COGNEX

Cognex Vision Software

GigE Vision Cameras

User Guide

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Symbols

The following symbols indicate safety precautions and supplemental information:

WARNING: This symbol indicates a hazard that could cause death, serious personal injury or electrical shock.

CAUTION: This symbol indicates a hazard that could result in property damage.

Note: This symbol indicates additional information about a subject.

Tip: This symbol indicates suggestions and shortcuts that might not otherwise be apparent.

Cognex Software and GigE Vision Cameras

Cognex VisionPro and CVL software provide support for acquiring, processing, and displaying images from GigE Vision cameras.

For information on using a GigE Vision camera with your Cognex vision software, see the VisionPro or CVL documentation. In addition, the Cognex documentation support site may contain additional documentation about using GigE Vision for your machine vision application.

Security Requirements

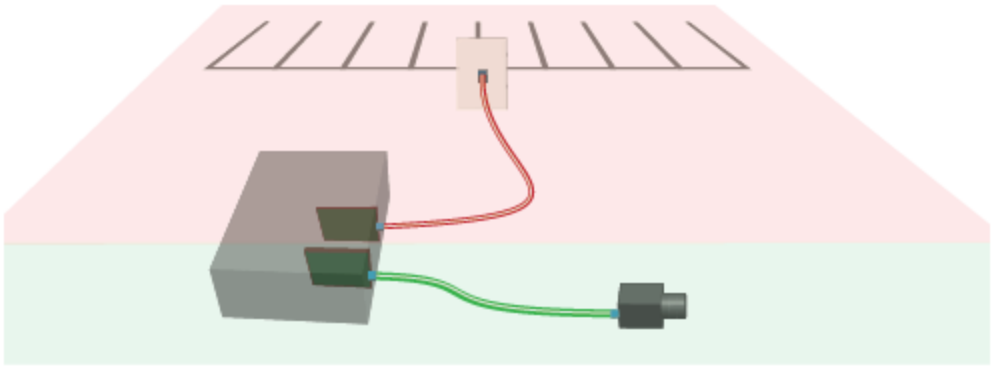
In addition to the standard software and hardware requirements listed in your product documentation, your PC must include one of the following security mechanisms to run Cognex software:

- A Cognex frame grabber
- A Cognex security key (dongle)

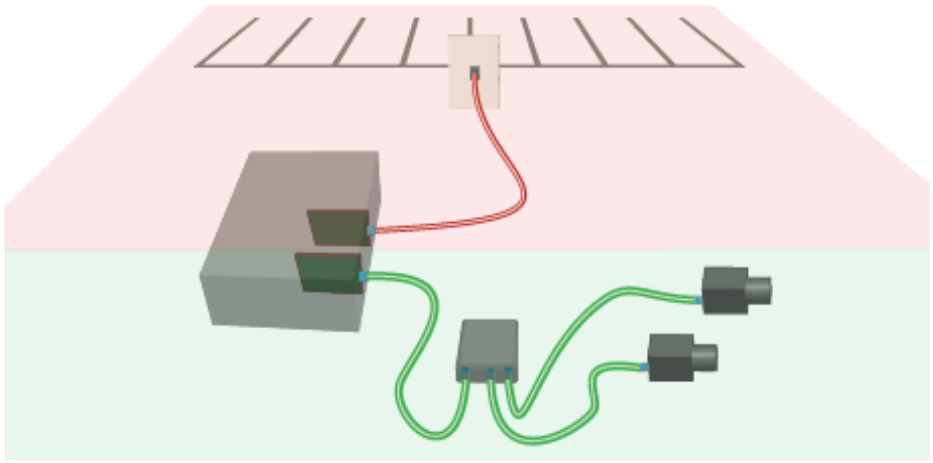
Either of these devices can provide your Cognex software with required license information. See your Cognex sales representative for details.

GigE Vision Camera Networks

For an application that uses only one camera, the GigE Vision camera network will consist only of a Gigabit Ethernet network adapter and the camera:



If you are using more than one camera, you can use a multi-port network adapter or a Gigabit Ethernet switch (shown):



Be aware the network bandwidth is shared among all connected the cameras when you are using a network switch.

Your PC may already have a network adapter that is used to connect your PC to a local area network or to the Internet. The network adapter(s) you use for image acquisition should be dedicated only for GigE Vision cameras and not connected to your local area network or to the Internet.

To avoid electromagnetic interference, any Ethernet cables you use must be shielded. Cognex strongly recommends Cat 6 or Cat 7 cables with S/STP shielding.

GigE Vision Network Adapters and Switches

Cognex recommends Gigabit Ethernet network adapters that use the PCI Express bus, and supports a variety of multi-port adapters and Ethernet switches. Select a network adapter that support a minimum of 9000 Kbytes jumbo frame size.

Contact your Cognex sales representative for assistance in choosing the best GigE Vision devices for your vision solution, and install the Gigabit Ethernet network device(s) according to the instructions from the manufacturer.

Install Your Cognex Vision Software

After installing the manufacturer-based drivers for your GigE Vision network adapters, install your Cognex vision software (CVL or VisionPro) including the Cognex Drivers.

