Watec USB Camera

User's Manual

Rev. 3.01

Watec Co., Ltd.

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Revision Record

Rev.	Date	Changes	Remarks
1.00	August 28, 2013	—	Initial Release
2.00	—	—	
3.00	August 29, 2016	・Correction to "Watec USB Camera" of The title ・Add WAT-02U2D and WAT-03U2 ・Add 5. Operation on Mac OS	
3.01	April 17, 2017	・Add WAT-03U2D	

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1. About this User's Manual

This User's Manual consists of instructions to connect the WAT-01U2 / WAT-02U2D / WAT-03U2 / WAT-03U2D (The following is the Watec USB Camera) to a PC and describes and explains the settings for the Video Capture Pin/Video Capture Filter and describes the Snapshot feature which utilizes the GPIO connection.

When the settings of the Watec USB Camera is changed according to the Watec USB Camera user's manual, check to see that the operation and the effects of the changes made to the camera are acceptable.

The Watec USB Camera user manual is subject to change by design and the specifications of the product without notice.

2. Connecting the Watec USB Camera with a PC

The diagram below shows the connections between the Watec USB Camera and a PC.
When connecting WAT-02U2D / WAT-03U2D, use Micro-B to type A conversion connector.

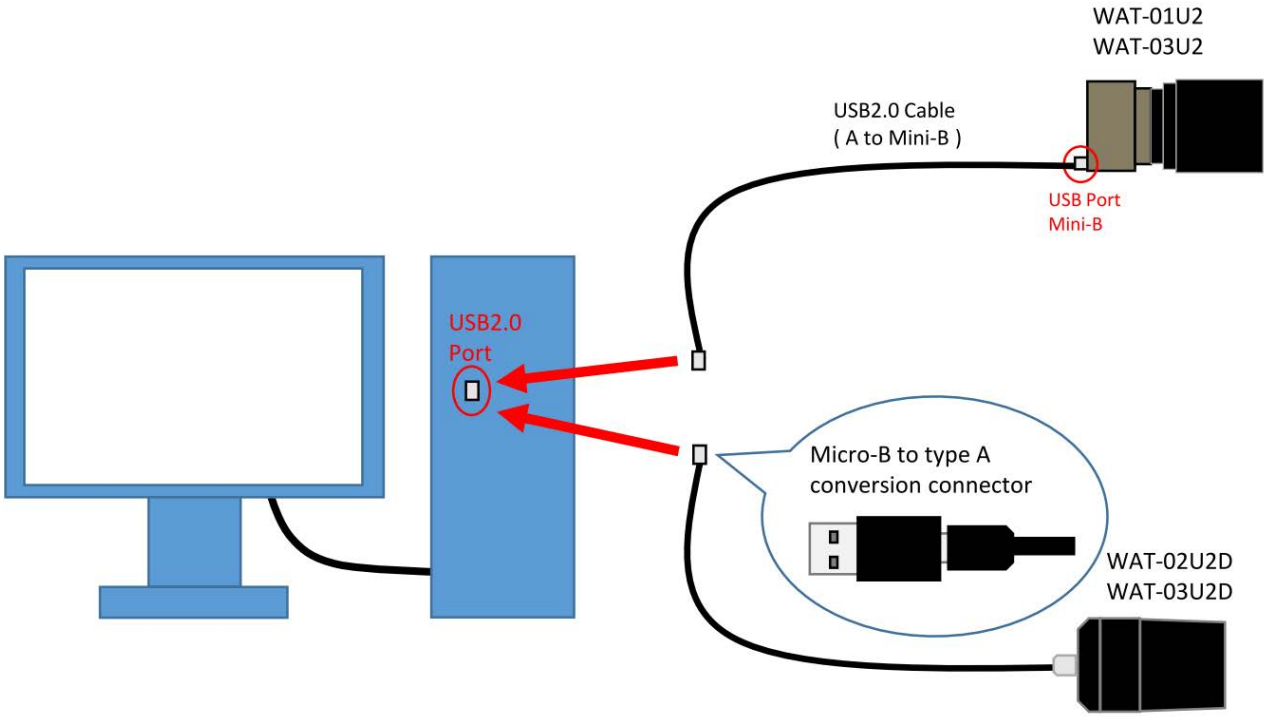


Fig.1 Watec USB Camera - PC Connection Diagram

Please use the following OS with USB2.0 port about a connected PC.

OS	Bit	WAT-01U2	WAT-02U2D	WAT-03U2	WAT-03U2D
Windows XP (Since SP2)	32	○	○	×	×
	64	○	○	×	×
Windows Vista	32	○	○	×	×
	64	○	○	×	×
Windows 7	32	○	○	○	○
	64	○	○	○	○
Windows 8	32	○	○	○	○
	64	○	○	○	○
Windows 8.1	32	○	○	○	○
	64	○	○	○	○
Windows 10	32	○	○	○	○
	64	○	○	○	○

Watec USB Camera is compatible with USB Video Class.
When the Watec USB Camera is connected to a PC for the first time, the Driver will be installed automatically. If the Driver installation does not occur, and the Watec USB Camera is not recognized by the PC, please check to make sure that the connection is correct, and please check that the PC requirements are met.

It is recommended that a version of Windows Vista or newer (and inclusive) be used. With Windows XP, it is possible to obtain video, however, there are some limitations to select functions. Please refer to Section 3 “Functions and Settings” for details.

Please connect the camera to the PC, and after confirming that the camera is recognized, please start the viewer software and begin Preview/Capture of video.

3. Functions and Settings

The Watec USB Camera settings are separated into Video Capture Pin, which is used to set the output image size, and the Video Capture Filter, which is used to set the image brightness and color.

This section explains each of the functions of the Watec USB Camera and their respective setting methods using the WatecCameraViewer (Watec USB Camera Capture Software which can be downloaded from our company's website, http://www.watec.co.jp/) as an example.
(For details on how to install the software, please refer to the readme.txt file included with the WatecCameraViewer software.)

