F1024/F1280

Uncooled Thermal Imaging Module

Operating Commands User Manual

V1.0.0

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Version History

Version	Date	Description
V1.0.0	2024-08	Initial Version

1.Serial Port Settings

Table 1 Serial Port Default Settings

Baud rate	Format			Parity
115200bps	8bit data bits	1bit start bit	1bit stop bit	None

Note: *Start transmission from the LSB (Least Significant Bit).*

2.Command Format

2.1Receiving Command Format

Table 2 Command Format of Common 01 Instruction Set

Start byte	Byte Count	CW0	CW1	OW	PRM0	PRM	…	PRMn	SC	End byte	
		Process Body									
0xAA	0xXX	0x01	0xXX	0x00 0x01	0xXX	0xXX	0xXX	0xXX	0xXX	0xEB	0xAA

Note：

1. *All data in the table above is hexadecimal, same below;*
2. *Number of byte is the sum of all bytes from CW0 (including) to SC (including).*
3. *SC (sum check) value is the value of all the bytes before the SC byte summed and then mod 256;*
4. *The commands and parameter information are described in "Command format.*
5. *If the parameter is 16bit or 32bit, make the low byte in front, for example, bit0~bit7, bit8~bit15, bit16~bit23, bit24~bit31.*
6. *Start byte is fixed to 0xAA, and end bytes are fixed to 0xEB and 0xAA;*
7. *Command Word starting with 0x08 represents extended instructions of the thermal camera.*

Table 3 Command Receiving Format of Expansion 07

Start byte	Byte Count	CW0	CW1	OW	PRM0	PRM1	…	PRMn	SC	End byte	
		Process Body									
0xAA	0xXX	0x07	0xXX	0x00 0x01	0xXX	0xXX	0xXX	0xXX	0xBA	0xEB	0xAA

Note:

1. *Number of byte is the sum of all bytes from CW0 (including) to SC (including).*
2. *SC (sum check) value is the value of all the bytes before the SC byte summed and then mod 256;*
3. *The commands and parameter information are described in "Command format.*

4. *If the parameter is 16bit or 32bit, make the low byte in front, for example, bit0~bit7, bit8~bit15, bit16~bit23, bit24~bit31.*
5. *Start byte is fixed to 0xAA, and end bytes are fixed to 0xEB and 0xAA;*
6. *Command Word starting with 0x01 represents common instructions of the thermal camera.*

Table 4 Command Receiving Format of Expansion 08

Start byte	Byte Count	CW0	CW1	OW	PRM0	PRM1	…	PRMn	SC	End byte	
		Process Body									
0xAA	0xXX	0x08	0xXX	0x00 0x01	0xXX	0xXX	0xXX	0xXX	0xBA	0xEB	0xAA

Note:

1. *Number of byte is the sum of all bytes from CW0 (including) to SC (including).*
2. *SC (sum check) value is the value of all the bytes before the SC byte summed and then mod 256;*
3. *The commands and parameter information are described in "Command format.*
4. *If the parameter is 16bit or 32bit, make the low byte in front, for example, bit0~bit7, bit8~bit15, bit16~bit23, bit24~bit31.*
5. *Start byte is fixed to 0xAA, and end bytes are fixed to 0xEB and 0xAA;*
6. *Command word starting with 0x01 represents common instructions of the thermal camera.*

2.2The Command Format of Return Status

Table 5 Command Format of Return Status (Common 01)

Start byte	Byte Count	CW	OW	RV	RV	…	RV	SC	End byte	
		Process Body								
0x55	0xXX	0xXX	0x33	0xXX	0xXX	0xXX	0xXX	0xXX	0xEB	0xAA

Note:

1. *The return status information of the thermal camera reflects the performance of the executive command inside the thermal camera;*
2. *Refer to the "Command Format of Return Status Table" for CW and RV. The low byte should be in front for RV. For example: the corresponding hexadecimal of 512 is 0x200, the RV is 0x00 and 0x02 successively;*
3. *Number of byte is the sum of all bytes from CW0 (including) to SC (including).*
4. *If the RV is 16bit or 32bit, make the low byte in front, for example, bit0~bit7, bit8~bit15, bit16~bit23, bit24~bit31.*
5. *CW is corresponding to the command which is made by the users, the OW is fixed at 0x33;*
6. *The start byte of the RV is fixed at 0x55, the end byte of the RV is fixed at 0xEB and 0xAA.*

Table 6 Command Format of Return Status (Expansion 07)

Start byte	Byte Count	CW0	CW1	OW	RV	RV	…	RV	SC	End byte	
		Process Body									
0x55	0xXX	0x07	0xXX	0x33	0xXX	0xXX	0xXX	0xXX	0xXX	0xEB	0xAA

Note:

1. *The return status information of the thermal camera reflects the performance of the executive command inside the thermal camera;*
2. *Refer to the "Command Format of Return Status Table" for CW and RV. The low byte should be in front for RV. For example: the corresponding hexadecimal of 512 is 0x200, the RV is 0x00 and 0x02 successively;*
3. *Number of byte is the sum of all bytes from CW0 (including) to SC (including).*
4. *If the RV is 16bit or 32bit, make the low byte in front, for example, bit0~bit7, bit8~bit15, bit16~bit23, bit24~bit31.*
5. *CW0 is 0x08 which is the the inherent returned command, CW1 is corresponding to the command which is made by the users, the OW is fixed at 0x33;*
6. *The start byte of the RV is fixed at 0x55, the end byte of the RV is fixed at 0xEB and 0xAA.*

Table 7 Command Format of Return Status (Expansion 08)

Start byte	Byte Count	CW0	CW1	OW	RV	RV	…	RV	SC	End of byte	
		Process Body									
0x55	0xXX	0x08	0xXX	0x33	0xXX	0xXX	0xXX	0xXX	0xXX	0xEB	0xAA

Note:

1. The return status information of the thermal camera reflects the performance of the executive command inside the thermal camera;
2. Refer to the "Command Format of Return Status Table" for CW and RV. The low byte should be in front for RV. For example: the corresponding hexadecimal of 512 is 0x200, the RV is 0x00 and 0x02 successively;
3. Number of byte is the sum of all bytes from CW0 (including) to SC (including).
4. If the RV is 16bit or 32bit, make the low byte in front, for example, bit0~bit7, bit8~bit15, bit16~bit23, bit24~bit31.
5. CW0 is 0x08 which is the the inherent returned command, CW1 is corresponding to the command which is made by the users, the OW is fixed at 0x33;
6. The start byte of the RV is fixed at 0x55, the end byte of the RV is fixed at 0xEB and 0xAA.

If the command words that the thermal camera returned to the PC Software are 0xFF and the only one RV (returned value) is the value shown in Table 4, which indicates the communication protocol is wrong. Users can find the cause of error by consulting Table 4.

Table 8 Error List of RV

Returned Value	Cause of Error
0xF1	Command sending overtime
0xFB	None of CW
0xFD	DRC Parity Byte error
0xFF	Packet start 0xAA error

2.3 The Receiving Command and Status Information of Thermal Camera

2.3.1Basic Settings

Read PN Code

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x70	0x00	0	none	20
Receive	AA 04 01 EB 00 9A EB AA				
Return	55 17 EB 33 **31 30 32 34 34 30 30 30 33 31 00 00 00 00 00 00 00 00 00 00** 79 EB AA				

***Note**: the PN Code in the illustration is 1024400031, in the return value of 20 bytes, 0x00 indicates an unused byte.*

Read SN Code

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x71	0x00	0	none	20
Receive	AA 04 01 71 00 20 EB AA				
Return	55 17 71 33 **41 39 32 36 31 30 30 35 00 00 00 00 00 00 00 00 00 00** B8 EB AA				

***Note:** the SN code in the illustration is A9261005, complement 0x00 if there is no byte used in the 20 RVs.*

Read FPA Width

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x72	0x00	0	none	2
Receive	AA 04 01 72 00 21 EB AA				
Return	55 05 72 33 **80 02** 81 EB AA				

***Note**: the FPA width in the illustration is 640（0280H.*

Read FPA Height

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x73	0x00	0	none	2
Receive	AA 04 01 73 00 22 EB AA				
Return	55 05 73 33 **00 02** 02 EB AA				

***Note**: the FPA height in the illustration is 512（0200H）.*

Background Correction

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x02	0x02	2		1
Receive	AA 06 01 02 02 **00 02** B7 EB AA				
Return	Succeed: 55 04 02 33 **01** 8F EB AA Fail: 55 04 02 33 **00** 8E EB AA				

Shutter Correction

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x02	0x02	2		1
Receive	AA 06 01 02 02 **01 01** B7 EB AA				
Return	Succeed: 55 04 02 33 **01** 8F EB AA Fail: 55 04 02 33 **00** 8E EB AA				

Set Manual/Auto Shutter Correction

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x01	0x01	1	0x00 manual 0x01 auto	1
Receive	Manual: AA 05 01 01 01 **00** B2 EB AA Auto: AA 05 01 01 01 **01** B3 EB AA				

Set Time Interval for Auto Shutter

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x03	0x01	1	unit: min	1
Receive	AA 05 01 03 01 **03** B7 EB AA				
Return	Succeed: 55 04 03 33 **01** 90 EB AA Fail: 55 04 03 33 **00** 8F EB AA				

Note: *the time interval in this illustration is 3min.*

Read Time Interval for Auto Shutter

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x03	0x00	0	null	1
Receive	AA 04 01 03 00 B2 EB AA				
Return	55 04 03 33 **03** 92 EB AA				

