SONY

C-216-100-**12**(1)

Color Camera Module

Technical Manual

FCB-EV7520
FCB-CV7520
FCB-EV7517

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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
  - Tone correction (Visibility Enhancer) and Defog functions
- **Lens**
  The camera is equipped with a bright lens with 30× optical zoom and F1.6 aperture (optical zoom + digital zoom = 360×).

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.

Notification on BSD License Application Software

Please read the contents of description below at least once.

FILE:sha2.c,sha2.h,sha2prog.c,sha2speed.c,sha2test.pl
AUTHOR: Aaron D. Gifford - http://www.aarongifford.com/

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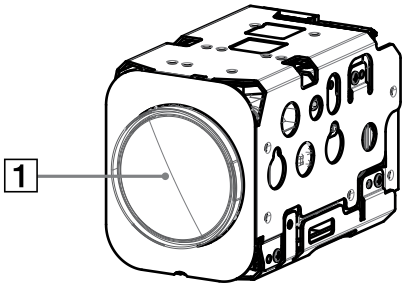
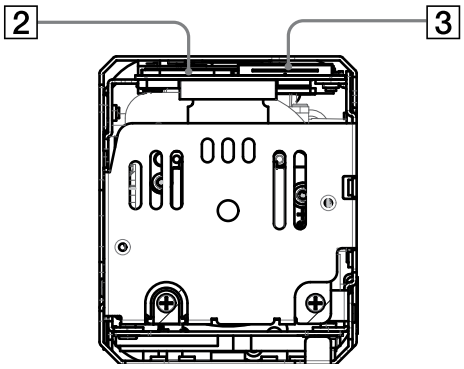
Locations of Controls

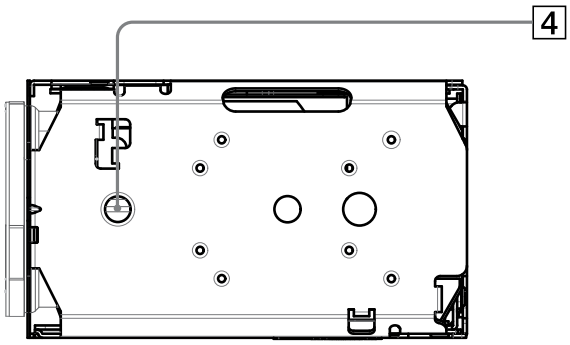
Front



Back



Bottom



1 **Lens**
2 **CN401 connector**
3 **CN501 connector**
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

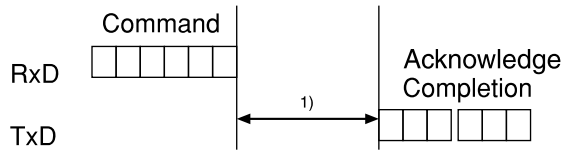
Overview of Functions

The camera control is performed by VISCA Commands.

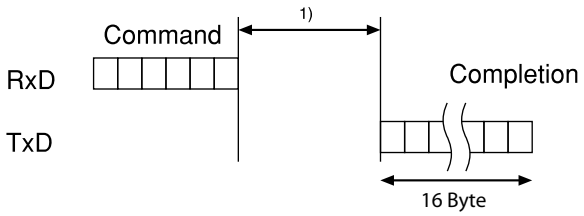
Timing Chart

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



Query Commands



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**
  Powers the camera on and off.
  When the power is off, 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.

Zoom

The FCB camera incorporates a 30× optical zoom lens combined with a digital zoom function; this camera allows you to zoom up to 360×.

- **Optical 30×, f = 4.3 mm to 129 mm (F 1.6 to F 4.7)**

The horizontal angle of view is approximately 63.7 degrees (wide end) to 2.3 degrees (tele end).
Digital Zoom enlarges the center of the subject by expanding each image in both the vertical and horizontal directions. When 360× zoom is used, the number of effective picture elements in each direction reduces to $^{1}/_{12}$ and the overall resolution deteriorates.

Zoom has the following modes.

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

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

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

Digital Zoom
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.

About Continuous Zoom Position Reply
With ZoomDirect mode, or when zooming according to a preset, the camera outputs zoom position data when Continues Zoom Position Reply is set to On via a command.
Continues Zoom Position Reply: y0 07 04 69 0p 0p 0q 0q 0q 0q FF
pp: D-Zoom Position
qqqq: Zoom Position

Focus

Focus has the following modes.

- **Auto Focus Mode**
  The 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.

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

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

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

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, Bright, 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** [1)]
  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.
  1) Flicker in the East Japan area (50 Hz power supply frequency) can be eliminated by setting shutter to 1/100s.
- **Iris Priority**
  Adjust with Variable Iris (F1.6 to Close, 14 steps), Auto Gain and Shutter speed
- **Manual**
  Adjust with Variable Shutter, Iris and Gain
- **Bright**
  Adjust with Variable Iris and Gain (Close to F1.6, 14 steps and F1.6 at 15 steps)

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.

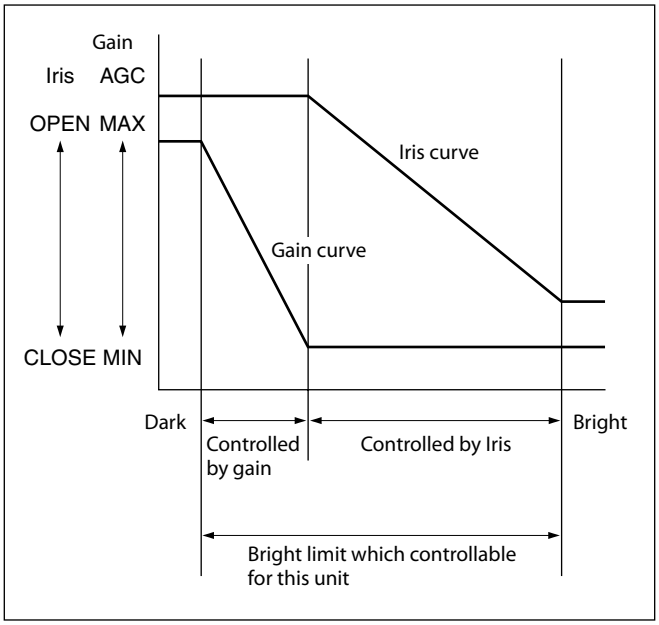
Data	Setting value	Data	Setting value
11	F1.6	0A	F5.6
10	F2	09	F6.8
0F	F2.4	08	F8
0E	F2.8	07	F9.6
0D	F3.4	06	F11
0C	F4	05	F14
0B	F4.8	00	CLOSE

AE – Manual

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

AE – Bright

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

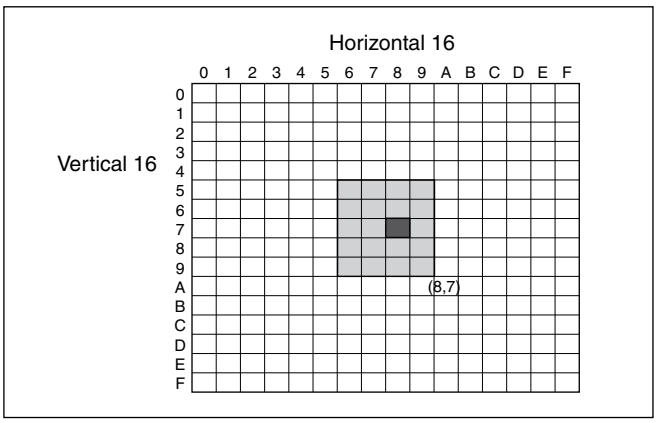


Data	Iris	Gain	Data	Iris	Gain
1F	F1.6	50.0 dB (28 step)	11	F1.6	0 dB (0 step)
1E	F1.6	46.4 dB (26 step)	10	F2	0 dB (0 step)
1D	F1.6	42.8 dB (24 step)	0F	F2.4	0 dB (0 step)
1C	F1.6	39.3 dB (22 step)	0E	F2.8	0 dB (0 step)
1B	F1.6	35.7 dB (20 step)	0D	F3.4	0 dB (0 step)
1A	F1.6	32.1 dB (18 step)	0C	F4	0 dB (0 step)
19	F1.6	28.6 dB (16 step)	0B	F4.8	0 dB (0 step)
18	F1.6	25.0 dB (14 step)	0A	F5.6	0 dB (0 step)
17	F1.6	21.4 dB (12 step)	09	F6.8	0 dB (0 step)
16	F1.6	17.8 dB (10 step)	08	F8	0 dB (0 step)
15	F1.6	14.3 dB (8 step)	07	F9.6	0 dB (0 step)
14	F1.6	10.7 dB (6 step)	06	F11	0 dB (0 step)
13	F1.6	7.1 dB (4 step)	05	F14	0 dB (0 step)
12	F1.6	3.6 dB (2 step)	00	CLOSE	0 dB (0 step)

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

Spot Exposure Mode

In Full Auto AE, the level for the entire screen is computed and the optimum Auto Iris and Gain levels are determined. In Spot AE, a particular section of the subject can be designated, and then that portion of the image can be weighted and a value computed so that Iris and Gain can be optimized to obtain an image. For example, in an image with a lot of movement and with varying levels of brightness, portions without much change can be designated as such a "spot," and changes to the screen can be minimized in that area. As shown in the diagram below, a range of 16 blocks vertically and 16 blocks horizontally can be designated. In the case where the center is designated (shown in black), the level is computed along with a weighted value for the surrounding block (shaded), including the specified portions; and then the Gain and Iris are set. The value of the designated portions and the surrounding areas should be calculated as 100%, the rest should be set to 20%. The range of the Spot AE frame is fixed to 5 blocks vertically and 4 blocks horizontally.



Exposure Compensation

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

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

Slow AE (Auto Exposure)

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

High Resolution Mode

This mode enhances edges and produces higher definition images.

Aperture Control

Aperture control is a function which adjusts the edge enhancement of objects in the picture. 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.

Wide Dynamic Range Mode (WD) (Supported in FW version 7.00 or later for FCB-EV7520/CV7520 only)

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 WD 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 WD 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 WD is On, false colors may appear in some parts of the image. This phenomenon is unique to WD, and is not an indication of a camera malfunction.
- When switching WD mode, images are shown at a maximum of 8 frames at the same time.

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 WD 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.

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 2D/3D NR independent setting is supported in version 6.00 or later.

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

In this mode, the maximum gain increases, enabling to obtain a brighter output even in a darker environment. However, if the gain reaches high level (up to 4x), the image will have a large amount of noise.

Variable Gamma Mode

There are standard (01h) mode and straight gamma (02h) mode.

Gamma Offset

You can set the brightness from -16 (00h) to +64 (40h) in each mode of variable gamma mode.

Contrast Adjustment Function (supported in version 6.00 or later)

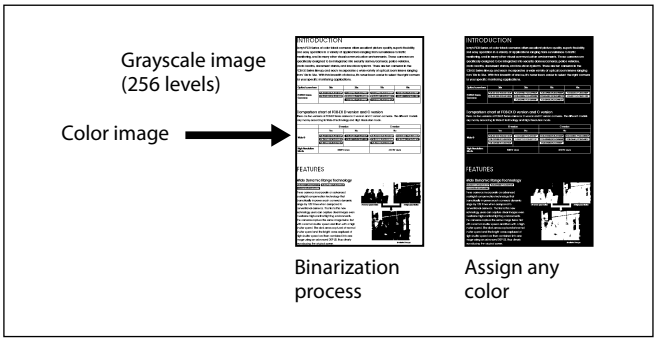
You can adjust the contrast level in the range from 0 (00h) to 255 (FFh). The initial setting is 128 (80h). The smaller the value is, the lower the contrast becomes, and the larger the value is, the higher the contrast becomes.

Note

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

Color Enhancement

A color image can be created two colors brighter and darker than the threshold value.
(The threshold level can be set with an optional level.)



Note

Flicker on images with color enhancement is not a malfunction of the camera. Flicker can be reduced by setting the threshold level and the aperture control.

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.

"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. The digital zoom can be further used to zoom up to 360×. At the wide end, you can obtain images without any reduction in the resolution because the digital zoom is not switched On. On the other hand, at the tele end, the correction effect by the Image Stabilizer function is at its maximum so blurring is reduced. The "StableZoom" function can be switched On/Off in the register settings.

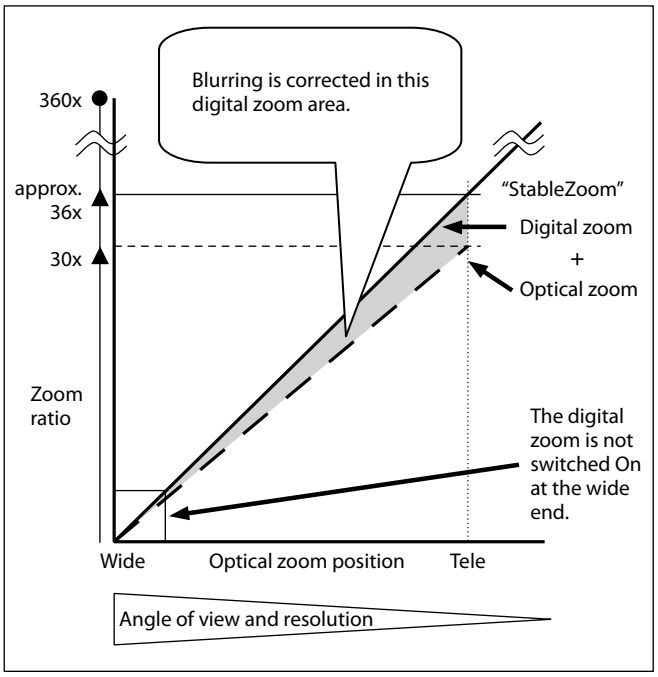


Image Stabilizer

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.

