CIS

3G-SDI × 4ch

4K UHDTV CMOS Color Camera Module

DCC-4K2

Product Specification

& Operational Manual

CIS Corporation

Table of Contents

1. Handling Precautions

1.1. Camera Handling Precautions

- ☐ Please make sure to take appropriate measures for heat dissipation. Operating camera module without taking appropriate heat dissipation may cause damages or malfunction.
- ☐ Do not use or store camera module in dusty or humid places.
- ☐ Do not apply excessive force, vibration, or static electricity that could damage camera. Handle camera module with care.
- ☐ Do not shoot direct images that are extremely bright (e.g., light source, sun, etc.). When extremely strong light source is shot, smear or blooming may occur. Put the front cap on when camera is not in use.
- ☐ Follow the instructions in Chapter 3.2., "External Connector" for connecting camera module. Improper connection may cause damages not only to camera module but also to the connected devices.
- ☐ Confirm mutual ground potential carefully before connecting camera module to monitors or computers. Any AC leak from the connected devices may cause damages or destroy camera module.
- ☐ Do not apply excessive voltage. (Use only the specified voltage.) Unstable or improper power supply voltage may cause damages or malfunction of camera module.
- ☐ Our warranty does not apply to damages or defects caused by irregular and/or abnormal use of the product.
- ☐ Please make sure to use fully dust-proof chassis/casing to avoid dust reaching the surface of the image sensor. Assemble camera module to your products under clean environment such as clean room.

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 module must not be used under conditions or environments other than those 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.

2. Product Outline

DCC-4K2 is a 4K UHDTV color camera module without casing/chassis. Using a 1.0" global shutter CMOS image sensor, the maximum frame rate achieves 60fps. 3G-SDI x 4ch interface and features CIS proprietary ISP, "Clairvu™" image processing engine for superb imaging quality and high speed processing. Complies with BT.2020 (Wide color gamut) and BT2100 (Hybrid Log-Gamma). Suitable for broadcasting applications, VR/AR systems, surveillance systems, and medical imaging systems.

2.1. Features

- ☐ Features CIS proprietary ISP, state-of-the-art "Clairvu™" for superb imaging quality.
- ☐ Compact in size: Lens mount block: 65mm×65mm×12mm, Main block: 29mm×65mm×89mm (without projection).
- ☐ Global shutter type CMOS image sensor.
- ☐ Noise reduction function (2DNR).
- ☐ GenLock function (3-values analog signals or Black burst).
- ☐ Supports RS-232C control and RS-422 control.
- ☐ LTC (Longitudinal Time code)

2.2. Accessories

- ☐ Optional accessories
  - Lens mount conversion ring from M42 to C Mount
  - Lens mount conversion ring from M42 to F Mount

- ☐ Software

  CIS control software is available 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 evaluation and testing of this product only, and is not intended for commercial use by customer. CIS will not customize the program nor provide the source code.

3. Specifications

3.1. General Specifications

Electrical Specifications			
Image sensor	Sensor type	1.0" global shutter type color CMOS sensor	
	Unit cell size	3.45μm(H) × 3.45μm(V)	
Resolution		UHDTV (4ch output) 3840 (H) × 2160(V)	
		1080p (1ch output) 1920(H) × 1080(V)	
Aspect ratio		16 : 9	
Video output format		3840 x2160p YUV422 @60, 59.94, 50 fps (Level A)	3G-SDI ×4 - 2SI / Square Division
		3840 x2160p YUV422 @60, 59.94, 50 fps (Level B)	3G-SDI ×4 - Square Division
		3840 x2160p YUV444 @30, 29.97, 25, 24, 23.98 fps (Level A)	3G-SDI ×4 - 2SI
		1920 x 1080p YUV422 @60, 59.94, 50 fps (Level A / B)	3G-SDI ×1
		1920 x 1080 i YUV422 @60, 59.94, 50 fps	HD-SDI ×1
Sync system		Internal sync. / External sync.	
Video output standard		HD-SDI and 3G-SDI : Y/Pb/Pr(10bit) HD-BNC or H.FL75 connector (HIROSE) Characteristic impedance 75Ω	
Sensitivity		F5.6 (2000 lx)	
Minimum illumination		3.0 lx (F1.4) Conditions: VIDEO 50%, Gain 30dB, Shutter OFF	
Gain variable range		AGC : 0dB ~ +48 dB	
		MANUAL : 0dB ~ +48 dB	
Shutter speed variable range		AUTO : 1/13600s ~ 1/23.98s User can set limits of shutter variable range. Minimum shutter speed varies depending on frame rate setting.	
		MANUAL : 1/13600s ~ 1/23.98s Minimum shutter speed varies depending on frame rate setting.	
White balance adjustment		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	
Color saturation adjustment		0%(B/W) ~ 100% ~ 200%	
Color saturation suppression		OFF, 1~7	
Noise reduction		ON, OFF	
Gamma		Complies with BT.709 curve : Contrast -2, -1, 0, +1, +2 Complies with BT.2100 (HLG)	
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 ~ +100	

