SHIMADZU

347-07040
May. 2015

High-Speed Video Camera
Hyper Vision

HPV-X2

Instruction Manual

Read the instruction manual thoroughly before you use the product.

Keep this instruction manual for future reference.

No Text

Introduction

Read this Instruction Manual thoroughly before using the product.

Thank you for purchasing this product.

This manual describes the installation, operation, usage cautions, and accessories and options for this product. Read this manual thoroughly before using the product and operate the product in accordance with the instructions in this manual.

Also, keep this manual for future reference.

IMPORTANT

- If the user or usage location changes, ensure that this Instruction Manual is always kept together with the product.
- If this manual or a product warning label is lost or damaged, immediately contact your Shimadzu representative to request a replacement.
- To ensure safe operation, read all Safety Instructions before using this product. Be sure to read the "Safety Instructions" before you use the product.
- Any export of Shimadzu High-Speed Camera, HPV-X is subject to export control regulations of the nation, based on Part2 of NSG guideline, 5.B.3. Please contact sales agent or representative of Shimadzu, should you have any question.

Notice

- Information in this manual is subject to change without notice and does not represent a commitment on the part of the vendor.
- Any errors or omissions which may have occurred in this manual despite the utmost care taken in its production will be corrected as soon as possible, although not necessarily immediately after detection.
- All rights are reserved, including those to reproduce this manual or parts thereof in any form without permission in writing from Shimadzu Corporation.
- Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries. Other company names and product names mentioned in this manual are trademarks or registered trademarks of their respective companies. The TM and symbols are omitted in this manual.
- Hyper Vision is a registered trademark of Shimadzu Corporation.

(Original version is approved in English.)

Indications Used in This Manual

Warnings, Cautions, and Notes are indicated using the following conventions:

⚠ Warning	Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or possibly death.
⚠ Caution	Indicates a potentially hazardous situation which, if not avoided, may result in minor to moderate injury or equipment damage.

The following symbols are used in this manual:

 Prohibitions	Indicates an action that must not be performed.
 Instructions	Indicates an action that must be performed.
Note	Emphasizes additional information that is provided to ensure the proper use of this product.
 Reference	Indicates the location of related reference information.

Safety Instructions

To ensure safe product operation, read these important safety instructions carefully before use and follow all WARNING and CAUTION instructions given in this section.

■ Installation Site

⚠ Warning

● **Avoid humidity and dust**

Do not place the product in an environment with high humidity or dust. This may result in fire or electric shock.

⚠ Caution

● **Avoid unstable locations**

Do not place the product on a shaky table or inclined surface. It may fall or tip, resulting in injury.

● **Do not place heavy objects on the product**

Do not place anything 2 kg, or heaver, on the product. This may cause the product to overbalance and tip, resulting in injury.

● **Use the product under the following site conditions.**

- Locations with room temperature between 5 and 40℃
- Locations not exposed to direct sunlight
- Locations with low vibration levels
- Locations with low dust and humidity levels
- Locations without corrosive gases
- Locations with 75 % or lower relative humidity
- Indoor locations only
- Installation category : II
- Pollution degree : 2
- Operating altitude: Max. 2,000 m

■ Installation

⚠ Warning

● **Apply the designated voltage**

The power supply requirements for this product are 120 V / 220 V to 230 V AC, 200 VA, and 2A.

Connect the product to a power supply that complies with the above.

If the power supply voltage is unstable or if the power supply has insufficient capacity, it may not be possible to maintain specified performance. Also calculate the power requirements of the entire system to ensure adequate power is supplied.

The power supply breaking capacity is 35 A.

● **Apply the designated voltage**

Use only the designated power supply. Any other supply voltage may result in fire or electric shock.

● **Use only the designated power cable**

Use only the designated power cable. Any other power cable may result in fire or electric shock.

● **Use only the designated fuse**

Use only the designated fuse. Any other fuse may result in fire or electric shock.

● **Be sure to ground the ground wire**

This product is grounded via a 3-wire power cable equipped with a ground wire.
Be sure to insert this cable in a socket that is equipped with a ground terminal. Failure to do so may result in fire or electric shock due to damage or electric leakage.

● **Pull out the power plug with dry hands**

Do not pull out the power plug with wet hands. Doing so may result in electric shock.

● **Keep the power cable away from heaters**

Do not allow the power cable to come too close heaters. This may result in fire or electric shock.

● **Do not damage the power cable**

Do not place heavy objects on, alter, forcibly bend, twist, pull, or heat the power cable. This can damage the power cable, resulting in fire or electric shock.

If the power cable is damaged (exposed or broken wires), contact your Shimadzu representative for a replacement. Using a damaged cable may result in fire or electric shock.

● **Do not pull on the cable to pull out the power plug**

Do not pull on the cable to pull out the power plug. This can damage the power cable, resulting in fire or electric shock. To pull out the power plug, hold the plug itself.

■ Operation

⚠ Warning

● **Disconnect all cables before moving the product**

Before moving the product, turn off the power switch and pull the plug from the power outlet, and disconnect all external cables. Failure to do so may damage cables, resulting in fire or electric shock.

● **Do not pull on the cable to pull out the power plug**

Do not pull on the cable to pull out the power plug. This can damage the power cable, resulting in fire or electric shock. To pull out the power plug, hold the plug itself.

● **Pull out the power plug if an emergency such as the following occurs**

- When the product falls and is damaged
- When the product emits smoke
- When the product makes a strange noise or emits abnormal odorsc
- When the power cable is damaged

Continuing to use the product in this condition may result in fire or electric shock. Immediately contact your Shimadzu representative.

● **Avoid operation in strong electromagnetic fields**

Do not use the product in locations subject to strong electromagnetic fields. This may result in incorrect or abnormal operation.

● **Do not put vessels containing liquid or small metal objects on the product**

Do not put vessels containing liquid or small metal objects on the product. These may spill or fall into the product, causing fire or electric shock.

● **Avoid getting this product wet**

Pay special care when using this product in locations subject to rain and snow, near the coast or watery locations. Failure to do so may result in fire or electric shock.

● **Do not put foreign objects or water inside the product**

If foreign objects or water enter the product, first turn off the power switch and pull out the plug from the power outlet.

Continuing to use the product in this condition may result in fire or electric shock. Next, contact your Shimadzu representative.

● **Do not touch the plug or connectors if thunder can be heard**

Do not touch the power plug or other connectors if thunder can be heard. This may result in electric shock.

⚠ Caution

- Do not press hard on the control PC monitor

  The control PC monitor is made of glass. Pressing hard on the monitor may result in damage.

- Apply no impact or unnecessary force to the product

  This is a high-precision optical product. Do not apply impact by dropping the product or apply unnecessary force to the lens mounting area. This may result in damage.

- Do not touch the lens or camera head entrance window

  Do not directly touch the lens or camera head entrance window with your hands. This may cause scratching and contamination.

- Set up the power unit so that the power switch can be easily reached.

  If the power switch is positioned so that it is difficult to reach, if an emergency occurs, shutting off the power supply cannot be performed quickly.

■ Inspection and Maintenance

⚠ Warning

- Before performing servicing, pull out the plug

  Before performing servicing, such as wiping off dirt, pull out the power plug from the power outlet to ensure safety.

  Failure to do so may result in electric shock.

- Never open the camera head, power unit or control PC

  Do not remove the camera head covers.

  Doing so may result in electric shock.

- Do not disassemble or modify

  Do not disassemble or modify the product. Doing so may result in fire or electric shock.

  Contact your Shimadzu representative for inspection, servicing or repair of the product inside.

⚠ Caution

- Do not use volatile solvents (paint thinner, benzene, etc.) or a damp cloth to clean the product.

  Do not use volatile solvents or a damp cloth to clean the product. Doing so may result in rusting or discoloration.

  Use a soft, dry cloth to wipe dirt off the product.

Instructions

- **Avoid impact and storage in low temperature and humidity**

  This is a high-precision optical product. Store it in a location not subject to impact or high temperature and humidity.

  - Storage temperature range: 0 to 50℃
  - Storage humidity range: 20 to 80 %RH, no condensation

Emergency Measures

If an abnormality is discovered, such a smell of something burning or an unusual fan noise, unplug the power unit.

Before using the instrument again, inspect it and, if necessary, contact a Shimadzu field engineer.

Warning Labels

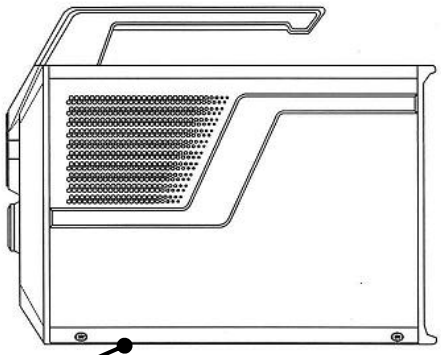
To ensure the safe operation of this product, warning labels are attached in locations where caution is required.

If a warning label is lost or damaged, obtain a new label through your Shimadzu representative and attach it in the correct position.

Warning Label (P/N 037-72020-10)

■ Residual Risk Information

● Residual Risk Map



Mechanical Location A	
⚠ CAUTION	No.1

● Residual Risk List

Preparations

No.	Mechanical Location	Description	Protective Measure taken by machine user	-	-
1	A	⚠ CAUTION Fixing to a tripod is insufficient and the camera falls, and a hand or a foot is inserted.	The camera is fixed tightly at a fixed screw hole in a tripod attaching area.	Reference	P.10
				Operation Category	Attaching Camera
				Required Qualification/ Education	Qualified person received training to use the instrument

Warranty

Shimadzu Corporation provides the following warranty for this product.

1. Period:

Please contact your Shimadzu representative for information about the period of this warranty.

2. Description:

If a product/part failure occurs for reasons attributable to Shimadzu during the warranty period, Shimadzu will repair or replace the product/part free of charge. However, in the case of products which are usually available on the market only for a short time, such as personal computers and their peripherals/parts, Shimadzu may not be able to provide identical replacement products.

3. Limitations of Liability:

1) In no event will Shimadzu be liable for any lost revenue, profit or data, or for special, indirect, consequential, incidental or punitive damages, however caused regardless of the theory of liability, arising out of or related to the use of or inability to use the product, even if Shimadzu has been advised of the possibility of such damage.
2) In no event will Shimadzu's liability to you, whether in contract, tort (including negligence), or otherwise, exceed the amount you paid for the product.

4. Exceptions:

Failures caused by the following are excluded from the warranty, even if they occur during the warranty period.

1) Improper product handling
2) Repairs or modifications performed by parties other than Shimadzu or Shimadzu designated service companies
3) Product use in combination with hardware or software other than that designated by Shimadzu
4) Computer viruses leading to device failures and damage to data and software, including the product's basic software
5) Power failures, including power outages and sudden voltage drops, leading to device failures and damage to data and software, including the product's basic software
6) Turning OFF the product without following the proper shutdown procedure leading to device failures and damage to data and software, including the product's basic software
7) Reasons unrelated to the product itself
8) Product use in harsh environments, such as those subject to high temperatures or humidity levels, corrosive gases, or strong vibrations
9) Fires, earthquakes, or any other act of nature, contamination by radioactive or hazardous substances, or any other force majeure event, including wars, riots, and crimes
10) Consumable items
    Note: Recording media such as floppy disks and CD-ROMs are consumable items.

* Note: If there is a document such as a warranty provided with the product, or there is a separate contract agreed upon that includes warranty conditions, the provisions of those documents shall apply.

SOFTWARE LICENSE AGREEMENT

PLEASE READ THIS AGREEMENT CAREFULLY BEFORE USING THE SOFTWARE.
SHIMADZU Corporation ("SMZ") is willing to license the SMZ software provided herein, together with accompanying documentation (collectively "SOFTWARE") to you only upon the condition that you accept all of the terms and condition contained in this License Agreement. By using the SOFTWARE, you agree to be bound by the terms of this Agreement. If you do not agree to all these terms of this Agreement, promptly return the unused SOFTWARE to the party (either SMZ or its reseller) from whom you acquired it to receive a refund of the amount you paid.

1. LICENSE.
   SMZ grants you a non-exclusive and nontransferable license to use the SOFTWARE subject to the following terms and conditions.

2. LIMITATION OF USE.
   Except as specifically authorized by SMZ, you may NOT:
   a. Use the SOFTWARE, or permit the SOFTWARE to be used, on more than one computer at any one time.
   b. Copy the SOFTWARE except one (1) archival copy of the SOFTWARE.
   c. Modify, reverse engineer, decompile, disassemble, or create derivative works based upon the SOFTWARE.
   d. Transfer, rent, lease or grant any rights in the SOFTWARE in any form to anyone else.

3. TITLE AND OWNERSHIP.
   This license is not for sale and it may not be assigned or sublicensed to anyone else. Title and all associated intellectual property rights to the SOFTWARE shall remain in SMZ and/or its licensor.

4. UPGRADES.
   You are entitled to receive all official software upgrades for the SOFTWARE that SMZ will release as deemed necessary by SMZ. An upgrade means certain supplemental program modules and/or information for bug fixing and/or updates to the defects and/or failures of the SOFTWARE that are acknowledged or confirmed by SMZ. An upgrade excludes hardware, network, consulting services, third party products, operation and general computer system maintenance. All supplemental program module for upgrades and enhancements furnished to you shall be deemed to be part of the SOFTWARE and subject to the terms and conditions set forth in this Agreement.

5. LIMITED WARRANTY.
   SMZ warrants that for a period of one (1) year from the date of purchase, as evidenced by a copy of the receipt, the media on which SOFTWARE is furnished will be free of defects in materials and workmanship under normal use.

   Except for the foregoing, SOFTWARE is provided AS IS. Your exclusive remedy and the entire liability of SMZ and its suppliers under this limited warranty will be, at SMZ's option, repair, replacement, or refund of the Software if reported (or, upon request, returned) to the party supplying the SOFTWARE to you. In no event does SMZ warrant that the Software is error free or that you will be able to operate the SOFTWARE without problems or interruptions.

   EXCEPT AS SPECIFIED IN THIS WARRANTY, ALL EXPRESS OR IMPLIED CONDITIONS, REPRESENTATIONS, AND WARRANTIES INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NONINFRINGEMENT, ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE, ARE HEREBY EXCLUDED TO THE EXTENT ALLOWED BY APPLICABLE LAW.

6. LIMITATION OF LIABILITY.
   IN NO EVENT WILL SMZ BE LIABLE FOR ANY LOST REVENUE, PROFIT OR DATA, OR FOR SPECIAL, INDIRECT, CONSEQUENTIAL, INCIDENTIAL OR PUNITIVE DAMAGES, HOWEVER CAUSED REGARDLESS OF THE THEORY OF LIABILITY, ARISING OUT OF OR RELATED TO THE USE OF OR INABILITY TO USE SOFTWARE, EVEN IF SMZ HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE. IN NO EVENT WILL SMZ'S LIABILITY TO YOU, WHETHER IN CONTRACT, TORT (INCLUDING NEGRIGENCE), OR OTHERWISE, EXCEED THE AMOUNT YOU PAID FOR SOFTWARE.

7. TERMINATION.
   This License is effective until terminated. You may terminate this License at any time by destroying all copies of SOFTWARE including any documentation. This License will terminate immediately without notice from SMZ if you fail to comply with any provision of this License. Upon termination, you must destroy all copies of SOFTWARE.

8. GENERAL
   a. This Agreement is the entire agreement. If any provision of this agreement is held invalid, the remainder of this agreement shall continue in full force and effect.
   b. This Agreement shall be construed and governed in accordance with the laws of Japan, excluding its conflict of law rules.
   c. The exclusive jurisdiction for any disputes arising out of or in connection with this Agreement shall be Kyoto District Court of Japan.
   d. The invalidity or unenforceability of any provision of this Agreement shall not affect the validity or enforceability of any other provision.

Analytical & Measuring Instruments Division, SHIMADZU Corporation
1 Nishinokyo-Kuwabaracho, Nakagyo-ku, Kyoto 604-8511, Japan

After-Sales Service and Availability of Replacement Parts

- After-Sales Service

  If any problem occurs with this product, perform an inspection and take appropriate corrective action as described in "6.1 Troubleshooting."

  If the problem persists, or the symptoms are not covered in the troubleshooting section, contact your Shimadzu representative.

- Replacement Parts Availability

  Replacement parts for this product will be available for a period of seven (7) years after the product is discontinued."

  Thereafter, such parts may cease to be available.

  Note, however, that the availability of parts not manufactured by Shimadzu shall be determined by the relevant manufacturers.

Maintenance, Inspections, and Adjustment

In order to maintain the instrument's performance and obtain accurate recording data, daily inspection and periodic inspection are necessary.

- For daily maintenance, inspection, and replacement parts, see 6. Maintenance.
- Periodic inspection should be requested to your Shimadzu representative.

Patents

This product has licences of the following US PATENTs

5,471,515	6,107,618	6,476,860	6,825,059	5,793,322	6,107,619	6,486,503	6,838,301
5,841,126	6,115,065	6,515,702	6,839,452	5,880,691	6,124,819	6,519,371	6,933,488
5,886,659	6,166,768	6,546,148	6,943,838	5,887,049	6,175,383	6,549,235	6,944,352
5,909,026	6,326,230	6,555,842	6,980,230	5,929,800	6,346,700	6,570,617	7,002,626
5,949,483	6,373,050	6,606,122	7,019,345	5,952,645	6,380,572	6,665,013	7,053,929
5,990,506	6,384,413	6,721,464	7,105,371	6,021,172	6,400,824	6,744,068	7,190,398
6,057,539	6,403,963	6,787,749	7,268,814	6,101,232	6,456,326	6,801,258	7,369,166
6,828,540	7,235,771	7,468,501					

Contents

1. Product Overview

This high-speed video camera is capable of recording and playing up to 256 serial images as moving images at speeds of up to ten million frames per second. The HPV-X2 consists of a camera head with high-performance FTCMOS image sensor, a power unit, and a control computer (Windows 7 based. Here in after Windows 7 is collectively called Windows.), and offers multiple trigger and recording modes for handling a wide variety of recording conditions.

■ Key Features

- Records serial images (maximum 256 frames in HP mode or maximum 400 X 250 pixels (100,000 pixels) in FP mode) at ultra fast speeds (maximum ten million frames per second).
- High-performance FTCMOS sensor enables easily recording high-quality images at ultra fast speeds.
- The ability to set the trigger point at any frame ensures the instant of a phenomenon can be captured.
- At recording speeds up to 2 Mfps, exposure time is settable in increments of 10 ns.
- A high-speed LAN connection between the camera and control computer means recorded images can be immediately played back as moving images.
- Synchronized recording can be performed by connecting two cameras with a synchronization cable.

No Text

2. Names and Functions of Components

2.1 Instrument Composition

The HPV-X2 comprises the following units and parts. When unpacking, make sure that all of these items are included.

(1) Camera head

(2) Power unit

(3) Ethernet cable

(4) Power cable

(11) Synchronization cable

(5) AC cable (For US)

(5) AC cable (For EU)

(6) Control computer (sold separately)

Table 2-1 List of Components

No.	Part Name	Q'ty
(1)	Camera head	1
(2)	Power unit	1
(3)	Ethernet cable	1
(4)	Power cable	1
(5)	AC cable (For US or For EU)	1
(6)	Control computer (sold separately)	1
(7)	Instruction manual (this manual)	1
(8)	Carry case	1
(9)	Install CD	1
(10)	Setup Parameter CD	1
(11)	Synchronization cable	1

2.2 Control Computer (Application) Functions

■ Image Display Window (Playback Parameter Settings Window)

This window (Fig. 2-1) is used to playback recorded images, manage image files, and perform other operations.

- Image monitor (image display area)
  Displays recorded images and live images.
- Playback parameter settings area
  This area has functions for setting up the parameters for playing back recorded images.
- File management
  This button provides functions for opening files, saving and deleting image files, and converting images.

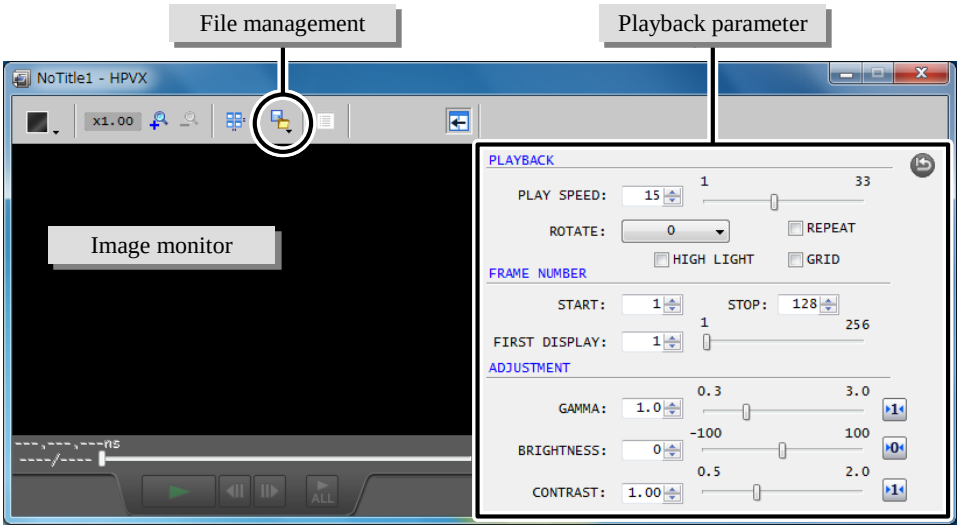


Fig. 2-1 Image Display Window

■ Recording Parameter Settings Window

This window is used for specifying recording parameters.

Recording parameters are specified via [REC] (Fig. 2-2) and [I/O PORT] (Fig. 2-3) windows.

It also starts recording and operates live functions.

