F384/F640

Uncooled Thermal Imaging Module

Operating Commands User Manual

V1.0.0

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Historical Versions

Version	Date	Description
V1.0.0	2024-07	Initial release

1 Serial Port Settings

Table 1 Serial Port Default Settings

Baud Rate	Transmission Format			Parity Check
115200bps	Data bit: 8 bit	Start bit: 1 bit	Stop bit: 1 bit	None

***Note**: For each byte of information, the least significant bit (LSB) is transmitted first.*

2 Command & Information Format of Module Component

2.1 Command Reception Format of Module Component

Table 2 Command Reception Format of Common 01 Instruction Set

Head	Bytes	Word 0	Word 1	Operation Word	Parameter 0	Parameter 1	…	Parameter n	Parity Bit	Tail	
		Head									
0xAA	0xXX	0x01	0xXX	0x00 0x01	0xXX	0xXX	0xXX	0xXX	0xXX	0xEB	0xAA

Notes:

(1). The above numbers and letters are in the hexadecimal byte format and this note will not be given again in the following content;

(2). The number of bytes is the total number of bytes from command word 0 (inclusive) to parity bit (inclusive);

(3). The parity bit is the sum of all bytes before the parity bit of the command and the remainder of 256;

(4). Refer to the Module Component Command Reception and Status Information Table for detailed commands and parameters;

(5). If the parameter is a 16-bit or 32-bit data, please put the low byte first, such as bit0~bit7, bit8~bit15, bit16~bit23, bit24~bit31;

(6). The command header is fixed at 0xAA, and the command footer is fixed at 0xEB and 0xAA;

(7). Command word 0 is 0x01, indicating a module extended instruction.

Table 3 Command Reception Format of Extension 07 Instruction Set

Head	Bytes	Word 0	Word 1	Operation Word	Parameter 0	Parameter 1	…	Parameter n	Parity Bit	Tail	
		This section pertains to the command body.									
0xAA	0xXX	0x07	0xXX	0x00 0x01	0xXX	0xXX	0xXX	0xXX	0xXX	0xEB	0xAA

Notes:

(1). The number of bytes is the total number of bytes from command word 0 (inclusive) to parity bit (inclusive);

(2). The parity bit is the sum of all bytes before the parity bit of the command and the remainder of 256;

(3). Refer to the Module Component Command Reception and Status Information Table for detailed commands and parameters;

(4). If the parameter is a 16-bit or 32-bit data, please put the low byte first, such as bit0~bit7, bit8~bit15, bit16~bit23, bit24~bit31;

(5). The command header is fixed at 0xAA, and the command footer is fixed at 0xEB and 0xAA;

(6). Command word 0 is 0x07, indicating a module common instruction.

Table 4 Command Reception Format of Extension 08 Instruction Set

Head	Bytes	Word 0	Word 1	Operation Word	Parameter 0	Parameter 1	…	Parameter n	Parity Bit	Tail	
		This section pertains to the command body.									
0xAA	0xXX	0x08	0xXX	0x00 0x01	0xXX	0xXX	0xXX	0xXX	0xXX	0xEB	0xAA

Notes:

(1). The number of bytes is the total number of bytes from command word 0 (inclusive) to parity bit (inclusive);

(2). The parity bit is the sum of all bytes before the parity bit of the command and the remainder of 256;

(3). Refer to the Module Component Command Reception and Status Information Table for detailed commands and parameters;

(4). If the parameter is a 16-bit or 32-bit data, please put the low byte first, such as bit0~bit7, bit8~bit15, bit16~bit23, bit24~bit31;

(5). The command header is fixed at 0xAA, and the command footer is fixed at 0xEB and 0xAA;

(6). Command word 0 is 0x08, indicating a module common instruction.

2.2 Module Component Return Status Information Command Format

Table 5 Return Status Information Command Format of Common 01 Instruction Set

Head	Bytes	Word	Operation Word	Return Value	Return Value	…	Return Value	Parity Bit	Tail	
		This section pertains to the command body.								
0x55	0xXX	0xXX	0x33	0xXX	0xXX	0xXX	0xXX	0xXX	0xEB	0xAA

Notes:

(1). The status information returned by the module component reflects the completion of internal command execution within the module component;

(2). For command words and return values, please refer to the Module Component Command Reception and Status Information Table. Place the low byte of the return value first; For example, if 512 corresponds to hexadecimal 0x200, the return value will be 0x00 followed by 0x02;

(3). The number of bytes is the total number of bytes from command word 0 (inclusive) to parity bit (inclusive);

(4). If the return value is a 16-bit or 32-bit data, please put the low byte first, such as bit0~bit7, bit8~bit15, bit16~bit23, bit24~bit31;

(5). The command word corresponds to the command issued by the user, and the operation word is fixed at 0x33;

(6). The command header of the returned information is fixed at 0x55, and the command tail of the returned information is fixed at 0xEB, 0xAA;

Table 6 Return Status Information Command Format of Extension 07 Instruction Set

Head	Bytes	Word 0	Word 1	Operation Word	Return Value	Return Value	…	Return Value	Parity Bit	Tail	
		This section pertains to the command body.									
0x55	0xXX	0x07	0xXX	0x33	0xXX	0xXX	0xXX	0xXX	0xXX	0xEB	0xAA

Notes:

(1). The status information returned by the module component reflects the completion of internal command execution within the module component;

(2). For command words and return values, please refer to the Module Component Command Reception and Status Information Table. Place the low byte of the return value first; For example, if 512 corresponds to hexadecimal 0x200, the return value will be 0x00 followed by 0x02;

(3). The number of bytes is the total number of bytes from command word 0 (inclusive) to parity bit (inclusive);

(4). If the return value is a 16-bit or 32-bit data, please put the low byte first, such as bit0~bit7, bit8~bit15, bit16~bit23, bit24~bit31;

(5). Command word 0 is 0x07, which is an extended inherent return instruction. Command word 1 corresponds to the instruction issued by the user. The operation word is fixed at 0x33;

(6). The command header of the returned information is fixed at 0x55, and the command tail of the returned information is fixed at 0xEB, 0xAA;

Table 7 Return Status Information Command Format of Extension 08 Instruction Set

Head	Bytes	Word 0	Word 1	Operation Word	Return Value	Return Value	…	Return Value	Parity Bit	Tail	
		This section pertains to the command body.									
0x55	0xXX	0x08	0xXX	0x33	0xXX	0xXX	0xXX	0xXX	0xXX	0xEB	0xAA

Notes:

(1). The status information returned by the module component reflects the completion of internal command execution within the module component;

(2). For command words and return values, please refer to the Module Component Command Reception and Status Information Table. Place the low byte of the return value first; For example, if 512 corresponds to hexadecimal 0x200, the return value will be 0x00 followed by 0x02;

(3). The number of bytes is the total number of bytes from command word 0 (inclusive) to parity bit (inclusive);

(4). If the return value is a 16-bit or 32-bit data, please put the low byte first, such as bit0~bit7, bit8~bit15, bit16~bit23, bit24~bit31;

(5). Command word 0 is 0x08, which is an extended inherent return instruction. Command word 1 corresponds to the instruction issued by the user. The operation word is fixed at 0x33;

(6). The command header of the returned information is fixed at 0x55, and the command tail of the returned information is fixed at 0xEB, 0xAA;

When the module component is controlled by the user, if the command words returned to the upper computer are 0xFF and only one byte has the return value as shown in Table 8, it indicates a communication protocol error. Users can identify the error reason based on the table.

