SONY

A-CED-100-**21**(1)

Color Camera Module

Technical Manual

FCB-PV480

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Table of Contents

Features **3**

Precautions **4**

Locations of Controls **5**

Basic Functions **6**
- Overview of Functions 6
- Eclipse 28
- Spectral Sensitivity Characteristics 28
- Vibration Specifications 28
- Key Switch Circuitry 29
- Key Function Specifications 30
- Initial Settings, Custom Preset and Backup 32
- Mode Condition 34

Command List **37**
- VISCA/RS-232C Commands 37
- FCB Camera Commands 43

Specifications **57**

Features

- The FCB camera is equipped with a CCD which adopts the all-pixel read-out method for all 330,000 effective picture elements “progressive scan” and the primary color filter, enabling use of square pixels. The adoption of this type of CCD enables the high resolution and high color reproduction of this camera. Thus, this is an ideal camera for use in capturing digital images.
- 18× optical zoom.
- Digital data output, supporting three output modes.
  – 16-bit PS output mode, 8-bit PS output mode and 8-bit interlace output mode (Substantially comparable to ITU-R BT601 and ITU-R BT656.)
- Spherical Privacy Zone Masking function which corresponding to 3 dimensions.
  – Enabling mosaic masking.
- E-FLIP function
- An infrared (IR) Cut-Filter can be disengaged from the image path for increased sensitivity in low light environments. The ICR will automatically engage depending on the ambient light, allowing the camera to be effective in day/night environments.
- Slow shutter mode (max 1 sec)
- VISCA is a communications protocol, which enables the camera to be controlled remotely by commands from a host computer/controller. Also, high communication speeds are available (19200 bps and 38400 bps).

With consideration given to environmental protection, this module is designed to operate with low power consumption and also incorporates lead-free and halogen-free circuit boards.

Precautions

Software

Use of the demonstration software developed by Sony Corporation or use of the software with customer developed application software may damage hardware, the application program or the camera. Sony Corporation is not liable for any damages under these conditions.

Operation

Start the camera control software on your computer after you turn on the camera and the image is displayed.

Operation and Storage Locations

Do not shoot images that are extremely bright (e.g., light sources, the sun, etc.) for long periods of time. Do not use or store the camera in the following extreme conditions:

- Extremely hot or cold places (operating temperature 0 ˚C to +40 ˚C (32 ˚F to 104 ˚F))
- Close to generators of powerful electromagnetic radiation such as radio or TV transmitters
- Where it is subject to fluorescent light reflections
- Where it is subject to unstable (flickering, etc.) lighting conditions
- Where it is subject to strong vibration

Care of the Unit

Remove dust or dirt on the surface of the lens with a blower (commercially available).

Other

Do not apply excessive voltage. (Use only the specified voltage.) Otherwise, you may get an electric shock or a fire may occur.

In case of abnormal operation, contact your authorized Sony dealer or the store where you purchased the product.

Phenomena specific to CCD image sensors

The following phenomena that may appear in images are specific to CCD (Charge Coupled Device) image sensors. They do not indicate malfunctions.

White flecks

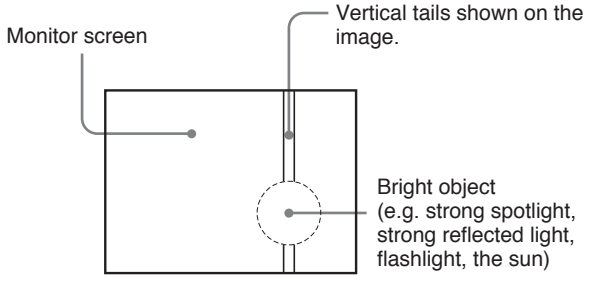
Although the CCD image sensors are produced with high-precision technologies, fine white flecks may be generated on the screen in rare cases, caused by cosmic rays, etc.
This is related to the principle of CCD image sensors and is not a malfunction.

The white flecks especially tend to be seen in the following cases:

- when operating at a high environmental temperature
- when you have raised the master gain (sensitivity)
- when operating in Slow-Shutter mode

Vertical smear

When an extremely bright object, such as a strong spotlight or flashlight, is being shot, vertical tails may be produced on the screen, or the image may be distorted.

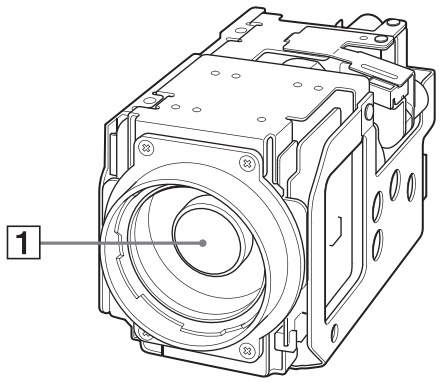


Aliasing

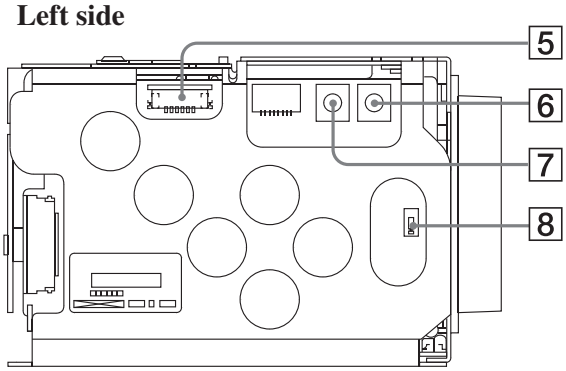
When fine patterns, stripes, or lines are shot, they may appear jagged or flicker.

Locations of Controls

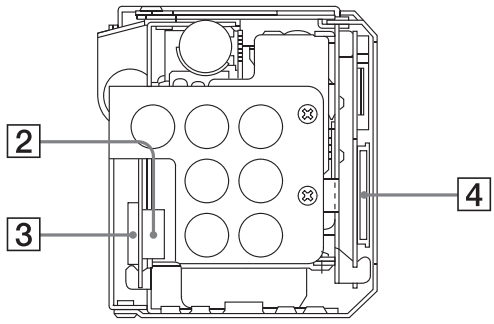
Front



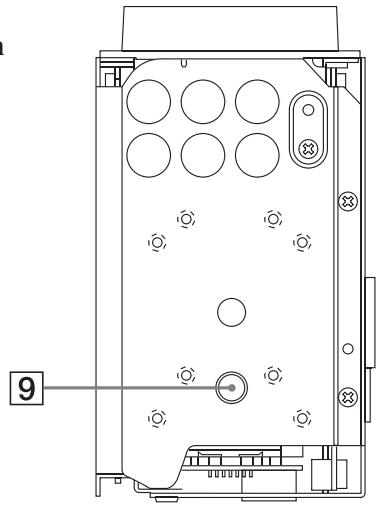
Left side



Rear



Bottom



1 **Lens**
2 **CN702 connector**
3 **CN701 connector**
4 **CN501 connector**
5 **CN403 connector (for key switch)**

6 **TELE button**
7 **WIDE button**
8 **S501 Switch**
Used to change the output mode between 16-bit and 8-bit output modes.

9 **Tripod screw holes**
When a tripod is used, please use 10 mm ($^{13}/_{32}$ in.) screws to attach it to the camera. Also, please be sure to attach the tripod securely.

Basic Functions

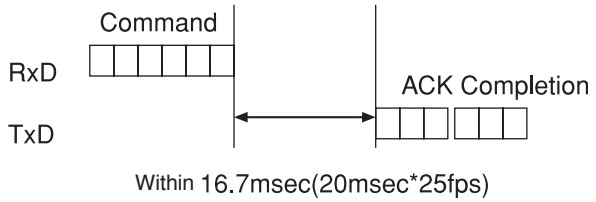
Overview of Functions

VISCA commands are the basis of camera control.

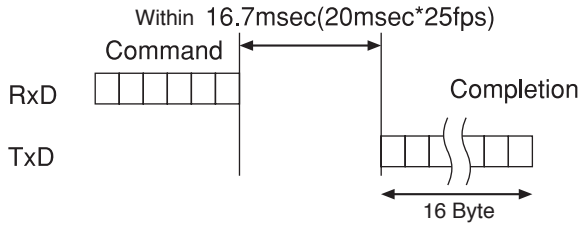
Timing Chart

As VISCA Command processing can only be carried out one time in a Vertical cycle, it takes the maximum 1V cycle time for an ACK/Completion to be returned. If the Command ACK/Completion communication time can be cut shorter than the1V cycle time, then every 1V cycle can receive a Command.

General Commands



Query Commands



Commands

- **Power On/Off**
  Powers the camera on and off. When the power is off, the camera is able to accept only the lowest level of VISCA Commands; the display and other features are turned off.
- **I/F clear**
  Clears the Command buffer of the FCB camera. Clearing the buffer can also be carried out from the control application software when the power is on.
- **Address set**
  VISCA is a protocol, which normally can support a daisy chain of up to seven attached devices. However, the FCB camera does not support camera connections in a daisy chain. Therefore, whenever a camera is connected for the first time, be sure to use the address set to confirm the address.
- **ID Write**
  Sets the camera ID.
- **Mute**
  Blanks the screen and sends out a synchronizing signal.
- **Lens Initialization**
  Initializes the zoom and focus of the lens. Even when power is already on, it initializes the zoom and the focus.

Zoom

The FCB camera employs an 18× optical zoom lens.

Lens specifications: Optical 18×, f = 4.1 to 73.8 mm (F1.4 to F3.0)

The horizontal angle of view is approximately 48 degrees (wide end) to 2.8 degrees (tele end).

You can activate the zoom in the following two ways:

- **By pressing the TELE or WIDE buttons on the camera itself.**
- **Using a VISCA Command**

  Using Standard Mode
  Using Variable Mode
  There are eight levels of zoom speed.
  Direct Mode
  Setting the zoom position enables quick movement to the designated position.

  In these standard and variable Speed Modes, it is necessary to send a "Stop Command" to stop the zoom operation.

Focus

Focus has the following modes, all of which can be set using VISCA Commands.

- **Auto Focus Mode**
  The minimum focus distance is 290 mm at the optical wide end and 800 mm at the optical tele end (distance from the front end of the lens), and is independent of the digital zoom.
  The AutoFocus (AF) function automatically adjusts the focus position to maximize the high frequency content of the picture in a center measurement area, taking into consideration the high luminance and strong contrast components.

  - Normal AF Mode
  This is the normal mode for AF operations.
  - Interval AF Mode
  The mode used for AF movements carried out at defined intervals. The time intervals for AF movements and for the timing of the stops can be set in one-second increments using the Set Time Command. The initial value for both is set to five seconds.
  - Zoom Trigger Mode
  When the zoom is changed with the TELE or the WIDE buttons, the pre-set value (initially set at 5 seconds) becomes that for AF Mode. Then, it returns to Manual Focus mode.

  AF sensitivity can be set to either Normal or LOW.
  - Normal
  Reaches the highest focus speed quickly. Use this when shooting a subject that moves frequently. Usually, this is the most appropriate mode.
  - LOW
  Improves the stability of the focus. When the lighting level is low, the AF function does not take effect, even though the brightness varies, contributing to a stable image.

- **Manual Focus Mode**
  Manual Focus has both a Standard Speed Mode and a Variable Speed Mode. Standard Speed Mode focuses at a fixed rate of speed. Variable Speed Mode has eight speed levels that can be set using a VISCA Command.

  In these standard and variable Speed Modes, it is necessary to send a "Stop Command" to stop the zoom operation.

- **One Push Trigger Mode**
  When a Trigger Command is received, the lens moves to adjust the focus for the subject. The focus lens then holds the same position until the next Trigger Command is input.

- **Infinity Mode**
  The lens is forcibly moved to a position suitable for an unlimited distance.

- **Near Limit Mode**
  Can be set in a range from 1000 (∞) to C000 (10 mm). The focus range is narrowed by excluding the unnecessary range.

White Balance

White Balance has the following modes, all of which can be set using VISCA Commands.

- **Auto White Balance**
  Auto white balance obtains the proper color reproduction by automatically adjusting white balance to ensure a white object always looks white. This function computes the white balance value output using color information from the entire screen. It outputs the proper value using a pre-set value for a color temperature radiating from a black subject based on a rage of values from 2000 to 10000K. This mode is the default setting.

Note

When the light source suddenly changes from the light source available when the FCB camera was turned on, the proper color reproduction may not be obtained because the system cannot compensate the sudden change of color temperature.

- **ATW**
  Auto Tracing White balance (2000 to 10000 K)
- **Indoor**
  3200 K Base Mode
- **Outdoor**
  5800 K Base Mode
- **One Push WB**
  The One Push White Balance mode is a fixed white balance mode that may be automatically readjusted only at the request of the user (One Push Trigger), assuming that a white subject, in correct lighting conditions and occupying more than $^1/_2$ of the image, is submitted to the camera.
  One Push White Balance data is lost when the power is turned off. If the power is turned off, reset the One Push White Balance.
- **Manual WB**
  Manual control of R and B gain, 256 steps each

Automatic Exposure Mode

The variety of AE functions, which allow video signal to output the optimum image for subjects from low light conditions to bright light conditions, are available.

- **Full Auto**
  Auto Iris and Gain, Fixed Shutter Speed ($^1/_{30}$ s)
- **Shutter Priority**
  Variable Shutter Speed, Auto Iris and Gain ($^1/_1$ to $^1/_{10,000}$ s, 22 steps, std. shutter: 16 steps, slow shutter: 6 steps)
- **Iris Priority**
  Variable Iris (F1.4 to Close, 18 steps), Auto Gain and Shutter speed.
- **Manual**
  Variable Shutter, Iris and Gain.
- **Bright**
  Variable Iris and Gain (Close to F1.6, 17 steps at 0 dB: F1.4, 15 steps from 0 to 28 dB)

AE – Shutter Priority

The shutter speed can be set freely by the user to a total of 22 steps – 16 high speeds and 6 low speeds. When the slow shutter is set, the speed can be $^1/_{30}$, $^1/_{15}$, $^1/_8$, or $^1/_4$ s. The picture output is read at a normal rate from the memory. The memory is updated at a low rate from the CCD. AF capability is low.
In high speed mode, the shutter speed can be set up to $^1/_{10,000}$ s. The iris and gain are set automatically, according to the brightness of the subject.

Data	30fps	25fps
15	10000	10000
14	6000	6000
13	4000	3500
12	3000	2500
11	2000	1750
10	1500	1250
0F	1000	1000
0E	725	600
0D	500	425
0C	350	300
0B	250	215
0A	180	150
09	125	120
08	100	100
07	90	75
06	60	50
05	30	25
04	15	12
03	8	6
02	4	3
01	2	2
00 [a)]	1	1

a) For AE-Manual only.

Note

When the shutter speed 1/1 s or 1/2 s is used, Auto Focus and White Balance may not function fully.

AE – Iris Priority

The iris can be set freely by the user to 18 steps between F1.4 and Close.
The gain and shutter speed are set automatically according to the brightness of the subject.

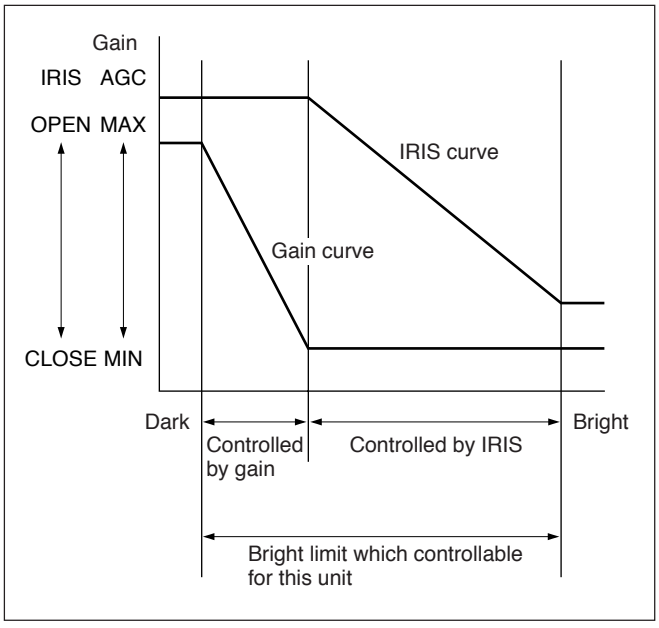
Data	Setting value	Data	Setting value
11	F1.4	08	F6.8
10	F1.6	07	F8.0
0F	F2.0	06	F9.6
0E	F2.4	05	F11
0D	F2.8	04	F14
0C	F3.4	03	F16
0B	F4.0	02	F19
0A	F4.8	01	F22
09	F5.6	00	CLOSE

AE – Manual

The shutter speed (22 steps), iris (18 steps) and gain (16 steps) can be set freely by the user.

AE – Bright

The bright control function adjusts both the gain and iris using an internal algorithm according to a brightness level freely set by the user. Exposure is controlled by gain when dark and by iris when bright. As both gain and iris are fixed, this mode is used when exposing at a fixed camera sensitivity. When switching from Full Auto or Shutter Priority Mode to Bright Mode, the current status will be retained for a short period of time.
Only when the AE mode is set to “Full Auto” or “Shutter Priority,” the user can switch it to “Bright.”

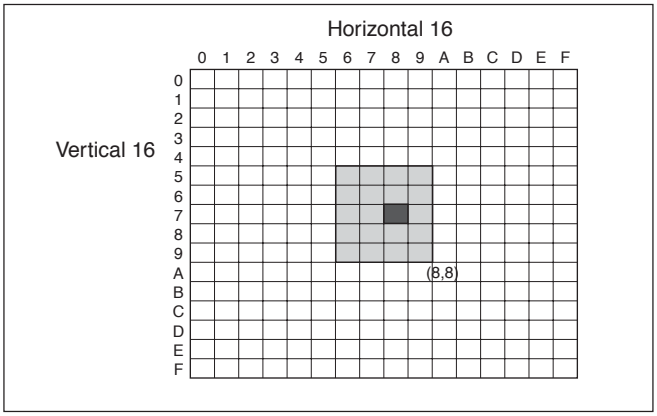


Data	Iris	Gain	Data	Iris	Gain
1F	F1.4	28 dB	0F	F2.0	0 dB
1E	F1.4	26 dB	0E	F2.4	0 dB
1D	F1.4	24 dB	0D	F2.8	0 dB
1C	F1.4	22 dB	0C	F3.4	0 dB
1B	F1.4	20 dB	0B	F4.0	0 dB
1A	F1.4	18 dB	0A	F4.8	0 dB
19	F1.4	16 dB	09	F5.6	0 dB
18	F1.4	14 dB	08	F6.8	0 dB
17	F1.4	12 dB	07	F8.0	0 dB
16	F1.4	10 dB	06	F9.6	0 dB
15	F1.4	8 dB	05	F11	0 dB
14	F1.4	6 dB	04	F14	0 dB
13	F1.4	4 dB	03	F16	0 dB
12	F1.4	2 dB	02	F19	0 dB
11	F1.4	0 dB	01	F22	0 dB
10	F1.6	0 dB	00	CLOSE	0 dB

When switching from the Shutter Priority mode to the Bright mode, the shutter speed set in the Shutter Priority mode is maintained.

Spot Exposure Mode

In Full Auto AE, the level for the entire screen is computed and the optimum Auto Iris and Gain levels are determined. In Spot AE, a particular section of the subject can be designated, and then that portion of the image can be weighted and a value computed so that Iris and Gain can be optimized to obtain an image.
For example, in an image with a lot of movement and with varying levels of brightness, portions without much change can be designated as such a “spot,” and changes to the screen can be minimized in that area.
As shown in the diagram below, a range of 16 blocks vertically and 16 blocks horizontally can be designated.
In the case where the center is designated (shown in black), the level is computed along with a weighted value for the surrounding block (shaded), including the specified portions; and then the Gain and Iris are set.
The value of the designated portions and the surrounding areas should be calculated as 100% and the rest should be set to 0%. The range of the Spot AE frame is fixed to five blocks vertically and four blocks horizontally.



Exposure Compensation

Exposure compensation is a function which offsets the internal reference brightness level used in the AE mode by steps of 1.5 dB.

Data	Step	Setting value
0E	7	10.5 dB
0D	6	9 dB
0C	5	7.5 dB
0B	4	6 dB
0A	3	4.5 dB
09	2	3 dB
08	1	1.5 dB
07	0	0 dB
06	–1	–1.5 dB
05	–2	–3 dB
04	–3	–4.5 dB
03	–4	–6 dB
02	–5	–7.5 dB
01	–6	–9 dB
00	–7	–10.5 dB

Aperture Control

Aperture control is a function which adjusts the enhancement of the edges of objects in the picture. There are 16 levels of adjustment, starting from “no enhancement.” When shooting text, this control may help by making the text sharper.

Back Light Compensation

When the background of the subject is too bright, or when the subject is too dark due to shooting in the AE mode, back light compensation will make the subject appear clearer.

Slow Shutter – Auto/Manual

When the Slow Shutter is set to “Auto,” this ensures that the slow shutter is engaged automatically when the brightness drops. This occurs only when the AE mode is set to “Full Auto.”
“Slow Shutter Manual” is the factory setting.

ICR (IR Cut-Removable) Mode

An infrared (IR) Cut-Filter can be disengaged from the image path for increased sensitivity in low light environments. The ICR will automatically engage depending on the ambient light, allowing the camera to be effective in day/night environments.

