



# *FASTCAM-ultima APX Hardware Manual*

---

*Rev. 1.1*

**Photron**

PHOTRON LIMITED  
2006



# Table of contents

<i>Chapter 1 Introduction</i> .....	7
1.1. Preface .....	8
1.2. Warranty .....	9
1.3. How To Use This Manual .....	10
1.4. Precautions.....	11
 <i>Chapter 2 Setting Up</i> .....	13
<b>2.1. To Start</b> .....	<b>14</b>
2.1.1. Unpacking.....	14
2.1.2. Optional Accessories .....	14
<b>2.2. Names of Components</b> .....	<b>15</b>
2.2.1. Processor.....	15
2.2.2. Camera Head .....	16
2.2.3. Changeable Lens Mount.....	16
2.2.3. Changeable Lens Mount.....	17
2.2.4. Remote Control Keypad.....	19
2.2.5. GENERAL IN Cable .....	20
2.2.6. GENERAL OUT Cable .....	21
2.2.7. MCDL / RS422 Cable(Optional) .....	22
2.2.8. DC Power IN Cable.....	24
<b>2.3. System Connection</b> .....	<b>25</b>
2.3.1. Connecting Camera Head .....	25
2.3.2. Connecting Remote Control Keypad.....	26
2.3.3. Connecting Video Monitor.....	27
2.3.4. Power Connection .....	27
2.3.4. Power Connection .....	28
<b>2.4. Basics of Remote Control Keypad Operation</b> .....	<b>29</b>

2.4.1. Details of Controls on Keypad.....	30
2.4.2. Menu List Display .....	31
2.4.3. Menu Selection .....	31
2.4.4. Canceling Menu Selection .....	32
2.4.5. Menu / Manual Reference.....	32
<b>2.5. Setting Up System (Date, Time and Revision).....</b>	<b>33</b>
2.5.1. Setting Date and Time .....	33
2.5.2. Switching Date / Time .....	34
2.5.3. Displaying System Revision.....	35
 <i>Chapter 3 Recording .....</i>	 <i>37</i>
<b>3.1. Initialization (Calibration) .....</b>	<b>38</b>
3.1.1. Start Calibration .....	38
3.1.2. Saving Calibrated Setting .....	39
3.1.3. Loading Calibrated Setting.....	39
<b>3.2. Selecting Frame Rate .....</b>	<b>40</b>
<b>3.3. Selecting Resolution .....</b>	<b>41</b>
<b>3.4. Selecting Shutter Speed.....</b>	<b>42</b>
3.4.1. Switching Shutter Speed Steps.....	43
3.4.2. Switching Shutter Modes .....	44
<b>3.5. Selecting Trigger Mode .....</b>	<b>45</b>
3.5.1. START Mode .....	46
3.5.2. CENTER Mode .....	47
3.5.3. END Mode .....	48
3.5.4. MANUAL Mode .....	49
3.5.5. RANDOM Mode .....	52
3.5.6. RANDOM RESET Mode .....	55
3.5.7. RANDOM CENTER Mode .....	57
3.5.8. RANDOM MANUAL Mode .....	60
3.5.9. DUAL FRAMING RATE Mode.....	64



<b>3.6. Adjusting White Balance (for Color Model only).....</b>	<b>67</b>
3.6.1. Fixed (Preset) White Balance .....	67
3.6.2. Manual (One Touch) White Balance .....	68
<b>3.7. Partitioning Memory .....</b>	<b>70</b>
<b>3.7.1. Prepare for Memory Partitioning (Set Number of Sections).....</b>	<b>70</b>
3.7.2. Recording into Divided Sections .....	72
3.7.3. Playback of Recorded Sections .....	72
3.7.4. PARTITION MODE.....	73
<b>3.8. Look-Up Table (LUT) Operation .....</b>	<b>74</b>
3.8.1. Operating Preset LUT .....	75
3.8.2. Customizing LUT Patterns .....	77
<b>3.9. Extended Dynamic Range Mode .....</b>	<b>78</b>
<b>3.10. External Trigger Input.....</b>	<b>79</b>
3.10.1. Input of External Trigger Signals.....	79
3.10.2. Output of Trigger Signals to External Equipment .....	81
<b>3.11. Input of External Sync Signals .....</b>	<b>82</b>
3.11.1. Input of External Sync Signals .....	82
3.11.2. Output of External Sync Signals.....	83
3.11.3. Sync Operation of Multiple APX Systems .....	84
3.11.4. Sync Operation with External Equipment.....	86
3.11.5. Sync Operation of APX and Other Models of Cameras.....	88
<b>3.12. Setting GENERAL IN / OUT Signals .....</b>	<b>90</b>
3.12.1. Setting GENERAL IN Signals .....	90
3.12.2. Setting GENERAL OUT Signals .....	91
<b>3.13. Event Marker Function .....</b>	<b>92</b>
<b>3.14. MCDL – Multi-Channel Data Link (Data aquisiton).....</b>	<b>93</b>
<b>3.15. IRIG Timecode.....</b>	<b>94</b>

<i>Chapter 4 Playback .....</i>	<i>95</i>
<b>4.1. Playing Recorded Images .....</b>	<b>96</b>
<b>4.2. Searching Images of Interest (Fast Forward/Rewind Play) .....</b>	<b>97</b>
<b>4.3. Slow Playback (Jog) .....</b>	<b>98</b>
<b>4.4. Zooming (Zoom/Fit/Scroll) .....</b>	<b>99</b>
4.4.1. Fitting Image Frame to Video Screen .....	100
4.4.2. Zooming Playback Image Frame .....	101
4.4.3. Scrolling Playback Image Frame .....	102
<b>4.5. Block Playback (Playback of Clips of Scenes of Interest) .....</b>	<b>103</b>
<b>4.6. Text Display – Hide / Unhide .....</b>	<b>104</b>
<b>4.7. Displaying Crosshair Cursor .....</b>	<b>105</b>
<b>4.8. Displaying R G B Planes .....</b>	<b>106</b>
<b>(Color Model Only).....</b>	<b>106</b>
<b>4.9. Switching NTSC / PAL Video Output.....</b>	<b>107</b>
<b>4.10. Automatic Playback.....</b>	<b>108</b>
<b>4.11. Playback Event Markers .....</b>	<b>109</b>
 <i>Chapter 5 Connecting APX to a PC.....</i>	 <i>111</i>
<b>5.1. Connecting APX to a PC .....</b>	<b>112</b>
5.1.1. Using IEEE1394 Interface.....	113
5.1.2. Using Ethernet Interface .....	113
5.1.3. Using Optical Interface.....	114
<b>5.2. Connecting Multiple APX's to a PC .....</b>	<b>120</b>
<b>5.3. Connecting Mixed Models of Cameras to a PC.....</b>	<b>121</b>
 <i>Chapter 6 Specifications.....</i>	 <i>123</i>
<b>6.1. Specifications .....</b>	<b>124</b>
6.1.1. Product Specifications.....	124
6.1.2. Miscellaneous (To be completed) .....	125
6.1.3. Accessories and Optional Items.....	126

6.1.4. Frame Rates and Resolutions .....	127
6.1.5. Number of Recorded Images vs. Resolution .....	129
6.1.5. Number of Recorded Images vs. Resolution .....	129
6.1.6. Shutter Speed Table (COARSE Steps) .....	130
6.1.7. RS422 Serial Control Commands.....	131
6.1.8. STATUS OUT.....	136
<b>6.2. Mechanical Data.....</b>	<b>137</b>
6.2.1. Camera Head (millimeters) .....	137
6.2.2. Processor (millimeters) .....	138
6.2.3. Keypad (millimeters) .....	139
<b>6.3. Care of Lenses .....</b>	<b>140</b>

*Memo*

# *Chapter 1 Introduction*

*1.1. Preface*

*1.2. Warranty*

*1.3. How To Use This Manual*

*1.4. Precautions*

## *1.1. Preface*

The FASTCAM-ultima APX High-Speed Video Camera System will prove itself a truly powerful visualization tool giving solution to engineers and scientists in such fields as general research and development, designing, manufacturing, quality assurance, scientific researches, medical and biological researches, space and aeronautics engineering. With its mega-pixel, ultra-high sensitivity imaging sensor that enables framing under extremely low level of light, the APX offers a great basic feature of extremely high-speed recording of up to 120,000 frames per second (fps). Another outstanding feature is that it promises an excellent user-friendliness of intuitive recording of subjects moving at a very high speed thanks to its real-time video output and easy-to-operate keypad-type remote control unit. Also, the hybrid-design scheme of the APX makes it possible to seamlessly connect with a PC via a high-speed digital interface, combined with easy-to-use control software, to form an image recording and processing system that offers a much easier means for analyzing captured events immediately, which has been very difficult with conventional systems.

You will find this new recording technology most useful to capture the image of high-speed moving subjects for subsequent slow-motion observation and motion analysis, and image processing applications. This manual presents the technical details of the APX system and how to operate it.

### **Remarks:**

1. For the best use of the system, please read through this manual.
2. The content of this manual is based on the best knowledge of the manufacturer. However, in case any error or missed information is found in this manual, please inform the manufacturer of such shortcomings. Notwithstanding the above, the manufacturer is not responsible for any results of the use of this equipment.
3. Copying all or any part of this manual without permission is prohibited.
4. The content of this manual may be changed any time without prior notice.
5. The manufacturer assumes no responsibility for any direct or indirect damages or loss of profit resulting from the use of this equipment
6. The manufacturer assumes no responsibility for any result of the use of this equipment.
7. Copying all or any part of the software included in this system without prior written permission by the author is an infringement of copyright.

## 1.2. Warranty

### **New Equipment Warranty PHOTRON FASTCAM-ultima APX**

PHOTRON LIMITED warrants this PHOTRON FASTCAM-ultima APX ("APX") and accessories manufactured by PHOTRON LIMITED to function properly for one year from the date of shipment, provided the warranty registration card was filled out and returned to PHOTRON USA, INC. or PHOTRON EUROPE LIMITED within thirty days of shipment. PHOTRON LIMITED, in conjunction with PHOTRON USA, INC. or PHOTRON EUROPE LIMITED, agrees to perform the following equipment warranty services:

1. Repair service: If shipped to PHOTRON at any of the addresses shown below, repairs will be made at no charge.
2. Parts replacement: Replacement parts installed under warranty will be provided at no charge.

THIS WARRANTY DOES NOT APPLY UNDER THE FOLLOWING CONDITIONS:

Failure to operate the APX in accordance with Photon's written instructions, including environmental specifications listed in the User's Manual.

If there is evidence of the APX being subjected to accidental damage, misuse or abuse.

If the APX has been repaired or tampered with by persons other than PHOTRON personnel, customer personnel trained by PHOTRON or without permission of PHOTRON.

Shipping damage is not covered by this warranty. The purchaser has the responsibility to place a claim of damage in shipment with the carrier.

PHOTRON LIMITED makes no other warranties, express or implied, including the implied warranties of merchantability and fitness for a particular purpose. If this APX does not function properly during the warranty period, PHOTRON LIMITED will repair it without charge according to the terms stated above. Repair without charge is PHOTRON LIMITED's only obligation under this warranty. PHOTRON LIMITED, PHOTRON USA, INC. or PHOTRON EUROPE LIMITED will not be responsible for any consequential or incidental damages resulting from the sale, use or improper functioning of this equipment even if loss or damage is caused by the negligence or other fault of PHOTRON LIMITED, PHOTRON USA, INC. or PHOTRON EUROPE LIMITED.

Return the equipment that needs warranty service to:

In Americas & Antipodes  
**PHOTRON USA, INC.**  
9520 Padgett Street  
Suite 110  
San Diego, CA 92126-4446  
USA  
Phone: 858-684-3555  
Fax: 858-684-3558  
E-mail: [image@photron.com](mailto:image@photron.com)  
[www.photron.com](http://www.photron.com)

In Europe:  
**PHOTRON EUROPE LTD.**  
Willowbank House  
84 Station Road  
Marlow, Bucks SL7 1NX  
U. K.  
Phone: +44(0) 1628 89 4353  
Fax: +44(0) 1628 89 4354  
E-mail: [image@photron.com](mailto:image@photron.com)  
[www.photron.com](http://www.photron.com)

In other areas:  
**PHOTRON LIMITED**  
FUjimi 1-1-8, Chiyoda-ku  
Tokyo 102-0071  
Japan  
Phone: +81 3 3238 2170  
Fax: +81 3 3238 2134  
E-mail: [image@photron.com](mailto:image@photron.com)  
[www.photron.co.jp](http://www.photron.co.jp)

## *1.3. How To Use This Manual*

### **DEFINITION OF TERMS**

You will notice that some of the information in this manual is presented as a NOTE, CAUTION or WARNING. It is important that you understand the significance of these three terms. For safe operation of the system, please follow the safety instructions below:

**“Note”** includes information that should be emphasized regarding the operation of the APX.

**“Caution”** includes important information regarding operation. If it is neglected and the equipment is used in the wrong manner, damage may be caused to the content of recording, the equipment and related peripheral devices.

**“Warning”** presents very important information regarding safety of the operators. If it is neglected and the equipment is used in the wrong manner, a serious hazardous sequence involving human injury or death may result. It must not be disregarded.

### **Chapters**

*This manual is divided into six chapters each discussing subject matters related to its chapter title.*

#### **Chapter 1. Introduction**

Contains Warranty, precautions, introduction and how to use this manual.

#### **Chapter 2. Set Up**

Introduces you to the components of the APX and explains the use of each connector, keypad operation and parameter settings to make ready for recording.

#### **Chapter 3. Recording**

Explains the operation of the APX for recording.

#### **Chapter 4. Playback**

Discusses playback of recorded images and filing image data.

#### **Chapter 5. Connection to a PC**

Shows how to connect and operate the APX to a PC (Operation of the APX from PC is discussed in the PFV Software Manual).

#### **Chapter 6. Specifications**

Provides detailed specifications of the APX system.



## *1.4. Precautions*

### **Ambient Temperature**

Photron FASTCAM-ultima APX has been designed to work properly in an ambient temperature range of 0 to 35 degrees Celsius (32 to 95 degrees Fahrenheit), no condensation.

### **Storage Temperature**

The APX must be stored in a place with an ambient temperature range of -20 to +70 degrees Celsius (-4 to +158 degrees Fahrenheit), no condensation.

### **Transportation**

Save the original carton the unit came in for future transportation. Do not transport the unit under ambient temperature of below -20 degrees Celsius (-4 degrees Fahrenheit) or above 70 degrees Celsius (+158 degrees Fahrenheit).

### **FEDERAL COMMUNICATIONS COMMISSION STATEMENTS**

WARNING: This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class computing device pursuant to Subpart A of Part 15 of the FCC Rules and VDE 0871 Class B which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

This device complies with Part 15 of the FCC Rules and VDE 0871. Operation is subject to the following two conditions: (1) this equipment may cause harmful interference, and (2) this equipment must accept any interference received including interference that may cause undesired operation.

### **WARNING**

This product is grounded through the power cord. This protective ground connection is essential for safe operation of the equipment. Avoid electrical shock by plugging the power cord into a properly wired power outlet. A loss of the protective grounding, for any reason, could result in electrical shock. Use the proper power cord and insure that it is in good condition.

*Memo*

## *Chapter 2 Setting Up*

*2.1. To Start*

*2.2. Names of Components*

*2.3. System Connection*

*2.4. Basics of Remote Control Keypad Operation*

*2.5. Setting Up System*

## *2.1. To Start*

### *2.1.1. Unpacking*

The APX system consists of the following items. Make sure if all the components are found in the package.

1. Camera Head	1 ea.
2. Processor	1 ea.
3. Remote Control Keypad	1 ea.
4. AC Power Adapter (attached to processor unit) / AC Cable	1 ea.
5. Camera Cable (5 meters long)	1 ea.
6. C-Mount Lens Adapter	1 ea.
7. Allen Wrench for Changing Lens Mount	1 ea.
8. Lens Mount Cap	1 ea.
9. GENERAL IN Cable	1 ea.
10. GENERAL OUT Cable	1 ea.
11. Ferrite Core For Cable	1 ea.
12. CD-ROM For Driver/Application Setup	1 ea.
13. FASTCAM-ultima APX Hardware Manual	1 ea.
14. FASTCAM Control Software Operation Manual	1 ea.
15. Warranty Registration Card	1 ea.
16. Optical PCI Interface Board	1 ea.*
17. Optical Cable (5 meter long, 2 cables)	1 set*

Note 1: Items 17 and 18 are available only with a system with optical interface connection.

Note 2: The optical cable, item 18, is a single mode fiber cable (9/125  $\mu$  mSMF, 5 meters long).

### *2.1.2. Optional Accessories*

Following optional items are available for the APX:

1. High-G Mount Kit for the APX (High-G lens mount with High-G warranty)
2. IEEE1394 Optical Link (IEEE1394 Optical fiber extension unit)
3. 4-Channel MCDL Analog Waveform Synchronized Recording Unit
4. 4-Output Trigger Box
5. MCDL/RS422 Cable

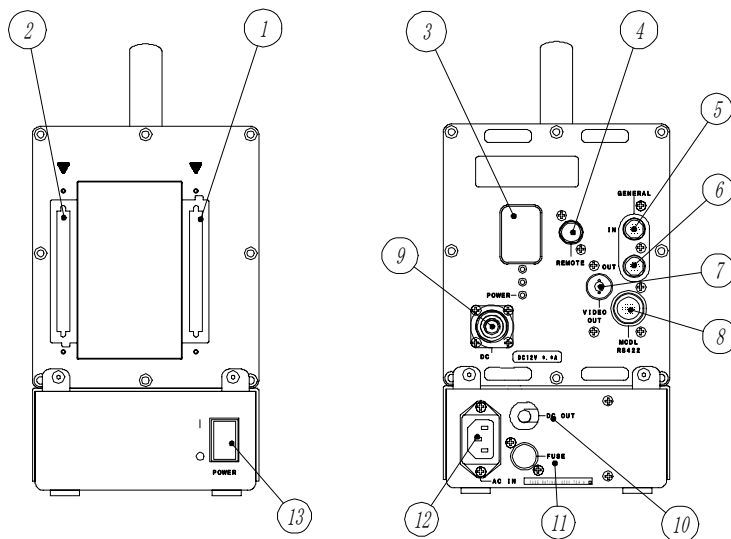
## 2.2. Names of Components

The APX system consists of a processor, camera head, remote-control keypad and control software.

### 2.2.1. Processor

The APX processor is designed to have a set of IC memory with a capacity of 2.6GB, standard, and a maximum of 8GB, to store non-compressed digital data of high-speed recorded images. The processor has a video output connector to display the recorded images on the video monitor, an IEEE1394 digital interface to control the camera from a PC and download recorded image data, input and output connectors for external sync and trigger signals, and a port to accept IRIG timecode and MCDL analog waveform signals(optional).

Names of Components

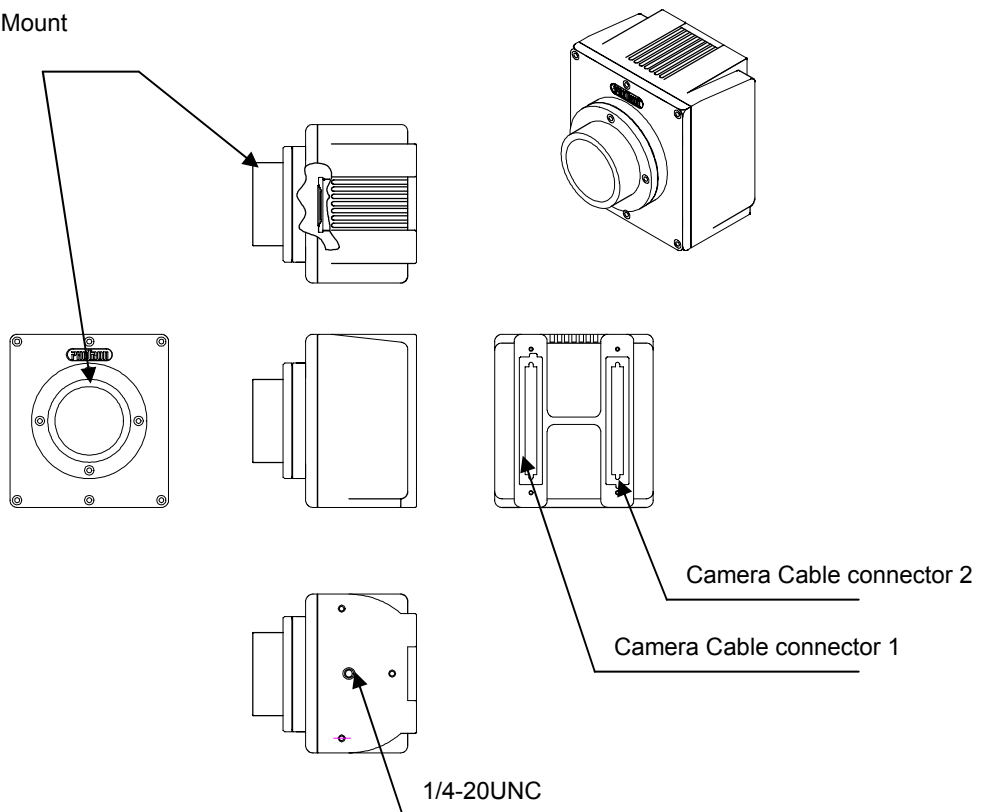


No.	Name	No.	Name
1	Camera Cable Connector 1	8	MCDL/RS422 Connector
2	Camera Cable Connector 2	9	DC Power IN Connector
3	Interface Connector (IEEE1394, Ether or Optical)	10	DC Power OUT Cable
4	Remote Control Keypad Connector	11	Fuse Box
5	GENERAL IN Connector	12	AC Power IN Connector
6	GENERAL OUT Connector	13	AC Power Switch
7	VIDEO OUT Connector		

### *2.2.2. Camera Head*

The lightweight and compact-sized APX camera head has been designed for ease of handling under various recording conditions and environments. The lens mount can be selected from C-type, F-type or High-G type to the user's application. The camera head has a tripod-mounting screw hole on its base plate.

Lens Mount

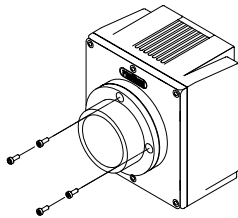


### *2.2.3. Changeable Lens Mount*

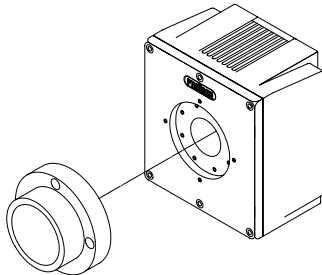
The lens mount for the APX can be changed to the particular needs of application. Three types of lens mounts are available to choose from: Nikon F-type mount, C-type mount and Hi-G mount (optional). Please note that lenses other than F-type may cause vignetting in the image corners when full resolution (1024 x 1024 pixels) recording is carried out.

#### **How to Change Lens Mounts (from F-type to C-type)**

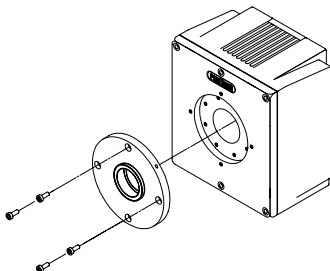
1. Using the attached Allen wrench, remove the four retaining screws (90 degree apart from each other) of the F-type lens mount unit.



2. Pull the whole unit of F-type mount to remove it from the camera front.

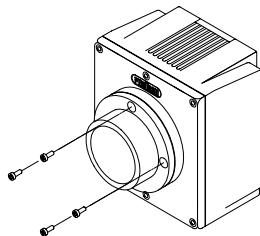


3. Place a C-type mount in the recess aligning the screw holes. Fasten the mount with four retaining screws. Make sure the mount has been firmly attached.

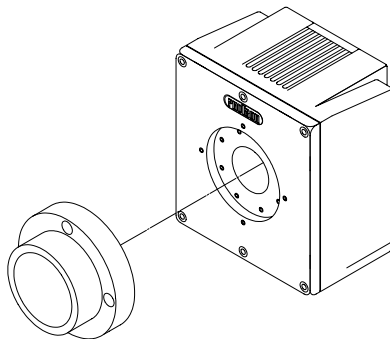


## **How to Change Lens Mounts (from F-type to Hi-G type)**

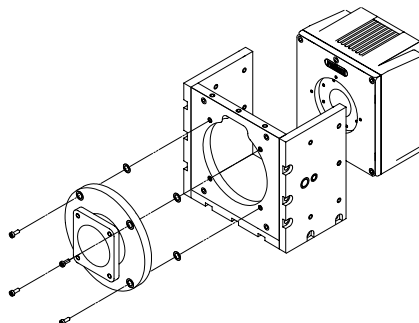
1. Remove another set of four retaining screws (other than the ones removed in the previous page) using a hex wrench



2. Remove the F-type mount and the shim from the mount base. The mount base remains in its place on the camera front plate.



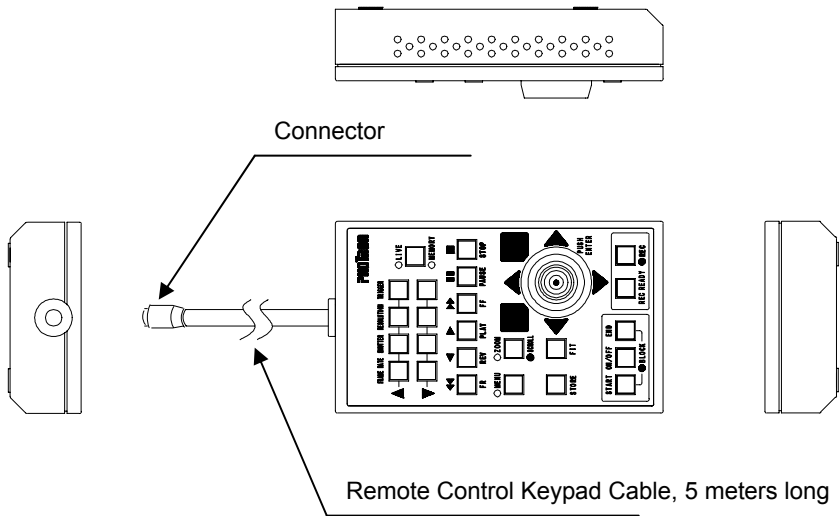
3. Place the High-G mount and High-G adapter, with shims in between, using the retaining screws as shown below. The flange back length is readjusted by increasing or decreasing the number of thin shims between the High-G mount and the High-G mount adapter. A stack of ten shims (each 0.05 mm thick) is factory-installed to meet the designed flange back length. If more shims are needed, use the attached extra shims as necessary. If your Hi-G lens has shims in its rear end, use them first to readjust the flange back length.





