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# **Photron *FASTCAM* Viewer**

***for High Speed Digital Imaging***

 **Waveform Recording Manual**

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***Revision 1.05E***

**Photron**

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# Introduction

Thank you for purchasing your Photron FASTCAM series high-speed camera system. When using the Photron FASTCAM Viewer (referred to below as PFV), this manual specifies the settings and precautions for when the Multi-Channel-Data-Link (below, MCDL) or a waveform input board is connected.

Please read the entire manual before using the software.

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

# Manual Notation

The following icons and symbols are used in the Descriptions in this manual.

Icon/Symbol	Description
 Supplement	This symbol indicates supplementary items to be aware of when using the software.
 Reference	This symbol indicates the location of a reference.
 Important	This symbol indicates content that should always be read.
 Caution	This symbol indicates instructions that should always be followed when using the software, or things to be careful of when using the software.
 MEMO	This symbol indicates a space for you to use for making notes.
“ ”	This symbol is used to indicate the names of items on a screen, references, dialog names, and keyboard keys.
[ ]	This symbol is used to indicate screen names, button names, and menu names.
< >	This symbol is used to explain operating procedures in diagrams and supplementary items.

# Table of Contents

<b>Chapter. 1</b>	<b>About Data Acquisition</b>	<b>1</b>
<b>Chapter. 2</b>	<b>Using the MCDL</b>	<b>5</b>
2.1.	Preparation before Recording.....	6
<b>Chapter. 3</b>	<b>Using the CONTEC Co., Ltd. Waveform Input Board</b>	<b>7</b>
3.1.	Driver Installation .....	8
3.2.	Software Setup .....	14
3.3.	Settings for Using the REC POS Signal .....	16
3.3.1.	Connection Method.....	16
3.3.2.	Software Settings.....	16
3.4.	Settings for Using the REC POS Signal (When Synchronizing to the Camera's V-SYNC Signal) .....	18
3.4.1.	Connection Method.....	18
3.4.2.	Software Settings.....	18
3.5.	Setup Screen .....	20
3.6.	About The Board.....	24
<b>Chapter. 4</b>	<b>Using the Interface Corporation Waveform Input Board</b>	<b>25</b>
4.1.	Driver Installation .....	26
4.2.	Software Setup .....	29
4.3.	Settings for Using the REC POS Signal .....	31
4.3.1.	Connection Method.....	31
4.3.2.	Software Settings.....	31
4.4.	Settings for Using the REC POS Signal (When Synchronizing to the Camera's V-SYNC Signal) .....	33
4.4.1.	Connection Method.....	33
4.4.2.	Software Settings.....	33
4.5.	Setup Screen .....	35
4.6.	About The Board.....	39
<b>Chapter. 5</b>	<b>Alert Display</b>	<b>41</b>
<b>Chapter. 6</b>	<b>Using Waveform Input Data</b>	<b>43</b>
6.1.	Graphic Display of Waveform Input Data .....	44
6.2.	Settings for Graphic Display of Waveform Data .....	48
6.2.1.	Changing the Channel Name.....	49
6.2.2.	Setting Style of Displayed Graph .....	50
6.2.3.	Setting Display Unit, Gradient and Segment .....	51
6.2.4.	Setting Range of Graphic Display.....	52
6.2.5.	Graph View Window.....	54
6.3.	Storing Waveform Input Data in PC.....	56
6.3.1.	Storing In CIH (MCD/WVD) Format .....	56
6.3.2.	Save As Image.....	56
6.3.3.	Storing In CSV format .....	57
6.4.	Displaying Stored Waveform Input Data.....	60
6.4.1.	Opening CIH (MCD/WVD) Format Files .....	60
6.4.2.	Opening CSV Format Files .....	60

**Chapter. 7 Piezo Control System (When Using a Microscope) 63**

7.1. Driver Installation .....64  
7.2. Connection Method.....67  
7.3. Piezo Control Settings and Shooting .....68

**Chapter. 8 Contacting Photron 75**



# Chapter. 1 About Data Acquisition

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With PFV using MCDL or a waveform input board manufactured by CONTEC Co., Ltd. or Interface Corporation, you can simultaneously record analog signals and digital signals with high-speed camera video, or play graphs and video synchronized.

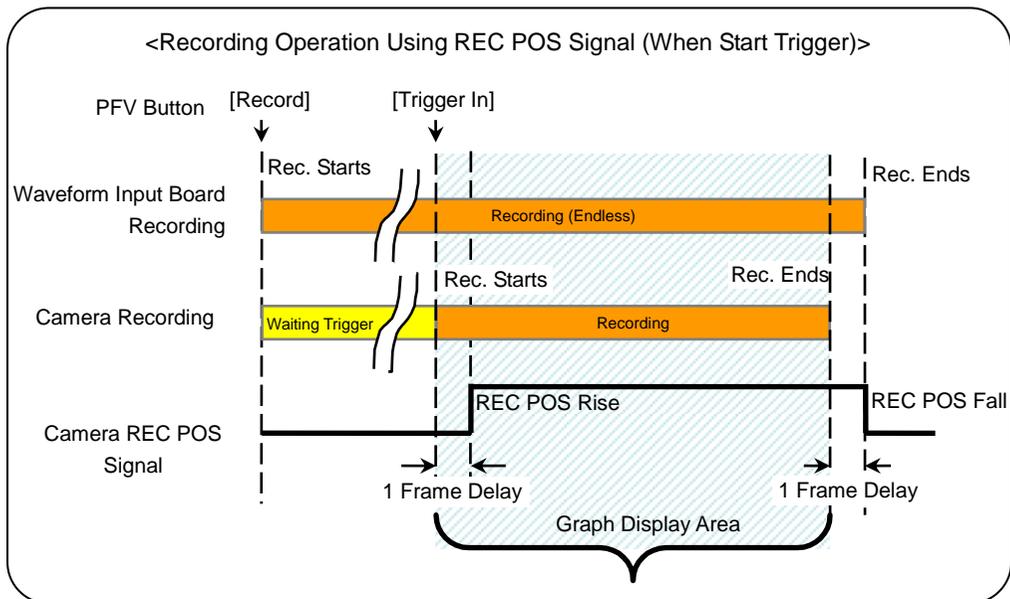
For a CONTEC Co., Ltd. or Interface Corporation waveform input board, you can apply triggers to the waveform input board using the REC POS signal output from the camera's GENERAL OUT terminal. In this way, you can record with the same connection method for the start, center, end, and manual triggers.

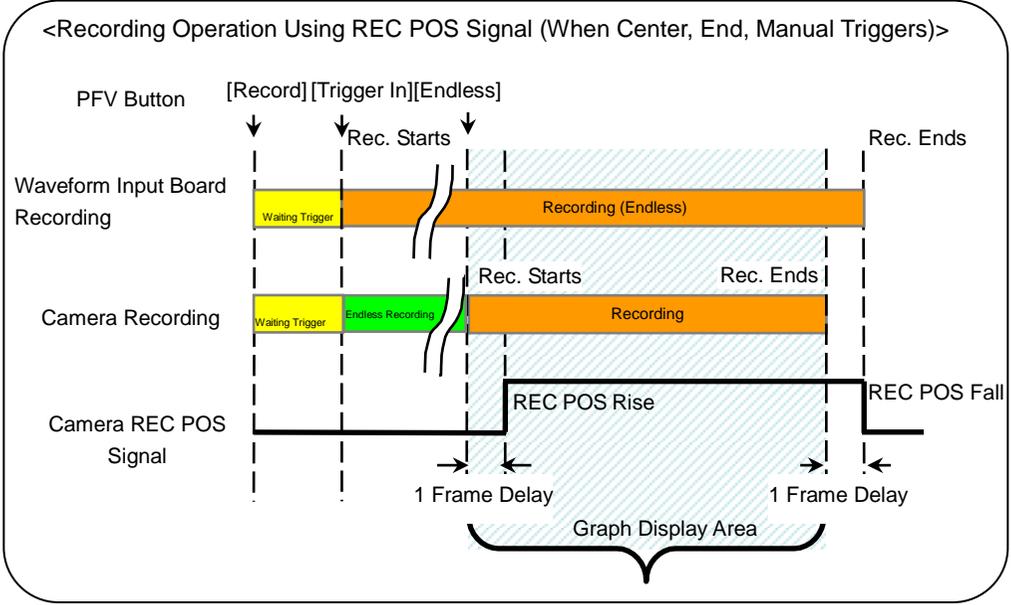
**Reference**

- For MCDL, refer to the Multi-Channel-Data-Link User's Manual.

◆ Recording Outline

1. The waveform input board enters the endless recording state from when the camera starts to prepare to record (the states where [Trigger In] or [Endless Rec] is displayed in PFV).
2. Input the trigger and start recording. At this time the waveform input board continues recording.
3. After recording finishes, when the waveform input board detects the REC POS signal falling, the waveform input board finishes recording.
4. Since the REC POS signal falls 1 frame late from the end of recording, the waveform input board obtains 1 extra frame of data, and when the data is displayed, the data is displayed with 1 frame cut from the end.







# Chapter. 2 **Using the MCDL**

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## 2.1. Preparation before Recording

With a high-speed camera system that supports the MCDL input function, two or four channels of analog data or six channels of digital data from external sources can be input to the camera.

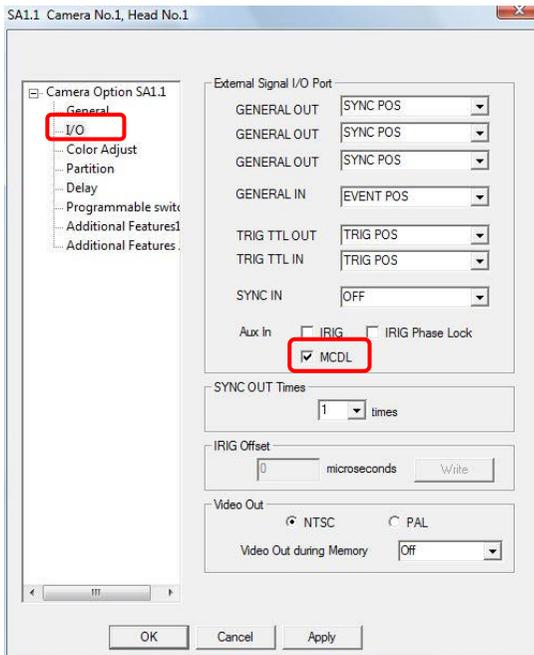
### Supplement

- The MCDL Unit is optional waveform recording equipment available from Photron.

#### 1. Activating MCDL function

Click the [Camera Option] button on the control panel.

Select and click [I/O] from the tree in the left hand side field, and check [MCDL] box.



# Chapter. 3 **Using the CONTEC Co., Ltd. Waveform Input Board**

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## 3.1. Driver Installation

When installing the PCI analog waveform input board manufactured by CONTEC Co., Ltd., install the driver with the procedure below.

### Caution

- If the “An unidentified program wants access to your computer” message is displayed, click the [Allow] button.
- If the “User Account Control” dialog box is displayed during installation, click the [Continue] button.

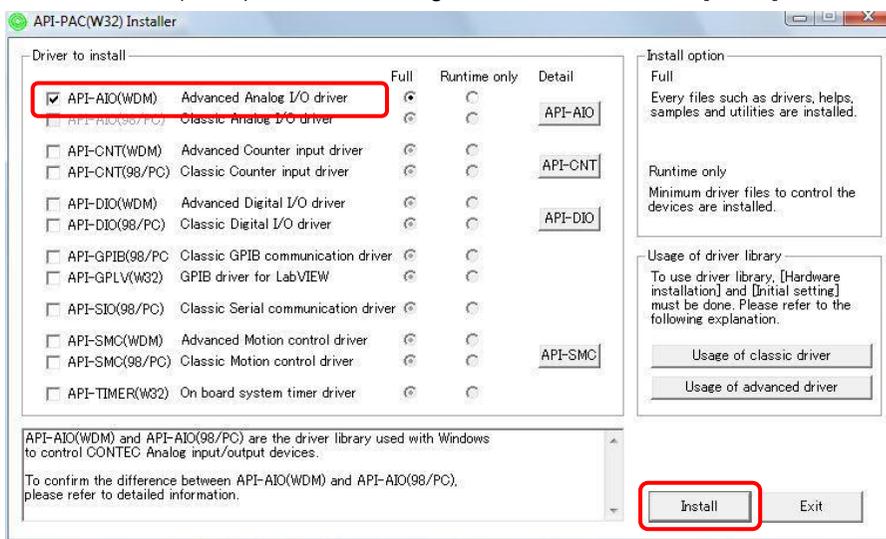
1. Place the API-PAC (W32) CD in the CD or DVD drive.  
The installer screen is displayed.  
Click the [Install Development or Execution Environment] button.



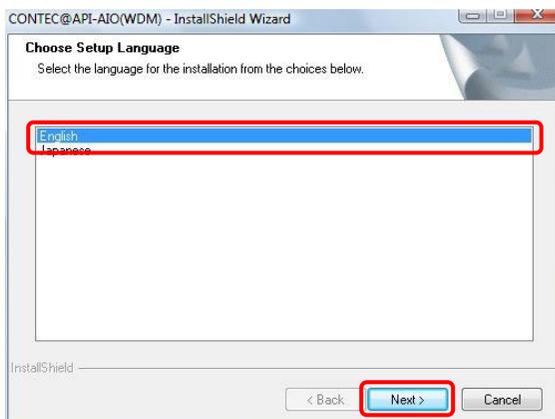
### Supplement

- If the installer is not displayed, open the CD drive and double click the “AUTORUN.exe” file.

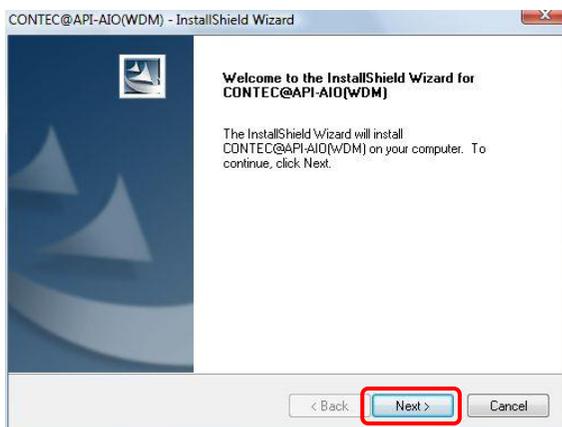
2. Check “API-AIO(WDM) Advanced Analog I/O driver” and click the [Install] button.



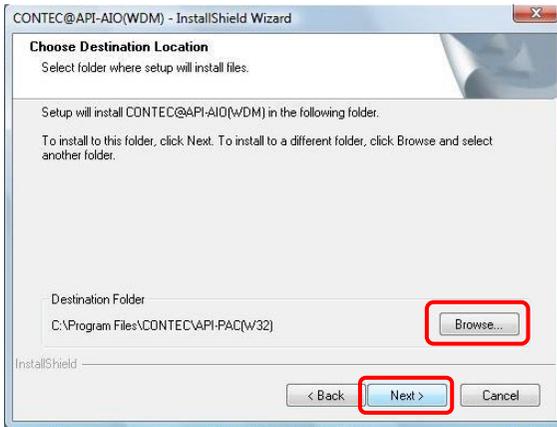
3. Select “English” and click the [Next] button.



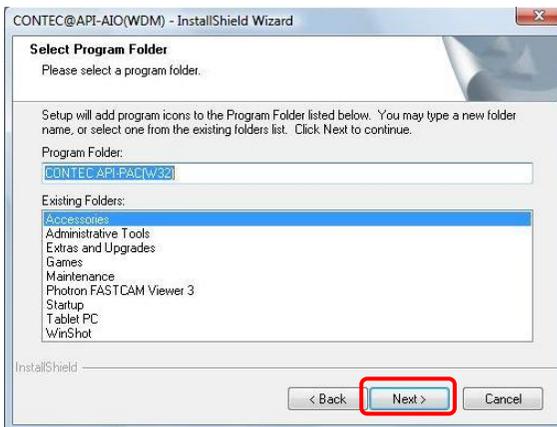
4. The install wizard screen is displayed. Click the [Next] button.



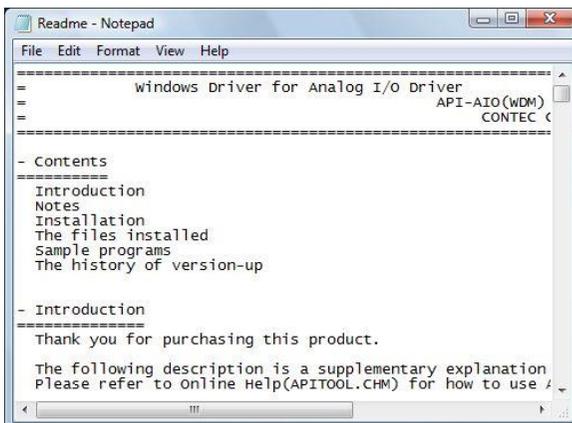
5. Specify the installation destination. The default setting for the destination folder is "C:\ProgramFiles\CONTEC\API-PAC(W32)".  
When necessary, the destination folder can be changed to the desired location by clicking the [Browse] button.  
After specifying the destination, click the [Next] button.



6. Specify the Program Folder. The default setting is "CONTEC API-PAC(W32)".  
When necessary, this setting can be changed.  
After specifying the Program Folder, click the [Next] button.



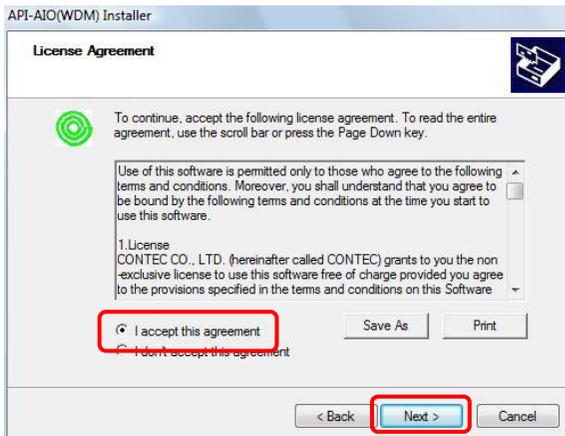
7. When the installation has finished, the Readme file is displayed.



