GS camera modules

MP2030M-GS

Technical reference manuals

Ver. 1.00

Revision History

Ver 1.00	2019 / 06 / 01	Ver.1.00 Release /

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1. Unique features

1. Global Shutter CMOS Sensors

This system is equipped with a 1/1.8-type image sensor with an effective 3.2 million-pixel global shutter function that exposes all pixels in a single row using an in-pixel memory. This system eliminates focal plane distortion that occurs in general rolling shutter type image sensors and greatly improves image visibility in moving subjects.

Rolling shutter system

Global shutter system

2. Still image shooting function

Still image shooting mode for shooting still images with trigger pulses is installed. The exposure duration setting has three modes: Auto setting, Manual setting, and Trigger-pulse-width setting. The continuous shooting function allows you to set the number of shots and the shooting interval.

3. Multi-image output

Video signals have uncompressed camera output (LVDS output) and analog VBS output. Register settings enable the selection of 1080p/60, 59.94, 50, 30, 25fps, 1080i/60, 59.94, 50fps, 720/60, 50fps, and VBS (NTSC/PAL).

4. High magnification optical zoom lens

It is equipped with a high-magnification, bright zoom lens with an optical power of 30× and F1.6. You can take up to 480× magnified images by combining optical zoom and digital zoom.

5. Variety of camera functions

It has a variety of camera functions including camera control by VISCA commands, slow shutter function, Auto ICR (infrared-cut filter ON/OFF) function, Image Stabilizer function, wide dynamic range (WD) function by signal-processing method, Defog function, noise reduction function, privacy mask function, and title-display function.

2. Handling precaution

Software

We shall not be liable for any damage to your hardware or software caused by the demonstration software provided by us or your own application software.

Location of use and storage

Do not take pictures of very bright subjects (illumination, sun, etc.) for a long time. Do not use or store the product in the following places.

- Extremely hot or cold (operating temperature-5°C to +60°C)
- Near TV and radio stations that emit powerful radio waves
- Places affected by the reflection of fluorescent lamps and windows
- Under unstable lighting (causing flicker)
- Vigorous vibrations
- No laser light is projected.

Care

Remove dust and dirt from the lens surface with a commercially available blower.

Others

Please be careful not to apply excessive loads to the top and side boards when handling the equipment. As the cause of the failure due to the possibility of internal breakage due to deformation of the board.

Please do not apply excessive load to the sensor circuit board on the rear surface. The sensor board is mounted on the lens after precise adjustment. If a force is applied, the optical performance may be affected by misalignment of the optical axis or blurring.

Static electricity (ESD) may damage the electric circuit (electrostatic breakdown).
In order to prevent electrostatic breakdown, when this machine is handled, it is advisable to discharge the Static electricity by touching the grounded metal, etc.

Please do not apply a power supply voltage other than the specified one. Failure to do so may result in electric shock or fire.

If any abnormality or malfunction occurs, contact the designated dealer of Tamron or the retailer from whom the product was purchased.

Phenomena peculiar to CMOS imaging devices

The following phenomena appearing on the shooting picture are for CMOS (Complementary Metal-Oxide Semiconductor) peculiar phenomena, not a failure.

White spot

Although CMOS image sensors are manufactured with extremely precise techniques, minute white spots may rarely appear on the picture due to cosmic rays and other influences. This is due to the principles of CMOS imagers and is not a failure.

In the following cases, white spots are easily visible.

- Use in a high-temperature environment.
- When the master gain (sensitivity) is increased
- In slow shutter mode

Folding distortion

Shooting fine patterns, vertical stripes, lines, etc. may reveal jaggedness or flicker.

Lens-specific phenomena

Ghosting

When intense light such as the sun is near the incident angle of the lens, the light reflects diffusely inside the lens and high bright shadows may appear on the image.

Regarding the image output frequency

LVDS power

This system can output up to 1080p/60fps, but the signal frequency is 148.5MHz. Use a device that can receive this frequency for the signal interface circuit.

3. Basic function

3.1 Imaging and VISCA control

□ Camera image output

By extracting the camera images from the uncompressed camera output (LVDS output) and the analogue output The default setting is 1080P/60fps. The settings with VISCA commands can change output signal size and frame length.

Pixel and Frame rate	Output terminal	
	LVDS_OUT（Digital Output）	VBS_OUT（Analog Output）
1920x1080p/60	○	x
1920x1080p/59.94	○	x
1920x1080p/50	○	x
1920x1080p/30	○	x
1920x1080p/25	○	x
1920x1080i/60	○	x
1920x1080i/59.94	○	x
1920x1080i/50	○	x
1280x720p/60	○	x
1280x720p/50	○	x
NTSC	x	○ (4:3 vertical)
PAL	x	○ (4:3 vertical)

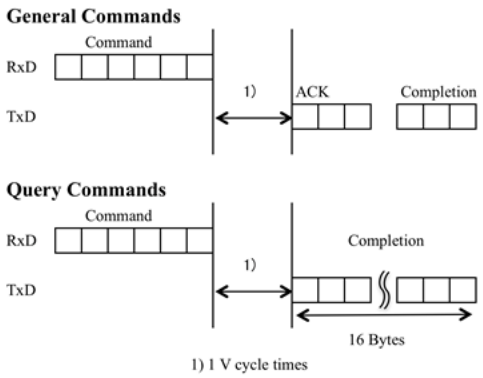
Image Size and Image Output Terminal

□ VISCA control

All camera controls operate with VISCA commands.

Refer to the command listing for more information on VISCA commands.

The VISCA command process runs one command at the V cycle. To ACK/Completion responses It takes the shortest 1 V period. When Command/ACK/Completion communication time expires 1V cycle time, commands can be accepted every 1V cycle.



Timing chart

□ **General function**

IF Clear (Command:IF_Clear)

Clear the command buffer in the camera.

Address set (Command:AddressSet)

Address Setting Function for Daisy Chaining of VISCA. Direct daisy chain connection is not supported in this product.

System reboot (Command: CAM_Reboot)

The system can be rebooted while the power is supplied. After changing the camera register settings, to reboot to reflect the changes is needed.

Camera/Lens Initialize (Command: CAM_Initialize)

This is used when the lens or image sensor needs to be initialized.

NOTE) Lens initialization during continuous energization

The lens operation of this camera is controlled based on the lens position initialized from the photo sensor inside the lens when the power is turned on. When using the camera continuously energized for a long period of time, external factors such as vibration shock to the lens or temperature environment changes may occasionally cause errors in the initialization value and the actual lens value, which may degrade the performance of the lens operation. When using the camera continuously energized for a long period of time, initialize the lens periodically so that the camera can be used under optimum lens operation conditions.

3.2 Still image trigger function

A still image trigger function for capturing a still image at the timing of a trigger signal is provided.

□ Mode transition and image output

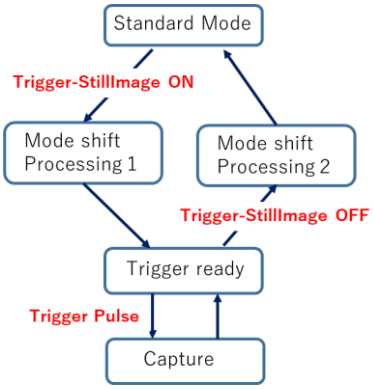
Mode transition

The figure below shows the transition to the still image trigger. Migration processing is performed by the mode setting operation.

In the still image trigger mode, trigger pulses are ready to receive after all transition processing is completed. This is *Trigger ready*. This condition can be checked by VISCA commands.

When the mode is returned to the normal mode (movie), the post-transfer mode is changed in the same manner.

The mode shift processing is executed after all still image trigger operations are completed, and several volts are required for the processing time.



Mode transition

When the camera is switched from the normal mode to the still image trigger mode, the main settings inside the camera are HOLD, the DZOOM and EIS functions that cannot be used in combination on the system are automatically disabled.

Refer to the following table for details on shifting the internal setting state. Since Auto system cannot operate in still image trigger mode, VISCA commands other than mode switching are not accepted. Perform the necessary settings before switching the mode.

Function	Condition	Comment
ZOOM	Hold	Hold on a zoom position before the mode change
Digital ZOOM	Off	OFF automatically
Focus	Hold	Hold on a focus position before the mode change
ImageStabilizer	Off	OFF automatically
White balance	Hold	Hold on a White balance before the mode change
IRIS	Hold or Manual	Hold on a IRIS position before the mode change
GAIN	Hold or Manual	Hold on a Gain before the mode change☒
Shutter	Auto or Manual	Edge Detection Auto: Hold on a Shutter before the mode change Edge Detection Manual: shift to Manual Mode Width detection: Shift to Manual Mode
Slow Shutter	Hold	Hold the status just before switching mode
Auto ICR	Hold	Hold the status just before switching mode

Camera settings in still image trigger mode

Trigger pulse and still image output

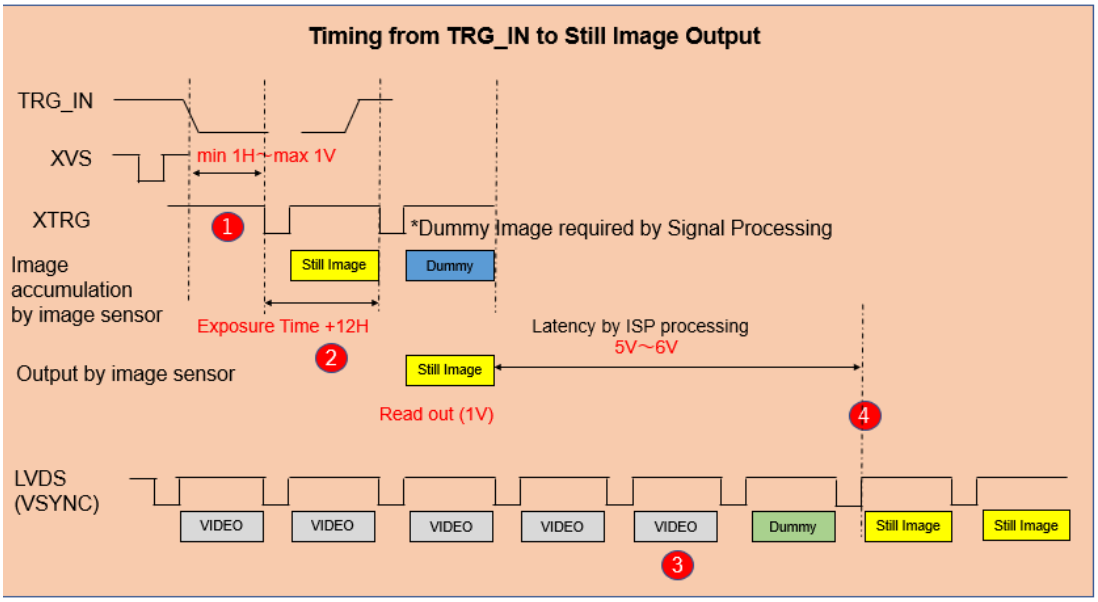
The figure below shows the timing from the trigger pulse (EXT. TRIGI) until the still image is outputted. After the trigger pulse is issued, the image sensor outputs a still image after the maximum 3 V.

