

# CIS

**12G/6G/3G/HD-SDI  
4K UHD/Full HD  
CMOS Color Camera**

# VCC-4K5

**Product Specifications  
& Operational Manual**

**CIS Corporation**

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## 1. Handling Precautions

### 1.1. Camera Handling Precautions

- To protect the camera, do not use it in dusty or humid places.
- Please handle the camera with care to avoid strong shocks and static electricity. Failure to do so may result in malfunction.
- To protect the CMOS image sensor, please do not expose it to direct sunlight or high-intensity lights, etc. directly. Also, please protect the CMOS image sensor with a protective cap or seal when the camera is not in use.
- Connect to the camera in accordance with [Section 3.2. Part Names and Functions](#). Please note that incorrect connection may not only damage the camera itself, but also cause irrecoverable damage to the connected equipment.
- If there is an AC leak from the equipment (monitor/computer, etc.) connected to the camera, the camera may be damaged. Check the ground potential between the devices before connecting them and make sure that there is no problem.
- Use the correct power supply voltage for the camera within the specifications. Use of a power supply that does not meet the specifications or an unstable power supply may result in camera malfunction or failure.
- Since this camera VCC-4K5 is small in size, the housing temperature will be high. We recommend you to take measures to dissipate the heat, such as mounting the camera on a metal plate etc.
- Any malfunction or failure of the camera due to misuse without observing the above precautions is not covered by the product warranty.

**Our warranty does not apply to damages or defects caused by neglecting the instructions and precautions explained in this manual.**

### 1.2. Restrictions on Applications

- The camera must not be used for any nuclear equipment or aerospace equipment with which mechanical failure or malfunction could result in serious bodily injury or loss of human life.
- The camera must not be used under conditions or in environments other than those specified in the specifications, especially in applications where safety is required.

### 1.3. Disclaimers (Exception Clause)

CIS should not be liable for any damages or losses if;

- damages or losses are caused by earthquake, lightning strike, fire, flood, or other acts of God.
- damages or losses are caused by deliberate or accidental misuse by user, or failure to observe information and instructions explained in this manual.
- damages or losses are caused by repair or modification conducted by user or any unauthorized party.

## 2. Product Overview

VCC-4K5 is an ultra-compact 4K color camera using a 1/1.8 type rolling shutter CMOS image sensor. Features CIS's proprietary ISP, "Clairvu™" image processing engine, for superior image quality and high-speed processing. Supports AE, auto white balance, color correction, edge enhancement, noise reduction, gamma, genlock, external sync and other functions. Complies with BT.709 and BT.2100 (HLG).

With its compact 29x29x77mm footprint, the VCC-4K5 is suitable for broadcast, ROV, drone and vehicle, traffic monitoring, medical imaging, microscopy and other life science equipment and systems.

### 2.1. Features

- CIS original Image Signal Processor, "Clairvu™" for superior imaging quality.
- Ultra-small footprint: 29mm×29mm×77mm (without projection)
- Corresponds to video output UHDTV 60p/59.94p/50p/(12G-SDI) 30p/29.97p/25p/24p/23.98p(6G-SDI) HDTV 60p/59.94p/50p(3G-SDI) 60i/59.94i/50i/30p/29.97p/25p/24p/23.98p(HD-SDI)
- GenLock function (Tri-level analog signal or black burst)
- Camera is controllable via RS-232C.
- LTC (Longitudinal Time code)
- Supports OSD (On Screen Display) function via optional remote controller.

### 2.2. Accessories

- Standard Accessories
  - 6-pin connector for power supply
- Optional Accessory
  - RU-100 remote controller (OSD control, RS-232C to USB conversion).

## 3. Specifications

## 3.1. General Specifications

Electrical Specifications		
Image sensor	Sensor type	1/1.8", Rolling shutter type CMOS sensor (color) SONY IMX678AAQR1
	Effective pixels	3840(H) × 2160(V)
	Unit cell size	2.0μm(H) × 2.0μm(V)
Resolution	2160p:	3840(H) × 2160(V)
	1080p, 1080i:	1920(H) × 1080(V)
Aspect ratio	16 : 9	
Video output format	3840 x 2160p @60fps	12G-SDI
	3840 x 2160p @59.94fps	12G-SDI
	3840 x 2160p @50fps	12G-SDI
	3840 x 2160p @30fps	6G-SDI
	3840 x 2160p @29.97fps	6G-SDI
	3840 x 2160p @25fps	6G-SDI
	3840 x 2160p @24fps	6G-SDI
	3840 x 2160p @23.98fps	6G-SDI
	1920 x 1080p @60fps (Level A)	3G-SDI
	1920 x 1080p @60fps (Level B)	3G-SDI
	1920 x 1080p @59.94fps (Level A)	3G-SDI
	1920 x 1080p @59.94fps (Level B)	3G-SDI
	1920 x 1080p @50fps (Level A)	3G-SDI
	1920 x 1080p @50fps (Level B)	3G-SDI
	1920 x 1080i @60fps	HD-SDI
	1920 x 1080i @59.94fps	HD-SDI
	1920 x 1080i @50fps	HD-SDI
	1920 x 1080p @30fps	HD-SDI
	1920 x 1080p @29.97fps	HD-SDI
	1920 x 1080p @25fps	HD-SDI
	1920 x 1080p @24fps	HD-SDI
	1920 x 1080p @23.98fps	HD-SDI
Sync system	Internal sync. / External sync.	
Video output standard	12G-SDI/6G-SDI/3G-SDI/HD-SDI : Y/Pb/Pr(4:2:2 10bit) BNC 75Ω terminal	
Sensitivity	F4 2000 lx Measuring conditions: Gain:0dB, Shutter:1/60s, D-Range:Normal, Knee:OFF	
Minimum illumination	F1.4 3.2 lx Measuring conditions: VIDEO 50%, Gain:30dB, Shutter:1/60s, D-Range:Normal	
Gain variable range	AGC (Max. gain: 0dB~48dB) MANUAL: 0dB~48dB *Noise may be noticeable at 36 dB or higher.	
Shutter speed variable range	AUTO : 1/13600s~1/23.98s (Upper/lower limits settable) *Frame rate setting of video output format limits the slowest shutter speed. MANUAL : 1/13600s~1/23.98s *Frame rate setting of video output format limits the slowest shutter speed.	
White balance adjustment range	AUTO : Standard, Outdoor, Fluorescent MANUAL : Red Gain, Blue Gain, One Push PRESET : Custom (Color temperature settings), Tungsten(3200K), Daylight(5500K), Cloudy(6500K), Shade(8000K)	
DC IRIS output	Auto/Open selectable. Can be used with electric shutter. (with priority over electric shutter)	

