Full HD Camera Module

MP1010M-VC

Technical Reference Manual

Ver. 1.01

REVISION HISTORY

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1. FEATURES

1. The Industry's First Optics Vibration Compensation Mechanism *
   - By the original optics vibration compensation mechanism, it can reduce the blurring of the image and get clear video image in the environment with vibration and/or in far side of zooming.
   - In spite of the optics vibration compensation mechanism deployment, it realized compact form factor.

2. Small size and Light Weight High Resolution Camera
   - Overall length is 58.4mm. Weight is about 77g. It achieved small size and light weight.
   - Because of the small size and light weight, it enables to use existing housing and reduce space.

3. Full HD High Quality Camera
   - It supports 1920 x 1080 full HD video output.
   - It is available by various uses around a surveillance market.

4. High Optics Performance
   - It realizes color blur reduction and high contrast by putting TAMRON's original optics design and low reflection coating technologies together.

2. PRECAUTIONS

Software

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

Operation and storage conditions

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 module in the following extreme conditions:

- Extremely hot or cold places (operating temperature -5 degree C to +60 degree C (23 degree F to 140 degree 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 commercially available blower.

Others

Please warn the top surface and a lateral board on the occasion of this plane handling not to take excessive load. Disconnection may occur by the transformation of the board inside and causes the trouble.

Please do not take excessive load on the sensor board which a back part has. The sensor board is installed on a lens after adjustment precisely. When load increases, influence may leave an optical axis gap, the sided blur, etc. in optics performance.

In addition, an electric circuit may be injured by static electricity (ESD) (electrostatic destruction). When handling this module, please discharge static electricity (e.g. touch the grounded metal) in order to prevent electrostatic destruction.

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

In case of abnormal operation, contact your authorized TAMRON 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 (complementary metal-oxide semiconductor) image sensors. They do not indicate malfunctions.

Rolling shutter skew

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 module 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.

Output Format

This module can output 1080p 60fps and 50 fps, 148.5MHz digital output. A receiver must be designed to support the frequency.

Optical Vibration Compensation

This camera module's Vibration Compensation function compensates approximately 2 Hz to 17 Hz frequency range. If a vibration frequency exceeding its range is applied, the vibration cannot be compensated or unnecessary vibration may appear despite VC ON / OFF. To prevent such case, please arrange a camera installation so that the vibration is not transmitted to the camera. There is also a limit on the correction amount, so the effect of the compensation may be reduced if a vibration with a large amplitude exceeding the correction amount is applied.

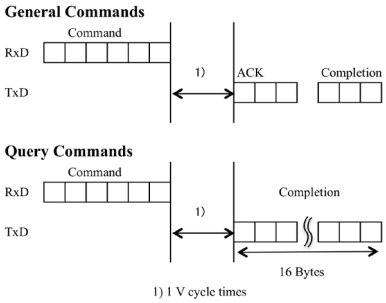
3. BASIC FUNCTIONS

3.1 VISCA COMMANDS

Camera control is performed by VISCA commands.

TIMING CHART

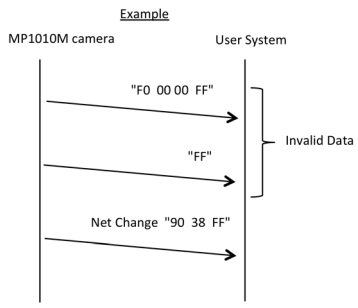
As VISCA Command processing can only be carried out one time in a Vertical cycle, it takes the maximum 1V cycle time for an ACK/Completion to be returned. If the Command ACK/Completion communication time is shorter than the 1V cycle time, then every 1V cycle can receive a Command.



VISCA commands are described in detail at Chapter 4 Command List.

TURN ON A MP1010M-VC (FROM NO POWER SUPPLIED)

When MP1010M-VC is turned on from no power supplied, MP1010M-VC transmits a "Network Change" command through TxD. Because of “From No Power Supplied”, there might be invalid data transmitted before the "Network Change" command at the time. One terminator "FF" is added just before the "Network Change" command, so the terminator "FF" and other previous data and packets can be detected and must be ignored.



3.2 ZOOM

The camera module employs a 10× optical zoom lens. MP1010M-VC does not support digital zoom.

- Lens Specification
  f = 3.3 mm to 33.0 mm (F 1.8 to F 3.4)
  Horizontal view of angle 59.2 degree (wide end) 6.7 degree (tele end)

The following are zoom modes. A VISCA command (CAM_Zoom Command) controls the modes.

Standard Speed Mode

Zoom moves at fixed speed.

Variable Speed Mode

There are eight levels of zoom speed that can be set by a VISCA Command.

In these standard speed mode and variable speed mode, send Stop Command to stop the zoom operation.

Direct Zoom Position setting

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

Continues 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 VISCA command (CAM_ContinuousZoomReply Command).

Users can set the Interval Time using CAM_ReplyIntervalTimeSet Command.

3.3 FOCUS

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

- Auto Focus Mode

The Auto Focus (AF) function automatically adjusts the focus position to strong contrast subject. The minimum focus distance is 10 mm at the optical wide end and 800 mm at the optical tele end. The default minimum focus distance is 250mm.

- Normal AF Mode

This is the normal mode so that AF operations are always active.

- 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 value for both is set to five seconds.

- Zoom Trigger Mode

When the zoom is changed, AF starts after stopping zoom within pre-set value (initially set at 5 seconds). After the pre-set value, even target moves, focus operation is terminated.

AF sensitivity can be set to Normal or Low with AF Sensitivity Command.

- Normal

The follow-up ability to the change of subject becomes sensitive. Please use this mode to photograph a subject with much movement. This mode is usually most suitable.

- Low

The stability of the focus improves. When the illumination is low, AF does not start, even though brightness changes to some extent, and a stable image outputs.

- **Manual Focus Mode**

Manual Focus has two modes, a Standard Speed Mode and a Variable Speed Mode. Standard Speed Mode focuses at a fixed speed. Variable Speed Mode has eight speed levels that can be set using a VISCA Command.

In these Standard and Variable Speed Modes, it is necessary to send Stop Command to stop the focus lens movement.

-Direct Focus Position

The focus position can be set by using Direct Command in CAM_Focus CommandSet.

-Direct Zoom Focus Position

Both of Zoom Position and Focus Position can be set at a time by using CAM_Zoom Focus Command.

- **One Push Trigger Mode**

When a One Push Trigger Command is sent, whole area scan is executed so that a subject is focused. The focus lens then holds that position until the next One Push Trigger Command or focus movement command (Standard Speed/Variable Speed) is received. At Auto Focus mode, after whole area scan, AF operation continues.

- **Near Limit Setting**

It can be set in a range from 1000h (∞) to B000h (10 mm). Default setting is 8000h (250 mm)

At slow speed mode (shutter time is longer than frame period) MP1010M-VC enters long exposure mode so that the follow-up ability will be lower.

3.4 VIBRATION COMPENSATION

Optical Vibration Compensation can be enable/disable by a VISCA command (CAM_VibrationCompensation). The default is “disable”.

Corrective Vibration Frequency becomes the suppression rate of less than 10% from 2Hz to 17Hz.

3.5 WHITE BALANCE

White Balance has the following modes, all of which can be set by using VISCA Command (CAM_WB Command).

- **Auto White Balance (AWB)**

AWB has two modes, ATW1 (Narrow) and ATW2 (Wide).

  - ATW1 (Narrow)
    This covers about 7000K to 2500K color temperature.
    ATW1 is factory default setting.
  - ATW2 (Wide)
    This covers about 10000K to 2200K color temperature.

- Manual WB

R gain (CAM_RGain Command) 256 steps and B gain (CAM_BGain command) 256 steps can be set manually.

- Fixed Color Temperature mode
  - INDOOR
    Fixed color temperature for indoor use. (about 3200K)
  - OUTDOOR
    Fixed color temperature for outdoor use. (about 5800K)

- **One Push Trigger**

  After having taken the image of white paper throughout a screen, please issue One Push Trigger Command in CAM_WB Command. White balance is calculated and shifts to One Push WB mode.

- **One Push WB**

The One Push White Balance mode is a function to photograph a subject with a fixed white balance mode that use generated WB data by the latest One Push Trigger.

3.6 AE (AUTOMATIC EXPOSURE)

AE has the following 4 modes, all of which can be set using VISCA Command (CAM_AE Command). A variety of AE functions are available for optimal output of subjects in lighting conditions that range from low to high.

-Full Auto

-Shutter Priority

-Iris Priority

-Manual

The motion in each mode is as follows.

	Iris	Shutter	Gain
Full Auto	Auto	Auto	Auto
Shutter Priority	Auto	Fix	Auto
Iris Priority	Fix	Auto	Auto
Manual	Fix	Fix	Fix

AE – FULL AUTO

This mode can be set using Full Auto Command.

Controlling automatically Iris, Gain, and Shutter Speed. In this mode, users can select *Flicker Auto Detect On* in which camera module automatically detects electricity frequency and adjusts the shutter speed in order to eliminate flickering (or so called banding) and *Flicker Auto Detect Off* in which camera module does not detect. Setting On/Off uses On/Off Command in CAM_FlickerAutoDetect Command. The default setting is Off.

AE - SHUTTER PRIORITY

This mode can be set using Shutter Priority Command. The shutter speed can be set one out of 22 steps . Iris and Gain are automatically adjusted. Users can set a Shutter Speed with auto Iris and Gain. (1/1 to 1/10,000 sec., 16 high-speed shutter speeds plus 6 low-speed shutter speeds)

**Flicker can be eliminated by setting shutter speed to ;*

- *1/100 in countries with a 50 Hz power supply frequency*
- *1/120 in countries with a 60 Hz power supply frequency*

	Data	**60/30 mode**	**50/25 mode**
Shutter Speed	15	1/10000	1/10000
	14	1/6000	1/6000
	13	1/4000	1/4000
	12	1/3000	1/3000
	11	1/2000	1/2000
	10	1/1500	1/1500
	0F	1/1000	1/1000
	0E	1/725	1/725
	0D	1/500	1/500
	0C	1/350	1/350
	0B	1/250	1/250
	0A	1/180	1/180
	09	1/120	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

Data can be set using Direct Command in CAM_Shutter Command.

AE - IRIS PRIORITY

This mode can be set using Iris Priority Command.

The iris can be set one in 16 steps between F1.8 and Close. The gain and shutter speed are set automatically.

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

Data can be set using Direct Command in CAM_Iris Command.

AE - MANUAL

This mode can be set using Manual Command. The shutter speed (22 steps), iris (16 steps) and gain (24 steps) can be set individually.

Gain Setting:

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

Data can be set using Direct Command in CAM_Gain CommandSet.

At the same time, set Iris Data and Shutter Data together.

