



FASTCAM-1024PCI Hardware Manual

*Rev.1.02
English Version*

Photron
PHOTRON LIMITED
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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-1024PCI High-Speed Video Camera System will prove itself a truly powerful imaging tool, providing solutions for engineers and scientists in such fields as general research and development, designing, manufacturing, quality assurance, scientific researches, medical and biological researches, and space and aeronautical engineering. The 1024PCI seamlessly connects to a PC, becoming an integral part of the computer, and when combined with its easy-to-use control software provides an image recording and processing system for analyzing captured fast moving or high-speed events immediately, a task which has often proven difficult with conventional video systems.

You will find this new recording technology most useful to capture images of high-speed subjects for subsequent slow-motion observation, motion analysis, and image processing applications. This manual presents the technical details of the 1024PCI system and how to operate it.

Remarks:

1. For the best use of the Photron FASTCAM 1024PCI 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 immediately. 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-1024PCI

PHOTRON LIMITED warrants this PHOTRON FASTCAM-1024PCI ("1024PCI") 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 1024PCI in accordance with Photon's written instructions, including environmental specifications listed in the User's Manual.

If there is evidence of the 1024PCI being subjected to accidental damage, misuse or abuse.

If the 1024PCI 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 1024PCI 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.
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E-mail: image@photron.com
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 FASTCAM-1024PCI.

“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 seriously hazardous sequence involving human injury or death may result. It must not be disregarded.

For Correct and Safe Use

Please read the following section carefully and follow all the safety warnings and cautions for correct and safe use avoiding any danger or damage to users and other people and properties around.

Please understand the following definitions of indications of notes depending on the degree of danger depending on the incorrect use of the equipment:

Warning:

This means that a serious human injury or death is expected if the instruction is not followed.

Caution:

This means that human injury or physical damage is expected if the instruction is not followed.

- ◆ Note the meaning of the following indication marks and follow the instructions:



This mark leads information calling attention.



This mark means prohibition.



This mark means an instruction that must be followed.

Warning



Do not damage the power cord or plug (such as scratching, modifying, bringing near heat-producing device, forcing to bend, twist, pulling, putting under heavy object, binding, etc.)



Using a damaged cord may result in a fire, electrical shock or short circuit.



Do not use over the rating of the power outlet or other wirings, or other than 100 VAC power. Using the system over rated voltage may cause a fire by overheat.



Do not put metal object, water or any liquid in the equipment.



It may cause a fire or electrical shock.



Do not try to disassemble or modify the equipment. It may cause electrical shock because there is high voltage within the equipment.



For check up and repair of the equipment, please contact your dealer or a nearby Photron office.



Do not handle the power plug with your hand wet.



It may cause electrical shock.



Plug the power plug firmly into a power outlet to the full depth.



Insufficient contact may cause electrical shock or fire by heating.



When abnormality is found, unplug the power cord from the power outlet.

- Water or any other liquid or metal object is erroneously put inside the equipment.
- When the housing is somehow damaged due to drop or fall.
- When smoke, unusual smell or sound is detected.



Using the equipment with any of such abnormal conditions uncorrected may cause fire or electrical shock.

Caution



When the equipment is not used for a long time, keep power plug of the equipment unplugged.



Storing or leaving the equipment for a long time plugged to power outlet may cause fire because of insulation deterioration or electrical leakage.



Do not place the equipment in a place where the temperature may rise significantly.



Especially, the ambient temperature inside a car cabin or trunk may go up to as high as over 60 degrees Celsius in summer, which may cause defect on the housing material and parts inside, or may even cause fire.



Do not place the equipment in a place where the equipment may be exposed to oily smoke, steam, moisture or dust.



Electricity may flow via oil, moisture or dust and result in fire or electrical shock.

Chapters

This manual is divided into three 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. Setting Up

Introduces you to the components of the 1024PCI and explains the use of each connector, keypad operation and parameter settings for recording.

Chapter 3. Recording

Explains the operation of the 1024PCI for recording.

1.4. Precautions

Ambient Temperature

Photron FASTCAM-1024PCI has been designed to work properly in an ambient temperature range of 0 to 40 degrees Celsius (32 to 104 degrees Fahrenheit), no condensation. (Temperature range depends on PC specification.)

Storage Temperature

The 1024PCI 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. Set Up

- 2.1. Introduction*
- 2.2. About the Camera*
- 2.3. Installation of Hardware*
- 2.4. Setting up for Multiple-Camera Recording*
- 2.5. Extended Dynamic Range Mode Operation*

2.1. Introduction

2.1.1. Unpacking

The 1024PCI consists of the following items. When you open up the package, be sure to check all components are present.

1. Camera Head (with Lens Mount and Lens Cap)	1
2. Grabber Board (PCI Board)	1
3. Grabber Board Power Cable	1
4. Camera Cable to Connect between Camera and Grabber Board (5 meters long)	1
5. C-mount Adapter	1
6. Set of Allen Wrenches (1.5 mm, 2 mm and 4 mm)	1
7. Lens Mount Cap	1
8. External Signal Compound Cable for Input	1
9. External Signal Compound Cable for Output	1
10. FASTCAM Series Driver CD	1
11. Imager Setup CD-ROM	1
12. FASTCAM-1024PCI Hardware Manual	1
13. Photron FASTCAM Viewer (PFV) Operation Manual	1
14. Warranty Registration Card	1

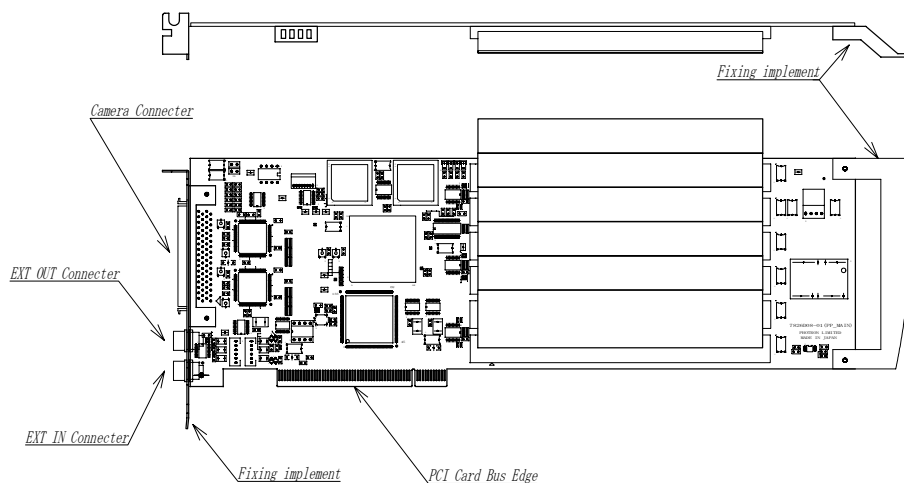
2.2. About the Camera

The FASTCAM-1024PCI consists of a Grabber Board (PCI Board), camera head and control software program set.

2.2.1. Grabber Board

The grabber board of the FASTCAM-1024PCI has been designed so that up to four FASTCAM-1024PCI boards can be installed in ATX standard PCI slots of a PC.

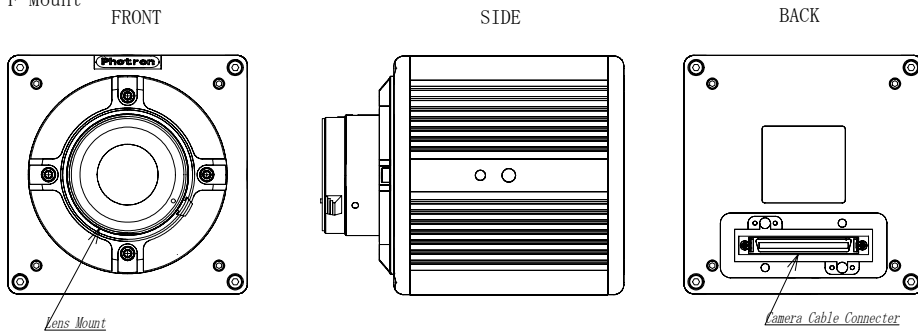
Note: When you are installing four grabber boards in one PC, the PCI slot right next to the AGP slot in the PC becomes unusable. This means the PC must have five or more PCI slots in it to accommodate four grabber boards.



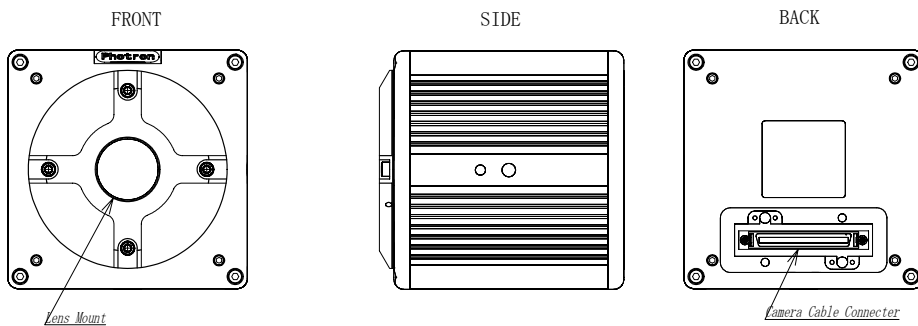
2.2.2. Camera Head and Camera Cable

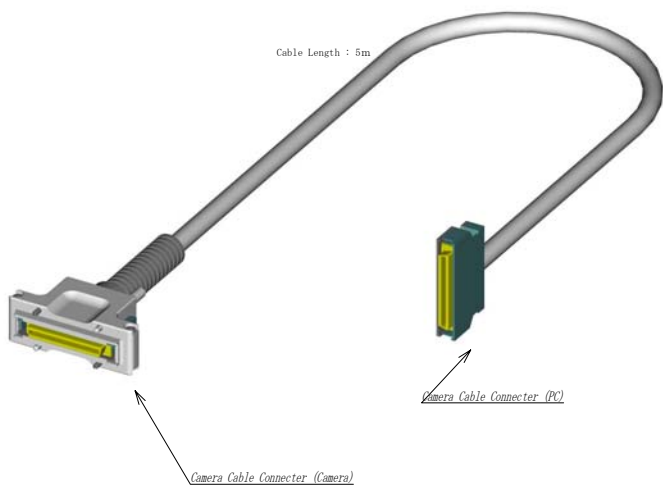
The 1024PCI camera head is of lightweight and compact structure specifically designed for easy handling in varied recording conditions. It takes lenses of C- type mount. A tripod shoe groove is provided on each side of the camera.

F Mount



C mount

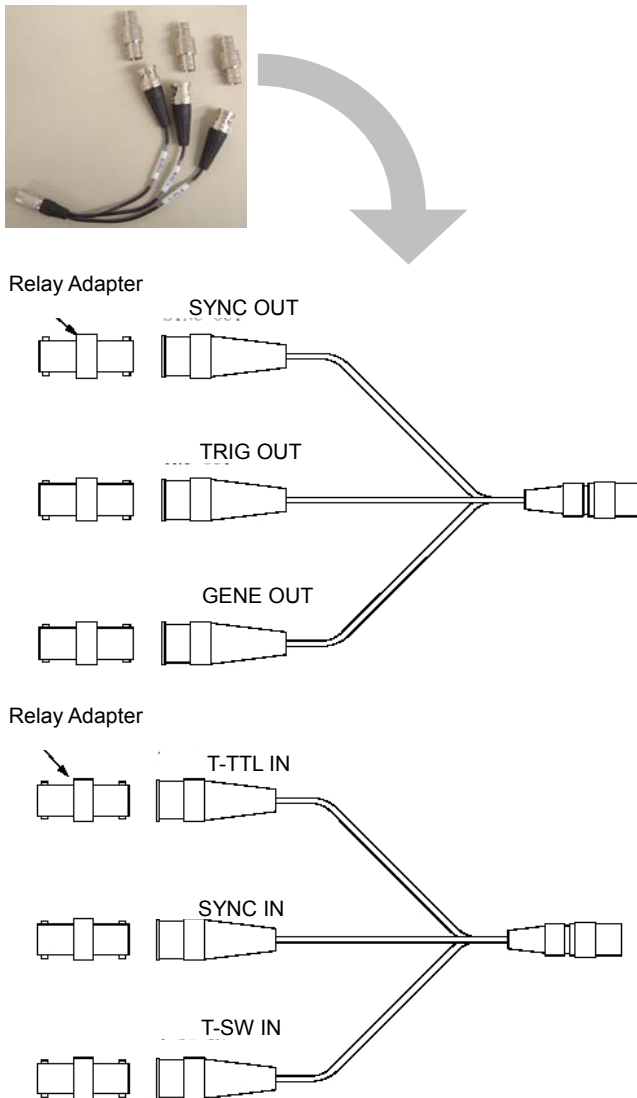




2.2.3. Accessories

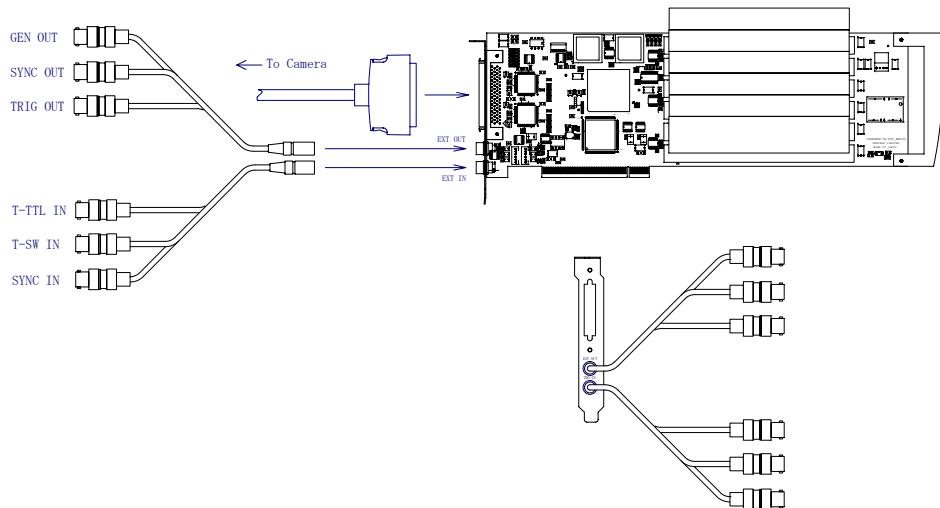
EXT OUT/ EXT IN Cables

The Grabber Board has two compound connectors to connect it to external equipment and devices via cables to receive and send out signals such as external trigger and sync signals. Two compound cables are included in the package as shown below.