Table 8 List of Return Value Errors

Return Value	Error Reason
0xF1	Command Timeout
0xFB	No Command Word
0xFD	DRC Checksum Byte Error
0xFF	Packet Header 0xAA Error

2.3 Module Component Command Reception and Status Information

2.3.1 Basic Settings

Read SN code

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x71	0x00	0	None	20
Core Reception	AA 04 01 71 00 20 EB AA				
Core Return	55 17 71 33 **41 39 32 36 31 30 30 35 00 00 00 00 00 00 00 00 00 00 00 00** B8 EB AA				

Note: *in the example, the SN code is A9261005, and within the 20-byte return value, "0x00" represents unused bytes.*

Read focal plane width

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x72	0x00	0	None	2
Core Reception	AA 04 01 72 00 21 EB AA				
Core Return	55 05 72 33 **80 02** 81 EB AA				

***Note**: The focal plane width in the example is 640 (0280H).*

Read focal plane height

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x73	0x00	0	None	2
Core Reception	AA 04 01 73 00 22 EB AA				
Core Return	55 05 73 33 **00 02** 02 EB AA				

***Note**: The focal plane width in the example is 512(0200H).*

Background correction

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x02	0x02	2		1
Core Reception	AA 06 01 02 02 **00 02** B7 EB AA				
Core Return	Success: 55 04 02 33 **01** 8F EB AA Failure: 55 04 02 33 **00** 8E EB AA				

Shutter correction

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x02	0x02	2		1
Core Reception	AA 06 01 02 02 **01 01** B7 EB AA				
Core Return	Success: 55 04 02 33 **01** 8F EB AA Failure: 55 04 02 33 **00** 8E EB AA				

Set manual/automatic shutter correction

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x01	0x01	1	0x00 manual 0x01 auto	1
Core Reception	Manual: AA 05 01 01 01 **00** B2 EB AA Auto: AA 05 01 01 01 **01** B3 EB AA				

Automatic shutter time interval setting

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x03	0x01	1	Unit:min	1
Core Reception	AA 05 01 03 01 **03** B7 EB AA				
Core Return	Success: 55 04 03 33 **01** 90 EB AA Failure: 55 04 03 33 **00** 8F EB AA				

Note: *In the example, the time interval is set to 3 minutes.*

Read automatic shutter time interval

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x03	0x00	0	None	1
Core Reception	AA 04 01 03 00 B2 EB AA				
Core Return	55 04 03 33 **03** 92 EB AA				

Note: *The returned interval in the example is 3 minutes.*

Automatic shutter focal plane interval setting

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x04	0x01	1	Unit: 0.1℃	1
Core Reception	AA 05 01 04 01 **05** BA EB AA				
Core Return	Success: 55 04 04 33 **01** 91 EB AA Failure: 55 04 04 33 **00** 90 EB AA				

Note: *In the example, the focal plane temperature interval is set to 0.5°C, and the setting value 05 is the actual temperature value multiplied by 10.*

Automatic shutter focal plane temperature interval reading

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x04	0x00	0	None	1
Core Reception	AA 04 01 04 00 B3 EB AA				
Core Return	55 04 04 33 **05** 95 EB AA				

***Note**: The focal plane temperature interval returned in the example is 0.5°C, and the return value 05 is the actual temperature value multiplied by 10.*

Automatic shutter core temperature interval setting

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x0D	0x01	1	Unit: 0.1℃	1
Core Reception	AA 05 01 0D 01 **14** D2 EB AA				
Core Return	Success: 55 04 0D 33 **01** 9A EB AA Failure: 55 04 0D 33 **00** 99 EB AA				

***Note:** In the example, the module temperature interval is set to 2.0℃, and the setting value 14 (16 for hexadecimal, 20 for decimal) is the actual temperature value multiplied by 10.*

Automatic shutter module temperature interval reading

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x0D	0x00	0	None	1
Core Reception	AA 04 01 0D 00 BC EB AA				
Core Return	55 04 0D 33 **14** AD EB AA				

***Note:** The module temperature interval returned in the example is 2°C, and the return value 14 (16 for hexadecimal, 20 for decimal) is the actual temperature value multiplied by 10.*

Read core temperature

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x7C	0x00	0	None	2
Core Reception	AA 04 01 7C 00 2B EB AA				
Core Return	55 05 7C 33 **95 0B** A9 EB AA				

Note: *In the example, the temperature of the module component is 29.65℃, and the return value 0B95 is the actual temperature multiplied by 100.*

Read focal plane temperature

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0xC3	0x00	0	None	2
Core Reception	AA 04 01 C3 00 72 EB AA				
Core Return	55 05 C3 33 **87 0B** E2 EB AA				

Note: *In the example, the focal plane temperature is 29.51℃, and the return value 0B87 is the actual temperature multiplied by 100.*

Save settings

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x7F	0x02	0	None	1
Core Reception	AA 04 01 7F 02 30 EB AA				
Core Return	Success: 55 04 7F 33 **01** 0C EB AA Failure: 55 04 7F 33 **00** 0B EB AA				

Factory reset

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x82	0x02	1	0x00	1
Core Reception	AA 05 01 82 02 00 34 EB AA				
Core Return	Success: 55 04 82 33 **01** 0F EB AA Failure: 55 04 82 33 **00** 0E EB AA				

2.3.2 Video Setting

Digital Zoom

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x40	0x02	8	Refer to *Note*	1
Core Reception	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
Core Return	Success: 55 04 40 33 **01** CD EB AA Failure: 55 04 40 33 **00** CC EB AA

Note:

The command parameters are the coordinates of the upper left corner and the coordinates of the lower right corner. Note that the coordinate system starts from (0,0), first x and then y, that is, the number of columns first and then the number of rows.

Parameter 0: col low byte upper left corner coordinate, parameter 1: col high byte, parameter 2: row low byte, parameter 3: row high byte, parameter 4: col low byte lower right corner coordinate, parameter 5: col high byte, parameter 6: row low byte, and parameter 7: row high byte.

