SONY®

Color Camera Module

Technical Manual

FCB-EV7520A
FCB-CV7520A

Table of Contents

Features

- **Imager**
This camera uses a 1/2.8" "Exmor R" CMOS (complementary metal-oxide semiconductor) image sensor (approx. 2.13 million effective pixels) that supports FULL HD (high definition) to produce high-quality images.

- **ISP**
Using the image signal processor (ISP), the following images can be obtained.
    - Full HD 60fps output image
    - Low focal plane distortion image using the high-speed readout of imager

The following functions are provided.
    - Noise Reduction (NR), and Image Stabilizer functions
    - Wide Dynamic Range Mode (Wide-D), Tone correction (Visibility Enhancer), and Defog functions

- **Lens**
The camera is equipped with a bright lens with 30× optical zoom and F1.6 aperture.

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

Precautions

Software

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

Operation

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

Operation and storage locations

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

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.

Locations of Controls

Front
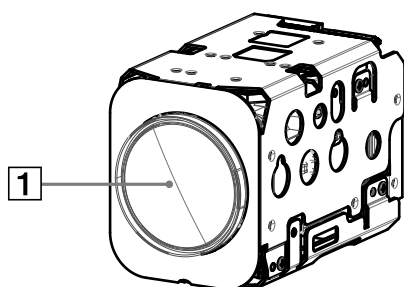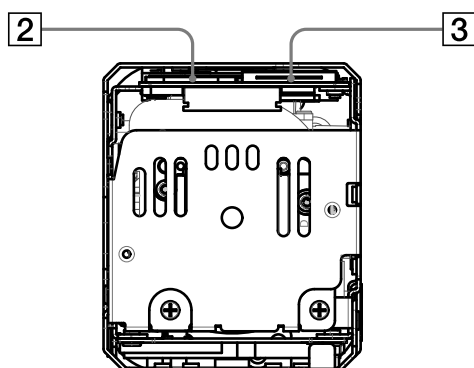
Back   **Bottom**
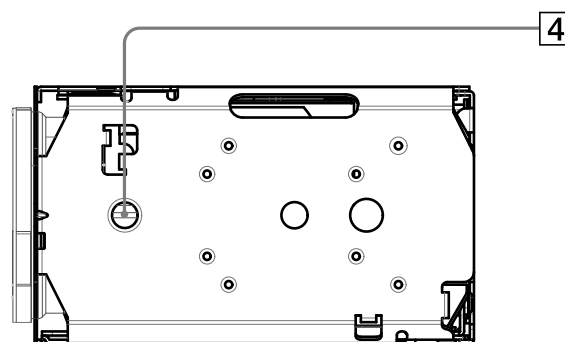
1 **Lens**
2 **Digital/Analog output connector**
3 **Maintenance connector**
   * Do not connect here, this is for maintenance purpose.
4 **Tripod screw hole**
   When a tripod is used, please use 7 mm ($9/_{32}$ in.) or less screw to attach it to the camera.
   Also, please be sure to attach the tripod securely.

Basic Functions

Overview of Functions

The camera control is performed by VISCA Commands.

Timing Chart

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

General Commands

Command

RxD

1)

Acknowledge
Completion

TxD

Query Commands
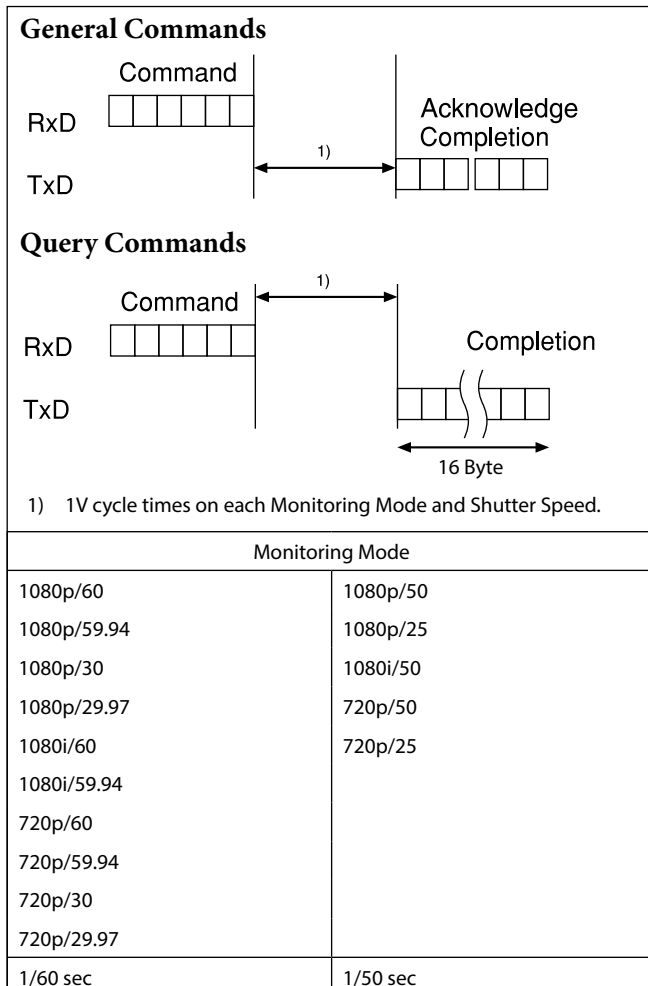
1)

Command

RxD

Completion

TxD

16 Byte

1)   1V cycle times on each Monitoring Mode and Shutter Speed.

Monitoring Mode	
1080p/60	1080p/50
1080p/59.94	1080p/25
1080p/30	1080i/50
1080p/29.97	720p/50
1080i/60	720p/25
1080i/59.94	
720p/60	
720p/59.94	
720p/30	
720p/29.97	
1/60 sec	1/50 sec

In general

- **Power On/Off (Standby)**
  Powers the camera on and off.
  When the power is off (on Standby), the camera is able to accept the VISCA Commands although the screen is set non-displayed.

- **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.

Video Output

This camera can output two types of video, HD Digital output and SD Analog output.

• HD Digital output

This can video output the Monitoring Mode as shown in the table below. The video interface is the LVDS (Low Voltage Differential Signaling).

Monitoring Mode	
1080p/60	1080p/50
1080p/59.94	1080p/25
1080p/30	1080i/50
1080p/29.97	720p/50
1080i/60	720p/25
1080i/59.94	
720p/60	
720p/59.94	
720p/30	
720p/29.97	
1/60 sec	1/50 sec

• SD Analog output

This can video output the Monitoring Mode of NTSC and PAL. The video interface is the CVBS (Composite Video, Blanking, and Sync).
The SD Analog output is created by down conversion from the image of the HD Digital output. The size conversion from 16:9 to 4:3 can be selected from the two types below.

- **Side Cut**

   This method equally trims the left and right ends of the 16:9 image to adjust to the 4:3 size.

HD Digital image (16:9)   **SD Analog image (4:3)**
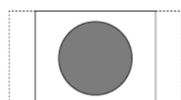
- **Squeeze**

   This method compresses the left and right sides of the 16:9 image to adjust to the 4:3 size.

HD Digital image (16:9)   **SD Analog image (4:3)**
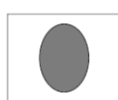
Notes

- The title and the Privacy Zone masking cannot be displayed during the SD Analog output.
- The HD Digital output and the SD Analog output cannot be output simultaneously.

• The horizontal stripe noise may occur in the image during the SD Analog output.
This occurs due to the high ground impedance of the SD Analog output. If dark noise occurs, noise is reduced by lowering the ground impedance with the measures described below.
   - Shortening the Micro coaxial cable length
   - Using the FCB chassis ground. (e.g., Connecting the FCB chassis ground to the chassis ground of your camera system.)
   To connect to the FCB chassis ground, use the screw holes as shown in the diagram below.

Back ×2
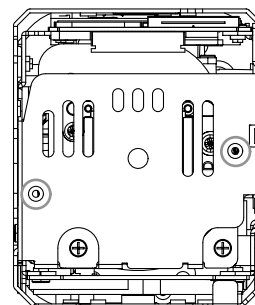
Top ×9
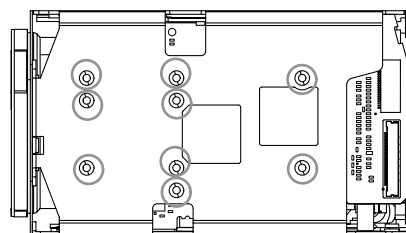
Bottom ×9
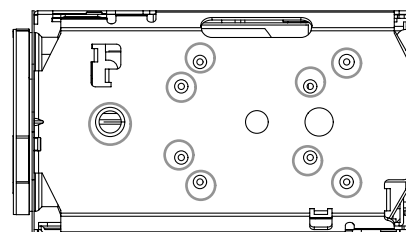
Left side ×3
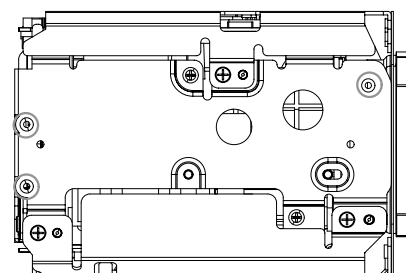
Right side ×5
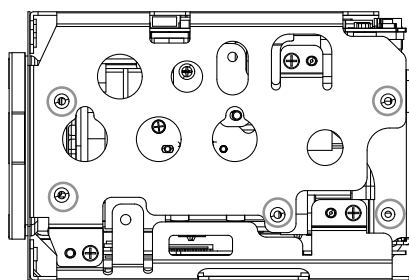
Zoom

The zoom function contains 2 functions, optical zoom and digital zoom.

- **Optical zoom**
The function to zoom optically by moving the zoom lens to change focus distance.
This can zoom up to 30×.

- **Digital zoom**
The function to zoom images digitally by cropping the center part of captured images to zoom with the CMOS image sensor.
When the zoom diameter goes up, the resolution will go down. This can zoom up to 12×.

By combining the optical zoom and digital zoom, the unit can zoom up to 360×.

Zoom has the following modes.

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

Notes

- The zoom will be stopped when a Stop Command is sent after the zoom operation is started in Standard Mode or Variable mode. If you do not send a Stop Command, the zoom will be stopped after reaching the Wide end or the Tele end.
- Direct Mode cannot be operated while zooming in Standard Mode or Variable Mode.
Operate Direct Mode after Stop Command.
- The StableZoom and Zoom Separate mode do not work at the same time. When one function is ON, the other function cannot be turned ON.

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

Digital Zoom
The Zoom Mode supports, a OFF, a Combined Mode and a 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.

Note

When you operate Direct Mode Digital Zoom
When the Digital Zoom is operated in the Direct Mode, the Direct Zoom Position of the Inquiry Command is not immediately reflected.
Place a wait time before reading the position.
When using the Slow Shutter, place a wait time more than twice the shutter speed.
When not using Slow Shutter, place a wait time of 0.1 seconds or more.

About Continuous Zoom Position Reply

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

Continuous 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 minimum focus distance is 10 mm at the optical Wide end and 1200 mm at the optical Tele end, and is independent of the digital zoom. 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.

- **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.

Note

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

- **One push AF**
  When sending a One Push Trigger command in Manual Focus Mode, the lens moves to focus on the subject. After that, it will convert to the normal Manual Focus Mode.
  There are two kinds of One Push Trigger commands.

    - **One Push Trigger**
    As with the Auto Focus, move the focus smoothly and focus on the subject.

    - **Full Scan One Push Trigger**
    Perform a Full Scan (move the focus to the whole area from the Near end to the Far end), and focus on the subject after confirming the distance with the subject.
    Unlike the One Push Trigger, the time to focus is longer because of full scan operation, but you can focus more accurately.

- **Near Limit**
  Can be set in a range from 1000 (∞) to F000 (10 mm).
  Initial setting: D000h (30 cm)

Spot Light Avoidance

When shooting a subject with a spot light source such as an outdoor light, the camera may not be in focus due to AF / One push AF.
For example, when shooting outdoors at night with a surveillance camera, this symptom is likely to occur. In that situation, using the Spot Light Avoidance function, you can focus with the AF / One push AF.

- **Example of subject that can be focused by the Spot Light Avoidance**

Spot Light Avoidance OFF   **Spot Light Avoidance ON**
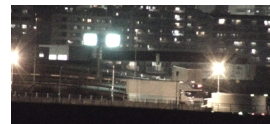
White Balance (WB)

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 the Full Auto, Shutter Priority, Iris Priority, Spot Exposure and Manual in the AE mode. Use this setting when you want to obtain image in which signal-to-noise ratio is particularly important.

- **Shutter Priority**
  Adjust with Variable Shutter Speed (1/1 to 1/10,000 sec., 16 high-speed shutter speeds plus 6 low-speed shutter speeds), Auto Iris and Gain.

- **Iris Priority**
  Adjust with Variable Iris (F1.6 to Close, 14 steps), Auto Gain and Shutter speed.

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

AE – Shutter Priority

The shutter speed can be set freely by the user to a total of 22 steps – 16 high speeds and 6 low speeds. When the slow shutter is set, the speed can be 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
15	1/10000	1/10000
14	1/6000	1/6000
13	1/4000	1/3500
12	1/3000	1/2500
11	1/2000	1/1750
10	1/1500	1/1250
0F	1/1000	1/1000
0E	1/725	1/600
0D	1/500	1/425
0C	1/350	1/300
0B	1/250	1/215
0A	1/180	1/150

09	1/125	1/120
08	1/100	1/100
07	1/90	1/75
06	1/60	1/50
05	1/30	1/25
04	1/15	1/12
03	1/8	1/6
02	1/4	1/3
01	1/2	1/2
00	1/1	1/1

AE – Iris Priority

The iris can be set freely by the user to 14 steps between F1.6 and Close.
The gain and shutter speed are set automatically, according to the brightness of the subject.

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

AE – Manual

The shutter speed (22 steps), iris (14 steps) and gain (15 steps) can be set freely by the user.

Spot Exposure Mode

In Full Auto AE, the level for the entire screen is computed and the optimum Auto Iris and Gain levels are determined. In Spot AE, a particular section of the subject can be designated, and then that portion of the image can be weighted and a value computed so that Iris and Gain can be optimized to obtain an image. For example, in an image with a lot of movement and with varying levels of brightness, portions without much change can be designated as such a "spot," and changes to the screen can be minimized in that area. As shown in the diagram below, a range of 15 blocks vertically and 17 blocks horizontally can be designated. In the case where the center is designated (shown in black), the level is computed along with a weighted value for the surrounding block (shaded), including the specified portions; and then the Gain and Iris are set. The value of the designated portions and the surrounding areas should be calculated as 100%, the rest should be set to 20%. The range of the Spot AE frame is fixed to 5 blocks vertically and 4 blocks horizontally.

```
                        Horizontal 17
              0 1 2 3 4 5 6 7 8 9 A B C D E F 10
            0
            1
            2
            3
 Vertical 15 4
            5
            6
            7
            8
            9
            A                    (8,7)
            B
            C
            D
            E
```
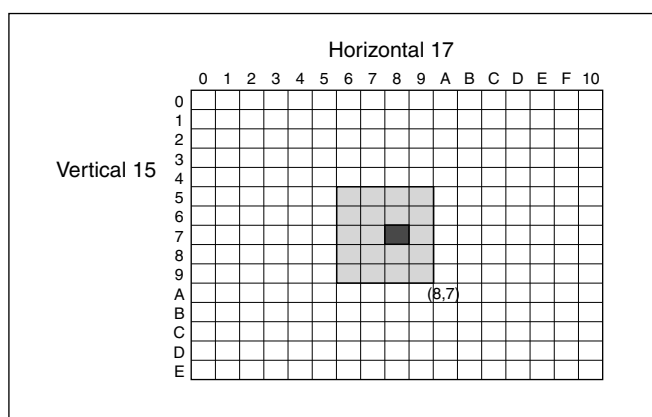
Notes

- Wide-D/HLC/Backlight Compensation/Spot Exposure Mode do not work at the same time.
- When Wide-D is ON, Gain Limit does not work.

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.

Aperture Control

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

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.

Note

Wide-D/HLC/Backlight Compensation/Spot Exposure Mode do not work at the same time.

Wide Dynamic Range Mode (Wide-D)

The Wide Dynamic Range mode is a function for dividing an image into several blocks and correcting blocked-up shadows and blown-out highlights in accordance with the intensity difference. It enables you to obtain images in which portions ranging from dark to light can be recognized, even when capturing a subject with a large intensity difference that is backlit or includes extremely light portions.

Images with wide dynamic range are produced by combining long-exposure signals (normal shutter) with the signals of the high-intensity portions obtained with a short exposure (high-speed shutter).

