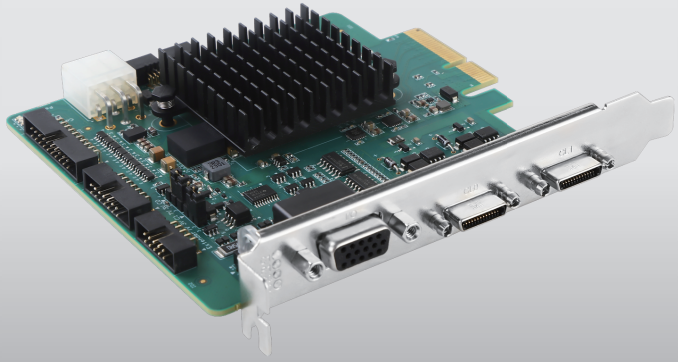
INOVANCE

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CameraLink Series Image Frame Grabber

User Guide

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

Data code PS00020992A00

Legal Information

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Due to continuous updates and improvements of products and technologies, the content of this documentation may not fully match the actual products. In the event of any discrepancies, the actual products shall prevail.

The contents are subject to change without notice due to product upgrade.

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 CameraLink series image frame grabber is specifically designed for the CameraLink series line scan camera, serving as an ideal solution for efficient data transmission. It is typically applied in industries such as 3C, semiconductors, PCBs, lithium batteries, and silicon crystals.

This guide introduces the product information, hardware installation, and software control information of the CameraLink series image frame grabber, including the technical specifications, hardware installation, connection, software installation and commissioning on clients, maintenance, and common faults. This guide also includes safety precautions, electromagnetic interference prevention, warranty statements, nameplate description, and component description.

Note

- The drawings in the user guide are shown for illustration only and may be different from the product. Actual products may vary.
- The user guide is subject to change due to product upgrade, specification modification as well as efforts to improve the accuracy and convenience of the guide.

More Data

Name	Data Code	Description
CameraLink Series Line Scan Camera User Guide	PS00017498	Describes the technical specifications, installation, usage and maintenance information of the series.
CameraLink Series Image Frame Grabber User Guide (this guide)	PS00020992	Describes the product information, hardware installation, and software control information of the CameraLink series image frame grabber.

Revision History

Date	Version	Description
June 2025	A00	Initial release.

Access to the Guide

This guide is not delivered with the product. You can obtain the PDF version in the following way:

- Visit *www.inovance.com*, go to Support > Download, search by keyword, and then download the PDF file.

- **QR code**: Scan the QR code on the product with your smart phone.
- **My Inovance app:** Scan the QR code below to install the My Inovance app, and search for the file in the app.

Warranty

For faults and damage incurred during normal use in the warranty period, Inovance provides free repair service. (For details of the warranty period, see the purchase order.) A maintenance fee will be charged out of the warranty period.

Even in the warranty period, a maintenance fee will be charged for repair of the following damage:

- Damage caused by operations not following the instructions in the guide
- Damage caused by fire, flood, or abnormal voltage
- Damage caused by unintended use of the product
- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (such as natural disaster, earthquake, and lightning strike)

The maintenance fee will be charged according to our latest Price List if not otherwise agreed upon.

For details, see the Product Warranty Card.

Safety Precautions

Safety Disclaimer

- This chapter presents essential safety instructions for a proper use of the equipment. Before operating the equipment, read through the guide and comprehend all the safety instructions. Failure to comply with the safety precautions may result in equipment damage, severe physical injuries, or even death.
- "DANGER", "WARNING", and "CAUTION" items in this guide do not indicate all safety precautions that need to be followed; instead, they just supplement the 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 personal injuries or even death.



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



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

Safety Precautions

- Some drawings in the guide shows the product without covers or protective guards to display more details. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- 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, and 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 whether the package contents are consistent with the packing list before unpacking.

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 by only 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.
- After wiring is done, check that all cables are connected properly and no screws, washers, or exposed cables are left inside the equipment. Failure to comply may result in electric shocks or equipment damage.
- 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.
- After wiring is done, check that all cables are connected properly and no screws, washers, or exposed cables are left inside the equipment. Failure to comply may result in electric shocks or equipment damage.
- During wiring, follow proper electrostatic discharge (ESD) procedures and wear an anti-static wrist strap. Failure to comply can 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 by only professionals.
- Do not maintain the equipment while power is on. Failure to comply may 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 by only professionals. • Do not repair the equipment while power is on. Failure to comply may result in electric shocks.
WARNING • When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly. • Replace quick-wear parts of the equipment in according with the replacement instructions. • After the equipment is replaced, check the wiring and set parameters again.

Disposal
WARNING • Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injuries, or even death. • Recycle retired equipment by observing industry waste disposal standards 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 Product Information

1.1 Product Introduction

The VG10-CL-S-P CameraLink frame grabber supports the CameraLink 2.1 standard and can be connected to one or two cameras.

- In single-camera mode, four configuration options are supported: Base, Medium, Full, and 80bit.
- In dual-camera mode, only dual Base mode is supported for both camera channels.

Equipped with 1 GB of onboard memory, it enables image buffering, Tap reordering, and other functions.

It can be connected to CameraLink cameras compliant with GenCP 1.2. It allows command-line control through a virtual serial port bridge. It supports camera control software communication through either Frame Grabber Port or a virtual serial port.

- Compliant with the CameraLink 2.1 standard, it supports a pixel clock of 20 M to 85 M, with a maximum bandwidth of 6.8 Gbps.
- It supports both Single Full and Dual Base modes.
- It supports PoCL (Power over CameraLink), delivering up to 6 W of power in single-camera mode.
- It supports a unique strobe mode, enabling FFC (Flat Field Correction) for line-scan cameras in strobe mode.
- In strobe mode, it supports multi-channel image splitting, reducing CPU load.
- It supports I/O loop-out and multi-frame grabber synchronization.
- It is compatible with PCIe Gen2x4 or PCIe Gen3x4.

1.2 Model and Nameplate

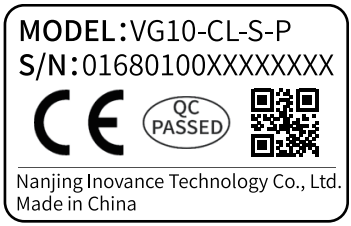
Model description

VG10-CL-S-P

① ② ③ ④ ⑤

① **Product family** VA: Intelligent camera VC: Industrial camera VG: Vision components	③ **Interface type** CL: CameraLink CXPII: CoaXPress 2.0 S2: S2.0 standard protocol	⑤ **Power supply mode** P: By cable
② **Product series** 10: Frame grabber 20: Capture box 30: Distribution box	④ **Connector type** S: SDR connector M: MDR connector	

Nameplate description



1.3 Components

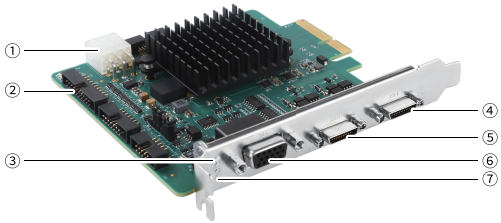


Figure 1-1 Components

No.	Connector Name	Function Description
①	Power	When the PoCL function is enabled, power must be supplied through this connector.
②	CardLink	A synchronization connector for multi-card setups, featuring 8 bidirectional I/Os for transmitting internal signals.
③	CL indicator	A dual-color LED indicating the data acquisition status of the CameraLink frame grabber.
④	CL1	• Single Full: Data and control. • Dual Base: Data and control for Camera #1.

No.	Connector Name	Function Description
⑤	CL0	• Single Full: Data and control. • Dual Base: Data and control for Camera #0.
⑥	I/O	DB15 female connector, used to connect to I/O signals of the frame grabber.
⑦	PoCL indicator	A red LED indicating the power supply status of PoCL.

1.4 Product Dimensions

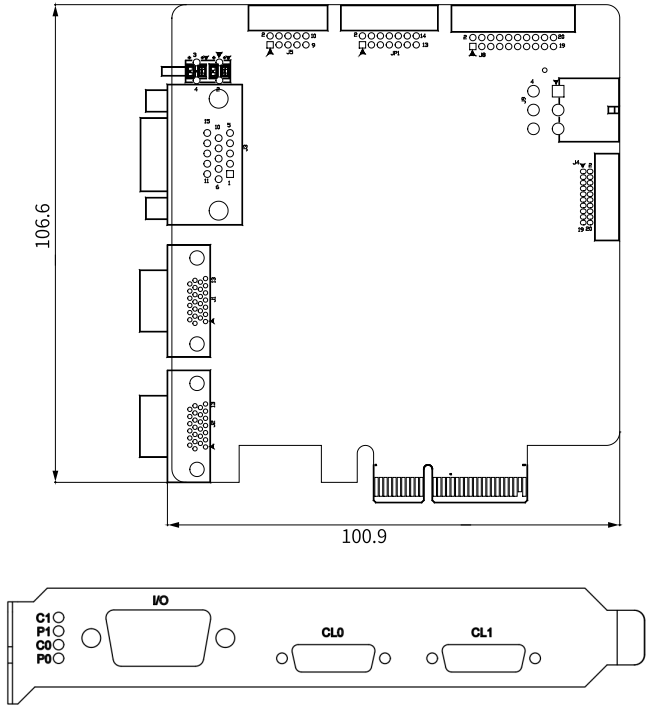


Figure 1-2 Outline dimensions (unit: mm)

1.5 Technical Specifications

Model		VG10-CL-S-P
Memory	Board memory size	1 GB
Host interface	Bus interface	PCIe Gen2x4 or PCIe Gen3x4
	Total bandwidth	Up to 6.8 Gbps

Model		VG10-CL-S-P
Camera interface	Standard	CameraLink 2.1
	Number of interfaces	2 x SDR
	Number of cameras supported	Up to 2
	Interface transmission mode	• In single-camera mode, four configuration options are supported: Base, Medium, Full, and 80bit. • In dual-camera mode, only dual Base mode is supported for both camera channels.
	Number of channel indicators	4
General I/O	I/O function	TTL input/output: 4 RS422 input: 2 Photocoupler input: 2
	Connector	D-Sub 15-pin female connector
Electrical characteristics	Full load power consumption	12 W
	Single-channel Max. output power consumption	6 W
	Power supply	The host power supply provides power to the frame grabber through the ATX4 connector.
Structure	Outline dimensions	106.6 mm x 100.9 mm
	Temperature	5°C to 50°C
	Humidity	⩽ 80% RH, no condensation
General specifications	Software	INOMV
	Operating system	Windows 10
	Certification	CE

2 Image Frame Grabber Hardware

2.1 I/O Interface

The following table describes definitions of I/O interfaces of the frame grabber.

Table 2–1 Assignment of connectors

No.	Electrical Standard	Direction	Single Full
1+ / 2–	RS422	Input	RS422_IN0
3+ / 4–	RS422	Input	RS422_IN1
5, 8, 15	GND	-	-
6+ / 11–	Photocoupler, 3.3 V to 30 V	Input	OPTO_IN0
7+ / 12–	Photocoupler, 3.3 V to 30 V	Input	OPTO_IN1
13	TTL input, 0 V to 5 V	Input	TTL_IN0
9	TTL input, 0 V to 5 V	Input	TTL_IN1
14	TTL output, 0 V to 5 V	Input	TTL_OUT0
10	TTL output, 0 V to 5 V	Input	TTL_OUT1

Note

In Single Full mode, all I/O signals are available. In Dual Base mode, the output signals are evenly distributed between the two CameraLink channels.

2.2 CardLink Interface

When multiple frame grabbers work in coordination, they need to exchange signals such as triggers. In such scenarios, using external I/Os cannot achieve low latency and synchronization reliability. The bidirectional I/O signals defined in the CardLink connector are internal signals of the frame grabber, transmitted to other frame grabbers through driver chips, ensuring low latency. Since multiple frame grabbers use the same processed signal, synchronization performance is improved.

Table 2–2 AUX I/O loopback interface definition

No.	Definition	No.	Definition
1	CardLink0	15	CardLink5
3	CardLink1	17	CardLink6
5	CardLink2	19	CardLink7

No.	Definition	No.	Definition
7	CardLink3	Others	GND
13	CardLink4	-	-

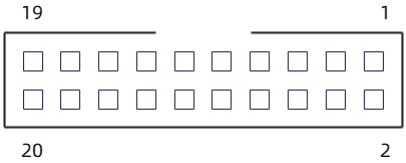


Figure 2-1 CardLink interface pin arrangement

Note

The pin numbering follows the order of top to bottom and right to left.

2.3 CardLink Indicator

Table 2–3 Statuses of LED indicator

LED Color	State	Definition
Flashing red and green alternatively	0.5 Hz	The frame grabber is in maintenance mode and can only perform upgrades, not image acquisition.
Red	Steady ON	The camera connected to this CameraLink connector is abnormal: either not connected or no clock signal detected.
Green	Steady ON	The camera is successfully connected.
Green	0.5 Hz	Acquisition has started, but the camera is not outputting image data.
Green	8 Hz	Acquisition has started, and the camera is outputting image data normally.
LED#1 OFF		The frame grabber is configured with Single Full mode but is currently operating in Base mode.

2.4 PoCL Indicator

Table 2–4 PoCL indicator colors and definitions

LED Color	State	Definition
Red	Steady ON	The CameraLink connector is powered.
OFF		The CameraLink connector is not powered.