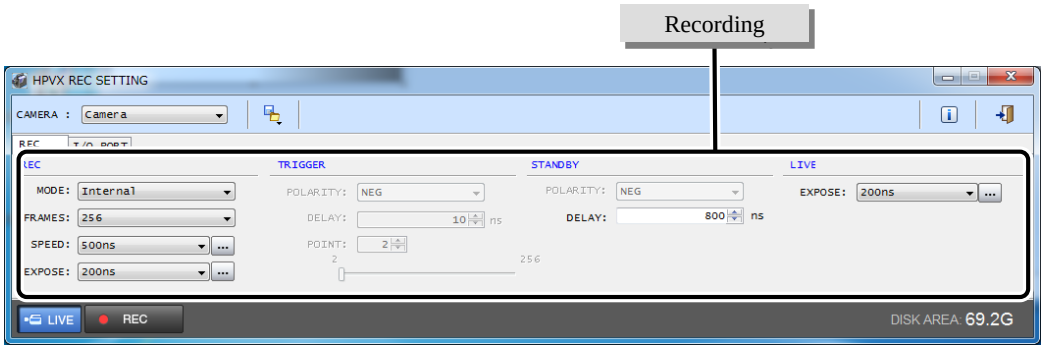


Fig. 2-2 [REC] Window

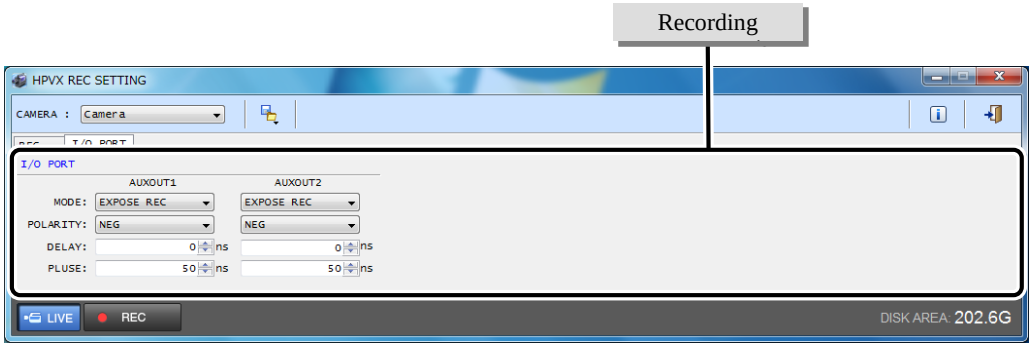
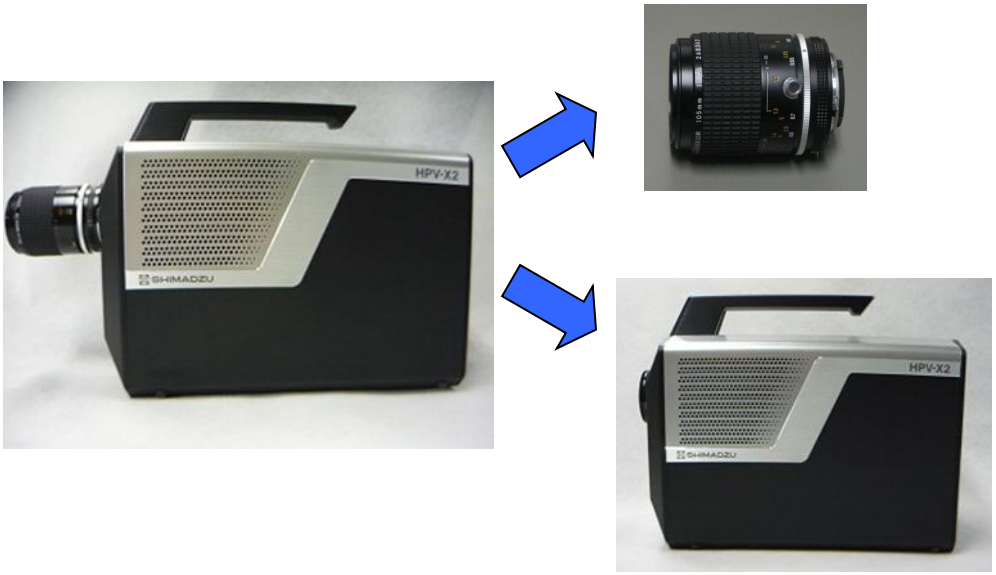


Fig. 2-3 [I/O PORT] Window

2.3 Names and Functions of Parts – Camera Head

The camera consists of the camera head and lens (optional).
The camera head accepts Nikon F-mount compatible lenses.
The following figures show the camera head and its parts.



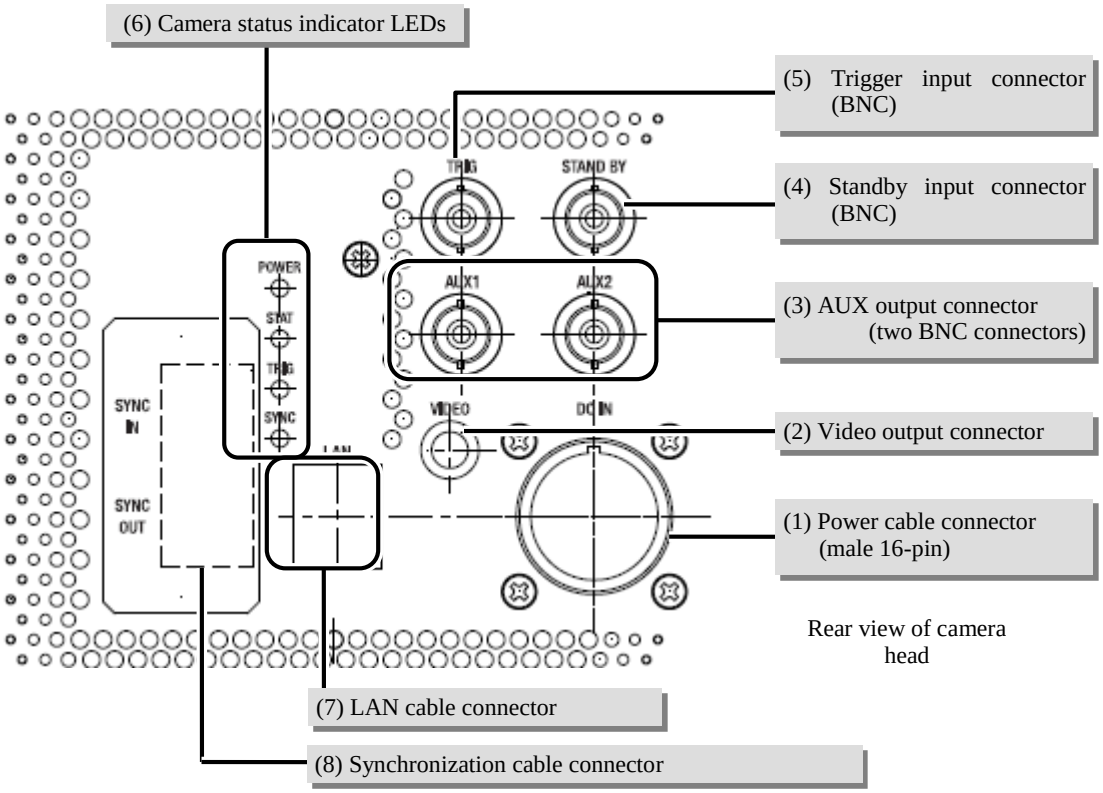
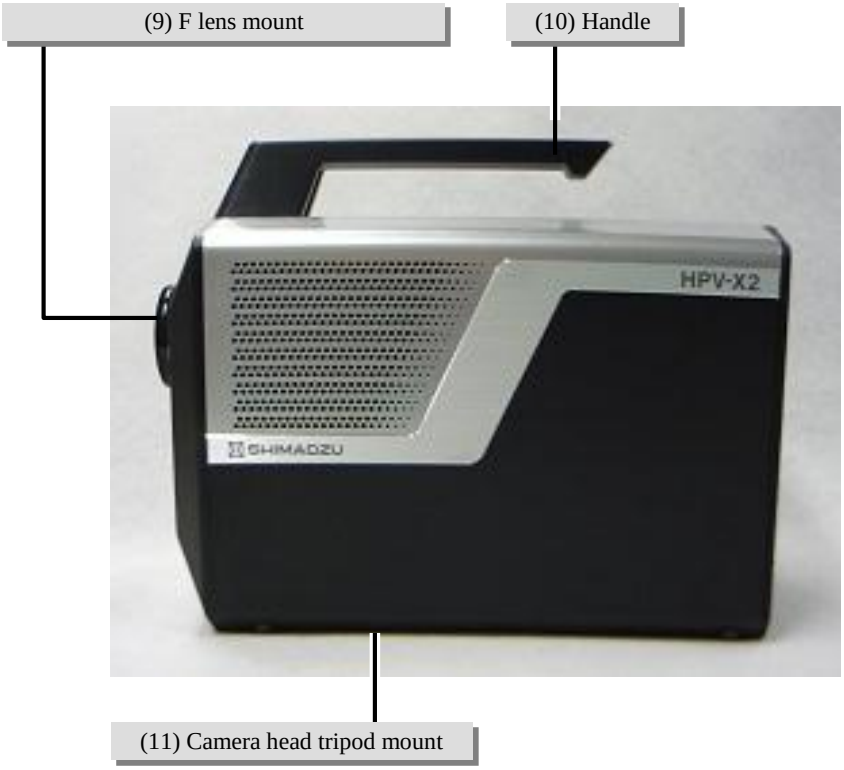


Fig. 2-4 Camera Head



Side view of camera head

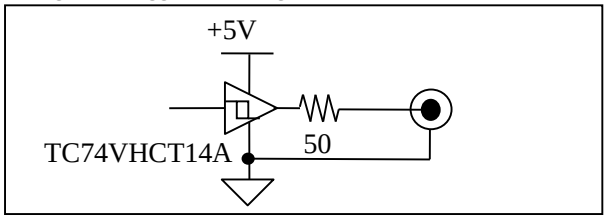
Fig. 2-5 Camera Head (Continued)

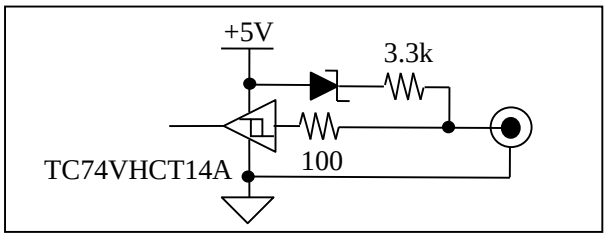
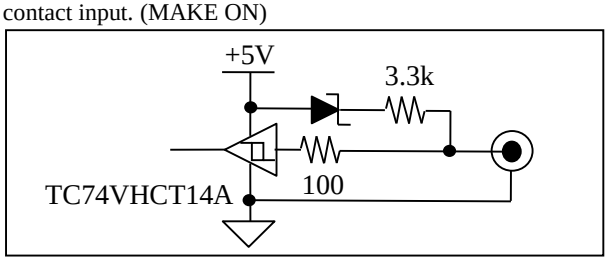
⚠ Caution

Prohibitions

- Do not apply a voltage exceeding the range of 5V-TTL level on the trigger input connector and the standby input connector.

  There is a risk that the device fails or does not work correctly

No.	Part Name	Description
(1)	Power cable connector (male 16-pin)	Connector used to connect the power supply cable
(2)	Video output connector	Connector used to connect the video cable It outputs a video (NTSC / PAL) signal of live images.
(3)	AUX output connector (two BNC connectors)	Connector used to confirm the clock signal while waiting for the signal to trigger recording 
(4)	Standby input connector (BNC)	Connector used to input the recording standby signal Input can be a TTL 5 V signal or normally open contact input.

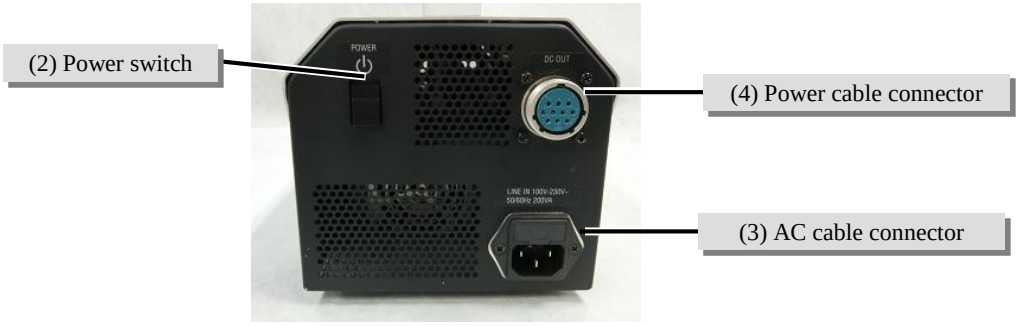
No.	Part Name	Description
		
(5)	Trigger input connector (BNC)	Connector used to input the trigger signal The trigger input can be a TTL 5 V signal or normally open contact input. (MAKE ON) 
(6)	Camera status indicator LEDs	These indicate the camera status. The four indicators, [POWER], [STAT], [TRIG], and [SYNC], indicate the following.
	POWER	Illuminates green when the camera power is switched ON.
	STAT	Illuminates red when an error occurs.
	TRIG	Flashes green when the camera is ready for trigger input and illuminates green during recording. It remains OFF when not waiting for a trigger input or recording.
	SYNC	Illuminates green when a synchronization cable is connected.
(7)	LAN cable connector	Ethernet connector used to connect the LAN cable
(8)	Synchronization cable connector	Connector used to connect the synchronization cable
(9)	F lens mount	Mount used to attach lenses This is an F mount.
(10)	Handle	Hold the handle for carrying the camera head. Note Always hold the handle when carrying the camera head. Failure to do so may result in damage.
(11)	Camera head tripod mount	A tripod can be attached to the camera head using the UNC3/8 screw in this mount. Three screw holes are provided. Select the appropriate hole to achieve a good weight balance of the camera head with the lens attached. Note Do not forcibly put screws other than UNC3/8 screw into the camera tripod screw holes. Doing so may damage the screw threads.

2.4 Names and Functions of Parts – Power Unit

The Power unit supplies power to the camera head.

Power supply unit side view

Power supply unit front view



Power supply unit rear view

Fig. 2-6 Power Unit

No.	Part Name	Description
(1)	LED	Illuminates green when the power unit is switched ON.
(2)	Power switch	Switches the entire camera system ON/OFF.
(3)	AC cable connector	Connects the AC cable that supplies power to the power unit.
(4)	Power cable connector	Connects the power cable that supplies power to the camera head.

3. Specifications

■ Camera Head

Lens Mount	Nikon F mount[1)]	
Image Sensor	FTCMOS2 image sensor	
Recording Speed[2)] (frame rate)	HP mode	10 Mfps, 5 Mfps (fixed)
	FP mode	5 Mfps (fixed)
	Both modes	Variable recording speed (in a 1/(10 ns) interval) in a range from 60 fps to 2 Mfps
Continuous Recording Capacity	HP mode	256 frames max.
	FP mode	128 frames max.
Resolution	HP mode	50,000 pixels (zigzag lattice pixel array) [3)]
	FP mode	100,000 pixels (400 (horizontal) X 250 (vertical)
Color/Gradations	Monochrome, 10 bits[4)]	
Exposure Time[5)]	0 Mfps (fixed at 50 ns), 5 Mfps (fixed at 110 ns)	
	Variable in a 10 ns interval starting from 200 ns in a range from 60 fps to 2 Mfps	
Synchronized Recording Function	Synchronized recording can be performed on two cameras.	
External Trigger Input	Two channels (TRIGIN, STANDBY) TTL level (5 V), capable of either positive or negative polarity	
Recording Mode	Internal trigger, external trigger, continuous trigger	
Optional Output	Two channels (The exposure start timing, trigger detection timing, etc. are output by setting.)	
Trigger Point Settings	Can be set to any frame from the second frame onwards	
LAN Connection	1000 Base-T/100 Base-TX, 1 port	
External Monitor Output	NTSC / PAL Output	
Data Memory Format	10-bit dedicated format, BMP, AVI (8-bit and 24-bit formats supported), JPEG, TIFF (8-bit and 16-bit formats supported)	

■ Control PC (Recommended Values)

OS	Windows 7 Professional (64 bit) Service Pack 1 or later
CPU	Intel Core i5 or faster
Memory	4 GB or more
HDD	250 GB or more
Screen Size	1,366 X 768 or larger
Interface	1000 Base-T/100 Base-TX
External Recording Device	DVD-RW
Other Peripherals	Mouse and keyboard

■ Power Unit

Input Power Supply	Single Phase 100V/220V to 230V AC, 200 VA, 50/60 Hz

■ Operating Conditions

Operating Temperature Range	5 to 40 ℃
Operating Humidity Range	35 to 75 % RH, no condensation
Storage Temperature Range	0 to 50℃
Storage Humidity Range	20 to 80 % RH, no condensation

■ Size and Weight

Camera Head	160(W) x 330(D) x 260(H) mm,approx. 6.4 kg
Power Unit	150(W) x 392(D) x 185(H) mm,approx. 5.2 kg
Length of Interface Cable (Between Camera and Control PC)	Approx. 2 m
Length of Power Cable (Between Camera and Power Unit)	Approx. 2.8 m

1) Shimadzu does not guarantee that all F-mount lenses can be attached.
2) The recording speed is a reference value. It is not guaranteed to be an accurate value for the time interval between recording frames.
3) Stored images will be 400 pixels (horizontal) x 250 pixels (vertical).
4) 10 bit is used to identify the data format. The data precision is not guaranteed.
5) Exposure times are for reference only. Exact exposure time ratios are not guaranteed for all recording speeds.

4. Preparations for Operation

4.1 Connecting Cables

⚠ Warning

Instructions

- To avoid electric shock, be sure to insert cables in a socket that is equipped with a grounded terminal.

  Failure to do so may result in electric shock.

Instructions

- To avoid electric shock if a 3-to-2 prong plug adapter is used, be sure to connect the adapter ground wire to ground.

  Failure to do so may result in electric shock.

Note

Before connecting or disconnecting cables, be sure to switch the power OFF.
Failure to do may cause instrument damage.

Note

If the LAN cable between the camera head and control computer is routed via a HUB connection, be sure to use Gigabit Ethernet cable (1000 BASE-T) compatible products to avoid any slowdown in functionality due to slower transmission.

Connect the cables as shown in Fig. 4-1.

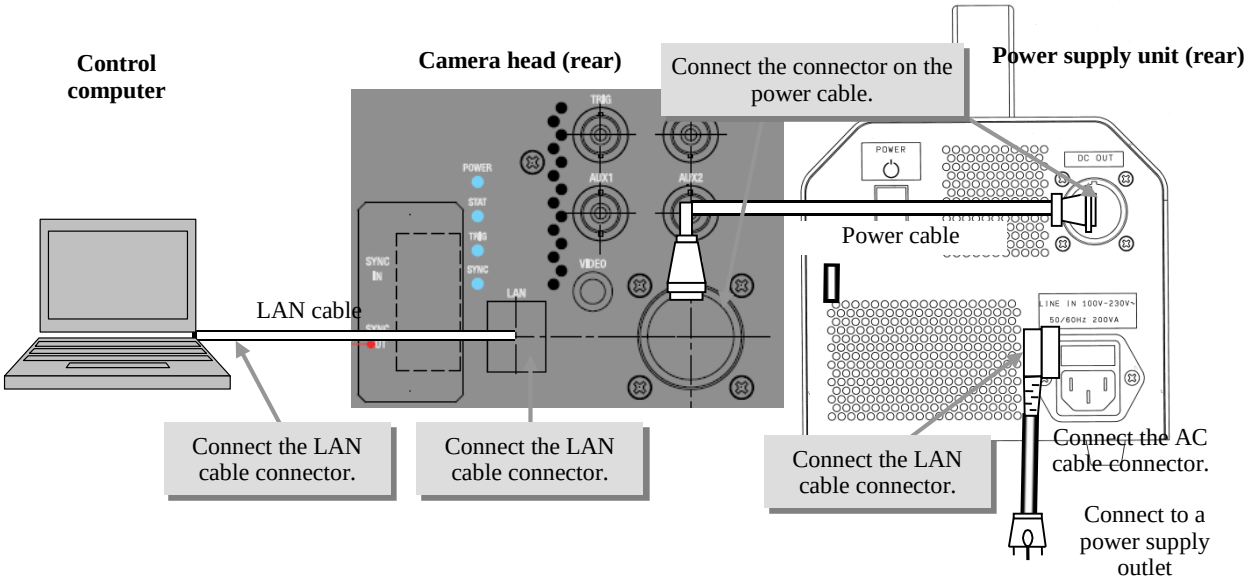


Fig. 4-1 Cable Layout Diagram

4.2 Mounting and Removing Lenses

■ Mounting the Lens

1. Remove lens caps from the lens and camera head.

Fig. 4-2 Camera Head and Lens

2. Firmly hold the lens, and align the lens with the camera head mount.

Fig. 4-3 Mounting the Lens 1

3. Insert the lens into the camera head mount with the dot mark on top of the lens turned clockwise about 30 degrees.

> ✎ Note
>
> Position the lens so that it fits without leaving a clearance between the lens and camera head mount. Failure to do so may result in damage.

Fig. 4-4 Mounting the Lens 2

4. Turn the lens counterclockwise until you hear it click into place.

> ✎ Note
>
> Make sure that there is no clearance between the lens and camera head before turning the lens. Failure to do so may result in damage.

Fig. 4-5 Mounting the Lens 3

5. Confirm that the lens is mounted securely to the camera head.

Fig. 4-6 Mounted Lens

■ Removing the Lens

To remove the lens from the camera head, turn the lens clockwise (opposite direction to mounting) while pushing the lug shown in Fig. 4-7 in the direction of the arrow.

Fig. 4-7 Removing the Lens

✎ Note

The above description is for removal/attachment of a regular F-mount lens. However, the camera may be connected to various other optical systems depending on the user's specific camera application. When connecting to other optical systems, such as microscope lenses, refer to the instruction manual for the optical system to which the camera is being connected.

We also recommend using a jig or other support device to prevent applying any excessive loads on the mount. Excessive loads could damage the mount.

Shimadzu does not guarantee that all F-mount lenses can be attached.

■ Lenses with an Aperture Ring

If using a lens with an aperture ring, align the aperture dial on the front of the camera head to [CLOSE] and use ring on the lens to adjust the aperture.

Fig. 4-8 Lens with Aperture Ring

Fig. 4-9 Aperture Dial

■ Lenses Without an Aperture Ring

If using a lens without an aperture ring, use the dial on the front of the camera head to adjust the aperture.

Fig. 4-10 Lens without Aperture Ring

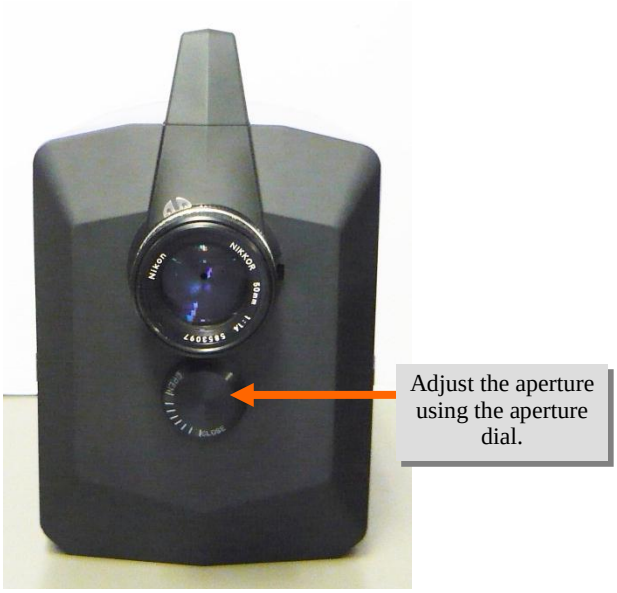


Fig. 4-11 Aperture Dial

> ✎ Note
>
> The process of adjusting aperture is the same for the aperture dial and ring. However, note that the markings only provide a guideline and do not ensure that the amount of incident light is adjusted accurately.

4.3 Starting Up the High-Speed Video Camera

1. Hold down the power button on the power unit for three seconds to switch ON the camera system.
2. Switch the control computer ON.
3. Log in to Windows. (See Logging In and Out of Windows.)
4. Double-click the  icon on the desktop.

   The main window of the display software is displayed.

> Note
>
> If the camera system is switched ON while the display software is running, restart the display software.

4.4 Logging In and Out of Windows

■ Logging In to Windows

1. Display the logon screen for Windows.
2. In the logon screen, enter "shiva" in the password field under [HPV-X] and press the [Enter] key.

   The Windows desktop appears.

> Note
>
> The control computer is a dedicated controller for the high-speed video camera. It is not intended for use as a general use computer. Consequently, high-speed video camera operation is not guaranteed if any of the factory settings are changed or if other software is installed.
>
> The HPV-X password can be changed, but make a note of the changed password, as it is required during maintenance or to make changes to the system.
>
> Without the password, it may be impossible to log in to the system.

■ Logging Out of Windows

1. Click the [Start] button (1) on the taskbar.

2. Click button (2) on the Start menu.

The shutdown options menu is displayed.