- Next, install the hardware driver.  
Click the [Next] button.



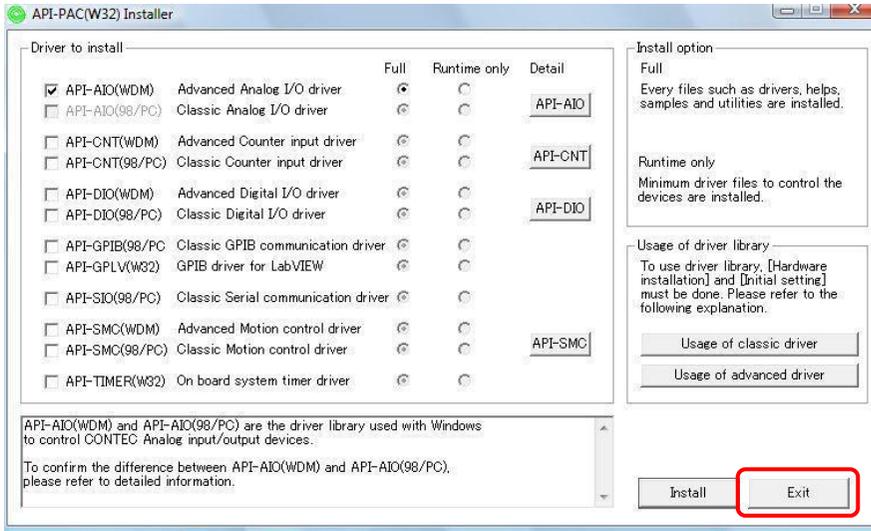
- After reviewing the license agreement, select "I accept this agreement" and click the [Next] button.



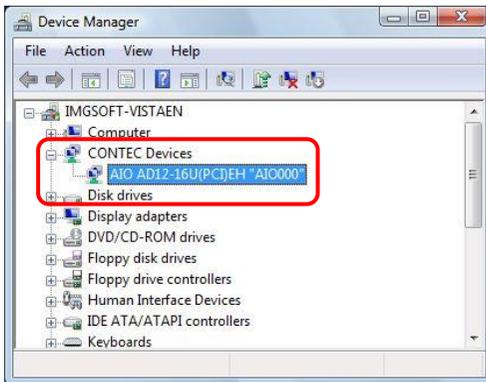
- The driver is installed and the completion screen is displayed. Click the [Finish] button.



- After clicking the [Exit] button to close the installer screen, turn off the PC's power, install the board, and then restart the PC.



- Check if the board has been correctly recognized. Start Device Manager, open the "CONTEC Devices" tree and check that the device is displayed.

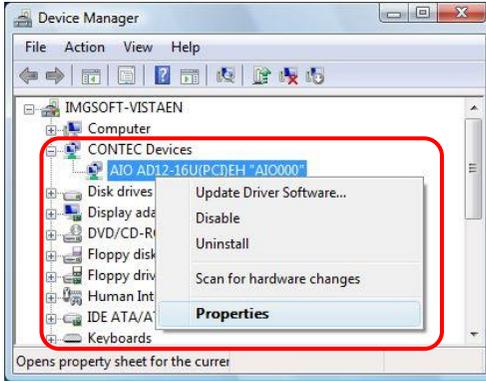


 Supplement

- Device Manager can be started by right clicking "Computer" on the start menu, selecting "Properties", and clicking "Device Manager" under "Tasks" on the displayed screen.

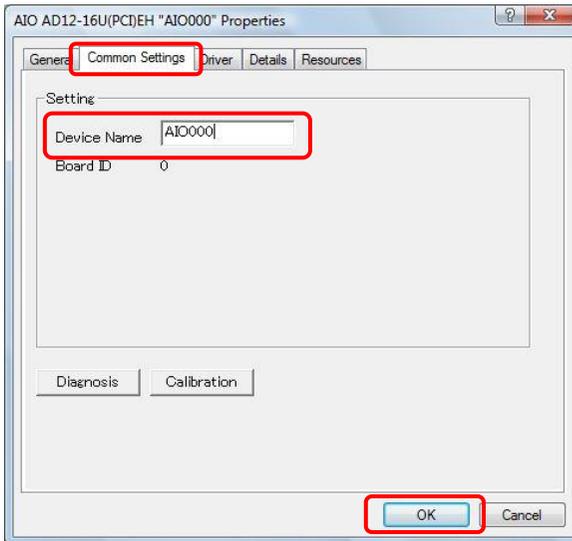
13. Set the device name.

Right click on the device you wish to name and select [Properties].



14. Confirm that a device name is entered in “Device Manager” on the “Common Settings” tab and click the [OK] button.

When necessary, “Device Manager” can be changed. To change, enter the desired name and click the [OK] button.



**Caution**

- Even when not changing the device name, always click the [OK] button.

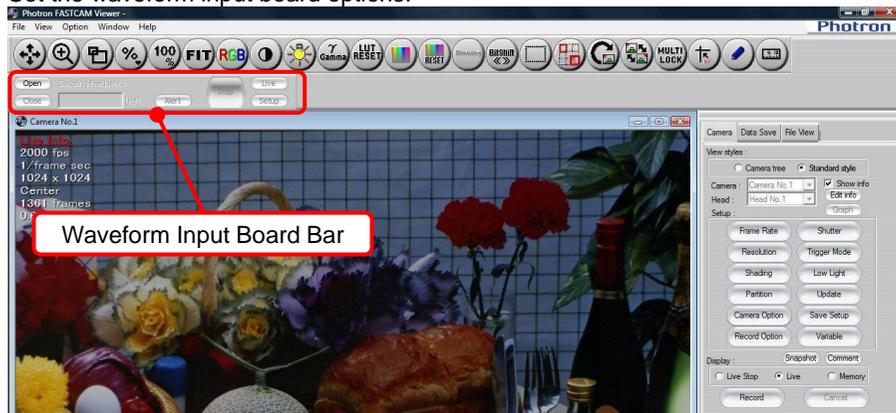
**Supplement**

- If the board was not installed correctly, refer to the waveform input board manual.

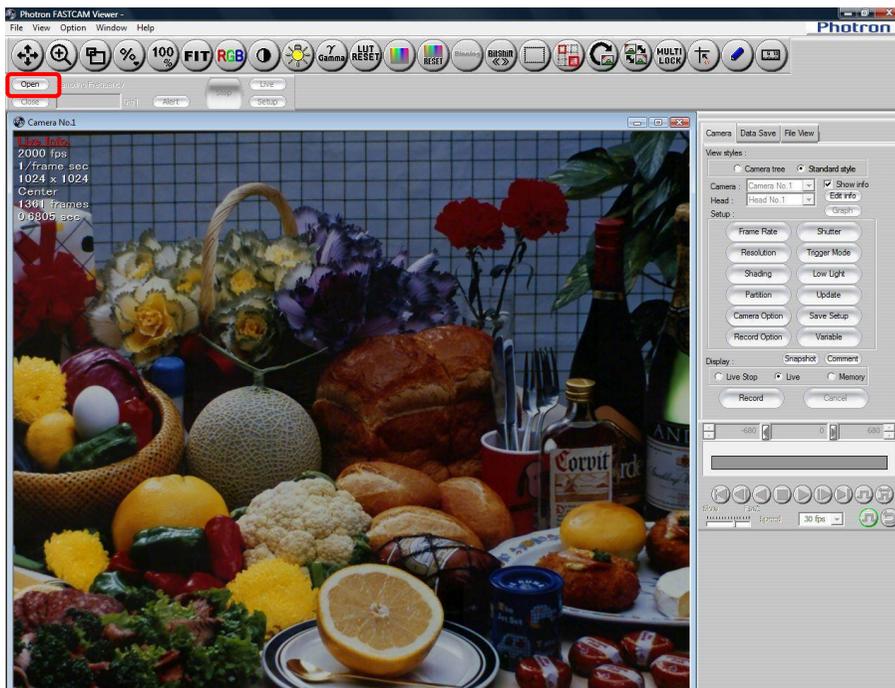
## 3.2. Software Setup

After installing the driver, the waveform input board bar is displayed on the PFV screen.

Set the waveform input board options.



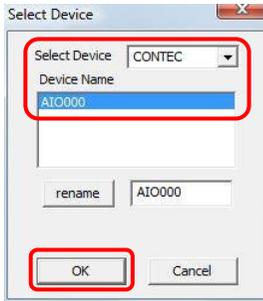
1. Click the [Open] button on the waveform input board.



### Supplement

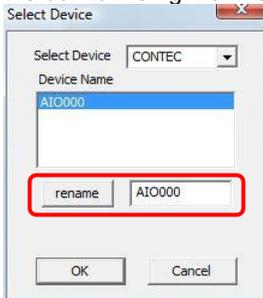
- If the waveform input board bar is not displayed, click [View] – [Waveform Input Board Bar] on the menu.

2. With "Select Device", select the manufacturer of the waveform input board to use. Select the board to use from the list displayed in "Device Name" and click the [OK] button.



### Supplement

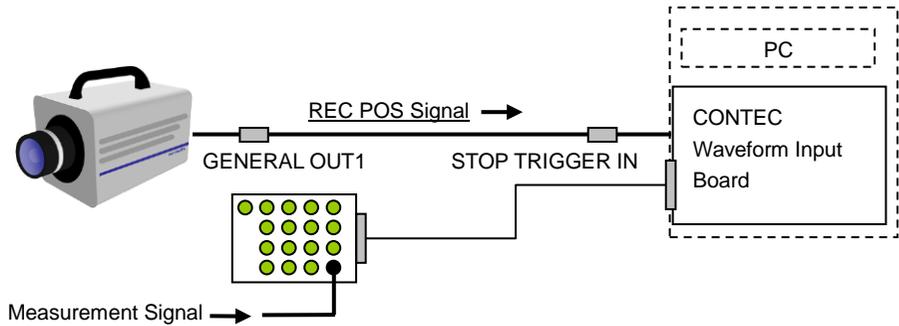
- The name shown in "Device Name" must be the same as the device name shown in Device Manager. If the names are different, after selecting the board to change, enter the changed name in the box to the right of the [Rename] button, then click the [Rename] button to change it.



## 3.3. Settings for Using the REC POS Signal

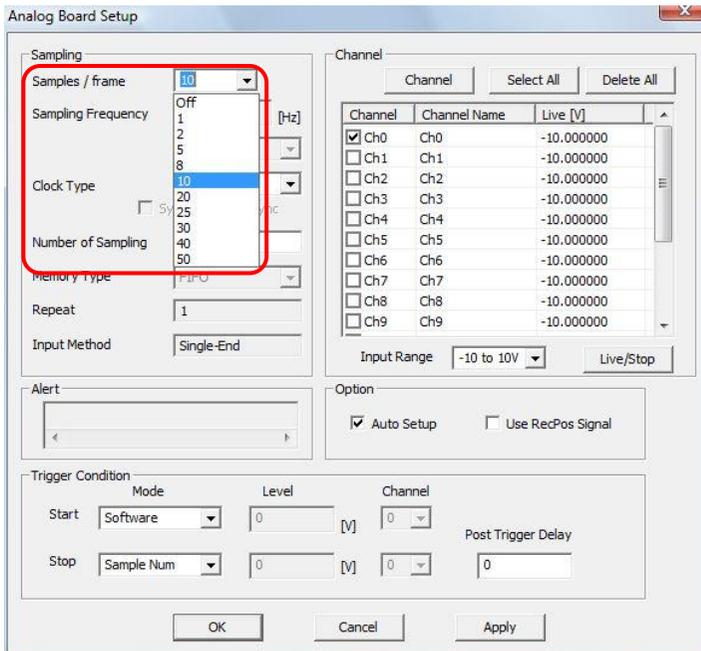
### 3.3.1. Connection Method

1. Connect the camera's GENERAL OUT1 terminal to the STOP TRIGGER IN terminal on the CONTEC board, and set the output of GENERAL OUT1 terminal to REC POS signal.

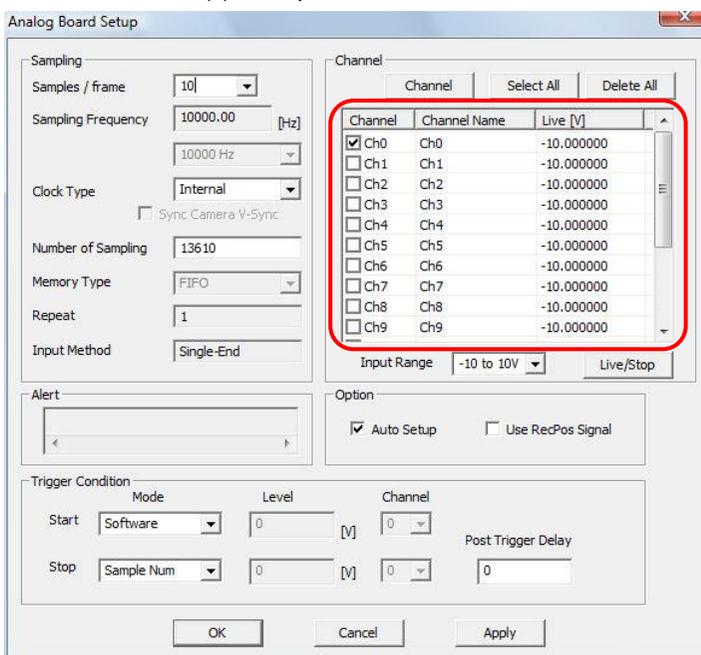


### 3.3.2. Software Settings

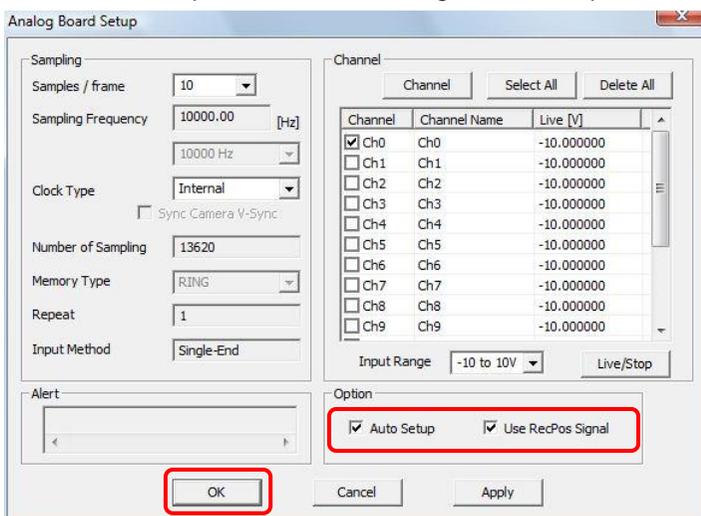
1. Click the “Samples / frame” [▼] button and select the desired value from the list displayed.



2. Check the channel(s) to acquire data.



3. Check "Auto Setup" and "Use RecPos Signal" under "Option" and click the [OK] button.



**Caution**

- When the sampling frequency is set high, an alert may be displayed after completing the above settings.  
If no alert is shown then there are no problems with the settings.

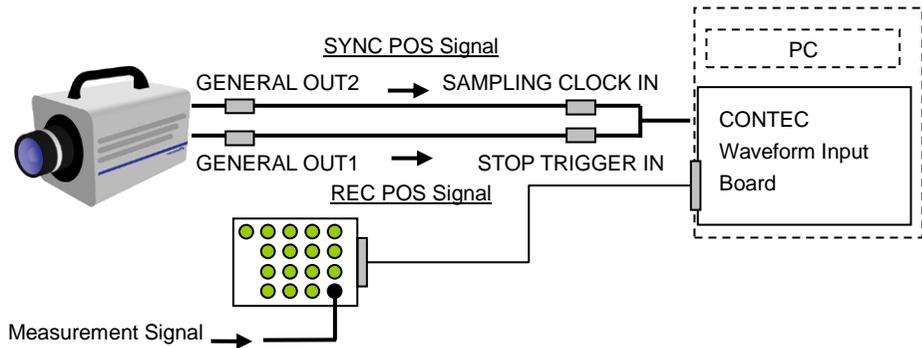
**Reference**

- For the alert display, refer to "Chapter. 5. Alert Display", page 41.

## 3.4. Settings for Using the REC POS Signal (When Synchronizing to the Camera's V-SYNC Signal)

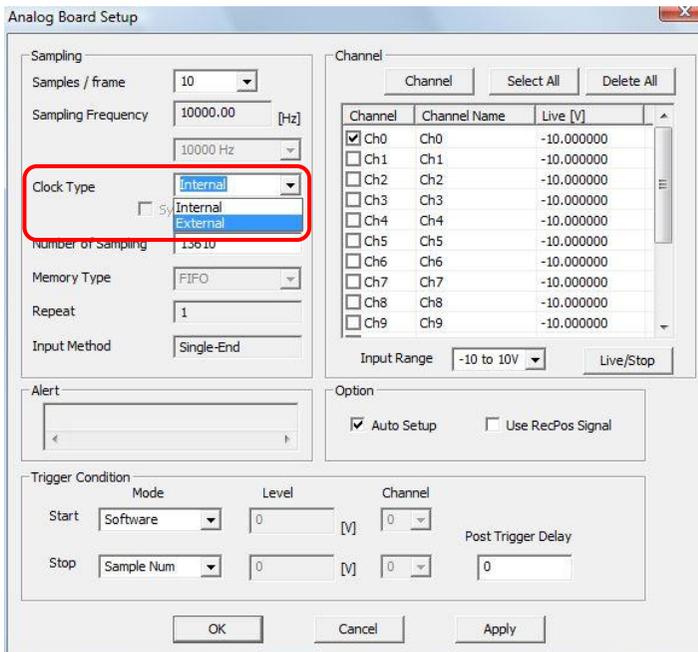
### 3.4.1. Connection Method

1. Connect the camera's GENERAL OUT1 terminal to the STOP TRIGGER IN terminal on the CONTEC board, and set the output of GENERAL OUT1 terminal to REC POS signal.
2. Connect the camera's GENERAL OUT2 terminal to the SAMPLING CLOCK IN terminal on the CONTEC board, and set the output of GENERAL OUT2 terminal to SYNC POS signal.