2.2.4. Connector Specifications

Details of the two compound cables are as follows:



1. GENERAL Output (GEN OUT) Connector

A BNC connector that outputs the following signals under software control.

Expose pos/neg : Outputs a signal that specifies the exposure period of the sensor. Signal is present during both LIVE display and recording.

Rec pos/neg : A signal that specifies the recording process period of the Grabber Board.

2. EXTERNAL SYNC Output (SYNC OUT) Connector

A BNC connector that outputs the camera's vertical sync signal to synchronize external equipment such as strobe unit and pulsed laser.

3. TRIGGER TTL Output (TRIG OUT) Connector

A BNC connector that outputs trigger signal for slaved boards to follow.

4. TRIGGER TTL IN Input(T-TTL IN) Connector

A BNC connector that receives TTL signal from external source to control the start and end of a recording in currently selected recording mode. Input signal is a pulse of +5V, 5μsec wide, positive going. Current is 10mA, recommended, and 20mA maximum.

5. TRIGGER SW IN Input (T-SW IN) Connector

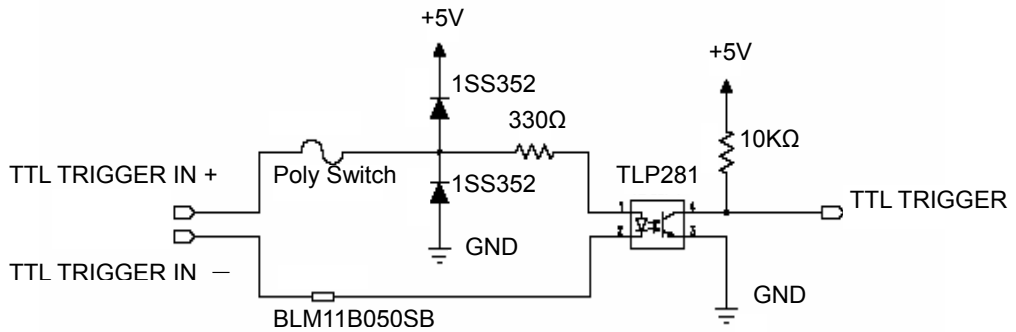
A BNC connector whose co-axial cable shield and center conductors are used to send contact closure signals to control the start and end of a recording in currently selected recording mode.

Caution: To avoid possible damage to the camera system, do NOT input signals other than contact closure to T-SW IN connector.

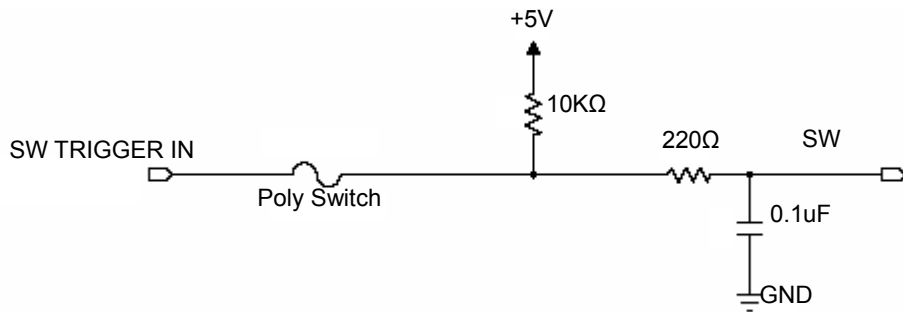
6. EXTERNAL SYNC Input(SYNC IN) Connector

A BNC connector that receives sync signal from master board or external equipment.

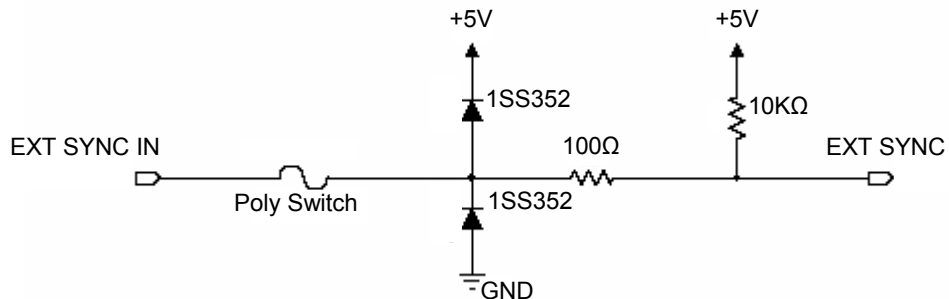
TRIGGER TTL IN (T-TTL IN) Input Circuit



TRIGGER SW IN (T-SW IN) Input



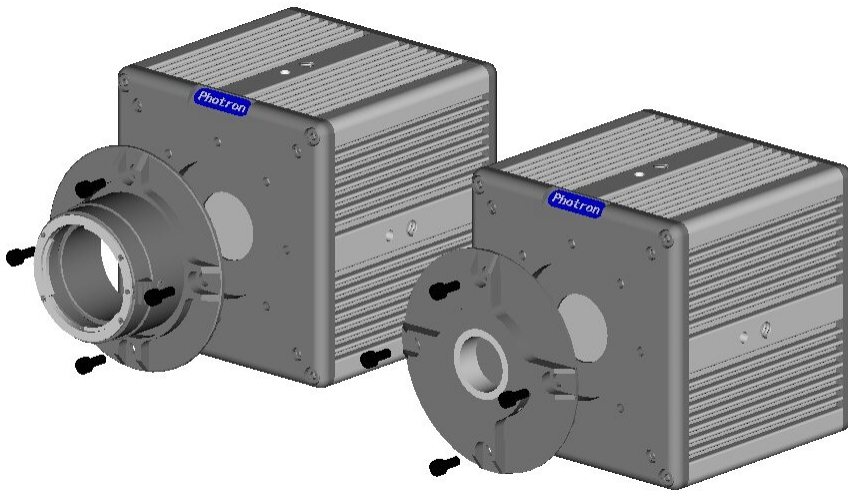
EXTERNAL SYNC IN Input



2.2.5. Changeable Lens Mount

You can change the lens mount of the FASTCAM-1024PCI depending on the specific need of your application. Two types of lens mounts - Nikon F type and C type - are available to choose from.

How to change lens mounts (Example: Changing from the F mount to C mount)



1. Remove and set aside the four retaining screws of the mount using the provided Allen (hex) wrench.
2. Pull the whole F mount unit away from the camera front plate.
3. Place the C mount unit on the camera front plate. Fasten the unit with the four retaining screws using the Allen wrench. Make sure that the C mount has been firmly fastened to the camera front plate.

Caution: Use care when fastening the retaining screws. Do not force them too tightly or you may damage the screws or the screw holes on the camera front plate.

2.3. Installation of Hardware

Warning:

Turn off the computer and unplug the power cord from power outlet before connecting between the camera head and Grabber Board, and installing the Grabber Board in the PC to avoid electrical shock and possible damage to the system and/or components.

Caution: Remove the cable twist-ties before connecting.

2.3.1. Installing Grabber Board in PC

Follow the procedure below to install the Grabber Board in the PC:

1. Turn off the PC and unplug the power cable.
2. Remove covers of the PC following the PC's instruction manual.
3. Make sure there are unused PCI slot(s).
4. Remove the metal cover plate in the back of the unused PCI slot where you wish to install the Grabber Board.
5. Insert the Grabber Board into the unused PCI slot. Firmly press the edge of the Grabber Board so the connector engages perfectly. Fasten the board with retaining screws.

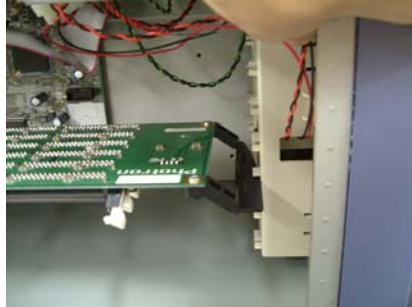


Insert the board squarely into a PCI slot and fasten it with screws.

The position of the guide plate on the end of the Grabber Board can be readjusted by redoing the retaining screws. See the board guide on the PC to check for the best position for the guide plate.



Holder bar



Board fitted with its holder bar along the board guide

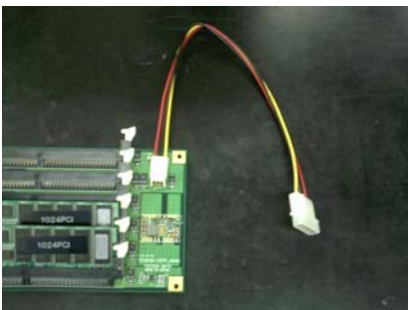
6. Connect the power cable to the Grabber Board.



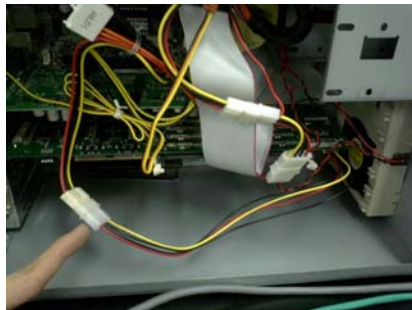
Smaller cable connector



Smaller cable connector connected to Grabber Board



Larger cable connector



Larger cable connector connected to Grabber Board

7. Replace the covers on the PC following the instructions in the PC manual.

8. Connect the camera cable to the camera connector on the Grabber Board. Be careful about the connector orientation. Fasten the retaining screws tightly. Pull the cable lightly to check if the connector does not come loose.



Connection to Board



Connection to camera head

Fasten connectors firmly with retaining screws.

Warning:

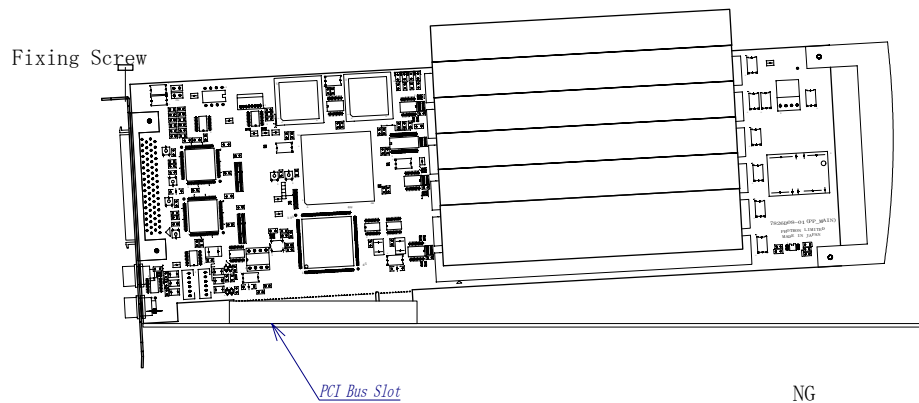
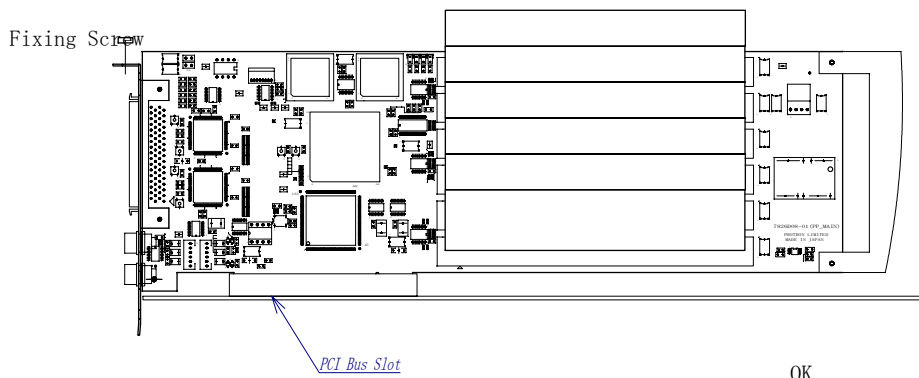
Turn off the PC and unplug the power cord before installing the Grabber Board in the PC.