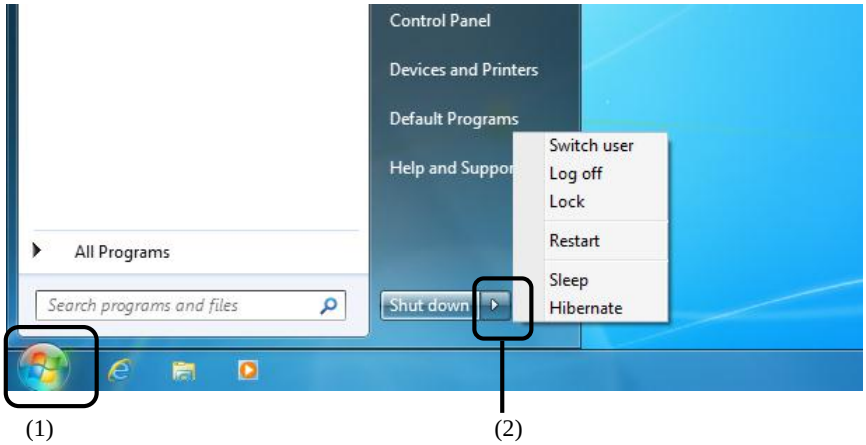


Fig. 4-12 Logging Out of Windows

3. Select the desired logoff option.

Selecting [Shut down]

Windows closes all open applications and switches OFF power to the control computer.

Selecting [Hibernate]

All running applications remain in the same state, but the logon screen is displayed. This is convenient for leaving the camera unattended while keeping all windows unchanged. (For more details, refer to the Windows User's Guide.)

Selecting [Restart]

All running Windows applications close, the system is restarted, and the Windows logon window is displayed. This is convenient for rebooting the system after an error occurs in a running application. (For more details, refer to the Windows User's Guide.)

> ✎ Note
>
> If Windows power control is enabled and the control computer enters the standby mode, a communication error occurs and the software closes. Therefore, do not enable power control in Windows.
>
> Always shut down Windows as instructed in "■Logging Out of Windows" above. Shutting OFF the power incorrectly may result in lost data.

4.5 Connecting to a Network

No settings related to network connections are set before the instrument is shipped from the factory.
Consult the network administrator regarding connecting to the network before specifying network settings. For more details about the settings, refer to the Windows help files or User's Guide.

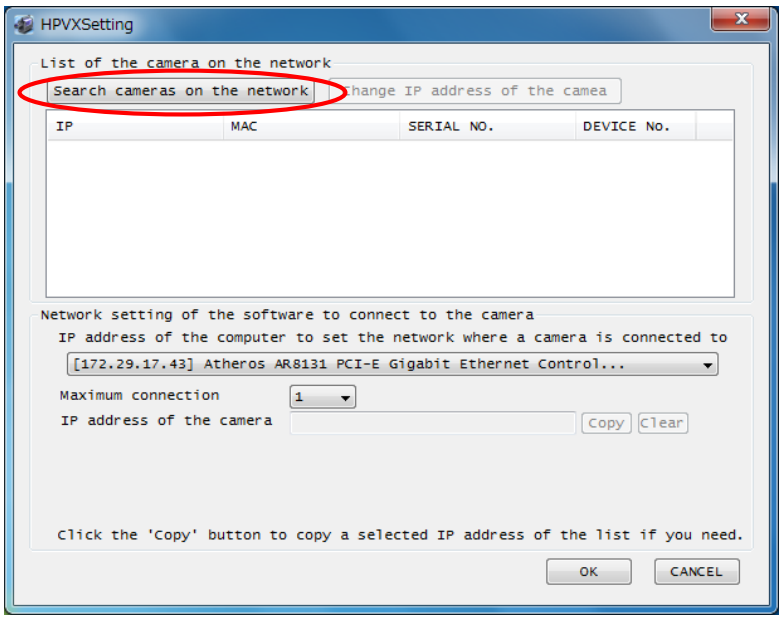
> **Note**
>
> Shimadzu assumes no warranty for security problems that may arise from a permanent network connection.
> Also, Shimadzu cannot guarantee the installation or normal operation of antivirus software or network security software on the control computer. That is the responsibility of the customer.

4.6 Registering Cameras to Be Connected

4.6.1 Procedure for Registering Cameras to Be Connected

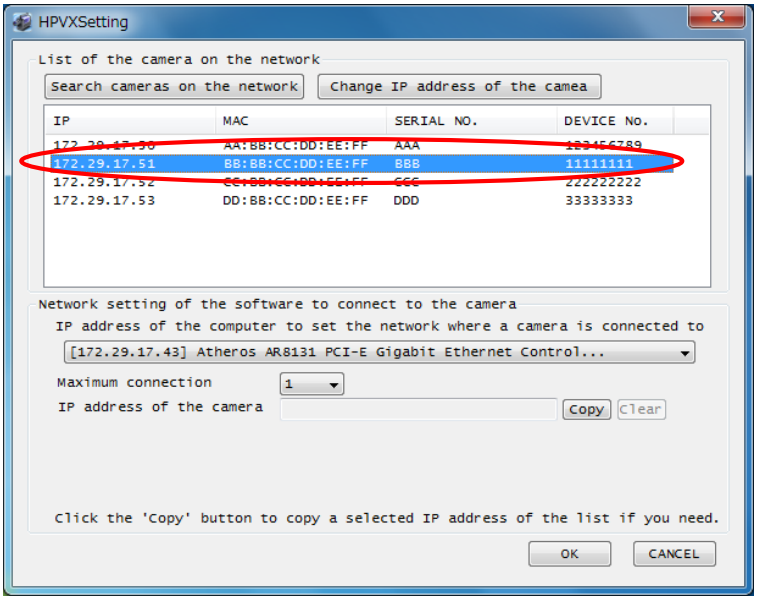
1. Double-click the [HPV-X Setting] shortcut on the desktop to display the following window.

Click [Search cameras on the network].

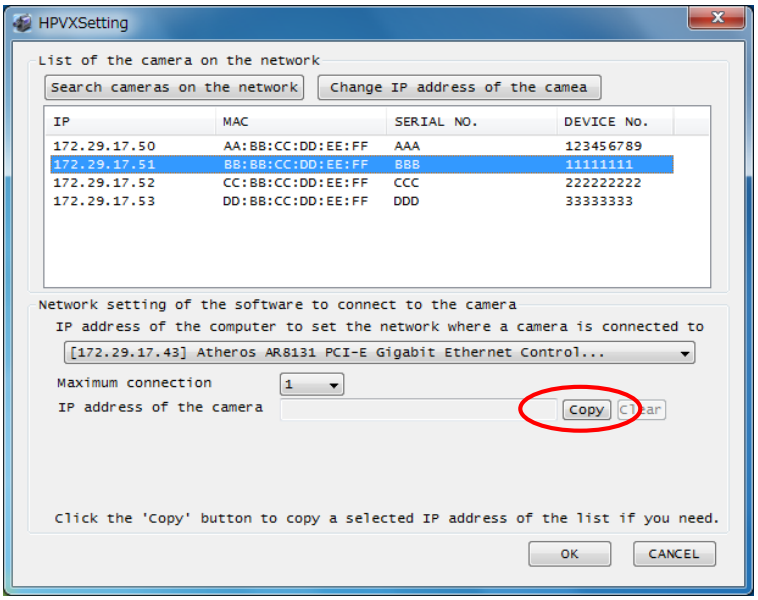


> **Note**
>
> To change IP address of cameras on the network, see 4.6.2 Procedure for Changing the IP Address of Cameras.

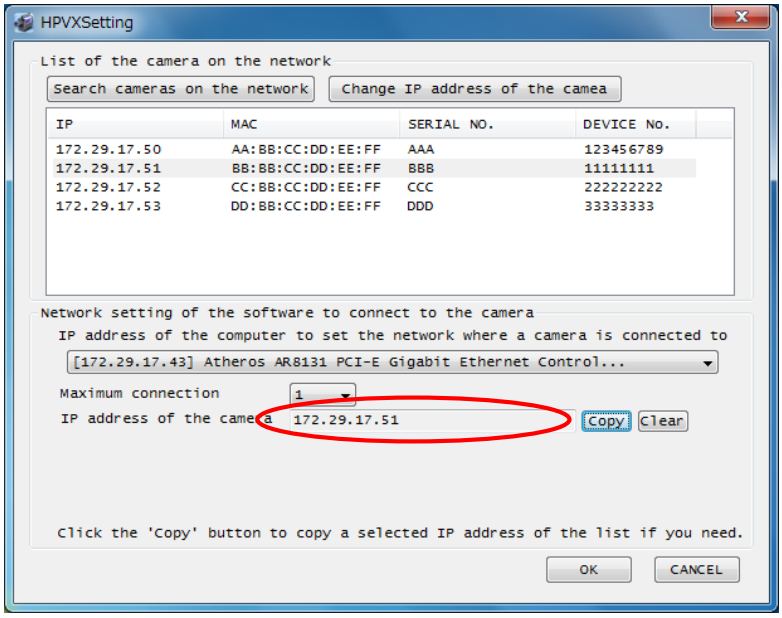
2. Click [Search cameras on the network] to list all cameras on the network. In the list, select the cameras to connect.



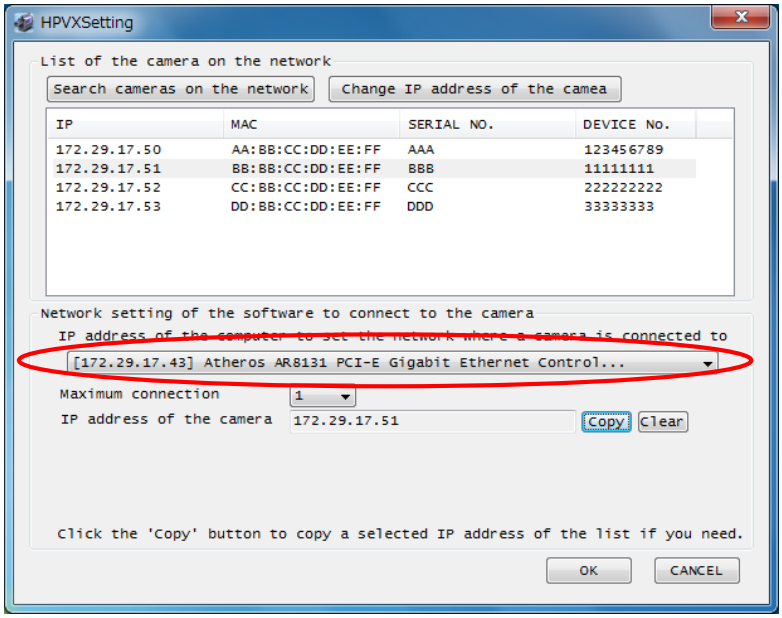
3. After selecting the cameras to be connected from the list, click [IP address of the camera] – [Copy].



4. This lists IP addresses for cameras being connected in [IP address of the camera] field.



5. In the [IP address of the computer to set the network where a camera is connected to] field, select the IP address of the computer.

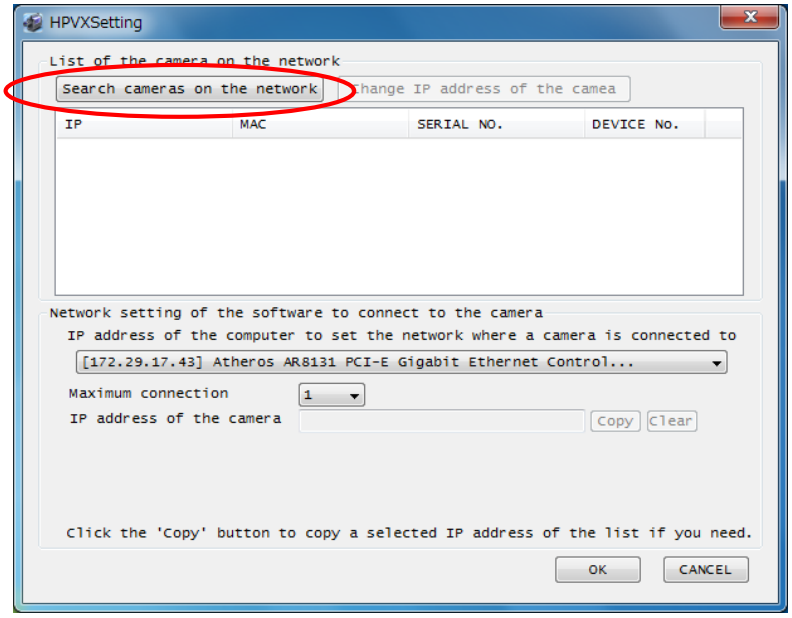


After selecting the computer IP address, click [OK] to finish registration.

4.6.2 Procedure for Changing the IP Address of the Camera

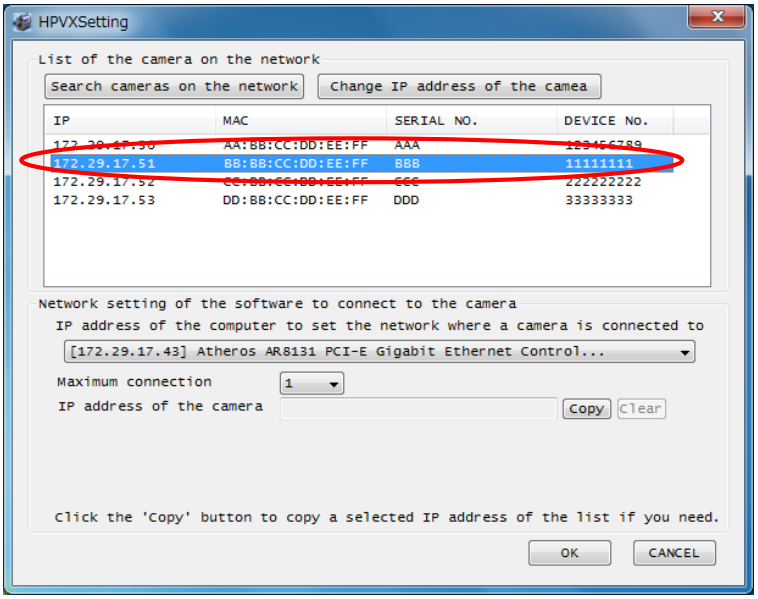
1. Double-click the [HPV-X Setting] shortcut on the desktop to display the following window.

Click [Search cameras on the network].

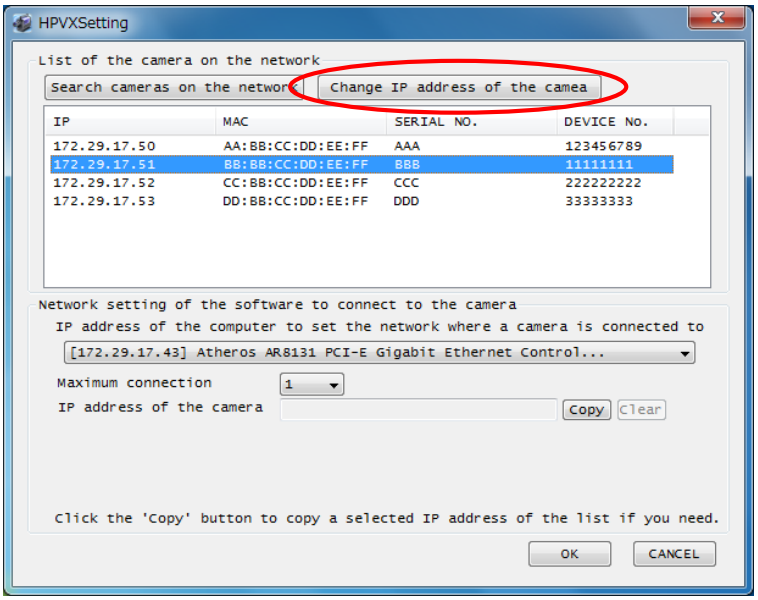


2. Clicking [Search cameras on the network] lists all cameras on the network.

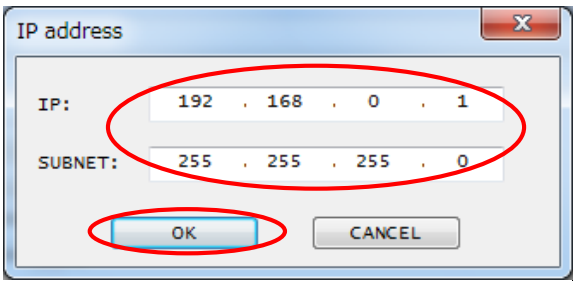
In the list, select the camera IP address to change.



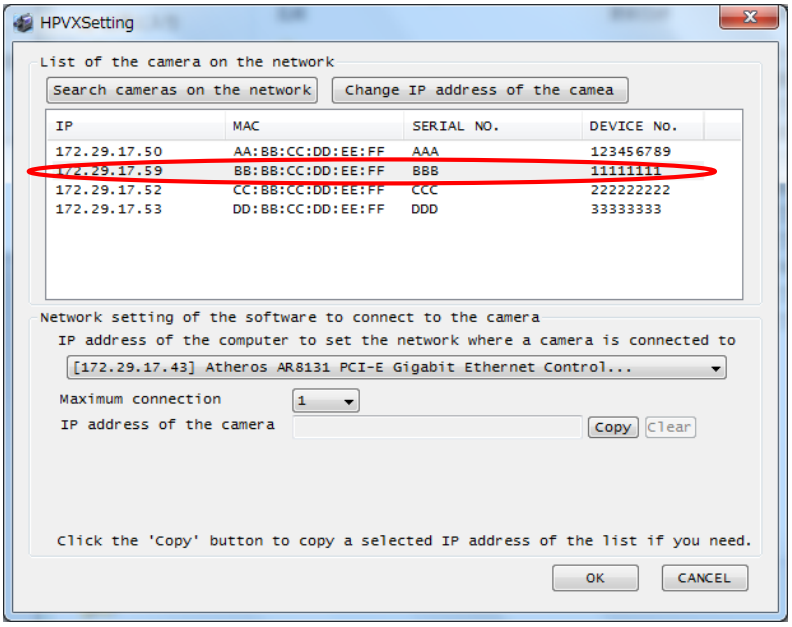
3. After selecting the camera IP address to change, click [IP address of the camera].



4. The following window is displayed. Change the IP address and subnet mask settings as desired and click [OK].



5. Finish the procedure by verifying that the corresponding camera IP address appears changed in the list.



4.7 Shutting Down the High-Speed Video Camera

4.7.1 Shutting Down Without a Camera Connected

1. Click  in the Viewer window.

   If no other Viewer windows are displayed, a shutdown confirmation dialog box is displayed. If another Viewer window is displayed, the shutdown confirmation dialog box is not displayed.

2. Click [OK].

   The Viewer window closes and the desktop is displayed again.

3. Log out of Windows. (See 4.4 Logging In and Out of Windows.)

   The control computer is switched OFF.

4. Hold down the power button on the power unit for three seconds to switch OFF power to the camera system.

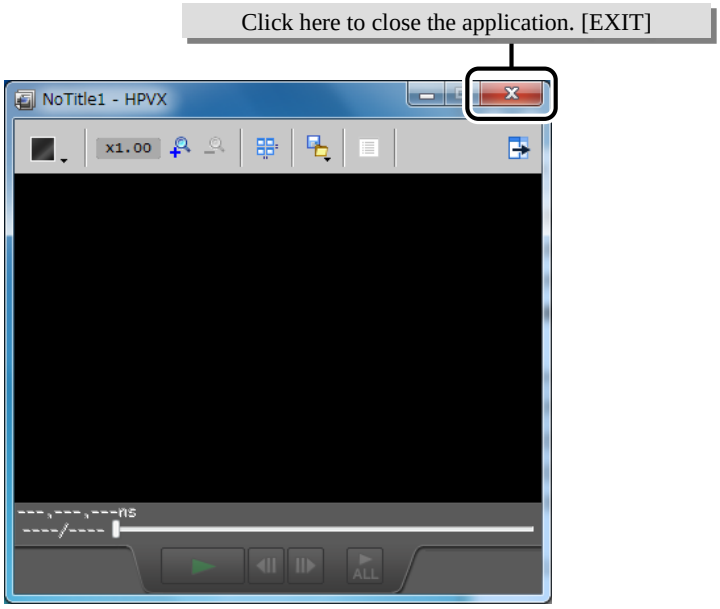


Fig. 4-13 Viewer Window (with No Connected Cameras)

4.7.2 Shutting Down with a Camera Connected

1. Click the  or  icon in the recording parameter settings window.

   A shutdown confirmation dialog box is displayed.

2. Click [OK].

   The HPV-X software closes and the desktop is displayed again.

3. Log out of Windows. (See 4.4 Logging In and Out of Windows)

   The control computer is switched OFF.

4. Disconnect the LAN cable connecting the camera to the control computer.

5. Hold down the power button on the power unit for three seconds to switch OFF power to the camera system.

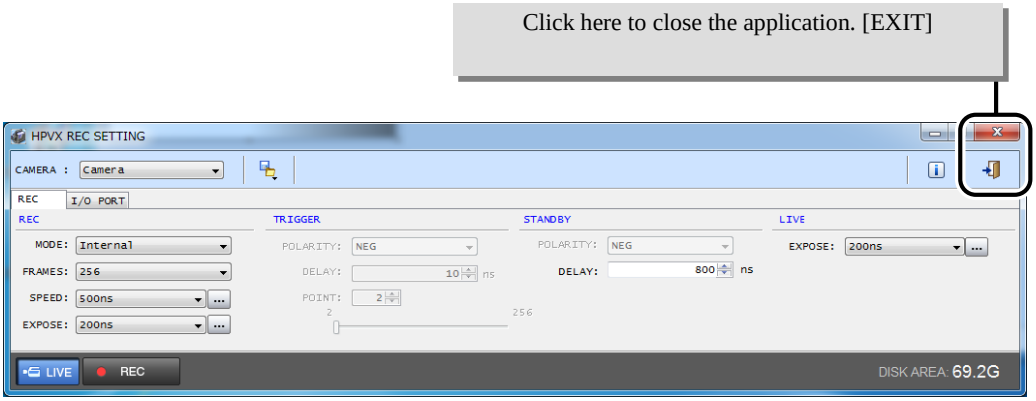


Fig. 4-14 Recording Parameter Settings Window

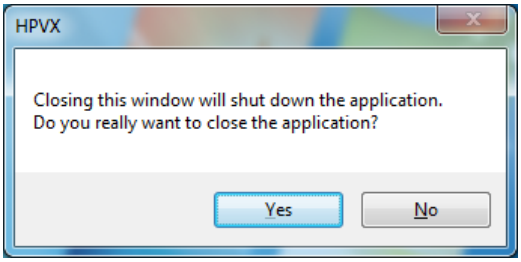


Fig. 4-15 Shutdown Confirmation Dialog Box

> **Note**
>
> Clicking  or  closes the application, but not Viewer being run for file operations. Close Viewer not linked to a camera individually. (See 4.7.1 Shutting Down Without a Camera Connected.)

No Text

5. Operating the Camera

This section describes how to operate the camera.

