

Full HD Camera Module

MP1110M-VC

Technical Reference Manual

Ver. 1.0

REVISION HISTORY

Ver. 1.00

2018/01/08

Tentative

Aegis Electronic Group, Inc.

TABLE OF CONTENTS

1. Features	6
2. Precautions.....	7
3. Basic Functions	10
3.1 VISCA commands	10
Timing Chart	10
Turn On a MP1110M-VC (from no power supplied).....	10
3.2 Zoom	11
3.3 Focus	12
3.4 Vibration compensation.....	13
3.5 White Balance	14
3.6 AE (Automatic Exposure).....	15
AE - Full auto	15
AE - Shutter priority	16
AE - Iris priority	16
AE - Manual.....	17
3.7 Spot Exposure.....	17
3.8 Exposure Compensation.....	19
3.9 AE Response.....	19
3.10 Long Exposure (Slow Shutter).....	19
3.11 Slow Shutter LIMIT	20
3.12 Gain Limit Setting	20
3.13 Aperture Control.....	21
3.14 Back Light Compensation.....	21
3.15 Wide Dynamic Range Mode (WDR)	21
3.16 Defog	22
3.17 Noise Reduction.....	22
3.18 3D noise reduction.....	22

3.19 Gamma	23
3.20 Temperature Reading Function.....	23
3.21 Low-Illumination Chroma Suppress	23
3.22 Color Gain.....	23
3.23 Color Hue	24
3.24 Effect	24
3.25 E-flip and mirror	24
3.26 FREEZE.....	24
3.27 Memory	24
3.28 Register setting	26
3.29 Title Display	29
3.30 Privacy Zone Masking Function	30
Features	30
PRIVACY ZONE MASK COMMAND LIST	30
PRIVACY ZONE MASK INQUIRY COMMAND LIST	30
How to use EACH COMMAND.....	31
3.31 Keystone Correction.....	33
3.32 Motion Detection	34
3.33 Initial Settings, Custom Presets	39
4. VISCA Commands	41
4.1 VISCA/RS-232 Commands	41
4.2 Overview of VISCA	41
4.3 VISCA Communication Specifications	42
VISCA packet structure.....	42
Commands and Inquiries	42
Responses for commands and inquiries.....	43
Socket number.....	44
Command execution cancel	44
4.4 VISCA Device Setting Commands.....	45
For VISCA network administration.....	45

VISCA interface commands	45
VISCA interface and inquiry	46
4.5 VISCA Commands/ACK Protocol.....	47
4.6 VISCA Camera-Issued Messages	47
ACK/Completion Messages.....	47
Error Messages	47
Network Change Message	47
4.7 VISCA Command List.....	48
4.8 VISCA Command Setting Values.....	54
5. Specification	60
5.1 specification	60
5.2 dimension and eclipse	61
5.3 interface.....	62
5.4 pin assignment.....	63
5.5 LVDS pixel data format.....	64
5.6 LVDS Rx circuit example	66
5.7 LVDS cable specification (reference)	67
5.8 synchronization code.....	68
6. Software license	71
OPEN SOURCE LICENSE REPORT ON THE PRODUCT	71
GNU GENERAL PUBLIC LICENSE	71
GNU LESSER GENERAL PUBLIC LICENSE	79

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.

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.

Aegis Electronic Group, Inc.

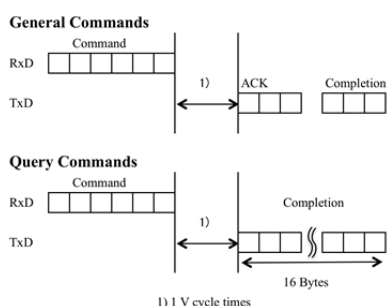
3. BASIC FUNCTIONS

3.1 VISCA COMMANDS

Camera control is performed by VISCA commands.

TIMING CHART

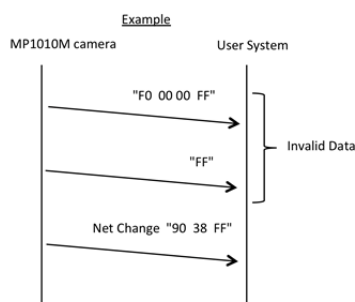
As VISCA Command processing can only be carried out one time in a Vertical cycle, it takes the maximum 1V cycle time for an ACK/Completion to be returned. If the Command ACK/Completion communication time is shorter than the 1V cycle time, then every 1V cycle can receive a Command.



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

TURN ON A MP110M-VC (FROM NO POWER SUPPLIED)

When MP110M-VC is turned on from no power supplied, MP110M-VC transmits a "Network Change" command through Tx D. 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 and supports 16x digital zoom.

- **Lens Specification**

F value: 3.3 mm to to 33.0mm (F1.8 to F3.4)

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.

Digital Zoom On/Off

After the Optical Zoom has reached its maximum level, the camera switches to Digital Zoom Mode.

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 10mm 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) MP1110M-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.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0																	
1			■	■	■												
2			■	■	■												
3			■	■	■												
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	

- Spot photometry : center area
- Spot photometry : surrounding area

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. MP1110M-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:

MP1110M-VC WDR does not reduce frame rate. For example, if MP1110M-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 uses 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% (0h) 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.

Aegis Electronic Group, Inc.

	Register No.	Value (Hex)	
VSCA Baud Rate	00	00 (default)	9600 bps
		01	19200 bps
		02	38400 bps
		03	115200 bps
D-Zoom Max	52	00	x1
		C0	x4
		EB: (Default)	x12
		F0	x16
Zoom Tracking AF	54	00	Off
		01 (default)	On
Keystone Correction	60	0x0= Off (default) 0x1= Correction level : lowest ... 0x12= Correction level: Highest	
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
		09	720/59.94p
		0B	NTSC
		0D	PAL
		0E	720/29.97p
		0F	720/30p
		11	720/25p
		13	1080/59.94p
		14	1080/29.97p
LVDS mode	74	00 (default)	Single
		01	Dual
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	
Maximum 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 the table of image quality to Default
		00, 2b	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.

MP1110M-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	0s	0s	FF							Setting Mask(Size) Parameter : 0m 0n 0r 0s 0s m : mask number 000 F) n=0 : Modify n=1 : New rr : W ss : H
	Display	8x	01	04	77	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	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	FF							Setting Pan/Tilt Angle ppp: Pan angle, qq: Tilt angle
	SetPTZMask	8x	01	04	7B	mm	0p	0p	0p	0q	0q	0r	0r	0r	0r	FF		Setting the direct position of PTZ ppp: Pan , qq: 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 rr: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: 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, qq: Tilt
CAM_PrivacyPTZInq	8x	09	04	7B	mm	FF	y0	50	0p	0p	0p	0q	0q	0r	0r	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_PrivacyMonitoring	8x	09	04	6F	FF	y0	50	pp	pp	pp	pp	FF										Inquiry about the mask currently displayed 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 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.