Because of the latency of the 5 V~6 V caused by the signal processing, still images are outputted after 8 V to 9 from trigger pulses.

The last image in the previous mode appears HOLD when the mode is changed from the movie.

For the convenience of the system, an invalid image is output and then the captured still image is

output. The still image is HOLD until the next image is output. The timing of capturing into the image sensor can be checked with the timing of the trigger output signal (H→L)



Trigger and image output timing

Trigger pulse invalidation period

During the period until the image reading from the image sensor (dummy image + still image) is completed, the trigger pulse is disabled. To retrieve continuous still images, use the continuous shooting function.

☐ **Close sequence function**

There are two types of still image trigger modes.

Standard (Command:CAM_Trigger-StillImage/On(Standard))

One still image can be captured at the timing of the trigger pulse.

Continuous shooting (Command:CAM_Trigger-StillImage/On(Continuous shooting))

The preset number of still pictures can be shot continuously, and the continuous shooting interval is set in frame rate units as determined. select the best shot from multiple images is also available.

Setting the number of consecutive shots

You can set the number of consecutive shots during continuous shooting. 1, 2, 4, 8, 16, 32, 64, 128 sheets can be set.

Setting the shooting interval

You can set the shooting interval in frame rate units. Continuous, 1 V, 2 V, 4 V, 8 V, 16V, 32V, 64V, 128V, and 255V can be set.

□ **Selecting exposure settings**

You can select the exposure setting method. Installed before switching to the still image trigger mode

Edge Detection Auto (Command:CAM_TriggerSignal and Exposure/Edge Detection Auto))

Automatically sets the exposure time. The exposure mode is maintained immediately before switching to the still image mode.

If you want to set the exposure time to be shorter in the AUTO mode, set the aperture to open in the IRIS preferred mode and the shortest exposure time can be obtained.

Customer setting (Command:CAM_TriggerSignal and Exposure/ Customer Setting)

Set the exposure time by the trigger pulse width. In this mode, the IRIS is open and the gain is fixed by 0 dB.

3.3 Zoom control

An optical 30× zoom lens is used.

□ **Lens specifications and horizontal angle of view**

F number: F1.6-F5.3

Focal Length: Nominal Value: f = 6.5 mm - 195 mm

Designed Value: f=6.7mm – 190mm

The horizontal angle of view: WIDE 54.5 deg +/- 10% (Object Distance 1m)

TELE 2.59deg +/-10%(Object Distance 8m)

Horizontal angle of view (when 1080p is output) of 2 degree at tele end with object distance of infinity is a calculated value based on the above object distance as designed value.

□ **Optical zoom**

Optical zoom has the following modes. Stop command has to be sent to stop zooming

Variable zooming (Command: CAM_Zoom)

The zoom speed can be set in 8 steps. Since the speed setting 7 is set to the maximum moving speed, zoom tracking (tracking of the focus lens) is not supported.

Data	Speed [pps]	Operating time from Wide to Tele(Sec.)	Zoom tracking
0	16	120	Yes
1	32	60	Yes
2	48	40	Yes
3	96	20	Yes
4	192	12	Yes
5	384	7.5	Yes
6	768	6.5	Yes
7	768	2.8	No

Approximate zoom speed (wide end → telephoto end)

Specify Direct Zoom Position (Command: CAM_Zoom/ Direct)

Move to the specified zoom position by setting the position data.

☐ **Digital Zoom (Command: CAM_DZoom)**

You can enlarge the image up to 16 times, and you can set the speed in 8 steps. There are two modes in combination with Optical zoom. Stop command has to be sent to stop zooming

Combine Mode (Command:CAM_DZoom/ Combine Mode)

After the optical zoom reaches the T-edge, the image can be continuously enlarged.

Separate Mode(Command:CAM_DZoom/ Separate Mode)

Optical zoom is fixed. Electronic zoom can magnify the image.

☐ **Read out zoom position (Command: CAM_Continuous ZoomPosReply)**

The zoom position data can be read out from the camera at any time, and the read-out interval time can be also set.

3.4 Focusing control

This function moves the focus lens to focus.

☐ **Auto Focus Mode(Command:CAM_Focus/Auto Focus)**

Focus on a subject with high contrast in the measurement frame near the center of the screen. There are three modes and the AF mode can be selected to suit the application.

Normal AF(Command:CAM_AFMode / Normal AF)

This is a normal AF operation mode with emphasis on responsiveness.

Interval AF(Command:CAM_AFMode/ Interval AF)

AF runs at regular intervals and this mode is recommended for applications with little change in subject. This mode emphasizes lens durability. With Active/Interval Time commands for operating and stopping times you can set in seconds. The default value is 5 seconds.

Zoom Trigger AF (Command:CAM_AFMode/ Zoom Trigger AF)

This is a mode in which the AF operates in conjunction with the zoom operation and stops after focusing.

□ **Manual Focus mode (Command: CAM_Focus/Manual Focus)**

Eight-step operation speed setting is possible. Sending the stop command is needed to stop the focus lens,

Specify Direct Focus Position (Command: CAM_Focus/ Direct)

You can move to the specified focus position.

Near:1000 Far:C000

NOTE) When the Focus position is moved to the Near/Far end in the vicinity of the ZOOM-Wide, the range of movement of the lenses is small and it causse computational errors and the readout of Focus positions does not reach 1000 per C000.

Infinity(Command:CAM_Focus/Infinity)

The focus position moves to infinity.

□ **One Push Trigger mode (Command: CAM_Focus/ One Push Trigger)**

The focus range is fully scanned and the focus range is contrasted at the time of the One Push Trigger command.

Automatically adjusts the focus to the point of the subject with a strong strike. Transitions can be made only in Manual Focus mode, and until the next One Push Trigger command comes in Focus move command, hold the focus position.

□ **AF parameter settings**

You can set AF parameters.

AF Sensitivity Normal (Command:AF Sensitivity/Normal)

Focusing on the ability to follow subject changes. This is useful for shooting a moving subject. This setting is default seting.

AF Sensitivity Low(Command:AF Sensitivity/Low)

Focus stability is emphasized. When the illumination is low or the brightness changes frequently, Stable by suppressing AF restart due to small changes in the screen, such as when objects traverse the screen frequently.

Near Limit setting (Command: CAM_Focus/Near Limit)

By narrowing the range of motion of the focus lens, the response of the AF can be significantly improved.

In addition, the focus can be prevented from being incorrectly focused on dirt or water droplets on

the lens cover. Default is 0. 3 m.

Data	Limit distance(m)
1000h	INF
2000h	10.0m
3000h	5.0m
4000h	3.3m
5000h	2.5m
6000h	2.0m
7000h	1.7m
8000h	1.5m
9000h	1.0m
A000h	0.5m
B000h	0.3m
C000h	0.15m
D000h	No settings

Focus range and closest distance

3.5 White balance control

It has a white balance function to correct the color temperature of the light source and obtain optimum color reproduction. The white balance can be set in the following modes.

☐ **Auto (ATW) mode (Command: CAM_WB/ Auto)**

Follow the color temperature of about 2200 K to about 10000 K and automatically adjust the white balance.

☐ **Manual mode (Command: CAM_WB/ Manual)**

You can arbitrarily set the R gain 256 step and the B gain 256 step.

This is valid for use in light of a particular color temperature

☐ **Fixed value output mode**

The fixed output mode is valid when the light source is constant. The following color temperature output is possible.

INDOOR(Command:CAM_WB/Indoor)

A white balance value of about 3200k is output in a mode assuming a light-bulb light source.

OUTDOOR(Command:CAM_WB/Outdoor)

The white balance value of about 5800k is output in the mode in which sunlight is assumed.

☐ **One Push WB (Command: CAM_WB/ One Push WB)**

Outputs white-balance values calculated by One Push Trigger. Stable white balance can be obtained under changing subject conditions with a variety of subject colors.

□ **One Push Trigger(Command:CAM_WB/One Push Trigger)**

Commands for calculating One Push WB outputs. This command calculates the white balance and shifts to One Push WB mode automatically with command input timing. By using a white subject, it is possible to calculate the white balance value with high accuracy.

3.6 AE (Automatic Exposure Adjustment) Control

AE is a function to set the exposure conditions of the camera so that the optimum image can be obtained. There is a mode of the following four. By combining aperture (IRIS), electronic shutter, and circuit gain, this covers subject conditions of high to low illuminance.

□ **Full Auto(Command:CAM_AE/Full Auto)**

The aperture, electronic shutter, and circuit gain are automatically set to optimize exposure.

The circuit gain, aperture, and electronic shutter are changed in this order in the direction in which the shooting illumination becomes brighter.

□ **Shutter Priority (Command:CAM_AE/Shutter Priority)**

With the electronic shutter fixed (set by the user), stop and turn automatically to achieve optimum exposure.

The road gain is set. Electronic shutter speed is 1/1 to 1/10,000 second, 22 steps.

(16 steps on the high-speed shutter side and 6 steps on the slow shutter side) can be set.

The slow shutter is valid only when the slow shutter mode is ON.

Data	Frame late	
	60fps/30fps	50fps/25fps
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

Shutter Speed

□ **Iris Priority (Command:CAM_AE/Iris Priority)**

Electronic shutter and circuit gain are ste automatically to achieve optimum exposure with aperture fixed (user set). The aperture can be set in 15 steps from F1.6 to Close.

Data	F No.
11	F1.6
10	F2.0
0F	F2.4
0E	F2.8
0D	F3.4
0C	F4.0
0B	F4.8
0A	F5.6
09	F6.8
08	F8.0
07	F9.6
06	F11
05	F14
04	F16
03	Close
02	Close
01	Close
00	Close

F-value data

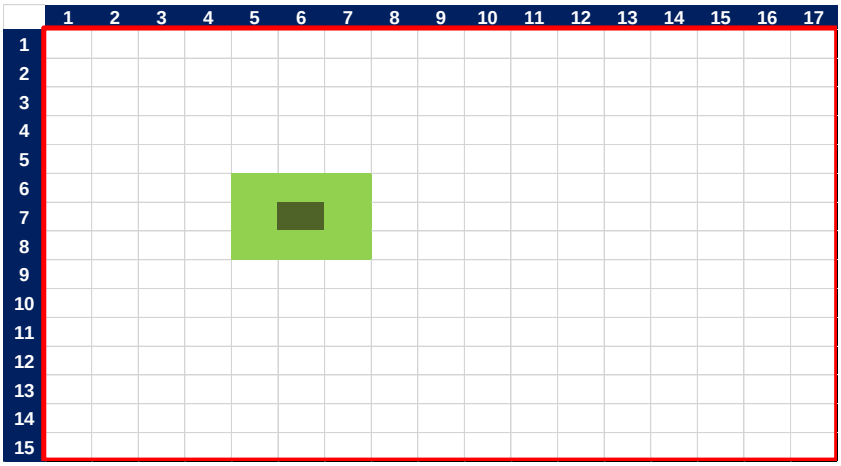
☐ **Manual(Command:CAM_AE/Manual)**

This is a mode for manually setting AE. You can individually set 22 steps of electronic shutter, 15 steps of aperture and 26 steps of circuit gain.

