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S2.0 Series
Area Scan Camera

User Guide

Industrial Automation | New Energy Vehicle | Intelligent Elevator | Intelligent Robot | Digital Energy | Rail Transit

Data code PS00018348A03

Legal Information

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Waste Disposal

The storage, use, and disposal of this product (including optional accessories) must comply with local laws and regulations.

Qualified Personnel

The product/system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel can identify the risks of the product/system and prevent possible dangers.

Proper Use of the Product

Proper transportation, storage, assembly, installation, commissioning, operation, and maintenance are required to ensure the safe operation of the product without any problems. The required ambient conditions must be met. All operations must follow the guidelines provided in this documentation.

Preface

Introduction

The S2.0 series area scan camera supports a bandwidth of 6 Gbit/s, improving the capture efficiency by 600% compared to GE cameras. It supports stable long-distance transmission of up to 15 meters and ensures continuous production with zero missed captures. With its compact 29 mm × 29 mm miniature dimensions, it adapts to confined installation spaces. It applies to industries such as 3C, semiconductors, PCBs, lithium batteries, and silicon wafers.

This document describes the technical specifications, installation, and usage and maintenance information of the series, including the camera hardware, installation and connection guide, nameplate description, component description, installation and commissioning on clients, maintenance guide, and common faults. The product is certified with CE, RoHS, and KC marks, ensuring compliance with environmental and safety standards.

More documents

Name	Data code	Description
S2.0 Series Image Frame Grabber User Guide	PS00018308	Describes the product information, hardware installation, and software control information of the S2.0 series image frame grabber.
S2.0 Series Micro Area Scan Camera User Guide	PS00018248	Describes the technical specifications, installation, usage and maintenance information of the S2.0 series micro area scan camera.
INOMV Image Acquisition and Commissioning Software SDK Installation Guide	19012919	Describes the INOMV operating environment requirements, software installation, and so on.
INOMV Image Acquisition and Commissioning Software SDK User Guide	19012910	Describes the INOMV environment configuration, interface, and functions, including device management, device properties control, data acquisition and preview, and tools.
S2.0 Series Area Scan Camera User Guide (this guide)	PS00018348	Describes the technical specifications, installation, usage and maintenance information of the S2.0 series area scan camera.

Revision history

Date	Version	Description of change(s)
January 2026	A03	• Added *"2.2 Model and Nameplate" on page 11*. • Added *"2.5 Technical Specifications" on page 14*. • Added *"2.6 Spectrum Response Curve" on page 22*. • Added *"5.3.2 Image Format Control" on page 39*. • Added *"5.4.4 Trigger mode." on page 50*.
October 2025	A02	**Updated sections:** • Added *"2.4 Product Dimensions" on page 13* • Added technical specifications (in color) to *"2.5 Technical Specifications" on page 14*. • Added spectral response curves (in color) to *"2.6 Spectrum Response Curve" on page 22*. • Added a figure of the subject being imaged, camera installation direction, and imaging direction to *"4.2.2 Installing the Camera" on page 31*. • Added the drive installation description to *"5.2.1 Installing INOMV" on page 34*. • Added the classification of camera parameters to *" Basic Functions" on page 37*. • Added KC certification to *"8.1 CE, RoHS, and KC Certification" on page 63*. **Added sections:** • Added *"5.3.2 Image Format Control" on page 39*. • Added *"5.3.3 Acquisition Control" on page 41*. • Added *"5.3.6 Image Signal Processor" on page 45*. • Added *" Image Collection and Transmission" on page 46*.
April 2025	A01	• Updated *"2.1 Product Introduction" on page 11*. • Updated *"2.5 Technical Specifications" on page 14*. • Updated *"2.6 Spectrum Response Curve" on page 22*. • Updated *"4.1.1 Operating Environment Requirements" on page 31*.
April 2025	A00	First release.

Access to the guide

The guide is not delivered with the product. Download the PDF file in the following ways:

- Visit *https://www.inovance.com/global*, choose Service&Support > **Support >** Documentation Download.
- Scan the **QR code** on the product with your smartphone.

- Scan the QR code below to install **My Inovance app**, where you can search for and download the guide.

Warranty

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is caused by proper operation of the user. Maintenance will be charged after the warranty expires.

Within the warranty period, maintenance fee will be charged for the following damage:

- Damage caused by operations not following the instructions in the guide
- Damage caused by fire, flood, and unusual voltage
- Damage caused by using the product for unintended functions
- Damage caused by using the product outside the specified scope
- Secondary damage caused by force majeure (natural disasters, earthquakes and lightning strikes)

When applicable, relevant maintenance fee will be charged according to the latest Price List of Inovance. If otherwise agreed upon, the agreed terms and conditions shall prevail.

For details, see the Warranty Card.

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1 Fundamental Safety Instructions

1.1 Safety Precautions

Safety Disclaimer

- This section presents essential safety precautions for proper use of the product. Before use, read through the user guide and comprehend all the safety precautions. Failure to comply with the safety instructions may result in damage to equipment, serious injury, or even death.
- "CAUTION", "WARNING", and "DANGER" messages in the document are supplementary only and do not cover all safety precautions.
- Use this product in environments meeting the design and specification requirements; otherwise, a fault may occur. Noncompliance-caused malfunction or damage to parts are not covered in product quality warranty.
- Inovance shall not be held liable for any physical injuries or property damage caused by improper use.

Safety Levels and Definitions



indicates that failure to comply with the notice will result in severe physical injuries or even death.



indicates that failure to comply with the notice may result in severe physical injuries or even death.



indicates that failure to comply with the notice may result in minor or moderate physical injuries or damage to the equipment.

Fundamental Safety Instructions

- Some drawings in this guide show the product without covers or protective guards to display more details. Be sure to install the covers and protective guards before using the product and operate the product in accordance with this guide.
- Product illustrations in this guide are for reference only. Actual products may vary.

Unpacking



- Do not install the product when you find that the product and its accessories have any damage or corrosion or they have been used.
- Do not install the product when there is water inside the product or any of its parts is missing or damaged.
- Do not install the product when the product name is inconsistent with that in the packing list.



- Check whether the packing is intact and whether there is damage, water seepage, dampness, or deformation before unpacking.
- Unpack the product layer by layer. Do not strike the package violently.
- Check the surface of the equipment and accessories for any damage, rust, and scratches.
- Check the equipment, accessories, and materials in the package against the packing list.

Storage and Transportation



- Package the product strictly before transporting it, and use an enclosed container for long-distance transportation.
- Avoid storage and transportation in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid product and component dropping and strong vibration during transportation.
- Never transport this product with materials that harm or have negative impacts on this product.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply will result in equipment damage.

Installation



- The product installation process must strictly comply with all electrical safety regulations of the country and region of use.
- Installation can be performed only by professionals with a qualification certificate or experience in installing and maintaining low-voltage systems and experience and qualifications in related work, or professionals with basic knowledge and operational skills in low-voltage wiring and low-voltage electronic circuit connections. Non-professionals are not allowed to operate on the equipment.
- Never install indoor products in environments where they may be exposed to rain or moisture. Failure to comply may result in fires or electric shocks.
- Place the products in a location without direct sunlight, away from heat sources such as heaters and flames.



- Read through the guide and safety instructions before installation.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply will result in mechanical hazards.
- Do not modify the product.

Wiring



- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Be sure to use a power adapter provided by a reputable manufacturer. The power adapter must comply with limited power source (LPS) requirements of the safety specifications. For specific requirements, see the product's technical specifications.



- Wiring cables must meet diameter and shielding requirements.
- To avoid electric shock and product damage, make sure that all cables are correctly connected without being exposed and no screws or washers are fallen.
- Reasonably assess the wiring space and do not pull the cables.
- Shield the cables properly or do not route the product cable together with high-power equipment cables.
- To avoid electric shock and product damage, make sure that all cables are correctly connected without being exposed and no screws or washers are fallen.
- During wiring, follow proper electrostatic discharge (ESD) proceduresand wear an antistatic wrist strap. Failure to comply will result in damage to the equipment or internal product circuits.

Power-On



- Before power-on, make sure that the product is installed properly with reliable wiring.
- Check that the power supply meets equipment requirements before power-on to prevent equipment damage or fire.

Operation



- Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply will result in electric shocks.
- Do not touch any heatsink components of the product to check temperature. Failure to comply may result in burns.

Maintenance



- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not maintain the equipment while power is on. Failure to comply will result in electric shocks.



- Do not directly touch the image sensor. When cleaning it, use a soft and clean cloth slightly dampened with alcohol to wipe the sensor.
- Attach the dust cover to the equipment not in use to prevent contamination of the image sensor.
- Perform routine and periodic inspection and maintenance on the equipment and keep a maintenance record.

Repair
DANGER . Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals. . Do not repair the equipment while power is on. Failure to comply may result in electric shock.
WARNING . The equipment must be troubleshooted and repaired by professionals in accordance with the maintenance instructions. The repair person must maintain maintenance records. . Replace quick-wear parts of the product according to the replacement instructions. . After the equipment is replaced, perform wiring inspection and parameter settings again.

Disposal
WARNING . Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, physical injuries, or even death. . Recycle retired equipment in accordance with waste disposal standards of the industry to avoid environmental pollution.

Electromagnetic Interference Prevention Precautions

This product may cause radio interference in life. In this case, users may need to take practical measures to address the interference.

Warning

- Do not place the product in any place with electromagnetic interference.
- When using shielded cables, ensure the integrity.
- Product control lines and industrial light source power cables must be wired separately to prevent bundled wiring.
- Product power cables must be wired separately from data cables and signal cables.
- If the product is frequently powered on and off, enhance voltage stabilization and isolation.
- Insulate any unused cables of the product.
- During product installation and use, prevent high-voltage leakage and similar phenomena.
- Use network cables with the shielding function to connect to the product.

1.2 Industrial Information Security

This product provides an interface to connect to the network and transmit data through the network interface. To protect factories, systems, machines, and networks from cyber attacks, appropriate industrial information security protection mechanisms need to be implemented to ensure the safe operation of factories, systems, machines, and networks.

The customer is responsible for providing and continuously ensuring a secure connection between the product and the customer's network or any other network, to prevent unauthorized access to their factory, systems, machines, and networks. The system or machine may only be connected to

the corporate network or the Internet when a secure connection is established and proper security measures are in place (for example, using antivirus software and installing firewalls).

INOVANCE continuously develops and improves its products and solutions to enhance safety. It is strongly recommended that you update your products promptly and always use the latest product versions.



Malware (such as viruses, Trojans, and worms) can bring the device into an unsafe operating state, resulting in death, serious injury, and property damage. Observe the following precautions strictly:

- Always use the latest software version. If the product version is no longer supported or the latest program version is not applied, customers are at increased risk of cyberattacks.
- Implement and maintain appropriate security measures (including but not limited to deploying anti-virus software, firewall, WAF, IPS/IDS, situational awareness system, ID verification, and data encryption) to prevent files in the removable storage device from being damaged by malware and to protect products, networks, systems, and interfaces from unauthorized access, disruption, intrusion, data leakage, or information theft.
- Check all safety-related interfaces and settings after commissioning.

2 Product Information

2.1 Product Introduction

The S2.0 series industrial area scan camera features a new advanced transmission protocol and the Power Over Coax (PoC) coaxial cable power supplying technology. A single cable provides a transmission bandwidth of up to 6 Gbit/s, with strong anti-interference capability for data transmission, and supports a maximum transmission distance of 15 m without a relay. The product is widely used in industries such as 3C, semiconductors, PCBs, lithium batteries, and silicon crystals.

S2.0 series area scan camera features:

- Up to 6 Gbit/s bandwidth
- High stability, reliable connection, and no frame loss
- Plug and play with simple configuration
- Ultra-small size: 29 mm x 29 mm x 40.9 mm
- Power supply, data transmission, and signal control through a single cable
- Low power consumption of 0.7 W at least

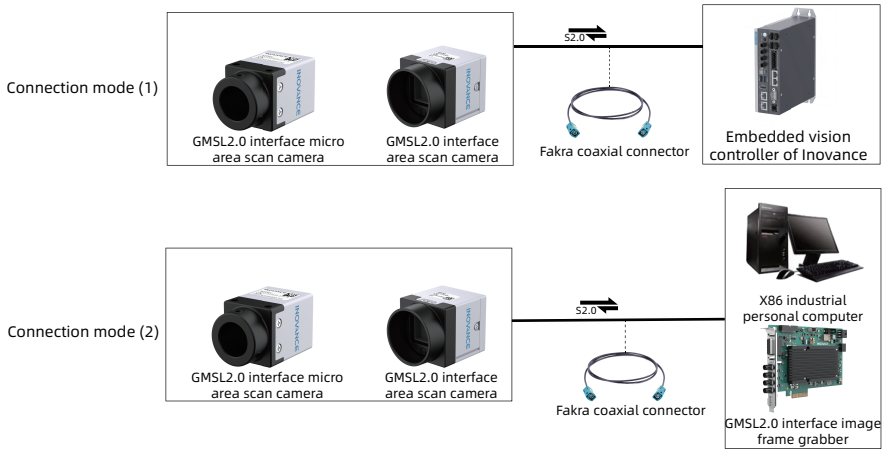


Figure 2-1 System application topology

2.2 Model and Nameplate

VC 21-050 S M-073-D-*
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

Table 2–1 Model description

① **Product family** VC: Industrial camera	⑤ **Color specifications** M: Black-white C: Color CN: Color and near infrared
② **Product series** 21: 2D area scan 22: 2D line scan	⑥ **Frame rate/Line frequency** 073: 73 FPS (2D area scan) 100: 100 kHz (2D line scan)

③ **Resolution** 050: 5M (2D area scan) 081: 8K line scan, 1 line (2D line scan) 166: 16K line scan, 6 line (2D area scan)	⑦ **Extension bit** X: 20 mm x 20 mm enclosure D: 29 mm x 29 mm enclosure
④ **Interface type** C: CameraLink interface X: CoaXPress interface G: GigE interface 10G: 10GigE interface U: USB interface S: GMSL2.0 interface	⑧ **Version** INT: International version

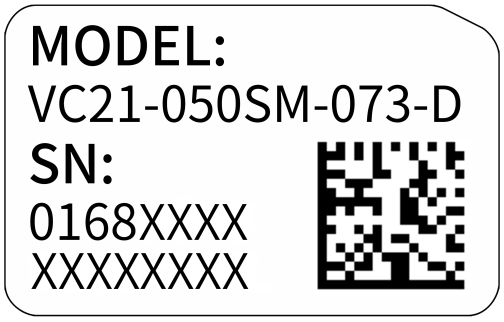
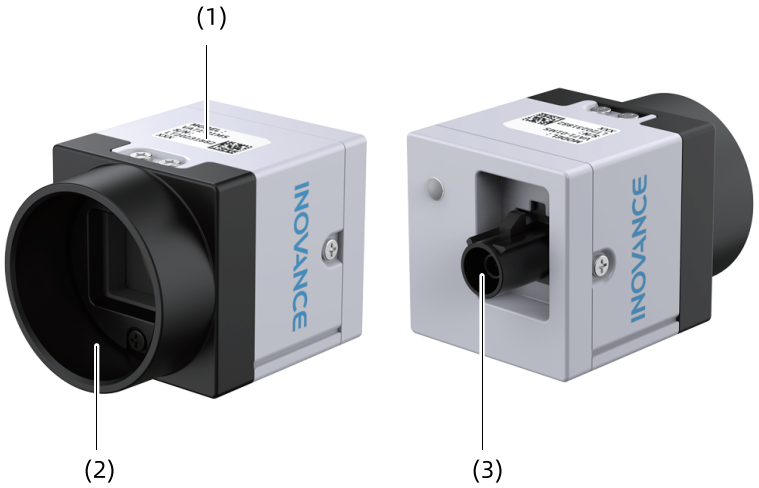


Figure 2-2 Nameplate

2.3 Components



No.	Component
(1)	Nameplate
(2)	Lens interface
(3)	Fakra connector interface

2.4 Product Dimensions

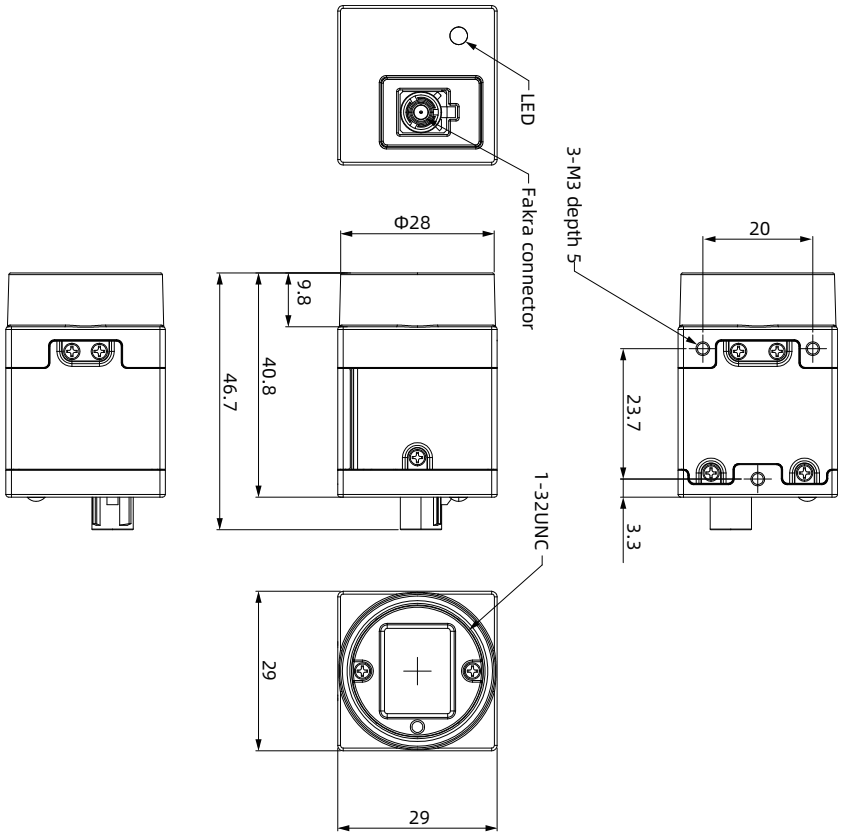


Figure 2-3 Dimensions of S2.0 series area scan camera (unit: mm)

2.5 Technical Specifications

Table 2–2 Technical specifications (black-white)