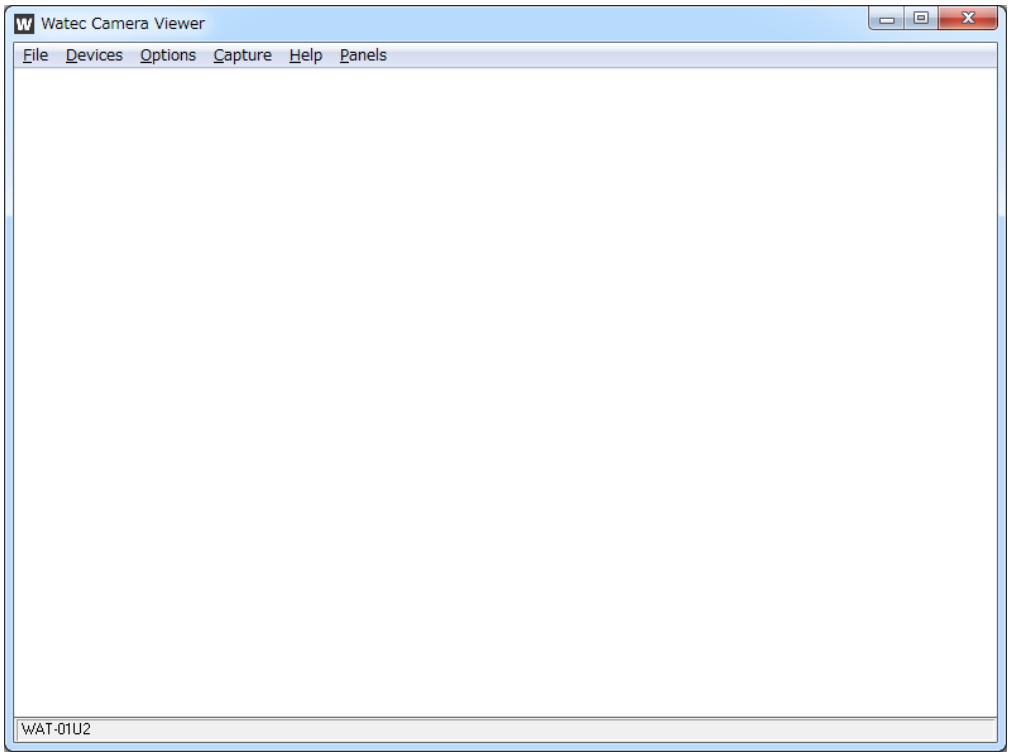


Fig.2 WatecCameraViewer Window

3.1.Video Capture Pin

The Color Space and Video Format can be set in the Video Capture Pin. The setting can be accessed from the menu at the top of the window (Options -> Video Capture Pin).

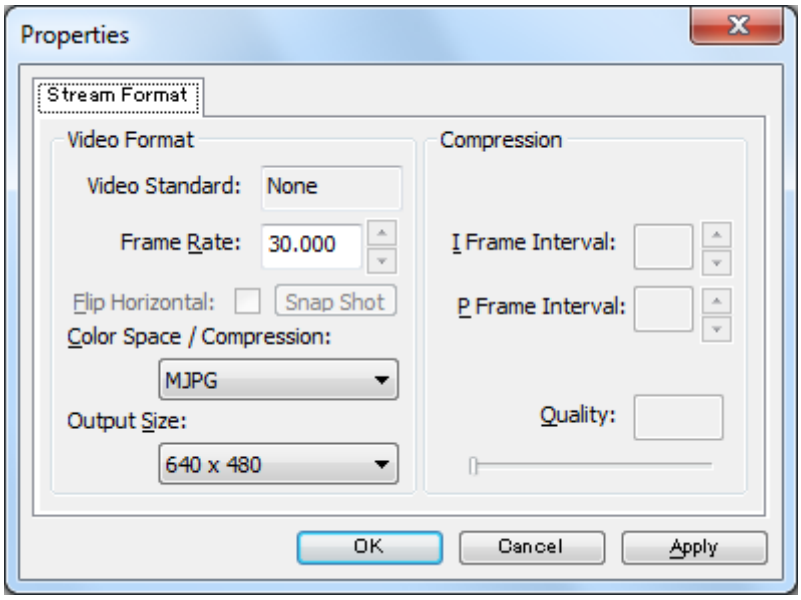


Fig.3 Video Capture Pin Window

The same setting is accessible from the Panels -> Camera Control menu at the top of the window.

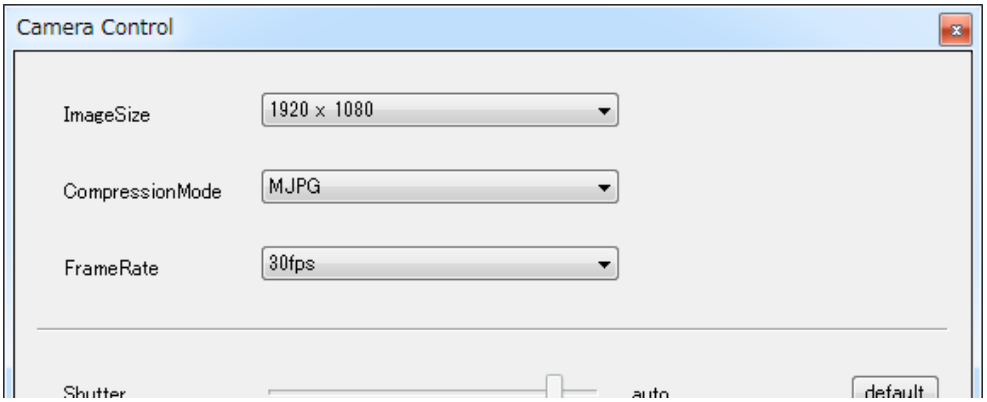


Fig.4 Camera Control Window

3.1.1.Color Space/Compression(Compression Mode)

Can be selected from YUY2 and MJPG.

