SONY

D-406-100-**13**(1)

Color Camera Module

Technical Manual

FCB-ES8230
FCB-CS8230

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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 –5 ˚C to +60 ˚C (23 ˚F to 140 ˚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
- Where it is subject to radiation from laser beams

Care of the unit

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

Other

- Design and specifications are subject to change without notice.
- Do not apply excessive voltage. (Use only the specified voltage.) Otherwise, you may get an electric shock or a fire may occur.
- The CMOS image sensor and IC included in this camera may break if exposed to static electricity. When directly handling this camera, wear an antistatic strap, spread a conductive sheet or similar item under your workbench, and take measures to eliminate static electricity.
- In case of abnormal operation, contact your authorized Sony dealer or the store where you purchased the product.

Handling precautions

- When handling this unit, be careful not to apply an excessive load to all portions of the unit except for the sheet-metal cover. Otherwise, it may result in a failure.
- This unit is designed to be built in the housing. Therefore, take measures to prevent the unit from receiving the intense light such as sunlight directly from the direction other than the front side. Otherwise, it may cause the image quality degradation.

Phenomena specific to CMOS image sensors

The following phenomena that may appear in images are specific to CMOS image sensors. They do not indicate malfunctions.

Rolling shutter

As CMOS image sensors use shutters that capture images line-by-line, there is a slight time difference between the top and bottom of an image. As a result, images may appear skewed if the camera is moved.

White flecks

Although the CMOS 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 CMOS 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

Aliasing

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

Phenomena Specific to Lenses

Ghosting

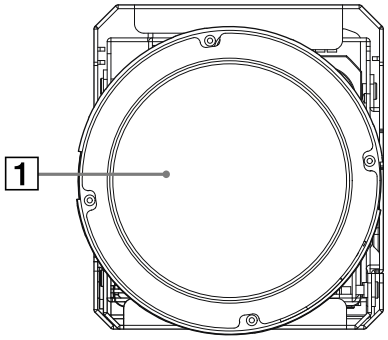
If a strong light source (e.g., the sun) exists near the incidence angle of the lens, bright spots may appear in the image due to diffuse reflection within the lens.

About the trademark

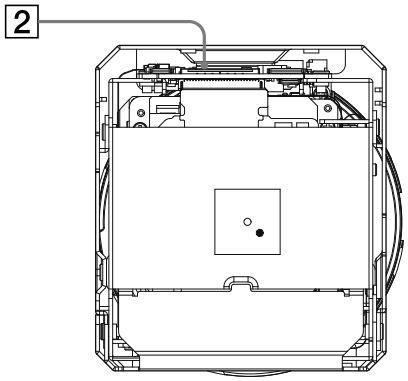
- "Exmor R" and "StableZoom" are trademarks of Sony Corporation.
- The terms HDMI and HDMI High-Definition Multimedia Interface, and the HDMI Logo are trademarks or registered trademarks of HDMI Licensing Administrator, Inc. in the United States and other countries.

Locations of Controls

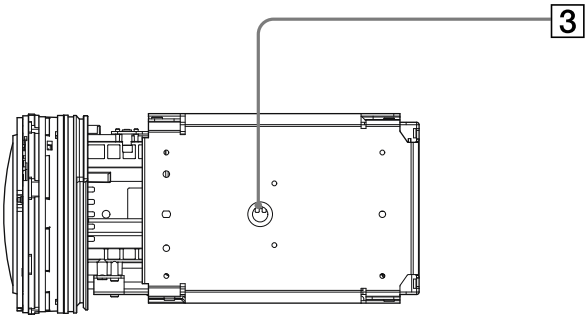
Front



Back



Bottom



1 **Lens**
2 **CN1701 connector**
3 **Tripod screw hole**
When a tripod is used, please use 6 mm (1/4 in.) or less screw to attach it to the camera.
Also, please be sure to attach the tripod securely.

Basic Functions

Overview of Functions

The camera control is performed by VISCA and PTP commands. For the camera control by PTP, refer to "Camera control PTP".

In general

- **Power On/Off**
  Powers the camera on and off.
  Although the screen is set non-displayed when the power is off, the camera is able to accept VISCA Command.
- **I/F Clear**
  Clears the Command buffer of the FCB camera.
- **Address Set**
  VISCA is a protocol, which normally supports a daisy chain of up to seven connected cameras via RS-232C interface. In such cases, the address set command can be used to assign addresses from 1 to 7 to each of the seven cameras, allowing you to control the seven cameras with the same personal computer.
  Although the FCB camera does not support direct connection of cameras in a daisy chain, be sure to use the address set command to set the address whenever a camera is connected for the first time.
- **ID Write**
  Sets the camera ID.
- **Mute**
  Blanks the screen and sends out a synchronizing signal.
- **Lens Initialize**
  Initializes the zoom and focus of the lens. Even when power is turned on, it initializes the zoom and the focus.
- **APR (Auto Pixel Restoration)**
  During operation of the FBC camera, the temperature of the set rises and white flecks may be generated on the CMOS image sensor.
  The APR detects and corrects the white flecks, making them unnoticeable.
  The detection function of the APR needs to be done while white flecks are generating.
  If white flecks are not being generated, such as when the temperature of the camera is not high immediately after the set turns on, previously generated white flecks cannot be detected even if the APR is used. Therefore, please be sure to use the APR while white flecks are generating.
  By turning on the APR and turning the power OFF/ON, white flecks are detected and corrected, and then recorded in the set.
  Please be sure to turn "APR" to OFF when the APR correction is completed. The correction data is maintained even if "APR" is OFF.

Zoom

The FCB camera incorporates a 12× optical zoom lens combined with a digital zoom function; this camera allows you to zoom up to 144×.

- **Optical 12×, f = 9.3 mm to 111.6 mm (F 2.8 to F 4.5)**

The zoom magnification can be set in the following methods.

Using Standard Mode
Using Variable Mode
There are eight levels of zoom speed.

In these standard and variable modes, it is necessary to send Stop Command to stop the zoom operation.

Direct Mode
Setting the zoom position enables quick movement to the designated position.

Digital Zoom
There are three types of zoom modes; OFF, combined mode and separate mode.

Combined Mode
This is the previously existing zoom method. After the optical zoom has reached its

maximum level, the camera switches to Digital Zoom Mode.

Separate Mode

In this mode, Optical Zoom and Digital Zoom can be operated separately. You can use digital zoom magnification at any time from within any level of optical magnification.

In the combined mode, the digital zoom range can be set.

Super Resolution Zoom

Through the use of "all pixel super resolution technology" developed by Sony Corporation, this product provides superior images while maintaining the resolution without degrading image quality, even when magnified. By combining with optical zoom 12×, zoom is achieved up to 18× in QFHD and 24× in FHD.

About Continuous Zoom Position Reply

With ZoomDirect mode, or when zooming according to a preset, the camera outputs zoom position data when Continues Zoom Position Reply is set to On via a command.

Continues Zoom Position Reply: y0 07 04 69 0p 0p 0q 0q 0q 0q FF

pp: D-Zoom Position

qqqq: Zoom Position

Focus

Focus has the following modes.

- **Auto Focus Mode**

  The Auto Focus (AF) function automatically adjusts the focus position to maximise the high frequency content of the picture in a center measurement area, taking into consideration the high luminance and strong contrast components.

  The minimum focus distance is 80 mm at the optical wide end and 1000 mm at the optical tele end.

  - **Normal AF Mode**

    This is the normal mode for AF operations.

  - **Interval AF Mode**

    The mode used for AF movements carried out at particular 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 setting for both is set to 5 seconds.

  - **Zoom Trigger Mode**

    When zoom position is changed,it becomes AF mode during the pre-set value (initial setting is set to 5 seconds). Then it stops.

- **AF Sensitivity**

  The switching of AF sensitivity can be set.

  - **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 Mode and a Variable Mode. Standard Mode focuses at a fixed rate of speed. Variable Mode has eight speed levels.

  In these standard and variable modes, it is necessary to send Stop Command to stop the zoom operation.

- **One Push Trigger Mode**

  When a Trigger Command is sent, the lens moves to adjust the focus for the subject. The focus lens then holds that position until the next Trigger Command is input.

- **Near Limit**

  Can be set in a range from 1000 (∞) to F000 (80 mm). Initial setting: B000h (25 cm)

- **Spot focus mode**

  The spot focus mode allows you to focus on a specific portion of the subject. This mode is used when it is difficult to focus on the subject by using the normal auto focus, and so on. The focusing spot is specified by the area of the entire screen divided into 16-split both vertically and horizontally.

White Balance (WB)

White Balance has the following modes.

- **Auto**

  This mode computes the white balance value output using color information from the entire screen. It outputs the proper value using the color temperature radiating from a black subject based on a range of values from 2500K to 7500K.

  This mode is the initial setting.

- **ATW**

  Auto Tracing White balance (2000K to 10000K)

- **Indoor**

  3200K Base Mode

- **Outdoor**

  5800K 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 One Push White Balance.

- **Manual WB**
  This is a mode that enables you to manually set the control of R and B gain up to 256 steps.

- **Outdoor Auto**
  This is an auto white balance mode specifically for outdoors. It allows you to capture images with natural white balance in the morning and evening.

- **Sodium Vapor Lamp Auto**
  This is an auto white balance mode that is compatible with sodium vapor lamps.
- **Sodium Vapor Lamp**
  This is a fixed white balance mode specifically for sodium vapor lamps.

- **Sodium Vapor Lamp Outdoor Auto**
  This is an auto white balance mode specifically for outdoors, which is compatible with sodium vapor lamps.

Note

High-pressure sodium lamps are supported. Proper white balance may not be captured for some subjects when using low-pressure sodium lamps.

Auto Exposure Mode (AE)

A variety of AE functions are available for optimal output of subjects in lighting conditions that range from low to high.

- **Full Auto**
  Iris, Gain and Shutter Speed can be set automatically.

- **Gain Limit Setting**
  The gain limit can be set at Full Auto, Shutter Priority, Iris Priority, Bright, Spot Exposure and Manual in AE mode. Use this setting when you want to obtain images with a focus on the signal-to-noise ratio.

- **Shutter Priority** [1)]
  Adjust with Variable Shutter Speed (1/1 to 1/10,000 sec., 16 high-speed shutter speeds plus 12 low-speed shutter speeds), Auto Iris and Gain.
  1) Flicker in the East Japan area (50 Hz power supply frequency) can be eliminated by setting shutter to 1/100s.

- **Iris Priority**
  Adjust with Variable Iris (F2.8 to F11, 17 steps), Auto Gain and Shutter speed

- **Gain**
  Adjust with Variable Gain (0 to 36 dB, 13 steps, 38 steps on High sensitivity mode), Auto Iris and Shutter speed

- **Manual**
  Adjust with Variable Shutter speed, Iris and Gain

- **Bright**
  Adjust with Variable Iris and Gain (F11 to F2.8, 29 steps and High Sensitivity Mode at 33 steps)

AE – Shutter Priority

The shutter speed can be set freely by the user to a total of 28 steps – 16 high speeds and 12 low speeds. When the slow shutter is set, the speed can be adjusted according to subject brightness. The picture output is read at a normal rate from the memory. The memory is updated at a low rate from the CMOS. AF following capability is lowered and also the number of frame to be displayed is decreased.
In high speed mode, the shutter speed can be set up to 1/10,000s. The iris and gain are set automatically, according to the brightness of the subject.

Data	59.94/29.97 mode	50/25 mode	23.98 mode
21	1/10000	1/10000	1/10000
20	1/6000	1/6000	1/4800
1F	1/4000	1/3500	1/2400
1E	1/3000	1/2500	1/1200
1D	1/2000	1/1750	1/576
1C	1/1500	1/1250	1/400
1B	1/1000	1/1000	1/288
1A	1/725	1/600	1/200
19	1/500	1/425	1/192
18	1/350	1/300	1/144
17	1/250	1/215	1/120
16	1/180	1/150	1/100
15	1/125	1/120	1/96
14	1/100	1/100	1/60
13	1/90	1/60	1/50
12	1/60	1/50	1/48
11	1/50	1/30	1/40
10	1/30	1/25	1/25
0F	1/20	1/20	1/24
0E	1/15	1/15	1/20
0D	1/10	1/12	1/12
0C	1/8	1/8	1/8
0B	1/6	1/6	1/6
0A	1/4	1/4	1/4
9	1/3	1/3	1/3
8	1/2	1/2	1/2
7	2/3	2/3	2/3
6	1/1	1/1	1/1

AE – Iris Priority

The iris can be set freely by the user in 17 steps between F2.8 and F11.
The gain and shutter speed are set automatically according to the brightness of the subject.

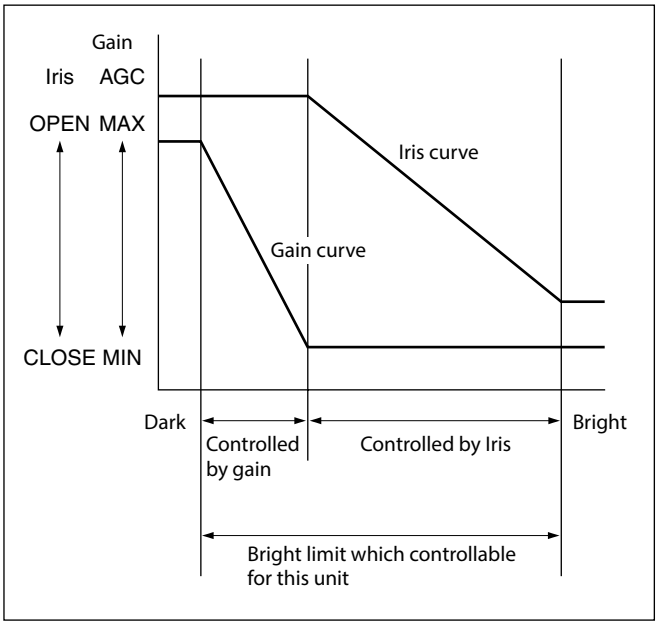
Data	Setting value	Data	Setting value
15	F2.8	0C	F6.2
14	F3.1	0B	F6.8
13	F3.4	0A	F7.3
12	F3.7	09	F8.0
11	F4.0	08	F8.7
10	F4.4	07	F9.6
0F	F4.8	06	F10
0E	F5.2	05	F11
0D	F5.6		

AE – Manual

The shutter speed (28 steps), iris (17 steps) and gain (17 steps) can be set freely by the user.

AE – Bright

The bright control function adjusts both 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," can you switch it to "Bright."



Data	Iris	Gain	Data	Iris	Gain
25*	F2.8	48 dB	14	F3.1	0 dB
24*	F2.8	45 dB	13	F3.4	0 dB
23*	F2.8	42 dB	12	F3.7	0 dB
22*	F2.8	39 dB	11	F4.0	0 dB
21	F2.8	36 dB	10	F4.4	0 dB
20	F2.8	33 dB	0F	F4.8	0 dB
1F	F2.8	30 dB	0E	F5.2	0 dB
1E	F2.8	27 dB	0D	F5.6	0 dB
1D	F2.8	24 dB	0C	F6.2	0 dB
1C	F2.8	21 dB	0B	F6.8	0 dB
1B	F2.8	18 dB	0A	F7.3	0 dB
1A	F2.8	15 dB	09	F8.0	0 dB
19	F2.8	12 dB	08	F8.7	0 dB
18	F2.8	9 dB	07	F9.6	0 dB
17	F2.8	6 dB	06	F10	0 dB
16	F2.8	3 dB	05	F11	0 dB
15	F2.8	0 dB			

*When high sensitivity mode is on.

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

Gain Limit Setting

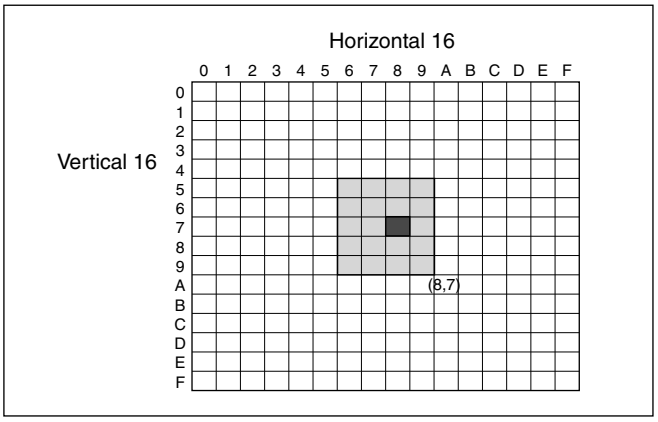
The gain limit can be set at the Full Auto, Shutter Priority and Iris Priority of the Auto Exposure Mode. Use this setting when you want to obtain image in which signal-to-noise ratio is particularly important.

Gain Point Setting

Set the Gain Point in the middle between 0dB and gain limit. The shutter speed can be changed from the point when the set gain value is reached. When you want to obtain the motion-priority image, use this setting.

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 is computed so that the 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. The level is calculated by the value of the surrounding blocks (shaded) including the designated center block (black). The range of the Spot AE frame is fixed to 5 blocks vertically and 4 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

Slow AE (Auto Exposure)

The slow AE Response function allows you to reduce the exposure response speed. Usually the camera is set up so that the optimum exposure can be obtained automatically within about 1 second. However, using the slow AE response function allows you to lengthen the auto exposure response speed from the initial setup speed (01h) to approx. 10 minutes (30h) (at normal shutter speed).
For example, with the normal setting (about 1 second), if the headlights of a car are caught by the camera, the camera automatically adjusts the exposure so that it can shoot a high-intensity subject (in this case, the headlights). As a result, images around the headlights, that is, the rest of the subject, except the headlights, becomes relatively dark, and poorly distinguished. However, using the slow AE function means the AE response speed will be slower, and response time will be longer. As a result, even if the camera catches a high-intensity subject (e.g., the headlights) for a moment, you can still easily distinguish the portions of the image surrounding the headlights.

High Resolution Mode

This mode enhances edges and produces higher definition images.

Aperture Control

Aperture control is a function which adjusts the edge enhancement of objects in the picture.
When it is set to Auto, the adjustment is performed automatically.
When it is set to Manual, you can adjust multiple setting items. Sometimes, the noise particle that is generated when the gain is increased becomes noticeable because its edge is enhanced by this function. In this case, lower the edge enhancement level or adjust the edge enhancement amount of noise by “Crispening”.

Backlight 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.

Visibility Enhancer (VE)

Depending on the imaging scene, the Visibility Enhancer function makes the darker part of a camera image brighter, and automatically correct brightness and contrast to show bright parts clearly.

Defog mode

When the surrounding area of the subject is foggy and low contrast, the defog mode will make the subject appear clearer.
You can select four levels for this function: OFF, Low, Middle and High.

Highlight Compensation (HLC)

HLC (highlight correction) is a function to adjust AE and AF, and to perform the masking of light area as required when a high intensity spot light is detected. It allows you to easily read the number of vehicles and number plate in the indoor parking area or in the outdoor during the night.

Maximum Shutter Limit

The brighter the object is, the shutter speed will increase. This is the function to set the upper limitation on the shutter speed. This will help to make images smooth with less inconsistent motions when you shoot bright objects.