3.7 SPOT EXPOSURE

In each exposure mode except Manual mode, the level for the entire screen is calculated, and the optimum Iris, Gain and Shutter levels are determined. In Spot Exposure, a particular section of the subject can be designated, and then that portion

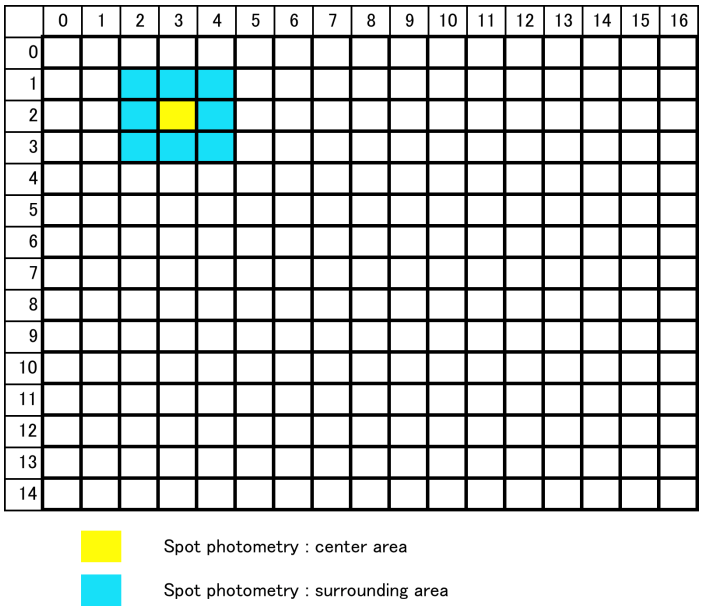
of the image is weighted and the value calculated so that Iris, Gain and Shutter are optimized to obtain the entire screen image.

This mode can be set using On/Off Command in CAM_Spot AE Command.

For example, in an image with frequent changes of brightness by a lot of movement, portions without much change can be designated as such a “spot,” and changes to the screen can be minimized.

As shown in the diagram below, a spot block in a range of 15 blocks vertically and 17 blocks horizontally can be designated. In the case where the center block is designated (shown in yellow), the level is calculated along with a weighted value for the surrounding blocks (blue) and the specified center (yellow) block, and then the Iris, Gain and Shutter are set. The weight of the center (yellow) block is 100% and the weight of surrounding blocks (blue) is 20%. The range of the Spot AE frame is fixed to 3 blocks vertically and 3 blocks horizontally.

Since Spot Exposure and Back Light Compensation cannot be set at the same time, please use it after setting Back Light Compensation to Off.



The above coordinate is selected by Position Command of CAM_Spot AE Command. It is an example which is set using 8X 01 04 29 00 03 00 02 FF command when the coordinate is x=3, y=2.

3.8 EXPOSURE COMPENSATION

Exposure compensation adjusts brightness in the AE mode. Normal brightness is 0. The adjusted brightness can be brighter or darker by 2dB/Step.

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

Data can be set using Direct Command in CAM_ExpComp Command, and is activated by On Command.

3.9 AE RESPONSE

AE Response (convergence speed) function controls the exposure response speed. Using the AE response function sets the automatic exposure response speed from the fastest speed (01 (hex)) to the slowest speed (30 (hex)).

For example, with the fastest setting, 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, if the AE response speed is slower, as a result, even if the camera catches a high-intensity subject (e.g., the headlights) for a moment, the image surrounding the headlights can still easily be distinguished.

Data can be set using Direct Command in CAM_AE_Response Command.

3.10 LONG EXPOSURE (SLOW SHUTTER)

In very dark environment, the long exposure (VISCA : CAM_SlowShutter Auto/Manual) can get more bright image.

Using VISCA command (Auto/Manual Command in CAM_Slow Shutter CommandSet) can set Slow Shutter mode. At Auto mode it automatically gets into slow shutter at AE Full Auto mode and Iris priority mode. In Manual mode, it won't become slow shutter automatically. It becomes slow shutter by setting shutter speed at Shutter Priority mode and Manual Mode. Factory default is Manual.

3.11 SLOW SHUTTER LIMIT

It limits the longest shutter time when slow shutter auto mode is active.

It uses Register Setting command and parameters are the following ;

CAM_Register Value command :

Addr = 0x7C

Val = 0 : 1/4 sec (default)

1 : 1/1 sec

2 : 1/2 sec

3 : 1/3 sec

4 : 1/4 sec

5 : 1/6 sec

6 : 1/8 sec

7 : 1/12.5 sec(25/50 fps mode) or 1/15 sec(30/60 fps mode)

3.12 GAIN LIMIT SETTING

The gain limit can be set at the Full Auto, Shutter Priority, Iris Priority mode. Use this setting when image signal-to-noise ratio is particularly important. MP1010M-VC has max. 46dB gain. If you limit the gain by Gain Limit to lower gain like 28dB, you will get better signal-to-noise ratio.

3.13 APERTURE CONTROL

When shooting text, this control may help to increase readability by making them sharper. There are 16 steps of adjustment. The factory default is level 8. Level 0 is edge enhancement off. Data can be set using Direct Command or Up/Down command in CAM_Aperture Command.

3.14 BACK LIGHT COMPENSATION

When the background of the subject is too bright and the subject is too dark due to AE, back light compensation will make the subject appear clearer.

Since this can not be used together with spot exposure, spot exposure must be Off beforehand.

This can be set using BackLight Comp On Command in CAM_LightAdjust Command.

3.15 WIDE DYNAMIC RANGE MODE (WDR)

The Wide Dynamic Range mode is a function to compensate image with blocked-up shadows and blown-out highlights in accordance with the intensity difference. It enables you to obtain images from dark part to bright part can be recognized, even when capturing a subject with a large intensity difference that is backlight or includes extremely bright portions.

This mode is set using WD On/Off Command in CAM_WD Command.



WDR OFF



WDR ON

Note:

Mp1010M-VC WDR does not reduce frame rate. For example, if Mp1010M-VC is set to 1080p 60 frames per second and turn WDR on, it still keeps 60 frames per second output.

3.16 DEFOG

This function is set using Defog Command.





Defog function is to get better subject recognition at fog environment.

DEFOG OFF DEFOG ON

3.17 NOISE REDUCTION

The NR (Noise Reduction) function removes noise (random noise, etc.) to provide clearer images. This function is set using CAM_NR Command.

This function has six steps: levels 1 to 5, plus off (0). The NR effect is applied in proportion to the gain. In bright subjects, the NR effect difference between levels will become smaller.

3.18 3D NOISE REDUCTION

The 3D Noise Reduction (3DNR) function removes noise (random noise, etc.) to provide clearer images with focusing on temporal changes of noise. This function is set using CAM_NR Command.

This function has six steps: levels 1 to 5, plus off (0). It should be aware that higher level increases afterimage phenomenon against moving subjects.

3.19 GAMMA

Gamma correction can be changed using CAM_Gamma Command. The following four options are available.

00: Standard : for normal use

01: Straight : liner conversion

02: Low Noise (Narrow Range) : Narrower dynamic range than standard to reduce noise

03: Wide Range : Wider dynamic range than standard

3.20 TEMPERATURE READING FUNCTION

To read temperature usees CAM_TempInq Command.

The conversion value (hex) of the temperature sensor built in the camera can be read by using an Inquiry command. The conversion value has some error range, and because the temperature sensor is inside of the camera, this value is not the ambient temperature round the camera. Use it as a reference value.

3.21 LOW-ILLUMINATION CHROMA SUPPRESS

This can configure a chroma suppress mode for low-illumination conditions. This can be useful when color noise is particularly noticeable in such conditions.

This uses CAM_ChromaSuppress Command. Four levels (Off and 1-3 levels) are available for the low-illumination chroma suppress mode. Higher setting value produces stronger chroma suppressing effect.

As it becomes low-illumination more, chroma suppress effect becomes stronger.

3.22 COLOR GAIN

This can changes color gain (color strength).

This uses Direct Command in CAM_ColorGain Command.

The initial setting 100% (4h) can be set to range from approx. 60% (Oh) to 200% (Eh) with 15 stages.

3.23 COLOR HUE

This can change the color hue (color phase).

This uses Direct Command in CAM_Color Hue Command.

The initial setting 0 degrees (7h) is adjustable between approx. -14 degrees (0h) and +14 degrees (Eh), in 15 increments.

3.24 EFFECT

This uses Commands in CAM_PictureEffect Command.

It consists of the following functions.

. Off

. Black & White: Monochrome Image

3.25 E-FLIP AND MIRROR

This uses Commands in CAM_PictureFlip Command and CAM_LR_Reverse Command.

E-flip

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

Mirror

This function reverses the video output from the camera horizontally.

3.26 FREEZE

This function captures one frame from the video stream and continuously output the captured one frame.

CAM_FREEZE Command controls On/Off. At power on, it is always Off.

3.27 MEMORY

Memory (Position preset)

Using the position preset function, 4 sets of camera shooting conditions can be stored and recalled. This uses Commands in CAM_Memory Command.

Reset

Clear the designated memory.

Set

Save the data to the designated memory.

Recall

Read the data from designated memory.

The following items are saved in the memory.

. Zoom Position

. Focus Auto/Manual

. Focus Position

. AE Mode

. Flicker Auto Detect On/Off

. Shutter control parameters

. Iris control parameters

. Gain control parameters

. Exposure Compensation On/Off

. Exposure Level

. Backlight Compensation On, Off

. Slow Shutter Auto/Manual

. AE Response

. White Balance Mode

. R/B Gain

. OnePushWB data

. Aperture Level

. WD On, Off

. Defog On, Off

. Gamma

Note:

Too much frequent memory writes may cause memory corruption. It is not recommended to create too much frequent memory writes such as writing data every time when setting is changed.

3.28 REGISTER SETTING

This uses CAM_RegisterValue Command.

The register setting command can set and change the camera default setting.

Register Setting Command (CAM_RegisterValue Command):

8x 01 04 24 mm 0p 0q FF

mm: Register No. (=00 to 7F)

pq: Register Value (=00 to FF)

Register Inquiry Command (CAM_RegisterValueInq Command):

8x 09 04 24 mm FF

mm: Register No.

y0 50 0p 0p FF

pp: Register Value

(returned from the camera)

Example: To set communication speed to 38400 bps

8x 01 04 24 00 00 02 FF

After sending this command, turn power off and back on (power reset) to resume communication control at 38400 bps.

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 (Hex)	
VISCA Baud Rate	00	00 (default)	9600 bps
		01	19200 bps
		02	38400 bps
		03	115200 bps
Zoom Tracking AF	54	00	Off
		01 (default)	On
Monitoring Mode	72	01(default)	1080/30p
		02	1080/25p
		03	1080/60i
		04	1080/50i
		05	720/60p
		06	720/50p
		07	1080/60p
		08	1080/50p
Lens Distortion Compensation	78	Upper 4bit	0: Crop, 1: All
		Lower 4bit	0: Off, 1-4: Table No.1-4
			default: 0x01
Maximum F Number	79	03	F22
		04	F16
		05	F14
		06(default)	F11
		07	F9.6
		08	F8.0
F Number for Small Aperture Elimination	7A	0x09:F6.8, 0x0A:F5.6, 0x0B:F4.8, 0x0C:F4.0(default), 0x0D:F3.4, 0x0E:F2.8, 0x0F:F2.4, 0x10:F2.0, 0x11:F1.8	
Minimum Shutter Speed	7B	0x0B:1/250, 0x0C:1/350, 0x0D:1/500, 0x0E:1/725, 0x0F:1/1000(default), 0x10:1/1500, 0x11:1/2000, 0x12:1/3000, 0x13:1/4000, 0x14:1/6000, 0x15:1/10000	
Maxmum Shutter Speed	7C	0x00:1/4, 0x01:1, 0x02:1/2, 0x03/1/3, 0x04:1/4(default),	
		0x05:1/6, 0x06:1/8, 0x07:1/15 or 1/12.5	
Setup Control	7D	0D	Reset Parameters to Default
		3A	Firmware Update Mode

3.29 TITLE DISPLAY

Data can be set using Commands in CAM_MultiLineTitle Command.