☐ **Spot AE(Command:CAM_SpotAE)**

Set the detection area to an arbitrary position on the screen, and optimize exposure based on brightness information of the area.

The detection area is divided into 17 horizontal divisions and 15 vertical divisions, and the upper left corner is 0. For the detection method, the AE level is calculated by weighting the specified and the surrounding area.



NOTE) The combination of SPOT AE and backlight compensation is not recommended because of conflicting effects.

□AE parameter setting

<u>Exposure compensation (Command: CAM_ExpComp)</u>

Exposure compensation is a function that corrects the brightness when the AE converges. To a standard brightness of 0 dB, on the other hand, it can be lightened or darkened by 2dB per Step.

The correction range is ±12 dB, and the manual.

This can be corrected in other AE modes.

Data	STEP	Gain (dB)
0D	+6	+12
0C	+5	+10
0B	+4	+8
0A	+3	+6
09	+2	+4
08	+1	+2
07	0	0
06	-1	-2
05	-2	-4
04	-3	-6
03	-4	-8
02	-5	-10
01	-6	-12

Exposure compensation

Backlight Adjustment (Command: CAM_Light Adjustment)

When the background of the subject is bright and the main subject is imaged dark by AE, the main subject is corrected by backlight correction.

AE RESPONSE(Command:CAM_AE_Response)

The response speed of AE can be set in the range of 01h to 30h. The default setting is 10h.

By setting the bundle speed to the fastest side, the AE response to the brightness change can be accelerated.

By setting the bundle speed to the slowest side, the AE convergence speed to the brightness change can be reduced. It is advisable to slow down the response speed when it is desired to suppress AE changes due to vehicle headlights.

Gain Limit (Command:CAM_Gain/Gain Limit)

You can set the limit (upper limit of the circuit gain) for the circuit gain. If needed images that emphasize S/N, use this setting.

Data	Gain (dB)	Data	Gain (dB)
00	0	0D	24
01	0	0E	26
02	2	0F	28
03	4	10	30
04	6	11	32
05	8	12	34
06	10	13	36
07	12	14	38
08	14	15	40
09	16	16	42
0A	18	17	44
0B	20	18	46
0C	22	19	48

Gain setting

□ Slow Shutter

By setting exposure for a long time in a low-illumination environment, a clearer image can be obtained.

Slow Shutter Command	AE Mode			
	Full Auto	Shutter Priority	Iris Priority	Manual
Auto	Auto	Manual	Auto	Manual
Manual	x	Manual	x	Manual

Relationship between slow shutter and AE mode

Slow Shutter Auto (Command:CAM_SlowShutter/Auto)

Automatically enters the slow shutter area in Full Auto mode and Iris Priority mode.

Slow Shutter Manual (Command:CAM_SlowShutter/Manual)

The slow shutter does not enter the slow shutter area in Full Auto mode or Iris Priority mode.

The slow shutter operates by setting the shutter speed in Shutter Priority mode and Manual mode.

Slow Shutter Limit (Command:CAM_SlowShutter/Limit)

You can set a limit on the Auto Slow Shutter (long exposure) accumulation time.

Data	Frame late	
	60fps/30fps	50fps/25fps
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

Limit setting for long exposure

3.7 Auto ICR

ON/OFF the IR-cut filter (Command: CAM_ICR). By turning off the IR cut filter, the sensitivity of the infrared region of the image sensor can be used, and the camera sensitivity can be increased. In general, turn on the ICR when using a visible light source (400 nm to 650 nm), or turn off the ICR when using an IR light source (850 nm or 940 nm).

□ Auto ICR(Command:CAM_AutoICR)

Auto ICR is a function to automatically ON/OFF the removal of IR-cut filters. This function operates in the AE Full Auto mode setting. The IR-cut filter is automatically turned on when a certain level of darkness (Gain Limit setting) is reached. The IR-cut filter is automatically turned off when a certain level of darkness is reached. You can set the brightness from ICR ON to OFF (Command: CAM_AutoICR/ Threshold).

The default Gain is approximately 34.5dB.

<Formula for Threshold Settings and Switching Gain>

Switching Gain= GainLimit Setting Value-(Gain Limit Setting Value*Threshold Setting Value/FF(h))

NOTE 1) When the IR cut filter removal is turned on, the immediately preceding white balance value is retained. White balance control is started from the retained data when the IR cut filter removal is switched to OFF.

3.8 Image Stabilizer

EIS (Electronic Image Vibration Correction) function is provided to detect camera vibration using a two-axis angular velocity sensor and to electronically correct the position at which signals are read from the image memory. If the camera image is blurred due to vibration, etc., turning on the EIS function will stabilize the image. (Command:CAM_ImageStabilizer)

NOTE 1) When the Image Stabilizer function is turned on, the electronic zooming and ePT functions are automatically disabled.

NOTE 2) Since the electronic shake compensation method is used, the Image Stabilizer function is turned on to automatically enlarge the output image by about 10%.

□ **ePT function (Command: CAM_ePT)**

You can use Image Stabilizer Systems to change Memory Read Locations in Signal-Processing. Simple ePT function and lens optical axis correction function are realized by using this function. Corrected pixels are horizontal ±64 pixels (per even-numbered step) and vertical ±34 pixels (for each even-numbered step). The optical axis is adjusted to the optimum value in the initial state.

3.9 Image quality setting function

The image quality setting function is provided in the ISP.

□ **Wide Dynamic Range (Command: CAM_WD)**

Automatically compensates for black blurring or whitening of an image that occurs under subject conditions with large brightness differences by signal processing.

This function improves visibility from dark to bright areas.

<Corrected image>

WD OFF

WD ON

□ **Aperture (Command: CAM_Aperture)**

To improve resolution, emphasize the outline to make it easier to see (16 steps)

Please note that increasing the setting emphasizes the noise.

□ **Digital Noise Reduction (Command: CAM_NR)**

DNR (Noise Reduction) focuses temporal change of noise (random noise) and this function removes the noise and obtains an image with less noise. To the status of the OFF

Including OFF status, six levels can be set from Level 1 to Level 5.

The upper 4 bits are the strength of the 3DNR, and the lower 4 bits are the strength of the 2D (Bayer NR.) (0: OFF, 1: weakest to 5: strongest)

NOTE) By increasing the 3NR setting, increases the afterimage of moving subjects.

□ **Gamma setting (Command: CAM_Gamma)**

You can change the gamma curve settings. You can select one of the following four gamma curves.

00: Standard setting

01: Straight gamma

The linear signal can be extracted for the brightness of the subject.

02: Low noise (narrow range)

By narrowing the dynamic range compared to normal status, this setting reduces noise

03: Wide range

This is a gamma setting that allows the dynamic range to be wider than normal.

□ Color Gain/Hue (Command:CAM_ColorGain, Command:CAM_ColorHue)

You can change the color density (color gain) and hue. Initial color gain setting of 100% (4 h) about 60% (0 h). Up to about 200% (Eh) can be changed to 15 levels. Initial color phase is 0 degrees (7 h), and 15 levels are set from about-14 degrees (0 h) to about +14 degrees (Eh).

□ Low Illumination Chroma Suppress (Command)

You can set the achromatic level to improve color noise under low illumination conditions. Low intensity achromatic cconfiguration can be made in four levels (disabled and three levels enabled) and can be achromatic by up to 6 dB. The larger the set value, the stronger the achromatic effect.

3.10 Special-effect

This function has a special effect on the output image. Processing is performed in the ISP.

□ Defog (Command:CAM_Defog)

It is possible to improve the visibility of images under low contrast subject conditions such as dark fog.

Improvement effect image

Defog OFF

Defog ON

□ Effect (effect) (Command: CAM_PictureEffect)

Images can be output as Black &White (monochrome image).

□ Screen reverse

Up-down Reverse (E-flip) (Command: CAM_PictureFlip

Turn the camera's video output up and down.

Left-Right Reverse (Mirror) (Command: CAM_LR_Reverse)

Turn the camera video output to the right and left.

☐ **Freeze (Command: CAM_Freeze)**

One image can be captured and output continuously.

3.11 Privacy zone masking function

Privacy zone masks are functions for surveillance cameras to protect privacy-related locations. Masks privacy zones, such as windows and doorways, within the camera's field of view on the monitor so that they are not visible. By receiving VISCA commands tailored to changes in pan, tilt, and zoom, masking can be performed in three-dimensional spaces compatible with pan, tilt, and zoom.

Main specification

1. Mask can be set and displayed at up to 24 positions depending on the pan tilt position.
2. Each of the 24 masks can be individually turned on/off.
3. Color setting of 2/14 colors is possible for each of the 24 masks.
4. Pan/tilt/zoom interlock control
5. Pan/tilt non-interlock control

☐ Privacy Zone Setup Command List

Command Set	Command	Command Packet	Comments
CAM_PrivacyZone	SetMask	8x 01 04 76 mm nn 0r 0r 0s 0s FF	Mask Setting (Size) Please refer 「mm: Mask setting List」of 「Parameter」, 「nn: setting」and 「rr:w、ss:h」
	Display	8x 01 04 77 pp pp pp pp FF	Mask Display ON/OFF setting Please refer「pp pp pp pp: Mask bit 」of 「Parameter」 pp pp pp pp: Mask speficy（0:OFF、1:ON）
	SetMaskColor	8x 01 04 78 pp pp pp pp qq rr FF	Mask Color setting Please refer 「pp pp pp pp: Mask bit」of 「Parameter」and 「qq、rr: Color code 」 qq: Color setting when selecting Mask bit 0 rr: Color setting when selecting Mask bit 1
	SetPanTiltAngle	8x 01 04 79 0p 0p 0p 0q 0q 0q FF	set up Pan/Tilt angle Please refer 「Pan/Tilt angle setting」of 「Parameter」 ppp: Pan、ppp: Tilt
	SetPTZMask	8x 01 04 7B mm 0p 0p 0p 0q 0q 0q 0r 0r 0r 0r FF	Direct setting of Pan/Tilt／Zoom positions Please refer 「mm: Mask setting list」of 「Parameter」and 「Pan/Tilt angle setting 」 ppp: Pan、qqq: Tilt、rrr: Zoom
	Non_InterlockMask	8x 01 04 6F mm 0p 0p 0q 0q 0r 0r 0s 0s FF	Mask setting non-linked with Pan/Tilt Please refer 「mm: Mask setting List」of 「Parameter」and 「pp:x、qq:y、rr:w、ss:h」

☐ Privacy Zone Query Command List

Inquiry Command	Command Packet	Inwuiry Packet	Comments
CAM_PrivacyDisplayInq	8x 09 04 77 FF	y0 50 pp pp pp pp FF	Inquire Mask Display ON/OFF setting status Please refer の「pp pp pp pp: Mask bit」of 「Parameter」 1: On、0:Off
CAM_PrivacyPanTiltInq	8x 09 04 79 FF	y0 50 0p 0p 0p 0q 0q 0q FF	inquire current Pan/Tilt position setting information Please refer 「Pan/Tilt angle setting」of 「Parameter」 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	Inquire Pan/Tilt/Zoom position at mm Mask setting Please refer の「mm: Mask Setting List」of「Parameter」 and 「Pan/Tilt angle setting」 ppp: Pan、qqq: Tilt、rrrr: Zoom
CAM_PrivacyMonitorInq	8x 09 04 6F FF	y0 50 pp pp pp pp FF	Inquire the current displaying Mask Please refer 「pp pp pp pp: Mask bit」of 「Parameter」

☐ Parameter list

mm: Mask Settings List

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

The display priority of the mask changes from A (high) to X (low). Setting the non-interlocking mask is recommended to set a high-priority mask for matching.

nn: setting

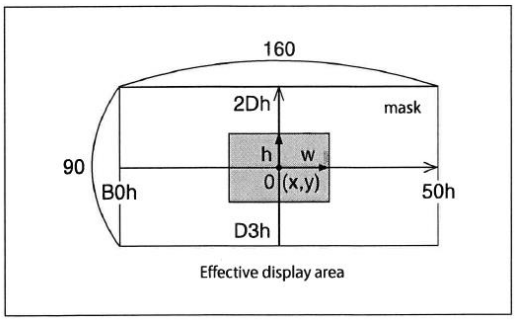
nn	Condition
00	Reset existing mask size
01	Set new mask size

pp pp pp pp: Mask bit

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

Set "-" to "0".