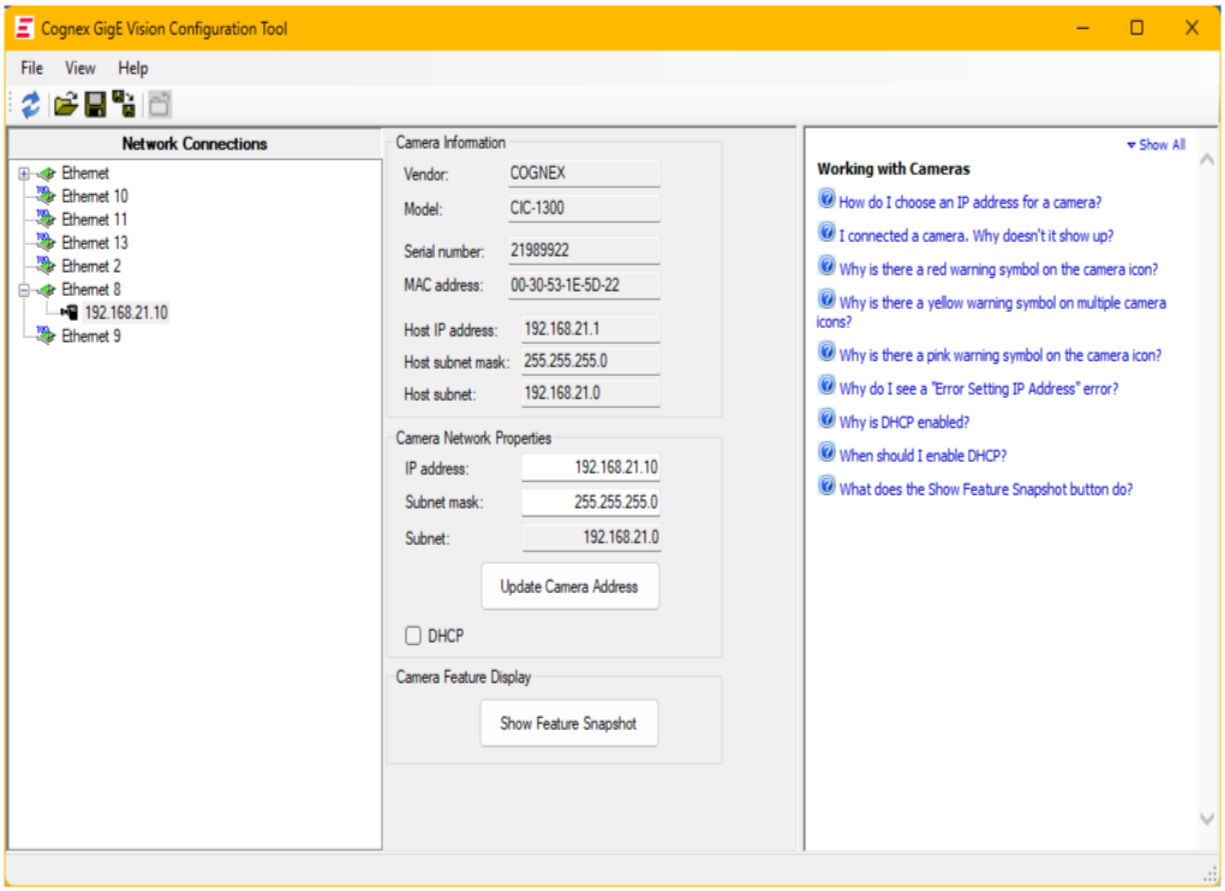
CVL and VisionPro installations include a utility for configuring your GigE Vision network adapter and camera, as well as the eBus Universal Pro driver that improves the performance of GigE Vision applications for most production environments.

GigE Vision Configuration Tool

Launch the Cognex GigE Vision Configuration Tool to assign IP addresses to each GigE Vision network adapter port and the camera connected to it.

Tip: Ensure that your GigE camera is connected to the adapter and powered on before launching the GigE Vision Configuration Tool. Stop any applications that use CVL or VisionPro.

Start the GigE Vision Configuration Tool through the Windows Start menu. The tool appears similar to the following figure:



The center panel displays information about the available network connections and cameras. In most environments at least one of your **Ethernet** connections represents the GigE Vision network adapter (or one port of a multi-port adapter) of the PC. Check with your network administrator if you are not sure which one it is.