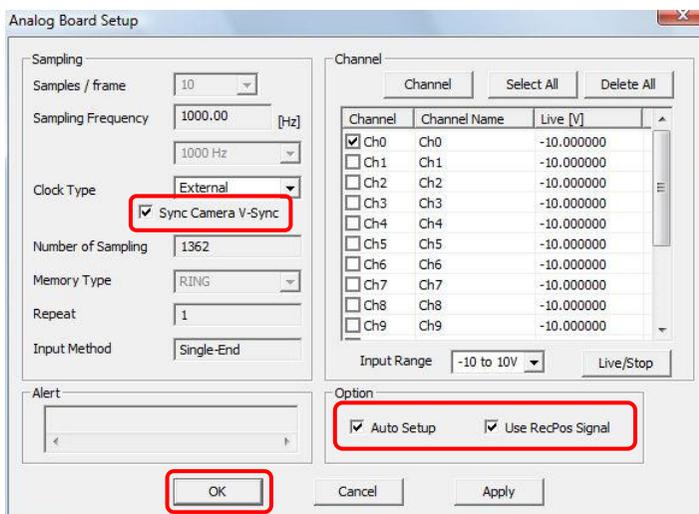


### 3.4.2. Software Settings

1. Click the "Clock Type" [▼] button and select "External" from the list displayed.



2. Check “Sync Camera V-Sync” and “Auto Setup”, “Use RecPos Signal” under “Option” and click the [OK] button.



### Caution

- An alert may be displayed after completing the above settings. If no alert is shown then there are no problems with the settings.

### Supplement

- If “Sync Camera V-Sync” is checked, the sampling frequency is set to the camera's V-Sync. For cameras with the “SYNC OUT TIMES setting”, the sampling frequency is set as shown below. Sampling frequency = frame rate × SYNC OUT multiplying factor

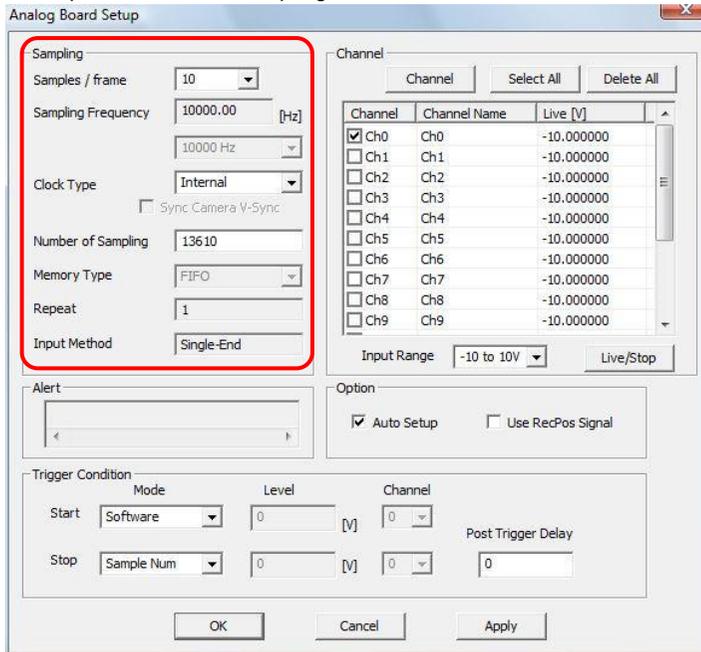
### Reference

- For the alert display, refer to “Chapter. 5. Alert Display”, page 41.

### 3.5. Setup Screen

◆ Sampling

Sets options related to sampling



Item	Description
Samples / frame	Select from the list how many points of data to acquire in 1 frame. The sampling frequency is set according to this value and the camera's frame rate. When setting a desired sampling frequency, select "Off".
Clock Type	Select the clock type. Internal : Internal clock, operates with waveform input board's internal clock. External : External clock, operates with an externally input clock signal. When using an external clock, you must also set the sampling frequency of the signal to input. When setting the external clock's sampling frequency matched to the camera's V-Sync output frequency, check "Sync Camera V-Sync".
Number of Sampling	Sets the number of samplings. If "Auto Setup" is checked, this setting is automatically calculated from the sampling frequency, frame rate, and recording frame count. If an alert is displayed, adjust manually.
Memory Type	Select the recording technique. FIFO :After recording starts, ends recording when the number of samplings set is reached. RING :After recording starts, endless recording. After the trigger input, performs sampling after the post trigger delay amount and ends recording.

Item	Description
Repeat	Sets the repeat count. The repeat count means the number of times to repeat from the establishment of the conditions to start sampling until the end of sampling including the sampling delay. Set this option when using triggers such as random or random reset.
Input Method	Displays the connection method of the analog signal to input. This setting can only be set with the board's jumpers. Single-end input (Single-End) or differential input (Differential) is displayed.

**Caution**

- If the waveform input board is set to a sampling frequency that is not possible in the specification, it is automatically set to an approximate value.

**Supplement**

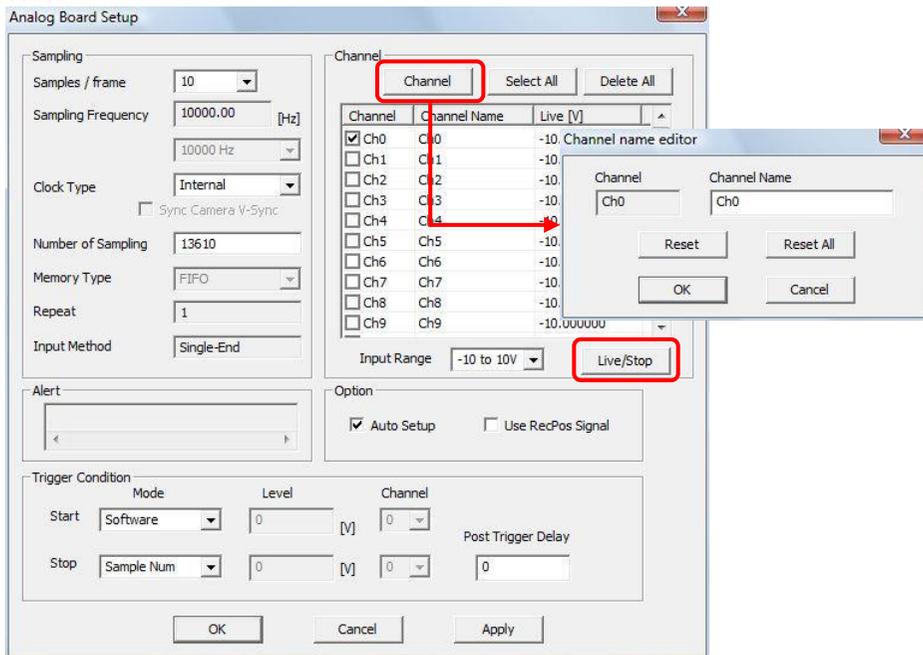
- If "Samples / frame" is set to "Off", sampling frequencies that fulfill the below conditions are displayed in the "Sampling Frequency" list.
  - Integral multiple of the frame rate
  - Input board specification

◆ Channel

Check the channel(s) to use.

You can change the channel name by clicking the [Channel] button.

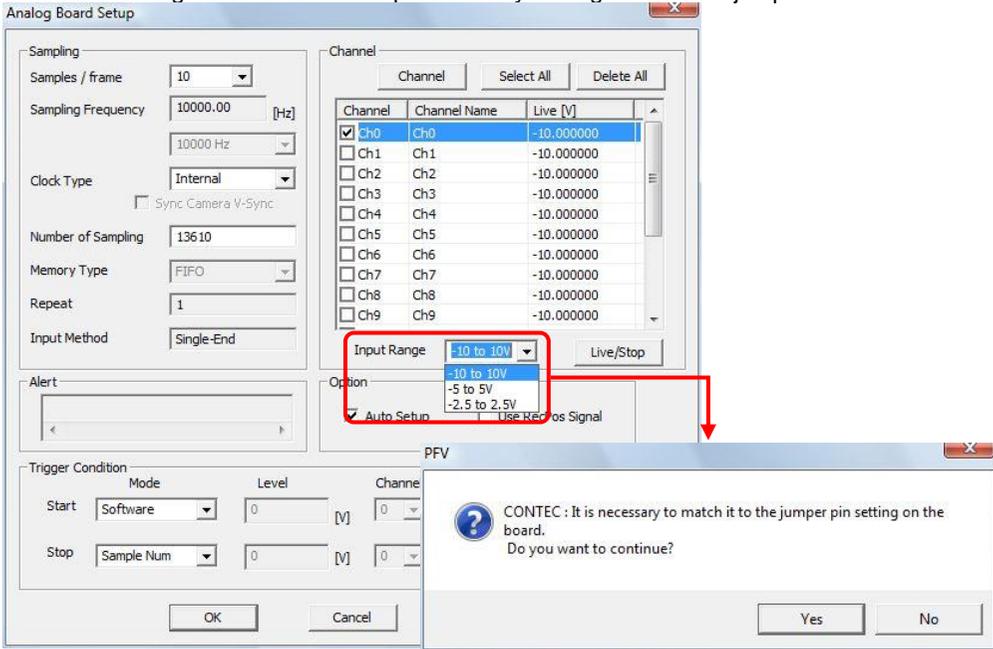
The voltage is displayed (real-time display) for each channel. To stop the display, click the [Live/Stop] button.



**Supplement**

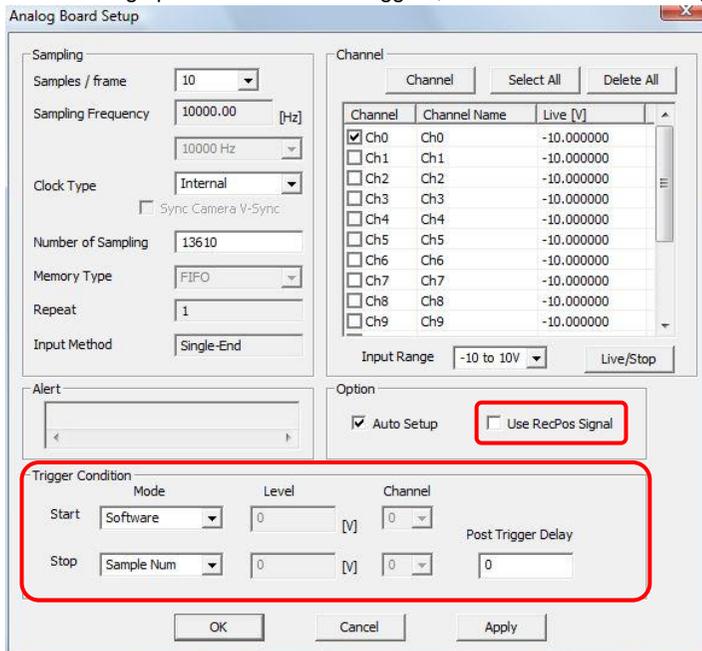
- To set the input voltage range, after selecting the channel to set, click the “Input Range” [▼] button and set. After setting the option a verification message is displayed.

Match the setting on the waveform input board by setting the board's jumpers.



◆ Trigger Condition

When setting options related to the triggers, uncheck “Use RecPos Signal”.



Item	Description							
Start	Sets the recording start and stop conditions.							
	<table border="1"> <tr> <td>Software</td> <td>Input the trigger in conjunction with the PFV Record button (start trigger only)</td> </tr> <tr> <td>Sample Num</td> <td>When the specified number of samples is obtained (stop trigger only)</td> </tr> <tr> <td>External Down</td> <td>External trigger falls</td> </tr> </table>	Software	Input the trigger in conjunction with the PFV Record button (start trigger only)	Sample Num	When the specified number of samples is obtained (stop trigger only)	External Down	External trigger falls	
	Software	Input the trigger in conjunction with the PFV Record button (start trigger only)						
Sample Num	When the specified number of samples is obtained (stop trigger only)							
External Down	External trigger falls							
<table border="1"> <tr> <td>External Up</td> <td>External trigger rises</td> </tr> <tr> <td>Level Up</td> <td>When the voltage input to the channel passed the voltage level set in [Level] in the rising direction</td> </tr> <tr> <td>Level Down</td> <td>When the voltage input to the channel passed the voltage level set in [Level] in the falling direction</td> </tr> <tr> <td>Level Up or Down</td> <td>When the voltage input to the channel passed the voltage level set in [Level] regardless of rising or falling</td> </tr> </table>	External Up	External trigger rises	Level Up	When the voltage input to the channel passed the voltage level set in [Level] in the rising direction	Level Down	When the voltage input to the channel passed the voltage level set in [Level] in the falling direction	Level Up or Down	When the voltage input to the channel passed the voltage level set in [Level] regardless of rising or falling
External Up	External trigger rises							
Level Up	When the voltage input to the channel passed the voltage level set in [Level] in the rising direction							
Level Down	When the voltage input to the channel passed the voltage level set in [Level] in the falling direction							
Level Up or Down	When the voltage input to the channel passed the voltage level set in [Level] regardless of rising or falling							
Stop								
Level	Specifies the trigger voltage when either “Level Up”, “Level Down”, or “Level Up or Down” is specified in the trigger conditions (“Start” or “Stop”).							
Channel	Specifies the channel to input the analog signal which becomes the trigger when either “Level Up”, “Level Down”, or “Level Up or Down” is specified in the trigger conditions (“Start” or “Stop”).							
Post Trigger Delay	Enter the delay count. From the input of the trigger, start/end the actual sampling of data delayed by the amount of the delay count entered here.							



### Caution

- When “Auto Setup” is checked, the settings change in conjunction with changes in the camera settings.
- Auto setup is simply one example of coordination with the camera.  
In particular, the trigger conditions must be reset for the recording environment.
- You can only make the camera coordinate with the board when the camera is set to start trigger, center trigger, end trigger, manual trigger, or random trigger.
- Setting the sampling frequency high may result in an error.

## 3.6. About The Board

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This waveform input board can perform sampling under the following conditions.

- Maximum sampling frequency: 1 MHz/ch
- Maximum input channels: 16 channels
- Maximum input voltage: 10V

For details, refer to the waveform input board's manual.

### Caution

- You can sample up to a maximum of 1 MHz with 1 channel, but with each increase in the number of channels used, the maximum sampling frequency decreases to a value divided by the number of channels.

Example :

When 5 channels are used, the maximum sampling frequency is 200 kHz.

- This waveform input board uses a multiplexer architecture and therefore has the following restrictions.
  - A delay of 1 microsecond occurs per channel.
  - Depending on the signal generator the board is connected to, there is a possibility that the signals input to other channels may be affected.  
In order to avoid this, leave an opening between the channels to input signals to and short the ground wires with the signal wires of the open channels. Since this can discharge the electrical charge stored in the neighboring channels, the affect to the other channels can be avoided. However, the number of channels that can be used is restricted to a maximum of 8 channels.

# Chapter. 4 **Using the Interface Corporation Waveform Input Board**

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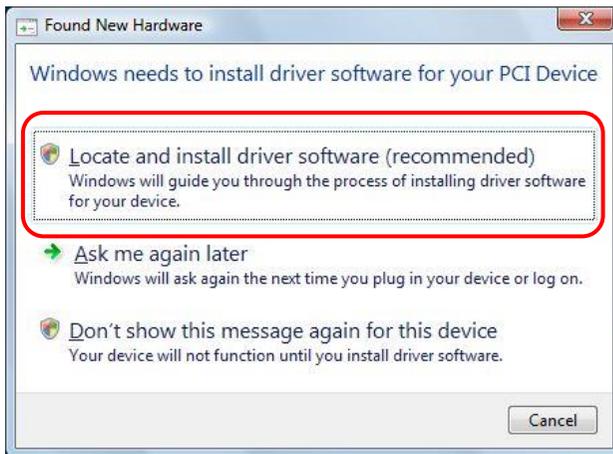
## 4.1. Driver Installation

When installing the PCI analog waveform input board manufactured by Interface Corporation, install it with the procedure below.

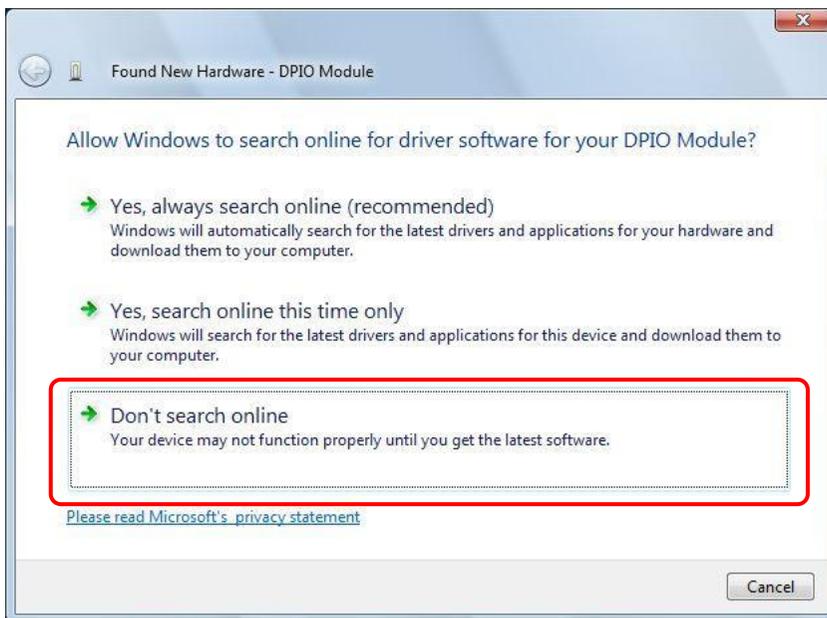
### Caution

- If the “An unidentified program wants access to your computer” message is displayed, click the [Allow] button.
- If the “User Account Control” dialog box is displayed during installation, click the [Continue] button.