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



qq, rr: Color code

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

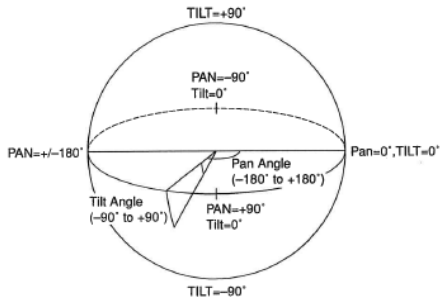
Pan/tilt angle setting

Setting pan/tilt angle

Angle/Parameter of Angle (ppp, qqq)

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

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



☐ **How to Use Each Command**

Set Mask

You can set a new mask or resize a configured mask.

Set the mask after displaying the subject at the center of the screen. With a value of "nn" of 1 the current pan/tilt/zoom position is stored in the internal memory. Value of "nn" of 0, the contents of the memory are not changed.

<Parameter Details>

mm: see "mm: Mask Settings List" in "mm: Mask Settings "Parameters"

nn: select whether to set a new mask or reset an existing mask "Parameter" "nn: Settings".

rr: set the value w of 1/2 of the mask width

ss: set the value h of 1/2 of the mask height, and set the "pp:x, qq:y, rr:w, ss:h " of the "Parameter"

Set Display

24 privacy zones are individually turned on/off by single VISCA commands. Privacy zone bits that you want to display are set to “1 “and privacy zone that you do not want to display are set to 0.

<Parameter Details>

pp pp pp pp: **24** Privacy Zones response to each bits and see "pp pp pp pp: Mask Bits" in " Parameters "

Set Mask Color

You can select two different mask colors. Selected two colors can be assigned individually.

If the bits (pp pp pp pp) of the parameters are 0, the color of the mask is the color of the color code “qq”. If the bits (pp pp pp pp) of the parameters are 1, the mask color is the color of the color code "rr".

<Parameter Details>

pp pp pp pp**: 24** Privacy Zones response to each bits and see "pp pp pp pp: Mask Bits" in " Parameters "

qq: Set color code

rr: Set Color Code, see "qq, rr: Color Code" in Parameter

Set PanTilt Angle

Sets the current pan and tilt angles.

<Parameter Details>

ppp: pan angle

qqq: tilt angle

See "Pan/Tilt Angle Settings" in "Parameters"

Set PTZ Mask

You can use the command to set the pan and tilt angles and the zoom position to the desired position. When setting the angle, please specify that the pan/tilt position is set at the center of the camera.

<Parameter Details>

mm: configure mask, see "mm: Mask Configuration List" in "Parameters"

ppp: pan angle (000-FFF)

qqq: tilt angle (000-FFF)

See "Pan/Tilt Angle Settings" in "Parameters"

rrrr: Zooming position (000 to 4000)

Non Interlock Mask

This is set when you do not want the mask to be interlocked with pan/tilt. If Non Interlock Mask commands and Set Mask commands are configured for the same masks, then later configured command is enabled.

<Parameter Details>

mm: Configure mask, see "mm: Mask Configuration List" in "Parameters"

pp: Set the center position x of the mask on the screen

qq: Set the center position y of the mask on the screen

rr: Sets the value w of 1/2 of the mask width

ss: Set the value h of 1/2 of the mask height

See pp:x, qq:y, rr:w, ss:h in Parameters

3.12 Other functions

□ Temperature read function (Inquiry Command: CAM_TempInq)

The thermistor value attached to the lens barrel can be read. By using this value, you can know the temperature inside the camera.

NOTE) Thermistor values vary from individual to individual.

Calibration with actual temperature is necessary.

□ Title (Command: CAM MultiLineTitle)

The title display can be set up to 12 lines with 20 characters per line. By each line you can set the ON/OFF, level starting position, flashing, font size, and font color.

By entering "F" on the display ON/OFF, all lines are displayed ON/OFF at the same time.

Title Set1 Command															
8x	01	04	73	1L	00	nn	0p	0q	00	00	00	00	00	00	FF
L	: line number [0x00 - 0x0B]														
nn	: H-position [nn x 20 pix, nn=0～5F]														
p	: Color														
q	: Blink & font size														

Color	
Value	Color
0x0	WHITE
0x1	YELLOW
0x2	VIOLET
0x3	RED
0x4	CYAN
0x5	GREEN
0x6	BLUE

Blink & Font size		
Value	Blink	Font Size
0x0	OFF	Tiny
0x1	ON	Tiny
0x2	OFF	Small
0x3	ON	Small
0x4	OFF	Medium
0x5	ON	Medium
0x6	OFF	Large
0x7	ON	Large

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	“	:	‘	.	,	/	-

□ **Register setting (Command: CAM_RegisterValue)**

The Register Settings command allows you to change the settings of the camera's internal parameters.

VISCA communication baud rate (Address = 00)

You can change the VISCA communication baud rate.

0=9600bps, 1=19200bps, 2=38400bps, 3=115200bps

Output Signal Format Setting (Address = 72)

You can set the output signal format. CVBS/NTSC and CVBS/PAL are output from the VBS_OUT terminal.

01=1080/30p, 02=1080/25p, 03=1080/60i, 04=1080/50i, 05=720/60p,
06=720/50p, 07=1080/60p, 08=1080/50p, 09=1080/59.94p, 0A=1080/59,94i
0D=CVBS/NTSC, 0E= CVBS/PAL

Small aperture countermeasure F-value setting (Address = 79)

You can change the small aperture limiter value set in the AE operation.

04=F16, 05=F14, 06=F11, 07=F9.6, 08=F8.0

Max. open F setting (Address=7A)

Maximum open F value can be set during AE operation.

09=F6.8, 0A=F5.6, 0B=F4.8, 0C=F4.0, 0D=F3.4, 0E=F2.8, 0F=F2.4, 10=F2.0,
11=F1.6

Minimum Shutter Speed Setting (Address=7B)

You can set the minimum shutter speed (shorten the accumulation time) during AE operation.

0B=1/250or215, 0C=1/350or300, 0D=1/500or425, 0E=1/725or600, 0F=1/1000,
10=1/1500or1250, 11=1/2000or1750, 12=1/3000or1/2500, 13=1/4000or3500,
14=1/6000, 15=1/10000

Max. Shutter Speed Setting (Address=7C)

You can set the maximum shutter speed (increase the accumulation time) during AE operation.

0=1/1, 1=1/2, 2=1/4or3 3=1/8or6, 4=1/15or12, 5=1/30or25, 6=1/60or50,
7=1/90or75

□ **Position Preset(Command:CAM_Memory)**

You can preset the camera settings in 16 ways.

Reset

Clear the specified memory.

Set

Saves the current setting to the specified memory.

Recall

Reads the settings from the specified memory.

The following items can be saved in the camera's internal memory.

- Zoom position
- Digital ZOOM position
- Focusing Auto/Manual
- Focus position
- AE mode
- Automatic Flicker Determination On/Off
- Shutter control value
- Iris control value
- Gain control value
- Exposure compensation On/Off
- Exposure-level
- Backlight correction On and Off
- Slow shutter Auto/Manual
- AE Response
- White balance mode
- R/B gain
- One Push WB data
- Contour enhancement level
- WD On, Off
- Defog On, Off
- Gamma
- ePT

NOTE) In general, the number of rewriting semiconductor memory is limited by the component specifications.

□ **Initialization (custom preset) (Command: CAM_CUSTOM)**

Camera operation can be started with preset settings when the power is turned on.

You can save parameters other than those set by register setting.

Reset

Clear saved data.

Set

Saves the current configuration data.

Recall

Reads saved data.

set up parameters	Initial settings (Factory settings)	set up parameters	Initial settings (Factory settings)
Zoom Position	Wide end	SpotAE Position Setting	X: 0x08, Y: 0x07
D-Zoom ON/OFF	OFF	ICR	OFF
D-Zoom Separate/Combine	Combine	Auto ICR ON/OFF	OFF
D-Zoom Position	x1	AutoICR Threshold	0x48
Focus Position	Infinity	Aperture Level	0x07
Focus Auto/Manual	Auto	LR Reverse On/Off	OFF
Near Limit Setting	30cm	Picture Effect	OFF
AF Sensitivity	Normal	NR Level	0x33 (Middle)
AF Mode	Normal AF	Gain Limit	0x19 (+48dB)
AF Run Time	5秒	Low - Illumination Chroma Suppress	0x03 (-6dB)
AF Interval	5秒	Color Gain	0x04 (100%)
WB Mode ATW1	ATW	Color Hue	0x07 (0 degree)
WB Data (Rgain, Bgain)	-	Title Display On/Off	OFF
One Push WB Data	-	Title Setting	
AE Mode	Full Auto	Mask Setting	
AE Response	0x10 (0x01 - 0x30)	Mask Display On/Off	OFF
WD On/Off	OFF	Mask Color Setting	
Defog On/Off	OFF	E - Flip On/Off	OFF
Slow Shutter Mode	Manual	Mute ON/OFF	OFF
Slow Shutter Limit	0x04	Privacy Zone On/Off	OFF
Shutter Position	0x06 (1/60 or 1/50)	Privacy Zone Setting	
Iris Position	Iris Open	ZoomPos Continuous Output On/Off	OFF
Gain Position	Gain Min.	ZoomPos Continuous Output Interval	0x3C (60 frames)
Exposure Compensation On/Off	OFF	Gamma	0 : Standard
Exposure Compensation Amount	0x07 (0dB)	e-PT ON/OFF	ON
BackLight Compensation On/Off	OFF		
SpotAE On/Off	OFF		

3.13 Mode condition

The VISCA setting condition is as follows.

Because some combinations are not capable of delivering performance depending on the setting conditions, please note the followings.