Auto ICR Mode

Auto ICR Mode automatically switches the setting needed for attaching or removing the IR Cut Filter. With a pre-set level of darkness, the IR Cut Filter is automatically disabled (ICR ON), and the infrared sensitivity is increased. With a pre-set level of brightness, the IR Cut Filter is automatically enabled (ICR OFF). Also, on systems equipped with an IR light, the proper decisions are made to avoid inappropriate operations.
The following three threshold levels are available to switch the ICR ON or OFF.
• 1st threshold level
• 2nd threshold level
• 3rd threshold level

Threshold level at which ICR is switched from ON to OFF:

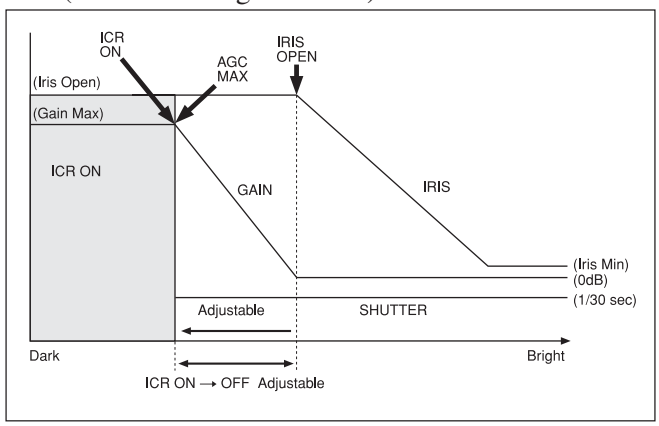
1st threshold level: The VISCA command allows you to set this level.
2nd threshold level: Fixed value

Threshold level at which ICR is switched from OFF to ON:

3rd threshold level: Fixed value

When ICR is OFF

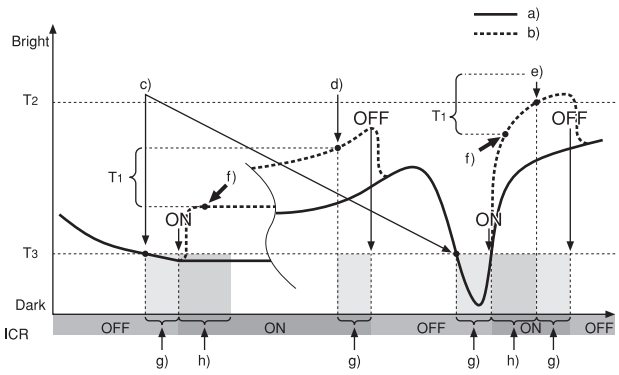
When the iris opens, and the light is darker than the maximum AGC value, ICR is switched from OFF to ON. (Refer to the figure below)



When ICR is ON

There are threshold levels at which ICR is switched from ON to OFF. Usually, the 1st threshold level is used to switch ICR from ON to OFF.
The following figure shows the process by which ICR is switched from ON to OFF.

Automatic ICR ON/OFF process



T1: 1st threshold level
T2: 2nd threshold level
T3: 3rd threshold level
a) Luminance level of the subject
b) Luminance when the IR cut filter is not attached
c) The luminance crops below the 3rd threshold level.
d) "(Current luminance) - (Reference level)" is higher than the 1st threshold level.
e) The luminance is higher than the 2nd threshold level.
f) Reference level
g) The FCB camera checks the luminance.
h) The reference level is determined within the predetermined time

Reference level

It takes about 1 second after ICR is switched to ON for AE to stabilize, then data on luminance is obtained for about 3 seconds. Averaged data for that 3 seconds is used as the reference level.

Timing when ICR is switched from ON to OFF

- When the level of "(current luminance) - (reference level)" continues to exceed the 1st threshold level for about 5 seconds, ICR is switched from ON to OFF.
- If the brightness reaches a level at which it continues to exceed the 2nd threshold level for more than 5 seconds, ICR will also be switched from ON to OFF.

Notes

Possible causes why ICR may not be switched from ON to OFF are as follows.
- The value of the 1st threshold level is not set properly.
- Due to a sudden change of luminance just after ICR has been switched to ON, the reference level may not be calculated correctly.

In the cases described above, ICR will not be switched to OFF until the luminance reaches the 2nd threshold level.

Camera ID

The ID can be set up to 65,536 (0000 to FFFF). As this will be memorized in the nonvolatile memory inside the camera, data will be saved regardless of whether it has been backed up.

Effect

It consists of the following function.
- **Black White:** Monochrome Image

New VISCA Commands

The following two commands have been added.
- Register Set command
  Changing the value of the register of the camera control CPU directly enables use of a large number of modes.

Note

After changing the command, be sure to turn the camera off once, and then turn on again. Otherwise the new command will not become effective and the mode will not be changed.

- Auto ICR threshold Adjustment
  This feature allows you to change the hysteresis width of the auto ICR by setting the threshold of Auto ICR ON or OFF.

Function	Syntax	Note
Register set	8x 01 04 24 mm 0p 0p ff	VISCA bit rate
		Frame rate
		Digital I/F format selection register
Auto ICR threshold adjustment	8x 01 04 21 00 00 0p 0p ff	Variable Auto ICR threshold
	dB	1 10 16 18 20 22 24
	pp (h)	01 0A 10 12 14 16 18

	Register # mm	Value pp	
VISCA Baud Rate	00	00	9600 bps
		01	19200 bps
		02	38400 bps
Frame Rate	70	01	29.97 fps
		02	25 fps
IF Mode	71	01	Progressive
		02	Interlace (REC656 Only)

Digital Image Output Modes

Three kinds of digital image output modes are available. Also, 30 fps and 25 fps modes are available for each of these digital image output modes. In total, six digital image output modes are supported.

I/F mode	Output	SYNC	Frame rate	Clock
16bit Progressive	YUV	HSYNC/ VSYNC	29.97 fps / 25.0 fps	13.5 MHz
	16-bit 4:2:2			
8bit Progressive	YUV	HSYNC/ VSYNC	29.97 fps / 25.0 fps	27.0 MHz
	8-bit 4:2:2	SAV/EAV		
8bit Interlace Scan	YUV	HSYNC/ VSYNC	29.97 fps / 25.0 fps	27.0 MHz
	8-bit 4:2:2	SAV/EAV		

Mode set at the factory : 16-bit PS, 29.97 fps

Selecting digital image output modes

- The S501 switch of the FCB camera allows you to change the output mode between 16-bit and 8-bit output modes.
- The new VISCA command allows you to select either PS mode or IS mode.

Selecting frame rate

New VISCA commands allow you to select either 29.97 (p) or 25.0 (p) mode.
Either 59.94 (i) or 50.0 (i) is available for Interlace.

Others

E-FLIP

This function turns the video output from the camera upside down.

Mirror Image

This function reverses the video output from the camera horizontally.

Freeze

This function captures an image in the field memory of the camera so that this image can be output continuously.
Because communication inside the camera is based on V cycle, the captured image is always the one 3V to 4Vs after the sending of a Command. Thus, you can not specify a time period after sending a Command.

Memory (Position Preset)

Using the position preset function, 6 sets of camera shooting conditions can be stored and recalled.
This function allows you to achieve the desired status instantly even without adjusting the following items each time:

- **Zoom Position**
- **Digital Zoom On/Off**
- **Focus Auto/Manual**
- **Focus Position**
- **AE Mode**
- **Shutter control parameters**
- **Bright Control**
- **Iris control parameters**
- **Gain control parameters**
- **Exposure Compensation On/Off**
- **Exposure Level**
- **Backlight Compensation On/Off**
- **Slow Shutter Auto/Manual**
- **White Balance Mode**
- **R/B Gain**
- **Aperture**
- **ICR Shoot On/Off**

Custom Preset

As with the position preset function, the camera shooting conditions can be stored and recalled. The settings are recalled when the power is turned on.

For setting items, see the "Initial Settings, Custom Preset and Backup" section on page 32.

User Memory Area

A user area of 16 bytes allows you to write data, such as an ID for each customer, data for each system, and so on, freely.

Note

Rewriting of memory is not unlimited. Be careful to avoid using the memory area for such as unnecessary tasks as rewriting the contents of the memory for every operation.

Privacy Zone Settings

For details, see page 14.

Alarm

For details, see page 18.

Title Display

The camera can be given a title containing up to 20 characters such as “ENTRANCE” or “LOBBY”. The position of the first character (horizontal, vertical) of the title, blinking state, and color can also be changed.

Vposition	00 to 0A	
Hposition	00 to 17	
Blink	00: Does not blink	
	01: Blinks	
Color	00	White
	01	Yellow
	02	Violet
	03	Red
	04	Cyan
	05	Green
	06	Blue

00	01	02	03	04	05	06	07
A	B	C	D	E	F	G	H
08	09	0a	0b	0c	0d	0e	0f
I	J	K	L	M	N	O	P
10	11	12	13	14	15	16	17
Q	R	S	T	U	V	W	X
18	19	1a	1b	1c	1d	1e	1f
Y	Z	&		?	!	1	2
20	21	22	23	24	25	26	27
3	4	5	6	7	8	9	0
28	29	2a	2b	2c	2d	2e	2f
À	È	Ì	Ò	Ù	Á	É	Í
30	31	32	33	34	35	36	37
Ó	Ú	Â	Ê	Ô	Æ	Œ	Ã
38	39	3a	3b	3c	3d	3e	3f
Õ	Ñ	Ç	ß	Ä	Ï	Ö	Ü
40	41	42	43	44	45	46	47
Å	$	₧	¥	DM	£	¿	¡
48	49	4a	4b	4c	4d	4e	4f
ø	“	:	‘	.	,	/	-

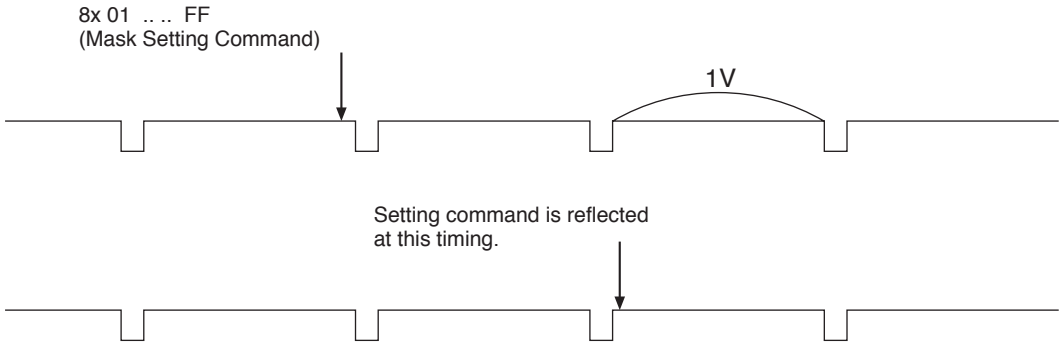
Privacy Zone Function

Privacy Zone masking protects private objects and areas such as house windows, entrances, and exits which are within the camera's range of vision but not subject to surveillance.
Privacy zone masking can be masked on the monitor to protect privacy.

Features

- Mask can be set on up to 24 places according to Pan/Tilt positions.
- Mask can be displayed on 8 places per screen simultaneously.
- Privacy Zones are displayed according to priority in alphabetical order.
- Individual on/off zone masking settings.
- Two colors from among 28 colors including a mosaic can be individually set for each of 24 privacy zones. (Color mosaic masking is available for privacy zone.)
- Interlocking control with zooming.
- Interlocking control with Pan/Tilt.
- Non-interlocking control with Pan/Tilt.

Timing chart



Privacy Zone Setting Command List

Command Set	Command	Command Packet	Comments
CAM_PrivacyZone	SetMask	8x 01 04 76 mm nn 0r 0r 0s 0s FF	Setting Mask(Size) See “mm: mask setting list”, “nn: setting”, and “rr: w, ss: h” in “Parameters” on page 16.
	Display	8x 01 04 77 pp pp pp pp FF	Setting Mask Display On/Off See “pp pp pp pp: Mask bit” in “Parameters” on page 16. pp pp pp pp: Mask setting (0: OFF, 1: ON)
	SetMaskColor	8x 01 04 78 pp pp pp pp qq rr FF	Setting Color of Mask See “pp pp pp pp: Mask bit” and “qq, rr: Color code” in “Parameters” on page 16. qq: Color setting when setting the Mask bit to 0 rr: Color setting when setting the Mask bit to 1
	SetPanTiltAngle	8x 01 04 79 0p 0p 0p 0q 0q 0q FF	Setting Pan/Tilt Angle See “Setting pan/tilt angle” in “Parameters” on page 16. ppp: Pan angle, qqq: Tilt angle
	SetPTZMask	8x 01 04 7B mm 0p 0p 0p 0q 0q 0q 0r 0r 0r 0r FF	Setting the direct position of PTZ mm: See “mm: mask setting list” and “Setting pan/tilt angle” in “Parameters” on page 16. ppp: Pan , qqq: Tilt , rrrr: Zoom
	Non_InterlockMask	8x 01 04 6F mm 0p 0p 0q 0q 0r 0r 0s 0s FF	Setting non-interlocking the mask to pan/tilt See “mm: mask setting list” and “pp: x, qq: y, rr: w, ss: h” in “Parameters” on page 16.
	Grid On	8x 01 04 7C 02 FF	Setting Grid Display On/Off
	Grid Off	8x 01 04 7C 03 FF	
	CenterLineOn	8x 01 04 7C 04 FF	Setting the center line On

Privacy Zone Inquiry Command List

Inquiry Command	Command Packet	Inquiry Packet	Comments
CAM_Privacy DisplayInq	8x 09 04 77 FF	y0 50 pp pp pp pp FF	Inquiry about the status of Setting Mask Display On/Off See “pp pp pp pp: Mask bit” in “Parameters” on page 16. 1:On, 0:Off
CAM_PrivacyPan TiltInq	8x 09 04 79 FF	y0 50 0p 0p 0p 0q 0q 0q FF	Inquiry about the pan/tilt position currently set See “Setting pan/tilt angle” in “Parameters” on page 16. ppp: Pan, qqq: Tilt
CAM_Privacy PTZInq	8x 09 04 7B mm FF	y0 50 0p 0p 0p 0q 0q 0q 0r 0r 0r 0r FF	Inquiry about pan/tilt/zoom position at the mm Mask setting See “mm: Mask setting list” and “Setting pan/tilt angle” in “Parameters” on page 16. ppp: Pan Position, qqq: Tilt Position rrrr: Zoom Position
CAM_Privacy MonitorInq	8x 09 04 6F FF	y0 50 pp pp pp pp FF	Inquiry about the mask currently displayed See “pp pp pp pp: Mask bit” in “Parameters” on page 16.

Parameters

mm: Mask setting list

Mask Name	mm (Hex)
Mask_A	00h
Mask_B	01h
Mask_C	02h
Mask_D	03h
Mask_E	04h
Mask_F	05h
Mask_G	06h
Mask_H	07h
Mask_I	08h
Mask_J	09h
Mask_K	0Ah
Mask_L	0Bh

Mask Name	mm (Hex)
Mask_M	0Ch
Mask_N	0Dh
Mask_O	0Eh
Mask_P	0Fh
Mask_Q	10h
Mask_R	11h
Mask_S	12h
Mask_T	13h
Mask_U	14h
Mask_V	15h
Mask_W	16h
Mask_X	17h

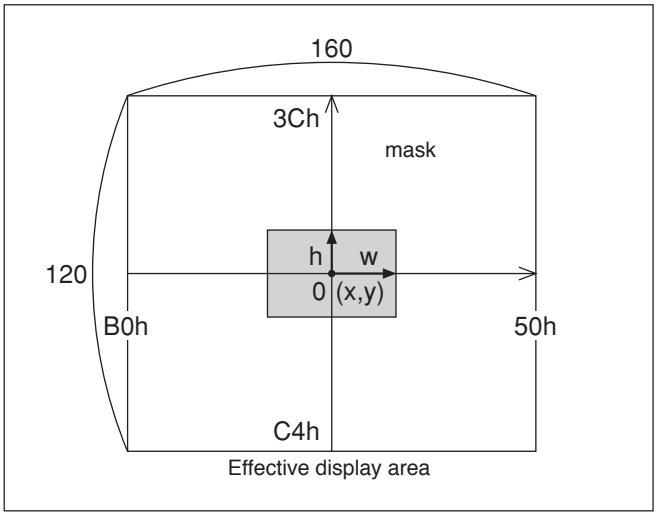
Note

The priority order of the mask display is in the sequence from A (highest) to X (lowest).
When you set the parameters of masks non-sequentially, it is recommended that you set the mask whose priority order is higher, first.

nn: Setting

nn	Setting
00	Resetting the zone size (the value of w, h) for the existing mask.
01	Setting newly the zone size (the value of w, h).

pp: x, qq: y, rr: w, ss: h



pp pp pp pp: Mask bit

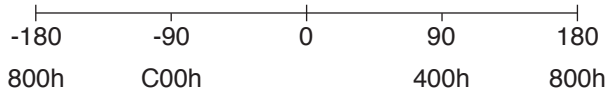
	pp								pp								pp								pp							
bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Mask	-	-	X	W	V	U	T	S	-	-	R	Q	P	O	N	M	-	-	L	K	J	I	H	G	-	-	F	E	D	C	B	A

qq, rr: Color code

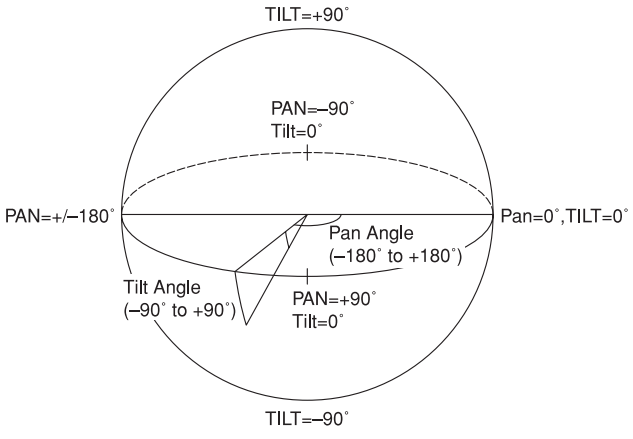
Mask (Color)	Code (qq, rr)	Semi-transparency (qq, rr)
Black	00h	10h
Gray1	01h	11h
Gray2	02h	12h
Gray3	03h	13h
Gray4	04h	14h
Gray5	05h	15h
Gray6	06h	16h
White	07h	17h
Red	08h	18h
Green	09h	19h
Blue	0Ah	1Ah
Cyan	0Bh	1Bh
Yellow	0Ch	1Ch
Magenta	0Dh	1Dh
Mosaic	7Fh	–

Setting pan/tilt angle

Angle/Parameter of Angle (ppp, qqq)



Set the angle resolution to 360 (degree)/4096 (1000h).



Details of Setting Commands

Set Mask

Command: 8x 01 04 76 mm nn 0r 0r 0s 0s FF

Parameters:

mm	Setting Mask See “mm: mask setting list” in “Parameters” on page 16.
nn	Selects new setting or resetting for the zone. See nn: Setting” in “Parameters” on page 16.
rr	Sets the half value “w” of the Mask Width.
ss	Sets the half value “h” of the Mask Height. See “rr: w, ss: h” in “Parameters” on page 16.

Comments: To set the mask, first display the object at the center of the screen. When “nn” is set to 1, the current Pan/Tilt/Zoom position is recorded in internal memory.
When “nn” is set to 0, the Pan/Tilt/Zoom position in memory is not changed.

Notes

- The tilt angle at which you can set the mask is between –70 to +70 degrees.
- It is recommended that you set the size to at least twice the size of the object (height and width).

Set Display

Command: 8x 01 04 77 pp pp pp pp FF

Parameter:

pp pp pp pp	Each 24 Privacy Zones corresponds to 1 bit. See “pp pp pp pp: Mask bit” in “Parameters” on page 16.

Comments: Each of 24 Privacy zones can be switched on and off individually by a single VISCA command. If you want to display a Privacy zone, you must set its bit to 1. If you do not want to display a Privacy zone, you must set its bit to 0.

Set Mask Color

Command: 8x 01 04 78 pp pp pp pp qq rr FF

Parameter:

pp pp pp pp	Each 24 Privacy Zones correspond with the BIT. See “pp pp pp pp: Mask bit” in “Parameters” on page 16.
qq	Set the color code include the semi-transparency code.
rr	Set the color code include the semi-transparency code. See “qq, rr: Color code” in “Parameters” on page 16.

Comments: Two different color masks can be chosen.
The colors can be chosen from among 14 colors including the possibility for semi-transparency of each color. Therefore two colors from among the total of 28 colors can be individually set for each of 24 privacy zones.
If the bit of parameter (pp pp pp pp) is set to “0”, mask color will be “qq” color (Color code). If the bit of parameter (pp pp pp pp) is set to “1”, the mask color will be “rr” color (Color code).

Example: 8x 01 04 78 00 00 00 03 10 07 FF
The mask color of Mask_A and Mask_B is White (color code 07h), and the mask color of the other Mask (C to X) is semi-transparent Black (color code 10h).

Set Pan Tilt Angle

Command: 8x 01 04 79 0p 0p 0p 0q 0q 0q FF

Parameter:

ppp	Pan Angle
qqq	Tilt Angle See “Setting pan/tilt angle” in “Parameters” on page 16.

Comments: Pan/Tilt angle settings are hexadecimal data.
The resolution of Pan/Tilt angle is 0.088 degrees.

Note

When you set the pan/tilt angle, locate the pan/tilt position at the center point of the FCB camera’s position.

Non Interlock Mask

Command: 8x 01 04 6F mm 0p 0p 0q 0q 0r 0r 0s 0s FF

Parameters:

mm	Setting Mask See “mm: mask setting list” in “Parameters” on page 16.
pp	Sets the center position “x” of the Mask on screen.
qq	Sets the center position “y” of the Mask on screen.
rr	Sets the half value “w” of the Mask Width.
ss	Sets the half value “h” of the Mask Height. See “pp: x, qq: y, rr: w, ss: h” in “Parameters” on page 16.

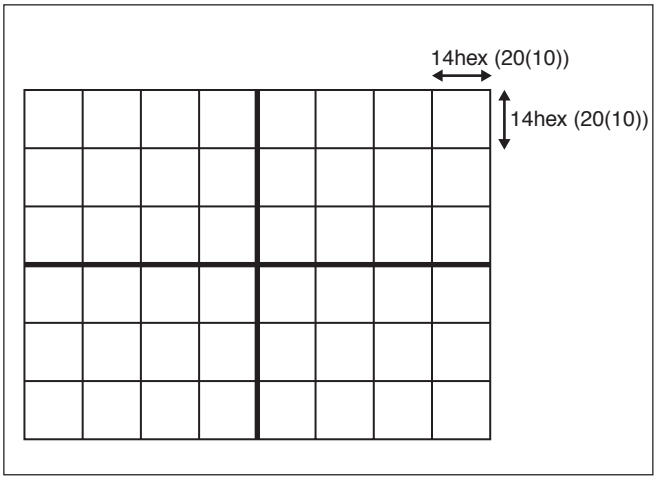
Commands: Mask does not interlock with pan/tilt.
The limitations of parameters are as follows.
(hexadecimal representation)
x: ±50h
w: ±50h
y: ±3ch
h: ±3ch

Note

When the Set Mask command and the Non Interlock Mask command are set to the same mask, the command set later becomes effective.