- The title composes of up to 12 lines. Each line can contain up to 20 characters.
- Each line can be individually set to display on/off.
- The top-left X and Y position (every 20 pixels) of title display area and font size (4 sizes) can be set.

TABLE : Character Code (Font Number)

Font Number	00	01	02	03	04	05	06	07
Character	A	B	C	D	E	F	G	H
Font Number	08	09	0A	0B	0C	0D	0E	0F
Character	I	J	K	L	M	N	O	P
Font Number	10	11	12	13	14	15	16	17
Character	Q	R	S	T	U	V	W	X
Font Number	18	19	1A	1B	1C	1D	1E	1F
Character	Y	Z	&	[space]	?	!	1	2
Font Number	20	21	22	23	24	25	26	27
Character	3	4	5	6	7	8	9	0
Font Number	28	29	2A	2B	2C	2D	2E	2F
Character	a	b	c	d	e	f	g	h
Font Number	30	31	32	33	34	35	36	37
Character	i	j	k	l	m	n	o	p
Font Number	38	39	3A	3B	3C	3D	3E	3F
Character	q	r	s	t	u	v	w	x
Font Number	40	41	42	43	44	45	46	47
Character	y	z	%	[	]	*	+	=
Font Number	48	49	4A	4B	4C	4D	4E	4F
Character	_	"	:	'	.	,	/	-

Example: The point located in x=100pix/y=220pix from the upper left corner of a screen is designated as the starting point. “V5r%" is displayed on the 3rd line in max. size.

- Title Set1 : 8x 01 04 73 10 00 05 0B 03 00 00 00 00 00 00 FF
  (Set the coordinate and font size)
- Title Set2 : 8x 01 04 73 22 15 22 39 42 00 00 00 00 00 00 FF
  (Set the characters displayed on the 3rd line)
- On : 8x 01 04 74 22 FF (Display the “3rd “ line)

3.30 PRIVACY ZONE MASKING FUNCTION

Privacy zone masking protects private objects and areas such as house windows, entrances and exits. Privacy zone masking masks such subjects which are within the camera's range of vision, on the monitor.

MP1010M-VC complies with the three-dimension privacy zone masking which enables to process the mask for Pan/Tilt/Zoom movement by receiving Pan/Tilt/Zoom VISCA command.

Data can be set using Commands in CAM_PrivacyZone Command.

FEATURES

1. Corresponding to the Pan/Tilt position, Mask setup and display are possible up to 16 areas.
2. ON/OFF is available to the 16 areas respectively.
3. 2 out of 14 Color Setup is available to the 16 areas respectively.
4. Enabling Interlock Control of Pan/Tilt/Zoom
5. Enabling Non Interlock Control of Pan/Tilt

PRIVACY ZONE MASK COMMAND LIST

CommandSet	Command	CommandPacket															Comments
		H	1	2	3	4	5	6	7	8	9	10	11	12	13	14	T	
CAM_PrivacyZone	SetMask	8x	01	04	76	0m	0n	0r	0r	0s	0s	FF						Setting Mask(Size) Parameter : 0m 0n 0r 0r 0s 0s m : mask number [0(1 F) m=0 : Modify m=1 : New rr : W ss : H
	Display	8x	01	04	77	pp	pp	pp	pp	FF								Setting Mask Display On/Off pp pp pp pp: Mask setting (0: OFF, 1: ON)
	SetMaskColor	8x	01	04	78	pp	pp	pp	pp	qq	rr	FF						Setting Color of Mask qq: Color setting when setting the Mask bit to 0 rr: Color setting when setting the Mask bit to 1 pp pp pp pp: Mask Color Setting, 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						Setting Pan/Tilt Angle ppp: Pan angle, qqq: Tilt angle
	SetPTZMask	8x	01	04	7B	mm	0p	0p	0p	0q	0q	0q	0r	0r	0r	0r	FF	Setting the direct position of PTZ ppp: Pan , qqq: Tilt , rrrr: Zoom
	Non_InterlockMask	8x	01	04	6F	mm	0p	0p	0q	0q	0r	0r	0s	0s	FF			Setting non-interlocking the mask to pan/tilt m:w, ss: h" in "Parameters".

PRIVACY ZONE MASK INQUIRY COMMAND LIST

Inquiry Command	CommandPacket						InquiryPacket													Comments
	H	1	2	3	4	5	H	1	2	3	4	5	6	7	8	9	10	11	12	13	
CAM_PrivacyDisplayInq	8x	09	04	77	FF		y0	50	pp	pp	pp	pp	FF								Inquiry about the status of Setting Mask Display On/Off 1: On, 0: Off 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						Inquiry about the pan/tilt position currently set 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		Inquiry about pan/tilt/zoom position at the mm Mask setting ppp: Pan Position, qqq: Tilt Position rrrr: Zoom Position
CAM_PrivacyMonitorInq	8x	09	04	6F	FF		y0	50	pp	pp	pp	pp	FF								Inquiry about the mask currently displayed pp pp pp pp: Current Displayed Mask

HOW TO USE EACH COMMAND

SetMask

Set new mask or change the size of mask.

SetMask	8x	01	04	76	0m	0n	0r	0r	0s	0s	FF					Setting Mask(Size) Parameter : 0m 0n 0r 0r 0s 0s mm : mask number n=1 : upper-left point n=2 : bottom-right point rr : w(1/2) ss :h(1/2)

The mask number of a target is chosen in mm. A processing method is chosen in nn. In the case of 00, mask width (twice of w) and mask height (twice of h) are updated over the existing mask.

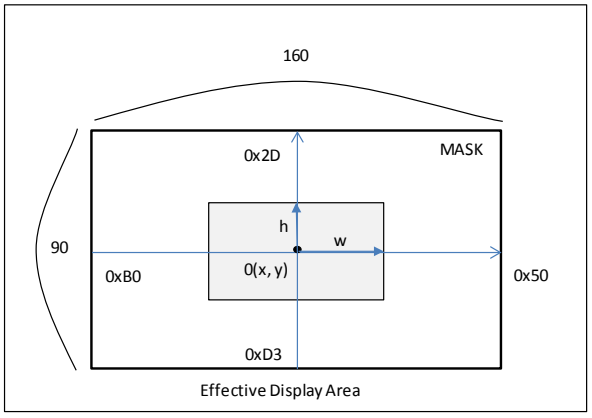
In the case of 01, new mask that contains the mask number mm, mask width (twice of w), and height (twice of h) in the center of the screen will be created on the current pan/tilt/zoom position.

mm : Mask Number

Mask	mm (hex)
0	0x00
1	0x01
2	0x02
3	0x03
4	0x04
5	0x05
6	0x06
7	0x07
8	0x08
9	0x09

Mask	mm (hex)
A	0x0A
B	0x0B
C	0x0C
D	0x0D
E	0x0E
F	0x0F

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



nn : Setting

nn	Opreration
00	Update the zone size （value of w、 h）
01	Set a new zone size （value of w、 h）

Display

Display the mask. Each mask can be turned ON/OFF individually.

Display	8x	01	04	77	pp	pp	pp	pp	FF							Setting Mask Display On/Off pp pp pp pp: Mask setting (0: OFF, 1: ON)

Each bit represents each mask and “1” turns on the mask and “0” turns off the mask.

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	-	-	-	-	F	E	D	C	-	-	-	-	B	A	9	8	-	-	-	-	7	6	5	4	-	-	-	-	3	2	1	0

SetMaskColor

Set color of masks.

SetMaskColor	8x	01	04	78	pp	pp	pp	pp	qq	rr	FF					Setting Color of Mask pp pp pp pp: Mask setting (0: OFF, 1: ON) qq: Color setting when setting the Mask bit to 0 rr: Color setting when setting the Mask bit to 1

2 out of 14 colors (see below chart.) can be selected as mask color. The color of each mask is decided by mask bit setting of 1/0. It becomes a color code qq by setting 0, and it becomes a color code rr by setting 1. The relation of mask/bit position and pp are the same as **Display** section. Set a color of each mask with this command before turning on the Display.

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	-	-	-	-	F	E	D	C	-	-	-	-	B	A	9	8	-	-	-	-	7	6	5	4	-	-	-	-	3	2	1	0

qq, rr : Color Code	
Mask(Color)	Code (qq, rr)
Black	00h
Gray1	1h
Gray2	2h
Gray3	3h
Gray4	4h
Gray5	5h
Gray6	6h
White	7h
Red	8h
Green	9h
Blue	0Ah
Cyan	0Bh
Yellow	0Ch
Magenta	0Dh

SetPanTiltAngle

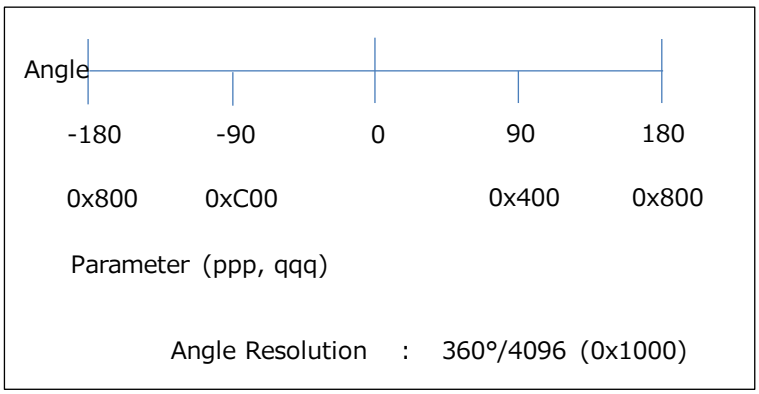
Set the present angle of pan and tilt.

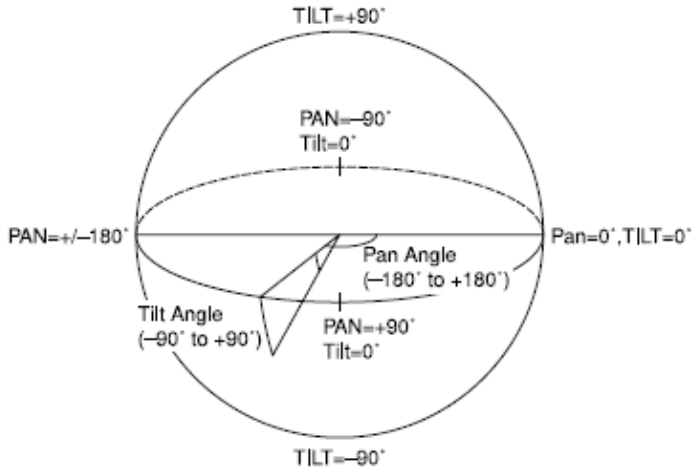
SetPanTiltAngle	8x	01	04	79	0p	0p	0p	0q	0q	0q	FF					Setting Pan/Tilt Angle ppp: Pan angle, qqq: Tilt angle

ppp indicates Pan-angle, qqq indicates Tilt-angle. The values are 0~0xFFF. Therefore, 360 degrees is divided into 4096 and resolution is about 0.088 degree.

This command informs the angle of current pan and tilt to the camera. The camera will calculate position of the mask with the information.

Setting Pan/Tilt Angle





SetPTZMask

Set Pan/Tilt/Zoom position of each mask directly.

SetPTZMask	8x	01	04	7B	mm	0p	0p	0p	0q	0q	0q	0r	0r	0r	0r	FF	Setting the direct position of PTZ mm: mask number ppp: Pan , qqq: Tilt , rrrr: Zoom

Non_InterlockMask

Set a mask that does not link to Pan/Tilt movement but link to Zoom movement.

