SENTECH

# 1080p HD Auto Focus Camera

## Product Specifications

### Features

- HD1080p Resolution
- 60 FPS
- LVDS or SDI Output

# 1 Product Precautions

- **Handle the camera with care. Do not abuse the camera. Avoid striking or shaking it. Improper handling or storage could damage the camera.**
- **Do not pull or damage the camera cable.**
- **During camera use, do not wrap the unit in any material. This will cause the internal temperature of the unit to increase.**
- **Do not expose the camera to moisture, or do not try to operate it in wet areas.**
- **Do not operate the camera beyond its temperature, humidity and power source ratings.**
- **While the camera is not being used, keep the lens or lens cap on the camera to prevent dust or contamination from getting in the CCD or filter area and scratching or damaging this area.**
- **Do not keep the camera under the following conditions:**
  - **In wet, moist, and high humidity areas**
  - **Under hot direct sunlight**
  - **In high temperature areas**
  - **Near an object that releases a strong magnetic or electric field**
  - **Areas with strong vibrations**
- **Apply the power that satisfies the requirements specified in this document to the camera.**
- **Use a soft cloth to clean the camera. Use pressured air spray to clean the surface of the glass. DO not scratch the surface of the glass.**
- **The camera is a general-purpose electronic device; using the camera for the equipment that may threaten human life or cause dangers to human bodies directly in case of failure or malfunction of the camera is not guaranteed. Use the camera for special purposes at your own risk.**

# Contents

# 2 Introduction

This document describes the specification of the following cameras:

[LVDS Output]
STC-AF243LVD

[SDI Output]
STC-AF243SDI

## 2.1 Features

- **1080poutput CMOS Sensor**
- **x 20 Zoom Lens**
- **Auto Focus, Auto IRIS**
- **Day＆Night function**
- **LVDS, SDI output**
- **OSCD(On Screen Character Display)**
- **Configurable parameters through Control Software**
- **Eight configurable DSP files can be saved**
- **Wide Dynamic Rage (ATR-EX),Defog**
- **Pixel Blemish Correction**
- **Multi-Protocol support (Sentech, and another protocol)**

## 2.2 Naming Method

STC-AF243xx

**Back Panel**
LVD: LVDS Output
SDI: SDI Output

## 2.3 Peripheral Equipment

**Sentech provide as follow peripheral equipment**

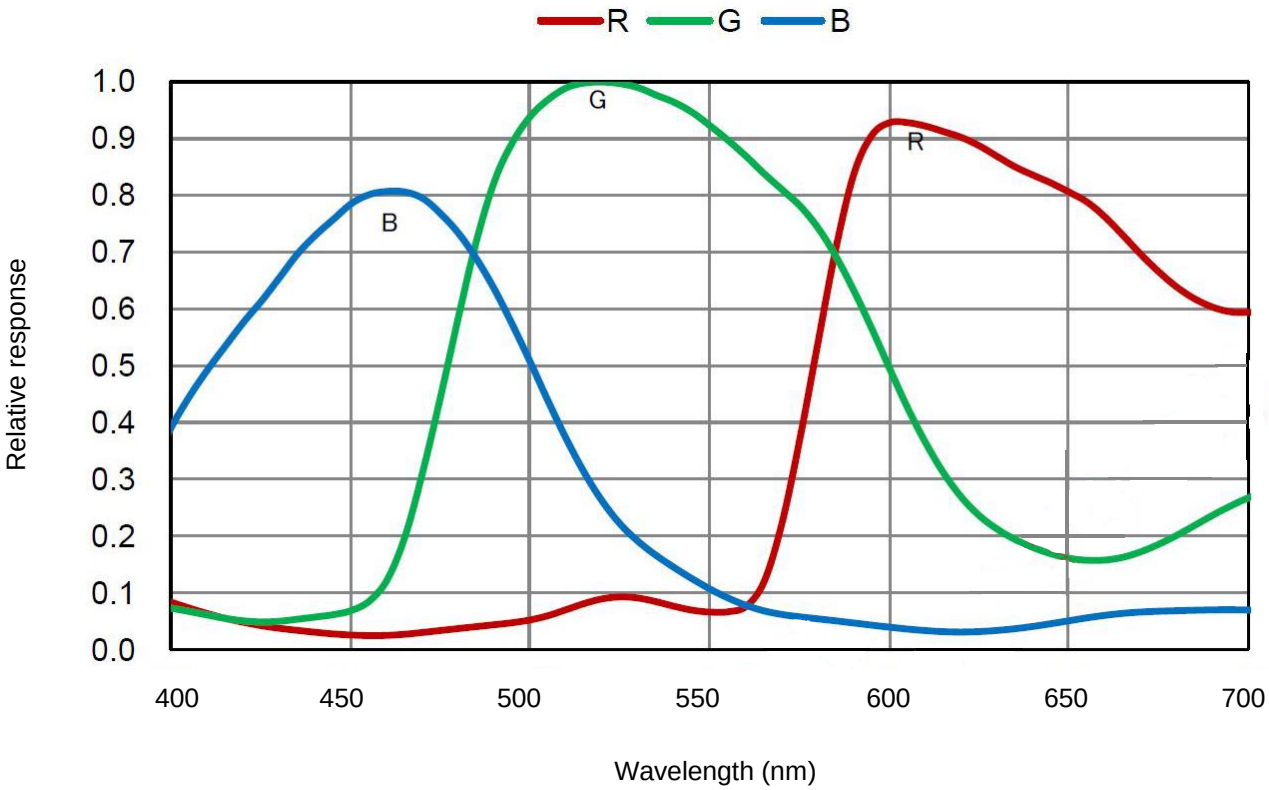
① **Control Software : KGACtrl**

# 3 Specifications

## 3.1 Electronic specifications / Mechanical specifications / Environmental specifications Bold: Initial Value

| Product | | | STC-AF243* |
|---|---|---|---|
| Electronic | Imager | | 1/2.8" 2.3Mega pixel CMOS (SONY: IMX136), Rolling Shutter |
| | Active picture elements | | 1936 (H) x 1096 (V) |
| | HD active picture elements | | 1920 (H) x 1080 (V) |
| | Optical size | | 5.44 (H) x 3.09 (V) mm |
| | Cell size | | 2.8 (H) x 2.8 (V) µm |
| | Sync system | | Progressive |
| | Minimum scene illumination | | 1.4 Lux @F1.6, with IRC filter, Exposure time 1/60 sec |
| | Sync. System | | Internal |
| | Video output | LVDS Model | 1080P60//50/30/, 720P60/(59.94)/50 Default :1080P60 |
| | | SDI Model | 3G-SDI(Physical layer: SMPTE 424M, Data Mapping: SMPTE 425M Level-A Compliant ),<br>4:2:2 YCbCr 10bit 1080P60/(59.94)/50HD-SDI<br>(SMPTE292M Compliant) 4:2:2 YCbCr 10bit 1080P30/(29.97)/25,720P60/(59.94)/50 |
| | Camera functions | | |
| | | ALC | Electrical shutter / AGC / Mechanical IRIS linkage Default : ALC ON |
| | | Shutter speed | 1/60～1/10,000 seconds Default :fixed **1/100** |
| | | Gain | AGC / Fixed gain 0 to 45 dB Default : AGC |
| | | Gamma | Selectable gamma through 5 preset (one preset is manual, / 0.45 / 0.6 / 0.8 / 1)<br>Default : Manual |
| | | White balance | Auto white balance / Manual white balance / Push to set white balance<br>Default : Auto white balance |
| | | Mirror image | Normal image / Horizontal flip / Vertical flip / Horizontal vertical flip(180 degree rotation)<br>Default: Normal image |
| | | DSP Preset | 8 user preset mode Default : Preset 0 |
| | | Line generator | Both horizontal and vertical with all available colors (Line number: 2)<br>Default : Disable |
| | | Shadow mask generator | Both horizontal and vertical with shading level adjustment<br>Default : Disable |
| | | Privacy mask | 8 windows with all available colors, width, position Default : Disable |
| | | Communication | UART communication （RS232C +3.3V,RS485 +5V）<br>（Boudrate: 115,200bps,38,400bps, 19,200bps, 9,600bps） |
| | | Character generator | Built-in character generation function via the UART communication |
| | | Another | Pixel blemish collection, WDR, Defog, Hue, Brightness, Contrast etc. |
| | | | ※Above functions can be configurable through UART |
| | Lens control | | Working Distance Wide:Infinity to 1cm / Tele:Infinity to 1m |
| | | Optical zoom | UART communication(LVDS model / SDI model),<br>Zoom function can be controlled through External control (SDI model) |
| | | Focus | Auto focus / Manual focus / Push set focus<br>(Selectable control via the UART communication) Default : Auto focus |
| | | IRIS | Auto IRIS / Manual IRIS / Push set IRIS<br>(Selectable control via the UART communication) Default : Auto IRIS |
| | | ICR (IR Cut filter Removable) | Selectable IR cut filter Auto / Manual<br>(Selectable control via the UART communication) Default : Manual |
| | Power | Input voltage | +9 to +15 Vdc (Typical: +12 Vdc) |
| | | Consumption | Zoom and Focus: 3.5W, Zoom and Disable-focus: 3.2W |
| Mechanical | Dimensions | | 53 (W) x 60 (H) x 89.5(D) mm |
| | Auto focus lens | | 20x auto focus zoom lens, Demountable IR cut filter<br>Optical zoom range: from 4.7mm to 94mm (F No.1.6～3.0) |
| | Optical filter | | OPLF on |
| | Interface connector | Video output | LVDS model : CN02(USL00-30L-C,KEL),SDI model : RF(MM9329-2700 cable Murata) |
| | | Power input, External control UART communication | LVDS model : CN02(USL00-30L-C,KEL)<br>SDI model : CN06(SM14B-SRSS-TB,JST) |
| | Weight | | LVDS: Approximately 300g, SDI: Approximately 300g |
| Environmental | Operational temperature | | 0 to 45 deg. C |
| | Storage temperature | | -30 to 65 deg. C |
| | Vibration | | 5Hz to 25Hz to 5Hz (4min./cycle), amplitude 2mm , XYZ 3 directions 60 min. each) to |
| | Shock | | Acceleration 60G, half amplitude 11ms, XYZ 3 directions 1times each |
| | RoHS | | RoHS compliance |

## 3.2 Spectral Sensitivity Characteristics




## 3.3 Support Option

As following features can be supported as option.

① **Resolution / Frame rate: 1080P 59.94 / 29.97, 720 / 59.94**
② **Serial Communication : LVDS model 5V TTL**
③ **Accuracy of temperature sensor : Range: -10℃ to 100℃, Accuracy±1℃**

## 3.4 External Connector Specifications

### 3.4.1 LVDS Model

CN02: Connector model number : USL00-30L-C,KEL

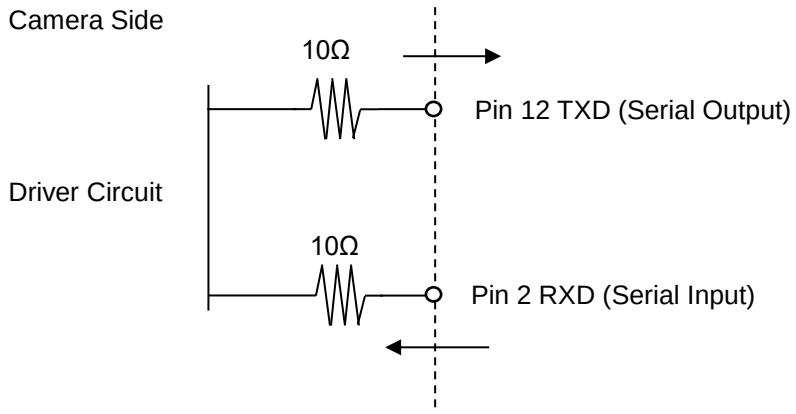
**Pin assignment**

| No. | Signal |
|---|---|
| 1 | TD1+ |
| 2 | TD1- |
| 3 | TCLK1+ |
| 4 | TCLK1- |
| 5 | TC1+ |
| 6 | TC1- |
| 7 | TB1+ |
| 8 | TB1- |
| 9 | TA1+ |
| 10 | TA1- |
| 11 | GND |
| 12 | TXD |
| 13 | RXD |
| 14 | +12V |
| 15 | +12V |

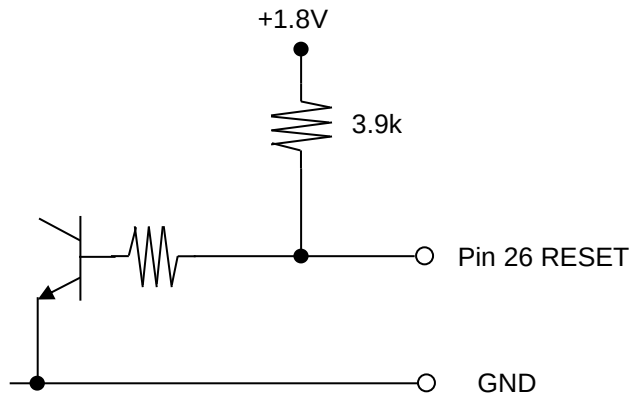
| No. | Signal |
|---|---|
| 16 | +12V |
| 17 | +12V |
| 18 | +12V |
| 19 | GND |
| 20 | GND |
| 21 | TD2+ |
| 22 | TD2- |
| 23 | TC2+ |
| 24 | TC2- |
| 25 | NC |
| 26 | RESET |
| 27 | TB2+ |
| 28 | TB2- |
| 29 | TA2+ |
| 30 | TA2- |

LVDS Connector (Pin1 to 10, 21 to 24, 27 to 30)
As for the detail, please refer to another chapter 6.6.2 LVDS Interface.

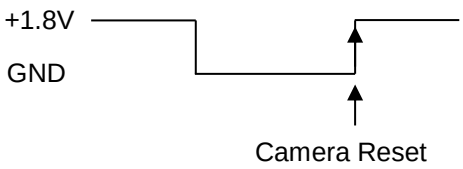
Serial Communication port (Pin 12,13)
Signal Level on Input and Output: 3.3V CMOS Level ( * 5V TTL Level can be supported as option)



RESET Input Port(Pin 26)




RESET Input Signal




∗ This camera can be reset through Low to High on RESET Pin.

### 3.4.2 SDI Model

**Video Signal Output Cable**

Cable Model Number: Murata MXTK92TK2000
Applicable Connector：Murata MM9329-2700

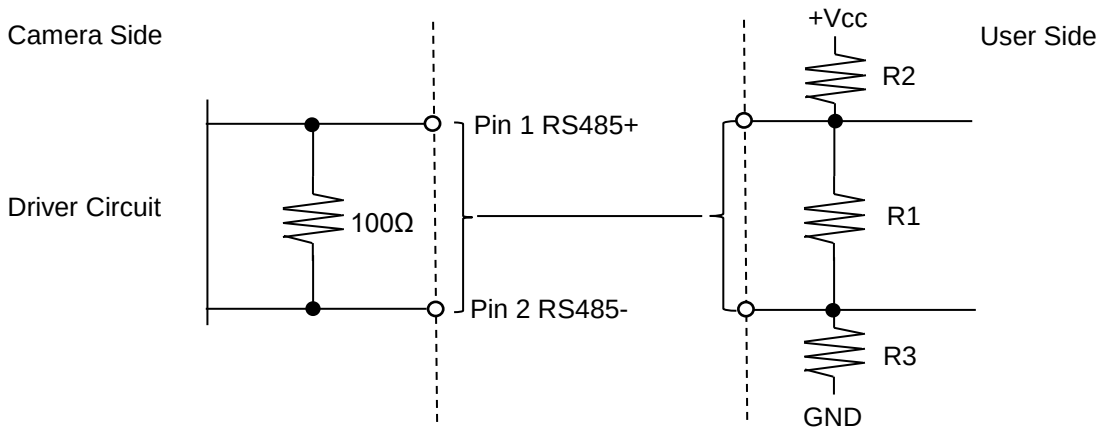
Connector model number: SM14B-SRSS-TB, JST

**Pin Assignment**

| No. | Signal |
|---|---|
| 1 | RS485 + |
| 2 | RS485 - |
| 3 | +12V |
| 4 | +12V |
| 5 | GND |
| 6 | GND |
| 7 | N.C. |
| 8 | N.C. |
| 9 | KEY ENTER |
| 10 | KEY UP |
| 11 | KEY DOMN |
| 12 | KEY LEFT |
| 13 | KEY RIGHT |
| 14 | POWER LED |

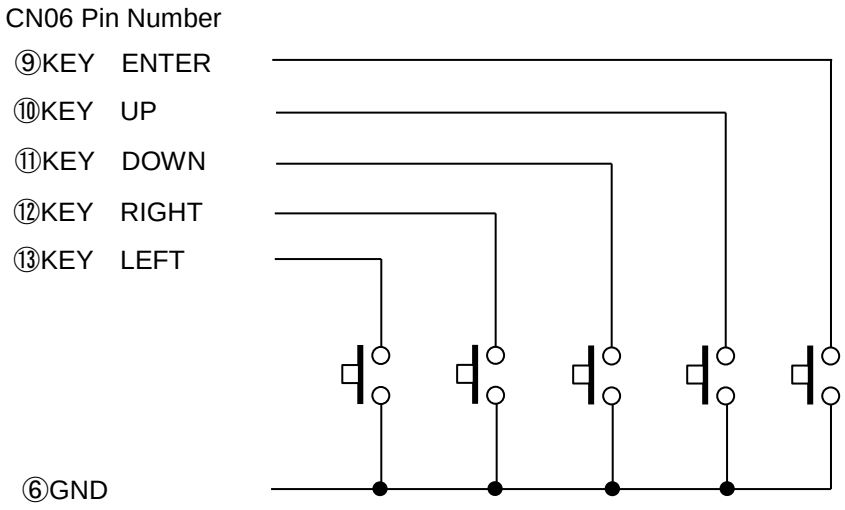
**RS485 Input Output Port**

Common Mode Range: －7V to＋12V




Please assign termination register (R1), pull up register on RS-485 (R2), pull down register on RS-485(R3) if necessary.

### KEY Connector circuit diagram (e.g. User side)

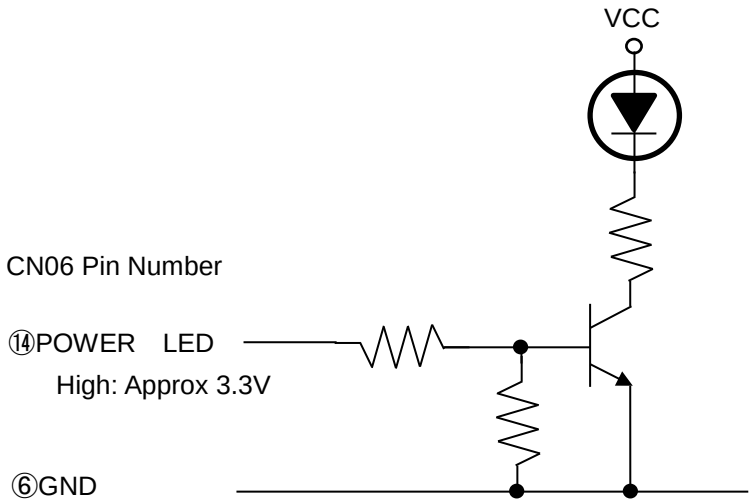



As for the manipulation of KEY, please refer to another chapter.

### POWER LED Connector circuit diagram (e.g. User side)

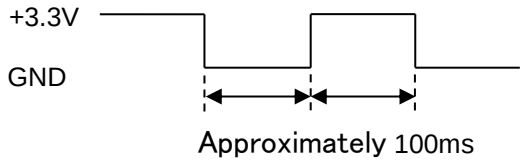
**This port outputs High when camera is turned ON. Camera status can be read through LED via transistor and so on.**

Pin 14 outputs 3.3V CMOS Level and have to be less than 2mA.



