NDI®

4K UHDTV CMOS

AF ZOOM Color Camera Module

DCC-4KNDI

Product Specification

& Operational Manual

(Preliminary)

CIS Corporation

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1. Handling Precautions

1.1. Camera Handling Precautions

- ☐ Do not use or store the camera module in dusty or humid places.
- ☐ Due to zoom lens structure itself, dust may reach the surface of the image sensor while zooming and could have a bad influence on output images. Please make sure to embed the camera module into a fully dust-proof chassis/casing.
- ☐ When building-in the camera module to your products, we highly recommend you to work in a clean environment such as a clean room to avoid dust adhering around the image sensor.
- ☐ Do not apply excessive force, vibration, or static electricity that could damage the camera module. Please handle camera module with care.
- ☐ Do not shoot direct images that are extremely bright (e.g., strong light source, sun, etc.). When extremely strong light source was shot, smear or blooming may occur.
- ☐ When strong light irradiates the lens-barrel of the camera module, a leak of light could reach the surface of the image sensor and its projection could appear on an output image. Therefore, please use the camera module shielded from strong light irradiating other than the lens. Please make sure that a leak of light does not affect your system with the camera module embedded.
- ☐ Refer to Chapter 3.2., "External Connectors" for connecting the camera module.
  Improper connection may cause damages not only to the camera module but also to the connected devices.
- ☐ Confirm the mutual ground potential carefully before connecting the camera to monitors or computers.
  Any AC leaks from the connected devices may cause damages or destroy the camera module.
- ☐ Make sure to take protection countermeasures against surge voltage when camera is in use with surge voltage concerned to be applied to LAN cable connected.
- ☐ Do not apply excessive voltage. (Use only the specified voltage.) When using an AC adaptor, use only the CIS optional AC adaptor. Unstable or improper power supply voltage may cause damages or malfunction of the camera module and may cause a smoke, fire, and rupture.
- ☐ Air-cooling fan is equipped at the camera rear panel for cooling electronic components. Do not block the opening of ventilation hole.

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 module 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 environments other than specified in this manual.

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.
- deterioration of image quality is caused by dust adhered to image sensor area after shipment.
- deterioration of image quality is caused by scratches on image sensor and optical parts damaged by user.

2. Product Outline

DCC-4KNDI is a NDI® compatible 4K PoV camera with x18 auto focus zoom lens. Using a 1/1.8", rolling shutter CMOS image sensor, the camera outputs NDI® output signals corresponds to 3840 x 2160 or 1920 x 1080 with 60p/59.94p/50p/30p/29.97p/25p/24p/23.98p.

The addition of NDI® compatibility to its DCC-4KZM will greatly enhance its versatility by eliminating the use of SDI cables and enabling a single Ethernet cable connection to the acquisition system, making it more mobile and easy to control. This camera will neatly migrate into the advanced IP-based workflow made possible by NDI® technology.

*NDI® is a registered trademark of Vizrt Group

2.1. Features

- ☐ Complies with NDI® (Network Device Interface)
- ☐ Features CIS original ISP, "Clairvu™" for superb imaging quality.
- ☐ Noise reduction function (2DNR and 3DNR).
- ☐ x18 auto focus zoom lens.
- ☐ Dimensions: (H) 68.5mm x (W) 68mm ×(D) 120.6mm (without projection)
- ☐ Controllable with Ethernet or RS-232C.

2.2. Accessories

- ☐ Standard Accessory
  - Lens cap
- ☐ Optional Accessory
  - AC adaptor (model name: 5V-5A-S2-A-A)
- ☐ Software

※ CIS control software is provided for evaluation purpose only.

CIS should be held harmless for any damage arising from the use of this control software. The purpose of this control software is restricted to the evaluation and testing of this product only, and is not intended for commercial use by the customer. CIS will not customize the program nor provide the source code.

3. Specifications

3.1. General Specifications

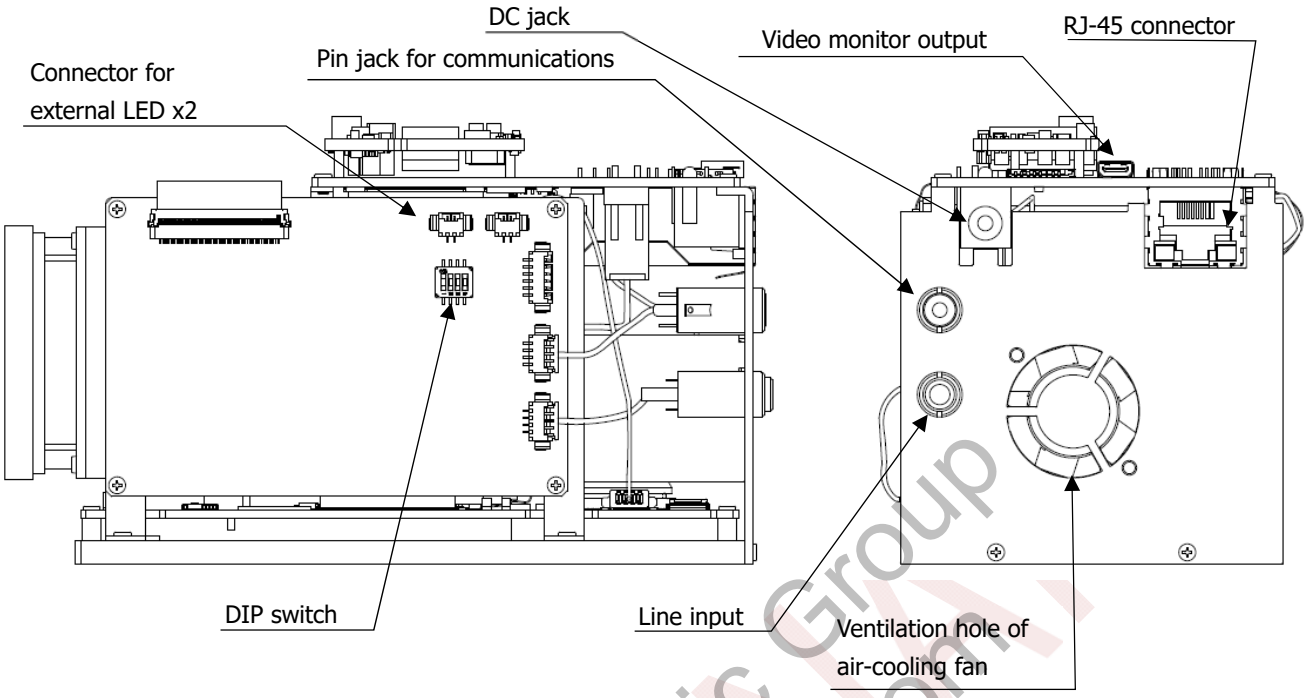
Electrical Specifications			
Pickup device	Device type	1/1.8" color CMOS sensor	
	Unit cell Size	2.0μm (H) × 2.0μm (V)	
Resolution		2160p: 3840 (H) × 2160 (V) 1080p: 1920 (H) × 1080 (V)	
Aspect ratio		16 : 9	
Video output format		NDI® output	Monitor output
		3840×2160p 60fps	1280×720p 60fps
		3840×2160p 59.94fps	1280×720p 59.94fps
		3840×2160p 50fps	1280×720p 50fps
		3840×2160p 30fps	1920×1080p 30fps
		3840×2160p 29.97fps	1920×1080p 29.97fps
		3840×2160p 25fps	1920×1080p 25fps
		3840×2160p 24fps	1920×1080p 24fps
		3840×2160p 23.98fps	1920×1080p 23.98fps
		1920×1080p 60fps	1280×720p 60fps
		1920×1080p 59.94fps	1280×720p 59.94fps
		1920×1080p 50fps	1280×720p 50fps
		1920×1080p 30fps	1920×1080p 30fps
		1920×1080p 29.97fps	1920×1080p 29.97fps
		1920×1080p 25fps	1920×1080p 25fps
		1920×1080p 24fps	1920×1080p 24fps
		1920×1080p 23.98fps	1920×1080p 23.98fps
Video format		NDI®	
Sensitivity		F4.0 (2000lx)	
Minimum illumination		0.7 lx (Conditions: AGC+48dB, iris fully open, electric shutter OFF)	
Gain variable range		AGC : 0dB～+48 dB * Noises may be noticeable at high gain.	
		MANUAL : 0dB～+ 48dB	
Shutter speed variable range		AUTO : 1/13600s～1/23.98s (Set the upper and the lower limitation. Minimum shutter speed varies depending on frame rate).	
		MANUAL : 1/13600s～1/23.98s (Minimum shutter speed varies depending on frame rate).	
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)	
Auto exposure detection		Average, Center-Weighted, Spot (1/256), Backlight Compensation	
Flicker cancellation		ON, OFF	
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	