- **About Wide-D Set Parameter**
  (Command: 8x 01 04 2D 00 0q 0r 0s 00 00 00 00 FF)
  q: Display brightness
      (0: Dark to 6: Bright)
      The brightness and the darkness can be adjusted to seven levels. The normal brightness is set to 3.
      Initial setting: 3
  r: Brightness compensation selection
      (0: Darker, 1: Dark, 2: Standard, 3: Bright)
      Set the area which you want to adjust the brightness of the image with Wide-D effect.
      Initial setting: 2

s: Compensation level
(0: Low, 1: Mid, 2: High)
The compensation of the brightness, which you select from the parameter, can be set to three levels.
Initial setting: 1

Notes

- When the Wide-D is On, false colors may appear in some parts of the image. This phenomenon is unique to Wide-D, and is not an indication of a camera malfunction.
- When Wide-D is switched, images may be disported.
- Wide-D/HLC/Backlight Compensation/Spot AE do not work at the same time.
- After the Wide-D ON/OFF switchover, the Visca command will not be accepted for up to 2 seconds and an error message may be returned from the camera.
- When Wide-D is ON, Gain Limit does not work.

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.

Note

This function is also used in the Wide-D operation.

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 this function from the four levels: OFF, Low, Middle and High.

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.

Note

Wide-D/HLC/Backlight Compensation/Spot Exposure Mode do not work at the same time.

MinimumShutter

When the subject becomes dark, the shutter speed becomes slow, and then 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.
The functions of both 2D NR (removal of 2-dimentional noise) and 3D NR (removal of 3-dimentional noise) are provided. When the 2D NR level is increased, the details of image may be lost because the smoothing of image with the peripheral area is performed. Also, when the 3D NR level is increased, adverse effects such as image blur and blending in the successive images occur in the moving portion. In this function, the mode to set the level of effect by combining 2D/3D (normal setting) and the mode to individually set the level of effect respectively (independent setting) are available.

- In the normal setting, you can select the noise reduction level from 6 levels: levels 1 to 5, plus off. In this setting, the users cannot adjust the ratio of 2D/3D effect level.
- In the independent setting, you can individually select the 2D NR and 3D NR from 6 levels respectively: 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.

High sensitivity mode

This function increases the max gain to allow bright output in darker environments.
However, with a strong gain (up to 10×), the captured image will contain a lot of noise.

Note

When Wide-D is ON, the High sensitivity mode does not work.

Flicker Reduction

This function automatically reduces flicker such as that caused by fluorescent light.
When the camera detects flicker, it automatically changes the shutter speed and reduces flicker.

The shutter speed is automatically selected according to conditions such as subject brightness and the Auto Slow Shutter setting.
See the table below for the shutter speed to be selected.

Video mode	Flicker Frequency	Shutter speed
60 FPS	50 Hz	Auto Slow Shutter OFF: 1/100 Auto Slow Shutter ON: 1/100, 1/50, 1/25, 1/12.5
30 FPS	50 Hz	Auto Slow Shutter OFF: 1/100, 1/50 Auto Slow Shutter ON: 1/100, 1/50, 1/25, 1/12.5
50 FPS	60 Hz	Auto Slow Shutter OFF: 1/120, 1/60 Auto Slow Shutter ON: 1/120, 1/60, 1/30, 1/15
25 FPS	60 Hz	Auto Slow Shutter OFF: 1/120, 1/60, 1/30 Auto Slow Shutter ON: 1/120, 1/60, 1/30, 1/15

If the camera does not detect flicker, it will run normal AE operation.

Notes

- This function operates only during AE-Full Auto.
- Flicker Reduction does not work in AE-Shutter Priority/Iris Priority/Manual/Spot Exposure Mode or Wide Dynamic Range Mode.
- After the camera detects flicker and the shutter speed is changed, Extended Normal Shutter and Minimum Shutter are inoperative.
- The Flicker Reduction may not work if the subject is bright under an environment where flicker occurs. If the shutter speed is 1/100 (flicker frequency 50 Hz) or 1/120 (flicker frequency 60Hz) and the brightness exceeds the Iris variable area (F14), stop the Flicker Reduction and run a normal AE operation.

Variable Gamma Mode

There are standard (00h) mode and straight gamma (01h) mode.

Gamma Offset

You can set the brightness from −64 to +64 in each mode of variable gamma mode.

Contrast Adjustment Function

You can adjust the contrast level in the range from 0 (00h) to 255 (FFh). The initial setting is 128 (80h). The smaller the value is, the lower the contrast becomes, and the larger the value is, the higher the contrast becomes.

Note

This function is available when the variable gamma mode is set to standard (00h) mode and when VE/Wide-D/HLC are set to OFF.

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.

Image Stabilizer

Switching On the Image Stabilizer function reduces image blurring caused by, for example, vibration, which allows you to obtain images without much blurring. A correction effect is possible for a vibration frequency of around 10 Hz. The Image Stabilizer function employs the digital zoom system, so the angle of view and resolution are changed, but the sensitivity is maintained.

"StableZoom"

"StableZoom" is a function for performing correction using the Image Stabilizer function in accordance with the zoom ratio, and smoothly zooming up to approximately 36× using a combination of the optical zoom and digital zoom. As no digital zoom by the Image Stabilizer is available on the wide side, you can obtain a wider image with no resolution degradation. Only the electronic zoom operates between Wide end and 1.2×, and only the optical zoom operates between 1.2× and Tele end. The Image Stabilizer does not work between Wide end and 1.2×, and only works after 1.2×. The "StableZoom" function can be switched On/Off in the register settings.
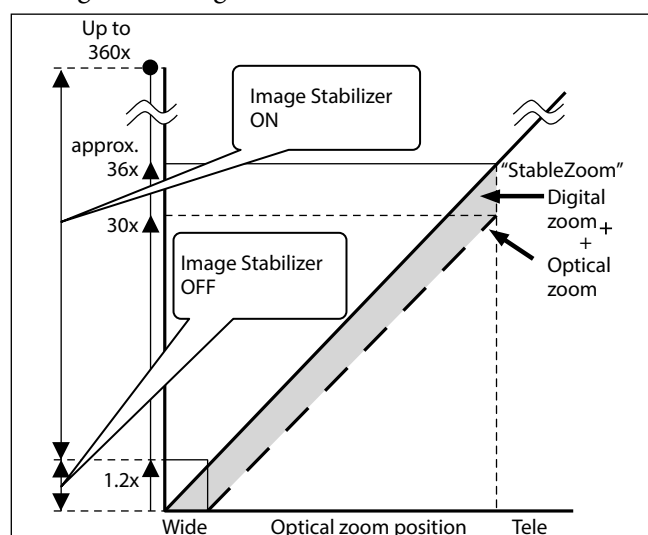
Hold Function of Image Stabilizer

With the Image Stabilizer function, suddenly stopping high-speed movement (pan, tilt, etc.) of the camera produces a blur sensor counteraction that may cause image movement. In such a case, you can use a command setting (hold) to maintain the correction of the Image Stabilizer function. In this case the image stabilizer is off, but there is no change in the angle of view.

Notes

- The hand shake correction function may not work correctly under the condition that high-frequency vibra tion component exits. In such a case, set the image stabilizer function to Off.
- The StableZoom and Zoom Separate mode do not work at the same time. When one function is ON, the other function cannot be turned ON.

Auto 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

An infrared (IR) Cut-Filter can be disengaged from the image path for increased sensitivity in low light environments. The ICR will automatically engage depending on the ambient light, allowing the camera to be effective in day/night environments.
When the auto ICR mode is set to On, the image becomes black and white.

Custom Color Gain

You can configure the color gain.
The initial setting is 4h and the setting can be set to 15 levels from 0h to Eh.
The higher the setting value, the higher the color saturation. The lower the setting value, the lower the color saturation.

Custom Color Phase

You can configure the color phase.
The initial setting is 7h and the setting can be set to 15 levels from 0h to Eh.
The higher the setting value, the color phase shifts to the + side. The lower the setting value, the color phase shifts to the – side.

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.
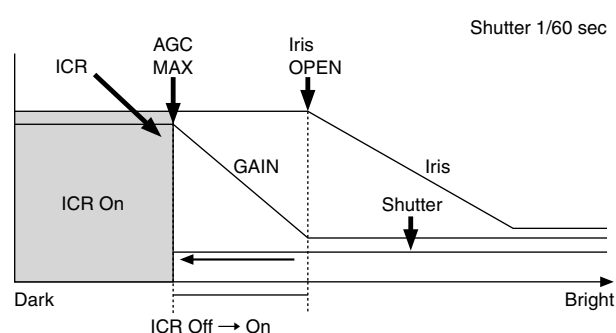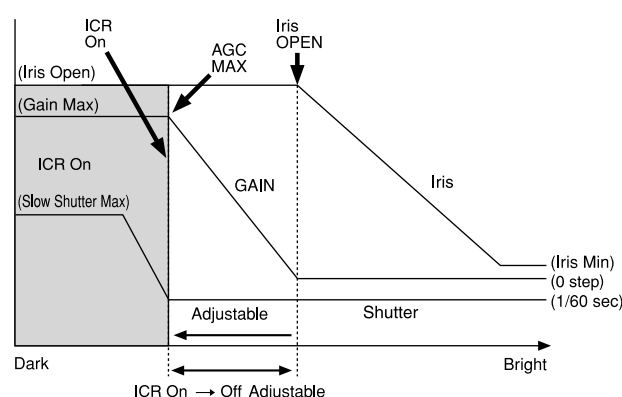
Note

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.

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 functions.

• **Black & White:** Monochrome Image

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.

Note

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.

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**
• **Focus Auto/Manual**
• **Focus Position**
• **AE Mode**
• **Shutter control parameters**
• **Iris control parameters**
• **Gain control parameters**
• **Exposure Compensation On/Off**
• **Exposure Level**
• **Backlight Compensation On/Off**
• **Auto Slow Shutter On/Off**
• **White Balance**

• **R/B Gain**
• **Aperture Control**
• **ICR On/Off**
• **Defog**
• **Wide-D On/Off**
• **Wide-D Parameter**
• **VE On /Off**
• **VE Parameter**
• **Minimum Shutter Mode**
• **Minimum Shutter Limit**

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 and backup of camera" section on page 25.

User Memory Area
This is the memory area with 16-byte capacity which users can overwrite freely.
This can be used as a Serial No. for individual recognition.

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.
LVDS Mode: 74
    LVDS 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×).

"StableZoom": 53

> ON/OFF can be set. (initial setting is OFF.)
> *For details, see "StableZoom" on page 13.*

FocusTrace: 54

> When you want to prioritize zoom speed, set FocusTrace to Off to minimize the transition time between Wide and Tele zoom (although the image may be blurred because focus is not tracked).

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.*

AE parameter change during VE On, Defog On: 58

> ON/OFF can be set. (initial setting is ON.)

Auto slow shutter limit: 59

> The auto slow shutter limit can be set. (initial setting is 04.)
> *For details, refer to "Register Setting" (page 55).*

Extended normal shutter: 5A

> The lower limit of slow shutter when the Auto Slow Shutter mode is set to OFF can be set. (initial setting is OFF.)

Defog Limit: 5B, 5C, 5D

> The maximum value of Defog mode in the low, mid and high levels can be set respectively.

Extended mode: 5F

> ON/OFF can be set. (initial setting is OFF.)
> *For details, see "Extended mode" on page 55.*

Spot Light Avoidance: 20

> ON/OFF can be set. (initial setting is OFF.)

Note

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

Privacy Zone Masking Settings

For details, see "Privacy Zone Masking Function" on page 17.

Motion detection

For details, see "Motion Detection (MD) Function" on page 19.

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	"	:	'	.	,	/	-

Note

The title cannot be displayed during the SD Analog output.

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 18.
nn	Selects new setting or resetting for the zone. See "nn: Setting" in "Parameters" on page 18.
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 18.

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 18.

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 18.
qq	Set the color code
rr	Set the color code. See "qq, rr: Color code" in "Parameters" on page 19.

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 19.

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 18.
ppp	Pan Angle (000 to FFF) See "Setting pan/tilt angle" in "Parameters" on page 19.
qqq	Tilt Angle (000 to FFF) See "Setting pan/tilt angle" in "Parameters" on page 19.
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.

Notes

- 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.
- Privacy Zone Masking cannot be displayed during the SD Analog output.

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 18.
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 18.

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 Name	mm (Hex)
Mask_A	00h	Mask_M	0Ch
Mask_B	01h	Mask_N	0Dh
Mask_C	02h	Mask_O	0Eh
Mask_D	03h	Mask_P	0Fh
Mask_E	04h	Mask_Q	10h
Mask_F	05h	Mask_R	11h
Mask_G	06h	Mask_S	12h
Mask_H	07h	Mask_T	13h
Mask_I	08h	Mask_U	14h
Mask_J	09h	Mask_V	15h
Mask_K	0Ah	Mask_W	16h
Mask_L	0Bh	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
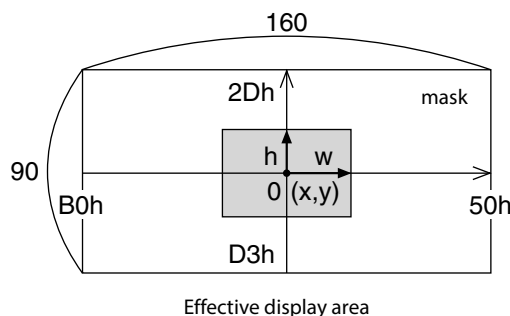
Note

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)
Black	00 h
Gray1	01 h
Gray2	02 h
Gray3	03 h
Gray4	04 h
Gray5	05 h
Gray6	06 h
White	07 h
Red	08 h
Green	09 h
Blue	0A h
Cyan	0B h
Yellow	0C h
Magenta	0D h

Setting pan/tilt angle

-180	-90	0	90	180
800h	C00h		400h	800h

Angle/Parameter of Angle (ppp, qqq)

Set the angle resolution to 360 (degree)/4096 (1000h).
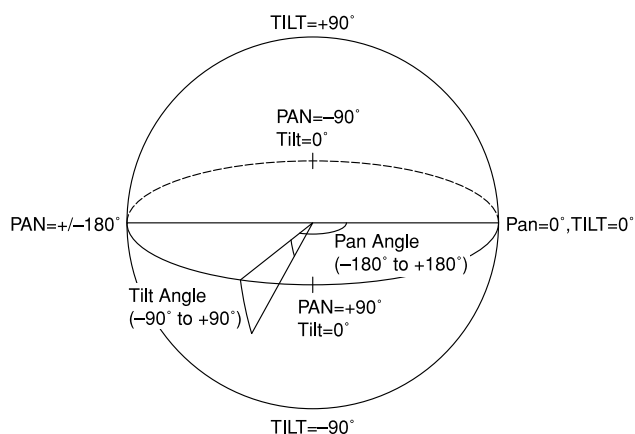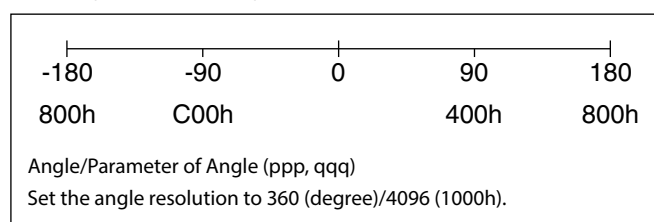
Motion Detection (MD) Function

This function instructs the camera to detect movement within the monitoring area and then send an alarm signal automatically.

The Detect signal goes out through the VISCA Command.

Features

- You can set a frame for the detection range of 17 (horizontally) × 15 (vertically) blocks.
- You can set up to four frames.
- When the motion is detected in the set frame, the Alarm Replay VISCA Command is sent.
- The threshold level for detection can be set (common to four frames).
- The interval of alarm detection can be set up to 255 seconds in units of one second.
- You can set ON/OFF for each frame.
- The frame number is also sent with Alarm Replay to report in which frame the motion has been detected.

Frames

Setting frames

You can set the frame by assigning the starting point and terminating point vertically and horizontally.
You can set up to four frames.

When motion is detected within the range where frames overlap

The alarms are sent for both frames.

Frame 1
Frame 2
Frame 3
Frame 4

At this position, the alarm for frame 3 is sent.