Grid

Use the grid displayed on the screen to set mask positions (see the figure below).



Alarm Function

This function instructs the camera to detect movement within the monitoring area and then send an alarm signal automatically.
A High level signal is output when camera detects movement inside the monitoring area. A Low level signal is output when object stops moving.
However, when the mode is set to “DAY/NIGHT”, the High level signal is output for dark and the Low level signal is output for bright.
The Detect signal goes out through the serial command (VISCA) communication line.

Example

1. A door is motionless, so the Detect Level is Low.
2. At the moment when the door is opened by someone, the Detect Level goes to High.
3. The Detect Level is High while the shooting object is moving.
4. When the door is closed, Detect Level goes to Low again, or signals are output only once at the time of switching between High Level and Low Level.

ALARM Setting Command List

Command Set	Command	Command Packet	Comments
CAM _ Alarm	On	8x 01 04 6B 02 FF	Alarm start
	Off	8x 01 04 6B 03 FF	Alarm stop
	Set Mode	8x 01 04 6C pp FF	Mode Setting *Select one from 13 modes
	Set Day Night Level	8x 01 04 6D 0p 0p 0p 0q 0q 0q FF	ppp: Day distinction AE level qqq: Night distinction AE level.

90 07 04 6B 01 FF	High signal output (Low ⟶ High edge)
90 07 04 6B 00 FF	Low signal output (High ⟶ Low edge)

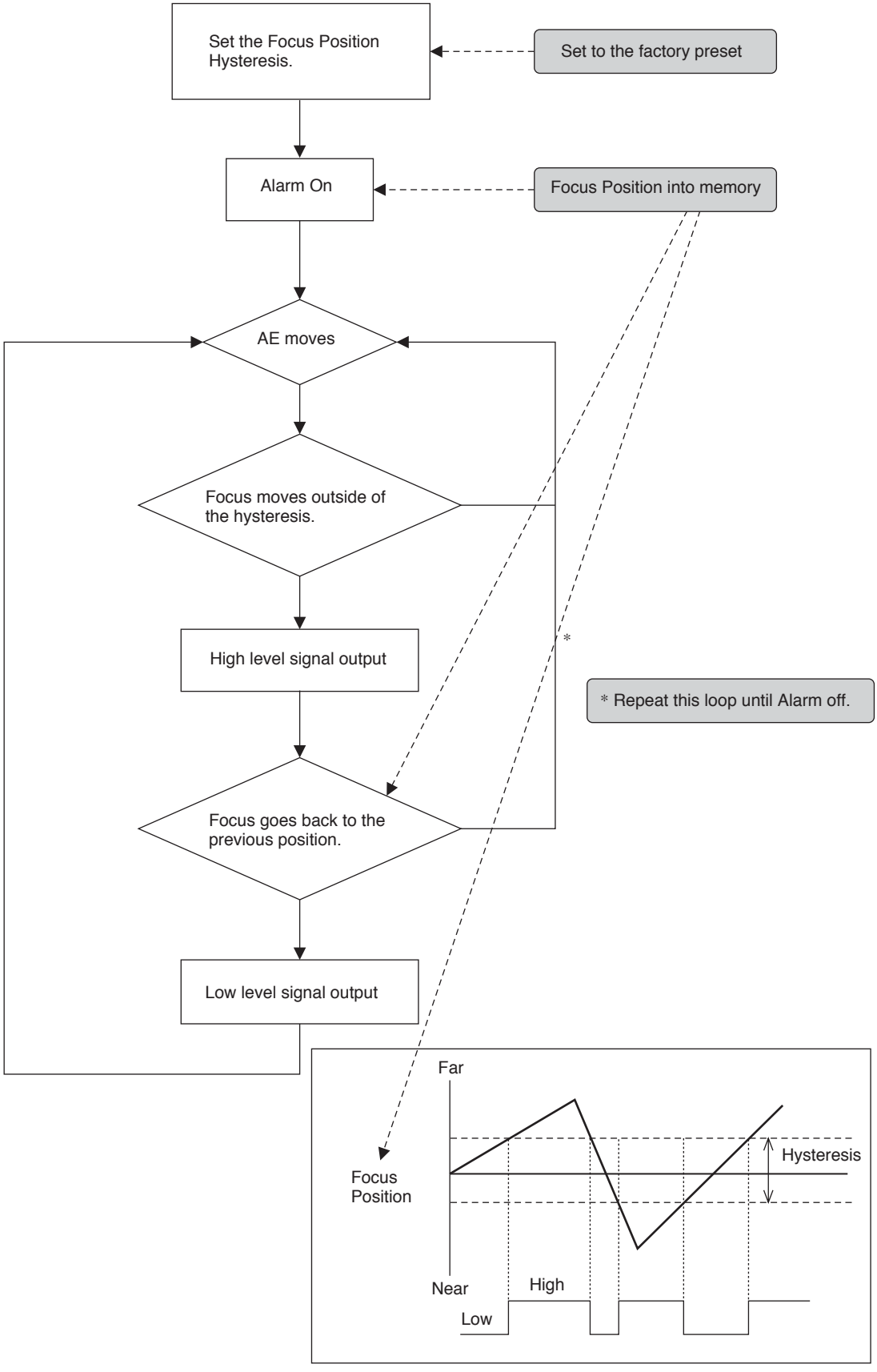
VISCA Mode Code (pp)	Details of Mode
00	Set the internal focus position. When focus movement is detected, the detect signal is High. When focus goes back to the previous position, the detect signal is Low.
01	Set a fixed period of time. When focus does not move during the time, the focus position is memorized as a rest position and the detect signal is Low. When focus moves, the detect signal is High. Afterwards when focus does not move for the fixed period of time, the focus position is memorized and the detect signal becomes Low.
02	Set the internal AE Level. When AE movement is detected, the detect signal is High. When AE Level goes back to the previous level, the detect signal is Low.
03	Set a fixed period of time. When AE Level does not change during this time, the AE value is memorized as a rest value and the detect signal is Low. When AE value changes, the detect signal is High. Afterwards when AE value does not change for the fixed period of time, the AE value is memorized and the detect signal becomes Low.
04	mode “00” and mode “02”
05	mode “00” and mode “03”
06	mode “01” and mode “02”
07	mode “01” and mode “03”
08	mode “00” or mode “02”
09	mode “00” or mode “03”
0A	mode “01” or mode “02”
0B	mode “01” or mode “03”
0C	Day-Night Mode

ALARM Inquiry Command List

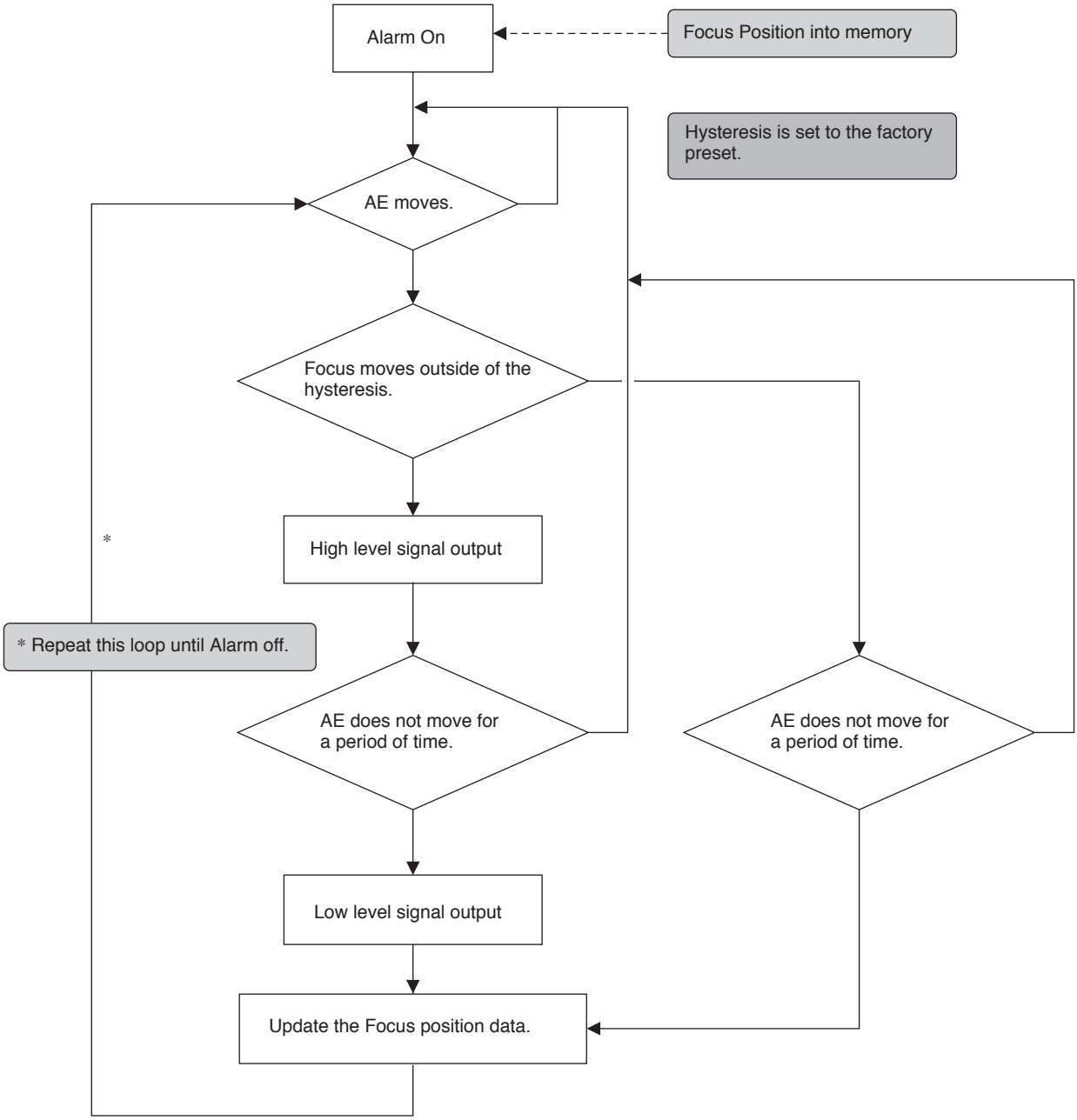
Inquiry Command	Command Packet	Inquiry Packet	Comments
CAM _ Alarm Inq	8x 09 04 6B FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM _ Alarm Mode Inq	8x 09 04 6C FF	y0 50 pp FF	pp: Alarm Mode
CAM_AlarmDayNightLevel Inq	8x 09 04 6D FF	y0 50 0p 0p 0p 0q 0q 0q 0r 0r 0r FF	ppp: Day setting AE Level qqq; Night setting AE Level rrr: Now AE Level
CAM_AlarmDetLevelInq	8x 09 04 6E FF	y0 50 01 FF y0 50 00 FF	Detect Level is High. Detect Level is Low.

Flowchart of 12 Modes Function

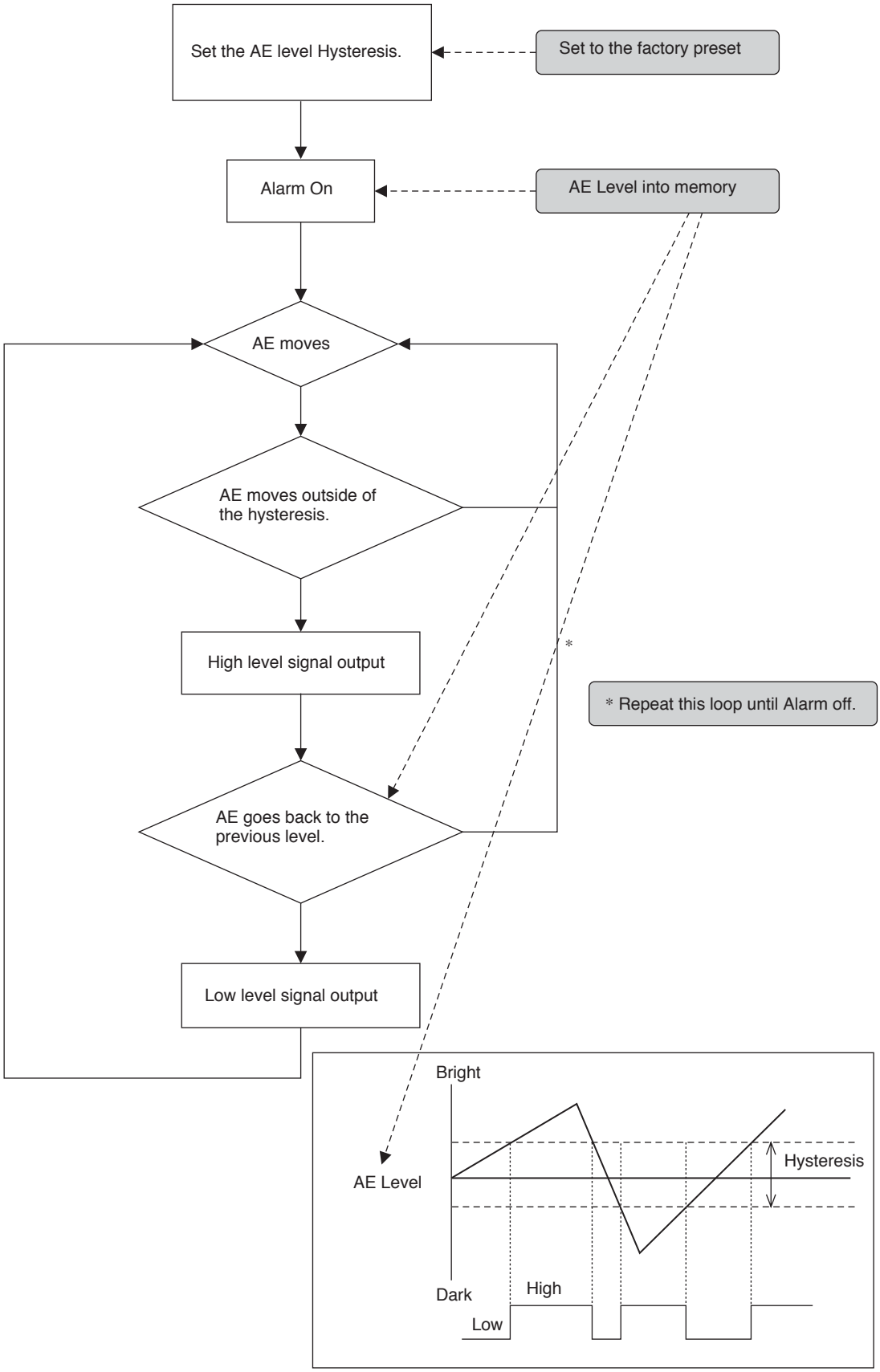
Mode “00”



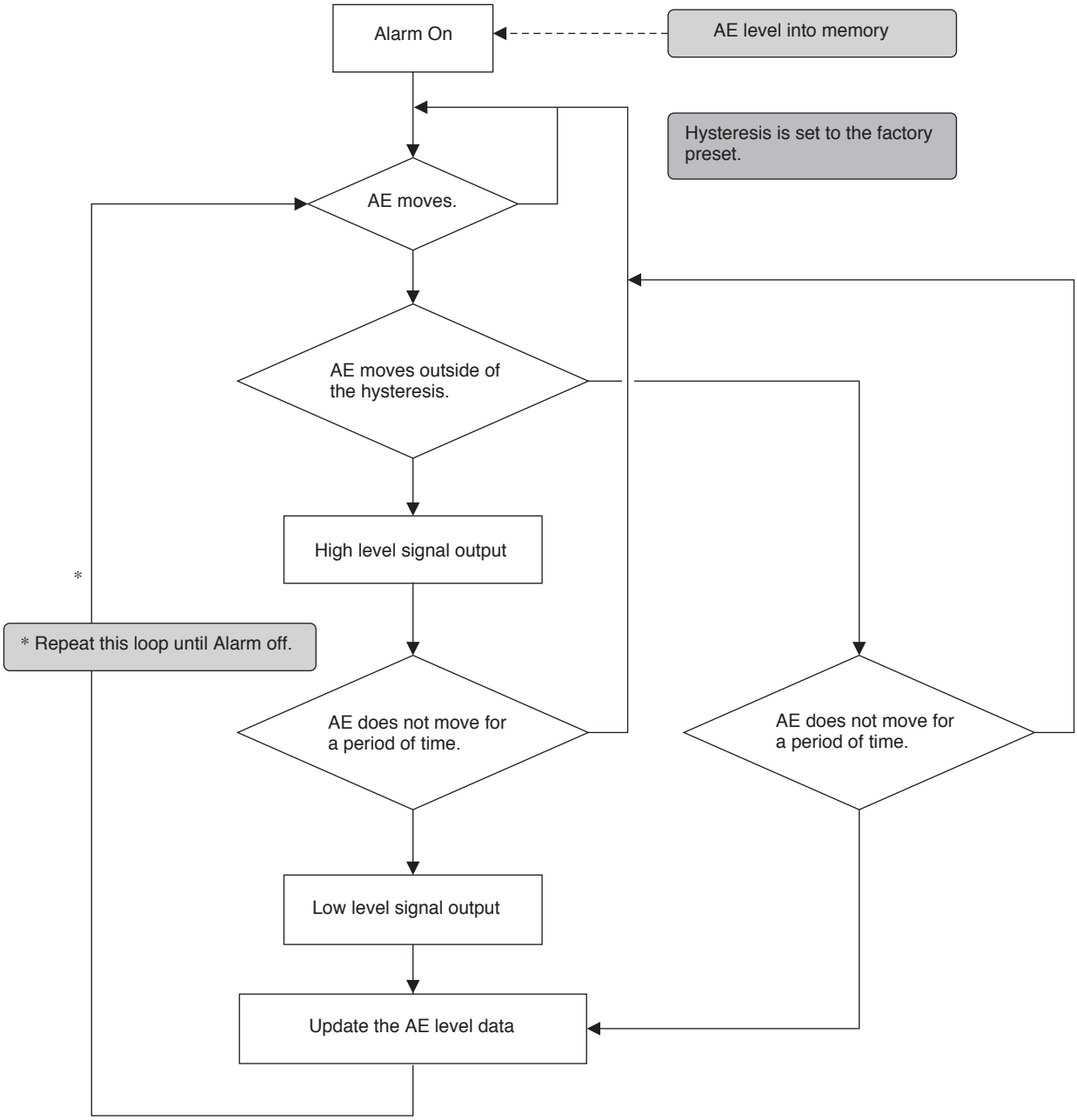
Mode “01”


Alarm On
Focus Position into memory
Hysteresis is set to the factory preset.
AE moves.
Focus moves outside of the hysteresis.
High level signal output
*
* Repeat this loop until Alarm off.
AE does not move for a period of time.
AE does not move for a period of time.
Low level signal output
Update the Focus position data.

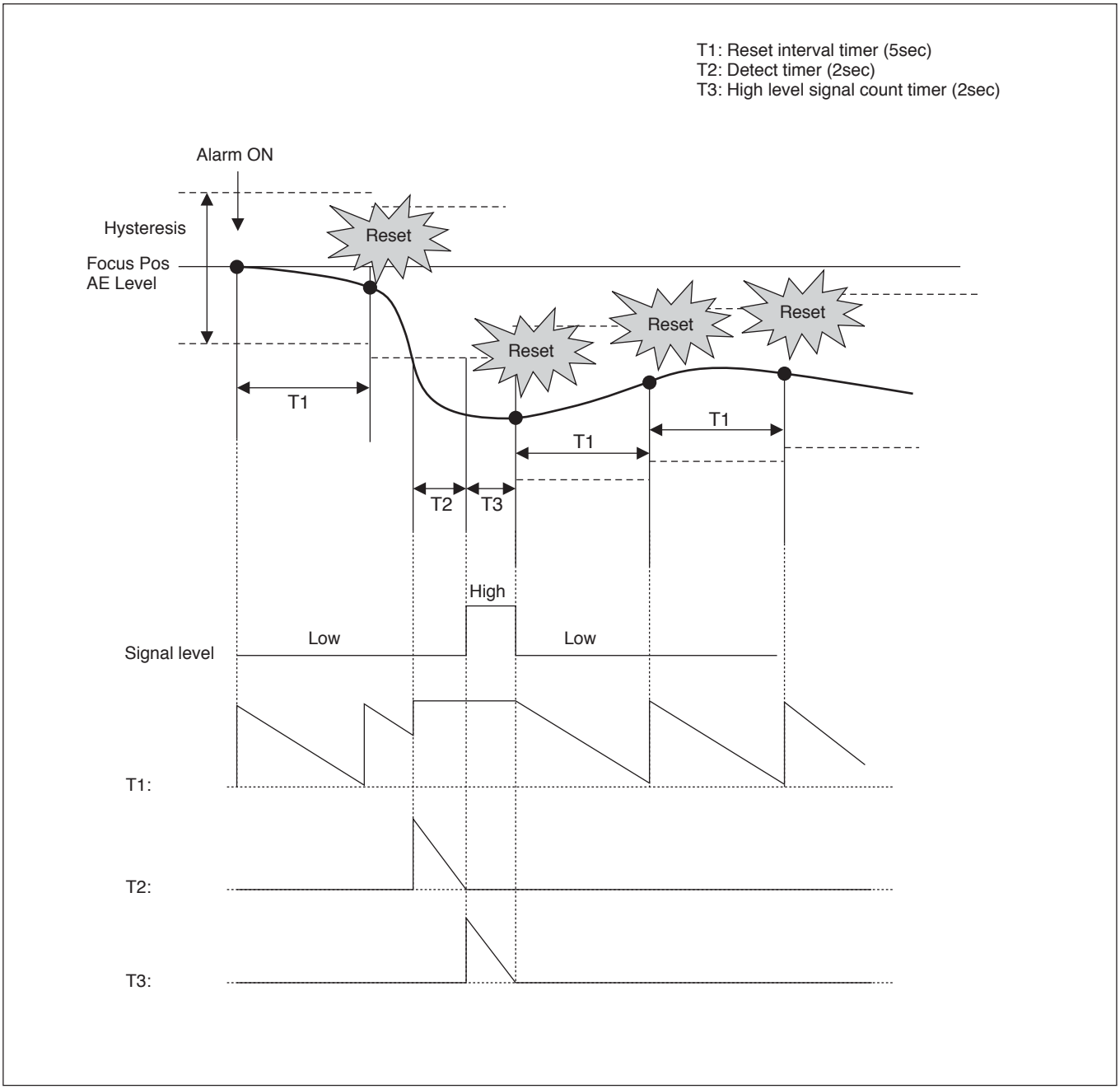
Mode “02”