<How to read Table>

○: Accept the command

×：Syntax Error or Command not Executable

General

Mode	During initials	Power On	Freeze On	MemRecall	Trigger mode On
Address Set	○	○	○	○	○
IF_Clear	○	○	○	○	○
Command Cancel	○	○	○	○	○

Lens

Mode	During initials	Power On	Freeze ON	Mem Recall	Trigger mode ON	ZOOM Direct	Focus Direct	Focus Auto
Zoom Tele/Wide/Stop	x	○	○	x	x	x	○	○
Zoom Direct	x	○	○	x	x	○	○	○
DZoom On/Off	x	○	○	x	x	x	○	○
Dzoom Separate/Combine	x	○	○	x	x	x	○	○
Dzoom Tele/Wide/Stop	x	○	○	x	x	x	○	○
Dzoom Direct	x	○	○	x	x	○	○	○
Focus Far/Near/Stop	x	○	○	x	x	○	x	x
Focus Direct	x	○	○	x	x	○	○	x
Focus Auto/Manual	x	○	○	x	x	○	x	○
AF OnePush Trigger	x	○	○	x	x	○	x	x
Focus Infinity	x	○	○	x	x	○	x	○
Focusnearlimit	x	○	○	x	x	○	x	○
AF Sensitivirity Normal/Low	x	○	○	x	x	○	○	○
AF Mode Normal/Interval/Zoom	x	○	○	x	x	○	○	○
AF Active/IntervalTime	x	○	○	x	x	○	○	○
IR Correction Standard/IR Light	x	○	○	x	x	○	○	○
Initialize Lens/Cam	x	○	○	x	x	x	x	○
CAM_Memory set/Reset	x	○	○	x	x	x	x	○
CAM_Memory Recall	x	○	○	x	x	x	x	○

White balancing

Mode	During iinitials	Power On	Freeze On	Mem Recall	Trigger mode ON	WB AUTO	Indoor	Outdoor	One push	Manual
WB Mode switch	x	○	○	x	x	○	○	○	○	○
One Push Trigger	x	○	○	x	x	x	x	x	○	x
R gain	x	○	○	x	x	x	x	x	x	○
B gain	x	○	○	x	x	x	x	x	x	○

Exposed

Mode	During initials	Power On	Freeze On	Mem Recall	Trigger mode ON	AE FullAUTO	AE Manual	Shutter Priority	Iris Priority	WD
AE Full Auto	x	○	○	x	x	-	○	○	○	○
AE Manual	x	○	○	x	x	○	-	○	○	○
Shutter Priority	x	○	○	x	x	○	○	-	○	○
Iris Priority	x	○	○	x	x	○	○	○	-	○
Shutter Up/Down/Reset	x	○	○	x	x	○	○	○	○	○
Shutter Direct	x	○	○	x	x	○	○	○	○	○
Iris Up/Down/Reset	x	○	○	x	x	○	○	○	○	○
IRIS Direct	x	○	○	x	x	○	○	○	○	○
Gain Up/Down/Reset	x	○	○	x	x	○	○	○	○	○
Gain Direct	x	○	○	x	x	○	○	○	○	○
ICR On/Off	x	○	○	x	x	○	○	○	○	○
Auto ICR On/Off	x	○	○	x	x	○	○	○	○	○
Auto ICR Threshold	x	○	○	x	x	○	○	○	○	○
ExpComp On/Off	x	○	○	x	x	○	○	○	○	○
ExpComp Up/Down/Reset	x	○	○	x	x	○	○	○	○	○
ExpComp Direct	x	○	○	x	x	○	○	○	○	○
LightAdjust On/Off	x	○	○	x	x	○	○	○	○	○
SpotAE On/Off	x	○	○	x	x	○	○	○	○	○
SpotAE Position	x	○	○	x	x	○	○	○	○	○
WD On/Off	x	○	○	x	x	○	○	○	○	○

Other

Mode	During initials	Power On	Freeze On	MemRecall	Trigger modeON	Stabilizer On
ImageStabilizer On/Off	x	○	○	x	x	○
Defog On/Off	x	○	○	x	x	○
Aperture Up/Down/Reset	x	○	○	x	x	○
Aperture Direct	x	○	○	x	x	○
NR	x	○	○	x	x	○
Gamma	x	○	○	x	x	○
LR_Reverse On/Off	x	○	○	x	x	○
Freeze On/Off	x	○	○	x	x	○
PictureEffect Off/B&W	x	○	○	x	x	○
PictureFlip On/Off	x	○	○	x	x	○
MultiLineTitle On/Off	x	○	○	x	x	○
MultiLineTitle Set/Clear	x	○	○	x	x	○
Mute On/Off	x	○	○	x	x	○
PrivacyZone	x	○	○	x	x	○
ChromaSuppress	x	○	○	x	x	○
ColorGain	x	○	○	x	x	○
ColorHue	x	○	○	x	x	○
Trigger-StillImage On/Off	x	○	○	x	○	○
StillImage-Output(need to confirm communication)	x	○	○	x	x	○
CAM_TriggerSignal and Exposure	x	○	○	x	x	○
StillImage-ExpCorrect(need to confirm communication)	x	○	○	x	x	○
ePT	x	○	○	x	x	x

4. VISCA Command

4.1 VISCA/RS-232 commands

By operating the RS-232C control software created based on this command list, TAMRON is not guaranteed on your hardware/software malfunctions and damages

4.2 VISCA outline

In VISCA, the side that issues commands such as computers is called the controller, and the side that receives commands such as cameras is called the peripheral device. ・ Communication rate: 9. 6 kbps, 19. 2 kbps, 38. 4 kbps, 115. 2 kbps. VISCA uses RS-232 compliant communication to connect the camera module to the controller. RS-232 The parameters are as follows:

- Data bits: 8 bits
- Start bit: 1-bit
- Stop bit: 1-bit
- Non Parity

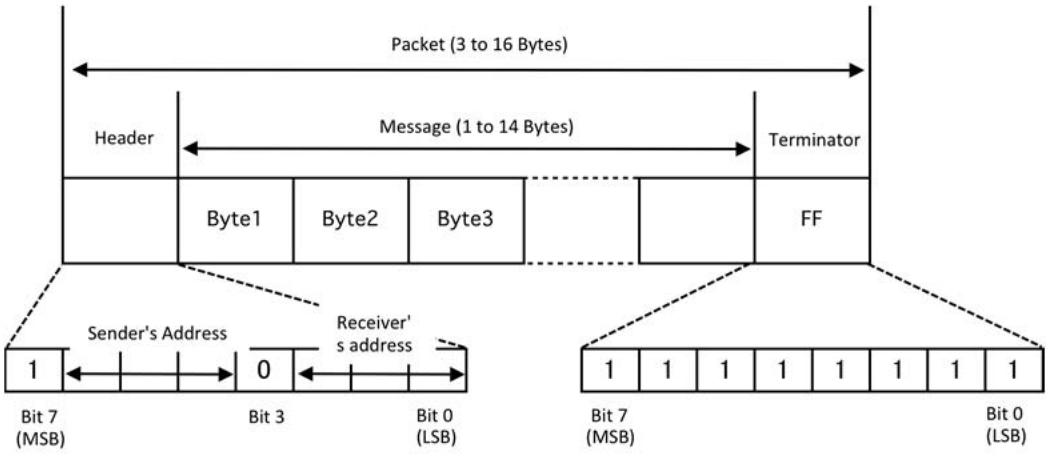
Flow-control using XON/XOFF or RTS/CTS is not supported

※ "VISCA" is a trademark of Sony Corporation.

4.3 VISCA communication format

☐ **Structures of VISCA Packets**

The basic units of VISCA communication are called Packet. The first byte of Packet is called a Header and contains the address of the source and destination. For example, Header of Packet sent from the controller at address 0 to the camera at address 1 is 81 (H) in hexadecimal. Packet sent to the camera at address 2 is 82 (H). In the command list table, Header is 8X. Please put the address of the camera in the X part. In addition, Header of the answering Packet from the cameras at address 1 is 90 (H). Packet from cameras with address 2 is A0(H). Some camera settings commands can be sent to all devices at once (broadcast). For broadcasts, Header is assumed to be 88(H) in hexadecimal. Terminator is FF(H) to indicate the end of packets.



□ Commands and queries

Commands (Command)

Instruct the camera to operate.

Inquiry (Inquiry)

This is used to check the status of the 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(Camera1), 06(Pan/Tilter), 07(Camera2)

X = 1 to 7: camera address

□ Response to commands and queries

ACK messages (ACK Message)

The camera returns when it receives the command. In the case of messages for inquiries ACK is not returned.

Completion messages (Completion Message)

Returns by the camera when you finish executing a command or query. If Command is inquiry, the response data to the inquiry is entered in the third byte or later of the packet. If ACK messages are omitted, the socket number will contain 0.

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

X = 9 to F: Camera address + 8

Error message (Error Message)

Returns an error message instead of a message if the command or query instruction cannot be executed or fails to execute

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: camera address + 8, Y = socket number

□ Socket number

Generally, after sending a command message, the system waits for the return of a complete or error message and sends the next command message. To realize more advanced communication, this camera has two sets of buffers (memories) for commands so that up to two commands can be received, including the commands being executed. When the camera receives a command, the camera uses the socket number of ACK message to indicate which command buffer was used. The socket number is also attached to the completion message or error message, so you can know which command has ended. Camera management commands and some inquiry messages can be executed even when both command buffers are used. No ACK message is returned for these commands or queries, and only the completion message of socket number 0 is returned.

4.4 Device setting command

Be sure to send as broadcast the AddressSet and IF_Clear commands prior to starting control.

☐ For managing VISCA networks

AddressSet Command

Set the address of the peripheral device. This command is used when initializing the network or receiving the following network change message

Network Change

Content from peripheral devices when devices in the network are removed or added

This command is sent from the peripheral device to the controller. When this message is received, you need reconfigure the address.

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

X = 9 to F: camera address + 8

☐VISCA interface commands

IF_Clear Command

Clears the command buffer in the camera and suspends the instruction 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: Addresses of cameras (for Inquiry packet)

X = 9 to F: Addresses of cameras + 8 (for reply packet)

☐ VISCA interface inquiry

CAM_VersionInq

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 (0023: TAMRON) HHHH = Model ID **(F011 : MP1010M-VC)** **JJJJ = ROM revision**

KK = Maximum socket #(02)

X = 1 to 7: Addresses of cameras (for Inquiry packet)

Y = 9 to F: Addresses of cameras + 8 (for reply packet)

4.5 VISCA command and ACK protocols

Command	Command Message	Reply Message	comments
General command	81 01 04 38 02 FF (Example)	90 41 FF (ACK)+90 51 FF (Completion) 90 42 FF 90 52 FF	It returns ACK upon receiipt of the command and Completion upon completion of execution of the command.
	81 01 04 38 FF (Example)	90 60 02 FF (Syntax Error)	An unsupported command or a command with insufficient parameters was accepted.
	81 01 04 38 02 FF (Example)	90 60 03 FF (Command Buffer Full)	There were two commands in progress and we could not accept them.
	81 01 04 08 02 FF (Example)	90 61 41 FF (Command Not Executable) 90 62 41FF	The existing mode could not execute the command.
Inquiry command	81 09 04 38 FF (Example)	90 50 02 FF (Completion)	The inquiry command does not return ACK
	81 09 05 38 FF (Example)	90 60 02 FF (Syntax Error)	An unsupported command was accepted.
Address Set	88 30 01 FF	88 30 02 FF	The instrument address is returned + 1.
IF_Clear(Broadcast)	88 01 00 01 FF	88 01 00 01 FF	The same command is returned
IF_Clear（x に対して）	**Not Support**		
Command Cancel			has already been completed.