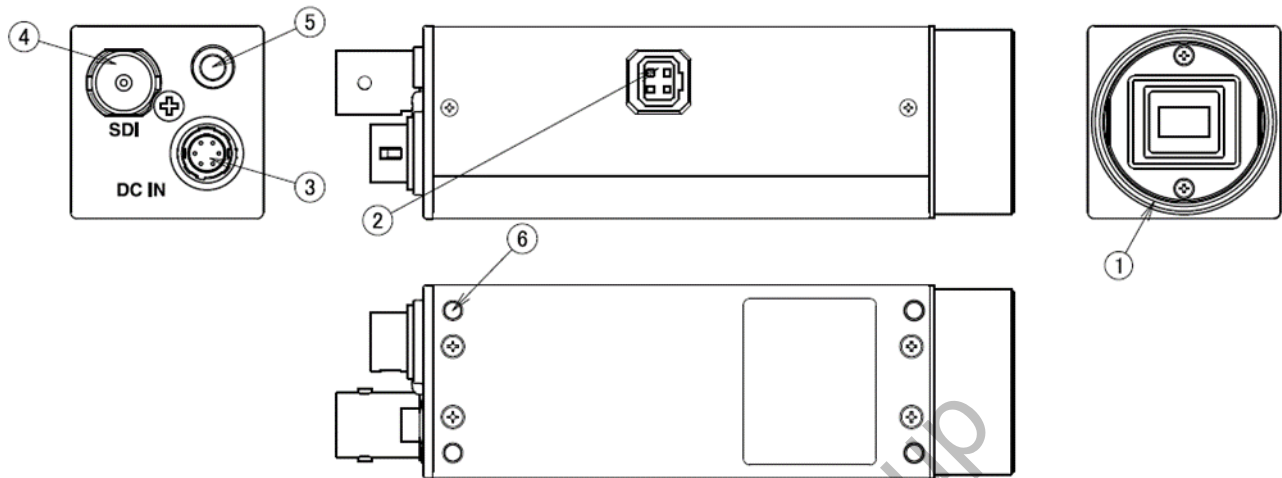
Auto exposure detection	Average, Center-Weighted, Spot, Backlight Compensation
Flicker cancellation	OFF, ON: Power frequency 50Hz, 60Hz
Edge enhancement	OFF, 1~7
Color correction	Auto, Standard, Fluorescent Light, Tungsten Lamp
Saturation adjustment	0%(B/W)~100%(typ.)~200%
Cyan suppression adjustment	0~15
Color saturation suppression	OFF, 1~7
Noise reduction	OFF,1~6
Gamma (Contrast)	Complies with BT.709 curve (Contrast: -2, -1, 0, +1, +2) Complies with BT.2100 (HLG) curve
Dynamic range	Low (with priority over better SNR), Normal, High
Knee point	OFF, 100%, 95%, 90%, 85%, 80%, 75%
Color gamut	BT.709, BT.2020
Master Pedestal	-100 ~ 0 ~ +100
Pedestal (R,G,B)	RGB each -100 ~ 0 ~ +100
Color balance	RGB each 0 ~ 100 ~ 200
Defective pixel correction (white spot)	Corrected upon shipment.
LTC	OFF, ON Accepts external SMPTE time code at the LTC IN terminal. (Supports resetting internal self-counting time code.)
Camera preset settings	1, 2, 3, 4 (Four types of preset for saving.)
Remote control communications	Camera is controllable by connecting an RS-232C signal via a $\phi$ 3.5 (4-pole) plug. Use a control software to configure the camera settings from a PC. Supports OSD function by connecting the optional remote controller, RU-100.
Power requirements	DC+9~+15V
Power consumption	5.5W
<b>Mechanical Specifications</b>	
Dimensions	Refer to the camera dimensional drawing in <a href="#">Section 7</a> .
Weight	Approx. 84 g
Lens mount	C mount *Refer to the camera dimensional drawing in <a href="#">Section 7</a> .

<b>Environmental Specifications</b>		
Safety/Quality Standards	<p>CE: EMC: 2014/30/EU                      Emission: EN61000-6-3:2007+A1:2011                      Immunity: EN61000-6-2:2019                      IEC61000 4-5 (Surge) is not applicable to this product, so if the cable length is longer than 30m or wiring is done outdoors, use a surge protector to prevent surges from entering the product.</p> <p>RoHS: 2011/65/EU (EU)2015/863                      EN50581 (RoHS2)</p> <p>FCC Class A Digital Device                      This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.</p>	
Durability	Vibration	<p>Acceleration: 98m/s<sup>2</sup> (10G)</p> <p>Frequency: 20 ~ 200Hz</p> <p>Direction: X, Y, and Z 3 directions</p> <p>Testing time: 120min for each direction</p>
	Shock	No malfunction with 980m/s <sup>2</sup> (100)G for ±X, ±Y, and ±Z, 6 directions without packaging.
	Operational temperature	<p>-5 ~ +45°C</p> <p>Humidity: 20 ~ 80%RH with no condensation.</p>
	Storage temperature	<p>-25 ~ +60°C</p> <p>Humidity: 20 ~ 80%RH with no condensation.</p>

[3G-SDI output Level A and Level B]

The difference between Level A and Level B is the mapping of Y and Cb/Cr signals to 3G-SDI standard signals, and it does not affect the resolution of video signals. Depending on the 3G-SDI receiver, there are some that support only Level A, some that support only Level B, and some that support both Level A and B. Therefore, please set the camera mode according to the 3G-SDI receiver you are using.

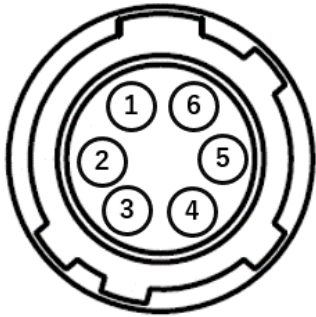
## 3.2. Part Names and Functions



- ① C mount  
This is to mount a C mount lens.  
For C mount lenses, use lenses with a thread length of 6 mm or less and protrusion of 8 mm or less from the lens mount surface. When a lens is not mounted, make sure to put on a cap or seal to prevent exposure of an image sensor.
- ② DC-IRIS connector  
Connection terminal for DC-IRIS lens.
- ③ Connector for power input and GenLock and LTC signal input  
Connect according to the external connection connector specifications.
- ④ Video signal output  
Use monitors and BNC cables that are compatible with the output format and frequency. (Cannot connect to analog monitors.)
- ⑤  $\phi$ 3.5 (4-pole) connector (RS-232C)  
Connector for RS-232C signals.  
Connect according to the external connection connector specifications.  
Refer to the separate document for the communication method.  
※ Do not connect audio equipment such as earphones, etc., as it may damage the connected equipment.
- ⑥ Screw holes for camera installation.