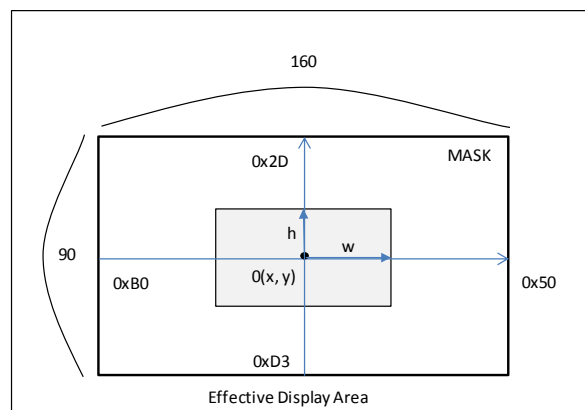
In the case of 01, new mask that contains the mask number mm, mask width (twice of w), and height (twice of h) in the center of the screen will be created on the current pan/tilt/zoom position.

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	Operation
00	Update the zone size (value of w, h)
01	Set a new zone size (value of w, h)

SetPanTiltAngle

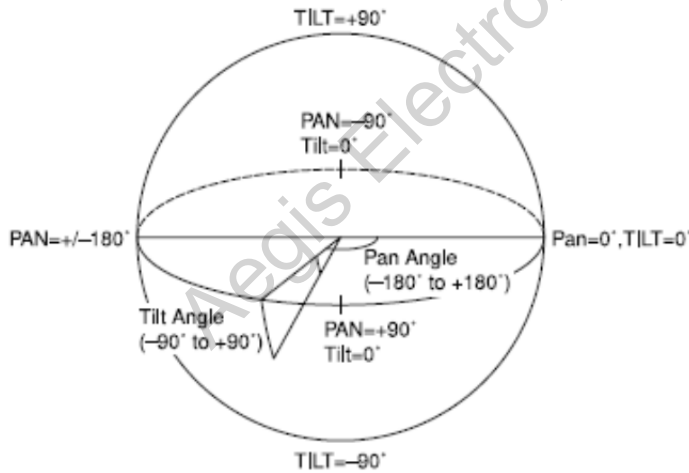
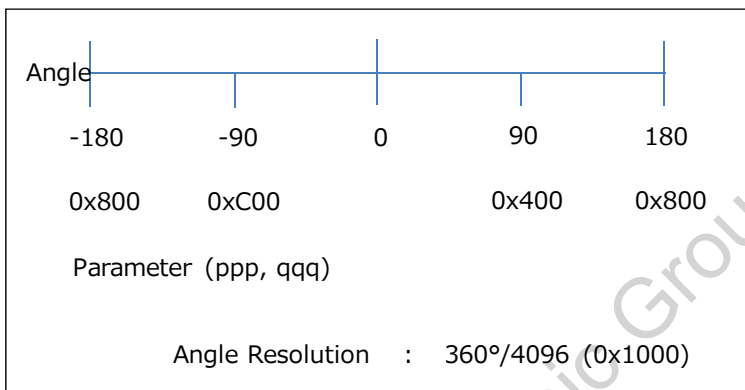
Set the present angle of pan and tilt.

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

ppp indicates Pan-angle, qqg 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 , qq: 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.

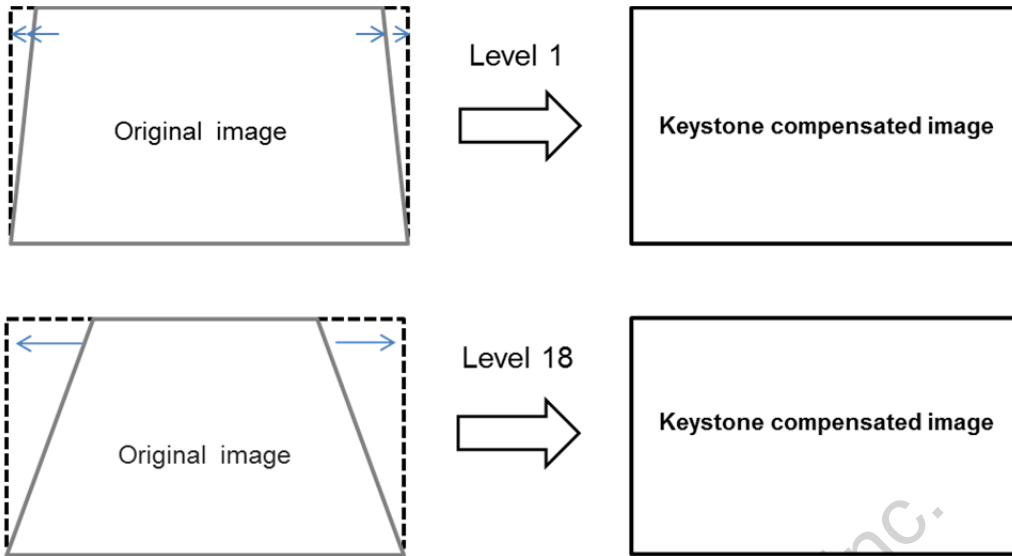
Setting orders

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 KEYSTONE CORRECTION

The upper edge of the keystone image can be expanded by Keystone Correction.

Compensation Level: Step1 (lowest) - Step18 (Highest)



CommandSet	Command	CommandPacket																Comments	
		H	1	2	3	4	5	6	7	8	9	10	11	12	13	14	T		
CAM_RegisterValue	-	8x	01	04	24	mm	0p	0q	FF										addr = 60 : Keystone correction 0x0= Off 0x1= Correction level : lowest 0x12= Correction level: Highest mm: Resister No (60) pq: Correction level (00: Correction off, 01: Lowest, 12: Highest)

3.32 MOTION DETECTION

This function instructs the camera to detect movement within the monitoring area and send an alarm signal automatically. The Detect signal goes out through the VISCA Command.

Features

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

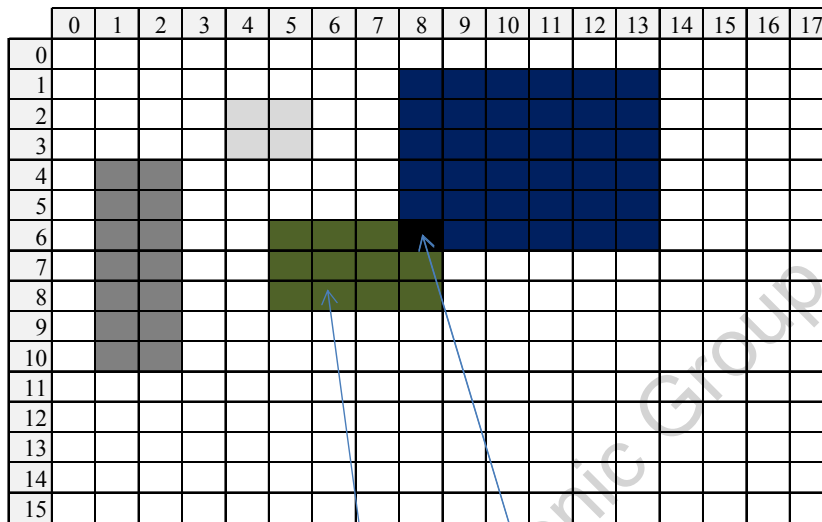
Frames

Setting frames

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

When motion is detected within the range where frames overlap

The alarms are sent for both frames.