Set the AE level Hysteresis.
Set to the factory preset
Alarm On
AE Level into memory
AE moves
AE moves outside of the hysteresis.
High level signal output
*
* Repeat this loop until Alarm off.
AE goes back to the previous level.
Low level signal output
Bright
AE Level
Hysteresis
Dark
High
Low

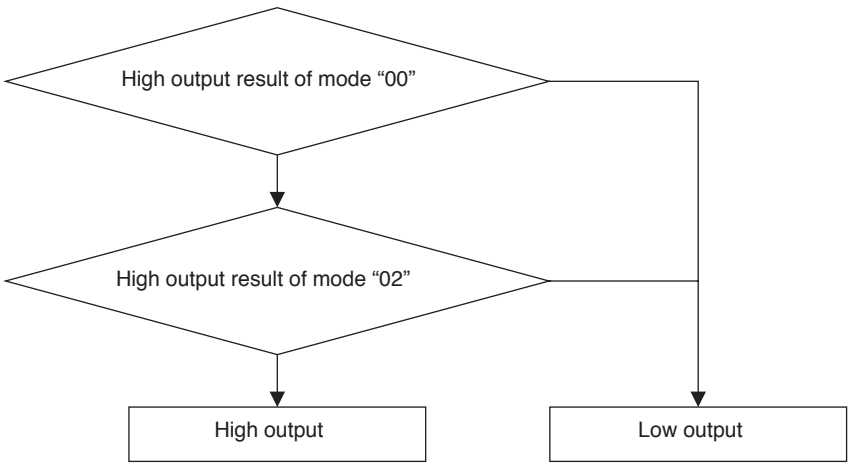
Mode “03”


Alarm On
AE level into memory
Hysteresis is set to the factory preset.
AE moves.
AE moves outside of the hysteresis.
High level signal output
*
* Repeat this loop until Alarm off.
AE does not move for a period of time.
AE does not move for a period of time.
Low level signal output
Update the AE level data

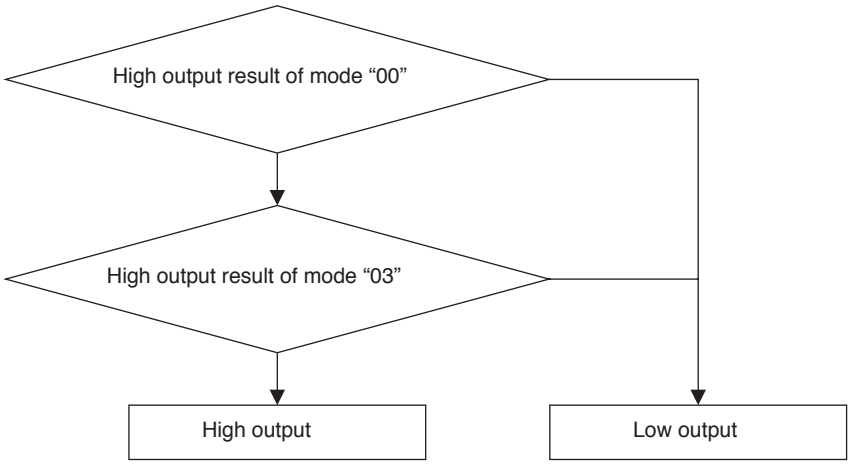
Details of Mode “01”/”03"



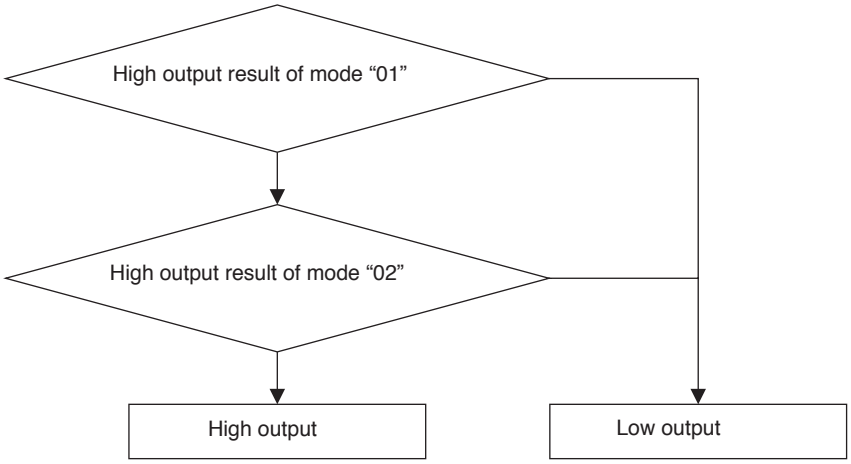
Mode “04”



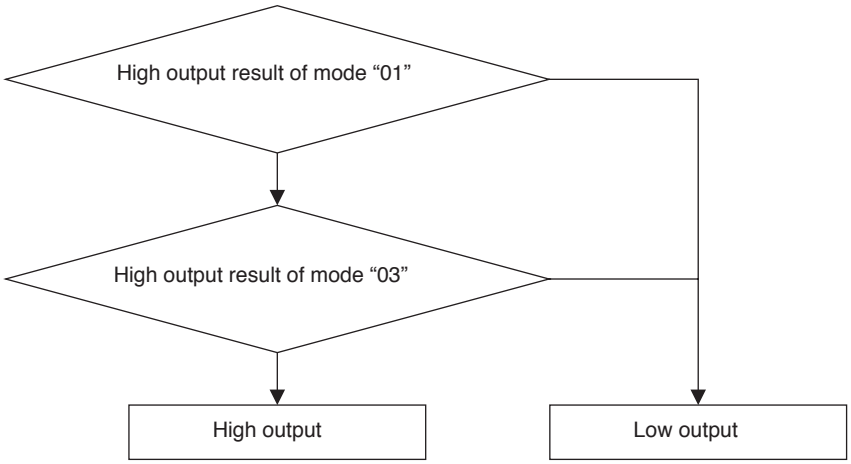
Mode “05”



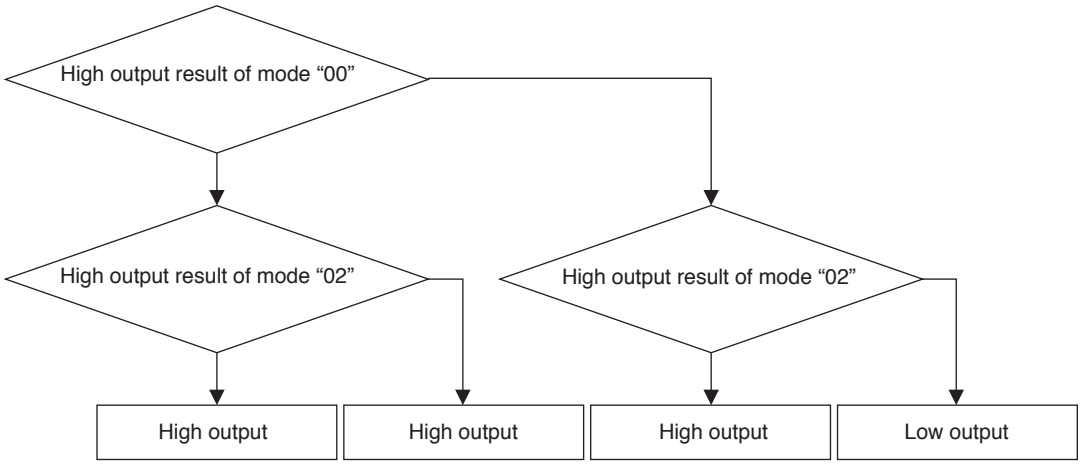
Mode “06”



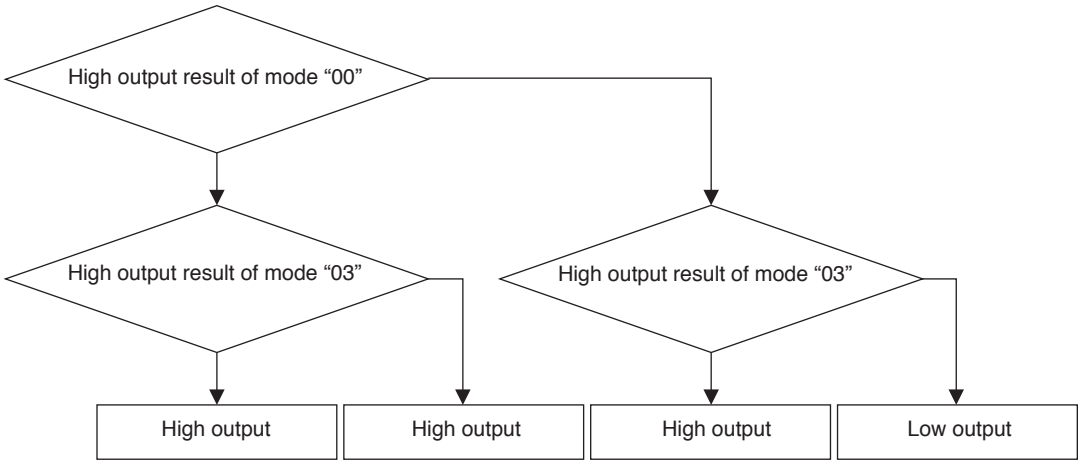
Mode “07”



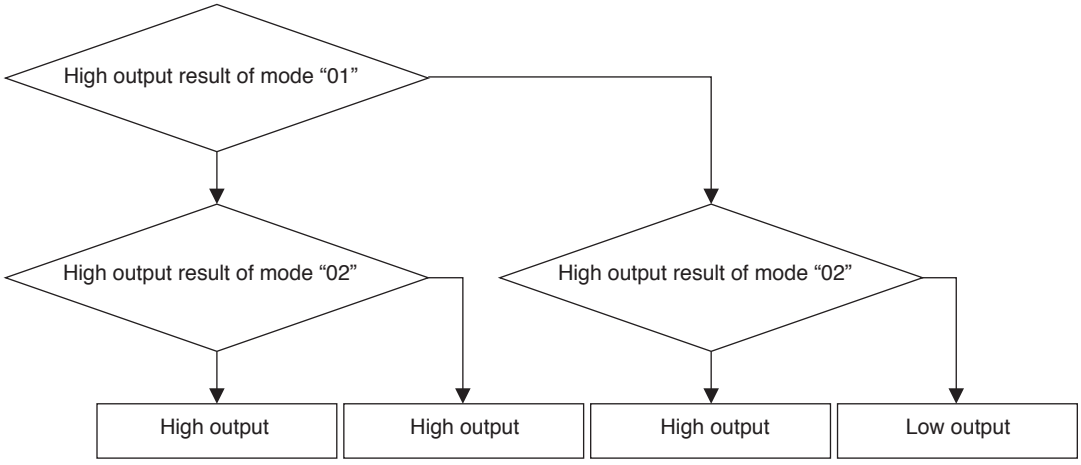
Mode “08”



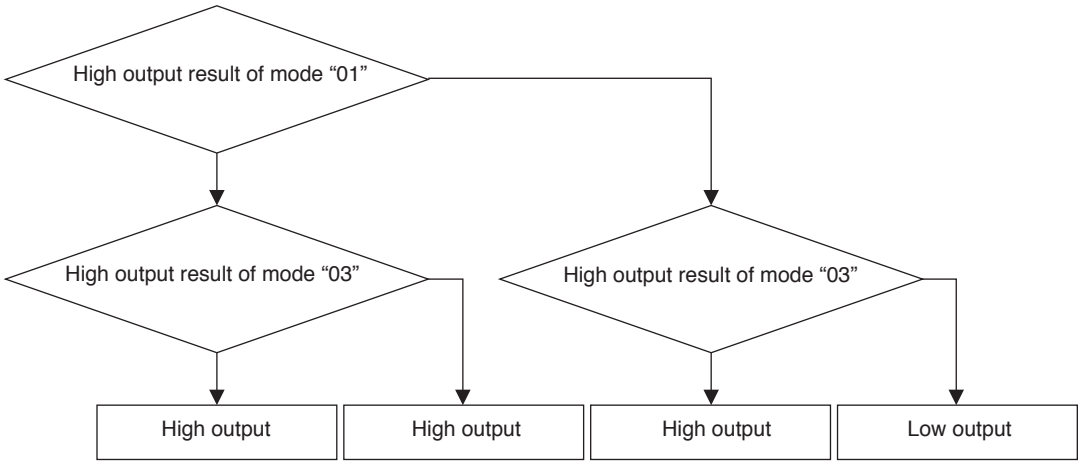
Mode “09”



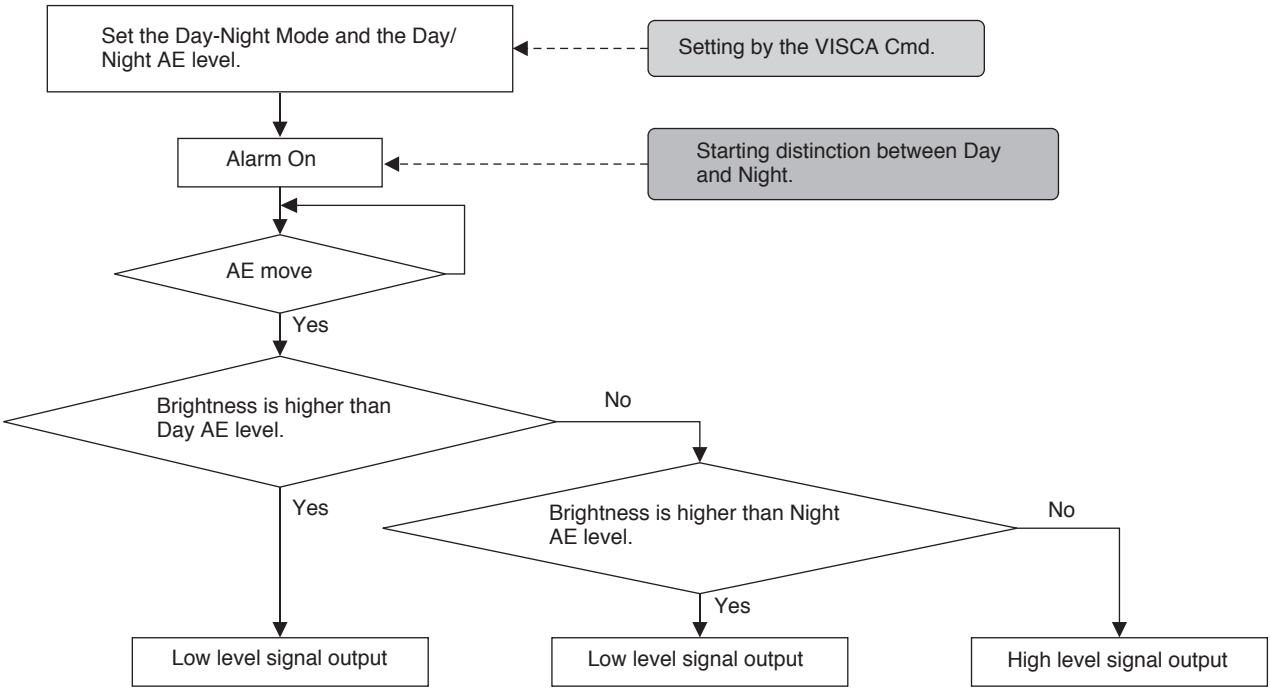
Mode “0A”

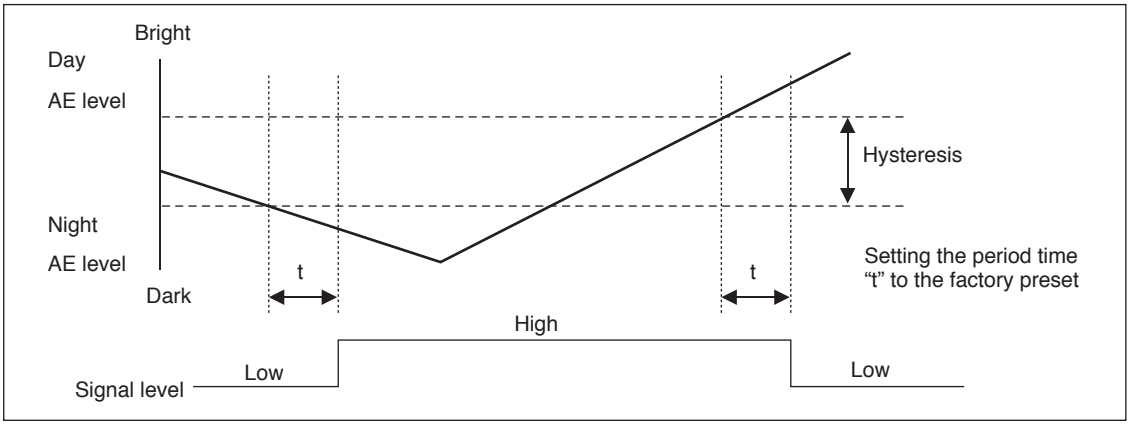


Mode “0B”



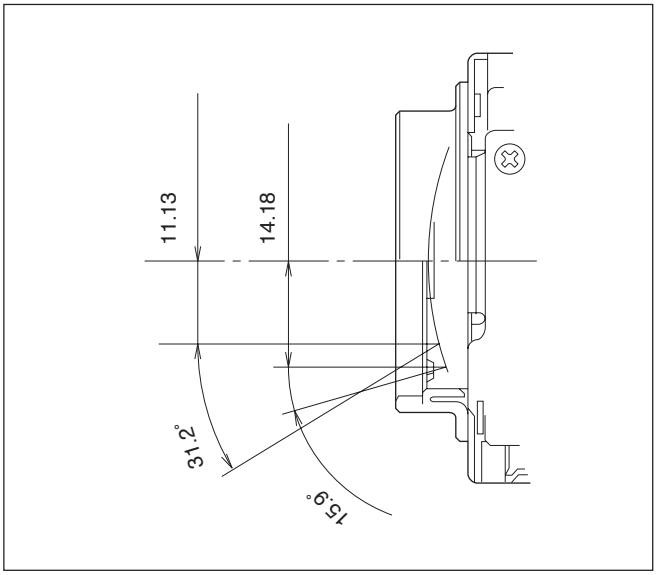
Day-Night Mode (Mode “0C”)



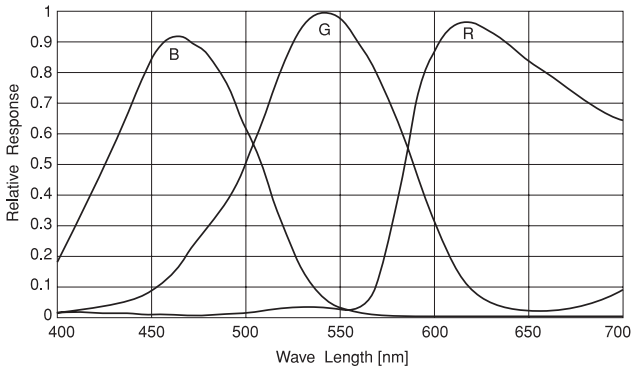


Eclipse

When designing the housing, refer to the dimensional allowance as shown in the figure below.



Spectral Sensitivity Characteristics



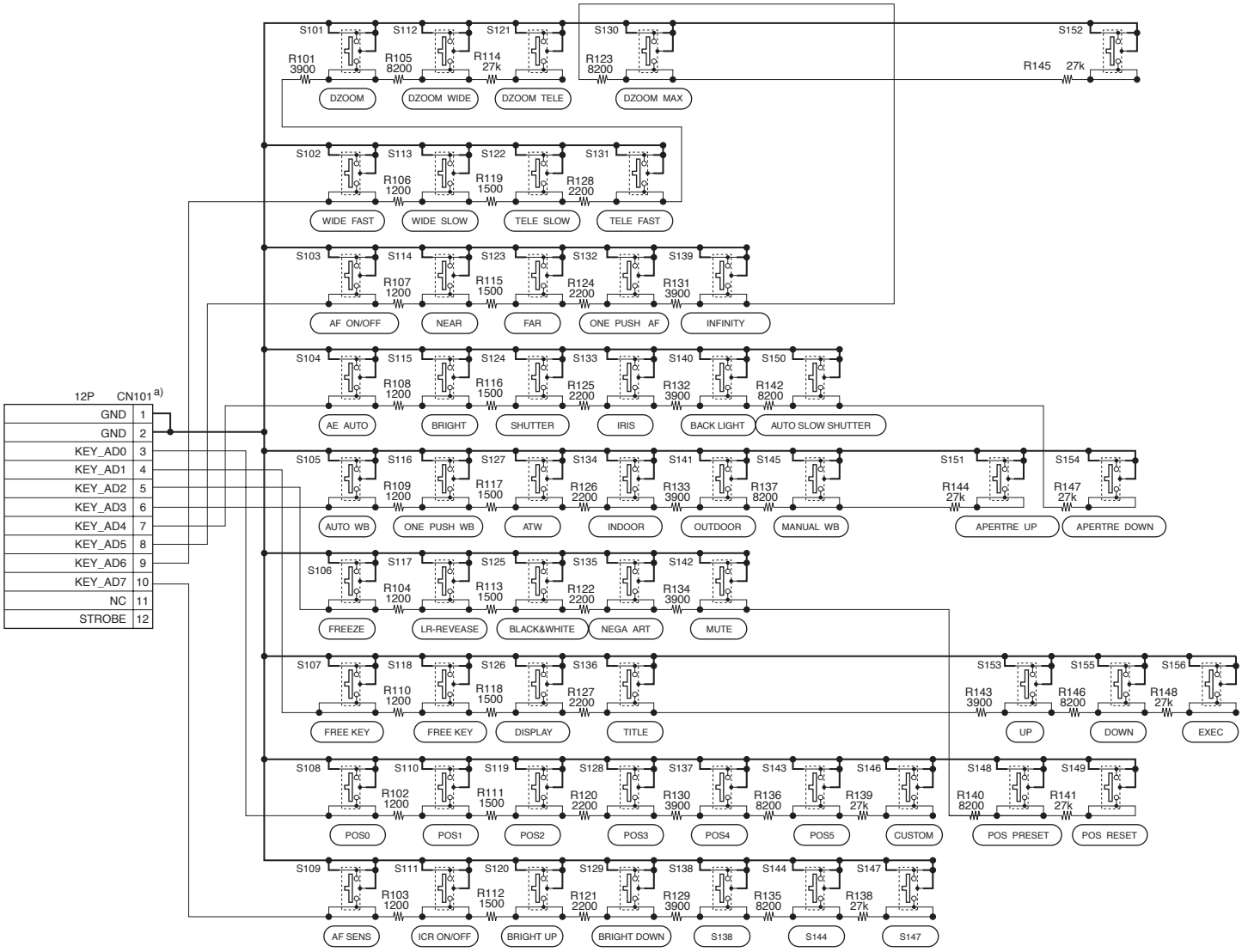
Vibration Specifications

Test Method (Random vibration)

- Fix the camera at the four fixation points of the base using M2 screws.
- Perform the random vibration test under the following conditions in the X, Y and Z directions for 20 minutes in each direction.
- The camera vibration specification is to have no malfunction after this test.

