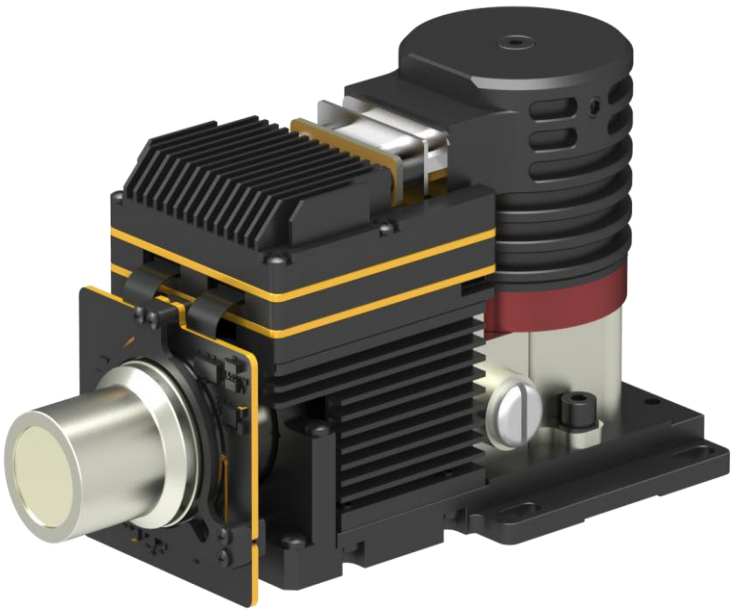
Gavin615L
User Manual V1.0



Document Version

Date	Version	Comments	author
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Scope

The Gavin615L series cooled infrared module(equipped with C615S-2LP/RS058F or C615S-2LS/RS058F detector) is a GUIDIR standard infrared thermal imaging module. The module is called Gavin615L and hereinafter referred to as Gavin615L. This document provides relevant information and technical support for module integration and secondary development applications.

User Instructions

Precautions for safe use

This content is to ensure that the user uses the product properly to avoid danger or property damage. Before using this product, please read the instructions carefully and properly keep it for future reference.

As shown below, the precautions are divided into two parts, i.e., "warnings" and "cautions":

Warning: Ignoring a warning may result in death or serious injury.

Caution: Ignoring a caution may result in injury or property damage.

	
Warning Instructions to ensure the users to avoid potential dangers may result in death or serious injury.	**Caution** Instructions to ensure the users to avoid potential dangers may result in injury or property damage.

Warnings

- Install and use this product in strict accordance with all relevant national and local electrical safety regulations.
- Use power adapters supplied by legitimate manufacturers, power supply of the module: DC24V/3A.
- Do not connect multiple modules to a power adapter (overload of the adapter may result in excessive heat or fire).
- Power off the module during wiring, disassembly and other operations, do not allow live operation.
- Immediately power off the module off in the event of smoke, stench or noise during its use, and contact the distributor or service center to deal with related matters.
- If the equipment does not work properly, please contact the store where you purchased the equipment or the nearest service center. Do not disassemble or modify the equipment in any way. (We are not liable for any problems arising from unauthorized modification or repair).

Cautions

- Do not aim the module at the strong energy source, such as laser beam.
- Do not drop any object on the equipment or vigorously shake the equipment, and keep the equipment away from magnetic field interference. Avoid installing the equipment to a place where the surface vibrates or is subject to impact. (Ignoring this may damage the equipment).
- Do not use the equipment in environment with high temperature (higher than 60℃) or low temperature (lower than -40℃) or high humidity (higher than 95%).
- Do not put the equipment in the place with poor ventilation or near heat sources such as heater and heating (ignoring this item may lead to fire hazard).
- Do not frequently power on/off the machine, turn it on at least 30 seconds after it is turned off, otherwise the module life will be affected.
- Do not touch the surface coating of the module lens directly with your hand, or scratch the lens with a hard object, which may lead to blurred imaging, affecting image quality.
- Use sufficiently soft dry cloth or other alternatives to wipe the lens surface to clean the module. Do not use alkaline detergent.
- It is recommended to shut down the module twice a week under the continuous start-up state, and each shutdown time is 2H.

Disclaimer

Please ensure that you have read and fully understand the product instructions and the statement before using this product. You should install and use this

product in strict accordance with the product instructions. If the user fails to strictly follow the instructions to install and use this product, it may bring great inconvenience to use, and may even cause property damage and personal injury. We assume no legal responsibility for any property damage and personal injury arising from improper installation or improper use of the product.

Service Principle

The series of products enjoy one-month replacement and one-year warranty. The specific service principle shall follow the provisions on the attached warranty card to perform warranty services. For products that have been discontinued, obsolescence or sold at a discount, the execution time shall follow written documents such as the notice of company.

1 Product Overview

1.1 Product introduction

Gavin615A is a universal cooled infrared module, which has the following characteristics:

- Large area array with resolution of 640*512；
- High frame rate, supporting 50 Hz/100 Hz；
- Support PAL analog video output;
- Support RS422 external synchronization;
- Electron doubling, supporting X1/X2/X4 times;
- Supports linear/histogram/blending dimming modes;
- Supports false colors, 8 options to meet different industry needs;
- Supports horizontal/vertical/diagonal mirroring;
- Supports Nonuniformity Correction (NUC), Adaptive Dynamic Range Compression (AGC), Intelligent Image Enhancement (IDE);
- Shock and vibration resistance;
- Extensibility, providing industry standard interfaces for OEM customers to secondary development.

It is suitable for handheld, sighting, security monitoring and other fields.

The basic frame of Gavin615L cooled infrared module is as shown in Figure 1-1 .

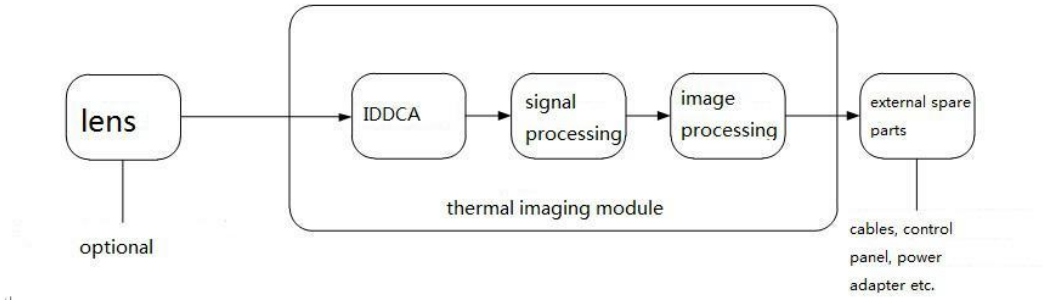


Figure 1-1 Basic Frame Diagram of Gavin615L Module

The module is the basic unit of thermal imager and mainly supports the basic imaging function of the thermal infrared imager. It includes a detector assembly, a signal processing assembly and an image processing assembly.

Among them:

For the detector assembly, the world's leading Global Sensor Technology self-research detector is used;

The signal processing assembly supports ultra-low noise signal processing and timing transmission;

The image processing assembly supports image algorithm processing, analog and digital video output, communication exchange and other functions.

1.2 Product configuration

- Detector：Cooled LW 640×512
  - Material：MCT
  - Pixel size：15um；
  - Spectrum：7.7um~9um；
  - F number：F2
  - NETD：≤30mK
  - Non-uniformity of response rate：≤8％
  - Bad pixel：number of bad pixels ≤0.5%；

  The bad pixel distribution meets the requirements as shown in Table 1-1.

Table 1-1 Bad Pixel Distribution Indexes

Size of clustered bad pixels	Quantity (Inside the central zone 320X256)	Quantity (Outside the central zone 320X256)
7-12	X	Y
13-19	0	≤2
20-35	0	≤1
＞35	0	0
Note：X+Y≤6。		

- Specifications

- The noise equivalent temperature difference NETD: < 30mK, test condition: ambient temperature 25±3℃;

➢ Output

- Analog video ：CVBS, 75 ohms characteristic impedance, PAL system.
- Digital video: supports 8-bit or 16-bit LVDS output, standard Cameralink interface,Base mode .

➢ Control communication ： RS422

- Startup completion time: ≤ 8 min @ 25±3°C, ≤ 12min @ 60±3°C, supporting customization of boot screen.
- Support image mirroring, magnification, enhancement, pseudo color, bad pixel correction, etc.

➢ Physical attribute

- Bare equipment size ： 155㎜×67㎜×80㎜ （bare module does not include lens ）.
- Interface type: 4×Φ4.5 slotted holes
- Weight: 900 g±5g (bare module)

➢ Electrical properties

- Power supply: DC 24±4 V
- Power consumption (module only) ：

  Steady-state power consumption: ≤15W@24V, 25±3°C ；

  Peak power consumption: ≤20W@24V, 25±3°C ；

  Peak power consumption: ≤28W@24V, 60±3°C .
- Ambient operating temperature: -40℃～+60℃;humidity: 0%-80% RH
- Storage temperature: -55°C to +70°C; humidity: 0%-85% RH
- Random vibration:
  1) 5Hz～28Hz，0.0036g2/Hz～0.08g2/Hz；
  2) 28Hz～250Hz，0.08g2/Hz；
  3) 250Hz～2000Hz，0.08g2/Hz～0.0012g2/Hz；
  4) 3 axes (x, y, z), 5 min/axis

- Sinusoidal vibration:
  1) 5Hz～9Hz，peak value:12g；
  2) 9Hz～27Hz，peak value:4g；
  3) 27Hz～200Hz，peak value:5g；
  4) 200Hz～300Hz，peak value:4g；
  5) 300Hz～2000Hz，peak value:2g；
  6) 3 axes (x, y, z), scan rate at 1 octave/min .
- Shock ：

  Half-sine wave, peak acceleration of 50 g, duration of 6 ms, positive and negative directions of x, y, z, 3 times in each direction.

1.3 Optical configuration

The module optics is designed according to different F-number optical interfaces and can be developed with typical lenses, which are as shown in Table 1-2.

Table 1-2 Optical Configuration

Focus	25mm
Resolution/Pixel size	640x512/15um
F/#	2
FOV (H x V, ±5%)	21.74° ×17.47°
Coating type	AR or IDLC
Size (mm×mm×mm)	155×67×80
Weight (module+lens)	≤2500g

*Note: AR stands for anti-reflection coating and DLC stands for diamond-like coating. When there is a protection window outside the module lens, AR lens is selected. Otherwise, DLC lens is selected.

1.4 PC software

CoolStanduleController can control Gavin615L series module online.

Operating system: Supports Windows 7/8/10/XP, etc.

Language ： support for Chinese/English, etc.

Typical baud rate: 115200;

1.5 Unpacking

The standard configuration is as shown in Table 1-3.

Since the module contains electrostatically sensitive electronic components, please unpack the case in a good electrostatic protection environment to use it to avoid damage to the module due to static electricity.

Anti-static foam material has been filled in the product packing box to prevent the module from being damaged during transportation.

Table 1-3 Configuration List

Item	Quantity	Unit	Functions
Infrared module	1	Set	Thermal imager
J30JZ/XN25TJCAL01	1	Pcs.	For customer integration
J30JZ/XN9TJCAL01	1	Pcs.	For customer integration (option)
Cable	1	Pcs.	For power-on(option)
Keypad box	1	Pcs.	For debug (option)
RS422 converter	1	Pcs.	For debug (option)
Adapter and power cable	1	set	For power supply(option)
User manual	1	Pcs.	Specification
Certificate, desiccant and anti-static gloves	1	set	Accessories

2 Interface Description

2.1 Power requirements

Gavin615L series cooled infrared module power supply: DC24±4V (this voltage refers to the terminal voltage of the module, please reserve a margin in actual application);

Steady-state power consumption: ≤15W@24V, 25±3°C;

Peak power consumption: ≤20W@24V, 25±3°C;

Peak power consumption: ≤28W@24V, 60±3°C

Insufficient power supply to the module may cause the startup or function abnormally. It is recommended that customers reserve power consumption of not less than 30 W .

2.2 Hardware interface

Gavin615L series cooled infrared module includes three external interfaces, 25Pin interface, 9Pin interface and 30Pin interface.

The 25Pin interface includes power input/output, analog/digital video, RS422 external control interface and RS422 external synchronization interface.

9Pin interface includes power output, shutter control interface and RS422 servo communication interface.

The 30pin connector includes:parallel CMOS interface and extension interface.

Recommended docking interface models ：

J30JZLN25ZKWA000，(25Pin，Male)；

J30JZLN9ZKWA000，(9Pin，Male)；

USL00-30L，(30Pin)；

Mating models：

J30JZ/XN25TJCAL01，(25Pin，Female)；

J30JZ/XN9TJCAL01，(9Pin，Female)；

USL20-30SS，(30Pin)；

The position of the 25Pin interface on the circuit board and the order of pins are as shown in XS1 of Figure 2-1, and the 9Pin interface is as shown in XS2 of Figure 2-1. The first pin of the 25Pin and 9Pin stands in Figure 2-1 are marked as shown,and the other pins are arranged in sequence.

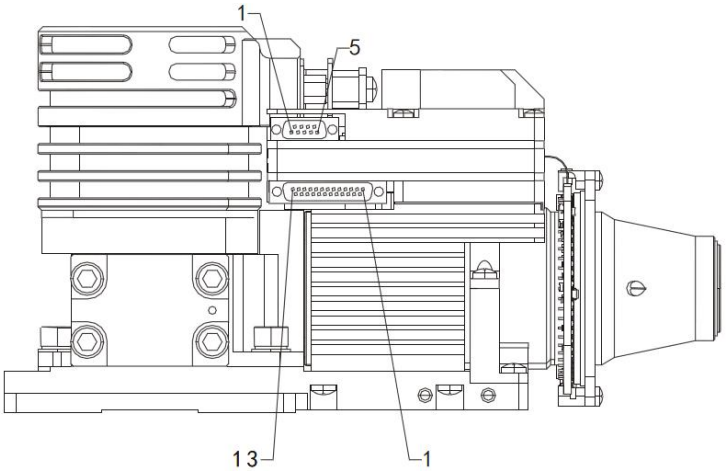


Figure 2-1 External interface location 1

The position of 30-pin connector in the module is shown in Figure 2-2a. The position and pin sequence on the circuit board are shown in xs6 in the lower left corner of figure 2-2b. The first pin and the 30th pin are marked as shown in the figure, and the other pins are arranged in order.

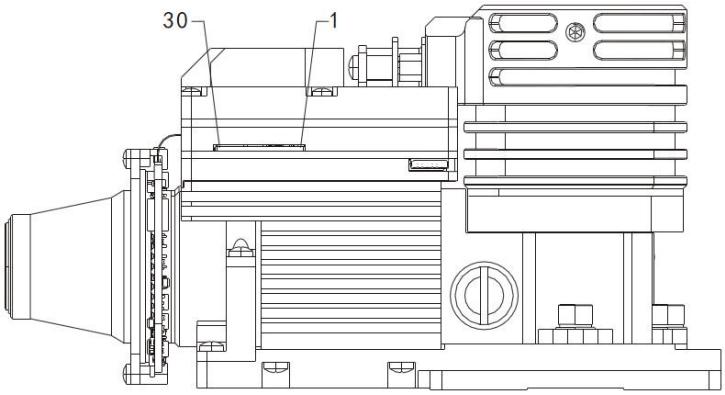


Figure 2-2a External interface location 2

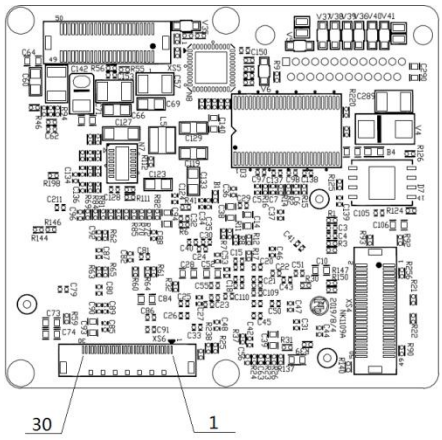


Figure 2-2b External interface location 3

The definition of the 25Pin external interface is as shown in Table 2-1, and the pin allocation of Cameralink using 16-bit data encoding is as shown in Table 2-2.

Table 2-1 Definition of 25Pin Interface

Pin NO.	Signal definition	Signal direction	description
1	PAL_OUT1	O	Analog video output of the module
2	GND_7179	GND	Analog video ground
3	PAL_OUT2	O	Analog video output of the module (reserved)
4	DGND	GND	Power ground
5	RS422_Z	O	RS422 output-
6	RS422_B	I	RS422 input-
7	RS422_A	I	RS422 input+
8	RS422_Y	O	RS422 output+
9	RS422_A	I	External synchronization+
10	RS422_B	I	External synchronization-
11	SW_VIN	POWER	Power positive (+24V input)
12	SW_VIN	POWER	Power positive (+24V input)
13	CGND	GND	Power ground (for power input)
14	DGND	GND	Power ground (signal ground)
15	Tx2850UT0-	O	LVDS data0-
16	Tx2850UT0+	O	LVDS data0+
17	Tx2850UT1-	O	LVDS data1-
18	Tx2850UT1+	O	LVDS data1+
19	Tx2850UT2-	O	LVDS data2-
20	Tx2850UT2+	O	LVDS data2+
21	Tx285CLKOUT-	O	LVDS clk-

22	Tx285CLKOUT+	O	LVDS clk+
23	Tx285OUT3-	O	LVDS data3-
24	Tx285OUT3+	O	LVDS data3+
25	CGND	GND	Power ground (for power input)

Note:

Signal direction O represents output while I represents input.