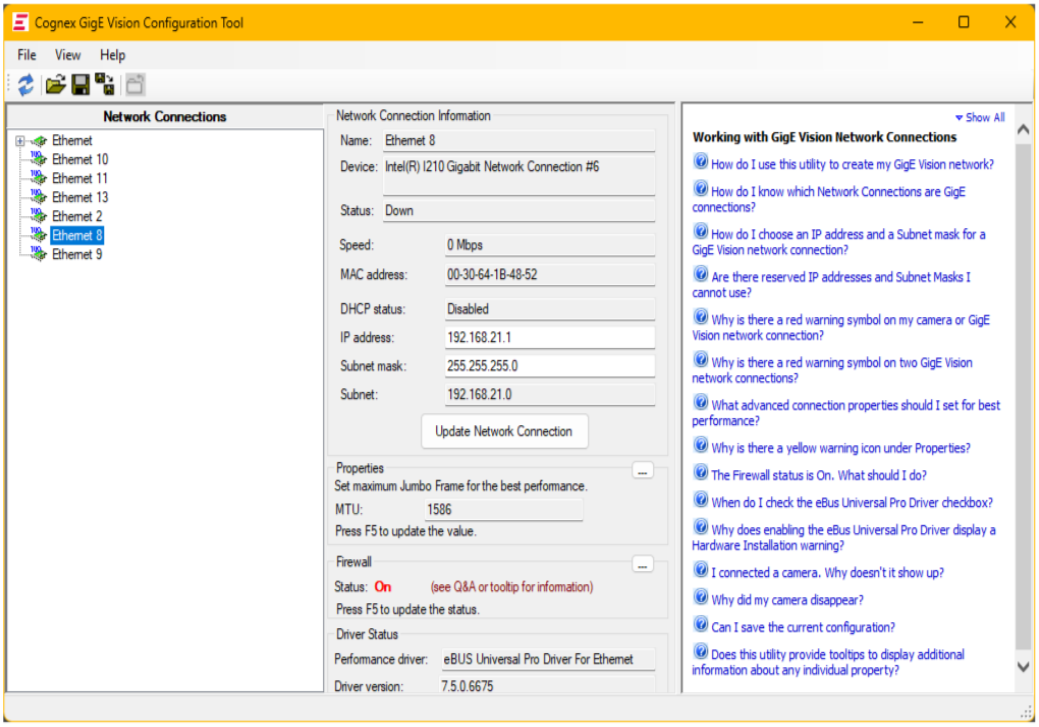
An interactive list of Questions and Answers appears on the right side of the utility to guide you in setting IP addresses and configuring other system properties.

Network Adapter IP Address

Each GigE Vision network adapter (or each port of a multi-port adapter) must have its own IP address on its own subnet. To set the IP address of a GigE Vision network adapter:

1. Select the **Ethernet** connection that corresponds to the adapter port connected to your GigE Vision camera(s). Refer to the embedded Questions and Answers in the utility for guidance in selecting the correct connection.

   The center panel displays information about the selected adapter port:



2. Enter an **IP address** and **Subnet mask** for the adapter.
3. Click **Update Network Connection**.

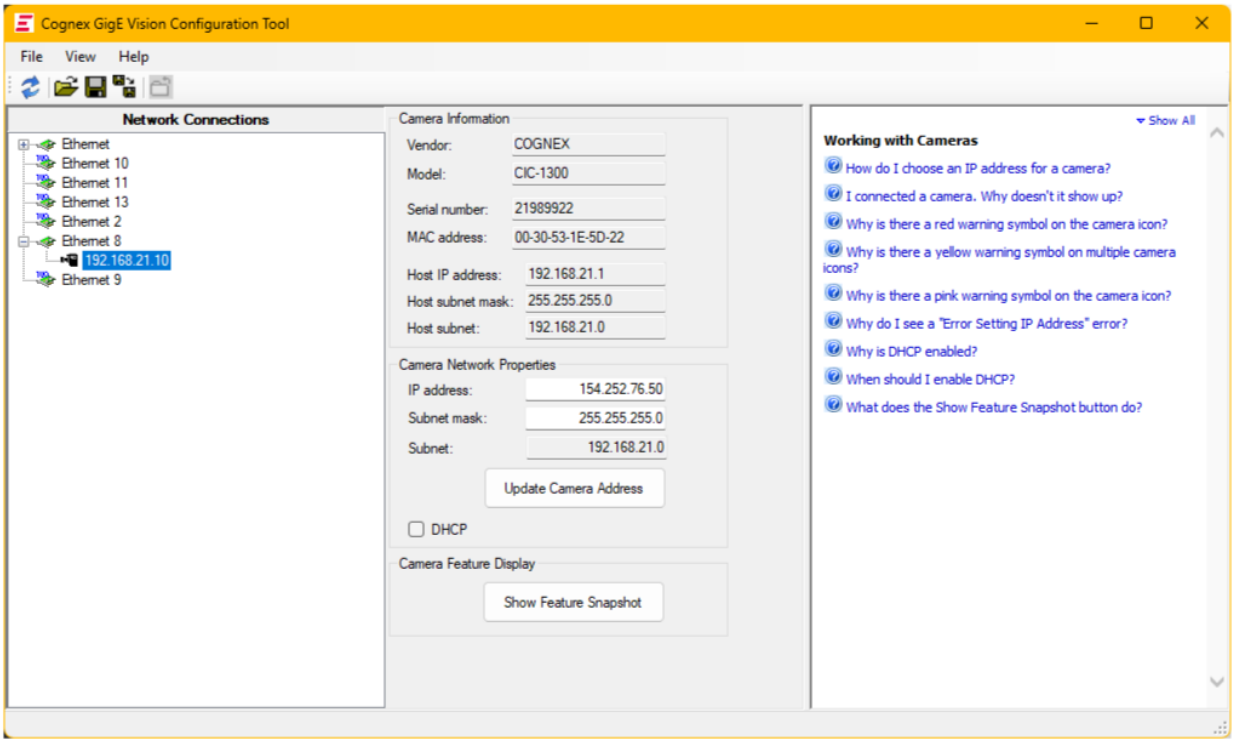
   If you are not familiar with TCP/IP networking, Cognex recommends you use the following values:

Network Adapter	IP Address	Subnet Mask
1st adapter port	192.168.21.203	255.255.255.0
2nd adapter port	192.168.22.203	255.255.255.0
3rd adapter port	192.168.23.203	255.255.255.0

Camera IP Addresses

Each camera must have an IP address in the same subnet as its network adapter. To set the IP address for a GigE Vision camera:

1. Select the camera connected to the network adapter. The center panel displays information about the selected camera.



2. Enter an **IP Address** and a **Subnet mask** for the camera.

   The IP address of the camera must be on the same subnet as its network adapter (or adapter port), which appears as the **Host IP address**. In addition, the subnet mask for the camera must be the same as the **Host subnet mask.**

   For example, with a network adapter IP address of *192.168.21.203* and a subnet mask of *255.255.255.0*, the camera connected to this network adapter can be numbered from *192.168.21.1* to *192.168.21.254*, excluding *192.168.21.203* (the network adapter IP address).

3. Click **Update Camera Address**.

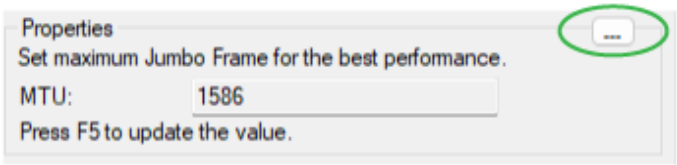
   CVL and VisionPro order cameras according to their network addresses.

   Be aware that you cannot successfully change the IP address of a camera while your vision application is running. You must stop the application and restart it after changing the IP address.

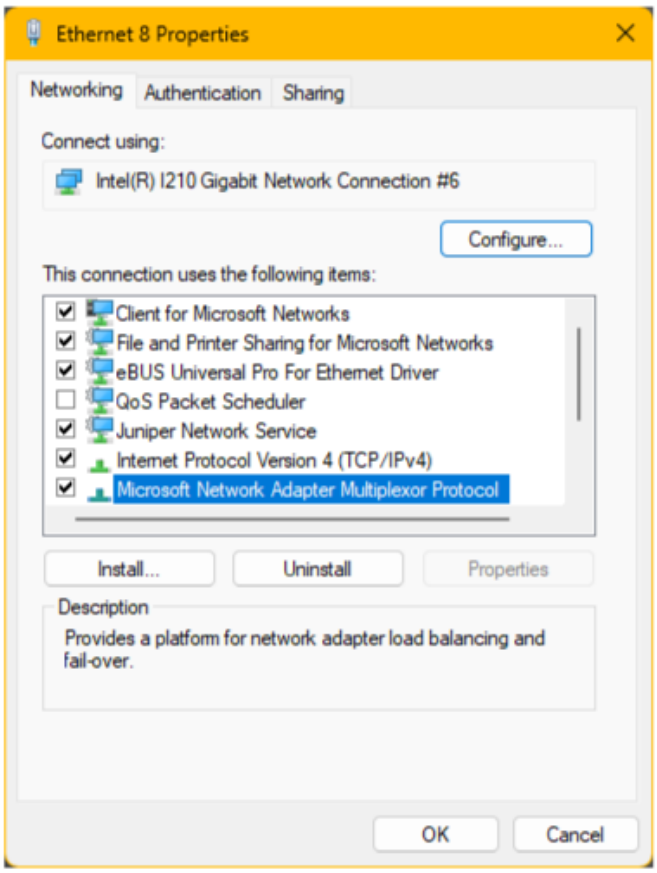
Change System Properties

The GigE Vision Configuration Tool allows you to modify networking and Ethernet properties of your PC that allow for the best performance of your GigE Vision camera.

Access Windows settings by clicking the settings button in the **Properties** section when viewing **Network Connection Information**:

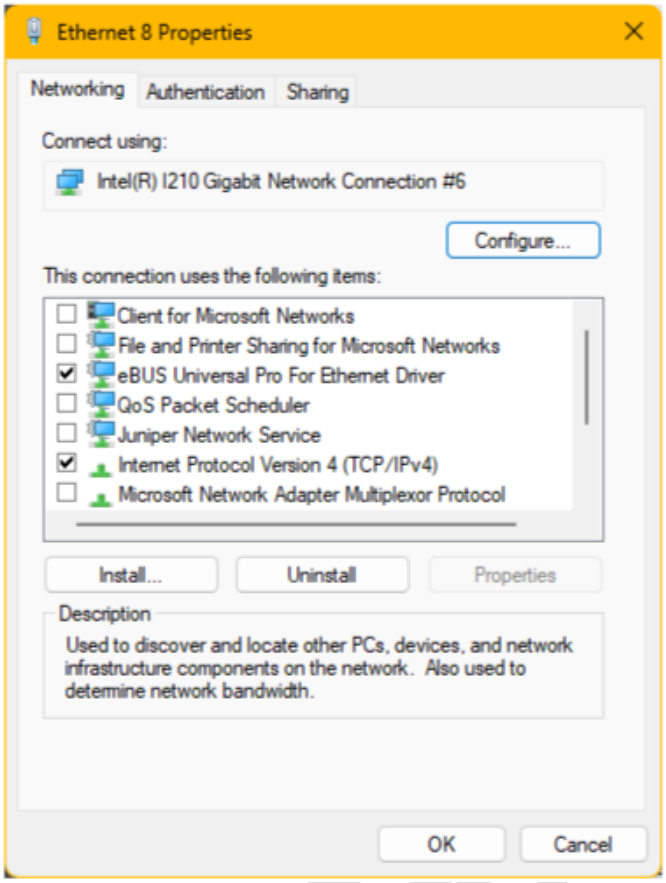


Windows displays a set of tabs for modifying various properties:

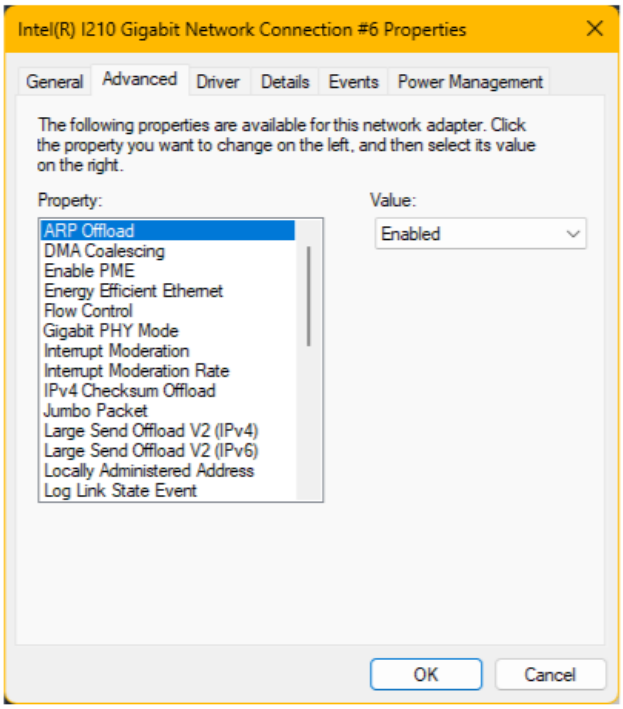


Modify/verify the following properties:

1. In the **Networking** tab, clear all the check boxes listed under **This connection uses the following items** except for **eBUS Universal Pro Driver** and **Internet Protocol Version 4 (TCP/IPv4)**:



2. Click **Configure** and then choose the **Advanced** tab:



Modify the following properties as follows:

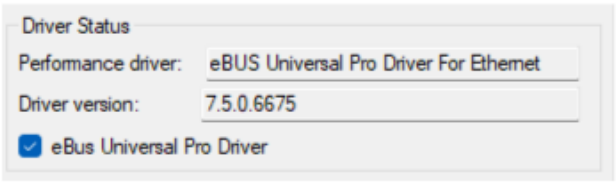
Advanced Setting	Correct Value
Energy Efficient Ethernet	**Off**
Interrupt Moderation	**Enabled**
Interrupt Moderation Rate	**Extreme**
Jumbo Packet (Jumbo Frames)	Greater than or equal to **9000**
Receive Buffers	Highest available (for example, **2048**)
Transmit Buffers	Highest available (for example, **2048**)
Maximum Number of RSS Queues	Highest available value (for example, **4 Queues**)

3. Select the **Driver** tab to confirm the **Driver Provider** is from the OEM/chipset manufacturer (commonly Intel) and that the **Driver Date** is within the last 1-2 years.

> **Note**: Cognex recommends the most recent driver for your card/chipset to provide your vision application with the best possible performance.

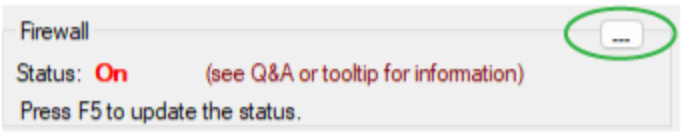
4. Select the **Power Management** tab and disable the option **Allow the computer to turn off this device to save power** if is not already disabled.
5. Click **OK** to close the dialog box.

Verify the GigE Vision Configuration Tool displays the **eBus Universal Pro Driver** with the checkbox enabled and the driver version, which will vary between releases:



Check Windows Firewall Status

The GigE Vision Configuration Tool indicates the Windows Firewall On/Off status for the selected adapter port. Cognex recommends you disable the Firewall status for most vision applications. The tool offers a settings button for modifying the Firewall status:



Refer to the embedded Questions and Answers of the GigE Vision Configuration Tool for details on turning the Windows Firewall On or Off for your particular operating system.

