COGNEX®

# Cognex Vision Software

## GigE Vision Cameras User's Guide

## Cognex Software and GigE Vision Cameras

Cognex VisionPro and CVL software provide support for acquiring, processing, and displaying images from GigE Vision cameras. This document describes how to install and configure the drivers to support this capability under Windows XP and Windows 7.

► For information on using a GigE Vision camera with your Cognex vision software, see the VisionPro or CVL documentation.

The Cognex technical support site may contain additional documentation about using GigE Vision for your machine vision application.

To use GigE Vision cameras with your Cognex software you must:

1. Install Cognex software.

   See the *VisionPro Quick Reference* or the *CVL Getting Started* for installation instructions.
2. Install the network adapters and their manufacturer's drivers.
3. Connect the cameras.
4. Set the IP address for each network adapter.
5. Set the IP address fo r each GigE Vision camera.
6. Enable the GigE Vision performance driver.
7. Disable the Microsoft Windows firewall for each adapter.

## System Requirements

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

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

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

## Install Your Cognex Vision Software

CVL and VisionPro installations include utilities for configuring your GigE Vision camera, as well as custom performance drivers that improve the performance of GigE Vision applications for most production environments.

Be sure to install your Cognex vision software (CVL or VisionPro) including the Cognex drivers, before attempting to acquire any images with your GigE Vision camera.

## Gigabit Ethernet Adapters and Switches

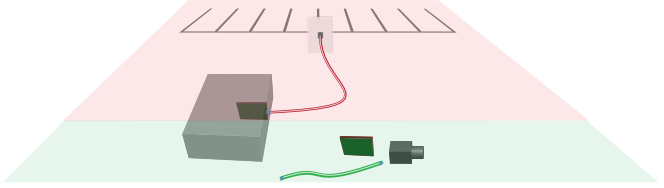
Cognex recommends Gigabit Ethernet adapters that use the PCI Express bus. Specifically, Cognex recommends the following Gigabit Ethernet devices:

- Intel PRO/1000 PT Dual Port Server Adapter (EXPI9402PT)
- Advantech EKI-2725 Unmanaged Gigabit Ethernet Switch

  ► The Gigabit Ethernet adapter or switch that you choose should support Jumbo Frames for best application performance. The Cognex-recommended devices support Jumbo Frames.

Install the Gigabit Ethernet network device(s) and drivers according to the manufacturer's instructions.

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 adapters you use for image acquisition should be dedicated only for GigE Vision cameras and not connected to your local area network.



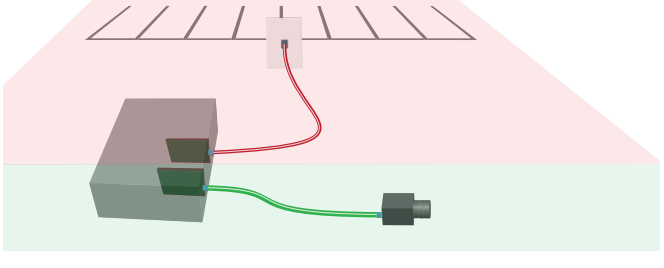
## Connecting GigE Vision Cameras

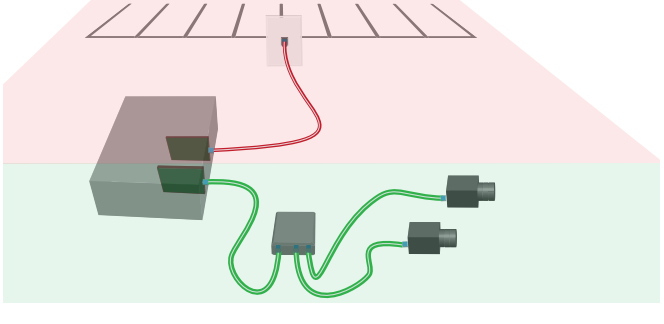
If your camera included the manufacturer's drivers or software development kit, Cognex recommends that you do not install them. Furthermore, Cognex recommends you uninstall any such drivers you may have already installed.