Within this overlapped range, alarms are sent for both frame 3 and frame 4.
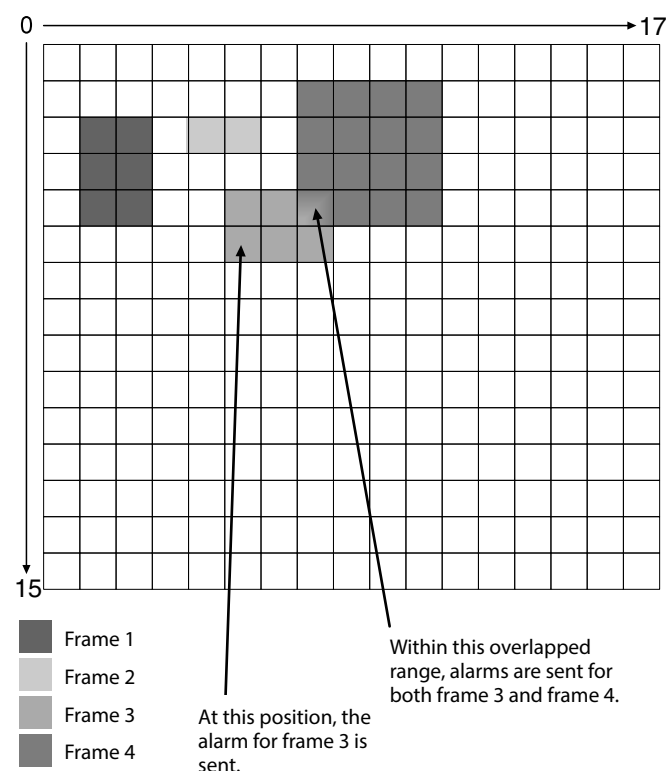
Sending Alarms

- When motion is detected, the Alarm Replay command is issued via the serial command (VISCA) communication line.
- When multiple motions are detected or motion is detected in another frame within the set interval following the original time the alarm was issued, another alarm command is not issued.
- When motion is detected after the interval time elapsed, the alarm is issued again.
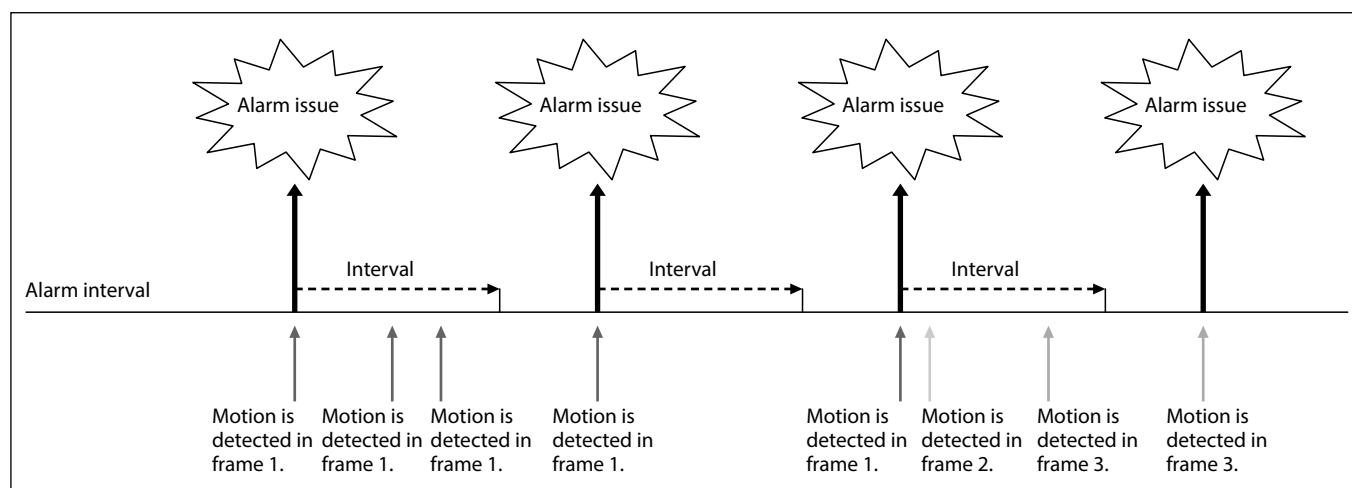
Setting Commands

- **MD On/Off**

The Display mode is selected by the Function Set command and frames are set by the Frame Set command. By sending an MD On command, the frame is displayed when motion is detected in the set frame. The Alarm Reply command is sent via the serial command (VISCA) communication line.

8x 01 04 1B 02 FF --- On
8x 01 04 1B 03 FF --- Off

- **Function Set**

Select the detected frame, and set the Threshold Level and the Interval Time.

8x 01 04 1C 0m 0n 0p 0q 0r 0s FF
m: Display Mode   on/off (bit0)
n: Detection Frame set   on/off (bit0:Frame0, bit1: Frame1, bit2:Frame2, bit3:Frame3)
                                       - (0 to F)
pq: Threshold   - (00 to FF)
rs: Interval time set   - (00 to FF)
(When pq and rs are 0, the command is received, but the setting is disabled.)

- **Frame Set**

You can set up to four frames by assigning the starting and terminating points.

Note

Set a terminating point higher vertically and horizontally than the starting point. If you set the wrong value, an error occurs.

8x 01 04 1D 0m 0p 0q rr 0s FF
m: Select Detection Frame (0: Frame0, 1: Frame1, 2: Frame2, 3: Frame3)   - (0, 1, 2, 3)
p: Frame set Start Horizontal Position   - (00 to 10)
q: Frame set Start Vertical Position   - (00 to 0E)
r: Frame set End Horizontal Position   - (01 to 11)
s: Frame set End Vertical Position   - (01 to 0F)

- **Alarm Reply**

When motion is detected in the set frame, the camera issues this command. This command includes the information on the number of the detected frame.

y0 07 04 1B 0p FF
p: Frame Number (bit0: Frame0, bit1: Frame1, bit2: Frame2, bit3: Frame3)

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 11.
- **Aperture Control**
  The setting can be set to 256 levels (00h to FFh).
  For details, see page 11.
- **Custom Color Gain**
  You can configure the color gain.
  The initial setting is 80h and the setting can be set to 256 levels from 00h to FFh.
  The higher the setting value, the higher the color saturation. The lower the setting value, the lower the color saturation.
  You can set the color saturation more widely and finely than the normal color gain variable.
  For details, see page 14.
- **Custom Color Phase**
  You can configure the color phase.
  The initial setting is 80h and the setting can be set to 256 levels from 00h to FFh.
  The higher the setting value, the color phase shifts to the + side. The lower the setting value, the color phase shifts to the – side.
  You can set the color phase more finely than the normal color phase variable.
  For details, see page 14.
- **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 14.

  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.

User's Updating

Overview

The details on the firmware version upgrade are described.
To perform the firmware version upgrade, the following three steps are required.
1) Shifting to the maintenance mode using the Visca command
2) Binary transmission (X model protocol) of the firmware in the maintenance mode
3) Finalizing setting using the Visca command

Each step is described as follows.
1) **Shifting to the maintenance mode using the Visca command**
   After entering the standby mode using the Visca command, the unit shifts to the maintenance mode.
   Note that if the power is turned off during the writing, the program will be broken and cannot be restored.

2) **Binary transmission (X model protocol) of the firmware in the maintenance mode**

   Serial Port Setting during maintenance mode

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

   In the maintenance mode, the terminal software capable of sending the character command is used. The terminal software that is provided with the XMODEM binary transfer protocol is used.
   When you transfer the camera firmware (uug.bin file) using this function, the transferred file is written in FlashROM. The writing takes approximately 6 minutes.
   Note that if the power is turned OFF during writing, the program may be broken and may not be restorable.
   After the writing is completed, the unit restarts automatically, and then the camera firmware is started.

3) **Finalizing setting using the Visca command**
   The finalizing setting is performed using the Visca command.
   You cannot read the correct camera firmware version without performing this setting. Be sure to perform this setting.

Update Procedure

Enter Maintenance Mode
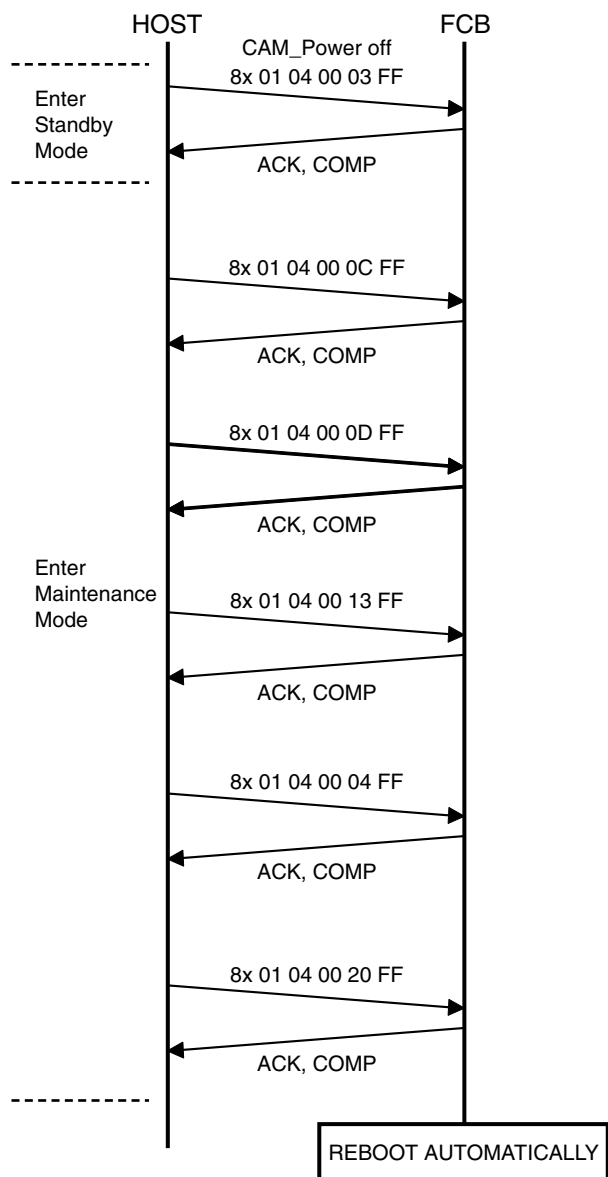
Maintenance Mode

```
        HOST              FCB
        CAM_Power off
        8x 01 04 00 03 FF
- - - - - - - ->
Enter
Standby     <- ACK, COMP
Mode
- - - - - -

        8x 01 04 00 0C FF
        ->

        <- ACK, COMP

        8x 01 04 00 0D FF
        ->

        <- ACK, COMP

Enter
Maintenance 8x 01 04 00 13 FF
Mode        ->

        <- ACK, COMP

        8x 01 04 00 04 FF
        ->

        <- ACK, COMP

        8x 01 04 00 20 FF
        ->

        <- ACK, COMP
- - - - - -
                REBOOT AUTOMATICALLY
```

*Do not turn OFF the power while updating because there is a possibility that the camera will break.

```
        HOST              FCB
        CODE NAME+
        VERSION + CR
        <-

Firmware Update  "ready" + CR
Ready Message    <-

        "reprogram ( )" + CR
        ->

        <- "receive"+ CR
- - - - - -
        Sending Firmware Binary
        with X modem protocol
Sending firmware  <===>
- - - - - -
                * Writing in FlashROM
        <- 'reboot'+ CR
```
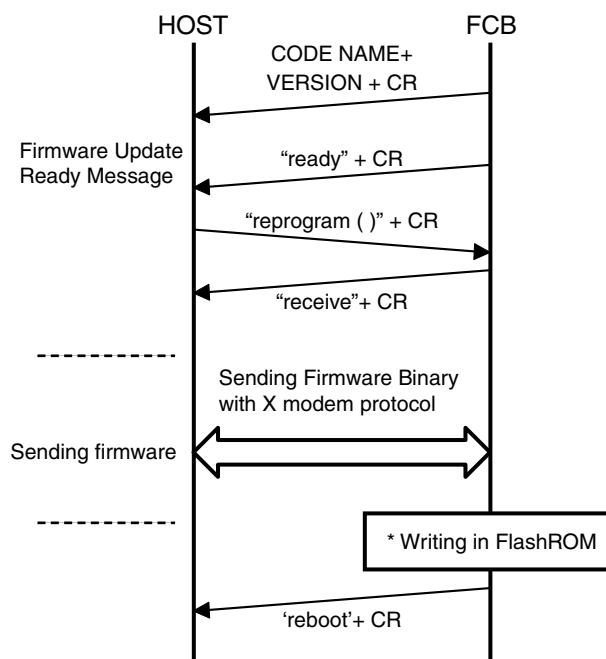
*Do not turn OFF the power while updating because there is a possibility that the camera will break.

Finalizing procedure

After the maintenance mode, perform the following finalizing procedure.

```
        HOST                          FCB
         │                             │
         │──── 8x 01 7F 01 7F FF ─────▶│
         │                             │
         │◀──────── ACK, COMP ─────────│
         │                             │
         │── 8x 01 7F 7F 02 00 00 01 00 01 FF ─▶│
         │                             │
         │◀──────── ACK, COMP ─────────│
         │                             │
         │ 8x 01 7F 7F 02 03 08 00 00 08 FF: EV7520A ▶│
         │                             │
         │◀──────── ACK, COMP ─────────│
         │                             │
         │── 8x 01 7F 7F 02 03 00 00 06 01 FF ─▶│
         │                             │
         │◀──────── ACK, COMP ─────────│
         │                             │
         │── 8x 01 7F 7F 02 03 00 01 06 01 FF ─▶│
         │                             │
         │◀──────── ACK, COMP ─────────│
         │                             │
         │──── 8x 09 7F 7F 01 03 00 02 FF ────▶│
         │                             │
         │◀── 9x 50 00 00 00 01 FF is received.*1│
         │                             │
         │──── 8x 01 04 19 03 FF ─────▶│
         │                          ┌──────────────┐
         │                          │ Reboots      │
         │                          │ automatically.│
         │                          └──────────────┘
         │──── 8x 09 00 02 FF ────────▶│
         │                             │
         │◀ 9x 50 00 20 HH HH JJ JJ 02 FF is received.│
 ┌────────────────┐                    │
 │ Check that JJJJ is the              │
 │ same as the updated                 │
 │ FW version. *2 │                    │
 └────────────────┘                    │
```

*1   When 9x 50 00 00 00 00 FF is received,
     retransmit 8x 09 7F 7F 01 03 00 02 FF
     until 9x 50 00 00 00 01 FF is received.

*2   If it is not the same, perform the
     update procedure from the beginning.

Eclipse

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

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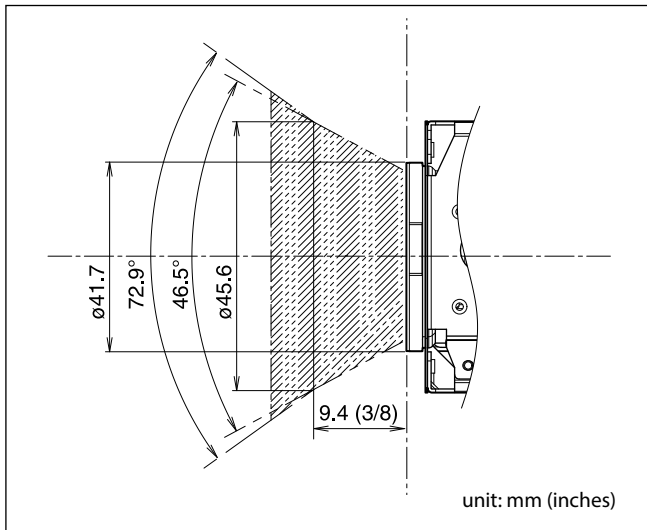
Spectral Sensitivity Characteristics
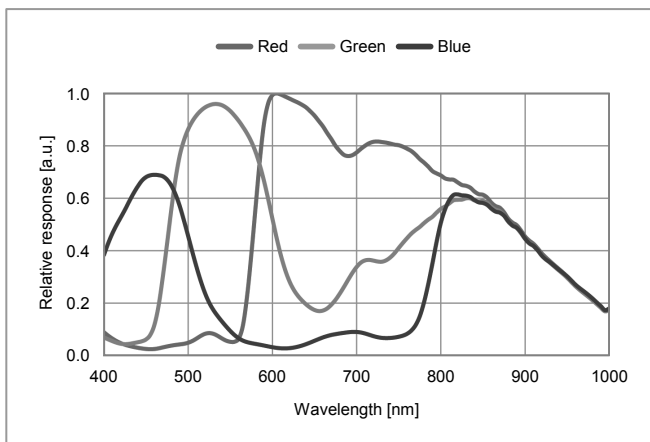
Use the graph as a reference value. (We can not guarantee these values.)
This data is measured when the IR cut filter is removed and the characteristics of the lens and optical source characteristics are ignored.

Initial settings and backup of camera

"Initial settings" is the factory preset value.
"Custom Preset", indicates data that can be stored with ○ and data that cannot be stored with × using the custom preset function.
"Back up on standby" indicates that ○ is retained while on Standby and × is not retained.