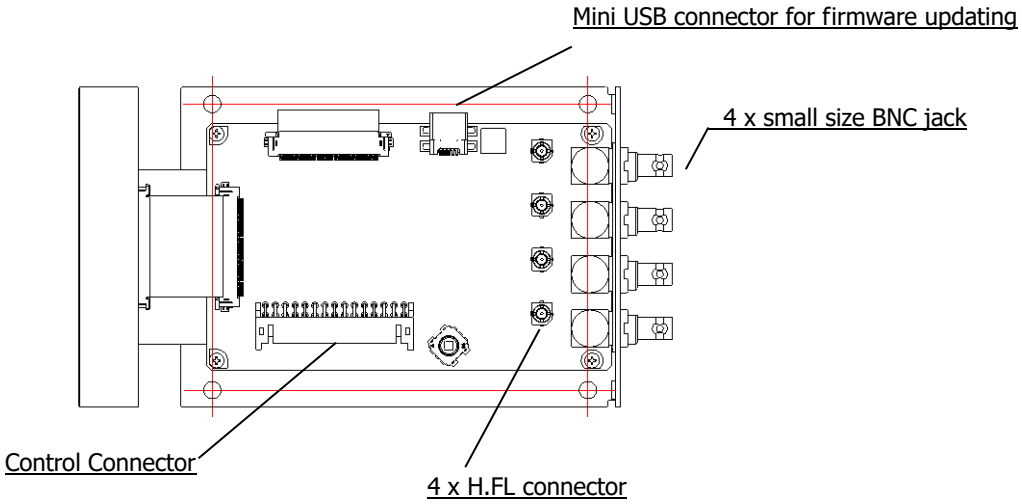
Electrical Specifications (cont.)	
Pedestal (R,G,B)	RGB independent: -100 ~ 0 ~ +100
Color balance	RGB independent: 0 ~ 100 ~ 200
Pixel defect correction (white spot)	Corrected upon shipment.
LTC	OFF, ON Accepts external SMPTE Time code in the LTC IN terminal. (Supports resetting internal time code.)
Camera preset settings	1, 2, 3, 4 (Four kinds of preset to store.)
Remote control communications	Supports RS-232 signals and RS-422 signals to control camera settings. Refer to Section 5. Serial Communication for details.
Power requirements	DC +9 ~ +15V
Power consumption	12W (Conditions: DC+12V IN)

Mechanical Specifications	
Dimensions	Lens mount block H:65mm W:65mm D:12mm Main block H:29mm W:65mm D:89mm excluding projection Refer to Section 6. Dimensions.
Weight	180g
Lens mount	M42 mount Refer to Section 6. Dimensions.