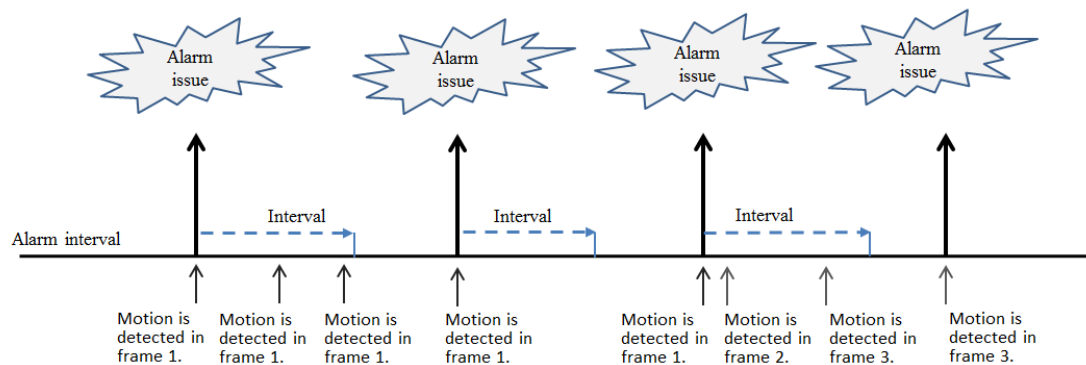
- Frame 1
- Frame 2
- Frame 3
- Frame 4

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

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

Sending Alarms

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



Setting Commands

-MD ON/OFF

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

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

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

-Function Set

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

8x 01 04 1C 0m 0n 0p 0q 0r 0s FF

m: Display mode on/off(bit0)

n: Detection frame set on/off (bit0:Frame0, bit1: Frame1,
bit2: Frame2, bit: Frame3)

-- (0 to F)

pq: Threshold -- (00 to FF)

rs: Interval time set -- (00 to FF)

(When pq and rs are 0, the command is received, but the setting is disabled)

-Frame Set

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

Note:

Set a terminating point higher vertically and horizontally than the starting point.

If you set the wrong value, an error occurs.

8x 01 04 1D 0m 0p 0q rr 0s FF

m: Select Detection Frame (0: Frame0, 1: Frame1,2: Frame2,3: Frame3) -- (0,1,2,3)	
p: Frame set Start Horizontal Position	--(00 to 0F)
q: Frame set Start Vertical Position	--(00 to 07)
r: Frame set End Horizontal Position	--(01 to 10)
s: Frame set End Vertical Position	--(01 to 08)

-Alarm Reply

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

y0 07 04 1B 0p FF

p: Frame number (bit0: Frame0, bit1: Frame1, bit2: Frame2, bit3:Frame3)

3.33 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.

Aegis Electronic Group, Inc.

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
Vibration Compensation	Off

4. VISCA COMMANDS

4.1 VISCA/RS-232 COMMANDS

This chapter outlines an RS-232 control protocol and command list for MP1110M-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.

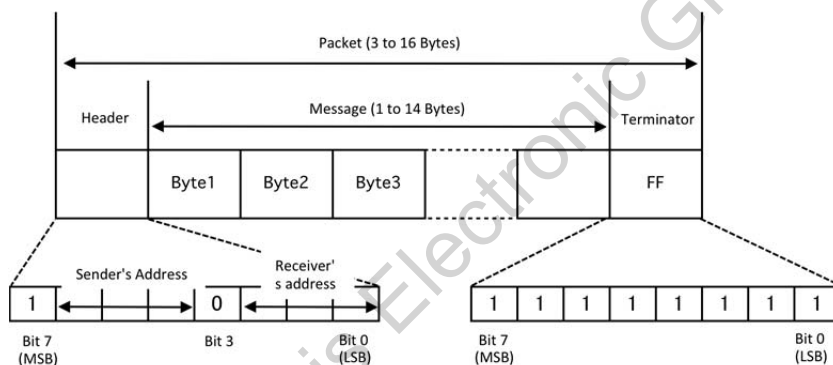
* VISCA is a protocol which controls consumer camcorders developed by Sony. “VISCA” is a registered trademark of Sony Corporation.

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 RRFF	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)

VISCA INTERFACE AND INQUIRY

- 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 (F012 : MP1110M-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)

Aegis Electronic Group, Inc.

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

4.7 VISCA COMMAND LIST

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	Or	0s	FF							pqrs: Zoom Position : 0000h - 4000h	0x0000	
CAM_Dzoom	On	8x	01	04	06	02	FF										Dzoom x1: 4000h, Dzoom x2: 6000h, Dzoom x4: 7000h Dzoom x8: 7800h, Dzoom x12: 7AC0h, Dzoom x16: 7C00h	-	
	Off	8x	01	04	06	03	FF											-	
CAM_Focus	Stop	8x	01	04	08	00	FF											-	
	Far (Standard)	8x	01	04	08	02	FF											-	
	Near (Standard)	8x	01	04	08	03	FF											-	
	Far (Variable)	8x	01	04	08	2p	FF										P=0 (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	Or	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	Or	0s	FF							pqrs: Focus Near Limit Position	0x8000		
AF Sensitivity	Normal	8x	01	04	58	02	FF										AF sensitivity Normal	-	
	Low	8x	01	04	58	03	FF										AF sensitivity Low	0x02	
CAM_AFMMode	Normal AF	8x	01	04	57	00	FF										AF Movement Mode : Normal	-	
	Interval AF	8x	01	04	57	01	FF										AF Movement Mode : Interval	0x00	
	Zoom Trigger AF	8x	01	04	57	02	FF										AF Movement Mode : Zoom Trigger AF	-	
Active/Interval Time	8x	01	04	27	0p	0q	Or	0s	FF							pq: Movement Time, rs: Interval Time : (second)	0x05, 0x05		
CAM_ZoomFocus	Direct	8x	01	04	47	0p	0q	Or	0s	0t	0v	0w	FF			pqrs: Zoom Position, tuvw: Focus Position Zoom : 0000h - 4000h, Focus : 1000h(far) - B000h(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)	-		
	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 calculation by One Push Trigger	-		
	ATW2	8x	01	04	35	04	FF									ATW2(Wide)	0x00		
	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 Calculate 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									pg: 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		
	Manual	8x	01	04	39	03	FF											Manual Control Mode		
	Shutter Priority/Tv	8x	01	04	39	0A	FF											Shutter priority AE	0x00	
	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									pg: 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									pg: 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									pg: Gain Position : Enabled at AE manual mode or AE shutter priority mode (0x00 - 0x18)	0x01
	Gain Limit	8x	01	04	2C	pq	FF												pg: 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													
	Up	8x	01	04	0E	02	FF												Exposure Compensation Amount Setting : Enabled at CAM_ExpComp On	-
	Down	8x	01	04	0E	03	FF													
CAM_BackLightModelnq	Direct	8x	01	04	4E	00	00	0p	0q	FF									pg: ExpComp position : Enabled at CAM_ExpComp On	0x07
	On	8x	01	04	33	02	FF											Back Light Compensation On/Off : Exclusive to SpotAE. Can be used at SpotAE Off	0x03	
CAM_SpotAE	Off	8x	01	04	33	03	FF													
	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													
CAM_AE_Response	Position	8x	01	04	29	0p	0q	0r	0s	FF								pg: X(00-10), rs: Y(00-0E)	X=0x08 Y=0x07	
	Direct	8x	01	04	5D	pp	FF											pg: 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													
CAM_NR	Direct	8x	01	04	42	00	00	0p	0q	FF								pg: Aperture Gain 00-0fh	0x08	
	-	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 : Straight Gamma 02 : Low noise (Narrow dynamic range) 03 : Wide dynamic range	0x00	
	-	8x	01	04	5B	0p	FF													