Note: *the returned time interval in this illustration is 3min.*

Set FPA Temperature Interval of Auto Shutter

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x04	0x01	1	unit:0.1℃	1
Receive	AA 05 01 04 01 **05** BA EB AA				
Return	Succeed: 55 04 04 33 **01** 91 EB AA Fail: 55 04 04 33 **00** 90 EB AA				

Note: *the set FPA temperature interval in this illustration is 0.5℃, the set 05 is the actual temperature×10.*

Read FPA Temperature Interval of Auto Shutter

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x04	0x00	0	null	1
Receive	AA 04 01 04 00 B3 EB AA				
Return	55 04 04 33 **05** 95 EB AA				

Note*: the returned FPA temperature interval in this illustration is 0.5℃, the returned value 05 is the actual temperature value×10.*

Set Module Temperature Interval of Auto Shutter

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x0D	0x01	1	unit:0.1℃	1
Receive	AA 05 01 0D 01 **14** D2 EB AA				
Return	Succeed: 55 04 0D 33 **01** 9A EB AA Fail: 55 04 0D 33 **00** 99 EB AA				

Note*: the set module temperature interval in this illustration is 2.0℃, the set value 14 (hexadecimal , 20 in decimal) is actual temperature value ×10.*

Read Module Temperature Interval of Auto Shutter

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x0D	0x00	0	NULL	1
Receive	AA 04 01 0D 00 BC EB AA				
Return	55 04 0D 33 **14** AD EB AA				

Note: *the returned module temperature interval in this illustration is 2℃, the returned value is 14(hexadecimal, 20 in decimal) is actual temperature value ×10.*

Read Module Temperature

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x7C	0x00	0	null	2
Receive	AA 04 01 7C 00 2B EB AA				
Return	55 05 7C 33 **95 0B** A9 EB AA				

Note: *the module temperature in this illustration is 29.65℃, the returned value 0B95 is actual temperature ×100.*

Read FPA Temperature

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0xC3	0x00	0	null	2
Receive	AA 04 01 C3 00 72 EB AA				
Return	55 05 C3 33 **87 0B** E2 EB AA				

Note: *the FPA temperature in this illustration is 29.51℃, the returned value 0B87 is actual temperature ×100.*

Save Settings

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x7F	0x02	0	null	1
Receive	AA 04 01 7F 02 30 EB AA				
Return	Succeed: 55 04 7F 33 **01** 0C EB AA Fail: 55 04 7F 33 **00** 0B EB AA				

Restore to Factory Defaults

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x82	0x02	1	0x00	1
Receive	AA 05 01 82 02 00 34 EB AA				
Return	Succeed: 55 04 82 33 **01** 0F EB AA Fail: 55 04 82 33 **00** 0E EB AA				

2.3.2 Video Settings

Set Color of User Cross Cursor

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x45	0x02	1	value of cursor color	1
Receive	AA 05 01 45 02 **32** 29 EB AA				
Return	Succeed: 55 04 45 33 **01** D2 EB AA Fail: 55 04 45 33 **00** D1 EB AA				

Note: *the cursor color should be set (gray value) on the condition that the cursor function has been enabled, the color range is between 0-255.*

Hidden/display Type of Cursor

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x43	0x02	1	0x00: hidden 0x80: type 1 0x81: type 2 0x82: type 3 0x83: type 4	1
Receive	Hidden: AA 05 01 43 02 **00** F5 EB AA type 1: AA 05 01 43 02 **80** 75 EB AA type 2: AA 05 01 43 02 **81** 76 EB AA type 3: AA 05 01 43 02 **82** 77 EB AA				

	type 4: AA 05 01 43 02 **83** 78 EB AA
Return	Succeed: 55 04 43 33 **01** D0 EB AA Fail: 55 04 43 33 **00** CF EB AA

Note*: the user cursor can be switched among these four types, hidden by default, it will be enabled while selecting a cursor type.*

Cursor Position/Move

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x44	0x02	5	refer to the notes	1
Receive	Set coordinate: AA 09 01 44 02 **05 68 01 20 01** 89 EB AA Move up 1: AA 09 01 44 02 **06 00 00 00 00** 00 EB AA Move down 1: AA 09 01 44 02 **07 00 00 00 00** 01 EB AA Move left 1: AA 09 01 44 02 **08 00 00 00 00** 02 EB AA Move right 1: AA 09 01 44 02 **09 00 00 00 00** 03 EB AA Move up 20: AA 09 01 44 02 **86 00 00 00 00** 80 EB AA Move down 20: AA 09 01 44 02 **87 00 00 00 00** 81 EB AA Move left 20: AA 09 01 44 02 **88 00 00 00 00** 82 EB AA Move right 20: AA 09 01 44 02 **89 00 00 00 00** 83 EB AA				
Return	Succeed: 55 04 44 33 **01** D1 EB AA Fail: 55 04 44 33 **00** D0 EB AA				

Note*: Command parameter 0: 0x05: set coordinates, 0x06: Move up 1, 0x07: move down 1, 0x08: move left 1, 0x09: move right 1, 0x86: move up 20, 0x87: move down 20, 0x88: move left 20, 0x89: move right 20;*

The coordinates are command parameters 1-4, parameter 1: col low byte, parameter 2: col high byte, parameter 3: row low byte, parameter 4: row high byte, it is valid when parameter 0 is 0x05; the set value 0168, 0120 in this illustration stands for the actual coordinate 360，288 respectively.

Switch of Video Standard

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x3F	0x02	1	0x00: NTSC 0x01: PAL	1
Receive	NTSC: AA 05 01 3F 02 **00** F1 EB AA PAL :AA 05 01 3F 02 **01** F2 EB AA				
Return	Succeed: 55 04 3F 33 **01** CC EB AA Fail: 55 04 3F 33 **00** CB EB AA				

***Note**: the video display size is 720x480 for NTSC, the video display size is 720x576 for PAL.*

E-Zoom

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x40	0x02	8	refer to the notes	1
Receive	no zoom: AA 0C 01 40 02 **00 00 00 00 7F 02 FF 01** 7A EB AA 1.1×: AA 0C 01 40 02 **1D 00 17 00 61 02 E7 01** 78 EB AA 1.2×: AA 0C 01 40 02 **35 00 2B 00 49 02 D4 01** 79 EB AA 1.3×: AA 0C 01 40 02 **4A 00 3B 00 35 02 C3 01** 79 EB AA 1.4×: AA 0C 01 40 02 **5B 00 49 00 23 02 B5 01** 78 EB AA 1.5×: AA 0C 01 40 02 **6B 00 55 00 14 02 A9 01** 79 EB AA 1.6×: AA 0C 01 40 02 **78 00 60 00 06 02 9E 01** 78 EB AA 1.7×: AA 0C 01 40 02 **84 00 69 00 FB 01 95 01** 78 EB AA 1.8×: AA 0C 01 40 02 **8E 00 72 00 F0 01 8D 01** 78 EB AA 1.9×: AA 0C 01 40 02 **98 00 79 00 E7 01 85 01** 78 EB AA 2.0×: AA 0C 01 40 02 **A0 00 80 00 DF 01 7F 01** 79 EB AA 2.1×: AA 0C 01 40 02 **A8 00 86 00 D7 01 78 01** 78 EB AA 2.2×: AA 0C 01 40 02 **AF 00 8C 00 D0 01 73 01** 79 EB AA 2.3×: AA 0C 01 40 02 **B5 00 91 00 CA 01 6E 01** 79 EB AA 2.4×: AA 0C 01 40 02 **BB 00 95 00 C4 01 69 01** 78 EB AA 2.5×: AA 0C 01 40 02 **C0 00 9A 00 BF 01 65 01** 79 EB AA 2.6×: AA 0C 01 40 02 **C5 00 9E 00 BA 01 61 01** 79 EB AA 2.7×: AA 0C 01 40 02 **C9 00 A1 00 B5 01 5D 01** 77 EB AA 2.8×: AA 0C 01 40 02 **CE 00 A5 00 B1 01 5A 01** 79 EB AA 2.9×: AA 0C 01 40 02 **D2 00 A8 00 AD 01 57 01** 79 EB AA 3.0×: AA 0C 01 40 02 **D5 00 AB 00 A9 01 54 01** 78 EB AA 3.1×: AA 0C 01 40 02 **D9 00 AD 00 A6 01 51 01** 78 EB AA 3.2×: AA 0C 01 40 02 **DC 00 B0 00 A2 01 4E 01** 77 EB AA 3.3×: AA 0C 01 40 02 **DF 00 B2 00 9F 01 4C 01** 77 EB AA 3.4×: AA 0C 01 40 02 **E2 00 B5 00 9D 01 4A 01** 79 EB AA 3.5×: AA 0C 01 40 02 **E5 00 B7 00 9A 01 48 01** 79 EB AA 3.6×: AA 0C 01 40 02 **E7 00 B9 00 97 01 46 01** 78 EB AA 3.7×: AA 0C 01 40 02 **EA 00 BB 00 95 01 44 01** 79 EB AA				