*2.2.4. Remote Control Keypad*

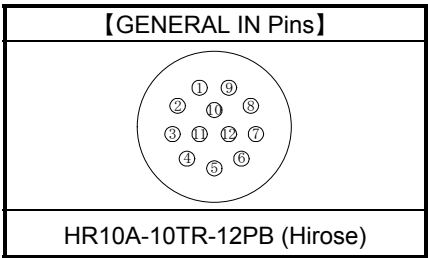
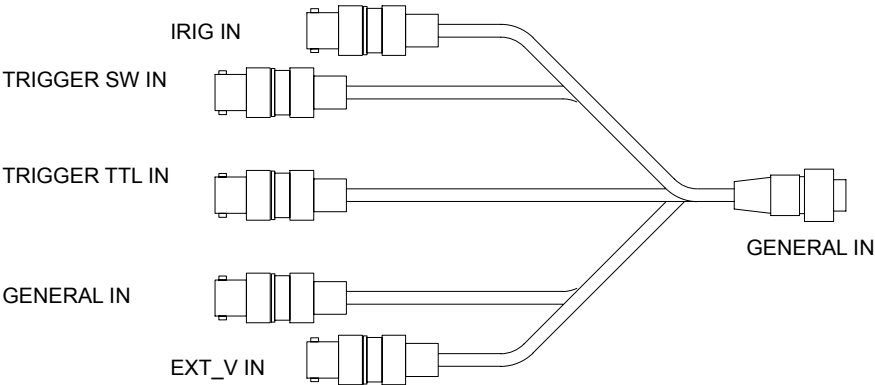
The APX Remote Control Keypad connects to the processor and controls all the functions of the camera system. The keypad is of “hot-plug” type and can be connected or disconnected with power on.



Connector on Processor	Signal	Connector Model (On Processor)	Connector Model (On Keypad)
REMOTE	Remote Keypad Signal	HR10A-10R-12SC (HIROSE)	HR10A-10P-12P (HIROSE)

### 2.2.5. GENERAL IN Cable

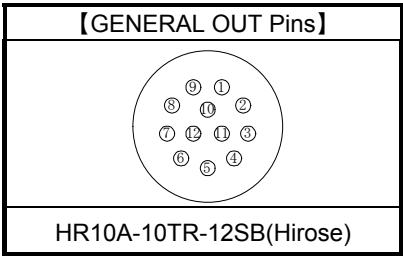
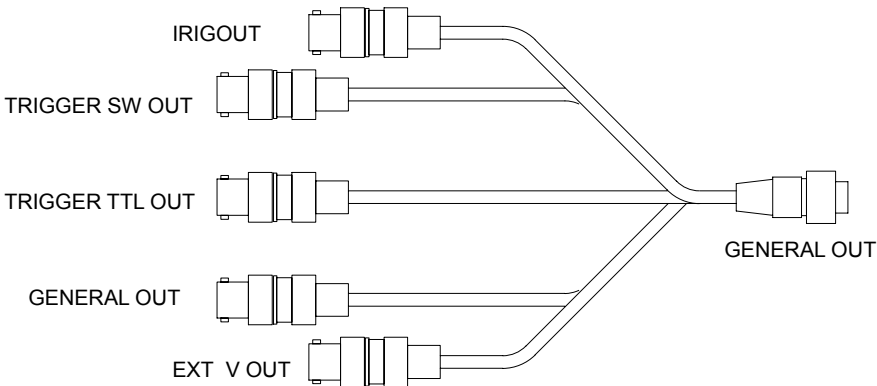
The APX can be used as an integral part of a testing system by its capability to work in sync with external trigger and sync signals from other devices and equipment within the system. The processor has a GENERAL IN connector on its rear panel, which combines relevant input signal lines into one connector.



Connector Name	Signal Name	Pin No.	Connector on Processor Model (Mfr)	Connector on Cable Model (Manufacturer)	Input Connectors
GENERAL IN	Trigger SW IN	1	HR10A-10T R-12PB (Hirose)	HR10A-10TPA-12 S (Hirose)	BNC
	GND	2			BNC
	Trigger TTL IN	3			BNC
	GND	4			BNC
	EXT_V IN	5			BNC
	GND	6			BNC
	General IN	7			BNC
	GND	8			BNC
	IRIG IN	9			BNC
	GND	10			BNC

### 2.2.6. GENERAL OUT Cable

The APX can be used as an integral part of a testing system by its capability to make other devices and equipment in the system work in sync with the APX's exposure timing and sync signals. The processor has a GENERAL OUT connector on its rear panel, which distributes APX's output signals to relevant devices and equipment.



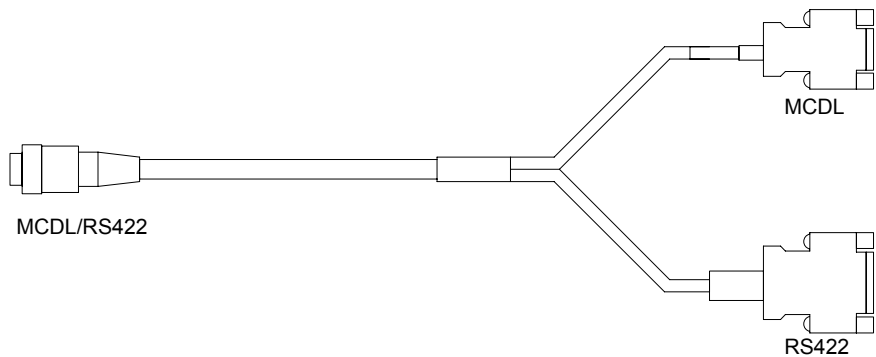
GENERAL OUT Connector Name	Signal Name	Pin No.	Connector on Processor Model (Mfr)	Connector on Cable Model (Manufacturer)	Output Connector
GENERAL OUT	Trigger SW OUT	1	HR10A-10T R-12SB (Hirose)	HR10A-10TP-12P (Hirose)	BNC
	GND	2			
	Trigger TTL OUT	9			BNC
	GND	10			
	EXT_V OUT	5			BNC
	GND	6			
	General OUT	7			BNC
	GND	8			
	IRIG OUT	3			BNC
	GND	4			

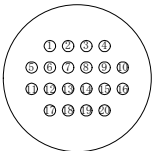
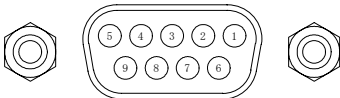
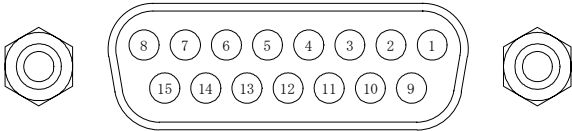
*2.2.7. MCDL / RS422 Cable (Optional)*

The APX has connectivity with Photron MCDL (Multi-Channel Data Link) unit (optional). The waveform data output (up to 4 channels of analog data and up to 6 channels of digital data) from MCDL is sampled and recorded together with image data.

The RS422 port is an interface to control the APX using RS422 communication protocol.

The MCDL and RS422 signal lines are combined into one composite cable, whose details are shown below:



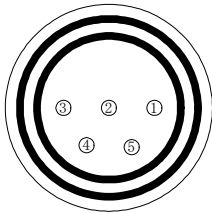
【MCDL/RS422 Connector Pins on Processor】	【MCDL Connector Pins】
 <p>HR10A-13TR-20SB (Hirose)</p>	 <p>9-pin D-sub Connector (Female)</p>
【RS422 Connector Pins】	
 <p>15-pin D-sub Connector (Female)</p>	

Connector Name	Connector on Processor Model (Manufacturer)	Connector on Cable Model (Manufacturer)	Signal Name / Pin No.		Input Connector / Pin No.
MCDL RS422	HR10A-13TR-20SB (Hirose)	HR10A-13TPD-20P (Hirose)	MCDL		9-pin D-sub Connector (Female)
			SYNC-	13	1
			SYNC+	12	2
			CLK+	14	4
			CLK-	15	5
			DATA_B-	9	6
			DATA_A-	8	7
			DATA_A+	7	8
			DATA_B+	10	9
			N.C.	--	3
			RS422		15-pin D-sub Connector (Female)
			N.C.	--	1
			TXD+	18	2
			TXD-	17	3
			RXD+	19	4
			RXD-	20	5
			II_CAM_V/ (N.S.)	5	6
			GND	6	7
			GND	4	8
			II_GATE (N.S.)	3	9
			GND	2	10
			II_RESET/ (N.S.)	1	11
			N.C.	--	12
			N.C.	--	13
			GND	11	14
			GND	16	15

N.C.: Not Connected

N.S.: Not Supported

### 2.2.8. DC Power IN Cable



【DC IN Pins】

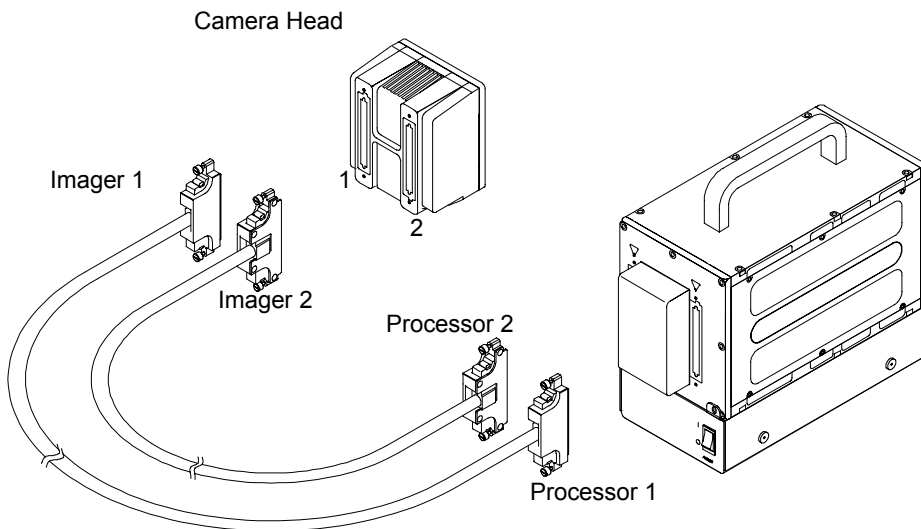
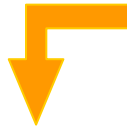
Connector Name	Signal Name	Pin No.	Connector on Processor Model (Mfr)	Connector on Cable Model (Mfr)
DC-IN	DC+12V	1	TRC01-A13R5FA (Tajimi)	TRC01-A13P5MA (Tajimi)
	DC+12V	2		
	N.C.	3		
	GND	4		
	GND	5		

## 2.3. System Connection

### 2.3.1. Connecting Camera Head

Follow the below procedure to connect between the camera head and processor.

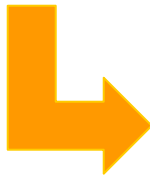
1. Be sure to turn the main power off on the processor.
2. Connect between the camera head and processor using the cables. Make sure the numbers on mating connectors match.



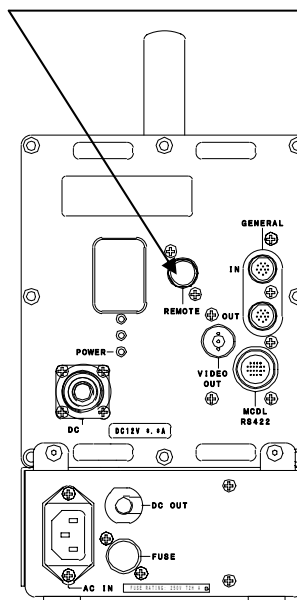
3. Fasten the retaining screws tightly on all connectors.

### *2.3.2. Connecting Remote Control Keypad*

1. Connect the keypad cable connector to the REMOTE connector on the processor rear panel.



Remote Control keypad connector

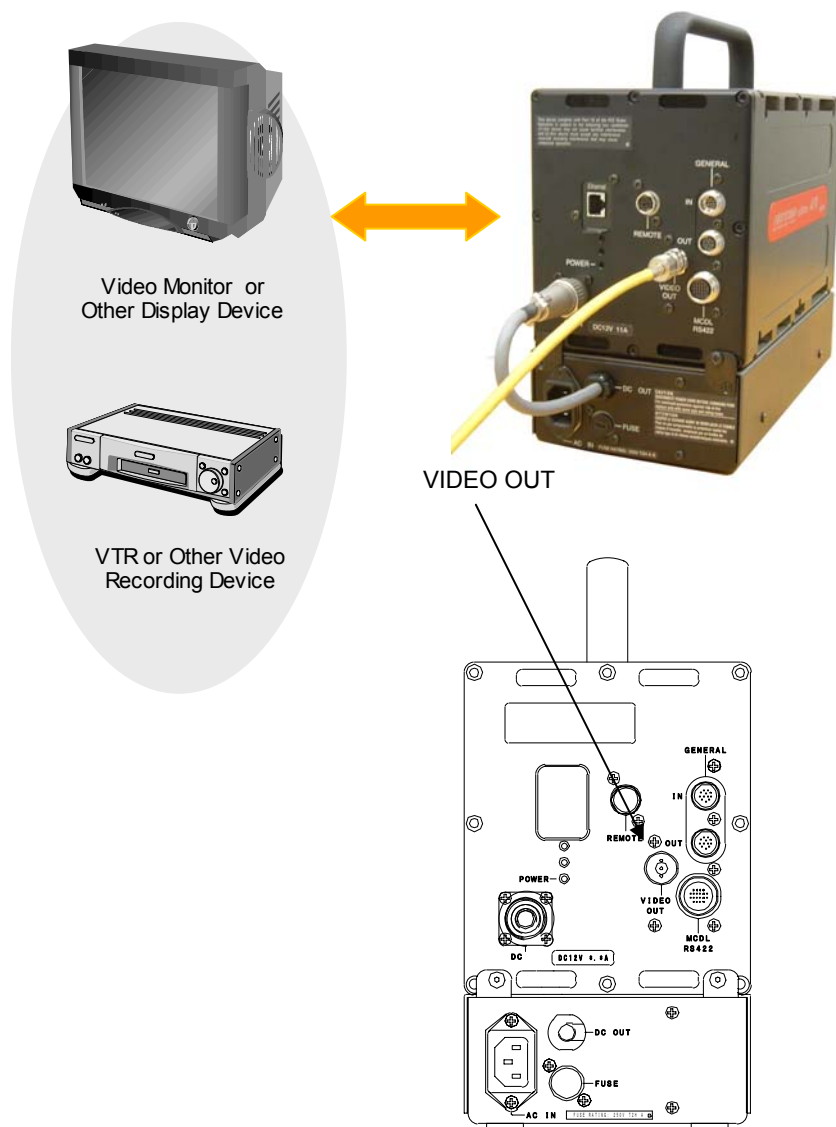


Note: The keypad is “hot-pluggable” and allows for connecting and disconnecting while power is on.



### 2.3.3. Connecting Video Monitor

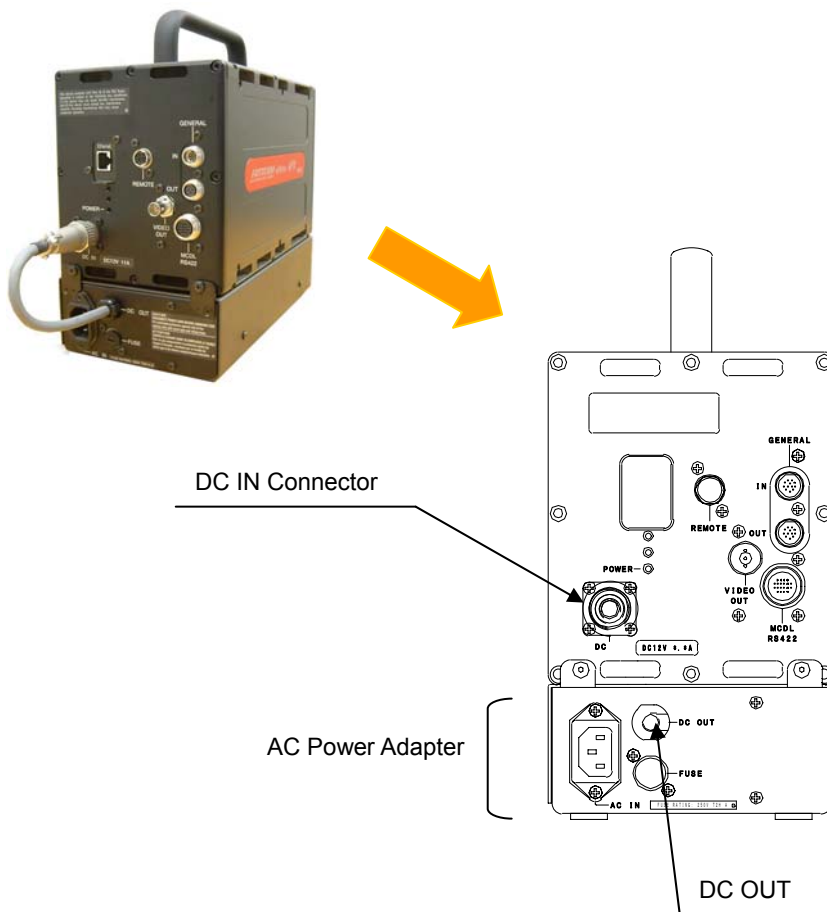
Connect a video monitor to the processor to monitor live image from the APX. Connect between the VIDEO OUT connector on the processor and the video in connector of a video monitor with a coax cable.



### *2.3.4. Power Connection*

The APX is powered by DC power fed from the attached AC power adapter that connects to a power line of 100 to 240 VAC.

1. Connect the DC output cable from the AC power adapter unit to the DC IN connector on the APX rear panel.



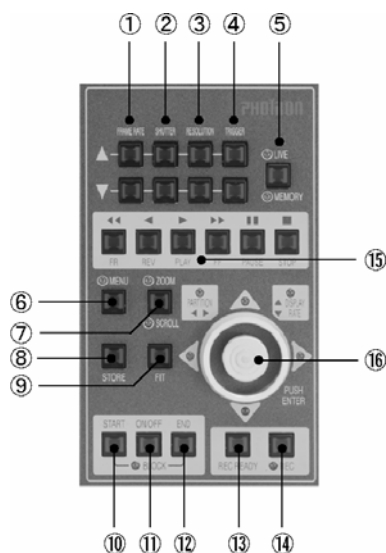
2. Connect the AC power cord to the AC IN connector on the AC power adapter unit.
3. Plug the power cord into an AC outlet.

## *2.4. Basics of Remote Control Keypad Operation*

The APX remote control keypad has been so designed that most of “frequently-used” functions are operated by one touch on the keypad as much as possible. Also, the menu has been so organized that parameter settings can be effectively carried out from the joystick.

This section discusses the basics of joystick operation that is necessary to use the menu in the most effective manner.

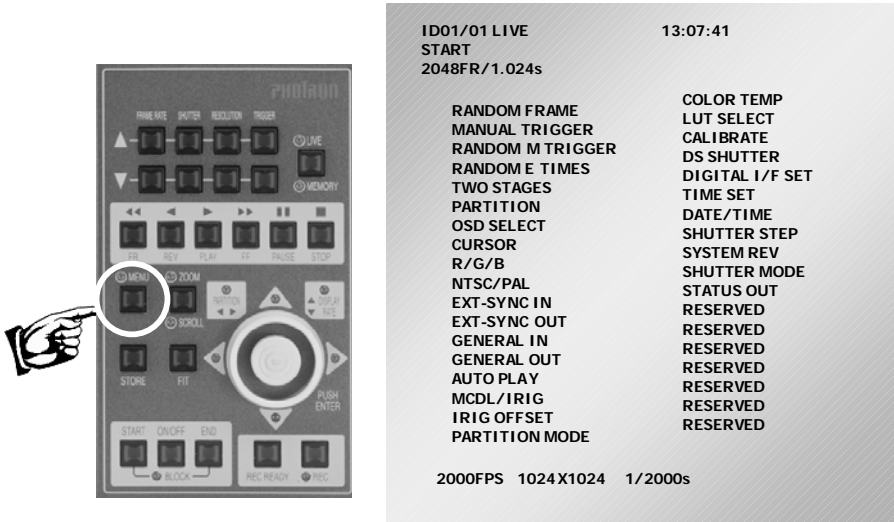
### 2.4.1. Details of Controls on Keypad



No.	Name of Key	Function	No.	Name of Key	Function
①	FRAME RATE	Sets frame rate.	⑨	FIT	Fits video image to frame size.
②	SHUTTER	Sets shutter speed.	⑩	START / BLOCK	Sets start frame of block play.
③	RESOLUTION	Sets resolution.	⑪	BLOCK ON/OFF	Switches ON / OFF of block playback.
④	TRIGGER	Sets trigger mode.	⑫	END / BLOCK	Sets end frame of block playback.
⑤	LIVE / MEMORY	Switches LIVE / Playback from memory.	⑬	REC READY	Makes ready for recording.
⑥	MENU	Displays menu.	⑭	REC	Starts recording.
⑦	ZOOM / SCROLL	Switches Zoom / Scroll	⑮	PLAYBACK	Playback buttons.
⑧	STORE	Stores settings and markers.	⑯	JOYSTICK	Steers selection.

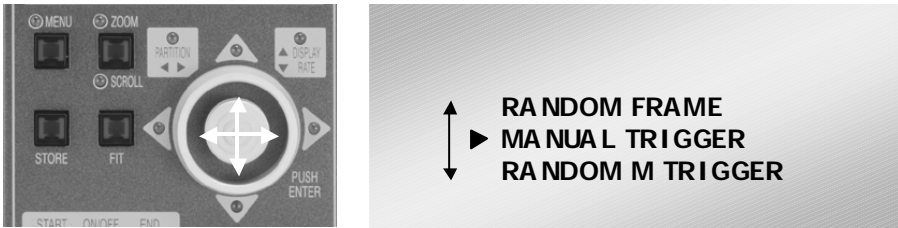
### *2.4.2. Menu List Display*

Press the MENU button on the keypad to display the menu list on the video monitor.



### *2.4.3. Menu Selection*

Move the joystick up, down, left or right to steer the cursor [>]. Bring the cursor to the top of a menu item that you wish to pick and press the joystick handle down firmly, and the menu item is selected.



#### *2.4.4. Canceling Menu Selection*

While the menu list is being displayed, press the MENU button to cancel a selected menu item.

#### *2.4.5. Menu / Manual Reference*

The following table is a quick index that directs your question about any of the menu items to a relevant page of the manual where in-depth explanation is given.

Menu Command Name	Page to See	Menu Command Name	Page to See
TIME SET	33	GENERAL IN	85
DATE/TIME	34	GENERAL OUT	90
SYSTEM REV	35	MCDL/IRIG	94
CALIBRATE	38	IRIG OFFSET	94
SHUTTER STEP	43	OSD SELECT	104
SHUTTER MODE	44	CURSOR	105
MANUAL TRIGGER	49	R/G/B	106
RANDOM FRAME	52	NTSC/PAL	107
RANDOM E TIMES	55	AUTO PLAY	108
RANDOM M TRIGGER	61	DIGITAL I/F SET	120
DUAL FRAME RATE	64	STATUS OUT	136
COLOR TEMP	67	RESERVED	
PARTITION	70	RESERVED	
PARTITION MODE	73	RESERVED	
LUT SELECT	74	RESERVED	
DS SHUTTER	78	RESERVED	
EXT-SYNC IN	82	RESERVED	
EXT-SYNC OUT	83	RESERVED	

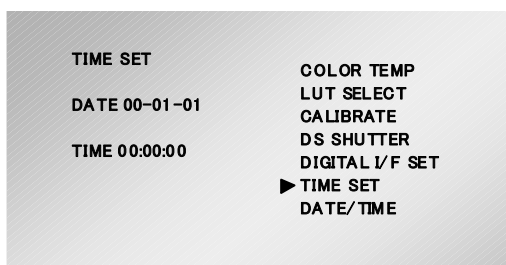
## 2.5. Setting Up System (Date, Time and Revision)

This section discusses how to set up the internal clock of the APX system. Data and time are correctly set up and are store as a part of recorded image data. Once the clock is set up, it is supported by an internal battery and the date and time are retained correctly even when the main power is turned off.

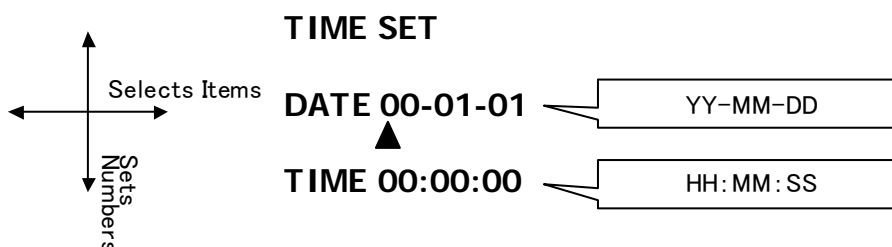
### 2.5.1. Setting Date and Time

Follow the below procedure to set up date and time of the clock.