Warning:

When connecting or disconnecting the camera head to the PC, turn off the PC, or damage to the camera or PC may result.

Warning:

Be sure to fasten the camera cable connectors firmly with retaining screws. If the camera cable is inadvertently disconnected while power is on, the camera and/or PC may be damaged.



Warning:

After installing the Grabber Board in the PC, make sure that the board has been set firmly and squarely in the PCI slot.
Poorly installed board may result in damage to the PC or Grabber Board.

2.3.2. Memory Modules

The Grabber Board of the FASTCAM-1024PCI allows up to six memory modules to be installed as shown below:

Memory capacity	Memory module
2 GB	1GB × 2
4 GB	2GB × 2
8 GB	2GB × 4
12 GB	2GB × 6
16 GB	4GB × 4
24 GB	4GB × 6



The overall size of the Grabber Board stays the same when up to four memory modules are inserted into the memory slot on it. However, when six memory modules are installed, the overall size of the Board expands, which may cause interference with a smaller-sized PC chassis.



Memory modules specifically offered by Photron are only guaranteed for proper functioning. Because fine readjustment, to be done by a specifically-trained Photron engineer, is required when changing the memory module configuration, memory modules **MUST NOT** be installed or tampered with by customer.

2.3.3. Installation of Pixel Gain/Shading Data

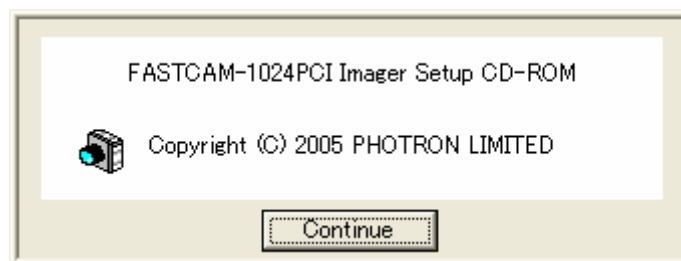
The PFV Control Software has the Pixel Gain/Shading feature that corrects uneven sensitivity between pixels of the C-MOS image sensor. The data for pixel gain/shading is unique to each sensor and the provided data should be installed to use the pixel gain/shading functionality.

Note: For multiple-camera operation, each of the cameras involved must be installed with its own pixel gain/shading data.

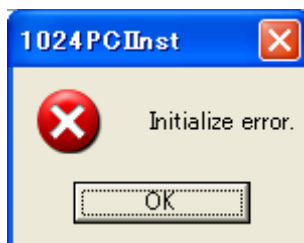
Installation is carried out using the provided FASTCAM-1024PCI Imager Setup CD-ROM in the following manner:

Note: Before installation, the Grabber Board should be set in the PC and the driver and PFV software must be installed.

Insert the Imager Setup CD-ROM in the CD driver, and setup procedure starts automatically.



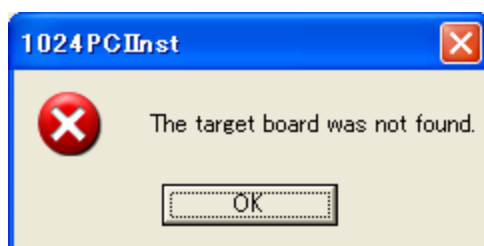
If the driver software, or the Grabber Board, has not been installed in the system, the Initialize error shows as shown below:



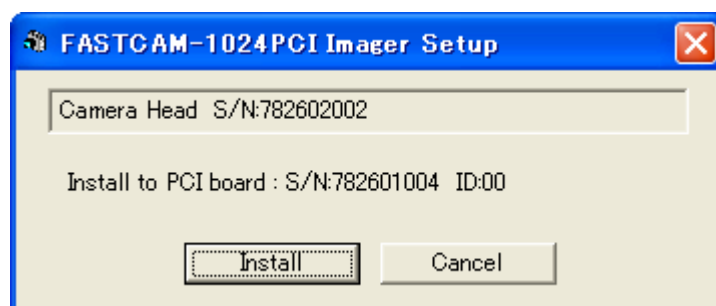
If the PFV has not been installed, the following error message is displayed.



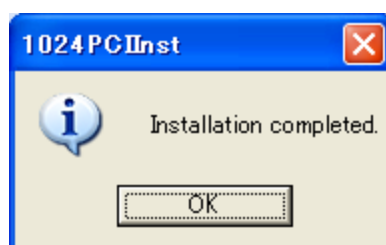
If the serial numbers of the camera head and the data do not match, the following error message is displayed:



When all preparations are done, the following execution window appears.



Press the [Install] button and installation starts. Installation ends with the following completion message displayed.



2.4. Setup for Multiple-Camera Recording

The FASTCAM-1024PCI is capable of multiple camera operation : up to four cameras can be connected to a single PC. It also supports synchronized recording by sync signal supplied from external equipment (signal generator, etc.). In multiple camera operation, the cameras record a common subject from different perspectives along a shared timeline. This capability can also be used to record images of a fast-moving subject, together with other subjects related to it, from different viewpoints simultaneously.

This section describes how to set up the FASTCAM-1024PCI for multiple camera operation.

Multiple camera operation requires the following setups.

- 2.4.1. Master/Slave Mode Setup**
- 2.4.2. Connection of Multiple Cameras**
- 2.4.3. Setting up ID on Each Camera**
- 2.4.4. Setting up Software (PFV – Photron FASTCAM Viewer)**
- 2.4.5. Tips on Multiple-Camera Sync Recording**

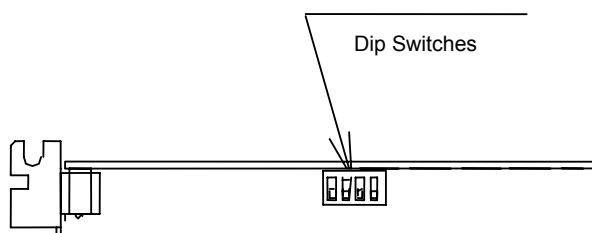
2.4.1. Master/Slave Mode Setup

For multiple-camera synchronized operation, one of the cameras must be set up as the master camera and the other cameras set up as slaves. With cameras set up in this way, the slaves operate following the sync signal provided by the master. As a result, all the cameras record images in a shared timeline.

To set up cameras in these modes, dipswitches on the Grabber Board must be positioned in the following manner:

1) Location of Dipswitches

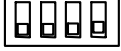

The dipswitches for master/slave mode setup are located on the top surface of the Grabber Board. The following figure shows the location of dipswitches as seen from above.



2) Setting up Master/Slave Mode Dipswitches

Operate the dipswitches to set up one board for master and the others for slaves as shown in the following table.

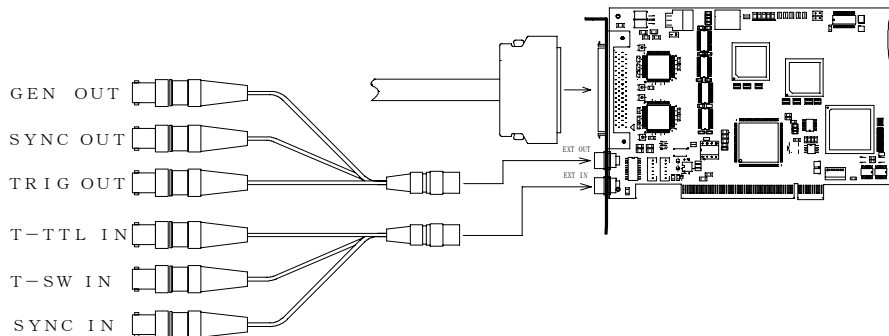
Warning: Turn the PC and cameras off and unplug the power cord before opening the computer enclosure.

	Dipswitch Position	Mode of Operation
Master Mode	<div style="display: flex; align-items: center;"> <div style="text-align: center;"> <div style="display: flex; justify-content: space-around; width: 100px;"> 4321 </div>  </div> <div style="margin-left: 10px;"> ON ↑ </div> </div> <p>All four in OFF position</p>	<p>Multiple-Camera Operation:</p> <p>This camera feeds its internally generated sync and trigger signals to the slaves to follow, and enables trigger signal from software.</p> <p>External Sync Operation:</p> <p>Disables the setup from software menu.</p>
Slave Mode	<div style="display: flex; align-items: center;"> <div style="text-align: center;"> <div style="display: flex; justify-content: space-around; width: 100px;"> 4321 </div>  </div> <div style="margin-left: 10px;"> ON ↑ </div> </div> <p>SW 4 in ON position</p>	<p>Multiple-Camera Operation:</p> <p>This camera follows the sync and trigger signals provided by the master.</p> <p>External Sync Operation:</p> <p>This camera follows sync and trigger signals from external source.</p>

2.4.2. Connection of Multiple Cameras

After making master/slave camera setup, connect the sync cables between boards as described in the following subsections:

2.4.2.1. Details of Connectors



1. GENERAL Output (GEN OUT) Connector
2. EXTERNAL SYNC Output (SYNC OUT) Connector
3. TRIGGER TTL Output (TRIG OUT) Connector
4. TRIGGER TTL IN Input (T-TTL IN) Connector
5. TRIGGER SW IN Input (T-SW IN) Connector
6. EXTERNAL SYNC Input (SYNC IN) Connector

2.4.2.2. Connection for Multiple Camera Sync Operation

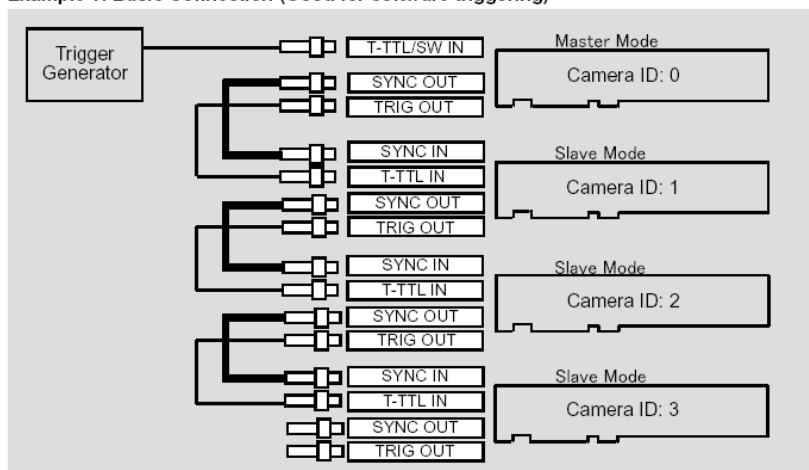
The following figures show how to connect between master and slave boards for sync recording. Connect cables so that the sync and trigger signals are fed to the input of slave boards.

Note: External signal cables have JJ (male-female conversion) connectors. Remove them before connecting to respective boards. Retain the removed conversion connectors for future use.

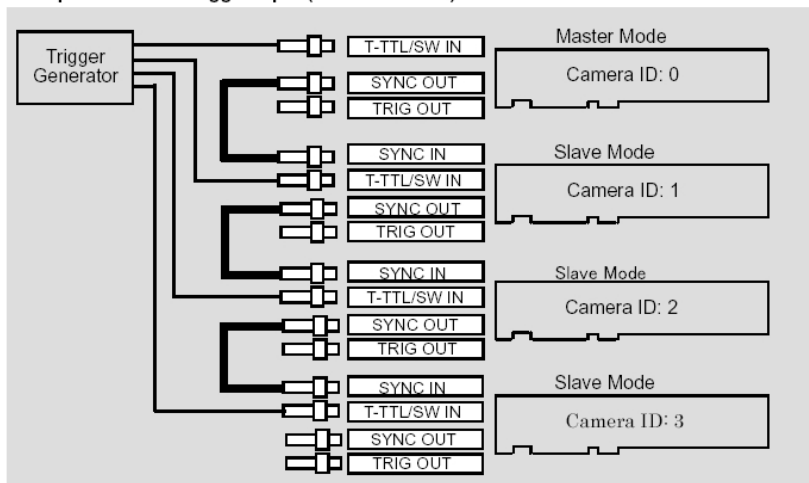
Connection between FASTCAM-1024PCI Cameras

The following two figures show sync cable connection for multiple PCI cameras. Due to delay of signals between the boards, Example 2 is recommended, except for using software trigger (see Section 3.3. Timing Charts).