The digital signal X16/Y16/Y8 can switch the digital signal output type through control software. The default digital output mode of the module is Y16.

For camerlink digital video, DS90CR285AMTD is used as the sending chip and DS90CR286AMTD is recommended as the receiving chip. The operating voltage of the chip is +3.3 V, or the module digital video interface is connected to PCIe-CPL64 (ADLINK) frame grabber for display.

Table 2-2 Camera Link Data Bit Coding Table

Tx Input Signal Name		28-bit Solution Pin Name (use 16bit)
Strobe		TxClk Out/TxClk In
LVAL		TX/RX 24
FVAL		TX/RX 25
DVAL		TX/RX 26
Spare		TX/RX 23
Port A0	(Bit0)	TX/RX 0
Port A1	(Bit1)	TX/RX 1
Port A2	(Bit2)	TX/RX 2
Port A3	(Bit3)	TX/RX 3
Port A4	(Bit4)	TX/RX 4
Port A5	(Bit5)	TX/RX 6
Port A6	(Bit6)	TX/RX 27
Port A7	(Bit7)	TX/RX 5

Port B0	(Bit8)	TX/RX 7
Port B1	(Bit9)	TX/RX 8
Port B2	(Bit10)	TX/RX 9
Port B3	(Bit11)	TX/RX 12
Port B4	(Bit12)	TX/RX 13
Port B5	(Bit13)	TX/RX 14
Port B6	(Bit14)	TX/RX 10
Port B7	(Bit15)	TX/RX 11

The definition of 9Pin external interface is as shown in Table 2-3.

Table 2-3 Definition of 9pin Interface

Pin NO.	Signal definition	Signal direction	description
1	VIN	POWER	Power positive (+12V output)
2	MGND	GND	Power ground
3	MGND	GND	Power ground/signal ground
4	SHUTTER-	O	DC motor driver negative terminal
5	SHUTTER+	O	DC motor driver positive terminal
6	RS422_A	I	RS422 input+
7	RS422_B	I	RS422 input-
8	RS422_Z	O	RS422 output-
9	RS422_Y	O	RS422 output+

The pin definitions of the 30-pin connector is shown in Table 2-4.

Table 2-4 pin definitions of the 30-pin connector

Pin NO.	Signal definition	Signal direction	Signal level	Description
1	CLK	O	H 3.3V/L 0V	Clk signal

2	DATAT_VS	O	H 3.3V/L 0V	Field synchronization signal
3	DATAT_HS	O	H 3.3V/L 0V	horizontal synchronization signals
4	RESERVED	O	H 3.3V/L 0V	RESERVED
5	DATA0	O	H 3.3V/L 0V	Digital video signal
6	DATA1	O	H 3.3V/L 0V	Digital video signal
7	DATA2	O	H 3.3V/L 0V	Digital video signal
8	DATA3	O	H 3.3V/L 0V	Digital video signal
9	DATA4	O	H 3.3V/L 0V	Digital video signal
10	DATA5	O	H 3.3V/L 0V	Digital video signal
11	DATA6	O	H 3.3V/L 0V	Digital video signal
12	DATA7	O	H 3.3V/L 0V	Digital video signal
13	DGND	GND	0V	Signal ground
14	DATA8	O	H 3.3V/L 0V	Digital video signal
15	DATA9	O	H 3.3V/L 0V	Digital video signal
16	DATA10	O	H 3.3V/L 0V	Digital video signal
17	DATA11	O	H 3.3V/L 0V	Digital video signal
18	DATA12	O	H 3.3V/L 0V	Digital video signal
19	DATA13	O	H 3.3V/L 0V	Digital video signal
20	DATA14	O	H 3.3V/L 0V	Digital video signal
21	DATA15	O	H 3.3V/L 0V	Digital video signal
22	DGND	GND	0V	Signal ground
23	RESERVED	O	H 3.3V/L 0V	RESERVED
24	RESERVED	O	H 3.3V/L 0V	RESERVED
25	RESERVED	O	H 3.3V/L 0V	RESERVED
26	RESERVED	O	H 3.3V/L 0V	RESERVED
27	UART_TX	O	H 3.3V/L 0V	Txd of serial port (Require customization)

28	UART_RX	O	H 3.3V/L 0V	Rxd of serial port (Require customization)
29	RESERVED	O	H 3.3V/L 0V	RESERVED
30	RESERVED	O	H 3.3V/L 0V	RESERVED

Note：

The signal direction : o represents the output and I represents the input.

The interface is compatible with CMOS16/bt.656/bt.1120.

The output video format of CMOS16 digital video is the same as that of Cameralink digital video, and X16/Y16/Y8 format can be switched through control software.

2.3 Digital video

2.3.1 Interface type

There are two interface forms to choose from：

（1）Standard Cameralink interface, base mode；

（2）Parallel CMOS interface

2.3.2 output format

The module supports output of various digital video formats. The frame rate, data range and clock are shown in Table 2-5.

Table 2-5 Overview of Digital Video Format

Digital source	Resolution	640×512					
	Frame frequency	50HZ			100HZ		
	Output format	X16	Y16	Y8	X16	Y16	Y8
Data width		16bit	16bit	16bit	16bit	16bit	16bit
Valid data range		0～16383	0～65535	0～255	0～16383	0～65535	0～255
clock (without parameter line)		18M	18M	18M	36M	36M	36M
clock (with parameter line)		18M	18M	18M	36M	36M	36M
remarks		1. X16 is the original data of the detector; 2. Y16 is non-uniformity corrected data;					

	3. Y8 is data subjected to dimming and superimposed with pseudo-color informateion(D15~D8 are UV data and D7~D0 are Y data)

2.3.3 Cameralink interface timing

2.3.3.1Digital video timing(without parameter line)

The timing parameters of digital video without parameters are shown in Table 2-6. The timing of this table is applicable to x16, Y16, Y8 data sources.

Table 2-6 digital video timing parameters(without parameters line)

Video format (data source)	50Hz (X16/Y16/Y8)			100Hz (X16/Y16/Y8)		
Item	Typical value	Unit	remarks	Typical value	Unit	remarks
Resolution	640*512			640*512		
NW	640			640		
NH	512			512		
DIGITAL_CLK	18	MHz	In general, F4 detector module supports a maximum frame frequency of 50Hz and an interface clock of 18MHz	36	MHz	In general, F2 detector module supports a maximum frame frequency of 100Hz and an interface clock of 36MHz
TLine	36.667	us	660 CLK	18.333	us	660 CLK
TLine_Valid	35.556	us	640 CLK	17.778	us	640 CLK
TLine_Blank	1.111	us	20 CLK	0.556	us	20 CLK
TPixel	0.056	us	1 CLK	0.028	us	1 CLK
TStart	0.3889	us	7 CLK	0.194	us	7 CLK
TFrame	20	ms	Frame period	10	ms	Frame period
TField_Valid	18.773	ms	512 Line	9.387	ms	512 Line
TField_Blank	1.227	ms	Frame blank	0.613	ms	Frame blank

The output timing of digital video excluding parameter line is as follows.

The data source is X16/Y16/Y8, and the timing diagram of the line-field relationship without parameter line is as shown in Figure 2-3:

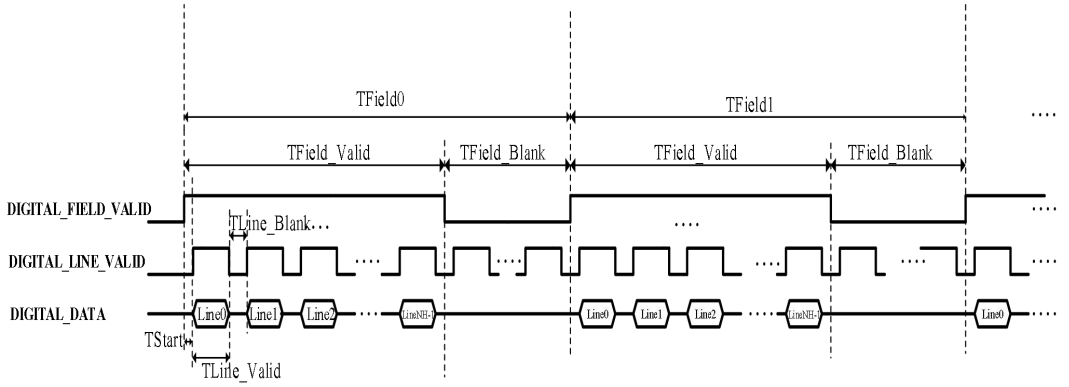


Figure 2-3 Timing Diagram of Line-field Relationship of Digital Video without Parameter

Figure 2-4 shows the relationship between lines with X16/Y16/Y8 data source and data timing:

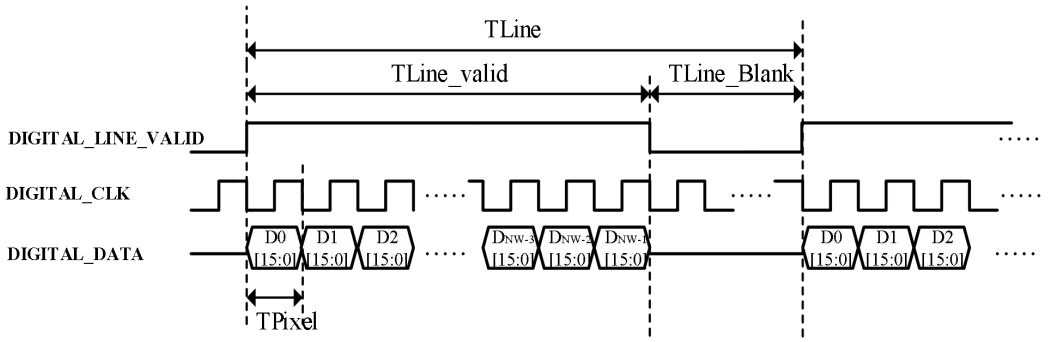


Figure 2-4 Digital Video Line and Data Timing Diagram

2.3.3.2 digital video with parameter line

The timing parameters of digital video including parameter line are as shown in Table 2-7. The timing of this table is applicable to data sources X16, Y16 and Y8.

Table 2-7 Timing Parameters of Digital Video (with parameter Lines)

Video format (data source)	50Hz (X16/Y16/Y8)			100Hz (X16/Y16/Y8)		
Item	Typical value	Unit	remarks	Typical value	Unit	remarks
Resolution	640*513			640*513		
NW	640			640		
NH	513 (with one line parameters)			513 (with one line parameters)		
DIGITAL_CLK	18	MHz	In general, F4	36	MHz	In general, F2

			detector module supports a maximum frame frequency of 50Hz and an interface clock of 18MHz			detector module supports a maximum frame frequency of 100Hz and an interface clock of 36MHz
TLine	36.667	us	660 CLK	18.333	us	660 CLK
TLine_Valid	35.556	us	640 CLK	17.778	us	640 CLK
TLine_Blank	1.111	us	20 CLK	0.556	us	20 CLK
TPixel	0.056	us	1 CLK	0.028	us	1 CLK
TStart	0.389	us	7 CLK	0.194	us	7 CLK
TFrame	20	ms	Frame period	10	ms	Frame period
TField_Valid	18.81	ms	513 Line	9.405	ms	513 Line
TField_Blank	1.19	ms	Frame blank	0.595	ms	Frame blank

The timing of digital video output including parameter line is as follows.

The data source is X16/Y16/Y8, and the timing diagram of the line-field relationship including parameter line is as shown in Figure 2-5:

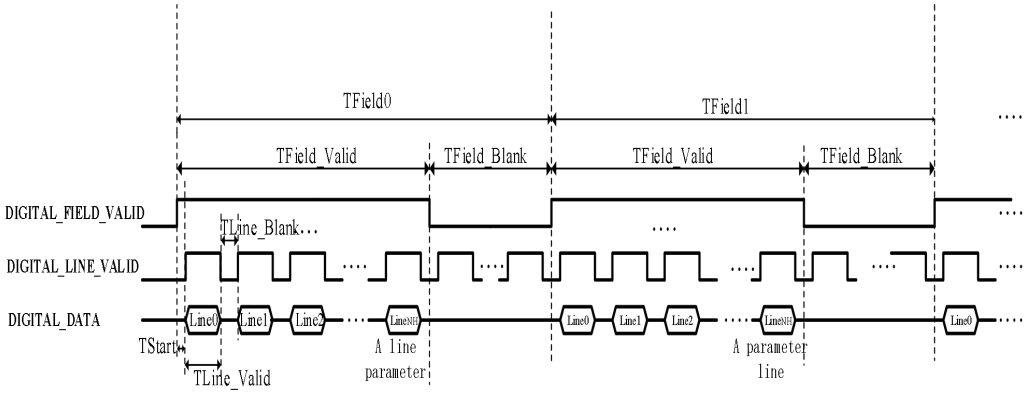


Figure 2-5 Timing Diagram of Line-field Relationship of Digital Video with Parameter line

Figure 2-6 shows the timing of lines and X16/Y16/Y8 data source ：

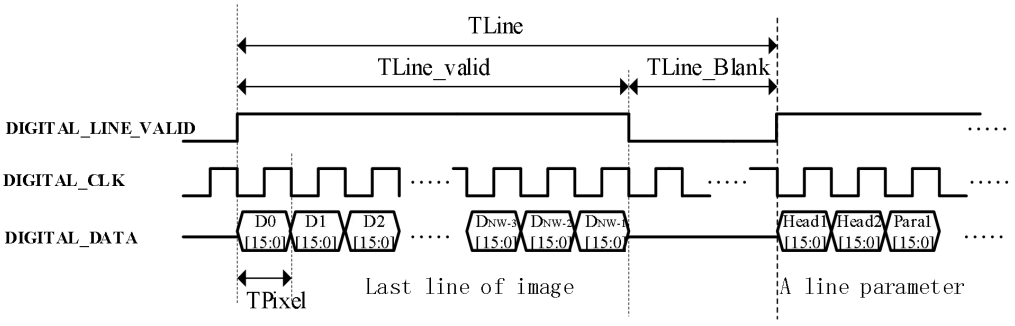


Figure 2-6 Digital Video Line and Data Timing Diagram

2.3.4 CMOS timing

The timing of CMOS interface is consistent with that of Cameralink. Please refer to Section 2.3.3 for the detailed timing diagram.

2.3.5 BT.656/ BT.1120 timing

Not supported.

2.4 Optional accessories

The optional accessories mainly include lens, power adapter, adapter power cord (American Standard, European standard, Australian standard), key box, debugging tooling line, RS422 to RS232 adapter, Cameralink acquisition card (pcie-cpl64) and extension cable, USB3.0 module and USB 3.0-typec interface cable. The matching diagram is shown in Figure 2-7 ~ Figure 2-14.

Figure 2-7 module(with 25mm lens)

Figure 2-8 Power Adapter

Figure 2-9 Adapter Power Cable (American Standard, European Standard and Australian Standard)

Figure 2-10 Control Panel

Figure 2-11 Control Panel

Figure 2-12 RS422 to RS232 Connector

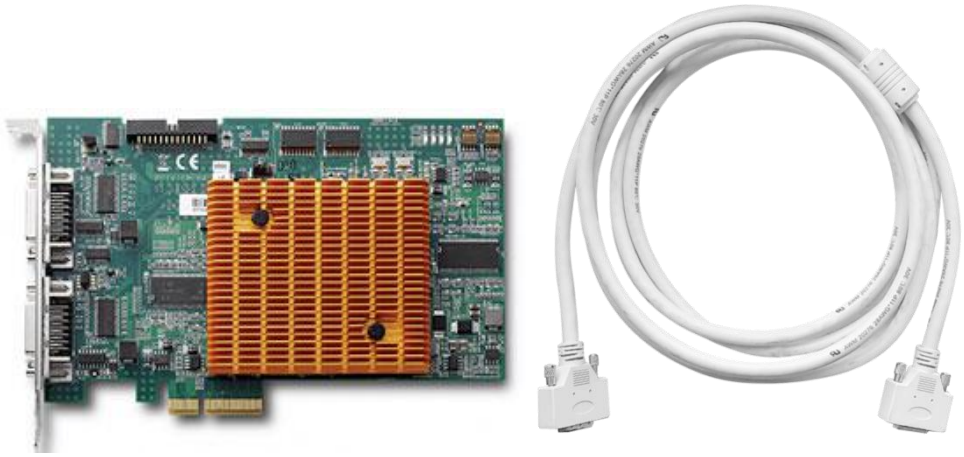


Figure 2-13 Cameralink Frame Grabber (PCIE-CPL64) and Extension Cable

Figure 2-14 USB3.0 module and USB3.0 TYPEC cable

3 ICC control software

3.1 Installation

This chapter mainly describes the installation method, steps and precautions of the infrared module software to achieve the normal use of the installed software.

1) Firstly, double-click the application installation file setup.exe for installation to pop up an installation window, click the button "Next" for installation at the next step, as shown in Figure 3-1.

Figure 3-1 Software installation screen 1

2) Click the button "Next" to pop up a window for selection of installation path and the installation object. After selecting the file installation path and object, click the button "Next" to proceed to the next step, as shown in Figure 3-2.