1. Press the MENU button to display the menu list. 「MENU」
2. Select [TIME SET] menu using the joystick on the keypad.
3. The TIME SET menu is shown as follows:



4. Left-Right movement of the joystick selects menu items, and up-down movement sets numbers.

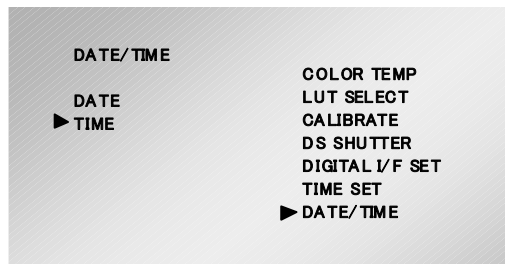


5. When all is done, press the joystick down firmly to enter the setting.

### *2.5.2. Switching Date / Time*

For display in the image frame, either date or time can be chosen. Follow the below procedure to make choice:

1. Press the MENU button to display the menu list.
2. Select the [DATE/TIME] menu by the joystick.
3. The DATE/TIME menu is displayed as follows:



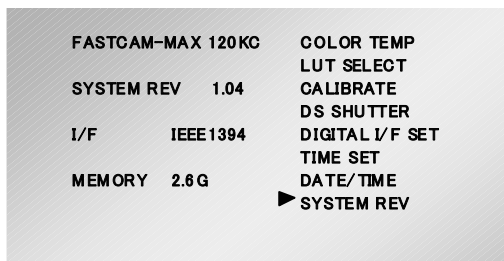
4. Move the cursor up or down to select either DATE or TIME. The selected item, DATE or TIME is now displayed.
5. When selection is done, press the joystick down firmly to set as default.
6. Check to see if the time indication is shown as it was intended.



### *2.5.3. Displaying System Revision*

The current system version number is shown on the display.

1. Press the MENU button to display the menu list.
2. Select [SYSTEM REV] by the joystick on the keypad.



3. The current system revision number is displayed.

*Memo*

## *Chapter 3 Recording*

- 3.1. Initialization (Shading Correction)*
- 3.2. Selecting Frame Rate*
- 3.3. Selecting Resolution*
- 3.4. Selecting Shutter Speed*
- 3.5. Selecting Trigger Mode*
- 3.6. Adjusting White Balance (Color Model)*
- 3.7. Partitioning Memory*
- 3.8. Look-Up Table Operation*
- 3.9. Extended Dynamic Range Mode*
- 3.10. External Trigger Input*
- 3.11. External Sync Input*
- 3.12. Setting Input and Output Signals*
- 3.13. Event Marker Function*
- 3.14. MCDL - Multi Channel Data Link*
- 3.15. IRIG Timecode*

## ***3.1. Initialization (Calibration)***

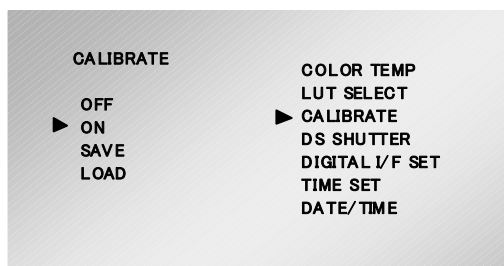
To take advantage of the high image quality of the APX system, it is important to correct the non-uniformity in sensitivity of each pixel of the imaging sensor. The APX has a calibration (shading correction) function that corrects the non-uniformity in output of each pixel based on black level. This function uses a uniform black image as reference to null the output of each pixel against black, making it possible to obtain uniform output from each of pixels in proportion to the level of incoming light.

Calibration is carried out automatically when the system is switched on. For the best result of recording, however, it is strongly recommended that whenever you change framing parameters such as gain, frame rate, shutter speed, etc., you carry out calibration of the camera before starting a recording.

The following procedure shows how to initialize the system.

### ***3.1.1. Start Calibration***

1. Set up framing parameters such as frame rate and shutter speed.
2. Place a cap on the lens completely cover it. The black image at this time is used as reference black. Make sure the lens is covered and there is no light falling on the imaging sensor.
3. Press the MENU button on the keypad to display the menu.
4. Use the joystick on the menu to go to [CALIBRATE] and press the joystick down to select.

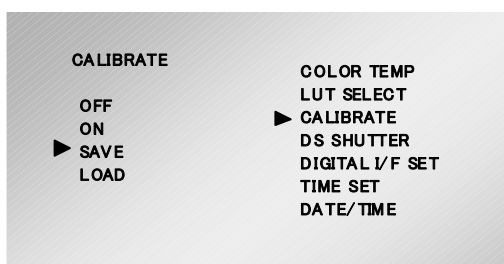


5. Use the joystick to go to [ON]. Double check if the lens is completely covered and press the joystick down to execute [CALIBRATE].
6. Remove the lens cap and make sure corrected image is displayed.

### 3.1.2. Saving Calibrated Setting

The APX can save one pattern of black image data obtained through the execution of calibration. Follow the below procedure to save a correction pattern.

1. Press the MENU button on the keypad to display the menu.
2. Use the joystick to go to [CALIBRATE] and press the joystick down to select.
3. Use again the joystick to go to [SAVE] and press the joystick down to execute [SELECT].

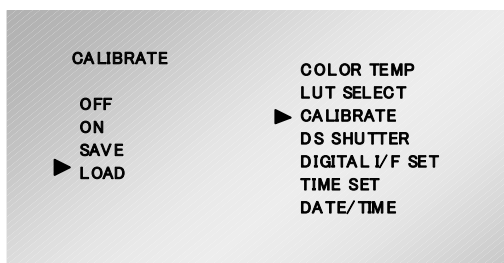


Note: It may take tens of seconds to several minutes to save data of a black image.

### 3.1.3. Loading Calibrated Setting

The black image data saved in the APX system may be loaded for subsequent use in the following manner.

1. Press the MENU button on the keypad to display the menu.
2. Use the joystick to go to [CALIBRATE] and press the joystick down to select.
3. Use the joystick to go to [LOAD] and press the joystick down to execute [LOAD].

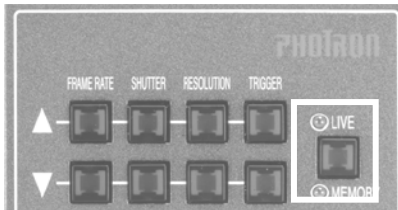


## *3.2. Selecting Frame Rate*

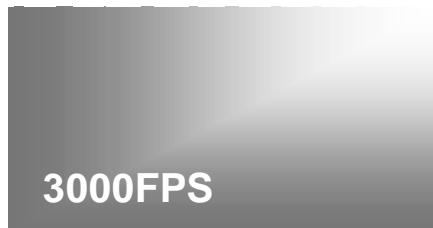
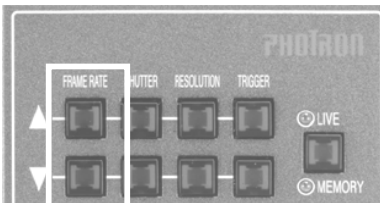
The APX can set a frame rate of from 60 Frames Per Second (FPS) up to 32,000 FPS depending on the particular need of a recording. With the APX, frame rates from 60 FPS to 2,000 FPS allows for recording of image using the full resolution of APX x APX pixels of the imaging sensor. For framing at frame rates higher than 2,000 FPS, high-speed recording is attained by limiting the read-out area (resolution) of the sensor.

The following discusses how to select a frame rate (FPS):

1. Make sure the camera is in the LIVE mode.



2. Press the FRAME RATE up or down button on the keypad. The frame rate increases as the up button is pressed and decreases as the down button is pressed.



3. Make sure the frame rate indication in the lower left corner of the video image changes as either button is pressed.

Note: At a frame rate higher than 2,000 FPS, the maximum resolution of those allowable under the currently selected frame rate is automatically selected. Please see the Frame Rate / Resolution reference table in section 6.1.4.

Note: When the camera is set to a lower frame rate (60 fps or 125 fps), several bright points (pixels) may appear in image. This is because the exposure time to the sensor is too long. The brightness of such points can be reduced by using a faster shutter speed.

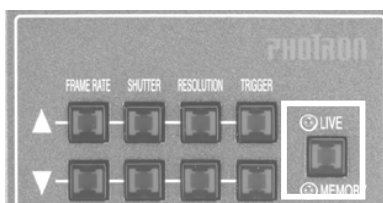
Note: The lowest frame rate for PAL operation is 50 fps.

### 3.3. Selecting Resolution

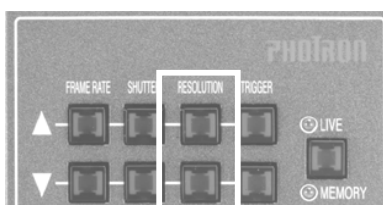
The APX has a high-speed mega-pixel imaging sensor with a full resolution of 1024 x 1024 pixels in its imager. It can produce a high-density image of 1,000,000 pixels in full resolution operation. Also, depending on the needs from each recording application, it can record at higher speeds by limiting the image resolution, or can record for a longer duration by reducing the amount of data of each of captured frames.

This section discusses how to select a resolution as follows:

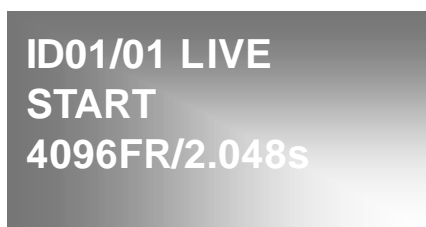
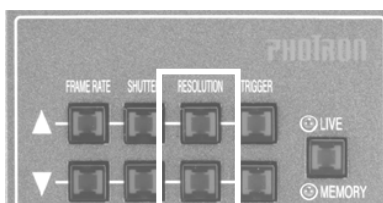
1. Make sure the camera system is in the LIVE mode.



2. Use the RESOLUTION buttons on the keypad to select a desired resolution. Press the UP[△] button to make resolution increased, and the DOWN [▽] button decreased.



3. Make sure the resolution indication in the lower left corner of the video frame changes as either of the RESOLUTION buttons is pressed.
4. The maximum available record duration is also updated together with resolution.



Note: Please see the Frame Rate/Resolution Reference Table (Section 6.1.4.)

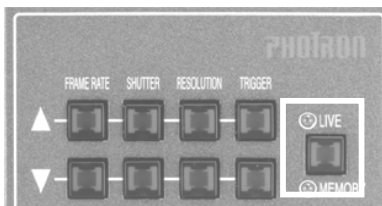
## *3.4. Selecting Shutter Speed*

The APX's electronic shuttering system makes it possible to control the exposure time within a frame regardless of the current frame rate. By using an exposure time that is shorter than the frame time determined by the frame rate (i.e. 1/frame rate sec.), you can capture events taking place at an extremely high speed as a still image without blurring effect.

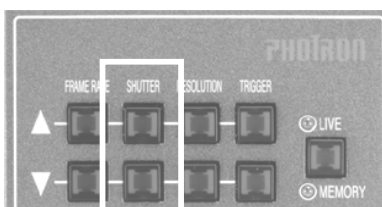
The shutter speed can be changed from the basic speed of 1/frame rate sec. up to 1/250,000 sec. (4 micro seconds) at an increment of 1/1,000 sec.

This section discusses how to select a shutter speed from the keypad.

1. Make sure the camera is in the LIVE mode.



2. Use the SHUTTER buttons on the keypad to select a shutter speed. Press the UP [ $\Delta$ ] button to have the shutter speed made higher, the DOWN [ $\nabla$ ] button lower.



3. Make sure the shutter speed indication in the lower left corner of the video frame changes as either of the SHUTTER buttons is pressed.

Note: See the Shutter Speed Table, Section 6.1.6.



### 3.4.1. Switching Shutter Speed Steps

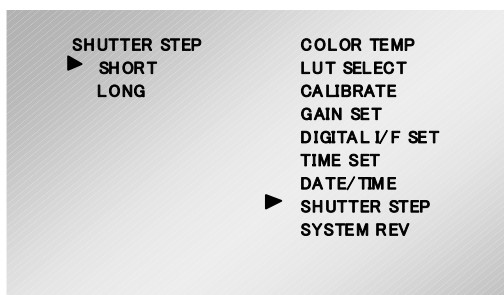
The APX system offers two choice of shutter speed increments, or steps, – FINE and COARSE – to choose from. With both sets of steps, the lowest shutter speed is 1/60 second with the speed doubling at each increment for the next five steps, up to 1/2000 regardless of which step mode is selected. After that, the COARSE step option causes the speed to double for the next several steps, and then offers users the more frequently-used shutter speeds.

With FINE steps, the shutter speed gradually increases after the 1/2,000 second threshold, in much finer increments of 1/1,000 seconds. With both options the highest shutter speed is 1/250,000 seconds.

Note: See the Shutter Speed Table, Section 6.1.6. for details of COARSE steps.

You can choose one of the two sets of shutter speed steps by the following operation:

1. Press the MENU button on the keypad to display the menu list.
2. Move the cursor to [SHUTTER STEP] and press the joystick down to select the menu.
3. The SHUTTER STEP menu is displayed as follows:



FINE	Shutter speed can be increased with 1/1,000 second step after 1/2,000.
COARSE	27 frequently-used shutter speeds are available to choose from

4. Move the cursor to [FINE] or [COARSE].
5. Press the joystick down to set the selection.

Note: See the COARSE Shutter Speed Table, Section 6.1.6.

### *3.4.2. Switching Shutter Modes*

By switching between MODE 1 and MODE 2 in the [SHUTTER MODE], you can change the mode of shutter speed setting as follows:

MODE 1: The shutter speed is automatically set to  $1/(\text{frame rate})$  sec when the frame rate is changed.

MODE 2: The shutter speed remains the same after the frame rate has been changed.

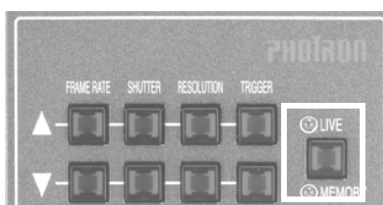
### 3.5. Selecting Trigger Mode

The APX has several different modes of triggering to meet the particular needs of capturing varied, instantaneous events.

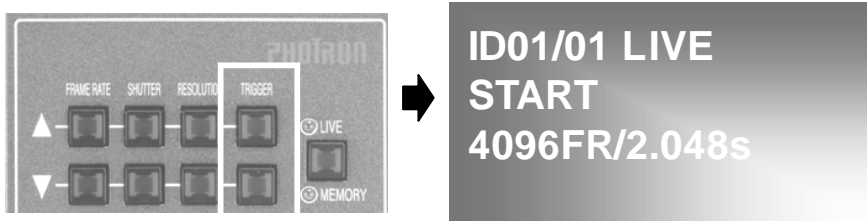
This section discusses how each of the trigger modes works.

First, the procedure to select a trigger mode is shown, and then how each trigger mode works is discussed.

1. Make sure that the camera is in the LIVE mode.



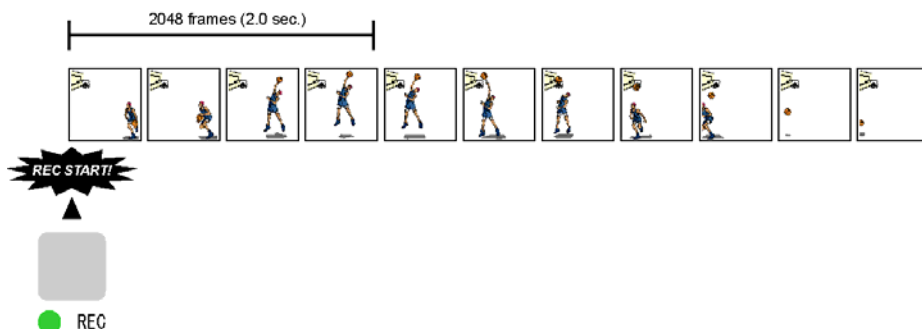
2. Press the TRIGGER  $\triangle$  or  $\nabla$  button on the keypad to select a trigger mode.



3. The selected trigger mode is displayed on the screen immediately. Make sure that the trigger mode indication changes as you press the  $\triangle$  or  $\nabla$  button.

### 3.5.1. START Mode

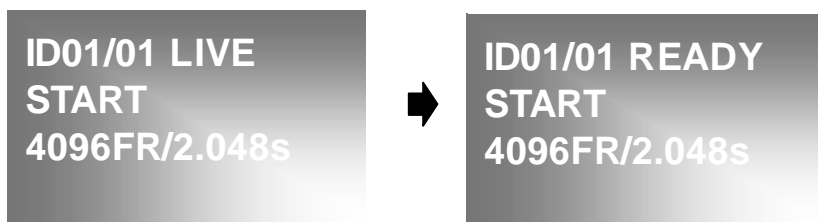
In the START trigger mode, the camera starts recording at the moment the REC button is pressed and continues recording until the memory is full, and automatically stops recording. This mode is useful when you know for sure when the anticipated event will occur. If your camera has a recording capacity of 2 seconds, for example, the camera records the high-speed event for two seconds after the REC button is pressed, as shown below.



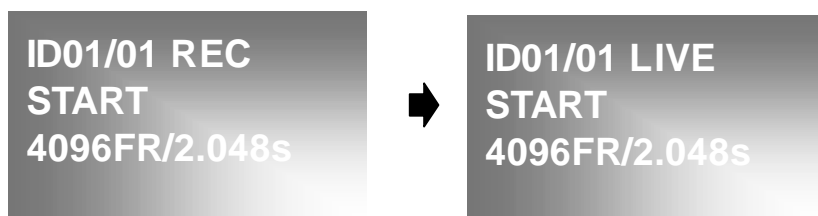
#### Recording in START Mode

Here is how to record in the START mode:

1. As discussed in Section 3.5, make sure that the camera is in the LIVE mode, and select the START trigger mode.
2. Press the REC READY button on the keypad. The camera is now in the READY mode. Make sure that the [LIVE] indication on the screen has changed to [READY].

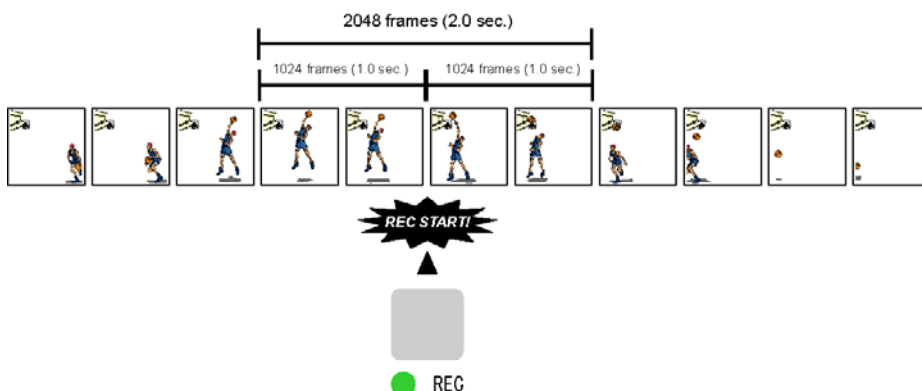


3. At the moment your interested event is coming up, press the REC button on the keypad. Note that the [READY] indication changes to [REC], indicating the camera is recording, and then it turns to [LIVE] when recording ends.



### 3.5.2. CENTER Mode

In the CENTER trigger mode, the camera records the target event in the same number of frames before and after the trigger. It is useful when you are interested in the scenes of before and after a particular event. If your camera has a recording capacity of two seconds, the camera records the scenes in the same number of frames (1024 frames – one second each) before and after the trigger as shown below.



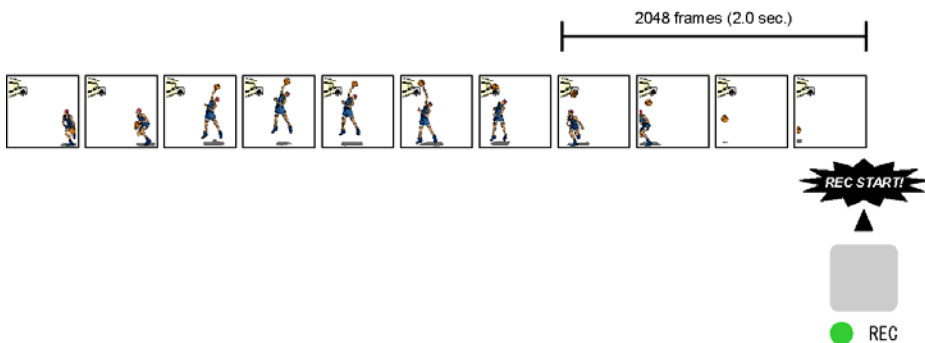
#### Recording in CENTER Mode

Follow the below procedure to record in the CENTER mode.

1. Following Section 3.5, make sure that the camera is in the LIVE mode, and select the CENTER trigger mode.
2. Press the REC READY button on the keypad. The camera is now in the READY mode. Make sure that the [LIVE] indication on the screen has changed to [READY].
3. Press the REC button on the keypad when your target event is expected to take place very soon. Note the indication on the screen has turned to [ENDLESS] showing that the camera is now recording the image of the target subject in the memory going around from end to end repeatedly.
4. At the moment you have seen your interested event has taken place, press the REC button again. The camera stops, having recorded the scenes before and after the event in the same number of frames. Note that the indication on the screen has turned from [ENDLESS] to [REC] to [LIVE].

### **3.5.3. END Mode**

The END trigger mode records the images of a target event right before the REC button is pressed. This mode is useful when it is hard to know when your target event will take place. For example, if your camera has a recording capacity of two seconds, it records images of the event in the memory for two seconds before the REC button is pressed as shown below.



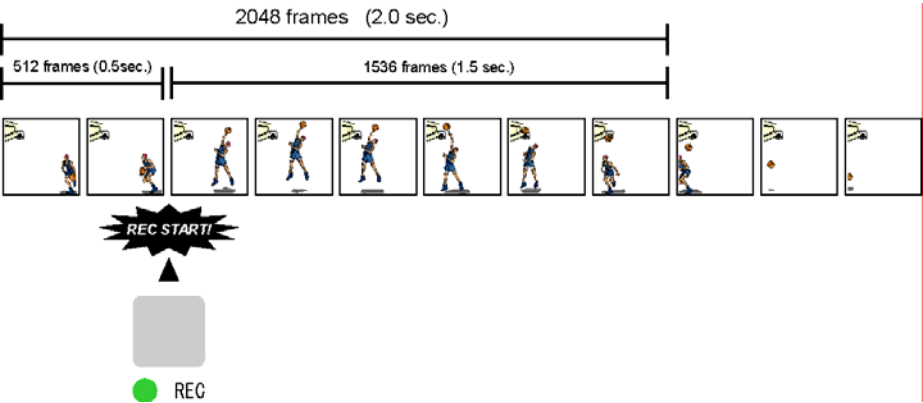
#### **Recording in END Mode**

Follow the below procedure to record in the END trigger mode:

1. As discussed in Section 3.5, make sure that the camera is in the LIVE mode, and select the END trigger mode.
2. Press the REC READY button on the keypad. The camera is now in the READY mode. Note that the indication on the screen has turned from [LIVE] to [READY].
3. Press the REC button on the keypad, and the indication on the screen turns to [ENDLESS]. The camera is now recording the image of the target subject in the memory going around from end to end repeatedly.
4. At the moment the event of your interest has taken place, press the REC button on the keypad again. The camera stops recording. The camera has recorded the event together with the scene right before it. Note the indication on the screen has turned from [ENDLESS] to [LIVE].

### 3.5.4. MANUAL Mode

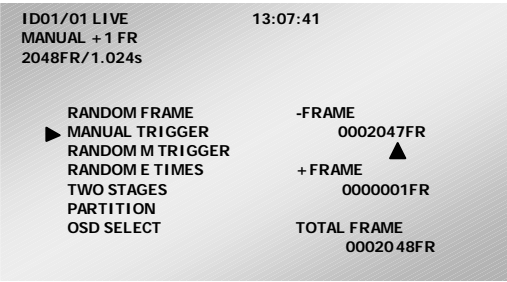
In the MANUAL trigger mode, the camera records scenes before and after the REC button is pressed. Unlike the CENTER mode, however, the numbers of frames to record before and after a trigger can be preset differently. For a camera with a recording capacity of two seconds, for example, record durations of 0.5 seconds before and 1.5 seconds after the trigger can be set as shown in the below figure.



### Setting MANUAL Mode

To use your camera in the MANUAL mode, you need to divide the memory into two parts – one part for scenes before and another for scenes after – a trigger. Here is how to divide the memory

1. Press the MENU button on the keypad to display the menu list.
2. Move the cursor to MANUAL TRIGGER and press the joystick down to select it.
3. The MANUAL TRIGGER menu comes up as shown below. The right hand portion of the menu is for presetting the numbers of frames before and after a trigger.

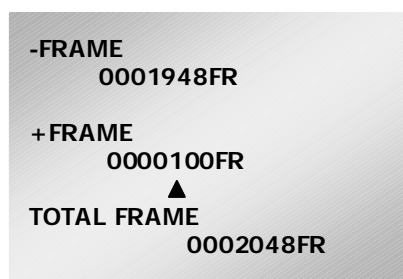
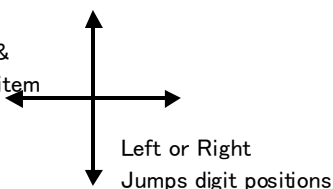


4. The meaning of each item is as follows:

-FRAME	Number of frames to record BEFORE a trigger.
+FRAME	Number of frames to record AFTER a trigger.
TOTAL FRAME	Total number of frames available in memory.

5. Now set the numbers of frames before and after a trigger. Using the joystick, up or down for increase or decrease the number, and left or right to jump the digit position, set a number. If you set the number for [-FRAME] as shown below, for example, the number for [+FRAME] is automatically set depending on the total number of frames available for recording.

Up or Down  
Changes  
number &  
Selects item



6. When you are done, press the joystick down to enter the settings. Now you should see the trigger mode setup indication of [MANUAL +100 FR] in the upper left corner of the screen as shown below, where the number of frames to record after a trigger is 100.
7. Now the camera is ready to record 1948 frames before and 100 frames after a trigger.