In the example, when the digital zoom is magnified 3 times, it is equivalent to following the setting values 00D5， 00AB， 01A9， 0154. The coordinate of the upper left corner of the actual magnified area is (213,171) and the coordinate of the lower right corner is (425,340).

The coordinate algorithm assumes that the width of the detector array is W, the height is H, and the preset amplification factor is m (accurate to 1 decimal place), then

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

Upper left corner $X = \frac{H}{2} - \frac{H}{2m}$

Upper left corner $X = \frac{W}{2} + \frac{W}{2m} - 1$

Upper left corner $X = \frac{H}{2} + \frac{H}{2m} - 1$

Image flip

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x4C	0x01	1	0x01: no flip 0x02: horizontal flip 0x04: vertical flip 0x08: diagonal flip from upper left to lower right	1
Core Reception	Not flip: AA 05 01 4C 01 **01** FE EB AA Horizontal flip:AA 05 01 4C 01 **02** FF EB AA Vertical flip:AA 05 01 4C 01 **04** 01 EB AA Diagonal flip from upper left to lower right:AA 05 01 4C 01 **08** 05 EB AA				
Core Return	Success: 55 04 4C 33 **01** D9 EB AA Failure: 55 04 4C 33 **00** D8 EB AA				

Analog video on/off

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x3D	0x02	1	0x00: on 0x01: off	1
Core Reception	On: AA 05 01 3D 02 **01** F0 EB AA Off: AA 05 01 3D 02 **00** EF EB AA				
Core Return	Success: 55 04 3D 33 **01** CA EB AA Failure: 55 04 3D 33 **00** C9 EB AA				

Video freeze/defreeze

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x3E	0x02	1	0x00: defreeze 0x01: freeze	1
Core Reception	Freeze: AA 05 01 3E 02 **01** F1 EB AA Defreeze: AA 05 01 3E 02 **00** F0 EB AA				
Core Return	Success: 55 04 3E 33 **01** CB EB AA Failure: 55 04 3E 33 **00** CA EB AA				

Note: *The "Defreeze" status is set by default, analog and digital functions freeze/defreeze are combined into one.*

Power-on LOGO on/off

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x49	0x02	1	0x80: On 0x00: Off	1
Core Reception	LOGO on: AA 05 01 49 02 **80** 7B EB AA LOGO off: AA 05 01 49 02 **00** FB EB AA				
Core Return	Success: 55 04 49 33 **01** D6 EB AA Failure: 55 04 49 33 **00** D5 EB AA				

Polarity and palette switching

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x42	0x02	1	See Note	1
Core Reception	White-hot: AA 05 01 42 02 **00** F4 EB AA Black-hot:: 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 Ice-fire: AA 05 01 42 02 **0C** 00 EB AA Cyan and red: 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
Core Return	Success: 55 04 42 33 **01** CF EB AA Failure: 55 04 42 33 **00** CE EB AA

Note: *color palette selection, command parameter 1 byte, 0x00: white-hot; 0x01: black-hot; 0x02: rainbow; 0x03: high-contrast rainbow; 0x04: iron red; 0x05: lava; 0x06: sky; 0x07: medium gray; 0x08: gray red; 0x09: purple orange; 0x0A: special; 0x0B: warning red; 0x0C: Ice and fire; 0x0D: cyan red; 0x0E: special II; 0x0F: gradient red; 0x10: gradient green; 0x11: gradient blue; 0x12: warning green; 0x13: warning blue.*

Get the current image palette style

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x42	0x00	1	0x00	1
Core Reception	AA 05 01 42 00 **00** F2 EB AA				
Core Return	55 04 42 33 **00** CE EB AA				

Note*: return value 1 byte, 0x00: white-hot; 0x01: black-hot; 0x02: rainbow; 0x03: high-contrast rainbow; 0x04: iron red; 0x05: lava; 0x06: sky; 0x07: medium gray; 0x08: gray red; 0x09: purple orange; 0x0A: special; 0x0B: warning red; 0x0C: Ice and fire; 0x0D: cyan red; 0x0E: special II; 0x0F: gradient red; 0x10: gradient green; 0x11: gradient blue; 0x12 : warning green; 0x13: warning blue.*

Warning red, green and blue threshold settings

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x4B	0x02	2	See note	1
Core Reception	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				
Core Return	Success: 55 04 4B 33 **01** D8 EB AA Failure: 55 04 4B 33 **00** D7 EB AA				

Note*: command parameter 0: threshold 0-255. In the example, C8 (H) is 200; parameter 1: warning type, 0x00: warning red, 0x01: warning green, 0x02: warning blue.*

Digital video switch and interface selection

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x5D	0x02	2	See note	1
Core Reception	Off: AA 06 01 5D 02 **00 00** 10 EB AA LVCMOS: AA 06 01 5D 02 **02 00** 12 EB AA BT.1120: AA 06 01 5D 02 **05 00** 15 EB AA BT.601: AA 06 01 5D 02 **05 20** 35 EB AA CDS_2: AA 06 01 5D 02 **05 80** 95 EB AA CDS_3: AA 06 01 5D 02 **05 40** 55 EB AA				
Core Return	Success: 55 04 5D 33 **01** EA EB AA Failure: 55 04 5D 33 **00** E9 EB AA				

Note: *command parameter 0:0x00: digital video off, 0x02: LVCMOS, 0x05： BT.1120; command parameter 1: for BT.1120 video: 0x20: BT.601, 0x80: CDS_2，0x40: CDS_3. Set 0x02 as bayer mode when data source is selected as DRC.*

Video source selection

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x5C	0x01	1	See note	1
Core Reception	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				
Core Return	Success: 55 04 5C 33 **01** E9 EB AA Failure: 55 04 5C 33 **00** E8 EB AA				

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

2.3.3 Gain Control

Image mode settings

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes

0x02	0x1A	Set: 0x01 Read: 0x00	1	0x00~0x04	1
Core Reception	Set: AA 05 02 1A 01 **00** CC EB AA Read: AA 04 02 1A 00 CA EB AA				
Core Return	Success: 55 04 1F 33 **01** AC EB AA Failure: 55 04 1F 33 **00** AB EB AA				

Read image mode

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x02	0x1A	0x00	0	None	4
Core Reception	AA 04 02 1A 00 CA EB AA				
Core Return	55 07 1A 33 **00 00 00 00** A9 EB AA				

Note:The first byte of the image mode returned value 0x00~0x04; 0x00: classical, 0x01: Sea&Sky, 0x02: forest, others have not been configured.