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	Op	FF									p: Memory Number (0-3)	-	
	Set	8x	01	04	3F	01	Op	FF										-	
	Recall	8x	01	04	3F	02	Op	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	nn	pp	Oq	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)] L: Line Number mnpqrstuvw: Character Font Number (1 to 10)	-	
	Title Set2	8x	01	04	73	2L	mm	nn	pp	qq	rr	ss	tt	uu	vv	ww	L: Line Number mnpqrstuvw: Character Font Number (11 to 20)	-	
	Title Set3	8x	01	04	73	3L	mm	nn	pp	qq	rr	ss	tt	uu	vv	ww	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	0s	0s	FF						Setting Mask(Size) Parameter: 0m 0n 0r 0s 0s m: mask number (0~F) n=0: Modify n=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	0q	0q	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	FF						Setting Pan/Tilt Angle ppp: Pan angle, qq: Tilt angle	-	
	SetPTZMask	8x	01	04	7B	mm	0p	0p	0q	0q	0q	0r	0r	0r	0r	FF	Setting the direct position of PTZ ppp: Pan, qq: Tilt, rrrr: Zoom, mm: mask number	-	
	Non_InterlockMask	8x	01	04	6F	mm	0p	0p	0q	0q	0r	0s	0s	FF			Setting non-interlocking the mask to pan/tilt pp:X, qq:Y, rr:W, ss:H	-	
CAM_ContinuousZoomPosReply	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	

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						
							y0	50	02	FF															Digital Zoom On		
CAM_DZoomModelInq	8x	09	04	06	FF		y0	50	03	FF											Digital Zoom Off						
							y0	50	02	FF															Auto Focus		
CAM_FocusModelInq	8x	09	04	38	FF		y0	50	03	FF											Manual Focus						
							y0	50	02	FF															pqrs: Focus Position		
CAM_FocusPosInq	8x	09	04	48	FF		y0	50	0p	0q	0r	0s	FF								pqrs: Near Focus Limit Position						
							y0	50	0p	0q	0r	0s	FF												AF Sensitivity High		
CAM_AFSensitivityInq	8x	09	04	58	FF		y0	50	01	FF											AF Sensitivity Normal						
							y0	50	02	FF														AF Sensitivity Low			
							y0	50	03	FF															AF Sensitivity Super Low		
							y0	50	04	FF																Normal AF	
CAM_AFModelInq	8x	09	04	57	FF		y0	50	00	FF											Interval AF						
							y0	50	01	FF															Zoom Trigger AF		
							y0	50	02	FF																pq: Movement Time, rs: Interval Time	
CAM_AFTimeSettingInq	8x	09	04	27	FF		y0	50	0p	0q	0r	0s	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)
CAM_WBModelInq	8x	09	04	35	FF		y0	50	05	FF											Manual						
							y0	50	00	FF															pq: R Gain		
CAM_RGainInq	8x	09	04	43	FF		y0	50	00	00	0p	0q	FF								pq: B Gain						
CAM_BGainInq	8x	09	04	44	FF		y0	50	00	00	0p	0q	FF									Full Auto					
CAM_AEModelInq	8x	09	04	39	FF		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
							y0	50	02	FF																	Auto
CAM_SlowShutterModelInq	8x	09	04	5A	FF		y0	50	03	FF											Manual						
							y0	50	00	00	0p	0q	FF												pq: Shutter Position		
CAM_ShutterPosInq	8x	09	04	4A	FF		y0	50	00	00	0p	0q	FF								pq: Iris Position						
CAM_IrisPosInq	8x	09	04	4B	FF		y0	50	00	00	0p	0q	FF									pq: Gain Position					
CAM_GainPosInq	8x	09	04	4C	FF		y0	50	00	00	0p	0q	FF									pq: Gain Limit					
CAM_GainLimitInq	8x	09	04	2C	FF		y0	50	pq	FF												ExpComp Mode On					
CAM_ExpCompModelInq	8x	09	04	3E	FF		y0	50	02	FF												ExpComp Mode Off					
							y0	50	03	FF																pq: ExpComp Position	
CAM_ExpCompPosInq	8x	09	04	4E	FF		y0	50	00	00	0p	0q	FF									On					
							y0	50	02	FF																Off	
CAM_BackLightModelInq	8x	09	04	33	FF		y0	50	03	FF												SpotAE Mode On					
							y0	50	02	FF																SpotAE Mode Off	
CAM_SpotAEModelInq	8x	09	04	59	FF		y0	50	03	FF												pq: X Position, rs: Y Position					
CAM_SpotAEPosInq	8x	09	04	29	FF		y0	50	0p	0q	0r	0s	FF									pp: 01 to 30 (hex)					
CAM_AE_ResponseInq	8x	09	04	5D	FF		y0	50	pp	FF												On					
CAM_WDModelInq	8x	09	04	3D	FF		y0	50	02	FF												Off					
							y0	50	03	FF																On	
CAM_DefogModelInq	8x	09	04	37	FF		y0	50	02	FF												Off					
							y0	50	03	FF																Off	
CAM_ApertureInq	8x	09	04	42	FF		y0	50	00	00	0p	0q	FF									pq: Aperture Gain					
CAM_NRModelInq	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_ReverseModelInq	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_PictureEffectModelInq	8x	09	04	63	FF		y0	50	00	FF												Picture Effect Mode Off					
							y0	50	04	FF																Picture Effect Mode B&W	
CAM_PictureFlipModelInq	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_TitleDisplayModelInq	8x	09	04	74	FF		y0	50	02	FF												Title Display Mode On					
							y0	50	03	FF																Title Display Mode Off	

4.8 VISCA COMMAND SETTING VALUES

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)

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

Digital Zoom Ratio	Digital Zoom Position Data
x1	4000h
x2	6000h
x4	7000h
x8	7800h
x12	7AC0h
x16	7C00h

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

Aegis Electronic Group, Inc.

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
D-Zoom Max	52	00	x1
		C0	x4
		EB: (Default)	x12
		F0	x16
Zoom Tracking AF	54	00	Off
		01 (default)	On
Keystone Correction	60	0x0= Off (default) 0x1= Correction level : lowest ... 0x12= Correction level: Highest	
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
		09	720/59.94p
		11	NTSC
		13	PAL
		14	720/29.97p
		15	720/30p
		17	720/25p
LVDS mode	74	00 (default)	Single
		01	Dual
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	
Maximum 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 the table of image quality to Default
		00, 2b	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

Aegis Electronic Group, Inc.

