3-CCD Color Camera

MODEL HV-F22F
HV-F31F

Register Map(IIDC Ver.1.30)

30-Aug-2004

Control and Status register (CSR)

HV-F31F and HV-F22F differ from earlier conventional cameras in that camera functions can be set by entering predetermined setting commands in the Control and Status register (CSR) of the 1394-based Digital Camera Specification Ver. 1.30.
Common and camera-specific CSR register setting operations are described below.

Indication example: Function name (CSR: xxxx xxxx h)
Function description

Lower 32 bits of 64 bit CSR address are displayed.
ex: F0F0 0800 h
means BUS_ID, NODE_ID, FFFF F0F0 0800 h.

Supported Video Mode

1. IEEE1394 interface (IEEE1394 connector)

1) Standard rating
1394-based Digital Camera Specification Ver.1.30 IIDC protocol

2) Transmit format

● **HV-F31F**

Camera Mode		Frame Rate	bit/pixel	bit/ch	Format	Mode(ID)
XGA (1024 x 768)	YUV	15	16	8	1	3
XGA (1024 x 768)	RGB	7.5	24	8	1	4
SVGA (800 x 600) NOTE 1	YUV	30	16	8	1	0
SVGA (800 x 600) NOTE 1	RGB	15	24	8	1	1
XGA (1024 x 768)	RGB	3.3	48	10	7	6

● **HV-F22F**

Camera Mode		Frame Rate	bit/pixel	bit/ch	Format	Mode(ID)
SXGA (1280 x 960)	YUV	7.5	16	8	2	0
SXGA (1280 x 960)	RGB	7.5	24	8	2	1
VGA (640 x 480) NOTE 2	YUV	30	16	8	0	3
VGA (640 x 480) NOTE 2	RGB	30	24	8	0	4
SXGA (1360 x 1024)	YUV	7.5	16	8	7	2
SXGA (1360 x 1024)	RGB	7.5	24	8	7	4
SXGA (1360 x 1024)	RGB	1.875	48	10	7	6

1. IIDC Standard CSR

(1) BRIGHTNESS (CSR: F0F0 0800 h)

Master black level is adjusted

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh (standard 80h)

Can be set in range of 00h to FFh. Setting value to 00h side lowers black level. FFh side raises black level.

(2) SHARPNESS (CSR: F0F0 0808 h)

Sharpness level adjustment (object contour correction)

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh (standard 80h)

Contour correction can be set in range of 00h to FFh. Setting value toward 00h side reduces correction for softer contours. Setting toward FFh side increases correction for sharper contours.

(3) WHITE BALANCE (CSR: F0F0 080C h)

White balance adjustment

-Manual adjustment-

Setting value 820xx0yy h xx: 00h to FFh (B gain)
yy: 00h to FFh (R gain)

White balance is adjusted manually by adjusting R and B gain. Gain is reduced at 00h side and raised at FFh side.

-One Push Auto White Balance (AWB)-

Setting value 86000000 h

State for automatic white balance adjustment.

-AUTO (ATW)-

Setting value 83000000 h

White balance is adjusted in real time (automatic tracking). An effective function when the scene is subject to changes in color temperature of the light source. The speed for changing the color temperature is selected by **A. WHT SPEED**.

(4) GAIN (CSR: F0F0 0820 h)

Electrical sensitivity is adjusted.

-Manual adjustment-

Setting value 82000xxx h xxx: 000h to 0C0h (1dB ≒ 010h)

Adjusts electrical sensitivity in the range of 0 to 12 dB.

-AUTO-

Setting value 83000000 h

Gain is automatically adjusted in the range of 0 to 12 dB in response to light source brightness.

(5) SHUTTER (CSR: F0F0-081C h)

Sets electronic shutter speed.

-OFF (HV-F22:1/15sec, HV-F31:1/30) -

Setting value 80000000 h

Switches off shutter operation.

