SL-640C(A)

Uncooled Thermal IP Camera Manual

Rev. 1.35

September 10, 2023

Revision History

Rev.	Date	Author	Description
1.00	01/31/22	Flytaki	Technical Documents, first version
1.35	09/10/23	Flytaki	English version

Contents

1. Product Overview

1.1 Product description

The SL-640C(A) is an IP thermal imaging camera that uses an uncooled sensor to perform sensor control, non-uniformity correction, and image processing and output IP and Video(NTSC). The camera type is divided into SL-640C for general security purposes, SL-640CT for measurement purposes, and SL-640CA for Zoom Lens Control purposes.

Figure 1. SL-640C Features

The basic framework of the thermal imaging module is as follows.

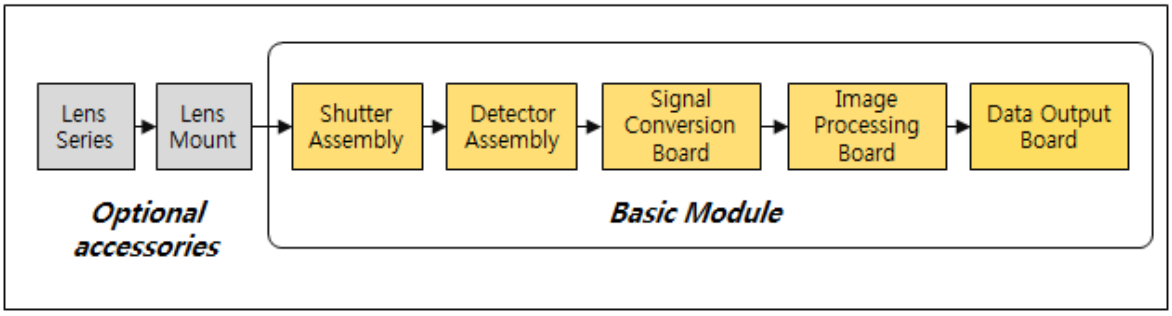


Figure 2. Basic framework of SL-640C module

The thermal imaging module consists of a shutter assembly and sensor assembly, signal conversion board, image processing board, Data output board. Sensor uses a 640x480, 12um uncooled sensor, and the signal conversion board performs sensor control, non-uniformity correction, and bad pixel correction. The image processing board performs improved AGC(Auto Gain Control) and image processing and outputs IP(H.264) and Analog(NTSC).

Video is transmitted using RTSP, and control uses a separate TCP/IP protocol and UART(3.3V TTL Level).

1.2 Technical Specification

The Specifications for SL-640C are listed in the table below.

Table 1. SL-640C Specifications

System Overview		***SL-640C***
Detector	Resolution	640 x 480
	Pixel Pitch	12μm
	NETD	<55mK@f/1.0, 30Hz, 300K
	Spectral Range	8 ~ 14μm
Function	Color Palette	11 Colors(Gray/Rainbow/Iron/Jet/Thermal/ BlueOrangeIcb/Smart/Cool/ Gray+Rainbow/Gray+Jet/Gray+Iron)
	Image Process	Local AGC, Level&Span, NUC, Mirror, Flip Invert, Image Enhancement
	Temperature Analysis	Min/Max/Center, ROI 10ea, Exception Mask 3ea Temperature Range : -20℃~+200℃
	Etc	Sun-Burn Protect Auto Focus with Zoom lens Control(Optional)
Output		Digital : Camera-Link(Optional) and IP(H.264) Analog : Video(NTSC)
Control		IP(TCP/IP), UART(RS-232)
Start-up time		<25 seconds
Lens		(TBD)
Power Input		+12Vdc
Power Consumption		<4W
Weight		<280g (w/o Lens)
Operating Temperature		-20℃ ~ +65℃
Storage Temperature		-45℃ ~ +85℃
Vibration		-
Dimension(WxHxD, mm)		50x50x70 (w/o Lens)

1.3 Optical Configuration

The Optical configuration is as shown in the table below. In order to use the lens of the user's desired type, a separate mount is required. If it is not for measurement purposes, an additional NUC is not required.

Table 2. Optical Configuration table

Focal Length	Coating	Resolution	F/#	FOV(HxV, ±5%)	Weight (Module+Lens)
6.2	AR/DLC	640x480@12um	1.00	75.0°x54.6°	30.0
8.0	AR/DLC	640x480@12um	1.00	58.3°x42.5°	27.5
11.0	AR/DLC	640x480@12um	1.00	38.8°x27.1°	39.7
15.0	AR/DLC	640x480@12um	1.03	28.7°x21.7°	30.0
19.0	AR/DLC	640x480@12um	1.03	22.8°x17.2°	35.0
25.0	AR/DLC	640x480@12um	1.00	17.4°x13.1°	28.7
35.0	AR/DLC	640x480@12um	1.00	12.5°x9.4°	87.1

2. Electrical Interface

2.1 Input Power requirements

After powering on, it consumes <4W@12V, 300K of power in a stable state.

2.2 Hardware Interface

The external interface consists of IP/Video/Power with a single 10-pin circular connector, and the SL-640CA(for Zoom lens) camera consists of a separate 6-pin circular connector. The circular connector uses the SN-10-10R connector, and the corresponding harness side connector is SN-10-10P.

Figure 3. SL-640C Rear connector configuration

Table 3. SN-10-10R Connector pin map

No	Name	In/Out	Description	Remarks
1	VCC	I	Power Input	+12Vdc
2	SGND	I/O	Source Ground	
3	UART_RX	I	UART Rx Signal	
4	UART_TX	O	UART Tx Signal	
5	TXP	O	LAN Tx Positive	
6	TXN	O	LAN Tx Negative	
7	RXP	I	LAN Rx Positive	
8	RXN	I	LAN Rx Negative	
9	CVBS	O	Video Output Signal	
10	AGND	I/O	Video Analog Ground	

2.3 Harness Interface

The external harness cable is in the following form, with +12Vdc power input for the outside, and IP and CVBS as outputs. The power source must be rated +12Vdc.

Figure 4. Camera Harness

3. Camera Connection

3.1 Camera Connect

The SL-640C camera's video uses the RTSP(Real-Time Streaming Protocol) Protocol, and control uses a separate TCP/IP protocol. Enter "root" as the ID and Password used when connecting.

3.1.1 RTSP Image Upload

Videos are uploaded using the RTSP protocol, and a total of three resolutions can be selected when uploading videos.

Table 4. RTSP Connection and Resolution

No	Resolution	Connect URL	Remarks
1	1280x720	rtsp://Camera-IP/cam0_0	
2	720x480	rtsp://Camera-IP/cam0_1	
3	320x240	rtsp://Camera-IP/cam0_2	

3.1.2 TCP/IP Camera Control

Control uses a separate TCP/IP protocol, and you can control the camera by connecting to the camera using the camera IP and port number "32000". You can also periodically receive set data(total of 50 words)

3.2 Software Run

When you run the IPThermalCam.exe file, a menu for setting the resolution appears as shown below. The Resolution can be set to 640x480, 640x512, 384x288 or other user-selected settings. (The set resolution is used for position conversion when setting ROI)

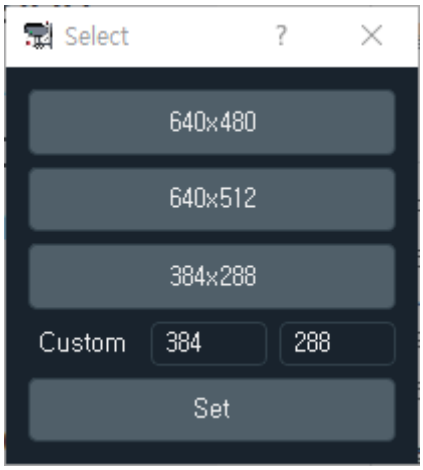


Figure 5. Resolution Select

When you click on a resolution, the main GUI runs.

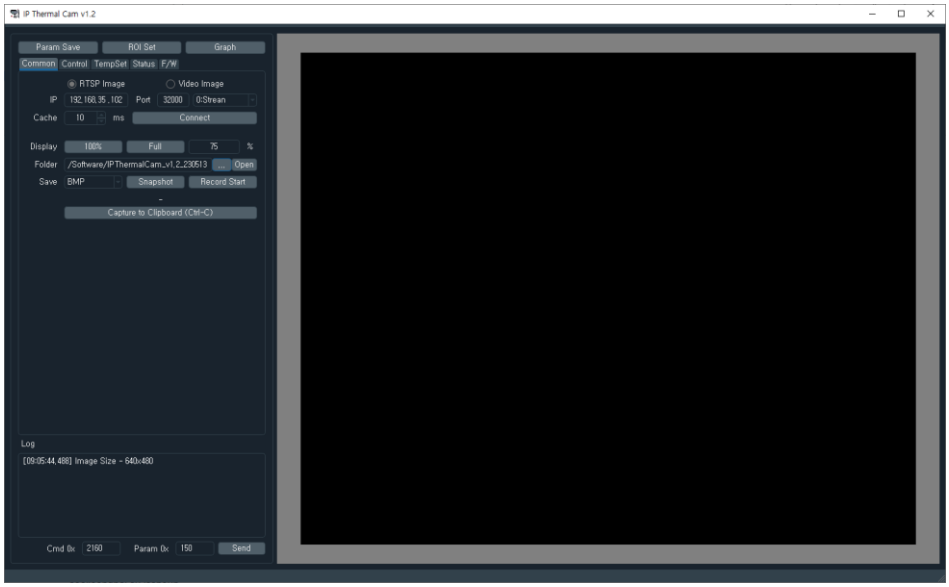


Figure 6. Main GUI

3.2.1 Main GUI Function

Looking at the Main GUI, it can be divided into 7 areas, and the functions of each are as follows.

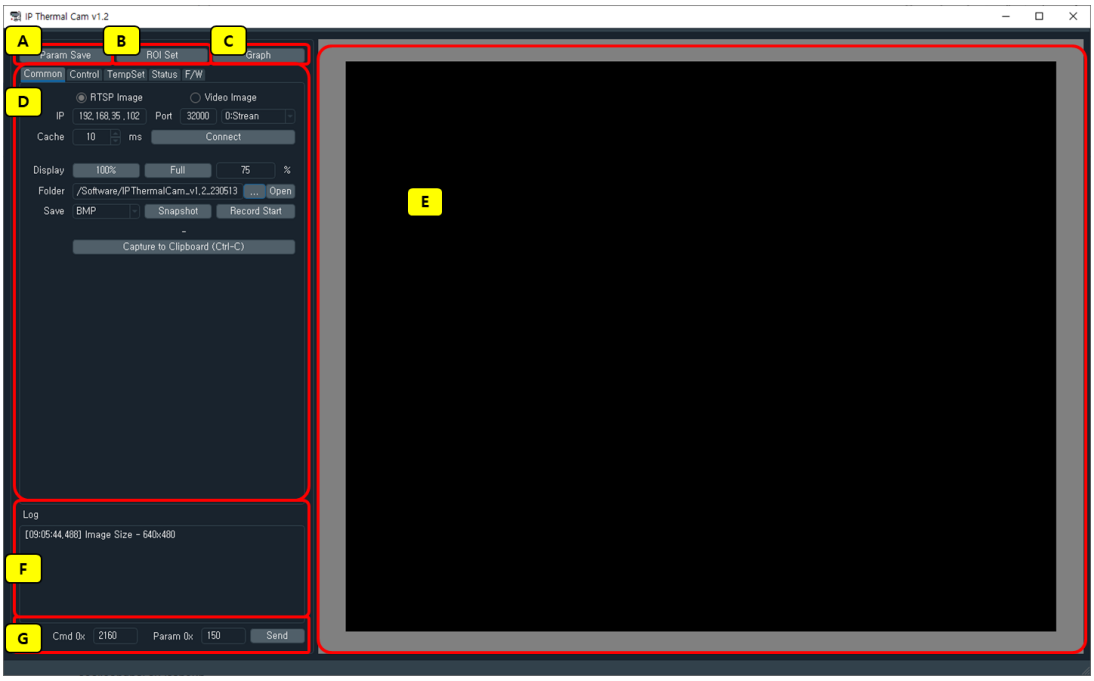


Figure 7. Main GUI

3.2.1.1 A-Zone Function

A-Zone is a “Parameter Save” function that saves the set values to the internal memory after setting each function. After setting the parameters, you must click “Save Parameters” so that the parameters can be applied when the power is reapplied.

3.2.1.2 B-Zone Function

B-Zone is the “ROI Set” function, which allows you to set a total a 10 Regions of Interest(ROI) and 3 Exception Masks. A separate settings window will appear as shown below, and you can set the area by dragging the selected ROI and Mask.