Electrical Specifications (continued)	
Gamma	Complies with BT.709 curve: Contrast -2, -1, 0, +1, +2 Complies with BT.2100 (HLG) curve
Dynamic range	Low (for better SNR), Normal, High
Knee point	OFF, 100%, 95%, 90%, 85%, 80%, 75%
Color gamut	BT.709, BT.2020
Master Pedestal	-100 ～ 0 (typ.) ～ +100
Pedestal (R,G,B)	RGB independent, -100 ～ 0 (typ.) ～ +100
Color balance	RGB independent, 0 ～ 100 (typ.) ～ 200
Audio	Stereo line input (Gain setting: -34.5dB～+33.0dB)
Built-in lens	x18 Auto focus zoom lens f=6.6 ~ 120mm / maximum aperture F value 1.61 (wide) ~ 4.13 (tele)
Pixel defect correction (white spot)	Corrected upon shipment. Supports user setting.
Camera preset settings	1, 2, 3, 4 (User can set four kinds of preset.)
Remote control communications	Ethernet or RS-232C
Power requirements	PoE+ (IEEE 802.3at) AC adaptor input: DC 5V±5%
Power consumption	18W

Mechanical Specifications	
Dimensions	H:68.5mm W:68mm D:120.6mm (without projection) Refer to Section 6. Dimensions.
Weight	500g

Environmental Specifications		
Safety/Quality standards		UL: Components used comply with UL. RoHS: 2011/65/EU EN50581 (RoHS2)
Durability	Vibration	Acceleration : 3G
		Frequency : 10~150 Hz
		Direction : X, Y, and Z 3 directions
		Testing time : 30 minutes each
	Shock	No malfunction after 10 times drop from 1m height on 6 surfaces, 3 edges and 1 corner
Operation Guaranteed Temperature		0°C ～ +45°C Humidity: 20 ~ 80%RH with no condensation
Storage Temperature		-30 ～ +60°C Humidity: 20 ~ 80%RH with no condensation

3.2. External Connectors



3.2.1. RJ-45 Connector

Model name: 7499511611A (Würth Elektronik)
Signal system: 1000Base-T / PoE+

Use PoE power supply that complies with IEEE 802.3 at 30W.
Use high quality LAN cable with CAT5e and over.

3.2.2. DC Jack

Model name: MJ-179PH (Marushin Electric Mfg. Co., Ltd.)

When you do not supply power via PoE, use this connector to supply power from an optional AC adaptor.
Do not connect the optional AC adaptor while supplying power by PoE.
5V/4A input, outer diameter ϕ5.5mm / inner diameter ϕ2.1mm.
Use only CIS optional AC adaptor (model name: 5V-5A-S2-A-A).
Issues associated with the use of a third party's AC adaptor are out of warranty.

3.2.3. Video Monitor Output

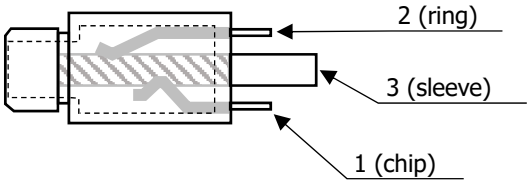
Model name: 10118242-001RLF (Amphenol ICC)

Video format is 1920 x 1080 (30fps and under) or 1280 x 720 (50fps and over) in 8 bit.
Frame rate varies depending on camera settings. Audio signals are not supported.

3.2.4. Line Input

Model name: MJ-074N-R (Marushin Electric Mfg. Co., Ltd.)

Connect ϕ3.5mm, 3-pole stereo mini plug.

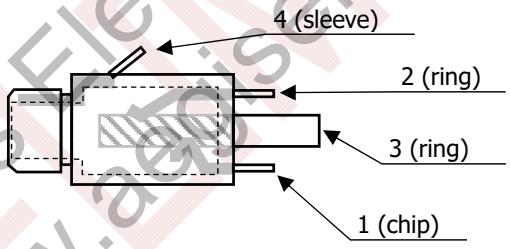


Pin No.	Signals
1	Line input (L)
2	Line input (R)
3	GND

3.2.5. Pin Jack for Communication

Model name: MJ-069-R (Marushin Electric Mfg. Co., Ltd.)

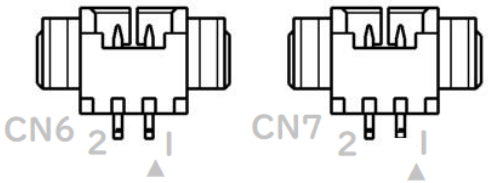
Connect ϕ2.5mm, 4-pole plug.

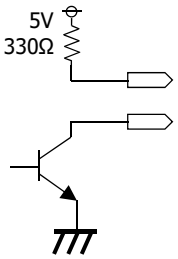


Pin No.	Signals
1	Test terminal. Do not connect.
2	RS-232C TX output
3	RS-232C RX input
4	GND

3.2.6. Connector for External LED

Model name: 53261-0271 (MOLEX)



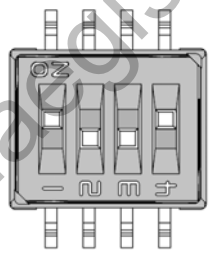


Connector Pin No.		Function
CN6	1	Connect cathode (-) of external LED_1.
	2	Connect anode (+) of external LED_1.
CN7	1	Connect cathode (-) of external LED_2.
	2	Connect anode (+) of external LED_2.

3.2.7. DIP Switch

Model name: CHS-04TB1 (COPAL)

This is not for users to operate. Do not change initial settings.



DIP-SW				Setting mode
1	2	3	4	
ON	OFF	OFF	ON	Camera normal operation
Other than the above				Test mode Camera stops operating normally.

4. Camera Functions

4.1. Defective Pixels Correction

In addition to the correction of defective pixels data registered upon shipment, we provide a method to update the defective pixels correction data. Please refer to Section 5.1.2, Serial Command List for details.

4.1.1 Defective Pixels Data Type

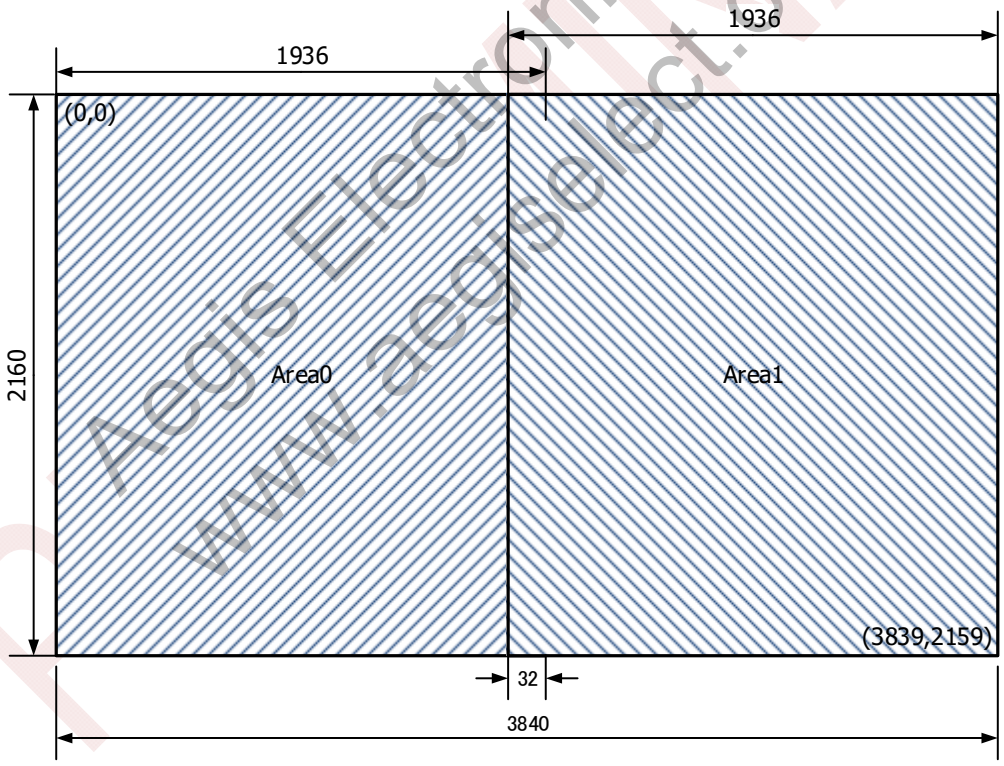
There are two types of defective pixels data.

