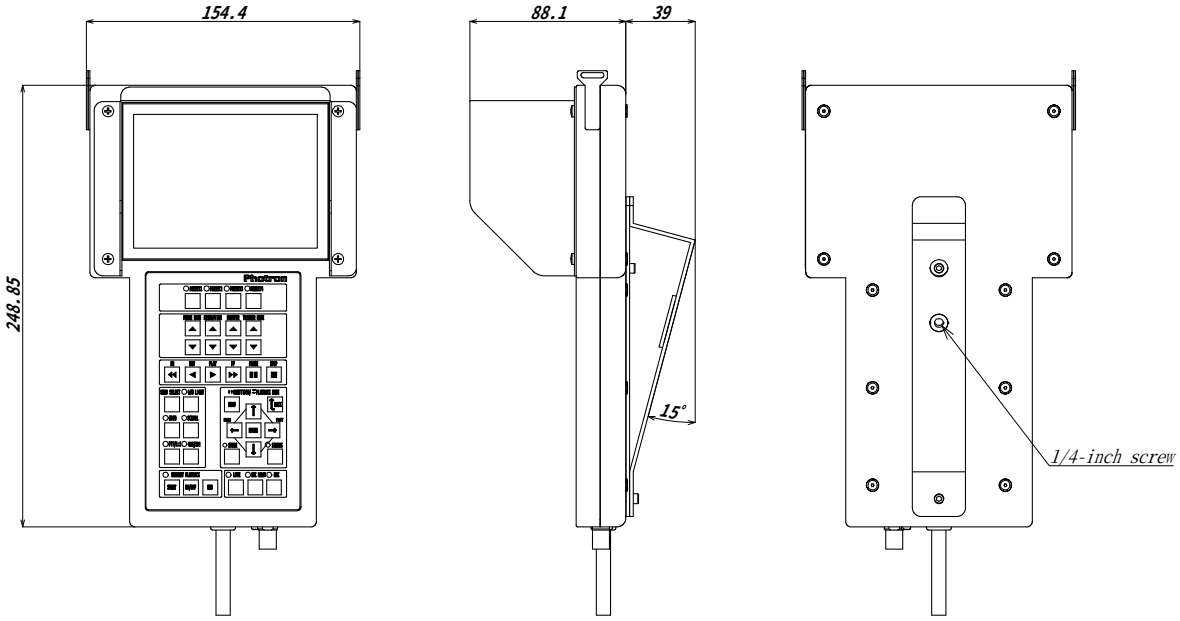
■**Dimensions with Attached Handle**

(mm)



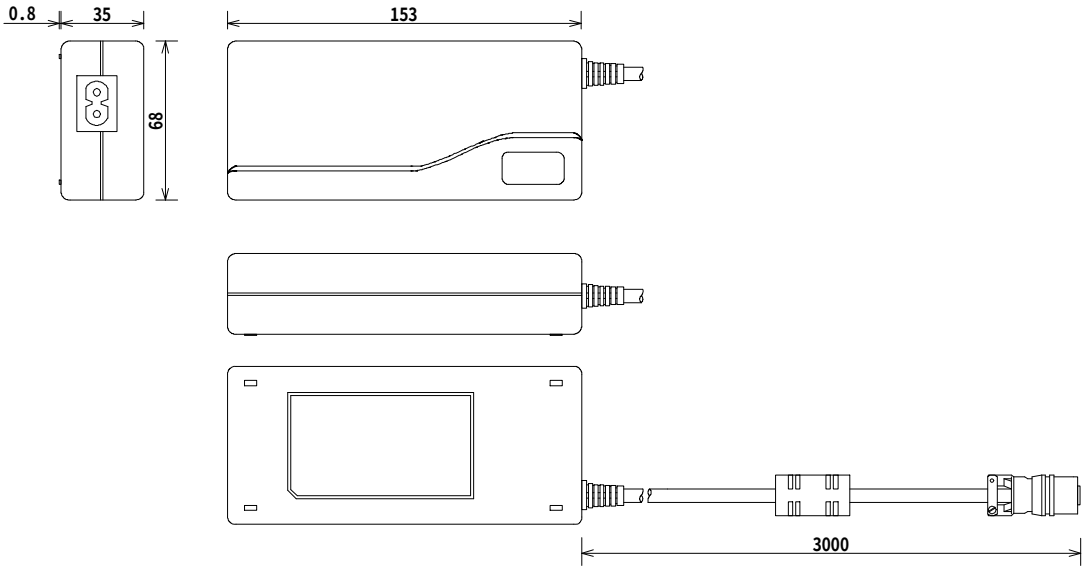
■**Dimensions with Tripod Adapter**

(mm)