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 dual-port network adapter or a Gigabit Ethernet switch. In either case, your camera should be on its own network and not connected to your Local Area Network or to the Internet.

Although you can use either Cat 5e or Cat 6 Ethernet cables to connect your cameras to the network adapter or to the switch, Cognex strongly recommends Cat 6 Ethernet cables.

The following diagrams illustrate good network configurations for GigE Vision applications.





When you are using a network switch, as in the lower illustration, the network bandwidth is shared among all the cameras connected to it.

## Setting the GigE Vision Network Adapter IP Address

Each GigE Vision network adapter (and each port of a multi-port adapter) must have its own IP address on its own subnet. In addition, each camera must have its own IP address on the same subnet as its network adapter, or the camera will not be able to communicate with the network adapter and you cannot enable the custom GigE Vision performance drivers.

Use the Cognex GigE Vision Configuration Tool to assign IP addresses to the Gigabit Ethernet network adapter and any camera connected to it.

- Make sure that your GigE camera is connected to the adapter and turned on before configuring any IP addresses.
- Stop any applications that use CVL or VisionPro.
- If you are using Windows 7 and User Account Control (UAC) is set to any setting other than **Never notify**, you need to right-click its icon and choose ***Run as administrator*** from the pop-up menu to run the utility with the appropriate permissions.
- If you are using Windows XP, you must use the GigE Vision Configuration Tool from an account with administrative privileges.

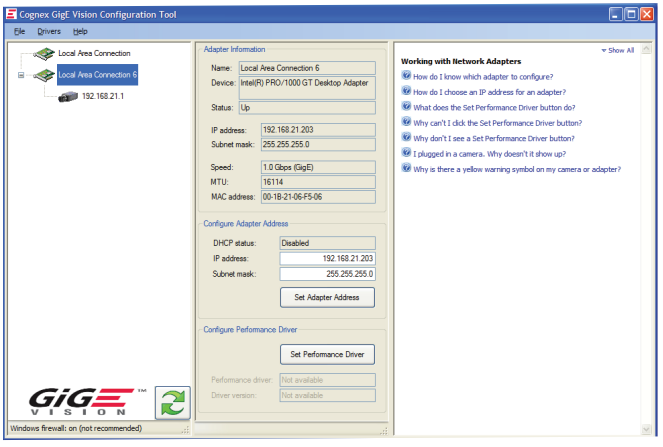
Start the GigE Vision Configuration Tool for CVL through the **Start** menu by choosing:

***Cognex->CVL->Cognex Utilities->GigE Vision->Cognex GigE Vision Configuration Tool***

For VisionPro:

***Cognex->VisionPro->Utilities->GigE Vision Configuration Tool***

The Cognex GigE Vision Configuration Tool displays all the network connections that correspond to the network adapters installed on your PC as well as the GigE Vision cameras connected to them:




The center panel displays information about the network adapter. In most environments at least one of your **Local Area Connections** is associated with the network connection of the PC. Check with your network administrator if you are not sure which one it is.

To set the IP address for a GigE Vision network adapter:

1. Select the **Local Area Connection** that corresponds to the network adapter connected to your GigE Vision camera(s).
2. Enter an IP address and subnet mask for the adapter in the **IP Address** and **Subnet** fields.