Product Model		VC21-004SM-450-D	VC21-016SM-246-D	VC21-020SM-130-D	VC21-050SM-073-D	VC21-060SM-060-D
Image parameters	Sensor type	OG02C1B	OG02C1B	SC235HGS-MS	GMAX3405-AVM	OS06A1B
	Max. resolution	720× 540	1440× 1080	1600 x 1200	2448× 2048	3200× 1944
	Sensor size	1/2.5''	1/2.5''	1/2.6''	2/3''	1/2.4''
	Pixel size (μm)	6.9	3.45	3.45	3.4	2
	Color	Black-white	Black-white	Black-white	Black-white	Black-white
	Image format	Mono 8/10	Mono 8/10	Mono 8/10	Mono 8/10	Mono 8/10
	Shutter	Global shutter	Global shutter	Global shutter	Global shutter	Rolling shutter
	Frame rate under full-frame resolution (FPS)	Continuous: 450 Trigger: 450[1]	Continuous: 246 Trigger: 246[1]	Continuous: 130 Trigger: [2]	Continuous: 73 Trigger: 73	Continuous: 60 Trigger: not supported
	Data depth (bit)	10/8	10/8	10/8	10/8	10/8
	Dynamic range (dB)	65.2	65.2	61.5	67	66
	Signal-to-noise ratio (dB)	40.8	40.8	37.5	39	39
	Exposure time	Range: 6.9 μs to 227.04 ms Step: 6.93 μs	Range: 6.9 μs to 227.04 ms Step: 6.93 μs	Range: 40 μs to 400 ms Step: 6.17 μs	Range: 3.2 μs to 426 ms Step: 0.05 μs	Range: 16.6 μs to 1s Step: 8.3 μs
	Binning	-	2x2 On average	2x2 On average	-	2x2 On average
	Temperature reading	Refresh during stream pull	Refresh during stream pull	Refresh during stream pull	Refresh in real time	-
	Number of defective pixels (PPM)	50	50	50	50	50
	Trigger mode.	FrameStart	FrameStart	ExposureStart	ExposureStart	ExposureStart
Electrical characteristics	Data interface	S2.0	S2.0	S2.0	S2.0	S2.0
	Power supply interface	S2.0	S2.0	S2.0	S2.0	S2.0
	Digital I/O	See the GMSL2.0 interface image frame grabber.	See the GMSL2.0 interface image frame grabber.	See the GMSL2.0 interface image frame grabber.	See the GMSL2.0 interface image frame grabber.	Not supported
	Power consumption (W)	0.816	0.9	0.7	1.5	0.6
	Operating voltage (V)	12 VDC	12 VDC	12 VDC	12 VDC	12 VDC

Product Model		VC21-004SM-450-D	VC21-016SM-246-D	VC21-020SM-130-D	VC21-050SM-073-D	VC21-060SM-060-D
Structure	Lens interface	C	C	C	C	C
	Outline dimensions (mm)	29×29×40.9	29×29×40.9	29×29×40.9	29×29×40.9	29×29×40.9
	Weight (g)	80	80	80	80	80
Operating environment	Temperature	Operating temperature: 0°C to 50°C Storage temperature: -30°C to +70°C	Operating temperature: 0°C to 50°C Storage temperature: -30°C to +70°C	Operating temperature: 0°C to 50°C Storage temperature: -30°C to +70°C	Operating temperature: 0°C to 50°C Storage temperature: -30°C to +70°C	Operating temperature: 0°C to 50°C Storage temperature: -30°C to +70°C
	Humidity	≤ 95% RH (without condensation)	≤ 95% RH (without condensation)	≤ 95% RH (without condensation)	≤ 95% RH (without condensation)	≤ 95% RH (without condensation)

Product Model		VC21-080SM-050-D	VC21-120SM-030-D	VC21-120SM-030B-D	VC21-200SM-020-D
Image parameters	Sensor type	AR0822NPSM	AR1223NPSM	GMAX3412-AVM	AR2020-CSSM
	Max. resolution	3840× 2160	4096× 3046	4096× 3072	5120× 3840
	Sensor size	1/1.8''	1/1.6''	1.1''	1/1.8''
	Pixel size (μm)	2	2	3.4	1.4
	Color	Black-white	Black-white	Black-white	Black-white
	Image format	Mono 8/10	Mono 8/10	Mono 8/10	Mono 8/10
	Shutter	Rolling shutter	Rolling shutter	Global shutter	Rolling shutter
	Frame rate under full-frame resolution (FPS)	Continuous: 50 Trigger: 49	Continuous: 30 Trigger: 30	Continuous: 30 Trigger: 30	Continuous: 20 Trigger: 20
	Data depth (bit)	10/8	10/8	10/8	10/8
	Dynamic range (dB)	78	78	68	73
	Signal-to-noise ratio (dB)	39	39	39	39
	Exposure time	Range: 13.1 μs to 859 ms Step: 9.1 μs	Range: 10.4 μs to 684 ms Step: 10.4 μs	Range: 31.3 μs to 655 ms Step: 0.05 μs	Range: 12.7 μs to 832 ms Step: 12.7 μs
	Binning	2x2 4x4 On average	2x2 4x4 On average	-	2x2 4x4 Downsampling
	Temperature reading	Refresh in real time	Refresh in real time	Refresh in real time	Refresh in real time
	Number of defective pixels (PPM)	50	50	50	50
	Trigger mode.	ExposureStart FrameStart GRR[3]	ExposureStart FrameStart GRR[3]	ExposureStart	ExposureStart GRR[3]
Electrical characteristics	Data interface	S2.0	S2.0	S2.0	S2.0
	Power supply interface	S2.0	S2.0	S2.0	S2.0
	Digital I/O	See the GMSL2.0 interface image frame grabber.	See the GMSL2.0 interface image frame grabber.	See the GMSL2.0 interface image frame grabber.	See the GMSL2.0 interface image frame grabber.
	Power consumption (W)	1.0	1.0	1.7	0.8
	Operating voltage (V)	12 VDC	12 VDC	12 VDC	12 VDC
Structure	Lens interface	C	C	C	C
	Outline dimensions (mm)	29×29×40.9	29×29×40.9	29×29×40.9	29×29×40.9
	Weight (g)	80	80	80	80

Product Model		VC21-080SM-050-D	VC21-120SM-030-D	VC21-120SM-030B-D	VC21-200SM-020-D
Operating environment	Temperature	Operating temperature: 0°C to 50°C Storage temperature: –30°C to +70°C	Operating temperature: 0°C to 50°C Storage temperature: –30°C to +70°C	Operating temperature: 0°C to 50°C Storage temperature: –30°C to +70°C	Operating temperature: 0°C to 50°C Storage temperature: –30°C to +70°C
	Humidity	≤ 95% RH (without condensation)	≤ 95% RH (without condensation)	≤ 95% RH (without condensation)	≤ 95% RH (without condensation)

Table 2–3 Technical specifications (in color)

Product Model		VC21-004SC-450-D	VC21-016SC-246-D	VC21-020SC-130-D	VC21-050SC-073-D	VC21-060SC-060-D
Image parameters	Sensor type	OG02C10	OG02C10	SC235HGS-CS	GMAX3405-AVC	OS06A10
	Max. resolution	720× 540	1440× 1080	1600 x 1200	2448× 2048	3200× 1944
	Sensor size	1/2.5''	1/2.5''	1/2.6''	2/2.53''	1/2.4''
	Pixel size (μm)	6.9	3.45	3.45	2.2	2
	Color	Color	Color	Color	Color	Color
	Image format	Bayer GB 8/10	Bayer GB 8/10	Bayer RG 8/10	Bayer GB 8/10	Bayer GB 8/10
	Shutter	Global shutter	Global shutter	Global shutter	Global shutter	Rolling shutter
	Frame rate under full-frame resolution (FPS)	Continuous: 450 Trigger: 450[1]	Continuous: 246 Trigger: 246[1]	Continuous: 130 Trigger: [2]	Continuous: 73 Trigger: 73	Continuous: 60 Trigger: not supported
	Data depth (bit)	10/8	10/8	10/8	10/8	10/8
	Dynamic range (dB)	65.2	65.2	61.5	67	66
	Signal-to-noise ratio (dB)	40.8	40.8	37.5	39	39
	Exposure time	Range: 6.9 μs to 227.04 ms Step: 6.93 μs	Range: 6.9 μs to 227.04 ms Step: 6.93 μs	Range: 40 μs to 400 ms Step: 6.17 μs	Range: 3.2 μs to 426 ms Step: 0.05 μs	Range: 16.6 μs to 1s Step: 8.3 μs
	Binning	-	2x2 On average	2x2 On average	-	2x2 On average
	Temperature reading	Refresh during stream pull	Refresh during stream pull	Refresh during stream pull	Refresh in real time	-
	Number of defective pixels (PPM)	50	50	50	50	50
	Trigger mode.	FrameStart	FrameStart	ExposureStart	ExposureStart	ExposureStart
Electrical characteristics	Data interface	S2.0	S2.0	S2.0	S2.0	S2.0
	Power supply interface	S2.0	S2.0	S2.0	S2.0	S2.0
	Digital I/O	See the GMSL2.0 interface image frame grabber.	See the GMSL2.0 interface image frame grabber.	See the GMSL2.0 interface image frame grabber.	See the GMSL2.0 interface image frame grabber.	Not supported
	Power consumption (W)	0.816	0.9	0.7	1.5	0.6
	Operating voltage (V)	12 VDC	12 VDC	12 VDC	12 VDC	12 VDC
Structure	Lens interface	C	C	C	C	C
	Outline dimensions (mm)	29×29×40.9	29×29×40.9	29×29×40.9	29×29×40.9	29×29×40.9
	Weight (g)	80	80	80	80	80

Product Model		VC21-004SC-450-D	VC21-016SC-246-D	VC21-020SC-130-D	VC21-050SC-073-D	VC21-060SC-060-D
Operating environment	Temperature	Operating temperature: 0°C to 50°C Storage temperature: -30°C to +70°C	Operating temperature: 0°C to 50°C Storage temperature: -30°C to +70°C	Operating temperature: 0°C to 50°C Storage temperature: -30°C to +70°C	Operating temperature: 0°C to 50°C Storage temperature: -30°C to +70°C	Operating temperature: 0°C to 50°C Storage temperature: -30°C to +70°C
	Humidity	≤ 95% RH (without condensation)	≤ 95% RH (without condensation)	≤ 95% RH (without condensation)	≤ 95% RH (without condensation)	≤ 95% RH (without condensation)

Product Model		VC21-080SC-050-D	VC21-120SC-030-D	VC21-120SC-030B-D	VC21-200SC-020-D
Image parameters	Sensor type	AR0822NPSC	AR1223NPSC	GMAX3412-AVC	AR2020-CSSC
	Max. resolution	3840× 2160	4096× 3046	4096× 3072	5120× 3840
	Sensor size	1/1.8''	1/1.6''	1.1''	1/1.8''
	Pixel size (μm)	2	2	3.4	1.4
	Color	Color	Color	Color	Color
	Image format	Bayer GR 8/10	Bayer GR 8/10	Bayer GB 8/10	Bayer GB 8/10
	Shutter	Rolling shutter	Rolling shutter	Global shutter	Rolling shutter
	Frame rate under full-frame resolution (FPS)	Continuous: 50 Trigger: 49	Continuous: 30 Trigger: 30	Continuous: 30 Trigger: 30	Continuous: 20 Trigger: 20
	Data depth (bit)	10/8	10/8	10/8	10/8
	Dynamic range (dB)	78	78	68	73
	Signal-to-noise ratio (dB)	39	39	39	39
	Exposure time	Range: 13.1 μs to 859 ms Step: 9.1 μs	Range: 10.4 μs to 684 ms Step: 10.4 μs	Range: 31.3 μs to 655 ms Step: 0.05 μs	Range: 12.7 μs to 832 ms Step: 12.7 μs
	Binning	2x2 4x4 On average	2x2 4x4 On average	-	2x2 4x4 On average
	Temperature reading	Refresh in real time	Refresh in real time	Refresh in real time	Refresh in real time
	Number of defective pixels (PPM)	50	50	50	50
	Trigger mode.	ExposureStart FrameStart GRR[3]	ExposureStart FrameStart GRR[3]	ExposureStart	ExposureStart GRR[3]
Electrical characteristics	Data interface	S2.0	S2.0	S2.0	S2.0
	Power supply interface	S2.0	S2.0	S2.0	S2.0
	Digital I/O	See the GMSL2.0 interface image frame grabber.	See the GMSL2.0 interface image frame grabber.	See the GMSL2.0 interface image frame grabber.	See the GMSL2.0 interface image frame grabber.
	Power consumption (W)	1.0	1.0	1.7	0.8
	Operating voltage (V)	12 VDC	12 VDC	12 VDC	12 VDC
Structure	Lens interface	C	C	C	C
	Outline dimensions (mm)	29×29×40.9	29×29×40.9	29×29×40.9	29×29×40.9
	Weight (g)	80	80	80	80

Product Model		VC21-080SC-050-D	VC21-120SC-030-D	VC21-120SC-030B-D	VC21-200SC-020-D
Operating environment	Temperature	Operating temperature: 0°C to 50°C Storage temperature: –30°C to +70°C	Operating temperature: 0°C to 50°C Storage temperature: –30°C to +70°C	Operating temperature: 0°C to 50°C Storage temperature: –30°C to +70°C	Operating temperature: 0°C to 50°C Storage temperature: –30°C to +70°C
	Humidity	≤ 95% RH (without condensation)	≤ 95% RH (without condensation)	≤ 95% RH (without condensation)	≤ 95% RH (without condensation)

Note

Models with the "-INT" suffix are international versions; their technical specifications are identical to the standard models without the suffix.

Note

[1]:

- In trigger mode, this model has specific requirements for exposure time and trigger period settings. Failure to meet these requirements will result in no image output. The formula is as follows:
  Trigger period > Exposure time + delay (326 μs)Additionally
  , to ensure the stability of the trigger period, trigger signals (
  such as those from a PLC) require filtering.
- In trigger mode, there will be a delay in exposure time.

[2]: In trigger mode, an appropriate exposure time must be set to avoid frame loss or image errors. The formula is as follows:

Formula	Abbreviation	Variable Meaning	Unit
T < P – 1000/f	P	Trigger period	ms
	f	Camera frame rate	FPS
	T	Exposure time	ms

For example, the trigger period is 10 ms (100 Hz) and the camera frame rate is 130 FPS.

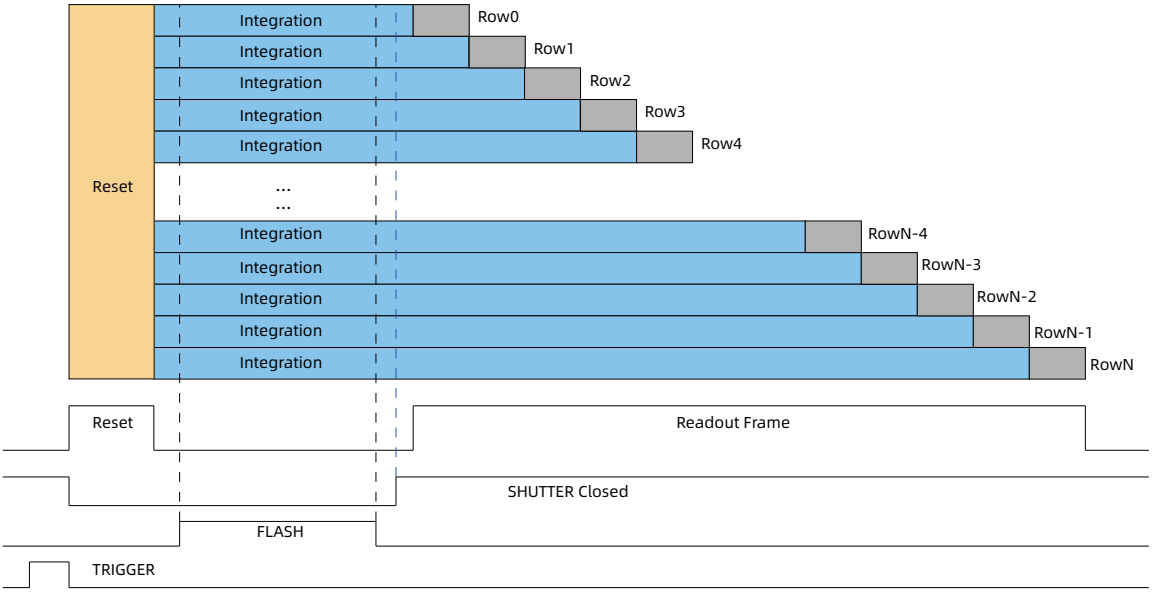
In this case, the formula is T < 10 – 1000/130. The exposure time is less than 2.3 ms.

[3]: GRR is short for Global Reset Release, which is an exposure mode. For details, see the next section.

GRR is short for Global Reset Release, which is an exposure mode.

By allowing all pixel rows to be reset simultaneously and integrating incident light, the GRR mode can help mitigate visual artifacts resulted from non-synchronous row exposure in electronic rolling shutters (ERSs).

In GRR mode, all rows begin to be exposed at the same time but the exposure end time varies with rows, as shown in the following figure:



GRR Mode Operation Timing Sequence

To achieve imaging effects equivalent to global shutters, you must control the time when the external light source is triggered. The GMSL2.0 interface image frame grabber can provide synchronous trigger pulse signals and strobe control signals.

