How to Deal with Frame Loss in GigE Vision Cameras

When using the GigE Vision Interface, a general-purpose LAN card (NIC) is often used on the PC side. However, since the NIC card does not have built-in image processing functions, the CPU on the host PC performs the processing tasks. As a result, image processing capability depends on the PC's performance. If the PC's performance is not robust enough, frame loss (dropped frames) could occur.

To avoid frame loss, a frame grabber board with dedicated image processing is recommended. However, in this document, some tips are provided for how to minimize frame loss when using a general purpose NIC card.

1. Windows OS settings

1.1 Disable Power Management

Under Windows 10 default settings, the setting designed to save bus-related power consumption may be set to "On." This means that the power supply to the PCIe bus will revert to a power saving mode after a certain non-active period. As a result, a NIC card, which typically operates on the PCIe bus, will stop working. To avoid this phenomenon, disabling power management on the PCIe bus is recommended.

Method:

"Control Panel" -> "All Control Panel items" -> "Power Options" -> "Change plan settings"

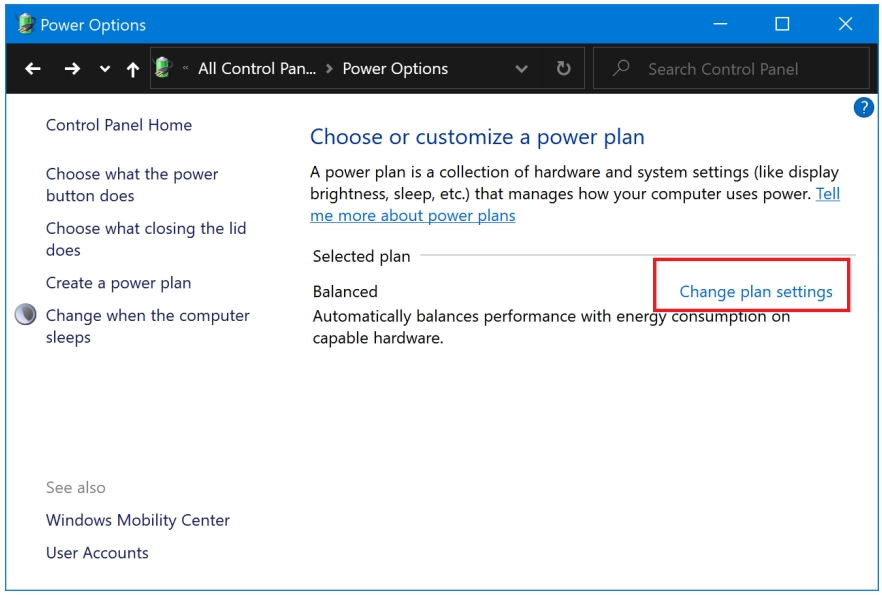

Fig. 1 - Power Options

Select “Change advanced power settings”

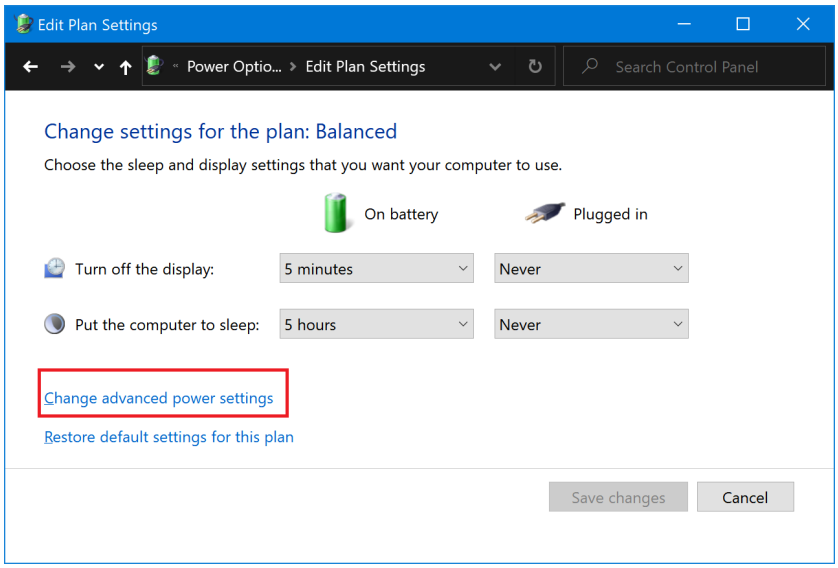

Fig. 2 - Change advanced power settings

“PCI Express” -> “Link State Power Management” -> “Settings: Off”

