

SONY

**CCD COLOR DIGITAL
CAMERA MODULE**

DFW-V500

DFW-VL500



Technical
Manual

(Ver. 1.0) —English—

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OUTLINE

The DFW-V500/VL500 is a color digital video camera utilizing a 1/3-type PS IT CCD. The DFW-V500 is the C-mounted type while the DFW-VL500 is a 12× zoom lens mounted type.

The IEEE1394-1995 digital interface realizes a transfer speed of 400M bps and outputs VGA (640 × 480)/YUV (4 : 2 : 2)/30 fps. In addition, the DFW-V500/VL500 also adopts a primary color filter CCD to realize good color reproductivity. Furthermore, they digitally transmit the original image quality without “Analog-to-Digital conversion” on the video capture board. The square pixels eliminate the need for aspect ratio conversion in the image processor.

MAIN FEATURES

◇ **1/3-type progressive scan IT CCD**

◇ **Primary color filter/square pixel/progressive scan CCD**

◇ **Non-compressed YUV (4 : 2 : 2) 8 bits each**

◇ **External trigger function**

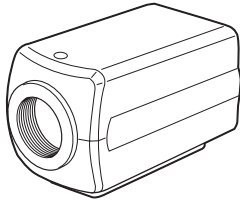
The external trigger shutter function allows the image exposure to be coordinated with external equipment and moving objects. The exposure time can be controlled via software over the IEEE1394 bus.

◇ **Solid aluminum diecast chassis**

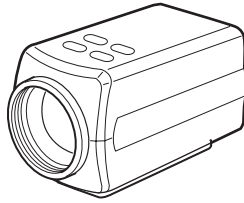
◇ **C-Mount with Flange-Back adjustment (DFW-V500)**

◇ **Remote control of camera settings and operation via IEEE-1394 commands**

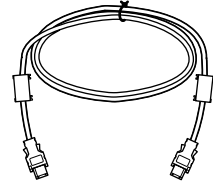
SYSTEM COMPONENTS



Video Camera Module
DFW-V500



Video Camera Module
DFW-VL500

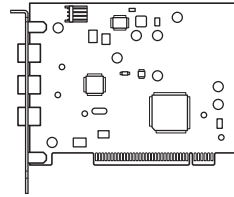


IEEE1394 Cable
(6-pin, 4.5 m)



C-mount Lens (Option)

- VCL-08YM
- VCL-12YM
- VCL-16Y-M
- VCL-25Y-M
- VCL-50Y-M
- J6 × 11 MACRO (Canon)



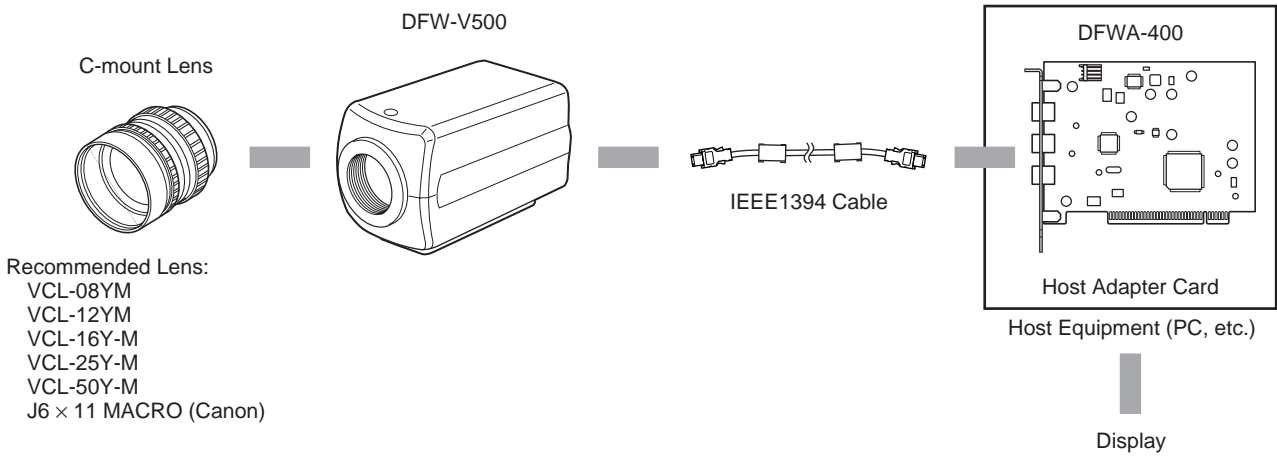
Host Adapter Card (Option)
DFWA-400

SPECIFICATIONS

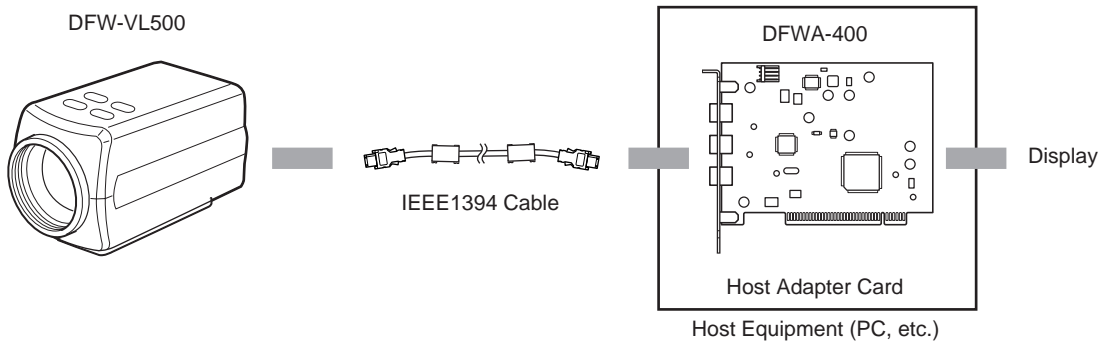
Image sensor	: 1/3-type progressive scan IT CCD
Number of effective pixels	: 659 (H) × 494 (V)
Cell size	: 7.4 (H) × 7.4 (V) μm
Interface format	: IEEE1394-1995
Protocol	: 1394-based Digital Camera Specification Version 1.20
Data format	: 640 × 480 YUV (4 : 2 : 2) 8 bits each Mode-3 640 × 480 YUV (4 : 1 : 1) 8 bits each Mode-2 320 × 240 YUV (4 : 2 : 2) 8 bits each Mode-1 160 × 120 YUV (4 : 4 : 4) 8 bits each Mode-0
Frame rate	: 3.75, 7.5, 15, 30 fps and One Shot
Transfer speed	: 100M, 200M, 400M bps
Lens mount	
DFW-V500	: C-mount
DFW-VL500	: Built-in 12× zoom lens When the shooting distance is infinite, the focus distance Tele side is 64 mm, Wide side is 5.5 mm 0.8 m at whole MOD zoom area, 1 cm at Wide end (distance from lens tip)
Flange back	
DFW-V500 only	: 17.526 mm
Minimum illumination	
DFW-V500	: 6 lx (F1.2)
DFW-VL500	: 14 lx (F1.8, Wide end)
White balance	: One Push (Color temperature during automatic adjustments: 2,400 K to 10,000 K)/ ATW (Color temperature during automatic adjustments: 2,800 K to 6,500 K) (Auto tracing)/ 3,200 K, 5,600 K, Manual adjustment
HUE	: Adjustable
Saturation	: Adjustable
Brightness	: Adjustable
Zoom/Focus	
DFW-VL500 only	: Adjustable/Manual adjustment (using the buttons on top side of the camera)
Gamma	: Switchable between three positions
CCD iris	: ON (1/30 to 1/2,000)/OFF
Shutter	: 5s to 1/15s, 1/30s to 1/10,000s, 1/20,000s, 1/50,000s, 1/100,000s
Gain	: Auto adjustment/Manual adjustment (0 to 18 dB, 1 dB/step) AGC operation range is the same as above
External trigger shutter	: ON/OFF
Supply voltage/power consumption	: DC +8 to +30 V (from IEEE1394 cable)/4 W
Operating temperature/storage temperature	: -10 to +50°C/-20 to +60°C
Dimensions	
DFW-V500	: 60 (W) × 61 (H) × 116.7 (D) mm
DFW-VL500	: 60 (W) × 61 (H) × 118.5 (D) mm
Mass	
DFW-V500	: Approx. 305 g
DFW-VL500	: Approx. 335 g
Accessories	: IEEE1394 cable (1), Lens mount cap (1) ... DFW-V500 Lens cap (1) ... DFW-VL500, Clamp filter (2) External trigger connector (male) (1), Operating Instructions (1)

CONNECTION

DFW-V500

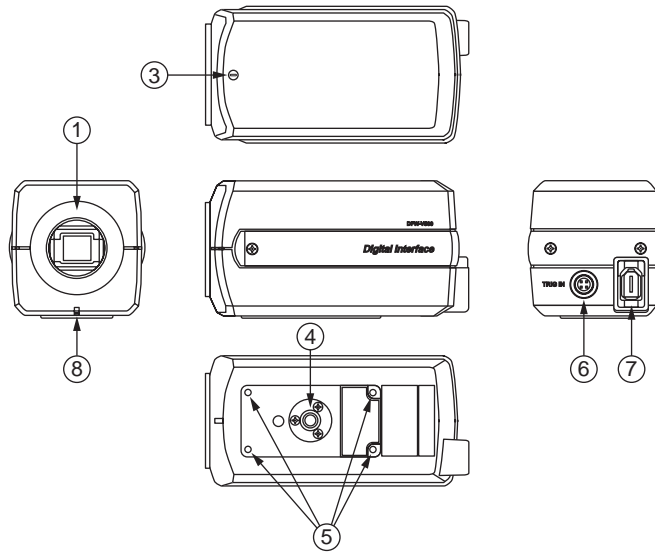


DFW-VL500

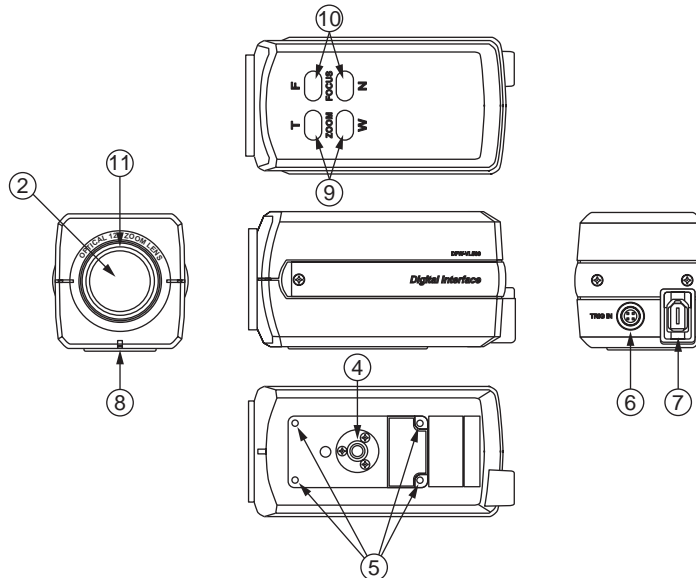


NAMES AND FUNCTIONS OF PARTS

DFW-V500

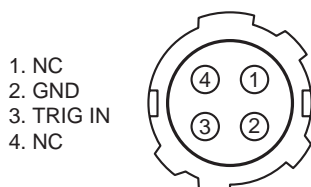


DFW-VL500



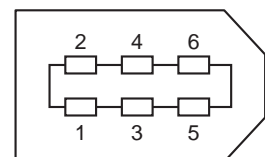
- ① Lens mount (C-mount) (DFW-V500)
- ② Built-in zoom lens (DFW-VL500)
- ③ Flange back hole (DFW-V500)
Adjust the flange back using a standard head screwdriver.
- ④ Screw hole for tripod mounting
- ⑤ Camera fixing reference holes
- ⑥ TRIG IN (Trigger) connector
Inputs the TTL level, negative polarity trigger signal.
- ⑦ Camera connector (IEEE1394 connector)
Connect to the host equipment using the IEEE1394 cable provided.
- ⑧ Pilot lamp
Lights green when the power is turned on, and orange in the isochronous transmission (enabled) state.
- ⑨ ZOOM buttons (DFW-VL500)
Press the “T (telephoto)” side to obtain a smaller angle of view and the “W (wide-angle)” side to have a larger angle of view.
- ⑩ FOCUS buttons (DFW-VL500)
Press the “F” side to focus on farther objects and the “N” side to focus on closer objects.
- ⑪ Filter screw (DFW-VL500)
Connect a 37 mm aperture filter here.