5.1 Operation Flowchart

Fig. 5-1 shows a process flowchart of operating cameras.
For details about operation, see the instructions in 5.2 Camera Settings and thereafter

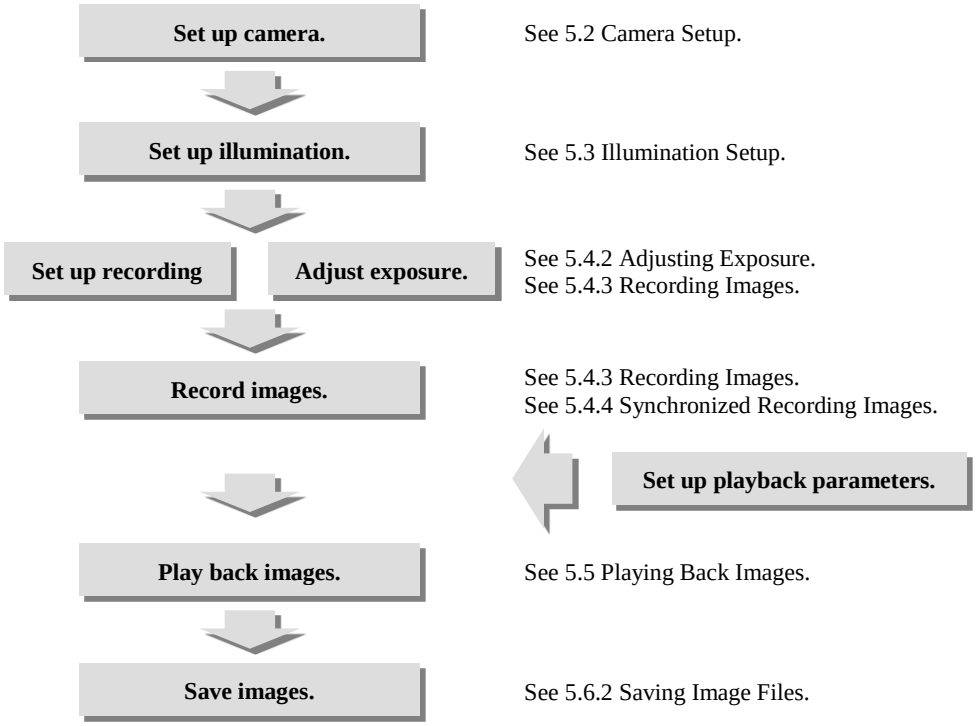


Fig. 5-1 Flowchart of Operating Process

5.2 Camera Settings

Use the live image to adjust the viewing angle and focal point, as follows.

Position the camera head while viewing the live image to make sure the desired view is properly within the viewing frame. Adjust the focus on the object being recorded by turning the focus ring on the lens.

Too much light, such when recording outdoors, can prevent displaying a clear live image. In such cases, adjust the aperture using the aperture ring or change the exposure time of the live image.

5.3 Illumination Settings

The exposure time decreases as the recording speed increases in such a way that a greater amount of light is required to achieve appropriate exposure.

After referring to 5.4.2 Adjusting Exposure, set up illumination settings so that the illumination type and layout provide a suitable light exposure level.

■ Using Laser Illumination

When using laser illumination (in particular the laser shadowgraph method, where laser light is applied from the back of an object and the projected shadow is recorded by high-speed video camera), interference patterns may appear in the recorded images at some laser wavelengths. One method of overcoming this is to place a screen in front of the camera and record the image projected onto the screen.

5.4 Recording Images

■ Actual Recording Procedure

1. Set the recording parameters.

2. Click [REC] in the Viewer window or the recording parameter settings window.

3. Input the standby OFF trigger signal.

The standby OFF trigger signal can be delayed by a preset delay time.
(This does not need to be input for the external trigger mode [External TRIG] or continuous external trigger mode [R-External TRIG]. These modes automatically generate a standby OFF trigger signal within the camera.)

4. Input the trigger signal.

The trigger signal can be delayed by a preset time.
(This does not need to be input for the internal trigger mode [Internal], external trigger mode [External STANDBY], or continuous external trigger mode [R-External STANDBY]. These modes automatically generate a trigger signal within the camera.) Once the trigger signal is input, the system saves the frames before and after the specified trigger point in recording data.

5. Save the image data.

5.4.1 Setting Recording Parameters

Specify recording parameters in the recording parameter settings window before starting recording.

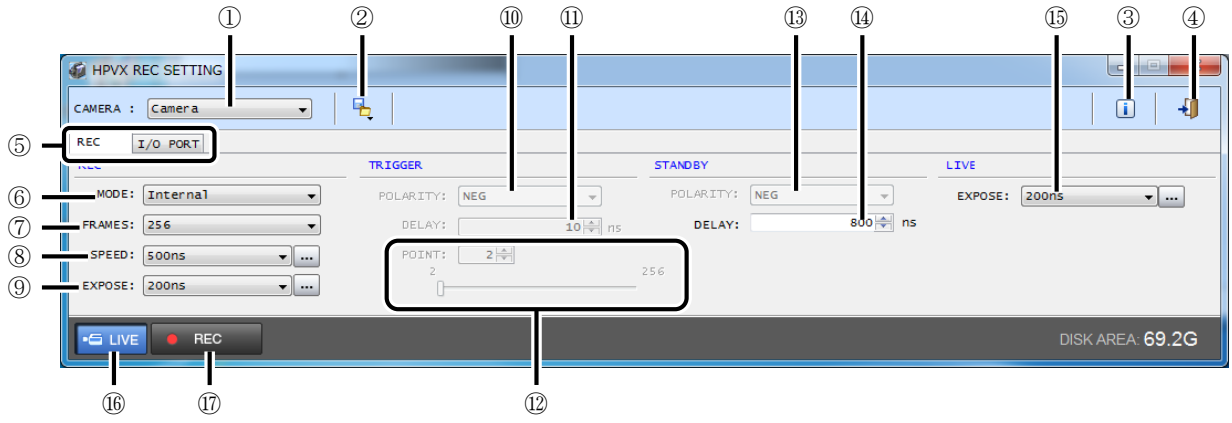


Fig. 5-2 [REC] Window

No.	Name	Description	See Page
①	CAMERA	Select the camera.	P.32
②	File Operation List Icon	Select file operations. • [Open Setting File] loads the recording parameter setting file. • [Save Setting File] saves the recording parameter setting file.	P.32

No.	Name	Description	See Page
		• [Auto Save Setting] selects the format for saving recording data.	
③	Version Information Display Icon	Displays version information.	P.35
④	EXIT	Closes the application.	P.35
⑤	Window Display Mode	Switches between windows for recording parameter settings	P.35
⑥	REC MODE	Select the recording mode.	P.35
⑦	REC FRAMES	Select the recording frame.	P.40
⑧	REC SPEED	Select the recording speed.	P. 40
⑨	REC EXPOSE	Select the exposure time for recording.	P.41
⑩	TRIGGER POLARITY	Set the polarity of the trigger signal.	P.42
⑪	TRIGGER DELAY	Set the delay time of the trigger signal.	P.42
⑫	TRIGGER POINT	Set trigger points.	P.42
⑬	STANDBY POLARITY	Set the polarity of the standby signal.	P.43
⑭	STANDBY DELAY	Set the delay time of the standby signal.	P.44
⑮	LIVE EXPOSE	Select the exposure time for live images.	P.44
⑯	LIVE	Displays live images.	P.45
⑰	REC	Records images.	P.45

■ Selecting the Camera – [CAMERA]

This displays the name of the currently active camera.

Clicking [CAMERA] allows selecting the camera to be operated from a list of all currently connected cameras.

Right-clicking [CAMERA] displays the [RENAME] window for renaming cameras (Fig. 5-3).

Click [OK] to rename the camera or [CANCEL] to cancel renaming the camera.

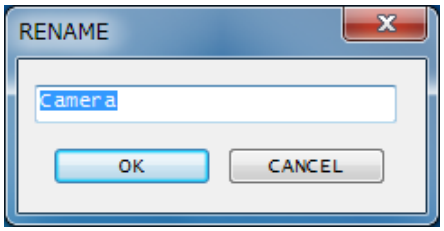


Fig. 5-3 Camera Rename Window

■ File Operation List Icon

Click the icon to display the [OPEN Setting File], [SAVE Setting File], or [Auto Save Setting] window.

- Loading recording parameter setting file – [OPEN Setting File]
  Clicking [OPEN Setting File] displays a window for loading files (Fig. 5-4).
  Select the desired recording parameter setting file and click [Open] to apply settings from the recording parameter setting file to the [REC] and [I/O PORT] windows.
  For more information about recording parameter setting files, see 5.7.3 Recording Parameter Setting Files.

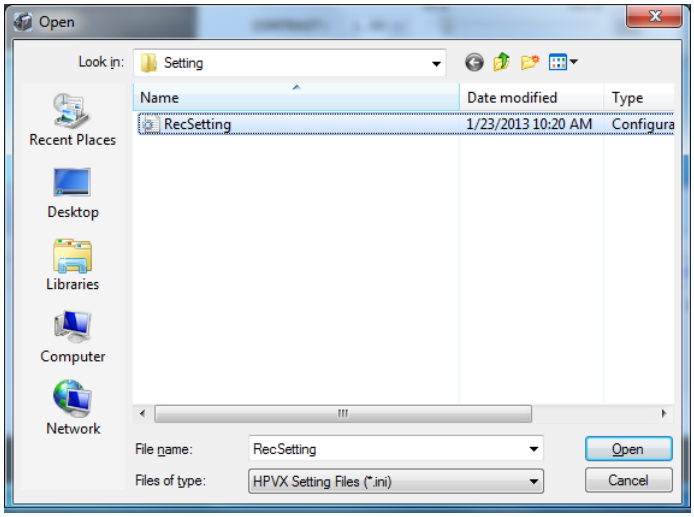


Fig. 5-4 Window for Loading Files

- Saving recording parameter setting files – [Save Setting File]
  Clicking [Save Setting File] displays a window for saving files (Fig. 5-5).
  Enter a file name and click [Save] to save the current recording parameter settings with the specified file name.
  For more information about recording parameter setting files, see 5.7.3 Recording Parameter Setting Files.

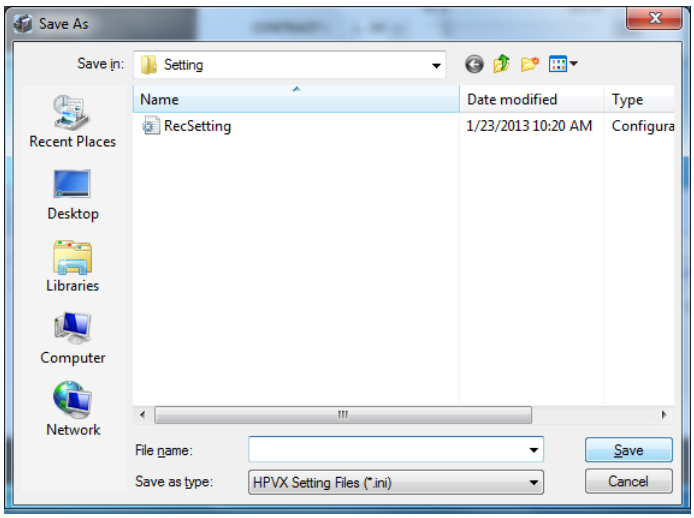


Fig. 5-5 Window for Saving Files

- Selecting the format for saving recording data – [Auto Save Setting]
  Clicking [Auto Save Setting] displays a window for selecting the format used to save recording data (Fig. 5-6).
  Specify the format for saving image files after recording, specify whether or not to display time information in images, specify whether or not to display the relative time with respect to trigger input in images, and specify settings for saving metadata for image files. (See 5.7.2 Metadata in Image Files.) Then click [OK] to apply the specified settings.
  Specify the format for saving image files after recording, specify whether or not to display time information in images, specify whether or not to display the relative time with respect to trigger input in images, and specify settings for saving metadata for image files. (See 5.7.2 Metadata in Image Files.) Then click [OK] to apply the specified settings.

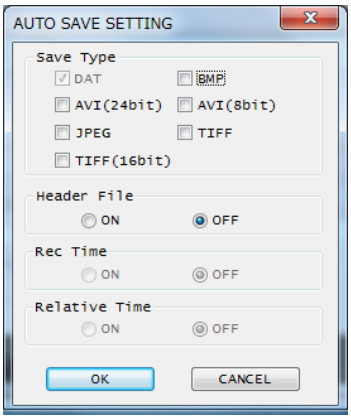


Fig. 5-6 Window for Selecting the Format for Saving Recording Data

No.	Name	Description
①	Save Type	Select one or more of the six image format types – DAT, BMP, JPEG, AVI(8-BIT),AVI(24-bit), TIFF, or TIFF (16-bit).
②	Header File	Specify settings for saving image files with metadata. Select [ON] to save the information file or [OFF] to not save the information.
③	Rec Time	Specify whether or not to display recording time information in the lower right corner of the images. Select [ON] to display the information or [OFF] to not display the information.
④	Relative Time	Specify whether or not to display relative-time-from-trigger-input information in the lower right corner of the images. Select [ON] to display the information or [OFF] to not display the information.

■ Displaying Version Information

Clicking the icon displays the version information display window (Fig. 5-7). Click [CLOSE] to close the window.

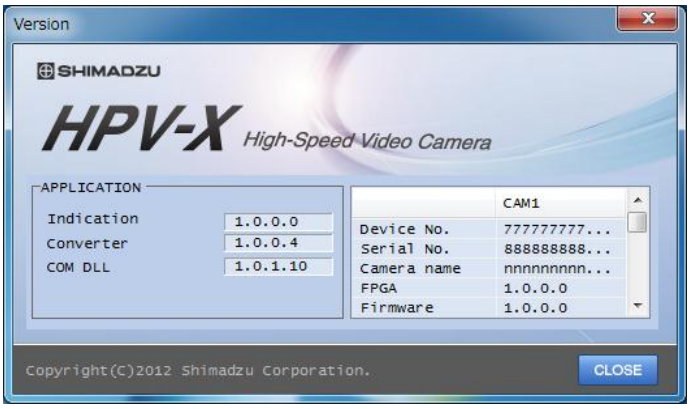


Fig. 5-7 Version Information Display Window

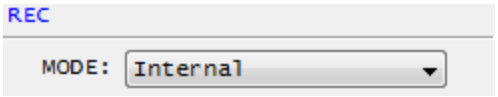
■ Closing the Application［EXIT］

Click the or icon to close the application. (See 4.7.2 Shutting Down with a Camera Connected.)

■ Switching Window Display Modes

Clicking [REC] displays the [REC] window (Fig. 5-2). Clicking [I/O PORT] displays the [I/O PORT] window (Fig. 5-15).

■ Selecting the Recording Mode in [REC] – [MODE]



Click the icon to display the nine recording modes.

- Internal trigger mode – [Internal]
  This mode starts recording immediately when [REC] is clicked.
  (The [Internal] mode does not require a standby or trigger signal input. These signals are automatically generated within the camera. In the [Internal] mode, the time between clicking [REC] and when recording actually starts can vary because it uses software to control recording.

- External standby mode – [External STANDBY]
  In this mode, recording starts immediately after receiving a standby signal input. This mode is used to ensure the time recorded for the standby signal input and start of recording are the same.
  After clicking [REC], the system waits for input of the standby signal and starts recording about 850 ns after receiving the standby signal input.
  (A trigger signal does not need to be input for the external standby mode [External STANDBY]. However, recording starts with the first frame. Recording in the trigger standby mode is not possible in the external standby mode.)

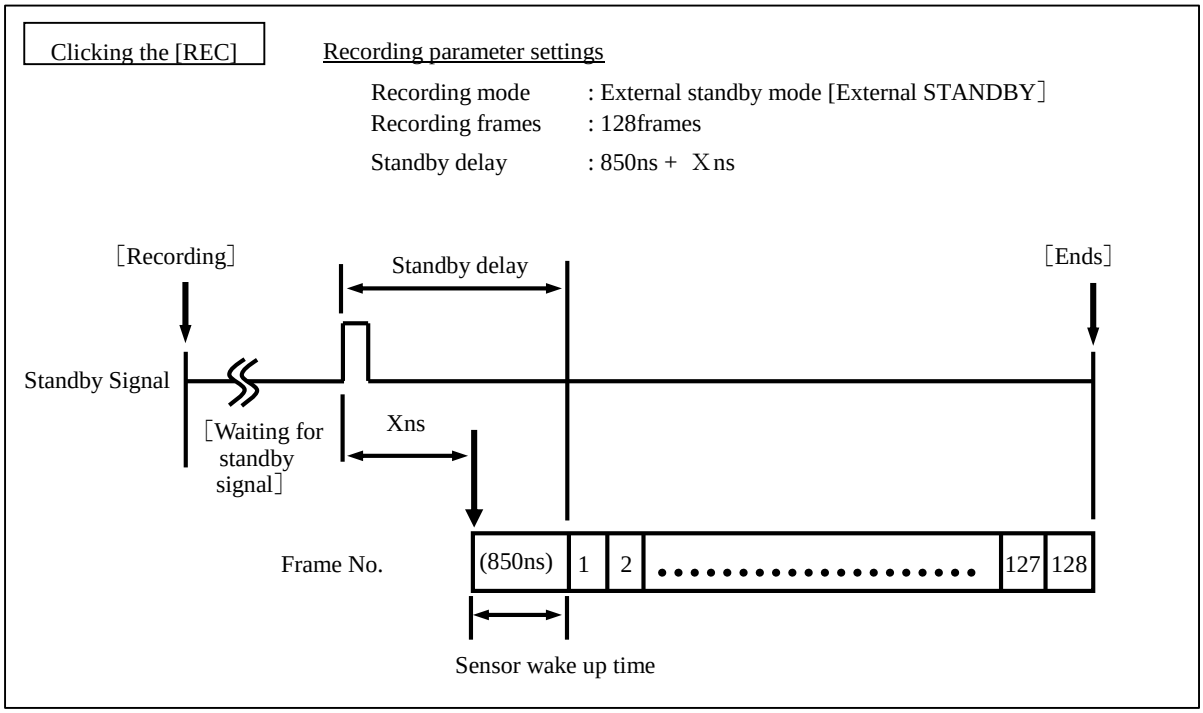


Fig. 5-8 Operation of the External Standby Mode

- External trigger mode – [External TRIG]
  This mode records frames before and after the trigger signal input.
  After clicking [REC] to start recording, the system waits for a trigger signal before recording the specified number of frames and then stops.

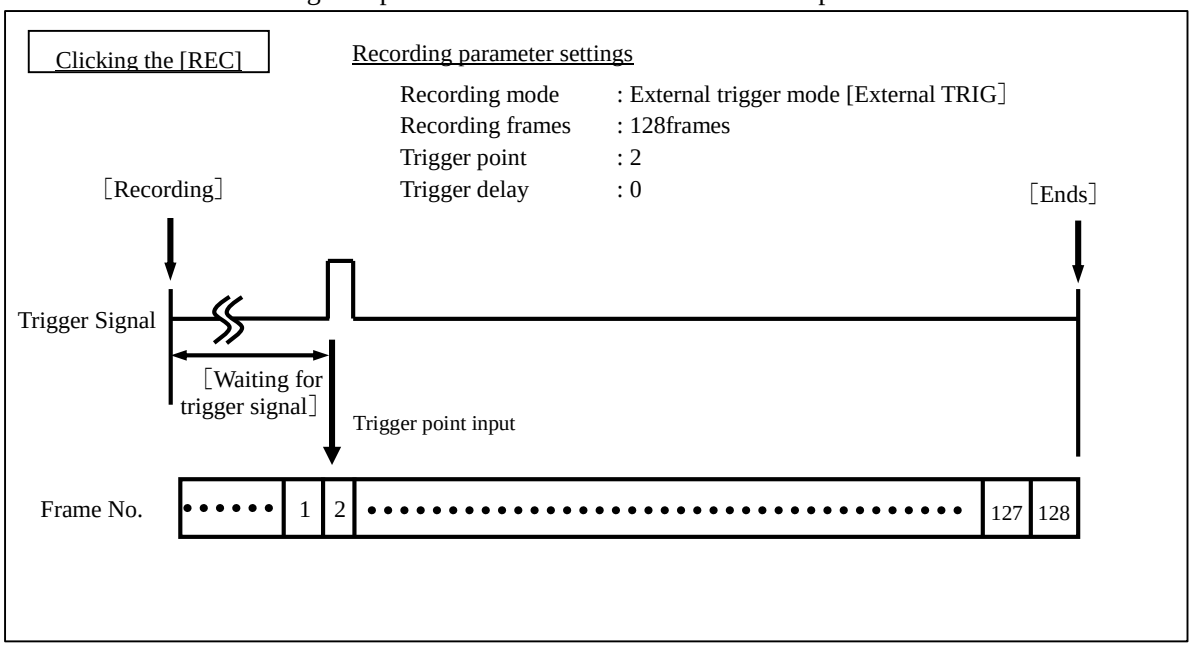


Fig. 5-9 Operation of the External Trigger Mode

- External separate mode – [External SEPARATE]
  This mode is a combination of the external standby and external trigger modes. It is used to record images after the camera has been in standby a long time.
  Clicking [REC] puts the camera in standby mode waiting for a standby signal. About 850 ns after the standby signal is input, it starts waiting for the trigger signal. After the trigger signal is received, it records the specified number of frames and then stops.

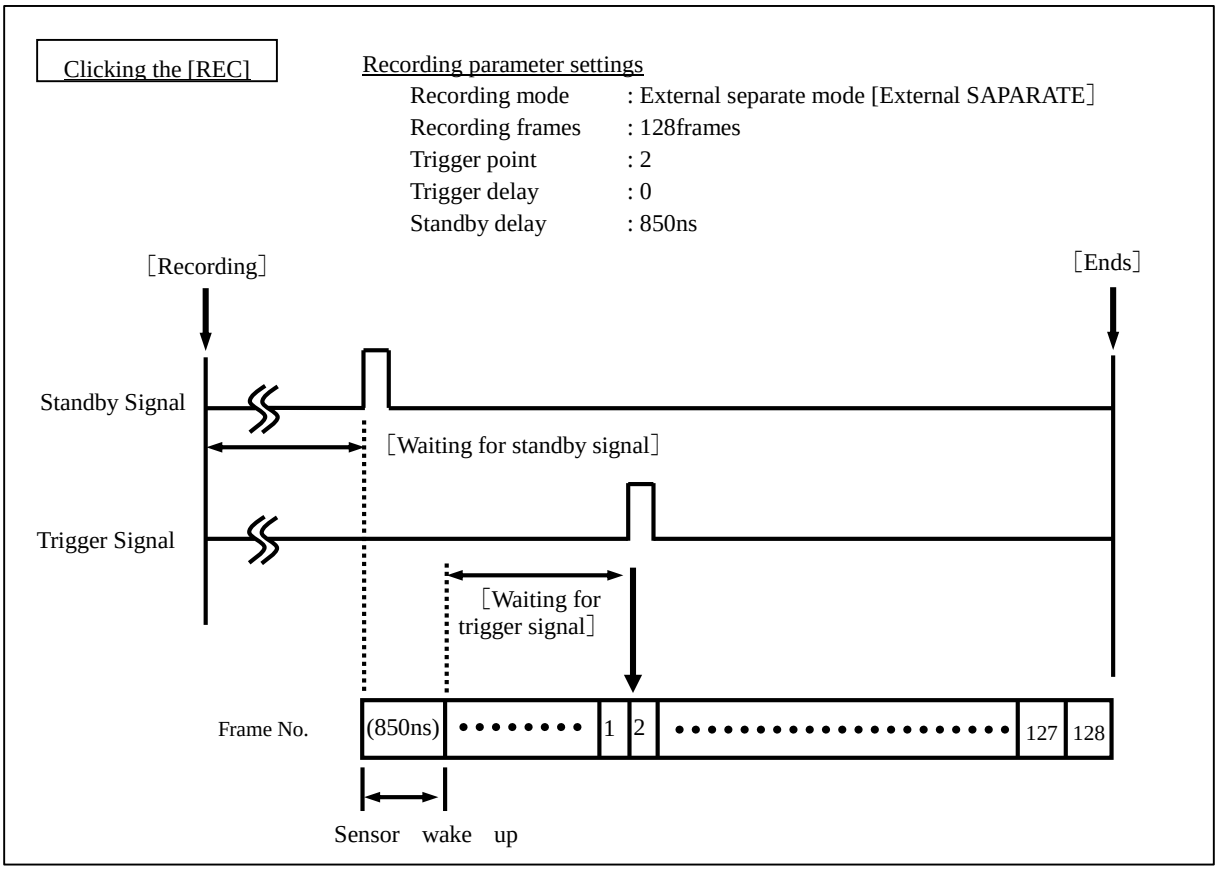


Fig. 5-10 Operation of the External Separate Mode

- External SYNCIN mode – [External SYNCIN]
  In this mode, synchronized recording can be performed by receiving the clock signal, standby signal, and trigger signal from the other camera via the synchronization cable connected to the SYNC IN connector.
  Clicking [REC] puts the camera in standby mode waiting for a standby signal. About 850 ns after the standby signal is input, it starts waiting for the trigger signal. After the trigger signal is received, it records the specified number of frames and then stops.
  Since the two cameras share the same clock signal, the exposure period does not become off over time.