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/59.94, 1080p/50, 1080p/30, 1080p/29.97, 1080p/25, 1080i/60, 1080i/59.94, 1080i/50, 720p/60, 720p/59.94, 720p/50, 720p/30, 720p/29.97, 720p/25
Signal system (SD)	NTSC/PAL
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, F1.8 to 3.4
Zoom mode	Standard /Variable/Direct
Zoom movement speed (wide to tele)	1.4 sec (Focus Tracking ON)
Digital Zoom	16x
Focusing system	Auto, Manual, One push, AF sensitivity
Horizontal viewing angle (wide to tele)	58.2° ~ 6.9°
Minimum Object distance (wide to tele)	10mm to 800mm

■ Interface

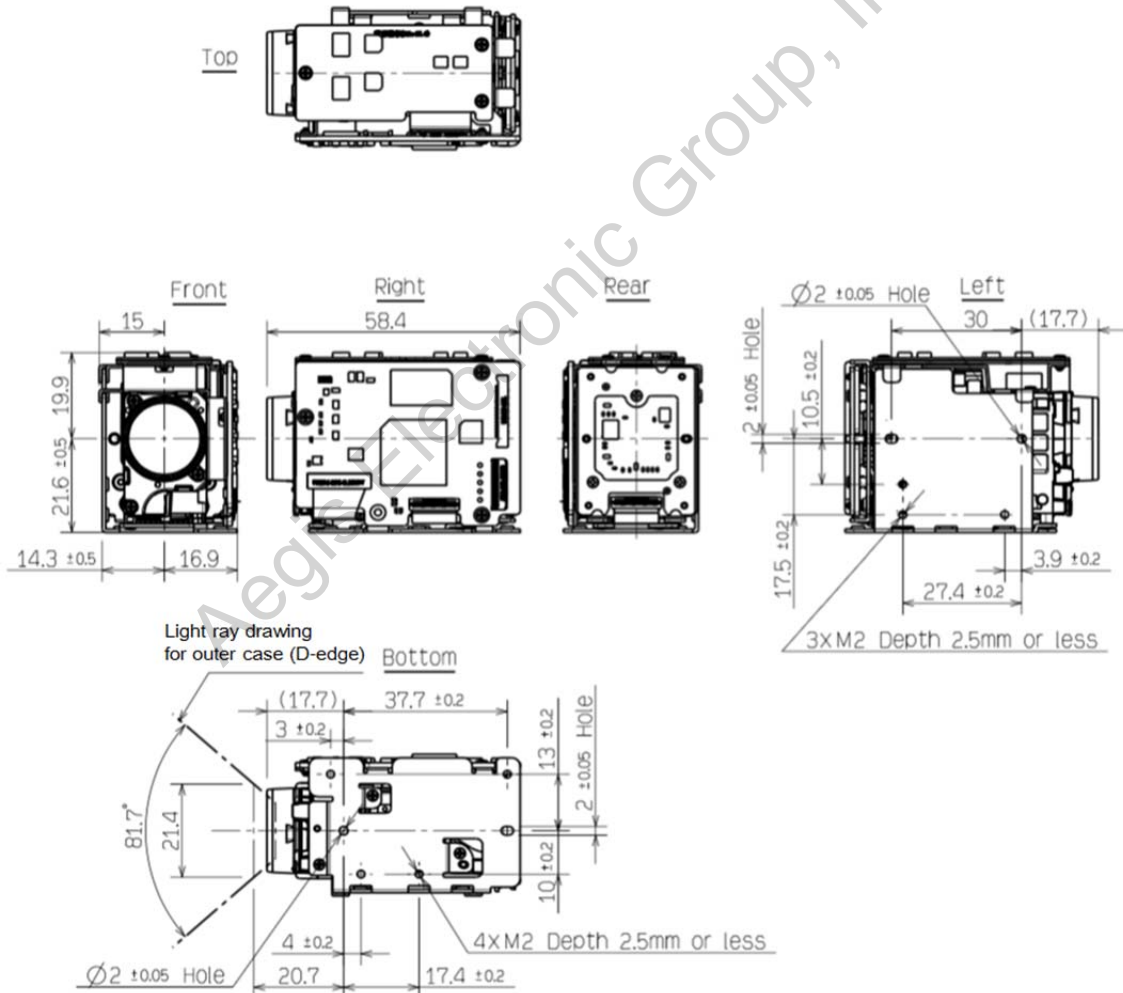
Video output(HD)	Digital: Y/Pb/Pr 4:2:2 (LVDS)
Video output(SD)	CVBS
Camera control interface	VISCA protocol * VISCA is a trademark of Sony Corporation.

■ Others

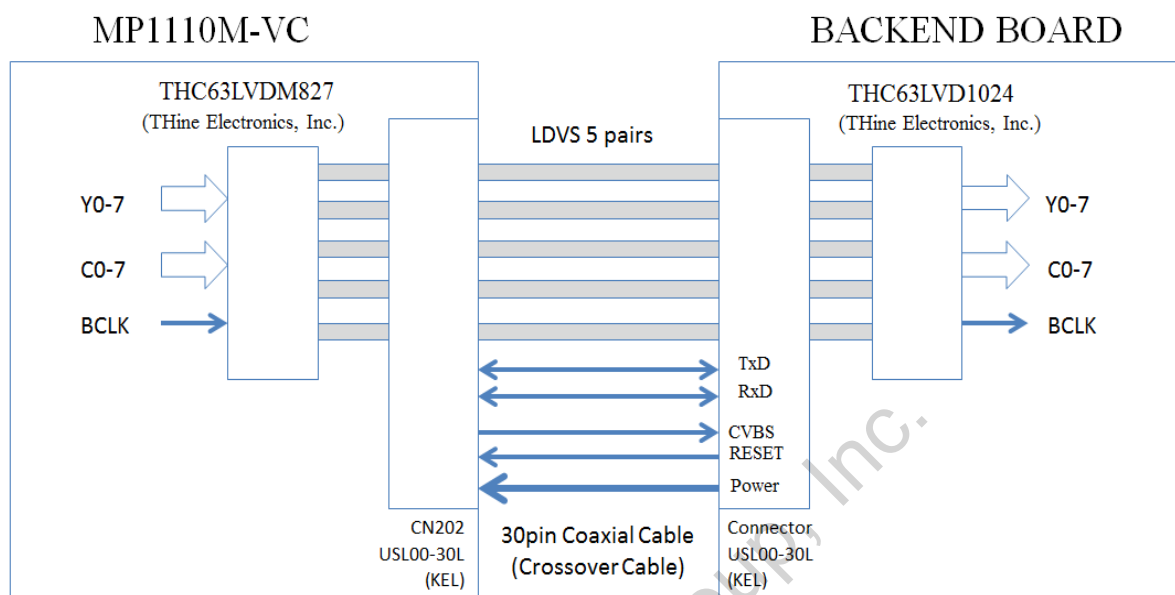
Operating Voltage	DC 8-12V
Power Consumption	3.0W (Typ. at draft mode, Lens actuator not included)
Operating Temperature	-5 ~ + 60°C
Storage Temperature	-40 ~ + 60°C
Operating Humidity	20% ~ 80% (No dew condensation)
Storage Humidity	20% ~ 90% (No dew condensation)
Dimension (W x H x D)	31.9 x 41.5 x 58.4 mm
Weight	Approx. 77g

5.2 DIMENSION AND ECLIPSE

UNIT : mm



5.3 INTERFACE



- MP1110M-VC is using THC63LVDM827(LVDS Tx IC). A receiver (i.e. Backend Board in the above figure.) needs LVDS Rx IC such as THC63LVD1024, etc.