Minimum Shutter Limit

When the subject becomes dark, the shutter speed becomes slow and the gain is increased. This is a function to put a limit on the shutter speed.
It prevents the camera shake when you shoot a moving subject in a dark place.

Noise Reduction (NR)

The NR function removes noise (both random and non-random) to provide clearer images.
This function has six steps: levels 1 to 5, plus off.
The NR effect is applied in levels based on the gain, and this setting value determines the limit of the effect.
In bright conditions, changing the NR level will not have an effect.
When it is set to level 7Fh, you can set NR of 2D/3D individually.

High Sensitivity Mode

In this mode, the maximum gain increases, enabling to obtain a brighter output even in a darker environment. However, if the gain reaches high level, the image will have a large amount of noise.

Variable Gamma Mode

Standard (00h), straight gamma (01h), 512 pattern (02h) are available for setting.

Gamma Offset

You can set the brightness from –64 (140h) to +64 (40h) in each mode of the variable gamma mode.

Temperature Reading Function

The conversion value (hex) of the temperature sensor built into to the camera can be read by using a query command. The conversion value has an error of ±3 C, and because the temperature sensor is inside the camera, this value is not the ambient temperature. Use it as a reference value.

Slow Shutter On/Off

When set to "On," the slow shutter functions automatically when the light darkens. This setting is available only when the AE mode is set to "Full Auto." The initial setting is "Auto Slow Shutter Off."

Low-Illumination Chroma Suppress Mode

You can configure a chroma suppress mode for low-illumination conditions. This can be useful when color noise is particularly noticeable in such conditions. Four levels (disabled and three levels) are available for the low-illumination chroma suppress mode.

ICR (IR Cut-Removable) Mode

The IR Cut-Filter installed in front of the CMOS image sensor can be engaged or disengaged by the mechanical structure. The sensitivity in the infrared region is increased by disengaging the IR Cut-Filter, allowing the camera to capture the image in darker places. When the auto ICR mode is set to On, the image becomes black and white.

Custom Color Gain

You can configure the color gain. Use this setting when bright color is particularly important.
The initial setting 100% (4h) can be set to range from approx. 60% (0h) to 200% (Eh) with 15 stages.

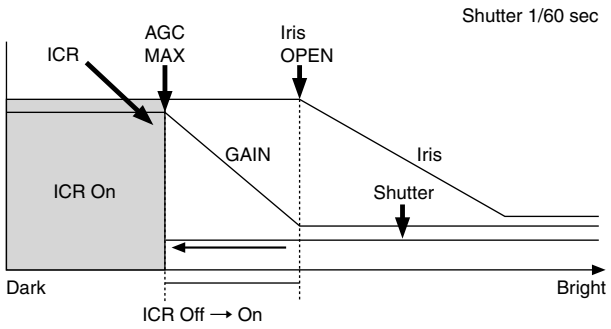
Custom Color Phase

You can configure the color phase. The initial setting 0 degrees (7h) is adjustable between approx. –14 degrees (0h) to +14 degrees (Eh), in 15 increments.

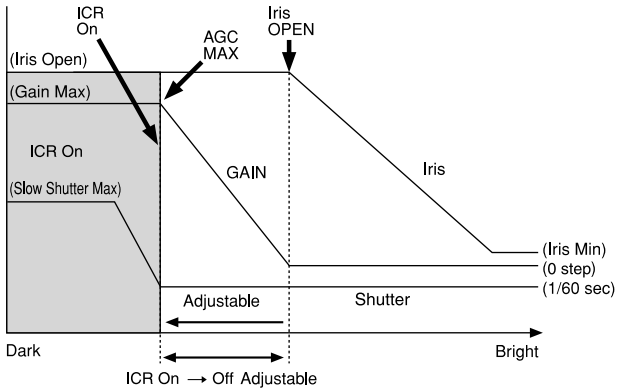
Auto ICR Mode

Auto ICR Mode automatically switches the settings needed for attaching or removing the IR Cut Filter. With a set level of darkness, the IR Cut Filter is automatically disabled (ICR On), and the infrared sensitivity is increased. With a set level of brightness, the IR Cut Filter is automatically enabled (ICR Off). Also, on systems equipped with an IR light, the internal data of the camera is used to make the proper decisions to avoid malfunctions.
Auto ICR Mode operates with the AE Full Auto setting.

When Auto Slow Shutter is Off (initial setting)



When Auto Slow Shutter is On



Note

Depending on the information such as brightness, etc., in the On/Off settings condition, a malfunction may occur when the subjects largely consisting of blue and green colors are taken.

ND Filter Mode

The ND Filter installed in front of the CMOS image sensor can be engaged or disengaged by the mechanical structure. The adjustable range of Iris and shutter speed are increased by using the ND Filter.
There are 2 types of ND Filters, and by combining them, the light quantity can be used at 1× (Filter Off), 1/4×, 1/16×, or 1/64×.

Camera ID

The ID can be set up to 65,536 (0000h to FFFFh). As this will be memorized in the nonvolatile memory inside, data will be saved.

Picture Effect

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

Image stabilizer

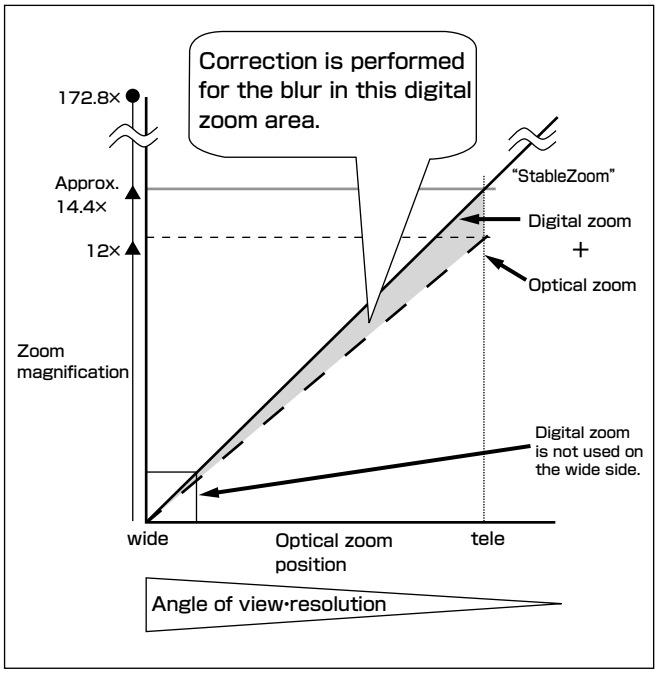
When the image stabilizer function is set to On, you can obtain the image with less screen blur caused by shaking and so on. The correction effect can be achieved at the vibration frequency around 10 Hz. The image stabilizer function uses the optical blur correction method. The change in the angle of view is very slight, and resolution and sensitivity are maintained.

Note

The image stabilizer function may not work under the environment of high frequency vibration components. When using the camera under such environment, set the image stabilizer function to Off.

"StableZoom"

"StableZoom" is a function to perform correction using the image stabilizer function according to the zoom magnification and zoom the image up to approx. 24× smoothly by combining the optical zoom with the digital zoom. By zooming the image furthermore using the digital zoom, the image is zoomed up to 288×. On the wide side, the image without the deterioration in resolution can be obtained because the digital zoom is not used. On the other hand, the correction effect by the image stabilizer function is maximized on the tele side, reducing the blur.
"StableZoom" can be set to On/Off by the register setting.



Others

E-FLIP
This function reverses the video output from the camera vertically and horizontally.

LR Reverse
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 EVEN, ODD or a Command.

Electronic Pan/Tilt
In QFHD (3840 × 2160) mode, crop the image at the designated position to Full HD (1920 × 1080) and display.
You can specify the central coordinate of cropped images by commands. Cropped sizes cannot be changed as it is fixed to FHD.

Memory (Position preset)
Using the position preset function, 16 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/Super Resolution Zoom**
- **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 On/Off**
- **White Balance**
- **R/B Gain**
- **Aperture Control**
- **ICR On/Off**
- **Defog**

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 24.

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.

Register Setting
The camera's initial settings can be changed by the register setting command.
Register Setting Command:
8x 01 04 24 mm 0p 0q FF
mm: Register No. (=00 to 7F)
pq: Register Value (=00 to FF)
Register Inquiry Command:
8x 09 04 24 mm FF
mm: Register No.
y0 50 0p 0p FF
pp: Register Value
(returned from the camera)

The register setting items and No. are as follows.
For details, see "Register Setting" on page 55.
Baud Rate: 00
Communication speed can be changed.
Monitoring Mode: 72
The output mode can be set.
Zoom Limit: 50 (wide end), 51 (tele end)
The wide and tele zoom limits can be set.
D-Zoom Max: 52
The maximum digital zoom limit can be set (initial settinig is 12×).
FocusOffset: 55
Placing a dome cover in front of the camera may cause the focal distance of the camera to change. Especially at the Tele end, this effect exceeds the AF range, so focus cannot track, although it responds to changes in this value.
For details, see "Register Setting" on page 55.
Extended mode: 5F
ON/OFF can be set. (initial setting is OFF.)
For details, see page 17.

Note

After changing the register setting, turn off the camera, then turn it on again.

Privacy Zone Masking Settings
For details, see page 15.

Title Display

- You can set a title of up to 11 lines. One line can contain up to 20 characters.
- You can set display on/off, the horizontal position of the first character, blinking state and color for each line.
- The camera gives priority to a title display when the camera status is displayed on the relevant line. On the lines where a title is not set, the camera status is displayed.

Line Number	00h to 0Ah	
H-position	00h to 1Fh	
Color	00h	WHITE
	01h	YELLOW
	02h	VIOLET
	03h	RED
	04h	CYAN
	05h	GREEN
	06h	BLUE
Blink	00h	Off
	01h	On

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		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	$		¥		£	¿	¡
48	49	4A	4B	4C	4D	4E	4F
ø	”	:	’	.	,	/	-

Privacy Zone Masking 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.
- Individual on/off zone masking settings.
- Two colors can be individually set for each of 24 privacy zones.
- Interlocking control with zooming.
- Interlocking control with Pan/Tilt.
- Non-interlocking control with Pan/Tilt.

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 15.
nn	Selects new setting or resetting for the zone. See "nn: Setting" in "Parameters" on page 15.
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 15.

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 the 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 to the BIT. See "pp pp pp pp: Mask bit" in "Parameters" on page 16.
qq	Set the color code
rr	Set the color code. See "qq, rr: Color code" in "Parameters" on page 17.

Comments: Two different color masks can be chosen. Two 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 00 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 Black (color code 00h).

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.

Notes

- When you set the pan/tilt angle, locate the pan/tilt position at the center point of the FCB camera's position.
- If you set the pan/tilt angle or zoom the camera, a bigger mask will be displayed for about one second.

Set PTZ Mask

Command: 8x 01 04 7B mm 0p 0p 0p 0q 0q 0q 0r 0r 0r 0r FF

Parameter:

mm	Setting Mask See “mm: Mask setting list” in “Parameters” on page 16.
ppp	Pan Angle (000 to FFF) See “Setting pan/tilt angle” in “Parameters” on page 16.
qqq	Tilt Angle (000 to FFF) See “Setting pan/tilt angle” in “Parameters” on page 16.
rrrr	Zoom Position (000 to 4000) See “Zoom Ratio and Zoom Position (for reference)” on page 53.

Comments: Mask can be set at the desired position by setting the pan tilt angle and zoom position using this command. The set value can be input by hexadecimal number.

Note

Privacy mask zone follows the change of angle of view according to zoom. However, the follow might be delayed for a moment if there is any big change, such as when using D-Zoom or E-FLIP.

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 15.
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 15.

Commands: Mask does not interlock with pan/tilt. The limitations of parameters are as follows. (hexadecimal representation)

x: ±50h
w: ±50h
y: ±2Dh
h: ±2Dh

Note

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

Parameters

mm: Mask setting list

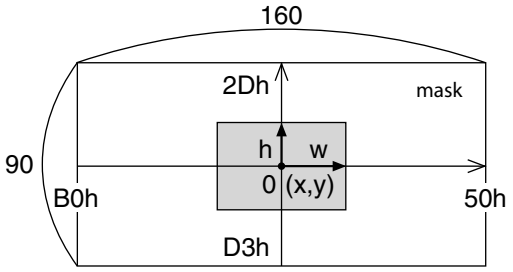
Mask Name	mm (Hex)
Mask_A	00h
Mask_B	01h
Mask_C	02h
Mask_D	03h
Mask_E	04h
Mask_F	05h
Mask_G	06h
Mask_H	07h
Mask_I	08h
Mask_J	09h
Mask_K	0Ah
Mask_L	0Bh

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

nn:Setting

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

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



Effective display area

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.

pp pp pp pp: Mask bit

	pp								pp							
bit	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

	pp								pp							
bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Mask	-	-	L	K	J	I	H	G	-	-	F	E	D	C	B	A

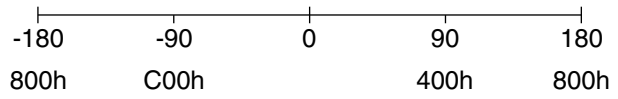
The “-” must be “0”.

qq, rr: Color code

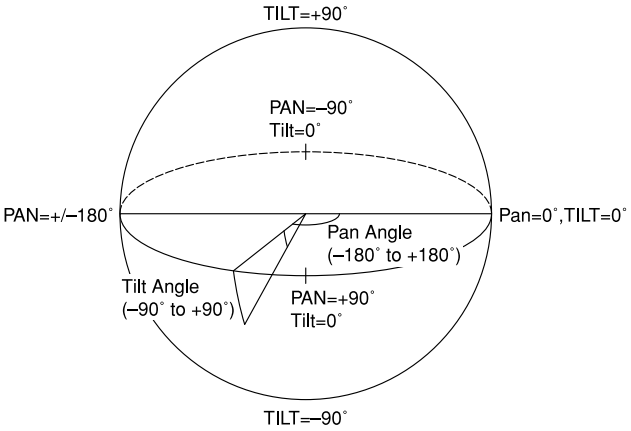
Mask (color)	Code (qq, rr)	Translucence (qq, rr)
Black	00 h	10 h
Gray1	01 h	11 h
Gray2	02 h	12 h
Gray3	03 h	13 h
Gray4	04 h	14 h
Gray5	05 h	15 h
Gray6	06 h	16 h
White	07 h	17 h
Red	08 h	18 h
Green	09 h	19 h
Blue	0A h	1A h
Cyan	0B h	1B h
Yellow	0C h	1C h
Magenta	0D h	1D h
Mosaic	7F h	

Setting pan/tilt angle

Angle/Parameter of Angle (ppp, qqq)



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



Extended Commands

Extended commands support the following functions (described previously).
Turn on this mode (for details, see “Extended Mode” in “Register Setting” on page 55) to enable the following functions.

- **Exposure Compensation**
  The setting can be set in steps of approximately 0.2dB (-128 (00h) to approximately +127 (FFh)).
  For details, see page 9.
- **Aperture Control**
  The setting can be set to 256 levels (00h to FFh).
  For details, see page 10.
- **Custom Color Gain**
  The initial setting is 100% (80h), and the setting can be set to 256 levels from approximately 0% (00h) to approximately 200% (FFh).
  For details, see page 11.
- **Custom Color Phase**
  The initial setting is 0 degrees (80h), and the setting can be set to 256 levels from approximately −14 degrees (00h) to approximately +14 degrees (FFh).
  For details, see page 11.
- **Auto ICR Mode**
  The setting of ICR ON→OFF threshold can be set when Auto ICR is on.
  The setting range is 0 step (00h) to 255 step (FFh).
  The setting of ICR OFF→ON threshold (On Level) can be set when Auto ICR is on.
  The setting range is 0 step (00h) to 28 step (1Ch).
  For details, see page 12.

Note

When the extended mode is Off, CMD_NOT_EXEC will be returned if you send the extended commands to the camera.
When the extended mode is On, CMD_NOT_EXEC will be returned if you send the normal commands to the camera.

About the firmware update

Overview

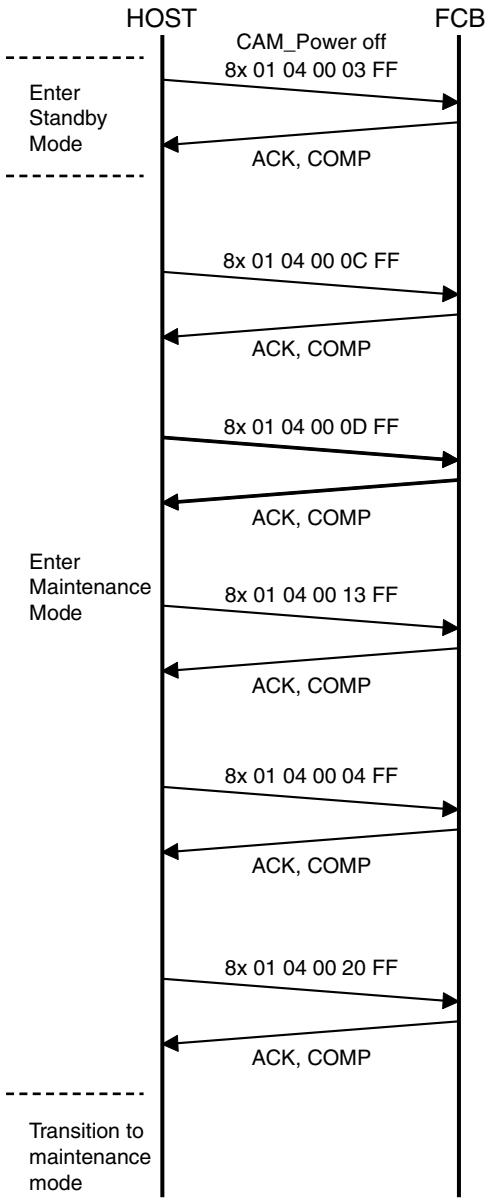
This document descries detailed operation for firmware update.