	3.8×: AA 0C 01 40 02 **EC 00 BD 00 93 01 42 01** 79 EB AA 3.9×: AA 0C 01 40 02 **EE 00 BE 00 91 01 40 01** 78 EB AA 4.0×: AA 0C 01 40 02 **F0 00 C0 00 8F 01 3F 01** 79 EB AA 4.1×: AA 0C 01 40 02 **F2 00 C2 00 8D 01 3D 01** 79 EB AA 4.2×: AA 0C 01 40 02 **F4 00 C3 00 8B 01 3B 01** 78 EB AA 4.3×: AA 0C 01 40 02 **F6 00 C4 00 89 01 3A 01** 78 EB AA 4.4×: AA 0C 01 40 02 **F7 00 C6 00 87 01 39 01** 78 EB AA 4.5×: AA 0C 01 40 02 **F9 00 C7 00 86 01 37 01** 78 EB AA 4.6×: AA 0C 01 40 02 **FA 00 C8 00 84 01 36 01** 77 EB AA 4.7×: AA 0C 01 40 02 **FC 00 CA 00 83 01 35 01** 79 EB AA 4.8×: AA 0C 01 40 02 **FD 00 CB 00 81 01 34 01** 78 EB AA 4.9×: AA 0C 01 40 02 **FF 00 CC 00 80 01 33 01** 79 EB AA 5.0×: AA 0C 01 40 02 **00 01 CD 00 7F 01 32 01** 7A EB AA 5.1×: AA 0C 01 40 02 **01 01 CE 00 7D 01 31 01** 79 EB AA 5.2×: AA 0C 01 40 02 **02 01 CF 00 7C 01 30 01** 79 EB AA 5.3×: AA 0C 01 40 02 **04 01 D0 00 7B 01 2F 01** 7A EB AA 5.4×: AA 0C 01 40 02 **05 01 D1 00 7A 01 2E 01** 7A EB AA 5.5×: AA 0C 01 40 02 **06 01 D1 00 79 01 2D 01** 79 EB AA 5.6×: AA 0C 01 40 02 **07 01 D2 00 78 01 2C 01** 79 EB AA 5.7×: AA 0C 01 40 02 **08 01 D3 00 77 01 2B 01** 79 EB AA 5.8×: AA 0C 01 40 02 **09 01 D4 00 76 01 2B 01** 7A EB AA 5.9×: AA 0C 01 40 02 **0A 01 D5 00 75 01 2A 01** 7A EB AA 6.0×: AA 0C 01 40 02 **0B 01 D5 00 74 01 29 01** 79 EB AA 6.1×: AA 0C 01 40 02 **0C 01 D6 00 73 01 28 01** 79 EB AA 6.2×: AA 0C 01 40 02 **0C 01 D7 00 72 01 28 01** 79 EB AA 6.3×: AA 0C 01 40 02 **0D 01 D7 00 71 01 27 01** 78 EB AA 6.4×: AA 0C 01 40 02 **0E 01 D8 00 70 01 26 01** 78 EB AA 6.5×: AA 0C 01 40 02 **0F 01 D9 00 70 01 26 01** 7A EB AA 6.6×: AA 0C 01 40 02 **10 01 D9 00 6F 01 25 01** 79 EB AA 6.7×: AA 0C 01 40 02 **10 01 DA 00 6E 01 25 01** 79 EB AA 6.8×: AA 0C 01 40 02 **11 01 DA 00 6E 01 24 01** 79 EB AA 6.9×: AA 0C 01 40 02 **12 01 DB 00 6D 01 24 01** 7A EB AA 7.0×: AA 0C 01 40 02 **12 01 DB 00 6C 01 23 01** 78 EB AA 7.1×: AA 0C 01 40 02 **13 01 DC 00 6C 01 23 01** 7A EB AA 7.2×: AA 0C 01 40 02 **14 01 DC 00 6B 01 22 01** 79 EB AA 7.3×: AA 0C 01 40 02 **14 01 DD 00 6A 01 22 01** 79 EB AA 7.4×: AA 0C 01 40 02 **15 01 DD 00 6A 01 21 01** 79 EB AA 7.5×: AA 0C 01 40 02 **15 01 DE 00 69 01 21 01** 79 EB AA 7.6×: AA 0C 01 40 02 **16 01 DE 00 69 01 20 01** 79 EB AA 7.7×: AA 0C 01 40 02 **16 01 DF 00 68 01 20 01** 79 EB AA 7.8×: AA 0C 01 40 02 **17 01 DF 00 68 01 1F 01** 79 EB AA 7.9×: AA 0C 01 40 02 **17 01 E0 00 67 01 1F 01** 79 EB AA 8.0×: AA 0C 01 40 02 **18 01 E0 00 67 01 1F 01** 7A EB AA
Return	Succeed: 55 04 40 33 **01** CD EB AA Fail: 55 04 40 33 **00** CC EB AA

Note: *command PRMs are coordinates in the top left corner and the bottom right corner. The coordinate should start from (0,0), X first Y later, that is column first, row later.*

PRM0: col low bit, coordinate in the top left corner, PRM1: col high bit, PRM2: row low bit, PRM3: row high bit, PRM4: col low bit coordinate in the bottom right corner, PRM5: col high bit, PRM6: row low bit, PRM7: row high bit.

The electronic zoom is 2.0 in the illustration, that is magnifying the coordinate in the top left corner（213,171）and the coordinate in the bottom right corner（425,340）according to the setting value 00D5，00AB，01A9，0154.

The coordinate algorithm is as following: suppose the array width is W, array height is H, magnification times of the preset value is m (the figure is accurate to one decimal place), then

Top left corner $X = \frac{W}{2} - \frac{W}{2 \cdot m}$

Top left corner $Y = \frac{H}{2} - \frac{H}{2 \cdot m}$

Bottom right corner $X = \frac{W}{2} + \frac{W}{2 \cdot m} - 1$

Bottom right corner $Y = \frac{H}{2} + \frac{H}{2 \cdot m} - 1$

Image Flip

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x4C	0x01	1	0x01: no flip 0x02: flip from left to right 0x04: flip up down 0x08: diagonal flip	1
Receive	no flip: AA 05 01 4C 01 **01** FE EB AA Flip from left to right: AA 05 01 4C 01 **02** FF EB AA Flip up down: AA 05 01 4C 01 **04** 01 EB AA Diagonal flip: AA 05 01 4C 01 **08** 05 EB AA				
Return	Succeed: 55 04 4C 33 **01** D9 EB AA Fail: 55 04 4C 33 **00** D8 EB AA				

Analog Video On/Off

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x3D	0x02	1	0x00: on 0x01: off	1
Receive	On: AA 05 01 3D 02 **01** F0 EB AA Off: AA 05 01 3D 02 **00** EF EB AA				
Return	Succeed: 55 04 3D 33 **01** CA EB AA Fail: 55 04 3D 33 **00** C9 EB AA				

Video Freeze/Unfreeze

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x3E	0x02	1	0x00:unfreeze 0x01: freeze	1
Receive	Freeze: AA 05 01 3E 02 **01** F1 EB AA Unfreeze: AA 05 01 3E 02 **00** F0 EB AA				
Return	Succeed: 55 04 3E 33 **01** CB EB AA Fail: 55 04 3E 33 **00** CA EB AA				

Note: *unfreeze by default, analog and digital functions are enabled or disabled at the same time.*

Start-up LOGO On/Off

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x49	0x02	1	0x80: on 0x00: off	1
Receive	LOGO on: AA 05 01 49 02 **80** 7B EB AA LOGO off: AA 05 01 49 02 **00** FB EB AA				
Return	Succeed: 55 04 49 33 **01** D6 EB AA Fail: 55 04 49 33 **00** D5 EB AA				

Polarity and Color Palettes Switch

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x42	0x02	1	refer to the notes	1
Receive	Whitehot: AA 05 01 42 02 00 F4 EB AA Blackhot: AA 05 01 42 02 01 F5 EB AA Rainbow: AA 05 01 42 02 02 F6 EB AA Rainbow HC: AA 05 01 42 02 03 F7 EB AA Iron: AA 05 01 42 02 04 F8 EB AA Lava: AA 05 01 42 02 05 F9 EB AA Sky: AA 05 01 42 02 06 FA EB AA Mid-gray: AA 05 01 42 02 07 FB EB AA Gray-red: AA 05 01 42 02 08 FC EB AA Purple-orange: AA 05 01 42 02 09 FD EB AA Special: AA 05 01 42 02 0A FE EB AA Warning red: AA 05 01 42 02 0B FF EB AA Icefire: AA 05 01 42 02 0C 00 EB AA Cyanred: AA 05 01 42 02 0D 01 EB AA Special 2: AA 05 01 42 02 0E 02 EB AA Gradient red: AA 05 01 42 02 0F 03 EB AA Gradient green: AA 05 01 42 02 10 04 EB AA Gradient blue: AA 05 01 42 02 11 05 EB AA Warning green: AA 05 01 42 02 12 06 EB AA Warning blue: AA 05 01 42 02 13 07 EB AA				
Return	Succeed: 55 04 42 33 **01** CF EB AA Fail: 55 04 42 33 **00** CE EB AA				

Note: *palette choosing, command PRM is 1 bit, 0x00: whitehot；0x01: blackhot；0x02: rainbow；0x03: rainbow HC；0x04: iron；0x05: lava；0x06: sky: 0x07: midgray；0x08: grayred；0x09: purple-orange；0x0A: special；0x0B: warning red；0x0C: icefire；0x0D: cyanred；0x0E: special 2；0x0F: gradient red；0x10: gradient green；0x11: gradient blue；0x12: warning green；0x13: warning blue.*

Acquire Current Image Palette Style

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x42	0x00	1	0x00	1
Receive	AA 05 01 42 00 **00** F2 EB AA				
Return	55 04 42 33 **00** CE EB AA				

Note: *RV is 1 bit, 0x00: whitehot；0x01: blackhot；0x02: rainbow；0x03: rainbow HC；0x04: iron；0x05: lava；0x06: sky；0x07: midgray；0x08: grayred；0x09: purple-orange；0x0A: special；0x0B:*

warning red； 0x0C: icefire； 0x0D: cyanred； 0x0E: special 2； 0x0F: gradient red； 0x10: gradient green；0x11: gradient blue；0x12: warning green；0x13: warning blue.