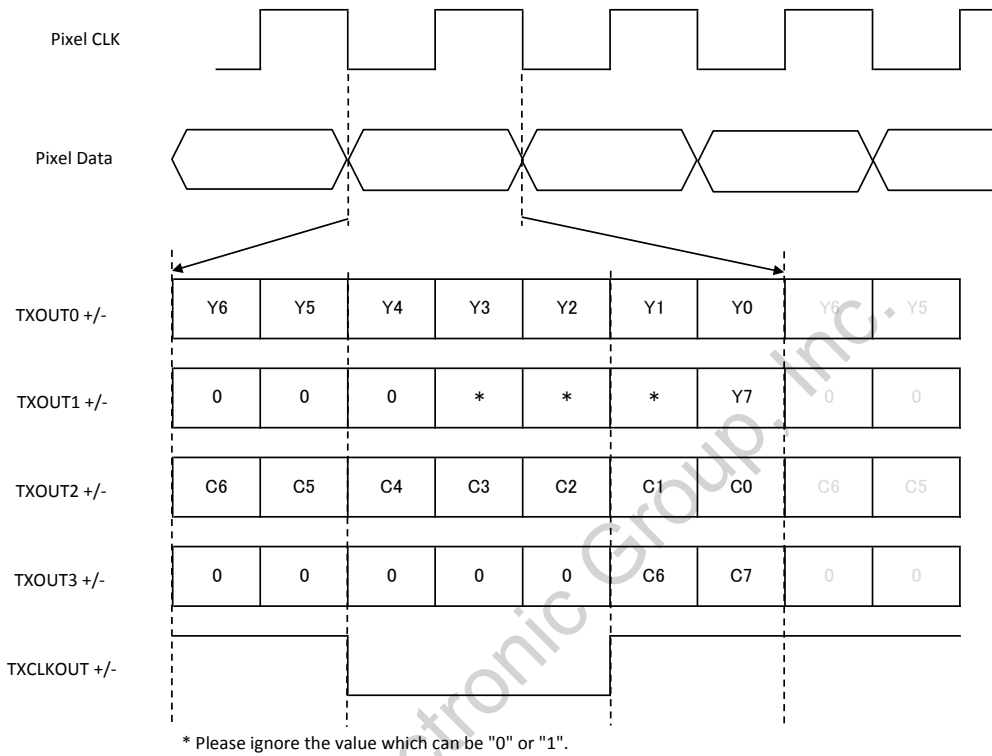
5.4 PIN ASSIGNMENT

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	
13	RxD HOST1	
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	TXOUT7+	Single out mode: 未使用 (オープン接続) No connection (An open connection.)
22	TXOUT7-	Single out mode: 未使用 (オープン接続) No connection (An open connection.)
23	TXOUT6+	Single out mode: 未使用 (オープン接続) No connection (An open connection.)
24	TXOUT6-	Single out mode: 未使用 (オープン接続) No connection (An open connection.)
25	CVBS	
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	TXOUT5+	Single out mode: 未使用 (オープン接続) No connection (An open connection.)
28	TXOUT5-	Single out mode: 未使用 (オープン接続) No connection (An open connection.)
29	TXOUT4+	Single out mode: 未使用 (オープン接続) No connection (An open connection.)
30	TXOUT4-	Single out mode: 未使用 (オープン接続) No connection (An open connection.)

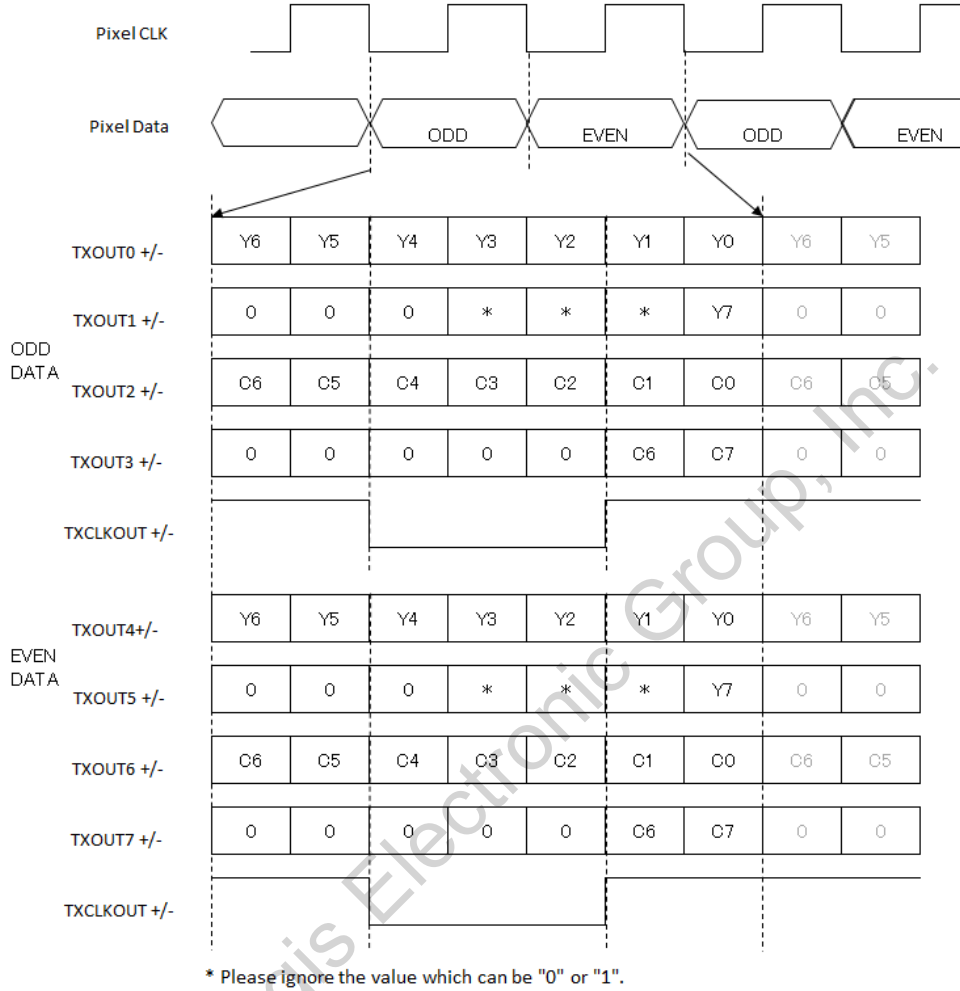
5.5 LVDS PIXEL DATA FORMAT

Single Mode



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

Dual Mode



Output Format	Pixel CLK[Hz]	TCLK+[Hz]
1080p/59.94	148.5M/1.001	74.25M/1.001
1080p/29.97	74.25M/1.001	37.125M/1.001
720p/59.94	74.25M/1.001	37.125M/1.001
720p/29.97	74.25M/1.001	37.125M/1.001
1080p/60	148.5M	74.25M
1080p/50	148.5M	74.25M
1080i/60	74.25M	37.125M
1080i/50	74.25M	37.125M
1080p/30	74.25M	37.125M
1080p/25	74.25M	37.125M
720p/60	74.25M	37.125M
720p/50	74.25M	37.125M

5.7 LVDS CABLE SPECIFICATION (REFERENCE)

端子 接続説明
Pin Descriptions for LVDS Connector

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

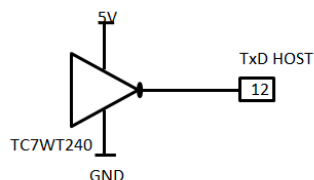


図2 内部等価回路 (Pin13 RxD HOST)
(Figure2 Internal Equivalent Circuit)

