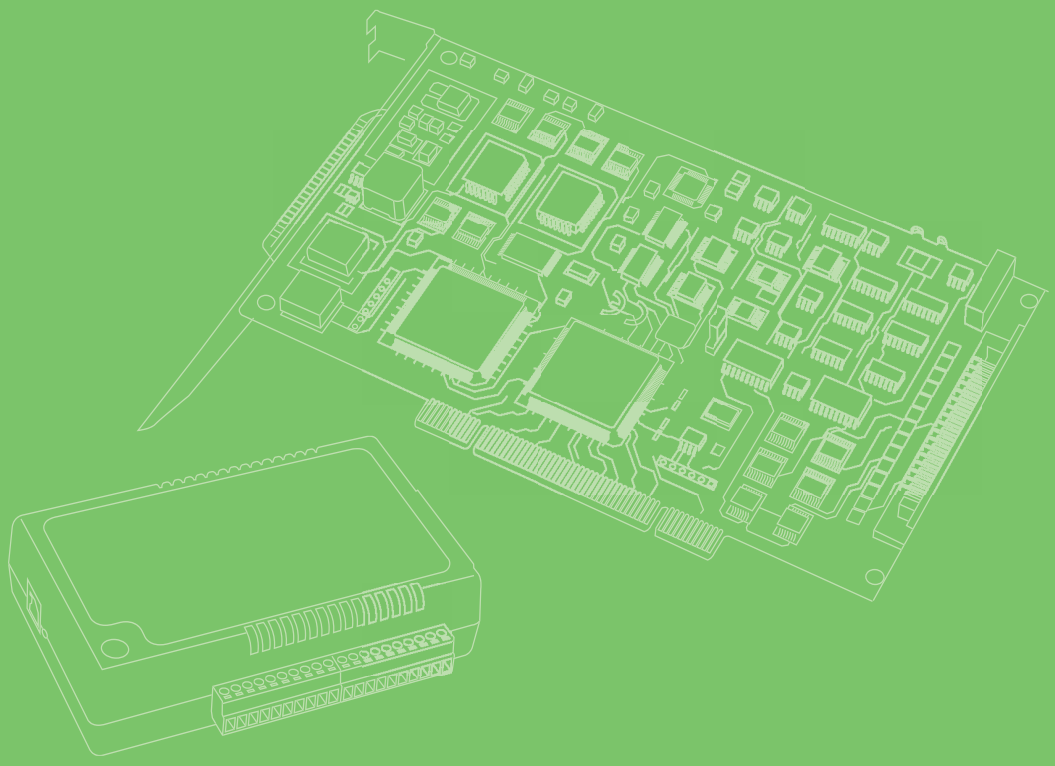

User Manual

PCIE-1172/1174

Reference Manual

ADVANTECH

Enabling an Intelligent Planet

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Contents

Chapter 1

Overview

1.1 Introduction

The PCIe-1172/1174 series is a PCI Express® dual/quad channel frame grabber for two/four independent GigE Vision cameras, features with GoE (GigE Vision Offload Engine), PoE (Power over Ethernet) and ToE (Trigger over Ethernet) for high performance, robust and reliable machine vision applications.

Unlike a conventional NIC (network interface controller) with GigE Vision protocol implemented in software and executed on the host CPU, the processor must spend more resources to handle the network traffic and incoming frames rather than the machine vision algorithms, especially in high bandwidth, multiple camera applications.

The GoE feature significantly off-loads the GigE Vision protocols into dedicated FPGA(Field Programmable Gate Array), reconstruct the image then transmit to the Host PC via DMA (Direct Memory Access) in real time, release the host processor resource to execute algorithm and applications and there is no frame or packet loss during the image acquisition.

The comprehensive ToE/PoE features can lower the installation/maintenance effort through the single cable connection, and reduce image acquisition latency, with the Ad hoc network feature, the connection between GigE Vision cameras and frame grabber are self-configuring, the user define IP address is no longer necessary anymore, and significantly reduces the installation and maintenance cost and effort.