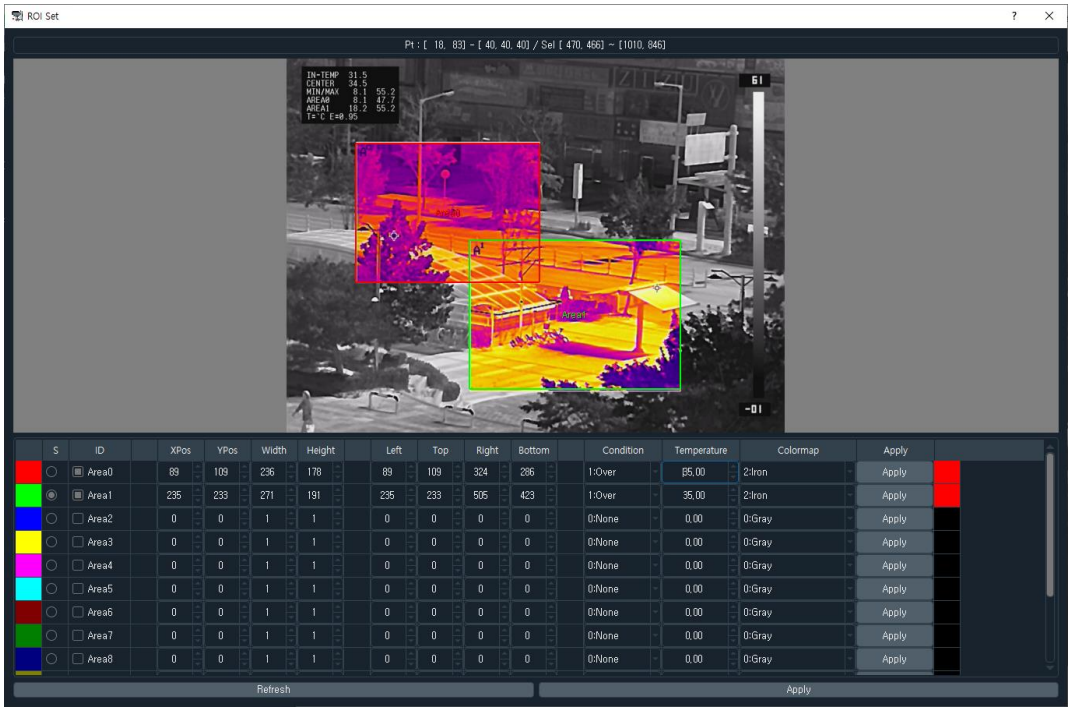


Figure 8. ROI Set Function GUI

3.2.1.3 C-Zone Function

C-Zone is a “Graph” function that displays the temperature information data received from the camera as a graph on the time axis.

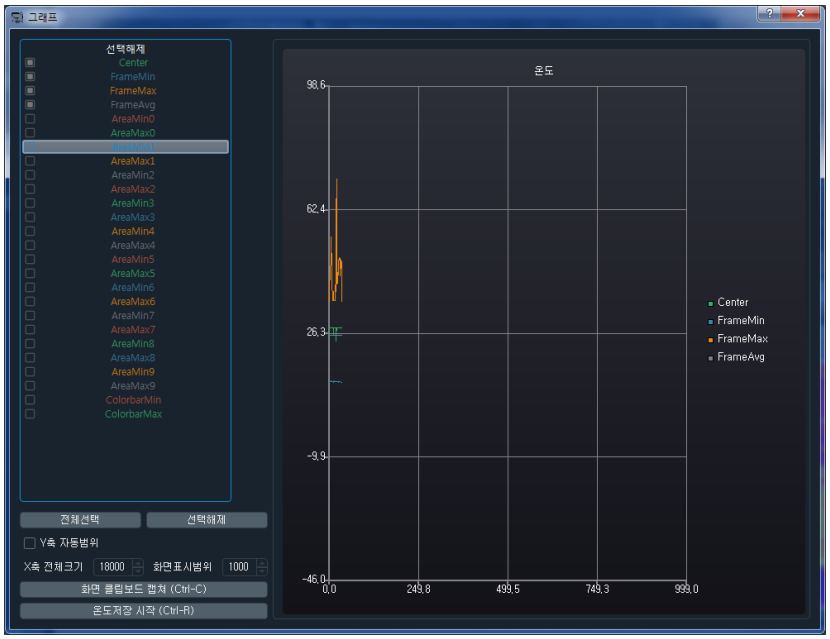


Figure 9. Graph Function GUI

3.2.1.4 D-Zone Function

D-Zone is function for setting various parameters. Performs IP connection, file storage(snapshots, recording), camera control and temperature-related parameter settings.

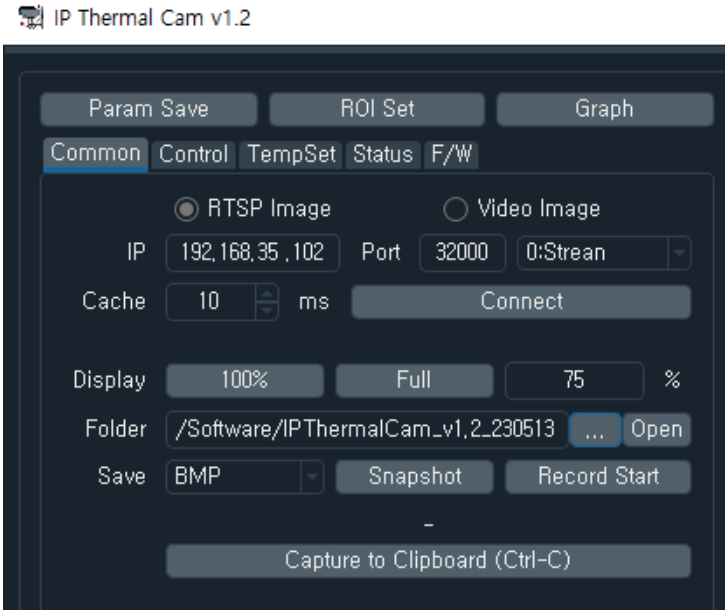


Figure 10. Parameter Set Function GUI

3.2.1.5 E-Zone Function

E-Zone is the main display windows, and can be zoomed in/out by scrolling the mouse.

3.2.1.6 F-Zone Function

F-Zone is a function for log messages.

3.2.1.7 G-Zone Function

G-Zone is a function for parameter debugging.

3.3 Common Menu

In order to connect to the camera, you must check the camera's IP using a separate IP Installer Software. After checking the camera IP, enter the IP in the IP input field of the connection menu, enter 32000 as the port number and click "Camera Connection". Next to the port number, 0:Stream0 receives video with a resolution of 1280x720, 1:Stream1 receives video with a resolution of 720x480, and 2:Stream2 receives video with a resolution of 320x240.

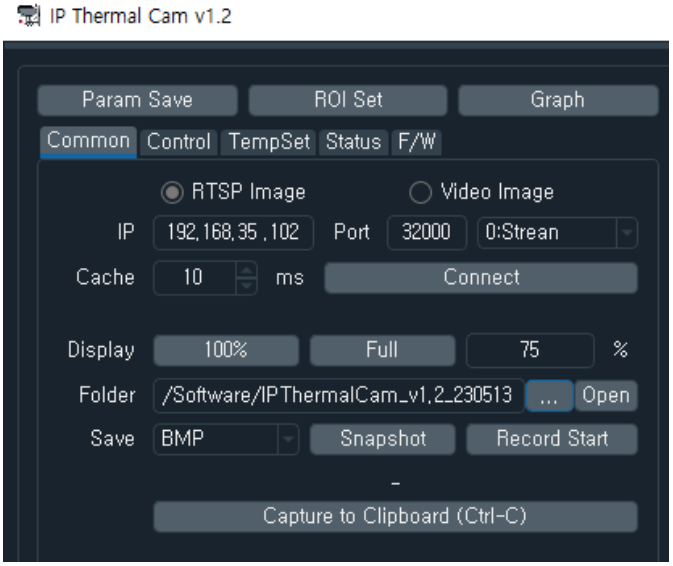


Figure 11. Camera connection menu

When you click "Camera Connection" a separate window for logging in appears as shown in the picture below. Enter root in the ID field and root in the Password field, then click "Log In" to connect. If you check Remember, it will be encrypted and saved on your PC, and the ID and password will automatically appear when you run the program again later.

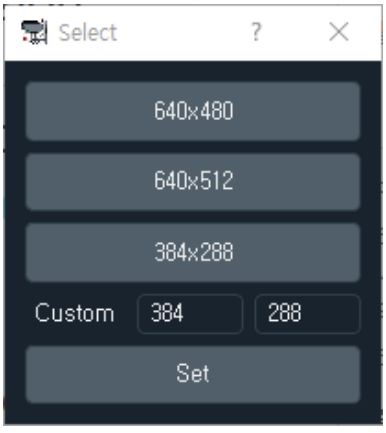


Figure 12. Log In GUI

Once the connection is complete, the actual image is displayed in the main display window as shown below.

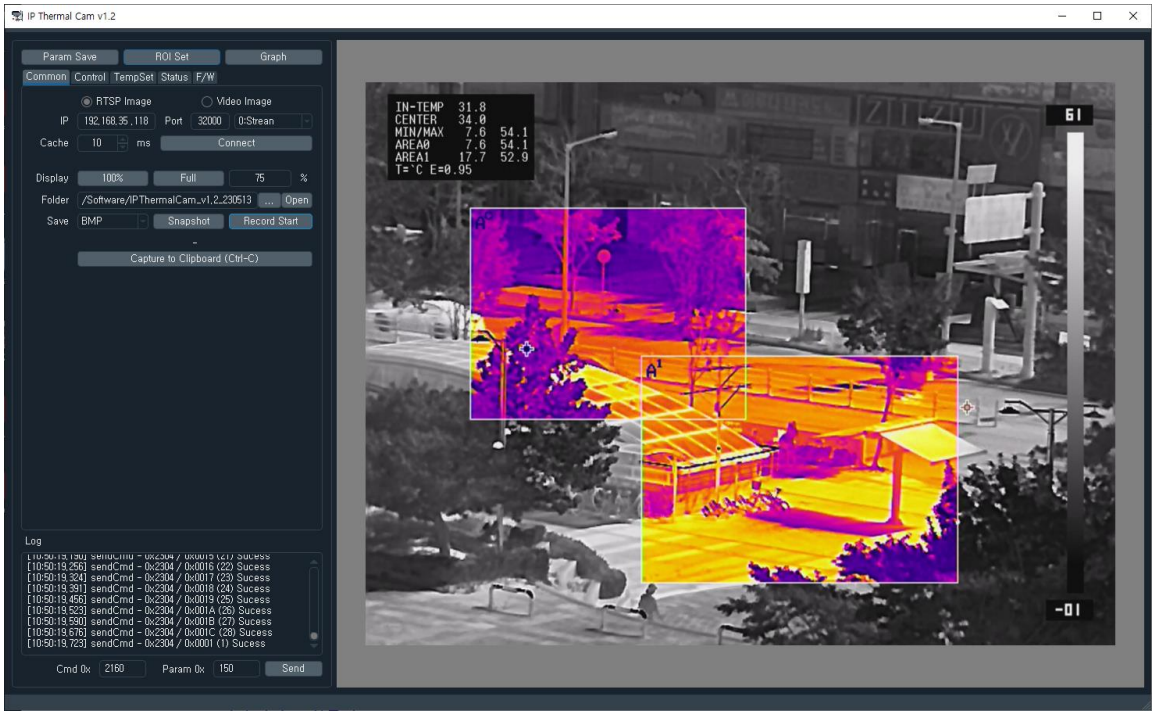


Figure 13. Main display video screen after connecting camera

In addition, there is a file storage(snapshot, recording) function, and when you click “Clipboard Capture(Ctrl-C)” the image in the main display window is copied to the clipboard so that the uses can use it when writing documents.

3.4 Control Menu

The control menu is a function that allows you to control the parameters of the thermal imaging camera. You can set image preview/color/inversion/calibration/AGC/image processing, etc. for detailed information on parameters, refer to 4.2 Command List.