Non_InterlockMask	8x	01	04	6F	mm	0p	0p	0q	0q	0r	0r	0s	0s	FF			Setting non-interlocking the mask to pan/tilt See “mm: Mack setting list” and “pp:x,qq:y, rr:w, ss: h” in “Parameters“.

As for the value of x, y, w, and h, please refer to the explanation of the parameter in the above command list.

Setting orders

1. Select color by **SetMaskColor** command. Choose 2 of 14 colors and set the color in each mask.

2. Move and face the camera to the target by setting **SetPanTiltAngle**. Zoom level is set by zoom command.

3. Execute **SetMask**.

4. Set mask on or off by **Display** command. 1=On 0=Off on the value P

5. Set the mask size with some margin to cover an error range. Make sure the target is covered or not by moving the camera.

6. The set up condition will be gone when turn off the power. To keep the set up condition Custom pre-set is recommended.

3.31 INITIAL SETTINGS, CUSTOM PRESETS

Initial settings for the various functions of the camera module are indicated in the "Initial Setting" row. It is same meaning of Factory Default.

For "Custom Preset", use VISCA CUSTOM command to save all parameters except parameters set by register setting (CAM_RegisterValue Command). When the camera is powered on, the parameters set by VISCA CUSTOM command, are recalled automatically.

Parameters except parameters set by Register Setting (CAM_RegisterValue Command) can be saved.

Reset

Clear the saved data.

Set

Save the current data.

Recall

Read the saved data.

Mode/Position Setting	Initial Setting (Factory Default)
Zoom Position	0x0000 (Wide End)
Focus Position	0x1000 (Infinity)
Focus Auto/Manual	Auto
Near Limit Setting	0x8000 (25 cm)
AF Sensitivity	Normal
AF Mode	Normal AF
AF Run Time	5 sec
AF Interval	5 sec
WB Mode	ATW1
WB Data (Rgain, Bgain)	(0x85, 0x64)
One Push WB Data	-
AE Mode	Full Auto
AE Response	0x10 (0x01 - 0x30)
WD On/Off	Off
Defog On/Off	Off
Slow Shutter Mode	Manual
Shutter Position	0x05 (1/30 or 1/25)
Iris Position	0x11 (F1.6)
Gain Position	0x01 (0dB)
Exposure Compensation On/Off	Off
Exposure Compensation Amount	0x07 (0dB)
BackLight Compensation On/Off	Off
SpotAE On/Off	Off
SpotAE Position Setting	X: 0x08, Y: 0x07
Aperture Level	0x08
LR Reverse On/Off	Off
Picture Effect	Off
NR Level	0x03 (Middle)
3DNR Level	0x03 (Middle)
Gain Limit	0x18 (+46dB)
Low-Illumination Chroma Suppress	0x02 (Middle)
Color Gain	0x04 (100%)
Color Hue	0x07 (0 degree)
Title Display On/Off	Off
Title Setting	
Mask Setting	
Mask Display On/Off	Off
Mask Color Setting	
E-Flip On/Off	Off
Privacy Zone On/Off	Off
Privacy Zone Setting	
ZoomPos Continuous Output On/Off	Off
ZoomPos Continuous Output Interval	0x3C (60 frames)
Gamma	0 : Standard Gamma
Vabration Compensation	Off

4. VISCA COMMANDS

4.1 VISCA/RS-232 COMMANDS

This chapter outlines an RS-232 control protocol and command list for MP1010M-VC.

THIS CONTROL PROTOCOL AND COMMAND LIST IS PROVIDED BY TAMRON WITHOUT WARRANTY OF ANY KIND. THIS CONTROL PROTOCOL AND COMMAND LIST SHOULD BE USED WITH CAUTION.

4.2 OVERVIEW OF VISCA

In VISCA, the device outputting commands, for example a computer, is called “controller”. The device receiving the commands, a camera module is called “peripheral device”. In VISCA, the camera module can be connected to a controller using communication conforming to the RS-232 standard. The parameters of RS-232 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.

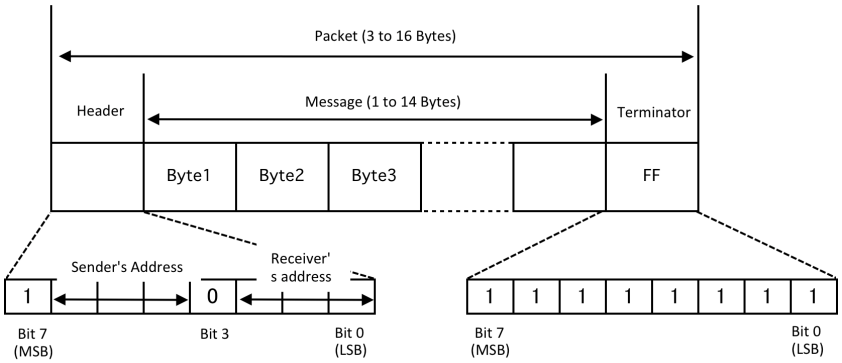
* VISCA is a protocol which controls consumer camcorders developed by Sony. “VISCA” is a registered trademark of Sony Corporation.

4.3 VISCA COMMUNICATION SPECIFICATIONS

VISCA PACKET STRUCTURE

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

Some of the commands for setting camera modules can be sent to all devices at one time (broadcast). In the case of broadcast, the header should be hexadecimal 88H. The terminator is FFH. It signifies the end of the packet.



COMMANDS AND INQUIRIES

- Command

  Sends operational commands to the camera.

- Inquiry

  Used for inquiring about current state 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

RESPONSES FOR COMMANDS AND INQUIRIES

- ACK Message

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

- Completion Message

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

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

X = 9 to F: camera address + 8

- Error Message

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

Error Packet	Description
X0 6Y 01 FF	Message length error (>14 bytes)
X0 6Y 02 FF	Syntax Error
X0 6Y 03 FF	Command buffer full
X0 6Y 04 FF	Command cancelled
X0 6Y 05 FF	No socket (to be cancelled)

X0 6Y 41 FF Command not executable

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

SOCKET NUMBER

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

COMMAND EXECUTION CANCEL

To cancel a command which has already been sent, send the Cancel command (CommandCancel 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: camera address, Y = socket number

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

4.4 VISCA DEVICE SETTING COMMANDS

Before starting control of the camera module, be sure to send AddressSet Command and IF_Clear Command as broadcast.

FOR VISCA NETWORK ADMINISTRATION

- AddressSet Command

Sets an address of a peripheral device. Use this when initializing the network, or receiving the following network change message.

- Network Change

Sent from a peripheral device to a controller when the 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: camera address + 8

VISCA INTERFACE COMMANDS

- IF_Clear Command

Clears the command buffers in the 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: camera address (For inquiry packet)

X = 9 to F: camera address +8 (For reply packet)

- CAM_VersionInq

Returns information of 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 (0023: TAMRON) HHHH = Model ID (F011 : MP1010M-VC) JJJJ = ROM revision KK = Maximum socket #(02)

X = 1 to 7: camera address (For inquiry packet)

Y = 9 to F: camera address +8 (For reply packet)

4.5 VISCA COMMANDS/ACK PROTOCOL

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

4.6 VISCA CAMERA-ISSUED MESSAGES

ACK/COMPLETION MESSAGES

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

z = Device address + 8

ERROR MESSAGES

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

NETWORK CHANGE MESSAGE

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

z= 9-F: camera address + 8

Command List (1/4)

CommandSet	Command	CommandPacket															Comments	Initial Value Factory Default
		H	1	2	3	4	5	6	7	8	9	10	11	12	13	14	T	
AddressSet	Broadcast	88	30	01	FF													Address Setting	0x01
IF_Clear	Broadcast	88	01	00	01	FF												I/F Clear (Broadcast)	-
	For x	8x	01	00	01	FF												I/F Clear (For x)	-
CommandCancel	-	8x	2y	FF														y: Socket No. (=1 or 2)	-
CAM_Power	Off (Reboot)	8X	01	04	00	03	FF											Reboot	
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 (Slow) to 7 (Fast)	-
	Wide (Variable)	8x	01	04	07	3p	FF											P=0 (Slow) to 7 (Fast)	-
	Direct	8x	01	04	47	0p	0q	0r	0s	FF								pqrs: Zoom Position : 0000h - 4000h	0x0000
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 (Slow) to 7 (Fast)	-
	Near (Variable)	8x	01	04	08	3p	FF											P=0 (Slow) to 7 (Fast)	-
	Direct	8x	01	04	48	0p	0q	0r	0s	FF								pqrs: Focus Position : 1000h(far) ~ C000h(near)	0x1000
	Auto Focus	8x	01	04	38	02	FF											AF On	-
	Manual Focus	8x	01	04	38	03	FF											AF Off (Manual)	-
	Auto/Manual	8x	01	04	38	10	FF											AF On/Off toggle	-
	One Push Trigger	8x	01	04	18	01	FF											One Push AF Trigger. Execute full scan even in Auto Focus mode	-
	Near Limit	8x	01	04	28	0p	0q	0r	0s	FF								pqrs: Focus Near Limit Position	0x8000
AF Sensitivity	Normal	8x	01	04	58	02	FF											AF sensitivity Normal	0x02
	Low	8x	01	04	58	03	FF											AF sensitivity Low	
CAM_AFMode	Normal AF	8x	01	04	57	00	FF											AF Movement Mode : Normal	0x00
	Interval AF	8x	01	04	57	01	FF											AF Movement Mode : Interval	
	Zoom Trigger AF	8x	01	04	57	02	FF											AF Movement Mode : Zoom Trigger AF	
	Active/Interval Time	8x	01	04	27	0p	0q	0r	0s	FF								pq: Movement Time, rs: Interval Time : (second)	0x05, 0x05
CAM_ZoomFocus	Direct	8x	01	04	47	0p	0q	0r	0s	0t	0u	0v	0w	FF				pqrs: Zoom Position 、tuvw: Focus Position Zoom : 0000h - 4000h, Focus : 1000h(far) - 8000h(near)	Zm=0x0000 Fcs=0x1000
CAM_VibrationCompensation	On	8x	01	04	34	02	FF												
	Off	8x	01	04	34	03	FF												
CAM_WB	ATW1	8x	01	04	35	00	FF											ATW1(Narrow)	0x00
	Indoor	8x	01	04	35	01	FF											Indoor WB(3200K)	
	Outdoor	8x	01	04	35	02	FF											Outdoor WB(5800K)	
	One Push WB	8x	01	04	35	03	FF											One push WB mode Reproduce WB of the last culculation by One Push Trigger	
	ATW2	8x	01	04	35	04	FF											ATW2(Wide)	
	Manual	8x	01	04	35	05	FF											Manual Control Mode (enable to set R gain and B gain.)	
	One Push Trigger	8x	01	04	10	05	FF											One Push WB Trigger Calcurate WB of current image that can be used at One Push WB	

Command List (2/4)