Serial Port Setting during maintenance mode

Communication Speed	115200 bps
Data bit	8 bit
Parity	None
Stop bit	1 bit
Flow control	None

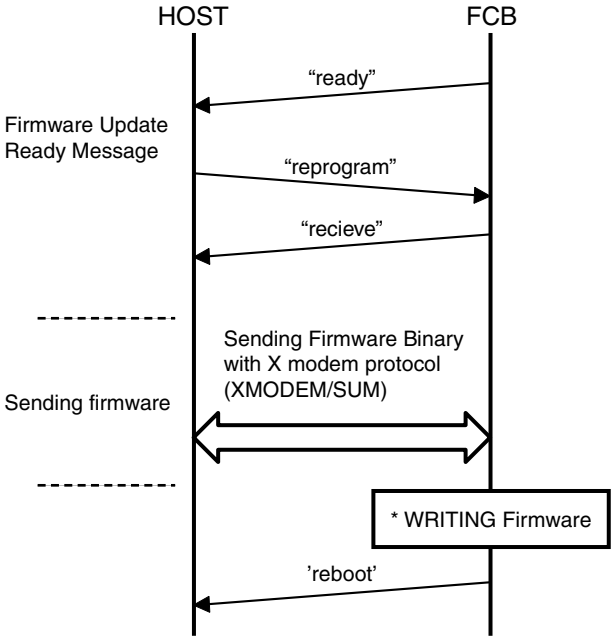
Update Procedure (UART)

Enter Maintenance Mode



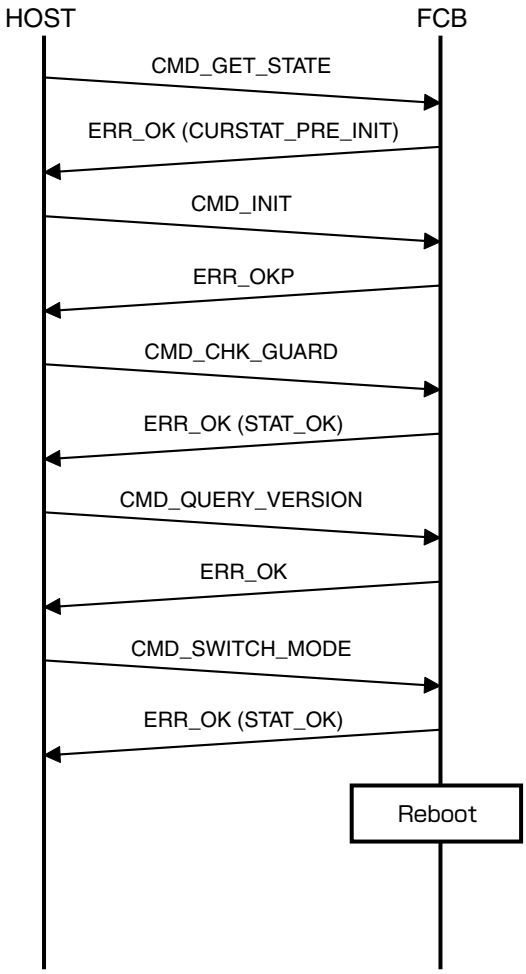
* It takes approximately 14 seconds to transition to maintenance mode.
* When power is off during this period, camera will be broken.

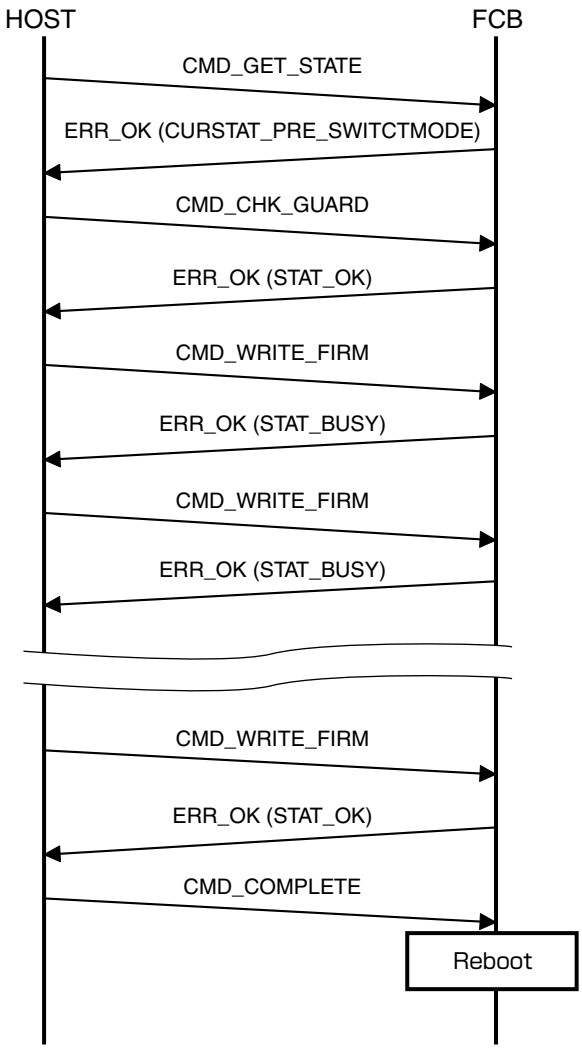
Maintenance Mode



* When power is off during this period, camera will be broken.

Update procedure (USB)



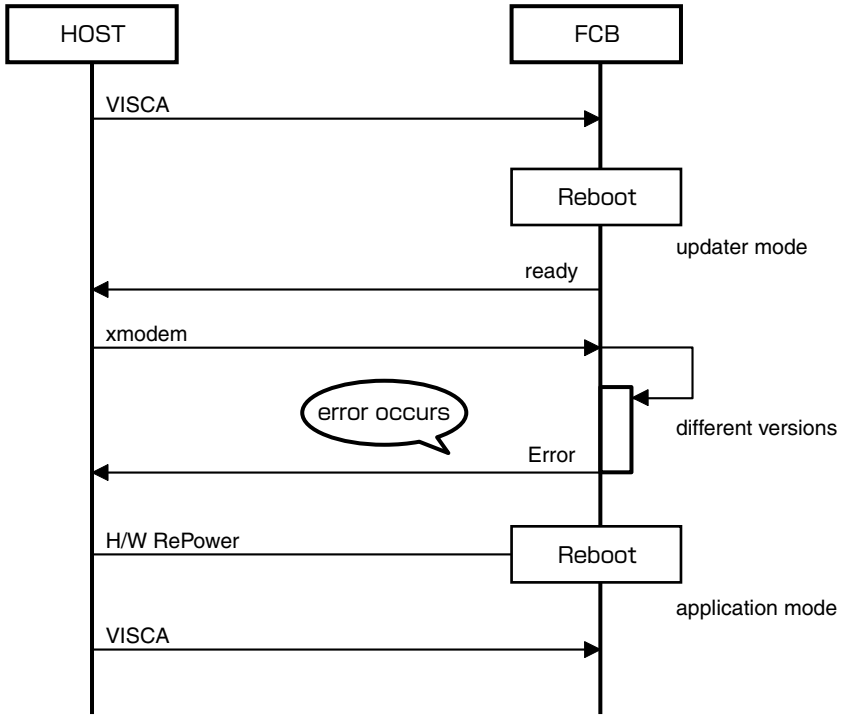


Error occurrence patterns

The update (UART) error patterns are as follows.

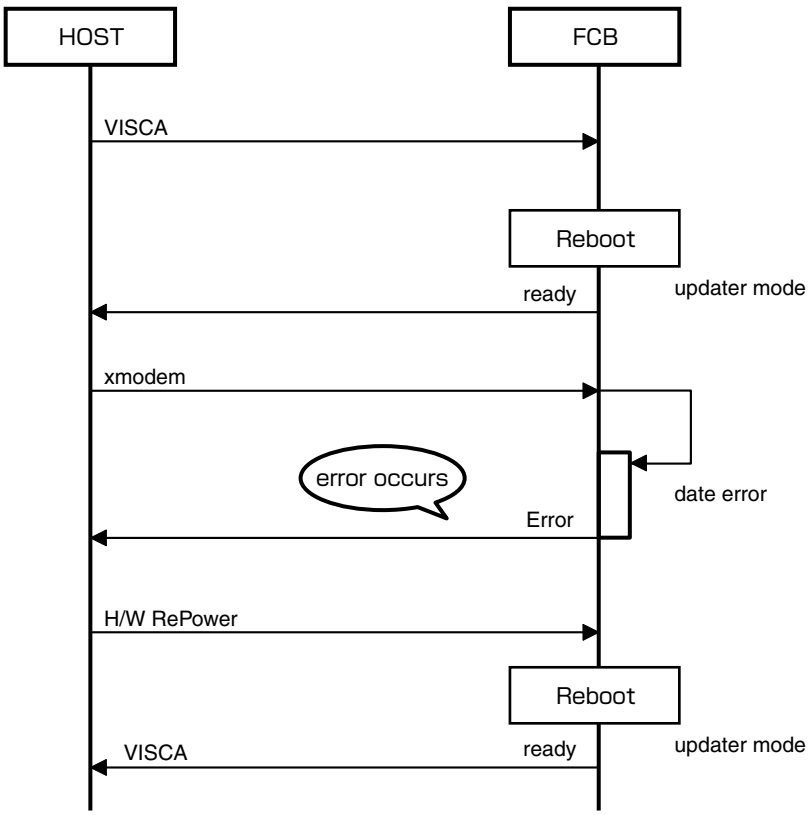
UART update-error 1

Different versions



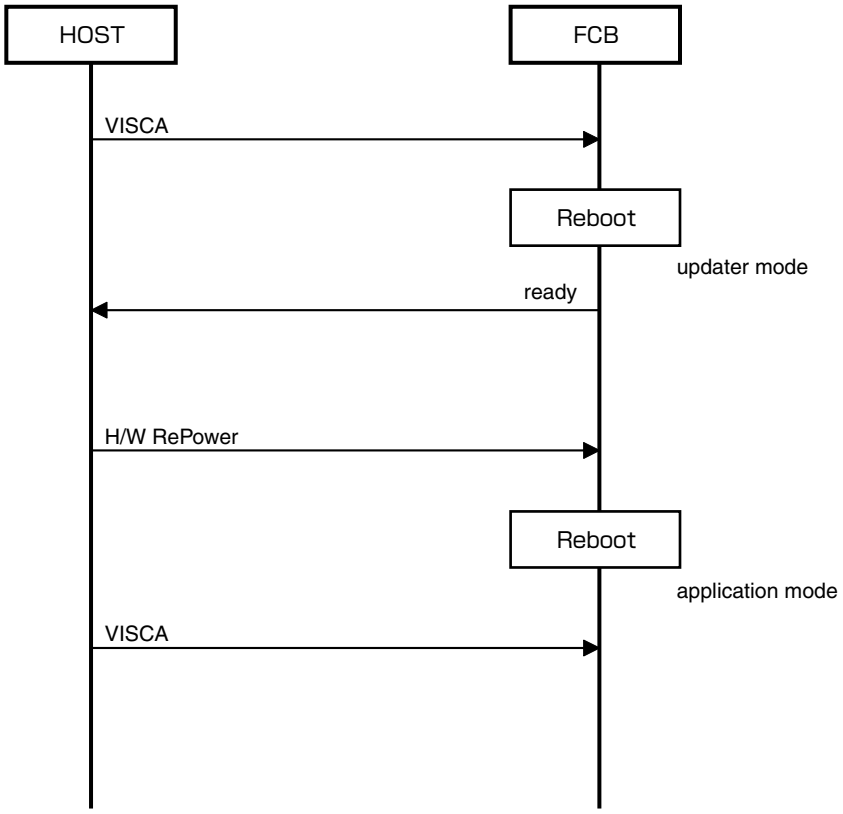
UART update-error 2

Error during update



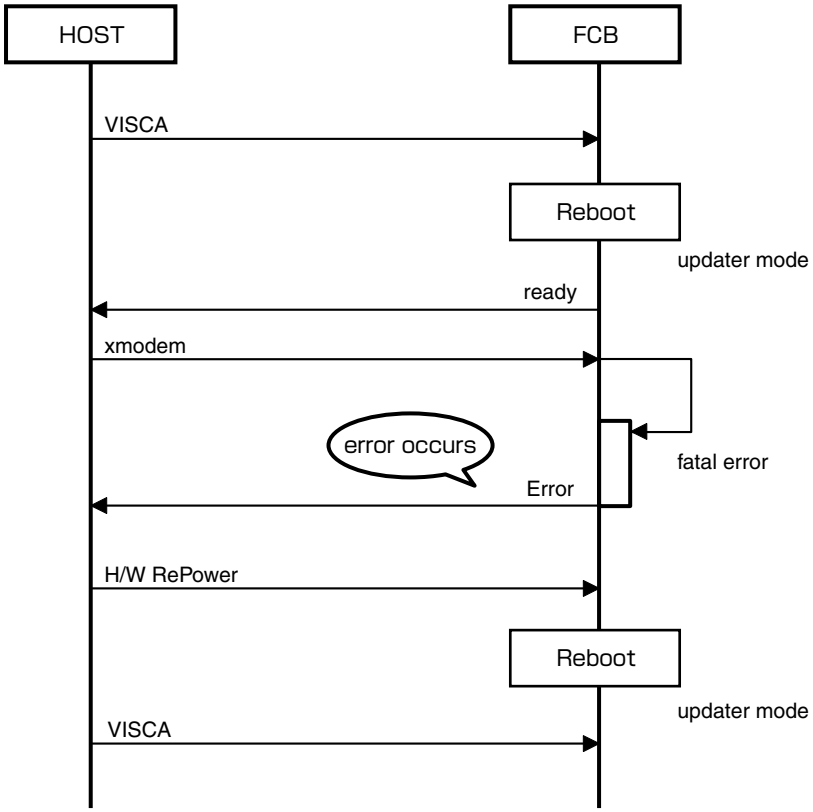
UART update-error 3

No update



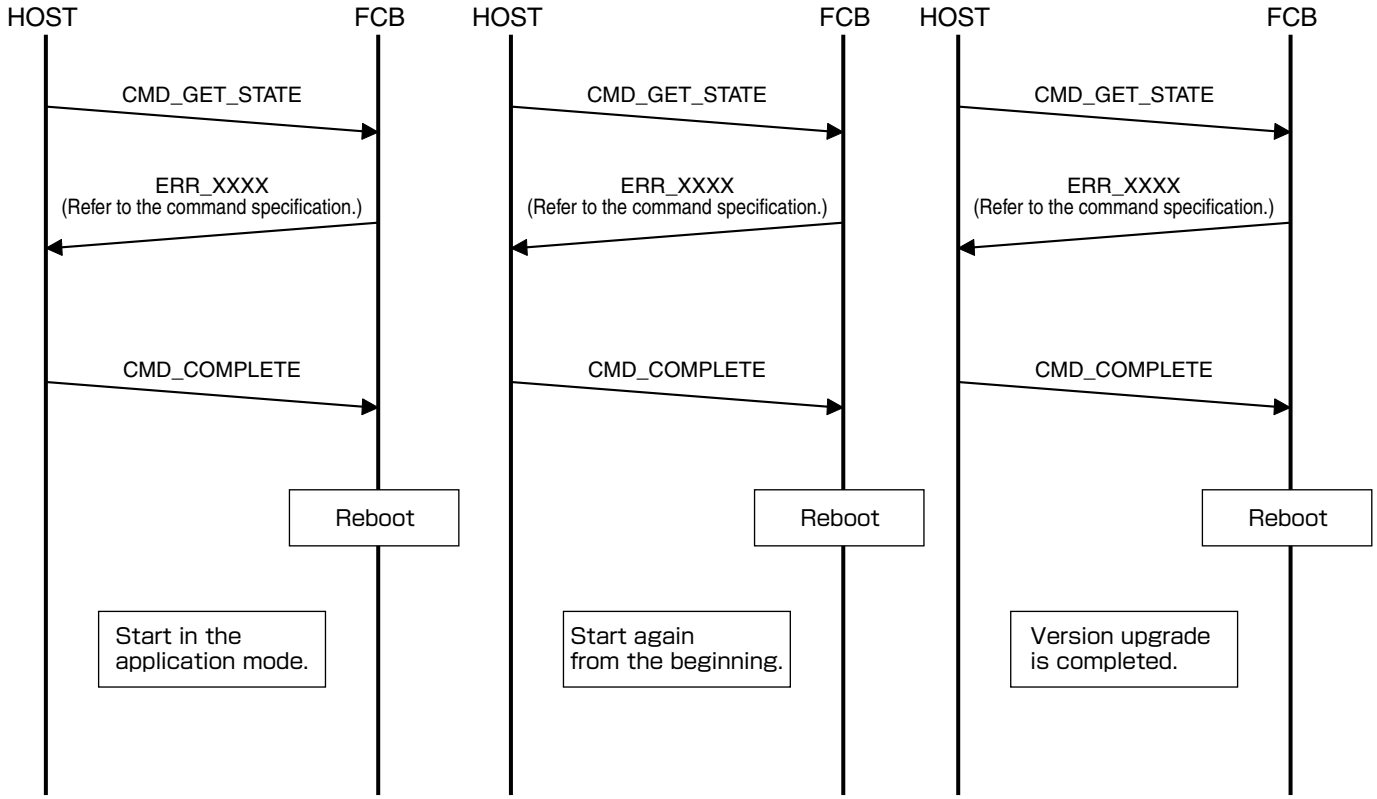
UART update-error 4

Fatal error



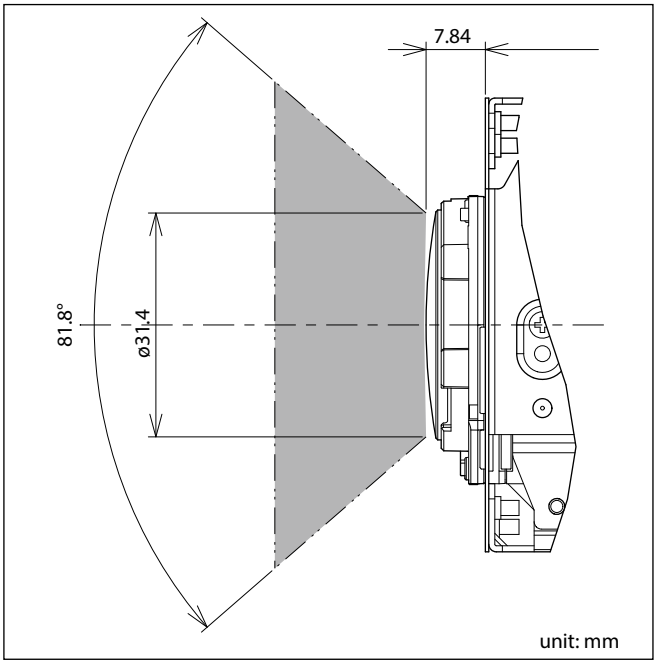
Update Procedure (USB)

The update (USB) error patterns are as follows.

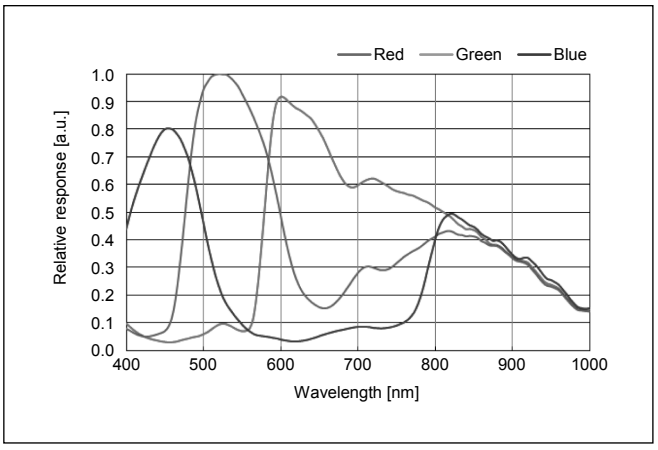


Eclipse

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



Spectral Sensitivity Characteristics



Use the graph as a reference value. (We can not guarantee these values.)
This data is measured when the IR cut filter is removed and the characteristics of the lens and optical source characteristics are ignored.

Initial Settings, Custom Preset and Backup

Initial Settings for the various functions of the FCB camera 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 “Back up at standby” column indicates whether the data is preserved even when the camera is in the standby mode.