The CAMNavi SDK runs under Windows 7/8/10 and supports the most common programming languages C++ and the .NET framework. The powerful SDK provides functions to control the frame grabber, including image acquisition, I/O, triggering and frame buffer management. The viewer utilities provide the graphical user interface to configure, evaluate and preview of the image date, meanwhile the PCIE-1172/1174 series are compatible with GENiCAM and GENTL software interface, users can easily connect to the machine vision software.

1.2 Features

- 2/4 channel GigE Vision ports
- PCI Express® x4 lane compliant
- GoE (GigE Vision Offload Engine)
- GigE Vision, GENiCAM and GENTL Compliant
- Automatic IP configuration
- 100 m cable length
- PoE, IEEE 802.3af Compliant
- Direct power from PCIe slot (Total Max. 14 W)
- ToE (Trigger over Ethernet)

1.3 Specifications

GigE Vision

- **Compatibility:** GigE Vision 1.2
- **PoE:** IEEE 802.3af
- **Speed:** 1000 Mbps
- **No. of Ports:** 2 or 4 Gigabit Ethernet
- **Connector:** 8-pin RJ45
- **Jumbo Frame:** 9 KB

Digital Input

- **Channels:** 2, 4 (PCIe-1174)
- **Compatibility:** 0 ~ 30 V_{DC} opto-isolated
- **Voltage:**
  - Logic 0: 3 V (max.)
  - Logic 1: 10 V (min.)
- **Interrupt:** Falling and Rising edge

Digital Output

- **Channels:** 4, 8 (PCIe-1174)
- **Compatibility:** 5 ~ 40 V_{DC} opto-isolated

Power Requirements

- **Input Voltage:** 12 V_{DC} direct from PCIe slot, Max. 18W or AT/ATX power input, Max.60 W
- **ESD:** 4 KV (Contact), 8KV(Air)
- **EFT:** 1 KV EFT
- **Bus Interface:** PCI Express® x4

Environment

- **Temperature:**
  - Operating: 0 -50°C (0-122°F)
  - Storage: -20 - 80°C (-4 -176°F)
- **Humidity:** 5 – 95% RH non-condensing (refer to IEC 60068-2-3)
- **Dimensions:** (W x D) 185 x 110 mm (7.3" x 3.9")

1.4 Ordering Information

- PCIe-1172: 2-port PCI Express Intelligent GigE Vision Frame Grabber
- PCIe-1174: 4-port PCI Express Intelligent GigE Vision Frame Grabber

1.5 Unpacking Checklist

Ensure that the following items are included in the package.

- PCIe-1172 or PCIe-1174 unit
- 2P / B4P Cable (only for PCIe-1174)
- DB-15 Bracket (only for PCIe-1174)

Chapter 2

Hardware Configuration

2.1 Initial Inspection

You should find the following items inside the shipping package:

- PCIe-1172 or PCIe-1174 unit
- 2P / B4P Cable (PCIe-1174 only)
- DB-15 Bracket (PCIe-1174 only)

We carefully inspected the card mechanically and electrically before we shipped it. It should be free of marks and scratches and in perfect working order on receipt. As you unpack the card, check it for signs of shipping damage (damaged box, scratches, dents, etc.). If it is damaged or it fails to meet specifications, notify our service department or your local sales representative immediately. Also notify the carrier. Retain the shipping carton and packing material for inspection by the carrier. After inspection we will make arrangements to repair or replace the unit. When you handle the PCI Express GbE PoE card series, remove it from its protective packaging by grasping the rear metal panel. Keep the anti-vibration packing. Whenever you remove the card from the PC, store it in this package for protection.