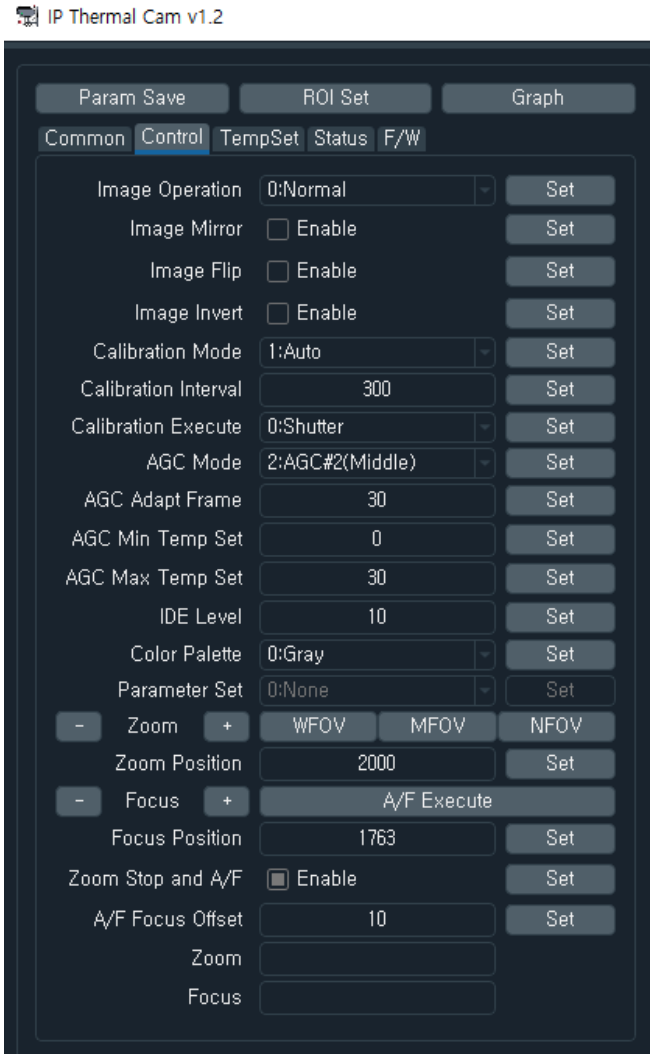


Figure 14. Control Menu

3.5 Temperautre Set Menu

The temperature setting menu is a function that allows you to set parameters related to temperature. Temperature information/Color bar/Center Mark/Min-Max Mark, etc. can be set emissivity data and transmission mode, temperature offset, etc.

Except for data transmission mode, it is applicable only to SL-640CT Camera.

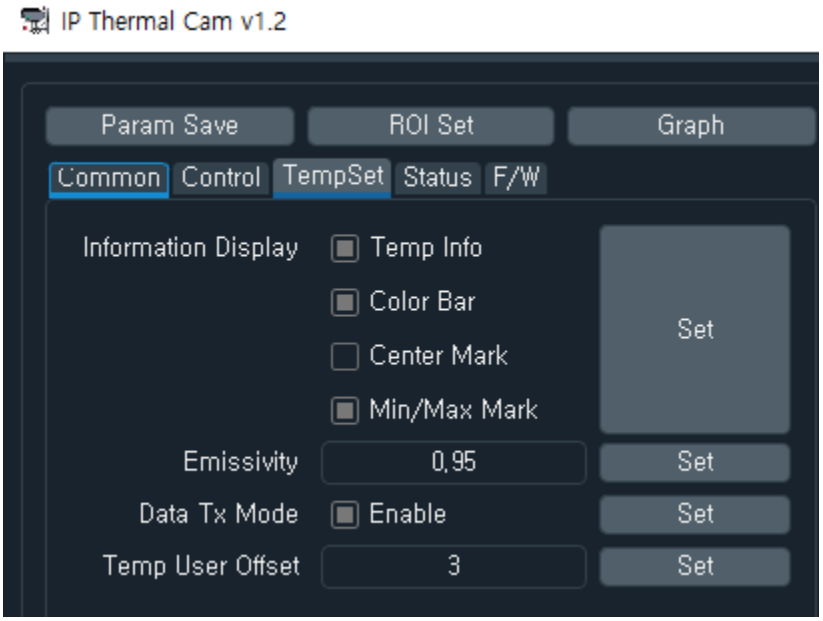


Figure 15. Temperature set menu

Data transmission mode is a parameter that determines whether to transmit the specified data(50 words) from the camera through TCP/IP, Temperature offset setting is a parameter that allows you to set an offset for temperature error.

3.6 Status information Menu

The Status information menu is a function that periodically receives and displays a total of 50 words of data from the thermal imaging camera when the data transmission mode is enabled. (for the format of received data, refer to 4.5 Tx Data List)

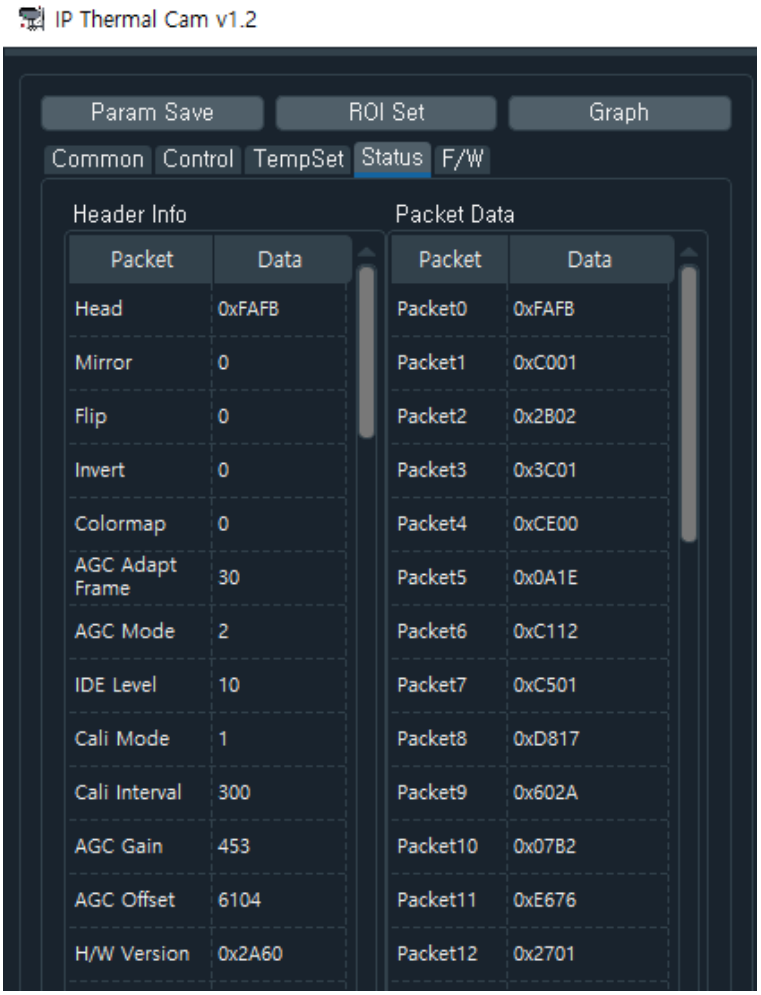


Figure 16. Status information menu

3.7 ROI Set menu

The ROIC Set window is a function that allows you to set a total of 10 Region of interest and 3 Exception masks. When you click on the function, a separate GUI window will appear as shown below

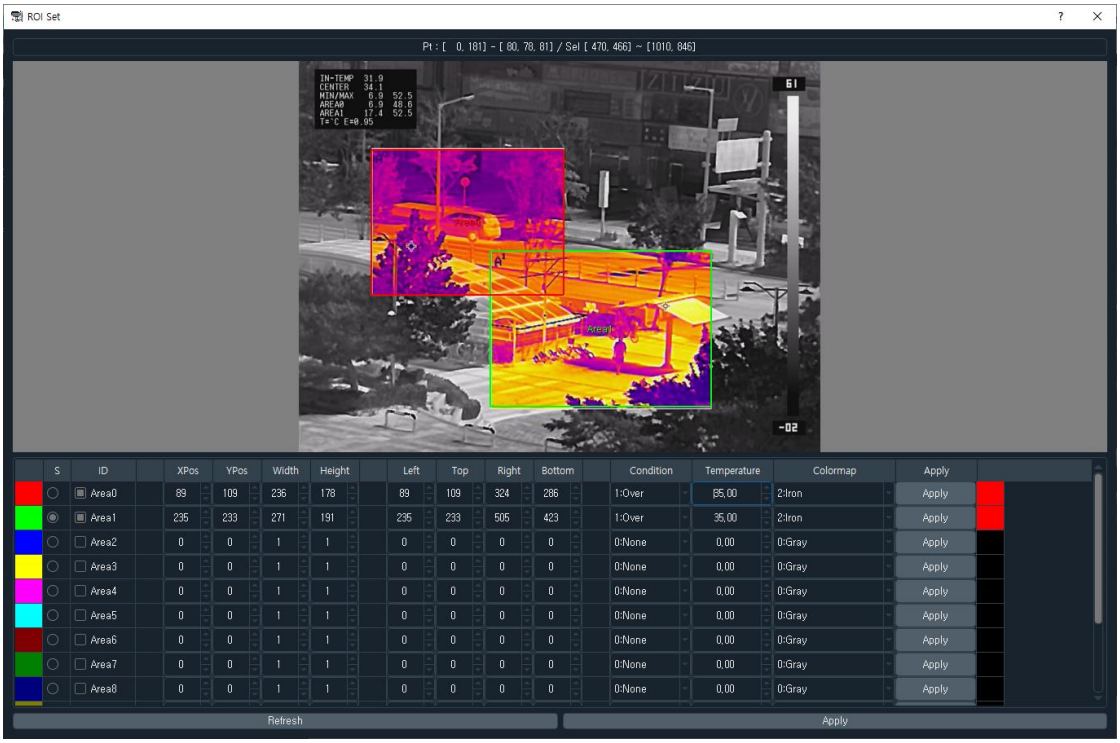


Figure 17. ROI set window

If you want to set ROI0, select ID Area0() and click “S” to set the size at the desired location by left-clicking and dragging the mouse on the display window. It is not possible to change the area that has been set, and change is possible only through coordinates(xPos/yPos/Width/Height,Left/Top/Right/Bottom)

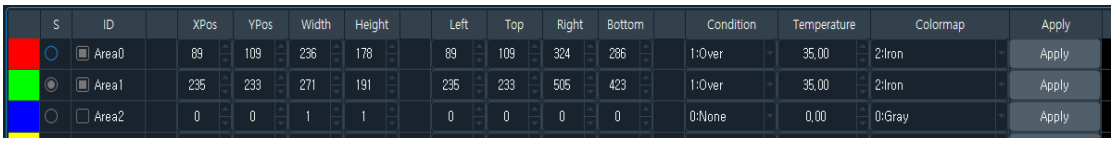


Figure 18. ROI Set

After setting the area, select the temperature setting and status(above, below) and the color palette displayed when the alarm occurs, and the click “Apply” to transmit and apply the relevant information values to the camera. The applied image is immediately displayed on the main display window, and the image can be updated through “Image

Update" in the GUI of the area of interest screen. (Clicking "Apply" at the bottom will apply all set parameters at once)

You can see that the area of interest and mask selected earlier are displayed in the main display window as shown below.