Environmental Specifications			
Safety/Quality standards		UL: Conform to UL Standard including materials. CE: RoHS: 2011/65/EU EN50581 (RoHS2)	
Durability※1	Vibration	Acceleration	: 29.4m/s^2 (3G)
		Frequency	: 20 ~ 200Hz
		Direction	: X,Y, and Z 3 directions
		Testing time	: 120min for each directions
	Shock	No malfunction with 294m/s^2 (30G) for ±X, ±Y, and ±Z, 6 directions. (Without packaging)	
Operational Temperature		-5°C ～ +45°C Note: FPGA temperature should not exceed 80 °C. Check with temperature measurement function. Absolute Maximum Rating: FPGA temperature should not exceed 120°C. Please refer to Section 6. Dimensions for the position of FPGA and heat dissipation point. Humidity: 20 ~ 80%RH with no condensation	
Storage Temperature		-30 ~ +60°C Humidity: 20 ~ 80%RH with no condensation.	

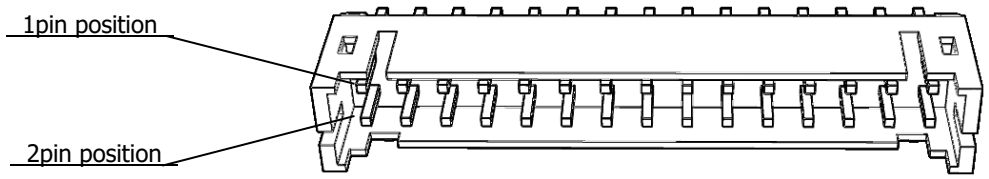
※1). Conditions: Screw the lens mount block and main block to a flat aluminum plate in size of W100 x D150 x H3mm.

3.2. External Connector



3.2.1 Control Connector

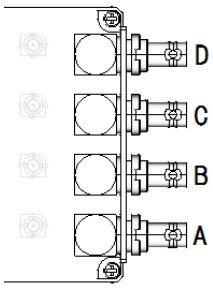
Model Name: S30B-PHDSS-B (J.S.T.MFG)



Pin No.	Description	Pin No.	Description
1	IRIS DUMP+	2	IRIS DRIVE+
3	IRIS DUMP-	4	IRIS DRIVE-
5	GND	6	GND
7	Power IN (DC+12V)	8	Power IN (DC+12V)
9	GND	10	GND
11	EXT SYNC IN	12	GND
13	LTC IN	14	GND
15	RS-422 TX-	16	RS-422 TX+
17	RS-422 RX-	18	RS-422 RX+
19	Reserved (Do not connect)	20	Reserved (Do not connect)
21	Reserved (Do not connect)	22	Reserved (Do not connect)
23	GND	24	TEST terminal (Do not connect)
25	RS-232C RXD In (Camera)	26	RS-232C TXD Out (Camera)
27	Reserved (Do not connect)	28	Reserved (Do not connect)
29	Reserved (Do not connect)	30	Reserved (Do not connect)

3.2.2 Small Size BNC Jack

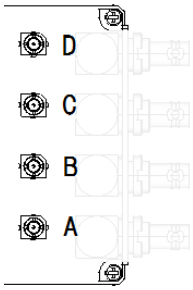
Model Name: 67-468-D66 (Coax Connectors)



Pin No.	Description
A	3G-SDI output CH0 (Upper left for SQD) HD-SDI output
B	3G-SDI output CH1 (Upper right for SQD)
C	3G-SDI output CH2 (Lower left for SQD)
D	3G-SDI output CH3 (Lower right for SQD)
Shell	Chassis GND

3.2.3 H.FL Connector

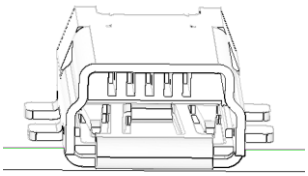
Model Name: H.FL-R-SMT (HIROSE)



Pin No.	Description
A	3G-SDI output CH0 (Upper left for SQD) HD-SDI output
B	3G-SDI output CH1 (Upper right for SQD)
C	3G-SDI output CH2 (Lower left for SQD)
D	3G-SDI output CH3 (Lower right for SQD)
Shell	Chassis GND

3.2.4 mini USB Connector

Model Name: UX60R-MB-5ST (HIROSE)



Pin No.	Description
1	USB VBAS
2	USB D-
3	USB D+
4	N.C
5	GND

[Note] Do not connect USB signals when power is OFF.