4. Messages from 6VISCA cameras

☐ ACK/ completion messages

	Command Message	comments
ACK	z0 4y FF (y:Socket No.)	returned when command was accepted
Completion	z0 5y FF (y:Socket No.)	Returned upon completion of command execution.

z = 9-F: Equipment Address+8

☐ Error message

	Command Message	comments
Syntax Error	z0 60 02 FF	It is returned when the command format is wrong or an invalid command parameter is received.
Command Buffer Full	z0 60 03 FF	Indicates that two sockets were already in use (while executing two commands) and that the command could not be accepted when another command was received.
Command Canceled	z0 6y 04 FF (y:Socket No.)	Returned when the command being executed is canceled on the socket specified by the cancel command. The completion message of the command being executed is not returned.
No Socket	z0 6y 05 FF (y:Socket No.)	Returned when there is no command being executed for the socket specified by the cancel command or when an invalid socket number is specified.
Command Not Executable	z0 6y 41 FF (y:Socket No.)	Depending on the condition, returned when an inoperable command is received. For example, during autofocus, when receiving a command to control focus manually.

z = 9-F: Equipment Address+8

☐ Network change message

	Command Message	comments
Network Change	z0 38 FF	Issued when power is supplied to the camera.

z = 9-F: Equipment Address+8

4. 7VISCA Command List

☐ Command list (1/3)

Command Set	Command	Command Packet																Comments & Initial settings	Initial setting	Initial Value
		H	1	2	3	4	5	6	7	8	9	10	11	12	13	14	T			
AddressSet	-	88	30	01	FF													Address setting	-	0x01
IF_Clear	-	88	01	00	01	FF												I/F Clear	-	-
CAM_Zoom	Stop	8x	01	04	07	00	FF											Zoom Stop	-	-
	Tele (Variable)	8x	01	04	07	2p	FF											Variable zoom p=0 (Slow) to 7 (Fast) Refer to Appendix Zoom Parameter	Wide-end	-
	Wide (Variable)	8x	01	04	07	3p	FF													-
	Direct	8x	01	04	47	0p	0q	0r	0s	FF								Move to the designated zoom position p,q,r,s=0000(Wide) p,q,r,s=4000(Tele)	-	-
CAM_DZoom	On	8x	01	04	06	02	FF											D-Zoom ON	OFF	-
	Off	8x	01	04	06	03	FF											D-Zoom OFF		-
	Clear Image Zoom	8x	01	04	06	04	FF											D-ZOOM Clear	-	-
	Combine Mode	8x	01	04	36	00	FF											Opt.Zoom -> Digital Zoom	Combine	-
	Separate Mode	8x	01	04	36	01	FF											Digital Zoom Only		-
	Stop	8x	01	04	06	00	FF											D-Zoom Stop	-	-
	Tele (Variable)	8x	01	04	06	2p	FF											Variable D-zoom (x1 to 16) p=0（Slow）～7（Fast）	x1	-
	Wide (Variable)	8x	01	04	06	3p	FF													-
	Direct	8x	01	04	46	00	00	0p	0q	FF								Set the designated magnification p,q=40 (x1) p,q=7C (x16)	-	-
CAM_Focus	Stop	8x	01	04	08	00	FF											Focus Stop	-	-
	Far (Variable)	8x	01	04	08	2p	FF											p=0 (Slow) to 7 (Fast)	-	-
	Near (Variable)	8x	01	04	08	3p	FF												-	-
	Direct	8x	01	04	48	0p	0q	0r	0s	FF								Move to the designated focus position p,q,r,s=1000(far) p,q,r,s=C000(near)	-	-
	Auto Focus	8x	01	04	38	02	FF											Auto focus/Manual focus	Auto Focus	-
	Manual Focus	8x	01	04	38	03	FF													-
	One Push Trigger	8x	01	04	18	01	FF											One Push focus scan	-	-
	Infinity	8x	01	04	18	02	FF											Move to infinity position	-	-
	Near Limit	8x	01	04	28	0p	0q	0r	0s	FF								Set Focus Near Limit Position	30cm	p=B, q=0 r=0,s=0
AF Sensitivity	Normal	8x	01	04	58	02	FF											Choice of the AF sensitivity	Normal	-
	Low	8x	01	04	58	03	FF													-
CAM_AFMode	Normal AF	8x	01	04	57	00	FF											Choice of the AF Mode	Normal AF	-
	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								Set the active and interval time of the Interval AF mode	Active 5Sec Interval 5Sec	p=0,q=5 r=0,s=5
CAM_IRCorrection	Standard	8x	01	04	11	00	FF											Visible light mode	Standard	-
	IR Light	8x	01	04	11	01	FF											IR light mode		-
CAM_Initialize	Lens	8x	01	04	19	01	FF											Lens Initialization	-	-
	Camera	8x	01	04	19	03	FF											Camera reset (ISP Cam-App restart)	-	-
CAM_ImageStabilizer	On	8x	01	04	34	02	FF											Image stabilizer On	OFF	-
	Off	8x	01	04	34	03	FF											Image stabilizer Off		-
	Hold	8x	01	04	34	04	FF											Image stabilizer Hold		
CAM_WB	Auto	8x	01	04	35	00	FF											Standard Auto	Auto	-
	Indoor	8x	01	04	35	01	FF											Indoor mode approximately 3200k		-
	Outdoor	8x	01	04	35	02	FF											Outdoor mode approximately 5800k		-
	One Push WB	8x	01	04	35	03	FF											One push WB mode		-
	Manual	8x	01	04	35	05	FF											Manual WB		-
	One Push Trigger	8x	01	04	10	05	FF											Loading the white balance data	-	-
CAM_RGain	Reset	8x	01	04	03	00	FF											R Gain Reset	-	-
	Up	8x	01	04	03	02	FF											R Gain UP		-
	Down	8x	01	04	03	03	FF											R Gain Down		-
	Direct	8x	01	04	43	00	00	0p	0q	FF								Set the designated R Gain	App. 5800k	-
CAM_BGain	Reset	8x	01	04	04	00	FF											B Gain Reset	-	-
	Up	8x	01	04	04	02	FF											B Gain UP		-
	Down	8x	01	04	04	03	FF											B Gain Down		-
	Direct	8x	01	04	44	00	00	0p	0q	FF								Set the designated B Gain	App. 5800k	-
CAM_AE	Full Auto	8x	01	04	39	00	FF											Auto Exposure	Full Auto	-
	Manual	8x	01	04	39	03	FF											Manual AE mode		-
	Shutter Priority	8x	01	04	39	0A	FF											Shutter Priority AE mode		-
	Iris Priority	8x	01	04	39	0B	FF											Iris Priority AE mode		-
CAM_SlowShutter	Auto	8x	01	04	5A	02	FF											Auto Slow Shutter ON	OFF	-
	Manual	8x	01	04	5A	03	FF											Auto Slow Shutter OFF		-
	Limit	8x	01	05	5A	0p	0q	FF										Set the Slow Shutter Limit	1/15	p=0,q=4
CAM_Shutter	Reset	8x	01	04	0A	00	FF											Shutter speed reset	-	-
	Up	8x	01	04	0A	02	FF											Shutter speed Up/Down	-	-
	Down	8x	01	04	0A	03	FF												-	-
	Direct	8x	01	04	4A	00	00	0p	0q	FF								Set the shutter Speed Refer to Appendix AE Parameter	1/60	p=0,q=6
CAM_Iris	Reset	8x	01	04	0B	00	FF											Iris position reset	-	-
	Up	8x	01	04	0B	02	FF											Iris position Up/Down	-	-
	Down	8x	01	04	0B	03	FF												-	-
	Direct	8x	01	04	4B	00	00	0p	0q	FF								Set the Iris position Refer to Appendix AE Parameter	Open	p=1,q=1

□ Command list (2/3)