- Defective data registered at factory
  Data registered upon shipment from our factory. These data cannot be over-written.
- Defective data registered by user
  Data registered by the user. These data can be over-written freely.

In case of H Flip and V Flip modes, coordinates of defective pixels are converted automatically with a shift of one pixel. This is due to the image sensor specifications.

4.1.2 Details on Defective Pixels Data

Defective pixels data are stored and controlled per two vertically divided regions. Up to 128 points per region, which makes it a total of 256 points, can be registered as user register data. There is an overlap of 32 pixels (width) between the two regions, and the defective pixel coordinates in the overlapping area are registered to both regions. Please refer to the below for the definition of region.



The coordinate system is based on the upper left origin. Each region is defined as;

- Area 0: (0, 0) – (1935, 2159)
- Area 1: (1904,0) – (3839,2159)

For example, if the defective pixel is at (1903,0), the data is registered only to region 0.
However, if the defective pixel is at (1904,0), the data is registered to both region 0 and 1.

4.1.3 Notes for Defective Pixels Correction

- To save data registered or deleted by a defective pixels correction command (SU 200~203), execute Save command (SU705).
- Init command (SU 700) does not restore defective pixels correction data. Use SU 203 to delete all data.
- Defective pixels correction data is not subject to Camera Setting Store/Load command (SU 100/101).
- User cannot save the same defective points as factory setting data as user registered data. If the same defective points as ex-factory data were detected, the camera ignores those points.
- If users specify a pixel data with the same coordinates of ex-factory data, camera returns an error.
- Please noted that the detected results may not always be the same due to temperature, noise, and other conditions.
- Neglecting the instruction may cause not only inappropriate pixel defect correction but also failure of getting proper images.

5. Camera Operation

There are three kinds of methods to control the camera.

☐ Control via serial communication (RS-232)

- All camera functions are supported.

☐ Control via HTTP

- All camera functions are supported.

☐ Control by NDI® PTZ Control

- Zoom and focus controls are supported.

5.1. Serial Communication

For network settings, please refer to Section 5.2 Operation by HTTP. "Serial Commands" are character strings to be sent via serial communication.

5.1.1 Serial Communication Specification

(1) Please refer to the below for the serial communication settings.

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

(2) Control code

- Text-based communication executes camera control. Only ASCII 0x20~0x7E, 0x0A(LF=¥n), 0x0D(CR=¥r) must be used. Please do not to use other than these codes.
- CR(0x0D) and LF(0x0A) are regarded as linefeed code and represent termination. Either CR or LF is used as linefeed code from host to camera. (CR is used as linefeed in the setting example (5) explained later). CR LF is used as linefeed code from camera to host.
- By sending command, parameter and linefeed code from host to camera, user can change camera settings and acquire camera setting parameters.
- There are two types of commands. One is SU command to send settings and instructions to the camera ("S" for "Set"), and the other is GU command ("G" for "Get") to obtain information from the camera. Function changes according to the address.
  Almost all addresses support both SU and GU commands. However, some addresses accept only SU or GU. GU commands acquire values set with SU commands (with some exceptions).

Command	Parameter 1	Parameter 2 (3, 4, ...)	Function
SU	Address	Set value (There may be more than one)	To change camera settings and instruct execution.
GU	Address	None (with some exceptions)	To obtain camera information such as set values.

(3) Serial command protocol

- Linefeed code and ">" should output from the camera as a prompt.
- Commands are not case-sensitive.
- Separate between a command and a parameter by single space (0x20).
- From the head of the input character to the linefeed code is defined as a single serial command.
- Parameters with 0x are regarded as Hexadecimal, the one with 0b are regarded as Binary, and others are

regarded as Decimal.

- Parameters are analyzed from the head to identifiable letters. Some inappropriate letters are ignored and some are regarded as errors.
- Please refer to "Section 5.1.2. Serial Command List" for details on address and data.
- Camera receives the returned command from the Host and echo it back. At this time, camera converts the linefeed code (CR or LF) to CR LF and echo it back.
- SU command returns prompt when successful. GU command returns acquired data (including linefeed) and prompt. When error occurs, both SU command and GU command return an error message starting with "ERROR" (including linefeed) and prompt.

(4) Other specifications

- Commands specified per pixel (AF frame, cross line position, and defective pixels related commands) are always specified by 3840 x 2160 coordinates regardless of video format settings.

(5) Setting examples

【Example of GU command】

To get information of the address 45 with GU command.

[Send]	GU[sp]45[¥r]	
[Returned value]	GU[sp]45[¥r][¥n]	[Echo back]
[Returned value]	100[¥r][¥n]	[Acquired data + Linefeed]
[Returned value]	[¥r][¥n]	[Linefeed]
[Returned value]	>[sp]	[> and space]

[¥r]=CR(0x0D)
[¥n]=LF(0x0A)
[sp]=space (0x20)

【Example of SU command】

To set 30 to the address 45 with SU command.

[Send]	SU[sp]45[sp]30[¥r]	
[Returned value]	SU[sp]45[sp]30[¥r][¥n]	[Echo back]
[Returned value]	[¥r][¥n]	[Linefeed]
[Returned value]	>[sp]	[> and space]

【Example of error occurred with SU command】

When setting 300 (out of setting range) to the address 45 with SU command.

[Send]	SU[sp]45[sp]300[¥r]	
[Returned value]	SU[sp]45[sp]300[¥r][¥n]	[Echo back]
[Returned value]	[ERROR] Parameter Error	[Error message] (Error message may be different).
[Returned value]	[¥r][¥n]	[Linefeed]
[Returned value]	>[sp]	[> and space]

5.1.2 Serial Command List

Video Format

Function	Address	Setting Value	Initial Value	Description
Video Format	1	0: 3840×2160p 60fps 1: 3840×2160p 59.94fps 2: 3840×2160p 50fps 3: 3840×2160p 30fps 4: 3840×2160p 29.97fps 5: 3840×2160p 25fps 6: 3840×2160p 24fps 7: 3840×2160p 23.98fps 8: 1920×1080p 60fps 9: 1920×1080p 59.94fps 10: 1920×1080p 50fps 11: 1920×1080p 30fps 12: 1920×1080p 29.97fps 13: 1920×1080p 25fps 14: 1920×1080p 24fps 15: 1920×1080p 23.98fps	0	This is to set NDI® video output format. Monitor output becomes the same frame rate, which is 1280x720 with over 50fps, and 1920 x 1080 with under 30fps.

AE related

Function	Address	Setting Value	Initial Value	Description
Gain Mode	2	0: Manual 1: Auto	1	This is to set gain control mode.
Gain Value	3	Magnification×0x10000 Setting range: 1～approx.251 (0x10000～0xFB304B)	0x10000 (65536)	This is to set gain value when gain mode is Manual. (*1) e.g.) To set x2 (approx. 6dB): SU 3 0x20000 ※ Please Refer to Section 5.1.3. Quick Reference Table for Gain Settings.
Gain Max Value	4	Magnification×0x10000 Setting range: 1～approx.251 (0x10000～0xFB304B)	0x200000 (2097152)	This is to set the maximum gain value when gain mode is Auto. (*1) ※Please refer to Section 5.1.3. Quick Reference Table for Gain Settings.
Shutter Mode	5	0: Manual 1: Auto	1	This is to set shutter control mode.
Shutter Value	6	Exposure time [s]×0x100000 Setting range: 1/13600～1/23.98s (0x4D～0xAAD6)	0x4444 (17476) 1/60s	This is to set shutter value (exposure time) when shutter mode is Manual. (*1) Shorter value than 1 frame length must be set. For example, when video format is 60fps, the maximum shutter value will be 0x4444 (1/60s) ※Please refer to Section 5.1.4 Quick Reference Table for Shutter Settings.