Example 1: Basic Connection (Good for software triggering)



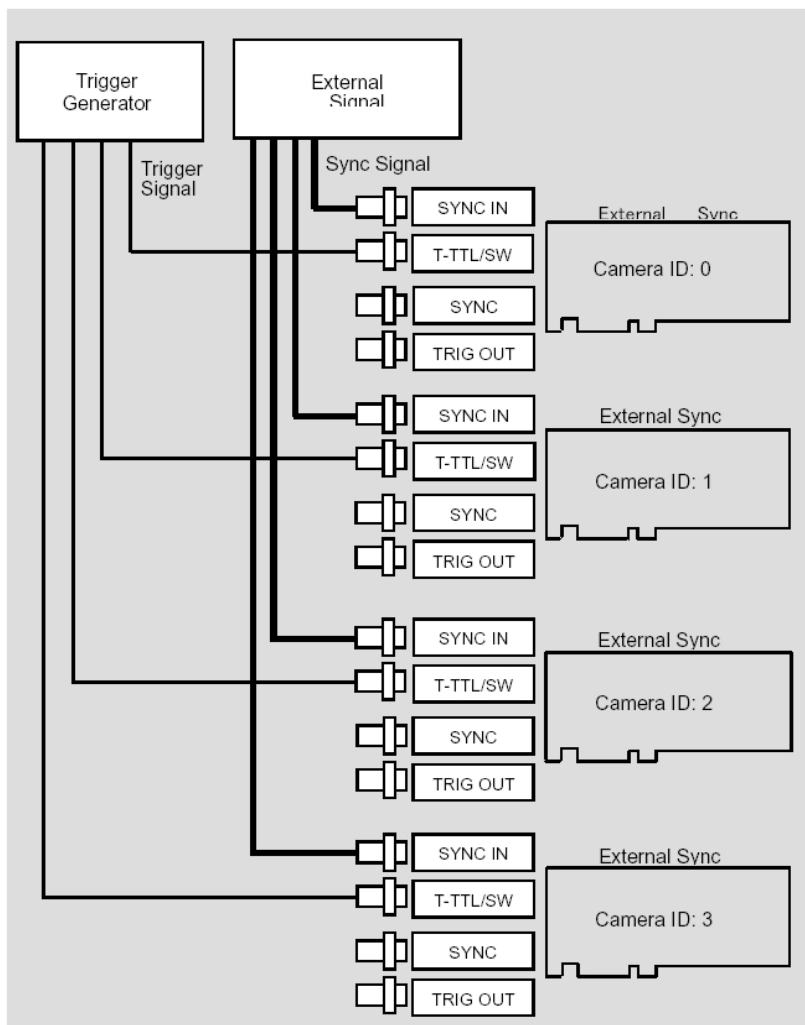
Example 2: Parallel Trigger Input (Recommended)



Using External Sync Generator

The below figure shows an example of connection using an external sync generator. To avoid any possible delay of sync and trigger signals between boards, this connection is highly recommended, unless using software triggering (see Subsection 3.3. Timing Charts).

Recommended Connection



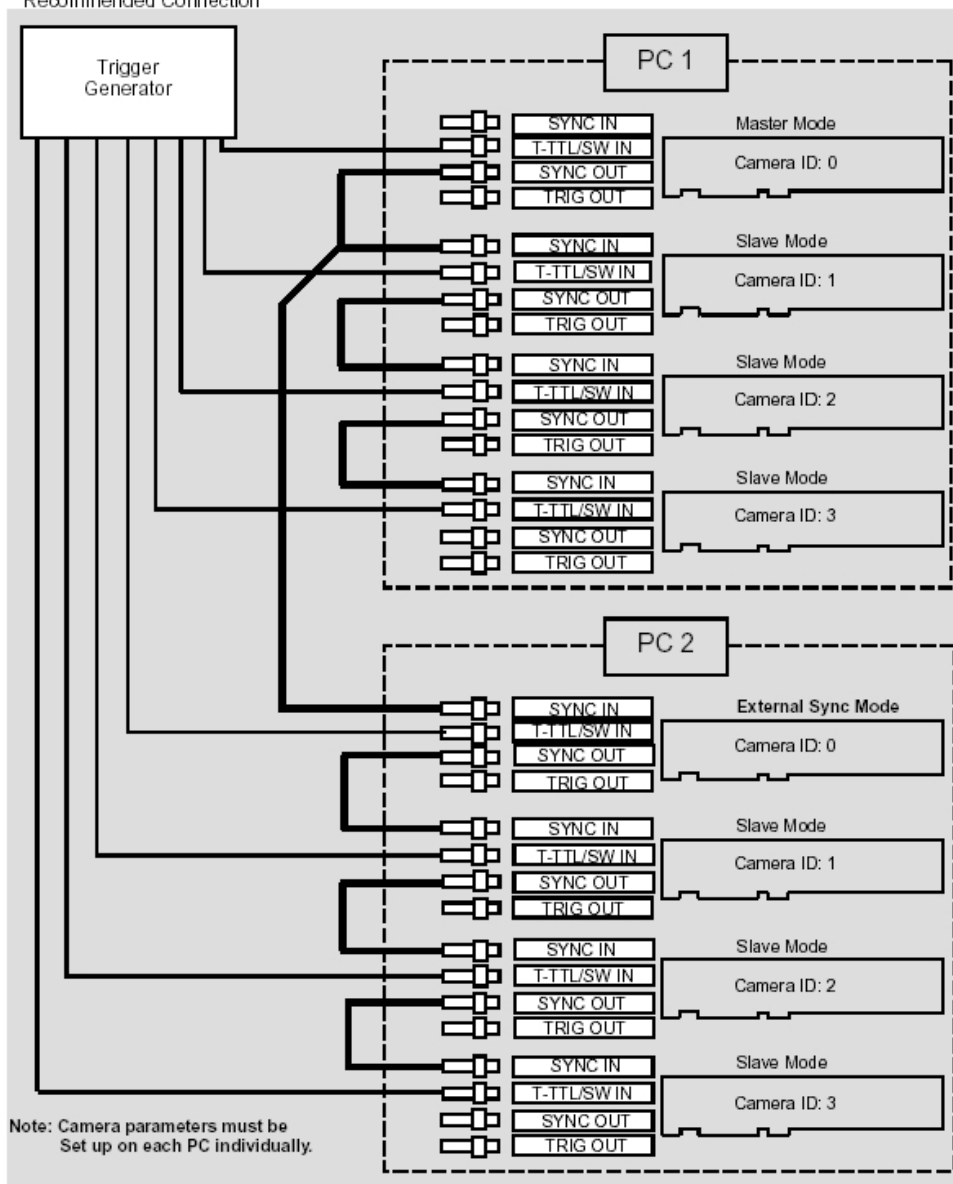
Note: The characteristic of the circuit configuration inside the 1024PCI camera inevitably causes a slight error of ± 12.68 nsec against the input sync signal.

Example: For 10,000 Hz input sync signal, the actual frame rate in each camera is:
 $100 \text{ usec} \pm 12.68 \text{ nsec} = 9,998 \text{ fps to } 10,002 \text{ fps}$

Multiple-PC Sync Operation with Multiple-1024PCI Cameras

The following is an example of connection involving two PC's and eight 1024PCI cameras. This connection is highly recommended to avoid possible delay of sync and trigger signals between cameras (see Subsection 3.3. Timing Charts). The basic connection works but is not recommended because of greater signal delays. Use it for software triggering only.

Recommended Connection



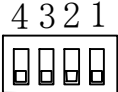
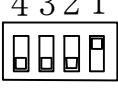
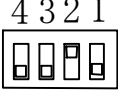
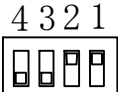
2.4.3. Setting Up Camera ID Numbers

For the software to recognize each camera involved in a multiple-camera operation, an ID number, from 0 to 3, is assigned to each camera. With this ID number, each camera is correctly recognized by the system even if the order of recognition is changed.

The following shows how to assign ID numbers to cameras used in a multiple camera system.

Dipswitch Operation to Set Up Camera ID Numbers

Camera ID numbers 1 to 4 are defined by the ON/OFF position of dipswitches 1, 2 and 3 as shown below.

ID No.	Dipswitches	SW 3	SW 2	SW 1
0		OFF	OFF	OFF
1		OFF	OFF	ON
2		OFF	ON	OFF
3		OFF	ON	ON

Note: The factory-set ID is 0.

Note: Assign ID No. 1 to the master board (or the board that receives sync signal from an external source), and other numbers to the slaves in the order of PCI slots in the computer chassis.

Note: Do not duplicate an ID number within a multiple-camera system.

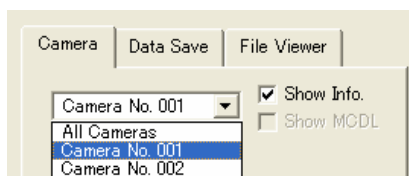
2.4.4. Setting Up Software

Once the setups of the hardware for multiple-camera sync operation procedures in the previous pages are completed, the system can be activated by the software. Follow the below procedure to set up software. For details of software operation, see the Software User's Manual.

2.4.4.1. Setting up Master Board

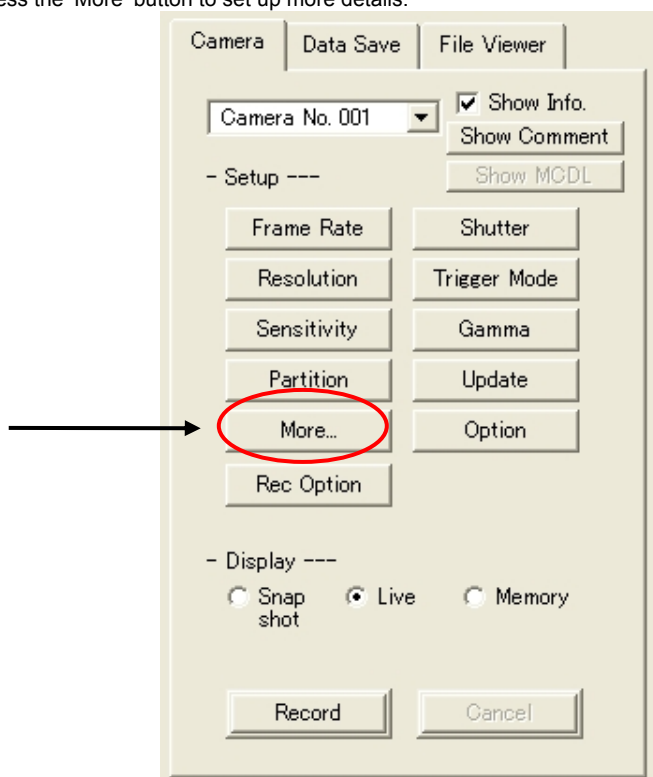
For sync operation of multiple FASTCAM-1024PCI cameras:

- 1) Select the camera ID number of the master camera of this system from the camera selection box.

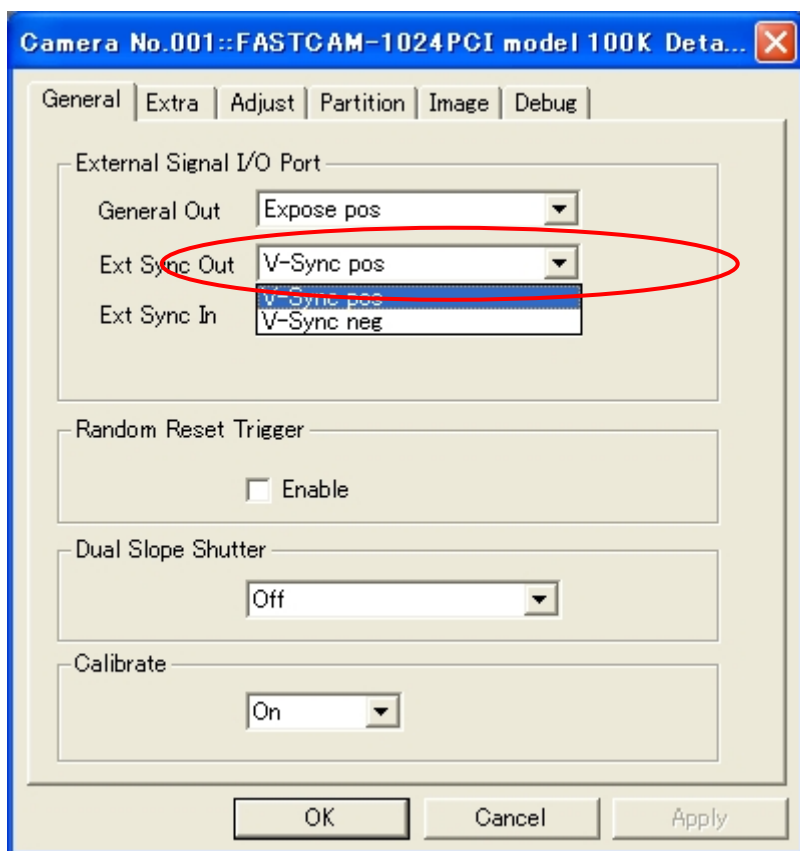


Note: For the relationship between Camera No. and Camera ID, see [Device Information] in [Help].