- Continuous external standby mode – [R-External STANDBY]
  This mode allows repeatedly recording images using the external standby mode [External STANDBY]. It starts recording when a standby signal is input and reads the image data after recording is finished. Then it immediately starts waiting for input of the next standby signal to repeat the process.

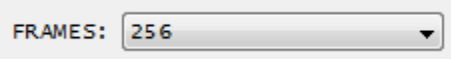
- Continuous external trigger mode – [R-External TRIG]
  This mode allows repeatedly recording images using the external trigger mode [External TRIG].
  Clicking [REC] starts recording with the camera in standby mode waiting for a trigger signal. After a trigger signal is input, it records the specified number of frames and reads the image data. Then it immediately starts waiting for input of the next trigger signal to repeat the process.

- Continuous separate mode – [R-External SEPARATE]
  This mode allows repeatedly recording images using the external separate mode [External SEPARATE].
  Clicking [REC] puts the system in standby mode waiting for a standby signal. After the standby signal is input, it starts recording by waiting for a trigger signal. When the

trigger signal is input, it records the specified number of frames and reads the image data. Then it immediately starts waiting for input of the next standby signal. This process is then repeated.

- Continuous external SYNCIN mode – [R-External SYNCIN]
  This mode allows repeatedly recording images using the external SYNCIN mode. Clicking [REC] puts the camera in standby mode waiting for a standby signal. About 850 ns after the standby signal is input, it starts waiting for the trigger signal. When the trigger signal is input, it records the specified number of frames and reads the image data. Then it immediately starts waiting for input of the next standby signal. This process is then repeated.

■ Selecting the Recording Frame in [REC] – [FRAMES]



Clicking the icon displays [128] and [256] settings.

■ Selecting the Recording Speed in [REC] – [SPEED]

Set the recording speed by clicking [REC] – [SPEED].

The default recording speed setting after initial startup can be selected from 100 ns, 200 ns, 500 ns, 1,000 ns, 2,000 ns, 5,000 ns, 10,000 ns, 20,000 ns, 50,000 ns, 100,000 ns, 2,000,000 ns, 5,000,000 ns, or 16,666,670 ns.

In addition, clicking the ... icon displays a window for editing the recording speed selection list (Fig. 5-11). This list of selectable recording speeds can be edited.

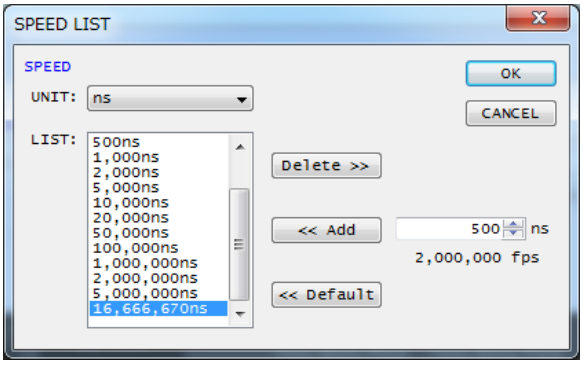


Fig. 5-11 Window for Editing the Recording Speed Selection List

Operations in the Window for Editing the Recording Speed Selection List

- Procedure for adding recording speeds to the recording speed selection list

1. Display the window for editing the recording speed selection list (Fig. 5-11).
2. In the field to the right of the [<< Add] button, enter the recording speed to be added to the list.
3. Click [<< Add] to add the recording speed entered in step 2 to the [LIST] field.
4. Click [OK].

   Save the settings and close the window. Once the settings are saved, the added recording speeds can be selected in [REC] – [SPEED] in the [REC] window.
   To not save the settings, click [CANCEL].

- Procedure for deleting recording speeds from the recording speed selection list

1. Display the window for editing the recording speed selection list (Fig. 5-11).
2. Select the recording speed to delete from the [LIST] field.
3. Click [Delete >>] to delete the recording speed selected in step 2.
4. Click [OK].

   Save the settings and close the window. Once the settings are saved, the deleted recording speeds are no longer selectable in [REC] – [SPEED] in the [REC] window.

To not save the settings, click [CANCEL].

- Changing the units for displaying recording speed

1. Display the window for editing the recording speed selection list (Fig. 5-11).
2. Select either [ns] or [fps] in the [UNIT] field.
3. Click [OK].

   Save the settings and close the window. Once the settings are saved, [REC] – [SPEED] values are displayed in terms of the changed units.
   To not save the settings, click [CANCEL].

- Initializing the recording speed selection list (default settings)

1. Display the window for editing the recording speed selection list (Fig. 5-11).
2. Clicking [<< Default] displays a confirmation dialog box.
3. Click [Yes].

   Clicking [Yes] resets the [LIST] values to default settings.
   Default values are 100 ns, 200 ns, 500 ns, 1,000 ns, 2,000 ns, 5,000 ns, 10,000 ns, 20,000 ns, 50,000 ns, 100,000 ns, 2,000,000 ns, 5,000,000 ns, and 16,666,670 ns.
   To not initialize settings, click [No].
4. Click [OK].

   Save the settings and close the window.
   To not save the settings, click [CANCEL].

> ✎ Note
>
> The range of recording speeds selectable in [REC] – [SPEED] differs depending on the recording frames specified in [REC] – [FRAMES].
>
> - If [REC] – [FRAMES] setting is 128
>   200 ns and 500 ns to 16,666,670 ns settings are selectable.
> - If [REC] – [FRAMES] setting is 256
>   100 ns, 200 ns, and 500 ns to 16,666,670 ns settings are selectable.

■ Selecting Exposure Time for Recording in [REC] – [EXPOSE]

Exposure time for recording is selected in the [REC] – [EXPOSE] field.

The default recording exposure time setting after initial startup is selectable from 200 ns, 500 ns, 1,000 ns, 2,000 ns, 5,000 ns, 10,000 ns, 20,000 ns, 50,000 ns, 100,000 ns, 1,000,000 ns, 2,000,000 ns, 5,000,000 ns, or 10,000,000 ns.

In addition, clicking the ... icon displays a window for editing the recording exposure time selection list (Fig. 5-12). This list of selectable recording exposure time settings can be edited.

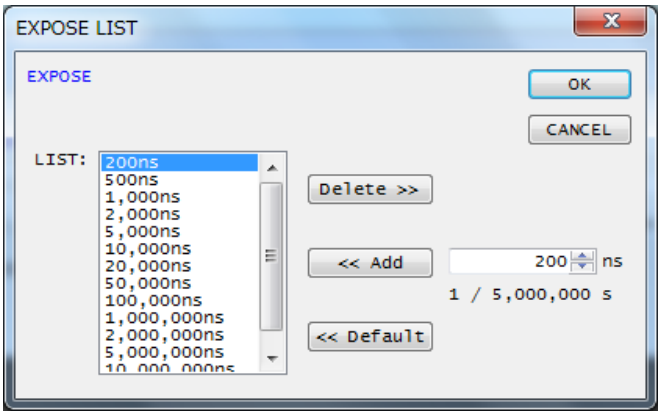


Fig. 5-12 Window for Editing the Recording Exposure Time Selection List

Operations in the Window for Editing the Recording Exposure Time Selection List

- Procedure for adding exposure time settings to the exposure time selection list

1. Display the window for editing the exposure time selection list (Fig. 5-12).
2. In the field to the right of the [<< Add] button, enter the exposure time setting to be added to the list.
3. Click [<< Add] to add the exposure time setting entered in step 2 to the [LIST] field.
4. Click [OK].

   Save the settings and close the window. Once the settings are saved, the added exposure time settings are selectable in [REC] – [EXPOSE] in the [REC] window.
   To not save the settings, click [CANCEL].

- Procedure for deleting exposure time settings from the exposure time selection list

1. Display the window for editing the exposure time selection list (Fig. 5-12).
2. Select the exposure time setting to delete from the [LIST] field.
3. Click [Delete >>] to delete the exposure time setting selected in step 2.
4. Click [OK].

   Save the settings and close the window. Once the settings are saved, the deleted exposure time settings are no longer selectable in [REC] – [EXPOSE] in the [REC] window.
   To not save the settings, click [CANCEL].

- Initializing the recording exposure time selection list (default settings)

1. Display the window for editing the exposure time selection list (Fig. 5-12).
2. Clicking [<< Default] displays a confirmation dialog box.
3. Click [Yes].

   Clicking [Yes] resets the [LIST] values to default settings.
   Default values are 200 ns, 500 ns, 1,000 ns, 2,000 ns, 5,000 ns, 10,000 ns, 20,000 ns, 50,000 ns, 100,000 ns, 1,000,000 ns, 2,000,000 ns, 5,000,000 ns, and 10,000,000 ns.
   To not initialize settings, click [No].
4. Click [OK].

   Save the settings and close the window.
   To not save the settings, click [CANCEL].

> ✎ Note
>
> The range of recording exposure times selectable in [REC] – [EXPOSURE] differs depending on the recording speed specified in [REC] – [SPEED].
> - If [REC] – [SPEED] setting is 100 ns or 200 ns
>   Recording exposure time is fixed and, therefore, not selectable.
> - If [REC] – [SPEED] setting is 500 ns to 16,666,670 ns
>   Exposure time settings between 200 ns and 300 ns less than the recording speed setting ([SPEED] setting - 300 ns) can be selected.

■ Setting External Signal (Trigger) Polarity in [TRIGGER] – [POLARITY]

This setting is not necessary for the trigger mode [Internal], [External STANDBY], [External SYNCIN], [R-External STANDBY] or [R-External SYNCIN].

External signals (triggers) can be input in two ways – either as step up (POS) or step down (NEG) signals. In the [TRIGGER] – [POLARITY] field, select either [POS] or [NEG].

■ Adjusting the Delay Time for External Signals (Trigger) in [TRIGGER] – [DELAY]

This setting is not necessary for the internal trigger mode [Internal], external standby mode [External STANDBY], or continuous external standby mode [R-External STANDBY].

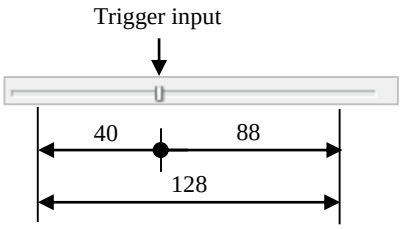
Set the trigger delay in the [TRIGGER] – [DELAY] field. When recording in the external signal (trigger) mode, the system recognizes the external signal (trigger) input signal after the delay time specified in [TRIGGER] – [DELAY] has elapsed. Delay times are specified at 10 ns intervals between 0 ns and 9,999,999,990 ns.

> ✎ Note
>
> The trigger delay time for the standby trigger mode is about 850 ns (fixed).

■ Setting the Trigger Point in [TRIGGER] – [POINT]

Select the frame for trigger detection in the [TRIGGER] – [POINT] field. It saves data from before and after the trigger signal.

Enter the trigger point setting values using the keyboard or mouse.
In this example, the trigger point is set to frame 40.



In this example, 40 frames are saved from before the trigger input and the remainder after the trigger input, until a total of 128 frames are recorded, including the 88 frames from after the trigger.

Fig. 5-13 shows the relationship between the trigger delay time and trigger point during recording.

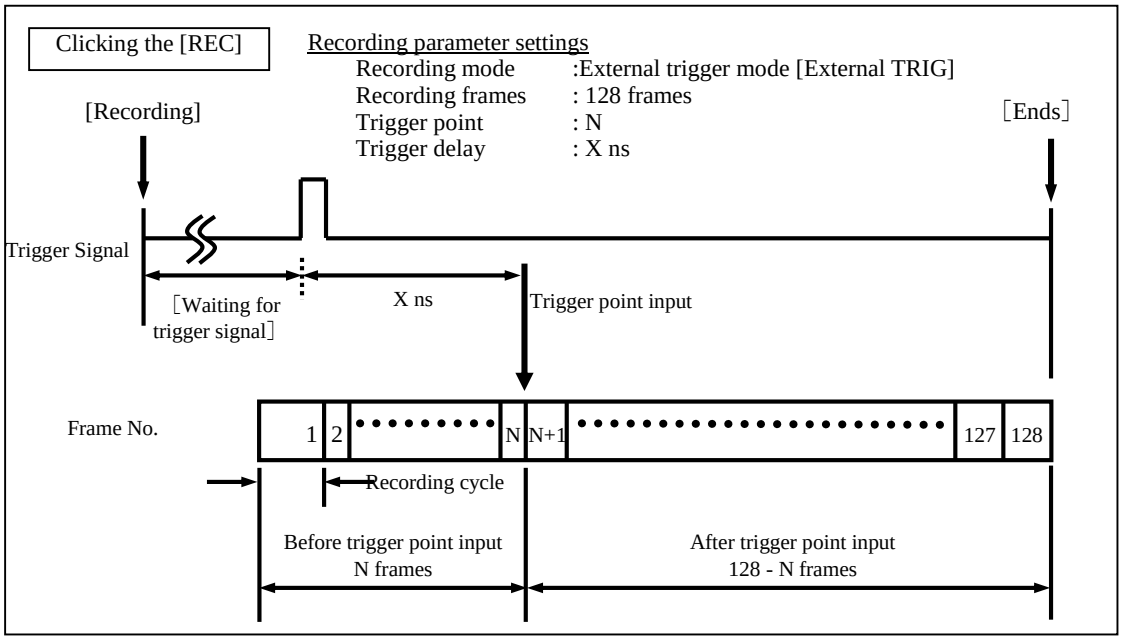


Fig. 5-13 Relationship between the trigger delay time and trigger point

■ Setting Polarity of External Signal (Standby OFF) in [STANDBY] – [POLARITY]

This setting is not necessary for the trigger mode [Internal], [External TRIG], [External SYNCIN], [R-External TRIG] or [R-External SYNCIN].

External signals (triggers) can be input in two ways – either as step up (POS) or step down (NEG) signals. In the [STANDBY] – [POLARITY] field, select either [POS] or [NEG].

■ Adjusting the Delay Time for External Signals (Standby OFF) in [STANDBY] – [DELAY]

This setting is not necessary for the external trigger mode [External TRIG] or continuous external trigger mode [R-External TRIG].

Set the standby delay in the [STANDBY] – [DELAY] field. When recording in the external signal (standby OFF) mode, the system recognizes the external signal (standby OFF) input signal after the delay time specified in [STANDBY] – [DELAY] has elapsed. Delay times are specified at 10 ns intervals between 100 ns and 9,999,999,990 ns.

■ Selecting the Exposure Time for Live Images in [LIVE] – [EXPOSE]

Select this setting in the [LIVE] – [EXPOSE] field. The default live image exposure time setting after initial startup is selectable from 200 ns, 500 ns, 1,000 ns, 2,000 ns, 5,000 ns, 10,000 ns, 20,000 ns, 50,000 ns, 100,000 ns, 1,000,000 ns, 2,000,000 ns, 5,000,000 ns, or 10,000,000 ns.

Clicking the  icon displays a window for editing the live image exposure time selection list (Fig. 5-14).

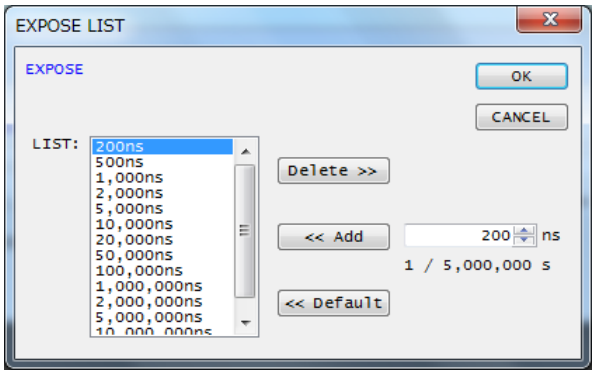


Fig. 5-14 Window for Editing the Live Image Exposure Time Selection List

Operations in the Window for Editing the Live Image Exposure Time Selection List

- Procedure for adding settings to the live image exposure time selection list

1. Display the window for editing the live image exposure time selection list (Fig. 5-14).

2. In the field to the right of the [<< Add] button, enter the live image exposure time setting to be added to the list.

3. Click [<< Add] to add the live image exposure time setting entered in step 2 to the [LIST] field.

4. Click [OK].

Save the settings and close the window. Once the settings are saved, the added live image exposure time settings are selectable in [LIVE] – [EXPOSE] in the [REC] window.

To not save the settings, click [CANCEL].

- Procedure for deleting settings from the live image exposure time selection list

1. Display the window for editing the live image exposure time selection list (Fig. 5-14).
2. Select the live image exposure time setting to delete from the [LIST].
3. Click [Delete >>] to delete the selected live image exposure time setting from the [LIST] field.
4. Click [OK].

   Save the settings and close the window. Once the settings are saved, the deleted exposure time settings are no longer selectable in [LIVE] – [EXPOSE] in the [REC] window.
   To not save the settings, click [CANCEL].

- Initializing the live image exposure time selection list (default settings)

1. Display the window for editing the live image exposure time selection list (Fig. 5-14).
2. Click [<< Default] to display a confirmation dialog box.
3. Click [YES] to initialize the live image exposure time selection list or [NO] to not initialize the list.

   Clicking [YES] resets the [LIST] values to default settings.
   Default values are 200 ns, 500 ns, 1,000 ns, 2,000 ns, 5,000 ns, 10,000 ns, 20,000 ns, 50,000 ns, 100,000 ns, 1,000,000 ns, 2,000,000 ns, 5,000,000 ns, and 10,000,000 ns.
4. Click [OK].

   Save the settings and close the window.
   To not save the settings, click [CANCEL].

■ Displaying a Live Image – [LIVE]

The [LIVE] button determines whether or not a live image is displayed in the Viewer window.

A live image is displayed if the [LIVE] button is clicked ON and not displayed if it is clicked OFF.

■ Recording – [REC]

In the internal trigger mode [Internal], clicking the [REC] button starts recording images immediately. In other recording modes, recording is started or stopped by an external signal input.

For more details, see [5.4.3. Recording] and [5.4.4 Synchronized Recording].

■ External Output Ports 1 and 2 in [AUXOUT1] or [AUXOUT2] – [MODE]

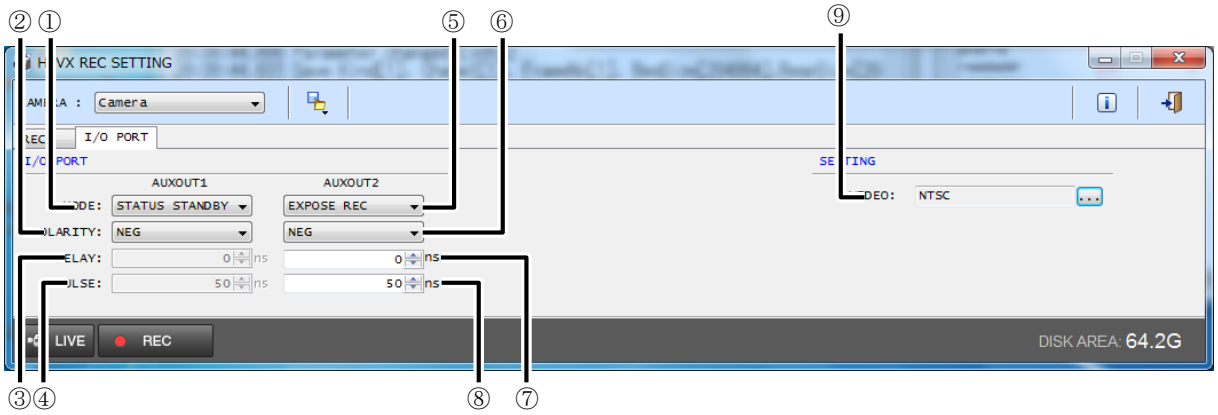


Fig. 5-15 [I/O PORT] Window

No.	Name	Description	See Page
①	[AUXOUT1 MODE]	Select the mode for external output port 1.	P.46
②	[AUXOUT1 POLARITY]	Set the polarity for external output port 1.	P.47
③	[AUXOUT1 DELAY]	Set the delay time for external output port 1.	P.47
④	[AUXOUT1 PULSE]	Set the pulse width for external output port 1.	P.48
⑤	[AUXOUT2 MODE]	Select the mode for external output port 2.	P.46
⑥	[AUXOUT2 POLARITY]	Set the polarity for external output port 2.	P.47
⑦	[AUXOUT2 DELAY]	Set the delay time for external output port 2.	P.47
⑧	[AUXOUT2 PULSE]	Set the pulse width for external output port 2.	P.48
⑨	[VIDEO]	Select the video output mode.	P.48

■ Selecting Modes

Clicking the 

icon displays eleven modes.

- EXPOSE REC
  Outputs the starting point of exposure periods for each frame during recording. Nothing is output during standby.
- EXPOSE LIVE
  Outputs the starting point of exposure periods for each frame in live images.
- EXPOSE BOTH
  Outputs the starting point of exposure periods for each frame during both recording and playing back live images. Nothing is output during standby.
- EXPOSE STANDBY
  Outputs the starting point of the exposure period for the first frame after the standby signal input.
  (If a standby delay time is specified in [STANDBY] – [DELAY], it outputs the starting point of the exposure period for the first frame after the delay.)
- EXPOSE TRIG
  Outputs the starting point of the exposure period for the first frame after the trigger signal input.
  (If a trigger delay time is specified in [TRIGGER] – [DELAY], it outputs the starting point of the exposure period for the first frame after the delay.)

- EXPOSE END
  Outputs the starting point of the exposure period for the last frame during recording.
- TRIG STANDBY
  Outputs a standby signal.
  (Does not include standby delay time, even if specified in [STANDBY] – [DELAY].)
- TRIG TRIG
  Outputs a trigger signal.
  (Does not include trigger delay time, even if specified in [TRIGGER] – [DELAY].)
- STATUS STANDBY
  Outputs standby periods (from start of waiting until the standby signal is detected).
  (Does not include standby delay time, even if specified in [STANDBY] – [DELAY].)
- STATUS TRIG
  Outputs signal during recording (from start of waiting until the trigger signal is detected).
  (Does not include standby delay time, even if specified in [STANDBY] – [DELAY].)
- STATUS REC
  Outputs signal during recording (from start of recording until the end of recording).
  (Does not include standby delay time, even if specified in [STANDBY] – [DELAY].)

■ Setting the Polarity of External Output Ports in [AUXOUT1] or [AUXOUT2] – [POLARITY]

External output port [AUXOUT] signals can be output in two ways – either as step up (POS) or step down (NEG) signals. In the [AUXOUT1] or [AUXOUT2] – [POLARITY] field, select either [POS] or [NEG].

■ Adjusting the Delay Time for External Output Ports in [AUXOUT1] or [AUXOUT2] – [DELAY]

This setting is unnecessary if [STATUS STANDBY], [STATUS TRIG], or [STATUS REC] is selected as the external output port mode in [AUXOUT1] or [AUXOUT2] – [MODE].

When outputting via external output ports, the system recognizes the output signal after the delay time specified in [AUXOUT1] or [AUXOUT2] – [DELAY] has elapsed. Delay times are specified at 10 ns intervals between 0 ns and 9,999,999,990 ns.