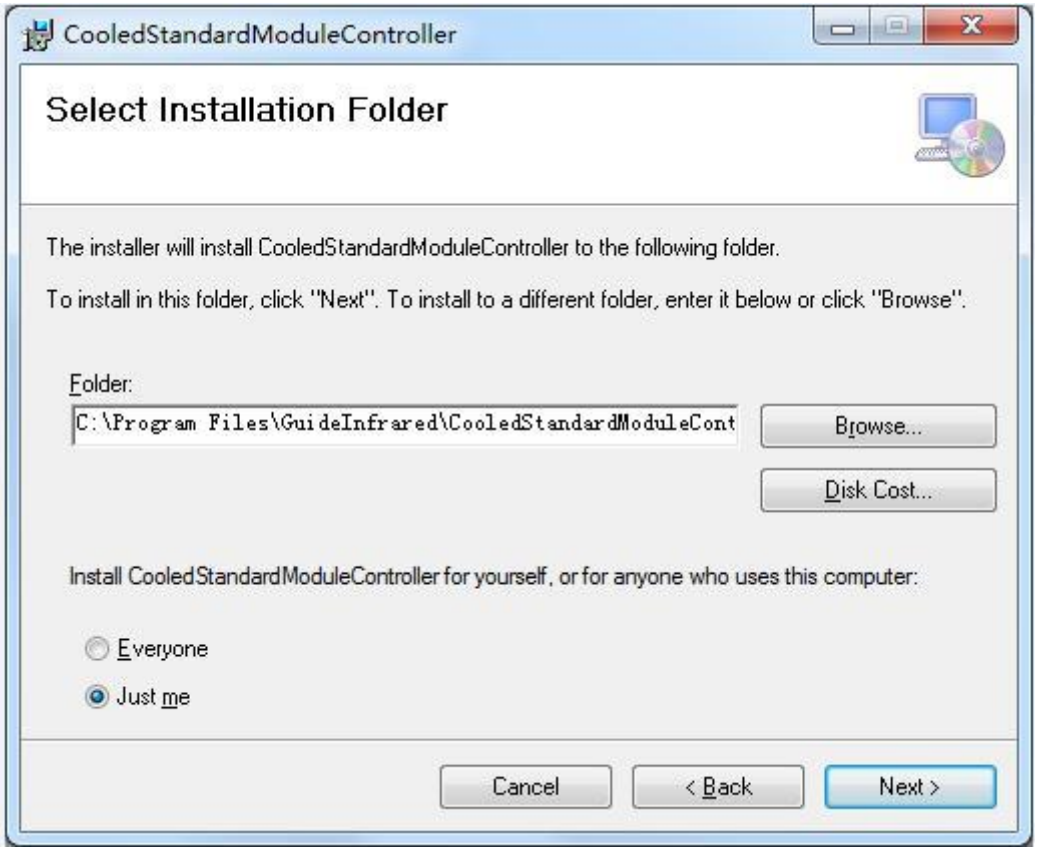


Figure 3-2 Software installation screen 2

3) In the new pop-up window, click the button "Next" to proceed to the next step, as shown in Figure 3-3.

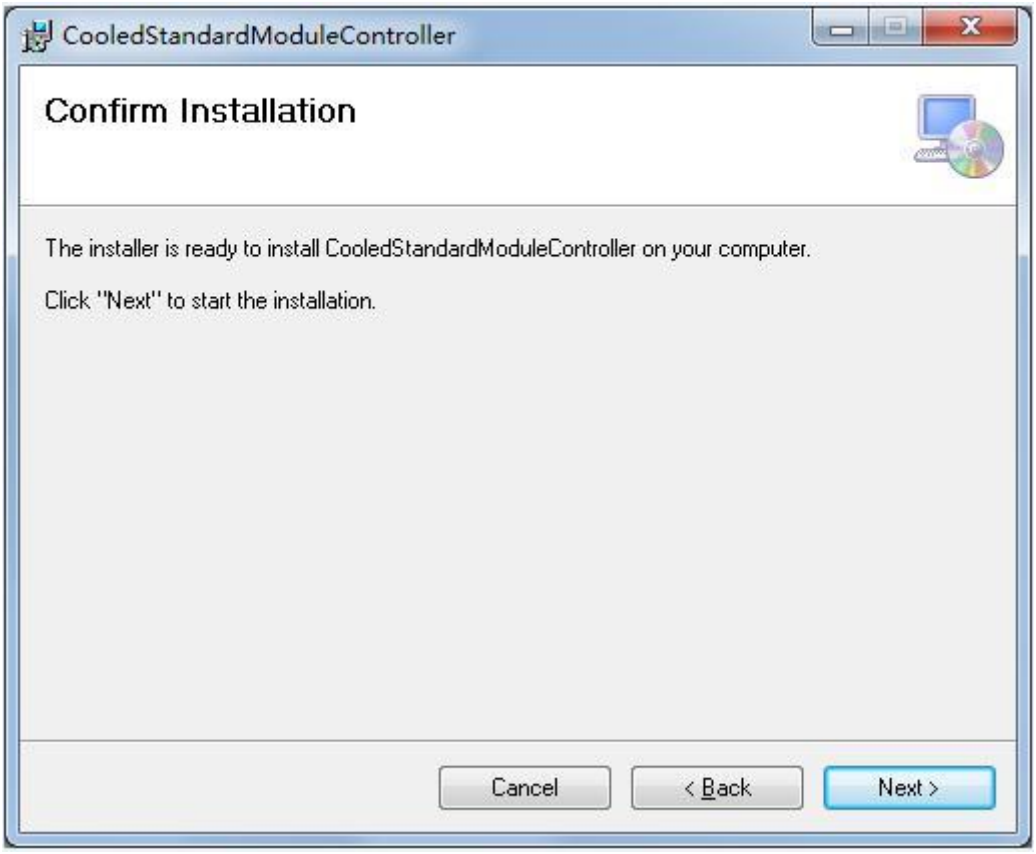


Figure 3-3 Software installation screen 3

4) During installation, the installation progress interface will appear, please wait for the installation to complete, as shown in Figure 3-4.

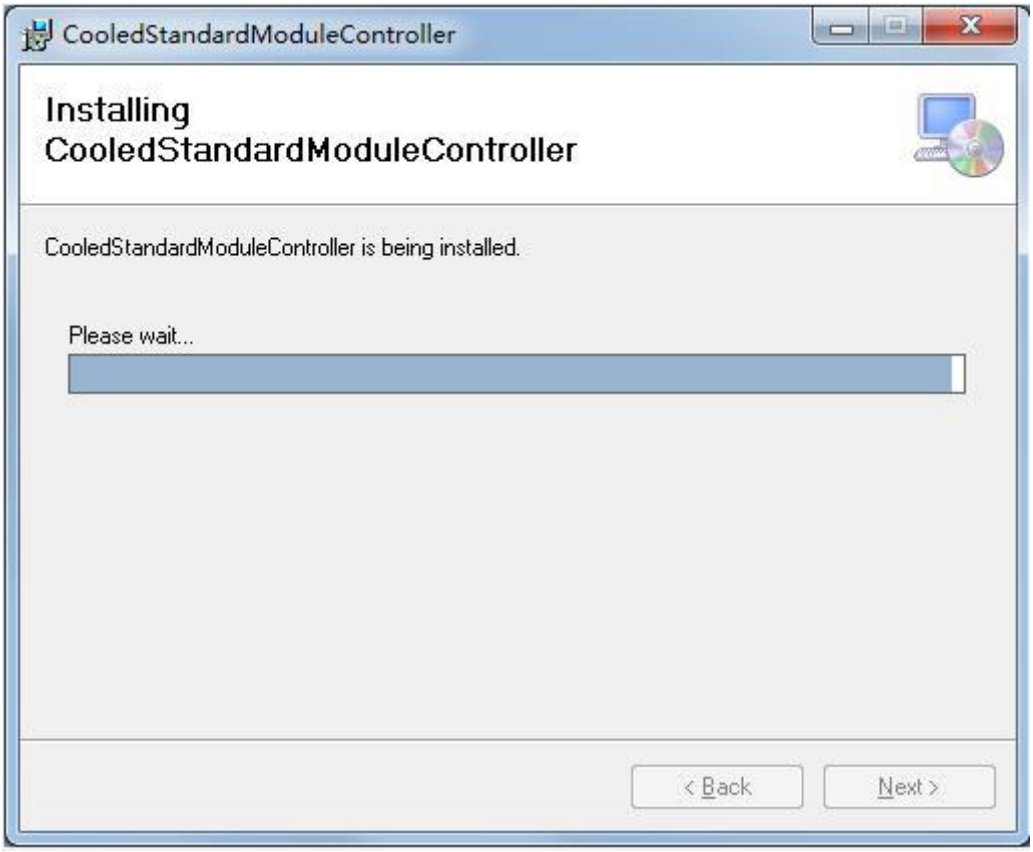


Figure 3-4 Software installation screen 4

5) After the installation, the installation completion window will pop up, as shown in Figure 3-5.

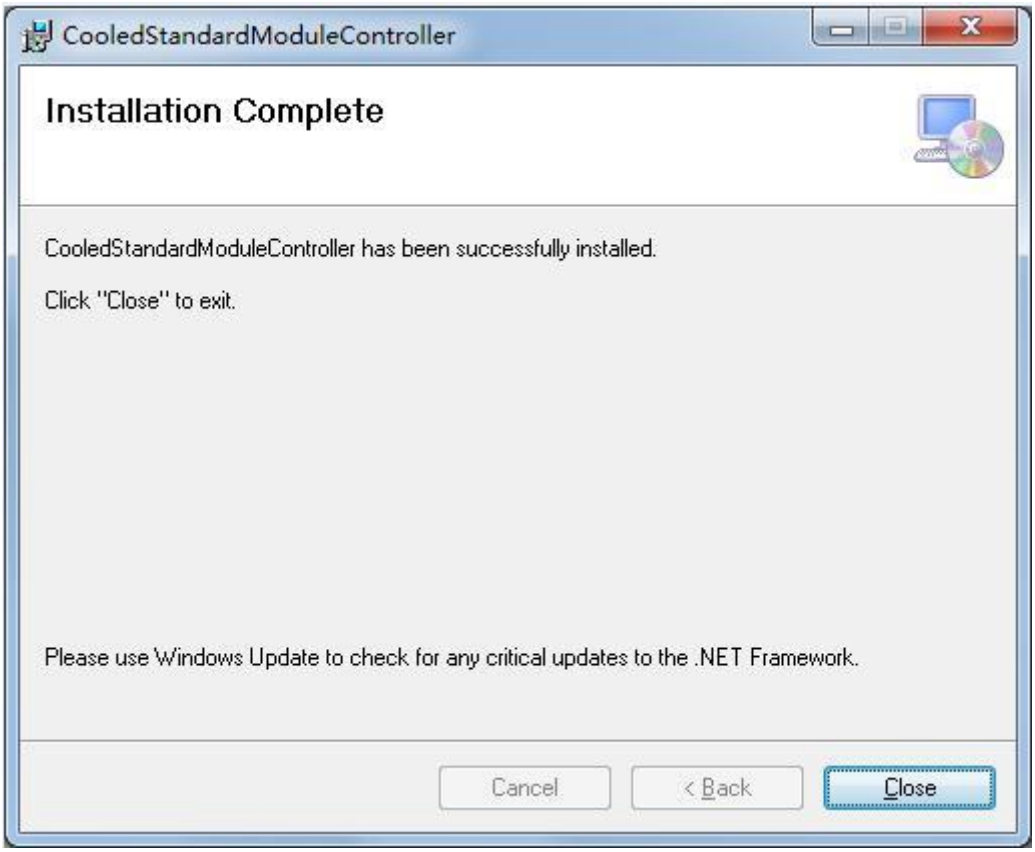


Figure 3-5 Pop-up window for software installation complete

Click the "close" button to finish the installation and exit the installation.

3.2 software and hardware interconnection

This chapter describes how to use infrared module software, infrared module, cable interconnection and control the display of the module.

3.2.1 Hardware interconnection

Connect the infrared module, cable (including serial port, power supply, analog video, Cameralink digital video), PC, pcie-cpl64 acquisition card (used to display Cameralink digital video), analog video display(PAL format), DC power supply, etc. the interconnection diagram is shown in Figure 3-6:

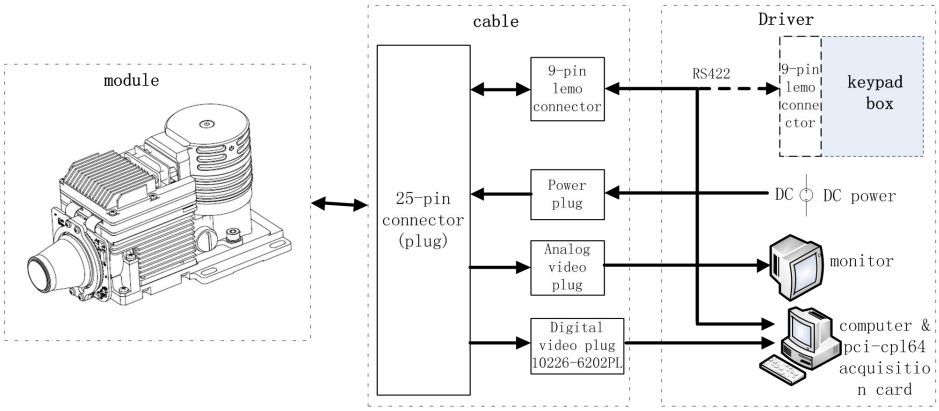


Figure 3-6 hardware interconnection

3.2.2Serial port software interconnection

1) Click the desktop icon  click the "cool standule controller" in the "start" of the computer to start the infrared movement software.

2) When the software is opened, customers can click the button  to automatically select the Chinese / English language according to the requirements. The interface is shown in Figure 3-7.

Figure 3-7 English connection wizard interface

3) The upper right corner will display two icons and the software version number of the upper computer. Clicking the icon X in the upper left corner will hide the window to the taskbar, click the icon — close the software; under the image is the status bar, showing the current setting information.

4) Clicking the icon b nd "serial port number" to select com number,

and clicking the icon behind "baud rate" to set baud rate (typical value: 115200), as shown in figures 3-8 and 3-9.

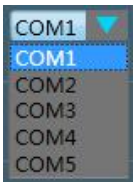


Figure 3-8 Selecting serial port number

Figure 3-9 Selecting serial baud rate

5) Clicking the button Connect to connect the core, and clicking the button Disconnect to disconnect the core. If the module is currently connected, the status bar at the bottom of the interface displays the current connection status as Connected; if the module is in the disconnected state, the status bar at the bottom of the interface displays the current connection status as Disconnected .

3.2.3 Cameralink digital video interconnection

1) After the serial port software is connected to the device, click the button to expand the Cameralink digital video page, as shown in Figure 3-10. Click the button and the digital video page is folded.

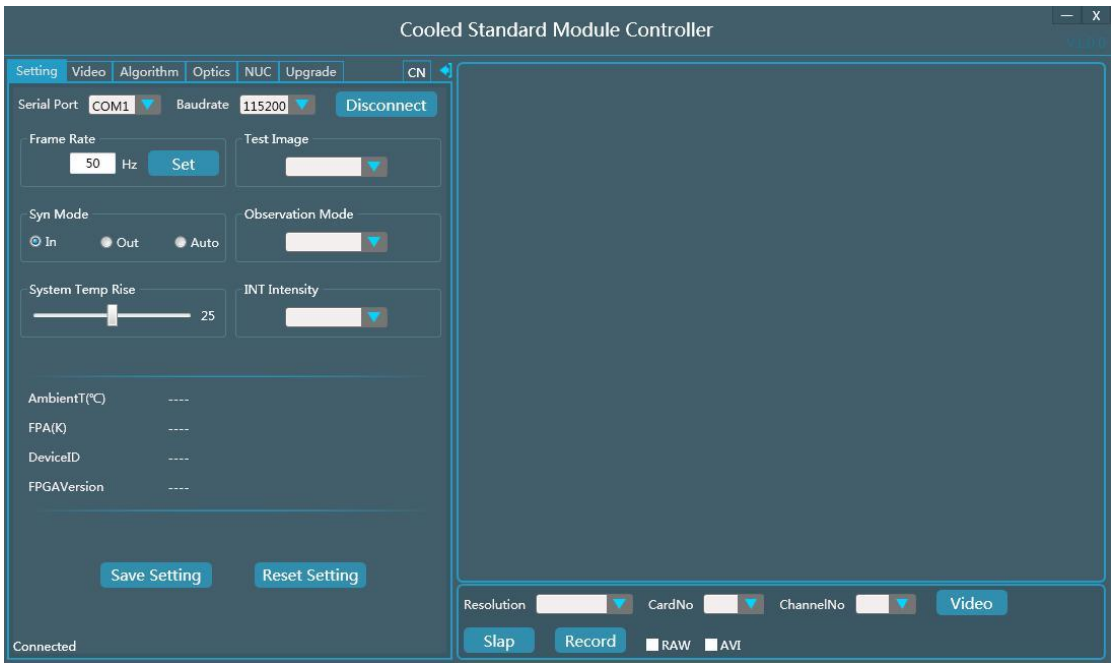


Figure 3-10 Cameralink digital video interface

2) After the camera link digital video page is expanded, it is necessary to set the digital video acquisition parameters. The digital video parameter setting column is shown in Figure 3-11.

Figure 3-11 Cameralink digital video parameters

3) Select the resolution (640 * 512), card number (0 or 1) and channel number (0 or 1) through the drop-down box options; the parameter line is selected according to the actual output protocol of the core. The camera link digital video parameter setting of this product is shown in Figure 3-12.

Figure 3-12 Cameralink parameters of the module

4) After setting the parameters, click the button  to collect and display the digital video.

5) After the module information displayed on the interface is correctly configured, It outputs digital video, and the display screen is shown in Figure 3-13~ Figure 3-16.