Mode/Position setting	Initial Settings	Custom Preset	Back up at standby
Zoom Position	wide end	○	○
D-Zoom On/Off	Off	○	○
D-Zoom Separate/Combine	Combine	○	○
D-Zoom Position	00h	○	○
Focus Position	—	○	○
Focus Auto/Manual	Auto	○	○
Near Limit Setting	B000 (25 cm)	○	○
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	○	○
AE Response	01h	○	○
Shutter Position	—	○	○
Maximum Shutter Limit	1Dh: 1/2000 (59.94 fps) 1Dh: 1/2000 (50 fps) 1Dh: 1/30 (29.97 fps) 1Dh: 1/25 (25 fps) 1Eh: 1/48 (23.98 fps)	○	○
Minimum Shutter Limit	12h: 1/60 (59.94 fps) 12h: 1/50 (50 fps) 10h: 1/30 (29.97 fps) 10h: 1/25 (25 fps) 12h: 1/48 (23.98 fps)	○	○
Slow Shutter Limit	0Dh: 1/10 (59.94 fps) 0Dh: 1/10 (29.97 fps) 0Dh: 1/12(50 fps) 0Dh: 1/12(25 fps) 0Dh: 1/12 (23.98 fps)	○	○
Iris Position	15h: F2.8	○	○
Gain Position	01h: 0dB	○	○
Bright Position	—	○	○
Exposure Compensation On/Off	Off	○	○
Exposure Compensation Amount	±0	○	○
BackLight On/Off	Off	○	○

A circle “○” in this column signifies that the data is preserved.

A cross “×” signifies that the data IS NOT preserved.

Mode/Position setting	Initial Settings	Custom Preset	Back up at standby
Spot AE On/Off	Off	○	○
Spot AE Position Setting	X=8, Y=8	○	○
Detail Level	07h	○	○
High Resolution Mode On/Off	Off	○	○
LR Reverse On/Off	Off	○	○
Freeze On/Off	Off	×	×
Picture Effect	Off	○	○
ICR On/Off	Off	○	○
Auto ICR On/Off	Off	○	○
Auto ICR Threshold Level	0Eh	○	○
ND Filter Off/ND1/ND2/ND3	Off	○	○
Camera Memory	Same as the factory value setting	×	○
Display On/Off	Off	○	○
Mute On/Off	Off	×	×
Auto ICR Alarm On/Off	Off	○	○
NR Level	3	○	○
Image Stabilizer	Off	○	○
Gain Limit	Off	○	○
Low-Illumination Chroma Suppress	1h (Low)	○	○
Color Gain	4h (100%)	○	○
Color Hue	7h (0 degrees)	○	○
Title Display On/Off	Off	○	○
Title Setting	—	○	○
Mask Setting	—	○	○
Mask Color Setting	—	○	○
Center Line Display On/Off	Off	○	○
E-Flip On/Off	Off	○	○
Privacy Zone On/Off	Off	○	○
Privacy Zone Setting	—	○	○
Camera ID	0000h	×	○
ZoomPos Continuous Output On/Off	Off	×	○
ZoomPos Continuous Output Interval	3Ch	×	○
HLC Level	Off	○	○
HLC Mask Level	Off	○	○

A circle "○" in this column signifies that the data is preserved.
A cross "×" signifies that the data IS NOT preserved.

Notes

- The number of times written to Non-volatile memory (when Custom Preset is executed) is limited.
- Privacy Zone Setting while digital zooming is not preserved by Custom Preset.

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	×	×	○	○	×	×	×	○	×
D-Zoom On/Off	×	×	○	○	×	×	○	×	○
D-Zoom Separate/Combine	×	×	○	○	×	×	○	×	○
D-Zoom Tele/Wide/Stop	×	×	○	○	×	○	○	○	○
D-Zoom ×1/Max	×	×	○	○	×	○	○	○	○
D-Zoom Direct	×	×	○	○	×	○	○	○	○
Focus Far/Near/Stop	×	×	○	○	×	○	×	×	×
Focus Direct	×	×	○	○	×	○	○	×	×
Focus Auto/Manual	×	×	○	○	×	○	×	×	○
One Push AF	×	×	○	○	×	○	×	×	×
Focus Near Limit	×	×	○	○	×	○	×	×	○
AF Sensitivity Normal/Low	×	×	○	○	×	○	○	○	○
AF Mode Norm/Interval/Zoom	×	×	○	○	×	○	○	○	○
AF Activation Time/Interval Setting	×	×	○	○	×	○	○	○	○
Camera Memory Set/Reset	×	×	○	○	×	×	×	×	○
Camera Memory Recall	×	×	○	○	○	×	×	×	○
Lens Initialize	×	×	○	○	×	×	×	×	○

White Balance

Mode	Power Off	Initializing	Power On	Freeze On	MemRecall	WB Auto	Indoor	Outdoor	Outdoor Auto	Sodium Lamp	Sodium Lamp Auto	Sodium Lamp Outdoor Auto	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	Shutter Priority	Iris Priority	Bright
AE Full Auto	×	×	○	○	×	○	○	○	○	○
AE Manual	×	×	○	○	×	○	○	○	○	○
Shutter Priority	×	×	○	○	×	○	○	○	○	○
Iris Priority	×	×	○	○	×	○	○	○	○	○
Bright	×	×	○	○	×	×	×	○	×	○
Shutter Setting	×	×	○	○	×	×	○	○	×	×
Iris Setting	×	×	○	○	×	×	○	×	○	×
Gain Setting	×	×	○	○	×	×	○	×	×	×
Bright Setting	×	×	○	○	×	×	×	×	×	○
Auto Slow Shutter On/Off	×	×	○	○	×	○	○	○	○	○
Exposure Compensation On/Off	×	×	○	○	×	○	○	○	○	○
Exposure Compensation Setting	×	×	○	○	×	○	○	○	○	○
BackLight On/Off	×	×	○	○	×	○	○	○	○	○
SpotAE On/Off	×	×	○	○	×	○	○	○	○	○
SpotAE Setting	×	×	○	○	×	○	○	○	○	○
Defog On/Off	×	×	○	○	○	○	○	○	○	○
Minimum Shutter On/Off	×	×	○	○	×	○	○	○	○	○
VE On/Off	×	×	○	○	×	○	○	○	○	○
HLC Setting (On/Off/Mask Level)	×	×	○	○	×	○	○	○	○	○

Others

Mode	Power Off	Initializing	Power On	Freeze On	MemRecall
Aperture Setting	×	×	○	○	×
High Resolution Mode On/Off	×	×	○	○	○
LR_Reverse On/Off	×	×	○	○	○
Freeze On/Off	×	×	○	○	○
Picture Effect Setting	×	×	○	○	○
ICR On/Off	×	×	○	○	○
Auto ICR On/Off	×	×	○	○	×
Auto ICR Threshold Level Setting	×	×	○	○	○
Auto ICR Alarm On/Off	×	○	○	○	○
ND Filter Off/ND1/ND2/ND3	×	×	○	○	○
Display On/Off	×	×	○	○	○
Mute On/Off	×	×	○	○	○
Title Setting	×	×	○	○	○
Mask On/Off	×	×	○	○	○
Mask Setting	×	×	○	○	○
MD On/Off	×	×	○	○	○
ID Write	×	×	○	○	○
Memory Save	×	×	○	○	○
Register Value Setting	×	×	○	○	○
NR Level Setting	×	×	○	○	○
Chroma Suppress	×	×	○	○	○
Color Gain	×	×	○	○	○
Color Hue	×	×	○	○	○

Command List

VISCA/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/115.2 kbps
- Data bits : 8
- Start bit : 1
- Stop bit : 1
- Non parity

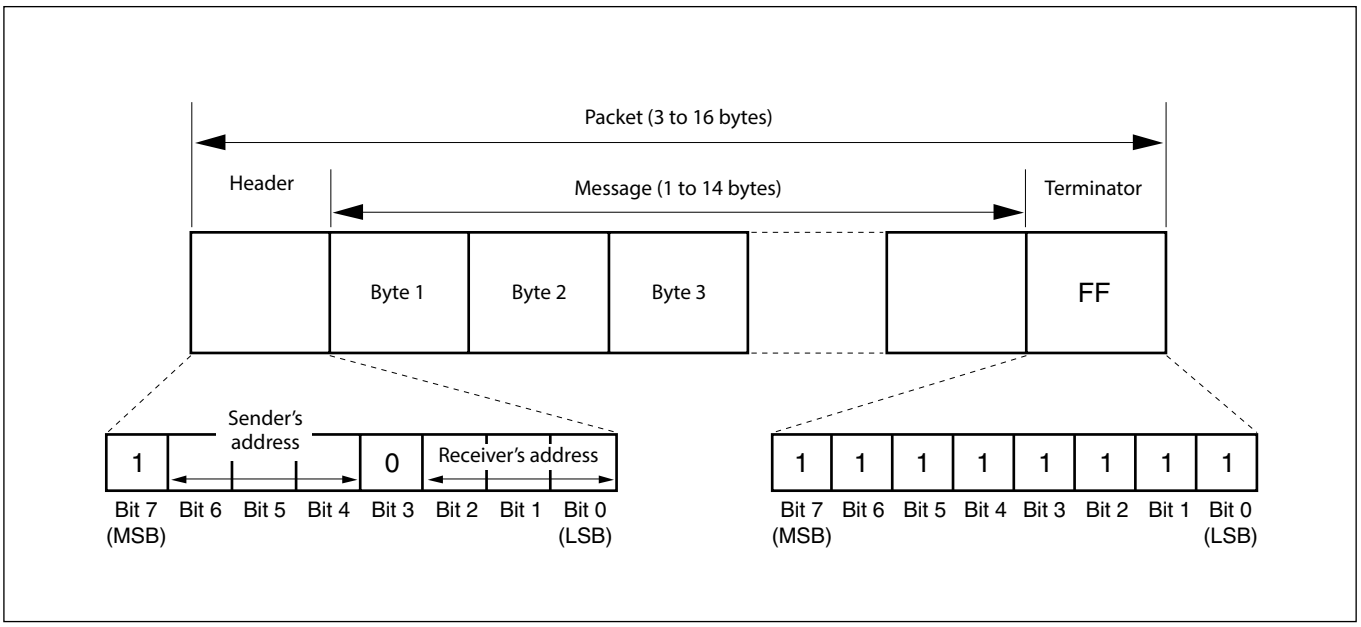
Flow control using XON/XOFF and RTS/CTS, etc., is not supported.

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.

Transmitting the commands regardless of the camera ID is called broadcasting.
In the case of broadcast, the header should be hexadecimal 88h.
When the terminator is FFh, it signifies the end of the packet.
The camera supports only Address Set and IF_Clear among the commands transmitted by broadcasting.



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/Tilt), 07 (camera 2)

X = 1 to 7: FCB camera address

Responses for commands and inquiries

● **Acknowledge message**
Returned by the FCB camera when it receives a command. No Acknowledge 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 Acknowledge message is omitted, the socket number will contain 0.

	Reply Packete
Acknowledge	X0 4Y FF
Completion (Commands)	X0 5Y FF
Completion (Inquiries)	X0 5Y ... FF

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

● **Error message**
When a command could not be executed or failed, an error message is returned instead of the Acknowledge message. After an Acknowledge message, an error message may be returned if the process of some command (zoom, etc.) has not been completed.
When a 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, send the next command message after waiting for the completion message or error message to return. However to deal with advanced uses, the FCB camera has two buffers (memories) for commands, so that up to two commands including the commands currently being executed can be received. When the FCB camera receives commands, it notifies the sender which command buffer was used using the socket number of the Acknowledge 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, an FCB camera management command and some inquiry messages can be executed.

The Acknowledge 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
Cancel	8X 2Y FF

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

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

VISCA Command/Acknowledge Protocol

Command	Command Message	Reply Message	Comments
General Command	81 01 04 38 02 FF (Example)	90 41 FF (Acknowledge) +90 51 FF (Completion) 90 42 FF 90 52 FF	Returns Acknowledge 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 41 FF	Could not execute the command in the current mode.
Inquiry Command	81 09 04 38 FF (Example)	90 50 02 FF (Completion)	Acknowledge 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)	Acknowledge 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

Acknowledge/Completion Messages

	Command Messages	Comments
Acknowledge	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 (1/7)

Command Set	Command	Command Packet	Comments
AddressSet	Broadcast	88 30 0p FF	Address Setting p:Address
IF_Clear	–	8x 01 00 01 FF	I/F Clear
	Broadcast	88 01 00 01 FF	
CommandCancel	–	8x 2p FF	p: Socket No. (=1 or 2)
CAM_Power	On	8x 01 04 00 02 FF	Power On/Off
	Off (Standby)	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 Min. 0000h Max. 4000h (In Separate mode) Max. 4000h (In Combine mode and DZoom=Off) Max. 5556h (In Combine mode, DZoom=Super Resolution Zoom, and monitoring mode QFHD) Max. 6000h (In Combine mode, DZoom=Super Resolution Zoom, and monitoring mode FHD or less) Max. 7AC0h (In Combine mode and DZoom=On)
CAM_DZoom	On	8x 01 04 06 02 FF	Digital Zoom On/Off/Super Resolution Zoom
	Off	8x 01 04 06 03 FF	
	Super Resolution Zoom	8x 01 04 06 04 FF	
	Combine Mode	8x 01 04 36 00 FF	Optical/Digital Zoom Combined
	Separate Mode	8x 01 04 36 01 FF	Optical/Digital Zoom Separate
	Stop	8x 01 04 06 00 FF	–
	Tele (Variable)	8x 01 04 06 2p FF	p=0 (Low) to 7 (High) * Enabled during Separate Mode
	Wide (Variable)	8x 01 04 06 3p FF	
	x1/Max	8x 01 04 06 10 FF	x1/MAX Magnification Switchover * Enabled during Separate Mode
	Direct	8x 01 04 46 00 00 0p 0q FF	pq: D-Zoom Position (00h to EBh) * Enabled during Separate Mode
CAM_Focus Mode	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	
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 0000h to F000h
	One Push Trigger	8x 01 04 18 01 FF	One Push AF Trigger
	Near Limit	8x 01 04 28 0p 0q 0r 0s FF	pqrs: Focus Near Limit Position 1000h to F000h
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

Command List (2/7)

Command Set	Command	Command Packet	Comments
CAM_SpotFocus	On	8x 01 05 08 02 FF	pq: X (0h to Fh), rs: Y (0h to Fh)
	Off	8x 01 05 08 03 FF	
	Position	8x 01 05 68 0p 0q 0r 0s FF	
CAM_AFSensitivity	Normal	8x 01 04 58 02 FF	AF Sensitivity switching
	Low	8x 01 04 58 03 FF	
CAM_IRCorrection	Standard	8x 01 04 11 00 FF	Focus IR compensation data switching
	IR Light	8x 01 04 11 01 FF	
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
	Camera	8x 01 04 19 03 FF	Camera reset
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
	Outdoor Auto	8x 01 04 35 06 FF	Outdoor auto
	Sodium Lamp Auto	8x 01 04 35 07 FF	Auto including sodium lamp source
	Sodium Lamp	8x 01 04 35 08 FF	Sodium lamp source fixed mode
	Sodium Lamp Outdoor Auto	8x 01 04 35 09 FF	Outdoor auto including sodium lamp source
CAM_WBTrigger	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 00h to FFh
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 00h to FFh
CAM_AE	Full Auto	8x 01 04 39 00 FF	Full Auto
	Manual	8x 01 04 39 03 FF	Manual Control mode
	Shutter Priority	8x 01 04 39 0A FF	Shutter Priority Auto Exposure mode
	Iris Priority	8x 01 04 39 0B FF	Iris Priority Auto Exposure mode
	Gain Priority	8x 01 04 39 0E FF	Gain Priority Auto Exposure mode
	Bright	8x 01 04 39 0D FF	Bright Mode (Manual control)
CAM_ LowLightBasisBrightness	On	8x 01 05 39 02 FF	p: Position
	Off	8x 01 05 39 03 FF	
	Position	8x 01 05 49 0p 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_MaxShutter	Limit	8x 01 05 2A 00 0p 0q FF	pq: High-speed shutter limit
CAM_MinShutter	Limit	8x 01 05 2A 01 0p 0q FF	pq: Low-speed shutter limit

Command List (3/7)

Command Set	Command	Command Packet	Comments
CAM_SlowShutter	On	8x 01 04 5A 02 FF	Slow Shutter On/Off
	Off	8x 01 04 5A 03 FF	
	Limit	8x 01 05 5A 0p 0q FF	pq: Slow Shutter Limit
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
	Gain Limit	8x 01 04 2C 0p FF	p: Gain Limit
	Gain Point Pos	8x 01 05 4C 0p 0q FF	pq: Gain Point
	Gain Point On/Off	8x 01 05 0C 0p FF	p:2=On, 3=Off
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 00h to 0Eh
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 Auto Exposure Setting
	Off	8x 01 04 59 03 FF	
	Position	8x 01 04 29 0p 0q 0r 0s FF	pq: X (0h to Fh), rs: Y (0h to Fh)
CAM_AE_Response	Direct	8x 01 04 5D pp FF	pp: Auto Exposure Response Setting (01h to 30h), default value: 01h
CAM_VE	Off	8x 01 04 3D 03 FF	VE Off
	VE On	8x 01 04 3D 06 FF	VE On
	Set Parameter	8x 01 04 2D 00 0q 0r 0s 00 00 00 00 FF	q: Display brightness level (0: Dark to 6: Bright) r: Brightness compensation selection (0: Very dark, 1: Dark, 2: Standard, 3: Bright) s: Compensation level (0: Low, 1: Mid, 2: High)
CAM_Defog	On	8x 01 04 37 02 0p FF	Defog On/Off p: Defog level (0: mid, 1: low, 2: mid, 3: high)
	Off	8x 01 04 37 03 00 FF	

Command List (4/7)