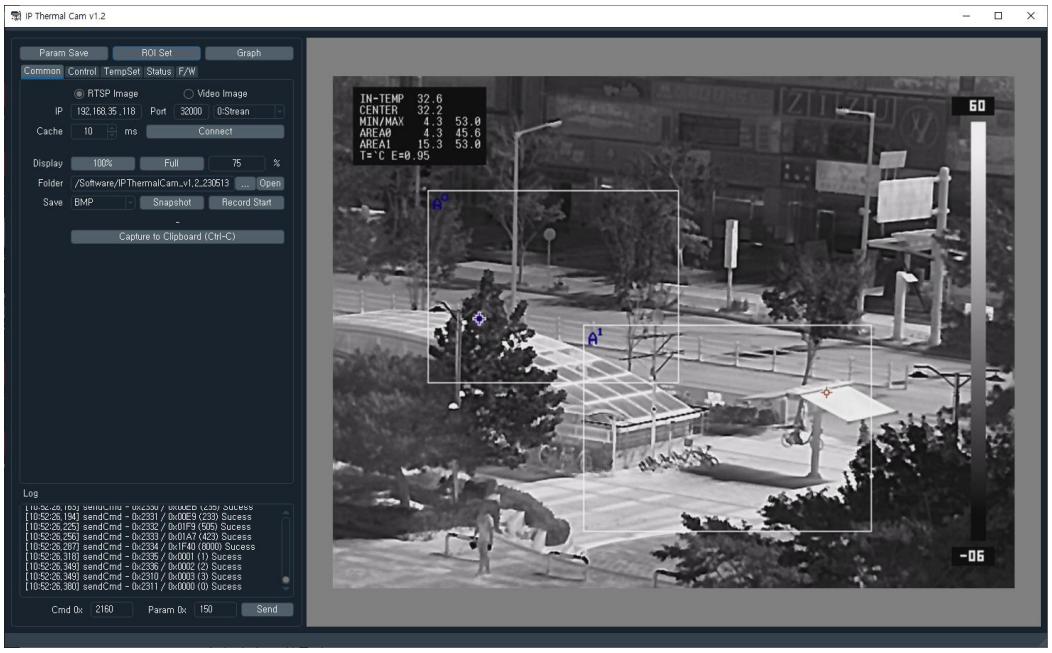


Figure 19. Main Display window ROI Set image

Below shows what is expressed in the set color palette when the temperature value(35 degrees) set in ROI0~ROI1 is exceeded (Alarm occurs)

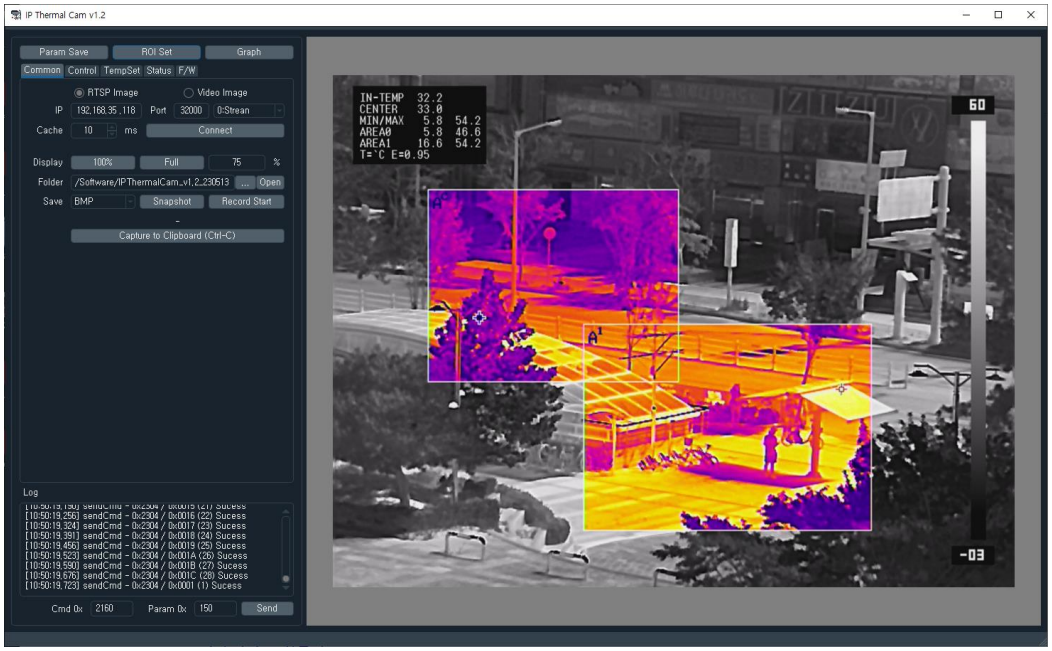


Figure 20. Screen display when alarm occurs

3.8 Grahp window

The graph screen is a function that displays temperature information received from the camera on time axis.

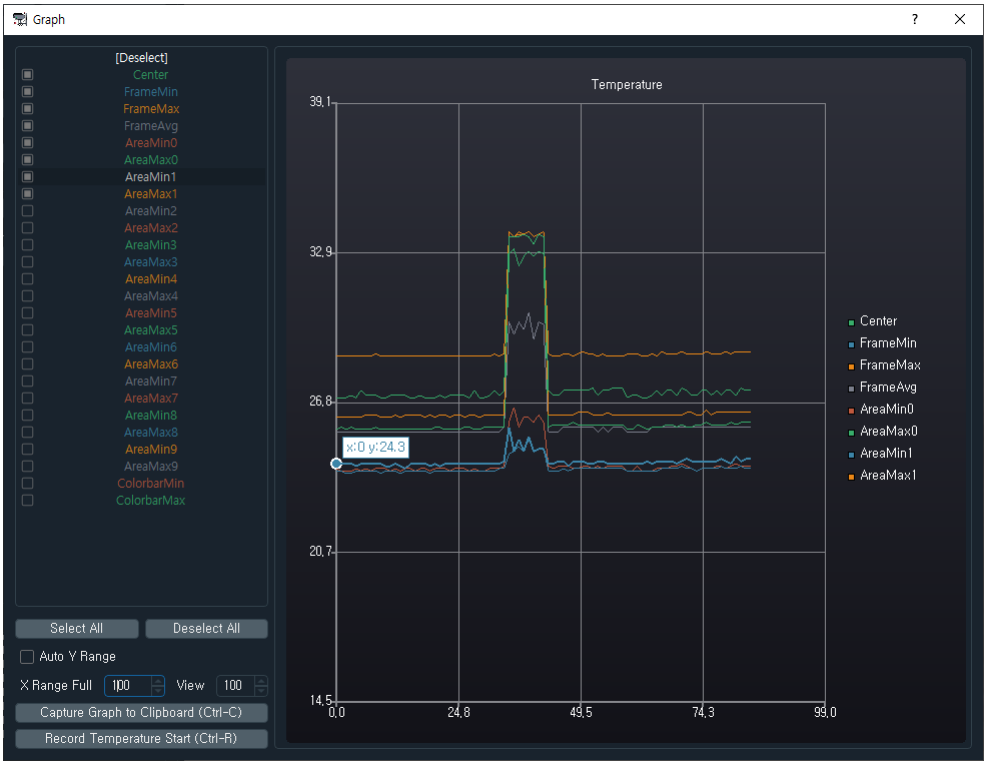


Figure 21. Graph display screen

If you select( ) the temperature information shown on the left in the windows above, it will be displayed on the graph on the right. Uncheck “Y-axis auto range” select screen display range area, left-click the mouse in the graph display window, and select up/down to move the Y-axis, and select left/rigth to move the X-axis.

You can zoom in/out using the mouse wheel. Also, clicking “Capture Graph to Clipboard(Ctrl-C)” copies the currently displayed graph window to the clipboard, and clicking “Record Temperature Start(Ctrl-R)” saves the selected temperature values as CSV file Recording continues until the end.

4. Command Protocol

4.1 Control Protocol

The SL-640C Camera control protocol format consists of a total of 7 Bytes as shown below, and camera Tx Data is transmitted periodically(3Hz) in a formation consisting of a total of 50 words.

Table 5. Command Control Protocol

Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
Header	Address	CMD_H	CMD_L	DATA_H	DATA_L	Checksum

- ✓ Header : 0xFF Fixed
- ✓ Address : Camera Address, 0x00 Fixed
- ✓ CMD_H : Command Address MSB 8bit
- ✓ CMD_L : Command Address LSB 8bit
- ✓ DATA_H : Command Data MSB 8bit
- ✓ DATA_L : Command Data LSB 8bit
- ✓ Checksum : Calculate by performing the 8bit sum of the payload bytes(Bytes 2 through 6) in the message.

Separate UART communication settings are as follows.

- ✓ Baud Rate : 115200bps
- ✓ Data bits : 8bit
- ✓ Parity bit : None
- ✓ Stop bit : 1

4.2 Command List

The Command List is as follows.

Table 6. Command List

Name	Address	Data Range	Unit	Description	Default	Remarks
Image Operation Set	0x2012	0~1	-	0x0:Normal, 0x1:High	0	High mode Optional
Image Mirror	0x2022	0~1	-	0x0:Disable, 0x1:Enable	0	
Image Flip	0x2023	0~1	-	0x0:Disable, 0x1:Enable	0	
Image Invert	0x2024	0~1	-	0x0:Disable, 0x1:Enable	0	
Calibration Execute	0x2030	0~1	-	0:Shutter, 1:OutScene	0	
Calibration Mode	0x2031	0~2	-	0:Manual, 1:Auto, 2:Interval	1	
Calibration Interval	0x2032	10~600	-	Calibration Interval Time(sec)	300	
Parameter Save	0x21B0	0~2		0x0:None, 0x1:Init, 0x2:Update	0	
AGC Mode	0x2100	0~3	-	0x0:MGC Mode, 0x1:AGC#1(Low Range), 0x2:AGC#2(Middle Range), 0x3:AGC#3(High Range)	2	
AGC Adapt Frame	0x2101	5~60		AGC Adapt Frame Number	50	
AGC Min Temp Set	0x2102	-32767~+32767	-	AGC Min Temp Set @ SL-640CT Low Digital Value @ not SL-640CT	10	Signed
AGC Max Temp Set	0x2103	-32767~+32767	-	AGC Max Temp Set @ SL-640CT	35	Signed

				Low Digital Value @ not SL-640CT		
AGC Contrast Level Set	0x2104	-50~+50	-	AGC Contrast Level Set(~±50%)	0	Signed
AGC Brightness Level Set	0x2105	-50~+50	-	AGC Brightness Level Set(~±50%)	0	Signed
IDE Set	0x2110	0~30	-	Image Detail Enhancement Level Set	15	
Gamma Filter Set	0x2112	0~7		0x0:0.7, 0x1:0.8, 0x2:0.9, 0x3:1.0, 0x4:1.1, 0x5:1.2, 0x6:1.3, 0x7:1.4	0x3	
Color Palette Select	0x2113	0~10	-	0x0:Gray, 0x1:Rainbow, 0x2:Iron, 0x3:Jet, 0x4:Thermal, 0x5:BlueOrangeICB, 0x6:Smart, 0x7:Cool, 0x8:Gray+Rainbow, 0x9:Gray+Jet, 0xA:Gray+Iron	0	
Calibration Mark Set	0x2117	0~1	-	0:Disable, 1:Enable	0	
Histogram ROI Set	0x211A	0~6		0x0:Mode0(90%), 0x1:Mode1(75%), 0x2:Mode2(50%), 0x3:Mode3(68%), 0x4:Mode4(45%), 0x5:Mode5(23%), 0x6:Mode6(39%)	0x0	
Digital Zoom Set	0x2120	1~4		0x1:x1, 0x2:x2, 0x3:x4, 0x4:x8	1	
Zoom In/Out	0x2200	0~2		0:No Change, 1:Zoom In, 2:Zoom Out	0	Only SL-640CA
Zoom FOV	0x2201	0~3		0:None, 1:WFOV, 2:MFOV, 3:NFOV	0	Only SL-640CA
Zoom Position Move Value	0x2203	0~		Zoom Position Value and Move	0	Only SL-640CA
Zoom Move Stop	0x2204	-		Zoom Move Stop	0	Only SL-640CA

Zoom Move complete and A/F	0x2205	0~1	-	Zoom Move complete and A/F Execute	0	Only SL-640CA
Focus Far/Near	0x2210	0~2		0:No Change, 1:Focus Far, 2:Focus Near	0	Only SL-640CA
Focus Position Move Value	0x2212	0~		Focus Position Value and Move	0	Only SL-640CA
Focus Move Stop	0x2213	-		Focus Move Stop	0	Only SL-640CA
A/F Execute	0x2220	-		A/F Execute	0	Only SL-640CA
A/F Offset Value	0x2221	-32767~+32767		A/F Offset Set	0	Only SL-640CA
A/F Initialize Position Set	0x2222	-		A/F Initialize Position Set	-	Only SL-640CA
Temperature Information Display	0x2300	0~	-	Bit0:Temp Information Display(0:Off, 1:On) Bit1:Colorbar Display(0:Off, 1:On) Bit2:Center Mark Display(0:Off, 1:On) Bit3:Min/Max Mark Display(0:Off, 1:On)	0	
Temperature User Offset	0x2301	-32768~+32768	-	Temperature User Offset Data	0	Signed, *100
Emissivity Value	0x2302	0.9~1.0		Emissivity Value	98	*100
Data Tx Mode	0x2304	0~1		0x0:None, 0x1:Enable **0x10:Area0 Position, 0x11:Area1 Position,… 0x19:Area9 Position 0x1A:Mask0 Position, 0x1B:Mask1 Position,	0x1	