You have several other options for turning Windows Firewall On/Off and preventing it from interfering with GigE acquisition:

- By network domain type
- By connection
- By application

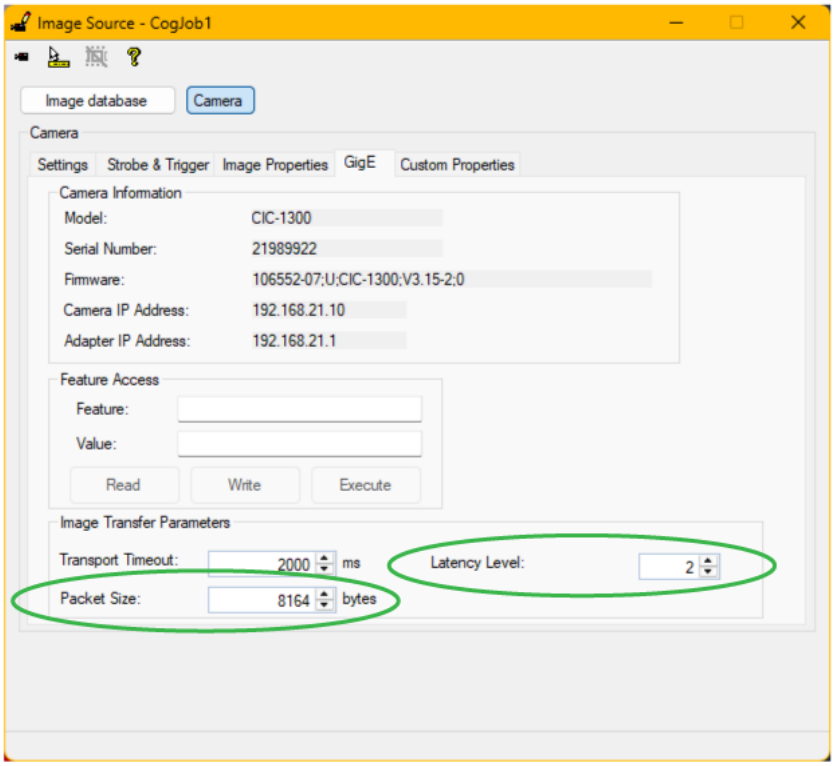
In addition, Windows allows users to customize the firewall response to various network activity. Consult your Windows documentation for details.

Be aware that the utility only detects the local setting for Windows Firewall, and not any settings determined by a group policy that overrides the local setting on this PC. In these situations the GigE Vision Configuration Tool can report that the Windows Firewall is on for the PC while the group policy safely disables it, allowing you to ignore the warning message.

VisionPro Settings

If you use QuickBuild to develop your vision application, perform the following steps to optimize the performance of your GigE Vision camera:

1. Open the image source and select the **GigE** tab:
2. Locate the parameters for **Packet Size** and **Latency Level**:



3. Set **Packet Size** to a value equal to or greater than 8000.
4. Set **Latency Level** to 0 or 1.

> **Note**: Reducing Latency Level typically increases the CPU load for acquisition, so depending on the needs of your application you might not want or need to reduce this all the way to 0.

Disable Unused Network Clients

By default, Windows installs and enables network clients that are not required for GigE Vision. By disabling these unused clients, you can improve GigE performance.

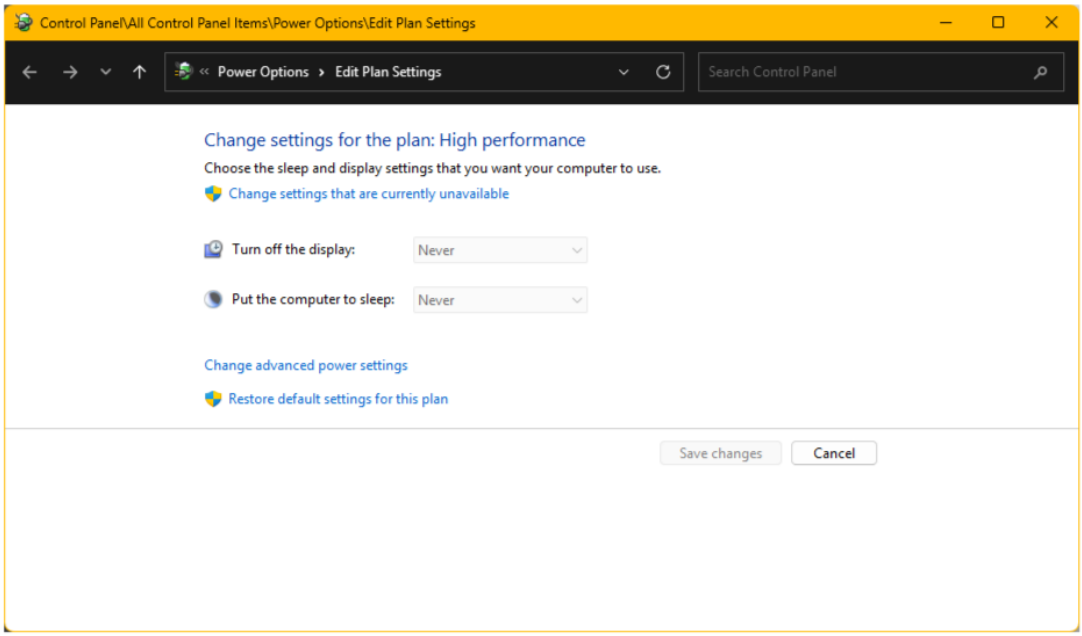
To disable unused clients under Windows:

1. Open the **Control Panel > Network and Sharing Center**.
2. Click **Change Adapter Settings**.
3. Right-click on the icon that represents the Gigabit Ethernet adapter you are using for the GigE Vision network and choose **Properties**.
4. Ensure that only the following items are checked:
   - **Internet Protocol Version 4 (TCP/IPv4)**
   - **Ethernet Bus Filter (eBus Universal)**