AE related (continued)

Function	Address	Setting Value	Initial Value	Description
Shutter Limit	7	The 1st Parameter: Max value Exposure time [s]×0x100000 Setting range: 1/13600～1/23.98s (0x4D～0xAAD6)	0x4444 (17476) 1/60s	This is to set shutter variable range when shutter mode is Auto. (*1) Shorter value than 1 frame length must be set. Max<Min is invalid. e.g.) To set Max=1/60s, Min=1/8000s: SU 7 0x4444 0x83 ※Please refer to Section 5.1.4 Quick Reference Table for Shutter Settings
		The 2nd Parameter: Min value Exposure time [s]×0x100000 Setting range: Same as Max value	0x4D (77) 1/13600s	
Iris Mode	61	0：Manual 1：Auto	1	This is to set iris control mode.
Maximum Aperture	63	None	None	This is to acquire the current maximum aperture F value. (GU only). F value varies depending on zoom position.
Aperture Value	64	0：Close 0x800(F22.6)～0x62C30(F1.61)	0x62C30 (404528)	This is to set aperture value when Iris Mode is Manual (*1). Calculates aperture value with F value. Aperture Value = 0x100000 / (F value x F value) e.g.) To set F4.0: SU 64 0x10000 Please refer to Section 5.1.5 Quick Reference Table or Iris Settings.
Aperture Limit	65	The 1st Parameter: Max value 0x800～0x62C30	0x62C30 (404528)	This is to set variable range of aperture value when Iris Mode is Auto. (*1) Max < Min is invalid. e.g.) To set Max=F2.0, Min=F8.0; SU 65 0x40000 0x4000
		The 2nd Parameter: Min value 0x800～0x62C30	0x800 (2048)	
Metering Mode	8	0：Average 1：Center-Weighted 2：Spot 3：Backlight Compensation	1	This is to set metering mode.
Spot Block	9	The 1st Parameter: X value: 0~15	7	This is to set X, Y, W, and H values for Spot metering. X: Far left of metering field Block, X coordinate Y: Top of metering field Block, Y coordinate W: Width of metering field (Block number) H: Height of metering field (Block number) e.g.) Execute SU 9 6 7 4 2 to set 4x2 block from the coordinate (6, 7).
		The 2nd Parameter: Y value: 0~15	7	
		The 3rd Parameter: W value: 1~16	2	
		The 4th Parameter: H value: 1~16	2	
AE Speed	10	0～15	10	This is to set AE convergence speed.

AE related (continued)

Function	Address	Setting Value	Initial Value	Description
Exposure Compensation Value	11	0: -12dB 1: -11dB ... 12: 0dB ... 23: +11dB 24: +12dB	12	This is to set exposure compensation value. Set value 12 is equivalent to 0dB. Settable per 1dB.
Flicker Cancel	12	0: Off 1: On	0	This is to set ON/OFF of flicker cancel. Valid only when video format is with 60fps, 59.94fps, 30fps, and 29.97fps.
Gain Value, Plus Minus	13	-1: decrease 1dB 1 : increase 1dB	None	This is to change gain value by ±1dB from the current setting. (*1) Valid when gain mode is Manual. (Dedicated to SU)
Shutter Speed, Plus Minus	14	-1: decrease 1step (1/4EV) 1 : increase 1step (1/4EV)	None	This is to change shutter speed by ±1 step (1/4EV) from the current value. When shutter value decreases by 1step, shutter value becomes bigger. (*1) Valid when shutter mode is with Manual. (Dedicated to SU)
Iris(F-number), Plus Minus	15	-1: decrease 1step (1/4EV) 1 : increase 1step (1/4EV)	None	This is to change F value of iris by ±1step (1/4EV) from the current setting. When the value reduces by 1step, aperture value becomes bigger. (*1) Valid when iris mode is Manual. (Dedicated to SU)
Current Gain	55	None	None	This is to acquire the current gain. (Dedicated to GU) (*1)
Current Shutter	56	None	None	This is to acquire the current shutter value. (Dedicated to GU) (*1)
Current Aperture	57	None	None	This is to acquire the current aperture (iris) value. (Dedicated to GU) (*1)

(*1)Note that in some cases, the specified values may not be reflected due to the physical limitation of the lens. One such instance is with the iris control, whereby the maximum F value is determined by the zoom position of the lens, and thus, depending on the zoom position of the lens, the actual F value can vary from the theoretical F value specified by the iris setting parameter. Confirm the actual control values with Current Gain, Current Shutter, and Current Aperture commands.

WB related

Function	Address	Setting Value	Initial Value	Description
WB Mode	20	0: Manual 1: Auto 2: Preset	1	This is to set White Balance (WB) mode.
WB Manual Memory	21	0～4	0	This is to choose the memory to store setting values when WB Mode is with Manual. You can store 5 types (0~4) of setting values.
Manual Red Gain	22	100～1600 (%)	191	This is to set Red Gain when WB Mode is Manual.
Manual Blue Gain	23	100～1600 (%)	179	This is to set 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	This is to execute One Push WB when WB mode is Manual. Choose a detection range with setting values. If execution of One Push WB is not properly processed, camera will return Run Time Error. (Do not shield light to execute this command). (Dedicated to SU)
WB Auto Func	25	0: Standard 1: Outdoor 2: Fluorescent	0	This is to choose 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	This is to choose operation when WB Mode is Preset.
WB Preset Temp	27	2500～15000(K)	5500	This is to set color temperature when WB Preset Func is Custom.
WB LB Shift	28	-10～10	0	This is to set shift amount of WB gain to Black Direction.
WB CC Shift	29	-10～10	0	This is to set shift amount of WB gain to Green Magenta direction.
Current Red Gain	58	None	None	This is to acquire the current Red Gain. (Dedicated to GU)
Current Blue Gain	59	None	None	This is to acquire the current Blue Gain. (Dedicated to GU)

Image Quality related

Function	Address	Setting Value	Initial Value	Description
Detail	30	0: Off 1(Low)~7(High)	3	This is to set details.
Gamma	35	0: BT.709 -2 1: BT.709 -1 2: BT.709 3: BT.709 +1 4: BT.709 +2 5: HLG75	2	This is to set gamma type and contrast. 0~4 are the curves comply with BT.709. Contrast changes in the range of -2 ~ +2. 5 is for HLG75 that means 75% output level is regarded as 100% input level.
Knee	36	0: Off 1: 100% 2: 95% 3: 90% 4: 85% 5: 80% 6: 75%	4	This is to set knee point. Valid except when Gamma is BT.709 and D-range is Low. Knee slope varies according to the selected maximum D-Range.
Master Pedestal	37	-100～+100	0	This is to set Master pedestal.
Red Pedestal	38	-100～+100	0	This is to set Red pedestal.
Green Pedestal	39	-100～+100	0	This is to set Green pedestal.
Blue Pedestal	40	-100～+100	0	This is to set Blue pedestal.
Red Balance	41	0～200	100	This is to set Red balance.
Green Balance	42	0～200	100	This is to set Green balance.
Blue Balance	43	0～200	100	This is to set Blue balance.
D-Range	44	0: Low Equivalent to 120% in BT.709 Invalid for HLG (Handled as Normal) 1: Normal Equivalent to 200% at BT.709 Equivalent to 600% at HLG 2: High 400% at BT.709 Equivalent to 1200% at HLG	1	This is to set Dynamic range. When Low, both D range and sensitivity decrease, but noise level becomes the lowest. When High, the minimum gain value will be limited to 0x20000. (Even with a lower value setting, gain value becomes 0x20000.) ※ The D-range definition of BT.709 and HLG are different, ref. below. (*2) [BT.709] 100% output level (without Knee) is regarded as 100% input level. [HLG] 50% output level is regarded as 100% input level.

(*2) The standard is IRE100% of when output range is set to the limited range (with super white).

Image Quality related (continued)

Function	Address	Setting Value	Initial Value	Description
Color Saturation	45	0～200	100	This is to set color saturation.
Cyan Suppression	46	0～15	15	This is to set suppression for Cyan saturation.
Color Adjustment	47	The 1st Parameter: Selection of color 0: Magenta 1: Red 2: Yellow 3: Green 4: Cyan 5: Blue The 2nd Parameter: Selection of item to adjust 0: Hue 1: Saturation 2: Depth The 3rd Parameter: Adjustment value -20～20	All 0	This is to set color adjustment values. There are three kinds of adjustment items for each 6 color, which makes it a total of 18 parameters for color adjustment. e.g.) To set -3 to Cyan Hue SU 47 4 0 -3 To execute GU, please specify the 1st parameter and the 2nd parameter. e.g.) To acquire adjustment value of Cyan Hue GU 47 4 0
Output Range	49	0: Limited range (without super white) 1: Limited range (with super white) 2: Full range	1	This is to set output range. Output range of Y (brightness) and C (Color difference) change as follows. At 0: Y:16～235, C: 16～240 At 1: Y:16～254, C: 1～254 At 2: Y: 0～255, C: 0～255
Noise Reduction	50	0: Off 1 (Low)～6 (High)	3	This is to set the level of noise reduction. With level 1, only 2DNR is effective. With level 2 and over, both 2DNR and 3DNR are effective. (*3)
Color Correction	52	0: Auto 1: Standard 2: Fluorescent Light 3: Tungsten Lamp	0	This is to set color correction.
Color Suppression	53	0: Off 1 (Low)~7(High)	0	This is to set color suppression.
Color Space	54	0: BT.709 1: BT.2020	0	This is to set color gamut.

