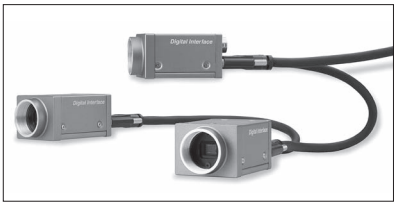
XCD-U100 (B/W)
XCD-U100CR (RAW Color)
XCD-SX90 (B/W)
XCD-SX90CR (RAW Color)
XCD-V60 (B/W)
XCD-V60CR (RAW Color)



IEEE-1394b Digital Output | Progressive Scan | Square Pixels | *1 1.18 Type CCD | *2, *3 1/3 Type CCD | C Lens Mount | *1 UXGA Output | *2 SXGA Output | *3 VGA Output

Partial Scan | Long Exposure | Normal Shutter | External Trigger Shutter | Bulk Trigger | Sequential Trigger | *4 One-Push White Balance | *4 Fixed White Balance | *4 Manual White Balance

*4 ATW White Balance | One Shot | *5 Image Filter | LUT | Auto Shutter | Nega/Posi Reversal | *4 RAW Color | *5 B/W

*1 XCD-U100/U100CR
*2 XCD-SX90/SX90CR
*3 XCD-V60/V60CR
*4 XCD-U100CR/SX90CR/V60CR
*5 XCD-U100/SX90/V60

Connection Diagram P32

Outline

The six models of the XCD-series digital camera modules (Black and white models and RAW color models) employing the IEEE1394b-2002 standard are equipped with quality digital camera features.
Although it is compact, the camera allows high-speed image transfer and daisy chain connection with two IEEE1394b connectors. The camera also has versatile features such as hardware preprocessing in the camera that reduces the load of image processing in a PC, bus synchronization, and broadcast delivery of commands.
The XCD-series digital output cameras conforming to the IIDC 1.31 protocol take full advantages of IEEE1394 capabilities.

Features

■ High image quality, high-speed image output

The image device, output frame rate and resolution of the cameras are as follows:

- XCD-U100/U100CR: 1/1.8-type PS IT CCD, 15 fps, UXGA
- XCD-SX90/SX90CR: 1/3-type PS IT CCD, 30 fps, SXGA
- XCD-V60/V60CR: 1/3-type PS IT CCD, 90 fps, VGA

■ Daisy chain connection

The camera is equipped with two IEEE1394b connectors that support connection of multiple cameras. As the power can be supplied from a 12-pin connector (EIAJ), the camera achieves daisy chain connection without limitation of power supply capacity so that a simple image processing system with multiple cameras can be developed.

■ Hardware preprocessing

The camera is equipped with hardware LUT (Lookup Table). The black and white models are also equipped with 3 x 3 image matrix operation.

■ Bus synchronization

The cameras connected to the same bus automatically operate in synchronization with the 1394 bus, without using an external sync signal. The exposure timing on multiple cameras is synchronized correctly via the IEEE1394b cable only.

■ Broadcast delivery of commands

The camera settings for all the cameras connected to the same bus can be changed at the same time. For example, the gain or shutter speed is set to the same value on all the cameras, or exposure starts on all the cameras simultaneously using a software trigger.

■ Memory channel

The memory channel allows storage of up to 15 sets of camera settings such as gain and shutter.

■ Bulk trigger mode

The Bulk trigger mode allows output of multiple images with a shot of a trigger signal. Each image is shot with the camera settings stored in the memory channel. Up to 15 image settings are possible.

■ Memory shot

The image exposed from the sensor is stored in the cameraís built-in memory. The stored image can be read out using a command from the host PC when required.

		XCD-U100 XCD-U100CR	XCD-SX90 XCD-SX90CR	XCD-V60 XCD-V60CR
Standard image size (H X V)		1,600 X 1,200 (UXGA)	1,280 X 960 (SXGA)	640 X 480 (VGA)
Bit length	Mono8/ Raw8	8 frames	13 frames	54 frames
	Mono16/ Raw16	4 frames	6 frames	27 frames

■ Partial scan

Partial scan clips a required angle of view (area) from the entire screen to be read out. As a part of the image is read out, the unit takes advantage of reduced image data and high-speed transfer. The minimum clipping unit is 32 pixels × 24 lines.