YUY2: Uncompressed video output using YUY2(YUV422) format as Color Space.
The resolution is higher than MJPG, however, the frame rate is limited as described in the later section.

MJPG: Output video is compressed with MJPG(Motion-JPEG) format. The resolution will decrease, however, the frame rate will be maintained even at the maximum image size.

3.1.2.Output Size(Image Size)

The video image output size of the WAT-01U2 / WAT-02U2D is selected from the following 8 selections.

Image size (H x V)	Aspect Ratio	No. of Pixels	Resolution ※
1920 x 1080	16 : 9	2,073,600	HD 1080p
160 x 120	4 : 3	19,200	Quarter-Quarter-VGA
176 x 144	11 : 9	25,344	Quarter-CIF
320 x 240	4 : 3	76,800	Quarter-VGA
640 x 480	4 : 3	307,200	VGA
1280 x 1024	5 : 4	1,310,720	SXGA
1280 x 720	16 : 9	921,600	HD 720p
1280 x 800	16 : 10	1,024,000	WXGA

The video image output size of the WAT-03U2 / WAT-03U2D is selected from the following 4 selections.

Image size (H x V)	Aspect Ratio	No. of Pixels	Resolution ※
1280 x 960	4:3	1,228,800	Quad-VGA
320 x 240	4:3	76,800	Quarter-VGA
640 x 480	4:3	307,200	VGA
1280 x 720	16:9	921,600	HD 720p

※Resolution :
HD 1080p : Full-HD
VGA : Video Graphics Array
SXGA : Super-XGA
WXGA : Wide-XGA

3.1.3.Frame Rate

The frame rate will be fixed by the Color Space/Compression mode and image size settings.

The frame rate of WAT-01U2 / WAT-02U2D is as follows.

Color Space/ Compression	Image Size	Frame Rate (fps) ※
YUY2	1920 x 1080	5
	160 x 120	30
	176 x 144	30
	320 x 240	30
	640 x 480	30
	1280 x 1024	7.5
	1280 x 720	10
	1280 x 800	10
MJPG	1920 x 1080	30
	160 x 120	30
	176 x 144	30
	320 x 240	30
	640 x 480	30
	1280 x 1024	30
	1280 x 720	30
	1280 x 800	30

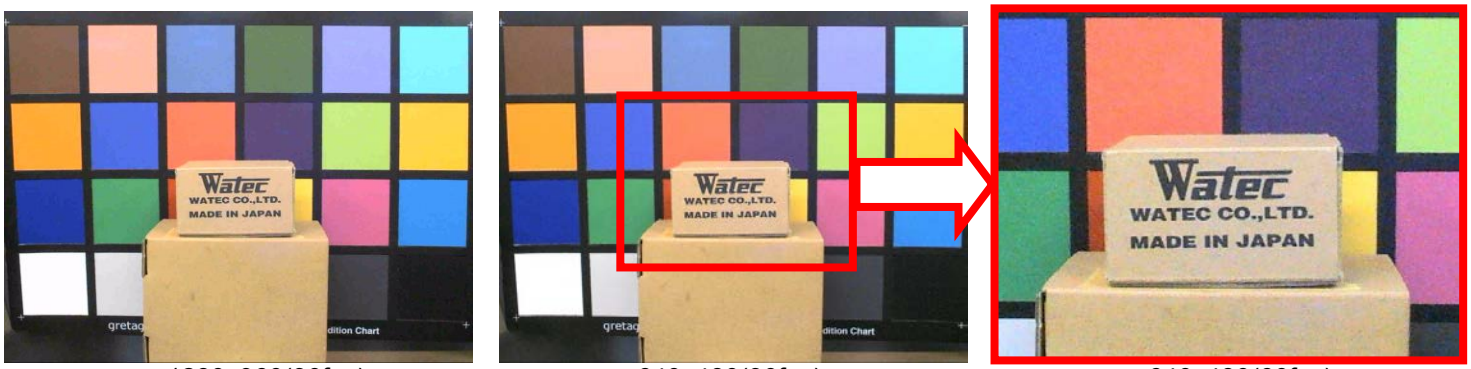
The frame rate of WAT-03U2 / WAT-03U2D is as follows.

Color Space/ Compression	Image Size	Frame Rate (fps) ※
YUY2	1280 x 960	7.5
	320 x 240	30
	640 x 480	30
	1280 x 720	7.5
MJPG	1280 x 960	30
	320 x 240	60
		30
	640 x 480	60
		30
	1280 x 720	30

※fps :

Frames Per Second, the number of frames processed per second in a video image, higher frame rates produce smoother, more fluid, video.

On WAT-03U2 / WAT-03U2D, the frame rate is selectable from 30fps or 60fps when MJPG is set with 320x240 or 640x480.
It cuts and outputs a read area from the image sensor when 60fps is selected. In order to cut and output the central part of the screen, the angle of view is different from other frame rates.



1280x960(30fps) 640x480(30fps) 640x480(60fps)

Please note that “Use Frame Rate” (Capture -> Set Frame Rate…) setting differs depending on frame rate selection methods. Choose “OFF” when selecting the frame rate from “Video Capture Pin”. Choose “ON” when selecting the frame rate from “Camera Control”.

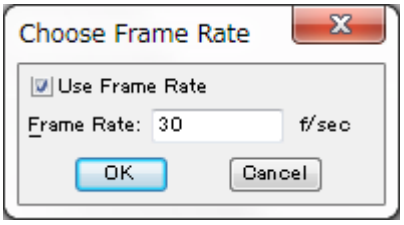


Fig.5 Set Frame Rate Window

3.2.Video Capture Filter Image Adjustment(Video Proc Amp)

The functions can be adjusted. The setting is accessed by selecting Options -> Video Capture Filter from the menus at the top.