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.

Note

The hand shake correction function may not work correctly under the condition that high-frequency vibration component exits. In such a case, set the image stabilizer function to Off.

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

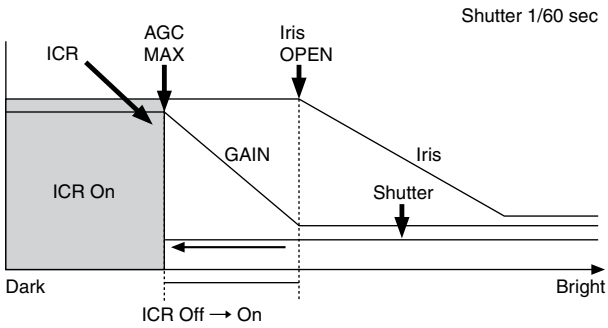
Custom Color Phase

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

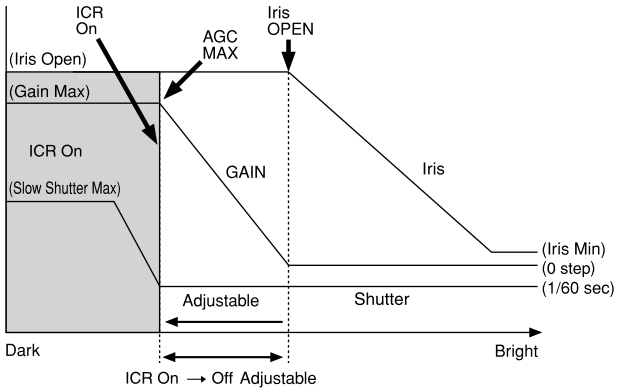
Auto ICR Mode

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

When Auto Slow Shutter is Off (initial setting)



When Auto Slow Shutter is On



Note

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

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.
- **Neg. Art:** Negative/Positive Reversal
- **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.

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**
- **Bright Control**
- **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**
- **WD On/Off *Supported in FW version 7.00 or later for FCB-EV7520/CV7520 only**
- **WD Parameter *Supported in FW version 7.00 or later for FCB-EV7520/CV7520 only**
- **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, Custom Preset and Backup" section on page 25.

User Memory Area

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

Note

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

Register Setting

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

The register setting items and No. are as follows.
For details, see "Register Setting" on page 55, 56.
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 page 12.
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 56.
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 56).
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 page 21.

Note

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

Privacy Zone Masking Settings

For details, see page 17.

Motion detection

For details, see 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	”	:	’	.	,	/	-

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 19.

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 19.
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.

Note

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

Non Interlock Mask

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

Parameters:

mm	Setting Mask See "mm: Mask setting list" in "Parameters" on page 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

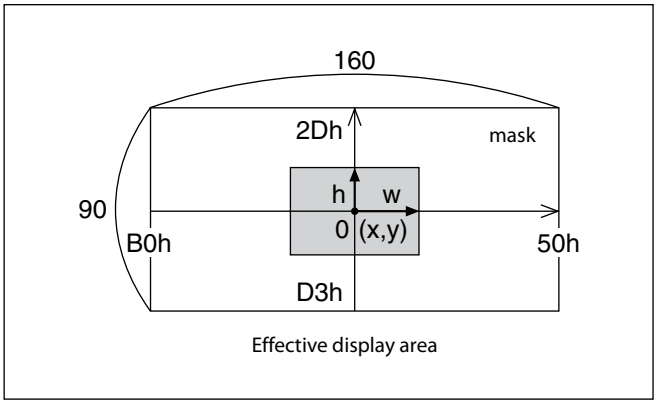
Mask Name	mm (Hex)
Mask_A	00h
Mask_B	01h
Mask_C	02h
Mask_D	03h
Mask_E	04h
Mask_F	05h
Mask_G	06h
Mask_H	07h
Mask_I	08h
Mask_J	09h
Mask_K	0Ah
Mask_L	0Bh

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

nn:Setting

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

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



Note

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

pp pp pp pp: Mask bit

	pp								pp							
bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Mask	-	-	X	W	V	U	T	S	-	-	R	Q	P	O	N	M

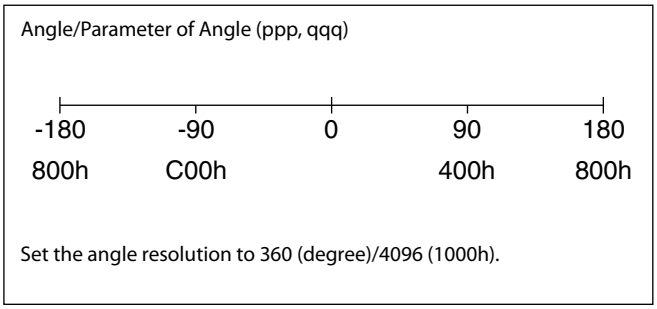
	pp								pp							
bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Mask	-	-	L	K	J	I	H	G	-	-	F	E	D	C	B	A

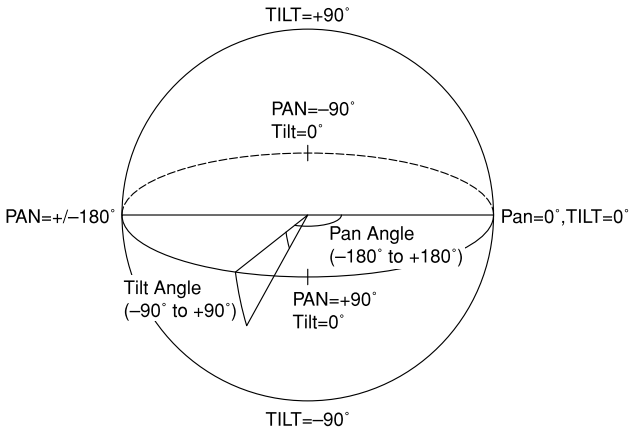
The "-" must be "0".

qq, rr: Color code

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

Setting pan/tilt angle





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 16 (horizontally) × 8 (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.

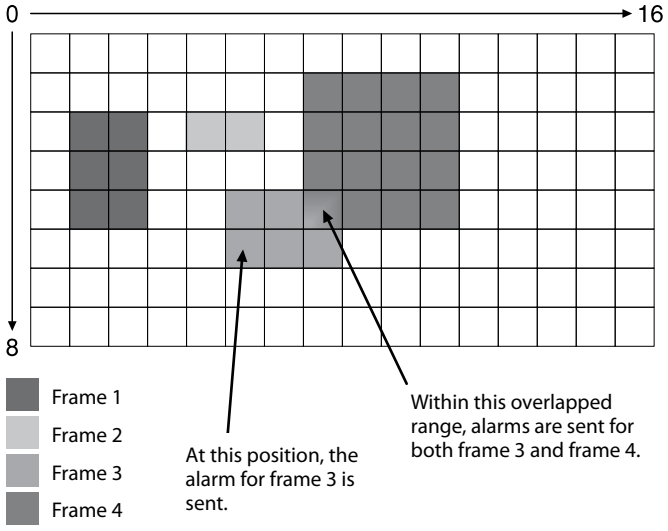
Frames

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.

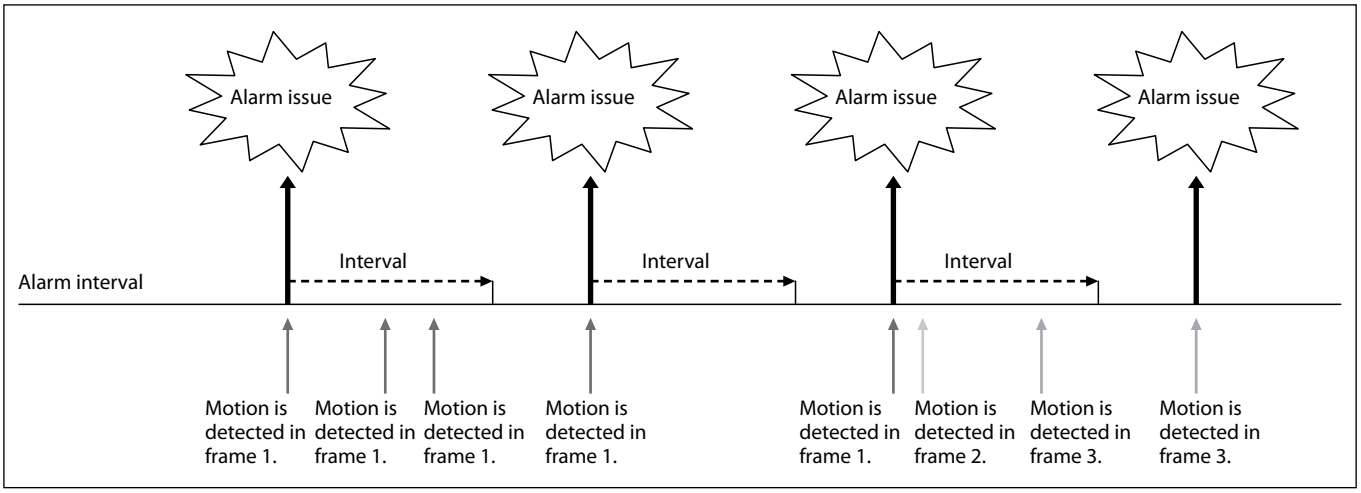
When motion is detected within the range where frames overlap

The alarms are sent for both frames.



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 0F)
q: Frame set Start Vertical Position -- (00 to 07)
r: Frame set End Horizontal Position -- (01 to 10)
s: Frame set End Vertical Position -- (01 to 08)

- **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 56) 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**
  The initial setting is 100% (80h), and the setting can be set to 256 levels from approximately 0% (00h) to approximately 200% (FFh).
  For details, see page 13.
- **Custom Color Phase**
  The initial setting is 0 degrees (80h), and the setting can be set to 256 levels from approximately −14 degrees (00h) to approximately +14 degrees (FFh).
  For details, see page 13.
- **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 13.

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.
When shifting to the maintenance mode, the Writer program is written in FlashROM after the last Visca command is sent, and then the Writer program is started after reboot. The writing takes approximately 5 seconds.
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

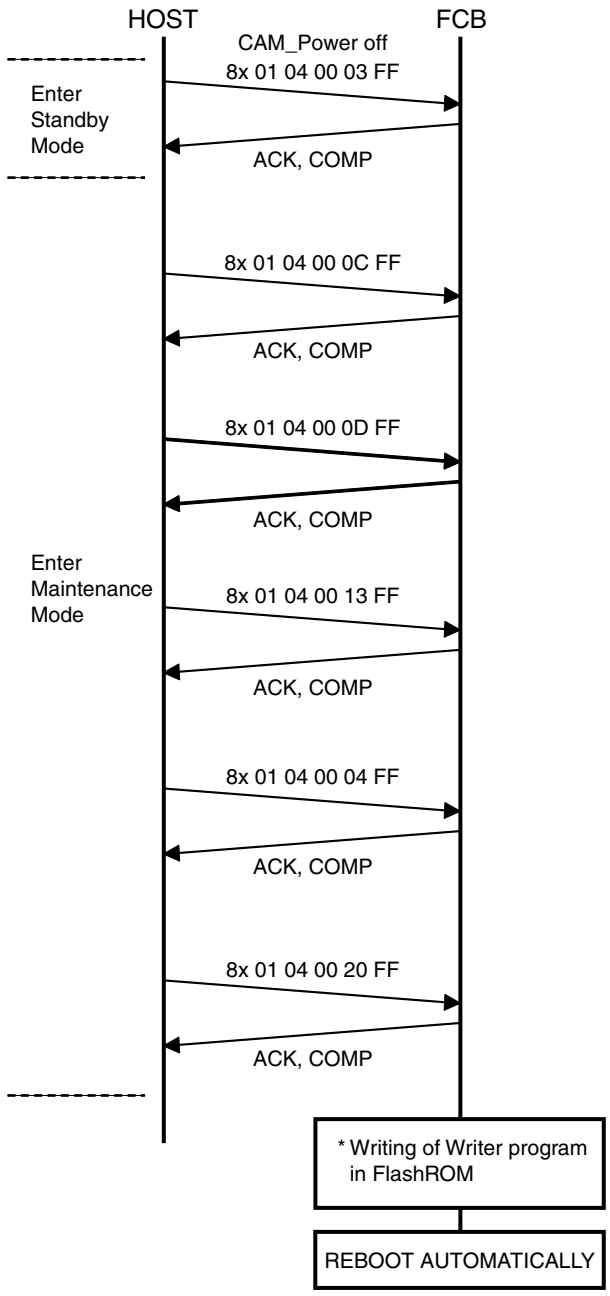
In the maintenance mode, the terminal software capable of sending the character command is used.
The terminal software that is provided with the XMODEM binary transfer protocol is used.
When you transfer the camera firmware (uug.bin file) using this function, the transferred file is written in FlashROM. The writing takes approximately 4 minutes.
Note that if the power is turned off during the writing, the program will be broken and cannot be restored.
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.