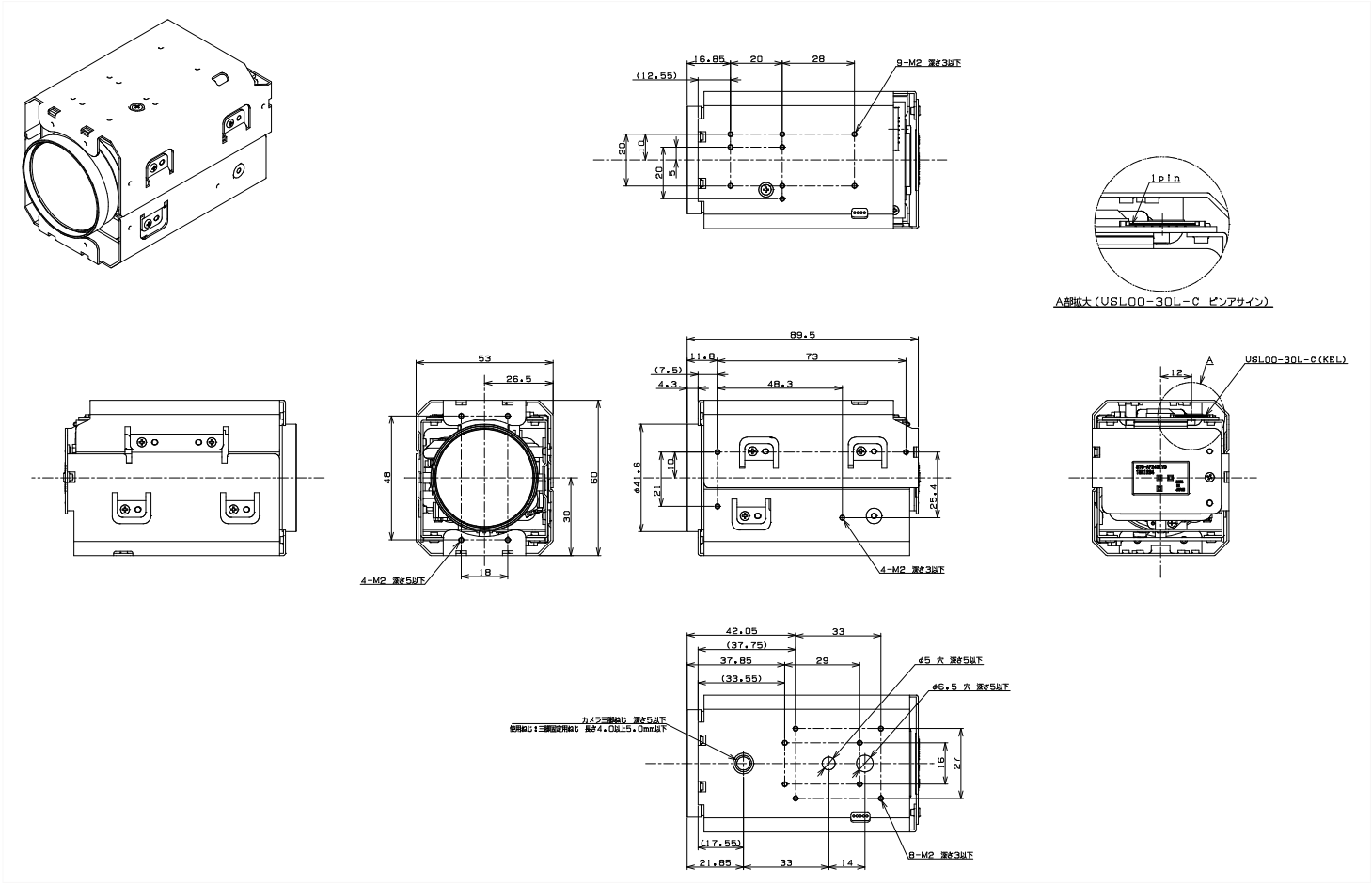

Note) If the camera works under an abnormal condition, an approximate 100mHz High – Low signal will be outputted.

POWER LED output wave form under abnormal condition



# 4 Dimensions

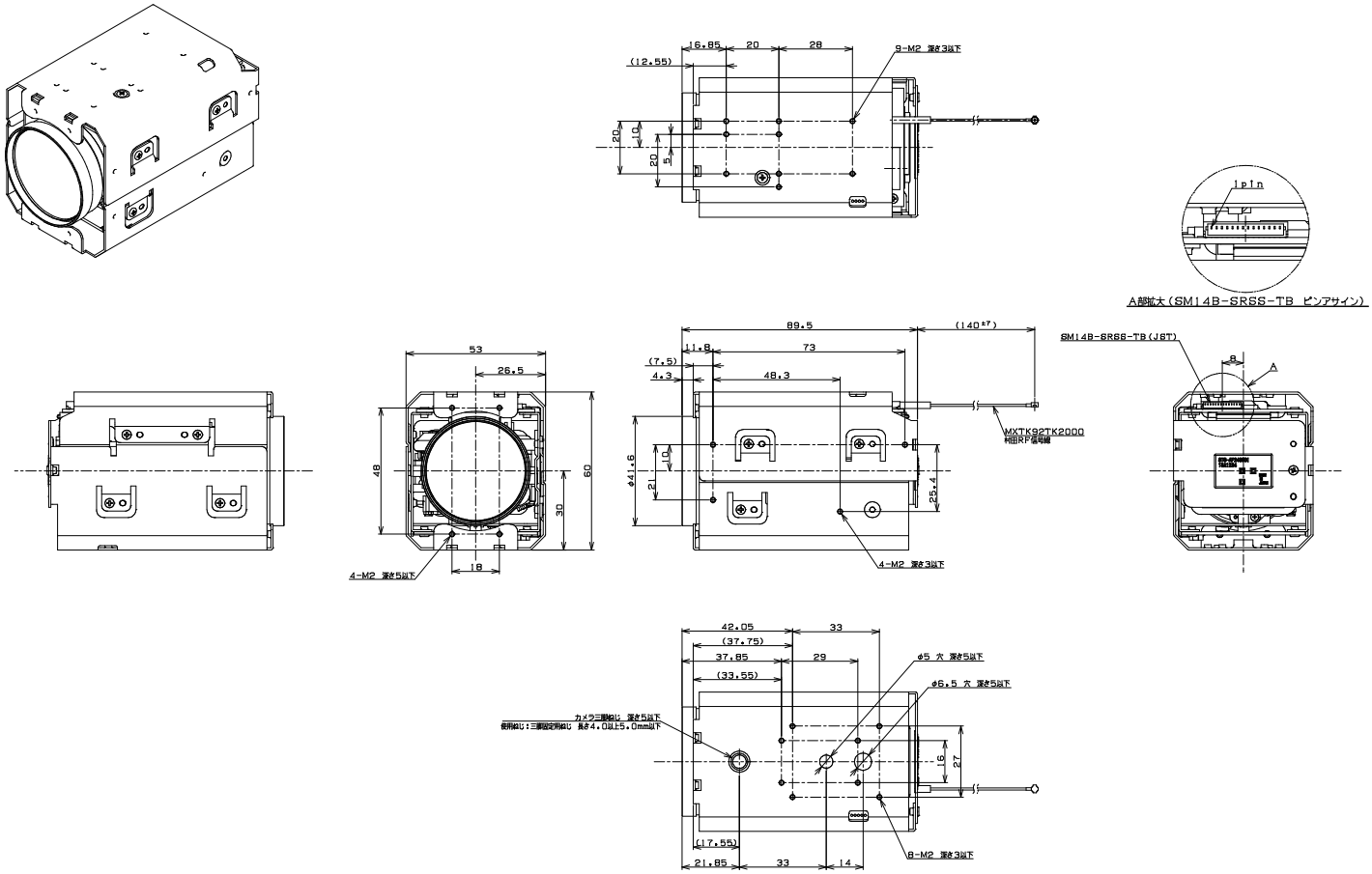
## 4.1 STC-AF243LVD




unit : mm

*Note: Please use 4.0mm to 5.0mm length screw to fix the camera on the tripod. We recommend to use tripod screw or M2 screw to fix the camera.

## 4.2 STC-AF243SDI




unit : mm

*Note: Please use 4.0mm to 5.0mm length screw to fix the camera on the tripod. We recommend to use tripod screw or M2 screw to fix the camera.

# 5 Users guide for the communication software

## 5.1 The required software and JIG

- **Communiation software: KGACtrl**

LVDS model

Connect camera's TXD to PC's serial input signal and connect camera's RXD to PC's serial output signal. Signal Level is 3.3V CMOS (*5V TTL can be supported as option)

SDI model

Connect camera's RS485+/RS485- port to PC's RS485+/- signal.

## 5.2 The basic operation procedure

① **Power on the camera then connect the communication JIG to the camera. Then connect the communication JIG to the PC with the USB cable.**
② **Install KGACtrl software. KGACtrl communication software starts when running KGACtrl.exe.**
③ **Select COM Port with "Port Setting" under "Comm(C)" in the menu.**
④ **Select "Read All" button which is located at the bottom-left in the software to load the camera settings to the PC.**
⑤ **The camera settings are adjustable.**

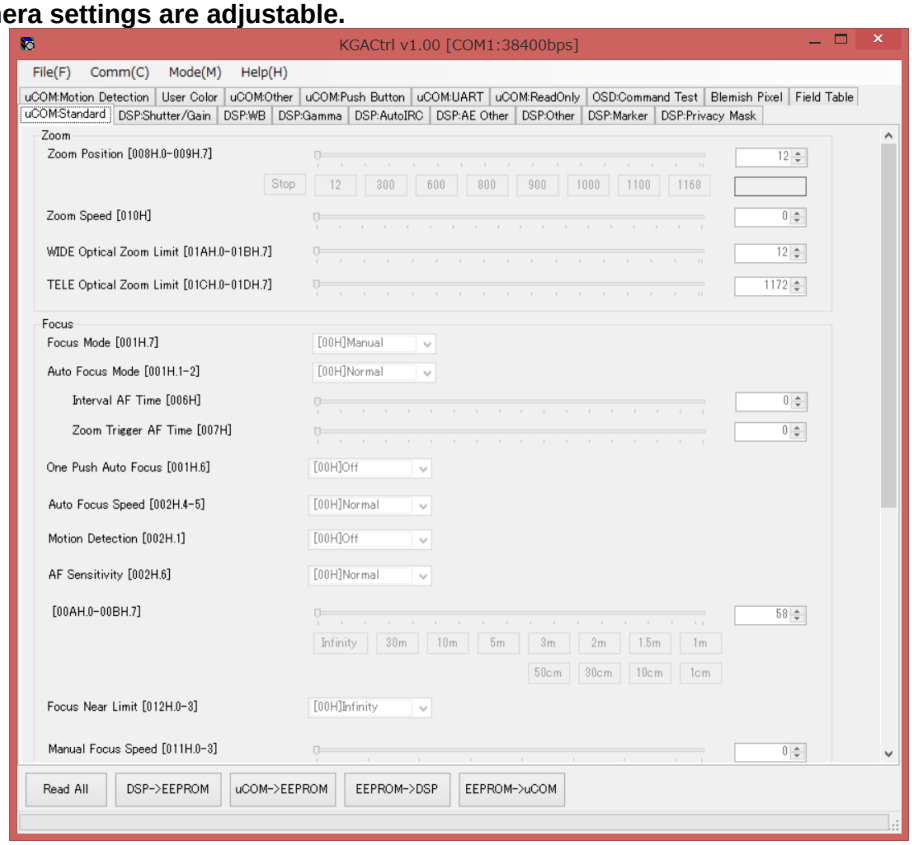
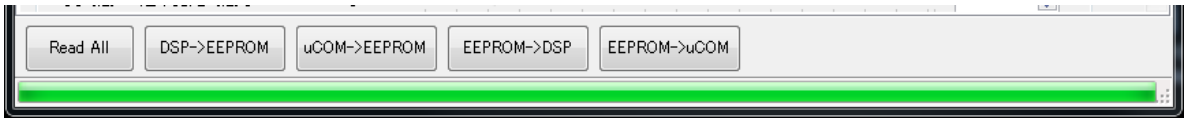



**Fig 1: KGACtrl start up window**

## 5.3 The descriptions for the buttons




**Read All**

The settings of DSP registers and uCOM registers are loaded from the camera.
Please MUST select this button after power on the camera.

**DSP -> EEPROM**

The settings of DSP registers, which is the settings in “DSP:xxx” window, are saved to the EEPROM on the camera.

**uCOM -> EEPROM**

The settings of uCOM registers, which is the settings in “uCOM:xxx” window, are saved to the EEPROM on the camera.

**EEPROM -> DSP**

The settings of DSP registers, which is the settings in “DSP:xxx” window, are loaded from the EEPROM on the camera.

**EEPROM -> uCOM**

The settings of uCOM registers, which is the settings in “uCOM:xxx” window, are loaded from the EEPROM on the camera.

## 5.4 The difference between the uCOM register and the DSP register

The settings that are related to the image are in the DSP registers.
The settings that are related to the lens control, the communication and the button functions are in the uCOM registers.
The DSP registers have eight user preset files and are selectable.

## 5.5 The descriptions for the functions

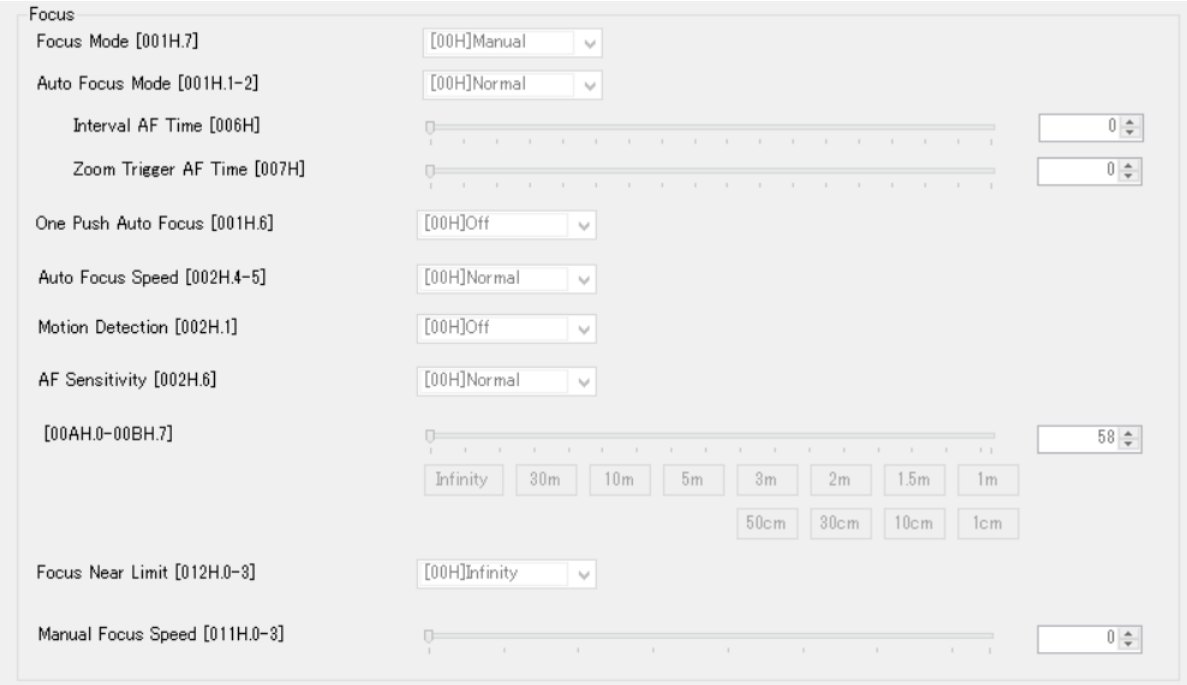
uCOM:Standard Tab


Zoom Position
Set the zoom position.

Zoom Speed
Set the zoom speed.

WIDE Optical Zoom Limit
Set the optical zoom position limit for the WIED. It is necessary to set a value smaller than the value of “TELE Optical Zoom Limit”.

TELE Optical Zoom Limit
Set the optical zoom position limit for the TELE. It is necessary to set a value greater than the value of “TELEOptical Zoom Limit”.




Focus Mode

Select auto focus or manual focus for the focus mode.

Auto Focus Mode

Select normal mode, interval AF mode or Zoom trigger mode for the auto focus mode.

Interval AF Time

Set the time for interval AF mode.

Zoom Trigger AF Time

Set the time for zoom trigger AF mode.

One Push Auto Focus

Execute the push to set auto focus.

Auto Focus Speed

Set the speed for the auto focus at TELE.

Motion Detection

Select to enable or disable the motion detection function.

AF Sensitivity

Set the sensitivity to start auto focus function.

Focus Distance

Set the focus distance. This is only valid when manual focus mode is selected.

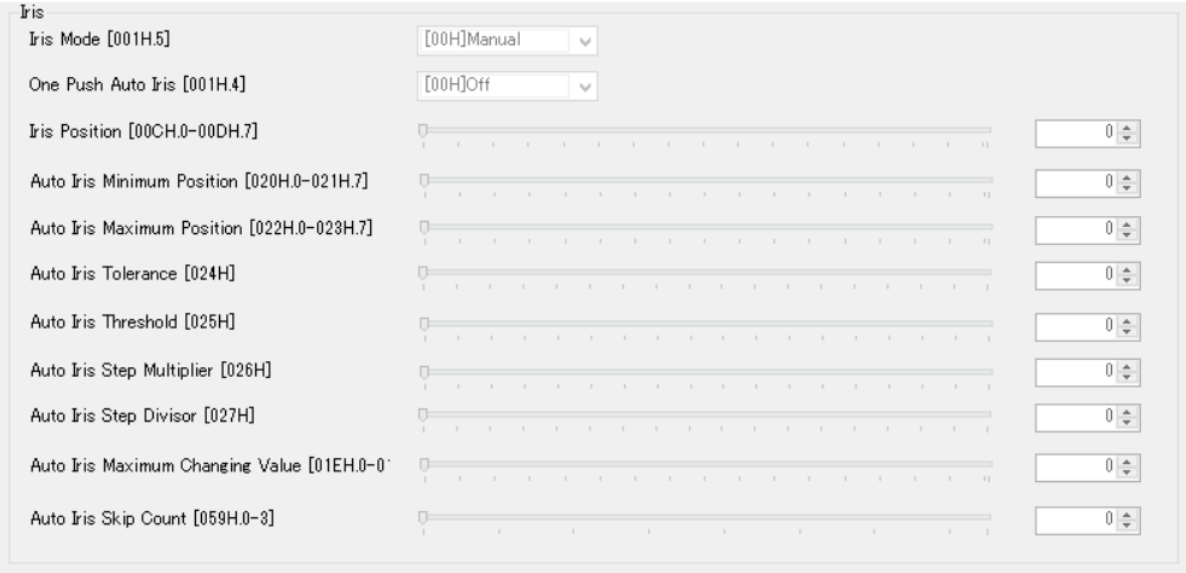
Focus Near Limit

Set the minimum distance for focus at NEAR.

50cm to 1cm setting is valid at WIDE. The minimum distance at TELE is 1m.

Manual Focus Speed

Set the focus speed for manual focus mode.




Iris Mode

Select auto iris or manual iris for iris mode.

One Push Auto Iris

Execute the push to set iris.

Iris position

Set the iris open ratio for the manual iris mode.

Auto Iris Minimum Position

Set the minimum iris open ratio for the auto iris mode.

Auto Iris Maximum Position

Set the maximum iris open ratio for the auto iris mode.

Auto Iris Tolerance

Set the tolerance to start the iris control for the auto iris mode.

Auto IRIS Threshold

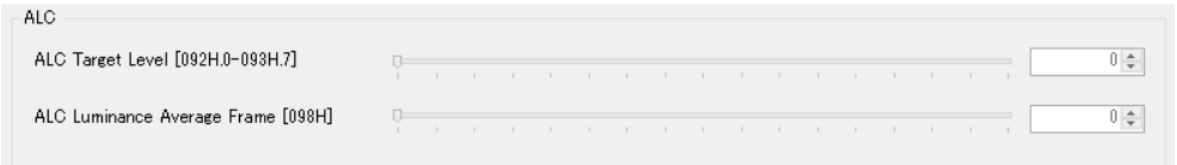
Set the threshold to stop the iris control for the auto iris mode.

Auto Iris Step Multiplier, Auto Iris Step Divisor, Auto Iris Maximum Changing Value and Auto Iris Skip Count

Set the iris control speed for the auto iris mode.

DSP: Shutter/Gain Tab

**ALC（Auto Luminance Control）**




**ALC Target Level**

Set the target brightness level for the ALC function. The ALC maintains the brightness at this value.

**ALC Luminance Average Frame**

Set the number of frames used for the ALC function.

**Shutter**


Shutter Control

Select to enable or disable the AE (Auto Exposure control) function.

Shutter Time

Set the exposure time when AE is OFF (Disable).

AEE Minimum Shutter Time and AEE Maximum Shutter Time

Set the minimum and the maximum exposure time for the AE function.

AEE Tolerance

Set the tolerance to start the AE function.

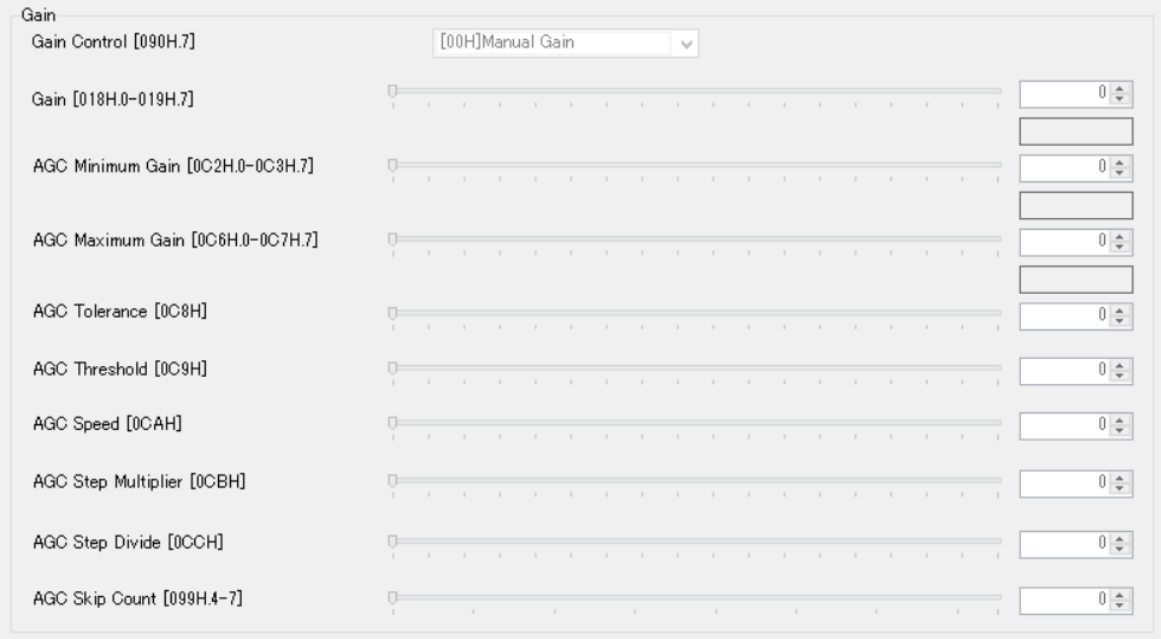
AEE Threshold

Set the threshold to stop the AE function.