■ Adjusting the Pulse Width for External Output Ports in [AUXOUT1] or [AUXOUT2] – [PULSE]

This setting is unnecessary if [STATUS STANDBY], [STATUS TRIG], or [STATUS REC] is selected as the external output port mode in [AUXOUT1] or [AUXOUT2] – [MODE].

This setting outputs signals via external output ports with a pulse width specified in [AUXOUT1] or [AUXOUT2] – [PULSE]. Settings are specified at 10 ns intervals between 50 ns and 10,000,000 ns.

> ✎ Note
>
> When the pulse width is short or a long cable is used, output signal waveform may be deformed, hindering correct operation. In this case, adding a terminator may improve the condition though it reduces voltage magnitude.

■ Selecting the Video Output Mode – [VIDEO]

Two video output modes are available – either "NTSC" or "PAL" output. In the [VIDEO] field, select either [NTSC] or [PAL].

5.4.2 Adjusting Exposure

To adjust exposure, follow the procedure below and use the internal trigger mode [Internal].

1. Set up and switch ON illumination.
2. In recording parameter settings, change the recording mode in [REC] – [MODE] to the internal trigger mode [Internal].
3. Click [REC] in the application.

   Recording starts immediately and the image specified in "Selecting First Frame to Display" in 5.5 Playing Back Images, is displayed in the Viewer window.
4. Adjust the illumination, lens aperture, and exposure time while looking at the image until a suitable exposure is obtained.
5. If necessary, refocus the lens after adjusting the lens aperture.

   Repeat steps (3) to (5) until a suitable exposure is obtained.
   Similar adjustments are possible in the external trigger recording mode but a trigger is required to record images.

5.4.3 Recording

> **Note**
>
> Sensor elements generate heat during recording. Therefore, to protect the sensor elements from heat when recording at speeds of 5Mfps or more, in all recording modes except the internal trigger mode [Internal], recording is stopped if a trigger signal is not detected within 60 seconds in waiting a trigger signal. Recording is also stopped if 60 minutes have elapsed since recording started.
>
> In some cases, depending on the ambient temperature, continuous recording, or other factors, recording may stop to protect the sensor elements from heat when they become hot. Once the element protection mode starts, recording is disabled until element temperature drops and element protection is switched OFF.

■ Recording in Internal Trigger Mode [Internal]

Clicking [REC] starts recording immediately and displays a window (Fig. 5-16).

To stop recording before it is finished, click [REC STOP]. After recording is finished, the image specified in "Selecting First Frame to Display" in 5.5 Playing Back Images, is displayed in the Viewer window.

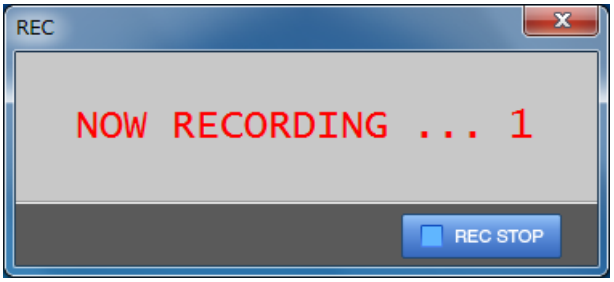


Fig. 5-16 Window Displayed During Recording and External Signal Standby

■ Recording in External Standby Mode [External STANDBY]

In this mode, recording starts immediately after receiving a standby signal input. This mode is used to ensure the time recorded for the standby signal input and start of recording are the same.

In "Selecting the Recording Mode in [REC] – [MODE]" in 5.4.1 Setting Recording Parameters, specify the external trigger mode [External STANDBY] to use as the recording mode. Then click [REC]. The window in Fig. 5-16 is displayed and recording remains in standby mode until a standby signal is input.
To not record or to stop recording before it is finished, click [REC STOP].

After the standby signal input and recording finishes, the image specified in "Selecting First Frame to Display" in 5.5 Playing Back Images, is displayed in the Viewer window.

■ Recording in the External Trigger Mode [External TRIG]

This mode records frames before and after the trigger signal input.
In "Selecting the Recording Mode in [REC] – [MODE]" in 5.4.1 Setting Recording Parameters, specify the external trigger mode [External TRIG] to use as the recording mode. Then click [REC]. After the window in Fig. 5-16 is displayed and recording starts, the system waits for a trigger signal. To not record or to stop recording before it is finished, click [REC STOP].

After the trigger signal input and recording finishes, the image specified in "Selecting First Frame to Display" in 5.5 Playing Back Images, is displayed in the Viewer window.

■ Recording in the External Trigger Mode [External SEPARATE]

This mode is a combination of the external standby and external trigger modes. It is used to record images after the camera has been in standby a long time.
In "Selecting the Recording Mode in [REC] – [MODE]" in 5.4.1 Setting Recording Parameters, specify the external trigger mode [External SEPARATE] to use as the recording mode. Then click [REC]. The window in Fig. 5-16 is displayed and the system waits until standby and trigger signal inputs are detected. About 850 ns after the standby signal is input, it starts waiting for the trigger signal. After the trigger signal is detected, it records the specified number of frames.
To not record or to stop recording before it is finished, click [REC STOP].

After the external signal (standby OFF) and external signal (trigger) are input and recording is finished, the image specified in "Selecting First Frame to Display" in 5.5 Playing Back Images, is displayed in the Viewer window.

■ Recording in the Continuous External Trigger Mode [R-External STANDBY]

This mode allows repeatedly recording frames using the external standby mode [External STANDBY]. It starts recording when a standby signal is input and reads the image data after recording is finished. Then it immediately starts waiting for input of the next standby signal to repeat the process.

In "Selecting the Recording Mode in [REC] – [MODE]" in 5.4.1 Setting Recording Parameters, specify the continuous external trigger mode [R-External STANDBY] to use as the recording mode. Then click [REC]. The window in Fig. 5-16 is displayed and recording remains in standby mode until a standby signal is input. To not record or to stop recording before it is finished, click [REC STOP].

After the external signal (standby OFF) input and recording finishes, the image specified in "Selecting First Frame to Display" in 5.5 Playing Back Images, is displayed in the Viewer window. Then the window in Fig. 5-16 is displayed and recording starts in standby mode waiting for an external signal (standby OFF).
The "NOW RECORDING…" window shown in Fig. 5-16 indicates the current number of times recording was performed.

■ Recording in the Continuous External Trigger Mode [R-External TRIG]

This mode allows repeatedly recording using the external trigger mode [External TRIG]. Clicking [REC] starts recording with the camera in standby mode waiting for a trigger signal. After a trigger signal is input, it records the specified number of frames and reads the image data. Then it immediately starts waiting for input of the next trigger signal to repeat the process.

In "Selecting the Recording Mode in [REC] – [MODE]" in 5.4.1 Setting Recording Parameters, specify the continuous external trigger mode [R-External TRIG] to use as the recording mode. Then click [REC]. The window in Fig. 5-16 is displayed and the system waits until an external trigger signal input is detected. To not record or to stop recording before it is finished, click [REC STOP].

After the external trigger signal input and recording finishes, the image specified in "Selecting First Frame to Display" in 5.5 Playing Back Images, is displayed in the Viewer window.
Then the window in Fig. 5-16 is displayed and recording starts in standby mode waiting for an external trigger signal. The "NOW RECORDING" window shown in Fig. 5-16 indicates the current number of times recording was performed.

■ Recording in the Continuous External Trigger Mode [R-External SEPARATE]

This mode allows repeated recording using the external separate mode [External SEPARATE].

In "Selecting the Recording Mode in [REC] – [MODE]" in 5.4.1 Setting Recording Parameters, specify the continuous external trigger mode [R-External SEPARATE] to use as the recording mode. After clicking [REC], the system starts waiting for a standby signal. After the standby signal is input, it starts recording by waiting for a trigger signal. When the trigger signal is input, it records the specified number of frames and reads the image data. Then it immediately starts waiting for input of the next standby signal. This process is then repeated. To not record or to stop recording before it is finished, click [REC STOP].

After the external signal (standby OFF) and external signal (trigger) are input and recording is finished, the image specified in "Selecting First Frame to Display" in 5.5 Playing Back Images, is displayed in the Viewer window.
Then the window in Fig. 5-16 is displayed and recording starts again in standby mode waiting for an external trigger signal.
The "NOW RECORDING…" window shown in Fig. 5-16 indicates the current number of times recording was performed.

5.4.4 Synchronized Recording

This function enables recording in synchronized frame timing by connecting two cameras using a synchronization cable.

The cameras can be distinguished as the master camera that sends signals and the slave camera that receives signals by setting how the synchronization cable is connected.

When the cover on the rear of the camera is removed, then the synchronization signal input and output connectors can be found.

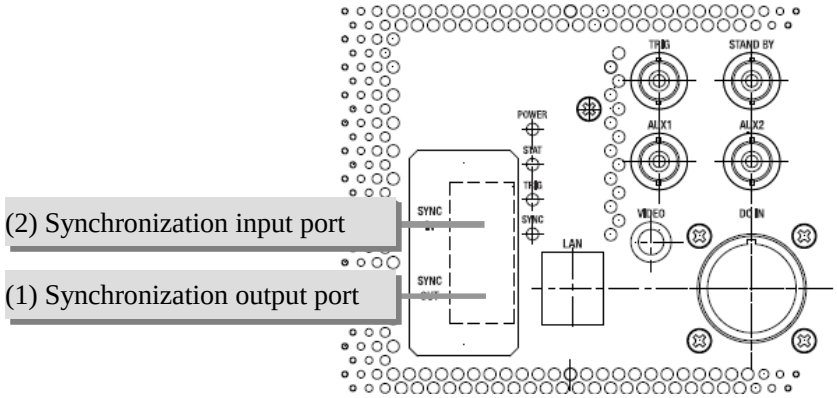


Fig. 5-17 Rear of the Camera

No.	Part Name	Description
①	Synchronization signal output connector	Port used to connect the synchronization cable. It sends timing signals.
②	Synchronization signal input connector	Port used to connect the synchronization cable. It receives timing signals.

> ✎ Note
>
> Be sure to use the optional synchronization cable.
> One control PC cannot control two cameras.

The camera with the synchronization cable connected to its synchronization signal output connector becomes the master camera and the camera with the synchronization cable connected to its synchronization signal input connector becomes the slave camera.

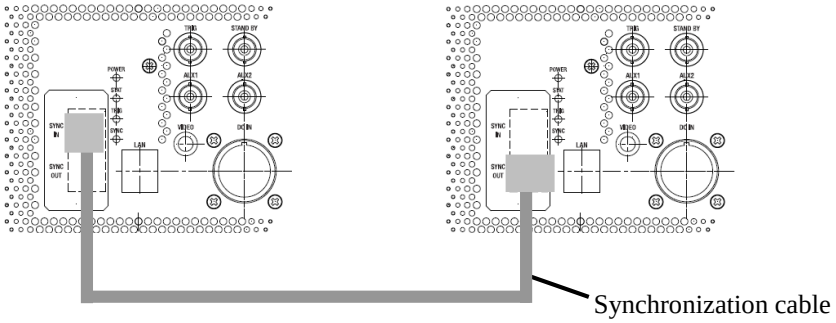


Fig. 5-18 Synchronization Cable Layout Diagram

> **Note**
>
> Do not connect the cable to the LAN connector.
> Do not connect the both ends of the cable to the synchronization signal output connectors.
> Synchronized recording cannot be performed by connecting three or more cameras.

■ Recording in the External Trigger Mode [External SYNCIN]

The slave camera records images at the same time as the master camera via the synchronization cable connected to the SYNC IN connector.

This section describes recording when the master camera is set in the external trigger mode [External SEPARATE].

First, configure settings on the slave camera.

In "Selecting the Recording Mode in [REC] – [MODE]" in 5.4.1 Setting Recording Parameters, specify the external trigger mode [External SYNCIN] to use as the recording mode. Then click [REC]. The window in Fig. 5-16 is displayed and the system waits until standby and trigger signal inputs from the master camera are detected.

Then, configure settings on the master camera.

In "Selecting the Recording Mode in [REC] – [MODE]" in 5.4.1 Setting Recording Parameters, specify the external trigger mode [External SEPARATE] to use as the recording mode. Then click [REC]. The window in Fig. 5-16 is displayed and the system waits until standby and trigger signal inputs from the master camera are detected.

About 850 ns after the standby signal is input, it starts waiting for the trigger signal. After the trigger signal is input, it records the specified number of frames.
To not record or to stop recording before it is finished, click [REC STOP].

After the external signal (standby OFF) and external signal (trigger) are input and recording is finished, the image specified in "Selecting First Frame to Display" in 5.5 Playing Back Images, is displayed in the Viewer window.

■ Recording in the Continuous External Trigger Mode [R-External SYNCIN]

This mode allows repeatedly recording frames using the external trigger mode [External SYNCIN].

This section describes recording when the master camera is set in the external trigger mode [External SEPARATE].

First, configure settings on the slave camera.

In "Selecting the Recording Mode in [REC] – [MODE]" in 5.4.1 Setting Recording Parameters, specify [R-External SYNCIN] to use as the recording mode. Then click [REC]. The system waits until standby and trigger signal inputs from the master camera are detected.

Then, configure settings on the master camera.

In "Selecting the Recording Mode in [REC] – [MODE]" in 5.4.1 Setting Recording Parameters, specify the external trigger mode [External SEPARATE] to use as the recording mode. Then click [REC]. The window in Fig. 5-16 is displayed and the system waits until standby and trigger signal inputs from the master camera are detected.

About 850 ns after the standby signal is input, it starts waiting for the trigger signal. After the trigger signal is input, it records the specified number of frames and reads the image data. Then, it immediately starts waiting for input of the next standby signal. This process is then repeated.
To not record or to stop recording before it is finished, click [REC STOP].

The image specified in "Selecting First Frame to Display" in 5.5 Playing Back Images, is displayed in the Viewer window.
Then, the window in Fig. 5-16 is displayed and the system starts waiting for recording and an external signal.
The "NOW RECORDING" window shown in Fig. 5-16 indicates the current number of times recording was performed.

✎ Note

The standby signal and trigger signal operations of the slave camera are approximately 110 ns delay from the operations of the master camera. Adding approximately 110 ns to the [TRIGGER] – [DELAY] and [STANDBY] – [DELAY] values of the master camera improves the synchronization accuracy of videos.

Synchronized recording is performed by allowing the slave camera to share the master camera's timing signal to start recording. For this reason, the slave camera needs to enter a status waiting for the timing signal to start recording sent from the master camera before the master camera sends the signal. During synchronized recording, set the recording mode of the master camera to a mode other than [R-External STANDBY], [R-External TRIG], and [R-External SEPARATE].

To stop synchronized recording, stop recording on both cameras.

5.5 Playing Back Images

The HPV-X software immediately displays recorded images as moving images. Images can also be played back one frame at a time by manual operation.

Before playing back moving images, click [DETAIL] in Viewer and set the playback parameters.

5.5.1 Setting Playback Parameters – Viewer Operations

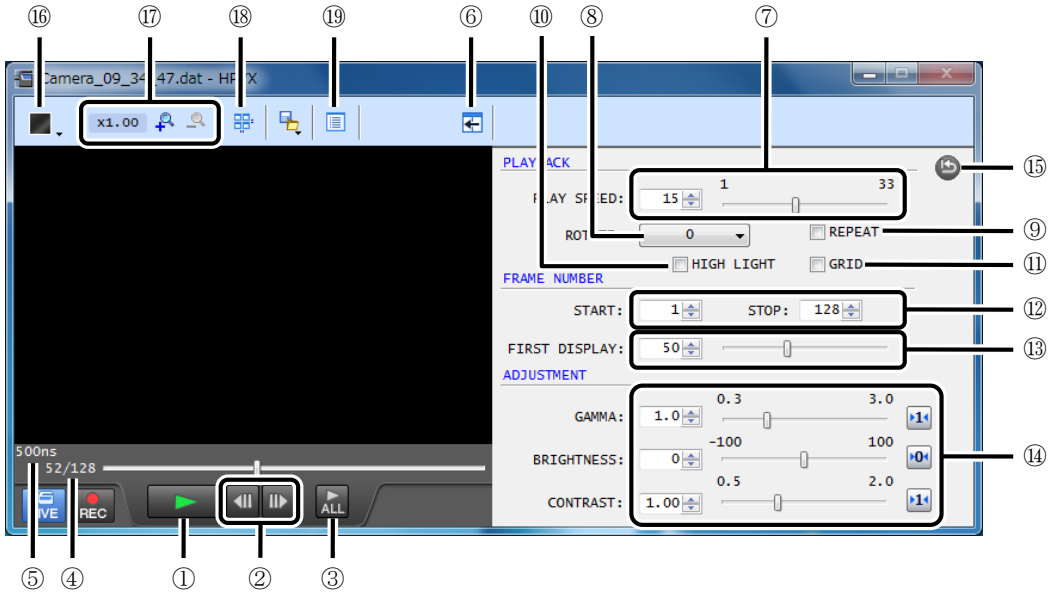


Fig. 5-19 Setting Playback Parameters in the Viewer Window

No.	Name	Description	See Page
①	／	Playback/stop	P.56
②	／	Moves one frame back/forward.	P.56
③	／	Plays all or stops all.	P.56
④	Frame No.	Displays the current frame number.	P.56
⑤	Relative Time Since Trigger Input	Relative time since trigger input	P.56
⑥	／［DETAIL］	Switches display mode for playback parameter settings window.	P.56
⑦	［PLAY SPEED］	Set playback speed.	P.56
⑧	［ROTATE］	Set display angle.	P.56
⑨	［REPEAT］	Specifies repeated playback.	P.57
⑩	［HIGH LIGHT］	Displays overexposure area.	P.57
⑪	［GRID］	Displays grid.	P.57
⑫	［START］ ［STOP］	Set frame range.c	P.57
⑬	［FIRST DISPLAY］	Select the first frame to display.	P.57
⑭	［GAMMA］ ［BRIGHTNESS］ ［CONTRAST］	Set playback window display settings.	P.57

No.	Name	Description	See Page
⑮		Restores default settings.	P.58
⑯		Switches window display mode.	P.58
⑰	Zoom Rate	Sets image display magnification setting.	P.59
⑱		Organizes Viewer windows into rows and columns.	P.60
⑲		Displays details.	P.60

■ Play/Stop (/)

Plays back the currently displayed image.

To stop playback midway, click the icon. (See 5.5.2 Playing Back Images)

■ One Frame Back/Forward (/)

Moves the currently displayed image one frame back or forwards.

Clicking the icon displays the frame before the currently displayed frame. Clicking the icon displays the next frame after the currently displayed frame.

■ Play All/Stop All (/)

Plays image data simultaneously in all currently displayed Viewers. To stop playback, click the icon in each individual Viewer.

Clicking the icon stops playback in all Viewers that are playing back image data.Viewer

■ Current Frame Number Display

Displays the frame number of the currently displayed image.

"----/----" is displayed when there is no displayed image.

■ Relative Time Since Trigger Input

Displays the relative time since the trigger input was detected for the currently displayed image.

"----,----,----ns" is displayed when there is no displayed image.

■ Playback Parameter Settings Window [Detail]

Clicking the icon displays the playback parameter settings window (playback parameter settings area shown in 2.2 Control Computer (Application) Functions).

Clicking the icon closes the playback parameter settings window.

■ Playback Speed Setting [PLAY SPEED]

The playback speed is set in terms of fps (frames per second), which indicates how many frames are displayed per second.

The playback speed can be set to any value between 1 fps (minimum) and 33 fps (maximum).

■ Display Angle Setting [ROTATE]

Images can be rotated by 0 degree, 90 degree, 180 degree, or 270 degree, or mirrored.

■ Repeated Playback Setting [REPEAT]

Set whether or not to repeat playback.
Playback is repeated when [REPEAT] is selected.
When [REPEAT] is not selected, images are only played back once.

■ Overexposed Area Display [HIGH LIGHT]

Set whether to display/hide overexposed areas of the displayed image.
When [HIGH LIGHT] is selected, overexposed areas are displayed in red. When [HIGH LIGHT] is not selected, images are displayed as normal, with overexposed areas not displayed.

■ Grid Display [GRID]

Set whether to display/hide grid lines in the displayed images.
When [GRID] is selected, grid lines are displayed.
When [GRID] is not selected, grid lines are not displayed.

■ Frame Range Setting [START] [STOP]

Set the first and last frames displayed during playback.

■ Selecting First Frame to Display [FIRST DISPLAY]

Select the frame number of the first frame displayed in the Viewer window after recording. The image of the frame number selected in [FIRST DISPLAY] is displayed in the Viewer window.

■ Playback Window Display Settings

- ［GAMMA］
  Set the gamma correction values for displaying images in the playback window.
  Gamma correction values can be adjusted between 0.3 and 3.0 in the [GAMMA] field.
  Clicking the  icon resets the setting to [1.0].
- ［BRIGHTNESS］
  Set the brightness of images displayed during playback.
  Brightness values can be adjusted between -100 and 100 in the [BRIGHTNESS] field.
  Clicking the  icon resets the setting to [0].
- ［CONTRAST］
  Set the contrast of images displayed during playback.c
  Contrast values can be adjusted between 0.5 and 2.0 in the [CONTRAST] field.
  Clicking the  icon resets the setting to [1.00].

■ Default Settings ( )

Restores playback parameter settings to their default values.
Clicking the con displays the default value setting confirmation window (Fig. 5-20).

Clicking [Yes] sets playback parameter settings to their default values.
Clicking [No] cancels restoring default values.

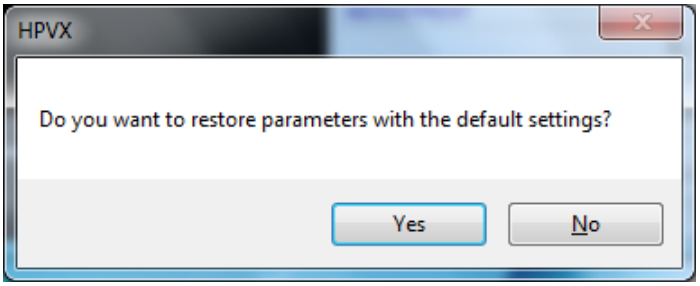


Fig. 5-20 Default Value Setting Confirmation Window

■ Window Display Mode

Click the icon to switch between the following two window display modes.

- Normal display [Normal View]
  Displays images normally in the Viewer.

- Enlarged view [Scope View]
  Displays images magnified by four times. Since the displayed area can move when images are enlarged, vertical and horizontal scroll bars appear in the Viewer window. Sliding the sliders with the mouse allows moving the displayed area of the image. The enlargement status can be played back as well.