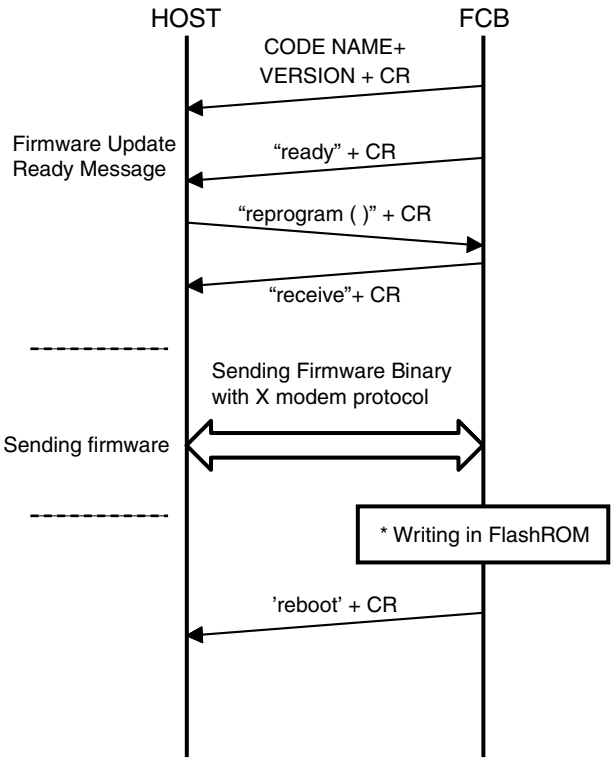
Update Procedure

Enter Maintenance Mode



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

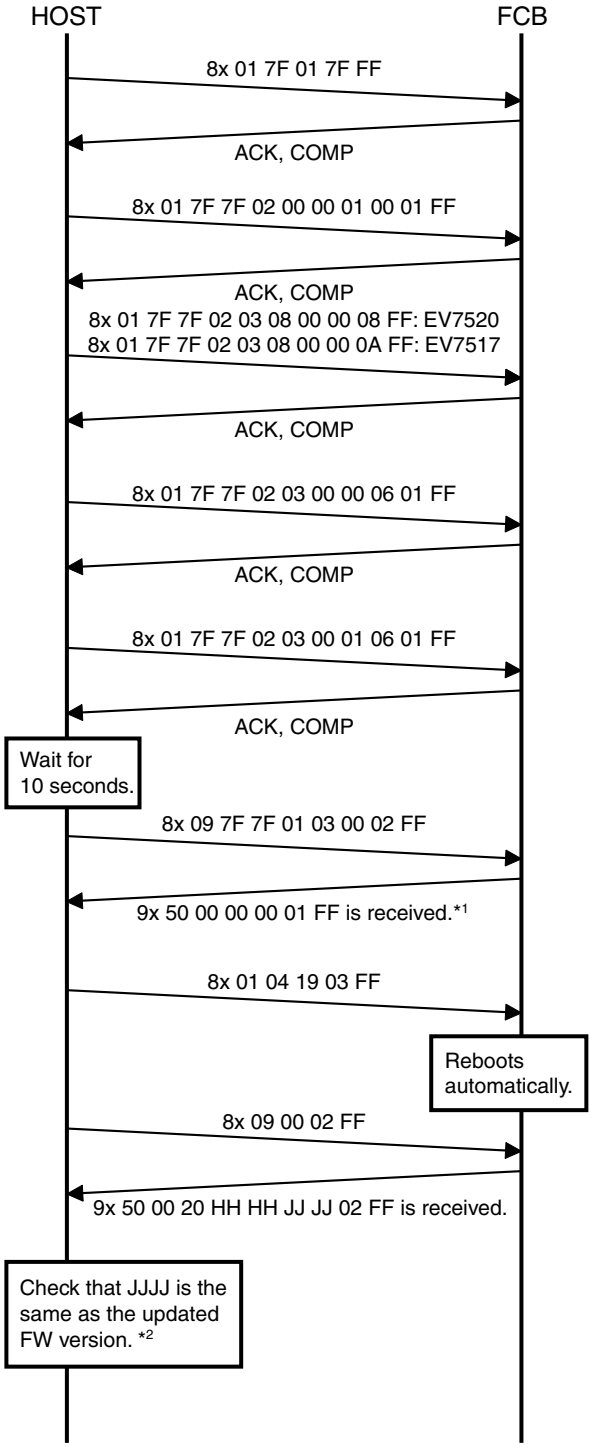
Maintenance Mode



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

Finalizing procedure

After the maintenance mode, perform the following finalizing procedure.

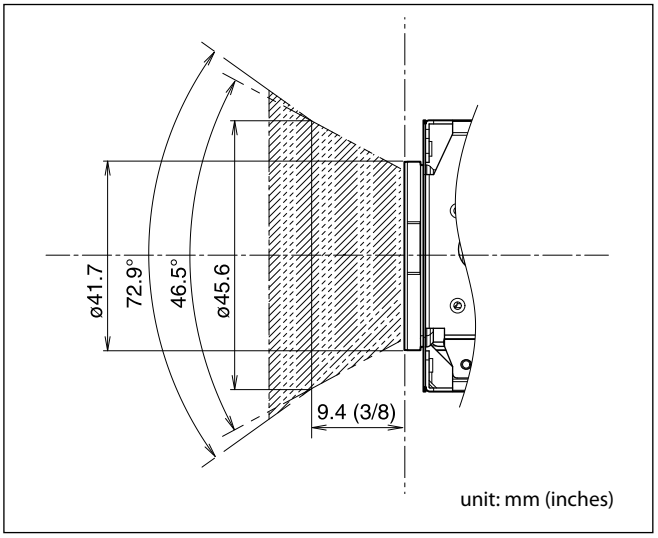


*1 When 9x 50 00 00 00 00 FF is received, retransmit 8x 09 7F 7F 01 03 00 02 FF until 9x 50 00 00 00 01 FF is received.

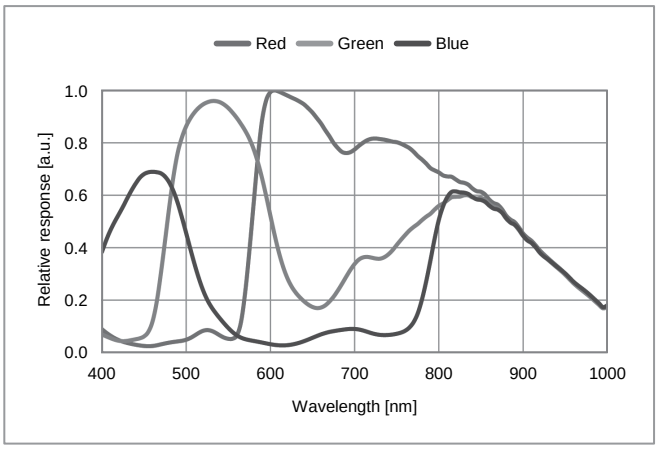
*2 If it is not the same, perform the update procedure from the beginning.

Eclipse

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



Spectral Sensitivity Characteristics



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

Initial Settings, Custom Preset and Backup

Initial Settings for the various functions of the FCB camera are indicated in the “Initial Settings” column. The “Custom Preset” column indicates whether the custom preset function can be used to store the settings. The function enables the stored settings to be recalled automatically when the camera is turned on. The “Back up at standby” column indicates whether the data is preserved even when the camera is in the standby mode.

Mode/Position setting	Initial Settings	Custom Preset	Back up at standby
Zoom Position	Wide end	○	○
D-Zoom On/Off	On	○	○
D-Zoom Separate/Combine	Combine	○	○
D-Zoom Position	00h	○	○
Focus Position	—	○	○
Focus Auto/Manual	Auto	○	○
Near Limit Setting	D000 (30 cm)	○	○
AF Sensitivity	Normal	○	○
AF Mode	Normal	○	○
AF Run Time	5 sec	○	○
AF Interval	5 sec	○	○
WB Mode	Auto	○	○
WB Data (Rgain, Bgain)	—	○	○
One Push WB Data	—	○	○
AE Mode	Full Auto	○	○
AE Response	01	○	○
Auto Slow Shutter Mode	Off	○	○
Shutter Position	—	○	○
Iris Position	—	○	○
Gain Position	—	○	○
Bright Position	—	○	○
Exposure Compensation On/Off	Off	○	○
Exposure Compensation Amount	±0	○	○
BackLight On/Off	Off	○	○
Spot AE On/Off	Off	○	○
Spot AE Position Setting	X=8, Y=8	○	○
Aperture Level	0Ah	○	○
High Resolution Mode On/Off	Off	○	○
LR Reverse On/Off	Off	○	○
Freeze On/Off	Off	×	×
Picture Effect	Off	○	○
ICR On/Off	Off	○	○
Auto ICR On/Off	Off	○	○
Auto ICR Threshold Level	0Eh	○	○
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	○	○
NR level (normal setting)	3	○	○

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

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

Mode/Position setting	Initial Settings	Custom Preset	Back up at standby
NR level (independent setting) *1	Disabled	○	○
Gain Limit	—	○	○
Color Enhancement On/Off	Off	○	○
Color Enhancement Threshold Level	30h	○	○
Color Enhancement High Luminance Color Setting Y	00h	○	○
Color Enhancement High Luminance Color Setting Cr	40h	○	○
Color Enhancement High Luminance Color Setting Cb	40h	○	○
Color Enhancement Low Luminance Color Setting Y	64h	○	○
Color Enhancement Low Luminance Color Setting Cr	47h	○	○
Color Enhancement Low Luminance Color Setting Cb	14h	○	○
Low-Illumination Chroma Suppress	2h (Mid)	○	○
Color Gain	4h (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)	○	○
WD On/Off *2	Off	○	○
WD Parameter *2	Display brightness level: 3 Brightness compensation selection: 2 (Standard) Compensation level: 1 (Mid)	○	○
Contrast Adjustment *1	80h	○	○

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

Notes

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

*1 Supported in FW version 6.00 or later
*2 Supported in FW version 7.00 or later for FCB-EV7520 only

Mode Condition

Condition

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

Lens

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

White Balance

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

Exposure

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

Others

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

Command List

VISCA/RS-232C Commands

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

Overview of VISCA

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

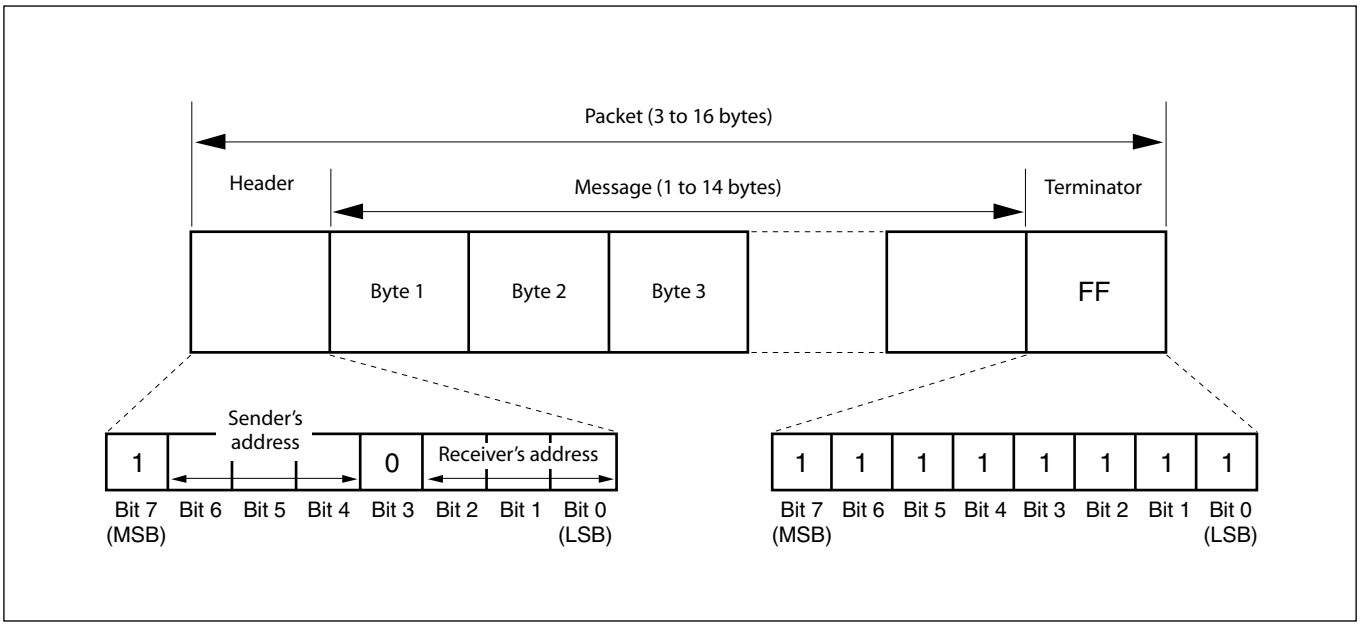
- Communication speed: 9.6 kbps/19.2 kbps/ 38.4 kbps/115.2 kbps
- Data bits : 8
- Start bit : 1
- Stop bit : 1
- Non parity