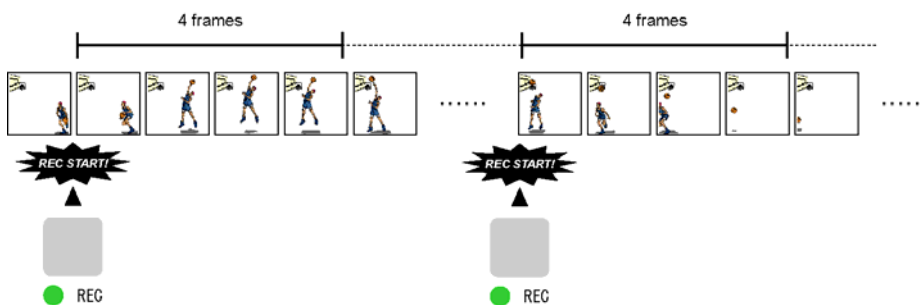
## **Recording in MANUAL Mode**

After presetting the numbers of frames to record before and after a trigger as shown in the above example, follow the below procedure to record in the MANUAL trigger mode:

1. Following Section 3.5, make sure the camera is in the LIVE mode, and select the MANUAL trigger mode.
2. Press the REC READY button on the keypad. The camera is now in the READY mode. Make sure that the [LIVE] indication has turned to [READY].
3. Press the REC button on the keypad when your target event is expected to take place very soon. Note the indication on the screen has turned to [ENDLESS] showing that the camera is now recording the images of the subject in the memory going around from end to end repeatedly.
4. At the moment you have seen the event of your interest taking place, press the REC button again. The camera stops. It has recorded in its memory 1948 frames before and 100 frames after the trigger, respectively, as preset in the above example. Make sure that the indication on the screen has turned from [REC] to [LIVE].

### 3.5.5. *RANDOM Mode*

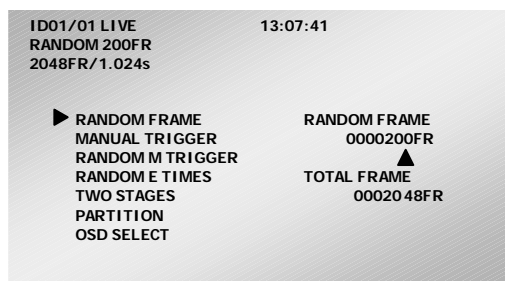
In the RANDOM trigger mode, the camera records in its memory a preset number of frames of images every time a trigger is given. This mode is useful to record images of events that take place at an unpredictable timing with output of a trigger signal. The number of frames to record at each trigger can be set any number from 1 (one) up to the total number of available frames in the memory.



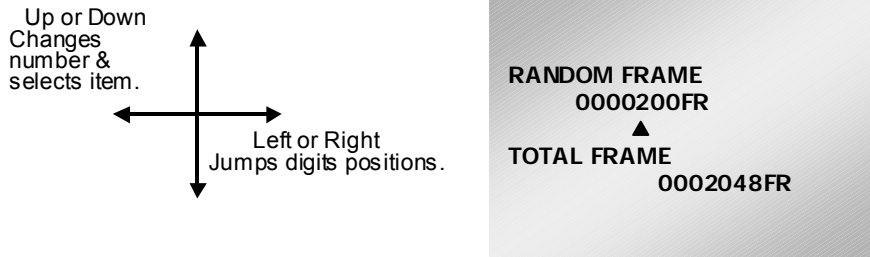
#### **Setting Number of Frames for RANDOM Mode Recording**

To operate the camera in the RANDOM trigger mode, you need to preset the number of frames to record at each trigger. Follow the procedure below:

1. Press the MENU button on the keypad to display the menu list.
2. Use the joystick on the keypad to move the cursor to [RANDOM TRIGGER]. Press the joystick down to select the menu.
3. The RANDOM TRIGGER menu appears as shown below. The number of frames to record at each trigger is shown in the lower right area.



4. Now you can set the number of frames to record at each trigger by moving the cursor with the joystick as shown in the following figure on the next page. Move the joystick, left or right, to select a digit, and, up or down, to increase or decrease the number in each digit as necessary.



5. When you are done, press the joystick down to enter the settings. Now you should see the number of frames to record at each trigger as [RANDOM 20 FR] in the upper left area of the screen as shown below, where the number of frames to record at each trigger is 20.



## **Recording in RANDOM Mode**

Follow the below procedure to record in the RANDOM mode.

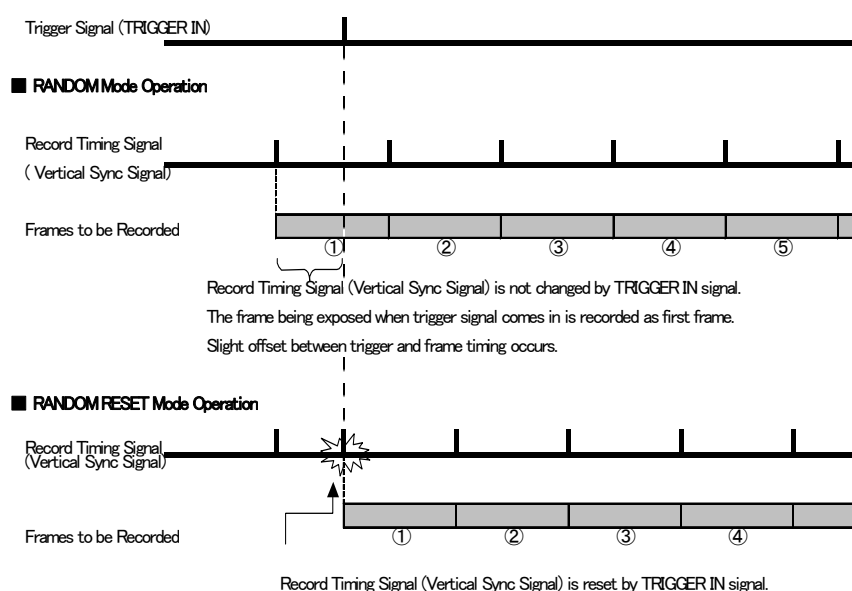
1. Following Section 3.5, make sure the camera is in the LIVE mode and the RANDOM trigger mode has been selected.
2. Press the REC READY button on the keypad. The camera is now in the READY mode. Make sure that the indication on the screen has turned from [LIVE] to [READY].
3. Press the REC button on the keypad for the first time. Note the indication on the screen has turned from [READY] to [REC]. The camera is now recording images in the memory going around from end to end repeatedly.
4. Press the REC button again when you know events of your interest are coming up very soon. The camera records in the memory the preset number of frames of images and stands by for a next trigger. In addition to the REC button on the keypad, contact or TTL signals from external trigger input terminals can be used to trigger the camera in the RANDOM mode (see Section 3.10 External Trigger Input).
5. The camera automatically stops recording when the memory is full (\*). Make sure the indication on the screen has turned from [REC] to [LIVE].

\*Note: You can stop recording by pressing the REC READY button at any time during recording.

### 3.5.6. *RANDOM RESET Mode*

This section describes the principle of operation of the RANDOM RESET mode in comparison with the RANDOM and START mode. To simply put it, the RANDOM RESET mode is a mode of recording operation that has been devised to improve the accuracy of temporal relationship between the timing of trigger input and that of start of recording by resetting the recording timing, i.e. vertical sync, at the input of a trigger.

The following figure is a visual presentation of the basic idea of the RANDOM RESET mode.



The above figure shows the difference in timing of trigger input and start of recording between the RANDOM (or START) mode and RANDOM RESET mode.

In the RANDOM or START mode, the record timing signal (vertical sync) advances regardless of the timing of trigger input as shown in the above. Because of this fact, the recording start time of the first frame may be slightly brought forward, up to about 3/4 of a framing cycle, depending on when the trigger is given, and there is no knowing how much the offset may be.

In the RANDOM RESET mode, on the other hand, the record timing signal (vertical sync) is reset by the trigger input and restarts working from that point. By resetting the vertical sync at the trigger, we now know exactly the temporal relationship between the trigger input and start of recording of the first frame. It is a known fact that it takes 100 ns from the input of a trigger signal to reset of the vertical sync signal, i.e. start of recording.

Note: Technically, there is a slight time lag between the record timing (vertical sync) and start of exposure, which is dependant on the framing rate being used (7.4 us at 2,000 fps).

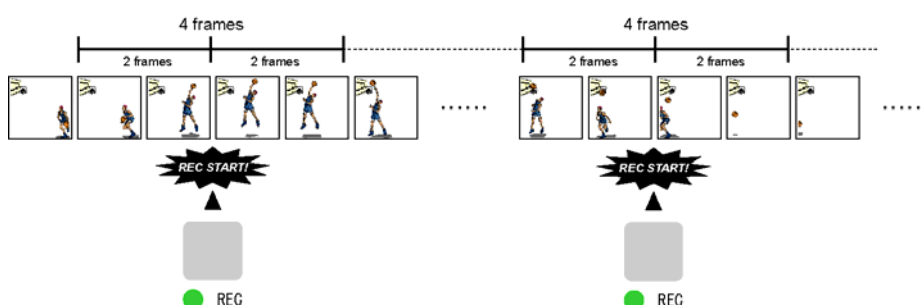
Note: The RANDOM RESET mode cannot be used in conjunction with the Sync Operation (frame rate synchronization) with External Equipment (Section 3.11.4.)

Note: When you wish to operate multiple APX cameras in the RANDOM RESET mode, use [GENERAL IN] for trigger input. Do not use [TRIGGER TTL IN] or [TRIGGER SW IN] because it is likely that proper recording cannot be attained due to delay of trigger signals.

Note: The enforced reset of timing signal may cause an image brightness difference of up to 3 percent between the first frame and subsequent frames of a recording.

### 3.5.7. RANDOM CENTER Mode

In the RANDOM CENTER trigger mode, the camera records in the memory a preset number of frames of images at each trigger, as in the case with the RANDOM mode. The difference is that the RANDOM CENTER mode records the preset number of frames before and after a trigger, while the RANDOM mode only records after a trigger. This mode is useful to record images of events that take place at an unpredictable timing with output of a trigger signal and that you wish to observe together with scenes preceding the it. The number of frames to record at each trigger can be set any number from 1 (one) up to the total number of available frames in the memory.



#### Setting Number of Frames and Triggers for RANDOM CENTER Mode Recording

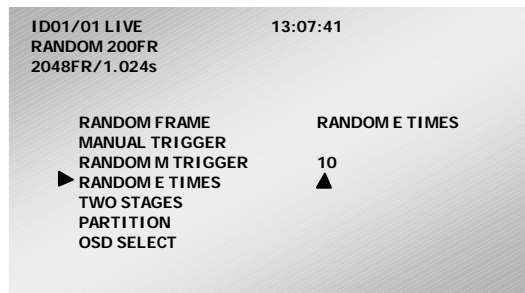
The procedures for presetting the number of frames to record at each trigger and the number of triggers to be given during a recording session are the same as the ones used in the RANDOM trigger mode. See the previous Section 3.5.5 RANDOM Mode.

#### Setting Number of Recording for RANDOM CENTER Mode Recording

The maximum number of trigger accepted in RANDOM CENTER mode operation is ten (10) times. It is possible to end a series of recordings when a preset number of input triggers finished. This subsection describes how to preset a number of trigger inputs.

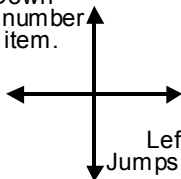
1. Press the MENU button on the keypad to display the menu list.
2. Move the cursor to [RANDOM E TIMES] and press the joystick down to set the selection.

3. The RANDOM E TIMES menu is displayed as shown below. The number of trigger acceptance is preset in the right-hand side area of the screen



4. Set a number of trigger acceptance using the joystick on the keypad.

Up or Down  
Changes number  
& selects item.



Left or Right  
Jumps digit position.





## **Recording in RANDOM CENTER Mode**

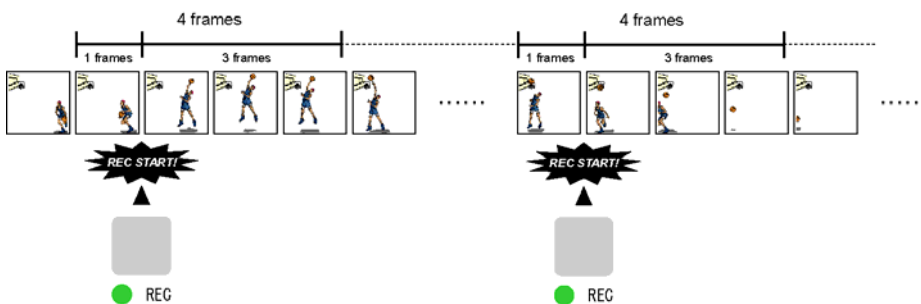
Here is how to record in the RANDOM CENTER mode:

1. Following Section 3.5, make sure that the camera is in the LIVE mode, and select the RANDOM CENTER mode.
4. Press the REC READY button on the keypad. The camera is now ready to record. Make sure that the indication [LIVE] has turned [READY].
3. Press the REC button on the keypad for the first time, which will turn the camera into ENDLESS recording mode. Note the indication on the screen has turned from [READY] to [ENDLESS]. The camera is now recording images in the memory going around from end to end repeatedly.
4. Press the REC button again when you know events of your interest are coming very soon. The camera records in the memory the preset number of frames of images before and after the event, and stands by for a next trigger. In addition to the REC button on the keypad, contact or TTL signals from external trigger input terminals can be used to trigger the camera in the RANDOM mode (see Section 3.10 External Trigger Input).
5. The camera automatically stops recording when the memory is full (\*). Make sure the indication on the screen has turned from [ENDLESS] to [LIVE].

\*Note: You can stop recording by pressing the REC READY button at any time during a recording session.

### **3.5.8. RANDOM MANUAL Mode**

In the RANDOM MANUAL trigger mode, the camera records in the memory a preset number of frames of images at each trigger, as in the case with the RANDOM CENTER mode. The difference is that the RANDOM MANUAL allows for any number of frames to be recorded before and after a trigger, while the RANDOM SENTER mode records the same number of frames before and after a trigger. This mode is useful to record images of events that take place at an unpredictable timing with output of a trigger signal and that you wish to observe together with scenes preceding the it. The number of frames to record at each trigger can be set any number from 1 (one) up to the total number of available frames in the memory.



### **Setting Number of Frames and Triggers for RANDOM MANUAL Mode**

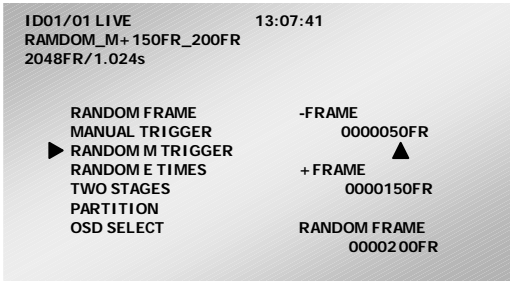
The procedures for presetting the number of frames to record at each trigger and the number of triggers to be given during a recording session are the same as the ones used in the RANDOM CENTER trigger mode. See the previous Section 3.5.5 RANDOM CENTER Mode. After presetting these numbers, go to the following procedure for RANDOM MANUAL mode setting.

### **Setting RANDOM MANUAL Mode Recording**

To use your camera in the RANDOM MANUAL mode, you need to preset numbers of frames to record before and after each trigger. Here is how to preset these numbers:

1. Press the MENU button on the keypad to display the menu list.
2. Move the cursor by the joystick to [RANDOM TRIGGER] and press the joystick down to select the menu.

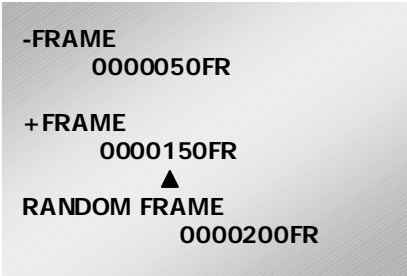
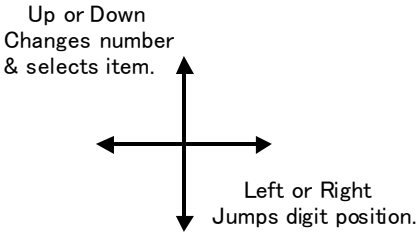
3. The RANDOM M TRIGGER menu is displayed as shown below. The numbers of frames to record before and after a trigger are shown in the right hand area.



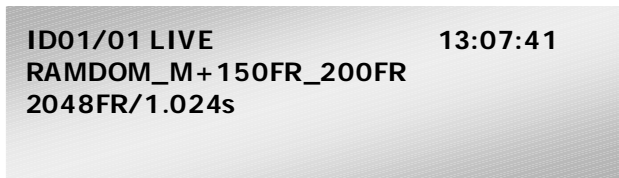
- 4 The meaning of each item is as follows:

-FRAME	Number of frames to record BEFORE a trigger.
+FRAME	Number of frames to record AFTER a trigger.
TOTAL FRAME	Total number of frames to record at a trigger.

5. Now set the numbers of frames to record before and after a trigger. Using the joystick, up or down to increase or decrease the number, and left or right to jump the digit position, set a number. If you set the number for [-FRAME] as shown below, for example, the number for [+FRAME] is automatically set depending on the total number of frames to record at each trigger.



6. When you are done, press the joystick down to enter the settings. Now you should see the trigger mode setup indication of [RANDOM\_M+150FR\_200FR] in the upper left corner of the screen as shown below, where the number of frames to record after a trigger is 150 and the total number of frames to record at each trigger 200. Now the camera is ready to record 50 frames before and 150 frames after each trigger.



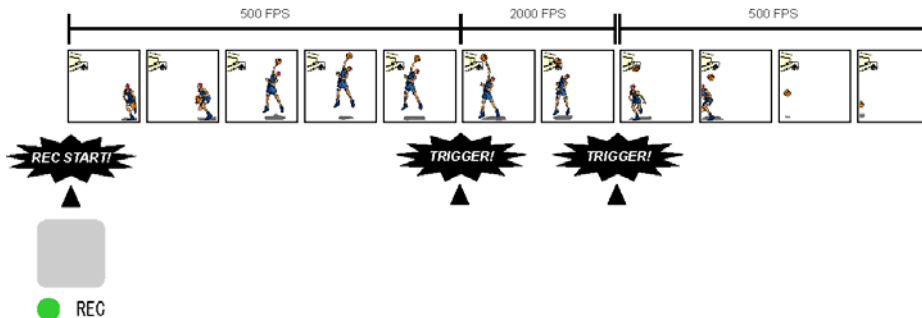
## **Recording in RANDOM MANUAL Mode**

Follow the below procedure to make a recording in the RANDOM MANUAL mode:

1. Following Section 3.5, make sure the camera is in the LIVE mode, and select the RANDOM MANUAL mode.
2. Press the REC READY button on the keypad. The camera is now in the READY mode. Make sure the indication [LIVE] on the screen has turned to [READY].
3. Press the REC button on the keypad for the first time, which will turn the camera into ENDLESS recording mode. Note the indication on the screen has turned from [READY] to [ENDLESS]. The camera is now recording images in the memory going around from end to end repeatedly.
4. Press the REC button again when you know events of your interest are coming up very soon. The camera records in the memory the preset number of frames of images before and after the event, and stands by for a next trigger. In addition to the REC button on the keypad, contact or TTL signals from external trigger input terminals can be used to trigger the camera in the RANDOM MANUAL mode (see Section 3.10 External Trigger Input).
5. The camera automatically stops recording when the memory is full (\*). Make sure the indication on the screen has turned from [ENDLESS] to [LIVE].

\*Note: You can stop recording by pressing the REC READY button at any time during a recording.

### 3.5.9. DUAL FRAMING RATE Mode



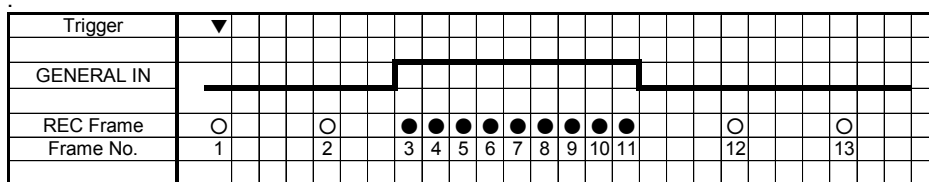
The DUAL FRAMING RATE Mode has been devised to use two preset framing rates alternately. It allows for changing the framing rate during a recording to capture faster or more interesting events for slower playback. For example, while shooting, at a slower framing rate, a basketball player nearing the goal, you can record the instance the basketball player stuffing the ball into the basket in a higher temporal resolution for subsequent motion analysis. This section describes how the Dual Framing Rate Mode works.

## Concept of Dual Framing Rate Mode and External Control Signal Input

To use the Dual Frame Rate mode, you first set a higher framing rate with which you wish to capture the instance of important event. Then, you set a slower framing rate as 1/2, 1/4 or 1/8 of the higher framing rate.

The change of the frame rate during recording is effected by an external TTL signal input using the GENERAL IN cable connector.

The following figure is a visual presentation of the temporal relationship between the trigger signals and corresponding recorded to be recorded in an example of 1:4 rate setting.



Where the white circle denotes frames recorded at the lower rate and the black at higher rate.

The START mode is the mode of recording used in the Dual Framing Rate mode.

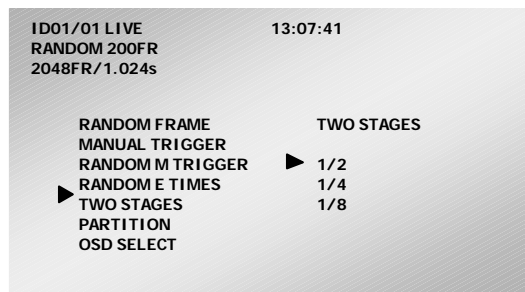
TTL change over signals to be fed to the GENERAL IN connector are defined as follows (e.g. for positive signal setting):

GENERAL_IN Input "H"	Change to higher rate from the next frame
GENERAL_IN Input "L"	Change to lower rate from the next frame

### **Parameter Setting for Dual Framing Rate Mode Operation**

The following shows how to set parameters for a higher and lower framing rates.

1. Referring to Section 3.2. [Selecting Frame Rate], select a framing rate for the higher rate, for example 2000 fps.
2. Press the MENU button on the keyboard to display the menu list.
3. Move the cursor by the joystick to [TWO STAGES] and press the joystick down to select the item.
4. The TWO STAGE menu appears on the screen. In the right-hand area, framing rate ratios of 1/2, 1/4 and 1/8 are shown to choose from.



5. Move the cursor to one of the ratios, for example 1/4, and press the joystick down to select it.
6. Now the system has been set to record at 2,000 fps for the higher rate and 500 fps for the lower rate.
7. Press the MENU button to exit and go back to the LIVE screen.

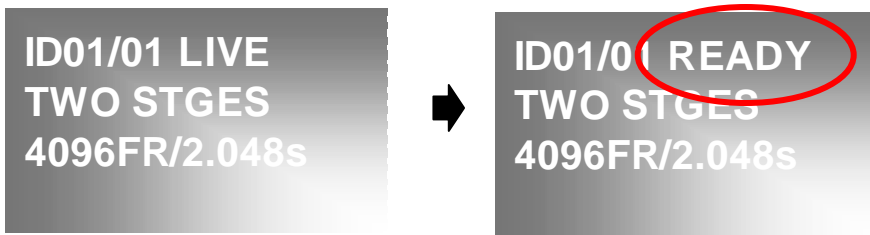
## **Recording in Dual Framing Rate Mode**

Follow the below procedure to record in the Dual Framing Rate mode.

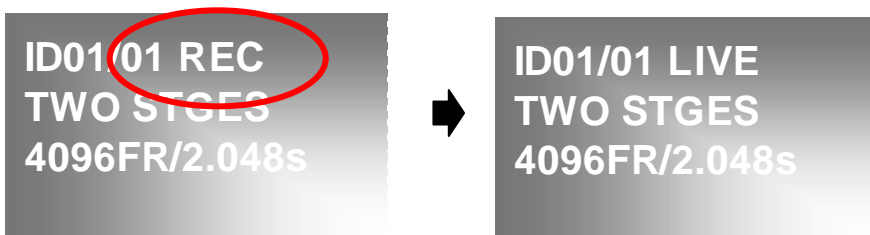
1. Referring to Section 3.5. Selecting Trigger Mode, make sure the camera is in the LIVE mode and the trigger mode is TWO STAGES.
2. Connect a TTL trigger input to the GENERAL IN connector. See the table below for TTL signal and recording frame rate (e.g. for positive signal setting):

GENERAL_IN Input "H"	Change to higher rate from the next frame
GENERAL_IN Input "L"	Change to lower rate from the next frame

3. Press the REC READY button on the keypad to turn the system into the READY mode. Make sure the indication on the screen has turned from [LIVE] to [READY].



4. At the moment you wish to start recording, press the REC button. The system starts recording and the indication turns to [REC]. When the recording is done, i.e. the memory is full, the system automatically stops recording. The indication turns to [LIVE].





## 3.6. Adjusting White Balance (for Color Model only)

A digital camera must have a proper white balance that renders a white target as a “pure white” image in both live and playback modes. In order to make accurate color reproduction with a color model of the APX, color balance must be correctly set under the color temperature of lighting. The APX has re-adjustable R, G and B color channels so that proper white balance can be attained by tweaking the balance of them depending on the characteristics of lighting.

Two different methods - Fixed (preset) and Manual (one touch balancing) - of color balance readjustment are offered with the APX.

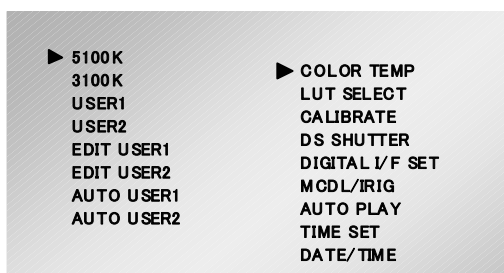
This section describes these readjustment methods.