4. Camera Functions

4.1. GenLock

Gen Lock function is available by inputting Analog External Sync signal (Black burst or 3-values SYNC) into the EXT SYNC IN terminal of the control connector. Corresponding external sync signals vary depending on camera output format. Please refer to the chart below for details.

CAMERA FORMAT	EXT SYNC IN				
UHD/HD 60p/60i			1080i60	720p60	1080p30
UHD/HD 59.9p/59.9i	NTSC		1080i59.9	720p59.9	1080p29.9
UHD/HD 50p/50i		PAL	1080i50	720p50	1080p25
UHD 30p			1080i60	720p60	1080p30
UHD 29.9p	NTSC		1080i59.9	720p59.9	1080p29.9
UHD 25p		PAL	1080i50	720p50	1080p25
UHD 24p					1080p24
UHD 23.9p					1080p23.9

- Input Black Burst signals for NTSC/PAL signals.
- Input 3-values SYNC signals for other than NTSC/PAL signals.
- Terminate EXT SYNC IN with 75Ω.
- When an external signal specified above is input, the camera will automatically be in external sync mode.
- When there is no external signal input, the camera will operate in internal sync mode.
- Disturbance images occur immediately after inputting external signal. However, this is normal.
- Disturbance images may occur or there will be no image when inputting signals other than those specified in the above chart to the EXT SYNC IN terminal.
- Maximum ±10 pixels difference between video signals and external sync signals occur immediately after initializing camera or changing output format. If this difference (error) is not acceptable, automatically lock with external sync and match the timing with user adjustment commands.

4.2. LTC (Longitudinal Time Code)

Supports Time Code insertion to 3G-SDI signals.

Input LTC signals (time code) to the LTC IN terminal of control connector to insert external time code. When there is no signal-input to the LTC IN terminal, user can insert internal time code. Internal time code starts with 00:00:00.00 when power is ON, and when signals are input to the LTC IN terminal, time code switches to external time code. Under this condition, if no signal is input to the LTC IN terminal, internal time code starts.

Signal format: SMPTE Time code
Signal level: 0.5~2[Vp-p]

4.3. Defective Pixel Correction

In addition to the correction of defective pixel data registered upon shipment, we provide a method to update the defective pixel data. Please refer to Section 5.2, Command List for details.

4.3.1 Defective Pixels Type

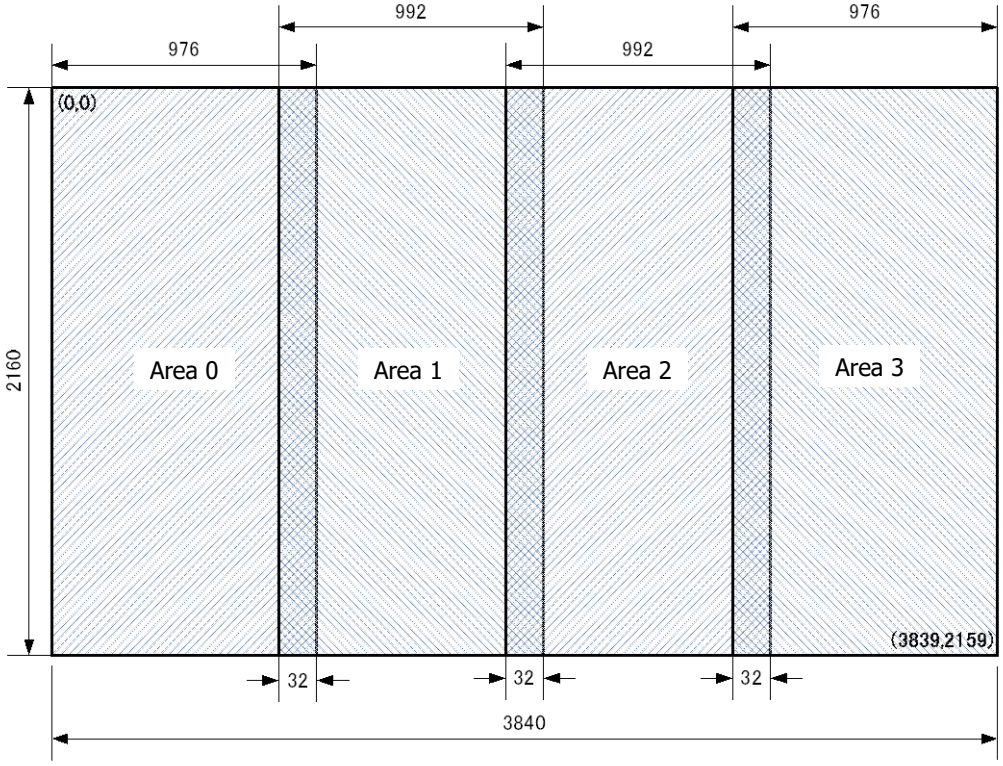
There are two types of defective pixel data.