Mode/Position setting	Initial Settings	Custom Preset	Back up at standby
Zoom Position	Wide end	○	○
D-Zoom On/Off	On	○	○
D-Zoom Separate/Combine	Combine	○	○
D-Zoom Position	00h	○	○
Focus Position	—	○	○
Focus Auto/Manual	Auto	○	○
Near Limit Setting	D000h	○	○
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	○	○
Auto Slow Shutter Mode	Off	○	○
Shutter Position	—	○	○
Iris Position	—	○	○
Gain Position	—	○	○
Exposure Compensation On/Off	Off	○	○
Exposure Compensation Amount	±0	○	○
BackLight On/Off	Off	○	○
Spot AE On/Off	Off	○	○
Spot AE Position Setting	X=8 Y=7	○	○
Aperture Level	Ah	○	○
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	○	○
Camera Memory	Same as the initial value setting	×	○
Display On/Off	Off	○	○
Mute On/Off	Off	×	×
Auto ICR Alarm On/Off	Off	○	○
Image Stabilizer On/Off/Hold	Off	○	○
High Sensitivity mode On/Off	Off	○	○
Gamma	0: standard	○	○
Defog On/Off	Off	○	○

Mode/Position setting	Initial Settings	Custom Preset	Back up at standby
NR level (normal setting)	3	○	○
NR level (independent setting)	Disabled	○	○
Gain Limit	—	○	○
Low-Illumination Chroma Suppress	2h (Mid)	○	○
Color Gain	04h (100%)	○	○
Color Hue	7h (0 degrees)	○	○
Title Display On/Off	Off	○	○
Title Setting	—	○	○
Mask Setting	—	○	○
Mask Display On/Off	Off	○	○
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	×	○
MD On/Off	Off	○	○
MD Display Setting	Off	○	○
MD Threshold Level	10h	○	○
MD Interval	1 sec	○	○
MD Window Setting	—	○	○
ZoomPos Continuous Output On/Off	Off	×	○
ZoomPos Continuous Output Interval	3Ch	×	○
Minimum Shutter Mode	Off	○	○
Minimum Shutter Limit	1/125	○	○
HLC Level	Off	○	○
HLC Mask Level	Off	○	○
VE On/Off	Off	○	○
VE Parameter	Display brightness level: 3 Brightness compensation selection: 2 (Standard) Compensation level: 1 (Mid)	○	○
Wide-D On/Off	Off	○	○
Wide-D Parameter	Display brightness level: 3 Brightness compensation selection: 2 (Standard) Compensation level: 1 (Mid)	○	○
Contrast Adjustment	80h	○	○
Flicker Reduction	Off	○	○

Notes

- Acceptable number to write custom presets 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 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	One Push	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	Wide-D	VE/Defog	HLC
AE Full Auto	×	×	○	○	×	○	○	○	○	○	○	○
AE Manual	×	×	○	○	×	○	○	○	○	×	○	○
Shutter Priority	×	×	○	○	×	○	○	○	○	×	○	○
Iris Priority	×	×	○	○	×	○	○	○	○	×	○	○
Shutter Setting	×	×	○	○	×	×	○	○	×	×	○	○
Iris Setting	×	×	○	○	×	×	○	×	○	×	○	○
Gain 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)	×	×	○	○	○	○	○	○	○	×	○	○
Wide-D On/Off	×	×	○	○	○	○	×	×	×	○	○	○
Flicker Reduction	×	×	○	○	○	○	×	×	×	×	○	○

Others

Mode	Power Off	Initializing	Power On	Freeze On	MemRecall
Aperture Setting	×	×	○	○	×
LR_Reverse On/Off	×	×	○	○	×
Freeze On/Off	×	×	○	○	×
Picture Effect Setting	×	×	○	○	×
ICR On/Off	×	×	○	○	×
Auto ICR On/Off	×	×	○	○	×
Auto ICR Threshold Level Setting	×	×	○	○	○
Auto ICR Alarm On/Off	○	○	○	○	○
Display On/Off	×	×	○	○	○
Mute On/Off	×	×	○	○	○
Title Setting	×	×	○	○	○
Mask On/Off	×	×	○	○	○
Mask Setting	×	×	○	○	○
MD On/Off	×	×	○	○	○
MD Window Setting	×	×	○	○	○
MD Function Setting	×	×	○	○	○
ID Write	×	×	○	○	○
Memory Save	×	×	○	○	×
Register Value Setting	×	×	○	○	○
NR Level Setting	×	×	○	○	○
Chroma Suppress	×	×	○	○	○
Color Gain	×	×	○	○	○
Color Hue	×	×	○	○	○
Contrast Adjustment	×	×	○	○	○
Flicker Reduction	×	×	○	○	○

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.

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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.

Some of the commands for setting cameras can be sent to all devices at one time (broadcast). In the case of broadcast, the header should be hexadecimal 88h. When the terminator is FFh, it signifies the end of the packet.
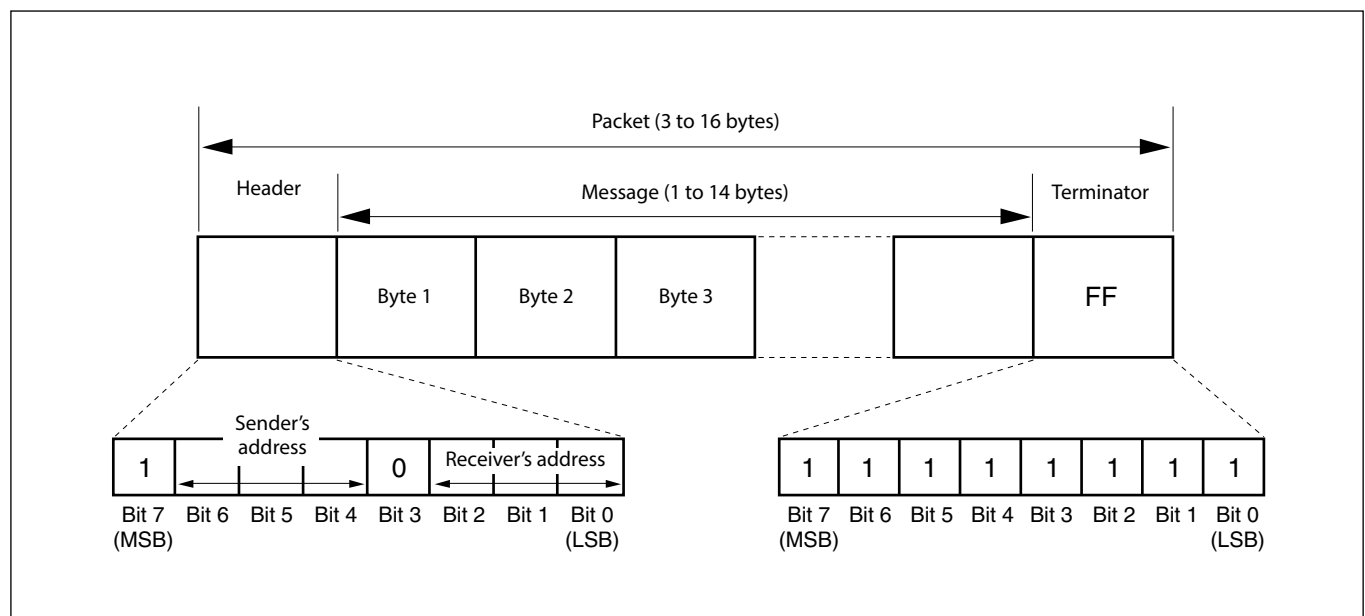
Command and inquiry

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

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

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

[2] RR = 00 (Interface), 04 (camera 1), 06 (Pan/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 Packet	Note
Acknowledge	X0 4Y FF	Y = socket number
Completion (Commands)	X0 5Y FF	Y = socket number
Completion (Inquiries)	X0 5Y ... FF	Y = socket number

X = 9 to F: FCB camera address + 8

● **Error message**
When a command 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	Note
Cancel	8X 2Y FF	Y = socket number

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

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

VISCA Device Setting Command

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

For VISCA network administration

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

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

	Packet	**Note**
Address	88 30 01 FF	Always broadcasted.
Network Change	X0 38 FF	
X = 9 to F: FCB camera address + 8		

Note

Please start the camera and start sending the VISCA command after receiving the Network Change.

VISCA interface command

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

	Command Packet	**Reply Packet**	**Note**
IF_Clear	8X 01 00 01 FF	X0 50 FF	
IF_Clear (broadcast)	88 01 00 01 FF	88 01 00 01 FF	
X = 1 to 7: FCB camera board address (For inquiry packet)			
X = 9 to F: FCB camera board address +8 (For reply packet)			

VISCA interface and inquiry

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

Inquiry	Inquiry Packet	Reply Packet	Description
CAM_VersionInq	8X 09 00 02 FF	Y0 50 GG GG HH HH JJ JJ KK FF	GGGG = Vender ID (0020: Sony)
			HHHH = Model ID
			0640: FCB-EV7520A
			0641: FCB-CV7520A
			JJJJ = ROM revision
			KK = Maximum socket #(02)

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

VISCA Command/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 4<u>2</u> FF 90 5<u>2</u> 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 6<u>2</u> 41 FF	Could not execute the command in the current mode.
Inquiry Command	81 09 04 38 FF (Example)	90 50 <u>02</u> 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 <u>01</u> FF	88 30 <u>02</u> 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 (1/6)

Command Set	Command	Command Packet	Comments
AddressSet	Broadcast	88 30 01 FF	Address Setting
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
CAM_DZoom	On	8x 01 04 06 02 FF	Digital Zoom On/Off
	Off	8x 01 04 06 03 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)
	Wide (Variable)	8x 01 04 06 3p FF	* Enabled during Separate Mode
	Direct	8x 01 04 46 00 00 0p 0q FF	pq: D-Zoom Position * Enabled during Separate Mode
CAM_Focus	Stop	8x 01 04 08 00 FF	—
	Far (Standard)	8x 01 04 08 02 FF	
	Near (Standard)	8x 01 04 08 03 FF	
	Far (Variable)	8x 01 04 08 2p FF	p=0 (Low) to 7 (High)
	Near (Variable)	8x 01 04 08 3p FF	
	Direct	8x 01 04 48 0p 0q 0r 0s FF	pqrs: Focus Position
	Auto Focus	8x 01 04 38 02 FF	AF On/Off
	Manual Focus	8x 01 04 38 03 FF	
	Auto/Manual	8x 01 04 38 10 FF	
	One Push Trigger	8x 01 04 18 01 FF	One Push AF Trigger
	Full Scan One Push Trigger	8x 01 04 18 03 FF	Full Scan One Push AF Trigger
	Near Limit	8x 01 04 28 0p 0q 0r 0s FF	pqrs: Focus Near Limit Position
CAM_AFSensitivity	Normal	8x 01 04 58 02 FF	AF Sensitivity High/Low
	Low	8x 01 04 58 03 FF	
CAM_AFMode	Normal AF	8x 01 04 57 00 FF	AF Movement Mode
	Interval AF	8x 01 04 57 01 FF	
	Zoom Trigger AF	8x 01 04 57 02 FF	
	Active/Interval Time	8x 01 04 27 0p 0q 0r 0s FF	pq: Movement Time, rs: Interval
CAM_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

Command List (2/6)

Command Set	Command	Command Packet	Comments
CAM_WB	Auto	8x 01 04 35 00 FF	Normal Auto
	Indoor	8x 01 04 35 01 FF	Indoor mode
	Outdoor	8x 01 04 35 02 FF	Outdoor mode
	One Push WB	8x 01 04 35 03 FF	One Push WB mode
	ATW	8x 01 04 35 04 FF	Auto Tracing White Balance
	Manual	8x 01 04 35 05 FF	Manual Control mode
	One Push Trigger	8x 01 04 10 05 FF	One Push WB Trigger
	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_RGain	Reset	8x 01 04 03 00 FF	Manual Control of R Gain
	Up	8x 01 04 03 02 FF	
	Down	8x 01 04 03 03 FF	
	Direct	8x 01 04 43 00 00 0p 0q FF	pq: R Gain
CAM_BGain	Reset	8x 01 04 04 00 FF	Manual Control of B Gain
	Up	8x 01 04 04 02 FF	
	Down	8x 01 04 04 03 FF	
	Direct	8x 01 04 44 00 00 0p 0q FF	pq: B Gain
CAM_AE	Full Auto	8x 01 04 39 00 FF	Auto Exposure mode
	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
CAM_AutoSlowShutter	On	8x 01 04 5A 02 FF	Auto Slow Shutter On/Off
	Off	8x 01 04 5A 03 FF	
CAM_Shutter	Reset	8x 01 04 0A 00 FF	Shutter Setting
	Up	8x 01 04 0A 02 FF	
	Down	8x 01 04 0A 03 FF	
	Direct	8x 01 04 4A 00 00 0p 0q FF	pq: Shutter Position
CAM_Iris	Reset	8x 01 04 0B 00 FF	Iris Setting
	Up	8x 01 04 0B 02 FF	
	Down	8x 01 04 0B 03 FF	
	Direct	8x 01 04 4B 00 00 0p 0q FF	pq: Iris Position
CAM_Gain	Reset	8x 01 04 0C 00 FF	Gain Setting
	Up	8x 01 04 0C 02 FF	
	Down	8x 01 04 0C 03 FF	
	Direct	8x 01 04 4C 00 00 0p 0q FF	pq: Gain Position
	Gain Limit	8x 01 04 2C 0p FF	p: Gain Position

Command List (3/6)

Command Set	Command	Command Packet	Comments
CAM_ExpComp	On	8x 01 04 3E 02 FF	Exposure Compensation On/Off
	Off	8x 01 04 3E 03 FF	
	Reset	8x 01 04 0E 00 FF	Exposure Compensation Amount Setting
	Up	8x 01 04 0E 02 FF	
	Down	8x 01 04 0E 03 FF	
	Direct	8x 01 04 4E 00 00 0p 0q FF	pq: ExpComp Position
CAM_BackLight	On	8x 01 04 33 02 FF	Back Light Compensation On/Off
	Off	8x 01 04 33 03 FF	
CAM_SpotAE	On	8x 01 04 59 02 FF	Spot Auto Exposure Setting
	Off	8x 01 04 59 03 FF	
	Position	8x 01 04 29 0p 0q 0r 0s FF	pq: X (0h to 10h), rs: Y (0h to Eh)
CAM_AE_Response	Direct	8x 01 04 5D pp FF	pp: Auto Exposure Response Setting (01h to 30h), initial setting: 01h
CAM_VE	On	8x 01 04 3D 06 FF	VE On
	Off	8x 01 04 3D 03 FF	Off (The Off command is the same for VE/WDR)
	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_WD	On	8x 01 04 3D 02 FF	Wide-D On
	Off	8x 01 04 3D 03 FF	Off (The Off command is the same for VE/WDR)
	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
	Off	8x 01 04 37 03 00 FF	p: Defog level (1: low, 2: mid, 3: high)
CAM_Aperture	Reset	8x 01 04 02 00 FF	Aperture Control
	Up	8x 01 04 02 02 FF	
	Down	8x 01 04 02 03 FF	
	Direct	8x 01 04 42 00 00 0p 0q FF	pq: Aperture Gain (0h to Fh)
CAM_NR	Noise Reduction	8x 01 04 53 pq FF	pq: NR setting (00: Off, 01 to 05: level 1 to 5, 7F: 2D/3D NR independent setting available)
	2D/3D NR independent setting	8x 01 05 53 0p 0q FF	p: 2DNR level (0: OFF, 1 to 5: level 1 to 5) q: 3DNR level (0: OFF, 1 to 5: level 1 to 5)
CAM_Gamma	—	8x 01 04 5B 0p FF	p: Gamma Setting (0: Standard, 1: Straight)
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	

Command List (4/6)

Command Set	Command	Command Packet	Comments
CAM_MinShutter	On	8x 01 04 12 02 FF	pq: Minimum Shutter Position (05h to 14h)
	Off	8x 01 04 12 03 FF	
	Limit	8x 01 04 13 00 00 0p 0q 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
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
CAM_Stabilizer	On	8x 01 04 34 02 FF	Stabilizer On/Off/HOLD
	Off	8x 01 04 34 03 FF	
	Hold	8x 01 04 34 00 FF	
CAM_Memory	Reset	8x 01 04 3F 00 0p FF	p: Memory Number (=0h to Fh)
	Set	8x 01 04 3F 01 0p FF	
	Recall	8x 01 04 3F 02 0p FF	
CAM_Custom	Reset	8x 01 04 3F 00 7F FF	Starts 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 (8x 01 06 06 02 FF)	Display On/Off
	Off	8x 01 04 15 03 FF (8x 01 06 06 03 FF)	
	On/Off Switch	8x 01 04 15 10 FF (8x 01 06 06 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
	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

Command List (5/6)