Power off the host before installing the frame grabber to avoid damaging the frame grabber and host.

3 Image Frame Grabber Installation and Connection

3.1 Operating Environment and Conditions

3.1.1 Work Environment Requirements

Item	Environment Requirements
Operating temperature	5°C to 50°C
Operating humidity	⩽ 80% RH, no condensation
Transportation and storage temperature	–10°C to +70°C
Transportation and storage humidity	⩽ 80% RH, no condensation

3.1.2 Installing the Frame Grabber



Power off the host before installing the frame grabber to avoid damaging the frame grabber and host.

To use the PoCL function, the host power supply must provide power to the frame grabber through the ATX4 connector on the board edge, and a PoCL-compatible cable is required.

Installation procedure

1. Ensure that the host PCIe slot supports PCIe 2x4 or PCIe 3x4 and the host is powered off.
2. After inserting the frame grabber, secure the bracket with screws or quick-release fasteners; otherwise, inserting CameraLink cables may dislodge the frame grabber from the PCIe slot
3. To use the PoCL function, the host power supply must provide power to the frame grabber through the ATX4 connector.
4. Use SDR-MDR/SDR-SDR cables to connect the frame grabber and camera as specified in the following table. If the PoCL function is required, a cable that supports PoCL must be used.

Table 3–1 Connection between the frame grabber and the camera in Single Full mode

Camera	Frame Grabber	Function	Description
CL#0	CL#0	Data and control	-
CL#1	CL#1	Data	If the camera operates in Base mode, this cable does not need to be connected.

Table 3–2 Connection between the frame grabber and the camera in Dual Base mode

Camera #0	Camera #1	Frame Grabber	Function
CL#0	X	CL#0	Data and control
X	CL#0	CL#1	Data and control

3.2 I/O Electrical Characteristics and Wiring

3.2.1 I/O Interface Electrical Characteristics

RS422 input signal

The frame grabber internally uses AM26LV32 as the RS422 receiver chip, with a 100-ohm termination resistor. When the external input is RS422 or RS485 signal, connect the electrical equipment to the frame grabber as follows.

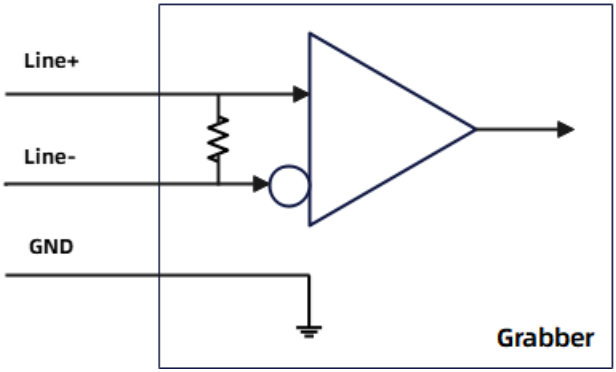


Table 3–3 Electrical characteristics of frame grabber RS422 input

Parameter Name	Parameter Value	Parameter Name	Parameter Value
Input frequency	10 MHz	Signal delay	16 ns

Wide-voltage optocoupler input signal

The voltage range of the wide-voltage optocoupler input signal is 0 VDC to 30 VDC. You can select the high-level threshold according to the current input signal. Two high-level thresholds are available: 3 VDC and 8 VDC, and are selected through jumpers on the frame grabber.

The following figure shows the jumper configuration. J6 represents OPTO_IN0 and J7 represents OPTO_IN1. When the jumper connects pins 1/2, the threshold is set to 3 V. When the jumper connects pins 2/3, the threshold is set to 8 V.

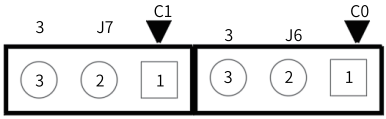


Table 3–4 Electrical characteristics of frame grabber's wide-voltage optocoupler input

Parameter Name	Parameter Value	Parameter Name	Parameter Value
Input frequency	50 kHz	Signal delay	0.1 µs
8-V threshold	Low (< 6 VDC) High (8 VDC)	Input current	10 mA
3-V threshold	Low (< 2.6 VDC) High (3.5 VDC)	-	-

When using optocoupler input, ensure the voltage difference between Line+ and Line– is sufficient to reliably turn the optocoupler on or off, avoiding indeterminate states between these thresholds.

When the input is TTL or other single-end signals, use the connection method shown in the following diagram.

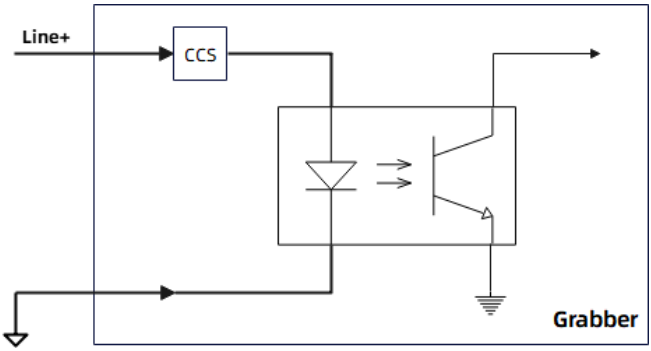


Figure 3-1 Connection of single-end signal input

When the input is NPN-type switch signals, use either of the two connection methods shown in the following diagram.

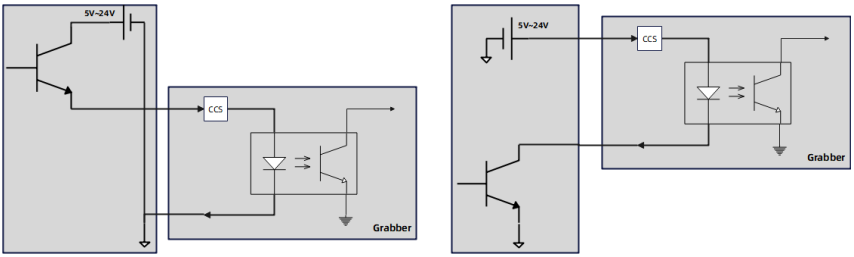


Figure 3-2 Connection of NPN-type switch signal input

When the input is PNP-type switch signals, use the connection method shown in the following diagram.

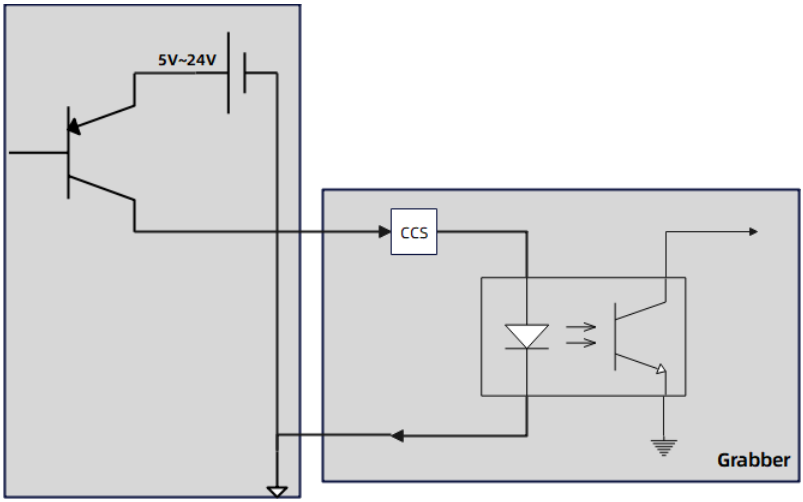


Figure 3-3 Connection of PNP-type switch signal input

Note

Ensure the drive current exceeds 10 mA when connecting switch-type signals.

TTL signal

TTL input signal

The I/O connector provides 2 TTL inputs with the following electrical parameters.

Table 3–5 TTL input electrical characteristics

Parameter Name	Parameter Value	Parameter Name	Parameter Value
Switching frequency	1 MHz	Signal delay	< 20 ns
Input high level	2 VDC	Input voltage range	0 V to 5.5 V
Input low level	< 0.8 VDC	-	-

TTL output signal

The I/O connector provides 2 TTL outputs with the following electrical parameters.

Table 3–6 TTL output electrical characteristics

Parameter Name	Parameter Value	Parameter Name	Parameter Value
Switching frequency	1 MHz	Signal delay	< 20 ns
Output high level	4.4 VDC	Output current	< 24 mA
Output low level	< 0.5 VDC	-	-

3.2.2 CardLink Interface Electrical Characteristics

The CardLink connector internally features 8 bidirectional I/Os for low-latency transmission of FPGA internal signals between two frame grabbers, typically used for collaborative image acquisition across multiple frame grabbers. It facilitates the transfer of signals such as frame triggers or line triggers between two frame grabbers. CardLink signals follow the 3.3 V LVTTL standard and are designed exclusively for interconnection between two frame grabbers. They must not be connected to external signals, as this may damage the frame grabber. When two frame grabbers are interconnected, a simple 20-pin one-to-one DuPont cable is sufficient.

Table 3–7 CardLink signal electrical characteristics

Parameter Name	Parameter Value	Parameter Name	Parameter Value
Signal frequency	1 MHz	Signal delay	0.01 μs

4 Installation and Connection on Client

4.1 Installation on Client

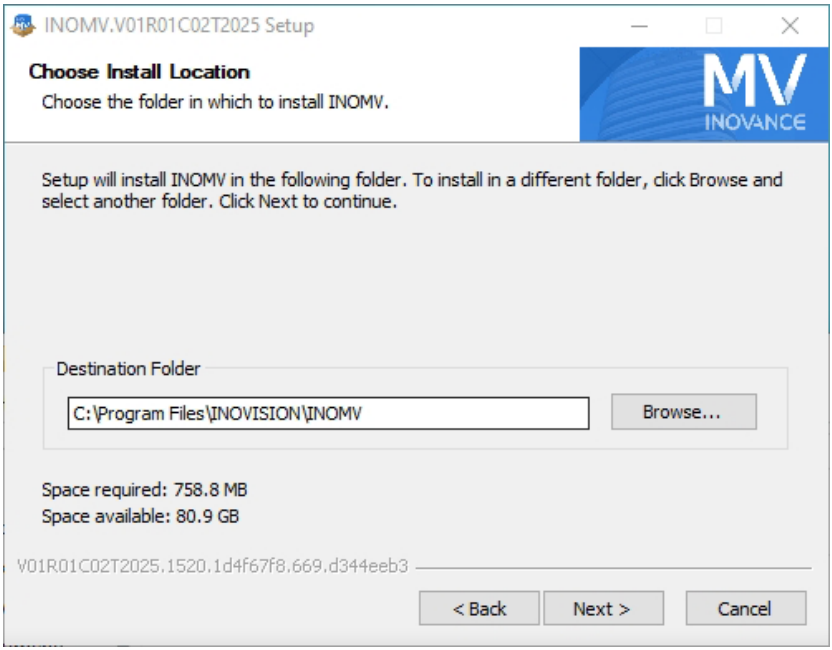
The VG10-CL-S-P client software is INOMV that supports 64-bit Windows 10.

Installation of the client software includes the following two parts:

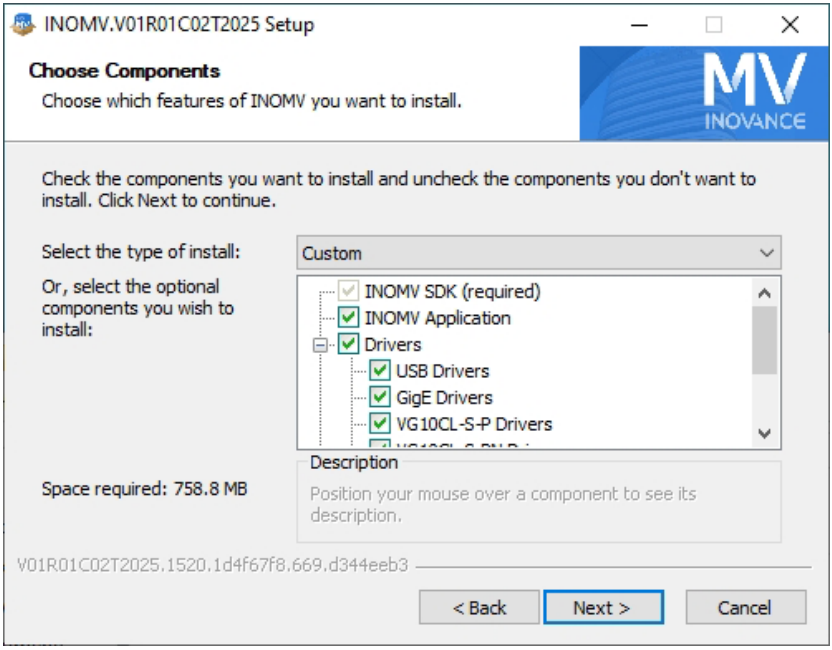
1. Installation of the frame grabber GUI client.
2. Installation of the frame grabber driver.