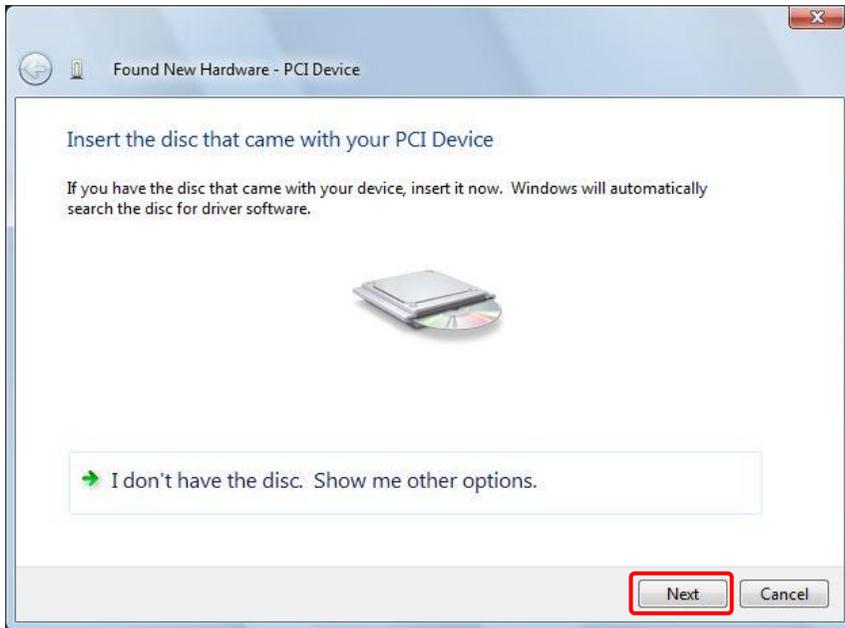
1. After installing the board, when you start PC the “Found New Hardware” screen is displayed. Click [Locate and install driver software (recommended)].



2. Click [Don't search online].



3. Insert the driver CD in the CD (or DVD) drive and click the [Next] button.



4. Installation starts. A warning may be displayed during the installation process. Click [Install this driver software anyway] to continue installing.



5. The installation complete dialog box is displayed. Click the [Close] button.



6. You must install a total of three drivers for this board. Repeat steps 1 through 5 a total of three times.

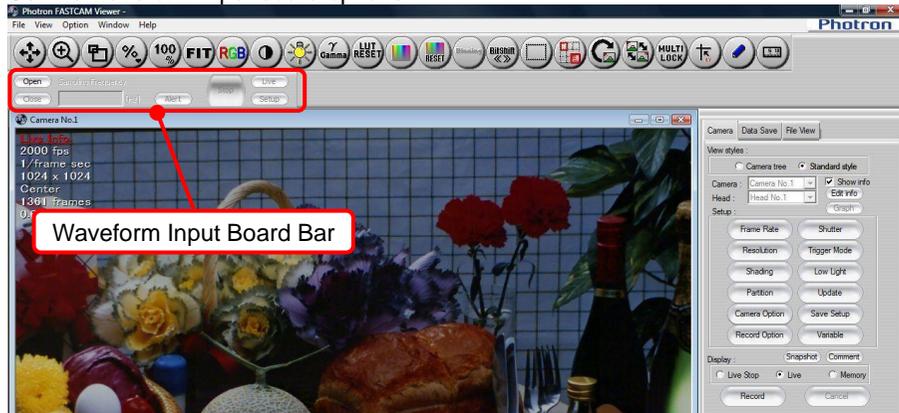
 **Supplement**

- If the board was not installed correctly, refer to the waveform input board manual.

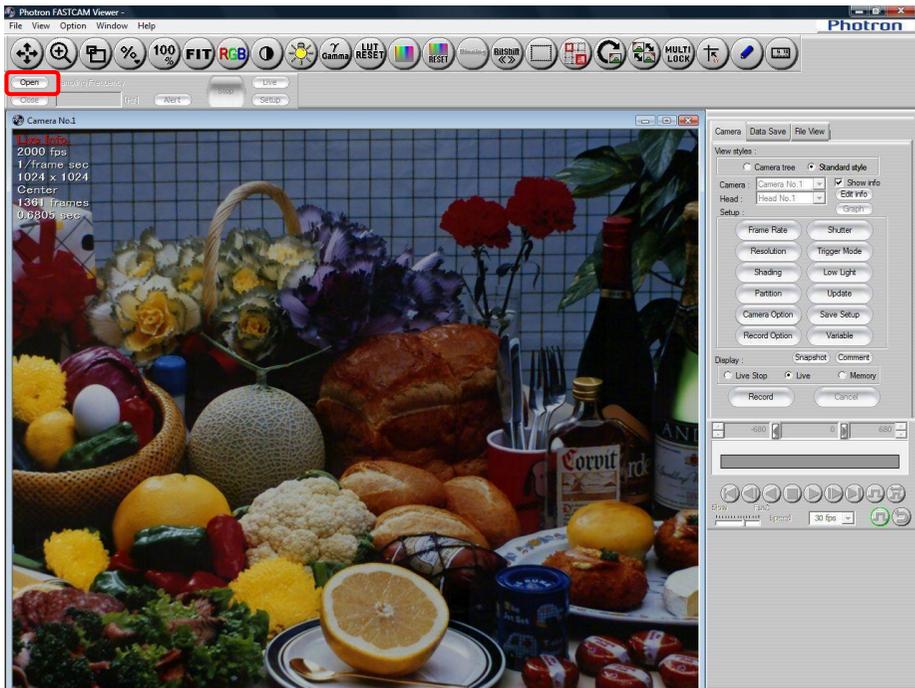
## 4.2. Software Setup

After installing the driver, the waveform input board bar is displayed on the PFV screen.

Set the waveform input board options.



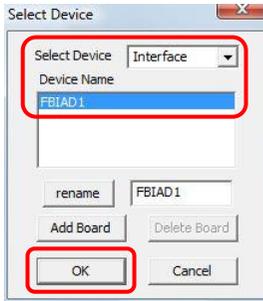
1. Click the [Open] button on the waveform input board.



### Supplement

- If the waveform input board bar is not displayed, click [View] – [Waveform Input Board Bar] on the menu.

2. With "Select Device", select the manufacturer of the waveform input board to use. Select a board to use from the list displayed in "Device Name" and click the [OK] button.



 Supplement

- The name shown in "Device Name" must be the same as the device name shown in Device Manager. If the names are different, after selecting the board to change, enter the changed name in the box to the right of the [Rename] button, then click the [Rename] button to change it.

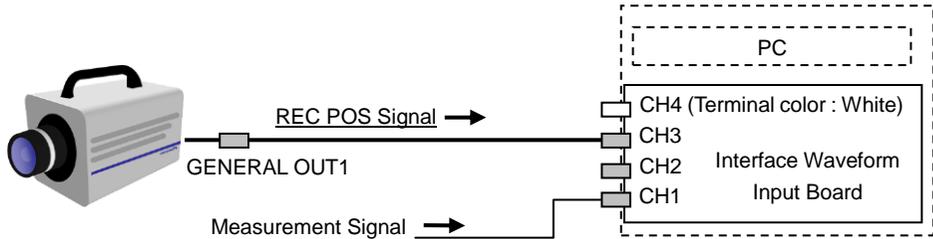


- To use multiple boards, add them with the [Add Board] button. To delete a board, after selecting the board to delete, click the [Delete Board] button.

## 4.3. Settings for Using the REC POS Signal

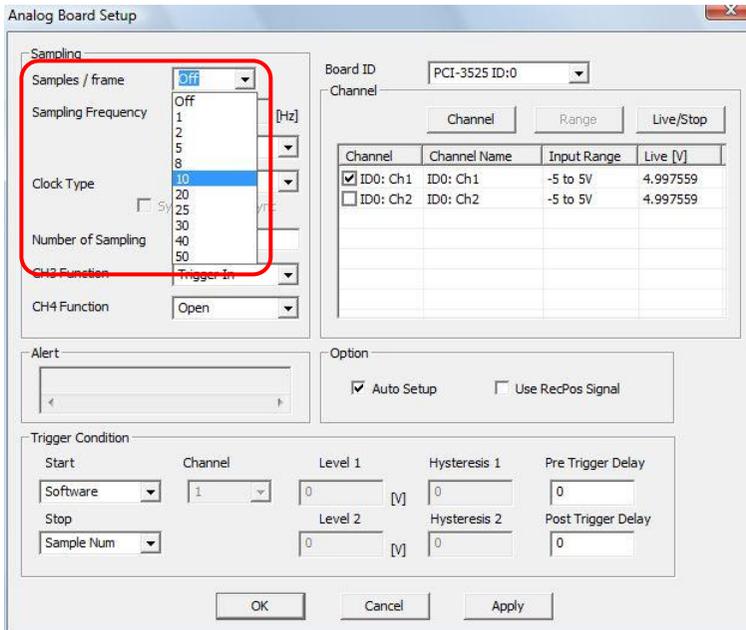
### 4.3.1. Connection Method

1. Connect the camera's GENERAL OUT1 terminal to the CH3 terminal on the Interface board, and set the output of GENERAL OUT1 terminal to REC POS signal.

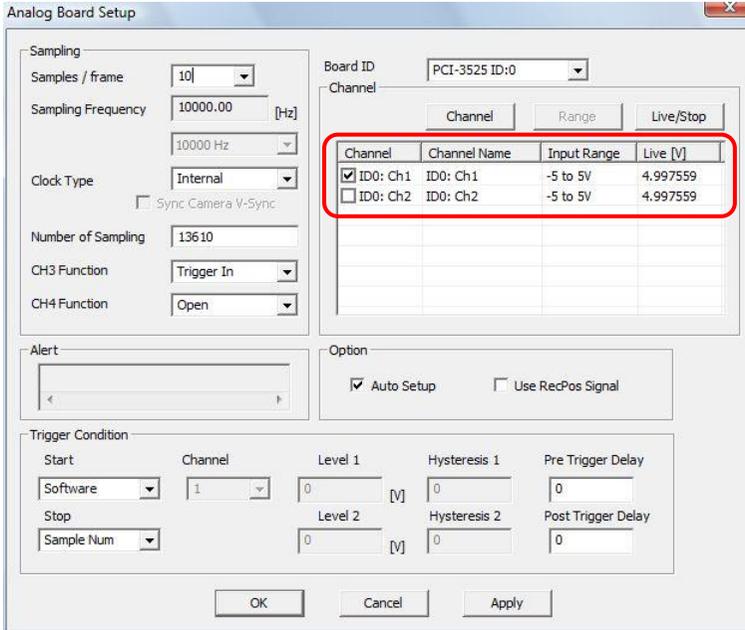


### 4.3.2. Software Settings

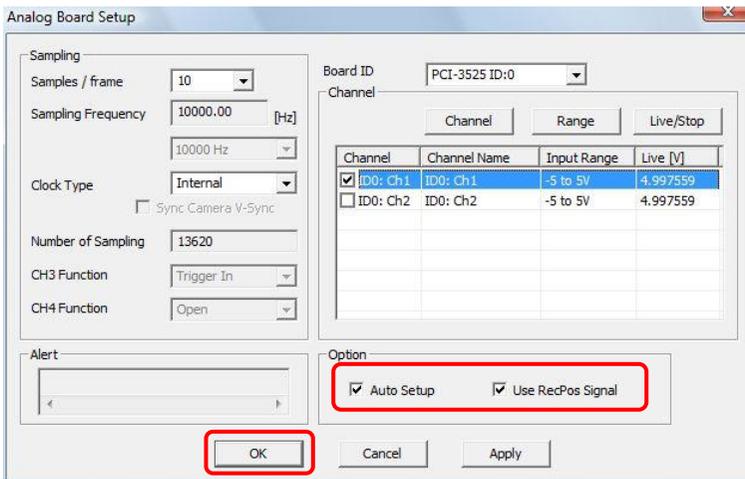
1. Click the “Samples / frame” [▼] button and select the desired value from the list displayed.



2. Check the channel(s) to acquire data.



3. Check “Auto Setup” and “Use RecPos Signal” under “Option” and click the [OK] button.



**Caution**

- When the sampling frequency is set high, an alert may be displayed after completing the above settings.  
If no alert is shown then there are no problems with the settings.

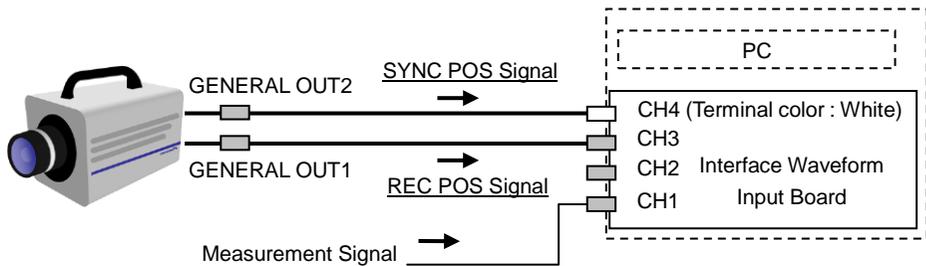
**Reference**

- For the alert display, refer to “Chapter. 5. Alert Display”, page 41.

## 4.4. Settings for Using the REC POS Signal (When Synchronizing to the Camera's V-SYNC Signal)

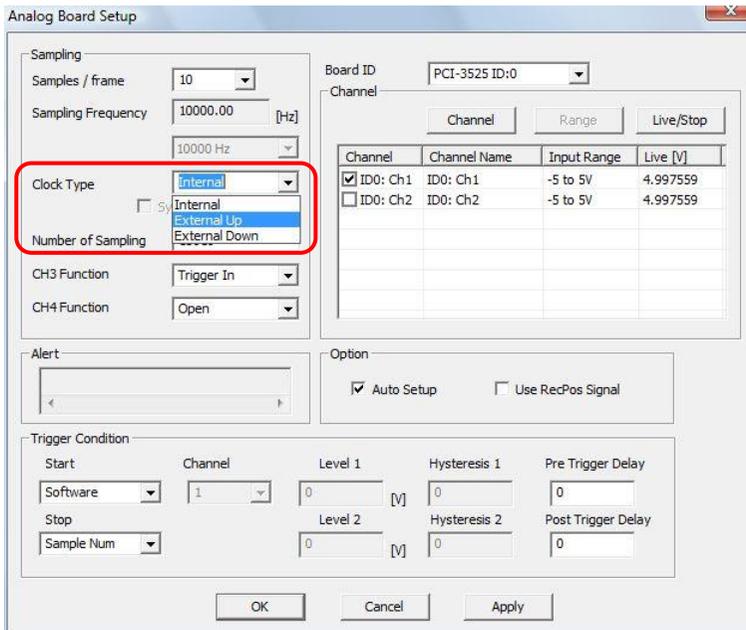
### 4.4.1. Connection Method

1. Connect the camera's GENERAL OUT1 terminal to the CH3 terminal on the Interface board, and set the output of GENERAL OUT1 terminal to REC POS signal.
2. Connect the camera's GENERAL OUT2 terminal to the CH4 terminal on the Interface board, and set the output of GENERAL OUT2 terminal to SYNC POS signal.  
The terminal name varies according to the camera. ([SYNC OUT] or [EXT\_V OUT] etc.)

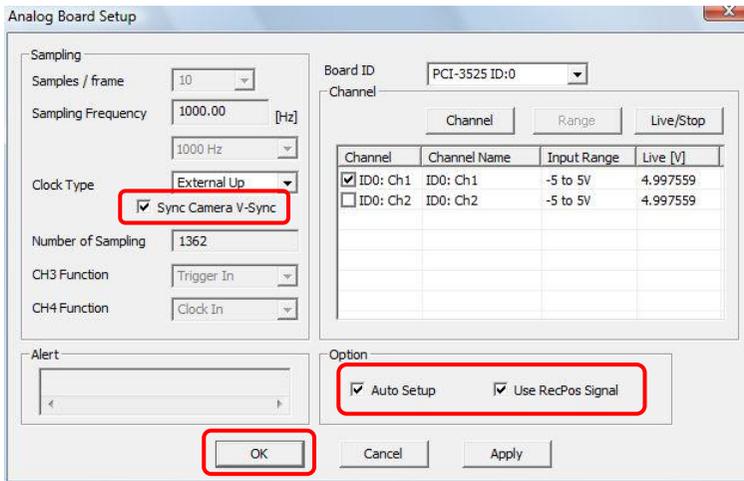


### 4.4.2. Software Settings

1. Click the "Clock Type" [▼] button and select "External Up" or "External Down" from the list displayed.



2. Check “Sync Camera V-Sync” and “Auto Setup”, “Use RecPos Signal” under “Option” and click the [OK] button.



**Caution**

- An alert may be displayed after completing the above settings. If no alert is shown then there are no problems with the settings.

**Supplement**

- If “Sync Camera V-Sync” is checked, the sampling frequency is set to the camera's V-Sync. For cameras with the “SYNC OUT TIMES setting”, the sampling frequency is set as shown below. Sampling frequency = frame rate × SYNC OUT multiplying factor

**Reference**

- For the alert display, refer to “Chapter. 5. Alert Display”, page 41.

## 4.5. Setup Screen

### ◆ Sampling

Sets options related to sampling.