-Manual adjustment-

Setting value 82000xxx h xxx: (HV-F22) 7C5h to B6Ch / (HV-F31) 789h to B27h

Electronic shutter can be set in the range of 4 to 1/100,000 second.

Shutter speed setting value can be derived as follows.

OFF_SPEED = 15 (HV-F22), 30 (HV-F31).

Cause of shutter speed ≦ (1 / OFF_SPEED)

a) Setting value obtained from fluorescent time.

nnnh = 800h + $log_{0.99}$(OFF_SPEED×"Shutter Speed")

b) Fluorescent time obtained from setting value.

Shutter Speed[sec] = **OFF_SPEED** × $0.99^{(nnn—800h)}$

Ex. 1 Fluorescent time with HV-F31 = setting value nnn to obtain 1/100 second.

800h+ $log_{0.99}$(30×(1/100)) = 800h+ log(30×(1/100)) / log0.99

= 878h

Ex. 2 Setting value nnn that produces 1/100 second fluorescent time with HV-F31F.

(1/30) × $0.99^{(878h-800h)}$ = 1/100(sec)

- **Cause of shutter speed > (1 / OFF_SPEED)**

a) Setting value obtained from fluorescent time.

nnnh = 801h - (**OFF_SPEED**×*"Shutter Speed")*

b) Fluorescent time obtained from setting value.

Shutter Speed[sec] = (801h – nnn) / **OFF_SPEED**

Example Fluorescent time = 1/7.5s usable as setting value nnn with HV-F31F.

801h - (30×(1/7.5)) = 7FDh

-AUTO-

Setting value 83000000 h

Auto electronic shutter operates to vary the shutter speed in the range of OFF to 1/100,000 second in response to light source brightness.

If light is excessive, a suitable level is selected for maintaining a video output. This function is effective when using microscope or other optical system without an automatic lens iris.

(6) AUTO EXPOSURE (CSR: F0F0 0804 h)

At auto gain or shutter setting, the sensitivity is automatically adjusted to maintain the proper video level.

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh (standard:80 h)

Video level decreases toward 00h and increases toward FFh.

(7) SATURATION (CSR: F0F0 0814 h)

Color saturation is adjusted.

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh (standard: 80 h)

Saturation is reduced toward 00h and raised toward FFh.

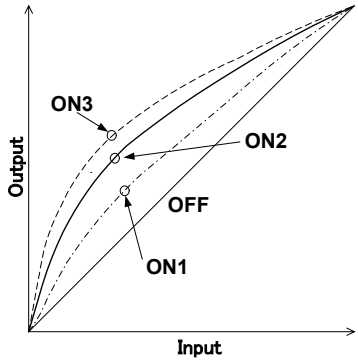
(8) GAMMA (CSR: F0F0-0818 h)

Gamma correction is adjusted.

-OFF-

Setting value 80000000h

Gamma correction is set to OFF.



-Manual adjustment-

Setting value 8200000x h x: 0- ON1, 1- ON2, 2- ON3, F- Variable

Positions 1,2 and 3 are effective for additionally fine adjustment of RGB gamma.

ON1: Dark component gradation reduced.

ON2: Standard setting

ON3: Dark component gradation increased.

When setting to Variable, **R GAMMA (CSR: F200 0054 h), G GAMMA (CSR: F200 0058 h), B GAMMA (CSR: F200 005C h)** of Setting value become to effect and adjust the detail gamma.

(9) TRIGGER (CSR: F0F0 0830 h)

Sets external trigger operating mode.

-OFF-

Setting value 80000000 h

Trigger function set to OFF

-Manual adjustment-

Setting value 8x0y0000 h x:2- LOW ACTIVE, 3- HIGH ACTIVE

y:0- MDOE0, 1- MODE1

Trigger mode polarity is switched at external signal values x and y.

See trigger operation details and timing chart (page 39).