2.2 Hardware View

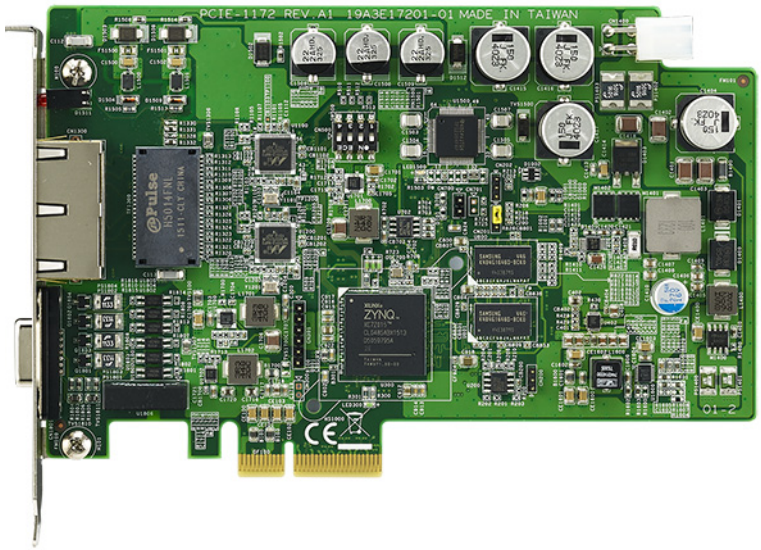


Figure 2.1 PCIe-1172 Board Layout

2.3 PIN Assignments

PCIe-1172/PCIe-1174 Digital Input/Output:

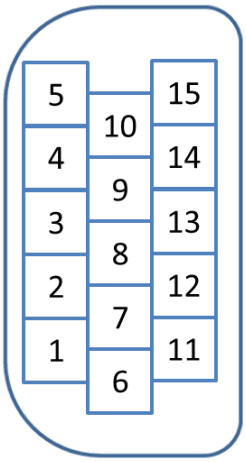


Figure 2.2 PCIe-1172/PCIe-1174 Pin Assignment

Description of PIN

Pin No.	PCIE-1172	PCIE-1174
1	Isolated digital input for Port 1	
2	Isolated digital input for Port 2	
3	Common pin for isolated digital input	
4		Isolated digital input for Port 3
5		Isolated digital input for Port 4
6	Isolated digital output channel 0 for Port 1	
7	Isolated digital output channel 1 for Port 1	
8	Isolated digital output channel 0 for Port 2	
9	Isolated digital output channel 1 for Port 2	
10	Digital ground	
11	Common pin for digital output inductive loads	
12		Isolated digital output channel 0 for Port 3
13		Isolated digital output channel 1 for Port 3
14		Isolated digital output channel 0 for Port 4
15		Isolated digital output channel 1 for Port 4

2.4 Signal Connections

Isolated Digital Input:

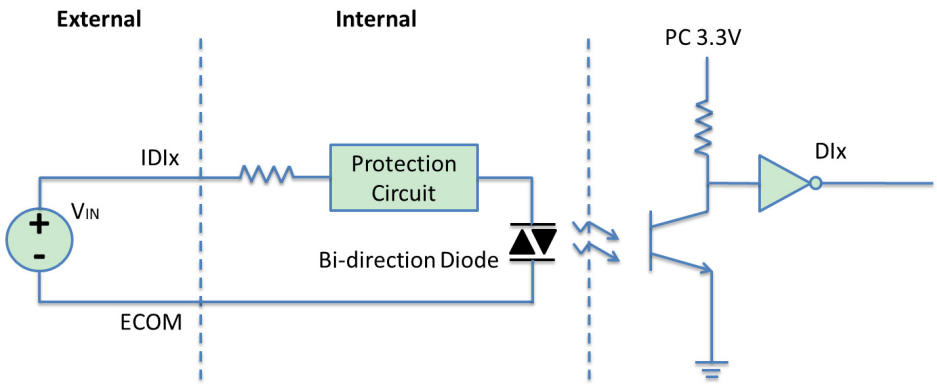
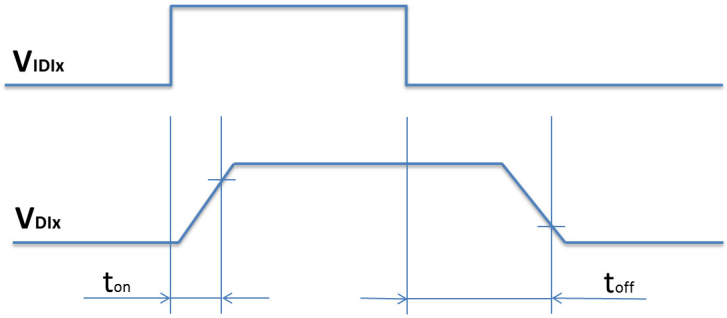