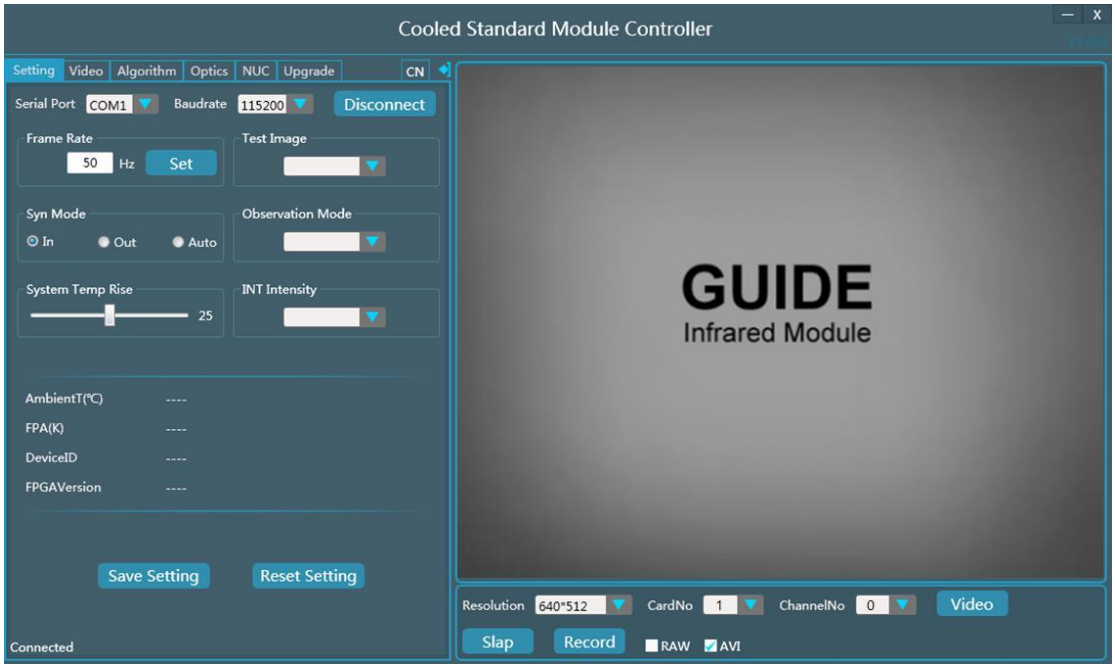


Figure 3-13 startup screen

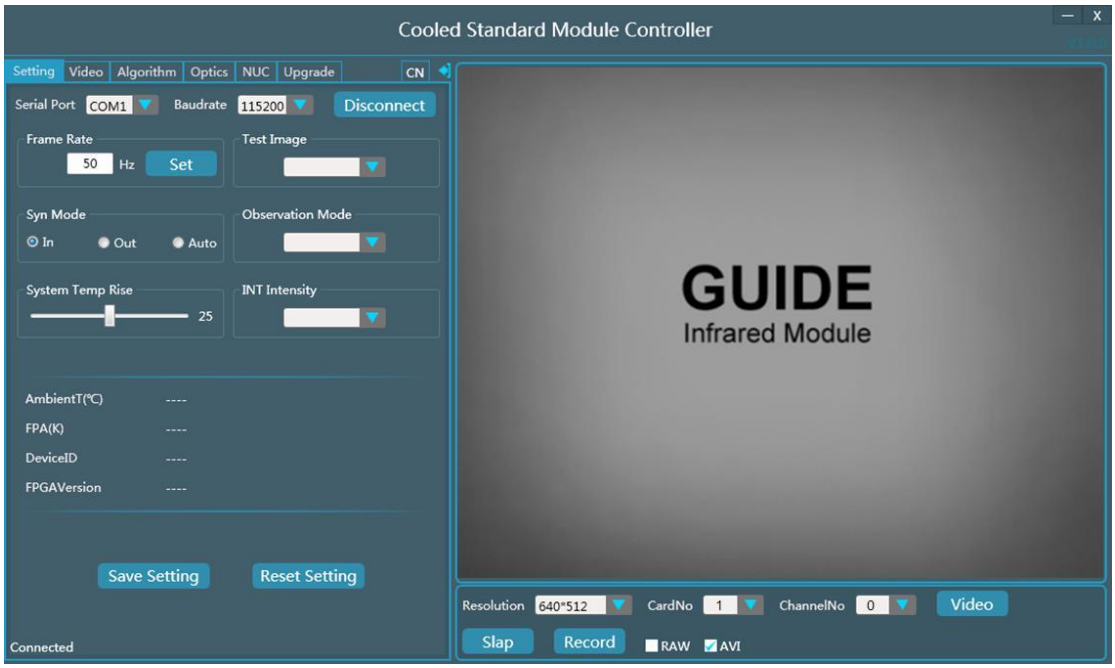


Figure 3-14 the module self check screen

Figure 3-15 Cooldown screen of Imaging module

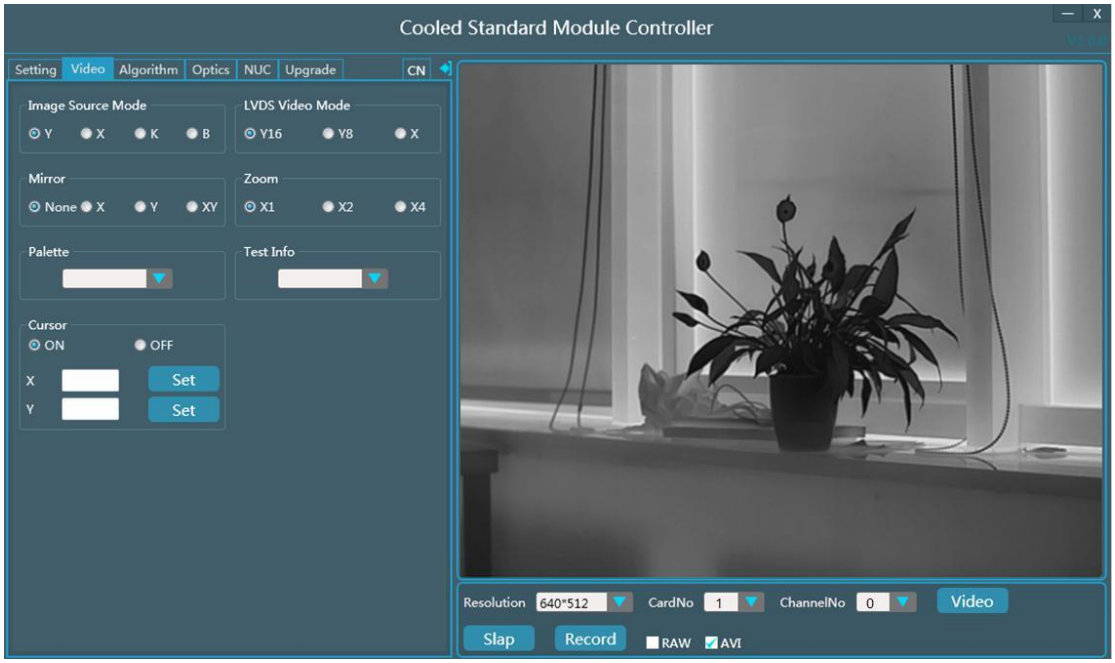


Figure 3-16 real time screen displaying

6) The digital video acquisition software has the functions of taking pictures and recording video, as shown in Figure 3-17. Users can choose to take pictures or record videos according to their needs. Click the button Slap to capture an image and save it in *. BMP file format. The photo image is stored in the installation directory image folder by default.

Figure 3-17 photo taking function

7)According to the actual needs of users, the video recording function of digital video acquisition software can select raw or avi format, and then click the button Record to pop up the path selection dialog box, as shown in Figure 3-18. Select the storage path, start recording, and update the parameter setting column to figure 3-19. Click Button Stop Record to stop recording; click Video Catalog to open the file directory where the video is located to view the video recording data.

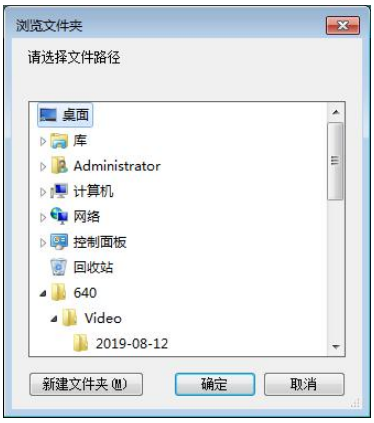


Figure 3-18 video storage path function

Figure 3-19 video control

3.3 Control instructions

After the imaging module is successfully connected with ICC control software, the imaging module can be operated. The functions and operation methods of the interface are described in the following chapters.

3.3.1 settings

This chapter mainly describes the frame rate setting, synchronization setting and other basic application settings of the current connecting movement, and introduces the user quick application settings.

3.3.1.1 basic application settings

Click "setting" on the top of the interface to enter the movement setting interface, as shown in Figure 3-20.

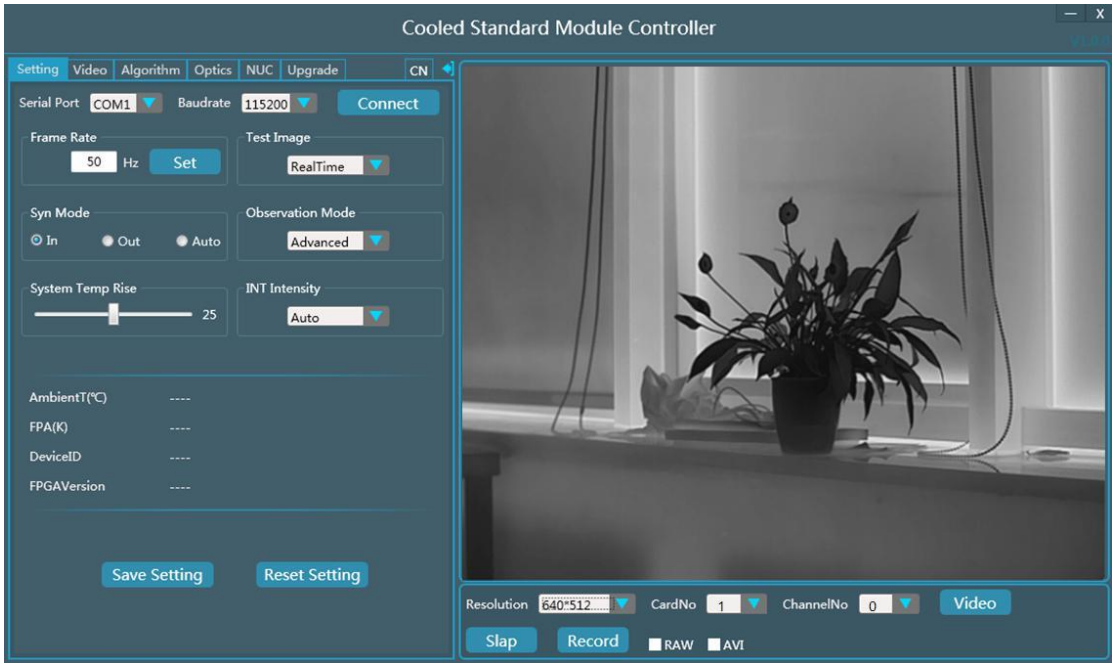


Figure 3-20 the module setting interface

Frame rate：The frame rate is adjustable (1 ~ 200Hz is supported), and the frame rate of the module is set in Hz. Generally, it is recommended that F4 detector default maximum frame rate is 50 Hz (adjustable range: 1 ~ 50 Hz) and F2 detector is recommended to be 100 Hz (adjustable range: 1 ~ 100 Hz). Typical module default F4 set frame rate of 50 Hz, default F2 set frame rate of

100 Hz.

Synchronization mode: the synchronization mode is divided into internal synchronization, external synchronization and automatic synchronization.

a) Internal synchronization mode

The trigger signal is generated inside the module to work at a fixed frame rate.

b) External synchronization mode

External periodic high and low levels are provided as trigger signals (the width of high level is greater than 5us, and the falling edge is triggered). After the module detects the external synchronization signal, it checks and works at this frame rate.

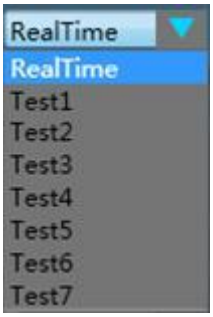
* Before setting the external synchronization mode, make sure that there is a stable external synchronization signal input, and the maximum frequency of the external synchronization signal is not higher than the maximum frame rate supported by the module.

c) Automatic mode

When there is an external synchronization signal and the calibration is successful, the external synchronization mode works; when there is no external synchronization signal or the calibration fails, the internal synchronization mode is used.

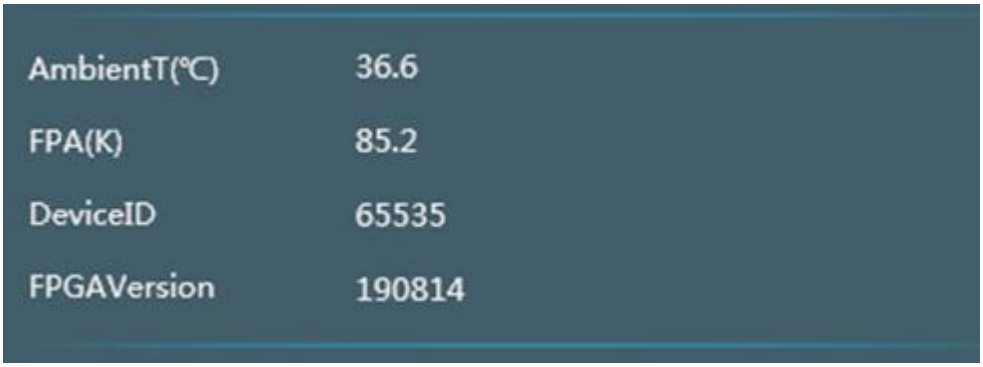
Test image:

The module provides 8 kinds of image display, including real-time image and 7 kinds of test image. The test image includes checkerboard, horizontal gray scale, half day and half ground, rolling gray scale, simulated target, longitudinal gray scale, and increment.



System temperature rise： The module provides an interface for system temperature rise, which is used to compensate the influence of internal temperature rise before and after the module is installed into the whole machine on the collected data of the module. The setting value range is 0 ℃ - 50 ℃.

Status display： Provide information about the working environment temperature, focal plane temperature, machine identification code and program version number of the module.



Save configuration：Save the parameters of upper computer software configuration to the core (non-uniformity correction data is not saved).

Restore factory settings：In addition to the background data collected by

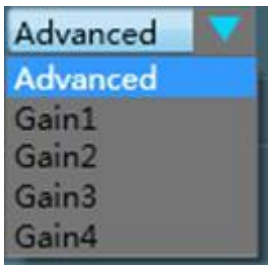
the user, click "restore factory settings" to restore the default configuration status of the core.

3.3.1.2 Quickly application mode

The module is prefabricated with the user's quick application mode setting function, including observation mode and integral strength two operation settings. Customers can select the appropriate gear for comparative application.

1） Introduction of observation mode

Gavin series module sets five observation modes, corresponding to five gears: custom, gain 1, gain 2, gain 3, gain 4. In each gear, six parameters, such as IDE switch, detail gain, DDE, dimming mode, brightness and contrast, are set for each gear, which can be used in different scenes through the combination of these parameters.



In the custom mode, the six parameters, such as IDE switch, detail gain, DDE, dimming mode, brightness and contrast, can be set and adjustable, while in the gain 1-gain 4 modes, the above 6 parameters are factory fixed and

do not support user adjustment.

In general, gain 1 mode is suitable for indoor human observation scene; gain 2 mode is suitable for indoor low radiation target observation scene, such as plants; gain 3 mode is suitable for outdoor sunny scene; gain 4 mode is suitable for outdoor overcast and rainy day scene. If users have specific application scenarios, they can adjust to the custom mode, and achieve the desired image effect through parameter configuration.

By default, the movement is configured as custom mode, and the default parameters of custom mode are the same as gain 3.

2） Introduction to integral strength

Gavin series movement sets four kinds of integral strength, including automatic gain, gain 1, gain 2 and gain 3.

Gain 1, gain 2 and gain 3 are suitable for low temperature, normal temperature and high temperature environment respectively. Users can switch according to the actual environment.

Under the condition of automatic gain, it can automatically switch between gain 1, gain 2 and gain 3 according to the ambient temperature of the module.

By default, the module is configured as automatic mode. At normal temperature, the observation effect of automatic mode is the same as that of gain 2.

3.3.2 Video

This chapter mainly describes the application of image source, Cameralink video mode, mirror image, magnification and so on.

Click ″setting″ on the top of the interface to enter the movement

setting interface, as shown in Figure 3-21.