(10) INITIALIZE (CSR: F0F0 0000 h)

Return equipment to status at time of release from factory.

-Initialization-

Setting value 80000000 h

(11) MEMORY SAVE (EXECUTE) (CSR: F0F0 0618 h)

Make back up of presently effective memory channels.

-BACK UP execute-

Setting value 80000000 h

(12) MEMORY SAVE (Ch SET) (CSR: F0F0 0620 h)

Select channel carried out memory backup.

-channel set-

Setting value x0000000 h x: 1- ch1, 2- ch2, 3- ch3, 4- ch4

(13) CURRENT MEMORY (CSR: F0F0 0624 h)

Loading memory channel designating data

-LOAD BACK UP-

Setting value x0000000 h x: 0- FACTORY SETUP, 1- ch1, 2- ch2, 3- ch3, 4- ch4

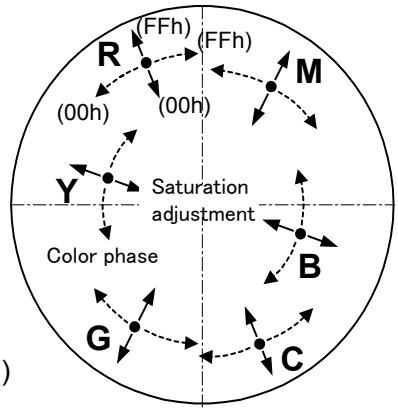
2. Advanced Features CSR

2-1. Image color reproduction and color balance related CSR

(1) (MASKING (CSR: F200 0020 h)

RGB and Ye Cy Mg color saturation and hue can be separately varied (6 vector independent masking). Color reproduction detail and fidelity are effectively enhanced.

When engaged, **R saturation (CSR: F200 0024) - M hue ((CSR: F200 0050)** can be set, with color phase and saturation adjusted for each color phase.



-OFF-

Setting value 80000000 h

-ON-

Setting value 82000000 h

a) (MASKING) R SATURATION (CSR: F200 0024 h)

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh (standard: 80 h)

b) (MASKING) Y SATURATION (CSR: F200 0028 h)

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh (standard: 80 h)

c) (MASKING) G SATURATON (CSR: F200 002C h)

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh (standard: 80 h)

d) (MASKING) C SATURATION (CSR: F200 0030 h)

-Manual adjustment-

Setting value 820000xx h xx: 00hto FFh (standard: 80 h)

e) (MASKING) B SATURATION (CSR: F200 0034 h)

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh (standard: 80 h)

f) (MASKING) M SATURATION (CSR: F200 0038 h

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh (standard: 80 h)

g) (MASKING) R HUE (CSR: F200 003C h)

-Manual adjustment-

Setting value 820000xx h xx: 00hto FFh (standard: 80 h)

h) (MASKING) Y HUE (CSR: F200 0040 h)

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh (standard: 80 h)

i) (MASKING) G HUE (CSR: F200 0044 h)

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh (standard: 80 h)

j) (MASKING) C HUE (CSR: F200 0048 h)

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh (standard: 80 h)

k) (MASKING) B HUE (CSR: F200 004C h)

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh (standard: 80 h)

l) (MASKING) M HUE (CSR: F200 0050 h)

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh (standard: 80 h)

(2) GAMMA

When set to Variable, total and RB gamma correction can be individually adjusted.

a) (GAMMA) Total (CSR: F200 0058 h)

-Manual adjustment -

Setting value 820000xx h xx: 00h to FFh

b) (GAMMA) R ch (CSR: F200 0054 h)

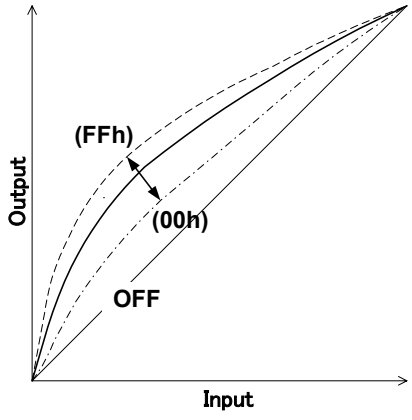
- Manual adjustment -

Setting value 820000xx h xx: 00h to FFh

c) (GAMMA) B ch (CSR: F200 005C h)

- Manual adjustment -

Setting value 820000xx h xx: 00h to FFh



(3) SHADING (CSR:F200 0060 h)

Color irregularity (white shading) likely to occur vertically on the screen due to lens characteristics is automatically compensated.