CAM_Gain	Reset	8x	01	04	0C	00	FF											Gain reset	-	-
	Up	8x	01	04	0C	02	FF											Gain Up/Down	-	-
	Down	8x	01	04	0C	03	FF												-	-
	Direct	8x	01	04	4C	00	00	0p	0q	FF								Set the Gain Refer to Appendix AE Parameter	0dB	p=0,q=1
	Gain Limit	8x	01	04	2C	pq	FF											Set the Gain limit	48dB	pq=19
CAM_ExpComp	On	8x	01	04	3E	02	FF											Exposure correction ON/OFF	OFF	-
	Off	8x	01	04	3E	03	FF													-
	Reset	8x	01	04	0E	00	FF											Exposure correction reset	-	-
	Up	8x	01	04	0E	02	FF											Exposure correction Up/Down	-	-
	Down	8x	01	04	0E	03	FF												-	-
	Direct	8x	01	04	4E	00	00	0p	0q	FF								Set the Exposure correction Refer to AE Parameter	Standard	p=0,q=7
CAM_LightAdjust	On	8x	01	04	33	02	FF											Backlight correction ON/OFF	OFF	-
	Off	8x	01	04	33	03	FF													-
CAM_SpotAE	On	8x	01	04	59	02	FF											Spot AE mode ON/OFF	OFF	-
	Off	8x	01	04	59	03	FF													-
	Position	8x	01	04	29	0p	0q	0r	0s	FF								X（00～10）、Y（00～0E）	Center	p=0,q=8 r=0,s=7
CAM_Flicker	On	8x	01	04	09	02	FF											Flicker cancellation ON/OFF	OFF	-
	Off	8x	01	04	09	03	FF													-
CAM_AE_Response	Direct	8x	01	04	5D	pp	FF											Set the AE response speed p,q= 01 to 30	Standard	10
CAM_WD	On	8x	01	04	3D	02	FF											Wide Dynamic Range ON/OFF	OFF	-
	Off	8x	01	04	3D	03	FF													-
CAM_Defog	On	8x	01	04	37	02	00	FF										Defog ON/OFF	OFF	-
	Off	8x	01	04	37	03	00	FF												-
CAM_Aperture	Reset	8x	01	04	02	00	FF											Aperture level reset	-	-
	Up	8x	01	04	02	02	FF											Aperture level Up/Down	-	-
	Down	8x	01	04	02	03	FF												-	-
	Direct	8x	01	04	42	00	00	0p	0q	FF								Set the aperture level 00=Min, 0F=Max	Standard	pq=07
CAM_NR	-	8x	01	04	53	pq	FF											Set the noise reduction level p,q=0(Min), p,q=5(Max)	Standard	pq=33
CAM_Gamma	-	8x	01	04	5B	0p	FF											Select Gamma curve 0:standard,1:straight, 2: narrow, 3:wide	Standard	p=0
CAM_LR_Reverse	On	8x	01	04	61	02	FF											LR reverse ON/OFF	OFF	-
	Off	8x	01	04	61	03	FF													-
CAM_Freeze	On	8x	01	04	62	02	FF											Image fixing mode ON/OFF	OFF	-
	Off	8x	01	04	62	03	FF													-
CAM_PictureEffect	Off	8x	01	04	63	00	FF											Picture effect ON/OFF	OFF	-
	B&W	8x	01	04	63	04	FF													-
CAM_PictureFlip	On	8x	01	04	66	02	FF											Picture rotation ON/OFF	OFF	-
	Off	8x	01	04	66	03	FF													-
CAM_ICR	On	8x	01	04	01	02	FF											ICR Mode On/Off	OFF	-
	Off	8x	01	04	01	03	FF													-
CAM_AutoICR	On	8x	01	04	51	02	FF											Auto ICR ON/OFF	OFF	-
	Off	8x	01	04	51	03	FF													-
	Threshold	8x	01	04	21	00	00	0p	0q	FF								pq: ICR On →Off Threshold Level (00h to FFh)	-	p=4,q=8
CAM_Memory	Reset	8x	01	04	3F	00	0p	FF										Memory data reset p=0～F	-	-
	Set	8x	01	04	3F	01	0p	FF										Keep the VISCA setting data p=0～F	-	-
	Recall	8x	01	04	3F	02	0p	FF										Recall the memory data p=0～F	-	-
CAM_CUSTOM	Reset	8x	01	04	3F	00	7F	FF										Customize data reset	-	-
	Set	8x	01	04	3F	01	7F	FF										Customize the initial setting	-	-
	Recall	8x	01	04	3F	02	7F	FF										Recall the customize data	-	-
CAM_MultiLineTitle	Title Set1	8x	01	04	73	1L	00	nn	0p	0q	00	00	00	00	00	00	FF	Title Setting 1 L=0 to B (Line number) nn=0 to 5F (H-position) p=Color q=Blink&font size Refer to Appendix Title Setting	-	-
	Title Set2	8x	01	04	73	2L	mm	nn	pp	qq	rr	ss	tt	uu	vv	ww	FF	Title Setting 2 L=0 to B (Line number) m,n,p,q,r,s,t,u,v,w; Character setting (1-10 line)	-	-
	Title Set3	8x	01	04	73	3L	mm	nn	pp	qq	rr	ss	tt	uu	vv	ww	FF	Title Setting 3 L=0 to B (Line number) m,n,p,q,r,s,t,u,v,w; Character setting (11-20 line)	-	-
	Title Clear	8x	01	04	74	1p	FF											Title setting clear p=0 to B (Line number) p=F All lines	-	-
	On	8x	01	04	74	2p	FF											Title ON/OFF p=0 to B (Line number) p=F All lines	OFF	-
	Off	8x	01	04	74	3p	FF													-
CAM_Mute	On	8x	01	04	75	02	FF											Image mute ON/OFF Image mute: Blue	OFF	-
	Off	8x	01	04	75	03	FF													-
	On/Off(Toggle)	8x	01	04	75	10	FF													-

☐ Command list (3/3)

CAM_PrivacyZone	SetMask	8x	01	04	76	mm	nn	0r	0r	0s	0s	FF						Mask Index and size setting Refer to Appendix Mask Parameter	-	-
	Display	8x	01	04	77	pp	pp	pp	pp	FF								Mask Display ON/OFF Refer to Appendix Mask Parameter	OFF	
	SetMaskColor	8x	01	04	78	pp	pp	pp	pp	qq	rr	FF						Mask color setting Refer to Appendix Mask Parameter	-	-
	SetPanTiltAngle	8x	01	04	79	0p	0p	0p	0q	0q	0q	FF						Set Pan Tilt angle Refer to Appendix Mask Parameter	-	-
	SetPTZMask	8x	01	04	7B	mm	0p	0p	0p	0q	0q	0q	0r	0r	0r	0r	FF	Pan, Tilt and Zoom setting for the mask mm: Mask index, ppp: Pan(000 to FFF), qqq: Tilt(000 to FFF), rrrr: Zoom(0000 to 4000)	-	-
	Non_InterlockMask	8x	01	04	6F	mm	0p	0p	0q	0q	0r	0r	0s	0s	FF			Non-interlock mask setting mm: Mask index, pp: X, qq: Y, rr: W, ss: H Refer to Appendix Mask Parameter	-	-
CAM_Continuous ZoomPosReply	On	8x	01	04	69	02	FF											Continuous output of zoom position data ON/OFF	OFF	-
	Off	8x	01	04	69	03	FF													-
	ReplyIntervalTimeSet	8x	01	04	6A	00	00	0p	0p	FF								Interval Time [Vertical timing]	-	0x3C
CAM_RegisterValue	-	8x	01	04	24	mm	0p	0q	FF									mm: resister No(00~7F) Refer to Register Setting	Baud rate: 9600bps Signal format: 1080/60p Iris Close Limit F11 Iris Open Limit Open Minimum shutter speed: 1/10000 Maximum shutter speed: 1/1	mm;00 p=0,q= 0 mm;72 p=0,q=7 mm;79 p=0,q=6 mm;7A p=1,q=1 mm;7B p=1,q=5 mm;7C p=0,q=0
		8x	01	04	24	7D	0p	0q	FF									Restore See Appendix Register data		p=0,q=0
CAM_ChromaSuppress	-	8x	01	04	5F	0p	FF											Set the Chroma Suppress value p;0(0dB) to 3(-6dB)	-	p=03
CAM_ColorGain	Direct	8x	01	04	49	00	00	00	0p	FF								Color Gain Setting p:0 (60%) to E (200%)	-	p=4
CAM_ColorHue	Direct	8x	01	04	4F	00	00	00	0p	FF								Color Hue Setting p= 0 (-14 degrees) to E (+14 degrees)	-	p=7
CAM_Reboot	Direct	8x	01	04	7F	00	00	00	00	FF								Linux Reboot	-	-
CAM_Trigger-StillImage	Off	8x	01	04	80	03	00	00	FF									Trigger-still Image mode ON/OFF	OFF	-
	On（Standard）	8x	01	04	80	02	00	00	FF											-
	On（Continuous shooting）	8x	01	04	80	0A	0p	0q	FF									Continuous shooting mode Refer to Appendix Continuous shooting parameter	-	-
CAM_TriggerSignal and Exposure	Customer Setting	8x	01	04	8B	05	FF											Capture timing and exposure are controlled by Trigger Pulse (Iris;open, Gain;0dB)	Edge Detection Auto	-
	Edge Detection Auto	8x	01	04	8B	00	FF											Capture timing is controlled by the Trigger Pulse Auto Exposure		-
CAM_StillImage-ExpCorrect	Direct	8x	01	04	84	01	00	0p	FF									Exposure correction on the Edge Detection Auto mode p=08(center) ±6Step(2dB)	-	p=8
CAM_ePT	ON	8x	01	7E	06	00	02	FF										ePT ON/OFF	ON	-
	OFF	8x	01	7E	06	00	03	FF												-
	Absolute Position	8x	01	7E	06	20	00	00	0p	0q	0r	0s	FF					Change the read out position Horizontal pixel:±64 Vertical pixel:±36 (Two pixels of units)		

□ Inquiry command (1/2)

Inquiry Command	H	1	2	3	4	5	H	1	2	3	4	5	6	7	8	9	10	11	12	13	14	T	Command
CAM_PowerInq	8x	09	04	00	FF		y0	50	02	FF													On
CAM_ZoomPosInq	8x	09	04	47	FF		y0	50	0p	0q	0r	0s	FF										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: Active Time, rs: Interval Time
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													In Door
							y0	50	02	FF													Out Door
							y0	50	03	FF													One Push WB
							y0	50	05	FF													Manual
CAM_RGainInq	8x	09	04	43	FF		y0	50	00	00	0p	0q	FF										pq: R Gain
CAM_BGainInq	8x	09	04	44	FF		y0	50	00	00	0p	0q	FF										pq: B Gain
CAM_AEModeInq	8x	09	04	39	FF		y0	50	00	FF													Full Auto
							y0	50	03	FF													Manual
							y0	50	0A	FF													Shutter Priority
							y0	50	0B	FF													Iris Priority
CAM_SlowShutterModeInq	8x	09	04	5A	FF		y0	50	02	FF													Auto
							y0	50	03	FF													Manual
CAM_SlowShutterLimitInq	8x	09	05	5A	FF		y0	50	0p	0q	FF												pq: Slow Shutter Limit
CAM_ShutterPosInq	8x	09	04	4A	FF		y0	50	00	00	0p	0q	FF										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	pq	FF													p: Gain Limit
CAM_ExpCompModeInq	8x	09	04	3E	FF		y0	50	02	FF													On
							y0	50	03	FF													Off
CAM_ExpCompPosInq	8x	09	04	4E	FF		y0	50	00	00	0p	0q	FF										pq: ExpComp Position
CAM_LightAdjustInq	8x	09	04	33	FF		y0	50	02	FF													On
							y0	50	03	FF													Off
CAM_SpotAEModeInq	8x	09	04	59	FF		y0	50	02	FF													On
							y0	50	03	FF													Off
CAM_SpotAEPosInq	8x	09	04	29	FF		y0	50	0p	0q	0r	0s	FF										pq: X Position, rs: Y Position
CAM_AE_ResponseInq	8x	09	04	5D	FF		y0	50	pp	FF													pp: 01h to 30h
CAM_WDModeInq	8x	09	04	3D	FF		y0	50	02	FF													On Wide-D
							y0	50	03	FF													Off
CAM_DefogInq	8x	09	04	37	FF		y0	50	02	00	FF												Defog ON
							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_NRModeInq	8x	09	04	53	FF		y0	50	pq	FF													Noise Reduction p=3D NR, q=2D NR
CAM_GammaInq	8x	09	04	5B	FF		y0	50	0p	FF													Gamma p: 00h, 01h
CAM_LR_ReverseModeInq	8x	09	04	61	FF		y0	50	02	FF													ON
							y0	50	03	FF													OFF
CAM_FreezeModeInq	8x	09	04	62	FF		y0	50	02	FF													ON
							y0	50	03	FF													OFF
CAM_PictureEffectModeInq	8x	09	04	63	FF		y0	50	00	FF													OFF
							y0	50	04	FF													B/W
CAM_PictureFlipModeInq	8x	09	04	66	FF		y0	50	02	FF													Picture Flip ON
							y0	50	03	FF													Picture Flip 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_MemoryInq	8x	09	04	3F	FF		y0	50	pp	FF													pp: Memory number recalled last
CAM_TitleDisplayModeInq	8x	09	04	74	FF		y0	50	02	FF													Title Display Mode On
							y0	50	03	FF													Title Display Mode Off

□ Inquiry command (2/2)