⑥ Pin assignment of TRIG IN connector (female)



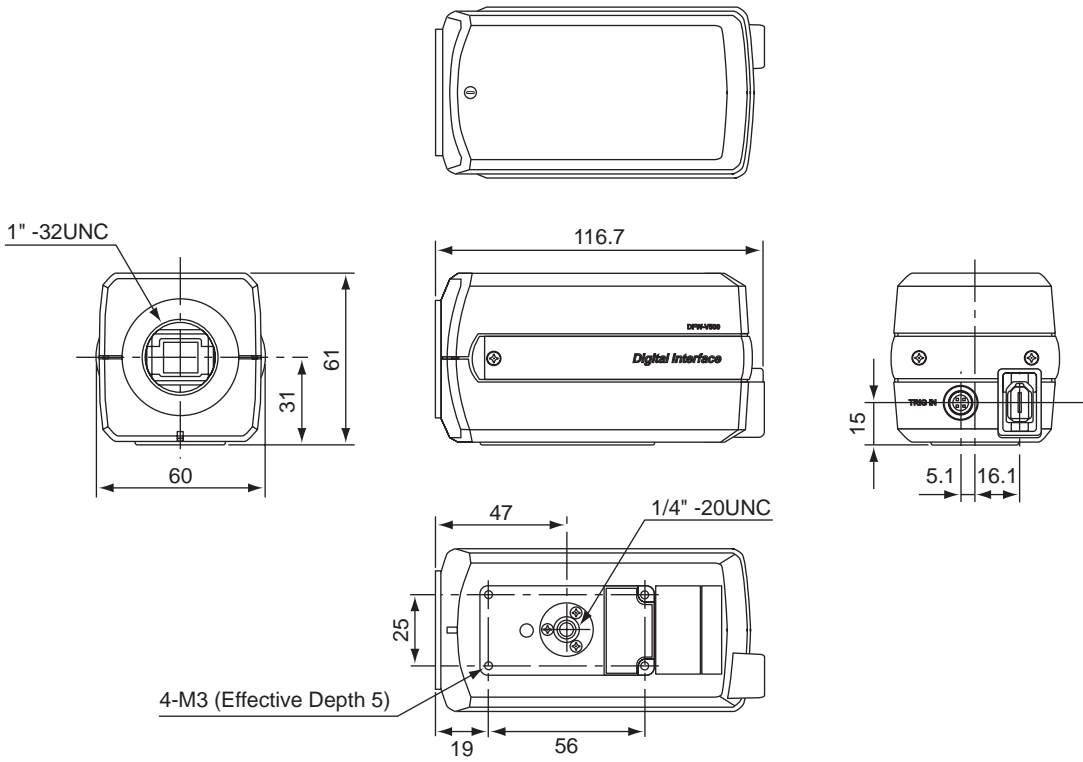
⑦ Pin assignment of camera connector

- 1. Power
- 2. Power (GND)
- 3. TPB-
- 4. TPB+
- 5. TPA-
- 6. TPA+



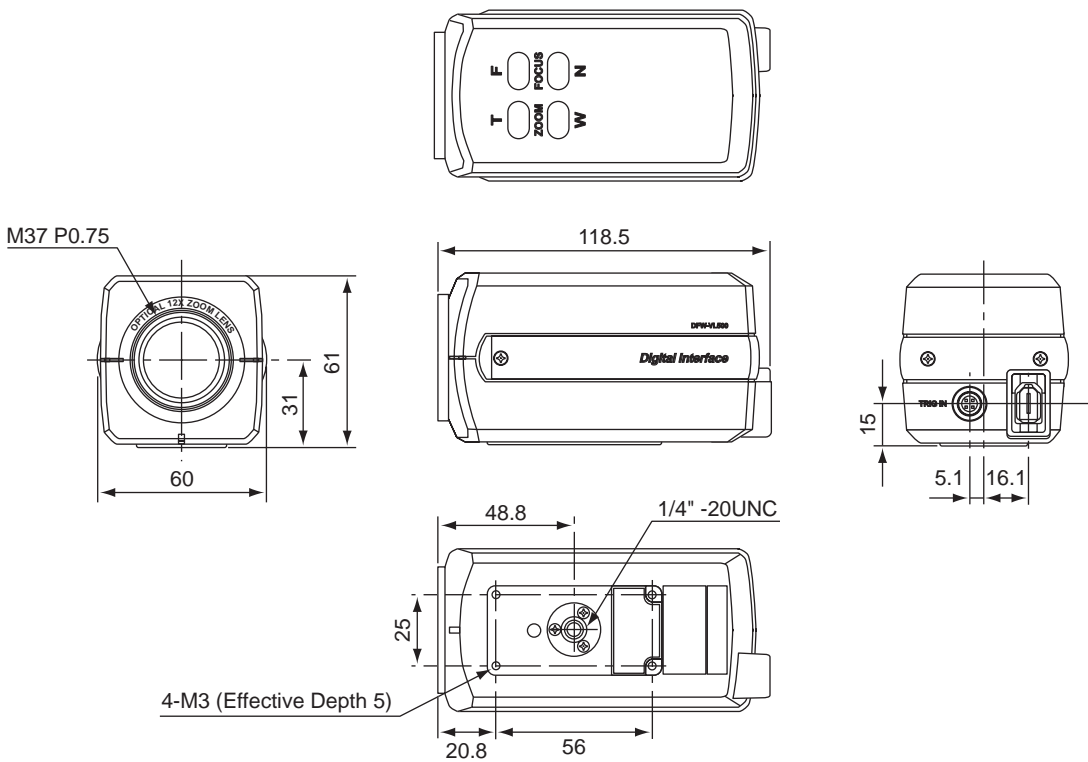
DIMENSIONS

DFW-V500



Unit: mm

DFW-VL500

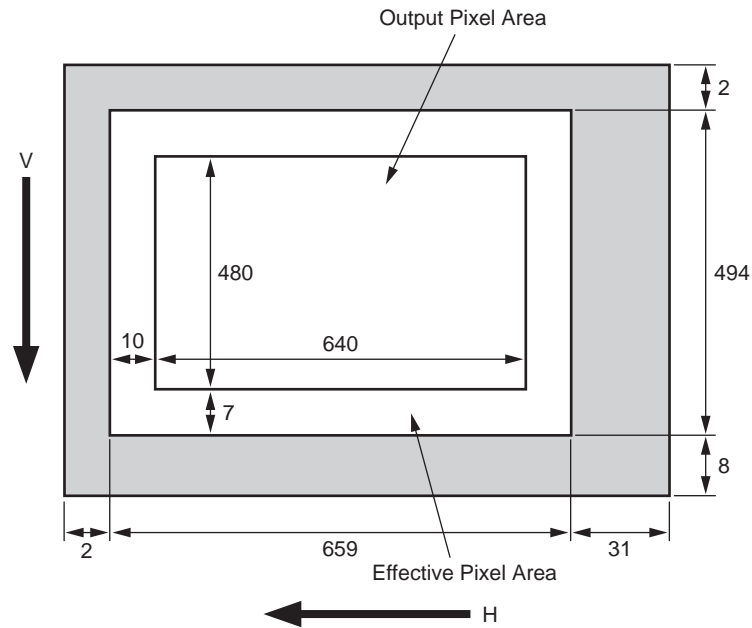


Unit: mm

CCD PIXEL LOCATION

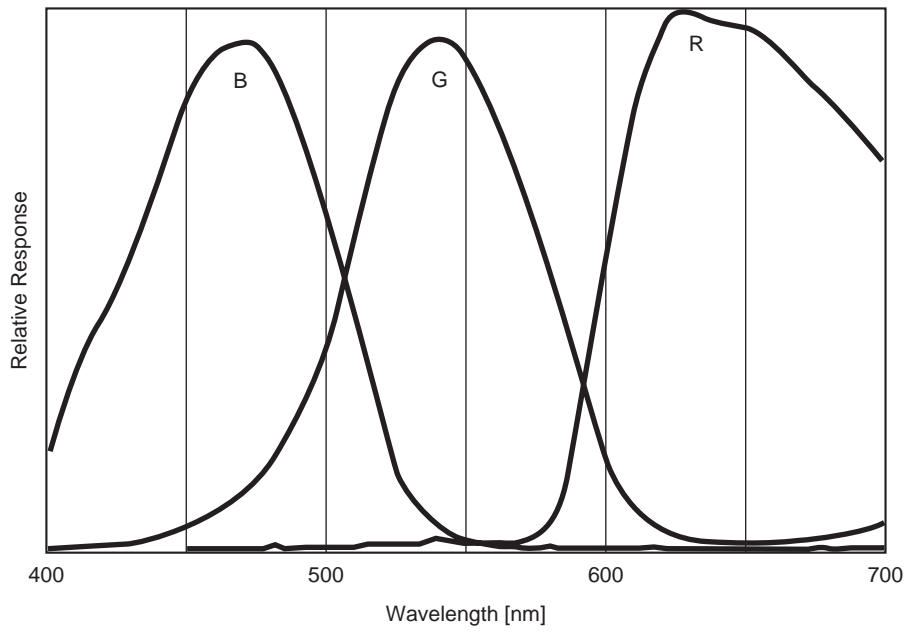
Total number of pixels : 692 (H) × 504 (V)
Number of effective pixels: 659 (H) × 494 (V)
Number of output pixels : 640 (H) × 480 (V)
Unit cell size : 7.4 μm (H) × 7.4 μm (V)

Top View



Note) Center of output pixel area is luminous axis.

SPECTRAL CHARACTERISTICS (TYPICAL VALUES)



FUNCTIONS

The DFW-V500/VL500 differs from conventional analog cameras in that no video signals will be output by just supplying power. It will start operating when designated commands are written in the CSR (Control & Status Register) specified in the 1394-based Digital Camera Specification Ver.1.20. For details on the steps to video signal output and details of CSR, refer to “SETTINGS OF CAMERA CONTROL AND STATUS REGISTER” on page 13 and “COMMAND SENDING PROCEDURE UNTIL IMAGES ARE DISPLAYED” on page 22.

This chapter describes the functions of the camera which can be set using the CSR.

Camera Functions

◇ Gain

Used for setting the gain of the video signal amplifier. The gain can be set in 18 steps between the standard gain and maximum +18 dB.

By setting AUTO to ON, the gain will be automatically adjusted to the appropriate exposure. The range of operation is 0 to +18 dB.

Note) For 18 dB, there may be an inconsistency of approximate +3 dB.
1 step is about 1 dB.

◇ Shutter

The CCD exposure time can be set between the maximum 5 seconds and minimum 1/100,000 seconds. By setting the CCD Iris to ON, the exposure time will be automatically adjusted to the appropriate exposure. The range of operation is 1/30 to 1/2,000 seconds.

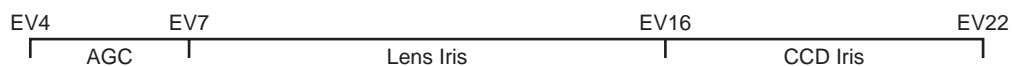
◇ Iris (DFW-VL500 only)

Used for setting the built-in zoom lens iris from fully opened (F1.8 at Wide end) to fully closed. By setting AUTO to ON, the iris will be automatically adjusted to the appropriate exposure. The range of operation is about F1.8 to F32.

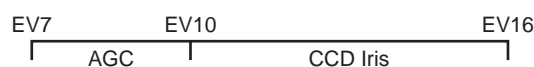
◇ Auto Exposure

Used for setting the exposure compensation when Gain, Shutter, or Iris is operating in the AUTO mode. When Gain, Shutter, and Iris are all set to Manual, the Auto Exposure setting will not be used. The range of operation is about -1EV to +0.5EV.

Operation ranges of AGC, Lens Iris, CCD Iris When DFW-VL500



When DFW-V500 (Lens Iris: F = 5.6)



These values are approximate values and may differ according to the adjusted and operating state of the camera.

FUNCTIONS

◇ Brightness

The brightness of images can be controlled by changing the black level setting. Adjust the brightness if the appropriate gradation cannot be obtained due to the blurring of the black portions of the image.

When maximum value of Y output data is 255

Command setting	Y output value (full black level)
00h	0
80h	1
FFh	50

These values are approximate values and may differ according to the adjusted state of the camera.