3.3. External Connector Specifications

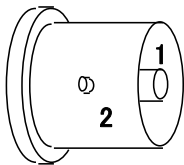
3.3.1 6-pin Circular Connector



Part name: SNH-8-6(RPCB) (SamWoo Electronics)

Pin	Signal Name
1	Power IN DC+12V
2	EXT SYNC IN
3	LTC IN
4	N.C.
5	GND
6	GND

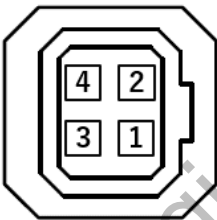
3.3.2 BNC



Part name: BNC(75)-PLR-PC(D)-12G-3 (Hirose Electric)

Pin	Signal Name
1	12G/6G/3G/HD SDI output
2	GND

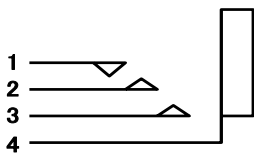
3.3.3 DC-IRIS Connector



Part name: D4-157J-250 (Technical Electron)

Pin	Signal Name
1	DAMP-
2	DAMP+
3	DRIVE+
4	DRIVE-(GND)

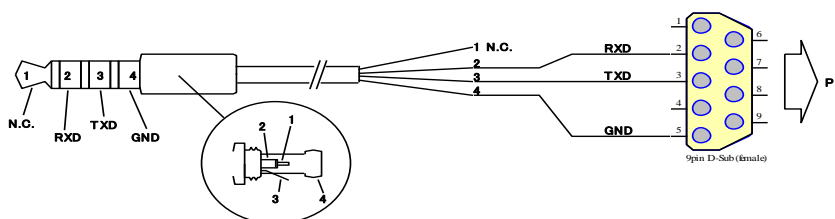
3.3.4 φ3.5mm 4-pole (RS-232C) Connector



Part name: M03-A41A0 (Marushin Electric Mfg.)

Pin	Signal Name
1	Power(+5V) *for optional use
2	TXD(Camera)
3	RXD(Camera)
4	GND

φ3.5 (4-pole) connector (RS-232C) connection method



#### 4. Camera Functions

##### 4.1. GenLock

- GenLock is available by inputting an analog external sync. signal (black burst or tri-level SYNC) to the EXT SYNC IN terminal on the 6-pin connector.
- The type of external sync. signal supported varies depending on the output format of the camera. Input signals according to the following list.

		EXT SYNC IN				
CAMERA FORMAT	2160/1080 60p			1080i60	720p60	1080p30
	2160/1080 59.94p	NTSC		1080i59.9	720p59.9	1080p29.9
	2160/1080 50p		PAL	1080i50	720p50	1080p25
	2160/1080 30p			1080i60	720p60	1080p30
	2160/1080 29.97p	NTSC		1080i59.9	720p59.9	1080p29.9
	2160/1080 25p		PAL	1080i50	720p50	1080p25
	2160/1080 24p					1080p24
	2160/1080 23.98p					1080p23.9
	1080 60i			1080i60	720p60	1080p30
	1080 59.94i	NTSC		1080i59.9	720p59.9	1080p29.9
	1080 50i		PAL	1080i50	720p50	1080p25

[Note]

- Input Black Burst signal for NTSC/PAL signals. Input tri-level SYNC signal for other than NTSC/PAL signals.
- The EXT SYNC IN terminal is 75Ω terminated.
- When an external signal from the above list is input, it automatically becomes the external sync. mode.
- If no external sync signal is input, it operates in internal sync. mode.
- Immediately after inputting an external sync signal, the image will be distorted, however this is not a malfunction.
- If a signal is input to the EXT SYNC IN terminal in a combination other than the above, the image may be distorted or may not output.

##### 4.2. LTC (Longitudinal Time Code)

- Supports time code insertion into 12G/6G/3G/HD-SDI signals.
- Input LTC (time code) signal to the LTC IN terminal of the 6-pin connector to insert an external time code. If there is no input to the LTC IN terminal, user can insert an internal time code. Internal time code starts with 00:00:00.00 when the power is ON, however it is set to the external time code when a signal is input to the LTC IN pin. In this state, when the signal at the LTC IN terminal is lost, internal time code starts with the set time code.

Signal format: SMPTE Timecode

Signal level: 0.5~2 [Vp-p]

### 4.3. Defective Pixel Correction

CIS applies defective pixel correction to the pixel defects caused by the image sensor prior to shipment of the product. In addition to the defect pixel data registered at the factory, user can also detect defects and register/delete defective pixels by specifying coordinates. User can register defective pixels up to 256 points. Refer to the "[Command List](#)" for specific commands.

#### 4.3.1 Defective Pixel Data Type

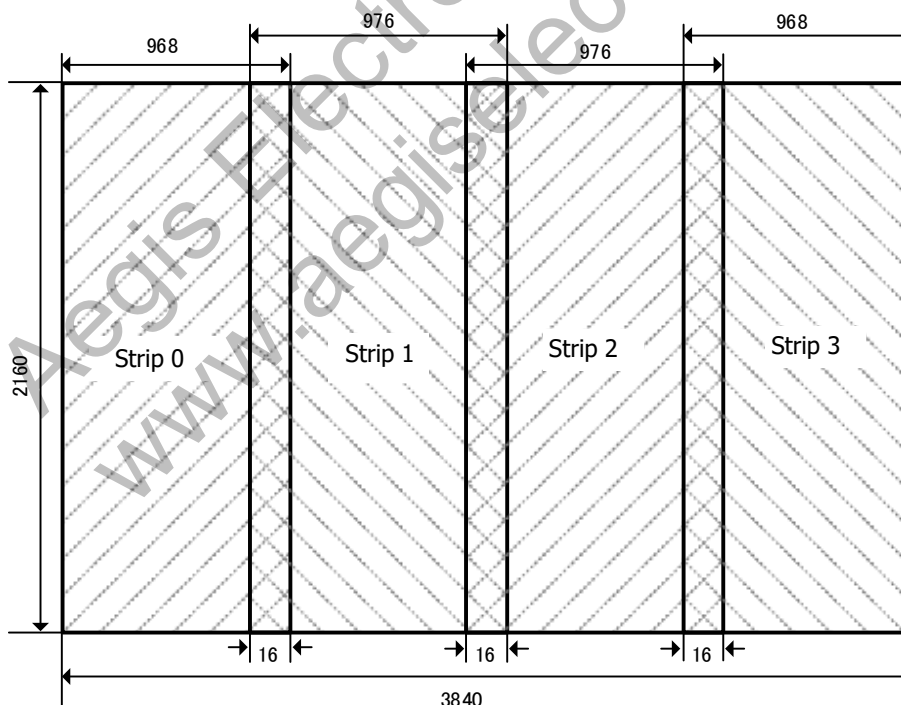
There are two types of defective pixel data.

- Defective pixel data registered at factory  
User cannot overwrite this data.
- Defective pixel data registered by user  
User can rewrite this data.

Please note that the defective pixel data is automatically converted to coordinates according to the H flip and V flip settings (using common data). At this time, due to image sensor specifications, the coordinates are not inverted but shifted by one pixel.