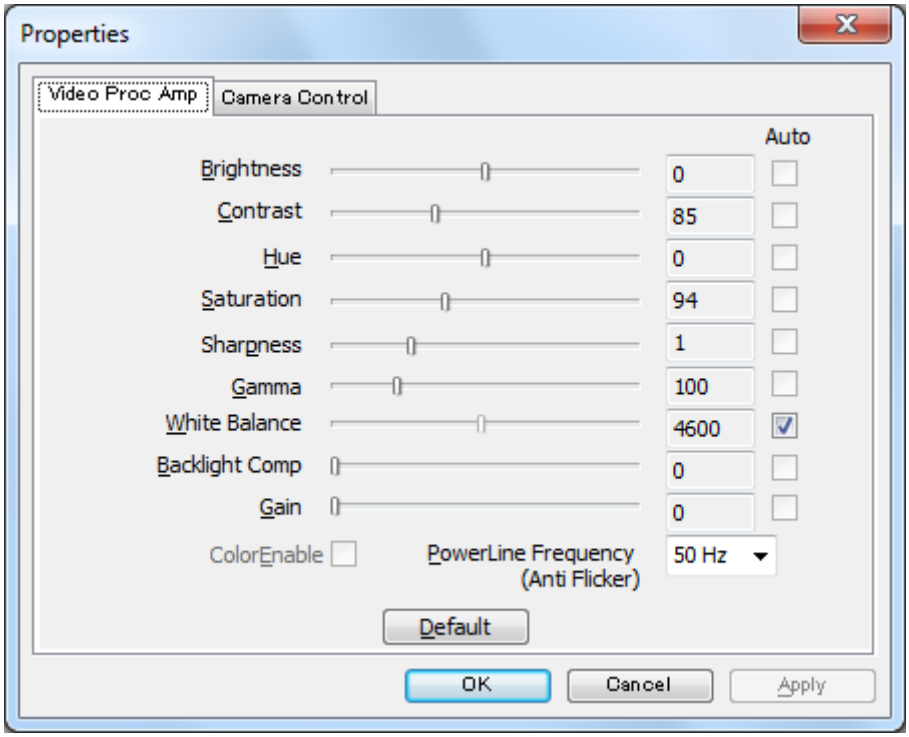


Fig.6 Video Capture Filter Video Proc Amp window

The same setting is accessible from the Panels -> Camera Control menu at the top of the window.

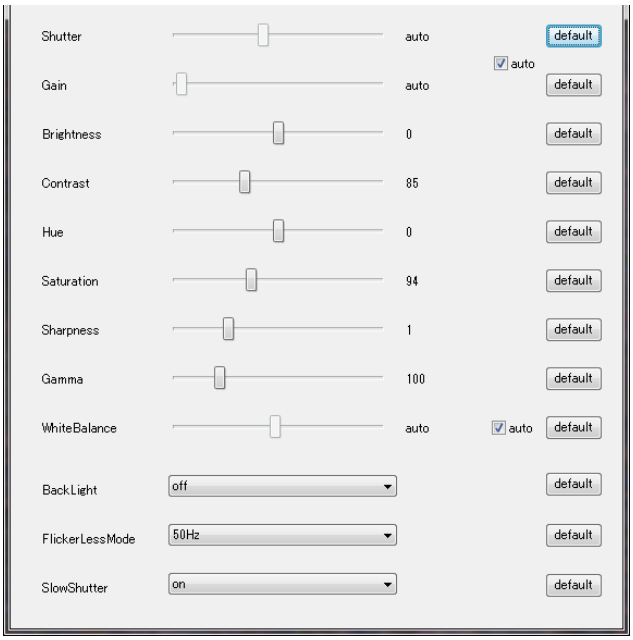


Fig.7 Camera Control window

3.2.1.Brightness

Increasing the value will increase the image brightness.
Default: “0” (WAT-01U2 / WAT-02U2D) / “10” (WAT-03U2 / WAT-03U2D).
Adjustment is made in the range of "-128" - "127".


Brightness@-128


Brightness@0


Brightness@127

※The pictures were taken by WAT-01U2.

3.2.2.Contrast

Increasing the value will increase the contrast.
Default: “85” (WAT-01U2 / WAT-02U2D) / “95” (WAT-03U2 / WAT-03U2D)
Adjustment is made in the range of "0" - "255".


Contrast@0


Contrast@85


Contrast@255

※The pictures were taken by WAT-01U2.

3.2.3.Hue

The image hue can be adjusted.
Default: “0”　The adjustment is made in the range between “-40” - “40”.
The hue is varied so as to change in a hue circle and will have same hue at “±40”.

Hue@0

Hue@-20

Hue@20

Hue@±40

※The pictures were taken by WAT-01U2.

3.2.4.Saturation

Increase in this value increases the color saturation of the image.
Default: “94” (WAT-01U2 / WAT-02U2D) / “100” (WAT-03U2 / WAT-03U2D)
Adjustment is made in the range of "0" - "255".


Saturation@0


Saturation@94


Saturation@255

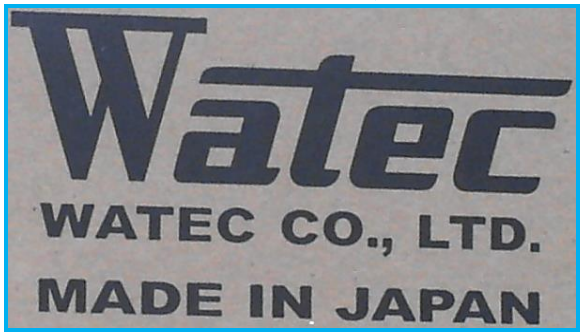
※The pictures were taken by WAT-01U2.

3.2.5.Sharpness

Increase in this value will emphasize the edges of inside the image and increase the Sharpness.
Default: “1”　Adjustment is made in the range of "0" - "4".