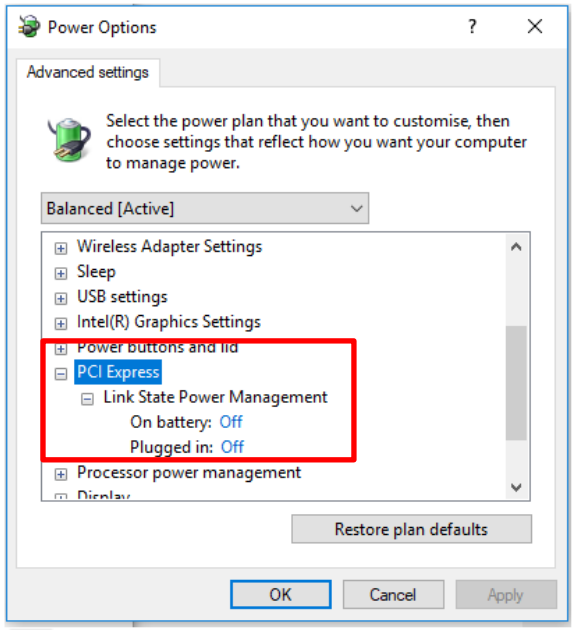

Fig. 3 - Detail Settings

1.2 Disable Transparency

In Windows 10 default settings, the Start Menu and/or Task bar are transparent (desktop and/or windows can be seen behind the menu/bar). The transparency is helpful for users, but it causes high CPU loads. To avoid this, the disabling of transparency is recommended.

Settings:
Right click on desktop, then click “personal settings.” The following settings window appears.
Select “Colors” from the left list, then search for “Other Option” -> “Transparency Effect” from the right-side window. If it is On, change it to Off.