2.6 Spectrum Response Curve

Spectrum response curves of S2.0 series area scan cameras

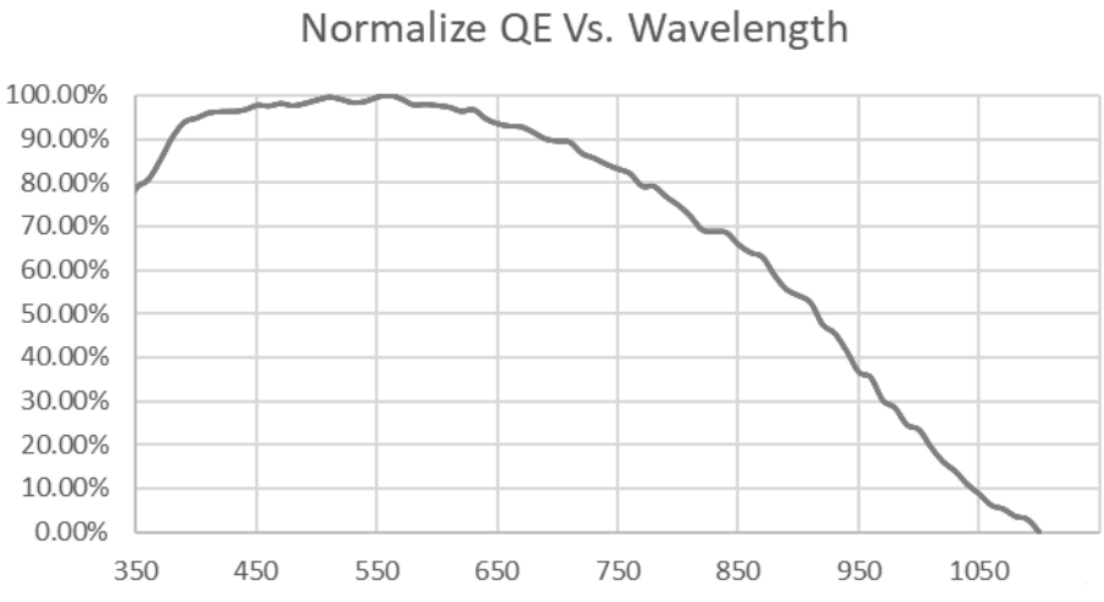


Figure 2-4 Spectrum response curve for VC21-004SM-450-D and VC21-016SM-246-D

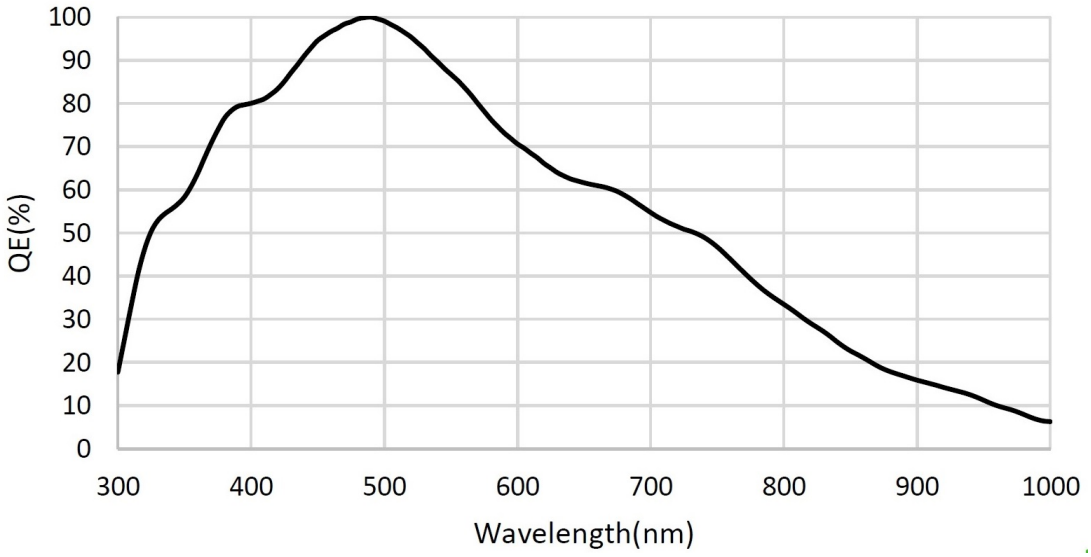


Figure 2-5 Spectrum response curve for VC21-020SM-130-D

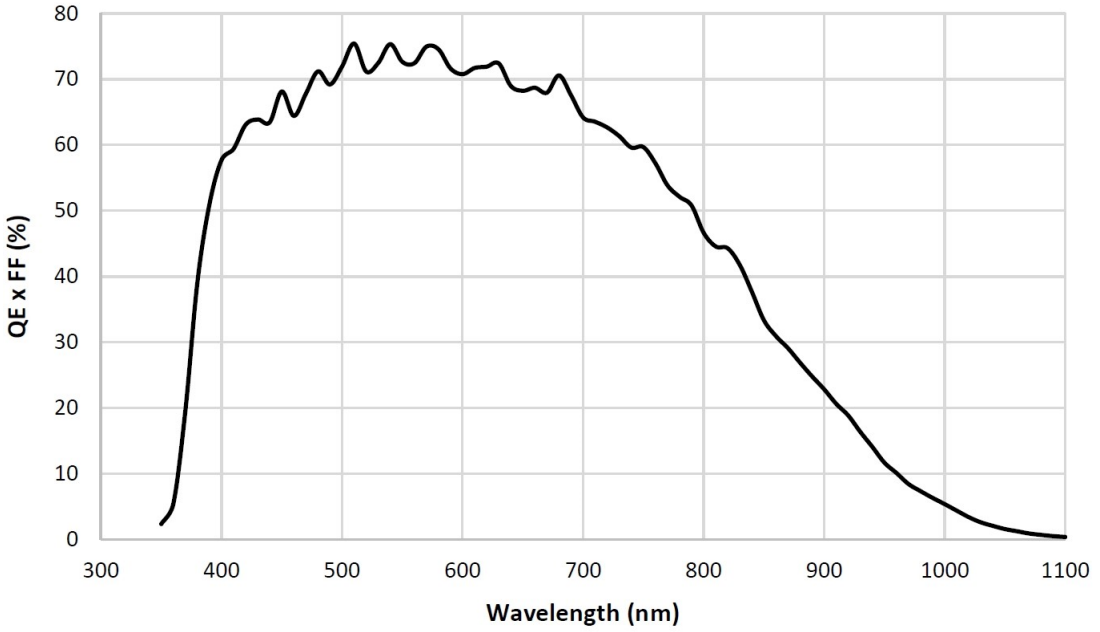


Figure 2-6 Spectrum response curve for VC21-050SM-073-D

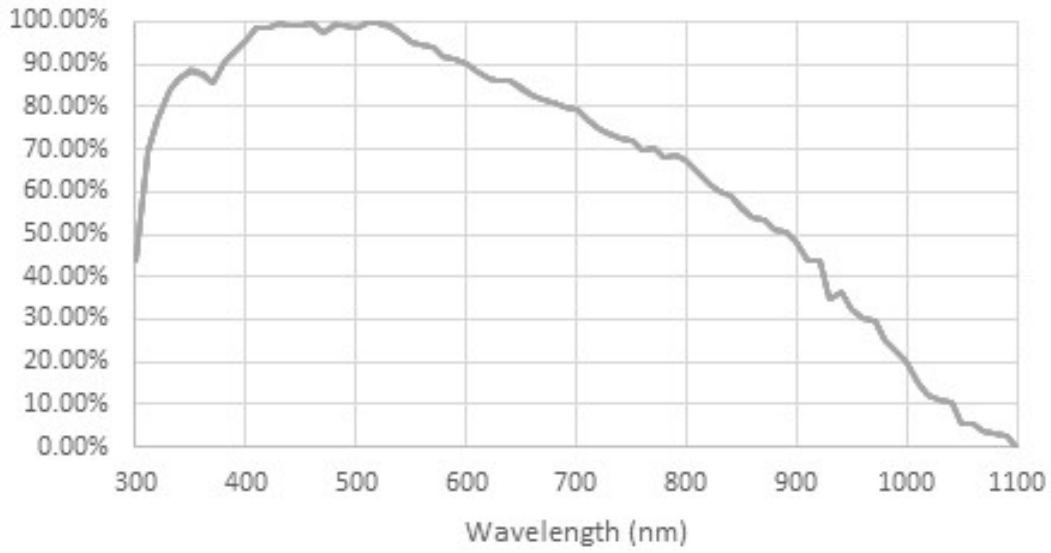


Figure 2-7 Spectrum response curve for VC21-060SM-060-D

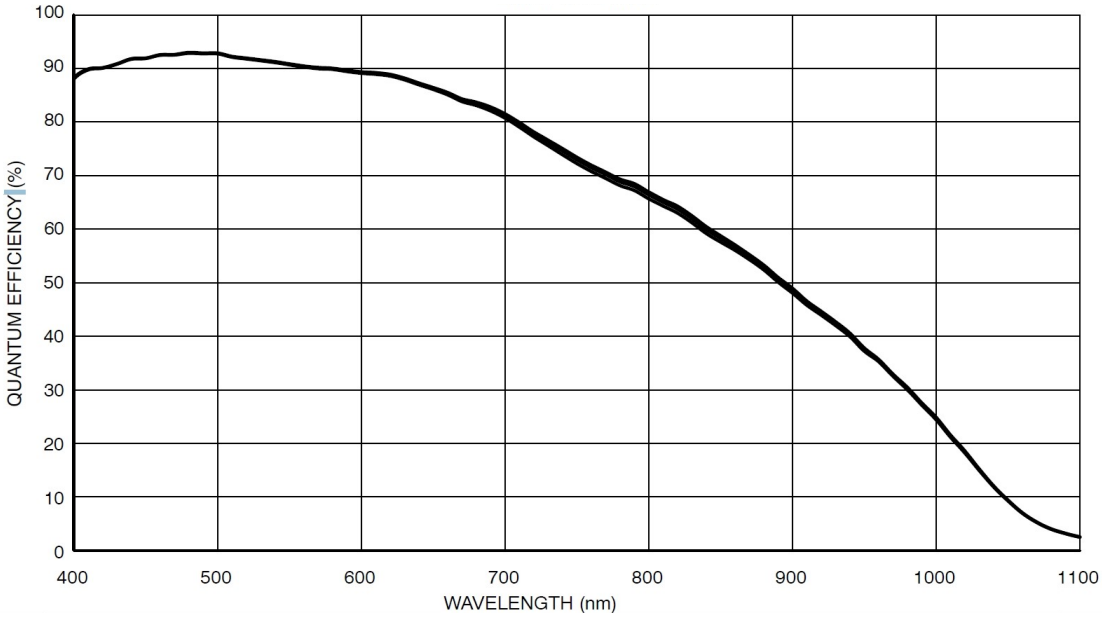


Figure 2-8 Spectrum response curve for VC21-080SM-050-D and VC21-120SM-030-D

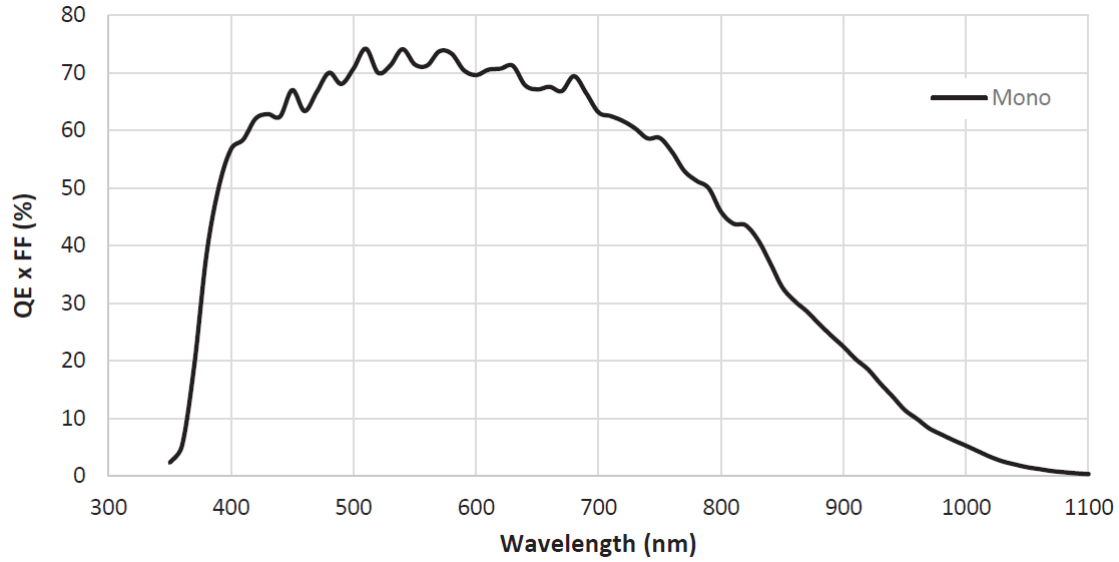


Figure 2-9 Spectrum response curve for VC21-120SM-030B-D

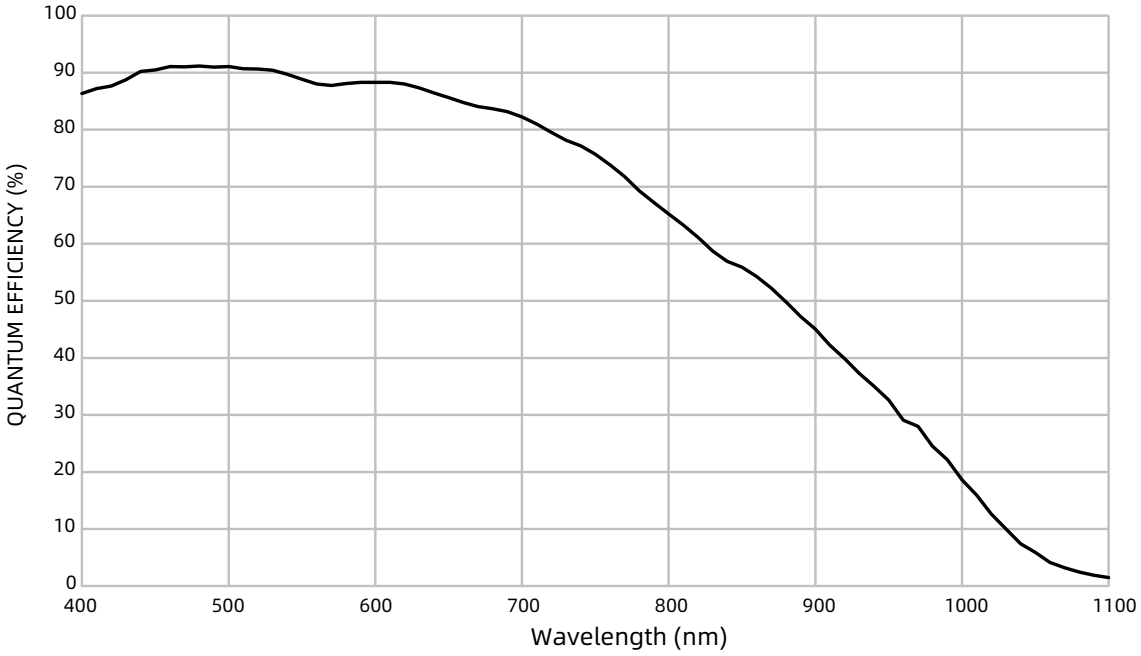


Figure 2-10 Spectrum response curve for VC21-200SM-020-D

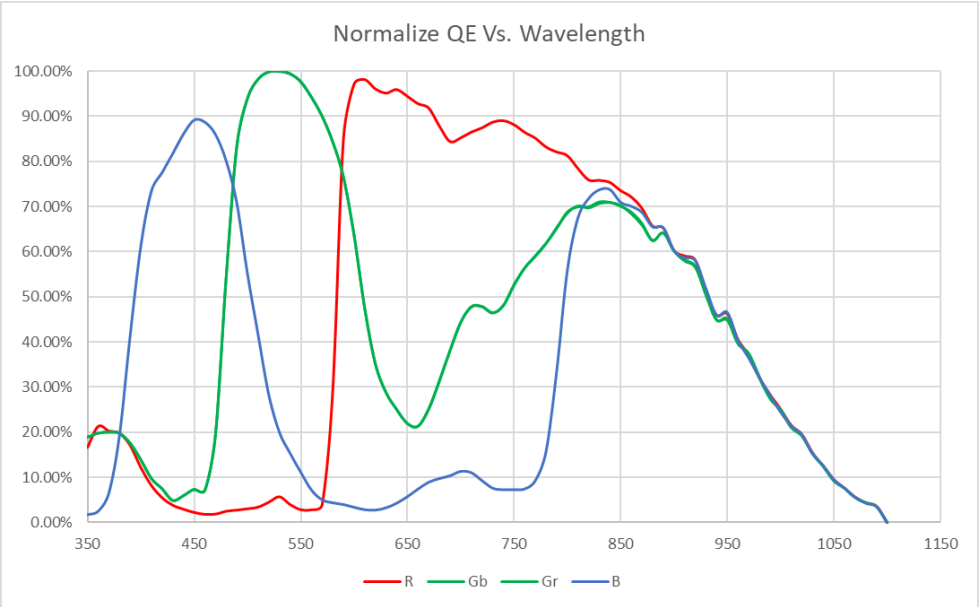


Figure 2-11 Spectrum response curve for VC21-004SC-450-D and VC21-016SC-246-D

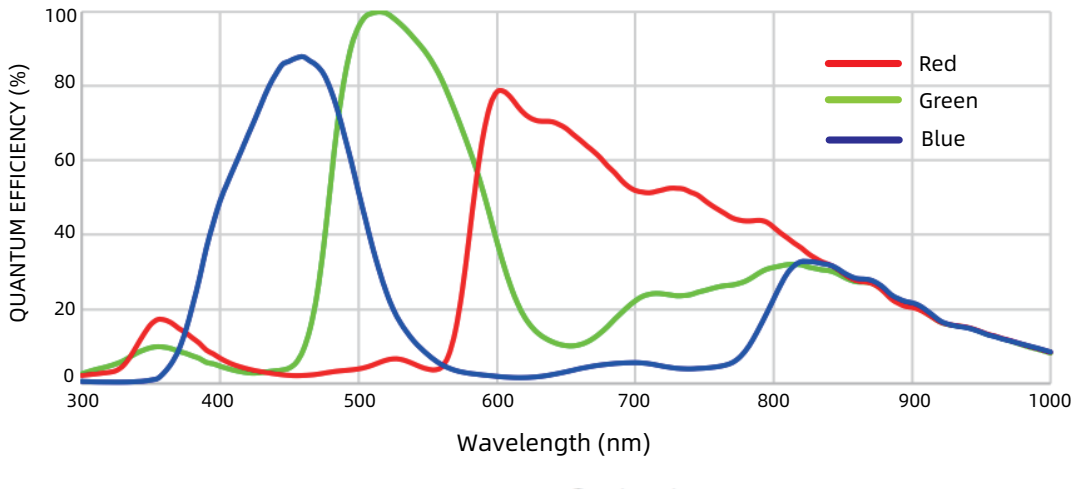


Figure 2-12 Spectral response curve for VC21-020SC-130-D

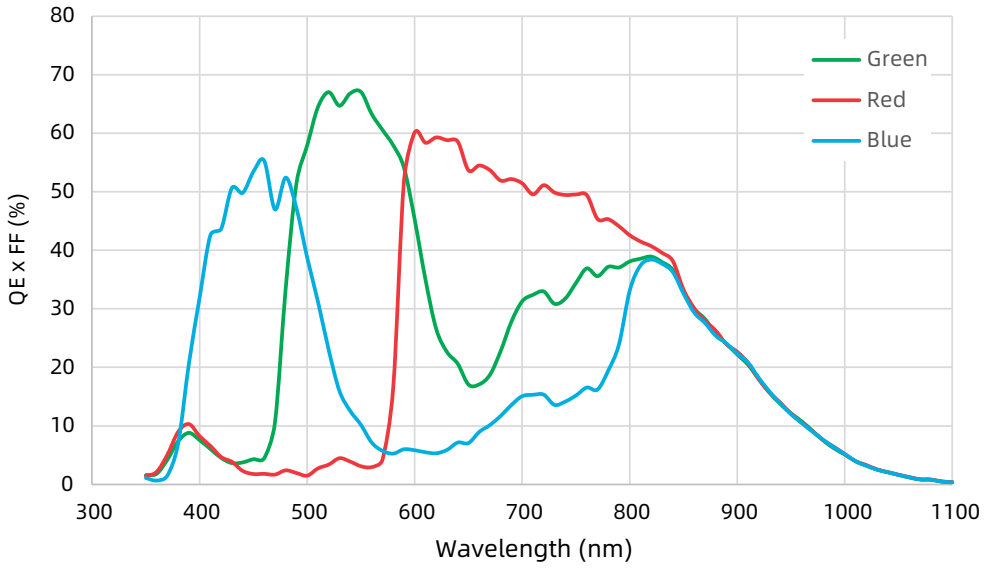


Figure 2-13 Spectrum response curve for VC21-050SM-073-D

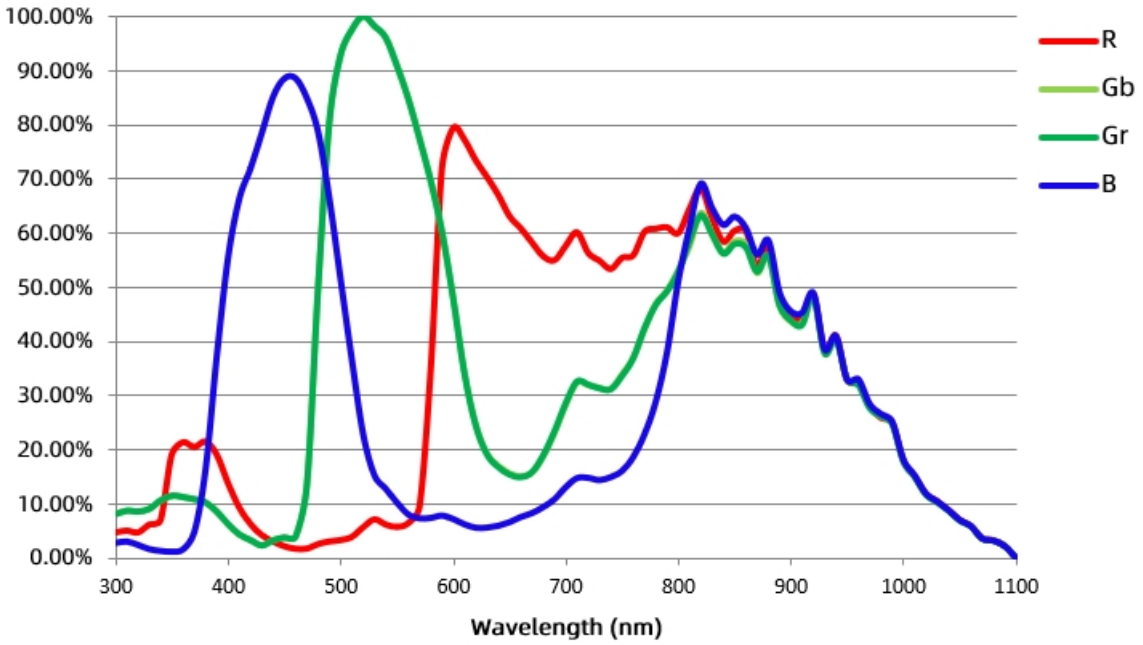


Figure 2-14 Spectral response curve for VC21-060SC-060-D

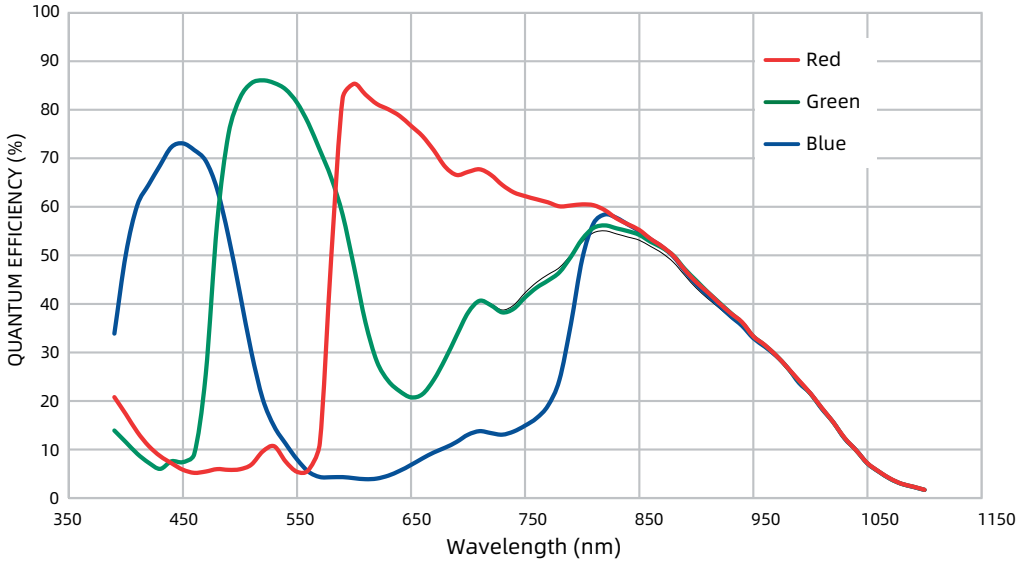


Figure 2-15 Spectral response curve for VC21-080SC-050-D and VC21-120SC-030-D

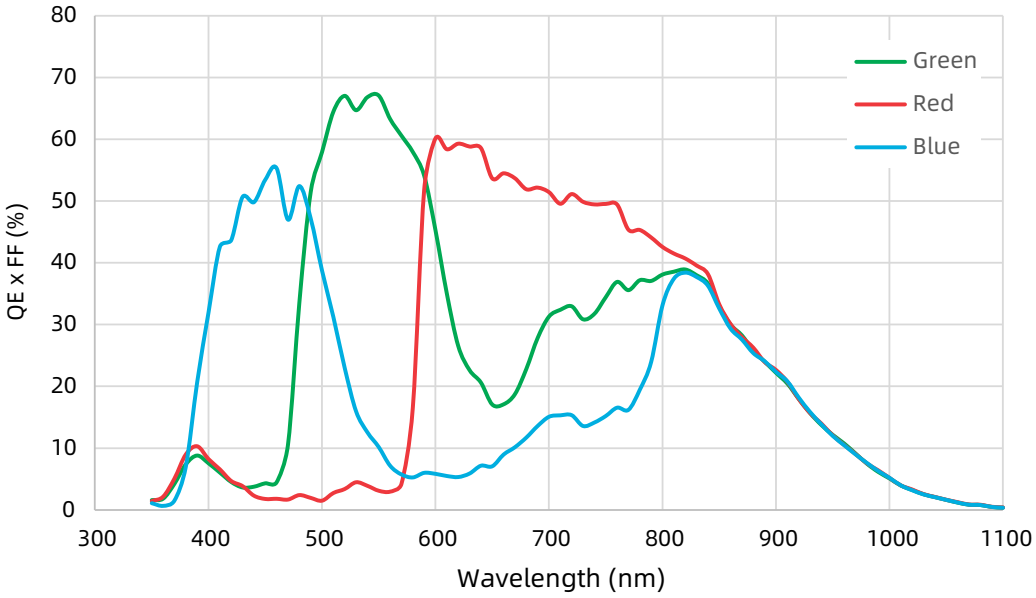


Figure 2-16 Spectral response curve for VC21-120SC-030B-D

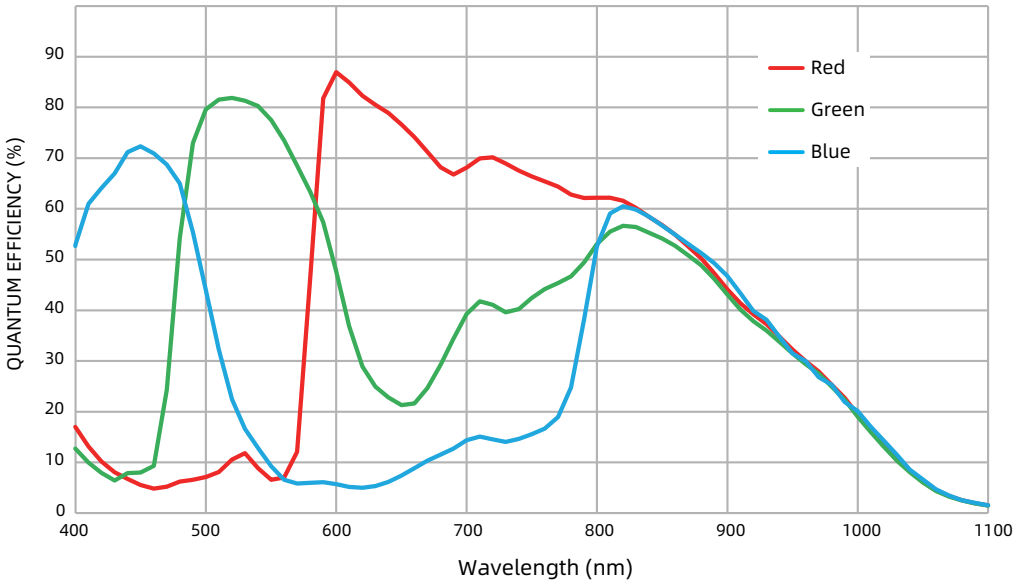


Figure 2-17 Spectral response curve for VC21-200SC-020-D

3 Camera Hardware

3.1 Power Supply

The S2.0 series camera features the PoC coaxial cable power supplying technology and is used with the GMSL2.0 interface image frame grabber of Inovance. The coaxial cable is used to transmit data and power to the camera. Do not supply power for the camera in other ways.

3.2 S2.0 Transmission

S2.0 transmission is a custom transmission name by Inovance, which is used to transmit full-duplex high-speed Serdes signals.

3.3 Communication Interface

Theoretically, the GMSL2.0 interface supports a maximum transmission rate of 6 Gbit/s and a maximum transmission distance of 15 m. To achieve the transmission performance, use the cables provided by Inovance.

3.4 LED Indicator

An GMSL2.0 interface camera is equipped with a monochrome green LED indicator.

- Steady on: The power supply for the device is normal.
- Off: The device is not connected to any power supply, or the device is faulty.

3.5 Trigger Input

The trigger input of the S2.0 series camera is embedded in the coaxial cable for transmission. The external hard trigger signal or the soft trigger signal of the host computer can be sent to the camera only through the image frame grabber or vision controller. The trigger delay is on a microsecond (μs) level. For details about trigger configuration, see the S2.0 Series Image Frame Grabber User Guide.

4 Camera Installation and Connection

4.1 Operating Environment and Conditions

4.1.1 Operating Environment Requirements

- Ambient temperature: 0°C to 50°C
- Ambient humidity: 20% to 80% RH (no condensing)
- Storage temperature: –30°C to +75°C
- Storage humidity: 20% to 80% RH (no condensing)

4.1.2 Operating Environment and Heat Dissipation

- A camera has extremely low power consumption, requiring no special heat dissipation. Keep the camera away from external heat sources to prevent impact.