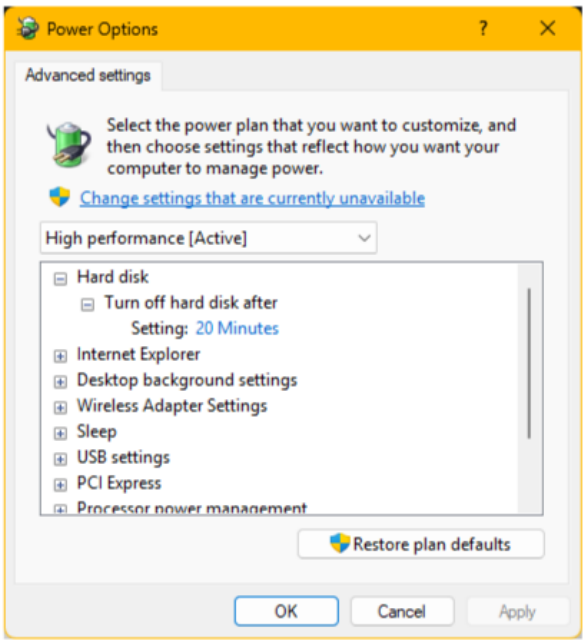
     As stated elsewhere in this guide, ensure any third-party Ethernet drivers are disabled on the network stack or uninstalled.
5. Click **OK**.

Check PC Power Settings

Perform a Windows search for "edit power plan" and access the Windows Control Panel for power plan settings:

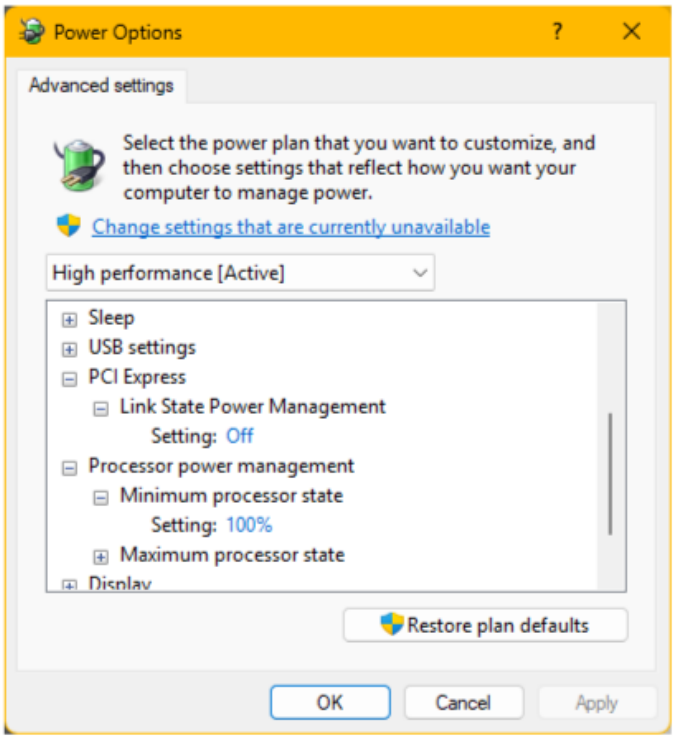


Click **Change advanced power settings** to open the **Power Options** dialog box:



Locate and change the following settings:

- **PCI Express** -> **Link State Power Management**: **Off**
- **Processor power management** -> **Minimum processor state**: **100%**



Tip: Any settings that may allow the PC to go into sleep or hibernate mode should be disabled.

Using GigE Vision Cameras

Refer to the original documentation from the manufacturer as the best source of information for your GigE Vision camera.

Video Formats

GigE Vision cameras you obtain through Cognex use one of the following Generic GigEVision video formats:

- Mono, Mono10, Mono10 Packed, Mono12, Mono12 Packed, Mono14, or Mono16
- Bayer Color
- RGB8 Color
- YUV422 Packed

There are no camera-specific CCF files for GigE Vision cameras.

Supported GigE Vision Features

Cognex vision software supports the following GigE Vision features through the Cognex vision software API.

GigE Vision features supported in Cognex API

- AcquisitionMode
- AcquisitionStart
- AcquisitionStop
- AcquistionFrameRateAbs
- BlackLevel
- ExposureTime
- Gain
- OffsetX
- OffsetY
- PixelFormat
- TriggerMode
- Width
- Height

See your camera documentation for a complete list of supported features.

Always set features with a Cognex API if one exists. If a Cognex API does not exist for a given feature, you can read and write directly using the VisionPro class `ICogGigEAccess` or the CVL class `ccGigEVisionCamera`.

Adapters and Cables

Ensure that all components in your GigE Vision network conform to Gigabit Ethernet standards and that you are using Cat 6, Cat 6a, or Cat 7 cables with S/STP shielding.

Sample Programs

Your Cognex software includes several sample programs that will help you learn how to use VisionPro or CVL with your GigE Vision camera.