AEE Speed and AEE Skip Count

Set the speed for the AE function.

**Gain**




Gain Control
Select to enable or disable the AGC function.
Gain
Set the gain when the AGC function is off (Disabled).
AGC Minimum Gain
Set the minimum gain for the AGC.
AGC Maximum Gain
Set the maximum gain for the AGC.
AGC Tolerance
Set the tolerance to start the AGC.
AGC Threshold
Set the threshold to stop the AGC.
AGC Speed, AGC Step Multiplier, AGC Step Divide and AGC Skip Count
Set the speed for the AGC.

DSP: WB


White Balance Mode

Select the Auto White balance, the Full Open, the AWB Hold, the Custom color temperature and the USER mode for the White Balance Mode.

Please use USER mode for manual white balance.

AWB Pull-in Speed

Set the white balance process speed (Unit: Number of the frame).

This is valid when the Auto White Balance or the Full Open is selected for the white balance mode.

AWB Pull-in Delay

Set the number of frames to restart the auto white balance process for the auto white balance mode.

AWB Convergence Step inside target area

Set the convergence step for the auto white balance target neighbor to stop the white balance adjustment process.

The white balance adjustment speed is faster when a smaller value is set.

AWB Convergence Step outside target area

Set the convergence step for the outside area of the auto white balance target neighbor to stop the white balance adjustment process.

The white balance adjustment speed is faster when a smaller value is set.

**Auto White Balance Offset, R/G, B/G**

Adjust White balance to set the color offset on AWB.

USER Mode


Set the manual white balance. These settings are valid when the USER mode is selected for the white balance mode.

Custom Target Color Temperature


Adjust the white balance manually based on the color temperature.
The display value is the approximate color temperature.

DSP: AutoICR


IRC Filter

Select the IR cut filter on or off manually. This is valid when the auto IRC filter control is off (Manual).

Auto IRC Filter Control

Select the IR cut filter on or off automatically.

IRC Filter Interlock with BW

Select on or off to switch the monochrome image automatically when the IR cut filter is off.

IR Light Wavelength

Sets the wave length of IR light when the IR light is using.
The focus tracking performance while zooming is improved.

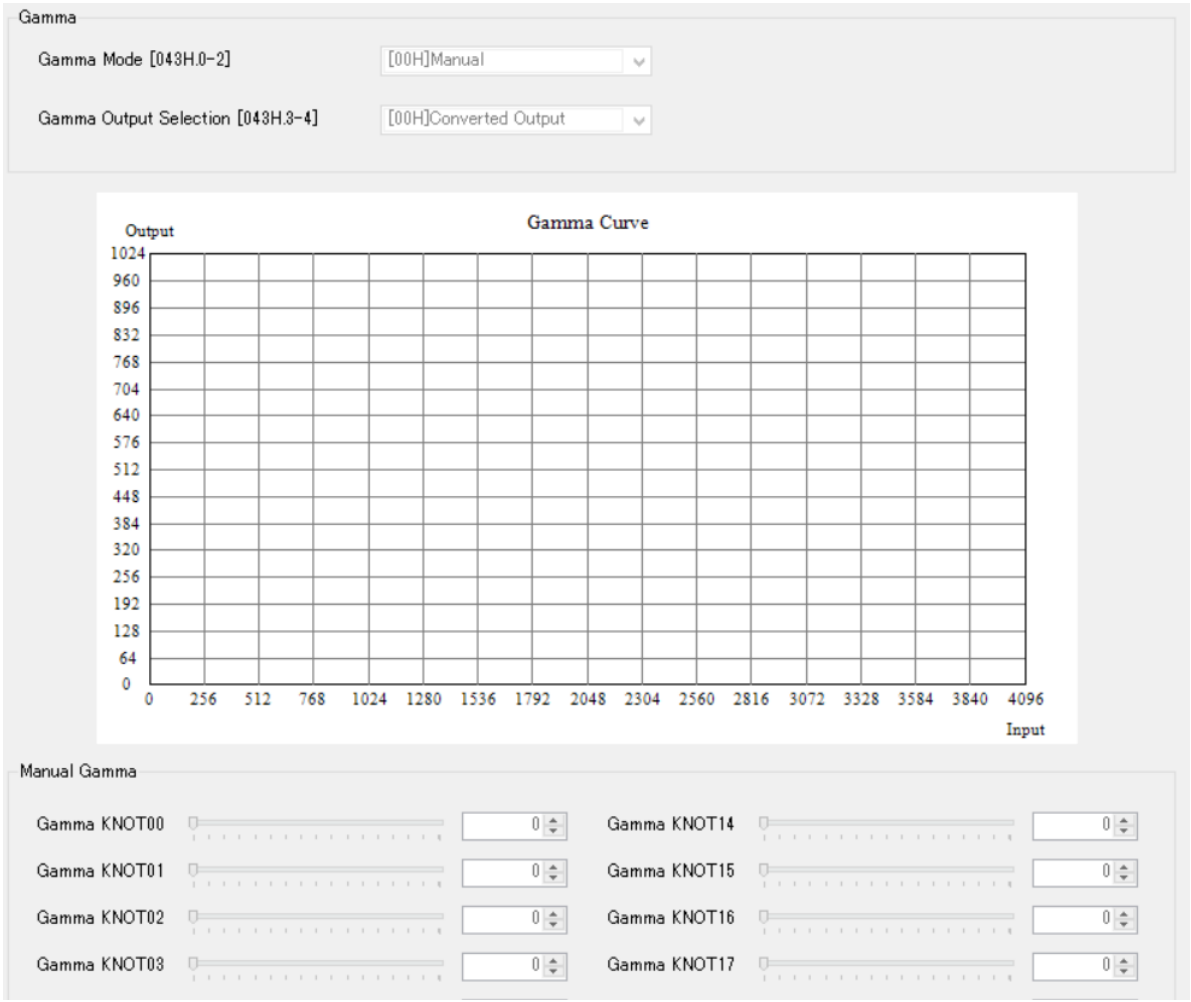
Auto IRC Filter Disable Gain

Sets the gain threshold to the IR cut filter off for the auto IRC filter control.

Auto IRC Filter Enable Gain

Sets the gain threshold to the IR cut filter on for the auto IRC filter control.

DSP: Gamma




**Gamma Mode**

Select the manual or the presets (0.45, 0.6, 0.8 or 1.0) for the gamma mode.
The gamma curve that cleats by the manual gamma is applied for the manual gamma mode.

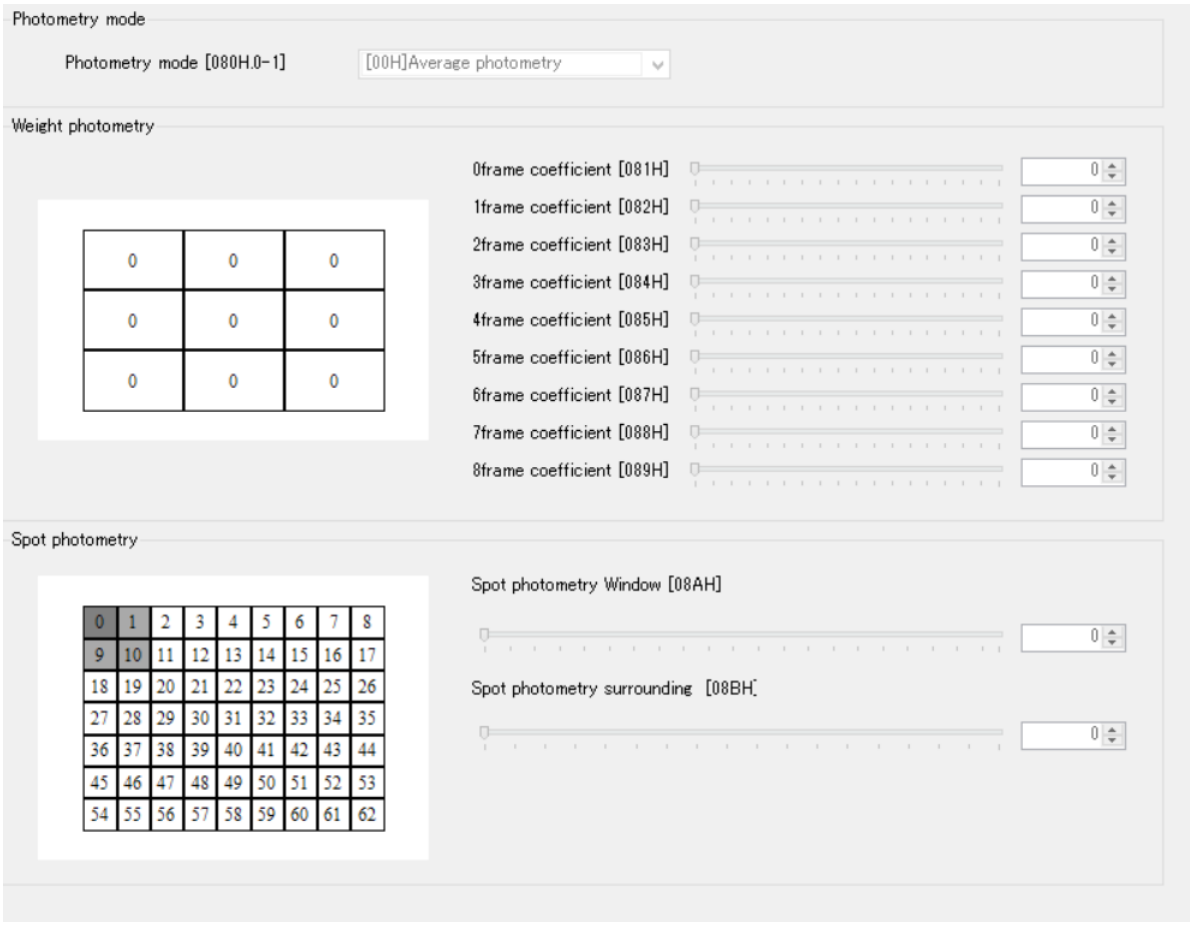
**Gamma Output Selection**

Select the gamma converted image or not converted image as the output from the camera.
The gamma setting is applied when the gamma converted image output is selected.

**Gamma Offset**

Adjust the Gamma offset level that is selected on Gamma Mode.
Note: The Gamma Curve on KGACtrl does not reflect this adjustment.

DSP: AE Other




**Photometry Mode**

The brightness level is maintained for the specific area of the image or the brightness level with the weight for the area or the histogram of the brightness. Select the average photometry, the emphasis photometry, the spot photometry or the backlight compensation.

For the average photometry, the average brightness level of the all images is used for the brightness adjustment.

For the emphasis photometry, the weighted brightness of nine areas is used for the brightness adjustment.

For the spot photometry, the weighted brightness for the surrounded areas of the specific area is used for the brightness adjustment.

DSP: Other


Resolution/FrameRate

Select the output format (resolution and the frame rate).

Image output Inversion

Select the normal image, the horizontal flip image, the vertical flip image or the horizontal and the vertical flip image.

Sharpness Gain

Set the sharpness gain.

Wide Dynamic Range

This function avoids the clipped whites and the crushed shadows by compressing the low brightness and the high brightness areas to the middle brightness area and expand to the optimal gray scale.

The object visibility is improved for the hazy image with the contras enhanced process when “Defog” is selected.

Nega/Posi

Select the negative image or the positive image.

Shading Correction

Select the enable and the disable for the shading correction function.

Color/Black and White

Select the color image output or the monochrome image output for the camera.

Contrast

Set the contrast.

Brightness

Sets the brightness of the image.


**Noise Reduction**

Noise Reduction

0(weak)～5(strong)：Choose from 6 levels, reduction effect would be different from gain level.

6：Fixed the level that was set on User Setting[0F9H]. reduction effect is the same as any gain level. This setting should be effective under lighting condition.

Local Correlation

Set the local correlation type of Noise Reduction level.

Horizontal LPF

Filtered on horizontal direction and do flat processing to reduce noise.


Horizontal Aperture Level / Vertical Aperture Level

The image edge is enhanced to improve the image resolution.

When the aperture level increases the image edge becomes strong, but the noise becomes more visible.


Hue Adjustment

Adjust the hue of the image.

Saturation Adjustment

Adjust the color saturation of the image.

uCOM: Motion Detection


Frame 0 / Frame 1

Select to enable or disable for the motion detection frame to the alarm output.

Motion Detection Threshold

Set the motion detection sensitivity threshold.

Interval Time

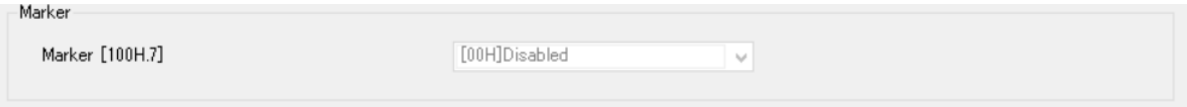
Set the hold time (unit is second) for the result of the motion detection.


**Frame 0 Height, Frame 0 Tilt, Frame 0 Width, Frame 0 Pan,**
**Frame 1 Height, Frame 1 Tilt, Frame 0 Width and Frame 1 Pan**

Set the motion detection frame (Height, horizontal position, width and vertical position).

DSP: Marker

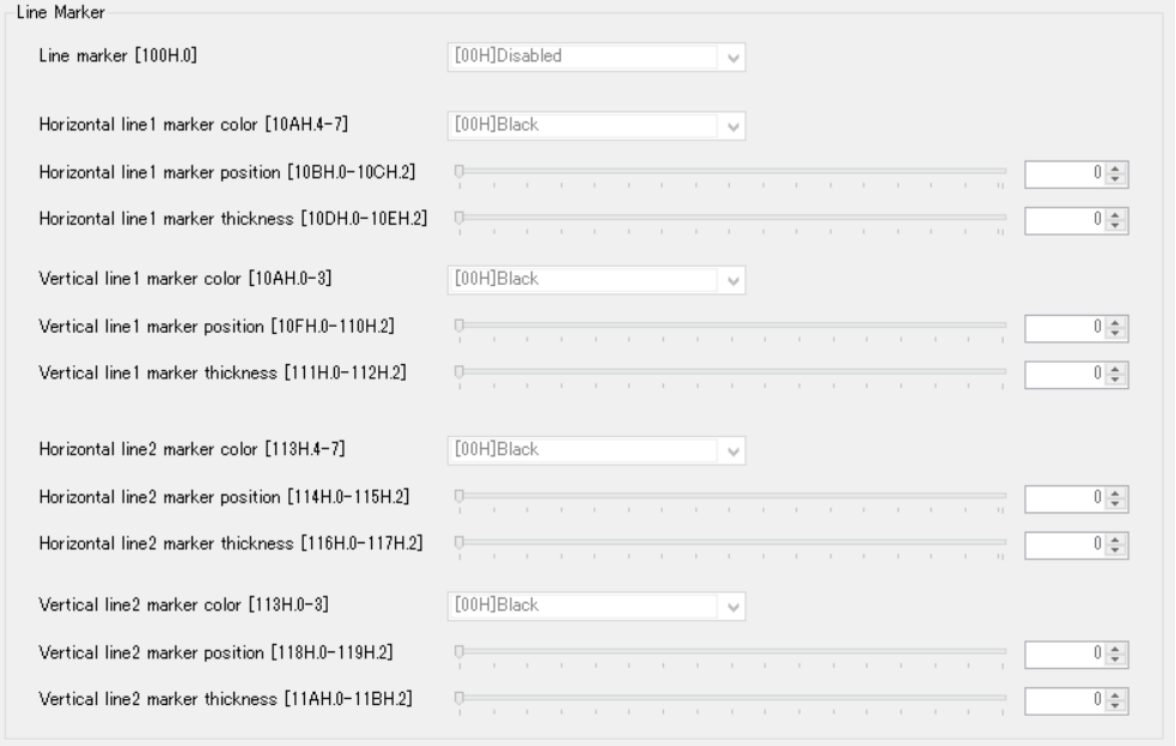
The marker function is to display the horizontal line, the vertical line or the shadow mask on the image.




Marker

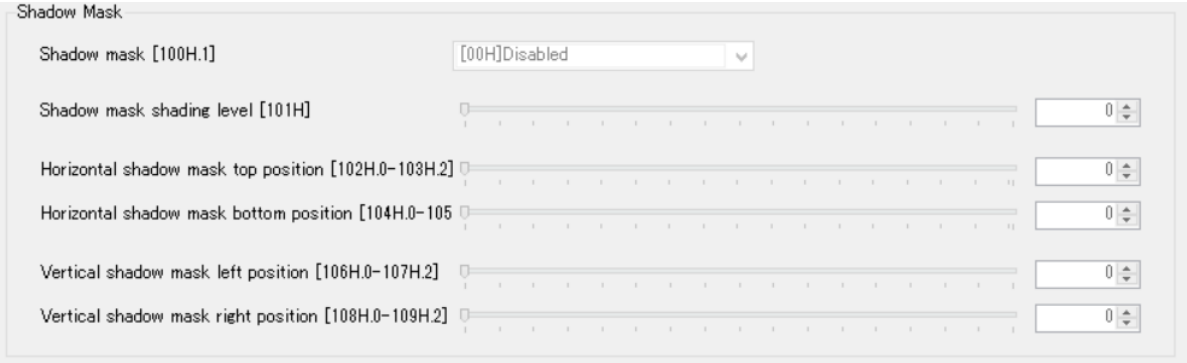
Select to enable or disable the marker function.

Enable or disable the line maker and shadow mask individually when the marker function is enabled.




Line Maker

Set the color, the position and the thickness individually for the two horizontal and two vertical lines.




Shadow Mask

Set the area for the shadow mask.

The display priority is Shadow mask > Line maker 2 > Line maker 1.

DSP: Privacy Mask


Mask Size linked by Zoom

Select to enable or disable the privacy mask size and the position is linked with the zoom function.

To enable or disable, the color, the size and the position can be set for each individual privacy mask.
The masking priority is Mask 0 > Mask 1 > … > Mask 7 > Shadow mask > Line maker 2 > Line maker 1.

Please check the protocol information for more details.

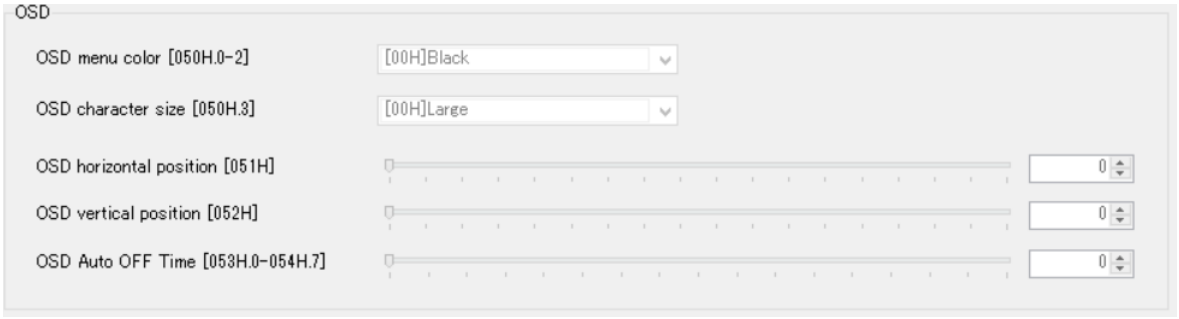
uCOM: User Color


Define the custom color for the privacy mask or the line marker.

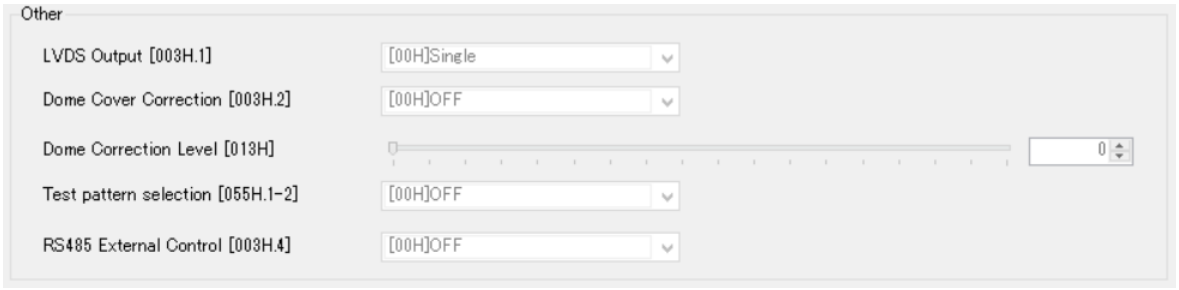
uCOM: Other


UserPreset

Select the DPS preset setting from eight DSP preset files (Preset 0 to Preset 7).




Set the OSD for the external controller. This is only valid for the SDI model.



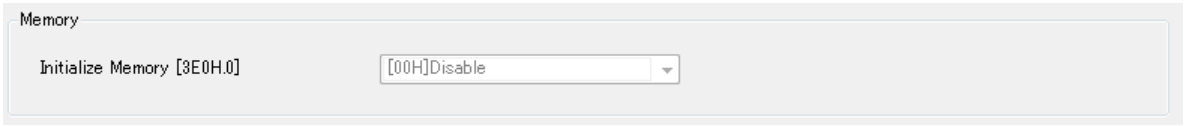

LVDS Output

Select the single link or the dual link for the LVDS output. This is only valid for the LVDS mode.

Test pattern selection

Select the test pattern.

The OSD, the privacy mask, the line marker and the shadow mask cannot be changed while the test pattern is the output.