CommandSet	Command	CommandPacket															Comments	Initial Value Factory Default
		H	1	2	3	4	5	6	7	8	9	10	11	12	13	14	T	
CAM_RGain	Reset	8x	01	04	03	00	FF											Manual Control of R Gain at Manual WB mode	
	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 at Manual WB mode	0x80
CAM_BGain	Reset	8x	01	04	04	00	FF											Manual Control of B Gain at Manual WB mode	
	Up	8x	01	04	04	02	FF												
	Down	8x	01	04	04	03	FF												-
	Direct	8x	01	04	44	00	00	0p	0q	FF								qp: B Gain at Manual WB mode	0x80
CAM_AE	Full Auto	8x	01	04	39	00	FF											Automatic Exposure mode	0x00
	Manual	8x	01	04	39	03	FF											Manual Control Mode	
	Shutter Priority/Tv	8x	01	04	39	0A	FF											Shutter priority AE	
	Iris Priority/Av	8x	01	04	39	0B	FF											Iris priority AE	
CAM_SlowShutter	Auto	8x	01	04	5A	02	FF											Auto Slow Shutter On/Off For low illumination of subject at Auto, use Slow Shutter before gain up.After Shutter speed reaches 133ms, gain goes up.	0x03
	Manual	8x	01	04	5A	03	FF												
CAM_Shutter	Reset	8x	01	04	0A	00	FF											Shutter Setting : Enabled at AE manual mode or AE shutter priority mode	-
	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 : Enabled at AE manual mode or AE shutter priority mode	0x05
CAM_Iris	Reset	8x	01	04	0B	00	FF											Iris Setting : Enabled at AE manual mode or AE shutter priority mode	-
	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	0x11
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 : Enabled at AE manual mode or AE shutter priority mode (0x00 - 0x18)	0x01
	Gain Limit	8x	01	04	2C	pq	FF											pq: Gain Position : Enabled at AE manual mode or AE shutter priority mode (0x04 - 0x18)	0x18
CAM_ExpComp	On	8x	01	04	3E	02	FF											Exposure Compensation On/Off : Enabled at other mode than AE manual mode.	0x03
	Off	8x	01	04	3E	03	FF												
	Reset	8x	01	04	0E	00	FF											Exposure Compensation Amount Setting : Enabled at CAM_ExpComp On	-
	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 : Enabled at CAM_ExpComp On	0x07
CAM_BackLight	On	8x	01	04	33	02	FF											Back Light Compensation On/Off : Exclusive to SpotAE. Can be used at SpotAE Off	0x03
	Off	8x	01	04	33	03	FF												
CAM_SpotAE	On	8x	01	04	59	02	FF											Spot AE Setting : Exclusive to BackLight. Can be used at BackLight Off	0x03
	Off	8x	01	04	59	03	FF												
	Position	8x	01	04	29	0p	0q	0r	0s	FF								pq: X(00-10) 、rs: Y(00-0E)	X=0x08 Y=0x07
CAM_AE_Response	Direct	8x	01	04	5D	pp	FF											pp: AE Response Setting (01-30), default value: 10	0x10
CAM_WD	On	8x	01	04	3D	02	FF												0x03
	Off	8x	01	04	3D	03	FF												
CAM_Defog	On	8x	01	04	37	02	0p	FF										p: 0:mid, 1:low, 2:mid, 3:high	0x03/Off
	Off	8x	01	04	37	03	00	FF											
CAM_Aperture/Sharpness	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 00-0fh	0x08
CAM_NR	-	8x	01	04	53	pq	FF											p: 3DNR Setting (0:Off, 1-5: Level) q: 2DNR Setting (0:Off, 1-5: Level)	0x33
CAM_Gamma	-	8x	01	04	5B	0p	FF											p: Gamma Setting (0: Standard, 1-3) 00 : Standard Gamma 01 : Streight Gamma 02 : Low noise (Narrow dynamic range) 03 : Wide dynamic range	0x00

Command List (3/4)

CommandSet	Command	CommandPacket															Comments	Initial Value Factory Default
		H	1	2	3	4	5	6	7	8	9	10	11	12	13	14	T	
CAM_LR_Reverse	On	8x	01	04	61	02	FF											Mirror Image On/Off	0x03
	Off	8x	01	04	61	03	FF												
CAM_FREEZE	On	8x	01	04	62	02	FF											Video Freeze On/Off	0x03
	Off	8x	01	04	62	03	FF												
CAM_PictureEffect	Off	8x	01	04	63	00	FF											Picture Effect Setting	0x00
	B&W	8x	01	04	63	04	FF												
CAM_PictureFlip	Flip On	8x	01	04	66	02	FF											Picture Flip (upside-down & mirror) On	0x03
	Flip Off	8x	01	04	66	03	FF											Picture Flip (upside-down & mirror) Off	
CAM_Memory	Reset	8x	01	04	3F	00	0p	FF										p: Memory Number (0-3)	-
	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										Start 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_MultiLineTitle	Title Set1	8x	01	04	73	10	00	nn	pp	0q	00	00	00	00	00	00	FF	nn: Title start point X (1 unit = 20 pixel, 00 ~ 7F) pp: Title start point Y (1 unit = 20 pixel, 00 ~ 7F) q: Font size [0(smallest) - 3(largest)]	-
	Title Set2	8x	01	04	73	2L	mm	nn	pp	qq	rr	ss	tt	uu	vv	ww	FF	L: Line Number mnpqrstuvw: Character Font Number (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: Character Font Number (11 to 20)	-
	Title Clear	8x	01	04	74	1p	FF											p: 0 to 0xb line, p=f : all lines	-
	On	8x	01	04	74	2p	FF											p: 0 to 0xb line, p=f : all lines	-
	Off	8x	01	04	74	3p	FF											p: 0 to 0xb line, p=f : all lines	-
CAM_Mute	On	8x	01	04	75	02	FF											Mute On/Off	0x03
	Off	8x	01	04	75	03	FF												
CAM_PrivacyZone	SetMask	8x	01	04	76	0m	0n	0r	0r	0s	0s	FF						Setting Mask(Size) Parameter : 0m 0n 0r 0r 0s 0s m : mask number [0 ~ F) m=0 : Modify m=1 : New rr : W ss : H	-
	Display	8x	01	04	77	0p	0p	0p	0p	FF								Setting Mask Display On/Off pppp : Mask setting (0: OFF, 1: ON)	-
	SetMaskColor	8x	01	04	78	0p	0p	0p	0p	qq	rr	FF						Setting Color of Mask qq: Color setting when setting the Mask bit to 0 rr: Color setting when setting the Mask bit to 1 pppp : Mask Color Setting,	-
	SetPanTiltAngle	8x	01	04	79	0p	0p	0p	0q	0q	0q	FF						Setting Pan/Tilt Angle ppp: Pan angle, qqq: Tilt angle	-
	SetPTZMask	8x	01	04	7B	mm	0p	0p	0p	0q	0q	0q	0r	0r	0r	0r	FF	Setting the direct position of PTZ ppp: Pan , qqq: Tilt , rrr: Zoom, mm: mask number	-
	Non_InterlockMask	8x	01	04	6F	mm	0p	0p	0q	0q	0r	0r	0s	0s	FF			Setting non-interlocking the mask to pan/tilt pp:X, qq:Y, rr:W, ss:H	-
CAM_Continuous ZoomPosReply	On	8x	01	04	69	02	FF											ZoomPosition data Continuous Output On/Off	0x03
	Off	8x	01	04	69	03	FF												
CAM_ReplyIntervalTimeSet	_	8x	01	04	6A	00	00	0p	0p	FF								pp: Interval Time [Vertical timing] (frame count)	0x3C

Command List (4/4)

CommandSet	Command	CommandPacket															Comments	Initial Value Factory Default
		H	1	2	3	4	5	6	7	8	9	10	11	12	13	14	T	
CAM_RegisterValue	-	8x	01	04	24	mm	0p	0p	FF									mm = addr (hex) pp = val (hex) addr = 00: VISCA communication baud rate val : 00=9600bps, 01=19200bps, 02=38400bps, 03=115200bps addr = 54: Zoom tracking val : 00=off, 01=on addr = 72: Monitor mode val : 01=1080/30p, 02= 1080/25p, 03=1080/60i, 04=1080/50i, 05=720/60p 06=720/50p, 07=1080/60p, 08=1080/50p addr = 78: Lens distortion compensation upper 4bit 0:Crop, 1:All lower 4bit 0:Off, 1-4 :Table No.1-4 addr = 79: Maximum F number val : 03=F22, 04=F16, 05=F14, 06=F11, 07=F9.6, 08=F8.0 addr = 7A: F number for Small Aperture Elimination val : 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=F1.8 addr = 7B: Minimum Shutter Speed val : 0B=1/250, 0C=1/350, 0D:1/500, 0E:1/725, 0F:1/1000(default), 10:1/1500, 11:1/2000, 12:1/3000, 13:1/4000, 14:1/6000, 15:1/10000 addr = 7C: Maxmum Shutter Speed val : 00=1/4, 01=1/1, 02=1/2, 03=1/3, 04=1/4, 05=1/6 06=1/8, 07=1/15 or 1/12.5 addr = 7D: Setup Control val : 0D=Reset Parameters to Default 3A=Firmware Update Mode	00 val = 0x00 54 val = 0x01 72 val = 0x01 78 val = 0x01 79 val = 0x06 7A val = 0x0C 7B val = 0x15 7C val = 0x04
CAM_ChromaSuppress	-	8x	01	04	5F	pp	FF											pp: Chroma Suppress setting level 00 : Lowest 01-03: On (3 levels) Effect increases as the level number increases.	0x02
CAM_ColorGain/Saturation	Direct	8x	01	04	49	00	00	00	0p	FF								p: Color Gain Setting 0h (60%) - Eh (200%)	0x04
CAM_ColorHue	Direct	8x	01	04	4F	00	00	00	0p	FF								p: Color Hue Setting 0h (-14 degrees) - Eh (+14 degrees)	0x07

d: Camera address + 1 (Normally 2)
x: Camera Address (1-7)
y: Socket No. (0-1)
z: Camera Address + 8 (9-F)

Inquiry Command List (1/2)