■ Binning

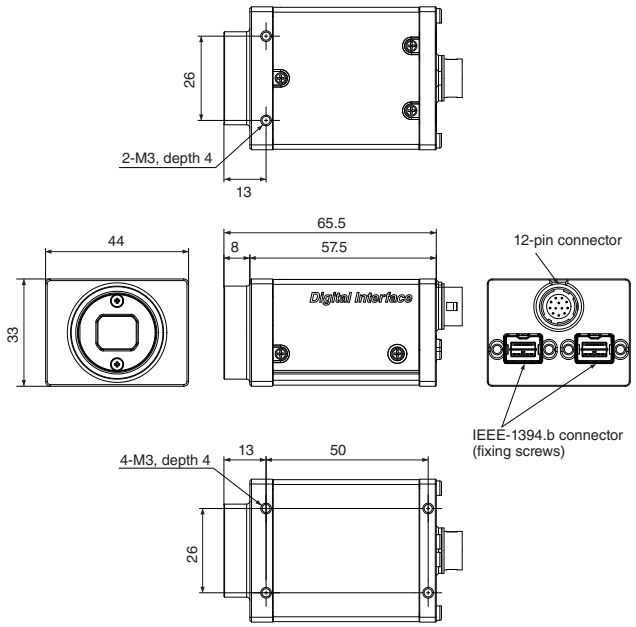
Binning increases the sensitivity and frame rate based on mixing the pixel data.

■ 9-pin connector with fixing screws

■ Low power consumption, vibration-resistant structure, and compact size

■ IIDC Ver. 1.31 protocol compliant

Dimensions



Unit: mm

Accessories

■ Compact camera adaptor
- DC-700/700CE

■ 12-pin camera cable (CE standard)
- CCXC-12P02N (2 m)
- CCXC-12P05N (5 m)
- CCXC-12P10N (10 m)
- CCXC-12P25N (25 m)