Figure 2.3 Isolated Digital Input Connection



ton: 10us Typ. ; toff: 60us Typ.
(VIN settling time is not included)

Figure 2.4 Isolated Digital Input Response Time

Each isolated digital input channel can accept bi-directional voltage input under 30 VDC. In addition, all channels share the same common pin. Figure 2.4 shows how to connect an external input source to one of the card's isolated input channels.

Isolated Digital Output:

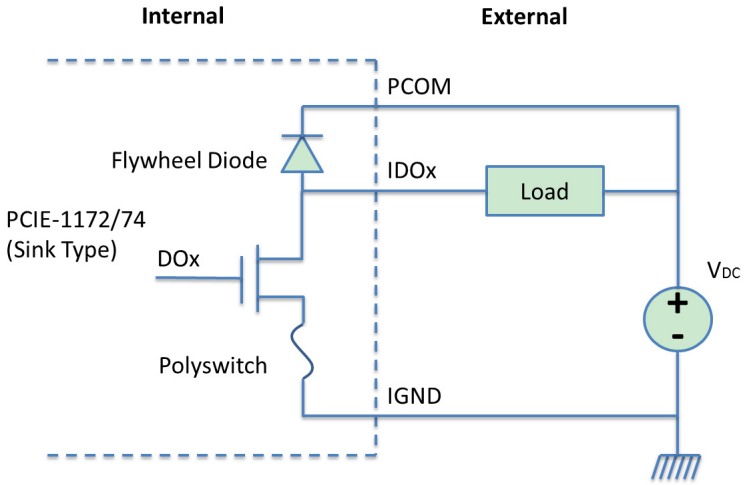
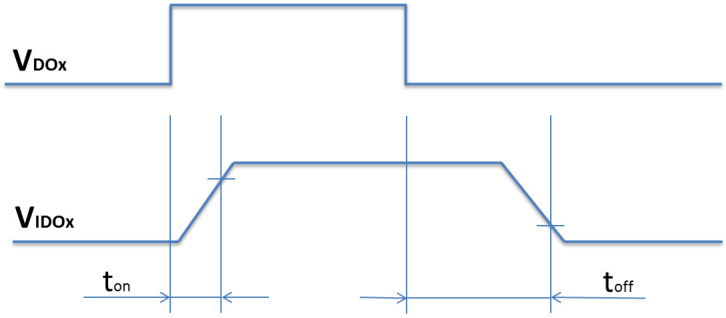


Figure 2.5 Isolated Digital Output Connection



ton: 10us Typ. ; toff: 60us Typ.
(VDC settling time is not included)

Figure 2.6 Isolated Digital Output Response Time

Each isolated output channel consists of a MOSFET, a poly-switch and a flywheel diode. Once an external voltage source (5 ~ 40 V_{DC}) is applied to the channel, the current will stream from the external source into the device. The maximum current flow of each IDO channel must not exceed 500 mA, or the device may undergo an unrecoverable damage. Otherwise, to dissipate the energy of inductive loads, the fly-wheel diode should be activated by connecting PCOM to V_{DC}.

2.5 Hardware Installation

Note! *We strongly recommend that you install the software driver before you install the hardware into your system, since this will guarantee a smooth and trouble-free installation process.*

Turn off your PC's power supply whenever you install or remove the card or its cables. Static electricity can easily damage computer equipment. Ground yourself by touching the chassis of the computer (metal) before you touch any boards.