Notes:

1. **When using the camera for the first time, or after replacing the lens, be sure to conduct auto shading adjustment.**
2. **When used under fluorescent, mercury or other special types of lighting, flicker can impair white balance or shading adjustment. In such cases, adjust the shutter speed to reduce the flicker to the extent possible, then adjust white balance or shading.**

-OFF-

Setting value 80000000 h

Set white shading compensation to OFF.

-Mode selection-

Setting value 8200000x h x: 0- COLOR mode, 1- LUMINUNCE mode, 2- FLAT mode

COLOR :Auto shading correction operates to minimize vertical color irregularity in the image. Use for non-uniformly lit general-purpose image material.

LUMINANCE :Auto shading compensation operates to maintain uniform vertical level for the RGB video signals. Use with microscopes and other uniformly illuminated equipment.

FLAT :Auto shading compensation operates to maintain uniform RGB video signal level for the full screen. Use with microscopes and other equipment when peripheral shading is of concern.

If shading is grossly large or light variation random, compensation error can occur. Adjust uniformity of the light source.

-One push (ASC)-

Setting value 8600000x h x: Same as above.

Conduct by the following procedure.

1. Use auto lens iris or adjust manually to a suitable iris value.
2. Pickup a white image that completely fills the screen. Observe the object is evenly lighted from top to bottom.
3. Conduct white balance adjustment.
4. Conduct auto adjustment to correct for screen shading.

The image flashes during automatic adjustment.

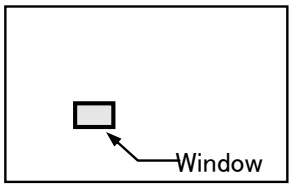
(4) WHITE GATE (CSR: F200-0098 h)

A portion of the screen is set aside as a sampling area for white balance adjustment. When a white or gray color is positioned at this window, optimum white balance can be adjusted in real time.

-OFF-

Setting value 80000000 h

The video signal of the overall screen is detected for white balance control. The window is not shown on the screen.



-ON-

Setting value 820xx0yy h xx: 00h to FFh (H position)

yy: 00h to FFh (V position)

The window is displayed on the screen during AUTO or ONE PUSH WHITE BALANCE operation for video signal detection.

The window horizontal position setting is xx, and vertical position setting is yy.

(5) BLACK BALANCE (CSR: F200 0064 h)

Black balance is adjusted.

-Manual adjustment-

Setting value 820xx0yy h xx: 00h to FFh (B black)

yy: 00h to FFh(R black)

-AUTO ADJUST (One Push) (ABB)-

Setting value 86000000 h

Conduct with oblique light, such as with closed lens iris.

2-2. Image quality related CSR

(1) SHARPNESS

Object contours can be finely adjusted.

a) (SHARPNESS) FREQ. (CSR: F200 00B0 h)

Sharpness signal width can be set.

-Manual adjustment-

Setting value 8200000x h x: 0- LOW, 1- MID, 2- HIGH

LOW: Width is thick.

MID: Width set to standard.

HIGH: Width set to fine.

b) (SHARPNESS) LEVEL DEPENDENT. (CSR: F200 00B4 h)

Sharpness is decreased at levels below a certain amount. Used mainly to avoid noise enhancement in dark signal components.