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

VISCA Communication Specifications

VISCA packet structure

The basic unit of VISCA communication is called a packet. The first byte of the packet is called the header and comprises the sender's and receiver's addresses. For example, the header of the packet sent to the FCB camera assigned address 1 from the controller (address 0) is hexadecimal 81h. The packet sent to the camera assigned address 2 is 82h. In the command list, as the header is 8X, input the address of the camera at X. The header of the reply packet from the camera assigned address 1 is 90h. The packet from the camera assigned address 2 is A0h.
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

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 046F: FCB-EV7520 xxxx: FCB-CV7520 0471 : FCB-EV7517 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 42 FF 90 52 FF	Returns Acknowledge when a command has been accepted, and Completion when a command has been executed.
	81 01 04 38 FF (Example)	90 60 02 FF (Syntax Error)	Accepted a command which is not supported or a command lacking parameters.
	81 01 04 38 02 FF (Example)	90 60 03 FF (Command Buffer Full)	There are two commands currently being executed, and the command could not be accepted.
	81 01 04 08 02 FF (Example)	90 61 41 FF (Command Not Executable) 90 62 41 FF	Could not execute the command in the current mode.
Inquiry Command	81 09 04 38 FF (Example)	90 50 02 FF (Completion)	Acknowledge is not returned for the inquiry command.
	81 09 05 38 FF (Example)	90 60 02 FF (Syntax Error)	Accepted an incompatible command.
Address Set	88 30 01 FF	88 30 02 FF	Returned the device address to +1.
IF_Clear(Broadcast)	88 01 00 01 FF	88 01 00 01 FF	Returned the same command.
IF_Clear (For x)	8x 01 00 01 FF	z0 50 FF (Completion)	Acknowledge is not returned for this command.
Command Cancel	8x 2y FF	z0 6y 04 FF (Command Canceled)	Returned when the command of the socket specified is canceled. Completion for the command canceled is not returned.
		z0 6y 05 FF (No Socket)	Returned when the command of the specified socket has already been completed or when the socket number specified is wrong.

VISCA Camera-Issued Messages

Acknowledge/Completion Messages

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

z = Device address + 8

Error Messages

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

Network Change Message

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

FCB Camera Commands

Command List (1/6)

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) * Enabled during Separate Mode
	Wide (Variable)	8x 01 04 06 3p FF	
	x1/Max	8x 01 04 06 10 FF	x1/MAX Magnification Switchover * Enabled during Separate Mode
	Direct	8x 01 04 46 00 00 0p 0q FF	pq: D-Zoom Position * 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
	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
	Bright	8x 01 04 39 0D FF	Bright Mode (Manual control)
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
CAM_Bright	Reset	8x 01 04 0D 00 FF	Bright Setting
	Up	8x 01 04 0D 02 FF	
	Down	8x 01 04 0D 03 FF	
	Direct	8x 01 04 4D 00 00 0p 0q FF	pq: Bright Position

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 Fh), rs: Y (0h to Fh)
CAM_AE_Response	Direct	8x 01 04 5D pp FF	pp: Auto Exposure Response Setting (01h to 30h), initial setting: 01h
CAM_VE	Off	8x 01 04 3D 03 FF	Off
	VE On	8x 01 04 3D 06 FF	VE On
	Set Parameter	8x 01 04 2D 00 0q 0r 0s 00 00 00 00 FF	q: Display brightness level (0: Dark to 6: Bright) r: Brightness compensation selection (0: Very dark, 1: Dark, 2: Standard, 3: Bright) s: Compensation level (0: Low, 1: Mid, 2: High)
CAM_WD (Supported in FW version 7.00 or later for FCB-EV7520/CV7520 only)	On	8x 01 04 3D 02 FF	WD On
	Off	8x 01 04 3D 03 FF	WD Off
	VE On	8x 01 04 3D 06 FF	VE On
	Set Parameter	8x 01 04 2D 00 0q 0r 0s 00 00 00 00 FF	q: Display brightness level (0: Dark to 6: Bright) r: Brightness compensation selection (0: Very dark, 1: Dark, 2: Standard, 3: Bright) s: Compensation level (0: Low, 1: Mid, 2: High)
CAM_Defog	On	8x 01 04 37 02 0p FF	Defog On/Off p: Defog level (1: low, 2: mid, 3: high)
	Off	8x 01 04 37 03 00 FF	
CAM_Aperture	Reset	8x 01 04 02 00 FF	Aperture Control
	Up	8x 01 04 02 02 FF	
	Down	8x 01 04 02 03 FF	
	Direct	8x 01 04 42 00 00 0p 0q FF	pq: Aperture Gain
CAM_HR	On	8x 01 04 52 02 FF	High Resolusion Mode On/Off
	Off	8x 01 04 52 03 FF	
CAM_NR	Noise Reduction	8x 01 04 53 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 (Supported in FW version 6.00 or later)	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
	Neg.Art	8x 01 04 63 02 FF	
	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	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 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 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	CenterLineOn	8x 01 04 7C 04 FF	Center Line Display On
CAM_MD	On	8x 01 04 1B 02 FF	MD 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 0p 0q 0r 0s FF	m: Select Detection Frame (0, 1, 2, 3) p: Start Horizontal Position (00h to 0Fh) q: Start Vertical Position (00h to 07h) r: Stop Horizontal Position (01h to 10h) s: Stop Vertical Position (01h to 08h)
	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_ColorEnhance	Parameter Set	8x 01 04 20 mm 00 pp qq rr ss tt uu FF	mm: Threshold level pp: Y fixed color for high-intensity qq: Cr fixed color for high-intensity rr: Cb fixed color for high-intensity ss: Y fixed color for low-intensity tt: Cr fixed color for low-intensity uu: Cb fixed color for low-intensity Each parameter setting 00h to 7Fh
	On	8x 01 04 50 02 FF	Color Enhancement On/Off
	Off	8x 01 04 50 03 FF	
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 (60%) to Eh (200%)
CAM_ColorHue	Direct	8x 01 04 4F 00 00 00 0p FF	p: Color Hue Setting 0h (-14 degrees) to Eh (+14 degrees)
CAM_GammaOffset	Direct	8x 01 04 1E 00 00 00 0s 0t 0u FF	s: Polarity offset (0 is plus, 1 is minus) tu: Offset s=0 (00h to 40h) Offset s=1 (00h to 10h)

Command List (6/6)

Command Set	Command	Command Packet	Comments
CAM_ContrastAdjLevel (Supported in FW version 6.00 or later)	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 (0%) to FFh (200%)
CAM_ExColorHue	Direct	8x 01 04 1F 4F 00 00 0p 0q FF	Color Hue Setting pq: Phase setting level pq=00h (-14 degrees) to FFh (14 degrees)
CAM_HLC	Parameter Set	8x 01 04 14 0p 0q FF	p: HLC level (0: Off, 1: Low, 2: Mid, 3: High) q: HLC mask level (0: Off, 1 to F: from low to high level)

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
		y0 50 0D FF	Bright
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_BrightPosInq	8x 09 04 4D FF	y0 50 00 00 0p 0q FF	pq: Bright Position
CAM_ExpCompModeInq	8x 09 04 3E FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_ExpCompPosInq	8x 09 04 4E FF	y0 50 00 00 0p 0q FF	pq: ExpComp Position
CAM_BackLightModeInq	8x 09 04 33 FF	y0 50 02 FF	On
		y0 50 03 FF	Off

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 (Supported in FW version 7.00 or later for FCB-EV7520/CV7520 only)	8x 09 04 3D FF	y0 50 02 FF	On
		y0 50 03 FF	Off
		y0 50 06 FF	VE On
CAM_WDParameterInq (Supported in FW version 7.00 or later for FCB-EV7520/CV7520 only)	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_HRModeInq	8x 09 04 52 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_NRInq	8x 09 04 53 FF	y0 50 pq FF	pq: NR level (00: Off, 01 to 05: level 1 to 5, 7F: 2D/3D NR independent setting available)
CAM_NR2D3Dinq (Supported in FW version 6.00 or later)	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 02 FF	Neg.Art
		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 (04xx) 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 0p 0q 0r 0s FF	m: Select Detection Frame (0, 1, 2, 3) p: Start Horizontal Position (00h to 0Fh) q: Start Vertical Position (00h to 07h) r: Stop Horizontal Position (01h to 10h) s: Stop Vertical Position (01h to 08h)
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_ColorEnhanceInq	8x 09 04 20 FF	y0 50 mm 00 pp qq rr ss tt uu FF	mm: Threshold level pp: Y fixed color for high-intensity qq: Cr fixed color for high-intensity rr: Cb fixed color for high-intensity ss: Y fixed color for low-intensity tt: Cr fixed color for low-intensity uu: Cb fixed color for low-intensity
	8x 09 04 50 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
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 (60%) to Eh (200%)
CAM_ColorHueInq	8x 09 04 4F FF	y0 50 00 00 00 0p FF	p: Color Hue Setting 0h (– 14 degrees) to Eh (+ 14 degrees)
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 10h)
CAM_ContrastAdjLevelInq (Supported in FW version 6.00 or later)	8x 09 05 5D FF	y0 50 0p 0q FF	pq: Contrast adjustment value (low) 00h - 80h (no adjustment) - 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 (0%) to FFh (200%)
CAM_ExColorHueInq	8x 09 04 1F 4F 00 FF	y0 50 0p 0q FF	pq: Phase setting level pq: 00h (-14 degree) to FFh (+14 degree)
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 to F: from low to high level)

Block Inquiry Command List

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

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

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

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

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

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

Byte	Bit	Comments
6	7	0
	6	0
	5	0
	4	0
	3	WB Mode
	2	
	1	
	0	
7	7	0
	6	0
	5	0
	4	0
	3	Aperture Gain
	2	
	1	
	0	
8	7	0
	6	0
	5	0
	4	Exposure Mode
	3	
	2	
	1	
	0	
9	7	0
	6	0
	5	High Resolution 1: On 0: Off
	4	VE 1: On 0: Off WD (1: Other than Off, 0: Off) *Supported in FW version 7.00 or later for FCB-EV7520/CV7520 only)
	3	Spot AE 1: On 0: Off
	2	Backlight 1: On 0: Off
	1	Exposure Comp. 1: On 0: Off
	0	Slow Shutter 1: On 0: Off
10	7	0
	6	0
	5	0
	4	Shutter Position
	3	
	2	
	1	
	0	

Byte	Bit	Comments
11	7	0
	6	0
	5	0
	4	Iris Position
	3	
	2	
	1	
	0	
12	7	0
	6	0
	5	0
	4	0
	3	Gain Position
	2	
	1	
	0	
13	7	0
	6	0
	5	0
	4	Bright Position
	3	
	2	
	1	
	0	
14	7	0
	6	0
	5	0
	4	0
	3	Exposure Comp. Position
	2	
	1	
	0	
15	7	1 Terminator (FFh)
	6	1
	5	1
	4	1
	3	1
	2	1
	1	1
	0	1

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

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

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

Byte	Bit	Comments
12	7	0
	6	0
	5	0
	4	Memory 1: Provided 0: Not provided
	3	0
	2	ICR 1: Provided 0: Not provided
	1	Stabilizer 1: Provided 0: Not provided
	0	System 1: 1/50, 1/25 0: 1/60, 1/30
13	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	0
	0	0
14	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	0
	0	0
15	7	1 Terminator (FFh)
	6	1
	5	1
	4	1
	3	1
	2	1
	1	1
	0	1

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

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

Byte	Bit	Comments
6	7	0
	6	0
	5	0
	4	0
	3	AF Interval Time (H)
	2	
	1	
	0	
7	7	0
	6	0
	5	0
	4	0
	3	AF Interval Time (L)
	2	
	1	
	0	
8	7	0
	6	0
	5	0
	4	0
	3	Spot AE Position (X)
	2	
	1	
	0	
9	7	0
	6	0
	5	0
	4	0
	3	Spot AE Position (Y)
	2	
	1	
	0	
10	7	0
	6	0
	5	0
	4	0
	3	0
	2	MD (1: On, 0: Off)
	1	0
	0	E-Flip (1: On, 0: Off)

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

Extended Function2 Query Command .....Command Packet 8x 09 7E 7E 04 FF

Byte	Bit	Comments
0	7	Destination Address
	6	
	5	
	4	
	3	Source Address
	2	
	1	
	0	
1	7	0 Completion Message (50h)
	6	1
	5	0
	4	1
	3	0
	2	0
	1	0
	0	0
2	7	0
	6	0
	5	0
	4	0
	3	0
	2	0
	1	WD
	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
0	7	Destination Address
	6	
	5	
	4	
	3	Source Address
	2	
	1	
	0	
1	7	0 Completion Message (50h)
	6	1
	5	0
	4	1
	3	0
	2	0
	1	0
	0	0
2	7	0
	6	0
	5	0
	4	0
	3	Color Hue
	2	(0h(– 14 degrees) to Eh(+ 14 degrees))
	1	
	0	
3	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	
4	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	
5	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	