#### 4.3.2 Details of Defective Pixel Data

Defective pixel data is managed in units of areas on strips vertically divided into 4 sections. User can register up to 64 points as user-registered data for each strip, for a total of up to 256 points. Each of the strips overlaps by 16 pixels, and the points of the overlap are registered on both strips. The strip is defined as shown in the figure below.



The coordinate system has its origin in the upper left corner of the screen, and each strip has an area as its coordinate below.

- Strip 0: (0,0) – (967,2159)
- Strip 1: (952,0) – (1927,2159)
- Strip 2: (1912,0) – (2887,2159)
- Strip 3: (2872,0) – (3839,2159)

For example, a defect of (951,0) will only be registered in strip 0, however (952,0) will be registered in both strips 0 and 1.

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### 4.3.3 Notes for Defective Pixel Correction

- To save the data registered or deleted with defective pixels correction commands (SU 200~203), execute SAVE command (SU 705).
- Init command (SU 700) does not restore defective pixel correction data. Execute SU 203 to delete all data.
- Defective pixel correction data is not subject to Camera Setting Store/Load command (SU 100/101). (Four types of correction data cannot be switched.)
- Factory data and user-registered data cannot be the same. Therefore, if user detects the same defective points as factory data, this function ignores those points.
- If user specifies a pixel data with the same coordinates as factory setting, error will occur.
- Specify coordinates with standard 3840×2160 regardless of video format.
- Please note that the detected results may not always be the same due to temperature, noise, and other conditions.
- Inappropriate data registration of defective pixels may cause difficulties to acquire proper images.

Neglecting these instructions may cause not only incorrect pixel defect correction, but also failure of acquiring proper images.

## 5. Serial Communication

### 5.1. Serial Communication Settings

(1) Serial communication settings are as follows.

Baud rate	9600bps (factory setting), 38400bps, 115200bps
Data	8bit
Stop bit	1bit
Parity	None
XON/XOFF	No control

(2) Control code

- Controls via text-based communication, using only ASCII characters 0x20~0x7E, 0x0A(LF=¥n), 0x0D(CR=¥r). Do not use codes other than these.
- By sending the command parameter CR (0x0D) from the PC to the camera, the user can change the camera settings and obtain the configuration information. (CR can also be substituted with LF.)
- There are two types of commands: the GU (Get User) command, which obtains data set in the camera, and the SU (Set User) command, which sets data in the camera.

Command	Parameter 1	Parameter 2	Function
GU	Address	Normally none (There are some exceptions.)	To obtain camera setting information.
SU	Address	Data (There may be more than one.)	To change camera settings.

(3) How to set a command

- Camera outputs ">" as a prompt.
- Commands are not case sensitive.
- Separate a command and each argument with a space (0x20).
- The head of the input character to the line feed code (CR) is considered as one command.
- Numbers starting with 0x are treated as hexadecimal numbers, numbers starting with 0b as binary numbers, and all other numbers are treated as decimal numbers.
- Parameters are parsed from the first character to the first distinguishable character.
- Refer [Section 5.2. Command List](#) for addresses and data.
- Do not enter any numeric values or characters other than those listed in the commands in the previous page and on the [Section 5.2. Command List](#).
- The camera receives commands sent from the PC and echoes them back. At this time, line feed codes (CR) are converted to CR LF and echoed back.

## (4) Setting examples

## 【GU command】

To get information on address 10

[Send] GU[sp]10[¥r]

[Returned value] GU[sp]10[¥r][¥n]

[Returned value] 50[¥r] [¥n]

[Returned value] [¥r] [¥n]

[Returned value] &gt;[sp]

[Echo back]

[Obtained data + Linefeed]

[Linefeed]

[Prompt (&gt; and space)]

[¥r]=CR(0x0D)

[¥n]=LF(0x0A)

[sp]=Space(0x20)

## 【SU command】

To set 30 at address 10

[Send] SU[sp]10[sp]30[¥r]

[Returned value] SU[sp]10[sp]30[¥r][¥n]

[Returned value] [¥r] [¥n]

[Returned value] &gt;[sp]

[Echo back]

[Linefeed]

[Prompt (&gt; and space)]

## 5.1.1 How to Change the Baud Rate

The user can change the baud rate to 9600bps, 38400bps, or 115200bps by the Baud Rate command (SU 725).

- The changed settings will take effect after the reboot, not immediately after the command is executed.
- Execute Save command (SU 705) to save the set values.
- Baud rate command is not subject to Init command (SU 700) so that executing Init command does not return the settings to their default values.
- Baud Rate command is not subject to Camera Setting Store/Load command (SU 100/101). (User cannot switch four types of correction data.)
- If the baud rate is set other than 9600 bps, the RU-100 remote controller becomes invalid.

## 5.2. Command List

**Video Format**

Function	Address	Set value	Initial value	Descriptions
Video Format	1	0: 3840 x 2160p @60fps 1: 3840 x 2160p @59.94fps 2: 3840 x 2160p @50fps 3: 3840 x 2160p @30fps 4: 3840 x 2160p @29.97fps 5: 3840 x 2160p @25fps 6: 3840 x 2160p @24fps 7: 3840 x 2160p @23.98fps 8: 1920 x 1080p @60fps (Level A) 9: 1920 x 1080p @59.94fps (Level A) 10: 1920 x 1080p @50fps (Level A) 11: 1920 x 1080p @60fps (Level B) 12: 1920 x 1080p @59.94fps (Level B) 13: 1920 x 1080p @50fps (Level B) 14: 1920 x 1080i @60fps 15: 1920 x 1080i @59.94fps 16: 1920 x 1080i @50fps 17: 1920 x 1080p @30fps 18: 1920 x 1080p @29.97fps 19: 1920 x 1080p @25fps 20: 1920 x 1080p @24fps 21: 1920 x 1080p @23.98fps	0	Set the video output format.

**AE related**

Function	Address	Set value	Initial value	Descriptions
Gain Mode	2	0: Manual 1: Auto	1	Set the gain control mode.
Gain Value	3	Magnification×0x10000 Setting range: 1~ Approx. x251 (0x10000~0xFB304B)	0x10000 (65536)	Set the gain when Gain Mode is Manual. (*1) Ex) To set x2 (Approx.6dB): SU 3 0x00020000 ※ Refer to <a href="#">Section 5.3.1. Quick Reference Table for Gain Settings.</a>
Gain Max Value	4	Magnification×0x10000 Setting range: 1~Approx. x251 (0x10000~0xFB304B)	0x200000 (2097152)	Set the maximum gain when Gain Mode is Auto. (*1) ※ Refer to <a href="#">Section 5.3.1. Quick Reference Table for Gain Settings.</a>
Shutter Mode	5	0: Manual 1: Auto	1	Set the shutter control mode.