Command Set	Command	Command Packet	Comments
CAM_PrivacyZone	Non_InterlockMask	8x 01 04 6F mm 0p 0p 0q 0q 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_MD	On	8x 01 04 1B 02 FF	Motion Detection On/Off
	Off	8x 01 04 1B 03 FF	
	Function Set	8x 01 04 1C 0m 0n 0p 0q 0r 0s FF	m: Display mode n: Detection Frame Set (00h to 0Fh) pq: Threshold Level (00h to FFh) rs: Interval Time set (00h to FFh)
	Window Set	8x 01 04 1D 0m pp 0q rr 0s FF	m: Select Detection Frame (0, 1, 2, 3) pp: Start Horizontal Position (00h to 10h) q: Start Vertical Position (00h to 0Eh) rr: Stop Horizontal Position (01h to 11h) s: Stop Vertical Position (01h to 0Fh)
	Alarm (Reply)	y0 07 04 1B 0p FF	p: Detection Frame Number
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]
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]
CAM_RegisterValue	—	8x 01 04 24 mm 0p 0p FF	mm: Register No. (=00h to 7Fh) pp: Register Value (=00h to FFh)
CAM_ChromaSuppress	—	8x 01 04 5F pp FF	pp: 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 to Eh
CAM_ColorHue	Direct	8x 01 04 4F 00 00 00 0p FF	p: Color Hue Setting 0h to Eh
CAM_GammaOffset	Direct	8x 01 04 1E 00 00 00 0s 0t 0u FF	s: Polarity offset (0 is plus, 1 is minus) tu: Offset value (brightness) setting (00h to 40h)

Command List (6/6)

Command Set	Command	Command Packet	Comments
CAM_ContrastAdjLevel	Direct	8x 01 05 5D 01 0p 0q FF	pq: 00h to FFh 00h to 7Fh: The smaller the value is, the lower the contrast becomes. 80h (Initial setting): No contrast adjustment 81h to FFh: The larger the value is, the higher the contrast becomes.
CAM_ExExpComp	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	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	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 1Ch
CAM_ExColorGain	Direct	8x 01 04 1F 49 00 00 0p 0q FF	Color Gain Setting pq: Gain setting level pq=00h to FFh
CAM_ExColorHue	Direct	8x 01 04 1F 4F 00 00 0p 0q FF	Color Hue Setting pq: Phase setting level pq=00h to FFh
CAM_HLC	Parameter Set	8x 01 04 14 0p 0q FF	p: HLC level (0: Off, 1: Low, 2: Mid, 3: High) q: HLC mask level (0: Off, 1: Low, 2: Mid, 3: High)
CAM_FlickerReduction	ON	8x 01 04 32 02 FF	Flicker reduction ON/OFF
	OFF	8x 01 04 32 03 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
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_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_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
CAM_AutoSlowShutterInq	8x 09 04 5A FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_ShutterPosInq	8x 09 04 4A FF	y0 50 00 00 0p 0q FF	pq: Shutter Position
CAM_IrisPosInq	8x 09 04 4B FF	y0 50 00 00 0p 0q FF	pq: Iris Position
CAM_GainPosInq	8x 09 04 4C FF	y0 50 00 00 0p 0q FF	pq: Gain Position
CAM_GainLimitInq	8x 09 04 2C FF	y0 50 0q FF	p: Gain Limit
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

Inquiry Command List (2/4)

Inquiry Command	Command Packet	Inquiry Packet	Comments
CAM_SpotAEModeInq	8x 09 04 59 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_SpotAEPosInq	8x 09 04 29 FF	y0 50 0p 0q 0r 0s FF	pq: X Position, rs: Y Position
CAM_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_WDModeInq	8x 09 04 3D FF	y0 50 02 FF	Wide-D On
		y0 50 03 FF	Wide-D and VE Off
		y0 50 06 FF	VE On
CAM_WDParameterInq	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 (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_NRInq	8x 09 04 53 FF	y0 50 pq FF	pq: NR level (00: Off, 01 to 05: level 1 to 5, 7F: 2D/3D NR independent setting available)
CAM_NR2D3Dinq	8x 09 05 53 FF	y0 50 0p 0q FF	p: 2D NR level (0: Off, 01 to 05: level 1 to 5) q: 3D NR level (0: Off, 01 to 05: level 1 to 5)
CAM_GammaInq	8x 09 04 5B FF	y0 50 0p FF	Gamma p: 00h, 01h
CAM_HighSensitivityInq	8x 09 04 5E FF	y0 50 02 FF	On
		y0 50 03 FF	Off
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_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)

Inquiry Command List (3/4)

Inquiry Command	Command Packet	Inquiry Packet	Comments
CAM_DisplayModeInq	8x 09 04 15 FF (8x 09 06 06 FF)	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_StabilizerModeInq	8x 09 04 34 FF	y0 05 02 FF	On
		y0 05 03 FF	Off
		y0 05 00 FF	Hold
CAM_MuteModeInq	8x 09 04 75 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_PrivacyDisplayInq	8x 09 04 77 FF	y0 50 pp pp pp pp FF	pp pp pp pp: Mask Display (0: Off, 1: On)
CAM_PrivacyPanTiltInq	8x 09 04 79 FF	y0 50 0p 0p 0p 0q 0q 0q FF	ppp: Pan qqq: Tilt
CAM_PrivacyPTZInq	8x 09 04 7B mm FF	y0 50 0p 0p 0p 0q 0q 0q 0r 0r 0r 0r FF	mm: Mask Settings ppp: Pan qqq: Tilt rrrr: Zoom
CAM_PrivacyMonitorInq	8x 09 04 6F FF	y0 50 pp pp pp pp FF	pp pp pp pp: Mask is displayed now.
CAM_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 (06xx) rstu: ROM version vw: Socket Number (=02)
CAM_MDModeInq	8x 09 04 1B FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_MDFunctionInq	8x 09 04 1C FF	y0 50 0m 0n 0p 0q 0r 0s FF	m: Display mode n: Detection Frame Set (00h to 0Fh) pq: Threshold Level (00h to FFh) rs: Interval Time set (00h to FFh)
CAM_MDWindowInq	8x 09 04 1D 0m FF	y0 50 pp 0q rr 0s FF	m: Select Detection Frame (0, 1, 2, 3) pp: Start Horizontal Position (00h to 10h) q: Start Vertical Position (00h to 0Eh) rr: Stop Horizontal Position (01h to 11h) s: Stop Vertical Position (01h to 0Fh)
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_FocusReply IntervalTimeInq	8x 09 04 1A FF	y0 50 00 00 0p 0p FF	pp: Interval Time
CAM_RegisterValueInq	8x 09 04 24 mm FF	y0 50 0p 0p FF	mm: Register No. (=00h to 7Fh) pp: Register Value (=00h to FFh)
CAM_ChromaSuppressInq	8x 09 04 5F FF	y0 50 pp FF	pp: Chroma Suppress setting level
CAM_ColorGainInq	8x 09 04 49 FF	y0 50 00 00 00 0p FF	p: Color Gain Setting 0h to Eh
CAM_ColorHueInq	8x 09 04 4F FF	y0 50 00 00 00 0p FF	p: Color Hue Setting 0h to Eh
CAM_TempInq	8x 09 04 68 FF	Y0 50 00 00 0p 0q FF	pq: Lens Temperature
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 40h)
CAM_ContrastAdjLevelInq	8x 09 05 5D FF	y0 50 0p 0q FF	pq: Contrast adjustment value (low) 00h to 80h (no adjustment) to FFh (high)
CAM_ExExpCompPosInq	8x 09 04 1F 4E FF	y0 50 00 00 0p 0q FF	pq: Exposure compensation level pq = 00h to FFh

Inquiry Command List (4/4)

Inquiry Command	Command Packet	Inquiry Packet	Comments
CAM_ExApertureInq	8x 09 04 1F 42 FF	y0 50 00 00 0p 0q FF	pq: Aperture control level pq=00h to FFh
CAM_ExColorGainInq	8x 09 04 1F 49 00 FF	y0 50 0p 0q FF	pq: Gain setting level pq=00h to FFh
CAM_ExColorHueInq	8x 09 04 1F 4F 00 FF	y0 50 0p 0q FF	pq: Phase setting level pq=00h to FFh
CAM_ExAutoICRThresholdInq	8x 09 04 1F 21 00 FF	y0 50 00 00 0p 0q FF	pq: ICR On→Off threshold level when Auto ICR pq=00h to FFh
CAM_ExAutoICROnLevelInq	8x 09 04 1F 21 01 FF	y0 50 00 00 0p 0q FF	pq: ICR Off→On threshold level when Auto ICR pq=00h to 1Ch
CAM_MinShutterInq	8x 09 04 12 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_MinShutterLimitInq	8x 09 04 13 FF	y0 50 00 00 0p 0q FF	pq: MinShutter Position
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: Low, 2: Mid, 3: High)
CAM_FlickerReductionInq	8x 09 04 32 FF	y0 50 02 FF	ON
		y0 50 03 FF	OFF

Block Inquiry Command List

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

Byte	Bit	Comments	Byte	Bit	Comments	Byte	Bit	Comments
0	7	Destination Address	6	7	0	12	7	0
	6			6	0		6	0
	5			5	0		5	0
	4			4	0		4	0
	3	Source Address		3	Focus Near Limit (H)		3	0
	2			2			2	0
	1			1			1	0
	0			0			0	0
1	7	0 Completion Message (50h)	7	7	0	13	7	0
	6	1		6	0		6	0
	5	0		5	0		5	DZoomMode 0: Combine 1: Separate
	4	1		4	0		4	0: Normal 1: Interval
	3	0		3	Focus Near Limit (L)		3	2: Zoom Trigger
	2	0		2			2	AF Sensitivity 0: Low 1: Normal
	1	0		1			1	Digital Zoom 1: On 0: Off
	0	0		0			0	Focus Mode 1: Auto 0: Manual
2	7	0	8	7	0	14	7	0
	6	0		6	0		6	0
	5	0		5	0		5	0
	4	0		4	0		4	0
	3	Zoom Position (HH)		3	Focus Position (HH)		3	0
	2			2			2	Camera Memory Recall 1: Executing 0: Stopped
	1			1			1	Focus Command 1: Executing 0: Stopped
	0			0			0	Zoom Command 1: Executing 0: Stopped
3	7	0	9	7	0	15	7	1 Terminator (FFh)
	6	0		6	0		6	1
	5	0		5	0		5	1
	4	0		4	0		4	1
	3	Zoom Position (HL)		3	Focus Position (HL)		3	1
	2			2			2	1
	1			1			1	1
	0			0			0	1
4	7	0	10	7	0			
	6	0		6	0			
	5	0		5	0			
	4	0		4	0			
	3	Zoom Position (LH)		3	Focus Position (LH)			
	2			2				
	1			1				
	0			0				
5	7	0	11	7	0			
	6	0		6	0			
	5	0		5	0			
	4	0		4	0			
	3	Zoom Position (LL)		3	Focus Position (LL)			
	2			2				
	1			1				
	0			0				

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

Byte	Bit	Comments	Byte	Bit	Comments	Byte	Bit	Comments
0	7	Destination Address	6	7	0	11	7	0
	6			6	0		6	0
	5			5	0		5	0
	4			4	0		4	Iris Position
	3	Source Address		3	WB Mode		3	
	2			2			2	
	1			1			1	
	0			0			0	
1	7	0 Completion Message (50h)	7	7	0	12	7	0
	6	1		6	0		6	0
	5	0		5	0		5	0
	4	1		4	0		4	0
	3	0		3	Aperture Gain		3	Gain Position
	2	0		2			2	
	1	0		1			1	
	0	0		0			0	
2	7	0	8	7	0	13	7	0
	6	0		6	0		6	0
	5	0		5	0		5	0
	4	0		4	Exposure Mode		4	0
	3	R Gain (H)		3			3	0
	2			2			2	0
	1			1			1	0
	0			0			0	0
3	7	0	9	7	0	14	7	0
	6	0		6	0		6	0
	5	0		5	0		5	0
	4	0		4	VE 1: On 0: Off Wide-D (1: Other than Off, 0: Off)		4	0
	3	R Gain (L)		3	Spot AE 1: On 0: Off		3	Exposure Comp. Position
	2			2	Back Light 1: On 0: Off		2	
	1			1	Exposure Comp. 1: On 0: Off		1	
	0			0	Slow Shutter 1: On 0: Off		0	
4	7	0	10	7	0	15	7	1 Terminator (FFh)
	6	0		6	0		6	1
	5	0		5	0		5	1
	4	0		4	Shutter Position		4	1
	3	B Gain (H)		3			3	1
	2			2			2	1
	1			1			1	1
	0			0			0	1
5	7	0						
	6	0						
	5	0						
	4	0						
	3	B Gain (L)						
	2							
	1							
	0							

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

Byte	Bit	Comments	Byte	Bit	Comments	Byte	Bit	Comments
0	7	Destination Address	6	7	0	12	7	0
	6			6	0		6	0
	5			5	0		5	0
	4			4	0		4	Memory 1: Provided 0: Not provided
	3	Source Address		3	0		3	0
	2			2	0		2	ICR 1: Provided 0: Not provided
	1			1	0		1	Stabilizer 1: Provided 0: Not provided
	0			0	0		0	System 1: 1/50, 1/25 0: 1/60, 1/30
1	7	0 Completion Message (50h)	7	7	0	13	7	0
	6	1		6	0		6	0
	5	0		5	0		5	0
	4	1		4	0		4	0
	3	0		3	0		3	0
	2	0		2	0		2	0
	1	0		1	0		1	0
	0	0		0	0		0	0
2	7	0	8	7	0	14	7	0
	6	0		6	0		6	0
	5	0		5	0		5	0
	4	0		4	0		4	0
	3	Auto ICR Alarm (1: On, 0: Off)		3	Camera ID (HH)		3	0
	2	Auto ICR 1: On 0: Off		2			2	0
	1	0		1			1	0
	0	Power 1: On 0: Off		0			0	0
3	7	0	9	7	0	15	7	1 Terminator (FFh)
	6	Stabilizer 1: On 0: Off		6	0		6	1
	5	Stabilizer Hold 1: Hold 0: Off		5	0		5	1
	4	ICR 1: On 0: Off		4	0		4	1
	3	Freeze 1: On 0: Off		3	Camera ID (HL)		3	1
	2	LR Reverse 1: On 0: Off		2			2	1
	1	0		1			1	1
	0	0		0			0	1
4	7	0	10	7	0			
	6	0		6	0			
	5	Privacy Zone 1: On 0: Off		5	0			
	4	Mute 1: On 0: Off		4	0			
	3	Title Display 1: On 0: Off		3	Camera ID (LH)			
	2	Display 1: On 0: Off		2				
	1	0		1				
	0	0		0				
5	7	0	11	7	0			
	6	0		6	0			
	5	0		5	0			
	4	0		4	0			
	3	Picture Effect Mode		3	Camera ID (LL)			
	2			2				
	1			1				
	0			0				

Extended Function1 Query Command ....Command Packet 8x 09 7E 7E 03 FF

Byte	Bit	Comments	Byte	Bit	Comments	Byte	Bit	Comments
0	7	Destination Address	6	7	0	11	7	0
	6			6	0		6	Color Gain (0h to Eh)
	5			5	0		5	
	4			4	0		4	
	3	Source Address		3	AF Interval Time (H)		3	
	2			2			2	Advanced Privacy (1: Provided, 0: Not provided)
	1			1			1	Reserved
	0			0			0	E-Flip (1: Provided, 0: Not provided)
1	7	0 Completion Message (50h)	7	7	0	12	7	0
	6	1		6	0		6	0
	5	0		5	0		5	0
	4	1		4	0		4	AE Response
	3	0		3	AF Interval Time (L)		3	
	2	0		2			2	
	1	0		1			1	
	0	0		0			0	
2	7	0	8	7	0	13	7	0
	6	0		6	0		6	Gamma
	5	0		5	0		5	
	4	0		4	SpotAE Position (X)		4	
	3	Digital Zoom Position (H)		3			3	0
	2			2			2	NR Level (The lower 3 bits of the CAM_NRInq return value pq are stored.)
	1			1			1	
	0			0			0	
3	7	0	9	7	0	14	7	0
	6	0		6	0		6	Chroma Suppress
	5	0		5	0		5	
	4	0		4	SpotAE Position (Y)		4	
	3	Digital Zoom Position (L)		3			3	Gain Limit
	2			2			2	
	1			1			1	
	0			0			0	
4	7	0	10	7	0	15	7	1 Terminator (FFh)
	6	0		6	0		6	1
	5	0		5	0		5	1
	4	0		4	0		4	1
	3	AF Activation Time (H)		3	0		3	1
	2			2	MD (1: On, 0: Off)		2	1
	1			1	0		1	1
	0			0	E-Flip (1: On, 0: Off)		0	1
5	7	0						
	6	0						
	5	0						
	4	0						
	3	AF Activation Time (L)						
	2							
	1							
	0							