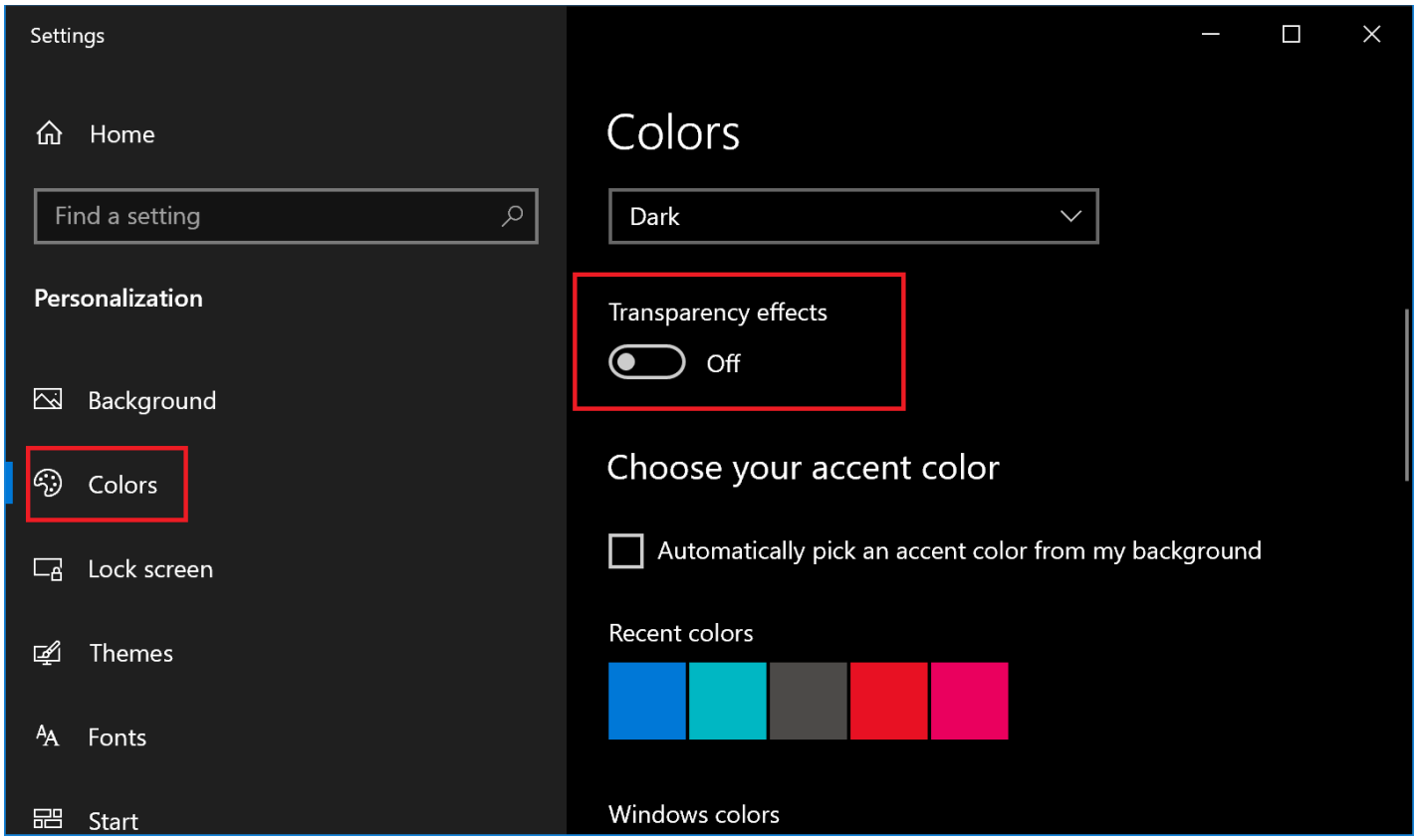

Fig. 4 - Transparency Effect

2. Settings in eBus SDK for JAI

2.1 Installation status of drivers

Launch “Start Menu” -> “eBus” -> “eBus Driver Installation Tool”. Confirm the status as “Installed” for GigE Vision as follows. If “Install” button is active, press the button and install the driver.

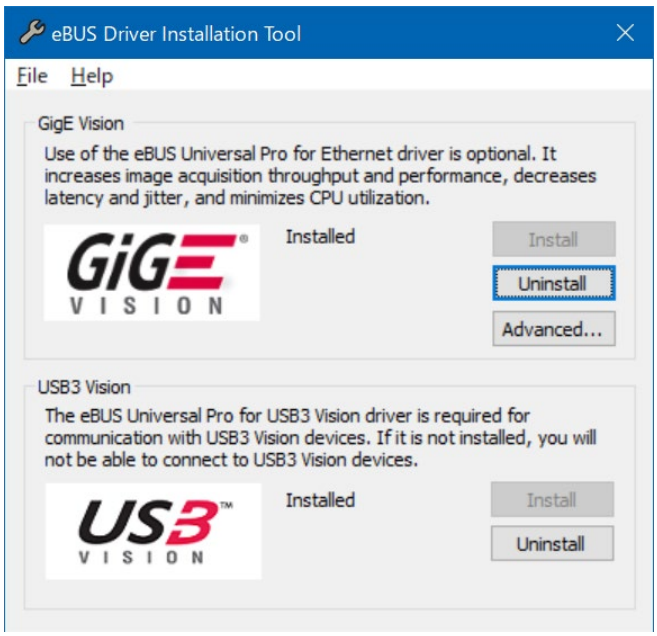

Fig. 5 - Driver Status

2.2 Detail Settings

Receive Buffers and Jumbo Packets

On the above “eBus Driver Installation Tool”, click “Advanced” to cause the “Network Adapter Configuration” to appear.

In the Network Adapters selector, select the network card to which the camera is connected.

Tick the check boxes for “eBus Universal Pro for Ethernet Driver” and “Jumbo Packets” then set “Receive Buffers” to “2048-Maximum.” Having a large number of receive buffers reduces overhead when receiving data. However, it consumes memory equal to “the number of receiving buffers” x “buffer size.” If the amount of system memory is limited, a smaller number of buffers such as 1024 or 512 would be better.

By ticking the Jumbo Packets box, large packet sizes are enabled. When transferring frame data, the data is divided into multiple packets. If the packet size is small, the number of packets increases and the CPU must work harder to process all of them. With Jumbo Packets enabled, the packet size is large and the number of packets decreases. This reduces the load on the CPU.

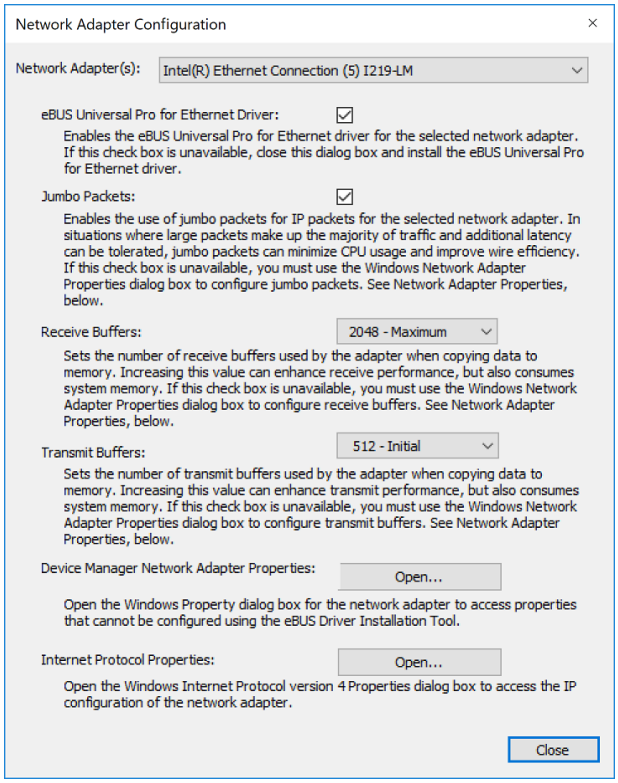

Fig. 6 - Network adapter configuration

Interrupt Moderation Rate:

While still in the Network Adapter Configuration panel, click “Device Manager Network Adapter Properties”-> “Open” to make the property window appear.