Contrast settings

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x37	0x01	1	0x00~0x64	1
Core Reception	AA 05 01 37 01 **05** ED EB AA				
Core Return	Success: 55 04 22 33 **01** AF EB AA Failure: 55 04 22 33 **00** AE EB AA				

Note: *command parameter is configured value, 05 in the example is actual contrast 5(the value range is 0~100, that is 0x00~0x64）*

Read contrast

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x37	0x00	0	None	1
Core Reception	AA 04 01 37 00 E6 EB AA				
Core Return	55 04 37 33 **32** F5 EB AA				

Note: *The command parameter is represented by the returned numerical value. In the example, a return value of 32 corresponds to an actual contrast of 50 (within the restricted numerical range of 0 to 100, i.e., 0x00 to 0x64).*

Brightness Settings

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x36	Set: 0x01 Read: 0x00	1	0x00~0x64	1
Core Reception	AA 05 01 36 01 **11** F8 EB AA				
Core Return	Success: 55 04 23 33 **01** B0 EB AA Failure: 55 04 23 33 **00** AF EB AA				

Note: *The command parameter represents the set value, where in the example, a set value of 11 corresponds to an actual brightness setting of 17 (within the restricted numerical range of 0 to 100, i.e., 0x00 to 0x64).*

Read brightness

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x36	0x00	0	None	1
Core Reception	AA 04 01 36 00 E5 EB AA				
Core Return	55 04 36 33 **32** F4 EB AA				

Note: *The command parameter is represented by the returned numerical value. In the example, a reply value of 32 corresponds to an actual brightness of 50 (within the restricted numerical range of 0 to 100, i.e., 0x00 to 0x64).*

DDE settings

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x38	0x01	1	0x00~0x64	1
Core Reception	AA 05 01 38 01 **05** EE EB AA				
Core Return	Success: 55 04 1B 33 01 A8 EB AA Failure: 55 04 1B 33 00 A7 EB AA				

Note: *The command parameter represents the set value, where in the example, a set value of 05 corresponds to an actual setting of detail enhancement at 5 (within the restricted numerical range of 0 to 100, i.e., 0x00 to 0x64).*

Read DDE

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x38	0x00	0	None	1
Core Reception	AA 04 01 38 00 E7 EB AA				
Core Return	55 04 38 33 **32** F6 EB AA				

Note: *The command parameter is represented by the returned numerical value. In the example, a reply value of 32 corresponds to an actual detail enhancement setting of 50 (within the restricted numerical range of 0 to 100, i.e., 0x00 to 0x64).*

Spatial filtering settings

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x39	0x01	1	0x00~0x64	1
Core Reception	AA 05 01 39 01 **05** EF EB AA				
Core Return	Success: 55 04 1B 33 01 A8 EB AA Failure: 55 04 1B 33 00 A7 EB AA				

Note: *The command parameter is represented by the returned numerical value. In the example, a reply value of 05 corresponds to an actual spatial filtering setting of 5 (within the restricted numerical range of 0 to 100, i.e., 0x00 to 0x64).*

Read spatial filtering

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x39	0x00	0	None	1
Core Reception	AA 04 01 39 00 E8 EB AA				
Core Return	55 04 39 33 **32** F7 EB AA				

Note: *The command parameter is represented by the returned numerical value. In the example, a reply value of 32 corresponds to an actual spatial filtering setting of 50 (within the restricted numerical range of 0 to 100, i.e., 0x00 to 0x64).*

Temporal filtering settings

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x19	0x01	1	0x00~0x64	1
Core Reception	AA 05 01 40 01 **05** F6 EB AA				
Core Return	Success: 55 04 19 33 **01** A6 EB AA Failure: 55 04 19 33 **00** A5 EB AA				

Note*: The command parameter is represented by the returned numerical value. In the example, a reply value of 05 corresponds to an actual temporal filtering setting of 5 (within the restricted numerical range of 0 to 100, i.e., 0x00 to 0x64).*

Read temporal filtering

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x19	0x00	0	None	1
Core Reception	AA 04 01 40 00 EF EB AA				
Core Return	55 04 01 40 33 **0A** D6 EB AA				

Note: *The command parameter is represented by the returned numerical value. In the example, a reply value of 0A corresponds to an actual temporal filtering setting of 10 (within the restricted numerical range of 0 to 100, i.e., 0x00 to 0x64).*

2.3.4 Motor Control

a.Basic Settings

Lens type reading

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x03	0x00	1	0x00	1
Core Reception	AA 05 08 03 00 00 BA EB AA				
Core Return	55 05 08 03 33 **03** 9B EB AA				

***Note**: The return value 0x03 represents a dual FOV lens, 0x00 represents no lens or a fixed focus non-adjustable lens, 0x01 represents a continuous zoom lens, 0x02 represents a fixed focus electrically adjustable lens, and 0x03 represents a dual FOV lens.*

Lens type settings

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x03	0x01	1	0xXX	1
Core Reception	No lens or fixed-focus non-adjustable lens: AA 05 08 03 01 00 BB EB AA Continuous zoom lens: AA 05 08 03 01 01 BC EB AA Fixed-focus adjustable lens: AA 05 08 03 01 02 BD EB AA Dual FOV lens: AA 05 08 03 01 03 BE EB AA				
Core Return	Success: 55 05 08 03 33 **01** 99 EB AA Failure: 55 05 08 03 33 **00** 98 EB AA				

***Note:** command parameter 0: 0x00 represents no lens or a fixed-focus non-adjustable lens, 0x01 represents a continuous zoom lens, 0x02 represents a fixed-focus electrically adjustable lens, and 0x03 represents a dual FOV lens. Note*: The lens type must be consistent with the actual one.*

Manual enable/disable warning

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x00	0x01	1	0x01-enable 0x00-disable	1
Core Reception	Enable: AA 05 08 00 01 01 B9 EB AA Disable: AA 05 08 00 01 00 B8 EB AA				
Core Return	Success: 55 05 08 03 33 **01** 99 EB AA Failure: 55 05 08 03 33 **00** 98 EB AA				

***Note**: After you manually turn on the alarm, the alarm I/O output will be pulled high. After you manually turn off the alarm, the alarm I/O output will be pulled low.*

Automatic focusing after zooming or FOV switching

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x04	0x01	1	0x01: on 0x00: off	1
Core Reception	On: AA 05 08 04 01 **01** BD EB AA Off: AA 05 08 04 01 **00** BC EB AA				
Core Return	Success: 55 05 08 04 33 **01** 9A EB AA Failure: 55 05 08 04 33 **00** 99 EB AA				

Lens defocus fine-tuning temperature interval setting

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x08	0x01	2	Unit: 0.01℃	1
Core Reception	AA 06 08 08 01 **F4 01** B6 EB AA				
Core Return	Success: 55 05 08 08 33 **01** 9E EB AA Failure: 55 05 08 08 33 **00** 9D EB AA				