Shutter Value	6	Exposure time [s]×0x100000 Setting range: 1/13600~1/23.98s (0x4D~0xAAD6)	0x4444 (17476) 1/60s	Set the shutter value (exposure time) when Shutter Mode is Manual (*1) A value shorter than one frame must be set. For example, when Video Format is 60fps, the upper limit of Shutter Value is 0x4444 (1/60s). ※ Refer to <a href="#">Section 5.3.2. Quick Reference Table for Shutter Settings.</a>
Shutter Limit	7	The 1 <sup>st</sup> Param: Max value Exposure time [s]×0x100000 Setting range: 1/13600~1/23.98s (0x4D~0xAAD6)	0x4444 (17476) 1/60s	Set the variable shutter value range when Shutter Mode is Auto. (*1) A value shorter than one frame must be set. Also, it is not possible to set Max < Min. Ex) To set Max=1/60s, Min=1/8000s: SU 7 0x4444 0x83 ※ Refer to <a href="#">Section 5.3.2. Quick Reference Table for Shutter Settings.</a>
		The 2 <sup>nd</sup> Param: Min value Exposure time [s]×0x100000 Setting range: Same as Max value.	0x4D (77) 1/13600s	
Metering Mode	8	0: Average 1: Center-Weighted 2: Spot 3: Backlight Compensation	1	Set the metering mode.
Spot Block	9	The 1 <sup>st</sup> Param: X value: 0~15	7	Set the X, Y, W, and H values for spot metering. X: Left edge block of photometric area: X coordinate Y: Top block of photometric area: Y coordinate W: Photometric area width (Number of blocks) H: Photometric area height (Number of blocks) Ex) To set up a 4×2 block from coordinates (6, 7): SU 9 6 7 4 2.
		The 2 <sup>nd</sup> Param: Y value: 0~15	7	
		The 3 <sup>rd</sup> Param: W value: 1~16	2	
		The 4 <sup>th</sup> Param: H value: 1~16	2	
AE Speed	10	0~15	10	Set the convergence speed of AE.
Exposure Compensation Value	11	0(-12dB) ~ 12(0dB) ~ 24(+12dB)/ in 1dB increments	12	Set the exposure compensation value.
Flicker Cancel	12	0: Off 1: 50Hz power mode 2: 60Hz power mode	0	Set the flicker cancellation. Select the mode according to the power supply frequency.
Gain Value, Plus Minus	13	-1: Lower 1dB 1 : Raise 1dB	None	Change the gain ±1 dB from the current value. (*1) Effective when Gain Mode is Manual. (Dedicated to SU)
Shutter Speed, Plus Minus	14	-1: Lower 1step (1/4EV) 1 : Raise 1step (1/4EV)	None	Change the shutter speed by ±1step (1/4EV) from the current value. 1 step lower will increase the Shutter Value. (*1) Effective when Shutter Mode is Manual. (Dedicated to SU)

High Sensitivity Mode	19	0: Off 1: On	0	Set the high sensitivity mode. Not subject to AE control. Turning this mode on improves sensitivity by about 8.6 dB, but it is more susceptible to saturation. (*2)
Current Gain	55	None	None	Obtain the current gain. (Dedicated to GU) (*1)
Current Shutter	56	None	None	Obtain the current shutter value. (Dedicated to GU) (*1)

(\*1) Gain and shutter controls are handled based on sensor/circuit specifications. For this reason, it may not be possible to control as per the Value and Limit set by the command. User can check the actual control value with the Current Gain or Current Shutter command.

(\*2) The increase in sensitivity due to the high sensitivity mode is not included in the Gain Value or Gain Max Value settings.

### WB related

Function	Address	Set value	Initial value	Descriptions
WB Mode	20	0: Manual 1: Auto 2: Preset	1	Set the white balance (WB) mode.
WB Manual Memory	21	0~4	0	Select the memory to store the set values when WB Mode is Manual. User can store 5 types of memory, from 0 to 4.
Manual Red Gain	22	100~1600(%)	226	Set the Red Gain when WB Mode is Manual.
Manual Blue Gain	23	100~1600(%)	187	Set the Blue Gain when WB Mode is Manual.
One Push Trigger	24	1: W×H 2: W/2×H/2 3: W/4×H/4	None	Execute One Push WB when WB Mode is Manual. Select the detection range according to the set value. When One Push WB cannot be executed normally, such as in a light shielded condition, it returns a Run Time Error. (Dedicated to SU)
WB Auto Func	25	0: Standard 1: Outdoor 2: Fluorescent	0	Select the operation when WB Mode is Auto.
WB Preset Func	26	0: Custom 1: Tungsten (3200K) 2: Daylight (5500K) 3: Cloudy (6500K) 4: Shade (8000K)	2	Select the operation when WB Mode is Preset.
WB Preset Temp	27	2500~15000(K)	5500	Set the color temperature when WB Preset Func is Custom.
WB LB Shift	28	-10~10	0	Set the amount of shift of WB gain toward black.
WB CC Shift	29	-10~10	0	Set the amount of shift of WB gain toward green magenta.
Current Red Gain	58	None	None	Obtain the current Red Gain. (Dedicated to GU)
Current Blue Gain	59	None	None	Obtain the current Blue Gain. (Dedicated to GU)

**Image Quality related**

Function	Address	Set value	Initial value	Descriptions
Detail	30	0: Off 1 (Low)~7 (High)	3	Set the intensity of edge enhancement.
Gamma	35	0: BT.709 -2 1: BT.709 -1 2: BT.709 3: BT.709 +1 4: BT.709 +2 5: HLG75	2	Set the gamma type and contrast. 0~4 is a gamma curve compliant with BT.709, and -2~+2 indicates high or low contrast. + is high contrast. 5 is the BT.709 100% output signal assigned to the HLG 75% signal level.
Knee	36	0: Off 1: 100% 2: 95% 3: 90% 4: 85% 5: 80% 6: 75%	4	Set the knee point. Effective when Gamma is BT.709 series and D-Range is other than Low. The knee slope is selected to be the maximum of the selected D-Range.
Master Pedestal	37	-100~+100	0	Set the master pedestal.
Red Pedestal	38	-100~+100	0	Set the Red pedestal.
Green Pedestal	39	-100~+100	0	Set the Green pedestal.
Blue Pedestal	40	-100~+100	0	Set the Blue pedestal.
Red Balance	41	0~200	100	Set the Red balance.
Green Balance	42	0~200	100	Set the Green balance.
Blue Balance	43	0~200	100	Set the Blue balance.
D-Range	44	0: Low Equivalent to 120% at BT.709. Disabled when HLG. (treated as Normal) 1: Normal Equivalent to 200% when BT.709. Equivalent to 600% when HLG. 2: High Equivalent to 400% when BT.709. Equivalent to 1200% when HLG.	1	Set the dynamic range. Low is lower in both D-range and sensitivity, but it has lower noise. At High, the lower limit of gain is 0x20000 (even if set lower than that, it is treated as 0x20000). ※The D-Range value differs between BT.709 and HLG as the criteria are as follows. [BT.709] Input range when input is 100% with output 100% with Knee Off. [HLG] Input range when input is 100% with output 50%.
Color Saturation	45	0~200	100	Set the color saturation.
Cyan Suppression	46	0~15	15	Set cyan saturation suppression.