■ Tripod adaptor
- VCT-ST70I

Specifications

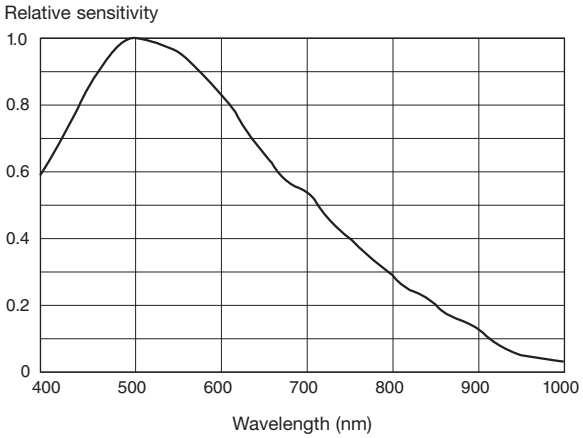
	XCD-U100	XCD-U100CR	XCD-SX90	XCD-SX90CR	XCD-V60	XCD-V60CR
Image sensor	1/1.8-type progressive scan IT transfer CCD		1/3-type progressive scan IT transfer CCD			
Effective lines Output image size (H) × (V)	1,600 × 1,200 (UXGA)		1,280 × 960 (SXGA)		640 × 480 (VGA)	
Unit Cell size (H) × (V)	4.4 μm × 4.4 μm		3.75 μm × 3.75 μm		7.4 μm × 7.4 μm	
Minimum illumination	2 lx F1.4 Gain: 24 dB	20 lx F1.4 Gain: 18 dB	2 lx F1.4 Gain: 24 dB	20 lx F1.4 Gain: 18 dB	2 lx F1.4 Gain: 24 dB	20 lx F1.4 Gain: 18 dB
Bit length	Mono 8: 8 bits/pixel Mono 16: 10 bits/pixel	Raw 8: 8 bits/pixel Raw 16: 10 bits/pixel	Mono 8: 8 bits/pixel Mono 16: 10 bits/pixel	Raw 8: 8 bits/pixel Raw 16: 10 bits/pixel	Mono 8: 8 bits/pixel Mono 16: 10 bits/pixel	Raw 8: 8 bits/pixel Raw 16: 10 bits/pixel
Lens mount	C mount					
Digital interface	IEEE1394b-2002 x2, bilingal (with fixing screw)					
Protocol	IIDC 1394-based Digital Camera Specification Version 1.31 compliant					
Transfer rate	800 / 400 Mbps					
Frame rate	15 fps		30 fps		90 fps	
Gain	Auto/Manual (0 dB to 24 dB)	Auto/Manual (0 dB to 18 dB)	Auto/Manual (0 dB to 24 dB)	Auto/Manual (0 dB to 18 dB)	Auto/Manual (0 dB to 24 dB)	Auto/Manual (0 dB to 18 dB)
Electronic shutter	1/100,000 sec to 16 sec (Absolute value control possible)					
External trigger shutter	Edge detection (Mode 0), Exposure time setting by trigger width (Mode 1), Software trigger (IEEE1394 bus), Bulk trigger, Sequential trigger, Trigger inhibition setting, Trigger/strobe delay setting					
Image Memory	16 MB					
Memory Chanel	15 sets					
Broadcast delivery of commands	Using IEEE1394 BUS, Camera software setting					
Functions	Partial scan, binning, LUT, 3×3 filter (For B/W models), Optical filter (Color model only), AWB (Color model only)					
Power requirements	DC 8 V to 30 V (from IEEE1394b 9 pin cable or 12 pin connector: 12 pin : Priority)					
Power consumption	3.0 W (12 V)		2.8 W (12 V)			
Dimensions	44 (W) × 33 (H) × 57.5 (D) mm (not including projecting parts)					
Mass	140 g					
Operation temperature	–5°C to +45°C					
Storage temperature	–30°C to +60°C					
Performance guarantee temperature	0°C to 40°C					
Operation humidity	20% to 80% (Non condensation)					
Storage humidity	20% to 95% (Non condensation)					
Vibration resistance	10 G (20 Hz to 200 Hz)					
Shock resistance	70 G					
MTBF	56,270 hours (Approx. 6.4 years)		58,260 hours (Approx. 6.7 years)		57,170 hours (Approx. 6.5 years)	
Regulatory compliance	UL60950-1+CSA C22.2 No.60950.1, FCC/ICES-003: Class A, CE: EN61326, AS/NZ: EN55022, VCCI: Class A, Korea MIC					
Supplied accessories	Lens mout cap (1), Operating Instructions (1)					

The values for mass and dimension are approximate.

Spectral Sensitivity Characteristics

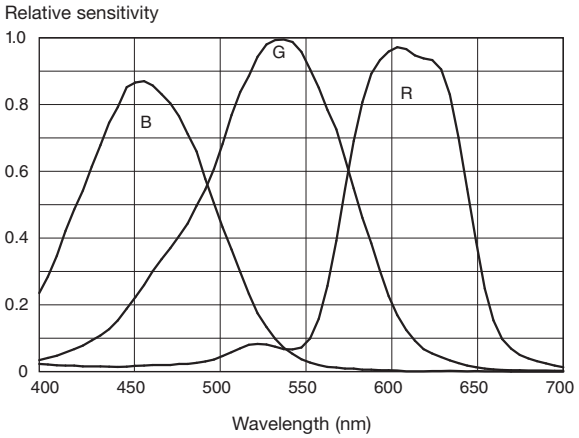
• XCD-V60

Spectral sensitivity (relative response) parameters
(without lens and light source parameters)