(*3) When noise reduction level goes higher, residual images may become evident.

Noisy video source could result in higher bandwidth after image compression, which could result in drop of video frames. In such cases, please reduce the noise level by reducing gain and/or increasing noise reduction level.

Lens Control related

Function	Address	Setting Value	Initial Value	Description
Zoom Drive	66	The 1st Parameter: Move mode 0: To specify the absolute zoom position 1: To specify the relative zoom position 2: To specify direction for zoom to move	0	This is to move the zoom lens. There are three kinds of way to specify. Select with move mode. When move mode is 0 and 1, lens moves to the specified position and stops. When move mode is 2, lens starts moving by specifying -1 or 1, and stops with 0. (It also stops when lens reaches the wide edge or the tele edge). This command is non-blocking so that it returns prompt before completing its movement. (*4)
		The 2nd Parameter: 【When move mode is 0】 0 (wide edge)～1024 (tele edge) 【When move mode is 1】 -1024 (wide)～1024 (tele) 【When move mode is 2】 -1: Move to wide direction 1: Move to tele direction 0: Stop	0	
		The 3rd Parameter: Move speed 0～64	64	
Focus Drive	67	The 1st Parameter: Move mode 0: To specify absolute focus position 1: To specify relative focus position 2: To specify direction for focus to move.	0	This is to move focus lens when focus mode is Manual. There are three kinds of way to specify. Select with move mode. When move mode is 0 and 1, lens moves to the specified position and stops. When move mode is 2, lens starts moving by specifying -1 or 1, and stops with 0. (It also stops when lens reaches the far edge or the near edge). This command is non-blocking so that it returns prompt before completing its movement. (*4)
		The 2nd Parameter: 【When move mode is 0】 0 (far edge)～3584 (near edge) 【When move mode is 1】 -3584 (far side)～3584 (near side) 【When move mode is 2】 -1: Move to far direction 1: Move to near direction 0: Stop	0	
		The 3rd Parameter: Move speed 0～64	64	
Focus Mode	68	0：Manual 1：Auto	1	This is to set focus control mode. (*5)
Focus One Push Trigger	69	1 (Fixed)	None	This is to execute One Push AF when focus mode is Manual. This command is non-blocking so that it returns prompt before completing its movement. With GU 69, user can acquire operating status of One Push AF. (0=stop, 1=in operation).

(*4) If user changes video format while the lens is moving (zooming), the lens stops movement.

(*5): In AF mode, the AF may lose focus when abrupt zoom in/out is applied.

Lens Control related (continued)

Function	Address	Setting Value	Initial Value	Description
Current Zoom Speed	71	None	None	This is to acquire the current zoom speed. (GU Only) (*6)
Current Focus Speed	72	None	None	This is to acquire the current focus speed (GU Only) (*6)
AF Frame	73	The 1st Parameter: X value 0～3360	480	This is to set AF detection area. X: X coordinate of the left edge of AF detection area Y: Y coordinate of the top of AF detection area W: Width of AF detection area H: Height of AF detection area When improper combination such as (X+W>3840 or Y+H>2160) are set, error will occur. e.g.) To set detection area 1920x1080 from the coordinates (960,540), SU 73 960 540 1920 1080
		The 2nd Parameter: Y value 0～1890	270	
		The 3rd Parameter: W value 480～3840	2880	
		The 4th Parameter: H value 270～2160	1620	
Current ICF Position	74	None	None	This is to acquire the current position of IR cut filter. (GU Only). Returns 0=Out or 1=In.
IRCut Filter Mode	75	0: IR cut filter Out 1: IR cut filter In 2: IR cut filter Auto	1	This is to set IR cut filter mode. Set OUT when you wish to remove the IR cut filter. The image automatically changes to monochrome. With Auto mode, control of IR cut filter Out/In automatically changes according to the gain value.
Auto ICF Threshold	76	The 1st Parameter: Out Threshold 0x10000～0xFB304B	0x200000	This is to set the threshold when IR cut filter mode is Auto. Out Threshold: When IR cut filter mode is IN, it will become OUT if gain value exceeds this value. In Threshold: When IR cut filter mode is OUT, it will become IN if gain value becomes lower than this value. Out Threshold≦In Threshold is invalid.
		The 2nd Parameter: In Threshold 0x10000～0xFB304B	0x10000	
Current Zoom Position	78	None	None	This is to acquire the current zoom position. (GU Only). (*7)
Current Focus Position	79	None	None	This is to acquire the current focus position. (GU Only). (*7)

(*6): 0 may return if user executes this command immediately after issuing Zoom drive or Focus drive commands. If you wish to execute this command to check the completion of movement, wait for at least more than one frame after executing Zoom Drive or Focus Drive.

(*7): In some cases, the actual zoom position or focus position may not match the values set by Zoom Drive or Focus Drive because zoom position and focus position use normalized values.

OSD related

Function	Address	Setting Value	Initial Value	Description
OSD Up button	90	0: 1 push 1: continuous push	None	Commands to operate OSD. Send commands every 60msec for continuous push. (SU Only)
OSD Down button	91	0: 1 push 1: continuous push	None	
OSD Right button	92	0: 1 push 1: continuous push	None	
OSD Left button	93	0: 1 push 1: continuous push	None	
OSD Center button	94	0: 1 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	This is to set the text color of OSD menu.
Highlight Color	96	0: Black 1: Blue 2: Red 3: Magenta 4: Green 5: Cyan 6: Yellow 7: White	5	This is to set the selected letter's font color of OSD menu. If user specifies the same color as the text color, error will occur because the selected letters cannot be recognized.
OSD Off	99	1 (fixed)	None	This is to close OSD menu.

Others

Function	Address	Setting Value	Initial Value	Description
Camera Setting Store	100	0～3	0	User can store four kinds of camera settings. Execute SAVE (SU 705 1) to save the registered values into the nonvolatile memory. The registered data and where to store (the value for this address) are not subject to Init command (SU 700 0).
Camera Setting Load	101	0～3		This is to read out and reflect the registered values set by Camera Setting Store to the camera. Selection of address to store and address to load are common so that this command keeps the last set values with Store or Load. (GU 100 and GU 101 always return the same value).
H Flip	110	0: Off 1: On	0	This is to set horizontal flip of the output image.
V Flip	111	0: Off 1: On	0	This is to set vertical flip of the output image.
Test Pattern	120	0: Off 1: Cross Line 2: Color Bar	0	This is to set test pattern. H Flip and V Flip settings does not affect the test pattern. (Test pattern does not flip).
Cross Line Position	121	The 1st Parameter: X coordinate 0～3839	1920	This is to set the address of the crossing point when Cross Line is selected
		The 2nd Parameter: Y coordinate 0～2159	1080	
Audio Gain	130	0: -34.5dB 1: -33.0dB … 23: 0dB … 44: 31.5dB 45: 33dB	23	This is to set gain for audio line input. Setting value 23 is equivalent to 0dB. Settable per 1.5dB.
FPGA Temperature	180	None	None	This is to acquire FPGA temperature【℃】 (GU Only).
Init	700	0 (fixed)	None	This is to restore camera settings to initial values. Camera store data, where to store, defective pixel correction data, and baud rate are not subject to this command. (SU Only)
Save	705	1 (fixed)	None	This is to save camera settings. After storing the current camera settings by Store (Equivalent to SU100), this command saves the stored data, the address to store, defective pixel correction data, baud rate, and lens adjustment values. (SU Only) (*8)
Version Information	721	1: Microcomputer version 2: FPGA version	None	This is to acquire version information. (GU Only)

(8*) : As to Zoom Drive and Focus Drive, the current zoom position and the current focus position at execution of SAVE command will be saved instead of the set values. When loaded, the lens will return to the saved zoom and focus position.