Analog Board Setup

Board ID: PCI-3525 ID:0

Channel: Channel Range Live/Stop

Channel	Channel Name	Input Range	Live [V]
<input checked="" type="checkbox"/>	ID0: Ch1	-5 to 5V	4.997559
<input type="checkbox"/>	ID0: Ch2	-5 to 5V	4.997559

Alert: [ ]

Option:  Auto Setup  Use RecPos Signal

Trigger Condition

Start	Channel	Level 1	Hysteresis 1	Pre Trigger Delay
Software	1	0 [V]	0	0
Stop	Channel	Level 2	Hysteresis 2	Post Trigger Delay
Sample Num		0 [V]	0	0

Buttons: OK Cancel Apply

Item	Description
Samples / frame	Select from the list how many points of data to acquire in 1 frame. The sampling frequency is set according to this value and the camera's frame rate. When setting a desired sampling frequency, select "Off".
Clock Type	Select the clock type. Internal :Internal clock, operates with waveform input board's internal clock. External Up/Down :External clock, operates with the rise or fall of an externally input clock signal. When using an external clock, you must also set the sampling frequency of the signal to input. When setting the external clock's sampling frequency matched to the camera's V-Sync output frequency, check "Sync Camera V-Sync".
Number of Sampling	Sets the number of samplings. If "Auto Setup" is checked, this setting is automatically calculated from the sampling frequency, frame rate, and recording frame count. If an alert is displayed, adjust manually.
CH3 Function	Disable :Not used Trigger In :External trigger input Trigger Out :Trigger output Clock In :External clock input Clock Out :Clock output

Item	Description
CH4 Function	Disable :Not used
	Open :Analog output
	Trigger In :External trigger input
	Trigger Out :Trigger output
	Clock In :External clock input
	Clock Out :Clock output

**Caution**

- If the waveform input board is set to a sampling frequency that is not possible in the specification, it is automatically set to an approximate value.

**Supplement**

- If “Samples / frame” is set to “Off”, sampling frequencies that fulfill the below conditions are displayed in the “Sampling Frequency” list.
  - Integral multiple of the frame rate
  - Input board specification

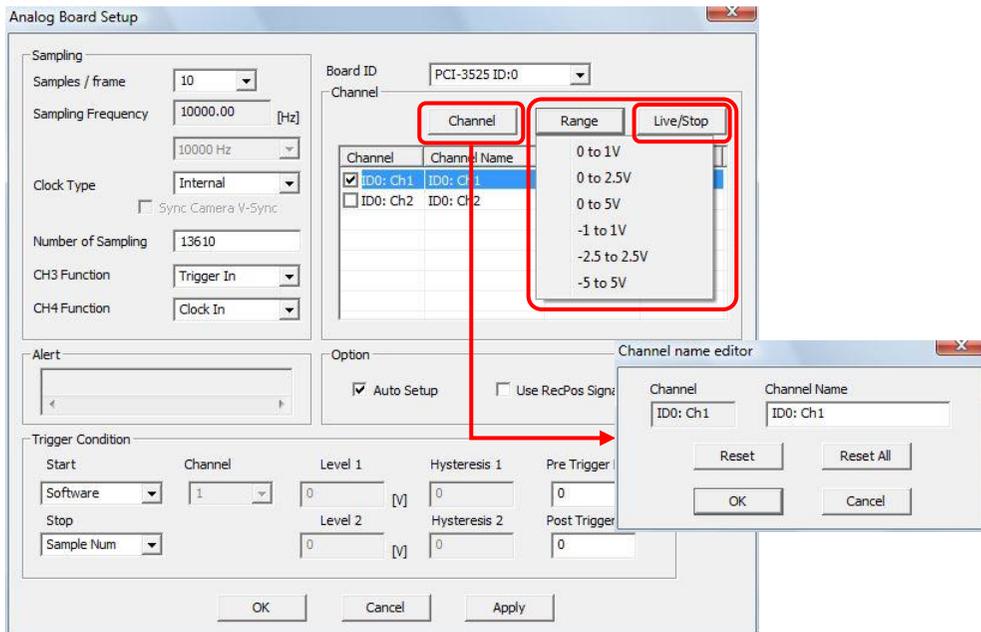
◆ Channel

Check the channel(s) to use.

To change the voltage range, after selecting the channel to change, click the [Range] button or right click on the channel line to change and set the option from the list displayed.

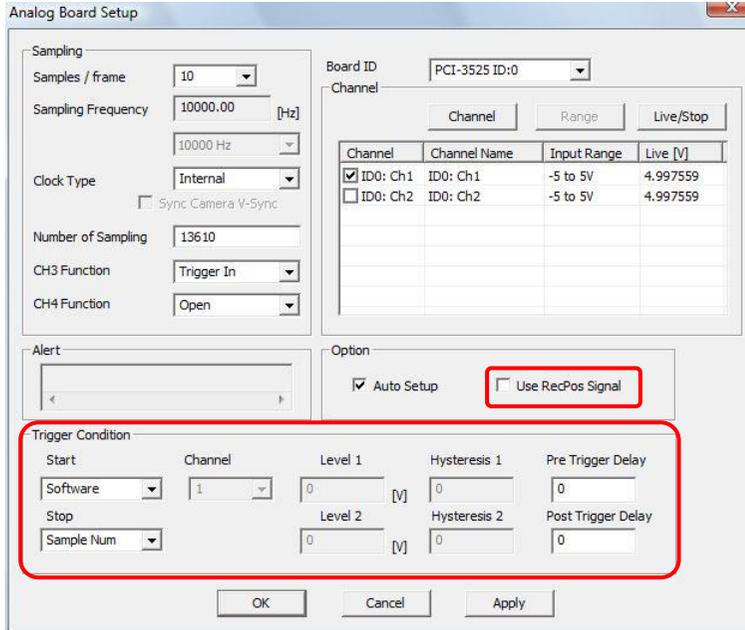
You can change the channel name by clicking the [Channel] button.

The voltage is displayed (real-time display) for each channel. To stop the display, click the [Live/Stop] button.



◆ Trigger Condition

When setting options related to the triggers, uncheck “Use RecPos Signal”.



Item	Description	
Start	Sets the recording start and stop conditions.	
	Software	Input the trigger in conjunction with the PFV Record button
	External Down	External trigger falls
	External Up	External trigger rises
	Sample Num	When the specified number of samples is obtained (stop trigger only)
	Level1 Up	When the voltage input to the channel passed the voltage level set in [Level1] in the rising direction
	Level1 Down	When the voltage input to the channel passed the voltage level set in [Level1] in the falling direction
Stop	Level1 Up or Down	When the voltage input to the channel passed the voltage level set in [Level1] regardless of rising or falling
	Level2 Up	When the voltage input to the channel passed the voltage level set in [Level2] in the rising direction
	Level2 Down	When the voltage input to the channel passed the voltage level set in [Level2] in the falling direction
	Level2 Up or Down	When the voltage input to the channel passed the voltage level set in [Level2] regardless of rising or falling
Channel	Specifies the channel to input the analog signal which becomes the trigger when “Level1” or “Level2” is specified in the trigger conditions (“Start” or “Stop”).	
Level 1	Specifies the trigger voltage when “Level1” or “Level2” is specified in the trigger conditions (“Start” or “Stop”).	
Level 2		
Hysteresis 1	Specifies the hysteresis voltage of the trigger voltage when “Level1” or “Level2” is specified in the trigger conditions (“Start” or “Stop”).	
Hysteresis 2		

Item	Description
Pre Trigger Delay	Enter the delay count. From the input of the trigger, start/end the actual sampling of data before the amount of the delay count entered here.
Post Trigger Delay	Enter the delay count. From the input of the trigger, start/end the actual sampling of data delayed by the amount of the delay count entered here.

 **Caution**

- When “Auto Setup” is checked, the settings change in conjunction with changes in the camera settings.
- Auto setup is simply one example of coordination with the camera. In particular, the trigger conditions must be reset for the recording environment.
- You can only make the camera coordinate with the board when the camera is set to start trigger, center trigger, end trigger, or manual trigger.
- Setting the sampling frequency high may result in an error.

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## 4.6. About The Board

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This waveform input board can perform sampling under the following conditions.

- Maximum sampling frequency: when 1 ch, 20 MHz; when 2 ch, 10 MHz
- Maximum input channels: 2 channels
- Maximum input voltage: 5V

For details, refer to the waveform input board's manual.

### Caution

- According to the PC and camera resolution, when the sampling frequency is set to 4 MHz or higher, sampling may stop during recording.  
In that case, set the sampling frequency lower or set the camera to Live Stop mode and start recording.



# Chapter. 5 **Alert Display**

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When there is an error in a waveform input board setting, the [Alert] button on the waveform input board bar is displayed in red.

If you click the [Alert] button, a message box is displayed and you can confirm the content of the alert. This error is also displayed in “Alert” on the “Analog Board Setup” dialog box.

When “Auto Setup” is checked, an alert may be displayed when the frame rate or resolution is changed.



Error Display	Error Content
Frequency Over	The sampling frequency exceeds the range that can be set.
Samples / frame not integer error	The sampling frequency is not an integral multiple of the frame rate.
Frequency change Error	The intended sampling frequency was not set. The sampling frequency has been set with the nearest possible value.
Number of Sampling Over	The number of samples exceeds the value that can be set.
Camera Trigger mode Error	The present trigger mode cannot be synchronized with the waveform input board.
Channel Error	The number of channels that can be set has been exceeded.
CH3 Error (Interface waveform input board only)	CH3 cannot be set.
CH4 Error (Interface waveform input board only)	CH4 cannot be set.

# Chapter. 6 **Using Waveform Input Data**

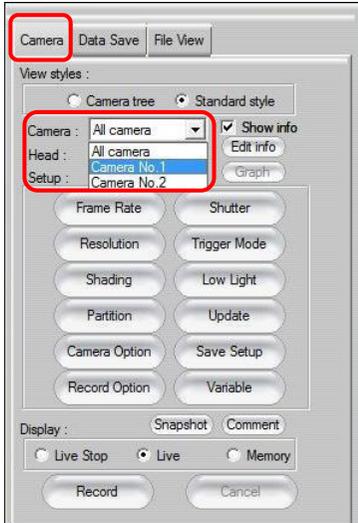
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PFV can graph and display waveform input data recorded simultaneously when recording video.

## 6.1. Graphic Display of Waveform Input Data

This step sets the camera to graphically display external data at a recording.

1. After recording, have the [Camera] tab displayed on the control panel and, within the [Camera] tab, select the camera that has recorded the waveform input data to be replayed.



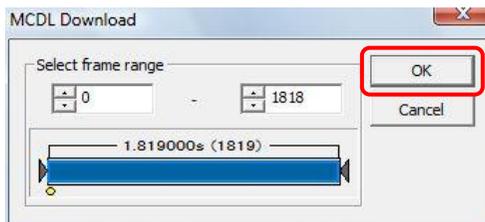
2. Select and check [Memory] in the [Display] field.



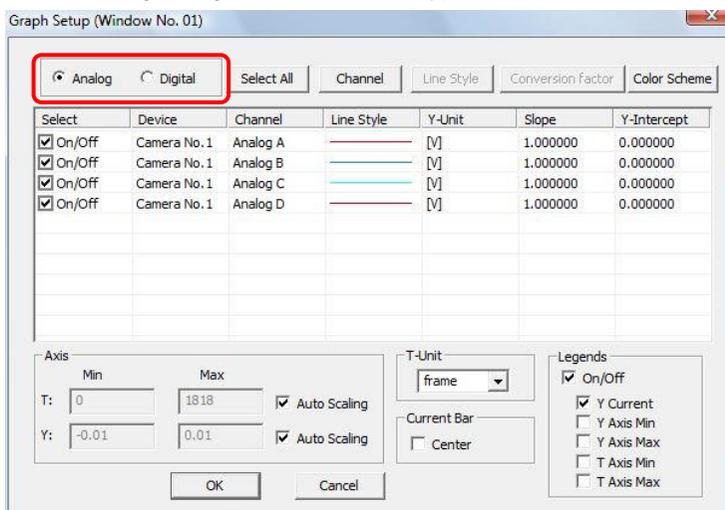
- Click the [Graph] button. Note, however, if waveform input data has not been recorded during the recording, this button is grayed out.



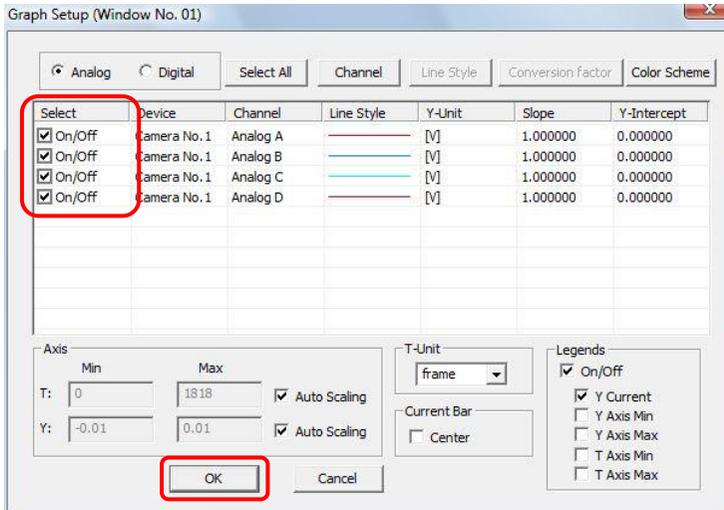
- For MCDL, the "MCDL Download" dialog box is displayed. (If not MCDL, the dialog box is not displayed. Proceed to step 5. ) Click the [OK] button and download of waveform input data begins. To set a range of data for display, select any range of data to download and click the [OK] button.



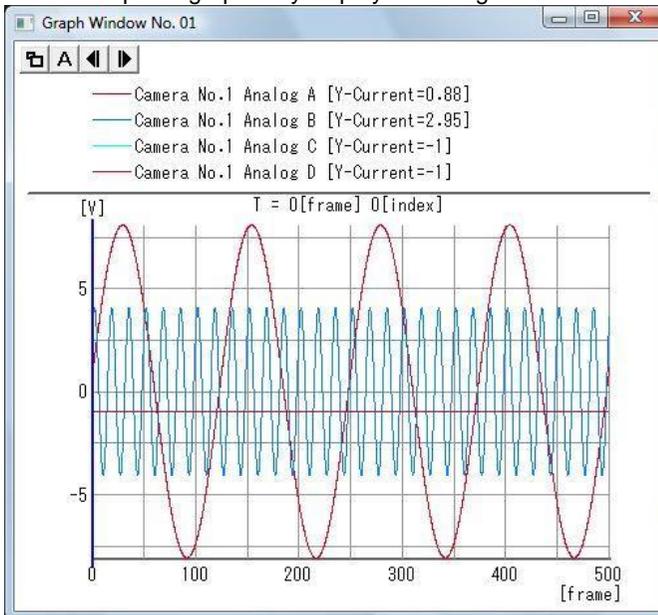
- The desired data is downloaded and [Graph Setup] dialog box is displayed. The camera name or waveform input board name that captured the waveform input data is displayed in "Device". Check Analog or Digital to select either type of the recorded data for display.



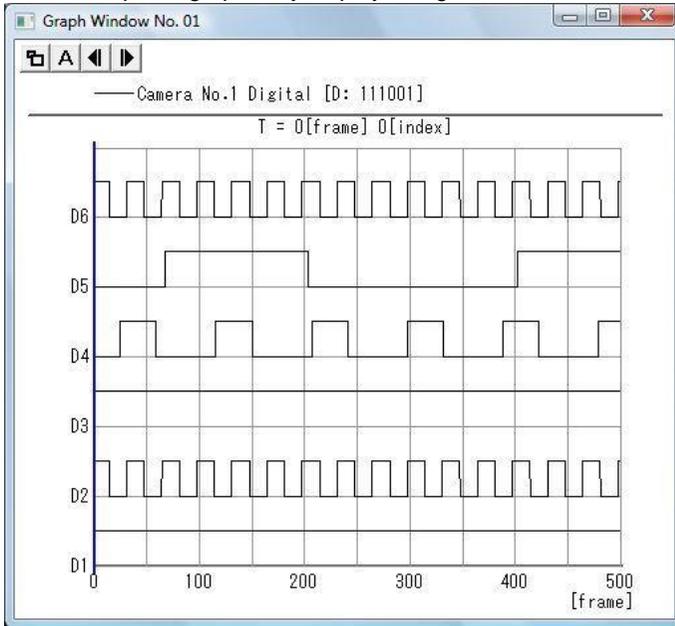
- Select channels to display.  
Check the desired channels in the [Select] column and click the [OK] button.



- Graph is displayed.  
• An example of graphically displayed analog waveform data



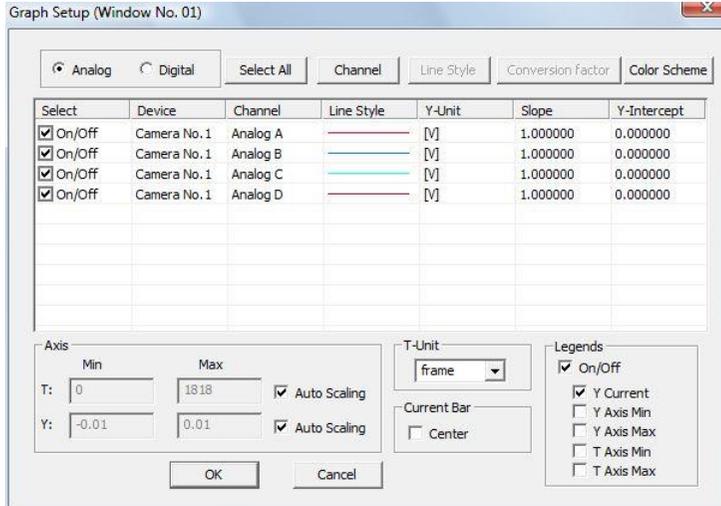
- An example of graphically displayed digital data



## 6.2. Settings for Graphic Display of Waveform Data

After download of waveform input data, or by right-clicking on the graph and clicking [Graph Setup], the [Graph Setup] dialog box appears.