***Note**: In the example, the actual temperature interval is set to 5°C, which is the set value 01F4 divided by 100.*

Lens defocus fine-tuning temperature interval reading

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x08	0x00	1	0x00	2
Core Reception	AA 05 08 08 00 **00** BF EB AA				
Core Return	55 06 08 08 33 **F4 01** 93 EB AA				

***Note**: The temperature interval returned in the example is 5℃, which is the actual return value 01F4 divided by 100.*

Automatic Focusing

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x2F	0x01	1		1
Core Reception	AA 05 08 2F 01 00 E7 EB AA				
Core Return	Success: 55 05 08 2F 33 **01** C5 EB AA Failure: 55 05 08 2F 33 **00** C4 EB AA				

b.Settings of Focusing Motor

Drive focusing motor rotation type

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x21	0x01	2	See Note	1
Core Reception	Close-up: AA 06 08 21 01 **01 00** DB EB AA Close-up fine-tuning: AA 06 08 21 01 **01 01** DC EB AA Distant view: AA 06 08 21 01 **02 00** DC EB AA Distant view fine-tuning: AA 06 08 21 01 **02 01** DD EB AA				
Core Return	Success: 55 05 08 21 33 **01** B7 EB AA Failure: 55 05 08 21 33 **00** B6 EB AA				

Note: *command parameter 0:0x01-close range, 0x02-distant view; parameter 1:0x00-coarse tuning, 0x01-fine tuning.*

Focusing motor stopping

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x22	0x01	1	0x00	1
Core Reception	AA 05 08 22 01 **00** DA EB AA				
Core Return	Success: 55 05 08 22 33 **01** B8 EB AA Failure: 55 05 08 22 33 **00** B7 EB AA				

Get the current position of the focusing motor

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x23	0x00	1	0x00	2
Core Reception	AA 05 08 23 00 **00** DA EB AA				
Core Return	55 06 08 23 33 **01 00** BA EB AA				

***Note**: The return value is the current position, marked with two bytes, with the low byte first.*

Set focusing motor speed

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x24	0x01	1	Speed value (0~0x20)	1
Core Reception	AA 05 08 24 01 **0A** E6 EB AA				
Core Return	Success: 55 05 08 24 33 **01** BA EB AA Failure: 55 05 08 24 33 **00** B9 EB AA				

Read focusing motor speed

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x24	0x01	1	0x00	1
Core Reception	AA 05 08 24 00 **00** DB EB AA				
Core Return	55 05 08 24 33 **0A** C3 EB AA				

Get focusing motor stroke

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x25	0x00	1	0x00	6
Core Reception	AA 05 08 25 00 **00** DC EB AA				
Core Return	55 08 08 25 33 **00 00 00 00** BD EB AA				

***Note:** return value byte 0: low 8 bits of the minimum position, byte 1: high 8 bits of the minimum position, byte 2: low 8 bits of the maximum position, byte 3: low 8 bits of the minimum position.*

c.Settings of Focusing(Zooming) Motor

Drive focusing/zooming motor rotation type

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x31	0x01	2	See note	1
Core Reception	Short focus: AA 06 08 31 01 **01 00** EB EB AA Short focus fine tuning: AA 06 08 31 01 **01 01** EC EB AA Telephoto: AA 06 08 31 01 **02 00** EC EB AA Telephoto fine tuning: AA 06 08 31 01 **02 01** ED EB AA				
Core Return	Success: 55 05 08 31 33 **01** C7 EB AA Failure: 55 05 08 31 33 **00** C6 EB AA				

Note: *command parameter 0:0x01-close range, 0x02-distant view; parameter 1:0x00-coarse tuning, 0x01-fine tuning.*

Focusing/zooming motor stopping

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x32	0x01	1	0x00	1
Core Reception	AA 05 08 32 01 **00** EA EB AA				
Core Return	Success: 55 05 08 32 33 **01** C8 EB AA Failure: 55 05 08 32 33 **00** C7 EB AA				

Get the current position of the focusing/zooming motor

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x33	0x00	1	0x00	2
Core Reception	AA 05 08 33 00 **00** EA EB AA				
Core Return	55 06 08 33 33 **01 00** CA EB AA				

Note: *The current position value returned is two bytes, with the low byte first.*

Set focusing motor speed

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x34	0x01	1	Speed value (0~0x20)	1
Core Reception	AA 05 08 34 01 **0A** F6 EB AA				
Core Return	Success: 55 05 08 34 33 **01** CA EB AA Failure: 55 05 08 34 33 **00** C9 EB AA				

Read focusing motor speed

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x34	0x01	1	0x00	1
Core Reception	AA 05 08 34 00 **00** EB EB AA				
Core Return	55 05 08 34 33 **0A** D3 EB AA				

Get focusing motor stroke

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x35	0x00	1	0x00	6
Core Reception	AA 05 08 35 00 **00** EC EB AA				
Core Return	55 08 08 35 33 **00 00 00 00** CD EB AA				

Note: *return value byte 0: low 8 bits of the minimum position, byte 1: high 8 bits of the minimum position, byte 2: low 8 bits of the maximum position, byte 3: low 8 bits of the minimum position.*

d.Preset Setting

Preset writing

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x83	0x01	2	See note	1
Core Reception	AA 06 08 83 01 **00 00** 3C EB AA				
Core Return	Success: 55 05 08 83 33 **01** 19 EB AA Failure: 55 05 08 83 33 **00** 18 EB AA				

***Note**: command parameter 0: 00 tuning motor, 01 focus motor; command parameter 1: preset point group 0-9; In the example, the 0th group of preset points of the tuning motor is set; up to 10 groups of presets are supported. The specific operation method is: first run the corresponding motor to the specified position, and then send the instruction.*

Preset reading

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x83	0x00	2	See note	2
Core Reception	AA 06 08 83 00 **00 00** 3B EB AA				
Core Return	55 06 08 83 33 **9B 0E** C2 EB AA				

***Note:** command parameter 0: 00 tuning motor 01 focusing motor; parameter 1: preset point group 0-9; return value low byte first, high byte last. The example is 0x0E9B;*

Preset calling

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x87	0x01	2	See note	1
Core Reception	AA 06 08 87 01 **00 00** 40 EB AA				
Core Return	Success: 55 05 08 87 33 **01** 1D EB AA Failure: 55 05 08 87 33 **00** 1C EB AA				

***Note**: command parameter 0: 00 tuning motor, 01 focusing motor; parameter 1: preset point group 0-9; return parameter 0: 00-failure, 01-success.*