Installing the frame grabber GUI client

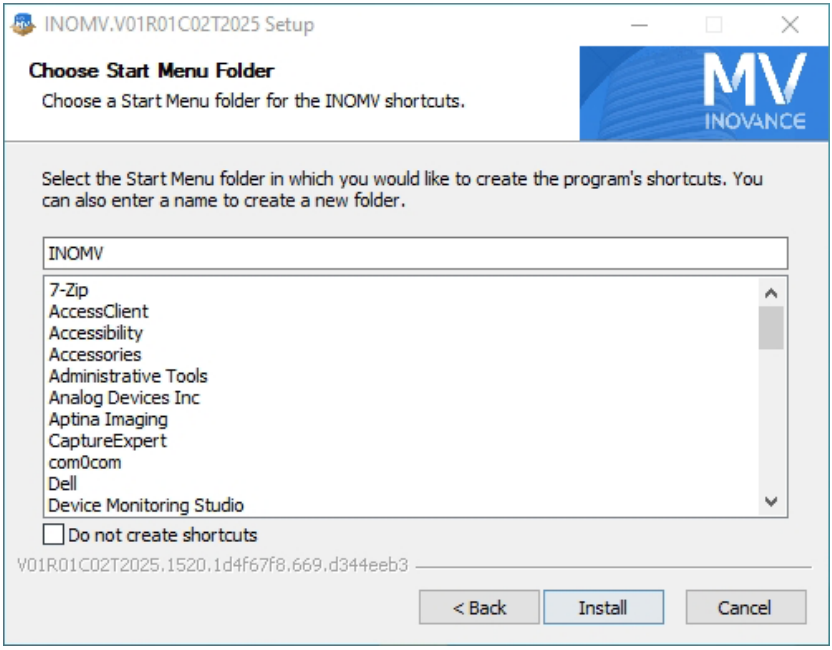
1. Double-click the INOMV installation file, select an installation path, and click "Next".



2. On the component selection page, select "INOMV Application" and a VG10 driver (if not selected, refer to the driver installation section in the INOMV Image Collection Commissioning Software SDK Installation User Guide), and then click "Next".



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.

Installing the driver

If the "VG10 Driver" option has been selected during the INOMV installation, you may skip this section.

1. Run INOMV and choose "Common" > "Tool" in the menu bar.
2. If the driver is not installed, the "Install" button will appear under PCIe (VG10). Click "Install".

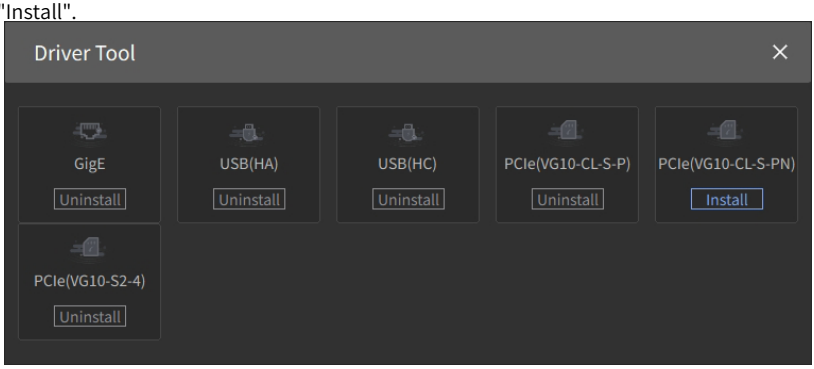


Figure 4-1 INOMV driver installation page

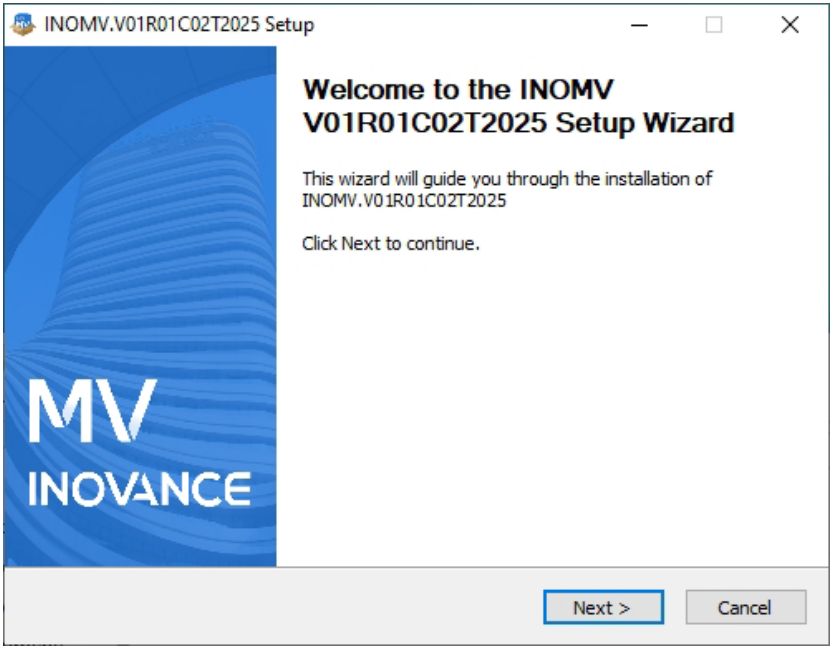


Figure 4-2 InstHCVG10Driver installation page

If an older version of the driver is already installed, you must first uninstall the old driver. In INOMV, disconnect the local device from the frame grabber.

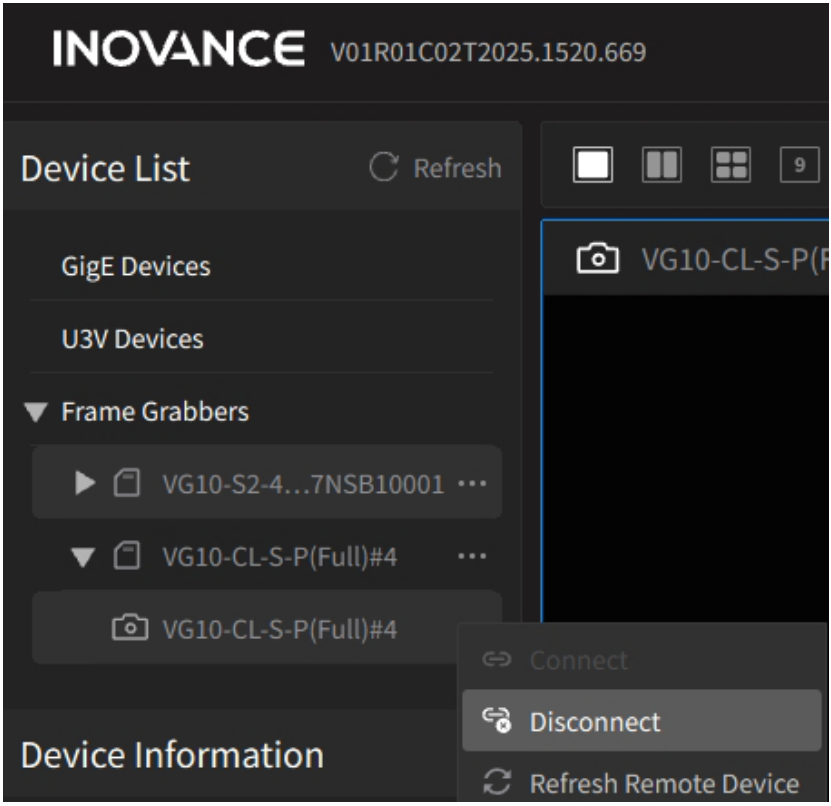


Figure 4-3 Disconnecting the local device from the frame grabber in INOMV

Click "Uninstall" under PCIe (VG10) to remove the old driver before installing the new one. After successful driver installation, the following page will be displayed.

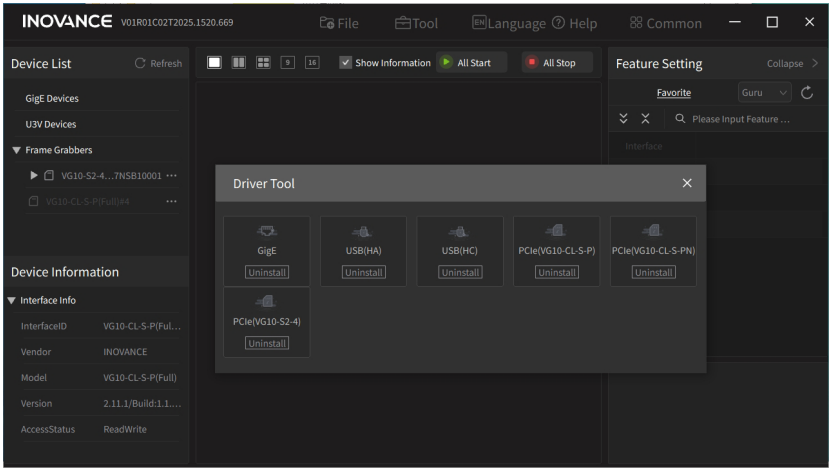


Figure 4-4 Uninstalling driver in INOMV

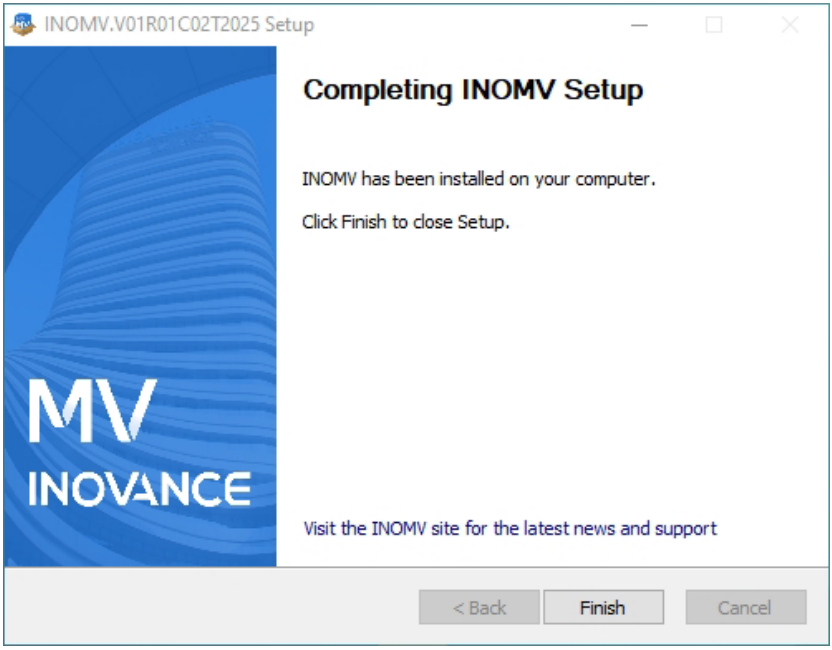


Figure 4-5 InstHCVG10Driver installation completion page

3. Check Device Manager. If the driver is installed successfully, the device will be displayed as "VG10-CL-S-P (Full)".

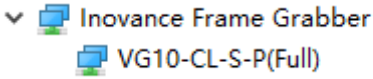


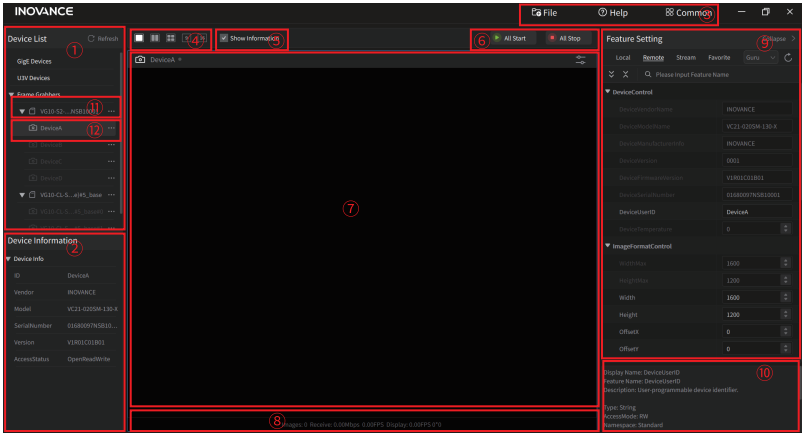
Figure 4-6 Frame grabber in Device Manager

Caution

Disconnect the camera from the frame grabber before uninstalling drivers; otherwise, the uninstallation process may freeze.

4.2 Using Client Software

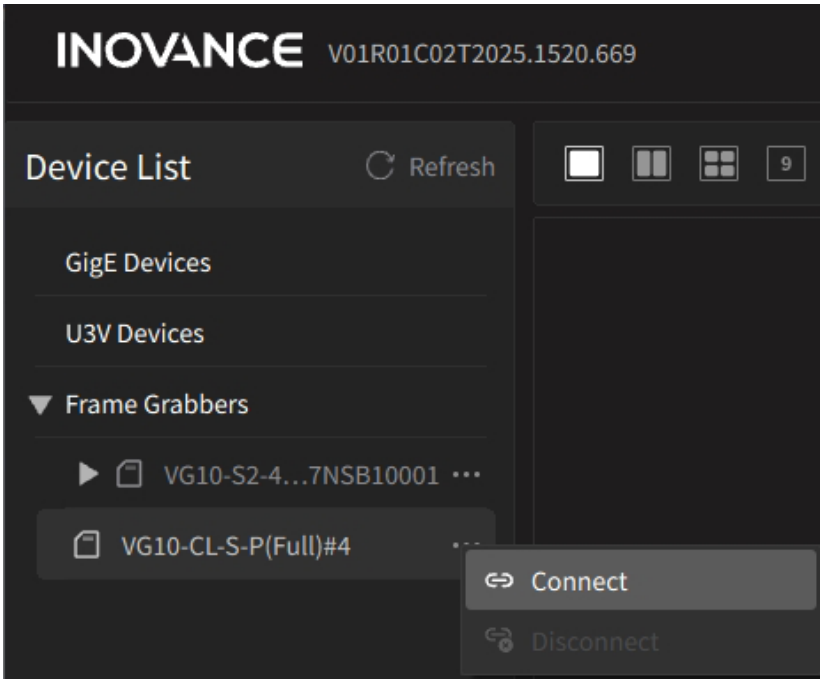
After INOMV is started, the software main screen is displayed, as shown in the following figure. The following table lists the functions of each area.