Others (continued)

Function	Address	Setting Value	Initial Value	Description
Baud Rate	725	9600, 38400, 115200 (bps)	9600	This is to set the speed of serial communication. Reflects changes made after rebooting. Execute SAVE command (SU 705) to save the setting. This command is not subject to Camera Setting Store/Load command (SU 100/101) This command is not subject to Init command (SU 700) so that Initi command does not restore the settings. Execute Factory Reset command (SU 9999) to restore the setting. (Reflects changes made after rebooting). CIS remote controller, RU-100, operates only with 9600bps.
Factory Reset	9999	1 (fixed)	None	This is to restore settings to factory settings. No need to execute SAVE command. Please reboot the camera after executing this command. This command restores entire settings, not only camera settings but also network settings and others. (SU Only).

Defective Pixels Correction

Function	Address	Setting Value	Initial Value
Detection of defective pixels	200	The 1st Parameter: Threshold level: 0 ~ 4095 The 2nd Parameter: Registration mode. 0: New registration 1: Additional registration	This is to detect defective pixels (white defect) and register them as user register data. Defective pixels are output value, which exceeds the threshold level. Execute this command with light shielded and set appropriate gain and shutter values.
Registration of defective pixels	201	The 1st Parameter: X coordinate 0 ~ 3839 The 2nd Parameter: Y coordinate 0 ~ 2159	This is to register defective pixels as user register data by specifying their coordinates.
Deletion of defective pixels	202	The 1st Parameter: X coordinate: 0 ~ 3839 The 2nd Parameter: Y coordinate 0 ~ 2159	This is to delete defective pixels from user register data by specifying their coordinates. (Dedicated to SU)
Deletion of defective pixels correction data	203	1: Entire deletion	Delete all of user register Data. (Dedicated to SU)
Indication of defective pixels correction data	204	1: Indicate the coordinates and their attributes of all defective pixels. 2: Indicate the coordinates and their attributes of user register data. 3: Indicate the total number of all registered defective pixels per reed. 4: Indicate the number of user register data per reed.	This is to indicate information on the registered defective pixels correction data. (Dedicated to GU)

- When user specifies "new registration" with defective pixel detection command, the command deletes only user register data by defective pixel detection. The command does not delete data registered by defective pixel registration command.
- The command classifies the registered defective pixels into four types. Attribute [W] and [B] are for the data registered at factory, attribute [U] is the data registered by user with defective pixels detection command, and attribute [P] is the data registered by user with defective pixels registration command.
- [GU 200] command shows the number of pixels classified under [U] attribute, and [GU 201] command shows the number of pixels classified under [P] attribute.
- User can change only user register data, and cannot remove the factory setting data.
- User cannot register the pixels already been registered as factory data.

Lens Adjustment

Function	Address	Setting Value	Initial Value	Function
Gain for fine tuning focus position	270	0 (x0) ～32 (x2)	16	This is to set gain for fine tuning focus position. Valid as a gain against temperature offset parameter. Specify values in the multiple of 16. (The initial value of 16 means x1). Usually, use with the initial value. This command is not subject to Camera Setting Store/Load and Init.
Offset for fine tuning focus position	271	-16～16	0	This is for defining offset value for fine tuning the focus position. Valid as an offset against original zoom tracking curve. Usually, use with the initial value. This command is not subject to Camera Setting Store/Load and Init.

5.1.3 Quick Reference Table for Gain Settings

	Magnification	dB	Gain Value (Mag.×0x10000)	
			DEC	HEX
0	**1.000**	**0.000**	**65536**	**00010000**
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
6	**2.000**	**6.021**	**131072**	**00020000**
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
12	**4.000**	**12.041**	**262144**	**00040000**
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
18	**8.000**	**18.062**	**524288**	**00080000**
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
24	**16.000**	**24.082**	**1048576**	**00100000**
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
30	**32.000**	**30.103**	**2097152**	**00200000**
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
36	**64.000**	**36.124**	**4194304**	**00400000**
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
42	**128.000**	**42.144**	**8388608**	**00800000**
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

5.1.4 Quick Reference Table for Shutter Settings

Exposure time [s]	Shutter Value (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

5.1.5 Quick Reference Table for Iris Settings

F Value	Aperture Value ((1/F2) × 0x100000)	
	DEC	HEX
22.6	2048	00000800
19.0	2896	00000B50
16.0	**4096**	**00001000**
13.5	5792	000016A0
11.3	8192	00002000
9.51	11585	00002D41
8.00	**16384**	**00004000**
6.73	23170	00005A82
5.66	32768	00008000
4.76	46340	0000B504
4.00	**65536**	**00010000**
3.36	92681	00016A09
2.83	131072	00020000
2.38	185363	0002D413
2.00	**262144**	**00040000**
1.68	370727	0005A827
1.61	**404528**	**00062C30**

5.1.6 How to Operate Camera with OSD Function

In addition to operation by serial communication explained earlier, you can operate the camera with OSD menu on a monitor screen by connecting an optional remote controller (TBD) to the camera. Note that OSD menu does not appear on NDI® output screen. The remote controller sends OSD related commands explained in the Command List so that you can also operate OSD menu by sending these commands without using the remote controller.

How to operate OSD menu by optional remote controller.

[CENTER]	This is to indicate OSD top menu on your monitor screen. This is also used to choose the selected menu.
[▲]	Move up
[▼]	Move down
[◀]	Change options.
[▶]	Change options.

Indication of OSD menu

- Menu with ▼ at the line end indicates that submenu can be opened with CENTER button.
- Menu with ↵ at the line end indicates that menu returns to the upper menu with CENTER button.
- Menu with ▶ at the line head indicates that the selected value is reflected (Executes command) with CENTER button. Push CENTER button to reflect the selected values. Menu shows the reflected values as [5], and shows values to be reflected (not reflected yet) as <5>.
- For other items without ▶ at the line head, values are reflected (Execute commands) every time selections are changed by [◀] [▶].
- As to gain and shutter values, only representative values can be selected. For detailed settings, please use serial commands.
- Shown menus change according to modes. For example, Gain Value menu will not appear when gain mode is with Auto.

5.2. How to Operate Camera with HTTP

You can operate camera with HTTP. Basically, WEB API defines all function. By executing Web API, you can operate camera and control camera settings. Web UI is also prepared for camera control via Web browser.

5.2.1 Web API Specification

Protocol	HTTP
HTTP Method	GET (Valid all function except firmware update function) POST (Valid only for firmware update function)
Authentication	None (default) / HTTP Basic / HTTP Digest
Request URI	`/api/v1/cam/...` (camera related) `/api/v1/net/...` (network related) `/api/v1/sys/...` (system related) Use character strings only with ASCII below. Alphabet: `A`〜`Z`, `a`〜`z` Numbers : `0`〜`9` Hyphen-minus: `-` Dot: `.` Underscore: `_` Slush: `/` (Only as a separator, delimiter)
Response	JSON format (`Content-type: application/json`) code (numerical value) : execution result (0=normal completion, Other than 0 =error occurred) message (character strings) : acquired data and others

Examples shown in the later section are execution examples using curl command < https://curl.se/>, with assuming IP address was 192.0.2.10. In case of when HTTP authentication is set, you need to add proper authentication information using --user, --digest options.

5.2.2 Camera Related API

You can execute serial commands via Web API. Use serial commands in the command list as they are.