Set Threshold Value of Warning Red, Warning Green and Warning Blue

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x49	0x02	2	See“Note”	1
Receive	Warning red: AA 06 01 4B 01 **C8 00** C5 EB AA Warning green: AA 06 01 4B 01 **C8 01** C6 EB AA Warning blue: AA 06 01 4B 01 **C8 02** C7 EB AA				
Return	Succeed: 55 04 4B 33 **01** D8 EB AA Fail: 55 04 4B 33 **00** D7 EB AA				

***Note**: command PRM0: threshold value 0-255, the C8（H） in this illustration is 200, PRM1: warning style, 0x00：warning red，0x01：warning green，0x02：warning blue.*

Digital Video Switch and Interface to Select

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x5D	0x02	2	refer to the notes	1
Receive	Off: AA 06 01 5D 02 **00 00** 10 EB AA LVDS-H: AA 06 01 5D 02 **03 00** 13 EB AA LVDS-F: AA 06 01 5D 02 **03 10** 23 EB AA LVCMOS: AA 06 01 5D 02 **02 00** 12 EB AA BT.656: AA 06 01 5D 02 **04 00** 14 EB AA BT.1120: AA 06 01 5D 02 **05 00** 15 EB AA CDS_2: AA 06 01 5D 02 **05 80** 95 EB AA LVDS&CMOS:AA 06 01 5D 02 **06 00** 16 EB AA LVDS&BT656:AA 06 01 5D 02 **07 00** 17 EB AA LVDS&BT1120:AA 06 01 5D 02 **08 00** 18 EB AA				
Return	Succeed: 55 04 5D 33 **01** EA EB AA Fail: 55 04 5D 33 **00** E9 EB AA				

***Note:** command parameter 0: 0x00: digital video closed， 0x02: LVCMOS， 0x03: LVDS， 0x04: BT.656，0x05: BT.1120；PRM1: LVDS 0x00: LVDS-H，0x10: LVDS-F，BT.1120 0x80: CDS_2. If DRC is chosen for data source, 0x02 stands for bayer mode.*

*For modules with 1280*1024 array format, the parameter definition is different: command parameter 0: 0x00: digital video off, 0x02: LVCMOS，0x03: LVDS_H， 0x05: BT.1120，0x08: LVDS and BT1120 output at the same time; parameter 1: 0x80: CDS_2 under BT.1120.*

Select Video Source

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x5C	0x01	1	refer to the notes	1
Receive	LVDS digital video: ORG: AA 05 01 5C 01 **00** 0D EB AA NUC: AA 05 01 5C 01 **10** 1D EB AA DRC: AA 05 01 5C 01 **20** 2D EB AA DNS: AA 05 01 5C 01 **50** 5D EB AA LVCMOS digital video: ORG: AA 05 01 5C 01 **00** 0D EB AA NUC: AA 05 01 5C 01 **01** 0E EB AA DRC: AA 05 01 5C 01 **02** 0F EB AA DNS: AA 05 01 5C 01 **05** 12 EB AA				
Return	Succeed: 55 04 5C 33 **01** E9 EB AA Fail: 55 04 5C 33 **00** E8 EB AA				

Note: *command parameter 1byte, high 4 bits（bit4~bit7）represents serial transmission data source：0x00：ORG，0x10：NUC，0x20：DRC，0x50：DNS；parameter low 4 bit（bit0~bit3）represents parallel transmission data source: 0x00：ORG，0x01：NUC，0x02：DRC， 0x05：DNS.*

*For modules with 1280*1024 array format, the parameter definition is different: parameter: 0x00：ORG，0x01：NUC，0x02：DRC.*

2.3.3 Gain Control

Image Mode

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x1F	0x01	1	0x00~0x02	1
Receive	Auto mode 0: AA 05 01 1F 01 **01** D1 EB AA Auto mode 1: AA 05 01 1F 01 **02** D2 EB AA Manual mode: AA 05 01 1F 01 **00** D0 EB AA				
Return	Succeed: 55 04 1F 33 **01** AC EB AA Fail: 55 04 1F 33 **00** AB EB AA				

Change Contrast in Manual Mode

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x22	0x01	1	0x00~0xff	1
Receive	Set: AA 05 01 22 01 **64** 37 EB AA				
Return	Succeed: 55 04 22 33 **01** AF EB AA Fail: 55 04 22 33 **00** AE EB AA				

***Note**: the command parameters are well-setting values, the set value 64 in this illustration is actual contrast 100.*

Set Brightness in Manual Mode

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x23	0x01	2	0x0000~0x01ff	1
Receive	Set: AA 06 01 23 01 **C8 00** 9D EB AA				
Return	Succeed: 55 04 23 33 **01** B0 EB AA Fail: 55 04 23 33 **00** AF EB AA				

***Note:** the command parameters are well-setting values, the set value 00C8 in this illustration is actual contrast 200.*

Set Image Filter On/Off

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x1B	0x02	1	Refer to the notes	1
Receive	On: AA 05 01 1B 02 01 CE EB AA Off: AA 05 01 1B 02 00 CD EB AA				
Return	Succeed: 55 04 1B 33 01 A8 EB AA Fail: 55 04 1B 33 00 A7 EB AA				

Read Image Filter On/Off

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x1B	0x00	1	0x00	1
Receive	AA 05 01 1B 00 00 CB EB AA				
Return	On: 55 04 1B 33 01 A8 EB AA Off: 55 04 1B 33 00 A7 EB AA				

DDE Mode Switch

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x19	0x01	1	0x01~0x8: Mode0-Mode 7	1
Receive	Mode 0: AA 05 01 19 01 **01** CB EB AA Mode 1: AA 05 01 19 01 **02** CC EB AA Mode 2: AA 05 01 19 01 **03** CD EB AA Mode 3: AA 05 01 19 01 **04** CE EB AA Mode 4: AA 05 01 19 01 **05** CF EB AA Mode 5: AA 05 01 19 01 **06** D0 EB AA Mode 6: AA 05 01 19 01 **07** D1 EB AA Mode 7: AA 05 01 19 01 **08** D2 EB AA				
Return	Succeed: 55 04 19 33 **01** A6 EB AA Fail: 55 04 19 33 **00** A5 EB AA				

Set DDE On/Off

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x1A	0x01	1	refer to the notes	1
Receive	On: AA 05 01 1A 02 **01** CD EB AA Off: AA 05 01 1A 02 **00** CC EB AA				
Return	Succeed: 55 04 1A 33 **01** A7 EB AA Fail: 55 04 1A 33 **00** A6 EB AA				

Read DDE On/Off

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x1A	0x00	1	0x00	1
Receive	AA 05 01 1A 00 00 CA EB AA				
Return	On: 55 04 1A 33 01 A7 EB AA Off: 55 04 1A 33 00 A6 EB AA				

Set ROI

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x2B	0x01	8	refer to the notes	1
Receive	Set: AA 0C 01 2B 01 **40 00 3C 00 E8 00 C2 00** 09 EB AA				
Return	Succeed: 55 04 2B 33 **01** B8 EB AA Fail: 55 04 2B 33 **00** B7 EB AA				

Note: *command parameter 0-1: x coordinate in the top left corner, low bit in front; command parameter 2-3; y coordinate in the top left corner, low bit in front, command parameter 4-5: x coordinate in the*

*bottom right corner, low bit in front; command parameter 6-7: y coordinate in the bottom right corner, low bit in front; if the coordinate in the top left corner is （0,0）, the coordinate in the bottom right corner is （383,287）for resolution 384*288 or （639,511）for resolution 640*512, then the ROI function is disabled, the ROI function is enabled when coordinates are set the in other regions.*

2.3.4 Motor Control

a. Basic Settings

Read Lens Type

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x03	0x00	1	0x00	1
Receive	AA 05 08 03 00 00 BA EB AA				
Return	55 05 08 03 33 **03** 9B EB AA				

Note: *the returned value 0x03 stands for double FOV lens, 0x00 stands for no lens or fixed focus unadjustable lens, 0x01 stands for continuous zoom lens, 0x02 stands for fixed auto focus lens, 0x03 stands for double FOV lens.*

Set Lens Type

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x03	0x01	1	0xXX	1
Receive	no lens or fixed unadjustable lens: AA 05 08 03 01 00 BB EB AA continuous zoom lens: AA 05 08 03 01 01 BC EB AA fixed adjustable lens: AA 05 08 03 01 02 BD EB AA double FOV: AA 05 08 03 01 03 BE EB AA				
Return	Succeed: 55 05 08 03 33 **01** 99 EB AA Fail: 55 05 08 03 33 **00** 98 EB AA				

Note: *command parameter 0: 0x00 stands for no lens or fixed unadjustable lens, 0x01 stands for continuous zoom lens, 0x02 stands for fixed auto focus lens, 0x03 stands for double FOV lens.*
Lens Type should be consistent with the actual one.