On the “Details” tab, select “Interrupt moderation rate.”
Select “Extreme” for the Interrupt moderation rate.

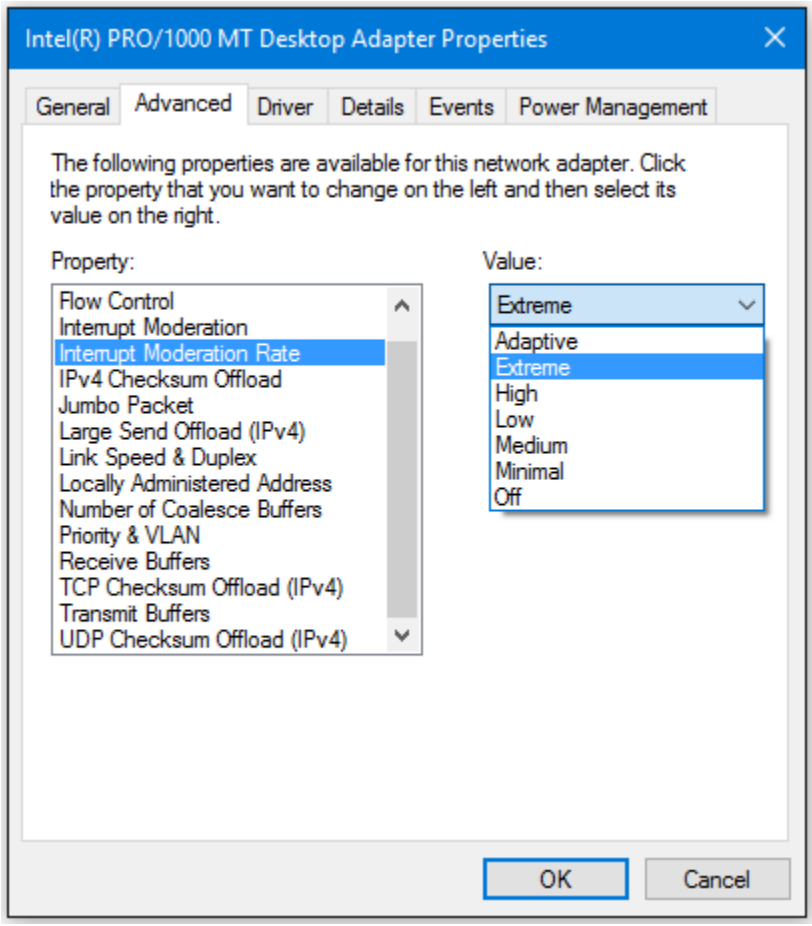

Fig. 7 - Interrupt Moderation

This setting determines the priority of handling data received from the camera. If the priority is low, data handling of images might be postponed by other host tasks and frame loss could occur. Therefore, the maximum moderation rate is recommended in most cases. However, if CPU performance is extremely high, the interrupt moderation priority can be reduced or even turned off. Furthermore, in some cases, when packet size is set to be small, a high interrupt moderation rate can actually make the total performance worse. In this case, a lower interrupt moderation rate can help make the total performance higher.

Set 'Flow Control' to 'Disabled'.

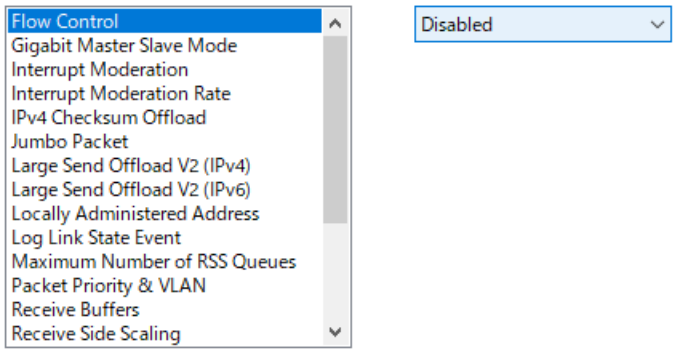

Figure 8 Flow Control

When 'Flow Control' is set to 'Disabled' in the network settings, data flow is allowed to occur freely without specific restrictions or regulations, leading to the maximum utilization of bandwidth and reducing latency.