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

Byte	Bit	Comments
11	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	
12	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	
13	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	
14	7	0
	6	Reserved
	5	
	4	
	3	
	2	
	1	
	0	
15	7	1 Terminator (FFh)
	6	1
	5	1
	4	1
	3	1
	2	1
	1	1
	0	1

VISCA Command Setting Values

Exposure control (1/2)

		59.94/29.97 mode	50/25 mode
Shutter Speed	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)

		Iris	Gain
Bright	1F	F1.6	50.0 dB (28 step)
	1E	F1.6	46.4 dB (26 step)
	1D	F1.6	42.8 dB (24 step)
	1C	F1.6	39.3 dB (22 step)
	1B	F1.6	35.7 dB (20 step)
	1A	F1.6	32.1 dB (18 step)
	19	F1.6	28.6 dB (16 step)
	18	F1.6	25.0 dB (14 step)
	17	F1.6	21.4 dB (12 step)
	16	F1.6	17.8 dB (10 step)
	15	F1.6	14.3 dB (8 step)
	14	F1.6	10.7 dB (6 step)
	13	F1.6	7.1 dB (4 step)
	12	F1.6	3.6 dB (2 step)
	11	F1.6	0 dB (0 step)
	10	F2	0 dB (0 step)
	0F	F2.4	0 dB (0 step)
	0E	F2.8	0 dB (0 step)
	0D	F3.4	0 dB (0 step)
	0C	F4	0 dB (0 step)
	0B	F4.8	0 dB (0 step)
	0A	F5.6	0 dB (0 step)
	09	F6.8	0 dB (0 step)
	08	F8	0 dB (0 step)
	07	F9.6	0 dB (0 step)
	06	F11	0 dB (0 step)
	05	F14	0 dB (0 step)
	00	CLOSE	0 dB (0 step)

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

Digital Zoom Separate mode

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

Lens control

Zoom Position	0000 to 4000 to 7AC0 Wide end Optical 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.

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

Temperature Reading Conversion Value (Reference Value)

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

Register Setting

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

	Register No.	Value	
VISCA Baud Rate	00	00 (Iinitial Setting)	9600 bps
		01	19200 bps
		02	38400 bps
		03	115200 bps
Monitoring Mode	72	01 (Iinitial Setting)	1080i/59.94
		02	1080i/60
		03	NTSC Analog Output (Stop Digital Output)
		04	1080i/50
		05	PAL Analog Output (Stop Digital Output)
		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
LVDS Mode	74	00 (Iinitial Setting)	Single output
		01	Double output
Zoom Limit	50	00-FF (Iinitial Setting: 00)	Wide Limit (0: Disabled)
	51	00-FF (Iinitial Setting: 00)	Tele Limit (0: Disabled)
D-Zoom Max	52	00-EB (Iinitial Setting: EB)	Max. digital zoom ratio = 256 ÷ (256-Value)
“StableZoom”	53	00 (Iinitial Setting: 00)	Off
		01	On

	Register No.	Value	
FocusTrace @ZoomDirect	54	00	Off
		01 (Iinitial Setting: 01)	On
FocusOffset @DomeCover	55	00-FF (Iinitial Setting: 00)	00: None to FF: Max.
AE Parameter Change During VE On, Defog On	58	00	OFF
		01 (Iinitial Setting)	ON
Auto Slow Shutter Limit	59	01	1/30
		02	1/15
		03	1/8
		04 (Iinitial Setting)	1/4
		05	1/2
		06	1/1
Extended Normal Shutter	5A	00 (Iinitial Setting)	OFF
		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 (Iinitial Setting: FF)	Defog level Low Limit
	5C	00-FF (Iinitial Setting: FF)	Defog level Mid Limit
	5D	00-FF (Iinitial Setting: FF)	Defog level High Limit
Extended Mode	5F	00 (Iinitial Setting)	OFF
		bit: 0 Exposure compensation Extended 256 levels On/Off bit: 1 Aperture Extended 256 levels On/Off bit: 2 Color Gain/Hue Extended 256 levels On/Off bit: 3 Auto ICR Off → On setting enable On/Off *For all of bit, 1 is to activate, 0 is Off	

Others

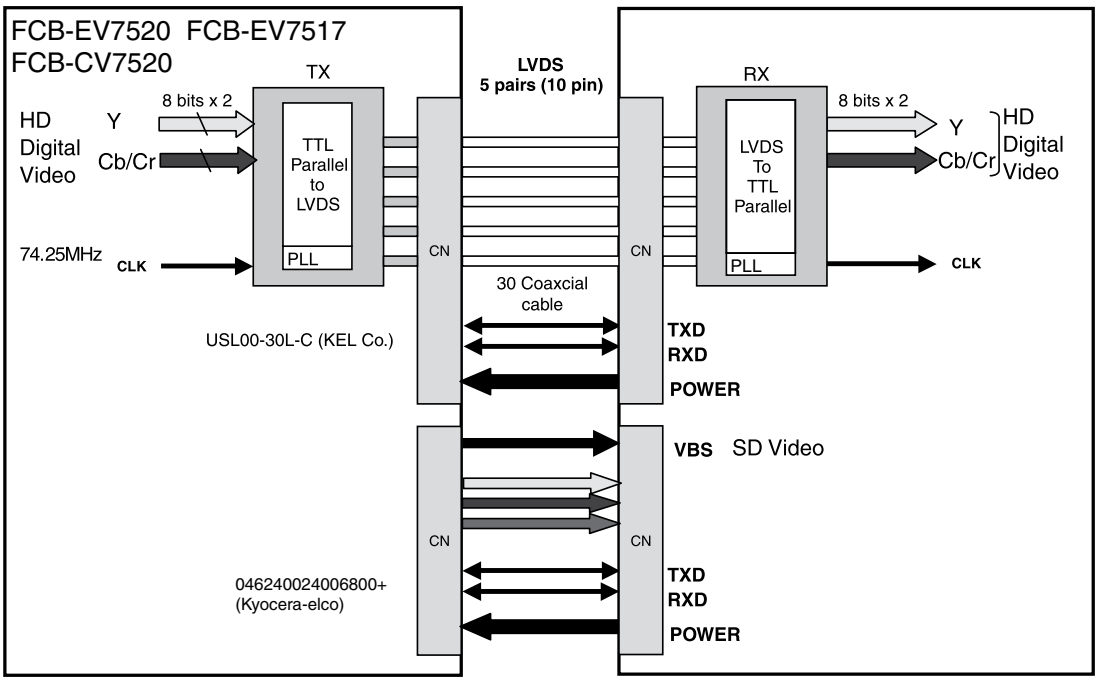
AF Active Time[1)]	00	to	FF
AF Interval Time[1)]	00	to	FF
Spot AE X position	00	to	0F
Spot AE Y position	00	to	0F
R Gain	00	to	FF
B Gain	00	to	FF
Aperture Control Level	00	to	0F
AE Response	01	to	30
AutoICR On → Off Threshold Level	00	to	1C
MD Threshold Level	00	to	FF
MD Interval Time[1)]	00	to	FF
MD Set Horizontal Position	00	to	10
MD Set Vertical Position	00	to	08
Chroma Suppress setting level	00	to	03
Color Gain setting level	00	to	0E
Color Hue setting level	00	to	0E
Color Enhancement threshold level	00	to	7F
Color Enhancement Y fixed color	00	to	7F
Color Enhancement Cr fixed color	00	to	7F
Color Enhancement Cb fixed color	00	to	7F

[1)] Unit: One second

Specifications

Imager 1/2.8 Type "Exmor R" CMOS Sensor
Picture elements 2130K pixels
Lens 30× Zoom
F= 4.3 mm (WIDE) to 129 mm (TELE), F1.6 to F4.7
Zoom movement speed
Optical WIDE – Optical TELE
4.6 sec (Focus Tracking On)
3.2 sec (Focus Tracking Off)
Optical WIDE – Digital TELE
6.7 sec (29.97p/59.94p mode)
7.1 sec (25p/50p mode)
Digital WIDE – Digital TELE
2.2 sec (29.97p/59.94p mode)
2.7 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 (Typical value) In the case of ICR-Off
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
S/N ratio 50 dB (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
(Supported in FW version 7.00 or later for FCB-EV7520/CV7520 only)
Noise Reduction
On/Off (level 5 to 1 / Off, 6 steps)
Defog mode On/Off
Color Enhancement
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)
Analog SD: VBS
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. 255 g (9.0 oz.)
Dimensions 50.0 × 60 × 89.7 mm ($2 \times 2\ ^3/_8 \times 3\ ^5/_8$ in.) (w/h/d)

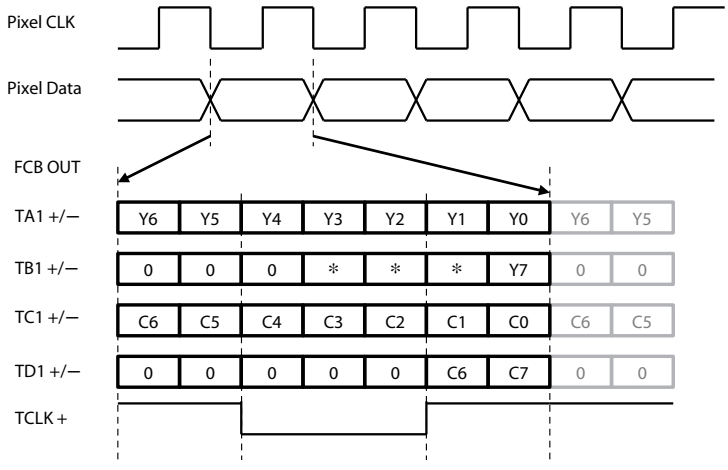
Interface



- In FCB-EV7520/FCB-CV7520/FCB-EV7517, 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 thin coaxial cable
  Connector: USL20-30S (KEL)

LVDS Pixel Data Format

Single Mode

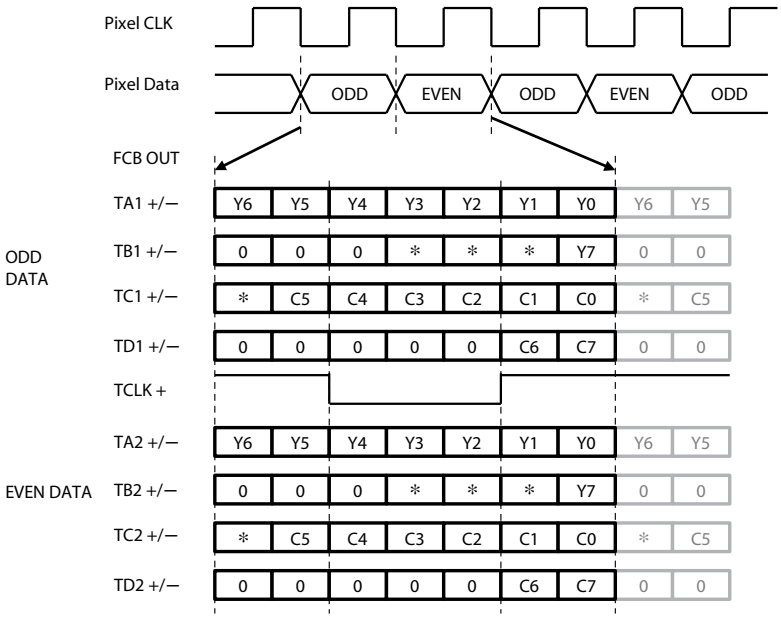


* Please ignore the value which can be “0” or “1”.

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”.