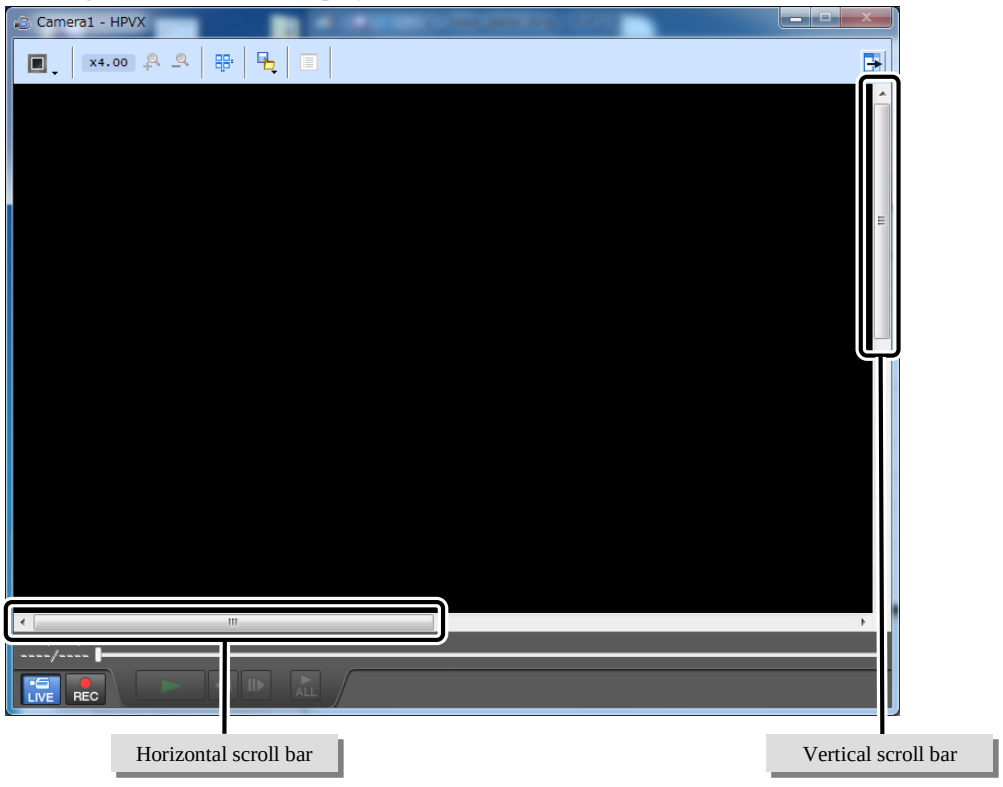


Fig. 5-21 Scope View Display

■ Zoom Rate

- Zoom rate of displayed image x1.00
  Displays the magnification rate of the currently displayed image.
- Zoom In
  (This icon is not available when there is no image data displayed in Viewer.)
  This icon enlarges the displayed image. The magnification rate can be set to x1.5 or x2 the current magnification of the displayed image. Note, however, that the maximum enlargement ratio is x2.
- Zoom Out
  (This icon is not available when there is no image data displayed in Viewer.)
  This icon reduces the displayed image. The magnification rate can be set to x1 or x1.5 the current magnification of the displayed image. Note, however, that the minimum magnification rate is x1.

> **Note**
>
> Images can be displayed at higher magnification rates than 2 times by using the scope view function described in "■Window Display Mode" to achieve 4 times magnification

> **Note**
>
> The Viewer window size can be changed by dragging the edge of the window, but that does not change the magnification rate.
>
> The window size cannot be increased larger than the indicated enlarged window size by dragging. Making the window smaller than the indicated size displays vertical and horizontal scroll bars in Viewer. Sliding the sliders with the mouse allows moving the displayed area of the image.

■ Viewer Window Cleanup

Displays the currently displayed Viewer windows in evenly spaced rows and columns.

For up to four windows, windows are displayed spaced apart. For five or more windows, windows are displayed tiled.

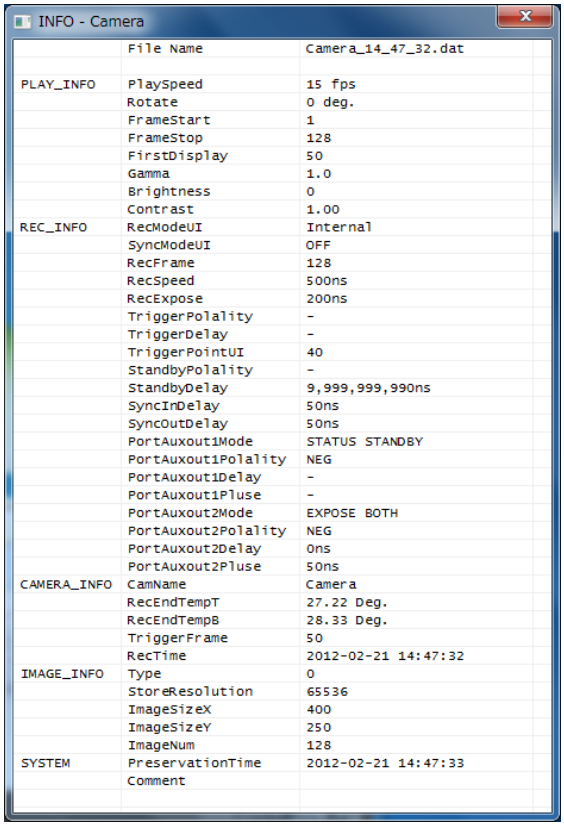
> **Note**
>
> Viewer windows are spaced evenly so they do not overlap, but for some screen resolutions the edges may overlap.

■ Details Display

(This icon is not available when there is no image data displayed in Viewer.)

This icon displays detailed information (e.g. recording parameters) of the currently displayed image data (Fig. 5-22).

To close the detailed information confirmation window, click the icon or click the icon again.



	File Name	Camera_14_47_32.dat
PLAY_INFO	PlaySpeed	15 fps
	Rotate	0 deg.
	FrameStart	1
	FrameStop	128
	FirstDisplay	50
	Gamma	1.0
	Brightness	0
	Contrast	1.00
REC_INFO	RecModeUI	Internal
	SyncModeUI	OFF
	RecFrame	128
	RecSpeed	500ns
	RecExpose	200ns
	TriggerPolality	-
	TriggerDelay	-
	TriggerPointUI	40
	StandbyPolality	-
	StandbyDelay	9,999,999,990ns
	SyncInDelay	50ns
	SyncOutDelay	50ns
	PortAuxout1Mode	STATUS STANDBY
	PortAuxout1Polality	NEG
	PortAuxout1Delay	-
	PortAuxout1Pluse	-
	PortAuxout2Mode	EXPOSE BOTH
	PortAuxout2Polality	NEG
	PortAuxout2Delay	0ns
	PortAuxout2Pluse	50ns
CAMERA_INFO	CamName	Camera
	RecEndTempT	27.22 Deg.
	RecEndTempB	28.33 Deg.
	TriggerFrame	50
	RecTime	2012-02-21 14:47:32
IMAGE_INFO	Type	0
	StoreResolution	65536
	ImageSizeX	400
	ImageSizeY	250
	ImageNum	128
SYSTEM	PreservationTime	2012-02-21 14:47:33
	Comment	

Fig. 5-22 Detailed Information Confirmation Window

5.5.2 Playing Back Images

Follow the procedure below to play back recorded images.

1. Click the icon in the Viewer window.
2. Set playback parameter settings. (See 5.5.1 Setting Playback Parameters – Viewer Operations.)
3. Click the icon in the Viewer window.

   The image is played back.
   To stop playback before it is finished, click the icon.

It is also possible to play back saved files. (See 5.6 Image File Management and System Shutdown.)

5.6 Image File Management and System Shutdown

On the HPV-X sofware, recorded images can be saved as image files.

File operations allow files to be displayed, unwanted files to be deleted, and files to be converted. To perform file operations, click the file operation list icon in Viewer and select the desired operation and image file.

5.6.1 Image File Operations

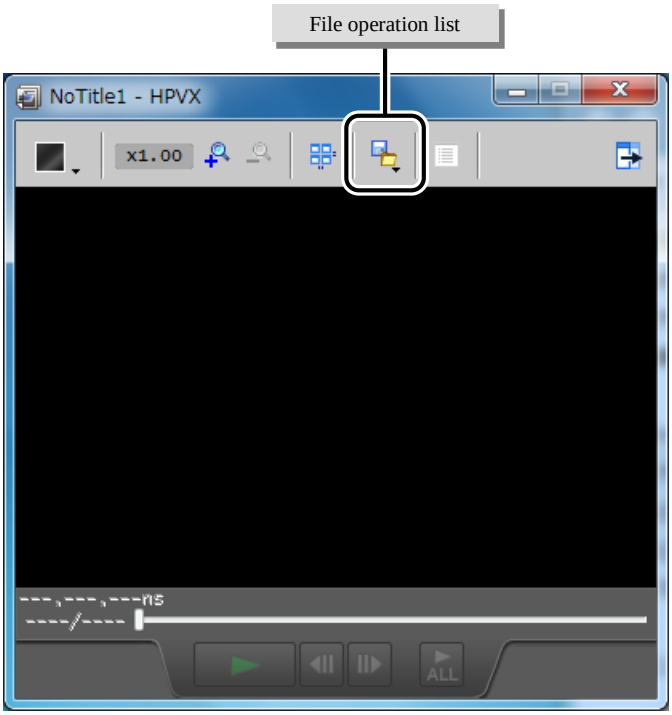


Fig. 5-23 Viewer Window (File Operation Area)

■ File Operation List 

- Opening files [OPEN]
  Clicking [OPEN] displays the open confirmation window (Fig. 5-24).
  Clicking [Yes] opens the image file in a new Viewer window. Clicking [No] opens the image file in the currently active Viewer window.

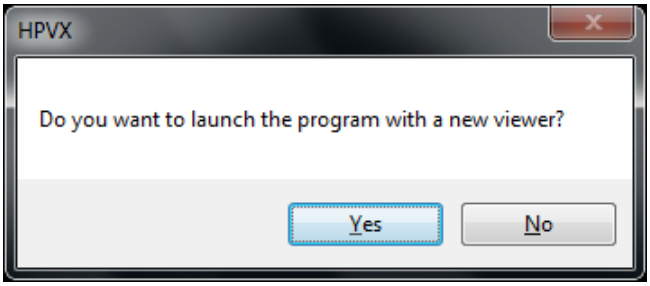


Fig. 5-24 Open Confirmation Window

> **Note**
>
> If the Viewer window is not interlocked to the camera and the recorded image is not displayed, the confirmation window in Fig. 5-19 is not displayed. In that case, the recorded image is displayed unconditionally in the currently active Viewer window.

Clicking [Yes] or [No] displays a window for opening files (Fig. 5-25).
Select the desired image file to display and click [Open] to display the selected image file in a Viewer window.
To abort the operations, click [Cancel].

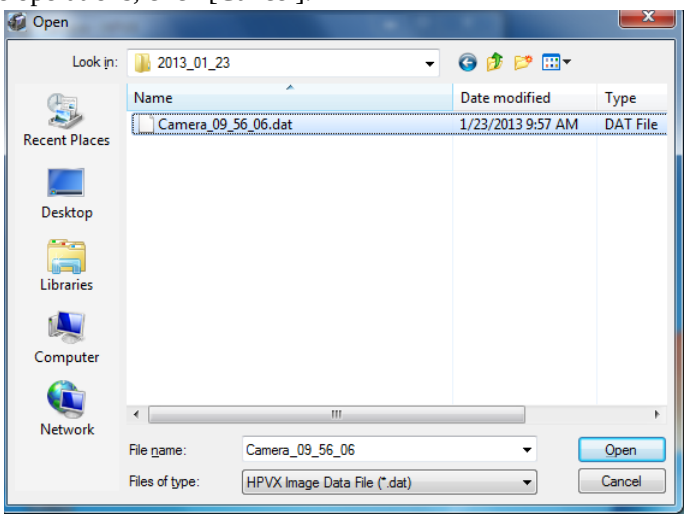


Fig. 5-25 Window for Opening Files (OPEN)

> **Note**
>
> Up to eight Viewer windows can be displayed simultaneously.

- Saving files [SAVE]
  Clicking [Save] displays a window for saving files.
  For details, see 5.6.2 Saving Image Files.
- Converting files [CONVERT]
  Clicking [Convert] displays a window for converting files (Fig. 5-26).
  Select the image file to convert and then click [Convert]. (Multiple image files can be selected by holding down the [Ctrl] key and right-clicking on the desired files.)
  In the [Convert Type] field, select the type of file to convert (BMP, JPEG, AVI(8-bit), AVI(24-bit), TIFF, or TIFF (16-bit).
  Converted image files are saved to the respective folders listed in Fig. 5-23, in 5.6.2 Saving Image Files.
  To abort the operations, click [Cancel].

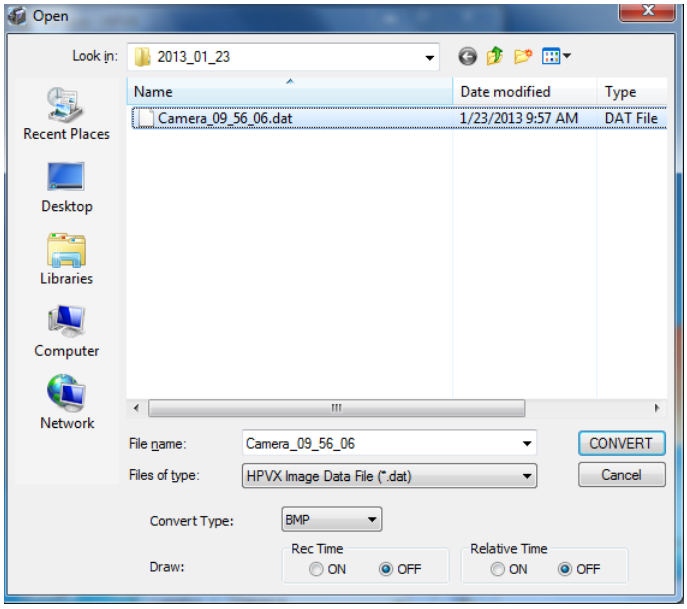


Fig. 5-26 File Conversion Window (CONVERT)

> **Note**
>
> If a TIFF (16-bit) image cannot be displayed correctly in the currently active Viewer, change the "Tiff16Upper=" [Auto Save Setting] to either "0" or "1" in the "HPVX.ini" file, located in the same folder as the "HPVX.exe" file, before converting the image.
>
> To display TIFF (16-bit) images in standard Windows software (such as Windows Media Player) set it to "1." The default setting is "1." (Do not change anything else in the "HPVX.ini" file.)

> **Note**
>
> The file conversion function is applied only to existing image files.
>
> To convert the format of recorded images, first save the recorded image as an image file.

- Deleting files [DELETE]
  To delete a file, first display the desired image data in a Viewer window. If the file is not yet displayed, click [OPEN] to open the image file to be deleted.
  When the file to be deleted is displayed, click [DELETE]. A confirmation dialog box (Fig. 5-27) is displayed to prevent unintentional deletion of files.
  Confirm the name of the file to delete and then click [OK].
  To cancel the deletion, click [CANCEL].

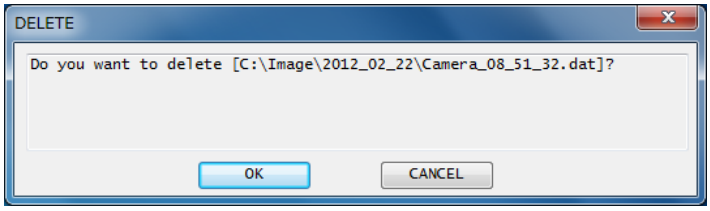


Fig. 5-27 Deletion Confirmation Dialog Box (DELETE)

5.6.2 Saving Image Files

This section describes the procedure for saving recorded images (Figs. 5-28, 5-29, and 5-30).

Factory settings save images to the "Image" folder on the C: drive. To save images on a different drive, change the "C" or other drive name indicated in the "ImagePath=C:¥Image" in the "HPVX.ini" file, located in the same folder as the "HPVX.exe" file, to the desired drive. (Do not change anything else in the HPVX.ini file.)

When images are recorded for the first time on a particular day, image files are automatically saved in the "Image" folder, in a subfolder named based on the current date ("2012_01_09" for a folder created on January 9, 2012, for example).

In addition, dedicated 16-bit format image files are automatically created inside the "YYYY_MM_DD" folder. These files are named based on the name of the camera used for recording and the time the images were recorded, in the form "(camera name)_HH_MM_SS.dat" (where, "Cam1_12_34_56.dat" indicates an image file recorded at 12:34:56 using camera "Cam1," for example).

Also, if an image file format other than DAT is selected, as described in "Selecting the format for saving recording data" in 5.4.1 Setting Recording Parameters, a folder named "BMP," "JPEG," "AVI8, "AVI24," "TIFF," or "TIFF16" is automatically created at the same directory level as where the image file is saved and image data is saved in that folder, separated into individual folder named in the form "(camera name)_HH_MM_SS" folders. (See Fig. 5-28.)

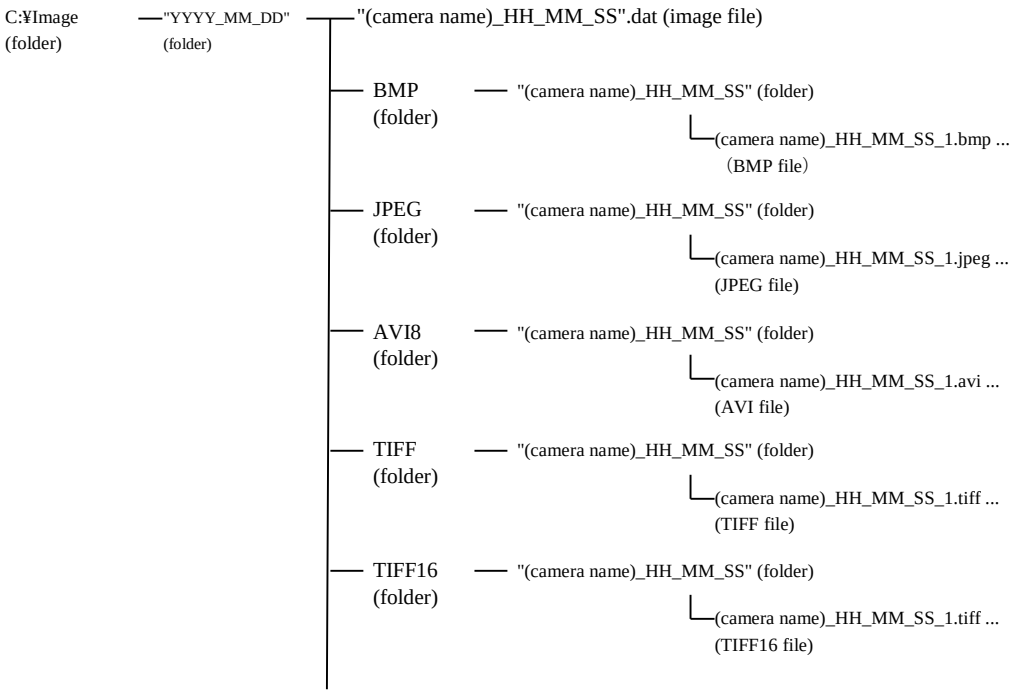


Fig. 5-28 Hierarchical Structure of Data Files

If the available space on the drive where images are save drops below 200 MB, clicking the [REC] button will display a confirmation dialog box. (See "Recording" in 5.4.1 Setting Recording Parameters.)

If the message appears, free up at least 200 MB of space on the drive for saving the image data or change the destination to a different drive with at least 200 MB of space available.

The free space required for each recording using respective file formats is indicated in Table 5-1.

Table 5-1 Space Requirements for Image Files

Number of Frames	Format	Space Required
128	Dedicated 16-bit (dat)	About 25 Mbyte
	bmp	About 12 Mbyte
	jpeg	About 300 Kbyte
	avi8	About 12 Mbyte
	avi24	About 36 Mbyte
	tiff	About 400 Kbyte
	tiff16	About 25 Mbyte
256	Dedicated 16-bit (dat)	About 50 Mbyte
	bmp	About 24 Mbyte
	jpeg	About 600 Kbyte
	avi8	About 24 Mbyte
	avi24	About 72 Mbyte
	tiff	About 800 Kbyte
	tiff16	About 50 Mbyte

■ 16-Bit Dedicated (DAT) Format (When Adding Comments and Resaving)

1. Display the image that is to be saved with comments in the Viewer window.

   Load the applicable image data, as described in 5.6.1 Image File Operations.

2. Click [SAVE] from file operation list icon to display the window for saving files.

3. Select [Header File] – [ON] to save metadata in image files, as shown in Fig. 5-29, or [OFF] to not save the information.

   For more information about metadata in image files, see 5.7.2 Metadata in Image Files.

4. Enter any comments in the [Comment] field in the window for saving files.

5. Specify where to save the file in the [Saving Place] field.

6. If necessary, change the file name.

7. Select "DAT" in [Save Type].

8. Click [Save].

When overwriting a file, the original DAT file is updated.
If the file name is changed, the DAT file is created in the current directory using the new file name.
To not save the file, click [Cancel].

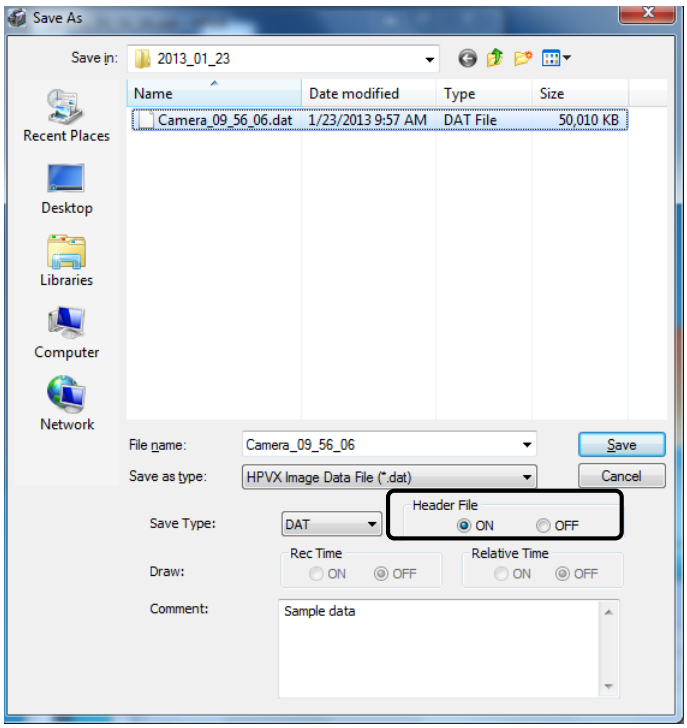


Fig. 5-29 Window for Saving Files 1 (SAVE)

■ Other Formats

1. Display the image that is to be saved with comments in the Viewer window.

Load the applicable image data, as described in 5.6.1 Image File Operations.

2. Click [SAVE] from the file operation list icon to display the window for saving files.

3. Since the converted image file is named based on the name of the DAT file being converted, change the file name as required.

4. Select the file format from BMP, JPEG, AVI(8-bit), AVI(24-bit), TIFF or TIFF (16-bit) in [Save Type].

To specify including the date/time or relative time information in the lower right corner of images, as shown in Fig. 5-31, select [ON] for [Rec Time] and [Relative Time] settings in the window for saving files (Fig. 5-30) or [OFF] to not display the information.

5. Specify the destination for saving the file.

6. Click [Save].

If saving to a file format other than DAT, a folder named for the specified file format (such as "BMP" folder or folder named based on the file name if BMP format is specified) is created in the destination folder. Then the converted image file is saved in these folders.
To not save the file, click [Cancel].