1. Install software driver and power off computer, refer to section 3.1 and 3.2 for detail instructions.
2. Disconnect the power cord and any other cables of the computer.
3. Remove the PC's cover (refer to your user's guide if necessary).
4. Install and plug the card on your PCI Express slot.
5. Replace the PC's cover. Connect the cables you removed in step 2 and connect the power connector and power supply with the power cable in the package.
6. Refer to the section 2.3, 2.4 and connect to the cameras, external Input/Output devices.
7. Power on computer, execute the Device Manager utility to make sure the card is installed.

Chapter 3

Driver Setup and Installation

3.1 Introduction

This chapter describes the driver installation, configuration procedures for the Windows operating system, including Windows XP/Vista/7 32/64 bits.

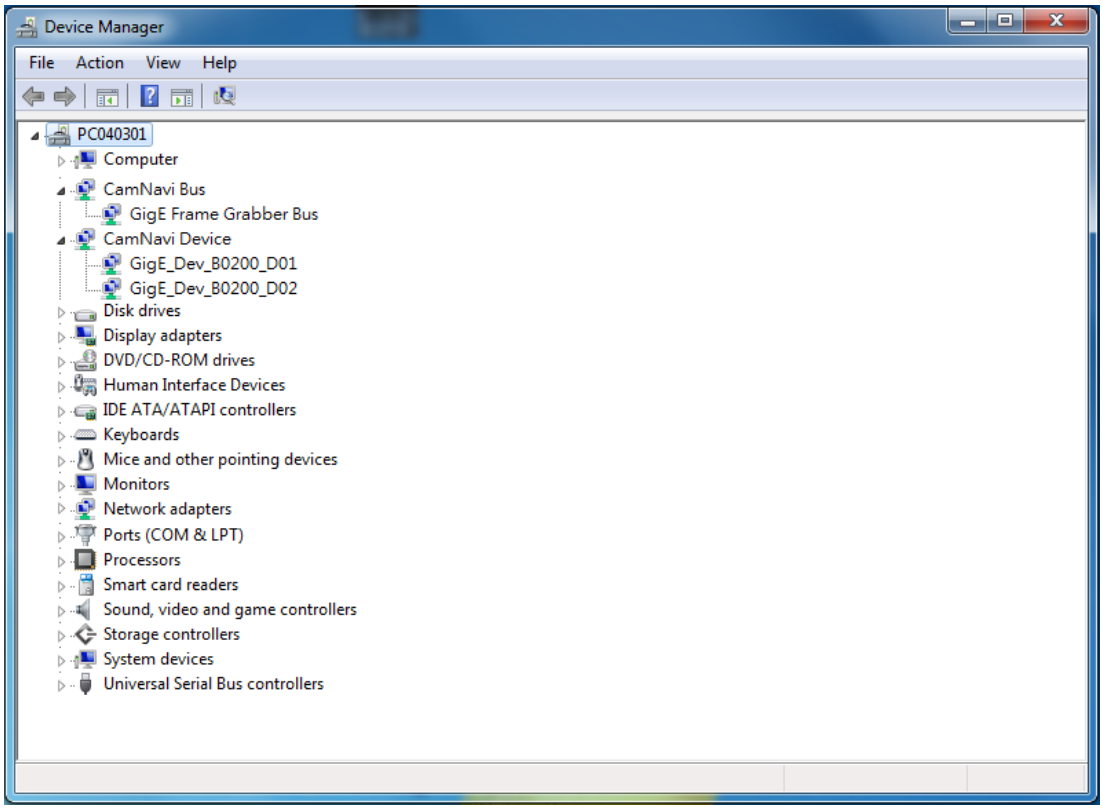
3.2 Driver Setup

In order to utilize the advanced features of Windows 7/8/10, such as multi-process and multi-thread, 32-bit and 64-bit Windows device drivers are provided for the cards.