Color Adjustment	47	The 1 <sup>st</sup> Param: Color selection 0: Magenta 1: Red 2: Yellow 3: Green 4: Cyan 5: Blue	All 0	Set the color adjustment value. Three adjustment items for each of the six colors, for a total of 18 parameters, are available for color adjustment. Ex) To set Cyan Hue to -3: SU 47 4 0 -3 Specify the 1 <sup>st</sup> Param and 2 <sup>nd</sup> Param when executing GU. Ex) To obtain Cyan Hue adjustment value: GU 47 4 0
		The 2 <sup>nd</sup> Param: Selection of adjustment items 0: Hue 1: Saturation 2: Depth		
		The 3 <sup>rd</sup> Param: Adjustment value -20~20		
Noise Reduction	50	0: OFF 1: Level 1 (Low) 2: Level 2 ... 6: Level 6 (High)	0	Set the noise reduction.
Color Correction	52	0: Auto 1: Standard 2: Fluorescent Light 3: Tungsten Lamp	0	Set the color correction.
Color Suppression	53	0: Off 1(Low)~7(High)	0	Set the color saturation suppression.
Color Space	54	0: BT.709 1: BT.2020	0	Set the color gamut.

**Lens Control related**

Function	Address	Set value	Initial value	Descriptions
DC Iris Mode	61	0: Open 1: Auto	0	Set to Open when DC iris lens is not in use. (*2)
DC Iris Response Speed	77	0 (Slow) ~ 15 (Fast)	8	Set the response speed of DC Iris when DC Iris Mode is Auto. The larger the value, the faster the DC Iris response time. If the iris is hunting, slow down the response speed or make other adjustments to match the characteristics of the DC iris lens.

(\*2) DC Iris may cause hunting under certain conditions when imaging high-intensity subjects. In this case, it may be possible to suppress hunting by adjusting the DC Iris Response Speed or Exposure Compensation Value.

**OSD related**

Function	Address	Set value	Initial value	Descriptions
OSD Up button	90	0: One push 1: Continuous push	None	Commands for OSD menu operation. For continuous push operation, issue a command every 60ms. (Dedicated to SU)
OSD Down button	91	0: One push 1: Continuous push	None	
OSD Right button	92	0: One push 1: Continuous push	None	
OSD Left button	93	0: One push 1: Continuous push	None	
OSD Center button	94	0: One push 1: Continuous push	None	
Text Color	95	0: Black 1: Blue 2: Red 3: Magenta 4: Green 5: Cyan 6: Yellow 7: White	7	Set the text color of the OSD menu.
Highlight Color	96	0: Black 1: Blue 2: Red 3: Magenta 4: Green 5: Cyan 6: Yellow 7: White	5	Set the text color of the selected letters of the OSD menu. If user sets the same color as Text Color, an error will occur because the selected text cannot be distinguished.
OSD Off	99	1 (Fixed)	None	Close the OSD menu. (Dedicated to SU)

**Others**

Function	Address	Set value	Initial value	Descriptions
Camera Setting Store	100	0~3	0	User can register 4 types of camera settings, from 0 to 3. The registered settings are saved in nonvolatile memory by executing Save (SU 705 1). The registered data and the address to store camera settings are not subject to Init command (SU 700 0).
Camera Setting Load	101	0~3		Reads and reflects camera settings registered in the Camera Setting Store. Since the address to store and to load camera settings are common, the value set at the end of Store or Load is retained (GU 100 and GU 101 always return the same value).
LTC Mode	103	0: Off 1: On	0	Set LTC signal insertion.
LTC Reset	104	1: Reset	None	Supports resetting internal self-counting time code (Dedicated to SU).
GenLock V Offset	106	-1024~1023	0	Set V phase adjustment for external synchronization.
GenLock H Offset	107	-2048~2047	0	Set H phase adjustment for external synchronization.
H Flip	110	0: Off 1: On	0	Set the horizontal inversion of the video output.
V Flip	111	0: Off 1: On	0	Set the vertical inversion of the video output.
Test Pattern	120	0: Off 1: Cross Line 2: Color Bar	0	Set the test pattern display. The test pattern is not affected by the H flip and V flip settings (Not reversible).
Cross Line Position	121	The 1 <sup>st</sup> Param: X coordinate 0~3839	1920	Set the display position when the Test Pattern is Cross Line in terms of the coordinates of the intersection.
		The 2 <sup>nd</sup> Param: Y coordinate 0~2159	1080	
Init	700	0 (Fixed)	None	Reset the camera settings to their default values. Stored data, address to store, defective pixel correction data, and baud rate are not subject to the Init command. (Dedicated to SU)
Save	705	1 (Fixed)	None	Save the camera settings. Store the currently used camera setting values (equivalent to SU 100), then save the stored data, address to store, defective pixel correction data, and baud rate. (Dedicated to SU)

Version Information	721	1: Microcomputer version 2: FPGA version	None	Obtain version information. (Dedicated to GU)
Baud Rate	725	9600, 38400, 115200 (bps)	9600	Set the serial communication speed. Refer to <a href="#">Section 5.1.1 How to Change the Baud Rate</a> .
SDI Compatibility Mode	750	0: Off 1: On	0	In the default state (Off), the camera reflects SDI Payload ID when HLG75 or BT.2020 is selected, but not when set to On. Turn On when the user uses a receiver that does not output images when HLG75 or BT.2020 is selected.
User String	770	Any character string from 0x21 to 0x7E in ASCII (Max. 30 characters)	None	Init command does not initialize the set character string. ※ User cannot use space (ASCII 0x20) with User String.
User String Clear	771	1: Delete	None	Delete the character string set by user. (Dedicated by SU)

#### **Defective Pixel Correction**

Function	Address	Set value	Descriptions
Defective pixel detection	200	The 1 <sup>st</sup> Param: Threshold value (0~4095)	Detect defective pixels (white defects) and register them as user-registered data. A pixel is considered defective if its output value exceeds the threshold value. Execute it with the light shielded and the gain and shutter values properly set.
		The 2 <sup>nd</sup> Param: Registration mode 0: New registration 1: Additional registration	
Defective pixel registration	201	The 1 <sup>st</sup> Param: X coordinate 0~3839	Register the user-registered data by specifying the coordinates.
		The 2 <sup>nd</sup> Param: Y coordinate 0~2159	
Defective pixel deletion	202	The 1 <sup>st</sup> Param: X coordinate 0~3839	Delete the user-registered data by specifying the coordinates. (Dedicated to SU)
		The 2 <sup>nd</sup> Param: Y coordinate 0~2159	
Defective pixel correction data deletion	203	1: Complete deletion	Delete all user-registered data (Dedicated to SU)