Power spectrum density	5 to 50 Hz 4.14 m^2/s^3 {0.043 G^2/Hz} 50 to 100 Hz –36 dB/oct
Effective overall value	14.3 m/s^2 {1.46 G}
Test time	20 minutes

Key Switch Circuitry



a) The CN101 is connected to the CN403 on the FCB camera main unit.

Key Function Specifications

Classification	Name	Function	Button operation	Mode display
ZOOM	WIDE	Move ZOOM to WIDE side quickly.	Pressing repeatedly allowed.	ZOOM bar displayed for 3 s.
	WIDE SLOW	Move ZOOM to WIDE side slowly.	Pressing repeatedly allowed.	ZOOM bar displayed for 3 s.
	TELE SLOW	Move ZOOM to TELE side slowly.	Pressing repeatedly allowed.	ZOOM bar displayed for 3 s.
	TELE FAST	Move ZOOM to TELE side quickly.	Pressing repeatedly allowed.	ZOOM bar displayed for 3 s.
D-ZOOM	DZOOM	Turn on/off the mode for shifting from optical MAX to electronic ZOOM in combined mode.	Switch on/off.	ZOOM bar displayed for 3 s.
	DZOOM WIDE	Move the electronic ZOOM to WIDE side in separate mode.	Pressing repeatedly allowed.	ZOOM bar displayed for 3 s.
	DZOOM TELE	Move the electronic ZOOM to TELE side in separate mode.	Pressing repeatedly allowed.	ZOOM bar displayed for 3 s.
	DZOOM MAX	Switch the electronic ZOOM between 1× and MAX in separate mode.	Switch between 1× and MAX magnification.	ZOOM bar displayed for 3 s.
FOCUS	AF	Switch between Auto Focus and Manual Focus.	Switch between Auto and Manual.	Manual F indication
	NEAR	Move focus to NEAR side in Manual Focus mode.	Pressing repeatedly allowed.	Near indication
	FAR	Move focus to FAR side in Manual Focus mode.	Pressing repeatedly allowed.	Far indication
	ONE PUSH AF	Perform AF operation once in Manual Focus mode.	Request One Push AF.	Manual F indication flashes while request is made.
	INFINITY	Move focus forcibly to Infinity resulting in Manual Focus mode, regardless of the current focus mode.	Request Infinity.	Far indication
AE	AE AUTO	Switch to AE FULL Auto mode.	Request AE Full Auto.	No display
	BRIGHT	Switch to variable brightness mode (BRIGHT), depending on the conditions for mode shifting.	Request Bright mode. Pressing Up/Down key repeatedly allowed.	Bright bar display
	SHUTTER	Shutter priority AE mode	Request shutter priority AE mode.	Shutter code display
	IRIS	Iris priority AE mode	Request iris priority AE mode.	Iris code display
	BACK LIGHT	Switch backlight on/off.	Switch on/off.	Backlight indication
WB	AUTO WB	Switch to AUTO WB mode.	Request Auto WB mode.	No display
	ONE PUSH WB	Switch to One Push WB mode when pressed once and capture data when pressed 2nd time.	Request One Push WB mode and trigger.	One Push indication flashes at 0.8 Hz before capturing data, at 3.2 Hz during capturing, and stays lit after capturing.
	ATW	Switch to ATW mode.	Request AWB mode.	ATW display
	INDOOR	Enable WB at 3200K in INDOOR mode.	Request Indoor mode.	Indoor indication
	OUTDOOR	Enable WB at 5800K in OUTDOOR mode.	Request Outdoor mode.	Outdoor indication
	MANUAL WB	Switch to Manual WB mode. Enable R control when pressed once and enable B control when pressed 2nd time. Switchable with UP/DOWN key.	Switch between R control and B control in manual WB mode./Pressing Up/Down key repeatedly allowed.	“WB-MAN” (character display)

Classification	Name	Function	Button operation	Mode display
FEATURE	FREEZE	Capture still image.	Switch on/off.	FREEZE indication
	LR-REVERSE	Horizontal reversal	Switch on/off.	Horizontal reversal indication
	BLACK & WHITE	Black-and-white output	Switch on/off.	B&W display
	NEGA ART	Negative art output	Switch on/off.	Neg Art display
	MUTE	Mute video output	Switch on/off.	“MUTE” (character display)
DISPLAY	DISPLAY	Display	Switch on/off.	
	TITLE	Title setting	Request setting. → Setting is started with Exec. Pressing Up/Down key repeatedly allowed.	Title setting screen display
	EXEC	Confirm title/clock settings.	Select with Up/Down and confirm with Exec.	Setting screen selection highlighted in yellow.
UP/DOWN	UP	Data UP key (priority for AE mode, Bright, manual WB, title, and clock)	Request UP.	Selection highlighted.
	DOWN	Data DOWN key (priority for AE mode, Bright, manual WB, title, and clock)	Request DOWN.	Selection highlighted.
PRESET	POS1	Recall preset position 1.	Request recall.	RECALL POS0
	POS2	Recall preset position 2.	Request recall.	RECALL POS1
	POS3	Recall preset position 3.	Request recall.	RECALL POS2
	POS4	Recall preset position 4.	Request recall.	RECALL POS3
	POS5	Recall preset position 5.	Request recall.	RECALL POS4
	POS6	Recall preset position 6.	Request recall.	RECALL POS5
	POS7	Recall custom preset.	Request recall.	RECALL
	POS PRESET	Write data. Enabled when pressed together with POS button.	Request setting. Enabled when pressed together with POS key.	PRESET display
	POS RESET	Delete data. Enabled when pressed together with POS button.	Request deletion. Enabled when pressed together with POS key.	RESET display
Others	APERTURE UP	Increase aperture (Aperture UP)	Request UP.	Aperture bar displayed for 3 s.
	AUTO SLOW SHUTTER	Switch Auto Slow Shutter on/off.	Switch on/off.	“ASS” (character display)
	APERTURE DOWN	Decrease aperture (Aperture DOWN)	Request DOWN.	Aperture bar displayed for 3 s.
	AF SENSITIVITY	Switch AF sensitivity between Normal and Low.	Switch between Normal and Low.	“SENS L” (character display)
	BRIGHT UP	Raise brightness setting (Bright UP) (When not in Bright mode, switching to Bright mode is made automatically depending on the conditions.)	Request UP./Pressing repeatedly allowed.	Bright bar display
	BRIGHT DOWN	Lower brightness setting (Bright DOWN) (When not in Bright mode, switching to Bright mode is made automatically depending on the conditions.)	Request DOWN./Pressing repeatedly allowed.	Bright bar display
	ICR ON/OFF	Switch ICR mode on/off	Switch on/off	

Note

Key operation is disabled for certain functions, depending on the model of your camera.

Initial Settings, Custom Preset and Backup

Initial settings for the various functions are indicated in the “Initial settings” column.
The “Custom preset” column indicates whether the custom preset function can be used to store the settings. The function enables the stored settings to be recalled automatically when the camera is turned on.
The “Standby backup” column indicates whether the data is preserved even when the camera is powered OFF. A circle “○” in this column signifies that the data is preserved. A cross “×” signifies that the data IS NOT preserved.

Mode/Position	Initial settings	Custom preset	Standby backup
Zoom Position	Wide end	○	○
Focus Position	—	○	○
Focus Auto/Manual	Auto	○	○
Near Limit Setting	8000h (29cm)	○	○
AF Sensitivity	Normal	○	○
AF Mode	Normal	○	○
AF Run Time	5 sec	○	○
AF Interval	5 sec	○	○
WB Mode	Auto	○	○
WB Data (Rgain, Bgain)	—	○	○
One Push WB Data	—	○	○
AE Mode	Full Auto	○	○
Slow Shutter Mode	Manual	○	○
Shutter Position	1/30 s (30fps), 1/25 s (25fps)	○	○
Iris Position	—	○	○
Gain Position	—	○	○
Bright Position	—	○	○
Exposure Compensation On/Off	Off	○	○
Exposure Compensation Amount	±0	○	○
Backlight On/Off	Off	○	○
Spot AE On/Off	Off	○	○
Spot AE Position Setting	X=8, Y=8	○	○
Aperture Level	5	○	○
LR Reverse On/Off	Off	○	○
Freeze On/Off	Off	×	×
Picture Effect	Off	○	○
ICR On/Off	Off	○	○
Auto ICR On/Off	Off	○	○
Camera Memory	Same as the initial value setting	○	○
Display On/Off	Off	○	○
Mute On/Off	Off	×	×

Mode/Position	Initial settings	Custom preset	Standby backup
Title Display On/Off	Off	○	○
Title Setting	—	○	○
Mask Setting	—	○	○
Mask Display On/Off	Off	○	○
Mask Color Setting	—	○	○
Alarm On/Off	Off	○	○
Alarm Mode	—	○	○
Alarm Detect Level	—	○	○
E-Flip On/Off	Off	○	○
Privacy Zone On/Off	Off	○	○
Privacy Zone Setting	—	○	○
Key Lock On/Off	Off	○	○
Camera ID	0000h	○	○

Note

The number of times data can be written to EEPROM (by executing Custom Preset) is limited.

Mode Condition

Condition

Mode	Power Off	Initializing	Power On	Freeze On	MemRecall
Address Set	○	○	○	○	○
IF_Clear	○	○	○	○	○
Command Cancel	○	○	○	○	○
Power On/Off	○	○	○	○	○

Lens

Mode	Power Off	Initializing	Power On	Freeze On	MemRecall	Zoom Direct	Focus Direct	ZmFo Direct	Focus Auto
Zoom Tele/Wide/Stop	×	×	○	×	×	×	○	×	○
Zoom Direct	×	×	○	×	×	○	○	×	○
Zoom Focus Direct	×	×	○	×	×	×	×	○	×
Focus Far/Near/Stop	×	×	○	×	×	○	×	×	×
Focus Direct	×	×	○	×	×	○	○	×	×
Focus Auto/Manual	×	×	○	×	×	○	×	×	○
One Push AF	×	×	○	×	×	○	×	×	×
Focus Infinity	×	×	○	×	×	○	×	×	○
Focus Near Limit	×	×	○	×	×	○	×	×	○
AF Sensitivity Normal/Low	×	×	○	×	×	○	○	○	○
AF Mode Norm/Interval/Zoom	×	×	○	×	×	○	○	○	○
AF Activation Time/Interval Setting	×	×	○	×	×	○	○	○	○
Camera Memory Set/Reset	×	×	○	○	×	×	×	×	○
Camera Memory Recall	×	×	○	○	○ a)	×	×	×	○
Lens Initialization	×	×	○	○	×	×	×	×	○

a) × during recalling from key

White Balance

Mode	Power Off	Initializing	Power On	Freeze On	MemRecall	WB AUTO	Indoor	Outdoor	OnePush	ATW	Manual
WB Mode Switchover	×	×	○	×	×	○	○	○	○	○	○
One Push WB	×	×	○	×	×	×	×	×	○	×	×
RGain Setting	×	×	○	×	×	×	×	×	×	×	○
BGain Setting	×	×	○	×	×	×	×	×	×	×	○

Exposure

Mode	Power Off	Initializing	Power On	Freeze On	MemRecall	AE Full Auto	AE Manual	ShutterPriority	Iris Priority	Bright
AE Full Auto	×	×	○	×	×	○	○	○	○	○
AE Manual	×	×	○	×	×	○	○	○	○	○
Shutter Priority	×	×	○	×	×	○	○	○	○	○
Iris Priority	×	×	○	×	×	○	○	○	○	○
Bright	×	×	○	×	×	○	×	○	×	○
Shutter Setting	×	×	○	×	×	×	○	○	×	×
Iris Setting	×	×	○	×	×	×	○	×	○	×
Gain Setting	×	×	○	×	×	×	○	×	×	×
Bright Setting	×	×	○	×	×	×	×	×	×	○
Slow Shutter Auto/Manual	×	×	○	×	×	○	○	○	○	○
Exposure Compensation On/Off	×	×	○	×	×	○	○	○	○	○
Exposure Compensation Setting	×	×	○	×	×	○	○	○	○	○
Backlight On/Off	×	×	○	×	×	○	×	×	×	×
SpotAE On/Off	×	×	○	×	×	○	○	○	○	○
SpotAE Setting	×	×	○	×	×	○	○	○	○	○

Others

Mode	Power Off	Initializing	Power On	Freeze On	MemRecall
Aperture Setting	×	×	○	×	×
LR_Reverse On/Off	×	×	○	×	×
Freeze On/Off	×	×	○	○	×
Picture Effect Setting	×	×	○	×	×
ICR On/Off	×	×	○	×	×
Auto ICR On/Off	×	×	○	×	×
Display On/Off	×	×	○	○	○
Mute On/Off	×	×	○	○	○
Title Setting	×	×	○	○	○
Privacy Zone On/Off/Clear	×	×	○	○	○
Privacy Zone Setting	×	×	○	○	○
Key Lock On/Off	×	×	○	○	○
ID Write	×	×	○	○	○

Command List

VISCA[1]/RS-232C Commands

This Manual outlines an RS-232C control protocol and command list for certain Sony cameras from which control software can be developed.
THIS CONTROL PROTOCOL AND COMMAND LIST IS PROVIDED BY SONY ON AN “AS-IS BASIS” WITHOUT WARRANTY OF ANY KIND. SONY DOES NOT WARRANT ANY PARTICULAR RESULT FROM THE USE OF THIS CONTROL PROTOCOL AND COMMAND LIST AND DISCLAIMS AND EXCLUDES ALL WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO THAT CONTROL PROTOCOL AND COMMAND LIST, INCLUDING, BUT NOT LIMITED TO, ANY OR ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN FACT, SONY SPECIFICALLY ACKNOWLEDGES THAT SOFTWARE DEVELOPED BASED ON THIS CONTROL PROTOCOL AND COMMAND LIST MAY CAUSE MALFUNCTION OR DAMAGE TO HARDWARE AND SOFTWARE USED WITH IT (INCLUDING SONY HARDWARE AND SOFTWARE) AND SPECIFICALLY DISCLAIMS ANY LIABILITY FOR ANY SUCH MALFUNCTION OR DAMAGE. THIS CONTROL PROTOCOL AND COMMAND LIST SHOULD BE USED WITH CAUTION.

Overview of VISCA

In VISCA the device outputting commands, for example, a computer, is called the controller. The device receiving the commands, an FCB camera is called the peripheral device. In VISCA, up to seven peripheral devices like the FCB camera can be connected to one controller using communication conforming to the RS-232C standard. The parameters of RS-232C are as follows:

- Communication speed: 9.6 kbps/19.2 kbps/ 38.4 kbps
- Data bits : 8
- Start bit : 1
- Stop bit : 1/2
- Non parity

Flow control using XON/XOFF, RTS/CTS, etc., is not supported.

1) VISCA is a protocol which controls consumer camcorders developed by Sony. “VISCA” is a trademark of Sony Corporation.

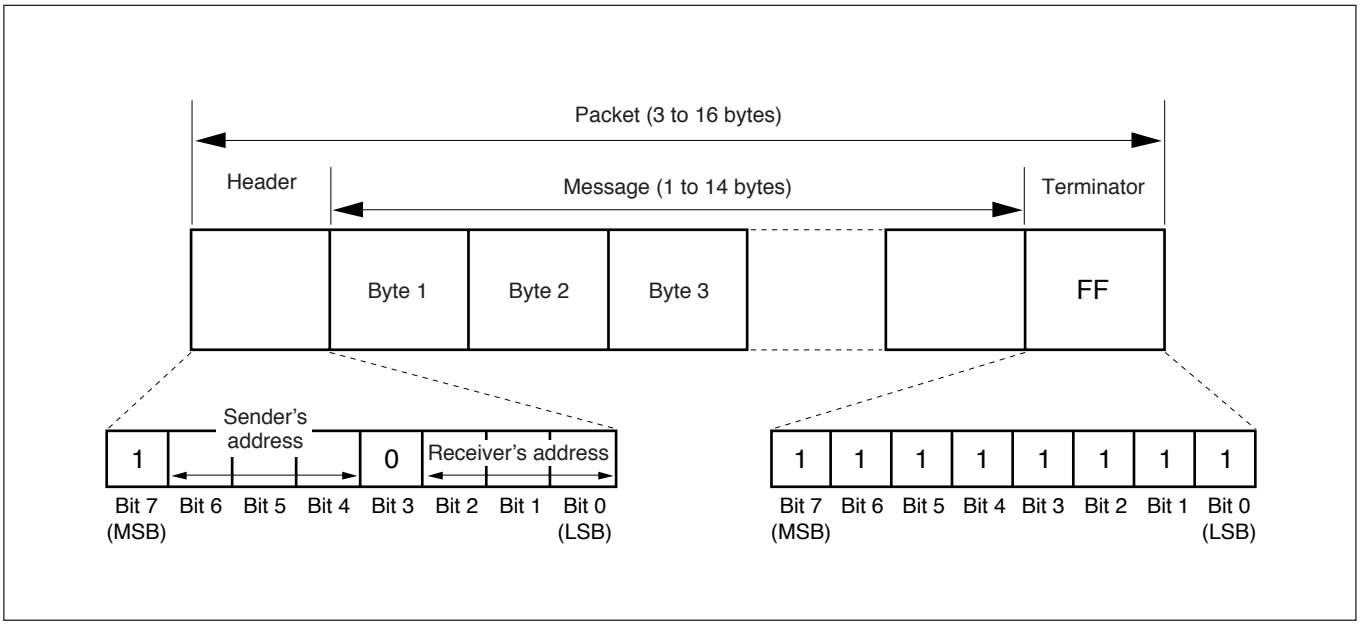
VISCA Communication Specifications

VISCA Packet Structure

The basic unit of VISCA communication is called a packet. The first byte of the packet is called the header and comprises the sender's and receiver's addresses. For example, the header of the packet sent to the FCB camera assigned address 1 from the controller (address 0) is hexadecimal 81H. The packet sent to the camera assigned address 2 is 82H. In the command list, as the header is 8X, input the address of the camera at X. The header of the reply packet from the camera assigned address 1 is 90H. The packet from the camera assigned address 2 is A0H.

Some of the commands for setting cameras can be sent to all devices at one time (broadcast). In the case of broadcast, the header should be hexadecimal 88H.

When the terminator is FFH, it signifies the end of the packet.



Command and Inquiry

- **Command**
  Sends operational commands to the FCB camera.
- **Inquiry**
  Used for inquiring about the current state of the FCB camera.

	Command Packet	Note
Inquiry	8X QQ RR ... FF	QQ[1] = Command/Inquiry, RR[2] = category code

[1] QQ = 01 (Command), 09 (Inquiry)

[2] RR = 00 (Interface), 04 (camera 1), 06 (Pan/Tilter), 07 (camera 2)

X = 1 to 7: FCB camera address

Responses for Commands and Inquiries

● **ACK message**
Returned by the FCB camera when it receives a command. No ACK message is returned for inquiries.

● **Completion message**
Returned by the FCB camera when execution of commands or inquiries is completed. In the case of inquiry commands, it will contain reply data for the inquiry after the 3rd byte of the packet. If the ACK message is omitted, the socket number will contain 0.

	Reply Packet	Note
Ack	X0 4Y FF	Y = socket number
Completion (commands)	X0 5Y FF	Y = socket number
Completion (Inquiries)	X0 5Y ... FF	Y = socket number

X = 9 to F: FCB camera address + 8

● **Error message**
When a command or inquiry command could not be executed or failed, an error message is returned instead of the completion message.

Error Packet	Description
X0 6Y 01 FF	Message length error (>14 bytes)
X0 6Y 02 FF	Syntax Error
X0 6Y 03 FF	Command buffer full
X0 6Y 04 FF	Command cancelled
X0 6Y 05 FF	No socket (to be cancelled)
X0 6Y 41 FF	Command not executable

X = 9 to F: FCB camera address + 8, Y = socket number

Socket Number

When command messages are sent to the FCB camera, it is normal to send the next command message after waiting for the completion message or error message to return. However to deal with advanced uses, the camera has two buffers (memories) for commands, so that up to two commands including the commands currently being executed can be received. When the camera receives commands, it notifies the sender which command buffer was used using the socket number of the ACK message. As the completion message or error message also has a socket number, it indicates which command has ended. Even when two command buffers are being used at any one time, a camera management command and some inquiry messages can be executed.
The ACK message is not returned for these commands and inquiries, and only the completion message of socket number 0 is returned.

Command Execution Cancel

To cancel a command which has already been sent, send the Cancel command as the next command. To cancel one of any two commands which have been sent, use the cancel message.

	Cancel Packet	Note
Cancel	8X 2Y FF	Y = socket number

X = 1 to 7: FCB camera address, Y = socket number

An error message will be returned for this command, but this is not a mistake. This message indicates that the command has been canceled.

VISCA Device Setting Command

Before starting control of the FCB camera, be sure to send the Address command and the IF_Clear command using the broadcast function.

For VISCA Network Administration

● **Address**
Sets an address of a peripheral device. Use when initializing the network and when receiving the network change message indicated below.

● **Network Change**
Sent from the peripheral device to the controller when a device is removed from or added to the network. The address must be re-set when this message is received.

	Packet	Note
Address	88 30 01 FF	Always broadcasted.
Network Change	X0 38 FF	

X = 9 to F: FCB camera address + 8

VISCA Interface Command

● **IF_Clear**
Clears the command buffers in the FCB camera and cancels the command currently being executed.