- 2) Press the 'More' button to set up more details.



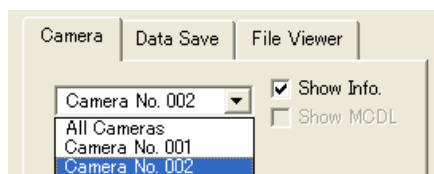
3) Select the desired polarity of sync signal from the 'Ext Sync Out' box.



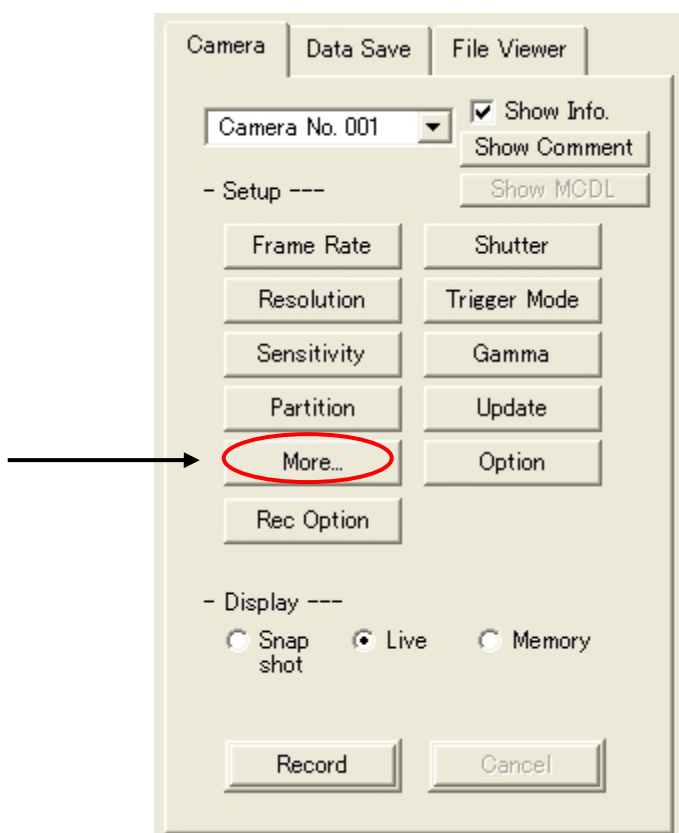
Note: The polarity of sync signal must match that selected for the slave board.

Setting up Slave Boards

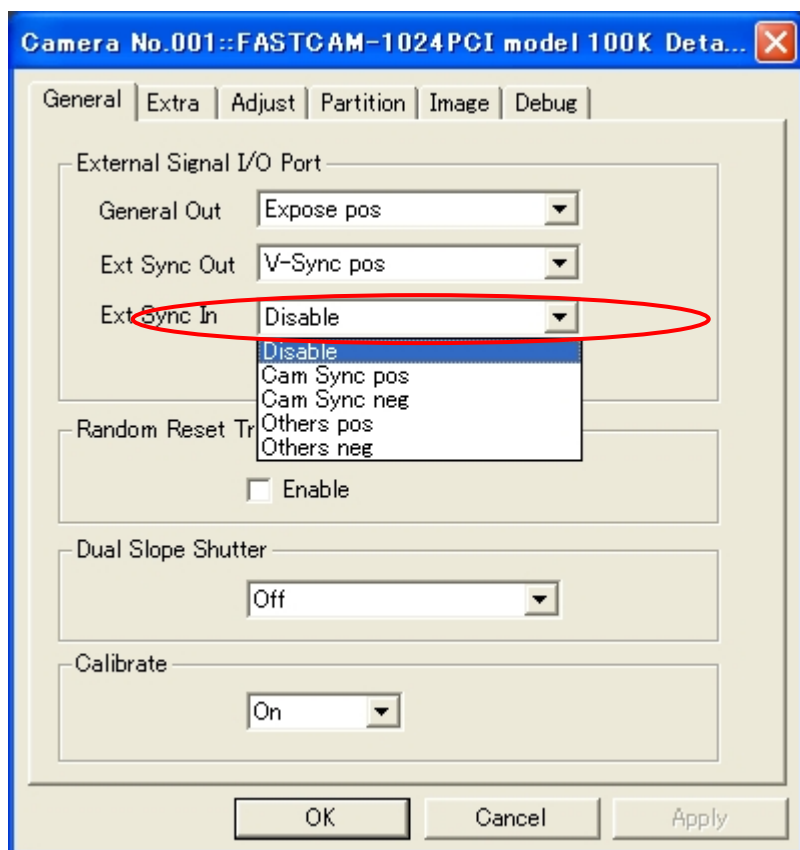
- 1) Select the camera ID number of the slave camera of this system from the camera selection box.



- 2) Press the 'More' button to set up more details.



3) Select a mode of synchronization from the 'Ext Sync In' box. Now this slave camera can be synchronized with, and triggered by, the master camera. In other words, this camera has been set up in the external sync mode. As soon as a selection is made in the 'Ext Sync In' box, the software makes frame-accurate calculation of the frame rate of vertical sync signal to synchronize this slave camera.



Items to choose from in the 'Ext Sync In' box:

Disable	Disable	Voids external sync.
Cam Sync pos.	Normal Modes	Sync operation of multiple 1024PCI cameras
Cam Sync neg.		
Others pos.	External Sync Modes	Sync operation of multiple 1024PCI cameras with external sync signal. Or, sync operation of multiple 1024PCI cameras with multiple PC's.
Others neg.		

Note: The EXT SYNC IN window for the master camera is turned gray and no selection can be made.

Note: The polarity must match that selected in the 'EXT SYNC OUT' box of the master camera or that of the sync signal from the external source being used.

Note: When more than one slave cameras are involved, each of them must be individually set up.

How External Sync Signal Mode Works?

External Sync Signal Mode works as follows (See also 2.4.1.):

1. As soon as either the 'Others pos' or 'Others neg' synchronization mode is selected in the 'EXT SYNC IN' box for a slave camera, this camera can be synchronized with and triggered by the master camera. In other words, this camera has been set up for external sync mode operation.
2. As a selection is made in the 'EXT SYNC IN' box, the software makes frame-accurate calculations of the frame rate from the vertical sync signal being fed by the external source (master camera or external generator) to synchronize this slave camera.
3. When the vertical sync signal (frame rate) from the external source is changed, you are required to re-select mode of synchronization in the 'EXT SYNC IN' box so that the software can re-calculate the frame rate for the slave camera to follow.

2.4.5. Tips on Multiple-Camera Sync Recording

Using Software Triggers

The software trigger is issued only to a board set up as the master board with ID "0" that has been set up for sync operation with sync signal from external source. It is not issued to any other boards. By relaying the software trigger that is issued to the master, connecting the TRIG OUT of the master board to T-TTL IN of the first slave board and so forth (see Section 2.4.2.2. Example 1: Basic Connection), multiple-camera triggering is attained without delays caused within the PCI bus.

Despite the above, however, a slight delay is inevitably caused between trigger and vertical sync signals while they are forwarded from board to board. This delay may, in rare cases, result in an offset of one recorded image frame between the master and a slave camera. To avoid this delay, if necessary, use the parallel sync distribution technique shown in Section 2.4.2.2. Example 2: Parallel Trigger Input.

Using External Triggers

In multiple-camera sync operation with trigger signals from an external source, the use of parallel trigger input is recommended (see Section 2.4.2.2. Example 2: Parallel Trigger Input).

Relayed trigger signal (see Section 2.4.2.2. Example 1: Basic Connection) works in this operation. But, because of likely delay of relayed trigger, as is the case with the relayed software trigger described in the previous subsection, it is not recommended.

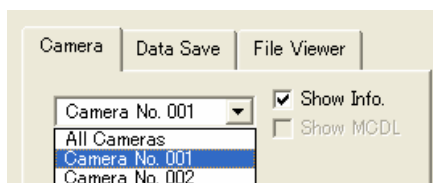
2.5. Use of Extended Dynamic Range Mode

The Extended Dynamic Range Mode offers the functionality of recording high-light-level and low-light-level portions of a subject in one image screen by adjusting the exposure amount of light inside the image sensor. With this feature, the image sensor works in such a way that both high-light and low-light parts of a subject scene with an extremely wide deviation of illumination are shot with appropriate exposure. The amount of exposure adjustment can be selected from three different adjustment levels depending on the gradient of illumination within the scene.

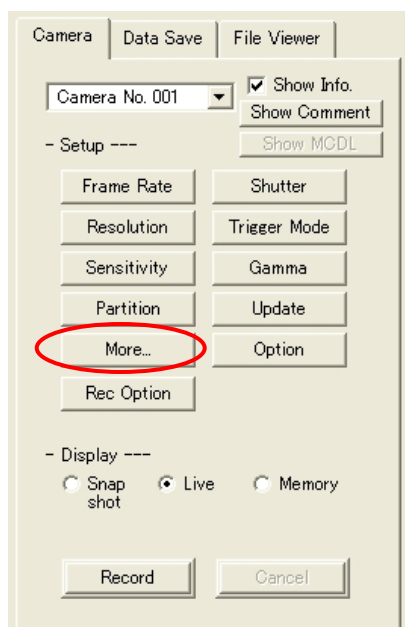
Note: Color balance of color image sensors is optimized for the best possible color reproduction for use in the standard mode of operation, and it tends to be adversely affected by setting the system for Extended Dynamic Range mode resulting in an imbalance of color that may cause lowered color reproducibility.

How to Set up for Extended Dynamic Range Mode

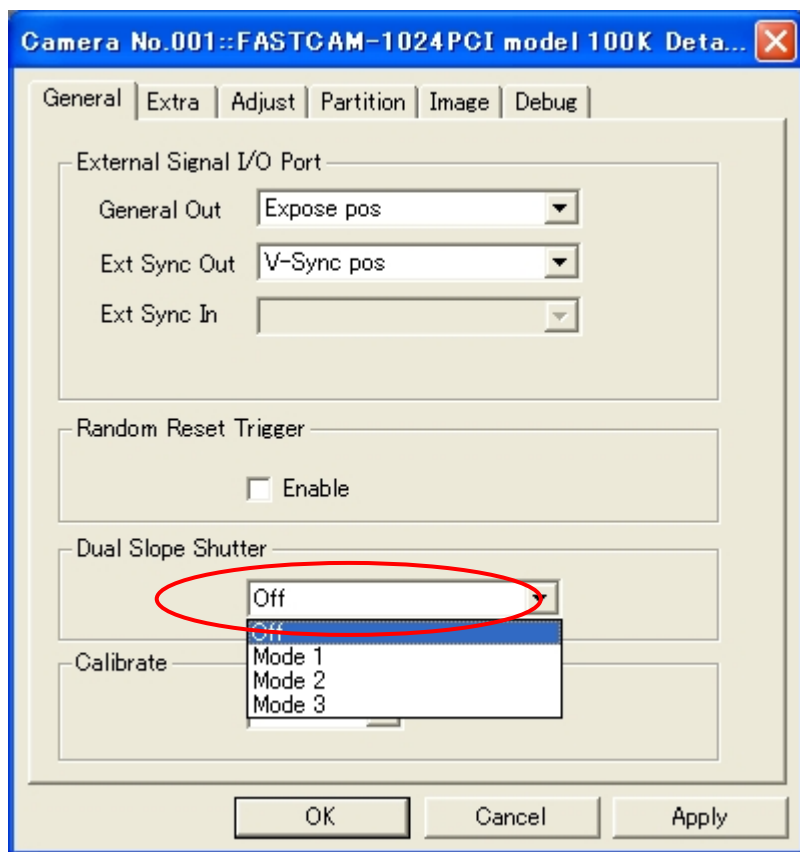
- 1) Select a camera to use from the camera selection pull-down box.



- 2) Press the [More] button to start setting up.



- 3) Select the Dual Slope Shutter mode in the [General] tab.