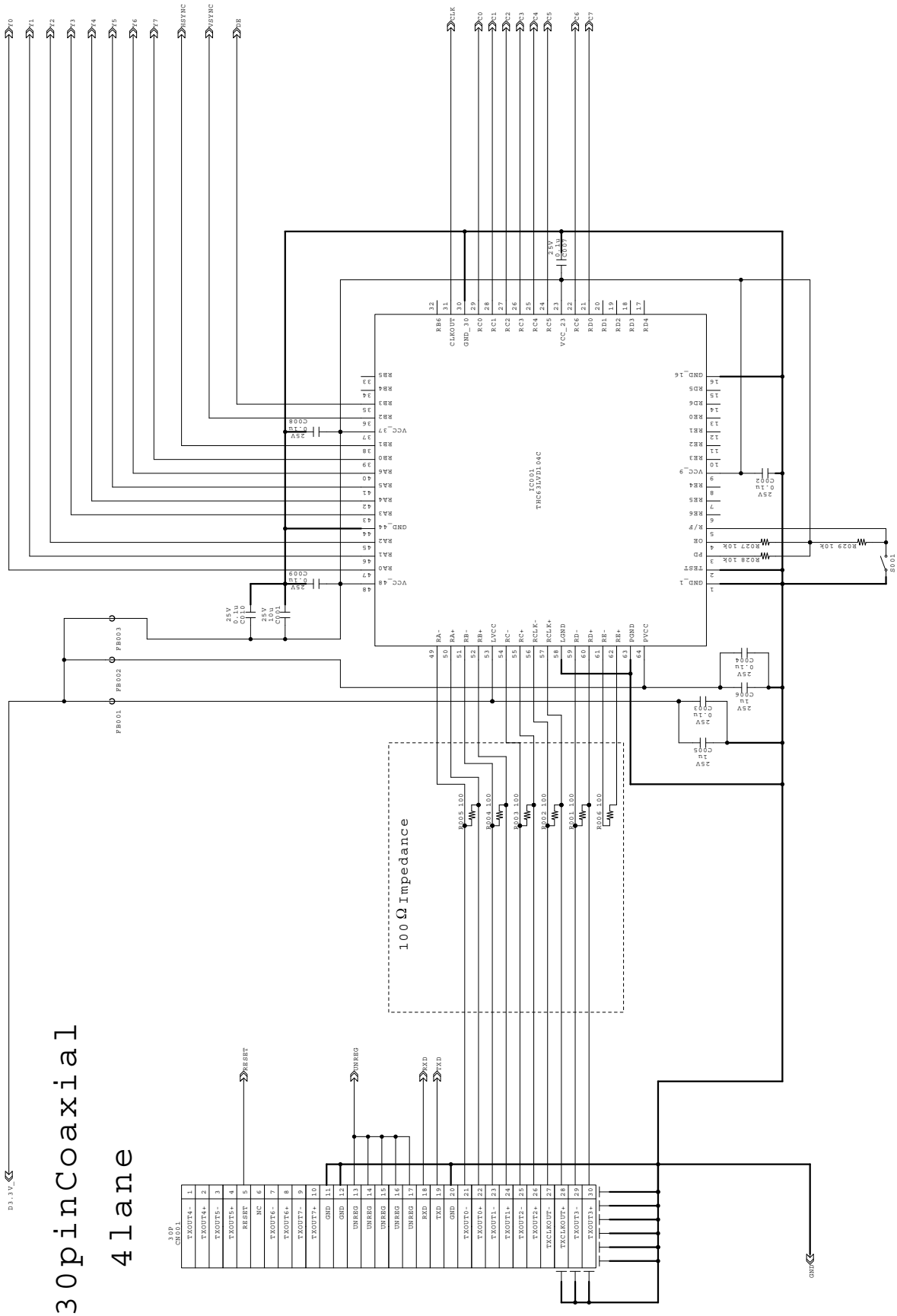
Output Format	Pixel CLK[Hz]	TCLK+[Hz]
1080p/60	148.5M	74.25M
1080p/59.94	148.5M/1.001	74.25M/1.001
1080p/30	74.25M	37.125M
1080p/29.97	74.25M/1.001	37.125M/1.001
1080i/60	74.25M	37.125M
1080i/59.94	74.25M/1.001	37.125M/1.001
1080i/50	74.25M	37.125M
720p/60	74.25M	37.125M

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

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



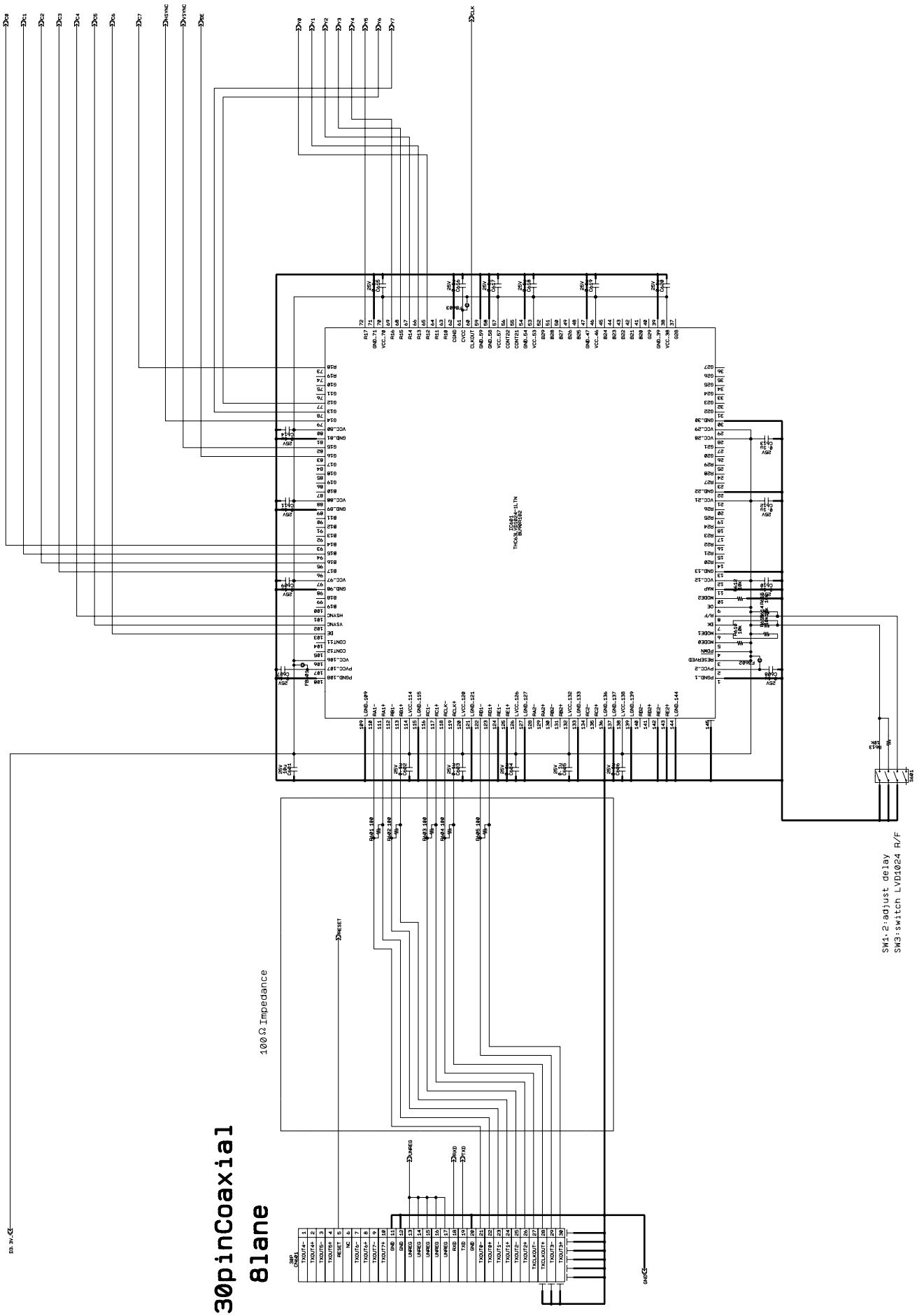
• The switch (S001) selects whether to input the rising edge or falling edge of the signal.

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
1	GND_1	
2	TEST	
3	PD	
4	OE	
5	R/F	
6	RE6	
7	RE5	
8	RE4	
9	VCC_9	
10	RE3	
11	RE2	
12	RE1	
13	RE0	
14	RD6	
15	RD5	
16	GND_16	
17	RD4	
18	RD3	
19	RD2	
20	RD1	
21	RD0	C7
22	RC6	C6
23	VCC_23	
24	RC5	C5
25	RC4	C4
26	RC3	C3
27	RC2	C2
28	RC1	C1
29	RC0	C0
30	GND_30	
31	CLKOUT	CLK
32	RB6	

Pin No.	Description	Signal
33	RB5	
34	RB4	
35	RB3	DE
36	RB2	VSYNC
37	VCC_37	
38	RB1	HSYNC
39	RB0	Y7
40	RA6	Y6
41	RA5	Y5
42	RA4	Y4
43	RA3	Y3
44	GND_44	
45	RA2	Y2
46	RA1	Y1
47	RA0	Y0
48	VCC_48	
49	RA−	TXOUT0−
50	RA+	TXOUT0+
51	RB+	TXOUT1−
52	RB−	TXOUT1+
53	LVCC	
54	RC−	TXOUT2−
55	RC+	TXOUT2+
56	RCLK−	TXCLKOUT−
57	RCLK+	TXCLKOUT+
58	LGND	
59	RD−	TXOUT3−
60	RD+	TXOUT3+
61	RE−	
62	RE+	
63	PGND	
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.

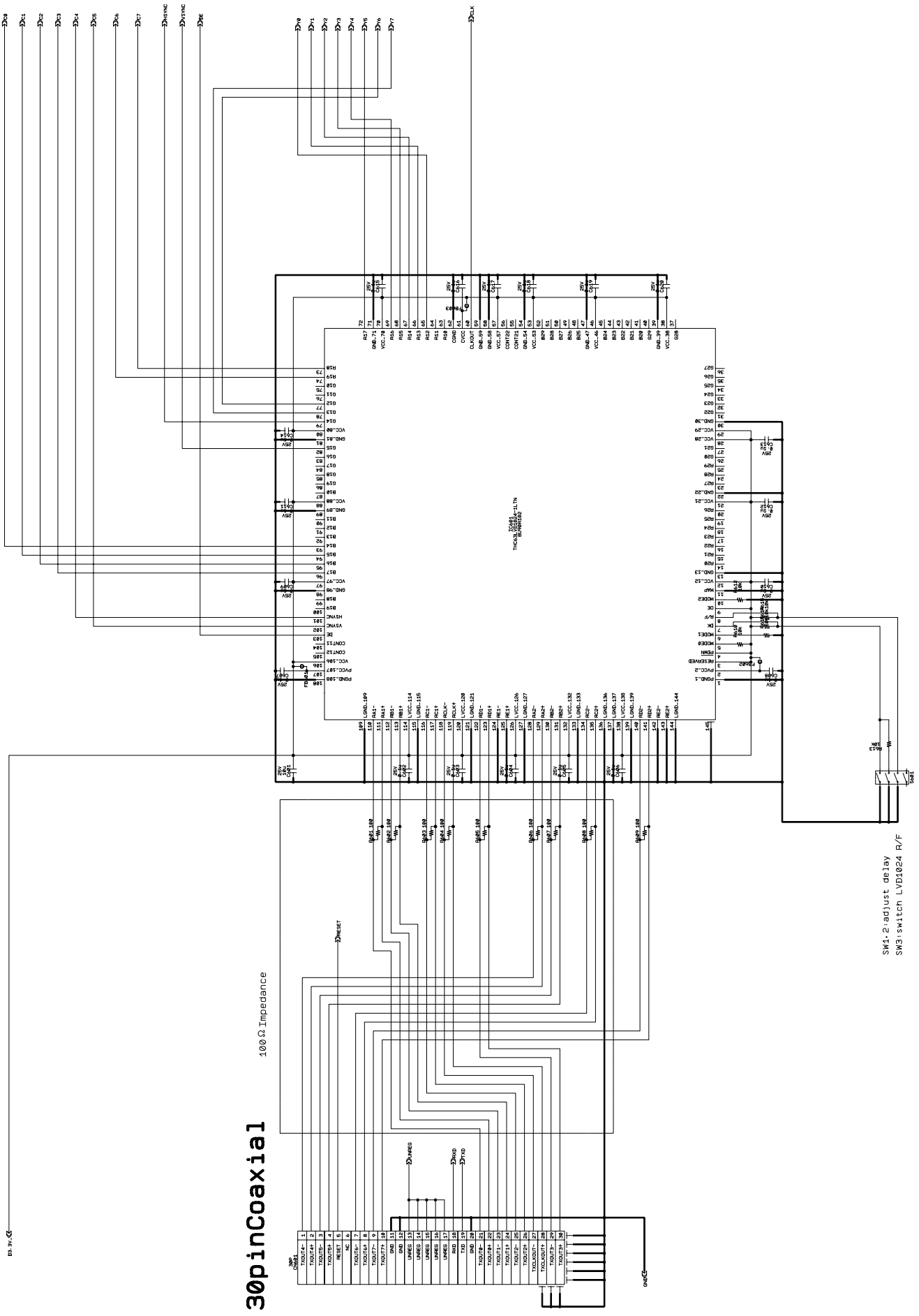
LVDS receiver IC (e.g., THC63LVD1024, BU90R102)
Pin assigment Single mode LVDS input - CMOS output

Pin No.	Description	Signal
1	PGND_1	
2	PVCC_2	
3	RESERVED	
4	PDWN	
5	MODE0	
6	MODE1	
7	DK	
8	R/F	
9	OE	
10	MODE2	
11	MAP	
12	VCC_12	
13	GND_13	
14	R20	
15	R21	
16	R22	
17	R23	
18	R24	
19	R25	
20	R26	
21	VCC_21	
22	GND_22	
23	R27	
24	R28	
25	R29	
26	G20	
27	G21	
28	VCC_28	
29	VCC_29	
30	GND_30	
31	G22	
32	G23	
33	G24	
34	G25	
35	G26	
36	G27	
37	G28	
38	VCC_38	
39	GND_39	
40	G29	
41	B20	
42	B21	
43	B22	
44	B23	
45	B24	
46	VCC_46	
47	GND_47	
48	B25	
49	B26	
50	B27	