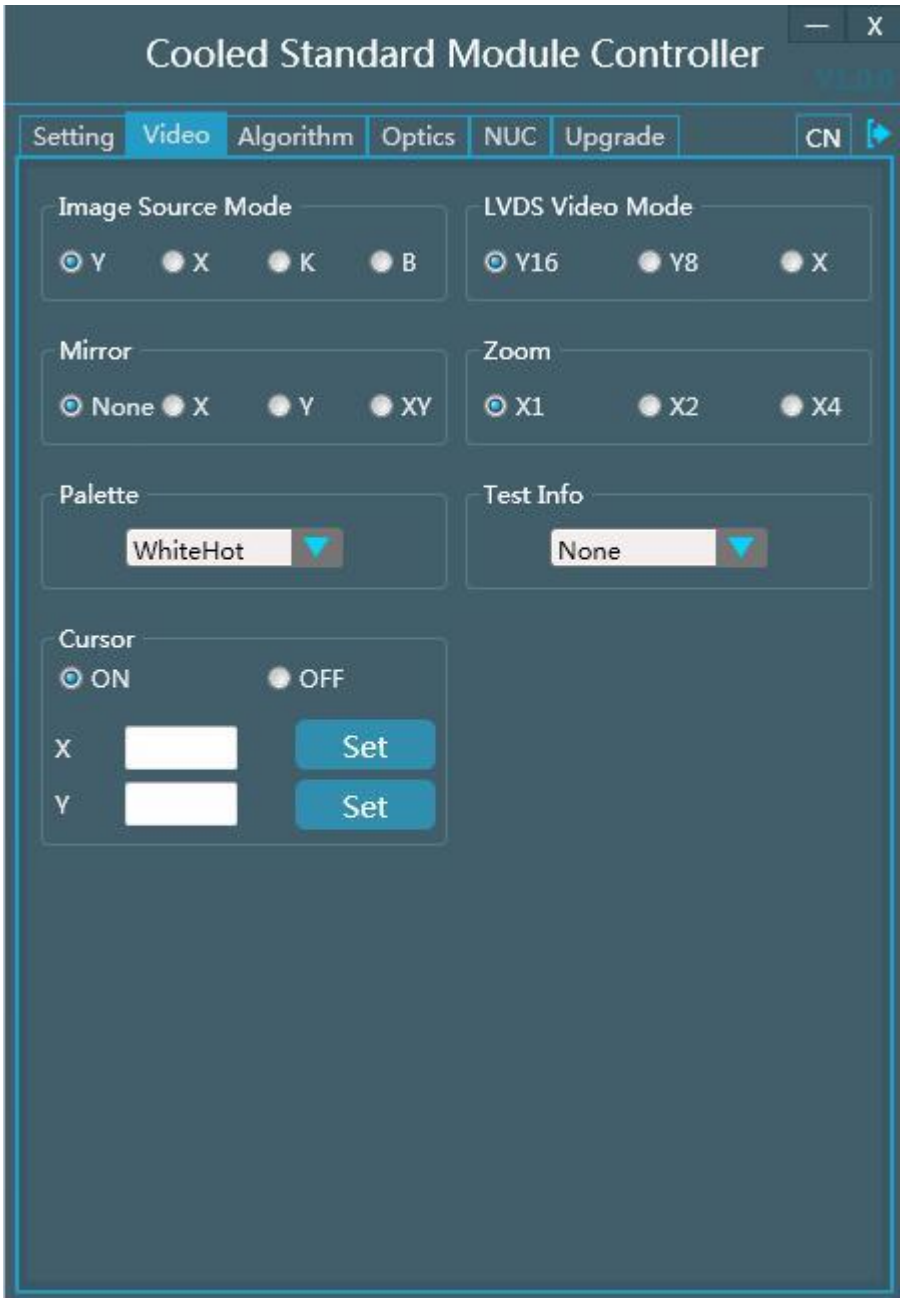
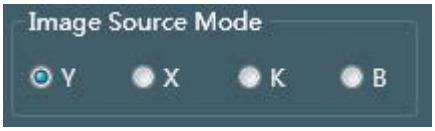


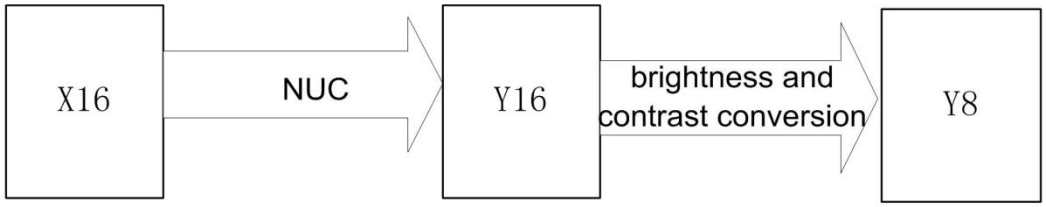
Figure 3-21 video interface

Image source mode:

The image output mode can output the original data, process data and final data in NUC correction process. Original data X (16bit data after AD conversion of detector), process data K / b (generated by two-point NUC correction), and final data y (data after nonuniformity correction)



LVDS video mode：LVDS video mode provides three digital video modes: x16 (the detector outputs the original data after AD conversion); Y16 (non-uniform correction and filtering of X data, the data before dimming processing, data width is 16 bits); Y8 (refers to the data obtained after dimming Y16 data for output display, data width is 16 bits).



mirror： supports four image flipping modes, which are suitable for analog video and digital video.

n： Keep the original image direction of the detector unchanged.

X：The original image is mirrored horizontally. The pixels in the upper right corner of the detector are mapped to the upper left corner of the output video. When you need to mirror the scene horizontally or the movement is reversed in the left and right directions, you can select the X mirror mode.

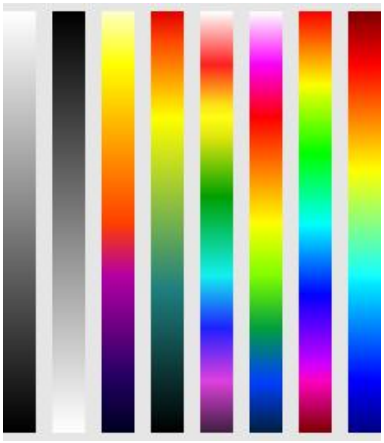
Y： The original image is mirrored vertically. The pixels in the upper left corner of the detector are mapped to the lower left corner of the output video. When you need to mirror the scene vertically or the movement is reversed up and down, you can select the Y mirror mode

XY： The original image is mirrored both horizontally and vertically.

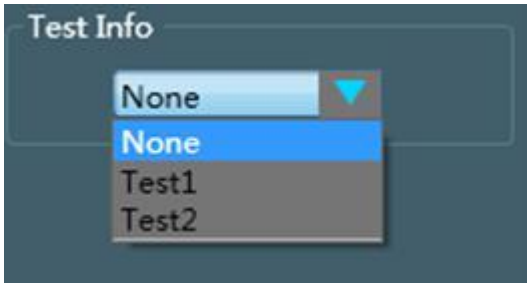
The pixels in the upper left corner of the detector are mapped to the lower right corner of the output video. When you need to mirror a scene diagonally, you can choose XY mirror mode.

Zoom in: support to enlarge the middle area of the image by 2 times and 4 times

Pseudo color: including polarity switching (black heat / white heat) and other six pseudo colors. The movement detects and images the temperature, and maps the temperature to 0 ~ 255. In black and white mode, grayscale 0 is displayed as pure black and gray 255 as pure white. The gray range of 0 ~ 255 can also be mapped by internal look-up table. Different look-up tables represent different color bands. The movement usually selects the white hot mode (the whiter the display is, the hotter it is). Color mapping can also be done through color look-up table, including white heat, black heat, iron red, hot iron, medical, Arctic, rainbow 1 and rainbow 2.



Test infomation: The test information includes test1, test2 and test3. Among them, test1 mainly includes AD sampling value display, ad fluctuation value display, focal temperature display and program version number, which is mainly used to assist in observing whether the movement works normally; test2 mainly includes data acquisition related information, focal temperature display, ad mean value and other information, in addition to auxiliary observation whether the movement works normally, it also provides data acquisition related parameter display; test3 is mainly used to observe whether the movement is working normally It is used for continuous zoom lens to update the focal length information in the upper right corner of the image in real time.



Cursor: Video cursor display switch. Select "cursor on" to display

the cursor at the corresponding position of analog video. Set the X, y coordinate values and move the cursor display position.

3.3.3 Algorithm

This section describes in detail the algorithm functions of the movement such as filtering, enhancement and dimming. Click "algorithm" on the interface to enter the algorithm setting interface, as shown in Figure 3-22.

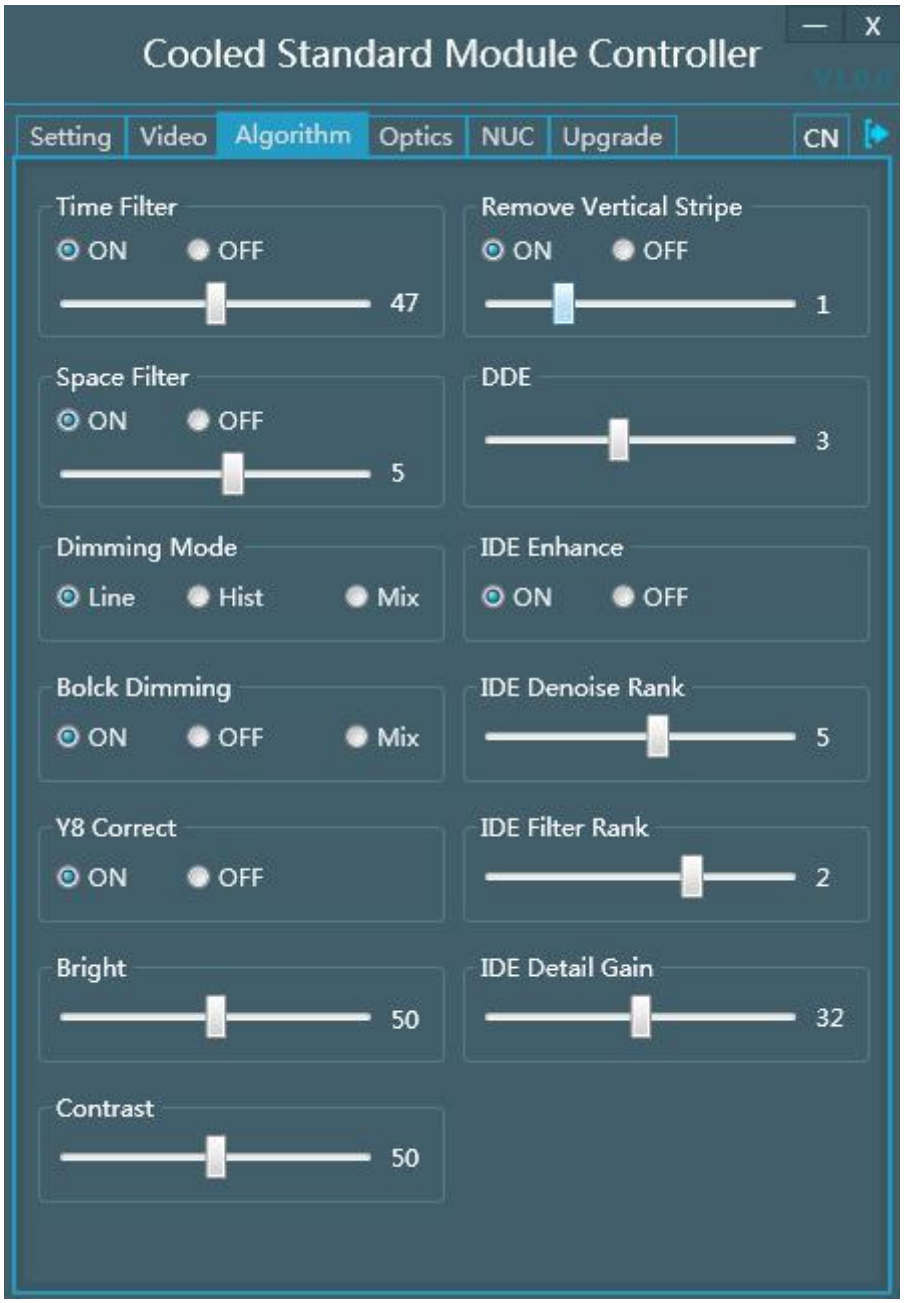
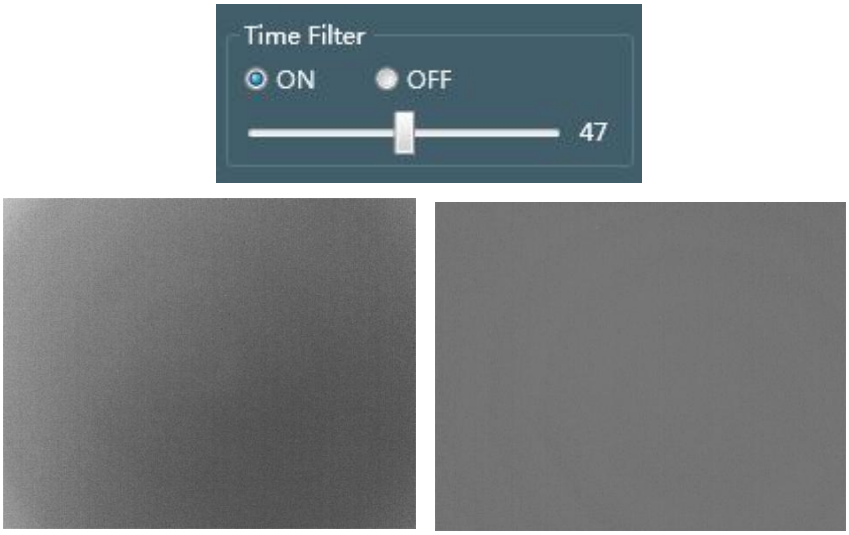


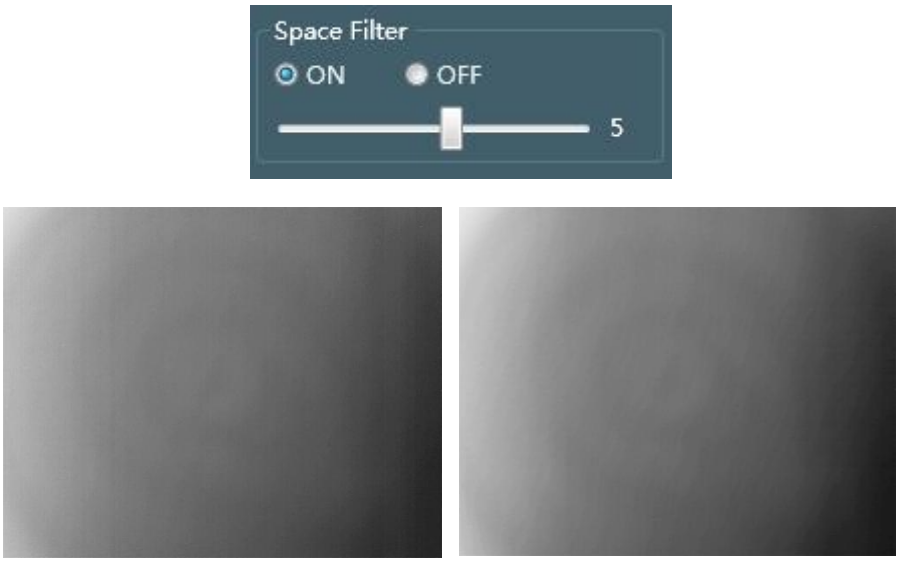
Figure 3-22 algorithm interface

Time domain filtering：The random noise in the infrared image sequence is filtered, and the filtering intensity range of random noise is 0-94. The larger the value is, the greater the degree of filtering is, the smoother the image is, and the more obvious the side effect of drag shadow is, otherwise, the weaker. When adjusting the coefficient, first click "on"  and then adjust the filter coefficient.



Comparison of time domain filter off and on (uniform scene)

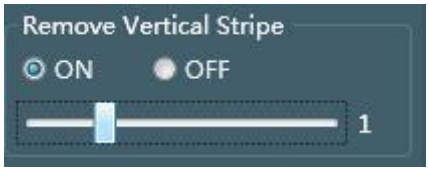
spatial filtering: Similar to time-domain filtering, the spatial noise in infrared image sequence is filtered, and the filtering intensity range of spatial noise is 0-9. The larger the value, the greater the degree of filtering, the smoother the image, the more obvious the side effect of water ripple, otherwise the weaker. When adjusting the coefficient, first click on "on"  and then adjust the filter coefficient.

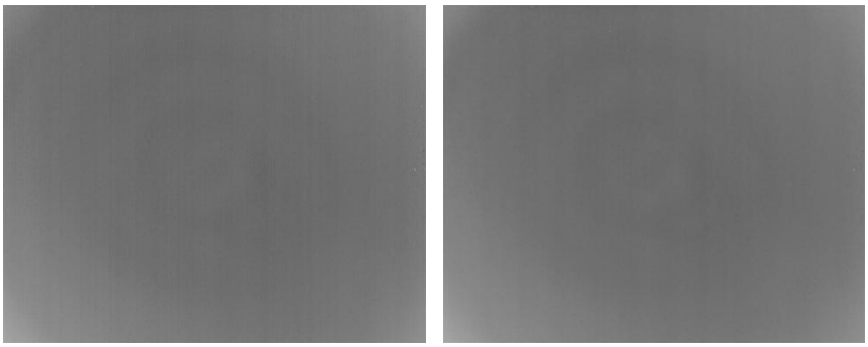


Spatial filtering closing and opening map (uniform scene)

Remove vertical lines: This function can weaken the vertical line noise on the image and remove the column direction non-uniformity noise in the

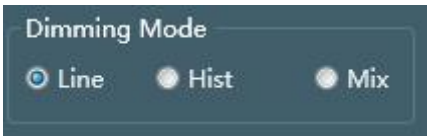
infrared image sequence, so as to obtain a better infrared image.





Algorithm off Algorithm on

Dimming mode: In order to make different scenes present the best image effect, the module provides three dimming algorithms: linear dimming, histogram dimming and hybrid dimming.



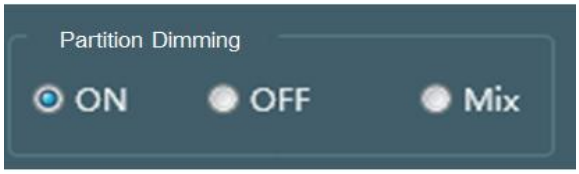
linear: In the linear dimming mode, the image brightness contrast is automatically optimized according to the image information statistics through the linear transformation function to realize the dynamic range compression of image data, which is suitable for uniform scenes.