- The transmission rate of the camera is high. Therefore, protect the camera from interference by strong electric or magnetic fields nearby.

4.2 Camera Installation

4.2.1 Installing Components

The following table lists the components required for camera installation.

No.	Component	Quantity	Description
1	Camera	1	GMSL2.0 interface camera
2	Cable	1	GMSL2.0 interface cable, which must be separately purchased. For details, see . *"4.3.1 Cable Selection" on page 33*
3	Lens	1	C-mount lens

Caution

- An GMSL2.0 interface industrial camera is an electronic product, which should be operated and stored in dry conditions.
- In muggy, acidic, or alkaline environments, take proper isolation and protection measures to prevent corrosion to the surface or internal components.
- When using the lens, ensure a non-humid environment to prevent moisture from entering the lens. Failure to comply will result in fogging.

4.2.2 Installing the Camera

The procedure for installing the camera is as follows:

1. Install the prepared lens onto the camera.

The camera lens is a C-mount lens. Simply screw it tightly.



Caution

When installing the lens, be careful not to touch the lens surface with your hands to prevent contamination.

2. Install the camera with the lens attached to a fixed position.
3. Connect the installed camera to the image frame grabber or vision controller using an GMSL2.0 interface cable.

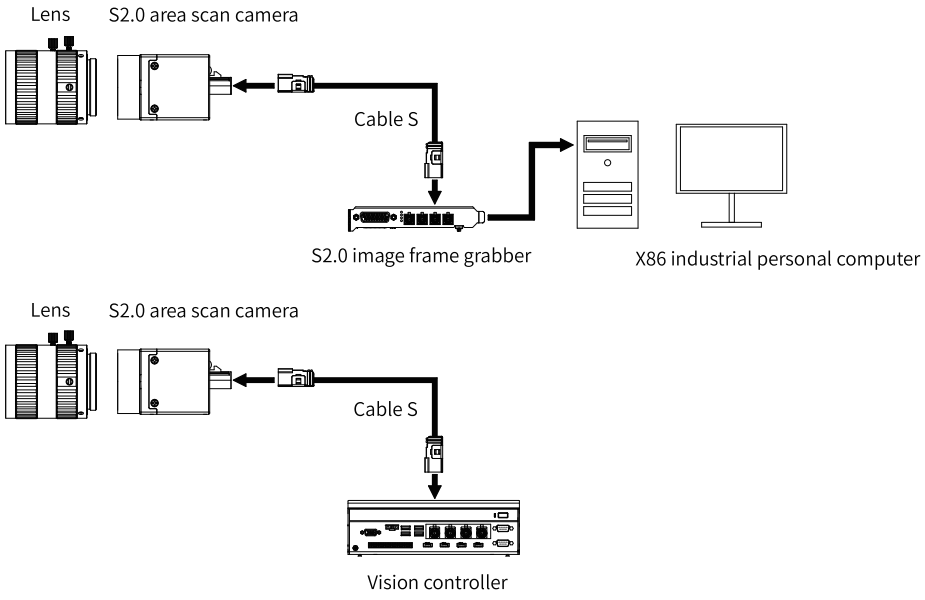


Figure 4-1 Camera connection diagram

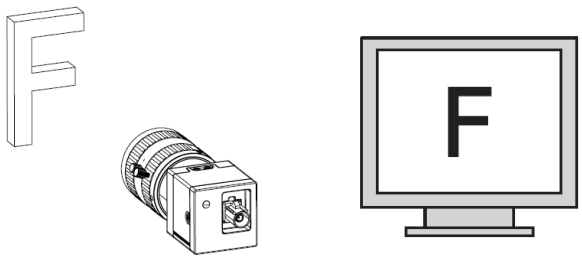


Figure 4-2 Subject, camera installation direction, and imaging direction

4.3 Cable Specifications

4.3.1 Cable Selection

GMSL interface camera cables are customized cables. You can select appropriate cables based on length and installation environments. The following table lists the cable models.

No.	Type	Length	Model
1	Both straight connectors, standard cable	5 m	VC02-S5L
2	Both straight connectors, standard cable	10 m	VC02-S10L
3	Both straight connectors, standard cable	15 m	VC02-S15L
4	Right-angle connector and straight connector, standard cable	5 m	VC02-S5L-L
5	Right-angle connector and straight connector, standard cable	10 m	VC02-S10L-L
6	Right-angle connector and straight connector, standard cable	15 m	VC02-S15L-L
7	Both straight connectors, high-flexibility cable	5 m	VC02-S5LH
8	Both straight connectors, high-flexibility cable	10 m	VC02-S10LH
9	Both straight connectors, high-flexibility cable	15 m	VC02-S15LH
10	Right-angle connector and straight connector, high-flexibility cable	5 m	VC02-S5LH-L
11	Right-angle connector and straight connector, high-flexibility cable	10 m	VC02-S10LH-L
12	Right-angle connector and straight connector, high-flexibility cable	15 m	VC02-S15LH-L

Caution

- Use a short cable whenever installation conditions allow to minimize signal attenuation.
- In installation environments limited in length, right-angle connectors can be used.
- For motion conditions, use specially customized high-flex cables.

4.3.2 Routing Requirements

- Do not route the cables and high-voltage cables in the same slots or mix them together.
- Minimize the routing distance.
- Avoid contact with moving objects to prevent wear on coaxial cables.

5 Installation and Commissioning on Client

5.1 System Overview

The INOMV client software supports Windows 10 and later. INOMV.V1R01C02 and later versions support S frame grabbers.