Defective pixel correction data display	204	1: Display coordinates and attributes of all defective pixel data. 2: Display coordinates and attributes of user registration data 3: Display the number of all defective pixel data registrations 4: Display the number of user-registered data registrations	Display information about the registered defective pixel correction data. (Dedicated to GU)
---	-----	---	---

- When specifying "New Registration" in the defective pixel detection command, delete only the data already registered by the defective pixel detection command, not the data registered by the defective pixel registration command.
- The attributes when displaying data indicate that "W" and "B" are factory data, "U" is user-registered data based on the defective pixel detection command, and "P" is user-registered data based on the defective pixel registration command.
- GU 200 shows the number of registrations for the U attribute and GU 201 shows the number of registrations for the P attribute.
- Only user-registered data can be changed with the above commands; factory data is not affected.
- Pixels that have already been registered as factory data cannot be registered as user-registered data.

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## 5.3. Quick Reference Table

## 5.3.1 Quick Reference Table for Gain Settings

	Magnification	dB	GainValue (Magnification×0x10000)	
			DEC	HEX
<b>0</b>	<b>1.000</b>	<b>0.000</b>	<b>65536</b>	<b>00010000</b>
1	1.122	1.003	73561	00011F59
2	1.260	2.007	82570	0001428A
3	1.414	3.010	92681	00016A09
4	1.587	4.014	104031	0001965F
5	1.782	5.017	116771	0001C823
<b>6</b>	<b>2.000</b>	<b>6.021</b>	<b>131072</b>	<b>00020000</b>
7	2.245	7.024	147123	00023EB3
8	2.520	8.027	165140	00028514
9	2.828	9.031	185363	0002D413
10	3.175	10.034	208063	00032CBF
11	3.564	11.038	233543	00039047
<b>12</b>	<b>4.000</b>	<b>12.041</b>	<b>262144</b>	<b>00040000</b>
13	4.490	13.045	294246	00047D66
14	5.040	14.048	330280	00050A28
15	5.657	15.051	370727	0005A827
16	6.350	16.055	416127	0006597F
17	7.127	17.058	467087	0007208F
<b>18</b>	<b>8.000</b>	<b>18.062</b>	<b>524288</b>	<b>00080000</b>
19	8.980	19.065	588493	0008FACD
20	10.079	20.069	660561	000A1451
21	11.314	21.072	741455	000B504F
22	12.699	22.076	832255	000CB2FF
23	14.254	23.079	934175	000E411F
<b>24</b>	<b>16.000</b>	<b>24.082</b>	<b>1048576</b>	<b>00100000</b>
25	17.959	25.086	1176986	0011F59A
26	20.159	26.089	1321122	001428A2
27	22.627	27.093	1482910	0016A09E
28	25.398	28.096	1664510	001965FE
29	28.509	29.100	1868350	001C823E
<b>30</b>	<b>32.000</b>	<b>30.103</b>	<b>2097152</b>	<b>00200000</b>
31	35.919	31.106	2353974	0023EB36
32	40.317	32.110	2642246	00285146
33	45.255	33.113	2965821	002D413D
34	50.797	34.117	3329021	0032CBFD
35	57.018	35.120	3736700	0039047C
<b>36</b>	<b>64.000</b>	<b>36.124</b>	<b>4194304</b>	<b>00400000</b>
37	71.838	37.127	4707947	0047D66B
38	80.635	38.130	5284492	0050A28C
39	90.510	39.134	5931642	005A827A
40	101.594	40.137	6658043	006597FB
41	114.035	41.141	7473400	007208F8
<b>42</b>	<b>128.000</b>	<b>42.144</b>	<b>8388608</b>	<b>00800000</b>
43	143.675	43.148	9415894	008FACD6
44	161.270	44.151	10568984	00A14518
45	181.019	45.154	11863283	00B504F3
46	203.187	46.158	13316085	00CB2FF5
47	228.070	47.161	14946800	00E411F0
48	251.189	48.000	16461899	00FB304B

## 5.3.2 Quick Reference Table for Shutter Settings

Exposure time [s]	ShutValue (Exposure time[s]×0x100000)	
	DEC	HEX
1/23.98	43734	0000AAD6
1/24	43691	0000AAAB
1/25	41943	0000A3D7
1/29.97	34987	000088AB
1/30	34953	00008889
1/50	20972	000051EC
1/59.94	17494	00004456
1/60	17476	00004444
1/90	11651	00002D83
1/100	10486	000028F6
1/125	8389	000020C5
1/180	5825	000016C1
1/250	4194	00001062
1/350	2996	00000BB4
1/500	2097	00000831
1/725	1446	000005A6
1/1000	1049	00000419
1/1500	699	000002BB
1/2000	524	0000020C
1/3000	350	0000015E
1/4000	262	00000106
1/6000	175	000000AF
1/8000	131	00000083
1/9600	109	0000006D
1/11200	94	0000005E
1/13600	77	0000004D

## 6. How to Operate the Camera with OSD Function

Connect a remote control (sold separately) to the remote control terminal of the camera to display the OSD menu on the monitor for operation.

### 6.1. How to Operate OSD Menu by Remote Controller

[CENTER]	Pressing this button when the OSD menu is hidden will display the OSD top menu on the monitor. It is also used to confirm the selected menu item.
[▲]	Move up.
[▼]	Move down.
[◀]	Change the option of the item.
[▶]	Change the option of the item.

### 6.2. Indication of OSD Menu

- Items with ▼ at the end of the line indicates that there are submenus to open with CENTER button.
- Items with ◀ at the end of the line indicates that there is an upper hierarchical menu to return with CENTER button.
- Items with ▶ at the beginning of the line indicates that CENTER button can execute command for the selected item. For other menus, commands are executed each time a selection is changed using [◀] [▶].
- User can only select typical values for gain, shutter value, etc. Not all values are adjustable. For more detailed settings, please use serial commands.
- Items that depend on the mode may be hidden depending on the mode setting. For example, if the gain mode is Auto, the camera will not display the gain value.

### 6.3. OSD Menu Hierarchical Structure

The hierarchical structure of the OSD menu is as follows. (Items for moving through the hierarchy are omitted.)