Histogram: In the case of gray level mapping, the gray level histogram is used to realize the dynamic range of the image.

mixed dimming mode: In the mixed dimming mode, the fusion of linear and histogram maps is adjusted according to the statistical information of the image, so as to automatically adjust the image effect according to different scenes.

Region dimming: In this algorithm, the image is divided into several

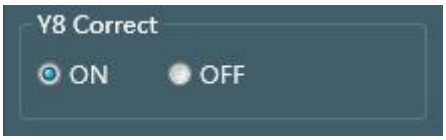
blocks, and each block image is dimmed independently, which highlights the details of the regional image



Building: linear dimming mixed dimming region dimming

Sea surface: linear dimming mixed dimming region dimming

Y8 correction: Adjust the overall brightness and contrast of the image after dimming. After Y8 correction is turned on, the user can adjust the brightness and contrast of the image after dimming; if Y8 correction is turned off, the brightness and contrast of the image after dimming cannot be adjusted.

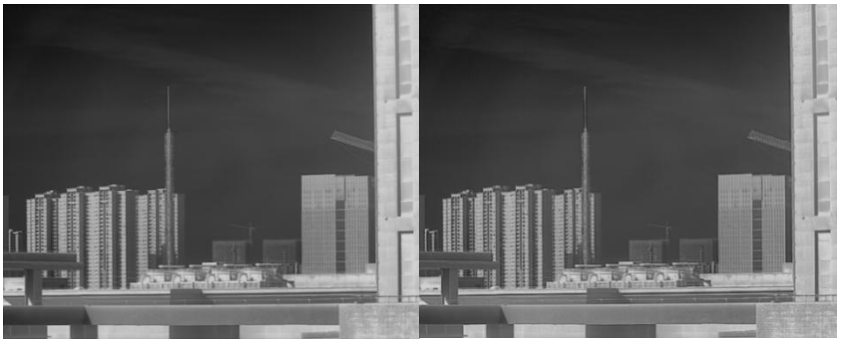


Brightness: Reflect the overall brightness of the image and adjust it in the form of percentage. The size of brightness parameter is positively related to the overall brightness of the image. Parameter

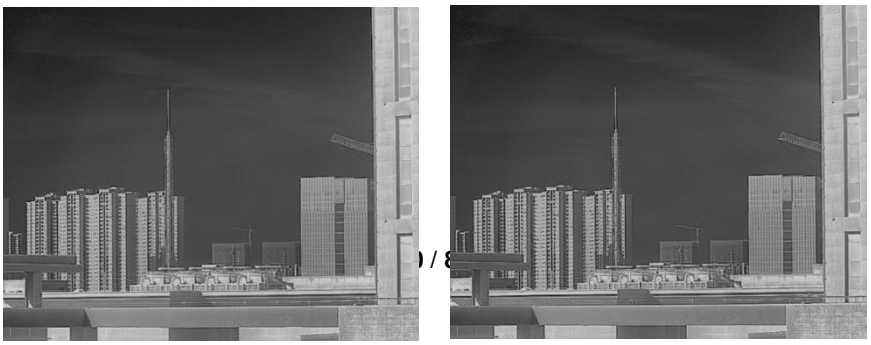
adjustable range: 0-100, the larger the parameter, the higher the brightness, otherwise the lower the brightness.

Contrast： reflects the overall contrast of the image and is adjusted in the form of percentage. Parameter adjustable range: 0-100, the larger the parameter, the stronger the contrast; otherwise, the smaller the contrast.

DDE： DDE (Digital detail enhancement), with different coefficients and different enhancement capabilities, can be adjusted from 0 to 7 levels; where 0 means that DDE is turned off, the larger the gear, the sharper the edge, and at the same time, the image noise will be amplified.

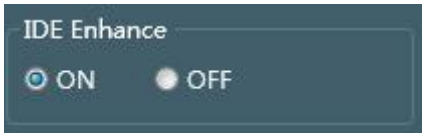


Enhancement level is 2　　Enhancement level is 4



Enhancement level is 6　　Enhancement level is 7

IDE enhancement: IDE (image detail enhancement), image detail enhancement algorithm, mainly processes on Y8 data to enhance image details.



IDE function off　　IDE function on

IDE noise reduction level: IDE noise reduction level controls the image noise level, the larger the parameters, the smaller the noise.

IDE filtering level(valid only when IDE enhancement is on): The bigger the parameters, the richer the details。

IDE gain (valid only when IDE enhancement is on) : The gain of IDE is controlled at different detail levels. When the parameter value is less than 16, it is a smoothing effect; the larger the value is, the more obvious

the image details are enhanced.

3.3.4 Optical control

This part describes the optical system setting and control of the core in detail, mainly including the control of optical lens. Click "optical control" on the interface to enter the detector setting interface, as shown in Figure 3-23.

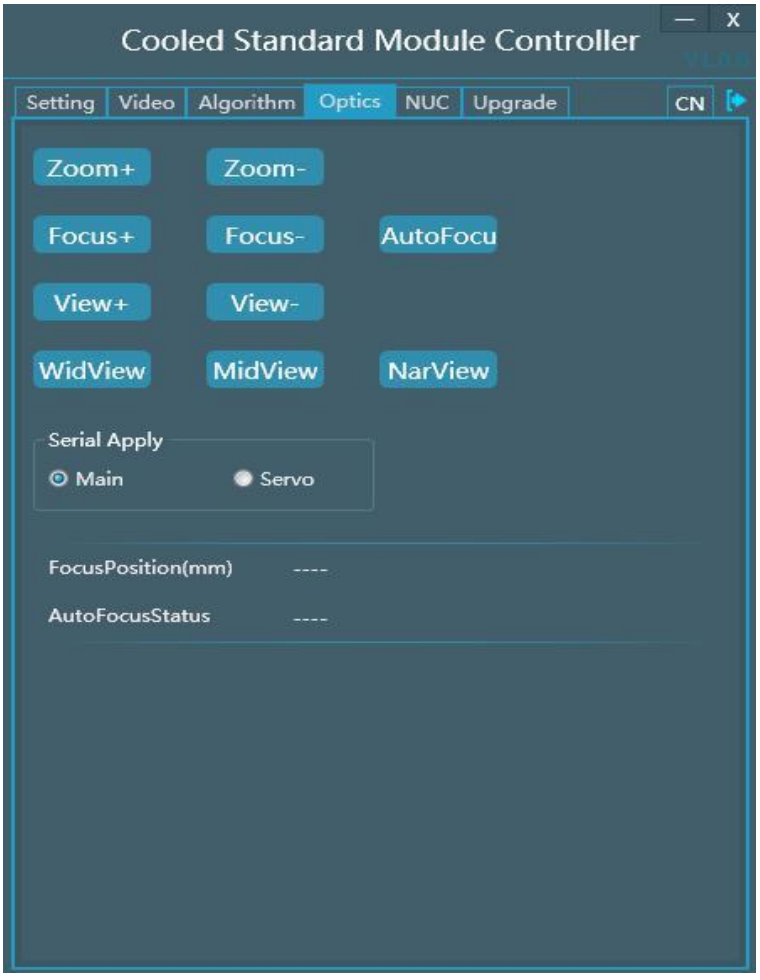


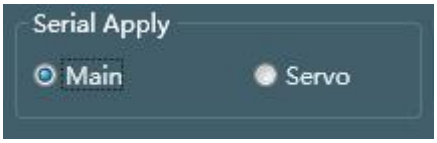
Figure 3-23 optical control interface

Continuous zoom lens: Including zoom, focus and auto focus functions. "Zoom +" and "zoom -" adjust the focal length of the lens; "focus +" and "focus -" fine tune the focus; click "auto focus" to automatically adjust

the image to the best clarity point (do not click continuously before the character disappears, otherwise the success rate of focusing will be affected).

Multi-FOV lens： Including field of view increase and decrease switch and one key switch function. "Field of view +" and "field of view -" switch between two similar fields of view, while "wide field of view", "medium field of view" and "narrow field of view" switch between multiple fields of view with one key.

Serial port expansion： Serial port extension is used to adjust the direct connection between external serial port and motherboard serial port module or servo board control serial port module. The default is "main board control"; the "servo board control" mode is mainly used in the company's internal servo board debugging.



3.3.5 NUC

3.3.5.1 NUC correction

This section describes in detail how the movement NUC correction (two-point correction). Click "NUC" on the top of the interface, and the NUC correction interface is shown in Figure 3-24.

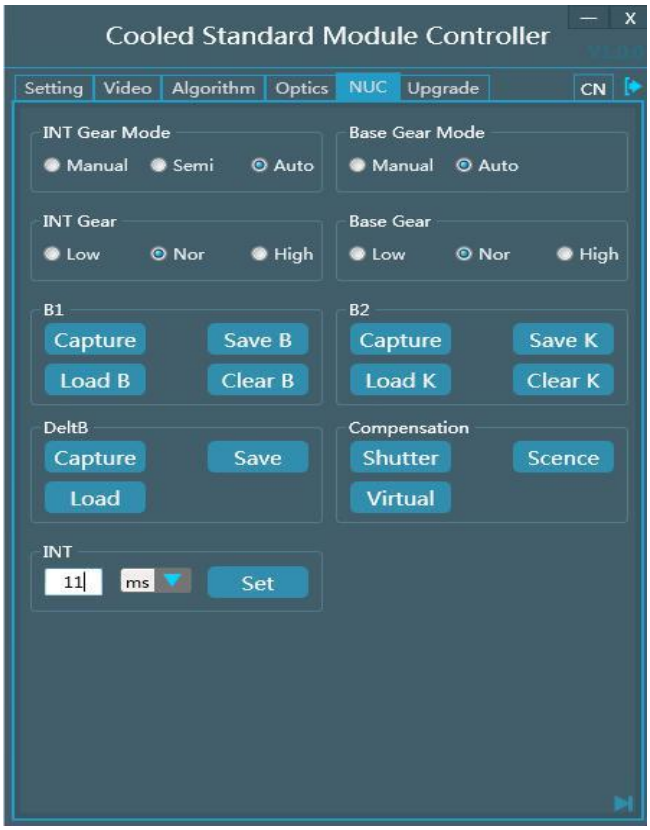
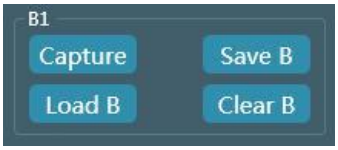
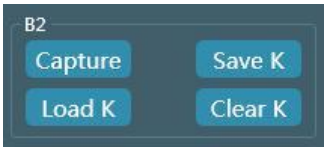


Figure 3-24 NUC interface

B1： In two-point calibration, the collected uniform low-temperature data can realize the functions of collecting, saving B, loading B and clearing b value.



B2： In two-point calibration, the uniform high-temperature data collected can realize the functions of collecting, saving K, loading K and clearing K value.



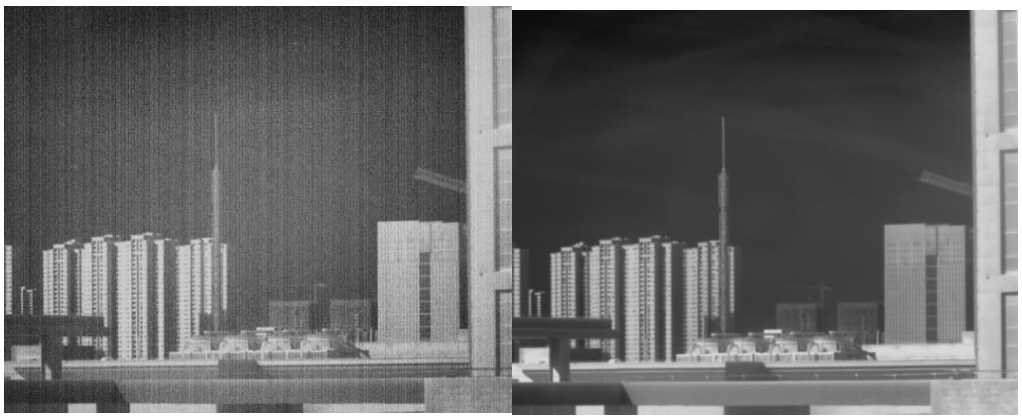
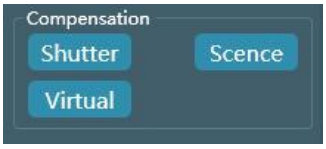


Image before and after NUC correction

DeltB: When the module contains a shutter, in order to eliminate the non-uniformity of the shutter, deltb operation can realize the functions of acquisition, saving and loading.

Scene compensation and shutter compensation: The scene compensation is a single point correction for the uniform surface, which can improve the discrimination ability of moving objects; the shutter compensation is a single point correction for the shutter, which can improve the nonuniformity of the picture.

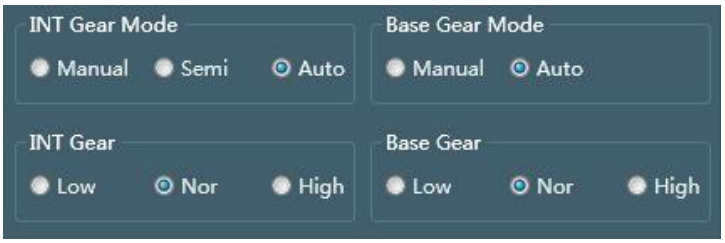
Virtual focus compensation: Virtual focus compensation refers to adjusting the lens to the blur state of the picture (the scene should be as uniform as possible) without scene compensation conditions (no uniform surface occlusion), simulate the uniform surface, and then make a scene compensation. Virtual focus compensation can effectively improve the image nonuniformity.



Integral time: Set the integration time, in MS, the minimum integral time that the movement can respond is 0.1ms; the maximum integration time

is determined by the frame rate; the maximum integration time is 16.5ms at 50 Hz; 6.5ms at 100Hz; 1.5ms at 200Hz.

Integral gear、background gear： Due to the defects of infrared materials, the non-uniformity of doping, the instability of production process control, the processing accuracy of optical system and the non-uniformity of signal path, the output signal of IRFPA array is inconsistent under uniform radiation, so it is necessary to carry out non-uniformity correction (NUC correction) for the movement. The movement can carry out 9-level NUC correction, that is, the movement can store 9 groups of K and b values High temperature group, normal temperature group and low temperature group.



3.3.5.2 recommendation table of nonuniformity correction

NUC correction of the module or thermal imager must be carried out after the adjustment of the optical system, otherwise, the nonuniformity introduced by the optical lens (such as the inconsistency of black and white at four corners of the image, abnormal bad points, etc.) will not be eliminated. It is recommended to use 3 levels (short integration time, medium integration time, long integration time) or 9 levels (in the case of 3 integration time, then carry out 3-level calibration of high temperature, medium temperature and low temperature) NUC correction parameters. In the process of shifting or continuous working, the single point correction can be carried out in real time according to the needs, which can ensure the better visual effect of the image. The 9th gear has better nonuniformity correction effect than the 3rd gear.

The correction list is shown in table 3-1.

table 3-1 The correction list of NUC

Integral time	The 3 gear NUC correction	The 9 gear NUC correction
INT1	coefficient: B1、K1; Scope of application: low temperature; Two point correction temperature point recommendation: -30℃、-10℃。 For example,below 0 ℃ scenario, When the temperature is 0 ℃, adjust INT to make the ad value of the movement close to but not more than 11000, the INT is INT1	coefficient: B1、K1; Integral time=INT1; Two point correction temperature point recommendation: -40℃、-10℃
		coefficient: B2、K2; Integral time =INT1; Two point correction temperature point recommendation: -10℃、10℃
		coefficient: B3、K3; Integral time =INT1; Two point correction temperature point recommendation: 10℃、25℃ When the temperature is 25 ℃, adjust INT to make the ad value close to but not more than 11000, In this case, INT is INT1.
INT2	coefficient: B2、K2; Scope of application: normal temperature; Two point correction temperature point recommendation: 10℃、40℃。 For example, 0 ℃ - 50 ℃scenario When the temperature is	coefficient: B4、K4; Integral time =INT2; Two point correction temperature point recommendation: -10℃、20℃
		coefficient: B5、K5; Integral time =INT2; Two point correction temperature point recommendation: 20℃、35℃
		coefficient: B6、K6; Integral time =INT2;

	50 ℃, adjust INT to make the ad value of the core about 11000, and the INT is INT2	Two point correction temperature point recommendation: 35℃、50℃ When the temperature is 50 ℃, adjust INT to make the ad value of the movement about 11000, and the INT is INT2
INT3	coefficient: B3、K3; Scope of application: high temperature; Two point correction temperature point recommendation: 55℃、65℃。 For example, temperature is higher than 50 ℃. When the temperature is 65 ℃, adjust INT to make the ad value of the movement about 11000, and the INT is INT3	coefficient: B7、K7; Integral time =INT3; Two point correction temperature point recommendation: 10℃、30℃
		coefficient: B8、K8 Integral time =INT3; Two point correction temperature point recommendation: 30℃、50℃
		coefficient: B9、K9; Integral time =INT3; Two point correction temperature point recommendation: 50℃、65℃ When the temperature is 65 ℃, adjust INT to make the ad value of the movement about 11000, and the INT is INT3

3.3.5.3 integral gear switching scheme

Scheme 1: automatic mode

Mode description: during the startup process, the integral gear is automatically switched according to the ambient temperature. After entering the real-time image, the integral file is periodically judged (every minute) to switch the integration time.

Advantages: no need to manually switch, less manual operation

Disadvantages: when the ambient temperature is at the critical point, image jitter may be caused by frequent switching, and the image effect

may be poor if the compensation is not carried out after shifting.