**Initialize Memory**

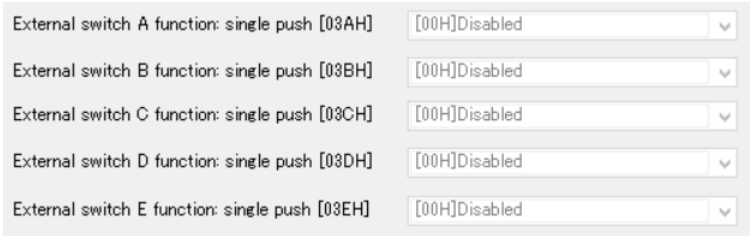
The factory default setting can be loaded into EEPROM. When set enable, then the factory default data is overwritten into EEPORM and then camera is rebooted.

uCOM: Push Button

**Button**


Select the function to be assigned to the buttons of the remote controller.

**Push button**

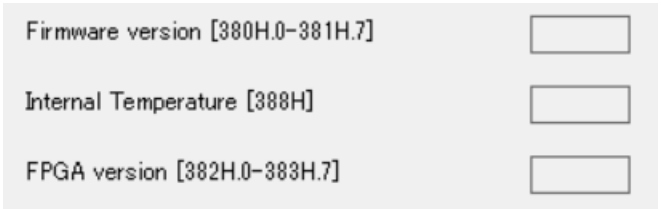



Select the function to be assigned to the push buttons.

uCOM: UART


Set the communication settings.

uCOM: ReadOnly




Display the firmware version of the camera and the camera internal temperature.

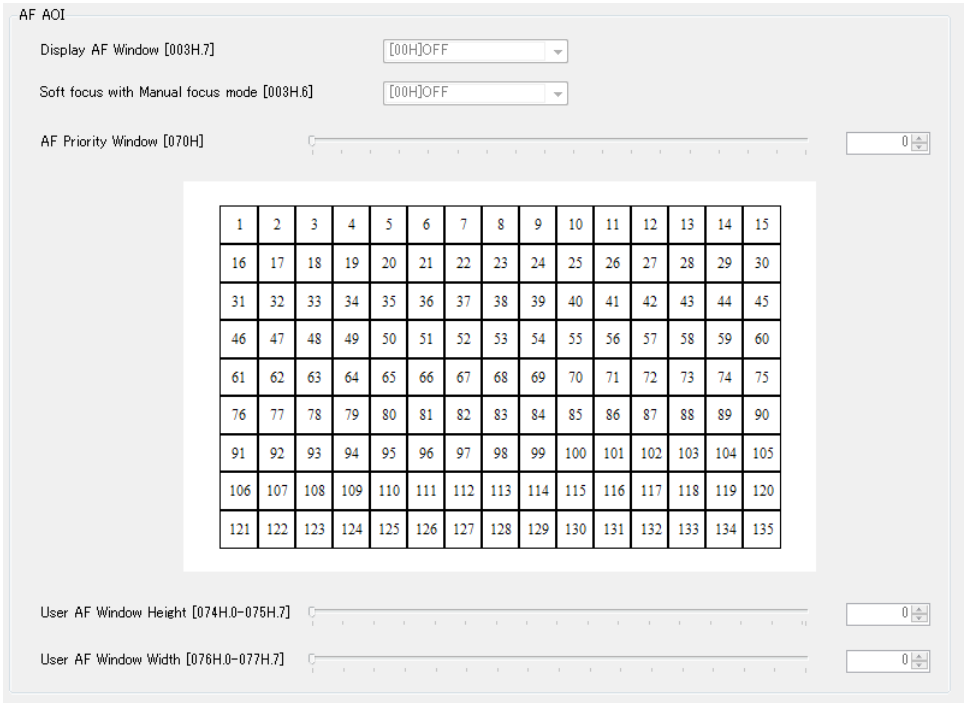
OSD Command Test

OSD command can be tested. Please check the protocol information for more details.

Blemish Pixel


The white pixel blemish is corrected when “Auto Detect” button is selected.

COM: AFAOI




Set the AF’s position / size of primary focus area.
When Display AF Window :ON, selected detection window’s position / size come up.
Note) Privacy mask 5 is not shown when Display AF Window :ON.

Field: Table

Standard | Tab Page Filter | Different Filter

| Device | TabPage | Address | Name | EEPROM | Register |
|---|---|---|---|---|---|
| uCOM | Standard | 001H.1-2 | オートフォーカスモード | [00H]ノーマル | [00H]ノーマル |
| uCOM | Standard | 001H.4 | ワンプッシュオートアイリス | [00H]オフ | [00H]オフ |
| uCOM | Standard | 001H.5 | アイリスモード | [01H]オート | [01H]オート |
| uCOM | Standard | 001H.6 | ワンプッシュオートフォーカス | [00H]オフ | [00H]オフ |
| uCOM | Standard | 001H.7 | フォーカスモード | [01H]オート | [01H]オート |
| uCOM | Standard | 002H.1 | モーションディテクション | [00H]オフ | [00H]オフ |
| uCOM | Standard | 002H.4-5 | オートフォーカス速度 | [02H]高速度 | [02H]高速度 |
| uCOM | Standard | 002H.6 | AF感度 | [00H]ノーマル | [00H]ノーマル |
| uCOM | Standard | 006H | インターバルAF時間 | 5 | 5 |
| uCOM | Standard | 007H | ズームトリガAF時間 | 5 | 5 |
| uCOM | Standard | 008H.0-009H.7 | ズーム位置 | 12 | 12 |

Display the list of the settings.

# 6 Protocol specifications

## 6.1 Communication settings

| Setting | Value |
|---|---|
| Baud rate | 9,600 bps / 19,200 bps / 38,400 bps, 15,200 bps (Default: 38,400 bps) |
| Data bit | 8 bits |
| Parity | None |
| Stop bit | 1 bit |
| Flow control | None |

## 6.2 Communication format

The format for sending / receiving data between the PC and the camera is as follow:

| SOF | Command | Direction | Data length | Data | Check sum | EOF |
|---|---|---|---|---|---|---|
| 8 bits | 8 bits | 1 bit | 15 bits | [Data length] byte | 8 bits | 8 bits |

Details for the format:

| | Details |
|---|---|
| SOF | Start of the Frame. This value is always “0x02”. |
| Command | Command code. Please refer “Camera Control Command” for more details. |
| Direction | “0”: Reading or receiving data from the camera is always ‘”0”.<br>“1”: Writing or sending data to the camera is always “1”.<br>Note: This value is always “0” for the response from the camera. |
| Data length | The data length must be specified in bytes. |
| Data | Set the option of writing / sending data for the commands, or receiving data from camera.<br>The size must be specified as the “Data length”. |
| Check sum | The check sum function to verify the integrity of the communication transmission.<br>The check sum value should equal to the last (low) 8 bits of the summary of<br>[Command + Direction + Data length + Data] |
| EOF | End of the Frame. This value is always “0x03”. |

## 6.3 Camera Control Commands

All data in this section is described in Hexadecimal format (HEX).

### 6.3.1 The Command List for the Communication

| Command (HEX) | Command details |
|---|---|
| 4A | This command is for Reading data from or Writing data to the camera ICs (i.e.: EEPROM, DSP, CPU).<br>Use the slave addresses describe in “Slave address of the ICs (8 bits) list” to address each IC.<br>In the case of writing, the maximum number of addresses can be written at once is 32 addresses, data must be written 8 times separately if 256 bytes data must be written.<br><br>[SLV]: Slave address of ICs<br>[START_H] x 16 + [START_L]: First address (0000 to 03FF)<br>[END_H] x 16 + [END_L]: Last address (0000 to 03FF)<br>[DATA (i)]: Data of address (i)<br>[DataLenH]: Upper byte of the two bytes calculated as [END_H] x 16 + [END_L] – [START_H] x 16 + [START_L] + 6<br>[DataLenL]: Lower byte of the two bytes calculated as [END_H] x 16 + [END_L] – [START_H] x 16 + [START_L] + 6<br><br>1. The format for the reading data from the ICs is as follows:<br>A. Sending data from the PC<br>02, 4A, 00, 05, [SLV], [START_H], [START_L], [END_H], [END_L], [CHK], 03<br><br>In this example, the value of [CHK] is the last (low) 8 bits of the summary of (4A, 00, 05, [SLV], [START_H], [START_L], [END_H], [END_L])<br><br>B. Receiving data from the camera with above sending command.<br>02, 4A, [DataLenH], [DataLenL], [SLV], [START_H], [START_L], [END_H], [END_L], [DATA(START)], [DATA(START+1)], ,,, , [DATA(END)], [CHK], 03<br><br>In this example, the value of [CHK] is the last (low) 8 bits of the summary of (4A, [DataLenH], [DataLenL], [SLV], [START_H], [START_L], [END_H], [END_L], [DATA(START)], [DATA(START+1)], ,,, , [DATA(END)])<br><br>* An example of the sending command to read out all data (address 0000 to 03FF) from the IC (Slave address of the IC is 20h) is as follows:<br>02, 4A, 00, 05, 20, 00, 00, 03, FF, 71, 03 |

| Command (HEX) | Command details |
|---|---|
| 4A | 2. The format for the writing data to the ICs is as follows:<br>A. Sending data from the PC<br>02, 4A, [DataLenH]+80, [DataLenL], [SLV], [START_H], [START_L], [END_H], [END_L], [DATA(START)], [DATA(START+1)], ,,, , [DATA(END)], [CHK], 03<br><br>In this example, the value of [CHK] is the last (low) 8 bits of the summary of (4A, [DataLenH]+80, [DataLenL], [SLV], [START_H], [START_L], [END_H], [END_L], [DATA(START)], [DATA(START+1)], ,,, , [DATA(END)])<br><br>B. Receiving data from the camera with above sending command.<br>02, 4A, [DataLenH], [DataLenL], [SLV], [START_H], [START_L], [END_H], [END_L], [DATA(START)], [DATA(START+1)], ,,, , [DATA(END)], [CHK], 03<br><br>In this example, the value of [CHK] is the last (low) 8 bits of the summary of (4A, [DataLenH], [DataLenL], [SLV], [START_H], [START_L], [END_H], [END_L], [DATA(START)], [DATA(START+1)], ,,, , [DATA(END)])<br><br>* An example of the sending command to write 23 to the address 0010 of the IC (Slave address of the IC is 20h) is as follows:<br>02, 4A, 80, 06, 20, 00, 10, 00, 23, 33, 03 |
| 50 | This command is for the sending the OSCD (On Screen Character Display) command to the camera. 16 bytes OSCD command is the maximum amount of the data that can be written to the camera at one communication.<br><br>In order to generate the OSCD, sets the 50h value to the command, sets the OSCD command to the data and sets the number of byte of the OSCD command to the data length. |

6.3.2 Slave address for the ICs (8 bits) list

| IC | Address | Description of the IC |
|---|---|---|
| EEPROM | 90 | The EEPROM zone for the preset 0 DSP data |
| EEPROM | 91 | The EEPROM zone for the preset 1 DSP data |
| EEPROM | 92 | The EEPROM zone for the preset 2 DSP data |
| EEPROM | 93 | The EEPROM zone for the preset 3 DSP data |
| EEPROM | 94 | The EEPROM zone for the preset 4 DSP data |
| EEPROM | 95 | The EEPROM zone for the preset 5 DSP data |
| EEPROM | 96 | The EEPROM zone for the preset 6 DSP data |
| EEPROM | 97 | The EEPROM zone for the preset 7 DSP data |
| uCOM | 30 | The uCOM for the lens control and the iris control |
| EEPROM | 40 | The EEPROM zone for the uCOM data |

Note: There is a maximum number to write the data to the EEPROM (1,000,000 times)

6.3.3 The error code list

If the communication error occurs, the camera will send the error code with the following format:
The command number of the error message is FF (HEX). The data length is 0002.

| Error | Receiving data |
|---|---|
| Check sum does NOT match the data being transmitted | 02, FF, 00, 02, 03, 00, 04, 03 |
| The command being transmitted does NOT exist or invalid | 02, FF, 00, 02, 04, 00, 05, 03 |
| Unprocessed data remains in the receiving buffer | 02, FF, 00, 02, 05, 00, 06, 03 |
| Time out | 02, FF, 00, 02, 06, 00, 07, 03 |
| Over run error | 02, FF, 00, 02, 08, 00, 09, 03 |
| Framing error | 02, FF, 00, 02, 09, 00, 0A, 03 |
| Data length error (too long) | 02, FF, 00, 02, 0B, 00, 0C, 03 |
| Communication error | 02, FF, 00, 02, 10, 00, 11, 03 |

Note.1: The camera will disregard the data that is not started with SOF.
Note.2: The time out error occurs when the camera doesn't receive the next set of the data within 3 seconds after the last received data.

## 6.4 The uCOM register mapping list

Note: DO NOT change the “Reserved” address or bit.

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 000 | | | | | | X | X | X | User preset<br>Up to eight different DSP settings can stored.<br>The camera starts with saved preset at the power up the camera when saving to the EEPROM.<br>0: Preset 0 1: Preset 1<br>2: Preset 2 3: Preset 3<br>4: Preset 4 5: Preset 5<br>6: Preset 6 7: Preset 7 | 0 |
| | X | X | X | X | X | | | | Reserved | |
| 001 | | | | | | | | X | Reserved | |
| | | | | | | X | X | | Auto focus mode<br>0: Normal auto focus 1: Interval auto focus<br>2: Zoom trigger auto focus<br>The interval auto focus is invalid when the interval push to set auto focus is enabled. | 0 |
| | | | | | X | | | | Interval push auto focus<br>0: Disable 1: Enable<br>Push to set focus is enabled each period of time that is specified by [006h] address when the interval push to auto focus is enabled. | 0 |
| | | | | X | | | | | Push to set iris<br>0: Disable 1: Enable<br>The iris is adjusted automatically once when the push to set iris is enabled. Automatically resets to disable after the iris is adjusted. | 0 |
| | | | X | | | | | | Iris mode<br>0: Fixed iris 1: Auto iris<br>It is necessary to set the target brightness level at ALC target brightness [092h, 093h] address for the auto iris | 1 |
| | | X | | | | | | | Push to set focus<br>0: Disable 1: Enable<br>The focus is adjusted once automatically when the push to set focus is enabled. Automatically resets to disable after the focus is adjusted. | 0 |
| | X | | | | | | | | Focus mode<br>0: Manual focus 1: Auto focus | 1 |

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 002 | | | | | | | | X | Reserved | |
| | | | | | | | X | | Motion detection<br>The focus becomes stable while the object is moving when the motion detection is enabled.<br>0: Disable 1: Enable | 0 |
| | | | | | X | X | | | Reserved | |
| | | | X | X | | | | | Auto focus speed<br>Sets the focus speed at TELE end<br>0: Normal speed 1: Medium speed<br>2: Fast speed | |
| | | X | | | | | | | Auto focus control start threshold<br>Sets the threshold to start auto focus.<br>0: Normal 1: Low sensitive | 0 |
| | X | | | | | | | | Reserved | |
| 003 | | | | | | | | X | Privacy mask linked the zoom function<br>Privacy mask size and the position is changed based on the zoom ratio.<br>0: Disable 1: Enable | 1 |
| | | | | | | | X | | LVDS output<br>0: LVDS single link output 1: LVDS dual link output | 0 |
| | | | X | X | X | X | | | Reserved | |
| | | X | | | | | | | Slow AF function<br>The focus is adjusting slowly when the priority auto focus detection frame number is changed.<br>0: Disable 1: Enable<br>This function is disabled when using the auto focus mode. | 0 |
| | X | | | | | | | | Display AF detection frame<br>Select display or not display the priority auto focus detection frame.<br>The privacy mask does not display when the priority auto focus detection frame is displaying.<br>0: Not display 1: Display | 0 |
| 004 | X | X | X | X | X | X | X | X | Reserved | |
| 005 | | | | | | | | X | Sentech communication protocol<br>0: Disable 1: Enable | 1 |
| | | | | | | | X | | VISCA protocol<br>0: Disable 1: Enable | 1 |
| | | | | | | X | | | Pelco D protocol<br>0: Disable 1: Enable | 0 |
| | X | X | X | X | X | | | | Reserved | |
| 006 | X | X | X | X | X | X | X | X | Interval auto focus time<br>Sets the interval time for the interval auto focus and the interval push to set focus with second. | 5 |
| 007 | X | X | X | X | X | X | X | X | Interval time for the zoom trigger auto focus<br>Sets the interval time for the zoom trigger auto focus with second. | 5 |

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 008 | X | X | X | X | X | X | X | X | Zoom position [little-endian] | 12 |
| 009 | 0 | 0 | 0 | 0 | X | X | X | X | 12: WIDE end 1168: TELE end<br>The zoom position moves to saved position at the power up when the value saves to the EEPROM.<br>Zooming is stopped by the zoom position at moment when 0 is set while zooming. | |
| 00A | X | X | X | X | X | X | X | X | Focus distance [little-endian] | 101 |
| 00B | 0 | 0 | 0 | 0 | 0 | 0 | X | X | 0: Infinity 898: Infinity<br>898: Approximately 1cm<br>The focus distance moves to saved distance at the power up when the value saves to the EEPROM.<br>Focusing is stopped by the focus distance at the moment when 0 is set while focusing at the manual focus. | |
| 00C | X | X | X | X | X | X | X | X | Iris open ratio | 500 |
| 00D | 0 | 0 | 0 | 0 | 0 | 0 | X | X | 0: 100% close 1000: 100% open<br>The iris is adjusting with saved open ratio at the power up when the value is saved to the EEPROM. | |
| 00E | | | | | | | | X | Push button<br>0: Disable 1: Enable | 1 |
| | X | X | X | X | X | X | X | | Reserved | |
| 00F | | | | | | | X | X | UART baud rate<br>0: 9,600 bps 1: 19,200 bps<br>2: 38,400 bps 3: 115,200 bps | 2 |
| | | | X | X | X | X | | | Reserved | |
| | | X | | | | | | | The return data and data length of UART write command<br>0: Return data includes the exact same data of write command.<br>1: Return data excludes data of write command, and data length is 0. | 0 |
| | X | | | | | | | | UART check sum<br>0: Disable 1: Enable<br>The camera will process the command even the check sum of the sending data does not match when the UART check sum is disabled. | 1 |
| 010 | X | X | X | X | X | X | X | X | Zoom lens speed<br>The zoom lens moves fast with the greater pps setting<br>0: 800 pps 1: 400 pps 2: 180 pps 3: 150 pps<br>4: 120 pps 5: 60 pps 6: 40 pps 7: 25 pps<br>8: 750 pps 9: 700 pps 10: 650 pps 11: 600 pps<br>12: 550 pp 13: 500 pps 14: 450 pps<br>15 or greater: 800 pps | 0 |
| 011 | X | X | X | X | X | X | X | X | Manual focus speed<br>0: Slow speed 7: Fast speed | 0 |

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 012 | | | | | X | X | X | X | Minimum focus distance<br>Sets the minimum focus distance at NEAR end<br>0: Infinity 1: 30 m 2: 10 m 3: 5 m<br>4: 3 m 5: 2m 6: 1.5 m 7: 1m<br>8: 50 cm 9: 30 cm 10: 10 cm 11: 1 cm<br>12 or greater: Prohibited<br>1 m is the minimum focus distance at TELE end. | 7 |
| | X | X | X | X | | | | | Reserved | |
| 013 | X | X | X | X | X | X | X | X | Dome cover correction level (%)<br>Sets the limit expand range at NEAR end when the dome cover correction function is enabled. | 100 |
| 014 | | | | | | | | X | Motion detection frame 0<br>0: Disable 1: Enable | 1 |
| | | | | | | | X | | Motion detection frame 1<br>0: Disable 1: Enable | 0 |
| | | | | | | X | | | Display motion detection frame 0<br>0: Not display 1: Display | 0 |
| | | | | | X | | | | Display motion detection frame 1<br>0: Not display 1: Display | 0 |
| | | | | X | | | | | Alarm output for Motion detection frame 0<br>0: Disable 1: Enable | 0 |
| | | | X | | | | | | Alarm output for Motion detection frame 1<br>0: Disable 1: Enable | 0 |
| | X | X | | | | | | | Reserved | |
| 015 | X | X | X | X | X | X | X | X | Motion detection sensitivity threshold<br>Sensitivity threshold = Value / 255 x 100 (%) | 40 |
| 016 | X | X | X | X | X | X | X | X | Motion detection interval time<br>Set the motion detection result holding time (second) | 5 |
| 017 | | | | | | | | X | Motion detect result for frame 0 (read only)<br>0: No detection 1: Detect | |
| | | | | | | | X | | Motion detect result for frame 1 (read only)<br>0: No detection 1: Detect | |
| | X | X | X | X | X | X | | | Reserved | |
| 018 | | | | | X | X | X | X | User color Y | 0 |
| | X | X | X | X | | | | | Reserved | |
| 019 | | | | | X | X | X | X | User color Cr | 0 |
| | X | X | X | X | | | | | User color Cb | 0 |
| 01A | X | X | X | X | X | X | X | X | Optical zoom range (WIDE end) [little-endian] | 12 |
| 01B | 0 | 0 | 0 | 0 | X | X | X | X | 12: WIDE end 1168: TELE end | |
| 01C | X | X | X | X | X | X | X | X | Optical zoom range (TELE end) [little-endian] | 1168 |
| 01D | 0 | 0 | 0 | 0 | X | X | X | X | 12: WIDE end 1168: TELE end | |
| 01E | X | X | X | X | X | X | X | X | Maximum voltage change for auto iris | 0 |
| 01F | 0 | 0 | X | X | X | X | X | X | Set the limitation for the control voltage change derived from the auto iris step multiplier and the auto iris step divisor.<br>When a smaller value is set, the iris control is smooth but the movement becomes slower when the brightness is changed dynamically. | |