	Command Packet	Reply Packet	Note
IF_Clear	8X 01 00 01FF	X0 50 FF	
IF_Clear (broadcast)	88 01 00 01 FF	88 01 00 01 FF	

X = 1 to 7: FCB camera address (For inquiry packet)
X = 9 to F: FCB camera address +8 (For reply packet)

VISCA Interface and Inquiry

● **CAM_VersionInq**
Returns information on the VISCA interface.

Inquiry	Inquiry Packet	Reply Packet	Description
CAM_VersionInq	8X 09 00 02 FF	Y0 50 GG GG	GGGG = Vender ID
	HH HH JJ JJ	(0020: Sony)	
		KK FF	HHHH = Model ID
			0440 = FCB-PV480
			JJJJ = ROM revision
			KK = Maximum socket # (02)

X = 1 to 7: FCB camera address (For inquiry packet)
X = 9 to F: FCB camera address +8 (For reply packet)

VISCA Command/ACK Protocol

Command	Command Message	Reply Message	Comments
General Command	81 01 04 38 02 FF (Example)	90 41 FF (ACK)+90 51 FF (Completion) 90 42 FF 90 52 FF	Returns ACK when a command has been accepted, and Completion when a command has been executed.
	81 01 04 38 FF (Example)	90 60 02 FF (Syntax Error)	Accepted a command which is not supported or a command lacking parameters.
	81 01 04 38 02 FF (Example)	90 60 03 FF (Command Buffer Full)	There are two commands currently being executed, and the command could not be accepted.
	81 01 04 08 02 FF (Example)	90 61 41 FF (Command Not Executable) 90 62 41FF	Could not execute the command in the current mode.
Inquiry Command	81 09 04 38 FF (Example)	90 50 02 FF (Completion)	ACK is not returned for the inquiry command.
	81 09 05 38 FF (Example)	90 60 02 FF (Syntax Error)	Accepted an incompatible command.
Address Set	88 30 01 FF	88 30 02 FF	Returned the device address to +1.
IF_Clear (Broadcast)	88 01 00 01 FF	88 01 00 01 FF	Returned the same command.
IF_Clear (For x)	8x 01 00 01 FF	z0 50 FF (Completion)	ACK is not returned for this command.
Command Cancel	8x 2y FF	z0 6y 04 FF (Command Canceled)	Returned when the command of the socket specified is canceled. Completion for the command canceled is not returned.
		z0 6y 05 FF (No Socket)	Returned when the command of the specified socket has already been completed or when the socket number specified is wrong.

VISCA Camera-Issued Messages

ACK/Completion Messages

	Command Messages	Comments
ACK	z0 4y FF (y:Socket No.)	Returned when the command is accepted.
Completion	z0 5y FF (y:Socket No.)	Returned when the command has been executed.

z = Device address + 8

Error Messages

	Command Messages	Comments
Syntax Error	z0 60 02 FF	Returned when the command format is different or when a command with illegal command parameters is accepted.
Command Buffer Full	z0 60 03 FF	Indicates that two sockets are already being used (executing two commands) and the command could not be accepted when received.
Command Canceled	z0 6y 04 FF (y:Socket No.)	Returned when a command which is being executed in a socket specified by the cancel command is canceled. The completion message for the command is not returned.
No Socket	z0 6y 05 FF (y:Socket No.)	Returned when no command is executed in a socket specified by the cancel command, or when an invalid socket number is specified.
Command Not Executable	z0 6y 41 FF (y:Socket No.)	Returned when a command cannot be executed due to current conditions. For example, when commands controlling the focus manually are received during auto focus.

Network Change Message

	Command Message	Comments
Network Change	z0 38 FF	Issued when power is being routed.

FCB Camera Commands

Command List (1/4)

Command Set	Command	Command Packet	Comments
AddressSet	Broadcast	88 30 01 FF	
IF_Clear	Broadcast	88 01 00 01 FF	
CommandCancel		8x 2p FF	p: Socket No.(=1or2)
CAM_Power	On	8x 01 04 00 02 FF	Power ON/OFF
	Off	8x 01 04 00 03 FF	
CAM_Zoom	Stop	8x 01 04 07 00 FF	
	Tele(Standard)	8x 01 04 07 02 FF	
	Wide(Standard)	8x 01 04 07 03 FF	
	Tele(Variable)	8x 01 04 07 2p FF	p=0 (Low) to 7 (High)
	Wide(Variable)	8x 01 04 07 3p FF	
	Direct	8x 01 04 47 0p 0q 0r 0s FF	pqrs: Zoom Position
CAM_Focus	Stop	8x 01 04 08 00 FF	
	Far(Standard)	8x 01 04 08 02 FF	
	Near(Standard)	8x 01 04 08 03 FF	
	Far(Variable)	8x 01 04 08 2p FF	p=0 (Low) to 7 (High)
	Near(Variable)	8x 01 04 08 3p FF	
	Direct	8x 01 04 48 0p 0q 0r 0s FF	pqrs: Focus Position
	Auto Focus	8x 01 04 38 02 FF	AF ON/OFF
	Manual Focus	8x 01 04 38 03 FF	
	Auto/Manual	8x 01 04 38 10 FF	
	One Push Trigger	8x 01 04 18 01 FF	One Push AF Trigger
	Infinity	8x 01 04 18 02 FF	Forced infinity
	Near Limit	8x 01 04 28 0p 0q 0r 0s FF	pqrs: Focus Near Limit Position
AF Sensitivity	Normal	8x 01 04 58 02 FF	AF Sensitivity High/Low
	Low	8x 01 04 58 03 FF	
CAM_AFMode	Normal AF	8x 01 04 57 00 FF	AF Movement Mode
	Interval AF	8x 01 04 57 01 FF	
	Zoom Trigger AF	8x 01 04 57 02 FF	
	Active/Interval Time	8x 01 04 27 0p 0q 0r 0s FF	pq: Movement Time, rs: Interval
CAM_ZoomFocus	Direct	8x 01 04 47 0p 0q 0r 0s 0t 0u 0v 0w FF	pqrs: Zoom Position tuvw: Focus Position
CAM_Initialize	Lens	8x 01 04 19 01 FF	Lens Initialization Start

Command List (2/4)

Command Set	Command	Command Packet	Comments
CAM_WB	Auto	8x 01 04 35 00 FF	Normal Auto
	Indoor	8x 01 04 35 01 FF	Indoor mode
	Outdoor	8x 01 04 35 02 FF	Outdoor mode
	One Push WB	8x 01 04 35 03 FF	One Push WB mode
	ATW	8x 01 04 35 04 FF	Auto Tracing White Balance
	Manual	8x 01 04 35 05 FF	Manual Control mode
	One Push Trigger	8x 01 04 10 05 FF	One Push WB Trigger
CAM_RGain	Reset	8x 01 04 03 00 FF	Manual Control of R Gain
	Up	8x 01 04 03 02 FF	
	Down	8x 01 04 03 03 FF	
	Direct	8x 01 04 43 00 00 0p 0q FF	pq: R Gain
CAM_BGain	Reset	8x 01 04 04 00 FF	Manual Control of B Gain
	Up	8x 01 04 04 02 FF	
	Down	8x 01 04 04 03 FF	
	Direct	8x 01 04 44 00 00 0p 0q FF	pq: B Gain
CAM_AE	Full Auto	8x 01 04 39 00 FF	Automatic Exposure mode
	Manual	8x 01 04 39 03 FF	Manual Control mode
	Shutter Priority	8x 01 04 39 0A FF	Shutter Priority Automatic Exposure mode
	Iris Priority	8x 01 04 39 0B FF	Iris Priority Automatic Exposure mode
	Bright	8x 01 04 39 0D FF	Bright Mode (Manual control)
CAM_SlowShutter	Auto	8x 01 04 5A 02 FF	Auto Slow Shutter ON/OFF
	Manual	8x 01 04 5A 03 FF	
CAM_Shutter	Reset	8x 01 04 0A 00 FF	Shutter Setting
	Up	8x 01 04 0A 02 FF	
	Down	8x 01 04 0A 03 FF	
	Direct	8x 01 04 4A 00 00 0p 0q FF	pq: Shutter Position
CAM_Iris	Reset	8x 01 04 0B 00 FF	Iris Setting
	Up	8x 01 04 0B 02 FF	
	Down	8x 01 04 0B 03 FF	
	Direct	8x 01 04 4B 00 00 0p 0q FF	pq: Iris Position
CAM_Gain	Reset	8x 01 04 0C 00 FF	Gain Setting
	Up	8x 01 04 0C 02 FF	
	Down	8x 01 04 0C 03 FF	
	Direct	8x 01 04 4C 00 00 0p 0q FF	pq: Gain Position
CAM_Bright	Reset	8x 01 04 0D 00 FF	Bright Setting
	Up	8x 01 04 0D 02 FF	
	Down	8x 01 04 0D 03 FF	
	Direct	8x 01 04 4D 00 00 0p 0q FF	pq: Bright Position
CAM_ExpComp	On	8x 01 04 3E 02 FF	Exposure Compensation ON/OFF
	Off	8x 01 04 3E 03 FF	
	Reset	8x 01 04 0E 00 FF	Exposure Compensation Amount Setting
	Up	8x 01 04 0E 02 FF	
	Down	8x 01 04 0E 03 FF	
	Direct	8x 01 04 4E 00 00 0p 0q FF	pq: ExpComp Position
CAM_Backlight	On	8x 01 04 33 02 FF	Back Light Compensation ON/OFF
	Off	8x 01 04 33 03 FF	
CAM_SpotAE	On	8x 01 04 59 02 FF	Spot Automatic Exposure Setting
	Off	8x 01 04 59 03 FF	
	Position	8x 01 04 29 0p 0q 0r 0s FF	pq: X (0 to F), rs: Y (0 to F)

Command List (3/4)

Command Set	Command	Command Packet	Comments
CAM_Aperture	Reset	8x 01 04 02 00 FF	Aperture Control
	Up	8x 01 04 02 02 FF	
	Down	8x 01 04 02 03 FF	
	Direct	8x 01 04 42 00 00 0p 0q FF	pq: Aperture Gain
CAM_LR_Reverse	On	8x 01 04 61 02 FF	Mirror Image ON/OFF
	Off	8x 01 04 61 03 FF	
CAM_Freeze	On	8x 01 04 62 02 FF	Still Image ON/OFF
	Off	8x 01 04 62 03 FF	
CAM_PictureEffect	Off	8x 01 04 63 00 FF	Picture Effect Setting
	B&W	8x 01 04 63 04 FF	
CAM_PictureFlip	On	8x 01 04 66 02 FF	Picture flip ON/OFF
	Off	8x 01 04 66 03 FF	
CAM_ICR	On	8x 01 04 01 02 FF	Infrared Mode ON/OFF [a)]
	Off	8x 01 04 01 03 FF	
CAM_AutoICR	On	8x 01 04 51 02 FF	Auto Infrared Mode ON/OFF [a)]
	Off	8x 01 04 51 03 FF	
CAM_Memory	Reset	8x 01 04 3F 00 0p FF	p: Memory Number (=0 to 5)
	Set	8x 01 04 3F 01 0p FF	
	Recall	8x 01 04 3F 02 0p FF	
CAM_CUSTOM	Reset	8x 01 04 3F 00 7F FF	Starts in this mode at Power ON.
	Set	8x 01 04 3F 01 7F FF	
	Recall	8x 01 04 3F 02 7F FF	
CAM_MemSave	Write	8x 01 04 23 0X 0p 0p 0q 0q FF	X: 00 to 07 (Address) Total 16 Byte ppqq: 0x0000 to 0xFFFF (Data)
CAM_Display	On	8x 01 04 15 02 FF (8x 01 06 06 02 FF)	Display ON/OFF
	Off	8x 01 04 15 03 FF (8x 01 06 06 03 FF)	
	On/Off	8x 01 04 15 10 FF (8x 01 06 06 10 FF)	
CAM_Title	Title Set1	8x 01 04 73 00 mm nn pp qq 00 00 00 00 00 00 FF	mm: Vposition, nn: Hposition pp: Color, qq: Blink
	Title Set2	8x 01 04 73 01 mm nn pp qq rr ss tt uu vv ww FF	mnpqrstuvw: Setting of Display Characters (1st to 10st Character)
	Title Set3	8x 01 04 73 02 mm nn pp qq rr ss tt uu vv ww FF	mnpqrstuvw: Setting of Display Characters (11th to 20th Character)
	Title Clear	8x 01 04 74 00 FF	Title Setting Clear
	On	8x 01 04 74 02 FF	Title Display ON/OFF
	Off	8x 01 04 74 03 FF	
CAM_Mute	On	8x 01 04 75 02 FF	Mute ON/OFF
	Off	8x 01 04 75 03 FF	
	On/Off	8x 01 04 75 10 FF	

a) Some models do not support Infrared Mode.

Command List (4/4)

Command Set	Command	Command Packet	Comments
CAM_PrivacyZone	SetMask	8x 01 04 76 mm nn 0r 0r 0s 0s FF	mm: Mask Settings nn 00: Modify, 01: New rr: W, ss:H
	Display	8x 01 04 77 pp pp pp pp FF	Mask Display ON/OFF pp pp pp pp: Mask Settings (0: OFF, 1: ON)
	SetMask Color	8x 01 04 78 pp pp pp pp qq rr FF	pp pp pp pp: Mask Color Settings qq: “0” Color Settings rr: “1” Color Settings
	SetPan TiltAngle	8x 01 04 79 0p 0p 0p 0q 0q 0q FF	Pan/Tilt Angle Settings ppp: Pan qqq: Tilt
	SetPTZMask	8x 01 04 7B mm 0p 0p 0p 0q 0q 0q 0r 0r 0r 0r FF	Pan/Tilt/Zoom Settings for Mask mm: Mask Setings ppp: Pan, qqq: Tilt, rrrr: Zoom
	Non_InterlockMask	8x 01 04 6F mm 0p 0p 0q 0q 0r 0r 0s 0s FF	mm: Non-Interlock Mask Settings pp: X, qq: Y, rr: W, ss: H
	GridOn	8x 01 04 7C 02 FF	Grid Display On
	GridOff	8x 01 04 7C 03 FF	Grid/Center Line Display Off
CAM_KeyLock	Off	8x 01 04 17 00 FF	Camera Control Enable/Disable
	On	8x 01 04 17 02 FF	
CAM_IDWrite		8x 01 04 22 0p 0q 0r 0s FF	pqrs: Camera ID (=0000 to FFFF)
CAM_ExternalLock	INT	8x 01 04 55 00 FF	Internal mode
	Line Lock	8x 01 04 55 01 FF	Line Lock mode
CAM_Alarm	On	8x 01 04 6B 02 FF	Alarm ON/OFF
	Off	8x 01 04 6B 03 FF	
	SetMode	8x 01 04 6C pp FF	PP: Mode Settings 00 Focus Move Detection (The rest position is fixed.) 01 Focus Move Detection (The rest position is reset.) 02 AE Move Detection (The rest value is fixed.) 03 AE Move Detection (The rest value is reset.) 0C Day/Night detection
	SetDayNightLevel	8x 01 04 6D 0p 0p 0p 0q 0q 0q FF	ppp: Day Detect Level Setting qqq: Night Detect Level Setting
	Alarm (Reply)	y0 07 04 6B 01 FF	Detect Level “Low” → ”High”
		y0 07 04 6B 00 FF	Detect Level “High” → ”Low”
CAM_ContinuesZoomPosReply	On	8x 01 04 69 02 FF	ZoomPos continuous ON/OFF
	Off	8x 01 04 69 03 FF	
	(Reply)	y0 07 04 69 0p 0p 0q 0q 0q 0q FF	pp: FD-Zoom Position * 00 setting when mode is Combine qqqq: Zoom Position
CAM_ReplyIntervalTimeSet		8x 01 04 6A 00 00 0p 0p FF	pp: Interval Time [V timing]
CAM_RegisterValue		8x 01 04 24 mm 0p 0p FF	mm: Register # (=00-7F) pp: Register Value (=00-FF)

Inquiry Command List (1/2)

Inquiry Command	Command Packet	Inquiry Packet	Comments
CAM_PowerInq	8x 09 04 00 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_ZoomPosInq	8x 09 04 47 FF	y0 50 0p 0q 0r 0s FF	pqrs: Zoom Position
CAM_FocusModeInq	8x 09 04 38 FF	y0 50 02 FF	Auto Focus
		y0 50 03 FF	Manual Focus
CAM_FocusPosInq	8x 09 04 48 FF	y0 50 0p 0q 0r 0s FF	pqrs: Focus Position
CAM_FocusNearLimitInq	8x 09 04 28 FF	y0 50 0p 0q 0r 0s FF	pqrs: Focus Near Limit Position
CAM_AFSensitivityInq	8x 09 04 58 FF	y0 50 02 FF	AF Sensitivity Normal
		y0 50 03 FF	AF Sensitivity Low
CAM_AFModeInq	8x 09 04 57 FF	y0 50 00 FF	Normal AF
		y0 50 01 FF	Interval AF
		y0 50 02 FF	Zoom Trigger AF
CAM_AFTimeSettingInq	8x 09 04 27 FF	y0 50 0p 0q 0r 0s FF	pq: Movement Time, rs: Interval
CAM_WBModeInq	8x 09 04 35 FF	y0 50 00 FF	Auto
		y0 50 01 FF	In Door
		y0 50 02 FF	Out Door
		y0 50 03 FF	One Push WB
		y0 50 04 FF	ATW
		y0 50 05 FF	Manual
CAM_RGainInq	8x 09 04 43 FF	y0 50 00 00 0p 0q FF	pq: R Gain
CAM_BGainInq	8x 09 04 44 FF	y0 50 00 00 0p 0q FF	pq: B Gain
CAM_AEModeInq	8x 09 04 39 FF	y0 50 00 FF	Full Auto
		y0 50 03 FF	Manual
		y0 50 0A FF	Shutter Priority
		y0 50 0B FF	Iris Priority
		y0 50 0D FF	Bright
CAM_SlowShutterModeInq	8x 09 04 5A FF	y0 50 02 FF	Auto
		y0 50 03 FF	Manual
CAM_ShutterPosInq	8x 09 04 4A FF	y0 50 00 00 0p 0q FF	pq: Shutter Position
CAM_IrisPosInq	8x 09 04 4B FF	y0 50 00 00 0p 0q FF	pq: Iris Position
CAM_GainPosInq	8x 09 04 4C FF	y0 50 00 00 0p 0q FF	pq: Gain Position
CAM_BrightPosInq	8x 09 04 4D FF	y0 50 00 00 0p 0q FF	pq: Bright Position
CAM_ExpCompModeInq	8x 09 04 3E FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_ExpCompPosInq	8x 09 04 4E FF	y0 50 00 00 0p 0q FF	pq: ExpComp Position
CAM_BacklightModeInq	8x 09 04 33 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_SpotAEModeInq	8x 09 04 59 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_SpotAEPosInq	8x 09 04 29 FF	y0 50 0p 0q 0r 0s FF	pq: X position, rs: Y position
CAM_ApertureInq	8x 09 04 42 FF	y0 50 00 00 0p 0q FF	pq: Aperture Gain

Inquiry Command List (2/2)

Inquiry Command	Command Packet	Inquiry Packet	Comments
CAM_LR_ReverseModeInq	8x 09 04 61 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_FreezeModeInq	8x 09 04 62 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_PictureEffectModeInq	8x 09 04 63 FF	y0 50 00 FF	Off
		y0 50 04 FF	B&W
CAM_PictureFlipModeInq	8x 09 04 66 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_ICRModeInq	8x 09 04 01 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_AutoICRModeInq	8x 09 04 51 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_MemoryInq	8x 09 04 3F FF	y0 50 pp FF	pp: Last Recall Memory No.
CAM_MemSaveInq	8x 09 04 23 0X FF	y0 50 0p 0p 0q 0q FF	X: 00 to 07 (Address) ppqq: 0x0000 to 0xFFFF (Data)
CAM_DisplayModeInq	8x 09 04 15 FF (8x 09 06 06 FF)	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_TitleDisplayModeInq	8x 09 04 74 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_MuteModeInq	8x 09 04 75 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_PrivacyDisplayInq	8x 09 04 77 FF	y0 50 pp pp pp pp FF	pp pp pp pp: Mask Display (0: OFF, 1: ON)
CAM_PrivacyPanTiltInq	8x 09 04 79 FF	y0 50 0p 0p 0p 0q 0q 0q FF	ppp: Pan qqq: Tilt
CAM_PrivacyPTZInq	8x 09 04 7B mm FF	y0 50 0p 0p 0p 0q 0q 0q 0r 0r 0r 0r FF	mm: Mask Settings ppp: Pan qqq: Tilt rrrr: Zoom
CAM_PrivacyMonitorInq	8x 09 04 6F FF	y0 50 pp pp pp pp FF	pp pp pp pp: Mask is displayed now
CAM_KeyLockInq	8x 09 04 17 FF	y0 50 00 FF	Off
		y0 50 02 FF	On
CAM_IDInq	8x 09 04 22 FF	y0 50 0p 0q 0r 0s FF	pqrs: Camera ID
CAM_VersionInq	8x 09 00 02 FF	y0 50 00 20 mn pq rs tu vw FF	mnpq: Model Code (04xx) rstu: ROM version vw: Socket Number (=02)
CAM_AlarmInq	8x 09 04 6B FF	y0 50 02 FF y0 50 03 FF	On Off
CAM_AlarmModeInq	8x 09 04 6C FF	y0 50 pp FF	pp: Alarm Mode
CAM_AlarmDayNightLevelInq	8x 09 04 6D FF	y0 50 0p 0p 0p 0p 0q 0q 0q 0r 0r 0r FF	ppp: Day Detect Level qqq: Night Detect Level rrr: Current AE Level
CAM_AlarmDetectLevelInq	8x 09 04 6E FF	y0 50 01 FF	Detect Level “High”
		y0 50 00 FF	Detect Level “Low”
CAM_ContinuesZoomPosReplyModeInq	8x 09 04 69 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_ReplyIntervalTimeInq	8x 09 04 6A FF	y0 50 00 00 0p 0p FF	pp: Interval Time
CAM_RegisterValueInq	8x 09 04 24 mm FF	y0 50 0p 0p FF	mm: Register # pp: Register Value