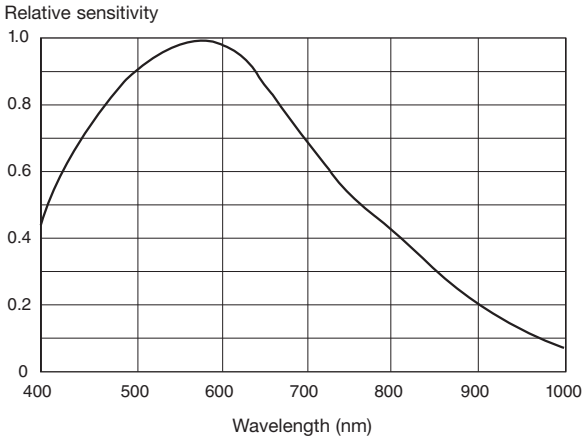
• XCD-V60CR

Spectral sensitivity (relative response) parameters
(without lens and light source parameters)



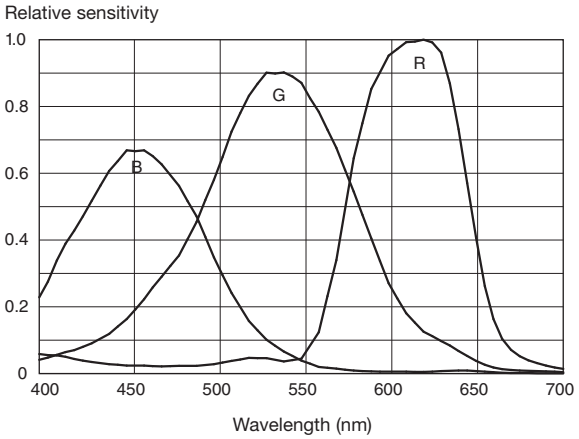
• XCD-SX90

Spectral sensitivity (relative response) parameters
(without lens and light source parameters)



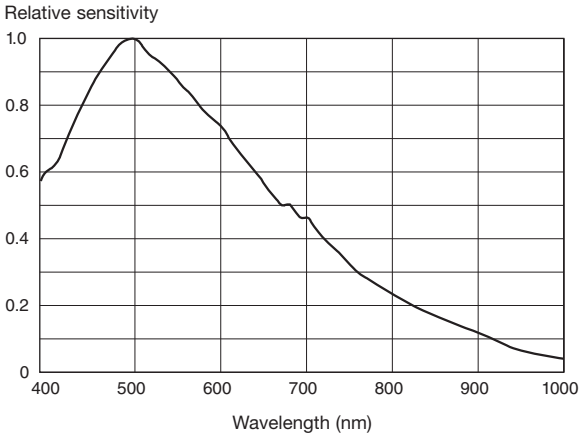
• XCD-SX90CR

Spectral sensitivity (relative response) parameters
(without lens and light source parameters)



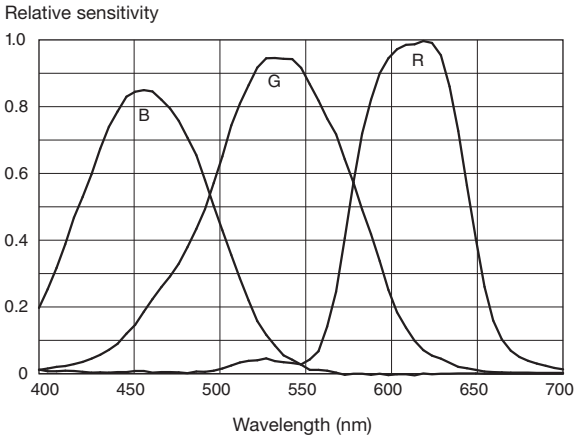
• XCD-U100

Spectral sensitivity (relative response) parameters
(without lens and light source parameters)