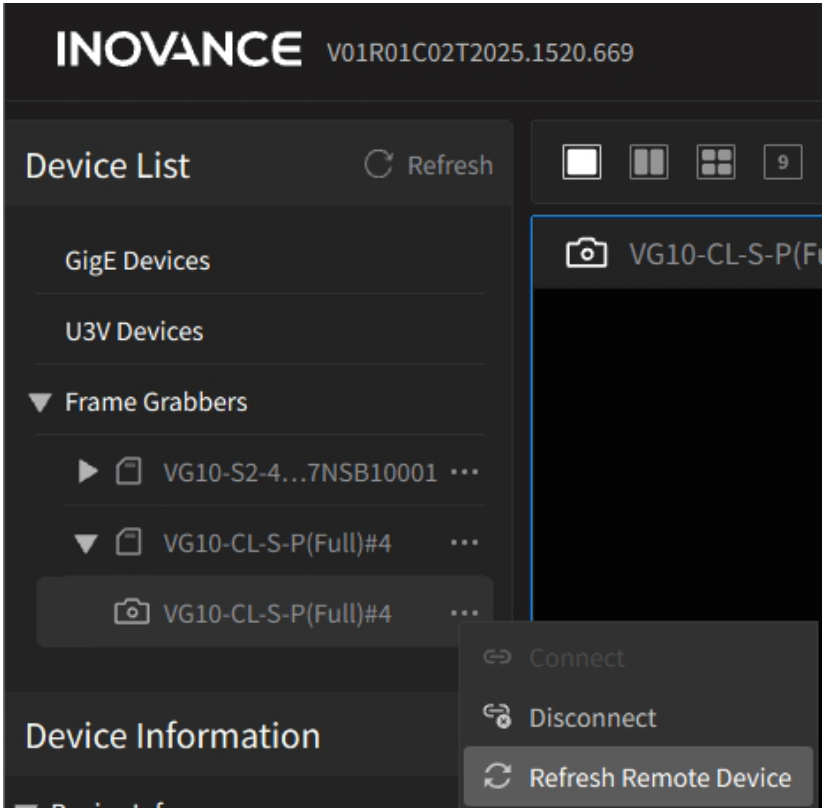
Area	Function
①	Device List
②	Device Information
③	Menu bar
④	Image window quantity setting
⑤	Image information display setting
⑥	Collection start/stop button
⑦	Image display area
⑧	Image information area
⑨	Property setting area

Area	Function
⑩	Property information area
⑪	Frame grabber port
⑫	Frame grabber local device

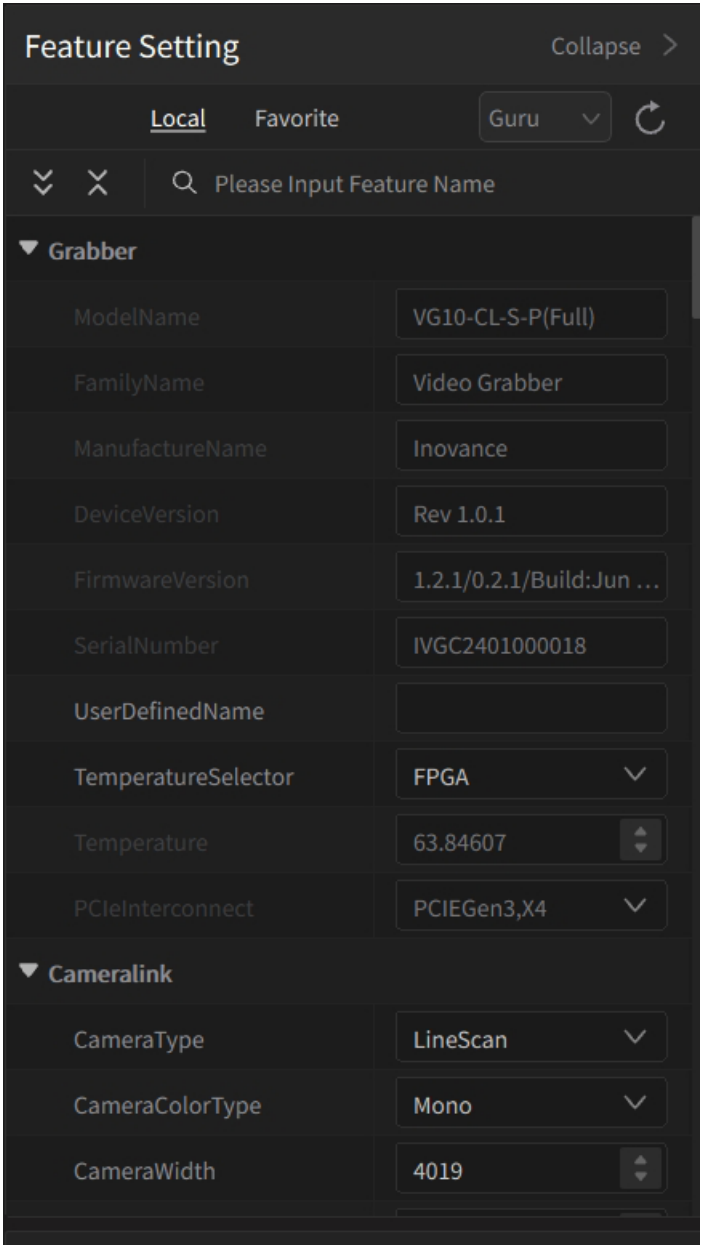
- When only frame grabbers are connected, choose "Device List" > "Frame Grabbers", right-click a local device, and click "Connect". After a successful connection, you can set the frame grabber parameters in "Feature Setting" on the right.



- 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.


Feature Setting
Collapse
Local
Favorite
Guru
Please Input Feature Name
Grabber
ModelName
VG10-CL-S-P(Full)
FamilyName
Video Grabber
ManufactureName
Inovance
DeviceVersion
Rev 1.0.1
FirmwareVersion
1.2.1/0.2.1/Build:Jun ...
SerialNumber
IVGC2401000018
UserDefinedName
TemperatureSelector
FPGA
Temperature
63.84607
PCIeInterconnect
PCIEGen3,X4
Cameralink
CameraType
LineScan
CameraColorType
Mono
CameraWidth
4019

4.3 Basic Functions

4.3.1 CameraLink Data Acquisition

After opening the frame grabber, you can configure parameters related to the CameraLink interface in the parameter settings area of the frame grabber.

Parameter Name	Type	Function
CameraLink	Category	Directory of registers related to CameraLink data acquisition
CameraType	Enumeration	Selects the type of the connected camera: area-scan or line-scan.
CameraColorType	Enumeration	Selects the camera color format: Mono/Bayer/ RGB/RGBY.
CameraWidth	Integer	The image width of the camera. Some Geometry settings have requirements on width configuration.
CameraHeight	Integer	The image height of the camera. For line scan cameras, this is the acquisition height.
CameraBitsPerPixel	Enumeration	Selects the pixel bit depth of the camera. For RGB/RGBY types, this refers to the component bit depth.
CameraLinkConfig	Enumeration	The CameraLink configuration calculated based on the selected pixel bit depth and image Geometry format.
CameraLinkGeometry	Enumeration	The name of the Tap arrangement method compliant with the GenICam standard.
CameraLinkDvalIsEnabled	Boolean	Enables or disables the camera DVAL signal.
CameraLinkClockFrequency	Integer	Sets the CameraLink pixel clock frequency (20 M to 85 M).
CameraReConnect	Command	Reconnects the camera when data acquisition fails due to hot-plugging.
CameraCC	Category	Directory of registers related to camera control signals (CC1 to CC4)
CCSelector	Enumeration	CameraLinkControl signal selection
CCSource	Enumeration	CameraLinkControl signal source
CCStaticsFreq	Float	CameraLinkControl signal frequency
PoCL	Boolean	Sets whether to power the camera through the CameraLink connector.
PoCL Status	Integer	Displays the status of PoCL (whether power supply is successful).
InternalPattern	Category	Internal test patterns of the frame grabber
TestPattern	Enumeration	Selects the internal test pattern of the frame grabber. "Off" means using the camera image.

Parameter Name	Type	Function
TestPatternMaxFrameRate	Float	The maximum achievable frame rate for the test pattern under the current settings
TestPatternFrameRate	Float	Sets the frame rate of the test pattern (it must be less than the maximum frame rate).

Note

The maximum achievable frame rate depends on the acquisition mode, host buffer number, and CPU performance.

4.3.1.1 Setting the Camera Frame

The camera frame width (CameraWidth) refers to the number of pixels per line of the camera image.

The valid values for CameraWidth depend on the selected Tap format (CameraLinkGeometry) and must be an integer multiple of the number of horizontal regions. For example, when Geometry is set to CameraLink8X_1Y, there are 8 regions outputting simultaneously in the X direction. Therefore, the frame width must be a multiple of 8. If it is set to CameraLink1X8_1Y, there is only one region in the X direction, with 8 pixels outputting simultaneously within Region 1. In this case, CameraWidth has no restrictions.

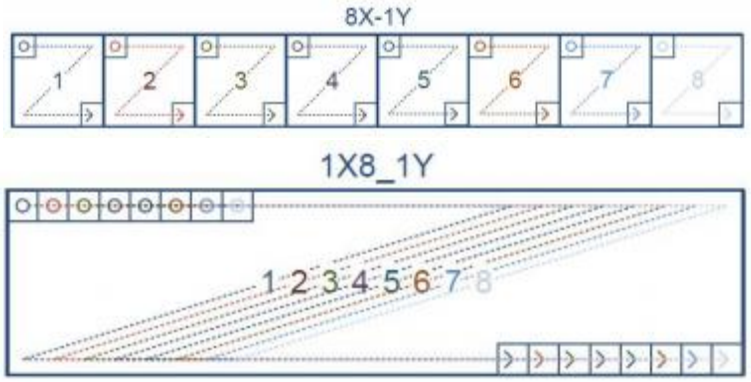


Figure 4-7 CameraLink 8X and 1X8 Tap

Note

- Image acquisition will not start if the set Region of Interest (ROI) is invalid.
- For CameraLinkGeometry definitions, see the Appendix.

4.3.1.2 CameraLinkConfig

CameraBitsPerPixel refers to the pixel bit depth of the camera. For data formats like RGB, CameraBitsPerPixel indicates the bit depth of each color component.

The frame grabber determines the CameraLinkConfig (Base/Medium/Full/80bit) based on the configured CameraBitsPerPixel, CameraColorType, and CameraLinkGeometry (Tap arrangement). If the combination is invalid, it will display as InvalidConfig, in which case image acquisition is not available.

The following table shows the currently supported combinations by the frame grabber.

Table 4–1 CameraLink Tap arrangements supported by the frame grabber

Tap	ColorType	8-bit	10-bit	12-bit	14-bit	16-bit	GenICam Geometry
1	Mono/Bayer	B	B	B	B	B	Area scan: 1X-1Y Line scan: 1X
2	Mono/Bayer	B	B	B	M	M	Area scan: 1X2-1Y/2X-1Y/2XE-1Y/2XM-1Y Line scan: 1X2/2X/2XE/2XM
3	Mono/Bayer	B	M	M	M	M	Area scan: 1X3-1Y/3X-1Y Line scan: 1X3/3X
	RGB	B	M	M	M	M	Area scan: 1X3-1Y Line scan: 1X3
4	Mono/Bayer	M	M	M	F	F	Area scan: 1X4-1Y/4X-1Y/2X2-1Y/2X2E-1Y/2X2M-1Y Line scan: 1X4/4X/2X2/2X2E/2X2M
	RGBY	M	M	M	F	F	Area scan: 1X4-1Y Line scan: 1X4
5	Mono/Bayer	M	F	F	-	80	Area scan: 1X5-1Y/5X-1Y Line scan: 1X5/5X
6	Mono/Bayer	M	F	F	-	-	Area scan: 1X6-1Y/6X-1Y Line scan: 1X6/6X
	RGB	M	F	F	-	-	Area scan: 1X6-1Y/2X3-1Y/2X3E-1Y/2X3M-1Y Line scan: 1X6/2X3/2X3E/2X3M
7	Mono/Bayer	F	80	-	-	-	Area scan: 1X7-1Y/7X-1Y Line scan: 1X7/7X
8	Mono/Bayer	F	80	-	-	-	Area scan: 1X8-1Y/8X-1Y/4X2-1Y/4X2E-1Y Line scan: 1X8/8X/4X2/4X2E
	RGB	F	80	-	-	-	Area scan: 1X8-1Y
	RGBY	F	80	-	-	-	Line scan: 1X8
9	Mono/Bayer	F	-	-	-	-	Area scan: 1X9-1Y/9X-1Y
	RGB	F	-	-	-	-	Line scan: 1X9/9X
10	Mono/Bayer	80	-	-	-	-	Area scan: 1X10-1Y/10X-1Y
	RGB	80	-	-	-	-	Line scan: 1X10/10X

Tap arrangement for RGB-type cameras are defined as follows: For RGB-type cameras, the Geometry definition treats each color channel as independent. For example, when one pixel (three color components) is output per clock cycle, it is defined as 1X3 mode.