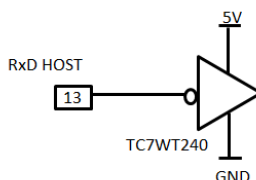
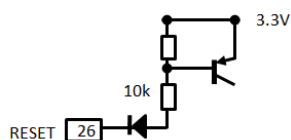
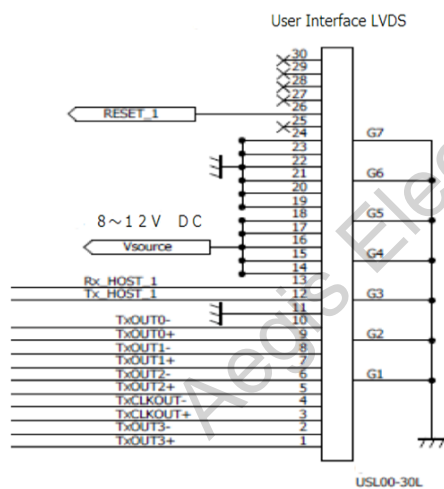


図3 内部等価回路 (Pin26 RESET)
(Figure3 Internal Equivalent Circuit)



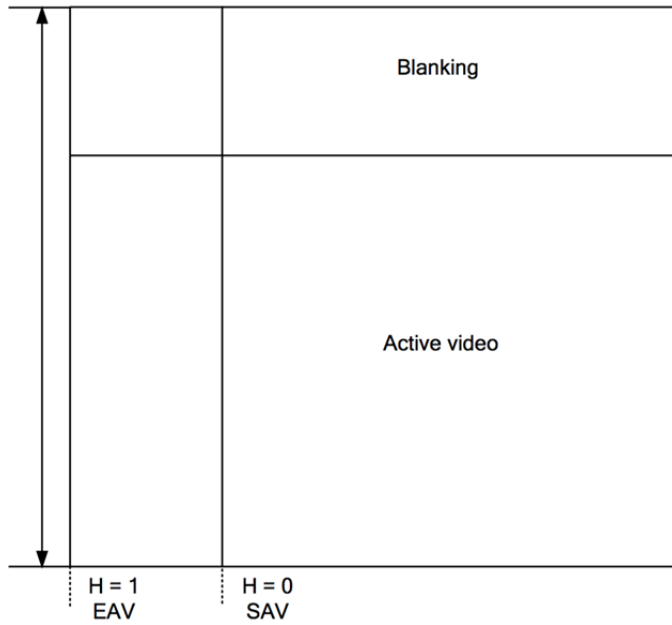
LVDS OUT 接続説明 LVDS OUT pin connections



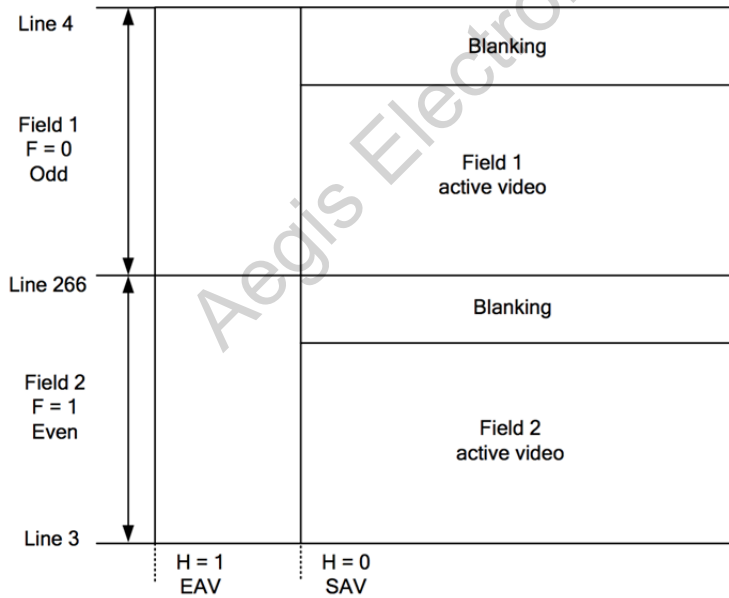
ケーブル参考資料
コネクタ: USL20-30S(KEL社製)
ケーブル: #42 薄膜同軸ケーブル
クロスオーバー

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

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

Aegis Electronic Group, Inc.

6. SOFTWARE LICENSE

OPEN SOURCE LICENSE REPORT ON THE PRODUCT

The software included in this product contains copyrighted software that is licensed under the GPL/LGPL.

You may obtain the complete Corresponding Source code from us for a period of three years after our last shipment of this product by sending email to icm@tamron.co.jp

If you want to obtain the complete Corresponding Source code in the physical medium such as CD-ROM, the cost of physically performing source distribution might be charged.

- GPL S/W □

 - Linux kernel and drivers, jffs2, uboot, Busybox, mtd-utils □

- LGPL S/W

 - uClibc □

GNU GENERAL PUBLIC LICENSE

Version 2, June 1991

Copyright (C) 1989, 1991 Free Software Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software-- to make sure the software is free for all its users. This General Public License applies to most of the Free Software Foundation's software and to any other program whose authors commit to using it. (Some other Free Software Foundation software is covered by the GNU Lesser General Public License instead.) You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the software, or if you modify it.

For example, if you distribute copies of such a program, whether gratis or for a fee, you must give the recipients all the rights that you have. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

We protect your rights with two steps: (1) copyright the software, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the software. □

Also, for each author's protection and ours, we want to make certain that everyone understands that there is no warranty for this free software. If the software is modified by someone else and passed on, we want its recipients to know that what they have is not the original, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that redistributors of a free program will individually obtain patent licenses, in effect making the program proprietary. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

The precise terms and conditions for copying, distribution and modification follow.

TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0. This License applies to any program or other work which contains a notice placed by the copyright holder saying it may be distributed under the terms of this General Public License. The "Program", below, refers to any such program or work, and a "work based on the Program" means either the Program or any derivative work under copyright law: that is to say, a work containing the Program or a portion of it, either verbatim or with

modifications and/or translated into another language. (Hereinafter, translation is included without limitation in the term "modification".) Each licensee is addressed as "you".

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running the Program is not restricted, and the output from the Program is covered only if its contents constitute a work based on the Program (independent of having been made by running the Program). Whether that is true depends on what the Program does.

1. You may copy and distribute verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and give any other recipients of the Program a copy of this License along with the Program. You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.
2. You may modify your copy or copies of the Program or any portion of it, thus forming a work based on the Program, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:
 - a) You must cause the modified files to carry prominent notices stating that you changed the files and the date of any change.
 - b) You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License.
 - c) If the modified program normally reads commands interactively when run, you must cause it, when started running for such interactive use in the most ordinary way, to print or display an announcement including an appropriate copyright notice and a notice that there is no warranty (or else, saying that you provide a warranty) and that users may redistribute the program under these conditions, and telling the user how to view a

copy of this License. (Exception: if the Program itself is interactive but does not normally print such an announcement, your work based on the Program is not required to print an announcement.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Program, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program.

In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may copy and distribute the Program (or a work based on it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you also do one of the following:

- . a) Accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,
- . b) Accompany it with a written offer, valid for at least three years, to give any third party, for a charge no more than your cost of physically performing source distribution, a complete machine-readable copy of the corresponding source code, to be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,
- c) Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)

The source code for a work means the preferred form of the work for making modifications to it. For an executable work, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

If distribution of executable or object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place counts as distribution of the source code, even though third parties are not compelled to copy the source along with the object code.

4. You may not copy, modify, sublicense, or distribute the Program except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense or distribute the Program is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance. □

5. You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Program or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Program (or any work based on the Program), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Program or works based on it. □

6. Each time you redistribute the Program (or any work based on the Program), the recipient automatically receives a license from the original licensor to copy, distribute or modify the Program subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties to this License.