Manual Enable/disable Alarm

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x00	0x01	1	0x01-on 0x00-off	1
Receive	On: AA 05 08 00 01 01 B9 EB AA Off: AA 05 08 00 01 00 B8 EB AA				
Return	Succeed: 55 05 08 03 33 **01** 99 EB AA Fail: 55 05 08 03 33 **00** 98 EB AA				

Note: *after opening alarm manually, the level of alarm IO output will be pulled up; after closing alarm manually, the level of alarm IO output will be pulled down.*

Zoom or Auto Focus after FOV Switched

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x04	0x01	1	0x01: on 0x00: off	1
Receive	On : AA 05 08 04 01 **01** BD EB AA Off: AA 05 08 04 01 **00** BC EB AA				
Return	Succeed: 55 05 08 04 33 **01** 9A EB AA Fail: 55 05 08 04 33 **00** 99 EB AA				

Set Temp Interval (Fine Tuning of Lens Virtual Focus)

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x08	0x01	2	Unit: 0.01℃	1
Receive	AA 06 08 08 01 **F4 01** B6 EB AA				
Return	Succeed: 55 05 08 08 33 **01** 9E EB AA Fail: 55 05 08 08 33 **00** 9D EB AA				

Note: *the actual temp interval is 5℃ in the example, that is the set value 01F4 divided by 100.*

Read Temp Interval (Fine Tuning of Lens Virtual Focus)

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x08	0x00	1	0x00	2
Receive	AA 05 08 08 00 **00** BF EB AA				
Return	55 06 08 08 33 **F4 01** 93 EB AA				

Note: *the returned temp interval is 5℃ in the example, that is the actual RV 01F4 divided by 100.*

Auto-focus

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x2F	0x01	1		1
Receive	AA 05 08 2F 01 00 E7 EB AA				
Return	Succeed: 55 05 08 2F 33 **01** C5 EB AA Fail: 55 05 08 2F 33 **00** C4 EB AA				

b. Set Focus Motor

Parameter Setup (Whether Rotation Direction of Focus Motor Is Reversed or Not)

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x20	0x01	1	0x01: reversed 0x00: not reversed	1
Receive	reversed : AA 05 08 20 01 01 D9 EB AA not reversed : AA 05 08 20 01 00 D8 EB AA				
Return	Succeed: 55 05 08 20 33 **01** B6 EB AA Fail: 55 05 08 20 33 **00** B5 EB AA				

Parameter Readout (Whether Rotation Direction of Focus Motor Is Reversed or Not）

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x20	0x00	1	0x00	1
Receive	AA 05 08 20 00 **00** D7 EB AA				
Return	55 05 08 20 33 **00** B5 EB AA				

***Note**: RV0x00: no reversal, 0x01：reversal*

Rotation Type of Drive Focus Motor

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x21	0x01	2	refer to the notes	1
Receive	close view: AA 06 08 21 01 **01 00** DB EB AA fine tuning of close view: AA 06 08 21 01 **01 01** DC EB AA far view: AA 06 08 21 01 **02 00** DC EB AA fine tuning of far view : AA 06 08 21 01 **02 01** DD EB AA				
Return	Succeed: 55 05 08 21 33 **01** B7 EB AA Fail: 55 05 08 21 33 **00** B6 EB AA				

***Note**: command parameter0: 0x01-close view,0x02-far view； PRM1: 0x00-coarse tuning,0x01-fine tuning.*

Focus Motor Shutoff

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x22	0x01	1	0x00	1
Receive	AA 05 08 22 01 **00** DA EB AA				
Return	Succeed: 55 05 08 22 33 **01** B8 EB AA Fail: 55 05 08 22 33 **00** B7 EB AA				

Get Current Position of Focus Motor

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x23	0x00	1	0x00	2
Receive	AA 05 08 23 00 **00** DA EB AA				
Return	55 06 08 23 33 **01 00** BA EB AA				

***Note:** RV represents the current position, marked by two bytes, low byte in front.*

Set Rotation Speed of Focus Motor

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x24	0x01	1	Speed value (0~0x20)	1
Receive	AA 05 08 24 01 **0A** E6 EB AA				
Return	Succeed: 55 05 08 24 33 **01** BA EB AA Fail: 55 05 08 24 33 **00** B9 EB AA				

Read Rotation Speed of Focus Motor

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x24	0x01	1	0x00	1
Receive	AA 05 08 24 00 **00** DB EB AA				
Return	55 05 08 24 33 **0A** C3 EB AA				

Get Focus Motor Route

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x25	0x00	1	0x00	6
Receive	AA 05 08 25 00 **00** DC EB AA				
Return	55 08 08 25 33 **00 00 00 00** BD EB AA				

Note: *RV byte0: the minimum position low 8 bit, byte 1: the minimum position high 8bit, byte 2: the max position low 8bit, byte 3: the minimum position low 8bit.*

c.Set Zoom Motor

Parameter Setup (Whether Rotation Direction of Zoom Motor Is Reversed or Not)

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x30	0x01	1	0x01: reversed 0x00: not reversed	1
Receive	Reversed: AA 05 08 30 01 01 E9 EB AA not reversed: AA 05 08 30 01 00 E8 EB AA				
Return	Succeed: 55 05 08 30 33 **01** C6 EB AA Fail: 55 05 08 30 33 **00** C5 EB AA				

Parameter Readout (Whether Rotation Direction of Zoom Motor Is Reversed or Not）

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x30	0x00	1	0x00	1
Receive	AA 05 08 30 00 **00** E7 EB AA				
Return	55 05 08 30 33 **00** C5 EB AA				

Note*: RV0x00: no reversal, 0x01: reversal*

Rotation Type of Drive Zoom Motor

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x31	0x01	2	refer to the notes	1
Receive	short focus: AA 06 08 31 01 **01 00** EB EB AA fine tuning of short focus: AA 06 08 31 01 **01 01** EC EB AA long focus: AA 06 08 31 01 **02 00** EC EB AA fine tuning of long focus: AA 06 08 31 01 **02 01** ED EB AA				

Return	Succeed: 55 05 08 31 33 **01** C7 EB AA Fail: 55 05 08 31 33 **00** C6 EB AA

Note: *command parameter0: 0x01-close view, 0x02-far view； PRM1: 0x00-coarse tuning,0x01-fine tuning*

Zoom Motor Shutoff

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x32	0x01	1	0x00	1
Receive	AA 05 08 32 01 **00** EA EB AA				
Return	Succeed: 55 05 08 32 33 **01** C8 EB AA Fail: 55 05 08 32 33 **00** C7 EB AA				

Get Current Position of Zoom Motor

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x33	0x00	1	0x00	2
Receive	AA 05 08 33 00 **00** EA EB AA				
Return	55 06 08 33 33 **01 00** CA EB AA				

Note: the returned value of current position occupies two bytes, low byte in front.

Set Rotation Speed of Zoom Motor

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x34	0x01	1	Speed value (0~0x20)	1
Receive	AA 05 08 34 01 **0A** F6 EB AA				
Return	Succeed: 55 05 08 34 33 **01** CA EB AA Fail: 55 05 08 34 33 **00** C9 EB AA				

Read Rotation Speed of Zoom Motor

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x34	0x01	1	0x00	1
Receive	AA 05 08 34 00 **00** EB EB AA				
Return	55 05 08 34 33 **0A** D3 EB AA				

Get Zoom Motor Route

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x35	0x00	1	0x00	6
Receive	AA 05 08 35 00 **00** EC EB AA				
Return	55 08 08 35 33 **00 00 00 00** CD EB AA				

***Note**: RV byte0: the minimum position low 8 bit, byte1: the minimum position high 8bit, byte 2: the max position low 8bit, byte 3: the minimum position low 8bit.*

d. Set Double FOV Motor

Read Switch Location Info of Close (Big) Fov or Distant (Small) Fov

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x80	0x00	1	0x00	1
Receive	AA 05 08 80 00 **00** 37 EB AA				
Return	55 08 08 80 33 **78 05 08 07** A4 EB AA				

***Note:** RV byte0: close(big) fov low 8bit, byte1: close(big) fov high 8bit, byte2: distant(small) fov low 8bit, byte3: distant(small) fov low 8bit; the returned close(big) fov in the example is 0578(hexadecimal), the actual close(big) fov is 1400; the returned distant(small) fov 0708(hexadecimal), the actual distant(small) fov is 1800.*

Set Switch Location Info of Close (Big) Fov or Distant (Small) Fov

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x80	0x01	3	refer to the notes	1
Receive	Close (big) fov location: AA 07 08 80 01 **01 00 00** 3B EB AA far (small) fov location: AA 07 08 80 01 **02 00 00** 3C EB AA				
Return	Succeed: 55 05 08 80 33 **01** 16 EB AA Fail: 55 05 08 80 33 **00** 15 EB AA				

Note: command parameter0: 0x01-close（big）fov,0x02-distant fov，PRM1 and PRM2 0x00 fixed.

FOV Switch

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x81	0x01	1	0x01: close FOV 0x02: far FOV	1
Receive	Switch to close(big) FOV: AA 05 08 81 01 **01** 3A EB AA Switch to distant(small) fov: AA 05 08 81 01 **02** 3B EB AA				
Return	Succeed: 55 05 08 80 33 **01** 16 EB AA Fail: 55 05 08 80 33 **00** 15 EB AA				

e. Set Presets

Write Presets

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x83	0x01	2	refer to the notes	1
Receive	AA 06 08 83 01 **00 00** 3C EB AA				
Return	Succeed: 55 05 08 83 33 **01** 19 EB AA Fail: 55 05 08 83 33 **00** 18 EB AA				

***Note**: command parameter 0:00 zoom motor, 01 focus motor; command parameter 1: preset group 0-9; the set preset in this example is preset group 0; support 10 groups of presets, the detailed operation method is to operate the motor to the assigned position first, then send the command.*

Read Presets

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x83	0x00	2	refer to the notes	2
Receive	AA 06 08 83 00 **00 00** 3B EB AA				
Return	55 06 08 83 33 **9B 0E** C2 EB AA				

***Notes**: command parameter 0: 00 zoom motor 01 focus motor; parameter 1: preset group 0-9;*
The low byte of RV is in front, the high byte of RV is followed behind , the illustration is 0x0E9B；

Invoke Presets

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x87	0x01	2	refer to the notes	1
Receive	AA 06 08 87 01 **00 00** 40 EB AA				
Return	Succeed: 55 05 08 87 33 **01** 1D EB AA Fail: 55 05 08 87 33 **00** 1C EB AA				