Select an exposure adjustment level from the three available levels shown below:

Menu	Exposure Adjustment Level
OFF	Sets Extended Dynamic Range mode off.
MODE 1	Sets exposure adjustment to minimum level.
MODE 2	Sets exposure adjustment to medium level.
MODE 3	Sets exposure adjustment to maximum level.

Memo

Chapter 3 Appendix

3.1. Specifications

3.2. Mechanical Data

3.3. Timing Charts

3.4. Care for Lenses

3.1. Specifications

3.1.1. Basic Specifications

Resolution (Full)	1024 x 1024 pixels, 10 bits
Max. Frame Rate (at Full Res.)	1,000 FPS (1024 x 1024)
Highest Frame Rate	109,500 FPS (128 x 16)
Sensor Size	17.4 x 17.4 mm (Pixel Size: 17 μ m x 17 μ m)
Sensor Type	Color (Bayer) or Monochrome
Lens Mount	F mount; C mount (changeable)
Segmentation	Available
Electronic Shutter	Available
Camera Head Dimensions & Weight	F mount: W 120 x D 113.4 x H 120 mm (excluding protrusions) W 120 x D 148.6 x H 120 mm (including protrusions) Weight: 1.57 kg C mount: W 120 x D 113.4 x H 120 mm (excluding protrusions) W 120 x D 120.4 x H 120 mm (including protrusions) Weight: 1.50 kg
Gain Settings	LUT Function Incorporated (Software-operated)
Camera Cable	68-pin Camera Cable ; 16.4' (5m)
	Camera Head: fastened by shell screws PCI Board: locked by latch

3.1.2. Specifications – Grabber Board

Recording Method	Digital recording of 10-bit/pixel image data in onboard memory
Recording Modes	<p>START: Records frames to the max number of frames available in the memory.</p> <p>END: Stops recording when a trigger is input.</p> <p>CENTER: Records the same number of frames before and after a trigger.</p> <p>MANUAL: Assigns the number of frames to record individually before and after a trigger</p> <p>RANDOM: Records a preset number of frames every time a trigger is input (the number of frames to record is set from control software within a limit).</p> <p>RANDOM CENTER/MANUAL: Records a preset number of frames (same or individually set number) before and after a trigger within a limit.</p> <p>DUAL-RATE RECORDING: Changes framing rate at an external timing signal from GENERAL IN. (Available rates: 1/2; 1/4 and 1/8 of set frame rate)</p> <p>Note: START and RANDOM framing rates support the Random Reset trigger mode (to be set YES/NO from control software)</p>
PCI Standard Applied	Rev2.1 Standard (+5V/32bits/33MHz)
Board Size	PCI Full size standard (1-slot width)
Memory Size	Standard: 2 GB
	Maximum: 24 GB
Live Display during Recording	Available
External Trigger Input (Use special BNC cable)	<p>TTL input (Recommend: +5V/10mA, Positive-going) (Maximum Limits: +5.8V/13.7mA, Positive-going)</p> <p>Warning: Do not input unusual TTL signal, over Maximum Limits, it may cause to damage the PC or board, camera.</p> <p>Contact closure input (also used as General In for Dual Rate Mode)</p>
Sync Signal Input	External sync signal input (Vertical sync) TTL+5V (Pos/Neg selectable) (Synchronization by multiple cameras, sync generator or external equipment) available.
Output Signal 1 (GENERAL) (GENE OUT)	General OUT Connector In-Recording Signal: TTL +5V (Pos/Neg Selectable) Exposure Timing Signal: TTL+5V (Pos/Neg Selectable)
Output Signal 2 (SYNC OUT)	SYNC OUT Connector Vertical Sync Signal TTL+5V (Pos/Neg selectable) (Signal is output by special BNC cable) Note: Sync signal for multiple-camera recording operations.
Output Signal 3 (TRIG OUT)	Trigger Signal TTL+5V (Positive-going) Note: Sync signal for multiple-camera recording operations.

3.1.3. Other Specifications

Application Software and OS	PFV (Photron FASTCAM Viewer) / SDK compatible Windows 2000 or Windows XP
Memory Partitioning	2 memory modules: up to 8 sections
	4 memory modules: up to 16 sections
	6 memory modules: up to 24 sections
Camera ID Number	To be set by switches on Grabber Board
Master/Slave Setting for Sync	To be set by switches on Grabber Board
Number of Grabber Boards Installable per PC	Up to 4 boards (PC must have five or more slots)
Multiple Cameras per Grabber Board	Multiple camera heads can be used with one Grabber Board. Note: Mixed use of Color and Monochrome cameras available.
Power Supplies	See the table below.
Ambient Temperature	0 to 40 degrees Celsius, No condensation (must be within the allowable temperature range for the PC)

Power Supplies

	Voltage	Current	
PCI BUS	+5.0V	1.5A	
	+3.3V	2.0A	
PC Power	+12.0V	1.5A	
	+5.0V	1G×2 (2GB)	1.5A
		2G×2 (4GB)	2.5A
		2G×4 (8GB)	4.0A
		2G×6 (12GB)	5.0A
		4G×4 (16GB)	4.5A
		4G×6 (24GB)	6.0A



Make sure, before use, that the power requirement on the PCI bus does not exceed the supply capacity of the PC's power supply unit.



Make sure, before use, that the total power requirement on the power cable between the PC's power supply unit and PCI board does not exceed the PC's supply capacity on the +12.0 and/or +5.0 VDC lines.

In case of excessive power requirement on the power cable (between the PC's power supply unit and the PCI boards) as a result of a multiple-camera operation involving two or more cameras, a power cable(s) with a power source(s) independent from the currently used PC must be added as necessary.

3.1.4. Frame Rate vs. Image Resolution

The maximum resolution setting available to each frame rate is shown in the below table. Other resolutions may be selected from the list in subsection 3.1.5.

Frame Rate (Frames Per Second)	Maximum Resolution (Pixels)
60 FPS	1024 x 1024
125 FPS	1024 x 1024
250 FPS	1024 x 1024
500 FPS	1024 x 1024
1000 FPS	1024 x 1024
2000 FPS	1024 x 512
3000 FPS	512 x 512
6000 FPS	512 x 256
10000 FPS	256 x 256
18000 FPS	256 x 128
27000 FPS	128 x 128
45000 FPS	128 x 64
73000 FPS	128 x 32
109500 FPS	128 x 16

3.1.5 Frame Rate and Image Size

Frame rate and image size can be selected from the following tables to the particular need of your recording (See subsection 3.4.5. "VARIABLE Setting" in the Photron FASTCAM View (PVF) Operation Manual).

H \ V	1024	1008	992	976	960	944	928	912
1024	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
896	1,000	1,000	1,000	1,200	1,200	1,200	1,200	1,200
768	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
640	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
512	1,800	1,800	1,800	1,800	1,800	1,800	2,000	2,000
384	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,500
256	2,700	2,700	3,000	3,000	3,000	3,000	3,000	3,000
128	3,750	3,750	3,750	3,750	3,750	4,500	4,500	4,500

H \ V	896	880	864	848	832	816	800	784
1024	1,000	1,200	1,200	1,200	1,200	1,200	1,200	1,200
896	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,500
768	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
640	1,500	1,500	1,800	1,800	1,800	1,800	1,800	1,800
512	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
384	2,500	2,500	2,500	2,500	2,700	2,700	2,700	2,700
256	3,000	3,000	3,000	3,000	3,000	3,600	3,600	3,750
128	4,500	4,500	4,500	5,000	5,000	5,000	5,000	5,400

H \ V	768	752	736	720	704	688	672	656
1024	1,200	1,200	1,200	1,200	1,500	1,500	1,500	1,500
896	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,800
768	1,500	1,500	1,800	1,800	1,800	1,800	2,000	2,000
640	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
512	2,000	2,000	2,500	2,500	2,500	2,500	2,700	2,700
384	2,700	3,000	3,000	3,000	3,000	3,000	3,000	3,000
256	3,750	3,750	3,750	3,750	3,750	3,750	3,750	4,500
128	5,400	5,400	5,400	5,400	6,000	6,000	6,000	6,000

H \ V	640	624	608	592	576	560	544	528
1024	1,500	1,500	1,500	1,500	1,800	1,800	1,800	1,800
896	1,800	1,800	1,800	1,800	2,000	2,000	2,000	2,000
768	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,500
640	2,000	2,000	2,500	2,500	2,500	2,700	2,700	2,700
512	2,700	2,700	3,000	3,000	3,000	3,000	3,000	3,000
384	3,000	3,600	3,600	3,750	3,750	3,750	3,750	3,750
256	4,500	4,500	4,500	4,500	5,000	5,000	5,400	5,400
128	6,000	6,000	6,000	6,000	6,000	7,500	7,500	7,500

H \ V	256	240	224	208	192	176	160	144
1024	3,750	3,750	4,500	4,500	5,000	5,400	6,000	6,000
896	4,500	4,500	5,000	5,400	6,000	6,000	6,000	7,500
768	5,000	5,400	5,400	6,000	6,000	6,000	7,500	7,500
640	5,400	6,000	6,000	6,000	7,500	7,500	9,000	10,000
512	6,000	7,500	7,500	7,500	9,000	10,000	10,000	10,000
384	7,500	9,000	9,000	10,000	10,000	10,000	10,000	10,000
256	10,000	10,000	10,000	10,000	10,000	15,000	15,000	18,000
128	15,000	15,000	15,000	18,000	18,000	18,000	22,500	22,500

H \ V	128	112	96	80	64	48	32	16
1024	7,500	9,000	10,000	10,000	15,000	18,000	27,000	45,000
896	7,500	10,000	10,000	10,000	15,000	18,000	30,000	45,000
768	10,000	10,000	10,000	15,000	18,000	22,500	30,000	54,000
640	10,000	10,000	15,000	15,000	18,000	27,000	36,500	54,000
512	10,000	15,000	15,000	18,000	22,500	30,000	36,500	67,500
384	15,000	18,000	18,000	22,500	30,000	36,500	45,000	73,000
256	18,000	22,500	22,500	30,000	36,500	45,000	54,000	90,000
128	27,000	30,000	36,500	36,500	45,000	54,000	73,000	109,500

3.1.6. Resolution and Shutter Speed

With the 1024PCI, the available shutter speed varies by the horizontal resolution.

Horizontal Resolution (Pixels)	1024	896	768	640	512	384	256	128
Available Shutter Speed	1/657,000	1/657,000	1/657,000	1/657,000	1/657,000	1/657,000	1/657,000	1/657,000
	1/505,000	1/505,000	1/505,000	1/505,000	1/505,000	1/505,000	1/505,000	1/505,000
	1/402,000	1/402,000	1/402,000	1/402,000	1/402,000	1/402,000	1/402,000	1/402,000
	1/303,000	1/303,000	1/303,000	1/303,000	1/303,000	1/303,000	1/303,000	1/303,000
	1/227,000	1/227,000	1/227,000	1/227,000	1/227,000	1/227,000	1/227,000	1/227,000
	1/159,000	1/164,000	1/170,000	1/176,000	1/183,000	1/190,000	1/197,000	1/205,000
	1/122,000	1/129,000	1/136,000	1/144,000	1/153,000	1/163,000	1/174,000	1/188,000
	1/100,000	1/106,000	1/113,000	1/122,000	1/131,000	1/143,000	1/156,000	1/173,000
	1/84,000	1/90,000	1/97,000	1/105,000	1/115,000	1/127,000	1/142,000	1/160,000
	1/72,000	1/78,000	1/85,000	1/93,000	1/103,000	1/115,000	1/130,000	1/149,000
	1/64,000	1/69,000	1/76,000	1/83,000	1/93,000	1/104,000	1/119,000	1/140,000
	1/57,000	1/62,000	1/68,000	1/75,000	1/84,000	1/96,000	1/111,000	1/131,000
	1/51,000	1/56,000	1/62,000	1/69,000	1/77,000	1/88,000	1/103,000	1/124,000
	1/47,000	1/51,000	1/57,000	1/63,000	1/71,000	1/82,000	1/97,000	1/117,000
	1/43,000	1/47,000	1/52,000	1/58,000	1/66,000	1/77,000	1/91,000	1/111,000
	1/40,000	1/44,000	1/49,000	1/54,000	1/62,000	1/72,000	1/86,000	1/106,000
	1/37,000	1/41,000	1/45,000	1/51,000	1/58,000	1/68,000	1/81,000	1/101,000
	1/35,000	1/38,000	1/42,000	1/48,000	1/55,000	1/64,000	1/77,000	1/97,000
	1/33,000	1/36,000	1/40,000	1/45,000	1/52,000	1/61,000	1/73,000	1/93,000
	1/31,000	1/34,000	1/38,000	1/43,000	1/49,000	1/58,000	1/70,000	1/89,000
	1/29,000	1/32,000	1/36,000	1/40,000	1/47,000	1/55,000	1/67,000	1/85,000
	1/28,000	1/30,000	1/34,000	1/38,000	1/44,000	1/52,000	1/64,000	1/82,000
	1/26,000	1/29,000	1/32,000	1/37,000	1/42,000	1/50,000	1/61,000	1/79,000
	1/25,000	1/28,000	1/31,000	1/35,000	1/41,000	1/48,000	1/59,000	1/76,000
	1/24,000	1/26,000	1/30,000	1/34,000	1/39,000	1/46,000	1/57,000	1/74,000
	1/23,000	1/25,000	1/28,000	1/32,000	1/37,000	1/44,000	1/55,000	1/71,000
	1/22,000	1/24,000	1/27,000	1/31,000	1/36,000	1/43,000	1/53,000	1/69,000
	1/21,000	1/23,000	1/26,000	1/30,000	1/35,000	1/41,000	1/51,000	1/67,000
	1/20,000	1/22,000	1/25,000	1/29,000	1/33,000	1/40,000	1/49,000	1/65,000