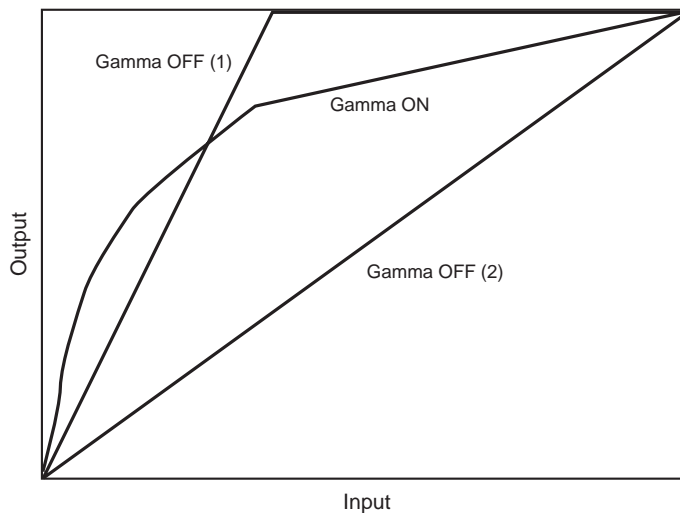
◇ Gamma

Used for setting gamma compensation to ON or OFF.

ON : For obtaining natural gradation taking into account the characteristics of the monitor.

OFF (1): Outputs CCD signals for image processing linearly according to the sensitivity when Gamma is ON.

OFF (2): Outputs CCD signals for image processing linearly. The sensitivity drops, but the dynamic range increases from OFF (1).



Concept of Gamma Characteristics

◇ Sharpness

Used for adjusting sharpness of the image.

◇ White Balance

Used for adjusting white balance by adjusting R-gain and B-gain. White subjects can be shot in white by setting the white balance according to the color temperature of the luminance light. The White Balance operation mode can be selected from three modes – Manual, One Push, and ATW.

FUNCTIONS

◇ Color Temperature

This function was originally intended for selecting the optical filter. However with the DFW-V500/VL500, the R-gain and B-gain are set to the appropriate White Balance when color temperatures 3,200 K and 5,600 K light sources are used.

◇ Hue

Used for adjusting the hue of the image.

Command setting	Hue changing amount
00h	Equivalent changing amount when the luminance point of the NTSC Vector Scope is rotated by about 15 degrees in the clockwise direction from the factory setting.
80h	Factory setting
FFh	Equivalent changing amount when the luminance point of the NTSC Vector Scope is rotated by about 15 degrees in the counterclockwise direction from the factory setting.

These values are approximate values and may differ according to the adjusted state of the camera.

◇ Saturation

Used for adjusting the saturation of the image.

Command setting	Saturation changing amount
00h	0%
80h	100% (Factory setting)
FFh	Approx. 200% Saturation

These values are approximate values and may differ according to the adjusted state of the camera.

◇ Zoom (DFW-VL500 only)

Used for adjusting the zoom range of built-in zoom lens.

◇ Focus (DFW-VL500 only)

Used for adjusting the focus of the built-in zoom lens.

◇ Isochronous Start/Stop

Used for turning ON/OFF the output of IEEE1394 isochronous transmitted images. When an image is being transmitted, the LED in front of the camera will light up orange.

FUNCTIONS

◇ One Shot

Used for capturing only one image data (one frame) in the Isochronous OFF state, then transmitted in the Isochronous ON state. The difference between this function and Trigger described in the next section is that image input is started by the IEEE1394 command instead of external trigger signals. The timing at which exposure starts is also undefined (within 70 ms after the command is received).

The LED in front of the camera lights up orange when image data is isochronously transmitted by the One Shot function.

◇ Trigger

Used for setting the external trigger mode to ON or OFF. No normal moving image signals are output in this mode.

Isochronous output is stopped at the point Trigger ON is set even in the Isochronous ON state. When external trigger pulses (TTL level, negative polarity, pulse width above 1 ms) are input, one image (one frame) is exposed for the specified time (specified at the shutter) will be output at the end of exposure.

The time from input of external trigger pulse to the start of image data output varies according to the exposure time and timing of the external trigger pulse for the reference pulse (VD) inside the camera.

◇ Memory_Save/Mem_Save_Ch/Cur_Mem_Ch

Used for memorizing the current camera setting data in the internal memory of the camera. Two types of settings can be memorized. These are called Memory_Channels 1 and 2.

To memorize the settings, first specify the Memory_Channel recorded at Mem_Save_Ch, and then memorize with Memory_Save.

The memorized setting data can be read out and reset to the camera. The Memory_Channel to be read out can be specified and executed at the same time with the Cur_Mem_Ch. It is also possible to return it to the factory setting.

<Settings that are saved>

- Frame Rate
- Video Mode
- Video Format
- Iso Channel Speed
- Memory Save Channel
- Brightness
- Auto Exposure
- Sharpness
- White Balance
- Hue
- Saturation
- Gamma
- Shutter
- Gain
- Iris (DFW-VL500 only)
- Focus (DFW-VL500 only)
- Trigger
- Zoom (DFW-VL500 only)
- Optical Filter

◇ Y/R – Y/B – Y → R/G/B conversion

The DFW-V500/VL500 outputs Y/R – Y/B – Y signals as digital image signals.

The equations for converting these signals to R/G/B signals are as follows.

$$R \approx Y + (R - Y)$$

$$G \approx Y - 0.5085 (R - Y) - 0.1864 (B - Y)$$

$$B \approx Y + (B - Y)$$

SETTING OF CAMERA CONTROL AND STATUS REGISTER

- This chapter describes CSR addresses using the lower 32 bits of 64 bits. (CSR: Abbreviation of Control and Status Register) The omitted upper 32 bits are ****F0FFh. (**** changes according to the connection of the IEEE1394 Serial Bus.)
- Read/Write of the CSR is executed in units of Quadlet (4 bytes). The CSR address is the address of the leading byte of the Quadlet.
- When describing the 32-bit command set for CSR in Hex, bit 0 is described as MSB (Most Significant Bit).

Example : 82012345h = 10000010 00000001 00100011 01000101b
 :
 bit 0 bit 31

CSR F0F00000h Camera Initialize Register (Write Only)

Executes the same operations as when Factory Setup was selected in Current Memory Channel of CSR F0F00624h.

Command: 80000000h

Resets the CSR F0F00800h – F0F0088Ch functions to factory settings.
 At this time, return the CSR F0F00624h Current Mem. channel also to “0”.

NOTE : As serial No. 100101 to 100700 (DFW-V500), 100101 to 100900 (DFW-VL500) cameras do not have this function, select Factory Setup in the CSR F0F00624h Current Memory Channel.

CSR F0F00600h to F0F00624h control isochronous image transmission, and load/save settings of the camera.

CSR F0F00600h Current Frame Rate

Specify the Frame Rates 1 to 4. (Frame Rate 1 cannot be used for Mode0)

Frame Rate	Command
1 (3.75 fps)	20000000h
2 (7.5 fps)	40000000h
3 (15 fps)	60000000h
4 (30 fps)	80000000h

NOTE : Set when CSR F0F00614h Iso_EN is OFF (STOP).

SETTINGS OF CAMERA CONTROL AND STATUS REGISTER

CSR F0F00604h Current Video Mode

Specify the Video Modes 0 to 3.

Video Mode	Command
0 (160 × 120 YUV (4 : 4 : 4))	00000000h
1 (320 × 240 YUV (4 : 2 : 2))	20000000h
2 (640 × 480 YUV (4 : 1 : 1))	40000000h
3 (640 × 480 YUV (4 : 2 : 2))	60000000h

NOTE : Set when CSR F0F00614h Iso_EN is OFF (STOP).

CSR F0F00608h Current Video Format

Specify the Video Format. As the DFW-V500/VL500 is only compatible with Format0, the command is always 00000000h.

NOTE : Set when CSR F0F00614h Iso_EN is OFF (STOP).

CSR F0F0060Ch Isochronous Channel, Transmit Speed

Specify Isochronous Channel (0 – 0Fh), Transmit Speed (100M, 200M, 400M bps).

Speed	Command
0 (100M bps)	n0000000h
1 (200M bps)	n1000000h
2 (400M bps)	n2000000h

n: Isochronous Channel 0 – Fh

NOTE : ● Set when CSR F0F00614h Iso_EN is OFF (STOP).

● The Transmit Speed which can be selected differs according to Video Mode and Frame Rate. Refer to the following table.

Frame Rate	mode0	mode1	mode2	mode3
3.75	— — —	100M bps 200M bps 400M bps	100M bps 200M bps 400M bps	100M bps 200M bps 400M bps
7.5	100M bps 200M bps 400M bps	100M bps 200M bps 400M bps	100M bps 200M bps 400M bps	100M bps 200M bps 400M bps
15	100M bps 200M bps 400M bps	100M bps 200M bps 400M bps	100M bps 200M bps 400M bps	— 200M bps 400M bps
30	100M bps 200M bps 400M bps	100M bps 200M bps 400M bps	— 200M bps 400M bps	— — 400M bps

SETTINGS OF CAMERA CONTROL AND STATUS REGISTER

CSR F0F00614h Isochronous Transmission Start/Stop

Set the Start/Stop of image transmission by Isochronous.

Start : Command = 80000000h

Stop : Command = 00000000h

NOTE : Before setting Start of image transmission, set the CSR F0F00600h – F0F0060Ch.

CSR F0F00618h Memory Save

The current settings of the camera using commands CSR F0F00600h – F0F0060Ch, CSR F0F00620h, and CSR F0F00800h – F0F0088Ch are memorized in the Memory Channel specified by CSR F0F00620h.

The settings will be preserved in the memory even when the camera power is turned off.

Execute: Command = 80000000h

NOTE :

- Before setting Execute, set the CSR F0F00620h Memory Save Channel.
- Memory Save requires about one second to execute. After setting, do not write other commands for one second.
- Serial No. 100101 to 100700 (DFW-V500), 100101 to 100900 (DFW-VL500) cameras memorize only the CSR F0F00800h to F0F0088Ch settings.

CSR F0F0061Ch One Shot

Perform the isochronous transmission of images for only one frame.

Execute: Command = 80000000h

NOTE :

- Can be used only when CSR F0F00614h Iso_EN is OFF (STOP).
- Do not set a new One Shot command until isochronous transmission ends after setting the One Shot command to CSR.

CSR F0F00620h Memory Save Channel

Specify the Memory Channel (ch1, ch2) for memorizing the current camera settings.

ch1: Command = 10000000h

ch2: Command = 20000000h

SETTINGS OF CAMERA CONTROL AND STATUS REGISTER

CSR F0F00624h Current Memory Channel

Read out the camera settings (ch1, ch2) memorized by the CSR F0F00618h Memory Save or the factory settings (Factory) from the memory, and set in the camera.

The Memory Channel that was specified last will be automatically memorized. When the power is turned ON the next time, the settings memorized in this Memory Channel will be effective.

Channel	Command
Factory	00000000h
ch1	10000000h
ch2	20000000h

CSR F0F00800h to F0F0088Ch control the various functions of the camera.

CSR F0F00800h Brightness

Adjust the black level of the image.

Command = 820000nnh

nn: Adjust in the range of 00h (dark) – FFh (bright).
80h is the standard value.

CSR F0F00804h Auto Exposure

Adjust the exposure compensation of Auto Exposure.

Command = 820000nnh

nn: Adjust in the range of 01h (under) – FFh (over).
80h is the standard value.

NOTE : Auto Exposure will not be effective unless either the Shutter, Gain, or Iris is set to Auto.

CSR F0F00808h Sharpness

Adjust the sharpness of the image contour.

Command = 820000nnh

nn: Adjust in the range of 00h (soft) – FFh (sharp).
80h is the standard value.

SETTINGS OF CAMERA CONTROL AND STATUS REGISTER

CSR F0F0080Ch White Balance

Adjust the red and blue gains to properly capture white subjects in color. Two types of automatic adjustment modes are available.

- NOTE** :
- If the CSR F0F00830h Trigger is set to ON or if the CSR F0F0081Ch Shutter setting is less than 800h, the Auto function cannot be used.
 - The CSR F0F0088Ch Optical Filter is canceled by this command. (Priority to latter)

(1) Manual adjustment

Command = 820mm0nnh

mm: Adjust B-gain in the range of 01h (min) – FFh (max).

nn : Adjust R-gain in the range of 01h (min) – FFh (max).

80h is the standard value.

(2) One-Push Auto White Balance

Perform automatic adjustment when command is received to maintain the white balance at that time.

Execute: Command = 86*****h

*****: Undefined

When this operation is complete, the command is read out as 82*****h (*****: Undefined).