-Manual adjustment-

Setting value 820000xx h xx: 00h toFFh

Setting toward FFh reduces the sharpness level and expand the video signal level range.

c) (SHARPNESS) CLISP (CSR: F200 00B8 h)

Below a certain level, the sharpness signal is removed to avoid appearing as noise. But if the level is set too low, some blurring can occur in detailed components.

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh

Setting toward 00h reduces sharpness level; setting toward FFh increases sharpness level.

d) (SHARPNESS) H/V BALANCE (CSR: F200 00BC h)

Balance setting for horizontal and vertical sharpness level.

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh

Setting toward 00h reduces vertical sharpness level; setting toward FFh reduces horizontal sharpness level.

e) (SHARPNESS) COLOR DTL Ch1 (CSR: F200 00C0 h)

Color detail can be adjusted in the range of the color phase sharpness level setting.

The color phase can be set in different ranges for channels 1 and 2. The color detail channel 1 width/level can be set in any combination. Select channel 1 or 2, then set the color phase for adjusting detail.

-OFF-

Setting value 80000000 h

Color detail function is set to OFF.

-ON (Manual adjustment)-

Setting value 82000xyy h x: 0- R, Y- 1, 2- G, 3- C, 4- B, 5- M (phase)

yy: 00h to FFh (phase(fine))

Select 6 color phases from x values and then fine adjust with yy.

-One Push (AUTO SETUP)-

Setting value 86000000 h

The currently displayed color phases are automatically set by **AUTO SETUP**.

f) (SHARPNESS) COLOR DTL Ch1 WIDTH/LEVEL (CSR: F200 00C4 h)

The effective phase range and sharpness level can be adjusted.

-Manual adjustment-

Setting value 820xx0yy h xx: 00h to FFh (Width)

yy: 00h to FFh (Level)

Set color phase range with xx value. Reduce range toward 00h; increase range toward FFh. Select range with Phase and position at color phase center to set.

Set sharpness level in range set by yy. Reduce sharpness toward 00h for a soft image. Increase sharpness toward FFh for a stark image. Channels 1 and 2 can be set independently.

g) (SHARPNESS) COLOR DTL Ch2 (CSR: F200 00C8 h)

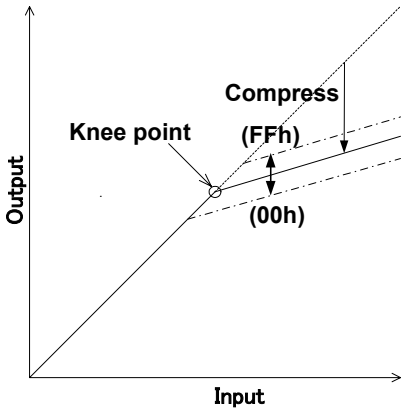
Same function as COLOR DTL Ch1 (F200-00C0). (Ch 1 and 2 can be used as independent functions.)

h) (SHARPNESS) COLOR DTL Ch2 WIDTH/LEVEL (CSR: F200 00CC h)

Same function as COLOR DTL Ch1 (F200-00C4). (Ch 1 and 2 can be used as independent functions.)

(2) KNEE (CSR: F200 00D4 h)

Image high luminosity component is compressed (knee corrected) reducing gradation in high luminosity images.



-OFF-

Setting value 80000000 h

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh

Image compression level (knee point) decreases toward 00h and increases toward FFh.

-AUTO-

Setting value 83000000h

The auto setting increases the light amount and the knee point is automatically adjusted to compensate.

(3) DNR (Digital Noise Reduction) (CSR: F200 00A0 h)

Improve S/N by digital noise reduction.

-OFF-

Setting value 80000000 h

-ON-

Setting value 8200000x h x: 1- MODE1, 2- MODE2

Although MODE 2 provides greater noise reduction, there is some sacrifice in resolution.

2-3. Image level related CSR

(1) (A.E) PEAK/AVERAGE (CSR: F200 0070 h)

Sets PEAK or AVERAGE signal level detection for the **AUTO EXPOSURE** function.