Note*: command parameter 0: 00- zoom motor, 01-focus motor; parameter 1: preset group 0-9; The returned parameter 0 : 00-fail, 01-succeed.*

2.3.5 Temperature Measurement Commands

a. Parameter Settings

Enable/disable Temperature Measurement Display

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x00	0x01	1	on/off	1
Receive	On: AA 05 07 00 01 **01** B8 EB AA Off: AA 05 07 00 01 **00** B7 EB AA				
Return	55 05 07 00 33 **01** 95 EB AA				

Read the Current Temperature Unit

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x02	0x00	1	00	1
Receive	AA 05 07 02 00 **00** B8 EB AA				
Return	55 05 07 02 33 **00** 96 EB AA				

Note: *command parameter one byte, the representing temperature unit: 0x00: Celsius; 0x01: Kelvin; 0x02: Fahrenheit.*

Set the Current Temperature Unit

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x02	0x01	1	temperature unit	1
Receive	Celsius: AA 05 07 02 01 **00** B9 EB AA Kelvin: AA 05 07 02 01 **01** BA EB AA Fahrenheit: AA 05 07 02 01 **02** BB EB AA				
Return	55 05 07 02 33 **01** 97 EB AA				

Note: *command parameter one byte, the representing temperature unit: 0x00: Celsius; 0x01: Kelvin; 0x02: Fahrenheit.*

Read the Reflected Temperature in Environmental Variables

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x0F	0x00	1	00	4
Receive	AA 05 07 0F 00 **00** C5 EB AA				
Return	55 08 07 0F 33 **90 D0 03 00** 09 EB AA				

Note: *the returned value is 32-bit data, low bit in front, the actual data is the RV/`10000(Celsius/ Kelvin/ Fahrenheit).*

Set the Reflected Temperature in Environmental Variables

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x0F	0x01	4	temperature value	1
Receive	AA 08 07 0F 01 **90 D0 03 00** 2C EB AA				
Return	55 05 07 0F 33 **01** A4 EB AA				

Note*: the set temperature unit (Celsius/ Kelvin/ Fahrenheit) is the actual value * 10000 , low bit in front.*

Read the Ambient Temperature in Environmental Variables

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x10	0x00	1	00	4
Receive	AA 05 07 10 00 **00** C6 EB AA				
Return	55 08 07 10 33 **90 D0 03 00** 0A EB AA				

Note: *the returned value is 32-bit data, low bit in front, the actual data is RV/10000(Celsius/ Kelvin/ Fahrenheit).*

Set the Ambient Temperature in Environmental Variables

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x10	0x01	4	temperature unit	1
Receive	AA 08 07 10 01 **90 D0 03 00** 2D EB AA				
Return	55 05 07 10 33 **01** A5 EB AA				

Note: *the set temperature (Celsius/ Kelvin/ Fahrenheit) is actual value * 10000, low bit in front.*

Read the Emissivity in Environmental Variables

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x12	0x00	1	00	4
Receive	AA 05 07 12 00 **00** C8 EB AA				
Return	55 08 07 12 33 **10 27 00 00** E0 EB AA				

Note； *the returned value is 32-bit data, low bit in front, the actual data is RV/10000.*

Set the Emissivity in Environmental Variables

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x12	0x01	4	emissivity value	1
Receive	AA 08 07 12 01 **10 27 00 00** 03 EB AA				
Return	55 05 07 12 33 **01** A7 EB AA				

Note*: the set emissivity is the actual value* 10000, low bit in front.*

Read the Target Distance in Environmental Variables

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x13	0x00	1	00	4
Receive	AA 05 07 13 00 **00** C9 EB AA				
Return	55 08 07 13 33 **D0 07 00 00** 81 EB AA				

Note: *the returned value is 32-bit data, low bit in front, the actual data is RV/10000(km).*

Set the Target Distance in Environmental Variables

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x13	0x01	4	distance value	1
Receive	AA 08 07 13 01 **D0 07 00 00** A4 EB AA				
Return	55 05 07 13 33 **01** A8 EB AA				

Note: *the set target distance(km) is the actual data*10000, low bit in front.*

Read the Relative Humidity in Environmental Variables

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x11	0x00	1	00	4
Receive	AA 05 07 11 00 **00** C7 EB AA				
Return	55 08 07 11 33 **A0 0F 00 00** 57 EB AA				

Note: *the returned value is 32-bit data, low bit in front, the actual data is RV/10000.*

Set the Relative Humidity in Environmental Variables

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x11	0x01	4	RH value	1
Receive	AA 08 07 11 01 **A0 0F 00 00** 7A EB AA				
Return	55 05 07 11 33 **01** A6 EB AA				

Note； *the set RH is the actual value*10000, low bit in front.*

Read the Visual Distance in Environmental Variables

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x19	0x00	1	00	4
Receive	AA 05 07 19 00 **00** CF EB AA				
Return	55 08 07 19 33 **40 0D 03 00** 00 EB AA				

Note: *the returned value is 32-bit data, low bit in front, the actual data is RV/10000(KM).*

Set the Visual Distance in Environmental Variables

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x19	0x01	4	Distance value	1
Receive	AA 08 07 19 01 **40 0D 03 00** 23 EB AA				
Return	55 05 07 19 33 **01** AE EB AA				

Note: *the set visual distance(km) is the actual value*10000, low bit in front.*

Enable the change of Environmental Parameters/Environmental Variables

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x18	0x01	1	0	1
Receive	AA 05 07 18 01 **00** CF EB AA				
Return	55 05 07 18 33 **01** AD EB AA				

Note*: the new environmental variables are enabled after the commands have been sent.*

Read Temperature Info of A Certain Spot

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x1F	0x00	4	the temperature spot coordinate to be read(x, y)	4
Receive	AA 08 07 1F 00 **0A 00 14 00** F6 EB AA (the coordinate to be read (10, 20))				
Return	55 08 07 1F 33 **FF 3F 00 00** F4 EB AA				

Note: *the returned temperature value (Celsius/ Kelvin/ Fahrenheit) is 32-bit data, low bit in front, the actual temperature is the returned temperature value/10.*

b. Parameter Settings of Region Temperature Measurement

Enable/Disable Region Temperature Measurement Display

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x40	0x01	2	0x00	1
Receive	AA 06 07 40 01 00 01 F9 EB AA (enable region 0) AA 06 07 40 01 00 00 F8 EB AA (disable region 0)				
Return	Succeed: 55 05 07 40 33 01 D5 EB AA Fail: 55 05 07 40 33 00 D4 EB AA				

Note: *command parameter 0: the region No. to be enabled is region 0~4, command parameter 1: 0x00-disable，0x01-enable.*

Read Region Coordinate Info.

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x42	0x00	1	0x00	9
Receive	AA 05 07 42 **00** 00 F8 EB AA				
Return	55 0D 07 42 33 **00 64 00 64 00 C8 00 C8 00** 36 EB AA				

Note: *command parameter 0: the region No. to be read is region 0~4; the returned value 0: region No. 0~4, the returned value 1: the coordinate x of top left spot low 8 bit, the returned value 2: coordinate x of the top left high 8 bit, the returned value 3: coordinate y of top left low 8 bit, the returned value 4：coordinate y of top left high 8 bit, the returned value 5: coordinate x of bottom right low 8 bit, the returned value 6: coordinate x of bottom right high 8 bit, the returned value 7: coordinate y of bottom right low 8 bit, the returned value 8: coordinate y of bottom right high 8 bit.*

Set Region Coordinate

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x42	0x00	9	refer to the notes	1
Receive	AA 0D 07 42 01 **00 64 00 64 00 C8 00 C8 00** 59 EB AA				
Return	Succeed: 55 05 07 42 33 **01** D7 EB AA Fail: 55 05 07 42 33 **00** D6 EB AA				

Note: *command parameter 0, the region No. to be set 0~4, command parameter 1: coordinate x of top left low 8 bit, command parameter 2: coordinate x of top left high 8 bit, command parameter 3: coordinate y of top left low 8 bit, command parameter 4: coordinate y of top left high 8 bit, command parameter 5: coordinate x of bottom right low 8 bit, command parameter 6: coordinate x of bottom right height 8 bit, command parameter 7: coordinate y of bottom right low 8 bit, command parameter 8：coordinate y of bottom right high 8 bit.*

The Region Max. Temperature Value and Coordinate Reading

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x45	0x00	1	0x00	9
Receive	AA 05 07 45 00 **00** FB EB AA				
Return	55 0D 07 45 33 **00 4E 01 00 00 10 00 0A 00** 4A EB AA				

Note: *command parameter 0: the region No. to be read 0~4；the returned value 0: region No. 0~4，the returned value 1~4: temperature data (real data*10), low bit in front; the returned value 5~6: coordinate x, low bit in front, returned value 7~8: coordinate y, low bit in front.*

The Region Min. Temperature Value and Coordinate Reading

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x48	0x00	1	0x00	9
Receive	AA 05 07 48 00 00 FE EB AA				
Return	55 0D 07 48 33 00 42 01 00 00 2B 00 15 00 67 EB AA				

Note: *command parameter 0: the region No. to be read 0~4；the returned value 0: region No. 0~4，the returned value 1~4: temperature data (real data*10), low bit in front; the returned value 5~6: coordinate x, low bit in front, returned value 7~8: coordinate y, low bit in front.*

The Region Center Temperature Value and Coordinate Reading

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x4B	0x00	1	0x00	9
Receive	AA 05 07 4B 00 **00** 01 EB AA				
Return	55 0D 07 4B 33 **00 33 01 00 00 96 00 96 00** 47 EB AA				