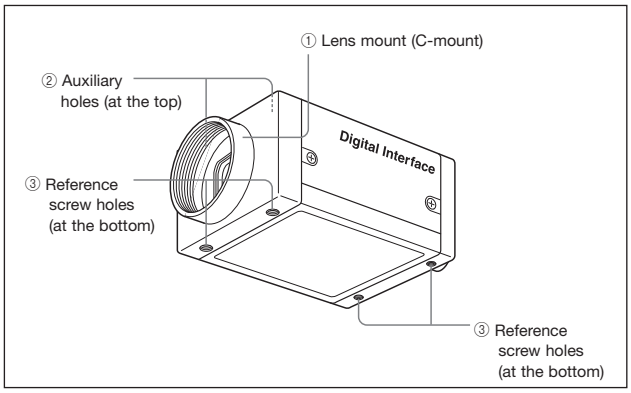


• XCD-U100CR

Spectral sensitivity (relative response) parameters
(without lens and light source parameters)



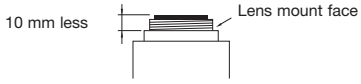
Location and Function of Parts and Controls



① Lens mount (C-mount)
Attach any C-mount lens or other optical equipment.

Note

The lens must not project more than 10 mm from the lens mount.

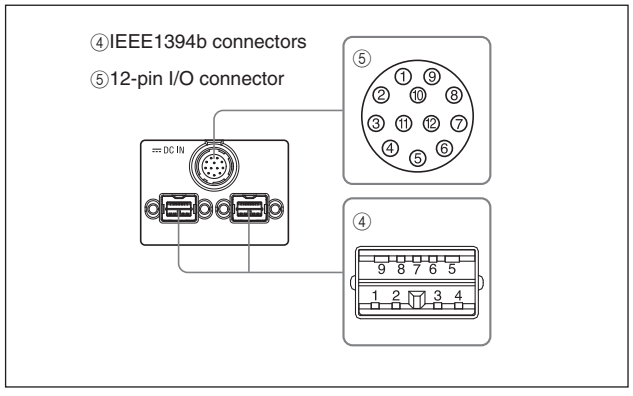


② Auxiliary screw holes (at the top)

③ Reference screw holes/Tripod screw holes (at the bottom)
These precision screw holes are for locking the camera module. Locking the camera module into these holes secures the optical axis alignment.

Four screw reference holes ③ can be used as the tripod adaptor screw holes, too. Screw the VCT-ST70I tripod adaptor into the four screw holes when you use a tripod.

Rear and Connector Pin Assignments



④ IEEE1394b connectors
Connect an IEEE1394b camera cable (not supplied) to this connector.

Pin No.	Signal	Pin No.	Signal
1	TPB–	6	VG
2	TPB+	7	NC
3	TPA–	8	VP
4	TPA+	9	TPBG
5	TPAG		

⑤ 12-pin I/O connector
When power from the IEEE1394b connector is insufficient, power is supplied through this connector.
Connect a camera cable such as the CCXC-12P05N to this connector.

Pin No.	Signal	Pin No.	Signal
1	Power GND	7	GPIO IN 2
2	Power IN	8	GPIO OUT 2–
3	ISO GND	9	GPIO OUT 2+
4	Strobe OUT	10	GPIO IN 1
5	GPIO OUT 1–	11	Trigger IN
6	GPIO OUT 1+	12	ISO GND

GAIN

Both Manual and Auto Gain settings are available with this camera. The variable range extends from 0 dB to 24 dB for the black and white models or from 0 dB to 18 dB for the color models. The camera is designed so that the gain can be subdivided and set by 0.0359 dB. At the factory default setting, the gain is set to 0 dB. When Auto Gain is selected, the gain is adjusted automatically, based on the brightness of the subject. At this time, the reference level (target point) is set in the AutoExposure register.

Shutter

This camera allows both Manual and Auto Shutter settings.
The variable range extends from 10 microseconds to 16.0 seconds; relative values are indicated by a 12-bit integer, and absolute values are indicated using a 32-bit floating point value.