Sharpness@0

Sharpness@4



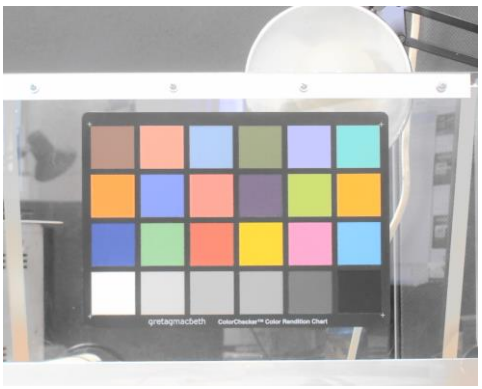
※The pictures were taken by WAT-01U2.

3.2.6.Gamma

The function is for the adjustment of the gradation characteristics curve of the image to compensate for the Gamma characteristics (image gradation response characteristics) of the display.
Default: “100” Adjustment is made in the range of "48" - "300".


Gamma@48


Gamma@100


Gamma@300

※The pictures were taken by WAT-01U2.

3.2.7.White Balance

The White Balance function is used to calibrate “white” color under varying color temperature lighting conditions.
Default: “auto”. The default value in manual adjustment mode is “4600”.
Adjustment is made in the range of "2800" - "6500".
The White Balance of the image will be optimally adjusted per the value selected for the particular color temperature environment.
When Auto is “ON”, the camera will automatically adjust the White Balance by judging the lighting conditions in the image being shot.


Auto White Balance


Manual White Balance@4600

※The pictures were taken by WAT-01U2.

3.2.8.Backlight Compensation

The Backlight Compensation function adjusts the exposure of the center of the image to compensate for the dark shadow created due to lighting from the back of the object.
”0” (Backlight Compensation OFF) or “1” (Backlight Compensation ON) can be selected. Default: “0”

Backlight Compensation OFF

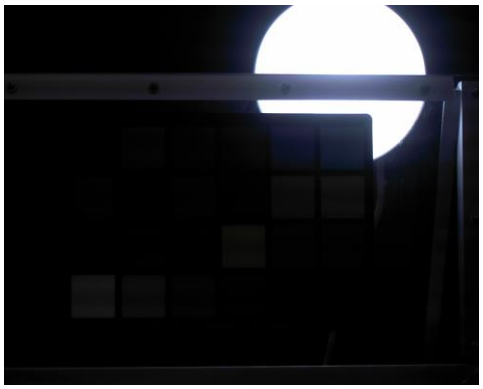
Backlight Compensation ON

※The pictures were taken by WAT-01U2.

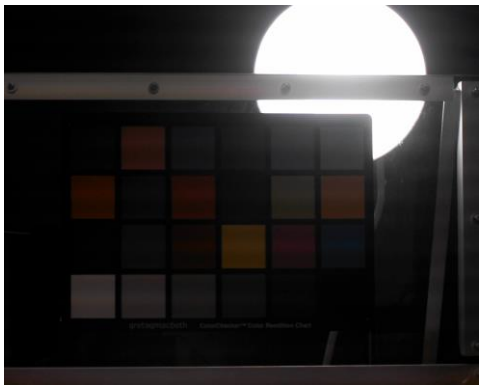
3.2.9.Gain

Higher the value set, the higher the gain (amplification) of the signal, which will increase the brightness of the image. However, the noise element of the image will also be amplified.
Default: “0” The setting is accessed by manually setting the Exposure in the Camera Control menu as described in the proceeding section of this manual.
Adjustment of WAT-01U2 / WAT-02U2D is made in the range of "0" - "24" (dB). Adjustment of WAT-03U2 / WAT-03U2D is made in the range of "0" - "72" (dB).

※This function is not adjustable with Windows XP and older OS.

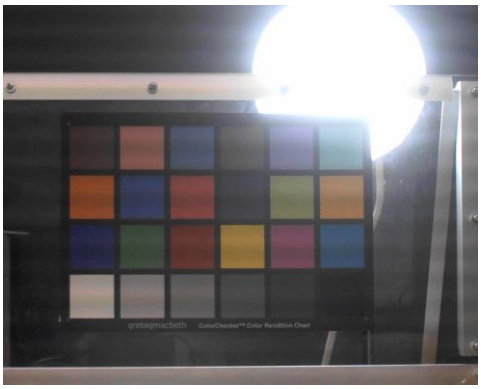


Gain@0



Gain@6

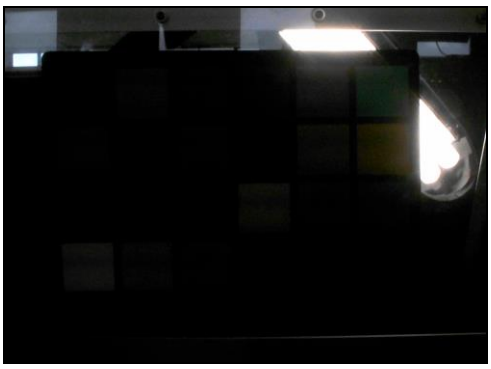
Gain@12



Gain@18

Gain@24

※The pictures were taken by WAT-01U2, and the exposure was fixed to "-8".

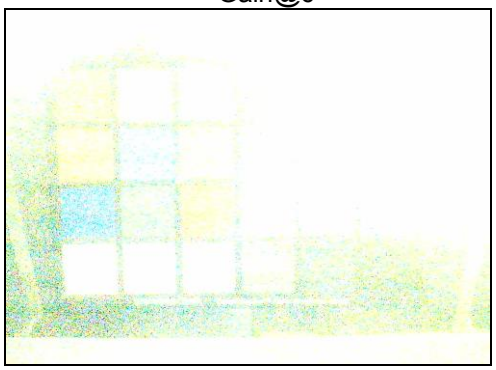


Gain@0

Gain@6

Gain@12

Gain@36



Gain@48

Gain@72

※The pictures were taken by WAT-03U2, and the exposure was fixed to "-8".