Block Inquiry Command List

Lens Control System Inquiry Commands ..... Command Packet 8x 09 7E 7E 00 FF

Byte	Bit	Comments
0	7	Destination Address
	6	
	5	
	4	
	3	Source Address
	2	
	1	
	0	
1	7	0 Completion Message (50h)
	6	1
	5	0
	4	1
	3	0
	2	0
	1	0
	0	0
2	7	0
	6	0
	5	0
	4	0
	3	Zoom Position (HH)
	2	
	1	
	0	
3	7	0
	6	0
	5	0
	4	0
	3	Zoom Position (HL)
	2	
	1	
	0	
4	7	0
	6	0
	5	0
	4	0
	3	Zoom Position (LH)
	2	
	1	
	0	
5	7	0
	6	0
	5	0
	4	0
	3	Zoom Position (LL)
	2	
	1	
	0	

Byte	Bit	Comments
6	7	0
	6	0
	5	0
	4	0
	3	Focus Near Limit (H)
	2	
	1	
	0	
7	7	0
	6	0
	5	0
	4	0
	3	Focus Near Limit (L)
	2	
	1	
	0	
8	7	0
	6	0
	5	0
	4	0
	3	Focus Position (HH)
	2	
	1	
	0	
9	7	0
	6	0
	5	0
	4	0
	3	Focus Position (HL)
	2	
	1	
	0	
10	7	0
	6	0
	5	0
	4	0
	3	Focus Position (LH)
	2	
	1	
	0	
11	7	0
	6	0
	5	0
	4	0
	3	Focus Position (LL)
	2	
	1	
	0	

Byte	Bit	Comments
12	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	0
	0	0
13	7	0
	6	0
	5	0
	4	0: Normal 1: Interval
	3	2: Zoom Trigger
	2	AF Sensitivity 0: Slow 1: Normal
	1	0
	0	Focus Mode 0:Manual 1:Auto
14	7	0
	6	0
	5	0
	4	0
	3	Low Contrast Detection 1: Yes 0: No
	2	Camera Memory Recall 1: Executing 0: Stopped
	1	Focus Command 1: Executing 0: Stopped
	0	Zoom Command 1: Executing 0: Stopped
15	7	1 Terminator (FFh)
	6	1
	5	1
	4	1
	3	1
	2	1
	1	1
	0	1

Camera Control System Inquiry Commands ..... Command Packet 8x 09 7E 7E 01 FF

Byte	Bit	Comments
0	7	Destination Address
	6	
	5	
	4	
	3	Source Address
	2	
	1	
	0	
1	7	0 Completion Message (50h)
	6	1
	5	0
	4	1
	3	0
	2	0
	1	0
	0	0
2	7	0
	6	0
	5	0
	4	0
	3	R Gain (H)
	2	
	1	
	0	
3	7	0
	6	0
	5	0
	4	0
	3	R Gain (L)
	2	
	1	
	0	
4	7	0
	6	0
	5	0
	4	0
	3	B Gain (H)
	2	
	1	
	0	
5	7	0
	6	0
	5	0
	4	0
	3	B Gain (L)
	2	
	1	

Byte	Bit	Comments
6	7	0
	6	0
	5	0
	4	0
	3	0
	2	WB Mode
	1	
	0	
7	7	0
	6	0
	5	0
	4	0
	3	Aperture Gain
	2	
	1	
	0	
8	7	0
	6	0
	5	0
	4	Exposure Mode
	3	
	2	
	1	
	0	
9	7	0
	6	0
	5	0
	4	0
	3	Spot AE 1: On 0: Off
	2	Back Light 1:On 0:Off
	1	Exposure Comp. 1:On 0:Off
	0	Slow Shutter 1:Auto 0:Manual
10	7	0
	6	0
	5	0
	4	Shutter Position
	3	
	2	
	1	
	0	
11	7	0
	6	0
	5	0
	4	Iris Position
	3	
	2	
	1	
	0	

Byte	Bit	Comments
12	7	0
	6	0
	5	0
	4	0
	3	Gain Position
	2	
	1	
	0	
13	7	0
	6	0
	5	0
	4	Bright Position
	3	
	2	
	1	
	0	
14	7	0
	6	0
	5	0
	4	0
	3	Exposure Comp. Position
	2	
	1	
	0	
15	7	1 Terminator (FFh)
	6	1
	5	1
	4	1
	3	1
	2	1
	1	1
	0	1

Other Inquiry Commands ..... Command Packet 8x 09 7E 7E 02 FF

Byte	Bit	Comments
0	7	Destination Address
	6	
	5	
	4	
	3	Source Address
	2	
	1	
	0	
1	7	0 Completion Message (50h)
	6	1
	5	0
	4	1
	3	0
	2	0
	1	0
	0	0
2	7	0
	6	0
	5	0
	4	0
	3	0
	2	Auto ICR 1: On 0: Off
	1	Key Lock 1: On 0: Off
	0	Power 1:On 0:Off
3	7	0
	6	0
	5	0
	4	ICR 1: On 0: Off
	3	Freeze 1:On 0:Off
	2	LR Reverse 1:On 0:Off
	1	0
	0	0
4	7	0
	6	0
	5	Privacy Zone 1: On 0: Off
	4	Mute 1: On 0: Off
	3	Title Display 1: On 0: Off
	2	Display 1: On 0: Off
	1	0
	0	0
5	7	0
	6	0
	5	0
	4	0
	3	Picture Effect Mode
	2	
	1	
	0	

Byte	Bit	Comments
6	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	0
	0	0
7	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	0
	0	0
8	7	0
	6	0
	5	0
	4	0
	3	Camera ID (HH)
	2	
	1	
	0	
9	7	0
	6	0
	5	0
	4	0
	3	Camera ID (HL)
	2	
	1	
	0	
10	7	0
	6	0
	5	0
	4	0
	3	Camera ID (LH)
	2	
	1	
	0	
11	7	0
	6	0
	5	0
	4	0
	3	Camera ID (LL)
	2	
	1	
	0	

Byte	Bit	Comments
12	7	0
	6	0
	5	0
	4	Memory 1: Provided 0: Not provided
	3	Clock 1: Provided 0: Not provided
	2	ICR 1: Provided 0: Not provided
	1	0
	0	Frame rate 1:25fps, 0:29.97fps
13	7	0
	6	0
	5	0
	4	0
	3	0
	2	
	1	
	0	
14	7	0
	6	0
	5	0
	4	0
	3	0
	2	
	1	
	0	
15	7	1 Terminator (FFh)
	6	1
	5	1
	4	1
	3	1
	2	1
	1	1
	0	1

Enlargement Function Query Command ..... Command Packet 8x 09 7E 7E 03 FF

Byte	Bit	Comments
0	7	Destination Address
	6	
	5	
	4	
	3	Source Address
	2	
	1	
	0	
1	7	0 Completion Message (50h)
	6	1
	5	0
	4	1
	3	0
	2	0
	1	0
	0	0
2	7	0
	6	0
	5	0
	4	0
	3	0
	2	
	1	
	0	
3	7	0
	6	0
	5	0
	4	0
	3	0
	2	
	1	
	0	
4	7	0
	6	0
	5	0
	4	0
	3	AF Activation Time (H)
	2	
	1	
	0	
5	7	0
	6	0
	5	0
	4	0
	3	AF Activation Time (L)
	2	
	1	
	0	

Byte	Bit	Comments
6	7	0
	6	0
	5	0
	4	0
	3	AF Interval Time (H)
	2	
	1	
	0	
7	7	0
	6	0
	5	0
	4	0
	3	AF Interval Time (L)
	2	
	1	
	0	
8	7	0
	6	0
	5	0
	4	0
	3	SpotAE Position (X)
	2	
	1	
	0	
9	7	0
	6	0
	5	0
	4	0
	3	SpotAE Position (Y)
	2	
	1	
	0	
10	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	Alarm (1: On, 0: Off)
	0	Picture flip (1: On, 0: Off)

Byte	Bit	Comments
11	7	0
	6	0
	5	0
	4	0
	3	0
	2	Advanced Privacy (1: Provided, 0: Not provided)
	1	Alarm (1: Provided, 0: Not provided)
	0	Picture flip (1: Provided, 0: Not provided)
12	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	0
	0	0
13	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	0
	0	0
14	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	0
	0	0
15	7	1 Terminator (FFh)
	6	1
	5	1
	4	1
	3	1
	2	1
	1	1
	0	1

VISCA Command Setting Values

Exposure Control (1/2)

		30fps	25fps
Shutter Speed	15	10000	10000
	14	6000	6000
	13	4000	3500
	12	3000	2500
	11	2000	1750
	10	1500	1250
	0F	1000	1000
	0E	725	600
	0D	500	425
	0C	350	300
	0B	250	215
	0A	180	150
	09	125	120
	08	100	100
	07	90	75
	06	60	50
	05	30	25
	04	15	12
	03	8	6
	02	4	3
	01	2	2
	00	1	1
Iris	11	F1.4	
	10	F1.6	
	0F	F2.0	
	0E	F2.4	
	0D	F2.8	
	0C	F3.4	
	0B	F4.0	
	0A	F4.8	
	09	F5.6	
	08	F6.8	
	07	F8.0	
	06	F9.6	
	05	F11	
	04	F14	
	03	F16	
	02	F19	
	01	F22	
	00	CLOSE	

Gain	0F	28 dB
	0E	26 dB
	0D	24 dB
	0C	22 dB
	0B	20 dB
	0A	18 dB
	09	16 dB
	08	14 dB
	07	12 dB
	06	10 dB
	05	8 dB
	04	6 dB
	03	4 dB
	02	+2 dB
	01	0
	00	–3 dB

Exposure Control (2/2)

		IRIS	GAIN
Bright	1F	F1.4	28 dB
	1E	F1.4	26 dB
	1D	F1.4	24 dB
	1C	F1.4	22 dB
	1B	F1.4	20 dB
	1A	F1.4	18 dB
	19	F1.4	16 dB
	18	F1.4	14 dB
	17	F1.4	12 dB
	16	F1.4	10 dB
	15	F1.4	8 dB
	14	F1.4	6 dB
	13	F1.4	4 dB
	12	F1.4	2 dB
	11	F1.4	0
	10	F1.6	0
	0F	F2.0	0
	0E	F2.4	0
	0D	F2.8	0
	0C	F3.4	0
	0B	F4.0	0
	0A	F4.8	0
	09	F5.6	0
	08	F6.8	0
	07	F8.0	0
	06	F9.6	0
	05	F11	0
	04	F14	0
	03	F16	0
	02	F19	0
	01	F22	0
	00	CLOSE	0
Exposure Comp.	0E	7	10.5 dB
	0D	6	9 dB
	0C	5	7.5 dB
	0B	4	6 dB
	0A	3	4.5 dB
	09	2	3 dB
	08	1	1.5 dB
	07	0	0 dB
	06	–1	–1.5 dB
	05	–2	–3 dB
	04	–3	–4.5 dB
	03	–4	–6 dB
	02	–5	–7.5 dB
	01	–6	–9 dB
	00	–7	–10.5 dB

Zoom Ratio and Zoom Position (for reference)

Zoom Position 0000 (WIDE end) ~ 4000 (TELE end)

Zoom Ratio	Optical Zoom position data
×1	0000
×2	1804
×3	2296
×4	28F0
×5	2D58
×6	30AA
×7	3350
×8	357E
×9	3758
×10	38F0
×11	3A52
×12	3B84
×13	3C90
×14	3D7A
×15	3E42
×16	3EF0
×17	3F82
×18	4000

Lens Control (for reference)

Focus Position 1000 (FAR end) ~ C000 (NEAR end)

NEAR Limit	Focus distance
1000	Over Inf
2000	8 m
3000	3.5 m
4000	2 m
5000	1.4 m
6000	1 m
7000	80 cm
8000	29 cm
9000	10 cm
A000	4.7 cm
B000	2.3 cm
C000	1 cm

Mask Setting

MASK set	Mask_A	00
	Mask_B	01
	Mask_C	02
	Mask_D	03
	Mask_E	04
	Mask_F	05
	Mask_G	06
	Mask_H	07
	Mask_I	08
	Mask_J	09
	Mask_K	0A
	Mask_L	0B
	Mask_M	0C
	Mask_N	0D
	Mask_O	0E
	Mask_P	0F
	Mask_Q	10
	Mask_R	11
	Mask_S	12
	Mask_T	13
	Mask_U	14
	Mask_V	15
	Mask_W	16
	Mask_X	17

Size of Mask	Width (W)	00 ~ 50
	High (H)	00 ~ 3C

Mask of Offset	H Position (X)	B0 ~ 50
	V Position (Y)	C4 ~ 3C

Mask Bit	Bit	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0
	Mask	- - X W V U T S	- - R Q P O N M	- - L K J I H G	- - F E D C B A

MASK Display color	Black	00	10
	Gray1	01	11
	Gray2	02	12
	Gray3	03	13
	Gray4	04	14
	Gray5	05	15
	Gray6	06	16
	White	07	17
	Red	08	18
	Green	09	19
	Blue	0A	1A
	Cyan	0B	1B
	Yellow	0C	1C
	Magenta	0D	1D
	Mosaic	7F	

PTZ angle	Angle	–180º	~ –90º	~ 0º	~ 90º	~ 180º
	Set	800	~ C00	~ 000	~ 400	~ 800

Register Setting

	Register # mm	Value pp	
VISCA Baud Rate	00	00	9600 bps
		01	19200 bps
		02	38400 bps
Frame Rate	70	01	29.97 fps
		02	25 fps
Image Out mode	71	01	Progressive
		02	Interlace (Only REC656 mode)

Others

AF Active time	00 ~ FF
AF interval time	00 ~ FF
Spot AE X table	00 ~ 0F
Spot AE Y table	00 ~ 0F
R Gain	00 ~ FF
B Gain	00 ~ FF
Aperture	00 ~ 0F
ICR ON → OFF Threshold Level	00 ~ FF

Title Setting

Vposition	00 to 0A	
Hposition	00 to 17	
Blink	00: Does not blink	
	01: Blinks	
Color	00	White
	01	Yellow
	02	Violet
	03	Red
	04	Cyan
	05	Green
	06	Blue

00	01	02	03	04	05	06	07
A	B	C	D	E	F	G	H
08	09	0a	0b	0c	0d	0e	0f
I	J	K	L	M	N	O	P
10	11	12	13	14	15	16	17
Q	R	S	T	U	V	W	X
18	19	1a	1b	1c	1d	1e	1f
Y	Z	&		?	!	1	2
20	21	22	23	24	25	26	27
3	4	5	6	7	8	9	0
28	29	2a	2b	2c	2d	2e	2f
À	È	Ì	Ò	Ù	Á	É	Í
30	31	32	33	34	35	36	37
Ó	Ú	Â	Ê	Ô	Æ	Œ	Ã
38	39	3a	3b	3c	3d	3e	3f
Õ	Ñ	Ç	ß	Ä	Ï	Ö	Ü
40	41	42	43	44	45	46	47
Å	$	₧	¥	DM	£	¿	¡
48	49	4a	4b	4c	4d	4e	4f
ø	“	:	‘	.	,	/	-

Specifications

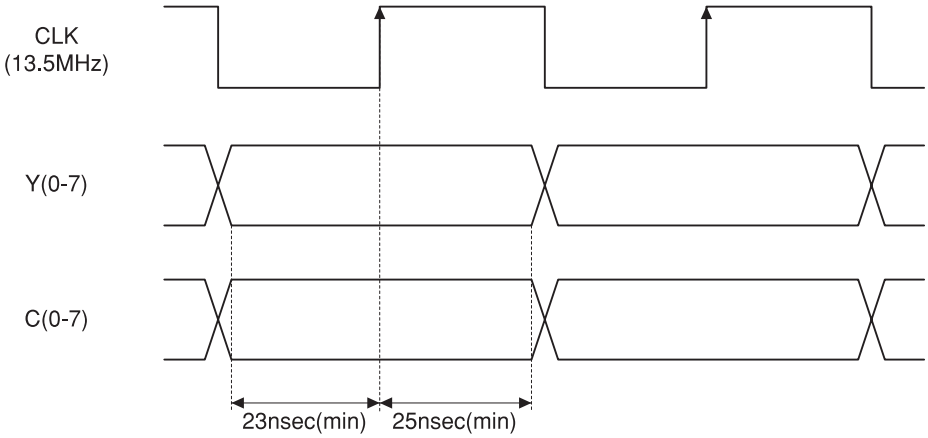
Image sensor	1/4 type IT CCD (HAD)
Picture elements	Approx. 330K pixels (659 (H) × 494 (V))
Horizontal resolution	VGA 640 × 480
Lens	18× zoom F= 4.1 mm (WIDE) to 73.8 mm (TELE), F1.4 to F3.0 Zoom movement speed Optical WIDE/Optical TELE 2.1 s ∞ to Near 0.5 s
Angle of view (H)	48 degree (WIDE end) to 2.8 degree (TELE end)
Min. working distance	290 mm (WIDE end), 800 mm (TELE end)
Sync system	Internal
Min. illumination	1.6 lx (F1.4, 1/30 s : Typical value) 0.38 lx (F1.4, 1/30 s, ICR ON : Typical value)
Recommended illumination	100 to 100,000 lx
S/N ratio	50 dB or more
Back light compensation	ON/OFF
Electronic shutter speed	1/1 to 1/10,000 s (22 steps)
White balance	AUTO, ATW, Indoor, Outdoor, One Push WB, Manual WB
Gain	Auto/Manual (–3 to 28 dB, 2 dB steps)
Aperture control	16 steps
Preset	6-POSITIONS
Serial interface	VISCA protocol (TTL/CMOS) 9.6 Kbps, 19.2 Kbps, 38.4 Kbps, Stop bit, 1/2 bit
Video Output	YUV 4:2:2 (16 bit or 8 bit) See the following pages for the timing chart.
Storage temperature/Humidity	–20 to 60 °C (–4 to 140 °F)/20 to 95 %
Operating temperature/Humidity	0 to 50 °C (32 to 122 °F)/20 to 80 %
Power requirements/Power consumption	6 to 12 V DC/1.5 W (2.7 W)
Weight	230 g (8.1 oz.)
Dimensions	52.0 × 57.5 × 92.6 mm (2 1/8 × 2 3/8 × 3 3/4 in.) (w/h/d)

Design and specifications are subject to change without notice.

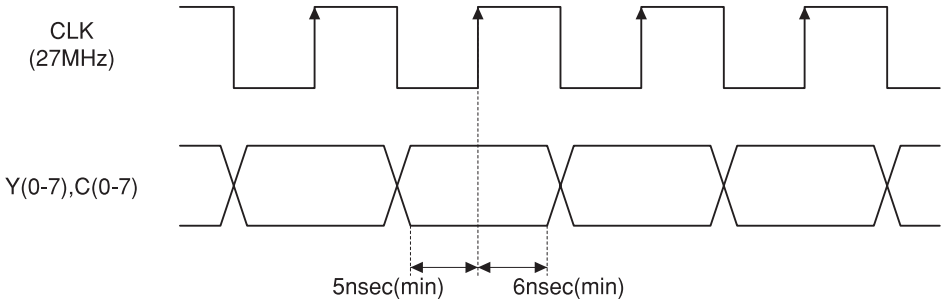
Timing Charts

DIGITAL Port Interface

Rec601



Rec656

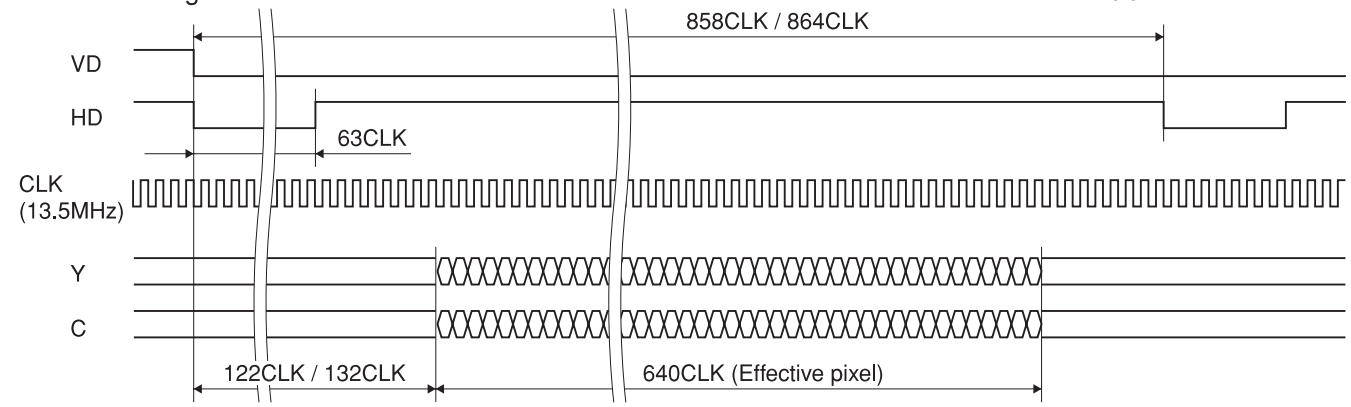


Output Timing (Rec601 Progressive)

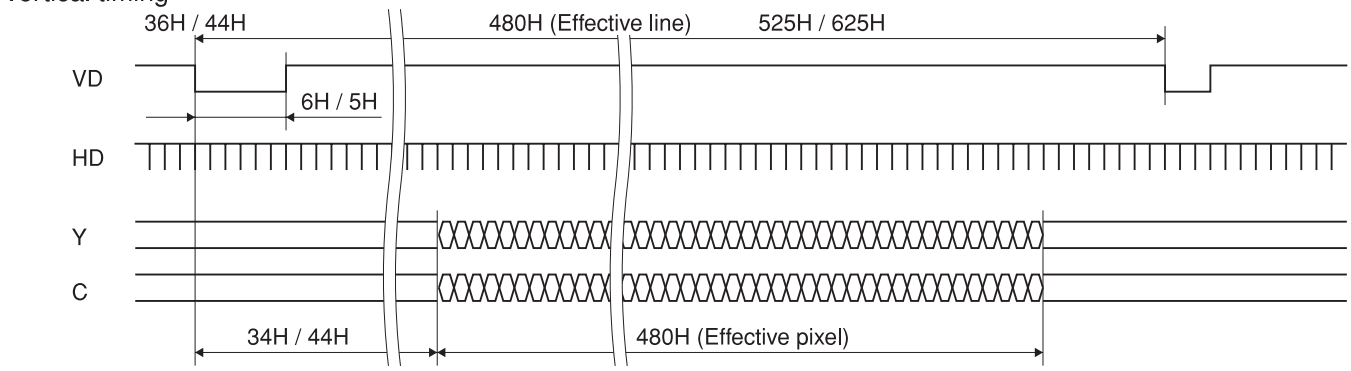
* 29.97 fps/25 fps

PCCK = 13.5 MHz (74.07 ns)
1H= 858ck (63.555 μs)
fh= 15.734 kHz
1v= 525 H
1V= 29.97 Hz