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

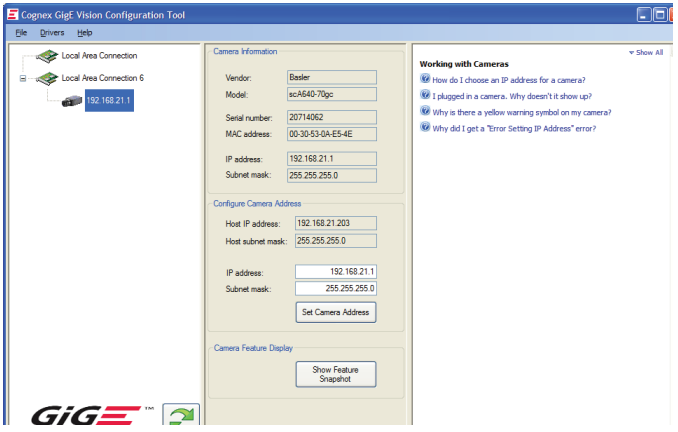
| Network Adapter | IP Address | Subnet Mask |
|---|---|---|
| 1st GigE Network Adapter | 192.168.21.203 | 255.255.255.0 |
| 2nd GigE Network Adapter | 192.168.22.203 | 255.255.255.0 |
| 3rd GigE Network Adapter | 192.168.23.203 | 255.255.255.0 |

3. Click **Set Adapter Address**.

If you experience difficulty setting the IP address of the GigE Vision network adapter, consult the Release Information for your particular Cognex software for the latest news and information.

## Setting the Camera IP Address

Each camera must have an IP address in the same subnet as its network adapter.




1. Select a camera on the left. The center panel displays information about the camera.
2. Enter an **IP Address** and a **Subnet mask** for the camera.

   The IP address of the camera must have the same first three octets as the network adapter, which appears as the **Host IP address**. You can use any unused value from 1 to 254 for the last octet. Note that the address 192.168.21.203 is already used by the network adapter, so it cannot be assigned to a camera.

   The subnet mask for the camera should be the same as the **Host subnet mask**.

   In the preceding example, the network adapter's IP address is 192.168.21.203. The cameras connected to this network adapter can be numbered from 192.168.21.1 to 192.168.21.254, excluding 192.168.21.203.
3. Click **Set Camera Address**.

CVL and VisionPro order cameras according to their network addresses.

If you change the IP address of a camera while your vision application is running, you must exit the vision application and restart it.

## Disabling the Firewall

Disable the Windows Firewall for the network adapters you use for image acquisition. If you do not disable the firewall, you may not be able to acquire images or your application may time out.

Although camera configuration is not affected by the presence of a firewall, your vision application might not be able to acquire any images if the firewall is not disabled.

- ► You can disable the firewall for an individual network adapter without disabling the firewall system-wide. If your firewall settings are set by group policy, consult your network administrator for assistance.

To disable the firewall on Windows XP:

1. Open the **Windows Firewall** control panel
2. Click the **Advanced** tab
3. Disable the firewall for the **Local Area Connections** that correspond to the network adapters you are using for image acquisition.
4. Click **OK**.

To disable the firewall on Windows 7:

1. Open the **Windows Firewall** control panel
2. Click **Change Settings**. If you have User Access Control enabled, you will be asked to confirm this step.
3. In the **Windows Firewall Settings** dialog, select the **Advanced** tab
4. Disable the firewall for the **Local Area Connections** that correspond to the network adapters you are using for image acquisition.
5. Click **OK**.

- ► You will need to reset the per-adapter firewall setting if you update a driver on a network adapter. If you change the performance driver setting, for instance, be sure to disable the firewall for that network adapter again.

## Optimizing Your Application

Once you have installed and configured the network adapters, connected the cameras and provided IP addresses, you can take some steps to tune the network adapter and improve overall GigE Vision camera performance.

### Performance Drivers

A Cognex software (CVL or VisionPro) installation includes a set of custom GigE Vision drivers that can improve the performance of GigE Vision cameras for most production environments.

By default, Cognex software does not enable any of these drivers, but you can use the Cognex GigE Vision Configuration Tool to enable the appropriate performance driver based on the specific Gigabit Ethernet adaptor that you have installed.

Cognex recommends the following sequence for enabling the performance drivers:

1. Launch the Cognex GigE Vision Configuration Tool.

   See the section *Setting the Network Adapter IP Address* on page 5 for details.