CommandSet	CommandPacket						InquiryPacket													Comments
	H	1	2	3	4	5	H	1	2	3	4	5	6	7	8	9	10	11	12	13	
CAM_PowerInq	8x	09	04	00	FF		y0	50	02	FF											Power On
							y0	50	03	FF											Power Off(Stanby)
CAM_ZoomPosInq	8x	09	04	47	FF		y0	50	0p	0q	0r	0s	FF								pqrs: Zoom Position
CAM_FocusModeInq	8x	09	04	38	FF		y0	50	02	FF											Auto Focus
							y0	50	03	FF											Manual Focus
CAM_FocusPosInq	8x	09	04	48	FF		y0	50	0p	0q	0r	0s	FF								pqrs: Focus Position
CAM_FocusNearLimitInq	8x	09	04	28	FF		y0	50	0p	0q	0r	0s	FF								pqrs: Near Focus Limit Position
CAM_AFSensitivityInq	8x	09	04	58	FF		y0	50	01	FF											AF Sensitivity High
							y0	50	02	FF											AF Sensitivity Normal
							y0	50	03	FF											AF Sensitivity Low
							y0	50	04	FF											AF Sensitivity Super 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 Time
CAM_WBModeInq	8x	09	04	35	FF		y0	50	00	FF											ATW1(Narrow)
							y0	50	01	FF											Indoor(3200K)
							y0	50	02	FF											Outdoor(5800K)
							y0	50	03	FF											One Push WB
							y0	50	04	FF											ATW2(Wide)
							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	01	FF											Auto_LN
							y0	50	03	FF											Manual
							y0	50	0A	FF											Shutter Priority
							y0	50	0B	FF											Iris Priproty
							y0	50	0C	FF											Gain Priority
CAM_SlowShutterModeInq	8x	09	04	5A	FF		y0	50	02	FF											Auto
							y0	50	03	FF											Manual
CAM_ShutterPosInq	8x	09	04	4A	FF		y0	50	00	00	0p	0q	FF								pq: Shutter Position
CAM_IrisPosInq	8x	09	04	4B	FF		y0	50	00	00	0p	0q	FF								pq: Iris Position
CAM_GainPosInq	8x	09	04	4C	FF		y0	50	00	00	0p	0q	FF								pq: Gain Position
CAM_GainLimitInq	8x	09	04	2C	FF		y0	50	pq	FF											pq: Gain Limit
CAM_ExpCompModeInq	8x	09	04	3E	FF		y0	50	02	FF											ExpComp Mode On
							y0	50	03	FF											ExpComp Mode Off
CAM_ExpCompPosInq	8x	09	04	4E	FF		y0	50	00	00	0p	0q	FF								pq: ExpComp Position
CAM_BackLightModeInq	8x	09	04	33	FF		y0	50	02	FF											On
							y0	50	03	FF											Off
CAM_SpotAEModeInq	8x	09	04	59	FF		y0	50	02	FF											SpotAE Mode On
							y0	50	03	FF											SpotAE Mode 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: 01 to 30 (hex)
CAM_WDModeInq	8x	09	04	3D	FF		y0	50	02	FF											On
							y0	50	03	FF											Off
CAM_DefogModeInq	8x	09	04	37	FF		y0	50	02	FF											On
							y0	50	03	FF											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											p: 0-5 3D Noise Reduction q: 0-5 2D Noise Reduction
CAM_GammaInq	8x	09	04	5B	FF		y0	50	0p	FF											p: 0-4 Gamma
CAM_LR_ReverseModeInq	8x	09	04	61	FF		y0	50	02	FF											Mirror Mode On
							y0	50	03	FF											Mirror Mode Off
CAM_FREEZEInq	8x	09	04	62	FF		y0	50	02	FF											Video Freeze On
							y0	50	03	FF											Video Freeze Off
CAM_PictureEffectModeInq	8x	09	04	63	FF		y0	50	00	FF											Picture Effect Mode Off
							y0	50	04	FF											Picture Effect Mode B&W
CAM_PictureFlipModeInq	8x	09	04	66	FF		y0	50	02	FF											Picture Flip & Miller On
							y0	50	03	FF											Picture Flip & Miller Off
CAM_MemoryInq	8x	09	04	3F	FF		y0	50	pp	FF											pp : Memory Number (most recent call)
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 List (2/2)

CommandSet	CommandPacket						InquiryPacket													Comments
	H	1	2	3	4	5	H	1	2	3	4	5	6	7	8	9	10	11	12	13	
CAM_PrivacyDisplayInq	8x	09	04	77	FF		y0	50	pp	pp	pp	pp	FF								Inquiry about the status of Setting Mask Display On/Off See "pp pp pp pp: Mask bit" in "Parameters" on page 17. 1:On, 0:Off 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						Inquiry about the pan/tilt position currently set See "Setting pan/tilt angle" in "Parameters" on page 17. 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		Inquiry about pan/tilt/zoom position at the mm Mask setting See "mm: Mask setting list" and "Setting pan/tilt angle" in "Parameters" on page 17. ppp: Pan Position, qqq: Tilt Position rrrr: Zoom Position
CAM_PrivacyMonitorInq	8x	09	04	6F	FF		y0	50	pp	pp	pp	pp	FF								Inquiry about the mask currently displayed See "pp pp pp pp: Mask bit" in "Parameters" on page 17. pp pp pp pp: Current Displayed Mask
CAM_MuteModeInq	8x	09	04	75	FF		y0	50	02	FF											On
							y0	50	03	FF											Off
CAM_VersionInq	8x	09	00	02	FF		y0	50	00	23	mn	pq	rs	tu	vw	FF					mnpq: Model ID (F011) rstu: ROM Version vw: Socket Number (=02)
CAM_ContinuousZoomPosReplyModeInq	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	pp	FF											pp: 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 Temperature

d: Camera address + 1 (Normally 2)
x: Camera Address (1-7)
y: Socket No. (0-1)
z: Camera Address + 8 (9-F)

Exposure control (1/2)

	Data	60/30 mode	50/25 mode
Shutter Speed	15	1/10000	1/10000
	14	1/6000	1/6000
	13	1/4000	1/4000
	12	1/3000	1/3000
	11	1/2000	1/2000
	10	1/1500	1/1500
	0F	1/1000	1/1000
	0E	1/725	1/725
	0D	1/500	1/500
	0C	1/350	1/350
	0B	1/250	1/250
	0A	1/180	1/180
	09	1/120	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	F1.8	
	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	
	04	F16	
	03	F22	
	00	CLOSE	

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

Exposure control (2/2)

		IRIS	GAIN
Exposure Comp.	0D	+6	+12 dB
	0C	+5	+10 dB
	0B	+4	+8 dB
	0A	+3	+6 dB
	09	+2	+4 dB
	08	+1	+2 dB
	07	0	0 dB
	06	-1	-2 dB
	05	-2	-4 dB
	04	-3	-6 dB
	03	-4	-8 dB
	02	-5	-10 dB
	01	-6	-12 dB

Zoom Ratio and Zoom Position

(for reference)

Zoom Ratio	Zoom Position Data
x1	0000
x2	18C3
x3	2430
x4	2B0C
x5	3049
x6	3430
x7	37CF
x8	3AAA
x9	3D86
x10	4000

x1 : Wide end

x10 : Tele end

Lens control

Focus Position and Near Limit

Focus Position	1000(Far End) to B000(Near End)	
Focus	1000	Inf
Near Limit	2000	4.7 m
	3000	2.3 m
	4000	1.5 m
	5000	1.1 m
	6000	0.9 m
	7000	0.8 m
	8000	25 cm
	9000	9 cm
	A000	3.4 cm
	B000	1.0 cm

* initial setting

* Above distance numbers are approximate values.

Title Setting Font Map

Font Number	00	01	02	03	04	05	06	07
Character	A	B	C	D	E	F	G	H
Font Number	08	09	0A	0B	0C	0D	0E	0F
Character	I	J	K	L	M	N	O	P
Font Number	10	11	12	13	14	15	16	17
Character	Q	R	S	T	U	V	W	X
Font Number	18	19	1A	1B	1C	1D	1E	1F
Character	Y	Z	&	[space]	?	!	1	2
Font Number	20	21	22	23	24	25	26	27
Character	3	4	5	6	7	8	9	0
Font Number	28	29	2A	2B	2C	2D	2E	2F
Character	a	b	c	d	e	f	g	h
Font Number	30	31	32	33	34	35	36	37
Character	i	j	k	l	m	n	o	p
Font Number	38	39	3A	3B	3C	3D	3E	3F
Character	q	r	s	t	u	v	w	x
Font Number	40	41	42	43	44	45	46	47
Character	y	z	%	[	]	*	+	=
Font Number	48	49	4A	4B	4C	4D	4E	4F
Character	_	"	:	'	.	,	/	-

Temperature Reading Conversion Value
(Reference Value)

Reading Value (pq hex)	Temperature Conversion Value C
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 (Hex)	
VISCA Baud Rate	00	00 (default)	9600 bps
		01	19200 bps
		02	38400 bps
		03	115200 bps
Zoom Tracking AF	54	00	Off
		01 (default)	On
Monitoring Mode	72	01(default)	1080/30p
		02	1080/25p
		03	1080/60i
		04	1080/50i
		05	720/60p
		06	720/50p
		07	1080/60p
		08	1080/50p
Lens Distortion Compensation	78	Upper 4bit	0: Crop, 1: All
		Lower 4bit	0: Off, 1-4: Table No.1-4
			default: 0x01
Maximum F Number	79	03	F22
		04	F16
		05	F14
		06(default)	F11
		07	F9.6
		08	F8.0
F Number for Small Aperture Elimination	7A	0x09:F6.8, 0x0A:F5.6, 0x0B:F4.8, 0x0C:F4.0(default), 0x0D:F3.4, 0x0E:F2.8, 0x0F:F2.4, 0x10:F2.0, 0x11:F1.8	
Minimum Shutter Speed	7B	0x0B:1/250, 0x0C:1/350, 0x0D:1/500, 0x0E:1/725, 0x0F:1/1000(default), 0x10:1/1500, 0x11:1/2000, 0x12:1/3000, 0x13:1/4000, 0x14:1/6000, 0x15:1/10000	
Maxmum Shutter Speed	7C	0x00:1/4, 0x01:1, 0x02:1/2, 0x03/1/3, 0x04:1/4(default),	
		0x05:1/6, 0x06:1/8, 0x07:1/15 or 1/12.5	
Setup Control	7D	0D	Reset Parameters to Default
		3A	Firmware Update Mode

White Balance Modes and Gamma

WhiteBalance Mode

Value	Mode
00	ATW1
01	Indoor
02	Outdoor
03	One Push WB
04	ATW2
05	Manual

Gamma

Value	Comment
00	Standard
01	Straight Gamma
02	Low noise (narrow dynamic range)
03	Wide Range

5. SPECIFICATION

5.1 SPECIFICATION

■Camera

Image sensor	1/3-type CMOS (Progressive Scan)
Effective number of pixels	Approx. 4,080,000 pixels
Signal system(HD)	1080p/60, 1080p/50, 1080p/30, 1080p/25, 1080i/60, 1080i/50, 720p/60, 720p/50
Minimum illumination	0.5 lx (1/30sec, F1.8, 50%)
Recommended illumination	100 lx to 100,000 lx
S/N ratio	More than 50dB
Gain	Auto / Manual
Shutter speed	1/1 to 1/10,000 sec
Sync system	Internal
Exposure compensation	-12dB to +12dB (Total 13 steps)
Backlight compensation	ON/OFF
Gamma	4 gamma curves
Aperture control	16 steps
White balance	ATW1(Narrow), ATW2(Wide), One push, Manual (B, R) indoor, outdoor
AE (Auto exposure mode)	Auto, Manual, Priority mode (shutter/iris)
Lens (wide to tele)	10x optical zoom f=3.3 to 33.0 mm F1.8 to 3.4
Zoom mode	Standard /Variable/Direct
Zoom movement speed (wide to tele)	1.4 sec (Focus Tracking ON)
Focusing system	Auto, Manual, One push, AF sensitivity
Horizontal viewing angle (wide to tele)	58.2° to 6.9°
Minimum object distance (wide to tele)	10mm to 800mm
Horizontal resolution	800 TV lines