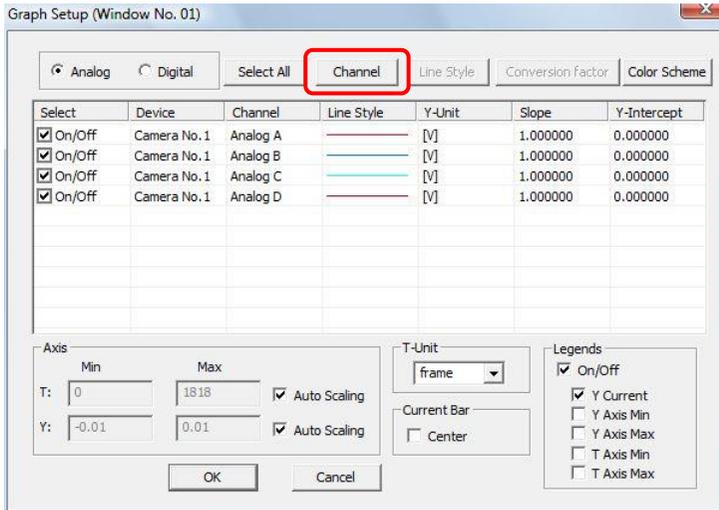
In the [Graph Setup] dialog box, parameters such as the width, color and gradient for the graph can be set.



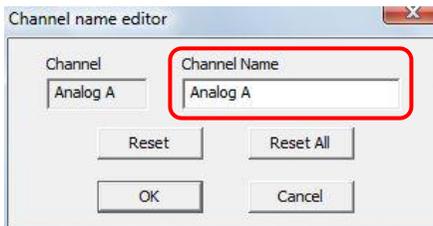
Item	Description
Select	Sets Hide/Unhide for the recorded data.
Device	Shows the name of the camera that has recorded waveform data.
Channel	Shows the channel name. The name can be changed by double clicking on it.
Line style	Shows the style of lines to display graph - color, type, width, etc. of lines. A right click can change line styles.
Y-Unit	Shows the unit of displayed data. A right click can change units.
Slope	Shows the slope of graph of displayed data. A right click can change slope values.
Y-Intercept	Shows the Y-intercept of displayed data. A right click can change intercept values.

## 6.2.1. Changing the Channel Name

1. Select the channel to change and click the [Channel] button.



2. Enter the desired name in "Channel Name" and click the [OK] button. The channel name is reset to the original channel name (displayed in "Channel") by clicking the [Reset] button. All the channel names are reset by clicking the [Reset All] button.



### Caution

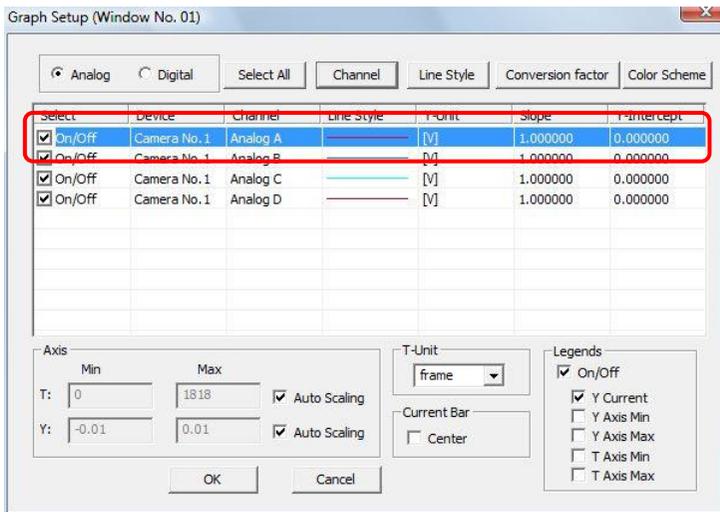
- When using MCDL, channel names changed with the "Graph Setup" dialog box are also displayed at the next startup and are also reflected in the names when saving data and outputting to CSV. However, when the connected camera setup is changed, the channel names are reset to the original names.
- When using the waveform input board, channel names changed with the "Graph Setup" dialog box are reflected in saved data and CSV output, but they are not displayed at the next startup. Channel names changed with the "Analog Board Setup" dialog box are also displayed at the next startup and are also reflected in the names when saving data and outputting to CSV.

### Supplement

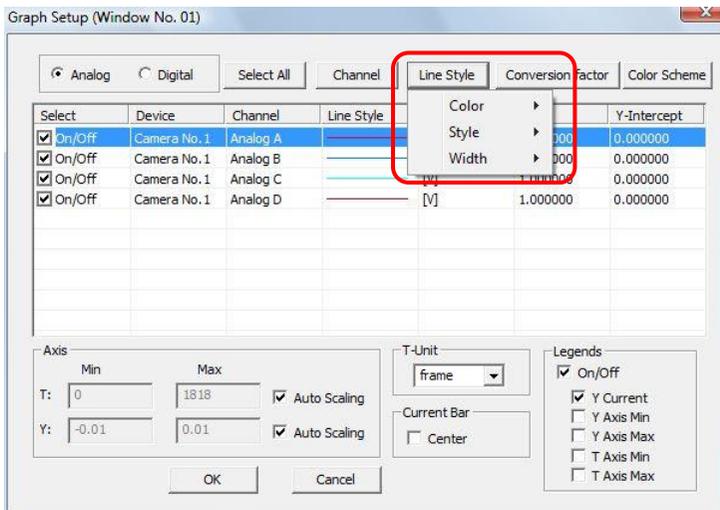
- You can also change the channel name by double clicking on the channel to change.

## 6.2.2. Setting Style of Displayed Graph

1. Click on the channel where setting should take place.

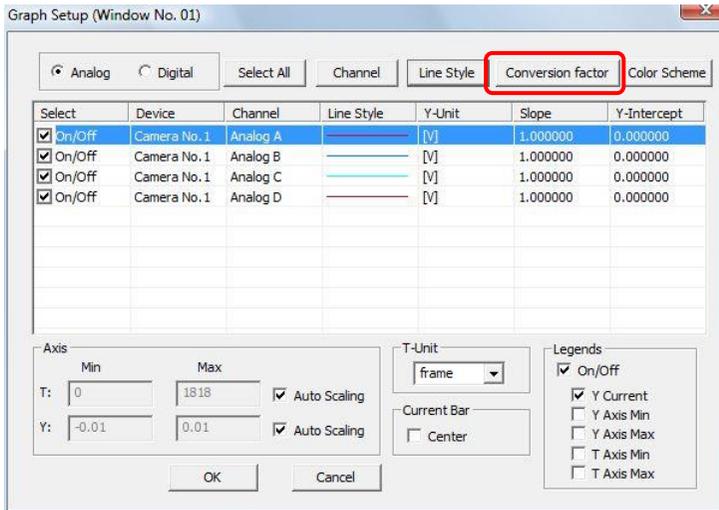


2. Click [Line style] and select a color, style and width from the displayed list. Setting can also be made by right clicking on the [Line style] column of selected channels.

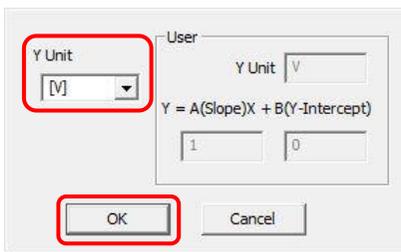


## 6.2.3. Setting Display Unit, Gradient and Segment

1. Click the [Conversion factor] button.



2. Set a unit from the [Y Unit] list and click the [OK] button.  
Select [user] and set any value.



### ! Caution

- Slope and Y-Intercept can be set to each channel independently.  
A unit cannot be set independently on each channel. One same unit is set and reflected on all channels.

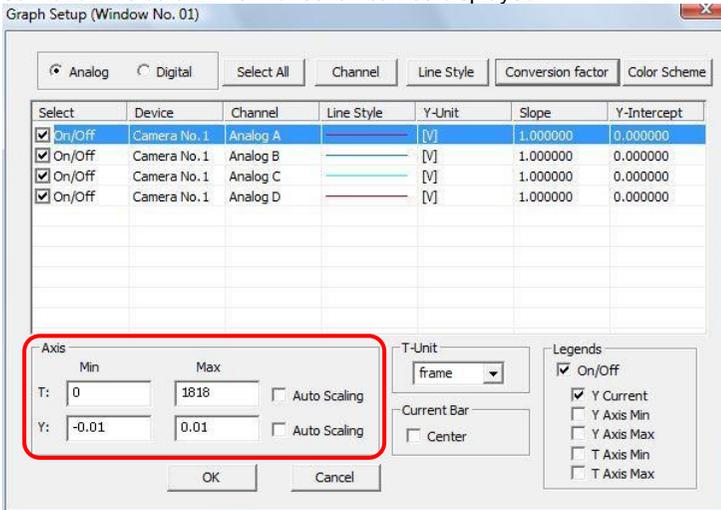
### 6.2.4. Setting Range of Graphic Display

◆ Axis (scale or calibrations)

A range of display can be set.

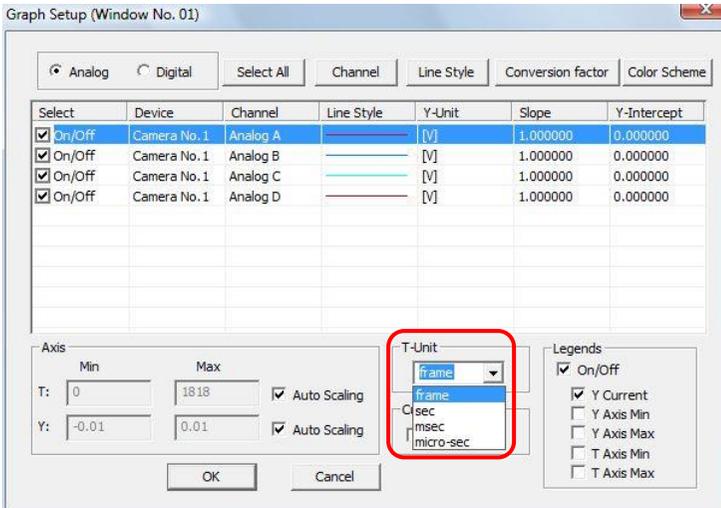
Check the [Auto Scaling] checkbox of [T] field, and the time axis range of the displayed graph is interlocked with the playback range on the play control panel.

Check the [Auto Scaling] checkbox of [Y] field, the Y-axis range is automatically controlled and readjusted so that all the data in the Y direction can be displayed.



◆ T-Unit

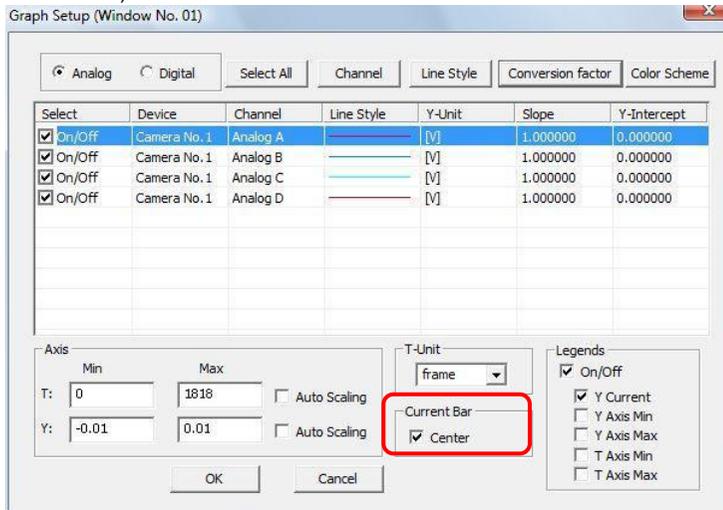
The unit for the time axis set is set.



◆ Display of current bar

Check the [Center] checkbox and the current bar is fixed in the center of the display screen. In usual playback operations, the image display screen and the current bar on the graph are displayed interlocked with each other.

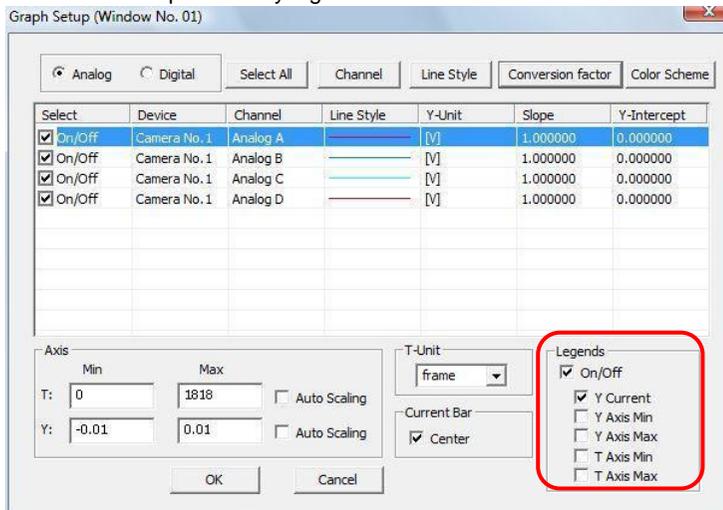
When "Center" is checked, only the maximum value of the time axis can be changed (the minimum value is fixed at 0).



◆ Legends

When [On/Off] is checked, the legend window is displayed.

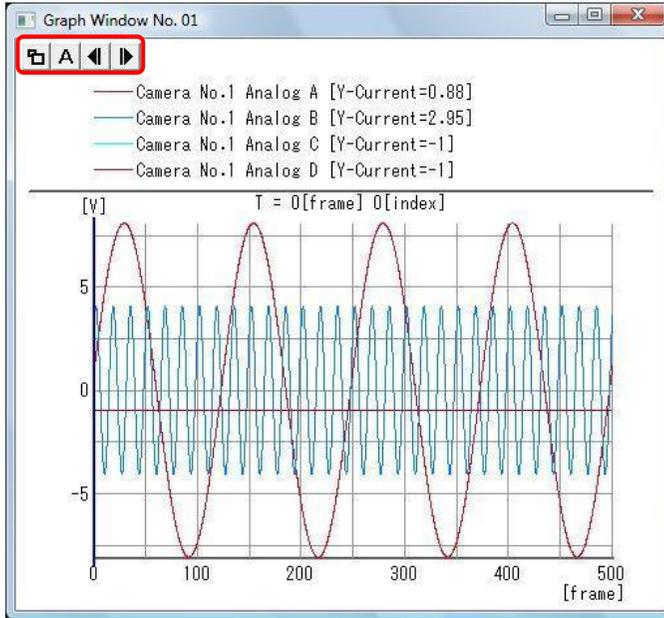
The information provided by legend covers the maximum and minimum values and the current value.



## 6.2.5. Graph View Window

### ◆ Graph View Window Button Functions

You can set the following with the buttons on the graph view window.

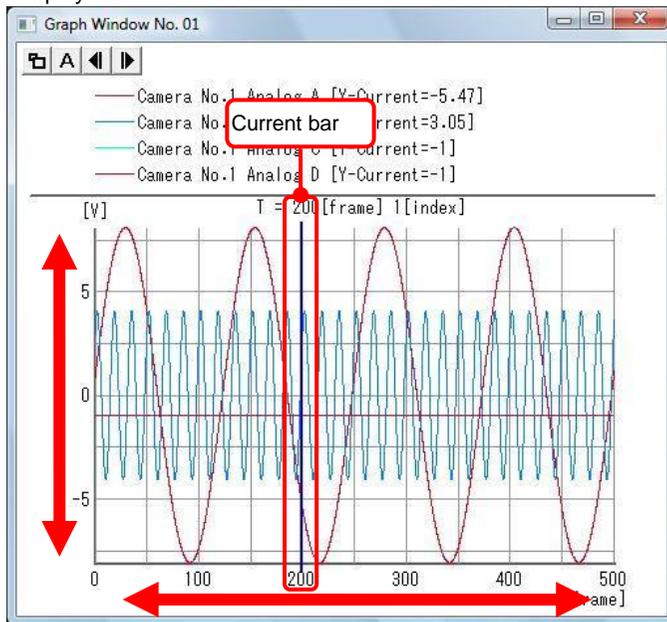


Button	Button Name/Function
	<b>Area Zoom</b> After clicking this button, drag the cursor drawing a rectangle over the portion of the graph area to display and the specified area is enlarged.
	<b>Auto-Scale</b> Displays the entire waveform.
	<b>Frame Rewind</b> Rewinds the frame by the data point unit (index unit) when clicked.
	<b>Frame Advance</b> Advances the frame by the data point unit (index unit) when clicked.

◆ Adjustment display area

A mouse drag in the horizontal direction on the graph can move the position of the current bar.

A mouse drag in the vertical or horizontal direction along the Y-axis or T-axis, respectively, changes the display area.



## 6.3. Storing Waveform Input Data in PC

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Waveform input data can be stored in the PC as a data file of CSV or other data formats.

### 6.3.1. Storing In CIH (MCD/WVD) Format

After a recording, store the waveform data in the PC in the same manner as that for image data. For MCDL, the waveform data is saved as a MCD file. For a waveform input board, the waveform data is saved as a WVD file.

The file information on this MCD file is written in the CIH file which is automatically generated at the time of storing in the PC. The waveform input data can be graphically displayed by opening this CIH file.

#### Reference

- For how to save images to the PC, refer to "Chapter 5. Saving Images to the PC" in the PFV User's Manual.

### 6.3.2. Save As Image

You can save the content of the graph as an image.

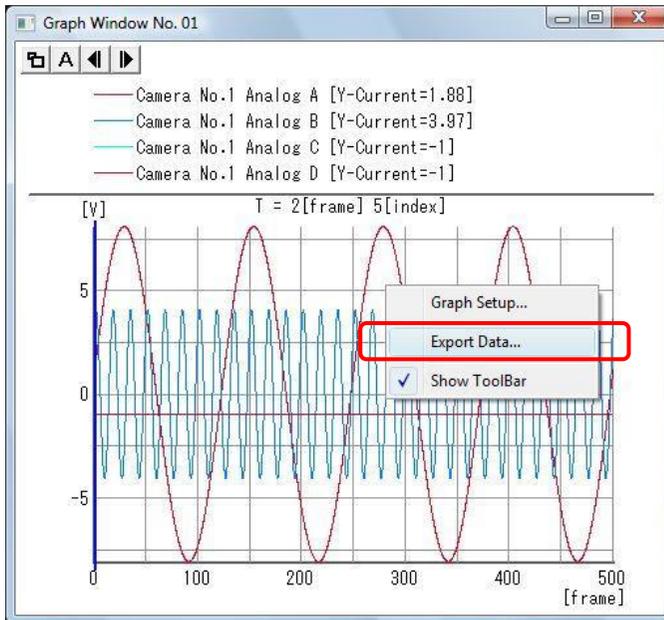
When saving as an image, the content of the graph is saved as Layout Save.