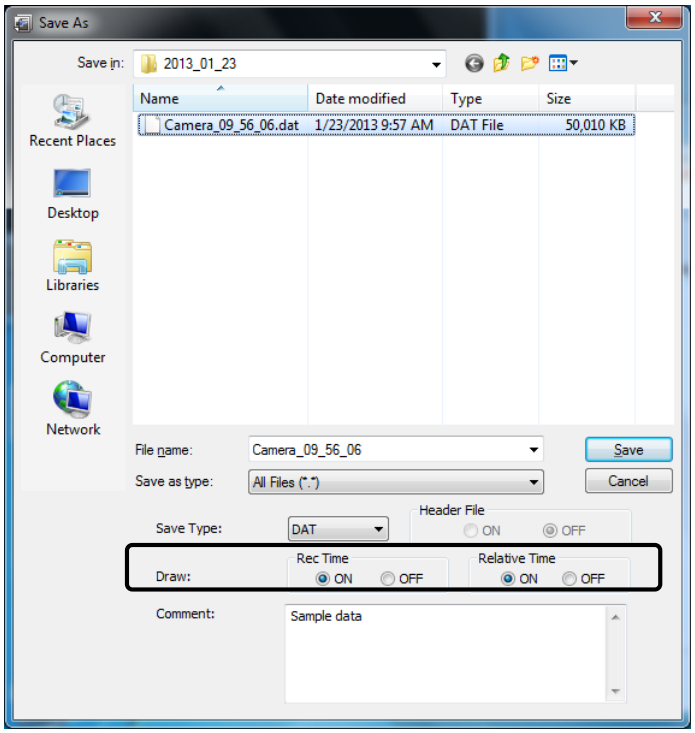


Fig. 5-30 Window for Saving Files 2 (SAVE)

Fig. 5-31 Inserting Recording Time and Time Relative to Trigger Input in Images

> **Note**
>
> When recorded images are saved, they are saved after the playback parameters (playback speed, display angle, and playback window display settings) are applied to images in the Viewer window.

5.6.3 Closing the Application

Clicking the  icon in the recording parameter settings window displays a shutdown confirmation dialog box (Fig. 5-32).

To exit the application, click [Yes].

To cancel the exit, click [No].

For instructions on how to log out, see 4.4 Logging In and Out of Windows.

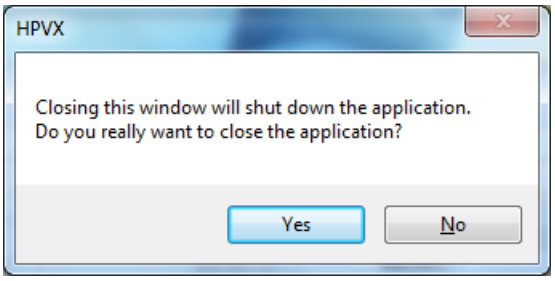


Fig. 5-32 Shutdown Confirmation Dialog Box

5.7 Input/Output File Formats

5.7.1 Image File Formats

■ File Composition

Description	Proprietary format for saving both recorded images and metadata Saved after recording is finished.

Tag Entries	Item	Size
	Data tag	4 byte
	Type of data 0:CHAR（INT8） 1:SHORT（INT16） 2:INT（INT32） 3:SYSTEMTIME（16byte）	2 byte
	Data count	4 byte
	Data position	4 byte
	Values	Varies depending on data content.

File Structure	Binary format
Data Elements	Consists of the following tag entries for each data record.
File Extension	.dat
Image Data Format	DIB Data Format

■ Information Saved

Data Content		Tag Entries			Remarks
Section	Key	Data Tag (4 byte)	Type of Data (2 byte)	Data Count (4 byte)	
SYSTEM	Date	Fixed binary from beginning of file (16 bytes)			Setting value: Systemtime type
	RecordVersion	Fixed binary from beginning of file (4 bytes)			Setting value: -5:HPV-X
	Comment	0x1010, 0x1001	0	1024	Setting value: (Character string) ASCII, SHIFT-JIS, carriage return code (CR+LF), and "¥0" pre-added to end of character strings
PLAY_INFO	PlaySpeed	0x2020, 0x2001	2	1	Setting values: 1 to 33 (fps)
	Display angle	0x2020, 0x2002	2	1	Setting value: 0 : 0° 1 : 90° 2 : 180° 3 : 270° 4 : Mirror
	Playback starting frame	0x2020, 0x2003	2	1	Setting value: 1 to 255
	Playback stopping frame	0x2020, 0x2004	2	1	Setting value: 2 to 256
	Display frame	0x2020, 0x2005	2	1	Setting value: 1 to 255

Data Content		Tag Entries			Remarks
Section	Key	Data Tag (4 byte)	Type of Data (2 byte)	Data Count (4 byte)	
	Gamma correction factor	0x2020, 0x2006	2	1	Setting value: 30 to 300 (1/100)
	Brightness	0x2020, 0x2007	2	1	Setting value: -100 to 100
	Contrast	0x2020, 0x2008	2	1	Setting value: 50 to 200 (1/100)
REC_INFO	Recording mode (on UI)	0x3030, 0x3001	2	1	Setting value: 0: Internal 1: External STANDBY 2: External TRIG 3: External SEPARATE 4: R-External STANDBY 5: R-External TRIG 6: R-External SEPARATE 7: External SYNCIN 8: R-External SYNCIN
	Synchronized recording mode (on UI)	0x3030, 0x3002	2	1	Setting value: 0:OFF 1:Master 2:Slave
	Trigger points (on UI)	0x3030, 0x3003	2	1	Setting value: 2 to 256
	Trigger mode	0x3030, 0x3004	0	16	Setting value: (Character string) Internal E-trig E-stdby E-sep Sync
	Recording mode	0x3030, 0x3005	0	16	Setting value: (Character string) CFP BFP BHP UBFA5 UBHA5 UBHA10 UBHA20
	Recording frame count	0x3030, 0x3006	2	1	Setting value: 1 to 256
	Recording speed	0x3030, 0x3007	0	24	Setting value: (Character string) 100 to 16666670 (in 10 ns steps of 1 ns units)
	Recording exposure time	0x3030, 0x3008	0	24	Setting value: (Character string) 200 to 10000000 (in 10 ns steps of 1 ns units)
	Trigger input logic	0x3030, 0x3009	2	1	Setting value: 0:NEG 1:POS
	Trigger input delay setting	0x3030, 0x300A	0	24	Setting value: (Character string) 0 to 9999999990 (in 10 ns steps of 1 ns units)
	Frames after trigger	0x3030, 0x300B	2	1	Setting value: (Character string) 1 to 256
	Standby OFF input logic	0x3030, 0x300C	2	1	Setting value: 0:NEG 1:POS

Data Content		Tag Entries			Remarks
Section	Key	Data Tag (4 byte)	Type of Data (2 byte)	Data Count (4 byte)	
	Standby OFF input delay setting	0x3030, 0x300D	0	24	Setting value: (Character string) 100 to 9999999990 (in 10 ns steps of 1 ns units)
	Synchronized (internal) circuit delay setting	0x3030, 0x300E	0	24	Setting value: (Character string) 0 to 100 (in 10 ns steps of 1 ns units)
	Synchronized (output) circuit delay setting	0x3030, 0x300F	0	24	Setting value: (Character string) 0 to 100 (in 5 ns steps of 1 ns units)
	PortAuxout1Mode AUXOUT1 mode	0x3030, 0x3010	2	1	Setting value: 0:EXPOSE REC 1:EXPOSE LIVE 2:EXPOSE BOTH 3:EXPOSE STANDBY 4:EXPOSE TRIG 5:EXPOSE END 6:TRIG STANDBY 7:TRIG TRIG 8:STATUS STANDBY 9:STATUS TRIG 10:STATUS REC
	PortAuxout1Polarity AUXOUT1 logic	0x3030, 0x3011	2	1	Setting value: 0:NEG 1:POS
	PortAuxout1Delay AUXOUT1 delay time	0x3030, 0x3012	0	24	Setting value: (Character string) 0 to 9999999990 (in 10 ns steps of 1 ns units)
	AUXOUT1 signal width	0x3030, 0x3013	0	24	Setting value: (Character string) 50 to 10000000 (in 10 ns steps of 1 ns units)
	PortAuxout2Mode AUXOUT2 mode	0x3030, 0x3014	2	1	Setting value: 0:EXPOSE REC 1:EXPOSE LIVE 2:EXPOSE BOTH 3:EXPOSE STANDBY 4:EXPOSE TRIG 5:EXPOSE END 6:TRIG STANDBY 7:TRIG TRIG 8:STATUS STANDBY 9:STATUS TRIG 10:STATUS REC
	PortAuxout2Polarity AUXOUT2 logic	0x3030, 0x3015	2	1	Setting value: 0:NEG 1:POS
	PortAuxout2Delay AUXOUT2 delay time	0x3030, 0x3016	0	24	Setting value: (Character string) 0 to 9999999990 (in 10 ns steps of 1 ns units)
	PortAuxout2Pulse AUXOUT2 signal width	0x3030, 0x3017	0	24	Setting value: (Character string) 50 to 10000000 (in 10 ns steps of 1 ns units)

Data Content		Tag Entries			Remarks
Section	Key	Data Tag (4 byte)	Type of Data (2 byte)	Data Count (4 byte)	
CAMERA_INFO	CamName Camera name	0x4040, 0x4001	0	16	Setting value: (Character string) Camera names settable in the recording parameter settings window
	CamSerialNumber Camera serial number	0x4040, 0x4002	0	16	Setting value: (Character string) Camera serial number
	DevSerialNumber Device number	0x4040, 0x4003	0	16	Setting value: (Character string) Camera device number
	FpgaVersion FPGA version	0x4040, 0x4004	0	128	Setting value: (Character string) Camera FPGA version
	SoftwareVersion Software version	0x4040, 0x4005	0	128	Setting value: (Character string) Camera software version
	TableVersion Table version	0x4040, 0x4006	0	128	Setting value: (Character string) Table version of applicable recording modes
	CamError Camera error information	0x4040, 0x4007	2	1	Setting value: Camera error information
	AfeOffset AFE offset setting	0x4040, 0x4008	2	40	Setting value: 0 to 4095
	AfeSmp AFE sampling setting	0x4040, 0x4009	2	1	Setting value: 0 to 31 (in 5 ns units)
	ReadAddress Starting address for camera transmission	0x4040, 0x400A	2	1	Setting value: Starting address for camera transmission of images
	ReadSize Camera transmission size	0x4040, 0x400B	2	1	Setting value: Camera transmission size for transmitting images
	MemoryFrame Starting frame number in sensor memory	0x4040, 0x400C	2	1	Setting value: Starting frame number in sensor memory for transmitting images
	TriggerFrame Trigger detection frame	0x4040, 0x400D	2	1	Setting value: Frame number where trigger was detected
	RecTime Trigger detection time	0x4040, 0x400E	3	1	Setting value: Systemtime type
	RecEndTempP Temperature after recording	0x4040, 0x400F	2	1	Setting value: Temperature after recording (units of 1/1000)
	RecEndTempT Temperature after recording	0x4040, 0x4010	2	1	Setting value: Temperature after recording (units of 1/1000)
	RecEndTempB Temperature after recording	0x4040, 0x4011	2	1	Setting value: Temperature after recording (units of 1/1000)
CORRECTION_TABLE	CorrectionTable Name of pixel gain correction table	0x5050, 0x5001	0	260	Setting value: (Character string) Name of pixel gain correction table for applicable recording mode
	DataTime Date/time created	0x5050, 0x5002	0	24	Setting value: (Character string) Date/time pixel gain correction table for

Data Content		Tag Entries			Remarks
Section	Key	Data Tag (4 byte)	Type of Data (2 byte)	Data Count (4 byte)	
					applicable recording mode was created
	Sensor Applicable sensor number	0x5050, 0x5003	0	24	Setting value: (Character string) Camera sensor number
	RecMode Recording mode	0x5050, 0x5004	0	24	Setting value: (Character string) Recording mode for pixel gain correction table for applicable recording mode
	Offset Offset	0x5050, 0x5005	2	1	Setting value: (Character string) Offset value for pixel gain correction table for applicable recording mode
	DataResolution Data gradations	0x5050, 0x5006	2	1	Setting value: (Character string) Data gradations for pixel gain correction table for applicable recording mode
IMAGE_INFO	Type Image format type	0x6060, 0x6001	2	1	Setting value: 0: HPV-X
	StoreResolution Save gradations	0x6060, 0x6002	2	1	Setting value: 65536: HPV-X
	ImageSizeX Horizontal image size	0x6060, 0x6003	2	1	Setting value: 400: HPV-X
	ImageSizeY Vertical image size	0x6060, 0x6004	2	1	Setting value: 256: HPV-X
	ImageNum Number of images in image data	0x6060, 0x6005	2	1	Setting value: Number of images in image data
	ImageRelative Relative time elapsed from trigger detection	0x6060, 0x6006	0	ImageNum× 24	Setting value: In 10 ns steps of 1 ns units
IMAGE	ImageData Image data	0xA0A0, 0xA001	1	ImageNum× 256×400	Setting value: Image data in DIB format

Note: Position and value of tag entries omitted.

5.7.2 Metadata in Image Files

■ File Composition

Description	File used to save metadata for image files as text. Auto Save Setting function () in the recording parameter settings window allows specifying saving files after recording.
File Structure	INI format
Data Elements	Section, key Example: ［SYSTEM］ RecTime=2011-12-22 19:10:10
File Extension	.ini

■ Information Saved

Section	Key	Remarks
SYSTEM	RecTime Date/time saved	Example: RecTime =2011-12-22 19:10:10
	Comment Comment	Example: Comment =Sample data
PLAY_INFO	PlaySpeed Playback speed	Example: PlaySpeed =15 fps
	Rotate Display angle	Example: Rotate =90 deg.
	FrameStart Playback starting fram	Example: FrameStart= 1
	FrameStop Playback stopping frame	Example: FrameStop =256
	FirstDisplay Display frame	Example: FirstDisplay =1
	Gamma Gamma correction factor	Example: Gamma =1.2
	Brightness Brightness	Example: Brightness =10
	Contrast Contrast	Example: Contrast =0.98
REC_INFO	RecModeUI Recording mode (setting value)	Example: RecModeUI =Internal
	SyncModeUI Synchronized recording mode (setting value)	Example: SyncModeUI =OFF
	RecFrame Recording frame count (setting value)c	Example: RecFrame =256
	RecSpeed Recording speed in ns units	Example: RecSpeed =10,000,000 ns
	RecExpose Recording exposure time in ns unit	Example: RecExpose =300 ns
	TriggerPolarity TRIG signal (trigger) input logic	Example: TriggerPolarity =NEG
	TriggerDelay TRIG delay time in ns units	Example: TriggerDelay =10,000,000 ns
	TriggerPoint Trigger points (setting value)	Example: TriggerPoint =40

Section	Key	Remarks
	StandbyPolarity STANDBY signal (standby OFF) input logic	Example: StandbyPolarity =POS
	StandbyDelay STANDBY signal (standby OFF) delay time in ns units	Example: StandbyDelay =10,000,000 ns
	PortAuxout1Mode External output port 1 mode	Example: PortAuxout1Mode =EXPOSE STANDBY
	PortAuxout1Polarity External output port 1 input logic	Example: PortAuxout1Polarity =NEG
	PortAuxout1Delay External output port 1 delay time in ns units	Example: PortAuxout1Delay =10,000,000 ns
	PortAuxout1Pulse External output port 1 signal width in ns unitsc	Example: PortAuxout1Pulse =10,000,000 ns
	PortAuxout2Mode External output port 2 mode	Example: PortAuxout2Mode =EXPOSE REC
	PortAuxout2Polarity External output port 2 input logic	Example: PortAuxout2Polarity =NEG
	PortAuxout2Delay External output port 2 delay time in ns units	Example: PortAuxout2Delay =10,000,000 ns
	PortAuxout2Pulse External output port 2 signal width in ns units	Example: PortAuxout2Pulse =10,000,000 ns
CAMERA_INFO	CamName Camera name	Example: CamName =Camera1
	RecEndTempT Temperature after recording	Example: RecEndTempT =25.22 Deg.
	RecEndTempB Temperature after recording	Example: RecEndTempB =25.33 Deg.
	TriggerFrame Trigger detection frame	Example: TriggerFrame =40
	RecTime Trigger detection time	Example: RecTime= 2011-12-22 19:10:10
IMGE_INFO MAINT	Type Image format type	Example: Type =0
	StoreResolution Save gradations	Example: StoreResolution= 65536
	ImageSizeX Image X-size	Example: ImageSizeX =400
	ImageSizeY Image Y-size	Example: ImageSizeY =250
	ImageNum Frame count	Example: ImageNum =256
IMAGE_INFO_1 to IMAGE_INFO_256	ImageRelative Relative time elapsed from trigger detection in ns units	Example: ［IMAGE_INFO_1］ ImageRelative=-100,000 . . . ［IMAGE_INFO_256］ ImageRelative=150,000

5.7.3 Recording Parameter Setting Files

■ File Composition

Description	File used to save recording parameters in the recording parameter settings window as text. Read/write using Open Setting File () and Save Setting File functions in the recording parameter settings window.
File Structure	INI format
Data Elements	Section, key Example: ［SYSTEM］ Date =2011-12-22 19:10:10
File Extension	.ini

■ Information Saved

Section	Key	Remarks
SYSTEM	Date Remarks	Example: Date=2011-12-22 19:10:10
	RecodeVersion System version	Example: RecodeVersion = -5
	FileType File format	Example: FileType =SaveSetting
	CameraName Camera name	Example: CameraName =Camera1
REC_SETTING	RecMode Recording mode setting	Example: RecMode=0 Setting value: 0:Internal 1:External STANDBY 2:External TRIG 3:External SEPARATE 4:R-External STANDBY 5:R-External TRIG 6:R-External SEPARATE
	RecFrame Recording frame count setting	Example: RecFrame=1 Setting value: 0:128 1:256
	RecSpeed Recording speed setting	Example: RecSpeed =500
	RecExpose Recording exposure time setting	Example: RecExpose =200
	LiveExpose Live image exposure time setting	Example: LiveExpose =300
	TriggerPolarity TRIG signal (trigger) input method setting	Example: TriggerPolarity=0 Setting value: 0:NEG 1:POS
	TriggerDelay TRIG signal (trigger) delay time	Example: TriggerDelay =0
	TriggerPoint Frame number where trigger is detected	Example: TriggerPoint =50

Section	Key	Remarks
	StandbyPolarity Standby signal polarity setting	Example: StandbyPolarity=0 Setting value: 0:NEG 1:POS
	StandbyDelay Standby signal delay time	Example: StandbyDelay=100
	PortAuxout1Mode External output port 1 mode setting	Example: PortAuxout1Mode=0 Setting value: 0:EXPOSE REC 1:EXPOSE LIVE 2:EXPOSE BOTH 3:EXPOSE STANDBY 4:EXPOSE TRIG 5:EXPOSE END 6:TRIG STANDBY 7:TRIG TRIG 8:STATUS STANDBY 9:STATUS TRIG 10:STATUS REC
	PortAuxout1Polarity External output port 1 polarity setting	Example: PortAuxout1Polarity=0 Setting value: 0:NEG 1:POS
	PortAuxout1Delay External output port 1 delay time setting	Example: PortAuxout1Delay=100
	PortAuxout1Pulse External output port 1 signal width setting	Example: PortAuxout1Pulse=50
	PortAuxout2Mode External output port 2 mode setting	Example: PortAuxout2Mode=0 Setting value: 0:EXPOSE REC 1:EXPOSE LIVE 2:EXPOSE BOTH 3:EXPOSE STANDBY 4:EXPOSE TRIG 5:EXPOSE END 6:TRIG STANDBY 7:TRIG TRIG 8:STATUS STANDBY 9:STATUS TRIG 10:STATUS REC
	PortAuxout2Polarity External output port 2 polarity setting	Example: PortAuxout2Polarity=0 Setting value: 0:NEG 1:POS

Section	Key	Remarks
	PortAuxout2Delay External output port 2 delay time setting	Example: PortAuxout2Delay=0
	PortAuxout2Pulse External output port 2 signal width setting	Example: PortAuxout2Pulse=50

5.8 Displaying Version Information

The following describes how to display version information. If a camera is connected, click the icon in the recording parameter settings window or activate an application window and press the [F1] key to display the version information display window (Fig. 5-33).

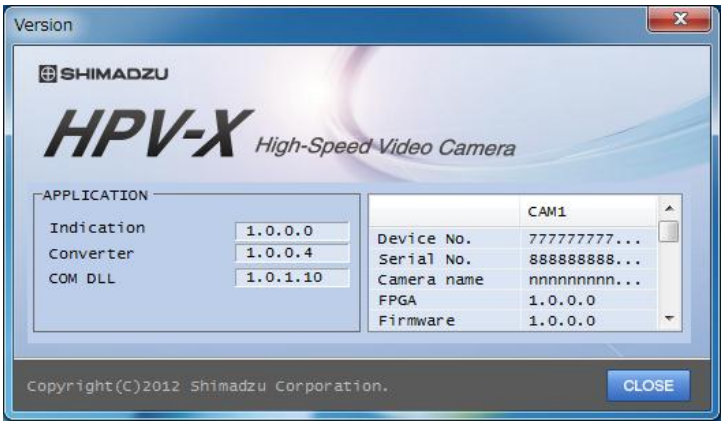


Fig. 5-33 Version Information Display Window (With Cameras Connected)

If no cameras are connected, the version information display window (Fig. 5-34) is displayed.

Fig. 5-34 Version Information Display Window (With No Cameras Connected)

6. Maintenance

6.1 Troubleshooting

To minimize trouble, the HPV-X2 has been designed with full consideration of safety and reliability issues. Nevertheless, problems may occur due to a variety of causes.

Use the troubleshooting table below if the system does not perform normally or if instrument trouble is suspected.

Symptom	Possible Cause	Remedy
Power does not switch ON.	Disconnected cable	Correctly connect the cable.
	Fuse in power unit blown	The problem is presumably in the electrical system. Therefore, contact a Shimadzu service representative.
Recorded image appears dark.	Insufficient light during recording	Try moving the lighting closer or increasing the brightness setting. (See 5.2 Camera Settings.)
Recorded image appear overexposed.	Too much light during recording	Adjust the lens aperture.
Recorded images appear darker than previous images taken using the same parameters.	GAMMA, BRIGHTNESS and CONTRAST values shown in the playback window have changed.	Search for appropriate settings by varying the GAMMA, BRIGHTNESS and CONTRAST values shown in the playback window. (See "Playback Window Display Settings" in 5.5.1 Setting Playback Parameters – Viewer Operations.)
	Recording parameters may have changed.	Check the recording parameters again.
Recorded images appear whiter than previous images taken using the same parameters.	GAMMA, BRIGHTNESS and CONTRAST values shown in the playback window have changed.	Search for appropriate settings by varying the GAMMA, BRIGHTNESS and CONTRAST values shown in the playback window. (See "Playback Window Display Settings" in 5.5.1 Setting Playback Parameters – Viewer Operations.)
	Recording parameters may have changed.	Check the recording parameters again.
The trigger signal standby status was canceled.	One minute elapsed in the standby status.	Click [REC] again.
	Sensor elements are hot.	Wait without recording until the cooling fan decreases the element temperature adequately before recording again. (See "Selecting Recording Modes" in 5.4.1 Setting Recording Parameters.)
The sensor temperature does not drop.	The room temperature is high.	Lower the room temperature so that the fan can cool efficiently.
	Repeatedly recording at high speeds causes sensors and surrounding circuits to heat up.	Try recording again using different recording or illumination parameter settings. (See 5.4.1 Setting Recording Parameters.)

6.2 Unit Cleaning

⚠ Warning

Instructions

- Always disconnect the power cable before cleaning the product.
  Failure to do so may result in electric shock.

Note

- Do not use volatile solvents (paint thinner, benzene, etc.) or a damp cloth to clean the product. Use a soft, dry cloth. Failure to do so may result in rusting or damage.
- Avoid getting this product wet with water.
  Failure to do so may result in rusting or damage.

Follow the procedure below to clean the camera head.

1. Clean away any dust from around the camera head and control computer.
   When cleaning these areas, be careful not to scratch the control computer monitor.
2. Use a soft dry cloth to remove any dirt.
3. Use a vacuum cleaner to clean around the air intake port.

Fig. 6-1 Cleaning the Air Intake Portc

Index