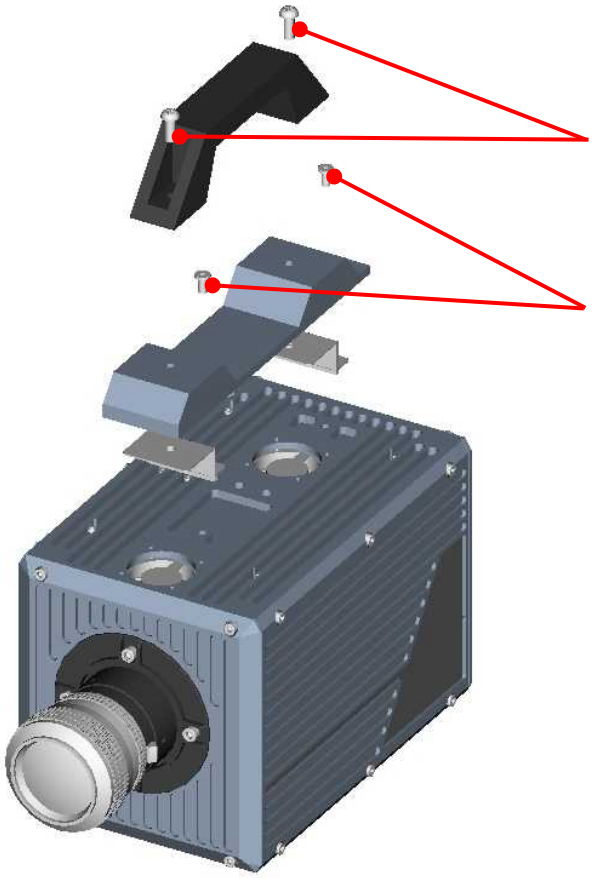
7.2.3. AC Adapter

(mm)



7.3. Filter Cleaning

Modern high speed cameras generate a good deal of heat, in order to cope with this heat, the system use force air circulation in the camera body by a fan. In order to lower the risk that dirt and dust in the air will enter the camera, the air vent and exhaust vent are fitted with filters.
Clean the filters and the area around the filters regularly in order to keep the system in top condition.



1. Open the covers on both ends of the handle and remove the screw in each location.
2. Remove the bolts with hexagonal holes that hold the duct portion on from both locations.
3. Clean the filters, duct, and around the fans on the camera body.

Do not remove any of the screws on the camera body except for the screws in the locations shown in the diagram above.

The risk of trouble can be lowered by cleaning the filters. Problems caused by the effects of heat increased through not cleaning the filters are exempted from warranty service even if it occurs during the system's warranty period.

The filter reduces the risk that dirt and dust will enter the camera body, but any trouble that is caused by dirt and dust entering the camera body is not guaranteed. Even during the warranty period it is exempt from warranty service, so give careful consideration to the operating environment.

MEMO

Chapter 8. Warranty

8.1. Warranty

8.1. Warranty

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

When submitting the system for repair, be sure to include the warranty card with the system.

■ Warranty Exceptions

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

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

For inquires related to malfunction, contact the dealer where the system was purchased, or the nearest Photron office (refer to 9.1. Contacting Photron.).

Chapter 9. Contacting Photron

9.1. Contacting Photron

9.1. Contacting Photron

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

The following items will be required when contacting Photron, so note them in advance.

1. Contact Information: Company name, school name, customer name, phone number
2. Product Name: FASTCAM SA1
3. Serial Number: Check on the nameplate seal.
4. Reason for Inquiry: Condition of the system and what is known about it.

■ Contact Information

In Americas and Antipodes:

PHOTRON USA, INC.
9520 Padgett Street, Suite 110
San Diego, CA 92126-4446, 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
Willowbank House
84 Station Road
Marlow, Bucks SL7 1NK, U.K.
Phone: +44(0) 1628 89 4353
Fax: +44(0) 1628 89 4354
E-mail: image@photron.com
www.photron.com

In other areas:

PHOTRON LIMITED
21F, Jimbocho Mitsui Bldg.,
1-105 Kanda Jimbocho, Chiyoda-Ku, Tokyo
101-0051
Phone : +81 3 3518 6271
Fax : +81 3 3518 6279
E-mail : image@photron.co.jp
www.photron.co.jp

FASTCAM SA1

Hardware Manual

Publication Date June, 2015

Publisher PHOTRON LIMITED

21F, Jimbocho Mitsui Bldg.,

1-105 Kanda Jimbocho, Chiyoda-Ku, Tokyo 101-0051, JAPAN

(Control No. E20150616U)

FASTCAM SA1
Hardware Manual

Publication Date April, 2018
Publisher PHOTRON LIMITED
21F, Jimbocho Mitsui Bldg.,
1-105 Kanda Jimbocho, Chiyoda-Ku, Tokyo 101-0051

(Control No. E180409U)