- NOTE** :
- Execute after capturing a white subject lit using the light source used for shooting over the whole screen at the appropriate exposure. It will take a maximum of 10 seconds to complete automatic adjustment.
 - Execute again if the light source used for shooting has been changed.

(3) Auto Tracing White Balance

Perform automatic adjustment continuously to trace the white balance according to changes in the shooting conditions.

ON : Command = 83*****h

*****: Undefined

OFF : Set the command of (1) or (2).

- NOTE** :
- Operations stop if the exposure is inappropriate.
 - When the area of the white subject in the screen is small, adjustment accuracy will drop.

CSR F0F00810h Hue

Adjust the hue of the image.

Command = 820000nnh

nn: Adjust in the range of 00h (Skin Tone → Red) – FFh (Skin Tone → Yellow).

80h is the standard value.

CSR F0F00814h Saturation

Adjust the saturation of the image.

Command = 820000nnh

nn: Adjust in the range of 00h (light) – FFh (deep).

80h is the standard value.

SETTINGS OF CAMERA CONTROL AND STATUS REGISTER

CSR F0F00818h Gamma

Set the gamma characteristics.

80h is the standard value.

Gamma	Command
ON	82000080h
OFF (1)	82000081h
OFF (2)	82000082h

CSR F0F0081Ch Shutter

Set the exposure time of the electronic shutter. Auto exposure (CCD Iris) can be also set.

(1) Manual adjustment

Command = 82000nnnh

nnn: Adjust in the range of 76Ah (long) – A0Fh (short).
800h is the standard value.

5.0 sec ≥ Shutter Speed ≥ 1/30 sec

nnn = 800h – 30 * Shutter Speed (sec)

1/30 sec > Shutter Speed ≥ 1/10,000 sec

nnn = 2573.6 – 15734.3 * Shutter Speed (sec)

Shutter Speed = 1/20,000 sec

nnn = A0Dh

Shutter Speed = 1/50,000 sec

nnn = A0Eh

Shutter Speed = 1/100,000 sec

nnn = A0Fh

NOTE : When nnn < 800h, do not turn ON the Gain, Iris, and White Balance Auto functions.

Remark) The logical exposure time for the setting is as follows.

76Ah ≤ nnn < 800h

Shutter Speed (sec) = (800h – nnn)/30.00732

800h ≤ nnn < A0Ch

Shutter Speed (sec) = (2,007,365 – 780 * nnn)/12,288,000

(2) Auto exposure (CCD Iris)

ON : Command = 83000***h

***: Undefined

OFF : Set the command of (1).

NOTE : When the CSR F0F00830h Trigger is ON, do not set Auto exposure (CCD Iris) to ON.

SETTINGS OF CAMERA CONTROL AND STATUS REGISTER**Setting values of shutter speed for DFW-V500/VL500**

Exposure Time (sec.)	Setting Value (Decimal)	Setting Value (Hexadecimal)
5	1898	76AH
2	1988	7C4H
1	2018	7E2H
1/2	2033	7F1H
1/3.75	2040	7F8H
1/7.5	2044	7FCH
1/15	2046	7FEH
1/30	2048	800H
1/50	2258	8D2H
1/60	2309	905H
1/125	2448	990H
1/250	2511	9CFH
1/500	2542	9EEH
1/1,000	2558	9FEH
1/2,000	2566	A06H
1/4,000	2570	A0AH
1/10,000	2572	A0CH
1/20,000	2573	A0DH
1/50,000	2574	A0EH
1/100,000	2575	A0FH

SETTINGS OF CAMERA CONTROL AND STATUS REGISTER

CSR F0F00820h Gain

Adjust the gain of the video signal amplifier. Auto Gain Control can be also set.

(1) Manual adjustment

Command = 82000nnh

nn: Adjust in the range of 00h (min) – 12h (max).
00h is the standard value.

(2) Auto Gain Control

ON : Command = 83000**h

** : Undefined

OFF : Set the command of (1).

- NOTE** :
- When the CSR F0F0081Ch Shutter setting is less than 800h, do not set Auto Gain Control to ON.
 - When the CSR F0F00830h Trigger is ON, do not set Auto Gain Control to ON.

CSR F0F00824h Iris (DFW-VL500 only)

Adjust the iris of the built-in lens. Auto exposure (Lens Iris) can be also set.

(1) Manual adjustment

Command = 82000nnh

nnn: Adjust in the range of 000h (close) – FFFh (open).

(2) Auto exposure (Lens Iris)

ON : Command = 83000***h

*** : Undefined

OFF : Set the command of (1).

- NOTE** :
- When the CSR F0F0081Ch Shutter setting is less than 800h, do not set Auto exposure (Lens Iris) to ON.
 - When the CSR F0F00830h Trigger is ON, do not set Auto exposure (Lens Iris) to ON.

CSR F0F00828h Focus (DFW-VL500 only)

Adjust the focus of the built-in lens.

Command = 82000nnh

nnn: Adjust in the range of 000h (near) – 1BFh (far).
The value is 100h in factory setting mode.

SETTINGS OF CAMERA CONTROL AND STATUS REGISTER

CSR F0F00830h Trigger

When inputting a negative polarity signal to the TRIG IN connector at the back of the camera, isochronous transmission of images for only one frame will be performed.

ON : Command = 82000000h

OFF : Command = 80000000h

- NOTE** :
- To set Trigger ON, set the Auto functions of Shutter, Gain, Iris, and White Balance to OFF.
 - If the CSR F0F00600h – F0F0060Ch settings are not set properly and Iso_EN is not ON at the same time, no isochronous transmission of images will be executed even when trigger signals are input.
 - Do not input a new external trigger signal until isochronous transmission of images ends after the input of the external trigger signal, otherwise the camera may not operate correctly.

CSR F0F00880h Zoom (DFW-VL500 only)

Adjust the zoom range of built-in zoom lens.

Command = 82000nnnh

nnn: Adjust in the range of 028h (wide) – 598h (tele).

The value is 040h in factory setting mode.

CSR F0F0088Ch Optical Filter

Set the appropriate white balance preset for the main light source.

Lighting	Command
-----	-----
tungsten lamp (3,200 K)	82000000h
day light (5,600 K)	82000001h

- NOTE** : The CSR F0F0080Ch White Balance value is canceled by this command. (Priority to latter)

COMMAND SENDING PROCEDURE UNTIL IMAGES ARE DISPLAYED

(1) Acquiring the camera control register base address

Read out the Configuration ROM and acquire the base address of the camera control register.

The base address of the Configuration ROM is FFFF F0000000H.

	Offset	0 – 7	8 – 15	16 – 23	24 – 31
Bus Info Block	400H	04	1F	CE	D4
	404H	31	33	39	34
	408H	20	FF	60	00
	40CH	08	00	46	02
	410H	00	03	02	8B
Root Directory	414H	00	04	C8	0A
	418H	03	08	00	46
	41CH	0C	00	83	C0
	420H	8D	00	00	02
	424H	D1	00	00	04

Obtain the offset address for Node Uniq ID Leaf

$$420H + 000002H * 4 = 428H \leftarrow$$

Obtain the offset address for Unit Directory

$$424H + 000004H * 4 = 434H \leftarrow$$

Node Uniq ID Leaf	428H	00	02	E7	33
	42CH	08	00	46	02
	430H	00	05	00	0B

Unit Directory	434H	00	03	7D	AF
	438H	12	00	A0	2D
	43CH	13	00	01	01
	440H	D4	00	00	01

Obtain the offset address for Unit Dependent Info

$$440H + 000001H * 4 = 444H \leftarrow$$

Unit Dependent Info	444H	00	03	4F	EA
	448H	40	3C	00	00
	44CH	81	00	00	02
	450H	82	00	00	05

Obtain the offset address for Camera Control register

$$FFFFF0000000H + 3C0000H * 4 = FFFFF0F00000H \leftarrow$$

The base address of the control register of this camera is FFFF F0F00000H.

COMMAND SENDING PROCEDURE UNTIL IMAGES ARE DISPLAYED

(2) Acquiring the format/mode/frame rate

a) Check available formats

Refer to the Inquiry register for video format and check the available formats.

Address	Action	Data
F0F00100H	Read	80000000H

As bit 0 is set, it means that Format0 is available.

b) Check available video modes

Refer to Inquiry register for video mode, and check which video mode in Format0 is available.

Address	Action	Data
F0F00180H	Read	F0000000H

As bits 0, 1, 2, and 3 are set, it means that Mode0, Mode1, Mode2, and Mode3 are available.

c) Check available frame rates (Example: Mode3)

Address	Action	Data
F0F0020CH	Read	78000000H

As bits 1, 2, 3, and 4 are set, it means that 3.75 fps, 7.5 fps, 15 fps, and 30 fps are available.

(3) Video transmission start command

When the following values are set for Status and Control registers for the camera, the camera starts video transmission.

(Example: Video Format = 0, Video Mode = 3, Frame Rate = 30 fps, ISO Speed = 400M bps)

Address	Action	Data	
F0F00600H	Write	80000000H	Frame Rate = 30 fps
F0F00604H	Write	60000000H	Video Mode = 3
F0F00608H	Write	00000000H	Video Format = 0
F0F0060CH	Write	02000000H	ISO ch = 0, Speed = 400M bps
F0F00614H	Write	80000000H	ISO Enable ON

To stop the video, set the ISO Enable bit to 0.

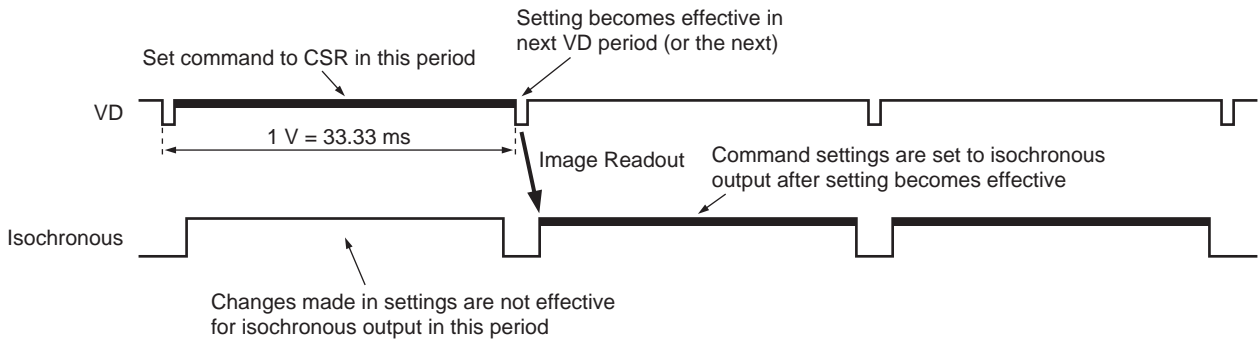
Address	Action	Data	
F0F00614H	Write	00000000H	ISO Enable OFF

COMMAND SETTING AND OPERATION TIMING

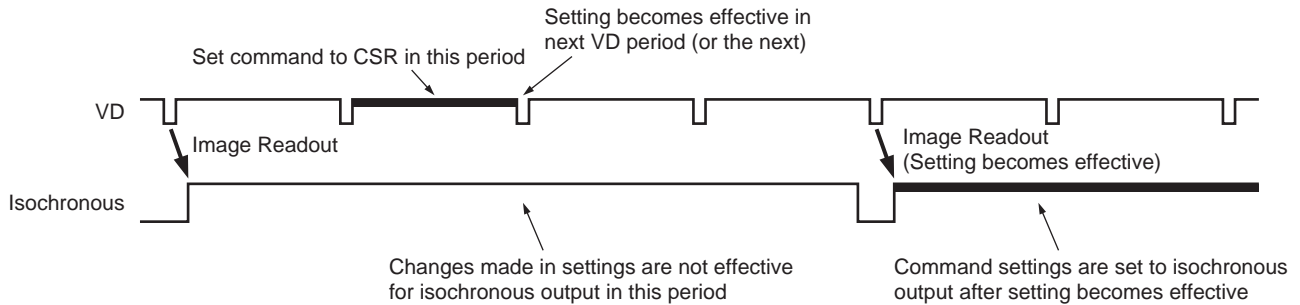
The DFW-V500/VL500 operates synchronously with 33.33 ms cycle internal pulses called VD. VDs are reference signals inside the camera and cannot be observed from outside the camera.

Even if commands are set to the CSR of the camera, it does not mean that they become effective the instant they have been written. They become effective after the VD period set to the CSR has been completed and the next VD pulse is generated as shown in the following figure. The command settings are set for video signals by the Isochronous output after that. (The timing at which the command settings become effective may be delayed according to the internal state of the camera.)