Function	Execution of GU command
Request URI	/api/v1/cam/gu/<addr>
Response	code: 0=normal completion Other than 0 = error occurred message: Acquired information (with normal completion) or error message (when error occurred)
Explanation	This is to execute GU command. Not case-sensitive for "gu" part. When executing GU command with a parameter, use slash instead of a space. /api/v1/cam/gu/<addr>/<param> For example, to acquire setting values of Video Format, execute http://<camera IP address>/api/v1/cam/gu/1 and the response will be as follows. {"code": 0, "message": "0"}
Initial value	Refer to Serial Command List
Example	To execute GU 50 (to acquire setting values of Noise Reduction), $ curl http://192.0.2.10/api/v1/cam/gu/50 {"code": 0, "message": "3"}

Function	Execution of SU command
Request URI	/api/v1/cam/su/<addr>/<param>
Response	code: 0=normal completion Other than 0 = error occurred message: Empty string (with normal completion) or error message (when error occurred)
Explanation	This is to execute SU command. Not case-sensitive for "su" part. When executing SU command with several parameters, use slash instead of a space. /api/v1/cam/su/<addr>/<param1>/<param2> For example, to set 2 as Video Format setting value, execute http://<camera IP address>/api/v1/cam/su/1/2 and the response will be as follows. {"code": 0, "message": ""}
Example	To execute SU 1 2 (to set Video Format to 2), $ curl http://192.0.2.10/api/v1/cam/su/1/2 {"code": 0, "message": ""}

5.2.3 Network Related API

Function	Acquisition of device name
Request URI	/api/v1/net/get/devname
Response	code: 0=normal completion Other than 0 = error occurred message: Device name (with normal completion)
Explanation	This is to acquire device name.
Initial value	4kndi
Example	$ curl http://192.0.2.10/api/v1/net/get/devname {"code": 0, "message": "4kndi"}

Function	Setting device name
Request URI	/api/v1/net/set/devname/<devname>
Response	code: 0=normal completion Other than 0 = error occurred message: The set device name (with normal completion)
Explanation	This is to set device name (host name). Specify device name to the position of <devname> within 30 letters. Use only alphabet, number, and hyphen-minus. Function converts alphabets to lower case letters. Do not use hyphen-minus at the head and the end. At normal completion, camera reboots automatically after returning response.
Example	To set device name as foobar. $ curl http://192.0.2.10/api/v1/net/set/devname/foobar {"code": 0, "message": "foobar"}

Function	Acquisition of NDI® name
Request URI	/api/v1/net/get/ndiname
Response	code: 0=normal completion Other than 0 = error occurred message: NDI® name (with normal completion)
Explanation	This is to acquire NDI® name.
Initial value	NDI
Example	$ curl http://192.0.2.10/api/v1/net/get/ndiname {"code": 0, "message": "NDI"}

Function	Setting NDI® name
Request URI	/api/v1/net/set/ndiname/<ndiname>
Response	code: 0=normal completion Other than 0 = error occurred message: The set NDI® name with normal completion.
Explanation	This is to set NDI® name. Specify NDI® name to the position of <ndiname> within 30 letters. All character strings for request URI are usable except slash. When setting, NDI® output temporally stops.
Example	To set NDI® name as foobar. $ curl http://192.0.2.10/api/v1/net/set/ndiname/foobar {"code": 0, "message": "foobar"}

Function	Acquisition of NDI® group
Request URI	/api/v1/net/get/ndigroup
Response	code: 0=normal completion Other than 0 = error occurred message: NDI® group (with normal completion).
Explanation	This is to acquire NDI® group.
Initial value	None (empty letter string)
Example	$ curl http://192.0.2.10/api/v1/net/get/ndigroup {"code": 0, "message": ""}

Function	Setting NDI® group
Request URI	/api/v1/net/set/ndigroup (To set no NDI® group) /api/v1/net/set/ndigroup/<ndigroup> (To set NDI® group)
Response	code: 0=normal completion Other than 0 = error occurred message: The set NDI® group with normal completion.
Explanation	This is to set NDI® group. With the Request URI shown as the 1st line in the above, no NDI® group is set. With the Request URI shown as the 2nd line in the above, specify NDI® group to the position of <ndigroup> within 30 letters. All character strings for Request URI except slash are valid. When setting, NDI® output temporally stops.
Example	To set NDI® group as foobar, $ curl http://192.0.2.10/api/v1/net/set/ndigroup/foobar {"code": 0, "message": "foobar"}

Function	Acquisition of NDI® discovery server
Request URI	/api/v1/net/get/ndidiscovery
Response	code: 0=normal completion Other than 0 = error occurred message: IP address of NDI® discovery server with normal completion.
Explanation	This is to acquire IP address of NDI® discovery server. Returns empty letter strings with no setting.
Initial value	None (empty letter string)
Example	$ curl http://192.0.2.10/api/v1/net/get/ndidiscovery {"code": 0, "message": ""}

Function	Setting NDI® discovery server
Request URI	/api/v1/net/set/ndidiscovery (To set no NDI® discovery server) /api/v1/net/set/ndidiscovery/<address> (To set NDI® discovery server)
Response	code: 0=normal completion Other than 0 = error occurred message: The set IP address of NDI® discovery server with normal completion.
Explanation	This is to set IP address of NDI® discovery server. With the Request URI shown as the 1st line in the above, NDI® discovery server setting will be none. With the Request URI shown as the 2nd line in the above, function specifies IP address of NDI® discovery server. NDI® output temporally stops when setting.
Example	To set 203.0.113.1 as the IP address of NDI® discovery server. $ curl http://192.0.2.10/api/v1/net/set/ndidiscovery/203.0.113.1 {"code": 0, "message": "203.0.113.1"}

Function	How to transmit NDI®
Request URI	`/api/v1/net/get/nditransmission`
Response	code: 0=normal completion Other than 0 = error occurred message: Information on how to transmit with normal completion.
Explanation	This is to acquire information on how to transmit NDI® Returns one out of `tcp, udp, multicast/<netprefix>/<netmask>/<ttl>`
Initial value	tcp
Example	`$ curl http://192.0.2.10/api/v1/net/get/nditransmission` `{"code": 0, "message": "tcp"}`

Function	Setting how to transmit NDI®
Request URI	`/api/v1/net/set/nditransmission/tcp` (To set TCP) `/api/v1/net/set/nditransmission/udp` (To set UDP) `/api/v1/net/set/nditransmission/multicast/<netprefix>/<netmask>/<ttl>` (To set multicast)
Response	code: 0=normal completion Other than 0 = error occurred message: Any one of `tcp, udp, and multicast` with normal completion.
Explanation	This is to set how to transmit NDI®. TCP with default. To use UDP, enable UDP with receiving side as well. To use multicast, please make sure network environment supports conditions. NDI® output temporally stops when setting.

Example	To set TCP transmission for NDI®
	`$ curl http://192.0.2.10/api/v1/net/set/nditransmission/tcp`
	`{"code": 0, "message": "tcp"}`

Function	Acquisition of IP address
Request URI	`/api/v1/net/get/ipaddr`
Response	code: 0=normal completion Other than 0 = error occurred message: IP address information (with normal completion)
Explanation	This is to acquire IP address information. When IP address is DHCP setting, it returns `dhcp`. When IP address is static setting, it returns `static/<address>/<netmask>` or `static/<address>/<netmask>/<gateway>`. The former means that default gate way is not set.
Initial value	dhcp

Example	With DHCP setting,
	`$ curl http://192.0.2.10/api/v1/net/get/ipaddr`
	`{"code": 0, "message": "dhcp"}`
	
	With static setting (when default gate way is not set),
	`$ curl http://192.0.2.10/api/v1/net/get/ipaddr`
	`{"code": 0, "message": "static¥/192.0.2.10¥/255.255.255.0"}`

Function	Setting IP address
Request URI	/api/v1/net/set/ipaddr/dhcp /api/v1/net/set/ipaddr/static/<address>/<netmask> /api/v1/net/set/ipaddr/static/<address>/<netmask>/<gateway>
Response	code: 0=normal completion Other than 0 = error occurred message: dhcp or static with normal completion
Explanation	This is to set IP address. By specifying dhcp, you can get an IP address from DHCP server. When DHCP server is not found, Auto IP function works and automatically assigns a link local address with 169.254.ddd.ddd format. By specifying static, you can assign an IP address statically. Default gate way is optional. All <address>, <netmask>, and <gateway> must be in ddd.ddd.ddd.ddd format to specify. At normal completion, camera reboots automatically after returning response. Please note that invalid settings may disconnect your network. In such cases, execute Factory Reset Command by serial communication to restore to factory settings.
Example	To set address 192.0.2.20, netmask 255.255.255.0. $ curl http://192.0.2.10/api/v1/net/set/ipaddr/static/192.0.2.20/255.255.255.0 {"code": 0, "message": "static"}

5.2.4 System related API

Function	Acquisition of HTTP authentication information
Request URI	/api/v1/sys/get/auth
Response	code: 0=normal completion Other than 0 = error occurred message: HTTP authentication information (with normal completion)
Explanation	This is to acquire HTTP authentication information. none: No HTTP authentication is required. (You can access HTTP without authentication.) basic: HTTP basic authentication is set. digest: HTTP digest authentication is set. Neither user name or password can be acquired when basic authentication or digest authentication is set.
Initial value	none

Example	With no authentication setting.
	$ curl http://192.0.2.10/api/v1/sys/get/auth
	{"code": 0, "message": "none"}
	
	With digest authentication setting. (User name foo, password bar)
	$ curl --digest --user foo:bar http://192.0.2.10/api/v1/sys/get/auth
	{"code": 0, "message": "digest"}