Note*: command parameter 0: the region No. to be read 0~4；the returned value 0: region No. 0~4，the returned value 1~4: temperature data (real data*10), low bit in front; the returned value 5~6: coordinate x, low bit in front, returned value 7~8：coordinate y, low bit in front.*

Read the Region Avg. Temperature Value

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x4C	0x00	1	0x00	5
Receive	AA 05 07 4C 00 **00** 02 EB AA				
Return	55 09 07 4C 33 **00 33 01 00 00** 18 EB AA				

Note*: command parameter 0: the region No. to be read 0~4；the returned value 0: region No. 0~4，the returned value 1~4: temperature data (real data*10).*

c. Parameter Settings of the Full Frame

Enable /Disable the temperature measurement display of the full frame

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x24	0x01	1	On/Off	1
Receive	On: AA 05 07 24 01 **01** DC EB AA Off: AA 05 07 24 01 **00** DB EB AA				
Return	55 05 07 24 33 **01** B9 EB AA				

Enable/Disable the Max. Temperature Display of the Full Frame

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x26	0x01	1	On/Off	1
Receive	On: AA 05 07 26 01 **01** DE EB AA Off: AA 05 07 26 01 **00** DD EB AA				
Return	55 05 07 26 33 **01** BB EB AA				

Enable/Disable the Min. Temperature Display of the Full Frame

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x28	0x01	1	On/Off	1
Receive	On: AA 05 07 28 01 **01** E0 EB AA Off: AA 05 07 28 01 **00** DF EB AA				
Return	55 05 07 28 33 **01** BD EB AA				

Enable/Disable the Center Temperature Display of the Full Frame

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x2B	0x01	1	On/Off	1
Receive	On: AA 05 07 2B 01 **01** E3 EB AA Off: AA 05 07 2B 01 **00** E2 EB AA				
Return	55 05 07 2B 33 **01** C0 EB AA				

Read the Avg. Temperature of the Full Frame

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x2A	0x00	1	0	4
Receive	AA 05 07 2A 00 **00** E0 EB AA				
Return	55 08 07 2A 33 **FE 3F 00 00** FE EB AA				

***Note**: the returned temperature value(Celsius/ Kelvin/Fahrenheit) is 32-bit data, low bit in front, the actual temperature is RV/10.*

Read the Max. Temperature of the Full Frame

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x27	0x00	1	00	8
Receive	AA 05 07 27 00 **00** DD EB AA				
Return	55 0C 07 27 33 **FF 3F 00 00 05 00 05 00** 0A EB AA				

***Note:** the returned value byte 0~3 represents the highest temperature (Celsius/ Kelvin/ Fahrenheit), 32-bit data low bit in front, the actual temperature is RV/10; Byte 4~5 represents coordinate X of the highest temperature, low bit in front; Byte 6~7 represents coordinate y of the highest temperature, low bit in front.*

Read the Min. Temperature of the Full Frame

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x29	0x00	1	00	8
Receive	AA 05 07 29 00 **00** DF EB AA				
Return	55 0C 07 29 33 **FF 3F 00 00 05 00 05 00** 0C EB AA				

***Note**: the returned value byte 0~3 represents the lowest temperature (Celsius/ Kelvin/ Fahrenheit), 32-bit data low bit in front, the actual temperature is RV/10; Byte 4~5 represents coordinate X of the lowest temperature, low bit in front; Byte 6~7 represents coordinate y of the lowest temperature, low bit in front.*

Read the Center Temperature of the Full Frame

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x2C	0x00	1	00	6
Receive	AA 05 07 2C 00 **00** E2 EB AA				
Return	55 0C 07 2C 33 **FF 3F 00 00 40 01 00 01** 47 EB AA				

***Note:** the returned value byte 0~3 represents the center temperature (Celsius/ Kelvin/ Fahrenheit), 32-bit data low bit in front, the actual temperature is RV/10; Byte 4~5 represents coordinate X of the center temperature, low bit in front; Byte 6~7 represents coordinate y of the center temperature, low bit in front.*

Enable/Disable Fire Alarm

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x30	0x01	1	Enable /Disable	1
Receive	Enable: AA 05 07 30 **01** 01 E8 EB AA Disable: AA 05 07 30 **01** 00 E7 EB AA				
Return	55 05 07 30 33 **01** C5 EB AA				

Set Fire Alarm Threshold

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x31	0x01	2	refer to the notes	1
Receive	Set: AA 06 07 31 **01** 10 27 E8 EB AA				
Return	55 05 07 31 33 **01** C6 EB AA				

Note: *parameter range is between 1 and 16384, normally set between 10000 and 14000, the alarm threshold in the illustration is 0x2710=10000.*

Read Fire Alarm Threshold

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x31	0x00	0		1
Receive	Read: AA 04 07 31 **00** E6 EB AA				
Return	55 06 07 31 33 **10 27** FD EB AA				

Note: *parameter threshold is between 1 and 16384, normally set between 10000 and 14000, the alarm threshold in the illustration is 0x2710=10000.*

Serial Port Alarm of Fire Alarm

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x08	0x01	21	refer to the notes	1
Send	AA 19 01 08 01 03 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 D0 EB AA				

Note: *send alarm 3 times/ s after the fire alarm is triggered, at most 5 central spot info of fire alarm can be sent, parameter 0: fixed 0x03，parameter 1-parameter 4: central position of fire region No. 1, write 0x00 if no, parameter 1: center x low 8 bit of fire region No. 1 parameter 2: center x high 8 bit of fire*

region No. 1, parameter 3: center y low 8 bit of fire region No. 1, parameter 4: fire region-center y high 8 bit of fire region No. 1; parameter 5 -parameter 8: central position of fire region No. 2; parameter 9-parameter 12: central position of fire region No. 3; parameter 13-parameter 16: central position of fire region No. 4; parameter 17-parameter 20: central position of fire region No. 5.

Enable /Disable Above Alarm

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x2D	0x01	1	Enable /disable	1
Receive	Enable: AA 05 07 2D 01 **01** E5 EB AA Disable: AA 05 07 2D 01 **00** E4 EB AA				
Return	55 05 07 2D 33 01 C2 EB AA				

Set Above Alarm Threshold

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x2D	0x01	1	enable/disable	1
Receive	AA 08 07 1E 01 **C0 C6 2D 00** 8B EB AA				
Return	Succeed: 55 05 07 1E 33 **01** B3 EB AA Fail: 55 05 07 1E 33 **00** B2 EB AA				

***Note**: the set value is 32-bit, low bit in front, the set value=actual value* 10000, the set above alarm threshold in this illustration is 300(Celsius/Kelvin/ Fahrenheit).*

Read Above Alarm Threshold

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x2D	0x01	1	enable/disable	1
Receive	AA 05 07 1E **00 00** D4 EB AA				
Return	55 08 07 1E 33 **C0 C6 2D 00** 68 EB AA				

***Note:** the actual temperature (Celsius/Kelvin/ Fahrenheit) =the read threshold/10000, the read threshold in this example is 3000000, the actual value is 300.*

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Serial Port Alarm of Above Alarm

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x08	0x01	21	refer to the notes	1
Send	AA 19 01 08 01 **02 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00** D0 EB AA				

Note: *the alarm will be made 2 times/s after the above alarm is triggered, parameter 0: fixed 0x02, parameter 1: 0x01-alarm appears, 0x00- alarm disappears, other bytes are meaningless.*

d. Secondary Calibration

Enable/Disable secondary calibration

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x60	0x01	1	Enable /Disable	1
Receive	Enable: AA 05 07 60 01 **01** 18 EB AA Disable: AA 05 07 60 01 **00** 17 EB AA				
Return	55 05 07 60 33 **01** F5 EB AA				

Note: *Enable/disable the function of secondary calibration.*

Read whether the module has saved the secondary calibration data before

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x6A	0x00	1	00	1
Receive	AA 04 07 6A **00** 1F EB AA				
Return	Not saved: 55 05 07 6A 33 **00** FE EB AA Saved: 55 05 07 6A 33 **01** FF EB AA				

Clear the Secondary Calibration Data

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x6B	0x02	1	00	1
Receive	AA 05 07 6B 02 **00** 23 EB AA				
Return	55 05 07 6B 33 **01** 00 EB AA				

Secondary Calibration

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x6F	0x02	3	target temperature value	1
Receive	Target Temperature is 10℃: AA 07 07 6F 02 **64 00 01** 8E EB AA Target Temperature is 50℃: AA 07 07 6F 02 **F4 01 02** 20 EB AA				
Return	55 05 07 6F 33 **01** 04 EB AA				

Note: *calibration process is as follows: aim to the low temp blackbody after the lens have been changed, send target temperature via this command (temperature data is filled in according to the blackbody temperature, the temperature in this example is 10℃ (0064, 100 in decimal, the actual temperature *10), parameter 2(0x01）fixed); then aim to the high temperature blackbody, send target temperature via this command, the temperature data is filled in according to the blackbody temperature, the temperature in this example is 50 ℃(01F4, 500 in decimal, the actual temperature*10）, the parameter 2 （0x02）fixed）； the thermal camera module will perform secondary calibration calculation when the target temperature is sent for the second time.*

Save the Secondary Calibration Data

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x07	0x6A	0x02	1	00	1
Receive	AA 05 07 6A 02 **00** 22 EB AA				
Return	Succeed: 55 05 07 6A 33 **01** FF EB AA Fail: 55 05 07 6A 33 **00** FE EB AA				

e. Strong Light Protection Settings

Read On/off State, Threshold and Protection Time of Strong Light Protection

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x08	0x00	1	0x00	1
Receive	Read On/off State, Threshold and Protection Time of Strong Light Protection: AA 05 01 08 00 **00** B8 EB AA				
Return	55 07 08 33 **00 8B 06 58** 80 EB AA				

Set On/off State, Threshold and Protection Time of Strong Light Protection

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x08	0x01	4	refer to the notes	1
Receive	strong light protection on: AA 08 01 08 01 **01 8B 06 58** A6 EB AA strong light protection off: AA 08 01 08 01 **00 8B 06 58** A5 EB AA Write strong light protection threshold and protection time: AA 08 01 08 01 **00 8B 06 58** A5 EB AA				
Return	Succeed: 55 04 08 33 **01** 95 EB AA Fail: 55 04 08 33 **00** 94 EB AA				

Note: *command parameter 0: 0x01-enable, 0x00-disable; parameter 1: threshold low 8 bit, parameter 2: threshold high 8 bit; parameter 3: protection time; the 068B and 58 in this example represents that the strong light protection threshold is 1675, and protection time is 88s.*

Auto Send Info after Strong Light Protection is Triggered.