Pin No.	Description	Signal
51	B28	
52	B29	
53	VCC_53	
54	GND_54	
55	CONT21	
56	CONT22	
57	VCC_57	
58	GND_58	
59	GND_59	
60	CLKOUT	CLK
61	CVCC	
62	CGND	
63	R10	
64	R11	
65	R12	Y0
66	R13	Y1
67	R14	Y2
68	R15	Y3
69	R16	Y4
70	VCC_70	
71	GND_71	
72	R17	Y5
73	R18	C7
74	R19	C6
75	G10	
76	G11	
77	G12	Y6
78	G13	Y7
79	G14	HSYNC
80	VCC_80	
81	GND_81	
82	G15	VSYNC
83	G16	DE
84	G17	
85	G18	
86	G19	
87	B10	
88	VCC_88	
89	GND_89	
90	B11	
91	B12	
92	B13	
93	B14	C0
94	B15	C1
95	B16	C2
96	B17	C3
97	VCC_97	
98	GND_98	
99	B18	
100	B19	

Pin No.	Description	Signal
101	HSYNC	C4
102	VSYNC	C5
103	DE	C6
104	CONT11	
105	CONT12	
106	VCC_106	
107	PVCC_107	
108	PGND_108	
109	LGND_109	
110	RA1−	TXOUT0−
111	RA1+	TXOUT0+
112	RB1−	TXOUT1−
113	RB1+	TXOUT1+
114	LVCC_114	
115	LGND_115	
116	RC1−	TXOUT2−
117	RC1+	TXOUT2+
118	RCLK−	TXCLKOUT−
119	RCLK+	TXCLKOUT+
120	LVCC_120	
121	LGND_121	
122	RD1−	TXOUT3−
123	RD1+	TXOUT3+
124	RE1−	
125	RE1+	
126	LVCC_126	
127	LGND_127	
128	RA2−	
129	RA2+	
130	RB2−	
131	RB2+	
132	LVCC_132	
133	LGND_133	
134	RC2−	
135	RC2+	
136	LGND_136	
137	LGND_137	
138	LVCC_138	
139	LVCC_139	
140	RD2−	
141	RD2+	
142	RE2−	
143	RE2+	
144	LGND_144	

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.

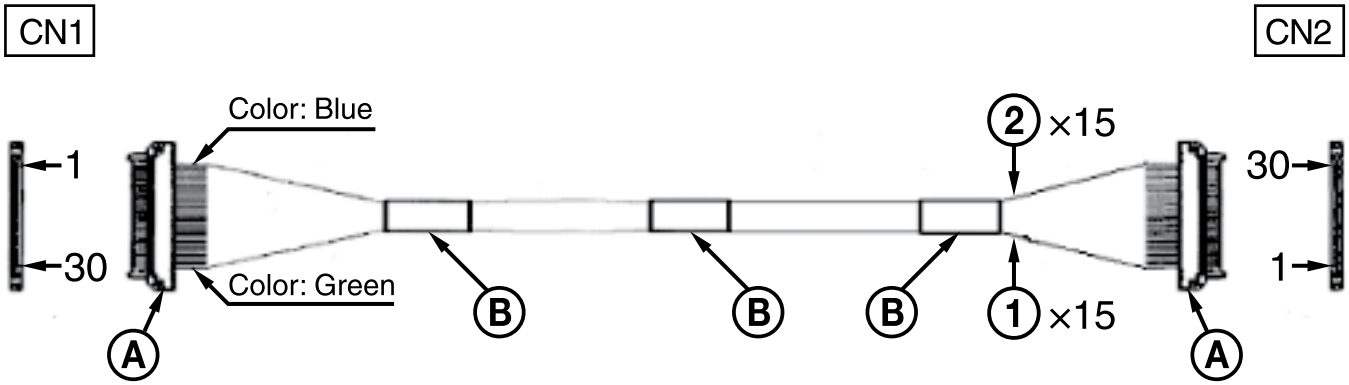
LVDS receiver IC (e.g., THC63LVD1024, BU90R102)
Pin assigment Double mode LVDS input - CMOS output

Pin No.	Description	Signal
1	PGND_1	
2	PVCC_2	
3	RESERVED	
4	PDWN	
5	MODE0	
6	MODE1	
7	DK	
8	R/F	
9	OE	
10	MODE2	
11	MAP	
12	VCC_12	
13	GND_13	
14	R20	
15	R21	
16	R22	
17	R23	
18	R24	
19	R25	
20	R26	
21	VCC_21	
22	GND_22	
23	R27	
24	R28	
25	R29	
26	G20	
27	G21	
28	VCC_28	
29	VCC_29	
30	GND_30	
31	G22	
32	G23	
33	G24	
34	G25	
35	G26	
36	G27	
37	G28	
38	VCC_38	
39	GND_39	
40	G29	
41	B20	
42	B21	
43	B22	
44	B23	
45	B24	
46	VCC_46	
47	GND_47	
48	B25	
49	B26	
50	B27	

Pin No.	Description	Signal
51	B28	
52	B29	
53	VCC_53	
54	GND_54	
55	CONT21	
56	CONT22	
57	VCC_57	
58	GND_58	
59	GND_59	
60	CLKOUT	CLK
61	CVCC	
62	CGND	
63	R10	
64	R11	
65	R12	Y0
66	R13	Y1
67	R14	Y2
68	R15	Y3
69	R16	Y4
70	VCC_70	
71	GND_71	
72	R17	Y5
73	R18	C7
74	R19	C6
75	G10	
76	G11	
77	G12	Y6
78	G13	Y7
79	G14	HSYNC
80	VCC_80	
81	GND_81	
82	G15	VSYNC
83	G16	
84	G17	
85	G18	
86	G19	
87	B10	
88	VCC_88	
89	GND_89	
90	B11	
91	B12	
92	B13	
93	B14	C0
94	B15	C1
95	B16	C2
96	B17	C3
97	VCC_97	
98	GND_98	
99	B18	
100	B19	

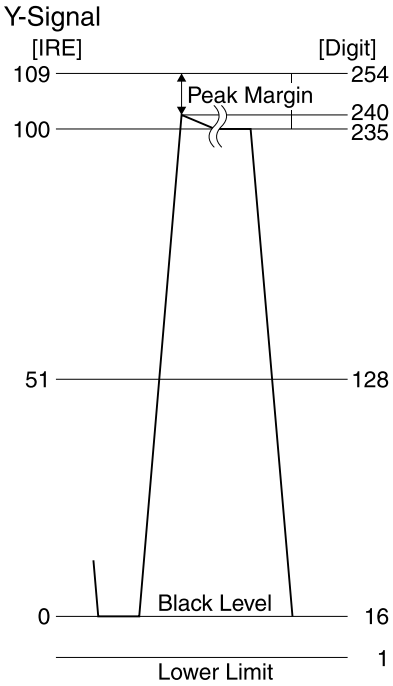
Pin No.	Description	Signal
101	HSYNC	C4
102	VSYNC	C5
103	DE	DE
104	CONT11	
105	CONT12	
106	VCC_106	
107	PVCC_107	
108	PGND_108	
109	LGND_109	
110	RA1–	TXOUT0–
111	RA1+	TXOUT0+
112	RB1–	TXOUT1–
113	RB1+	TXOUT1+
114	LVCC_114	
115	LGND_115	
116	RC1–	TXOUT2–
117	RC1+	TXOUT2+
118	RCLK–	TXCLKOUT–
119	RCLK+	TXCLKOUT+
120	LVCC_120	
121	LGND_121	
122	RD1–	TXOUT3–
123	RD1+	TXOUT3+
124	RE1–	
125	RE1+	
126	LVCC_126	
127	LGND_127	
128	RA2–	TXOUT4–
129	RA2+	TXOUT4+
130	RB2–	TXOUT5–
131	RB2+	TXOUT5+
132	LVCC_132	
133	LGND_133	
134	RC2–	TXOUT6–
135	RC2+	TXOUT6+
136	LGND_136	
137	LGND_137	
138	LVCC_138	
139	LVCC_139	
140	RD2–	TXOUT7–
141	RD2+	TXOUT7+
142	RE2–	
143	RE2+	
144	LGND_144	

Cable reference specifications (crossover)



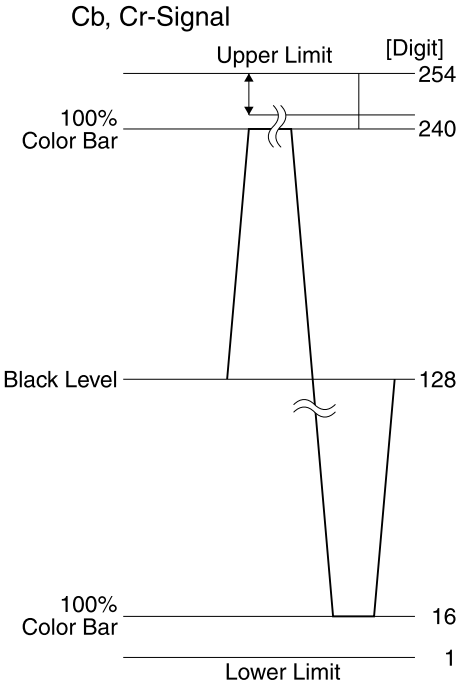
• Recommended connectors and cables
Cable① green: #42 thin coaxial cable
Cable② blue: #42 thin coaxial cable
ConnectorⒶ: USL20-30S (KEL)
Binding tapeⒷ

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



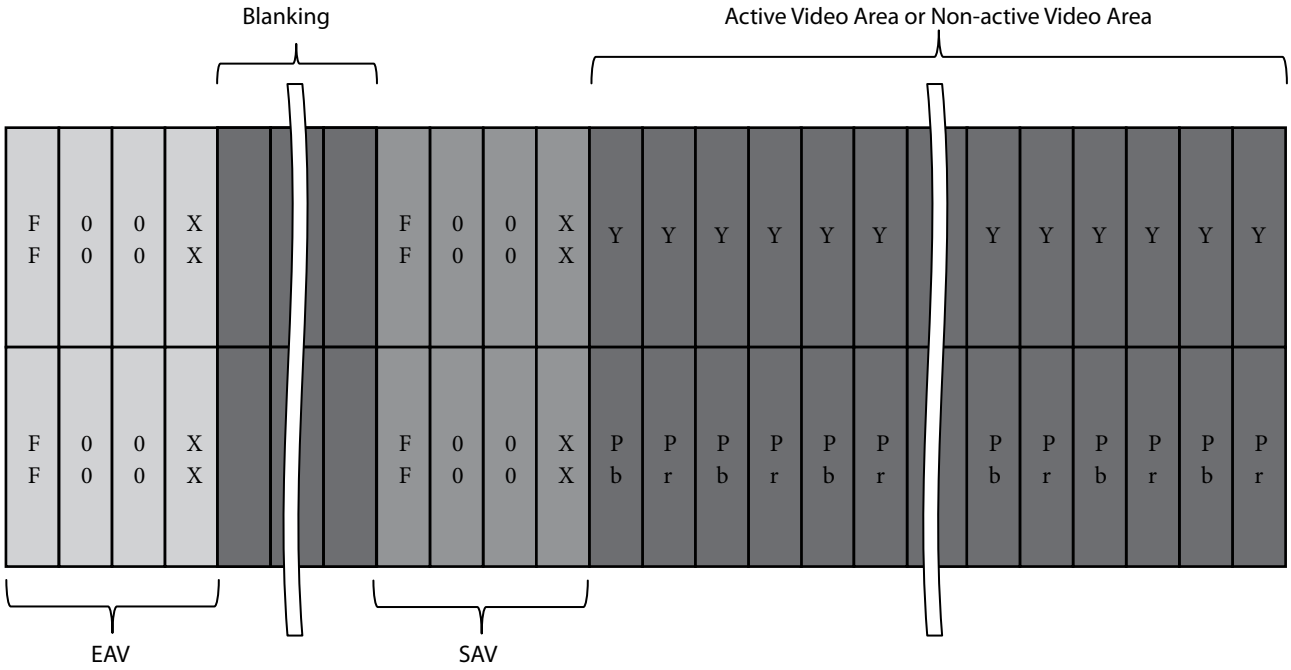
Data Format : Straight Binary
Black Level : 16 (10h)
100IRE : 235
Prohibited Data : 0,255 (0h,FFh)

Color coding complies with BT709.