3.2.10.PowerLine Frequency(Anti Flicker)

Proper setting of this feature is used to compensate for flicker caused by environments such as lighting with fluorescent lighting.
Default: “50Hz”　Selection is made between either "50Hz" or "60Hz".
Please select the frequency which matches the power mains frequency of the environment which the camera is used.
This function is active only when the Exposure function is set to "Auto".

※This function is not available with Windows XP and older OS.

FlickerLess@50Hz

FlickerLess@60Hz

※The pictures were taken by WAT-01U2.
※The mains power frequency at the location of the captured images is “50Hz”.

3.3.Video Capture Filter Camera Control

The settings related to shutter speed is adjusted from the Camera Control of the Video Capture Filter menu.
The settings window is accessed from the Options -> Video Capture Filter: Camera Control menu at the top of the window.

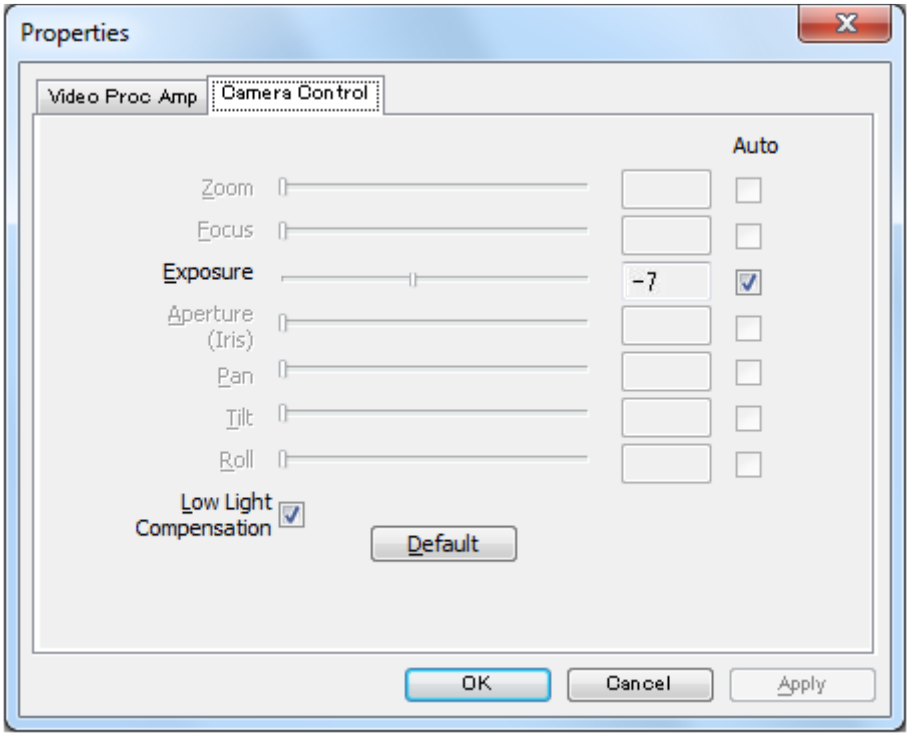


Fig.8 Video Capture Filter Camera Control window

The same setting is accessible from Panels->Camera Control menu at the top of the window.

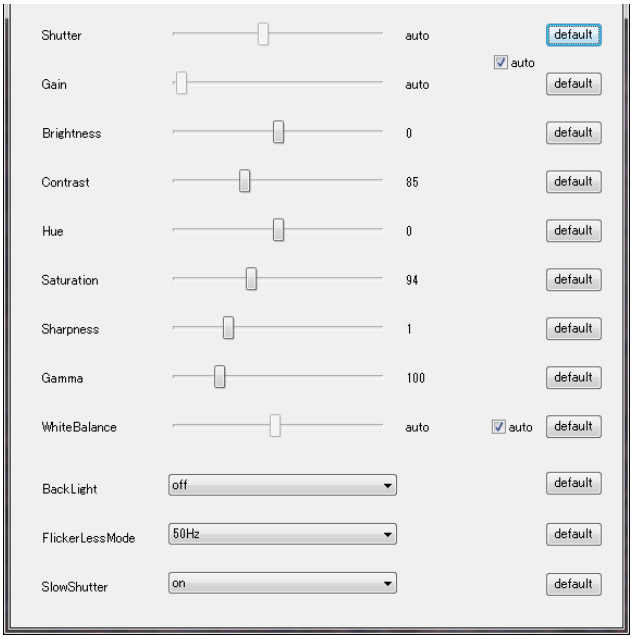
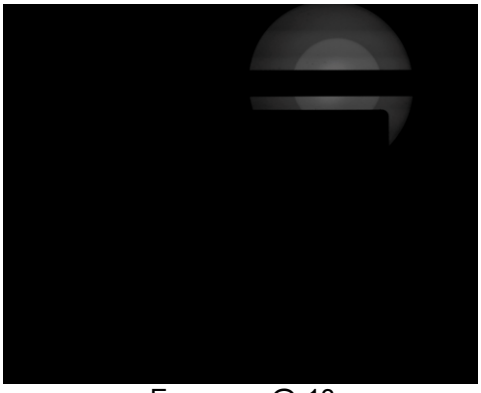


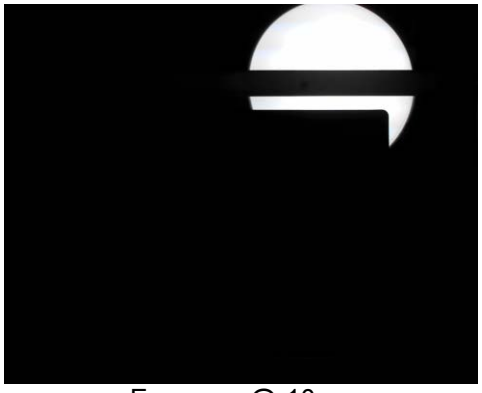
Fig.9 Camera Control window

3.3.1.Exposure(Shutter)

When the exposure value is x, the shutter speed is 2 raised to the power of x.
As the exposure value increases, the image becomes brighter.
The default is set to “Auto”. The default value for Manual Control is “-7”.
Adjustment of WAT-01U2 / WAT-02U2D is made in the range of "-13" - "-4" (1/8192 - 1/16 seconds). Adjustment of WAT-03U2 / WAT-03U2D is made in the range of "-13" - "1" (1/8192 - 2 seconds).The frame rate will be reduced if the Color Space / Compression and Image Size were set to 30fps or 60fps. For example, the frame rate will be reduced to approximately 15fps at Exposure@-4.