2.3 PacketSize Auto Negotiation

eBus Player for JAI has a function to negotiate and determine packet size. This function is effective for determining the optimum packet size to use.

Settings:

- Launch eBus Player for JAI: “Start Menu” -> “eBus” -> “eBus Player for JAI”
- If the camera is connected, disconnect the camera.
- Select “Tools” -> “Default GigE Vision Communication Parameters”
- Select “True” on “StreamingPacketSize” -> “AutoNegotiation”.
- Save the settings by “Tools” -> “Save Preferences”.

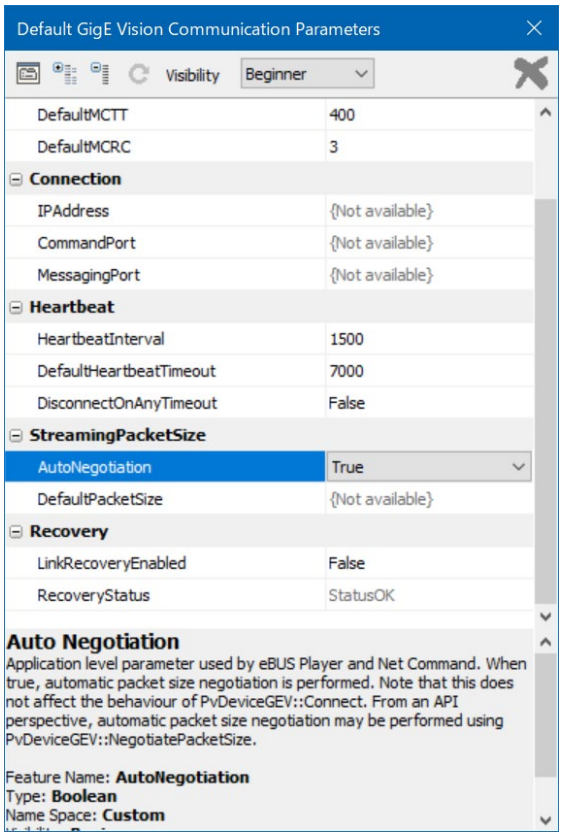

Fig. 9 - Auto Negotiation

2.4 Heartbeat Timeout

When the camera application is not so busy, such as when waiting a long time for a trigger, the priority of the application software becomes lower. In this case, polling against a heartbeat will be delayed and a heartbeat timeout will occur. To avoid this phenomenon, a longer heartbeat timeout setting is recommended.

Settings:

- Launch eBus Player for JAI: “Start Menu” -> “eBus” -> “eBus Player for JAI”
- If the camera is connected, disconnect the camera.
- Select “Tools” -> “Default GigE Vision Communication Parameters”

- Set longer time into DefaultHeartbeatTimeout.
- Save the settings by “Tools” -> “Save Preferences”.

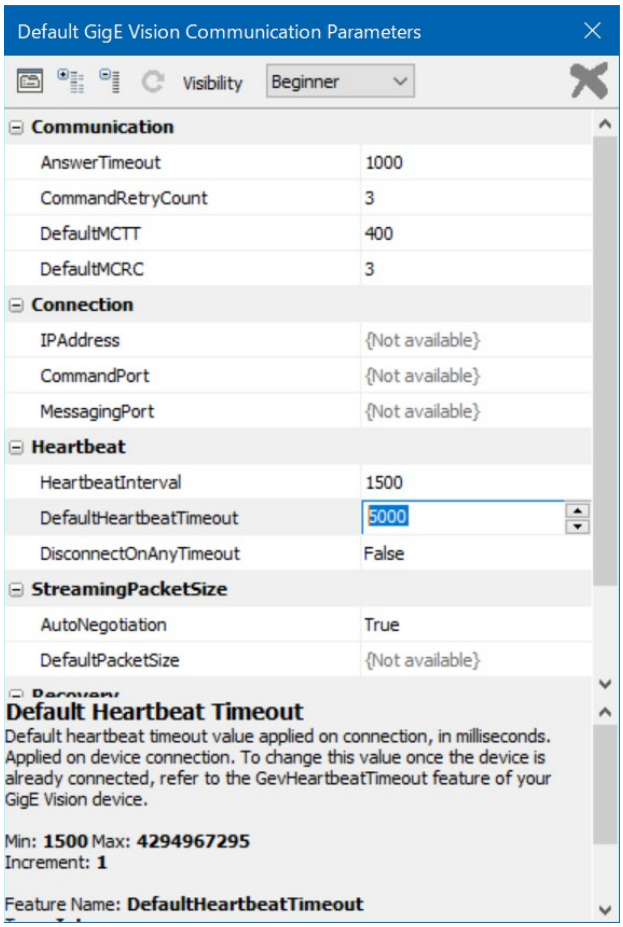

Fig. 10 - Default Heartbeat Timeout

3. Camera Settings

3.1 Subnet settings, in multiple cameras connection

When multiple NIC ports and/or multiple NICs are installed in one PC and multiple cameras are connected there, each NIC port should have an independent subnet. Cameras connected to a NIC port should have the same subnet with that of the NIC port.