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 020 | X | X | X | X | X | X | X | X | Auto iris minimum open ratio [little-endian]<br>The iris open ratio for the auto iris operation is always greater than this. | 0 |
| 024 | 0 | 0 | 0 | 0 | 0 | 0 | X | X | 0: 100% close 1000: 100% open | |
| 022 | X | X | X | X | X | X | X | X | Auto iris maximum open ration [little-endian]<br>The iris open ratio for the auto iris operation is always smaller than this. | 1000 |
| 023 | 0 | 0 | 0 | 0 | 0 | 0 | X | X | 0: 100% close 1000: 100% open | |
| 024 | X | X | X | X | X | X | X | X | Auto iris control tolerance<br>Stop the auto iris control when the difference between the current brightness and the target brightness becomes smaller than this. | 3 |
| 025 | X | X | X | X | X | X | X | X | Auto iris control Threshold<br>Start the auto iris control when the difference between the current brightness and the target brightness becomes greater than this. | 3 |
| 026 | X | X | X | X | X | X | X | X | Auto iris step multiplier<br>Adjust the voltage change for the iris control<br>Voltage change = (Target brightness - current brightness) x (auto iris step multiplier + 1 ) / (auto iris step divisor + 1) | 0 |
| 027 | X | X | X | X | X | X | X | X | Auto iris step divisor<br>Adjust the voltage change for the iris control<br>Voltage change = (Target brightness - current brightness) x (auto iris step multiplier + 1 ) / (auto iris step divisor + 1) | 2 |
| 028 | X | X | X | X | X | X | X | X | Reserved | |
| 029 | | | | | X | X | X | X | “Down” (for displaying menu) is assigned push button<br>10: SW A 11: SW B 12: SW C 13: SW D<br>14: SW E | 12 |
| | X | X | X | X | | | | | “Up” (for displaying menu) is assigned push button<br>10: SW A 11: SW B 12: SW C 13: SW D<br>14: SW E | 11 |
| 02A | | | | | X | X | X | X | “Right” (for displaying menu) is assigned push button<br>10: SW A 11: SW B 12: SW C 13: SW D<br>14: SW E | 14 |
| | X | X | X | X | | | | | “Left” (for displaying menu) is assigned push button<br>10: SW A 11: SW B 12: SW C 13: SW D<br>14: SW E | 13 |
| 02B | | | | | X | X | X | X | “Return” (for displaying menu) is assigned push button<br>10: SW A 11: SW B 12: SW C 13: SW D<br>14: SW E | 10 |
| | X | X | X | X | | | | | “Enter” (for displaying menu) is assigned push button<br>10: SW A 11: SW B 12: SW C 13: SW D | 15 |
| 02C to 039 | X | X | X | X | X | X | X | X | Reserved | |

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 03A | X | X | X | X | X | X | X | X | Initial function for SW A<br>Please check the available function in the push button function list. | 1 |
| 03B | X | X | X | X | X | X | X | X | Initial function for SW B<br>Please check the available function in the push button function list. | 4 |
| 03C | X | X | X | X | X | X | X | X | Initial function for SW C<br>Please check the available function in the push button function list. | 5 |
| 03D | X | X | X | X | X | X | X | X | Initial function for SW D<br>Please check the available function in the push button function list. | 2 |
| 03E | X | X | X | X | X | X | X | X | Initial function for SW E<br>Please check the available function in the push button function list. | 3 |
| 03F to 04F | X | X | X | X | X | X | X | X | | |
| 050 | | | | | | X | X | X | Menu color for OSCD<br>0: Black 1: Blue 2: Green 3: Cyan<br>4: Red 5: Magenta 6: Yellow 7: White | 7 |
| | | | | | X | | | | Character size for OSCD<br>0: Large 1: Small | 0 |
| | X | X | X | X | | | | | Reserved | |
| 051 | X | X | X | X | X | X | X | X | OSCD horizontal display position<br>0: Left 255: Right | 0 |
| 052 | X | X | X | X | X | X | X | X | OSCD vertical display position<br>0: Top 255: Bottom | 0 |
| 053 | X | X | X | X | X | X | X | X | OSCD automatically disable time | 0 |
| 054 | X | X | X | X | X | X | X | X | Set the time to disable the OSCD from the last OSCD operation (second). This is valid only for the camera internal OSCD. | |
| 055 | | | | | | | | X | Reserved | |
| | | | | | | X | X | | Test pattern<br>0: Disable (Video output) 1: Horizontal color bar<br>2: Ramp 3: Vertical color bar | 0 |
| | X | X | X | X | X | | | | Reserved | |
| 056 | | | | | | | 0 | 0 | Reserved | 0 |
| | | | | | | X | | | OSD menu ON / OFF | |
| | | | | | X | | | | OSD menu Up | |
| | | | | X | | | | | OSD menu Down | |
| | | | X | | | | | | OSD menu Left | |
| | | X | | | | | | | OSD menu Right | |
| | 0 | | | | | | | | Reserved | |
| 057 to 058 | X | X | X | X | X | X | X | X | Reserved | |
| 059 | | | | | X | X | X | X | Number of frames skipped for auto iris control<br>Set the number of the frame that is skipped for the auto iris control. | 3 |
| | X | X | X | X | | | | | Reserved | |
| 05A to 06F | X | X | X | X | X | X | X | X | Reserved | |

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 070 | X | X | X | X | X | X | X | X | The priority auto focus detection frame number<br>Select the priority frame for the auto focus function<br>0, 136 or greater: Fixed center, size and position<br>1 to 135: select priority frame from 135 frame (15 horizontal x 9 vertical) | 0 |
| 071 to 073 | X | X | X | X | X | X | X | X | Reserved | |
| 074 | X | X | X | X | X | X | X | X | Vertical size (height) for the priority auto focus detection frame<br>This size is valid for the 1 to 135 priority detection frames | 720 |
| 075 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 076 | X | X | X | X | X | X | X | X | Horizontal size (width) for the priority auto focus detection frame<br>This size is valid for the 1 to 135 priority detection frames | 1024 |
| 077 | | | | | | | | | | |
| 078 to 080 | X | X | X | X | X | X | X | X | Reserved | |
| 081 | X | X | X | X | X | X | X | X | VISCA address to recover Sentech protocol | 15 |
| 082 | X | X | X | X | X | X | X | X | Pelco D camera address | 0 |
| 083 | X | X | X | X | X | X | X | X | Pelco D command to recover Sentech protocol | 129 |
| 084 to 1DF | X | X | X | X | X | X | X | X | Reserved | |
| 1E0 | X | X | X | X | X | X | X | X | Height for Motion detection frame 0 | 1080 |
| 1E1 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 1E2 | X | X | X | X | X | X | X | X | Vertical position for Motion detection frame 0<br>(Complement on two) | 0 |
| 1E3 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 1E4 | X | X | X | X | X | X | X | X | Width for Motion detection frame 0 | 1920 |
| 1E5 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 1E6 | X | X | X | X | X | X | X | X | Horizontal position for Motion detection frame 0<br>(Complement on two) | 0 |
| 1E7 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 1E8 | X | X | X | X | X | X | X | X | Height for Motion detection frame 1 | 1080 |
| 1E9 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 1EA | X | X | X | X | X | X | X | X | Vertical position for Motion detection frame 1<br>(Complement on two) | 0 |
| 1EB | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 1EC | X | X | X | X | X | X | X | X | Width for Motion detection frame 1 | 1920 |
| 1ED | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 1EE | X | X | X | X | X | X | X | X | Horizontal position for Motion detection frame 1<br>(Complement on two) | 0 |
| 1EF | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 1F0 to 37F | X | X | X | X | X | X | X | X | Reserved | |
| 380 | X | X | X | X | X | X | X | X | Firmware version (read only) | |
| 381 | 0 | 0 | 0 | 0 | 0 | 0 | X | X | | |
| 382 to 387 | X | X | X | X | X | X | X | X | Reserved | |
| 388 | X | X | X | X | X | X | X | X | Temperature sensor data output (read only) | |
| 389 to 3FF | X | X | X | X | X | X | X | X | Reserved | |

AF AOI (Area Of Interest)

The priority auto focus frame number is assigned as below.
The focus is adjusted following the priority of the object in the priority auto focus detection frame.
If the auto focus target object is not in the selected priority auto focus detection frame, the focus will adjusted to the first object that is in focus in the full screen.

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
| 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 |
| 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 |
| 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |
| 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 |

Zoom table

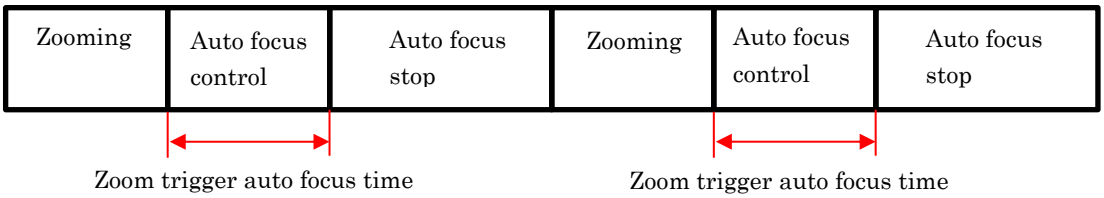
| Zoom position | Magnification | Zoom position | Magnification |
|---|---|---|---|
| 12 | 1.0 | 750 | 4.5 |
| 100 | 1.1 | 800 | 5.2 |
| 150 | 1.2 | 850 | 6.0 |
| 200 | 1.4 | 900 | 7.1 |
| 250 | 1.5 | 950 | 8.4 |
| 300 | 1.6 | 1000 | 10 |
| 350 | 1.8 | 1050 | 12 |
| 354 | 1.8 | 1100 | 14 |
| 400 | 2.0 | 1120 | 15 |
| 450 | 2.2 | 1130 | 16 |
| 500 | 2.4 | 1140 | 17 |
| 550 | 2.7 | 1150 | 18 |
| 600 | 3.0 | 1160 | 19 |
| 650 | 3.4 | 1168 | 20 |
| 700 | 3.9 | | |

Focus table

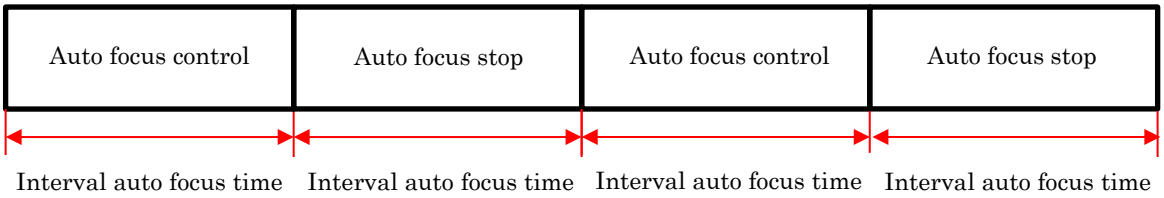
| Focus distance | Setting | Focus distance | Setting |
|---|---|---|---|
| Infinity | 101 | Dead zone | 604 to 638 |
| 30 m | 125 | 50 cm | 656 |
| 10 m | 169 | 30 cm | 677 |
| 5 m | 231 | 10 cm | 746 |
| 3 m | 306 | 1 cm | 898 |
| 2 m | 390 | | |
| 1.5 m | 467 | | |
| 1 m | 603 | | |

Zoom trigger auto focus and interval auto focus operation

Zoom trigger auto focus: Auto focus control for specified time after zooming




Interval auto focus: Auto focus control and stop repeatedly with the specified interval time




Note: The interval auto focus function is disabled automatically when the interval push to set auto focus is enabled.

Temperature sensor data table

| Temperature sensor data (Hex) | Temperature (deg. C) |
|---|---|
| 7F | 128 |
| 7F | 127 |
| 64 | 100 |
| 50 | 80 |
| 4B | 75 |
| 32 | 50 |
| 19 | 25 |
| 0 | 0 |
| FF | -1 |
| EF | -25 |
| C9 | -55 |

### 6.4.1 Push button fuctions for the displey menu

The initial function assignment for each switch for the display menu is follows:

| | Menu is displayed | Menu is OFF |
|---|---|---|
| SW A: Menu | Open / close menu | |
| SW B: Up | Cursor moves to up / increase value | Focus to NEAR |
| SW C: Down | Cursor moves to down / decrease value | Focus to FAR |
| SW D: Left | Cursor moves to left | Zoom to WIDE |
| SW E: Right | Cursor moves to right | Zoom to TELE |

### 6.4.2 Push button function list

| Value | Function | Descriptions |
|---|---|---|
| 0x00 | Disable | Key functions are disabled. |
| 0x01 | Display menu | Display the menu. |
| 0x02 | Zoom to WIDE | Zoom position moves to the WIDE. |
| 0x03 | Zoom to TELE | Zoom position moves to the TELE. |
| 0x04 | Focus to NEAR | Focus distance moves to the NEAR. |
| 0x05 | Focus to FAR | Focus distance moves to the FAR. |

## 6.5 DSP register mapping list

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 001 to 015 | X | X | X | X | X | X | X | X | Reserved | |
| 016 | X | X | X | X | X | X | X | X | Exposure time [little-endian] | 100 |
| 017 | X | X | X | X | X | X | X | X | Set the exposure time for the manual shutter control.<br>Value rage for 60fps is 1 to 166, for 50fps is 1 to 199,<br>for 30fps is 1 to 331<br>Exposure time (second) = Value / 10,000 | |
| 018 | X | X | X | X | X | X | X | X | Gain [little-endian] | 0 |
| 019 | X | X | X | X | X | X | X | X | Set the gain for the manual gain<br>Gain (dB) = Value x 0.3 + 1.2 | |
| 01A to 02F | X | X | X | X | X | X | X | X | Reserved | |
| 02C to 02D | X | X | X | X | X | X | X | X | Gamma offset | |
| 02E to 02F | X | X | X | X | X | X | X | X | Reserved | |
| 030 | | | | | X | X | X | X | White balance mode<br>0: Auto 1: Full open<br>2: AWB hold 3: Custom color temperature<br>4: USER mode | 0 |
| | | | | X | | | | | Indoor / outdoor mode<br>0: Indoor mode 1: Outdoor mode | 0 |
| | | X | X | | | | | | Reserved | |
| | X | | | | | | | | Push lock white balance<br>Switch to AWB hold after push lock white balance selected.<br>0: Disable 1: Enable | 0 |
| 031 | X | X | X | X | X | X | X | X | Auto white balance start tolerance<br>Set the number of the frame that is the outside of the dead zone continuously, to start the auto white balance function. | 8 |
| 032 | X | X | X | X | X | X | X | X | Auto white balance process speed<br>Set the white balance process speed (number of the frame()<br>This is valid for the auto white balance or the full open. | 1 |
| 033 | X | X | X | X | X | X | X | X | Auto white balance convergence step for near target<br>The auto white balance process speed is faster when setting the smaller steps. | 12 |
| 034 | X | X | X | X | X | X | X | X | Auto white balance convergence step for far target<br>The auto white balance process speed is faster when setting the smaller steps. | 12 |
| 035 | X | X | X | X | X | X | X | X | Full open convergence step<br>The auto white balance process speed is faster when smaller steps are set. | 2 |
| 036 | X | X | X | X | X | X | X | X | Red gain for USER mode | 4565 |
| 037 | X | X | X | X | X | X | X | X | This is only valid for the USER mode. | |
| 038 | X | X | X | X | X | X | X | X | Blue gain for USER mode | 4191 |
| 039 | X | X | X | X | X | X | X | X | This is only valid for the USER mode. | |
| 03A | X | X | X | X | X | X | X | X | Custom color temperature | 39 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 03B | X | X | X | X | X | X | X | X | Reserved | |
| 03C to 03D | X | X | X | X | X | X | X | X | AWB offset R/G<br>Available on Auto mode | |
| 03E to 03F | X | X | X | X | X | X | X | X | AWB offset B/G<br>Available on Auto mode | |

Descriptions for the white balance mode

・Auto (Auto Trace White balance)

The white balance is adjusted automatically based on the pull-in frame and the pull-in limit frame when the color temperature is changed.
The auto white balance tolerance, speed and the convergence step are adjustable.

Indoor / outdoor mode
Set the pull-in frame for the auto white balance. The pull-in frame is expanded when indoor mode is selected.

・Full open

The white balance is adjusted regardless of the object condition.
This function is not dependent on the pull-in frame. The color of the extensive area is pull-in the white.

・Auto white balance hold

The white balance is hold with the white balance gain when the Auto white balance hold is selected.

Push lock function

When the white balance mode is changed from the full open to the auto white balance hold, the white balance gain is saved to the EEPROM.
When the camera starts with the auto white balance hold mode, the white balance gain in the EEPROM is used in the white balance control and the white balance function is hold.
When “Push Lock” button in the software is selected, the white balance mode is changed from the full open to the auto white balance hold and then it is saved to the EEPROM automatically.

・Custom color temperature mode

Set the white balance as the target color temperature manually.

| Value [h] | Color temperature | Value [h] | Color temperature | Value [h] | Color temperature |
|---|---|---|---|---|---|
| 00 | 1,500 | 18 | 2,227 | 30 | 4,324 |
| 03 | 1,564 | 1B | 2,371 | 33 | 4,900 |
| 06 | 1,633 | 1E | 2,534 | 36 | 5,654 |
| 09 | 1,709 | 21 | 2,722 | 39 | 6,682 |
| 0C | 1,793 | 24 | 2,940 | 3C | 8,167 |
| 0F | 1,885 | 27 | 3,196 | 3F | 10,500 |
| 12 | 1,986 | 2A | 3,500 | | |
| 15 | 2,100 | 2D | 3,868 | | |

・USER mode

The white balance sets to manual.
Please set the white balance manually with USER R/G (036h to 037h) and USER B/G (038h to 039h).

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 040 | 0 | 0 | 0 | 0 | X | X | X | X | Resolution / Frame rate<br>0: 1080p 60fps 1: 1080p 30fps<br>3: 1080p 50fps 4: 1080p 25fps<br>6: 720p 60fps 7: 720p 50fps<br>10: 1080p 59.94fps 11: 1080p 29.97fps<br>13: 720p 59.94fps | 0 |
| 041 | | | | | | | X | X | Mirror image<br>0: Normal image 1: Horizontal mirror<br>2: Vertical mirror 3: Horizontal and vertical mirror | 0 |
| | X | X | X | X | X | X | | | Reserved | |
| 042 | X | X | X | X | X | X | X | X | Reserved | |

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 043 | | | | | | X | X | X | Gamma mode<br>0: Manual 1: 0.45 2: 0.6 3: 0.8<br>4: 1.0 | 0 |
| | | | | X | X | | | | Gamma output for the image<br>0: Gamma apply 1: Not apply | 0 |
| | X | X | X | | | | | | Reserved | |
| 044 | X | X | X | X | X | X | X | X | Manual gamma control point 00 [little-endian] | 408 |
| 045 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 046 | X | X | X | X | X | X | X | X | Manual gamma control point 01 [little-endian] | 432 |
| 047 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 048 | X | X | X | X | X | X | X | X | Manual gamma control point 02 [little-endian] | 464 |
| 049 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 04A | X | X | X | X | X | X | X | X | Manual gamma control point 03 [little-endian] | 496 |
| 04B | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 04C | X | X | X | X | X | X | X | X | Manual gamma control point 04 [little-endian] | 544 |
| 04D | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 04E | X | X | X | X | X | X | X | X | Manual gamma control point 05 [little-endian] | 592 |
| 04F | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 050 | X | X | X | X | X | X | X | X | Manual gamma control point 06 [little-endian] | 640 |
| 051 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 052 | X | X | X | X | X | X | X | X | Manual gamma control point 07 [little-endian] | 688 |
| 053 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 054 | X | X | X | X | X | X | X | X | Manual gamma control point 08 [little-endian] | 736 |
| 055 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 056 | X | X | X | X | X | X | X | X | Manual gamma control point 09 [little-endian] | 768 |
| 057 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 058 | X | X | X | X | X | X | X | X | Manual gamma control point 10 [little-endian] | 0 |
| 059 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 05A | X | X | X | X | X | X | X | X | Manual gamma control point 11 [little-endian] | 636 |
| 05B | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 05C | X | X | X | X | X | X | X | X | Manual gamma control point 12 [little-endian] | 869 |
| 05D | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 05E | X | X | X | X | X | X | X | X | Manual gamma control point 13 [little-endian] | 992 |
| 05F | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 060 | X | X | X | X | X | X | X | X | Manual gamma control point 14 [little-endian] | 1088 |
| 061 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 062 | X | X | X | X | X | X | X | X | Manual gamma control point 15 [little-endian] | 1168 |
| 063 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 064 | X | X | X | X | X | X | X | X | Manual gamma control point 16 [little-endian] | 1240 |
| 065 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 066 | X | X | X | X | X | X | X | X | Manual gamma control point 17 [little-endian] | 1300 |
| 067 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 068 | X | X | X | X | X | X | X | X | Manual gamma control point 18 [little-endian] | 1320 |
| 069 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 06A | X | X | X | X | X | X | X | X | Manual gamma control point 19 [little-endian] | 1332 |
| 06B | 0 | 0 | 0 | 0 | X | X | X | X | | |

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 06C | X | X | X | X | X | X | X | X | Manual gamma control point 20 [little-endian] | 1348 |
| 06D | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 06E | X | X | X | X | X | X | X | X | Manual gamma control point 21 [little-endian] | 1360 |
| 06F | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 070 | X | X | X | X | X | X | X | X | Manual gamma control point 22 [little-endian] | 1372 |
| 071 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 072 | X | X | X | X | X | X | X | X | Manual gamma control point 23 [little-endian] | 1388 |
| 073 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 074 | X | X | X | X | X | X | X | X | Manual gamma control point 24 [little-endian] | 1404 |
| 075 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 076 | X | X | X | X | X | X | X | X | Manual gamma control point 25 [little-endian] | 1420 |
| 077 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 078 | X | X | X | X | X | X | X | X | Manual gamma control point 26 [little-endian] | 1436 |
| 079 | 0 | 0 | 0 | 0 | X | X | X | X | | |
| 07A | X | X | X | X | X | X | X | X | Manual gamma control point 27 [little-endian] | 1452 |
| 07B | X | X | X | X | X | X | X | X | | |
| 07C | X | X | X | X | X | X | X | X | Color hue adjustment (Compliment on two) | 0 |
| 07D | X | X | X | X | X | X | X | X | Color saturation adjustment | 100 |
| 07E | X | X | X | X | X | X | X | X | Sharpness gain | 64 |
| 07F | | | | | | | | X | ART-EX (Wide dynamic range) function<br>0: Disable 1: Enable | 0 |
| | | | | | | | X | | Defog function<br>0: Disable 1: Enable | 0 |
| | | | | | | X | | | Negative / Positive function<br>0: Disable 1: Enable | 0 |
| | | | | | X | | | | Shading function<br>0: Enable 1: Disable | 0 |
| | X | X | X | X | | | | | Reserved | |
| 080 | | | | | | | | X | Photometry mode<br>0: Average 1: Emphasis<br>2: Spot 3: Backlight | 0 |
| | X | X | X | X | X | X | X | | Reserved | |
| 081 | X | X | X | X | X | X | X | X | Weight for frame 0 (Only valid for Emphasis photometry) | 9 |
| 082 | X | X | X | X | X | X | X | X | Weight for frame 1 (Only valid for Emphasis photometry) | 15 |
| 083 | X | X | X | X | X | X | X | X | Weight for frame 2 (Only valid for Emphasis photometry) | 9 |
| 084 | X | X | X | X | X | X | X | X | Weight for frame 3 (Only valid for Emphasis photometry) | 18 |
| 085 | X | X | X | X | X | X | X | X | Weight for frame 4 (Only valid for Emphasis photometry) | 72 |
| 086 | X | X | X | X | X | X | X | X | Weight for frame 5 (Only valid for Emphasis photometry) | 18 |
| 087 | X | X | X | X | X | X | X | X | Weight for frame 6 (Only valid for Emphasis photometry) | 12 |
| 088 | X | X | X | X | X | X | X | X | Weight for frame 7 (Only valid for Emphasis photometry) | 30 |
| 089 | X | X | X | X | X | X | X | X | Weight for frame 8 (Only valid for Emphasis photometry) | 12 |
| 08A | X | X | X | X | X | X | X | X | Photometry frame for spot photometry mode | 31 |
| 08B | X | X | X | X | X | X | X | X | Weight of outside frame for the spot photometry mode | 32 |
| 08C | | | | | | | | X | Mute<br>0: Disable 1: Enable | 0 |
| | X | X | X | X | X | X | X | | Reserved | |
| 08D to | X | X | X | X | X | X | X | X | Reserved | |

| 08F | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|

- Gamma mode
  Please select 1: 0.45, 2: 0.6, 3: 0.8, or 4: 1.0 for the preset gamma.
  Please select 0: Manual and set the gamma control points for the manual gamma.