■Interface

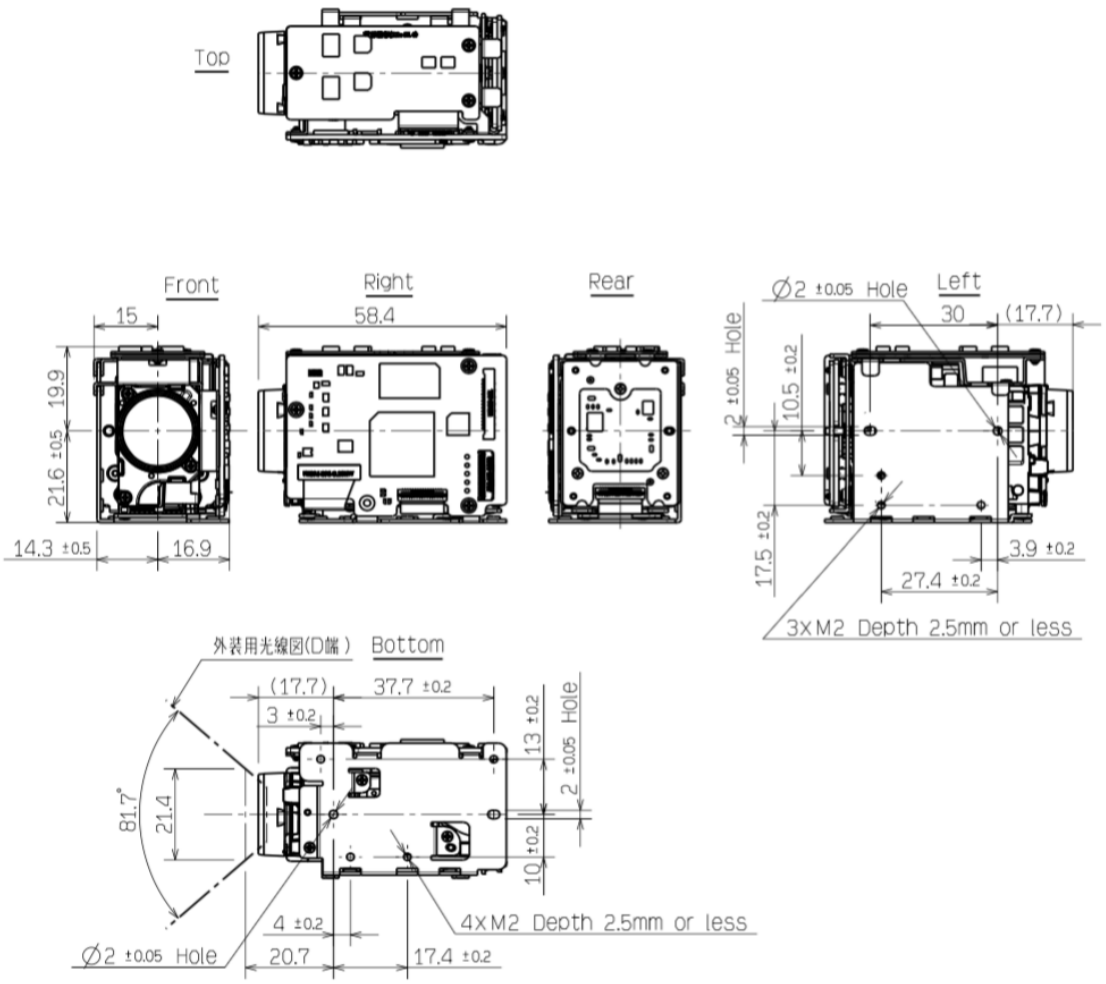
Video output	Digital: Y/Pb/Pr 4:2:2 (LVDS)
Camera control interface	VISCA protocol ＊VISCA is a tragemark of Sony Corporation.

■Others

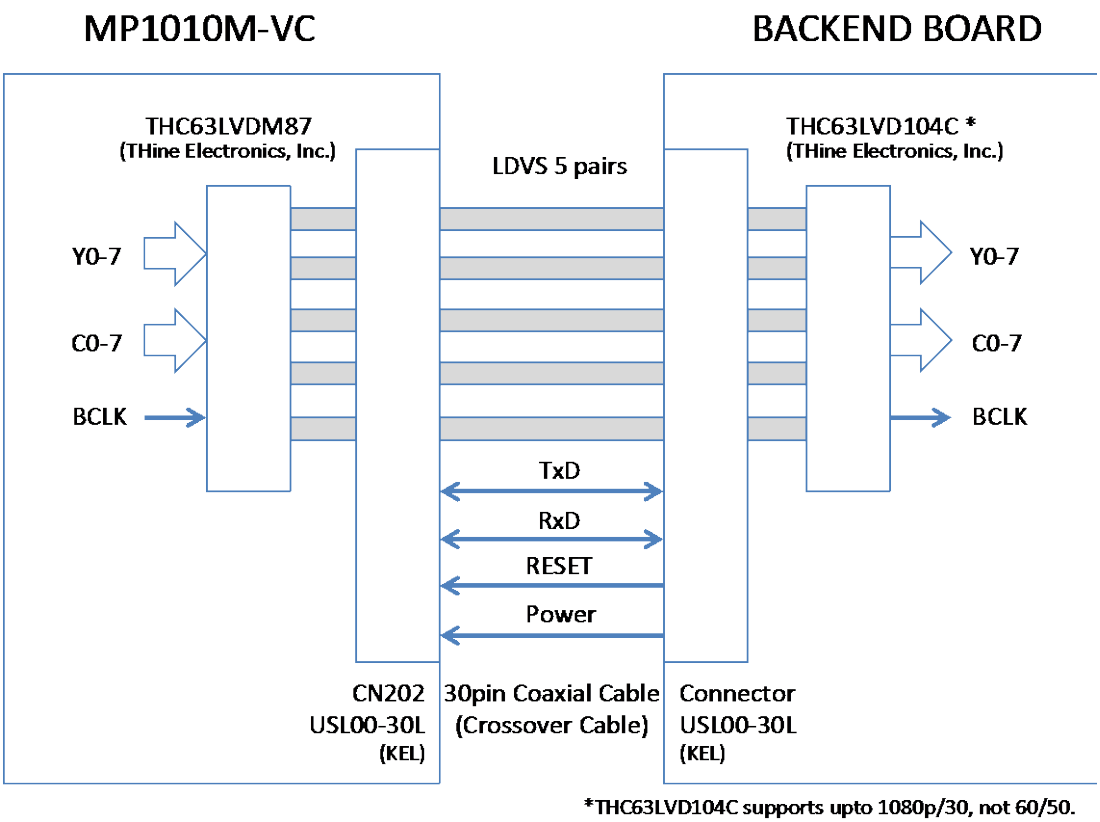
Operating Voltage	DC 8-12V
Power Consumption	Normal 3 Watt max. About 4W (at motor moving)
Operating Temperature	-5 ～ + 60℃
Storage Temperature	-40 ～ + 60℃
Operating Humidity	20% ～ 80% (No dew condensation)
Storage Humidity	20% ～ 90% (No dew condensation)
Dimension (W x H x D)	31.9 x 41.5 x 58.4 mm
Weight	~77g

5.2 DIMENSION AND ECLIPSE

UNIT : mm



5.3 INTERFACE



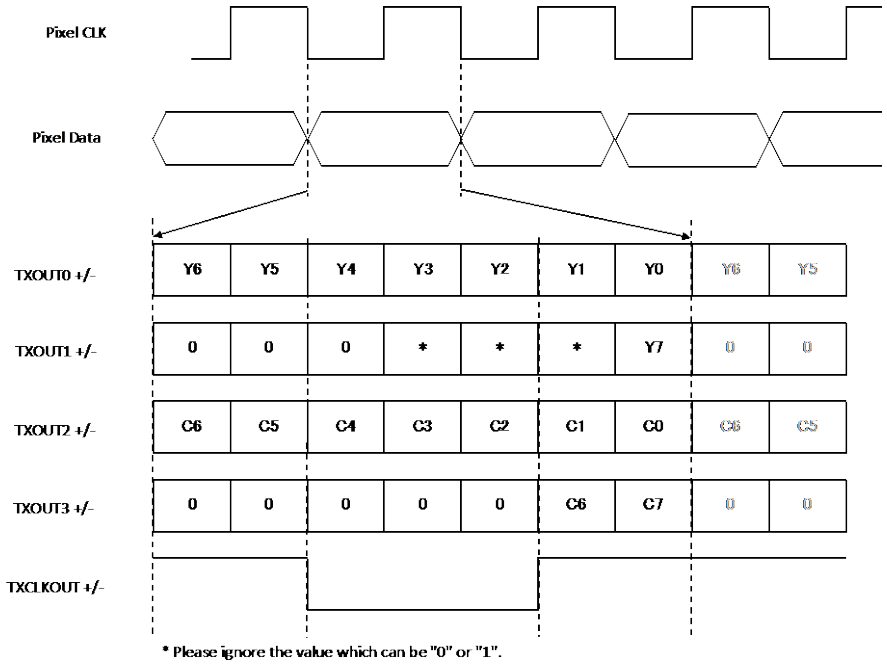
- MP1010M-VC is using THC63LVDM87(LVDS Tx IC). A receiver (i.e. Backend Board in the above figure.) needs LVDS Rx IC such as TC63LVD104C, THC63LVD1024, BU90R102, etc.

5.4 PIN ASSIGNMENT

CN202 pin assignment :

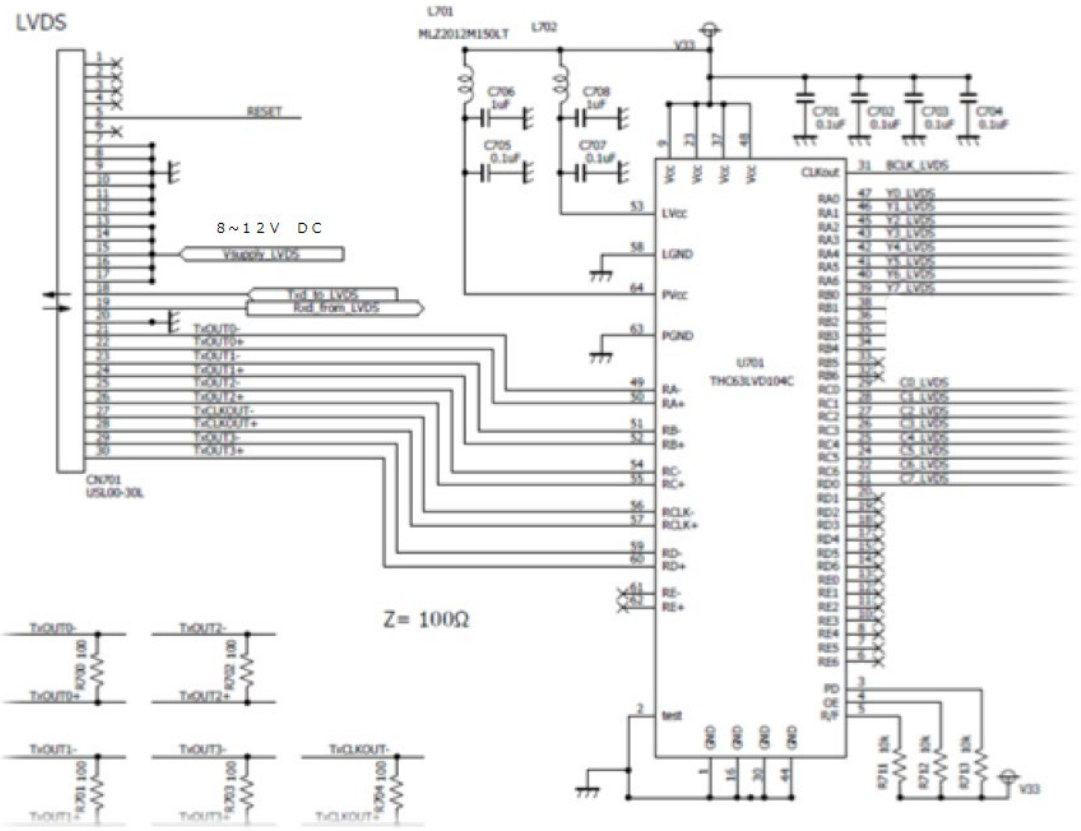
No	名称 Pin Name	説明/備考 Description/Remarks
1	TXOUT3+	
2	TXOUT3-	
3	TXCLKOUT+	
4	TXCLKOUT-	
5	TXOUT2+	
6	TXOUT2-	
7	TXOUT1+	
8	TXOUT1-	
9	TXOUT0+	
10	TXOUT0-	
11	GND	
12	TxD HOST1	CMOS 3.3 V (Low: Max 0.55 V、High: Min 2.5 V)
13	RxD HOST1	CMOS 3.3 V (Low: Max 0.6 V、High: Min 2.4 V Max 5.0V)
14	DC IN	8 ～ １２V DC
15	DC IN	8 ～ １２V DC
16	DC IN	8 ～ １２V DC
17	DC IN	8 ～ １２V DC
18	DC IN	8 ～ １２V DC
19	GND	
20	GND	
21	GND	
22	GND	
23	GND	
24	GND	
25	NC	未使用 （ オープン接続） No connection (An open connection.)
26	RESET	外部リセット端子 リセット(Reset): Low(GND), 通常(Operat'n): Open(3.3V)
27	NC	未使用 （ オープン接続） No connection (An open connection.)
28	NC	未使用 （ オープン接続） No connection (An open connection.)
29	NC	未使用 （ オープン接続） No connection (An open connection.)
30	NC	未使用 （ オープン接続） No connection (An open connection.)