If the subnet mask is not configured appropriately, the following warning appears.

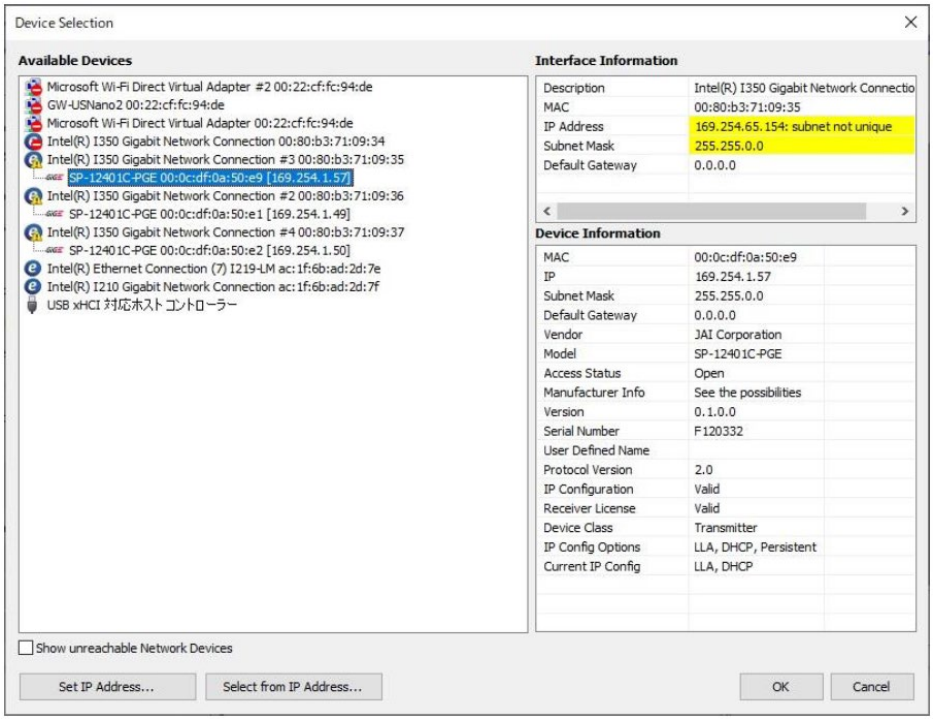

Fig. 11- Subnet warning

In Fig. 11 on the next page, the following subnets are suitable:

The first NIC: IP Address 192.168.11.10, subnet mask 255.255.255.0
The first camera: IP Address 192.168.11.11, subnet mask 255.255.255.0

The second NIC: IP Address 192.168.12.10, subnet mask 255.255.255.0
The second camera: IP Address 192.168.12.11, subnet mask 255.255.255.0

The third NIC: IP Address 192.168.13.10, subnet mask 255.255.255.0
The third camera: IP Address 192.168.13.11, subnet mask 255.255.255.0