### 3.6.1. Fixed (Preset) White Balance

The APX has two sets of preset (fixed) white balance values to cover typical color temperatures of 5100K and 3100K, each representing the following light:

5100K:	Bright daylight, outdoor
3100K:	Hologen lamps

1. Press the MENU button to display the menu and select the COLOR TEMP command.
2. Then select 5100K, or 3100K, depending on the current lighting setup.

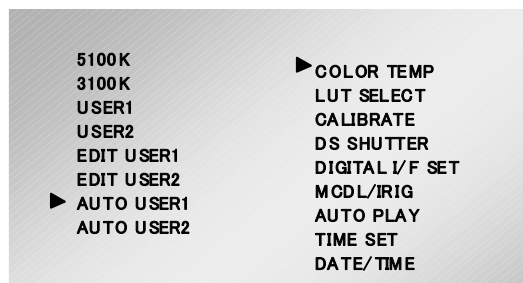


3. Make sure that white balance has been updated.

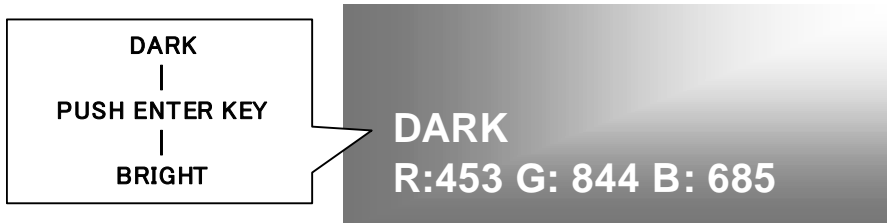
### 3.6.2. Manual (One Touch) White Balance

To obtain a better white balance, the APX has a means for setting up white balance semi-automatically. Two patterns of setting can be saved in memory as preset parameters. Follow the below procedure:

1. Set up parameters for an upcoming recording – frame rate, shutter speed and resolution.
2. Press the MENU button on the keypad to display the menu list.
3. Move the cursor to the [COLOR TEMP] command using the joystick.
4. Press the joystick down and the COLOR TEMP menu appears as shown below.



5. Move the cursor by the joystick to AUTO USER1 (or AUTO USER2) and press the joystick down to enter the white balance readjustment mode.
6. Make sure that the value of each of R, G and B channels and indication of DARK or GRIGHT are shown in the lower left corner of the screen.



7. Turn the light on and shoot a piece of white paper or something that is a reference white target, and place it in the center of the picture frame.
8. Control the lens iris to readjust the amount of incoming light onto the imaging sensor. While doing this, make sure that the indicator changes from [DARK] to [PUSH ENTER] to [BRIGHT], or other way around, as the incoming light amount varies. If the indication does not change even when the overall brightness of the image frame is changing, check if the white target is in the center part of the view field. If the target is not in the center, replace it until the indicator changes to the movement of the iris.
9. Control the iris until the indicator shows PUSH ENTER.

10. Press the joystick down to enter the current setting of white balance while PUSH ENTER is displayed.
11. Now the APX system has obtained a set of R, G and B values for a proper white balance. Make sure that the displayed image has been updated.
12. The set of R, G and B values are saved in the USER 1 (or USER 2) window.

## *3.7. Partitioning Memory*

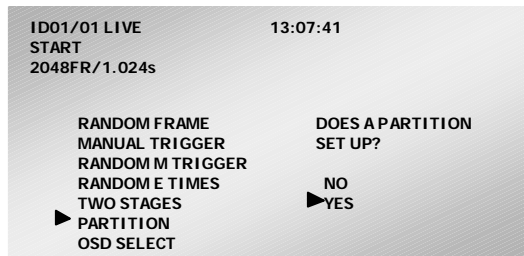
The APX has a large capacity memory of 2.6GB, standard, or up to 8GB with optional additional memory units. The memory can be partitioned into several sections and each section is used for a recording session. The memory can be divided into up to 64 sections of equal capacity. Each section is given its own ID number for recording management purposes. Each of the divided sections can have its own recording parameter settings, which is a useful feature when an event is recorded repeatedly under several different shooting conditions.

### *3.7.1. Prepare for Memory Partitioning (Set Number of Sections)*

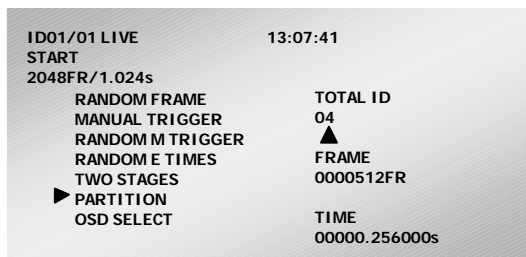
To take advantage of the memory partitioning feature, it is necessary to decide on how to divide the memory and set it up accordingly. This section discusses how to set up memory partitioning.

1. Press the MENU button on the keypad to display the MENU.
2. Select [PARTITION] with the joystick.
3. The PARTITION menu is now displayed on the screen.
4. A dialog window is displayed asking if you wish to set up partitions.

Note: If you partition the memory or change the current partitions, all the image data currently stored in the memory is erased.



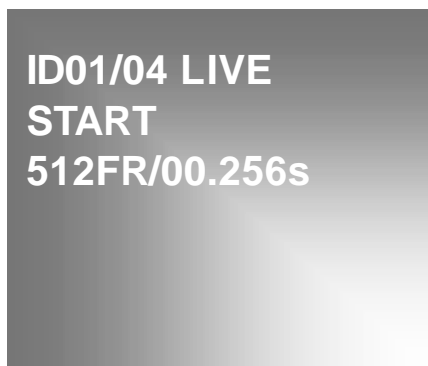
5. If you wish to partition the memory, select YES. A setup menu is displayed.



6. Move the joystick up or down to select the desired number for divided sections.



↔  
Select ID Number

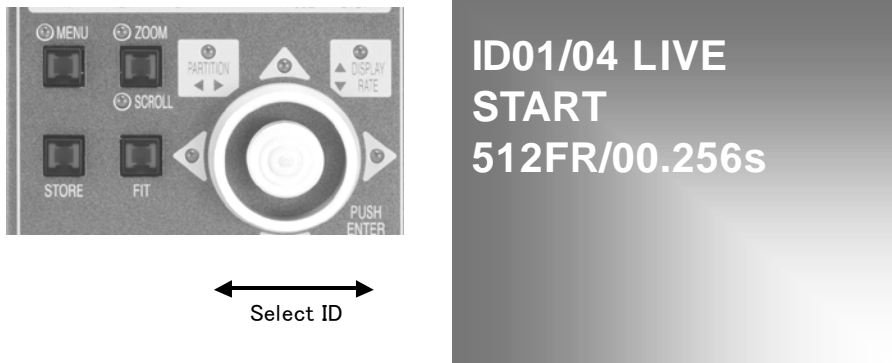


7. Once the selection is done, press the joystick down to enter the setting.
8. Make sure the ID indication is in fractional number mode now.

### *3.7.2. Recording into Divided Sections*

This section describes how to record in the PARTITIONED MEMORY mode.

1. Make sure that the camera is in the LIVE mode.
2. Move the joystick left or right to select the ID number of the section that you wish to record. Make sure if the ID number displayed in the screen is correct.



3. Once the ID number has been selected, start a recording in the usual manner.

### *3.7.3. Playback of Recorded Sections*

Recorded image in any of the sections can be played by selecting the ID of the particular section of interest as follows:

1. Make sure that the camera is in the MEMORY mode.
2. Move the joystick on the keypad, left or right, to select a section that you wish to play. Make sure if the displayed ID number is correct.
3. Once the section that you wish to play back has been selected, play it in the usual manner.

### **3.7.4. PARTITION MODE**

The previous section 3.7.2. Recording into Divided Sections shows how to record when PARTITION MODE 1 is selected.

When PARTITION MODE 2 is selected, manual selection of ID is not needed. The following describes how to record in PARTITION MODE 2 with the number of partitions set to 10, for example:

1. In partition ID01, set the camera in READY status.
2. Send a trigger pulse to start recording.
3. Recording ends.
4. ID is automatically increased to 02 and the camera is set in the status waiting for a REC trigger. The camera is in the READY mode if it is in the START recording mode and in the ENDLESS recording mode if in the CENTER, END or MANUAL mode.
5. Send a REC trigger to start recording.
6. Recording ends.
7. ID is automatically increased to 03 and the camera is set in the status waiting for a REC trigger.
8. The camera automatically repeats the above until it ends recording at ID10, and the camera returns to LIVE.

This operation saves the trouble of manually changing the ID and setting the camera in the status waiting for a REC trigger, and is useful to record events in series changing ID numbers.

Note: The above MODE 2 operation can only be used in the START, CENTER, END or MANUAL recording mode.

## ***3.8. Look-Up Table (LUT) Operation***

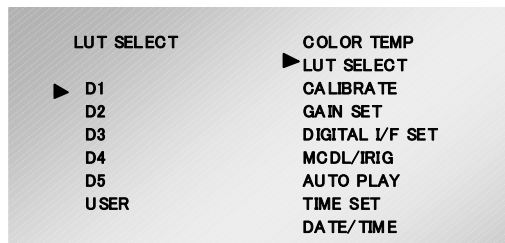
The look-up table is a reference table that defines the mutual relationship between the grayscale values of the recorded image data and that of the displayed image on the computer monitor or video display screen.

The APX has a built-in hardware LUT that offers a means to enhance the contrast of image to make the subject look more clearly, or to enhance a particular range of gray level within a frame to make the subject outstand in the scene. This gray level manipulation is effective only on the displayed image and the original recorded image data is not altered in any way.

This section discusses the relationship between the LUT, video output and PC software of the APX system.

The following is a description of the relationship between the LUT, output image and PC software:

1. Press the MENU button on the keypad to display the menu list.
2. Move the cursor to [LUT SELECT] and press the joystick down to set the selection.
3. The LUT SELECT menu is displayed as follows:



4. Select an LUT from D1 to D5, or USER
5. Press the joystick down to set the selection.

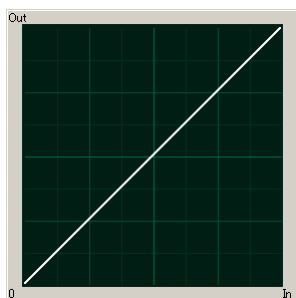


### 3.8.1. Operating Preset LUT

The APX has five (5) preset LUT patterns. All the five patterns are shown here:

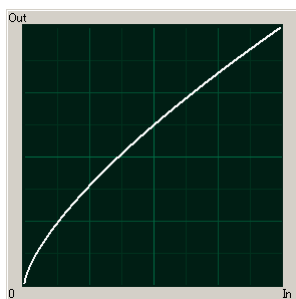
#### D1

This is an LUT pattern whose output is always linear to the input. It is the standard LUT that is used in usual applications.



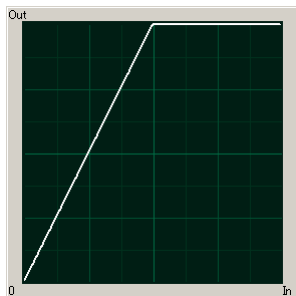
#### D2

This is an LUT pattern with a 0.6 gamma.



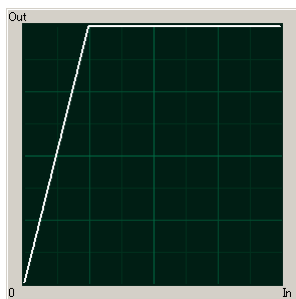
### **D3**

This is an LUT pattern that allocates the lower APX of the 1024 total steps to output. It expands the darker portion of an original recorded image.



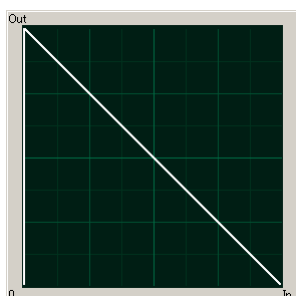
### **D4**

This is an LUT pattern that allocates the lower 256 of the 1024 total steps to output. It expands the darker portion of an image, more than D3 LUT.



## **D5**

This is an LUT pattern that inverts the input image data.



### *3.8.2. Customizing LUT Patterns*

LUT patterns can be created from the PFV (Photron FASTCAM Viewer) Control Software. See the PFV Software Manual for details of LUT pattern creation.

## **USER**

This mode uses a custom LUT created from the PFV Control Software.

## ***3.9. Extended Dynamic Range Mode***

The Extended Dynamic Range Mode has been developed to record highlight and lowlight portions together in one image frame by readjusting the exposure in the imaging sensor. With this feature, the sensor automatically makes a necessary adjustment so that both highlight and lowlight areas within one frame can be recorded with appropriate exposure when the target event has an extremely wide range of brightness.

This exposure adjustment function has three different levels, each assignable to a different magnitude of brightness variation of the subject.

### **How to Set Extended Dynamic Range Mode**

1. Press the MENU button on the keypad to display the menu.
2. Move the cursor by joystick to select the DS SHUTTER menu.
3. The menu shows the following items:

Menu Items	Description
OFF	Switches Extended Dynamic Mode off.
ON MODE 1	Sets magnitude of exposure adjustment low.
ON MODE 2	Sets magnitude of exposure adjustment medium.
ON MODE 3	Sets magnitude of exposure adjustment high.

4. Move the cursor by joystick to select a mode. Once the desired mode is selected, press the joystick down to set it.

## 3.10. External Trigger Input

The APX can operate in response to external triggers that are provided depending on the needs of each application.

This section discusses the different kinds of external triggers and how to set up the system for each of them.

### 3.10.1. Input of External Trigger Signals

The trigger signals that are used on the APX and the corresponding input connectors are shown below.

Connectors (Input)	Menu Setting	Signals
TRIGGER SW IN	None	Contact signal Trigger on CLOSURE
TRIGGER TTL IN	None	Optical isolator input Positive logic, 5V, 15mA(recommended) 7V, 23mA(maximum)
GENERAL IN	TRIGGER POS	TTL level, Positive logic 5V(maximum)
	TRIGGER NEG	TTL level, Negative logic 5V(maximum) Contact signal, Trigger on CLOSURE

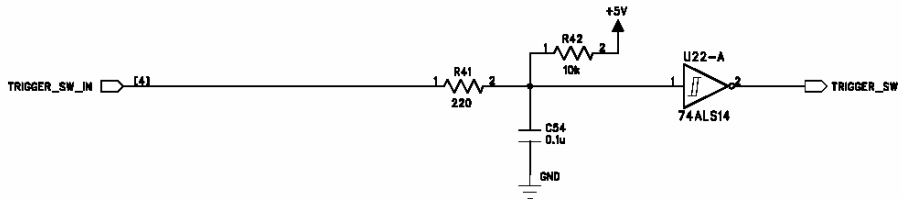
Note: For input trigger signals for GENERAL IN, the GENERAL IN circuit must be set up for the type of the input signal from the menu in advance. Please see the GENERAL IN section elsewhere in this manual for details.

Note: When GENERAL IN is set [TRIGGER POS/NEG], TRIGGER SW IN and TRIGGER TTL IN inputs become void.

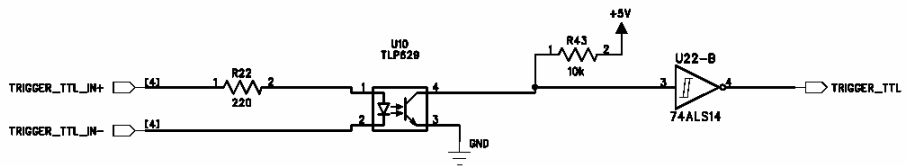
Note: Do not input any trigger signals other than contact signals to TRIGGER SW IN, otherwise the camera may be seriously damaged.

Note: Do not apply trigger signals of excessive voltage or current to TRIGGER SW IN or GENERAL IN, otherwise the camera may be seriously damaged.

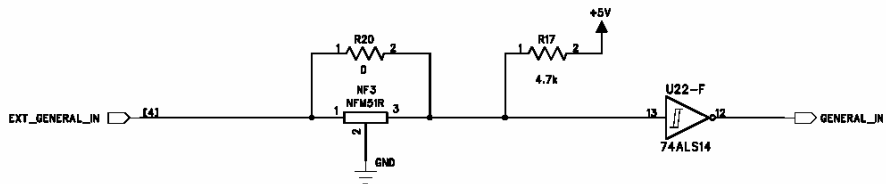
## TRIGGER SW IN Circuit



## TRIGGER TTL IN Circuit



## GENERAL IN Circuit



### 3.10.2. Output of Trigger Signals to External Equipment

The APX can output trigger signals to external equipment and devices. The output signals are provided from the TRIGGER SW OUT and TRIGGER TTL OUT connectors. In addition, other trigger output are available from the GENERAL OUT connector by setting up the circuit as necessary.

The following table shows the output connectors and the relevant output signals.

Connector (Output)	Menu Setting	Signal	Delay (Approx.)
TRIGGER SW OUT	None	Contact signal	5 nsec
TRIGGER TTL OUT	None	CMOS (74ACT541 buffered) Output, Positive logic	2.7 $\mu$ sec
GENERAL OUT	TRIGGER POS	CMOS (74ACT541 buffered) Output, Positive logic	55 nsec
	TRIGGER NEG	CMOS (74ACT541 buffered) Output, Negative logic	70 nsec

Note: For output trigger signals from GENERAL IN, the GENERAL IN circuit must be set up for the type of the input signal from the menu in advance. See Section 3.12.2. GENERAL OUT for details.

## *3.11. Input of External Sync Signals*

The APX has an operation mode for recording in sync with external sync signal. By using sync signals fed from outside, synchronized multiple-camera recording or single- or multiple-camera recording in sync with external instrumentation and lighting equipment is possible.

This section describes how to set up the APX system in external sync environment giving some tips and precautions.

### *3.11.1. Input of External Sync Signals*

The table below shows external signals that can be input to the APX system. Follow the below procedure to set up the system.

1. Connect an external sync signal to the processor.
2. The green LED (POWER LED) on the rear panel blinks.
3. Press the MENU button to display the menu list.
4. Use the joystick on the keypad to select [EXT-SYNC IN] menu.
5. The menu is shown. Details of the menu is as follows:

Menu Display	Description	Signal
OFF	Switches External Sync off.	None
ON POS CAM	Operates in sync with APX.	TTL level, Pos. logic
ON NEG CAM	Operates in sync with APX.	TTL level, Neg. logic
ON POS OTHERS	Operates in sync with external equipment.	TTL level, Pos. logic
ON NEG OTHERS	Operates in sync with external equipment.	TTL level, Neg. logic

6. Move the joystick up or down to select a menu item.
7. Once the selection is done, press the joystick down to set.

Note: A use of a terminating resistor is strongly recommended to avoid any disturbance of sync signal that may cause the camera to malfunction depending on the environment.



### 3.11.2. Output of External Sync Signals

The APX can output sync signals to outside equipment and devices. The following table shows the output signals from the APX. Set up sync signal output in the following procedure.

1. Press the MENU button on the keypad to display the menu list.
2. Move the joystick on the keypad to select the [EXT-SYNC OUT] menu.
3. The menu is displayed. Details are shown below:

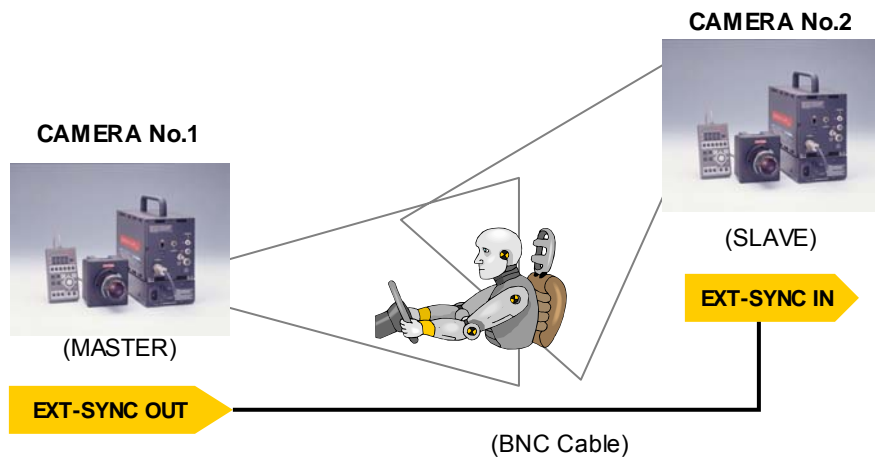
Menu Display	Description	Signal	Remarks (Input delay, approx.)	
VSYNC POS	Outputs positive logic VSYNC signal.	CMOS (74ACT541 buffered) output, Positive logic	EXT-V IN is set in positive logic.	50 nsec
			EXT-V IN is set in negative logic	80 nsec
VSYNC NEG	Outputs negative logic SYNC signal.	CMOS(74ACT541 buffered) output, Negative logic	EXT-V IN is set in positive logic.	50 nsec
			EXT-V IN is set in negative logic.	80 nsec

4. Move the joystick up or down to select an output signal.
5. Once selection is done, press the joystick down to complete the setting.

### *3.11.3. Sync Operation of Multiple APX Systems*

Multiple APX systems can be synchronized, using the external input and output features of the system, for synchronized recording.

Concept of Sync Operation



This section describes how to set up external sync signals necessary for sync operation of two cameras.

### **Setting up Master Camera (That Outputs Sync Signal)**

First decide the master camera that provides sync signal to the other camera, and make necessary setting on it in the following manner:

1. Press the MENU button on the keypad to display the menu list.
2. Move the cursor by the joystick to [EXT-SYNC OUT] menu and press the joystick down to enter the selection.
3. Move the joystick up or down to select an output signal, **VSYNC POS** in this example, and press the joystick down.
4. Now the system has been set in a way that a sync signal (positive going) is output from EXT-SYNC OUT connector.

### **Setting up Slave Camera (That Receives Sync Signal)**

Next, set up input sync signal on the slave camera.

1. Connect between the EXT-SYNC OUT of the master camera and the EXT-SYNC IN of the slave camera with a BNC cable to feed the sync signal from the master camera to the slave.
2. Make sure that the green LED (POWER LED) on the rear panel of the slave camera blinks.
3. To set up the type of sync signal that the slave receives, press the MENU button on the keypad to display the menu list.
4. Move the cursor by the joystick to select the [EXT-SYNC IN] menu.
5. Move the cursor by the joystick to select the type of output signal. Because the master camera has been set to positive (VSYNC POS), **ON POS CAM** should be selected here.
6. Once the selection is done, press the joystick down to set it.

Note: If the steps 3 to 6 are done without input sync signal from the master, the slave camera operates at the frame rate that is currently set and no EXT-SYNC OUT is output from the slave camera.

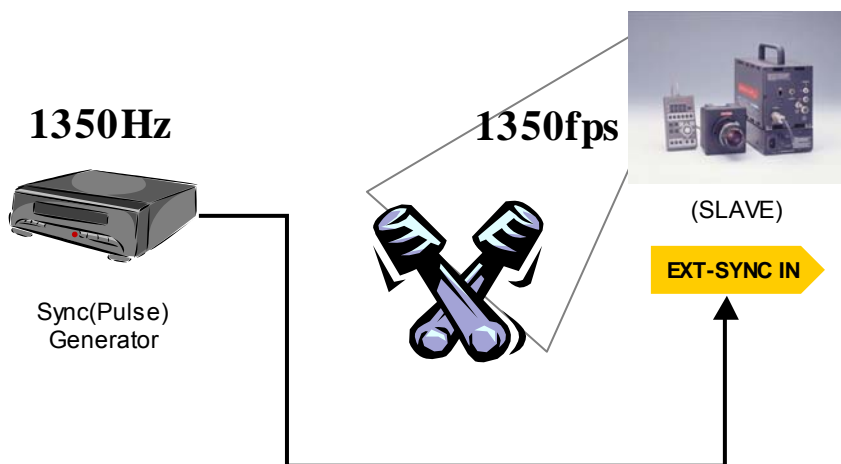
Note: Blinking of green LED indicates that input sync signal is present. If the sync signal stops or is lost, the LED stops blinking.

Note: When you wish to operate multiple APX cameras in the RANDOM RESET mode, use [GENERAL IN] for trigger input. Do not use [TRIGGER TTL IN] or [TRIGGER SW IN] because it is likely that proper recording cannot be attained due to delay of trigger signals.

### *3.11.4. Sync Operation with External Equipment*

In addition to its original framing rates, the APX has a feature of setting up a frame rate locked to the frequency of a sync signal from external source. With this feature, it has considerably expanded its range of application. For example, it can work in sync with a manufacturing machine running at 1350 rpm, to record the machine's behavior at 1350 FPS.

#### **Concept of External Sync Recording**



This section describes the function that makes the APX work in sync with external equipment.

#### **Requirement on Input Signals**

For the APX to work in sync with external equipment, the basic requirement on the input signal is as follows:

- ◆ TTL level, Positive or Negative logic
- ◆ 60 Hz to 120,000 Hz

## **Camera Setup**

1. Feed a sync signal to the APX processor. Connect between the sync signal generator and the EXT-SYNC IN on the APX rear panel with a BNC cable.
2. Make sure that the green LED (POWER LED) on the APX processor rear panel blinks when a sync signal from the generator is present.
3. Press the MENU button to display the menu list.
4. Move the cursor by the joystick to the [EXT-SYNC IN] and press the joystick down to select it.
5. Move the cursor by the joystick, up or down, to select a type of sync signal, **ON POS OTHERS** (positive) or **ON NEG OTHERS** (negative).
6. Once the selection is done, press the joystick down to set it.
7. Start the external signal source sending sync signal to the camera. Make sure that the camera recognizes the signal frequency and the frame rate is in sync with the input signal. The current frame rate recognized by the APX system is displayed in the lower left corner of the screen.

Note: The frequency of the sync signal from the external source should not be changed when the camera is in the LIVE mode or recording (malfunctioning may result).

Note: Every time the frequency of the external sync source is changed for any reason, do the steps 1 through 7 again to set up the system to the new frequency.