The relationship between the parameter and the exposure time is given by the following formulas, where:

P = Parameter (003h to 47Eh)
E = Exposure time (sec)

If P= 3

$$E = 0.00001$$

If 4 <= P <= 1000

$$E = \frac{P^2}{1000000}$$

If 1000 <= P <= 1150

$$E = (P - 1000) \times 0.1 + 1$$

Setting examples

3 (003h) : 10 μs (1/100000)
32 (020h) : 1 ms (1/1000)
100 (064h) : 10 ms (1/100)
1000 (3E8h) : 1 sec
1010 (3F2h) : 2 sec
1150 (47Eh) : 16 sec

When Auto Shutter is selected, the exposure time is adjusted automatically, based on the brightness of the subject. At this time, the reference level (target point) is set in the AutoExposure register.

For long exposure times
When the exposure time is longer than the frame period, the camera enters the long exposure time mode, and the actual frame rate is reduced in accordance with the exposure time.

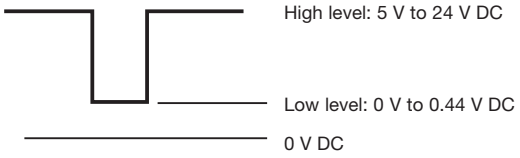
Trigger

Trigger shutter is useful for capturing images in response to a trigger that starts the exposure to match a preset timing. It can also be used to capture an image using multiple cameras with the same timing.
When a trigger shutter is used, the required trigger is input via the 12-pin connector on the rear panel. The input signal is a 5 V to 24 V negative pulse.
As the input connector is pulled inside of the camera, the camera can receive a trigger only by short-circuiting the input pin and ISO (GND) pin.

Note

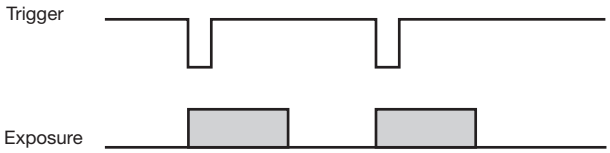
To connect to ground, use a device having a minimum pulse width of 10 microseconds and an input current of 0.5 mA or more.
When using DC-700, use a 5-volt negative polarity pulse for the input signal.

This camera supports four trigger modes: 0, 1, 14 and 15.



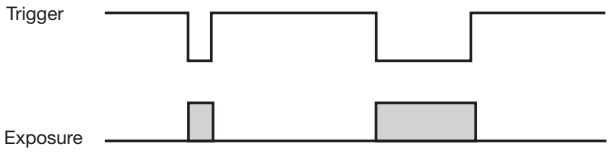
Trigger mode 0

Trigger mode 0 starts exposure by detecting the falling edge of a trigger signal. The exposure time is determined by the shutter parameter.



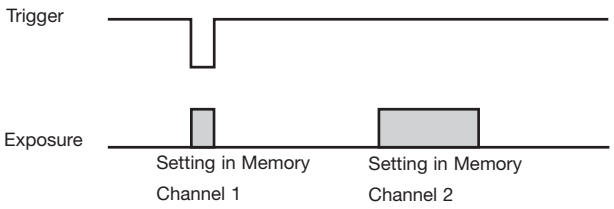
Trigger mode 1

Trigger mode 1 controls the exposure time using the width of the trigger signal pulse. When trigger mode 1 is used, there is actually no limit to the exposure time.



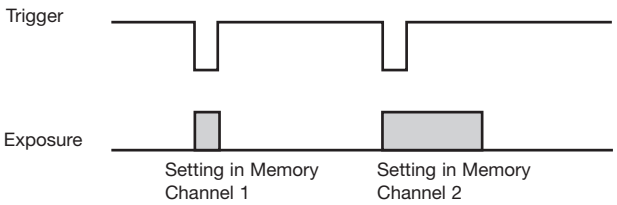
Trigger mode 14 (Bulk trigger mode)

Trigger mode 14 allows shooting of multiple images with different camera settings using only one trigger signal. The camera settings should be prestored in memory channels.



Trigger mode 15 (Sequential trigger mode)

Trigger mode 15 allows shooting of images by loading the camera settings prestored in memory channels in sequence each time a trigger is input.