3.2.1 Windows XP/Vista/7 Driver Setup

Follow the steps below for the PCIE1172/PCIE-1174 Windows 32-bit/64-bit driver installation.

1. Visit the Advantech website, search for PCIE-1172, click the Manual/ Driver/ BIOS/ FAQ icon and download the Driver.
2. Unzip the Driver, double click the .exe file.
3. After the installation, the device will show up in the device manager.



Chapter 4

Operation Theory

4.1 I/O Control

4.1.1 Digital Input

There is one opto-isolated digital input for each Port, the digital input can act as the trigger start signal for the camera, and support debouncer and inverter features. The debouncer feature identifies the valid and invalid input signals via setting the debouncer value (the minimum period of time for the valid signal). In this way, the circuit will only respond to the signal that the pulse width is greater than debouncer value.

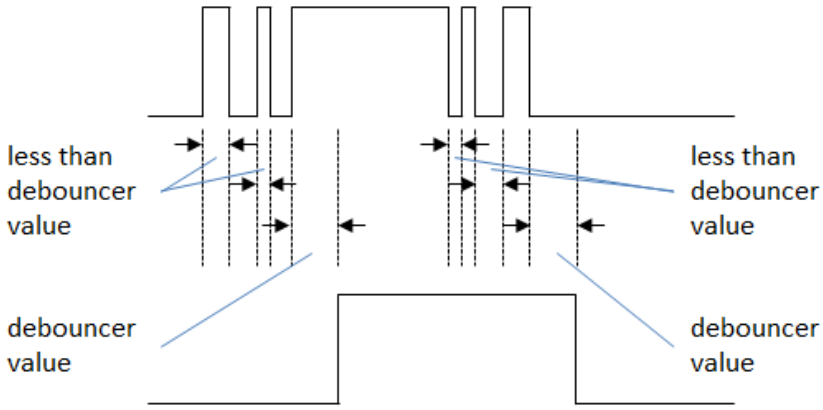


Figure 4.1 Isolated Digital Input Response

4.1.2 Digital Output

There are two opto-isolated digital output for each Port, each digital output supports inverter feature and can be configured as three different modes, including User Programmable Mode, Pass Mode and Counter Mode.

User Programmable Mode:

User can program the state of the digital output line.

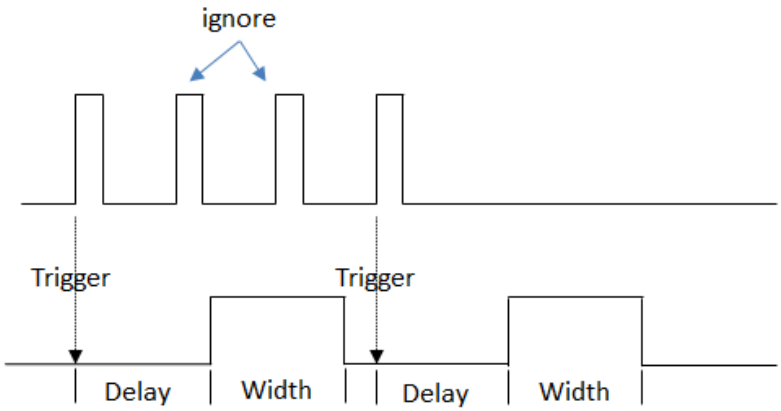
Pass Mode:

The digital output signal is active when a valid digital input occurs.

Counter Mode:

In this mode, the digital input acts as the trigger source, user can set the falling or raising edge as the trigger start signal, and the digital output acts as a pulse output, user can set the delay time, and pulse width for the digital output, the operation and timing chart for raising edge Counter Mode is as follows:

1. A raising edge of the digital input occurs.
2. When the delay expires, the digital output signal becomes high.
3. When the duration period expires, the digital output signal becomes low.