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: Til
CAM_PrivacyPTZInq	8x	09	04	7B	mm	FF	y0	50	0p	0p	0p	0q	0q	0q	0r	0r	0r	FF			mm: Mask Settings ppp: Pan qqq: Tilt rrrr: Zoom
CAM_PrivacyMonitorInq	8x	09	04	6F	FF		y0	50	0p	0q	0r	0s	FF								pp pp pp pp: Current Displayed Mask
CAM_VersionInq	8x	09	00	02	FF		y0	50	00	23	mn	pq	rs	tu	vw	FF					mnpq: Model ID (F040) rstu: ROM Version (xxxx) vw: Socket Number (=02)
CAM_ContinuousZoomPos ReplyModeInq	8x	09	04	69	FF		y0	50	02	FF											Continuous Zoom Position Reply On
							y0	50	03	FF											Continuous Zoom Position Reply Off
CAM_ReplyIntervalTimeInq	8x	09	04	6A	FF		y0	50	00	00	0p	0q	FF								pq: Interval Time
CAM_RegisterValueInq	8x	09	04	24	mm	FF	y0	50	0p	0q	FF										mm: Register No. (00-7F) pq: Register Value (00-FF)
CAM_ChromaSuppressInq	8x	09	04	5F	FF		y0	50	0p	FF											0p: Chroma Suppress setting level 00: Lowest 01-03: On (3 levels) Effect increases as the level number increases.
CAM_ColorGainInq	8x	09	04	49	FF		y0	50	00	00	00	0p	FF								p: Color Gain Setting 0h (60%) - Eh (200%)
CAM_ColorHueInq	8x	09	04	4F	FF		y0	50	00	00	00	0p	FF								p: Color Hue Setting 0h (-14 degrees) - Eh (+14 degrees)
CAM_TempInq	8x	09	04	68	FF		y0	50	00	00	0p	0q	FF								pq: Lens TemperatureLens
CAM_ImageStabilizerInq	8x	09	04	34	FF		y0	50	02	FF											ON
	8x	09	04	34	FF		y0	50	03	FF											OFF
CAM_ePTInq	8x	09	7E	06	00	FF	y0	50	02	FF											ON
	8x	09	7E	06	00	FF	y0	50	03	FF											OFF
CAM_ePT_AbsolutePosInq	8x	09	7E	06	20	FF	y0	50	00	00	0p	0q	0r	0s	FF						pq : 水平方向 r= 垂直方向
CAM_Trigger-StillimageInq	8x	09	04	80	FF		y0	50	0p	0q	0r	FF									p=3 q=0 r=0 (OFF) p=2 q=0 r=0 (ON) p=A q=0-7 r=0-9 (ON:continuous shooting)
CAM_TriggerSignal and ExposureInq	8x	09	04	8B	FF		y0	50	0p	FF											p=5 (Customer Setting) p=0 (Edge Detection Auto)
CAM_Stillimage-ExpCorrectInq	8x	09	04	84	01	FF	y0	50	00	0p	FF										p=2-E

5 Specification

Product specification

Image pickup device: 1/1.8 type Global shutter CMOS
(SONY IMX265LQR-C)

Valid pixel count: 2064(H) x1544(V) approximately 3.19 mega pixels

Lens: 30× inner focus lens
F number F1.6 (Wide end) F5.3 (Tele end)
Focal length (Nominal Value) 6.5mm-195mm
(Designed Value) 6.7 mm-190 mm

Scanning method: Progressive

Synchronization method: Internal synchronization

Video Output: Digital (LVDS)or Analog VBS

Maximum resolution: 1920(H)×1080(V)

Minimum subject illumination: 0.2 lux (F1.630 fps 50% output)

Digital Output Image Size & Frame Rate:
1920x1080p/60, 1920x1080p/59.94, 1920x1080p/50,
1920x1080p/30, 1920x1080p/25,
1920x1080i /60, 1920x1080i /59.94, 1920x1080i /50,
1280x720p/60, 1280x720p/50

Angle of view (horizontal): Wide about 54°, Tele about 2.0°.

Recommended subject illuminance: 100 Lux~10000 Lux

Zoom travel time: About 2.8 seconds under no zoom tracking condition
Zoom Tracking Approx. 6.5 sec. Maximum speed condition

Digital zoom: 16× (up to 480× in combination with optical zoom)

Minimum object distance: 0.1 m Initial setting: 0. 3 m (Zooming Wide)
1.5 m (Zoom Tele)

White Balance: ATW/Manual/One Push/Indoor/Outdoor

AE: Auto/Manual/ Shutter Priority/Iris Priority

Shutter speed setting: 1/1 Sec to 1/10000 Sec 22 Step

Aperture setting: F 1.6~Close 15 Step

Gain setting: 0dB to 48dB25Step

Camera Control: VISCA (see VISCA Commands List for detailed specifications)

Camera function :

- Still image trigger mode
  Continuous shot

Exposure tie setting

Auto/Manual

Image reading by trigger signal

Image sensor exposure start timing notification

- Image stabilizer (Electronic, Gyrosensor)
- BLC (Back Light Compensation)
- Exposure compensation 13 step ±12 dB
- Auto Slow Shutter (Max 1sec)
- Auto ICR
- WDR (Tone Curve Correction)
- DNRs (Combinations of 2D+3D)
- Defog
- Privacy Zone Mask setting (24 possible settings)
- Temperature reading function (thermistor data only output)
- Title display 1 line, 20 characters, up to 12 lines
- Picture effects (black and white, freeze, up/down, left/right)
- Dynamic defect correction
- Quality of the image

  Four gamma settings,

  Aperture control (intensity setting 16 steps)

  Color density and phase

Input voltage: 8.0 V~13.2 V

Power Consumption: Approx. 4. 5 W Zooming & Focusing

Approx. 5 W zooming

Recommended operating temperature: 0℃to 40℃

Performance temperature:-5°C to 60°C

Operating temperature:-10°C to 65°C

External dimension WxHxD: about 55.0×62.3 x125.0 mm

Mass: approx. 370 g

Interface

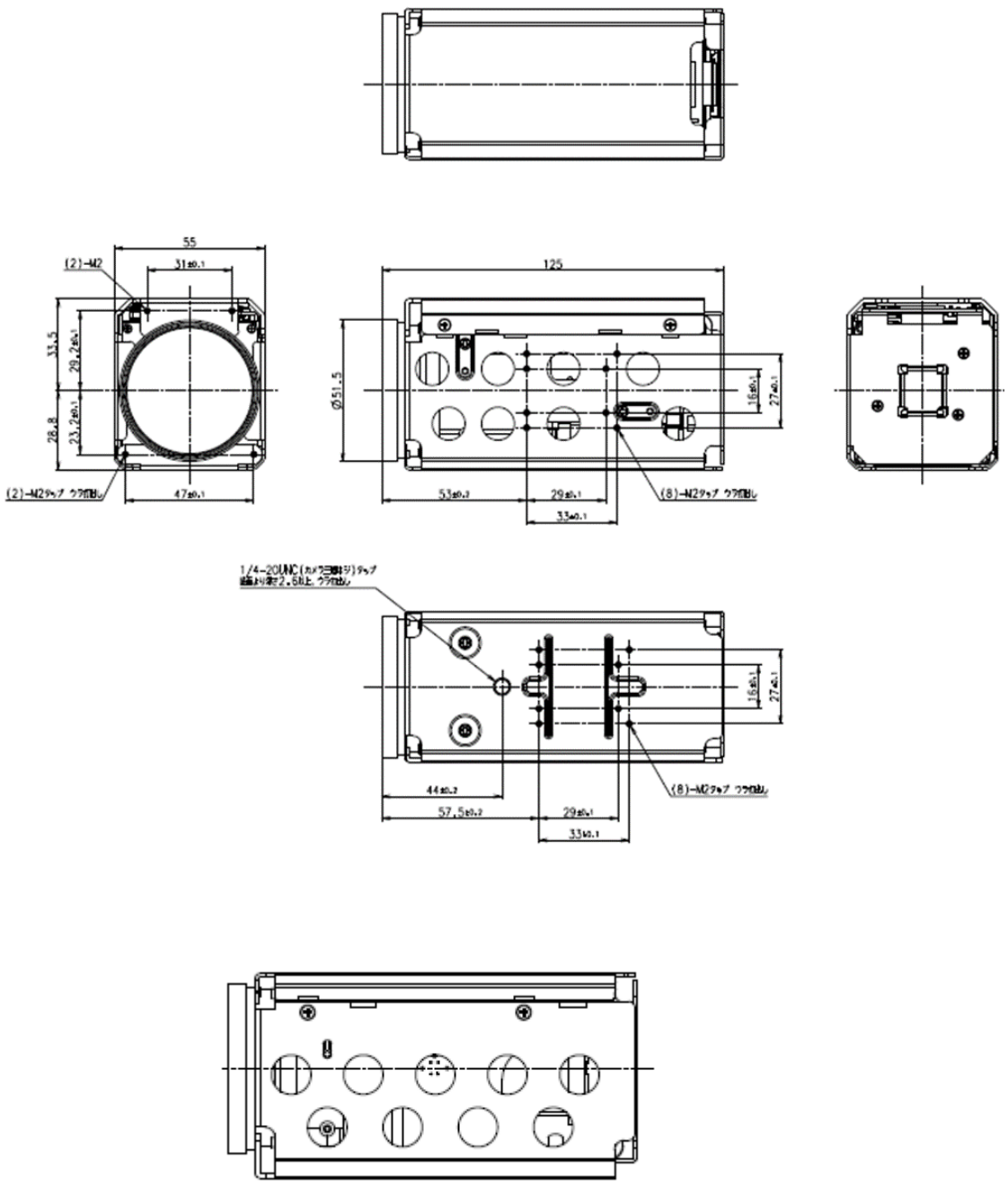
Pin NO.	Pin Name	I/O	Description/Remarks
1	LVDS_RXIN3+	O	Camera Signal Out(LVDS 4CH+Clock)
2	LVDS_RXIN3-	O	
3	LVDS_CLKIN+	O	
4	LVDS_CLKIN-	O	
5	LVDS_RXIN2+	O	
6	LVDS_RXIN2-	O	
7	LVDS_RXIN1+	O	
8	LVDS_RXIN1-	O	
9	LVDS_RXIN0+	O	
10	LVDS_RXIN0-	O	
11	GND		
12	VISCA_TXD		VISCA Communication
13	VISCA_RXD		
14	DC_IN	I	
15	DC_IN	I	
16	DC_IN	I	
17	DC_IN	I	
18	DC_IN	I	
19	GND		
20	GND		
21	GND		
22	GND		
23	GND		
24	GND		
25	VBS_OUT	O	Analog Video Out (75Ω終端　1 Vp-p)
26	Reset	I	Camera Reset（Reboot)
27	TRIG_IN	I	Trigger Plus　("L"Active)
28	TRIG__OUT	O	Image Sensor Capture Timing（H→L)
29	NC		No Connection
30	NC		No Connection

USL00-30 L: board-side connectors

Manufactured by KEL

References: USL20-30: Harness-side connector made of KEL

6 External view



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Version 2, June 1991

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