Exposure @-13



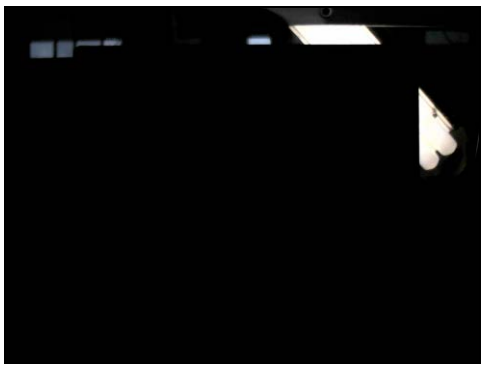
Exposure @-10

Exposure @-7

Exposure @-4

※The pictures were taken by WAT-01U2, and the gain was fixed to "0".

Exposure @-13

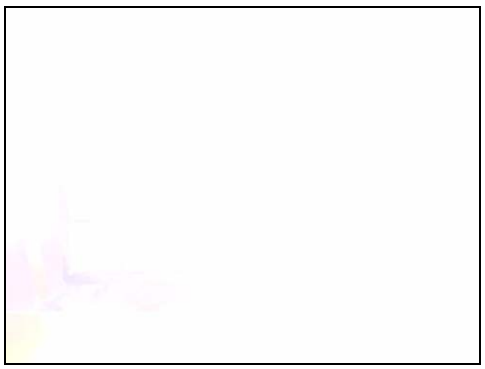


Exposure @-10

Exposure @-7

Exposure @-4

Exposure @-1



Exposure @1

※The pictures were taken by WAT-03U2, and the gain was fixed to "0".

3.3.2.Low Light Compensation(SlowShutter)

The default setting is "ON" (checked box). When Low Light Compensation is "ON", the camera will decrease the shutter speed to increase sensitivity, if the camera judges that there is not enough illumination. In this mode, the frame rate will decrease.

※The shutter speed does not change due to Low Light Compensation when the frame rate is 7.5fps on WAT-03U2 / WAT-03U2D.
※This function is not available with Windows XP and older OS.

4. GPIO Connection

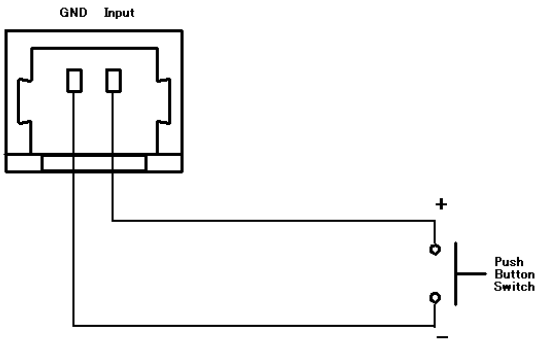
The WAT-01U2 / WAT-03U2 has a 2 pin GPIO (General Purpose Input/Output) connector at the back of the camera. Currently, an external trigger for capturing Snapshot is assigned to this connection.
The WAT-02U2D / WAT-03U2D doesn't have this function.

4.1.Snapshot Function

To use the GPIO Snapshot function, connect the 2 pin cable to the WAT-01U2 / WAT-03U2 GPIO connector and use a push button switch (for example) as the trigger is recognized by closing of the circuit.

When the button is pressed (circuit is closed), the camera will stop video capture and switch to static image capture. A static image approximately 1 second after the button is pressed will be output. Thereafter, the camera will revert back to video capture.

From the time when the button is pressed until the Snapshot is output, the camera will adjust the exposure and white balance. During this time, if the environment changes, such as lighting conditions, a good Snapshot may not be captured.



4.1.1.Method to Confirm Operation (saving of static image)

The saving of the image file captured by the Snapshot function is done by using the WatecCameraViewer (available for download from our website: http://www.watec.co.jp/).

While the WatecCameraViewer is open, and the video image can be previewed, shorting the GPIO circuit will save a Snapshot to an image file (.jpg or .bmp).
(The image file will be saved in the same folder as where the WatecCameraViewer is operating)

The same Snapshot function can be operated from the WatecCameraViewer.
(Capture->Trigger for Still Capture)

※Please heed caution to the following when using the WatecCameraViewer in the Windows Vista/7/8/8.1/10 OS environments:

・When starting the program from C:¥ProgramFiles¥.. with UAC(User Account Control) enabled, make sure to start up the WatecCameraViewer with Administrator rights, as creating and saving of new files in this folder/directory tree is not permitted without Administrator rights. (Right Click on WatecCameraViewer executable file -> Run as administrator)

Please refer to the following section for setting of the image file to be saved.

4.1.2.Image File Setting

The image file format and size can be changed in the Options -> Still Capture Pin setting.