Applicable scenarios: three gear splitting time needs to be opened to ensure environmental adaptability; machine system, temperature cycling and other occasions.

Other instructions: if the machine is placed in a sealed environment and the temperature rise is large, DELTT can be added on the basis of the critical temperature of integral shift, so that the nonuniformity correction data used by the machine can be applied to external targets.

Scheme 2: manual mode

Mode description: the user manually switches the integration file and selects appropriate integration time and nonuniformity correction data.

Advantage: prevent frequent mode skipping and image dithering

Disadvantages: more human-computer interaction.

Applicable scenario: the user has manual switching conditions, and the environment temperature jump is small.

Scheme 3: semi automatic mode

Mode description: when in this mode, the integral file is automatically switched according to the ambient temperature during the startup process. After entering the real-time image, if the timing compensation is set for the shutter movement, the ambient temperature is judged before each shutter opening, the integral file / background is switched, and then the shutter compensation is carried out.

Advantages: through timing compensation, good non-uniformity of the image can be ensured. There is no jitter in the process of shifting, and the image has good nonuniformity after shifting.

Disadvantages: the image may freeze suddenly during the shutter process, which is not conducive to target tracking.

Applicable scenario: the machine needs to be started continuously for a long time, and the shutter is allowed to be opened.

3.3.5.4 bad point correction

This section describes in detail how to correct the bad points of the movement. Click the button at the lower right corner of the NUC interface to expand the data acquisition interface of bad point correction and "pot cover removal", as shown in Figure 3-25.

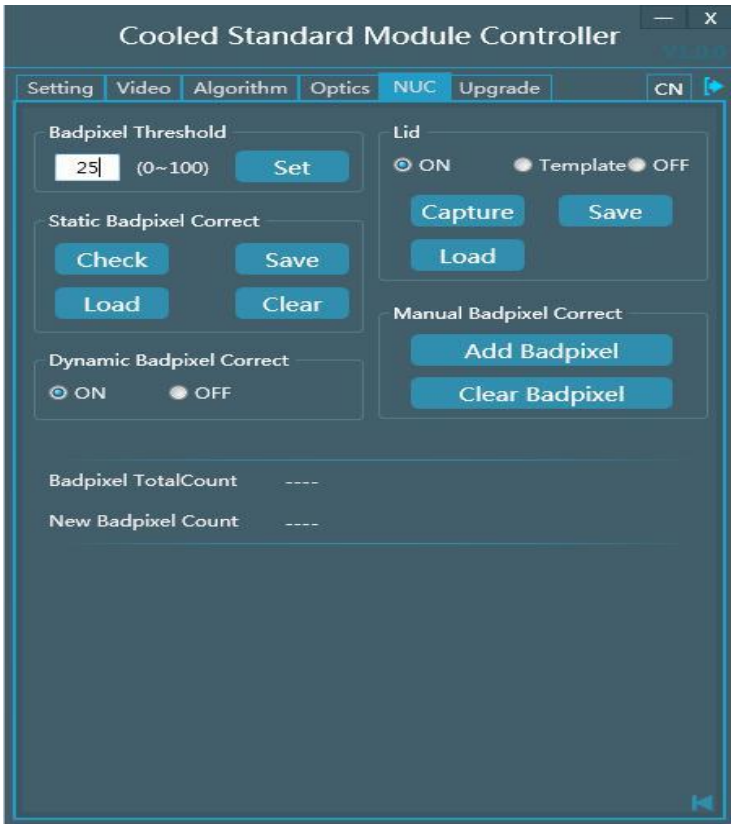
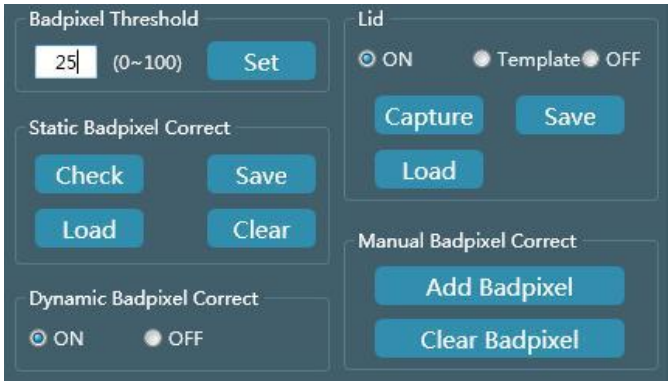


Figure 3-25 interface of bad point correction and "pot cover" data acquisition

There are static correction, manual correction and dynamic correction. The first two correction methods aim at fixed or definite bad points, and dynamic correction methods aim at the new bad points after the thermal imager works continuously for a period of time.



Static correction bad point: For the first time, the bad points are removed first, then the threshold value of the bad points is set, and then the two-point correction is carried out. After the two-point correction is completed, the thermal imager is automatically correcting the high-temperature blackbody and the low-temperature blackbody, respectively, until there is no obvious bad point on the image. Finally, the bad points are saved.

The specific process is as follows: first remove the bad points Clear , then enter the NUC interface for two-point correction, and then set the "bad point search threshold" 20 (0~100) Set , which is recommended to be 15-25 (as long as all the bad points can be found and the number of bad points is not more than 1% of the detector pixel), the module is facing the uniform surface (high temperature and low temperature in turn), and click to detect the bad points Check , generate the number of bad points Badpixel TotalCount ---- , and finally save the bad points Save ; when the corrected bad points are far more than a certain number, that is, after the correction phenomenon occurs, it is necessary to clear the bad points again Clear , and repeat the process of correcting the bad points until there are no bad points and no over calibration in the picture.

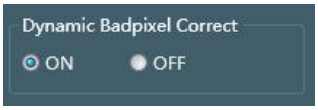
Add bad points manually： After the automatic correction of bad points, if there are still some bad points on the screen and cannot be corrected, manually add bad points to remove the bad points manually. Open the cursor, position the cursor to the bad point coordinates, click "manually add coordinate bad points" and save.

The specific process is: open the cursor and determine the coordinate position of the bad point; then manually add the bad 

point , and finally save the bad point 

.

Dynamic bad point correction： Turn on the algorithm to correct the random bad points in the moving scene .



Four-corner correction：After infrared module and optics are assembled inside a sealed infrared thermal imager, along with working time pasts, the circuit board generates a lot of head which is transferred to the optical system through structural parts, resulting in the non-uniform local heating of optical structure parts and the phenomenon of brighter four-corner(the four corners of image are brighter than the central area of image, roughly showing a round sharp that is symmetric with the center of image; with the increase of working time, the area of bright is getting closer to the center, and it is difficult to see the scene in image in the serious case). This phenomenon often appears on the module equipment with wide FOV when the phenomenon of bright four-corner is very serious, the whole image will become white, which affects observation. Click 

to enable the “four-corner” removal algorithm. Click 

to close the “four-corner” removal algorithm.

Basic process of four-corner correction：**The thermal imager works in the normal temperature state and directly faces the uniform face; In addition, it is necessary to ensure that the thermal imager is in the wide FOV;the thermal imager with lens is turned on for a certain time until the four-corner brightness appears;click** Capture and Save to **complete the collection of four-corner once.click** Template to view the “four-corner” template data collected;click Load to call the template data saved.

3.3.6program upgrade

This section describes the core program upgrade in detail. Click "program upgrade" on the interface to enter the program upgrade main page, as shown in Figure 3-26.

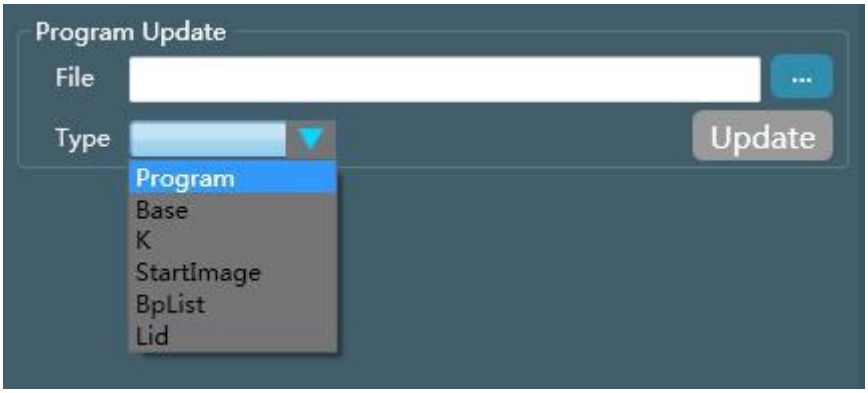
Figure 3-26 program upgrade interface

Program upgrade: Product upgrade by loading "*. Raw" file.

Procedures for program upgrade: First, select the type (you can select the upgrade type: program, background, K value, startup picture, bad point list, pot cover), and then click ... to open the directory where the file is located, select the file to be upgraded, and then click Update. In the process of program upgrade, the message "data transfer completed, upgrading in progress" will pop up Dialog box; after the upgrade is completed, "upgrade succeeded!" will pop up Dialog box, the "upgrade successful" dialog box will pop up before power failure and restart.

* Note: it is strictly forbidden to power off during the upgrade process, otherwise

the movement will not work normally or even damage the movement!



4 FAQ

4.1 application demonstration

The whole machine is packed in safety box. The basic conditions for analog video demonstration are: infrared core, tooling cable, key box, adapter and portable display, as shown in Figure 4-1.

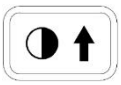
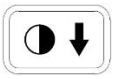
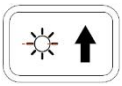
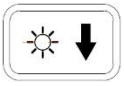
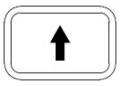
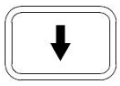
Figure 4-1 analog video demonstration

The basic conditions for digital video demonstration are: infrared module, cables, pushbutton box, adapter, PC with pcie-cpl64 digital acquisition card, and Cameralink extension cable.

4.2 operation instructions of keypad box

Table 4-1 operation instructions of keypad box

icon	name	Function description	remarks

	C+	Click execute，（1）contrast+ (not entering menu) (2)parameter+/Confirm(entering menu)	
	C-	Click execute，（1）contrast－(not entering menu)(2)parameter-/Confirm(entering menu)	
	B+	Click execute , (1)Bright+((not entering menu) (2) Move Right(entering menu)	
	B-	Click execute , (1)Bright-(not entering menu) (2) Move left(entering menu)	
	MENU	Click enter/Exit men	
	ZOOM+	Zoom In（Stop when button is up）	Suitable for continuous zoom lens debugging control
	ZOOM-	Zoom Out(Stop when button is up)	
	focus+	Far Focus(Stop when button is up)	
	focus-	Near Focus(Stop when button is up)	
	Auto Focus	Click to perform autofocus	
	ZOOM	Electronic amplification, click to achieve the switch of 1x / 2x / 4x	

4.3 Emissivity of common materials

Material	Emissivity	Material	Emissivity
Brass mirror	0.03	Bright paint(All colour)	0.90
Polished aluminum or aluminum foil	0.09	Stone	0.92
Pebble	0.28~0.04	Concrete	0.94
Gold-plated copper	0.30	Dark paint	0.95
Solder coated copper	0.35	Water	0.95~0.96
Wood	0.78	Smooth black paint	0.96~0.98
Paper	0.80~0.95	Bark	0.98
Bitumen	0.85	Ice	0.98
Sheet metal	0.88~0.90	Skin	0.98

5 Specification of Serial Communication Protocol

5.1 Overview

This chapter describes the applicable scope and format of serial protocol of the module.

1) Interface type: RS-422 interface;

Data format: 1 start bit, 8 bit data bit, no check bit, 1 stop bit. 8-bit data always low bit first, high bit last: for 16 bit word (2 bytes), always pass high byte first, then low byte.

Baud rate：115200bps;

2) Serial command control frame format

Table 5-1 Serial command control frame format

Frame header (2 bytes)		frame start, two bytes [55] [AA]
Command section (4 bytes)	Functional classification	D1: Main function items
	Page number	D2: Main function item subordinate function item
	options	D3: Attached information 1

	Command word	D4: Attached information 2
XOR check (one byte)		XOR: the XOR check word of 4 bytes in the command section;
End of frame (one byte)		End of communication frame, one byte [F0]

5.2 Communication protocol

The upper computer software sends the control command to the core, and the movement feeds back the corresponding function status (except for the "general key setting page").

5.2.1general key setting page

All downlink commands on the general key setting page: (55 AA 01 + option + command word (2 bytes) + check + F0).

表 5-2 通用按键设置页命令

Option content	Option	command	operation	Setting instruction
The button pops up	0x01	00 00	Used with "zoom", "focus" and other instructions	55 AA 01 01 00 00 XOR F0
Menu	0x02	00 00	Enter/Exit Menu	55 AA 01 02 00 00 XOR F0
B+	0x04	00 00	（1）Bright+(not entering menu) （2）Move Right(entering menu)	55 AA 01 04 00 00 XOR F0
B-	0x05	00 00	（1）Bright-(not entering menu) （2）Move Left(entering menu)	55 AA 01 05 00 00 XOR F0
C+	0x06	00 00	（1）Contrast+(not entering menu) （2）Parmeter +/Confirm(entering menu)	55 AA 01 06 00 00 XOR F0
C-	0x07	00 00	（1）Contrast-(not entering menu) （2）Parmeter -/Confirm(entering menu)	55 AA 01 07 00 00 XOR F0
ZOOM	0x08	00 00	Electronic amplification, click to achieve the switch of	55 AA 01 08 00 00 XOR F0

			1x / 2x / 4x	

Example of instruction calculation:

The button pops up: 55 AA 01 01 00 00 00 F0

ZOOM: 55 AA 01 08 00 00 09 F0

5.2.2 SETUP page

All downlink commands on function setting page: (55 AA 02 + option + command word (2 bytes) + check + F0).

Table 5-2 Setup command

Option content	option	command	Operation	setting instruction	response command
Frame rate	0x01	xx xx	×100传递	55 AA 02 01 xx xx XOR F0	55 BB 02 01 xx xx XOR F0
Synchronous mode	0x02	00 00	Internal synchronization	55 AA 02 02 00 00 XOR F0	55 BB 02 02 00 00 XOR F0
		00 01	External synchronization	55 AA 02 02 00 01 XOR F0	55 BB 02 02 00 01 XOR F0
		00 02	adaptive	55 AA 02 02 00 02 XOR F0	55 BB 02 02 00 02 XOR F0
Test screen	0x03	00 00	Real time	55 AA 02 03 00 00 XOR F0	55 BB 02 03 00 00 XOR F0
		00 01	Checkerboard	55 AA 02 03 00 01 XOR F0	55 BB 02 03 00 01 XOR F0
		00 02	Horizontal gray scale	55 AA 02 03 00 02 XOR F0	55 BB 02 03 00 02 XOR F0
		00 03	半天半地	55 AA 02 03 00 03 XOR F0	55 BB 02 03 00 03 XOR F0
		00 04	Rolling gray scale	55 AA 02 03 00 04 XOR F0	55 BB 02 03 00 04 XOR F0
		00 05	Simulation target	55 AA 02 03 00 05 XOR F0	55 BB 02 03 00 05 XOR F0
		00 06	Vertical gray	55 AA 02 03 00 06 XOR F0	55 BB 02 03 00 06 XOR F0

			scale		
		00 07	Incremental number	55 AA 02 03 00 07 XOR F0	55 BB 02 03 00 07 XOR F0
Save settings	0x04	00 01		55 AA 02 04 00 01 XOR F0	55 BB 02 04 00 01 XOR F0
Restore factory settings	0x05	00 01		55 AA 02 05 00 01 XOR F0	55 BB 02 05 00 01 XOR F0
System temperature rise	0x06	00 xx	0~50	55 AA 02 06 00 xx XOR F0	55 BB 02 06 00 xx XOR F0
Observation model	0x07	00 00	Advanced	55 AA 02 07 00 00 XOR F0	55 BB 02 07 00 00 XOR F0
		00 01	Gain1	55 AA 02 07 00 01 XOR F0	55 BB 02 07 00 01 XOR F0
		00 02	Gain2	55 AA 02 07 00 02 XOR F0	55 BB 02 07 00 02 XOR F0
		00 03	Gain3	55 AA 02 07 00 03 XOR F0	55 BB 02 07 00 03 XOR F0
		00 04	Gain4	55 AA 02 07 00 04 XOR F0	55 BB 02 07 00 04 XOR F0
Integral strength	0x08	00 00	Auto	55 AA 02 08 00 00 XOR F0	55 BB 02 08 00 00 XOR F0
		00 01	Gain1	55 AA 02 08 00 01 XOR F0	55 BB 02 08 00 01 XOR F0
		00 02	Gain2	55 AA 02 08 00 02 XOR F0	55 BB 02 08 00 02 XOR F0
		00 03	Gain3	55 AA 02 08 00 03 XOR F0	55 BB 02 08 00 03 XOR F0

Example of instruction calculation:

Frame rate (50HZ): 55 AA 02 01 13 88 98 F0

Synchronous mode (External synchronization): 55 AA 02 02 00 01 01 F0

5.2.3 video setting page

All downlink commands on video display page: (55 AA 03 + option + command word (2 bytes) + check + F0).