You can find VisionPro sample programs in: `%VPRO_ROOT%\samples\Programming\Acquisition`

If you are using QuickBuild scripting, you can find examples QuickBuild job files in the following directory: `%VPRO_ROOT%\samples\QuickBuild\`

The QuickBuild job files that illustrate GigE Vision techniques are named beginning with `Script_GigE`.

You can find CVL sample programs in `%VISION_ROOT%\sample\cvl`

Triggers, Strobes, and Bandwidth

In many cases your vision application will use strobes to illuminate the scene and freeze motion and triggers to control image acquisition. To ensure reliable operation, you may also be concerned about the bandwidth of your GigE Vision network.

In general the properties that control strobes, triggers, and bandwidth differ from manufacturer to manufacturer and from camera to camera, which makes it impossible to support them directly in the Cognex vision API.

The sample programs installed with your software include examples of how to use triggers, strobes, and how to control bandwidth on GigE Vision cameras.

You can use the timestamps included with each acquired image to detect missed images or missed triggers. You can learn more about timestamps from the topic *Using Timestamps with GigE Vision Cameras* in the VisionPro User Guide. If you are using CVL, see the sample program `%CVL_ROOT%\sample\cvl\gige_timestamp.cpp`.

Third Party Considerations

If your camera included the drivers from the manufacturer or a software development kit, Cognex recommends that you not install them. Uninstall any such drivers before installing Cognex software.

All systems that use GigE Vision set the environment variables **%GENICAM_ROOT%** and **%GENICAM_CACHE_V3_4%** to point to the location of the GenICam libraries. When you install Cognex vision software, the installer sets these environment variables to the location where it installs its libraries.

Troubleshooting

- If you are experiencing difficulty setting the IP address of a GigE network adapter, consult the Release Information for your particular Cognex software for the latest news and information.
- In most cases, image corruption or failure to create acquisition FIFOs is the result of using incompatible Gigabit Ethernet adapters. The best way to correct or avoid such problems is to use a Cognex-recommended adapter.
- During the installation of the eBus Universal Pro Driver on Windows, Windows may display a Security Alert dialog. To permanently accept Microsoft Authenticode certificate from Pleora, when the dialog appears, click **Pleora Technologies Inc > Install Certificate > Next**. Select **Place all certificates in the following store**. In the **Certificate store** field, type **Trusted Publishers**. Click **Next > Finish > OK**. The Security Alert dialog will no longer appear.
- Aborting the Cognex Driver installation can leave the network adapter in an invalid state.
- Intel ProSet software may not be compatible with the eBus Universal Pro Driver that Cognex uses. Cognex recommends that you do not install Intel ProSet software or other software that behaves similarly.
- The GigE Vision eBus Universal Pro Driver does not support power management. To turn off your PC, use **Shut down** rather than **Standby** or **Hibernate**.

- Due to an issue with the Pacific Instruments USB driver installer, the eBus Universal Pro Driver may be removed during the installation. To fix the issue, re-install the Cognex Drivers after installing the USB drivers.
- Click the refresh button or select **View > Refresh** to update the GigE Vision Configuration Tool with the latest IP addresses, which might not reflect the current settings after you set the IP address of a GigE network adapter or GigE Vision camera.
- In some cases a VisionPro application that uses a dual-tap GigE Vision camera can exhibit a vertical line down the center of the image while the two halves appear unbalanced. Refer to the topic Configuring a Dual-Tap GigE Vision Camera in the VisionPro online documentation for details on how to balance the taps.
- Be aware that while jumbo frame support is enabled by default on most NETGEAR switches, it is disabled by default on the NETGEAR GS110TP Power over Ethernet switch. Refer to your GS110TP documentation for instructions on configuring jumbo frame support. Cognex recommends the maximum size available.

Other Considerations

With high-bandwidth acquisition, receiving individual image packets from a GigE Vision camera can be susceptible to interruptions from other applications running on the PC.

The GigE Vision standard supports some packet-resend functionality, but in some circumstances your application might experience packet loss resulting in errors such as, "AUTO_ABORTED", "TOO_MANY_CONSECUTIVE_RESENDS", and "RESENDS_FAILURE".

The settings described in the section *Change System Properties* on page 9 can limit the the chances of interference, however, issues may persist. In this case, Cognex recommends examining other software running on the PC that might be causing contention, especially antivirus software or other applications that influence or monitor network traffic. Verify the services running on the PC cannot interfere with the image packets being sent from the camera.

Be aware that momentary contention issues might be caused by applications that do not appear to consume significant amounts of resources in general.

Precautions

To reduce the risk of injury or equipment damage, observe the following precautions when you install the Cognex product:

- Route cables and wires away from high-current wiring or high-voltage power sources to reduce the risk of damage or malfunction from the following causes: over-voltage, line noise, electrostatic discharge (ESD), power surges, or other irregularities in the power supply.
- Changes or modifications not expressly approved by the party responsible for regulatory compliance could void the user's authority to operate the equipment.
- Ensure that the cable bend radius begins at least six inches from the connector. Cable shielding can be degraded or cables can be damaged or wear out faster if a service loop or bend radius is tighter than 10X the cable diameter.
- This device is certified for office use only and if used at home, there can be frequency interference problems.
- This device should be used in accordance with the instructions in this manual.
- All specifications are for reference purposes only and can change without notice.