- 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 user.

There are four kinds of position data for defective pixels; No Flip, H Flip only, V Flip only, and both H/V Flip. According to the combination of H Flip and V Flip settings, the type of position data changes automatically.

4.3.2 Details on Defective Pixel Data

Defective pixel data are stored and controlled per four vertically divided regions. User can register up to 64 points per region, which makes it a total of 256 points as user register data. There are overlaps of 32 pixels (width) between the regions. The command register the defective pixel coordinates in the overlapping area to both regions. Please refer to the below for the definition of regions.



The upper left is the origin of coordinate system. Definition of each region is

- Reed Area 0 : (0,0) - (975, 2159)
- Reed Area 1 : (944,0) - (1935 ,2159)
- Reed Area 2 : (1904,0) - (2895, 2159)
- Reed Area 3 : (2864,0) - (3839, 2159)

For example, if the defective pixel is at (943, 0), the data is registered only to region 0.
However, if the defective pixel is at (944, 0), the data is registered to both region 0 and 1

4.3.3 Notes for Defective Pixel Correction

- To save the data registered or deleted with defective pixel correction command (SU 200~203), execute SAVE command (SU705).
- Init command (SU 700) does not restore defective pixel correction data. Use SU 203 to delete all data.
- Defective pixel correction data is not subject to Camera Setting Store/Load command (SU 100/101).
- Factory data and user-register data cannot be the same. Therefore, if user detects the same defective points, this function ignores those points.
- If user specifies the same coordinates as factory setting data, error will occur.
- Please note that the detected results may not always be the same due to temperature, noise, and other conditions.

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) Please refer to the chart below for serial communication settings.

Baud rate	9,600bps
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), and 0x0D (CR=¥r) must be used. Please do not use other than these codes.
- A control code consists of command, parameter, and CR (0Dh). By sending command, parameter, and linefeed code from host to camera, user can change camera settings and acquire camera-setting parameters. Either CR or LF can be a linefeed code.
- There are two types of commands. One is SU command to send settings and instructions to camera ("S" for "Set"), and the other is GU command ("G" for "Get") to obtain information from the camera.

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

(3) How to input commands

- “>” must be 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 linefeed code (CR) is defined as a single serial command.
- Parameters start with 0x are regarded as hexadecimal, parameters start with 0b are regarded as binary, and others are regarded as decimal.
- Commands analyze parameters from the head to identifiable letters.
- Please refer to “Section 5.2. Command List” for details on address and data.
- Do not input values and letters other than those explained in the above and those mentioned in “Section 5.2. Command List”.
- Camera receives the returned command from Host, and echo the command back. At this time, camera converts the linefeed code (CR) to CR LF and echo the code back.

(4) Setting examples

【Example of GU command】

To get information of address 10

[Send]	GU [sp] 10[¥r]	
[Returned value]	GU [sp] 10[¥r] [¥n]	[Echo back]
[Returned value]	50[¥r] [¥n]	[Acquired data + Linefeed]
[Returned value]	[¥r] [¥n]	[Linefeed]
[Returned value]	> [sp]	[Prompt (> and space)]

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

【Example of SU command】

To set 30 to address 10

[Send]	SU [sp] 10[sp] 30[¥r]	
[Returned value]	SU [sp] 10[sp] 30[¥r] [¥n]	[Echo back]
[Returned value]	[¥r] [¥n]	[Linefeed]
[Returned value]	> [sp]	[Prompt (> and space)]