Table 5-3 video settings page commands

Option	option	command	Operation	setting instruction	response command

content					
Analog video mode	0x01	00 00	Y	55 AA 03 01 00 00 XOR F0	55 BB 03 01 00 00 XOR F0
		00 01	X	55 AA 03 01 00 01 XOR F0	55 BB 03 01 00 01 XOR F0
		00 02	K	55 AA 03 01 00 02 XOR F0	55 BB 03 01 00 02 XOR F0
		00 03	B	55 AA 03 01 00 03 XOR F0	55 BB 03 01 00 03 XOR F0
Digital video mode	0x02	00 00	Y16	55 AA 03 02 00 00 XOR F0	55 BB 03 02 00 00 XOR F0
		00 01	Y8	55 AA 03 02 00 01 XOR F0	55 BB 03 02 00 01 XOR F0
		00 02	X	55 AA 03 02 00 02 XOR F0	55 BB 03 02 00 02 XOR F0
Test information	0x03	00 00	无	55 AA 03 03 00 00 XOR F0	55 BB 03 03 00 00 XOR F0
		00 01	Test1	55 AA 03 03 00 01 XOR F0	55 BB 03 03 00 01 XOR F0
		00 02	Test2	55 AA 03 03 00 02 XOR F0	55 BB 03 03 00 02 XOR F0
pseudocolor	0x04	00 00	White hot	55 AA 03 04 00 00 XOR F0	55 BB 03 04 00 00 XOR F0
		00 01	fulgurite	55 AA 03 04 00 01 XOR F0	55 BB 03 04 00 01 XOR F0
		00 02	Iron red	55 AA 03 04 00 02 XOR F0	55 BB 03 04 00 02 XOR F0
		00 03	Hot iron	55 AA 03 04 00 03 XOR F0	55 BB 03 04 00 03 XOR F0
		00 04	medical	55 AA 03 04 00 04 XOR F0	55 BB 03 04 00 04 XOR F0
		00 05	arctic	55 AA 03 04 00 05 XOR F0	55 BB 03 04 00 05 XOR F0
		00 06	rainbow1	55 AA 03 04 00 06 XOR F0	55 BB 03 04 00 06 XOR F0
		00 07	rainbow2	55 AA 03 04 00 07 XOR F0	55 BB 03 04 00 07 XOR F0
mirror	0x05	00 00	无	55 AA 03 05 00 00 XOR F0	55 BB 03 05 00 00 XOR F0
		00 01	Mirror in X direction	55 AA 03 05 00 01 XOR F0	55 BB 03 05 00 01 XOR F0
		00 02	Mirror in Y direction	55 AA 03 05 00 02 XOR F0	55 BB 03 05 00 02 XOR F0
		00 03	Mirror in XY direction	55 AA 03 05 00 03 XOR F0	55 BB 03 05 00 03 XOR F0
ZOOM	0x06	00 00	1X	55 AA 03 06 00 00 XOR F0	55 BB 03 06 00 00 XOR F0
		00 01	2X	55 AA 03 06 00 01 XOR F0	55 BB 03 06 00 01 XOR F0
		00 02	4X	55 AA 03 06 00 02 XOR F0	55 BB 03 06 00 02 XOR F0
Coordinate switch	0x07	00 00	关	55 AA 03 07 00 00 XOR F0	55 BB 03 07 00 00 XOR F0
		00 01	开	55 AA 03 07 00 01 XOR F0	55 BB 03 07 00 01 XOR F0
Coordinate X	0x08	xx xx	0~width-1	55 AA 03 08 xx xx XOR F0	55 BB 03 08 xx xx XOR F0
Coordinate Y	0x09	xx xx	0~height-1	55 AA 03 09 xx xx XOR F0	55 BB 03 09 xx xx XOR F0

Examples of command calculation:

Analog video mode (Y): 55 AA 03 01 00 00 02 F0

Coordinate switch (on): 55 AA 03 07 00 01 05 F0

Coordinate X (639): 55 AA 03 08 02 7F 76 F0

5.2.4 Algorithm control page

All downlink commands of Algorithm control page:(55 AA 04+option+command word(2 bytes)+ check + F0)

Table5-4 commands of algorithm control page

Content	Option	Command	Operation	Instruction	response
Time domain filtering switch	0x01	00 00	off	55 AA 04 01 00 00 XOR F0	55 BB 04 01 00 00 XOR F0
		00 01	on	55 AA 04 01 00 01 XOR F0	55 BB 04 01 00 01 XOR F0
Time domain filtering intensity	0x02	00 xx	0~94	55 AA 04 02 00 xx XOR F0	55 BB 04 02 00 xx XOR F0
Vertical stripe removal switch	0x03	00 00	off	55 AA 04 03 00 00 XOR F0	55 BB 04 03 00 00 XOR F0
		00 01	on	55 AA 04 03 00 01 XOR F0	55 BB 04 03 00 01 XOR F0
Space domain filtering switch	0x05	00 00	off	55 AA 04 05 00 00 XOR F0	55 BB 04 05 00 00 XOR F0
		00 01	on	55 AA 04 05 00 01 XOR F0	55 BB 04 05 00 01 XOR F0
Space domain filtering intensity	0x06	00 xx	0~9	55 AA 04 06 00 xx XOR F0	55 BB 04 06 00 xx XOR F0
DDE intensity	0x07	00 xx	0~7	55 AA 04 07 00 xx XOR F0	55 BB 04 07 00 xx XOR F0
Y8 deviation-correcting switch	0x08	00 00	off	55 AA 04 08 00 00 XOR F0	55 BB 04 08 00 00 XOR F0
		00 01	on	55 AA 04 08 00 01 XOR F0	55 BB 04 08 00 01 XOR F0
bright	0x09	00 xx	0~100	55 AA 04 09 00 xx XOR F0	55 BB 04 09 00 xx XOR F0
contrast	0x0a	00 xx	0~100	55 AA 04 0a 00 xx XOR F0	55 BB 04 0a 00 xx XOR F0
Partition dimming	0x0b	00 00	off	55 AA 04 0b 00 00 XOR F0	55 BB 04 0b 00 00 XOR F0
		00 01	on	55 AA 04 0b 00 01 XOR F0	55 BB 04 0b 00 01 XOR F0
		00 03	mixture	55 AA 04 0b 00 03 XOR F0	55 BB 04 0b 00 03 XOR F0
Dimming mode	0x0c	00 00	linear	55 AA 04 0c 00 00 XOR F0	55 BB 04 0c 00 00 XOR F0
		00 01	histogram	55 AA 04 0c 00 01 XOR F0	55 BB 04 0c 00 01 XOR F0
		00 02	mixture	55 AA 04 0c 00 02 XOR F0	55 BB 04 0c 00 02 XOR F0

IDE filtering level	0x0e	00 00	Level 0	55 AA 04 0e 00 00 XOR F0	55 BB 04 0e 00 00 XOR F0
		00 01	Level 1	55 AA 04 0e 00 01 XOR F0	55 BB 04 0e 00 01 XOR F0
		00 02	Level 2	55 AA 04 0e 00 02 XOR F0	55 BB 04 0e 00 02 XOR F0
		00 03	Level 3	55 AA 04 0e 00 03 XOR F0	55 BB 04 0e 00 03 XOR F0
IDE switch	0x0f	00 00	off	55 AA 04 0f 00 00 XOR F0	55 BB 04 0f 00 00 XOR F0
		00 01	on	55 AA 04 0f 00 01 XOR F0	55 BB 04 0f 00 01 XOR F0
IDE noise reduction level	0x10	00 xx	0~9	55 AA 04 10 00 xx XOR F0	55 BB 04 10 00 xx XOR F0
IDE gain	0x11	00 xx	0~64	55 AA 04 11 00 xx XOR F0	55 BB 04 11 00 xx XOR F0

Examples of command calculation:

Time domain filtering switch (on): 55 AA 04 01 00 01 04 F0

Time domain filtering intensity (10): 55 AA 04 02 00 0A 0C F0

5.2.5 Optical control page

All downlink commands of optical control page: **(55 AA 05 + option + command(2 字节) + check + F0)**

Table5-5 commands of optical control page

Content	option	Command	operation	instruction	response
Focus-	0x01	00 01	Used in conjunction with “key up”	55 AA 05 01 00 01 XOR F0	55 BB 05 01 00 01 XOR F0
Focus+		00 02		55 AA 05 01 00 02 XOR F0	55 BB 05 01 00 02 XOR F0
Zoom-	0x02	00 01	Used in conjunction with “key up”	55 AA 05 02 00 01 XOR F0	55 BB 05 02 00 01 XOR F0
Zoom+		00 02		55 AA 05 02 00 02 XOR F0	55 BB 05 02 00 02 XOR F0
Auto focus	0x03	00 01		55 AA 05 03 00 01 XOR F0	55 BB 05 07 00 01 XOR F0
Wide FOV	0x04	00 01		55 AA 05 04 00 01 XOR F0	55 BB 05 04 00 01 XOR F0

Narrow FOV		00 02		55 AA 05 04 00 02 XOR F0	55 BB 05 04 00 02 XOR F0
Medium FOV		00 03		55 AA 05 04 00 03 XOR F0	55 BB 05 04 00 03 XOR F0

Examples of command calculation:

Zoom- (FOV from narrow to wide):

Send command first: 55 AA 05 02 00 01 06 F0,

Send command after switching to desired FOV: 55 AA 01 01 00 00 00 F0

Auto focus: 55 AA 05 03 00 01 07 F0

5.2.6 Non-uniform correction page

All downlink commands of correction page: (55 AA 06 + option + command(2 bytes) + check + F0)

Table5-6 Non-uniform correction page commands

Content	Option	Command	Operation	Instruction	response
Integration time mode	0x01	01 00	automatic	55 AA 06 01 01 00 XOR F0	55 BB 06 01 01 00 XOR F0
		01 01	manual	55 AA 06 01 01 01 XOR F0	55 BB 06 01 01 01 XOR F0
		01 02	Semi-automatic	55 AA 06 01 01 02 XOR F0	55 BB 06 01 01 02 XOR F0
Integration time mode		10 00	Low temperature mode	55 AA 06 01 10 00 XOR F0	55 BB 06 01 10 00 XOR F0
		10 01	Normal temperature mode	55 AA 06 01 10 01 XOR F0	55 BB 06 01 10 01 XOR F0
		10 02	High temperature mode	55 AA 06 01 10 02 XOR F0	55 BB 06 01 10 02 XOR F0
INT setting	0x02	xx xx		55 AA 06 02 xx xx XOR F0	55 BB 06 02 xx xx XOR F0
Background image mode	0x03	01 00	automatic	55 AA 06 03 01 00 XOR F0	55 BB 06 03 01 00 XOR F0
		01 01	manual	55 AA 06 03 01 01 XOR F0	55 BB 06 03 01 01 XOR F0
background		10 00	Low temperature mode	55 AA 06 03 10 00 XOR F0	55 BB 06 03 10 00 XOR F0
		10 01	Normal temperature mode	55 AA 06 03 10 01 XOR F0	55 BB 06 03 10 01 XOR F0
		10 02	High temperature mode	55 AA 06 03 10 02 XOR F0	55 BB 06 03 10 02 XOR F0

Acquisition B1	0x04	00 01		55 AA 06 04 00 01 XOR F0	55 BB 06 04 00 01 XOR F0
Save B		00 02		55 AA 06 04 00 02 XOR F0	55 BB 06 04 00 02 XOR F0
Load B		00 03		55 AA 06 04 00 03 XOR F0	55 BB 06 04 00 03 XOR F0
Clean B		00 04		55 AA 06 04 00 04 XOR F0	55 BB 06 04 00 04 XOR F0
Acquisition B2	0x05	00 01		55 AA 06 05 00 01 XOR F0	55 BB 06 05 00 01 XOR F0
Save K		00 02		55 AA 06 05 00 02 XOR F0	55 BB 06 05 00 02 XOR F0
Load K		00 03		55 AA 06 05 00 03 XOR F0	55 BB 06 05 00 03 XOR F0
Clean K		00 04		55 AA 06 05 00 04 XOR F0	55 BB 06 05 00 04 XOR F0
Acquisition DeltB	0x06	00 01		55 AA 06 06 00 01 XOR F0	55 BB 06 06 00 01 XOR F0
Save DeltB		00 02		55 AA 06 06 00 02 XOR F0	55 BB 06 06 00 02 XOR F0
Load DeltB		00 03		55 AA 06 06 00 03 XOR F0	55 BB 06 06 00 03 XOR F0
Shutter correction	0x07	00 01		55 AA 06 07 00 01 XOR F0	55 BB 06 07 00 01 XOR F0
Scene correction		00 02		55 AA 06 07 00 02 XOR F0	55 BB 06 07 00 02 XOR F0

Content	Option	Command	Operation	Instruction	response
Defocusing correction		00 03		55 AA 06 07 00 03 XOR F0	55 BB 06 07 00 03 XOR F0
Four-corner correction switch	0x08	00 00	off	55 AA 06 08 00 00 XOR F0	55 BB 06 08 00 00 XOR F0
		00 01	Four-corner template	55 AA 06 08 00 01 XOR F0	55 BB 06 08 00 01 XOR F0
		00 02	on	55 AA 06 08 00 02 XOR F0	55 BB 06 08 00 02 XOR F0

Acquisition four-corner image	0x09	00 01		55 AA 06 09 00 01 XOR F0	55 BB 06 09 00 01 XOR F0
Save four-corner correction		00 02		55 AA 06 09 00 02 XOR F0	55 BB 06 09 00 02 XOR F0
Load four-corner correction		00 03		55 AA 06 09 00 03 XOR F0	55 BB 06 09 00 03 XOR F0
Bad pixel dynamic correction	0x0a	00 00	off	55 AA 06 0a 00 00 XOR F0	55 BB 06 0a 00 00 XOR F0
		00 01	on	55 AA 06 0a 00 01 XOR F0	55 BB 06 0a 00 01 XOR F0
Bad pixel threshold	0x0b	00 xx	0~100	55 AA 06 0b 00 xx XOR F0	55 BB 06 0b 00 xx XOR F0
Seek bad pixel	0x0c	00 01		55 AA 06 0c 00 01 XOR F0	55 BB 06 0c 00 01 XOR F0
Save bad pixel		00 02		55 AA 06 0c 00 02 XOR F0	55 BB 06 0c 00 02 XOR F0
Load bad pixel		00 03		55 AA 06 0c 00 03 XOR F0	55 BB 06 0c 00 03 XOR F0
Clean up bad pixel		00 04		55 AA 06 0c 00 04 XOR F0	55 BB 06 0c 00 04 XOR F0
Manually clean coordinated bad pixel	0x0d	00 00		55 AA 06 0d 00 00 XOR F0	55 BB 06 0d 00 00 XOR F0
Manually add coordinated bad pixel		00 01		55 AA 06 0d 00 01 XOR F0	55 BB 06 0d 00 01 XOR F0

*Note：INT is setting value item.If the selected unit from host is ms,transmit through setting value ×1000.If the selected unit from host is us,transmit through setting value directly.

Examples of command calculation:

Scene correction:55 AA 06 07 00 02 03 F0

Integration time setting value for 11ms:55 AA 06 02 2A F8 D6 F0

6 Mechanical interface description

6.1 Mechanical interface

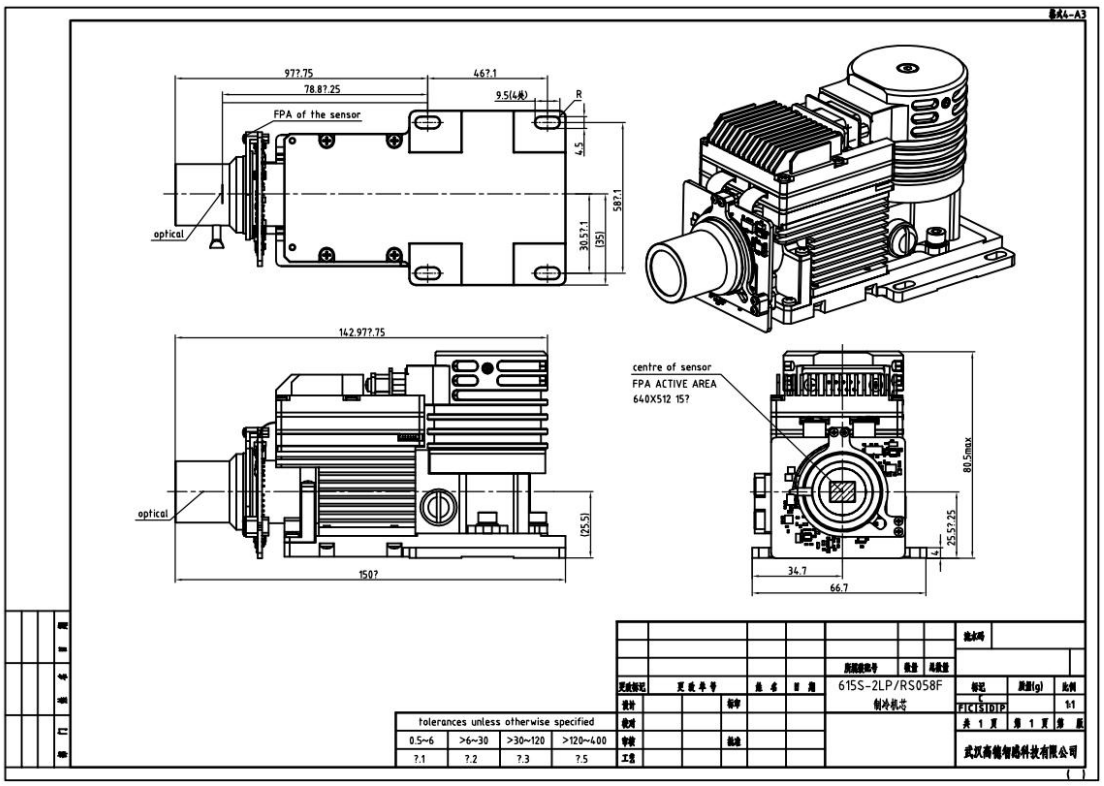


Figure 4-1 Gavin615L mechanical interface

6.2 Optical interface