#### Reference

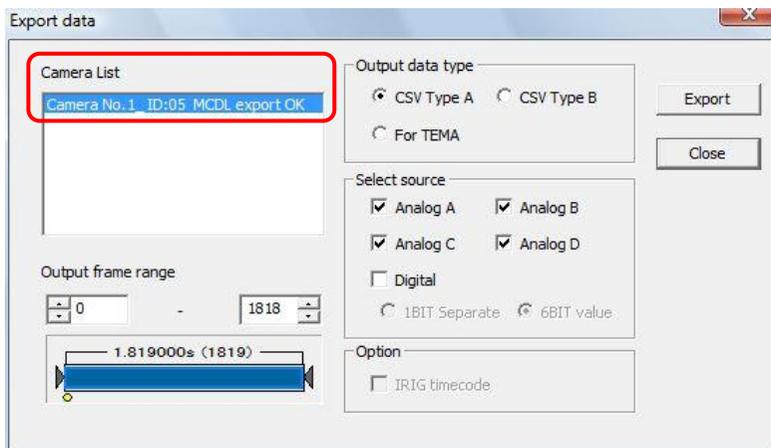
- For layout save, refer to "5.3. Layout Save" in the PFV User's Manual.

### 6.3.3. Storing In CSV format

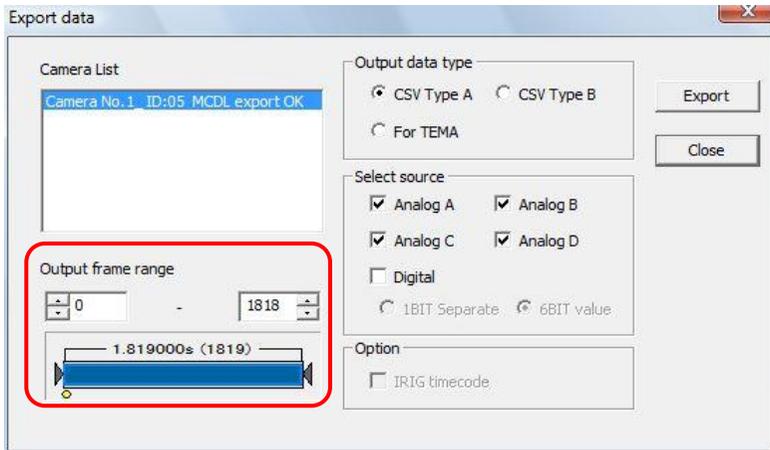
1. Graphically display the waveform input data that you wish to store in the PC.
2. Right click on the graph and select [Export Data].



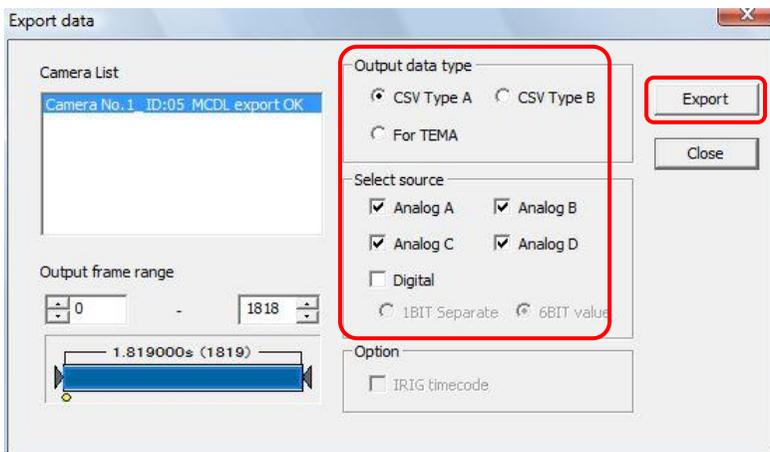
3. The "Export data" dialog box is displayed.  
From "Camera List", select the camera or waveform input board that captured the data to save.  
For cameras, when there is data that can be saved, "MCDL export OK" is displayed.



- Specify a frame range to be stored using the “Output frame range” window.



- Select an output format by “Output data type”, check data type checkboxes and click the [Export] button.  
For the digital data, select a form of output data, 1-bit divided output of six channels or output data of one single value of 6 bits.



### Supplement

- Select [For TEMA] to download waveform input data in the format compatible with the TEMA waveform data import function (ISO format).

### Reference

- For the CSV output format, refer to "8.9. CSV File Structure" in the PFV User's Manual.

- Specify the file name and the storage to store the file in, and click the [Save] button.



- After export is done, click the [OK] button.  
Click the [Close] button of the "Graph data output" dialog box to close it.

## 6.4. Displaying Stored Waveform Input Data

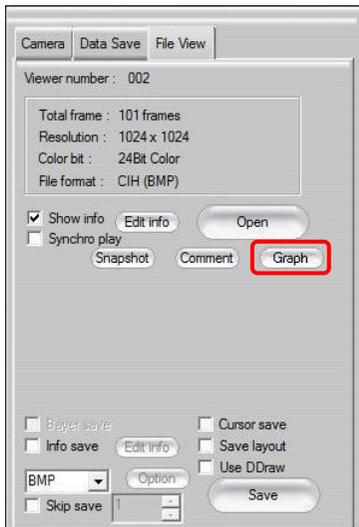
### 6.4.1. Opening CIH (MCD/WVD) Format Files

1. Display the “File View” tab on the control panel and open a saved CIH file.

#### Reference

- For how to open a saved file, refer to "6.1.1. Open Saved Data" in the PFV User's Manual.

2. Click the [Graph] button on the control panel.  
When there is no waveform input data (MCD/WVD file information) in the CIH file, the button is shown gray.



3. The [Graph Setup] dialog box is displayed.  
Make necessary settings for graphic display and click the [OK] button.

#### Reference

- For details of graphic display setting, refer to “6.2. Settings for Graphic Display of Waveform Data”, page 48.

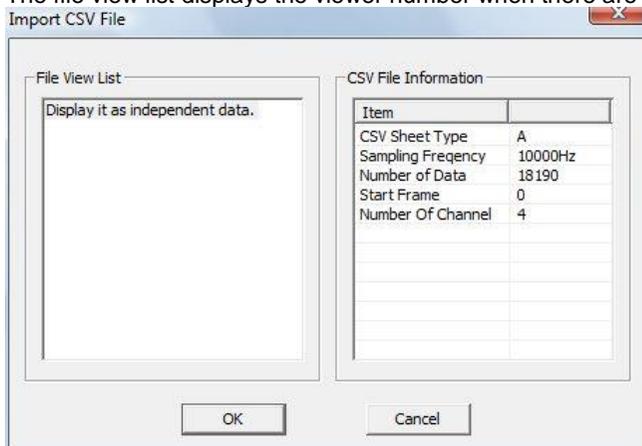
### 6.4.2. Opening CSV Format Files

1. Display the “File View” tab on the control panel and open a saved CSV file.

#### Reference

- For how to open a saved file, refer to "6.1.1. Open Saved Data" in the PFV User's Manual.

- The “Import CSV File” dialog box below is displayed.  
The file view list displays the viewer number when there are images that are already open.



- Select the viewer number of the images you wish to associate the data with from the file view list or select “Display it as independent data.” when opening the data as independent waveform data and click the [OK] button.
- The “Graph Setup” dialog box is displayed.  
After setting items for the graph display, click the [OK] button.

#### Reference

- For details of graphic display setting, refer to “6.2. Settings for Graphic Display of Waveform Data”, page 48.

#### Supplement

- When a CSV file is opened associated with images, instead of #FrameRate in the CSV file, the time axis is calculated from the images' frame rate and #SamplingRate in the CSV file.
- When a CSV file is opened associated with images, the waveform data is also saved together with the images when the images are saved.
- Even when “Display it as independent data.” is selected, you can playback the data synchronized with images by checking “Synchro play”.

#### Caution

- The only CSV files that can be opened with PFV are those output by PFV.
- Reading IRIG data is not supported. Data is read ignoring the IRIG data portion.
- Reading digital data is not supported. However, data saved as “1-bit separate values” is read as analog 0s and 1s. Data saved as “6-bit values” is recognized as analog data but the values are all 0.



# Chapter. 7 **Piezo Control System** **(When Using a Microscope)**

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You can construct a Piezo control system using the CONTEC Co., Ltd. waveform input board and the Micro Science waveform output board.

With a Piezo control system, you can shoot by controlling a Piezo actuator to change the position of the objective lens attached to a microscope.

## 7.1. Driver Installation

To construct the Piezo control system, you must install the CONTEC Co., Ltd. waveform input board driver and the Micro Science waveform output board driver.  
Install the Micro Science waveform output board drive with the procedure below.

### Caution

- The Piezo control system requires a Piezo actuator which is compatible with this system, Piezo controller, microscope, and objective lens.
- For devices compatible with this system, refer to “Chapter. 8. Contacting Photron”, page 75, and contact Photron.
- If the “An unidentified program wants access to your computer” message is displayed, click the [Allow] button.
- If the “User Account Control” dialog box is displayed during installation, click the [Continue] button.

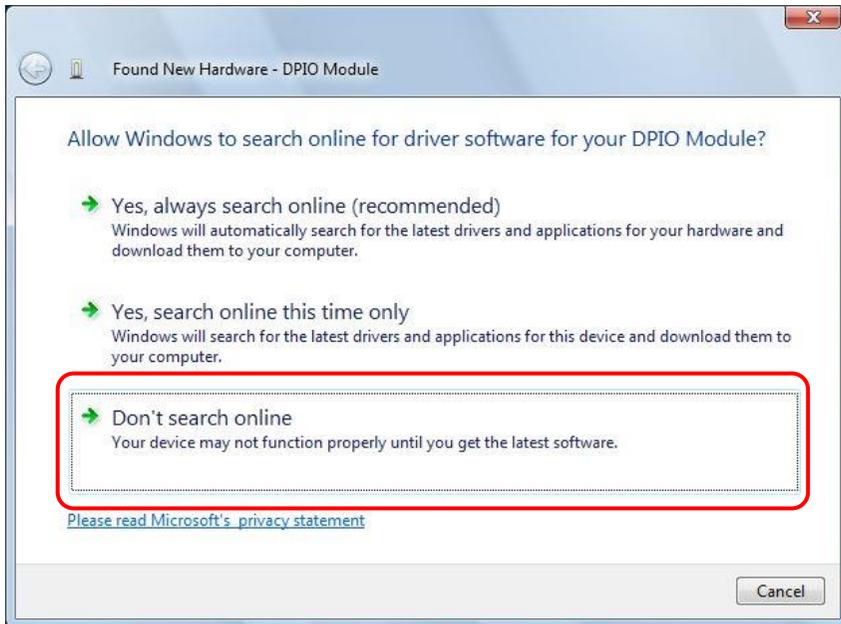
### Reference

- For how to install the CONTEC Co., Ltd. waveform input board driver, refer to “3.1. Driver Installation”, page 8.

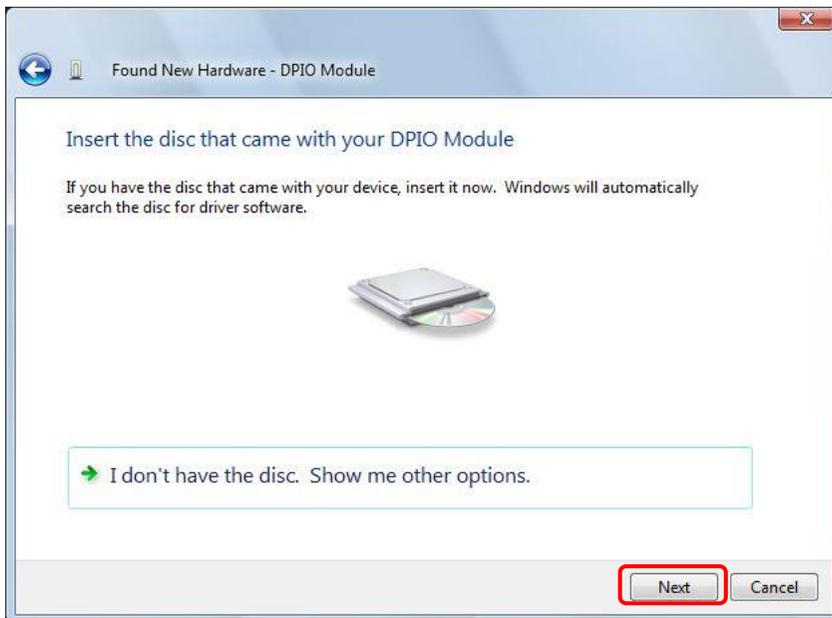
1. After installing the board, when you start the PC the “Found New Hardware” screen is displayed. Click [Locate and install driver software (recommended)].



2. Click [Don't search online].



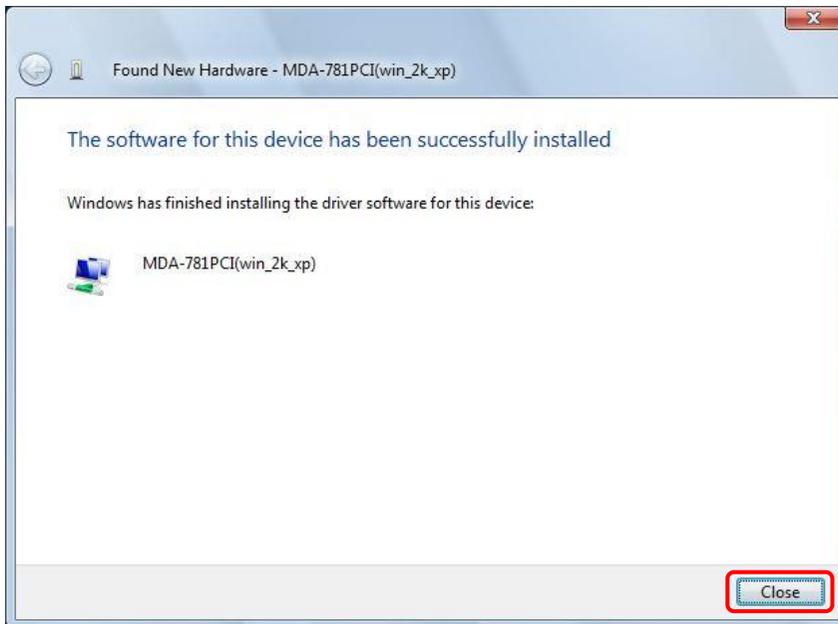
3. Insert the driver CD in the CD (of DVD) drive and click the [Next] button.



- Installation starts. A warning may be displayed during the installation process. Click [Install this driver software anyway] to continue installing.

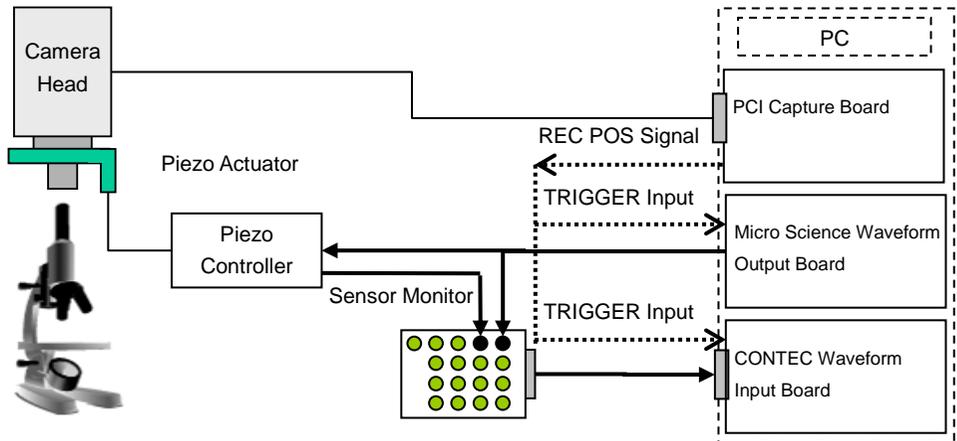


- The installation complete screen is displayed. Click the [Close] button.



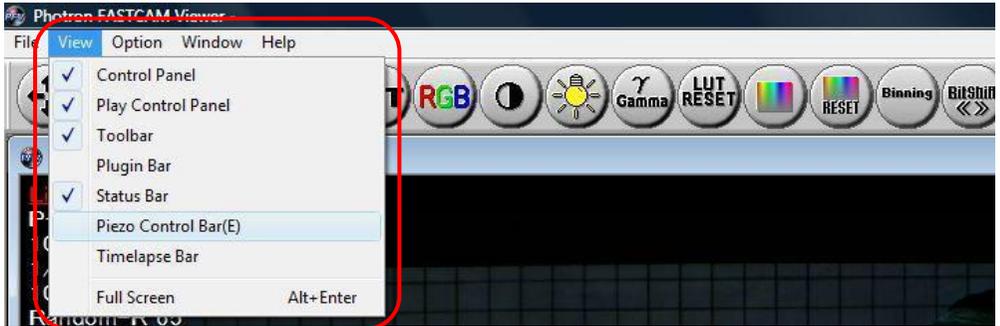
## 7.2. Connection Method

1. Connect a BNC splitter to the camera's General Out cable, then connect the waveform output board's trigger input cable and the waveform input board's START TRIGGER IN terminal.
2. Connect a BNC splitter to the waveform output board's output terminal (BNC terminal), then connect the Piezo controller's analog input terminal and the waveform input board's CH0 input terminal.
3. Connect the waveform input board's CH0 input terminal with the Piezo controller's SENSOR MONITOR terminal.