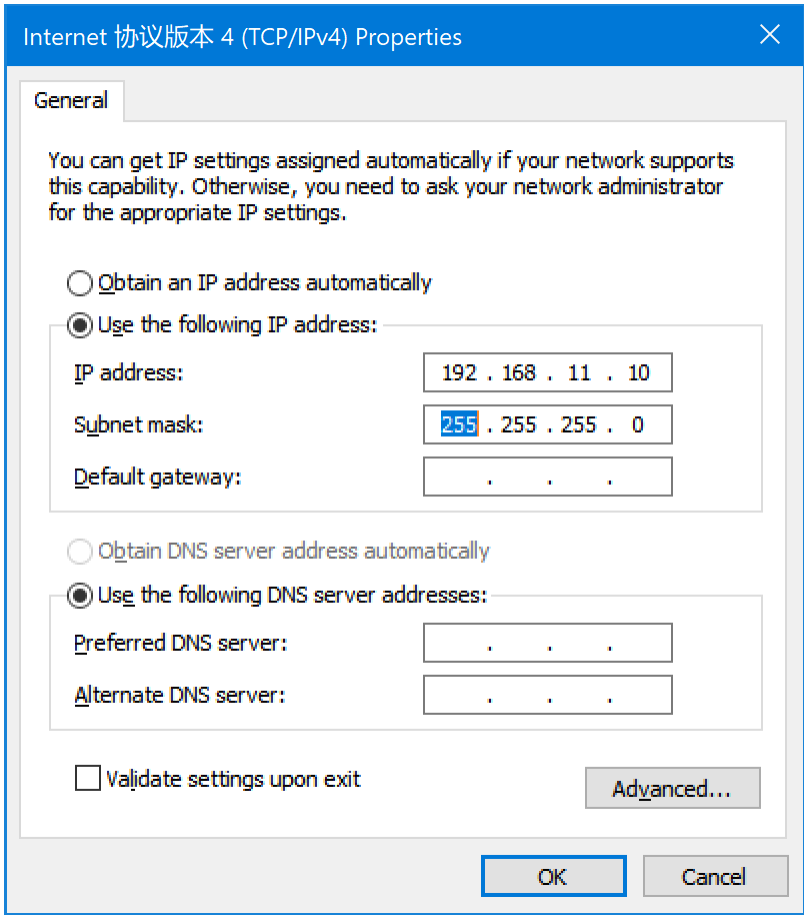

Fig. 12 - IP settings

4. Tips for FS Series:

As described in section 2.3, eBus player supports packet size auto negotiation feature.

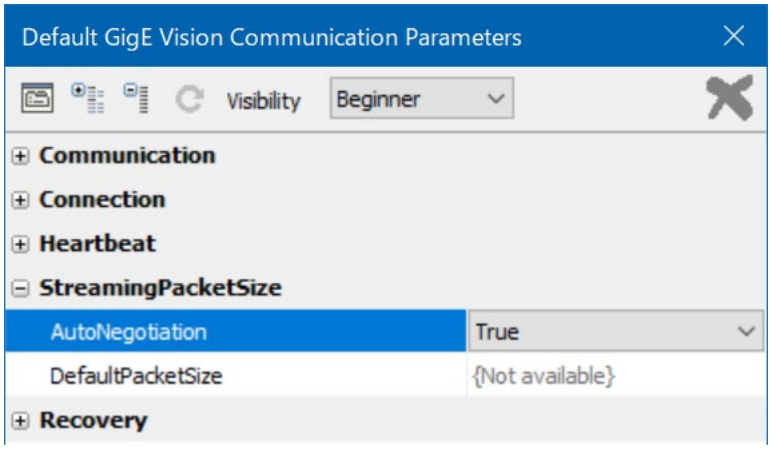

Fig. 13 – Packet Size Auto Negotiation

When using multi-stream cameras such as those in JAI's Fusion Series series, the auto negotiation works for Stream0/Sensor0, but does not work for the 2nd or 3rd streams.

The GevSCPSPacketSize for GevStreamChannelSelector=0 is automatically set, but the packet size for GevStreamChannelSelector=1 or 2 is not set automatically.

Therefore, the user should set it manually as follows:

1) Select GevStreamChannelSelector=0 and check the value of GevSCPSPacketSize. In the following figure, it is 8976.

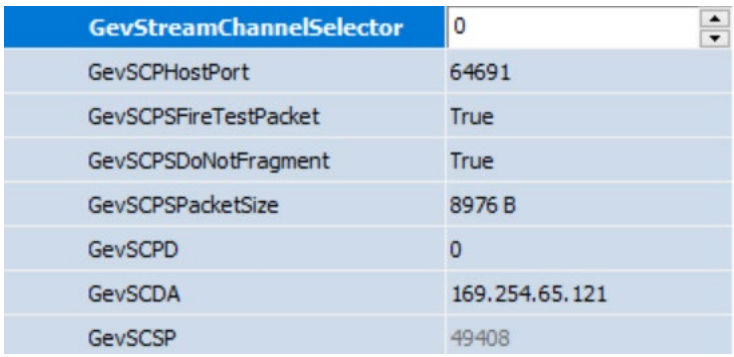

Fig. 14 – GevSCPSPacketSize for GevStreamChannelSelector=0

2) Select GevStreamChannelSelector=1 and enter the same value from GevStreamChannelSelector=0 into GevSCPSPacketSize.

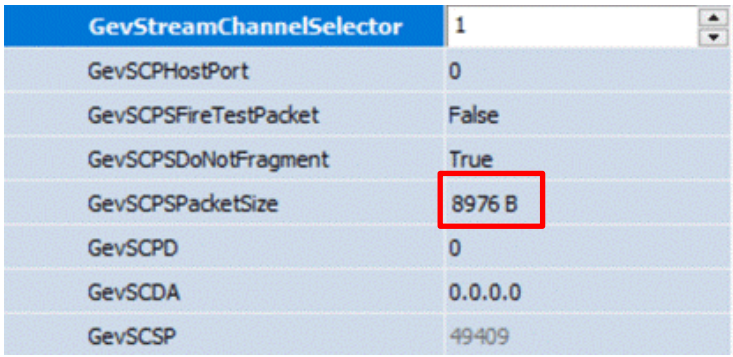

Fig. 15 – GevSCPSPacketSize for GevStreamChannelSelector=1

3) For a three stream/sensor camera, repeat the same operation after selecting GevStreamChannelSelector=2.