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x08	0x00	1	0x00	1
Auto Send	Trigger(close shutter): AA 19 01 08 01 01 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 CF EB AA protection finished(open shutter): AA 19 01 08 01 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 CE EB AA				

2.3.6 PT Control

Read the Address of RS-485 Bus (The address is used for PELCO-D communication)

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x8A	0x00	1	0x00	1
Receive	AA 07 08 8A 00 **00** 41 EB AA				
Return	55 06 08 8A 33 **FE** 1F EB AA				

Note*: the address by defaut is 0xFE.*

Write the Address of RS-485 Bus (The address is used for PELCO-D communication)

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x8A	0x01	1	new address	1
Receive	AA 07 08 8A 01 **FE** 40 EB AA				
Return	55 06 08 8A 33 **01** 1F EB AA				

***Note**: set the address as 0xFE, the returned parameter: 0x00-fail，0x01-succeed.*

Tilt Command

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x71	0x01	0	refer to the notes	1
Receive	Up : AA 07 08 71 01 **01 00 1F** 4B EB AA Down: AA 07 08 71 01 **01 01 1F** 4C EB AA				
Return	Succeed: 55 05 08 71 33 **01** 07 EB AA Fail: 55 05 08 71 33 **00** 06 EB AA				

***Note**： command parameter 0: address; parameter 1: 00-up, 01-down; parameter 2-speed; returned parameter 0: 00- fail, 01- succeed.*

Pan Command

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x72	0x01	0	refer to the notes	1
Receive	Left: AA 07 08 72 01 **01 00 1F** 4C EB AA Right: AA 07 08 72 01 **01 01 1F** 4D EB AA				
Return	Succeed: 55 05 08 72 33 **01** 08 EB AA Fail: 55 05 08 72 33 **00** 07 EB AA				

***Note:** command parameter 0: address; parameter 1: 00-left, 01-right; parameter 2-speed; returned value 0: 00-fail, 01-succeed.*

Rotation Stop Command

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x77	0x01	0	refer to the notes	1
Receive	Stop: AA 05 08 77 01 **01 30** EB AA				
Return	Succeed: 55 05 08 77 33 **01** 0D EB AA Fail: 55 05 08 77 33 **00** 0C EB AA				

Note: *command parameter 0: address; parameter 1: fixed 0x30；the returned parameter 0: 00-fail, 01-succeed.*

Presets Operation Commands

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x73	0x01	2	refer to the notes	1
Receive	Set: AA 07 08 73 01 **01 00 01** 2F EB AA Clear: AA 07 08 73 01 **01 01 01** 30 EB AA Invoke: AA 07 08 73 01 **01 02 01** 31 EB AA				
Return	Succeed: 55 05 08 73 33 **01** 09 EB AA Fail: 55 05 08 73 33 **00** 08 EB AA				

Note: *command parameter 0: address, parameter 1: preset No. (the preset No. in this example is No. 1), parameter 2: fixed 0x01；the returned value 0: 00-fail, 01-succeed.*

2.3.7 Advanced Functions

a. Calibration

Display or Hide of the Bad Pixel Cursor

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x43	0x02	1	0xC1: Display 0x40:Hide	1
Receive	Display of bad pixel cursor: AA 05 01 43 02 **C1** B6 EB AA Hide of bad pixel cursor: AA 05 01 43 02 **40** 35 EB AA				
Return	Succeed: 55 04 43 33 **01** D0 EB AA Fail: 55 04 43 33 **00** CF EB AA				

Move of Bad Pixel Cursor

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x44	0x02	1	refer to the notes	1
Receive	Move up 1: AA 05 01 44 02 **01** F7 EB AA Move down 1: AA 05 01 44 02 **02** F8 EB AA Move left 1: AA 05 01 44 02 **03** F9 EB AA Move right 1: AA 05 01 44 02 **04** FA EB AA Move up 20: AA 05 01 44 02 **81** 77 EB AA Move down 20: AA 05 01 44 02 **82** 78 EB AA Move left 20: AA 05 01 44 02 **83** 79 EB AA Move right 20: AA 05 01 44 02 **84** 7A EB AA				
Return	Succeed: 55 04 44 33 **01** D1 EB AA Fail: 55 04 44 33 **00** D0 EB AA				

***Note**: command parameter 0: 0x01: move up 1; 0x02： move down 1; 0x03: move left 1; 0x04: move right 1; 0x81: move up 20; 0x82: move down 20; 0x83: move left 20; 0x84: move right 20.*

Add and Cancel Bad Pixel

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x90	0x01	1	0x01: add 0x02: cancel	1
Receive	Add: AA 05 01 90 01 **01** 42 EB AA Cancel: AA 05 01 90 01 **02** 43 EB AA				
Return	Succeed: 55 04 90 33 **01** 1D EB AA Fail: 55 04 90 33 **00** 1C EB AA				

Save Pixel

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0x91	0x02	0	NULL	1
Receive	Save: AA 04 01 91 02 42 EB AA				
Return	Succeed: 55 04 91 33 **01** 1E EB AA Fail: 55 04 91 33 **00** 1D EB AA				

K Calibration/Gain Calibration Coefficient

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0xA0	0x01	1	refer to the notes	1
Receive	Get low temperature data: AA 05 01 A0 01 **0A** 5B EB AA Get high temperature data: AA 05 01 A0 01 **0B** 5C EB AA Calculate: AA 05 01 A0 01 **0C** 5D EB AA Save: AA 05 01 A0 01 **0D** 5E EB AA Clear: AA 05 01 A0 01 **0E** 5F EB AA				
Return	Succeed: 55 04 A0 33 **01** 2D EB AA Fail: 55 04 A0 33 **00** 2C EB AA				

Note*: command parameter 0: 0x0A: get low temperature data, 0x0B: get high temperature data, 0x0C: calculate K, 0x0E: clear K; 0x0D: save K.*

Image Recompensation

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0xA1	0x01	1	0x00: collect data and calculate 0x01: save calculation results 0x02: clear	1
Receive	Clear: AA 05 01 A1 01 **02** 54 EB AA Get: AA 05 01 A1 01 **00** 52 EB AA Save: AA 05 01 A1 01 **01** 53 EB AA				
Return	Save: 55 04 A1 33 **01** 2E EB AA Fail: 55 04 A1 33 **00** 2D EB AA				

Read External Sync Mode and Frequency

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0xA3	0x00	1	0x01	1
Receive	AA 05 01 A3 00 **01** 54 EB AA				
Return	55 05 A3 33 **00 32** 62 EB AA				

Note: *returned value 0: 0x00-self sync， 0x01-internal sync， 0x02-external sync， 0x03-self-adaptation；returned value 1: frequency, the example 32 is in hexadecimal, then the frequency is 50Hz.*

Set External Sync Mode and Frequency

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x01	0xA3	0x01	2	refer to the notes	1
Receive	AA 06 01 A3 01 **00 32** 87 EB AA				
Return	Succeed: 55 05 A3 33 **01** 31 EB AA Fail: 55 05 A3 33 **00** 30 EB AA				

Note: *command parameter 0: 0x00-self sync, 0x01-internal sync, 0x02-external sync, 0x03-self adaptation; command parameter 1: frequency settings, range: 25Hz~50Hz， the example is 32 in hexadecimal, then the frequency is 50Hz.*

b. Other Settings

Get the Current Focal Length

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x8B	0x00	1	0x00	2
Receive	AA 05 08 8B 00 **00** 42 EB AA				
Return	55 06 00 8B 33 **DC 05** FA EB AA				

Note: *the returned value is 10 times of focal length, low bit in front, high bit behind, take this RV as an example, the returned focal length is 0x05DC=1500, the final focal length is 1500/10 = 150mm.*

Set the Position of Focal Length

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x8E	0x01	2	Refer to the notes	1
Receive	AA 06 08 8E 01 **84 03** CE EB AA				
Return	Succeed: 55 06 08 8E 33 **34 09** 61 EB AA Fail: 55 05 08 8E 33 **00** 23 EB AA				

Note*: the set value is 10 times of the focal length, low bit in front, high bit behind, take 90 mm as an example, the sent value 90*10=900=0x0384；the parameter of RV is the position where the focus motor should go, pos = 0x0934 in this example.*

Display the Switch of Focal Length

CW0	CW1	OW	PRM Byte Count	PRM	RV Byte Count
0x08	0x8D	0x01	1	0x00/0x01	1
Receive	Off: AA 05 08 8D 01 **00** 45 EB AA On: AA 05 08 8D 01 **01** 46 EB AA				
Return	Succeed: 55 05 08 8D 33 **01** 23 EB AA Fail: 55 05 08 8D 33 **00** 22 EB AA				