Horizontal Resolution (Pixels)	1024	896	768	640	512	384	256	128
Available Shutter Speed	1/19,000	1/21,000	1/24,000	1/28,000	1/32,000	1/38,000	1/48,000	1/63,000
	1/18,000	1/20,000	1/23,000	1/27,000	1/31,000	1/37,000	1/46,000	1/61,000
	1/17,000	1/19,000	1/22,000	1/26,000	1/30,000	1/36,000	1/45,000	1/60,000
	1/16,000	1/18,000	1/21,000	1/25,000	1/29,000	1/35,000	1/44,000	1/58,000
	1/15,000	1/17,000	1/20,000	1/24,000	1/28,000	1/34,000	1/42,000	1/57,000
	1/14,000	1/16,000	1/19,000	1/23,000	1/27,000	1/33,000	1/41,000	1/55,000
	1/13,000	1/15,000	1/17,000	1/22,000	1/26,000	1/32,000	1/40,000	1/54,000
	1/12,000	1/14,000	1/16,000	1/21,000	1/25,000	1/31,000	1/39,000	1/53,000
	1/11,000	1/13,000	1/15,000	1/20,000	1/24,000	1/30,000	1/38,000	1/51,000
	1/10,000	1/12,000	1/14,000	1/19,000	1/23,000	1/29,000	1/37,000	1/50,000
	1/9,000	1/11,000	1/13,000	1/18,000	1/22,000	1/28,000	1/36,000	1/49,000
	1/8,000	1/10,000	1/12,000	1/17,000	1/21,000	1/27,000	1/35,000	1/48,000
	1/7,000	1/9,000	1/11,000	1/16,000	1/20,000	1/26,000	1/34,000	1/47,000
	1/6,000	1/8,000	1/10,000	1/15,000	1/19,000	1/25,000	1/33,000	1/46,000
	1/5,000	1/7,000	1/9,000	1/14,000	1/18,000	1/24,000	1/32,000	1/45,000
	1/4,000	1/6,000	1/8,000	1/13,000	1/17,000	1/23,000	1/31,000	1/44,000
	1/3,000	1/5,000	1/7,000	1/12,000	1/16,000	1/22,000	1/30,000	1/43,000
	1/2,000	1/4,000	1/6,000	1/11,000	1/15,000	1/21,000	1/29,000	1/42,000
	1/1,000	1/3,000	1/5,000	1/10,000	1/14,000	1/20,000	1/28,000	1/41,000
	1/500	1/2,000	1/4,000	1/9,000	1/13,000	1/19,000	1/27,000	1/40,000
	1/250	1/1,000	1/3,000	1/8,000	1/12,000	1/18,000	1/26,000	1/39,000
	1/125	1/500	1/2,000	1/7,000	1/11,000	1/17,000	1/25,000	1/38,000
	-	1/250	1/1,000	1/6,000	1/10,000	1/16,000	1/24,000	1/37,000
	-	1/125	1/500	1/5,000	1/9,000	1/15,000	1/23,000	1/36,000
	-	-	1/250	1/4,000	1/8,000	1/14,000	1/22,000	1/35,000
	-	-	1/125	1/3,000	1/7,000	1/13,000	1/21,000	1/34,000
	-	-	-	1/2,000	1/6,000	1/12,000	1/20,000	1/33,000
	-	-	-	1/1,000	1/5,000	1/11,000	1/19,000	1/32,000
	-	-	-	1/500	1/4,000	1/10,000	1/18,000	1/31,000
	-	-	-	1/250	1/3,000	1/9,000	1/17,000	1/30,000
	-	-	-	1/125	1/2,000	1/8,000	1/16,000	1/29,000

Horizontal Resolution (Pixels)	1024	896	768	640	512	384	256	128
Available Shutter Speed	-	-	-	-	1/1,000	1/7,000	1/15,000	1/28,000
	-	-	-	-	1/500	1/6,000	1/14,000	1/27,000
	-	-	-	-	1/250	1/5,000	1/13,000	1/26,000
	-	-	-	-	1/125	1/4,000	1/12,000	1/25,000
	-	-	-	-	-	1/3,000	1/11,000	1/24,000
	-	-	-	-	-	1/2,000	1/10,000	1/23,000
	-	-	-	-	-	1/1,000	1/9,000	1/22,000
	-	-	-	-	-	1/500	1/8,000	1/21,000
	-	-	-	-	-	1/250	1/7,000	1/20,000
	-	-	-	-	-	1/125	1/6,000	1/19,000
	-	-	-	-	-	-	1/5,000	1/18,000
	-	-	-	-	-	-	1/4,000	1/17,000
	-	-	-	-	-	-	1/3,000	1/16,000
	-	-	-	-	-	-	1/2,000	1/15,000
	-	-	-	-	-	-	1/1,000	1/14,000
	-	-	-	-	-	-	1/500	1/13,000
	-	-	-	-	-	-	1/250	1/12,000
	-	-	-	-	-	-	1/125	1/11,000
	-	-	-	-	-	-	-	1/10,000
	-	-	-	-	-	-	-	1/9,000
	-	-	-	-	-	-	-	1/8,000
	-	-	-	-	-	-	-	1/7,000
	-	-	-	-	-	-	-	1/6,000
	-	-	-	-	-	-	-	1/5,000
	-	-	-	-	-	-	-	1/4,000
	-	-	-	-	-	-	-	1/2,000
	-	-	-	-	-	-	-	1/1,000
	-	-	-	-	-	-	-	1/500
	-	-	-	-	-	-	-	1/250
	-	-	-	-	-	-	-	1/125

Exposure time in second

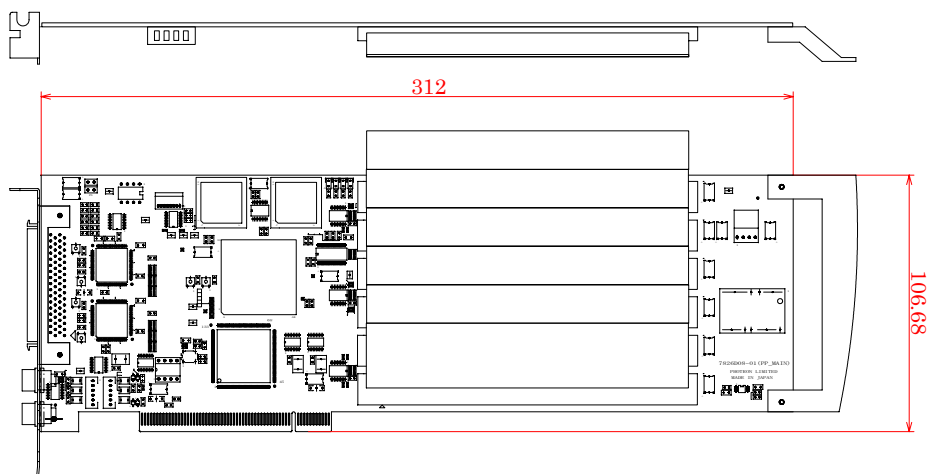
3.1.7. Frame Rate vs. Number of Recorded Frames and Record Duration

Resolution (Pixels)	Frame Rate (FPS)	2 GB Memory (1 GB x 2)		4 GB Memory (2 GB x 2)	
		Record Duration (sec)	Number of Recorded Frames	Record Duration (sec)	Number of Recorded Frames
1024 × 1024	1,000	1.54	1,536	3.20	3,200
1024 × 512	2,000	1.60	3,200	3.20	6,400
512 × 512	3,000	2.13	6,400	4.35	13,056
512 × 256	6,000	2.13	12,800	4.35	26,112
256 × 256	10,000	2.61	26,112	5.22	52,224
256 × 128	18,000	2.90	52,224	5.80	104,448
128 × 128	27,000	3.87	104,448	7.74	208,896
128 × 64	45,000	4.64	208,896	9.28	417,792
128 × 32	73,000	5.72	417,792	11.45	835,584
128 × 16	109,500	7.63	835,584	15.26	1,671,168

Resolution (Pixels)	Frame Rate (FPS)	8 GB Memory (2 GB x 4)		12 GB Memory (2 GB x 6)	
		Record Duration (sec)	Number of Recorded Frames	Record Duration (sec)	Number of Recorded Frames
1024 × 1024	1,000	6.40	6,400	9.60	9,600
1024 × 512	2,000	6.40	12,800	9.60	19,200
512 × 512	3,000	8.70	26,112	13.06	39,168
512 × 256	6,000	8.70	52,224	13.06	78,336
256 × 256	10,000	10.44	104,448	15.67	156,672
256 × 128	18,000	11.61	208,896	17.41	313,344
128 × 128	27,000	15.47	417,792	23.21	626,688
128 × 64	45,000	18.57	835,584	27.85	1,253,376
128 × 32	73,000	22.89	1,671,168	34.34	2,506,752
128 × 16	109,500	30.52	3,342,336	45.79	5,013,504

Resolution (Pixels)	Frame Rate (FPS)	16 GB Memory (4 GB x 4)		24 GB Memory (4 GB x 6)	
		Record Duration (sec)	Number of Recorded Frames	Record Duration (sec)	Number of Recorded Frames
1024 × 1024	1,000	12.80	12,800	19.20	19,200
1024 × 512	2,000	12.80	25,600	19.20	38,400
512 × 512	3,000	17.41	52,224	26.11	78,336
512 × 256	6,000	17.41	104,448	26.11	156,672
256 × 256	10,000	20.89	208,896	31.33	313,344
256 × 128	18,000	23.21	417,792	34.82	626,688
128 × 128	27,000	30.95	835,584	46.42	1,253,376
128 × 64	45,000	37.14	1,671,168	55.71	2,506,752
128 × 32	73,000	45.79	3,342,336	68.68	5,013,504
128 × 16	109,500	61.05	6,684,678	91.57	10,027,017

3.2.2. Grabber Board (Millimeters)



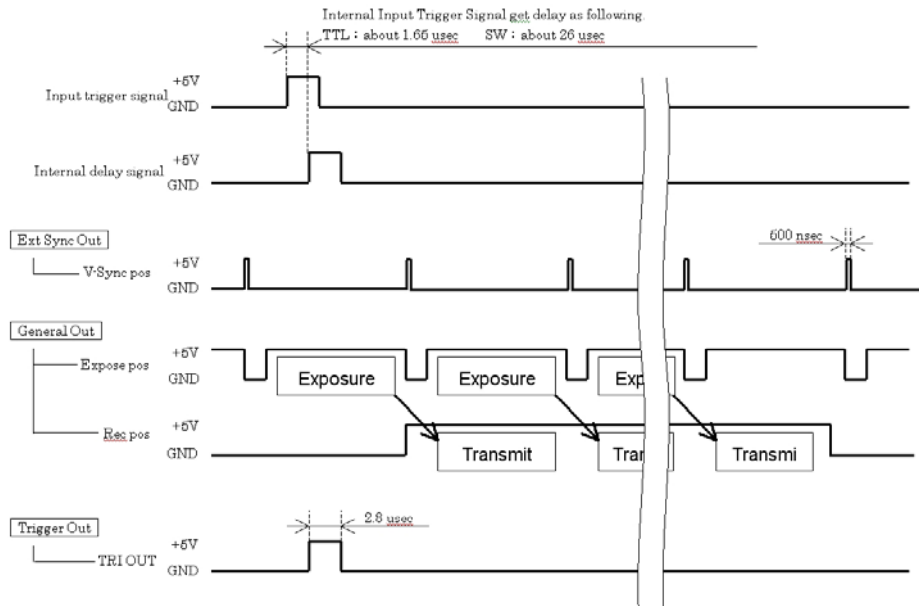
3.3. Timing of Recording Operations

This section describes the temporal relationship between recording, exposure, sync signals and delayed caused in cables. Refer to these charts when it is necessary to know the exact timing of such components mentioned above.