				0x1C:Mask2 Position		
ROI(AreaX) Set Enable	0x2310	0~		Bit0:ROI0, Bit1:ROI1,… Bit9:ROI9 [0:Off, 1:On]	0x0	
Mask Set Enable	0x2311	0~		Bit0:Mask0, Bit1:Mask1, Bit2:Mask2 [0:Off, 1:On]	0x0	
ROI0 Start X Position	0x2320	10~629		ROI0 Start X Position Value	0	
ROI0 Start Y Position	0x2321	10~469		ROI0 Start Y Position Value	0	
ROI0 End X Position	0x2322	10~629		ROI0 End X Position Value	0	
ROI0 End Y Position	0x2323	10~469		ROI0 End Y Position Value	0	
ROI0 Temperature Threshold	0x2324	-32767~+32767		ROI Temperature Threshold Value	3500	Signed, *100
ROI0 Condition	0x2325	0~2		ROI0 Temperature Over and Under Set, [0:None, 1:Over, 2:Under]	1	
ROI0 Color Palette	0x2326	0~10		ROI0 Alarm Color Palette	0	
ROI1 Start X Position	0x2330	10~629		ROI1 Start X Position Value	0	
ROI1 Start Y Position	0x2331	10~469		ROI1 Start Y Position Value	0	
ROI1 End X Position	0x2332	10~629		ROI1 End X Position Value	0	
ROI1 End Y Position	0x2333	10~469		ROI1 End Y Position Value	0	
ROI1 Temperature Threshold	0x2334	-32767~+32767		ROI1 Temperature Threshold Value	3500	Signed, *100
ROI1 Condition	0x2335	0~2		ROI1 Temperature Over and Under Set, [0:None, 1:Over, 2:Under]	1	
ROI1 Color Palette	0x2336	0~10		ROI1 Alarm Color Palette	0	

ROI2 Start X Position	0x2340	10~629		ROI2 Start X Position Value	0	
ROI2 Start Y Position	0x2341	10~469		ROI2 Start Y Position Value	0	
ROI2 End X Position	0x2342	10~629		ROI2 End X Position Value	0	
ROI2 End Y Position	0x2343	10~469		ROI2 End Y Position Value	0	
ROI2 Temperature Threshold	0x2344	-32767~+32767		ROI2 Temperature Threshold Value	3500	Signed, *100
ROI2 Condition	0x2345	0~2		ROI2 Temperature Over and Under Set, [0:None, 1:Over, 2:Under]	1	
ROI2 Color Palette	0x2346	0~10		ROI2 Alarm Color Palette	0	
ROI3 Start X Position	0x2350	10~629		ROI3 Start X Position Value	0	
ROI3 Start Y Position	0x2351	10~469		ROI3 Start Y Position Value	0	
ROI3 End X Position	0x2352	10~629		ROI3 End X Position Value	0	
ROI3 End Y Position	0x2353	10~469		ROI3 End Y Position Value	0	
ROI3 Temperature Threshold	0x2354	-32767~+32767		ROI3 Temperature Threshold Value	3500	Signed, *100
ROI3 Condition	0x2355	0~2		ROI3 Temperature Over and Under Set, [0:None, 1:Over, 2:Under]	1	
ROI3 Color Palette	0x2356	0~10		ROI3 Alarm Color Palette	0	
ROI4 Start X Position	0x2360	10~629		ROI4 Start X Position Value	0	
ROI4 Start Y Position	0x2361	10~469		ROI4 Start Y Position Value	0	
ROI4 End X Position	0x2362	10~629		ROI4 End X Position Value	0	
ROI4 End Y Position	0x2363	10~469		ROI4 End Y Position Value	0	
ROI4 Temperature	0x2364	-32767~+32767		ROI4 Temperature Threshold Value	3500	Signed, *100

Threshold						
ROI4 Condition	0x2365	0~2		ROI4 Temperature Over and Under Set, [0:None, 1:Over, 2:Under]	1	
ROI4 Color Palette	0x2366	0~10		ROI4 Alarm Color Palette	0	
ROI5 Start X Position	0x2370	10~629		ROI5 Start X Position Value	0	
ROI5 Start Y Position	0x2371	10~469		ROI5 Start Y Position Value	0	
ROI5 End X Position	0x2372	10~629		ROI5 End X Position Value	0	
ROI5 End Y Position	0x2373	10~469		ROI5 End Y Position Value	0	
ROI5 Temperature Threshold	0x2374	-32767~+32767		ROI5 Temperature Threshold Value	3500	Signed, *100
ROI5 Condition	0x2375	0~2		ROI5 Temperature Over and Under Set, [0:None, 1:Over, 2:Under]	1	
ROI5 Color Palette	0x2376	0~10		ROI5 Alarm Color Palette	0	
ROI6 Start X Position	0x2380	10~629		ROI6 Start X Position Value	0	
ROI6 Start Y Position	0x2381	10~469		ROI6 Start Y Position Value	0	
ROI6 End X Position	0x2382	10~629		ROI6 End X Position Value	0	
ROI6 End Y Position	0x2383	10~469		ROI6 End Y Position Value	0	
ROI6 Temperature Threshold	0x2384	-32767~+32767		ROI6 Temperature Threshold Value	3500	Signed, *100
ROI6 Condition	0x2385	0~2		ROI6 Temperature Over and Under Set, [0:None, 1:Over, 2:Under]	1	
ROI6 Color Palette	0x2386	0~10		ROI6 Alarm Color Palette	0	

ROI7 Start X Position	0x2390	10~629		ROI7 Start X Position Value	0	
ROI7 Start Y Position	0x2391	10~469		ROI7 Start Y Position Value	0	
ROI7 End X Position	0x2392	10~629		ROI7 End X Position Value	0	
ROI7 End Y Position	0x2393	10~469		ROI7 End Y Position Value	0	
ROI7 Temperature Threshold	0x2394	-32767~+32767		ROI7 Temperature Threshold Value	3500	Signed, *100
ROI7 Condition	0x2395	0~2		ROI7 Temperature Over and Under Set, [0:None, 1:Over, 2:Under]	1	
ROI7 Color Palette	0x2396	0~10		ROI7 Alarm Color Palette	0	
ROI8 Start X Position	0x23A0	10~629		ROI8 Start X Position Value	0	
ROI8 Start Y Position	0x23A1	10~469		ROI8 Start Y Position Value	0	
ROI8 End X Position	0x23A2	10~629		ROI8 End X Position Value	0	
ROI8 End Y Position	0x23A3	10~469		ROI8 End Y Position Value	0	
ROI8 Temperature Threshold	0x23A4	-32767~+32767		ROI8 Temperature Threshold Value	3500	Signed, *100
ROI8 Condition	0x23A5	0~2		ROI8 Temperature Over and Under Set, [0:None, 1:Over, 2:Under]	1	
ROI8 Color Palette	0x23A6	0~10		ROI8 Alarm Color Palette	0	
ROI9 Start X Position	0x23B0	10~629		ROI9 Start X Position Value	0	
ROI9 Start Y Position	0x23B1	10~469		ROI9 Start Y Position Value	0	
ROI9 End X Position	0x23B2	10~629		ROI9 End X Position Value	0	
ROI9 End Y Position	0x23B3	10~469		ROI9 End Y Position Value	0	
ROI9 Temperature	0x23B4	-32767~+32767		ROI9 Temperature Threshold Value	3500	Signed, *100

Threshold						
ROI9 Condition	0x23B5	0~2		ROI9 Temperature Over and Under Set, [0:None, 1:Over, 2:Under]	1	
ROI9 Color Palette	0x23B6	0~10		ROI9 Alarm Color Palette	0	
Mask0 Start X Position	0x23C0	10~629		Exception Mask0 Start X Position Value	0	
Mask0 Start Y Position	0x23C1	10~469		Exception Mask0 Start Y Position Value	0	
Mask0 End X Position	0x23C2	10~629		Exception Mask0 End X Position Value	0	
Mask0 End Y Position	0x23C3	10~469		Exception Mask0 End Y Position Value	0	
Mask1 Start X Position	0x23D0	10~629		Exception Mask1 Start X Position Value	0	
Mask1 Start Y Position	0x23D1	10~469		Exception Mask1 Start Y Position Value	0	
Mask1 End X Position	0x23D2	10~629		Exception Mask1 End X Position Value	0	
Mask1 End Y Position	0x23D3	10~469		Exception Mask1 End Y Position Value	0	
Mask2 Start X Position	0x23E0	10~629		Exception Mask2 Start X Position Value	0	
Mask2 Start Y Position	0x23E1	10~469		Exception Mask2 Start Y Position Value	0	
Mask2 End X Position	0x23E2	10~629		Exception Mask2 End X Position Value	0	
Mask2 End Y Position	0x23E3	10~469		Exception Mask2 End Y Position Value	0	

4.3 Command Detail Description

4.3.1 Image Operation Set [0x2012]

Command to set the camera operation mode.

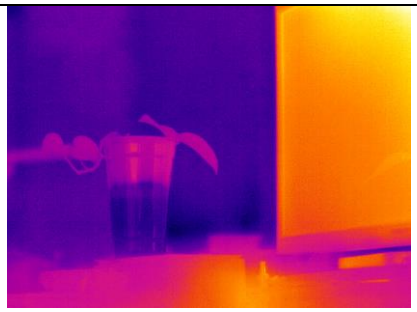
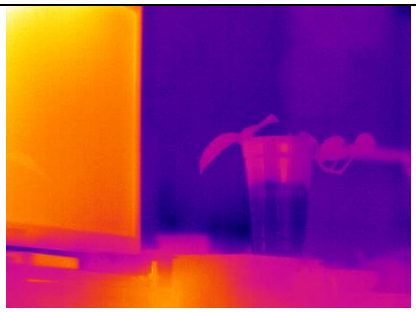
Parameter	Command	Range	Description	Default
Image Operation Set	0x2012	0~1	Image Operation Set	0

High mode : Optional

4.3.2 Image Mirror [0x2022]

Command to set the Image Mirror Function.

Parameter	Command	Range	Description	Default
Image Mirror	0x2022	0~1	0:Disable, 1:Enable	0

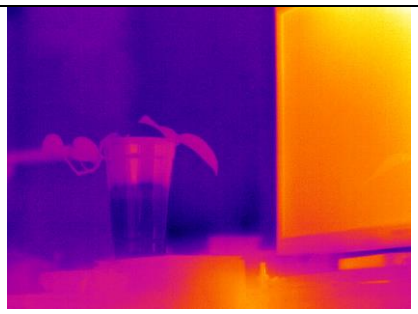
Mirror Disable(Default)	Mirror Enable
	

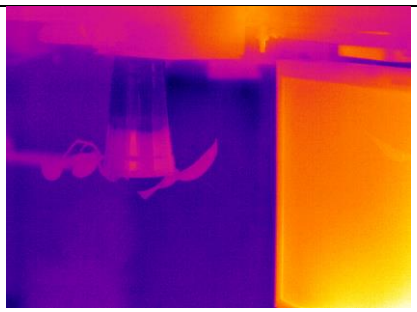
4.3.3 Image Flip [0x2023]

Command to set the Image Flip Function.

Parameter	Command	Range	Description	Default
Image Flip	0x2023	0~1	0:Disable, 1:Enable	0

Flip Disable(Default)	Flip Enable

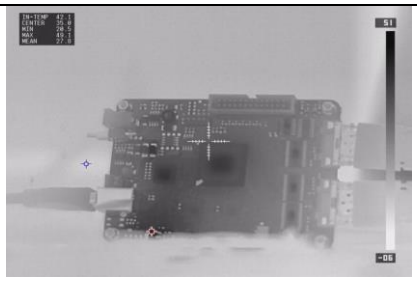




4.3.4 Image Invert [0x2024]

Command to set the Image Invert Function

Parameter	Command	Range	Description	Default
Image Invert	0x2024	0~1	0:Disable, 1:Enable	0

Invert Disable(Default)	Invert Enable
	

4.3.5 Calibration Execution [0x2030]

Command to set the Image Calibration Function.

Parameter	Command	Range	Description	Default
Calibration Execution	0x2030	0~1	Calibration Execution (0:Shutter, 1:Out Scene)	0

When performing calibration with 1:Out Scene, a ghost phenomenon will occur if a flat surface is not placed in front of the lens.

4.3.6 Calibration mode [0x2031]

Command to set the Image Calibration Mode Function. There are Manual/Auto/Interval modes.

Parameter	Command	Range	Description	Default

Calibration mode	0x2031	0~2	0:Manual, 1:Auto, 2:Interval	0

Manual mode is a function in which the user performs manual calibration, and Auto mode is a function in which the camera automatically determines and performs calibration according to the internal temperature and time. Interval mode is a function that automatically performs calibration every second set as Calibration Interval time.

4.3.7 Calibration Interval time [0x2032]

Command to set the Calibration Interval. It can be set in seconds.