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	Wide-D
	0	0: Off 1: On 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	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	Byte	Bit	Comments	Byte	Bit	Comments
0	7	Destination Address	6	7	0	11	7	0
	6			6	Reserved		6	Reserved
	5			5			5	
	4			4			4	
	3	Source Address		3			3	
	2			2			2	
	1			1			1	
	0			0			0	
1	7	0 Completion Message (50h)	7	7	0	12	7	0
	6	1		6	Reserved		6	Reserved
	5	0		5			5	
	4	1		4			4	
	3	0		3			3	
	2	0		2			2	
	1	0		1			1	
	0	0		0			0	
2	7	0	8	7	0	13	7	0
	6	0		6	Reserved		6	Reserved
	5	0		5			5	
	4	0		4			4	
	3	Color Hue (0h to Eh)		3			3	
	2			2			2	
	1			1			1	
	0			0			0	
3	7	0	9	7	0	14	7	0
	6	Reserved		6	Reserved		6	Reserved
	5			5			5	
	4			4			4	
	3			3			3	
	2			2			2	
	1			1			1	
	0			0			0	
4	7	0	10	7	0	15	7	1 Terminator (FFh)
	6	Reserved		6	Reserved		6	1
	5			5			5	1
	4			4			4	1
	3			3			3	1
	2			2			2	1
	1			1			1	1
	0			0			0	1
5	7	0						
	6	Reserved						
	5							
	4							
	3							
	2							
	1							
	0							

VISCA Command Setting Values

Exposure control (1/2)

Shutter Speed		59.94/29.97 mode	50/25 mode
	15	1/10000	1/10000
	14	1/6000	1/6000
	13	1/4000	1/3500
	12	1/3000	1/2500
	11	1/2000	1/1750
	10	1/1500	1/1250
	0F	1/1000	1/1000
	0E	1/725	1/600
	0D	1/500	1/425
	0C	1/350	1/300
	0B	1/250	1/215
	0A	1/180	1/150
	09	1/125	1/120
	08	1/100	1/100
	07	1/90	1/75
	06	1/60	1/50
	05	1/30	1/25
	04	1/15	1/12
	03	1/8	1/6
	02	1/4	1/3
	01	1/2	1/2
	00	1/1	1/1

Iris		
	11	F1.6
	10	F2
	0F	F2.4
	0E	F2.8
	0D	F3.4
	0C	F4
	0B	F4.8
	0A	F5.6
	09	F6.8
	08	F8
	07	F9.6
	06	F11
	05	F14
	00	CLOSE

Gain		
	0F	50.0 dB (28 step)
	0E	46.4 dB (26 step)
	0D	42.8 dB (24 step)
	0C	39.3 dB (22 step)
	0B	35.7 dB (20 step)
	0A	32.1 dB (18 step)
	09	28.6 dB (16 step)
	08	25.0 dB (14 step)
	07	21.4 dB (12 step)
	06	17.8 dB (10 step)
	05	14.3 dB (8 step)
	04	10.7 dB (6 step)
	03	7.1 dB (4 step)
	02	3.6 dB (2 step)
	01	0 dB (0 step)

Gain Limit		
	0F	50.0 dB (28 step)
	0E	46.4 dB (26 step)
	0D	42.8 dB (24 step)
	0C	39.3 dB (22 step)
	0B	35.7 dB (20 step)
	0A	32.1 dB (18 step)
	09	28.6 dB (16 step)
	08	25.0 dB (14 step)
	07	21.4 dB (12 step)
	06	17.8 dB (10 step)
	05	14.3 dB (8 step)
	04	10.7 dB (6 step)

Exposure control (2/2)

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×	16A1
3×	2063
4×	2628
5×	2A1D
6×	2D13
7×	2F6D
8×	3161
9×	330D
10×	3486
11×	35D7
12×	3709
13×	3820
14×	3920
15×	3AOA
16×	3ADD
17×	3B9C
18×	3C46
19×	3CDC
20×	3D60
21×	3DD4
22×	3E39
23×	3E90
24×	3EDC
25×	3F1E
26×	3F57
27×	3F8A
28×	3FB6
29×	3FDC
30×	4000

Digital Zoom Combine mode

Digital Zoom Ratio	Digital Zoom Position Data
1×	4000
2×	6000
3×	6A80
4×	7000
5×	7300
6×	7540
7×	76C0
8×	7800
9×	78C0
10×	7980
11×	7A00
12×	7AC0

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

Note

In the Monitoring Mode 720p/NTSC/PAL, the maximum magnification of the Digital Zoom is less than 12×. Therefore, when setting the zoom to the maximum magnification, the Zoom Position will be the value below.

■ 720p (Max Digital Zoom Ratio: 11.13×)
- Combine mode: up to 0x7A40
- Separate mode: up to 0xE9

■ NTSC (Max Digital Zoom Ratio: 6.40×)
- Combine mode: up to 0x7600
- Separate mode: up to 0xD8

■ PAL (Max Digital Zoom Ratio: 6.40×)
- Combine mode: up to 0x7600
- Separate mode: up to 0xD8

Lens control

Zoom Position	0000 to 4000 to 7AC0 Wide end Optical Digital Tele end Tele end	
Focus Position	1000 to F000 Far end Near end	
Focus Near Limit	1000: Over Inf 2000: 20 m 3000: 10 m 4000: 6 m 5000: 4.2 m 6000: 3.1 m 7000: 2.5 m 8000: 2.0 m 9000: 1.65 m A000: 1.4 m B000: 1.2 m C000: 0.8 m D000: 30 cm (initial setting) E000: 11 cm F000: 1 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.

Temperature Reading Conversion Value (Reference Value)

Reading Value pq (hex)	Temperature Conversion Value (ºC)
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

Wide/Tele Limit Setting

Wide/Tele Limit Setting Value	Wide Limit		Tele Limit	
Limit Setting Value	Zoom Position	Zoom Ratio	Zoom Position	Zoom Ratio
00	0000	1	4000	30
10	00C4	1.02	3F3B	25.5
20	0188	1.04	3E77	22.7
30	024C	1.06	3DB3	20.7
40	0310	1.08	3CEF	19.1
50	03D4	1.11	3C2B	17.8
60	0498	1.13	3B67	16.7
70	055C	1.15	3AA3	15.7
80	0620	1.18	39DF	14.8
90	06E4	1.2	391B	14
A0	07A8	1.23	3857	13.2
B0	086C	1.26	3793	12.5
C0	0930	1.28	36CF	11.8
D0	09F4	1.31	360B	11.2
E0	0AB8	1.34	3547	10.6
F0	0B7C	1.38	3483	10
FF	0C33	1.41	33CC	9.5

Register Setting

Register name	Register No.	Setting value		Setting value reflection timing*
VISCA Baud Rate	00	00 (Initial Setting)	9600 bps	Reflected after camera reset
		01	19200 bps	
		02	38400 bps	
		03	115200 bps	
Monitoring Mode	72	01 (Initial Setting)	1080i/59.94	Reflected after camera reset
		02	1080i/60	
		03	NTSC SD Analog Side Cut (Digital output Stopped)	
		04	1080i/50	
		05	PAL SD Analog Side Cut (Digital output Stopped)	
		06	1080p/29.97	
		07	1080p/30	
		08	1080p/25	
		09	720p/59.94	
		0A	720p/60	
		0B	Reserved	
		0C	720p/50	
		0D	Reserved	
		0E	720p/29.97	
		0F	720p/30	
		10	Reserved	
		11	720p/25	
		12	Reserved	
		13	1080p/59.94	
		14	1080p/50	
		15	1080p/60	
		16	NTSC SD Analog Squeeze (Digital output Stopped)	
		17	PAL SD Analog Squeeze (Digital output Stopped)	
LVDS Mode	74	00 (Initial Setting)	Single output	Reflected after camera reset
		01	Double output	
Zoom Limit	50	00-FF (Initial Setting: 00)	Wide Limit (0: Disabled)	Reflected after camera reset
	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)	Reflected after camera reset

Register name	Register No.	Setting value		Setting value reflection timing*
"StableZoom"	53	00 (Initial Setting: 00)	Off	Immediate reflection
		01	On	
FocusTrace @ZoomDirect	54	00	Off	Reflected after camera reset
		01 (Initial Setting: 01)	On	
FocusOffset @DomeCover	55	00-FF (Initial Setting: 00)	00: None to FF: Max.	Reflected after camera reset
AE Parameter Change During VE On, Defog On	58	00	OFF	Immediate reflection
		01 (Initial Setting)	ON	
Auto Slow Shutter Limit	59	01	1/30	Immediate reflection
		02	1/15	
		03	1/8	
		04 (Iinitial Setting)	1/4	
		05	1/2	
		06	1/1	
Extended Normal Shutter	5A	00 (Initial Setting)	OFF	Immediate reflection
		01	Allowed up to 1/30	
		02	Allowed up to 1/15	
		03	Allowed up to 1/8	
		04	Allowed up to 1/4	
		05	Allowed up to 1/2	
		06	Allowed up to 1/1	
Defog Limit	5B	00-FF (Initial Setting: 8C)	Defog level Low Limit	Reflected after camera reset
	5C	00-FF (Initial Setting: A6)	Defog level Mid Limit	
	5D	00-FF (Initial Setting: C0)	Defog level High Limit	
Extended Mode	5F	00 (Initial Setting)	OFF	Immediate reflection
		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		
Spot Light Avoidance	20	00 (Initial Setting: 00)	Off	Immediate reflection
		1	On	

* Timing to reflect register setting value changes

- Reflect after camera reset: After the setting value is changed, changes are reflected following camera reset by "Camera reset command" or "Camera power supply turned OFF and then ON again".

- Reflect immediately: Changes are reflected immediately after the setting value is changed.

Others

AF Active Time[1]	00	to	FF
AF Interval Time[1]	00	to	FF
Spot AE X position	00	to	10
Spot AE Y position	00	to	0E
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	1C
MD Threshold Level	00	to	FF
MD Interval Time[1]	00	to	FF
MD Set Horizontal Position	00	to	11
MD Set Vertical Position	00	to	0F
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

Specifications

Imager	1/2.8 Type "Exmor R" CMOS Sensor
Picture elements	2130K pixels
Lens	30× Zoom
(Typical value)	f= 4.3 mm (WIDE) to 129 mm (TELE), F1.6 to F4.7

Zoom movement speed
Optical WIDE – Optical TELE
    5.0 sec (Focus Tracking On)
    2.5 sec (Focus Tracking Off)
Optical WIDE – Digital TELE
    (Digital 12×)
    7.0 sec (29.97p/59.94p mode)
    7.4 sec (25p/50p mode)
Digital WIDE – Digital TELE
    (Digital 12×)
    2.1 sec (29.97p/59.94p mode)
    2.5 sec (25p/50p mode)
Focus Movement time
∞ to Near   1.1 sec

Digital Zoom	12× (360× with optical zoom)
Angle of view (H)	Approx. 63.7 degrees (Wide end), approx. 2.3 degrees (Tele end)

Min. working distance
    10 mm (Wide end), 1200 mm (Tele end)

Sync system	Internal
Min. illumination	In the case of ICR-Off
(Typical value)	0.01 lx (1/30 sec, 50%, High Sensitivity mode On)

    0.1 lx (1/30 sec, 50%, High Sensitivity mode Off)
    0.0013 lx (1/4 sec, 1/3 sec, 50%, High Sensitivity mode On)
    0.013 lx (1/4 sec, 1/3 sec, 50%, High Sensitivity mode Off)
In the case of ICR-On
    0.0015 lx (1/30 sec, 50%, High Sensitivity mode On)
    0.006 lx (1/30 sec, 50%, High Sensitivity mode Off)
    0.0008 lx (1/4 sec, 1/3 sec, 30%, High Sensitivity mode On)
Recommended illumination
    100 lx to 100,000 lx

Image S/N	50dB (Weight On)

Back light compensation
    On/Off
Electronic shutter speed
    1/1 sec to 1/10000 sec (22 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 50.0 dB (0 to 28 step))

    Max. Gain Limit
    (10.7 to 50.0 dB (6 to 28 step))
Wide Dynamic Range Mode
    On/Off
Noise Reduction
    On/Off (level 5 to 1 / Off, 6 steps)

Defog mode	On/Off
Aperture control	16 steps
Preset	16-POSITIONS
Camera control	VISCA protocol (CMOS 5V)

    9.6 kbps, 19.2 kbps, 38.4 kbps, 115.2 kbps, Stop bit, 1 bit

Video Output	HD: Digital (LVDS)
	SD: Analog (CVBS)

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
    3.2 W
    (during motor operation: 4.0 W)

Mass	Approx. 250 g (8.8 oz.)
Dimensions	50 × 60 × 89.7 mm (2 × 2 $^3/_8$ × 3 $^5/_8$ in.) (w/h/d)

Interface

- In FCB-EV7520A/FCB-CV7520A, the video signal is transmitted by using LVDS. The LVDS receiver IC chip (e.g., THC63LVD1024, THC63LVD104C, BU90R102) is recommended.
- Recommended connectors and cables
  Cable: #42 Micro coaxial cable
  Connector: USL20-30S (KEL)

LVDS Pixel Data Format

Single Mode
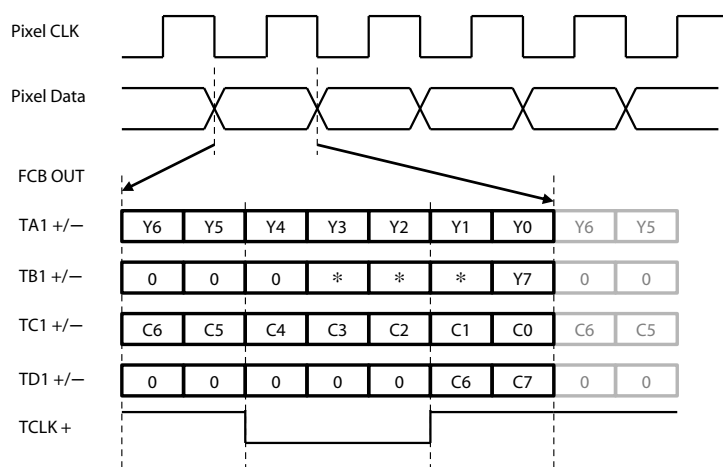
✻ Please ignore the value which can be "0" or "1".

Output Format	Pixel CLK[Hz]	TCLK+[Hz]
1080p/60	148.5M	148.5M
1080p/59.94	148.5M/1.001	148.5M/1.001
1080p/30	74.25M	74.25M
1080p/29.97	74.25M/1.001	74.25M/1.001
1080i/60	74.25M	74.25M
1080i/59.94	74.25M/1.001	74.25M/1.001
1080i/50	74.25M	74.25M
720p/60	74.25M	74.25M

Output Format	Pixel CLK[Hz]	TCLK+[Hz]
720p/59.94	74.25M/1.001	74.25M/1.001
720p/30	74.25M	74.25M
720p/29.97	74.25M/1.001	74.25M/1.001
1080p/50	148.5M	148.5M
1080p/25	74.25M	74.25M
720p/50	74.25M	74.25M
720p/25	74.25M	74.25M

Double Mode
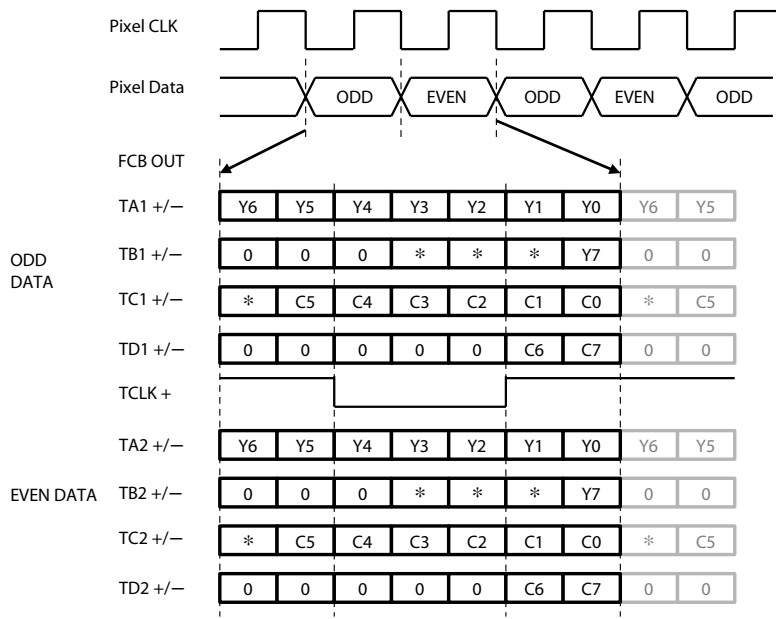
＊ Please ignore the value which can be "0" or "1".

Output Format	Pixel CLK[Hz]	TCLK+[Hz]
1080p/60	148.5M	74.25M
1080p/59.94	148.5M/1.001	74.25M/1.001
1080p/30	74.25M	37.125M
1080p/29.97	74.25M/1.001	37.125M/1.001
1080i/60	74.25M	37.125M
1080i/59.94	74.25M/1.001	37.125M/1.001
1080i/50	74.25M	37.125M
720p/60	74.25M	37.125M

Output Format	Pixel CLK[Hz]	TCLK+[Hz]
720p/59.94	74.25M/1.001	37.125M/1.001
720p/30	74.25M	37.125M
720p/29.97	74.25M/1.001	37.125M/1.001
1080p/50	148.5M	74.25M
1080p/25	74.25M	37.125M
720p/50	74.25M	37.125M
720p/25	74.25M	37.125M

LVDS receiver circuit example (Single output)

Sony Corporation is not liable for any damages to user's hardware incurred by the use of the circuit example shown below.