2.3.5 Temperature Measurement Commands (For radiometric cores only)

***Note:** In temperature measurement commands, commands related to fire alarm and solar protection are supported by both temperature measurement cores and imaging cores. Other temperature measurement-related commands are only supported by temperature measurement cores. It is prohibited for imaging cores to send temperature measurement-related commands; otherwise, issues may arise at your own risk.*

a.Parameter Settings

Set temperature measurement range

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x01	0x01	1	High gain: 00 Low gain: 01 Auto: 03	1
Core Reception	-20~150℃(high gain): AA 05 07 01 01 **00** B8 EB AA 0~650℃(low gain): AA 05 07 01 01 **01** B9 EB AA Auto switch: AA 05 07 01 01 **03** BB EB AA				
Core Return	55 05 07 01 33 **01** 96 EB AA				

Enable/disable Temperature Measurement Display

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x00	0x01	1	On/Off	1
Core Reception	On: AA 05 07 00 01 **01** B8 EB AA Off: AA 05 07 00 01 **00** B7 EB AA				
Core Return	55 05 07 00 33 **01** 95 EB AA				

Read the Current Temperature Unit

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x02	0x00	1	00	1
Core Reception	AA 05 07 02 00 **00** B8 EB AA				
Core 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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x02	0x01	1	temperature unit	1
Core Reception	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				
Core 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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x0F	0x00	1	00	4
Core Reception	AA 05 07 0F 00 **00** C5 EB AA				
Core 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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x0F	0x01	4	temperature value	1
Core Reception	AA 08 07 0F 01 **90 D0 03 00** 2C EB AA				
Core 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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x10	0x00	1	00	4
Core Reception	AA 05 07 10 00 **00** C6 EB AA				
Core 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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x10	0x01	4	temperature value	1
Core Reception	AA 08 07 10 01 **90 D0 03 00** 2D EB AA				
Core 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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x12	0x00	1	00	4
Core Reception	AA 05 07 12 00 **00** C8 EB AA				
Core 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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x12	0x01	4	emssivity value	1
Core Reception	AA 08 07 12 01 **10 27 00 00** 03 EB AA				
Core 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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x13	0x00	1	00	4
Core Reception	AA 05 07 13 00 **00** C9 EB AA				
Core 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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x13	0x01	4	distance value	1
Core Reception	AA 08 07 13 01 **D0 07 00 00** A4 EB AA				
Core 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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x11	0x00	1	00	4
Core Reception	AA 05 07 11 00 **00** C7 EB AA				
Core 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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x11	0x01	4	RH value	1
Core Reception	AA 08 07 11 01 **A0 0F 00 00** 7A EB AA				
Core 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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x19	0x00	1	00	4
Core Reception	AA 05 07 19 00 **00** CF EB AA				
Core 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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x19	0x01	4	Distance value	1
Core Reception	AA 08 07 19 01 **40 0D 03 00** 23 EB AA				
Core 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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x18	0x01	1	0	1
Core Reception	AA 05 07 18 01 **00** CF EB AA				
Core Return	55 05 07 18 33 **01** AD EB AA				

***Note**: After setting all environment variables, the new environment variables take effect once the command is sent.*

Read the temperature information at any specific point

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x1F	0x00	4	the temperature spot coordinate to be read(x, y)	4
Core Reception	AA 08 07 1F 00 **0A 00 14 00** F6 EB AA(the coordinate to be read (10, 20))				
Core 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 the Full Frame

Enable/Disable the center point temperature display of the full frame

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x2B	0x01	1	On/Off	1
Core Reception	On: AA 05 07 2B 01 **01** E3 EB AA Off: AA 05 07 2B 01 **00** E2 EB AA				
Core Return	55 05 07 2B 33 **01** C0 EB AA				

Read the center point temperature of the full frame

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x2C	0x00	1	00	6
Core Reception	AA 05 07 2C 00 **00** E2 EB AA				
Core 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 point 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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x30	0x01	1	Enable /Disable	1
Core Reception	Enable: AA 05 07 30 01 **01** E8 EB AA Disable: AA 05 07 30 01 **00** E7 EB AA				
Core Return	55 05 07 30 33 **01** C5 EB AA				

Set Fire Alarm Threshold

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x31	0x01	2	See note	1
Core Reception	Set: AA 06 07 31 01 **10 27** E8 EB AA				
Core Return	55 05 07 31 33 **01** C6 EB AA				

Note: *parameter range is between 1 and 16383, normally set between 10000 and 14000, the alarm threshold in the illustration is 0x2710=10000.*

Read Fire Alarm Threshold

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x31	0x00	0		1
Core Reception	Read: AA 04 07 31 **00** E6 EB AA				
Core Return	55 06 07 31 33 **10 27** FD EB AA				

Note: *parameter range is between 1 and 16383, normally set between 10000 and 14000, the alarm threshold in the illustration is 0x2710=10000.*

Serial Port Alarm of Fire Alarm

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x08	0x01	21	See note	1
Core sending	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 D0 EB AA				

Note: *send alarm 1 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, paremeter 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 postion of fire region No. 3; parameter 13-parameter 16: central postion of fire region No. 4; parameter 17-parameter 20: central position of fire region No. 5.*

Enable/disable level/span

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0xF0	0x01	1	Enable/disable	1
Core Reception	Enable: AA 05 07 F0 01 **01** A8 EB AA Disable: AA 05 07 F0 01 **00** A7 EB AA				
Core Return	55 05 07 F0 33 01 85 EB AA				

Set low temperature threshold of level/span

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x2D	0x01	4	Actual value*10000	1
Core Reception	AA 08 07 1D 01 **40 0D 03 00** 27 EB AA				
Core Return	Success: 55 08 07 1D 33 **01** B2 EB AA Failure: 55 08 07 1D 33 **00** B1 EB AA				

Note: *The setting value is 32 bits, with the low bits at the front. The setting value is calculated as "setting value = actual value * 10000". In this example, the high-temperature warning threshold is set to 20 (in degrees Celsius/Kelvin/Fahrenheit).*

Read low temperature threshold of level/span

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x1D	0x00	0	None	4
Core Reception	AA 05 07 1D **00** D2 EB AA				
Core Return	55 08 07 1D 33 **40 0D 03 00** 04 EB AA				

Note*: The actual temperature (in degrees Celsius/Kelvin/Fahrenheit) is calculated as "actual temperature = read threshold / 10000". In this example, if the read value is 200000 (or 0x00030D40 in hexadecimal), the actual temperature is 20.*

Set high temperature threshold of level/span

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x2D	0x01	4	Actual value*10000	1
Core Reception	AA 08 07 1E 01 **80 1A 06 00** 78 EB AA				
Core Return	Success: 55 05 07 1E 33 **01** B3 EB AA Failure: 55 05 07 1E 33 **00** B2 EB AA				

Note: *The setting value is 32 bits long, with the low bits in the front. The setting value is calculated as "setting value = actual value * 10000". In this example, the high-temperature warning threshold is set to 40 (in degrees Celsius/Kelvin/Fahrenheit).*