When operating at a low frame rate such as 7.5 frame/s even if the transmission time of one frame exceeds one VD, and the CSR settings are changed during transmission, the command settings will not be set to the video signals until the frame currently being output is complete.



When Frame Rate is 30 Frame/s



When Frame Rate is 7.5 Frame/s

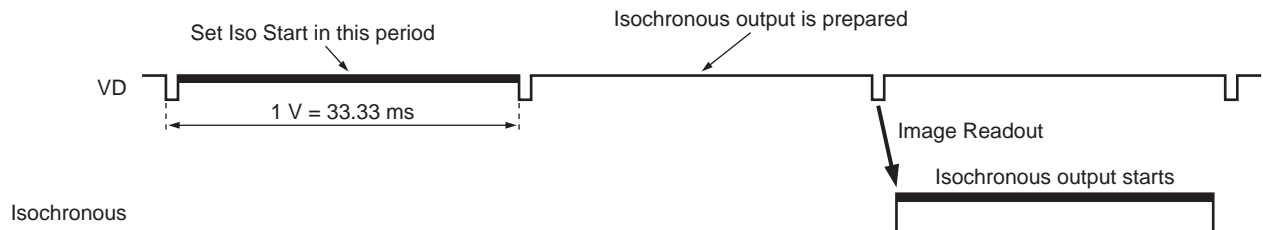
(When other than 30 frame/s is selected, changes in settings are made effective for the output after the isochronous output before or while setting the command has been completed)

COMMAND SETTING AND OPERATION TIMING

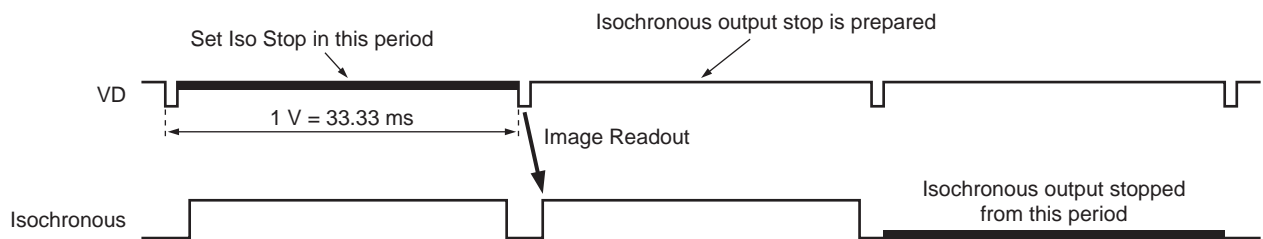
◇ Isochronous Transmission Start/Stop command and actual operation timing

As shown in the following figure, it takes at least about 1 V for the actual isochronous transmission of image data to start or stop after the Isochronous Start/Stop command (CSR F0F00614h: ISO_EN) has been set to the CSR of the camera. (VDs are the reference signals inside the camera and cannot be observed from outside the camera.)

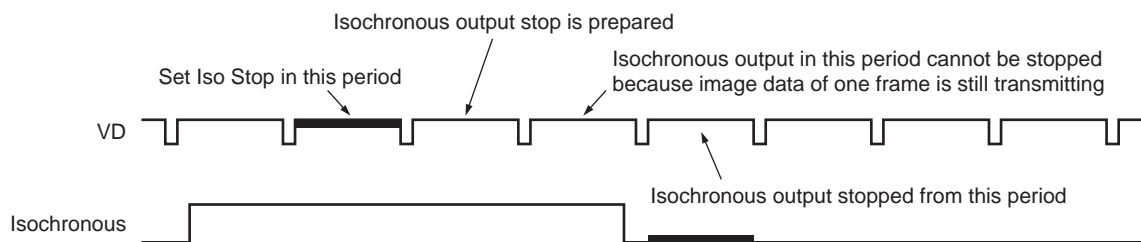
Isochronous transmission start/stop is executed in units of frames. Isochronous transmission will not start/stop before one image output ends. This means that if a low frame rate at which the transmission of one image takes a long time is selected, the time taken for executing Isochronous Stop will be long.



When Isochronous Start



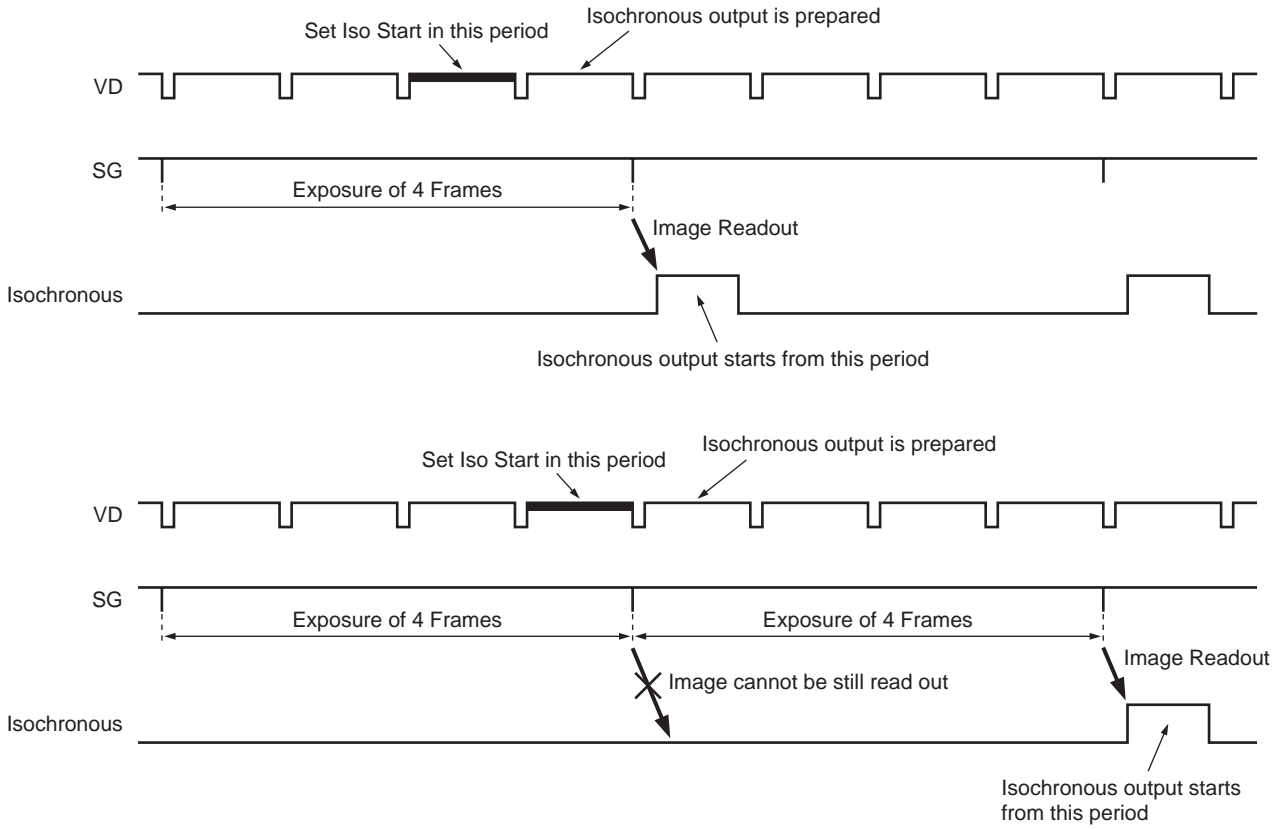
When Isochronous Stop (30 Frame/s)



When Isochronous Stop (7.5 Frame/s)

COMMAND SETTING AND OPERATION TIMING

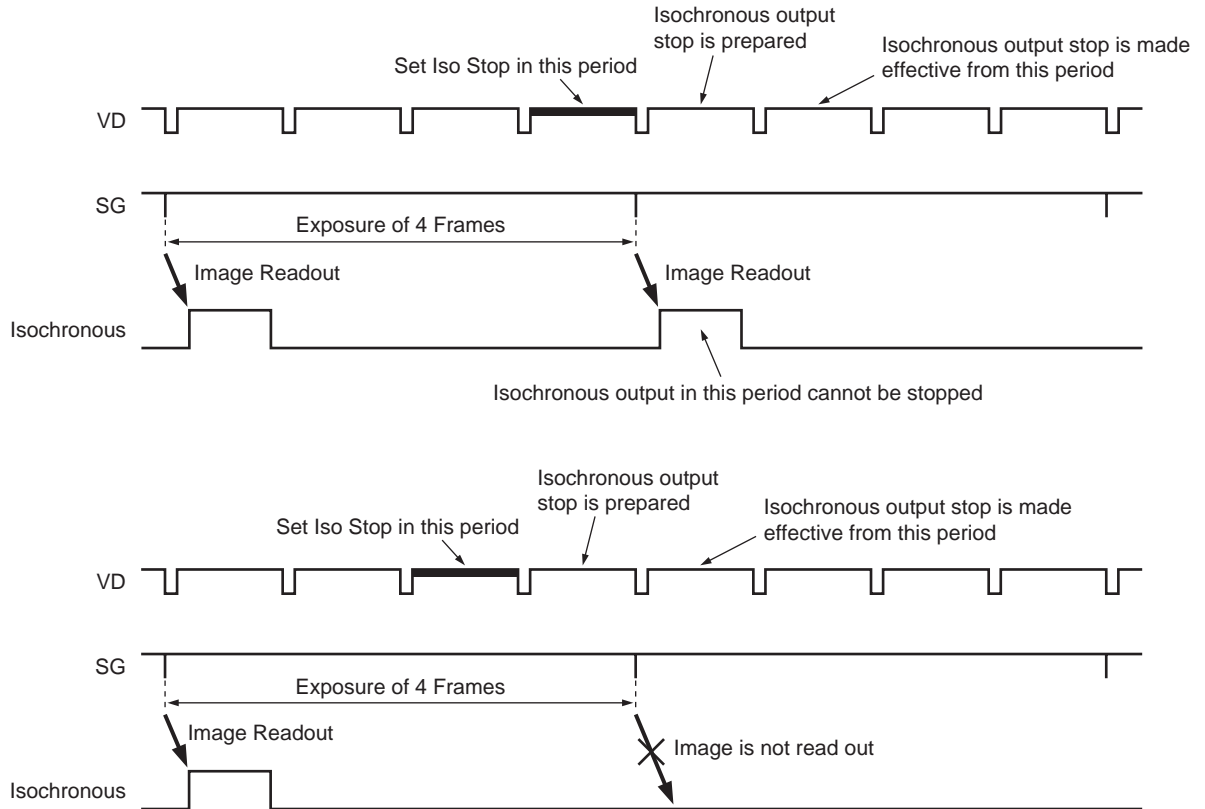
If Shutter (CSR F0F0081Ch) is set to the extended exposing mode, command execution may be delayed for the exposure time at maximum in addition to the previous delay for Isochronous Start.



When Isochronous Start (Exposure Time: 4 Frames)

COMMAND SETTING AND OPERATION TIMING

If Shutter (CSR F0F0081Ch) is set to the extended exposing mode, command execution may also be delayed same as the previous command for Isochronous Stop.