2. Select the **Local Area Connection** corresponding to your GigE Vision network adapter.

   If you have not already set the IP address of your GigE Vision network adapter and camera, do so as previously described.

3. Click **Set Performance Driver**.

   Follow the prompts and allow the utility to install the performance driver on the selected GigE Vision network adapter.

   The Cognex GigE Vision Configuration Tool will prompt you to restart your PC.

4. Restart your PC, launch the GigE Vision Configuration Tool again to reset the IP address of the network adapter.
5. Repeat steps 2-4 for any additional GigE Vision network adapters.

### Jumbo Frames

Using jumbo frames can improve performance.

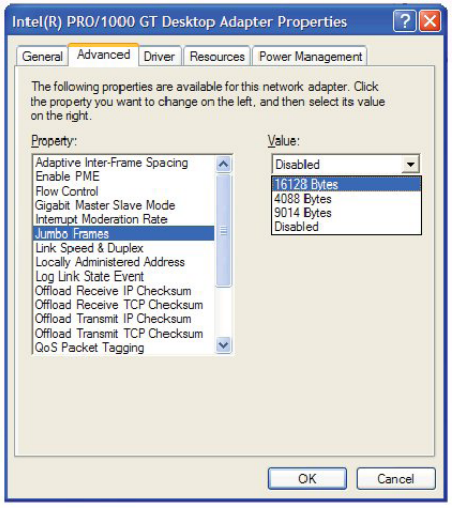
- ► If you are using the performance drivers with an Intel network adapter, you do not need to enable Jumbo Frames.

**Windows XP**

To enable Jumbo Frames under Windows XP:

1. Open the **Network Connections** applet of the Windows Control Panel.
2. Right-click the icon that corresponds to the Gigabit Ethernet adapter you are using for the GigE Vision network and choose **Properties.**
3. Click **Configure**.
4. Select the **Advanced** tab.

   From the **Property** list on the left, select **Jumbo Frames**.



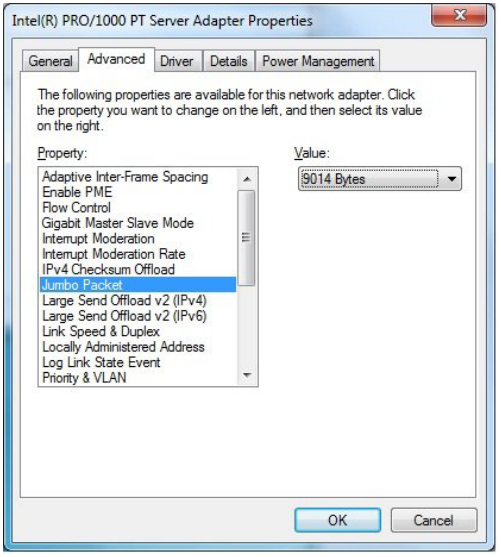

   If you do not see an entry for **Jumbo Frames**, either your adapter does not support them or you need to update its driver.

5. Choose the highest value offered from the drop-down **Value** list and click **OK**.

**Windows 7**

To enable Jumbo Frames under Windows 7:

1. Open **Control Panel->Network and Sharing Center.**
2. Click **Change Adapter Settings**.
3. Right-click the icon that represents the Gigabit Ethernet adapter you are using for the GigE Vision network and choose **Properties**.
4. Click **Configure** and select the **Advanced** tab.
5. Select **Jumbo Frames** or **Jumbo Packet.**




   If you do not see an entry for **Jumbo Frames**, your adapter may not support them, or you may need to update the driver for the network adapter.

6. Choose the highest value offered from the drop-down **Value** list and click **OK**.

## Disabling Unused Network Clients

By default, both Windows XP and Windows 7 install and enable network clients that are not required for GigE vision. By disabling these unused clients, you can improve GigE performance.