Read high temperature threshold of level/span

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x1E	0x00	0	None	4
Core Reception	AA 04 07 1E 00 D3 EB AA				
Core Return	55 08 07 1E 33 **80 1A 06 00** 55 EB AA				

Note: *The actual temperature (in degrees Celsius/Kelvin/Fahrenheit) is calculated as "actual temperature = read threshold / 10000". In this example, if the read value is 400000 (or 0x00061A80 in hexadecimal), the actual temperature is 40.*

Isotherm Status Settings

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x2D	0x01	1	00: off 01: below 02: above 04:interval	1
Core Reception	AA 05 07 2D 01 **00** E4 EB AA				
Core Return	Success: 55 08 07 1D 33 **01** B2 EB AA Failure: 55 08 07 1D 33 **00** B1 EB AA				

Read Isotherm Status

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x2D	0x00	0	None	1
Core Reception	AA 04 07 2D 00 E2 EB AA				
Core Return	55 05 07 2D 33 **02** C3 EB AA				

In the return value, the data represents the following conditions:

00: Off; 01: Below the threshold; 02: Above the threshold; 04: Within the threshold

Set isotherm low temperature threshold

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x2E	0x01	4	Actual value*10	1
Core Reception	AA 08 07 2E 01 **C8 00 00 00** B0 EB AA				
Core Return	55 05 07 2E 33 **01** C3 EB AA				

***Note**: The actual temperature (in degrees Celsius/Kelvin/Fahrenheit) is calculated as "actual temperature = read threshold / 10". In this example, if the read value is 200 (or 000000C8 in hexadecimal), the actual temperature is 20.*

Read isotherm low temperature threshold

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x2E	0x00	0	None	4
Core Reception	AA 04 07 2E 00 E3 EB AA				
Core Return	55 08 07 2E 33 **C8 00 00 00** 8D EB AA				

***Note**: The actual temperature (in degrees Celsius/Kelvin/Fahrenheit) is calculated as "actual temperature = read threshold / 10". In this example, if the read value is 200 (or 000000C8 in hexadecimal), the actual temperature is 20.*

Set isotherm high temperature threshold

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x2E	0x01	4	Actual value*10	1
Core Reception	AA 08 07 2F 01 **90 01 00 00** 7A EB AA				
Core Return	55 05 07 2F 33 **01** C4 EB AA				

***Note:** The actual temperature (in degrees Celsius/Kelvin/Fahrenheit) is calculated as "actual temperature = read threshold / 10". In this example, if the read value is 400 (or 00000190 in hexadecimal), the actual temperature is 40.*

Read isotherm high temperature threshold

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x2E	0x00	0	None	4
Core Reception	AA 04 07 2F 00 E4 EB AA				
Core Return	55 08 07 2F 33 **90 01 00 00** 57 EB AA				

***Note**: The actual temperature (in degrees Celsius/Kelvin/Fahrenheit) is calculated as "actual temperature = read threshold / 10". In this example, if the read value is 400 (or 00000190 in hexadecimal), the actual temperature is 40.*

c.Secondary Calibration

Enable/disable correction data of temperature measurement lens

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x60	0x01	1	On/Off	1
Core Reception	Enable: AA 05 07 60 01 **01** 18 EB AA Disable: AA 05 07 60 01 **00** 17 EB AA				
Core Return	55 05 07 60 33 **01** F5 EB AA				

***Note:** Enable/Disable Temperature Measurement Lens Correction Function .*

Read whether the core has saved temperature measurement lens correction data before.

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x6A	0x00	1	00	1
Core Reception	AA 04 07 6A **00** 1F EB AA				
Core Return	Unsaved: 55 05 07 6A 33 **00** FE EB AA Saved: 55 05 07 6A 33 **01** FF EB AA				

Clear temperature measurement correction data of the lens

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x6B	0x02	1	00	1
Core Reception	AA 05 07 6B 02 **00** 23 EB AA				
Core Return	55 05 07 6B 33 **01** 00 EB AA				

Lens temperature measurement data correction

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x6F	0x02	3	Target temperature	1
Core Reception	Target temperature at 10℃: AA 07 07 6F 02 **64 00 01** 8E EB AA Target temperature at 50℃: AA 07 07 6F 02 **F4 01 02** 20 EB AA				
Core Return	55 05 07 6F 33 **01** 04 EB AA				

***Note**: The correction process is roughly as follows: After assembling the core with the lens, it is first aimed at a low-temperature target black body. Then, this command is used to send the target temperature (the temperature should be filled in based on the calibration black body temperature, in this example, it's 10 degrees or 0x0064 in hexadecimal, equivalent to 100 in decimal, representing the actual temperature * 10), with parameter 2 (0x01) fixed. Afterward, it is aimed at a high-temperature target black body, and again, this command is used to send the target temperature (temperature is filled in based on the calibration black body temperature, in this example, it's 50 degrees or 0x01F4 in hexadecimal, equivalent to 500 in decimal, representing the actual temperature * 10), with parameter 2 (0x02) fixed. When sending the target temperature for the second time, the core will perform the calculation of lens correction data.*

Save temperature measurement correction data of the lens

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x07	0x6A	0x02	1	00	1
Core Reception	AA 05 07 6A 02 **00** 22 EB AA				
Core Return	Success: 55 05 07 6A 33 **01** FF EB AA Failure: 55 05 07 6A 33 **00** FE EB AA				

d.Solar Protection Setting

Solar protection on/off, threshold, and protection time reading

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x08	0x00	1	0x00	1
Core Reception	High light protection switch, threshold and protection time reading: AA 05 01 08 00 **00** B8 EB AA				
Core Return	55 07 08 33 **00 8B 06 58** 80 EB AA				

Solar protection on/off, threshold and protection time settings

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x08	0x01	4	See note	1
Core Reception	Solar protection on: AA 08 01 08 01 **01 8B 06 58** A6 EB AA Solar protection off: AA 08 01 08 01 **00 8B 06 58** A5 EB AA Write solar protection threshold and protection time: AA 08 01 08 01 **00 8B 06 58** A5 EB AA				
Core Return	Success: 55 04 08 33 **01** 95 EB AA Failure: 55 04 08 33 **00** 94 EB AA				

***Note**: command parameter 0: 0x01-enable, 0x00-disable; parameter 1: threshold low 8 bits, parameter 2: threshold high 8 bits; parameter 3: protection time; the values 068B and 58 written in the example are actually settings. The high light protection threshold is 1675 and the protection time is 88 seconds.*

Automatically send information after being triggered by high light

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x08	0x00	1	0x00	1
Core Auto Sending	Trigger (shutter off): 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 completed (shutter on): 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 PTZ Control

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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x8A	0x00	1	0x00	1
Core Reception	AA 07 08 8A 00 **00** 41 EB AA				
Core Return	55 06 08 8A 33 **FE** 1F EB AA				