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	
	Level	8x 01 04 42 00 00 0p 0q FF	pq: Aperture Gain (00h to 0Fh)
	Mode	8x 01 05 42 01 0p FF	p: Auto (0)/Manual (1) selection
	BandWidth	8x 01 05 42 02 0p FF	p: Bandwidth setting 0: default (initial value) 1: low bandwidth 2: mid bandwidth 3: wide bandwidth 4: broad bandwidth
	Crispening	8x 01 05 42 03 0p FF	p: Crispening (0h to 7h)
	H/V balance	8x 01 05 42 04 0p FF	p: H/V Balance (5h to 9h)
	B/W balance	8x 01 05 42 05 0p FF	p: B/W Balance (0h to 4h)
	Limit	8x 01 05 42 06 0p FF	p: Limit (0h to 7h)
	HighLightDetail	8x 01 05 42 07 0p FF	p: High light detail (0h to 4h)
	SuperLow	8x 01 05 42 08 0p FF	p: Super low emphasis (0h to 7h)
CAM_HR	On	8x 01 04 52 02 FF	High Resolusion Mode On/Off
	Off	8x 01 04 52 03 FF	
CAM_NR	Noise Reduction	8x 01 04 53 pp FF	p: NR setting (00h: Off, 01h to 05h: level, 7Fh: 2D/3D manual setting)
	2D NR/3D NR	8x 01 05 53 0p 0q FF	p: 2D NR level (0h to 5h), q: 3D NR level (0h to 5h)
CAM_Stabilizer	On	8x 01 04 34 04 FF	Image Stabilizer On/Off
	Off	8x 01 04 34 03 FF	
CAM_Gamma	—	8x 01 04 5B 0p FF	p: Gamma Setting (0: Standard, 1: Straight, 2: Pattern)
	Pattern	8x 01 05 5B 0p 0q 0r FF	pqr: Selection pattern (001h to 200h)
	Offset	8x 01 04 1E 00 00 00 0s 0t 0u FF	s: Polarity offset (0 is plus, 1 is minus) tu: Offset s=0 (00h to 40h) Offset s=1 (00h to 40h)
CAM_HighSensitivity	On	8x 01 04 5E 02 FF	High Sensitivity mode On/Off
	Off	8x 01 04 5E 03 FF	
CAM_LR_Reverse	On	8x 01 04 61 02 FF	LR Reverse On/Off
	Off	8x 01 04 61 03 FF	
CAM_Freeze	On	8x 01 04 62 02 FF	Freeze On/Off
	Off	8x 01 04 62 03 FF	
CAM_PictureEffect	Off	8x 01 04 63 00 FF	Picture Effect Setting
	Black & White	8x 01 04 63 04 FF	
CAM_PictureFlip	On	8x 01 04 66 02 FF	E-Flip On/Off
	Off	8x 01 04 66 03 FF	
CAM_ICR	On	8x 01 04 01 02 FF	ICR Mode On/Off
	Off	8x 01 04 01 03 FF	
CAM_AutoICR	On	8x 01 04 51 02 FF	Auto ICR Mode On/Off
	Off	8x 01 04 51 03 FF	
	Threshold	8x 01 04 21 00 00 0p 0q FF	pq: ICR On → Off Threshold Level (00h to FFh)
CAM _AutoICRAlarmReply	On	8x 01 04 31 02 FF	Auto ICR switching Alarm On/Off
	Off	8x 01 04 31 03 FF	
	(Reply)	y0 07 04 31 02 FF	ICR Off → On
		y0 07 04 31 03 FF	ICR On → Off

Command List (5/7)

Command Set	Command	Command Packet	Comments
CAM_NDFilter	ND Filter	8x 01 7E 01 53 0p	p=0: OFF p=1: ND1 p=2: ND2 p=3: ND3
CAM_Memory	Reset	8x 01 04 3F 00 pp FF	pp: Memory Number (=0h to 63h)
	Set	8x 01 04 3F 01 pp FF	
	Recall	8x 01 04 3F 02 pp FF	
CAM_Custom	Reset	8x 01 04 3F 00 7F FF	Starts up in this mode when the power is turned 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 0q 0r 0s FF	X: 00h to 07h (Address), total 16 byte pqrs: 0000h to FFFFh (Data)
CAM_Display	On	8x 01 04 15 02 FF	Display On/Off
	Off	8x 01 04 15 03 FF	
	On/Off	8x 01 04 15 10 FF	
CAM_MultiLineTitle	Title Set1	8x 01 04 73 1L 00 nn pp qq 00 00 00 00 00 00 FF	L: Line Number, nn: H-position pp: Color, qq: Blink
	Title Set2	8x 01 04 73 2L mm nn pp qq rr ss tt uu vv ww FF	L: Line Number, mnpqrstuvw: Setting of characters (1 to 10)
	Title Set3	8x 01 04 73 3L mm nn pp qq rr ss tt uu vv ww FF	L: Line Number, mnpqrstuvw: Setting of characters (11 to 20)
	Title Clear	8x 01 04 74 1p FF	Title Setting clear (p: 0h to Ah, F= all lines)
	On	8x 01 04 74 2p FF	Title display On/Off (p: 0h to Ah, F= all lines)
	Off	8x 01 04 74 3p FF	
CAM_Mute	On	8x 01 04 75 02 FF	Muting On/Off
	Off	8x 01 04 75 03 FF	
	On/Off	8x 01 04 75 10 FF	
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
	SetMaskTable	8x 01 05 70 0p FF	p: Table (0h to 1h)
	Display	8x 01 04 77 pp pp pp pp FF	Mask Display On/Off pp pp pp pp: Mask Settings (0: Off, 1: On)
	SetMaskColor	8x 01 04 78 pp pp pp pp qq rr FF	pp pp pp pp: Mask Color Settings qq: Color Setting when 0 is selected rr: Color Setting when 1 is selected
	SetPanTiltAngle	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 ppp: Pan, qqq: Tilt, rrrr: Zoom, mm: Mask Settings
	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
	CenterLineOff	8x 01 04 7C 03 FF	Center Line Display Off
	CenterLineOn	8x 01 04 7C 04 FF	Center Line Display On
CAM_IDWrite	—	8x 01 04 22 0p 0q 0r 0s FF	pqrs: Camera ID (=0000h to FFFFh)
CAM_Continuous ZoomPosReply	On	8x 01 04 69 02 FF	Zoom Position data Continuous Output On/Off
	Off	8x 01 04 69 03 FF	
	(Reply)	y0 07 04 69 0p 0p 0q 0q 0q 0q FF	pp: D-Zoom Position * 00: When Zoom Mode is Combine qqqq: Zoom Position
CAM_ZoomPos ReplyIntervalTimeSet	—	8x 01 04 6A 00 00 0p 0p FF	pp: Interval Time [V cycle] 01h to FFh

Command List (6/7)

Command Set	Command	Command Packet	Comments
CAM_Continuous FocusPosReply	On	8x 01 04 16 02 FF	Focus Position data Continuous Output On/Off
	Off	8x 01 04 16 03 FF	
	(Reply)	y0 07 04 16 00 00 0p 0p 0p 0p FF	pppp: Focus Position
CAM_FocusPosReply IntervalTimeSet	—	8x 01 04 1A 00 00 0p 0p FF	pp: Interval Time [V cycle] 01h to FFh
CAM_RegisterValue	—	8x 01 04 24 mn 0p 0q FF	mn: Register No. (=00h to 7Fh) pq: Register Value (=00h to FFh)
CAM_ChromaSuppress	—	8x 01 04 5F 0p FF	p: Chroma Suppress setting level 00: Off 01h to 03h: On (3 levels). Effect increases as the level number increases.
CAM_ColorGain	Direct	8x 01 04 49 00 00 00 0p FF	p: Color Gain Setting 0h (60%) to Eh (200%)
CAM_ColorHue	Direct	8x 01 04 4F 00 00 00 0p FF	p: Color Hue Setting 0h (-14 degrees) to Eh (+14 degrees)
CAM_ExExpComp (Extended command)	Reset	8x 01 04 1F 0E 00 00 FF	Exposure compensation reset
	Up	8x 01 04 1F 0E 02 pp FF	Exposure compensation up pp: Step number pp=00h to 7Fh (However, 00h is the same operation as 01h.)
	Down	8x 01 04 1F 0E 03 pp FF	Exposure compensation down pp: Step number pp=00h to 7Fh (However, 00h is the same operation as 01h.)
	Direct	8x 01 04 1F 4E 00 00 0p 0q FF	Set the exposure compensation to the specified level pq: Level pq=00h to FFh
CAM_ExAperture (Extended command)	Reset	8x 01 04 1F 02 00 00 FF	Aperture control reset
	Up	8x 01 04 1F 02 02 pp FF	Aperture control up pp: Step number pp=00h to 7Fh (However, 00h is the same operation as 01h.)
	Down	8x 01 04 1F 02 03 pp FF	Aperture control down pp: Step number pp=00h to 7Fh (However, 00h is the same operation as 01h.)
	Direct	8x 01 04 1F 42 00 00 0p 0q FF	Set the aperture control to the specified level pq: Level pq=00h to FFh
CAM_ExAutoICR (Extended command)	Threshold (ON→OFF)	8x 01 04 1F 21 00 00 0p 0q FF	pq: ICR ON→OFF threshold level when Auto ICR pq=00h to FFh
	On Level	8x 01 04 1F 21 01 00 0r 0s FF	pq: ICR OFF→ON threshold level when Auto ICR pq=00h to 16h
CAM_ExColorGain (Extended command)	Direct	8x 01 04 1F 49 00 00 0p 0q FF	Color Gain Setting pq: Gain setting level pq=00h (0%) to FFh (200%)
CAM_ExColorHue (Extended command)	Direct	8x 01 04 1F 4F 00 00 0p 0q FF	Color Hue Setting pq: Phase setting level pq=00h (-14 degrees) to FFh (14 degrees)
CAM_HLC	Parameter Set	8x 01 04 14 0p 0q FF	p: HLC level (0: Off, 1: On) q: HLC mask level (0: Off, 1: On)
CAM_ColorBar	Off	8x 01 7E 04 7D 00 FF	—
	On (Color bar 100% 8 colors)	8x 01 7E 04 7D 01 FF	
	On (Color bar 100% 7 colors)	8x 01 7E 04 7D 02 FF	
	On (Gray scale)	8x 01 7E 04 7D 03 FF	

Command List (7/7)

Command Set	Command	Command Packet	Comments
CAM_ePT	On	8x 01 7E 06 00 02 FF	
	Off	8x 01 7E 06 00 03 FF	
	Absolute Position	8x 01 7E 06 20 00 00 0y 0y 0y 0y 0z 0z 0z 0z FF	yyyy: Pan Position, zzzz: Tilt Position *Supplementary explanation: Pan Position is specified in units of 6 pixels and Tilt Position is specified in units of 4.5 pixels (cut off after the decimal point)
CAM_MaintenanceMode	Step1	8x 01 04 00 0C FF	Used in maintenance mode
	Step2	8x 01 04 00 0D FF	
	Step3	8x 01 04 00 13 FF	
	Step4	8x 01 04 00 04 FF	
	Updata	8x 01 04 00 20 FF	

Inquiry Command List (1/4)

Inquiry Command	Command Packet	Inquiry Packet	Comments
CAM_PowerInq	8x 09 04 00 FF	y0 50 02 FF	On
		y0 50 03 FF	Off (Standby)
CAM_ZoomPosInq	8x 09 04 47 FF	y0 50 0p 0q 0r 0s FF	pqrs: Zoom Position
CAM_DZoomModeInq	8x 09 04 06 FF	y0 50 02 FF	D-Zoom On
		y0 50 03 FF	D-Zoom Off
		y0 50 04 FF	Super Resolution Zoom
CAM_DZoomC/SModeInq	8x 09 04 36 FF	y0 50 00 FF	Combine Mode
		y0 50 01 FF	Separate Mode
CAM_DZoomPosInq	8x 09 04 46 FF	y0 50 00 00 0p 0q FF	pq: D-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_SpotFocusModeInq	8x 09 05 08 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_SpotFocusPosInq	8x 09 05 68 FF	y0 50 0p 0q 0r 0s FF	pq: X, rs: Y
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_LowLightBasis BrightnessInq	8x 09 05 39 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_LowLightBasis BrightnessPosInq	8x 09 05 49 FF	y0 50 0p FF	p: Position
CAM_IRCorrectionInq	8x 09 04 11 FF	y0 50 00 FF	Standard
		y0 50 01 FF	IR Light
CAM_WBModeInq	8x 09 04 35 FF	y0 50 00 FF	Auto
		y0 50 01 FF	Indoor
		y0 50 02 FF	Outdoor
		y0 50 03 FF	One Push WB
		y0 50 04 FF	ATW
		y0 50 05 FF	Manual
		y0 50 06 FF	Outdoor Auto
		y0 50 07 FF	Sodium Lamp Auto
		y0 50 08 FF	Sodium Lamp
		y0 50 09 FF	Sodium Lamp Outdoor Auto
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_ShutterPosInq	8x 09 04 4A FF	y0 50 00 00 0p 0q FF	pq: Shutter Position
CAM_MaxShutterInq	8x 09 05 2A 00 FF	y0 50 0p 0q FF	pq: High-speed shutter limit
CAM_MinShutterInq	8x 09 05 2A 01 FF	y0 50 0p 0q FF	pq: Low-speed shutter limit
CAM_SlowShutterInq	8x 09 04 5A FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_SlowShutterLimitInq	8x 09 05 5A FF	y0 50 0p 0q FF	pq: Slow Shutter Limit

Inquiry Command List (2/4)

Inquiry Command	Command Packet	Inquiry Packet	Comments
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_GainLimitInq	8x 09 04 2C FF	y0 50 0q FF	p: Gain Limit
CAM_GainPointInq	8x 09 05 4C FF	y0 50 0p 0q FF	pq: Gain Point
Gain Point On/Off Inq	8x 09 05 0C FF	y0 50 02 FF	On
		y0 50 03 FF	Off
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_SpotAEPosInq	8x 09 04 29 FF	y0 50 0p 0q 0r 0s FF	pq: X Position, rs: Y Position
CAM_SpotAEModeInq	8x 09 04 59 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_VEModeInq	8x 09 04 3D FF	y0 50 03 FF	Off
		y0 50 06 FF	VE On
CAM_VEParameterInq	8x 09 04 2D FF	y0 50 00 0q 0r 0s 0t 0u 00 00 FF	q: Display brightness level (0: Dark to 6: Bright) r: Brightness compensation selection (0: Very dark, 1: Dark, 2: Standard, 3: Bright) s: Compensation level (00h: Low, 01h: Mid, 02h: High) tu: Always 0
CAM_AEResponseInq	8x 09 04 5D FF	y0 50 pp FF	pp: 01h to 30h
CAM_DefogInq	8x 09 04 37 FF	y0 50 02 0p FF	p: Defog level (0: mid, 1: low, 2: mid, 3: high)
		y0 50 03 00 FF	Defog Off
CAM_ApertureInq	8x 09 04 42 FF	y0 50 00 00 0p 0q FF	pq: Aperture Gain
CAM_ApertureModeInq	8x 09 05 42 01 FF	x0 50 0p FF	p: Auto (0), Manual (1)
CAM_ApertureBandwidthInq	8x 09 05 42 02 FF	x0 50 0p FF	p: Bandwidth
CAM_ApertureCrispeningInq	8x 09 05 42 03 FF	x0 50 0p FF	p: Crispening
CAM_ApertureH/VBalance	8x 09 05 42 04 FF	x0 50 0p FF	p: H/V Balance
CAM_ApertureB/WBalance	8x 09 05 42 05 FF	x0 50 0p FF	p: B/W Balance
CAM_ApertureLimitInq	8x 09 05 42 06 FF	x0 50 0p FF	p: Limit
CAM_ ApertureHighLightDetailInq	8x 09 05 42 07 FF	x0 50 0p FF	p: High light detail
CAM_ApertureSuperLowInq	8x 09 05 42 08 FF	x0 50 0p FF	p: Super low emphasis
CAM_HRModeInq	8x 09 04 52 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_NRInq	8x 09 04 53 FF	y0 50 0p FF	Noise Reduction p: 00h to 05h, 7Fh
CAM_NR2D3DInq	8x 09 05 53 FF	y0 50 0p 0q FF	p: 2D NR Level, q: 3D NR Level
CAM_StabilizerModeInq	8x 09 04 34 FF	y0 05 04 FF	On
		y0 05 03 FF	Off
CAM_GammaInq	8x 09 04 5B FF	y0 50 0p FF	Gamma p: 00h, 01h
CAM_GammaPatternInq	8x 09 05 5B FF	y0 50 0p 0q 0r FF	pqr: Selection pattern
CAM_GammaOffsetInq	8x 09 04 1E FF	y0 50 00 00 00 0s 0t 0u FF	s: Polarity offset (0 is plus, 1 is minus) tu: Offset s=0 (00h to 40h) Offset s=1 (00h to 10h)
CAM_HighSensitivityInq	8x 09 04 5E FF	y0 50 02 FF	On
		y0 50 03 FF	Off

Inquiry Command List (3/4)

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	Black & White
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_AutoICRThresholdInq	8x 09 04 21 FF	y0 50 00 00 0p 0q FF	pq: ICR On → Off Threshold Level
CAM_AutoICRAlarmReplyInq	8x 09 04 31 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_AutoICRAlarmReply	(Reply)	y0 07 04 31 0p FF	p: 2=Off → On, 3=On → Off
CAM_MemoryInq	8x 09 04 3F FF	y0 50 pp FF	pp: Memory number recalled last
CAM_MemSaveInq	8x 09 04 23 0X FF	y0 50 0p 0q 0r 0s FF	X: 00h to 07h (Address) pqrs: 0000h to FFFFh (Data)
CAM_DisplayModeInq	8x 09 04 15 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_SetMaskTableInq	8x 09 05 70 FF	y0 50 0m FF	m: Table
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_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 0705: FCB-ES8230 0706: FCB-ES8250 rstu: ROM version vw: Socket Number (=02)
CAM_ContinuousZoomPos ReplyModeInq	8x 09 04 69 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_ZoomPosReply IntervalTimeInq	8x 09 04 6A FF	y0 50 00 00 0p 0p FF	pp: Interval Time
CAM_Continuous FocusPosReplyModeInq	8x 09 04 16 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_ExAutoICROnLevelInq	8x 09 04 1F 21 01 FF	y0 50 00 00 0p 0q FF	pq:Auto ICR Off/On threshold at ICR pq=00h to 1Ch
CAM_NDFilterInq	8x 09 7E 01 53 FF	y0 50 0p FF	p=0: OFF, p=1: ND1 p=2: ND2 p=3: ND3

Inquiry Command List (4/4)

Inquiry Command	Command Packet	Inquiry Packet	Comments
CAM_HLCInq	8x 09 04 14 FF	y0 50 0p 0q FF	p: HLC level (0: OFF, 1: low, 2: mid, 3: high) q: HLC mask level (0: OFF, 1 to F: level low to high)
CAM_RegisterValueInq	8x 09 04 24 pp FF	y0 50 0q 0q FF	pp: Register No.
CAM_FocusPosReplyInterval TimeInq	8x 09 04 1A FF	y0 50 00 00 0p 0p FF	pp: Interval Time
(Reply)	-	y0 07 04 16 00 00 0p 0p 0p 0p FF	pppp: Focus Position
CAM_ColorBarInq	8x 09 7E 04 7D FF	y0 50 00 FF	OFF
		y0 50 01 FF	Color bar 100% 8 colors
		y0 50 02 FF	Color bar 100% 7 colors
		y0 50 03 FF	Grayscale
CAM_ePTModeInq	8x 09 7E 06 00 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_ePTPositionInq	8x 09 7E 06 20 FF	y0 50 00 00 0p 0p 0p 0p 0t 0t 0t 0t FF	pppp: Pan Position tttt: Tilt Position
CAM_TempInq	8x 09 04 68 FF	y0 50 00 00 0p 0p FF	pp: Lens Temperature
CAM_ExExpCompPosInq (Extended Mode)	8x 09 04 1F 4E FF	y0 50 00 00 0p 0p FF	pp: Exposure compensation level
CAM_ExAutoICRThresholdInq (Extended Mode)	8x 09 04 1F 21 00 FF	y0 50 00 00 0p 0p FF	pp: ICR On→Off threshold level when Auto ICR
CAM_ExDetailInq (Extended Mode)	8x 09 04 1F 42 FF	y0 50 00 00 0p 0p FF	pp: Ex Detail Level
CAM_ChromaSuppressInq	8x 09 04 5F FF	y0 50 0p FF	p: Chroma Suppress setting level
CAM_ColorGainInq (Saturation)	8x 09 04 49 FF	y0 50 00 00 00 0p FF	p: Color Gain
CAM_ExColorGainInq (Extended Mode)	8x 09 04 1F 49 00 FF	y0 50 0p 0p FF	pp: Color Gain
CAM_ColorHueInq	8x 09 04 4F FF	y0 50 00 00 00 0p FF	p: Color Hue
CAM_ExColorHueInq (Extended Mode)	8x 09 04 1F 4F 00 FF	y0 50 0p 0p FF	pp: Color Hue
CenterLine	8x 09 04 7C FF	y0 50 0p FF	p: 3=Off, 4=On