-Manual adjustment-

Setting value 8200000x h x: 0- 0/100, 1- 15/18, 2- 25/75, 3- 50/50

Set auto level control for Peak or Average in 4 steps of 50/50, 15/85, 25/75, or 0/100. At high Average setting, background may be difficult to see in picture bright components. Increasing the Peak setting may render spotlighted components easier to see.

(2) (A.E) SPEED (CSR: F200 0074 h)

AGC and AES response speed

-Manual adjustment

Setting value 8200000x h x: 0- SLOW, 1- MID, 2- FAST

SLOW : Scene brightness variation rate is sufficiently slow to allow stable observing of detail.

Allows a stable image when a strong light source enters the scene.

STANDARD : Standard setting.

FAST : Scene brightness variation rate is too rapid to stable use of effects such as microscope variable magnification.

(3) (A.E) GATE (CSR: F200 0078 h)

AUTO EXPOSURE signal detect area (8 x 8) can be set as desired.

-OFF-

Setting value 80000000 h

The screen overall video signal is detected for **AUTO EXPOSURE** control.

-ON-

Setting value 82000000 h

GATE for detecting the **AUTO EXPOSURE** video signal is set in lines 1-2 to 7-8. The area is not shown on the screen.

a) (A.E) GATE line1-2 (CSR: F200 007C h)

-Manual adjustment-

Setting value 820xx0yy h

xx: LINE 1 ON/OFF data

yy: LINE 2 ON/OFF bit map data

b) (A.E) GATE line3-4 (CSR: F200 0080 h)

-Manual adjustment-

Setting value 820xx0yy h

xx: LINE 3 ON/OFF data

yy: LINE 4 ON/OFF data

c) (A.E) GATE line5-6 (CSR: F200 0084 h)

-Manual adjustment-

Setting value 820xx0yy h

xx: LINE 5 ON/OFF data

yy: LINE 6 ON/OFF data

d) (A.E) GATE line7-8 (CSR: F200 0088 h)

-Manual adjustment-

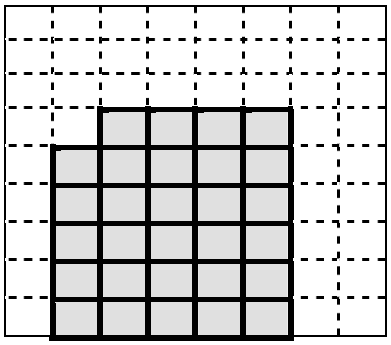
Setting value 820xx0yy h

xx: LINE 7 ON/OFF bit map data

yy: LINE 8 ON/OFF bit map data

(A.E) GATE line1-2 to line7-8 setting examples

Screen detect areas



Setting values corresponding to detect areas

Detect area (ON): 1 Non-detect area (OFF): 0

	7	6	5	4	3	2	1	0
GATE line1-2 xx values	0	0	0	0	0	0	0	0
GATE line1-2 yy values	0	0	0	0	0	0	0	0
GATE line3-4 xx values	0	0	0	0	0	0	0	0
GATE line3-4 yy values	0	0	1	1	1	1	0	0
GATE line5-6 xx values	0	1	1	1	1	1	0	0
GATE line5-6 yy values	0	1	1	1	1	1	0	0
GATE line7-8 xx values	0	1	1	1	1	1	0	0
GATE line7-8 yy values	0	1	1	1	1	1	0	0

Values for setting the above map detection area

(A.E) GATE line1-2: 82 00 00 00 h

(A.E) GATE line3-4: 82 00 00 3C h

(A.E) GATE line5-6: 82 07 C0 7C h

(A.E) GATE line7-8: 82 07 C0 7C h

2-4. CSR related to other functions

(1) FLASH (CSR: F200 0018 h)

Adjusts flash signal timing for mode 0 trigger operation.