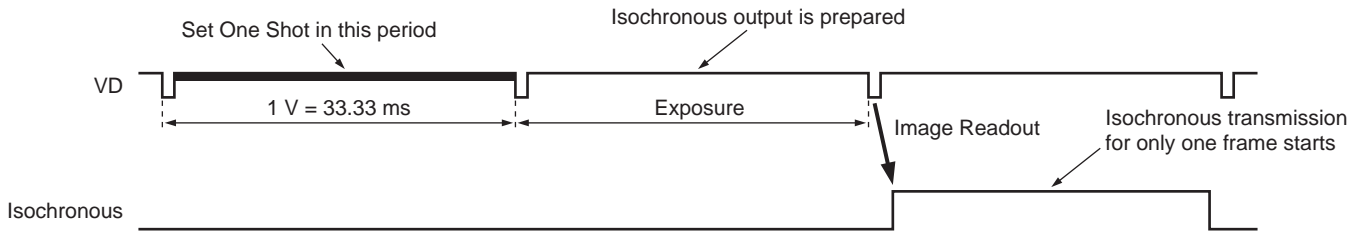
When Isochronous Stop (Exposure Time: 4 Frames)

COMMAND SETTING AND OPERATION TIMING

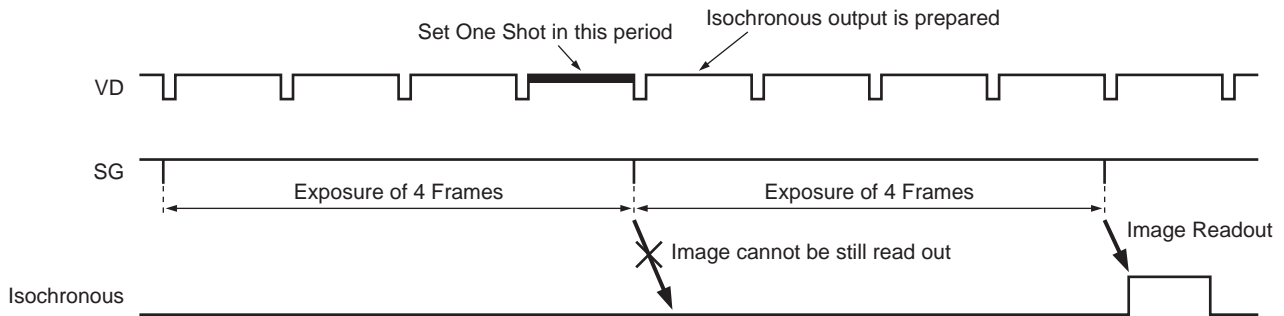
◇ One Shot CMD and actual operation timing

As shown in the following figure, it takes at least about 1 V for the actual isochronous transmission to start after the One Shot command (CSR F0F0061Ch) has been set to the CSR of the camera.

(VDs are the reference signals inside the camera and cannot be observed from outside the camera.)

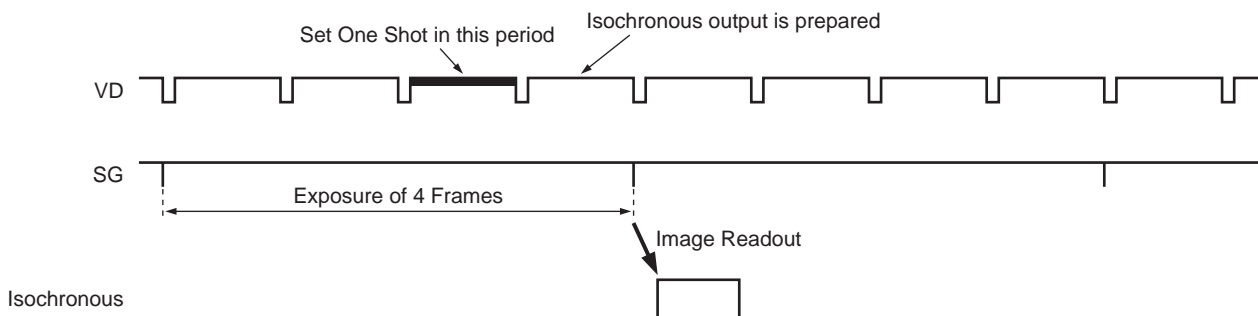


If Shutter (CSR F0F0081Ch) is set to the extended exposing mode, isochronous transmission start may be delayed for the exposure time at maximum in addition to the previous delay.



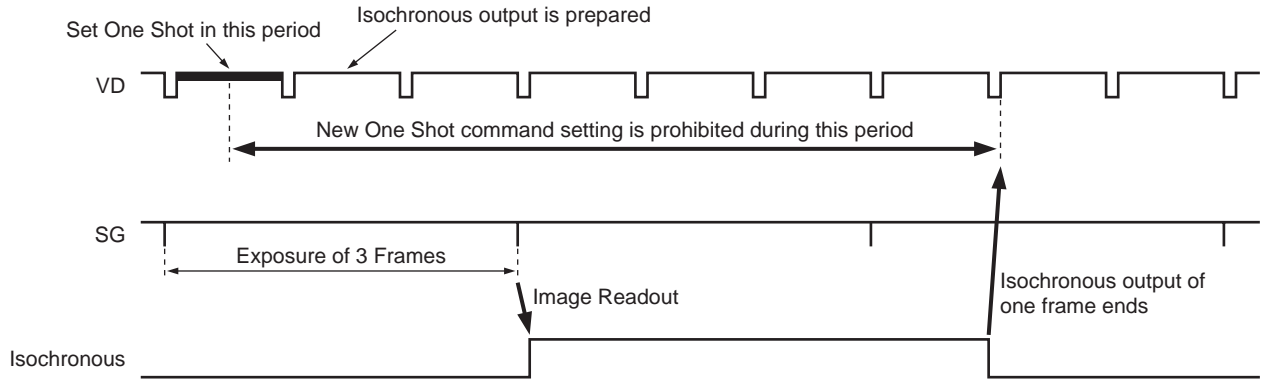
When One Shot (Exposure Time: 4 Frames)

If Shutter (CSR F0F0081Ch) is set to the extended exposing mode, image data for which exposure has been started before One Shot command is set may be output.



COMMAND SETTING AND OPERATION TIMING

Do not set a new One Shot command until isochronous transmission of one frame image data ends after the One Shot command has been set.



When Frame Rate is 7.5 Frame/s and Exposure Time is 3 Frames

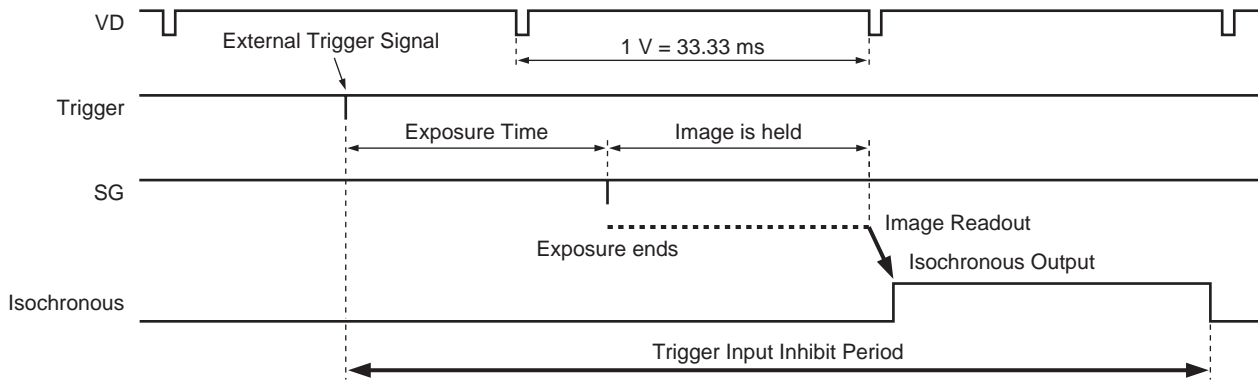
COMMAND SETTING AND OPERATION TIMING

◇ Timing between external trigger signal and video signal output

When the Trigger Mode (CSR F0F00830h) is set to ON, the camera will start exposure as shown in the following figure when it detects the external trigger signal.

After the exposure time is set by the Shutter command (CSR F0F0081Ch), the image held will be output in the next VD period. (VDs are the reference signals inside the camera and cannot be observed from outside the camera.)

Do not input a new external trigger signal until the isochronous transmission of images ends after the external trigger signal has been input.

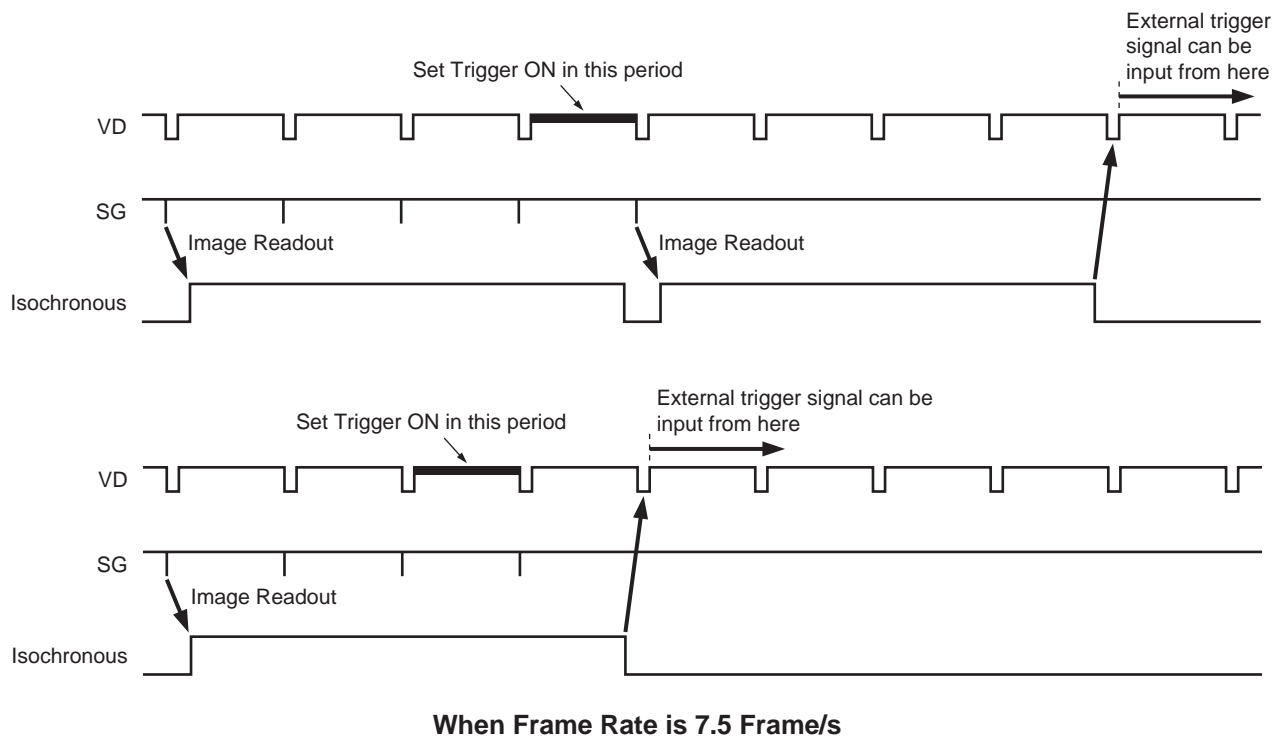
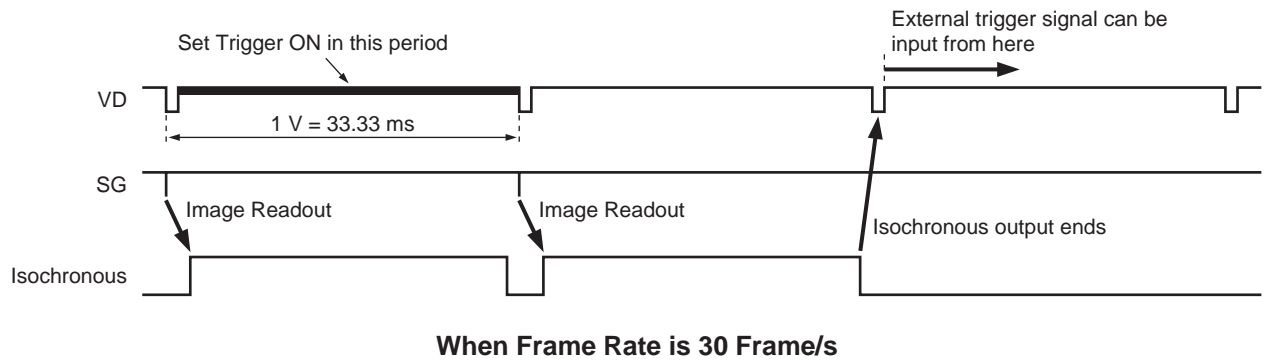


COMMAND SETTING AND OPERATION TIMING

◇ Trigger Mode command and actual operation timing

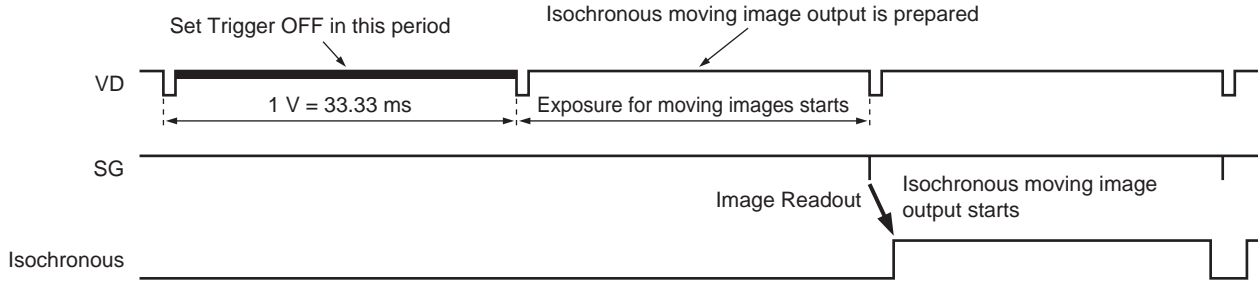
It takes at least about 1 V for external trigger signals to be received (Trigger Mode) after the Trigger ON command has been set to the CSR (F0F00830h) of the camera during the isochronous output of the moving image. (VDs are the reference signals inside the camera and cannot be observed from outside the camera.)