Horizontal timing



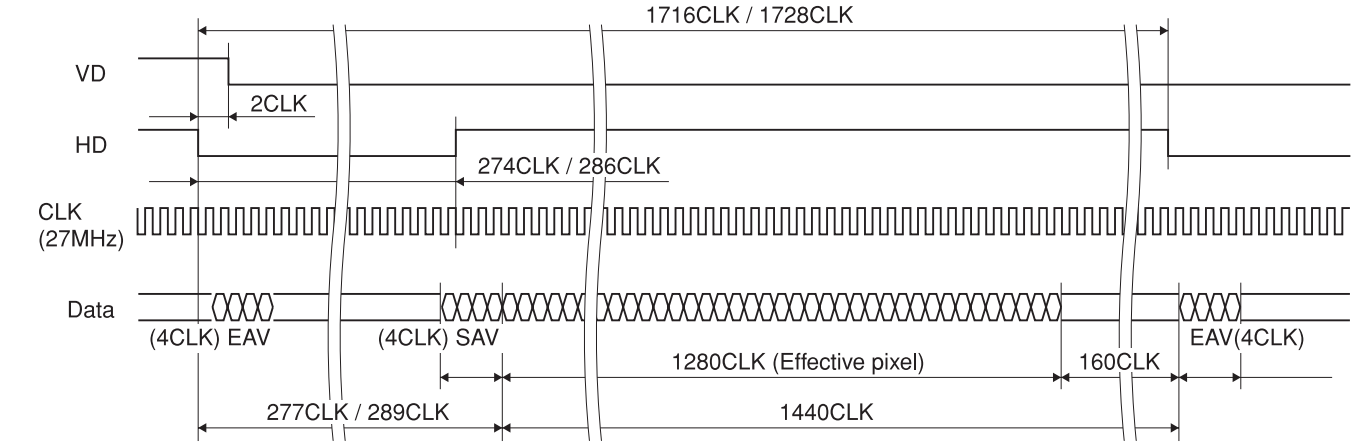
Vertical timing



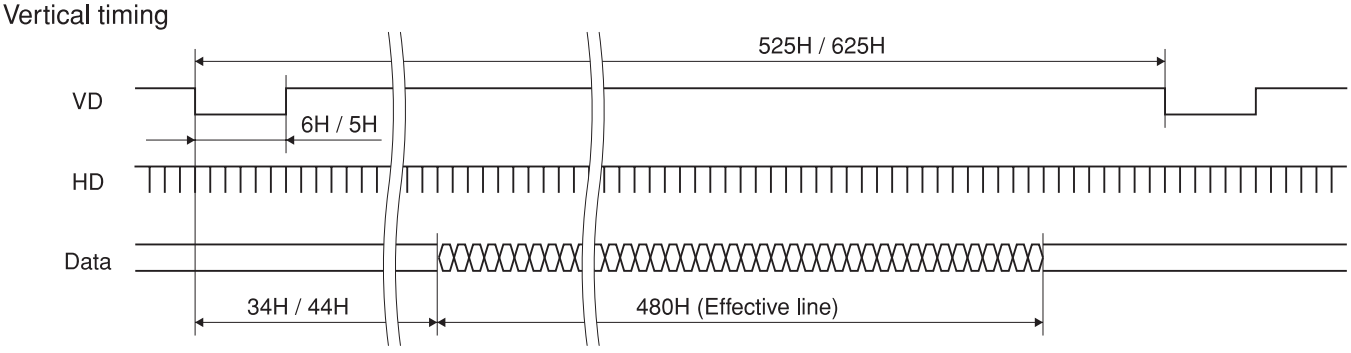
Output Timing (Rec656 Progressive)

* 29.97 fps/25 fps

Horizontal timing



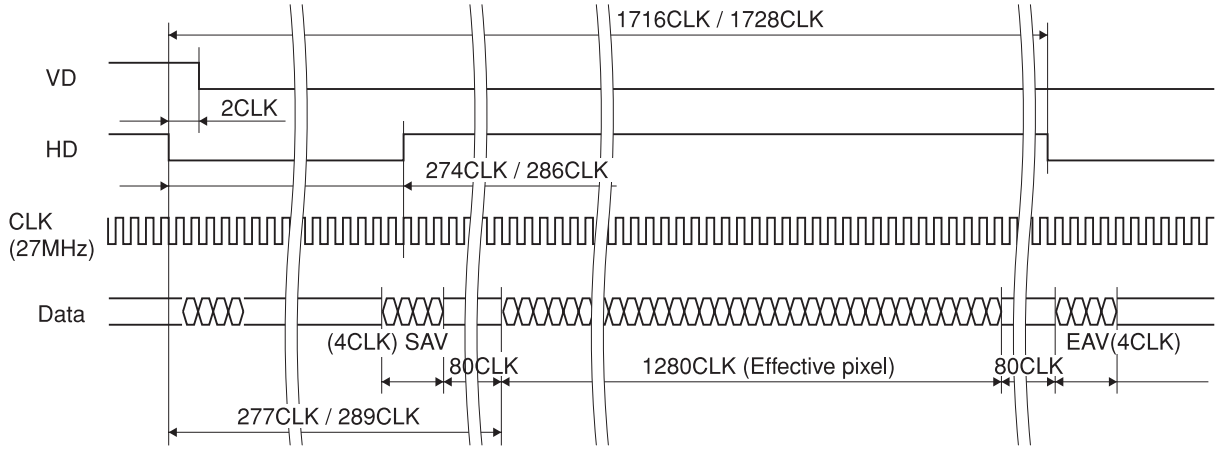
Vertical timing



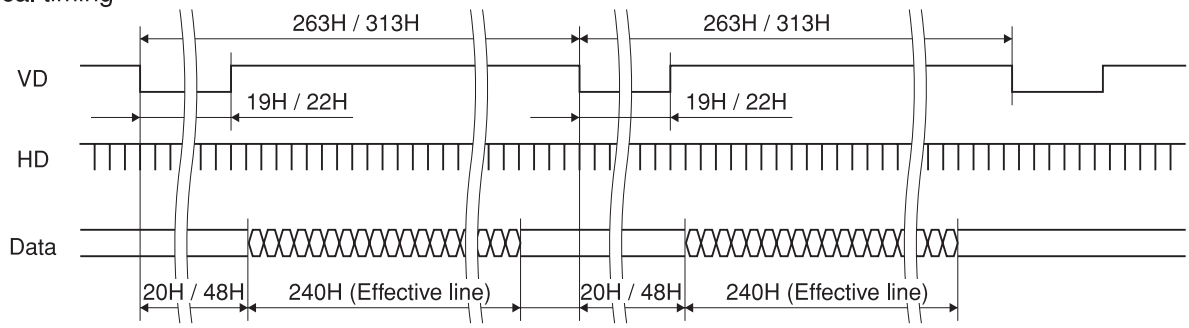
Output Timing (Rec656 Interlace)

* 29.97 fps/25 fps

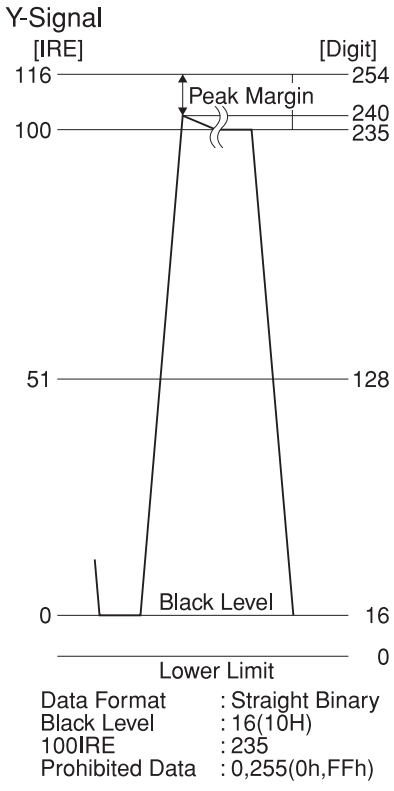
Horizontal timing



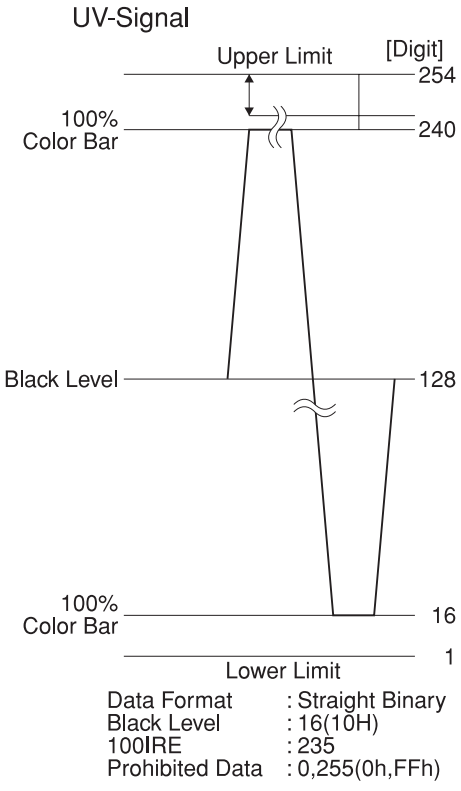
Vertical timing



DIGITAL Image Output Y, Cr, Cb 4:2:2 FORMAT



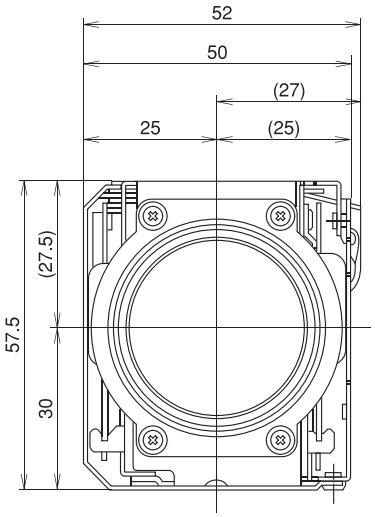
Data Format : Straight Binary
Black Level : 16(10H)
100IRE : 235
Prohibited Data : 0,255(0h,FFh)



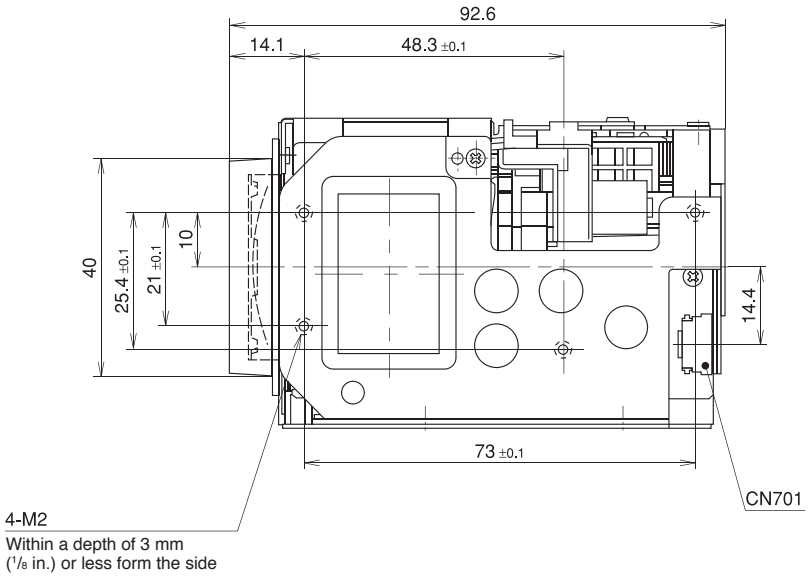
Data Format : Straight Binary
Black Level : 16(10H)
100IRE : 235
Prohibited Data : 0,255(0h,FFh)

External Dimensions

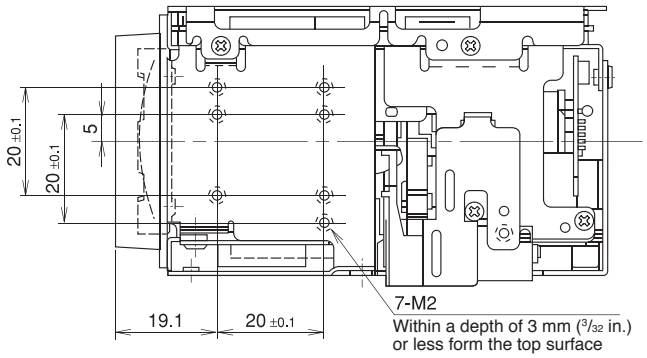
Front



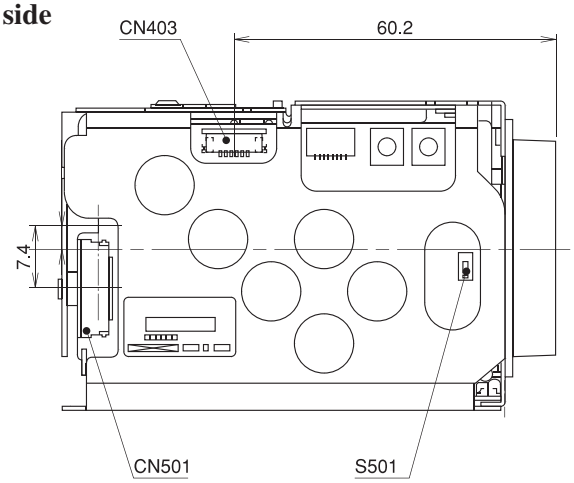
Right side



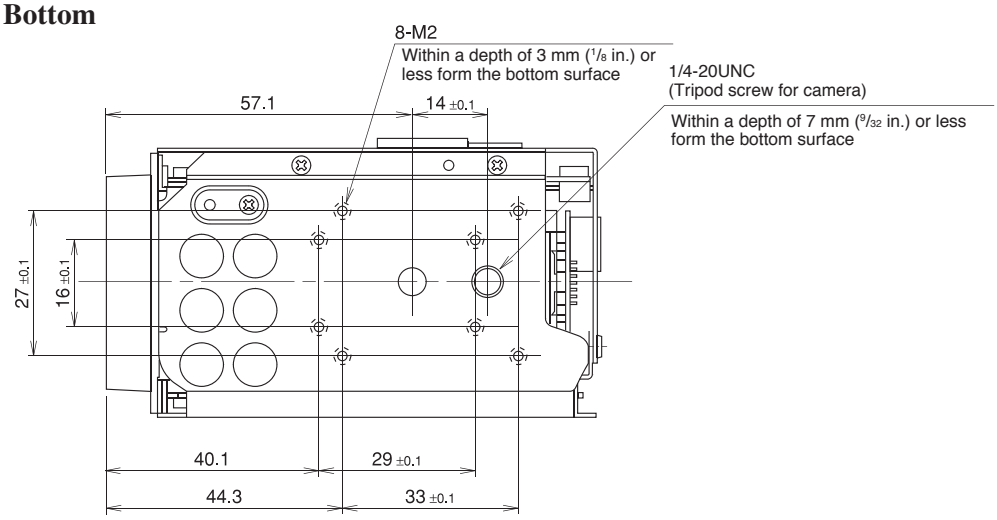
Top



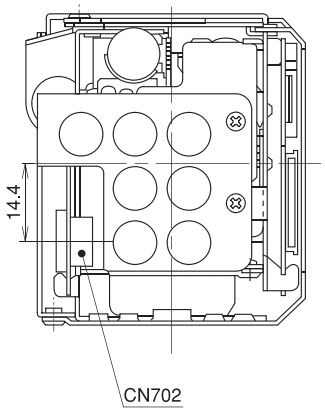
Left side



Bottom



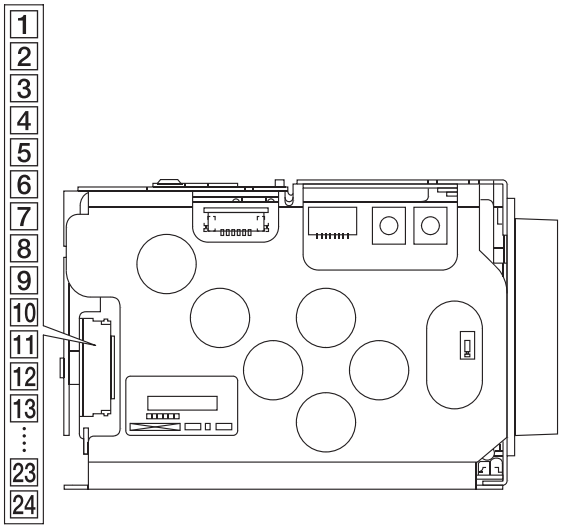
Back



Pin Assignment

CN501

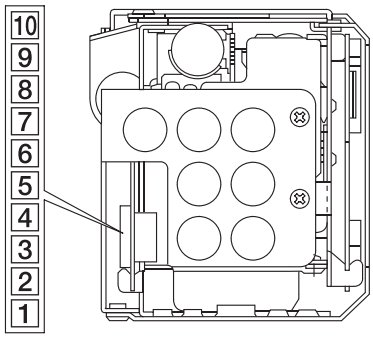
24P FFC (0.5mm)
KYOCERA ELCO Co. 046240024006848+



Pin No.	Name	16 bit data bus	Level	8 bit data bus	Level
1	GND	Signal Ground			
2	Y0	Digital Y-Out 0	0 - 3.3 Vp-p	Digital Out 0	0 - 3.3 Vp-p
3	Y1	Digital Y-Out 1	0 - 3.3 Vp-p	Digital Out 1	0 - 3.3 Vp-p
4	Y2	Digital Y-Out 2	0 - 3.3 Vp-p	Digital Out 2	0 - 3.3 Vp-p
5	Y3	Digital Y-Out 3	0 - 3.3 Vp-p	Digital Out 3	0 - 3.3 Vp-p
6	Y4	Digital Y-Out 4	0 - 3.3 Vp-p	Digital Out 4	0 - 3.3 Vp-p
7	Y5	Digital Y-Out 5	0 - 3.3 Vp-p	Digital Out 5	0 - 3.3 Vp-p
8	Y6	Digital Y-Out 6	0 - 3.3 Vp-p	Digital Out 6	0 - 3.3 Vp-p
9	Y7	Digital Y-Out 7	0 - 3.3 Vp-p	Digital Out 7	0 - 3.3 Vp-p
10	GND	Signal Ground			
11	C0	Digital C-Out 0	0 - 3.3 Vp-p	Hi imp	
12	C1	Digital C-Out 1	0 - 3.3 Vp-p	Hi imp	
13	C2	Digital C-Out 2	0 - 3.3 Vp-p	Hi imp	
14	C3	Digital C-Out 3	0 - 3.3 Vp-p	Hi imp	
15	C4	Digital C-Out 4	0 - 3.3 Vp-p	Hi imp	
16	C5	Digital C-Out 5	0 - 3.3 Vp-p	Hi imp	
17	C6	Digital C-Out 6	0 - 3.3 Vp-p	Hi imp	
18	C7	Digital C-Out 7	0 - 3.3 Vp-p	Hi imp	
19	GND	Signal Ground			
20	VSYNC	Vertical SYNC	0 - 3.3 Vp-p		0 - 3.3 Vp-p
21	HSYNC	Horizontal SYNC	0 - 3.3 Vp-p		0 - 3.3 Vp-p
22	GND	Signal Ground			
23	CLOCK	Clock signal	0 - 3.3 Vp-p		0 - 3.3 Vp-p
24	GND	Signal Ground			

CN701

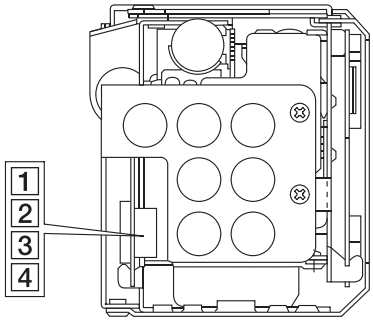
10P FFC (0.5mm)
KYOCERA ELCO Co. 046240010006848+



Pin No.	Name		Level
1	UNREG	Power Input	6 - 12 V (dc)
2	UNREG	Power Input	6 - 12 V (dc)
3	UNREG	Power Input	6 - 12 V (dc)
4	UNREG	Power Input	6 - 12 V (dc)
5	GND	Ground	
6	GND	Ground	
7	GND	Ground	
8	GND	Ground	
9	TD		TTL Level (0 - 5.0 Vp-p)
10	SD		TTL Level (0 - 5.0 Vp-p)

CN702

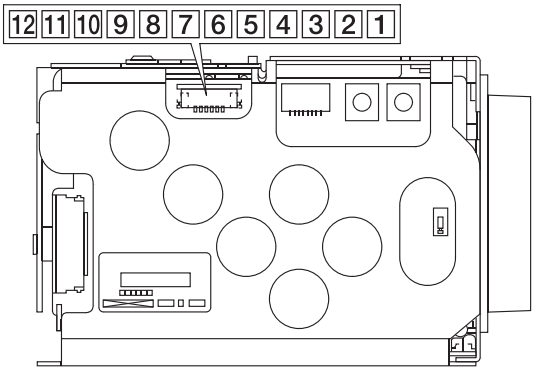
4P connector
J.S.T. Mfg Co. S4B-ZR-SM4A-TF(LF)



Pin No.	Name		Level
1	UNREG	Power Input	6 - 12 V (dc)
2	GND	Ground	
3	TD		TTL Level (0 - 5.0 Vp-p)
4	RD		TTL Level (0 - 5.0 Vp-p)

CN403

12P FFC (0.5mm)
KYOCERA ELCO Co. 086222012101848+



Pin No.	Name	Level
1	GND	
2	GND	
3	KEY_AD0	Pull up to 3.0 V by 100 kohm
4	KEY_AD1	Pull up to 3.0 V by 100 kohm
5	KEY_AD2	Pull up to 3.0 V by 100 kohm
6	KEY_AD3	Pull up to 3.0 V by 100 kohm
7	KEY_AD4	Pull up to 3.0 V by 100 kohm
8	KEY_AD5	Pull up to 3.0 V by 100 kohm
9	KEY_AD6	Pull up to 3.0 V by 100 kohm
10	KEY_AD7	Pull up to 3.0 V by 100 kohm
11	NC	
12	Strobe	Strobe timing pulse (0 to 3 V)