- Photometry mode
  The brightness level is adjusted by adjusting the gain and the exposure time based on the weight for the image automatically.

  Average photometry mode: The same weight for all frames
  Emphasis photometry mode: The weight is set for nine frames
  Spot photometry mode: The weight is set for specified spot frame and the surrounding frame.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 |
| 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 |
| 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 |
| 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 |

  Backlight compensate mod: Backlight compensate mode.

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 090 | | | X | X | X | X | X | X | Reserved | |
| | | X | | | | | | | Exposure control<br>0: Fixed shutter 1: AEE (Auto shutter) | 0 |
| | X | | | | | | | | Gain control<br>0: Fixed gain control 1: AGC (Auto gain control) | 1 |
| 091 | | | | | | | X | X | Reserved | |
| | | | | | | X | | | IR cut filter ON / OFF auto control<br>IR cut filter on / off control automatically based on the IRC disable gain.<br>0: Disable 1: Enable | 0 |
| | | | | | X | | | | Image switch to the monochrome when IR cut filter off<br>0: Disable 1: Enable | 0 |
| | | | | X | | | | | Reserved | |
| | | X | X | | | | | | IR light wavelength<br>0: Standard 1: 850 nm 2: 940 nm 3: N/A | 0 |
| | X | | | | | | | | IR cut filter manual control<br>This is valid when IR cut filter on / off auto control is disabled.<br>0: ON 1: OFF | 0 |
| 092 | X | X | X | X | X | X | X | X | Target brightness for ALC [little-endian] | 200 |
| 093 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 094 to 097 | X | X | X | X | X | X | X | X | Reserved | |
| 098 | 0 | 0 | X | X | X | X | X | X | ALC average integration frames<br>Calculates the average brightness with this frame for ALC control.<br>0: 1 frame (No average) 1: 2 frames<br>2: 4 frames 3: 8 frames<br>4: 16 frames 5: 32 frames<br>6: 64 frames 7: 128 frames<br>8: 256 frames 9: 512 frames<br>10: 1,024 frames<br>11 or greater: Please check the ALC average integration frame table | 1 |
| 009 to 0A1 | X | X | X | X | X | X | X | X | Reserved | |
| 0A2 | X | X | X | X | X | X | X | X | AEE minimum exposure time | 1 |
| 0A3 | 0 | 0 | 0 | 0 | 0 | X | X | X | Value rage for 60fps is 1 to 166, for 50fps is 1 to 199,<br>for 30fps is 1 to 331<br>Exposure time (second) = Value / 10,000 | |
| 0A4 | X | X | X | X | X | X | X | X | AEE maximum exposure time | 166 |
| 0A5 | 0 | 0 | 0 | 0 | 0 | X | X | X | Value rage for 60fps is 1 to 166, for 50fps is 1 to 199,<br>for 30fps is 1 to 331<br>Exposure time (second) = Value / 10,000 | |
| 0A6 to 0A9 | X | X | X | X | X | X | X | X | Reserved | |

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 0AA | X | X | X | X | X | X | X | X | AEE tolerance<br>The AEE control is stopped when “Target brightness - current brightness” is smaller than Target brightness x value. | 3 |
| 0AB | X | X | X | X | X | X | X | X | AEE Threshold<br>The AEE control is started when “Target brightness - current brightness” is greater than Target brightness x (AEE tolerance + value). | 3 |
| 0AC | X | X | X | X | X | X | X | X | AEE speed<br>Set the AEE control speed, which is the maximum exposure time change at one step.<br>No limitation exposure time when 0 is set. | 150 |
| 0AD to 0BF | X | X | X | X | X | X | X | X | Reserved | |

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 0C0 to 0C1 | X | X | X | X | X | X | X | X | Reserved | |
| 0C2 | X | X | X | X | X | X | X | X | AGC minimum gain [little-endian] | 0 |
| 0C3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Value range is 0 to 150.<br>Gain (dB) = Value x 0.3 + 1.2 | |
| 0C4 to 0C5 | X | X | X | X | X | X | X | X | Reserved | |
| 0C6 | X | X | X | X | X | X | X | X | AGC maximum gain [little-endian] | 97 |
| 0C7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Value range is 0 to 150.<br>Gain (dB) = Value x 0.3 + 1.2 | |
| 0C8 | X | X | X | X | X | X | X | X | AGC tolerance<br>The AGC control is stopped when “Target brightness - current brightness” is smaller than “Target brightness” x value. | 3 |
| 0C9 | X | X | X | X | X | X | X | X | AGC threshold<br>The AGC control is started when “Target brightness - current brightness” is greater than Target brightness x (AGC tolerance + value). | 3 |
| 0CA | X | X | X | X | X | X | X | X | AGC speed<br>Set the AGC control speed, which is the maximum gain change at one step.<br>No limitation gain when 0 is set. | 20 |
| 0CB | X | X | X | X | X | X | X | X | AGC step multiplier<br>Adjust the voltage change for the AGC control<br>Voltage change = (Target brightness - current brightness) x (AGC step multiplier + 1 ) / (AGC step divisor + 1) | 0 |
| 0CC | X | X | X | X | X | X | X | X | AGC step divisor<br>Adjust the voltage change for the AGC control<br>Voltage change = (Target brightness - current brightness) x (AGC step multiplier + 1 ) / (AGC step divisor + 1) | 1 |
| 0CD to 0D3 | X | X | X | X | X | X | X | X | Reserved | |
| 0D4 | X | X | X | X | X | X | X | X | IR cut filter disable gain | 60 |
| 0D5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Value range is 0 to 150.<br>Gain (dB) = Value x 0.3 + 1.2 | |
| 0D6 | X | X | X | X | X | X | X | X | IR cut filter enable gain | 30 |
| 0D7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Value range is 0 to 150.<br>Gain (dB) = Value x 0.3 + 1.2 | |
| 0D8 to 0Df | X | X | X | X | X | X | X | X | Reserved | |

Descriptions for ALC control

AEE, AGC and the auto iris are linked as follows:

| Object | | Exposure time | Iris | Gain |
|---|---|---|---|---|
| Bright | | Minimum | Minimum open ratio | Minimum |
| | | Fluctuation | | |
| | | Maximum | Fluctuation | |
| | | | Maximum open ratio | |
| | | | | Fluctuation |
| Dark | | | | Maximum |

Note: It is possible that the camera CANNOT perform auto focus with the noisy image with the high gain is set. Please reduce the gain or the focus adjusts manually.

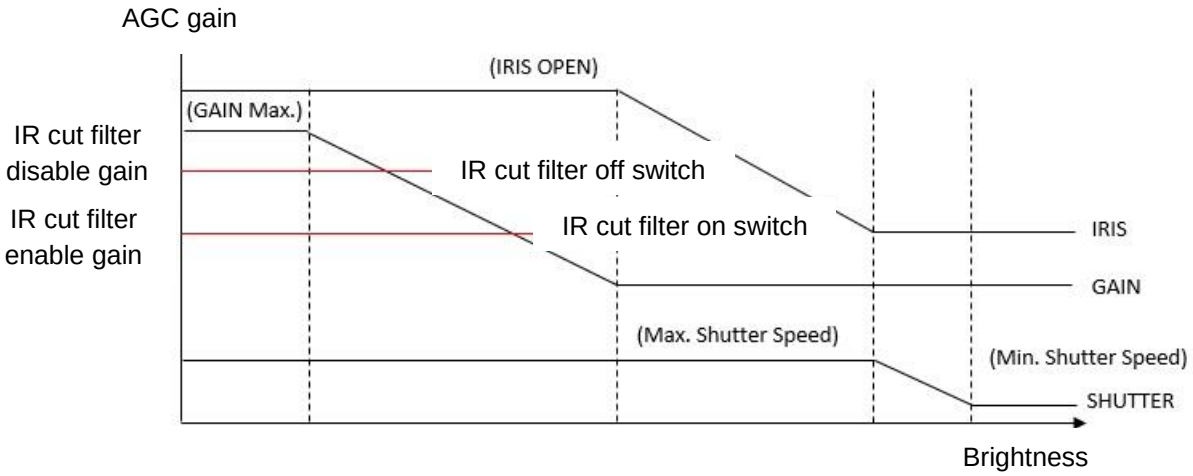
ALC average integration frames

When the longer average integration frames is set, ALC response slowly for the dynamic brightness change.

| Value | Frames | Value | Frames | Value | Frames | Value | Frames | Value | Frames |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 10 | 1,024 | 20 | 9,131 | 30 | 17,571 | 40 | 26,011 |
| 1 | 2 | 11 | 1,535 | 21 | 9,975 | 31 | 18,415 | 41 | 26,855 |
| 2 | 4 | 12 | 2,379 | 22 | 10,819 | 32 | 19,259 | 42 | 27,699 |
| 3 | 8 | 13 | 3,223 | 23 | 11,663 | 33 | 20,103 | 43 | 28,543 |
| 4 | 16 | 14 | 4,067 | 24 | 12,507 | 34 | 20,947 | 44 | 29,387 |
| 5 | 32 | 15 | 4,911 | 25 | 13,351 | 35 | 21,791 | 45 | 30,231 |
| 6 | 64 | 16 | 5,755 | 26 | 14,195 | 36 | 22,635 | 46 | 31,075 |
| 7 | 128 | 17 | 6,599 | 27 | 15,039 | 37 | 23,479 | 47 | 31,919 |
| 8 | 256 | 18 | 7,443 | 28 | 15,883 | 38 | 24,323 | 48 | 32,763 |
| 9 | 512 | 19 | 8,287 | 29 | 16,727 | 39 | 25,167 | 49 or greater | 1 |

Descriptions for Auto IR cut filter control

The auto IR cut filter control function is operated as follow:




IR cut filter is off automatically when the gain is greater than the IR cut filter disable gain.
IR cut filter is on automatically when the gain is smaller than the IR cut filter enable gain.
It is necessary to set the IR cut filter disable gain and the IR cut filter enable gain with enough tolerance to avoid charting.

IR light wavelength

It is necessary to change the IR light wavelength for [091h. bit5, 6] if the IR light is used when the IR cut filter is OFF. The out of focus issue due to the IR light influence is corrected.

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 0E0 | X | X | X | X | X | X | X | X | Size shift for Privacy mask 0 (complement on two) | 0 |
| 0E1 | X | X | X | X | X | X | X | X | Size shift for Privacy mask 1 (complement on two) | 0 |
| 0E2 | X | X | X | X | X | X | X | X | Size shift for Privacy mask 2 (complement on two) | 0 |
| 0E3 | X | X | X | X | X | X | X | X | Size shift for Privacy mask 3 (complement on two) | 0 |
| 0E4 | X | X | X | X | X | X | X | X | Size shift for Privacy mask 4 (complement on two) | 0 |
| 0E5 | X | X | X | X | X | X | X | X | Size shift for Privacy mask 5 (complement on two) | 0 |
| 0E6 | X | X | X | X | X | X | X | X | Size shift for Privacy mask 6 (complement on two) | 0 |
| 0E7 | X | X | X | X | X | X | X | X | Size shift for Privacy mask 7 (complement on two) | 0 |
| 0E8 to 0F0 | X | X | X | X | X | X | X | X | Reserved | |
| 0F1 | | | X | X | X | X | X | X | Vertical mosaic size for Privacy mask | 32 |
| | X | X | | | | | | | Reserved | |
| 0F2 | | | X | X | X | X | X | X | Horizontal mosaic size for Privacy mask | 32 |
| | X | X | | | | | | | Reserved | |
| 0F3 to 0F8 | X | X | X | X | X | X | X | X | Reserved | |
| 0F9 | X | X | X | X | X | X | X | X | User setting for noise reduction | 0 |
| 0FA | X | X | X | X | X | X | X | X | Local correlation noise reduction level | 0 |
| 0FB | | | | | | X | X | X | Noise reduction level<br>0: Low 5: High | 0 |
| | | | | | X | | | | Reserved | |
| | | X | X | X | | | | | Horizontal Low Path Filter<br>0: Low 4: High | 0 |
| | X | | | | | | | | Reserved | |
| 0FC | X | X | X | X | X | X | X | X | Horizontal aperture level | 0 |
| 0FD | X | X | X | X | X | X | X | X | Vertical aperture level | 0 |
| 0FE to 0FF | X | X | X | X | X | X | X | X | Reserved | |

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | | | | | | | | X | Line maker setup<br>Setup the line maker 1 and 2 simultaneously.<br>0: Disable 1: Enable | 1 |
| | | | | | | | X | | Shadow mask<br>0: Disable 1: Enable | 1 |
| | | | | | | X | | | Reserved | |
| | | | | | X | | | | Line maker 1<br>Setup the line maker 1 when the line maker setup is disabled.<br>0: Disable 1: Enable | 0 |
| | | | | X | | | | | Line maker 2<br>Setup the line maker 2 when the line maker setup is disabled. | 0 |
| | X | X | X | | | | | | Reserved | |
| 101 | X | X | X | X | X | X | X | X | Shadow mask density<br>0: No masking (invisible) 16: Black | 0 |
| 102 | X | X | X | X | X | X | X | X | Horizontal shadow mask upper part position [little-endian] | 50 |
| 103 | 0 | 0 | 0 | 0 | 0 | X | X | X | 0: Top 1080: Bottom | |
| 104 | X | X | X | X | X | X | X | X | Horizontal shadow mask lower part position [little-endian] | 670 |
| 105 | 0 | 0 | 0 | 0 | 0 | X | X | X | 0: Top 1080: Bottom | |
| 106 | X | X | X | X | X | X | X | X | Vertical shadow mask left part position [little-endian] | 50 |
| 107 | 0 | 0 | 0 | 0 | 0 | X | X | X | 0: Left 1920: Right | |
| 108 | X | X | X | X | X | X | X | X | Vertical shadow mask right part position [little-endian] | 1230 |
| 109 | 0 | 0 | 0 | 0 | 0 | X | X | X | 0: Left 1920: Right | |
| 10A | | | | | X | X | X | X | Horizontal line maker 1 color<br>Please check the color code list. | 8 |
| | X | X | X | X | | | | | Vertical line maker 1 color<br>Please check the color code list. | 8 |
| 10B | X | X | X | X | X | X | X | X | Horizontal line maker 1 position [little-endian] | 100 |
| 10C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | 0: Top 1080: Bottom | |
| 10D | X | X | X | X | X | X | X | X | Horizontal line maker 1 size [little-endian] | 6 |
| 10E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | 0: No line (invisible) 1080: Thickest line | |
| 10F | X | X | X | X | X | X | X | X | Vertical line maker 1 position [little-endian] | 100 |
| 110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | 0: Left 1920: Right | |
| 111 | X | X | X | X | X | X | X | X | Vertical line maker 1 size [little-endian] | 6 |
| 112 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | 0: No line (invisible) 1920: Thickest line | |
| 113 | | | | | X | X | X | X | Horizontal line maker 2 color<br>Please check the color code list. | 10 |
| | X | X | X | X | | | | | Vertical line maker 2 color<br>Please check the color code list. | 10 |
| 114 | X | X | X | X | X | X | X | X | Horizontal line maker 2 position [little-endian] | 620 |
| 115 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | 0: Top 1080: Bottom | |
| 116 | X | X | X | X | X | X | X | X | Horizontal line maker 2 size [little-endian] | 6 |
| 117 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | 0: No line (invisible) 1080: Thickest line | |
| 118 | X | X | X | X | X | X | X | X | Vertical line maker 2 position [little-endian] | 1180 |
| 119 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | 0: Left 1920: Right | |
| 11A | X | X | X | X | X | X | X | X | Vertical line maker 2 size [little-endian] | 6 |
| 11B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | 0: No line (invisible) 1920: Thickest line | |
| 11C to | X | X | X | X | X | X | X | X | Reserved | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 128 | | | | | | | | | | |

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 129 | X | X | X | X | X | X | X | X | Contrast<br>Set the gain for the output signal.<br>Contrast = Value / 128 | 128 |
| 12A | | X | X | X | X | X | X | X | Reserved | |
| | X | | | | | | | | Color image / monochrome image<br>0: Color image 1: Monochrome image | 0 |
| 12B to 12C | X | X | X | X | X | X | X | X | Reserved | |
| 12D | X | X | X | X | X | X | X | X | Brightness | 0 |
| 12E to 12F | X | X | X | X | X | X | X | X | Reserved | 0 |
| 130 | | | | | | | | X | Privacy mask 0<br>0: Disable 1: Enable | 0 |
| | | | | | | | X | | Privacy mask 0 mosaic display<br>0: Disable 1: Enable | 0 |
| | | | X | X | X | X | | | Privacy mask 0 color<br>Please check the color code list. | 8 |
| | | X | | | | | | | Privacy mask 0 transparency<br>0: No transparency 1: Transparency | 0 |
| | X | | | | | | | | Privacy mask 0 linked zoom function<br>0: Enable 1: Disable | 0 |
| 131 | | | | | | | | X | Privacy mask 1<br>0: Disable 1: Enable | 0 |
| | | | | | | | X | | Privacy mask 1 mosaic display<br>0: Disable 1: Enable | 0 |
| | | | X | X | X | X | | | Privacy mask 1 color<br>Please check the color code list. | 8 |
| | | X | | | | | | | Privacy mask 1 transparency<br>0: No transparency 1: Transparency | 0 |
| | X | | | | | | | | Privacy mask 1 linked zoom function<br>0: Enable 1: Disable | 0 |
| 132 | | | | | | | | X | Privacy mask 2<br>0: Disable 1: Enable | 0 |
| | | | | | | | X | | Privacy mask 2 mosaic display<br>0: Disable 1: Enable | 0 |
| | | | X | X | X | X | | | Privacy mask 2 color<br>Please check the color code list. | 8 |
| | | X | | | | | | | Privacy mask 2 transparency<br>0: No transparency 1: Transparency | 0 |
| | X | | | | | | | | Privacy mask 2 linked zoom function<br>0: Enable 1: Disable | 0 |