External trigger signal inputs during the isochronous transmission will not be accepted. Input external trigger signals after the isochronous transmission completes.

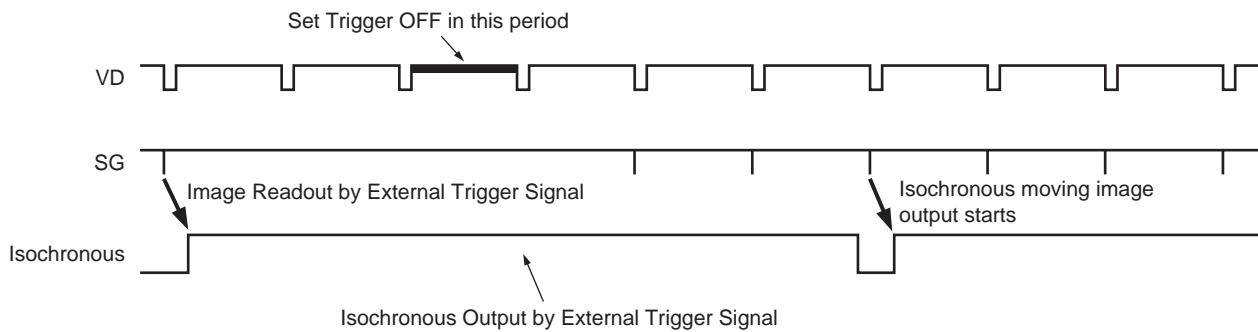


COMMAND SETTING AND OPERATION TIMING

As shown in the following figure, it takes at least about 1 V for the normal transmission of moving images to start after the Trigger OFF command has been set to the CSR (F0F00830h) of the camera. (VDs are the reference signals inside the camera and cannot be observed from outside the camera.)

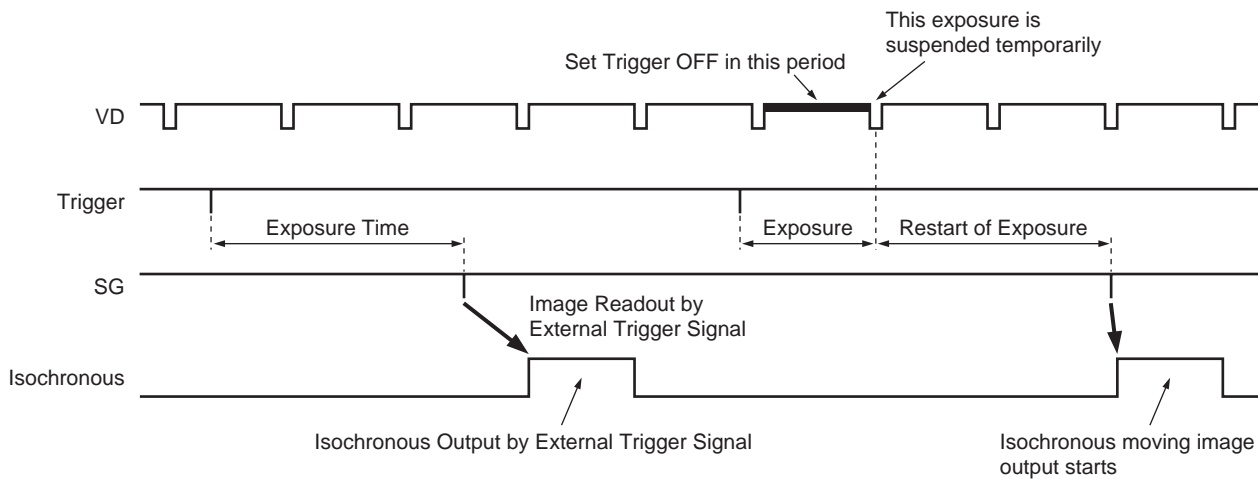


When low frame rate at which the transmission of one image takes a long time is selected, isochronous transmission may not have been completed when Trigger OFF is executed. In this case, output of normal moving images will start after transmission ends.



When Trigger OFF is Set during Image Output at Low Frame Rate

When Trigger OFF is set during extended exposing mode, exposure is discontinued and re-exposure is started in the normal moving image mode.



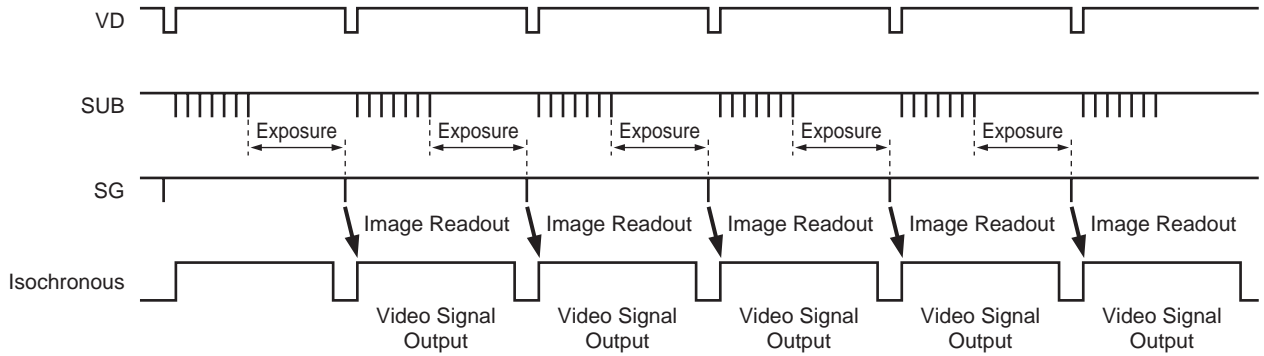
When Trigger OFF is Set during Extended Exposing Mode

SHUTTER

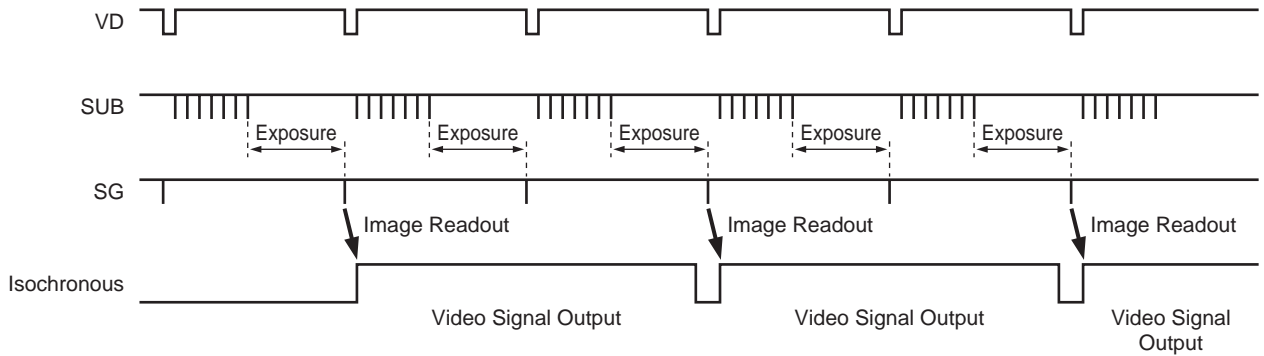
◇ When exposure time is 1 frame or shorter

VDs are generated continuously inside the camera, and the video signals synchronize with them and are output by isochronous transmission. (VDs are the reference signals inside the camera and cannot be observed from outside the camera.)

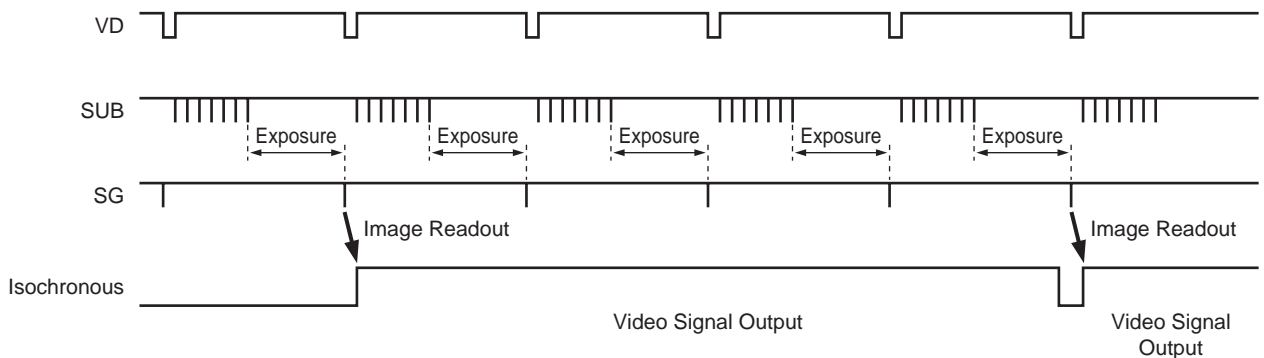
If a frame rate lower than 30 frame/s is selected at CSR F0F00600h Current Frame Rate, the image data output at the actual 30 frame/s will be interpolated in unit frame and transmitted at the designated frame rate.



When Frame Rate is 30 Frame/s



When Frame Rate is 15 Frame/s

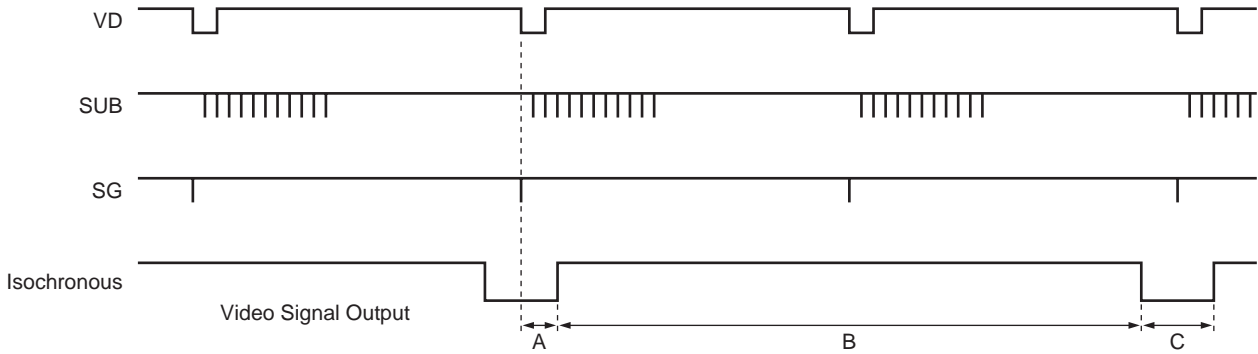


When Frame Rate is 7.5 Frame/s

SHUTTER

The timing at which the video signal is output by isochronous transmission is as follows.

Because the packet serving as the reference of the timing above 1394 bus and camera VD are asynchronous and the camera cannot dominate the bus 100% when other equipments are connected to the 1394 bus, the following output timing will vary.