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	Digital Zoom (H)
	5	DZoomMode 0: Combine 1: Separate
	4 3	0: Normal 1: Interval 2: Zoom Trigger
	2	AF Sensitivity 0: Low 1: Normal
	1	Digital Zoom 1: On 0: Off
	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	
	0	

Byte	Bit	Comments
6	7	0
	6	0
	5	0
	4	0
	3	WB Mode
	2	
	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	0
	3	Exposure Mode
	2	
	1	
	0	
9	7	0
	6	0
	5	High Resolution 1: On 0: Off
	4	VE 1: On 0: Off
	3	Spot AE 1: On 0: Off
	2	Backlight 1: On 0: Off
	1	Exposure Comp. 1: On 0: Off
	0	Slow Shutter 1: On 0: Off
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	Auto ICR Alarm (1: On, 0: Off)
	2	Auto ICR 1: On 0: Off
	1	0
	0	Power 1: On 0: Off
3	7	0
	6	Stabilizer 1: On 0: Off
	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	0
	2	ICR 1: Provided 0: Not provided
	1	Stabilizer 1: Provided 0: Not provided
	0	System 1: 1/50, 1/25 0: 1/59.94, 1/29.97
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

Extended Function1 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	Digital Zoom Position (H)
	2	
	1	
	0	
3	7	0
	6	0
	5	0
	4	0
	3	Digital Zoom Position (L)
	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	Spot AE Position (X)
	2	
	1	
	0	
9	7	0
	6	0
	5	0
	4	0
	3	Spot AE Position (Y)
	2	
	1	
	0	
10	7	0
	6	0
	5	0
	4	0
	3	0
	2	Reserved
	1	0
	0	E-Flip (1: On, 0: Off)

Byte	Bit	Comments
11	7	0
	6	Color Gain (0h (60%) to Eh (200%))
	5	
	4	
	3	
	2	Advanced Privacy (1: Provided, 0: Not provided)
	1	Reserved
	0	E-Flip (1: Provided, 0: Not provided)
12	7	0
	6	0
	5	AE Response
	4	
	3	
	2	
	1	
	0	
13	7	0
	6	Gamma
	5	
	4	
	3	High Sensitivity mode (1: On, 0: Off)
	2	NR Level
	1	
	0	
14	7	0
	6	Chroma Suppress
	5	
	4	
	3	Gain Limit
	2	
	1	
	0	
15	7	1 Terminator (FFh)
	6	1
	5	1
	4	1
	3	1
	2	1
	1	1
	0	1

Extended Function2 Query Command .....Command Packet 8x 09 7E 7E 04 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	0
	1	VE
	0	0: Off 2: VE On
3	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	0
	0	0
4	7	0
	6	0
	5	0
	4	0
	3	0
	2	Display brightness level setting
	1	0: Dark to 6: Bright
	0	
5	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	Brightness compensation selection
	0	0: Very dark 1: Dark 2: Standard 3: Bright

Byte	Bit	Comments
6	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	Compensation level
	0	0: Low 1: Mid 2: High
7	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	0
	0	Defog 0: Off 1: On
8	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	Defog Level
	0	0: mid 1: low 2: mid 3: high
9	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	0
	0	0
10	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	0
	0	0

Byte	Bit	Comments
11	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	0
	0	0
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

Extended Function3 Query Command .....Command Packet 8x 09 7E 7E 05 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	Color Hue (0h(– 14 degrees) to Eh(+ 14 degrees))
	2	
	1	
	0	
3	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	
4	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	
5	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	

Byte	Bit	Comments
6	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	
7	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	
8	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	
9	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	
10	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	

Byte	Bit	Comments
11	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	
12	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	
13	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	
14	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	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 (1/3)

		59.94/29.97 mode	50/25 mode	23.98 mode
Shutter Speed/ Slow Shutter Limit	21	1/10000	1/10000	1/10000
	20	1/6000	1/6000	1/4800
	1F	1/4000	1/3500	1/2400
	1E	1/3000	1/2500	1/1200
	1E	1/2000	1/1750	1/576
	1C	1/1500	1/1250	1/400
	1B	1/1000	1/1000	1/288
	1A	1/725	1/600	1/200
	19	1/500	1/425	1/192
	18	1/350	1/300	1/144
	17	1/250	1/215	1/120
	16	1/180	1/150	1/100
	15	1/125	1/120	1/96
	14	1/100	1/100	1/60
	13	1/90	1/60	1/50
	12	1/60	1/50	1/48
	11	1/50	1/30	1/40
	10	1/30	1/25	1/25
	0F	1/20	1/20	1/24
	0E	1/15	1/15	1/20
	0D	1/10	1/12	1/12
	0C	1/8	1/8	1/8
	0B	1/6	1/6	1/6
	0A	1/4	1/4	1/4
	09	1/3	1/3	1/3
	08	1/2	1/2	1/2
	07	2/3	2/3	2/3
	06	1/1	1/1	1/1

		59.94/29.97 mode	50/25 mode	23.98 mode
High speed Shutter Limit	21	1/10000	1/10000	1/10000
	20	1/6000	1/6000	1/4800
	1F	1/4000	1/3500	1/2400
	1E	1/3000	1/2500	1/1200
	1D	1/2000	1/1750	1/576
	1C	1/1500	1/1250	1/400
	1B	1/1000	1/1000	1/288
	1A	1/725	1/600	1/200
	19	1/500	1/425	1/192
	18	1/350	1/300	1/144
	17	1/250	1/215	1/120
	16	1/180	1/150	1/100
	15	1/125	1/120	1/96
	14	1/100	1/100	1/60
	13	1/90	1/60	1/50
	12	1/60	1/50	1/48
	11	1/50	1/30	1/40
	10	1/30	1/25	1/25
	0F	-	-	1/24
Slow Shutter Limit	11	1/50	1/30	1/40
	10	1/30	1/25	1/25
	0F	1/20	1/20	1/24
	0E	1/15	1/15	1/20
	0D	1/10	1/12	1/12
	0C	1/8	1/8	1/8
	0B	1/6	1/6	1/6
	0A	1/4	1/4	1/4
	09	1/3	1/3	1/3
	08	1/2	1/2	1/2
	07	2/3	2/3	2/3
	06	1/1	1/1	1/1

Exposure control (2/3)

Iris	15	F2.8
	14	F3.1
	13	F3.4
	12	F3.7
	11	F4.0
	10	F4.4
	0F	F4.8
	0E	F5.2
	0D	F5.6
	0C	F6.2
	0B	F6.8
	0A	F7.3
	09	F8.0
	08	F8.7
	07	F9.6
	06	F10
	05	F11

Gain	11	48 dB
	10	45 dB
	0F	42 dB
	0E	39 dB
	0D	36 dB
	0C	33 dB
	0B	30 dB
	0A	27 dB
	09	24 dB
	08	21 dB
	07	18 dB
	06	15 dB
	05	12 dB
	04	9 dB
	03	6 dB
	02	3 dB
	01	0 dB

0E to 11 can be set only when the high-sensitivity mode is ON.

		High Sensitivity mode	
		Off	**On**
Gain Limit	D	36 dB	48 dB
	C	33 dB	45 dB
	B	30 dB	42 dB
	A	27 dB	39 dB
	9	24 dB	36 dB
	8	21 dB	33 dB
	7	18 dB	30 dB
	6	15 dB	27 dB
	5	12 dB	24 dB
	4	9 dB	21 dB

Exposure control (3/3)

		Iris	Gain
Bright	25	F2.8	48 dB
	24	F2.8	45 dB
	23	F2.8	42 dB
	22	F2.8	39 dB
	21	F2.8	36 dB
	20	F2.8	33 dB
	1F	F2.8	30 dB
	1E	F2.8	27 dB
	1D	F2.8	24 dB
	1C	F2.8	21 dB
	1B	F2.8	18 dB
	1A	F2.8	15 dB
	19	F2.8	12 dB
	18	F2.8	9 dB
	17	F2.8	6 dB
	16	F2.8	3 dB
	15	F2.8	0 dB
	14	F3.1	0 dB
	13	F3.4	0 dB
	12	F3.7	0 dB
	11	F4.0	0 dB
	10	F4.4	0 dB
	0F	F4.8	0 dB
	0E	F5.2	0 dB
	0D	F5.6	0 dB
	0C	F6.2	0 dB
	0B	F6.8	0 dB
	0A	F7.3	0 dB
	9	F8.0	0 dB
	8	F8.7	0 dB
	7	F9.6	0 dB
	6	F10	0 dB
	5	F11	0 dB

25 to 22 can be set only when the high-sensitivity mode is ON.

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)

Optical Zoom Ratio	Optical Zoom Position Data
1×	0000
2×	17F7
3×	232E
4×	2A2A
5×	2F1D
6×	32E9
7×	35F7
8×	3887
9×	3ABA
10×	3CAA
11×	3E68
12×	4000

Digital Zoom Combine mode

Digital Zoom Ratio	Digital Zoom Position Data
1×	4000
2×	6000
3×	6AAB
4×	7000
5×	7334
6×	7556
7×	76DC
8×	7800
9×	78E4
10×	799A
11×	7A2F
12×	7AC0

Digital Zoom Separate mode

Digital Zoom Ratio	Digital Zoom Position Data
1×	00
2×	80
3×	AA
4×	C0
5×	CC
6×	D5
7×	DB
8×	E0
9×	E3
10×	E6
11×	E8
12×	EB

Lens control

Zoom Position	0000 to 4000 to 7AC0 wide end Optical tele end Digital tele end	
Focus Position	1000 to F000 Far end Near end	
Focus Near Limit	1000: Over Inf 2000: 5 m 3000: 3 m 4000: 2 m 5000: 1.5 m 6000: 1.2 m 7000: 1.0 m 8000: 80 cm 9000: 55 cm A000: 35 cm B000: 25 cm (initial setting) C000: 18 cm D000: 14 cm E000: 10 cm F000: 8 cm	As the distance on the left will differ due to temperature characteristics, etc., use as approximate values. *The lower 1 byte is fixed at 00.

wide/tele Limit Setting

wide/tele Limit Setting Value	wide Limit		tele Limit	
	Zoom Position	Zoom Ratio	Zoom Position	Zoom Ratio
00	0000	1.00	4000	12.00
10	0170	1.01	3E8F	11.69
20	02E0	1.02	3D1F	11.38
30	0450	1.04	3BAF	11.09
40	05C0	1.05	3A3F	11.80
50	0730	1.06	38CF	10.52
60	08A1	1.08	375E	10.24
70	0A11	1.09	35EE	9.98
80	0B81	1.10	347E	9.72
90	0CF1	1.12	32F7	9.47
A0	0E61	1.13	319E	9.23
B0	0FD1	1.15	302E	8.99
C0	1142	1.16	2EBD	8.76
D0	12B2	1.18	2D4D	8.53
E0	1422	1.19	2BDD	8.32
F0	1592	1.21	2A6D	8.11
FF	16EB	1.22	2914	8.53

Temperature Reading Conversion Value (Reference Value)

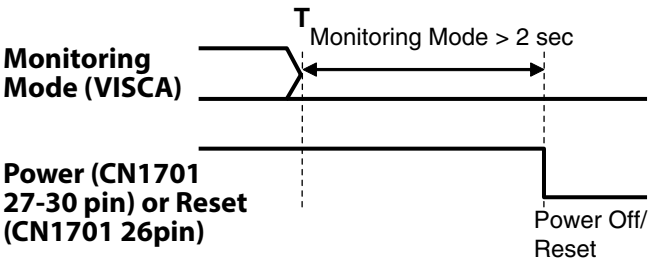
Reading Value pq (hex)	Temperature Conversion Value (°C)
FB	−8 to −2
00	−3 to +3
0A	7 to 13
14	17 to 23
1E	27 to 33
28	37 to 43
32	47 to 53
3C	57 to 63

Register Setting

The register settings are enabled when the power is turned off and then back on again. After turning the power back on again, verify that the mode settings have been changed.

Notes

- Please be sure to wait at least 2 seconds before turning OFF the power when the mode settings have been changed. If the interval is short, the mode may not be set correctly. Images may not be output or black images may appear. In this case, perform the mode setting again, making sure to wait at least 2 seconds before turning OFF the power.



- If you switch to PTP with switching VISCA/USB_PTP, you can no longer communicate with VISCA after that.
  When switching to VISCA, switch to VISCA with PTP control.
  For the PTP control, refer to “Camera control PTP”.

	Register No.	Value	
VISCA Baud Rate	00	00 (Initial Setting)	9600 bps
		01	19200 bps
		02	38400 bps
		03	57600 bps
		04	115200 bps
Switching VISCA/ USB_PTP	01	00 (Initial Setting: 00)	VISCA
		01	USB_PTP
Digital Output	60	00 (Initial Setting)	YUV
		01	RGB
Monitoring Mode	72	1D (Initial Setting)	System: QFHD (3840 × 2160) 29.97p Output: 3840 × 2160 29.97p 1920 × 1080 29.974p When electronic pan/tilt is ON.
		1E	System: QFHD (3840 × 2160) 25p Output: 3840 × 2160 25p 1920 × 1080 25p When electronic pan/tilt is ON.
		20	System: QFHD (3840 × 2160) 23.98p Output: 3840 × 2160 23.98p 1920×1080 23.98p When electronic pan/tilt is ON.
		13	System: FHD (1920 × 1080) 59.94p Output: 1920 × 1080 59.94p
		14	System: FHD (1920 × 1080) 50p Output: 1920 × 1080 50p
		01	System: FHD (1920 × 1080) 59.94i Output: 1920 × 1080 59.94i
		04	System: FHD (1920 × 1080) 50i Output: 1920 × 1080 50i
		06	System: FHD (1920 × 1080) 29.97p Output: 1920 × 1080 29.97p
		08	System: FHD (1920 × 1080) 25p Output: 1920 × 1080 25p
		1F	System: FHD (1920 × 1080) 23.98p Output: 1920 × 1080 23.98p
		09	System: HD (1280 × 720) 59.94p Output: 1280 × 720 59.94p
		0C	System: HD (1280 × 720) 50p Output: 1280 × 720 50p
		1B	System: SD (720 × 480) 59.94p Output: 720 × 480 59.94p
		1C	System: SD (720 × 576) 50p Output: 720 × 576 50p

The frame rate of system in the monitoring mode is the screen update interval.

	Register No.	Value	
Zoom Limit	50	00-FF (Initial Setting: 00)	Wide Limit (0: Disabled)
	51	00-FF (Initial Setting: 00)	Tele Limit (0: Disabled)
D-Zoom Max	52	00-EB (Initial Setting: EB)	Max. digital zoom ratio = 256 ÷ (256-Value)
"StableZoom"	53	00 (Initial Setting: 00)	Off
		01	On
APR	56	00 (Initial Setting: 00)	On start-up APR OFF
		01	On start-up APR ON
FocusOffset @DomeCover	55	00-FF (Initial Setting: 00)	00: None to FF: Max.
Extended Mode	5F	00	0FF
		bit: 0 Exposure compensation Extended 256 levels On/Off bit: 1 Aperture Extended 256 levels On/Off bit: 2 Color Gain/Hue Extended 256 levels On/Off bit: 3 Auto ICR Off → On setting enable On/Off *For all of bit, 1 is to activate, 0 is Off	

Others

AF Active Time[1)]	00	to	FF
AF Interval Time[1)]	00	to	FF
Spot AE X position	00	to	0F
Spot AE Y position	00	to	0F
R Gain	00	to	FF
B Gain	00	to	FF
Aperture Control Level	00	to	0F
AE Response	01	to	30
AutoICR On → Off Threshold Level	00	to	FF
Chroma Suppress setting level	00	to	03
Color Gain setting level	00	to	0E
Color Hue setting level	00	to	0E

[1)] Unit: One second

USB commands for firmware update

Basic specifications of commands and response

- Communication is performed in units of packets.
- The packet consists of a header (32 bytes) and body (from 0 byte).
- Two types of packets in a command and response are defined as described below.
  - Command Data transfer of a host to this unit
  - Response Data transfer of this unit to a host
  - One response packet is necessarily returned to one command packet.
    * However, there is no response in a specific command.
- Byte array is based on a little-endian format.

- Description of notation

  Notation of type

  uint: Unsigned integer (Does not depend on the data length.)

  Binary: Binary data string

- Packet structure

  The packet consists of a fixed-length (32-byte) header and size-variable body.

  The maximum packet size is prescribed for each command or during communication parameter setting.

Data array	Size [Byte]	Type
Packet{		
Packet Header	32	Packet Header
Body	n	Binary
}		

- Packet Header (Common in both a command and response)

Data array	Size [Byte]	Type
Packet Header{		
BodySize	4	uint
Protocol Version	2	uint
Command ID	2	uint
Response ID	2	uint
Sequence No.	2	uint
reserved	4	uint
reserved	4	uint
reserved	4	uint
reserved	8	uint
}		

- Meaning

Body Size

This is the size of a body following a packet header. (The size of a packet header is not contained.)

Protocol Version

This is the version of a communication protocol. Fixed to 0x0100.
(The host sets the protocol version contained in firmware data.)

Command ID

Command packet: Sets the command to be executed.

Response packet: The same value as the corresponding command packet is set.

Response ID

Command packet: Fixed to 0x0000.

Response packet: ID indicating the processing result of the corresponding command

For more details, refer to the specifications for each command. (See pages 58 to 62.)

Sequence No.

Command packet: Sequence number unique in all commands
Returned to 1 when an overflow occurs in the range of 1 to 65536.

Response packet: Returns the sequence number of the corresponding command as it is.
An error does not especially occur even when the value of a sequence number is skipped.

- Body

Data used as each command and response parameter is stored.

The body varies depending on each command and response.

ID list

Command ID	Definition of ID	Outline description
/*Initial communication*/		
0x0001	CMD_INIT	Initializes communication.
/*Judgment of rush conditions*/		
0x0010	CMD_CHK_GUARD	Starts the judgment of rush conditions.
/*Inquiry of firmware version*/		
0x0020	CMD_QUERY_VERSION	Inquires the version of firmware.
/*Start mode switching request*/		
0x0030	CMD_SWITCH_MODE	Executes the switching to a firmware update mode.
/*Firmware rewrite*/		
0x0040	CMD_WRITE_FIRM	Transfers firmware data and writes it.
/*Completion check notification of rewrite processing*/		
0x0100	CMD_COMPLETE	Notifies the completion check of firmware update.
/*Acquisition of firmware update processing status in this unit*/		
0x0200	CMD_GET_STATE	Acquires the firmware update processing status.