3.3.1. Timing Charts for Recording Operations

Timing Chart for START and RANDOM Recording Modes

The below chart shows the temporal relationship between signals related to recording operation in START and RANDOM trigger modes (random reset not effective).

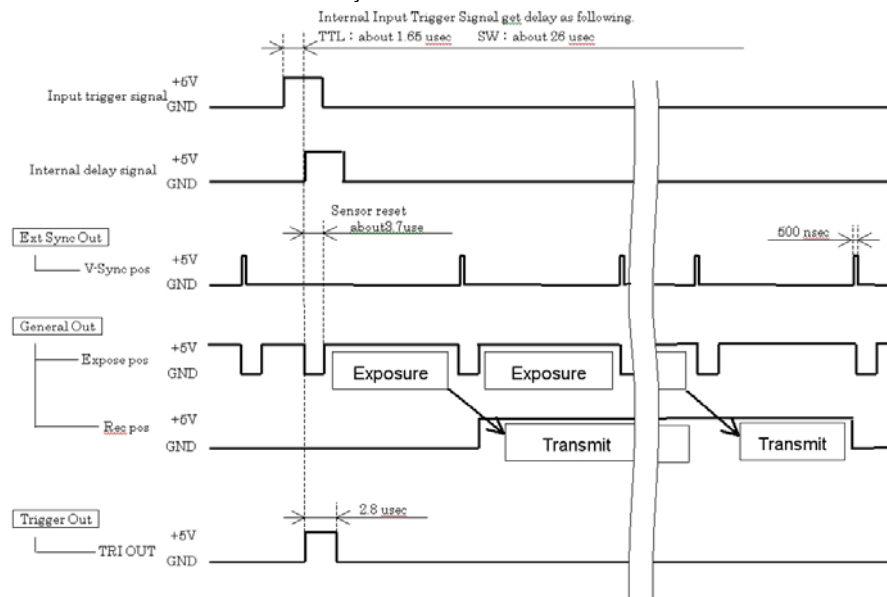


Note: The START trigger mode starts recording when a trigger is received and records images until the memory is full. The RANDOM mode records a preset number of frames at each trigger and records until the memory is full.

Note: When shutter is used, the "shuttered exposure period" becomes shorter than what is shown as "un-shuttered" exposure period in the above chart and it always takes place toward the end of, but within, the then effective exposure period.

Timing Chart for START and RANDOM Trigger Modes with "Reset" in Effect

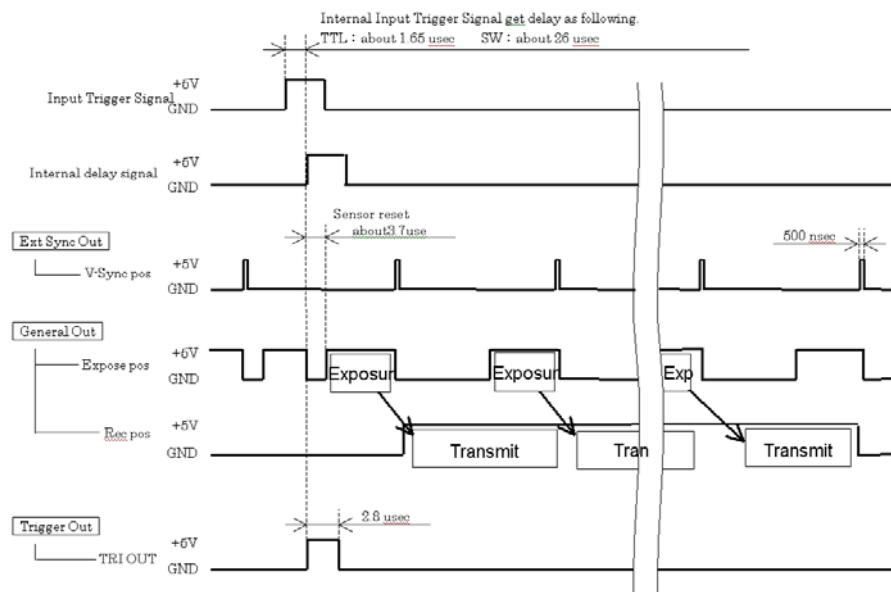
When "Reset" function is activated, Expose pos (vertical sync) signal is reset by the incoming trigger so that the timing of the incoming trigger signal and the start of exposure coincide more accurately as shown in the below chart.



Note: The START trigger mode starts recording when a trigger is received and continues recording images until the memory is full. The RANDOM mode records a preset number of frames at each trigger and records until the memory is full.

Timing Chart for Shuttered Operation in START and RANDOM Trigger Modes with “Reset” in Effect

The below chart shows the temporal relationship between timing signals when shuttering function is added to START and RANDOM trigger mode with Reset is in effect.

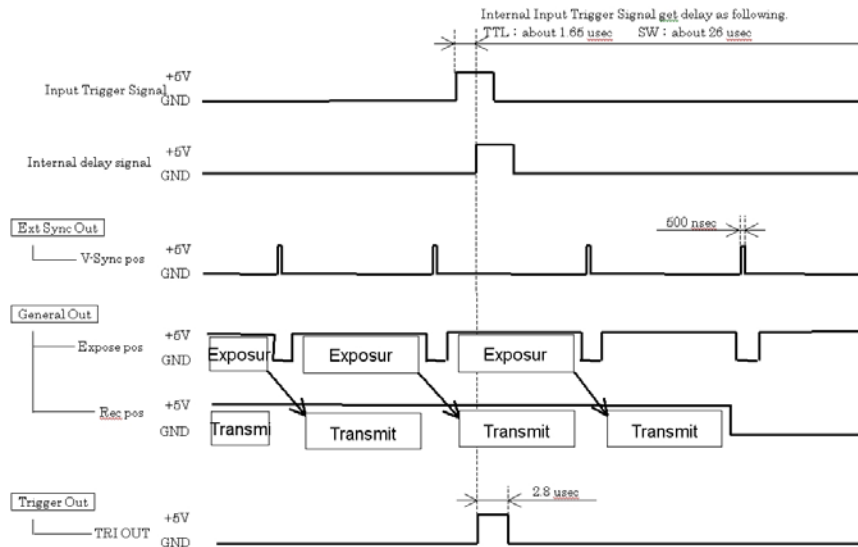


Note: A shorter exposure period is set by the shuttering function, in addition to the Expose pos signal being reset at the incoming trigger.

Note: The START trigger mode starts recording when a trigger is received and continues recording images until the memory is full. The RANDOM mode records a preset number of frames at each trigger and records until the memory is full.

Timing Chart for END, CENTER and MANUAL Trigger Modes

The below chart shows the temporal relationship of timing signals in END trigger mode. Note the exposure, and consequently recording, ends as soon as a trigger comes in.



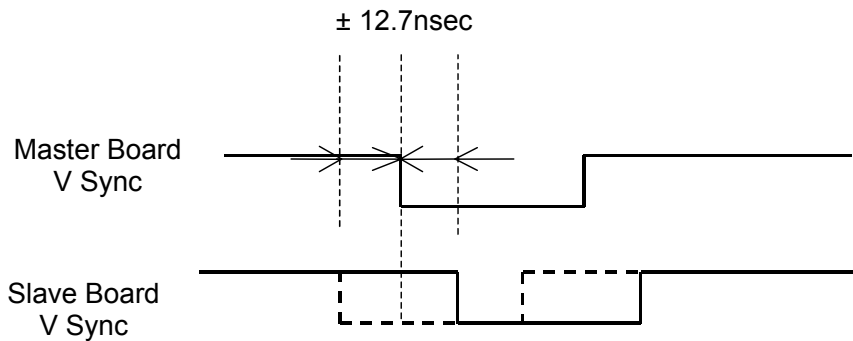
Note: The above timing chart is for an End-Trigger operation.

Note: The CENTER trigger mode ends recording after filling the latter half of the available memory. The MANUAL trigger mode records a preset number of frames after a trigger comes in.

Note: When shutter is used, the "shuttered exposure period" becomes shorter than what is shown as "un-shuttered" exposure period in the above chart and it always takes place toward the end of, but within, the then effective exposure period.

3.3.2. Sync Timing in Multi-Camera Operations

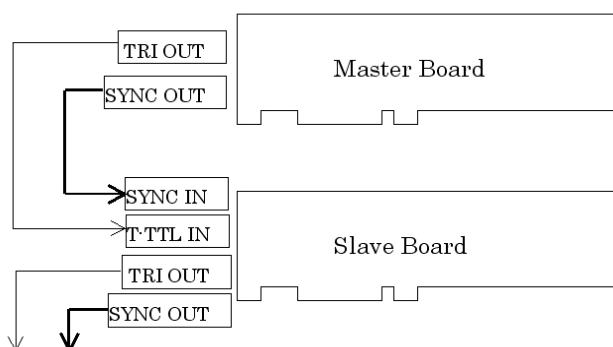
In multiple-camera operation of FASTCAM-1024PCI cameras, if sync and trigger signals are connected in series as shown below, signal delay inevitably becomes obvious. In extreme cases, this delay may cause an offset of one full image frame between cameras involved in multiple-camera operation. To avoid this drawback, other connection methods shown in 2.4.2. are recommended.



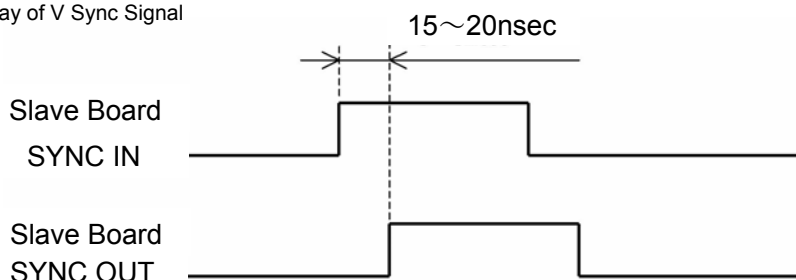
Note: The delay is caused in the camera.

3.3.3. Delay of Vertical Sync and Trigger Signals in Multiple-Camera Operation

In multiple-camera operation, a signal delay is caused in V sync and trigger signals between boards.

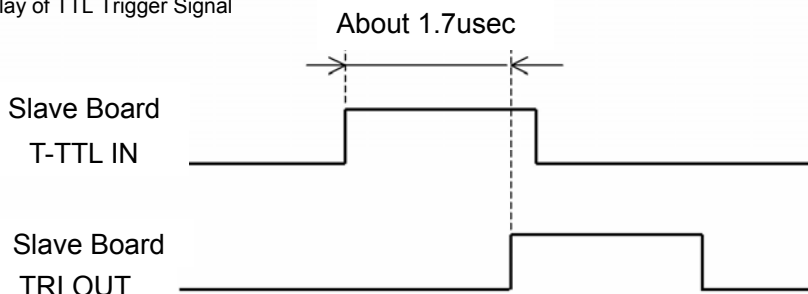


Delay of V Sync Signal



V Sync signals on Slave Board go through from Sync-In to Sync-out.

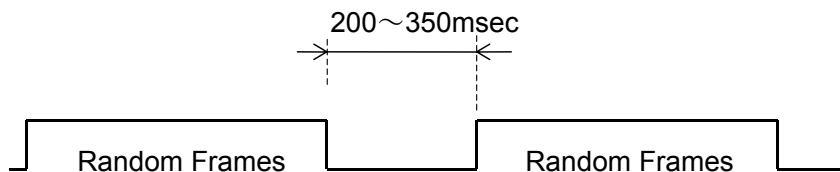
Delay of TTL Trigger Signal



Note: These delays may cause an offset of one frame between cameras in multiple-camera operation depending on a certain timing of trigger entry.

3.3.4. Recording Interval in Random Center and Random Manual Trigger Modes

In Random Center and Random Manual modes, because Center or Manual operation is repeatedly executed, the following interval is necessary between one recording and next. The interval can be checked by observing Rec Pos/Neg signal on GENERAL OUT.

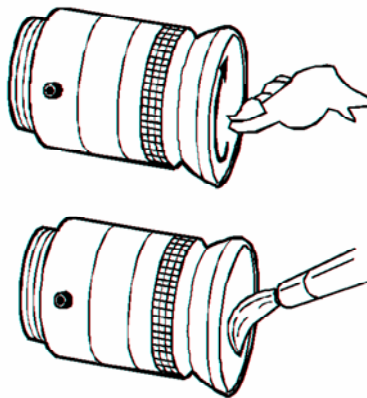


Note: The necessary interval depends on the specifications of the PC being used. More interval may be needed depending on the nature of the PC. The above interval is needed when using a PC with Pentium 4 (2.4GHz).

3.4. 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.



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FASTCAM-1024PCI Hardware Manual

English Version

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