The following figure illustrates the arrangement of RGB data in host memory, where each color channel has an 8-bit depth, and the number following the color component indicates the pixel position.

Table 4–2 Data output of RGB-format cameras

R0	R1	R2	R3	R4	R5	R6	R7	R8	R9
G0	G1	G2	G3	G4	G5	G6	G7	G8	G9
B0	B1	B2	B3	B4	B5	B6	B7	B8	B9

Table 4–3 Memory arrangement of RGB-format camera data in host memory

R0	R1	R2	R3
G0	G1	G2	G3
B0	B1	B2	B3

Table 4–4 Memory arrangement of RGB-format camera data in host memory

R0	G0	B0	R1	G1	B1	R2	G2	B2	R3	G3	B3

4.3.1.3 Camera Connection

PoCL

When connecting a PoCL-compatible camera to the frame grabber, ensure the host is powered off, and supply power from the host chassis to the frame grabber through the ATX4 connector on its edge. Use a PoCL-certified cable for camera connection. Set the PoCL register to True in the software. After successful power supply, the PoCL Status register will display 0x1 (Base) or 0x3 (Medium and above). If power supply fails due to abnormalities, it will display 0x0.

CameraReconnect

If a connected CameraLink camera loses connection (for example, due to cable disconnection) while originally functioning normally, execute the CameraReConnect command to re-establish the connection.

CameraLink Clock Frequency & Data Valid

Properly configure the CameraLinkClockFrequency register to match the camera clock frequency.

For cameras with DataValid function, set CameraLinkDvalIsEnabled to True.

4.3.1.4 Test Pattern

The frame grabber has built-in test patterns that can generate images without connecting a camera, used for testing.

In Mono mode, the following test patterns are provided:

HorizontalGreyScale

Horizontal grayscale: PixelValue[X,Y] = X%FullScale. X, Y represent the pixel coordinates, and FullScale represents the maximum grayscale value + 1 under the current bit depth. For example, for 8-bit depth, FullScale = 256.



Figure 4-8 HorizontalGreyScale

VerticalGrayScale

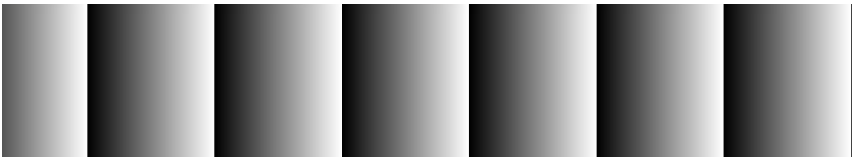
Vertical grayscale: PixelValue[X,Y] = Y%FullScale.



Figure 4-9 VerticalGrayScale

HorizontalMovingGrayScale

Horizontal moving grayscale: PixelValue[X,Y] = (X+FrameCounter)%FullScale.



VerticalMovingGrayScale

Vertical moving grayscale: PixelValue[X,Y] = (Y+FrameCounter)%FullScale.



Figure 4-10 VerticalMovingGrayScale

FrameCounter

Frame counter grayscale: PixelValue[X,Y] = FrameCounter%FullScale.



Figure 4-11 FrameCounter

DiagonalMovingGrayScale

Diagonal moving grayscale: PixelValue[X,Y] = (X+Y+FrameCounter)%FullScale.

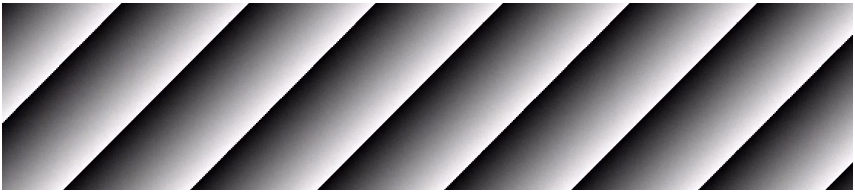


Figure 4-12 DiagonalMovingGrayScale

In RGB mode, one test pattern is provided: ColorBar.

From left to right, each color bar is 256 pixels wide. Taking 8-bit depth as an example, the pixel values (R, G, B) are as follows:

Red (255, 0, 0), Green (0, 255, 0), Blue (0, 0, 255), Yellow (255, 255, 0), Purple (255, 0, 255), Cyan (0, 255, 255), White (255, 255, 255), Black (0, 0, 0).

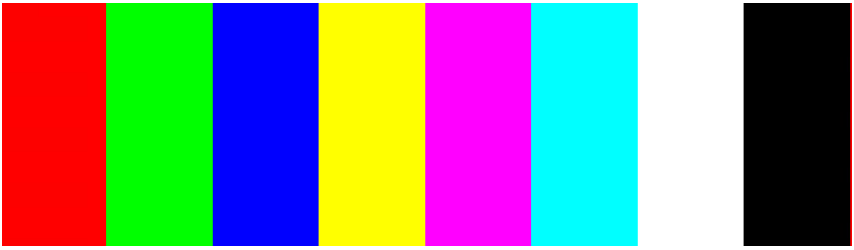


Figure 4-13 ColorBar

In RGBY mode, one test pattern is provided: ColorBar. The RGB part is the same as above. The Y component has grayscale bars, each 256 pixels wide, with grayscale values starting from 0 and increasing by 1/8 of the full grayscale value. For 8-bit depth, the grayscale values are as follows:

0, 32, 64, 96, 128, 160, 192, 224. (The current version of INOMV does not support displaying RGBA. You can save the Rawbinary format for viewing.)



Figure 4-14 Y-channel test pattern of ColorBar

Note

PoCL and Geometry configurations do not affect the output of test patterns.

After CameraWidth, CameraHeight, and CameraBitsPerPixel are set, the maximum achievable frame rate

for the test pattern, TestPatternMaxFrameRate, is automatically calculated. The user-set TestPatternFrameRate cannot exceed the maximum frame rate.

Note

When the acquisition frame rate is high, you must configure BlockMode and the number of Buffers to achieve the maximum acquisition frame rate.

4.3.2 Acquisition Control

The following table lists registers related to acquisition control.

Table 4–5 AcquisitionControl category register definitions

Parameter Name	Type	Function
AcquisitionControl	Category	Directory of data acquisition control-related registers
AcquisitionMode	Enumeration	Continuous acquisition or triggered acquisition
AcquisitionFrameCount	Integer	Number of images to capture when AcquisitionMode is TriggerMultiFrame mode
TriggerSelector	Enumeration	Trigger signal type
TriggerSource	Enumeration	Signal source for the trigger signal
TriggerActivation	Enumeration	Active edge/level of the trigger signal

The frame grabber supports four image acquisition modes.

Table 4–6 AcquisitionMode

Acquisition Mode	Camera Type	Trigger Type	Description
Continuous	Area scan, line scan	-	Continuous acquisition
TriggerFixedFrame	Line scan	Edge, level	In level mode, acquisition starts when the signal goes high.
TriggerInfiniteFrame	Area scan, line scan	Edge	-
TriggerMultiFrame	Area scan, line scan	Edge	-

4.3.2.1 Continuous Acquisition

Area scan camera

In continuous acquisition mode, after the software issues the GrabStart command, the frame grabber will start acquisition from a valid frame. If Camera.FVAL is active when the GrabStart command is issued, the current frame (FRM-1) will be discarded, and acquisition will start from the next frame (FRM-2). If Camera.FVAL has not ended when GrabStart is completed (FRM-3), the frame grabber will terminate the current frame early. You can retrieve the valid height of the current image using the SDK functions.

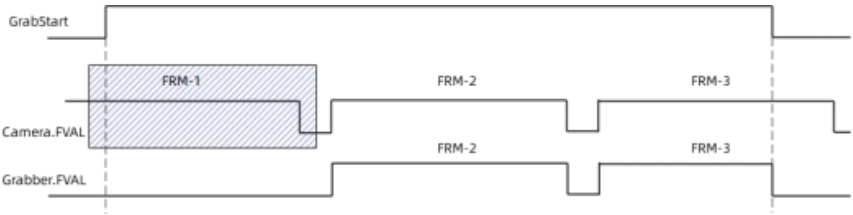


Figure 4-15 Continuous acquisition mode for area scan camera

Line scan camera

In continuous acquisition mode, after the software issues the GrabStart command, the frame grabber will start acquisition from the latest valid line and complete a virtual frame (FRM-1) once the height reaches CameraHeight. If the acquisition height has not reached CameraHeight when the software issues a stop command, the frame grabber will wait for the current line to finish before terminating the virtual frame early (FRM-2). You can obtain the valid image height through the SDK. While GrabStart remains active, the frame grabber will continuously generate virtual frames (FRM-3, FRM-4, and so on).

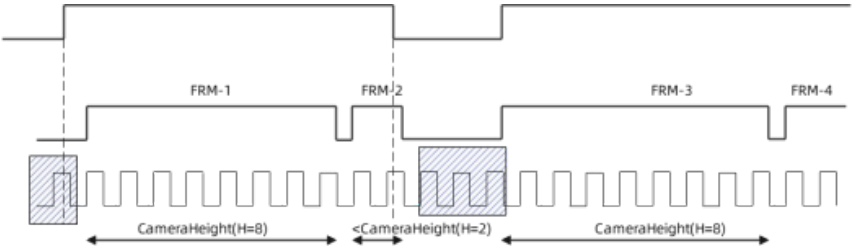


Figure 4-16 Continuous acquisition mode for line scan camera

4.3.2.2 Fixed-Height Acquisition

Only line scan cameras support this mode. Area scan cameras do not.

In fixed-height acquisition mode, an external trigger signal (AcquisitionStart) is required to control image acquisition. The behavior varies depending on the selected polarity of the external input signal (edge or level).

Edge triggering

Upon receiving a valid trigger edge (AcquisitionStart#1), the frame grabber will start capturing the image from the latest valid line, with a fixed acquisition height of CameraHeight. When the acquisition height is reached, the virtual frame (FRM-1) will end. Any remaining lines will be discarded until the next valid AcquisitionStart edge arrives.

If the fixed-height (CameraHeight) acquisition is not completed within an active acquisition period (AcquisitionStart#2), any new trigger signal (AcquisitionStart#3) will be ignored, and

a TriggerMissed signal will be generated. You can monitor this event through Counter, Meta information, or other means.

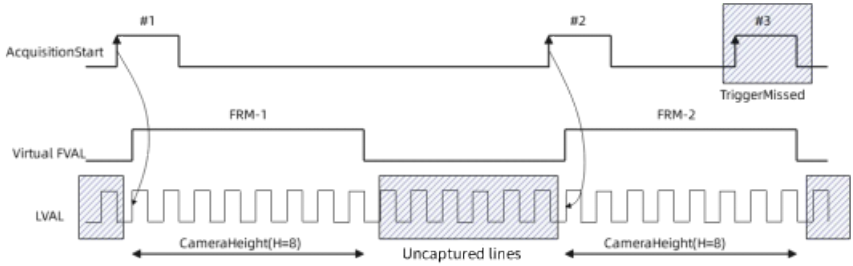


Figure 4-17 TriggerFixedFrame, edge triggering

Level triggering

During the active AcquisitionStart level, the frame grabber will continuously capture images. If the AcquisitionStart active level duration is longer than the duration of one virtual frame, the image will be split into multiple frames for transmission, each with a height of CameraHeight (FRM-1). When AcquisitionStart ends, the height of the last frame (FRM-2) may be less than CameraHeight.

If the AcquisitionStart active level duration is shorter than the duration of one virtual frame, the actual image height will match the duration of the AcquisitionStart active level (FRM-3).

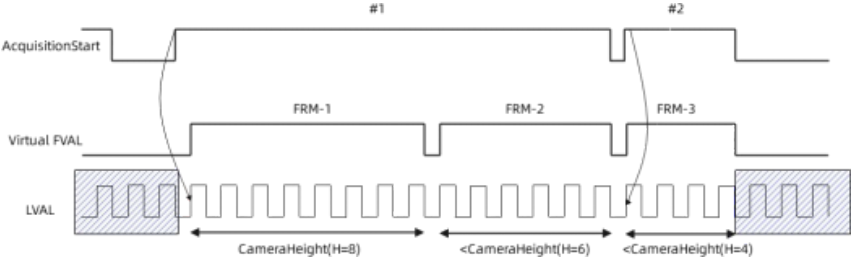


Figure 4-18 TriggerFixedFrame, level triggering

4.3.2.3 Triggering Multi-Frame Acquisition

These two modes support both area scan and line scan operation. The trigger signal is only edge-triggered.

TriggerInfiniteFrame

After receiving the active edge of a trigger signal, the frame grabber begins image acquisition and continues until the software issues a stop command (AcquisitionEnable=0).

TriggerMultiFrame

After receiving the active edge of a trigger signal, the frame grabber acquires the number of images specified by AcquisitionFrameCount. Upon completion, it waits for the next valid AcquisitionStart edge signal. During acquisition, if the preset frame count has not been reached, any new AcquisitionStart signals will be ignored.

The figure below illustrates the case where AcquisitionFrameCount is set to 2. Since the active edge of Trigger #2 occurs during the second frame of Trigger #1, it is ignored.