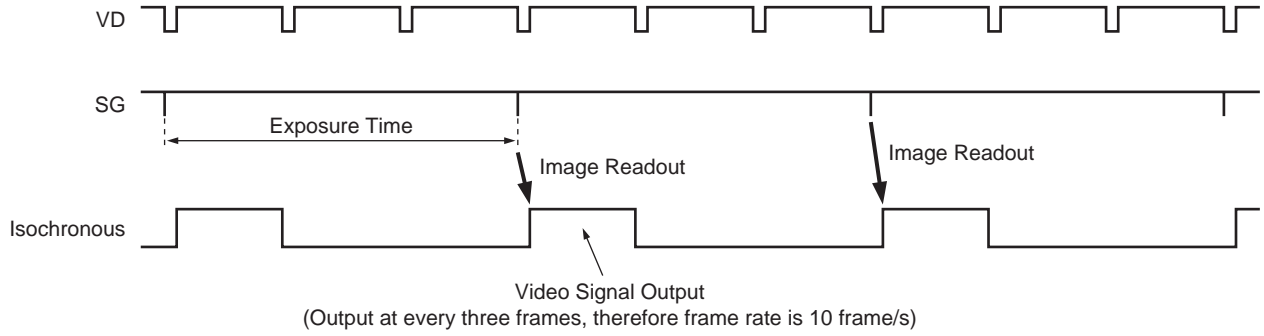


Video Mode	Frame Rate	A [ms]	B [ms]	C [ms]
0	3.75	—	—	—
	7.5	3.1	120	13.3
	15	3.1	60	6.7
	30	3.1	30	3.3
1	3.75	2.3	240	26.6
	7.5	2.3	120	13.3
	15	2.3	60	6.7
	30	2.3	30	3.3
2	3.75	1.9	240	26.6
	7.5	1.9	120	13.3
	15	1.9	60	6.7
	30	1.9	30	3.3
3	3.75	1.9	240	26.6
	7.5	1.9	120	13.3
	15	1.9	60	6.7
	30	1.9	30	3.3

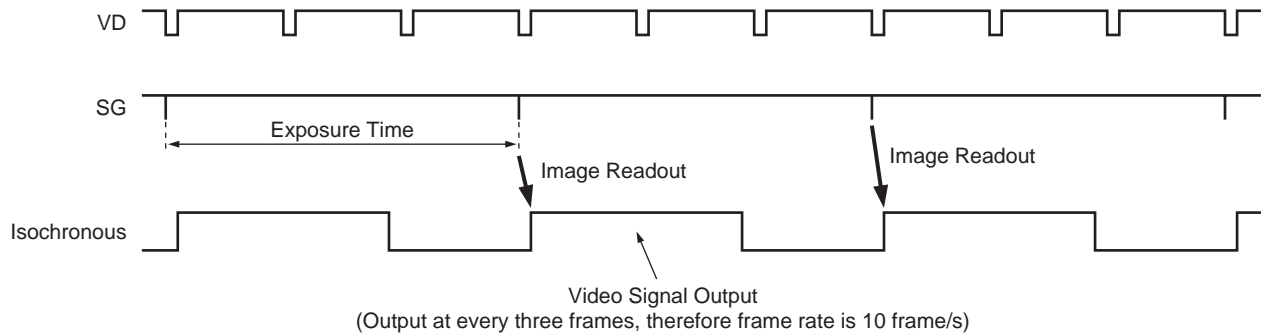
SHUTTER

◇ When exposure time is over 1 frame

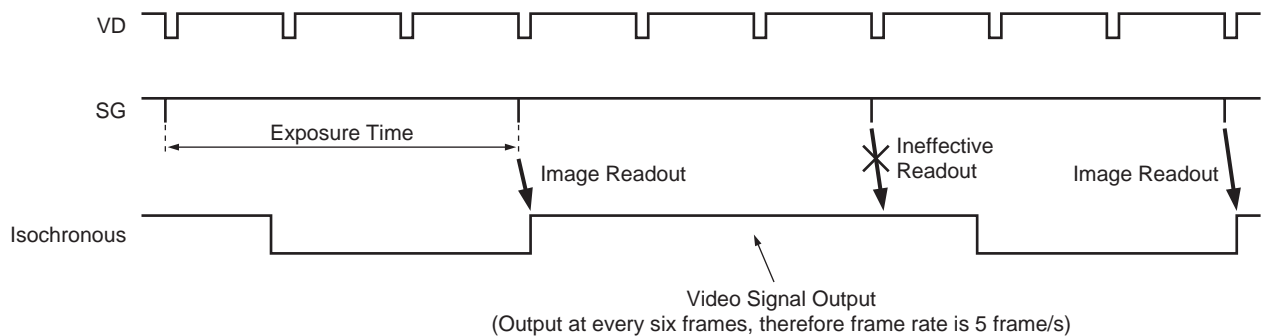
Even if the exposure time over 1 frame (1/30 sec) is set, the time (A period) to the output of the video signal from VD at the time exposure completes and the time required (B period) for isochronous transmitting video signal of one frame will be the same as the previous section. However, as no images are output during the exposure time, the actual frame rate may be lower than the value specified at the CSR F0F00600h Current Frame Rate.



When Exposure Time is 3 Frames and Frame Rate is 30 Frame/s



When Exposure Time is 3 Frames and Frame Rate is 15 Frame/s



When Exposure Time is 3 Frames and Frame Rate is 7.5 Frame/s

HOST ADAPTER CARD DFWA-400

The DFWA-400 host adapter card is an IEEE1394 serial bus interface card. You can install this card in the PCI bus slot in IBM PC/AT compatible computer.

Features

PCI interface

- Complies with PCI Short Card (5 V, 32-bit) standard
- Complies with PCI Local Bus Rev 2.1 standard
- Supports the PCI Bus Master function
- Supports the PCI Bus DMA transfer function

IEEE1394 interface

- High-speed data transfer rate: 100M/200M/400M bits/second
- Supports both asynchronous transfer and isochronous transfer
- Supports the isochronous cycle master function
- Provides three 6-pin connectors to connect the camera module

Recommended Specifications for Personal Computer (PC)

Processor	: Pentium 500 MHz or more
Free main memory	: 40 MB or more
Video memory	: 8 MB or more
Display mode	: Can display 1,280 × 1,024 (true color)
Expansion slot	: With 1 × PCI bus
OS	: Windows* 98 or Windows* NT4.0

NOTE : For details on the peripherals and the computer to which you are connecting the DFWA-400 card, see the respective manuals.

* “Windows” is a trademark of Microsoft Corporation, registered in the U.S.A. and other countries.

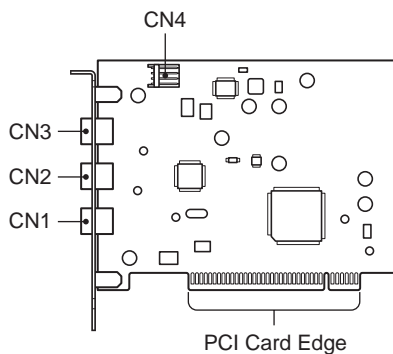
Note) Zenkuman (indicated on the card) is a registered trademark of Technoscope, Co., Ltd.

HOST ADAPTER CARD DFWA-400

Specifications

I/F standard	: IEEE1394-1995 standard
Chip set	: PCI Lynx
Number of ports	: 3
Supply voltage	: +5 V, +12 V
Operating temperature	: 10 to 35°C (no condensation)
Dimensions	: 107 × 138 mm
Connectors	
IEEE1394	: IEEE1394 6-pin connector
External power supply	: 176153-4 (AMP) or equivalent
Accessories	: Setup disk (1), Operating Instructions (1)

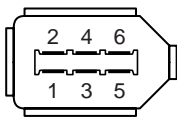
Board configuration



CN1, 2, 3	: IEEE1394 6-pin connector
CN4	: External power supply connector
PCI card edge	: 124-pin PCI local bus connector

Pin assignment

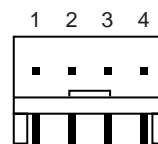
IEEE1394 6-pin connector



Pin No.	Signal
1	VP
2	VG
3	TPB*
4	TPB
5	TPA*
6	TPA

Common to CN1, CN2, and CN3.

External power supply connector



Pin No.	Signal
1	+12 V
2	GND
3	GND
4	+5 V (Not used)

External power supply connector

The IEEE1394 bus power supplied from PCI bus is about 0.5 A. If you need more power, use a separate power branch cable and connect the FDD power socket to this connector. You can get up to 1.5 A power through this connector.

(Example: Mounted connector 176153-4 (AMP))

HOST ADAPTER CARD DFWA-400

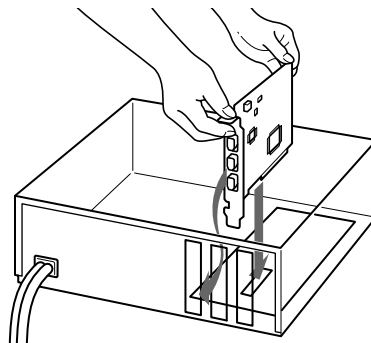
Installing the Host Adapter Card

NOTE : Before installing the host adapter card in the computer, be sure to install the setup disk software provided. Otherwise the computer may freeze when started.

- (1) After starting the computer, insert the floppy disk provided into the floppy disk drive.
- (2) Open “My Computer” and select the floppy disk drive.
- (3) Open Readme.txt.
- (4) While reading Readme.txt, install the software.
- (5) After installing, eject the floppy disk, shut down Windows, and turn off the power of the computer.
- (6) Unplug the computer power cable from the wall outlet.

NOTE : Make sure you unplug the computer power cable from the wall outlet. Installing the host adapter card without unplugging the power cable may damage both the computer and the card.

- (7) Open the computer case and remove the PCI bus slot cover.
- (8) Securely insert the host adapter card into the PCI bus slot and affix in place it with the screw.



NOTE :

- When you install the card, hold the top part of the card. Make sure that the PCI card edge is parallel to the slot. Insert the card into the slot as straight in as possible.
- You may need to apply some force when installing the card into the slot. Insert the card until the card snaps into the slot.
- If you are having difficulty inserting the card properly, remove it from the slot and try again.
- Some computers do not require a screw to affix the card in place.

- (9) Install the computer case.

HOST ADAPTER CARD DFWA-400

Setup of the Driver◇ **Precautions****(1) Precautions on installing the DFWA-400 in the PC using Windows 98**

The DFWA-400 does not run with the standard Windows 98 IEEE1394 driver.

If the DFWA-400 is run with the standard driver, the PC may crash. To prevent this, before installing the DFWA-400 in the PC, make sure to install the DFWA-400 driver.

To ensure this, be sure to perform the following procedure in Setting Up the Driver (for Windows 98).

Operations may not be performed normally if the board is installed without following the procedure below.

(2) Precautions on software provided

- The driver and demonstration software included in the floppy disk (hereafter referred to as FD) provided are compatible only for Windows 98 and Windows NT4.0. In any other operating system, these will not operate. Use of the driver and demonstration software may cause malfunction or damage to user's hardware and software. Sony Corporation is not liable for any of such damages.
- The demonstration software can be used for both Windows 98 and Windows NT4.0.
- The demonstration software can operate only with the Sony IEEE1394 digital camera DFW and XCD series*. It will not operate with other Sony products such as the Digital Handycam.
- During use with the DFW-V300, the demonstration software may not operate normally in some video modes.
- If the demonstration software does not operate normally during use, shut down the demonstration software, disconnect and reconnect the camera cable, and start the demonstration software again.
- Display color modes which can be displayed for the demonstration software are 24 bits and 32 bits. Other color modes are not supported.
- If the PC performance (CPU clock, memory installed, etc.) is insufficient, the demonstration software may not operate normally.

* The Sony IEEE1394 digital camera DFW and XCD series include the DFW-V300, DFW-V500, DFW-VL500, DFW-SX900, DFW-X700, XCD-SX900, and XCD-X700. (The CCM-DS250 does not operate with this software.)

HOST ADAPTER CARD DFWA-400

◇ Setting up the driver

<For Windows 98>

- (1) Turn on the PC power without installing the DFWA-400 in the PC, and start Windows.
- (2) Start \Setup98\Setup recorded in the FD.
- (3) After ejecting the FD, quit Windows, and turn off the PC power.
- (4) Unplug from wall outlet.
- (5) Install the DFWA-400 in an expansion PCI bus slot.
- (6) Turn on the PC power, and start Windows.
- (7) The DFWA-400 will be identified by the Windows Plug and Play function. For the driver used, select \Setup98\Driver\SonyPFW.inf in the FD.
- (8) After installing the driver, eject the FD and restart the PC according to the message on screen.

<For Windows NT4.0>

- (1) Turn on the PC power, and start Windows.
- (2) Execute \SetupNT\Setup.exe in the FD. (The installer starts automatically.)
- (3) After installing the software, select “No, I will restart my computer later”.
- (4) After ejecting the FD, quit Windows, and turn off the PC power.
- (5) Unplug from wall outlet.
- (6) Install the DFWA-400 in an expansion PCI bus slot.
- (7) Turn on the PC power, and start Windows.

This completes the setup of the driver.

◇ Setting up the demonstration software

Copy \Demo\Dfwnt.exe in the FD to the desired directory for both Windows 98 and Windows NT4.0.

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