LVDS receiver circuit example ① (Single output)　＊Not compatible with 1080p/60, 59.94, 50

• The switch (S001) selects whether to input the rising edge or falling edge of the signal.

LVDS receiver IC (e.g., THC63LVD104C)
Pin assigment Single mode LVDS input - CMOS output   * Not compatible with 1080p/60, 59.94, 50

Pin No.	Description	Signal	Pin No.	Description	Signal
1	GND_1		33	RB5	
2	TEST		34	RB4	
3	PD		35	RB3	DE
4	OE		36	RB2	VSYNC
5	R/F		37	VCC_37	
6	RE6		38	RB1	HSYNC
7	RE5		39	RB0	Y7
8	RE4		40	RA6	Y6
9	VCC_9		41	RA5	Y5
10	RE3		42	RA4	Y4
11	RE2		43	RA3	Y3
12	RE1		44	GND_44	
13	RE0		45	RA2	Y2
14	RD6		46	RA1	Y1
15	RD5		47	RA0	Y0
16	GND_16		48	VCC_48	
17	RD4		49	RA−	TXOUT0−
18	RD3		50	RA+	TXOUT0+
19	RD2		51	RB+	TXOUT1−
20	RD1		52	RB−	TXOUT1+
21	RD0	C7	53	LVCC	
22	RC6	C6	54	RC−	TXOUT2−
23	VCC_23		55	RC+	TXOUT2+
24	RC5	C5	56	RCLK−	TXCLKOUT−
25	RC4	C4	57	RCLK+	TXCLKOUT+
26	RC3	C3	58	LGND	
27	RC2	C2	59	RD−	TXOUT3−
28	RC1	C1	60	RD+	TXOUT3+
29	RC0	C0	61	RE−	
30	GND_30		62	RE+	
31	CLKOUT	CLK	63	PGND	
32	RB6		64	PVCC	

LVDS receiver circuit example ② (Single output)

- No.1 and 2 of S601 adjust the signal delay. No.3 selects whether to input the rising edge or falling edge of the signal.

LVDS receiver IC (e.g., THC63LVD1024, BU90R102)
Pin assigment Single mode LVDS input - CMOS output

Pin No.	Description	Signal		Pin No.	Description	Signal		Pin No.	Description	Signal
1	PGND_1			51	B28			101	HSYNC	C4
2	PVCC_2			52	B29			102	VSYNC	C5
3	RESERVED			53	VCC_53			103	DE	C6
4	PDWN			54	GND_54			104	CONT11	
5	MODE0			55	CONT21			105	CONT12	
6	MODE1			56	CONT22			106	VCC_106	
7	DK			57	VCC_57			107	PVCC_107	
8	R/F			58	GND_58			108	PGND_108	
9	OE			59	GND_59			109	LGND_109	
10	MODE2			60	CLKOUT	CLK		110	RA1−	TXOUT0−
11	MAP			61	CVCC			111	RA1+	TXOUT0+
12	VCC_12			62	CGND			112	RB1−	TXOUT1−
13	GND_13			63	R10			113	RB1+	TXOUT1+
14	R20			64	R11			114	LVCC_114	
15	R21			65	R12	Y0		115	LGND_115	
16	R22			66	R13	Y1		116	RC1−	TXOUT2−
17	R23			67	R14	Y2		117	RC1+	TXOUT2+
18	R24			68	R15	Y3		118	RCLK−	TXCLKOUT−
19	R25			69	R16	Y4		119	RCLK+	TXCLKOUT+
20	R26			70	VCC_70			120	LVCC_120	
21	VCC_21			71	GND_71			121	LGND_121	
22	GND_22			72	R17	Y5		122	RD1−	TXOUT3−
23	R27			73	R18	C7		123	RD1+	TXOUT3+
24	R28			74	R19	C6		124	RE1−	
25	R29			75	G10			125	RE1+	
26	G20			76	G11			126	LVCC_126	
27	G21			77	G12	Y6		127	LGND_127	
28	VCC_28			78	G13	Y7		128	RA2−	
29	VCC_29			79	G14	HSYNC		129	RA2+	
30	GND_30			80	VCC_80			130	RB2−	
31	G22			81	GND_81			131	RB2+	
32	G23			82	G15	VSYNC		132	LVCC_132	
33	G24			83	G16	DE		133	LGND_133	
34	G25			84	G17			134	RC2−	
35	G26			85	G18			135	RC2+	
36	G27			86	G19			136	LGND_136	
37	G28			87	B10			137	LGND_137	
38	VCC_38			88	VCC_88			138	LVCC_138	
39	GND_39			89	GND_89			139	LVCC_139	
40	G29			90	B11			140	RD2−	
41	B20			91	B12			141	RD2+	
42	B21			92	B13			142	RE2−	
43	B22			93	B14	C0		143	RE2+	
44	B23			94	B15	C1		144	LGND_144	
45	B24			95	B16	C2				
46	VCC_46			96	B17	C3				
47	GND_47			97	VCC_97					
48	B25			98	GND_98					
49	B26			99	B18					
50	B27			100	B19					

LVDS receiver circuit example ③ (Double output)
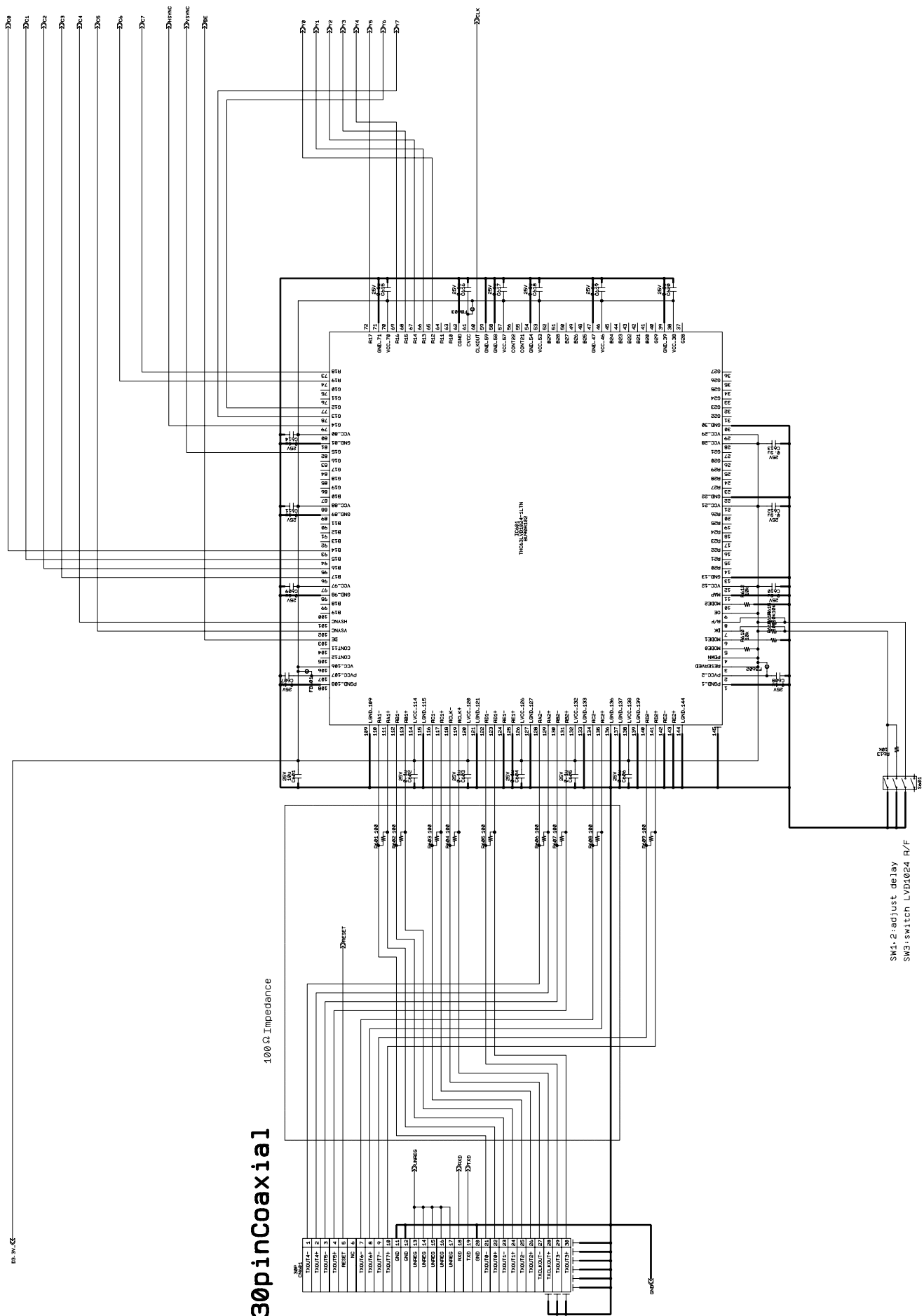
- No.1 and 2 of S601 adjust the signal delay. No.3 selects whether to input the rising edge or falling edge of the signal.

LVDS receiver IC (e.g., THC63LVD1024, BU90R102)
Pin assigment Double mode LVDS input - CMOS output

Pin No.	Description	Signal	Pin No.	Description	Signal	Pin No.	Description	Signal
1	PGND_1		51	B28		101	HSYNC	C4
2	PVCC_2		52	B29		102	VSYNC	C5
3	RESERVED		53	VCC_53		103	DE	DE
4	PDWN		54	GND_54		104	CONT11	
5	MODE0		55	CONT21		105	CONT12	
6	MODE1		56	CONT22		106	VCC_106	
7	DK		57	VCC_57		107	PVCC_107	
8	R/F		58	GND_58		108	PGND_108	
9	OE		59	GND_59		109	LGND_109	
10	MODE2		60	CLKOUT	CLK	110	RA1−	TXOUT0−
11	MAP		61	CVCC		111	RA1+	TXOUT0+
12	VCC_12		62	CGND		112	RB1−	TXOUT1−
13	GND_13		63	R10		113	RB1+	TXOUT1+
14	R20		64	R11		114	LVCC_114	
15	R21		65	R12	Y0	115	LGND_115	
16	R22		66	R13	Y1	116	RC1−	TXOUT2−
17	R23		67	R14	Y2	117	RC1+	TXOUT2+
18	R24		68	R15	Y3	118	RCLK−	TXCLKOUT−
19	R25		69	R16	Y4	119	RCLK+	TXCLKOUT+
20	R26		70	VCC_70		120	LVCC_120	
21	VCC_21		71	GND_71		121	LGND_121	
22	GND_22		72	R17	Y5	122	RD1−	TXOUT3−
23	R27		73	R18	C7	123	RD1+	TXOUT3+
24	R28		74	R19	C6	124	RE1−	
25	R29		75	G10		125	RE1+	
26	G20		76	G11		126	LVCC_126	
27	G21		77	G12	Y6	127	LGND_127	
28	VCC_28		78	G13	Y7	128	RA2−	TXOUT4−
29	VCC_29		79	G14	HSYNC	129	RA2+	TXOUT4+
30	GND_30		80	VCC_80		130	RB2−	TXOUT5−
31	G22		81	GND_81		131	RB2+	TXOUT5+
32	G23		82	G15	VSYNC	132	LVCC_132	
33	G24		83	G16		133	LGND_133	
34	G25		84	G17		134	RC2−	TXOUT6−
35	G26		85	G18		135	RC2+	TXOUT6+
36	G27		86	G19		136	LGND_136	
37	G28		87	B10		137	LGND_137	
38	VCC_38		88	VCC_88		138	LVCC_138	
39	GND_39		89	GND_89		139	LVCC_139	
40	G29		90	B11		140	RD2−	TXOUT7−
41	B20		91	B12		141	RD2+	TXOUT7+
42	B21		92	B13		142	RE2−	
43	B22		93	B14	C0	143	RE2+	
44	B23		94	B15	C1	144	LGND_144	
45	B24		95	B16	C2			
46	VCC_46		96	B17	C3			
47	GND_47		97	VCC_97				
48	B25		98	GND_98				
49	B26		99	B18				
50	B27		100	B19				

Cable reference specifications (crossover)

CN1   CN2

Color: Blue

Color: Green

1

30

②×15

①×15

30

1

A   B   B   B   A
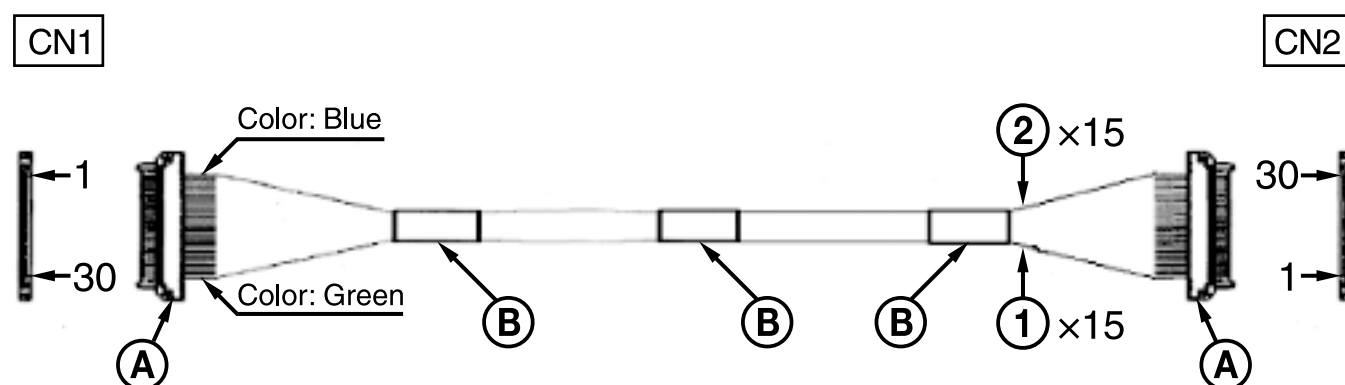
• Recommended connectors and cables
   Cable ① green: #42 Micro coaxial cable
   Cable ② blue: #42 Micro coaxial cable
   Connector Ⓐ: USL20-30S (KEL)
   Binding tape Ⓑ

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

Y-Signal

[IRE]		[Digit]
109		254
	Peak Margin	240
100		235
51		128
0	Black Level	16
	Lower Limit	1

Data Format   : Straight Binary
Black Level   : 16 (10h)
100IRE   : 235
Prohibited Data   : 0,255 (0h,FFh)
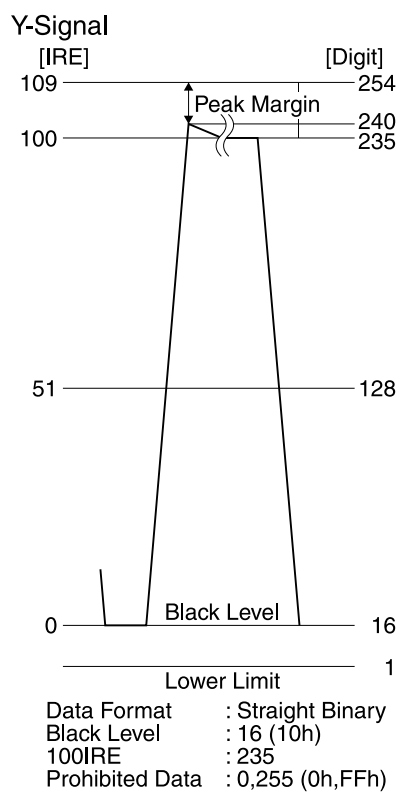
Color coding complies with BT709.