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 133 | | | | | | | | X | Privacy mask 3<br>0: Disable 1: Enable | 0 |
| | | | | | | | X | | Privacy mask 3 mosaic display<br>0: Disable 1: Enable | 0 |
| | | | X | X | X | X | | | Privacy mask 3 color<br>Please check the color code list. | 8 |
| | | X | | | | | | | Privacy mask 3 transparency<br>0: No transparency 1: Transparency | 0 |
| | X | | | | | | | | Privacy mask 3 linked zoom function<br>0: Enable 1: Disable | 0 |
| 134 | | | | | | | | X | Privacy mask 4<br>0: Disable 1: Enable | 0 |
| | | | | | | | X | | Privacy mask 4 mosaic display<br>0: Disable 1: Enable | 0 |
| | | | X | X | X | X | | | Privacy mask 4 color<br>Please check the color code list. | 8 |
| | | X | | | | | | | Privacy mask 4 transparency<br>0: No transparency 1: Transparency | 0 |
| | X | | | | | | | | Privacy mask 4 linked zoom function<br>0: Enable 1: Disable | 0 |
| 135 | | | | | | | | X | Privacy mask 5<br>0: Disable 1: Enable | 0 |
| | | | | | | | X | | Privacy mask 5 mosaic display<br>0: Disable 1: Enable | 0 |
| | | | X | X | X | X | | | Privacy mask 5 color<br>Please check the color code list. | 8 |
| | | X | | | | | | | Privacy mask 5 transparency<br>0: No transparency 1: Transparency | 0 |
| | X | | | | | | | | Privacy mask 5 linked zoom function<br>0: Enable 1: Disable | 0 |
| 136 | | | | | | | | X | Privacy mask 6<br>0: Disable 1: Enable | 0 |
| | | | | | | | X | | Privacy mask 6 mosaic display<br>0: Disable 1: Enable | 0 |
| | | | X | X | X | X | | | Privacy mask 6 color<br>Please check the color code list. | 8 |
| | | X | | | | | | | Privacy mask 6 transparency<br>0: No transparency 1: Transparency | 0 |
| | X | | | | | | | | Privacy mask 6 linked zoom function<br>0: Enable 1: Disable | 0 |

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 137 | | | | | | | | X | Privacy mask 7<br>0: Disable 1: Enable | 0 |
| | | | | | | | X | | Privacy mask 7 mosaic display<br>0: Disable 1: Enable | 0 |
| | | | X | X | X | X | | | Privacy mask 7 color<br>Please check the color code list. | 8 |
| | | X | | | | | | | Privacy mask 7 transparency<br>0: No transparency 1: Transparency | 0 |
| | X | | | | | | | | Privacy mask 7 linked zoom function<br>0: Enable 1: Disable | 0 |
| 138 to 13F | X | X | X | X | X | X | X | X | Reserved | 0 |
| 140 | X | X | X | X | X | X | X | X | Privacy mask 0 width [little-endian] | 20 |
| 141 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 142 | X | X | X | X | X | X | X | X | Privacy mask 0 horizontal position [little-endian] | -75 |
| 143 | 0 | 0 | 0 | 0 | 0 | X | X | X | (complement on two) | |
| 144 | X | X | X | X | X | X | X | X | Privacy mask 0 height [little-endian] | 20 |
| 145 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 146 | X | X | X | X | X | X | X | X | Privacy mask 0 vertical position [little-endian] | -30 |
| 147 | 0 | 0 | 0 | 0 | 0 | X | X | X | (complement on two) | |
| 148 | X | X | X | X | X | X | X | X | Privacy mask 1 width [little-endian] | 20 |
| 149 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 14A | X | X | X | X | X | X | X | X | Privacy mask 1 horizontal position [little-endian] | -25 |
| 14B | 0 | 0 | 0 | 0 | 0 | X | X | X | (complement on two) | |
| 14C | X | X | X | X | X | X | X | X | Privacy mask 1 height [little-endian] | 20 |
| 14D | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 14E | X | X | X | X | X | X | X | X | Privacy mask 1 vertical position [little-endian] | -30 |
| 14F | 0 | 0 | 0 | 0 | 0 | X | X | X | (complement on two) | |
| 150 | X | X | X | X | X | X | X | X | Privacy mask 2 width [little-endian] | 20 |
| 151 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 152 | X | X | X | X | X | X | X | X | Privacy mask 2 horizontal position [little-endian] | 25 |
| 153 | 0 | 0 | 0 | 0 | 0 | X | X | X | (complement on two) | |
| 154 | X | X | X | X | X | X | X | X | Privacy mask 2 height [little-endian] | 20 |
| 155 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 156 | X | X | X | X | X | X | X | X | Privacy mask 2 vertical position [little-endian] | -30 |
| 157 | 0 | 0 | 0 | 0 | 0 | X | X | X | (complement on two) | |
| 158 | X | X | X | X | X | X | X | X | Privacy mask 3 width [little-endian] | 20 |
| 159 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 15A | X | X | X | X | X | X | X | X | Privacy mask 3 horizontal position [little-endian] | 75 |
| 15B | 0 | 0 | 0 | 0 | 0 | X | X | X | (complement on two) | |
| 15C | X | X | X | X | X | X | X | X | Privacy mask 3 height [little-endian] | 20 |
| 15D | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 15E | X | X | X | X | X | X | X | X | Privacy mask 3 vertical position [little-endian] | -30 |
| 15F | 0 | 0 | 0 | 0 | 0 | X | X | X | (complement on two) | |

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 160 | X | X | X | X | X | X | X | X | Privacy mask 4 width [little-endian] | 20 |
| 161 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 162 | X | X | X | X | X | X | X | X | Privacy mask 4 horizontal position [little-endian] | -75 |
| 163 | 0 | 0 | 0 | 0 | 0 | X | X | X | (complement on two) | |
| 164 | X | X | X | X | X | X | X | X | Privacy mask 4 height [little-endian] | 20 |
| 165 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 166 | X | X | X | X | X | X | X | X | Privacy mask 4 vertical position [little-endian] | 30 |
| 167 | 0 | 0 | 0 | 0 | 0 | X | X | X | (complement on two) | |
| 168 | X | X | X | X | X | X | X | X | Privacy mask 5 width [little-endian] | 20 |
| 169 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 16A | X | X | X | X | X | X | X | X | Privacy mask 5 horizontal position [little-endian] | -25 |
| 16B | 0 | 0 | 0 | 0 | 0 | X | X | X | (complement on two) | |
| 16C | X | X | X | X | X | X | X | X | Privacy mask 5 height [little-endian] | 20 |
| 16D | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 16E | X | X | X | X | X | X | X | X | Privacy mask 5 vertical position [little-endian] | 30 |
| 16F | 0 | 0 | 0 | 0 | 0 | X | X | X | (complement on two) | |
| 170 | X | X | X | X | X | X | X | X | Privacy mask 6 width [little-endian] | 20 |
| 171 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 172 | X | X | X | X | X | X | X | X | Privacy mask 6 horizontal position [little-endian] | 25 |
| 173 | 0 | 0 | 0 | 0 | 0 | X | X | X | (complement on two) | |
| 174 | X | X | X | X | X | X | X | X | Privacy mask 6 height [little-endian] | 20 |
| 175 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 176 | X | X | X | X | X | X | X | X | Privacy mask 6 vertical position [little-endian] | 30 |
| 177 | 0 | 0 | 0 | 0 | 0 | X | X | X | (complement on two) | |
| 178 | X | X | X | X | X | X | X | X | Privacy mask 7 width [little-endian] | 20 |
| 179 | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 17A | X | X | X | X | X | X | X | X | Privacy mask 7 horizontal position [little-endian] | 75 |
| 17B | 0 | 0 | 0 | 0 | 0 | X | X | X | (complement on two) | |
| 17C | X | X | X | X | X | X | X | X | Privacy mask 7 height [little-endian] | 20 |
| 17D | 0 | 0 | 0 | 0 | 0 | X | X | X | | |
| 17E | X | X | X | X | X | X | X | X | Privacy mask 7 vertical position [little-endian] | 30 |
| 17F | 0 | 0 | 0 | 0 | 0 | X | X | X | (complement on two) | |
| 180 to 1BF | X | X | X | X | X | X | X | X | Reserved | |

| Address | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Descriptions | Default |
|---|---|---|---|---|---|---|---|---|---|---|
| 1C0 | X | X | X | X | X | X | X | X | Privacy mask 0 horizontal position shift [little-endian] | 20 |
| 1C1 | 0 | 0 | 0 | 0 | 0 | X | X | X | (compliment on two) | |
| 1C2 | X | X | X | X | X | X | X | X | Privacy mask 0 vertical position shift [little-endian] | 20 |
| 1C3 | 0 | 0 | 0 | 0 | 0 | X | X | X | (compliment on two) | |
| 1C4 | X | X | X | X | X | X | X | X | Privacy mask 1 horizontal position shift [little-endian] | 20 |
| 1C5 | 0 | 0 | 0 | 0 | 0 | X | X | X | (compliment on two) | |
| 1C6 | X | X | X | X | X | X | X | X | Privacy mask 1 vertical position shift [little-endian] | 20 |
| 1C7 | 0 | 0 | 0 | 0 | 0 | X | X | X | (compliment on two) | |
| 1C8 | X | X | X | X | X | X | X | X | Privacy mask 2 horizontal position shift [little-endian] | 20 |
| 1C9 | 0 | 0 | 0 | 0 | 0 | X | X | X | (compliment on two) | |
| 1CA | X | X | X | X | X | X | X | X | Privacy mask 2 vertical position shift [little-endian] | 20 |
| 1CB | 0 | 0 | 0 | 0 | 0 | X | X | X | (compliment on two) | |
| 1CC | X | X | X | X | X | X | X | X | Privacy mask 3 horizontal position shift [little-endian] | 20 |
| 1CD | 0 | 0 | 0 | 0 | 0 | X | X | X | (compliment on two) | |
| 1CE | X | X | X | X | X | X | X | X | Privacy mask 3 vertical position shift [little-endian] | 20 |
| 1CF | 0 | 0 | 0 | 0 | 0 | X | X | X | (compliment on two) | |
| 1D0 | X | X | X | X | X | X | X | X | Privacy mask 4 horizontal position shift [little-endian] | 20 |
| 1D1 | 0 | 0 | 0 | 0 | 0 | X | X | X | (compliment on two) | |
| 1D2 | X | X | X | X | X | X | X | X | Privacy mask 4 vertical position shift [little-endian] | 20 |
| 1D3 | 0 | 0 | 0 | 0 | 0 | X | X | X | (compliment on two) | |
| 1D4 | X | X | X | X | X | X | X | X | Privacy mask 5 horizontal position shift [little-endian] | 20 |
| 1D5 | 0 | 0 | 0 | 0 | 0 | X | X | X | (compliment on two) | |
| 1D6 | X | X | X | X | X | X | X | X | Privacy mask 5 vertical position shift [little-endian] | 20 |
| 1D7 | 0 | 0 | 0 | 0 | 0 | X | X | X | (compliment on two) | |
| 1D8 | X | X | X | X | X | X | X | X | Privacy mask 6 horizontal position shift [little-endian] | 20 |
| 1D9 | 0 | 0 | 0 | 0 | 0 | X | X | X | (compliment on two) | |
| 1DA | X | X | X | X | X | X | X | X | Privacy mask 6 vertical position shift [little-endian] | 20 |
| 1DB | 0 | 0 | 0 | 0 | 0 | X | X | X | (compliment on two) | |
| 1DC | X | X | X | X | X | X | X | X | Privacy mask 7 horizontal position shift [little-endian] | 20 |
| 1DD | 0 | 0 | 0 | 0 | 0 | X | X | X | (compliment on two) | |
| 1DE | X | X | X | X | X | X | X | X | Privacy mask 7 vertical position shift [little-endian] | 20 |
| 1DF | 0 | 0 | 0 | 0 | 0 | X | X | X | (compliment on two) | |
| 1E0 to 1FF | X | X | X | X | X | X | X | X | Reserved | |

The example settings for the privacy mask

In the case of privacy size, the position are related to zoom:

1. Select “Enable” for the privacy mask that links to the zoom function [uCOM 003h.bit0].
2. Zoom position moves to WIDE.
3. Select “Enable” for the privacy mask 0 [DSP 130h.bit0].
4. Set the position and the size for the privacy mask 0 [DSP 140h to 147h].
5. Zoom position moves to TELE.
6. Set the position and the size [DSP 1C0 to 1C3].

Caution for the privacy mask

The privacy mask 5, 6 and 7 are used to display the priority auto focus detection frame and display the motion detection frame 0 and 1. While displaying the detection frame, the privacy mask does not display, but the value for privacy mask 5, 6 and 7 will be hold.

Color code list

| Code | Color | Code | Color |
|---|---|---|---|
| 0 | Black | 8 | Red |
| 1 | Gray 0 | 9 | Green |
| 2 | Gray 1 | 10 | Blue |
| 3 | Gray 2 | 11 | Cyan |
| 4 | Gray 3 | 12 | Yellow |
| 5 | Gray 4 | 13 | Magenta |
| 6 | Gray 5 | 14 | User color |
| 7 | White | 15 | Prohibit |

## 6.6 OSCD (On Screen Character Display) command

28 characters per line and 12 lines of the characters can be displayed.

### 6.6.1 Command

| Function | 1st.Byte | 2nd.Byte | 3rd.Byte | 4th.Byte | 5th.Byte | 6th.Byte～ |
|---|---|---|---|---|---|---|
| Display control | 0x07 | Value | — | — | — | — |
| Character size | 0x08 | Size | — | — | — | — |
| Character position | 0x09 | H Start | V Start | — | — | — |
| Character cursor | 0x10 | X | Y | — | — | — |
| Property cursor | 0x11 | X | Y | — | — | — |
| Character | 0x12 | Font | — | — | — | — |
| Property | 0x13 | Code | — | — | — | — |
| Character array | 0x14 | Font1 | Font2 | Font3 | Font4 | ・・・・・・・・ |
| Property array | 0x15 | Code1 | Code2 | Code3 | Code4 | ・・・・・・・・ |
| Property for character array | 0x16 | Code | Font1 | Font2 | Font5 | ・・・・・・・・ |

Display control

This command controls the characters display.

Setting

Bit 0 0: Character displays OFF, 1: Character displays ON

Bit 2 The character display is updated when 1 is set. This setting is cleared after update the character display.

Bit 4 The character display is cleared when 1 is set. This setting is cleared after clear the character display.

Note: The display character does not update newly write characters. It is necessary to update the character display with Bit2 after write mew characters.

Character size

This command specifies the character size.

Size：0: Large character, 1: Small character

Character position

This command specifies the character display start position. The horizontal and the vertical position can be specified individually.

H start：Horizontal display start position

V start：Vertical display start position

Character cursor

This command specifies the character display position.

X: Horizontal position (0 to 27)

Y: Vertical line (0 to 11 line)

Property cursor

This command specifies the character property position.

X: Horizontal position (0 to 27)

Y: Vertical line (0 to 11 line)

Character (Character control)

This command writes the display character with the character cursor specified position.
The character cursor increments automatically after write the character.
When the horizontal cursor reaches to the right end (27), the cursor for the next character is the beginning of the next line.

Character code

| Font | Character | Font | Character | Font | Character | Font | Character |
|---|---|---|---|---|---|---|---|
| 000 | Blank | 010 | F | 020 | V | 030 | * |
| 001 | 0 | 011 | G | 021 | W | 031 | % |
| 002 | 1 | 012 | H | 022 | X | 032 | + |
| 003 | 2 | 013 | I | 023 | Y | 033 | - |
| 004 | 3 | 014 | J | 024 | Z | 034 | × |
| 005 | 4 | 015 | K | 025 | ! | 035 | / |
| 006 | 5 | 016 | L | 026 | ? | 036 | = |
| 007 | 6 | 017 | M | 027 | # | 037 | “ |
| 008 | 7 | 018 | N | 028 | & | 038 | ‘ |
| 009 | 8 | 019 | O | 029 | ( | 039 | _ |
| 00A | 9 | 01A | P | 02A | ) | 03A | @ |
| 00B | A | 01B | Q | 02B | , | | |
| 00C | B | 01C | R | 02C | _ | | |
| 00D | C | 01D | S | 02D | : | | |
| 00E | D | 01E | T | 02E | ; | | |
| 00F | E | 01F | U | 02F | ~ | | |

Property

This command specifies the property of the character that is defined by the character cursor command.

| | | |
|---|---|---|
| Bit 0: Font background | 0: Transparency color | 1: Background color |
| Bit 1: Font reverse | 0: Normal | 1: Reverse the character and background color |
| Bit 2: Font bordering | 0: No bordering | 1: With bordering |

Character array (Character control)

This command writes the display characters that start with defined character cursor continuously.
The character cursor increments with the number of written characters automatically after write the characters.
When the horizontal cursor reaches to the right end (27), the cursor for the next character will be the start of the next line.

Property array

This command specifies the property of the characters that are defined by the property cursor command.
The property cursor is inclement with the number of written characters automatically after write the properties.
When the horizontal cursor reaches to the right end (27), the cursor for the next property will be the start of the next line.

Property for character array

This command specifies the property of all the characters that are defined by the character cursor command continuously.
The character cursor increments with the number of written characters automatically after write the characters.
When the horizontal cursor reaches to the right end (27), the cursor for the next character will be the start of the next line.

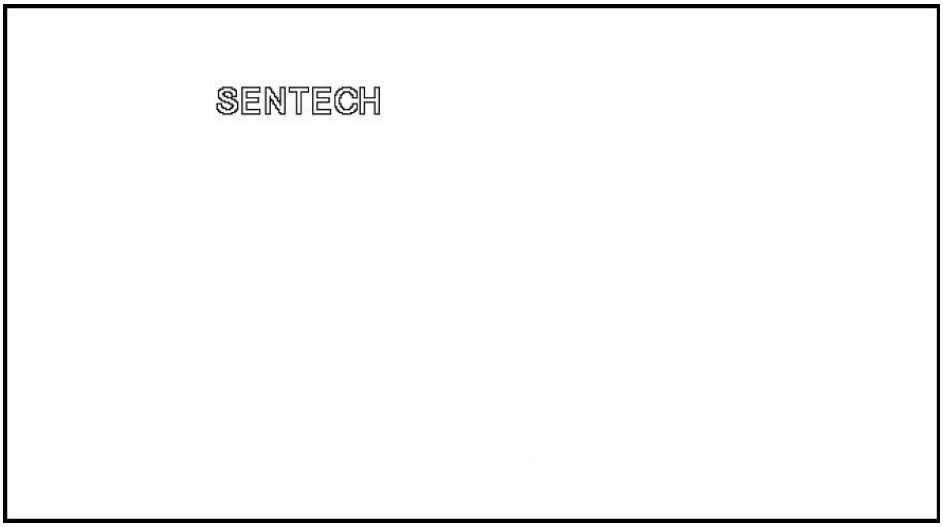
### 6.6.2 Sample command

Sample sending command and the character displaying

Sending command

| | |
|---|---|
| Set the character cursor | 02 50 80 03 10 04 01 E8 03<br>(Set character position, 5th at horizontal and 2nd line at vertical) |
| Set the property for the character array | 02 50 80 09 16 04 1D 0F 18 1E 0F0D 12 83 03<br>(Set S, E, N, T, E, C, H with bordering) |
| Display control | 02 50 80 02 07 05 DE 03<br>(Character display is ON and update the screen) |

Character display



# 7 Camera Setting Guideline

The following two methods can manipulate the camera.

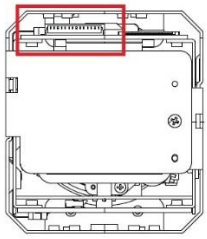
A. Via external switch (SDI model only).
B. Via serial communication *As for details, please refer to another chapter.

## 7.1 Camera setting via external switch(SDI model only)

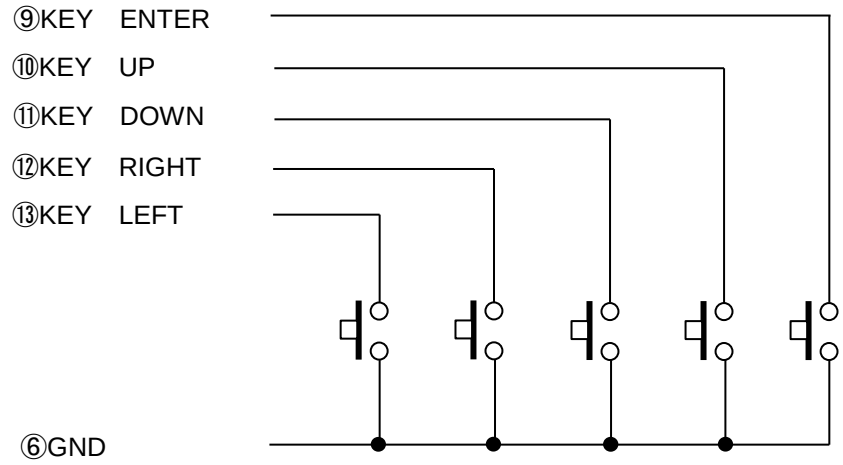
### 7.1.1 Camera setting via switch connect to CN06

A. Assign the switch function via communication software before using.

B. Camera Connector (Back side).



C. Switch circuit diagram.




D. Switch Button Function.

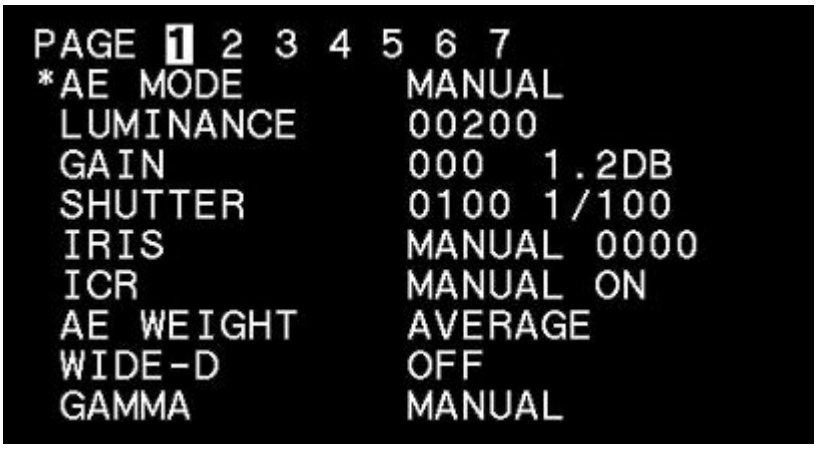
The following functions are assigned to SW-A to SW-E.