-OFF-

Setting value 80000000h

Flash signal output absent.

-Manual adjustment-

Setting value 8200xyyy h x: 0-NARROW, 1- MIDDLE, 2- WIDE （pulse width）

yyy: 000h to FFFh （START)

See flash signal pulse width and timing chart on page 41.

(2) BAR (CSR: F200 00DC h)

Set to ON for Color Bars.

-OFF-

Setting value 80000000 h

-ON-

Setting value 82000000 h

(3) NEGA (CSR: F200 00E0 h)

On setting produces negative image.

-OFF-

Setting value 80000000 h

-ON-

Setting value 82000000 h

(4) GL IN 75 ohm (CSR: F200 00E4 h)

Impedance changes over of input to the GL signal.

-OFF(High Z)-

Setting value 80000000 h

-ON (75 ohm)-

Setting value 82000000 h

(5) H PHASE (CSR: F200 00E8 h)

Horizontal phase can be adjusted.

-Manual adjustment-

Setting value 820000xx h xx: 00h to FFh

See setting range on page 42 “External sync timing”.

(6) PIXEL CONCEALMENT (CSR: F200 00F0 h)

Sets pixel concealment on/off.

-OFF-

Setting value 80000000 h

-ON-

Setting value 82000000 h

(7) FOCUS

Setting register for focus data output.

a) FOCUS GATE (SIZE) (CSR: F200 00F4 h)

Setting for focus data output area size.

-ON-

Setting value 820xx0yyh xx: 00h to FFh (H size)
yy: 00h to FFh (V size)

b) FOCUS GATE (POSITION) (CSR: F200 00F8 h)

Setting for focus data output area position.

-ON-

Setting value 820xx0yy h xx: 00h to FFh (H position)
yy: 00h to FFh (V position)

c) FOCUS DETECTION (CSR：F200 00FC h) (read only)

Return focus data.

-DATA-

00000000 h(MIN) to FFFFFFFF h(MAX)

(8) INDICATOR (CSR: F200 0100 h)

Each type of indicator is displayed.

-OFF-

Setting value 80000000 h

-ON-

Setting value 8200000x h x：1- display WHITE GATE、2- display FOCUS GATE

(9) AUTO SETUP STATE (CSR: F200 01004 h) (read only)

Resulting data of One Push Auto White Balance (AWB), One push Auto BLACK Balance (ABB), One push Auto Shading (ASC) and One Push (Color DTL Auto Setup) are shown.

-DATA-

000xyyzzh x : 0- NON, 1- WHITE, 2- BLACK, 3- SHAD, 4- DTL

yy : Progress condition 00h- 0% , FF- 100%

zz : Result 00h - Normal end

FFh - under adjustment (busy)

11h to 26h - Error end

Result codes: Procedure

11h: Turn off the color bar

12h: (WHITE BALANCE) change to Manual

13h: Increase the intensity of illumination, turn lens iris to ward open direction, or increase the gain to provide a proper video level.

14h: Decrease the intensity of illumination, turn lens iris toward closed direction, or decrease the gain to provide a proper video level.

15h: The color temperature is too high, making it impossible to reach the optimum value in adjustment. (If there is no problem in practical application, use the camera under the current condition.)
Add a filter to the lens or illumination to decrease the color temperature.

16h: The color temperature is too low, making it impossible to reach the optimum value. (If there is no problem in practical application, use the camera under the current condition.)
Add a filter to the lens or illumination to increase the color temperature.

18h: Carry out auto setup again. If this message appears in repeated attempts, it is necessary to inspect the inside of the camera. In this case, notify your local Hitachi Denshi sales agent or Hitachi Denshi service office

1Fh: The color saturation is too low, making it impossible to reach the optimum value

24h: Release the long shutter mode.

25h: Release the external trigger mode.

26h: Change a frame rate to the one under 30fps (HV-F22F only)