Function	Setting of HTTP authentication
Request URI	/api/v1/sys/set/auth/none /api/v1/sys/set/auth/basic/<user>/<password> /api/v1/sys/set/auth/digest/<user>/<password>
Response	code: 0=normal completion Other than 0 = error occurred message: Any one of none, basic, and digest, with normal completion.
Explanation	This is to set HTTP authentication. Specify none to enable access without HTTP authentication. Specify basic to enable access with HTTP basic authentication. Specify digest to enable access with HTTP digest authentication. User can set only single set of user name and password. When a new user name is set, prior user name becomes invalid. Both user name and password must be in 1～16 letters to set. Please take caution with your user name and password since these information simply flow on network when executing API. With normal completion, camera reboots automatically after returning response. If you lost your user name or password and unable to connect HTTP, execute Factory Reset Command from serial communication to restore to factory settings.
Example	To set digest authentication with user name foo and password bar, $ curl http://192.0.2.10/api/v1/sys/set/auth/digest/foo/bar {"code": 0, "message": "digest"}

Function	Reboot
Request URI	`/api/v1/sys/reboot`
Response	code: 0=normal completion Other than 0 = error occurred message: none
Explanation	This is to reboot after returning response.
Example	`$ curl http://192.0.2.10/api/v1/sys/reboot` `{"code": 0, "message": ""}`

Function	Factory reset
Request URI	`/api/v1/sys/factoryreset`
Response	code: 0=normal completion Other than 0 = error occurred message: none
Explanation	This is the same as Factory Rest (SU 9999 1) with serial command to restore all settings to factory Settings. Only the difference from using serial command is to reboot automatically after returning response.
Example	`$ curl http://192.0.2.10/api/v1/sys/factoryreset` `{"code": 0, "message": ""}`

Function	Firmware update
Request URI	`/api/v1/sys/fwup`
Response	code: 0=normal completion Other than 0 = error occurred message: Return `updated` with normal completion.
Explanation	This is to update firmware. This API only uses POST. Upload files with `Content-Type: multipart/form-data` With normal completion, camera reboots automatically after returning response. It takes approx. 10 seconds to return response. Do not disconnect power while waiting.

Example	When update file, fwup-4kndi-1_2.bin, is in the current directory,
	(Note that –X and POST are optional although example below shows these.)
	`$ curl -X POST -F fw=@fwup-4kndi-1_2.bin http://192.0.2.10/api/v1/sys/fwup`
	`{"code": 0, "message": "updated"}`

5.2.5 How to Operate Camera via Web Browser

You can operate camera via Web browser as well instead of directly using Web API. For example, when using an NDI® studio monitor, click the gear-shaped icon shown at the right bottom. It opens a Web browser and allows you to operate camera via Web browser. Recommendation to use is Google Chrome.

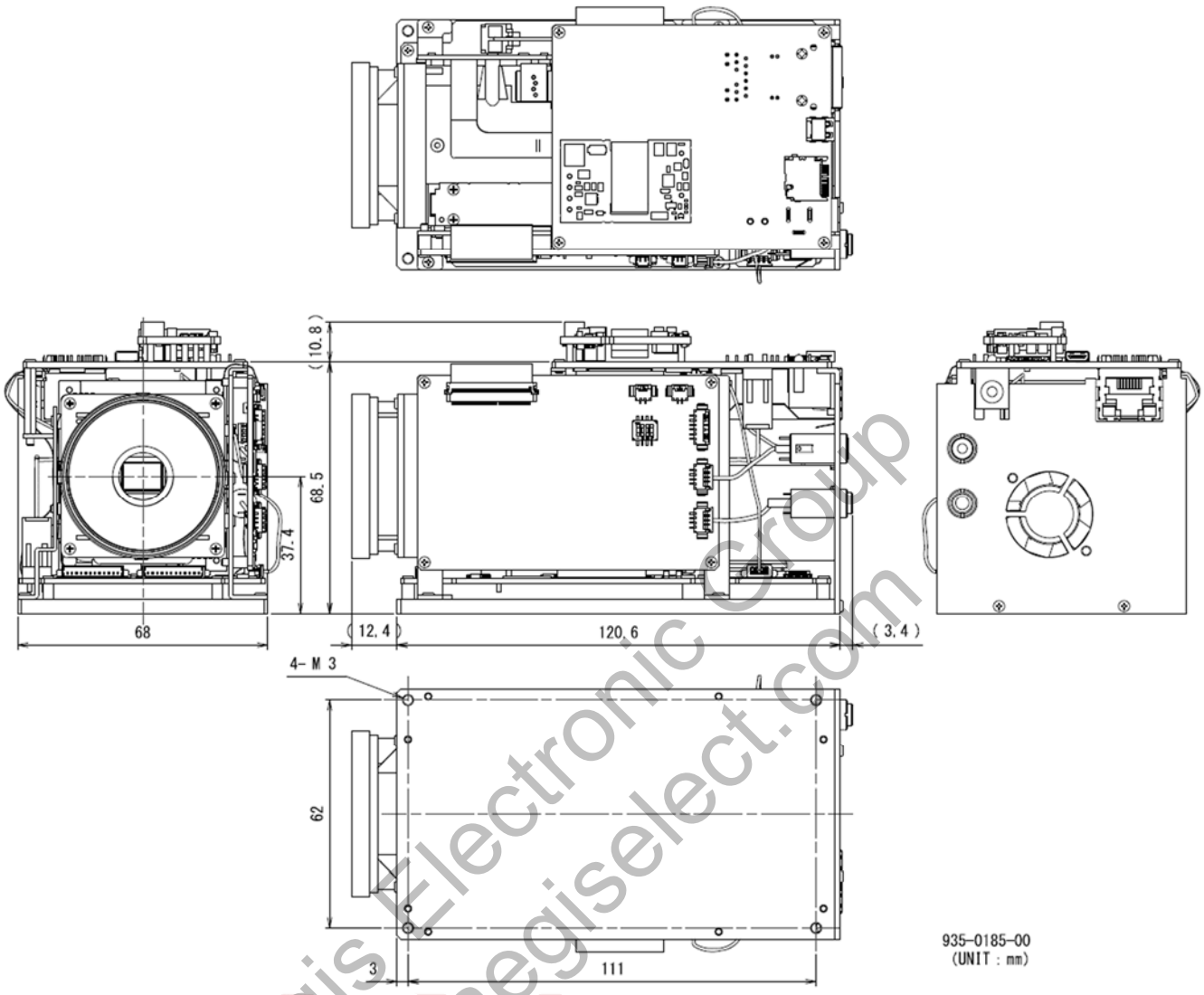
The values when you open the page will appear. Browser does not reflect the values changed by serial command or PTZ control explained later. If you wish to update the status, reload. To update the zoom and focus position information, there is a dedicated REFRESH button.

5.3. How to Operate Camera with NDI® PTZ Control

You can operate only zoom and focus of camera using PTZ control function supported by NDI®.

For example, when using an NDI® studio monitor, check [Settings] – [PTZ Settings] – [Show PTZ Controls]. It shows PTZ control for you to use and operate zoom and focus of camera (including switching of auto focus and manual focus).

6. Dimensions



7. Case for Indemnity (Limited Warranty) and Others

7.1. Product Warranty

The term of warranty of this product is within 1.5 years from the date of shipping out from our factory.
If you use the product properly and discover a defect during the warranty period, and if that was caused by designing or manufacturing, CIS Corporation, at its option, repairs or replaces it at no charge to you. Products out of warranty period will be subject to charge.

CIS should be exempted from taking responsibility and held harmless for damages or losses incurred by the following cases

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

7.2. CMOS Defective Pixels

CIS applies defective pixels correction prior to the 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.

7.3. Product Support

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.

7.4. License of Use

NDI® is a registered trademark of Vizrt Group. DCC-4KNDI uses the following open source software.

Software	URL	License
Vue.js	https://vuejs.org/	https://github.com/vuejs/vue/blob/dev/LICENSE
Vue Router	https://router.vuejs.org/	https://github.com/vuejs/vue-router/blob/dev/LICENSE
Vuetify	https://vuetifyjs.com/	https://github.com/vuetifyjs/vuetify/blob/master/LICENSE.md
axios	https://axios-http.com/	https://github.com/axios/axios/blob/master/LICENSE
core-js	https://github.com/zloirock/core-js	https://github.com/zloirock/core-js/blob/master/LICENSE
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