4.2 Camera control

The PCIe-1172/1174 series provides two approaches for camera control. First, user can open CamNavi Viewer to control camera. In second approach, user can create customized application program with CamNavi SDK.

4.2.1 Acquisition Start and Stop

The camera control procedure requires following major configuration:

- **Camera Acquisition Mode**
  The camera acquisition mode contains two types setting: **singe frame** and **continuous frame**. If the acquisition mode is configured as **singe frame**, camera will perform acquisition process once, and return single frame by each **acquisition start** command.
  If the **continuous frame** is used, camera performs acquisition continuously until **acquisition stop** is executed.
- **Camera Acquisition Start / Stop**
  If the **camera acquisition start** is executed, the camera will run the acquisition and return image to frame grabber. After the **camera acquisition stop** is executed, the camera will stop the acquisition process.
- **Frame Grabber Acquisition Start / Stop**
  If the **frame grabber acquisition start** is executed, the frame grabber will transfer all images from camera into memory buffer of system; On the other hand, **frame grabber acquisition stop** will trigger frame grabber to stop image transformation and ignore all images from camera.

The following example shows the camera control procedure for image acquisition

```
//Define the AcquisitionMode as "2" ("Continues Acquisition Mode")
pAcquisitionMode->SetValue(2);
// Start the camera image acquisition function
pAcquisitionStart->Execute();
// Start Acquisition and grab 10 image frames
pCamera->StartAcq(10);
```

4.2.1.1 Camera Configuration

In CamNavi SDK, user can use two methods for camera configuration.

- **Pre-defined camera parameters**
  If the target camera parameter is pre-defined, user can configure parameter with CamNavi API directly.
- **Customized camera parameters**
  In customized parameters, CamNavi API required parameter name which is defined in camera profile (xml file) for configuration.

The following example shows the camera detail configuration.

```
//Get the pre-defined image width
IIntNode *pWidth = pCamConfigure->GetWidth();
int64_t iValue = pWidth->GetValue();
iValue = pWidth->GetMax();
iValue = pWidth->GetMin();
//Get the customized "TestImageSelector" control node from camera
profile
IEnumNode *pTestImage = pCamConfigure->GetEnumNode("TestImageSelec-
tor");
pTestImage->SetValue(1);
```

4.3 Image Acquisition

4.3.1 Software Trigger Mode

In software trigger mode, users can use the software API to control the image acquisition, and the camera will not acquire frames unless an software acquisition command is executed, below is the operation procedures:

1. Configure the camera in software trigger mode.
2. Execute the image acquisition command through software API.
3. The camera will acquire the images after receiving image acquisition command, then send out the image date to host PC.
4. The camera will return to the standby mode, and wait for the next acquisition command.

4.3.2 Hardware Trigger

In hardware trigger mode, the digital output pin of PCIE-1172/PCIE1174 must be connected to the digital input or trigger input of the cameras, and the camera will begin the process of exposing and reading out a frame only when the digital output of PCIE-1172/PCIE-1174 is active, below is the operation procedures:

1. Configure the camera in hardware trigger mode.
2. Configure the digital input signal of the camera as the trigger source.
3. Applying a digital output pulse to the camera digital.
4. The camera will acquire the images, then send out the image date to host PC.
5. The camera will return to the standby mode, and wait for the next valid trigger signal.

4.3.3 ToE

In ToE mode, the digital input pin of PCIE-1172/PCIE-1174 must be connected to the external trigger source, such as in-position sensor. The PCIE-1172/PCIE-1174 will send the image acquisition command via the Ethernet cable as soon as the digital input of PCIE-1172/PCIE-1174 is active, then the camera will begin the process of exposing and reading out a frame only, below is the operation procedures:

1. Configure the camera in software trigger mode.
2. Applying a digital output pulse to PCIE-1172/PCIE-1174 digital input pin.
3. The camera will acquire the images, send out the image date to host PC as soon as it receive the acquisition command from PCIE-1172/PCIE-1174.
4. The camera will return to standby mode, and wait for the next acquisition command.

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