Parameter	Command	Range	Description	Default
Calibration Interval	0x2032	10~360	Calibration Interval Set	60

4.3.8 Parameter Save [0x21B0]

Command to set the Parameter Save Function.

Parameter	Command	Range	Description	Default
Parameter Save	0x21B0	0~2	0x0:None, 0x1:Init, 0x2:Update	0

When Initialize(0x1), the parameters are initialized to default, so use with caution.

4.3.9 AGC Mode [0x2100]

Command to set the AGC(Auto Gain Control) Function.

Parameter	Command	Range	Description	Default
AGC mode Set	0x2100	0~3	0x0:MGC, 0x1:AGC#1(Low Range), 0x2:AGC#2(Middle Range), 0x3:AGC#3(High Range)	2

When set to MGC(0x0), the user can set the Min/Max Temperature value to be displayed. AGC is classified into AGC#1/#2/#3 depending on the mode, and the distribution(range) of the analyzed data can be expressed as Low/Middle/High range depending on the mode. As the image goes to Low range(AGC#1), the contrast of the image increases because the image is expressed in a narrow range.

4.3.10 AGC Adapt Frame [0x2101]

Command to set cumulative average number of frames when performing AGC.

Parameter	Command	Range	Description	Default
AGC Adapt Frame Set	0x2101	5~60	AGC Adapt Frame Set	50

If the adapt frame value is small, AGC can be processed by quickly reacting to image changes, but some flickering may occur. If the value is large, AGC is applied by slowly reflecting image changes, so select an appropriate value for the situation.

4.3.11 AGC Min Temp Set [0x2102]

Command to set manually Min Temperature the AGC mode is MGC.

Parameter	Command	Range	Description	Default
Min Temp Set	0x2102	-32767~+32767	AGC Min Temperature Set	10

If it is not for measurement purposes, it must be set to Low Digital Value.

4.3.12 AGC Max Temp Set [0x2103]

Command to set manually Max Temperature the AGC mode is MGC.

Parameter	Command	Range	Description	Default
Max Temp Set	0x2103	-32767~+32767	AGC Max Temperature Set	35

If it is not for measurement purposes, it must be set to Max Digital Value.

4.3.13 AGC Contrast Level Set [0x2104]

Command to set Adjust the Contrast value of AGC.

Parameter	Command	Range	Description	Default
AGC Contrast Level Set	0x2104	-50%~+50%	AGC Contrast Level Set	0%

4.3.14 AGC Brightness Level Set [0x2105]

Command to set Adjust the Brightness value of AGC.

Parameter	Command	Range	Description	Default
AGC Brightness Level Set	0x2105	-50%~+50%	AGC Brightness Level Set	0%

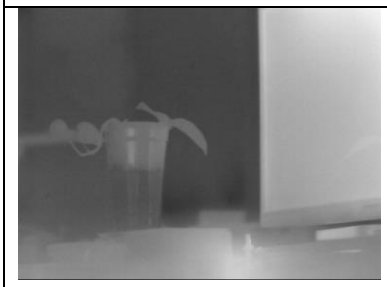
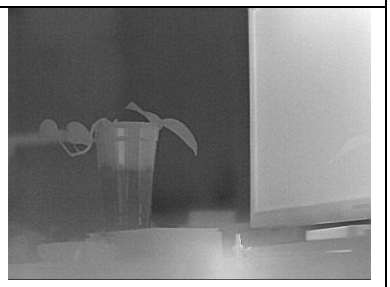
4.3.15 IDE Set [0x2110]

Command to set Image Enhancement Function.

Parameter	Command	Range	Description	Default
IDE Set	0x2110	0~30	IDE Level Set	15

If you set the value to a large value, the edges will be emphasized and the clarity of the image will be improved, but noise in the pixels will also stand out, so you must set an appropriate value before use.

Image processing images according to IDE Level are as follows.

Level:0	Level:15	Level:20
		

4.3.16 Gamma Filter Set [0x2112]

Command to set Image Gamma filter Function.

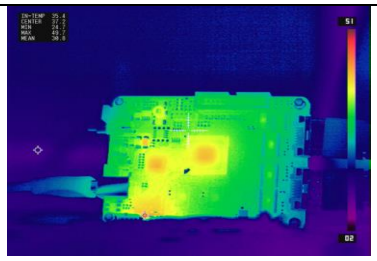
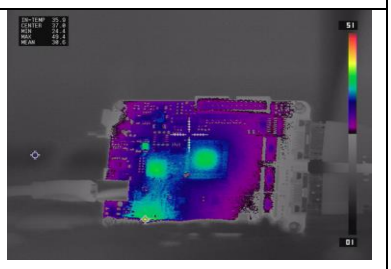
Parameter	Command	Range	Description	Default
Gamma Filter Set	0x2112	0~7	0x0:0.7, 0x1:0.8, 0x2:0.9, 0x3:1.0, 0x4:1.1, 0x5:1.2, 0x6:1.3, 0x7:1.4	0x3

4.3.17 Color palette Set [0x2113]

Command to set Color palette.

Parameter	Command	Range	Description	Default
Color palette Set	0x2113	0~10	0:Gray, 1:Rainbow, 2:Iron, 3:Jet, 4:Thermal, 5:BlueOrangeIcb, 6:Smart, 7:Cool, 8:Gray+Rainbow, 9:Gray+Jet, 10:Gray+Iron	0

The images according to the color palette are as follows.

Gray Color	Rainbow Color	Gray+Rainbow Color
		

4.3.18 Calibration Mark Set [0x2117]

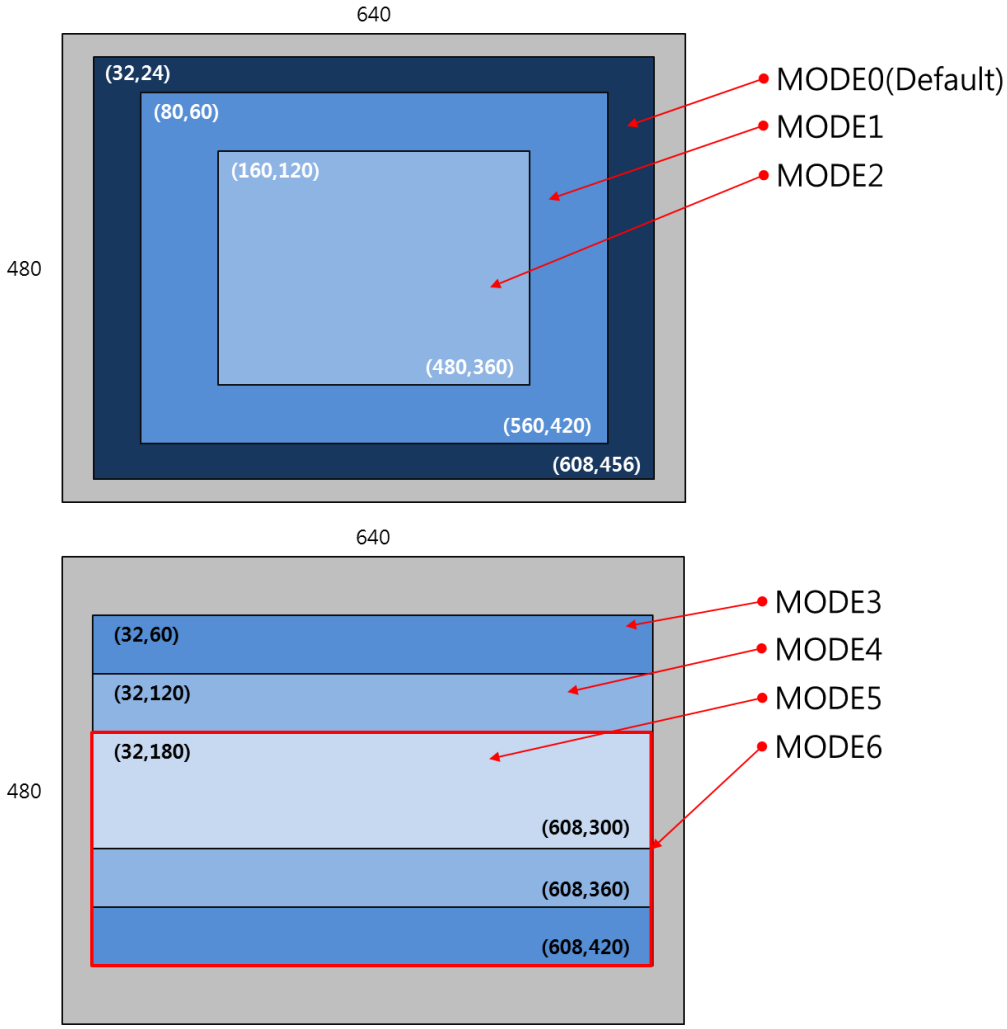
Command to set display a calibration mark at the bottom left of the image during calibration.

Parameter	Command	Range	Description	Default
Calibration Mark Set	0x2117	0~1	0:Disable, 1:Enable	0

4.3.19 Histogram ROI Set [0x211A]

Command to set Histogram Region of Interest function.

Parameter	Command	Range	Description	Default
Histogram ROI Set	0x211A	0~6	0x0:Mode0(90%) 0x1:Mode1(75%) 0x2:Mode2(50%) 0x3:Mode3(68%) 0x4:Mode4(45%) 0x5:Mode5(23%) 0x6:Mode6(39%)	0



4.3.20 Digital Zoom Set [0x2120]

Command to set Digital Zoom Function.

Parameter	Command	Range	Description	Default
Digital Zoom Set	0x2120	1~4	1:x1, 2:x2, 3:x4, 4:x8	1

4.3.21 Zoom In/Out [0x2200]

Command to set Zoom In(Narrower) or Zoom Out(Wider) Function.

Parameter	Command	Range	Description	Default
Zoom In/Out	0x2200	0~2	0:No Change, 1:Zoom In, 2:Zoom Out	0

4.3.22 Zoom FOV [0x2201]

Command to set Zoom FOV Position Function(Wide FOV/Medium FOV/Narrow FOV)

Parameter	Command	Range	Description	Default
Zoom FOV	0x2201	0~3	0:Continues Zoom 1:WFOV, 2:MFOV, 3:NFOV	0

4.3.23 Zoom Position Move Value [0x2203]

Command to set Move Zoom Position to the value desired by the user Function.

Parameter	Command	Range	Description	Default
Zoom Position Move Value	0x2203	0~	Zoom Position value and Move	

4.3.24 Zoom Move Stop [0x2204]

Command to set Zoom Move Stop Function.

Parameter	Command	Range	Description	Default
Zoom Move Stop	0x2204	0	Zoom Move Stop	0

4.3.25 Zoom Move Complete and A/F [0x2205]

Command to set performs A/F after completing the zoom movement Function.

Parameter	Command	Range	Description	Default
Zoom Move Complete and A/F	0x2205	0~1	0:None, 1:Zoom Move Complete and A/F	0

4.3.26 Focus Far/Near [0x2210]

Command to set Focus Far or Near Move Function.

Parameter	Command	Range	Description	Default
Focus Far/Near	0x2210	0~2	0:No Change, 1:Focus Far, 2:Focus Near	0

4.3.27 Focus Position Move Value [0x2212]

Command to set Move Focus Position to the value desired by the user Function.

Parameter	Command	Range	Description	Default
Focus Position Move Value	0x2212	0~	Focus Position Value and Move	-

4.3.28 Focus Move Stop [0x2213]

Command to set Focus Move Stop Function.

Parameter	Command	Range	Description	Default
Focus Move Stop	0x2213	0	Focus Move Stop	0

4.3.29 A/F Execute [0x2220]

Command to set Auto Focus Function.

Parameter	Command	Range	Description	Default
A/F Execute	0x2220	0~2	Auto Focus Execute 0:Scan Area0, 1:Scan Area1, 2:Scan Area2	0

4.3.30 A/F Offset Set [0x2221]

Command to set offset by the focus motor after A/F Function.

Parameter	Command	Range	Description	Default
A/F Offset Set	0x2221	-32767~+32767	A/F Offset Set	0

4.3.31 A/F Initialize Position Set [0x2222]

Command to set Initial position value for A/F.

Parameter	Command	Range	Description	Default
A/F Initialize Position Set	0x2222	-	A/F Initialize Position Set	0

4.3.32 Temperature Infor Display [0x2300]

Command to set Temperature Information Display Function.

Parameter	Command	Range	Description	Default
Temperature Information Display	0x2300	0~	Bit0:Temp Information Display Bit1:Colorbar Display Bit2:Center Mark Display Bit3:Min/Max Mark Display	0

4.3.33 Temperature User Offset [0x2301]

Command to set Temperature Offset value Function.