SW-A: Show OSD menu
SW-B: Select Up (Menu and select setting)
SW-C: Select Down (Menu and select setting)
SW-D: Select Left (select setting)
SW-E: Select Right (select setting)

7.1.2 OSD display with external switch

∗ OSD menu display can be manipulated on uCOM register 056H.

Page 1




1) AE MODE

Set Enable / Disable of Auto Exposure (Default: AGC+AI).

a) AGC

Control the Gain automatically on AE MODE.

b) AEE

Control the Exposure time on AE MODE.

c) AI

Control the IRIS Open Ration on AE MODE.

d) FULL AUTO

All of AGC,AEE and AI are set to ON.

e) MANUAL

All of AGC,AEE and AI are set to OFF.

f) AGC+AEE,AGC+AI,AEE+AI

Combine the mode like AGC+AEE,AGC+AI,AEE+AI on AE MODE.

2) LUMINANCE

Set the target Luminance.

3) GAIN

Set the Gain when AGC OFF.

4) SHUTTER

Set the Exposure Time when AEE OFF.

5) IRIS

Set the IRIS open ratio when AI ON / OFF switch timing or AI OFF.

6) ICR
Select the IR cut filter position when AUTO ICR ON / OFF or AUTO ICR MANUAL.

7) AE WEIGHT
Set the weight ratio on AE.
a) AVERAGE
Average Photometry.

b) GRAVITY
Gravity Photometry.

c) SPOT
Spot Photometry.

d) BACK LIGHT
Back Light compensation.

8) WIDE-D
Sets Enable / Disable wide dynamic range.
a) OFF
Wide Dynamic Range OFF.

b) ON
Wide Dynamic Range ON.

c) DEFOG
De-fug function ON.

9) GAMMA
Set the Gamma value (Default: MANUAL).
Select the value from MANUAL, 0.45, 0.60, 0.80, 1.00.

Page 2


1) WB MODE
Set the White Balance mode(default: AWB).

a) AWB
Set the Auto White Balance to control white balance.

b) FULL OPEN
Set the full open of WB. As for the detail, please refer to the another chapter.

c) AWB HOLD
Hold the current white balance.

d) CUSTOM
Set the specific color temperature.

e) USER MODE
Adjust the white balance to set USER R/G or USER B/G by user.

2) USER R/G
Set the R/G Gain on WB MODE when USER MODE is selected.

3) USER B/G
Set the B/G Gain on WB MODE when USER MODE is selected.

4) BRIGHT
Set the Brightness of the image (default: 0).

5) CONTRAST
Set the Contrast of the image (default: 128).

6) SHARPNESS
Set the Sharpness (Edge / Coring) of the image (default: 0).

7) COLOR
Set the Color of the image (default: COLOR).

a) COLOR
Show color image.

b) B&W
Show monochrome image.

c) NEGA POSI
Show Monochrome inversion image.

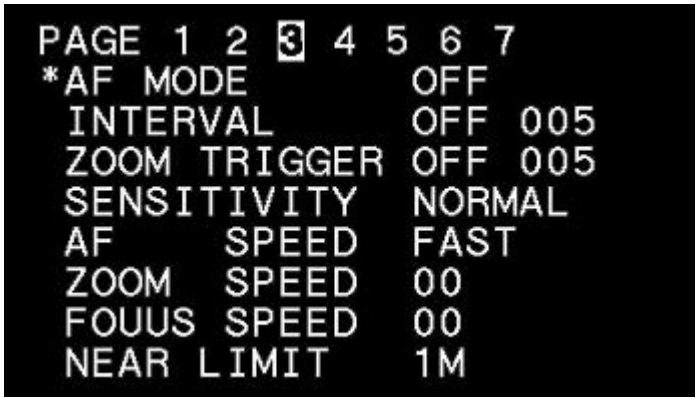
GAIN
Adjust the Color Shading.

HUE
Adjust the Hue.

8) NR
Set the Noise reduction Level (Default 0).

9) CAC
Set Chromatic Aberration Correction ON / OFF and set the level (Default: OFF, 064).

Page 3




1) AF MODE
Select the Auto Focus MODE(default: ON).

2) INTERVAL
Select interval AF MODE ON/OFF and set time.

3) ZOOM TRIGGER
Select ZOOM TRIGGER AF MODE ON/OFF and set time.

4) SENSITIVITY
Set the sensitivity to start AF(Default: NORMAL).

a) NORMAL
Start to focus with following the moving object.

b) LOW
Un-focus and stable the image when fast moving object or small variation object appears.

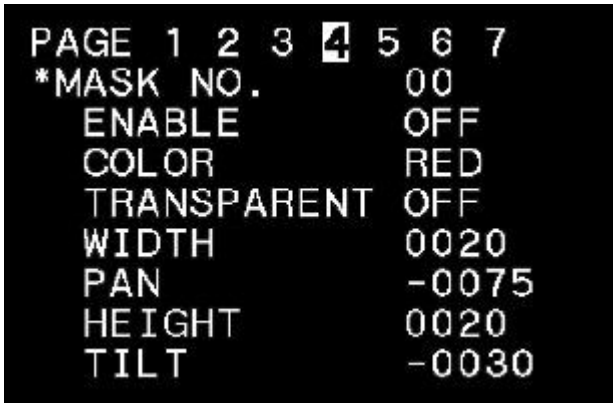
5) AF SPEED
Set the Auto Focus speed on TELE side (Default: FAST).

6) ZOOM SPEED
Set the zoom adjustment speed (Default: 0).

7) FOCUS SPEED
Set the focus position adjustment speed (Default: 0).

8) NEAR LIMIT
Set the limitation on minimum working distance (Default: 1M).

Page 4




1) MASK NO
Set the Privacy Mask number.

2) ENABLE
Set Enable/Disable for Privacy Mask that is selected on 1).

3) COLOR
Set Privacy Mask color for Privacy Mask that is selected on 1).

4) TRANSPARENT
Set Privacy Mask transparency for the Privacy Mask that is selected on 1) (Default: OFF).

5) WIDTH
Set Privacy Mask Horizontal width for the Privacy Mask that is selected on 1).

6) PAN
Set Privacy Mask Horizontal position for the Privacy Mask that is selected on 1).

7) HEIGHT
Set Privacy Mask Vertical width for the Privacy Mask that is selected on 1).

8) TILT
Set Privacy Mask Vertical position for the Privacy Mask that is selected on 1).

Page 5


1) LINE1,LINE2

Set to Enable/Disable Line Marker (Default: OFF).

a) ON

Show Line Marker.

Horizontal Line Marker, Vertical Line Marker can be set individually.

Positon, Size and Color can be set. When Size is set to 0, Line dispears.

When Position is set to 0, horizontal line marker will be at the Top, and vertical line marker will be at the Left.

Color can be selected from Black, White, Red, Green. Blue, Cyan, Magenta, Yellow and User define color.

b) OFF

Disable Line Marker.

Page 6


1) SHADOW

Set Enable / Disable Shadow Mask (default: ON).

a) ON

Show Shadow Mask.
Set always ON on GRAPHICS.
Horizontal Line Marker, Vertical Line Marker can be set individually.
Positon, Size and Color can be set when Size is set to 0, Line dispears.
When Position is set to 0, horizontal line marker will be at the Top, and vertical line marker will be at the Left.

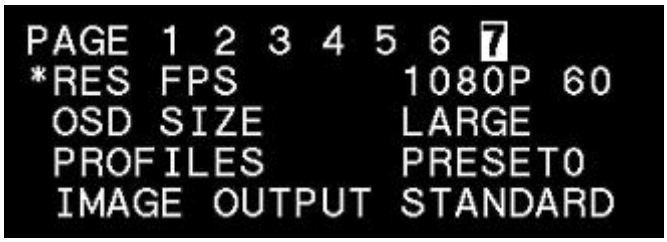
b) OFF

Disable Shadow Mask.

C) GRADE

Set Shadow Mask's shading.

Page 7




1) RES / FPS
Show the Frame rate (Frequency) of video output.

2) OSD SIZE
Set the character size of OSD (Default: LARGE).

a) LARGE
Show larger character on OSD.

b) SMALL
Show smaller character on OSD.

3) PROFILE
Load the preset data from PRESET0 to PRESET7 (Default: PRESET0)

a) PRESET0 to PRESET7
Load selected PRESET data.

4) IMAGE OUTPUT
Select video output.

a) STANDARD
Output Normal image.

b) INVERSION
Output Horizontal Flip image.

c) V INVERSION
Outputs Vertical Flip image.

d) HV INVERSION
Output Horizontal and Vertical Flip image.

Page 8


1) EEPROM

Modified settings on Page1 to Page7 can be saved as default.

a) SAVE

Select and execute SAVE, confirmation message (ARE YOU OK?) will show up.
Select execute again, camera setting will be saved into camera as default.
Confirmation message (CMOPLETE) will show up, saving process is completed.

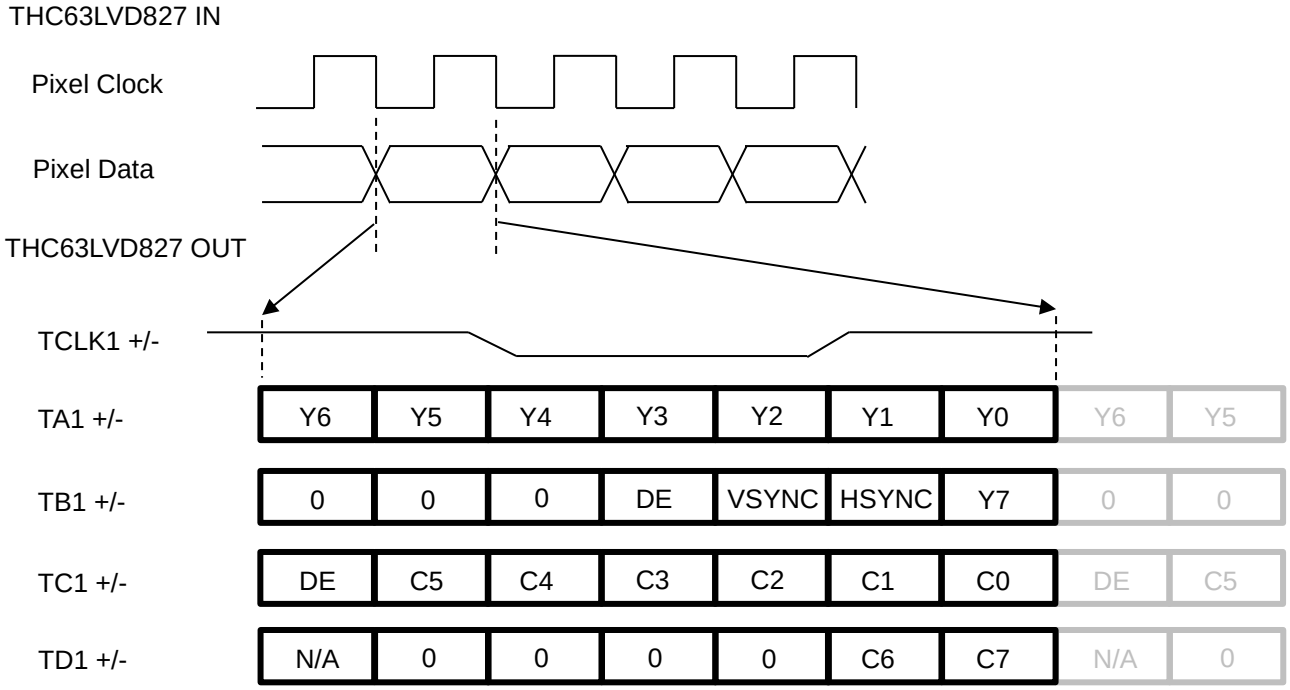
Cancel the saving process, when execute “Execution” on confirmation message (ARE YOU OK?)

## 7.2 LVDS Interface（LVDS model only）

### 7.2.1 LVDS Pixel Data Format

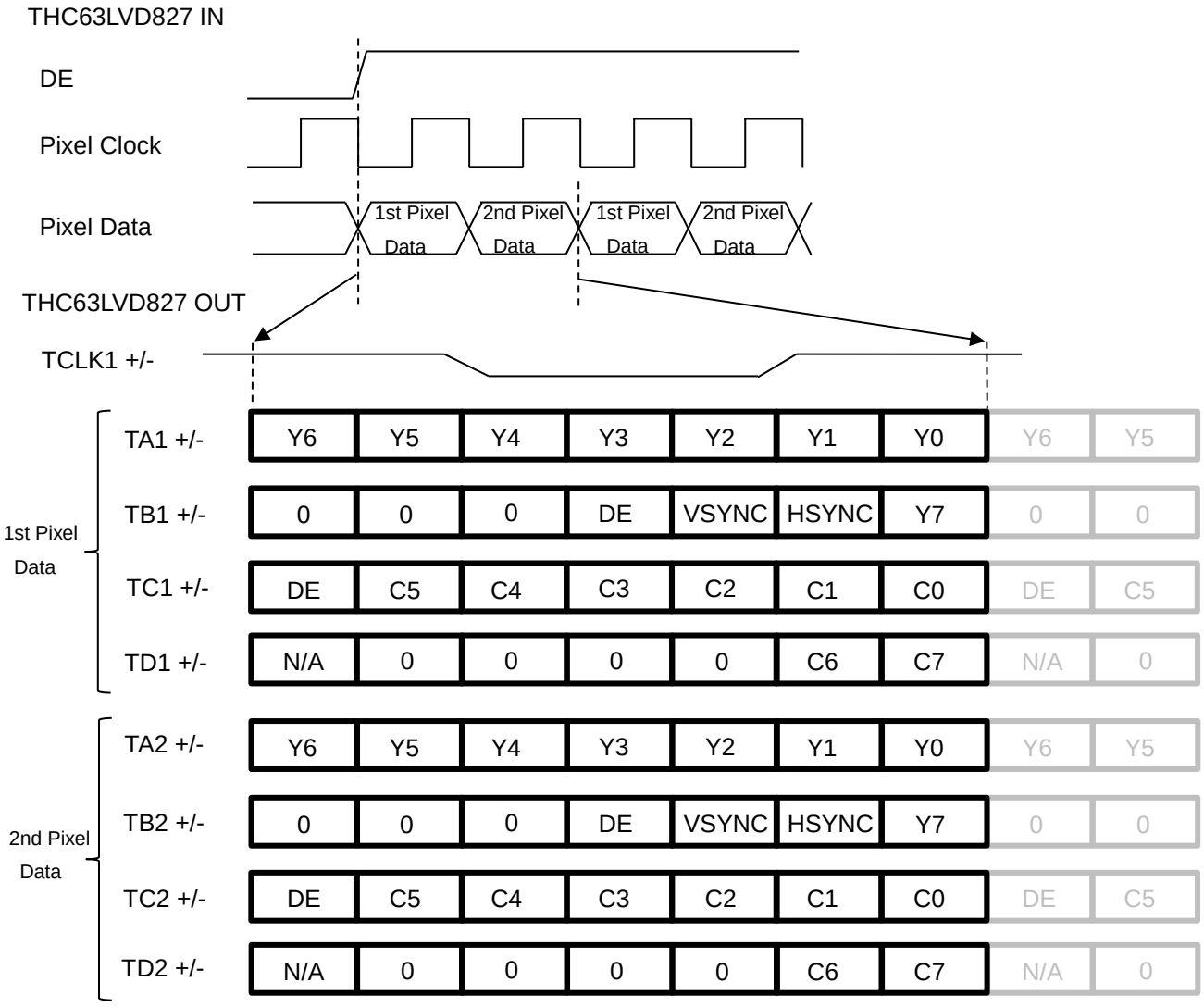
Camera Transmitter : THC63LVD827

Single Mode



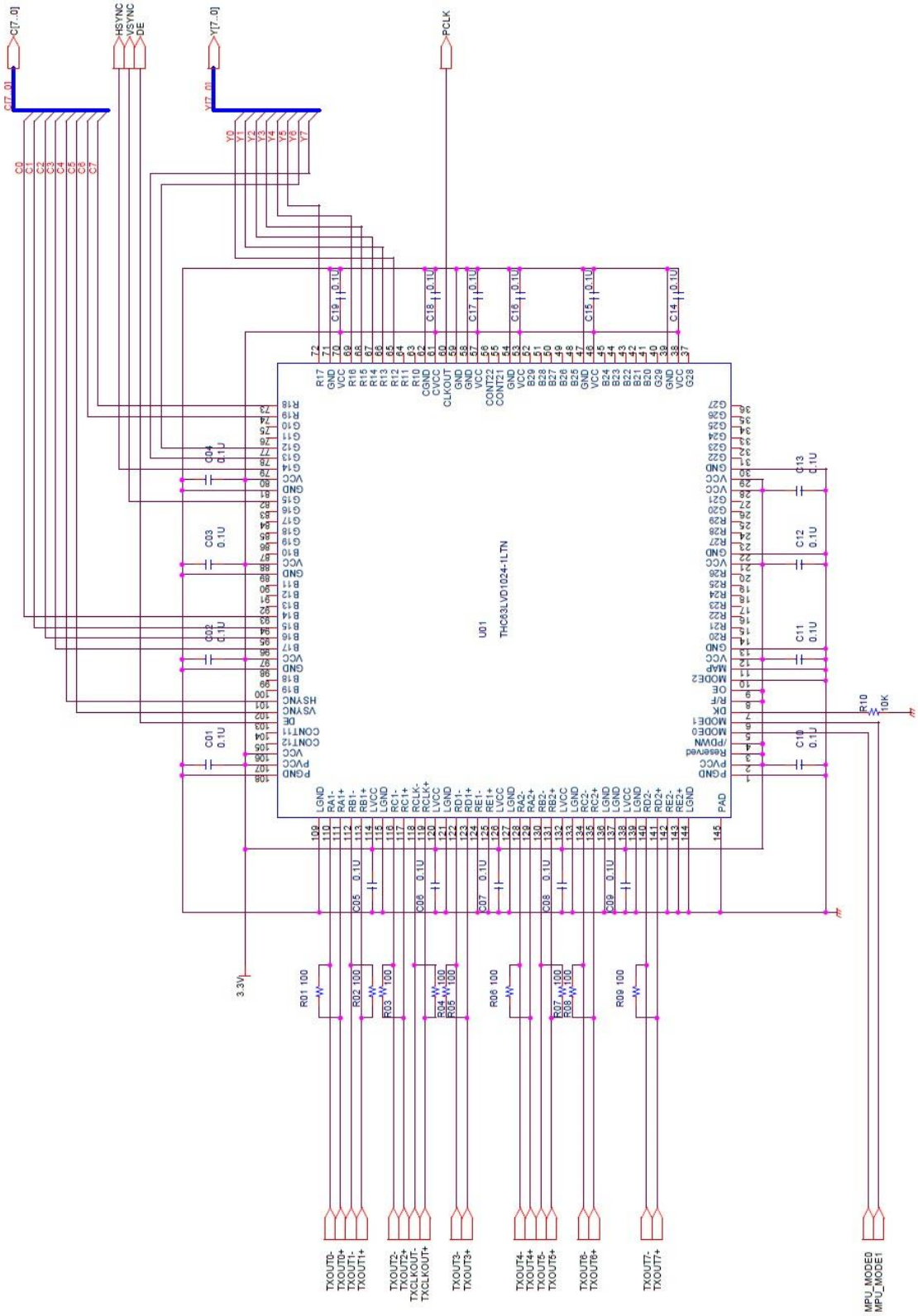

| Output Format | Pixel Clock(Hz) | TCLK+(Hz) |
|---|---|---|
| 1080p/60 | 148.5M | 148.5M |
| 1080p/50 | 148.5M | 148.5M |
| 1080p/30 | 74.25M | 74.25M |
| 1080p/25 | 74.25M | 74.25M |
| 720p/60 | 74.25M | 74.25M |
| 720p/50 | 74.25M | 74.25M |
| (1080p/59.94) | 148.5M/1.001 | 148.5M/1.001 |
| (1080p/29.97) | 74.25M/1.001 | 74.25M/1.001 |
| (720p/59.94) | 74.25M/1.001 | 74.25M/1.001 |

Double Mode




| Output Format | Pixel Clock(Hz) | TCLK+(Hz) |
|---|---|---|
| 1080p/60 | 148.5M | 74.25M |
| 1080p/50 | 148.5M | 74.25M |
| 1080p/30 | 74.25M | 37.125M |
| 1080p/25 | 74.25M | 37.125M |
| 720p/60 | 74.25M | 37.125M |
| 720p/50 | 74.25M | 37.125M |
| (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 |

### 7.2.2 Example of receiver Circuite




| Mode Settings | MPU_MODE0 | MPU_MODE1 |
|---|---|---|

| | | |
|---|---|---|
| Single Mode | High | High |
| Double Mode | High | Low |

## 8 Revision History

| Rev | Date | Changes | Note |
|---|---|---|---|
| 00 | 2015/12/09 | New document | |
| | 2015/12/28 | Added Users guide for the communication software | |
| | | Added Protocol specifications | |
| | | Added P.21 AWB offset | |
| | | Added P.14 Gamma offset | |
| | | Added P.48 to P.49 AWB offset and Gamma offset on Register Map | |
| | | Revised P.52 Default value on Color saturation adjustment (128→100) | |

Note
Specifications are subject to change without notice.

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