Response ID	Definition of ID (STAT_ is also the same.)	Outline description (The detailed meaning varies depending on each command.)
/*Normal system*/		
0x0001	ERR_OK	Normal termination
0x0002	ERR_BUSY	Processing in progress
/*Communication protocol error*/		
0x0100	ERR_PROV	Difference in protocol version
0x0101	ERR_SEQUENCE	Sequence error. This is not a state in which a command can be received.
0x0102	ERR_BIG	A packet is too large. (A receive buffer is insufficient.)
0x0103	ERR_INVALID_PARAM	A parameter is illegal.
/*0x1xxx: Processing error in this unit*/		
0x1xxx	ERR_INTERNAL	Internal processing error in this unit

Response ID	Definition of ID	Outline description (The detailed meaning varies depending on each command.)
/*Normal system*/		
0x0001	STAT_OK	
0x0002	STAT_BUSY	
/*Status of rush conditions*/		
0x0140	STAT_INVALID_MODEL	A model differs.
0x0141	STAT_INVALID_REGION	Destination differs.
/*Firmware data error*/		
0x0040	STAT_INVALID_DATA	The received firmware data is illegal (damaged). (The data is falsified and cannot be detected by CRC of a package file.)

A processing error in this unit is notified to a ResponseID field as an error.

CurStatus ID	Definition of ID	Outline description
0x0100	CURSTAT_PRE_INIT	Before CMD_INIT reception
0x0200	CURSTAT_PRE_SWITCHMODE	After CMD_SWITCHMODE reception

Command specifications

<table>
<tr><th>Command</th><th>Description</th></tr>
<tr><td>CMD_GET_STATE</td><td>
▪ Outline
This command acquires the firmware update processing status in this unit.
*This command can be accepted at any time when communication is established.
▪ Command parameter
None
▪ Response (ID/Parameter)
ERR_OK
Initialization succeeded. The subsequent maximum packet size and minimum time-out are turned to a parameter.
Parameter →
<table>
<tr><th>Parameter data arrangement</th><th>Size [Byte]</th><th>Type</th></tr>
<tr><td>OK Parameter{</td><td></td><td></td></tr>
<tr><td> currentState ID</td><td>2</td><td>uint</td></tr>
<tr><td>}</td><td></td><td></td></tr>
</table>
▪ Meaning
currentState ID
This is the set state at the point of time where a command was received.
Refer to the ID list of each STAT ID. (See page 58.)
CURST AT_PRE_INIT During start *From when PC application issues a CMD_INIT command
CURST AT_SWITCHMODE During mode switching (State in which a command cannot be returned by INIT)
*From when PC application issues a CMD_SWITCH_MODE command
ERR_PROV
This cannot be used for the communication protocol version set to a packet header.
No parameter
▪ Remarks
</td></tr>
<tr><td>CMD_INIT</td><td>
▪ Outline
This command initializes communication and transfers the required parameter.
This unit returns the internal state to the initial state by receiving the parameter.
There is a state in which the parameter cannot be received.
▪ Command parameter
None
▪ Response (ID / Parameter)
ERR_OK
Initialization succeeded. The subsequent maximum packet size and minimum time-out are turned to a parameter.
Parameter →
<table>
<tr><th>Parameter data arrangement</th><th>Size [Byte]</th><th>Type</th></tr>
<tr><td>OK Parameter{</td><td></td><td></td></tr>
<tr><td> maxCmdPacketSize</td><td>4</td><td>uint</td></tr>
<tr><td> maxResPacketSize</td><td>4</td><td>uint</td></tr>
<tr><td> minTimeOut</td><td>4</td><td>uint</td></tr>
<tr><td> intervalBeforeCommand</td><td>4</td><td>uint</td></tr>
<tr><td> intervalBeforeResponse</td><td>4</td><td>uint</td></tr>
<tr><td>}</td><td></td><td></td></tr>
</table>
▪ Meaning
maxCmdPacketSize
This is the maximum packet size [byte] of a command packet after initialization has succeeded.
Not including a CMD_GET_STATE command
maxResPacketSize
This is the maximum packet size [byte] of a response packet after initialization has succeeded.
minTimeOut
This is the minimum timeout time [msec] common to each command after communication initialization has succeeded.
The host must time out using a value of more than the minimum timeout time.
intervalBeforeCommand
This is the min time [msec] required from when the host receives a response until it issues the next command.
intervalBeforeResponse
This is the min time [msec] required from when the host issues a command until it issues the reception request of a response to the command issuing.
</td></tr>
</table>

<table>
<tr><th>Command</th><th>Description</th></tr>
<tr><td>CMD_INIT</td><td>
ERR_PROV
This cannot be used for the communication protocol version set to a packet header.
No parameter
ERR_SEQUENCE
Communication sequence error. No parameter.
This is a state in which a CMD_INIT command cannot be received.
▪ Remarks
</td></tr>
<tr><td>CMD_CHK_GUARD</td><td>
▪ Outline
This command starts the confirmation processing of rush conditions.
▪ Command parameter
<table>
<tr><th>Parameter data arrangement</th><th>Size [Byte]</th><th>Type</th></tr>
<tr><td>CHK_GUARD Parameter{</td><td></td><td></td></tr>
<tr><td>dataNo</td><td>4</td><td>uint</td></tr>
<tr><td>remainSize</td><td>4</td><td>uint</td></tr>
<tr><td>firmData</td><td>dataSize</td><td>Binary</td></tr>
<tr><td>}</td><td></td><td></td></tr>
</table>
▪ Meaning
dataNo.
This is the number of times by which this command was issued to confirm rush conditions. “0” is not used.
Increment this from 1 irrespective of the existence of firmData.
remainSize
This is the size of firmware data that has not been transmitted yet. (The data size becomes zero during final transfer.)
This gives compatibility with the WRITE_FIRM command described later.
firmData
To confirm rush conditions, the top of firmware data (the data division of “FDAT” chunk) is split for transfer. The size of data to be transferred is specified by windowSize. Operation is completed when STAT_OK is returned.
*See pages 65 and 66.
▪ Response (ID/Parameter)
Common parameter that does not vary depending on response ID
<table>
<tr><th>Parameter data arrangement</th><th>Size [Byte]</th><th>Type</th></tr>
<tr><td>Response Parameter{</td><td></td><td></td></tr>
<tr><td>windowSize</td><td>4</td><td>uint</td></tr>
<tr><td>numStatus</td><td>4</td><td>uint</td></tr>
<tr><td>for (i = 0; i < numStatus; i++){</td><td></td><td></td></tr>
<tr><td>Status ID</td><td>2</td><td>uint</td></tr>
<tr><td>}</td><td></td><td></td></tr>
<tr><td>{</td><td></td><td></td></tr>
</table>
▪ Meaning
windowSize
This is the size of firmData that this unit can receive.
A packet (including firmData) of less than windowSize can be received.
It is necessary to satisfy packetSize ≧ 32 [byte] header + windowSize + 8 (parameters other than firmData).
numStatus
This is the number of status IDs following numStatus.
Status ID
Confirmation result of rush conditions
STAT_OK Conditions are satisfied.
STAT_BUSY Processing in progress
STAT_INVALID_MODEL A model differs.
STAT_INVALID_REGION Destination differs.
STAT_INVALID_DATA Firmware data is damaged.
For OK and Busy, this is necessarily set as Status ID at the top.
ERR_OK
A command was received normally.
ERR_PROV
This cannot be used for the communication protocol version set to a packet header.
No parameter
</td></tr>
</table>

<table>
<tr><th>Command</th><th>Description</th></tr>
<tr><td>CMD_CHK_GUARD</td><td>
ERR_SEQUENCE
Communication sequence error. No parameter.
This cannot be received before communication is initialized.
ERR_BIG
Packet size is too large.
ERR_INVALID_PARAM
dataNo is invalid. (A value is skipped.) dataSize is invalid.
Errors other than described above are processing errors in this unit.
</td></tr>
<tr><td>CMD_QUERY_VERSION</td><td>
▪ Outline
This command inquires the version of new and old firmware.
▪ Command parameter
None
▪ Response (ID/Parameter)
ERR_OK
Normal termination. The version of new and old firmware is returned using a parameter.
Parameter →
<table>
<tr><th>Parameter data arrangement</th><th>Size [Byte]</th><th>Type</th></tr>
<tr><td>OK Parameter{</td><td></td><td></td></tr>
<tr><td>oldFirmMinorVersion</td><td>2</td><td>uint</td></tr>
<tr><td>oldFirmMajorVersion</td><td>2</td><td>uint</td></tr>
<tr><td>newFirmMinorVersion</td><td>2</td><td>uint</td></tr>
<tr><td>newFirmMajorVersion</td><td>2</td><td>uint</td></tr>
<tr><td>}</td><td></td><td></td></tr>
</table>
▪ Meaning
oldFirmMinorVersion
oldFirmMajorVersion
Minor and major version numbers of old firmware
newFirmMinorVersion
newFirmMajorVersion
Minor and major version numbers of new firmware
Fixed to 0x0000 before rush conditions are confirmed. → The version is not known yet.

ERR_PROV
This cannot be used for the communication protocol version set to a packet header.
No parameter
ERR_SEQUENCE
Communication sequence error. No parameter.
This cannot be accepted before communication is initialized.
Errors other than described above are processing errors in this unit.
</td></tr>
<tr><td>CMD_SWITCH_MODE</td><td>
▪ Outline
This command performs switching to a firmware update mode.
▪ Command parameter
None
▪ Response (ID/Parameter)
ERR_OK
A firmware update mode switching command is received normally.
Parameter →
<table>
<tr><th>Parameter data arrangement</th><th>Size [Byte]</th><th>Type</th></tr>
<tr><td>OK Parameter{</td><td></td><td></td></tr>
<tr><td>reserved = 0</td><td>4</td><td>uint</td></tr>
<tr><td>numStatus = 1</td><td>4</td><td>uint</td></tr>
<tr><td>Status ID</td><td>2</td><td>uint</td></tr>
<tr><td>}</td><td></td><td></td></tr>
</table>
▪ Meaning
numStatus
This is the number of statuses following numStatus. (Fixed to 1.)
Status ID
STAT_OK Mode switching processing is terminated normally.
STAT_BUSY Mode switching processing in progress
</td></tr>
</table>

<table>
<tr><th>Command</th><th>Description</th></tr>
<tr><td>CMD_SWITCH_MODE</td><td>
ERR_PROV
This cannot be used for the communication protocol version set to a packet header.
No parameter
ERR_SEQUENCE
Communication sequence error. No parameter.
This cannot be accepted while the application of the main set is in operation and when rush conditions are not established.
Errors other than described above are in-set errors.
</td></tr>
<tr><td>CMD_WRITE_FIRM</td><td>
▪ Outline
This command rewrites firmware.
▪ Command parameter
<table>
<tr><th>Parameter data arrangement</th><th>Size [Byte]</th><th>Type</th></tr>
<tr><td>WRITE_FIRM Parameter{</td><td></td><td></td></tr>
<tr><td>dataNo</td><td>4</td><td>uint</td></tr>
<tr><td>remainSize</td><td>4</td><td>uint</td></tr>
<tr><td>firmData</td><td></td><td>Binary</td></tr>
<tr><td>}</td><td></td><td></td></tr>
</table>
▪ Meaning
dataNo
This is the number of times by which this command was issued to transfer firmware data. “0” is not used.
This is incremented every time firmware data is transferred.
This is reset by initialization of communication.
remainSize
This is the size of firmware data that has not been transmitted yet. (The data size becomes zero during final transfer.)
firmData
Firmware data (the data division of “FDAT” chunk) is split for transfer.
*See pages 65 and 66.
▪ Response (ID/Parameter)
Common parameter that does not vary depending on response ID
<table>
<tr><th>Parameter data arrangement</th><th>Size [Byte]</th><th>Type</th></tr>
<tr><td>Response Parameter{</td><td></td><td></td></tr>
<tr><td>windowSize</td><td>4</td><td>uint</td></tr>
<tr><td>numStatus = 1</td><td></td><td></td></tr>
<tr><td>Status ID</td><td>2</td><td></td></tr>
<tr><td>}</td><td></td><td></td></tr>
</table>
▪ Meaning
windowSize
This is the size of firmData that this unit can receive.
A packet (including firmData) of less than windowSize can be received.
It is necessary to satisfy packetSize ≧ 32 [byte] header + windowSize + 8 (parameters other than firmData).
Status ID
Rewrite processing status
STAT_OK Firmware rewrite processing is terminated normally.
STAT_BUSY Processing in progress
STAT_INVALID_DATA Firmware data is damaged.
ERR_OK
Firmware data was received normally.
ERR_PROV
This cannot be used for the communication protocol version set to a packet header.
No parameter
ERR_SEQUENCE
Communication sequence error. No parameter.
This cannot be accepted while an update mode is in operation and before rush conditions are confirmed.
ERR_BIG
This could not be received because packet size is too large.
This could not be received because a receive buffer is insufficient in capacity.
The whole relevant packet is discarded when this error occurs.
</td></tr>
</table>

Command	Description
CMD_WRITE_FIRM	**ERR_INVALID_PARAM** dataNo is invalid. (A value is skipped.) dataSize is invalid. Errors other than described above are errors in this unit. ▪ Remarks
CMD_COMPLETE	▪ Outline This command notifies to confirm that firmware rewrite completion notification was accepted. ▪ Command parameter None ▪No response This unit is automatically restarted when this command is received.

Issuing the CMD_CHK_GUARD and CMD_WRITE_FIRM commands

▪ Packet Header (Common in both a command and response)

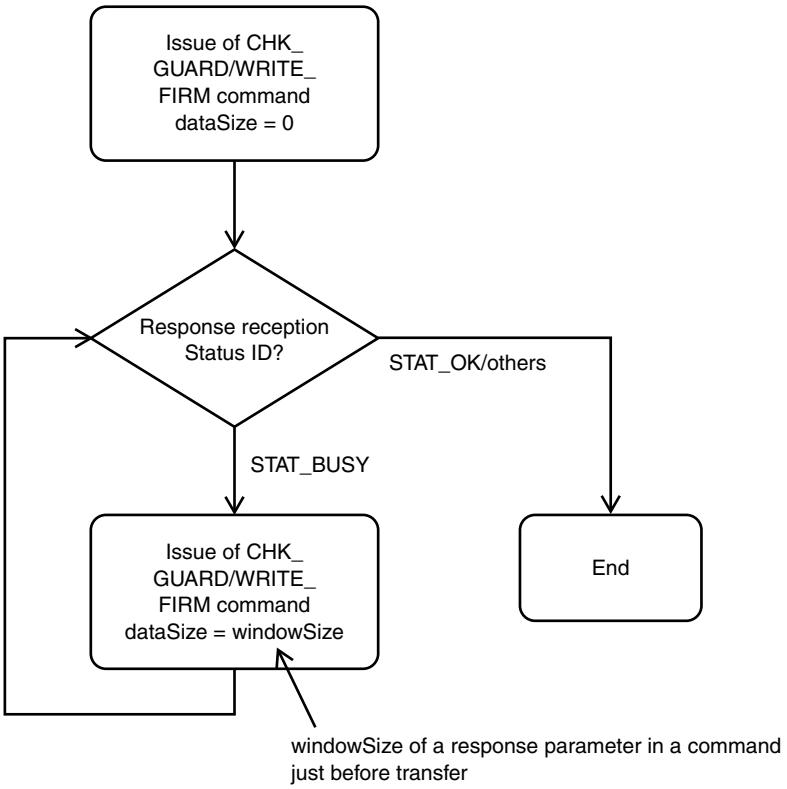
Data arrangement	Size [Byte]	Type
Packet Header{		
BodySize	4	uint
Protocol Version	2	uint
Command ID	2	uint
Response ID	2	uint
Sequence No.	2	uint
reserved	4	uint
reserved	4	uint
reserved	4	uint
reserved	8	uint
}		

▪ Command Parameter

Parameter data arrangement	Size [Byte]	Type
CHK_GUARD Parameter{		
dataNo	4	uint
remainSize	2	uint
firmData	dataSize	Binary
}		

Parameter data arrangement	Size [Byte]	Type
Response Parameter{		
windowSize	4	uint
numStatus	4	uint
for (i = 0; i < numStatus; i++){		
Status ID	2	uint
}		
}		

Firmware data is transferred from the host to the unit using CHK GUARD and WRITE_FIRM commands. For dataSize to be transferred, specify a value of less than windowSize set to the Response data that was issued just before transfer. When transmitting a command first, issue a command (with dataSize set to “0”) without sending firmData and then issue a command for transferring data actually after confirming windowSize set to the Response data. Transmit data continuously until commands other than STAT_BUSY are returned.

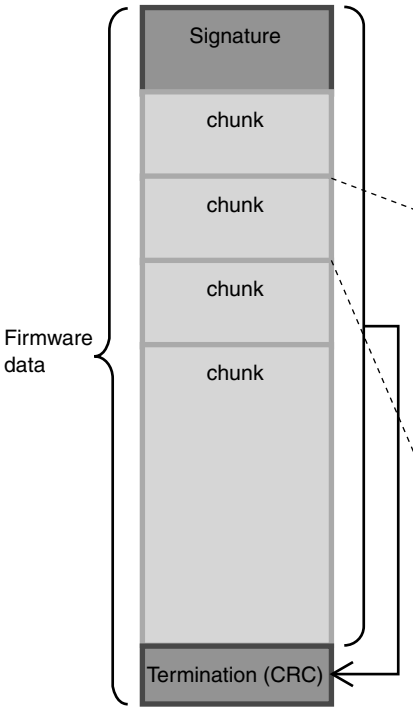


Discriminating the camera mode and updater mode

As described in the section of a UUD Firmware data structure, the USB PID, USB VID, and operating mode of equipment to be updated are described in the UDID chunk of firmware package data. The host to be updated confirms that USB PID and USB VID which acquired a USB descriptor from the unit are contained in the UDID chunk. By the ID operating mode, judge whether the unit is started in a camera mode or updater mode.