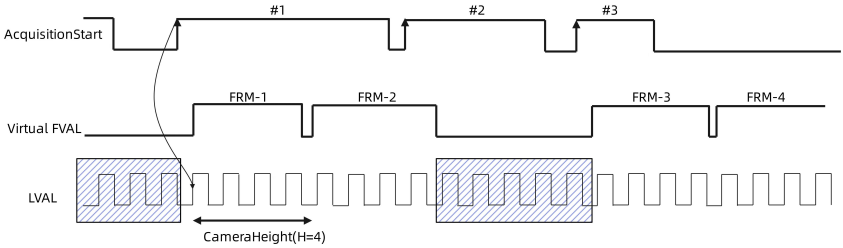


Figure 4-19 TriggerMultiFrame

4.3.3 Image Data Stream

Table 4–7 Stream category registers

Parameter Name	Type	Function
Stream	Category	Directory of image data stream-related registers
MultiStreamMode	Enumeration	Sets the image data stream splitting mode.
StreamSelector	Enumeration	Selects the image data stream.
Width[StreamSelector]	Integer	Image width of the current image data stream
Height[StreamSelector]	Integer	Image height of the current image data stream
BitsPerPixel[StreamSelector]	Enumeration	Bit depth of the current image data stream

About image splitting

The frame grabber provides four image splitting modes, which divide a single camera data source into multiple image data streams transmitted to the host on a line-by-line basis. The image height of each data stream is 1/N of the original height (N = 1, 2, 3, or 4). When N is 1, no image splitting occurs.

The following figure illustrates image splitting according to the MultiStreamMode = X1_Y4 method.

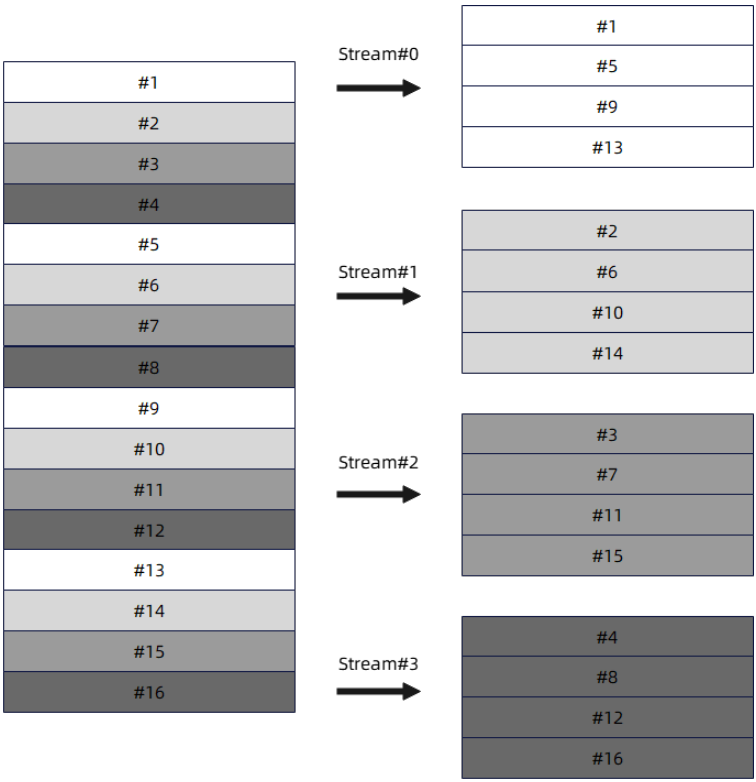


Figure 4-20 1:4 image splitting illustration

4.3.4 Digital I/O Control

Table 4–8 DigitalIOControl directory registers

Parameter Name	Type	Function
DigitalIOControl	Category	Directory of digital I/O control registers
/LineIO	Category	Directory of registers related to frame grabber input/output line
LineSelector	Enumeration	Selects an input/output line.
LineFormat	Enumeration	Read-only. The electrical format of the input/output line
LineMode	Enumeration	Direction of the input/output line
LineInverter	Boolean	Reverse control of the input/ output line

Parameter Name	Type	Function
LineSource	Enumeration	Selects the signal source of the output line.
LineDebouncerTime	Float	Debouncing width of the input line
LineStatusAll	Integer	Read-only. The level status of all lines
UserOutputValue	Category	Directory of registers related to user output
UserOutputSelector	Enumeration	Selects user output 0 or 1.
UserOutputValue	Boolean	Value of the user output signal
UserOutputValueALl	Integer	Value of all user output signals
UserOutputValueAllMask	Integer	Mask bits of all user output signal values
PulseGenerator	Category	Directory of registers related to pulse generator
PulseSelector	Enumeration	Selects the pulse generator.
PulseTriggerSource	Enumeration	Trigger signal source of the pulse generator
PulseTriggerActivation	Enumeration	Active polarity of the trigger signal for the pulse generator
PulseDelay	Float	Low-level duration of the pulse signal
PulseDuration	Float	High-level duration of the pulse signal
CardLink	Category	Directory of registers related to board synchronization signal
CardLinkSelector	Enumeration	Selects the synchronization signal.
CardLinkSignalMode	Enumeration	Selects the I/O direction of the synchronization signal.
CardLinkSignalSource	Enumeration	Signal source of the synchronization signal
CardLinkSignalInverter	Boolean	Reverse control of synchronization signal
CardLinkSignalStatusAll	Integer	Status value of all synchronization signals
IODelayer	Category	Directory of registers related to delay lines
IODelayerSelector	Enumeration	Selects the delay line.
IODelayerTimeBase	Enumeration	Time precision of the delay line
IODelayerValue	Integer	Delayer value
IODelayerInput	Enumeration	Selects the input signal for the delay line.

Parameter Name	Type	Function
FrequencySynthesiser	Category	Frequency multiplier/divider directory
FreqSynthesiserSelector	Enumeration	Selects the frequency multiplier.
FreqSynthesiserEnable	Boolean	Enables the frequency multiplication function.
FreqSynthesiserSig Source	Enumeration	Selects the signal to be multiplied.
FreqSynthesiserUpperLimit	Float	Sets the frequency lower limit for the input signal. Signals below this frequency will be filtered out.
FreqSynthesiserLowerLimit	Float	Sets the frequency upper limit for the input signal. Signals above this frequency will be filtered out.
FreqSynthesiserCoeff	Float	Frequency multiplication coefficient, ranging from 0.01 to 100
FreqSynthesiserStatus	Enumeration	Status of the frequency multiplier
FreqSynthesiserResult	Float	Output signal frequency of frequency multiplier
EncoderControl	Category	Quadrature encoder control directory
EncoderSelector	Enumeration	Selects the encoder.
EncoderSourceA	Enumeration	Selects the encoder phase A input signal.
EncoderSourceB	Enumeration	Selects the encoder phase B input signal.
EncoderMode	Enumeration	Sets the encoder operation mode (X1/X2/X4).
EncoderDirection	Enumeration	Sets the encoder identification direction, with A leading or B leading.
EncoderOutputMode	Enumeration	Sets the encoder output mode, including ALL, ForwardOnly, and Compensated.
EncoderResetSource	Enumeration	Sets the reset signal source for the encoder counter.
EncoderResetActivation	Enumeration	Sets the active mode of the encoder reset signal.
EncoderValue	Integer	Sets or reads the displacement pulse count of the encoder.

Parameter Name	Type	Function
EncoderValueAtReset	Integer	Reads the count value of the encoder at reset.
EncoderOutPulseWidth	Integer	Sets the output pulse width when the encoder operates in X4 mode.

The following figure shows the internal logic relationship of DigitalIOControl.

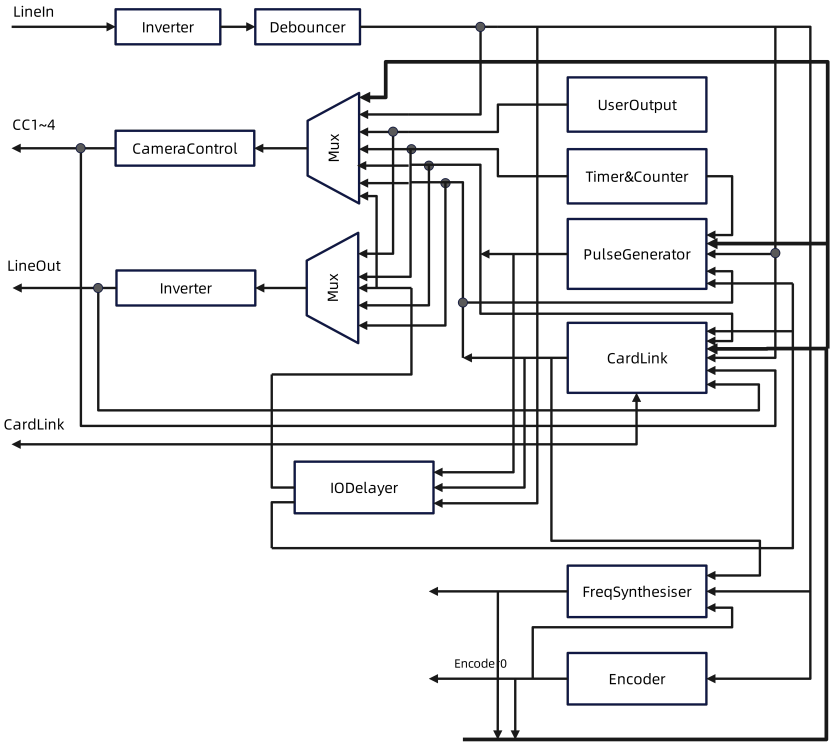


Figure 4-21 Internal logic relationship of DigitalIOControl

Debouncing for LineIn

The LineIn signal entering the frame grabber from an external source may contain glitches, requiring debouncing. You can set the debouncing width, and then only level changes lasting longer than this width are considered valid. Therefore, there is a time delay equal to the debouncing width between the original and debounced signals.

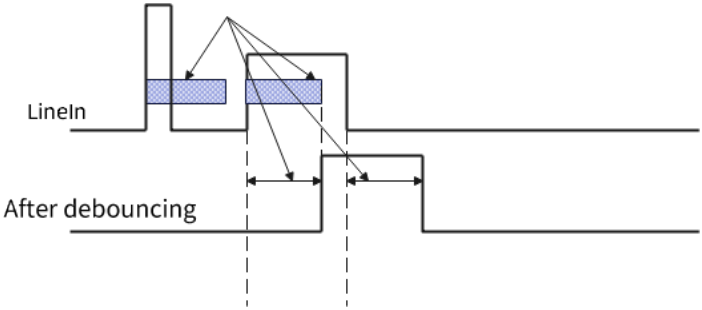


Figure 4-22 Debouncing for LineIn

PulseGenerator

The PulseGenerator generates a signal with a specified delay and pulse width based on an external trigger source. This signal can be used as LineOut, CardLink, or CameraControl signal source.

During the Delay and Duration periods, new external trigger signals will be ignored.

When TriggerSource is set to any value other than "Off", the PulseGenerator will continuously generate pulses according to the Delay and Duration settings.

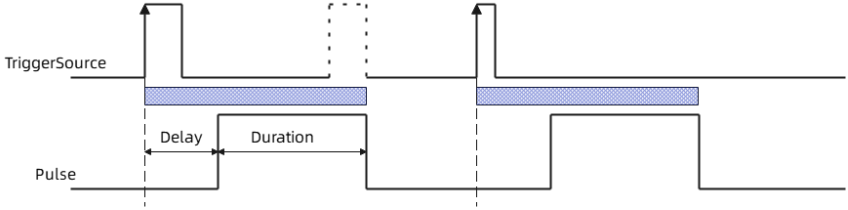


Figure 4-23 PulseGenerator

Delay line (IODelayer)

The frame grabber provides four 1000-stage delay lines. The time precision (TimeBase) has three levels: 0.1 μs, 10 μs, and 1000 μs. The actual signal delay time is DelayValue x TimeBase.

Note

1. Due to differences in sampling positions, signals passing through the delay line may have an error of 1 to 2 TimeBase units.
2. If the pulse width is smaller than the TimeBase, the delay line might fail to sample the input signal.

FrequencySynthesiser

The frequency multiplier can perform frequency multiplication on the selected input signal. When the frequency of FreqSynthesiserSigSource is within the range of FreqSynthesiserUpperLimit and FreqSynthesiserLowerLimit, the frequency multiplier processes the signal according to the coefficient (FreqSynthesiserCoeff). If the coefficient is smaller than 1, it functions as a frequency divider.

1. When the FrequencySynthesiser is enabled, the frequency upper and lower limits must be set. The LineRescaler filters out pulses exceeding the frequency range to avoid interference with the frequency multiplier.
2. The external signal should have relatively stable frequency. If the frequency fluctuates significantly, the output of the frequency multiplier will also fluctuate and exhibit some lag.

Quadrature encoder (EncoderControl)

The encoder requires a pair of signals (A-phase and B-phase) from a quadrature encoder. You can select two signals from Line8 to Line15 of the frame grabber as the A-phase and B-phase signals for the encoder. The encoder module has the following functions:

- Edge detection with three modes: X1, X2, and X4.
- Reverse motion compensation.
- Displacement counting.
- Three output modes: full output, forward output, and compensated output.

In X1 mode, the encoder output signal is the same as the A-phase signal.

In X2 mode, the encoder output signal can be expressed as: Q = A! = B (the encoder outputs a high pulse when A and B signals differ, and a low pulse when they are the same).