5.5 LVDS PIXEL DATA FORMAT



Output Format	Pixel CLK[Hz]	TCLK+[Hz]
1080p/60	148.5M	148.5M
1080p/50	148.5M	148.5M
1080i/60	74.25M	74.25M
1080i/50	74.25M	74.25M
1080p/30	74.25M	74.25M
1080p/25	74.25M	74.25M
720p/60	74.25M	74.25M
720p/50	74.25M	74.25M

5.6 LVDS RX CIRCUIT EXAMPLE



5.7 LVDS CABLE SPECIFICATION (REFERENCE)

図1 内部等価回路 (Pin12 TxD HOST)
(Figure1 Internal Equivalent Circuit)

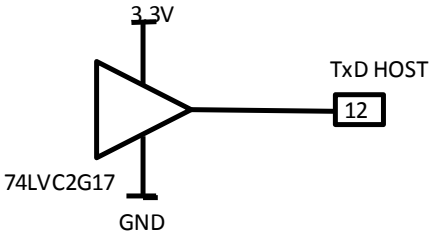


図2 内部等価回路 (Pin13 RxD HOST)
(Figure2 Internal Equivalent Circuit)

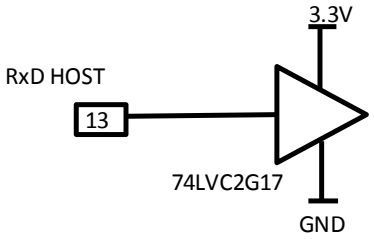
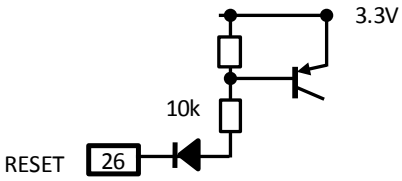
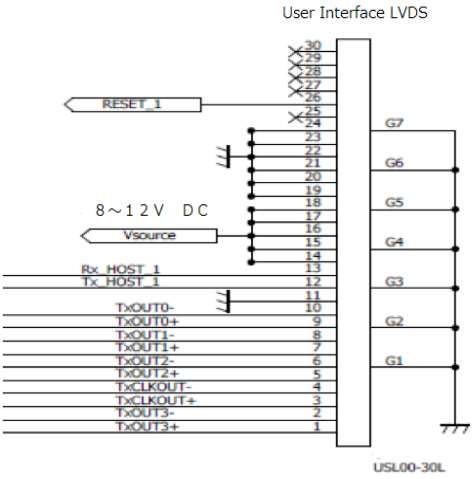
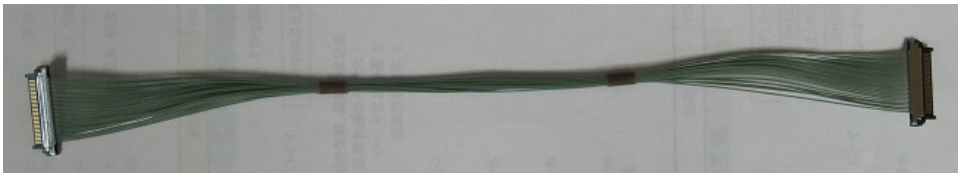


図3 内部等価回路 (Pin26 RESET)
(Figure3 Internal Equivalent Circuit)



LVDS OUT 接続説明
LVDS OUT pin connections

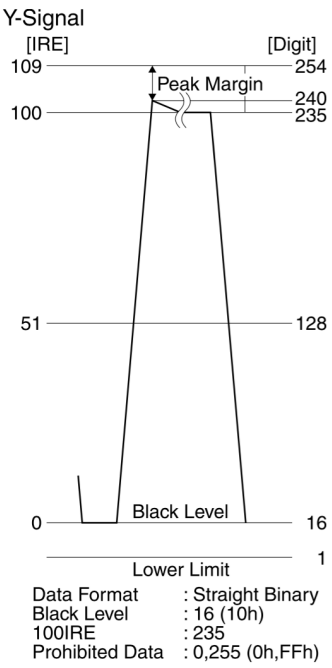




ケーブル参考資料
コネクタ:USL20-30S(KEL社製)
ケーブル:＃42 薄膜同軸ケーブル
クロスオーバー

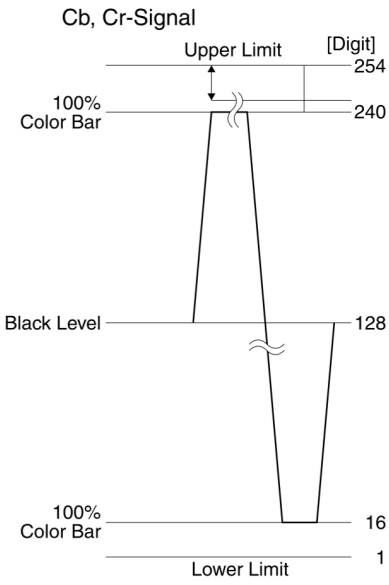
Cable Spec
Conector :USL20-30S (KEL Corp)
#42 thin coaxial cable
Crossover

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.

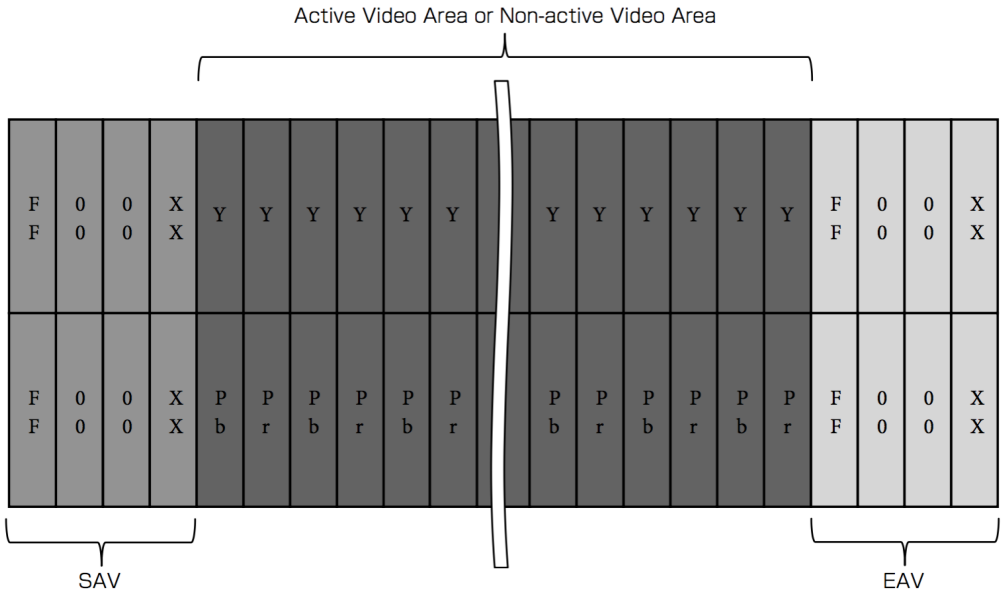


Data Format : Straight Binary
Black Level : 128 (80h)
Prohibited Data : 0,255 (0h,FFh)

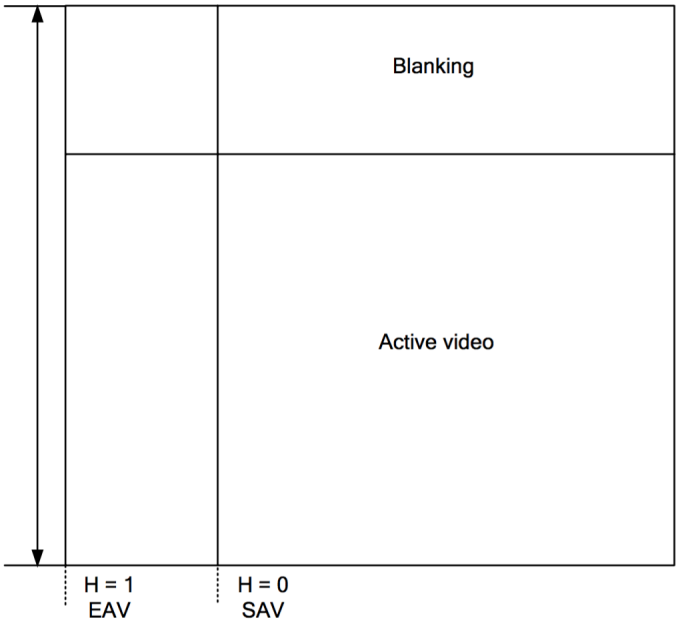
5.8 SYNCRONIZATION CODE

BT.1120, SMTPE296M/274M compliance.

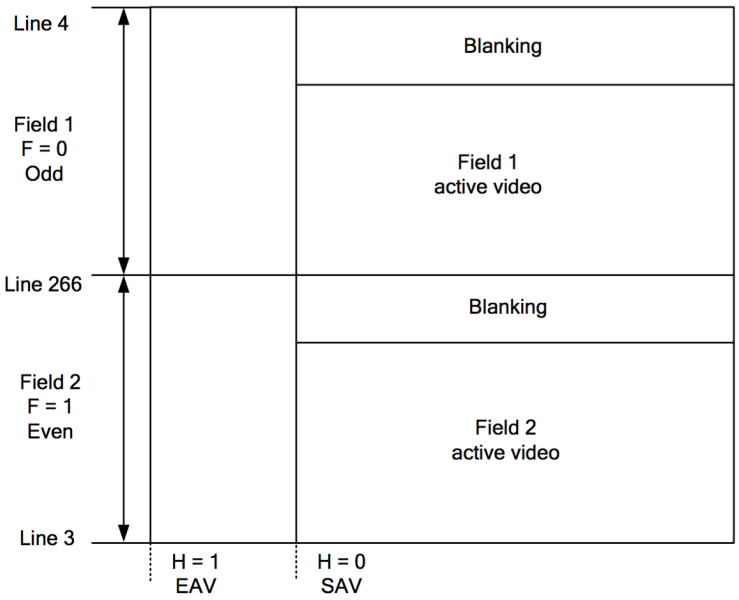
Sync. Code :



Output at progressive :



Output at interlace :



SAV and EAV :

(Only first field at progressive)

		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

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  uClibc

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Version 2, June 1991

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