Cb, Cr-Signal

	Upper Limit	[Digit]
		254
100% Color Bar		240
Black Level		128
100% Color Bar		16
	Lower Limit	1

Data Format   : Straight Binary
Black Level   : 128 (80h)
Prohibited Data   : 0,255 (0h,FFh)
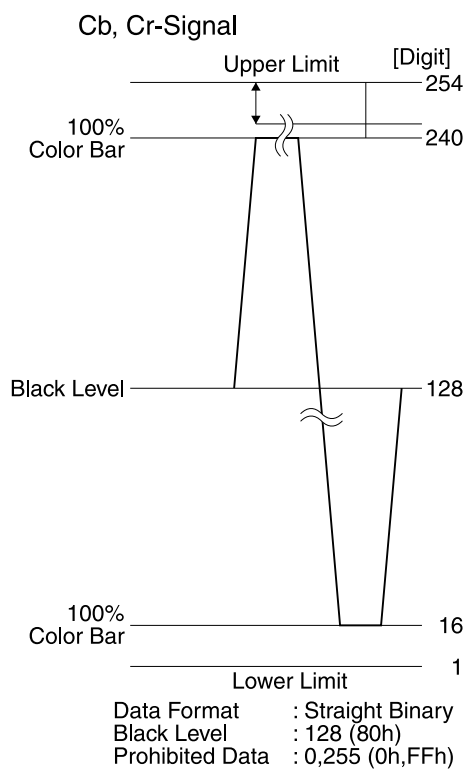
Synchronized codes
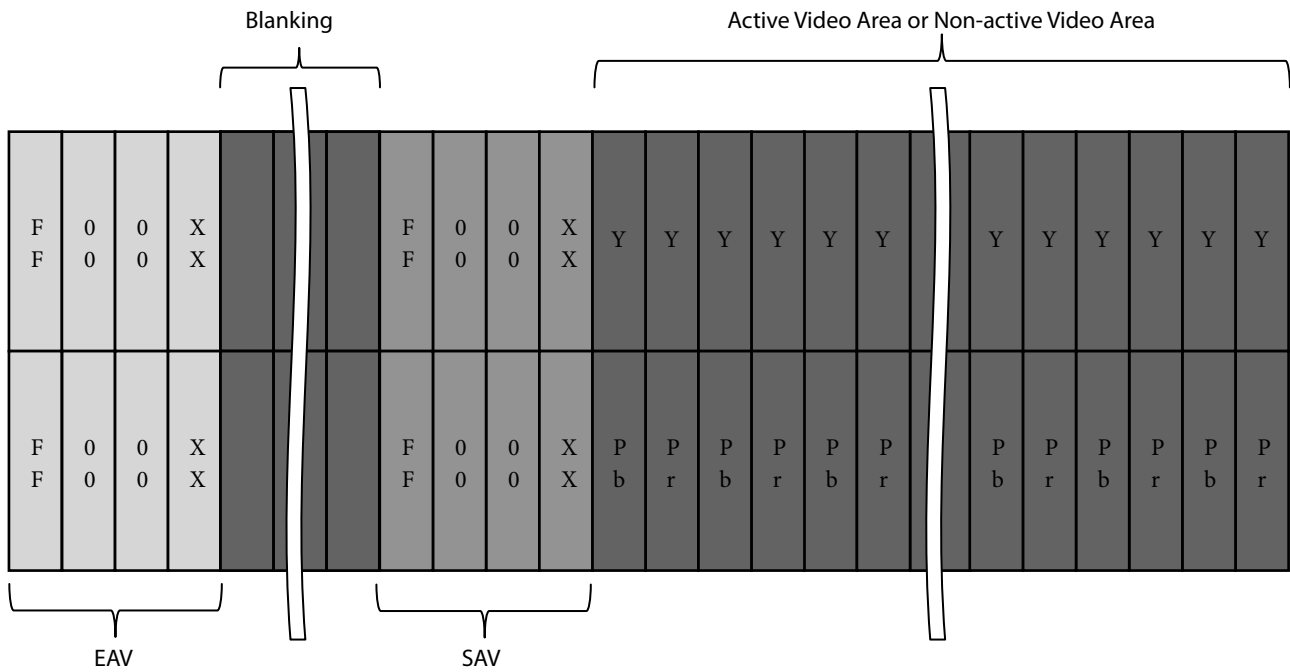
		XX for SAV	**XX for EAV**
First Field	Active Video Area	80h	9Dh
	Non-active Video Area	ABh	B6h
Second Field	Active Video Area	C7h	DAh
	Non-active Video Area	ECh	F1h

Synchronized codes

Interlace system (Comparable to SMPTE 274 M)

	EAV		SAV	
First Field	④	Blanking	②	Non-active Video Area
	③	Blanking	①	Active Video Area
	④	Blanking	②	Non-active Video Area
Second Field	⑧	Blanking	⑥	Non-active Video Area
	⑦	Blanking	⑤	Active Video Area
	⑧	Blanking	⑥	Non-active Video Area
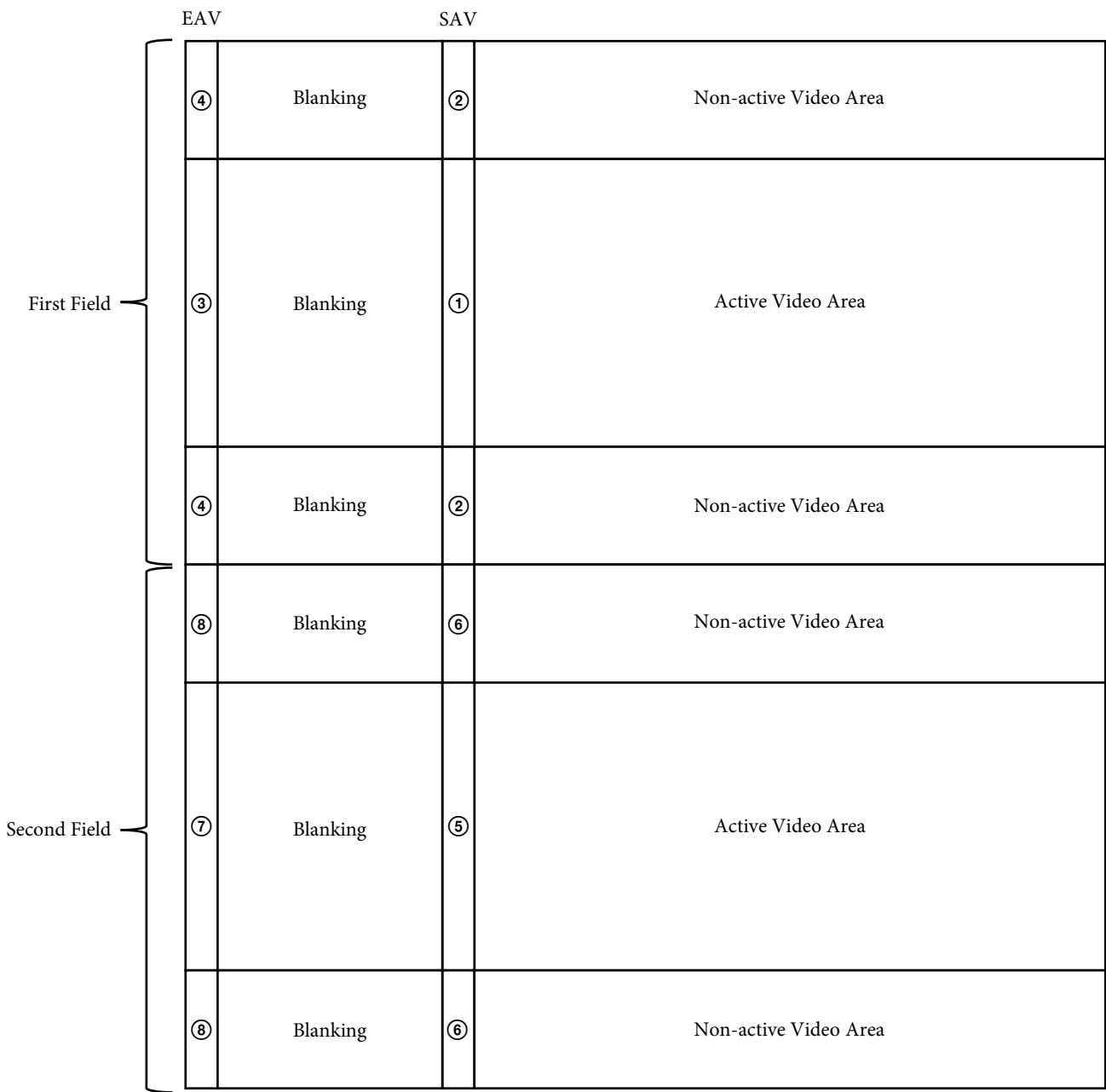
① SAV for First Field Active Video Area

② SAV for First Field Non-active Video Area

③ EAV for First Field Active Video Area

④ EAV for First Field Non-active Video Area

⑤ SAV for Second Field Active Video Area

⑥ SAV for Second Field Non-active Video Area

⑦ EAV for Second Field Active Video Area

⑧ EAV for Second Field Non-active Video Area

Synchronized codes

Progressive system (Comparable to SMPTE 274 M, 296 M)

EAV		SAV	
④	Blanking	②	Non-active Video Area
③	Blanking	①	Active Video Area
④	Blanking	②	Non-active Video Area

① SAV for Active Video Area

② SAV for Non-active Video Area

③ EAV for Active Video Area

④ EAV for Non-active Video Area

Dimensions

Front

Back

Digital I/O

Top

9 - M2
Within a depth of 3 mm (¹/₈ in.) or less from the top surface

Screw for camera tripod within a depth of 7 mm (⁹/₃₂ in.) or less (1/4-20UNC)

Bottom

8 - M2
Within a depth of 3 mm (¹/₈ in.) or less from the bottom surface

Left side

2 - M2 Within a depth of 3 mm (¹/₈ in.) or less from the side

Right side

Light beam area
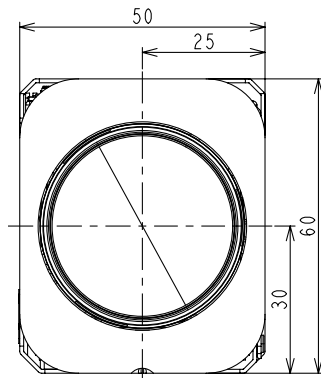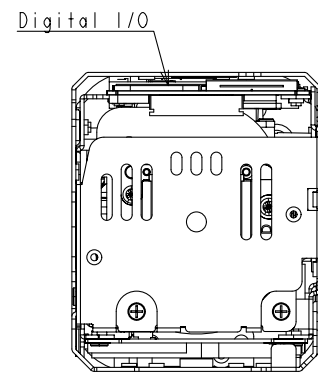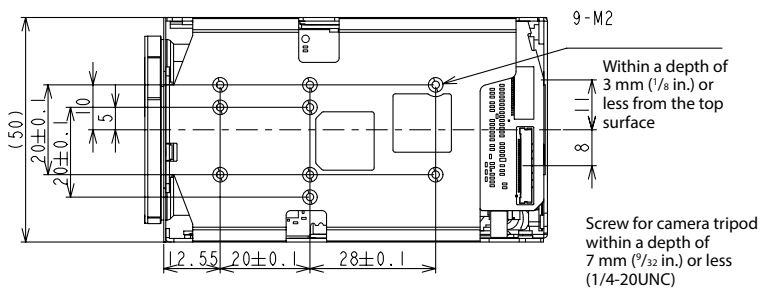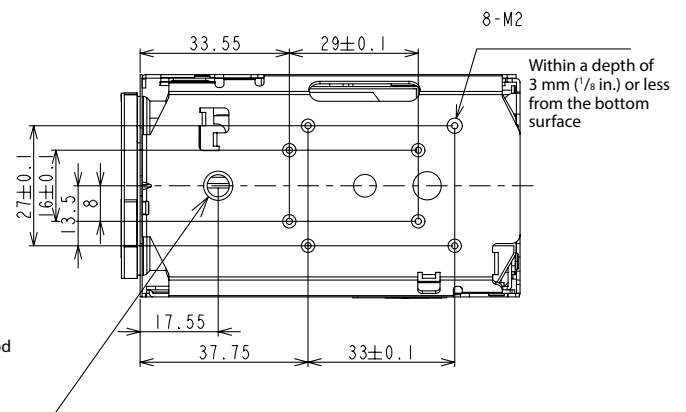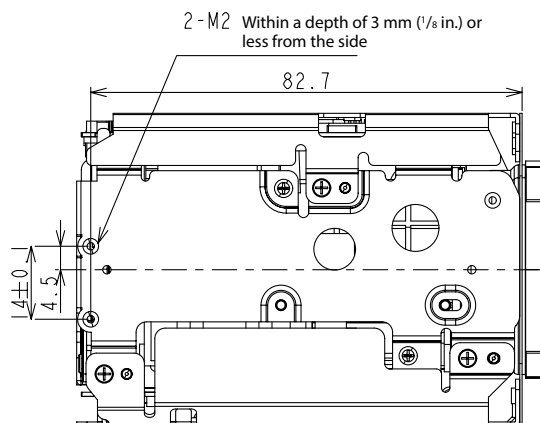
4 - M2
Within a depth of 3 mm (¹/₈ in.) or less from the side
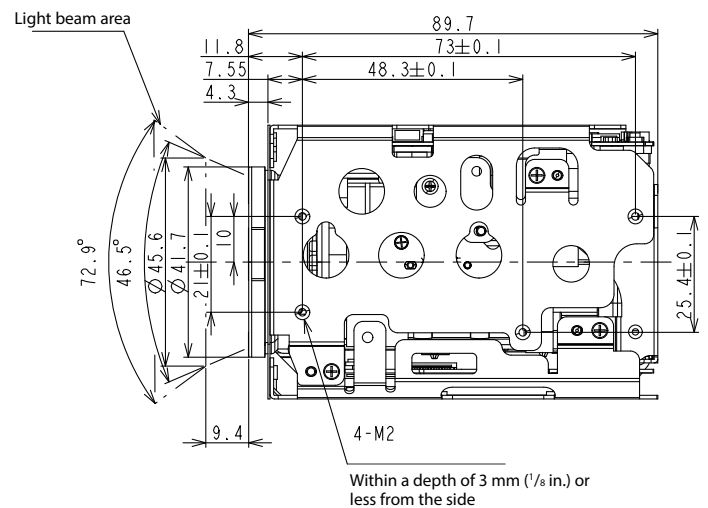
Unit: mm (inches)

Label drawings

Name plate

Manufacturing control label

FCB-EV7520A

Name plate

Manufacturing control label
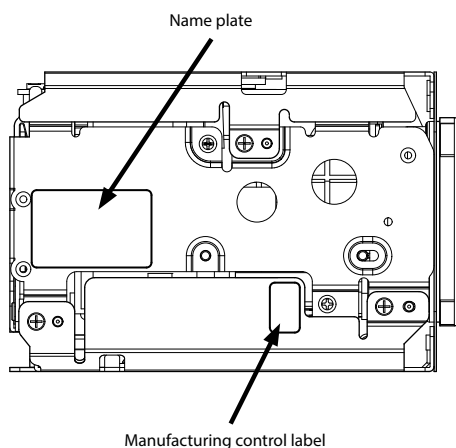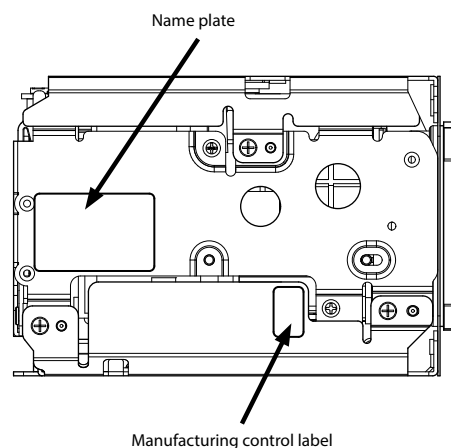
FCB-CV7520A

Pin assignment

Digital/Analog output connector
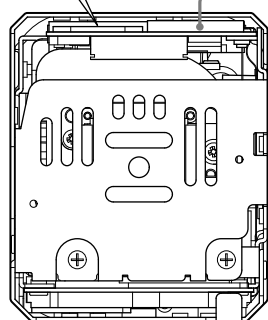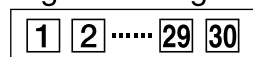
Maintenance connector
* Do not connect here, this is for maintenance purpose.

Digital/Analog output connector

KEL Co. USL00-30L-C

Pin No.	Name	Level
1	TXOUT3+	
2	TXOUT3−	
3	TXCLKOUT+	
4	TXCLKOUT−	
5	TXOUT2+	
6	TXOUT2−	
7	TXOUT1+	
8	TXOUT1−	
9	TXOUT0+	
10	TXOUT0−	
11	GND	
12	TxD	CMOS 5 V (Low: Max 0.1 V, High: Min 4.4 V)

Pin No.	Name	Level
13	RxD	CMOS 5 V (Low: Max 1.0 V, High: Min 2.3 V)
14	DC IN	6 to 12 V DC
15	DC IN	6 to 12 V DC
16	DC IN	6 to 12 V DC
17	DC IN	6 to 12 V DC
18	DC IN	6 to 12 V DC
19	GND	
20	GND	
21	TXOUT7+	Single out mode: open
22	TXOUT7−	Single out mode: open
23	TXOUT6+	Single out mode: open
24	TXOUT6−	Single out mode: open
25	SD Analog VBS-OUT	
26	RESET	Reset: Low (GND), Normal: Open (3.3V)
27	TXOUT5+	Single out mode: open
28	TXOUT5−	Single out mode: open
29	TXOUT4+	Single out mode: open
30	TXOUT4−	Single out mode: open

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Openssl

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