In X4 mode, the encoder detects both the rising and falling edges of A and B, and the output pulse width is determined by the EncoderOutPulseWidth register.

The following figure shows the signal behavior of the encoder in various modes.

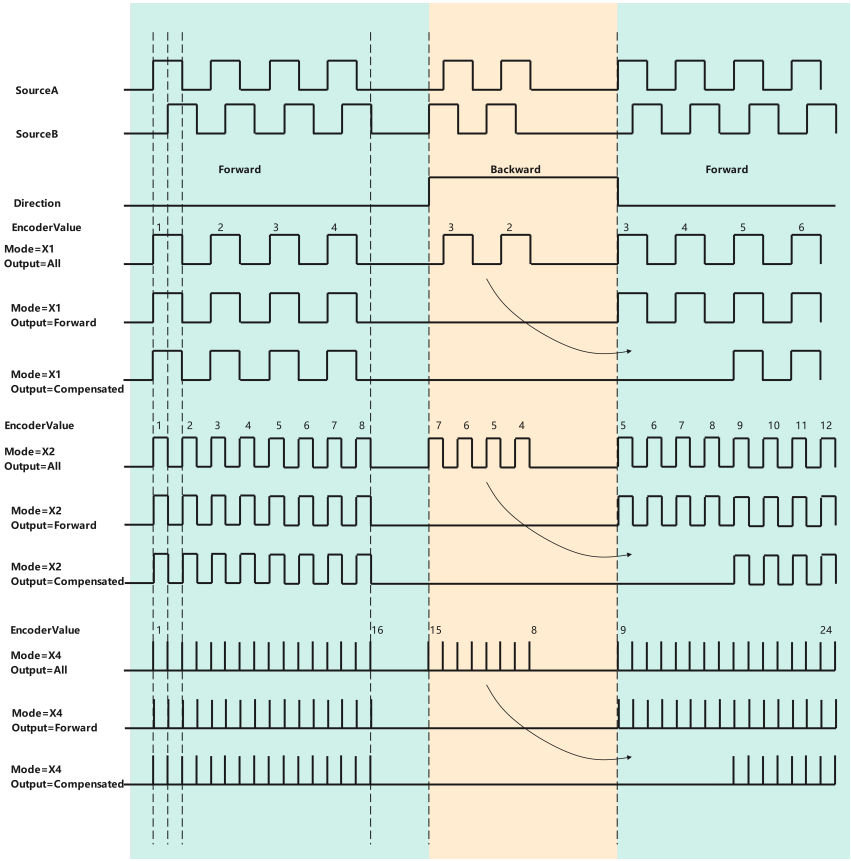


Figure 4-24 Encoder working principles

Note

1. When signal sources A/B are selected, appropriate debouncing must be applied in the LineDebouncer, and the debouncing width for both must be identical.
2. When the displacement count is 0, if reverse motion occurs, the displacement will not turn negative.

4.3.5 Counter and Timer

Table 4–9 CounterAndTimer directory registers

Parameter Name	Type	Function
CounterAndTimerControl	Category	Directory of registers related to counter and timer control
Counter	Category	Directory of registers related to timer
CounterSelector	Enumeration	Counter selection
CounterReset	Command	Counter reset
CounterResetSource	Enumeration	Counter reset signal source
CounterResetActivation	Enumeration	Active edge for counter reset signal
CounterEventSource	Enumeration	Counter event signal source
CounterEventActivation	Enumeration	Active edge for counter event signal
CounterDuartion	Integer	Maximum count value for the counter
CounterValue	Integer	Current count value of the counter read-only
Timer	Category	Directory of registers related to timer
TimerSelector	Enumeration	Timer selection
TimerReset	Command	Timer reset
TimerResetSource	Enumeration	Timer reset signal source
TimerResetActivation	Enumeration	Active edge/level for timer reset signal
TimerTriggerSource	Enumeration	Timer trigger signal source
TimerTriggerActivation	Enumeration	Active edge/level for timer trigger signal
TimerDuration	Float	Valid period for timer timing
TimerDelay	Float	Timer timing delay
TimerValue	Float	Timer timing value
TimerStatus	Enumeration	Timer status

Counter

Counters are used to count internal or I/O events. Multiple counters can be cascaded to extend the counting range. The CounterActive signal (indicating counter activity) can be used as a signal source for LineOut. The CounterStart and CounterEnd markers can serve as frame grabber events, which are sent to the host in the form of interrupts.

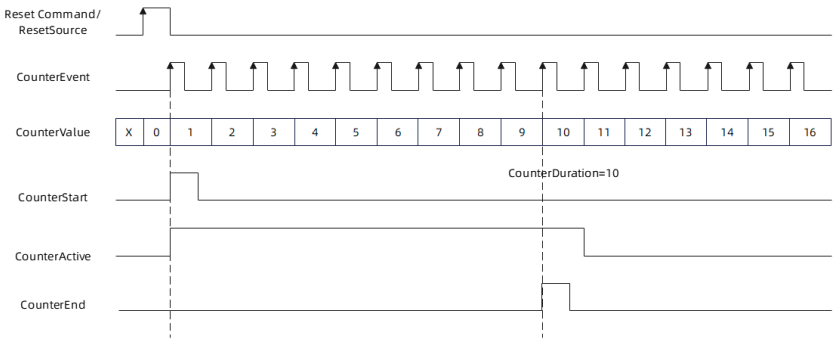


Figure 4-25 Counter

The following pseudocode demonstrates Counter #0 counting the number of RS422_IN0 pulses while TTL_IN0 is high.

Counter0.ResetSource=TTL_IN0

Counter0.ResetActivation=LevelLow

Counter0.EventSource=RS422_IN0

Counter0.EventActivation=RisingEdge

Counter0.Duration=1024

Counter0.Reset=1

Note

When the Counter reaches Duration, it will emit a CounterEnd signal, but the counting will not stop. If no Reset signal arrives, it will continue counting up to 0xffffffff and then halt.

Timer

Timers generate pulse signals of a specified width based on internal or external signals. The pulse signal can be used as a LineOut signal source. The TimerStart and TimerEnded markers can serve as frame grabber events, which are sent to the host as interrupts.

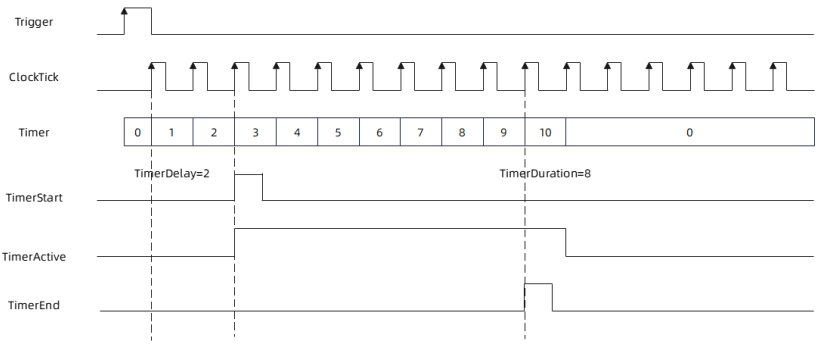


Figure 4-26 Timer

The following pseudocode demonstrates generating a 100-μs pulse on TTL_OUT0 when Counter0End occurs.

Timer0.TriggerSource=Counter0End

Timer0.TriggerActivation=RisingEdge

Timer0.Duration=100μs

Timer0.Delay=0

LineSelector=TTL_OUT0

TTL_OUT0.Source=Timer0Active

Note

When the Timer reaches Delay + Duration, it will wait for a new trigger signal before performing the next timing action.

4.3.6 Look-Up-Table

Table 4–10 LUT directory registers

Parameter Name	Type	Function
LUTControl	Category	Directory of LUT-related registers
LUTEnable	Boolean	Enables the LUT.
LUTMode	Enumeration	LUT mode
LUTIndex	Integer	LUT input index
LUTValue	Integer	LUT value

Parameter Name	Type	Function
LUTLoad	Command	Loads the LUT from Flash to FPGA.
LUTSave	Command	Save LUT in FPGA to Flash.

In Mono or Bayer color mode, when the data bit depth is Bpp10 or Bpp12, the LUT of the frame grabber can be used to transform the data. The LUT size is 4096 × 12 bits, meaning it supports 4K inputs with 12-bit output values.

It provides two transformation modes: Bpp10-to-Bpp10 or Bpp12-to-Bpp12 conversion; or Bpp10-to-Bpp8 or Bpp12-to-Bpp8 conversion.

You can modify each LUT entry individually using LUTIndex and LUTValue. After modification, the LUT can be saved to the frame grabber's Flash using LUTSave, and later reloaded using LUTLoad. If LUTSave is not used to store the LUT, all modifications will be lost after power-off.

In addition to modifying the LUT entry-by-entry with LUTIndex and LUTValue, you can also perform batch configuration through SDK programming.

Note

When LUTMode is set to Bpp10/12-to-Bpp8, BitsPerPixel displayed by Stream will switch to Bpp8. The host image buffer size is adjusted accordingly.

4.3.7 User Parameter Control

Table 4–11 User parameter control directory registers

Parameter Name	Type	Function
UserSetControl	Category	Directory of registers related to user parameters
UserSetBoot	Enumeration	Power-on startup parameter group
UserSetSelector	Enumeration	Selects user parameter group.
UserSetLoad	Command	Loads user parameters.
UserSetSave	Command	Stores user parameters.

You can save working parameters of the frame grabber in two ways:

- Click "File" in the software menu bar. Select "Save" or "Save As", specify a storage path, and then save the current properties as a configuration file to the path. If "Save" is selected again, the file will be saved to the last used path. The saved configuration file can later be loaded through "Open" or "Recent Files" to set registers of the frame

grabber. Configuration file storage and loading can also be performed using the SDK-provided interfaces.

- Use the UserSetControl register group of the frame grabber to save parameters to the frame grabber's Flash (up to 2 groups are supported). You can set the startup parameter group and load parameters stored in Flash.

There are three user parameter groups: Default, UserSet0, and UserSet1. The Default parameters are the frame grabber's factory-default or fail-safe settings. They can only be loaded (used) but not modified (saved). Any of these three parameter groups can be set as the startup parameters, that is, they will be applied immediately when the frame grabber powers on.

Note

- Only parameters displayed as Streamable=TRUE in the Information section will be stored.
- LUT and FFCCoeff require their respective save and load commands.
- After a firmware upgrade, user parameters will be erased.
- Both Full and DualBase modes have their own user parameters.

4.3.8 Camera Communication

Control of CameraLink cameras is implemented through the serial port within the CameraLink cable. The transmission protocols can be divided into manufacturer-defined protocols and protocols compliant with the GenICam.GenCP standard.

For the first method, manufacturers typically provide dedicated camera control software. For the second method, if the camera is from a manufacturer supported by INOMV, parameters can be configured by refreshing the remote device within INOMV.

Scanning for GenCP-compatible cameras using INOMV

After you run the INOMV software, INOMV will automatically connect to the detected frame grabber. Right-click the local device under the frame grabber and select "Connect". After the device is connected, right-click the local device again and select "Refresh Remote Device". INOMV will automatically search for supported remote cameras (must be from manufacturers listed in INOMV's compatibility list).

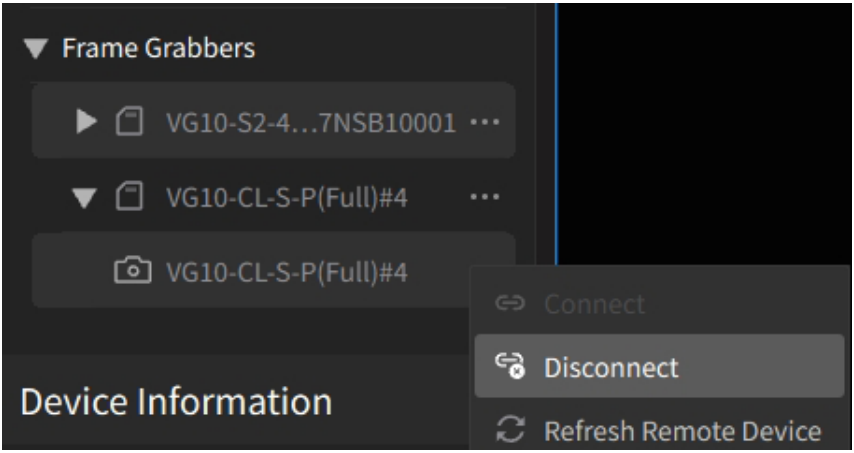


Figure 4-27 Connecting software to GenCP-compatible cameras

Controlling the camera through virtual serial port

Run the INOMV software. In the menu bar, choose "Common" > "Grabber Card" and bind the frame grabber port. Configure camera parameters through the virtual serial port.