5.2. Command List

Video format

Function	Address	Value	Initial Value	Description
Video format	1	0: UHDTV 2-Sample Interleave 60p (Level A) 1: UHDTV 2-Sample Interleave 59.94p (Level A) 2: UHDTV 2-Sample Interleave 50p (Level A) 3: UHDTV Square Division 60p (Level A) 4: UHDTV Square Division 59.94p (Level A) 5: UHDTV Square Division 50p (Level A) 6: Full-HD 60p (Level A) 7: Full-HD 59.94p (Level A) 8: Full-HD 50p (Level A) 9: Full-HD 60p (Level B) 10: Full-HD 59.94p (Level B) 11: Full-HD 50p (Level B) 12: UHDTV Square Division 60p (Level B) 13: UHDTV Square Division 59.94p (Level B) 14: UHDTV Square Division 50p (Level B) 15: Full-HD 60i 16: Full-HD 59.94i 17: Full-HD 50i 18: UHDTV 2-Sample Interleave 30p 444 (Level A) 19: UHDTV 2-Sample Interleave 29.97p 444 (Level A) 20: UHDTV 2-Sample Interleave 25p 444 (Level A) 21: UHDTV 2-Sample Interleave 24p 444 (Level A) 22: UHDTV 2-Sample Interleave 23.98p 444 (Level A)	3	This is to set video output format.

AE related

Function	Address	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: x1~x251 (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 0x00020000 ※Please refer to Section 5.3. Quick Reference Table for Gain Settings.
Gain max Value	4	Magnification ×0x10000 Setting range: x1~x251 (0x10000~0xFB304B)	0x200000 (2097152)	This is to set the maximum gain value when gain mode is Auto. (*1) ※Please refer to Section 5.3. 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 [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 5.4 Quick Reference Table for Shutter Settings.
Shutter limit	7	The 1st Parameter: Max value Exposure [s]×0x100000 Setting range: 1/13600~1/23.98s (0x4D~0xAAD6)	0x4444 (17476) 1/60s	This is to set shutter limit 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 5.4 Quick Reference Table for Shutter Settings.
		The 2nd Parameter: Min value Exposure[s] × 0x100000 Setting range: 1/13600 ~ 1/23.98s (0x4D~0xAAD6)	0x4D (77) 1/13600s	
Metering mode	8	0: Average 1: Center-Weighted 2: Spot 3: Backlight Compensation	1	This is to set metering mode.

AE related (Continued)

Function	Address	Value	Initial Value	Description
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 (number of block) H: Height of metering field (number of block) 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.
Exposure compensation value	11	0(-12dB) ~ 12(0dB) ~ 24 (+12dB) / per 1dB	12	This is to set exposure compensation value.
Flicker cancel	12	0: Off 1: On	0	This is to set ON/OFF of flicker cancel. Valid only when video format is 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 speed decreases by 1step, shutter value becomes bigger. (*1) Valid when shutter 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)

(*1) Due to physical limitation of the sensor and circuit, there are some cases that user cannot control values and limits of gain and shutter as designated by commands. User can check the actual values with Current Gain and Current Shutter commands.

WB related

Function	Address	Value	Initial Value	Description
WB mode	20	0: Manual 1: Auto 2: Preset	1	This is to set white balance mode.
WB Manual memory	21	0~4	0	This is to choose the memory to store set values when WB mode is Manual. Memory stores up to 5 types of settings (0~4).
Manual Red gain	22	100~1600(%)	167	This is to set Red Gain when WB Mode is Manual.
Manual Blue gain	23	100~1600(%)	192	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 the condition 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 the environmental lighting condition 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 the shifting amount of WB gain toward black.
WB CC shift	29	-10~10	0	This is to set the shifting amount of WB gain toward green magenta.
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	Value	Initial Value	Description
Detail (Edge Enhancement)	30	0: Off 1 (Low)~7(High)	3	This is to set the strength 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	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% for BT.709 Invalid for HLG (Handled as Normal) 1: Normal Equivalent to 200% for BT.709 Equivalent to 600% for HLG 2: High 400% for BT.709 Equivalent to 1200% for 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 if a lower value is set, gain value becomes 0x20000.) ※ The D-range definition of BT.709 and HLG are different, ref. below. [BT.709] 100% output level (without Knee) is regarded as 100% input level. [HLG] 50% output level is regarded as 100% input level.
Color saturation	45	0~200(%)	100	This is to set color saturation.
Noise reduction	50	0 : Off 1 : On	0	This is to set noise reduction.