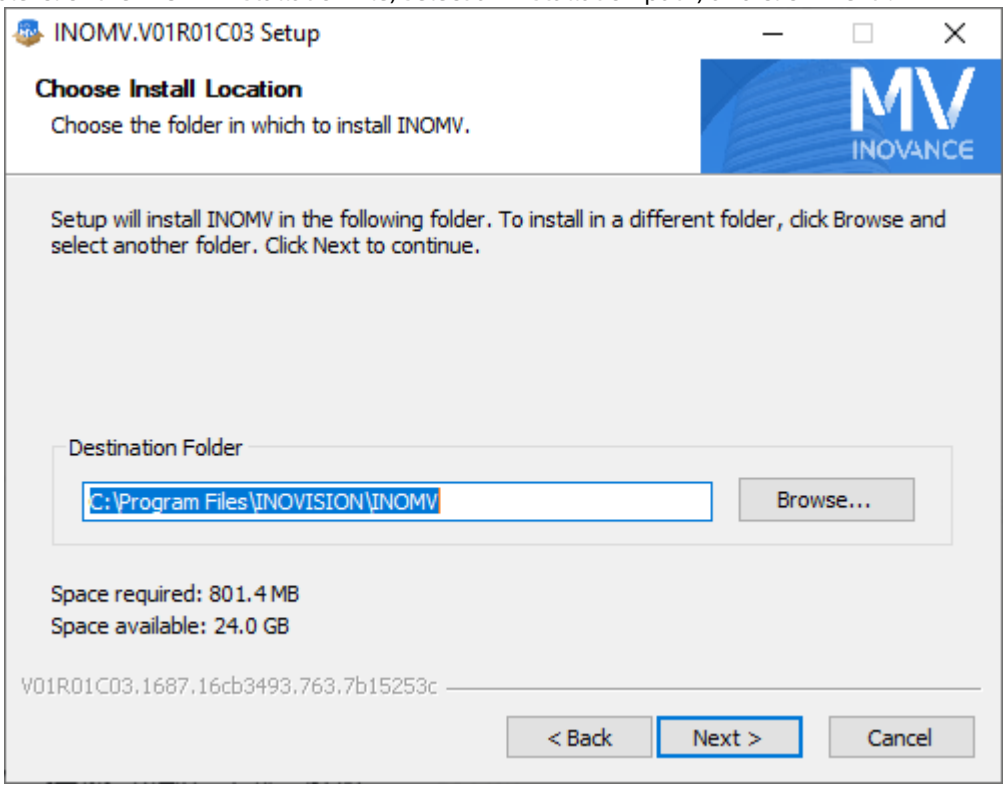
To install the INOMV client software, you must install the following three parts:

1. INOMV GUI software
2. Driver installer
3. INOMV SDK secondary development kit

5.2 Installation on Client

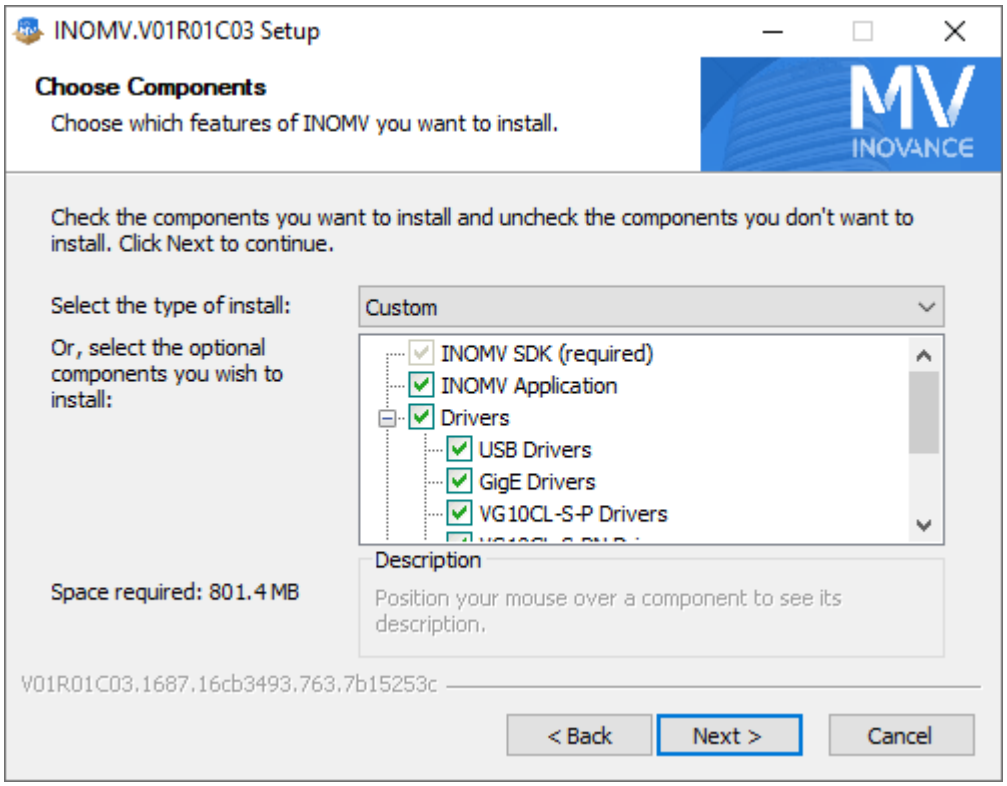
5.2.1 Installing INOMV

1. Double-click the INOMV installation file, select an installation path, and click "Next".

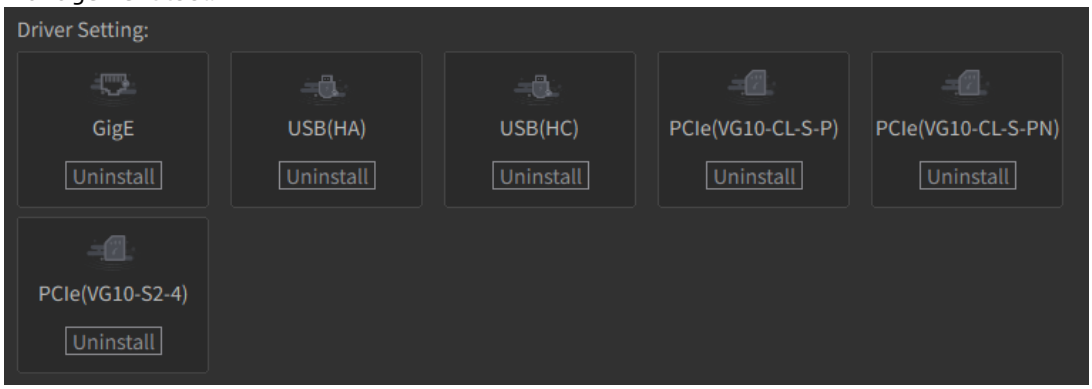


2. Select the INOMV components to be installed.

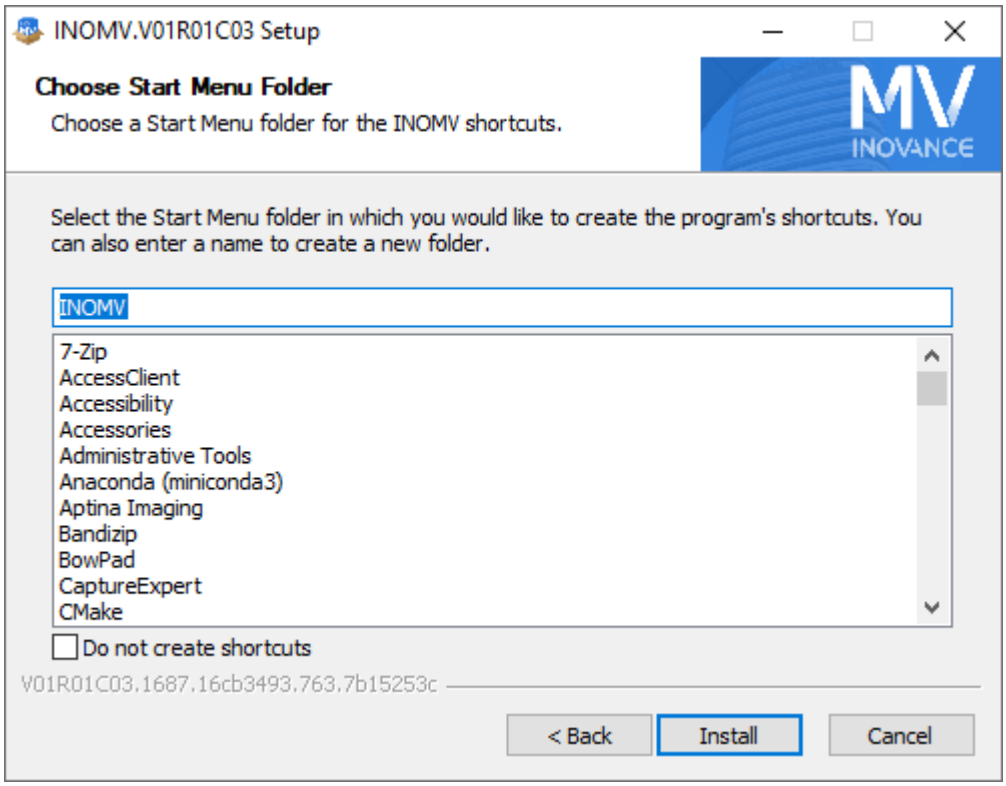
- On the component selection page, select "INOMV Application" and a related driver, and click "Next".



- The VG10-S2 driver is dedicated for S frame grabbers. By default, this driver is installed together with INOMV. You can verify whether this driver has been installed in the driver management tool.



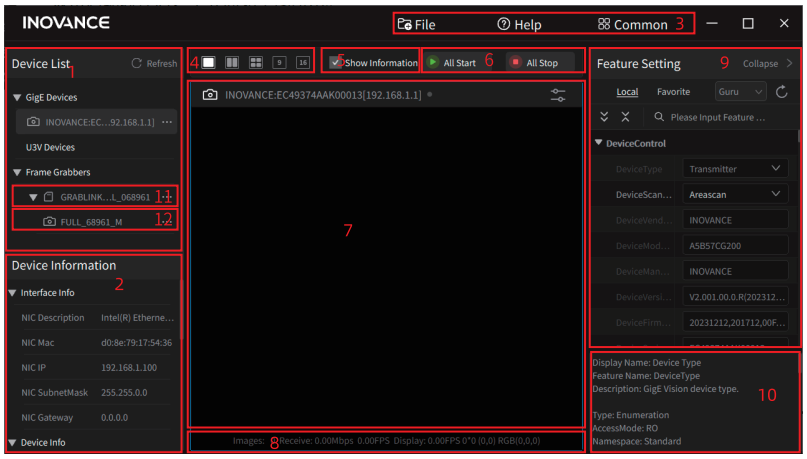
3. Select a start menu folder, select to create a shortcut, and click "Install".



4. If an earlier version of the software exists in the system, select "Add/Reinstall components" or "Uninstall before installing".
5. After installation is complete, you can find the corresponding shortcuts in the "Start" menu and on the desktop.

5.2.2 Using Client Software

After INOMV is started, the software main screen is displayed, as shown in the following figure.

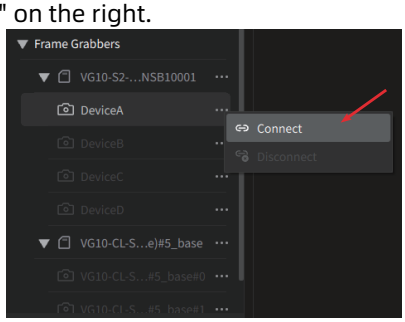


The following table lists the functions of each area.

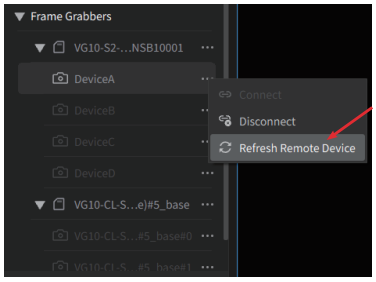
Area	Function
1	Device list
2	Device information
3	Menu bar
4	Image window quantity setting

Area	Function
5	Image information display setting
6	Collection start/stop button
7	Image display area
8	Image information area
9	Property setting area
10	Property information area
11	Frame grabber port
12	Frame grabber local device

- When only frame grabbers are connected, choose "Device List" > "Frame Grabbers", right-click a local device, and click "Connect". After a successful connection, you can set the frame grabber parameters in "Feature Setting" on the right.



- When both the frame grabber and camera are connected, after connecting the frame grabber, right-click a local device and click "Refresh Remote Device" to connect to the camera. After a successful connection, you can set the frame grabber and camera parameters in "Feature Setting" on the right.



5.3 Basic Functions

The following table describes the camera parameters.

Category	Description
Device control	View device information and modify the device name.
Image format control	View and set the camera resolution, imaging functions, and interested areas.
Acquisition control	View and set the frame rate, trigger mode, and exposure time of the camera.
Analog control	View and set the analog signals of the camera, such as the black level and gain.

Category	Description
User area control	Save and load parameter groups of the camera. You can also set the default parameter group.
Image signal processor	View and set the color parameters of a color camera, including white balance and color correction.

5.3.1 Equipment Control

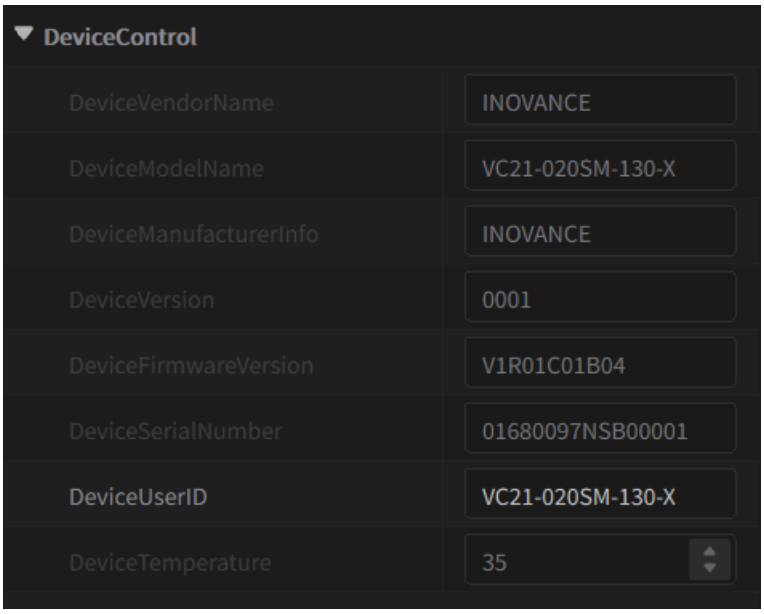


Table 5–1 Parameters

Parameter	Description	Modifiable	Type	Value Range
DeviceVendorName	Supplier name of the camera.	No	String	-
DeviceModelName	Model name of the camera.	No	String	-
DeviceManufacturerinfo	Manufacturer information of the camera.	No	String	-
DeviceVersion	Hardware version of the camera.	No	String	-
DeviceFirmwareVersion	Firmware version of the camera.	No	String	-
DeviceSerialNumber	Camera serial number.	No	String	-
DeviceUserID	User-defined ID of the camera.	Yes	String	The value can contain a maximum of 64 characters.
DeviceTemperature	Motor temperature.	No	Numeric	-

Note

Specific parameters are subject to specific camera models.

5.3.2 Image Format Control

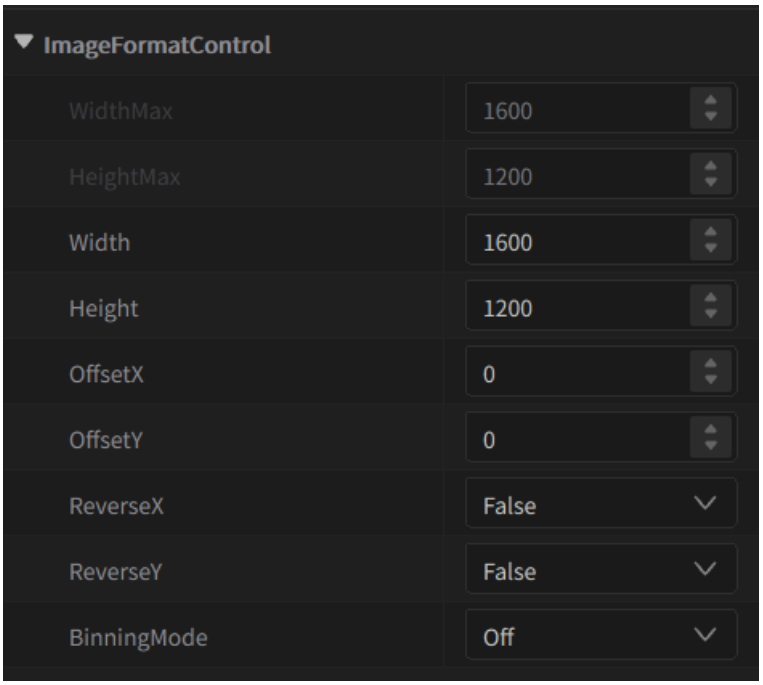


Table 5–2 Function parameters

Parameter	Function Description	Modifiable	Type	Value Range
WidthMax	Maximum number of pixels in the horizontal direction of the camera, determined by the specific camera sensor.	No	Numerical value	64 to 5120
HeightMax	Maximum number of pixels in the vertical direction of the camera, determined by the specific camera sensor.	No	Numerical value	2 to 3940
Width	Number of pixels in the horizontal direction of a camera image.	Yes	Numerical value	64 to WidthMax
Height	Number of pixels in the vertical direction of a camera image.	Yes	Numerical value	2 to HeightMax
OffsetX	Number of offset pixels in the horizontal direction of a camera image.	Yes	Numerical value	Width + OffsetX ≤ WidthMax
OffsetY	Number of offset pixels in the vertical direction of a camera image.	Yes	Numerical value	Height + OffsetY ≤ HeightMax
ReverseX	Camera image turning in the horizontal direction, with the horizontal (X) axis as the pivot.	Yes	Boolean	True and False
ReverseY	Camera image turning in the vertical direction, with the vertical (Y) axis as the pivot.	Yes	Boolean	True and False
BinningMode	Binning mode of camera images.	Yes	Enumerator	Off, 2×2, and 4×4

Note

Specific parameters are subject to specific camera models.

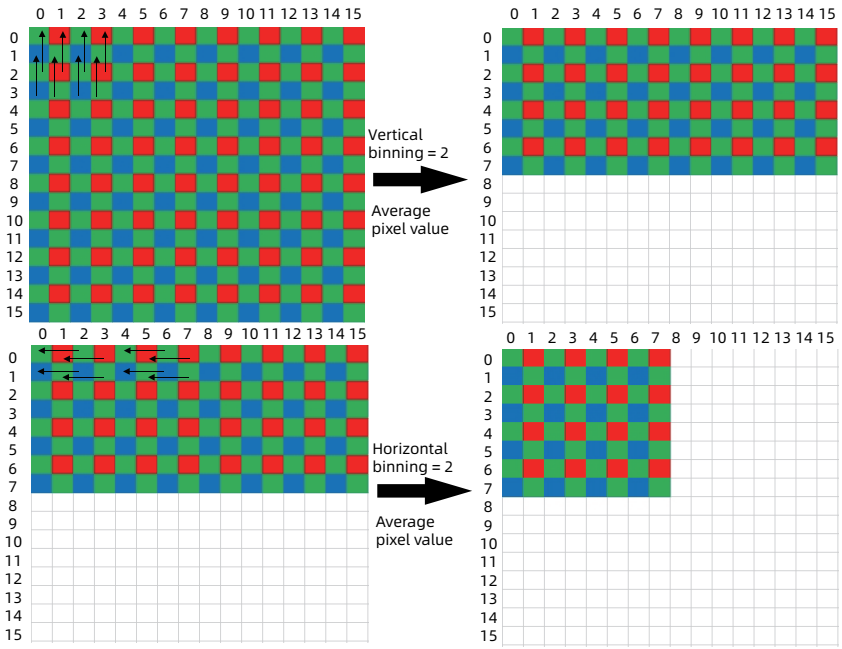
Width and Height

The following table lists the width and height ranges.