5. Other Settings

Here are some other tips to reduce frame loss:

5.1 Update drivers on the PC to the latest ones. Software tools such as Driver Booster, for example, are available for free and can update all drivers in one click.

5.2 Disable all anti-virus software.

5.3 Check the load on the hard disk by opening the Task Manager and clicking on the Resource Monitor button (see below and on next page).

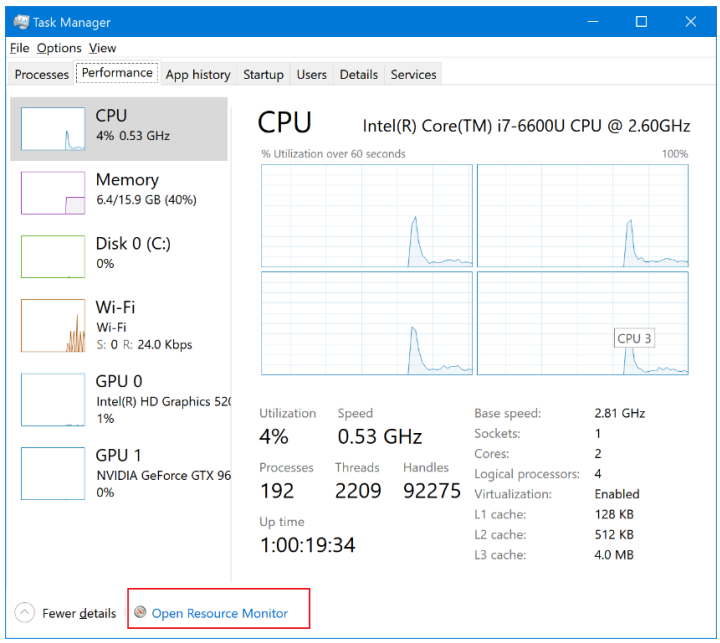

Fig. 16 - Task Manager

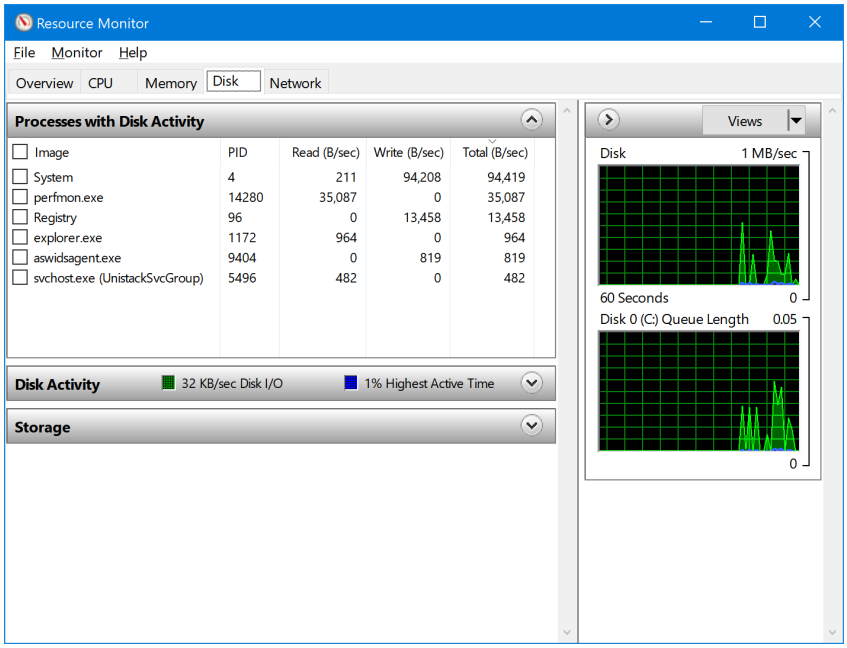

Fig. 17 - Resource Monitor

If the load on the hard disk is high, background programs/processes are likely affecting the whole system's performance. In this case, find the particular program(s)/process(es) with high read/write activity and stop them. Then, try capturing images with the camera.

End.

Revision history

Revision	Date	Changes
1	2020/5/21	New release
2	2020/7/21	Added Tips for FS Series
3	2024/1/17	Added Recommended Flow Control Setting