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

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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x8A	0x01	1	new address	1
Core Reception	AA 07 08 8A 01 **FE** 40 EB AA				
Core 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

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x71	0x01	0	See note	1
Core Reception	Upward : AA 07 08 71 01 **01 00 1F** 4B EB AA Downward: AA 07 08 71 01 **01 01 1F** 4C EB AA				
Core Return	Success: 55 05 08 71 33 **01** 07 EB AA Failure: 55 05 08 71 33 **00** 06 EB AA				

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

Pan command

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x72	0x01	0	See note	1
Core Reception	Leftward: AA 07 08 72 01 **01 00 1F** 4C EB AA Rightward: AA 07 08 72 01 **01 01 1F** 4D EB AA				
Core Return	Success: 55 05 08 72 33 **01** 08 EB AA Failure: 55 05 08 72 33 **00** 07 EB AA				

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

Rotation stop command

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x77	0x01	0	See note	1
Core Reception	Stop： AA 05 08 77 01 **01 30** EB AA				
Core Return	Success: 55 05 08 77 33 **01** 0D EB AA Failure: 55 05 08 77 33 **00** 0C EB AA				

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

Presets operation commands

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x73	0x01	2	See note	1
Core Reception	Set: AA 07 08 73 01 **01 00 01** 2F EB AA Clear: AA 07 08 73 01 **01 01 01** 30 EB AA Call: AA 07 08 73 01 **01 02 01** 31 EB AA				
Core Return	Success: 55 05 08 73 33 **01** 09 EB AA Failure: 55 05 08 73 33 **00** 08 EB AA				

Note: *command parameter 0: device 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 Features

a.Calibration

Defective Pixel Cursor Display and Hide

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x43	0x02	1	0xC1:display 0x40:hide	1
Core Reception	Defective pixel cursor displayed: AA 05 01 43 02 **C1** B6 EB AA Defective pixel cursor hidden: AA 05 01 43 02 **40** 35 EB AA				
Core Return	Success: 55 04 43 33 **01** D0 EB AA Failure: 55 04 43 33 **00** CF EB AA				

Defective Pixel Cursor Movement

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x44	0x02	1	See note	1
Core Reception	Move up1: AA 05 01 44 02 **01** F7 EB AA Move down 1: AA 05 01 44 02 **02** F8 EB AA Move left1: 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				
Core Return	Success: 55 04 44 33 **01** D1 EB AA Failure: 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.*

Defective pixel addition and cancellation

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x90	0x01	1	0x01: add 0x02: cancel	1
Core Reception	Add: AA 05 01 90 01 **01** 42 EB AA Cancel: AA 05 01 90 01 **02** 43 EB AA				
Core Return	Success: 55 04 90 33 **01** 1D EB AA Failure: 55 04 90 33 **00** 1C EB AA				

Defective pixel saving

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x91	0x02	0	None	1
Core Reception	Save: AA 04 01 91 02 42 EB AA				
Core Return	Success: 55 04 91 33 **01** 1E EB AA Failure: 55 04 91 33 **00** 1D EB AA				

Lens K calibration/gain correction coefficient

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0xA0	0x01	1	See note	1
Core Reception	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				
Core Return	Success: 55 04 A0 33 **01** 2D EB AA Failure: 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.*

Halo calibration/image re-compensation

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0xA1	0x01	1	0x00: collect data and calculate halo 0x01: save the halo calculation result 0x02: clear the halo	1
Core Reception	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				
Core Return	Success: 55 04 A1 33 **01** 2E EB AA Failure: 55 04 A1 33 **00** 2D EB AA				

Read external synchronization mode and frequency

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0xA3	0x00	1	0x01	1
Core Reception	AA 05 01 A3 00 **01** 54 EB AA				
Core Return	55 05 A3 33 **00 32** 62 EB AA				

Note: *return value 0: 0x00-self-synchronization, 0x01-internal synchronization, 0x02-external synchronization, 0x03-adaptive; return value 1: frequency; In the example, it is hexadecimal (32), and the frequency is 50Hz.*

Set external synchronization mode and frequency

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0xA3	0x01	2	See note	1
Core Reception	AA 06 01 A3 01 **00 32** 87 EB AA				
Core Return	Success: 55 05 A3 33 **01** 31 EB AA Failure: 55 05 A3 33 **00** 30 EB AA				

Note: *command parameter 0: 0x00-self-synchronization, 0x01-internal synchronization, 0x02-external synchronization, 0x03-adaptive; command parameter 1: frequency setting, with the range of 25Hz~50Hz; In the example, it is hexadecimal (32), and the frequency is set to 50Hz.*

b.Other Settings

Get the current focal length

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x8B	0x00	1	0x00	2
Core Reception	AA 05 08 8B 00 **00** 42 EB AA				
Core Return	55 06 00 8B 33 **DC 05** FA EB AA				

Note: *The return value is 10 times the focal length, with the low position in front and the high position in the back. Taking this return value as an example, the returned focal length value is 0x05DC=1500, and the final focal length value is 1500/10=150mm.*

Set focal length

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x8E	0x01	2	See note	1
Core Reception	AA 06 08 8E 01 **84 03** CE EB AA				
Core Return	Success: 55 06 08 8E 33 **34 09** 61 EB AA Failure: 55 05 08 8E 33 **00** 23 EB AA				

***Note**: Set the value to 10 times the focal length, with the low position first and the high position last. Taking 90mm as an example, the sent value is 90*10=900=0x0384. The parameter in the return value is the position where the tuning motor should go. In the example, pos= 0x0934;*

Display focal length on/off

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x08	0x8D	0x01	1	0x00/0x01	1
Core Reception	Off: AA 05 08 8D 01 **00** 45 EB AA On: AA 05 08 8D 01 **01** 46 EB AA				
Core Return	Success: 55 05 08 8D 33 **01** 23 EB AA Failure: 55 05 08 8D 33 **00** 22 EB AA				

Read FOV information

Word 0	Word 1	Operation Word	Number of Parameter Bytes	Parameter	Number of Return Value Bytes
0x01	0x31	0x00	1	HFOV: 0x00 VFOV: 0x01	4
Core Reception	HFOV: AA 05 01 31 00 **00** E1 EB AA VFOV: AA 05 01 31 00 **01** E2 EB AA				
Core Return	HFOV: 55 07 31 33 **B8 1E 8B 41** 62 EB AA VHOV: 55 07 31 33 **00 00 60 41** 61 EB AA				

***Note**:The instruction returns the field of view values as float type in little-endian format. The returned values for the horizontal field of view is 17.39 (418B1EB8 in hexadecimal), and the vertical field of view is 14 (41600000 in hexadecimal).*