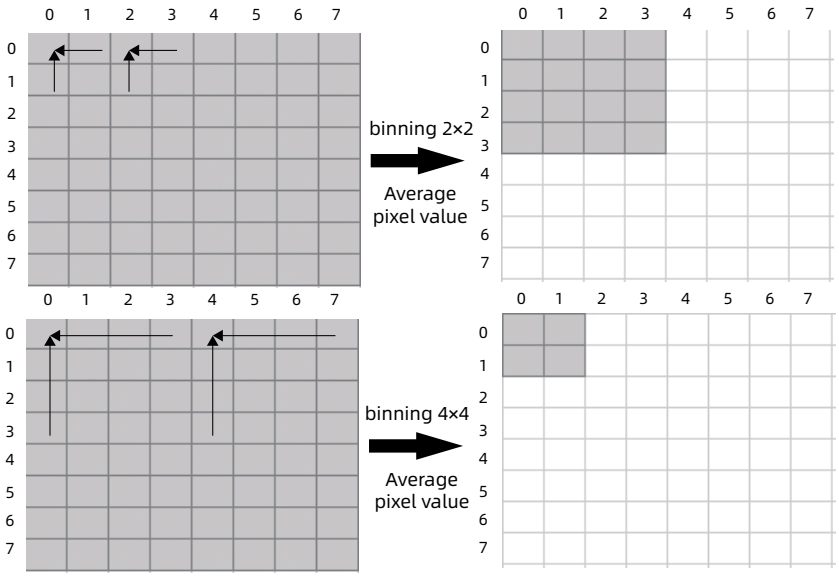
Product Model		VC21-004SM/C-450-D	VC21-016SM/C-246-D	VC21-020SM/C-130-D	VC21-050SM/C-073-D	VC21-060SM/C-060-D	VC21-080SM/C-050-D	VC21-120SM/C-030-D	VC21-120SM/C-030B-D	VC21-200SM/C-020-D
Width	Min.	32	32	64	128	64	128	128	128	224
	Max.	720	1440	1600	2448	3200	3840	4096	4096	5120
	Step	16	16	16	16	16	16	16	16	16
Height	Min.	4	4	2	2	2	8	8	2	2
	Max.	540	1080	1200	2048	1944	2160	3046	3072	3940
	Step	4	4	2	2	2	2	2	2	2
OffsetX	Min.	0								
	Max.	Max. width - Current width								
	Step	1								
OffsetY	Min.	0								
	Max.	Max. height - Current height								
	Step	1								

Binning

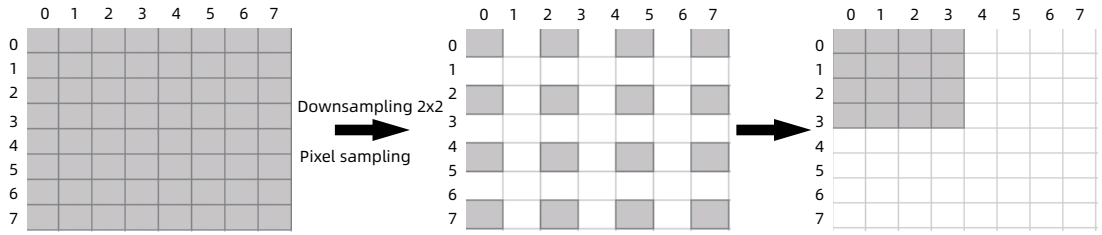
Binning is a technique used to reduce the resolution and improve the signal-to-noise ratio (SNR) of images by combining multiple adjacent pixels into one and then averaging the pixel values. A camera can horizontally or vertically combine adjacent pixels of the same color. The following figure shows the working mechanism of binning in a color camera.



When both the horizontal and vertical binning factors are set to 2, the camera combines four adjacent sub-pixels of the same color and outputs the combined value as a single sub-pixel. The following figure shows the working mechanism of binning in a black-white camera.



In some cameras, binning is actually downsampling. Downsampling aims to reduce the output resolution by selecting one pixel among multiple adjacent pixels. The following figure shows the working mechanism of downsampling in a black-white camera.



Note

The pixel binning supported varies with the camera model.

5.3.3 Acquisition Control

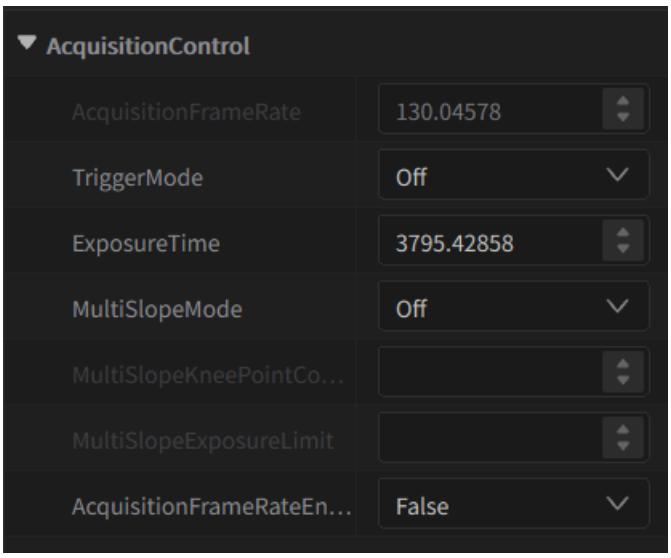


Table 5–3 Parameters

Parameter	Description	Modifiable	Type	Value Range
AcquisitionFrameRate	Image frame rate, in Hz. This parameter is valid when AcquisitionFrameRateEnable is set to True.	Yes	Numeric	1 to 130
TriggerMode	Trigger mode. The value Off indicates the internal continuous mode, and the value On indicates the external hardware-triggered mode.	Yes	Enumerated value	Off and On
ExposureTime	Total exposure time. Unit: μs.	Yes	Numeric	3.25 to 1000001.29
MultiSlopeMode	Multi-segment exposure mode. The value Off indicates no multi-segment exposure, and the value Manual indicates that multi-segment exposure is enabled.	Yes	Enumerated value	Off and Manual
MultiSlopeKneePointCount	Exposure breakover point supported in multi-segment exposure mode. The value is fixed at 1, indicating two-segment exposure. This parameter is valid when MultiSlopeMode is set to Manual.	No	Numeric	1
MultiSlopeExposureLimit	Percentage of the second segment exposure time in multi-segment exposure mode. This parameter is valid when MultiSlopeMode is set to Manual.	Yes	Numeric	0 to 1
AcquisitionFrameRateEnable	Whether to enable frame rate control. The default frame rate is 130 Hz. When a different frame rate is required, set this parameter to True and adjust the rate through AcquisitionFrameRate.	Yes	Boolean	True and False

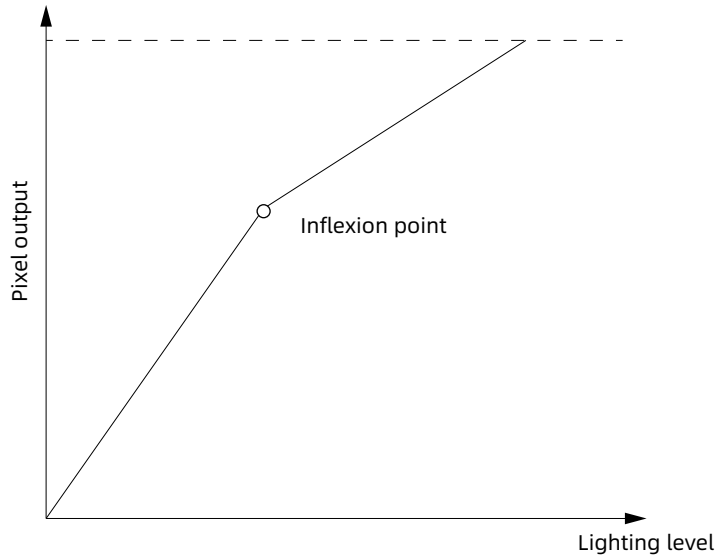
Note

Specific parameters are subject to specific camera models.

Multi-segment exposure

Multi-segment exposure is widely used to improve the image quality in camera systems requiring high dynamic range (HDR).

In multi-segment exposure, charge accumulation and sampling are performed multiple times within a single frame period and a different slope (sensitivity) is used for each sampling point to extend the sensor's dynamic range. A higher slope indicates more charges accumulated within the unit time, enhancing response to dark areas of images. A lower slope indicates less charges accumulated within the unit time, preventing overexposure in bright regions.



5.3.4 Gain Control



Parameter	Description	Modifiable	Type	Value Range
BlackLevel	Black level, which is the average grayscale value when the sensor is not exposed to light. This parameter determines the grayscale value offset of an output image. A larger value indicates more details in dark areas of the image.	Yes	Numeric	0 to 4095
AnalogGain	Analog gain of a camera image.	Yes	Numeric	1 to 16.76
DigitalGain	Digital gain of a camera image.	Yes	Numeric	1 to 15.99

Note

Specific parameters are subject to specific camera models.

5.3.5 User Area Control

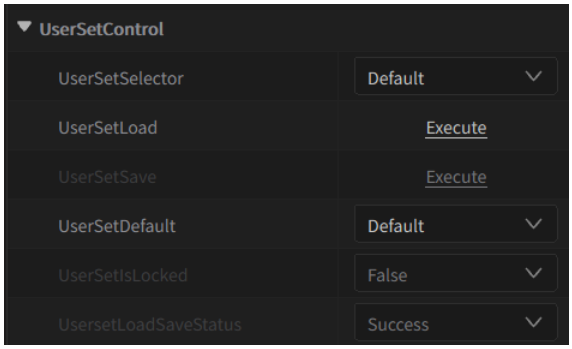


Table 5–4 Parameters

Parameter	Description	Modifiable	Type	Value Range
UserSetSelector	Load, storage, or setting in the user area. The value Default indicates the default parameter user area. When the value is Default, the UserSetSelector parameter cannot be modified and the UserSetSave operation is not executable. Values UserSet1 to UserSet3 are controlled by users.	Yes	Enumerated value	Default, UserSet1, UserSet2, and UserSet3
UserSetLoad	Load and activation of parameter settings in the selected user area. This parameter is valid when UserSetSelector is not set to Default.	Yes	Button	-
UserSetSave	Saving of parameter settings to the selected user area.	Yes	Button	-
UserSetDefault	Default loaded user area upon restart. This parameter can be set to Default or UserSet1 to UserSet3. The default value is Default.	Yes	Enumerated value	Default, UserSet1, UserSet2, and UserSet3
UserSetIsLocked	Whether the current user area can be set. In general, the user area will be locked after image frame grabbing.	No	Boolean	True and False
UsersetLoadSaveStatus	Load or storage status of the user area. When the UserSetLoad and UserSetSave operations are executed, the results can be Success, Failure, or Busy (not completed).	No	Enumerated value	Success, Failure, and Busy

Note

Specific parameters are subject to specific camera models.

5.3.6 Image Signal Processor

White balance

- In trigger or continuous mode, click "WhiteBalanceStatisticsOnce". XML will disable all image signal processors (ISPs) that affect the statistical effect of white balance. Specifically, it will disable the Color Correction Matrix (CCM) and Gamma calibration, and restore the brightness and contrast to the default value 1.
- In trigger mode, click "WhiteBalanceStatisticsOnce". Then, the trigger signal source of the camera will change to SoftTrigger and two image frames will be output.
  - The first frame is an image without white balance conversion and used to calculate the values of WhiteBalanceRedRatio and WhiteBalanceBlueRatio.
  - The second frame is an image after white balance conversion by using the new coefficients.

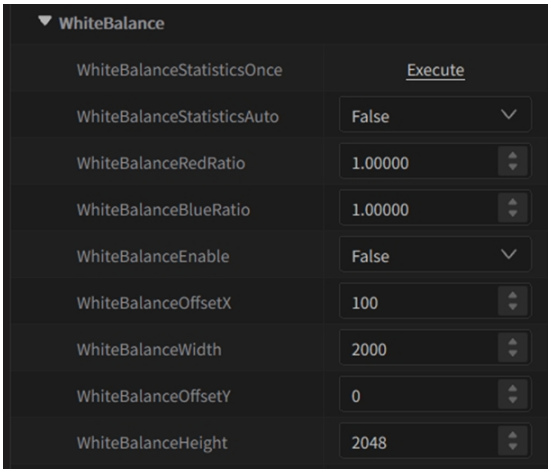


Table 5–5 White balance parameters

Parameter	Description	Value Range
WhiteBalanceStatisticsOnce	To calculate the coefficients for a single white balance operation.	Execute
WhiteBalanceRedRatio	White balance coefficient for the R component.	0 to 15.9999
WhiteBalanceBlueRatio	White balance coefficient for the B component.	0 to 15.9999
WhiteBalanceEnable	Whether to enable white balance.	True and False
WhiteBalanceOffsetX	Horizontal offset for white balance statistics.	Offset + Width ≤ Sensor output width
WhiteBalanceWidth	Horizontal width for white balance statistics.	Offset + Width ≤ Sensor output width
WhiteBalanceOffsetY	Vertical offset for white balance statistics.	Offset + Height ≤ Sensor output height
WhiteBalanceHeight	Vertical height for white balance statistics.	Offset + Height ≤ Sensor output height

Note

When you adjust white balance parameters, it is recommended that white paper be used for calibration. The calibration effect is optimal when the image grayscale value ranges from 50 to 200.

Color correction

Color correction aims to enhance color saturation.

- Increasing the value of Gain00, Gain01, or Gain02 will enhance the red saturation, while decreasing the value will reduce the red saturation.
- Increasing the value of Gain10, Gain11, or Gain12 will enhance the green saturation, while decreasing the value will reduce the green saturation.
- Increasing the value of Gain20, Gain21, or Gain22 will enhance the blue saturation, while decreasing the value will reduce the blue saturation.

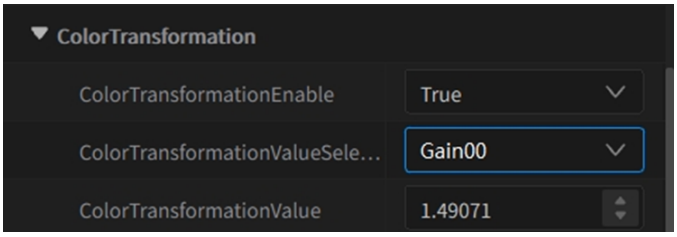


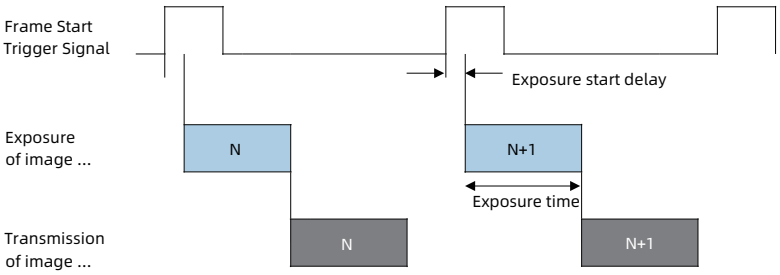
Table 5–6 Color correction parameters

Parameter	Description	Value Range
ColorTransformationEnable	Whether to enable the CCM.	True and False
ColorTransformationValueSelector	CCM coefficient.	Gain00, Gain01, Gain02, Gain10, Gain11, Gain12, Gain20, Gain21, Gain22
ColorTransformationValue	Coefficient value.	-15.99990 to +15.99990

5.4 Image Collection and Transmission

5.4.1 Time Sequence

The following figure shows the collection and transmission sequence of the area scan camera in the case of non-overlapping exposure and hard trigger.



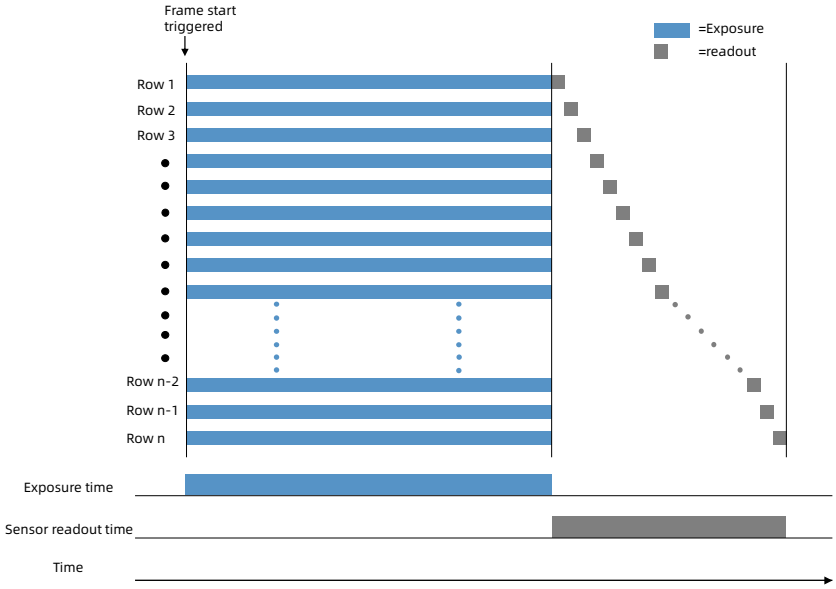
5.4.2 Shutter

The shutter type determines the method to capture and process image data. The shutter of an area scan camera is subject to the sensor used by the camera. Two types of shutters are supported: global shutter and rolling shutter.

Shutter	Advantage	Disadvantage
Global shutter	Suitable for shooting quickly moving objects	Environment distortion
Rolling shutter	Low ambient noise	Image distortion may occur while shooting quickly moving objects.
Global reset	• Low ambient noise • Suitable for shooting quickly moving objects	The flashlight must be turned on.

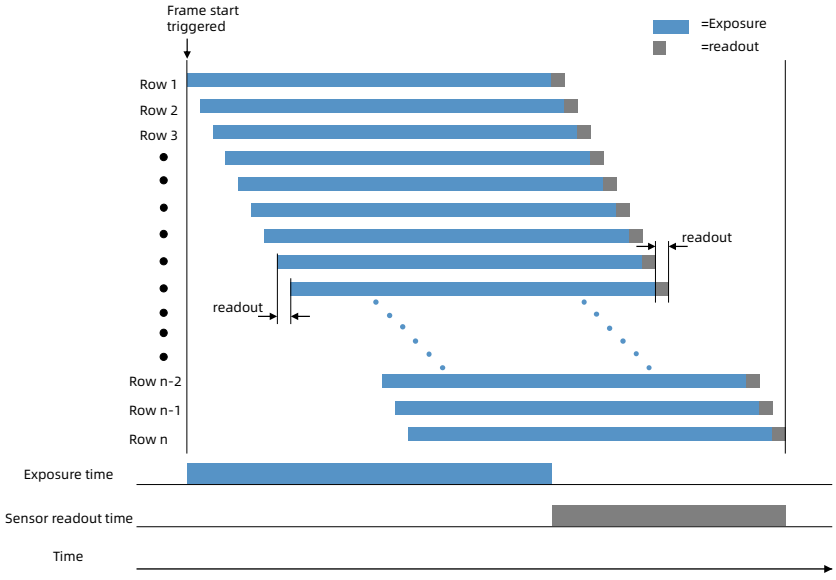
Global shutter

During image collection, all sensor pixels simultaneously start and stop exposure. Pixel data is read and processed row by row immediately after exposure. The camera sensor undergoes exposure and reads data for a consistent duration. However, the data readout end time differs, as shown in the following figure.