Note: If steps 3 to 7 are done without input sync signal, the camera operates at 60 FPS. In this case, the camera indicates 1 FPS in text, which means there is no sync signal input.

Note: Blinking of the green LED on the rear panel indicates the presence of a sync signal. It stops blinking when the input sync signal is lost.

Note: Frame rate sync operation with external equipment cannot be carried out in the RANDOM RESET mode.

Note: The internal circuit of the APX inevitably causes a slight frequency error of up to  $\pm 22.83$  nsec against the input sync signal cycle.

Example: When an external sync signal of 10,000 Hz is input from external equipment, the sync cycle within the internal circuit will be  $100 \text{ usec} \pm 22.83 \text{ nsec}$ , which will result in a frame rate of between 9,998fps and 10,002fps

### *3.11.5. Sync Operation of APX and Other Models of Cameras*

#### **(Sync Operation of Mixed Models of Cameras)**

Using the APX camera's feature of setting up a frame rate locked to the frequency of a sync signal from external sources described in the previous Section 3.11.4., the model allows for sync operation with other models of FASTCAM cameras, such as the Ultima 512 and 1024R2 models.

#### **Synchronizing the APX to 512**

To make the APX camera synchronized to the 512, the 512 is the master camera and the APX slave.

#### **Setting up the 512 (Master Camera That Feeds Sync Signal to the Slave)**

The 512 has rear panel connectors of the same specifications as the APX. Also, its control software GUI and remote keypad menu are of the same specifications as the APX. Because of these common specifications, setting up the 512 camera is carried out as if both cameras are of one same model, the 512 X or APX.

1. Press the MENU button on the keypad to display the menu list.
2. Move the cursor by the joystick to [EXT-SYNC OUT] menu and press the joystick down to enter the selection.
3. Move the joystick up or down to select an output signal, **VSYNC POS** in this example, and press the joystick down.
4. Now the system has been set in a way that a sync signal (positive going) is output from EXT-SYNC OUT connector.

#### **Setting up the APX (Slave Camera That Receives Sync Signal from the Master)**

Next, set up input sync signal on the slave camera.

1. Connect between the EXT-SYNC OUT of the master camera and the EXT-SYNC IN of the slave camera with a BNC cable to feed the sync signal from the master camera to the slave.
2. Make sure that the green LED (POWER LED) on the rear panel of the slave camera blinks.
3. To set up the type of sync signal that the slave receives, press the MENU button on the keypad to display the menu list.
4. Move the cursor by the joystick to select the [EXT-SYNC IN] menu.
5. Move the cursor by the joystick to select the type of output signal. Because the master camera has been set to positive (VSYNC POS), **ON POS CAM** should be selected here.
6. Once the selection is done, press the joystick down to set it.

Note: When you wish to make the 512 camera synchronized to the APX, the APX is the master camera and the 512 slave, follow the above procedure swapping the places of the two cameras.

### **Synchronizing the APX to FASTCAM-Ultima 1024R2**

To make the APX camera synchronized to an Ultima 1024R2, the 1024R2 is the master camera and the APX slave.

#### **Setting up the 1024R2 (Master Camera Feeding Sync Signal to the Slave)**

1. Press the MENU button on the keypad to display the menu list.
2. Move the cursor by the joystick to [EXT OUT] menu and press the ENTER key to enter the selection.
3. Move the joystick up or down to select an output signal from the EXT OUT connector. Select **[VSYNC POS]** in this example, and press the ENTER key.
4. Now the system has been set in a way that a sync signal (positive going) is output from EXT OUT connector.

#### **Setting up the APX (Slave Camera Receiving Sync Signal from the Master)**

Next, set up input sync signal on the slave camera.

1. Connect between the EXT OUT of the master camera and the EXT-SYNC IN of the slave camera with a BNC cable to feed the sync signal from the master camera to the slave.
2. Make sure that the green LED (POWER LED) on the rear panel of the slave camera blinks.
3. To set up the type of sync signal that the slave receives, press the MENU button on the keypad to display the menu list.
4. Move the cursor by the joystick to select the [EXT-SYNC IN] menu.
5. Move the cursor by the joystick to select the type of output signal. Because the master camera has been set to positive (VSYNC POS), **ON POS CAM** should be selected here.
6. Once the selection is done, press the joystick down to set it.

Note: It is not possible to make the 1024R2 synchronized to the APX because the 1024R2 does not have the function to follow sync signal from an external source.

## 3.12. Setting GENERAL IN / OUT Signals

With the previous Photron high-speed camera systems, all the external input and output signal lines were connected to individual connectors on the rear panel of the processor. With the APX, however, all these signal lines are combined into compound input and output cables and are connected to the GENERAL IN and GENERAL OUT connector, respectively (See Sections 2.2.5. and 2.2.6.)

### 3.12.1. Setting GENERAL IN Signals

This section describes how to set up input signals connected to the GENERAL IN connector.

1. Press the MENU button on the keypad to display the menu list.
2. Move the joystick to select the [GENERAL IN] menu.
3. The GENERAL IN menu is now displayed. The items are as follows:

Menu Items	Description	Signal
EVENT POS	Inputs event signals (Positive logic).	TTL level, Positive logic
EVENT NEG	Inputs event signals (Negative logic).	TTL level, Negative logic
TRIGGER POS	Inputs trigger signals (Positive logic).	TTL level, Positive logic
TRIGGER NEG	Inputs trigger signals (Negative logic).	TTL level, Negative logic Contact signals, Trigger on CLOSURE
READY POS	Inputs Ready signals (Positive logic).	TTL level, Positive logic
READY NEG	Inputs Ready signals (Negative logic).	TTL level, Negative logic Contact signals, Trigger on CLOSURE

#### READY POS/NEG

When READY POS or NEG is selected, the camera can be turned Ready by sending a pulse to it. When PARTITION MODE 2 has been selected in this case, a pulse will turn the camera into the status waiting for a REC trigger – into READY if the camera is in the START mode, and into ENDLESS recording status if the camera is in CENTER, END or MANUAL mode.

Note: When you use external signals to drive the whole system, be sure to check the nature of the incoming signals.

Note: See Section 3.13 (Event Marker Function) for detailed tips on how to set up EVENT POS or NEG.

Note: When TRIGGER POS or NEG is selected, the external trigger to [TRIGGER TTL IN] and [TRIGGER SW IN] becomes void.



### 3.12.2. Setting GENERAL OUT Signals

This section describes how to set up signals output from the GENERAL OUT connector.

1. Press the MENU button on the keypad to display the menu list.
2. Move the joystick to select the [GENERAL OUT] menu.
3. The GENERAL OUT menu is now displayed. The items are as follows:

Menu Display	Description	Signal
EXPOSE POS	Outputs sensor's exposure duration in HIGH level.	TTL level, Positive logic
EXPOSE NEG	Outputs sensor's exposure duration in LOW level.	TTL level, Negative logic
REC POS	Outputs recording duration in HIGH level.	TTL level, Positive logic
REC NEG	Outputs recording duration in LOW level.	TTL level, Negative logic
TRIGGER POS	Transfers received external trigger signal in HIGH level.	TTL level, Positive logic
TRIGGER NEG	Transfers received external trigger signal in LOW level.	TTL level, Negative logic
READY POS	Outputs pulse of specified level when camera is waiting for REC trigger. See note below.	TTL level, Positive logic
READY NEG	Outputs pulse of specified level when camera is waiting for REC trigger. See note below.	TTL level, Negative logic

#### READY POS/NEG

When READY POS or NEG has been selected, a pulse of the specified level is output if the camera is waiting for a REC trigger – a trigger that will turn the camera into READY if it is in START mode, and ENDLESS in CENTER, END or MANUAL. This feature is valid only in the START, CENTER, END or MANUAL mode.

Note: When you use these signals to drive the whole system, be sure to check the nature of the signals.

### *3.13. Event Marker Function*

The APX's Event Marker function makes it possible to record a frame number, on the fly, at each external marking signal so that you can jump to the marked frame (event frame) when playing recorded images. In addition to triggering points, these event marks given at any moments of interesting event will let you play back such interesting events quickly. Up to ten event frames can be marked in each partitioned section.

Marking is done at an edge of the incoming marker pulse. The immediately subsequent frame after receipt of a marker pulse is recorded as an event frame. The following describes how to place event marks:

1. Press the MENU button on the keypad to display the menu list. Move the joystick to select the GENERAL IN menu. Using the joystick in the GENERAL IN menu, select [EVENT POS] or [EVENT NEG]. EVENT POS marks an event at the rising edge of the marking signal and EVENT NEG at the falling edge.
2. Send pulses into the GENERAL IN connector each moment you see an interesting event during a recording session.
3. Up to ten marking pulses are accepted in a session.
4. Recording comes to an end.
5. Press the LIVE/MEMORY button to switch to the MEMORY mode.
7. Press the  $\triangle$  or  $\nabla$  FRAME RATE button to jump to the first marked event. At each press on either button, playback jumps to previous or subsequent event frames.
6. While an event frame is displayed on the screen, the text shows [EVENT FRAME x] where the x is a number between 1 and 10 each representing the serial number of an event frame.

Note: This function is not available with the DUAL FRAME RATE mode.

### 3.14. MCDL – Multi-Channel Data Link (Data Aquisiton)

The APX has connectivity with the Photron MCDL (Multi-Channel Data Link – optional), which makes it possible for the APX to record sampled waveform data (up to 4 channels of analog and 6 channels of digital signals) along with image data. The original waveform data from the MCDL is sampled at the frequency of ten times the current frame rate and the sapling tales place at a timing of every tenth of each frame period.

The recorded data is played as a waveform on the PFV. Also, it is added to the header when the image data is stored in the TIFF format. I may also be viewed on video monitor.

The following describes how to operate the APX together with an MCDL unit.

1. Connect the MCDL output cable to the MCDL connector (9-pin D-sub) on the APX rear panel.
2. Press the MENU button on the keypad to display the menu list. Move the joystick to select the [MCDL/IRIG] menu. Further select the [MCDL ON] and press the joystick down to set it on.
3. The waveform of the input signal is displayed in the text portion of the screen.
4. The waveform is now recorded superimposed on and in sync with the image.
5. To play a recorded waveform, press the LIVE/MEMORY button to get in the MEMORY mode. Press the PLAY button and the recorded waveform is shown superimposed on each corresponding image.

Note: This feature cannot be used at 128 x 16 resolution.

Note: When you use both MCDL and IRIG, select [MCDL IRIG ON].



### *3.15. IRIG Timecode(optional)*

The APX is compatible with the IRIG-B signal input and can add an IRIG code to each recorded frame. The sampling of IRIG code is once every frame.

The IRIG code recorded on each frame is displayed on video screen or PFV screen. It is added to the header when the recorded image data is stored in the TIFF format.

The required specification of IRIG code is as follows:

Connector: BNC

Code Format: IRIG—B (122), Analog

Amplitude: 1.2 Vp-p Minimum; 8.0 Vp-p Maximum

Modulation Ratio: 2:1 to 4:1

The following describes how to use the MCDL:

1. Connect the IRIG generator output cable to the IRIG IN connector (BNC) on the APX rear panel.
- 2.
3. Press the MENU button on the keypad to display the menu list. Move the joystick to select the [MCDL/IRIG] menu. Further select the [IRIG ON] and press the joystick down to set it on.
4. IRIG code is displayed in the text portion of the screen.
4. The IRIG code is now recorded on the image.
5. To play a recorded IRIG code, press the LIVE/MEMORY button to get in the MEMORY mode. Press the PLAY button and the recorded IRIG code is shown superimposed on each corresponding image.

Note: This feature cannot be used at 128 x 16 resolution.

Note: When you use both MCDL and IRIG, select [MCDL IRIG ON].

To add an offset to a sampled IRIG code:

1. Select the [IRIG OFFSET] menu.
2. Specify an offset within the range of +0.999999 sec to -0.999999 sec.
3. The specified offset is added to all sampled IRIG codes.

## *Chapter 4 Playback*

- 4.1. Playing Recorded Images*
- 4.2. Search Images of Interest  
(Fast Forward/Rewind Play)*
- 4.3. Slow Playback (Jog)*
- 4.4. Zooming (Zoom / Fit / Scroll)*
- 4.5. Block Playback (Playback of Clips of Interest)*
- 4.6. Text Display – Hide / Unhide*
- 4.7. Displaying Crosshair Cursor*
- 4.8. Display R / G / B Planes (Color Model Only)*
- 4.9. Switching NTSC / PAL Video Output*
- 4.10. Automatic Playback*
- 4.11. Playback Event Markers*

## 4.1. Playing Recorded Images

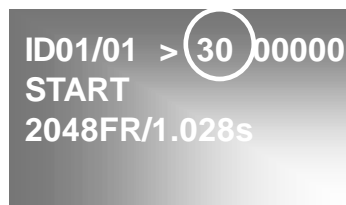
The APX can play back images recorded in the memory on the video monitor instantly. The following describes how to play recorded images.

1. If the camera is in the LIVE mode, press the LIVE/MEMORY button on the keypad to change to the MEMORY mode. Make sure the LED right next to the mode indication [MEMORY] is on now and that the video screen shows an image frame from memory.
2. Press the PLAY button on the keypad to play back the recorded images. The functions of playback buttons are shown in the below table.



Name	Function	Description
FR	Rewind and Play	Rewinds and plays recorded images at x10, x100 or x1000 the currently set playback speed. Each press on FR button changes playback speed.
REV	Reverse Play	Plays recorded images in reverse direction at 2 to 30 FPS in NTSC or 2 to 25 FPS in PAL.
PLAY	Play	Plays recorded images in normal direction at 2 to 30 FPS in NTSC and 2 to 25 FPS in PAL.
FF	Fast Forward	Plays recorded images at x10, x100 or x1000 the currently set playback speed. Each press on the FF button changes speed.
PAUSE	Temporary Stop	Stops playback temporarily. A [  ] mark is displayed on video screen. With this mark in the screen, you can jog frames by pressing the PLAY/REV button.
STOP	Stop	Stops playback and returns to the trigger frame.

3. Move the joystick up or down on the keypad to change playback speed. The current playback speed is displayed in the upper portion of the video screen.

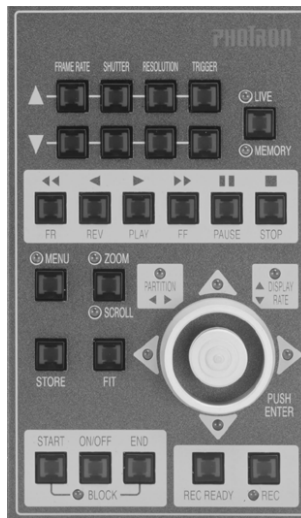


PAL Playback Rates	2; 4; 8; 12; 25 FPS
NTSC Playback Rates	2; 5; 10; 15; 30 FPS

## 4.2. Searching Images of Interest (Fast Forward/Rewind Play)

Make sure that the system is in the MEMORY mode.

1. Press the [ > ] (PLAY) button to start playback.



2. Press the [ > > ] (FF) or [ < < ] (FR) button to search your desired images on the fly.

Note: At each press on the button, speed changes to x10 to x100 to x1000.

3. As soon as you see your desired or interesting image, press the [ > ] (PLAY) button to go back to normal playback, or the [ || ] (PAUSE) button to stop playback temporarily.

## *4.3. Slow Playback (Jog)*

Make sure the system is in the MEMORY mode.

1. Press the [**>**] (PLAY) button to start playback.



2. Press the [**>>**] (FF) or [**<<**] (FR) button to search your desired image.



3. When your desired image is coming up, press the [**||**] (PAUSE) button to stop playback temporarily.



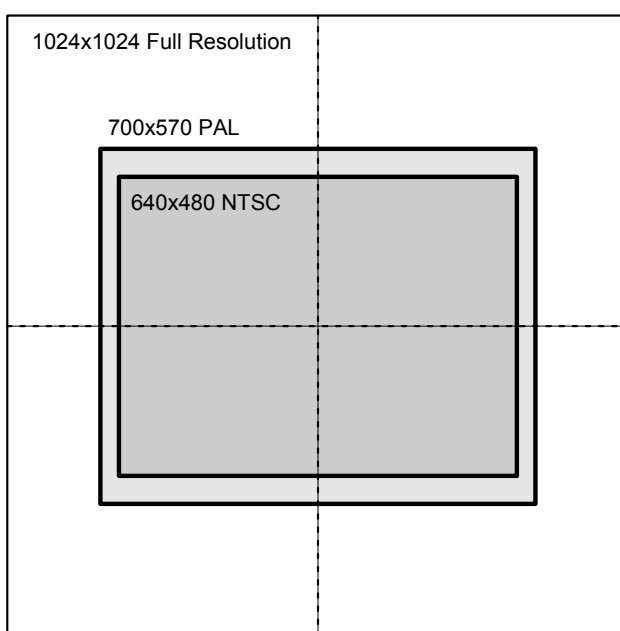
4. Make sure a [**||**] mark is displayed in the video screen.
5. Press the [**>**] (PLAY) button to play in the single-frame jog mode, or the FF or FR button to play in the ten-frame jog mode.



## 4.4. Zooming (Zoom/Fit/Scroll)

In high-resolution mode (1024 x 1024 pixels or 1024 x 512 pixels) recording, the APX system records images in a higher resolution than standard NTSC or PAL video resolution. In order to view the full image frame of recording on a video monitor, such high-resolution images from the APX system must be reduced to fit the NTSC or PAL video format. The Fit function of the APX performs this size reduction.

### Relationship between Video Formats and Resolution



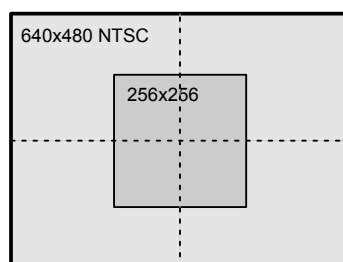
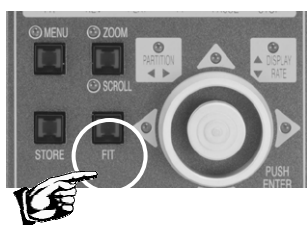
When the APX records at a higher frame rate than 2,000 FPS (e.g. 10,000 FP), the frame resolution of 512 x 256 pixels is much smaller than the standard video format. If the recorded image is displayed on the video monitor, it looks as a small frame taking only a portion of the full video screen. In this case, the playback image must be expanded to fill the video screen. The APX's Zoom/Fit function performs this expansion/fitting to display the playback image filling the full screen of the standard video format.

The following pages discuss the function of digital video signal zooming and how to use it.

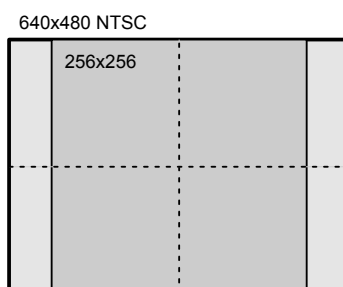
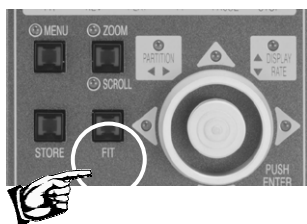
### 4.4.1. Fitting Image Frame to Video Screen

The Fit function of the APX system readjusts the size of each framing resolution to maximize the playback image fitting the video screen format. This section describes how a recorded image of 256 x 256 pixel resolution is readjusted to fit the video format screen by the Fit function.

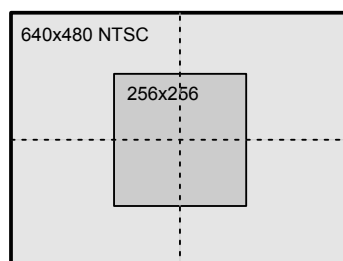
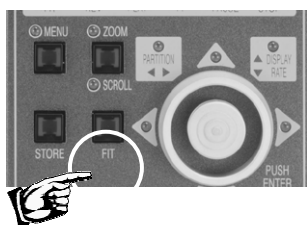
1. Press the FIT button on the keypad once.



2. The displayed image size has changed so that the recorded image area has been maximized within the video monitor screen.



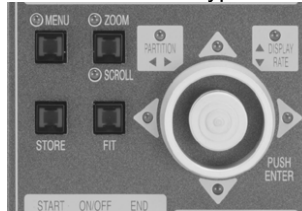
3. Give another press on the FIT button to revert to the original size of the recorded image.



#### *4.4.2. Zooming Playback Image Frame*

The APX's Zoom function magnifies the original recorded image at steps of x1, x2, x4 and x8 to display on the video screen. The following describes how to zoom the recorded image.

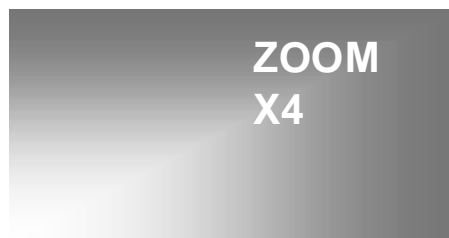
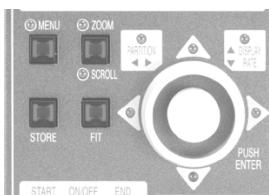
1. Press the ZOOM/SCROLL button on the keypad.



2. The ZOOM indication LED lights up. At the same time, the indication of ZOOM and the current magnification appear on the video monitor screen.



3. Move the joystick up or down to attain a desired magnification, x1, x2, x4 or x8. The image is zoomed with its center retained in the center of the video display.



### *4.4.3. Scrolling Playback Image Frame*

The APX's Scroll function moves a magnified, oversized image over the video monitor screen to display any portion of the bigger-than-the-screen image.

1. Press the ZOOM/SCROLL button on the keypad. This button switches the mode between ZOOM and SCROLL. Press it twice if necessary. Make sure the SCROLL indication LED lights up.



2. An indication of SCROLL has appeared on the video screen.



3. Move the joystick up or down, left or right to scroll the magnified image until your interested portion comes up in the screen. When the entire image is already displayed in the screen, the image does not scroll.

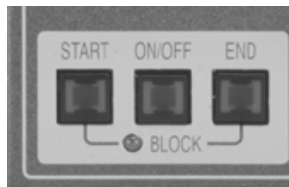
## 4.5. Block Playback (Playback of Clips of Interest)

Playing a high-speed recording footage is time-consuming. For example, a footage recorded at 2,000 FPS for one second takes 66 seconds to play back at 30 FPS: it takes over one minute to see a strip of recorded 2,000 frames from end to end. In many cases, however, the frames of real interest to you are only a few or several tens of the entire footage.

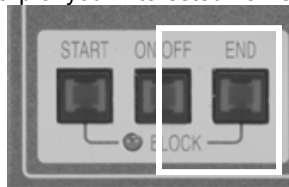
The APX's Block Play function lets you see only a portion of special interest to you out of the entire recorded frames. All you have to do is pick first and last frames of a clip you want to play.

The following describes how to use this function.

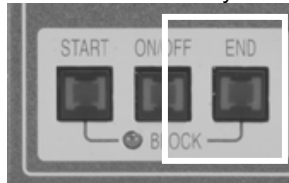
1. Press the LIVE/MEMORY button on the keypad to turn the system into the MEMORY (Playback) mode.
2. Press the PLAY button to play the footage in the usual manner.
3. Press the START button on the keypad at a frame that you wish to make the first frame of a clip.



4. Press the END button on the keypad at a frame that you wish to make the last frame of a clip. Now the clip of your interested frames has been defined.



5. Press the BLOCK ON/OFF button on the keypad and make sure the LED has lighted up. Now the system is in the Block Play mode.

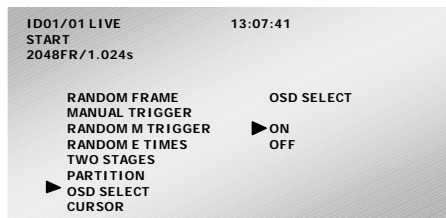


6. Now the system plays back the defined clip only. Start playing the clip in the Block Play mode as many times as necessary. You can use all playback buttons - FR, REV, PLAY, FF, PAUSE and STOP.
7. When you are done, press the BLOCK ON/OFF button to exit the Block Play mode. The clip setting is cancelled.

## *4.6. Text Display – Hide / Unhide*

The text display on the screen can be hidden or unhidden as necessary. Here is how to handle it.

1. Press the MENU button on the keypad to display the menu list.
2. Move the joystick up or down, left or right, to select the OSD SELECT menu.
3. The OSD SLELCT menu is displayed as shown below.

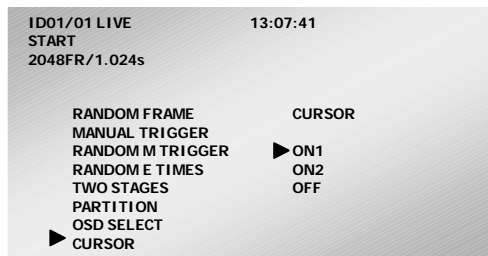


4. Move the joystick again up or down, left or right, to select the OFF indication.
5. Press the joystick down to set the selection.
6. Make sure the text display has been hidden.
7. Press the MENU button on the keypad to exit the menu.
8. To have the text displayed on the screen again, select ON in step 4 above.

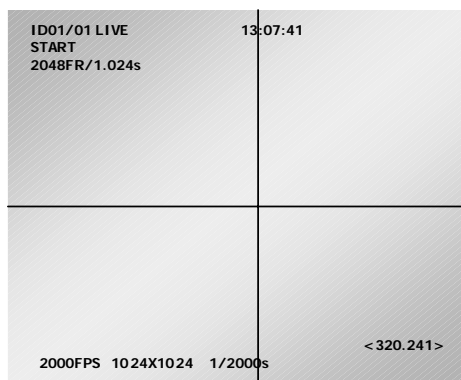
## 4.7. Displaying Crosshair Cursor

The APX has a crosshair cursor display function. This function is useful to pinpoint certain points of interest within the image displayed on the video screen at recording and playback. The following shows how to use the crosshair function.