Data Format : Straight Binary
Black Level : 128 (80h)
Prohibited Data : 0,255 (0h,FFh)

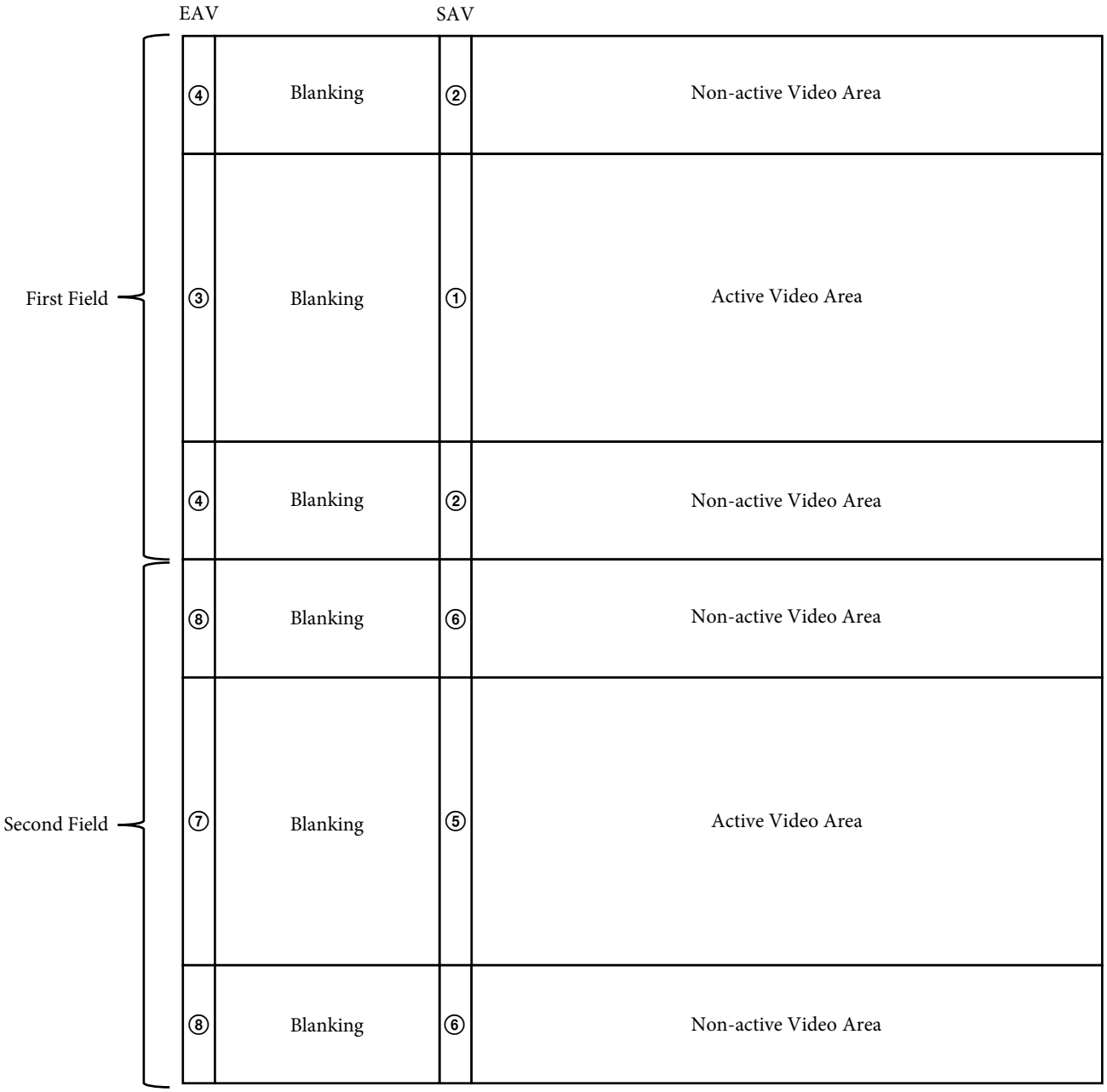
Synchronized codes



		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)



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

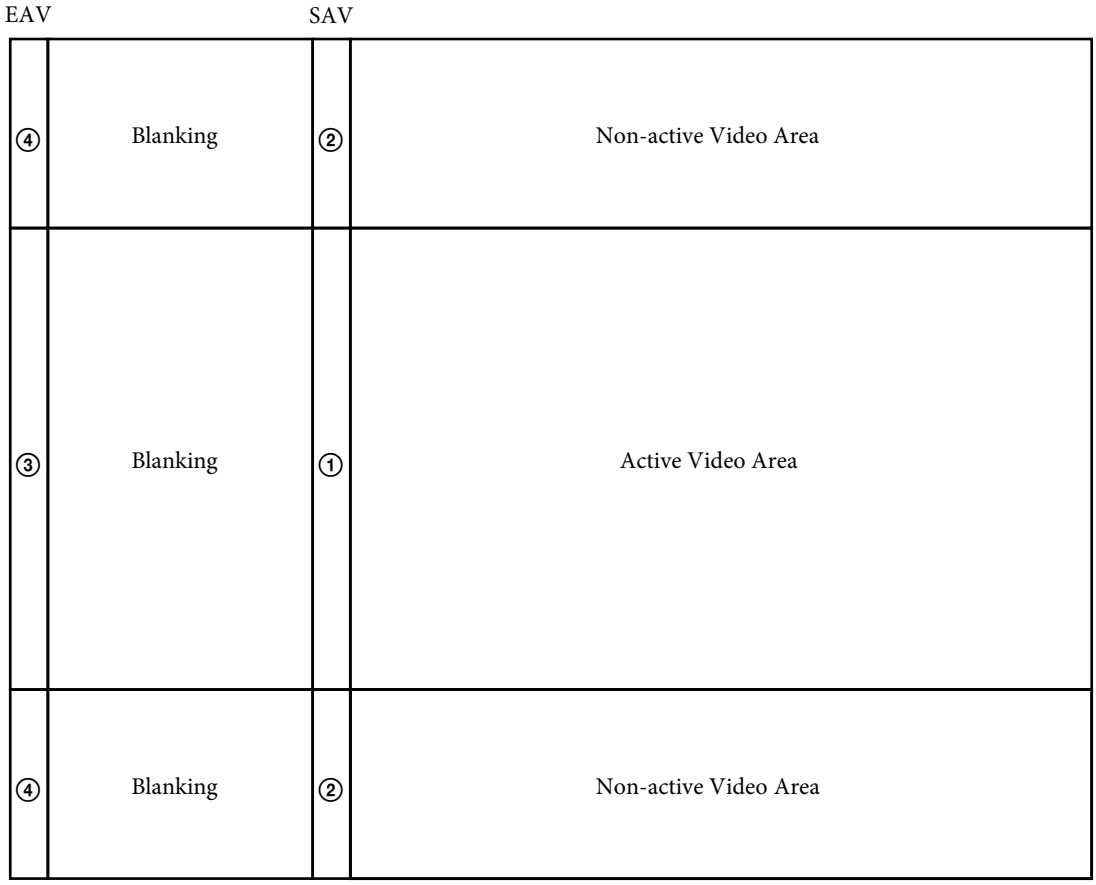
⑥ SAV for Second Field Non-active Video Area

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)



① SAV for Active Video Area

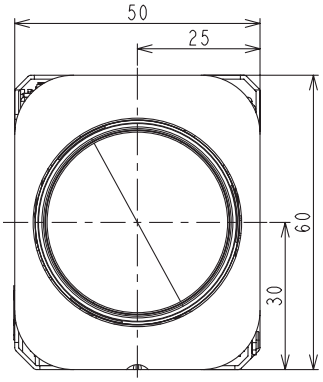
② SAV for Non-active Video Area

③ EAV for Active Video Area

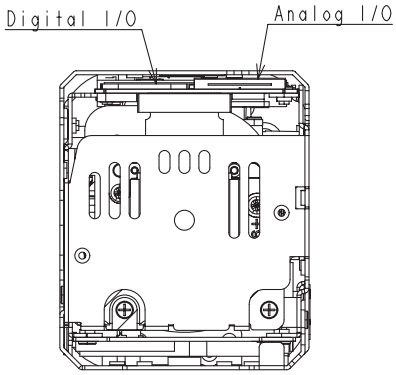
④ EAV for Non-active Video Area

Dimensions

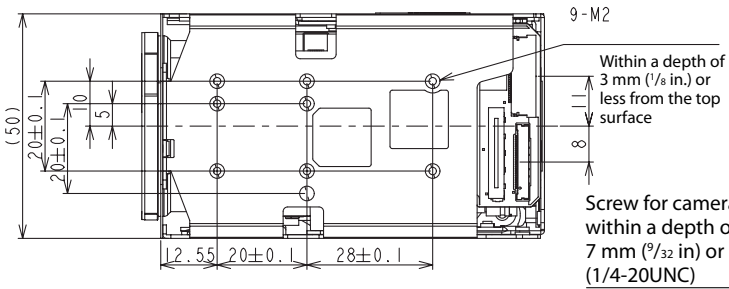
Front



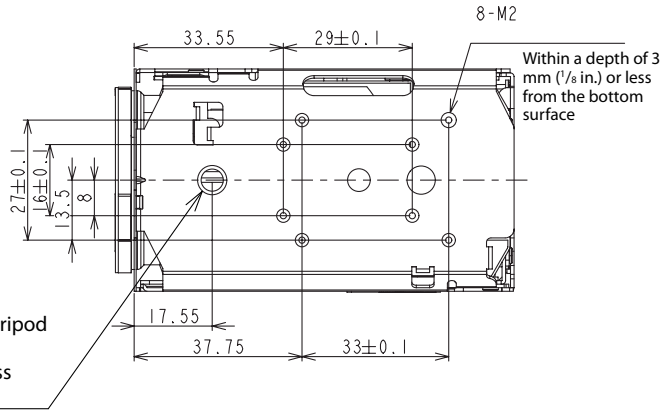
Back



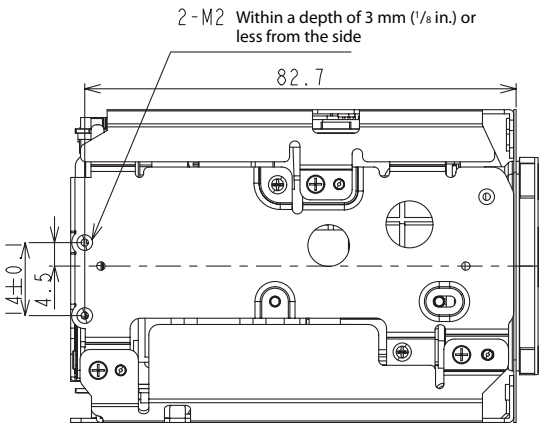
Top



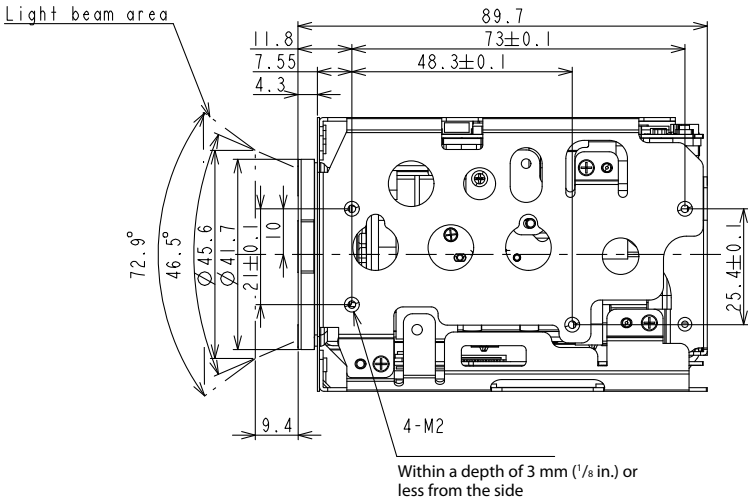
Bottom



Left side

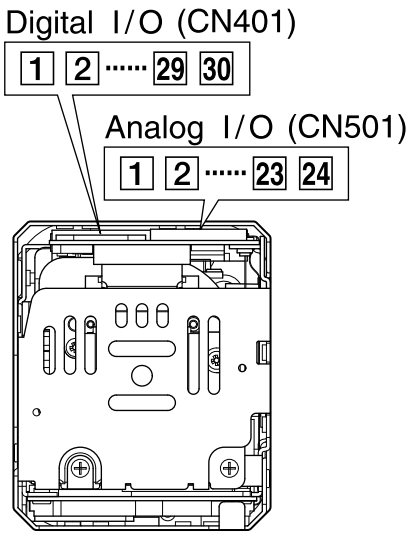


Right side



Unit: mm (inches)

Pin assignment



CN401

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)
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	NC	
26	RESET	Reset: Low (GND), Normal: Open (1.8V)
27	TXOUT5+	Single out mode: open
28	TXOUT5–	Single out mode: open
29	TXOUT4+	Single out mode: open
30	TXOUT4–	Single out mode: open

CN501

Kyocera-elco 046240024006800+

Pin No.	Name	Level
1	GND	
2	TxD	CMOS 5 V (Low: Max 0.1 V, High: Min 4.4 V)
3	RxD	CMOS 5 V (Low: Max 1.0 V, High: Min 2.3 V)
4	RESET	Reset: Low (GND), Normal: Open (1.8V)
5	GND	
6	NC	
7	GND	
8	NC	
9	GND	
10	VBS-OUT	
11	GND	
12	NC	
13	GND	
14	NC	
15	GND	
16	NC	
17	GND	
18	DC IN	6 to 12 V DC
19	DC IN	6 to 12 V DC
20	DC IN	6 to 12 V DC
21	DC IN	6 to 12 V DC
22	GND	
23	DC IN	6 to 12 V DC
24	GND	