7. If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License,

they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Program at all. For example, if a patent license would not permit royalty-free redistribution of the Program by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Program.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system, which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

8. If the distribution and/or use of the Program is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Program under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License. □

9. The Free Software Foundation may publish revised and/or new versions of the General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. □ Each version is given a distinguishing version number. If the Program specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If

the Program does not specify a version number of this License, you may choose any version ever published by the Free Software Foundation. □

10. If you wish to incorporate parts of the Program into other free programs whose distribution conditions are different, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally. □

NO WARRANTY

11. BECAUSE THE PROGRAM IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION. □
12. IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. □ **END OF TERMS AND CONDITIONS** □ **How to Apply These Terms to Your New Programs** □

If you develop a new program, and you want it to be of the greatest possible use to the public, the best way to achieve this is to make it free software which everyone can redistribute and change under these terms.

To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

<one line to give the program's name and a brief idea of what it does.> Copyright (C)
<year> <name of author>

This program is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation; either version 2 of the License, or (at your option) any later version.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.

You should have received a copy of the GNU General Public License along with this program; if not, write to the Free Software Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA.

Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

Gnomovision version 69, Copyright (C) year name of author Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'. This is free software, and you are welcome to redistribute it under certain conditions; type `show c' for details.

The hypothetical commands `show w' and `show c' should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than `show w' and `show c'; they could even be mouse-clicks or menu items--whatever suits your program.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the program, if necessary. Here is a sample; alter the names:

Yoyodyne, Inc., hereby disclaims all copyright interest in the program `Gnomovision' (which makes passes at compilers) written by James Hacker.

<signature of Ty Coon>, 1 April 1989 Ty Coon, President of Vice

This General Public License does not permit incorporating your program into proprietary programs. If your program is a subroutine library, you may consider it more useful to permit linking proprietary applications with the library. If this is what you want to do, use the GNU Lesser General Public License instead of this License.

GNU LESSER GENERAL PUBLIC LICENSE

Version 2.1, February 1999

Copyright (C) 1991, 1999 Free Software Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

[This is the first released version of the Lesser GPL. It also counts as the successor of the GNU Library Public License, version 2, hence the version number 2.1.]

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public Licenses are intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users.

This license, the Lesser General Public License, applies to some specially designated software packages--typically libraries--of the Free Software Foundation and other authors who decide to use it. You can use it too, but we suggest you first think carefully about whether this license or the ordinary General Public License is the better strategy to use in any particular case, based on the explanations below.

When we speak of free software, we are referring to freedom of use, not price. Our General Public Licenses are designed to make sure that you have the freedom to

79 / 90

Tamron Co., Ltd.

distribute copies of free software (and charge for this service if you wish); that you receive source code or can get it if you want it; that you can change the software and use pieces of it in new free programs; and that you are informed that you can do these things.

To protect your rights, we need to make restrictions that forbid distributors to deny you these rights or to ask you to surrender these rights. These restrictions translate to certain responsibilities for you if you distribute copies of the library or if you modify it.

For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code. If you link other code with the library, you must provide complete object files to the recipients, so that they can relink them with the library after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

We protect your rights with a two-step method: (1) we copyright the library, and (2) we offer you this license, which gives you legal permission to copy, distribute and/or modify the library.

To protect each distributor, we want to make it very clear that there is no warranty for the free library. Also, if the library is modified by someone else and passed on, the recipients should know that what they have is not the original version, so that the original author's reputation will not be affected by problems that might be introduced by others.

Finally, software patents pose a constant threat to the existence of any free program. We wish to make sure that a company cannot effectively restrict the users of a free program by obtaining a restrictive license from a patent holder. Therefore, we insist that any patent license obtained for a version of the library must be consistent with the full freedom of use specified in this license.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License. This license, the GNU Lesser General Public License, applies to certain designated libraries, and is quite different from the ordinary General Public License. We use this license for certain libraries in order to permit linking those libraries into non-free programs.

When a program is linked with a library, whether statically or using a shared library, the combination of the two is legally speaking a combined work, a derivative of the original library. The ordinary General Public License therefore permits such linking only if the entire combination fits its criteria of freedom. The Lesser General Public License permits more lax criteria for linking other code with the library.

We call this license the "Lesser" General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances.

For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, whereas the latter must be combined with the library in order to run.

TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0. This License Agreement applies to any software library or other program which contains a notice placed by the copyright holder or other authorized party saying it may

be distributed under the terms of this Lesser General Public License (also called "this License"). Each licensee is addressed as "you".

A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

1. You may copy and distribute verbatim copies of the Library's complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

- . a) The modified work must itself be a software library.
- . b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.
- . c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.
- . d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful. (For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License,

version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License. However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables. When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law. If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work.

(Executables containing this object code plus portions of the Library will still fall under Section 6.) □

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

- . a) Accompany the work with the complete corresponding machine- readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.) □
- . b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface- compatible with the version that the work was made with. □

c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

. d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

. e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

. a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.

. b) Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

8. You may not copy, modify, sublicense, link with, or distribute the Library except as expressly provided under this License. Any attempt otherwise to copy, modify,

sublicense, link with, or distribute the Library is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance. □

9. You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Library or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Library (or any work based on the Library), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Library or works based on it. □
10. Each time you redistribute the Library (or any work based on the Library), the recipient automatically receives a license from the original licensor to copy, distribute, link with or modify the Library subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties with this License. □
11. If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Library at all. For example, if a patent license would not permit royalty-free redistribution of the Library by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Library. □

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply, and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system which is

implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

12. If the distribution and/or use of the Library is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Library under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License. □
13. The Free Software Foundation may publish revised and/or new versions of the Lesser General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. □ Each version is given a distinguishing version number. If the Library specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Library does not specify a license version number, you may choose any version ever published by the Free Software Foundation. □
14. If you wish to incorporate parts of the Library into other free programs whose distribution conditions are incompatible with these, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally. □ **NO WARRANTY** □
15. BECAUSE THE LIBRARY IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE LIBRARY, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE LIBRARY

"AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE LIBRARY IS WITH YOU. SHOULD THE LIBRARY PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION. □

16. IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE LIBRARY AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE LIBRARY (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE LIBRARY TO OPERATE WITH ANY OTHER SOFTWARE), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. □

END OF TERMS AND CONDITIONS How to Apply These Terms to Your New Libraries

If you develop a new library, and you want it to be of the greatest possible use to the public, we recommend making it free software that everyone can redistribute and change. You can do so by permitting redistribution under these terms (or, alternatively, under the terms of the ordinary General Public License).

To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

<one line to give the library's name and a brief idea of what it does.> Copyright (C)
<year> <name of author>

This library is free software; you can redistribute it and/or modify it under the terms of the GNU Lesser General Public License as published by the Free Software Foundation; either version 2.1 of the License, or (at your option) any later version.

This library is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU Lesser General Public License for more details.

You should have received a copy of the GNU Lesser General Public License along with this library; if not, write to the Free Software Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA 02110- 1301 USA

Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the library, if necessary. Here is a sample; alter the names:

Yoyodyne, Inc., hereby disclaims all copyright interest in the library `Frob' (a library for tweaking knobs) written by James Random Hacker.

<signature of Ty Coon>, 1 April 1990 Ty Coon, President of Vice

That's all there is to it!