Structure of UUD Firmware data

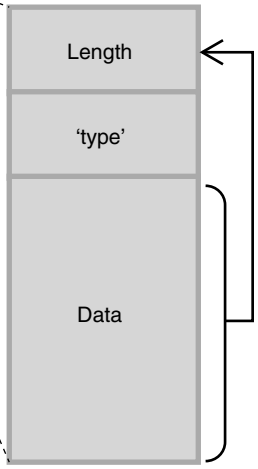
- Signature is assigned to the top of data.
- One or more variable length chunk is continued after signature.
- A chunk containing a CRC32-calculated value is assigned to the termination of data.
- The byte order is based on a big-endian format. (MSB first)



Signature
8-byte fixed value (Hexadecimal) (ASCII)

↓First Byte							↓8th Byte
1	2	3	4	5	6	7	8
89	55	46	55	0d	0a	1a	0a
¥211	U	F	U	¥r	¥n	¥032	¥n

Chunk structure



Length 4-byte fixed length
Indicates the data length of a data division.
Range [0 ～ (2^31) – 1]

'type' 4-byte fixed length
Indicates the type of a chunk.
Only the combined character code of 'A' to 'Z' and 'a' to 'z'

Data Variable length (Length byte)
Arbitrary data string corresponding to 'NAME'

Termination
Chunk indicating the termination data
The CRC-calculated value between the top of data (signature) and the chunk just before termination is stored.
For more details, see chunk list and detailed specifications. (page 66)

Chunk list and detailed specifications (Ver.1.0)

Description of type	
uint	Unsigned integer (Does not depend on the data length.)
Binary	Binary data string

<table>
<tr><th>Chunk type</th><th>Description</th></tr>
<tr><td>DATV</td><td>
Version of firmware data structure
▪ Limiting conditions
This necessarily exists as a chunk at the top.
▪ Data arrangement
<table>
<tr><th>Arrangement</th><th>Size [Byte]</th><th>Type</th><th>Value</th></tr>
<tr><td>DATV Chunk{</td><td></td><td></td><td></td></tr>
<tr><td>length</td><td>4</td><td>uint</td><td>0x00000004</td></tr>
<tr><td>type</td><td>4</td><td>uint</td><td>'DATV'</td></tr>
<tr><td>firmDataVersion</td><td>2</td><td>uint</td><td></td></tr>
<tr><td>reserved</td><td>2</td><td>uint</td><td></td></tr>
<tr><td>}</td><td></td><td></td><td></td></tr>
</table>
▪ Meaning
firmDataVersion
This indicates the protocol version of user firmware update.
Fixed to 0x0100.
reserved
0x0000
</td></tr>
<tr><td>PROV</td><td>
Communication protocol version of firmware update
▪ Limiting conditions
This necessarily exists as the second chunk.
▪ Data arrangement
<table>
<tr><th>Arrangement</th><th>Size [Byte]</th><th>Type</th><th>Value</th></tr>
<tr><td>PROV Chunk{</td><td></td><td></td><td></td></tr>
<tr><td>length</td><td>4</td><td>uint</td><td>0x00000004</td></tr>
<tr><td>type</td><td>4</td><td>uint</td><td>'PROV'</td></tr>
<tr><td>firmProtocolVersion</td><td>2</td><td>uint</td><td></td></tr>
<tr><td>reserved = 0</td><td>2</td><td>uint</td><td>0x0000</td></tr>
<tr><td>}</td><td></td><td></td><td></td></tr>
</table>
▪ Meaning
firmProtocolVersion
This indicates the protocol version of user firmware update.
Fixed to 0x0100.
</td></tr>
</table>

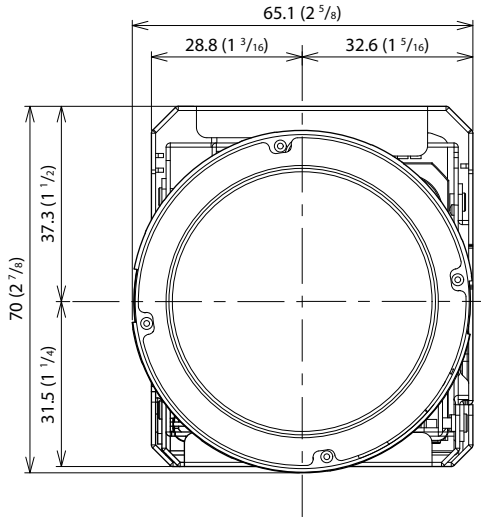
<table>
<tr><th>Chunk type</th><th>Description</th></tr>
<tr><td>UDID</td><td>
List of PID and VID corresponding to this unit to be updated in firmware
▪ Limiting conditions
This necessarily exists as a chunk.
▪ Data arrangement
<table>
<tr><th>Arrangement</th><th>Size [Byte]</th><th>Type</th><th>Value</th></tr>
<tr><td>UDID Chunk{</td><td></td><td></td><td></td></tr>
<tr><td>length</td><td>4</td><td>uint</td><td>4+id_count*8</td></tr>
<tr><td>type</td><td>4</td><td>uint</td><td>'UDID'</td></tr>
<tr><td>id_count</td><td>4</td><td>uint</td><td></td></tr>
<tr><td>/* Descriptor ID List */</td><td></td><td></td><td></td></tr>
<tr><td>for (i=0; i < id_count; i++){</td><td></td><td></td><td></td></tr>
<tr><td>PID</td><td>2</td><td>ID</td><td></td></tr>
<tr><td>VID</td><td>2</td><td>ID</td><td></td></tr>
<tr><td>Operating mode</td><td>1</td><td>uint</td><td></td></tr>
<tr><td>reserved = 0</td><td>3</td><td>uint</td><td>0x000000</td></tr>
<tr><td>}</td><td></td><td></td><td></td></tr>
<tr><td>}</td><td></td><td></td><td></td></tr>
</table>
▪ Meaning
id_count
This is the number of lists in the corresponding VID and PID.
PID
This is the corresponding PID.
VID
This is the corresponding VID.
Operating mode
This is information for identifying whether PID and VID are used during application operation of a main set or during updater mode operation.
ID during application operation of a main set: 0x01
ID during updater operation: 0x02
</td></tr>
<tr><td>FDAT</td><td>
Firmware data
▪ Limiting conditions
This necessarily exists as a chunk.
▪ Data arrangement
<table>
<tr><th>Arrangement</th><th>Size [Byte]</th><th>Type</th><th>Value</th></tr>
<tr><td>FDAT Chunk{</td><td></td><td></td><td></td></tr>
<tr><td>length</td><td>4</td><td>uint</td><td></td></tr>
<tr><td>type</td><td>4</td><td>uint</td><td>'FDAT'</td></tr>
<tr><td>Firmware data</td><td>length</td><td>Binary</td><td></td></tr>
<tr><td>}</td><td></td><td></td><td></td></tr>
</table>
▪ Meaning
Firmware data
</td></tr>
<tr><td>DEND</td><td>
Chunk indicating the termination of data
▪ Limiting conditions
This necessarily exists as a chunk.
The data stream after this chunk is ignored.
▪ Data arrangement
<table>
<tr><th>Arrangement</th><th>Size [Byte]</th><th>Type</th><th>Value</th></tr>
<tr><td>DEND Chunk{</td><td></td><td></td><td></td></tr>
<tr><td>length</td><td>4</td><td>uint</td><td></td></tr>
<tr><td>type</td><td>4</td><td>uint</td><td>'DEND'</td></tr>
<tr><td>CRC</td><td>4</td><td>uint</td><td></td></tr>
<tr><td>}</td><td></td><td></td><td></td></tr>
</table>
▪ Meaning
CRC
CRC32 value calculated for the data stream between Signature and the chunk just before a DEND chunk
Implementation: http://www.w3.org/TR/2003/REC-PNG-20031110/#D-CRCAppendix
</td></tr>
</table>

Specifications

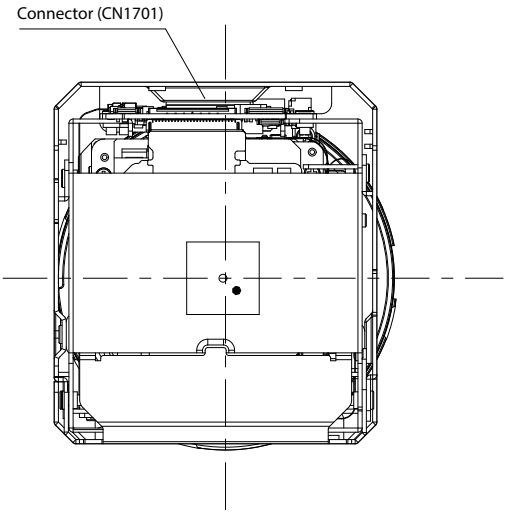
Imager	1 Type "Exmor R" CMOS Sensor
Picture elements	8510K pixels
Lens	12× Zoom
	f = 9.3 mm (Wide), 111.6 mm (Tele), F2.8 to F4.5
	Zoom movement speed
	Optical Wide – Optical Tele 2.56 sec (Focus Tracking On)
	Optical Wide – Super resolution zoom Tele 2.88 sec
	Digital Wide – Digital zoom Tele 4.61 sec
	Focus Movement time
	∞ to Near 0.34 sec
Digital zoom	12× (144× with optical zoom)
Angle of view (H)	
	Approx. 64.6 degrees (Wide end, Image stabilizer Off)
	Approx. 6.1 degrees (Tele end, Image stabilizer Off)
	Approx. 64.5 degrees (Wide end, Image stabilizer On)
	Approx. 6.1 degrees (Tele end, Image stabilizer On)
Min. working distance	
	80 mm (Wide end), 1000 mm (Tele end)
Min. illumination	
(Typical)	0.5 lx (1/30 sec, 50%, High Sensitivity mode On)
	2.0 lx (1/30 sec, 50%, High Sensitivity mode Off)
	0.067 lx (1/4 sec (1/3 sec), 50%, High Sensitivity mode On)
	0.267 lx (1/4 sec (1/3 sec), 50%, High Sensitivity mode Off)
Sync system	Internal
Recommended illumination	
	100 lx to 100,000 lx
S/N ratio	50 dB (Weight On)
Back light compensation	
	On/Off
Electronic shutter speed	
	1/1 sec to 1/10000 sec (28 steps)
White Balance	Auto, ATW, Indoor, Outdoor, One Push WB, Manual WB, Outdoor Auto, Sodium Vapor Lamp (Fix/Auto/Outdoor Auto)
Gain	Auto/Manual (0 to 48 dB (0 to 16 step))
	Max. Gain Limit (9 to 48 dB (3 to 12 step))
Noise Reduction	On/Off (level 5 to 1 / Off, 6 steps)
Defog mode	On/Off (Low, Mid, High)
Aperture control	16 steps
Preset	16-POSITIONS
Camera control IF	
	VISCA protocol (CMOS 3.1V)
	PTP USB 9.6 kbps, 19.2 kbps, 38.4 kbps, 115.2 kbps, Stop bit, 1 bit
Video Output	Digital (HDMI)
Storage temperature/Humidity	
	–20 °C to +60 °C (–4 °F to +140 °F)/ 20% to 95%
	Absolute humidity: 36 g/m^3
Operating temperature/Humidity	
	–5 °C to +60 °C (23 °F to 140 °F)/ 20% to 80%
	Absolute humidity: 36 g/m^3
Power requirements	
	6 V to 12 V DC
Power consumption	
	4.0 W (When the motor operates: 5.2 W)
Mass	520 g (18.3 oz.)
Dimensions	65.1 × 70.0 × 134.8 mm ($2\ ^5/_8 \times 2\ ^7/_8 \times 5\ ^3/_8$ in.) (w/h/d)

Dimensions

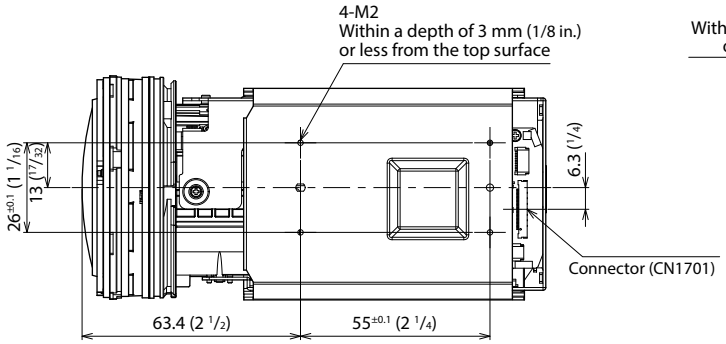
Front



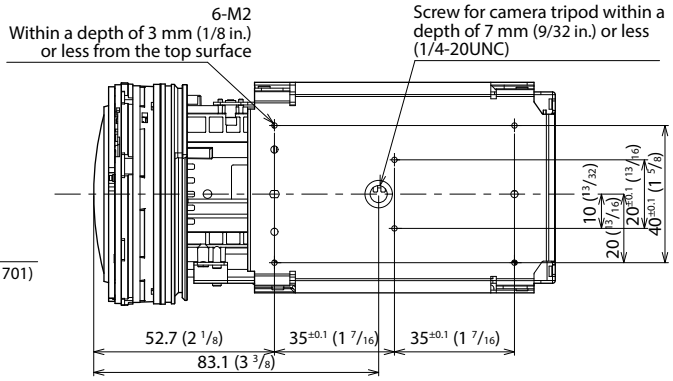
Back



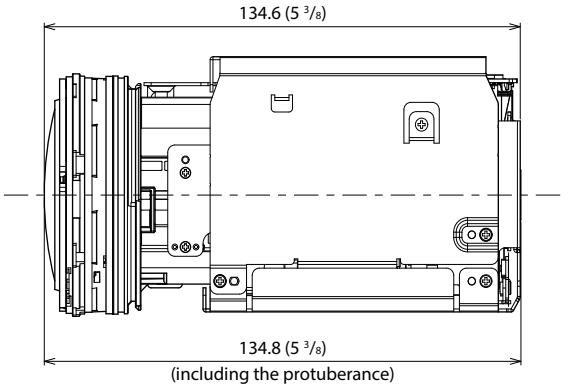
Top



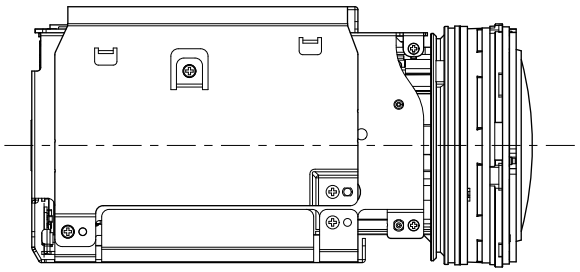
Bottom



Left side

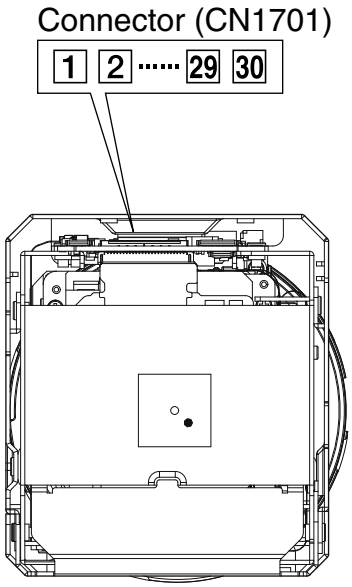


Right side



Unit: mm (inches)

Pin assignment



CN1701

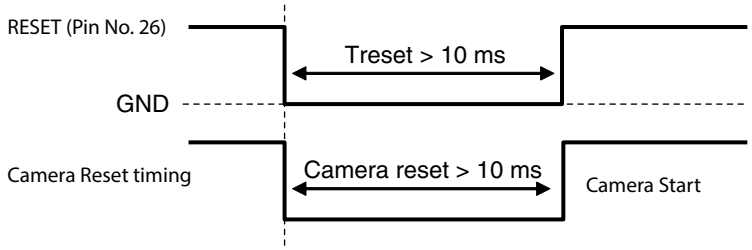
KEL Co.　USL00-30L-C

Pin No.	I/O	Name	Level
1	—	GND	
2	O	TMDS Clock –	
3	O	TMDS Clock +	
4	—	GND	
5	O	TMDS Data 0 –	
6	O	TMDS Data 0 +	
7	—	GND	
8	O	TMDS Data 1 –	
9	O	TMDS Data 1 +	
10	—	GND	
11	O	TMDS Data 2 –	
12	O	TMDS Data 2 +	
13	—	GND	
14	—	NC	Don't use
15	—	NC	Don't use
16	—	NC	Don't use
17	I	Hot Plug Detect	TMDS Out: 5V DC TMDS Stop: Open or GND
18	O	+ 5V Power	
19	I	USB_VBUS	USB communication active: 5 V DC USB communication inactive: Open or GND
20	—	GND	
21	I/O	USB_D –	
22	I/O	USB_D +	
23	—	GND	
24	I	VISCA_RxD	CMOS 3.1V (High: Min 2.3 [V], Low: Max 1.0 [V])
25	O	VISCA_TxD	CMOS 3.1V (High: Min 2.7 [V], Low: Max 0.4 [V])
26	I	RESET	Reset operation: Low (GND) Reset cancel: Open (High Impedance)
27	I	DC IN	6 to 12 V DC
28	I	DC IN	6 to 12 V DC
29	I	DC IN	6 to 12 V DC
30	I	DC IN	6 to 12 V DC

* It is assumed that Pin No. 18 is used as the 5 V power supply of HDMI.
* When you use the USB communication, connect VBUS of the USB host to Pin No. 19.
  If you cannot prepare VBUS, connect Pin No. 18 to Pin No. 19.

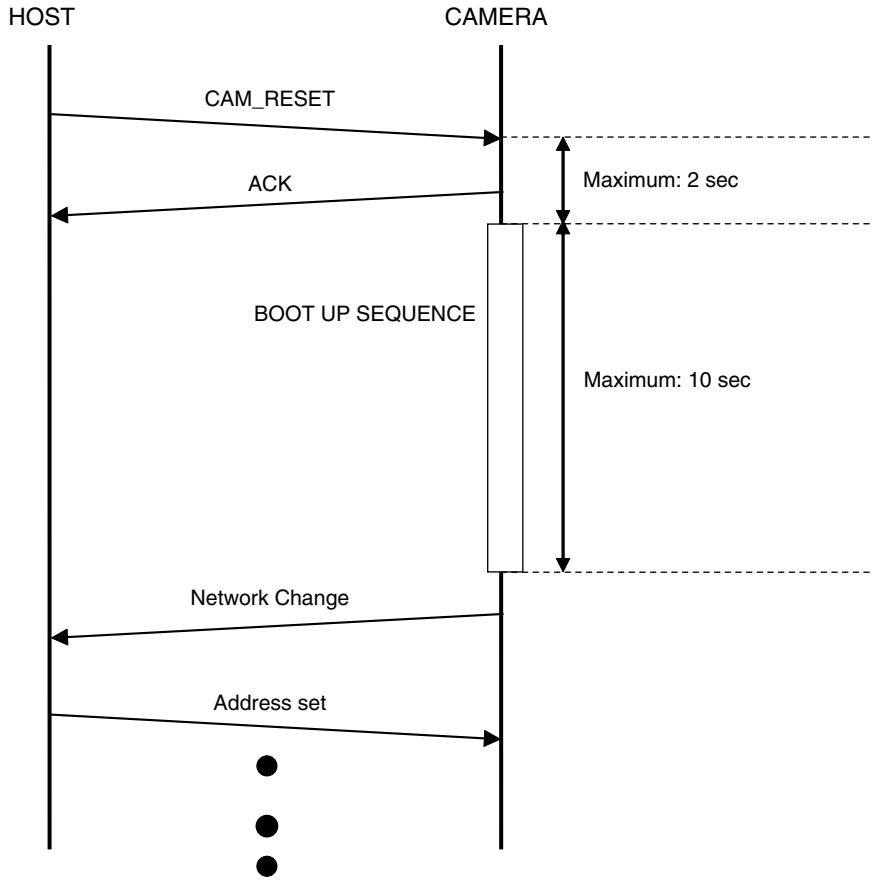
Reset Timing Specification

Low level (GND) pulse (whose width is 10 ms or more) resets this camera.



Reset by Visca command

The time required from the end of camera reset to the issue of Network Change is as shown below.



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[e2fsprogs]
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[ncurses]

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[pcre]

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The basic library functions are written in C and are freestanding. Also included in the distribution is a set of C++ wrapper functions.

THE BASIC LIBRARY FUNCTIONS

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[zlib]

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