Rolling shutter

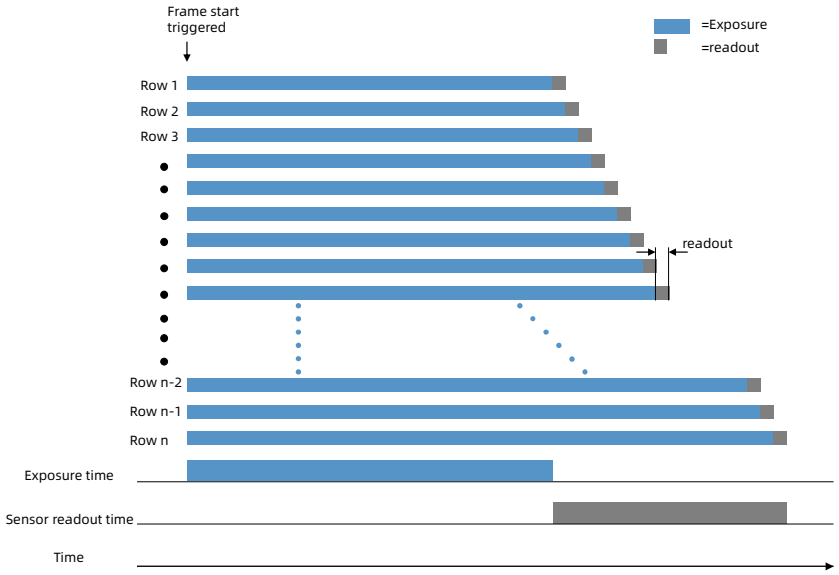
During image collection, the camera exposes pixel rows sequentially. The camera sensor starts to read data immediately after the first row is exposed, and starts to read data of the second row after data of the first row is completely read out. The time difference between the exposure start points of adjacent rows equals the data readout time. The camera sensor undergoes exposure and data readout for a consistent duration. However, the exposure start time differs, as shown in the following figure.



Global reset

The global reset function achieves global exposure by aligning the exposure start time of all image rows to the same point.

After global reset is enabled, the brightness may vary from top to bottom in an image due to different exposure time of the image rows. It is recommended that global reset be enabled in total darkness in combination with industrial light sources. Turn on the light source during the exposure time shown in the following figure, and keep it off at other times. This ensures that all image rows receive identical illumination during the exposure time, thereby controlling the brightness across the image rows.



Note

Only some rolling shutter cameras support the global reset feature. The support for this feature is subject to the actual specifications.

5.4.3 Overlapping Exposure and Non-overlapping Exposure

The process of a camera obtaining a frame of image can be divided into two stages: exposure and readout.

The overlapping relationship between the exposure time and readout time of a camera varies with the sensor used by the camera. It can be overlapping exposure or non-overlapping exposure. Compared to non-overlapping exposure, overlapping exposure can reduce the impact of exposure time on image output time.

Overlapping exposure

Overlapping exposure means that the exposure of the current frame overlaps with the readout process of the previous frame. In other words, the next frame begins exposure while the previous frame is still being read out. In overlapping exposure, the frame period is less than or equal to the sum of the exposure time and the frame readout time.

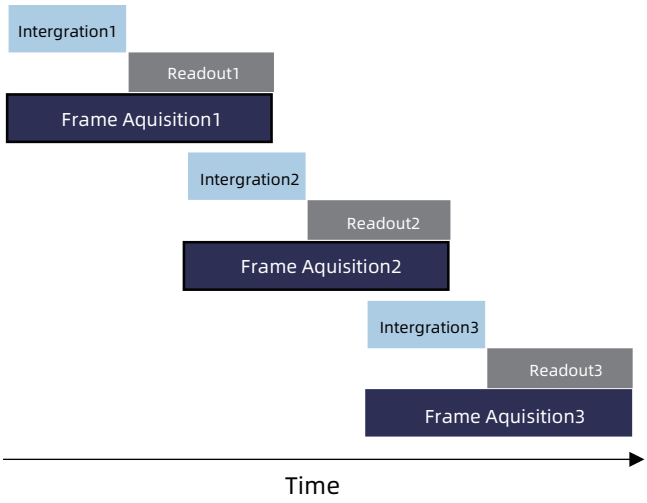


Figure 5-1 Overlapping exposure in internal trigger mode

Non-overlapping exposure

In non-overlapping exposure, the exposure and readout of the next frame begin only after both processes are completed for the current frame. In non-overlapping exposure, the frame period is greater than or equal to the sum of the exposure time and the frame readout time.

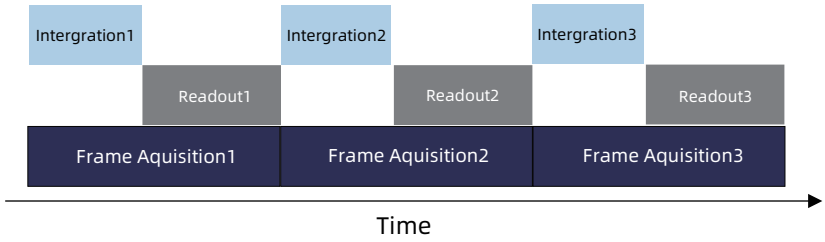


Figure 5-2 Non-overlapping exposure in internal trigger mode

5.4.4 Trigger mode.

For details about how to set the trigger delay and trigger source, see the "Trigger Principles and Cases" chapter in the S2.0 Series Image Frame Grabber User Guide.

Three trigger modes are supported: ExposureStart, FrameStart, and GRR.

ExposureStart

In ExposureStart mode, when a trigger signal is input, the camera starts exposure and readout.

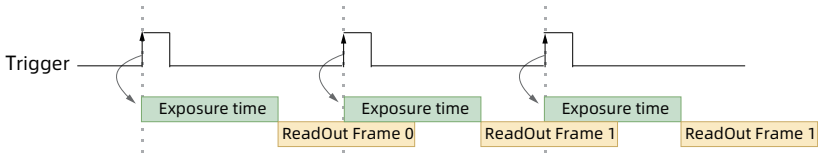


Figure 5-3 Overlapping exposure in ExposureStart mode

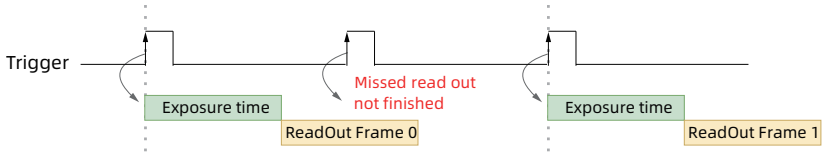


Figure 5-4 Non-overlapping exposure in ExposureStart mode

The following table describes the support for the two exposure modes in ExposureStart trigger mode.

Exposure mode	VC21-004SM/C-450-D	VC21-016SM/C-246-D	VC21-020SM/C-130-D	VC21-050SM/C-073-D	VC21-060SM/C-060-D	VC21-080SM/C-050-D	VC21-120SM/C-030-D	VC21-120SM/C-030B-D	VC21-200SM/C-020-D
Non-overlapping exposure	Supported	Supported	Supported	Not supported	Not supported	Supported	Supported	Not supported	Not supported
Overlapping exposure	Not supported	Not supported	Not supported	Supported	Not supported	Not supported	Not supported	Supported	Supported

FrameStart

In FrameStart mode, when a trigger signal is input, the camera delays a frame period before starting readout. The output format is fixed with a constant frame period. Readout occurs after exposure is completed in the latter part of the frame period. Overlapping exposure is supported in this mode.

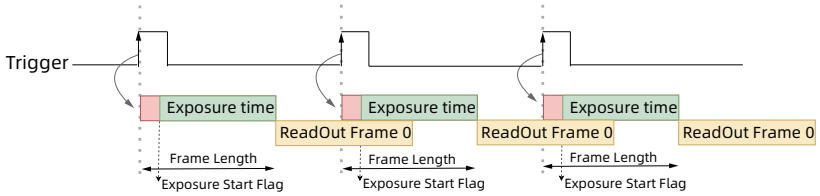


Figure 5-5 FrameStart mode

GRR

In GRR mode, all pixel rows of an image share the same exposure time and are read out in rolling mode. The exposure time of an image row is the sum of the specified exposure time and the time difference relative to the time when this row is read out in rolling mode. Overlapping exposure is not supported in FrameStart mode.

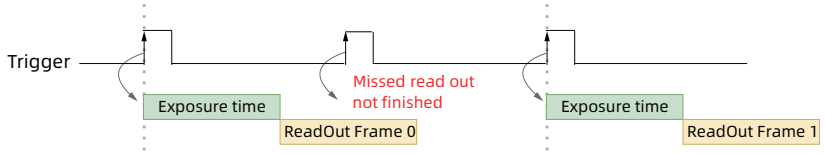


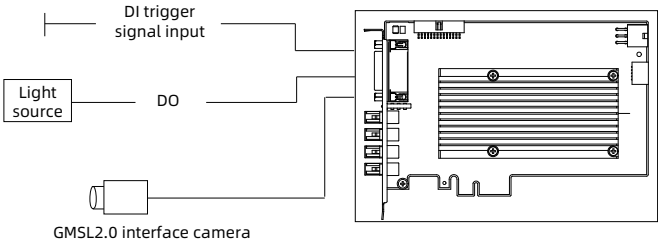
Figure 5-6 FrameStart mode

Note

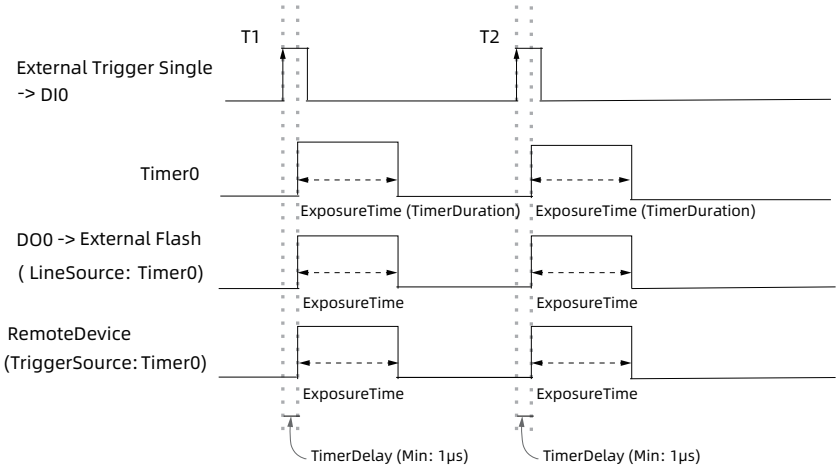
- In GRR mode, the external light source must be synchronized with the start and end points of the exposure time.
- You can use the I/O function of the image frame grabber to ensure that the light source and camera are triggered synchronously. For details, see the "Synchronous Triggering of the Camera and Flashlight" section in the S2.0 Series Image Frame Grabber User Guide.

5.4.5 Example: I/O Signal Light Source Sync Settings for Image Frame Grabber in GRR Mode

Grabber connection diagram



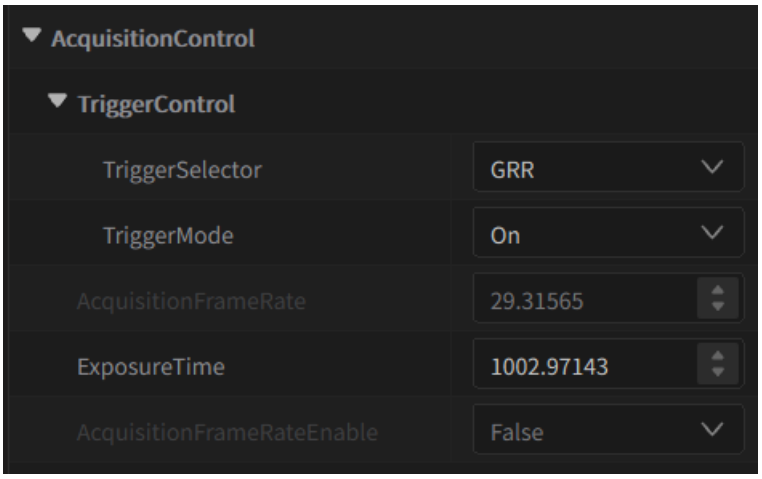
Light source synchronization time sequence in trigger mode



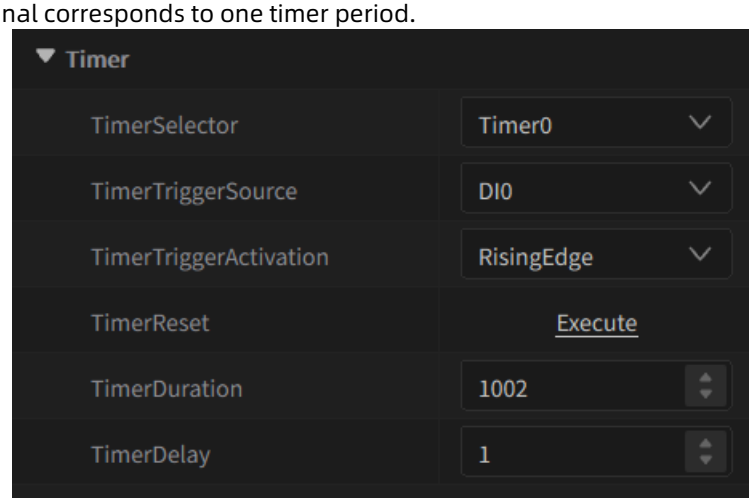
1. External Trigger Single -> DI0: Input the external trigger signal through DI0.
2. Timer0: periodic clock signal inside the grabber. One external trigger signal triggers one timer period. Set TimerDuration (high-level duration) to the exposure time of the camera.
3. DO0 -> External Flash (LineSource: Timer0): Output the Timer0 signal through DO0 to the external stroboscopic light source.
4. RemoteDevice (TriggerSource: Timer0): Set the camera trigger source to Timer0.

Example

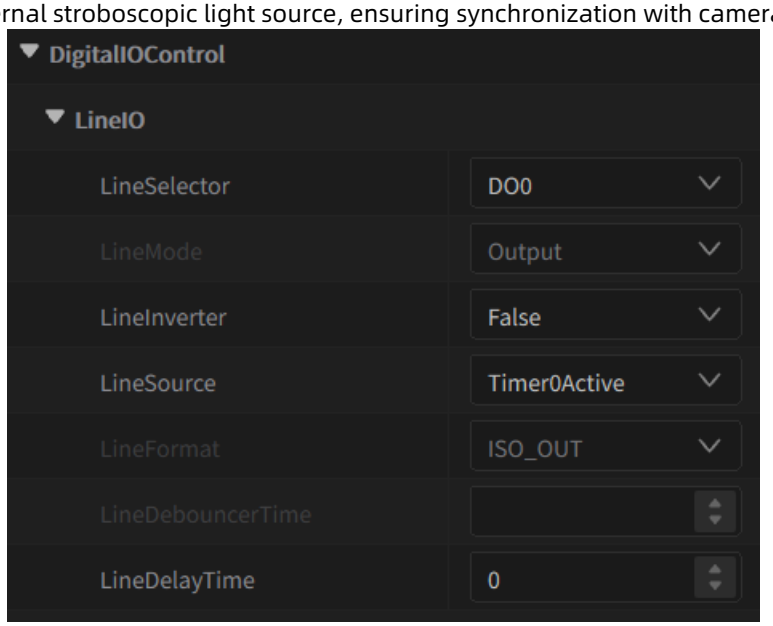
1. Camera trigger mode setting: Set TriggerSelector to GRR and TriggerMode to On. Make sure that ExposureTime is consistent with TimerDuration (high-level duration).



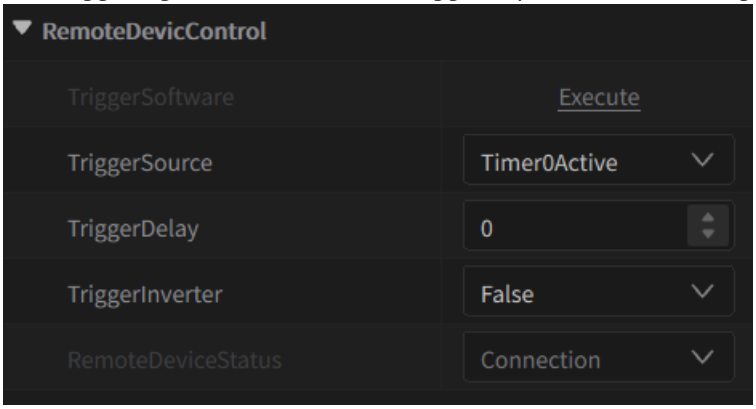
2. Timer signal setting: Set Timer0Active and TimerTriggerSource to DI0 and TimerTriggerActivation to RisingEdge. Make sure that TimerDuration (high-level duration) is consistent with the exposure time of the camera. Set TimerDelay (low-level duration) to the minimum value 1 μs. One rising edge trigger signal corresponds to one timer period.



3. Flash signal output setting: Set LineSelector under LineIO to DO0. Output a Timer0 signal to control the external stroboscopic light source, ensuring synchronization with camera exposure.



4. Trigger source and trigger signal delay setting: Set TriggerSource to Timer0Active. Synchronize the pulse signal as a trigger signal to the camera to trigger exposure and shooting.



Note

The input trigger signal cycle must be greater than the value on the timer specified by TimerXActive, where X is the timer sequence number and can be 0, 1, 2, or 3. This is to ensure a stable pulse signal trigger frequency.

6 Maintenance

6.1 Cleaning Guide

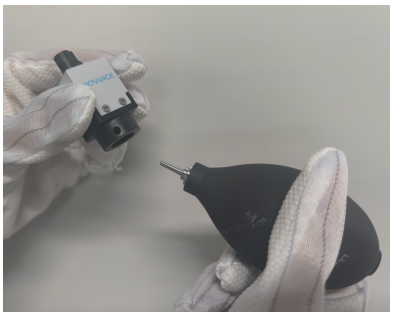
6.1.1 Cleaning the Camera and Lens

Dust or stains on the camera and lens can be removed by using the four methods in the table below. Different devices support different cleaning methods.

Cleaning Method	Camera	Lens
Air blow	Supported	Supported
Lens brush	Not supported	Supported
Contact	Supported	Supported
Lens paper	Not supported	Supported

- Air blow
  A simple handheld air blower can be used to blow dust off the camera filter and lens surface. The specific steps are as follows:

  1. Point the blower's nozzle downward and squeeze it several times to blow out dust from the nozzle and inside.
  2. Hold the camera or lens, tilt it downward, and position the blower nozzle at a 45° angle to the camera lens to blow away dust from the camera filter or lens surface.



Caution

- When cleaning the camera, do not insert the air blow nozzle too deeply into the camera mount to prevent direct contact with the dustproof glass.
- Do not blow on the lens with your mouth to prevent saliva particles from splashing onto the glass surface. Failure to comply may result in severe secondary contamination.

- Lens brush
  If the dust on the lens surface cannot be blown away, use a lens brush to gently sweep away the dust from the lens surface.