Parameter	Command	Range	Description	Default
Temperature User Offset	0x2301	-32767~+32767	Temperature User Offset (Signed, *100)	0

4.3.34 Emissivity Value [0x2302]

Command to set Emissivity Value Function.

Parameter	Command	Range	Description	Default
Emissivity Value	0x2302	0~	Emissivity Value(*100)	98

4.3.35 Data Tx Mode [0x2304]

Command to set Data Tx On/Off Function.

Parameter	Command	Range	Description	Default
Data Tx Mode	0x2304	0~	0x0:None, 0x1:Enable 0x10:Area0 Position, 0x11:Area1 Position,… 0x19:Area9 Position 0x1A:Mask0 Position, 0x1B:Mask1 Position, 0x1C:Mask2 Position	0

4.3.36 ROI Set Enable [0x2310]

Command to set ROI(Total 10) Enable Function

Parameter	Command	Range	Description	Default
ROI Set Enable	0x2310	0~	Bit0:ROI0, Bit1:ROI1,.. Bit9:ROI9	0

4.3.37 Mask Set Enable [0x2311]

Command to set Exception mask(Total 3) Function.

Parameter	Command	Range	Description	Default
Mask Set Enable	0x2311	0~	Bit0:Mask0, Bit1:Mask1, Bit2:Mask2	0

4.3.38 ROI0 Start X Position [0x2320]

Command to set ROI0 Start X-Position value Function.

Parameter	Command	Range	Description	Default
ROI0 Start X Position	0x2320	10~629	ROI0 Start X Position Value	0

4.3.39 ROI0 Start Y Position [0x2321]

Command to set ROI0 Start Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI0 Start Y Position	0x2321	10~469	ROI0 Start Y Position Value	0

4.3.40 ROI0 End X Position [0x2322]

Command to set ROI0 End X-Position value Function.

Parameter	Command	Range	Description	Default
ROI0 End X Position	0x2322	10~629	ROI0 End X Position Value	0

4.3.41 ROI0 End Y Position [0x2323]

Command to set ROI0 End Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI0 End Y	0x2323	10~469	ROI0 End Y Position Value	0

Position				

4.3.42 ROI0 Temperature Threshold [0x2324]

Command to set ROI0 Threshold Temperature value Function.

Parameter	Command	Range	Description	Default
ROI0 Temperature Threshold	0x2324	-32767~+32767	ROI0 Temperature Threshold Value	35

4.3.43 ROI0 Condition [0x2325]

Command to set ROI0 Condition Function.

Parameter	Command	Range	Description	Default
ROI0 Condition	0x2325	0~2	0:None, 1:Over, 2:Under	1

4.3.44 ROI0 Color Palette [0x2326]

Command to set color palette that is expressed when an alarm for ROI0 occurs.

Parameter	Command	Range	Description	Default
ROI0 Color Palette	0x2326	0~10	ROI0 Alarm Color Palette	0

4.3.45 ROI1 Start X Position [0x2330]

Command to set ROI1 Start X-Position value Function.

Parameter	Command	Range	Description	Default
ROI1 Start X Position	0x2330	10~629	ROI1 Start X Position Value	0

4.3.46 ROI1 Start Y Position [0x2331]

Command to set ROI1 Start Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI1 Start Y Position	0x2321	10~469	ROI1 Start Y Position Value	0

4.3.47 ROI1 End X Position [0x2332]

Command to set ROI1 End X-Position value Function.

Parameter	Command	Range	Description	Default
ROI1 End X Position	0x2332	10~629	ROI1 End X Position Value	0

4.3.48 ROI1 End Y Position [0x2333]

Command to set ROI1 End Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI1 End Y Position	0x2333	10~469	ROI1 End Y Position Value	0

4.3.49 ROI1 Temperature Threshold [0x2334]

Command to set ROI1 Threshold Temperature value Function.

Parameter	Command	Range	Description	Default
ROI1 Temperature Threshold	0x2324	-32767~+32767	ROI1 Temperature Threshold Value	35

4.3.50 ROI1 Condition [0x2335]

Command to set ROI1 Condition Function.

Parameter	Command	Range	Description	Default
ROI1 Condition	0x2325	0~2	0:None, 1:Over, 2:Under	1

4.3.51 ROI1 Color Palette [0x2336]

Command to set color palette that is expressed when an alarm for ROI1 occurs.

Parameter	Command	Range	Description	Default
ROI1 Color Palette	0x2336	0~10	ROI1 Alarm Color Palette	0

4.3.52 ROI2 Start X Position [0x2340]

Command to set ROI2 Start X-Position value Function.

Parameter	Command	Range	Description	Default
ROI2 Start X Position	0x2340	10~629	ROI2 Start X Position Value	0

4.3.53 ROI2 Start Y Position [0x2341]

Command to set ROI2 Start Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI2 Start Y Position	0x2341	10~469	ROI2 Start Y Position Value	0

4.3.54 ROI2 End X Position [0x2342]

Command to set ROI2 End X-Position value Function.

Parameter	Command	Range	Description	Default
ROI2 End X Position	0x2342	10~629	ROI2 End X Position Value	0

4.3.55 ROI2 End Y Position [0x2343]

Command to set ROI2 End Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI2 End Y Position	0x2343	10~469	ROI2 End Y Position Value	0

4.3.56 ROI2 Temperature Threshold [0x2344]

Command to set ROI2 Threshold Temperature value Function.

Parameter	Command	Range	Description	Default
ROI2 Temperature Threshold	0x2344	-32767~+32767	ROI2 Temperature Threshold Value	35

4.3.57 ROI2 Condition [0x2345]

Command to set ROI2 Condition Function.

Parameter	Command	Range	Description	Default

ROI2 Condition	0x2345	0~2	0:None, 1:Over, 2:Under	1

4.3.58 ROI2 Color Palette [0x2346]

Command to set color palette that is expressed when an alarm for ROI2 occurs.

Parameter	Command	Range	Description	Default
ROI2 Color Palette	0x2346	0~10	ROI2 Alarm Color Palette	0

4.3.59 ROI3 Start X Position [0x2350]

Command to set ROI3 Start X-Position value Function.

Parameter	Command	Range	Description	Default
ROI3 Start X Position	0x2350	10~629	ROI3 Start X Position Value	0

4.3.60 ROI3 Start Y Position [0x2351]

Command to set ROI3 Start Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI3 Start Y Position	0x2351	10~469	ROI3 Start Y Position Value	0

4.3.61 ROI3 End X Position [0x2352]

Command to set ROI3 End X-Position value Function.

Parameter	Command	Range	Description	Default
ROI3 End X Position	0x2352	10~629	ROI3 End X Position Value	0

4.3.62 ROI3 End Y Position [0x2353]

Command to set ROI3 End Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI3 End Y Position	0x2353	10~469	ROI3 End Y Position Value	0

4.3.63 ROI3 Temperature Threshold [0x2354]

Command to set ROI3 Threshold Temperature value Function.

Parameter	Command	Range	Description	Default
ROI3 Temperature Threshold	0x2354	-32767~+32767	ROI3 Temperature Threshold Value	35

4.3.64 ROI3 Condition [0x2355]

Command to set ROI3 Condition Function.

Parameter	Command	Range	Description	Default
ROI3 Condition	0x2355	0~2	0:None, 1:Over, 2:Under	1

4.3.65 ROI3 Color Palette [0x2356]

Command to set color palette that is expressed when an alarm for ROI3 occurs.

Parameter	Command	Range	Description	Default
ROI3 Color Palette	0x2356	0~10	ROI3 Alarm Color Palette	0

4.3.66 ROI4 Start X Position [0x2360]

Command to set ROI4 Start X-Position value Function.

Parameter	Command	Range	Description	Default
ROI4 Start X Position	0x2360	10~629	ROI4 Start X Position Value	0

4.3.67 ROI4 Start Y Position [0x2361]

Command to set ROI4 Start Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI4 Start Y Position	0x2361	10~469	ROI4 Start Y Position Value	0

4.3.68 ROI4 End X Position [0x2362]

Command to set ROI4 End X-Position value Function.

Parameter	Command	Range	Description	Default
ROI4 End X Position	0x2362	10~629	ROI4 End X Position Value	0

4.3.69 ROI4 End Y Position [0x2363]

Command to set ROI4 End Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI4 End Y Position	0x2363	10~469	ROI4 End Y Position Value	0

4.3.70 ROI4 Temperature Threshold [0x2364]

Command to set ROI4 Threshold Temperature value Function.

Parameter	Command	Range	Description	Default
ROI4 Temperature Threshold	0x2364	-32767~+32767	ROI4 Temperature Threshold Value	35

4.3.71 ROI4 Condition [0x2365]

ROI4 에 대한 Condition 을 설정할 수 있는 Command 이다.

Parameter	Command	Range	Description	Default
ROI4 Condition	0x2365	0~2	0:None, 1:Over, 2:Under	1

4.3.72 ROI4 Color Palette [0x2366]

Command to set color palette that is expressed when an alarm for RO4 occurs.

Parameter	Command	Range	Description	Default
ROI4 Color Palette	0x2366	0~10	ROI4 Alarm Color Palette	0

4.3.73 ROI5 Start X Position [0x2370]

Command to set ROI5 Start X-Position value Function.

Parameter	Command	Range	Description	Default

ROI5 Start X Position	0x2370	10~629	ROI5 Start X Position Value	0

4.3.74 ROI5 Start Y Position [0x2371]

Command to set ROI5 Start Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI5 Start Y Position	0x2371	10~469	ROI5 Start Y Position Value	0

4.3.75 ROI5 End X Position [0x2372]

Command to set ROI5 End X-Position value Function.

Parameter	Command	Range	Description	Default
ROI5 End X Position	0x2372	10~629	ROI5 End X Position Value	0

4.3.76 ROI5 End Y Position [0x2373]

Command to set ROI5 End Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI5 End Y Position	0x2373	10~469	ROI5 End Y Position Value	0

4.3.77 ROI5 Temperature Threshold [0x2374]

Command to set ROI5 Threshold Temperature value Function.

Parameter	Command	Range	Description	Default
ROI5 Temperature Threshold	0x2374	-32767~+32767	ROI5 Temperature Threshold Value	35

4.3.78 ROI5 Condition [0x2375]

Command to set ROI5 Condition Function.

Parameter	Command	Range	Description	Default
ROI5 Condition	0x2375	0~2	0:None, 1:Over, 2:Under	1

4.3.79 ROI5 Color Palette [0x2376]

Command to set color palette that is expressed when an alarm for ROI5 occurs.

Parameter	Command	Range	Description	Default
ROI5 Color Palette	0x2376	0~10	ROI5 Alarm Color Palette	0

4.3.80 ROI6 Start X Position [0x2380]

Command to set ROI6 Start X-Position value Function.

Parameter	Command	Range	Description	Default
ROI6 Start X Position	0x2380	10~629	ROI6 Start X Position Value	0

4.3.81 ROI6 Start Y Position [0x2381]

Command to set ROI6 Start Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI6 Start Y Position	0x2381	10~469	ROI6 Start Y Position Value	0

4.3.82 ROI6 End X Position [0x2382]

Command to set ROI6 End X-Position value Function.

Parameter	Command	Range	Description	Default
ROI6 End X Position	0x2382	10~629	ROI6 End X Position Value	0

4.3.83 ROI6 End Y Position [0x2383]

Command to set ROI6 End Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI6 End Y Position	0x2383	10~469	ROI6 End Y Position Value	0

4.3.84 ROI6 Temperature Threshold [0x2384]

Command to set ROI6 Threshold Temperature value Function.

Parameter	Command	Range	Description	Default
ROI6 Temperature Threshold	0x2384	-32767~+32767	ROI6 Temperature Threshold Value	35

4.3.85 ROI6 Condition [0x2385]

Command to set ROI6 Condition Function.

Parameter	Command	Range	Description	Default
ROI6 Condition	0x2385	0~2	0:None, 1:Over, 2:Under	1

4.3.86 ROI6 Color Palette [0x2386]

Command to set color palette that is expressed when an alarm for ROI6 occurs.

Parameter	Command	Range	Description	Default
ROI6 Color Palette	0x2386	0~10	ROI6 Alarm Color Palette	0

4.3.87 ROI7 Start X Position [0x2390]

Command to set ROI7 Start X-Position value Function.

Parameter	Command	Range	Description	Default
ROI7 Start X Position	0x2390	10~629	ROI7 Start X Position Value	0

4.3.88 ROI7 Start Y Position [0x2391]

Command to set ROI7 Start Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI7 Start Y Position	0x2391	10~469	ROI7 Start Y Position Value	0

4.3.89 ROI7 End X Position [0x2392]

Command to set ROI7 End X-Position value Function.