**Windows XP**

To disable unused clients under Windows XP:

1. Open the **Network Connections** applet of the Windows control panel.
2. Right-click the icon that corresponds to the Gigabit Ethernet

adapter you are using for the GigE Vision network and choose **Properties**.

3. Select the **General** tab.
4. Ensure that only the following items are checked:
   - **Internet Protocol (TCP/IP)**
   - **Ethernet Bus Filter (eBus Universal)**

   If no entry is present for **Ethernet Bus Filter**, then make sure that only **Internet Protocol (TCP/IP)** is checked.
5. Click **OK**.

**Windows 7**

To disable unused clients under Windows 7:

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)**

   If no entry is present for **Ethernet Bus Filter**, then make sure that only **Internet Protocol Version 4 (TCP/IPv4)** is checked.
5. Click **OK**.

# Using GigE Vision Cameras

The manufacturer's camera documentation is 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
- Mono12
- Mono12 Packed
- Mono16
- Bayer Color

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. A "feature" is a camera setting defined in the GenICam standard or by the camera manufacturer.

**GigE Vision features supported in Cognex API**

| | | |
|---|---|---|
| AcquisitionMode | AcquisitionStart | AcquisitionStop |
| PixelFormat | TriggerMode | |
| ExposureTimeAbs | ExposureTimeRaw | |
| BlackLevelRaw | GainRaw | |
| OffsetX | OffsetY | |
| Width | Height | |

See the *Acquiring Images: Application Notes* chapter of the CVL User's Guide for a complete list. For VisionPro see the *Acquisition:GigE Vision* section of the User's Guide.

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

## Adapters and Cables

To ensure the best performance, make sure that all components in your GigE Vision network conform to Gigabit Ethernet standards and that you are using Cat 5e or Cat 6 cables.

## 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 most 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 *Using Timestamps with GigE Vision Cameras* topic in the VisionPro User's 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 manufacturer's drivers or software development kit, Cognex recommends that you not install them. If you have already installed such drivers, you should uninstall them before installing Cognex software.

All systems that use GigE Vision set the environment variable `%GENICAM_ROOT_V1_1%` to point to the location of the GenICam libraries. When you install Cognex vision software, the installer sets this environment variable to the location where it installs its libraries. If you have installed another vendor's GigE Vision product, it may have already set the environment variable. In this case, the installer will warn you and ask you to confirm the change or to quit the installer.

### Troubleshooting

- 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 one of the Cognex-recommended adapters and enable the custom performance drivers.
- Some versions of Windows XP Service Pack 2 may crash or lock up when running the performance drivers. Microsoft offers a hotfix that corrects the issue. To learn more, see `http://support.microsoft.com/kb/921337`.
- During the installation of GigE Vision performance drivers on Windows 7, Windows may display a Security Alert dialog. To permanently accept Pleora's Microsoft Authenticode certificate, 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 GigE Vision Performance Driver installations may leave the network adapter in an invalid state. To recover, reinstall the manufacturer's network adapter driver.
- Due to an issue with the **Intel ProSet** software, the GigE Vision performance drivers may conflict. The issue occurs because the software continually tests for drivers and attempts to reinstall them. We recommend that you not install **Intel ProSet** or other software that behaves similarly.
- The GigE Vision performance drivers do 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, some GigE Vision performance drivers may be removed during the installation. To fix the issue, re-enable the performance drivers after installing the USB drivers.
- In some cases the DCHP function of the LAN network adapter can become disabled after setting the IP address of the GigE network adapter. See the release notes for your particular Cognex vision software for instructions on how to recover the LAN network connection.
- Click the refresh button (two green arrows in a circular pattern) located near the bottom of the GigE Vision Configuration Tool to update the utility with the latest IP addresses, which might not reflect the current settings after you enable the performance drivers or set the IP address of a GigE network adapter or GigE Vision camera.
- 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.

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