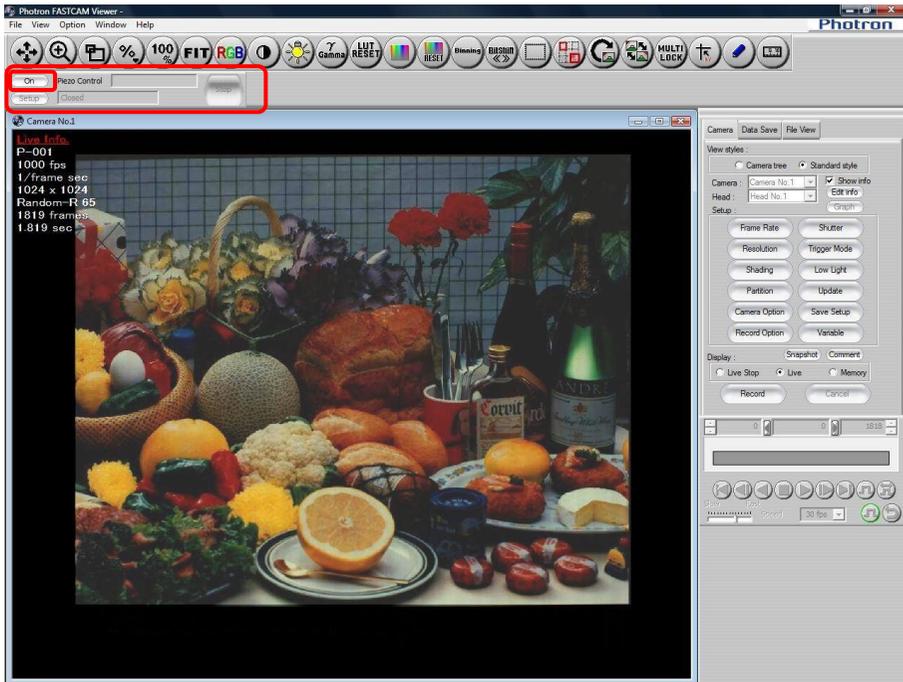


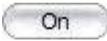
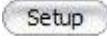
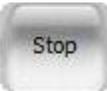
## 7.3. Piezo Control Settings and Shooting

1. Click [View] - [Piezo Control Bar] on the menu.



2. The Piezo control bar is displayed.  
Click the [On] button to enable Piezo control.  
When enabled, the trigger mode is set to "Random reset" and General Out terminal output is automatically set to REC POS signal.



Button	Button name/Function
	On/Off Click to enable Piezo control. Piezo control switches On/Off with each click.
	Setup Displays the setup screen for Piezo control.
	Stop/Recording/Waiting Trigger Displays the recording state.

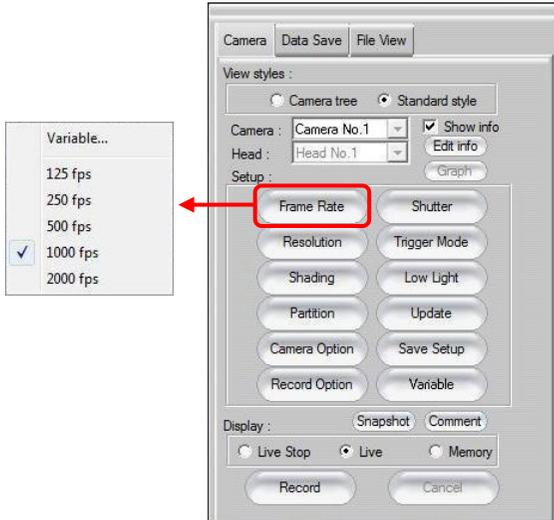


## Caution

- The Piezo control bar is displayed after the waveform input board and Piezo control system drivers are installed.
- If the waveform input board bar is displayed, hide it by clicking [View] – [Waveform Input Board Bar] on the menu.

### 3. Set the frame rate.

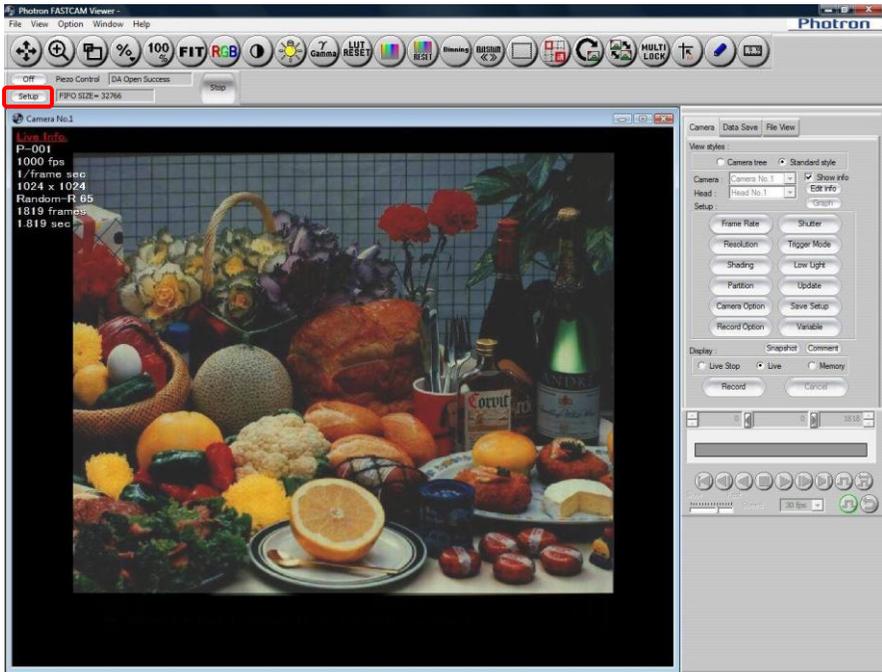
Set the frame rate in between 125fps and 2000fps.



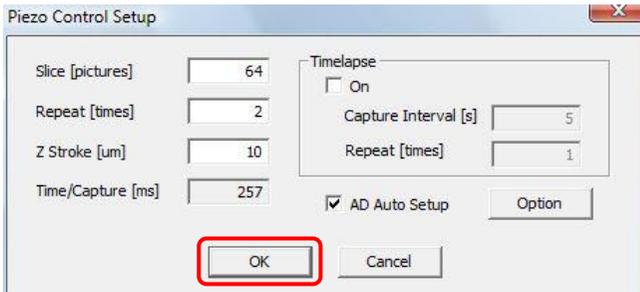
## Reference

- For how to set the frame rate, refer to “3.3. Setting and Registering the Frame Rate/Resolution” in the PFV user’s manual.

### 4. Click the [Setup] button on the Piezo control bar.



- The setup screen is displayed.  
Set the amount to shoot and how much to move the Piezo and click the [OK] button.



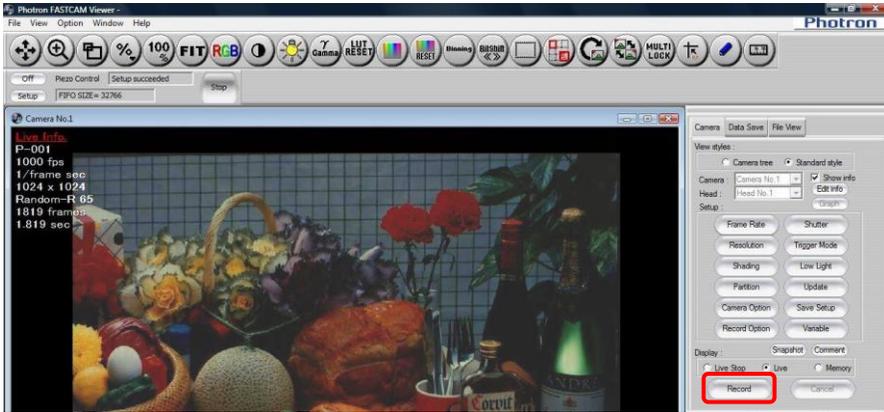
Item	Description
Slice [pictures]	Specifies the number of images recorded in a single rising interval of the Piezo.
Repeat [times]	Specifies the repeat count, with 1 count as the time from when the Piezo is raised until it falls.
Z Stroke [um]	Specifies the amount of Piezo movement in micrometers. The maximum specifiable stroke value can be checked with the [Options] button.
Time/Capture [ms]	Specifies the time for one recording in milliseconds.
Timelapse	When performing time-lapse recording, check and specify the trigger input interval and repeat count.

Item	Description																								
AD Auto Setup	<p>When using the AD board (waveform input board), check this setting. When checked, the values below are automatically set, and the settings are automatically checked when [Record] on the control panel is clicked.</p> <table border="1" data-bbox="544 276 1148 807"> <tr> <td>Number of channels</td> <td>2</td> </tr> <tr> <td>Channel number</td> <td>ch0 ,ch1</td> </tr> <tr> <td>Sampling frequency</td> <td>Same as camera frame rate</td> </tr> <tr> <td>Number of samples</td> <td>The camera's recordable image count</td> </tr> <tr> <td>Repeat count</td> <td>Maximum number of possible times to repeat</td> </tr> <tr> <td>Delay</td> <td>0</td> </tr> <tr> <td>Clock</td> <td>Internal clock</td> </tr> <tr> <td>Trigger start</td> <td>External trigger rise</td> </tr> <tr> <td>Trigger end</td> <td>Number of samples</td> </tr> <tr> <td>Memory method</td> <td>FIFO</td> </tr> <tr> <td>Voltage range</td> <td>0~10V</td> </tr> <tr> <td>Device name</td> <td>AIO000</td> </tr> </table>	Number of channels	2	Channel number	ch0 ,ch1	Sampling frequency	Same as camera frame rate	Number of samples	The camera's recordable image count	Repeat count	Maximum number of possible times to repeat	Delay	0	Clock	Internal clock	Trigger start	External trigger rise	Trigger end	Number of samples	Memory method	FIFO	Voltage range	0~10V	Device name	AIO000
Number of channels	2																								
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Delay	0																								
Clock	Internal clock																								
Trigger start	External trigger rise																								
Trigger end	Number of samples																								
Memory method	FIFO																								
Voltage range	0~10V																								
Device name	AIO000																								
[Option] Button	<p>The items below can be configured when clicked. Set them according to the Piezo actuator used.</p> <p>Maximum stroke: The maximum possible stroke value with the Piezo actuator used.</p> <p>Voltage at maximum stroke: The voltage value applied during the maximum stroke</p> <p>Recovery time: The time for the Piezo actuator to return from the raised position to its original position</p> <p>When this is the same as the rise time, check "Same as rising time".</p>																								

 **Caution**

- Do not set values which exceed the maximum values of the device. This may damage the device.

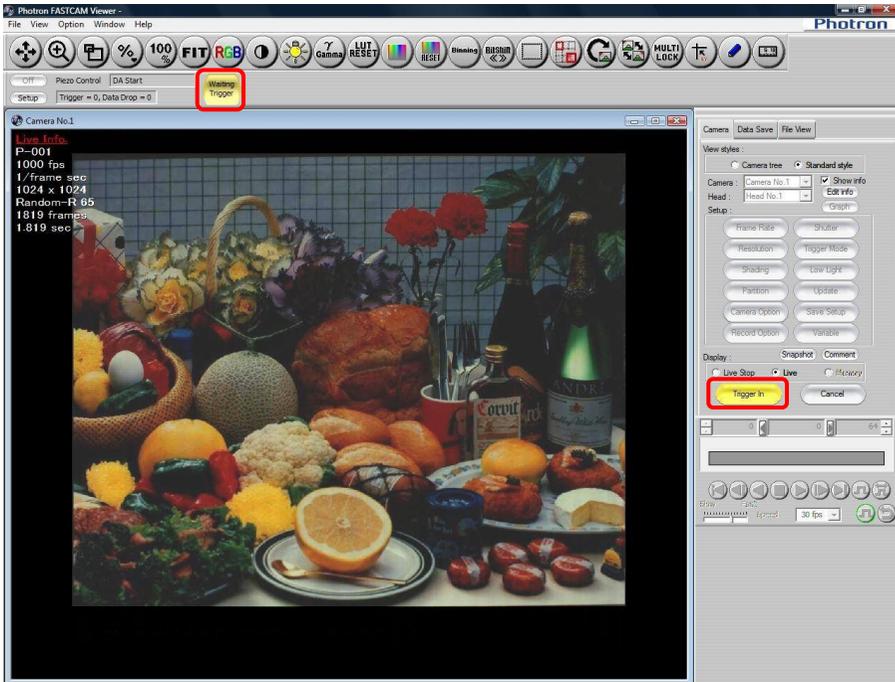
- Click the [Record] button on the control panel to start recording.



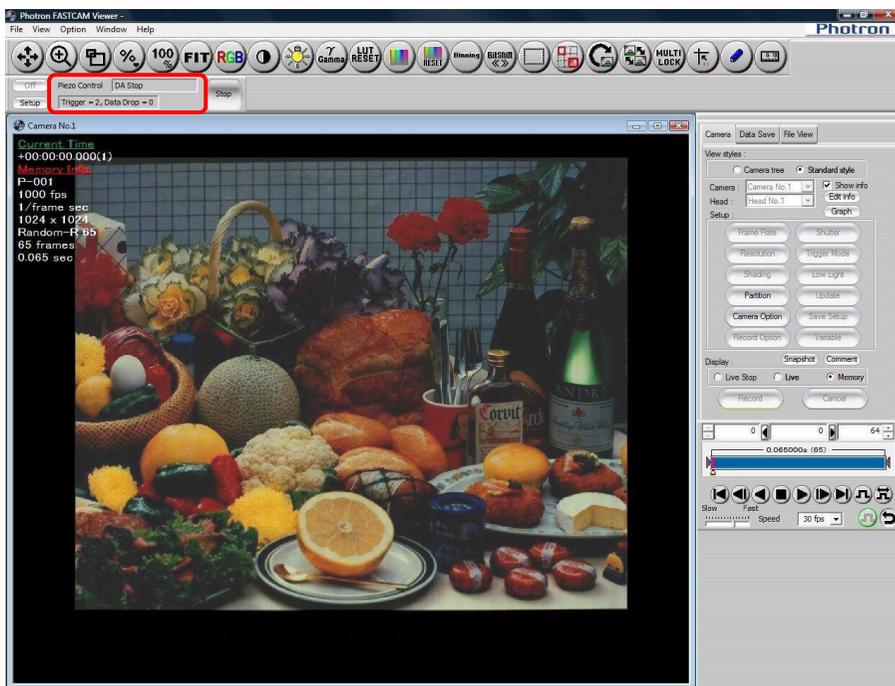
**Caution**

- When there is an error in the settings, an error is displayed after clicking the [Record] button. Check the description of the error and fix the settings.
- With AD board auto setup, the waveform input board automatically opens. To automatically open the board, the device name must be "AIO000".

- If there are no problems with the settings, the control panel button shows [Trigger In] and the Piezo control bar status displays shows [Waiting Trigger]. Click the [Trigger In] button on the control panel to start recording. If time-lapse is set, the trigger is automatically input at the set interval and repeat count.



8. After finishing recording, recording info is displayed on the Piezo control bar. The count of triggers and the number of times data was dropped is shown.  
 Trigger: Displays the count of triggers.  
 Data Drop: Displays the number of triggers which recording could not be performed.  
 Data drops occur if the DA board is sampling when the trigger was entered or when the time-lapse interval is too short and the PC operation was not on time.



**Caution**

- The time accuracy of time-lapse shooting is dependent on the PC environment and operating status.

**Reference**

- For how to shoot, refer to “3.11. Making a Recording” in the PFV user's manual.

**Supplement**

- Settings on the setup screen are saved in the registry, the next time PFV is started, it is started with the settings during the previous recording.
- The settings during recording are saved to the CIH file.
- In order to protect the Piezo element, DA board output continues until the set slice count and repeat count is over, even if stopped during recording.



# Chapter. 8 **Contacting Photron**

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For inquires related to PFV, contact Photron at the contact information listed below. Additionally, the following items will be verified when inquiring, so please prepare them in advance.

Items Verified	Concrete Example
Contact Information	Company, school or organization name, customer contact name, contact phone number, contact e-mail.
Product Name	The Photron FASTCAM Viewer version number and the high-speed camera name. For the version number, check the version information.
Condition of the system and what is known about it.	

Contact Information	
In Americas and Antipodes	<p><b>PHOTRON USA, INC.</b>                      9520 Padgett Street, Suite 110                      San Diego, CA 92126-4426, USA                      Phone : 800-585-2129 or 858-684-3555                      Fax : 858-684-3558                      E-mail : <a href="mailto:image@photron.com">image@photron.com</a>  <a href="http://www.photron.com">www.photron.com</a></p>
In Europe, Africa and India	<p><b>PHOTRON EUROPE LIMITED</b>                      The Barn, Bottom Road,                      West Wycombe, Buckinghamshire,                      HP14 4BS, U.K.                      Phone : +44(0) 1494 48 1011                      Fax : +44(0) 1494 48 7011                      E-mail : <a href="mailto:image@photron.com">image@photron.com</a>  <a href="http://www.photron.com">www.photron.com</a></p>
In other areas	<p><b>PHOTRON LIMITED</b>                      21F, Jimbocho Mitsui Bldg.,                      1-105 Kanda Jimbocho, Chiyoda-Ku, Tokyo 101-0051                      Phone : +81 3 3518 6271                      Fax : +81 3 3518 6279                      E-mail : <a href="mailto:image@photron.co.jp">image@photron.co.jp</a>  <a href="http://www.photron.co.jp">www.photron.co.jp</a></p>

# **Photron *FASTCAM* Viewer**

***for High Speed Digital Imaging***

Waveform Input Board Manual

Revision 1.05E

Publication Date      May, 2018

Publisher              PHOTRON LIMITED

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