As this camera is equipped with 15 memory channels, a repeat pattern of up to 15 image shootings can be set for trigger mode 14 or 15.
The number of the repeat patterns to be set in one cycle can be determined by the parameter of the trigger mode.
Memory channel 0 is not used for the Bulk trigger mode and the Sequential trigger mode.

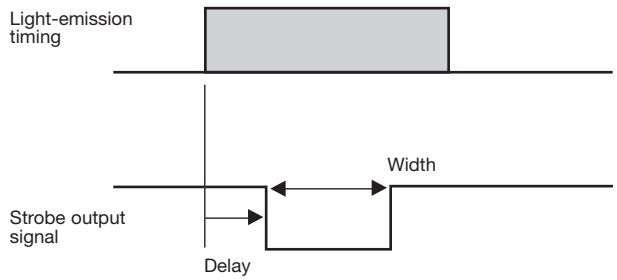
The following features are loaded from the memory to be set for shooting:
• Brightness • Sharpness • Saturation • White balance • Hue
• Gamma • Shutter • Gain • Pan/Tilt • Optical Filter

Note that the Auto mode of White Balance, Shutter and Gain cannot be set.
Also note that Pan/Tilt is set only when the current video mode is the same as the video mode selected when the setting has been stored in the memory channel.

This camera can also be used with a software trigger that issues the trigger signal via software command. Trigger modes 0, 1, 14 and 15 can be used with software triggers.

Strobe Control

A strobe control signal is assigned in the 12-pin connector.
This allows direct command of light-emission from the strobe connected to the camera and controls the light-emission timing and the signal width.
The output terminal is of the open-collector type and should be pulled at the strobe side. A strobe that emits light by short-circuiting the input to ground can be connected to the camera directly.



Note

Use the following conditions:
Recommended pull-up resistor: 4.7 kΩ
Recommended pull-up voltage: 5 V

The camera is equipped with a protective resistor of 220Ω. If the above conditions prove difficult in use, check the output voltage and determine the external pull-up resistor. The camera is capable of outputting a signal of about 10 microsecond width, although the rise time depends on the pull-up resistor.

Saturation (Color models only)

This feature controls the color density.

White Balance (Color models only)

This feature controls the white balance by setting the R and B levels relative to the G level.
The camera also supports the Auto white balance by which the camera automatically adjusts the white balance.

Optical Filter

You can change the Bayer patterns by moving the starting position from which to output pixel data by one position up, down, right, or left.

Patterns of Bayer arrangement are as follows:

Pattern 0

G	B
R	G

Pattern 1

B	G
G	R

Pattern 2

R	G
G	B

Pattern 3

G	R
B	G

Memory Shot

The camera is equipped with Memory Shot that temporarily stores an image in the frame memory inside the camera and transfers it later.

When multiple cameras are connected in the same bus, all the cameras may not output images at the same time due to the restriction of 800 Mbps band. Memory Shot may resolve this inconvenience.

When exposure starts, each camera stores an image in the frame memory without allocating the isochronous resource.

When outputting, each PC outputs the image from the camera allocating the isochronous resource.

The number of images to be stored depends on the video mode.

Broadcast Command

The normal1394 communication method specifies the node number at the host side so that only a specified camera responds to the command.

If the node number is set to 63, all the cameras connected to the same bus can receive the command simultaneously, i.e., only one command issued from the host can control multiple cameras at the same time.

All the commands including the video mode setting and the feature control are capable of broadcasting except the block writing command.

When setting different types of cameras using a broadcast command, be careful not to issue a command that the cameras do not support.

1394 Bus Synchronization

Timing used to start exposure is synchronized with the 1394 bus time cycle register.

If cameras are connected to the same bus, they are automatically synchronized in a 1394 bus operation. As 800 Mbps band restriction can affect the synchronization, you must set the video mode in which the cameras can transmit a video signal at the same time.

1394 synchronization does not work in long exposure mode and Partial scan mode. In a long exposure, the exposure time is set longer than the image transmission cycle.

1394 bus synchronization includes up to 1H cycle jitter. Hardware external synchronization will ensure greater accuracy.