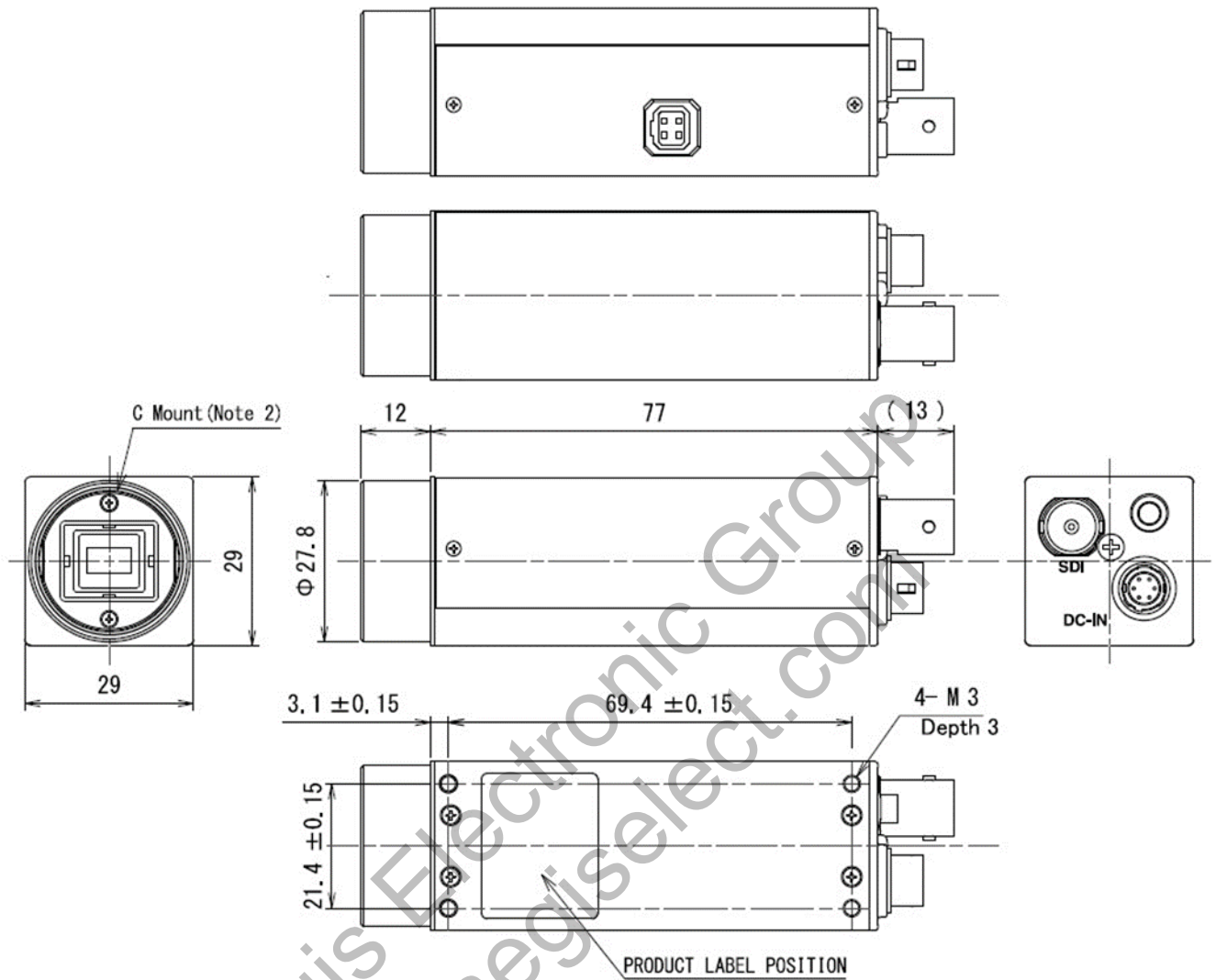
```

├ Output Format
|   └ Video Format
├ Gain/Shutter/Iris
|   ├── Gain Mode
|   ├── Gain Value
|   ├── Gain Max Value
|   ├── Shutter Mode
|   ├── Shutter Value
|   ├── Shutter Limit
|   ├── Iris Mode
|   ├── Iris Speed
|   ├── AE Speed
|   ├── Exp Comp Value
|   ├── Metering Mode
|   ├── Spot Block
|   ├── Flicker Cancel
|   └ High Sensitivity
├ White Balance
|   ├── WB Mode
|   ├── Auto Func
|   ├── Preset Func
|   ├── Preset Temp
|   └ Manual Memory

```

- | | Manual Red Gain
- | | Manual Blue Gain
- | | One Push WB
- | | LB Shift
- | | L CC Shift
- | Image Control
  - | | Red Balance
  - | | Green Balance
  - | | Blue Balance
  - | | Master Pedestal
  - | | Red Pedestal
  - | | Green Pedestal
  - | | Blue Pedestal
  - | | Detail
  - | | Gamma
  - | | Knee
  - | | D-Range
  - | | Noise Reduction
  - | | Color Correction
  - | | Color Saturation
  - | | Color Suppression
  - | | Cyan Suppression
  - | | Color Space
  - | | Color Adjustment
    - | | | Magenta (Hue/Saturation/Depth)
    - | | | Red (Hue/Saturation/Depth)
    - | | | Yellow (Hue/Saturation/Depth)
    - | | | Green (Hue/Saturation/Depth)
    - | | | Cyan (Hue/Saturation/Depth)
    - | | | L Blue (Hue/Saturation/Depth)
  - | | L SDI Compatibility
- | Flip
  - | | Horizontal Flip
  - | | L Vertical Flip
- | LTC
  - | | LTC Mode
  - | | L LTC Reset
- | GenLock
  - | | V Offset
  - | | L H Offset
- | Test Pattern
  - | | Test Pattern
  - | | Position X
  - | | L Position Y
- | OSD Color
  - | | OSD Color (Text/Highlight)
  - | | L Default
- | L Save/Load/Init
  - | | Save Settings
  - | | Load Settings
  - | | L Init Settings

7. Dimensions



Note 1. Screw length from the lens mount surface shall be less than 6mm.  
 And protruding portion of the C mount lens shall be less than 10mm.

935-0204-00  
 (Unit: mm)

Note 2. C mount screws comply with ANSI/ASME B1.1, 1-32UN(2B)

## 8. Warranty Policy, etc.

### 8.1. Product Warranty

The warranty period for this product is 1.5 years from the date of shipment.

If a failure occurs during this period due to our design or manufacturing, we will repair the product free of charge in accordance with the product service described in [Section 8.3. Product Services](#).

Repair after the warranty period will be charged if repair is possible.

CIS should not hold responsible for damages or losses if;

- damages or losses are caused by earthquake, lightning strike, fire, flood or other acts of God.
- damages or losses are caused by deliberate or accidental misuse by user, or failure to observe the information contained in the instructions in this Product Specification and Operational Manual.
- damages or losses are caused by repair or modification conducted by customer or any unauthorized party.

### 8.2. CMOS Pixel Defects

CIS applies defective pixel correction prior to shipment of the product. However, the number of defective pixels are subject to increase due primarily to the effect of cosmic rays. Due to this nature, CIS should not hold responsible for the natural increase of defective pixels.

### 8.3. Product Services

Should you have any problems in function of the product you purchased, and if you need our further analysis and/or repair, please contact your local distributor.

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