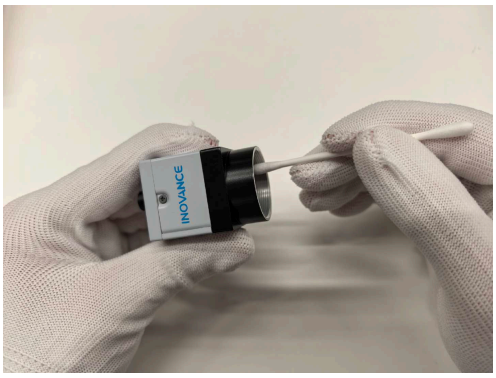
Caution

Do not touch the bristles with your hands.

- Contact
  For stubborn stains on the camera filter or lens surface, such as fingerprints or liquid residues, use a lint-free cotton swab or dust-free cloth dipped with high-purity alcohol for wiping and cleaning. Take a lint-free cotton swab as an example. The specific steps are as follows:

  1. Take a clean lint-free cotton swab, and dip it in an appropriate amount of alcohol or cleaning solution for lubrication. Ensure that your fingers do not touch the swab tip.
  2. Tilt the cotton swab at about 60°, press it against the camera filter or lens surface, and clean from left to right. Then, flip the swab to the other side and clean from right to left again.
  3. Take another lint-free cotton swab that has not been dipped in alcohol or cleaning solution, and gently sweep the camera filter or lens to absorb any residual alcohol or cleaning solution.
  4. Check whether any stains still exist. If yes, repeat steps 1 to 4 until all stains are removed.

  If the stains on the lens cannot be wiped clean, use lens paper for cleaning. For details, see the procedure of using lens paper for cleaning.

- Lens paper
  For lens stains that cannot be removed with a lint-free cotton swab or dust-free cloth, lens paper can be used for cleaning.

  Preconditions

  - Use lens paper purchased from a reputable and professional photography store.
  - Use lens paper that is freshly opened and in a moist state.

  Steps

  1. Ensure that the lens is free of hard dust.
  2. Tear open the lens paper packaging, fold the pre-moistened lens paper to a suitable wiping state, and slowly wipe in a spiral motion from the center of the lens outward in the same direction.

Caution

- Do not use hard paper, tissue, or napkin to clean the lens, as they contain abrasive wood pulp that can severely damage the quick-wear coating on the lens.
- When using lens paper to clean the lens, do not press hard on the lens surface. Failure to comply may wipe off the quick-wear coating on the lens surface.

After the lens is cleaned, the lens should appear free of dust and water stains from all angles. If stains remain, contact Inovance for factory cleaning.

6.1.2 Cleaning Housing

Clean the camera in a sealed environment to prevent large amounts of dust.

The detailed operations are as follows:

1. Disconnect the camera power.
2. Take a soft, lint-free cloth that does not cause static electricity during cleaning, and dampen it with a neutral cleaning agent.
3. Wipe the camera housing with the dampened lint-free cloth as needed.
4. After wiping, wait until the moisture completely evaporates and then reconnect the power supply for the camera.

Caution

Do not use compressed air to accelerate evaporation.

Confirm that the camera lens and housing are clean, position the camera mount downward, and install the camera lens cover or lens for storage.

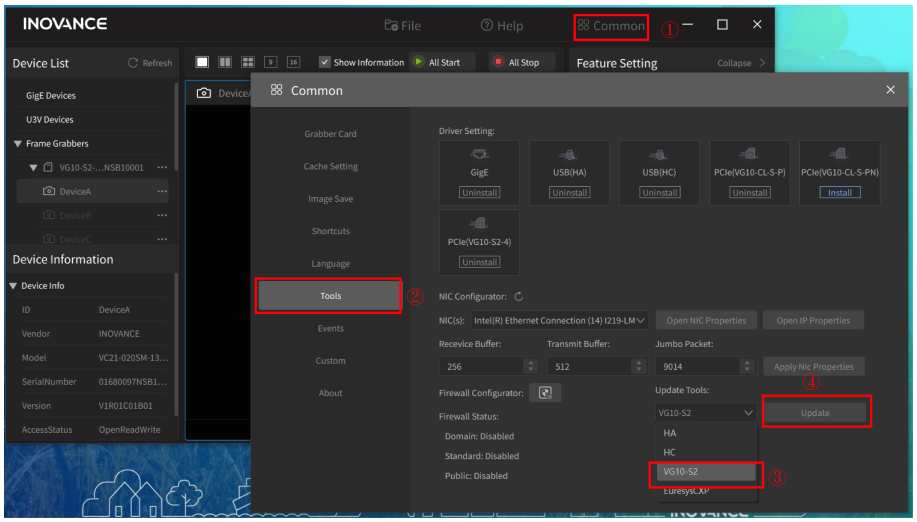
6.2 Firmware Upgrade

Caution

- If the upgrade fails, contact Inovance for technical support.
- After the upgrade is complete, shut down and restart the computer.

Firmware Upgrade Page

1. Click "Common" on the top toolbar.
2. Click "Tools" on the "Common" page.
3. Select "VG10-S2" from the "Update Tools" drop-down list.
4. Click "Update" to access the firmware upgrade page.

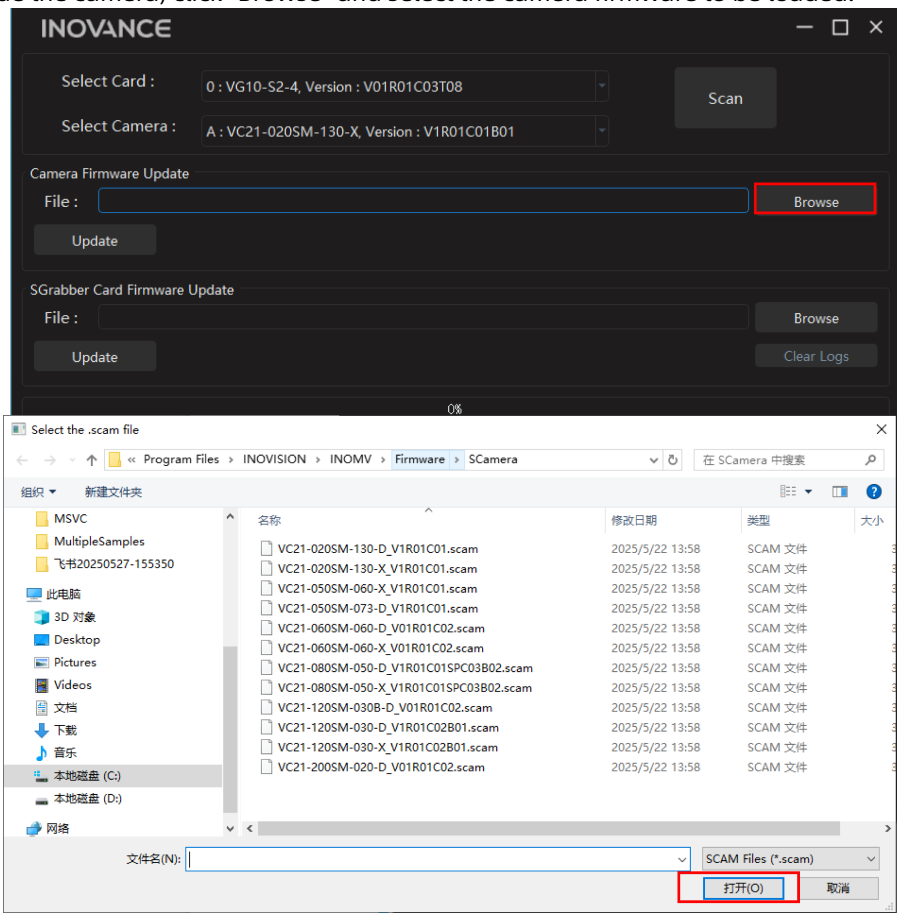


Procedure

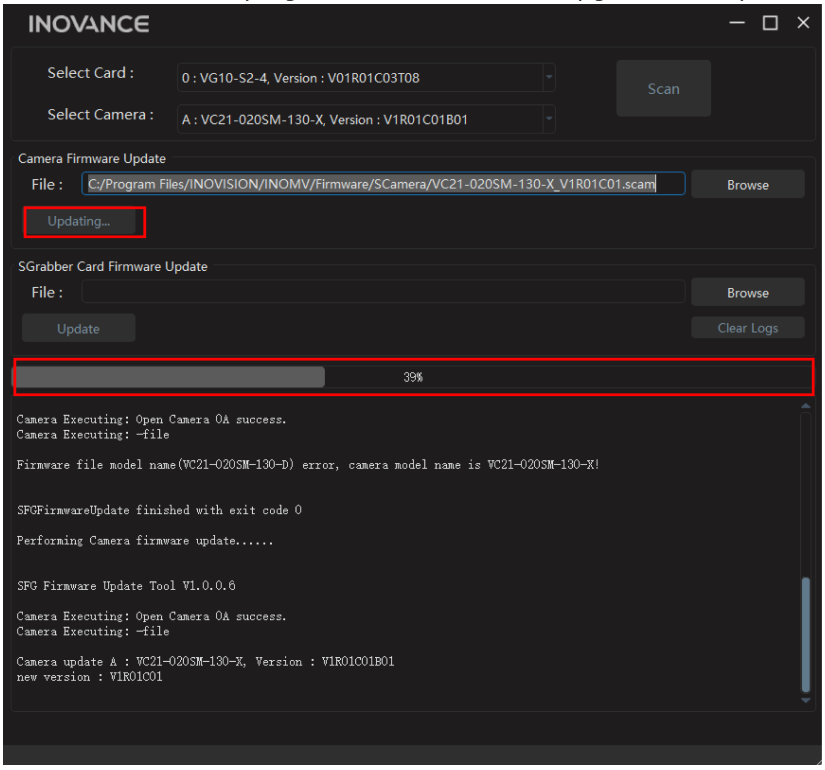
1. Click "Scan", and select the image frame grabber and camera to be upgraded from the scanned devices.



2. To upgrade the camera, click "Browse" and select the camera firmware to be loaded.



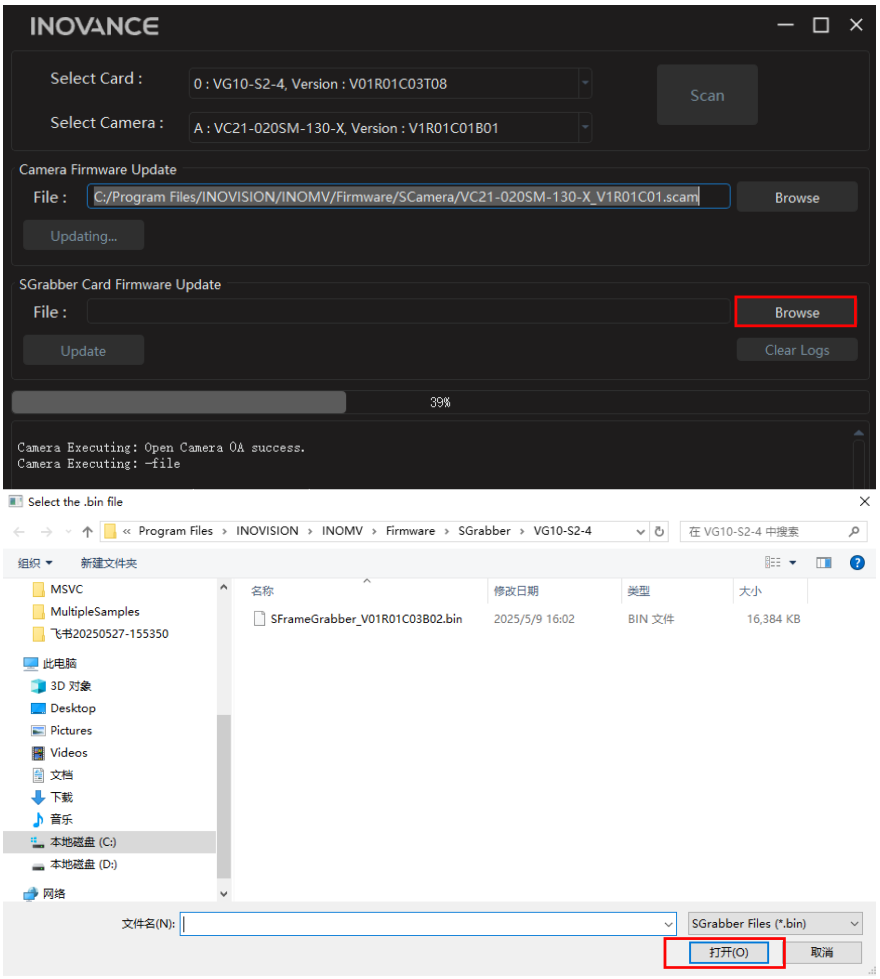
3. Click "Update". After the button text changes to "Updating", you can view the upgrade progress in the progress bar below. When the progress reaches 100%, the upgrade is complete.



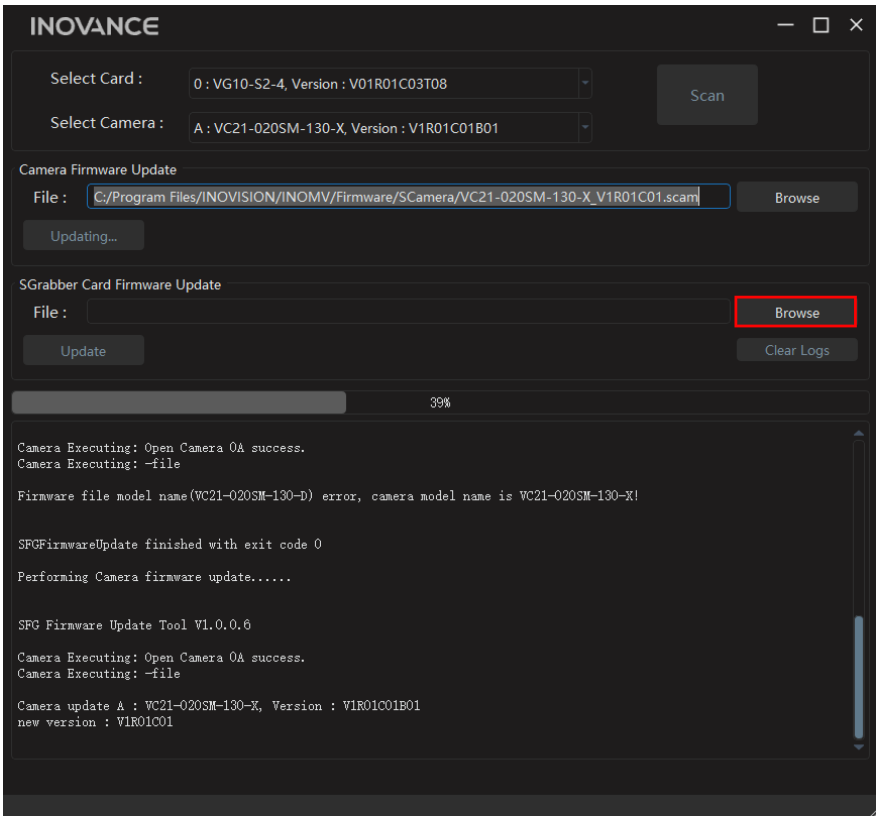
4. To upgrade the image frame grabber, click "Browse", select the image frame grabber to be loaded, and click "Update". When the progress reaches 100%, the upgrade is complete.

Caution

After the image frame grabber is upgraded, shut down and restart the computer.



5. Click "Clear Logs" to clear the log information generated in the log area during the upgrade process.


INOVANCE
Select Card :
0 : VG10-S2-4, Version : V01R01C03T08
Scan
Select Camera :
A : VC21-020SM-130-X, Version : V1R01C01B01
Camera Firmware Update
File :
C:/Program Files/INOVISION/INOMV/Firmware/SCamera/VC21-020SM-130-X_V1R01C01.scam
Browse
Updating...
SGrabber Card Firmware Update
File :
Browse
Update
Clear Logs
39%
Camera Executing: Open Camera 0A success.
Camera Executing: -file
Firmware file model name(VC21-020SM-130-D) error, camera model name is VC21-020SM-130-X!
SFGFirmwareUpdate finished with exit code 0
Performing Camera firmware update.....
SFG Firmware Update Tool V1.0.0.6
Camera Executing: Open Camera 0A success.
Camera Executing: -file
Camera update A : VC21-020SM-130-X, Version : V1R01C01B01
new version : V1R01C01

7 Common Faults

If you encounter problems while using the product, refer to this document.

1. **Camera power indicator off**

   Possible cause:

   The power supply is abnormal.

   Solution:

   - Check whether the 6-pin power supply of the image frame grabber is connected.
   - Check whether the camera power control is enabled on the software end.

2. **No image output by the camera**

   Possible cause:

   Parameter settings are incorrect or the camera is faulty.

   Solution:

   - Check whether the camera is operating in trigger mode without a trigger signal.
   - Check whether the camera parameters are set incorrectly. If so, try to restore the default settings.
   - If the camera is faulty, contact customer service personnel.

3. **Black image output by the camera**

   Possible cause:

   The lens aperture is not open, light source is off, or the camera faulty.

   Solution:

   - Check whether the camera is connected to a lens and whether the lens aperture is functioning properly.
   - Check whether the light source is off.
   - If the camera is faulty, contact customer service personnel.

4. **Failure to set the maximum size of output images for the camera**

   Possible cause:

   Parameter setting fails.

   Solution:

   - Check whether the binning parameter is enabled.
   - Check whether an image offset is set for the software.

8 Certification and Standard Compliance

8.1 CE, RoHS, and KC Certification

The product complies with the following CE, RoHS, and KC certification requirements. The attainment of certifications is subject to the marks on the nameplate of the product.

Certification	Directive		Standard
CE and RoHS certification	EMC directive	2014/30/EU	EN 61000-6-4 EN 61000-6-2
	RoHS	2011/65/EU amended by (EU) 2015/863	EN IEC 63000
KC certification	-	-	KN 61131-2



Figure 8-1 KC certification

Note

To ensure the best EMC performance of the camera, the housing must be grounded.

8.2 Reference Standards

- EN 55032: Electromagnetic compatibility of multimedia equipment - Emission requirements
- EN 55035: Electromagnetic compatibility of multimedia equipment - Immunity requirements

Service and Support

Should you encounter a safety accident during the use or operation of the product, or face challenges in operating and maintaining the equipment, which remain unresolved after the relevant documentation is consulted, we provide multiple channels to ensure prompt resolution:

- Channel #1: Contact service@inovance.com.
- Channel #2: Visit https://www.inovance.com/global to access document downloads, after-sales support, spare parts ordering, repair applications, and authenticity verification services.
- Channel #3: Download My Inovance app (https://zshc-eu.inovance.com/download-pc/) where you can access products info and documentation, and query product parameters.

We are committed to providing you with quick and professional technical support, and we look forward to your satisfaction and trust.

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