1. Press the MENU button on the keypad to display the menu list.
2. Move the joystick to select the [CURSOR] menu.
3. Now the CURSOR menu is displayed on the screen as shown below.



4. Two types of cursor lines are available – White (ON 1) and Black (ON 2) to choose from depending on the brightness of the image.
5. Move the joystick up or down to select ON 1, ON 2 or OFF. Press the joystick down to set the selection.
6. Press the MENU button to exit the menu.
7. If you have selected ON 1 or ON 2 in step 5 above, you will see a crosshair displayed in the video screen and the corresponding coordinates of the cross are shown in the lower right corner of the screen.
8. Move the joystick up or down and left or right to steer the crosshair over the screen.

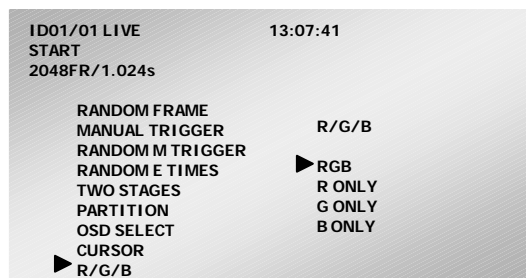


9. When you are done and you no longer need the crosshair cursor, repeat steps 1 to 6 selecting OFF in step 5 to make the cursor disappear.

## *4.8. Displaying R G B Planes (Color Model Only)*

The APX's R/G/B Display function lets you have image of R, G or B channel, or RGB combined (color) image displayed on the screen. The following describes how to make a selection.

1. Press the MENU button on the keypad to display the menu list.
2. Move the joystick to select the R/G/B menu.
3. The R/G/B menu is now displayed on the screen.



4. Move the joystick up or down to select one of R, G, B or RGB. Press the joystick down to set the selection.
5. Press the MENU button to exit the menu.



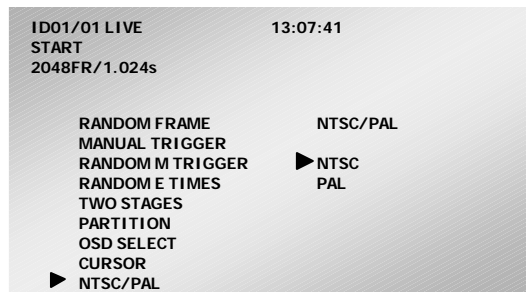
## 4.9. Switching NTSC / PAL Video Output

The APX has a function that lets you switch the video display format between NTSC and PAL to display images on the video screen.

Caution: You must have appropriate NTSC and PAL video monitors properly connected in the system to change the video format from NTSC to PAL, or other way around, using this function. When you are currently operating in an NTSC setup, for example, and if you inadvertently switch from NTSC to PAL without an appropriate PAL video monitor connected in the system, you will not only lose image display on the current NTSC video monitor, but also you will lose the ability to revert to NTSC operation by simple keypad operation. In such a case, you must reset the whole system from the PC control software.

The following describes how to switch the video format between NTSC and PAL.

1. Press the MENU button on the keypad to display the menu list.
2. Move the joystick to select the NTSC/PAL menu.
3. The NTSC/PAL menu is now displayed on the video monitor screen.



4. Move the joystick up or down to select the NTSC or PAL menu. Press the joystick down to set the selection.
5. Press the MENU button to exit the menu.
6. Turn the APX system off, and then turn the system on again.
7. Make sure that the video format has been changed on the relevant monitor screen.

## *4.10. Automatic Playback*

The APX has a function that makes the system automatically change from the LIVE mode to MEMORY mode as soon as a recording is done. The trigger frame of the recorded images is displayed on the monitor screen and the system is just ready to play back. This feature is useful when you wish to view the recorded images right after recording an event.

The following describes how to use this feature.

1. Press the MENU button on the keypad to display the menu list.
2. Move the joystick to select the AUTO PLAY menu.
3. The AUTO PLAY menu is displayed on the screen.
4. Move the joystick again to select ON or OFF. Press the joystick down to set the selection.
5. Press the MENU button to exit the menu.
6. Perform a test recording and make sure if the system automatically turns into the MEMORY mode when a recording finishes.

## 4.11. Playback Event Markers

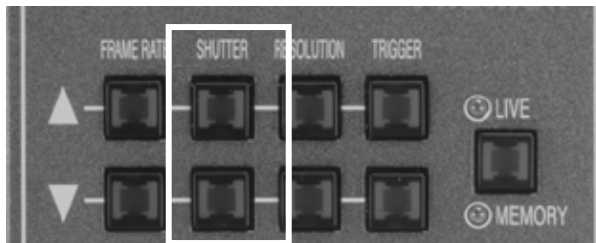
The APX has a function to set event markers, on the fly, to any frame of interest during playback. Up to ten event marks can be set within each partitioned recording. Once event markers are set, you can jump to any of the marked frames in subsequent playbacks.

The following shows how to set event markers.

1. Press the LIVE/MEMORY button on the keypad to turn the system into the MEMOEY mode.
2. Play a recorded footage in the usual manner.
3. When an interesting frame is being displayed on the screen, press the STORE button on the keypad.



4. Repeat steps 2 and 3 as necessary and until ten event marks have been set.  
Note: If the number of event marks exceeds ten, the eleventh and subsequent marks overwrite previous marks starting from the first mark.
5. Press the SHUTTER  $\triangle$  or  $\nabla$  button on the keypad to jump to previous or subsequent marked frames.



6. When a marked frame is being displayed on the screen, a text of [MARKER FRAME x] is shown, x being a number 1 to 10 representing the serial number of each marked frame within the currently played recording.

Note: If you try to set more than ten marker frames, the eleventh frame and thereafter will overwrite the first frame and thereafter in the order they have been set.

*Memo*

## *Chapter 5 Connecting APX to a PC*

*5.1. Connecting APX to a PC*

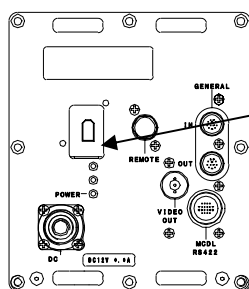
*5.2. Connecting Multiple APX's to a PC*

*5.3. Connecting Mixed Models of FASTACM Cameras  
to a PC*

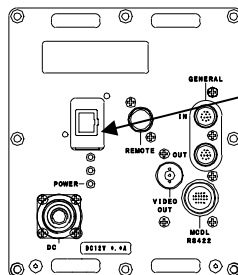
## 5.1. Connecting APX to a PC

The APX has connectivity with PC by digital interface and can be controlled by special control software installed in the computer. This section discusses connecting the APX camera to a PC using various types of interface. The FASTCAM APX camera can be fully operated from the PC via digital interface. For details of control software (PFV – Photron FASTCAM Viewer) operation, see the FASTCAM Control Software Operation Manual. Interface of your choice will come installed in the APX camera.

The following is the description about preparation for connecting the camera to a PC.

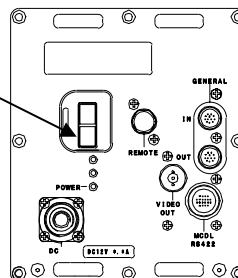


IEEE1394 Interface  
FASTCAM-APX



Ether Interface  
FASTCAM-APX

Optical Interface  
FASTCAM-APX



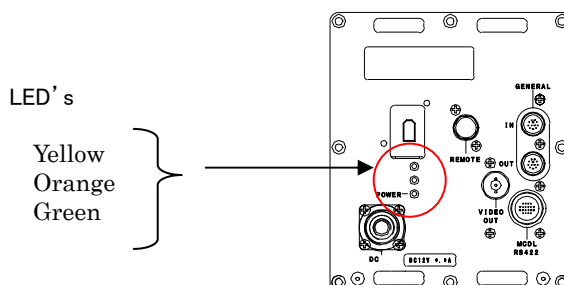
### 5.1.1. Using IEEE1394 Interface

To connect your APX camera to a PC via the IEEE1394 interface, use a commercially available IEEE1394 compatible cable. The connector on the APX processor is of a 6-pin type. The connector on the PC may be of 4-pin or 6-pin, depending on the PC model and interface being used. Use a suitable cable.

The IEEE1394 interface on the APX camera is hot-pluggable as is the case with most PC's and peripheral devices.

Install the driver software in the PC to set it up after connecting the APX camera to it with an IEEE1394 cable. For instructions for installation of and checking the driver software, refer to the "IEEE1394 Interface Driver Installation" section (2.3.1.) of the FASTCAM Control Software Operation Manual.

Checking the operation status by LED indicators



- Green: Power On/Sync On.....Lights when power is on. Blinks when sync input is on.
- Orange: Link.....Lights when linkage is established. Blinks during command/data transfer.
- Yellow: Trigger.....Lights when a trigger signal for recording is entered.

### 5.1.2. Using Ethernet Interface

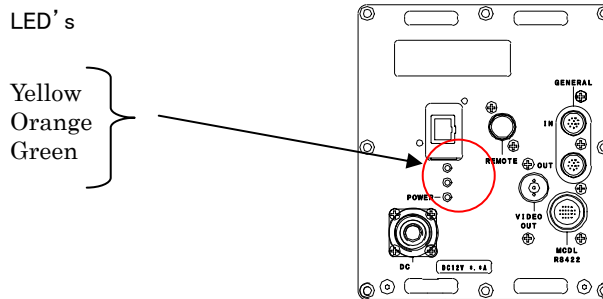
To connect your APX camera to a PC via the Ethernet interface, use a commercially available 100BASE-TX cable. Use a UTP cable of CAT5 rating or higher.

The maximum allowable length of the cable connecting between the APX camera and a PC is 100 meters. Up to 64 cameras can be connected to a PC via a switching hub that takes 100BASE-TX cables. To connect your camera directly to a PC, a cross cable is necessary. The maximum cable length between the camera (and PC) and a switching hub is 100 meters.

The driver software does not have to be installed in the PC to set up the PC after connecting the APX camera to the PC with a network cable. Instead, the IP address of the camera must be registered with the FASTCAM Control Software that comes with

the system. For instructions for registration of the IP address, refer to the “Registration of IP Address” section (3.13.5.) of the FASTCAM Control Software Operation Manual.

Checking the operation status by LED indicators



- Green: Power On/Sync On.....Lights when power is on. Blinks when sync input is on.
- Orange: Link.....Lights when linkage is established. Blinks during command/data transfer.
- Yellow: Trigger.....Lights when a trigger signal for recording is entered.

### *5.1.3. Using Optical Interface*

By installing Photron special optical interface board in the PC and connecting the APX camera to it with a dedicated optical cable, you can control the operation of the camera from the FASTCAM Control Software that comes with the system.

#### **5.1.3.1. Specification**

- Operating System: Windows 2000/XP
  - Plug & Play
  - 32-bit PCI bus (33 MHz)
  - Dimensions: 174.0 mm × 106.5 mm
  - Standard: Photron's proprietary protocol
  - Driver: Photron proprietary driver
  - Maximum number of cameras connected: 64
  - Supported application: PFV (Photron FASTCAM Viewer)
  - Ambient temperature: +5 to +40°C, no condensation
  - Interface connector: SC connector
  - Connecting cable: Special optical fiber cable
  - Other: Power consumption 4 W
- Note: The transfer speed depends on the specification of the PC.

① Optical fiber connecting cable



Specification of the cable

- Single Mode Fiber (SMF) 9/125 micro meters SMF  
Transfer distance: 10 km, maximum (theoretical value of the optical module)
- Multiple—Mode Fiber (MMF) 62.5/125 micro meters MMF  
Transfer distance: 550 meters, maximum (theoretical value of the optical module)
- Connector type: SC connector on both ends

Note: The standard optical cable attached to the system is a single mode fiber cable 9/125 micro meters SMF, 5 meters long.

② Bit rate: 1 GHz (125 Mbytes/s) on the optical cable

**5.1.3.2. Installing Optical I/F Board to PC**

When installing the optical I/F cable, be sure to turn the PC off and remove all other connecting cables. Open the PC housing and install the optical I/F board in an empty PCI slot.

Make sure the I/F board has been firmly inserted in the slot, squarely.

Note: Loose installation of the I/F board may result in damage to the board and/or the PC.

### **5.1.3.3. Cable Connection between PC and APX Camera**

Use the attached optical fiber cable to connect between the PC and FASTCAM-APX camera. The FASTCAM-APX optical interface is hot-pluggable: you can plug or unplug it even when power is on. See the following diagrams for details of connection.

Figure 1: Connecting one camera to PC

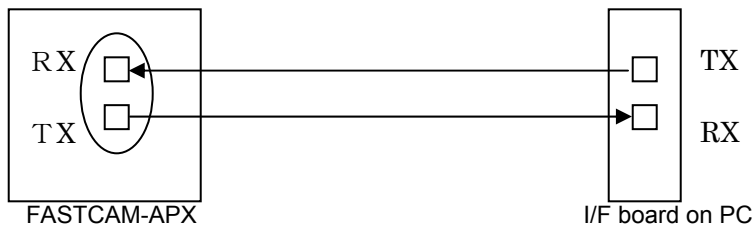
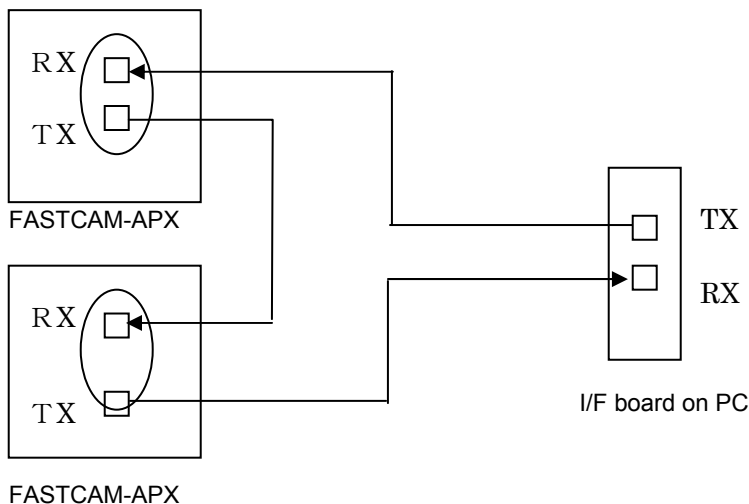


Figure 2: Connecting multiple cameras to PC

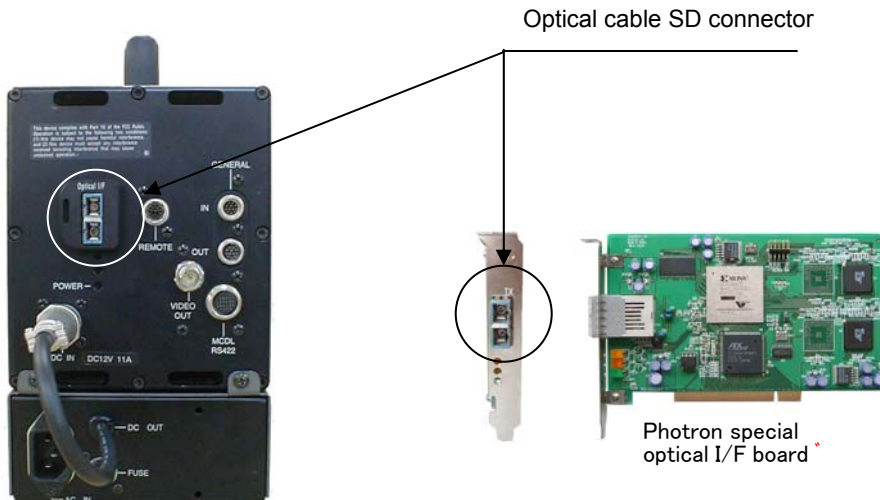


The optical interface has TX (transmit) and RX (receive) ports and, when connecting an APX camera to a PC using an optical interface, the corresponding TX and RX ports must be connected.

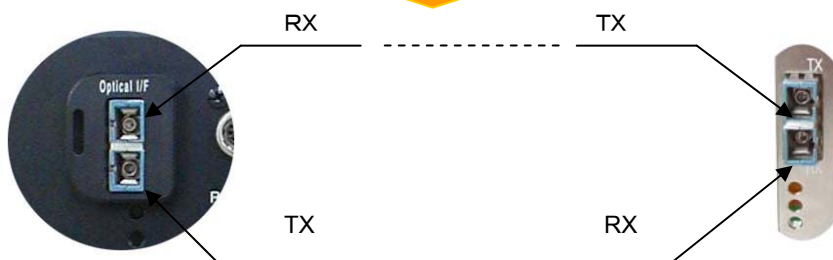
When connecting one single APX camera to a PC, connect as shown in Figure 1. To connect multiple cameras to a PC, connect between TX and RX ports forming a loop as shown in Figure 2. The optical cable itself has no polarity like TX or RX and either end of it connects to either TX or RX port of the optical I/F unit.

#### 5.1.3.4. Connection FASTCAM-APX to PC with Optical Cable

I/F board connector on APX processor

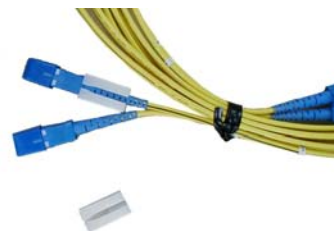


FASTCAM-APX cable connector



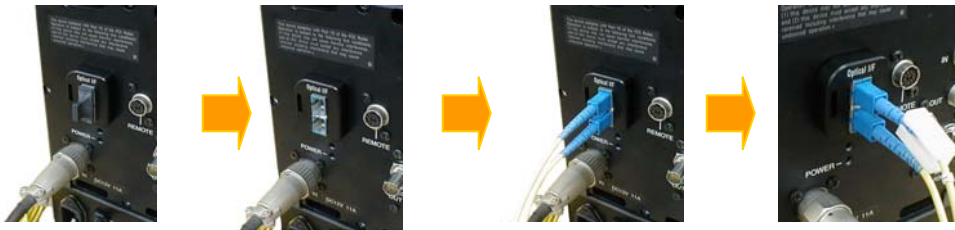
Follow the instruction below:

- ① Have the 5-meter optical cable ready.
- ② Remove the covers from the SC connectors.
- ③ Note the optical cable consists of two wires each tagged ① or ② on both ends, one for the RX and the other for TX signal,
- ④ Both cables are straight cables with no polarity.



Optical cable

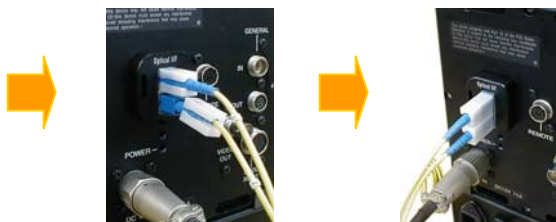
- ⑤ Connect the optical cable to the APX processor.



Remove protection cover.

Plug the optical cable  
to connector on the  
APX processor

Install a connector  
fastener.



Install a connector  
fastener on both  
connectors ① and ②.

Optical cable  
installed.

- ⑥ Connect the optical cable to the PC.



Plug the connectors to PC

Install connector fasteners.

Connector fasteners  
Installed.

- ⑦ Check the operation by the LED indicators.

When the system starts working with optical I/F connection, LED indicators either light or blink as follows:

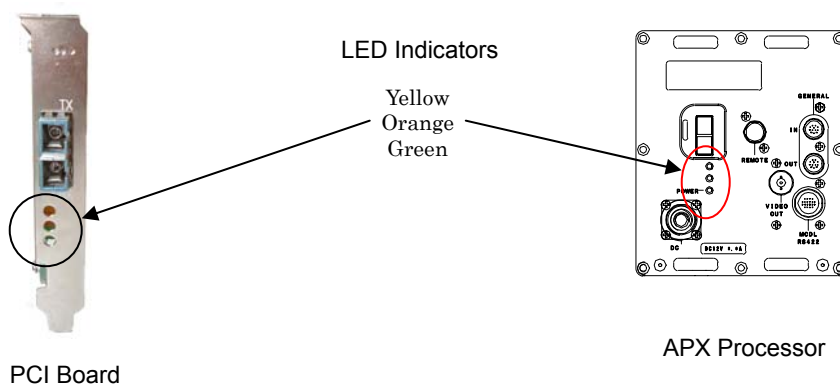
1. On the PCI Board

- Green > Power on ..... Lights when power is on.

- Orange > Link ..... Lights when linkage is established. Blinks during command /data transfer.
- Yello > Data reception ..... Lights when data is not being received. Blinks during data reception.

## 2. On the Camera

- Green > Power on/Sync on .....Lights when power is on. Blinks when sync signal is on.
- Orange > Link ..... Lights when link is established. Blinks during command/data transfer.
- Yellow > Trigger ..... Lights when a trigger for recording is entered.



### 5.1.3.5. Installation of Photron Optical Interface Driver

Install the driver software in the PC to set it up after connecting the APX camera to it with an optical cable. For instructions for installation of and checking the driver software, refer to the “Photron Optical Interface Driver Software Installation” section (2.3.4.) of the FASTCAM Control Software Operation Manual.



#### **Note: Laser Safety Information**

The optical module used in this product is IEC 60825-1 Class 1 material.

Class 1 Laser Product



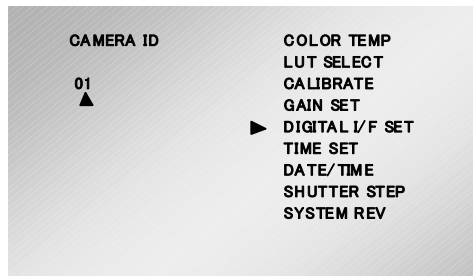
#### **Warning:**

While this product is powered on, do not look into the laser beam emission port (optical receptacle) with naked eye or by optical equipment. Serious damage may result to the eye.

## *5.2. Connecting Multiple APX Cameras to a PC*

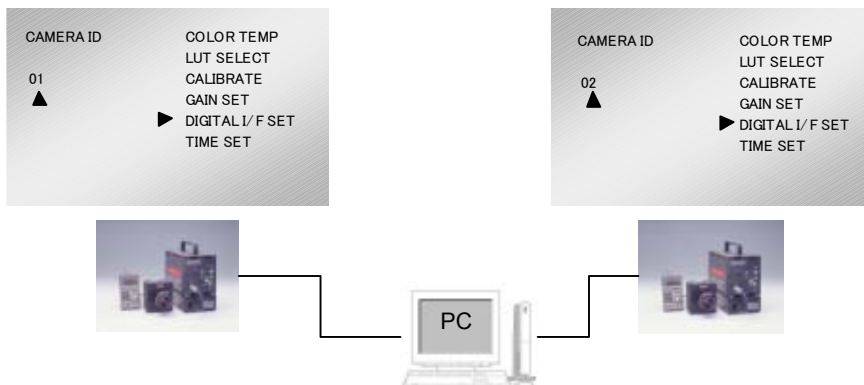
Multiple APX cameras can be connected to a PC for integrated, synchronized control. When hooking up cameras to a PC, be sure not to duplicate ID numbers: each camera must have a unique ID number.

1. Press MENU button on the keypad to display the menu.
2. Move the cursor to [DIGITAL I/F SET] and press the joystick down to set the selection.
3. The CAMERA ID menu is displayed as shown below.



4. Move the joystick up or down to select an ID and press the joystick down to set the selection.
5. Press the MENU button to exit the menu.
6. When the camera is connected to a PC, the above setting is reflected.

### **Example**



Note: For synchronized recording with multiple cameras, see Section 3.11.3. of this manual.

### 5.3. Connecting Mixed Models of Cameras to a PC

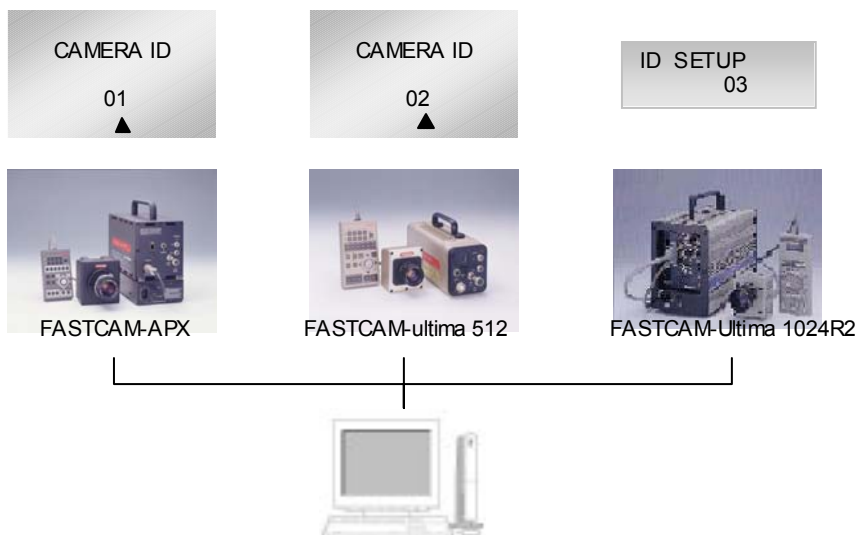
The APX is capable of working in synchronization with other IEEE1394 compatible FASTCAM series cameras such as the APX and Ultima 1024R2 in a multiple-camera system with mixed models under control from a PC. When connecting cameras to a PC, be sure the ID numbers do not duplicate: each camera must have a unique ID.

See the previous section for setting up camera ID on each of the cameras. For the Ultima 1024R2, refer to its user's manual.

**Note:** The Ultima 1024R2 has two IEEE1394 ports, one of which outputs +12 VDC (see the Ultima 1024R2 Manual for details). When you wish to use this port with DC voltage output, and if the PC's 1394 connector is a 6-pin type having a DC voltage output, be sure to kill the DC voltage from the PC to avoid short circuit.

#### Example

As described in the previous Section 5.2., Connecting Multiple APX's to a PC, set camera ID on each of the cameras as shown below (duplication of ID is prohibited). See the Ultima 1024R2 User's Manual for details of the 1024R2 setup.