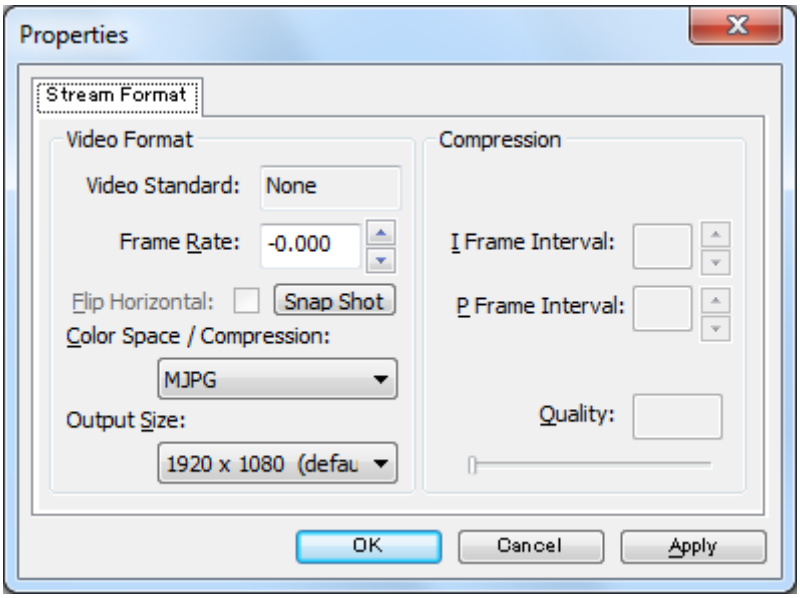


Fig.10 Still Capture Pin window

※The “Snap Shot” button in this menu is not active. Please trigger the Snapshot from the menu. (Capture -> Trigger for Still Capture)

※In Windows XP, the Still Capture Pin setting is fixed.
Setting of WAT-01U2 / WAT-02U2D is MJPG and 1920x1080. Setting of WAT-03U2 / WAT-03U2D is MJPG and 1280x960.
(A window as shown below will appear, however the settings cannot be changed)

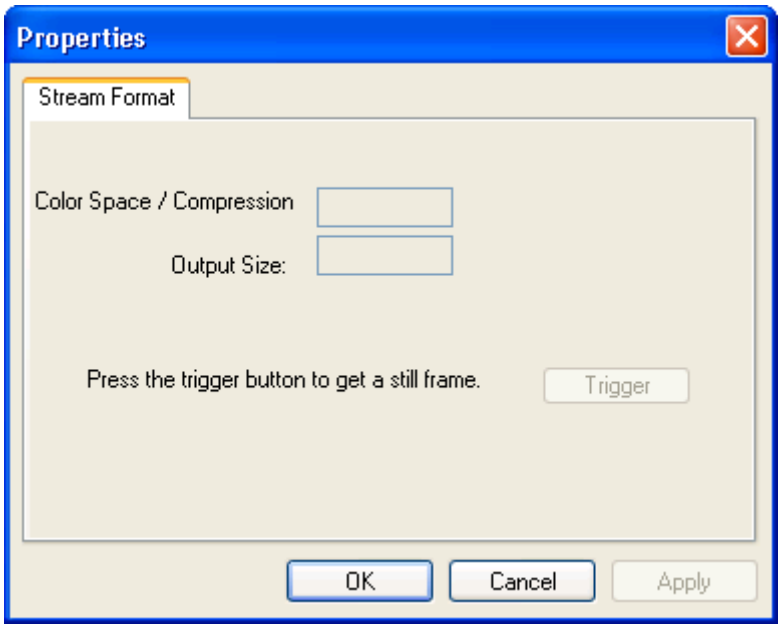


Fig.11 Still Capture Pin window(in Windows XP)

4.1.2.1.Color Space/Compression(CompressionMode)

Same as Video Capture Pin, select from YUY2 and MJPG.

YUY2: Snapshot image file is saved as .bmp file.

MJPG: Snapshot image file is saved as .jpg file.

※In Windows XP, MJPG(.jpg file) setting is fixed.

4.1.2.2.Output Size(ImageSize)

Image file will be saved at the image size selected.

The still image output size of the WAT-01U2 / WAT-02U2D is selected from the following 8 selections.

Image size (H x V)	Aspect Ratio	No. of Pixels	Resolution ※
1920 x 1080	16 : 9	2,073,600	HD 1080p
160 x 120	4 : 3	19,200	Quarter-Quarter-VGA
176 x 144	11 : 9	25,344	Quarter-CIF
320 x 240	4 : 3	76,800	Quarter-VGA
640 x 480	4 : 3	307,200	VGA
1280 x 1024	5 : 4	1,310,720	SXGA
1280 x 720	16 : 9	921,600	HD 720p
1280 x 800	16 : 10	1,024,000	WXGA

The still image output size of the WAT-03U2 / WAT-03U2D is selected from the following 4 selections.

Image size (H x V)	Aspect Ratio	No. of Pixels	Resolution ※
1280 x 960	4:3	1,228,800	Quad-VGA
320 x 240	4:3	76,800	Quarter-VGA
640 x 480	4:3	307,200	VGA
1280 x 720	16:9	921,600	HD 720p

※Resolution :
HD 1080p : Full-HD
VGA : Video Graphics Array
SXGA : Super-XGA
WXGA : Wide-XGA

※In Windows XP, the setting is fixed.
Setting of WAT-01U2 / WAT-02U2D is 1920x1080. Setting of WAT-03U2 / WAT-03U2D is 1280x960.
※Still images will be saved as the angle of view of 30fps when the frame rate is set with 60fps on WAT-03U2 / WAT-03U2D.

5. Remarks: Operation on Mac OS

We suppose that Watec USB Camera is mainly used under Windows OS environment, however, it is possible to operate under Mac OS X environment with various limitations of the function if you meet the following conditions. (Note: WatecCameraViewer cannot be operated on Mac OS X)

- Since Mac OS X version 10.4.9
- Equipped USB2.0 port

※Please note that even if the prescribed conditions is satisfied, it cannot always be operated.

The limitations of function under Mac OS X are as follows.

Video Capture Pin
Color Space/Compression: Settings are unchangeable.
Output Size: Output size is changeable depending on the capture software.

Video Capture Filter
The settings cannot be changed at all items. Each item will be the default value.

Snapshot Function
The snapshot functions cannot be operated.

We verified operations under following environments.

OS:	Mac OS X 10.8.4
Processor:	2.7GHz Intel Core i7
Memory:	16GB 1600MHz DDR3
Capture software:	QuickTime Player