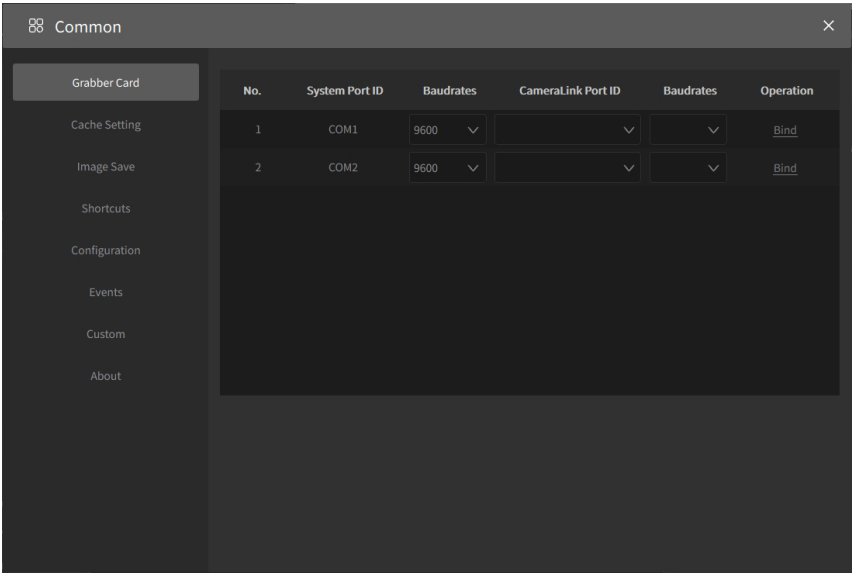


Figure 4-28 Binding the serial port in INOMV

4.3.9 Events

The frame grabber sends hardware-generated events to the host through interrupts. The following table describes three types of events.

Table 4–12 Types of events supported by frame grabber

Event Type	Function
Error message	Device failures, invalid parameters, and other statuses will be transmitted and printed in the Console window.
Hardware event	Trigger loss, data transmission overflow, CounterEnd, and other information can be viewed in the log window.
Heartbeat	The CameraLink connection status, data statistics, and other information can be viewed in the lower-right corner of the software or on the device maintenance page.

4.3.10Metadata

The frame grabber appends 512 bytes of metadata at the end of the image data transmitted to the host. You can utilize this information to monitor the image acquisition count, time, and external signal count.

Table 4–13 Metadata

Offset	Size	Definition
0x0	8	TimeStamp, frame grabber time, in µs
0x8	8	TimeStamp, frame grabber time, in µs
0x10	8	FrameNum, number of images captured by the frame grabber
0x18	8	FrameNum, number of images captured by the frame grabber
0x20	4	Count of Counter0
0x24	4	Count of Counter1
0x28 to 0x2c	8	Reserved
0x30	4	Count of MetaSignal0
0x34	4	Count of MetaSignal1
0x38	4	Count of MetaSignal2
0x3c	4	Count of MetaSignal3
0x40	4	Count of MetaSignal4
0x44	4	Count of MetaSignal5
0x48	4	Count of MetaSignal6
0x4c	4	Count of MetaSignal7
0x50 to 0x1ff	432	Reserved

4.3.11 Setting Host Data Capture Mode and Data Buffer

The frame grabber provides two modes for receiving data into the data buffer: BlockMode and Non-BlockMode.

- BlockMode: If the data buffer is full, new images will not be copied. Instead, they will be discarded by the hardware until space becomes available in the buffer.
- Non-BlockMode: The status of each frame buffer in the data buffer is not checked. Images are prioritized for entry, and if old images are not copied out, they will be overwritten.



- In cases where the acquisition area is large, the number of data buffers is limited by the host memory size. If the host memory is exceeded, the Console will print a message.
- When the acquisition frame rate is high, the number of data buffers needs to be increased.

5 Maintenance

5.1 Firmware Upgrade

Caution

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

You can perform firmware upgrades through the "Update Tool" page in the software.

Firmware upgrade

In the menu bar, choose "Common" > "Tool". From the drop-down list of "Update Tool", select "FG200" and then click "Update". Then the upgrade page is displayed.

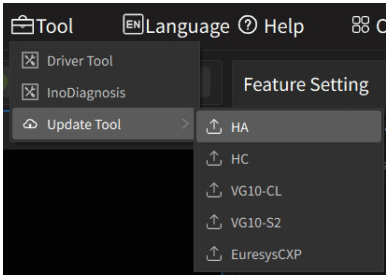


Figure 5-1 Firmware upgrade page

Rollback

If an error occurs during the upgrade process (such as power failure or host shutdown) resulting in incomplete firmware installation: If the host remains powered on, simply reopen the software and restart the upgrade process. If the host loses power, after re-powering, the frame grabber will enter the maintenance mode. Then, only firmware upgrade can be performed. Image acquisition cannot be performed.

5.2 SDK Commissioning

For details about SDK interface and usage, see the INOMV Image Collection Commissioning Software SDK Installation User Guide.

6 Common Faults

1. **Software cannot detect device**
   Possible cause:

   The driver is not installed properly.

   Solution:

   a. In the menu bar, choose "Common" > "Tool". In the "Driver Settings" section on the page displayed, check whether the driver is correctly installed.
   b. If the PoCL function is enabled, confirm the ATX power is supplied from the host power supply, not a separate power source.

2. **PoCL power supply failed**
   Possible cause:

   - The camera does not support PoCL.
   - The cable does not support PoCL.
   - The ATX power port is not connected.

3. **GenCP camera cannot be detected**
   Possible cause:

   - The camera is not in GenCP communication mode.
   - The camera is faulty.

   Solution:

   a. Check whether the camera supports GenCP communication.
   b. For some Dalsa camera models, serial communication may fail after multiple power cycles or cable re-connections. In this case, reboot the camera.

4. **Image acquisition is abnormal or no image is captured**
   Possible cause:

   - The clock frequencies of the camera and frame grabber do not match.
   - Data validation is not enabled.
   - Geometry settings are incorrect.
   - Pixel bit depth settings are incorrect.

   Solution:

   a. Check whether the frame grabber's AcquisitionMode is set to Continuous or Trigger. If in Trigger mode, switch to Continuous mode to verify normal operation.
   b. Use the frame grabber's internal test pattern to check whether acquisition works normally. If acquisition fails, check whether the CameraLinkConfig register shows "InvalidConfig". If yes, the following register parameter combinations are invalid (check Console window messages with LogLevel set to Warning):

      1). CameraType
      2). CameraColorType
      3). CameraWidth

4). CameraBitsPerPixel
5). CameraLinkGeometry

c. Check device list on the left panel to confirm CameraLink camera connection status.
d. Verify matching settings between camera and frame grabber for clock frequency, Dval, Geometry, and pixel bit depth.
e. If the camera is in trigger mode, check whether the trigger signal is being sent from the CC of the frame grabber to the camera. If uncertain, you can first set the camera to work in FreeRun mode.
f. For cameras with a large frame, ensure that the host has sufficient memory.
g. For color cameras, if the captured colors appear incorrect, use the ColorBar test pattern inside the frame grabber to verify whether the settings are correct.
h. When the frame rate is too high, reduce the display refresh rate.
i. In the menu bar, choose "Common" > "Cache Setting", and increase the number of buffers.

5. **In AcquisitionMode=Trigger mode, the number of captured images does not match the count from the electromechanical device**
Possible cause:

a. The AcquisitionStart signal has glitches, and no debouncing is applied or the debouncing width is set improperly.
b. Image loss occurs during transmission between the frame grabber and the host.

Solution:

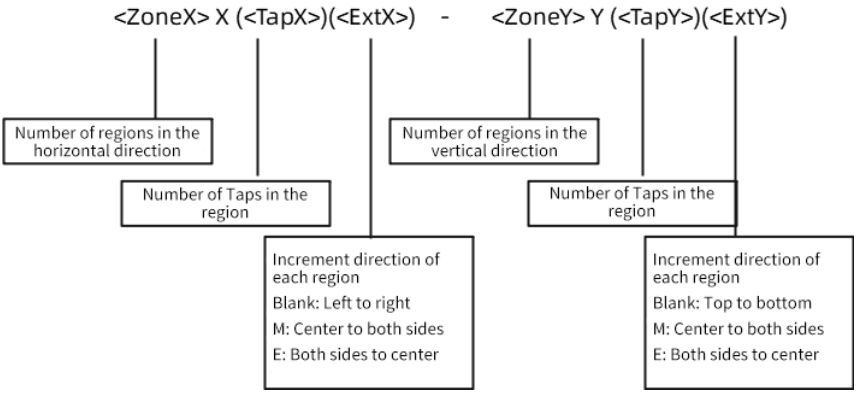
a. Set a reasonable debouncing value for the AcquisitionStart source signal.
b. If the camera also works in trigger mode, ensure there is a clear phase relationship between the AcquisitionStart source signal and the trigger signal (line trigger for line scan or frame trigger for area scan) to avoid invalid triggers. See the section 4.2 for details.
c. Use the Counter on the frame grabber to count the AcquisitionStart source signals and compare the count with the electromechanical device's count to check for difference.
d. Check the FrameCounter value under the Event directory of the frame grabber (this value represents the number of images transmitted from the frame grabber to the host).
e. The callback functions provided by the SDK include hardware-overlaid frame numbers and timestamps (the time since the frame grabber is powered on, not absolute time). Check the continuity of the frame numbers and whether the timestamps are reasonable. Alternatively, check whether the frame numbers match the Event/FrameCounter value.

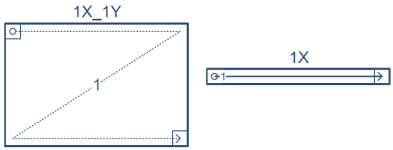
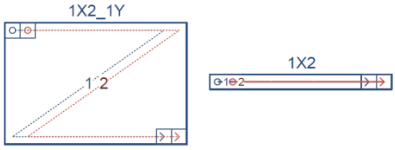
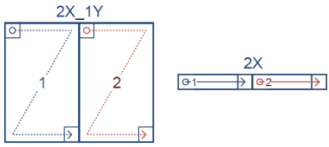
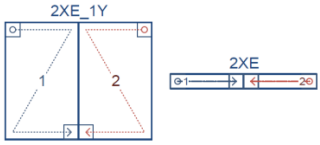
6. **A prompt indicating the device is occupied is displayed when you open the frame grabber**
Possible cause:

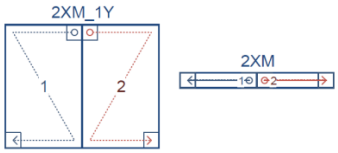
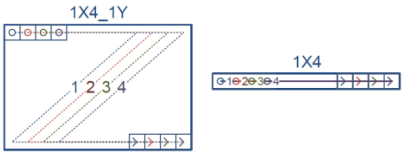
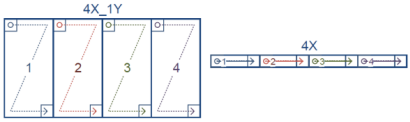
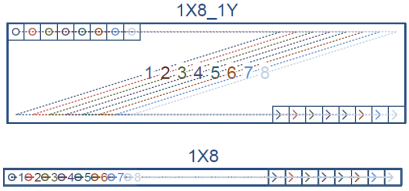
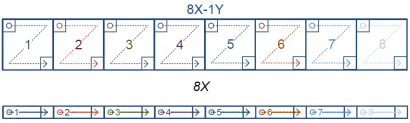
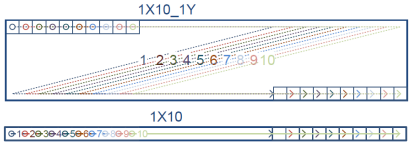
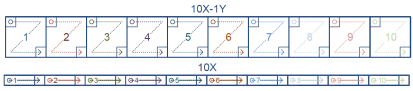
The camera control software is occupying clserino.dll.

Appendix

The following figure illustrates the definitions of each field in the CameraLinkGeometry format. Parentheses () indicate that if the value is 1 or empty, the enclosed part does not appear. For line scan cameras, the part after the hyphen "-" does not appear.



Type	Description	Illustration
1X-1Y (area scan)/ 1X (line scan)	In this mode, 1 pixel is output per clock, output from left to right and top to bottom.	
1X2-1Y (area scan)/ 1X2 (line scan)	In this mode, 2 pixels are output per clock (odd and even pixels output simultaneously), from left to right and top to bottom.	
2X-1Y (area scan)/ 2X (line scan)	In this mode, the horizontal direction is divided into 2 regions, each with 1 Tap, output from left to right and top to bottom.	
2XE-1Y (area scan)/ 2XE (line scan)	In this mode, the horizontal direction is divided into 2 regions. The first region outputs from left to right. The second region outputs from right to left.	

Type	Description	Illustration
2XM-1Y (area scan)/ 2XM (line scan)	In this mode, the horizontal direction is divided into 2 regions. The first region outputs from the middle to the left. The second region outputs from the middle to the right.	
1X4-1Y (area scan)/ 1X4 (line scan)	In this mode, the horizontal direction is divided into 1 region, with 4 pixels output simultaneously, from left to right and top to bottom.	
4X-1Y (area scan)/ 4X (line scan)	In this mode, the horizontal direction is divided into 4 regions, each with 1 Tap, output from left to right and top to bottom.	
1X8-1Y (area scan)/ 1X8 (line scan)	In this mode, the horizontal direction is divided into 1 region, with 8 pixels per clock, output from left to right and top to bottom.	
8X-1Y (area scan)/ 8X (line scan)	In this mode, the horizontal direction is divided into 8 regions, each with 1 Tap, output from left to right and top to bottom.	
1X10-1Y (area scan)/ 1X10 (line scan)	In this mode, the horizontal direction is divided into 1 region, with 10 pixels per clock, output from left to right and top to bottom.	
10X-1Y (area scan)/ 10X (line scan)	In this mode, the horizontal direction is divided into 10 regions, each with 1 Tap, output from left to right and top to bottom.	

7 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.
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