Parameter	Command	Range	Description	Default
ROI7 End X Position	0x2392	10~629	ROI7 End X Position Value	0

4.3.90 ROI7 End Y Position [0x2393]

Command to set ROI7 End Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI7 End Y Position	0x2393	10~469	ROI7 End Y Position Value	0

4.3.91 ROI7 Temperature Threshold [0x2394]

Command to set ROI7 Threshold Temperature value Function.

Parameter	Command	Range	Description	Default
ROI7 Temperature Threshold	0x2394	-32767~+32767	ROI7 Temperature Threshold Value	35

4.3.92 ROI7 Condition [0x2395]

Command to set ROI7 Condition Function.

Parameter	Command	Range	Description	Default
ROI7 Condition	0x2395	0~2	0:None, 1:Over, 2:Under	1

4.3.93 ROI7 Color Palette [0x2396]

Command to set color palette that is expressed when an alarm for ROI7 occurs.

Parameter	Command	Range	Description	Default
ROI Color Palette	0x2396	0~10	ROI7 Alarm Color Palette	0

4.3.94 ROI8 Start X Position [0x23A0]

Command to set ROI8 Start X-Position value Function.

Parameter	Command	Range	Description	Default

ROI8 Start X Position	0x23A0	10~629	ROI8 Start X Position Value	0

4.3.95 ROI8 Start Y Position [0x23A1]

Command to set ROI8 Start Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI8 Start Y Position	0x23A1	10~469	ROI8 Start Y Position Value	0

4.3.96 ROI8 End X Position [0x23A2]

Command to set ROI8 End X-Position value Function.

Parameter	Command	Range	Description	Default
ROI8 End X Position	0x23A2	10~629	ROI8 End X Position Value	0

4.3.97 ROI8 End Y Position [0x23A3]

Command to set ROI8 End Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI8 End Y Position	0x23A3	10~469	ROI8 End Y Position Value	0

4.3.98 ROI8 Temperature Threshold [0x23A4]

Command to set ROI8 Threshold Temperature value Function.

Parameter	Command	Range	Description	Default
ROI8 Temperature Threshold	0x23A4	-32767~+32767	ROI8 Temperature Threshold Value	35

4.3.99 ROI8 Condition [0x23A5]

Command to set ROI8 Condition Function.

Parameter	Command	Range	Description	Default
ROI8 Condition	0x23A5	0~2	0:None, 1:Over, 2:Under	1

4.3.100 ROI8 Color Palette [0x23A6]

Command to set color palette that is expressed when an alarm for ROI8 occurs.

Parameter	Command	Range	Description	Default
ROI8 Color Palette	0x23A6	0~10	ROI8 Alarm Color Palette	0

4.3.101 ROI9 Start X Position [0x23B0]

Command to set ROI9 Start X-Position value Function.

Parameter	Command	Range	Description	Default
ROI9 Start X Position	0x23B0	10~629	ROI9 Start X Position Value	0

4.3.102 ROI9 Start Y Position [0x23B1]

Command to set ROI9 Start Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI9 Start Y Position	0x23B1	10~469	ROI9 Start Y Position Value	0

4.3.103 ROI9 End X Position [0x23B2]

Command to set ROI9 End X-Position value Function.

Parameter	Command	Range	Description	Default
ROI9 End X Position	0x23B2	10~629	ROI9 End X Position Value	0

4.3.104 ROI9 End Y Position [0x23B3]

Command to set ROI9 End Y-Position value Function.

Parameter	Command	Range	Description	Default
ROI9 End Y Position	0x23B3	10~469	ROI9 End Y Position Value	0

4.3.105 ROI9 Temperature Threshold [0x23B4]

Command to set ROI9 Threshold Temperature value Function.

Parameter	Command	Range	Description	Default
ROI9 Temperature Threshold	0x23B4	-32767~+32767	ROI9 Temperature Threshold Value	35

4.3.106 ROI9 Condition [0x23B5]

Command to set ROI9 Condition Function.

Parameter	Command	Range	Description	Default
ROI9 Condition	0x23B5	0~2	0:None, 1:Over, 2:Under	1

4.3.107 ROI9 Color Palette [0x23B6]

Command to set color palette that is expressed when an alarm for ROI9 occurs.

Parameter	Command	Range	Description	Default
ROI9 Color Palette	0x23B6	0~10	ROI9 Alarm Color Palette	0

4.3.108 Mask0 Start X Position [0x23C0]

Command to set Mask0 Start X-Position value Function.

Parameter	Command	Range	Description	Default
Mask0 Start X Position	0x23C0	10~629	Mask0 Start X Position Value	0

4.3.109 Mask0 Start Y Position [0x23C1]

Command to set Mask0 Start Y-Position value Function.

Parameter	Command	Range	Description	Default
Mask0 Start Y Position	0x23C1	10~469	Mask0 Start Y Position Value	0

4.3.110 Mask0 End X Position [0x23C2]

Command to set Mask0 End X-Position value Function.

Parameter	Command	Range	Description	Default
Mask0 End X Position	0x23C2	10~629	Mask0 End X Position Value	0

4.3.111 Mask0 End Y Position [0x23C3]

Command to set Mask0 End Y-Position value Function.

Parameter	Command	Range	Description	Default
Mask0 End Y Position	0x23C3	10~469	Mask0 End Y Position Value	0

4.3.112 Mask1 Start X Position [0x23D0]

Command to set Mask1 Start X-Position value Function.

Parameter	Command	Range	Description	Default
Mask1 Start X Position	0x23D0	10~629	Mask1 Start X Position Value	0

4.3.113 Mask1 Start Y Position [0x23D1]

Command to set Mask1 Start Y-Position value Function.

Parameter	Command	Range	Description	Default
Mask1 Start Y Position	0x23D1	10~469	Mask1 Start Y Position Value	0

4.3.114 Mask1 End X Position [0x23D2]

Command to set Mask1 End X-Position value Function.

Parameter	Command	Range	Description	Default
Mask1 End X Position	0x23D2	10~629	Mask1 End X Position Value	0

4.3.115 Mask1 End Y Position [0x23D3]

Command to set Mask1 End Y-Position value Function.

Parameter	Command	Range	Description	Default
Mask0 End	0x23D3	10~469	Mask0 End Y Position Value	0

Y Position				

4.3.116 Mask2 Start X Position [0x23E0]

Command to set Mask2 Start X-Position value Function.

Parameter	Command	Range	Description	Default
Mask2 Start X Position	0x23E0	10~629	Mask2 Start X Position Value	0

4.3.117 Mask2 Start Y Position [0x23E1]

Command to set Mask2 Start Y-Position value Function.

Parameter	Command	Range	Description	Default
Mask2 Start Y Position	0x23E1	10~469	Mask2 Start Y Position Value	0

4.3.118 Mask2 End X Position [0x23E2]

Command to set Mask2 End X-Position value Function.

Parameter	Command	Range	Description	Default
Mask2 End X Position	0x23E2	10~629	Mask2 End X Position Value	0

4.3.119 Mask2 End Y Position [0x23E3]

Command to set Mask2 End Y-Position value Function.

Parameter	Command	Range	Description	Default
Mask2 End Y Position	0x23E3	10~469	Mask2 End Y Position Value	0

4.4 Tx Data Protocol

Tx Data transmitted through TCP/IP consists of a total of 50 words and is transmitted periodically in the formation below.

Table 7. Command Control Protocol

Word1	Word2	Word3	Word4	…	Word49	Word50
Header	Data1	Data2	Data3	…	Data48	Data49

- ✓ Header : 0xFBFA Fixed(LSB8bit:0xFA, MSB8bit:0xFB)

4.5 Tx Data List

The Tx Data List is as follows.

No	Data	Data Description	Remarks
0	Header	MSB8bit:0xFB, LSB8bit:0xFA	
1	DATA#1	Bit0:Mirror, Bit1:Flip, Bit2:Invert, Bit8~Bit11:Digital Zoom, Bit12~Bit15:Color Palette	
2	DATA#2	Bit4~Bit7:Gamma Filter, Bit8~Bit11:AGC Mode	
3	DATA#3	Bit0~Bit12:ROIx X-Start Position Value	For Data Tx Mode, 0x10~0x1C
4	DATA#4	Bit0~Bit12: ROIx Y-Start Position Value	For Data Tx Mode, 0x10~0x1C
5	DATA#5	Bit0~Bit7:IDE Level, Bit8~Bit15:AGC Adapt Frame Number	
6	DATA#6	Bit0~Bit3:Calibration Mode, Bit4~Bit15:Calibration Interval Time	
7	DATA#7	AGC Contrast Value	
8	DATA#8	AGC Brightness Value	
9	DATA#9	F/W Version Information(Bit0~Bit7:Minor Number, Bit8~Bit15:Major Number)	
10	DATA#10	Serial Number	
11	DATA#11	Shutter Temperature Value	(Value – 27300)/100
12	DATA#12	ROIx Threshold Temperature Value	For Data Tx Mode, 0x10~0x1C
13	DATA#13	Center Temperature Value	Signed, (Value/10)
14	DATA#14	Bit0:Temp Information Enable, Bit1:Colorbar Enable, Bit2:Center Mark Enable, Bit3:Min/Max Mark Enable	
15	DATA#15	Zoom Position Value	Only SL-640CA

16	DATA#16	Focus Position Value	Only SL-640CA
17	DATA#17	Bit0~Bit7:Focal Length, Bit8~Bit9:TBD, Bit10:Zoom Move Flag, Bit11:A/F Flag	
18	DATA#18	Bit0~Bit7:Frame Rate Value Bit8~Bit15:DataTx Mode Value	
19	DATA#19	Frame Min Temperature Value	Signed, (Value/10)
20	DATA#20	Frame Max Temperature Value	Signed, (Value/10)
21	DATA#21	Frame Average Temperature Value	Signed, (Value/10)
22	DATA#22	ROI0 Min Temperature Value	Signed, (Value/10)
23	DATA#23	ROI0 Max Temperature Value	Signed, (Value/10)
24	DATA#24	ROI1 Min Temperature Value	Signed, (Value/10)
25	DATA#25	ROI1 Max Temperature Value	Signed, (Value/10)
26	DATA#26	ROI2 Min Temperature Value	Signed, (Value/10)
27	DATA#27	ROI2 Max Temperature Value	Signed, (Value/10)
28	DATA#28	ROI3 Min Temperature Value	Signed, (Value/10)
29	DATA#29	ROI3 Max Temperature Value	Signed, (Value/10)
30	DATA#30	ROI4 Min Temperature Value	Signed, (Value/10)
31	DATA#31	ROI4 Max Temperature Value	Signed, (Value/10)
32	DATA#32	ROI5 Min Temperature Value	Signed, (Value/10)
33	DATA#33	ROI5 Max Temperature Value	Signed, (Value/10)
34	DATA#34	ROI6 Min Temperature Value	Signed, (Value/10)
35	DATA#35	ROI6 Max Temperature Value	Signed, (Value/10)
36	DATA#36	ROI7 Min Temperature Value	Signed, (Value/10)

37	DATA#37	ROI7 Max Temperature Value	Signed, (Value/10)
38	DATA#38	ROI8 Min Temperature Value	Signed, (Value/10)
39	DATA#39	ROI8 Max Temperature Value	Signed, (Value/10)
40	DATA#40	ROI9 Min Temperature Value	Signed, (Value/10)
41	DATA#41	ROI9 Max Temperature Value	Signed, (Value/10)
42	DATA#42	Colorbar Min Temperature Value	Signed, (Value/10)
43	DATA#43	Colorbar Max Temperature Value	Signed, (Value/10)
44	DATA#44	Emissivity Data	(Value/100)
45	DATA#45	User Temperature Offset Value	Signed, (Value/100)
46	DATA#46	Bit0:ROI0 Enable, Bit1:ROI1 Enable,… Bit9:ROI9 Enable, Bit10:Min/Max Enable, Bit11:Mask0 Enable, Bit12:Mask1 Enable, Bit13:Mask2 Enable	
47	DATA#47	Bit0:ROI0 Alarm, Bit1:ROI1 Alarm,… Bit9:ROI9 Alarm	0:None, 1:Alarm
48	DATA#48	ROIx X-End Position Value @ SL-640CT ETX Data, LSB8bit:0xFC, MSB8bit:0xFD @ SL-640CA	
49	DATA#49	ROIx X-End Position Value @ SL-640CT Checksum Data(0~48Words, Sum Data) @ SL-640CA	