Image Quality related (Cont.)

Function	Address	Value	Initial Value	Description
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)	5	This is to set color suppression.
Color space	54	0: BT.709 1: BT.2020	0	This is to set color gamut.

Lens Control related

	Address	Setting Value	Initial Value	Description
DC Iris Mode	61	0: Open 1: Auto	0	Set to Open when DC Iris lens is not in use.
DC Iris Response Speed	77	0 (Slow) ~ 15 (Fast)	8	This is to set response speed of DC Iris when DC Iris Mode is Auto. Response speed becomes faster with larger value setting. When hunting occurs, please set smaller value and adjust the response speed according to the characteristics of DC Iris lens used.

OSD related

Function	Address	Value	Initial Value	Description
OSD Up button	90	0: One push 1: Continuous push	None	This is to operate OSD. Send commands every 60msec for continuous push. (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	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.

Others

Function	Address	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 address to store (the set value of 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 camera. Selection of address to store and address to load are common so that this command keeps the last set value with Store or Load. (GU 100 and GU 101 always return the same value).
LTC mode	103	0: Off 1: On	0	This is to set OFF/ON of LTC signal insertion.
LTC reset	104	1: Reset	None	This is to reset the timer for internal self-run of LTC. (Dedicated to SU)
GenLock V offset	106	-1024~1023	0	Adjustment of V phase when mode is external sync.
GenLock H offset	107	-2048~2047	0	Adjustment of H phase when mode is external sync.
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.
FPGA temperature	180	None	None	This is to acquire FPGA temperature [°C] (Dedicated to GU) Make sure to take appropriate heat dissipation measures not to exceed 80 with this value.
Init	700	0 (Fixed)	None	This is to restore camera settings to factory settings. Camera store-data, address to store, and defective pixel correction data 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, and defective pixel correction data. (SU Only)
Version information	721	1: Microcomputer version 2: FPGA version	None	This is to acquire version information. (GU Only)

Defective Pixel Correction

Function	Address	Value	Description
Detection of defective pixel	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 pixel	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 pixel	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)
Entire deletion of defective pixel correction data	203	1: Entire deletion	This is to delete all user register Data. (Dedicated to SU)
Indication of defective pixel 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 region. 4: Indicate the number of user register defective pixels per region.	This is to indicate information on the registered defective pixel correction data. (Dedicated to GU)

Note:

- 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 registered defective pixels into four types. Attribute [W] and [B] are for data registered at factory, attribute [U] is data registered by user with defective pixel detection command, and attribute [P] is data registered by user with defective pixel 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.

5.3. Quick Reference Table for Gain Settings

	Magnification	dB	Gain Value (Mag.×0×10000)	
			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