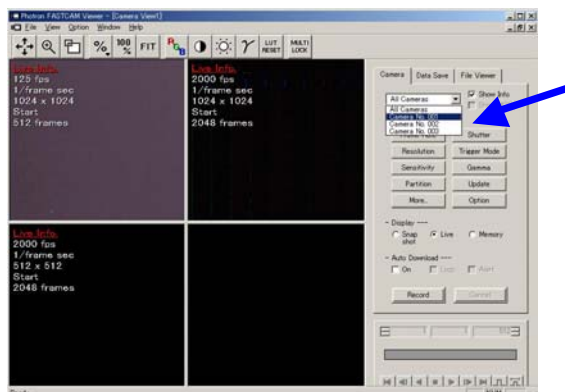
## Setting Up Mixed Cameras

Because of the difference in the specifications of each model, each camera must be set up separately, one at a time.

For details of camera setup, see FASTCAM Control Software Operation Manual, Section 3.6. (subsections 3.6.1. and 3.6.2.)

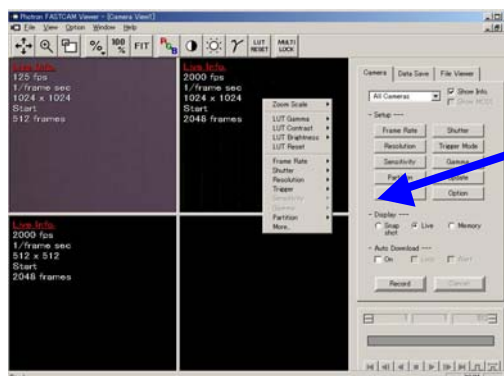
### Setup Method 1

From the camera selection tab select the model name of a camera you have in the multi-camera system and set it up following the instruction in Section 3.6. of Control Software Operation Manual. The below figure shows the PFV (Photron FASTACM Viewer) operation screen.



### Setup Method 2

Right-click on the screen, with the mouse cursor on the LIVE image screen, to display the camera selection tab. You can set up the camera whose LIVE image is being displayed on the monitor screen. The below figure shows the PFV (Photron FASTACM Viewer) operation screen.



Note: For synchronized recording with mixed, multiple cameras, see Section 3.11.5. of this manual



## *Chapter 6 Specifications*

- 6.1. Specifications*
- 6.2. Mechanical Data*
- 3.3. How to Care Lenses*

## 6.1. Specifications

### 6.1.1. Product Specifications

Imaging Sensor	C-MOS Imaging Sensor	
Sensor Resolution	1024 x 1024 Pixels	
Frame Rates	Up to 2,000 FPS, full resolution	
Lens Mount	F Mount (Nikon); C Mount; Hi-G Mount (optional) Changeable	
Recording	Monochrome	10 bits
Grayscale	Color	10 bits each on RGB (Bayer color filter array)
Shutter	Electronic Shutter	
Recording Media	IC Memory	
Memory Capacity	2.6GB Standard, 8GB Maximum	
Partitioned Recording	Partitioning of up to 64 sections	
Image Output Customization	Built-in Customizable LUT for Grayscale customization	
External Sync Input	5Vp-p, Pos/Neg Switchable; Synchronized with other systems sync	
External Sync Output	5Vp-p, Pos/Neg Switchable	
Trigger Signal Input	TTL, Contact	
Other Output Signals	Trigger, Exposure timing, In-Recording signals	
External Controls	Remote Keypad, RS422 External control interface	
Video Output Signal	RS170(NTSC/PAL), Real-time digital zoom function	
Digital Interface	IEEE1394, Ethernet (100BASE) or Optical I/F to be selected when ordering	

### 6.1.2. Miscellaneous Information

<b>Operating Conditions</b>	
Ambient Temperature	0 to 40 degrees Celsius (32 to 104 degrees Fahrenheit), No condensation
<b>Mechanical Data</b>	
Camera Head	120(H) x 110(W) x 99(D) mm; 4.7(H) x 4.3(W) x 3.9(D) inches
Processor	213(H) x 140(W) x 307(D) mm; 8.4(H) x 5.5(W) x 12.1(D) inches
AC Power Supply Unit	66(H) x 140(W) x 277(D) mm; 2.6(H) x 5.5(W) x 10.9(D) inches
Remote Keypad	38(H) x 82(W) x 139(D) mm; 1.5(H) x 3.2(W) x 5.5(D) inches
Camera Cable	5 meters long
<b>Power</b>	
Voltage	100/220 VAC
Frequency	50-60 Hz
Power Consumption	Approx. 130 VA
<b>Weight</b>	
Camera Head	1.0 kg; 2.2 lbs.
Processor	5.5 kg; 12.2 lbs.
AC Power Supply Unit	3.0 kg; 6.7 lbs.
Remote Keypad	0.9 kg; 1.9 lbs.

### *6.1.3. Accessories and Optional Items*

<b>Accessories</b>	<b>Quantity</b>
C-mount adapter	1
Allen (hex) wrench for changing lens mounts	1
Lens mount cap	1
GENERAL IN cable	1
GENERAL OUT cable	1
Ferrite core for power cable	3
Driver/Application setup CD-ROM	1
FASTCAM-APX Hardware Manual	1
FASTCAM Control Software operation manual	1
Warranty registration card	1

<b>Optional Items – User-set</b>
IEEE1394 optical extension unit (OpticalLink TE/RE)
4ch MCDL Waveform data input box
4ch Trigger box
Hi-G Lens kit
MCDL/RS422 Cable

## 6.1.4. Frame Rates and Resolutions

**Table 1 (60 FPS to 8,000 FPS)**

		Frame Rates (FPS)									
		60	125	250	500	1000	2000	3000	4000	6000	8000
Resolution	1024X1024	✓	✓	✓	✓	✓	✓				
	1024X768	✓	✓	✓	✓	✓	✓				
	1024x512	✓	✓	✓	✓	✓	✓		✓		
	1024x256	✓	✓	✓	✓	✓	✓		✓		✓
	1024x128	✓	✓	✓	✓	✓	✓		✓		✓
	512x1024	✓	✓	✓	✓	✓	✓	✓			
	512x512	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	512x256	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	512x128	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	512x64	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	256x512	✓	✓	✓	✓	✓	✓	✓	✓		✓
	256x256	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	256x128	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	256x64	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	256x32	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	128x256	✓	✓	✓	✓	✓	✓	✓	✓		✓
	128X32	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	128X16	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note: The lowest frame rate available for PAL mode is 50 FPS.

**Table 2 (10,000 FPS to 120,000 FPS)**

		Frame Rate (FPS)										
		10000	12500	15000	20000	24000	30000	40000	50000	87600	100000	120000
Resolution	1024X1024											
	1024X768											
	1024x512											
	1024x256											
	1024x128			✓								
	512x1024											
	512x512											
	512x256		✓									
	512x128		✓	✓		✓						
	512x64		✓	✓		✓		✓				
	256x512											
	256x256		✓	✓								
	256x128		✓	✓		✓	✓					
	256x64		✓	✓		✓	✓	✓	✓			
	256x32		✓	✓		✓	✓	✓	✓	✓		
	128x256				✓							
	128X32		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	128X16		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

### 6.1.5. Number of Recorded Images vs. Resolution

- 1 Model: 2.6GB Memory
- 2 Model: 8GB Memory

Display size	No. of Recorded Images 2.6GB Memory	No. of Recorded Images 8GB Memory
1024x1024	2048	6144
1024x768	2730	8190
1024 x 512	4096	12288
1024 x 256	8192	24576
1024 x 128	16384	49152
512 x 1024	4096	12288
512 x 512	8192	24576
512 x 256	16384	49152
512 x 128	32768	98304
512 x 64	65536	196608
256x512	16384	49152
256 x 256	32768	98304
256 x 128	65536	196608
256 x 64	131072	393216
256 x 32	262144	786432
128x256	65536	196608
128x32	524288	1572864
128x16	1048576	3145728

Record duration = Number of Images x (1/frame rate (FPS))

### *6.1.6. Shutter Speed Table (COARSE Steps)*

The following table shows the 27 available steps for the COARSE set of shutter speeds. Note the lowest speed is 1/60 seconds. The speed doubles up to 1/2,000 seconds and then offers the most frequently-used speeds as shown in the table.

For FINE steps, the shutter speed doubles from 1/60 to 1/2,000 seconds (as is the case with the COARSE steps - see the below table). After 1/2,000 seconds, however, the speed increases at a fine step of 1/1,000 seconds up to the highest speed of 1/250,000 seconds.

COARSE Shutter Speed Steps(seconds)
1/60
1/125
1/250
1/500
1/1000
1/2000
1/3000
1/4000
1/6000
1/8000
1/10000
1/15000
1/20000
1/24000
1/30000
1/40000
1/50000
1/87600
1/100000
1/120000
1/140000
1/160000
1/180000
1/200000
1/220000
1/240000
1/250000



### 6.1.1.7. RS422 Serial Control Commands

#### RS422 Protocol and Commands

##### RS422 Communication Protocol

The APX processor has a UART-type asynchronous system with its NRZ (Nonreturn-To-Zero) format comprising 8 data bits, 2 stop bits, non-parity. The baud rate is 4800.

##### Camera Setup Command

All camera parameters are set up by the camera setup commands. Each command works in the manner corresponding to the indication of the keypad button.

Camera Setup Commands	
FRAME RATE ↑	0x60
FRAME RATE ↓	0x61
RESOLUTION ↑	0x62
RESOLUTION ↓	0x63
SHUTTER ↑	0x64
SHUTTER ↓	0x65
TRIGGER ↑	0x66
TRIGGER ↓	0x67
LIVE/MEMO	0x68
PLAY < <	0x69
PLAY <	0x6A
PLAY >	0x6B
PLAY > >	0x6C
PLAY	0x6D
PLAY STOP	0x6E
BLOCK S	0x6F
BLOCK E	0x70
BLOCK ON/OFF	0x71
REC READY	0x72
REC	0x73
STORE	0x74
MENU ON/OFF	0x75
ENTER	0x76
ZOOM	0x77
FIT	0x78
CROSSHAIR KEY ↑	0x79
CROSSHAIR KEY ↓	0x7A
CROSSHAIR KEY ←	0x7B
CROSSHAIR KEY →	0x7C

**Camera Information Requirement Command**

Camera setup information can be obtained. Camera information corresponding to each command can be obtained.

Camera Information Requirement Commands	
FRAME RATE	0xA0
RESORUTION	0xA1
SHUTTER	0xA2
TRIGGER	0xA3
LIVE/MEMO	0xA4
ID	0xA5
RANDOM FRAME	0xB0
MANUAL TRIGGRE	0xB1
RAMNDOM M TRIGGER	0xB2
RANDOM E TIMES	0xB3
TWO STAGES	0xB4
OSD SELECT	0xB5
R/G/B	0xB6
EXT-SYNC IN	0xB7
EXT-SYNC OUT	0xB8
GENERAL IN	0xB9
GENERAL OUT	0xBA
COLOR TEMP	0xBB
LUT SELECT	0xBC
DS SHUTTER	0xBD
MCDL/IRIG	0xBE
AUTO PLAY	0xBF
DATE/TIME	0xC0
MAX ID	0xC1

## Camera Information Response Commands

The APX camera system returns the camera information to the requiring command. The returned information includes a camera information command indicating the kind of camera information followed by setup response command that shows the setup details. The setup response command has numeric meaning in it and has 8 bytes or 16 bytes (when the data bit portion only is converted) of information sent back in a row.

Note: A 16-byte transfer of data is available only when returning setup details on resolution information.

Example: Request frame rate information when the camera is set 2,000 FPS.

1. Send a camera information request command [0xA0].
2. An information command [0xD0] is returned by the camera.
3. Then, a setup response command consisting of 8 bytes of is returned in a row like [0x30], [0x30], [0x30], [0x30], [0x30], [0x30], [0x30], [0x30].

Camera Information Commands		Setup Response Commands (8 or 16bytes)
FRAME RATE	0xD0	00000060
		~
		00120000
RESORUTION	0xD1	00000128 00000016
		~
		00001024 00001024
SHUTTER	0xD2	00000060
		~
		00250000
TRIGGER	0xD3	00000000 : START
		00000001 : CENTER
		00000002 : END
		00000003 : MANUAL
		00000004 : RANDOM
		00000005 : RANDOM RESET
		00000006 : RANDOM CENTER
		00000007 : RANDOM MANUAL
		00000008 : TWO STAGES
LIVE/MEMO	0xD4	00000000 : LIVE
		00000001 : MEMO
		00000002 : READY
		00000003 : REC
		00000004 : ENDLESS
ID	0xD5	00000001
		~

		00000064
RANDOM FRAME	0xE0	00000001
		~
		0xxxxxxx
MANUAL TRIGGRE	0xE1	00000001
		~
		0xxxxxxx
RAMNDOM M TRIGGER	0xE2	00000001
		~
		0xxxxxxx
RANDOM E TIMES	0xE3	00000001
		~
		00000010
TWO STAGES	0xE4	00000002 : 1/2
		00000003 : 1/4
		00000004 : 1/8
OSD SELECT	0xE5	00000001 : ON
		00000002 : OFF
R/G/B	0xE6	00000001 : ALL
		00000002 : R
		00000003 : G
		00000004 : B
EXT-SYNC IN	0xE7	00000001 : OFF
		00000002 : ON POS CAM
		00000003 : ON NEG CAM
		00000004 : ON POS OTHERS
		00000005 : ON NEG OTHERS
EXT-SYNC OUT	0xE8	00000001 : VSYNC POS
		00000002 : VSYNC NEG
GENERAL IN	0xE9	00000001 : EVENT POS
		00000002 : EVENT NEG
		00000003 : TRIGGER POS
		00000004 : TRIGGER NEG
GENERAL OUT	0xEA	00000001 : EXPOSE POS
		00000002 : EXPOSE NEG
		00000003 : REC POS
		00000004 : REC NEG
		00000005 : TRIGGER POS
		00000006 : TRIGGER NEG
COLOR TEMP	0xEB	00000001 : 5100K
		00000002 : 3100K
		00000003 : USER 1
		00000004 : USER2

LUT SELECT	0xEC	00000001 : D1
		00000002 : D2
		00000003 : D3
		00000004 : D4
		00000005 : D5
		00000006 : USER
DS SHUTTER	0xED	00000001 : OFF
		00000002 : ON MODE 1
		00000003 : ON MODE2
		00000004 : ON MODE3
MCDL/IRIG	0xEE	00000001 : OFF
		00000002 : MCDL ON
		00000003 : IRIG ON
		00000004 : MCDL IRIG ON
AUTO PLAY	0xEF	00000001 : OFF
		00000002 : ON
DATE/TIME	0xF0	00000001 : DATE
		00000002 : TIME
TOTAL ID	0xF1	00000001
		~
		00000064

Digits of Setup Response Commands	
0	0x30
1	0x31
2	0x32
3	0x33
4	0x34
5	0x35
6	0x36
7	0x37
8	0x38
9	0x39

### *6.1.8. STATUS OUT*

By turning the STATUS OUT on in the menu, you can set the camera in the status where it always outputs image data in the serial format. The camera statuses where serial output can be made are LIVE, MEMORY, READY, REC and ENDLESS. As soon as the camera's status turns into one of them, the camera begins serial output of image data.

With the above setting, you can know the camera status without the need to issue a camera status request command.

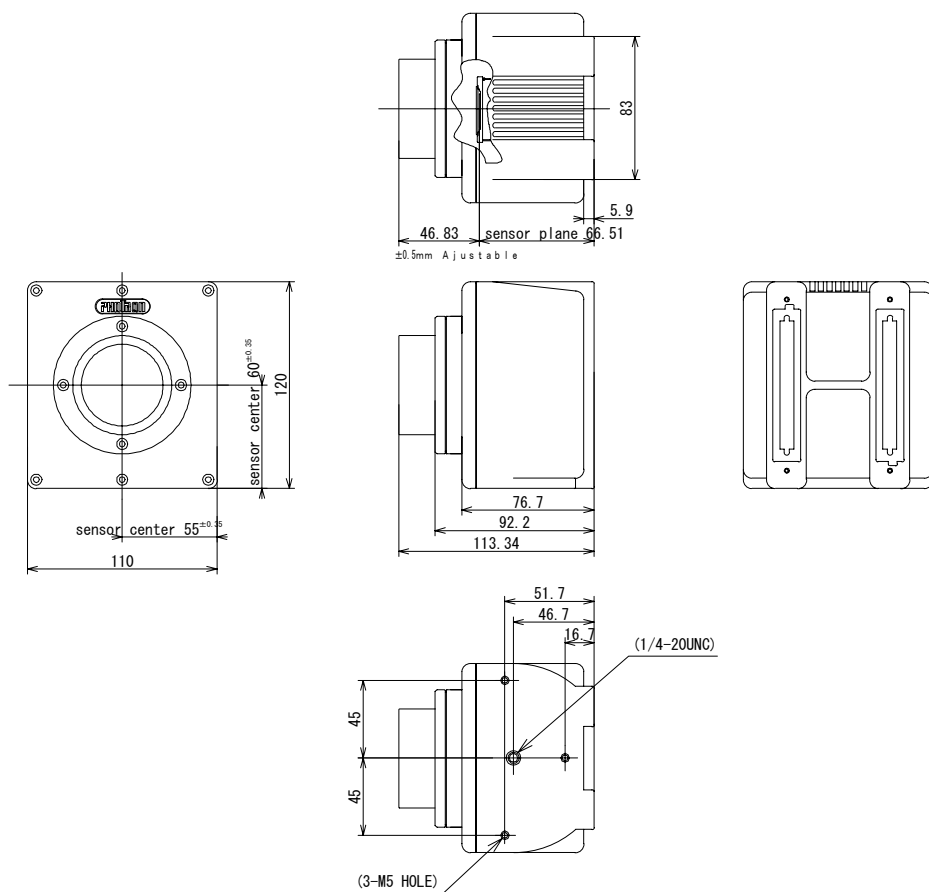
The serial commands for camera status are shown below:

LIVE	0x53, 0x30
MEMORY	0x53, 0x31
READY	0x53, 0x32
REC	0x54, 0x33
ENDLESS	0x53, 0x34

For example, the camera issues 0x53 and then 0x30 to change its status from MEMORY to LIVE.

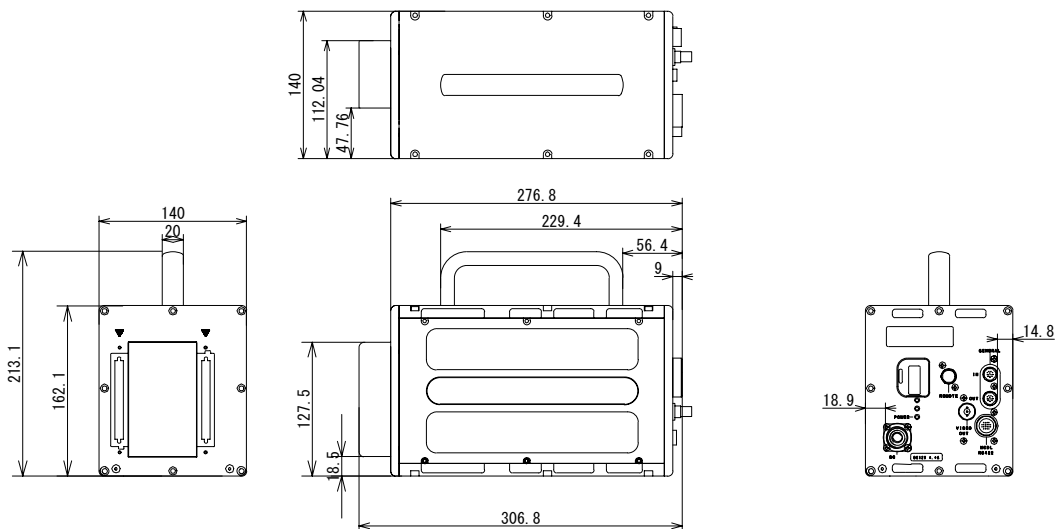
## 6.2. Mechanical Data

### 6.2.1. Camera Head (millimeters)

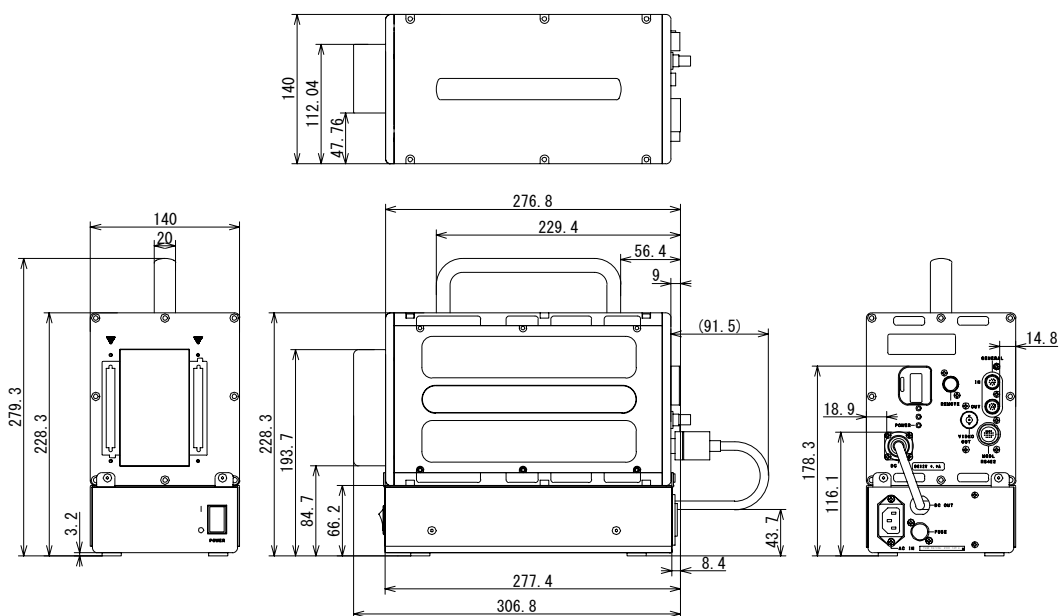


## 6.2.2. Processor (millimeters)

### Without AC/DC Unit

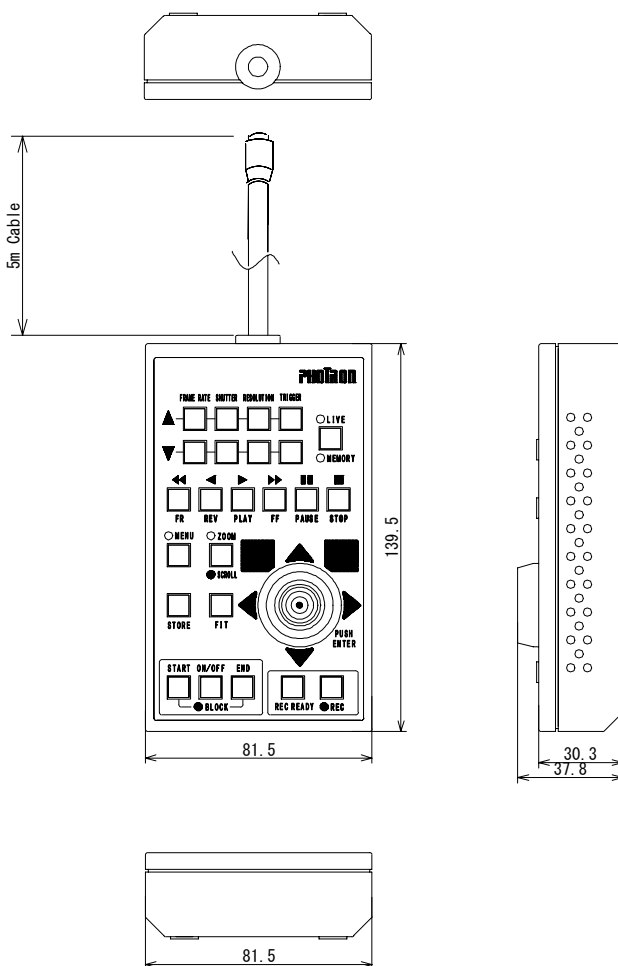


### With AC/DC Unit





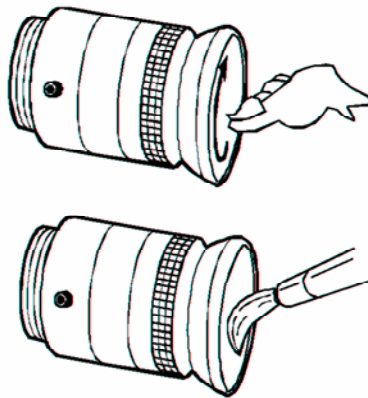
### 6.2.3. Keypad (millimeters)



## *6.3. Care of Lenses*

The surface of photographic lenses has thin coatings that reduce unwanted reflections. Extra care must be taken to protect these fragile coatings.

Protect the lens by installing a lens cap when you are not using the camera. Brush the lens gently with a camel hairbrush or loosely folded piece of lens paper to remove dust particles. For stubborn dirt use photographic lens cleaning solution and lens wipes. Never rub the lens with direct pressure or drop cleaning solution directly on the lens surface.



In Americas and Antipodes:

**PHOTRON USA, INC.**

9520 Padgett Street, Suite 110  
San Diego, CA 92126-4446, USA

Phone: 858-684-3555

Fax: 858-684-3558

E-mail: [image@photron.com](mailto:image@photron.com)

[www.photron.com](http://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](mailto:image@photron.com)

[www.photron.com](http://www.photron.com)

In other areas:

**PHOTRON LIMITED**

Fujimi 1-1-8, Chiyoda-Ku

Tokyo 102-0071, Japan

Phone: +81 3 3238 2107

Fax: +81 3 3238 2109

E-mail: [image@photron.com](mailto:image@photron.com)

[www.photron.co.jp](http://www.photron.co.jp)

**Photron**

FASTCAM-ultima APX User's Manual

English Version

2006/1

Rev.1.1