5.4. Quick Reference Table for Shutter Settings

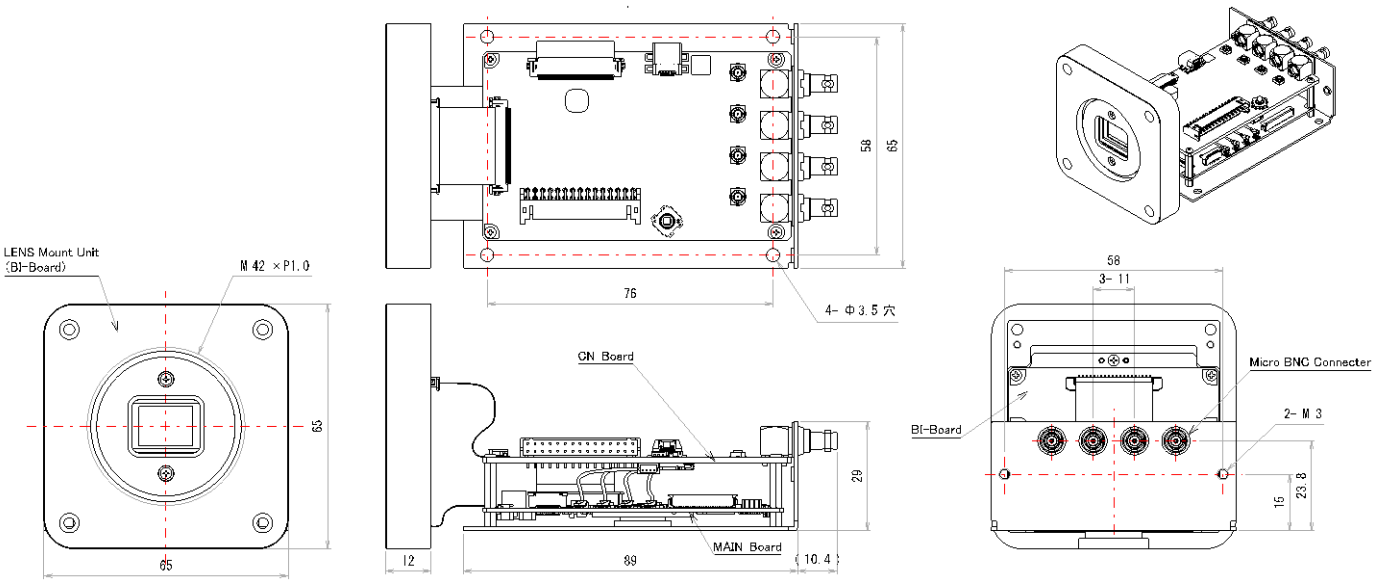
Exposure Time [s]	Shutter Value (Exp. [s]×0x100000)	
	DEC	HEX
1/23.98	43734	0000AAD6
1/24	43691	0000AAAB
1/25	41943	0000A3D7
1/29.97	34987	000088AB
1/30	34953	00008889
1/50	20972	000051EC
1/59.94	17494	00004456
1/60	17476	00004444
1/90	11651	00002D83
1/100	10486	000028F6
1/125	8389	000020C5
1/180	5825	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

5.5. Factory Settings

Functions	Factory settings
Video Format Setting	UHDTV Square Division 60p (Level A)
Gain Mode	Auto
Gain Value	65536 (0dB)
Gain Max Value	2097152 (Approx. 30dB)
Shutter Mode	Auto
Shutter Value	17476 (1/60)
Shutter Limit Max	17476 (1/60)
Shutter Limit Min	77 (1/13600)
Metering Mode	Center-Weighted
Spot Block	X=7, Y=7, W=2, H=2
AE Speed	10
Exposure Compensation Value	12 (0dB)
Flicker Cancel	Off
WB Mode	Auto
WB Manual Memory	0
Manual Red Gain	167
Manual Blue Gain	192
WB Auto Func	Standard
WB Preset Func	Daylight (5500K)
WB Preset Temp	5500K
WB LB Shift	0
WB CC Shift	0
Detail	3
Gamma	BT.709
Knee	85%
Master/Red/Green/Blue Pedestal	0
Red/Green/Blue Balance	100
D-Range	Normal
Color Saturation	100
Noise Reduction	Off
Color Correction	Auto
Color Suppression	5
Color Space	BT.709
DC Iris Mode	Open
DC Iris Response Speed	8
Text Color	White
Highlight Color	Cyan
Camera Setting Store/Load	0
LTC Mode	Off
GenLock V Offset	0
GenLock H Offset	0
H Flip	Off
V Flip	Off

6. Dimensions

6.1. Camera Dimensions



[Note]

Make sure to take appropriate heat dissipation measures to use this camera module.

Recommendation: Screw lens mount block and main block to a flat aluminum plate in size of W100 x D150 x H3mm.

7. Case for Indemnity (Limited Warranty)

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 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 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.

7.2. CMOS Defective Pixels

CIS applies defective pixel 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.

8. 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.